



Sean Rogan
Executive Director

**COMMUNITY DEVELOPMENT COMMISSION
of the County of Los Angeles**

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ADOPTED

BOARD OF SUPERVISORS
COUNTY OF LOS ANGELES

1-D

March 29, 2016

March 15, 2016

The Honorable Board of Commissioners
Community Development Commission
County of Los Angeles
383 Kenneth Hahn Hall of Administration
500 West Temple Street
Los Angeles, California 90012

Dear Commissioners:

LORI GLASGOW
EXECUTIVE OFFICER

**AWARD A JOB ORDER CONTRACT AND APPROVE A CONSTRUCTION TASK CATALOG
(ALL DISTRICTS) (3 VOTES)**

SUBJECT

This action recommends award of a Job Order Contract to Angeles Contractor, Inc., the Lowest Responsive and Responsible Bidder, to provide maintenance, repair, refurbishment, rehabilitation, retrofit, and other repetitive-type work for the Community Development Commission (Commission). This action will also adopt the January 2016 Job Order Contract Construction Task Catalog.

IT IS RECOMMENDED THAT THE BOARD:

1. Find that the award of Job Order Contract 30 and authorization for the Executive Director, or his designee, to issue work orders, and the adoption of the January 2016 Job Order Contract Construction Task Catalog are not a project under Section 15378(b) of the California Environmental Quality Act.
2. Adopt the January 2016 Job Order Contract Construction Task Catalog that is on file with the Construction Management Unit of the Community Development Commission.
3. Award a Job Order Contract (JOC 30) to Angeles Contractor, Inc., for a maximum amount of \$4,500,000, to be financed through various funding sources included in the Commission's approved Fiscal Year 2015-2016 budget and to be included in all future years' budgets accordingly.
4. Authorize the Executive Director, or his designee, to execute Job Order Contract 30 in the form previously approved as to form by County Counsel and to establish the effective date following receipt of approved Faithful Performance and Payment for Labor and Materials Bonds filed by

Angeles Contractor, Inc.

5. Authorize the Executive Director, or his designee, to issue work orders for maintenance, repair, refurbishment, rehabilitation, retrofit, remodeling, and other repetitive-type work, on an as-needed basis, to Angeles Contractor, Inc., in the aggregate work order amount not-to-exceed the maximum amount of the Job Order Contract.

6. Authorize the Executive Director, or his designee, upon his determination and as necessary and appropriate under the terms of the Job Order Contract, to amend the Job Order Contract; to terminate the Job Order Contract for convenience; or to terminate the contractor's right to proceed with the performance of the Job Order Contract.

PURPOSE/JUSTIFICATION OF RECOMMENDED ACTION

Approval of the recommended actions will award a Job Order Contract (JOC) to the Lowest Responsive and Responsible Bidder and authorize the Executive Director, or his designee, to issue work orders and adopt the January 2016 Job Order Contract Construction Task Catalog.

The JOC program is a flexible, cost-effective, unit price, and indefinite quantity contracting method used to effectively and efficiently accomplish maintenance, repair, refurbishment, rehabilitation, retrofit, and other repetitive-type work for Commission projects including the Residential Sound Insulation Program, Community Business Revitalization Program, Single-Family Grant Program, Community Development Block Grant projects, and other Commission projects without extensive plans and specifications. This process reduces administrative costs and lowers direct construction costs while meeting all Federal, State, and County procurement requirements.

JOC programs have been successfully implemented by the Commission, County's Internal Services Department, Department of Public Works and other local and Federal agencies.

As required by the California Public Contract Code section 20128.5, the proposed JOC will have a one year term, and will be used for maintenance, repair, remodeling, and refurbishment or other repetitive work, but will not be used for new construction.

FISCAL IMPACT/FINANCING

There is no impact on the County general fund. The contract will be funded with various funds included in the Commission's approved Fiscal Year 2015-2016 budget, and to be included in all future years' budgets accordingly

The Commission will incur JOC expenditures to the extent that project funds are available. Total expenditures will not exceed \$4,500,000.

FACTS AND PROVISIONS/LEGAL REQUIREMENTS

On April 3, 2012, your Board approved the award of a contract to the Gordian Group for consulting services to assist the Commission with the development, implementation, and support of the JOC program. The Gordian Group prepared the JOC Construction Task Catalog, which includes the labor, equipment, material costs, and specifications necessary for work under a JOC. The JOC Construction Task Catalog was updated in January 2016, and requires adoption by your Board.

The program is being funded with various funding sources included in the Commission's approved Fiscal Year 2015-2016 budget. All funding for future years will be included in the Commission's annual budget process accordingly.

Angeles Contractor, Inc. will comply with the requirements of the Greater Avenues for Independence (GAIN) Program, the General Relief Opportunity for Work (GROW) Program implemented by the County of Los Angeles, or Section 3 of the Housing and Community Development Act of 1968, as amended, which requires that employment and other economic opportunities generated by certain HUD assistance be directed to low- and very low-income persons, particularly to persons who are recipients of HUD housing assistance.

The JOC has been approved as to form by County Counsel and executed by Angeles Contractor, Inc.

ENVIRONMENTAL DOCUMENTATION

Pursuant to Title 24 of the Code of Federal Regulations, Section 58.35 (a)(3)(i),(ii) & (iii), this action is excluded from the National Environmental Policy Act because it involves activities that will not alter existing environmental conditions. Award of the JOC, adoption of the January 2016 Job Order Contract Construction Task Catalog, and authorization for the Executive Director or his designee to issue work orders under the JOC are not a project under California Environmental Quality Act (CEQA) Guidelines because they are excluded from the definition of project under Section 15378(b) of the State CEQA Guidelines. These activities are administrative actions of government and also involve the creation of a government funding mechanism or other government fiscal activities that do not involve any commitment to any specific project, which may result in a potentially significant impact or direct or indirect changes to the environment.

JOCs provide facilities repairs, maintenance, retrofits, and refurbishment services requested by the Commission, which are generally categorically exempt under Section 15301, Class 1 of the State CEQA Guidelines. The proposed projects are covered by the general rule that CEQA applies only to the projects that have the potential for causing a significant effect on the environment. Your Board's approval of the JOC does not include approval of work done pursuant to specific work orders. The implementation of each work order under the JOC shall be subject to prior determination and documentation by the Commission that the work is categorically exempt from CEQA. In the event the work is not exempt, your Board will be requested to approve the appropriate environmental finding and any applicable documentation pursuant to CEQA prior to implementation of work orders under the JOC.

CONTRACTING PROCESS

On January 13, 2016, the Commission publicly advertised bids on an open-competitive basis, in accordance with applicable Federal, State, and County requirements, to identify contractors to complete work on the JOC program. Announcements were sent to 506 contractors identified from the Commission vendor list. Advertisements also appeared in eight local newspapers and on the County and Commission websites.

On February 9, 2016, 14 bids were received and formally opened. The lowest bid, submitted by Angeles Contractor, Inc., was determined to be the lowest, responsive, and responsible bid, and it is being recommended for the JOC award.

The Summary of the Outreach Activities and bid results are provided as Attachment A.

IMPACT ON CURRENT SERVICES (OR PROJECTS)

The award of the JOC will expedite the completion of maintenance, repair, refurbishment, and other repetitive-type work for Commission projects in a timely and cost-effective manner.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Sean Rogan", followed by a horizontal line extending to the right.

SEAN ROGAN
Executive Director

SR:SS:iv

ATTACHMENT A
Summary of Outreach Activities

On January 13, 2016, the following outreach was initiated to identify contractors for the Job Order Contract.

A. Newspaper Advertising

Announcements appeared in the following local newspapers:

LA Times
The Daily News
International Daily News
LA Opinion
L.A. Sentinel
Dodge Construction News/Green sheet
Eastern Group Publications
Wave Community Newspapers

An announcement was also posted on the County and Commission websites.

B. Distribution of Bid Packages:

The Commission's vendor list was used to emailed notifications to 506 contractors. As a result of the outreach, 55 bid packages were requested and downloaded through the Commission's Website by contractors.

C. Pre-Bid Conference and Site Walk

On January 26, 2016, a mandatory pre-bid conference was conducted. Thirty-five firms were in attendance.

D. Bid Results:

Contractors provided Adjustment Factors which will be applied to items listed in the Construction Task Catalog (CTC) in order to determine the cost of jobs.

On February 9, 2016, a total of fourteen bids were received and publicly opened. The bid result was as follows:

<u>Company</u>	<u>Composite Bid</u>
Angeles Contractor, Inc.	0.6720
Pub Construction, Inc.	0.7395
Exbon Development, Inc.	0.7405
Access Pacific, Inc.	0.7482
Interlog Corporation	0.7746
Mackone Development, Inc.	0.7983
C-1 Construction Corp.	0.8984
KLD Construction Corp.	0.9212
Vincor Construction Inc.	0.9416
Spec Construction Co, Inc.	0.9516
Cal-City Construction, Inc.	0.9525
MTM Construction, Inc.	0.9850
Harry H. Joh Construction, Inc.	1.0200
New Creation Builders	1.0898

Angeles Contractor Inc.'s Adjustment Factor of 0.6720 indicates that Angeles Contractor Inc. will charge the Commission 67.20% of the listed price for items in the CTC.

E. Minority/Female Participation

<u>Name</u>	<u>Ownership</u>	<u>Employees</u>
Angeles Contractor, Inc.	Minority	Total: 66 48 Minorities 8 Women 73% Minorities 12% Women
Pub Construction, Inc.	Not a Minority	Total: 21 18 Minorities 4 Women 86% Minorities 19% Women
Exbon Development, Inc.	Minority and Women	Total: 35 35 Minorities 3 Women 100% Minorities 9% Women

**COMMUNITY DEVELOPMENT COMMISSON
OF THE COUNTY OF LOS ANGELES**

JOB ORDER CONTRACT NUMBER 30

BID NUMBER: CDC16-003

Bid Date: February 9, 2016

**COMMUNITY DEVELOPMENT COMMISSION
OF THE
COUNTY OF LOS ANGELES**

JOB ORDER CONTRACT

This JOB ORDER CONTRACT 30 (or "Contract") is made this ___ day of March, 2016 by and between the **Community Development Commission** of the County of Los Angeles, a body corporate and politic, hereinafter referred to as the "**Commission**" or the "**Owner**", and **Angeles Contractor, Inc.**, hereinafter referred to as the "**Contractor**".

WITNESSETH, that the Commission and the Contractor, for the consideration stated herein, mutually agree as follows:

ARTICLE 1
STATEMENT OF WORK

- 1.1 The Contractor shall be bound by the Construction Task Catalog dated January 2016, and all other items forming the Contract Documents.
- 1.2 The term "Work" includes performance, as set forth in the Contract Documents by the Contractor for improvement work on individual Work Orders. The Contractor shall provide and perform all Work and take all the necessary measures to complete Work on individual Work Orders against this Job Order Contract as described in the General Conditions attached hereto and made a part hereof, in a proper and workmanlike manner in strict accordance with the Contract Documents, and shall perform all obligations imposed by the Contract.
- 1.3 Commission desires the Contractor to perform the Work on the terms and conditions hereinafter set forth, and Contractor agrees to perform said Work on terms and conditions set forth below in a professional manner, to the satisfaction of the Commission.

ARTICLE 2
THE CONSTRUCTION CONTRACT

- 2.1 The Construction Contract means and includes all of the "Contract Documents". The Contract Documents which form the Construction Contract are incorporated herein by this reference and are made a part of this Construction Contract as if fully set forth herein. The Contract Documents consist of the following component parts:

PART A	Instructions to Bidders and General Conditions
PART B	Construction Task Catalog January 2016 (CTC) and Technical Specifications.
PART C	Bidder's Documents, Representations, Certifications, Bid, and Other Statements of Bidder

ALL ADDENDA TO THE ABOVE CONTRACT DOCUMENTS.

ARTICLE 3
TIME OF COMMENCEMENT AND COMPLETION

- 3.1 This is an annual Contract for repair, remodeling, or other repetitive work to be done according to unit prices specified in individual Job Orders. The effective date of the Contract shall be the date that the Contract is fully executed. All Job Orders must be issued within one year from the effective date of the Contract. In the event that a Job Order has been timely issued within such one-year period, but the work has not been completed within such period, the work may be completed thereafter, subject to all provisions of this Contract.

This contract is for a not-to-exceed amount of \$1,000,000 with the option by the Commission to extend the dollar amount to the maximum as set forth in the California Public Contract Code section 20128.5. The current annual adjusted amount, which reflects the percentage change in the California Consumer Price Index, for repair, remodeling, or other repetitive work to be done according to unit prices is in excess of \$4,500,000.

Performance time for each Job Order issued under this Contract will be determined in accordance with the General Conditions. The Schedule for each individual Job Order will determine at time of job order.

- 3.2 Performance shall be specified in each individual Job Order issued hereunder. Individual Job Order performance time will be negotiated in accordance with Supplemental General Conditions, Article 1.05, entitled "Ordering Procedures." The Contractor may, on individual Work Orders, be required to pay to the Community Development Commission of the County of Los Angeles as liquidated damages a sum in accordance with Supplemental General Conditions, Article 3.09, entitled "Liquidated Damages" for each calendar day that the Contractor shall be in default on that individual Work Order.

The Contractor shall not be charged with liquidated damages because of any delay in the completion of the Work due to unforeseeable causes beyond the control and without the fault or negligence of the Contractor.

The Owner may withhold, or cause to be withheld, from any monies payable on account of Work performed by the Contractor or subcontractor any accrued liquidated damages, amounts necessary to cover stop notices or alleged labor underpayments.

ARTICLE 4
CONTRACT SUM

- 4.1 The contract is an indefinite-quantity contract for the repair and/or remodel of the items specified. The maximum amount that may be ordered under this contract is stated in 3.1. There is no minimum or maximum value associated with individual Work Orders.

The Contractor shall perform all work required, necessary, proper for or incidental to completing the work called for in each individual Job Order issued against this Job Order Contract using the Construction Task Catalog February 2014 (CTC) and Technical Specifications incorporated herein using the following adjustment factors:

CA Commercial Prevailing Wage Adjustment Factor	<u>0.6800</u>
CA Residential Prevailing Wage Adjustment Factor	<u>0.6800</u>
Federal Residential Prevailing Wage Adjustment Factor	<u>0.6800</u>
Federal Building Prevailing Wage Adjustment Factor	<u>0.6800</u>
Non-prevailing Wage Adjustment Factor	<u>0.5000</u>
CA Commercial Overtime Prevailing Wage Adjustment Factor	<u>0.7000</u>
CA Residential Overtime Prevailing Wage Adjustment Factor	<u>0.7000</u>
Federal Residential Overtime Prevailing Wage Adjustment Factor	<u>0.7000</u>
Federal Building Overtime Wage Adjustment Factor	<u>0.7000</u>
Non-prevailing Overtime Wage Adjustment Factor	<u>0.7000</u>

- 4.2 The Contract Sum set forth herein includes the payment by Contractor of all sales and use taxes required by any local codes, or any law existing or which may hereafter be adopted by federal, state or governmental authority, taxing the materials, services required or labor furnished, and of any other tax levied by reason of the Work to be performed hereunder.
- 4.2 The Contract Sum is not subject to escalation, the Contractor having satisfied him/herself with said Contract Price, which includes all labor and material increases anticipated throughout the duration of this Construction Contract.
- 4.3 The Owner's obligation for purpose of this contract, may be payable from various sources of, including funds from the Department of Housing and Urban Development (HUD), federal, state, and county funds, and any other funds.

ARTICLE 5
PROGRESS PAYMENTS

- 5.1 Based upon applications for payment submitted by the Contractor to the Owner, and after approval by the Construction Management Division, the Owner shall make progress payments on account of the Contract Sum to the Contractor, as provided in the Instruction to Bidders of the Construction Contract.
- 5.2 Approved applications for progress payments will be paid by the thirtieth day of each month, provided that application for payment has been submitted to the Owner on or before the first working day of the month. Payment shall be subject to all provisions of

Section 01003, paragraphs 3.03.A. and B. of the Instructions to Bidders incorporated by reference into the Contract.

- 5.3 The Contractor and each Subcontractor shall submit all required Labor Compliance forms to the Commission before the start of construction. The Contractor shall submit to the Commission all of its payrolls for each pay period within seven (7) days after the pay period has ended. The Contractor shall also collect, review and submit to the Commission all of its subcontractors' payrolls for each pay period within seven (7) days after the pay period has ended. Contractor's failure to submit its payrolls or any subcontractor payrolls within seven (7) days after the pay period has ended, is a violation of this Contract and entitles the Commission to withhold up to ten percent (10%) from any pending progress payment until all such payrolls are received. Repeated, ongoing or flagrant failures by the Contractor to submit the required forms, its payrolls or the payrolls of its subcontractors in a timely manner and in accordance with this provision constitutes a material breach of this Contract which may result in the Commission terminating the Contract for default.
1. Lump Sum Payment – If an individual Work Order is scheduled for completion within 45 days or less, the County will make one payment after 30 days of Work to the Contractor, exclusive of Retention. Contractor may request for one payment (including Retention payment); however, payment will be made after Final Acceptance of the Work Order.
 2. Partial Payment – The County will consider a request for partial payments for Work Orders scheduled for a performance period of greater than 45 days.

ARTICLE 6
PROJECT CLOSEOUT

- 6.1 Prior to occupancy of any dwelling unit, building, or other portion of the project, the Owner shall receive a certificate from the Contractor that such portion of the project is ready for occupancy, and shall cause a Notice of Completion to be issued. A Notice of Completion shall be issued only when the Work, including all phases thereof, is finally completed, and all requirements of this Construction Contract have been satisfied. The Owner shall cause the Notice of Completion to be recorded with the County Recorder.
- 6.2 Upon Issuance of a Notice of Completion, final payment shall be made to the Contractor of the entire unpaid balance of the Contract Sum, including any sums due to the Contractor for changes in the Work approved by the Owner pursuant to Section 01003 paragraph 3.03.E. of the Instruction to Bidders, less any amounts which Owner is entitled to receive from the Contractor under the terms of this Contract or amounts necessary to cover stop notices or alleged labor underpayments, and less the five percent (5%) retention withheld, pursuant to Section 01003 paragraph 3.03.E. of the Instruction to Bidders.
- 6.3 In addition to all other requirements, a Notice of Completion shall be issued only when Owner has received the following:
- A. A Certificate of Completion, executed by Owner.

- B. All guarantees, warranties and Maintenance & Operational Manuals and any other Submittals required by the Owner, issued by the manufacturers or installers of equipment or other component parts of the project. Contractor guarantees that the equipment, materials, and workmanship, not otherwise covered by a guarantee or warranty, will be free from defects in materials and workmanship for a period of one (1) year following date of final acceptance of the project.
 - C. The waiver and release of all liens, claims of liens, or stop notice rights of the Contractor and all subcontractors, and the Contractor's Certificate and Release.
 - D. Verification from the Architect that Contractor has removed all waste materials, rubbish, tools, construction equipment, machinery, and surplus materials from the project site. If the Contractor has failed to remove any of such items, the Owner may remove such items, and the Contractor shall pay the Owner for all costs incurred in connection with such removal.
- 6.4 After recordation of the Notice of Completion, and expiration of the thirty-day period for filing of stop notices, the Owner shall use reasonable efforts to settle all claims and disputes, notify the Contractor of final acceptance of the project, and make final payment of the entire unpaid balance of the Contract Sum, including the five percent (5%) retention, less any amounts which the Owner is entitled to receive from the Contractor under the terms of this Construction Contract, including liquidated damages, and less amounts necessary to cover stop notices or alleged labor underpayments.

ARTICLE 7
BREACH AND TERMINATION

- 7.1 Waiver by the Owner of any breach of this Construction Contract shall not constitute a waiver of any other breach or of any future breach. No payment made hereunder shall be construed to be an acceptance of defective Work or improper materials.
- 7.2 In addition to any right of termination reserved to the Owner by Section 01003 paragraph 3.10 .of the Instruction to Bidders of the Construction Contract, the Owner may terminate this Construction Contract or performance under this Construction Contract, if the Contractor is adjudged bankrupt, a receiver is appointed because of the Contractor's insolvency, or the Contractor makes a general assignment for the benefit of its creditors, fails to make prompt payment to subcontractor(s), or for material or labor, persistently disregards laws, ordinances, rules, regulations or orders of any public authority having jurisdiction, fails to construct the project in accordance with the Drawings and Specifications, or otherwise substantially violates any provision of the Contract Documents.
- 7.3 The Owner shall give the Contractor and his/her surety written notice prior to terminating this Construction Contract or performance under this Construction Contract, pursuant to Section 01003 paragraph 3.10 of the Instruction to Bidders, provided that the Contractor shall, upon receipt of such notice, immediately stop the installation of improvements, or other permanent construction work encompassing part of the project. Upon termination, the Owner may take possession of the project and all materials, equipment, tools, and

construction equipment and machinery owned by the Contractor and located at the project site, and may finish the project by whatever method it may deem expedient. In such case, the Contractor shall not be entitled to receive any further payment under this Construction Contract.

7.4 The Owner shall not be deemed to have waived any of its other rights or remedies against the Contractor by exercising its right of termination under this Article.

7.5 Termination for Cause: This Contract may be terminated by the Commission upon written notice to the Contractor for cause (failure to perform satisfactorily any of the Contract terms, conditions, and Work items) with no penalties upon termination or upon the occurrence of any of the following events:

A. Continuing failure of the Contractor to perform any Work required to be performed hereunder in a timely and professional manner, or Contractor is not properly carrying out the provisions of the Contract in their true intent and meaning, then in such case, notice thereof in writing will be served upon the Contractor; and should the Contractor neglect or refuse to provide a means for a satisfactory compliance with this Contract and with the direction of the Commission within the time specified in such notices, the Commission shall have the power to suspend the performance of this Contract by Contractor in whole or in part.

B. Failure on the part of the Contractor to procure or maintain insurance required by this Contract shall constitute a material breach of contract upon which the Commission may immediately terminate this Contract.

C. Should the Contractor fail within five (5) days to perform in a satisfactory manner, in accordance with the provisions of this Contract, or if the Work to be done under said Contract is abandoned for more than three (3) days by the Contractor, then notice of deficiency thereof in writing will be served upon the Contractor. Should the Contractor fail to comply with the terms of said Contract within five (5) days, upon receipt of said written notice of deficiency, the Executive Director of the Commission shall have the power to suspend or terminate the operations of the Contractor in whole or in part.

D. In the event that a petition of bankruptcy shall be filed by or against the Contractor.

E. If, through any cause, the Contractor shall fail to fulfill, in a timely and proper manner, the obligations under this Contract, or if the Contractor shall violate any of the covenants, agreements, or stipulations of this Contract, the Commission shall thereupon have the right to terminate this Contract by giving written notice to the Contractor of such termination and specifying the effective date thereof, at least five (5) days before the effective date of such termination. In such event, all finished or unfinished documents, data, studies, surveys, drawings, maps, models, photographs and reports prepared by the Contractor under this Contract shall, at the option of the Commission become its property and the Contractor shall be entitled to receive just and equitable compensation for any work satisfactorily completed.

7.6 Termination for Improper Consideration: The Commission may, by written notice to the Contractor, immediately terminate the right of the Contractor to proceed under this Construction Contract if it is found that consideration, in any form, was offered or given by the Contractor, either directly or through an intermediary, to any Commission officer, employee or agent with the intent of securing the Contract or securing favorable treatment with respect to the award, amendment or extension of the Contract or the making of any determinations with respect to the Contractor's performance pursuant to the Contract. In the event of such termination, the Commission shall be entitled to pursue the same remedies against the Contractor as it could pursue in the event of default by the Contractor.

The Contractor shall immediately report any attempt by the Commission officer or employee to solicit such improper consideration. The Report shall be made to the Commission's Executive Director or designee.

Among other items, such improper consideration may take the form of cash, discounts, service, the provision of travel or entertainment, or tangible gifts.

7.7 Termination for Convenience: The Commission reserves the right to cancel this Contract for any reason at all upon thirty (30) days prior written notice to Contractor. In the event of such termination, Contractor shall be entitled to a prorated portion paid for all satisfactory work unless such termination is made for cause, in which event, compensation, if any, shall be adjusted in such termination.

7.8 The Commission's Quality Assurance Plan: The Commission will evaluate Contractor's performance under this Contract on not less than a quarterly basis. Such evaluation will include assessing Contractor's compliance with all Contract terms and performance standards. Contractor deficiencies which the Commission determines are severe or continuing and that may place performance of the Contract in jeopardy if not corrected will be reported to the Board of Commissioners. The report will include improvement/corrective action measures taken by the Commission and the Contractor. If improvement does not occur consistent with the corrective action measures, the Commission may terminate this Contract or pursue other penalties as specified in this Contract.

7.9 Non-payment after expiration or termination: Contractor shall have no claim against the Commission for payment of any money or reimbursement, of any kind whatsoever, for any service provided by Contractor after the expiration or other termination of this Agreement. Should Contractor receive any such payment, it shall immediately notify the Commission and shall immediately repay all such funds to the Commission. Payment by the Commission for services rendered after expiration/termination of this Agreement shall not constitute a waiver of the Commission's right to recover such payment from Contractor. This provision shall survive the expiration or other termination of this Agreement.

ARTICLE 8
MISCELLANEOUS PROVISIONS

- 8.1 Contractor shall give all notices and comply with all laws, rules, regulations, ordinances and orders of any governmental entity relating to the Work. Should Contractor become aware that any provision of the Construction Contract is at variance with any such rule, law, regulation, ordinance or order, he/she shall promptly give notice in writing to the Owner of such variance.
- 8.2 It is hereby declared to be the intention of the parties that the sections, paragraphs, sentences, clauses and phrases of this Construction Contract are severable, and if any phrase, clause, sentence, paragraph or section of this Construction Contract shall be declared unconstitutional, invalid or unenforceable by the valid judgment or decree of a court of competent jurisdiction, such unconstitutionality, invalidity or unenforceability shall not affect any of the remaining phrases, clauses, sentences, paragraphs and sections of this Construction Contract.
- 8.3 Anything mentioned in the Specifications and not shown on the Drawings, or shown on the Drawings and not mentioned in the Specifications, shall be of like effect as if shown or mentioned in both. In case of difference between Drawings and Specifications, the Specifications shall govern. In case of discrepancy within the Drawings, or within the Specifications, the matter shall be promptly submitted to the Contracting Officer, who shall promptly make a determination in writing. Any adjustment by the Contractor without such a determination by the Contracting Officer shall be at its own risk and expense. The Contracting Officer shall furnish from time to time such detailed drawings and other information as considered necessary, unless otherwise provided.

ARTICLE 9
CONTRACTOR APPROVAL

- 9.1 Contractor's Adherence to the Child Support Compliance Program
Contractor shall: 1) fully comply with all applicable State and Federal reporting requirements relating to employment reporting for its employees; and, 2) comply with all lawfully served Wage and Earnings Assignment Orders and Notice of Assignment and continue to maintain compliance during the term of any contract that may be awarded pursuant to this solicitation. Failure to comply may be cause for termination of a contract or initiation of debarment proceedings against the non-compliant contractor.
- 9.2 Contractor's Warranty of Adherence to Commission's Child Support Compliance Program
Contractor acknowledges that the Commission has established a goal of ensuring that all individuals who benefit financially from the Commission through a contract, are in compliance with their court-ordered child, family and spousal support obligations in order to mitigate the economic burden otherwise imposed upon the taxpayers of the County of Los Angeles.

As required by the Commission's Child Support Compliance Program and without limiting Contractor's duty under this Contract to comply with all applicable provisions of law,

Contractor warrants that it is now in compliance and shall, during the term of this Contract, maintain compliance with employment and wage reporting requirements as required by the Federal Social Security Act (42 USC Section 653a) and California Unemployment Insurance Code Section 1088.5, and shall implement all lawfully served Wage and Earnings Withholding Orders or Child Support Services Department (CSSD) Notices of Wage and Earnings Assignment for Child or Spousal Support, pursuant to Code of Civil Procedure Section 706.031 and Family Code Section 5246(b).

9.3 Termination For Breach of Warranty to Comply with Commission's Child Support Compliance Program

Failure of Contractor to maintain compliance with the requirements set forth in Paragraph 9.2, "Contractor's Warranty of Adherence to County's Child Support Compliance Program" shall constitute default under this Contract. Without limiting the rights and remedies available to the Commission under any other provision of this Contract, failure of Contractor to cure such default within ninety (90) calendar days of written notice shall be grounds upon which the Commission may terminate this Contract pursuant to Paragraphs under 7.5- "Termination for Cause" and pursue debarment of Contractor, pursuant to Commission Policy.

9.4 Post L. A.'s Most Wanted Parents List

Contractor acknowledges that the Commission places a high priority on the enforcement of child support laws and the apprehension of child support evaders. Contractor understands that it is the Commission's policy to encourage the Commission contractors to voluntarily post the Commission's "L.A.'s Most Wanted: Delinquent Parents" poster in a prominent position at Contractor's place of business. District Attorney will supply Contractor with the poster to be used.

ARTICLE 10
ADDITIONAL PROVISIONS

10.1 This Construction Contract and the obligations of the parties hereunder shall be interpreted, construed and enforced in accordance with the laws of the State of California.

10.2 This Construction Contract contains the entire agreement between the parties. No variations, modifications, or changes hereto shall be binding upon any party hereto unless set forth in a document duly executed by or on behalf of such party. All prior negotiations, representations and/or contracts between the parties relative to the subject matters hereof shall be superseded hereby and have no further force and effect.

10.3 No consent or waiver, expressed or implied, by either party to or of any breach or default by the other of its obligations hereunder shall be deemed or construed to be a consent or waiver to or of any other breach or default in the performance of such other party hereunder. Failure on the part of either party to complain of any such act of the other party or to declare the other party in default, irrespective of how long such failure continues, shall not constitute a waiver by such party of its rights hereunder.

10.4 Without limiting Contractor's duties to indemnify and defend as provided in this Contract, Contractor shall procure and maintain, at Contractor's sole expense for the duration of this Contract, the insurance policies described herein. Such insurance shall be secured from carriers admitted in California, or authorized to do business in California. Such carriers shall be in good standing with the California Secretary of State's Office and the California Department of Insurance. Such carriers must be admitted and approved by the California Department of Insurance and must be included on the California Department of Insurance List of Eligible Surplus Line Insurers (hereinafter "LESLI"). Such carriers must have a minimum rating of or equivalent to A:VIII in Best's Insurance Guide. Contractor shall, concurrent with the execution of this Contract, deliver to the Commission certificates of insurance with original endorsements evidencing the insurance coverage required by this Contract. If original endorsements are not immediately available, such endorsements may be delivered subsequent to the execution of this Contract, but no later than thirty (30) days following execution of this Contract. The certificates and endorsements shall be signed by a person authorized by the insurers to bind coverage on its behalf. Contractor shall provide the Commission with certificates of insurance and applicable endorsements each year during the term of this Contract to evidence its annual compliance with the insurance requirements set forth herein. The Commission reserves the right to require complete certified copies of all policies at any time. Said insurance shall be in a form acceptable to the Commission and may provide for such deductibles as may be acceptable to the Commission. Any self-insurance program and self-insured retention must be separately approved by the Commission. In the event such insurance does provide for deductibles or self-insurance, Contractor agrees that it will defend, indemnify and hold harmless the Commission, its elected and appointed officers, officials, representatives, employees, and agents in the same manner as they would have been defended, indemnified and held harmless if full coverage under any applicable policy had been in effect. Each policy shall be endorsed to stipulate that the Commission be given at least thirty (30) days' written notice in advance of any cancellation or any reduction in limit(s) for any policy of insurance required herein. Contractor shall give the Commission immediate notice of any insurance claim or loss which may be covered by insurance. Contractor represents and warrants that the insurance coverage required herein will also be provided by any entities with which Contractor contracts, as detailed below. All certificates of insurance and additional insured endorsements shall carry the following identifier: Job Order Contract #30

The insurance policies set forth herein shall be primary insurance with respect to the Commission. The insurance policies shall contain a waiver of subrogation for the benefit of the Commission. Failure on the part of Contractor, and/or any entities with which Contractor contracts, to procure or maintain the insurance coverage required herein may, upon the Commission's sole discretion, constitute a material breach of this Contract pursuant to which the Commission may immediately terminate this Contract and exercise all other rights and remedies set forth herein, at its sole and absolute discretion, and without waiving such default or limiting the rights or remedies of the Commission, procure or renew such insurance and pay any and all premiums in connection therewith and all monies so paid by the Commission shall be immediately repaid by the Contractor to the Commission upon demand including interest thereon at the default rate. In the event of such a breach, the Commission shall have the right, at its sole election, to participate in and control any insurance claim, adjustment, or dispute with the insurance carrier. Contractor's failure to

assert or delay in asserting any claim shall not diminish or impair the Commission's rights against the Contractor or the insurance carrier.

When Contractor or any entity with which Contractor contracts, is naming the Commission as an additional insured on any of the insurance policies set forth herein, then the additional insured endorsement shall contain language similar to the language contained in ISO form CG 20 10 11 85. In the alternative and in the Commission's sole and absolute discretion it may accept CG 20 10 10 01 and CG 2037 10 01 in place of CG 20 10 11 85. When any entity with which Contractor is contracting, is naming the Commission as an additional insured on any of the insurance policies set forth herein, then the additional insured endorsement shall contain language similar to the language contained in ISO form CG 20 10 11 85.

The following insurance policies shall be maintained by Contractor and any entity with which Contractor contracts for the duration of this Contract unless otherwise set forth herein:

- A. GENERAL LIABILITY INSURANCE (written on ISO policy form CG 20 10 85 or it's equivalent) including coverage for personal injury, death, property damage and contractual liability with limits of not less than the following:

General Aggregate	\$2,000,000
Products/ Completed Operations Aggregate	\$2,000,000
Personal and Advertising Injury	\$1,000,000
Each Occurrence	\$1,000,000

This policy shall also include coverage for explosion, collapse, and underground ("XCU") property damage liability. The Commission, the Community Development Commission of the County of Los Angeles ("Commission"), the County of Los Angeles ("County") (Commission, Commission and County are hereinafter collectively referred to as "Public Agencies"), and each of their elected and appointed officers, officials, representatives, employees, and agents (hereinafter collectively referred to as "Agents") shall be covered as additional insureds on such policy.

- B. WORKERS' COMPENSATION and EMPLOYER'S LIABILITY insurance providing workers' compensation benefits, as required by the Labor Code of the State of California. In all cases, the above insurance shall include Employer's Liability coverage with limits of not less than the following:

Each Accident	\$1,000,000
Disease-Policy Limit	\$1,000,000
Disease-Each Employee	\$1,000,000

- C. AUTOMOBILE LIABILITY INSURANCE (written on ISO policy form CA 00 01 or its equivalent) with a limit of liability of not less than one million dollars (\$1,000,000) for each incident. Such insurance shall include coverage of all "owned", "hired", and "non-owned" vehicles, or coverage for "any auto." The Public Agencies and their Agents shall be covered as additional insureds on such policy.

Contractor agrees that it will require that all of the above mentioned insurance requirements be incorporated in its contract with any entity with which it contracts in relation to this Contract or in relation to the Work, property or project that is the subject of this Contract.

- D. CRIME/FIDELITY INSURANCE, including coverage against loss of money, securities, inventory or other property. This insurance shall provide coverage for alleged employee dishonesty, embezzlement, forgery, robbery, safe burglary, computer fraud, wire transfer fraud, counterfeiting, and other criminal acts with limits in amounts not less than indicated below:

Employee Theft Coverage	\$100,000
Forgery Coverage	\$100,000
Client Coverage	\$100,000

- E. POLLUTION LIABILITY INSURANCE including coverage for bodily injury, property damages, and environmental damage with limits of not less than the following:

General Aggregate	\$ 1,000,000
Completed Operations	\$ 1,000,000
Each Occurrence	\$ 500,000

Said policy shall also include, but not be limited to: coverage for any and all remediation costs, including, but not limited to, restoration costs, and coverage for the removal, repair, handling, and disposal of asbestos and/or lead containing materials. The Public Agencies and their Agents shall be covered as additional insureds on the pollution liability insurance policy. If the general liability insurance policy and/or the pollution liability insurance policy is written on a claims-made form, then said policy or policies shall also comply with all of the following requirements:

- (i) The retroactive date must be shown on the policy and must be before the date of this Contract or the beginning of the Work;
- (ii) Insurance must be maintained and evidence of insurance must be provided for the duration of this Contract or for five (5) years after completion of the Work, whichever is greater;
- (iii) If coverage is canceled or non-renewed, and not replaced with another claims-made policy form with a retroactive date prior to the effective date of this Contract, then the contractor must purchase an extended period coverage for a minimum of five (5) years after completion of Work;
- (iv) A copy of the claims reporting requirements must be submitted to the Commission for review; and

(v) If the Work involves lead based paint or asbestos identification/remediation, then the Contractors Pollution Liability shall not contain any lead-based paint or asbestos exclusions.

Contractor agrees that it will require that all of the above mentioned insurance requirements be incorporated in its contract with any entity with which it contracts in relation to this Contract or in relation to the Work, Property or project that is the subject of this Contract.

- F. PROFESSIONAL LIABILITY INSURANCE (if applicable), including coverage for personal injury, death, property damage, and contractual liability in an amount not less than One Million Dollars (\$1,000,000). Said insurance shall be maintained for the statutory period during which the professional may be exposed to liability. Contractor shall require that the aforementioned professional liability insurance coverage language also be incorporated into its contract with any other entity with which it contracts for professional services

10.5 Compliance With Laws

The Contractor agrees to be bound by applicable federal, state and local laws, regulations, and directives as they pertain to the performance of this Contract. This Contract is subject to and incorporates the terms of the Housing and Community Development Act of 1974, as amended by the Cranston-Gonzalez National Affordable Housing Act, 1990, and the 24 CFR Part 85. If the compensation under this Contract is in excess of \$100,000 then Contractor shall comply with applicable standards, orders, or requirements issued under section 306 of the Clean Air Act (42 U.S.C. 18579(h)), section 508 of the Clean Water Act (33 U.S.C. 1368), Executive Order 11738, and Environmental Protection Agency Regulations (40 CFR part 15).

The Contractor must obtain and present all relevant state and local insurance, training and licensing pursuant to services required within this Contract.

Contractor shall comply with the following laws:

Airport And Airway Improvement Act Of 1982, Section 520 - General Civil Rights Provisions

The contractor assures that it will comply with pertinent statutes, Executive orders and such rules as are promulgated to assure that no person shall, on the grounds of race, creed, color, national origin, sex, age, or handicap be excluded from participating in any activity conducted with or benefiting from Federal assistance. This provision obligates the tenant/concessionaire/lessee or its transferee for the period during which Federal assistance is extended to the airport a program, except where Federal assistance is to provide, or is in the form of personal property or real property or interest therein or structures or improvements thereon. In these cases the provision obligates the party or any transferee for the longer of the following periods: (a) the period during which the property is used by the airport sponsor or any transferee for a purpose for which Federal assistance is extended, or for another purpose involving the provision of similar services or benefits or (b) the period during which the airport sponsor or any transferee retains ownership or possession of the property. In the case of contractors, this provision binds the contractors from the bid

solicitation period through the completion of the contract. This provision is in addition to that required of Title VI of the Civil Rights Act of 1964.

Buy American Preferences

The Buy American Preferences under 49 U.S.C. § 50101 require that all steel and manufactured goods used in Airport Improvement Program (AIP) funded projects be produced in the United States. In accepting AIP funding, grant recipients must certify that all steel or manufactured products used on any portion of the AIP-funded project are produced in the United States and are of 100 percent U.S. materials.

Contract Work-hours And Safety Standards Act Requirements 29 CFR Part 5

1. Overtime Requirements.

No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic, including watchmen and guards, in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

2. Violation; Liability for Unpaid Wages; Liquidated Damages.

In the event of any violation of the clause set forth in paragraph (1) above, the contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph 1 above, in the sum of \$10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph 1 above.

3. Withholding for Unpaid Wages and Liquidated Damages.

The Federal Aviation Administration or the Sponsor shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any monies payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other Federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph 2 above.

4. Subcontractors.

The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraphs 1 through 4 and also a clause requiring the subcontractor to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs 1 through 4 of this section.

Civil Rights Act of 1964, Title VI (Non-discrimination in Federally Assisted Programs)

Title VI provides that no person shall, on the grounds of race, color, national origin, or sex be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance.

Disadvantaged Business Enterprises

Contract Assurance (§26.13) - The contractor or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The contractor shall carry out applicable requirements of 49 CFR Part 26 in the award and administration of DOT assisted contracts. Failure by the contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy, as the recipient deems appropriate.

NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION - 41 CFR PART 60-2

1. The Offeror's or Bidder's attention is called to the "Equal Opportunity Clause" and the "Standard Federal Equal Employment Opportunity Construction Contract Specifications" set forth herein.
2. The goals and timetables for minority and female participation, expressed in percentage terms for the contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

Timetables

Goals for minority participation for each trade (Vol. 45 Federal Register pg. 65984 10/3/80)

Goals for female participation in each trade (6.9%)

These goals are applicable to all the contractor's construction work (whether or not it is Federal or federally-assisted) performed in the covered area. If the contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for such geographical area where the work is actually performed. With regard to this second area, the contractor also is subject to the goals for both its Federally involved and non-federally involved construction.

The contractor's compliance with the Executive Order and the regulations in 41 CFR Part 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 CFR 60-4.3(a), and its efforts to meet the goals. The hours of minority and female employment and training shall be substantially uniform throughout the length of the contract, and in each trade, and the contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from contractor to contractor or from project to project, for the sole purpose of meeting the contractor's goals, shall be a violation of the contract, the Executive Order, and the regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hours performed.

3. The contractor shall provide written notification to the Director, OFCCP, within 10 working days of award of any construction subcontract in excess of \$10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the name, address, and telephone number of the subcontractor; employer identification number of the subcontractor; estimated dollar amount of the subcontract; estimated starting and completion dates of subcontract; and the geographical area in which the subcontract is to be performed.
4. As used in this notice and in the contract resulting from this solicitation, the "covered area" is [insert description of the geographical areas where the contract is to be performed giving the state, county, and city, if any].

Prompt Payment (§26.29) - The prime contractor agrees to pay each subcontractor under this prime contract for satisfactory performance of its contract no later than **[10]** days from the receipt of each payment the prime contractor receives from **[CDC]**. The prime contractor agrees further to return retainage payments to each subcontractor within [10] days after the subcontractor's work is satisfactorily completed. Any delay or postponement of payment from the above referenced time frame may occur only for good cause following written approval of the **[CDC]**. This clause applies to both DBE and non-DBE subcontractors.

Section 109 of the Housing and Community Development Act of 1974

No person in the United States shall on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity funded in whole or in part with funds made available under this title.

Standard Federal Equal Employment Opportunity Construction Contract Specifications - 41 CFR Part 60.4.3

Trade Restriction Clause

The contractor or subcontractor, by submission of an offer and/or execution of a contract, certifies that it:

- a. is not owned or controlled by one or more citizens of a foreign country included in the list of countries that discriminate against U.S. firms published by the Office of the United States Trade Representative (USTR);
- b. has not knowingly entered into any contract or subcontract for this project with a person that is a citizen or national of a foreign country on said list, or is owned or controlled directly or indirectly by one or more citizens or nationals of a foreign country on said list;
- c. has not procured any product nor subcontracted for the supply of any product for use on the project that is produced in a foreign country on said list.

Unless the restrictions of this clause are waived by the Secretary of Transportation in accordance with 49 CFR 30.17, no contract shall be awarded to a contractor or subcontractor who is unable to certify to the above. If the contractor knowingly procures or subcontracts for the supply of any product or service of a foreign country on said list for use on the project, the Federal Aviation Administration may direct through the Sponsor cancellation of the contract at no cost to the Government.

Further, the contractor agrees that, if awarded a contract resulting from this solicitation, it will incorporate this provision for certification without modification in each contract and in all lower tier subcontracts. The contractor may rely on the certification of a prospective subcontractor unless it has knowledge that the certification is erroneous.

The contractor shall provide immediate written notice to the sponsor if the contractor learns that its certification or that of a subcontractor was erroneous when submitted or has become erroneous by reason of changed circumstances. The subcontractor agrees to provide written notice to the contractor if at any time it learns that its certification was erroneous by reason of changed circumstances.

This certification is a material representation of fact upon which reliance was placed when making the award. If it is later determined that the contractor or subcontractor knowingly rendered an erroneous certification, the Federal Aviation Administration may direct through the Sponsor cancellation of the contract or subcontract for default at no cost to the Government.

Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render, in good faith, the certification required by this provision. The knowledge and information of a contractor is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

This certification concerns a matter within the jurisdiction of an agency of the United States of America and the making of a false, fictitious, or fraudulent certification may render the maker subject to prosecution under Title 18, United States Code, Section 1001.

Veteran's Preference

In the employment of labor (except in executive, administrative, and supervisory positions), preference shall be given to Veterans of the Vietnam era and disabled veterans as defined in Section 515(c)(1) and (2) of the Airport and Airway Improvement Act of 1982. However, this preference shall apply only where the individuals are available and qualified to perform the work to which the employment relates.

Age Discrimination Act of 1975 and Section 504 of the Rehabilitation Act of 1973

No person in the United States shall be excluded from participating in, be denied the benefits of, or be subjected to discrimination under this Contract on the basis of age or with respect to an otherwise qualified disabled individual.

Executive Order 11246 and 11375, Equal Opportunity in Employment (Nondiscrimination in Employment by Government Contractors, Subcontractors, and Contractors)

During the performance of this Contract, the Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex or national origin. The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated fairly during employment, without regard to their race, color, religion, sex or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the contracting officer setting forth the provisions of this nondiscrimination clause. The Contractor will, in all

solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex or national origin.

The Contractor will send to each labor union or representative of workers with which he/she has a collective bargaining agreement or other contract or understanding, a notice to be provided by the Commission's contracting officer, advising the labor union or workers' representatives of the Contractor's commitments under Section 202 of Executive Order No. 11246 of September 24, 1965, and shall post copies of the notice in conspicuous places available to employees and applicants for employment. The Contractor will comply with all provisions of Executive Order No. 11246 of September 24, 1965, and of the rules, regulation and relevant orders of the Secretary of Labor.

The Contractor will furnish all information and reports required by the Executive Order No. 11246 of September 24, 1965, and by the rules, regulations and orders of the Secretary of Labor, or pursuant thereto, will permit access to his/her books, records, and accounts by the Commission and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

In the event of the Contractor's noncompliance with the nondiscrimination clauses of this Contract or with any of such rules, regulations or orders, this Contract may be canceled, terminated or suspended in whole or in part and the Contractor may be declared ineligible for further Government contracts in accordance with procedures authorized in the Executive Order and such other sanctions may be imposed and remedies invoked as provided in the Executive Order or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

The Contractor will include the provisions of these paragraphs in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of the Executive Order No. 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The Contractor will take such actions with respect to any subcontract or purchase order as the Commission may direct as a means of enforcing such provisions including sanctions for noncompliance; provided however, that in the event the Contractor becomes involved in, or is threatened with litigation with a subcontractor or vendor as a result of such direction by the Commission, the Contractor may request the United States to enter into such litigation to protect the interests of the United States.

Prevailing Wage Requirements

This Contract is funded in whole with public funds. Regardless of the funding source (federal, state or local), the Contractor shall comply with all labor requirements of the State of California prevailing wage laws, regulations, codes, etc. applicable to this contract, including but are not limited to, the following: California Labor Code Section 1770 et seq., which requires contractors to pay their workers based on the prevailing wage rates established and issued by the Department of Industrial Relations (DIR), Division of Labor Statistics. Said rates can be obtained on the website at www.dir.ca.gov. The Contractor and Subcontractor shall also: (1) Pay not less than the prevailing wage to all workers, as defined in

the California Code of Regulations (CCR) section 16000(a), and as set forth in Labor Code Sections 1771 and 1774; (2) Comply with the provisions of Labor Code Sections 1773.5, 1775, and 1777.5 regarding public works job sites; (3) Provide workers' compensation coverage as set forth in Labor Code Section 1861; (4) Comply with Labor Code Sections 1778 and 1779 regarding receiving a portion of wages or acceptance fee; (5) Maintain and make available for inspection payroll records, as set forth in Labor Code Section 1776; (6) Pay workers overtime pay, as set forth in Labor Code Section 1815 or as provided in the collective bargaining agreement adopted by the DIR Director as set forth in CCR's section 16200; (7) Comply with Section 16101 of these regulations regarding discrimination; (8) Be subject to provisions of Labor Code Section 1777.7 which specifies the penalties imposed on a contractor who willfully fails to comply with provisions of Section 1777.5; (9) Comply with those requirements as specified in Labor Code Sections 1810 and 1813; and (10) Comply with any other applicable requirements imposed by the State of California.

If federal funds are used on a project, the Federal Labor Standards Provisions (HUD 4010), including prevailing wage requirements of Davis-Bacon and Related Acts (DBRA) shall be enforced, in addition to all labor requirements of the State of California prevailing wage laws, regulations, codes, as set forth above. When federal and either state or local funds are used and a discrepancy between Federal Regulations and State Law is found to exist, the more stringent of the two shall prevail.

For residential construction projects and regardless of the funding source (federal, state or local), the State Residential Determination (issue date 12/1/2015) prevailing wage rates shall be applicable. For projects funded with federal funds or both federal and state or local funds, Federal Wage Decision CA150028 Mod. 21 Dated 12/1/2015 (federal residential) prevailing wage rates shall also be applicable in addition to the State Residential Determination prevailing wage rates, and the higher of the two rates shall be paid to all employees working at the site. In the absence of a residential prevailing wage determination, the Contractor shall refer to the Director's General Prevailing Wage Determination.

For commercial construction projects and regardless of the funding source (federal, state or local), the State [Director's General Prevailing Determinations](#) (LOS2015-2) for prevailing wage rates shall be applicable. For projects funded with federal funds or both federal and state or local funds, Federal Wage Decision CA150033 Mod. 18 dated 12/11/2015 (federal Building, Heavy & Highway Construction) shall also be applicable in addition to the State Director's General Prevailing Determinations for prevailing wage rates, and the higher of the two rates shall be paid to all employees working at the site.

For non-prevailing wage construction projects, State and Federal minimum wage requirements shall be applicable and the higher of the two rates shall be paid to all employees working at the site.

No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic, including watchmen and guards, in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such

laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

Both federal wage decisions and the State Residential Determination are attached to and part of this bid document. The State Director's General Prevailing Determinations are available on-line at www.dir.ca.gov.

Section 3 of the Housing and Community Development Act of 1968, as Amended requires that to the greatest extent feasible, opportunities for training and employment be given to lower income residents of the project area and contracts for work in connection with the project be awarded to business concerns which are located in or owned in substantial part by persons residing in the area of the project.

- A. The work to be performed under this Contract is subject to the requirements of Section 3 of the Housing and Urban Development Act of 1968, as amended, 12 U.S.C. 1701u (Section 3). The purpose of Section 3 is to ensure that employment and other economic opportunities generated by HUD assistance or HUD-assisted projects covered by Section 3, shall, to the greatest extent feasible, be directed to low- and very low-income persons, particularly persons who are recipients of HUD assistance for housing.
- B. The parties to this Contract agree to comply with HUD's regulations in 24 CFR Part 135, which implement Section 3. As evidenced by their execution of this Contract, the parties to this Contract certify that they are under no contractual or other impediment that would prevent them from complying with the Part 135 regulations.
- C. The Contractor agrees to send to each labor organization or representative of workers with which the Contractor has a collective bargaining Contract or other understanding, if any, a notice advising the labor organization or workers' representative of the Contractor's commitments under this Section 3 clause, and will post copies of the notice in conspicuous places at the work site where both employees and applicants for training and employment positions can see the notice. The notice shall describe the Section 3 preference, shall set forth minimum number and job titles subject to hire, availability of apprenticeship and training positions, the qualifications for each; and the name and location of the person(s) taking applications for each of the positions; and the anticipated date the work shall begin.
- D. The Contractor agrees to include this Section 3 clause in every subcontract subject to compliance with regulations in 24 CFR Part 135, and agrees to take appropriate action, as provided in an applicable provision of the subcontract or in this Section 3 clause, upon a finding that the subcontractor is in violation of the regulations in 24 CFR Part 135. The Contractor will not subcontract with any subcontractor where the Contractor has notice or knowledge that the subcontractor has been found in violation of the regulations in 24 CFR Part 135.
- E. The Contractor will certify that any vacant employment positions, including training positions, that are filled (i) after the Contractor is selected but before the Contract is executed, and (ii) with persons other than those to whom the regulations of 24 CFR Part

135 require employment opportunities to be directed, were not filled to circumvent the Contractor's obligations under 24 CFR Part 135.

- F. Noncompliance with HUD's regulations in 24 CFR Part 135 may result in sanctions, termination of this Contract for default, and debarment or suspension from future HUD assisted contracts.
- G. With respect to work performed in connection with Section 3 covered Indian Housing Assistance, Section 7(b) of the Indian Self-Determination and Education Assistance Act (25 U.S.C. 450e) also applies to the work to be performed under this Contract. Section 7(b) requires that to the greatest extent feasible (i) preference and opportunities for training and employment shall be given to Indians, and (ii) preference in the award of contracts and subcontracts shall be given to Indian organizations and Indian-owned Economic Enterprises. Parties to this Contract that are subject to the provisions of Section 3 and section 7(b) agree to comply with Section 3 to the maximum extent feasible, but not in derogation of compliance with section 7(b).

10.6 Access and Retention of Records

The Contractor shall provide access to the Commission, the Federal grantor agency, the Comptroller General of the United States, or any of their duly authorized representatives to any books, documents, papers and records of the Contractor which are directly pertinent to the specific Contract for the purpose of making audits, examinations, excerpts and transcriptions. The Contractor is required to retain the aforementioned records for a period of five (5) years after the Commission pays final payment and other pending matters are closed.

10.7 Conflict of Interest

The Contractor represents, warrants and agrees that to the best of its knowledge, it does not presently have, nor will it acquire during the term of this Contract, any interest direct or indirect, by contract, employment or otherwise, or as a partner, joint venturer or shareholder (other than as a shareholder holding a one percent (1%) or less interest in publicly traded companies) or affiliate with any business or business entity that has entered into any contract, subcontract or arrangement with the Commission. Upon execution of this Contract and during its term, as appropriate, the Contractor shall disclose in writing to the Commission, any other contract or employment during the term of this Contract by any other persons, business or corporation in which employment will or may likely develop a conflict of interest between the Commission's interest and the interests of the third parties.

10.8 Indemnification

The Contractor shall indemnify, defend, and hold harmless the Public Agencies and their Agents from and against any and all liability, demands, damages, claims, causes of action, fees (including reasonable attorney's fees and costs and expert witness fees), and expenses, including, but not limited to, claims for bodily injury, property damage, and death (hereinafter collectively referred to as "Liabilities"), arising from or connected with Contractor's acts, errors, and/or omissions arising from and/or relating to this Contract. Contractor shall not be required to indemnify, defend, and hold harmless the Public Agencies and their Agents from any Liabilities that arise from the active negligence, sole

negligence or willful misconduct of the Public Agencies, Public Agencies' agents, servants, or independent contractors who are directly responsible to the Public Agencies.

In the event that the Contractor provides design professional services in relation to this Contract, Work, Property or project that is the subject of this contract, Contractor agrees to indemnify, defend, and hold harmless Public Agencies and their Agents from and against any and all Liabilities that arise out of, pertain to, or relate to the negligence, recklessness, or willful misconduct of contractor, In the event that Contractor contracts with another entity for design Professional services (hereinafter " Design Professional Entity") to be provided in relation to this Contract , Work, Property or project that is the subject of this Contract, (hereinafter " Contractor-Design Professional Entity Contract"), Contractor agrees that language at least equivalent to the language in this paragraph, in favor of the Public Agencies and their Agents, shall be incorporated in the Contactor-Design Professional Entity Contract so that Design Professional Entity shall also indemnify the Public Agencies and their Agents.

The above indemnification language, or language substantially similar thereto, in favor of the Public Agencies, shall also be incorporated in Contractor's contracts with any and all entities with which it contracts in relation to the Contract, Work, or property or project that is the subject of this Contract. These indemnification provisions shall remain in full force and effect and survive the termination and/or expiration of this Contract.

10.09 Omitted

10.10 Assignment

The Contractor shall not assign its rights or delegate its duties under the Contract, or both, whether in whole or in part, without the prior written consent of the Commission, in its discretion, and any attempted assignment or delegation without such consent shall be null and void. For purposes of this paragraph, Commission consent shall require a written amendment to the Contract, which is formally approved and executed by the parties. Any payments by the Commission to any approved delegate or assignee on any claim under the Contract shall be deductible, at the Commission's sole discretion, against the claims, which the Contractor may have against the Commission. However, the Commission reserves the right to assign this Contract to another public agency without the consent of the Contractor.

Shareholders, partners, members, or other equity holders of the Contractor may transfer, sell, exchange, assign, or divest themselves of any interest they may have therein. However, in the event any such sale, transfer, exchange, assignment, or divestment is affected in such a way as to give majority control of the Contractor to any person(s), corporation, partnership, or legal entity other than the majority controlling interest therein at the time of execution of the Contract, such disposition is an assignment requiring the prior written consent of the Commission in accordance with applicable provisions of this Contract.

Any assumption, assignment, delegation, or takeover of any of the Contractor's duties, responsibilities, obligations, or performance of same by any entity other than the Contractor, whether through assignment, subcontract, delegation, merger, buyout, or any other mechanism, with or without consideration for any reason whatsoever without the

Commission's express prior written approval, shall be a material breach of the Contract which may result in the termination of the Contract. In the event of such termination, the Commission shall be entitled to pursue the same remedies against the Contractor as it could pursue in the event of default by the Contractor.

10.11 Confidentiality of Reports

The Contractor shall keep confidential all reports, information and data received, prepared or assembled pursuant to performance hereunder. Such information shall not be made available to any person, firm, corporation or entity without the prior written consent of the Commission.

10.12 Severability

In the event that any provision herein contained is held to be invalid, void or illegal by any court of competent jurisdiction, the same shall be deemed severable from the remainder of the Contract and shall in no way affect, impair or invalidate any other provision contained herein. If any such provision shall be deemed invalid due to its scope or breadth, such provision shall be deemed valid to the extent of the scope or breadth permitted by law.

10.13 Safety Standards and Accident Prevention

The Contractor shall comply with all applicable Federal, state and local laws governing safety, health and sanitation. The Contractor shall provide all safeguards, safety devices and protective equipment and take any other needed actions, on his/her own responsibility, reasonably necessary to protect the life and health of employees on the job and the public and to protect property in connection with the performance of this Contract.

10.14 Drug Free Workplace Act of the State of California

The Contractor certifies under penalty of perjury under the laws of the State of California that the Contractor will comply with the requirements of the Drug-Free Workplace Act of 1990.

10.15 Copyright

No report, maps, or other documents produced in whole or in part under this Contract shall be the subject of an application for copyright by or on behalf of the Contractor. All documents become the property of the Commission and the Commission holds all the rights to said data.

10.16 Independent Contractor

The Contractor shall perform the services as contained herein as an independent contractor and shall not be considered an employee of the Commission, or under Commission supervision or control. This Contract is by and between the Contractor and the Commission, and is not intended, and shall not be construed, to create the relationship of agent, servant, employee, partnership, joint venture, or association, between the Commission and the Contractor.

10.17 Waiver

No breach of any provision hereof can be waived unless in writing. Waiver of any one breach of any provision shall not be deemed to be a waiver of any breach of the same or any other provision hereof.

10.18 Notices

The Commission shall provide Contractor with notice of any injury or damage arising from or connected with services rendered pursuant to this Contract to the extent that the Commission has actual knowledge of such injury or damage. The Commission shall provide such notice within ten (10) days of receiving actual knowledge of such injury or damage.

Notices provided for in this Contract shall be in writing and shall be addressed to the representative of each Party.

Owner:

Community Development Commission
Scott Stevenson, Contracting Officer
700 W. Main St.
Alhambra, CA 91801

Contractor:

Angeles Contractor, Inc.
Young Kang, President
8461 Commonwealth Ave.
Buena Park, CA, 90621

Notices shall be deemed delivered on the third day after posting by U.S. Mail or when delivered in person with written acknowledgement of the receipt thereof. Commission and Contractor may designate a different address or addresses for notices to be sent by giving written notice of such change of address to all other parties entitled to receive notice.

10.19 Interpretation

No provision of this Contract is to be interpreted for or against either party because that party or that party's legal representative drafted such provision, but this Contract is to be construed as if it were drafted by both parties hereto.

10.20 Employees of Contractor

Workers' Compensation: Contractor understands and agrees that all persons furnishing services to the Commission pursuant to this Contract are, for the purposes of workers' compensation liability, employees solely of Contractor. Contractor shall bear sole responsibility and liability for providing Workers' Compensation benefits to any person for injury arising from an accident connected with services provided to the Commission under this Contract.

Professional Conduct: The Commission does not and will not condone any act, gestures, comments or conduct from the Contractor's employees, agents or subcontractors which may be construed as sexual harassment or any other type of activity or behavior that might be construed as harassment. The Commission will properly investigate all charges of harassment by residents, employees, agents or subcontractors and is responsible for taking appropriate action after reports of harassment are received by the Contractor.

Key Personnel

Please reference to the General Conditions Section 01003, Section 01003, Part 1.02.

10.21 Patent Rights

The Commission will hold all the patent rights with respect to any discovery or invention which arises or is developed in the course of, or under, this Contract.

10.22 Notice to Employees Regarding the Federal Earned Income Credit

The Contractor shall notify its employees, and shall require each subcontractor to notify its employees, that they may be eligible for the Federal Earned Income Credit under the federal income tax laws. Such notice shall be provided in accordance with the requirements set forth in Attachment A, Internal Revenue Service Notice 1015.

10.23 Use of Recycled-Content Paper Products

Consistent with the Board of Supervisors' policy to reduce the amount of solid waste deposited at the County landfills, the Contractor agrees to use recycled-content paper to the maximum extent possible on the project.

10.24 Contractor Responsibility and Debarment

A. A responsible Contractor is a contractor, consultant, vendor or operating agency who has demonstrated the attribute of trustworthiness, as well as quality, fitness, capacity and experience to satisfactorily perform the contract. It is the policy of the Commission, Commission, and County to conduct business only with responsible contractors.

B. The Contractor is hereby notified that if the Commission acquires information concerning the performance of the Contractor on this or other contracts which indicates that the Contractor is not responsible, the Commission may, in addition to other remedies provided in the contract, debar the Contractor from bidding or proposing on, or being awarded, and/or performing work on Commission contracts for a specified period of time, which generally will not to exceed five years but may exceed five years or be permanent if warranted by circumstances, and terminate any or all existing contracts the Contractor may have with the Commission.

C. The Commission may debar a contractor, consultant, vendor or operating agency if the Board of Commissioners finds, in its discretion, that the contractor has done any of the following: (1) violated any term of a contract with the Commission, Commission, or County or a nonprofit corporation created by the Commission, Commission, or County, (2) committed an act or omission which negatively reflects on the its quality, fitness or capacity to perform a contract with the Commission, Commission, or County, any other public entity, a nonprofit corporation created by the Commission, Commission, or County, or engaged in a pattern or practice which negatively reflects on same, (3) committed an act or offense which indicates a lack of business integrity or business honesty, or (4) made or submitted a false claim against the Commission, Commission, County, or any other public entity.

D. If there is evidence that the Contractor may be subject to debarment, the Commission will notify the Contractor in writing of the evidence, which is the basis for the proposed debarment and will advise the Contractor of the scheduled date for a debarment hearing before the Contractor Hearing Board.

- E. The Contractor Hearing Board will conduct a hearing where evidence on the proposed debarment is presented. The Contractor and/or the Contractor's representative shall be given an opportunity to submit evidence at that hearing. After the hearing, the Contractor Hearing Board shall prepare a tentative proposed decision, which shall contain a recommendation regarding whether the Contractor should be debarred, and, if so, the appropriate length of time of the debarment. The Contractor and the Commission shall be provided an opportunity to object to the tentative proposed decision prior to its presentation to the Board of Commissioners.
- F. After consideration of any objections, or if no objections are submitted, a record of the hearing, the proposed decision and any other recommendation of the Contract Hearing Board shall be presented to the Board of Commissioners. The Board of Commissioners shall have the right to modify, deny or adopt the proposed decision and recommendation of the Hearing Board.
- G. If a Contractor has been debarred for a period longer than five years, that Contractor may, after the debarment has been in effect for at least five years, submit a written request for review of the debarment determination to reduce the period of debarment or terminate the debarment. The Commission may, in its discretion, reduce the period of debarment or terminate the debarment if it finds that the Contractor has adequately demonstrated one or more of the following: (1) elimination of the grounds for which the debarment was imposed; (2) a bona fide change in ownership or management; (3) material evidence discovered after debarment was imposed; or (4) any other reason that is in the best interests of the Commission.
- H. The Contractor Hearing Board will consider a request for review of the debarment determination only where (1) the Contractor has been debarred for a period longer than five years; (2) the debarment has been in effect for at least five years; and (3) the request is in writing, states one or more of the ground for reduction of the debarment period or termination of the debarment, and includes supporting documentation. Upon receiving an appropriate request, the Contractor Hearing Board will provide notice of the hearing on the request. At the hearing, the Contractor Hearing Board shall conduct a hearing where evidence on the proposed reduction of debarment period or termination of debarment is presented. This hearing shall be conducted and the request for review decided by the Contractor Hearing Board pursuant to the same procedures as for a debarment Hearing.

The Contractor Hearing Board's proposed decision shall contain a recommendation on the request to reduce the period of debarment or terminate the debarment. The Contractor Hearing Board shall present its proposed decision and recommendation to the Board of Commissioners. The Board of Commissioners shall have the right to modify, deny or adopt the proposed decision and recommendation of the Contractor Hearing Board.

- I. These terms shall also apply to subcontractors and subconsultants of County, Commission, or Commission contractors, consultants, vendors and agencies.

10.25 Compliance With Jury Service Program

1. Unless Contractor has demonstrated to the County's satisfaction either that Contractor is not a "Contractor" as defined under the Jury Service Program or that Contractor qualifies for an exception to the Jury Service Program, Contractor shall have and adhere to a written policy that provides that its Employees shall receive from the Contractor, on an annual basis, no less than five days of regular pay for actual jury service. The policy may provide that Employees deposit any fees received for such jury service with the Contractor or that the Contractor deduct from the Employee's regular pay the fees received for jury service.
2. For purposes of this Section, "Contractor" means a person, partnership, corporation or other entity which has a contract with the Commission or a subcontract with an Commission contractor and has received or will receive an aggregate sum of \$50,000 or more in any 12-month period under one or more Commission contracts or subcontracts. "Employee" means any California resident who is a full time employee of Contractor. "Full time" means forty (40) hours or more worked per week, or a lesser number of hours if: 1) the lesser number is a recognized industry standard as determined by the Commission, or 2) Contractor has a long-standing practice that defines the lesser number of hours as full-time. Full-time employees providing short-term, temporary services of ninety (90) days or less within a 12-month period are not considered full-time for purposes of the Jury Service Program. If Contractor uses any subcontractor to perform services for the Commission under the Contract, the subcontractor shall also be subject to the provisions of this Section. The provisions of this Section shall be inserted into any such subcontract agreement and a copy of the Jury Service Program shall be attached to the agreement.
3. If Contractor is not required to comply with the Jury Service Program when the Contract commences, Contractor shall have a continuing obligation to review the applicability of its "exception status" from the Jury Service Program, and Contractor shall immediately notify the Commission if Contractor at any time either comes within the Jury Service Program's definition of "Contractor" or if Contractor no longer qualifies for an exception to the Program. In either event, Contractor shall immediately implement a written policy consistent with the Jury Service Program. The Commission may also require, at any time during the Contract and at its sole discretion, that Contractor demonstrate to the Commission's satisfaction that Contractor either continues to remain outside of the Jury Service Program's definition of "Contractor" and/or that Contractor continues to qualify for an exception to the Program.
4. Contractor's violation of this Section of the Contract may constitute a material breach of the Contract. In the event of such material breach, the Commission may, in its sole discretion, terminate the Contract and/or bar Contractor from the award of future Commission contracts for a period of time consistent with the seriousness of the breach.

10.26 Notice to Employees regarding The Safely Surrendered Baby Law

The Contractor shall notify and provide to its employees, and shall require each subcontractor to notify and provide to its employees, a fact sheet regarding the Safely Surrendered Baby Law, its implementation in Los Angeles County, and where and how to safely surrender a baby. The fact sheets are set forth in Attachment B of this Contract and are also available on the Internet at www.babysafela.org for printing purposes.

10.27 Contractor's Acknowledgment of Commission's Commitment to the Safely Surrendered Baby Law

The Contractor acknowledges that the Commission places a high priority on the implementation of the Safely Surrendered Baby Law. The Contractor understands that it is the Commission's policy to encourage all Commission contractors to voluntarily post the "Safely Surrendered Baby Law" poster in a prominent position at the Contractor's place of business. The Contractor will also encourage its Subcontractors, if any, to post this poster in a prominent position in the Subcontractor's place of business. The County's Department of Children and Family Services will supply the Contractor with the poster to be used.

10.28 Contractor's Charitable Contributions Compliance

The Supervision of Trustees and Fundraisers for Charitable Purpose Act regulates entities receiving or raising charitable contributions. The "Nonprofit Integrity Act of 2004" (SB 1262, Chapter 919) increased Charitable Purpose Act requirements. By requiring Contractors to complete the Charitable Contributions Certification as included in Part C of the Contract Documents, the Authority seeks to ensure that all Authority contractors that receive or raise charitable contributions comply with California law in order to protect the Authority and its taxpayers. A Contractor that receives or raises charitable contributions without complying with its obligations under California law commits a material breach subjecting it to either contract termination or debarment proceedings, or both.

10.29 Contractor's Warranty Of Compliance With County's Defaulted Property Tax Reduction Program

The Contractor acknowledges that the County of Los Angeles (County) has established a goal of ensuring that all individuals and businesses that benefit financially from the County through contract are current in paying their property tax obligations (secured and unsecured roll) in order to mitigate the economic burden otherwise imposed upon the County and its taxpayers. Unless the Contractor qualifies for an exemption or exclusion, the Contractor warrants and certifies that to the best of its knowledge it is now in compliance, and during the term of this Contract will maintain compliance, with the County's Defaulted Tax Program pursuant to Los Angeles County Code, Chapter 2.206.

10.30 Termination For Breach Of Warranty To Maintain Compliance With County's Defaulted Property Tax Reduction Program

Failure of the Contractor to maintain compliance with the requirements set forth in Paragraph 10.29, "Contractor's Warranty of Compliance with County's Defaulted Property Tax Reduction Program" shall constitute default under this Contract. Without limiting the rights and remedies available to the Commission under any other provision of this Contract, failure of the Contractor to cure such default within 10 days of notice shall be grounds upon which the Commission may terminate this contract and/or pursue debarment of the

IN WITNESS WHEREOF, the parties hereto have executed this Construction Contract on the date and year first written above.

OWNER

CONTRACTOR

COMMUNITY DEVELOPMENT
COMMISSION OF THE COUNTY OF
LOS ANGELES, A BODY
CORPORATE AND POLITIC

License Number: 858483

By: _____

By: _____

SEAN ROGAN

YOUNG KANG

Title: EXECUTIVE DIRECTOR

Title: PRESIDENT

Date: _____

Date: _____

APPROVED AS TO PROGRAM:

MONIQUE KING-VIEHLAND

Title: CONTRACTING OFFICER

Date: _____

APPROVED AS TO FORM
Office of County Counsel,
Mary C. Wickham
County Counsel

BUSINESS ADDRESS

8461 Commonwealth Ave.
Buena Park, CA, 90621

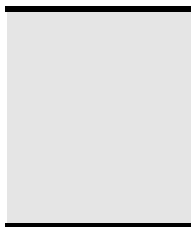
By: _____
Deputy

Telephone: 714.443.3655

Fax:

CORPORATE SEAL

Required Signatures:



If sole proprietor, one signature of sole proprietor.

If partnership, the signature of at least one general partner authorized to sign contracts on behalf of the partnership.

If Corporation, the signatures of those officers required to sign contracts on behalf of the Corporation, and the Corporate Seal.

ATTACHMENT A



Department of the Treasury
Internal Revenue Service

Notice 1015

(Rev. December 2013)

Have You Told Your Employees About the Earned Income Credit (EIC)?

What is the EIC?

The EIC is a refundable tax credit for certain workers.

Which Employees Must I Notify About the EIC?

You must notify each employee who worked for you at any time during the year and from whom you did not withhold income tax. However, you do not have to notify any employee who claimed exemption from withholding on Form W-4, Employee's Withholding Allowance Certificate.

Note. You are encouraged to notify each employee whose wages for 2013 are less than \$51,567 that he or she may be eligible for the EIC.

How and When Must I Notify My Employees?

You must give the employee one of the following:

- The IRS Form W-2, Wage and Tax Statement, which has the required information about the EIC on the back of Copy B.
- A substitute Form W-2 with the same EIC information on the back of the employee's copy that is on Copy B of the IRS Form W-2.
- Notice 797, Possible Federal Tax Refund Due to the Earned Income Credit (EIC).
- Your written statement with the same wording as Notice 797.

If you are required to give Form W-2 and do so on time, no further notice is necessary if the Form W-2 has the required information about the EIC on the back of the employee's copy. If a substitute Form W-2 is given on time but does not have the required information, you must

notify the employee within 1 week of the date the substitute Form W-2 is given. If Form W-2 is required but is not given on time, you must give the employee Notice 797 or your written statement by the date Form W-2 is required to be given. If Form W-2 is not required, you must notify the employee by February 7, 2014.

You must hand the notice directly to the employee or send it by first-class mail to the employee's last known address. You will not meet the notification requirements by posting Notice 797 on an employee bulletin board or sending it through office mail. However, you may want to post the notice to help inform all employees of the EIC. You can get copies of the notice from IRS.gov or by calling 1-800-829-3676.

How Will My Employees Know If They Can Claim the EIC?

The basic requirements are covered in Notice 797. For more detailed information, the employee needs to see Pub. 596, Earned Income Credit (EIC), or the instructions for Form 1040, 1040A, or 1040EZ.

How Do My Employees Claim the EIC?

Eligible employees claim the EIC on their 2013 tax return. Even employees who have no tax withheld from their pay or owe no tax can claim the EIC and get a refund, but they must file a tax return to do so. For example, if an employee has no tax withheld in 2013 and owes no tax but is eligible for a credit of \$800, he or she must file a 2013 tax return to get the \$800 refund.

Safely Surrendered



No shame. No blame. No names.

In Los Angeles County: 1-877-BABY SAFE • 1-877-222-9723

www.babysafela.org



Safely Surrendered Baby Law

What is the Safely Surrendered Baby Law?

California's Safely Surrendered Baby Law allows parents or other persons, with lawful custody, which means anyone to whom the parent has given permission to confidentially surrender a baby. As long as the baby is three days (72 hours) of age or younger and has not been abused or neglected, the baby may be surrendered without fear of arrest or prosecution.

How does it work?

A distressed parent who is unable or unwilling to care for a baby can legally, confidentially, and safely surrender a baby within three days (72 hours) of birth. The baby must be handed to an employee at a hospital or fire station in Los Angeles County. As long as the baby shows no sign of abuse or neglect, no name or other information is required. In case the parent changes his or her mind at a later date and wants the baby back, staff will use bracelets to help connect them to each other. One bracelet will be placed on the baby, and a matching bracelet will be given to the parent or other surrendering adult.

What if a parent wants the baby back?

Parents who change their minds can begin the process of reclaiming their baby within 14 days. These parents should call the Los Angeles County Department of Children and Family Services at 1-800-540-4000.

Can only a parent bring in the baby?

No. While in most cases a parent will bring in the baby, the Law allows other people to bring in the baby if they have lawful custody.

Does the parent or surrendering adult have to call before bringing in the baby?

No. A parent or surrendering adult can bring in a baby anytime, 24 hours a day, 7 days a week, as long as the parent or surrendering adult surrenders the baby to someone who works at the hospital or fire station.

Does the parent or surrendering adult have to tell anything to the people taking the baby?

No. However, hospital or fire station personnel will ask the surrendering party to fill out a questionnaire designed to gather important medical history information, which is very useful in caring for the baby. The questionnaire includes a stamped return envelope and can be sent in at a later time.

What happens to the baby?

The baby will be examined and given medical treatment. Upon release from the hospital, social workers immediately place the baby in a safe and loving home and begin the adoption process.

What happens to the parent or surrendering adult?

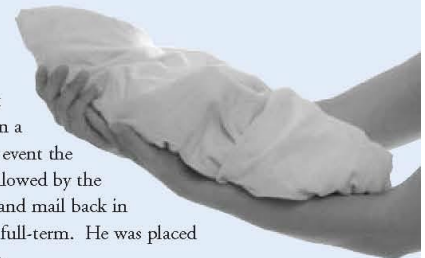
Once the parent or surrendering adult surrenders the baby to hospital or fire station personnel, they may leave at any time.

Why is California doing this?

The purpose of the Safely Surrendered Baby Law is to protect babies from being abandoned, hurt or killed by their parents. You may have heard tragic stories of babies left in dumpsters or public bathrooms. Their parents may have been under severe emotional distress. The mothers may have hidden their pregnancies, fearful of what would happen if their families found out. Because they were afraid and had no one or nowhere to turn for help, they abandoned their babies. Abandoning a baby is illegal and places the baby in extreme danger. Too often, it results in the baby's death. The Safely Surrendered Baby Law prevents this tragedy from ever happening again in California.

A baby's story

Early in the morning on April 9, 2005, a healthy baby boy was safely surrendered to nurses at Harbor-UCLA Medical Center. The woman who brought the baby to the hospital identified herself as the baby's aunt and stated the baby's mother had asked her to bring the baby to the hospital on her behalf. The aunt was given a bracelet with a number matching the anklet placed on the baby; this would provide some identification in the event the mother changed her mind about surrendering the baby and wished to reclaim the baby in the 14-day period allowed by the Law. The aunt was also provided with a medical questionnaire and said she would have the mother complete and mail back in the stamped return envelope provided. The baby was examined by medical staff and pronounced healthy and full-term. He was placed with a loving family that had been approved to adopt him by the Department of Children and Family Services.



Ley de Entrega de Bebés *Sin Peligro*



Los recién nacidos pueden ser entregados en forma segura al personal de cualquier hospital o cuartel de bomberos del Condado de Los Ángeles

Sin pena. Sin culpa. Sin nombres.

En el Condado de Los Ángeles: 1-877-BABY SAFE • 1-877-222-9723

www.babysafela.org



Ley de Entrega de Bebés Sin Peligro

¿Qué es la Ley de Entrega de Bebés sin Peligro?

La Ley de Entrega de Bebés sin Peligro de California permite la entrega confidencial de un recién nacido por parte de sus padres u otras personas con custodia legal, es decir cualquier persona a quien los padres le hayan dado permiso. Siempre que el bebé tenga tres días (72 horas) de vida o menos, y no haya sufrido abuso ni negligencia, pueden entregar al recién nacido sin temor de ser arrestados o procesados.

Cada recién nacido se merece la oportunidad de tener una vida saludable. Si alguien que usted conoce está pensando en abandonar a un recién nacido, infórmele que tiene otras opciones. Hasta tres días (72 horas) después del nacimiento, se puede entregar un recién nacido al personal de cualquier hospital o cuartel de bomberos del condado de Los Angeles.

¿Cómo funciona?

El padre/madre con dificultades que no pueda o no quiera cuidar de su recién nacido puede entregarlo en forma legal, confidencial y segura dentro de los tres días (72 horas) del nacimiento. El bebé debe ser entregado a un empleado de cualquier hospital o cuartel de bomberos del Condado de Los Ángeles. Siempre que el bebé no presente signos de abuso o negligencia, no será necesario suministrar nombres ni información alguna. Si el padre/madre cambia de opinión posteriormente y desea recuperar a su bebé, los trabajadores utilizarán brazaletes para poder vincularlos. El bebé llevará un brazalete y el padre/madre o el adulto que lo entregue recibirá un brazalete igual.

¿Qué pasa si el padre/madre desea recuperar a su bebé?

Los padres que cambien de opinión pueden comenzar el proceso de reclamar a su recién nacido dentro de los 14 días. Estos padres deberán llamar al Departamento de Servicios para Niños y Familias (Department of Children and Family Services) del Condado de Los Ángeles al 1-800-540-4000.

¿Sólo los padres podrán llevar al recién nacido?

No. Si bien en la mayoría de los casos son los padres los que llevan al bebé, la ley permite que otras personas lo hagan si tienen custodia legal.

¿Los padres o el adulto que entrega al bebé deben llamar antes de llevar al bebé?

No. El padre/madre o adulto puede llevar al bebé en cualquier momento, las 24 horas del día, los 7 días de la semana, siempre y cuando entreguen a su bebé a un empleado del hospital o cuartel de bomberos.

¿Es necesario que el padre/madre o adulto diga algo a las personas que reciben al bebé?

No. Sin embargo, el personal del hospital o cuartel de bomberos le pedirá a la persona que entregue al bebé que llene un cuestionario con la finalidad de recabar antecedentes médicos importantes, que resultan de gran utilidad para cuidar bien del bebé. El cuestionario incluye un sobre con el sello postal pagado para enviarlo en otro momento.

¿Qué pasará con el bebé?

El bebé será examinado y le brindarán atención médica. Cuando le den el alta del hospital, los trabajadores sociales inmediatamente ubicarán al bebé en un hogar seguro donde estará bien atendido, y se comenzará el proceso de adopción.

¿Qué pasará con el padre/madre o adulto que entregue al bebé?

Una vez que los padres o adulto hayan entregado al bebé al personal del hospital o cuartel de bomberos, pueden irse en cualquier momento.

¿Por qué se está haciendo esto en California?

La finalidad de la Ley de Entrega de Bebés sin Peligro es proteger a los bebés para que no sean abandonados, lastimados o muertos por sus padres. Usted probablemente haya escuchado historias trágicas sobre bebés abandonados en basureros o en baños públicos. Los padres de esos bebés probablemente hayan estado pasando por dificultades emocionales graves. Las madres pueden haber ocultado su embarazo, por temor a lo que pasaría si sus familias se enteraran. Abandonaron a sus bebés porque tenían miedo y no tenían nadie a quien pedir ayuda. El abandono de un recién nacido es ilegal y pone al bebé en una situación de peligro extremo. Muy a menudo el abandono provoca la muerte del bebé. La Ley de Entrega de Bebés sin Peligro impide que vuelva a suceder esta tragedia en California.

Historia de un bebé

A la mañana temprano del día 9 de abril de 2005, se entregó un recién nacido saludable a las enfermeras del Harbor-UCLA Medical Center. La mujer que llevó el recién nacido al hospital se dio a conocer como la tía del bebé, y dijo que la madre le había pedido que llevara al bebé al hospital en su nombre. Le entregaron a la tía un brazalete con un número que coincidía con la pulsera del bebé; esto serviría como identificación en caso de que la madre cambiara de opinión con respecto a la entrega del bebé y decidiera recuperarlo dentro del período de 14 días que permite esta ley. También le dieron a la tía un cuestionario médico, y ella dijo que la madre lo llenaría y lo enviaría de vuelta dentro del sobre con franqueo pagado que le habían dado. El personal médico examinó al bebé y se determinó que estaba saludable y a término. El bebé fue ubicado con una buena familia que ya había sido aprobada para adoptarlo por el Departamento de Servicios para Niños y Familias.





BUY SMART. BUILD BETTER.

JOB ORDER CONTRACT TECHNICAL SPECIFICATIONS

BOOK 1 OF 1 CSI DIVISIONS 01 - 43 JANUARY 2016

LOS ANGELES
COMMUNITY DEVELOPMENT COMMISSION



GORDIAN
JOC SOLUTIONS

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32 91 19 13	Concrete Revetment
32 91 19 13a	Septic Tank Systems

33 Utilities

33 01 30 41	Sewer Line Cleaning
33 01 30 42	Repair And Maintenance Of Imhoff Tanks
33 01 30 73	Repair And Maintenance Of Siphon Tank And Siphons
33 01 30 73a	Underground Ducts And Utility Structures
33 11 13 23	Sand Drains
33 11 13 23a	Hydronic Distribution
33 41 13 00	Storm Drainage
33 42 16 13	Culverts

34 Transportation

34 71 13 13	Beam-Type Guardrail
34 71 13 16	Active Vehicle Barriers

41 Material Processing And Handling Equipment

41 01 20 00	Material Handling Hoists
41 22 23 13	Monorails With Electric Powered Hoists
41 22 23 13a	Monorails With Manual Hoist

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SECTION 01 22 16 00 - NO SPECIFICATION REQUIRED

1.1 GENERAL

- A. A separate specification is not required for this item. The description given in the line item of the Construction Task Catalog completely defines the item.

1.2 PRODUCTS - (Not Used)

1.3 EXECUTION - (Not Used)

END OF SECTION 01 22 16 00



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Task	Specification	Specification Description
01 22 20 00	01 22 16 00	No Specification Required
01 22 23 00	01 22 16 00	No Specification Required



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SECTION 01 32 33 00 - SCHEDULE OF VALUES

1.1 GENERAL

A. Description Of Work

1. This specification covers the preparation, content and submittal of the schedule of values. The Schedule of Values is an itemized list that establishes the value or cost of each part of the Work. It shall be used as the basis for preparing progress payments.

B. Preparation

1. Schedule shall show breakdown of labor, materials equipment and other costs as directed by the Owner.
2. Costs shall be in sufficient detail to indicate separate amounts for each major subsection of the Work. The Contractor may include an item for bond, insurance, temporary facilities and job mobilization.
3. Schedule of Values shall be prepared on 8-1/2-inch by 11-inch white paper.
4. Use the major subsections of the Detailed Scope of Work as the basis for Schedule format. List sub-items of major products or systems as appropriate or when requested by the Owner.
5. When requested by the Owner, support values with data that will substantiate their correctness.
6. The sum of the individual values shown on the Schedule of Values must equal the total Job Order Price.
7. Schedule shall show the purchase and delivery costs for materials and equipment that the Contractor anticipates it shall request payment for prior to their installation.

- #### C. Submittal: Submit two copies of Schedule, or any other number of copies as directed by the Owner, to the Owner for approval at least 20 days prior to submitting first application for a progress payment. After review by the Owner, revise and resubmit Schedule as required until it is approved.

1.2 PRODUCTS (Not Used)

1.3 EXECUTION (Not Used)

END OF SECTION 01 32 33 00



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SECTION 01 32 33 00a - SPECIAL PROCEDURES FOR HISTORIC TREATMENT

1.1 GENERAL

A. Summary

1. This Section includes special procedures for historic treatment on Project including, but not limited to, the following:
 - a. Storage and protection of existing historic materials.
 - b. Temporary protection of historic materials during construction.
 - c. Protection during application of chemicals.
 - d. Protection during use of heat-generating equipment.
 - e. Historic treatment procedures.
 - f. Removal of bird excrement.
2. This specification applies to all tasks in the Construction Task Catalog® when they are used on Historic Buildings or Historic Sites.

B. Definitions

1. "Preservation": To apply measures necessary to sustain the existing form, integrity, and materials of a historic property. Work may include preliminary measures to protect and stabilize the property.
2. "Rehabilitation": To make possible a compatible use for a property through repair, alterations, and additions while preserving those portions or features that convey its historical, cultural, or architectural values.
3. "Restoration": To accurately depict the form, features, and character of a property as it appeared at a particular period of time by means of the removal of features from other periods in its history and the reconstruction of missing features from the restoration period.
4. "Reconstruction": To reproduce in the exact form and detail a building, structure, or artifact as it appeared at a specific period in time.
5. "Stabilize": To apply measures designed to reestablish a weather-resistant enclosure and the structural reinforcement of an item or portion of the building while maintaining the essential form as it exists at present.
6. "Protect and Maintain": To remove deteriorating corrosion, reapply protective coatings, and install protective measures such as temporary guards; to provide the least degree of intervention.
7. "Repair": To stabilize, consolidate, or conserve; to retain existing materials and features while employing as little new material as possible. Repair includes patching, piecing-in, splicing, consolidating, or otherwise reinforcing or upgrading materials. Within restoration, repair also includes limited replacement in kind, rehabilitation, and reconstruction, with compatible substitute materials for deteriorated or missing parts of features when there are surviving prototypes.
8. "Replace": To duplicate and replace entire features with new material in kind. Replacement includes the following conditions:
 - a. Duplication: Includes replacing elements damaged beyond repair or missing. Original material is indicated as the pattern for creating new duplicated elements.
 - b. Replacement with New Materials: Includes replacement with new material when original material is not available as patterns for creating new duplicated elements.
 - c. Replacement with Substitute Materials: Includes replacement with compatible substitute materials. Substitute materials are not allowed, unless otherwise indicated.
9. "Remove": To detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.
10. "Remove and Salvage": To detach items from existing construction and deliver them to the Owner ready for reuse.
11. "Remove and Reinstall": To detach items from existing construction, repair and clean them for reuse, and reinstall them where indicated.
12. "Existing to Remain" or "Retain": Existing items of construction that are not to be removed and that are not otherwise indicated to be removed and salvaged, or removed and reinstalled.



13. "Material in Kind": Material that matches existing materials, as much as possible, in species, cut, color, grain, and finish.

C. Submittals

1. Historic Treatment Program: Submit a written plan for each phase or process including protection of surrounding materials during operations. Describe in detail materials, methods, and equipment to be used for each phase of work.
2. Alternative Methods and Materials: If alternative methods and materials to those indicated are proposed for any phase of work, provide a written description including evidence of successful use on other, comparable projects, and program of testing to demonstrate effectiveness for use on this Project.
3. Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by historic treatment operations. Submit before work begins.

D. Quality Assurance

1. Historic Treatment Specialist Qualifications: A firm that employs personnel, including supervisory personnel, experienced and skilled in the processes and operations indicated.
2. Historic Treatment Preconstruction Conference: Conduct conference at Project site.

E. Storage And Protection Of Historic Materials

1. Removed and Salvaged Historic Materials:
 - a. Clean salvaged historic items.
 - b. Pack or crate items after cleaning. Identify contents of containers.
 - c. Store items in a secure area until delivery to the Owner.
 - d. Transport items to the Owner's storage area on-site **OR** off-site **OR** designated by the Owner **OR** indicated on Drawings, **as directed**.
 - e. Protect items from damage during transport and storage.
 - f. Do not dispose of items removed from existing construction without prior written consent of the Owner.
2. Removed and Reinstalled Historic Materials:
 - a. Clean and repair historic items to functional condition adequate for intended reuse.
 - b. Pack or crate items after cleaning and repairing. Identify contents of containers.
 - c. Protect items from damage during transport and storage.
 - d. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
3. Existing Historic Materials to Remain: Protect construction indicated to remain against damage and soiling during historic treatment. When permitted, items may be removed to a suitable, protected storage location during historic treatment and cleaned and reinstalled in their original locations after historic treatment operations are complete.
4. Storage and Protection: When removed from their existing location, store historic materials within a weathertight enclosure where they are protected from wetting by rain, snow, or ground water, and temperature variations. Secure stored materials to protect from theft.
 - a. Identify removed items with an inconspicuous mark indicating their original location.

F. Project-Site Conditions

1. Exterior Cleaning and Repairing:
 - a. Proceed with the work only when forecasted weather conditions are favorable.
 - 1) Wet Weather: Do not attempt repairs during rainy or foggy weather. Do not apply primer, paint, putty, or epoxy when the relative humidity is above 80 percent. Do not remove exterior elements of structures when rain is forecast or in progress.
 - 2) Do not perform exterior wet work when the air temperature is below 40 deg F (5 deg C).



- 3) Do not begin cleaning, patching, or repairing when there is any likelihood of frost or freezing.
- 4) Do not begin cleaning when either the air or the surface temperature is below 45 deg F (7 deg C) unless approved means are provided for maintaining a 45 deg F (7 deg C) temperature of the air and materials during, and for 48 hours subsequent to, cleaning.
 - b. Perform cleaning and rinsing of the exterior only during daylight hours.
2. the Owner will occupy portions of building immediately adjacent to historic treatment area. Conduct historic treatment so the Owner's operations will not be disrupted. Provide not less than 72 hours' notice to the Owner of activities that will affect the Owner's operations.

1.2 PRODUCTS (Not Used)

1.3 EXECUTION

A. Protection, General

1. Comply with manufacturer's written instructions for precautions and effects of products and procedures on adjacent building materials, components, and vegetation.
2. Ensure that supervisory personnel are present when work begins and during its progress.
3. Temporary Protection of Historic Materials during Construction:
 - a. Protect existing materials during installation of temporary protections and construction. Do not deface or remove existing materials.
 - b. Attachments of temporary protection to existing construction shall be approved prior to installation.
4. Protect landscape work adjacent to or within work areas as follows:
 - a. Provide barriers to protect tree trunks.
 - b. Bind spreading shrubs.
 - c. Use coverings that allow plants to breathe and remove coverings at the end of each day. Do not cover plant material with a waterproof membrane for more than 8 hours at a time.
 - d. Set scaffolding and ladder legs away from plants.
5. Existing Drains: Prior to the start of work or any cleaning operations, test drains and other water removal systems to ensure that drains and systems are functioning properly. Notify the Owner immediately of drains or systems that are stopped or blocked. Do not begin Work of this Section until the drains are in working order.
 - a. Provide a method to prevent solids including stone or mortar residue from entering the drains or drain lines. Clean out drains and drain lines that become blocked or filled by sand or any other solids because of work performed under this Contract.
 - b. Protect storm drains from pollutants. Block drains or filter out sediments, allowing only clean water to pass.

B. Protection During Application Of Chemicals

1. Protect persons, motor vehicles, surrounding surfaces of building being restored, building site, plants, and surrounding buildings from harm or damage resulting from applications of chemical cleaners and paint removers.
2. Comply with requirements in Division 01 Section "Temporary Facilities And Controls".
3. Cover adjacent surfaces with materials that are proven to resist chemical cleaners selected for Project unless chemicals being used will not damage adjacent surfaces. Use covering materials that contain only waterproof, UV-resistant adhesives. Apply masking agents to comply with manufacturer's written instructions. Do not apply liquid masking agent to painted or porous surfaces. When no longer needed, promptly remove masking to prevent adhesive staining.
4. Do not clean surfaces during winds of sufficient force to spread cleaning solutions to unprotected surfaces.
5. Neutralize and collect alkaline and acid wastes and dispose of off the Owner's property.



6. Dispose of runoff from chemical operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.

C. Protection During Use Of Heat-Generating Equipment

1. Comply with the following procedures while performing work with heat-generating equipment, including welding, cutting, soldering, brazing, paint removal with heat, and other operations where open flames or implements utilizing heat are used:
 - a. Obtain the Owner's approval for operations involving use of open-flame or welding equipment.
 - 1) Notification shall be given for each occurrence and location of work with heat-generating equipment.
 - b. As far as practical, use heat-generating equipment in shop areas or outside the building.
 - c. Before work with heat-generating equipment commences, furnish personnel to serve as a fire watch (or watches) for location(s) where work is to be performed.
 - d. Do not perform work with heat-generating equipment in or near rooms or in areas where flammable liquids or explosive vapors are present or thought to be present. Use a combustible gas indicator test to ensure that the area is safe.
 - e. Remove and keep the area free of combustibles, including, rubbish, paper, waste, etc., within area of operations.
 - 1) If combustible material cannot be removed, provide fireproof blankets to cover such materials.
 - f. Where possible, furnish and use baffles of metal or gypsum board to prevent the spraying of sparks or hot slag into surrounding combustible material.
 - g. Prevent the extension of sparks and particles of hot metal through open windows, doors, holes, and cracks in floors, walls, ceilings, roofs, and other openings.
 - h. Inspect each location of the day's work not sooner than 30 minutes after completion of operations to detect hidden or smoldering fires and to ensure that proper housekeeping is maintained.
2. Where sprinkler protection exists and is functional, maintain it without interruption while operations are being performed. If operations are performed close to automatic sprinkler heads, shield the individual heads temporarily with guards.

D. Historic Treatment Procedures

1. The principal aim of preservation work is to halt the process of deterioration and stabilize the item's condition, unless otherwise indicated. Repair is required where specifically indicated. The following procedures shall be followed:
 - a. Retain as much existing material as possible; repair and consolidate rather than replace.
 - b. Use additional material or structure to reinforce, strengthen, prop, tie, and support existing material or structure.
 - c. Use reversible processes wherever possible.
 - d. Use traditional replacement materials and techniques. New work shall be distinguishable to the trained eye, on close inspection, from old work.
 - e. Record the work before the procedure with preconstruction photos and during the work with periodic construction photos.
2. Prohibit smoking by personnel performing work on or near historic structures.
3. Obtain review and written approval in the form of a Constructive Change Directive or Supplemental Instruction before making changes or additions to construction or removing historic materials.
4. Notify the Owner of visible changes in the integrity of material or components whether due to environmental causes including biological attack, UV degradation, freezing, or thawing; or due to structural defects including cracks, movement, or distortion.
 - a. Do not proceed with the work in question until directed.



5. Where missing features are indicated to be repaired or replaced, provide features whose designs are based on accurate duplications rather than on conjectural designs, subject to the approval of the Owner and Historic Treatment Specialist.
 6. Where Work requires existing features to be removed, cleaned, and reused, perform these operations without damage to the material itself, to adjacent materials, or to the substrate.
 7. Identify new or replacement materials and features with inconspicuous, permanent marks to distinguish them from original materials. Record the legend of identification marks and the locations of these marks on Record Drawings.
 8. When cleaning, match samples of existing materials that have been cleaned and identified for acceptable cleaning levels. Avoid overcleaning to prevent damage to existing materials during cleaning.
- E. Removal Of Bird Excrement
1. General: Before disturbing accumulated bird excrement, consult with an occupational medicine physician, industrial hygienist, and authorities having jurisdiction to determine acceptable removal procedures and appropriate protective measures for personnel.
 2. Removing Bird Excrement: Treat bird excrement before its removal as required by authorities having jurisdiction.
 - a. Prior to removal, dampen excrement to prevent it from becoming airborne.
 - b. Use only nonmetallic tools (plastic spatulas and brushes with natural fiber or nylon bristles, or their equivalent) to remove excrement.
 - c. Collect removed excrement and legally disposed of off site.
 - d. Perform bird excrement removal work from the outside of the building with windows and other openings in the building closed.

END OF SECTION 01 32 33 00a



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SECTION 01 32 33 00b - LEED REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general requirements and procedures for compliance with certain USGBC LEED prerequisites and credits needed for Project to obtain LEED-Certified **OR** Silver **OR** Gold **OR** Platinum, **as directed**, certification based on USGBC's "LEED 2009 for New Construction & Major Renovations," "LEED 2009 for Commercial Interiors," "LEED 2009 for Core and Shell Development," or "LEED 2009 for Schools New Construction and Major Renovations."
1. Other LEED prerequisites and credits needed to obtain LEED certification depend on product selections and may not be specifically identified as LEED requirements. Compliance with requirements needed to obtain LEED prerequisites and credits may be used as one criterion to evaluate substitution requests and comparable product requests.
 2. Additional LEED prerequisites and credits needed to obtain the indicated LEED certification depend on Architect's design and other aspects of Project that are not part of the Work of the Contract.
 3. A copy of the LEED Project checklist is attached at the end of this Section for information only.
 4. Specific requirements for LEED are included in greater detail in other Sections.

1.2 DEFINITIONS

- A. Chain-of-Custody Certificates: Certificates signed by manufacturers certifying that wood used to make products was obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship." Certificates shall include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.
- B. Regional Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value. Manufacturing refers to the final assembly of components into the building product that is installed at Project site.
- C. Recycled Content: The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.
1. "Post-consumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
 2. "Pre-consumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials such as rework, regrind, or scrap generated in a process and capable of being reclaimed within the same process that generated it.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Respond to questions and requests from the Owner and the USGBC regarding LEED credits that are the responsibility of the Contractor, that depend on product selection or product qualities, or that depend



on Contractor's procedures until the USGBC has made its determination on the project's LEED certification application. Document responses as informational submittals.

1.4 ACTION SUBMITTALS

- A. General: Submit additional LEED submittals required by other Specification Sections.
- B. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.
- C. LEED Documentation Submittals:
 - 1. FOR CONSTRUCTION AND MAJOR RENOVATIONS:
 - a. Credit EA 5: Product data and wiring diagrams for sensors and data collection system used to provide continuous metering of building energy-consumption performance over time **OR** a period of time of not less than one year of post-construction occupancy, **as directed**.
 - b. Credit MR 2: Comply with Section 017419 "Construction Waste Management and Disposal."
 - c. Credit MR 3: Receipts for salvaged and refurbished materials used for Project, indicating sources and costs for salvaged and refurbished materials.
 - d. Credit MR 4: Product data and certification letter from product manufacturers indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content. Include statement indicating material cost for each product having recycled content.
 - e. Credit MR 5: Product data for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
 - f. Credit MR 7: Product data and chain-of-custody certificates for products containing certified wood. Include statement indicating cost for each certified wood product.
 - g. Credit IEQ 3.1:
 - 1) Construction indoor-air-quality management plan.
 - 2) Product data for temporary filtration media.
 - 3) Product data for filtration media used during occupancy.
 - 4) Construction Documentation: Six photographs at three different times during the construction period, along with a brief description of the SMACNA approach employed, documenting implementation of the indoor-air-quality management measures, such as protection of ducts and on-site stored or installed absorptive materials.
 - h. Credit IEQ 3.2:
 - 1) Signed statement describing the building air flush-out procedures including the dates when flush-out was begun and completed and statement that filtration media was replaced after flush-out.
 - 2) Product data for filtration media used during flush-out and during occupancy.
 - 3) Report from testing and inspecting agency indicating results of indoor-air-quality testing and documentation showing compliance with indoor-air-quality testing procedures and requirements.
 - i. Credit IEQ 4.1: Product data for adhesives and sealants used inside the weatherproofing system indicating VOC content of each product used.
 - j. Credit IEQ 4.2: Product data for paints and coatings used inside the weatherproofing system indicating VOC content of each product used.
 - k. Credit IEQ 4.4: Product data for products containing composite wood or agrifiber products or wood glues indicating that they do not contain urea-formaldehyde resin.
 - 2. FOR COMMERCIAL INTERIORS:



- a. Credit EA 3: Product data and wiring diagrams for sensors and data collection system used to provide continuous metering of building energy-consumption performance over time **OR** a period of time of not less than one year of postconstruction occupancy, **as directed**.
 - b. Credit MR 2: Comply with Section 017419 "Construction Waste Management and Disposal."
 - c. Credit MR 3.1 and Credit MR 3.2: Receipts for salvaged and refurbished materials used for Project, indicating sources and costs for salvaged and refurbished materials.
 - d. Credit MR 4: Product data and certification letter from product manufacturers indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content. Include statement indicating material costs for each product having recycled content.
 - e. Credit MR 5: Product data indicating location of material manufacturer for regionally manufactured materials. Include statement indicating cost for each regionally manufactured material and for each regionally extracted and manufactured material.
 - 1) Include statement indicating distance from manufacturer to Project for each regionally manufactured material.
 - 2) Include statement indicating location of and distance from Project to point of extraction, harvest, or recovery for each raw material used in regionally extracted and manufactured materials.
 - f. Credit MR 7: Product data and chain-of-custody certificates for products containing certified wood. Include statement indicating cost for each certified wood product.
 - g. Credit IEQ 3.1:
 - 1) Construction indoor-air-quality management plan.
 - 2) Product data for temporary filtration media.
 - 3) Product data for filtration media used during occupancy.
 - 4) Construction Documentation: Six photographs at three different times during the construction period, along with a brief description of the SMACNA approach employed, documenting implementation of the indoor-air-quality management measures, such as protection of ducts and on-site stored or installed absorptive materials.
 - h. Credit IEQ 3.2:
 - 1) Signed statement describing the building air flush-out procedures including the dates when flush-out was begun and completed and statement that filtration media was replaced after flush-out.
 - 2) Product data for filtration media used during flush-out and during occupancy.
 - 3) Report from testing and inspecting agency indicating results of indoor-air-quality testing and documentation showing compliance with indoor-air-quality testing procedures and requirements.
 - i. Credit IEQ 4.1: Product data for adhesives and sealants used inside the weatherproofing system indicating VOC content of each product used.
 - j. Credit IEQ 4.2: Product data for paints and coatings used inside the weatherproofing system indicating VOC content of each product used.
 - k. Credit IEQ 4.4: Product data for products containing composite wood or agrifiber products or wood glues indicating that they do not contain urea-formaldehyde resin.
3. FOR CORE AND SHELL DEVELOPMENT:
- a. Credit EA 5.1 and 5.2: Product data and wiring diagrams for sensors and data collection system used to provide continuous metering of building energy-consumption performance over time **OR** a period of time of not less than one year of postconstruction occupancy, **as directed**.
 - b. Credit MR 2: Comply with Section 017419 "Construction Waste Management and Disposal."
 - c. Credit MR 3: Receipts for salvaged and refurbished materials used for Project, indicating sources and costs for salvaged and refurbished materials.
 - d. Credit MR 4: Product data and certification letter from product manufacturers indicating percentages by weight of post-consumer and pre-consumer recycled content for products



- having recycled content. Include statement indicating material costs for each product having recycled content.
- e. Credit MR 5: Product data for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
 - f. Credit MR 6: Product data and chain-of-custody certificates for products containing certified wood. Include statement indicating cost for each certified wood product.
 - g. Credit IEQ 3:
 - 1) Construction indoor-air-quality management plan.
 - 2) Product data for temporary filtration media.
 - 3) Product data for filtration media used during occupancy.
 - 4) Construction Documentation: Six photographs at three different times during the construction period, along with a brief description of the SMACNA approach employed, documenting implementation of the indoor-air-quality management measures, such as protection of ducts and on-site stored or installed absorptive materials.
 - h. Credit IEQ 4.1: Product data for adhesives and sealants used inside the weatherproofing system indicating VOC content of each product used.
 - i. Credit IEQ 4.2: Product data for paints and coatings used inside the weatherproofing system indicating VOC content of each product used.
 - j. Credit IEQ 4.4: Product data for products containing composite wood or agrifiber products or wood glues indicating that they do not contain urea-formaldehyde resin.
4. FOR SCHOOLS:
- a. Credit EA 5: Product data and wiring diagrams for sensors and data collection system used to provide continuous metering of building energy-consumption performance over time **OR** a period of time of not less than one year of postconstruction occupancy, **as directed**.
 - b. Credit MR 2: Comply with Section 017419 "Construction Waste Management and Disposal."
 - c. Credit MR 3: Receipts for salvaged and refurbished materials used for Project, indicating sources and costs for salvaged and refurbished materials.
 - d. Credit MR 4: Product data and certification letter from product manufacturers indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content. Include statement indicating material costs for each product having recycled content.
 - e. Credit MR 5: Product data for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
 - f. Credit MR 7: Product data and chain-of-custody certificates for products containing certified wood. Include statement indicating cost for each certified wood product.
 - g. Credit IEQ 3.1:
 - 1) Construction indoor-air-quality management plan.
 - 2) Product data for temporary filtration media.
 - 3) Product data for filtration media used during occupancy.
 - 4) Construction Documentation: Six photographs at three different times during the construction period, along with a brief description of the SMACNA approach employed, documenting implementation of the indoor-air-quality management measures, such as protection of ducts and on-site stored or installed absorptive materials.
 - h. Credit IEQ 3.2:
 - 1) Signed statement describing the building air flush-out procedures including the dates when flush-out was begun and completed and statement that filtration media was replaced after flush-out.
 - 2) Product data for filtration media used during flush-out and during occupancy.



- 3) Report from testing and inspecting agency indicating results of indoor-air-quality testing and documentation showing compliance with indoor-air-quality testing procedures and requirements.
- i. Credit IEQ 4: Laboratory test reports for the following products and systems installed inside the weatherproofing system indicating that they meet the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
 - 1) Adhesives and sealants.
 - 2) Paints and coatings.
 - 3) Composite wood and agrifiber products.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For LEED coordinator.
- B. Project Materials Cost Data: Provide statement indicating total cost for materials used for Project. Costs exclude labor, overhead, and profit. Include breakout of costs for the following categories of items:
 1. Furniture.
 2. Plumbing.
 3. Mechanical.
 4. Electrical.
 5. Specialty items such as elevators and equipment.
 6. Wood-based construction materials.
- C. LEED Action Plans: Provide preliminary submittals within seven **OR 14 OR 30 OR 60, as directed**, days of date established for commencement of the Work **OR** the Notice to Proceed **OR** the Notice of Award, **as directed**, indicating how the following requirements will be met:
 1. FOR CONSTRUCTION AND MAJOR RENOVATIONS:
 - a. Credit MR 2: Waste management plan complying with Section 017419 "Construction Waste Management and Disposal."
 - b. Credit MR 3: List of proposed salvaged, refurbished, and reused materials. Identify each material that will be salvaged, refurbished, or reused, including its source, cost, and replacement cost if the item was to be purchased new.
 - c. Credit MR 4: List of proposed materials with recycled content. Indicate cost, post-consumer recycled content, and pre-consumer recycled content for each product having recycled content.
 - d. Credit MR 5: List of proposed regional materials. Identify each regional material, including its source, cost, and the fraction by weight that is considered regional.
 - e. Credit MR 7: List of proposed certified wood products. Indicate each product containing certified wood, including its source and cost of certified wood products.
 - f. Credit IEQ 3.1: Construction indoor-air-quality management plan.
 2. FOR COMMERCIAL INTERIORS:
 - a. Credit MR 2: Waste management plan complying with Section 017419 "Construction Waste Management and Disposal."
 - b. Credit MR 3.1 and Credit MR 3.2: List of proposed salvaged, refurbished, and reused materials. Identify each material that will be salvaged, refurbished, or reused, including its source, cost, and replacement cost if the item was to be purchased new.
 - c. Credit MR 4: List of proposed materials with recycled content. Indicate cost, post-consumer recycled content, and pre-consumer recycled content for each product having recycled content.
 - d. Credit MR 5: List of proposed regionally manufactured materials and regionally extracted and manufactured materials.
 - 1) Identify each regionally manufactured material, including its source and cost.



- 2) Identify each regionally extracted and manufactured material, including its source and cost.
 - e. Credit MR 7: List of proposed certified wood products. Indicate each product containing certified wood, including its source and cost of certified wood products.
 - f. Credit IEQ 3.1: Construction indoor-air-quality management plan.
 3. FOR CORE AND SHELL DEVELOPMENT:
 - a. Credit MR 2: Waste management plan complying with Section 017419 "Construction Waste Management and Disposal."
 - b. Credit MR 3: List of proposed salvaged, refurbished, and reused materials. Identify each material that will be salvaged, refurbished, or reused, including its source, cost, and replacement cost if the item was to be purchased new.
 - c. Credit MR 4: List of proposed materials with recycled content. Indicate cost, post-consumer recycled content, and pre-consumer recycled content for each product having recycled content.
 - d. Credit MR 5: List of proposed regional materials. Identify each regional material, including its source, cost, and the fraction by weight that is considered regional.
 - e. Credit MR 6: List of proposed certified wood products. Indicate each product containing certified wood, including its source and cost of certified wood products.
 - f. Credit IEQ 3: Construction indoor-air-quality management plan.
 4. FOR SCHOOLS:
 - a. Credit MR 2: Waste management plan complying with Section 017419 "Construction Waste Management and Disposal."
 - b. Credit MR 3: List of proposed salvaged, refurbished, and reused materials. Identify each material that will be salvaged, refurbished, or reused, including its source, cost, and replacement cost if the item was to be purchased new.
 - c. Credit MR 4: List of proposed materials with recycled content. Indicate cost, post-consumer recycled content, and pre-consumer recycled content for each product having recycled content.
 - d. Credit MR 5: List of proposed regional materials. Identify each regional material, including its source, cost, and the fraction by weight that is considered regional.
 - e. Credit MR 7: List of proposed certified wood products. Indicate each product containing certified wood, including its source and cost of certified wood products.
 - f. Credit IEQ 3.1: Construction indoor-air-quality management plan.
- D. LEED Progress Reports: Concurrent with each Application for Payment, submit reports comparing actual construction and purchasing activities with LEED action plans for the following:
1. FOR CONSTRUCTION AND MAJOR RENOVATIONS:
 - a. Credit MR 2: Waste reduction progress reports complying with Section 017419 "Construction Waste Management and Disposal."
 - b. Credit MR 3: Salvaged, refurbished, and reused materials.
 - c. Credit MR 4: Recycled content.
 - d. Credit MR 5: Regional materials.
 - e. Credit MR 7: Certified wood products.
 2. FOR COMMERCIAL INTERIORS:
 - a. Credit MR 2: Waste reduction progress reports complying with Section 017419 "Construction Waste Management and Disposal."
 - b. Credit MR 3.1 and Credit MR 3.2: Salvaged, refurbished, and reused materials.
 - c. Credit MR 4: Recycled content.
 - d. Credit MR 5: Regionally manufactured materials and regionally extracted and manufactured materials.
 - e. Credit MR 7: Certified wood products.
 3. FOR CORE AND SHELL DEVELOPMENT:
 - a. Credit MR 2: Waste reduction progress reports complying with Section 017419 "Construction Waste Management and Disposal."
 - b. Credit MR 3: Salvaged, refurbished, and reused materials.



- c. Credit MR 4: Recycled content.
- d. Credit MR 5: Regional materials.
- e. Credit MR 6: Certified wood products.
- 4. FOR SCHOOLS:
 - a. Credit MR 2: Waste reduction progress reports complying with Section 017419 "Construction Waste Management and Disposal."
 - b. Credit MR 3: Salvaged, refurbished, and reused materials.
 - c. Credit MR 4: Recycled content.
 - d. Credit MR 5: Regional materials.
 - e. Credit MR 7: Certified wood products.

1.6 QUALITY ASSURANCE

- A. LEED Coordinator: Engage an experienced LEED-Accredited Professional to coordinate LEED requirements. LEED coordinator may also serve as waste management coordinator.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Provide products and procedures necessary to obtain LEED credits required in this Section. Although other Sections may specify some requirements that contribute to LEED credits, the Contractor shall determine additional materials and procedures necessary to obtain LEED credits indicated.

2.2 SALVAGED, REFURBISHED, OR REUSED MATERIALS

- A. FOR CONSTRUCTION AND MAJOR RENOVATIONS
 - 1. Credit MR 3: Not less than 5 **OR** 10 percent, **as directed**, of building materials (by cost) shall be salvaged, refurbished, or reused materials. Certain materials may be salvaged, refurbished, or reused materials **as directed**.
- B. FOR COMMERCIAL INTERIORS
 - 1. Credit MR 3.1 and Credit MR 3.2: Not less than 5 **OR** 10 percent, **as directed**, of building materials (by cost) shall be salvaged, refurbished, or reused materials.
- C. FOR CORE AND SHELL DEVELOPMENT
 - 1. Credit MR 3: Not less than 5 percent of building materials (by cost) shall be salvaged, refurbished, or reused materials.
- D. FOR SCHOOLS
 - 1. Credit MR 3: Not less than 1 percent of building materials (by cost) shall be salvaged, refurbished, or reused materials.

2.3 RECYCLED CONTENT OF MATERIALS

- A. Credit MR 4: Building materials shall have recycled content such that post-consumer recycled content plus one-half of pre-consumer recycled content for Project constitutes a minimum of 10 **OR** 20, **as directed**, percent of cost of materials used for Project.



1. Cost of post-consumer recycled content plus one-half of pre-consumer recycled content of an item shall be determined by dividing weight of post-consumer recycled content plus one-half of pre-consumer recycled content in the item by total weight of the item and multiplying by cost of the item.
2. Do not include furniture, plumbing, mechanical and electrical components, and specialty items such as elevators and equipment in the calculation.

2.4 REGIONAL MATERIALS

- A. FOR CONSTRUCTION AND MAJOR RENOVATIONS, CORE AND SHELL DEVELOPMENT, and SCHOOLS
 1. Credit MR 5: Not less than 10 **OR** 20 percent, **as directed**, of building materials (by cost) shall be regional materials.
- B. FOR COMMERCIAL INTERIORS
 1. Credit MR 5, Option 1: Not less than 20 percent of materials (by cost) shall be regionally manufactured materials.
 2. Credit MR 5, Option 2: Not less than 10 percent of materials (by cost) shall be regionally extracted and manufactured materials.

2.5 CERTIFIED WOOD

- A. Wood-based materials include, but are not limited to, the following materials when made from wood, engineered wood products, or wood-based panel products:
 1. Rough carpentry.
 2. Miscellaneous carpentry.
 3. Heavy timber construction.
 4. Wood decking.
 5. Metal-plate-connected wood trusses.
 6. Structural glued-laminated timber.
 7. Finish carpentry.
 8. Architectural woodwork.
 9. Wood paneling.
 10. Wood veneer wall covering.
 11. Wood flooring.
 12. Wood lockers.
 13. Wood cabinets.
 14. Furniture
- B. FOR CONSTRUCTION AND MAJOR RENOVATIONS, COMMERCIAL INTERIORS , and SCHOOLS
 1. Credit MR 7: Not less than 50 percent (by cost) of wood-based materials shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
- C. FOR CORE AND SHELL DEVELOPMENT
 1. Credit MR 6: Not less than 50 percent (by cost) of wood-based materials shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."



2.6 LOW-EMITTING MATERIALS

A. FOR CONSTRUCTION AND MAJOR RENOVATIONS, COMMERCIAL INTERIORS, and CORE AND SHELL DEVELOPMENT

1. Credit IEQ 4.1: For field applications that are inside the weatherproofing system, adhesives and sealants shall comply with the following VOC content limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Wood Glues: 30 g/L.
 - b. Metal-to-Metal Adhesives: 30 g/L.
 - c. Adhesives for Porous Materials (Except Wood): 50 g/L.
 - d. Subfloor Adhesives: 50 g/L.
 - e. Plastic Foam Adhesives: 50 g/L.
 - f. Carpet Adhesives: 50 g/L.
 - g. Carpet Pad Adhesives: 50 g/L.
 - h. VCT and Asphalt Tile Adhesives: 50 g/L.
 - i. Cove Base Adhesives: 50 g/L.
 - j. Gypsum Board and Panel Adhesives: 50 g/L.
 - k. Rubber Floor Adhesives: 60 g/L.
 - l. Ceramic Tile Adhesives: 65 g/L.
 - m. Multipurpose Construction Adhesives: 70 g/L.
 - n. Fiberglass Adhesives: 80 g/L.
 - o. Contact Adhesive: 80 g/L.
 - p. Structural Glazing Adhesives: 100 g/L.
 - q. Wood Flooring Adhesive: 100 g/L.
 - r. Structural Wood Member Adhesive: 140 g/L.
 - s. Single-Ply Roof Membrane Adhesive: 250 g/L.
 - t. Special-Purpose Contact Adhesive (contact adhesive that is used to bond melamine-covered board, metal, unsupported vinyl, rubber, or wood veneer 1/16 inch or less in thickness to any surface): 250 g/L.
 - u. Top and Trim Adhesive: 250 g/L.
 - v. Plastic Cement Welding Compounds: 250 g/L.
 - w. ABS Welding Compounds: 325 g/L.
 - x. CPVC Welding Compounds: 490 g/L.
 - y. PVC Welding Compounds: 510 g/L.
 - z. Adhesive Primer for Plastic: 550 g/L.
 - aa. Sheet-Applied Rubber Lining Adhesive: 850 g/L.
 - bb. Aerosol Adhesive, General-Purpose Mist Spray: 65 percent by weight.
 - cc. Aerosol Adhesive, General-Purpose Web Spray: 55 percent by weight.
 - dd. Special-Purpose Aerosol Adhesive (All Types): 70 percent by weight.
 - ee. Other Adhesives: 250 g/L.
 - ff. Architectural Sealants: 250 g/L.
 - gg. Nonmembrane Roof Sealants: 300 g/L.
 - hh. Single-Ply Roof Membrane Sealants: 450 g/L.
 - ii. Other Sealants: 420 g/L.
 - jj. Sealant Primers for Nonporous Substrates: 250 g/L.
 - kk. Sealant Primers for Porous Substrates: 775 g/L.
 - ll. Modified Bituminous Sealant Primers: 500 g/L.
 - mm. Other Sealant Primers: 750 g/L.
2. Credit IEQ 4.2: For field applications that are inside the weatherproofing system, paints and coatings shall comply with the following VOC content limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Flat Paints and Coatings: VOC not more than 50 g/L.
 - b. Nonflat Paints and Coatings: VOC not more than 150 g/L.
 - c. Dry-Fog Coatings: VOC not more than 400 g/L.
 - d. Primers, Sealers, and Undercoaters: VOC not more than 200 g/L.
 - e. Anticorrosive and Antirust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.



- f. Zinc-Rich Industrial Maintenance Primers: VOC not more than 340 g/L.
 - g. Pretreatment Wash Primers: VOC not more than 420 g/L.
 - h. Clear Wood Finishes, Varnishes: VOC not more than 350 g/L.
 - i. Clear Wood Finishes, Lacquers: VOC not more than 550 g/L.
 - j. Floor Coatings: VOC not more than 100 g/L.
 - k. Shellacs, Clear: VOC not more than 730 g/L.
 - l. Shellacs, Pigmented: VOC not more than 550 g/L.
 - m. Stains: VOC not more than 250 g/L.
3. Credit IEQ 4.4: Composite wood, agrifiber products, and adhesives shall not contain urea-formaldehyde resin.

B. FOR SCHOOLS

- 1. Credit IEQ 4: The following products and systems, where installed inside the weatherproofing system, shall meet the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
 - a. Adhesives and sealants.
 - b. Paints and coatings.
 - c. Flooring systems.
 - d. Composite wood and agrifiber products.
 - e. Ceilings and wall systems.

PART 3 - EXECUTION

3.1 REFRIGERANT AND CLEAN-AGENT FIRE-EXTINGUISHING-AGENT REMOVAL

- A. Prerequisite EA 3: Remove CFC-based refrigerants from existing HVAC&R equipment indicated to remain and replace with refrigerants that are not CFC based. Replace or adjust existing equipment to accommodate new refrigerant as described in HVAC Sections.
- B. Credit EA 4: Remove clean-agent fire-extinguishing agents that contain HCFCs or halons and replace with agent that does not contain HCFCs or halons. See Section 212200 "Clean-Agent Fire-Extinguishing Systems" for additional requirements.

3.2 MEASUREMENT AND VERIFICATION

A. FOR CONSTRUCTION AND MAJOR RENOVATIONS and SCHOOLS

- 1. Credit EA 5: Implement measurement and verification plan consistent with Option B: Energy Conservation Measure Isolation **OR** Option D: Calibrated Simulation, Savings Estimation Method 2, **as directed**, in the EVO's "International Performance Measurement and Verification Protocol (IPMVP), Volume III: Concepts and Options for Determining Energy Savings in New Construction," and **as directed**.

B. FOR COMMERCIAL INTERIORS

- 1. Credit EA 3: Implement measurement and verification plan consistent with Option B: Energy Conservation Measure Isolation **OR** Option D: Calibrated Simulation, Savings Estimation Method 2, **as directed**, in the EVO's "International Performance Measurement and Verification Protocol (IPMVP), Volume III: Concepts and Options for Determining Energy Savings in New Construction," and **as directed**.

C. FOR CORE AND SHELL DEVELOPMENT



1. Credit EA 5.1 and 5.2: Implement measurement and verification plan consistent with Option B: Energy Conservation Measure Isolation **OR** Option D: Calibrated Simulation, Savings Estimation Method 2, **as directed**, in the EVO's "International Performance Measurement and Verification Protocol (IPMVP), Volume III: Concepts and Options for Determining Energy Savings in New Construction," and **as directed**.
 - D. If not already in place, install metering equipment to measure energy usage. Monitor, record, and trend log measurements.
 - E. Evaluate energy performance and efficiency by comparing actual to predicted performance.
 - F. Measurement and verification period shall cover at least one year of postconstruction occupancy.
- 3.3 CONSTRUCTION WASTE MANAGEMENT
- A. Credit MR 2: Comply with Section 017419 "Construction Waste Management and Disposal."
- 3.4 CONSTRUCTION INDOOR-AIR-QUALITY MANAGEMENT
- A. Credit IEQ 3.1: Comply with SMACNA's "SMACNA IAQ Guideline for Occupied Buildings under Construction."
 1. If Owner authorizes use of permanent heating, cooling, and ventilating systems during construction period as specified in Section 015000 "Temporary Facilities and Controls," install filter media having a MERV 8 according to ASHRAE 52.2 at each return-air inlet for the air-handling system used during construction.
 2. Replace all air filters immediately prior to occupancy.
 - B. Credit IEQ 3.2: Comply with one of the following requirements, **as directed**:
 1. After construction ends, prior to occupancy and with all interior finishes installed, perform a building flush-out by supplying a total volume of 14000 cu. ft. (4 300 000 L) of outdoor air per sq. ft. (sq. m) of floor area while maintaining an internal temperature of at least 60 deg F (16 deg C) and a relative humidity no higher than 60 percent.
 2. If occupancy is desired prior to flush-out completion, the space may be occupied following delivery of a minimum of 3500 cu. ft. (1 070 000 L) of outdoor air per sq. ft. (sq. m) of floor area to the space. Once a space is occupied, it shall be ventilated at a minimum rate of 0.30 cfm per sq. ft. (1.52 L/s per sq. m) of outside air or the design minimum outside air rate determined in Prerequisite IEQ 1, whichever is greater. During each day of the flush-out period, ventilation shall begin a minimum of three hours prior to occupancy and continue during occupancy. These conditions shall be maintained until a total of 14000 cu. ft./sq. ft. (4 300 000 L/sq. m) of outside air has been delivered to the space.
 3. Air-Quality Testing:
 - a. Conduct baseline indoor-air-quality testing, after construction ends and prior to occupancy, using testing protocols consistent with the EPA's "Compendium of Methods for the Determination of Air Pollutants in Indoor Air," and as additionally detailed in the USGBC's "Green Building Design and Construction Reference Guide."
 - b. Demonstrate that the contaminant maximum concentrations listed below are not exceeded:
 - 1) Formaldehyde: 27 ppb.
 - 2) Particulates (PM10): 50 micrograms/cu. m.



- 3) Total Volatile Organic Compounds (TVOC): 500 micrograms/cu. m.
 - 4) 4-Phenylcyclohexene (4-PH): 6.5 micrograms/cu. m.
 - 5) Carbon Monoxide: 9 ppm and no greater than 2 ppm above outdoor levels.
- c. For each sampling point where the maximum concentration limits are exceeded, conduct additional flush-out with outside air and retest the specific parameter(s) exceeded to indicate the requirements are achieved. Repeat procedure until all requirements have been met. When retesting noncomplying building areas, take samples from same locations as in the first test.
- d. Air-sample testing shall be conducted as follows:
- 1) All measurements shall be conducted prior to occupancy but during normal occupied hours, and with building ventilation system starting at the normal daily start time and operated at the minimum outside air flow rate for the occupied mode throughout the duration of the air testing.
 - 2) Building shall have all interior finishes installed including, but not limited to, millwork, doors, paint, carpet, and acoustic tiles. Nonfixed furnishings such as workstations and partitions are encouraged, but not required, to be in place for the testing.
 - 3) Number of sampling locations varies depending on the size of building and number of ventilation systems. For each portion of building served by a separate ventilation system, the number of sampling points shall not be less than one per 25,000 sq. ft. (2300 sq. m) or for each contiguous floor area, whichever is larger, and shall include areas with the least ventilation and greatest presumed source strength.
 - 4) Air samples shall be collected between 3 and 6 feet (0.9 and 1.8 m) from the floor to represent the breathing zone of occupants, and over a minimum four-hour period.

END OF SECTION01 32 33 00b.13

**SECTION 01 32 33 00c - REFERENCES****1.1 GENERAL****A. Definitions**

1. General: Basic Contract definitions are included in the Conditions of the Contract.
2. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
3. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
4. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
5. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
6. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
7. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
8. "Provide": Furnish and install, complete and ready for the intended use.
9. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

B. Industry Standards

1. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
2. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
3. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
 - a. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

C. Abbreviations And Acronyms

1. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

AA	Aluminum Association, Inc. (The) www.aluminum.org	(703) 358-2960
AAADM	American Association of Automatic Door Manufacturers www.aaadm.com	(216) 241-7333
AABC	Associated Air Balance Council www.aabchq.com	(202) 737-0202



AAMA	American Architectural Manufacturers Association www.aamanet.org	(847) 303-5664
AASHTO	American Association of State Highway and Transportation Officials www.transportation.org	(202) 624-5800
AATCC	American Association of Textile Chemists and Colorists (The) www.aatcc.org	(919) 549-8141
ABAA	Air Barrier Association of America www.airbarrier.org	(866) 956-5888
ABMA	American Bearing Manufacturers Association www.abma-dc.org	(202) 367-1155
ACI	ACI International (American Concrete Institute) www.aci-int.org	(248) 848-3700
ACPA	American Concrete Pipe Association www.concrete-pipe.org	(972) 506-7216
AEIC	Association of Edison Illuminating Companies, Inc. (The) www.aeic.org	(205) 257-2530
AF&PA	American Forest & Paper Association www.afandpa.org	(800) 878-8878 (202) 463-2700
AGA	American Gas Association www.aga.org	(202) 824-7000
AGC	Associated General Contractors of America (The) www.agc.org	(703) 548-3118
AHA	American Hardboard Association (Now part of CPA)	
AHAM	Association of Home Appliance Manufacturers www.aham.org	(202) 872-5955
AI	Asphalt Institute www.asphaltinstitute.org	(859) 288-4960
AIA	American Institute of Architects (The) www.aia.org	(800) 242-3837 (202) 626-7300
AISC	American Institute of Steel Construction www.aisc.org	(800) 644-2400 (312) 670-2400
AISI	American Iron and Steel Institute www.steel.org	(202) 452-7100
AITC	American Institute of Timber Construction	(303) 792-9559



	www.aitc-glulam.org	
ALCA	Associated Landscape Contractors of America (Now PLANET - Professional Landcare Network)	
ALSC	American Lumber Standard Committee, Incorporated www.alsc.org	(301) 972-1700
AMCA	Air Movement and Control Association International, Inc. www.amca.org	(847) 394-0150
ANSI	American National Standards Institute www.ansi.org	(202) 293-8020
AOSA	Association of Official Seed Analysts, Inc. www.aosaseed.com	(405) 780-7372
APA	Architectural Precast Association www.archprecast.org	(239) 454-6989
APA	APA - The Engineered Wood Association www.apawood.org	(253) 565-6600
APA EWS	APA - The Engineered Wood Association; Engineered Wood Systems (See APA - The Engineered Wood Association)	
API	American Petroleum Institute www.api.org	(202) 682-8000
ARI	Air-Conditioning & Refrigeration Institute www.ari.org	(703) 524-8800
ARMA	Asphalt Roofing Manufacturers Association www.asphaltroofing.org	(202) 207-0917
ASCE	American Society of Civil Engineers www.asce.org	(800) 548-2723 (703) 295-6300
ASCE/SEI	American Society of Civil Engineers/Structural Engineering Institute (See ASCE)	
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers www.ashrae.org	(800) 527-4723 (404) 636-8400
ASME	ASME International (The American Society of Mechanical Engineers International) www.asme.org	(800) 843-2763 (973) 882-1170
ASSE	American Society of Sanitary Engineering www.asse-plumbing.org	(440) 835-3040
ASTM	ASTM International (American Society for Testing and Materials International)	(610) 832-9585



	www.astm.org	
AWCI	AWCI International (Association of the Wall and Ceiling Industry International) www.awci.org	(703) 534-8300
AWCMA	American Window Covering Manufacturers Association (Now WCSC)	
AWI	Architectural Woodwork Institute www.awinet.org	(571) 323-3636
AWPA	American Wood-Preservers' Association www.awpa.com	(205) 733-4077
AWS	American Welding Society www.aws.org	(800) 443-9353 (305) 443-9353
AWWA	American Water Works Association www.awwa.org	(800) 926-7337 (303) 794-7711
BHMA	Builders Hardware Manufacturers Association www.buildershardware.com	(212) 297-2122
BIA	Brick Industry Association (The) www.bia.org	(703) 620-0010
BICSI	Building Industry Consulting Service International www.bicsi.org	(800) 242-7405 (813) 979-1991
BIFMA	BIFMA International (Business and Institutional Furniture Manufacturer's Association International) www.bifma.com	(616) 285-3963
BISSC	Baking Industry Sanitation Standards Committee www.bissc.org	(866) 342-4772
CCC	Carpet Cushion Council www.carpetcushion.org	(610) 527-3880
CDA	Copper Development Association www.copper.org	(800) 232-3282 (212) 251-7200
CEA	Canadian Electricity Association www.canelect.ca	(613) 230-9263
CFFA	Chemical Fabrics & Film Association, Inc. www.chemicalfabricsandfilm.com	(216) 241-7333
CGA	Compressed Gas Association www.cganet.com	(703) 788-2700
CIMA	Cellulose Insulation Manufacturers Association www.cellulose.org	(888) 881-2462 (937) 222-2462



CISCA	Ceilings & Interior Systems Construction Association www.cisca.org	(630) 584-1919
CISPI	Cast Iron Soil Pipe Institute www.cispi.org	(423) 892-0137
CLFMI	Chain Link Fence Manufacturers Institute www.chainlinkinfo.org	(301) 596-2583
CRRC	Cool Roof Rating Council www.coolroofs.org	(866) 465-2523 (510) 485-7175
CPA	Composite Panel Association www.pbmdf.com	(301) 670-0604
CPPA	Corrugated Polyethylene Pipe Association www.cppa-info.org	(800) 510-2772 (202) 462-9607
CRI	Carpet & Rug Institute (The) www.carpet-rug.com	(800) 882-8846 (706) 278-3176
CRSI	Concrete Reinforcing Steel Institute www.crsi.org	(847) 517-1200
CSA	Canadian Standards Association	(800) 463-6727 (416) 747-4000
CSA	CSA International (Formerly: IAS - International Approval Services) www.csa-international.org	(866) 797-4272 (416) 747-4000
CSI	Cast Stone Institute www.caststone.org	(717) 272-3744
CSI	Construction Specifications Institute (The) www.csinet.org	(800) 689-2900 (703) 684-0300
CSSB	Cedar Shake & Shingle Bureau www.cedarbureau.org	(604) 820-7700
CTI	Cooling Technology Institute (Formerly: Cooling Tower Institute) www.cti.org	(281) 583-4087
DHI	Door and Hardware Institute www.dhi.org	(703) 222-2010
EIA	Electronic Industries Alliance www.eia.org	(703) 907-7500
EIMA	EIFS Industry Members Association www.eima.com	(800) 294-3462 (770) 968-7945
EJCDC	Engineers Joint Contract Documents Committee www.ejdc.org	(703) 295-5000



EJMA	Expansion Joint Manufacturers Association, Inc. www.ejma.org	(914) 332-0040
ESD	ESD Association www.esda.org	(315) 339-6937
FIBA	Federation Internationale de Basketball (The International Basketball Federation) www.fiba.com	41 22 545 00 00
FIVB	Federation Internationale de Volleyball (The International Volleyball Federation) www.fivb.ch	41 21 345 35 35
FM Approvals	FM Approvals www.fmglobal.com	(781) 762-4300
FM Global	FM Global (Formerly: FMG - FM Global) www.fmglobal.com	(401) 275-3000
FMRC	Factory Mutual Research (Now FM Global)	
FRSA	Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc. www.floridarroof.com	(407) 671-3772
FSA	Fluid Sealing Association www.fluidsealing.com	(610) 971-4850
FSC	Forest Stewardship Council www.fsc.org	49 228 367 66 0
GA	Gypsum Association www.gypsum.org	(202) 289-5440
GANA	Glass Association of North America www.glasswebsite.com	(785) 271-0208
GRI	(Now GSI)	
GS	Green Seal www.greenseal.org	(202) 872-6400
GSI	Geosynthetic Institute www.geosynthetic-institute.org	(610) 522-8440
HI	Hydraulic Institute www.pumps.org	(888) 786-7744 (973) 267-9700
HI	Hydronics Institute www.gamanet.org	(908) 464-8200



HMMA	Hollow Metal Manufacturers Association (Part of NAAMM)	
HPVA	Hardwood Plywood & Veneer Association www.hpva.org	(703) 435-2900
HPW	H. P. White Laboratory, Inc. www.hpwhite.com	(410) 838-6550
IAS	International Approval Services (Now CSA International)	
IBF	International Badminton Federation www.internationalbadminton.org	(6-03) 9283-7155
ICEA	Insulated Cable Engineers Association, Inc. www.icea.net	(770) 830-0369
ICRI	International Concrete Repair Institute, Inc. www.icri.org	(847) 827-0830
IEC	International Electrotechnical Commission www.iec.ch	41 22 919 02 11
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The) www.ieee.org	(212) 419-7900
IESNA	Illuminating Engineering Society of North America www.iesna.org	(212) 248-5000
IEST	Institute of Environmental Sciences and Technology www.iest.org	(847) 255-1561
IGCC	Insulating Glass Certification Council www.igcc.org	(315) 646-2234
IGMA	Insulating Glass Manufacturers Alliance www.igmaonline.org	(613) 233-1510
ILI	Indiana Limestone Institute of America, Inc. www.iliai.com	(812) 275-4426
ISO	International Organization for Standardization www.iso.ch	41 22 749 01 11
	Available from ANSI www.ansi.org	(202) 293-8020
ISSFA	International Solid Surface Fabricators Association www.issfa.net	(877) 464-7732 (702) 567-8150
ITS	Intertek Testing Service NA www.intertek.com	(972) 238-5591
ITU	International Telecommunication Union www.itu.int/home	41 22 730 51 11



KCMA	Kitchen Cabinet Manufacturers Association www.kcma.org	(703) 264-1690
LMA	Laminating Materials Association (Now part of CPA)	
LPI	Lightning Protection Institute www.lightning.org	(800) 488-6864
MBMA	Metal Building Manufacturers Association www.mbma.com	(216) 241-7333
MFMA	Maple Flooring Manufacturers Association, Inc. www.maplefloor.org	(847) 480-9138
MFMA	Metal Framing Manufacturers Association, Inc. www.metalframingmfg.org	(312) 644-6610
MH	Material Handling (Now MHIA)	
MHIA	Material Handling Industry of America www.mhia.org	(800) 345-1815 (704) 676-1190
MIA	Marble Institute of America www.marble-institute.com	(440) 250-9222
MPI	Master Painters Institute www.paintinfo.com	(888) 674-8937
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc. www.mss-hq.com	(703) 281-6613
NAAMM	National Association of Architectural Metal Manufacturers www.naamm.org	(312) 332-0405
NACE	NACE International (National Association of Corrosion Engineers International) www.nace.org	(800) 797-6623 (281) 228-6200
NADCA	National Air Duct Cleaners Association www.nadca.com	(202) 737-2926
NAGWS	National Association for Girls and Women in Sport www.aahperd.org/nagws/	(800) 213-7193, ext. 453
NAIMA	North American Insulation Manufacturers Association www.naima.org	(703) 684-0084
NBGQA	National Building Granite Quarries Association, Inc. www.nbgqa.com	(800) 557-2848



NCAA	National Collegiate Athletic Association (The) www.ncaa.org	(317) 917-6222
NCMA	National Concrete Masonry Association www.ncma.org	(703) 713-1900
NCPI	National Clay Pipe Institute www.ncpi.org	(262) 248-9094
NCTA	National Cable & Telecommunications Association www.ncta.com	(202) 775-3550
NEBB	National Environmental Balancing Bureau www.nebb.org	(301) 977-3698
NECA	National Electrical Contractors Association www.necanet.org	(301) 657-3110
NeLMA	Northeastern Lumber Manufacturers' Association www.nelma.org	(207) 829-6901
NEMA	National Electrical Manufacturers Association www.nema.org	(703) 841-3200
NETA	InterNational Electrical Testing Association www.netaworld.org	(888) 300-6382 (303) 697-8441
NFHS	National Federation of State High School Associations www.nfhs.org	(317) 972-6900
NFPA	NFPA (National Fire Protection Association) www.nfpa.org	(800) 344-3555 (617) 770-3000
NFRC	National Fenestration Rating Council www.nfrc.org	(301) 589-1776
NGA	National Glass Association www.glass.org	(866) 342-5642 (703) 442-4890
NHLA	National Hardwood Lumber Association www.natlhardwood.org	(800) 933-0318 (901) 377-1818
NLGA	National Lumber Grades Authority www.nlga.org	(604) 524-2393
NOFMA	NOFMA: The Wood Flooring Manufacturers Association (Formerly: National Oak Flooring Manufacturers Association) www.nofma.com	(901) 526-5016
NRCA	National Roofing Contractors Association www.nrca.net	(800) 323-9545 (847) 299-9070
NRMCA	National Ready Mixed Concrete Association www.nrmca.org	(888) 846-7622 (301) 587-1400



NSF	NSF International (National Sanitation Foundation International) www.nsf.org	(800) 673-6275 (734) 769-8010
NSSGA	National Stone, Sand & Gravel Association www.nssga.org	(800) 342-1415 (703) 525-8788
NTMA	National Terrazzo & Mosaic Association, Inc. (The) www.ntma.com	(800) 323-9736 (540) 751-0930
NTRMA	National Tile Roofing Manufacturers Association (Now TRI)	
NWWDA	National Wood Window and Door Association (Now WDMA)	
OPL	Omega Point Laboratories, Inc. (Now ITS)	
PCI	Precast/Prestressed Concrete Institute www.pci.org	(312) 786-0300
PDCA	Painting & Decorating Contractors of America www.pdca.com	(800) 332-7322 (314) 514-7322
PDI	Plumbing & Drainage Institute www.pdionline.org	(800) 589-8956 (978) 557-0720
PGI	PVC Geomembrane Institute http://pgi-tp.ce.uiuc.edu	(217) 333-3929
PLANET	Professional Landcare Network (Formerly: ACLA - Associated Landscape Contractors of America) www.landcarenetwork.org	(800) 395-2522 (703) 736-9666
PTI	Post-Tensioning Institute www.post-tensioning.org	(602) 870-7540
RCSC	Research Council on Structural Connections www.boltcouncil.org	
RFCI	Resilient Floor Covering Institute www.rfci.com	(301) 340-8580
RIS	Redwood Inspection Service www.calredwood.org	(888) 225-7339 (415) 382-0662
SAE	SAE International www.sae.org	(877) 606-7323 (724) 776-4841
SDI	Steel Deck Institute www.sdi.org	(847) 458-4647
SDI	Steel Door Institute	(440) 899-0010



	www.steeldoor.org	
SEFA	Scientific Equipment and Furniture Association www.sefalabs.com	(516) 294-5424
SEI/ASCE	Structural Engineering Institute/American Society of Civil Engineers (See ASCE)	
SGCC	Safety Glazing Certification Council www.sgcc.org	(315) 646-2234
SIA	Security Industry Association www.siaonline.org	(703) 683-2075
SIGMA	Sealed Insulating Glass Manufacturers Association (Now IGMA)	
SJI	Steel Joist Institute www.steeljoist.org	(843) 626-1995
SMA	Screen Manufacturers Association www.smacentral.org	(561) 533-0991
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association www.smacna.org	(703) 803-2980
SMPTE	Society of Motion Picture and Television Engineers www.smpte.org	(914) 761-1100
SPFA	Spray Polyurethane Foam Alliance (Formerly: SPI/SPFD - The Society of the Plastics Industry, Inc.; Spray Polyurethane Foam Division) www.sprayfoam.org	(800) 523-6154
SPIB	Southern Pine Inspection Bureau (The) www.spib.org	(850) 434-2611
SPRI	Single Ply Roofing Industry www.spri.org	(781) 647-7026
SSINA	Specialty Steel Industry of North America www.ssina.com	(800) 982-0355 (202) 342-8630
SSPC	SSPC: The Society for Protective Coatings www.sspc.org	(877) 281-7772 (412) 281-2331
STI	Steel Tank Institute www.steeltank.com	(847) 438-8265
SWI	Steel Window Institute www.steelwindows.com	(216) 241-7333
SWRI	Sealant, Waterproofing, & Restoration Institute www.swrionline.org	(816) 472-7974



TCA	Tile Council of America, Inc. www.tileusa.com	(864) 646-8453
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance www.tiaonline.org	(703) 907-7700
TMS	The Masonry Society www.masonrysociety.org	(303) 939-9700
TPI	Truss Plate Institute, Inc. www.tpinst.org	(703) 683-1010
TPI	Turfgrass Producers International www.turfgrassod.org	(800) 405-8873 (847) 649-5555
TRI	Tile Roofing Institute www.tilerroofing.org	(312) 670-4177
UL	Underwriters Laboratories Inc. www.ul.com	(877) 854-3577 (847) 272-8800
UNI	Uni-Bell PVC Pipe Association www.uni-bell.org	(972) 243-3902
USAV	USA Volleyball www.usavolleyball.org	(888) 786-5539 (719) 228-6800
USGBC	U.S. Green Building Council www.usgbc.org	(202) 828-7422
USITT	United States Institute for Theatre Technology, Inc. www.usitt.org	(800) 938-7488 (315) 463-6463
WASTEC	Waste Equipment Technology Association www.wastec.org	(800) 424-2869 (202) 244-4700
WCLIB	West Coast Lumber Inspection Bureau www.wclib.org	(800) 283-1486 (503) 639-0651
WCMA	Window Covering Manufacturers Association (Now WCSC)	
WCSC	Window Covering Safety Council (Formerly: WCMA - Window Covering Manufacturers Association) www.windowcoverings.org	(800) 506-4636 (212) 297-2109
WDMA	Window & Door Manufacturers Association (Formerly: NWWDA - National Wood Window and Door Association) www.wdma.com	(800) 223-2301 (847) 299-5200
WI	Woodwork Institute (Formerly: WIC - Woodwork Institute of	(916) 372-9943



	California) www.wicnet.org	
WIC	Woodwork Institute of California (Now WI)	
WMMPA	Wood Moulding & Millwork Producers Association www.wmmpa.com	(800) 550-7889 (530) 661-9591
WSRCA	Western States Roofing Contractors Association www.wsrca.com	(800) 725-0333 (650) 570-5441
WWPA	Western Wood Products Association www.wwpa.org	(503) 224-3930
2.	Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.	
IAPMO	International Association of Plumbing and Mechanical Officials www.iapmo.org	(909) 472-4100
IBC	International Building Code (See ICC)	
ICBO	International Conference of Building Officials (See ICC)	
ICBO ES	ICBO Evaluation Service, Inc. (See ICC-ES)	
ICC	International Code Council www.iccsafe.org	(888) 422-7233 (703) 931-4533
ICC-ES	ICC Evaluation Service, Inc. www.icc-es.org	(800) 423-6587 (562) 699-0543
SBCCI	Southern Building Code Congress International, Inc. (See ICC)	
3.	Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.	
CE	Army Corps of Engineers www.usace.army.mil	
CPSC	Consumer Product Safety Commission www.cpsc.gov	(800) 638-2772 (301) 504-7923
DOC	Department of Commerce www.commerce.gov	(202) 482-2000



DOD	Department of Defense http://.dodssp.daps.dla.mil	(215) 697-6257
DOE	Department of Energy www.energy.gov	(202) 586-9220
EPA	Environmental Protection Agency www.epa.gov	(202) 272-0167
FAA	Federal Aviation Administration www.faa.gov	(866) 835-5322
FCC	Federal Communications Commission www.fcc.gov	(888) 225-5322
FDA	Food and Drug Administration www.fda.gov	(888) 463-6332
GSA	General Services Administration www.gsa.gov	(800) 488-3111
HUD	Department of Housing and Urban Development www.hud.gov	(202) 708-1112
LBL	Lawrence Berkeley National Laboratory www.lbl.gov	(510) 486-4000
NCHRP	National Cooperative Highway Research Program (See TRB)	
NIST	National Institute of Standards and Technology www.nist.gov	(301) 975-6478
OSHA	Occupational Safety & Health Administration www.osha.gov	(800) 321-6742 (202) 693-1999
PBS	Public Building Service (See GSA)	
PHS	Office of Public Health and Science www.osophs.dhhs.gov/ophs	(202) 690-7694
RUS	Rural Utilities Service (See USDA)	(202) 720-9540
SD	State Department www.state.gov	(202) 647-4000
TRB	Transportation Research Board http://gulliver.trb.org	(202) 334-2934
USDA	Department of Agriculture www.usda.gov	(202) 720-2791



list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CBHF	State of California, Department of Consumer Affairs Bureau of Home Furnishings and Thermal Insulation www.dca.ca.gov/bhfti	(800) 952-5210 (916) 574-2041
CCR	California Code of Regulations www.calregs.com	(916) 323-6815
CPUC	California Public Utilities Commission www.cpuc.ca.gov	(415) 703-2782
TFS	Texas Forest Service Forest Resource Development http://txforests-service.tamu.edu	(979) 458-6650

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 32 33 00c



SECTION 01 32 33 00d - ABBREVIATIONS, ACRONYMS, DEFINITIONS, AND SYMBOLS

1.1 GENERAL

A. Description Of Work

1. This specification covers abbreviations, acronyms, definitions, and symbols used in the Contract Documents.

B. Unit of Measure Definitions

1. Following is a list of Industry Standard abbreviations.

A	Area Square Feet; Ampere	B&W	Black and White
AB	Anchor Bolt	BC	Between Centers
ABC	Aggregate Base Course	BCY	Bank Cubic Yard
ABS	Acrylonitrile Butadiene Styrene	BDL	Bundle
AC	Alternating Current; Air-Conditioning; Asphaltic Concrete; Plywood Grade A & C	BD FT	Board Feet
ACFM	Actual Cubic Feet Per Minute	BEV	Bevel/Beveled
ACM	Asbestos Containing Material	BF	Board Feet
ACP	Asphaltic Concrete Paving	BFP	Boiler Feed Pump
ACR	Acre	BHN	Brinell Hardness Number
ACZA	Ammoniacal Copper Zinc Arsenate	BHP	Boiler Horsepower; Brake Horsepower
AD	Plywood, Grade A & D	BI	Black Iron
ADDL	Additional	Bit.	Bituminous
ADJ	Adjustable	Bitum.	Bituminous
ADMIN	Administer; Administration	Bk.	Backed
AGG	Aggregate	Brkrs.	Breakers
AH	Ampere Hours	Bldg.	Building
AHM	Ampere-Hour Meter	BLK	Black; Block
AHU	Air Handling Unit	BM	Bank Measure; Beam
AIC	Amperes Interrupting Capacity	BOD	Biochemical Oxygen Demand
AL	Aluminum	BOX	Box (each)
ALT	Alternate	BR	Bedroom
AMP	Ampere	Brg.	Bearing
AMT	Amount	BRK	Brick
AOT	Adjusted Oxygen Transfer	BTFLY VLV	Butterfly Valve
APP	Attactic Polypropylene	BTR	Better (Lumber)
APPROX	Approximate	BTU	British Thermal Units
Apt.	Apartment	BTU/HR	British Thermal Units per Hour
ART	Articulated	BUR	Built Up Roof
ASB	Asbestos	BW	Butt Weld
ASJ	All Surface Jacketing	BWG	Birmingham Wire Gauge
Avg.	Average	BX	Interlocked Armored Cable
AWG	American Wire Gauge	C	Centigrade; Conductance; Conductivity, Hundred
BAG	Bag	CA	Corrosion Allowance
BBL	Barrel	Cab.	Cabinet
B&B	Grade B and Better; Balled & Burlapped	CAP	Capacity
B&S	Bell and Spigot	CB	Circuit Breaker
		CC	Center to Center
		CCA	Chromate Copper Arsenate
		CCF	Hundred Cubic Feet



CCY	Compacted Cubic Yard	Dis.	Discharge
cd	Candela	Disch.	Discharge
cd/sf	Candela per Square Foot	DB	Dry Bulb; Decibel
CF	Cubic Foot (Feet)	DBL	Double
CFM	Cubic Feet per Minute	DC	Direct Current
CHG	Charge	DCS	Distributed Control System
CHW	Chilled Water; Commercial Hot Water	DDC	Direct Digital Control
CI	Cast Iron	Demob	Demobilization
CIP	Cast in Place; Cast Iron Pipe	DF	Douglas Fir
CIRC	Circulating; Circuit	DFT	Dry Film Thickness
CLF	Hundred Linear Feet; Current Limiting Fuse	DH	Double Hung
CLP	Cross Linked Polyethylene	DHW	Domestic Hot Water
cm	Centimeter	DI	Ductile Iron
CMP	Corrugated Metal Pipe	D/P	Differential Pressure
CMPA	Corrugated Metal Pipe - Arched	DIA	Diameter
CMU	Concrete Masonry Unit	Diam	Diameter
CO	Carbon Monoxide	Diag.	Diagonal
CO2	Carbon Dioxide	Distrib.	Distribution
COL	Column	DL	Dead Load; Diesel
Comb	Combination	DLH	Deep Long Span Bar Joist
Compr	Compressor	DPST	Double Pole, Single Throw
CONC	Concrete	DS	Double Strength
CONSTR	Construction	DSA	Double Strength A Quality Glass
Cont	Continuous; Continued	DSB	Double Strength B Quality Glass
Corr	Corrugated	DWV	Drain, Waste, Vent Piping
CP	Chrome Plated	DX	Deluxe White, Direct Expansion
CPE	Chlorinated Polyethylene	dyn	Dyne
Cplg.	Coupling	e	Eccentricity
CPM	Cycles per Minute	E	Electrical Grade (Fiberglass Construction)
CPM	Critical Path Method	EA	Each
CPS	Centipoise	Econ.	Economy
CPRSR	Compressor	ECR	Electrical Grade, Corrosion Resistant (Fiberglass Construction)
CPVC	Chlorinated Polyvinyl Chloride	EDP	Electronic Data Processing
CS	Carbon Steel	EDR	Equiv. Direct Radiation
CSF	Hundred Square Feet	EG	Electro Galvanized
CSPE	ChloroSulphinated Polyethylene	EIFS	Exterior Insulation Finish System
CSS	Cast Semi Steel	ELEC	Electric; Electrical
CT	Current Transformer	Elev.	Elevator; Elevating
CTB	Cement Treated Base	EM	Electron Microscopy
CTR	Center	EMT	Electric Metallic Tubing; Thin Wall Conduit
CU FT	Cubic Foot	Eng.	Engine, Engineered
CU IN	Cubic Inch	EPDM	Ethylene Propylene Diene Monomer
CU YD	Cubic Yard	EPS	Expanded Polystyrene
CW	Chilled Water; Cold Water	EQL	Equally
CWR	Chilled Water Return	Equip.	Equipment
CWS	Chilled Water Supply	ERW	Electrical Resistance Welded
CWT	Hundred Weight	EROPS	Enclosed Roll Over Protection System
CY	Cubic Yard (27 cu. ft.); Cycle	ES	Energy Saver
CYH	Cubic Yards Per Hour	Est.	Estimated
Cyl	Cylinder	EW	Each Way
d	Penny (nail size)	EWT	Entering Water Temperature
D	Deep; Depth; Discharge		



Excav.	Excavation	Gen.	General
EXH	Exhaust	GFCI	Ground Fault Circuit Interrupter
Exp.	Expansion; Exposure	GFR	Ground Fault Relay
EXP JT	Expansion Joint	GPD	Gallons per Day
Ext.	Exterior	GPH	Gallon per Hour
		GPM	Gallon per Minute
F	Fahrenheit; Female; Fill	GR	Grade
f	Fiber stress	Grnd.	Ground
f _c	Compressive Stress in Concrete	GSF	Ground Square Foot
f _y	Minimum Yield Stress of Steel	GVW	Gross Vehicle Weight
f _m	Compressive Strength of Masonry		
F&D	Flanged-and-Dished	H	High, Height; High Strength Bar Joist
F&I	Furnished and Installed	HC	Handicapped; High Capacity
Fab.	Fabricated	HD	High Density; Heavy Duty
FAD	Free Air Delivery	HDO	High Density Overlay
FBGS	Fiberglass	HDPE	High Density Polyethylene
FC	Footcandles	Hdr.	Header
FCXP	Fan Cooled Explosion Proof	Hdw.	Hardware
FDA	Food and Drug Administration	HEPA	High Efficiency Particulate Air
FEP	Fluorinated Ethylene Propylene (Teflon)	Hg	Mercury
FF	Flat Face	HIC	High Interrupting Capacity
Fig.	Figure	HM	Hollow Metal
Fin.	Finished	HNDL	Handle
FL	Full Load	HO	High Output; Heel Outlet
FLDG	Folding	Horiz.	Horizontal
Fl. Oz.	Fluid Ounces	HP	High Pressure; Horse Power
Flr.	Floor	HPF	High Pressure Factor
FM	Frequency Modulation; Factory Mutual	HPL	High Pressure Laminate
Frmg.	Framing	HR	Hour
Fndtn.	Foundation	HRS	Hot-Rolled Steel
FT	Foot, Feet	HS	High Speed; High Strength
FTNG(S)	Fitting(s)	HSC	High Short Circuit
FLG	Flange	HSLA	High Strength Low Alloy
FOB	Freight on Board	HT	Hospital Tips; Height
Fount.	Fountain	Htg.	Heating
FPM	Feet Per Minute	Htrs.	Heaters
FPS	Feet Per Second	HVAC	Heating, Ventilating & Air Conditioning
FPT	Female Pipe Thread	Hvy.	Heavy
FRP	Fiberglass Reinforced Plastic	HW	Hot Water
FS	Forged Steel	HWR	Hot Water Return
FSC	Cast Body, Cast Switch Box	HWS	Hot Water Supply
Ftg.	Footing	HWT	Hundred Carton Weight
Ft. Lb.	Foot Pound	Hyd.	Hydraulic
Furn.	Furniture	Hydr.	Hydraulic
FVNR	Full Voltage Non-Reversing	HZ	Hertz (cycles)
FXM	Female by Male		
		I	Moment of Inertia
G	Gravity	IC	Interrupt Capacity
g	Gram	ICFM	Inlet Cubic Feet per Minute
GA	Gauge or Gage	ID	Inside Diameter
G & A	General and Administrative	I.D.	Identification; Inside Dimension
GAL	Gallon	IF	Inside Frosted
Gal./Min.	Gallon per Minute	IMC	Intermediate Metal Conduit
GALV	Galvanized	IN	Inch
GBSD	Gear Box Sheave Diameter	IN LB	Inch Pound
		IN WC	Inches Water Column



Incan.	Incandescent	LE	Leading Edge; Lead Equivalent
Incl.	Include, Including	LED	Light Emitting Diode
Inst.	Install, Installation	LEL	Lower Explosive Limit
Insul.	Insulation, Insulated	LF	Linear Foot
Int.	Interior	LFD	Linear Feet Per Day
INTSCT	Intersect	LFTL	Lineal Feet Tube Length
IP	Iron Pipe	Lge.	Large; Long
IPS	International Pipe Standard	LH	Labor Hours; Long Span Bar Joist
	Iron Pipe Size	LIN	Linear
	Inches per Second	LL	Live Load
IPT	Iron Pipe Threaded	LLD	Lamp Lumen Depreciation
ISP	Inlet Steam Pressure	LNG	Liquid Natural Gas
IW	Indirect Waste	LOA	Length Over All
		L-O-L	Lateralolelet
J	Joule	LP(G)	Liquid Propane (Gas)
JOB	Job	LS	Low Speed; Lump Sum
JOC	Job Order Contracting	Lt	Light
JT	Joint	Lt Ga	Light Gauge
		LTL	Less than Truck Load
K	Thousand; Thousand Pounds; Heavy Wall Copper Tubing; Kelvin	Lt Wt	Light Weight
KAH	Thousand Amp Hours	LV	Low Voltage
KD	Kiln Dried; Knocked Down	lm	Lumen
KDAT	Kiln Dried After Treatment	lm/sf	Lumen per square foot
Kip	1000 Pounds	lm/W	Lumen per Watt
KO	Knockout	m	Meter
Km	Kilometer	m ³ /H	Cubic Meters per Hour
KLF	Kips per Linear Foot	mA	Milliampere
KSF	Kips per Square Foot	m/S	Meters per Second
KSI	Kips per Square Inch	M	Thousand; Male; Light Wall Copper Tubing
kA	KiloAmp	MATL	Material
kg	Kilogram	MAX	Maximum
kHz	Kilohertz	Mach	Machine
kJ	Kilojoule	Mag. Str.	Magnetic Starter
kV	Kilovolt	Maint.	Maintenance
kVA	Kilovolt Ampere (1,000 volt amps)	Mat	Material
KVAR	Kilovar (Reactance)	Mat'l;	Material
kW	Kilowatt	Max.	Maximum
kWh	Kilowatt Hour	Mb	Million Bytes (characters)
		MBF	Thousand Board Feet
L	Length; Long; Medium Wall Copper Tubing	MBH	Thousand BTU per Hour
L&E	Labor and Equipment	MBtu	Thousand British Thermal Units
LAB	Labor	MC	Metal Clad Cable
LAN	Lane	MCF	Thousand Cubic Feet
LAT	Latitude	MCM	Thousand Circular Mills
LAV	Lavatory	MCP	Motor Circuit Protector
L.B.	Load Bearing; L Conduit Body	MD	Medium Duty
LB	Pound (Force or Mass)	MDO	Medium Density Overlaid
LB/HR	Pounds per Hour	Med.	Medium
LBS	Pounds	MF	Thousand Feet
LBSF	Pounds per Square Foot	MF3	Thousand Cubic Feet
LCD	Liquid Crystal Display	Mfg.	Manufacturing
LCL	Less Than Carload Lot	Mfrs.	Manufacturers
LCY	Loose Cubic Yard	Mg	Milligram



MG	Market Grade	nW	Nanowatt
MGD	Million Gallons per Day	OAL	Overall Length
MGPH	Thousand Gallons per Hour	OB	Opposing Blade
MH	Manhole; Manhour; Metal Halide	OC	On Center
MHz	MegaHertz	OD	Outside Diameter
Mi	Mile	O.D.	Outside Dimension
MI	Malleable Iron; Mineral Insulated	ODP	Open Drip Roof
MIN	Minimum; Minute	ODS	Overhead Distribution System
MISC	Miscellaneous	OEM	Original Equipment Manufacturer
ml	Milliliter; Mainline	OG	Ogee
MLF	Thousand Linear Feet	OH	Overhead
mm	Millimeter	OH&P	Overhead and Profit
MO	Month	OHL	Over Hung Load
Mobil.	Mobilization	Oper.	Operator
Mog.	Mogul Base	Opng.	Opening
MPH	Miles Per Hour	OPR	Operating
MPT	Male Pipe Thread	Orna.	Ornamental
MRT	Mile Round Trip	OSA	Outside Air
ms	Millisecond	OSB	Oriented Strand Board
MSD	Motor Sheave Diameter	OS & Y	Outside Screw and Yoke
MSF	Thousand Square Feet	OUT	Outlet or Output (each)
MSY	Thousand Square Yards	Ovhd.	Overhead
MT	Mount	OWG	Oil, Water or Gas
MTD	Mounted	OWSJ	Open Web Steel Joist
MTG	Mounting	OZ	Ounce
MTR	Mill Test Report	P	Pole; Applied Load; Projection
MVA	Million Volt Ampere	p	Page
MVAR	Million Volt Amperes Reactance	pp	Pages
MV	Megavolt	PAPR	Powered Air Purifying Respirator
MW	Megawatt	PAR	Weatherproof Reflector
MXM	Male by Male	PB	Push Button
MYD	Thousand Yards	PC	Personal Computer; Piece;
N	Natural; North	PCs	Pieces
nA	Nanoampere	P.C.	Portland Cement; Power Connector
NA	Not Applicable	PCF	Pounds per Cubic Foot
NC	Normally Closed	PCM	Phase Contrast Microscopy
NEHB	Bolted Circuit Breaker to 600V	PE	Professional Engineer; Plain End Porcelain Enamel; Polyethylene;
NDT	Non Destructive Testing	PERF	Perforated
NIOSH	National Alloy	PH	Phase
NLB	Non-Load Bearing	PI	Pressure Injected
NM	Non-Metallic Cable	PID	Programmable Integral Derivative Con- troller
nm	Nanometer	PKG	Package
NO	Normally Open	PL	Plate
No.	Number	PLC	Programmable Loop Controller
NOM	Nominal	PLM	Polarized Light Microscopy
NQOD	Combination Plug-on/Bolt-on Circuit Breaker to 240V	PLTC	Power Limited Tray Cable
NRC	Noise Reduction Coefficient	PLY	Plywood
NPT	National Pipe Thread	PNEU	Pneumatic
NPS	Nominal Pipe Size	PNTD	Painted
NRP	Non-Removable Pins	POA	Priced On Application/Priced On Approv- al
NRS	Non-Rising Stem	PESB	Pre-engineered Steel Building
ns	Nanosecond		
NTE	Note		
NTP	National Taper Pipe (Thread)		



PPD	Pounds Per Day	ROM	Room
PP; PPL	Polypropylene	ROPS	Roll Over Protection System
PPM	Parts Per Million	ROW	Row
PPS	Polyphenylene Sulfide	R.O.W.	Right of Way
PR	Pair	RPM	Revolutions Per Minute
Prefab.	Prefabricated	RR	Direct Burial Feeder Conduit
Prefin.	Prefinished	RS	Rapid Start
PROGEN®	Proposal Generator Software for Job Order Contracting	RSC	Rigid Steel Conduit
PROP	Propelled; Propeller	RSR	Riser (Per Rise)
PSF	Pounds Per Square Foot	RT	Round Trip
PSI	Pounds Per Square Inch	RTD	Resistance Temperature Detector
PSIA	Pounds Per Square Inch Atmosphere	RTJ	Ring Type Joint
PSIG	Pounds Per Square Inch Gauge	RTRP	Reinforced Thermoset Resin Piping
PSP	Plastic Sewer Pipe	RVT	Reinforced Vinyl Tile
PT	Power or Potential Transformer	S	Suction; Single Entrance; South
Pt.	Pint	S1S2E	Surfaced 1 side, 2 Edges
Ptns.	Partitions	S2S	Surfaced 2 Sides
P&T	Pressure & Temperature	S4S	Surfaced 4 Sides
PTFE	Polytetrafluoroethylene	Sa	Sack
Pu	Ultimate Load	SA	Supply Air
PV	Photovoltaic	SBS	Styrene Butyl Styrene
PVA	Polyvinyl Acrylate	Scaf.	Scaffolding
PVC	Polyvinyl Chloride	SCFH	Standard Cubic Foot Per Hour
PVDC	Polyvinylidene Chloride	SCFM	Standard Cubic Foot per Minute
PVDF	Polyvinylidene Fluoride	SCH	Schedule
PVF	Polyvinyl Fluoride	SCR	Modular Brick
Pvmt.	Pavement	SCRD	Screwed
PVQ	Pressure Vessel Quality	SD	Sound Deadening
Pwr.	Power	SDR	Standard Dimension Brick; Size To Diameter Ratio
Q	Quantity Heat Flow	SE	Surfaced Edge; Semi-Elliptical
QA	Quality Assurance	SEA	Seat
QC	Quality Control; Quick Coupling	SER	Service Entrance Cable
QT	Quart	SEU	Service Entrance Cable
Quan.	Quantity	SET	Set
Qty.	Quantity	SF	Square Foot/Feet
R	Thermal Resistance	SFCA	Square Feet of Form in Contact with Concrete
R/L	Random Lengths	SHTS	Sheets
R/W/L	Random Widths and Lengths	SI	Square Inch
RA	Return Air; Registered Architect	SIS	Synthetic Heat-Resistant
RCP	Reinforced Concrete Pipe	SLDR	Solder
Rect.	Rectangle	SLH	Super Long Span Bar Joist
REINF	Reinforced/Reinforcing	SN	Solid Neutral
Req'd	Required	S-O-L	Socketolet
RF	Raised Face	SP	Self-Propelled; Single Pole; Space; Standpipe Static Pressure (measured in inches of water);
RGH	Rough	SPDT	Single Pole, Double Throw
RGS	Rigid Galvanized Steel	SPGR	Specific Gravity
RH	Relative Humidity	SPWG	Static Pressure Water Gauge
RHW	Rubber, Heat & Water Resistant; Residential Hot Water	SQ	Square; Hundred Square Feet (10' x 10' area)
rms	Root Mean Square		
RND	Round		
ROL	Roll (each)		



SQ FT	Square Foot/Square Feet	UA	Unequal Angle
SQ IN	Square Inch	UCI	Uniform Construction Index
SQ YD	Square Yard	UF	Underground Feeder
SS	Stainless Steel; Single Strength	UHF	Ultra High Frequency
SSB	Single Strength B Quality Glass	UI	United Inch
SSL	Self Sealing Lap	UNC	Unified Coarse (Threads)
STC	Sound Transmission Class	USP	United States Primed
STD	Standard	UTP	Unshielded Twisted Pair
STK	Select Tight Knot	UV	Under Voltage
STP	Stop (each); Standard Temperature & Pressure	V	Volt
SURF	Surface	VA	Volt Amperes
STL	Steel	VAV	Variable Air Volume
SURF	Surface	VCT	Vinyl Composition Tile
SW	Seam Weld	Vert.	Vertical
SW	Switch	VF	Vinyl Faced
SWBD	Switchboard	VHF	Very High Frequency
SWS	Segmentally Welded Steel	VLF	Vertical Linear Foot
SWSI	Single Width, Single Inlet	VLV	Valve
SY	Square Yard	Vol.	Volume
SYN	Synthetic	VRP	Vinyl Reinforced Polyester
SYP	Southern Yellow Pine	w/	With
SYS	System	W	Watt; Width; Wire; West
T	Thick; Temperature; Ton	WB	Wet Bulb
T&C	Threaded and Coupled	WC	Water Column; Water Closet
T&G	Tongue and Groove	WF	Wide Flange
TBC	Tensile Bolt Cloth	WG	Water Gauge
TBE	Threaded Both Ends	WHM	Watthour Meter
TC	Terra Cotta	WK	Week
TCLP	Toxicity Characteristic Leaching Procedure	Wldg.	Welding
TDS	Total Dissolved Solids	WOG	Water, Oil, Gas
TEAO	Totally Enclosed Air Over	W-O-L	Weldolet
TEFC	Totally Enclosed Fan Cooled	WP	Weather Protected
TETC	Totally Enclosed Tube Cooled	WR	Water Resistant
TFE	Tetrafluoroethylene (Teflon)	WSP	Water, Steam, Petroleum
THHN	Nylon Jacketed Wire	WT	Weight
THK	Thick	WWF	Welded Wire Fabric
THKNS	Thickness	X or x	By or Times
THW	Insulated Strand Wire	XFER	Transfer
THWN	Nylon Jacketed Wire	XFMR	Transformer
TI	Titanium	XHD	Extra Heavy Duty
TL	Truckload	XHHW; XLPE	Cross-Linked Polyethylene Wire Insulation
TM	Track Mounted	XLP	Cross-Linked Polyethylene
T-O-L	Threadolet	XP	Explosion Proof
TON	Ton	XRF	X-Ray Fluorescence
Tot.	Total	Y	Wye
TPH	Tons Per Hour	YD	Yard
Transf.	Transformer	YR	Year
TSHP	Total Shaft Horse Power		
T'STAT	Thermostat		
TV	Television		
TW	Thermoplastic Water Resistant Wire		

2. Symbols



Δ	Delta	∅	Diameter or Phase
/	per	'	feet
-	through or to	"	inches
@	at	#	pound or number
%	per 100 or percent	°	degree
\$	U.S. dollars	<	Less Than
~	Approximate	>	Greater Than

3. Explanation Of Terms

BTU: Stands for British Thermal Unit. The BTU number indicates the amount of heat required to raise one pound of water by one degree Fahrenheit. What this means is the higher the BTU rating, the higher the heating capacity of a product.

MBH: Equal to 1000 BTUs.

Tons (In Reference To Cooling): Unit of measurement for determining cooling capacity. One ton equals 12,000 BTUH.

SEER: Stands for Seasonal Energy Efficiency Ratio. This measures the cooling efficiency in air conditioners or heat pumps. The higher the SEER rating, the more energy-efficient the unit. The government's minimum SEER rating is 10.

4. Calculation Of Board Feet

a. All Lumber Grades Are Presumed To Be 75 Percent Construction And 25 Percent Standard Or Equivalent Grade Unless Otherwise Listed. Dimensions Are Nominal. Board Foot Is Defined As 1" x 12" x 1' Long; To Calculate BF/LF, Multiply The Size Of The Board Height x Width/12.

- 1) 1"x2" = 0.167 BF/LF
- 2) 1"x3" = 0.25 BF/LF
- 3) 2"x3" = 0.5 BF/LF
- 4) 2"x4" = 0.667 BF/LF
- 5) 2"x6" = 1.0 BF/LF
- 6) 2"x8" = 1.333 BF/LF
- 7) 2"x10" = 1.667 BF/LF
- 8) 2"x12" = 2.0 BF/LF
- 9) 4"x4" = 1.333 BF/LF
- 10) 6"x4" = 2.0 BF/LF
- 11) 6"x6" = 3.0 BF/LF
- 12) 8"x8" = 5.333 BF/LF
- 13) etc.

b. To Calculate Board Feet;

- 1) For most lumber: Thickness (inches) x width (inches) x length (feet) divided by 12 = board feet.
- 2) For small pieces: Thickness (inches) x width (inches) x length (inches) divided by 144 = board feet.

5. Conversion Tables

ENGLISH TO METRIC CONVERSION TABLE					
MULTIPLY	BY	TO GET	MULTIPLY	BY	TO GET
acres	0.404 687 3	Hectares	ounce(force)	0.278 013 9	newtons=N
board feet	0.002 359 74	cubic meter	pint(liq.)	0.473 176	liters=l



ENGLISH TO METRIC CONVERSION TABLE					
cubic ft.	0.028 316 85	cubic meter	pint(dry)	0.550 61	liters=l
cubic yd.	0.764 554 9	cubic meter	pound(wt.)	0.453 592 37	kilogram
feet	0.304 8	Meters	pound(force)	4.448 222	newtons=N
footcandles	10.763 91	lux=lumens/m ²	pound/sq.ft	47.880 26	pascal=N/m ²
ft.-lb _f	1.355 818	N□m=joule	pound/sq.in	6.894 757	kilopascals
gallon (US)	3.785 412	Liters	quart(liq.)	0.946 352 9	liters
horsepower [*]	745.699 9	watt=J/sec	sq. feet	0.092 903 04	sq. meter
* horsepower=550 ft-lb _f /sec			sq. in.	645.16	sq. mm
inch	25.4	Millimeters	sq. mile	258.998 8	hectares
inch-pound _f	0.112 984 8	N□m=joule	sq. mile	2.589 988	sq. km
kips	4.448 222	Kilonewton	sq. yard	0.836 127 4	sq. meter
kips/in ²	6.894 757	megapascal	ton(short)	0.907 184 7	metric ton
miles (US)	1.609 347	Kilometer	ton(short)	907.184 7	kilogram=kg
ounce (wt.)	28.349 52	Grams	ton(short)	8896.444	newtons=N
ounce(liq.)	29.573 53	MI	yards	0.914 4	meters=m

FOR TEMPERATURE CONVERSION USE °C= 5/9(°F - 32)



METRIC TO ENGLISH CONVERSION TABLE					
MULTIPLY	BY	TO GET	MULTIPLY	BY	TO GET
cubic meter	1.308 0	cubic yard	liter	0.264 17	gallon
	35.314 7	cubic foot		1.056 7	quart
	61,024	cubic inch		2.113 4	pint
	264.172	Gallon		33.814	fl.ounce
gram	0.035 274	ounce(wt)	milliliter	0.033 814	fl.ounce
	0.002 204 6	pound(wt)	liter/m	0.080 52	gal/ft
kilogram	35.274	ounce(wt)	liter/m ²	0.220 88	gal/sq.yd
	2.204 623	pound(wt)	lux	0.092 902	ft-candle
	0.002 204 6	Kip	meter	1.093 6	yard
	0.001 102 3	Ton		3.280 84	foot
megagram (metric ton)	1.102 3	ton	millimeter	0.039 370	inch
			kilometer	0.621 37	mile
hectare	2.471 04	Acre	micrometer	0.039 370 1	mil
	107,639	square feet	Newton	0.224 81	pound(f)
	11,959.9	square yard	kilonewton	0.224 81	kip(f)
	0.003 861 02	square mile	Pascal	0.020 885	lb/sq. feet
microare	0.155 00	square inch	kilopascal	0.145 04	lb/sq. inch
joule	0.737 56	foot pound	megapascal	0.145 04	kips/sq. inch
	8.849 5	inch pound	square meter	1.195 99	square yard
kg/m³	1.685 55	lbs./cubic yards		10.763 9	square feet
	0.062 428	lbs./cubic feet	square millimeter	0.001 55	square inch
km/hr	0.621 37	miles per hour	square kilometer	0.386 102	square mile
			watt (J/second)	0.001 341	horsepower
				0.737 56	ft-lb/second

FOR TEMPERATURE CONVERSION USE °F = 9/5 °C + 32



C. Material Weights/Engineering Values

1. The following engineering values are guidelines for establishing shrink/swell factors and shall be used unless otherwise directed by the Owner. The Owner has final authority in establishing unit weights that are appropriate for all material and may change the stated values.

a. Material weights (Lbs Per CY) for In-place (Bank) [BCY], Loose (Excavated Materials) [LCY], and Compacted [CCY]

<u>MATERIALS</u>	<u>BCY</u>	<u>LCY</u>	<u>CCY</u>
Earth, Common (Average)	3170	2536	3520
Sand (Dry)	2880	2590	3240
Sand (Wet)	3090	2940	3460
Earth, Dry	3030	2070	3520
Earth, Damp	3370	2360	3520
Earth, Wet	2940	2940	3520
Earth, Rock Mixture (75% E/ 25% R)	3380	2370	3720
Earth, Rock Mixture (50% E/ 50% R)	3750	2710	4000
Earth, Rock Mixture (25% E/ 75% R)	4120	3140	3680
Gravel (Average)	3280	2730	3570
Limestone	4380	2690	3220
Riprap Rock (Average)	4500	2610	3150
Granite	4540	2640	3170
Basalt	4950	3020	3640
Clay	3220	2150	3570
Gneiss	4550	2720	3180

D. Reclaimed Asphalt Pavement (RAP)

1. Origin

a. Reclaimed asphalt pavement (RAP) is the term given to removed and/or reprocessed pavement materials containing asphalt and aggregates. These materials are generated when asphalt pavements are removed for reconstruction, resurfacing, or to obtain access to buried utilities. When properly crushed and screened, RAP consists of high-quality, well-graded aggregates coated by asphalt cement.

b. Asphalt pavement is generally removed either by milling or full-depth removal. Milling entails removal of the pavement surface using a milling machine, which can remove up to 50 mm (2 in) thickness in a single pass. Full-depth removal involves ripping and breaking the pavement using a rhino horn on a bulldozer and/or pneumatic pavement breakers. In most instances, the broken material is picked up and loaded into haul trucks by a front-end loader and transported to a central facility for processing. At this facility, the RAP is processed using a series of operations, including crushing, screening, conveying, and stacking.

c. Although the majority of old asphalt pavements are recycled at central processing plants, asphalt pavements may be pulverized in place and incorporated into granular or stabilized base courses using a self-propelled pulverizing machine. Hot in-place and cold in-place recycling processes have evolved into continuous train operations that include partial depth removal of the pavement surface, mixing the reclaimed material with beneficiating additives (such as virgin aggregate, binder, and/or softening or rejuvenating agents to improve binder properties), and placing and compacting the resultant mix in a single pass.

2. Physical Properties

a. The properties of RAP are largely dependent on the properties of the constituent materials and the type of asphalt concrete mix (wearing surface, binder course, etc.). There can be substantial differences between asphalt concrete mixes in aggregate quality, size, and consistency. Since the aggregates in surface course (wearing course) asphalt concrete must have high resistance to wear/abrasion (polishing) to contribute to acceptable friction



- resistance properties, these aggregates may be of higher quality than the aggregates in binder course applications, where polishing resistance is not of concern.
- b. Both milling and crushing can cause some aggregate degradation. The gradation of milled RAP is generally finer and more dense than that of the virgin aggregates. Crushing does not cause as much degradation as milling; consequently, the gradation of crushed RAP is generally not as fine as milled RAP, but finer than virgin aggregates crushed with the same type of equipment.
 - c. The particle size distribution of milled or crushed RAP may vary to some extent, depending on the type of equipment used to produce the RAP, the type of aggregate in the pavement, and whether any underlying base or subbase aggregate has been mixed in with the reclaimed asphalt pavement material during the pavement removal.
 - d. During processing, virtually all RAP produced is milled or crushed down to 38 mm (1.5 in) or less, with a maximum allowable top size of either 51 mm (2 in) or 63 mm (2.5 in). Table 13-1 lists the typical range of particle size distribution that normally results from the milling or crushing of RAP. Milled RAP is generally finer than crushed RAP. The pavement fraction passing a 2.36 mm (No. 8) sieve can be expected to increase from a premilled range of 41 to 69 percent to a postmilled range of 52 to 72 percent. The fraction passing a 0.075 mm (No. 200) sieve can be expected to increase from approximately 6 to 10 percent to a range of 8 to 12 percent. Most sources of RAP will be a well-graded coarse aggregate, comparable to, or perhaps slightly finer and more variable than, crushed natural aggregates.
 - e. The unit weight of milled or processed RAP depends on the type of aggregate in the reclaimed pavement and the moisture content of the stockpiled material. The unit weight of milled or processed RAP has been found to range from 1940 to 2300 kg/m³ (120 to 140 lb/ft³), which is slightly lower than that of natural aggregates.
 - f. Moisture content of the RAP will increase while in storage. Crushed or milled RAP can pick up a considerable amount of water if exposed to rain. Moisture contents up to 5 percent or higher have been measured for stored crushed RAP. As noted earlier, during periods of extensive precipitation, the moisture content of some RAP stockpiles may be as high as 7 to 8 percent. Lengthy stockpiling of crushed or milled RAP should, therefore, be kept to a minimum.
 - g. The asphalt cement content of RAP typically ranges between 3 and 7 percent by weight. The asphalt cement adhering to the aggregate is somewhat harder than new asphalt cement. This is due primarily to exposure of the pavement to atmospheric oxygen (oxidation) during use and weathering. The degree of hardening depends on several factors, including the intrinsic properties of the asphalt cement, the mixing temperature/time (increases with increasing high temperature exposure), the degree of asphalt concrete compaction (increases if not well compacted), asphalt cement/air voids content (increases with lower asphalt/higher air voids content), and age in service (increases with age).



Table 1. Typical range of particle size distribution for reclaimed asphalt pavement (RAP) (percent by weight passing).

Screen Size (mesh)	Percent Finer After Processing or Milling
37.5 mm (1.5 in)	100
25 mm (1.0 in)	95 - 100
19 mm (3/4 in)	84 - 100
12.5 mm (1/2 in)	70 - 100
9.5 mm (3/8 in)	58 - 95
75 mm (No. 4)	38 - 75
2.36 mm (No. 8)	25 - 60
1.18 mm (No. 16)	17 - 40
0.60 mm (No. 30)	10 - 35 ^a
0.30 mm (No. 50)	5 - 25 ^b
0.15 mm (No. 100)	3 - 20 ^c
0.075 mm (No. 200)	2 - 15 ^d
a. Usually less than 30 percent b. Usually less than 20 percent c. Usually less than 15 percent d. Usually less than 10 percent	

- h. The RAP obtained from most wearing surface mixes will usually have an asphalt content in the 4.5 to 6 percent range. The recovered asphalt from RAP usually exhibits low penetration and relatively high viscosity values, depending on the amount of time the original pavement has been in service. Penetration values at 25°C (77°F) are likely to range from 10 to 80 while the absolute viscosity values at 60°C (140°F) may range from as low as 2,000 poises (equivalent to AC-20) up to as high as 50,000 poises or greater, depending on the extent of aging. Viscosity ranges from 4,000 to 25,000 poises can normally be expected from the asphalt cement that is recovered from RAP material. Table 2 provides a summary of the typical ranges of physical properties of RAP, other than gradation.

**Table 2. Physical and mechanical properties of reclaimed asphalt pavement (RAP).**

Type of Property	RAP Property	Typical Range of Values
Physical Properties	Unit Weight	1940 - 2300 kg/m ³ (120-140 lb/ft ³)
	Moisture Content	Normal: up to 5% Maximum: 7-8%
	Asphalt Content	Normal: 4.5-6% Maximum Range: 3-7%
	Asphalt Penetration	Normal: 10-80 at 25°C (77°F)
	Absolute Viscosity or Recovered Asphalt Cement	Normal: 4,000 - 25,000 poises at 60°C (140°F)
Mechanical Properties	Compacted Unit Weight	1600 - 2000 kg/m ³ (100-125 lb/ft ³)
	California Bearing Ratio (CBR)	100% RAP: 20-25% 40% RAP and 60% Natural Aggregate: 150% or higher

3. Chemical Properties

- a. Mineral aggregates constitute the overwhelming majority (93 to 97 percent by weight) of RAP. Only a minor percentage (3 to 7 percent) of RAP consists of hardened asphalt cement. Consequently, the overall chemical composition of RAP is essentially similar to that of the naturally occurring aggregate that is its principal constituent.
- b. Asphalt cement is made up of mainly high molecular weight aliphatic hydrocarbon compounds, but also small concentrations of other materials such as sulfur, nitrogen, and polycyclic hydrocarbons (aromatic and/or naphthenic) of very low chemical reactivity. Asphalt cement is a combination of asphaltenes and maltenes (resins and oils). Asphaltenes are more viscous than either resins or oils and play a major role in determining asphalt viscosity. Oxidation of aged asphalt causes the oils to convert to resins and the resins to convert to asphaltenes, resulting in age hardening and a higher viscosity binder.

4. Mechanical Properties

- a. The mechanical properties of RAP depend on the original asphalt pavement type, the method(s) utilized to recover the material, and the degree of processing necessary to prepare the RAP for a particular application. Since most RAP is recycled back into pavements, there is a general lack of data pertaining to the mechanical properties for RAP in other possible applications.
- b. The compacted unit weight of RAP will decrease with increasing unit weight, with maximum dry density values reported to range from 1600 kg/m³ (100 lb/ft³) to 2000 kg/m³ (125 lb/ft³). California Bearing Ratio (CBR) values for RAP material containing trap rock aggregate have been reported in the 20 to 25 percent range. However, when RAP is blended with natural aggregates for use in granular base, the asphalt cement in the RAP has a significant strengthening effect over time, such that specimens containing 40 percent RAP have produced CBR values exceeding 150 after 1 week.
- c. Table 2 provides a summary of the mechanical properties of RAP discussed in the preceding paragraphs.

1.2 PRODUCTS (Not Used)



1.3 EXECUTION (Not Used)

END OF SECTION 01 32 33 00d



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SECTION 01 52 13 00 - TEMPORARY FACILITIES AND CONTROLS

1.1 GENERAL

A. Summary

1. This Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Definitions

1. Permanent Enclosure: As determined by the Owner, permanent or temporary roofing is complete, insulated, and weathertight; exterior walls are insulated and weathertight; and all openings are closed with permanent construction or substantial temporary closures.

C. Use Charges

1. General: Cost or use charges for temporary facilities shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, the Owner's construction forces, the Owner, occupants of Project, testing agencies, and authorities having jurisdiction.
2. Water Service: Water from the Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.
3. Electric Power Service: Electric power from the Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

D. Submittals

1. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

E. Quality Assurance

1. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
2. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

F. Project Conditions

1. Temporary Use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before the Owner's acceptance, regardless of previously assigned responsibilities.

1.2 PRODUCTS

A. Materials

1. Pavement: Comply with Division 32 Section(s) "Asphalt Paving" OR "Concrete Paving", **as directed**.
2. Chain-Link Fencing: Minimum 2-inch (50-mm), 0.148-inch- (3.76-mm-) thick, galvanized steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts, with 1-5/8-inch- (42-mm-) OD top rails **OR** with galvanized barbed-wire top strand, **as directed**.
3. Portable Chain-Link Fencing: Minimum 2-inch (50-mm), 9-gage, galvanized steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts, with 1-5/8-inch- (42-



mm-) OD top and bottom rails. Provide concrete **OR** galvanized steel, **as directed**, bases for supporting posts.

4. Wood Enclosure Fence: Plywood, 6 feet (1.8 m) **OR** 8 feet (2.4 m), **as directed**, high, framed with four 2-by-4-inch (50-by-100-mm) rails, with preservative-treated wood posts spaced not more than 8 feet (2.4 m) apart.
5. Lumber and Plywood: Comply with requirements in Division 06 Section(s) "Rough Carpentry" **OR** "Miscellaneous Rough Carpentry", **as directed**.
6. Gypsum Board: Minimum 1/2 inch (12.7 mm) thick by 48 inches (1219 mm) wide by maximum available lengths; regular-type panels with tapered edges. Comply with ASTM C 36/C 36M.
7. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.
8. Paint: Comply with requirements in Division 09.

B. Temporary Facilities

1. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
2. Common-Use Field Office: Of sufficient size to accommodate needs of construction personnel. Keep office clean and orderly. Furnish and equip offices as follows:
 - a. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
 - b. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with not less than 1 receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- (1.2-m-) square tack board.
 - c. Drinking water and private toilet.
 - d. Coffee machine and supplies.
 - e. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F (20 to 22 deg C).
 - f. Lighting fixtures capable of maintaining average illumination of 20 fc (215 lx) at desk height.
3. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
 - a. Store combustible materials apart from building.

C. Equipment

1. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
2. HVAC Equipment: Unless the Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
 - a. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 - b. Heating Units: Listed and labeled for type of fuel being consumed, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
 - c. Permanent HVAC System: If the Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return air grille in system and remove at end of construction.

1.3 EXECUTION

A. Installation, General

1. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.



- a. For greenfield sites if reduced site disturbance is required for LEED-NC Credit SS 5.1: Locate facilities to limit site disturbance as specified in General Requirements.
 2. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.
- B. Temporary Utility Installation
1. General: Install temporary service or connect to existing service.
 - a. Arrange with utility company, the Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
 2. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
 - a. Connect temporary sewers to municipal system **OR** private system indicated, **as directed**, as directed by authorities having jurisdiction.
 3. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.
OR
Water Service: Use of the Owner's existing water service facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to the Owner. At Final Completion, restore these facilities to condition existing before initial use.
 - a. Where installations below an outlet might be damaged by spillage or leakage, provide a drip pan of suitable size to minimize water damage. Drain accumulated water promptly from pans.
 4. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
 - a. Toilets: Use of the Owner's existing toilet facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to the Owner. At Final Completion, restore these facilities to condition existing before initial use.
 5. Heating **OR** Heating and Cooling, **as directed**: Provide temporary heating **OR** heating and cooling, **as directed**, required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
 6. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
 7. Electric Power Service: Use of the Owner's existing electric power service will be permitted, as long as equipment is maintained in a condition acceptable to the Owner.
OR
Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
 - a. Install electric power service overhead **OR** underground, **as directed**, unless otherwise indicated.
 - b. Connect temporary service to the Owner's existing power source, as directed by the Owner.
 8. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
 - a. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
 - b. Install lighting for Project identification sign.
 9. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line for each field office.
 - a. Provide additional telephone lines for the following:
 - 1) Provide a dedicated telephone line for each facsimile machine and computer in each field office.



- b. At each telephone, post a list of important telephone numbers.
 - 1) Police and fire departments.
 - 2) Ambulance service.
 - 3) Contractor's home office.
 - 4) the Owner's office.
 - 5) the Owner's office.
 - 6) Principal subcontractors' field and home offices.
 - c. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.
 10. Electronic Communication Service: Provide temporary electronic communication service, including electronic mail, in common-use facilities.
 - a. Provide DSL **OR** T-1 line, **as directed**, in primary field office.
- C. Support Facilities Installation
 1. General: Comply with the following:
 - a. Provide incombustible construction for offices, shops, and sheds located within construction area or within 30 feet (9 m) of building lines. Comply with NFPA 241.
 - b. Maintain support facilities until near Final Completion. Remove before Final Completion. Personnel remaining after Final Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.
 2. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas as indicated **OR** within construction limits indicated, **as directed**, on Drawings.
 - a. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

OR
 3. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas in same location as permanent roads and paved areas. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
 - a. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
 - b. Prepare subgrade and install subbase and base for temporary roads and paved areas according to Division 31 Section "Earth Moving".
 - c. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
 - d. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Final Completion. Repair hot-mix asphalt base-course pavement before installation of final course according to Division 32 Section "Asphalt Paving".
 4. Traffic Controls: Comply with requirements of authorities having jurisdiction.
 - a. Protect existing site improvements to remain including curbs, pavement, and utilities.
 - b. Maintain access for fire-fighting equipment and access to fire hydrants.
 5. Parking: Provide temporary **OR** Use designated areas of the Owner's existing, **as directed**, parking areas for construction personnel.
 6. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
 - a. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties nor endanger permanent Work or temporary facilities.
 - b. Remove snow and ice as required to minimize accumulations.
 7. Project Identification and Temporary Signs: Provide Project identification and other signs as indicated on Drawings, **OR as directed**. Install signs where indicated to inform public and individuals seeking entrance to Project. Unauthorized signs are not permitted.
 - a. Provide temporary, directional signs for construction personnel and visitors.
 - b. Maintain and touchup signs so they are legible at all times.



8. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with General Requirements for progress cleaning requirements.
9. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
 - a. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
10. Temporary Elevator Use: Refer to Division 14 for temporary use of new elevators.
11. Existing Elevator Use: Use of the Owner's existing elevators will be permitted, as long as elevators are cleaned and maintained in a condition acceptable to the Owner. At Final Completion, restore elevators to condition existing before initial use, including replacing worn cables, guide shoes, and similar items of limited life.
 - a. Do not load elevators beyond their rated weight capacity.
 - b. Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged work so no evidence remains of correction work. Return items that cannot be refinished in field to the shop, make required repairs and refinish entire unit, or provide new units as required.
12. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.
13. Existing Stair Usage: Use of the Owner's existing stairs will be permitted, as long as stairs are cleaned and maintained in a condition acceptable to the Owner. At Final Completion, restore stairs to condition existing before initial use.
 - a. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If, despite such protection, stairs become damaged, restore damaged areas so no evidence remains of correction work.
14. Temporary Use of Permanent Stairs: Cover finished, permanent stairs with protective covering of plywood or similar material so finishes will be undamaged at time of acceptance.

D. Security And Protection Facilities Installation

1. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
2. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.
 - a. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
3. Stormwater Control: Comply with authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
4. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.
5. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Final Completion. Obtain extended warranty for the Owner. Perform control operations lawfully, using environmentally safe materials.
6. Site Enclosure Fence: Before construction operations begin **OR** When excavation begins, **as directed**, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
 - a. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations **OR** As indicated on Drawings, **as directed**.
 - b. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Provide the Owner with one set of keys, **as directed**.



7. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.
8. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
9. Covered Walkway: Erect structurally adequate, protective, covered walkway for passage of individuals along adjacent public street(s). Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction and requirements indicated on Drawings, **OR as directed**.
 - a. Construct covered walkways using scaffold or shoring framing.
 - b. Provide wood-plank overhead decking, protective plywood enclosure walls, handrails, barricades, warning signs, lights, safe and well-drained walkways, and similar provisions for protection and safe passage.
 - c. Extend back wall beyond the structure to complete enclosure fence.
 - d. Paint and maintain in a manner approved by the Owner.
10. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
 - a. Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.
11. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by the Owner and tenants from fumes and noise.
 - a. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant plywood on construction operations side.
 - b. If containment of airborne particles and dust generated by construction activities is critical to occupants of other spaces in building, e.g., occupied healthcare facilities: Construct dustproof partitions with 2 layers of 3-mil (0.07-mm) polyethylene sheet on each side. Cover floor with 2 layers of 3-mil (0.07-mm) polyethylene sheet, extending sheets 18 inches (460 mm) up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant plywood.
 - 1) Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches (1219 mm) between doors. Maintain water-dampened foot mats in vestibule.
 - c. Insulate partitions to provide noise protection to occupied areas.
 - d. Seal joints and perimeter. Equip partitions with dustproof doors and security locks.
 - e. Protect air-handling equipment.
 - f. Weather strip openings.
 - g. Provide walk-off mats at each entrance through temporary partition.
12. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.
 - a. Prohibit smoking in hazardous fire-exposure **OR** construction, **as directed**, areas.
 - b. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
 - c. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
 - d. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

E. Operation, Termination, And Removal

1. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
2. Maintenance: Maintain facilities in good operating condition until removal.



- a. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
3. Operate Project-identification-sign lighting daily from dusk until 12:00 midnight.
4. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Final Completion.
5. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Final Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
 - a. Materials and facilities that constitute temporary facilities are property of Contractor. the Owner reserves right to take possession of Project identification signs.
 - b. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
 - c. At Final Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements specified in General Requirements

END OF SECTION 01 52 13 00



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Task	Specification	Specification Description
01 52 13 00	01 22 16 00	No Specification Required
01 52 19 00	01 22 16 00	No Specification Required
01 52 19 00	01 52 13 00	Temporary Facilities and Controls
01 54 23 00	01 22 16 00	No Specification Required
01 54 26 00	01 22 16 00	No Specification Required
01 54 29 00	01 22 16 00	No Specification Required
01 55 23 00	01 22 16 00	No Specification Required
01 55 26 00	01 22 16 00	No Specification Required
01 56 16 00	01 22 16 00	No Specification Required



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SECTION 01 56 26 00 - SEDIMENT REMOVAL

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing of labor and equipment for sediment removal.

1.2 PRODUCTS - (Not Used)

1.3 EXECUTION

- A. The Contractor shall remove all material from areas as required to meet project requirements. Water and sediment removed from these areas shall be discharged to a sedimentation basin constructed and maintained by the Contractor. All work shall be in strict compliance with Pollution Control requirements and Dewatering requirements. All material removed shall be disposed of in an approved landfill in accordance with all State and Federal Regulations.

END OF SECTION 01 56 26 00



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SECTION 01 56 26 00a - EROSION CONTROL

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of mesh or netting for erosion control. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

1.2 PRODUCTS

A. Materials

1. Jute Mesh: Fed. Spec. CCC-C-467.
2. Plastic Mesh: Manufacturer's recommendation.
3. Plastic Netting: Manufacturer's recommendation.
4. Polypropylene Mesh: Manufacturer's recommendation.
5. Woven Fabric Fence: EPA specifications.
6. Hay-Bales: EPA specifications.

1.3 EXECUTION:

- A. Preparation: Grade, compact, fertilize, and seed the area to be protected.
- B. Installation: Apply blankets either horizontally or vertically to the slope. In ditches, apply blanket in direction of water flow. Lap and anchor blankets according to the manufacturer's instructions. Install woven fabric fence and hay bales adjacent to all excavated areas.

END OF SECTION 01 56 26 00a



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Task	Specification	Specification Description
01 56 26 00	01 22 16 00	No Specification Required
01 56 29 00	01 22 16 00	No Specification Required
01 56 33 00	01 22 16 00	No Specification Required
01 56 39 00	01 22 16 00	No Specification Required



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SECTION 01 58 13 00 - SIGNAGE**1.1 GENERAL****A. Description Of Work:**

1. This specification covers the furnishing and installation of materials for signage. Product shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Plaques.
 - b. Dimensional illuminated and non-illuminated characters.
 - c. Panel signs.
 - d. Illuminated panel signs.
 - e. Photoluminescent markings and signs.

C. Definitions

1. ADA-ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines."

D. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: Show fabrication and installation details for signs.
 - a. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
 - b. Provide message list, typestyles, graphic elements, including tactile characters and Braille, and layout for each sign.
 - c. Wiring Diagrams: Power, signal, and control wiring.
3. Samples: For each sign type and for each color and texture required.

E. Quality Assurance

1. Regulatory Requirements: Comply with applicable provisions in ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.
2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
3. Provide exit signs in accordance with NFPA 101, Building Code, and Fire Code.
4. Comply with National Fire Protection Association (NFPA) 101 - Life Safety Code.
5. Comply with Underwriters Laboratories, Inc. (UL) - 924 - Standard for Emergency Lighting and Power Equipment.

F. Field Quality Control

1. With room light fixtures illuminated, measure amount of illumination on face of each exit sign using handheld light meter.
2. Ensure that each location has minimum of 5 foot-candles of illumination.

G. Warranty

1. Manufacturer's standard form in which manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within Five years from date of Final Completion.



1.2 PRODUCTS

A. Materials

1. Aluminum Castings: ASTM B 26/B 26M, of alloy and temper recommended by sign manufacturer for casting process used and for use and finish indicated.
2. Aluminum Sheet and Plate: ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of Alloy 5005-H32.
3. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of Alloy 6063-T5.
4. Brass Castings: ASTM B 584, Alloy UNS No. C85200 (high-copper yellow brass).
5. Brass, Yellow, Sheet: ASTM B 36/B 36M, Alloy UNS No. C26000.
6. Bronze Castings: ASTM B 584, Alloy UNS No. C86500 (No. 1 manganese bronze).
7. Bronze Plate: ASTM B 36/B 36M.
8. Copper Sheet: ASTM B 152/B 152M.
9. Steel:
 - a. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating, either commercial or forming steel.
 - b. Steel Sheet: Uncoated, cold-rolled, ASTM A 1008/A 1008M, commercial steel, Type B, exposed **OR** Electrolytic zinc-coated, ASTM A 591/A 591M, with steel sheet substrate complying with ASTM A 1008/A 1008M, commercial steel, exposed, **as directed**.
 - c. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304 **OR** 316, **as directed**, stretcher-leveled standard of flatness.
 - d. Steel Members Fabricated from Plate or Bar Stock: ASTM A 529/A 529M or ASTM A 572/A 572M, 42,000-psi (290-MPa) minimum yield strength.
 - e. For steel exposed to view on completion, provide materials having flat, smooth surfaces without blemishes. Do not use materials whose surfaces exhibit pitting, seam marks, roller marks, rolled trade names, or roughness.
10. Fiberglass Sheet: Molded, seamless, thermosetting, glass-fiber-reinforced polyester panels with a minimum tensile strength of 15,000 psi (103 MPa) when tested according to ASTM D 638 and with a minimum flexural strength of 30,000 psi (207 MPa) when tested according to ASTM D 790.
11. Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), Type UVA (UV absorbing).
12. Polycarbonate Sheet: Of thickness indicated, manufactured by extrusion process, coated on both surfaces with abrasion-resistant coating:
 - a. Impact Resistance: 16 ft-lbf/in. (854 J/m) per ASTM D 256, Method A.
 - b. Tensile Strength: 9000 lbf/sq. in. (62 MPa) per ASTM D 638.
 - c. Flexural Modulus of Elasticity: 340,000 lbf/sq. in. (2345 MPa) per ASTM D 790.
 - d. Heat Deflection: 265 deg F (129 deg C) at 264 lbf/sq. in. (1.82 MPa) per ASTM D 648.
 - e. Abrasion Resistance: 1.5 percent maximum haze increase for 100 revolutions of a Taber abraser with a load of 500 g per ASTM D 1044.
13. Applied Vinyl: Die-cut characters from vinyl film of nominal thickness of 3 mils (0.076 mm) with pressure-sensitive adhesive backing, suitable for exterior applications.

B. Plaques

1. Cast Plaques: Provide castings free of pits, scale, sand holes, and other defects, as follows:
 - a. Plaque Material: Aluminum **OR** Bronze, **as directed**.
 - b. Background Texture: Manufacturer's standard pebble **OR** leatherette **OR** matte **OR** stipple, **as directed**, texture.
 - c. Border Style: Square, polished **OR** Plain bevel **OR** Projected bevel **OR** Raised flat band **OR** Double-raised line border, **as directed**.
 - d. Mounting: Rosettes and fasteners matching plaque finish **OR** Concealed studs, **as directed**, noncorroding, **as directed**, for substrates encountered.
2. Etched Plaques: Provide metal sheet or plate for etching, as follows:
 - a. Plaque Material: Aluminum **OR** Brass **OR** Bronze, **as directed**.



- b. Custom Paint Colors: Match Pantone, **as directed**, color matching system.
- c. Color(s): As indicated **OR** As selected from manufacturer's full range, **as directed**.
- d. Edge Style: Square, polished **OR** Plain bevel, **as directed**.
- e. Mounting: Concealed studs **OR** Exposed fasteners, **as directed**, noncorroding, **as directed**, for substrates encountered.
- f. Thickness: 0.125 inch (3.18 mm) **OR** 0.250 inch (6.35 mm), **as directed**, thick.

C. Dimensional Characters

- 1. Cast Characters: Produce characters with smooth flat faces, sharp corners, and precisely formed lines and profiles, free of pits, scale, sand holes, and other defects. Cast lugs into back of characters and tap to receive threaded mounting studs. Alloy and temper recommended by sign manufacturer for casting process used and for use and finish indicated. Comply with the following requirements.
 - a. Character Material: Aluminum **OR** Brass **OR** Bronze, **as directed**.
 - b. Thickness: As indicated.
 - c. Color(s): As indicated **OR** As selected from manufacturer's full range, **as directed**.
 - d. Mounting: Rosettes and fasteners matching character finish **OR** Concealed studs, **as directed**, noncorroding, **as directed**, for substrates encountered.
- 2. Aluminum Extrusions: Comply with the following requirements:
 - a. Finish: Anodized **OR** Painted, **as directed**.
 - b. Thickness: As indicated.
 - c. Custom Paint Colors: Match Pantone, **as directed**, color matching system.
 - d. Color(s): As indicated **OR** As selected from manufacturer's full range, **as directed**.
 - e. Mounting: Concealed studs, noncorroding, **as directed**, for substrates encountered.
- 3. Fabricated Channel Characters: Form exposed faces and sides of characters to produce surfaces free from warp and distortion. Include internal bracing for stability and attachment of mounting accessories. Comply with the following requirements:
 - a. Illuminated Backlighting **OR** Frontlighting, **as directed**, Channel Characters: Manufacturer's standard fluorescent tube **OR** fiber-optic **OR** LED **OR** neon tube, **as directed**, lighting including transformers, insulators, and other components. Make provisions for servicing and concealing connections to building electrical system.
 - b. Aluminum Sheet: Not less than 0.090 inch (2.29 mm) thick.
 - 1) Finish: Anodized **OR** Painted, **as directed**.
 - 2) Custom Paint Colors: Match Pantone, **as directed**, color matching system.
 - 3) Color: As indicated **OR** As selected from manufacturer's full range, **as directed**.
 - c. Bronze Sheet: Not less than 0.032 inch (0.81 mm) thick.
 - d. Brass Sheet: Not less than 0.032 inch (0.81 mm) thick.
 - e. Copper Sheet: Not less than 0.032 inch (0.81 mm) **OR** 0.048 inch (1.22 mm), **as directed**, thick.
 - f. Steel Sheet: Painted, not less than 0.050 inch (1.27 mm) thick for face and 0.031 inch (0.78 mm) thick for returns.
 - 1) Color: As indicated **OR** As selected from manufacturer's full range, **as directed**.
 - g. Stainless-Steel Sheet: Not less than 0.050 inch (1.27 mm) thick for face and 0.031 inch (0.78 mm) thick for returns.
 - 1) Finish: No. 4 **OR** No. 8, **as directed**.
 - h. Provide manufacturer's hardware for projection mounting of backlighting, **as directed**, channel characters at distance from wall surface indicated.
 - i. Provide translucent acrylic face sheet of thickness indicated. Attach characters to sheet metal back channels. Provide required to illuminate sign faces evenly.
 - 1) Color: As indicated **OR** As selected from manufacturer's full range, **as directed**.
 - j. Provide open-front, sheet metal channel characters.
- 4. Molded Plastic Characters: Thermoformed **OR** Injection molded, **as directed**, and as follows:
 - a. Illuminated Characters: Manufacturer's standard fluorescent tube **OR** fiber-optic **OR** LED **OR** neon tube, **as directed**, lighting including transformers, insulators, and other components. Make provisions for servicing and concealing connections to building electrical system.



- b. Integral Color **OR** Painted Finish, **as directed**: As indicated **OR** As selected from manufacturer's full range, **as directed**.
- 5. Cutout Characters: Provide characters with square-cut, smooth, eased, **as directed**, edges. Comply with the following requirements:
 - a. Acrylic: 0.25 inch (6.35 mm) **OR** 0.50 inch (12.7 mm), **as directed**, thick.
 - 1) Metal face laminated to acrylic base with painted edges, **as directed**.
 - a) Brass Face: Satin **OR** Polished, **as directed**, finish.
 - b) Stainless-Steel Face: No. 4 **OR** No. 8, **as directed**, finish.
 - c) Metal Thickness: 0.030 inch (0.76 mm).
 - 2) Custom Paint Colors: Match Pantone, **as directed**, color matching system.
 - 3) Color: As indicated **OR** As selected from manufacturer's full range, **as directed**.
 - b. Aluminum Sheet: 0.125 inch (3.18 mm) **OR** 0.25 inch (6.35 mm), **as directed**, thick.
 - 1) Finish: Anodized **OR** Painted, **as directed**.
 - 2) Custom Paint Colors: Match Pantone, **as directed**, color matching system.
 - 3) Color: As indicated **OR** As selected from manufacturer's full range, **as directed**.
 - c. Brass Sheet, Yellow: 0.125 inch (3.18 mm) **OR** 0.25 inch (6.35 mm), **as directed**, thick.
 - d. Bronze Sheet: 0.125 inch (3.18 mm) **OR** 0.25 inch (6.35 mm), **as directed**, thick.
 - e. Vinyl: Pressure sensitive, 3.5 mils (0.09 mm) thick.
 - 1) Custom Paint Colors: Match Pantone, **as directed**, color matching system.
 - 2) Color: As indicated **OR** As selected from manufacturer's full range, **as directed**.
 - f. Mounting: Adhesive **OR** Flush **OR** Projected **OR** Back bar **OR** Bracket, **as directed**, with concealed noncorroding studs, **as directed**, for substrates encountered.

D. panel signs

- 1. Interior Panel Signs: Provide smooth sign panel surfaces constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch (1.5 mm) measured diagonally from corner to corner, complying with the following requirements:
 - a. Aluminum Sheet: 0.050 inch (1.27 mm) **OR** 0.080 inch (2.03 mm), **as directed**, thick.
 - b. Laminated, Aluminum-Faced Sheet: 0.020-inch- (0.51-mm-) thick aluminum sheet laminated to each side of 0.197-inch- (5.0-mm-) **OR** 0.394-inch- (10.0-mm-), **as directed**, thick, corrugated **OR** phenolic **OR** acrylic, **as directed**, backing with painted edges, **as directed**.
 - c. Laminated, Polycarbonate-Faced Sheet: 0.060-inch- (1.52-mm-) thick, polycarbonate face sheet laminated to each side of 0.197-inch- (5.0-mm) **OR** 0.394-inch- (10.0-mm-), **as directed**, thick phenolic backing.
 - d. Acrylic Sheet: 0.060 inch (1.52 mm) **OR** 0.080 inch (2.03 mm), **as directed**, thick.
 - e. PVC Sheet: 0.060-inch- (1.52-mm-) **OR** 0.080-inch- (2.03-mm-), **as directed**, thick, extruded, high-impact PVC plastic in color to match face color **OR** with painted finish, **as directed**.
 - f. High-Pressure Decorative Laminate: 0.048 inch (1.21 mm) thick.
 - g. Phenolic-Backed Photopolymer Sheet: Provide light-sensitive, water-wash photopolymer face layer bonded to a phenolic base layer to produce a composite sheet with overall, face layer, and base-layer thicknesses, respectively, of 0.120, 0.040, and 0.080 inch (3.0, 1.0, and 2.03 mm) **OR** 0.160, 0.040, and 0.120 inch (4.06, 1.0, and 3.04 mm), **as directed**.
 - h. Laminated Sheet: High-pressure engraved stock with contrasting color, **as directed**, face laminated to acrylic core in finishes and color combinations indicated **OR** as selected from manufacturer's full range, **as directed**.
 - i. Laminated, Etched Photopolymer: Raised graphics with Braille, **as directed**, 1/32 inch (0.8 mm) above surface with contrasting colors in finishes and color combinations indicated **OR** as selected from manufacturer's full range, **as directed**, and laminated to acrylic back.
 - j. Laminated, Sandblasted Polymer: Raised graphics with Braille, **as directed**, 1/32 inch (0.8 mm) above surface with contrasting colors in finishes and color combinations indicated **OR** as selected from manufacturer's full range, **as directed**, and laminated to acrylic back.
 - k. Edge Condition: Square cut **OR** Beveled **OR** Bullnose, **as directed**.
 - l. Corner Condition: Square **OR** Rounded to radius indicated, **as directed**.



- m. Mounting: Framed **OR** Unframed **OR** As indicated, **as directed**.
 - 1) Wall **OR** Ceiling **OR** Projection, **as directed**, mounted with concealed anchors **OR** magnetic tape **OR** two-face tape, **as directed**.
 - 2) Manufacturer's standard anchors for substrates encountered.
 - n. Custom Paint Colors: Match Pantone, **as directed**, color matching system.
 - o. Color: As indicated **OR** As selected from manufacturer's full range, **as directed**.
 - p. Tactile Characters: Characters and Grade 2 Braille raised 1/32 inch (0.8 mm) above surface with contrasting colors.
2. Exterior Panel Signs: Provide smooth sign panel surfaces constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch (1.5 mm) measured diagonally from corner to corner, complying with the following requirements:
- a. Aluminum Sheet: 0.050 inch (1.27 mm) **OR** 0.080 inch (2.03 mm), **as directed**, thick.
 - b. Laminated, Aluminum-Faced Sheet: 0.020-inch- (0.51-mm-) thick aluminum sheet laminated to each side of 0.197-inch- (5.0-mm-) **OR** 0.394-inch- (10.0-mm-), **as directed**, thick, corrugated **OR** phenolic **OR** acrylic, **as directed**, backing with painted edges, **as directed**.
 - c. Acrylic Sheet: 0.060 inch (1.52 mm) **OR** 0.080 inch (2.03 mm), **as directed**, thick.
 - d. Fiberglass Sheet: 0.090-inch- (2.29-mm-) **OR** 0.125-inch- (3.18-mm-), **as directed**, thick sheet.
 - e. Edge Condition: Square cut **OR** Beveled **OR** Bullnose, **as directed**.
 - f. Corner Condition: Square **OR** Rounded to radius indicated, **as directed**.
 - g. Mounting: Framed **OR** Unframed **OR** As indicated, **as directed**.
 - 1) Wall **OR** Soffit **OR** Projection, **as directed**, mounted.
 - 2) Manufacturer's standard noncorroding, **as directed**, anchors for substrates encountered.
 - h. Custom Paint Colors: Match Pantone, **as directed**, color matching system.
 - i. Color: As indicated **OR** As selected from manufacturer's full range, **as directed**.
3. Laminated Interior **OR** Exterior, **as directed**, Signs: Solid phenolic panel core with graphic image covered with thermosetting resin face layer.
- a. Surface Finish: Mat **OR** Beaded **OR** Gloss **OR** UV resistant, outdoor, **as directed**.
 - b. Edge Condition: Square cut **OR** Beveled **OR** Bullnose, **as directed**.
 - c. Corner Condition: Square **OR** Rounded to radius indicated, **as directed**.
 - d. Thickness: 1/8 inch (3 mm) **OR** 1/4 inch (6 mm), **as directed**.
4. Brackets: Fabricate brackets and fittings for bracket-mounted signs from extruded aluminum to suit panel sign construction and mounting conditions indicated. Factory paint brackets in color matching background color of panel sign **OR** matching sample, **as directed**.
5. Panel Sign Frames:
- a. PVC Frames: Extruded, high-impact PVC plastic.
 - 1) Color: As indicated **OR** As selected from manufacturer's full range **OR** Match face color, **as directed**.
 - 2) Depth: As indicated.
 - 3) Profile: Square **OR** Beveled **OR** Rounded, **as directed**.
 - 4) Corner Condition: Square **OR** Rounded to radius indicated, **as directed**.
 - 5) Mounting: As indicated.
 - a) Wall **OR** Ceiling **OR** Projection, **as directed**, mounted with concealed anchors **OR** magnetic tape **OR** two-face tape, **as directed**.
 - b) Manufacturer's standard noncorroding, **as directed**, anchors for substrates encountered.
 - b. Extruded-Aluminum Frames: Mitered with concealed anchors and welded, **as directed**.
 - 1) Color: As indicated **OR** As selected from manufacturer's full range, **as directed**.
 - 2) Depth: As indicated.
 - 3) Profile: Square **OR** Beveled **OR** Rounded, **as directed**.
 - 4) Corner Condition: Square **OR** Rounded to radius indicated, **as directed**.
 - 5) Mounting: As indicated.
 - a) Wall **OR** Ceiling **OR** Projection, **as directed**, mounted with concealed anchors **OR** magnetic tape **OR** two-face tape, **as directed**.



- b) Manufacturer's standard noncorroding, **as directed**, anchors for substrates encountered.
 - c. Metal Frames:
 - 1) Bronze Plate: Not less than 0.032 inch (0.81 mm) thick.
 - 2) Brass Plate: Not less than 0.032 inch (0.81 mm) thick.
 - 3) Steel Sheet: Painted, not less than 0.050 inch (1.27 mm) thick for face and 0.031 inch (0.78 mm) thick for returns.
 - a) Color: As indicated **OR** As selected from manufacturer's full range, **as directed**.
 - 4) Stainless-Steel Sheet: Not less than 0.050 inch (1.27 mm) thick for face and 0.031 inch (0.78 mm) thick for returns.
 - 5) Depth: As indicated.
 - 6) Corner Condition: Square **OR** Rounded to radius indicated, **as directed**.
 - 7) Mounting: As indicated.
 - a) Wall **OR** Ceiling **OR** Projection, **as directed**, mounted with concealed anchors **OR** magnetic tape **OR** two-face tape, **as directed**.
 - b) Manufacturer's standard noncorroding, **as directed**, anchors for substrates encountered.
6. Changeable Message Inserts: Fabricate signs to allow insertion of changeable messages in the form of slide-in inserts **OR** transparent covers with paper inserts printed by the Owner **OR** changeable panel inserts for use in fixed frames, **as directed**.
 - a. Furnish insert material and software for creating text and symbols for PC-Windows **OR** Macintosh, **as directed**, computers for the Owner production of paper inserts.
 - b. Furnish insert material cut-to-size for changeable message insert.
7. Tactile and Braille Sign: Manufacturer's standard process for producing text and symbols complying with ADA-ABA Accessibility Guidelines and with ICC/ANSI A117.1. Text shall be accompanied by Grade 2 Braille. Produce precisely formed characters with square-cut edges free from burrs and cut marks; Braille dots with domed or rounded shape.
 - a. Panel Material: Opaque acrylic sheet **OR** Photopolymer **OR** Clear acrylic sheet with opaque color coating, subsurface applied, **as directed**.
 - b. Raised-Copy Thickness: Not less than 1/32 inch (0.8 mm).
8. Engraved Copy: Machine engrave letters, numbers, symbols, and other graphic devices into panel sign on face indicated to produce precisely formed copy, incised to uniform depth.
 - a. Engraved Plastic Laminate: Engrave through exposed face ply of plastic-laminate sheet to expose contrasting core ply.
 - b. Engraved Metal: Fill engraved copy with enamel.
 - c. Engraved Opaque Acrylic Sheet: Fill engraved copy with enamel.
 - d. Face-Engraved Clear Acrylic Sheet: Fill engraved copy with enamel. Apply opaque background color coating to back face of acrylic sheet.
9. Subsurface Copy: Apply minimum 4-mil- (0.10-mm-) thick vinyl copy to back face of clear acrylic sheet forming panel face to produce precisely formed opaque image. Image shall be free of rough edges.
10. Subsurface Engraved Acrylic Sheet: Reverse-engrave back face of clear acrylic sheet. Fill resulting copy with enamel. Apply opaque background color coating over enamel-filled copy.
11. Applied Vinyl: Die-cut characters from vinyl film of nominal thickness of 3 mils (0.076 mm) with pressure-sensitive adhesive backing. Apply copy to exposed face of panel sign **OR** glass **OR** doors **OR** wall surfaces, **as directed**.
 - a. Panel Material: Opaque acrylic sheet **OR** Clear acrylic sheet with opaque color coating, subsurface applied, **as directed**.
12. Colored Coatings for Acrylic Sheet: For copy and background and frame colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are UV and water resistant for three **OR** five, **as directed**, years for application intended.
 - a. Custom Paint Colors: Match Pantone, **as directed**, color matching system.
 - b. Color: As indicated **OR** As selected from manufacturer's full range, **as directed**.



- E. Photoluminescent Markings and Signs
1. All photoluminescent exit path markings, signs and materials shall be approved by Authorities having jurisdiction and meet minimum performance requirements.
 2. Photoluminescent Signs: Self-contained, single **OR** double, **as directed**, face, as follows:
 - a. Manufacturer's standard aluminum **OR** plastic, **as directed**, frame with translucent lettering and transparent polycarbonate face.
 - b. Exit sign, UL 924.
 - c. Mounting: As indicated.
 - 1) Wall **OR** Ceiling **OR** Projection, **as directed**, mounted with concealed anchors.
 - d. Face Color: Red **OR** Green **OR** Black, **as directed**.
 - e. Frame Color: As indicated **OR** As selected from manufacturer's full range, **as directed**.
 - f. Service Life: 10 **OR** 15 **OR** 20, **as directed**, years.
 - g. New Buildings.
 - 1) All new buildings of three or more stories in height shall be provided with approved photoluminescent exit path markings in all enclosed exit stairwells.
 - h. Existing buildings.
 - 1) All Group E, I, R-1 and R-2 occupancies in buildings of three or more stories in height shall be provided with approved photoluminescent exit path markings in all enclosed exit stairwells.
 - i. All other occupancies in buildings four or more stories in height shall be provided with approved photoluminescent exit path markings in all enclosed exit stairwells.
 - j. Exception: Exit path markings in existence at the time of the adoption and or at the time of this ordinance may continue to exist as installed as long as they are in proper working order.
- F. Accessories
1. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.
 2. Fasteners: Stainless or corrosion-resistant; type best suited to application.
- G. Fabrication
1. General: Provide manufacturer's standard signs of configurations indicated.
 - a. Welded Connections: Comply with AWS standards for recommended practices in shop welding. Provide welds behind finished surfaces without distortion or discoloration of exposed side. Clean exposed welded surfaces of welding flux and dress exposed and contact surfaces.
 - b. Mill joints to tight, hairline fit. Form joints exposed to weather to exclude water penetration.
 - c. Preassemble signs in the shop to greatest extent possible. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in location not exposed to view after final assembly.
 - d. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.
- H. Finishes, General
1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 2. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
 3. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.



- I. Aluminum Finishes
1. Clear Anodic Finish: Manufacturer's standard Class 1 clear anodic coating, 0.018 mm or thicker, over a satin (directionally textured) **OR** polished (buffed) **OR** nonspecular as fabricated, **as directed**, mechanical finish, complying with AAMA 611.
 2. Color Anodic Finish: Manufacturer's standard Class 1 integrally colored or electrolytically deposited color anodic coating, 0.018 mm or thicker, in light bronze **OR** medium bronze **OR** dark bronze **OR** gold **OR** black, **as directed**, applied over a satin (directionally textured) **OR** polished (buffed) **OR** nonspecular as fabricated, **as directed**, mechanical finish, complying with AAMA 611.
 3. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Apply baked enamel complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.
 - a. Organic Coating: Thermosetting, modified-acrylic enamel primer/topcoat system complying with AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm), medium gloss.
- J. Steel Finishes
1. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
 2. Factory Priming for Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment.
 - a. Shop Primer: Manufacturer's or fabricator's standard, fast-curing, lead- and chromate-free, universal primer, selected for resistance to normal atmospheric corrosion, for compatibility with substrate and field-applied finish paint system indicated, and for capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.
 3. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).
- K. Stainless-Steel Finishes
1. Remove tool and die marks and stretch lines or blend into finish. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
 2. Directional Satin Finish: No. 4 finish.
 3. Mirrorlike Reflective, Nondirectional Polish: No. 8 finish.
 4. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
- L. Copper-Alloy Finishes
1. Sheet or Plate Finish: Medium satin (directionally textured) **OR** Smooth specular (mirrorlike), buffed, **as directed**, finish.
 - a. Raised Finish: Satin **OR** Polished **OR** Painted, **as directed**.
 - b. Recessed Finish: Etched, painted, **as directed**.
 2. Cast-Bronze **OR** Cast-Brass, **as directed**, Character Finishes: Manufacturer's standard satin finish, **as directed**, with exposed surfaces free from porosity, burrs, and rough spots; with returns finished with fine-grain air blast.
 3. Cast-Bronze Plaque Finishes: Exposed surfaces free of porosity, burrs, and rough spots; with returns finished with fine-grain air blast.
 - a. Raised Areas: Hand-tool and buff borders and raised copy to produce manufacturer's standard satin **OR** polished, **as directed**, finish.
 - b. Background Finish: Painted **OR** Dark oxidized **OR** Green patina, **as directed**.
 4. Clear Protective Coating: Coat exposed surfaces of copper alloys with manufacturer's standard, clear organic coating specially designed for coating copper-alloy products.



M. Acrylic Sheet Finishes

1. Colored Coatings for Acrylic Sheet: For copy and background and frame colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and that are UV and water resistant for three **OR** five, **as directed**, years for application intended.

1.3 EXECUTION

A. Installation

1. Locate signs and accessories where indicated, using mounting methods of types described and complying with manufacturer's written instructions.
 - a. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - b. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches (75 mm) of sign without encountering protruding objects or standing within swing of door.
2. Wall-Mounted Signs: Comply with sign manufacturer's written instructions except where more stringent requirements apply.
 - a. Two-Face Tape: Mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.
 - b. Hook-and-Loop Tapes: Mount signs to smooth, nonporous surfaces.
 - c. Magnetic Tape: Mount signs to smooth, nonporous surfaces.
 - d. Silicone-Adhesive Mounting: Attach signs to irregular, porous, or vinyl-covered surfaces.
 - e. Shim Plate Mounting: Provide 1/8-inch- (3-mm-) thick, concealed aluminum shim plates with predrilled and countersunk holes, at locations indicated, and where other mounting methods are not practicable. Attach plate with fasteners and anchors suitable for secure attachment to substrate. Attach panel signs to plate using method specified above.
 - f. Mechanical Fasteners: Use nonremovable mechanical fasteners placed through predrilled holes. Attach signs with fasteners and anchors suitable for secure attachment to substrate as recommended in writing by sign manufacturer.
 - g. Signs Mounted on Glass: Provide matching opaque plate on opposite side of glass to conceal mounting materials.
3. Bracket-Mounted Signs: Provide manufacturer's standard brackets, fittings, and hardware for mounting signs that project at right angles from walls and ceilings. Attach brackets and fittings securely to walls and ceilings with concealed fasteners and anchoring devices to comply with manufacturer's written instructions.
4. Dimensional Characters: Mount characters using standard fastening methods to comply with manufacturer's written instructions for character form, type of mounting, wall construction, and condition of exposure indicated. Provide heavy paper template to establish character spacing and to locate holes for fasteners.
 - a. Flush Mounting: Mount characters with backs in contact with wall surface.
 - b. Projected Mounting: Mount characters at projection distance from wall surface indicated.
5. Cast-Metal Plaques: Mount plaques using standard fastening methods to comply with manufacturer's written instructions for type of wall surface indicated.
 - a. Concealed Mounting: Mount plaques by inserting threaded studs into tapped lugs on back of plaque. Set in predrilled holes filled with quick-setting cement.
 - b. Face Mounting: Mount plaques using exposed fasteners with rosettes attached through face of plaque into wall surface.
6. Photoluminescent Marking and Signs
 - a. Approved stair markings shall be provided for all enclosed stairways in buildings three or more stories above grade or three or more levels below grade and in any exit pathways leading from the stairways with the exception of ground floor lobbies leading to the exterior of the building in the following manner:
 - b. Horizontal Leading Edge of each stair step shall be marked by Option 1 or Option 2.



- 1) Option 1: A minimum one inch and a maximum of two inches (25 mm) shaped contrasting marker of photoluminescent material on both side edges of the step. These markers shall be placed a minimum of 0inch to a maximum of 1/2inch (13 mm) from the leading edge of the step parallel to the nose of the step or landing.
 - 2) Option 2: A minimum one inch and a maximum of two inches (25mm) "zig-zag" pattern contrasting marker of photoluminescent material on both sides of the step. This shall be a continuous pattern along the walls of the stair step. (See Option 1 & 2 attachments)
- c. Stair Landings shall also be marked with a contrasting photoluminescent pathway marker located around the perimeter wall and across the face or floor in front of non-exit doors, on or within four inches (102 mm) of the floor. The dimensions, distances and locations shall be consistent and uniform throughout the same exit. Any spaces intervening between portions of the stairwell shall be marked as directed by the Owner. (See attachments)
- d. Photoluminescent Directional Signs shall be placed in the following locations:
- 1) Stairwell or exit: directional arrow visible upon opening the door into the stairwell or exit indicating the direction of travel.
 - 2) Transfer levels: A directional arrow on the wall. Exception: Markings shall be as directed by the Owner if walls are not available.
 - 3) Wherever egress direction is not clear, (turns along horizontal extensions; at transitions from vertical to horizontal direction; at "T" intersections; etc.) a directional arrow or outlined path (or both as determined by the Owner) shall be installed.
- e. Door frames (top and sides) of all stair entry, intermediate and final exit doors of the enclosed stairway shall be marked with a solid and continuous contrasting one inch minimum and a two inch maximum (25 mm) stripe of photoluminescent material.
- f. An approved photoluminescent "exit" sign shall be mounted on all stair entry, intermediate and final exit doors or adjacent to the door (on the latch side) within 18 inch (455 mm) of the floor. The sign shall state "EXIT", "FINAL EXIT", "EXIT THROUGH LOBBY", or "EXIT TO STREET". These signs shall be required to be UL 924 listed if they are to be viewed at a distance of 50 feet or more.
- g. Handrails shall be marked with a minimum one inch and a maximum of two inches (25 mm) solid and continuous stripe of photoluminescent material either on the handrail or on the wall adjacent to handrail.
- h. Obstacles at or below six feet six inches (1981 mm) in height and projecting more than four inches (102 mm) into the egress path shall be outlined with markings no less than one inch (25 mm) in width and not more than a two inches maximum comprised of a pattern of alternating equal bands of photoluminescent material and black, with the alternating bands no more than two inches in width and angled at 45 degrees. Examples of such obstacles include standpipes, hose cabinets, wall projections, and restricted height areas.
- i. Exit pathways shall be marked with a minimum one inch and a maximum of two inches (25 mm) solid and continuous stripe of photoluminescent pathway marking material on or within four inches of the floor along each side of the pathway. Pathways more than 50 feet in length shall have directional arrows along the wall at intervals not exceeding 50 feet.
- j. Minimum Lighting Requirements:
- 1) All installed photoluminescent materials shall be exposed to a minimum of two foot candles of fluorescent light illumination at all times while the building is occupied or if incandescent lighting is used, the photoluminescent material chosen must be capable of meeting the minimum brightness rating required by this standard with the lighting provided.
 - 2) Motion sensor activated lighting is prohibited in the stairwells addressed by this standard.
 - 3) Timers on stairwell lighting, if used, shall be set to turn on the lights not less than one hour before the building is occupied each day.
- k. Maintenance Requirements:
- 1) Owners shall maintain the required photoluminescent signs and markings in good repair. Every 12 months owners shall perform a visual inspection of the signs and



markings with the normal lighting turned on. Signs and/or markings that are missing, damaged, loose or that show signs of wear shall be noted and properly repaired or replaced.

B. Cleaning And Protection

1. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by the Owner.

END OF SECTION 01 58 13 00



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Task	Specification	Specification Description
01 58 13 00	01 22 16 00	No Specification Required
01 66 19 00	01 22 16 00	No Specification Required
01 71 13 00	01 22 16 00	No Specification Required



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SECTION 01 71 23 16 - CUTTING AND PATCHING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for cutting and patching. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes procedural requirements for cutting and patching.

C. Definitions

1. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.
2. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

D. Submittals

1. Cutting and Patching Proposal: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
 - a. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
 - b. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
 - c. Products: List products to be used and firms or entities that will perform the Work.
 - d. Dates: Indicate when cutting and patching will be performed.
 - e. Utility Services and Mechanical/Electrical Systems: List services/systems that cutting and patching procedures will disturb or affect. List services/systems that will be relocated and those that will be temporarily out of service. Indicate how long services/systems will be disrupted.
 - f. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
 - g. the Owner's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

E. Quality Assurance

1. LEED Requirements for Building Reuse:
 - a. Credit MR 1.1 and 1.2, **as directed**: Maintain existing building structure (including structural floor and roof decking) and envelope (exterior skin and framing, excluding window assemblies and nonstructural roofing material) not indicated to be removed; do not cut such existing construction beyond indicated limits.
 - b. Credit MR 1.3: Maintain existing interior nonstructural elements (interior walls, doors, floor coverings, and ceiling systems) not indicated to be removed; do not cut such existing construction beyond indicated limits.
 - c. Credit MR 1.2 and 1.3, **as directed**: Maintain existing nonshell, nonstructural components (walls, flooring, and ceilings) not indicated to be removed; do not cut such existing construction beyond indicated limits.



2. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
 - a. **Refer to the Owner for list of elements that might otherwise be overlooked as structural elements and that require Architect's or Construction Manager's approval of a cutting and patching proposal.**
3. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operating elements include the following:
 - a. Primary operational systems and equipment.
 - b. Air or smoke barriers.
 - c. Fire-suppression systems.
 - d. Mechanical systems piping and ducts.
 - e. Control systems.
 - f. Communication systems.
 - g. Conveying systems.
 - h. Electrical wiring systems.
 - i. Operating systems of special construction in Division 13.
4. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Miscellaneous elements include the following:
 - a. Water, moisture, or vapor barriers.
 - b. Membranes and flashings.
 - c. Exterior curtain-wall construction.
 - d. Equipment supports.
 - e. Piping, ductwork, vessels, and equipment.
 - f. Noise- and vibration-control elements and systems.
5. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
6. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

F. Warranty

1. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

1.2 PRODUCTS

A. Materials

1. General: Comply with requirements specified in other Sections.
2. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 - a. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.



1.3 EXECUTION

A. Preparation

1. Temporary Support: Provide temporary support of Work to be cut.
2. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
3. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
4. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize **OR** prevent, **as directed**, interruption to occupied areas.

B. Performance

1. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - a. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
2. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - a. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - b. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - c. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - d. Excavating and Backfilling: Comply with requirements in applicable Division 31 where required by cutting and patching operations.
 - e. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 - f. Proceed with patching after construction operations requiring cutting are complete.
3. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.
 - a. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
 - b. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 - 1) Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - 2) Restore damaged pipe covering to its original condition.
 - c. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - 1) Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.



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- d. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
 - e. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.
4. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 01 71 23 16



Task	Specification	Specification Description
01 74 16 00	01 22 16 00	No Specification Required



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SECTION 01 74 19 00 - CONSTRUCTION WASTE MANAGEMENT

1.1 GENERAL

A. Summary

1. This Section includes administrative and procedural requirements for the following:
 - a. Salvaging nonhazardous demolition and construction waste.
Note: All salvageable materials remain the property of the Owner and shall be turned over as directed when specified in the Job Order.
 - b. Recycling nonhazardous demolition and construction waste.
 - c. Disposing of nonhazardous demolition and construction waste.

B. Definitions

1. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
2. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
3. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
4. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
5. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
6. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

C. Performance Goals **OR** Requirements, **as directed**

1. General: Develop waste management plan that results in end-of-Project rates for salvage/recycling of 50 **OR** 75, **as directed**, percent by weight of total waste generated by the Work.
2. Salvage/Recycle Goals **OR** Requirements, **as directed**: Owner's goal is to salvage and recycle as much nonhazardous demolition and construction waste as possible including the following materials:
OR
Salvage/Recycle Goals **OR** Requirements, **as directed**: Owner's goal is to salvage and recycle as much nonhazardous demolition and construction waste as possible. Owner has established minimum goals for the following materials:
 - a. Demolition Waste:
 - 1) Asphaltic concrete paving.
 - 2) Concrete.
 - 3) Concrete reinforcing steel.
 - 4) Brick.
 - 5) Concrete masonry units.
 - 6) Wood studs.
 - 7) Wood joists.
 - 8) Plywood and oriented strand board.
 - 9) Wood paneling.
 - 10) Wood trim.
 - 11) Structural and miscellaneous steel.
 - 12) Rough hardware.
 - 13) Roofing.
 - 14) Insulation.
 - 15) Doors and frames.



- 16) Door hardware.
 - 17) Windows.
 - 18) Glazing.
 - 19) Metal studs.
 - 20) Gypsum board.
 - 21) Acoustical tile and panels.
 - 22) Carpet.
 - 23) Carpet pad.
 - 24) Demountable partitions.
 - 25) Equipment.
 - 26) Cabinets.
 - 27) Plumbing fixtures.
 - 28) Piping.
 - 29) Supports and hangers.
 - 30) Valves.
 - 31) Sprinklers.
 - 32) Mechanical equipment.
 - 33) Refrigerants.
 - 34) Electrical conduit.
 - 35) Copper wiring.
 - 36) Lighting fixtures.
 - 37) Lamps.
 - 38) Ballasts.
 - 39) Electrical devices.
 - 40) Switchgear and panelboards.
 - 41) Transformers.
- b. Construction Waste:
- 1) Site-clearing waste.
 - 2) Masonry and CMU.
 - 3) Lumber.
 - 4) Wood sheet materials.
 - 5) Wood trim.
 - 6) Metals.
 - 7) Roofing.
 - 8) Insulation.
 - 9) Carpet and pad.
 - 10) Gypsum board.
 - 11) Piping.
 - 12) Electrical conduit.
 - 13) Packaging: Regardless of salvage/recycle goal indicated above, salvage or recycle 100 percent of the following uncontaminated packaging materials:
 - a) Paper.
 - b) Cardboard.
 - c) Boxes.
 - d) Plastic sheet and film.
 - e) Polystyrene packaging.
 - f) Wood crates.
 - g) Plastic pails.

D. Submittals

1. Waste Management Plan: Submit 3 copies of plan within 7 **OR** 30, **as directed**, days of date established for commencement of the Work **OR** the Notice to Proceed **OR** the Notice of Award, **as directed**.



2. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit three copies of report. Include separate reports for demolition and construction waste, **as directed**. Include the following information:
 - a. Material category.
 - b. Generation point of waste.
 - c. Total quantity of waste in tons (tonnes).
 - d. Quantity of waste salvaged, both estimated and actual in tons (tonnes).
 - e. Quantity of waste recycled, both estimated and actual in tons (tonnes).
 - f. Total quantity of waste recovered (salvaged plus recycled) in tons (tonnes).
 - g. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
 3. Waste Reduction Calculations: Before request for Final Completion, submit three copies of calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
 4. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
 5. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
 6. LEED Submittal: LEED letter template for Credit MR 2.1 and 2.2, **as directed**, signed by Contractor, tabulating total waste material, quantities diverted and means by which it is diverted, and statement that requirements for the credit have been met.
 7. Qualification Data: For Waste Management Coordinator and refrigerant recovery technician.
 8. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.
- E. Quality Assurance
1. Waste Management Coordinator Qualifications: LEED Accredited Professional by U.S. Green Building Council. Waste management coordinator may also serve as LEED coordinator.
 2. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.
 3. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
 4. Waste Management Conference: Conduct conference at Project site. Review methods and procedures related to waste management including, but not limited to, the following:
 - a. Review and discuss waste management plan including responsibilities of Waste Management Coordinator.
 - b. Review requirements for documenting quantities of each type of waste and its disposition.
 - c. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
 - d. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
 - e. Review waste management requirements for each trade.
- F. Waste Management Plan
1. General: Develop plan consisting of waste identification, waste reduction work plan, and cost/revenue analysis. Include separate sections in plan for demolition and construction waste if Project requires selective demolition or building demolition. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
 2. Waste Identification: Indicate anticipated types and quantities of demolition, site-clearing, and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.
 3. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.



- a. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
 - b. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
 - c. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
 - d. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.
4. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Include the following:
- a. Total quantity of waste.
 - b. Estimated cost of disposal (cost per unit). Include hauling and tipping fees and cost of collection containers for each type of waste.
 - c. Total cost of disposal (with no waste management).
 - d. Revenue from salvaged materials.
 - e. Revenue from recycled materials.
 - f. Savings in hauling and tipping fees by donating materials.
 - g. Savings in hauling and tipping fees that are avoided.
 - h. Handling and transportation costs. Include cost of collection containers for each type of waste.
 - i. Net additional cost or net savings from waste management plan.

1.2 PRODUCTS (Not Used)

1.3 EXECUTION

A. Plan Implementation

1. General: Implement waste management plan as approved by the Owner. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
 - a. Comply with Division 01 Section "Temporary Facilities And Controls" for operation, termination, and removal requirements.
2. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.
3. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
 - a. Distribute waste management plan to everyone concerned within three days of submittal return.
 - b. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
4. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - a. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
 - b. Comply with Division 01 Section "Temporary Facilities And Controls" for controlling dust and dirt, environmental protection, and noise control.

B. Salvaging Demolition Waste



1. Salvaged Items for Reuse in the Work:
 - a. Clean salvaged items.
 - b. Pack or crate items after cleaning. Identify contents of containers.
 - c. Store items in a secure area until installation.
 - d. Protect items from damage during transport and storage.
 - e. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.
 2. Salvaged Items for Sale and Donation: Not permitted.
 3. Salvaged Items for Owner's Use:
 - a. Clean salvaged items.
 - b. Pack or crate items after cleaning. Identify contents of containers.
 - c. Store items in a secure area until delivery to Owner.
 - d. Transport items to Owner's storage area on-site **OR** off-site **OR** designated by Owner, **as directed**.
 - e. Protect items from damage during transport and storage.
 4. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.
- C. Recycling Demolition And Construction Waste, General
1. General: Recycle paper and beverage containers used by on-site workers.
 2. Recycling Receivers and Processors: Refer to the Owner for available recycling receivers and processors.
 3. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Owner **OR** accrue to Contractor **OR** be shared equally by Owner and Contractor, **as directed**.
 4. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical.
 - a. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
 - 1) Inspect containers and bins for contamination and remove contaminated materials if found.
 - b. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - c. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
 - d. Store components off the ground and protect from the weather.
 - e. Remove recyclable waste off Owner's property and transport to recycling receiver or processor.
- D. Recycling Demolition Waste
1. Asphaltic Concrete Paving: Grind asphalt to maximum 1-1/2-inch (38-mm) **OR** 4-inch (100-mm), **as directed**, size.
 - a. Crush asphaltic concrete paving and screen to comply with requirements in Division 31 Section "Earth Moving" for use as general fill.
 2. Asphaltic Concrete Paving: Break up and transport paving to asphalt-recycling facility.
 3. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
 - a. Pulverize concrete to maximum 1-1/2-inch (38-mm) **OR** 4-inch (100-mm), **as directed**, size.
 - b. Crush concrete and screen to comply with requirements in Division 31 Section "Earth Moving" for use as satisfactory soil for fill or subbase.
 4. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.
 - a. Pulverize masonry to maximum 3/4-inch (19-mm) **OR** 1-inch (25-mm) **OR** 1-1/2-inch (38-mm) **OR** 4-inch (100-mm), **as directed**, size.



- 1) Crush masonry and screen to comply with requirements in Division 31 Section "Earth Moving" for use as general fill **OR** satisfactory soil for fill or subbase, **as directed**.
 - 2) Crush masonry and screen to comply with requirements in Division 32 Section "Plants" for use as mineral mulch.
 - b. Clean and stack undamaged, whole masonry units on wood pallets.
 5. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.
 6. Metals: Separate metals by type.
 - a. Structural Steel: Stack members according to size, type of member, and length.
 - b. Remove and dispose of bolts, nuts, washers, and other rough hardware.
 7. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.
 8. Gypsum Board: Stack large clean pieces on wood pallets and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.
 9. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.
 - a. Separate suspension system, trim, and other metals from panels and tile and sort with other metals.
 10. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.
 - a. Store clean, dry carpet and pad in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.
 11. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.
 12. Plumbing Fixtures: Separate by type and size.
 13. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.
 14. Lighting Fixtures: Separate lamps by type and protect from breakage.
 15. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.
 16. Conduit: Reduce conduit to straight lengths and store by type and size.
- E. Recycling Construction Waste
1. Packaging:
 - a. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
 - b. Polystyrene Packaging: Separate and bag materials.
 - c. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
 - d. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
 2. Site-Clearing Wastes: Chip brush, branches, and trees on-site **OR** at landfill facility, **as directed**.
 - a. Comply with requirements in Division 32 Section "Plants" for use of chipped organic waste as organic mulch.
 3. Wood Materials:
 - a. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
 - b. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
 - 1) Comply with requirements in Division 32 Section "Plants" for use of clean sawdust as organic mulch.
 4. Gypsum Board: Stack large clean pieces on wood pallets and store in a dry location.
 - a. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.
 - 1) Comply with requirements in Division 32 Section "Plants" for use of clean ground gypsum board as inorganic soil amendment.



F. Disposal Of Waste

1. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
 - a. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
 - b. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
2. Burning: Do not burn waste materials.
OR
Burning: Burning of waste materials is permitted only at designated areas on Owner's property, provided required permits are obtained. Provide full-time monitoring for burning materials until fires are extinguished.
3. Disposal: Transport waste materials and dispose of at designated spoil areas on Owner's property.
OR
Disposal: Transport waste materials off Owner's property and legally dispose of them.

END OF SECTION 01 74 19 00



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**SECTION 01 95 06 00 - MISCELLANEOUS CARPENTRY****1.1 GENERAL****A. Description Of Work:**

1. This specification covers the furnishing and installation of materials for miscellaneous carpentry. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Framing with dimension lumber.
 - b. Rooftop equipment bases and support curbs.
 - c. Wood blocking, cants, and nailers.
 - d. Wood furring and grounds.
 - e. Wood sleepers.
 - f. Interior wood trim.
 - g. Wood shelving and clothes rods.
 - h. Plywood backing panels.

C. Definitions

1. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater but less than 5 inches nominal (114 mm actual) in least dimension.
2. Lumber grading agencies, and the abbreviations used to reference them, include the following:
 - a. NeLMA: Northeastern Lumber Manufacturers' Association.
 - b. NHLA: National Hardwood Lumber Association.
 - c. NLGA: National Lumber Grades Authority.
 - d. SPIB: The Southern Pine Inspection Bureau.
 - e. WCLIB: West Coast Lumber Inspection Bureau.
 - f. WWPA: Western Wood Products Association.

D. Submittals

1. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - a. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 - b. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
 - c. For fire-retardant treatments specified to be High-Temperature (HT) type include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
 - d. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
 - e. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
2. LEED Submittals:
 - a. Product Data for Credit EQ 4.1: For adhesives, including printed statement of VOC content.
 - b. Product Data for Credit EQ 4.4: For composite-wood products, documentation indicating that product contains no urea formaldehyde.



- c. Certificates for Credit MR 7: Chain-of-custody certificates certifying that products specified to be made from certified wood comply with forest certification requirements. Include evidence that mill is certified for chain of custody by an FSC-accredited certification body.
 - 1) Include statement indicating costs for each certified wood product.
- 3. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:
 - a. Preservative-treated wood.
 - b. Fire-retardant-treated wood.
 - c. Power-driven fasteners.
 - d. Powder-actuated fasteners.
 - e. Expansion anchors.
 - f. Metal framing anchors.

E. Quality Assurance

- 1. Forest Certification: For the following wood products, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship":
 - a. Dimension lumber framing.
 - b. Miscellaneous lumber.
 - c. Interior wood trim.
 - d. Shelving and clothes rods.

F. Delivery, Storage, And Handling

- 1. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.
- 2. Deliver interior wood materials that are to be exposed to view only after building is enclosed and weatherproof, wet work other than painting is dry, and HVAC system is operating and maintaining temperature and humidity at occupancy levels.

1.2 PRODUCTS

A. Wood Products, General

- 1. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - a. Factory mark each piece of lumber with grade stamp of grading agency.
 - b. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
 - c. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
 - d. Provide dressed lumber, S4S, unless otherwise indicated.

B. Wood-Preservative-Treated Materials

- 1. Preservative Treatment by Pressure Process: AWWA C2, except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWWA C31 with inorganic boron (SBX).
 - a. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
 - b. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.



2. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
 3. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
 - a. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.
 4. Application: Treat all miscellaneous carpentry, unless otherwise indicated **OR** items indicated on Drawings, and the following, **as directed**:
 - a. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - b. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
 - c. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
 - d. Wood framing members that are less than 18 inches (460 mm) above the ground in crawl spaces or unexcavated areas.
 - e. Wood floor plates that are installed over concrete slabs-on-grade.
- C. Fire-Retardant-Treated Materials
1. General: Comply with performance requirements in AWWA C20 (lumber) and AWWA C27 (plywood).
 - a. Use treatment that does not promote corrosion of metal fasteners.
 - b. Use Exterior type for exterior locations and where indicated.
 - c. Use Interior Type A, High Temperature (HT) for enclosed roof framing, framing in attic spaces, and where indicated.
 - d. Use Interior Type A, unless otherwise indicated.
 2. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
 - a. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.
 3. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.
 4. Application: Treat all miscellaneous carpentry, unless otherwise indicated **OR** items indicated on Drawings, and the following, **as directed**:
 - a. Framing for raised platforms.
 - b. Concealed blocking.
 - c. Roof construction.
 - d. Plywood backing panels.
- D. Dimension Lumber Framing
1. Maximum Moisture Content: 15 percent **OR** 19 percent **OR** 15 percent for 2-inch nominal (38-mm actual) thickness or less, 19 percent for more than 2-inch nominal (38-mm actual) thickness, **as directed**.
 2. Non-Load-Bearing Interior Partitions: Construction or No. 2 **OR** Construction, Stud, or No. 3 **OR** Standard, Stud, or No. 3, **as directed**, grade of any species.
 3. Other Framing: No. 2 **OR** Construction or No. 2 **OR** Construction, Stud, or No., **as directed**, grade and any of the following species:
 - a. Hem-fir (north); NLGA.
 - b. Southern pine; SPIB.
 - c. Douglas fir-larch; WCLIB or WWPA.
 - d. Mixed southern pine; SPIB.
 - e. Spruce-pine-fir; NLGA.
 - f. Douglas fir-south; WWPA.
 - g. Hem-fir; WCLIB or WWPA.



- h. Douglas fir-larch (north); NLGA.
- i. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.

E. Miscellaneous Lumber

1. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - a. Blocking.
 - b. Nailers.
 - c. Rooftop equipment bases and support curbs.
 - d. Cants.
 - e. Furring.
 - f. Grounds.
 - g. Utility shelving.
2. For items of dimension lumber size, provide Construction or No. 2 **OR** Standard, Stud, or No. 3, **as directed**, grade lumber with 15 **OR** 19, **as directed**, percent maximum moisture content of any species.
3. For exposed boards, provide lumber with 15 **OR** 19, **as directed**, percent maximum moisture content and any of the following species and grades:
 - a. Eastern white pine, Idaho white, lodgepole, ponderosa, or sugar pine; Premium or 2 Common (Sterling) **OR** Standard or No. 3 Common, **as directed**, grade; NeLMA, NLGA, WCLIB, or WWPA.
 - b. Mixed southern pine, No. 1 **OR** 2, **as directed**, grade; SPIB.
 - c. Hem-fir or hem-fir (north), Select Merchantable or No. 1 Common **OR** Construction or No. 2 Common, **as directed**, grade; NLGA, WCLIB, or WWPA.
 - d. Spruce-pine-fir (south) or spruce-pine-fir, Select Merchantable or No. 1 Common **OR** Construction or No. 2 Common, **as directed**, grade; NeLMA, NLGA, WCLIB, or WWPA.
4. For concealed boards, provide lumber with 15 **OR** 19, **as directed**, percent maximum moisture content and any of the following species and grades:
 - a. Mixed southern pine, No. 2 **OR** 3, **as directed**, grade; SPIB.
 - b. Hem-fir or hem-fir (north), Construction or 2 Common **OR** Standard or 3 Common, **as directed**, grade; NLGA, WCLIB, or WWPA.
 - c. Spruce-pine-fir (south) or spruce-pine-fir, Construction or 2 Common **OR** Standard or 3 Common, **as directed**, grade; NeLMA, NLGA, WCLIB, or WWPA.
 - d. Eastern softwoods, No. 2 **OR** 3, **as directed**, Common grade; NELMA.
 - e. Northern species, No. 2 **OR** 3, **as directed**, Common grade; NLGA.
 - f. Western woods, Construction or No. 2 Common **OR** Standard or No. 3 Common, **as directed**, grade; WCLIB or WWPA.
5. For blocking not used for attachment of other construction Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
6. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
7. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

F. Interior Wood Trim

1. General: Provide kiln-dried finished (surfaced) material without finger-jointing, unless otherwise indicated.
2. Softwood Lumber Trim for Transparent (Stain or Clear) Finish: Provide one of the following species and grade:
 - a. Grade C Select **OR** D Select **OR** Finish **OR** Premium, **as directed**, eastern white pine; NeLMA or NLGA.
 - b. Grade C Select (Choice) **OR** D Select (Quality) **OR** 1 Common (Colonial) **OR** 2 Common (Sterling), **as directed**, Idaho white, lodgepole, ponderosa, or sugar pine; NLGA or WWPA.



- c. Grade Superior or C & Btr **OR** Prime or D, **as directed**, Finish Douglas fir-larch or Douglas fir-south; NLGA, WCLIB, or WWPA.
 - d. Clear Heart **OR** Grade A **OR** Grade B, **as directed**, western red cedar; NLGA, WCLIB, or WWPA.
 3. Hardwood Lumber Trim for Transparent (Stain or Clear) Finish: Clear red oak **OR** white maple, **as directed**, selected for compatible grain and color, **as directed**.
 4. Lumber Trim for Opaque (Painted) Finish: Either finger-jointed or solid lumber, of one of the following species and grades:
 - a. Grade D Select **OR** Finish **OR** Premium, **as directed**, eastern white pine; NeLMA or NLGA.
 - b. Grade D Select (Quality) **OR** 1 Common (Colonial) **OR** 2 Common (Sterling), **as directed**, Idaho white, lodgepole, ponderosa, or sugar pine; NLGA or WWPA.
 - c. Grade A **OR** B, **as directed**, Finish aspen, basswood, cottonwood, gum, magnolia, red alder, soft maple, sycamore, tupelo, or yellow poplar; NHLA.
 5. Moldings: Made to patterns included in WMMPA WM 7 and graded according to WMMPA WM 4.
 - a. Moldings for Transparent (Stain or Clear) Finish: N-grade eastern white, Idaho white, lodgepole, ponderosa, or sugar pine **OR** western red cedar **OR** Douglas fir **OR** red oak **OR** white maple, **as directed**, selected for compatible grain and color.
 - b. Moldings for Opaque (Painted) Finish: P-grade eastern white, Idaho white, lodgepole, ponderosa, or sugar pine **OR** aspen, basswood, cottonwood, gum, magnolia, soft maple, tupelo, or yellow poplar **OR** primed medium-density fiberboard, **as directed**.
- G. Shelving And Clothes Rods
 1. Shelving: Made from one of the following materials, 3/4-inch (19-mm) thick. Do not use particleboard or medium-density fiberboard that contains urea formaldehyde.
 - a. Melamine-faced particleboard with radiused and filled front edge.
 - b. Particleboard with radiused and filled **OR** solid-wood, **as directed**, front edge.
 - c. Medium-density fiberboard with radiused **OR** solid-wood, **as directed**, front edge.
 - d. Wood boards of same species and grade indicated above for interior lumber trim for opaque **OR** transparent, **as directed**, finish.
 2. Shelf Cleats: 3/4-by-3-1/2-inch (19-by-89-mm) boards **OR** 3/4-by-5-1/2-inch (19-by-140-mm) boards with hole and notch to receive clothes rods, **as directed**, of same species and grade indicated above for interior lumber trim for opaque finish.
 3. Shelf Brackets: Prime-painted formed steel with provision to support clothes rod where rod is indicated.
 4. Clothes Rods:
 - a. 1-1/2-inch- (38-mm-) diameter, clear, kiln-dried hardwood rods **OR** clear, kiln-dried softwood rods; either Douglas fir or southern pine **OR** aluminum tubes, **as directed**.
OR
1-1/4-inch- (32-mm-) diameter, chrome-plated steel **OR** stainless-steel, **as directed**, tubes.
 5. Rod Flanges: Clear, kiln-dried hardwood turnings **OR** Clear, kiln-dried softwood turnings **OR** Aluminum **OR** Chrome-plated steel **OR** Stainless steel, **as directed**.
- H. Plywood Backing Panels
 1. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, **as directed**, in thickness indicated or, if not indicated, not less than 1/2-inch (13-mm) nominal thickness.
- I. Fasteners
 1. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
 - a. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M **OR** of Type 304 stainless steel, **as directed**.
 2. Nails, Brads, and Staples: ASTM F 1667.
 3. Power-Driven Fasteners: NES NER-272.



4. Wood Screws: ASME B18.6.1.
 5. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
 6. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).
 7. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.
 8. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
 - a. Material:
 - 1) Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
OR
Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).
- J. Metal Framing Anchors
1. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.
 - a. Use for interior locations where stainless steel is not indicated.
 2. Stainless-Steel Sheet: ASTM A 666, Type 304 **OR** 316, **as directed**.
 - a. Use for exterior locations and where indicated.
- K. Miscellaneous Materials
1. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.
 - a. Use adhesives that have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1.3 EXECUTION

A. Installation, General

1. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
2. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.
3. Metal Framing Anchors: Install metal framing to comply with manufacturer's written instructions.
4. Do not splice structural members between supports, unless otherwise indicated.
5. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
 - a. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches (406 mm) o.c.
6. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
 - a. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches (2438 mm) o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
 - b. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches (2438 mm) o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal- (38-mm actual-) thickness.



- c. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. (9.3 sq. m) and to solidly fill space below partitions.
 - d. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet (6 m) o.c.
 7. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
 8. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 - a. Use inorganic boron for items that are continuously protected from liquid water.
 - b. Use copper naphthenate for items not continuously protected from liquid water.
 9. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - a. NES NER-272 for power-driven fasteners.
 - b. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
 - c. "Nailing Schedule," and Tables in Section 2304 of the ICC's International Building Code.
 - d. Table 2306.1, "Fastening Schedule," in SBCCI's Standard Building Code.
 - e. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
 - f. Table 602.3(1), "Fastener Schedule for Structural Members," and Table 602.3(2), "Alternate Attachments," in ICC's International One- and Two-Family Dwelling Code.
 10. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads, unless otherwise indicated.
- B. Wood Ground, Sleeper, Blocking, And Nailers Installation
1. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
 2. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.
 3. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches (38 mm) wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.
- C. Wood Furring Installation
1. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.
 2. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal- (19-by-63-mm actual-) size furring horizontally **OR** vertically **OR** horizontally and vertically, **as directed**, at 24 inches (610 mm) **OR** 600 mm, **as directed**, o.c.
 3. Furring to Receive Gypsum Board **OR** Plaster Lath, **as directed**: Install 1-by-2-inch nominal- (19-by-38-mm actual-) size furring vertically at 16 inches (406 mm) **OR** 400 mm, **as directed**, o.c.
- D. Wood Trim Installation
1. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches (610 mm) long except where necessary. Stagger joints in adjacent and related standing and running trim. Cope at returns and miter at corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints.
 - a. Match color and grain pattern across joints.
 - b. Install trim after gypsum board joint-finishing operations are completed.



- c. Drill pilot holes in hardwood before fastening to prevent splitting. Fasten to prevent movement or warping. Countersink fastener heads and fill holes.
- d. Install to tolerance of 1/8 inch in 96 inches (3 mm in 2438 mm) for level and plumb. Install adjoining finish carpentry with 1/32-inch (0.8-mm) maximum offset for flush installation and 1/16-inch (1.6-mm) maximum offset for reveal installation.

E. Protection

- 1. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- 2. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 01 95 06 00

**SECTION 01 95 06 00a - EXTERIOR FINISH CARPENTRY****1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for exterior finish carpentry. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Exterior standing and running trim.
 - b. Lumber, Plywood, and Hardboard siding.
 - c. Plywood and Hardboard soffits.
 - d. Exterior stairs and railings.
 - e. Exterior ornamental wood columns.

C. Definitions

1. Lumber grading agencies, and the abbreviations used to reference them, include the following:
 - a. NeLMA: Northeastern Lumber Manufacturers' Association.
 - b. NLGA: National Lumber Grades Authority.
 - c. RIS: Redwood Inspection Service.
 - d. SPIB: The Southern Pine Inspection Bureau.
 - e. WCLIB: West Coast Lumber Inspection Bureau.
 - f. WWPA: Western Wood Products Association.

D. Submittals

1. Product Data: For each type of process and factory-fabricated product.
2. Samples: For each type of siding indicated.
3. LEED Submittal:
 - a. Certificates for Credit MR 7: Chain-of-custody certificates certifying that products specified to be made from certified wood comply with forest certification requirements. Include evidence that mill is certified for chain of custody by an FSC-accredited certification body.
 - 1) Include statement indicating costs for each certified wood product.
4. Research/Evaluation Reports: For fire-retardant-treated wood.
5. Compliance Certificates:
 - a. For lumber that is not marked with grade stamp.
 - b. For preservative-treated wood that is not marked with treatment quality mark.
 - c. For fire-retardant-treated wood that is not marked with classification marking of testing and inspecting agency.
6. Warranties: Special warranties specified in this Section.

E. Quality Assurance

1. Forest Certification: For the following wood products, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship":
 - a. Exterior standing and running trim.
 - b. Exterior lumber, plywood, and hardboard siding.
 - c. Exterior plywood and hardboard soffits.
 - d. Exterior stairs and railings.
 - e. Exterior ornamental wood columns.

F. Delivery, Storage, And Handling



1. Protect materials against weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation. Provide for air circulation within and around stacks and under temporary coverings.

G. Warranty

1. Special Warranty for Cellular PVC Trim: Manufacturer's standard form, signed by manufacturer, Installer, and Contractor, in which manufacturer agrees to repair or replace trim that fails due to defects in manufacturing within 25 years from date of Final Completion. Failures include, but are not limited to rotting, corrosion, delamination, and excessive swelling from moisture.
2. Special Warranty for Hardboard Siding and Trim: Manufacturer's standard form, signed by manufacturer, Installer, and Contractor, in which manufacturer agrees to repair or replace siding that fails in materials or workmanship within specified warranty period. Failures include, but are not limited to, deformation or deterioration beyond normal weathering.
 - a. Warranty Period for Factory-Applied Finish: Five years from date of Final Completion.
 - b. Warranty Period for Siding and Trim (Excluding Finish): 25 years from date of Final Completion.
3. Special Warranty for Columns: Manufacturer's standard form, signed by manufacturer, Installer, and Contractor, in which manufacturer agrees to repair or replace columns that fail in materials or workmanship within five years from date of Final Completion.

1.2 PRODUCTS

A. Materials, General

1. Lumber: DOC PS 20 and applicable grading rules of inspection agencies certified by ALSC's Board of Review.
2. Softwood Plywood: DOC PS 1.
3. Hardboard: AHA A135.4.

B. Wood-Preservative-Treated Materials

1. Water-Repellent Preservative Treatment by Nonpressure Process: AWPA N1 (dip, spray, flood, or vacuum-pressure treatment).
 - a. Preservative Chemicals: 3-iodo-2-propynyl butyl carbamate (IPBC), combined with an insecticide containing chlorpyrifos (CPF).
 - b. Use chemical formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants in solution to distinguish treated material from untreated material.
 - c. Application: Items not required to be pressure-preservative treated.
 - d. Application: Exterior trim and wood siding.
2. Preservative Treatment by Pressure Process:
 - a. Lumber: AWPA C2 except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX). Kiln dry after treatment to a maximum moisture content of 19 percent.
 - b. Plywood: AWPA C9. Kiln dry after treatment to a maximum moisture content of 18 percent.
 - c. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
 - d. For exposed items indicated to receive transparent finish, do not use chemical formulations that contain colorants or that bleed through or otherwise adversely affect finishes.
 - e. Do not use material that is warped or does not comply with requirements for untreated material.
 - f. Mark lumber with treatment quality mark of an inspection agency approved by ALSC's Board of Review.



- 1) For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.
 - g. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
 - 1) For exposed plywood indicated to receive a stained or natural finish, mark back of each piece.
 - h. Application: Where indicated **OR** All exterior lumber and plywood, **as directed**.
- C. Fire-Retardant-Treated Materials
1. Lumber: Comply with performance requirements in AWPA C20, Exterior type. Kiln dry after treatment to a maximum moisture content of 19 percent.
 2. Plywood: Comply with performance requirements in AWPA C27, Exterior type. Kiln dry after treatment to a maximum moisture content of 15 percent.
 3. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not contain colorants and provide materials that do not have marks from spacer sticks on the exposed face.
 4. Do not use material that does not comply with requirements for untreated material or is warped or discolored.
 5. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
 - a. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.
 - b. For exposed plywood indicated to receive a stained or natural finish, mark back of each piece.
 6. Application: Where indicated **OR** All exterior lumber and plywood, **as directed**.
- D. Standing And Running Trim
1. Lumber Trim for Semitransparent-Stained Finish **OR** Clear Finish **OR** Unfinished Applications, **as directed**:
 - a. Species and Grade: Redwood, Clear All Heart **OR** Hart B **OR** Clear **OR** Grade B, **as directed**; RIS.
 - b. Species and Grade: Western red cedar, Clear Heart VG (Vertical Grain) **OR** Clear Heart **OR** Grade A **OR** Grade B, **as directed**; NLGA, WCLIB, or WWPA.
 - c. Species and Grade: Hem-fir, pressure-preservative treated; 1 **OR** 2, **as directed**, Common; NLGA, WCLIB, or WWPA.
 - d. Species and Grade: Southern pine, pressure-preservative treated; B & B **OR** C & Btr **OR** D, **as directed**; SPIB.
 - e. Maximum Moisture Content: 19 **OR** 15, **as directed**, percent with at least 85 percent of shipment at 12 percent or less, **as directed**.
 - f. Finger Jointing: Not allowed **OR** Allowed if made with wet-use adhesive complying with ASTM D 5572, **as directed**.
 - g. Face Surface: Surfaced (smooth) **OR** Saw textured, **as directed**.
 2. Lumber Trim for Opaque-Stained **OR** Painted, **as directed**, Finish:
 - a. Species and Grade: Redwood, Clear **OR** Grade B, **as directed**; RIS.
 - b. Species and Grade: Western red cedar, Grade A **OR** B, **as directed**; NLGA, WCLIB, or WWPA.
 - c. Species and Grade: Hem-fir, Prime or D finish **OR** 1 Common **OR** 2 Common, **as directed**; NLGA, WCLIB, or WWPA.
 - d. Species and Grade: Eastern white pine, eastern hemlock-balsam fir-tamarack, eastern spruce, or white woods; D Select (Quality) **OR** Finish or 1 Common (Colonial) **OR** Premium or 2 Common (Sterling), **as directed**; NeLMA, NLGA, WCLIB, or WWPA.
 - e. Species and Grade: Northern white cedar, D Select **OR** 1 Common **OR** 2 Common, **as directed**; NeLMA or NLGA.



- f. Maximum Moisture Content: 19 **OR** 15, **as directed**, percent with at least 85 percent of shipment at 12 percent or less, **as directed**.
 - g. Finger Jointing: Not allowed **OR** Allowed if made with wet-use adhesive complying with ASTM D 5572, **as directed**.
 - h. Face Surface: Surfaced (smooth) **OR** Saw textured, **as directed**.
 3. Moldings for Semitransparent-Stained Finish **OR** Clear Finish **OR** Unfinished Applications, **as directed**: WMMPA WM 4, N-grade wood moldings, without finger jointing. Made from kiln-dried stock to patterns included in WMMPA WM 12.
 - a. Species: Redwood **OR** Western red cedar **OR** Eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine, **as directed**.
 - b. Brick-Mold Pattern: WM 180, 1-1/4 by 2 inches (32 by 51 mm).
 - c. Drip-Cap Pattern: WM 197, 11/16 by 1-5/8 inches (17 by 41 mm).
 - d. Bed-Mold Pattern: WM 75, 9/16 by 1-5/8 inches (14 by 41 mm).
 - e. Screen-Bead Pattern: WM 144, 1/4 by 3/4 inch (6 by 19 mm).
 4. Moldings for Opaque-Stained **OR** Painted, **as directed**, Finish: WMMPA WM 4, P-grade wood moldings. Made from kiln-dried stock to patterns included in WMMPA WM 12.
 - a. Species: Redwood **OR** Western red cedar **OR** Eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine, **as directed**.
 - b. Finger Jointing: Not allowed **OR** Allowed if made with wet-use adhesive complying with ASTM D 5572, **as directed**.
 - c. Brick-Mold Pattern: WM 180, 1-1/4 by 2 inches (32 by 51 mm).
 - d. Drip-Cap Pattern: WM 197, 11/16 by 1-5/8 inches (17 by 41 mm).
 - e. Bed-Mold Pattern: WM 75, 9/16 by 1-5/8 inches (14 by 41 mm).
 - f. Screen-Bead Pattern: WM 144, 1/4 by 3/4 inch (6 by 19 mm).
 5. MDO Trim: Exterior Grade B-B, MDO plywood.
 6. Cellular PVC Trim: Extruded, expanded PVC with a small-cell microstructure, made from UV- and heat-stabilized, rigid material.
 - a. Density: Not less than 31 lb/cu. ft. (500 kg/cu. m).
 - b. Heat Deflection Temperature: Not less than 130 deg F (54 deg C), per ASTM D 648.
 - c. Coefficient of Thermal Expansion: Not more than 4.5×10^{-5} inches/inch x deg F (8.1×10^{-5} mm/mm x deg C).
 - d. Water Absorption: Not more than 1 percent, per ASTM D 570.
 - e. Flame-Spread Index: 75 or less, per ASTM E 84.
 7. Foam Plastic Moldings: Molded product of shapes indicated, with a tough outer skin on exposed surfaces; factory primed. Exposed surfaces shall not be shaped after molding. Product is recommended by manufacturer for exterior use.
 - a. Density: Not less than 20 lb/cu. ft. (320 kg/cu. m).
 - b. Flame-Spread Index: Not more than 75 when tested according to ASTM E 84.
 - c. Thickness: Not more than 1/2 inch (12.7 mm).
 - d. Width: Not more than 8 inches (204 mm).
 - e. Patterns: As indicated by manufacturer's designations.
- E. Lumber Siding
1. Provide kiln-dried lumber siding complying with DOC PS 20, factory coated with exterior alkyd primer, **as directed**.
 2. Species and Grade:
 - a. Clear All Heart VG **OR** Clear All Heart **OR** Clear VG (Vertical Grain) **OR** Clear **OR** Grade B, **as directed**, redwood; RIS.
 - b. Clear VG (Vertical Grain) Heart **OR** Grade A **OR** Grade B, **as directed** western red cedar; NLGA, WCLIB, or WWPA.
 - c. Grade 1 **OR** 2, **as directed**, Common spruce-pine-fir; NeLMA, NLGA, WCLIB, or WWPA.
 - d. Grade Prime or D finish **OR** 1 Common **OR** 2 Common, **as directed**, pressure-preservative-treated hem-fir; NLGA, WCLIB, or WWPA.



- e. Grade D Select (Quality) **OR** Finish or 1 Common (Colonial) **OR** Premium or 2 Common (Sterling), **as directed**, eastern white pine, eastern hemlock-balsam fir-tamarack, eastern spruce, or white woods; NeLMA, NLGA, WCLIB, or WWPA.
 - f. Grade D Select **OR** 1 Common **OR** 2 Common, **as directed**, northern white cedar; NeLMA or NLGA.
 - g. Grade B & B **OR** C & Btr **OR** D **OR** 1 Common **OR** 2 Common, **as directed**, pressure-preservative-treated southern pine; SPIB.
3. Pattern:
- a. Bevel siding, S1S2E, actual overall dimensions of 5-1/2 by 11/16 inch (140 by 17 mm) **OR** 5-1/2 by 3/4 inch (140 by 19 mm) **OR** 7-1/4 by 3/4 inch (184 by 19 mm) **OR** 9-1/4 by 3/4 inch (235 by 19 mm) **OR** 9-1/4 by 1-3/32 inches (235 by 28 mm), **as directed**, measured on the face and thick edge at 19 percent moisture content.
 - b. Drop siding, SPIB or WWPA pattern No. 105, actual face width (coverage) and thickness of 4-7/8 by 9/16 inch (124 by 14 mm) **OR** 4-7/8 by 23/32 inch (124 by 18 mm) **OR** 6-5/8 by 23/32 inch (168 by 18 mm) **OR** 8-5/8 by 23/32 inch (219 by 18 mm), **as directed**, measured at 19 percent moisture content.
 - c. V-edge, smooth-faced tongue-and-groove pattern with eased edges, actual face width (coverage) and thickness of 3-1/8 by 9/16 inch (79 by 14 mm) **OR** 3-1/8 by 23/32 inch (79 by 18 mm) **OR** 5-1/8 by 23/32 inch (130 by 18 mm) **OR** 6-7/8 by 23/32 inch (175 by 18 mm), **as directed**, measured at 19 percent moisture content.
- F. Plywood Siding
1. Plywood Type: APA-rated siding, pressure-preservative treated, **OR** factory coated with exterior acrylic latex stain, **as directed**, in panel sizes indicated.
 - a. Face Grade: 303-OC **OR** OL **OR** NR **OR** SR, **as directed**.
 - b. Face Grade: 303-6 **OR** 18 **OR** 30, **as directed-S OR W OR S/W, as directed**.
 2. Thickness: 11/32 inch (8.7 mm) **OR** 3/8 inch (9.5 mm) **OR** 15/32 inch (11.9 mm) **OR** 1/2 inch (12.7 mm) **OR** 19/32 inch (15.1 mm) **OR** 5/8 inch (15.9 mm) **OR** As indicated, **as directed**.
 3. Face Species: Southern pine **OR** Douglas fir **OR** Western red cedar **OR** Redwood, **as directed**.
 4. Pattern: Plain **OR** Channel groove; grooves 4 inches (101.6 mm) o.c. **OR** Texture 1-11; grooves 4 inches (101.6 mm) o.c. **OR** Reverse board-and-batten; grooves 12 inches (304.8 mm) o.c., **as directed**.
 5. Surface: Smooth **OR** Rough sawn, **as directed**.
- G. Hardboard Siding
1. Hardboard Siding: AHA A135.6, primed with manufacturer's standard exterior primer.
 - a. Type:
 - 1) 7/16-inch- (11-mm-) thick-by-6-inch- (152-mm-) **OR** 8-inch- (203-mm-), **as directed**, wide lap siding.
 - 2) 1/2-inch- (12.7-mm-) thick-by-8-inch- (203-mm-) wide, beaded-edge lap siding.
 - 3) 7/16-inch- (11-mm-) thick, shiplap-edge panels; with grooves 3-5/8 inches (92 mm) o.c., simulating wood drop siding.
 - 4) 1/2-inch- (12.7-mm-) thick, shiplap-edge panels; with grooves 5-1/2 inches (140 mm) o.c., simulating wood drop siding.
 - 5) 7/16-inch- (11-mm-) thick, square-edge flat panels; without grooves.
 - 6) 7/16-inch- (11-mm-) thick, shiplap-edge panels; channel grooved with grooves 8 inches (203.2 mm) o.c.
 - b. Texture: Smooth **OR** Wood grain **OR** Shingle **OR** Stucco, **as directed**.
 2. Primed Hardboard Trim: High-temperature-cured, high-resin, wood-fiber composite; factory primed on faces and edges. Recommended by manufacturer for exterior use.
 3. Colors, Textures, and Patterns: As selected by the Owner from manufacturer's full range.
- H. Plywood Soffits
1. Plywood Type: Exterior, Grade A-C **OR** Grade B-C **OR** Grade C-C, plugged and touch sanded **OR** APA-rated siding, **as directed**.
 - a. Face Grade: 303-OC **OR** OL **OR** NR **OR** SR, **as directed**.



- b. Face Grade: 303-6 **OR** 18 **OR** 30, **as directed**, -S **OR** W **OR** S/W, **as directed**.
 2. Thickness: 11/32 inch (8.7 mm) **OR** 3/8 inch (9.5 mm) **OR** 15/32 inch (11.9 mm) **OR** 1/2 inch (12.7 mm) **OR** 19/32 inch (15.1 mm) **OR** As indicated, **as directed**.
 3. Face Species: Southern pine **OR** Douglas fir **OR** Western red cedar **OR** Redwood, **as directed**.
 4. Pattern: Plain **OR** Channel groove; grooves 4 inches (101.6 mm) o.c. **OR** Texture 1-11; grooves 4 inches (101.6 mm) o.c., **as directed**.
 5. Surface: Smooth **OR** Rough sawn, **as directed**.
- I. Hardboard Soffits
 1. Hardboard Soffits: Primed hardboard, complying with AHA A135.6, with manufacturer's standard exterior primer.
 - a. Type: 7/16-inch- (11-mm-) **OR** 1/2-inch- (12.7-mm-), **as directed**, thick flat panels, smooth **OR** wood-grain textured **OR** stucco textured, **as directed**.
 2. Colors, Textures, and Patterns: As selected by the Owner from manufacturer's full range.
- J. Stairs And Railings
 1. Stairs:
 - a. Treads: 1-1/4-inch (32-mm) thick, kiln-dried, pressure-preservative-treated stepping with half-round or rounded edge nosing.
 - 1) Species and Grade: Douglas fir, C & Btr VG (Vertical Grain) stepping; NLGA, WCLIB, or WWPA **OR** Hem-fir, C & Btr VG (Vertical Grain) stepping; NLGA, WCLIB, or WWPA **OR** Southern pine, B & B stepping; SPIB, **as directed**.
 - b. Risers: 3/4-inch (19-mm) thick, kiln-dried, pressure-preservative-treated finish boards.
 - 1) Species and Grade: Douglas fir, C & Btr or Superior finish; NLGA, WCLIB, or WWPA **OR** Hem-fir, C & Btr or Superior finish; NLGA, WCLIB, or WWPA **OR** Southern pine, B & B; SPIB, **as directed**
 2. Railings: Clear, kiln-dried, solid, yellow poplar **OR** pressure-preservative-treated Douglas fir **OR** pressure-preservative-treated southern pine, **as directed**; railing stock of pattern indicated.
 3. Balusters: 1-1/16-inch- (27-mm-) square, clear, kiln-dried, solid, yellow poplar **OR** pressure-preservative-treated Douglas fir **OR** pressure-preservative-treated southern pine, **as directed**.
 4. Newel Posts: Clear, kiln-dried, yellow poplar **OR** pressure-preservative-treated, Douglas fir **OR** pressure-preservative-treated, southern pine, **as directed**, turned newel posts of pattern and size indicated.
 5. Newel Posts: 2-3/4-inch- (70-mm-) square, clear, kiln-dried yellow poplar **OR** pressure-preservative-treated Douglas fir **OR** pressure-preservative-treated southern pine, **as directed**; either solid or laminated.
- K. Ornamental Wood Columns
 1. Factory fabricate columns from clear stock, either solid or finger jointed, with a moisture content of not more than 15 **OR** 19, **as directed**, percent.
 - a. Wood Species: Redwood **OR** Western red cedar **OR** Eastern white, Idaho white, lodgepole, ponderosa, or sugar pine, **as directed**.
 2. Shafts: Built up from tongue-and-groove staves joined with waterproof glue. Lathe turn shafts to provide base diameter indicated and true architectural entasis taper. Precisely mill flutes as indicated.
 3. Capital and Base: Molded glass-fiber-reinforced plastic **OR** Built up from wood components with waterproof glue. Turn circular elements on lathes.
 4. Plinths: Cast-aluminum or molded glass-fiber-reinforced plastic, constructed to ventilate the interior of column shaft.
 5. Treatment and Finishing:
 - a. Treat wood columns with water-repellant preservative by nonpressure process.
 - b. Coat inside of column shafts with bituminous mastic.
 - c. Prime columns with two coats of exterior alkyd wood primer compatible with specified topcoats.



L. Miscellaneous Materials

1. Fasteners for Exterior Finish Carpentry: Provide nails or screws, in sufficient length to penetrate not less than 1-1/2 inches (38 mm) into wood substrate.
 - a. For face-fastening siding, provide ringed-shank siding nails unless hot-dip galvanized nails are used.
 - b. For redwood, provide brass/bronze **OR** stainless-steel **OR** hot-dip galvanized steel, **as directed**, fasteners.
 - c. For prefinished items, provide matching prefinished aluminum fasteners where face fastening is required.
 - d. For pressure-preservative-treated wood, provide stainless-steel **OR** hot-dip galvanized steel, **as directed**, fasteners.
 - e. For applications not otherwise indicated, provide stainless-steel **OR** hot-dip galvanized steel **OR** aluminum, **as directed**, fasteners.
2. Wood Glue: Waterproof resorcinol glue recommended by manufacturer for exterior carpentry use.
3. Adhesive for Cellular PVC Trim: Product recommended by trim manufacturer.
4. Flashing: Comply with requirements in Division 07 Section "Sheet Metal Flashing And Trim" for flashing materials installed in exterior finish carpentry.
 - a. Horizontal Joint Flashing for Panel Siding: Preformed, galvanized steel **OR** aluminum **OR** prefinished aluminum **OR** stainless-steel, **as directed**, Z-shaped flashing.
5. Insect Screening for Soffit Vents: Aluminum, 18-by-16 (1.4-by-1.6-mm) mesh **OR** PVC-coated glass-fiber fabric, 18-by-14 (1.4-by-1.8-mm) or 18-by-16 (1.4-by-1.6-mm) mesh **OR** Stainless steel, 18-by-18 (1.4-by-1.4-mm) mesh, **as directed**.
6. Continuous Soffit Vents: Aluminum hat channel shape with stamped louvers **OR** perforations, **as directed**, 2 inches (51 mm) wide, and in lengths not less than 96 inches (2438 mm).
 - a. Net Free Area: 4 sq. in./linear ft. (280 sq. cm/m) **OR** 6 sq. in./linear ft. (420 sq. cm/m) **OR** 8 sq. in./linear ft. (560 sq. cm/m), **as directed**.
 - b. Finish: Mill finish **OR** White paint **OR** Brown paint, **as directed**.
7. Round Soffit Vents: Stamped aluminum louvered vents, 2 inches (51 mm) **OR** 2-1/2 inches (64 mm) **OR** 3 inches (76 mm) **OR** 4 inches (102 mm), **as directed**, in diameter, made to be inserted into round holes cut into soffit.
 - a. Finish: Mill finish **OR** White paint **OR** Brown paint, **as directed**.
8. Sealants: Latex, complying with ASTM C 834, Type P, Grade NF and with applicable requirements in Division 07 Section "Joint Sealants", recommended by sealant manufacturer and manufacturer of substrates for intended application.

M. Fabrication

1. Back out or kerf backs of standing and running trim wider than 5 inches (125 mm), except members with ends exposed in finished work.
2. Ease edges of lumber less than 1 inch (25 mm) in nominal thickness to 1/16-inch (1.5-mm) radius and edges of lumber 1 inch (25 mm) or more in nominal thickness to 1/8-inch (3-mm) radius.

1.3 EXECUTION

A. Preparation

1. Clean substrates of projections and substances detrimental to application.
2. Prime lumber to be painted, including both faces and edges. Cut to required lengths and prime ends. Comply with requirements in Division 09 Section "Exterior Painting".

B. Installation, General

1. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.
 - a. Do not use manufactured units with defective surfaces, sizes, or patterns.
2. Install exterior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.



- a. Scribe and cut exterior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
- b. Install to tolerance of 1/8 inch in 96 inches (3 mm in 2438 mm) for level and plumb. Install adjoining exterior finish carpentry with 1/32-inch (0.8-mm) maximum offset for flush installation and 1/16-inch (1.5-mm) maximum offset for reveal installation.
- c. Install stairs with no more than 3/16-inch (4.7-mm) variation between adjacent treads and risers and with no more than 3/8-inch (9.5-mm) variation between largest and smallest treads and risers within each flight.
- d. Coordinate exterior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate exterior finish carpentry.

C. Standing And Running Trim Installation

1. Install flat grain lumber with bark side exposed to weather.
2. Install cellular PVC trim to comply with manufacturer's written instructions.
3. Install trim with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches (610 mm) long except where necessary.
 - a. Use scarf joints for end-to-end joints.
 - b. Stagger end joints in adjacent and related members.
4. Fit exterior joints to exclude water. Cope at returns and miter at corners to produce tight-fitting joints with full-surface contact throughout length of joint. Plane backs of casings to provide uniform thickness across joints, where necessary for alignment.
5. Unless otherwise indicated, countersink fasteners, fill surface flush, and sand where face fastening is unavoidable.

D. Siding Installation

1. Install siding to comply with manufacturer's written instructions and warranty requirements.
2. Horizontal Lumber Siding: Apply starter strip along bottom edge of sheathing or sill. Install first course of siding with lower edge at least 1/8 inch (3 mm) below starter strip and subsequent courses lapped 1 inch (25 mm) over course below. Nail at each stud. Do not allow nails to penetrate more than one thickness of siding.
3. Diagonal Lumber Siding: Begin application at corner with tongue edge up. Install subsequent courses with tongue-and-groove edges tightly fitted together. Nail at each stud.
 - a. Leave 1/8-inch (3-mm) gap at trim and corners unless otherwise recommended by manufacturer, and apply sealant.
 - b. Butt joints only over framing or blocking, nailing top and bottom on each side and staggering joints in subsequent courses.
 - c. Install prefabricated outside corners as recommended by manufacturer of siding materials.
4. Plywood Siding: Install panels with edges over framing or blocking. Nail at 6 inches (150 mm) o.c. at panel perimeter and 12 inches (300 mm) o.c. at intermediate supports unless manufacturer recommends closer spacing. Leave 1/16-inch (1.5-mm) gap between adjacent panels and 1/8-inch (3-mm) gap at perimeter, openings, and horizontal joints unless otherwise recommended by panel manufacturer.
 - a. Seal butt joints at inside and outside corners and at trim locations.
 - b. Install continuous metal flashing at horizontal panel joints.
 - c. Apply battens and corner trim as indicated. Countersink nail heads, fill flush, and sand filler.
 - d. Conceal fasteners to greatest practical extent by countersinking and filling, by placing in grooves of siding pattern or by concealing with applied trim or battens as detailed. Do not nail through overlapping pieces.
5. Hardboard Siding: Install hardboard siding complying with AHA's "Recommended Basic Application and Painting Instructions for Hardboard Siding." Install panels with edges over framing or blocking. Leave 3/16-inch (5-mm) gap at perimeter, openings, and horizontal panel joints unless otherwise recommended by panel manufacturer.
 - a. Seal butt joints at inside and outside corners and at trim locations.



- b. Install continuous metal flashing at horizontal panel joints.
 - c. Apply battens and corner trim as indicated.
 - d. Conceal fasteners to greatest practical extent by placing in grooves of siding pattern or by concealing with applied trim or battens as detailed.
6. Flashing: Install metal flashing as indicated on Drawings and as recommended by siding manufacturer.
 7. Finish: Apply finish within two weeks of installation.
- E. Stair And Railing Installation
1. Treads and Risers at Exterior Stairs: Secure treads and risers by gluing and nailing to carriages. Countersink nail heads, fill flush, and sand filler. Extend treads over carriages and finish with bullnose edge.
 2. Balusters: Fit balusters to treads, glue, and nail in place. Countersink nail heads, fill flush, and sand filler. Let into railings and glue in place.
 3. Newel Posts: Secure newel posts to stringers and risers with through bolts **OR** lag screws **OR** countersunk-head wood screws and glue, **as directed**.
 4. Railings: Secure wall rails with metal brackets. Fasten freestanding railings to newel posts and to trim at walls with countersunk-head wood screws or rail bolts, and glue.
- F. Ornamental Column Installation
1. Install columns to comply with manufacturer's written instructions. Comply with requirements below unless manufacturer's written instructions state otherwise.
 2. Lay out column locations on soffits and beams and plumb down to locate column locations at supports.
 3. Set plinths in location, shim as required to temporarily level, and scribe and trim as required so that top of plinths will sit level without use of shims. Fasten plinths in place to support using pins or fasteners as recommended by manufacturer.
 4. Scribe and trim tops of columns to fit to soffits and beams. Maintain ventilation passages to interior of columns.
 5. Seal ends of columns with two coats of wood sealer or primer.
 6. Install column caps and flashing on columns and fasten to column. Install caps and flashing so that loads are not imposed on caps and so that ventilation of column interior is not blocked.
 7. Secure columns in place at top and bottom with fasteners recommended by manufacturer.
- G. Adjusting
1. Replace exterior finish carpentry that is damaged or does not comply with requirements. Exterior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.
- H. Cleaning
1. Clean exterior finish carpentry on exposed and semiexposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.
- I. Protection
1. Protect installed products from damage from weather and other causes during construction.
 2. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.
 - a. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - b. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 01 95 06 00a



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**SECTION 01 95 06 00b - INTERIOR FINISH CARPENTRY****1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for interior finish carpentry. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Interior standing and running trim.
 - b. Fire-rated interior door and sidelight frames.
 - c. Plywood, Hardboard, and Board paneling.
 - d. Shelving and clothes rods.
 - e. Interior stairs and railings.
 - f. Interior ornamental wood columns.

C. Definitions

1. Lumber grading agencies, and the abbreviations used to reference them, include the following:
 - a. NeLMA: Northeastern Lumber Manufacturers' Association.
 - b. NHLA: National Hardwood Lumber Association.
 - c. NLGA: National Lumber Grades Authority.
 - d. SPIB: The Southern Pine Inspection Bureau.
 - e. WCLIB: West Coast Lumber Inspection Bureau.
 - f. WWPA: Western Wood Products Association.
2. MDF: Medium-density fiberboard.
3. MDO Plywood: Plywood with a medium-density overlay on the face.

D. Submittals

1. Product Data: For each type of process and factory-fabricated product.
2. Samples: For each type of paneling indicated.
3. LEED Submittals:
 - a. Product Data for Credit EQ 4.1: For adhesives and glues used at Project site, including printed statement of VOC content.
 - b. Product Data for Credit EQ 4.4: For composite-wood products, documentation indicating that product contains no urea formaldehyde.
 - c. Certificates for Credit MR 7: Chain-of-custody certificates certifying that products specified to be made from certified wood comply with forest certification requirements. Include evidence that mill is certified for chain of custody by an FSC-accredited certification body.
 - 1) Include statement indicating costs for each certified wood product.
4. Research/Evaluation Reports: Showing that fire-retardant-treated wood complies with building code in effect for Project.
5. Warranty: Special warranty specified in this Section.

E. Quality Assurance

1. Forest Certification: For the following wood products, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship":
 - a. Interior standing and running trim.
 - b. Interior plywood, hardboard, and board paneling.
 - c. Shelving and clothes rods.
 - d. Interior stairs and railings.



e. Interior ornamental wood columns.

F. Delivery, Storage, And Handling

1. Protect materials against weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation. Provide for air circulation within and around stacks and under temporary coverings.
2. Deliver interior finish carpentry materials only when environmental conditions meet requirements specified for installation areas. If interior finish carpentry materials must be stored in other than installation areas, store only where environmental conditions meet requirements specified for installation areas.

G. Warranty

1. Special Warranty for Columns: Manufacturer's standard form, signed by manufacturer, Installer, and Contractor, in which manufacturer agrees to repair or replace columns that fail in materials or workmanship five years from date of Final Completion.

1.2 PRODUCTS

A. Materials, General

1. Lumber: DOC PS 20 and applicable grading rules of inspection agencies certified by ALSC's Board of Review.
2. Softwood Plywood: DOC PS 1.
3. Hardboard: AHA A135.4.
4. MDF: ANSI A208.2, Grade 130, made with binder containing no urea-formaldehyde resin.
5. Particleboard: ANSI A208.1, Grade M-2 **OR** M-2-Exterior Glue **OR** M-2, made with binder containing no urea-formaldehyde resin, **as directed**.
6. Melamine-Faced Particleboard: Particleboard complying with ANSI A208.1, Grade M-2, finished on both faces with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.

B. Wood-Preservative-Treated Materials

1. Lumber: AWWA C2 **OR** AWWA C31 (treated with inorganic boron), **as directed**. Kiln dry after treatment to a maximum moisture content of 19 percent.
2. Plywood: AWWA C9. Kiln dry after treatment to a maximum moisture content of 18 percent.
3. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
4. For exposed items indicated to receive transparent finish, do not use chemical formulations that contain colorants or that bleed through or otherwise adversely affect finishes.
5. Do not use material that is warped or does not comply with requirements for untreated material.
6. Mark lumber with treatment quality mark of an inspection agency approved by ALSC's Board of Review.
7. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
8. Application: Where indicated.

C. Fire-Retardant-Treated Materials

1. Lumber: Comply with performance requirements in AWWA C20, Exterior type **OR** Interior Type A, **as directed**. Kiln dry after treatment to a maximum moisture content of 19 percent.
2. Plywood: Comply with performance requirements in AWWA C27, Exterior type **OR** Interior Type A, **as directed**. Kiln dry after treatment to a maximum moisture content of 15 percent.
3. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not contain colorants and provide materials that do not have marks from spacer sticks on the exposed face.



4. Do not use material that does not comply with requirements for untreated material or is warped or discolored.
5. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
6. Application: Where indicated **OR** All interior lumber and plywood, **as directed**.

D. Standing And Running Trim

1. Softwood Lumber Trim for Transparent Finish (Stain or Clear Finish):
 - a. Species and Grade:
 - 1) Eastern white pine, C Select **OR** D Select **OR** Finish or 1 Common **OR** Premium or 2 Common, **as directed**; NeLMA or NLGA.
 - 2) Idaho white, lodgepole, ponderosa, radiata, or sugar pine; C Select (Choice) **OR** D Select (Quality) **OR** 1 Common (Colonial) **OR** 2 Common (Sterling), **as directed**; NLGA or WWPA.
 - 3) Eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine; C Select (Choice) **OR** D Select (Quality) **OR** Finish or 1 Common (Colonial) **OR** Premium or 2 Common (Sterling), **as directed**; NeLMA, NLGA, or WWPA.
 - 4) White woods, C Select **OR** D Select **OR** 1 Common **OR** 2 Common, **as directed**; WWPA.
 - 5) Douglas fir-larch or Douglas fir south, Superior or C & Btr **OR** Prime or D, **as directed**, finish; NLGA, WCLIB, or WWPA.
 - 6) Southern pine, B & B **OR** C & Btr, **as directed**, finish; SPIB.
 - 7) Western red cedar, Clear Heart **OR** Grade A **OR** Grade B, **as directed**; NLGA, WCLIB, or WWPA.
 - b. Maximum Moisture Content: 19 **OR** 15, **as directed**, percent with at least 85 percent of shipment at 12 percent or less, **as directed**.
 - c. Finger Jointing: Allowed **OR** Not allowed, **as directed**.
 - d. Face Surface: Surfaced (smooth) **OR** Saw textured, **as directed**.
2. Hardwood Lumber Trim for Transparent Finish (Stain or Clear Finish):
 - a. Species and Grade: Red oak **OR** White maple **OR** Alder **OR** Aspen, basswood, cottonwood, sap gum, sycamore, white maple, or yellow poplar, **as directed**; Clear **OR** A finish **OR** B finish, **as directed**; NHLA.
 - b. Maximum Moisture Content: 13 **OR** 10 **OR** 9, **as directed**, percent.
 - c. Finger Jointing: Not allowed.
 - d. Gluing for Width: Allowed **OR** Not allowed **OR** Use for lumber trim wider than 6 inches (150 mm), **as directed**.
 - e. Veneered Material: Allowed **OR** Not allowed **OR** Use for lumber trim wider than 6 inches (150 mm), **as directed**.
 - f. Face Surface: Surfaced (smooth) **OR** Saw textured, **as directed**.
 - g. Matching: Selected for compatible grain and color.
3. Lumber Trim for Opaque Finish (Painted):
 - a. Species and Grade:
 - 1) Eastern white pine, D Select **OR** Finish or 1 Common **OR** Premium or 2 Common, **as directed**; NeLMA or NLGA.
 - 2) Idaho white, lodgepole, ponderosa, radiata, or sugar pine; D Select (Quality) **OR** 1 Common (Colonial) **OR** 2 Common (Sterling), **as directed**; NLGA or WWPA.
 - 3) Eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine; D Select (Quality) **OR** Finish or 1 Common (Colonial) **OR** Premium or 2 Common (Sterling), **as directed**; NeLMA, NLGA, or WWPA.
 - 4) White woods, D Select **OR** 1 Common **OR** 2 Common, **as directed**; WWPA.
 - 5) Douglas fir-larch or Douglas fir south, Superior or C & Btr **OR** Prime or D, **as directed**, finish; NLGA, WCLIB, or WWPA.
 - 6) Spruce-pine-fir, 1 **OR** 2, **as directed**, Common; NeLMA, NLGA, WCLIB, or WWPA.
 - 7) Alder, aspen, basswood, cottonwood, gum, magnolia, soft maple, sycamore, tupelo, or yellow poplar; A **OR** B, **as directed**, finish; NHLA.



- b. Maximum Moisture Content: 19 **OR** 15, **as directed**, percent with at least 85 percent of shipment at 12 percent or less, **as directed**.
 - c. Finger Jointing: Allowed **OR** Not allowed, **as directed**.
 - d. Face Surface: Surfaced (smooth) **OR** Saw textured, **as directed**.
 - e. Optional Material: Primed MDF of same actual dimensions as lumber indicated may be used in lieu of lumber.
4. Softwood Moldings for Transparent Finish (Stain or Clear Finish): WMMPA WM 4, N-grade wood moldings. Made to patterns included in WMMPA WM 12.
- a. Species: Eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine **OR** Southern pine **OR** Western red cedar **OR** Douglas fir, **as directed**.
 - b. Maximum Moisture Content: 15 percent with at least 85 percent of shipment at 12 percent or less.
 - c. Finger Jointing: Not allowed.
 - d. Matching: Selected for compatible grain and color.
 - e. Base Pattern: WM 623, 9/16-by-3-1/4-inch (14-by-83-mm) ogee **OR** WM 713, 9/16-by-3-1/4-inch (14-by-83-mm) ranch **OR** WM 753, 9/16-by-3-1/4-inch (14-by-83-mm) beaded-edge **OR** WM 620, 9/16-by-4-1/4-inch (14-by-108-mm) ogee **OR** WM 750, 9/16-by-4-1/4-inch (14-by-108-mm) beaded-edge, **as directed**, base.
 - f. Shoe-Mold Pattern: WM 129, 7/16-by-11/16-inch (11-by-17-mm) quarter-round **OR** WM 126, 1/2-by-3/4-inch (13-by-19-mm) quarter-round **OR** WM 131, 1/2-by-3/4-inch (13-by-19-mm) ogee, **as directed**, shoe mold.
 - g. Casing Pattern: WM 327, 11/16-by-2-1/4-inch (17-by-57-mm) clamshell **OR** WM 366, 11/16-by-2-1/4-inch (17-by-57-mm) featheredge **OR** WM 376, 11/16-by-2-1/4-inch (17-by-57-mm) beaded-edge, **as directed**, casing.
 - h. Mull-Casing Pattern: WM 957, 3/8-by-1-3/4-inch (9.5-by-44-mm) beaded-edge **OR** WM 973, 3/8-by-1-3/4-inch (9.5-by-44-mm) bullnose **OR** WM 983, 3/8-by-1-3/4-inch (9.5-by-44-mm) featheredge, **as directed**, casing.
 - i. Stop Pattern: WM 856, 3/8-by-1-3/8-inch (9.5-by-35-mm) ranch **OR** WM 946, 3/8-by-1-3/8-inch (9.5-by-35-mm) ogee **OR** WM 886, 3/8-by-1-3/8-inch (9.5-by-35-mm) bullnose, **as directed**, stop.
 - j. Chair-Rail Pattern: WM 297, 11/16-by-3-inch (17-by-76-mm) chair rail.
5. Hardwood Moldings for Transparent Finish (Stain or Clear Finish): WMMPA HWM 2, N-grade wood moldings made to patterns included in WMMPA HWM 1.
- a. Species: Red oak **OR** White maple **OR** Aspen, basswood, cottonwood, sap gum, sycamore, white maple, or yellow poplar, **as directed**.
 - b. Kiln-dried softwood or MDF, with exposed surfaces veneered with species indicated, may be used in lieu of solid wood.
 - c. Maximum Moisture Content: 9 percent.
 - d. Finger Jointing: Not allowed.
 - e. Matching: Selected for compatible grain and color.
 - f. Base Pattern: HWM 633, 7/16-by-3-1/4-inch (11-by-83-mm) ogee **OR** HWM 713, 7/16-by-3-1/4-inch (11-by-83-mm) ranch **OR** HWM 753, 7/16-by-3-1/4-inch (11-by-83-mm) beaded-edge **OR** WM 620, 7/16-by-4-1/4-inch (11-by-108-mm) ogee, **as directed**, base.
 - g. Shoe-Mold Pattern: HWM 129, 7/16-by-11/16-inch (11-by-17-mm) quarter-round **OR** HWM 126, 1/2-by-3/4-inch (13-by-19-mm) quarter-round **OR** HWM 131, 1/2-by-3/4-inch (13-by-19-mm) ogee, **as directed**, shoe mold.
 - h. Casing Pattern: HWM 328, 1/2-by-2-1/4-inch (13-by-57-mm) clamshell **OR** HWM 366, 1/2-by-2-1/4-inch (13-by-57-mm) featheredge **OR** HWM 376, 1/2-by-2-1/4-inch (13-by-57-mm) beaded-edge, **as directed**, casing.
 - i. Mull-Casing Pattern: HWM 989, 3/16-by-2-inch (5-by-51-mm) square-edge **OR** HWM 988, 3/8-by-1-1/2-inch (9.5-by-38-mm) featheredge **OR** HWM 987, 3/8-by-2-inch (9.5-by-51-mm) featheredge, **as directed**, casing.
 - j. Stop Pattern: HWM 856, 3/8-by-1-3/8-inch (9.5-by-35-mm) ranch **OR** HWM 946, 3/8-by-1-3/8-inch (9.5-by-35-mm) ogee **OR** HWM 886, 3/8-by-1-3/8-inch (9.5-by-35-mm) bullnose, **as directed**, stop.



- k. Chair-Rail Pattern: HWM 297, 11/16-by-3-inch (17-by-76-mm) chair rail.
 6. Moldings for Opaque Finish (Painted): Made to patterns included in WMMPA WM 12.
 - a. Softwood Moldings: WMMPA WM 4, P-grade.
 - 1) Species: Eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine.
 - 2) Maximum Moisture Content: 15 percent with at least 85 percent of shipment at 12 percent or less.
 - b. Hardwood Moldings: WMMPA HWM 2, P-grade.
 - 1) Species: Aspen, basswood, cottonwood, gum, magnolia, soft maple, tupelo, or yellow poplar.
 - 2) Maximum Moisture Content: 9 percent.
 - c. Optional Material: Primed MDF.
 - d. Finger Jointing: Allowed **OR** Not allowed, **as directed**.
 - e. Base Pattern: WM 623, 9/16-by-3-1/4-inch (14-by-83-mm) ogee **OR** WM 713, 9/16-by-3-1/4-inch (14-by-83-mm) ranch **OR** WM 753, 9/16-by-3-1/4-inch (14-by-83-mm) beaded-edge **OR** WM 620, 9/16-by-4-1/4-inch (14-by-108-mm) ogee **OR** WM 750, 9/16-by-4-1/4-inch (14-by-108-mm) beaded-edge, **as directed**, base.
 - f. Shoe-Mold Pattern: WM 129, 7/16-by-11/16-inch (11-by-17-mm) quarter-round **OR** WM 126, 1/2-by-3/4-inch (13-by-19-mm) quarter-round **OR** WM 131, 1/2-by-3/4-inch (13-by-19-mm) ogee, **as directed**, shoe mold.
 - g. Casing Pattern: WM 327, 11/16-by-2-1/4-inch (17-by-57-mm) clamshell **OR** WM 366, 11/16-by-2-1/4-inch (17-by-57-mm) featheredge **OR** WM 376, 11/16-by-2-1/4-inch (17-by-57-mm) beaded-edge, **as directed**, casing.
 - h. Mull-Casing Pattern: WM 957, 3/8-by-1-3/4-inch (9.5-by-44-mm) beaded-edge **OR** WM 973, 3/8-by-1-3/4-inch (9.5-by-44-mm) bullnose **OR** WM 983, 3/8-by-1-3/4-inch (9.5-by-44-mm) featheredge, **as directed**, casing.
 - i. Stop Pattern: WM 856, 3/8-by-1-3/8-inch (9.5-by-35-mm) ranch **OR** WM 946, 3/8-by-1-3/8-inch (9.5-by-35-mm) ogee **OR** WM 886, 3/8-by-1-3/8-inch (9.5-by-35-mm) bullnose, **as directed**, stop.
 - j. Chair-Rail Pattern: WM 297, 11/16-by-3-inch (17-by-76-mm) chair rail.
 7. PVC-Wrapped Moldings: WMMPA WM 2 and made to patterns included in WMMPA WM 12.
 - a. Base Pattern: WM 623, 9/16-by-3-1/4-inch (14-by-83-mm) ogee **OR** WM 713, 9/16-by-3-1/4-inch (14-by-83-mm) ranch, **as directed**, base.
 - b. Shoe-Mold Pattern: WM 129, 7/16-by-11/16-inch (11-by-17-mm) quarter-round **OR** WM 126, 1/2-by-3/4-inch (13-by-19-mm) quarter-round, **as directed**, shoe mold.
 - c. Casing Pattern: WM 327, 11/16-by-2-1/4-inch (17-by-57-mm) clamshell **OR** WM 366, 11/16-by-2-1/4-inch (17-by-57-mm) featheredge, **as directed**, casing.
 - d. Mull-Casing Pattern: WM 973, 3/8-by-1-3/4-inch (9.5-by-44-mm) bullnose **OR** WM 983, 3/8-by-1-3/4-inch (9.5-by-44-mm) featheredge, **as directed**, casing.
 - e. Stop Pattern: WM 856, 3/8-by-1-3/8-inch (9.5-by-35-mm) ranch **OR** WM 886, 3/8-by-1-3/8-inch (9.5-by-35-mm) bullnose, **as directed**, stop.
 - f. Chair-Rail Pattern: WM 297, 11/16-by-3-inch (17-by-76-mm) chair rail.
 - g. Colors, Textures, and Grain Patterns: As selected by the Owner from manufacturer's full range.
 8. Foam Plastic Moldings: Molded product of shapes indicated, with a tough outer skin on exposed surfaces; factory primed. Exposed surfaces shall not be shaped after molding.
 - a. Density: Not less than 20 lb/cu. ft. (320 kg/cu. m).
 - b. Flame-Spread Index: Not more than 75 when tested according to ASTM E 84.
 - c. Thickness: Not more than 1/2 inch (12.7 mm).
 - d. Width: Not more than 8 inches (204 mm).
 - e. Patterns: As indicated by manufacturer's designations.
- E. Fire-Rated Interior Door And Sidelight Frames
1. Frames, complete with casings, fabricated from fire-retardant particleboard or fire-retardant MDF with veneered exposed surfaces, or from solid fire-retardant-treated wood. Frames shall comply with NFPA 80 and be listed and labeled by a testing and inspecting agency acceptable to



authorities having jurisdiction, based on testing according to NFPA 252 **OR** IBC Standard 703, **as directed**.

- a. Species: Red oak **OR** White oak **OR** White maple **OR** Cherry, **as directed**.
- b. Fire Rating: 20 minutes **OR** 30 minutes **OR** 45 minutes **OR** 60 minutes **OR** 90 minutes **OR** As indicated, **as directed**.

F. Paneling

1. Hardwood Veneer Plywood Paneling: Manufacturer's stock hardwood plywood panels complying with HPVA HP-1, made without urea-formaldehyde adhesive.
 - a. Face Veneer Species and Cut: Rotary-cut white birch **OR** Plain-sliced red oak **OR** Plain-sliced hickory, **as directed**.
 - b. Veneer Matching: Random match **OR** Selected for similar color and grain, **as directed**.
 - c. Backing Veneer Species: Same species as face veneer **OR** Any hardwood compatible with face species, **as directed**.
 - d. Construction: Veneer core.
 - e. Thickness: 1/8 inch (3.2 mm) **OR** 5/32 inch (4 mm) **OR** 5 mm **OR** 1/4 inch (6.4 mm) **OR** 5/16 inch (7.9 mm) **OR** 7/16 inch (11 mm), **as directed**.
 - f. Glue Bond: Type II (interior) **OR** I (exterior), **as directed**.
2. Hardboard Paneling: Interior factory-finished hardboard paneling complying with AHA 135.5.
 - a. Thickness: 1/8 inch (3.2 mm) **OR** 5/32 inch (4 mm) **OR** 1/4 inch (6.4 mm), **as directed**.
 - b. Finish: Class I **OR** II, **as directed**.
 - c. Surface-Burning Characteristics: As follows, tested per ASTM E 84:
 - 1) Flame-Spread Index: 25 or less.
 - 2) Smoke-Developed Index: 450 or less.
3. Board Paneling: Interior wood board paneling complying with WMMPA WM 9.
 - a. Species: Eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine **OR** Southern pine **OR** Western red cedar **OR** Figured red gum, **as directed**.
 - b. Grade: Clear No. 1 **OR** Clear No. 2 **OR** Knotty No. 1 **OR** Knotty No. 2 **OR** Finger jointed, **as directed**.
 - c. Maximum Moisture Content: 15 percent with at least 85 percent of shipment at 12 percent or less **OR** 9 percent, **as directed**.
4. Board Paneling:
 - a. Species and Grade:
 - 1) Eastern white pine, C Select **OR** D Select **OR** Finish or 1 Common **OR** Premium or 2 Common, **as directed**; NeLMA or NLGA.
 - 2) Idaho white, lodgepole, ponderosa, radiata, or sugar pine; C Select (Choice) **OR** D Select (Quality) **OR** 1 Common (Colonial) **OR** 2 Common (Sterling), **as directed**; NLGA or WWPA.
 - 3) Eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine; C Select (Choice) **OR** D Select (Quality) **OR** Finish or 1 Common (Colonial) **OR** Premium or 2 Common (Sterling), **as directed**; NeLMA, NLGA, or WWPA.
 - 4) Southern pine, B & B **OR** C & Btr **OR** No. 2, **as directed**, Paneling; SPIB.
 - 5) Western red cedar, Clear Heart **OR** Grade A **OR** Grade B, **as directed**; NLGA, WCLIB, or WWPA.
 - b. Maximum Moisture Content: 19 **OR** 15, **as directed**, percent with at least 85 percent of shipment at 12 percent or less, **as directed**.

G. Shelving And Clothes Rods

1. Exposed **OR** Closet **OR** Utility, **as directed**, Shelving: Made from one of the following materials, **as directed**, 3/4 inch (19 mm) thick. Do not use particleboard or MDF that contains urea formaldehyde.
 - a. Particleboard with radiused and filled **OR** solid-wood, **as directed**, front edge.
 - b. MDF with radiused **OR** solid-wood, **as directed**, front edge.
 - c. MDO softwood plywood with solid-wood edge.



- d. Melamine-faced particleboard with radiused and filled **OR** applied PVC, **as directed**, front edge.
 - e. Wood boards as specified above for lumber trim for opaque **OR** softwood lumber trim for transparent **OR** hardwood lumber trim for transparent, **as directed**, finish.
 - f. Softwood Boards: Eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine; C Select (Choice) **OR** D Select (Quality) **OR** Finish or 1 Common (Colonial) **OR** Premium or 2 Common (Sterling), **as directed**; NeLMA, NLGA, or WWPA; kiln dried.
 - g. Softwood Boards: Douglas fir-larch, Douglas fir south, or hem-fir; Superior or C & Btr **OR** Prime or D, **as directed**, finish; NLGA, WCLIB, or WWPA; or southern pine, B & B **OR** C, **as directed**, finish; SPIB; kiln dried.
2. Shelf Cleats: 3/4-by-3-1/2-inch (19-by-89-mm) boards **OR** 3/4-by-5-1/2-inch (19-by-140-mm) boards **OR** 3/4-by-5-1/2-inch (19-by-140-mm) boards with hole and notch to receive clothes rods, **as directed**, as specified above for shelving **OR** lumber trim for opaque finish **OR** softwood lumber trim for transparent finish **OR** hardwood lumber trim for transparent finish, **as directed**.
 3. Shelf Brackets with Rod Support: BHMA A156.16, B04051; prime-painted formed steel.
 4. Shelf Brackets without Rod Support: BHMA A156.16, B04041; prime-painted formed steel.
 5. Standards for Adjustable Shelf Brackets: BHMA A156.9, B04102; powder-coat finished **OR** brass-finished **OR** zinc-plated, **as directed**, steel.
 6. Adjustable Shelf Brackets: BHMA A156.9, B04112; powder-coat finished steel **OR** brass-finished steel **OR** zinc-plated steel **OR** bronze-anodized aluminum **OR** black-anodized aluminum **OR** natural aluminum, **as directed**.
 7. Standards for Adjustable Shelf Supports: BHMA A156.9, B04071; powder-coat finished **OR** brass-finished **OR** zinc-plated, **as directed**, steel.
 8. Adjustable Shelf Supports: BHMA A156.9, B04081 or B04091; powder-coat finished **OR** brass-finished **OR** zinc-plated, **as directed**, steel.
 9. Clothes Rods: 1-1/2-inch- (38-mm-) diameter, clear, kiln-dried hardwood **OR** clear, kiln-dried softwood; either Douglas fir or southern pine, **as directed**.
 10. Clothes Rods: 1-5/16-inch- (33-mm-) diameter, aluminum tubes **OR** chrome-plated steel tubes **OR** chrome-plated steel telescoping tubes with end brackets for mounting on shelf cleats, **as directed**.
 11. Rod Flanges: Clear, kiln-dried, Douglas fir or southern pine **OR** eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine **OR** red oak **OR** white maple **OR** aspen, basswood, cottonwood, sap gum, white maple, or yellow poplar, **as directed**, turnings.
 12. Rod Flanges: Aluminum **OR** Chrome-plated steel **OR** Stainless steel, **as directed**.
- H. Stairs And Railings
1. Treads: 1-1/16-inch (27-mm), clear, kiln-dried, edge-glued, rift-sawn red oak **OR** red oak **OR** hard maple **OR** poplar, **as directed**, stepping with half-round nosing.
 2. Risers: 13/16-inch (21-mm), clear, kiln-dried, edge-glued red oak **OR** hard maple **OR** poplar, **as directed**, stock.
 3. Risers: 3/4-inch (19-mm) finish boards as specified above for interior lumber trim for opaque finish.
 4. Finished Stringers: 3/4-inch (19-mm) finish boards as specified above for interior lumber trim for opaque finish.
 5. Interior Railings: Clear, kiln-dried red oak **OR** hard maple **OR** yellow poplar, **as directed**.
 6. Balusters: Clear, kiln-dried, red oak **OR** hard maple **OR** yellow poplar, **as directed**.
 7. Newel Posts: Clear, kiln-dried, red oak **OR** hard maple **OR** yellow poplar, **as directed**.
 8. Factory fabricate columns for transparent finish from clear, kiln-dried eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine **OR** aspen, basswood, cottonwood, sap gum, white maple, or yellow poplar **OR** red oak **OR** white maple **OR** mahogany, **as directed**.
 9. Factory fabricate columns for opaque finish from clear, kiln-dried eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine **OR** aspen, basswood, cottonwood, sap gum, white maple, or yellow poplar, **as directed**. Column staves may be finger jointed.
 10. Shafts: Built up from tongue-and-groove staves joined with waterproof glue. Lathe turn shafts to provide indicated base diameter and true architectural entasis taper. Precisely mill flutes as indicated.



11. Capital and Base: Molded glass-fiber-reinforced plastic **OR** Built up from wood components with waterproof glue. Turn circular elements on lathes, **as directed**.
12. Prime columns for opaque finish with one coat of interior wood primer compatible with specified topcoats.

I. Miscellaneous Materials

1. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.
 - a. Where galvanized finish is indicated, provide fasteners and anchorages with hot-dip galvanized coating complying with ASTM A 153/A 153M.
2. Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use.
 - a. Use wood glue that has a VOC content of 30 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Installation Adhesive for Foam Plastic Moldings: Product recommended for indicated use by foam plastic molding manufacturer.
 - a. Use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
4. Paneling Adhesive: Comply with paneling manufacturer's written recommendations for adhesives.
 - a. Use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
5. Multipurpose Construction Adhesive: Formulation complying with ASTM D 3498 that is recommended for indicated use by adhesive manufacturer.
 - a. Use adhesive that has a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

J. Fabrication

1. Back out or kerf backs of the following members except those with ends exposed in finished work:
 - a. Interior standing and running trim except shoe and crown molds.
 - b. Wood board paneling.
2. Ease edges of lumber less than 1 inch (25 mm) in nominal thickness to 1/16-inch (1.5-mm) radius and edges of lumber 1 inch (25 mm) or more in nominal thickness to 1/8-inch (3-mm) radius.

1.3 EXECUTION

A. Preparation

1. Clean substrates of projections and substances detrimental to application.
2. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours unless longer conditioning is recommended by manufacturer.

B. Installation, General

1. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.
 - a. Do not use manufactured units with defective surfaces, sizes, or patterns.
2. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.
 - a. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
 - b. Countersink fasteners, fill surface flush, and sand where face fastening is unavoidable.



- c. Install to tolerance of 1/8 inch in 96 inches (3 mm in 2438 mm) for level and plumb. Install adjoining interior finish carpentry with 1/32-inch (0.8-mm) maximum offset for flush installation and 1/16-inch (1.5-mm) maximum offset for reveal installation.
- d. Install stairs with no more than 3/16-inch (4.7-mm) variation between adjacent treads and risers and with no more than 3/8-inch (9.5-mm) variation between largest and smallest treads and risers within each flight.
- e. Coordinate interior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate interior finish carpentry.

C. Standing And Running Trim Installation

1. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches (610 mm) long, except where necessary. Stagger joints in adjacent and related standing and running trim. Cope at returns and miter at corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints. Plane backs of casings to provide uniform thickness across joints where necessary for alignment.
 - a. Match color and grain pattern of trim for transparent finish (stain or clear finish) across joints.
 - b. Install trim after gypsum board joint finishing operations are completed.
 - c. Drill pilot holes in hardwood before fastening to prevent splitting. Fasten to prevent movement or warping. Countersink fastener heads on exposed carpentry work and fill holes.

D. Paneling Installation

1. Plywood Paneling: Select and arrange panels on each wall to minimize noticeable variations in grain character and color between adjacent panels. Leave 1/4-inch (6-mm) gap to be covered with trim at top, bottom, and openings. Install with uniform tight joints between panels.
 - a. Attach panels to supports with manufacturer's recommended panel adhesive and fasteners. Space fasteners as recommended by panel manufacturer.
 - b. Conceal fasteners to greatest practical extent.
 - c. Arrange panels with grooves and joints over supports. Fasten to supports with nails of type and at spacing recommended by panel manufacturer. Use fasteners with prefinished heads matching groove color.
2. Hardboard Paneling: Install according to manufacturer's written recommendations. Leave 1/4-inch (6-mm) gap to be covered with trim at top, bottom, and openings. Butt adjacent panels with moderate contact. Use fasteners with prefinished heads matching paneling color.
 - a. Wood Stud or Furring Substrate: Install with 1-inch (25-mm) annular-ring shank hardboard nails.
 - b. Plaster or Gypsum Board Substrate: Install with 1-5/8-inch (41-mm) annular-ring shank hardboard nails.
 - c. Nailing: Space nails 4 inches (100 mm) o.c. at panel perimeter and 8 inches (200 mm) o.c. at intermediate supports unless otherwise required by manufacturer.
3. Board Paneling: Install according to manufacturer's written instructions. Arrange in random-width pattern suggested by manufacturer unless boards or planks are of uniform width.
 - a. Install in full lengths without end joints.
OR
Stagger end joints in random pattern to uniformly distribute joints on each wall.
 - b. Install with uniform end joints with only end-matched (tongue-and-groove) joints within each field of paneling.
OR
Install with uniform end joints. Locate end joints only over furring or blocking.
 - c. Select and arrange boards on each wall to minimize noticeable variations in grain character and color between adjacent boards. Install with uniform tight joints between boards.
 - d. Fasten paneling by face nailing, setting nails, and filling over nail heads.
OR



Fasten paneling with trim screws, set below face and filled.

OR

Fasten paneling by blind nailing through tongues.

OR

Fasten paneling with paneling system manufacturer's concealed clips.

OR

Fasten paneling to gypsum wallboard with panel adhesive.

E. Shelving And Clothes Rod Installation

1. Cut shelf cleats at ends of shelves about 1/2 inch (13 mm) less than width of shelves and sand exposed ends smooth.
2. Install shelf cleats by fastening to framing or backing with finish nails or trim screws, set below face and filled. Space fasteners not more than 16 inches (400 mm) o.c. Use 2 fasteners at each framing member or fastener location for cleats 4 inches nominal (89 mm actual) in width and wider.
 - a. Apply a bead of multipurpose construction adhesive to back of shelf cleats right before installing. Remove adhesive that is squeezed out immediately after fastening shelf cleats in place.
3. Install shelf brackets according to manufacturer's written instructions, spaced not more than 36 inches (900 mm) o.c. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors.
4. Install standards for adjustable shelf supports according to manufacturer's written instructions. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors. Space fasteners not more than 12 inches (300 mm) o.c.
5. Install standards for adjustable shelf brackets according to manufacturer's written instructions, spaced not more than 36 inches (900 mm) o.c. and within 6 inches (150 mm) of end of shelves. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors.
6. Cut shelves to neatly fit openings with only enough gap to allow shelves to be removed and reinstalled. Install shelves, fully seated on cleats, brackets, and supports.
 - a. Fasten shelves to cleats with finish nails or trim screws, set flush.
 - b. Fasten shelves to brackets to comply with bracket manufacturer's written instructions.
7. Install rod flanges for rods as indicated. Fasten to shelf cleats, framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors. Install rods in rod flanges.

F. Stair And Railing Installation

1. Treads and Risers at Interior Stairs: Secure treads and risers by gluing and nailing to rough carriages.
 - a. Closed Stringers: House treads and risers into wall stringers, glue, and wedge into place **OR** Cope wall stringers to fit tightly over treads and risers, **as directed**.
 - b. Open Stringers: Miter risers and stringer at open stringers. Extend tread over open stringers and finish with bullnose edge cut from tread stock and fitted to tread with mitered return at nosing.
2. Balusters: Dovetail or mortise balusters into treads, glue, and nail in place. Let into railings and glue in place.
3. Newel Posts: Secure newel posts to stringers, rough carriages, and risers with countersunk-head wood screws and glue.
4. Railings: Secure wall rails with metal brackets. Fasten freestanding railings to newel posts and to trim at walls with countersunk-head wood screws or rail bolts, and glue. Assemble railings at goosenecks, easements, and splices with rail bolts and glue.

G. Ornamental Column Installation

1. Install columns to comply with manufacturer's written instructions. Comply with requirements below unless manufacturer's written instructions state otherwise.
2. Lay out column locations on ceiling and plumb down to locate column locations at floor.



3. Set plinths in location, shim to temporarily level, and scribe and trim as required so that tops of plinths will sit level without use of shims. Seal cut surfaces with wood sealer or primer and fasten plinths to floor using pins or fasteners as recommended by manufacturer.
 4. Set columns in location, shim as required to temporarily plumb, scribe and trim as required so that columns will sit plumb without shims.
 5. Scribe and trim tops of columns to fit to ceiling.
 6. Seal ends of columns with wood sealer or primer.
 7. Install column caps on columns and fasten to columns.
 8. Secure columns in place at top and bottom with fasteners recommended by manufacturer.
- H. Adjusting
1. Replace interior finish carpentry that is damaged or does not comply with requirements. Interior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.
- I. Cleaning
1. Clean interior finish carpentry on exposed and semiexposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.
- J. Protection
1. Protect installed products from damage from weather and other causes during remainder of the construction period.
 2. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.
 - a. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - b. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 01 95 06 00b



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SECTION 01 95 06 00c - INTERIOR ARCHITECTURAL WOODWORK**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for interior architectural woodwork. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Interior standing and running trim.
 - b. Interior frames and jambs.
 - c. Stairwork and rails.
 - d. Flush wood paneling and wainscots.
 - e. Interior ornamental work.
 - f. Wood cabinets.
 - g. Plastic-laminate cabinets.
 - h. Wood countertops.
 - i. Plastic-laminate countertops.
 - j. Solid-surfacing-material countertops.
 - k. Laminated-plastic laboratory tops.
 - l. Closet and utility shelving.
 - m. Shop finishing of interior woodwork.

C. Definitions

1. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.
2. Rough carriages for stairs are a part of interior architectural woodwork. Platform framing, headers, partition framing, and other rough framing associated with stairwork are specified in Division 06 Section "Rough Carpentry".

D. Submittals

1. Product Data: For panel products, high-pressure decorative laminate, adhesive for bonding plastic laminate, solid-surfacing material, fire-retardant-treated materials, cabinet hardware and accessories, handrail brackets, and finishing materials and processes.
 - a. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.
2. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
3. Samples:
 - a. Lumber with or for transparent finish, for each species and cut, finished on 1 side and 1 edge.
 - b. Veneer leaves representative of and selected from flitches to be used for transparent-finished woodwork.
 - c. Veneer-faced panel products with or for transparent finish for each species and cut. Include at least one face-veneer seam and finish as specified.
 - d. Lumber and panel products with shop-applied opaque finish, for each finish system and color, with exposed surface finished.
 - e. Plastic-laminates, for each type, color, pattern, and surface finish.
 - f. Thermoset decorative panels, for each type, color, pattern, and surface finish.
 - g. Solid-surfacing materials.



- h. Corner pieces as follows:
 - 1) Cabinet-front frame joints between stiles and rails, as well as exposed end pieces, 18 inches (450 mm) high by 18 inches (450 mm) wide by 6 inches (150 mm) deep.
 - 2) Miter joints for standing trim.
- i. Exposed cabinet hardware and accessories, one unit for each type and finish.
- 4. LEED Submittals:
 - a. Product Data for Credit EQ 4.1: For installation adhesives, including printed statement of VOC content.
 - b. Product Data for Credit EQ 4.4:
 - 1) For each composite-wood product used, documentation indicating that the bonding agent contains no urea formaldehyde.
 - 2) For each adhesive used, documentation indicating that the adhesive contains no urea formaldehyde.
 - c. Product Data for Credit(s) MR 4.1 and MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content
 - 1) Include statement indicating costs for each product having recycled content.
 - d. Certificates for Credit MR 7: Chain-of-custody certificates certifying that products specified to be made from certified wood comply with forest certification requirements. Include evidence that mill is certified for chain of custody by an FSC-accredited certification body.
 - 1) Include statement indicating costs for each certified wood product.
- 5. Product Certificates: For each type of product, signed by product manufacturer.
- 6. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates **OR** WI-certified compliance certificates, **as directed**.

E. Quality Assurance

- 1. Installer Qualifications: Fabricator of woodwork.
- 2. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" **OR** WI's "Manual of Millwork", **as directed**.
 - a. Provide AWI Quality Certification Program labels and certificates for woodwork, including installation.
 - b. Provide WI-certified compliance labels and certificates for woodwork, including installation.
- 3. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.
- 4. Forest Certification: Provide interior architectural woodwork produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
- 5. Preinstallation Conference: Conduct conference at Project site.

F. Delivery, Storage, And Handling

- 1. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.2 PRODUCTS

A. Materials



1. General: Provide materials that comply with requirements of AWI's **OR** WI's, **as directed**, quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.
 2. Wood Species and Cut for Transparent Finish: Red oak, plain sawn or sliced **OR** White oak, rift sawn or cut **OR** White ash, plain sawn or sliced **OR** Hickory, plain sawn or sliced, **as directed**.
 3. Wood Species for Opaque Finish: Any closed-grain hardwood **OR** Eastern white pine, sugar pine, or western white pine, **as directed**.
 4. Wood Products: Comply with the following:
 - a. Hardboard: AHA A135.4.
 - b. Medium-Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.
 - c. Particleboard: ANSI A208.1, Grade M-2 **OR** M-2-Exterior Glue, **as directed**.
 - d. Particleboard: Straw-based particleboard complying with requirements in ANSI A208.1, Grade M-2, except for density.
 - e. Softwood Plywood: DOC PS 1, Medium Density Overlay.
 - f. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no urea formaldehyde.
 5. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.
 - a. Provide PVC or polyester edge banding complying with LMA EDG-1 on components with exposed or semiexposed edges.
 6. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.
 7. Chemical-Resistant, High-Pressure Decorative Laminate: NEMA LD 3, Grade HGP.
 8. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.
 - a. Type: Standard type or Veneer type made from material complying with requirements for Standard type, as indicated, unless Special Purpose type is indicated.
 - b. Colors and Patterns: As selected by the Owner from manufacturer's full range.
 9. Float Glass for Cabinet Doors: ASTM C 1036, Type I, Class 1 (clear) **OR** 2 or 3 (tinted), **as directed**, Quality-Q3, 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm, **as directed**, thick.
 - a. Tint Color: Blue-green **OR** Bronze **OR** Green **OR** Gray, **as directed**.
 10. Tempered Float Glass for Cabinet Doors: ASTM C 1048, Kind FT, Condition A, Type I, Class 1 (clear) **OR** 2 or 3 (tinted), **as directed**, Quality-Q3, with exposed edges seamed before tempering, 6 mm thick, unless otherwise indicated.
 - a. Tint Color: Blue-green **OR** Bronze **OR** Green **OR** Gray, **as directed**.
 11. Mirror Glass for Cabinet Doors: ASTM C 1503, Mirror Select **OR** Glazing, **as directed**, Quality-Q3, 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm, **as directed**, thick.
 12. Decorative Glass for Cabinet Doors: Provide decorative glass complying with Division 08 Section "Decorative Glass Glazing".
 13. Tempered Float Glass for Cabinet Shelves: ASTM C 1048, Kind FT, Condition A, Type I, Class 1 (clear) **OR** 2 or 3 (tinted), **as directed**, Quality-Q3; with exposed edges seamed before tempering, 6 mm thick.
 - a. Tint Color: Blue-green **OR** Bronze **OR** Green **OR** Gray, **as directed**.
- B. Fire-Retardant-Treated Materials
1. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this Article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified.
 - a. Do not use treated materials that do not comply with requirements of referenced woodworking standard or that are warped, discolored, or otherwise defective.
 - b. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
 - c. Identify fire-retardant-treated materials with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.



2. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Comply with performance requirements of AWWPA C20 (lumber) and AWWPA C27 (plywood). Use the following treatment type:
 - a. Exterior Type: Organic-resin-based formulation thermally set in wood by kiln drying.
 - b. Interior Type A: Low-hygroscopic formulation.
 - c. Mill lumber after treatment within limits set for wood removal that do not affect listed fire-test-response characteristics, using a woodworking plant certified by testing and inspecting agency.
 - d. Mill lumber before treatment and implement special procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.
 - e. Kiln-dry materials before and after treatment to levels required for untreated materials.
3. Fire-Retardant Particleboard: Panels made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 25 or less per ASTM E 84.
4. Fire-Retardant Fiberboard: Medium-density fiberboard panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 200 or less per ASTM E 84.

C. Cabinet Hardware And Accessories

1. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 08 Section "Door Hardware".
2. Butt Hinges: 2-3/4-inch (70-mm), 5-knuckle steel hinges made from 0.095-inch- (2.4-mm-) thick metal, and as follows:
 - a. Semiconcealed Hinges for Flush Doors: BHMA A156.9, B01361.
 - b. Semiconcealed Hinges for Overlay Doors: BHMA A156.9, B01521.
3. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 100 **OR** 135 **OR** 170, **as directed**, degrees of opening, self-closing.
4. Back-Mounted Pulls: BHMA A156.9, B02011.
5. Wire Pulls: Back mounted, solid metal **OR** plastic, **as directed**, 4 inches (100 mm) long, 5/16 inch (8 mm) in diameter **OR** 5 inches (127 mm) long, 2-1/2 inches (63.5 mm) deep, and 5/16 inch (8 mm) in diameter, **as directed**.
6. Catches: Magnetic catches, BHMA A156.9, B03141 **OR** Push-in magnetic catches, BHMA A156.9, B03131 **OR** Roller catches, BHMA A156.9, B03071 **OR** Ball friction catches, BHMA A156.9, B03013, **as directed**.
7. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081 **OR** BHMA A156.9, B04102; with shelf brackets, B04112, **as directed**.
8. Shelf Rests: BHMA A156.9, B04013; metal **OR** plastic **OR** metal, two-pin type with shelf hold-down clip, **as directed**.
9. Drawer Slides: BHMA A156.9, B05091.
 - a. Standard Duty (Grade 1, Grade 2, and Grade 3): Side mounted and extending under bottom edge of drawer; full-extension **OR** partial-extension, **as directed**, type; zinc-plated steel **OR** epoxy-coated steel, **as directed**, with polymer rollers.
 - b. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Side mounted; full-extension **OR** full-overtravel-extension, **as directed**, type; zinc-plated steel ball-bearing slides.
 - c. Box Drawer Slides: Grade 1 **OR** Grade 1HD-100, **as directed**; for drawers not more than 6 inches (150 mm) high and 24 inches (600 mm) wide.
 - d. File Drawer Slides: Grade 1HD-100 **OR** Grade 1HD-200, **as directed**; for drawers more than 6 inches (150 mm) high or 24 inches (600 mm) wide.
 - e. Pencil Drawer Slides: Grade 2 **OR** Grade 1, **as directed**; for drawers not more than 3 inches (75 mm) high and 24 inches (600 mm) wide.
 - f. Keyboard Slides: Grade 1 **OR** Grade 1HD-100, **as directed**; for computer keyboard shelves.



- g. Trash Bin Slides: Grade 1HD-100 **OR** Grade 1HD-200, **as directed**; for trash bins not more than 20 inches (500 mm) high and 16 inches (400 mm) wide.
- 10. Plastic **OR** Aluminum, **as directed**, Slides for Sliding Glass Doors: BHMA A156.9, B07063.
- 11. Door Locks: BHMA A156.11, E07121.
- 12. Drawer Locks: BHMA A156.11, E07041.
- 13. Grommets for Cable Passage through Countertops: 1-1/4-inch (32-mm) **OR** 2-inch (51-mm), **as directed**, OD, brown **OR** black, **as directed**, molded-plastic grommets and matching plastic caps with slot for wire passage.
- 14. Paper Slots: 12 inches (305 mm) **OR** 17 inches (432 mm), **as directed**, long by 1-3/4 inches (45 mm) wide by 1 inch (25 mm) deep; brown **OR** black, **as directed**, molded-plastic, paper-slot liner with 1/4-inch (6.4-mm) lip.
- 15. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
 - a. Dark, Oxidized, Satin Bronze, Oil Rubbed: BHMA 613 for bronze base; BHMA 640 for steel base; match the Owner's sample.
 - b. Bright Brass, Clear Coated: BHMA 605 for brass base; BHMA 632 for steel base.
 - c. Satin Brass, Blackened, Bright Relieved, Clear Coated: BHMA 610 for brass base; BHMA 636 for steel base.
 - d. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.
 - e. Bright Chromium Plated: BHMA 625 for brass or bronze base; BHMA 651 for steel base.
 - f. Satin Stainless Steel: BHMA 630.
- 16. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

D. Miscellaneous Materials

- 1. Furring, Blocking, Shims, and Hanging Strips:
 - a. Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.
OR
Fire-retardant-treated softwood lumber, kiln dried to less than 15 percent moisture content.
- 2. Rough Carriages for Stairs:
 - a. Select Structural **OR** No. 1 **OR** No. 2, **as directed**, grade and any of the following species, kiln dried to 15 percent maximum moisture content:
 - 1) Douglas fir-larch.
 - 2) Douglas fir-south.
 - 3) Douglas fir-larch (north).
 - 4) Hem-fir.
 - 5) Hem-fir (north).
 - 6) Southern pine.
 - 7) Spruce-pine-fir (south).
 - 8) Spruce-pine-fir.**OR**
Laminated veneer lumber, made with an exterior-type adhesive complying with ASTM D 2559, and with the following allowable design values as determined according to ASTM D 5456:
 - 1) Extreme Fiber Stress in Bending, Edgewise: 2850 psi (19.7 MPa) **OR** 2600 psi (17.9 MPa) **OR** 2500 psi (17.2 MPa), **as directed**, for 12-inch nominal- (286-mm actual-) depth members.
 - 2) Modulus of Elasticity, Edgewise: 2,000,000 psi (13 800 MPa) **OR** 1,800,000 psi (12 400 MPa), **as directed**.
- 3. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.
- 4. Handrail Brackets: Cast **OR** Extruded **OR** Stamped, **as directed**, from malleable iron **OR** aluminum **OR** bronze **OR** stainless steel, **as directed**, with wall flange drilled for exposed anchor



- OR** and tapped for concealed hanger bolt, **as directed**, and with support arm for screwing to underside of rail. Sized to provide 1-1/2-inch (38-mm) clearance between handrail and wall.
5. Handrail/Bumper Rail Brackets: Pairs of extruded-aluminum channels; one for fastening to back of rail and one for fastening to face of wall. They are then assembled in overlapping fashion and fastened together top and bottom with self-tapping screws. Sized to provide 1-1/2-inch (38-mm) clearance between handrail and wall.
 6. Adhesives, General: Do not use adhesives that contain urea formaldehyde.
 7. VOC Limits for Installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Wood Glues: 30 g/L.
 - b. Contact Adhesive: 250 g/L.
 8. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement **OR** Contact cement **OR** PVA **OR** Urea formaldehyde **OR** Resorcinol, **as directed**.
 - a. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.
- E. Fabrication, General
1. Interior Woodwork Grade: Unless otherwise indicated, provide Premium **OR** Custom **OR** Economy, **as directed**,-grade interior woodwork complying with referenced quality standard.
 2. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.
 3. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
 4. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
 - a. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 3/4 Inch (19 mm) Thick or Less: 1/16 inch (1.5 mm).
 - b. Edges of Rails and Similar Members More Than 3/4 Inch (19 mm) Thick: 1/8 inch (3 mm).
 - c. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members and Rails: 1/16 inch (1.5 mm).
 5. Complete fabrication, including assembly, finishing, **as directed**, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
 6. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
 - a. Seal edges of openings in countertops with a coat of varnish.
 7. Install glass to comply with applicable requirements in Division 08 Section "Glazing" and in GANA's "Glazing Manual." For glass in wood frames, secure glass with removable stops.
- F. Interior Standing and Running Trim:
1. For transparent-finished trim items wider than available lumber, use veneered construction. Do not glue for width.
 2. Backout or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work.
 3. Assemble casings in plant except where limitations of access to place of installation require field assembly.
- G. Interior Frames and Jambs
1. Products fabricated from particleboard or medium-density fiberboard with veneered, exposed surfaces.



- H. Fire-Rated Interior Frames and Jambs
1. Products fabricated from fire-retardant particleboard or fire-retardant medium-density fiberboard with veneered, exposed surfaces and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.
 - a. Fire Rating: 20 minutes.
- I. Stairwork and Rails:
1. Treads: Transparent **OR** Opaque, **as directed**, finish.
 2. Risers: Transparent **OR** Opaque, **as directed**, finish.
 3. Stringers: Transparent **OR** Opaque, **as directed**, finish.
 4. Balusters: Transparent **OR** Opaque, **as directed**, finish.
 5. Handrails: Transparent **OR** Opaque, **as directed**, finish.
 6. Scotia, Cove, and Other Moldings: Transparent **OR** Opaque, **as directed**, finish.
- J. Flush Wood Paneling and Wainscots:
1. Lumber Trim and Edges: At fabricator's option, trim and edges indicated as solid wood (except moldings) may be either lumber or veneered construction compatible with grain and color of veneered panels.
 2. Matching of Adjacent Veneer Leaves: Book **OR** Slip **OR** Random, **as directed**, match.
 3. Veneer Matching within Panel Face: Running **OR** Balance **OR** Center-balance, **as directed**, match.
 4. Panel-Matching Method (Economy Grade): No matching between panels is required. Select and arrange panels for similarity of grain pattern and color between adjacent panels.
 5. Panel-Matching Method (Custom or Premium Grade): In each separate area, use premanufactured sets used full width **OR** premanufactured sets selectively reduced in width **OR** sequence-matched, uniform-size sets, **as directed**.
 6. Fire-Retardant-Treated Paneling: Provide panels consisting of wood veneer and fire-retardant particleboard or fire-retardant medium-density fiberboard. Panels shall have flame-spread index of 75 **OR** 25, **as directed**, or less and smoke-developed index of 450 or less per ASTM E 84.
- K. Interior Ornamental Work
1. Interior ornamental work includes the following:
 - a. Balustrades.
 - b. Columns.
 - c. Grilles.
 - d. Mantels.
 - e. Pediment heads.
 - f. Pilasters.
- L. Wood Cabinets for Transparent Finish:
1. AWI Type of Cabinet Construction: Flush overlay **OR** Reveal overlay **OR** Reveal overlay on face frame **OR** Flush inset **OR** Flush inset with face frame **OR** As indicated, **as directed**.
 2. WI Construction Style: Style A, Frameless **OR** B, Face Frame, **as directed**.
 3. WI Construction Type: Type I, multiple self-supporting units rigidly joined together **OR** II, single-length sections to fit access openings, **as directed**.
 4. WI Door and Drawer Front Style: Flush overlay **OR** Reveal overlay **OR** Lipped **OR** Flush, **as directed**.
 5. Reveal Dimension: 1/2 inch (13 mm) **OR** As indicated, **as directed**.
 6. Grain Direction: Vertically for drawer fronts, doors, and fixed panels **OR** Horizontally for drawer fronts, doors, and fixed panels **OR** As indicated, **as directed**.
 7. Matching of Veneer Leaves: Book **OR** Slip **OR** Random, **as directed**, match.
 8. Veneer Matching within Panel Face: Running **OR** Balance **OR** Center-balance, **as directed**, match.



9. Semiexposed Surfaces Other Than Drawer Bodies: Same species and cut indicated for exposed surfaces **OR** Thermoset decorative panels **OR** Compatible species to that indicated for exposed surfaces, stained to match, **as directed**.
10. Drawer Sides and Backs: Solid-hardwood lumber, same species indicated for exposed surfaces **OR** Solid-hardwood lumber, stained to match species indicated for exposed surfaces **OR** Solid hardwood lumber **OR** Thermoset decorative panels, **as directed**.
11. Drawer Bottoms: Hardwood plywood **OR** Thermoset decorative panels, **as directed**.
12. Provide dust panels of 1/4-inch (6.4-mm) plywood or tempered hardboard above compartments and drawers, unless located directly under tops.

M. Wood Cabinets for Opaque Finish:

1. AWI Type of Cabinet Construction: Flush overlay **OR** Reveal overlay **OR** Reveal overlay on face frame **OR** Flush inset **OR** Flush inset with face frame **OR** As indicated, **as directed**.
2. WI Construction Style: Style A, Frameless **OR** B, Face Frame, **as directed**.
3. WI Construction Type: Type I, multiple self-supporting units rigidly joined together **OR** II, single-length sections to fit access openings, **as directed**.
4. WI Door and Drawer Front Style: Flush overlay **OR** Reveal overlay **OR** Lipped **OR** Flush, **as directed**.
5. Reveal Dimension: 1/2 inch (13 mm) **OR** As indicated, **as directed**.
6. Species for Exposed Lumber Surfaces: Any closed-grain hardwood.
7. Panel Product for Exposed Surfaces: Medium-density fiberboard **OR** overlay, **as directed**.
8. Semiexposed Surfaces Other Than Drawer Bodies: Match materials indicated for exposed surfaces **OR** Thermoset decorative panels, **as directed**.
9. Drawer Sides and Backs: Solid-hardwood lumber **OR** Thermoset decorative panels, **as directed**.
10. Drawer Bottoms: Hardwood plywood **OR** Thermoset decorative panels, **as directed**.
11. Provide dust panels of 1/4-inch (6.4-mm) plywood or tempered hardboard above compartments and drawers, unless located directly under tops.

N. Plastic-Laminate Cabinets:

1. AWI Type of Cabinet Construction: Flush overlay **OR** Reveal overlay **OR** Reveal overlay on face frame **OR** Flush inset **OR** Flush inset with face frame **OR** As indicated, **as directed**.
2. WI Construction Style: Style A, Frameless **OR** B, Face Frame, **as directed**.
3. WI Construction Type: Type I, multiple self-supporting units rigidly joined together **OR** II, single-length sections to fit access openings, **as directed**.
4. WI Door and Drawer Front Style: Flush overlay **OR** Reveal overlay **OR** Lipped **OR** Flush, **as directed**.
5. Reveal Dimension: 1/2 inch (13 mm) **OR** As indicated, **as directed**.
6. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate as follows:
 - a. Horizontal Surfaces Other Than Tops: Grade HGS **OR** HGL, **as directed**.
 - b. Postformed Surfaces: Grade HGP, **as directed**.
 - c. Vertical Surfaces: Grade HGS **OR** VGS, **as directed**.
 - d. Edges: Grade HGS **OR** Grade VGS **OR** PVC tape, 0.018-inch (0.460-mm) minimum thickness, matching laminate in color, pattern, and finish **OR** PVC T-mold matching laminate in color, pattern, and finish **OR** PVC edge banding, 0.12 inch (3 mm) thick, matching laminate in color, pattern, and finish, **as directed**.
7. Materials for Semiexposed Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, Grade VGS **OR** High-pressure decorative laminate, Grade CLS **OR** Thermoset decorative panels, **as directed**.
8. Drawer Sides and Backs: Solid-hardwood lumber **OR** Thermoset decorative panels, **as directed**.
9. Drawer Bottoms: Hardwood plywood **OR** Thermoset decorative panels, **as directed**.
10. Colors, Patterns, and Finishes: As indicated by manufacturer's designations **OR** Match sample, **as directed**.
11. Colors, Patterns, and Finishes: As selected by the Owner from laminate manufacturer's full range of solid colors **OR** wood grains **OR** patterns, **as directed**, gloss **OR** matte, **as directed**, finish.



12. Provide dust panels of 1/4-inch (6.4-mm) plywood or tempered hardboard above compartments and drawers, unless located directly under tops.
- O. Wood Countertops
1. Type of Top:
 - a. Solid wood for transparent finish, edge glued, with crown direction reversed in adjacent boards, to produce widths indicated. Select boards for similarity of color and grain and arrange boards for optimum match between adjacent boards.
OR
Solid laminated for transparent finish. Narrow strips of lumber glued together with crown direction reversed in adjacent strips. Arrange strips for random mix of color and grain.
OR
Panel product for transparent finish (wood veneer laminated over core).
 - 1) Core Material: Particleboard or medium-density fiberboard **OR** Particleboard **OR** Medium-density fiberboard **OR** Particleboard made with exterior glue **OR** Medium-density fiberboard made with exterior glue **OR** Exterior-grade plywood **OR** Fire-retardant particleboard, **as directed**.
- P. Plastic-Laminate Countertops:
1. High-Pressure Decorative Laminate Grade: HGS **OR** HGP, **as directed**.
 2. Colors, Patterns, and Finishes: As selected by the Owner from laminate manufacturer's full range of solid colors **OR** wood grains **OR** patterns, **as directed**, gloss **OR** matte, **as directed**, finish.
 3. Edge Treatment: Same as laminate cladding on horizontal surfaces **OR** Lumber edge for transparent finish matching wood species and cut on cabinet surfaces **OR** As indicated, **as directed**.
 4. Core Material at Sinks: Particleboard made with exterior glue **OR** Medium-density fiberboard made with exterior glue or exterior-grade plywood, **as directed**.
- Q. Solid-Surfacing-Material Countertops:
1. Solid-Surfacing-Material Thickness: 1/2 inch (13 mm) **OR** 3/4 inch (19 mm), **as directed**.
 2. Colors, Patterns, and Finishes: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 3. Fabricate tops in one piece with shop-applied backsplashes **OR** loose backsplashes for field application, **as directed**. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.
 4. Install integral sink bowls in countertops in shop.
- R. Laminated-Plastic Laboratory Tops
1. High-Pressure Decorative Laminate: Grade HGS **OR** Grade HGP **OR** Chemical-resistant, Grade HGP, **as directed**.
 2. Colors and Patterns: Provide materials and products that result in colors and patterns of exposed laminate surfaces complying with the following requirements:
 3. Core Material: Particleboard **OR** Particleboard made with exterior glue **OR** Fire-retardant particleboard **OR** Rotary-cut lauan or closed-grain hardwood plywood **OR** Exterior-grade rotary-cut lauan or closed-grain hardwood plywood, **as directed**.
- S. Closet And Utility Shelving
1. Shelf Material: 3/4-inch (19-mm) solid lumber **OR** veneer-faced panel product with solid-lumber edge **OR** veneer-faced panel product with veneer edge banding **OR** thermoset decorative panel with solid-lumber edge **OR** thermoset decorative panel with PVC or polyester edge banding **OR** medium-density fiberboard with solid-lumber edge **OR** particleboard with solid-lumber edge **OR** medium-density fiberboard with radiused edge **OR** particleboard with radiused and filled edge, **as directed**.
 2. Cleats: 3/4-inch (19-mm) solid lumber **OR** thermoset decorative panel **OR** panel product, **as directed**.



3. Wood Species: Match species indicated for other types of transparent-finished architectural woodwork located in same area of building, unless otherwise indicated **OR** Match species indicated for door to closet where shelving is located **OR** Any closed-grain hardwood **OR** Eastern white pine, sugar pine, or western white pine, **as directed**.

T. Shop Finishing

1. Grade: Provide finishes of same grades as items to be finished.
2. General: Finish architectural woodwork at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.
3. General: Shop finish transparent-finished interior architectural woodwork at fabrication shop as specified in this Section. Refer to Division 07 for finishing opaque-finished architectural woodwork.
4. General: Drawings indicate items that are required to be shop finished. Finish such items at fabrication shop as specified in this Section. Refer to Division 07 for finishing architectural woodwork not indicated to be shop finished.
5. Shop Priming: Shop apply the prime coat including backpriming, if any, for transparent-finished items specified to be field finished. Refer to Division 07 for material and application requirements.
6. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.
 - a. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling and to end-grain surfaces. Concealed surfaces of plastic-laminate-clad woodwork do not require backpriming when surfaced with plastic laminate, backing paper, or thermoset decorative panels.

U. Transparent Finish:

1. Grade: Premium **OR** Custom **OR** Economy, **as directed**.
2. AWI Finish System: Acrylic lacquer **OR** Conversion varnish **OR** Catalyzed vinyl, **as directed**.
3. WI Finish System: 2, water-reducible acrylic lacquer **OR** 3b., catalyzed vinyl lacquer **OR** 4, conversion varnish, **as directed**.
4. Staining: None required **OR** Match approved sample, **as directed**.
5. Wash Coat for Stained Finish: Apply wash-coat sealer to woodwork made from closed-grain wood before staining and finishing.
6. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.
7. Filled Finish for Open-Grain Woods: After staining (if any), apply paste wood filler to open-grain woods and wipe off excess. Tint filler to match stained wood.
 - a. Apply wash-coat sealer after staining and before filling.
8. Sheen: Flat, 15-30 **OR** Satin, 31-45 **OR** Semigloss, 46-60 **OR** Gloss, 61-100, **as directed** gloss units measured on 60-degree gloss meter per ASTM D 523.

V. Opaque Finish:

1. Grade: Premium **OR** Custom **OR** Economy, **as directed**.
2. AWI Finish System: Conversion varnish **OR** Catalyzed vinyl, **as directed**.
3. WI Finish System: 3b., catalyzed vinyl lacquer **OR** 4, conversion varnish **OR** 7a., synthetic enamel, **as directed**.
4. Color: As indicated by manufacturer's designations **OR** Match sample **OR** As selected from manufacturer's full range, **as directed**.
5. Sheen: Flat, 15-30 **OR** Satin, 31-45 **OR** Semigloss, 46-60 **OR** Gloss, 61-100, **as directed**, gloss units measured on 60-degree gloss meter per ASTM D 523.

1.3 EXECUTION

A. Preparation



1. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.
2. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

B. Installation

1. Grade: Install woodwork to comply with requirements for the same grade specified in Part 1.2 for fabrication of type of woodwork involved.
2. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 1.2, to extent that it was not completed in the shop.
3. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).
4. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
5. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.
6. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.
7. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 36 inches (900 mm) **OR** 60 inches (1500 mm) **OR** 96 inches (2400 mm), **as directed**, long, except where shorter single-length pieces are necessary. Scarf running joints and stagger in adjacent and related members.
 - a. Fill gaps, if any, between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base if finished.
 - b. Install wall railings on indicated metal brackets securely fastened to wall framing.
 - c. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches (3 mm in 2400 mm).
8. Paneling: Anchor paneling to supporting substrate with concealed panel-hanger clips **OR** splined connection strips, **as directed**. Do not use face fastening, unless covered by trim **OR** otherwise indicated.
 - a. Install flush paneling with no more than 1/16 inch in 96-inch (1.5 mm in 2400-mm) vertical cup or bow and 1/8 inch in 96-inch (3 mm in 2400-mm) horizontal variation from a true plane.
9. Stairs: Securely anchor carriages to supporting substrates. Install stairs with treads and risers no more than 1/8 inch (3 mm) from indicated position.
10. Railings:
 - a. General: Install rails with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) variation from a straight line.
 - b. Stair Rails: Glue and dowel or pin balusters to treads and railings, and railings to newel posts.
 - c. Wall Rails: Support rails on indicated metal brackets securely fastened to wall framing.
11. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
 - a. Install cabinets with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
 - b. Maintain veneer sequence matching of cabinets with transparent finish.
 - c. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches (400 mm) o.c. with No. 10 wafer-head screws sized for 1-inch (25-mm) penetration into wood framing, blocking, or hanging strips **OR** No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish **OR** toggle bolts through metal backing or metal framing behind wall finish, **as directed**.



12. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
 - a. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
 - b. Install countertops with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
 - c. Secure backsplashes to tops with concealed metal brackets at 16 inches (400 mm) o.c. and to walls with adhesive.
 - d. Calk space between backsplash and wall with sealant specified in Division 07 Section "Joint Sealants".
13. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.
14. Refer to Division 07 for final finishing of installed architectural woodwork not indicated to be shop finished.

C. Adjusting And Cleaning

1. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
2. Clean, lubricate, and adjust hardware.
3. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 01 95 06 00c



Task	Specification	Specification Description
01 95 06 00	01 22 16 00	No Specification Required
01 95 07 00	07 62 00 00	Sheet Metal Flashing And Trim
01 95 08 00	01 22 16 00	No Specification Required



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SECTION 01 95 09 00 - CORK FLOORING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for cork flooring. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Cork floor tile.
 - b. Engineered cork floor tile.
 - c. Cork rubber floor tile.
 - d. Cork floating floor system.

C. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:
 - a. Product Data for Credit MR 6.0: For cork flooring, including printed statement of costs for each rapidly renewable material.
 - b. Product Data for Credit EQ 4.1: For adhesive, including printed statement of VOC content.
 - c. Product Data for Credit EQ 4.2: For field-applied sealer and finish coatings, including printed statement of VOC content.
 - d. Product Data for Credit EQ 4.4: For cork flooring and MDF, including printed statement indicating that the bonding agent and adhesive contain no urea-formaldehyde resins.
3. Shop Drawings: For each type of cork flooring. Include cork flooring layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
4. Samples: Full-size units of each shade and finish **OR** shade, pattern, and finish **OR** color and pattern, **as directed**, of cork flooring required.
5. Maintenance Data: For each type of cork flooring to include in maintenance manuals.

D. Quality Assurance

1. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 - a. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm **OR** Class II, not less than 0.22 W/sq. cm, **as directed**.
2. Product Certificates: For cork floating floor system, from manufacturer, certifying that MDF core contains no urea-formaldehyde resins.

E. Delivery, Storage, And Handling

1. Store cork flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store cork flooring on flat surfaces.

F. Project Conditions

1. Maintain ambient temperatures within range recommended by manufacturer, but not less than 65 deg F (18 deg C) or more than 75 deg F (24 deg C) where relative humidity is between 45 and 65 percent, in spaces to receive cork flooring during the following time periods:
 - a. 72 hours before installation.
 - b. During installation.
 - c. 72 hours after installation.



2. Until Final Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 65 deg F (18 deg C) or more than 75 deg F (24 deg C).
3. Close spaces to traffic during cork flooring installation.
4. Close spaces to traffic for 72 hours after cork flooring installation.
5. Install cork flooring after other finishing operations, including painting, have been completed.

1.2 PRODUCTS

A. Cork Floor Tile

1. Cork Floor Tile: Composed of 100 percent natural cork bark and recycled cork granules and set in a natural or synthetic, flexible resin matrix; homogeneous and uniform in composition throughout the tile thickness.
2. Provide cork floor tile made with adhesives and binders that do not contain urea-formaldehyde resins.
3. Minimum Density: 30 lb/cu. ft. (480 kg/cu. m) **OR** 34 lb/cu. ft. (544 kg/cu. m) **OR** 37 lb/cu. ft. (592 kg/cu. m), **as directed**.
4. Thickness: Nominal 0.180 inch (4.8 mm) **OR** Nominal 0.312 inch (8.0 mm), **as directed**.
5. Size: 12 by 12 inches (305 by 305 mm) **OR** 12 by 24 inches (305 by 610 mm) **OR** 24 by 24 inches (610 by 610 mm), **as directed**.
6. Shade: Light **OR** Medium **OR** Dark **OR** As indicated by manufacturer's designations **OR** Match sample, **as directed**.
7. Finish: Sanded or unfinished **OR** Waxed **OR** Polyurethane **OR** Polyurethane containing UV inhibitors **OR** Acrylic **OR** As indicated by manufacturer's designations **OR** Match sample, **as directed**.

B. Engineered Cork Floor Tile

1. Engineered Cork Floor Tile: Composed of 100 percent natural cork bark and recycled cork granules with laminated, patterned cork veneers and set in a natural or synthetic, flexible resin matrix; homogeneous and uniform in composition throughout the tile thickness.
2. Provide cork floor tile made with adhesives and binders that do not contain urea-formaldehyde resins.
3. Minimum Density: 30 lb/cu. ft. (480 kg/cu. m) **OR** 34 lb/cu. ft. (544 kg/cu. m) **OR** 37 lb/cu. ft. (592 kg/cu. m), **as directed**.
4. Thickness: Nominal 0.180 inch (4.8 mm) **OR** Nominal 0.312 inch (8.0 mm), **as directed**.
5. Size: 12 by 12 inches (305 by 305 mm) **OR** 12 by 24 inches (305 by 610 mm) **OR** 24 by 24 inches (610 by 610 mm), **as directed**.
6. Shade: Light **OR** Medium **OR** Dark **OR** As indicated by manufacturer's designations **OR** Match sample, **as directed**.
7. Pattern: As indicated by manufacturer's designations **OR** Match sample, **as directed**.
8. Finish: Sanded or unfinished **OR** Waxed **OR** Polyurethane **OR** Polyurethane containing UV inhibitors **OR** Acrylic **OR** As indicated by manufacturer's designations **OR** Match sample, **as directed**.

C. Cork Rubber Floor Tile

1. Cork Rubber Floor Tile: Composed of 70 percent natural cork granules and 30 percent rubber granules combined with fade-resistant pigments; homogeneous and uniform in composition throughout the tile thickness.
2. Provide cork rubber floor tile made with adhesives and binders that do not contain urea-formaldehyde resins.
3. Physical Characteristics:
 - a. Minimum Density: 78 lb/cu. ft. (1249 kg/cu. m).
 - b. Minimum Tensile Strength: 700 psi (4.8 MPa).
4. Thickness: Nominal 0.125 inch (3.2 mm).
5. Size: 18 by 18 inches (450 by 450 mm).



6. Texture: Lightly textured wear surface.
 7. Colors and Patterns: As indicated by manufacturer's designations **OR** Match sample **OR** As selected from full range of industry colors, **as directed**.
- D. Cork Floating Floor System
1. Cork Floating Floor System: Laminated planks made of two cork layers, top and bottom, sandwiched around an MDF core and containing no urea-formaldehyde resins.
 2. Plank Density:
 - a. Cork Top Layer: 28 lb/cu. ft. (448 kg/cu. m) **OR** Manufacturer's standard density, **as directed**.
 - b. Interlocking MDF Core: 45 lb/cu. ft. (720 kg/cu. m) **OR** Manufacturer's standard density, **as directed**.
 - c. Cork Underlayment Layer: 13 lb/cu. ft. (208 kg/cu. m) **OR** Manufacturer's standard density, **as directed**.
 3. Plank Thickness: Nominal 0.450-inch (11.4-mm) overall thickness made up as follows:
 - a. Cork Top Layer: Nominal 0.125 inch (3.2 mm) **OR** Manufacturer's standard dimension, **as directed**.
 - b. Interlocking MDF Core: Nominal 0.250 inch (6.3 mm) **OR** Manufacturer's standard dimension, **as directed**.
 - c. Cork Underlayment Layer: Nominal 0.078 inch (2.0 mm) **OR** Manufacturer's standard dimension, **as directed**.
 4. Plank Size: 18 by 18 inches (450 by 450 mm) **OR** 36 by 12 inches (900 by 305 mm), **as directed**.
 5. Plank Edge: Tongue-and-groove type **OR** Manufacturer's standard interlock, **as directed**.
 6. Shade: Light **OR** Medium **OR** Dark **OR** As indicated by manufacturer's designations **OR** Match sample, **as directed**.
 7. Pattern: As indicated by manufacturer's designations **OR** Match sample, **as directed**.
 8. Finish: Sanded or unfinished **OR** Waxed **OR** Polyurethane **OR** Polyurethane containing UV inhibitors **OR** Acrylic **OR** As indicated by manufacturer's designations **OR** Match sample, **as directed**.
- E. Installation Materials
1. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement-based or blended hydraulic-cement-based formulation provided or approved by cork flooring manufacturer for applications indicated.
 2. Vapor Retarder: ASTM D 4397, polyethylene sheet not less than 6.0 mils (0.15 mm) **OR** 8.0 mils (0.2 mm), **as directed**, thick.
 3. Adhesive: Water-resistant products as recommended by manufacturer to suit cork flooring and substrate conditions indicated.
 - a. Use adhesives that have a VOC content of not more than 50 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- F. Field-Applied Finishes
1. Cork Sealer: Product as recommended by cork flooring manufacturer.
 - a. Use sealers that have a VOC content of not more than 350 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Paste Wax: Products as recommended by cork flooring manufacturer.
 3. Finish Coatings: Products containing UV inhibitors as recommended by cork flooring manufacturer.
 - a. Use finish coatings that have a VOC content of not more than 350 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 4. Cork Rubber Tile Sealer: Product as recommended by cork rubber floor tile manufacturer.
 - a. Use sealers that have a VOC content of not more than 350 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).



1.3 EXECUTION

A. Preparation

1. Prepare substrates according to cork flooring manufacturer's written instructions to ensure adhesion of cork flooring.
2. Concrete Substrates: Prepare according to ASTM F 710.
 - a. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - b. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
 - c. Alkalinity and Adhesion Testing: Perform tests recommended by cork flooring manufacturer. Proceed with installation only after substrates pass testing.
 - d. Moisture Testing: Perform tests recommended by cork flooring manufacturer and as follows. Proceed with installation only after substrates pass testing.
 - 1) Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
 - 2) Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
3. Access Flooring Panels: Remove protective film of oil or other coating using method recommended by access flooring manufacturer.
4. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
5. Do not install cork flooring until materials are same temperature as space where they are to be installed.
 - a. Move cork flooring products and installation materials into spaces where they will be installed at least 72 hours in advance of installation.
6. Immediately before installation, sweep and vacuum clean substrates to be covered by cork flooring products.

B. Floor Tile Installation

1. Comply with cork flooring manufacturer's written instructions for installing cork flooring.
2. Mix floor tiles from each carton together to ensure uniform distribution of shade.
3. Discard broken, cracked, chipped, or deformed floor tiles.
4. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
5. Lay floor tiles square with room axis **OR** at a 45-degree angle with room axis **OR** in ashlar or staggered joint pattern **OR** in pattern indicated, **as directed**.
6. Apply adhesive to substrate and set floor tiles in adhesive.
7. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
8. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
9. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.
10. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of shade and finish **OR** shade, pattern, and finish **OR** color and pattern, **as directed**, between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

C. Cork Floating Floor System Installation



1. Comply with manufacturer's written instructions for installing cork floating floor system.
2. Install continuous vapor retarder over substrate, taping side and end laps.
3. Mix floor planks from several cartons to ensure uniform distribution of shade.
4. Discard broken, cracked, chipped, or deformed floor planks.
5. Do not attach floor planks to substrate.
6. Tightly interlock and adhere plank edges with adhesive. Remove excess adhesive from top surface of planks.
7. Lay floor planks in pattern indicated.
8. Use spacers to keep planks from shifting as subsequent rows are added. Remove spacers after installing cork floating floor system.
9. Maintain expansion space at walls and other obstructions and terminations of flooring as indicated on Drawings **OR** of not less than 3/8 inch (9.5 mm), **as directed**.
10. Extend floor planks into toe spaces, door reveals, closets, and similar openings. Extend floor planks to center of door openings.
11. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor planks as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.

D. Field-Applied Finishes

1. Apply finishes according to cork flooring manufacturer's written instructions.
2. Cork Sealer: Apply one **OR** two, **as directed**, coat(s).
3. Paste Wax: Apply one **OR** two **OR** three, **as directed**, coat(s).
4. Finish Coatings: Apply two **OR** three, **as directed**, coat(s).
5. Cork Rubber Tile Sealer: Apply one **OR** two, **as directed**, coat(s).

E. Cleaning And Protection

1. Comply with manufacturer's written instructions for cleaning and protecting cork flooring.
2. Remove adhesive and other blemishes from exposed surfaces.
3. Sweep and vacuum surfaces thoroughly.
4. Damp-mop surfaces to remove marks and soil.
5. Protect cork flooring products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
6. Cover cork flooring until Final Completion.

END OF SECTION 01 95 09 00



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Task	Specification	Specification Description
01 95 09 00	01 22 16 00	No Specification Required
01 95 09 00	09 65 23 00	Resilient Sheet Flooring
01 95 10 00	01 22 16 00	No Specification Required



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SECTION 01 95 22 00 - EMERGENCY PLUMBING FIXTURES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for emergency plumbing fixtures. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work

B. Summary

1. This Section includes the following emergency plumbing fixtures:
 - a. Emergency showers.
 - b. Eyewash equipment.
 - c. Self-contained eyewash equipment.
 - d. Personal eyewash equipment.
 - e. Eye/face wash equipment.
 - f. Hand-held drench hoses.
 - g. Combination units.
 - h. Water-tempering equipment.

C. Definitions

1. Accessible Fixture: Emergency plumbing fixture that can be approached, entered, and used by people with disabilities.
2. Plumbed Emergency Plumbing Fixture: Fixture with fixed, potable-water supply.
3. Self-Contained Emergency Plumbing Fixture: Fixture with flushing-fluid-solution supply.
4. Tepid: Moderately warm.

D. Submittals

1. Product Data: For each type of product indicated. Include flow rates and capacities, furnished specialties, and accessories.
2. Shop Drawings: Diagram power, signal, and control wiring.
3. Operation and maintenance data.

E. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. ANSI Standard: Comply with ANSI Z358.1, "Emergency Eyewash and Shower Equipment."
3. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.
4. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

1.2 PRODUCTS

A. Emergency Showers:

1. Description: Plumbed, single-shower-head horizontal, wall-mounting **OR** vertical, ceiling-mounting **OR** freestanding, **as directed**, emergency shower.
 - a. Capacity: Deliver potable water at rate not less than 20 gpm (76 L/min.) for at least 15 minutes.



- b. Supply Piping: NPS 1 (DN 25) **OR** NPS 1-1/4 (DN 32) **OR** galvanized steel **OR** chrome-plated brass or stainless steel **OR** PVC, **as directed**, with flow regulator and stay-open control valve.
 - c. Control-Valve Actuator: Pull rod **OR** chain, **as directed**.
 - d. Shower Head: 8-inch (200-mm) minimum diameter, chrome-plated brass or stainless steel **OR** plastic, **as directed**.
2. Description: Plumbed, multiple-spray emergency shower with eight **OR** 12 **OR** 16, **as directed**, small shower heads or nozzles.
- a. Capacity: Deliver potable water at rate not less than 20 gpm (76 L/min.) for at least 15 minutes.
 - b. Supply Piping: NPS 1-1/4 (DN 32) minimum galvanized **OR** chrome-plated brass or stainless, **as directed**, steel with flow regulator and stay-open control valve.
 - c. Control-Valve Actuator: Paddle **OR** Treadle, **as directed**.
3. Description: Plumbed, freeze-protected, freestanding emergency shower.
- a. Capacity: Deliver potable water at rate not less than 20 gpm (76 L/min.) for at least 15 minutes.
 - b. Supply Piping: NPS 1-1/4 (DN 32) galvanized steel with flow regulator and stay-open control valve.
 - c. Control-Valve Actuator: Pull rod **OR** chain, **as directed**.
 - d. Shower Head: 8-inch (200-mm) minimum diameter, chrome-plated brass or stainless steel **OR** plastic, **as directed**.
 - e. Heating System: 120 **OR** 240, **as directed**, -V ac electric; and insulation with protective jacket.

B. Eyewash Equipment

1. Description: Plumbed, freestanding eyewash equipment.
- a. Capacity: Deliver potable water at rate not less than 0.4 gpm (1.5 L/min.) for at least 15 minutes.
 - b. Supply Piping: NPS 1/2 (DN 15) chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
 - c. Control-Valve Actuator: Paddle **OR** Push bar **OR** Treadle, **as directed**.
 - d. Receptor: Chrome-plated brass or stainless-steel **OR** Plastic, **as directed**, bowl.
 - e. Drain Piping: NPS 1-1/4 (DN 32) minimum, chrome-plated brass, receptor drain, P-trap, waste to wall, and wall flange complying with ASME A112.18.2 **OR** Omit drain piping **OR** Include galvanized-steel indirect connection to drainage system, **as directed**.
2. Description: Plumbed, accessible, **as directed**, wall-mounting eyewash equipment with receptor and wall bracket.
- a. Capacity: Deliver potable water at rate not less than 0.4 gpm (1.5 L/min.) for at least 15 minutes.
 - b. Supply Piping: NPS 1/2 (DN 15) chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
 - c. Control-Valve Actuator: Paddle.
 - d. Receptor: Chrome-plated brass or stainless-steel **OR** Plastic, **as directed**, bowl.
 - e. Drain Piping: NPS 1-1/4 (DN 32) minimum, chrome-plated brass, receptor drain, P-trap, waste to wall, and wall flange complying with ASME A112.18.2.
3. Description: Plumbed, accessible, **as directed**, wall-mounting eyewash equipment with wall bracket.
- a. Capacity: Deliver potable water at rate not less than 0.4 gpm (1.5 L/min.) for at least 15 minutes.
 - b. Supply Piping: NPS 1/2 (DN 15) chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
 - c. Control-Valve Actuator: Paddle **OR** Movement sensor, **as directed**.
4. Description: Plumbed, adjacent-to-sink, swivel, counter-mounting eyewash equipment.
- a. Capacity: Deliver potable water at rate not less than 0.4 gpm (1.5 L/min.) for at least 15 minutes.



- b. Supply Piping: NPS 1/2 (DN 15) chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
 - c. Control-Valve Actuator: Paddle.
- C. Self-Contained Eyewash Equipment:
- 1. Description: Portable, pressurized, self-contained eyewash equipment.
 - a. Capacity: Deliver flushing fluid at rate not less than 0.4 gpm (1.5 L/min.) for at least 15 minutes.
 - b. Tank: 10 gal. (3.8 L), stainless steel, cylindrical, and suitable for on-floor installation.
 - c. Flushing Fluid: Medically acceptable solution manufactured and labeled according to applicable regulations.
 - d. Piping: Chrome-plated copper alloy or stainless steel with flow regulator and stay-open control valve.
 - e. Control-Valve Actuator: Paddle.
 - f. Spray Heads: Twin with covers.
 - 2. Description: Static, nonpressurized, self-contained eyewash equipment.
 - a. Capacity: Deliver flushing fluid at rate not less than 0.4 gpm (1.5 L/min.) for at least 15 minutes.
 - b. Tank: 14 gal. (53 L) minimum, plastic, and suitable for shelf mounting.
 - c. Flushing Fluid: Medically acceptable solution manufactured and labeled according to applicable regulations.
 - d. Actuator: Pull-down front panel.
 - e. Spray Heads: Protected, twin.
 - 3. Description: Freeze-protected, static, nonpressurized, self-contained eyewash equipment with heating system.
 - a. Capacity: Deliver flushing fluid at rate not less than 0.4 gpm (1.5 L/min.) for at least 15 minutes.
 - b. Tank: 14 gal. (53 L) minimum **OR** 20 gal. (76 L) minimum, **as directed**, plastic, and suitable for shelf mounting.
 - c. Flushing Fluid: Medically acceptable solution manufactured and labeled according to applicable regulations.
 - d. Actuator: Pull-down front panel.
 - e. Spray Heads: Protected, twin.
 - f. Heating System: Electric, 120-V ac; and insulation with protective jacket.
- D. Personal Eyewash Equipment:
- 1. Description: Portable, pressurized, personal eyewash equipment with spray heads.
 - a. Capacity: Deliver flushing fluid at rate not less than 0.4 gpm (1.5 L/min.), **as directed**.
 - b. Tank: 5 gal. (19 L), stainless steel, cylindrical, and with base suitable for on-floor installation.
 - c. Flushing Fluid: Medically acceptable solution manufactured and labeled according to applicable regulations.
 - d. Piping: Chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
 - e. Control-Valve Actuator: Paddle.
 - f. Spray Heads: Twin with covers.
 - 2. Description: Portable, pressurized, personal eyewash equipment with spray heads and drench hose.
 - a. Capacity: Deliver flushing fluid at rate not less than 0.4 gpm (1.5 L/min.), **as directed**.
 - b. Tank: 5 gal. (19 L), stainless steel, cylindrical, and with base suitable for on-floor installation.
 - c. Flushing Fluid: Medically acceptable solution manufactured and labeled according to applicable regulations.
 - d. Piping: Chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
 - e. Spray-Head, Control-Valve Actuator: Paddle.



- f. Spray Heads: Twin with covers.
 - g. Drench Hose: Rubber or plastic.
 - 1) Control-Valve Actuator: Hand-held squeeze valve.
 - 2) Spray Head: Single with cover.
- E. Eye/Face Wash Equipment:
- 1. Description: Plumbed, freestanding, pedestal eye/face wash equipment.
 - a. Capacity: Deliver potable water at rate not less than 3.0 gpm (11.4 L/min.) for at least 15 minutes.
 - b. Supply Piping: NPS 1/2 (DN 15) chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
 - c. Control-Valve Actuator: Paddle **OR** Push bar **OR** Treadle, **as directed**.
 - d. Receptor: Chrome-plated brass or stainless-steel **OR** Plastic, **as directed**, bowl.
 - e. Drain Piping: NPS 1-1/4 (DN 32) minimum, chrome-plated brass, receptor drain, P-trap, waste to wall, and wall flange complying with ASME A112.18.2. Include galvanized-steel indirect connection to drainage system.
 - 2. Description: Plumbed, accessible, **as directed**, wall-mounting eye/face wash equipment with receptor and wall bracket.
 - a. Capacity: Deliver potable water at rate not less than 3.0 gpm (11.4 L/min.) for at least 15 minutes.
 - b. Supply Piping: NPS 1/2 (DN 15) chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
 - c. Control-Valve Actuator: Paddle.
 - d. Receptor: Chrome-plated brass or stainless-steel **OR** Plastic, **as directed**, bowl.
 - e. Drain Piping: NPS 1-1/4 (DN 32) minimum, chrome-plated brass, receptor drain, P-trap, waste to wall, and wall flange complying with ASME A112.18.2.
 - 3. Description: Plumbed, accessible, **as directed**, wall-mounting eye/face wash equipment without receptor and with wall bracket.
 - a. Capacity: Deliver potable water at rate not less than 3.0 gpm (11.4 L/min.) for at least 15 minutes.
 - b. Supply Piping: NPS 1/2 (DN 15) chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
 - c. Control-Valve Actuator: Paddle.
 - 4. Description: Plumbed, adjacent-to-sink, swivel, counter-mounting eye/face wash equipment.
 - a. Capacity: Deliver potable water at rate not less than 3.0 gpm (11.4 L/min.) for at least 15 minutes.
 - b. Supply Piping: NPS 1/2 (DN 15) chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
 - c. Control-Valve Actuator: Paddle.
- F. Hand-Held Drench Hoses:
- 1. Description: Plumbed, wall-mounting, hand-held drench hose with wall bracket.
 - a. Capacity: Deliver potable water at rate not less than 3.0 gpm (11.4 L/min.) for at least 15 minutes.
 - b. Supply Piping: NPS 1/2 (DN 15) chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
 - c. Control-Valve Actuator: Paddle.
 - d. Hose: Coiled **OR** Plain, **as directed**, rubber or plastic.
 - e. Spray Heads: Single **OR** Twin, **as directed**.
 - 2. Description: Plumbed, counter-mounting, hand-held drench hose.
 - a. Capacity: Deliver potable water at rate not less than 3.0 gpm (11.4 L/min.) for at least 15 minutes.
 - b. Supply Fitting: NPS 1/2 (DN 15) brass with flow regulator.
 - c. Hose: Rubber or plastic.
 - d. Control-Valve Actuator: Hand-held squeeze valve.



- e. Spray Heads: Single **OR** Twin, **as directed**.

G. Combination Units:

1. Description: Plumbed, accessible, **as directed**, freestanding, with emergency shower and eyewash **OR** eye/face wash **OR** drench hose, **as directed**, equipment.
 - a. Piping: Galvanized steel **OR** Chrome-plated brass or stainless steel **OR** PVC, **as directed**.
 - 1) Unit Supply: NPS 1-1/4 (DN 32) minimum **OR** NPS 1-1/2 (DN 40), **as directed**, from top **OR** side, **as directed**.
 - 2) Unit Drain: Outlet at side near bottom.
 - 3) Shower Supply: NPS 1 (DN 25) with flow regulator and stay-open control valve.
 - 4) Eyewash **OR** Eye/Face Wash **OR** Drench Hose, **as directed**, Supply: NPS 1/2 (DN 15) with flow regulator and stay-open control valve.
 - b. Shower Capacity: Deliver potable water at rate not less than 20 gpm (76 L/min.) for at least 15 minutes.
 - 1) Control-Valve Actuator: Pull rod **OR** Pull chain **OR** Treadle, **as directed**.
 - 2) Shower Head: 8-inch (200-mm) minimum diameter, chrome-plated brass or stainless steel **OR** plastic, **as directed**.
 - c. Eyewash Equipment: With capacity to deliver potable water at rate not less than 0.4 gpm (1.5 L/min.) for at least 15 minutes.
 - 1) Control-Valve Actuator: Paddle **OR** Push bar, **as directed**.
 - 2) Receptor: Chrome-plated brass or stainless-steel **OR** Plastic, **as directed**, bowl.
 - d. Eye/Face Wash Equipment: With capacity to deliver potable water at rate not less than 3.0 gpm (11.4 L/min.) for at least 15 minutes.
 - 1) Control-Valve Actuator: Paddle **OR** Push bar, **as directed**.
 - 2) Receptor: Chrome-plated brass or stainless-steel **OR** Plastic, **as directed**, bowl.
 - e. Hand-Held Drench Hose: With capacity to deliver potable water at rate not less than 3.0 gpm (11.4 L/min.) for at least 15 minutes.
 - 1) Hose: Rubber or plastic.
 - 2) Control-Valve Actuator: Hand-held squeeze valve.
 - 3) Spray Head(s): Single **OR** Twin, **as directed**.
2. Description: Plumbed, accessible, **as directed**, freeze-protected, freestanding, with emergency shower and eye/face wash equipment.
 - a. Piping: Galvanized steel.
 - 1) Unit Supply: NPS 1-1/4 (DN 32) minimum **OR** NPS 1-1/2 (DN 40), **as directed**, from top **OR** side **OR** bottom, **as directed**.
 - 2) Shower Supply: NPS 1 (DN 25) with flow regulator and stay-open control valve.
 - 3) Eye/Face Wash Supply: NPS 1/2 (DN 15) with flow regulator and stay-open control valve.
 - b. Heating System: Electric, 120 **OR** 240, **as directed**, -V ac; and insulation with protective jacket.
 - c. Shower Capacity: Deliver potable water at rate not less than 20 gpm (76 L/min.) for at least 15 minutes.
 - 1) Control-Valve Actuator: Pull rod **OR** Pull chain **OR** Treadle, **as directed**.
 - 2) Shower Head: 8-inch (200-mm) minimum diameter, chrome-plated brass or stainless steel **OR** plastic, **as directed**.
 - d. Eye/Face Wash Equipment: With capacity to deliver potable water at rate not less than 3.0 gpm (11.4 L/min.) for at least 15 minutes.
 - 1) Control-Valve Actuator: Paddle **OR** Push bar, **as directed**.

H. Water-Tempering Equipment:

1. Description: Factory-fabricated, hot- and cold-water-tempering equipment with thermostatic mixing valve.
 - a. Thermostatic Mixing Valve: Designed to provide 85 deg F (29 deg C) tepid, potable water at emergency plumbing fixtures, to maintain temperature at plus or minus 5 deg F (3 deg C) throughout required 15-minute test period, and in case of unit failure to continue



- cold-water flow, with union connections, controls, metal piping, and corrosion-resistant enclosure.
2. Description: Factory-fabricated, steam and cold-water, water-tempering equipment with thermostatic mixing valve.
 - a. Thermostatic Mixing Valve: Designed to provide 85 deg F (29 deg C) tepid, potable water at emergency plumbing fixtures, to maintain temperature at plus or minus 5 deg F (3 deg C) throughout required 15-minute test period, and in case of unit failure to continue cold-water flow, with union connections, steam controls, heat exchanger, high-temperature-limit and freeze-protection devices, metal piping, and corrosion-resistant enclosure.
 3. Description: Factory-fabricated, water-tempering equipment with electric heating.
 - a. Heating System: Electric, designed to provide 85 deg F (29 deg C) tepid, potable water at emergency plumbing fixtures, to maintain temperature at plus or minus 5 deg F (3 deg C) throughout required 15-minute test period, and in case of unit failure to continue cold-water flow, with union connections, controls, heating coils, high-temperature-limit device, metal piping, and corrosion-resistant enclosure.
 - 1) Electrical Characteristics: 208-V ac, 38 **OR** 220-V ac, 40 **OR** 277-V ac, 32, **as directed**, A, single phase, 60 Hz.

1.3 EXECUTION

A. Installation

1. Assemble emergency plumbing fixture piping, fittings, control valves, and other components.
2. Install fixtures level and plumb.
3. Fasten fixtures to substrate.
4. Install shutoff valves in water-supply piping to fixtures. Use ball, gate, or globe valve if specific type valve is not indicated. Install valves chained or locked in open position if permitted. Install valves in locations where they can easily be reached for operation. Valves are specified in Division 22 Section "General-duty Valves For Plumbing Piping".
 - a. Exception: Omit shutoff valve on supply to group of plumbing fixtures that includes emergency plumbing fixture.
 - b. Exception: Omit shutoff valve on supply to emergency equipment if prohibited by authorities having jurisdiction.
5. Install shutoff valve and strainer in steam piping and shutoff valve in condensate return piping.
6. Install dielectric fitting in supply piping to fixture if piping and fixture connections are made of different metals. Dielectric fittings are specified in Division 22 Section "Common Work Results For Plumbing".
7. Install thermometers in supply and outlet piping connections to water-tempering equipment. Thermometers are specified in Division 22 Section "Meters And Gages For Plumbing Piping".
8. Install trap and waste to wall on drain outlet of fixture receptors that are indicated to be directly connected to drainage system.
9. Install indirect waste piping to wall on drain outlet of fixture receptors that are indicated to be indirectly connected to drainage system. Drainage piping is specified in Division 22 Section "Sanitary Waste And Vent Piping".
10. Install escutcheons on piping wall and ceiling penetrations in exposed, finished locations. Escutcheons are specified in Division 22 Section "Common Work Results For Plumbing".
11. Fill self-contained fixtures with flushing fluid.
12. Install equipment nameplates or equipment markers on fixtures and equipment signs on water-tempering equipment. Identification materials are specified in Division 22 Section "Identification For Plumbing Piping And Equipment".
13. Piping installation requirements are specified in other Division 14. Drawings indicate general arrangement of piping, fittings, and specialties.
14. Connect cold-water-supply piping to plumbed emergency plumbing fixtures not having water-tempering equipment.



15. Connect hot- and cold-water-supply piping to hot- and cold-water-tempering equipment. Connect output from water-tempering equipment to emergency plumbing fixtures.
16. Connect cold-water and steam supply and condensate return piping to steam and cold-water-tempering equipment. Connect output from water-tempering equipment to emergency plumbing fixtures.
17. Connect cold water and electrical power to electric heating water-tempering equipment.
18. Directly connect emergency plumbing fixture receptors with trapped drain outlet to sanitary drainage and vent piping.
19. Indirectly connect emergency plumbing fixture receptors without trapped drain outlet to sanitary or storm drainage piping.
20. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
21. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

B. Field Quality Control

1. Electrical-Component Testing: After electrical circuitry has been energized, test for compliance with requirements.
 - a. Test and adjust controls and safeties.
2. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.

C. Adjusting

1. Adjust or replace fixture flow regulators for proper flow.
2. Adjust equipment temperature settings.

END OF SECTION 01 95 22 00



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**SECTION 01 95 22 00a - PORCELAIN STEEL BATHTUB LINERS AND SURROUNDS**

DESCRIPTION OF WORK

This specification covers the furnishing and installation of materials for porcelain steel bathtub liners and surrounds. Products shall be as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

GENERAL

System Description

1. Performance Requirements: Comply with following:
 - a. Porcelain Enameled Formed Steel Plumbing Fixtures: FS WWP 542b, Section 12, Porcelain Enameled Fixtures:
 - 1) Specular Gloss: Determined in accordance with ASTM C 346.
 - a) Cover Coat: 45 degree specular gloss.
 - 2) Acid Resistance: Determined in accordance with ASTM C 282.
 - a) Cover Coat: Rating of not less than Class A.
 - 3) Alkali Resistance: Determined in accordance with ASTM C 614.
 - a) Cover Coat: Weight Loss: Not exceed 20 mg/square inch.
 - 4) Abrasion Resistance: Determined in accordance with ASTM C 448.
 - a) Surface Abrasion Index of Cover Coat: 40 or higher.
 - 5) Warpage: Comply with US Dept. of Commerce Commercial Standard (CS) 77, Paragraph 7.1; and US Dept. of Commerce Product Standard (PS) 5, Paragraph 6.2.2.
 - 6) Rigidity: Comply with PS 5, Paragraph 6.6.2.

Submittals

2. Product Data:
 - a. Include porcelain enamel steel samples, backer board material, and joint sealant.
3. Shop Drawings
 - a. Indicate proposed method of panel securing method.
 - b. Templates: Furnish plumber with templates of all openings required in porcelain enamel wall system to accommodate new plumbing trim.
4. Design Drawings: If required, prepare and submit drawings for approval to applicable governmental agencies and obtain necessary permits and certificates for compliance when required.
5. Samples:
 - a. Three samples of steel proposed to be used for bathtub liner and for wall panels.
 - 1) Samples without porcelain enamel coating.
 - 2) Sample: Used to calibrate elcometer to determine amount of porcelain enamel coatings applied.
 - b. Three samples of each type of porcelain enamel finish on steel for acceptance.
 - c. the Owner will retain one set of approved samples.
 - d. Keep one set of approved samples at site throughout construction period.
6. Quality Assurance/Control Submittals:
 - a. Test Reports: Results of testing by accredited independent laboratory demonstrating compliance of porcelain enamel with Performance Requirements.
 - b. Certificates: Manufacturer's written certification that bathtub liners and surrounds meet or exceed specified requirements.



Quality Assurance

7. Materials: Been in general use and satisfactorily performed for minimum of five years. Provide list of locations where such materials have been used.
8. Certifications: Comply with ANSI Z34.2.
9. Regulatory Requirements: Comply with following:
 - a. Install bathtub liners and surrounds in accordance with applicable codes and regulations. Should any specified items or requirements conflict with such codes and regulations, consult with the Owner.
 - b. Accessibility:
 - 1) Architectural Barriers Act of 1968 as amended (42 USC 4152-4157) and HUD implementing regulations (24 CFR Part 40).
 - a) Uniform Federal Accessibility Standards (UFAS).
 - 2) Section 504 of the Rehabilitation Act of 1973 as amended (29 USC 794) and HUD implementing regulations 24 CFR Part 8.
 - 3) Fair Housing Accessibility Guidelines (24 CF1R Chapter 1).
 - 4) Americans with Disabilities Act of 1990 (ADA) (28 CFR Part 35).
10. Mock-ups: Install one complete mock-up of each typical bathtub liner and surround installation. Comply with Section _____ for bathroom renovation mock-up requirements.
 - a. Locations: As directed.
 - b. Approved Mock-ups: Standard for rest of work.
 - c. Approved Mock-ups: May remain part of completed project.
11. Pre-Installation Meetings: Hold meeting with associated plumbing items installer. Notify the Owner of time and location of meeting.

Project Conditions

12. Existing Conditions:
 - a. Existing Utilities: Protect any sewer, water, gas, electric or other pipelines or conduits uncovered during work from damage.
13. Field Measurements: Field measure each bathroom before start of fabrication.

Scheduling And Sequencing

14. Scheduling: Schedule bathtub liner and surround work in coordination with associated plumbing work installer.
15. Scheduling and Completion: Comply with requirements of Detailed Scope of Work.

PRODUCTS

Bathtub Liners And Aprons

16. Description: Prefabricated customized inserts to fit existing bathtubs and provide new, substantial units, capable of supporting bather and coordinated and integrated with bathtub/shower surround system.
 - a. Bathtub Liners and Aprons: Completely and uniformly enclose existing bathtubs, obscuring them from view.
 - b. New Tub Liners and Aprons: Integrate with existing bathtubs, wall conditions, floor conditions, and plumbing connections to provide complete installation subject to individual dimensional variations in bathtub.
17. Bathtub Liner and Apron Materials: Sheet steel coated with porcelain enamel.
 - a. Sheet Steel Thickness: No. 16 gage through 20 gage as specified below:

Gage	No. 16	No. 18	No. 20
Standard Thickness, mm (inch)	1.52 (0.0598)	1.21 (0.0478)	1.01 (0.0398)
Minimum Thickness, mm (inch)	1.37 (0.054)	1.09 (0.043)	0.84 (0.0329)



Bathtub/Shower Surrounds

18. Panel System: Prefabricated panels in solid sections and continuous to cover back and side walls of bathtub/shower, coordinated and integrated with bathtub liners and aprons.
 - a. Height of Bathtub/Shower Surround: 1 500 mm (60 inches) above bathtub ledge.
 - b. Contractor's Option: One, two, or three piece back wall system.
 - c. Where window is located over bathtub, install porcelain enamel on steel on full depth of returns at full length of window stool and at jambs; from window stool to top of surround.
 - 1) Sill and Jamb System: Not interfere with easy use of and access to window pulls, handles, screen retainers, etc.
 - d. Access Panels: Provide easily removable panel to provide access to tub and shower valves. Provide panels with shallow formed edge on all four sides to receive bead of joint sealant.
 - e. Method of Securing: Not visible.
19. Panels: Coated with porcelain enamel to provide bright, hard, impervious panels.
 - a. Panels: Retain their surface characteristics and resist wear as result of abrasion or scouring, and staining due to use of ordinary household abrasive cleaners in popular use.
 - b. Material: Special purpose enameling iron or steel or low metalloid for carbon content, especially manufactured and processed for porcelain enamel units for architectural purposes.
 - 1) Thickness: 18 through 22 gage steel.
 - c. Panel Edges: 90 degree flange formed as part of face panel and of same finish.
20. Wall Clips Supporting Panels: Minimum 20 gage, hot-dipped galvanized.
21. Fastening Devices: As required and in accordance with panel manufacturer's instructions and accepted good industry practices and as approved.
 - a. Provide expansion toggle bolts, molly bolts, nylon and other plastic anchors, lead anchors as required for existing wall conditions.

Porcelain Enamel Finish

22. Porcelain Enamel Coating: Hard, impervious arid durable, glass-like coating produced by fusing carefully compounded mixture of mineral substances such as Cryolite, Feldspar, Quartz, Borax, Silica, Tin and Zirconium Oxide Clays at temperatures up to 980 degrees C (1800 degrees F) in accordance with ANSI A112.19.4M.
23. Porcelain Enamel: Apply to all areas of each component, including backs and flanges.
 - a. Initial Enamel Coating: Apply to all surfaces and apply additional separately fired coating of chemically resistant porcelain enamel as face coat.
 - b. Each coat of Porcelain Enamel: 0.10 to 0.15 mm (0.004 to 0.006 inch) when measured in accordance with ASTM D1186.
 - c. Two Coatings of Porcelain Enamel on Exposed Surfaces of Panels: Thickness of 0.20 to 0.05 mm (0.008 to 0.002 inch).
 - d. Final Porcelain Enamel Coat: Chemically resistant, complying with Performance Requirements in this Section.
 - e. Installed Liner and Surround: Uniform color.
 - 1) Color: White.

Accessories

24. Bracing Strips/Filler Material/Backer Board: Fire retardant perlite or molded polystyrene material providing zero capillarity water resistance, and permanent insulation properties.
 - a. Bracing Strips: Fire retardant molded polystyrene material.
 - b. Filler Material: Sound deadening and cushioning material.
 - c. Panel Backer Board: Minimum 12.7 mm (1/2 inch) thick.
25. Joint Sealant: Mildew resistant one-component silicone; FS TT-S-001543A, Class A; ASTM C 920, Type S, Grade NS, Class 25, Uses NT, G, and A.
 - a. Color: Match color of porcelain enamel.
26. Bath Accessories: See Division 10 Section "Bath Accessories."

Fabrication

27. Shop Assembly: Shop assemble panels to greatest extent possible.



- a. Coordinate with bath accessories provided under Division 10 Section "Bath Accessories."

EXECUTION

Examination

- 28. Site Verification of Conditions:
 - a. Existing Conditions: Examine bathrooms before beginning installation.
 - b. Field Measurements: Verify field measurements are as indicated on Shop Drawings.
 - c. Do not proceed with installation until conditions are satisfactory.

Preparation

- 29. Protection: Comply with requirements of Detailed Scope of Work.
 - a. Protect or repair utilities damaged by operations under this Section.
 - b. Protect adjacent elements from damage and disfiguration.
 - c. Repair or replace damaged elements in accordance with Detailed Scope of Work.
- 30. Preparation: Prepare bathtubs and surround walls as required for proper installation in accordance with Detailed Scope of Work.

Installation

- 31. Interface With Other Work: Coordinate installation of bathtub liner and surround wall panel system with installation of bath accessories under Division 10 Section "Bath Accessories" and plumbing work under Division 15 Section "Plumbing."
- 32. Bathtub Liners and Aprons:
 - a. Installation: Accomplished without removing existing bathtub fixture.
 - b. Bracing Strips/Filler Material: Partially line clearance between base of existing bathtubs and tub liner with bracing strips.
 - c. Insert new bathtub liner over and into existing bathtub, simultaneously bottoming on and compressing filler material and resting on and being supported by intimate contact with existing bathtub seat and rim on all four sides, to eliminate any movement.
 - d. Apron: Install new apron to extension to new bathtub liner ledge or seat portion; by inserting non-corrosive locating pins and/or fasteners as required between floor and roll rim of new tub liner.
 - e. Customized bathtub liner Insert in accordance with variable field dimensions into variably sized ledges and seat: both in plant fabrication and field installation as required.
 - 1) a. Verify dimensions and conditions by visiting each bathroom for work indicated and specified.
- 33. Tub Surround Wall Panel System: Integrate wall panels with installation of new tub liners.
 - a. Panel System: Install as extension of bathtub in upward direction bearing configuration and function of bathtub and shower enclosure.
 - b. Install window sill and jamb system where window is located over bathtub in manner not to interfere with easy use of and access to window pulls, handles, screen retainers, etc.
 - c. Existing Walls: Remove obstructions, encountered for installation of porcelain enamel panels.
 - 1) Patch and repair damaged wall board surfaces that are exposed after panel installation in accordance with Detailed Scope of Work.
 - 2) Backer Board: Provide between wall panels and existing masonry walls.
 - d. Method of Securing Panels: Mechanical and not visible.
 - 1) Provide at least two wall clips on both top and bottom flanges of each panel.
 - 2) Exposed bolts, screw heads, grommets, battens, channel moldings. or any other fastening devices not allowed.
 - e. Access Panels: Seal perimeter with joint sealant for waterproof joint.
 - f. Joint Sealing: Permanently seal perimeter edges between new panels and existing walls, joints between panels, joints at window sill and jamb system, and corner joint at juncture of back wall with side walls with joint sealant .



34. Joint Sealants: Apply in accordance with manufacturers recommendations.
 - a. Surfaces to be Sealed: Clean, dry and free of any foreign matter that would degrade adhesion.
 - b. Prime cleaned surfaces in accordance with sealant manufacturer's recommendations.
 - c. Protect surfaces adjacent to joints by masking tape before applying sealant. Remove tape upon finishing sealing work.

Cleaning

35. Cleaning: Comply with requirements of Detailed Scope of Work.
 - a. Clean bathtub liners and surrounds after installation is completed with materials compatible with porcelain enamel and having no detrimental effects on porcelain enamel.

END OF SECTION 01 95 22 00a



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Task	Specification	Specification Description
01 95 22 00	01 22 16 00	No Specification Required
01 95 22 00	01 95 06 00c	Interior Architectural Woodwork



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SECTION 01 95 23 00 - PACKAGED TERMINAL AIR CONDITIONERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for packaged terminal air conditioners. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes packaged terminal air conditioners and their accessories and controls, in the following configurations:
 - a. Through-the-wall and freestanding air conditioners.
 - b. Cooling-only units.
 - c. Heat-pump units.
 - d. Cooling units with electric heat.
 - e. Cooling units with hydronic heat.
 - f. Cooling units with indirect-fired gas heat.

C. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:
 - a. Product Data for Credit EA 4: Documentation required by Credit EA 4 indicating that equipment and refrigerants comply.
 - b. Product Data for Prerequisite EQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
3. Shop Drawings: For packaged terminal air conditioners. Include plans, elevations, sections, details for wall penetrations, seismic bracing, **as directed**, and attachments to other work.
 - a. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - b. Wiring Diagrams: For power, signal, and control wiring.
4. Color Samples: For unit cabinet, discharge grille, and exterior louver, and for each color and texture specified.
5. Field quality-control reports.
6. Operation and maintenance data.
7. Warranty: Sample of special warranty.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - "Ventilation Rate Procedures," and Section 7 - "Construction and Startup."
3. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

E. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of packaged terminal air conditioners that fail in materials or workmanship within specified warranty period.
 - a. Warranty Period for Sealed Refrigeration System: Manufacturer's standard, but not less than five years from date of Final Completion, including components and labor.
 - b. Warranty Period for Nonsealed System Parts: Manufacturer's standard, but not less than five years from date of Final Completion, including only components and excluding labor.



- c. Warranty Period for Heat Exchangers: Manufacturer's standard, but not less than five years from date of Final Completion.

1.2 PRODUCTS

A. Manufactured Units

1. Description: Factory-assembled and -tested, self-contained, packaged terminal air conditioner with room cabinet, electric refrigeration system, heating, **as directed**, and temperature controls; fully charged with refrigerant and filled with oil; with cord-connected **OR** hardwired, **as directed**, chassis.

B. Chassis

1. Cabinet: 0.052-inch- (1.32-mm-) thick steel with removable front panel with concealed latches.
 - a. Mounting: Wall with wall sleeve **OR** Floor with subbase, **as directed**.
 - b. Discharge Grille: Punched-louver discharge grille allowing four-way discharge-air pattern **OR** Extruded-aluminum discharge grille **OR** Reversible polycarbonate discharge grille allowing upward and horizontal airflow, **as directed**.
 - c. Louvers: Extruded aluminum with enamel finish **OR** Stamped aluminum with clear-anodized finish **OR** Stamped steel with enamel finish, **as directed**; white **OR** bronze **OR** brown **OR** beige, **as directed**, color.
 - d. Finish: Epoxy coating **OR** Baked enamel, **as directed**.
 - e. Access Door: Hinged door in top of cabinet for access to controls.
 - f. Cabinet Extension: Matching cabinet in construction and finish, allowing diversion of airflow to adjoining room; with grille.
 - g. Finish of Interior Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
 - h. Subbase: Enameled steel with adjustable leveling feet and adjustable end plates, with factory-installed and -wired, fused disconnect switch and receptacle sized for unit, **as directed**.
 - i. Wall Sleeves: Galvanized steel with polyester finish **OR** Molded polymer **OR** Molded fiberglass-reinforced polyester, **as directed**.
2. Refrigeration System: Direct-expansion indoor coil with capillary restrictor; and hermetically sealed scroll compressor with vibration isolation and overload protection.
 - a. Indoor and Outdoor Coils: Seamless copper tubes mechanically expanded into aluminum fins with capillary tube distributor on indoor coil, **as directed**.
 - b. Accumulator.
 - c. Constant-pressure expansion valve.
 - d. Reversing valve.
 - e. Charge: R-407C **OR** R-410A, **as directed**.
3. Indoor Fan: Forward curved, centrifugal; with motor and positive-pressure ventilation damper with concealed manual **OR** electric, **as directed**, operator.
4. Filters: Washable polyurethane in molded plastic frame.
5. Condensate Drain: Drain pan to direct condensate to outdoor coil for re-evaporation **OR** and piping to direct condensate to building waste and vent piping, **as directed**.
 - a. Comply with ASHRAE 62.1 for drain pan construction and connections.
6. Outdoor Fan: Forward curved, centrifugal **OR** Propeller, **as directed**, type with separate **OR** driven by indoor fan, **as directed**, motor.
 - a. Indoor and Outdoor Fan Motors: Two speed; comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - 1) Fan Motors: Permanently lubricated split capacitor.
 - 2) Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.



- 3) Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 22.

C. Heating

1. Electric-Resistance Heating Coil: Nickel-chromium-wire, electric-resistance heating elements with contactor and high-temperature-limit switch.
OR
Hot-Water Heating Coil: Seamless copper tubes mechanically expanded into aluminum fins with two-way modulating control valve and air vent.
OR
Gas Heat:
 - a. General Requirements for Gas-Fired, Noncondensing Furnaces: Factory assembled, piped, wired, and tested; complying with ANSI Z21.86/CSA 2.32, "Vented Gas-Fired Space Heating Appliances," and with NFPA 54.
 - b. Type of Gas: Natural **OR** Propane, **as directed**.
 - c. Heat Exchanger: Aluminized-steel **OR** Stainless steel, **as directed**.
 - d. Burner:
 - 1) Gas Valve: 100 percent safety two-stage **OR** modulating, **as directed**, main gas valve, main shutoff valve, pressure regulator, safety pilot with electronic flame sensor, limit control, transformer, and combination ignition/fan timer control board.
 - 2) Ignition: Electric pilot ignition with hot-surface igniter or electric spark ignition.
 - e. Gas-Burner Safety Controls:
 - 1) Electronic Flame Sensor: Prevents gas valve from opening until pilot flame is proven; stops gas flow on ignition failure.
 - 2) Flame Rollout Switch: Installed on burner box; prevents burner operation.
 - 3) Limit Control: Fixed stop at maximum permissible setting; de-energizes burner on excessive bonnet temperature; automatic reset.
 - f. Combustion-Air Inducer: Centrifugal fan prepurges heat exchanger and vents combustion products; thermally protected motor with sleeve bearings; pressure switch prevents operation if combustion-air inlet or flue outlet is blocked.
 - g. Furnace Controls: Solid-state board integrates ignition, heat, cooling, and fan speeds; adjustable fan-on and fan-off timing; and terminals for connection to accessories.

D. Controls

1. Control Module: Unit-mounted digital panel with touchpad temperature control and with touchpad for heating, cooling, and fan operation. Include the following features:
 - a. Low Ambient Lockout Control: Prevents cooling-cycle operation below 40 deg F (5 deg C) outdoor air temperature.
 - b. Heat-Pump Ambient Control: Field-adjustable switch changes to heat-pump heating operation above 40 deg F (5 deg C) and to supplemental heating below plus 25 deg F (minus 4 deg C).
 - c. Temperature-Limit Control: Prevents occupant from exceeding preset setback **OR** setup, **as directed**, temperature.
 - d. Building Automation System Interface: Allows remote on-off control with setback temperature control.
 - e. Reverse-Cycle Defrost: Solid-state sensor monitors frost buildup on indoor **OR** outdoor, **as directed**, coil and reverses unit to melt frost.
2. Remote Control: Standard unit-mounted controls with remote-mounted, low-voltage adjustable thermostat with heat anticipator, heat-off-cool-auto **OR** heat-off-cool, **as directed**, switch, and on-auto, **as directed**, fan switch.
3. Outdoor Air: Manual **OR** Motorized, **as directed**, intake damper. Open intake when unit indoor air fan runs, **as directed**.

E. Source Quality Control

1. Sound-Power Level Ratings: Factory test to comply with ARI 300, "Sound Rating and Sound Transmission Loss of Packaged Terminal Equipment."



2. Unit Performance Ratings: Factory test to comply with ARI 310/380/CSA C744, "Packaged Terminal Air-Conditioners and Heat Pumps."

1.3 EXECUTION

A. Installation

1. Install units level and plumb, maintaining manufacturer's recommended clearances and tolerances.
2. Install wall sleeves in finished wall assembly; seal and weatherproof. Joint-sealant materials and applications are specified in Division 07 Section "Joint Sealants".
3. Install and anchor wall sleeves to withstand, without damage to equipment and structure, seismic forces required by building code.

B. Connections

1. Comply with requirements for piping specified in Division 23 Section "Hydronic Piping". Drawings indicate general arrangement of piping, fittings, and specialties.
2. Comply with requirements for piping specified in Division 23 Section "Facility Natural-gas Piping". Drawings indicate general arrangement of piping, fittings, and specialties.
3. Install piping adjacent to machine to allow service and maintenance.

C. Field Quality Control

1. Perform tests and inspections.
2. Tests and Inspections:
 - a. Inspect for and remove shipping bolts, blocks, and tie-down straps.
 - b. After installing packaged terminal air conditioners and after electrical circuitry has been energized, test for compliance with requirements.
 - c. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - d. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Packaged terminal air conditioners will be considered defective if they do not pass tests and inspections.
4. Prepare test and inspection reports.

D. Startup Service

1. Perform startup service.
2. After installation, verify the following:
 - a. Unit is level on base and is flashed in exterior wall.
 - b. Unit casing has no visible damage.
 - c. Compressor, air-cooled condenser coil, and fans have no visible damage.
 - d. Labels are clearly visible.
 - e. Controls are connected and operable.
 - f. Shipping bolts, blocks, and tie-down straps are removed.
 - g. Filters are installed and clean.
 - h. Drain pan and drain line are installed correctly.
 - i. Electrical wiring installation complies with manufacturer's submittal and installation requirements in Division 22.
 - j. Installation. Perform startup checks according to manufacturer's written instructions, including the following:
 - 1) Lubricate bearings on fan.
 - 2) Check fan-wheel rotation for correct direction without vibration and binding.
3. After startup service and performance test, change filters.

E. Adjusting



1. Adjust initial temperature set points.
2. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

F. Demonstration

1. Train Owner's maintenance personnel to adjust, operate, and maintain packaged terminal air conditioners.

END OF SECTION 01 95 23 00



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Task	Specification	Specification Description
01 95 23 00	01 22 16 00	No Specification Required



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SECTION 01 95 26 00 - POWER VENTILATORS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for power ventilators. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Utility set fans.
 - b. Centrifugal roof ventilators.
 - c. Axial roof ventilators.
 - d. Upblast propeller roof exhaust fans.
 - e. Centrifugal wall ventilators.
 - f. Ceiling-mounting ventilators.
 - g. In-line centrifugal fans.
 - h. Propeller fans.

C. Performance Requirements

1. Project Altitude: Base fan-performance ratings on actual Project site elevations **OR** sea level, **as directed**.
2. Operating Limits: Classify according to AMCA 99.

D. Submittals

1. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also include the following:
 - a. Certified fan performance curves with system operating conditions indicated.
 - b. Certified fan sound-power ratings.
 - c. Motor ratings and electrical characteristics, plus motor and electrical accessories.
 - d. Material thickness and finishes, including color charts.
 - e. Dampers, including housings, linkages, and operators.
 - f. Roof curbs.
 - g. Fan speed controllers.
2. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - a. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - b. Wiring Diagrams: For power, signal, and control wiring.
3. Delegated-Design Submittal: For unit hangars and supports indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - a. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
 - b. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
4. Field quality-control reports.
 - a. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

E. Quality Assurance



1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency, and marked for intended use.
2. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.
3. UL Standard: Power ventilators shall comply with UL 705. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.

1.2 PRODUCTS

A. Utility Set Fans

1. Description: Direct **OR** Belt, **as directed**, -driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, and accessories.
2. Housing: Fabricated of galvanized, **as directed**, steel with side sheets fastened with a deep lock seam or welded to scroll sheets.
 - a. Housing Discharge Arrangement: Adjustable to eight standard positions.
3. Fan Wheels: Single-width, single inlet; welded to cast-iron or cast-steel hub and spun-steel inlet cone, with hub keyed to shaft.
 - a. Blade Materials: Steel **OR** Aluminum, **as directed**.
 - b. Blade Type: Backward inclined **OR** Forward curved **OR** Airfoil, **as directed**.
 - c. Spark-Resistant Construction: AMCA 99, Type A **OR** B **OR** C, **as directed**.
4. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
5. Shaft Bearings: Prelubricated and sealed, self-aligning, pillow-block-type ball bearings with ABMA 9, L₅₀ of 200,000 hours **OR** L₁₀ of 80,000 hours, **as directed**.
6. Belt Drives:
 - a. Factory mounted, with final alignment and belt adjustment made after installation.
 - b. Service Factor Based on Fan Motor Size: 1.5 **OR** 1.4 **OR** 1.3 **OR** 1.2, **as directed**.
 - c. Motor Pulleys: Adjustable pitch for use with motors through 5, **as directed**, hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
 - d. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
 - e. Belt Guards: Fabricate of steel for motors mounted on outside of fan cabinet.
7. Accessories:
 - a. Inlet and Outlet: Flanged.
 - b. Companion Flanges: Rolled flanges for duct connections of same material as housing.
 - c. Backdraft Dampers: Gravity actuated with counterweight and interlocking aluminum blades with felt edges in steel frame installed on fan discharge.
 - d. Access Door: Gasketed door in scroll with latch-type handles.
 - e. Scroll Dampers: Single-blade damper installed at fan scroll top with adjustable linkage.
 - f. Inlet Screens: Removable wire mesh.
 - g. Drain Connections: NPS 3/4 (DN 20) threaded coupling drain connection installed at lowest point of housing.
 - h. Weather Hoods: Weather resistant with stamped vents over motor and drive compartment.
 - i. Discharge Dampers: Assembly with parallel **OR** opposed, **as directed**, blades constructed of two plates formed around and to shaft, channel frame, sealed ball bearings, with blades linked outside of airstream to single control lever of same material as housing.
 - j. Variable Inlet Vanes: With blades supported at both ends with two permanently lubricated bearings of same material as housing. Variable mechanism terminating in single control lever with control shaft for double-width fans.
 - k. Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.

B. Centrifugal Roof Ventilators

1. Description: Direct- or belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.



2. Housing: Removable, spun-aluminum, dome top and outlet baffle **OR** extruded-aluminum, rectangular top **OR** galvanized steel, mushroom-domed top, **as directed**; square, one-piece, aluminum base with venturi inlet cone.
 - a. Upblast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains and grease collector, **as directed**.
 - b. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.
 3. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.
 4. Belt-Driven Drive:
 - a. Resiliently mounted to housing.
 - b. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
 - c. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
 - d. Pulleys: Cast-iron, adjustable-pitch motor pulley.
 - e. Fan and motor isolated from exhaust airstream.
 5. Accessories:
 - a. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
 - b. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside **OR** outside, **as directed**, fan housing, factory wired through an internal aluminum conduit.
 - c. Bird Screens: Removable, 1/2-inch (13-mm) mesh, aluminum or brass wire.
 - d. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.
 - e. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.
 6. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- (40-mm-) thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch (40-mm) wood nailer. Size as required to suit roof opening and fan base.
 - a. Configuration: Self-flashing without a cant strip, with mounting flange **OR** Built-in cant and mounting flange **OR** Built-in raised cant and mounting flange, **as directed**.
 - b. Overall Height: 8 inches (200 mm) **OR** 9-1/2 inches (240 mm) **OR** 12 inches (300 mm) **OR** 16 inches (400 mm) **OR** 18 inches (450 mm), **as directed**.
 - c. Sound Curb: Curb with sound-absorbing insulation matrix.
 - d. Pitch Mounting: Manufacture curb for roof slope.
 - e. Metal Liner: Galvanized steel.
 - f. Burglar Bars: 1/2-inch- (13-mm-) **OR** 5/8-inch- (16-mm-) **OR** 3/4-inch- (19-mm-), **as directed**, thick steel bars welded in place to form 6-inch (150-mm) squares.
 - g. Mounting Pedestal: Galvanized steel with removable access panel.
 - h. Vented Curb: Unlined with louvered vents in vertical sides.
- C. Axial Roof Ventilators
1. Description: Direct- or belt-driven axial fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.
 2. Housing: Heavy-gage, removable, spun-aluminum, dome top and outlet baffle; square, one-piece, hinged, aluminum base.
 - a. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.
 3. Fan Wheel: Aluminum **OR** Steel, **as directed**, hub and blades.
 4. Belt-Driven Drive Assembly: Resiliently mounted to housing, with the following features:
 - a. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
 - b. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
 - c. Pulleys: Cast-iron, adjustable-pitch motor pulley.
 5. Accessories:
 - a. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside **OR** outside, **as directed**, fan housing, factory wired through an internal aluminum conduit.
 - b. Bird Screens: Removable, 1/2-inch (13-mm) mesh, aluminum or brass wire.



- c. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.
 - d. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.
6. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- (40-mm-) thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch (40-mm) wood nailer. Size as required to suit roof opening and fan base.
- a. Configuration: Self-flashing without a cant strip, with mounting flange **OR** Built-in cant and mounting flange **OR** Built-in raised cant and mounting flange, **as directed**.
 - b. Overall Height: 8 inches (200 mm) **OR** 9-1/2 inches (240 mm) **OR** 12 inches (300 mm) **OR** 16 inches (400 mm) **OR** 18 inches (450 mm), **as directed**.
 - c. Sound Curb: Curb with sound-absorbing insulation matrix.
 - d. Pitch Mounting: Manufacture curb for roof slope.
 - e. Metal Liner: Galvanized steel.
 - f. Burglar Bars: 1/2-inch- (13-mm-) **OR** 5/8-inch- (16-mm-) **OR** 3/4-inch- (19-mm-), **as directed**, thick steel bars welded in place to form 6-inch (150-mm) squares.
 - g. Mounting Pedestal: Galvanized steel with removable access panel.
- D. Upblast Propeller Roof Exhaust Fans
1. Description: Direct- or belt-driven propeller fans consisting of housing, wheel, butterfly-type discharge damper, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.
 2. Wind Band, Fan Housing, and Base: Reinforced and braced galvanized steel **OR** aluminum, **as directed**, containing galvanized-steel **OR** aluminum, **as directed**, butterfly dampers and rain trough, motor and drive assembly, and fan wheel.
 - a. Damper Rods: Steel with bronze **OR** nylon, **as directed**, bearings.
 - b. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.
 3. Fan Wheel: Replaceable, cast **OR** extruded, **as directed**, -aluminum, airfoil blades fastened to cast-aluminum hub; factory set pitch angle of blades.
 4. Belt-Driven Drive Assembly: Resiliently mounted to housing; weatherproof housing of same material as fan housing with the following features:
 - a. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
 - b. Shaft Bearings: Prelubricated and sealed, self-aligning, pillow-block-type ball bearings.
 - c. Pulleys: Cast-iron, adjustable-pitch motor pulley.
 - d. Motor Mount: On outside of fan cabinet, adjustable base for belt tensioning.
 5. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- (40-mm-) thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch (40-mm) wood nailer. Size as required to suit roof opening and fan base.
 - a. Configuration: Self-flashing without a cant strip, with mounting flange **OR** Built-in cant and mounting flange **OR** Built-in raised cant and mounting flange, **as directed**.
 - b. Overall Height: 8 inches (200 mm) **OR** 9-1/2 inches (240 mm) **OR** 12 inches (300 mm) **OR** 16 inches (400 mm) **OR** 18 inches (450 mm), **as directed**.
 - c. Sound Curb: Curb with sound-absorbing insulation matrix.
 - d. Pitch Mounting: Manufacture curb for roof slope.
 - e. Metal Liner: Galvanized steel.
 - f. Burglar Bars: 1/2-inch- (13-mm-) **OR** 5/8-inch- (16-mm-) **OR** 3/4-inch- (19-mm-), **as directed**, thick steel bars welded in place to form 6-inch (150-mm) squares.
 - g. Mounting Pedestal: Galvanized steel with removable access panel.
- E. Centrifugal Wall Ventilators
1. Description: Direct- or belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, and accessories.
 2. Housing: Heavy-gage, removable, spun-aluminum, dome top and outlet baffle; venturi inlet cone.
 3. Fan Wheel: Aluminum hub and wheel with backward-inclined blades.



4. Belt-Driven Drive Assembly: Resiliently mounted to housing, with the following features:
 - a. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
 - b. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
 - c. Pulleys: Cast-iron, adjustable-pitch motor pulley.
 - d. Fan and motor isolated from exhaust airstream.
 5. Accessories:
 - a. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
 - b. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through internal aluminum conduit.
 - c. Bird Screens: Removable, 1/2-inch (13-mm) mesh, aluminum or brass wire.
 - d. Wall Grille: Ring type for flush mounting.
 - e. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in wall sleeve; factory set to close when fan stops.
 - f. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.
- F. Ceiling-Mounting Ventilators
1. Description: Centrifugal fans designed for installing in ceiling or wall or for concealed in-line applications.
 2. Housing: Steel, lined with acoustical insulation.
 3. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.
 4. Grille: Plastic **OR** Stainless steel **OR** Aluminum **OR** Painted aluminum, **as directed**, louvered grille with flange on intake and thumbscrew attachment to fan housing.
 5. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.
 6. Accessories:
 - a. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
 - b. Manual Starter Switch: Single-pole rocker switch assembly with cover and pilot light.
 - c. Time-Delay Switch: Assembly with single-pole rocker switch, timer, and cover plate.
 - d. Motion Sensor: Motion detector with adjustable shutoff timer.
 - e. Ceiling Radiation Damper: Fire-rated assembly with ceramic blanket, stainless-steel springs, and fusible link.
 - f. Filter: Washable aluminum to fit between fan and grille.
 - g. Isolation: Rubber-in-shear vibration isolators.
 - h. Manufacturer's standard roof jack or wall cap, and transition fittings.
- G. In-Line Centrifugal Fans
1. Description: In-line, direct **OR** belt, **as directed**, -driven centrifugal fans consisting of housing, wheel, outlet guide vanes, fan shaft, bearings, motor and disconnect switch, drive assembly, mounting brackets, and accessories.
 2. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.
 3. Direct-Driven Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing; with wheel, inlet cone, and motor on swing-out service door, **as directed**.
 4. Belt-Driven Units: Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.
 5. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.
 6. Accessories:
 - a. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
 - b. Volume-Control Damper: Manually operated with quadrant lock, located in fan outlet.
 - c. Companion Flanges: For inlet and outlet duct connections.



- d. Fan Guards: 1/2- by 1-inch (13- by 25-mm) mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.
- e. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.

H. Propeller Fans

1. Description: Direct- or belt-driven propeller fans consisting of fan blades, hub, housing, orifice ring, motor, drive assembly, and accessories.
2. Housing: Galvanized-steel sheet with flanged edges and integral orifice ring with baked-enamel finish coat applied after assembly.
3. Steel Fan Wheels: Formed-steel blades riveted to heavy-gage steel spider bolted to cast-iron hub.
4. Fan Wheel: Replaceable, cast **OR** extruded, **as directed**, -aluminum, airfoil blades fastened to cast-aluminum hub; factory set pitch angle of blades.
5. Belt-Driven Drive Assembly: Resiliently mounted to housing, statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.
 - a. Service Factor Based on Fan Motor Size: 1.4.
 - b. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
 - c. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
 - 1) Ball-Bearing Rating Life: ABMA 9, L₁₀ of 100,000 hours.
 - d. Pulleys: Cast iron with split, tapered bushing; dynamically balanced at factory.
 - e. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
 - f. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
 - g. Belt Guards: Fabricate of steel for motors mounted on outside of fan cabinet.
6. Accessories:
 - a. Gravity Shutters: Aluminum blades in aluminum frame; interlocked blades with nylon bearings.
 - b. Motor-Side Back Guard: Galvanized steel, complying with OSHA specifications, removable for maintenance.
 - c. Wall Sleeve: Galvanized steel to match fan and accessory size.
 - d. Weathershield Hood: Galvanized steel to match fan and accessory size.
 - e. Weathershield Front Guard: Galvanized steel with expanded metal screen.
 - f. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
 - g. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.

I. Motors

1. Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".
2. Enclosure Type: Open dripproof **OR** Totally enclosed, fan cooled, **as directed**.

J. Source Quality Control

1. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
2. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."



1.3 EXECUTION

A. Installation

1. Install power ventilators level and plumb.
2. Support units using elastomeric mounts **OR** restrained elastomeric mounts **OR** spring isolators **OR** restrained spring isolators, **as directed**, having a static deflection of 1 inch (25 mm). Vibration- and seismic-control devices are specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 - a. Secure vibration and seismic controls to concrete bases using anchor bolts cast in concrete base.
3. For projects not in seismic areas, install floor-mounting units on concrete bases. Concrete, reinforcement, and formwork requirements are specified in Division 03 Section "Cast-in-place Concrete".
4. For projects in seismic areas, install floor-mounting units on concrete bases designed to withstand, without damage to equipment, the seismic force required by code. Concrete, reinforcement, and formwork requirements are specified in Division 03 Section "Cast-in-place Concrete".
5. Secure roof-mounting fans to roof curbs with cadmium-plated hardware. Refer to Division 07 Section "Roof Accessories" for installation of roof curbs.
6. Ceiling Units: Suspend units from structure; use steel wire or metal straps.
7. Support suspended units from structure using threaded steel rods and elastomeric hangers **OR** spring hangers **OR** spring hangers with vertical-limit stops, **as directed**, having a static deflection of 1 inch (25 mm). Vibration-control devices are specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
8. Install units with clearances for service and maintenance.
9. Label units according to requirements specified in Division 23 Section "Identification For Hvac Piping And Equipment".
10. Duct installation and connection requirements are specified in other Division 21. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Air Duct Accessories".
11. Install ducts adjacent to power ventilators to allow service and maintenance.
12. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
13. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

B. Field Quality Control

1. Perform the following field tests and inspections and prepare test reports:
 - a. Verify that shipping, blocking, and bracing are removed.
 - b. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 - c. Verify that cleaning and adjusting are complete.
 - d. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
 - e. Adjust belt tension.
 - f. Adjust damper linkages for proper damper operation.
 - g. Verify lubrication for bearings and other moving parts.
 - h. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
 - i. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
 - j. Shut unit down and reconnect automatic temperature-control operators.
 - k. Remove and replace malfunctioning units and retest as specified above.



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2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

END OF SECTION 01 95 26 00



SECTION 01 95 26 00a - INTERIOR LIGHTING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for interior lighting. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Interior lighting fixtures, lamps, and ballasts.
 - b. Emergency lighting units.
 - c. Exit signs.
 - d. Lighting fixture supports.
 - e. Retrofit kits for fluorescent lighting fixtures.

C. Definitions

1. BF: Ballast factor.
2. CCT: Correlated color temperature.
3. CRI: Color-rendering index.
4. HID: High-intensity discharge.
5. LER: Luminaire efficacy rating.
6. Lumen: Measured output of lamp and luminaire, or both.
7. Luminaire: Complete lighting fixture, including ballast housing if provided.

D. Submittals

1. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
 - a. Physical description of lighting fixture including dimensions.
 - b. Emergency lighting units including battery and charger.
 - c. Ballast, including BF.
 - d. Energy-efficiency data.
 - e. Air and Thermal Performance Data: For air-handling lighting fixtures. Furnish data required in "Submittals" Article in Division 23 Section "Diffusers, Registers, And Grilles".
 - f. Sound Performance Data: For air-handling lighting fixtures. Indicate sound power level and sound transmission class in test reports certified according to standards specified in Division 23 Section "Diffusers, Registers, And Grilles".
 - g. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.
 - h. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.
 - 1) Testing Agency Certified Data: For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by manufacturer.
OR
Manufacturer Certified Data: Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
2. Shop Drawings: For nonstandard or custom lighting fixtures. Include plans, elevations, sections, details, and attachments to other work.



- a. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - b. Wiring Diagrams: For power, signal, and control wiring.
 3. Samples: For each lighting fixture indicated in the Interior Lighting Fixture Schedule. Each Sample shall include the following:
 - a. Lamps and ballasts, installed.
 - b. Cords and plugs.
 - c. Pendant support system.
 4. Installation instructions.
 5. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - a. Lighting fixtures.
 - b. Suspended ceiling components.
 - c. Partitions and millwork that penetrate the ceiling or extends to within 12 inches (305 mm) of the plane of the luminaires.
 - d. Ceiling-mounted projectors.
 - e. Structural members to which suspension systems for lighting fixtures will be attached.
 - f. Other items in finished ceiling including the following:
 - 1) Air outlets and inlets.
 - 2) Speakers.
 - 3) Sprinklers.
 - 4) Smoke and fire detectors.
 - 5) Occupancy sensors.
 - 6) Access panels.
 - g. Perimeter moldings.
 6. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.
 7. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, from manufacturer.
 8. Field quality-control reports.
 9. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.
 - a. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.
 10. Warranty: Sample of special warranty.
- E. Quality Assurance
1. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.
- OR**
- Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910, complying with the IESNA Lighting Measurements Testing & Calculation Guides.
2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 3. Comply with NFPA 70.
 4. FM Global Compliance: Lighting fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
- F. Coordination
1. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.



G. Warranty

1. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.
 - a. Warranty Period for Emergency Lighting Unit Batteries: 10 years from date of Final Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.
 - b. Warranty Period for Emergency Fluorescent Ballast and Self-Powered Exit Sign Batteries: Seven years from date of Final Completion. Full warranty shall apply for first year, and prorated warranty for the remaining six years.

1.2 PRODUCTS

A. General Requirements For Lighting Fixtures And Components

1. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
2. Incandescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5A.
3. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.
4. HID Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5B.
5. Metal Parts: Free of burrs and sharp corners and edges.
6. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.
7. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
8. Diffusers and Globes:
 - a. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - 1) Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.
 - 2) UV stabilized.
 - b. Glass: Annealed crystal glass unless otherwise indicated.
9. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
 - a. Label shall include the following lamp and ballast characteristics:
 - 1) "USE ONLY" and include specific lamp type.
 - 2) Lamp diameter code (T-4, T-5, T-8, T-12, etc.), tube configuration (twin, quad, triple, etc.), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.
 - 3) Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.
 - 4) Start type (preheat, rapid start, instant start, etc.) for fluorescent and compact fluorescent luminaires.
 - 5) ANSI ballast type (M98, M57, etc.) for HID luminaires.
 - 6) CCT and CRI for all luminaires.
10. Electromagnetic-Interference Filters: Factory installed to suppress conducted electromagnetic interference as required by MIL-STD-461E. Fabricate lighting fixtures with one filter on each ballast indicated to require a filter.
11. Air-Handling Fluorescent Fixtures: For use with plenum ceiling for air return and heat extraction and for attaching an air-diffuser-boot assembly specified in Division 15 Section "Diffusers, Registers, and Grilles."
 - a. Air-Supply Units: Slots in one or both side trims join with air-diffuser-boot assemblies.



- b. Heat-Removal Units: Air path leads through lamp cavity.
- c. Combination Heat-Removal and Air-Supply Unit: Heat is removed through lamp cavity at both ends of the fixture door with air supply same as for air-supply units.
- d. Dampers: Operable from outside fixture for control of return-air volume.
- e. Static Fixture: Air-supply slots are blanked off, and fixture appearance matches active units.

B. Ballasts For Linear Fluorescent Lamps

1. General Requirements for Electronic Ballasts:
 - a. Comply with UL 935 and with ANSI C82.11.
 - b. Designed for type and quantity of lamps served.
 - c. Ballasts shall be designed for full light output unless another BF, dimmer, or bi-level control is indicated.
 - d. Sound Rating: Class A **OR** Class A except Class B for T8/HO and T12/Slimline lamp ballasts, **as directed**.
 - e. Total Harmonic Distortion Rating: Less than 10 **OR** 20, **as directed**, percent.
 - f. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
 - g. Operating Frequency: 42 kHz or higher.
 - h. Lamp Current Crest Factor: 1.7 or less.
 - i. BF: 0.88 or higher.
 - j. Power Factor: 0.95 **OR** 0.98, **as directed**, or higher.
 - k. Parallel Lamp Circuits: Multiple lamp ballasts shall comply with ANSI C82.11 and shall be connected to maintain full light output on surviving lamps if one or more lamps fail.
2. Luminaires controlled by occupancy sensors shall have programmed-start ballasts.
3. Electronic Programmed-Start Ballasts for T5 **OR** T8 **OR** T5HO **OR** T5 and T5HO, **as directed**, Lamps: Comply with ANSI C82.11 and the following:
 - a. Lamp end-of-life detection and shutdown circuit for T5 diameter lamps.
 - b. Automatic lamp starting after lamp replacement.
4. Electromagnetic Ballasts: Comply with ANSI C82.1; energy saving, high-power factor, Class P, and having automatic-reset thermal protection.
 - a. Ballast Manufacturer Certification: Indicated by label.
5. Single Ballasts for Multiple Lighting Fixtures: Factory wired with ballast arrangements and bundled extension wiring to suit final installation conditions without modification or rewiring in the field.
6. Ballasts for Low-Temperature Environments:
 - a. Temperatures 0 Deg F (Minus 17 Deg C) and Higher: Electronic or electromagnetic type rated for 0 deg F (minus 17 deg C) starting and operating temperature with indicated lamp types.
 - b. Temperatures Minus 20 Deg F (Minus 29 Deg C) and Higher: Electromagnetic type designed for use with indicated lamp types.
7. Ballasts for Residential Applications: Fixtures designated as "Residential" may use low-power-factor electronic ballasts having a Class B sound rating and total harmonic distortion of approximately 30 percent.
8. Ballasts for Low Electromagnetic-Interference Environments: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for consumer equipment.
9. Ballasts for Dimmer-Controlled Lighting Fixtures: Electronic type.
 - a. Dimming Range: 100 to 5 percent of rated lamp lumens.
 - b. Ballast Input Watts: Can be reduced to 20 percent of normal.
 - c. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.
 - d. Control: Coordinate wiring from ballast to control device to ensure that the ballast, controller, and connecting wiring are compatible.
10. Ballasts for Bi-Level Controlled Lighting Fixtures: Electronic type.



- a. Operating Modes: Ballast circuit and leads provide for remote control of the light output of the associated lamp between high- and low-level and off.
 - 1) High-Level Operation: 100 percent of rated lamp lumens.
 - 2) Low-Level Operation: 30 percent of rated lamp lumens.
 - b. Ballast shall provide equal current to each lamp in each operating mode.
 - c. Compatibility: Certified by manufacturer for use with specific bi-level control system and lamp type indicated.
11. Ballasts for Tri-Level Controlled Lighting Fixtures: Electronic type.
- a. Operating Modes: Ballast circuit and leads provide for remote control of the light output of the associated lamp between high- and low-level and off.
 - 1) High-Level Operation: 100 percent of rated lamp lumens.
 - 2) Low-Level Operation: 30 and 50 **OR** 30 and 60, **as directed**, percent of rated lamp lumens.
 - b. Ballast shall provide equal current to each lamp in each operating mode.
 - c. Compatibility: Certified by manufacturer for use with specific tri-level control system and lamp type indicated.
- C. Ballasts For Compact Fluorescent Lamps
1. Description: Electronic-programmed rapid-start type, complying with UL 935 and with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:
 - a. Lamp end-of-life detection and shutdown circuit.
 - b. Automatic lamp starting after lamp replacement.
 - c. Sound Rating: Class A.
 - d. Total Harmonic Distortion Rating: Less than 20 percent.
 - e. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
 - f. Operating Frequency: 20 kHz or higher.
 - g. Lamp Current Crest Factor: 1.7 or less.
 - h. BF: 0.95 or higher unless otherwise indicated.
 - i. Power Factor: 0.95 **OR** 0.98, **as directed**, except fixtures designated as "Residential" may use low-power-factor electronic ballasts, **as directed**, or higher.
 - j. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.
- D. Emergency Fluorescent Power Unit
1. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast. Comply with UL 924.
 - a. Emergency Connection: Operate one fluorescent lamp(s) continuously at an output of 1100 lumens each. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
 - b. Nightlight Connection: Operate one fluorescent lamp continuously.
 - c. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
 - 1) Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - 2) Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - d. Battery: Sealed, maintenance-free, nickel-cadmium type.
 - e. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
 - f. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.



- g. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.
- 2. External Type: Self-contained, modular, battery-inverter unit, suitable for powering one or more fluorescent lamps, remote mounted from lighting fixture. Comply with UL 924.
 - a. Emergency Connection: Operate one fluorescent lamp continuously. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
 - b. Nightlight Connection: Operate one fluorescent lamp in a remote fixture continuously.
 - c. Battery: Sealed, maintenance-free, nickel-cadmium type.
 - d. Charger: Fully automatic, solid-state, constant-current type.
 - e. Housing: NEMA 250, Type 1 enclosure.
 - f. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - g. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - h. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
 - i. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

E. Ballasts For HID Lamps

- 1. Electromagnetic Ballast for Metal-Halide Lamps: Comply with ANSI C82.4 and UL 1029. Include the following features unless otherwise indicated:
 - a. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
 - b. Minimum Starting Temperature: Minus 22 deg F (Minus 30 deg C) for single-lamp ballasts.
 - c. Rated Ambient Operating Temperature: 104 deg F (40 deg C).
 - d. Open-circuit operation that will not reduce average life.
 - e. Low-Noise Ballasts: Manufacturers' standard epoxy-encapsulated models designed to minimize audible fixture noise.
- 2. Electronic Ballast for Metal-Halide Lamps: Include the following features unless otherwise indicated:
 - a. Minimum Starting Temperature: Minus 20 deg F (Minus 29 deg C) for single-lamp ballasts.
 - b. Rated Ambient Operating Temperature: 130 deg F (54 deg C).
 - c. Lamp end-of-life detection and shutdown circuit.
 - d. Sound Rating: Class A.
 - e. Total Harmonic Distortion Rating: Less than 20 percent.
 - f. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
 - g. Lamp Current Crest Factor: 1.5 or less.
 - h. Power Factor: 0.90 or higher.
 - i. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.
 - j. Protection: Class P thermal cutout.
 - k. Bi-Level Dimming Ballast: Ballast circuit and leads provide for remote control of the light output of the associated fixture between high- and low-level and off.
 - 1) High-Level Operation: 100 percent of rated lamp lumens.
 - 2) Low-Level Operation: 35 **OR** 50, **as directed**, percent of rated lamp lumens.
 - 3) Compatibility: Certified by ballast manufacturer for use with specific bi-level control system and lamp type indicated. Certified by lamp manufacturer that ballast operating modes are free from negative effect on lamp life and color-rendering capability.
 - l. Continuous Dimming Ballast: Dimming range shall be from 100 to 35 percent of rated lamp lumens without flicker.



- 1) Ballast Input Watts: Reduced to a maximum of 50 percent of normal at lowest dimming setting.
 3. High-Pressure Sodium Ballasts: Electromagnetic type, with solid-state igniter/starter. Igniter/starter shall have an average life in pulsing mode of 10,000 hours at an igniter/starter-case temperature of 90 deg C.
 - a. Instant-Restrike Device: Integral with ballast, or solid-state potted module, factory installed within fixture and compatible with lamps, ballasts, and mogul sockets up to 150 W.
 - b. Minimum Starting Temperature: Minus 40 deg F (Minus 40 deg C).
- F. Quartz Lamp Lighting Controller
1. General Requirements for Controllers: Factory installed by lighting fixture manufacturer. Comply with UL 1598.
 2. Standby (Quartz Restrike): Automatically switches quartz lamp on when a HID lamp in the fixture is initially energized and during the HID lamp restrike period after brief power outages.
 3. Connections: Designed for a single branch -circuit connection.
 4. Switching Off: Automatically switches quartz lamp off when HID lamp strikes.
- OR**
- Switching Off: Automatically switches quartz lamp off when HID lamp reaches approximately 60 percent light output.
- G. Exit Signs
1. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
 2. Internally Lighted Signs:
 - a. Lamps for AC Operation: Fluorescent, two for each fixture, 20,000 hours of rated lamp life.

OR

Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
 - b. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
 - 1) Battery: Sealed, maintenance-free, nickel-cadmium type.
 - 2) Charger: Fully automatic, solid-state type with sealed transfer relay.
 - 3) Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 - 4) Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - 5) LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - 6) Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
 - 7) Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.
 - c. Master/Remote Sign Configurations:
 - 1) Master Unit: Comply with requirements above for self-powered exit signs, and provide additional capacity in LED power supply **OR** ballast **OR** battery, **as directed**, for power connection to remote unit.
 - 2) Remote Unit: Comply with requirements above for self-powered exit signs, except omit power supply, battery, and test features. Arrange to receive full power requirements from master unit. Connect for testing concurrently with master unit as a unified system.



3. Self-Luminous Signs: Powered by tritium gas, with universal bracket for flush-ceiling, wall, or end mounting. Signs shall be guaranteed by manufacturer to maintain the minimum brightness requirements in UL 924 for 10 **OR** 15 **OR** 20, **as directed**, years.

OR

Self-Luminous Signs: Using strontium oxide aluminate compound to store ambient light and release the stored energy when the light is removed. Provide with universal bracket for flush-ceiling, wall, or end mounting.

H. Emergency Lighting Units

1. General Requirements for Emergency Lighting Units: Self-contained units complying with UL 924.
 - a. Battery: Sealed, maintenance-free, lead-acid type.
 - b. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - c. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 - d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - f. Wire Guard: Heavy-chrome-plated wire guard protects lamp heads or fixtures.
 - g. Integral Time-Delay Relay: Holds unit on for fixed interval of 15 minutes when power is restored after an outage.
 - h. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
 - i. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

I. Fluorescent Lamps

1. T8 rapid-start lamps, rated 32 W maximum, nominal length of 48 inches (1220 mm), 2800 initial lumens (minimum), CRI 75 (minimum), color temperature 3500 K, and average rated life 20,000 hours unless otherwise indicated.
2. T8 rapid-start lamps, rated 17 W maximum, nominal length of 24 inches (610 mm), 1300 initial lumens (minimum), CRI 75 (minimum), color temperature 3500 K, and average rated life of 20,000 hours unless otherwise indicated.
3. T5 rapid-start lamps, rated 28 W maximum, nominal length of 45.2 inches (1150 mm), 2900 initial lumens (minimum), CRI 85 (minimum), color temperature 3000 K, and average rated life of 20,000 hours unless otherwise indicated.
4. T5HO rapid-start, high-output lamps, rated 54 W maximum, nominal length of 45.2 inches (1150 mm), 5000 initial lumens (minimum), CRI 85 (minimum), color temperature 4100 K, and average rated life of 20,000 hours unless otherwise indicated.
5. Compact Fluorescent Lamps: 4-Pin, CRI 80 (minimum), color temperature 3500 K, average rated life of 10,000 hours at three hours operation per start, and suitable for use with dimming ballasts, **as directed**.

J. HID Lamps

1. High-Pressure Sodium Lamps: ANSI C78.42, CRI 21 (minimum), color temperature 1900 K, and average rated life of 24,000 hours, minimum.



- a. Dual-Arc Tube Lamps: Arranged so only one of two arc tubes is lighted at one time and, when power is restored after an outage, the cooler arc tube, with lower internal pressure, lights instantly, providing an immediate 8 to 15 percent of normal light output.
 2. Metal-Halide Lamps: ANSI C78.43, with minimum CRI 65, and color temperature 4000 K.
 3. Pulse-Start, Metal-Halide Lamps: Minimum CRI 65, and color temperature 4000 K.
 4. Ceramic, Pulse-Start, Metal-Halide Lamps: Minimum CRI 80, and color temperature 4000 K.
 5. Low-Pressure Sodium Lamps: ANSI 78.41, CRI 0, and color temperature 1800 K.
- K. Lighting Fixture Support Components
1. Comply with Division 26 Section "Hangers And Supports For Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.
 2. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
 3. Twin-Stem Hangers: Two, 1/2-inch (13-mm) steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.
 4. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).
 5. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage (2.68 mm).
 6. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.
 7. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.
- L. Retrofit Kits For Fluorescent Lighting Fixtures
1. Reflector Kit: UL 1598, Type I. Suitable for two- to four-lamp, surface-mounted or recessed lighting fixtures by improving reflectivity of fixture surfaces.
 2. Ballast and Lamp Change Kit: UL 1598, Type II. Suitable for changing existing ballast, lamps, and sockets.

1.3 EXECUTION

A. Installation

1. Lighting fixtures:
 - a. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
 - b. Install lamps in each luminaire.
2. Temporary Lighting: If it is necessary, and approved by the Owner, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.
3. Remote Mounting of Ballasts: Distance between the ballast and fixture shall not exceed that recommended by ballast manufacturer. Verify, with ballast manufacturers, maximum distance between ballast and luminaire.
4. Lay-in Ceiling Lighting Fixtures Supports: Use grid as a support element.
 - a. Install ceiling support system rods or wires, independent of the ceiling suspension devices, **as directed**, for each fixture. Locate not more than 6 inches (150 mm) from lighting fixture corners.
 - b. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
 - c. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees.
 - d. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.
5. Suspended Lighting Fixture Support:
 - a. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.



- b. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
 - c. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
 - d. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.
6. Air-Handling Lighting Fixtures: Install with dampers closed and ready for adjustment.
 7. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

B. Identification

1. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Division 26 Section "Identification For Electrical Systems".

C. Field Quality Control

1. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.
2. Verify that self-luminous exit signs are installed according to their listing and the requirements in NFPA 101.
3. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

D. Startup Service

1. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by the Owner. Burn-in fluorescent and compact fluorescent lamps intended to be dimmed, for at least 100 hours at full voltage.

E. Adjusting

1. Occupancy Adjustments: When requested within 12 months of date of Final Completion, provide on-site assistance in adjusting aimable luminaires to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Some of this work may be required after dark.
 - a. Adjust aimable luminaires in the presence of the Owner.

END OF SECTION 01 95 26 00a



Task	Specification	Specification Description
01 95 26 00	01 22 16 00	No Specification Required



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SECTION 02 41 13 13 - PORTLAND CEMENT CONCRETE REMOVAL

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for portland cement concrete removal. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Section Includes:

1. Provide all labor, materials and equipment required for the removal work and disposal of existing Portland Cement Concrete indicated on the drawings and specified, including but not limited to the following:
 - a. Saw cutting existing concrete pavements, sidewalks, driveways, curbs and gutters noted on drawings to be removed.
 - b. Saw cutting existing concrete sidewalks for new tree pit openings (refer to drawings for locations).
 - c. Saw cutting existing bituminous paving noted on drawings to be removed.
 - d. Removal and disposal of demolished concrete sidewalks, driveways, curbs and gutters, including concrete removed for new tree pit openings.
 - e. Removal and disposal of demolished bituminous paving.
 - f. All excavating, rough grading and compacting as required to establish subgrade for new sidewalks, and Subgrade and Sub-Base for driveways.
 - g. Providing, placing and grading sand fill under new sidewalks. Top of compacted subgrades shall allow for the placement of sidewalks plus thickness of sand fill.
 - h. Removal and disposal of excavated material.

C. Special Requirements:

1. Protection: Provide protection barricades, maintain all lights and signals and other measures as required by federal, state, and municipal laws, for the full period of demolition operations and remove same when directed. In removing work, perform all work required to protect and maintain adjacent property, streets, alleys, sidewalks, curbs, and other structures remaining in place.

1.2 PRODUCTS

A. Backfilling Material:

1. Sand: Natural sand, with the following gradation: 100% passing the 1 sieve-, 65-100% passing the No. 4 sieve; 40-90% passing the No. 10 sieve- 30-80% passing the No. 16 sieve- 10-50% passing the No. 50 sieve; 0-30% passing the No. 100 sieve, and 0-10% passing the No. 200 sieve.
2. Crushed Stone: Crushed stone having a #57 crusher run gradation.

1.3 EXECUTION

A. Demolition:

1. The contractor shall accept the site as it finds it and shall inform itself as to the character and types of work to be removed. The Owner assumes no responsibility for the condition of the existing construction to be removed or demolished.
2. No demolition shall be commenced until a program of operations has been coordinated with the Owner, except that preparatory work may be started if specifically approved by the Owner.



3. Operations shall be done in such manner as to avoid hazards to persons and property and interference with use of adjacent areas or interruption of free passage to and from such areas. Maintain Pedestrian access to all private entrances where construction of new sidewalks is in progress. Provide temporary walk ways or other means as required to maintain entry into the private properties, complying with all laws and ordinances and as approved by the Owner. Care shall be taken to prevent the spread of dust and flying particles.
4. Demolition and removal work shall be executed in a careful and orderly manner. Accumulation of rubbish will not be permitted.
5. After work is started, it shall be continued to completion at a rate that will allow the balance of the work to be completed within the time specified. If extra shifts are necessary beyond regular working hours, the work shall proceed with a minimum of nuisance to surrounding properties.
6. Contractor shall determine the nature and extent of demolition that will be necessary by comparing the drawings with the existing field conditions. It is expressly understood that this contract includes all work of a demolition nature that may be required or necessary for a full and complete execution of the work, whether particularly referred to herein or not.

B. Removal And Excavation:

1. When removing existing sidewalks, driveways, curbs and gutters provisions shall be made for satisfactory transition between replacements and the portion remaining in place. The contractor shall saw cut to a minimum depth of 1-1/2 inches with a concrete sawing machine to prevent the surface from spalling when the concrete is broken out. This work shall be done in such a manner that a straight joint will be secured.
2. It shall be the responsibility of the contractor to determine the thickness of the existing sidewalk to be removed. No additional compensation will be allowed because of variations from the assumed thickness or from the thickness shown on the plans.
3. After existing concrete sidewalks and driveways have been removed, excavate to depth required for sand fill.
4. The bottoms of all excavations shall be properly leveled off and all loose materials shall be removed from excavations. All wood, timber and organic materials, that are exposed at the bottom of all excavations, shall be removed and the area backfilled with sand and compacted.
5. Any excess or unauthorized excavation shall be backfilled with sand and compacted, at no additional cost to the Owner.
6. No backfill shall be placed in standing water, on frozen ground or on surfaces which have not been approved by the Commissioner.
7. Backfilling for all areas shall be approved material. Backfill shall be compacted to 95% maximum density in accordance with ASTM D 1557.
8. Contractor shall determine the nature and extent of excavation work that will be necessary by comparing the drawings with the existing areas to be excavated. It is expressly understood that this contract includes all work of an excavation nature that may be required or necessary for a complete execution of all excavation work, whether particularly referred to herein or not.

C. Disposal Of Materials:

1. All demolished and unsuitable materials, including excavated earth removed to establish required grade elevations shall be disposed of legally in such a manner that public or private property will not be damaged or endangered.

D. Clean-Up:

1. On completion of the demolition work, excavation work and before acceptance by the Owner, clean the areas affected, including areas outside the limits of the contractor's work area where permission to work has been granted. Remove surplus construction material or debris resulting from the demolition work and excavation work, and dispose of legally off the site.
2. Access routes to and from the site shall be kept clean of debris resulting from the work.

END OF SECTION 02 41 13 13



SECTION 02 41 16 13 - SELECTIVE DEMOLITION

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for selective demolition. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Demolition and removal of selected portions of building or structure.
 - b. Demolition and removal of selected site elements.
 - c. Salvage of existing items to be reused or recycled.

C. Definitions

1. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.
2. Remove and Salvage: Detach items from existing construction and deliver them to the Owner ready for reuse, **as directed**.
3. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
4. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

D. Materials Ownership

1. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to the Owner that may be encountered during selective demolition remain the Owner's property. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to the Owner.
 - a. Coordinate with the Owner's archaeologist **OR** historical adviser, **as directed**, who will establish special procedures for removal and salvage.

E. Submittals

1. Qualification Data: For demolition firm, professional engineer, refrigerant recovery technician, **as directed**.
2. Schedule of Selective Demolition Activities: Indicate the following:
 - a. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure the Owner's building manager's and other tenants' on-site operations are uninterrupted.
 - b. Interruption of utility services. Indicate how long utility services will be interrupted.
 - c. Coordination for shutoff, capping, and continuation of utility services.
 - d. Use of elevator and stairs.
 - e. Locations of proposed dust- and noise-control temporary partitions and means of egress, including for other tenants affected by selective demolition operations.
 - f. Coordination of the Owner's continuing occupancy of portions of existing building and of the Owner's partial occupancy of completed Work.
 - g. Means of protection for items to remain and items in path of waste removal from building.
3. Inventory: After selective demolition is complete, submit a list of items that have been removed and salvaged.



4. Predemolition Photographs or Videotapes: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by selective demolition operations. Submit before Work begins.
5. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.
 - a. Comply with submittal requirements in Division 01 Section "Construction Waste Management And Disposal".

F. Quality Assurance

1. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.
2. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.
3. LEED Requirements for Building Reuse:
 - a. Credit MR 1.1 and 1.2, **as directed**: Maintain existing building structure (including structural floor and roof decking) and envelope (exterior skin and framing, excluding window assemblies and nonstructural roofing material) not indicated to be demolished; do not demolish such existing construction beyond indicated limits.
 - b. Credit MR 1.3: Maintain existing interior nonstructural elements (interior walls, doors, floor coverings, and ceiling systems) not indicated to be demolished; do not demolish such existing construction beyond indicated limits.
 - c. Credit MR 1.2 and 1.3, **as directed**: Maintain existing nonshell, nonstructural components (walls, flooring, and ceilings) not indicated to be demolished; do not demolish such existing construction beyond indicated limits.
4. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
5. Standards: Comply with ANSI A10.6 and NFPA 241.
6. Predemolition Conference: Conduct conference at Project site. Review methods and procedures related to selective demolition including, but not limited to, the following:
 - a. Inspect and discuss condition of construction to be selectively demolished.
 - b. Review structural load limitations of existing structure.
 - c. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - d. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
 - e. Review areas where existing construction is to remain and requires protection.

G. Project Conditions

1. the Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so the Owner's operations will not be disrupted.
2. Conditions existing at time of inspection for bidding purpose will be maintained by the Owner as far as practical.
 - a. Before selective demolition, items will be removed as directed by the Owner.
3. Notify the Owner of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
4. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - a. Hazardous materials will be removed by the Owner before start of the Work **OR** have been removed by the Owner under a separate contract, **as directed**.
 - b. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify the Owner. the Owner will remove hazardous materials under a separate contract.

OR



5. Hazardous Materials: It is unknown whether hazardous materials will be encountered in the Work.
 - a. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify the Owner and the Owner. the Owner will remove hazardous materials under a separate contract.
6. Hazardous Materials (if asbestos abatement is part of Work of this Contract): Hazardous materials are present in construction to be selectively demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.
 - a. Hazardous material remediation is specified elsewhere in the Contract Documents.
 - b. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
7. Storage or sale of removed items or materials on-site is not permitted.
8. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - a. Maintain fire-protection facilities in service during selective demolition operations.

H. Warranty

1. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

1.2 PRODUCTS (Not Used)

1.3 EXECUTION

A. Utility Services And Mechanical/Electrical Systems

1. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.
2. Service/System Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - a. the Owner will arrange to shut off indicated services/systems when requested by Contractor.
 - b. Arrange to shut off indicated utilities with utility companies.
 - c. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - d. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.
 - 1) Where entire wall is to be removed, existing services/systems may be removed with removal of the wall.

B. Preparation

1. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
2. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 - a. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 - b. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.



- c. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
- d. Cover and protect furniture, furnishings, and equipment that have not been removed.
- e. Comply with requirements for temporary enclosures, dust control, heating, and cooling.
- 3. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
 - a. Strengthen or add new supports when required during progress of selective demolition.

C. Selective Demolition, General

- 1. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - a. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 - b. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
 - c. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 - d. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
 - e. Maintain adequate ventilation when using cutting torches.
 - f. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 - g. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 - h. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 - i. Dispose of demolished items and materials promptly. Comply with requirements in Division 01 Section "Construction Waste Management And Disposal".
- 2. Reuse of Building Elements: Project has been designed to result in end-of-Project rates for reuse of building elements as follows. Do not demolish building elements beyond what is indicated on Drawings without the Owner's approval.
 - a. Building Structure and Shell: 75 **OR** 100, **as directed**, percent.
 - b. Nonshell Elements: 50 percent.
- 3. Removed and Salvaged Items:
 - a. Clean salvaged items.
 - b. Pack or crate items after cleaning. Identify contents of containers.
 - c. Store items in a secure area until delivery to the Owner.
 - d. Transport items to the Owner's storage area on-site **OR** off-site **OR** designated by the Owner **OR** indicated on Drawings, **as directed**.
 - e. Protect items from damage during transport and storage.
- 4. Removed and Reinstalled Items:
 - a. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
 - b. Pack or crate items after cleaning and repairing. Identify contents of containers.
 - c. Protect items from damage during transport and storage.



- d. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
 5. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by the Owner, items may be removed to a suitable, protected storage location during selective demolition and cleaned, **as directed**, and reinstalled in their original locations after selective demolition operations are complete.
- D. Selective Demolition Procedures For Specific Materials
1. Concrete: Demolish in small sections. Cut concrete to a depth of at least 3/4 inch (19 mm) at junctures with construction to remain, using power-driven saw. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete indicated for selective demolition. Neatly trim openings to dimensions indicated.
OR
Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals, using power-driven saw, then remove concrete between saw cuts.
 2. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.
 3. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.
 4. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI-WP and its Addendum.
 - a. Remove residual adhesive and prepare substrate for new floor coverings by one of the methods recommended by RFCI.
 5. Roofing: Remove no more existing roofing than can be covered in one day by new roofing and so that building interior remains watertight and weathertight. Refer to Division 07 for new roofing requirements.
 - a. Remove existing roof membrane, flashings, copings, and roof accessories.
 - b. Remove existing roofing system down to substrate.
 6. Air-Conditioning Equipment: Remove equipment without releasing refrigerants.
- E. Disposal Of Demolished Materials
1. General: Except for items or materials indicated to be recycled, **as directed**, reused, salvaged, reinstalled, or otherwise indicated to remain the Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
 - a. Do not allow demolished materials to accumulate on-site.
 - b. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 - c. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
 - d. Comply with requirements specified in Division 01 Section "Construction Waste Management And Disposal".
 2. Burning: Do not burn demolished materials.
OR
Burning: Burning of demolished materials will be permitted only at designated areas on the Owner's property, **as directed**, provided required permits are obtained. Provide full-time monitoring for burning materials until fires are extinguished.
 3. Disposal: Transport demolished materials and dispose of at designated spoil areas on the Owner's property.
OR
Disposal: Transport demolished materials off the Owner's property and legally dispose of them.
- F. Cleaning



1. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

G. Selective Demolition Schedule

1. Existing Items **OR** Construction, **as directed**, to Be Removed, as directed by the Owner.
2. Existing Items to Be Removed and Salvaged, as directed by the Owner.
3. Existing Items to Be Removed and Reinstalled, as directed by the Owner.
4. Existing Items to Remain, as directed by the Owner.

END OF SECTION 02 41 16 13



SECTION 02 41 16 13a - BUILDING DEMOLITION

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for building demolition. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Demolition and removal of buildings and site improvements.
 - b. Abandoning in place **OR** Removing, **as directed**, below-grade construction.
 - c. Disconnecting, capping or sealing, and abandoning in-place **OR** removing, **as directed**, site utilities.
 - d. Salvaging items for reuse by the Owner.

C. Definitions

1. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged.
2. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to the Owner ready for reuse. Include fasteners or brackets needed for reattachment elsewhere.

D. Materials Ownership

1. Unless otherwise indicated, demolition waste becomes property of Contractor.
2. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to the Owner that may be uncovered during demolition remain the property of the Owner.
 - a. Carefully salvage in a manner to prevent damage and promptly return to the Owner.

E. Informational Submittals

1. Qualification Data: For refrigerant recovery technician.
2. Proposed Protection Measures: Submit informational report, including drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control, **as directed**. Indicate proposed locations and construction of barriers.
 - a. Adjacent Buildings: Detail special measures proposed to protect adjacent buildings to remain.
3. Schedule of Building Demolition Activities: Indicate the following:
 - a. Detailed sequence of demolition work, with starting and ending dates for each activity.
 - b. Temporary interruption of utility services.
 - c. Shutoff and capping or re-routing of utility services.
4. Inventory: Submit a list of items to be removed and salvaged and deliver to the Owner prior to start of demolition.
5. Predemolition Photographs **OR** Video, **as directed**: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by building demolition operations. Submit before the Work begins.
6. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.
7. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that



recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

F. Quality Assurance

1. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.
2. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
3. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.
4. Predemolition Conference: Conduct conference at Project site.
 - a. Inspect and discuss condition of construction to be demolished.
 - b. Review structural load limitations of existing structures.
 - c. Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - d. Review and finalize protection requirements.
 - e. Review procedures for noise control and dust control.
 - f. Review procedures for protection of adjacent buildings.
 - g. Review items to be salvaged and returned to the Owner.

G. Project Conditions

1. Buildings to be demolished will be vacated and their use discontinued before start of the Work.
2. Buildings immediately adjacent to demolition area will be occupied. Conduct building demolition so operations of occupied buildings will not be disrupted.
 - a. Provide not less than 72 hours' notice of activities that will affect operations of adjacent occupied buildings.
 - b. Maintain access to existing walkways, exits, and other facilities used by occupants of adjacent buildings.
 - 1) Do not close or obstruct walkways, exits, or other facilities used by occupants of adjacent buildings without written permission from authorities having jurisdiction.
3. the Owner assumes no responsibility for buildings and structures to be demolished.
 - a. Conditions existing at time of inspection for bidding purpose will be maintained by the Owner as far as practical.
 - b. Before building demolition, the Owner will remove certain items, as directed by the Owner.
4. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - a. Hazardous materials will be removed by the Owner before start of the Work.
 - b. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and the Owner. Hazardous materials will be removed by the Owner under a separate contract.

OR

Hazardous Materials: Hazardous materials are present in buildings and structures to be demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.

- a. Hazardous material remediation is specified elsewhere in the Contract Documents.
 - b. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
 - c. the Owner will provide material safety data sheets for materials that are known to be present in buildings and structures to be demolished because of building operations or processes performed there.
5. On-site storage or sale of removed items or materials is not permitted.

H. Coordination

1. Arrange demolition schedule so as not to interfere with the Owner's on-site operations **OR** operations of adjacent occupied buildings, **as directed**.



1.2 PRODUCTS

A. Soil Materials

1. Satisfactory Soils: Satisfactory Soils: For soils which is to be used for backfilling voids that result from demolition operations in below-grade areas, comply with requirements in Division 31 Section "Earth Moving".

1.3 EXECUTION

A. Examination

1. Verify that utilities have been disconnected and capped before starting demolition operations.
2. Review Project Record Documents of existing construction provided by the Owner. the Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
3. Inventory and record the condition of items to be removed and salvaged. Provide photographs **OR** video, **as directed**, of conditions that might be misconstrued as damage caused by salvage operations.
4. Perform **OR** Engage a professional engineer to perform, **as directed**, an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during building demolition operations.
 - a. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.
5. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

B. Preparation

1. Refrigerant: Remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction before starting demolition.
2. Existing Utilities: Locate, identify, disconnect, and seal or cap off indicated utilities serving buildings and structures to be demolished.
 - a. the Owner will arrange to shut off indicated utilities when requested by Contractor.
OR
Arrange to shut off indicated utilities with utility companies, **as directed**.
 - b. If removal, relocation, or abandonment of utility services will affect adjacent occupied buildings, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.
 - c. Cut off pipe or conduit a minimum of 24 inches (610 mm) below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing according to requirements of authorities having jurisdiction.**OR**
Existing Utilities: Refer to Division 22 AND Division 26 for shutting off, disconnecting, removing, and sealing or capping utilities. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing, **as directed**.
3. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.
 - a. Strengthen or add new supports when required during progress of demolition.
4. Salvaged Items: Comply with the following:
 - a. Clean salvaged items of dirt and demolition debris.
 - b. Pack or crate items after cleaning. Identify contents of containers.
 - c. Store items in a secure area until delivery to the Owner.
 - d. Transport items to storage area designated by the Owner **OR** indicated on Drawings, **as directed**.
 - e. Protect items from damage during transport and storage.



C. Protection

1. Existing Facilities: Protect adjacent walkways, loading docks, building entries, and other building facilities during demolition operations. Maintain exits from existing buildings.
2. Existing Utilities: Maintain utility services to remain and protect from damage during demolition operations.
 - a. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by the Owner and authorities having jurisdiction.
 - b. Provide temporary services during interruptions to existing utilities, as acceptable to the Owner and authorities having jurisdiction.
 - 1) Provide at least 72 hours' notice to occupants of affected buildings if shutdown of service is required during changeover.
3. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction, and as indicated. Comply with requirements in Division 01 Section "Temporary Facilities And Controls".
 - a. Protect adjacent buildings and facilities from damage due to demolition activities.
 - b. Protect existing site improvements, appurtenances, and landscaping to remain.
 - c. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
 - d. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 - e. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.
 - f. Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to building demolition operations.
 - g. Erect and maintain dustproof partitions and temporary enclosures to limit dust, noise, and dirt migration to occupied portions of adjacent buildings.
4. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

D. Demolition, General

1. General: Demolish indicated existing buildings and site improvements completely. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - a. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
 - b. Maintain fire watch during and for a specified time after flame cutting operations as directed by the Owner.
 - c. Maintain adequate ventilation when using cutting torches.
 - d. Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
2. Engineering Surveys: During demolition, perform surveys to detect hazards that may result from building demolition activities.
3. Site Access and Temporary Controls: Conduct building demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - a. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from the Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
 - b. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
4. Explosives: Use of explosives is not permitted, **unless directed otherwise**.

**E. Demolition By Mechanical Means**

1. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Remove debris from elevated portions of the building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
 - a. Remove structural framing members and lower to ground by method suitable to minimize ground impact and dust generation.
3. Salvage: Items to be salvaged are indicated on Drawings **OR** below, **as directed**:
 - a. Doors and door hardware.
 - b. Windows.
 - c. Cabinets.
 - d. Mirrors.
 - e. Chalkboards.
 - f. Tackboards.
 - g. Marker boards.
 - h. Plumbing fixtures.
 - i. Other items as directed.
4. Below-Grade Construction: Abandon foundation walls and other below-grade construction. Cut below-grade construction flush with grade.
OR
Below-Grade Construction: Demolish foundation walls and other below-grade construction that are within footprint of new construction and extending 5 feet (1.5 m) outside footprint indicated for new construction. Abandon below-grade construction outside this area.
 - a. Remove below-grade construction, including basements, foundation walls, and footings, completely **OR** to at least 6 inches (150 mm) below grade **OR** to at least 12 inches (300 mm) below grade **OR** to depths indicated, **as directed**.
OR
Below-Grade Construction: Demolish foundation walls and other below-grade construction.
 - b. Remove below-grade construction, including basements, foundation walls, and footings, completely **OR** to at least 6 inches (150 mm) below grade **OR** to at least 12 inches (300 mm) below grade **OR** to depths indicated, **as directed**.
5. Existing Utilities: Abandon existing utilities and below-grade utility structures. Cut utilities flush with grade.
OR
Existing Utilities: Demolish existing utilities and below-grade utility structures that are within 5 feet (1.5 m) outside footprint indicated for new construction. Abandon utilities outside this area.
 - a. Fill abandoned utility structures with satisfactory soil materials **OR** recycled pulverized concrete, **as directed**, according to backfill requirements in Division 31 Section "Earth Moving".
 - b. Piping: Disconnect piping at unions, flanges, valves, or fittings.
 - c. Wiring Ducts: Disassemble into unit lengths and remove plug-in and disconnecting devices.
OR
Existing Utilities: Demolish and remove existing utilities and below-grade utility structures.
 - a. Piping: Disconnect piping at unions, flanges, valves, or fittings.
 - b. Wiring Ducts: Disassemble into unit lengths and remove plug-in and disconnecting devices.

F. Demolition By Explosives – ONLY IF APPROVED BY THE OWNER

1. Explosives: Perform explosive demolition according to governing regulations.
 - a. Obtain written permission from authorities having jurisdiction before bringing explosives to, or using explosives on, Project site.
 - b. Do not damage adjacent structures, property, or site improvements when using explosives.
2. Comply with recommendation in Explosives Consultant's report.



G. Site Restoration

1. Below-Grade Areas: Rough grade below-grade areas ready for further excavation or new construction.

OR

Below-Grade Areas: Completely fill below-grade areas and voids resulting from building demolition operations with satisfactory soil materials **OR** recycled pulverized concrete **OR** recycled pulverized masonry, **as directed**, according to backfill requirements in Division 31 Section "Earth Moving".

2. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.

H. Repairs

1. Promptly repair damage to adjacent buildings caused by demolition operations.

I. Disposal Of Demolished Materials

1. Remove demolition waste materials from Project site and legally dispose of them in EPA approved landfill acceptable to authorities having jurisdiction. See Division 01 Section "Construction Waste Management And Disposal" for recycling and disposal of demolition waste.
 - a. Do not allow demolished materials to accumulate on-site.
 - b. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
2. Do not burn demolished materials.

J. Cleaning

1. Clean adjacent structures and improvements of dust, dirt, and debris caused by building demolition operations. Return adjacent areas to condition existing before building demolition operations began.
 - a. Clean roadways of debris caused by debris transport.

END OF SECTION 02 41 16 13a



Task	Specification	Specification Description
02 41 16 13	02 41 13 13	Portland Cement Concrete Removal
02 41 19 13	01 71 23 16	Cutting and Patching
02 41 19 13	02 41 16 13	Selective Demolition
02 41 19 13	02 41 16 13a	Building Demolition
02 41 19 13	02 41 13 13	Portland Cement Concrete Removal
02 41 19 16	02 41 16 13	Selective Demolition
02 41 19 16	02 41 16 13a	Building Demolition
02 41 19 16	02 41 13 13	Portland Cement Concrete Removal



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SECTION 02 58 13 00 - FARM-TYPE WIRE FENCING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of farm-type wire fencing. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: For each type of product indicated.

1.2 PRODUCTS

- #### A. Fabric shall be galvanized steel wire complying with ASTM A 116.

B. Framework

1. Steel
 - a. Posts shall comply with ASTM A 702, T-section, zinc-coated.
 - b. Stays shall be 9-1/2 gauge twisted wire, galvanized in compliance with ASTM A 641, Class 3.
2. Wood: Posts shall be cut from cedar, Douglas fir, pine, or other approved species of timber. Posts shall be peeled, treated, dressed, and cured and shall contain no unsound knots. All posts shall match existing post dimensions. All wood posts and braces shall be given a pressure preservative treatment in a closed retort. The treatment shall comply with AWPA C2.
 - a. Preservative. Wood cut or sawed after treatment shall have the cut surfaces well-coated with the preservative used in the treatment. All wood shall be pressure treated in accordance with AWPA C1 or AWPA C2, as applicable.

- #### C. Braces: Steel braces shall have the same configuration as line posts and uprights without the anchor plate. Braces shall meet all of the requirements for wood posts.

D. Connectors

1. Wire for Attaching Fabric to Posts shall be 12-1/2 gauge or coarser, galvanized in compliance with ASTM A 641, Class 3.
2. Staples and Nails shall comply with Fed. Spec. FF-N-105. Staples and nails shall be zinc-coated and of sufficient length for purpose required.

E. Gates

1. Tubular Steel:
 - a. Frame shall be a minimum of 1-3/8 inch outside diameter tubular steel, braced with a sturdy center bar and diagonal adjustable brace wire to prevent sagging. Gates shall be fitted with hinges. All material shall be hot-dipped zinc-coated.
 - b. Fabric for Gates shall be as specified for the fence and shall be securely tied to the framework at top, bottom, and sides with 9-gauge wire.
2. Angle Iron
 - a. Frame shall be fabricated of angle iron with cross ties and stays of light angle iron. Frame shall be zinc-coated in compliance with ASTM A 120 or A 153.
 - b. Fabric for Gates shall be as specified for the fence and shall be securely tied to the framework at top, bottom, and sides with 9-gauge wire.
3. Wood: Provide a 3/8-inch minimum diameter galvanized steel truss rod and turnbuckle.



- F. Barbed Wire shall comply with ASTM A 121 and shall be made from 2 strands of 12-1/2 gauge galvanized steel wire, twisted, with four-point barbs spaced five inches apart. Wire shall have Class 2 zinc coating.
- G. Hardware:
1. Gate Hardware shall include the following:
 - a. Bottom Hinge shall be designed to carry the weight of the gate.
 - b. The Upper Hinge shall be adjustable.
 - c. Lock with Chain shall be 1-3/4 inch size complying with ASTM F 883.
 - d. Keeper shall automatically engage and hold the gate leaf open until manually released.
 - e. Center Plunger Rod.
 - f. Center Stop.
 - g. Vertical Lift.
 - h. Sliding Track.
 2. Lightning Arresters, Insulators and Insulator Clamps, Fasteners, Signs, and Other Accessories shall be provided and installed as required.

1.3 EXECUTION

A. Installation

1. Wood Posts: Hold in line in a true vertical position by temporary bracing until backfilling is completed. Compact by hand tamping or other suitable methods to a density comparable to that of adjacent ground. Refasten all braces, gates, hardware, fabric, and other accessories.
2. Steel Posts: Steel posts shall be held in a vertical position and driven to the required depths by an approved post driver. Tops of posts shall not be damaged by driving operation.
3. Corner, Brace, or End Panels: Corner, brace, or end panels shall be constructed at the beginning and terminal ends, at gate openings, at all intersections, at all corners or changes in horizontal alignment of fences, in existing fence on both sides of junction with new fence, (except when junction is at a corner already braced), and on both sides of cattle guards.
4. Pull Posts shall be constructed when the distance of unbraced fencing exceeds 640 feet. Pull posts shall be spaced equidistant in the fence at intervals of 640 feet or less.
5. Wire Installation: Barbed and/or woven wire fabric shall be stretched to proper tension and securely fastened to posts. Top and bottom wires of fabric shall be tied or stapled to each post. Tie or staple every other wire to alternating posts. Every wire shall be tied to corner, pull, end, and gate posts. Wire for tying woven wire fabric and barbed wire shall be 9-gauge.
6. Restretching Existing Fabric: Fabric indicated to be restretched shall be restretched to proper tension and refastened to posts. Excess fabric extending beyond the post shall be removed.
7. Alignment: Finished fencing shall be plumb and in proper alignment with posts, and all wire work shall be taut.

END OF SECTION 02 58 13 00



SECTION 02 58 13 00a - SNOW AND OTHER TEMPORARY FENCING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of snow and other temporary fencing. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: For each type of product indicated.
2. Shop drawings shall be submitted for approval.

1.2 PRODUCTS

A. Pickets:

1. Size: Wood pickets shall be 3/8 inch thick, 1-1/2 inches wide, and 48 inches high.
2. Coating: Red oil paint or stain.
3. Spacing: Approximately 2 inches apart.
4. Attachment: Bind together with 3 double strands of wire.

B. Framework:

1. Materials: Wire shall be 13 ga. galvanized steel, complying with ASTM A 641.
2. Types: The framework shall consist of 3 parallel double strands of wire twisted between pickets to hold them securely in place.
3. Wire Connectors: Wire for attaching fabric to metal posts shall be 9 ga.
4. Staples and Nails shall comply with Fed. Spec. FF-N-105. Staples and nails shall be zinc-coated and of sufficient length for purpose required.

C. Gates:

1. Frame: Frame shall consist of 2 parallel horizontal wooden members with pickets attached at two-inch spacing.
2. Bracing: 2 wooden members laced diagonally on the gate between the frame boards.
3. Hardware shall include 2 strap hinges, latching device, and stop bar, all of zinc-coated steel, in compliance with ASTM A 153.

D. Supports:

1. Steel: Line posts and uprights shall be drive type, T sections, and provided with suitable anchor plate. The sections shall be hot-rolled steel complying with ASTM A 702, galvanized in compliance with ASTM A 123. The T sections shall have the following minimum sizes:



Post Length (Feet) Post Weight (Pounds)

5	7.32
5 1/2	7.99
6	8.65
6 1/2	9.32
7	9.98
7 1/2	10.64
8	11.31
9	12.64
10	13.97

2. Wood: Posts shall be cut from cedar, Douglas fir, pine, or other approved species of timber. Posts shall be peeled, treated, dressed, and cured. All wood posts and braces shall be given a pressure preservative treatment in a closed retort. The treatment shall comply with Fed. Spec. TT-W-571. Wood cut or sawed after treatment shall have the cut surfaces well brush-coated with the preservative used in the treatment.
3. Braces: Steel braces shall have same configuration as line posts and uprights without the anchor plate. Wood braces shall be treated No. 2 or better grade, Douglas fir or southern yellow pine. Braces shall meet all of the requirements for wood posts.
4. Location: Posts shall be evenly spaced to adequately support the fence framework.

1.3 EXECUTION

A. Installation

1. Wood Posts: Hold in line in a true vertical position by temporary bracing until backfilling is completed. Compact by hand tamping or other suitable methods to a density comparable to that of adjacent ground.
2. Steel Posts: Hold in a vertical position and drive to the required depths by an approved post driver. Post tops shall not be damaged during driving.
3. Corner, Brace, Or End Panels: Construct corner, brace, or end panels at the beginning and terminal ends, at gate openings, at all intersections, and at all corners or changes in horizontal alignment of fences, in existing fence on both sides of junction with new fence (except when junction is at a corner already braced).
4. Pull Posts shall be constructed when the distance of unbraced fencing exceeds 640 feet. Pull posts shall be spaced equidistant in the fence at intervals of 640 feet or less.
5. Framework Installation: Stretch to proper tension and securely fasten to posts. Top and bottom wires of fabric shall be tied or stapled to each post. Tie or staple every other wire to alternating posts. Every wire shall be tied or stapled to corner, pull, end, and gate posts. Wire for tied fabrics shall be 9 ga.
6. Picket Replacement: Where required, new pickets shall be securely fastened into the existing wire framework using 13 ga. galvanized wire.
7. Restretching Existing Fabric: Fabric designated to be restretched shall be restretched to proper tension and refastened to posts. Excess fabric extending beyond the post shall be removed.

END OF SECTION 02 58 13 00a

**SECTION 02 61 00 00 - EXCAVATION AND HANDLING OF CONTAMINATED MATERIAL****1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for excavation and handling of contaminated material. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Shop Drawings: Separate cross-sections of each area before and after excavation and after backfilling.
2. Product Data: Work Plan within 30 calendar days after notice to proceed. No work at the site, with the exception of site inspections and surveys, shall be performed until the Work Plan is approved. The Contractor shall allow 30 calendar days in the schedule for the Owner's review. No adjustment for time or money will be made if resubmittals of the Work Plan are required due to deficiencies in the plan. At a minimum, the Work Plan shall include:
 - a. Schedule of activities.
 - b. Method of excavation and equipment to be used.
 - c. Shoring or side-wall slopes proposed.
 - d. Dewatering plan.
 - e. Storage methods and locations for liquid and solid contaminated material.
 - f. Borrow sources and haul routes.
 - g. Decontamination procedures.
 - h. Spill contingency plan.
3. Closure Report: Three (3) copies of the Closure Report within 14 calendar days of work completion at the site.
4. Test Reports
 - a. Backfill
 - b. Surveys
 - c. Confirmation Sampling and Analysis
 - d. Sampling of Stored Material
 - e. Sampling Liquid
 - f. Compaction
 - g. Test results.

C. Surveys

1. Surveys shall be performed immediately prior to and after excavation of contaminated material to determine the volume of contaminated material removed. Surveys shall also be performed immediately after backfill of each excavation. The Contractor shall provide cross-sections on 25 foot (7.6 meter) intervals and at break points for all excavated areas. Locations of confirmation samples shall also be surveyed and shown on the drawings.

D. Regulatory Requirements

1. Permits and Licenses: The Contractor shall obtain required federal, state, and local permits for excavation and storage of contaminated material. Permits shall be obtained at no additional cost the Owner.
2. Air Emissions: Air emissions shall be monitored and controlled in accordance with the Owner's Environmental Requirements.

E. Chemical Testing

1. Required sampling and chemical analysis shall be conducted in accordance with local requirements and the Owner's requirements.



F. Scheduling

1. The Contractor shall notify the Owner five (5) calendar days prior to the start of excavation of contaminated material. The Owner will **OR** The Contractor shall, **as directed**, be responsible for contacting regulatory agencies in accordance with the applicable reporting requirements.

1.2 PRODUCTS

A. Backfill

1. Backfill material shall be obtained from the location indicated on the drawings **OR** offsite sources approved by the Owner, **as directed**. Backfill shall be classified in accordance with ASTM D 2487 as GW, GP, GM, GC, SW, SP, SM, SC, ML, MH, CL, or CH and shall be free from roots and other organic matter, trash, debris, snow, ice or frozen materials. Backfill material shall be tested for the parameters listed below at a frequency of once per 3000 cubic yards (cubic meters). A minimum of one set of classification tests shall be performed per borrow source. One backfill sample per borrow source shall also be collected and tested for the chemical parameters listed below.

<u>Physical Parameter</u>	<u>Test Method</u>
Grain Size	ASTM D 422
Compaction	ASTM D 698

Backfill shall not be used until borrow source chemical and physical test results have been submitted and approved.

B. Spill Response Materials

1. The Contractor shall provide appropriate spill response materials including, but not limited to the following: containers, adsorbents, shovels, and personal protective equipment. Spill response materials shall be available at all times when contaminated materials/wastes are being handled or transported. Spill response materials shall be compatible with the type of materials and contaminants being handled.

1.3 EXECUTION

A. Existing Structures And Utilities

1. No excavation shall be performed until site utilities have been field located. The Contractor shall take the necessary precautions to ensure no damage occurs to existing structures and utilities. Damage to existing structures and utilities resulting from the Contractor's operations shall be repaired at no additional cost to the Owner. Utilities encountered that were not previously shown or otherwise located shall not be disturbed without approval from the Owner.

B. Clearing

1. Clearing shall be performed to the limits shown on the drawings in accordance with Division 2 Section "Site Clearing."

C. Contaminated Material Removal

1. Excavation: Areas of contamination shall be excavated to the depth and extent shown on the drawings and not more than 0.2 feet (60 mm) beyond the depth and extent shown on the drawings unless directed by the Owner. Excavation shall be performed in a manner that will limit spills and the potential for contaminated material to be mixed with uncontaminated material. An excavation log describing visible signs of contamination encountered shall be maintained for each area of excavation. Excavation logs shall be prepared in accordance with ASTM D 5434.
2. Shoring: If workers must enter the excavation, it shall be evaluated, shored, sloped or braced as required by U.S. Army Corps of Engineers (USACE) EM 385-1-1 and U.S. National Archives and Records Administration (NARA) 29 CFR 1926 section 650.



3. Dewatering: Surface water shall be diverted to prevent entry into the excavation. Dewatering shall be limited to that necessary to assure adequate access, a safe excavation, prevent the spread of contamination, and to ensure that compaction requirements can be met. No dewatering shall be performed without prior approval of the Owner.
- D. Confirmation Sampling And Analysis
1. the Owner shall be present to inspect the removal of contaminated material from each site. After all material suspected of being contaminated has been removed, the excavation shall be examined for evidence of contamination. If the excavation appears to be free of contamination, field analysis shall be used to determine the presence of contamination using a real time vapor monitoring instrument **OR** immunoassay field kits, **as directed**. Excavation of additional material shall be as directed by the Owner. After all suspected contaminated material is removed, confirmation samples shall be collected and analyzed.
 2. Samples shall be collected at a frequency as directed by the Owner. A minimum of one sample shall be collected from the bottom and each side wall of the excavation. Based on test results, the Contractor shall propose any additional excavation which may be required to remove material which is contaminated above action levels. Additional excavation shall be subject to approval by the Owner. Locations of samples shall be marked in the field and documented on the as-built drawings.
- E. Contaminated Material Storage
1. Material shall be placed in temporary storage immediately after excavation **OR** after treatment while awaiting test results, **as directed**. The following paragraphs describe acceptable methods of material storage. Storage units shall be in good condition and constructed of materials that are compatible with the material or liquid to be stored. If multiple storage units are required, each unit shall be clearly labeled with an identification number and a written log shall be kept to track the source of contaminated material in each temporary storage unit.
 2. Stockpiles
 - a. Stockpiles shall be constructed to isolate stored contaminated material from the environment. The maximum stockpile size shall be as directed by the Owner. Stockpiles shall be constructed to include:
 - 1) A chemically resistant geomembrane liner free of holes and other damage. Non-reinforced geomembrane liners shall have a minimum thickness of 20 mils (0.5 mm). Scrim reinforced geomembrane liners shall have a minimum weight of 40 lbs. per 1000 square feet (20 kg/100 square meters). The ground surface on which the geomembrane is to be placed shall be free of rocks greater than 0.5 inches (12 mm) in diameter and any other object which could damage the membrane.
 - 2) Geomembrane cover free of holes or other damage to prevent precipitation from entering the stockpile. Non-reinforced geomembrane covers shall have a minimum thickness of 10 mils (0.25 mm). Scrim reinforced geomembrane covers shall have a minimum weight of 26 lbs. per 1000 square feet (13 kg/100 square meters). The cover material shall be extended over the berms and anchored or ballasted to prevent it from being removed or damaged by wind.
 - 3) Berms surrounding the stockpile, a minimum of 12 inches (300 mm) in height. Vehicle access points shall also be bermed.
 - 4) The liner system shall be sloped to allow collection of leachate. Storage and removal of liquid which collects in the stockpile, in accordance with paragraph Liquid Storage.
 3. Roll-Off Units: Roll-off units used to temporarily store contaminated material shall be water tight. A cover shall be placed over the units to prevent precipitation from contacting the stored material. The units shall be located as shown on the drawings. Liquid which collects inside the units shall be removed and stored in accordance with paragraph Liquid Storage.
 4. Liquid Storage: Liquid collected from excavations and stockpiles shall be temporarily stored in 55 gallon barrels (220 L barrels) **OR** 500 gallon tanks (2000 L tanks), **as directed**. Liquid storage containers shall be water-tight and shall be located as shown on the drawings.



F. Sampling

1. Sampling of Stored Material

- a. Samples of stored material shall be collected at a frequency as directed by the Owner.
- b. Stored material with contaminant levels that exceed the action levels shall be treated offsite. Analyses for contaminated material to be taken to an offsite treatment facility shall conform to local, state, and federal criteria as well as to the requirements of the treatment facility. Documentation of all analyses performed shall be furnished to the Owner. Additional sampling and analyses to the extent required by the approved offsite treatment, storage or disposal (TSD) facility shall be the responsibility of the Contractor and shall be performed at no additional cost to the Owner **OR** subject to approval by the Owner, **as directed**.

OR

Stored material with contaminant levels that exceed the action levels shall be treated onsite.

2. Sampling Liquid

- a. Liquid collected from excavations **OR** storage areas **OR** decontamination facilities, **as directed**, shall be sampled at a frequency of once for every 500 gallons (2,000 L) of liquid collected.
- b. Liquid with contaminant levels that exceed action levels shall be treated offsite. Analyses for contaminated liquid to be taken to an offsite treatment facility shall conform to local, state, and federal criteria as well as to the requirements of the treatment facility. Documentation of all analyses performed shall be furnished to the Owner. Additional sampling and analysis to the extent required by the approved offsite treatment, storage or disposal (TSD) facility receiving the material shall be the responsibility of the Contractor and shall be performed at no additional cost to the Owner **OR** subject to approval by the Owner.

OR

Liquid with contaminant levels that exceed action levels shall be treated onsite.

3. Sampling Beneath Storage Units

- a. Samples from beneath each storage unit shall be collected prior to construction of and after removal of the storage unit. Samples shall be collected at a frequency as directed by the Owner from a depth interval of 0 to 0.5 feet (0 to 0.15 m).
- b. Based on test results, soil which has become contaminated above action levels shall be removed at no additional cost to the Owner. Contaminated material which is removed from beneath the storage unit shall be handled in accordance with paragraph Sampling of Stored Material. as directed by the Owner and at no additional cost to the Owner, additional sampling and testing shall be performed to verify areas of contamination found beneath stockpiles have been cleaned up to below action levels.

G. Spills

1. In the event of a spill or release of a hazardous substance (as designated in NARA 40 CFR 302), pollutant, contaminant, or oil (as governed by the Oil Pollution Act [OPA], 33 U.S.C. 2701 et seq.), the Contractor shall notify the Owner immediately. If the spill exceeds the reporting threshold, the Contractor shall follow the pre-established procedures as described in the Contingency Plan for immediate reporting and containment. Immediate containment actions shall be taken to minimize the effect of any spill or leak. Cleanup shall be in accordance with applicable federal, state, and local regulations. as directed by the Owner, additional sampling and testing shall be performed to verify spills have been cleaned up. Spill cleanup and testing shall be done at no additional cost to the Owner.

H. Backfilling

1. Confirmation Test Results: Excavations shall be backfilled immediately after all contaminated materials have been removed and confirmation test results have been approved. Backfill shall be placed and compacted to the lines and grades shown on the drawings.



2. **Compaction:** Approved backfill shall be placed in lifts with a maximum loose thickness of 8 inches (200 mm). Soil shall be compacted to 90 percent of ASTM D 698 **OR** ASTM D 1557, **as directed**, maximum dry density. Density tests shall be performed at a frequency of once per 10,000 square feet (930 square meters) per lift. A minimum of one density test shall be performed on each lift of backfill placed. Field in-place dry density shall be determined in accordance with ASTM D 1556, ASTM D 2167, or ASTM D 2922. If ASTM D 2922 is used, a minimum of one in ten tests shall be checked using ASTM D 1556 or ASTM D 2167. Test results from ASTM D 1556 or ASTM D 2167 shall govern if there is a discrepancy with the ASTM D 2922 test results.
 - I. **Disposal Requirements**
 1. Offsite disposal of contaminated material shall be in accordance with Division 2 Section "Disposal of Hazardous Materials."
 - J. **Closure Report**
 1. Three copies of a Closure Report shall be prepared and submitted within 14 calendar days of completing work at the site. The report shall be labeled with the contract number, project name, location, date, and name of general contractor. The Closure Report shall include the following information as a minimum:
 - a. A cover letter signed by a responsible company official **OR** Professional Engineer registered in the state of the work who is a responsible company official, **as directed**, certifying that all services involved have been performed in accordance with the terms and conditions of the contract documents and regulatory requirements.
 - b. A narrative report including, but not limited to, the following:
 - 1) site conditions, ground water elevation, and cleanup criteria;
 - 2) excavation logs;
 - 3) field screening readings;
 - 4) quantity of materials removed from each area of contamination;
 - 5) quantity of water/product removed during dewatering;
 - 6) sampling locations and sampling methods;
 - 7) sample collection data such as time of collection and method of preservation;
 - 8) sample chain-of-custody forms; and
 - 9) source of backfill.
 - c. Copies of all chemical and physical test results.
 - d. Copies of all manifests and land disposal restriction notifications.
 - e. Copies of all certifications of final disposal signed by the responsible disposal facility official.
 - f. Waste profile sheets.
 - g. Scale drawings showing limits of each excavation, limits of contamination, known underground utilities within 50 feet (15 m) of excavation, sample locations, and sample identification numbers. On-site stockpile, storage, treatment, loading, and disposal areas shall also be shown on the drawings.
 - h. **Progress Photographs.** Color photographs shall be used to document progress of the work. A minimum of four views of the site showing the location of the area of contamination, entrance/exit road, and any other notable site conditions shall be taken before work begins. After work has been started, activities at each work location shall be photographically recorded daily **OR** weekly, **as directed**. Photographs shall be a minimum of 3 x 5 inches (76.2 x 127.0 mm) and shall include:
 - 1) Soil removal and sampling.
 - 2) Dewatering operations.
 - 3) Unanticipated events such as spills and the discovery of additional contaminated material.
 - 4) Contaminated material/water storage, handling, treatment, and transport.
 - 5) Site or task-specific employee respiratory and personal protection.
 - 6) Fill placement and grading.



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- 7) Post-construction photographs. After completion of work at each site, the Contractor shall take a minimum of four views of each excavation site. A digital version of all photos shown in the report shall be included with the Closure Report. Photographs shall be a minimum of 3 inches by 5 inches (76mm by 127 mm) and shall be mounted back-to-back in double face plastic sleeves punched to fit standard three ring binders. Each print shall have an information box attached. The box shall be typewritten and arranged as follows:
- Project Name: Direction of View:
 - Location: Date/Time:
 - Photograph No.: Description of View:

END OF SECTION 02 61 00 00



SECTION 02 61 13 00 - UNDERGROUND STORAGE TANK REMOVAL

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing of labor and equipment for the underground storage tank removal. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Work Plan: The Work Plan within 30 days after notice to proceed. The Contractor shall allow 30 days in the schedule for the Owner's review and approval. No adjustment for time or money will be made for resubmittals required as a result of noncompliance.
2. Qualifications: A document indicating that the Contractor meets the specified requirements.
3. Reports
 - a. Backfill Material.
 - b. Tank Contents Verification.
 - c. Contaminated Water Disposal.
 - d. Soil Examination, Testing, and Analysis.
 - e. Reports including the chain-of-custody records.
 - f. Backfilling.
 - g. Copies of all laboratory and field test reports.
 - h. Tank Closure Report: 3 copies of the report for each UST site opened, prepared in a standard 3-ring binder, within 14 days of completing work at each site. Each binder shall be labeled with contract number, project name, location and tank number; each binder shall be indexed. A copy of the report shall be furnished to the Installation Environmental Coordinator.
4. Records
 - a. Salvage Rights: A record of the disposition of salvaged materials at the end of the contract.
5. Qualifications
 - a. The Contractor shall have a minimum of 2 years of tank removal experience and shall be certified by the State in which the Project is located for tank removal work.
 - b. Laboratory Services: For laboratory services the Contractor shall be validated in accordance with state certification requirements.
 - c. Support Staff: The Contractor shall identify all staff involved for the various components, including personnel collecting and shipping samples. The qualifications of these staff members shall be detailed by the Contractor.

C. Regulatory Requirements

1. Permits and Licenses: The Contractor, as required or as directed by the Owner, shall obtain local, state, or federal permits and licenses that directly impact the Contractor's ability to perform the work prior to commencing removal operations.
2. Statutes and Regulations: Tank closures shall be carried out in accordance with 40 CFR 280, 40 CFR 262, 40 CFR 264, and 40 CFR 265 as well as the applicable local and State regulations. Hazardous material and/or waste shall be transported in accordance with applicable local and State regulations.

D. Project/Site Conditions: See the Detailed Scope of Work

1. Sequencing and Scheduling: The Contractor shall notify the Installation Environmental Coordinator and the Owner 5 days prior to tank removal. The Contractor shall be responsible for contacting the Implementation Agency (IA) in accordance with the applicable reporting requirements.



2. Work Plan

- a. The Contractor shall develop, implement, maintain, and supervise as part of the work, a comprehensive plan for tank removal and related operations. As a minimum the plan shall include, but not be limited to, excavation, removal, and ultimate disposal of the tank, its contents, and any contaminated materials. The Work Plan shall be based on work experience, on the requirements of this specification, and on the following references from the American Petroleum Institute:

API RP 1604.
 API Standard 2015.
 API RP 2003.
 API Publication 2217A.
 API Publication 2219.

No work at the site, with the exception of site inspections and mobilization, shall be performed until the Work Plan is approved. At a minimum, the Work Plan shall include:

- 1) Discussion of the removal approach, tank cleaning, and tank cutting procedures.
- 2) A Sampling and Analysis Plan.
- 3) Methods to be employed for product, sludge, vapor, and pumpable liquid removal; purging and inerting; and storage methods proposed for control of surface water.
- 4) Treatment options.
- 5) Identification of waste, tank and contaminated soil transporters and means of transportation.
- 6) Treatment, disposal, and alternate facilities, and means of treatment, disposal or remediation.
- 7) Borrow source.
- 8) Spill prevention plan.
- 9) Spill contingency plan.
- 10) Decontamination procedures, shoring plan, and safety measures.

1.2 PRODUCTS

A. Backfill Material

1. Backfill shall be classified in accordance with ASTM D 2487 as GW, GP, GM, GC, SW, SP, SM, SC, MH, CL, or CH and shall be free from roots and other organic matter, trash, debris, snow, ice or frozen materials. If off-site materials are used, soil classification test results shall be approved prior to bringing the material onsite. The testing frequency for backfill material shall be 1 per 1000 cubic yards or a minimum of 1 test. Non-contaminated material removed from the excavation shall be used for backfill in accordance with Paragraph BACKFILLING.

1.3 EXECUTION

A. General Requirements

1. Safety Guidelines: Personnel shall abide by the safety guidelines specified in Division 01.
2. Burning and Explosives: Use of explosives or burning debris will not be allowed.
3. Protection of Existing Structures and Utilities: The Contractor shall take all necessary precautions to avoid damage to existing structures, their appurtenances, monitoring wells, or utilities that may be affected by work activities. Any damage to utilities or monitoring wells resulting from the Contractor's operations shall be repaired at no expense to the Owner. The Contractor shall coordinate with the installation to locate underground utilities prior to beginning construction. Utilities encountered which were not previously shown or otherwise located shall not be disturbed without approval from the Owner.
4. Shoring: Shoring requirements shall be provided.

B. Tank Contents Verification



1. Sampling: Tank product, pumpable liquids, tank coatings and sludge shall be sampled by the Contractor. If the data is not adequate, additional sampling and analysis to the extent required by the approved permitted treatment, storage or disposal (TSD) facility receiving the material shall be the responsibility of the Contractor. Meeting all regulatory requirements, including the preparation of hazardous materials and waste for transportation shall be the responsibility of the Contractor.
 2. Analysis: Tank contents shall be tested by the Contractor for the parameters listed herein. Analyses shall include total petroleum hydrocarbons (TPH), benzene, ethylbenzene, toluene and xylene (BETX), and lead.
 3. Characterization: Prior to removing any of the tank contents, the contents shall be characterized to determine if the tank contents must be disposed as a hazardous or special waste or in a special manner based on local, state, and Federal disposal regulations. Tank product, pumpable liquids, and sludge shall be characterized in accordance with 40 CFR 261 and 40 CFR 279. The waste contents determination and accompanying test results for each phase present in the tank shall be submitted to the Owner. The Contractor shall be responsible for any additional requirements identified by the disposal facility. The tank contents shall not be removed until approval is given by the Owner.
- C. Clearing, Grubbing And Removals
1. Areas designated for clearing and grubbing shall be cleared of all trees, stumps, down timber, brush, rubbish, roots larger than 75 mm (3 inches) in diameter, and matted roots prior to commencing operations. Concrete or asphalt pavement shall be saw cut at the limits of removal, broken and removed with the resulting debris disposed of as directed by the Owner. Chain link fence shall be removed and salvaged for reuse or disposed of off-site, as directed by the Owner.
- D. Topsoil
1. Uncontaminated topsoil shall be stripped and stockpiled separately for reuse at a location approved by the Owner if it meets the requirements of clean fill given in Paragraph BACKFILLING. Additional topsoil in excess of that produced by excavation shall be obtained where directed by the Owner. All areas disturbed by tank removal operations, other than areas to receive pavement or similar surface under this contract, shall be topsoiled. Topsoil shall be used wherever directed by the Owner.
- E. Preparations For Excavation: Before excavating, the Contractor shall drain product piping back to the tank, remove residual liquids trapped in the product lines, and remove all product from the tank; and the tank shall be purged and vented in accordance with API RP 1604, and as specified herein.
1. Removal of Product, Pumpable Liquids, and Sludge: Tank product, pumpable liquids, and sludge shall be contained, and stored onsite, prior to disposal. Contaminated water shall be treated as specified. Tank product, pumpable liquids, and sludge shall be analyzed and segregated to recover reusable products by the Owner prior to being transported to the designated location or treatment, storage and disposal (TSD) facility. Tank product, pumpable liquids, and sludge shall be removed and disposed of by the Contractor. No Owner facilities shall be used for permanent storage or disposal of the wastes. Temporary storage on Owner's facilities will be allowed only until testing is complete, manifests (if necessary) are complete, and transportation is arranged. The Contractor shall be responsible for obtaining all required permits. Usable product shall be the property of the Contractor. The Contractor shall provide approved containers, vehicles, equipment, labor, signs, labels, placards and manifests and associated land disposal restriction notices and notifications, necessary for accomplishment of the work, including materials necessary for cleaning up spills that could occur from tank removal operations.
 2. Contaminated Water Disposal:
 - a. Sampling, Analysis, and Containment
 - 1) Contaminated water shall be sampled and analyzed both prior to and after treatment. Contaminated water produced from excavation operations and tank pumping treated onsite, shall be analyzed for pH; benzene, ethylbenzene, toluene, and xylene (BETX); total lead; oil and grease; total petroleum hydrocarbons (TPH). Sampling and analysis shall be performed prior to disposal for every 200,000 L



- (50,000 gallons) of contaminated water treated. Analysis for contaminated water to be taken to an off-site treatment facility shall conform to the requirements of the treatment facility with documentation of all analyses performed furnished to the Owner in accordance with paragraph RECORDS.
- 2) Contaminated water shall be contained, stored onsite, and analyzed and disposed of by the Contractor in accordance with applicable Federal and state disposal regulations. The Contractor shall provide approved containers, vehicles, equipment, labor, signs, labels, placards and manifests and associated land disposal notices and notifications, necessary for accomplishment of the work.
 - b. Treatment: Contaminated water shall be treated by oil water separation, filtering, air stripping and activated carbon, or other means as approved by the Owner. If contaminated water is to be treated onsite, the proposed treatment shall be specified in the Work Plan and submitted for approval. Temporary storage and treatment equipment shall be installed at a location approved by the Owner. Treated effluent shall be sampled and analyzed and the results approved by the Owner before discharge to the sanitary sewer or the surface. Effluent shall be treated and discharged in accordance with the discharge permit.
- F. Purging And Inerting: After the tank and piping contents have been removed, but prior to excavation beyond the top of the tank, the Contractor shall disconnect all the piping (except the piping needed to purge or inert the tank). Flammable and toxic vapors shall be purged from the tank or the tank made inert in accordance with API RP 1604, with the exceptions that filling with water shall not be used and, if dry ice is employed, the Contractor shall use a minimum of 1.8 kg per 500 L (3 pounds per 100 gallons) of tank volume. The tank atmosphere shall be continuously monitored for combustible vapors if the tank is purged, or continuously monitored for oxygen if the tank is inerted.
- G. Excavation: Excavation areas, as well as work near roadways, shall be marked as directed by the Owner.
 1. Exploratory Trenches: Exploratory trenches shall be excavated as necessary to determine the tank location, limits and the location of ancillary equipment.
 2. Tank Excavation: Excavation around the perimeter of the tank shall be performed limiting the amount of potentially petroleum contaminated soil that could be mixed with previously uncontaminated soil. Petroleum contaminated soil shall be segregated in separate stockpiles. The Contractor shall maintain around the tank an excavation of sufficient size to allow workers ample room to complete the work, but also protect the workers from sliding or cave-ins. Sheet piling, bracing, or shoring shall be installed in the absence of adequate side slopes if there is a need for workers to enter the excavated area. Surface water shall be diverted to prevent direct entry into the excavation. Dewatering of the excavation may require a discharge permit by the State and shall be limited to allow adequate access to the tank and piping, to assure a safe excavation, and to ensure that compaction and moisture requirements are met during backfilling. Dewatering may result in the production of petroleum contaminated water and/or free product. Free product shall be recovered from the groundwater only as part of necessary dewatering.
 3. Piping Excavation: Excavation shall be performed as necessary to remove tank piping and ancillary equipment in accordance with paragraphs: Shoring, Tank Excavation, and Open Excavations.
 4. Open Excavations: Open excavations and stockpile areas shall be secured while awaiting confirmation test results from the soil beneath the tank. The excavation shall be backfilled as soon as possible after tank and contaminated soil removals have been completed and confirmation samples have been taken. The Contractor shall divert surface water around excavations to prevent water from directly entering into the excavation.
 5. Stockpiles: Uncontaminated excavated soil and petroleum contaminated soil that is not a state-regulated hazardous waste shall be stockpiled and used for backfill in the tank excavation prior to using borrow material or disposed of off-site. Excavated material that is regulated by the state as a hazardous waste shall be considered contaminated and shall be placed in containers such as drums, roll-offs or dumpsters for sampling in accordance with paragraph Stockpiled Material



Sampling. Uncontaminated soil shall be stockpiled separately from the contaminated soil, a safe distance away from, but adjacent to, the excavation.

H. Removal Of Piping, Ancillary Equipment, And Tank

1. Piping and Ancillary Equipment: All piping and ancillary equipment shall be disconnected from the tank. The piping shall be removed completely (interior and exterior of the tank). All tank ancillary equipment and piping connections shall be capped, except those connections necessary to inert the tank within the excavation zone. The piping exterior and ancillary equipment shall be cleaned to remove all soil and inspected for signs of corrosion and leakage. The Contractor shall ensure no spillage of the piping contents occurs, as specified in the Work Plan, and as required in paragraph SPILLS. If the soil under and around the tank pad is contaminated, the tank pad shall be removed and disposed of off-site at an approved non-hazardous or hazardous waste facility, as required. If the soil under and around the tank pad is not contaminated, the tank pad shall remain in place.
2. Tank: The tank shall be removed from the excavation and the exterior cleaned to remove all soil and inspected for signs of corrosion, structural damage, or leakage. All materials coming into contact with the tank, or in the vicinity of the excavation such as shovels, slings and tools shall be of the non-sparking type. After removal from the excavation, the tank shall be placed on a level surface at an approved location and secured with wood blocks to prevent movement.
3. Contaminated Soil, Tank and Piping Excavation Examination: After the tank has been removed from the ground, the adjacent and underlying soil shall be examined for any evidence of leakage. The soil shall be visually inspected for staining after removal of all obviously contaminated soil, then screened for the presence of volatile and/or semi-volatile contamination using a real time vapor monitoring instrument or immunoassay field kits, as required. Uncontaminated soil or petroleum contaminated soil not regulated by the state as hazardous waste shall be transported off-site for disposal. Contaminated soil or suspected contaminated soil shall be containerized. the Owner shall determine the extent of the contaminated soil to be removed from each site. The Contractor shall report any evidence indicating that the amount of contaminated soil may exceed the individual site limit specified, to the Owner the same day it is discovered. If minimal additional excavation is required, the Owner may allow the Contractor to proceed. If extensive contamination is encountered, the excavation shall be sampled and backfilled in accordance with paragraph BACKFILLING. After the known contaminated soil is removed, the excavation shall be sampled and analyzed.

I. Tank Cleaning

1. Exterior: Soil shall be removed from the exterior of the tank, piping, and associated equipment to eliminate soil deposition on roadways during transportation to a temporary storage area, ensure markings will adhere to the surfaces, and simplify tank cutting. Soil shall be removed using non-sparking tools. Removed uncontaminated soil and soil not regulated by the state as a hazardous waste shall be recovered and used as backfill in the former tank excavation. Soil believed to be contaminated shall be removed and containerized.
2. Temporary Storage: If the tank is stored after the tank exterior is cleaned and ancillary equipment is removed, and prior to being cut into sections, the tank shall be labeled as directed in API RP 1604, placed on blocks, and temporarily stored in the area of the existing tank site. Prior to cleaning the tank interior the tank atmosphere shall be monitored for combustible vapors and purged or inerted if combustible vapors are detected.
3. Interior:
 - a. The tank interior shall be cleaned using a high pressure (greater than 500 psi (3.45 Mpa)), low volume (less than 2 gpm (0.13 L/s)) water spray or steam cleaned until all loose scale and sludge is removed, and contamination, in the form of a sheen, is no longer visible in the effluent stream. The interior surfaces of piping shall also be cleaned, to the extent possible, using the same method used for cleaning the tank. Contaminated water generated from interior cleaning operations (of both piping and tank) shall not exceed the following quantities for each UST cleaned:

UST VOLUME (LITERS)

PERCENT OF UST VOLUME



3,785 or less	5
37,850 or less	5 or 378 L, whichever is less
75,700 or less	1 or 568 L, whichever is less
greater than 75,700	1 or 946 L, whichever is less

UST VOLUME (GALLONS)	PERCENT OF UST VOLUME
1,000 or less	5
10,000 or less	5 or 100 gal., whichever is less
20,000 or less	1 or 150 gal., whichever is less
greater than 20,000	1 or 250 gal., whichever is less.

- b. All contaminated water resulting from cleaning operations shall be handled in accordance with paragraph Contaminated Water Disposal. Cleaning shall be accomplished eliminating, to the greatest extent possible, the need for personnel to enter the tank. Cleaning shall be done using specially designed tank cleaning equipment which allows the tank to be cleaned prior to cutting into sections without requiring personnel to enter the tank or, if less specialized equipment is used, the tank shall be partially dissected to overcome confined space entry hazards.

J. Soil Examination, Testing, And Analysis

1. Tank Excavation Sampling Procedures: After soil known to be contaminated has been removed or after soil excavation is complete, the excavation shall be sampled with procedures, number, location, and methodology in accordance with state regulations. Samples shall be obtained from the pits, in accordance with ASTM D 1587, using a backhoe with a Shelby tube attached to the bucket.
2. Stockpiled Material Sampling: Sampling locations, number and specific procedures shall be as required by the implementing agency and the disposal facility.
3. Analysis: Soil samples from the excavation and stockpiled material shall be tested in accordance with the approved Sampling and Analysis Plan for the following parameters: total petroleum hydrocarbon (TPH); benzene, ethylbenzene, toluene, xylene (BETX); toxicity characteristic leaching procedure (TCLP). Copies of all test results shall be provided to the Owner.

- K. Backfilling: The tank area and any other excavations shall be backfilled only after the soil test results have been approved. Contaminated soil removal shall be complete after the bottom of the tank excavation is determined to have soil contamination levels below the state standards of approval by the Owner. The excavation shall be dewatered if necessary. Stockpiled material subjected to chemical confirmation testing shall be used as backfill if it is found to conform to the requirements of clean fill per appropriate state and local regulations. Backfill consisting of clean fill shall be placed in layers with a maximum loose thickness of 200 mm (8 inches) and compacted to 90 percent maximum density for cohesive soils and 95 percent maximum density for cohesionless soils. Density tests shall be performed by an approved commercial testing laboratory or by facilities furnished by the Contractor. Test results shall be attached to contractor's Quality Control Report. A minimum of 1 density test shall be performed on each lift. Laboratory tests for moisture density relations shall be determined in accordance with ASTM D 1557, Method B, C, or D, or ASTM D 3017. A mechanical tamper may be used provided that the results are correlated with those obtained by the hand tamper. Field in-place density shall be determined in accordance with ASTM D 1556, ASTM D 2922, or ASTM D 2167.

L. Disposal Requirements

1. Treatment, Disposal, and Recycling: Disposal of hazardous or special wastes shall be in accordance with all local, State, and Federal solid and hazardous waste laws and regulations; and conditions specified herein. This work shall include all necessary personnel, labor, transportation, packaging, detailed analyses (if required for disposal, manifesting or completing waste profile sheets), equipment, and reports. Product and pumpable liquids removed from the tank shall be recycled to the greatest extent practicable. The tanks removed shall be disposed of



- at one of the state approved facilities. Each tank disposed of in this manner shall be manifested as required by the State to document delivery and acceptance at the disposal facility.
2. Tank and Ancillary Equipment Disposal: After the tank, piping, and ancillary equipment have been removed from the excavation and the tank cleaned, the tank shall be cut into sections with no dimension greater than 1500 mm (5 feet). Tank and piping sections shall be disposed of in a State approved off-site disposal facility or in a salvage yard. The tank shall be cut into sections prior to being taken from the tank removal site. The Contractor shall not sell the tank intact. Ancillary equipment shall be disposed of at an approved off-site disposal facility or a salvage yard. Piping shall be disconnected from the tank and removed or grouted full of a portland cement and water slurry consisting of 22.7 L (6 gallons) of clean water per 42.6 kg (94 pound) sack of portland cement, thoroughly mixed and free of lumps, unless otherwise indicated.
 3. Transportation of Wastes: Transportation shall be provided in accordance with Department of Transportation (DOT) Hazardous Material Regulations and State and local requirements, including obtaining all necessary permits, licenses, and approvals. Evidence that a State licensed hazardous waste or waste transporter is being used shall be included in the SUBMITTALS.
 4. Salvage Rights: The Contractor shall retain the rights to salvage value of recycled or reclaimed product and metal not otherwise identified, so long as the requirements of 40 CFR 266 and 40 CFR 279, or the applicable State requirements are met. At the end of the contract, the Contractor shall provide documentation on the disposition of salvaged materials.
 5. Records: Records shall be maintained of all waste determinations, including appropriate results of analyses performed, substances and sample location, the time of collection, and other pertinent data as required by 40 CFR 280, Section 74 and 40 CFR 262 Subpart D. Transportation, treatment, disposal methods and dates, the quantities of waste, the names and addresses of each transporter and the disposal or reclamation facility, shall also be recorded and available for inspection, as well as copies of the following documents:
 - a. Manifests.
 - b. Waste analyses or waste profile sheets.
 - c. Certifications of final treatment/disposal signed by the responsible disposal facility official.
 - d. Land disposal notification records required under 40 CFR 268 for hazardous wastes.
 6. Hazardous/Special Waste Manifests: Manifesting shall conform to Federal, State and local requirements.
 7. Documentation of Treatment or Disposal: The wastes, other than recyclable or reclaimable product or metal, shall be taken to a treatment, storage, or disposal facility which has EPA or appropriate state permits and hazardous or special waste identification numbers and complies with the provisions of the disposal regulations. Documentation of acceptance of special waste by a facility legally permitted to treat or dispose of those materials shall be furnished to the Owner not later than 5 working days following the delivery of those materials to the facility; and a copy shall be included in the Tank Closure Report. A statement of agreement from the proposed treatment, storage or disposal facility and certified transporters to accept hazardous or special wastes shall be furnished to the Owner not less than 14 days before transporting any wastes. If the Contractor selects a different facility than is identified in the contract, documentation shall be provided for approval to certify that the facility is authorized and meets the standards specified in 40 CFR 264.
- M. Spills: Immediate containment actions shall be taken as necessary to minimize effect of any spill or leak. Cleanup shall be in accordance with applicable Federal, State, local laws and regulations, and district policy at no additional cost to the Owner.
- N. Tank Closure Report: Tank Closure Reports shall include the following information as a minimum:
1. A cover letter signed by a Professional Engineer registered in the State in which the Project is located certifying that all services involved have been performed in accordance with the terms and conditions of this specification.
 2. A narrative report describing what was encountered at each site, including:
 - a. condition of the UST.
 - b. any visible evidence of leaks or stained soils.
 - c. results of vapor monitoring readings.



- d. actions taken including quantities of materials treated or removed.
 - e. reasons for selecting sample locations.
 - f. sample locations.
 - g. collection data such as time of collection and method of preservation.
 - h. reasons for backfilling site.
 - i. whether or not groundwater was encountered.
3. Copies of all analyses performed for disposal.
 4. Copies of all waste analyses or waste profile sheets.
 5. Copies of all certifications of final disposal signed by the responsible disposal installation official.
 6. Information on who sampled, analyzed, transported, and accepted all wastes encountered, including copies of manifests, waste profile sheets, land disposal restriction, notification and certification forms, certificates of disposal, and other pertinent documentation.
 7. Copies of all analyses performed for confirmation that underlying soil is not contaminated, with copies of chain-of-custody for each sample. Analyses shall give the identification number of the sample used. Sample identification numbers shall correspond to those provided on the one-line drawings.
 8. Scaled one-line drawings showing tank locations, limits of excavation, limits of contamination, underground utilities within 15 m (50 feet) sample locations, and sample identification numbers.
 9. Progress Photographs. The Contractor shall take a minimum of 4 views of the site showing such things as the location of each tank, entrance/exit road, and any other notable site condition before work begins. After work has been started at the site, the Contractor shall photographically record activities at each work location daily. Photographs shall be 76.2 x 127.0 mm (3 x 5 inches) and shall include:
 - a. Soil removal, handling, and sampling.
 - b. Unanticipated events such as discovery of additional contaminated areas.
 - c. Soil stockpile area.
 - d. Tank.
 - e. Site or task-specific employee respiratory and personal protection.
 - f. Fill placement and grading.
 - g. Post-construction photographs. After completion of work at each site, the Contractor shall take a minimum of four (4) views of the site. Prints shall illustrate the condition and location of work and the state of progress. The photographs shall be mounted and enclosed back-to-back in a double face plastic sleeve punched to fit standard three ring binders. Each color print shall show an information box, 40 x 90 mm (1-1/2 x 3-1/2 inches). The information box for the 76.2 x 127.0 mm (3 x 5 inch) photographs shall be scaled down accordingly, or taped to the bottom of the photo. The box shall be typewritten and arranged as follows:
 - Project No.
 - Contract No.
 - Location
 - Contractor/Photographer
 - Photograph No. Date/Time:
 - Description
 - Direction of View

END OF SECTION 02 61 13 00



SECTION 02 61 13 00a - PRECISION TESTING OF UNDERGROUND FUEL OIL TANKS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing of labor and equipment for the precision testing of underground fuel oil tanks. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

1.2 PRODUCTS - (Not Used)**1.3 EXECUTION**

- A. The Contractor shall furnish all the necessary labor and equipment to complete the Precision Fuel Oil Tank Testing at various buildings under the jurisdiction of the Owner. The pertinent quantity and the capacity of the tanks will be listed on each Job Order. When the contractor elects to use a volumetric tank tester, it shall be responsible to fill up and "top off" tank to a maximum of 100 gallons prior to the start of testing. The cost to "top off" tank will be the contractor's responsibility.
- B. The Contractor shall provide the material and labor necessary for the drilling and tapping of the existing oil tank manhole cover and the installation of new air bleeder valves. The air bleeder valve shall be a Hoffman Specialty #40 or #41 or their approved equal.
- C. Coordination of Work: Prior to performing any test, the contractor shall notify the Owner of the scheduled test date. Designated personnel from the Owner shall take necessary actions to coordinate fuel oil delivery and shall inform the contractor of the date and time of the fuel delivery. The contractor shall ascertain that the tanks are filled to capacity and shall be responsible to have the tanks "topped off" up to a maximum of 100 gallons prior to the start of testing. The contractor shall make arrangements to perform the testing within forty-eight (48) hours of notification that the oil tank has been filled. The Contractor's responsibility to "top off" tank only applies when the contractor elects to utilize a volumetric tank tester.
- D. Test Equipment: The Contractor shall be limited to using state approved Precision Testing methods equal to the following:
 - Ainlay Tank Tegrity Tester
 - Horner EZY 3
 - Hunter Leak Lokator
 - Tank Auditor
 - Petro Tite
- E. Test Results: The Contractor will be required to submit written reports of test results as noted below.
 1. The test reports' format shall be approved by the testing equipment manufacturer and the state.
 2. The Contractor shall submit one (1) type written report within seven (7) days of completion of the testing to the Owner.
 3. The Contractor shall submit one copy of the report to the state within thirty (30) days of completion of the testing. Proof of submission shall be appended to the request for payment.
 4. The test results shall include, but not be limited to:
 - a. Name and/or Number of Building
 - b. Address of Building



- c. Date and Time of Test
 - d. Results of test including (Actual Data Calculations Graphs)
 - e. Test Method
 - f. Name and address of Contractor
 - g. Signature of test technician
5. Should the test indicate a leakage condition, the contractor shall perform the following:
- a. Initiate procedure to isolate piping from tank and determine the source of the leak. This work shall be performed after notification of the Owner.
 - b. Submit a written proposal and cost estimate for work required to be performed to repair leak. Recommended proposal shall be submitted to the Owner within 48-hours after determining source of leak. No repair work shall proceed without authorization by the Owner.
 - c. Notify the state of leak discovered in underground buried tank. This notification shall take place within 2 hours of determining source of leak.
 - d. In these cases, the Owner may direct the Contractor to complete the work or exercise its option to perform the required work by its own forces or under separate contract.
6. After completion of the remedial work when applicable, the contractor shall perform a re-test, and shall issue a final test report in aforementioned format. The contractor shall be paid 50% of the bid unit price for the re-test.

END OF SECTION 02 61 13 00a



SECTION 02 61 13 00b - HYDROSTATIC PRESSURE TESTING OF AIR RECEIVING TANKS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing of labor and equipment for the hydrostatic pressure testing of air receiving tanks. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

1.2 PRODUCTS - (Not Used)**1.3 EXECUTION****A. General**

1. Disconnect all piping and remove safety valve from air receiving tank and temporarily plug all openings on the disconnected tank.
2. Perform hydrostatic test at not less than twice the charging pressure, at 70 degrees Fahrenheit, for fifteen (15) minutes in accordance with the Administrative Code of the applicable Authority.
3. Test shall be performed in the presence of a representative of the Inspection Unit. Contractor shall notify the Owner's Inspection Unit seventy-two (72) hours prior to test.
4. At the completion of each test, contractor shall reconnect all piping and reinstall all removed equipment.
5. The Contractor shall issue an affidavit of test to the Owner. The affidavit shall state the date of test, testing pressure and the maximum working pressure allowable until the next test.
6. Furnish and install a glass enclosed aluminum frame of suitable size to display affidavit. Frame shall be open at the top for easy access to affidavit. Frame shall be firmly affixed in a permanent location adjacent to receiver tank as directed by the Owner.

B. Intent: Pursuant to the provisions of the Administrative Code of applicable Authority, and in the interest of public safety, the Owner requires that:

1. All compressed air tanks shall be tested by a person who has received a Certificate of Fitness from the Owner to conduct such a test in the manner and to the pressure set forth in the code before being continued in use.
2. Licensed testers shall submit ten (10) day notice of appointments to the Owner.
3. A sworn statement by the person conducting the test, in proper affidavit form, attesting to the completion of such test, shall be filed with the Owner's office and a copy thereof posted on the premises.
4. The submission of such an affidavit or posting a copy thereof, where the required test has not been carried out in accordance with the foregoing provisions of law, shall be cause for the revocation of the Certificate of Fitness, denial of the required permits to maintain and operate equipment and may also subject the individual to criminal liability for filing a false affidavit and a fine of up to five hundred dollars, imprisonment of up to six months, or both.

END OF SECTION 02 61 13 00b



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Task	Specification	Specification Description
02 61 13 00	02 41 16 13	Selective Demolition
02 61 13 00	02 61 00 00	Excavation And Handling Of Contaminated Material
02 65 00 00	02 41 16 13	Selective Demolition
02 65 00 00	02 61 00 00	Excavation And Handling Of Contaminated Material
02 65 00 00	02 61 13 00	Underground Storage Tank Removal
02 65 00 00	02 61 13 00a	Precision Testing Of Underground Fuel Oil Tanks
02 65 00 00	02 61 13 00b	Hydrostatic Pressure Testing Of Air Receiving Tanks



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SECTION 02 81 00 00 - DISPOSAL OF HAZARDOUS MATERIALS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for disposal of hazardous materials. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Definition

1. Hazardous materials shall be defined as asbestos containing materials, lead-based paint, PCBs, bird waste, and other materials categorized as hazardous by the EPA.

C. Submittals

1. Before start of work: At the pre-construction meeting, the Contractor shall submit the following to the Owner's Representative for review. Do not start work until these submittal are returned with Owner's Representative stamp indicating that the submittal is returned for unrestricted use.
 - a. Copy of State or local license for hazardous waste hauler.
 - b. Certificate of at least one on-site supervisor which has satisfactorily completed the OSHA 40 hour Health and Safety course for handling hazardous materials.
 - c. Certificates of workers which have successfully completed the OSHA 40-Hour Health and Safety Course for Hazardous Materials.
 - d. List of the employees scheduled to perform this work.
 - e. Schedule of start and finish times and dates for this work.
 - f. Name and address of landfill where these waste materials are to be deposited. Include contact person and telephone number.
 - g. Material Safety Data Sheet (MSDS) for all materials to be removed.
 - h. If contractor introduces any chemical into the work environment, a MSDS for that chemical must be presented to the Owner's Representative prior to use.
 - i. Transporter must have notified the EPA and/or other appropriate local government agency in advance of its intentions to transport hazardous materials and, if applicable, receive an identification number.
 - j. Contingency Plan for handling emergencies with spills or leaks.
 - k. Certificates of workers which have successfully completed the OSHA 24-Hour Health and Safety Course for Hazardous Materials.

1.2 PRODUCTS**A. Materials**

1. Drums: Recovery or salvage drums acceptable for disposal of hazardous waste. Prior approval of drums is required. Drums or containers must meet the required OSHA, EPA (40 CFR Parts 264-264 and 300), and DOT Regulations (49 CFR Parts 171-178). Use of damaged containers shall not be allowed.
2. Labels: As required by the EPA and OSHA for handling, transportation, and disposal of hazardous waste.
3. Absorbent Material: Clay, soil or any commercially available absorbent used for the purpose of absorbing hazardous or potentially hazardous materials.

1.3 EXECUTION

02 - Existing Conditions



-
- A. All waste shall be transported and disposed of in accordance with all federal, state and local guidelines and regulations. The contractor is to obtain all permits, licenses, etc., which are necessary for the transporting and disposal of hazardous waste.
 - B. Waste haulers shall maintain waste manifest and shipment record forms.

END OF SECTION 02 81 00 00



Task	Specification	Specification Description
02 81 00 00	02 61 00 00	Excavation And Handling Of Contaminated Material



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SECTION 02 82 16 00 - ENCAPSULATION (LOCK-DOWN) OF ASBESTOS-CONTAINING MATERIALS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for encapsulation (lock-down) of asbestos-containing materials. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: Manufacturers technical information including label analysis and application instructions for each material proposed for use.
2. Installation Instructions: Manufacturer's installation instructions with specific project requirements noted.
3. Performance Warrantee: Manufacturers performance guarantee.
4. Material Safety Data Sheet: Material Safety Data Sheet in accordance with the OSHA Hazard Communication Standard (29 CFR 1910.1200) for each surfactant and encapsulating material proposed for use on the work. Include a separate attachment for each sheet indicating the specific worker protective equipment proposed for use with the material indicated.

C. Delivery And Storage: Deliver materials to the job site in original, new and unopened packages and containers bearing manufacturer's name and label, and following information:

1. Name or title of material
2. Manufacturer's stock number and date of manufacture
3. Manufacturer's name
4. Thinning instructions
5. Application instructions
6. Deliver materials together with a copy of the OSHA Material Safety Data Sheet for the material.
- 7.

D. Job Conditions: Apply encapsulating materials only when environmental conditions in the work area are as required by the manufacturer's instructions.**E. Quality Assurance**

1. Testing: Test material to be encapsulated using methods set forth in ASTM E1494 "Standard Practice for Encapsulants for Spray-or-Trowel-Applied Friable Asbestos-Containing Building Materials."

F. Warranty

1. Performance Warranty: Contractor shall submit written Performance Warranty, executed by the contractor, agreeing to repair/replace spray-on work which has cracked, fallen from substrate, or otherwise deteriorated to a condition where it would not perform effectively for its intended purposes due substantially to defective materials or workmanship and not due to abuse by occupants, improper maintenance, unforeseeable ambient exposures or other causes beyond anticipated conditions and contractors control. Warranty period shall be for at least one year after date of Final Completion.

1.2 PRODUCTS**A. Materials**



1. Encapsulant system shall be an acrylic, elastomeric type, spray, brush or roller-applied, tinted penetrating or tinted bridging type, specifically designed for application to asbestos-containing material. System shall be equal to Global Encasement System as manufactured by GLOBAL Encasement Inc., 132-32nd Street, Union City, NJ 07087 U.S.A., Tel. (800) 266-3982/(201) 902-9770.
 - a. All encasement topcoat materials shall be warranted to be heavy-bodied, from the same manufacturer, and shall be long lasting, highly-pure (low VOC) materials that remain flexible, chalk resistant and resist cracking, peeling, algae and fungus that can cause future indoor air quality concerns.
 - b. To allow for building movement without cracking or disturbing fibrous materials, coating systems shall have passed testing to ASTM standards for adhesion, permeability, aged flexibility and with aged elasticity for the encasement system of over 250%.
 - c. Coatings shall be Class A Fire Rated, water-based, non-toxic, safe and easy to use, contain no hazardous ingredients by OSHA definition, comply with all known building codes and be non-flammable.
 - d. Coating materials shall have low VOC (Volatile Organic Compound) content.
 - e. Coating materials shall not release health threatening toxic smoke and fumes in a fire and shall comply with all known building codes.
 - f. Coating materials shall have passed the following testing standards:
 - 1) ASTM E 119 fire tests demonstrating that applying a multi-layer system over fireproofing does not adversely affect the fireproof rating of the fireproofing (3 hour test).
 - 2) UPITT Combustion Toxicity Test proving nothing toxic is released in a fire.
 - 3) ASTM E 84 and E162 fire tests for "Class A" - Surface Flammability and Burning Characteristics (Flame Spread = 0, Smoke Developed = 5).
 - 4) "Pull-off Adhesion" test per ASTM E736 equals or exceeds 9,950 lbs./sq. ft. (89.1 lbs./sq. in.).
 - 5) ASTM D 1653 and E96 "Water Vapor Permeability" (showing the rate that water vapor can pass through the system).
 - 6) Impact Resistance, "Tensile Strength" shall exceed 150 psi; "Elongation" shall exceed 250%.
 - 7) System shall be mildew resistant, impact resistant, scrub resistant, non-yellowing, non-chalking, highly blister resistant, rust resistant, highly chemical resistant and shall remain flexible after 1000 hour ASTM Accelerated Weather testing.
 - 8) Water-Based materials (low VOC) Volatile Organic Content of Primer-Sealer-Neutralizer = 0.1 g/L (0.001 lb./gal.) and Encasement Top Coat = 0.1 g/L (0.001 lb./gal.) as tested by EPA Method 24.
 - 9) Materials comply with applicable standards for installation on interior and/or exterior surfaces of a building.
 - 10) Encasement Systems shall provide additional water-proofing protection.
- B. Related Materials:
1. Elastomeric architectural sealants, caulking compounds, primers, and similar materials shall be approved by the manufacturer of the encasement coatings. All materials used shall be applied in accordance with its manufacturer's recommendations.
- C. Applicable Standards
1. Product shall be rated as acceptable for use intended when field tested in accordance with ASTM E 1494.

1.3 EXECUTION

A. General



1. Prior to applying any encapsulating material in Work Areas, Contractor shall obtain final visual inspection approval by the Project Administrator.
 2. Prior to applying any encapsulating material, Contractor shall ensure that application of the sealer will not cause the base material to fail and allow the sealed material to fall of its own weight or separate from the substrate. Should Contractor doubt the ability of the installation to support the sealant, request direction from the Owner's Representative before proceeding with the encapsulating work.
 3. Do Not Commence Application of encapsulating materials until all removal work within the work area has been completed.
- B. Worker Protection
1. Before beginning work with any material for which a Material Safety Data Sheet has been submitted provide workers with the required protective equipment. Require that appropriate protective equipment be used at all times.
- C. Application
1. Comply with all manufacturer's instructions for particular conditions of installation. Consult with manufacturer's technical representative for conditions not covered.
 2. Encapsulate all surfaces in full compliance with manufacturer's procedures.
 3. At completion of Encapsulation and before removal of Work Area enclosures and Pressure Differential System, decontaminate space in accordance with requirements of manufacturer's instructions.
 4. Remove all debris from the project site and restore area to proper conditions by cleaning all surfaces in accordance with manufacturer's written recommendations.
 5. At completion of work submit manufacturer's record of inspection of completed work and Manufacturers Performance Guarantee executed by both manufacturer and Contractor.

END OF SECTION 02 82 16 00



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SECTION 02 82 33 00 - REMOVAL OF FRIABLE ASBESTOS-CONTAINING MATERIALS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for removal of friable asbestos-containing materials. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Description

1. Furnish all labor, materials, facilities, equipment, services, employee training and testing, permits and agreements necessary to perform the work required for asbestos removal, encapsulation, repair, clean-up, decontamination, re-insulation and all other work in accordance with these specifications, in accordance with the latest regulations from the U.S. Environmental Protection Agency (EPA), the Occupational Safety and Health Administration (OSHA), the recommendations of National Institute of Occupational Safety and Health (NIOSH), and any other applicable federal, state and local government regulations. Whenever there is a conflict or overlap of the above references, the most stringent provision is applicable.
2. The work specified herein shall be performed by competent persons trained, knowledgeable and qualified in the state-of-the-art techniques of asbestos abatement, handling and subsequent cleaning of contaminated areas.

C. Scope

1. The quantities of materials and limits of abatement work area(s) shall be verified by the asbestos contractor.

D. Asbestos Hazard

1. Asbestos-containing material when damaged or disturbed is subject to fiber releases. Wet methods are a primary means of controlling fiber release.
2. Strict compliance with each of the provisions outlined in these specifications for the encapsulation, repair and handling of asbestos-containing material is of great importance, because:
 - a. The inhalation of airborne asbestos fibers can cause a very serious and often fatal disease.
 - b. Workers may not be aware they are inhaling asbestos fibers.
 - c. Symptoms of the disease do not appear for many years.
 - d. Only the Contractor and its employees can prevent the inhalation of asbestos fibers, which can lead to the development of asbestos-related disease.
 - e. No insurance is available to provide for asbestos-related disease.

E. Other Hazardous Material

1. Contractor shall comply with OSHA 29 CFR 1926.62 - Lead in Construction when demolishing any equipment or architectural component identified as lead-containing or lead-based paint. The work of this project is considered a demolition activity.
2. the Owner anticipates that a substantial amount of the Project will involve lead paint.

F. Qualifications

1. the Owner and the Owner's Representative will verify and approve the experience of the Asbestos Abatement Contractor based upon submission at the time of bidding by Contractor evidence of the following:
 - a. Experience: Provide the names and locations of at least three asbestos abatement projects of comparable size and complexity comparable with this work. Provide the names and telephone numbers of contact person at previous projects. Provide the final air monitoring decontamination fiber levels achieved.



- b. Personnel: Provide the name(s) of "Competent Person" as defined by OSHA 29 CFR 1926.32(f) - Asbestos. Demonstrate the education and specialized training with successful completion of examination of an EPA approved course. Provide evidence of participation in five projects of complexity comparable with this project.
- c. Licensing and Certification: The Contractor must hold a current, valid asbestos license issued by the State in which the work is to be performed.

G. Notices And Record Keeping

1. Contractor shall maintain for at least 30 years, a record for each asbestos project in which the Contractor engages. Each record shall include the following information: name, address, and social security number of all personnel involved with the project, the name address and social security number of the OSHA "Competent Person" who will supervise the work, the amount of asbestos material that was removed, repaired, encapsulated or disturbed, the commencement and completion date of the work, copies of Hazardous Waste Manifest(s), personal air monitoring results and any other appropriate information.
2. The Contractor shall send written notification as required by USEPA National Emission Standards for Hazardous Air Pollutants (NESHAPS) Asbestos Regulations (40 CFR 61, Subpart M) to the Owner, at least 10 working days prior to beginning any work on asbestos-containing materials.
3. Include the following information:
 - a. Name and address of the Owner or operator.
 - b. Description of the facility being demolished or renovated, including the size, age, and prior use of the facility.
 - c. Estimate of the approximate amount of asbestos material present in the facility in terms of linear feet of pipe, and surface area on other facility components. For facilities in which the amount of asbestos materials is less than 80 linear meters (260 linear feet) on pipes and less than 15 square meters (160 square feet) on other facility components, explain techniques of estimation.
 - d. Location of the facility being demolished or renovated.
 - e. Scheduled starting and completion dates of demolition or renovation.
 - f. Nature of planned demolition or renovation and method(s) to be used.
 - g. Procedures to be used to comply with the requirements of USEPA National Emission Standards for Hazardous Air Pollutants (NESHAPS) Asbestos Regulations (40 CFR 61 Subpart M).
 - h. Name and location of the waste disposal site where the asbestos waste material will be deposited.
4. Prior to commencement of work, the Contractor shall submit the following documents to the Owner's Representative. No work will be allowed to start until these documents have been approved:
 - a. The schedule of the work, including manpower, length and number of work shifts. Schedule shall be coordinated with the Owner's full occupancy of all areas of the building.
 - b. Satisfactory proof that written notification has been provided to the EPA regional office and the Owner.
 - c. Proof that all required permits, disposal site locations, and arrangements for transportation and disposal of asbestos-contaminated materials, supplies and the like have been obtained.
 - d. Complete a worker certificate indicating that all employees have had instruction and training on the hazards of asbestos exposure, the use and fitting of respirators, protective dress, wet and dry decontamination procedures, entry and exit from work areas, and all aspects of work procedures and protective measures.
 - e. Documentation indicating that all employees have received appropriate medical examinations and have successfully passed fit testing for the respirator to be worn. As a minimum, medical exams must be consistent with OSHA 29 CFR 1926.1101(K)(9)(viii)(G)-Asbestos Regulation.



- f. Samples of signs to be used in and around the work area to comply with OSHA 29 CFR 1926.1101(K)(9)(viii)(I)- Asbestos regulations and as required by federal, state and municipal regulations.
 - g. Material Safety Data Sheets (OSHA form 174 or equivalent) for all chemicals used during work performed under this section.
 - h. Encapsulation data and encapsulation procedures.
 - i. Design of pressure differential system including calculation used to arrive at the number of machines necessary to achieve one air change per every 10 minutes.
 - j. Location of personnel and material decontamination units for each work area.
5. Contractor shall provide written notification to the Owner's Representative of its intent to start work at least five days in advance. In no case will the Contractor start work until authorization to proceed is given.
 6. During the work, Contractor shall maintain a daily log which will be kept at the job site. Items to be included in the daily log shall include but are not limited to the following:
 - a. Meetings, purpose, attendees, discussions, items of resolution.
 - b. Visitations, authorized and unauthorized.
 - c. Sign-in sheets of all personnel entering and leaving the work area.
 - d. Special or unusual events (i.e., barrier breeching equipment failures).
 - e. Personal air monitoring results.
 - f. Two copies of the daily log are required for Project Closeout.
- H. Terminology (Definitions)
1. Abatement - Procedures to control fiber release from asbestos-containing materials. Includes removal, enclosure or encapsulation.
 2. Air Lock - A system for permitting ingress or egress without permitting air movement between any two adjacent areas consisting of two curtained doorways. The air lock must be maintained in an uncontaminated condition at all times.
 3. Air Monitoring; - The process of measuring the asbestos fiber content of a specific volume of air in a stated period of time using methods approved or recommended by OSHA, EPA, NIOSH or other method approved by the Owner or the Owner's Representative.
 4. Amended water - Water to which a surfactant has been added.
 5. Asbestos - A generic name given to a number of naturally occurring hydrated mineral silicates that possess a unique crystalline structure, are incombustible in air, and are separable into fibers. Asbestos includes the asbestiform varieties of Chrysotile (serpentine), Crocidolite (Riebeckite), Amosite (Cummingtonite-Grunente), Anthophyllite, Actinolite, and Tremolite.
 6. Asbestos-containing material (ACM) - Any material that contains more than 1 percent asbestos by weight as determined by Polarized Light Microscopy (PLM).
 7. Authorized Visitor - the Owner or its designated representative, or a representative of any regulatory or other agency having jurisdiction over the project.
 8. Class I - Asbestos work means activities involving the removal of thermal systems insulation (TSI) and surfacing ACM and PACM.
 9. Class II - Asbestos work means activities involving the removal of ACM which is not TSI or surfacing material. This includes, but is not limited to, the removal of asbestos-containing wallboard, floor tile and sheeting, roofing and siding shingles, and construction mastics.
 10. Class III - Asbestos work means repair and maintenance operations where "ACM" including TSI and surfacing ACM and PACM is likely to be disturbed.
 11. Class IV - Asbestos work means maintenance and custodial activities during which employees contact but do not disturb ACM or PACM and activities to clean-up dust, waste and debris resulting from Class I, II and III activities.
 12. Critical Barrier - A unit of temporary construction which provides the only separation between an asbestos work area and an adjacent, potentially occupied, space. The critical barrier is composed of at least one intact sheet of polyethylene sheeting.
 13. Decontamination Enclosure System - A series of connected rooms with curtained doorways between any two adjacent rooms, for the decontamination of workers or of materials and equipment. A decontamination system contains at least two air locks.



14. Disposal - All procedures necessary to transport and deposit the asbestos-contaminated material stripped and removed from the building in a waste disposal site in compliance with applicable federal, state, and local regulations.
15. Disposal Site - A site approved by the EPA for the disposal of asbestos-containing wastes.
16. Encapsulant - A liquid which can be applied to asbestos-containing materials and which controls the possible release of fibers from the materials.
17. Encapsulation - The use of an agent to seal the surface (bridging encapsulant) or penetrate the bulk (penetrating encapsulant) of the asbestos-containing material.
18. HEPA -High Efficiency Particulate Air - A type of filter which is 99.97% efficient at filtering particles of 0.3 micrometers in diameter.
19. HEPA Vacuum Equipment - Vacuuming equipment equipped with a HEPA filter in the exhaust outlet, and so designed and maintained that 99.97% of all particles of 0.3 micrometer in diameter in the inlet air are collected and retained.
20. Negative Pressure Respirators - Respirators which function by the wearer breathing in air through a filter.
21. NIOSH - National Institute of Occupational Safety and Health.
22. the Owner's Representative - Authorized Consultants
23. Permissible Exposure Level (PEL) - A level of airborne fibers specified by OSHA as an occupational exposure standard for asbestos. It is 0.1 f/cc of air, eight-hour TWA, as measured by Phase Contrast Microscopy.
24. Repair - The restoration of damaged or deteriorated asbestos-containing material to intact condition.
25. Respirator Protection Program - A set of procedures and equipment required by OSHA if employees wear negative pressure respirators or if fiber levels are above the PEL.
26. Surfactant - Chemical wetting agent added to water to improve penetration, thus reducing the amount of water required for a given operation or area, and enhancing the effect of the water in reducing fiber release.
27. Thermal Systems Insulation - Material applied to pipes, fittings, boilers, breeching, tanks, ducts or other interior structural components to prevent heat loss or gain, or water condensation, or for other purposes.
28. Wet Cleaning - The process of eliminating asbestos contamination from building surfaces and objects by using cloths and mops or other cleaning tools that have been dampened with clean water and afterwards disposing of these cleaning tools as asbestos-contaminated waste.

I. Permits And Licenses:

1. The Contractor must maintain current licenses as required by applicable state or local jurisdictions for the removal, transporting, disposal or other regulated activity relative to the work of this contract.

J. Regulations

1. This section sets forth governmental regulations and industry standards which are included and incorporated herein by reference and made a part of the specifications. This section also sets forth those notices and permits which are known to the Owner and which either must be applied for and received, or which must be given to governmental agencies before start of work.
2. Except to the extent that more explicit or more stringent requirements are written directly into the contract documents, all applicable codes, regulations, and standards have the same force and effect (and are made a part of the contract documents by reference) as if copied directly into the contract documents, or as if published copies are bound herewith.
3. The Contractor shall assume full responsibility and liability for the compliance with all applicable federal, state, and local regulations pertaining to work practices, hauling, disposal, and protection of workers, visitors to the site, and persons occupying areas adjacent to the site. The Contractor is responsible for providing medical examinations and maintaining medical records of personnel as required by the applicable federal, state, and local regulations. The Contractor shall hold the Owner and the Owner's Representative harmless for failure to comply with any applicable work,



- hauling, disposal, safety, health or other regulation on the part of itself, its employees, or its Sub-Contractors.
4. Federal requirements which govern asbestos abatement work or hauling and disposal of asbestos waste materials include but are not limited to the following regulations:
 - a. U.S. Department of Labor, Occupational Safety and Health Administration, (OSHA), including but not limited to:
 - 1) U.S. Department of Labor, OSHA, including, but not limited to:
 - a) Occupational Exposure to Asbestos, Tremolite, Anthophyllite and Actinolite; Final Rules
Title 29, Part 1910, Section 1001
Part 1926, Section 1101 of the Code of Federal Regulations
 - b) Respiratory Protection
Title 29, Part 1910, Section 134 of the Code of Federal Regulations
 - c) Construction Industry
Title 29, Part 1926.1011, of the Code of Federal Regulation
 - d) Access to Employee Exposure and Medical Records
Title 29, Part 1910, Section 2 of the Code of Federal Regulations
 - e) Hazard Communication
Title 29, Part 1910, Section 1200 of the Code of Federal Regulations
 - f) Specifications for Accident Prevention Signs and Tags
Title 29, Part 1910, Section 145 of the Code of Federal Regulations
 - 2) U.S. Environmental Protection Agency (EPA) including, but not limited to:
 - a) Asbestos Abatement Projects Rule
40 CFR Part 762
CPTS 62044, FRL 2843-9
Federal Register, Vol. 50 No. 134, July 12, 1985
P28530-28540
 - b) Regulation for Asbestos
Title 40, Part 61, Subpart A of the Code of Federal Regulations
 - c) National Emission Standard for Asbestos
Title 40, Part 61, Subpart M (Revised Subpart B) of the Code of Federal Regulations
 - 3) State requirements which govern asbestos abatement work and/or hauling and disposal of asbestos waste materials.
 - 4) Contractor shall abide by all local requirements which govern asbestos abatement work or hauling and disposal of asbestos waste materials including the following:
 - a) American National Standards Institute (ANSI)
1430 Broadway
New York, NY 10018
(212) 354-3300
 - b) Fundamentals Governing the Design and Operation of Local Exhaust Systems
Publication Z9.2-79
 - c) Practices for Respiratory Protection Publication Z288.2-80
 - d) American Society for Testing and Materials (ASTM)
1916 Race Street
Philadelphia, PA 19103
(215) 299-5400
 - e) Specification for Encapsulants for Friable Asbestos-Containing Building Materials
 - f) Safety and Health Requirements Relating to Occupational Exposure to Asbestos

K. the Owner's Representative

1. the Owner's Representative is authorized by the Owner to perform the following:
 - a. Have free access to all asbestos work areas.



- b. To assist in interpretation of procedures.
- c. To advise on all provisions of the contract documents pertaining to the control of asbestos.
- d. To stop work if, in the course of performing their monitoring duties, an instance of substantial nonconformance with the contract documents is observed.
- e. To stop work if a situation presenting a health hazard to workers or the Owner's employees or occupants of the building is observed.
- f. To act as the Owner's liaison in technical matters involving the asbestos-related work.
- g. To perform air sampling inside and outside the asbestos work area during the project. The Contractor shall cooperate fully with the Owner's Representative, its agents and employees, and ensure cooperation of its workers during collection of air samples and work area inspections.
- h. the Owner's Representative role in advising the Owner on environmental health matters does not relieve the Contractor's obligation to comply with all applicable health and safety regulations. Air monitoring results generated by the Owner's Representative shall not be used by the Contractor to represent compliance with regulatory agency requirements for monitoring of worker's exposure to airborne asbestos, nor shall any other activity on the part of the Owner's Representative represent the Contractor's compliance with applicable health and safety regulations.

L. Pre-Construction Conference

- 1. An initial progress meeting recognized as "Pre-Construction Conference" shall be held prior to start of any work. Contractor shall meet at project site, with General Superintendent, the Owner, the Owner's Representative, and other entities concerned with asbestos abatement work. Record discussions and agreements and furnish copy to each participant. Provide at least 72 hours advance notice to all participants prior to convening Pre-Construction Conference.
- 2. This is an organizational meeting, to review responsibilities and personnel assignments, to locate the containment and decontamination areas; and temporary facilities including power, light, water, etc.
- 3. Submit waivers on forms, and executed in a manner acceptable to the Owner. Administrative requirements that must proceed or coincide with Contractor's submittal for final payment shall consist of the following:
 - a. Completion of project closeout requirements.
 - b. Completion of items specified for completion beyond time of Final Completion (regardless of whether special payment application was previously made).
 - c. Assurance, satisfactory to the Owner, that unsettled claims will be settled and that work not actually completed and accepted will be completed without undue delay.
 - d. Transmittal of required project construction records to the Owner.
 - e. Landfill receipts for all asbestos-containing material.
 - f. Proof, satisfactory to the Owner, that taxes, fees and similar obligations of Contractor have been paid.
 - g. Removal of temporary facilities, services, surplus materials, rubbish and similar elements.
 - h. Consent of surety for final payment.

M. Project Closeout

- 1. Project closeout is the term used to describe certain collective project requirements that indicate completion of the work to be fulfilled near the end of the contract time. Also, in preparation for final acceptance of the work by the Owner, as well as, final payment to the Contractor and the normal termination of the Contract.
- 2. Include supporting documentation for completion as indicated in these contract documents.
- 3. Submit a statement on accounting of changes to the Contract Sum.
- 4. Advise the Owner of pending insurance change-over requirements.
- 5. Submit specific warranties, workmanship and maintenance bonds, maintenance agreements, final certifications and similar documents.



6. Obtain and submit releases enabling the Owner's full, unrestricted use of the work area and access to services and utilities. Where required, include occupancy permits, operating certificates and similar releases.
7. Results of the completed inspection will form the initial "punch-list" for final acceptance.
8. A complete record, certified by the testing laboratory, of all personal air monitoring results.
9. Complete the following cleaning operations as outlined in Paragraph "Decontamination Procedures" before requesting the Owner's Representative inspection for certification of Final Completion.
 - a. Remove exposed labels in finished spaces which are not required as permanent labels on materials supplied as part of the work, except for "Asbestos", "Asbestos Free", or Thermal Insulation Labels specified elsewhere.
 - b. Clean transparent materials, affected by the work including mirrors and window/door glass, to a polished condition, removing substances which are noticeably vision-obscuring materials. Replace broken glass and damaged transparent materials.
 - c. Clean exposed hard-surfaced finishes affected by the work, to a dirt-free condition, free of dust, stains, films and similar distracting substances. Except as otherwise indicated, avoid disturbance of natural weathering of exterior surfaces. Restore reflective surfaces to original reflective condition.
 - d. Clean plumbing fixtures affected by the work to a sanitary condition, free of stains including those resulting from water exposure.
 - e. Replace all HVAC filters using materials supplied by the Owner or clean non-replaceable filters after minimum of two days of operation of HVAC equipment.
 - f. Clean light fixtures and lamps, which have been affected by the work so as to function with full efficiency. Replace lamps where inoperable.
 - g. Repair any damage to wall, ceiling and floor surfaces caused by installation and removal of the polyethylene sheeting.

N. Personnel Protection

1. Prior to commencement of work, the workers shall be instructed and be knowledgeable in the areas described in Paragraph "Submittals and Notices" having to do with employees.
2. Worker Protection - shall comply with 29 CFR 1910.134 (Respiratory Protection).
 - a. Because there is no known safe level of exposure to asbestos, it is prudent to reduce worker's exposures to as low a level as possible. Proper respiratory protection is critical in minimizing exposure.
 - b. Workers shall be provided, as a minimum, with personally issued and marked respirators equipped with high efficiency particulate filters approved by NIOSH to be worn in the designated work area and/or whenever a potential exposure to asbestos exists. Sufficient filters shall be provided for replacement as required by the workers or applicable regulations. Disposable respirators shall not be used.
 - c. No worker shall be exposed to levels greater than 0.01 f/cc as determined by the protection factor of the respirator worn and the work area fiber levels.
 - d. Whenever powered purifying respirator protection is used, a sufficient supply of replacement batteries and HEPA filter cartridges shall be provided to the workers.
 - e. Air monitoring required by OSHA is work of the Contractor and not covered in this specification. Contractor shall post, on a daily basis, results of the air monitoring results from the previous shift. A complete record, certified by the testing laboratory, of all personal air monitoring tests and results will be furnished to the Owner and the Owner's Representative prior to Contractor's Request for Final Payment.
 - f. During encapsulation operations or usage of other organic base aerosols (e.g., spray glue, expanding foam), workers shall be provided with combination cartridges consisting of organic vapor and HEPA sections.
 - g. Workers shall be provided with sufficient sets of protective full-body clothing to be worn in the designated work area and/or whenever potential exposure to asbestos exists. Such clothing shall include, but not be limited to, full-body coveralls, headgear and gloves. Workers shall assure that hoods covering their hair are worn in the designated work areas



- at all times. Eye protection and hard hats shall be provided as required by applicable safety regulations. Eye protection shall be worn during encapsulation operations. Non-disposable type protective clothing and footwear shall be left in the work area until the end of the asbestos abatement work, at which time such items will be disposed of as asbestos waste.
- h. Non-skid footwear shall be provided to all abatement workers. Disposable clothing shall be adequately sealed to the footwear to prevent body contamination.
 - i. Protective clothing shall not be worn in lieu of street clothing outside the work area.
 - j. Visitor Clothing: The Contractor shall provide authorized visitors with suitable respirator, protective clothing, headgear, eye protection, and footwear as described herein, whenever they enter the work area.
3. Decontamination and Work Procedures: The decontamination and work procedures to be followed by workers shall be posted as described in these specifications.
 4. Worker and Authorized Visitor Protection Procedures:
 - a. Each worker and authorized visitor shall, upon entering the job site, remove street clothes in a designated clean change area and put on a respirator with new filters and clean protective clothing before entering the work area.
 - b. The Contractor's employees shall perform a positive/negative respirator fit test each time it enters the work area. If leakage occurs, the respirator must be re-adjusted or replaced.
 - c. Workers shall maintain their respirators in a safe operating condition. The condition of respirators shall be checked daily.
 - d. Workers and visitors shall complete the decontamination procedures as outlined in the specification upon exiting the work area.
 - e. Workers shall not eat, drink, smoke, or chew gum or tobacco in or near the asbestos work areas.
 - f. Workers shall be fully protected with respirators and protective clothing immediately prior to the first disturbance of asbestos-containing or contaminated materials and until final cleanup is completed.
- O. Air Monitoring
1. The airborne fiber counts outside the work area will be monitored to detect faults in the work area isolation such as contamination of the building outside of the work areas with airborne asbestos fibers, failure of filtration or rupture in the negative pressure system. Should any of the above occur, the Contractor shall immediately cease asbestos abatement activities until the fault is corrected. Work shall not recommence until authorized by the Owner's Representative. In the case of mini-enclosures the Owner's Representative will monitor air in a remote location of the residence to determine the baseline of asbestos.
 2. The airborne fiber counts in the work area will be monitored. The purpose of this air monitoring will be to detect airborne fiber counts which may significantly challenge the ability of the work area isolation procedures to protect the balance of the building or outside of the building from contamination by airborne fibers. In the case of mini-enclosures the Owner's representative may monitor air outside of several enclosures if they are in close proximity.
 3. Contractor shall maintain an average airborne count inside the work area of less than 0.5 f/cc. If the fiber counts rise above this figure for any sample taken, revise work procedures to lower fiber counts. If the TWA fiber count for any work shift or eight-hour period exceeds 0.5 f/cc, stop all work, leave pressure differential system in operation and notify the Owner's Representative. Do not recommence work until authorized in writing by the Owner's Representative.
 4. If airborne fiber counts exceed 1.0 f/cc for any period of time cease all work until fiber counts fall below 0.5 f/cc and notify the Owner's Representative. Do not recommence work until authorized in writing by the Owner's Representative.
 5. If any air sample taken outside of the work area exceeds the 0.01 f/cc of air, Contractor shall immediately and automatically stop all work. If this air sample was taken inside the building and outside of critical barriers around the work area, immediately erect new critical barriers to isolate the affected area from the balance of the building. Erect Critical Barriers at the next existing structural isolation of the involved space (e.g., wall, ceiling, and floor). Leave Critical Barriers in



- place until completion of work and insure that the operation of the negative pressure system in the work area results in a flow of air from the balance of the building into the affected area.
6. If the exit from the clean room of the personnel decontamination unit enters the affected area, establish a temporary decontamination facility consisting of a shower room and changing room. After cleaning and decontamination of the affected area remove the shower room and leave the changing room in place as an air lock.
 7. After certification of visual inspection in the work area, remove critical barriers separating the work area from the affected area. Final air samples will be taken within the entire area.
 8. The following procedure will be used to resolve any disputes regarding fiber types when a project has been stopped due to excessive airborne fiber counts. "Airborne Fibers" referred to above include all fibers regardless of composition as counted in the Phase Contrast Microscopy (PCM) NIOSH 7400 Method procedures. If work has stopped due to high airborne fiber counts, air samples will be secured in the same area by the Owner's Representative for analysis by electron microscopy. "Airborne fibers" counted in samples analyzed by Scanning or Transmission Electron Microscopy (TEM) shall be only asbestos fibers, but of any diameter and length. Subsequent to analysis by Electron Microscopy the number of airborne fibers shall be determined by multiplying the number of fibers, regardless of composition, counted by the PCM NIOSH 7400 Method procedure by a number equal to asbestos fibers counted divided by all fibers counted in the electron microscopy analysis.
 9. If electron microscopy is used to arrive at the basis for determining airborne fiber counts in accordance with the above paragraph, and if the average of airborne asbestos fibers in all samples taken exceeds 0.1 f/cc, or if any one sample exceeds 0.2 f/cc, then the cost of such analysis will be born by the Contractor, at no additional cost to the Owner.
 10. the Owner's Representative will secure at least the following air samples to establish a base line before start of work involving large enclosures:

Location Sampled	Number of Samples	Analysis Method	Detection Limit f/cc	Minimum Volume Liters	Rate LPM
Each Work Area	1	PCM	0.01	1,900	2-16
Outside Each Work Area	1-3	PCM	0.01	1,900	2-16

11. Base Line is an action level expressed in f/cc, which is ten percent greater than the largest of the following:
 - a. Average of the samples collected on cellulose ester filters outside each work area.
 - b. Average of the samples collected on cellulose ester filters outside the building.
 - c. 0.01 fibers per cubic centimeter.
12. Daily: From start of work of Paragraph "Temporary Enclosure" through the work of Paragraph "Project Decontamination," the Owner may be taking the following samples on a daily basis. The location of each air sample will be determined by the Owner's Representative.
 - a. Baseline
 - b. Work Area
13. For larger enclosures samples will be collected on 25 mm cassettes with the following filter media:

PCM: 0.8 micrometer mixed cellulose ester.

Location Sampled	Number of Samples	Analysis Method	Detection Limit f/cc	Minimum Volume Liters	Rate LPM
Each Work Area	2	PCM	0.01	1,900 as required by conditions	2-16
Outside Each Work Area Critical Barrier	1	PCM	0.01	1,900	2-16
Clean Room	1	PCM	0.01	1,900	2-16
Equip Decon	1	PCM	0.01	1,900	2-16



14. Additional samples may be taken at the Owner or the Owner's Representative discretion. If airborne fiber counts exceed allowed limits, additional samples will be taken as necessary to monitor fiber levels.
15. The services of a testing laboratory will be employed by the Owner to perform laboratory analysis of the air samples. Samples will be sent daily so that verbal reports on air samples can be obtained in a timely manner. A complete record, certified by the testing laboratory, of all air monitoring tests and results will be furnished to the Owner's Representative, the Owner and the Contractor.
16. Air samples may be analyzed on site by the Owner's Representative, if they are to be analyzed by the NIOSH 7400 Method.
17. Cellulose ester filters will be analyzed using the PCM NIOSH 7400 Method. Thus analysis will be carried out at a laboratory located off the job site.
18. At the completion of the work in occupied areas and prior to the dismantling of the isolation system, final air clearance will be conducted by the Owner's Representative.
19. Decontamination of the work area will be considered complete when all samples indicate fiber levels are less than 0.01 f/cc of air as analyzed by PCM NIOSH 7400 Method or an average of less than 70 structures per square millimeter of filter area as analyzed by TEM; Level II AHERA Method.
20. The Contractor may conduct its own air monitoring and laboratory testing. If it elects to do this the cost of such air monitoring and laboratory testing shall be included in the Contract Sum.

P. Equipment Removal Procedures

1. Clean all external surfaces of contaminated waste containers and equipment thoroughly by wet sponging or HEPA vacuuming before moving such items into the equipment decontamination enclosure system washroom for final cleaning and removal to uncontaminated areas. Ensure that personnel do not leave the work areas through the equipment decontamination enclosure system.

Q. Disposal Activities

1. It is the responsibility of the Contractor to comply with current federal, state and local regulations concerning the waste handling, transportation, and disposal of asbestos-containing material (ACM) and accompanying solvents or residues.
2. The Contractor will document actual disposal of the waste at the designated landfill by completing Disposal Certificate or submitting proof of landfill receipt.

1.2 PRODUCTS

A. Materials

1. All Contractor's equipment delivered to the site shall be free of asbestos contamination.
2. Store all materials subject to damage off the ground, away from wet or damp surfaces, and under cover sufficient to prevent damage or contamination.
3. Damaged or deteriorating materials shall not be used and shall be removed from the premises. Materials that become contaminated shall be disposed of in accordance with applicable regulations.
4. Polyethylene flame retardant sheet of 6-mil thickness shall be used unless otherwise specified. Polyethylene sheeting shall be sized to minimize the frequency of joints. Polyethylene sheeting must satisfy the National Fire Prevention Association Standard 701, "Small Scale Fire Test for Flame Resistant Textile and Film."
5. Adhesive tape shall be capable of sealing joints of adjacent sheets of polyethylene and for use in attachment of polyethylene sheet to finished or unfinished surfaces of similar materials and shall be capable of adhering under dry and wet conditions, including use of amended water. Contractor shall use adhesive tape compatible with finished surfaces.



6. Protective devices such as, but not limited to, disposable clothing, respirators, gloves, hard hats, etc. shall be used.
7. Wetting agent shall be a mixture of 50/50 polyoxyethylene ether and polyglycol ester or equivalent commercial product.
8. Encapsulant materials shall be the bridging and penetrating type and conform with the following characteristics:
 - a. Encapsulants shall not be solvent-based or utilize a hydrocarbon in the liquid in which the solid parts of the encapsulant are suspended.
 - b. Encapsulant shall not be flammable.
9. A non-hardening lagging sealer for enclosing and sealing raw exposed edges and surfaces of asbestos-containing materials.
10. Pre-mixed or job mixed insulating plaster manufactured for use on plumbing equipment shall be used when repairing damaged thermal insulation material.
11. Non-woven fibrous glass mat and open weave glass fiber mat cloth for repair of thermal systems insulation.
12. Fire retardant sealant shall prevent fire, smoke, water and toxic fumes from penetrating through sealants. Sealant shall have a flame spread, smoke and fuel contribution of zero, and shall be ASTM and Underwriter's Laboratory (UL) rated for three hours for standard method of fire test for fire stop systems.

B. Tools And Equipment

1. Provide suitable tools for repair and encapsulation of asbestos-containing materials and for removal of asbestos-containing materials that are beyond repair. Wire brushes shall not be used as a means of removing or cleaning asbestos-containing materials from surfaces, if they are used as the surface is being sprayed with water or amended water.
2. Provide sufficient number of HEPA-filtered vacuum cleaners equipped with pick-up adapters, steel floor wands, crevice tools, and carpet tools.
3. Airless sprayers capable of spraying amended water shall be provided in sufficient number to allow continuous uninterrupted work.
4. Asbestos filtration devices shall utilize high efficiency particulate air (HEPA) filtration systems.
5. Transportation equipment, as required, shall be suitable for loading, temporary storage, and unloading of contaminated waste without exposure to persons or property, and shall be quiet in motion if used within the building.

1.3 EXECUTION

A. Safety Procedures For Power And Lighting

1. The use of wet methods for removal, repair, encapsulation or cleaning procedures increases the potential for electrical shock when working around electrical panels, conduit, light fixtures, alarm systems, junction boxes, transformers, etc. In coordination with the Owner, de-energize as much electrical equipment as possible to prevent electrical shock to employees performing the work. The Contractor shall use the following precautions:
 - a. Use non-conductive tools and vacuum attachments.
 - b. Utilize "hot line" covers over energized cables and power lines when possible.
 - c. Ensure all electrical equipment in use is properly grounded before the job starts. Check outlets, wiring, extension cords and power pickups.
 - d. Avoid stringing wiring across floors. Elevate wiring if possible.
 - e. Ensure electrical outlets are tightly sealed and taped to avoid water spray.
 - f. Determine operating voltages of equipment and lines before working on or near energized parts.
 - g. Energized parts must be insulated or guarded from employee contact and other conductive objects. Extension cords must be three-wire type and connected to a Ground Fault Interrupter (GFI) circuit.
 - h. Lock or secure de-energized circuits at panel and post warning signs.



- i. Seal heating vents with two layers of polyethylene sheeting prior to the start of work. The Contractor shall repair any damage caused by Contractor's operations to duct work, grilles, dampers, louvers or HVAC equipment at the completion of the work at Contractor's expense. Coordinate all lock out and or de-energizing with the Owner.

B. Temporary Facilities

1. Use qualified tradesmen for installation of temporary services and facilities. Locate temporary services and facilities where they will serve the entire project adequately and result in minimum interference with the performance of the work and operations of the building. Coordinate all installations and shut downs with building owner.
2. Relocate, modify and extend services and facilities as required during the course of work so as to accommodate the entire work of the project.
3. Provide new or used materials and equipment that are undamaged and in serviceable condition. Provide only materials and equipment that are recognized as being suitable for the intended use, by compliance with appropriate standards.
4. During the erection and/or moving of scaffolding, care must be exercised so that the polyethylene floor covering is not damaged.
5. Clean, as necessary, debris from non-slip surfaces.
6. At the completion of abatement work, clean all construction aids within the work area, wrap in one layer of 6-mil polyethylene sheet and seal before removal from the work area.
7. Temporary water service connections to the Owner's water system shall include back flow protection. Valves shall be temperature and pressure rated for operation of the temperatures and pressures encountered.
8. Employ heavy-duty abrasion-resistant hoses with a pressure rating 50 percent greater than the maximum pressure of the water distribution system to provide water into each work area and to each Decontamination Unit. Provide fittings as required to allow for connection to existing wall hydrants or spouts, as well as temporary water heating equipment, branch piping, showers, shut-off nozzles and equipment.
9. Electrical Services shall comply with applicable NEMA, NECA and UL standards and governing regulations for materials and layout of temporary electric service.
10. Provide a weatherproof, grounded temporary electric power service and distribution system of sufficient size, capacity, and power characteristics to accommodate performance of work during the construction period. Install temporary lighting adequate to provide sufficient illumination for safe work and traffic conditions in every area of work.
11. Provide receptacle outlets equipped with ground fault interrupters, reset button and pilot light, for plug-in connection of power tools and equipment.
12. Use only grounded extension cords; use "hard-service" cords where exposed to abrasion and traffic. Use single lengths or use waterproof connectors to connect separate lengths of electric cords, if single lengths will not reach areas of work. All cords shall be elevated off the floor inside the containment area.
13. Temporary wiring in the work area shall be type UL non-metallic sheathed cable located overhead and exposed for surveillance. Do not wire temporary lighting with plain, exposed (insulated) electrical conductors. Provide liquid tight enclosures or boxes for wiring devices.
14. Provide Type "A" fire extinguishers for temporary offices and similar spaces where there is minimal danger of electrical or grease-oil-flammable liquid fires. In other locations provide type "ABC" dry chemical extinguishers, or a combination of several extinguishers of NFPA recommended types for the exposures in each case.
15. Use of the Owner's existing toilet facilities, as indicated, will be permitted, so long as these facilities are properly cleaned and maintained in a condition acceptable to the Owner. At Final Completion, restore these facilities to the condition prevalent at the time of initial use. All provisions of these specifications regarding leaving the work area must be met.
16. When mini-enclosures area being used all of the requirements above will be enforced by the Owner's Representative. The construction and set-up of the mini-enclosures may be done by the Abatement Contractor.



C. Pressure Differential System

1. Before start of work Contractor shall submit design of pressure differential system to the Owner's Representative for review. Do not begin work until system has been approved by the Owner's Representative. Include in the submittal the following:
 - a. Number of pressure differential machines required and the calculations necessary to determine the number of machines.
 - b. Description of projected air-flow within work area and methods required to provide adequate air flow in all portions of the work area.
2. If the enclosure is not a mini-enclosure, the Contractor must supply the required number of asbestos air filtration units to the site in accordance with these specifications. Each unit shall include the following:
 - a. Cabinet constructed of steel or other durable materials able to withstand damage from rough handling and transportation. The width of the cabinet should be less than 30 inches to fit through standard-size doorways. Cabinet shall be factory sealed to prevent asbestos-containing dust from being released during use, transport, or maintenance. Access to and replacement of all air filters shall be from intake end. Unit shall be mounted on casters or wheels.
 - b. Rate capacity of fan according to useable air-moving capacity under actual operating conditions. Use centrifugal-type fan.
 - c. The final filter shall be the HEPA type. The filter media (folded into closely pleated panels) must be completely sealed on all edges with a structurally rigid frame.
 - d. A continuous rubber gasket shall be located between the filter and the filter housing to form a tight seal.
 - e. Provide HEPA Units that are individually tested and certified on site by an independent testing agency to have an efficiency of not less than 99.97 percent when challenged with 0.3 m dioctylphthlaate (DOP) particles when tested in accordance with Military Standard Number 2182 and Army Instruction Manual 136-300-175A. Provide filters that bear a UL586 label to indicate ability to perform under specified conditions.
 - f. Pre-filters, which protect the final filter by removing the larger particles, are required to prolong the operating life of the HEPA filter. Two stages of pre-filtration are required. The first-stage pre-filter shall be a low-efficiency type (e.g., for particles 10 microns and larger). The second-stage (or intermediate) filter shall have a medium efficiency (e.g., effective for particles down to 5 microns). Pre-filters and intermediate filters shall be installed either on or in the intake grid of the unit and held in place with special housings or clamps.
 - g. Each unit shall be equipped with a Magnahelic gauge or manometer to measure the pressure drop across filters and indicate when filters have become loaded and need to be changed. A table indicating the useable air-handling capacity for various static pressure readings on the Magnahelic gauge shall be affixed near the gauge for reference, or the Magnahelic reading indicating at what point the filters should be changed, noting Cubic Feet per Minute (CFM) air delivery at that point. Provide units equipped with an elapsed time meter to show the total accumulated hours of operation.
 - h. The unit shall have an electrical (or mechanical) lockout to prevent fan from operating without a HEPA filter. Units shall be equipped with automatic shutdown system to stop fan in the event of a major rupture in the HEPA filter or blocked air discharge. Warning lights are required to indicate normal operation, too high a pressure drop across the filters (i.e., filter overloading), and too low of a pressure drop (i.e., major rupture in HEPA filter or obstructed discharge).
 - i. Electrical components shall be approved by the National Electrical Manufacturers Association (NEMA) and Underwriters' Laboratories (UL). Each unit shall be equipped with overload protection sized for the equipment. The motor, fan, fan housing, and cabinet shall be grounded.
 - j. If a mini-enclosure is used the air filtration unit may be a HEPA filtered vacuum with a flow rate of at least 100 cubic feet per minute (CFM).
3. Provide a fully operational pressure differential system within the work area maintaining continuously a pressure differential across work area enclosures of 0.02 inches of water for glove



- bag operations and mini-containments. Demonstrate to the Owner's Representative the pressure differential by use of pressure differential meter or a manometer, before disturbance of any asbestos-containing materials. In the case of a mini-enclosure visual evidence of pressure differential through the use of a smoke generation tube shall be sufficient as in paragraph C.13 of this section.
4. Continuously monitor and record the pressure differential between the work area and the building outside of the work area.
 5. Provide fully operational negative pressure systems supplying a minimum of one air change every ten minutes (six changes per hour), less in the instance of a mini-enclosure. Determine the volume in cubic feet of the work area by multiplying floor area by ceiling height. Determine total ventilation requirement in cubic feet per minute (cfm) for the work area by dividing this volume by the air change rate.
 6. Ventilation Required (CFM) = Volume of work area (cu. ft.)/10 min.
 7. Determine number of units needed to achieve ten-minute change rate by dividing the ventilation requirement (CFM) above capacity of exhaust unit(s) used. Capacity of a unit for purposes of this section is the capacity in cubic feet per minute with fully loaded filters (pressure differential which causes loaded filter warning light to come on) in the machines labeled operating characteristics.
 8. Add one additional unit as a backup in case of equipment failure or machine shutdown for filter changing.
 9. Locate exhaust unit(s) so that makeup air enters work area primarily through decontamination facilities and traverses work area as much as possible. This may be accomplished by positioning the unit(s) at a maximum distance from the worker access opening or other makeup air sources.
 10. Vent to outside of building, unless authorized in writing by the Owner's Representative.
 11. Each unit shall be serviced by a dedicated minimum 115v-20A circuit with overload device tied into an existing building electrical panel which has sufficient spare capacity to accommodate the load of all pressure differential units connected. Dedication of an existing circuit may be accomplished by shutting down existing loads on the circuit.
 12. Test pressure differential system before any asbestos-containing material is wetted or removed. After the work area has been prepared, the decontamination facility set up, and the exhaust unit(s) installed, start the unit(s) (one at a time). Demonstrate operation and testing of pressure differential system to the Owner's Representative.
 13. Demonstrate of operations of the pressure differential system to the Owner's Representative will include, but not be limited to, the following:
 - a. Plastic barriers and sheeting move lightly in toward work area.
 - b. Curtain of decontamination units move lightly in toward work area.
 - c. There is a noticeable movement of air through the decontamination unit. Use stroke tube to demonstrate air movement from clean room, and from equipment room to work area.
 - d. Use smoke tubes to demonstrate a positive motion of air across all area in which work is to be performed.
 - e. Use a differential pressure meter or manometer to demonstrate a pressure difference of at least 0.02 inches (as allowed) of water across every barrier separating the work area from the balance of the building or outside. This is not required in the case of a mini enclosure.
 14. Start exhaust units before beginning work (before any asbestos-containing material is disturbed). After abatement work has begun, run units continuously to maintain a constant negative pressure until decontamination of the work area is complete. Do not turn off units at the end of the work shift or when abatement operations temporarily stop.
 15. Do not shut down pressure differential system during encapsulating procedures, unless authorized by the Owner's Representative in writing. Start abatement work at a location farthest from the exhaust units and proceed toward them. If an electric power failure occurs, immediately stop all abatement work and do not resume until power is restored and exhaust units are operating again.
 16. At completion of abatement work, allow exhaust units to run as specified to remove airborne fibers that may have been generated during abatement work and cleanup and to purge the work area with clean makeup air. The units may be required to run for a longer time after decontamination, if



dry or only partially wetted asbestos material was encountered during any abatement work. In the case of a mini-enclosure the vacuum may be removed and the entrance sealed following encapsulation until the clearance sample is collected.

- 17. Prior to final air test, remove pre-filter and wipe out inside lip of negative air machine.
- 18. When a final inspection and the results of final air tests indicate that the area has been decontaminated, exhaust units may be removed from the work area. Before removal from the work area, remove and properly dispose of pre-filter, and seal Intake to the machine with 6-mil polyethylene to prevent environmental contamination from the filters.

D. Work Area Preparation

- 1. The work area is the location where asbestos-abatement work occurs. It is a variable of the extent of work of the contract. It may be a portion of a room, a single room, or a complex of rooms. A "work area" is considered contaminated during the work, and must be isolated from the balance of the building, and decontaminated at the completion of the asbestos-control work.
- 2. Pre-clean fixed objects, walls and floor surfaces within the proposed work areas using HEPA filtered vacuum equipment and wet cleaning methods as appropriate.
- 3. Seal all openings, supply and exhaust vents, and convectors within ten feet of the work area with 6-mil polyethylene sheeting secured and completely sealed with plastic adhesion tape.
- 4. Contact fire control agencies to review procedures prior to start of work.
- 5. Provide flame resistant polyethylene sheeting that conforms to requirements set forth by the National Fire Protection Association Standard 701, Small Scale Fire Test for Flame-resistant Textiles and Films. Provide largest size possible to minimize seams, four- or six- mils thick, frosted or black.
- 6. Provide spray adhesive in aerosol cans which is specifically formulated to stick tenaciously to sheet polyethylene and supporting surface.
- 7. Completely isolate the work area from other parts of the building so as to prevent asbestos-containing dust or debris from passing beyond the isolated area. Should the area beyond the work area(s) become contaminated with asbestos-containing dust or debris as a consequence of the work, clean those areas in accordance with the procedures indicated in Paragraph "Decontamination Procedures." All such required cleaning or decontamination shall be performed at no additional cost to the Owner.
- 8. Place all tools (i.e., scaffolding, staging) necessary for the work in the area to be isolated prior to erection of plastic sheeting temporary enclosure.
- 9. Disable ventilation systems or any other system bringing air into or out of the work area. Disable system by disconnecting wires, removing circuit breakers, by lockable switch or other positive means that will prevent accidental premature restarting of equipment.
- 10. Remove and dispose of all electrical and mechanical items, such as lighting fixtures, clocks, diffusers, registers, escutcheon plates, etc., which cover any part of the surface on which work is to be performed.
- 11. All general construction items such as cabinets, casework, doors and window trim, moldings, ceilings, trim, etc., which cover the surface of the work as required to prevent interference with the work. To be performed by the Owner: clean, decontaminate and reinstall all such materials, upon completion of all removal work with materials, finishes, and workmanship to match existing installations before start of work.
- 12. Permit Access to the work area only through the Decontamination Unit. All other means of access shall be closed off and sealed and warning signs displayed on the clean side of the sealed access.
- 13. Provide Warning Signs at each visual and physical barriers reading as follows in both English and Spanish:

<u>Legend</u>	<u>Notation</u>
KEEP OUT	3" Sans Serif Gothic or Block
BEYOND THIS POINT	1" Sans Serif Gothic or Block
ASBESTOS ABATEMENT WORK	1" Sans Serif Gothic or Block



IN PROGRESS
BREATHING ASBESTOS DUST MAY BE
HAZARDOUS TO YOUR HEALTH

1" Sans Serif Gothic or Block
14 Point Gothic

14. Alternate methods of containing the work area may be submitted to the Owner's Representative for approval. Do not proceed with any such method(s) without prior written approval of the Owner's Representative.
15. Individually seal all ventilation openings (supply and exhaust), lighting fixtures, clocks, doorways, windows, convectors and speakers, and other openings into the work area with plastic adhesion tape alone or with polyethylene sheeting at least 4-mil in thickness, taped securely in place with plastic adhesion tape. Maintain seal until all work including Project Decontamination is completed. Take care in sealing off lighting fixtures to avoid melting or burning of sheeting.
16. Provide sheet plastic barriers at least 6-mil in thickness as required to completely seal openings from the work area into adjacent areas. Seal the perimeter of all sheet plastic barriers with plastic adhesion tape or spray cement.
17. Where applicable, construct framing of the containment out of fire treated wood or aluminum studs. Mini-enclosure frames may be constructed of Polyvinyl Chloride (PVC) tubing.
18. Cover all walls in work area extending to the underside of the ceiling grid system with one layer of polyethylene sheeting, at least 6-mil in thickness, mechanically supported and sealed with plastic adhesion tape or spray-glue in the same manner as "Critical Barrier" sheet plastic barriers. Tape all joints with plastic adhesion tape. Contractor shall be responsible for repair of damaged wall finishes.
19. Cover floor with two layers of 6-mil polyethylene sheeting (exclude for floor tile and adhesive).
20. Provide Pressure Differential System per Paragraph "Pressure Differential System."
21. If the enclosure barrier is breached in any manner that could allow the passage of asbestos debris or airborne fibers, then add the affected area to the work area, enclose it as required by this section of the specification and decontaminate it as described in Paragraph "Decontamination Procedures."
22. Establishing a Mini-Containment area:
 - a. Establish work area so that unauthorized entry is prevented; Construct a two-compartment fire treated wood frame around work area; install one layer 6-mil polyethylene sheeting to structural members and two layers 6 mil polyethylene sheeting to the floor. Exception: no floor required if mini-containment is being constructed to perform a floor tile activity. Seal all edges to wall, ceiling, and floor surfaces with duct tape. Install viewing inspection windows, where feasible.
 - b. Seal all penetrations with duct tape such as pipes, electrical conduit, or ducts contained within the mini-containment.
 - c. Install triple 6-mil polyethylene flaps at both doorways. Place portable sprayer with clean water, disposable towels, and pre-labeled disposal bag in air lock.
 - d. Install appropriate signs on outside of mini-containment area.
 - e. Install HEPA vacuum; extend hose into mini-containment area for general vacuuming, negative air, and cleaning of disposal suit.
 - f. Accumulate all loose materials for disposal. Place in approved container. Apply appropriate labels. Adequately wet clean all wall, floor, tool and equipment surfaces.
 - g. Abatement worker must wear two disposable suits. Remove outer suit in work area and place in a plastic bag. Enter air lock.
 - h. In air lock, wet wipe respirator and wash hands with clean water. Remove respirator and place in a clean plastic bag. Proceed to remote shower unit where inner suit may be removed.

E. Worker Protection

1. This section describes the equipment and procedures required for protecting workers against asbestos contamination and other work place hazards except for respiratory protection.
2. Respiratory Protection is specified in Paragraph "Respiratory Protection."



3. Train in accordance with EPA's Model Accreditation Plan, 40 CFR 763 - Asbestos, all workers in the dangers inherent in handling asbestos and breathing asbestos dust and in proper work procedures and personal and area protective measures. Include but do not limit the topics covered in the course to the following:
 - a. Methods of recognizing asbestos.
 - b. Health effects associated with asbestos.
 - c. Relationship between smoking and asbestos in producing lung cancer.
 - d. Nature of operations that could result in exposure to asbestos.
4. Importance of and instruction in the use of necessary protective controls, practices and procedures to minimize exposure including:

Engineering controls
Work practices
Respirators
Housekeeping procedures
Hygiene facilities
Protective clothing
Decontamination procedures
Emergency procedures
Waste disposal procedures
Appropriate work practices for the work
Requirements of medical surveillance program
Review of OSHA 29 CFR 1926.1101(k)(9)(viii)(G) - Asbestos
Pressure differential systems
Work practices including hands on or on job training
Personal decontamination procedures
Air monitoring, personal and area

5. Provide medical examinations for all workers who may encounter an airborne fiber level of 0.1 f/cc or greater for an 8 hour time weighted average. In the absence of specific airborne fiber data, provide medical examination for all workers who will enter the work area for any reason. Examination shall, at minimum, meet OSHA requirements as set forth in 29 CFR 1926.1101(k)(9)(viii)(G) - Asbestos. In addition, provide an evaluation of the individual's ability to work in environments capable of producing heat stress in the worker.
6. Before start of work Contractor shall submit the following to the Owner's Representative for review. Do not start work until receipt of the Owner's Representative.
 - a. An original signed copy of the Certificate of Worker's Acknowledgement found at the end of this specification, for each worker who is to be at the job site or enter the work area.
 - b. Courses outline or name of institution providing the worker training course.
 - c. Report from medical examination conducted within last 12 months as part of compliance with OSHA medical surveillance requirements for each worker who is to enter the work area.
7. Provide disposable full-body coveralls and disposable head covers, and require that they be worn by all workers in the work area. Provide a sufficient number for all required changes, for all workers in the work area.
8. Provide work boots with non-skid soles, and where required by OSHA, foot protectives, for all workers. Provide boots at no cost to workers. Paint uppers of all boots red with water proof enamel. Do not allow boots to be removed from the work area for any reason, after being contaminated with asbestos-containing material. Dispose of boots as asbestos contaminated waste at the end of the work.
9. Provide head protectives (hard hats) as required by OSHA for all workers, and provide four spares for use by the Owner's Representative, and the Owner. Label hats with same warning labels as used on disposal bags. Require hard hats to be worn at all times that work is in progress that may potentially cause head injury. Provide hard hats with plastic strap type suspension. Require hats



to remain in the work area throughout the work. Thoroughly clean, decontaminate and bag hats before removing them from work area at the end of the work.

10. Provide eye protectives (goggles) as required by OSHA for all workers involved in scraping, spraying, or any other activity which may potentially cause eye injury.
11. Provide work gloves to all workers and require that they be worn at all times in the work area. Do not remove gloves from work area. Dispose of gloves as asbestos contaminated waste at the end of the work.
12. Respirators, disposable coveralls, head covers, and footwear covers shall be provided by the contractor for the Owner, the Owner's Representative, and other authorized representatives who may inspect the job site.
13. Provide worker protection as required by the most stringent OSHA and/or EPA standards applicable to the work. The following procedures are minimums to be adhered to regardless of fiber count in the work area.
14. Each time work is entered, remove all street clothes in the changing room of the Personnel Decontamination Unit and put on new disposable coverall, new head cover, and a clean respirator. Proceed through shower room to equipment room and put on work boots.
15. In the event a mini-enclosure is used refer to Paragraph "Work Area Preparation" for personal decontamination procedures.

F. Respiratory Protection

1. Instruct and train each worker involved in asbestos abatement or maintenance and repair of friable asbestos-containing materials in proper respiratory use and require that each worker always wear a respirator, properly fitted on the face in the work area from the start of any operation which may cause airborne asbestos fibers until the work area is completely decontaminated. Use respiratory protection appropriate for the fiber level encountered in the work place or as required for other toxic or oxygen-deficient situations encountered.
2. Except to the extent that more stringent requirements are written directly into the Contract Documents, the following regulations and standards have the same force and effect (and are made a part of the Contract Documents by reference) as if copied directly into the Contract Documents, or as if published copies were bound herewith. Where there is a conflict in requirements set forth in these regulations and standards meet the more stringent requirement.
 - a. OSHA - U.S. Department of Labor Occupational Safety and Health Administration, Safety and Health Standards 29 CFR 1910, Section 1001 and Section 1910.134.29 CFR 1926.
 - b. ANSI - American National Standard Practices for Respiratory Protection. ANSI Z88.2-1980.
 - c. NIOSH - National Institute for Occupational Safety and Health.
 - d. MSHA - Mine Safety and Health Administration.

G. Type Of Respiratory Protection Required

1. Provide Respiratory Protection as indicated in paragraph below. Where paragraph below does not apply, determine the proper level of protection by dividing the expected or actual airborne fiber count in the work area by the "protection factors" given below. The level of respiratory protection which supplies an airborne fiber level inside the respirator, at the breathing zone of the wearer, at or below 0.01 fibers/cubic centimeter is the minimum level of protection allowed.
2. Eight-hour Time Weighted Average (TWA) of asbestos fibers to which any worker may be exposed shall not exceed 0.1 fibers/cubic centimeter.
3. For purposes of this section fibers are defined as all fibers regardless of composition as counted in the OSHA Reference Method (ORM), NIOSH P&CAM 239 or 7400 procedure, or asbestos fibers of any size as counted using either a scanning or transmission electron microscope.
4. Require that respiratory protection be used at all times that there is any possibility of disturbance of asbestos-containing materials whether intentional or accidental.
5. Require that a respirator be worn by anyone in a work area at all times, regardless of activity, during a period that starts with any operation which could cause airborne fibers until the area has been cleared for re-occupancy.



H. Respiratory Protection Factor

<u>Respirator Type</u>	<u>Protection Factor</u>
Air purifying: Negative pressure respirator High efficiency filter Half facepiece	10
Air purifying: Negative pressure respirator High efficiency filter Full facepiece	50
Powered-air purifying (PAPR): Positive pressure respirator High efficiency filter Half or Full facepiece	100
Type C supplied air: Positive pressure respirator continuous-flow Half or full facepiece	100
Type C supplied air: Positive pressure respirator pressure demand Full facepiece	1000
Type C supplied air: Positive pressure respirator pressure demand Full facepiece Equipped with an auxiliary positive pressure Self-contained breathing apparatus (SCBA)	over 1000
Self-contained breathing apparatus (SCBA): Positive Pressure respirator Pressure demand Full facepiece	over 1000

I. Air Purifying Respirator

1. Provide half face or full face type respirators. Equip full-face respirators with a nose cup or other anti-fogging device as would be appropriate for use in air temperatures less than 32 degrees Fahrenheit.
2. Provide, at a minimum, HEPA type filters labeled with NIOSH and MSHA certification for "Radionuclides, Radon Daughters, Dust, Fumes, Mists including Asbestos-Containing Dusts and Mists" and color coded in accordance with ANSI Z228.2 (1980). In addition, a chemical cartridge section may be added, if required, for solvents, etc., in use. In this case, provide cartridges that have each section of the combination canister labeled with the appropriate color code and NIOSH/MSHA Certification.
3. Supply with a sufficient quantity of respirator filters approved for asbestos, so that workers can change filters during the work day. Require that respirators be wet-rinsed, and filters discarded, each time a worker leaves the work area. Require that new filters be installed each time a worker re-enters the work area. Store respirators and filters at the job site in the changing room and protect totally from exposure to asbestos prior to their use. Do not use single use, disposable or quarterface respirators.



- J. Powered Air Purifying Respirator (PAPR)
1. Provide full-facepiece type respirators. Provide nose-cups for full-facepiece respirators. Provide, at a minimum, HEPA type cartridges approved by NIOSH/MSHA and certified for use in atmospheres containing asbestos dusts.
 2. Provide, at a minimum, one extra battery pack for each respirator so that one can be charging while one is in use.
 3. Provide non-cloth belts capable of being decontaminated in shower.
 4. Supply with a sufficient quantity of high efficiency respirator filters approved for asbestos so that workers can change filters at any time that flow through the face piece decreases to the level at which the manufacturer recommends filter replacement. Require that regardless of flow, filter cartridges be replaced after 40 hours of use. Require that HEPA elements in filter cartridges be protected from wetting during showering. Require entire exterior housing of respirator including blower unit, filter cartridges, hoses, battery pack, face mask, belt, and cords to be washed each time a worker leaves the work area. Caution should be used to avoid shorting battery pack during washing.
- K. Required Respiratory Protection
1. Regardless of airborne fiber levels, require the following minimum level of respiratory protection:
 - a. Half-face air purifying respirators may be used during set-up of the containment and removal of the material so long as fiber counts inside the respirator do not exceed .01 f/cc fibers per cubic centimeter.
- L. Decontamination Units -Three-Stage
1. Provide a Personnel Decontamination Unit consisting of a serial arrangement of rooms or spaces, Changing Room, Shower Room, Equipment Room adjacent to each full containment area.
 2. Require all persons without exception to pass through this decontamination unit for entry into and exiting from the work area for any purpose. Do not remove equipment or materials through Personnel Decontamination Unit.
 3. Changing (Clean) Room:
 - a. Provide a room that is physically and visually separated from the rest of the building for the purpose of changing into protective clothing.
 - b. Locate so that access to work area from changing room is through shower room.
 - c. Separate changing room from the building by a double-sheeted polyethylene flapped doorway.
 - d. Provide sub-panel at changing room to accommodate all removal equipment. Power sub-panel directly from a building electrical panel. Connect all electrical branch circuits in decontamination unit and particularly any pumps in shower room to a ground-fault circuit protection device.
 4. Shower Room:
 - a. Provide a completely water tight operational shower to be used for transit by cleanly dressed workers heading for the work area from the changing room, or for showering by workers headed out of the work area after undressing in the equipment room.
 - b. Construct room by providing a shower pan and two shower walls in a configuration that will cause water running down walls to drip into pan. Install a freely draining wood floor in shower pan at elevation of top of pan.
 - c. Separate this room from rest of building, drying room and airlock with airtight walls fabricated of 6-mil polyethylene.
 - d. Provide splash proof entrances to Drying Room and Airlock.
 5. Equipment Room (contaminated area):
 - a. Require work equipment, footwear and additional contaminated work clothing to be left here. This is a change and transit area for workers. Separate this room from the work area by a 6-mil polyethylene flap doorway.
 - b. Separate this room from the rest of the building, the shower room and work area with air tight walls fabricated of 6-mil polyethylene.



- 6. Clean Room: Provide Clean Room to isolate the holding room from the building exterior.
- 7. Load-out Area:
 - a. The load-out area is the transfer area from the building to a truck or dumpster.
 - b. Wet wipe bags before they are passed through the equipment decon-chamber.
 - c. When cleaning is complete pass items into holding room. Close all doorways except the doorway between the holding room and the Clean Room.
 - d. Workers from the area outside the containment area enter holding area and remove decontaminated equipment and/or containers for disposal.
 - e. Require these workers to wear full protective clothing and appropriate respiratory protection.
 - f. At no time is a worker from an uncontaminated area to enter the enclosure when a removal worker is inside.
 - g. Post an approximately 20 inch x 14 inch manufactured caution sign at each entrance to the work area displaying the following legend with letter sizes and styles of a visibility required by OSHA 29 CFR 1926.1101(k)(9)(viii)(J) - Asbestos.

LEGEND
DANGER

ASBESTOS

CANCER AND LUNG DISEASE HAZARD
RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED
IN THIS AREA

- h. Provide spacing between respective lines at least equal to the height of the respective upper line.
- i. Additional Signage: Shall also be posted in accordance with OSHA 29 CFR 1926.1101(k)(9)(viii)(J) - Asbestos

DANGER
ASBESTOS
CANCER AND LUNG DISEASE HAZARD

AUTHORIZED PERSONNEL ONLY
RESPIRATORS AND PROTECTIVE CLOTHING
ARE REQUIRED IN THIS AREA

DANGER
ASBESTOS
CANCER AND LUNG HAZARD
KEEP OUT

- j. Post an approximately 10 inch by 14 inch manufactured sign at each entrance to each work area displaying the following legend with letter sizes and styles of a visibility at least equal to the following:

<u>LEGEND</u>	<u>NOTATION</u>
No Food, Beverages or Tobacco Permitted	3/4 inch Block
All Persons Shall Don Protective Clothing (Coverings) Before Entering the Work Area	3/4 inch Block
All Persons Shall Shower Immediately After Leaving Work Area and Before Entering the Changing Area	3/4 inch Block



M. Decontamination Procedures

1. Contractor shall require all workers and visitors to adhere to the following personal decontamination procedures whenever they leave the work area:
 - a. Require that all workers use the following decontamination procedure as a minimum requirement whenever leaving the work area.
 - b. When exiting area, remove disposable coveralls, disposable head covers, and disposable footwear covers or boots in the Equipment Room.
 - c. Still wearing respirators, proceed to showers. Showering is mandatory. Care must be taken to follow reasonable procedures in removing the respirator to avoid asbestos fibers while showering. The following procedure is required as a minimum:
 - 1) Thoroughly wet body including hair and face. If using a PAPR, hold blower unit above head to keep canisters dry.
 - 2) With respirator still in place thoroughly wash body, hair, respirator face piece, and all parts of the respirator except the blower unit and battery pack on a PAPR. Pay particular attention to seal between face and respirator and under straps.
 - 3) Take a deep breath, hold it and/or exhale slowly, completely wet hair, face, and respirator. While still holding breath, remove respirator and hold it away from face before starting to breathe.
 - 4) Carefully wash face-piece of respirator inside and out.
 - d. If using PAPR, shut down in the following sequence, first cap inlets to filter cartridges, then turn off blower unit (this sequence will help keep debris which has collected on the inlet side of filter from dislodging and contaminating the outside of the unit). Thoroughly wash blower unit and hoses. Carefully wash battery pack with wet rag. Be extremely cautious of getting water in battery pack as this will short out and destroy battery.
 - 1) Shower completely with soap and water.
 - 2) Rinse thoroughly.
 - 3) Rinse shower room walls and floor prior to exit.
 - 4) Proceed from shower to changing room and change into street clothes or into new disposable work items.
 - e. Require that all workers use the following decontamination procedure as a minimum requirement whenever leaving the work area with a half or full face cartridge type respirator:
 - 1) When exiting area, remove disposable coveralls, disposable headcovers, and disposable footwear covers or boots in the equipment room.
 - 2) Still wearing respirators, proceed to showers. Showering is mandatory. Care must be taken to follow reasonable procedures in removing the respirator and filters to avoid asbestos fibers while showering. The following procedure is required as a minimum:
 - 3) Thoroughly wet body from neck down.
 - 4) Wet hair as thoroughly as possible without wetting the respirator filter if using an air purifying type respirator.
 - 5) Take a deep breath, hold it and/or exhale slowly, complete wetting of hair, thoroughly wetting face, respirator and filter (air purifying respirator). While still holding breath, remove respirator and hold it away from face before starting to breath.
 - 6) Dispose of wet filters from air purifying respirator.
 - 7) Carefully wash facepiece of respirator inside and out.
 - 8) Shower completely with soap and water.
 - 9) Rinse thoroughly.
 - 10) Rinse shower room walls and floor prior to exit.
 - 11) Proceed from shower to changing room and change into street clothes or into new disposable work items.

N. Project Decontamination

1. If the asbestos abatement work is on damaged or friable materials, then the building space is deemed contaminated before start of the work and in need of decontamination. In this case, the



- procedure includes two cleanings of the primary barrier plastic prior to its removal and two cleanings of the room surfaces to remove any new or existing contamination.
2. Work of this section includes the decontamination of air in the work area which has been, or may have been contaminated by the elevated airborne asbestos fiber levels generated during abatement activities, or which may previously have had elevated fiber levels due to friable materials in the space.
 3. Work of this section also includes the cleaning, decontamination, and removal of temporary facilities installed prior to abatement work and decontamination of all surfaces (ceiling, walls, floor) of the work area, and all furniture or equipment in the work area.
 4. First Cleaning
 - a. Carry out a first cleaning of all surfaces of the work area including items of remaining sheeting, tools, scaffolding and/or staging by use of damp-cleaning and mopping, and/or a HEPA filtered vacuum. (Note: A HEPA vacuum will fail if used with wet material). Do not perform dry dusting or dry sweeping. Use each surface of a cleaning cloth one time only and then dispose as contaminated waste. Continue this cleaning until there is no visible debris from removed materials on plastic sheeting or other surfaces. Upon authorization of the Owner's Representative proceed with encapsulation of substrate.
 - b. Perform encapsulation of substrate where required at this time. Maintain pressure differential system in operation during encapsulation work. Allow encapsulant to dry before proceeding with removal of Secondary layer of plastic.
 5. Second Cleaning
 - a. Upon authorization of the Owner's Representative, remove all Primary Barrier sheeting and Material Decontamination Unit, if there is one, leaving only the following:
 - 1) Critical Barrier which forms the sole barrier between the work area and other portions of the building or outside.
 - 2) Critical Barrier Sheeting over lighting fixtures and clocks, ventilation openings, doorways, convectors, speakers and other openings.
 - 3) Personnel Decontamination Unit.
 - 4) Pressure Differential System in continuous operation.
 - b. Remove all filters in Air Handling System(s) and dispose of as asbestos-containing waste.
 6. Final Cleaning: Carry out a final cleaning of all surfaces in the work in the same manner as the first cleaning immediately after removal of primary plastic. This cleaning is now being applied to existing room surfaces. Take care to avoid water marks or other damage to surfaces.
 7. Visual Inspection: Perform a complete visual inspection with the Owner's Representative of the entire work area including decontamination unit, all plastic sheeting, seals over ventilation openings, doorways, windows, and other openings; look for debris from any sources, residue on surfaces, dust or other matter. If any such debris, residue, dust or other matter is found repeat cleaning and continue decontamination procedure from that point. When the area is visually clean, complete the certification at the end of this section.
 8. Final Air Sampling
 - a. After the work area is found to be visually clean, air samples will be taken and analyzed in accordance with the procedures set forth in Paragraph "Powered Air Purifying Respirator (PAPR).
 - b. If Release Criteria are not met, repeat cleaning and continue decontamination procedure from that point.
 - c. If Release Criteria is met, remove the interior of the decontamination unit leaving in place only the Critical Barriers separating the work area from the rest of the building and the operating negative pressure system.
 - d. Any small quantities of residual material found upon removal of the plastic sheeting shall be removed with a HEPA filtered vacuum cleaner and local area protection. If significant quantities, as determined by the Owner's Representative, are found then the entire area affected shall be decontaminated as specified herein for the cleaning.

- O. Work Area Clearance
 1. Air Monitoring



- a. Visual Inspection is required as a prerequisite of air testing.
- b. To determine if the elevated airborne asbestos structure concentration during abatement operations have been reduced to the specified level, the Owner's Representative will secure samples and analyze them according to the following procedures.
- 2. Aggressive Sampling
 - a. All air samples will be taken using aggressive sampling techniques as follows. (There are no standards available for flow rate of leaf blowers or large fans. However, this information is not critical to the success of the procedure).
 - b. Before sampling pumps are started, the exhaust from forced-air equipment (leaf blower with at least 1 horsepower electric motor) will be swept against all walls, ceilings, floors, ledges and other surfaces in the room. This procedure will be continued for five minutes per 10,000 cubic feet of room volume.
 - c. Air samples will be collected in areas subject to normal air circulation away from room corners, obstructed locations, and sites near windows, doors or vents.
- 3. Schedule of Air Samples
 - a. General: The number and volume of air samples taken and analytical methods used by the Owner's Representative will be in accordance with the following schedule. Sample volumes given may vary depending upon the analytical instruments used. In each homogeneous work area after completion of all cleaning work, samples will be taken and analyzed by either PCM or TEM analysis.
 - b. Transmission Electron Microscopy (TEM) Samples:
 - 1) In each homogeneous work area after completion of all cleaning work, samples will be taken and analyzed by either PCM or TEM analysis as follows:
 - 2) Samples will be collected on 25 mm cassettes with filter media: TEM - 0.45 micrometer mixed cellulose ester or 0.40 micrometer polycarbonate, with 5.0 micron mixed cellulose ester backing filter.

Location Sampled	Number of Samples	Detection Limit (f/cc)	Minimum Volume (Liters)	Rate LPM
Each Work Area	5	0.005	1,300	2-10

- 3) TEM Analysis will be performed using the analysis method set forth in the AHERA Regulation 40 CFR Part 763 Appendix A.
- 4) Asbestos Structures referred to in this Section include asbestos fibers, bundles, clusters, or matrices, as defined by method of analysis.
- 5) Decontamination of the work site is complete when all the sample results are below 0.01 fibers per cubic centimeters (f/cc) of air or 70 structures per square millimeter.
- c. Phase Contrast Microscopy (PCM) Samples:
 - 1) In each homogeneous work area after completion of all cleaning work, samples may be taken and analyzed as follows:
 - 2) Samples will be analyzed by PCM for clearance in areas where ceiling tile and/or pipe insulation are removed
 - 3) Samples will be collected on 25 mm cassettes with filter media: PCM - 0.8 micrometer mixed cellulose ester.

Location Sampled	Number of Samples	Detection Limit (s/cc)	Minimum Volume (Liters)	Rate LPM
Each Work Area	1-5	0.01	2,400	2-10

- 4) PCM Analysis: Fibers on each filter will be measured using the NIOSH 7400 Method entitled "Fibers" published in the NIOSH Manual of Analytical Methods, 3rd Edition, Second Supplement, August 1987.



- 5) Fibers: Referred to in this section include fibers regardless of composition as counted by the phase contrast microscopy method used
 - 6) Decontamination of the work site is complete when all the sample results are below 0.01 fibers per cubic centimeters (f/cc) of air or 70 structures per square millimeter.
4. Failure of Clearance Sampling: Should results from analysis of final clearance air samples not meet the specified criteria, Contractor will be responsible for the payment of all costs, including Consultant's time for subsequent clearance air sampling. The costs associated with subsequent re-sampling for final clearance shall be deducted from the Contractor's final payment of the contract amount.

P. Removal Of Pipe Insulation

1. The work of this section applied to the removal of asbestos-containing Pipe Insulation.
 - a. Place one layer of 6-mil fire retardant polyethylene sheeting directly below the work. The sheet shall be of sufficient size to completely wrap the pipe once it has been removed.
 - b. Thoroughly wet the ends of the pipe with amended water and scrape off a minimum of 6 inches of asbestos wrap from both ends of the pipe. Immediately place the wetted material into pre-labeled asbestos disposal bag(s).
 - c. Detach the pipe at each scraped end and place the pipe onto one sheet of 6-mil fire retardant polyethylene sheeting. Wrap the pipe with the 6-mil fire retardant polyethylene sheeting. Contractor shall wrap the pipe with a second sheet of 6-mil, fire retardant polyethylene sheeting and label as asbestos-containing material. Dispose of the bag(s) and duct in accordance with the Paragraph "Handling and Disposal of Asbestos Contaminated Waste" of this specification.
 - d. Upon clearance from the Owner's Representative, Contractor shall remove the 6-trail, fire retardant polyethylene sheeting from the openings.

Q. Glove Bag Removal

1. The work of this section applies to full containment or glovebag removal.
2. Isolate the area in accordance with Paragraph "Temporary Facilities."
3. Construct a decontamination unit as described in Paragraph "Decontamination Units" and attach to the work area.
4. Set up pressure differential isolation and ventilation of the work area in accordance to Paragraph "Pressure Differential System."
 - a. Upon approval of the enclosure by the Owner's Representative, Contractor may proceed to remove the material using the following method.
 - b. Thoroughly wet to satisfaction of the Owner's Representative, asbestos-containing insulation to be removed prior to stripping and/or tooling to reduce fiber dispersal into the air. Accomplish wetting by a fine spray (mist) of amended water or removal encapsulant. Saturate material sufficiently to wet the substrate without causing excess dripping. Allow time for removal encapsulant to penetrate material thoroughly. If amended water is used, spray material repeatedly during the work process to maintain a continuously wet condition. If a removal encapsulant is used, apply in strict accordance with manufacturer's written instructions. If insulation is covered with canvas, Contractor will wet the exterior covering and slice it with utility knife while saturating the material.
 - c. Mist work area continuously with amended water whenever necessary to reduce airborne fiber levels using commercially available "foggers."
 - d. Remove saturated asbestos-containing material in small sections from all areas. Do not allow material to dry out. As it is removed, simultaneously pack material while still wet into disposal bags. Twist neck of bags, bend over and seal with minimum three wraps of duct tape. Clean outside and move to wash down station adjacent to material decontamination unit.
 - e. Evacuate air from disposal bags with a HEPA filtered vacuum cleaner before sealing.
 - f. Contractor must always clean area of visible asbestos debris prior to end of shift.
5. These procedures shall be followed to remove pipe insulation elbows:
 - a. Install critical barriers to isolate the work site. Install 2 or 3 Stage Decontamination Units.



- b. HEPA vacuum the work site.
 - c. Provide negative air machine in addition to those required, in the vicinity of the work. Arrange so that exhaust is into the work area, oriented in a direction away from the work. Extend a 2-inch diameter flexible non-collapsing duct from the intake end to a point no more than 4'-0" from any scraping or brushing activity.
 - d. Locate intake of duct so that airflow is horizontally and slightly downward into intake. Replace primary filter on negative air machine at an interval of no greater than 30 minutes. Allow no more than one scraping or brushing activity per negative air machine.
 - e. Check pipe where the work will be performed. Wrap damaged (broken lagging, hanging, etc.), pipe in 6 mil plastic and "candy-stripe" with duct tape. Place one layer of duct tape around undamaged pipe at each end where the glovebag will be attached.
 - f. Place necessary tools into pouch located inside glovebag. This will usually include: bone saw, utility knife, rags, scrub brush, wire cutters, tin snips and pre-wetted cloth.
 - g. Place one strip of plastic adhesion tape along the edge of the open top slit of glove bag for reinforcement.
 - h. Place the glove bag around section of pipe to be worked on and staple top together through reinforcing tape. Next, tape the ends of glovebag to pipe itself, where previously covered with plastic or tape.
 - i. Use smoke tube and aspirator bulb to test seal. Place tube into water sleeve (two-inch opening to glovebag) squeezing bulb and filling bag with visible smoke. Remove smoke tube and twist water sleeve closed. While holding the water sleeve tightly, gently squeeze glovebag and by using a flashlight, look for smoke leaking out, (especially at the top and ends of the glovebag). If leaks are found, tape closed using plastic adhesion tape and re-test.
 - j. Insert wand from garden sprayer through water sleeve. Plastic adhesion tape water sleeve tightly around the wand to prevent leakage.
 - k. One person places its hands into the long-sleeved gloves while the second person directs garden sprayer at the work.
 - l. Use bone saw, if required, to cut insulation at each end of the section to be removed. A bone saw is a serrated heavy gauge wire with ring-type handles at each end. Throughout this process, spray amended water or removal encapsulant on the cutting area to keep dust to a minimum.
 - m. Remove insulation using putty knives or other tools. Place pieces in bottom of bag without dropping.
 - n. Rinse all tools with water inside the bag and place back into pouch.
 - o. Using scrub brush, rags and water, scrub and wipe down the exposed pipe. (Inexpensive horse rub-down mittens work well for this).
 - p. Remove water wand from water sleeve and attach the small nozzle from HEPA-filtered vacuum. Turn on the vacuum only briefly to collapse the bag.
 - q. Remove the vacuum nozzle, twist water sleeve closed and seal with plastic adhesion tape.
- R. Handling And Disposal Of Asbestos-Containing Waste
1. All waste and asbestos contaminated waste shall be double bagged in pre-labeled 6-mil airtight puncture resistant bags. Labeling shall be in accordance with OSHA and EPA requirements.
 - a. Bags of asbestos-containing waste shall be sealed with tape in the work area. Asbestos waste shall not be allowed to dry out prior to sealing bags. While in the work area, bags shall be decontaminated of any bulk debris by wet wiping. Bags shall be pre-labeled in accordance with OSHA and EPA.
 - b. The Contractor shall ensure that the sealed bags are transported to the waste disposal site.
 2. The Contractor shall establish a manifest system to enable the Owner to report the quantity of asbestos waste being deposited at the landfill. Contractor shall report the quantity of waste in pounds or tons as appropriate. The Contractor must be able to demonstrate custody over all asbestos waste from the time it is removed from the work area until it is deposited at the land fill.



- a. Copies of the manifest and any receipts generated during the handling and disposal process shall be provided to the Owner's Representative and the Owner.
 - b. Final manifest and documents must be provided to the Owner's Representative and the Owner within two weeks of the removal of the asbestos materials from the site by the waste hauler.
- S. Encapsulation Of Asbestos-Containing Materials
1. General provisions of Contract, including General and Supplementary Conditions and Division 01, apply to work of this section.
 - a. The work includes the sealing of all piping or vessels from which asbestos-containing insulation has been removed with one coat of a lock down encapsulant.
 - b. Where repair work is being performed, the end will be sealed with a minimum of one coat of bridging encapsulant.
 2. Submittals
 - a. Product Data: Submit manufacturer's technical information including label analysis and application instructions for each material proposed for use.
 - b. Installation Instructions: Submit manufacturer's installation instructions with specific project requirements noted.
 - c. Performance Warrantee: Submit manufacturer's performance guarantee.
 - d. Certification: Submit written approval of entity installing the encapsulant from encapsulant manufacturer.
 - e. Material Safety Data Sheet: Submit the Material Safety Data Sheet, or equivalent, in accordance with the OSHA Hazard Communication Standard (29 CFR 1910.1200) for each surfactant and encapsulating material proposed for use on the work. Include a separate attachment for each sheet indicating the specific worker protective equipment proposed for use with the material indicated.
 3. Deliver materials to the job site in original, new and unopened packages and containers bearing manufacturer's name and label, and following information:
 - a. Name or title of material
 - b. Manufacturer's stock number and date of manufacture
 - c. Manufacturer's name
 - d. Thinning Instructions
 - e. Application Instructions
 4. Deliver materials together with a copy of the OSHA Material Safety Data Sheet for the material.
 5. Job Conditions
 - a. Apply encapsulating materials only when environmental conditions in the work area are as required by the manufacturer's instructions.
 6. Quality Assurance
 - a. Installation of Spray-on Encapsulation Materials: Install spray-on materials by a firm and personnel approved by the manufacturer of the primary materials.
 - b. Testing: Test material to be encapsulated using methods set forth in ASTM E1494 "Standard Practice for Encapsulants Spray-or-Trowel-Applied for Friable Asbestos-Containing Building Materials."
 - c. Performance Warranty: Submit written Performance Warranty, executed by the manufacturer and co-signed by the Contractor, agreeing to repair/replace spray-on work which has cracked, fallen from substrate, or otherwise deteriorated to a condition where it would not perform effectively for its intended purposes due substantially to defective materials or workmanship and not due to abuse by occupants, improper maintenance, non-foreseeable ambient exposures or other causes beyond anticipated conditions and manufacturer's/contractor's control.
 - d. Compatibility: Selection and use of encapsulant shall be compatible with replacement materials. Submit manufacturer's data indicating compatibility with replacement materials.
 7. Product Selection
 - a. Encapsulants: Provide penetrating or bridging type encapsulants specifically designed for application to asbestos-containing material.



- b. Standards: Product shall be rated as acceptable for use intended when field tested in accordance with ASTM E1494 "Standard Practice for Encapsulants Spray-or-Trowel-Applied for Friable Asbestos-Containing Building Materials."
 - c. Fire Safety: Use only materials that have a flame spread index of less than 25, when dry, when tested in accordance with ASTM E84.
 - 8. Manufacturers
 - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products, which may be incorporated in the work, include, but are not limited to the following:
 - 1) Penetrating Encapsulants: As currently accepted by the EPA. Refer to most recent EPA approval list.
 - 2) Bridging Encapsulants: As currently accepted by the EPA. Refer to most recent EPA approval list.
 - 9. General
 - a. Prior to applying any encapsulating material, ensure that application of the sealer will not cause the base material to fail and allow the sealed material to fall of its own weight or separate from the substrate. Should Contractor doubt the ability of the installation to support the sealant, request direction from the Owner's Representative before proceeding with the encapsulating work.
 - b. Do Not Commence Application of encapsulating materials until all removal work within the work area has been completed.
 - 10. Worker Protection
 - a. Before beginning work with any material for which a Material Safety Data Sheet has been submitted, provide workers with the required protective equipment. Require that appropriate protective equipment be used at all times.
 - b. In addition to protective breathing equipment required by OSHA requirements or by this specification, use painting pre-filters on respirators to protect the dust filters when organic solvent based encapsulants are used.
 - 11. Substrate
 - a. Apply lock down encapsulant to all substrate after all asbestos-containing materials have been removed. Apply in strict accordance with the manufacturer's printed instructions for use of the encapsulation as an asbestos coating. Any deviations from such printed instructions shall be approved by the Owner's Representative in writing prior to commencing work.
 - b. Apply encapsulant with an airless spray gun with air pressure and nozzle orifice as recommended by the encapsulant manufacturer.
- T. Removal Of Floor Tile
- 1. This section applies to the removal of floor tile.
 - a. Prior to start of work, wet wipe all surfaces including floor tile to remove any visible dust.
 - b. Isolate the room by sealing hallway or doors and installing critical barriers on all ducting, windows and other penetrations of the room, in the specified area. Install a splash guard a minimum of 4 feet high on the walls of the room with one layer of 6-mil fire retardant poly.
 - c. Install a two-stage decontamination configuration contiguous (under certain conditions may be remote) with the work in accordance with Paragraph "Decontamination Units."
 - d. Using water or amended water in a Hudson-type sprayer or garden sprayer, lightly mist the area where the material is to be removed. This may take several passes with the hose of the sprayer. Allow time for the water to soak into the material.
 - e. Immediately place individual tiles in proper asbestos disposal bags. Vacuum collapse the bag, twist the neck of the bag, tape with duct tape, fold the twisted portion over onto itself and tape again. Wipe the outside of the bag with clean damp cloths and place the bag into a second prelabeled disposal bag. Tape shut the second bag.
- U. Removal Of Fireproofing



1. The work of this section applies to the removal of all asbestos containing fireproofing including all over-spray that may be located on concrete block, columns, metal deck, beams, fixtures conduit and ducting.
 - a. Isolate the floor per Paragraph "Temporary Enclosure."
 - b. Construct a decontamination unit as described in Paragraph "Decontamination Units" and attach to the work area.
 - c. Set up pressure differential isolation and ventilation of the work area in accordance to Paragraph "Temporary Pressure Differential and Air Circulation System."
 - d. Upon approval of the enclosure by the Owner's Representative, contractor may proceed to remove the material using the following method.
 - e. Pre-clean columns, beams, electrical, mechanical and plumbing systems in the work area using wet wipe and HEPA vacuuming methods. Mask off with flame retardant polyethylene sheeting to protect from contamination during bulk abatement.
 - f. Thoroughly wet to satisfaction of the Owner's Representative, asbestos-containing fireproofing to be removed prior to stripping and/or tooling to reduce fiber dispersal into the air. Accomplish wetting by a fine spray (mist) of amended water or removal encapsulant. Saturate material sufficiently to wet the substrate without causing excess dripping. Allow time for removal encapsulant to penetrate material thoroughly. If amended water is used, spray material repeatedly during the work process to maintain a continuously wet condition. If a removal encapsulant is used, apply in strict accordance with manufacturer's written instructions.
 - g. Mist work area continuously with amended water whenever necessary to reduce airborne fiber levels using commercially available "foggers."
 - h. Remove saturated asbestos-containing material in small sections from all areas. Do not allow material to dry out. As it is removed, simultaneously pack material while still wet into disposal bags. Twist neck of bags, bend over and seal with minimum three wraps of duct tape. Clean outside and move to wash down station adjacent to material decontamination unit.
 - i. Evacuate air from disposal bags with a HEPA filtered vacuum cleaner before sealing.
 - j. Provide Pressure Differential Machine in addition to those required in Paragraph "Pressure Differential System," in the vicinity of the work. Arrange so that exhaust is into the work area, oriented in a direction away from the work. Extend a 12" diameter flexible non-collapsing duct from the intake end to a point no more than 4'-0" from any scraping or brushing activity.
 - k. Locate intake of duct so that air flow is horizontally and slightly down-ward into intake. Replace primary filter on pressure differential machine at an interval of no greater that 30 minutes. Allow no more than one scraping or brushing activity per pressure differential machine.
- V. Removal Of Wall Plaster: HEPA vacuum work site.
 1. Place two layers of 6-mil flame retardant polyethylene sheeting on the floor adjacent to the wall to be demolished. Pull the wall down in manageable sections onto the polyethylene sheeting. Control dust and fiber release by misting the air and lightly wetting the material with amended water from a Hudson-type sprayer or garden sprayer as it is demolished.
 2. Wrap the first layer of polyethylene sheeting around the material and seal with duct tape. Wrap the second layer of polyethylene sheeting around the bundle and seal with duct tape.
 3. Label and dispose of the entire bundle.
 4. Provide Pressure Differential Machine in addition to those required in Paragraph "Pressure Differential System," in the vicinity of the work. Arrange so that exhaust is into the work area, oriented in a direction away from the work. Extend a 12-inch diameter flexible non-collapsing duct from the intake end to a point no more than 4'-0" from any scraping or brushing activity.
 5. Locate intake of duct so that air flow is horizontally and slightly down-ward into intake. Replace primary filter on negative air machine at an interval of no greater that 30 minutes.

W. Clean-Up Of Asbestos-Containing Debris On Ceiling Tile Or Solid Ceiling



1. This section applies to the decontamination of the entire plaster ceiling, removal of existing fiberglass on duct work and removal of all batt insulation covering the existing plaster ceiling.
 - a. Isolate the floor per Paragraph "Temporary Facilities."
 - b. Construct a decontamination unit as described in Paragraph "Decontamination Units" and attach to the work area. General Contractor will give direction regarding exact location of decontamination unit(s).
 - c. Set up pressure differential isolation and ventilation of the work area in accordance to Paragraph "Temporary Pressure Differential and Air Circulation System."
 - d. Upon approval of the enclosure by the Owner's Representative, contractor may proceed to remove the material using the following method:
 2. These procedures shall be followed to for clean up of asbestos-containing debris on existing plaster ceiling:
 - a. This work will be performed prior to the removal of fireproofing. The isolation of the work area is considered essential to the pre-cleaning activities for the total area. Isolate the area in accordance with Paragraph "Temporary Facilities."
 - b. Remove asbestos-containing debris and fiberglass batt and duct insulation and decontaminate the area using the following procedures:
 - 1) Remove all small debris with the HEPA vacuum.
 - 2) Gently mist all fiberglass insulation, remove from ducts and ceiling and place into pre-labeled hazardous disposal bags and dispose of in accordance with Paragraph "Disposal of Asbestos Containing Waste Material."
 - 3) Exposure of ducting will expose all fireproofing overspray, this material may be removed during the removal of fireproofing from decks and beams.
 - 4) Pick up all large visible debris on the ceiling or any horizontal surfaces and place in the bottom of a 6-mil polyethylene disposal bag conforming to the requirements of Paragraph "Disposal of Asbestos-Containing Waste." Place pieces in the bag without dropping and avoiding unnecessary disturbance and release of material.
 - 5) HEPA vacuum the entire plaster ceiling surface.
 - c. Upon completion of the decontamination of the area request a visual inspection of the ceiling and other horizontal surfaces. This area will be considered a portion of work area for the duration of the work and will be included in the final encapsulation of the area.
- X. Removal Of Adhesive: This section applies to the removal of all asbestos-containing floor tile and adhesive, sheet vinyl flooring, vinyl floor tile, and baseboard adhesive, etc.
1. Ensure that workers are equipped with proper respiratory protection. In addition to the HEPA cartridges, respirators must also be equipped with organic solvent cartridges.
 2. Provide HEPA filtered fan units in the vicinity of the work. Arrange so that units exhaust outside the building. Replace primary filters on HEPA filtered fan units at an interval of no greater than 30 minutes.
 3. Apply adhesive removal solvent as recommended by manufacturer after removal of floor tile has been completed.
 4. Provide tile adhesive (mastic) remover that meets the following criteria:
 - a. Flash Point: 122E or greater.
 - b. Special Precautions: No heavy smoke generated if ignited.
 - c. Health Effects: Limited to mild skin rash or eye irritation.
 - d. Respiratory Protection: MSHA - NIOSH approved Organic vapor cartridges in conjunction with standard HEPA filters.
 - e. Petroleum Distillates: None.
 - f. Odor: Pine, Citrus or none.

Use of diesel fuel in the removal of tile and baseboard adhesive is strictly prohibited.

5. Remove adhesive in small sections from all areas. Do not allow material to dry out. As adhesive is removed, simultaneously pack rags contaminated with adhesive material into disposal bags. Twist



- neck of bags, bend over and seal with minimum three wraps of duct tape. Clean outside of bag and move to material decontamination unit.
6. Upon completion of adhesive removal, thoroughly clean bare substrate of all solvent residue.
 7. Place adhesive residue in proper asbestos disposal bags. Vacuum collapse the bag, twist the neck of the bag, tape with duct tape, fold the twisted portion over onto itself and tape again. Wipe the outside of the bag with clean damp cloths and place bag into second pre-labeled disposal bag. Tape shut the second bag.



CERTIFICATE OF WORKER'S ACKNOWLEDGEMENT

PROJECT NAME: _____

PROJECT ADDRESS: _____

CONTRACTOR: _____

WORKING WITH ASBESTOS CAN BE DANGEROUS. INHALING ASBESTOS FIBERS HAS BEEN LINKED WITH VARIOUS TYPES OF CANCER IF YOU SMOKE AND INHALE ASBESTOS FIBERS, THE CHANCE THAT YOU WILL DEVELOP LUNG CANCER IS GREATER THAN THAT OF THE NON-SMOKING PUBLIC.

Your employer's contract with the Owner for the above project requires that: You be supplied with the proper respirator and be trained in its use. You be trained in safe work practices and in the use of the equipment found on the job. You receive a medical examination. These things are to have been done at no cost to you. By signing this certification you are assuring the Owner that your employer has met these obligations to you.

RESPIRATORY PROTECTION: I have been trained in the proper use of respirators, and informed of the type respirator to be used on the above referenced project. I have a copy of the written respiratory protection manual issued by my employers. I have been equipped at no cost with the respirator to be used on the above project.

TRAINING COURSE: I have been trained in the dangers inherent in handling asbestos and breathing asbestos dust and in proper work procedures and personal and area protective measures. The topics covered in the course included the following:

- Physical characteristics of asbestos
- Health hazards associated with asbestos
- Respiratory protection
- Use of protective equipment
- Pressure differential systems
- Work practices including hands-on or on-the-job training
- Personal decontamination procedures
- Air monitoring, personal and area

MEDICAL EXAMINATION: I have had a medical examination within the last 12 months which was paid for by my employer. This examination included: health history, pulmonary function tests and may have included an evaluation of a chest x-ray.

Signature _____ Witness _____

Printed Name _____ Social Security Number _____



CERTIFICATION OF VISUAL INSPECTION

AREA _____

In accordance with Paragraph "Project Decontamination" the Contractor hereby certifies that it has visually inspected the work area (all surfaces including pipes, beams, ledges, walls, ceiling and floor, Decontamination Unit, sheet plastic, etc.) and has found no dust, debris or residue.

By: _____

Signature _____ Date _____

Print Name _____

Print Title _____

OWNER'S REPRESENTATIVE CERTIFICATION

the Owner's Representative hereby certifies that it has accompanied the Contractor on its visual inspection and verifies that this inspection has been thorough and to the best of its knowledge and belief, the Contractor's certification above is a true and honest one.

Signature _____ Date _____

Print Name _____

Print Title _____



RESPIRATORY PROTECTION PROGRAM

Project Name _____

Location _____

Date _____

Based upon airborne asbestos-fiber counts encountered on previous projects of similar type working on materials similar to those found on the above referenced project. The following level of respiratory protection is proposed for the indicated operations to maintain an Airborne Fiber Count (as measured by the NIOSH 7400 Method) below the specified Permissible Exposure Limit (PEL) inside the respirator face piece.

Operation	Anticipated f/cc	Respiratory Protection	Protection Factor	f/cc in Mask
Installing sheet plastic				
Removing trim in contact with asbestos-containing material				
Removal of architectural finish or fireproofing				
Removal of pipe insulation				
Removal of fitting insulation				
Encapsulation of pipe and boiler insulation				
Gross debris removal				
Cleaning "primary" sheet plastic				
Cleaning "critical" barrier				
Removing Decontamination Unit				
Other				

The Contractor certifies that to the best of its knowledge and belief the above represent a true and accurate representation of Airborne Fiber Counts to be expected for the operations indicated, and are based upon airborne fiber data from past projects with similar materials and operations.

Contractor _____

Signature _____ Date _____

Print Name _____ Title _____

END OF SECTION 02 82 33 00



SECTION 02 82 33 00a - REMOVAL OF NONFRIABLE ASBESTOS-CONTAINING MATERIALS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for removal of nonfriable asbestos-containing materials. Products shall be as follows or as directed by the the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Definitions

1. ACM: Asbestos Containing material which is any material containing more than one percent asbestos.
2. Amended Water: Water containing a wetting agent or surfactant with a maximum surface tension of 2.9 Pa 29 dynes per centimeter when tested in accordance with ASTM D 1331.
3. Area Sampling: Sampling of asbestos fiber concentrations which approximates the concentrations of asbestos in the theoretical breathing zone but is not actually collected in the breathing zone of an employee.
4. Asbestos: The term asbestos collectively refers to a naturally occurring mineral known by the following specific names: chrysotile, amosite, crocidolite, tremolite, anthophyllite, and actinolite.
5. Asbestos control Area: That area where asbestos removal operations are performed. The area shall be isolated by physical boundaries to assist in the prevention of the uncontrolled access by non-qualified persons.
6. Asbestos Fibers: Those fibers having an aspect ratio of at least 3:1 and longer than-5 micrometers as determined by National Institute for Occupational Safety and Health (NIOSH) Method 7400.
7. Asbestos Permissible Exposure Limit: 0.1 fibers per cubic centimeter of air as an e-hour time weighted average measured in the breathing zone as by defined 29 CFR 1926.1101 or other Federal legislation having legal jurisdiction for the protection of workers health.
8. Background: The ambient airborne asbestos concentration in an uncontaminated area as measured prior to any asbestos hazard abatement efforts. Background concentrations for contaminated areas are measured in similar but asbestos free locations.
9. Contractor: The Contractor is that individual, or entity under contract to the Owner to perform the herein listed work.
10. Contractor/Supervisor (Asbestos abatement): A person who has successfully completed training and is therefore accredited as a Contractor/Supervisor under a State Model Accreditation Plan or EPA Model Accreditation Plan as described in 40 CFR 763.
11. Critical Barrier: The layer of polyethylene sheeting that covers an opening or penetration in a room or area that is to become a negative pressure enclosure.
12. Encapsulation: The abatement of an asbestos hazard through the appropriate use of chemical encapsulants.
13. Encapsulants: Specific materials in various forms used to chemically or physically entrap asbestos fibers in various configurations to prevent these fibers from becoming airborne. There are four types of encapsulants as follows which must comply with performance requirements as specified herein.
 - a. Removal Encapsulant (can be used as a wetting agent)
 - b. Bridging Encapsulant (used to provide a tough, durable surface coating to asbestos containing material)
 - c. Penetrating Encapsulant (used to penetrate the asbestos containing material encapsulating all asbestos fibers and preventing fiber release due to routine mechanical damage)
 - d. Lock-Down Encapsulant (used to seal off or "lock-down" minute asbestos fibers left on surfaces from which asbestos containing material has been removed).
14. Friable Asbestos Material: Any material containing more than one percent asbestos that can be crumbled, pulverized, or reduced to powder by hand pressure when dry.



15. Glovebag Technique: Those asbestos removal and control techniques put forth in 29 CFR 1926.1101.
16. HEPA Filter Equipment: High efficiency particulate air (HEPA) filtered vacuum and/or exhaust ventilation equipment with a filter system capable of collecting and retaining asbestos fibers. Filters shall retain 99.97 percent of particles 0.3 microns or larger as indicated in UL 586.
17. the Owner: That qualified person employed directly by the Owner to monitor, sample, inspect the work, and advise the Owner.
18. Negative Pressure Enclosure (NPE): That engineering control technique described as a negative pressure enclosure in 29 CFR 1926.1101.
19. Non-friable Asbestos Material: Material that contains asbestos in which the fibers have been immobilized by a bonding agent, coating, binder, or other material so that the asbestos is well bound and will not normally release asbestos fibers during any appropriate use, handling, storage or transportation. It is understood that asbestos fibers may be released under other conditions such as demolition, renovation, removal, or mishap.
20. Personal Sampling: Air sampling which is performed to determine asbestos fiber concentrations within the breathing zone of a specific employee, as performed in accordance with 29 CFR 1926.1101.
21. Competent Person (CP): A person who has successfully completed training and is therefore accredited under a legitimate State Model Accreditation Plan or EPA Model Accreditation Plan as described in 40 CFR 763 as a Contractor/Supervisor and shall be appropriately licensed according to the Statutes of the State in which the work is to be performed.
22. TEM: Refers to Transmission Electron Microscopy.
23. Time Weighted Average (TWA): The TWA is an 8-hour time weighted average airborne concentration of asbestos fibers.
24. Wetting Agent: A chemical added to water to reduce the water's surface tension thereby increasing the water's ability to soak into the material to which it is applied. An equivalent wetting agent must have a surface tension of at most 2.9 Pa 29 dynes per centimeter when tested in accordance with ASTM D 1331.

C. Requirements

1. Description of Work: The work covered by this section includes the handling and control of asbestos containing materials and describes some of the resultant procedures and equipment required to protect workers, the environment and occupants of the building or area, or both, from contact with airborne asbestos fibers. The work also includes the disposal of any asbestos containing materials generated by the work. More specific operational procedures shall be outlined in the Asbestos Hazard Abatement Plan called for elsewhere in this specification. The asbestos work includes the use of non-friable removal technique(s) which is governed by 40 CFR 763 as indicated. Provide non-friable removal technique(s) as outlined in this specification for the locations indicated.
2. Medical Requirements: Provide medical requirements including but not limited to medical surveillance and medical record keeping as listed in 29 CFR 1926.1101.
 - a. Medical Examinations: Before exposure to airborne asbestos fibers, provide workers with a comprehensive medical examination as required by 29 CFR 1926.1101 or other pertinent State or local directives. This requirement must have been satisfied within the 12 months prior to the start of work on this contract. The same medical examination shall be given on an annual basis to employees engaged in an occupation involving asbestos and within 30 calendar days before or after the termination of employment in such occupation. Specifically identify x-ray films of asbestos workers to the consulting radiologist and mark medical record jackets with the word "ASBESTOS."
 - b. Medical Records: Maintain complete and accurate records of employees' medical examinations, medical records, and exposure data for a period of 30 years after termination of employment and make records of the required medical examinations and exposure data available for inspection and copying to: The Assistant Secretary of Labor for Occupational



- Safety and Health (OSHA), or authorized representatives of them, and an employee's physician upon the request of the employee or former employee.
- c. **Medical Certification:** Submit written certification for each worker and contractor/supervisor, signed by a licensed physician indicating that the worker and contractor/supervisor has met or exceeded all of the medical prerequisites listed herein and in 29 CFR 1926.1101 and 29 CFR 1910.134 as prescribed by law.
3. **Training:** Train all personnel involved in the asbestos control work in accordance with United States Environmental Protection Agency (USEPA) Asbestos Hazard Emergency Response Act (AHERA) training criteria or State training criteria whichever is more stringent. The Contractor shall document the training by providing a copy of a current training certification to the the Owner for each person assigned to work on this project. Furnish each employee with respirator training and fit testing documentation as required by 29 CFR 1910.134. Provide instruction on the engineering and other hazard control techniques and procedures to be used on this project.
 - a. **Employee Training:** Submit copies of training certificates for each employee indicating that the employee has received training at the appropriate level in accordance with 40 CFR 763.
 4. **Permits, Licenses, and Notifications:** Notify the local air pollution control district/agency and the the Owner in writing 10 working days prior to commencement of work in accordance with 40 CFR 61-SUBPART M or applicable state and local regulations. Obtain necessary permits or licenses in conjunction with asbestos removal, encapsulation, hauling, and disposal. Post the permit and/or license at the work site, visible from a non-controlled area. Notify the local fire department 3 days prior to removing fire-proofing material from the building including notice that the material contains asbestos.
 5. **Environment, Safety and Health Compliance:** Comply with the applicable requirements of the current issue of 29 CFR 1926.1101, 40 CFR 61-SUBPART A, and 40 CFR 61-SUBPART M or applicable State or local regulations regarding handling, storing, transporting, and disposing of asbestos waste materials. Submit matters of interpretation of standards to the appropriate administrative agency for resolution before starting the work. Where the requirements of this specification, applicable regulations, or referenced documents vary, the most stringent requirement shall apply.
 - a. **Site Inspection:** While performing asbestos engineering control work, the Contractor shall be subject to on-site inspection by the Federal, State, or local regulatory agencies and the Contracting Officer or its designated representative. If the work is found to be in violation of Federal, State, or local regulations or this specification, the Contracting Officer or its representative will issue a stop work order to be in effect immediately and until the violation is resolved. All related costs including standby time required to resolve the. violation shall be at the Contractor's expense.
 6. **Respiratory Protection Program:** Establish and implement a respirator program as required by ANSI 288.2 and 29 CFR 1910.134. Submit a written program manual or operating procedure including methods of compliance with regulatory statutes.
 - a. **Respirator Program Records:** Submit records of the respirator program as required by ANSI 288.2 and 29 CFR 1910.134.
 7. **Contractor/Supervisor (Asbestos Abatement):** The Contractor shall be represented on-site by a trained contractor/Supervisor. This person shall be on-site at all times when asbestos work is in progress. The Qualified Person, as defined herein, can be the Contractor/Supervisor.
 8. **Hazard Communication:** Adhere to all parts of 29 CFR 1910.1200 and 29 CFR 1926.59. Provide the Contracting Officer with a copy of the Material Safety Data Sheets (MSDS) for all materials brought to the site. Review the Asbestos Survey Report(s) provided by the the Owner, if any.
 9. **Asbestos Hazard Abatement Plan:** Submit a detailed plan of the safety precautions such as lockout, tag-out, tryout, fall protection, and confined space entry procedures and equipment and work procedures to be used in the removal of materials containing asbestos. The plan shall be prepared by the Contractor (and reviewed and signed by an asbestos consultant (LAC) licensed according to the Statutes of the State in which the work is to be performed) for review and recommendation for approval by the the Owner. The plan shall be forwarded to the the Owner for final approval at least 10 days prior to beginning abatement activities. The plan shall include but not be limited to the detailed description of personal protective equipment and work practices to



be used including, but not limited to, respiratory protection, type of whole-body protection, the location of asbestos control areas including clean and dirty areas, buffer zones, showers, storage areas, change rooms, removal method, interface of trades involved in the construction, sequencing of asbestos related work, disposal plan, type of wetting agent and asbestos encapsulant to be used, locations of local exhaust equipment, planned air sampling strategies, and a detailed description of the method to be employed in order to control environmental pollution. The plan shall also include both fire and medical emergency response plans. The Asbestos Hazard Abatement Plan must be approved in writing prior to starting any asbestos work.

10. Testing Laboratory: Submit the name, address, and telephone number of each testing laboratory selected for the sampling, analysis, and reporting of airborne concentrations of asbestos fibers along with evidence that each laboratory selected holds the appropriate State license and/or permits and certification that each laboratory is American Industrial Hygiene Association (AIHA) accredited and that persons counting the samples have been judged proficient by current inclusion on the AIHA Asbestos Analysis Registry (AAR) and successful participation of the laboratory in the Proficiency Analytical Testing (PAT) Program. Where analysis to determine asbestos content in bulk materials or transmission electron microscopy is required, submit evidence that the laboratory is accredited by the National Institute of Science and Technology (NIST) under National Voluntary Laboratory Accreditation Program (NVLAP) for asbestos analysis.
11. Landfill Approval: Submit written evidence that the landfill for disposal is approved for asbestos disposal by the USEPA and State and local regulatory agency(s).
12. Waste Shipment Records/Asbestos Waste Manifest: Submit waste shipment records and/or asbestos manifest records, prepared in accordance with applicable Federal, State, or local regulations, signed and dated by an agent of the landfill, certifying the amount of asbestos materials delivered to the landfill, within 3 days after delivery.
13. Negative Exposure Assessment: Submit objective data demonstrating that the method(s) used for the specified non-friable ACM removal does not release airborne concentrations of asbestos fibers exceeding the TWA PEL or excursion limit. This data may be from previous work within the last 12 months or from initial exposure assessments on this project. Data from previous work must have been gathered by the firm employed on this contract, using workers trained to the same level, with the ACM and workplace conditions "closely resembling" the conditions for this contract.
14. Contractor Daily Reports: Prepare a written report for each day that asbestos work is being accomplished. The report should be submitted to the the Owner monthly. The report as a minimum shall include the following, where applicable:
 - a. Daily Visual Inspection Reports: Prepare a written report documenting compliance with the Asbestos Hazard Abatement Plan and Federal, State, or local regulations.
 - b. Air Sampling Reports: Complete fiber counting within 24 hours of the "time off" of the sample pump. Notify the the Owner immediately of any airborne levels of asbestos fibers in excess of the acceptable limits. Sampling results shall be submitted to the the Owner the day following receipt. The affected employees will be provided copies of the results where required by law within 3 working days. These results shall be signed by the air sampler and the testing laboratory employee that analyzed the sample.
 - c. Pressure Differential Recordings for Local Exhaust System-Not Used
 - d. Asbestos Disposal Quantity Report: The Contractor shall record and report daily the amount of asbestos containing material removed and the amount transported for disposal. Deliver the report for the previous day and cumulative totals with amounts of material removed reported in linear meters or square meters linear feet or square feet as described initially in this specification and the amounts of material transported for disposal reported in cubic meters yards.

D. Submittals

1. Submit the following in accordance with Section "Submittal Procedures."
 - a. Vacuums and tools



- b. Respirators
- c. Wetting Agent
- d. Material Safety Data Sheets (MSDS) for all materials proposed for transport to the project site
- e. Local exhaust system
- f. Pressure differential automatic recording instrument
- g. Daily Reports
- h. Asbestos hazard abatement plan
- i. Testing laboratory
- j. Training Certificates
- k. Landfill approval
- l. Employee training
- m. Medical certification requirements
- n. Waste shipment records/Asbestos waste manifest
- o. Respiratory Protection Program
- p. Negative Exposure Assessment
- q. Local Exhaust system
- r. Show compliance with ANSI Z9.2 by providing manufacturers' certifications.
- s. Permits, licenses, and Notifications
- t. Rental equipment
- u. Respirator program records
- v. Protective clothing decontamination quality control records
- w. Protective clothing decontamination facility notification.

E. Quality Assurance

- 1. Glovebags-Not Used
- 2. Rental Equipment: Provide a copy of the written notification to the rental company concerning the intended use of the equipment and the possibility of asbestos contamination of the equipment.
- 3. Protective Clothing Decontamination Quality Control Records: Provide all records that document quality control for the decontamination of reusable outer protective clothing.
- 4. Protective Clothing Decontamination Facility Notification: Submit written evidence that persons who decontaminate, store, or transport asbestos contaminated clothing used in the performance of this contract were duly notified in accordance with 29 CFR 1926.1101.

1.2 PRODUCTS

A. Encapsulants

- 1. See Division 21 Section "Facility Fire-suppression Water-service Piping".

1.3 EXECUTION

A. Equipment

- 1. Respirators: Select respirators from those approved by the National Institute for Occupational Safety and Health (NIOSH). Provide personnel engaged in pre-cleaning, cleanup, handling, and removal of asbestos containing materials with the appropriate respiratory protection as specified in 29 CFR 1910.134.
- 2. Exterior Whole Body Protection
 - a. Outer Protective Clothing: Provide personnel exposed to asbestos with disposable "non-breathable," or reusable "non-breathable" whole body outer protective clothing, head coverings, gloves, and foot coverings. Provide disposable plastic or rubber gloves to protect hands. Cloth gloves may be worn inside the plastic or rubber gloves for comfort, but shall not be used alone. Make sleeves secure at the wrists, make foot coverings secure at the ankles, and make clothing secure at the neck by the use of tape. Reusable whole body



outer protective clothing shall be either disposed of as asbestos contaminated waste upon exiting from the asbestos regulated work area or be properly decontaminated.

- b. Work Clothing-Not Used
 - c. Decontamination of Reusable Outer Protective Clothing: When reusable outer protective clothing is used, transport the double bagged clothing to a previously notified commercial/industrial decontamination facility for decontamination. Perform non-destructive testing to determine the effectiveness of asbestos decontamination. If representative sampling is used, ensure the statistical validity of the sampling results. If representative sampling is used, reject any entire batch in which any of the pieces exceed 40 fibers per square millimeter. Inspect reusable protective clothing prior to use to ensure that it will provide adequate protection and is not or is not about to become ripped, torn, deteriorated, or damaged, and that it is not visibly contaminated. Notify, in writing, all personnel involved in the decontamination of reusable outer protective clothing as indicated in 29 CFR 1926.1101.
 - d. Eye Protection: Provide goggles to personnel engaged in asbestos abatement operations when the use of a full face respirator is not required.
3. Warning Signs and Labels: Provide bilingual warning signs printed in English and Spanish at all approaches to asbestos control areas. Locate signs at such a distance that personnel may read the sign and take the necessary protective steps required before entering the area. Provide labels and affix to all asbestos materials, scrap, waste, debris, and other products contaminated with asbestos.
- a. Warning Sign: Provide vertical format conforming to 29 CFR 1926.1101 minimum 20 by 14 inches (500 by 355 mm) displaying the following legend in the lower panel:

<u>Legend</u>	<u>Notation</u>
Danger	25 mm one inch Sans Serif Gothic or Block
Asbestos	25 mm one inch Sans Serif Gothic or Block
Cancer and Lung Disease Hazard	6 mm 1/4 inch Sans Serif Gothic or Block
Authorized Personnel only Respirators and Protective Clothing are Required in this Area	6 mm 1/4 inch Gothic 6 mm 1/4 inch Gothic

Spacing between lines shall be at least equal to the height of the upper of any two lines.

- b. Warning Labels: Provide labels conforming to 29 CFR 1926.1101 of sufficient size to be clearly legible, displaying the following legend:

DANGER
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD
BREATHING ASBESTOS DUST MAY
CAUSE SERIOUS BODILY HARM

- 4. Vacuums and Tools: Vacuums shall be leak proof to the filter and equipped with HEPA filters. Filters on vacuums shall conform to ANSI Z9.2 and UL 586. Do not use power tools to remove asbestos containing materials unless the tool is equipped with effective, integral HEPA filtered exhaust ventilation systems. Remove all residual asbestos from reusable tools prior to storage or reuse.

B. General



1. Pre-Asbestos Work Conference: The Contractor and the Contractor/Supervisor shall meet with the Contracting officer prior to beginning work, to discuss in detail the Asbestos Hazard Abatement Plan, including work procedures and safety precautions. Once approved by the Owners Engineer, the plan will be enforced as if a part of this specification. Any changes required in the specification as a result of the plan shall be identified specifically in the plan to allow for free discussion and approval by the Owners Engineer prior to starting work.
 2. Asbestos Control Area Requirements: The Contractor shall demarcate the asbestos control area(s) using physical barriers and signs to prevent access by unauthorized personnel. This area is defined by 29 CFR 1926.1101 as the regulated area.
 3. Work Procedure: Perform asbestos related work in accordance with 29 CFR 1926.1101, 40 CFR 61-SUBPART M, applicable State or local regulation, and as specified herein. Use wet removal procedures. Personnel shall wear and utilize protective clothing and equipment as specified herein. Eating, smoking, drinking, chewing gum or tobacco, or applying cosmetics shall not be permitted in the asbestos control area(s). Personnel of other trades not engaged in the removal of asbestos containing material shall not be exposed at any time to airborne concentrations of asbestos. If an asbestos fiber release or spill, stop work immediately, correct the condition to the satisfaction of the Owners Engineer, including clean-up and clearance sampling, if appropriate, prior to resumption of work.
 4. Furnishings: Furniture will be removed from the area of work by the Owner before asbestos work begins.
 5. Pre-cleaning: Wet wipe and HEPA vacuum all surfaces potentially contaminated with asbestos prior to establishment of an enclosure.
- C. Removal Procedures: Wet asbestos containing material with a fine spray of amended water during removal, cutting, or other handling so as to reduce the emission of airborne fibers. Remove material and immediately place in 0.15 mm 6 mil plastic disposal bags. Remove asbestos containing material in a gradual manner, with continuous application of the amended water in such a manner that no asbestos material is disturbed prior to being adequately wetted. Where unusual circumstances prohibit the use of 0.15 mm 6 mil plastic bags, submit an alternate proposal for containment of asbestos fibers to the Owner's Engineer for approval. Asbestos containing material shall be containerized while wet. At no time shall asbestos containing material be allowed to accumulate or become dry. Handle asbestos containing material as indicated in 40 CFR 61-SUBPART M, applicable State or local regulation, and 29 CFR 1926.1101.
1. Exposed Pipe Insulation Edges-Not Used
 2. Negative Pressure Enclosure: Block and seal openings in areas where the release of airborne asbestos fibers can be expected. Establish an asbestos negative pressure enclosure with the use of curtains, portable partitions, or other enclosures in order to prevent the escape of asbestos fibers from the contaminated asbestos work area.
 - a. Personnel/Equipment Decontamination Unit: Provide a temporary facility with a separate equipment/dirty change room and clean change room. Provide a shower that complies with 29 CFR 1926.51 in between the dirty room and clean room for personnel required to wear whole body protective clothing. Provide two separate lockers for each asbestos worker, one in each locker room. Keep street clothing and street shoes in the clean locker. HEPA vacuum and remove asbestos contaminated disposable protective clothing while still wearing respirators at the boundary of the asbestos work area and seal in impermeable bags or containers for disposal. Do not wear work clothing between home and work. All employees shall shower before changing into street clothes. Collect used shower water and filter with approved water filtration equipment to remove asbestos contamination. Dispose of filters and residue as asbestos waste. Discharge clean water to the sanitary system. Dispose of asbestos contaminated work clothing as asbestos contaminated waste or properly decontaminate as specified in the Asbestos Hazard Abatement Plan.
 - b. Waste Load-Out Unit: Provide a separate temporary area expressly for short-term storage of bagged asbestos containing material that is ready for disposal. The unit shall be the only port used to transfer waste to a truck, dumpster, or other approved on-site storage facility. It



shall not be used for personnel egress. A waste load-out unit shall be integral to each negative pressure enclosure.

3. Non-friable Removal Procedures:
 - a. Under normal conditions EPA Category II, non-friable asbestos containing materials may not be considered hazardous; however, this material may release airborne asbestos fibers during demolition and removal; therefore it must be handled in a manner to prevent the release of asbestos fibers. At no time will this material be mechanically chipped, sawed, sanded, or ground.
 - b. Prior to beginning removal, establish an Asbestos Control Area and install Critical Barriers as specified elsewhere in this section. Submit a Negative Exposure Assessment which is less than 12 months old to the the Owner for approval or conduct air sampling as specified elsewhere in this section to establish the exposure levels for the exact removal method being used. The Contractor will establish the correct level of Personal Protective Equipment required.
 - c. Acceptable methods of removal include, but are not limited to, the use of dry ice, a heat gun or lamp, citrus-based solvents, and hand tools with amended water. Removal shall be accomplished to keep the ACM substantially intact. Breakage into small pieces is an unacceptable work practice. The method shall be detailed in the Asbestos Abatement Plan and shall not be changed during the removal without Contracting Officer approval.
 - d. Upon completion of the removal and clean-up, but prior to removal of critical barriers, the Contractor Testing company shall conduct a visual inspection of all areas affected by the removal. Re-clean as required.

D. Field Quality Control Requirements

1. Visual Inspections: The the Owner will conduct periodic inspections of all areas where asbestos removal and activities are in progress to ensure compliance with the approved Asbestos Hazard Abatement Plan and Federal/State regulatory requirements. This inspection shall include confirmation of proper control/containment/enclosure, worker protection, housekeeping, exhaust equipment operation, decontamination procedures, proper wetting and disposal, and inspection of work progress and work practices. Each activity will be documented as acceptable or noted as unacceptable with justification for the non-compliance.
2. Air Sampling: Sampling of airborne concentrations of asbestos fibers shall be performed in accordance with 29 CFR 1926.1101 and as specified herein. Unless otherwise specified, use NIOSH Method 7400 for sampling and analysis. Air Sampling may be duplicated by the Government at the discretion of the Contracting Officer. If the air sampling results obtained by the Government differ from those results obtained by the Contractor, the Government will determine which results predominate.
 - a. Sampling Prior to Asbestos Work (Not Used)
 - b. Sampling During Asbestos Work
 - 1) The Contractor's testing company shall perform area sampling as indicated in 29 CFR 1926.1101 and governing environmental regulations. Perform area sampling at least once every week close to the work inside the enclosure, outside the personnel/equipment decontamination unit entrance to the enclosure.
 - 2) If sampling outside the enclosure shows airborne levels have exceeded background or 0.01 fibers per cubic centimeter, whichever is greater, stop all work, correct the condition(s) causing the fiber release, and notify the the Owner immediately. Determine by testing if adjacent areas are contaminated. If so the Contractor shall clean the contaminated areas, visually inspect, and sample the areas as specified herein.
 - 3) The Contractor shall conduct personal sampling of at least 25% of the workers engaged in asbestos handling (removal, disposal, transport and other associated work) throughout the duration of the project. If the quantity of airborne asbestos fibers monitored at the breathing zone of the workers at any time exceeds 0.1 fibers



per cubic centimeter, notify the PQP immediately, evaluate work practices, and take corrective action to reduce airborne asbestos fibers.

E. Clean-Up And Disposal

1. Housekeeping

- a. Essential parts of asbestos dust control are housekeeping and clean-up procedures. Maintain surfaces of the asbestos control area free of accumulations of asbestos fibers. Give meticulous attention to restricting the spread of dust and debris; keep waste from being distributed over the general area. Use HEPA filtered vacuum cleaners. **DO NOT BLOW DOWN THE SPACE WITH COMPRESSED AIR.** All asbestos waste shall be placed in an approved on-site storage facility or transported for disposal daily. When asbestos removal is complete, all asbestos waste is removed from the work-site, and final clean-up is completed, the PQP shall visually inspect the asbestos control area for cleanliness. After final clean-up and acceptable pre-clearance airborne concentrations are attained but before the local exhaust system is turned off and the negative pressure enclosure removed), remove all pre-filters on the building HVAC system and provide new pre-filters.
- b. Dispose of filters as asbestos contaminated materials. Reestablish HVAC, mechanical, and electrical systems in proper working order.

2. Title to Materials: All waste materials, except as specified otherwise, shall become the property of the Contractor and shall be disposed of as specified in applicable Federal, State, and local regulations and herein.

3. Disposal of Asbestos

- a. Collect all removed asbestos containing material, contaminated materials, contaminated water, scrap, debris, bags, containers, expendable equipment, and asbestos contaminated clothing which may produce airborne asbestos fibers and place in sealed fiber-proof, waterproof, non-returnable containers (e.g. double plastic bags 0.15 mm 6 mils thick, cartons, drums or cans). Wastes within the containers must be adequately wet in accordance with 40 CFR 61-SUBPART M. Affix a warning and Department of Transportation (DOT) label to each container including the bags or use at least 0.15 mm 6 mils thick bags with the approved warnings and DOT labeling preprinted on the bag.
- b. Each container or bag shall clearly indicate that the waste generator is the Owner and the development at which the waste is generated, and the Job Order number of the project.
- c. Prevent contamination of the transport vehicle (especially if the transport vehicle is a rented truck likely to be used in the future for non-asbestos purposes). These precautions include lining the vehicle cargo area with plastic sheeting (similar to work area enclosure) and thorough cleaning of the cargo area after transport and unloading of asbestos debris is complete. Dispose of waste asbestos material at an Environmental Protection Agency (EPA) or State-approved asbestos landfill off the Owner's property. For temporary storage, store sealed impermeable bags in asbestos waste drums or skids. An area for interim storage of asbestos waste-containing drums or skids will be coordinated with the the Owner. Procedure for hauling and disposal shall comply with 40 CFR 61-SUBPART M, State, regional, and local standards. Sealed plastic bags may be dumped from drums into the burial site unless the bags have been broken or damaged. Damaged bags shall remain in the drum and the entire contaminated drum shall be buried. Uncontaminated drums may be recycled. Workers unloading the sealed drums shall wear appropriate respirators and personal protective equipment when handling asbestos materials at the disposal site.

END OF SECTION 02 82 33 00a



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Task	Specification	Specification Description
02 82 33 00	01 22 16 00	No Specification Required
02 82 33 00	02 81 00 00	Disposal Of Hazardous Materials
02 82 33 00	02 82 16 00	Encapsulation (Lock-Down) Of Asbestos-Containing Materials



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**SECTION 02 83 19 13 - REMOVAL AND DISPOSAL OF LEAD-CONTAINING PAINT**

1.1 GENERAL

A. Description Of Work

1. This specification covers the removal and disposal of lead-based or lead-containing paint. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Definitions

1. Action Level: Employee exposure, without regard to use of respirators, to an airborne concentration of lead of 30 micrograms per cubic meter of air averaged over an 8 hour period in an occupational/industrial environment.
2. Area Sampling: Sampling of lead concentrations within the lead control area and inside the physical boundaries which is representative of the airborne lead concentrations but is not collected in the breathing zone of personnel.
3. Competent Person (CP): As used in this section, refers to a person employed by the Contractor who is trained in the recognition and control of lead hazards in accordance with current federal, State, and local regulations. An industrial hygienist or safety professional certified for comprehensive practice by the American Board of Industrial Hygiene or by the Board of Certified Safety Professionals is the best choice.
4. Contaminated Room: Room for removal of contaminated personal protective equipment (PPE).
5. Decontamination Shower Facility: That facility that encompasses a clean clothing storage room, and a contaminated clothing storage and disposal rooms, with a shower facility in between.
6. Eight-Hour Time Weighted Average (TWA): Airborne concentration of lead to which an employee is exposed, averaged over an 8 hour workday as indicated in 29 CFR 1926.62.
7. High Efficiency Particulate Air (HEPA) Filter Equipment: HEPA filtered vacuuming equipment with a UL 586 filter system capable of collecting and retaining lead-contaminated paint dust. A high efficiency particulate filter means 99.97 percent efficient against 0.3 micron or larger size particles.
8. Lead: Metallic lead, inorganic lead compounds, and organic lead soaps.
9. Lead-Based Paint (LBP): Paint or other surface coating that contains lead in excess of 1.0 milligrams per centimeter squared or 0.5 percent by weight.
10. Lead-Based Paint Hazard (LBP Hazard): Any condition that causes exposure to lead from lead-contaminated dust, lead-contaminated soil, lead-based paint that is deteriorated or present in accessible surfaces, friction surfaces, or impact surfaces that would result in adverse human health effects.
11. Lead-Containing Paint (LCP): Lead-based paint or other similar surface coating containing lead or lead compound in excess of 0.06 percent by weight of the total nonvolatile content of the paint.
12. Lead Control Area: An enclosed area or structure, constructed as a temporary containment equipped with HEPA filtered local exhaust, which prevents the spread of lead dust, paint chips, or debris existing as a condition of lead-based paint removal operations. The lead control area is also isolated by physical boundaries to prevent unauthorized entry of personnel.
13. Lead Permissible Exposure Limit (PEL): Fifty micrograms per cubic meter of air as an 8 hour time weighted average as determined by 29 CFR 1926.62. If an employee is exposed for more than eight hours in a work day, the PEL shall be determined by the following formula:
$$\text{PEL (micrograms/cubic meter of air)} = 400/\text{No. hrs. worked per day.}$$
14. Personal Sampling: Sampling of airborne lead concentrations within the breathing zone of an employee to determine the 8 hour time weighted average concentration in accordance with 29 CFR 1926.62. Samples shall be representative of the employees' work tasks. Breathing zone shall be considered an area within a hemisphere, forward of the shoulders, with a radius of 6 to 9 inches (150 to 225 mm) and centered at the nose or mouth of an employee.



15. Physical Boundary: Area physically roped or partitioned off around an enclosed lead control area to limit unauthorized entry of personnel. As used in this section, "inside boundary" shall mean the same as "outside lead control area but inside boundary."

C. Submittals: Submit the following:

1. Product Data:
 - a. Vacuum filters
 - b. Respirators
2. Test Reports
 - a. Sampling results
 - b. Assessment data report
3. Certificates
 - a. Qualifications of CP
 - b. Testing laboratory</SUB> qualifications
 - c. Third party consultant qualifications
 - d. Lead-Based Paint/Lead-Containing Paint Removal Plan including CP approval (signature, date, and certification number)
 - e. Rental equipment notification
 - f. Respiratory protection program
 - g. Hazard communication program
 - h. EPA approved hazardous waste treatment or disposal facility for lead disposal
 - i. Hazardous waste management plan
 - j. Vacuum filters
4. Manufacturer's Instructions
 - a. Chemicals and equipment
 - b. Materials
 - c. Material safety data sheets for all chemicals
5. Closeout Submittals
 - a. Completed and signed hazardous waste manifest from treatment or disposal facility
 - b. Certification of medical examinations
 - c. Employee training certification

D. Qualifications Of CP

1. Submit name, address, and telephone number of the CP selected to perform responsibilities specified in paragraph entitled "Competent Person (CP) Responsibilities." Provide previous experience of the CP. Submit proper documentation that the CP is trained and licensed and certified in accordance with Federal, State, and local laws.

E. Third Party Consultant Qualifications

1. Submit the name, address, and telephone number of the third party consultant selected to perform the wipe sampling for determining concentrations of lead in dust or soil sampling. Submit proper documentation that the consultant is trained and certified as an inspector technician or inspector/risk assessor by the USEPA authorized State (or local) certification and accreditation program.

F. Testing Laboratory

1. Submit the name, address, and telephone number of the testing laboratory selected to perform the air and wipe and soil sampling, testing, and reporting of airborne concentrations of lead. Use a laboratory accredited under the EPA National Lead Laboratory Accreditation Program (NLLAP) by either the American Association for Laboratory Accreditation (A2LA) or the American Industrial Hygiene Association (AIHA) and that is successfully participating in the Environmental Lead Proficiency Analytical Testing (ELPAT) program to perform sample analysis.

G. Lead-Based Paint/Lead-Containing Paint Removal Plan (LBP/LCPRP)



1. Submit a detailed job-specific plan of the work procedures to be used in the removal of LBP/LCP. The plan shall include a sketch showing the location, size, and details of lead control areas, location and details of decontamination facilities, viewing ports, and mechanical ventilation system. Include in the plan, eating, drinking, smoking and sanitary procedures, interface of trades, sequencing of lead related work, collected waste water and paint debris disposal plan, air sampling plan, respirators, personal protective equipment, and a detailed description of the method of containment of the operation to ensure that airborne lead concentrations of 30 micrograms per cubic meter of air and baseline lead dust/soil concentrations are not reached or exceeded outside of the lead control area. Include site preparation and cleanup procedures. Include occupational and environmental sampling, training and strategy, sampling methodology, frequency, duration of sampling, and qualifications of sampling personnel in the air sampling portion of the plan.
- H. Occupational And Environmental Sampling Results
1. Submit occupational and environmental sampling results to the the Owner within three working days of collection, signed by the testing laboratory responsible official, the employee that performed the sampling, and the CP.
 - a. The sampling results shall represent each job classification, or if working conditions are similar to previous jobs by the same employer, provide previously collected exposure data that can be used to estimate worker exposures in accordance with 29 CFR 1926.62. The data shall represent the worker's regular daily exposure to lead.
 - b. Submit worker exposure data conducted during the task based trigger operations of 29 CFR 1926.62.
 - c. The initial monitoring shall determine the requirements for further monitoring and the need to fully implement the control and protective requirements including the compliance program (LBP/LCP) in accordance with 29 CFR 1926.62.
- I. Occupational And Environmental Assessment Data Report:
1. Some LBP/LCP removal work may not require full implementation of the requirements of 29 CFR 1926.62. Based on the experience of the Contractor and/or the use of a specific process or method for performing the work, the Contractor may be able to provide historic data (previous 12 months) to demonstrate that airborne exposures are controlled below the action level. Such methods or controls shall be fully presented in the LBP/LCPRP. To reduce the full implementation of 29 CFR 1926.62, the Contractor shall provide documentation in an Assessment Data Report.
 2. Submit occupational and environmental assessment report to the the Owner prior to start of work, signed by the testing laboratory responsible official, and the CP.
 - a. Submit a report that supports the determination regarding the reduction of the need to fully implement the requirements of 29 CFR 1926.62 and supporting the LBP/LCP. The exposure assessments shall represent each job classification, or if working conditions are similar to previous jobs by the same employer, provide previously collected exposure data that can be used to estimate worker exposures in accordance with 29 CFR 1926.62. The data shall represent the worker's regular daily exposure to lead for stated work.
 - b. Submit worker exposure data conducted during the task based trigger operations of 29 CFR 1926.62 with a complete process description in supporting a negative assessment.
 - c. The initial assessment shall determine the requirement for further monitoring and the need to fully implement the control and protective requirements including the compliance program (LBP/LCPRP) in accordance with 29 CFR 1926.62.
- J. Quality Assurance
1. Medical Examinations: Initial medical surveillance as required by 29 CFR 1926.62 shall be made available to all employees exposed to lead at any time (1 day) above the action level. Full medical surveillance shall be made available to all employees on an annual basis who are or may be exposed to lead in excess of the action level for more than 30 days a year or as required by 29 CFR 1926.62. Adequate records shall show that employees meet the medical surveillance requirements of 29 CFR 1926.33, 29 CFR 1926.62, and 29 CFR 1926.103.



- a. Medical Records: Maintain complete and accurate medical records of employees for a period of at least 30 years or for the duration of employment plus 30 years, whichever is longer.
- b. Medical Surveillance: Provide medical surveillance to all personnel exposed to lead as indicated in 29 CFR 1926.62.
2. Competent Person (CP) Responsibilities
 - a. Certify training as meeting all federal, State, and local requirements.
 - b. Review and approve lead-based paint/lead-containing paint removal plan for conformance to the applicable referenced standards.
 - c. Continuously inspect lead-based paint removal work for conformance with the approved plan.
 - d. Perform air and wipe sampling.
 - e. Ensure work is performed in strict accordance with specifications at all times.
 - f. Control work to prevent hazardous exposure to human beings and to the environment at all times.
 - g. Certify the conditions of the work as called for elsewhere in this specification.
3. Training: Train each employee performing paint removal, disposal, and air sampling operations prior to the time of initial job assignment and annually thereafter, in accordance with 29 CFR 1926.21, 29 CFR 1926.62, and State and local regulations.
 - a. Training Certification: Submit a certificate for each employee, signed and dated by the approved training source, stating that the employee has received the required lead training.
4. Respiratory Protection Program
 - a. Furnish each employee required to wear a negative pressure respirator or other appropriate type with a respirator fit test at the time of initial fitting and at least annually thereafter as required by 29 CFR 1926.62.
 - b. Establish and implement a respiratory protection program as required by ANSI Z88.2, 29 CFR 1926.103, 29 CFR 1926.62, and 29 CFR 1926.55.
5. Hazard Communication Program: Establish and implement a Hazard Communication Program as required by 29 CFR 1926.59.
6. Hazardous Waste Management: The Hazardous Waste Management Plan shall comply with applicable requirements of federal, State, and local hazardous waste regulations and address:
 - a. Identification and classification of hazardous wastes associated with the work.
 - b. Estimated quantities of wastes to be generated and disposed of.
 - c. Names and qualifications of each contractor that will be transporting, storing, treating, and disposing of the wastes. Include the facility location and operator and a 24-hour point of contact. Furnish two copies of EPA, or State and local hazardous waste permit applications or permits or manifests, as required, and EPA Identification numbers.
 - d. Names and qualifications (experience and training) of personnel who will be working on-site with hazardous wastes.
 - e. List of waste handling equipment to be used in performing the work, to include cleaning, volume reduction, and transport equipment.
 - f. Spill prevention, containment, and cleanup contingency measures including a health and safety plan to be implemented in accordance with 29 CFR 1926.65.
 - g. Work plan and schedule for waste containment, removal and disposal. Wastes shall be cleaned up and containerized daily.
 - h. Unit cost for hazardous waste disposal according to this plan.
7. Environmental, Safety and Health Compliance: In addition to the detailed requirements of this specification, comply with laws, ordinances, rules, and regulations of Federal, State, and local authorities regarding removing, handling, storing, transporting, and disposing of lead waste materials. Comply with the applicable requirements of the current issue of 29 CFR 1926.62. Submit matters regarding interpretation of standards to the the Owner for resolution before starting work. Where specification requirements and the referenced documents vary, the most stringent requirement shall apply.



8. Pre-Construction Conference: Along with the CP, meet with the the Owner to discuss in detail the hazardous waste management plan and the lead-based paint/lead-containing paint removal plan, including work procedures and precautions for the removal plan.

K. Equipment

1. Respirators: Furnish appropriate respirators approved by the National Institute for Occupational Safety and Health (NIOSH), Department of Health and Human Services, for use in atmospheres containing lead dust. Respirators shall comply with the requirements of 29 CFR 1926.62.
2. Special Protective Clothing: Furnish personnel who will be exposed to lead-contaminated dust with proper disposable uncontaminated, reusable protective whole body clothing, head covering, gloves, and foot coverings as required by 29 CFR 1926.62. Furnish proper disposable plastic or rubber gloves to protect hands. Reduce the level of protection only after obtaining approval from the CP.
3. Rental Equipment Notification: If rental equipment is to be used during lead-based paint handling and disposal, notify the rental agency in writing concerning the intended use of the equipment. Furnish a copy of the written notification to the the Owner.
4. Vacuum Filters: UL 586 labeled HEPA filters.
5. Equipment for Owner's Personnel: Furnish the the Owner with two complete sets of personal protective equipment (PPE) daily, as required herein, for entry into and inspection of the paint removal work within the lead controlled area. Personal protective equipment shall include disposable whole body covering, including appropriate foot, head, and hand protection. PPE shall remain the property of the Contractor. Respiratory protection for the the Owner will be provided by the Owner.

L. Removal

1. Title to Materials: Materials resulting from demolition work, except as specified otherwise, shall become the property of the Contractor and shall be disposed of in accordance with Division 02 Section(s) "Selective Structure Demolition" OR "Structure Demolition", except as specified herein.

1.2 PRODUCT

A. Chemicals

1. Submit applicable Material Safety Data Sheets for all chemicals used in paint removal work. Use the least toxic product approved by the the Owner.

B. Materials

1. The soluble metal content and the total metal content shall not exceed values which would cause a material to be classified as a hazardous waste.

1.3 EXECUTION

A. Protection

1. Notification: Notify the the Owner 20 days prior to the start of any paint removal work.
2. Lead Control Area Requirements
 - a. If LBP will be removed by means which will not likely create airborne, lead-containing dust (such as careful wet scraping or chemical stripping), establish a lead control area by situating critical barriers and physical boundaries around the area or structure where LBP/LCP removal operations will be performed.
 - b. If removal practice will create airborne, lead-containing dust (such as sanding, abrasive blasting, thermal cutting, demolition, or needle gun use), utilize full containment procedures - Contain removal operations by the use of critical barriers and HEPA filtered exhaust **OR** a negative pressure enclosure system with decontamination facilities and with HEPA filtered exhaust if required by the CP, **as directed**. For containment areas larger than 1,000 square feet (100 square meters) install a minimum of two 18 inch (450 mm) square viewing



- ports. Locate ports to provide a view of the required work from the exterior of the enclosed contaminated area. Glaze ports with laminated safety glass.
3. Protection of Existing Work to Remain: Perform paint removal work without damage or contamination of adjacent areas. Where existing work is damaged or contaminated, restore work to its original condition or better.
 4. Boundary Requirements: Provide physical boundaries around the lead control area by roping off the area designated in the work plan or providing curtains, portable partitions or other enclosures to ensure that airborne concentrations of lead will not reach 30 micrograms per cubic meter of air outside of the lead control area.
 - a. Physical Boundary: Provide physical boundaries around the lead control area by roping off the area designated in the work plan or providing curtains, portable partitions or other enclosures to ensure that airborne concentrations of lead will not reach 30 micrograms per cubic meter of air outside of the lead control area.
 - b. Warning Signs: Provide warning signs at approaches to lead control areas. Locate signs at such a distance that personnel may read the sign and take the necessary precautions before entering the area. Signs shall comply with the requirements of 29 CFR 1926.62.
 5. Furnishings:
 - a. The Owner will remove furniture and equipment from the building before lead-based paint removal work begins.
OR
 Furniture and equipment will remain in the building. Protect and cover furnishings or remove furnishings from the work area and store in a location approved by the the Owner.
OR
 Existing furniture and equipment is lead contaminated, decontaminate, dispose of as lead contaminated waste.
 6. Heating, Ventilating and Air Conditioning (HVAC) Systems: Shut down, lock out, and isolate HVAC systems that supply, exhaust, or pass through the lead control areas. Seal intake and exhaust vents in the lead control area with 6 mil (0.15 mm) plastic sheet and tape. Seal seams in HVAC components that pass through the lead control area. Provide temporary HVAC system for areas in which HVAC has been shut down outside the lead control area.
 7. Decontamination Shower Facility: Provide clean and contaminated change rooms and shower facilities in accordance with this specification and 29 CFR 1926.62.
 8. Eye Wash Station: Where eyes may be exposed to injurious corrosive materials, suitable facilities for quick drenching or flushing of the eyes shall be provided within the work area.
 9. Mechanical Ventilation System
 - a. Use adequate ventilation to control personnel exposure to lead in accordance with 29 CFR 1926.62.
 - b. To the extent feasible, use fixed local exhaust ventilation connected to HEPA filters or other collection systems, approved by the CP. Local exhaust ventilation systems shall be designed, constructed, installed, and maintained in accordance with ANSI Z9.2.
 - c. Vent local exhaust outside the building only and away from building ventilation intakes.
 - d. Use locally exhausted, power actuated, paint removal tools.
 10. Personnel Protection: Personnel shall wear and use protective clothing and equipment as specified herein. Eating, smoking, or drinking or application of cosmetics is not permitted in the lead control area. No one will be permitted in the lead control area unless they have been appropriately trained and provided with protective equipment.
- B. Work Procedures: Perform removal of lead-based paint in accordance with approved lead-based paint/lead-containing paint removal plan. Use procedures and equipment required to limit occupational and environmental exposure to lead when lead-based paint is removed in accordance with 29 CFR 1926.62, except as specified herein. Dispose of removed paint chips and associated waste in compliance with Environmental Protection Agency (EPA), federal, State, and local requirements.
1. Personnel Exiting Procedures: Whenever personnel exit the lead-controlled area, they shall perform the following procedures and shall not leave the work place wearing any clothing or equipment worn during the work day:



- a. Vacuum themselves off.
 - b. Remove protective clothing in the contaminated change room, and place them in an approved impermeable disposal bag.
 - c. Shower **OR** Wash hands and face at the site, **as directed**, don appropriate disposable or uncontaminated reusable clothing; move to an appropriate facility; shower.
 - d. Change to clean clothes prior to leaving the physical boundary designated around the lead control area.
2. Air and Wipe Sampling
- a. Air sample for lead in accordance with 29 CFR 1926.62 and as specified herein. Air and wipe sampling shall be directed or performed by the CP.
 - 1) The CP shall be on the job site directing the air and non-clearance wipe sampling and inspecting the lead-based paint removal work to ensure that the requirements of the contract have been satisfied during the entire lead-based paint removal operation.
 - 2) Collect personal air samples on employees who are anticipated to have the greatest risk of exposure as determined by the CP. In addition, collect air samples on at least 25 percent of the work crew or a minimum of two employees, whichever is greater, during each work shift.
 - 3) Submit results of air samples, signed by the CP, within 72 hours after the air samples are taken. Notify the the Owner immediately of exposure to lead at or in excess of the action level of 30 micrograms per cubic meter of air outside of the lead control area.
 - 4) For high profile, sensitive work such as present in family housing, child care facilities, administrative buildings, kitchens, barracks, etc., surface dust sampling to determine clearance (i.e., that the work has not contaminated surfaces within and adjacent to the control area) should be performed by a third party to reduce a conflict of interest. Samples must be conducted by an individual not paid or employed or otherwise compensated by the LBP/LCP removal Contractor. State or local regulations may require third party testing if the LBP/LCP removal operation is considered a lead hazard reduction activity.
 - 5) Before any work begins, collect and analyze baseline or soil wipe samples in accordance with methods defined in federal, State, and local standards inside and outside of the physical boundary to assess the degree of dust contamination in the facility prior to lead-based paint removal.
 - b. Air Sampling During Paint Removal Work: Conduct area air sampling daily, on each shift in which lead-based paint removal operations are performed, in areas immediately adjacent to the lead control area. Sufficient area monitoring shall be conducted to ensure unprotected personnel are not exposed at or above 30 micrograms per cubic meter of air. If 30 micrograms per cubic meter of air is reached or exceeded, stop work, correct the condition(s) causing the increased levels. Notify the the Owner immediately. Determine if condition(s) require any further change in work methods. Removal work shall resume only after approval is given by the CP and the the Owner. For outdoor operations, at least one sample on each shift shall be taken on the downwind side of the lead control area.
3. Lead-Based Paint Removal
- a. Manual or power sanding of interior and exterior surfaces is not permitted. Provide methodology for removing LBP in work plan. Remove paint within the areas designated on the drawings in order to completely expose the substrate. Take whatever precautions necessary to minimize damage to the underlying substrate.
 - b. Avoid flash rusting or deterioration of the substrate. Provide surface preparations for painting in accord with Division 07.
 - c. Provide methodology for removing LBP/LCP removal processes to minimize contamination of work areas outside the control area with lead-contaminated dust or other lead-contaminated debris/waste and to ensure that unprotected personnel are not exposed to hazardous concentrations of lead. Describe this LBP/LCP removal process in the LBP/LCPRP.



- d. Indoor Lead Paint Removal: Perform manual **OR** mechanical **OR** thermal **OR** chemical, **as directed**, paint removal in lead control areas using enclosures, barriers, or containments and powered locally exhausted paint removal tools. Collect residue and/or debris for disposal in accordance with federal, State, and local requirements.
 - e. Outdoor Lead Paint Removal: Perform outdoor removal as indicated in federal, State, and local regulations and in the LBP/CPRP. The worksite preparation (barriers or containments) shall be job dependent and presented in the LBP/LCPRP.
 - f. Sampling After Paint Removal: After the visual inspection, conduct soil sampling if bare soil is present during external removal operations and collect air samples inside and outside the lead control area to determine the airborne levels of lead inside and outside the work area. Collect wipe samples according to the HUD protocol contained in HUD Guidelines to determine the lead content of settled dust and dirt in micrograms per square foot (square meter) of surface area and parts per million (ppm) or micrograms per gram ($\mu\text{g/g}$) for soil.
4. Cleanup and Disposal
- a. Cleanup: Maintain surfaces of the lead control area free of accumulations of paint chips and dust. Restrict the spread of dust and debris; keep waste from being distributed over the work area. Do not dry sweep or use compressed air to clean up the area. At the end of each shift and when the paint removal operation has been completed, clean the area of visible lead paint contamination by vacuuming with a HEPA filtered vacuum cleaner, wet mopping the area and wet wiping the area as indicated by the CP. Reclean areas showing dust or residual paint chips or debris. After visible dust, chips and debris is removed, wet wipe and HEPA vacuum all surfaces in the work area. If adjacent areas become contaminated at any time during the work, clean, visually inspect, and then wipe sample all contaminated areas. The CP shall then certify in writing that the area has been cleaned of lead contamination before restarting work.
 - b. Clearance Certification
 - 1) The CP shall certify in writing that the final air samples collected inside and outside the lead control area are less than 30 micrograms per cubic meter of air; the respiratory protection used for the employees was adequate; the work procedures were performed in accordance with 29 CFR 1926.62 and 40 CFR 745; and that there were no visible accumulations of material and dust containing lead left in the work site. Do not remove the lead control area or roped off boundary and warning signs prior to the the Owner's acknowledgement of receipt of the CP certification.
 - 2) A third party consultant shall certify surface wipe sample results collected inside and outside the work area are less than 100 micrograms per square foot (0.1 square meter) on uncarpeted floors, less than 500 micrograms per square foot (0.1 square meter) on interior window sills and less than 800 micrograms per square foot (0.1 square meter) on window troughs **OR** not significantly greater than the initial surface loading determined prior to work, **as directed**.
 - 3) For exterior paint removal work, soil samples taken at the exterior of the work site shall be used to determine if soil lead levels had increased at a statistically significant level (significant at the 95 percent confidence limit) from the soil lead levels prior to the work. If soil lead levels do show a statistically significant increase above any applicable Federal or State standard for lead in soil, the soil shall be remediated back to the pre-work level.
 - c. Testing of Lead-Based Paint Residue and Used Abrasive: Test paint residue and used abrasive in accordance with 40 CFR 261 for hazardous waste.
 - d. Disposal
 - 1) Collect lead-contaminated waste, scrap, debris, bags, containers, equipment, and lead-contaminated clothing which may produce airborne concentrations of lead particles. Label the containers in accordance with 29 CFR 1926.62 and 40 CFR 261. Dispose of lead-contaminated waste material at an EPA or State approved hazardous waste treatment, storage, or disposal facility off Owner's property.



- 2) Store waste materials in U.S. Department of Transportation (49 CFR 178) approved 55 gallon (208 liter) drums. Properly label each drum to identify the type of waste (49 CFR 172) and the date the drum was filled. The the Owner or an authorized representative will assign an area for interim storage of waste-containing drums. Do not store hazardous waste drums in interim storage longer than 90 calendar days from the date affixed to each drum.
- 3) Handle, store, transport, and dispose lead or lead-contaminated waste in accordance with 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, and 40 CFR 265. Comply with land disposal restriction notification requirements as required by 40 CFR 268.
- 4) All material, whether hazardous or non-hazardous shall be disposed in accordance with laws and provisions and Federal, State, or local regulations. Ensure waste is properly characterized. The result of each waste characterization (TCLP for RCRA materials) will dictate disposal requirements.
5. Disposal Documentation: Submit written evidence that the hazardous waste treatment, storage, or disposal facility (TSD) is approved for lead disposal by the EPA and State or local regulatory agencies. Submit one copy of the completed manifest, signed and dated by the initial transporter in accordance with 40 CFR 262.
6. Payment for Hazardous Waste: Payment for disposal of hazardous waste will not be made until a signed copy of the manifest from the treatment or disposal facility certifying the amount of lead-containing materials delivered is returned and a copy is furnished to the Owner.

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SECTION 02 83 19 13a - LEAD PAINT RELATED ABATEMENT PROCEDURES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for lead paint related abatement procedures. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. General Provisions

1. The site of this work will be occupied while work is being done. Perform the abatement work with the least inconvenience to the residents.
2. Take all necessary precautions to protect the property of the the Owner and its residents. Damaged property shall be repaired and restored to its original condition. If the damage is beyond repair, the Contractor shall replace it with new materials to match existing, at the Contractor's expense.
3. Hazardous waste generated during the abatement process (including lead-base paint) when carted away from the developments shall not be transferred from one vehicle to another except at a licensed transfer station.
4. Develop a work plan to be performed as requested by the the Owner. The detailed plan shall include sequencing of abatement work in a manner that will be least disruptive to the normal use of the non-work areas in the building. The plan should also include emergency procedures in case of fire.
5. The Contractor shall include all supplementary miscellaneous items not specified but implied or required in order to complete the work.
6. Workmanship required in the execution of the work herein specified shall be of good quality and subject to the approval of the the Owner.
7. Make in a timely fashion all applicable and necessary notifications to relevant Federal, State and Local authorities. The Contractor shall indemnify the the Owner and the the Owner's representative from, and pay all claims resulting from failure to adhere to these provisions.
8. the Owner may retain an independent Monitoring Contractor to monitor the abatement contract and conduct all wipe sampling and clearance tests.
9. Contractor performing lead-based paint abatement or renovation activities involving lead-based paint shall be a Certified Lead Abatement Contractor and shall ensure that supervisors and workers are trained and certified by U.S. EPA approved state program or equivalent, to perform lead paint removal operations.
10. Establish and implement a Chemical Hazard Communication Program as required by OSHA regulations 29 CFR 1926.59.
11. Provide workers with a comprehensive medical examination as required by OSHA regulations 29 CFR 1926.62 before exposure to lead contaminated dust. The medical examination shall be conducted to approve use of appropriate respirators and shall include biological monitoring. NIOSH/MSHA approved respirators shall be utilized.
12. For employees required to wear a negative pressure respirators: conduct a respirator fit test at the time of initial fitting and at least once every six (6) months thereafter as required by OSHA regulations 29 CFR 1926.62.
13. Determine if any worker will be exposed to lead at or above the action level in accordance with OSHA regulation 29 CFR 1926.62 and 29 CFR 1910.1025. Conduct an exposure assessment to identify the level of exposure a worker would be subjected to without respiratory protection. Assess the exposure level by obtaining personal monitoring samples representative of a full shift of at least an 8-hour TWA.
14. Furnish appropriate respirators approved by NIOSH/MSHA for use in atmospheres containing lead aerosols. Instruct workers in all aspects of respiratory protection. Maintain an adequate supply of HEPA filter elements and spare parts on site for all types of respirators in use.



15. For manual demolition, scraping, sanding, use of heat gun or power tool paint removal with HEPA collection systems, workers shall minimally use the half-mask negative pressure respirator with high efficiency filters (for airborne concentrations not in excess of 500µg/m³).
16. Ensure that work area preparation, work practices, and clean-up procedures comply with these specifications and applicable Federal, State and Local regulations.
17. Notify all applicable agencies five days prior to the date the abatement will begin and provide evidence of notifications to the the Owner at the pre-start meeting.

C. Submissions

1. Within ten (10) consecutive calendar days calculated from the date of the the Owner's Job Order, the Contractor shall tender all required submissions. Six (6) sets of each submission are required. Where physical samples are required two (2) physical samples shall be submitted for each item. In general, items shall include but not be restricted to the following:
 - a. Paint remover - corner cutter/Vac-Pac System by Pentek Inc; Decontamination Products Division 1026 Fourth Avenue, Corapolis, PA. 15108. Telephone No. (412) 262-0725 or approved equal.
 - b. Description of removal method to be used on each substrate condition including manufacturer's operating instructions and recommendation for equipment usage.
 - c. Copies of current training certificates of Staff to be assigned to the contract.
 - d. List of three previous lead abatement jobs performed successfully by Contractor and name, address, and telephone number of contact person for verification.
2. In the event that all or any portion of the submitted material is rejected by the the Owner, the Contractor shall tender new submissions. All submissions returned for corrections shall be resubmitted with the required corrections within ten(10) consecutive calendar days calculated from the date of rejection, until final submissions are obtained that require no further correction. In no event shall the Contractor be permitted to tender submissions hereunder beyond twenty (20) days from the the Owner's Job Order, unless duly extended in writing by the the Owner.
3. No work shall begin, nor shall the materials be ordered or delivered to the site until final approval of all submissions.

D. Applicable Regulations

1. 24 CFR Part 35
2. HUD "Guidelines For the Evaluation and Control of Lead-Based Paint Hazards in Housing"
3. Abatement work shall also be in accordance with applicable regulations of the Environmental Protection Agency (EPA), Occupational Safety & Health Agency (OSHA) and any State or Local LBP standards. Where there is a conflict between Federal, State or Local regulations, the more stringent requirement shall prevail.
4. OSHA Standards
 - a. 29 CFR 1926.20 General safety and health provisions;
 - b. 29 CFR 1926.21 Safety training and education;
 - c. 29 CFR 1925.25 Housekeeping;
 - d. 29 CFR 1926-28 Personal protective equipment;
 - e. 29 CFR 1926.51(f) Washing facilities;
 - f. 29 CFR 1926.55 Gases, vapors, fumes, dusts, and mists;
 - g. 29 CFR 1926.57 Ventilation
 - h. 29 CFR 1926.59 Hazardous Communication Standards;
 - i. 29 CFR 1926.103 Respiratory protection, and
 - j. 29 CFR 1926.62 Lead in Construction
5. The Contractor must comply with all applicable requirements of the Resource Conservation & Recovery Act (RCRA) of 1976 as amended in 1980 and 1984 by the Hazardous & Solid Waste Amendments (HSWA).
6. These Specifications refer to many requirements found in the preceding references but in no way is it intended to cite or reiterate all provisions therein or elsewhere. It is the Contractor's responsibility to obtain a copy, and know, understand and abide by all such regulations, guidelines and common practices.



1.2 PRODUCTS – (not used)

1.3 EXECUTION

A. Abatement

1. Have risk assessment or paint inspection performed by certified risk assessor or a certified inspector technician who is independent of the abatement contractor.
2. Develop a site specific lead hazard control plan, reviewed and signed by an asbestos consultant (LAC) who is licensed in the State in which the work is to be performed, and submit for review and approval to the the Owner.
3. Obtain any necessary building or waste permits, notify local authorities as required by applicable codes and laws.
4. Select specific building component replacement items, enclosure materials, paint removal equipment and/or chemicals, tools, and cleaning supplies. Consider waste management and historical preservation implications of selected treatment.
5. Develop project specific specifications.
6. Schedule other work so that leaded surfaces are not inadvertently disturbed and unprotected workers are not place at risk. Include time for clearance examinations and laboratory dust sample analysis in the scheduling process.
7. Select a certified abatement subcontractor.
8. Conduct a pre-construction conference to ensure that the subcontractor fully understands the work involved.
9. Notify residents of the dwelling and adjacent dwellings of the work and date it will begin. Coordinate this with the the Owner.
10. Correct any existing conditions that could impede the abatement work (i.e. trash removal, structural deficiencies).
11. Post warning signs and restrict entry to work area to authorized personnel. Implement worksite preparation procedures.
 - a. Place proper warning signs required by OSHA regulations at all entrances to the work area. Signage shall be minimum of 12" x 20" and shall state the following:

**WARNING
LEAD WORK AREA
POISON
NO SMOKING OR EATING**

12. Coordinate test, pilot or sample portion approach to the project with the Owner.
13. Shut-down forced air heating, ventilation and air conditioning systems and cover all vents, diffusers, windows etc., with a single layer six-mil polyethylene sheet secured with duct tape. Exceptions shall be for minor disturbances of area less than 2 square feet and where if vents, diffusers, and windows are more than 5 feet away from surface being disturbed, they need not be covered.
14. Collect preabatement soil samples, which may not have to be analyzed until post abatement soil samples have been collected, analyzed, and compared to clearance standards. If postabatement soil levels are below applicable limits, the preabatement samples need not be analyzed.
15. Cover entrances to the work area with a single layer of 6 mil polyethylene sheets taped to the top and weighted at bottom.
16. Rig a containment non-flammable polyethylene sheet underneath the work area. This containment method should catch all stripped paint for proper disposal.
17. Execute abatement work.
18. Avoid spreading dust and debris outside the work area.
19. Store all waste in a secure area and make sure it is properly labeled with an accumulation start date.
20. Conduct daily and final cleanup.
21. Execute waste disposal procedures.



22. Maintain appropriate records.

B. Paint Removal

1. Do not use the following prohibited paint removal methods:
 - a. Dry scraping or sanding (except for limited areas)
 - b. Use of heat gun over 1,100°F
 - c. Open flame burning or torching
 - d. Machine sanding or grinding without HEPA vacuum exhaust tool
 - e. Abrasive blasting or sandblasting without HEPA vacuum exhaust tool
 - f. Uncontained hydro blasting or high-pressure wash
 - g. Use of chemical strippers containing Methylene chloride.
2. Select the appropriate worksite preparation level.
3. For heat gun work, provide fire extinguishers in the work area and ensure that adequate electrical power is available. Use for limited areas only. Train workers to avoid gouging or abrading the substrate.
4. For mechanical removal methods, use tools equipped with HEPA exhaust capability. Be sure workers keep the shroud against the surface being treated. Vacuum blasting and needle guns should not be used on wood, plaster, drywall, or other soft substrates. Observe all manufacturers directions for the amount of vacuum airflow required.
5. For wet scraping, use a spray bottle or wet sponge attached to the scraper to keep the surface wet while scraping. Apply enough water to moisten the surface completely, but not so much that large amounts of water run onto the ground or floor. Do not moisten areas near electrical circuits.
6. For chemical paint removers, determine if the building component can be removed and stripped offsite. Offsite stripping is generally preferred to onsite paint removal. Observe all manufacturers' directions for use of paint removers.
7. For offsite stripping, determine how to remove the component. Score the edges with a knife or razor blade to minimize the damage to adjacent surfaces. Punch or tag the building component, if similar building components are also being stripped offsite (i.e. doors). This will ensure that the individual component is reinstalled in the same location. Inform the offsite paint remover that the lead-based paint component is present for shipping. Wrap the component in plastic and send to the offsite stripping location. Clean all surfaces before reinstallation and remove any lead residue by HEPA vacuuming all surfaces, cleaning with other lead-specific cleaners, or phosphate detergents, and HEPA vacuuming again.
8. For onsite paint removal, first test the product on a small area to determine its effectiveness. Chemical paint removers may not be effective or desirable on exterior, deteriorated wood surfaces, aluminum, and glass. Provide neoprene, nitrile, rubber, or polyvinyl chloride (PVC) gloves (or other type of glove recommended by the manufacture); face shields; respirators with combination filter cartridges for lead dust and organic vapors(if appropriate); and chemically resistant clothing. Be sure to select the right type of organic vapor filter cartridge, gloves, and clothing for the specific chemical being used. Portable eyewash stations capable of providing a 15-minute flow must be on-site. Apply the chemical and wait the required period of time. Securely store chemical s overnight. For caustic chemical paint removers, neutralize the surface before repainting using glacial acetic acid (not vinegar). Repaint.
9. Make sure all debris is caught in the containment sheet for proper disposal.
10. Mark and legally dispose of waste in accordance with all applicable Federal, State and Local regulations. Most wastes from paint removal projects, such as paint chips and paint remover sludge, will need to be managed as hazardous waste.
11. Conduct clean-up
12. Have a certified risk assessor or inspector technician conduct a clearance examination and provide documentation and a Statement of Lead-Based Paint Compliance.

C. Building Component Replacement

1. Prepare work area by selecting proper worksite preparation level.
2. Prepare the hazardous material building component for removal. Turn off and disconnect any electrical circuits inside or near the building component to be removed.



3. Lightly mist the component to be removed (unless electrical circuits are located nearby).
4. Score all painted seams with a sharp knife.
5. Remove any screw, nails, or other fasteners.
6. Use flat pry instrument and hammer to pry component from the substrate.
7. Remove or bend back all nails.
8. Wrap and seal all bulk components in plastic and take them to a covered truck or secured waste storage area along a pathway covered in plastic. Shovel any debris. Dispose of properly.
9. HEPA vacuum any dust or chips in the area where the component was located.
10. Conduct cleaning and clearance activities.

D. Soil and Exterior Dust Abatement

1. Determine if soil lead hazard exists. For hazard to exist, a total of at least 9 square feet of soil in a single yard or area must be bare and soil concentrations must exceed 2,000 μ g/gram lead for the yard or building perimeter or 400 μ g/gram of lead for small, high-contact play areas (pending the development of an EPA soil standard). Bare soil above these levels shall be treated by either interim controls or abatement. Soil abatement is most appropriate when levels of lead are extraordinarily high (greater than 5,000 μ g/gram lead) and when use patterns indicate contact frequency and exposure will be high.
2. Collect Preabatement soil samples to determine baseline levels. These samples need not be analyzed if post abatement samples are below applicable clearance levels.
3. Determine the method of soil abatement (soil removal and replacement, soil cleaning, or paving). Soil cultivation (rototilling or turning over the soil) is not permitted.
4. If paving, use a high quality concrete or asphalt. Observe normal precautions associate with traffic load weight and thermal expansion and contraction. Obtain necessary permits. Keep soil cultivation to a minimum.
5. If removing and replacing soil.
 - a. Determine if waste soil will be placed in an offsite burial pit. Prepare vehicle operation and soil movement plan. Test new replacement soil (should not contain more than 200 μ g/gram lead).
 - b. Contact local utilities to determine location of underground utilities including water, gas, cable TV, electric, telephone, and sewer. Mark all locations to be avoided
 - c. Remove fencing, if necessary to allow equipment access and define set limits with temporary fencing, signs, or yellow caution tape.
 - d. Tie and protect existing trees, shrubs, and bushes.
 - e. Have enough tools to avoid handling clean soil with contaminated tools.
 - f. Remove soil.
 - g. Clean all walkways, driveways, and street areas near abatement area.
 - h. Replace soil at proper grade to allow drainage. Replacement soil should be at least 2 inches above existing grade to allow for settling.
 - i. Install new soil covering (grass or sod) and maintain it through the growing season.
 - j. Determine if soil waste is hazardous and manage it accordingly
 - k. Conduct clean-up and clearance.
 - l. Provide walk-off doormats.
 - m. Maintain proper documentation.

E. Encapsulation

1. Determine if the applicable regulations also encapsulates to be used. Do not encapsulate the following surfaces:
 - a. Friction surfaces, such as window jambs and door jambs.
 - b. Surfaces that fail patch tests.
 - c. Surfaces with substrates or existing coatings that have a high level of deterioration.
 - d. Surfaces in which there is a known incompatibility between two existing paint layers.
 - e. Surfaces that cannot support the additional weight stress of encapsulation due to existing paint thickness.
 - f. Metal surfaces that are prone to rust or corrosion.
2. Conduct field tests of surfaces to be encapsulated for paint film integrity.



3. Consider special use and environmental requirements (i.e. abrasion resistance and ability to span base substrate cracks).
4. Provide to the the Owner encapsulant test data provided by the manufacturer.
5. Conduct at least one test patch on each type of building component where the encapsulant will be used. Report the results to the the Owner.
6. For both nonreinforced and reinforced coatings, use a 6" x 6" test patch area. Prepare the surface in the manner selected to complete the job. Prepared surfaces for patch testing should be at least 2" larger in each direction than the patch area.
7. For fiber-reinforced wall coverings, use 3" x 3" patch. For rigid coatings that cannot be cut with a knife, use soundness test. For all encapsulants, carry out the appropriate adhesion tests.
8. For liquid coating encapsulants, allow coating to cure, then visually examine it for wrinkling, blistering, cracking, bubbling, or other chemical reaction with the underlying paint.
9. Record results of all patch tests and provide to the the Owner.
10. Implement proper work site preparation level.
11. Repair all building components and substrates as needed (i.e. caulk cracks and repair sources of water leaks).
12. Prepare surfaces. Remove all dirt, grease, chalking paint, mildew and other surface contaminants, remnants of cleaning solutions, and loose paint. All surfaces should be deglossed, as needed.
13. Ventilate the contaminated area whenever solvents or chemicals are used.
14. During encapsulant application or installation, monitor temperature and humidity. For liquid coatings monitor coating thickness to ensure that the encapsulant manufacturer's installation/application specifications are followed.
15. Conduct clean up and clearance.
16. Provide the the Owner information on how to care for the encapsulation system properly.
17. Maintain records on the exact detailed locations of encapsulant applications, patch test specifications and results, product name, subcontractor, date of application, a copy of the product label and material Data Safety sheet (MSDS) for the product and provide to the the Owner.

F. Enclosure

1. Stamp, label or stencil all lead-based painted surfaces that will be enclosed with a warning approximately every 2 feet both horizontally and vertically on all components. The Warning shall read "**Danger Lead-Based Paint**". Deteriorated paint should not be removed from the surface to be enclosed.
2. Select the proper worksite preparation level.
3. Attach a durable drawing to the utility room closet showing where lead-based paint has been enclosed in the dwelling.
4. An independent inspector or technician or risk assessor should evaluate the integrity of the enclosure.
5. Repair any unsound substrates and structural members that will support the enclosure, if necessary.
6. Utilize appropriate enclosure material (drywall or fiberboard, wood paneling, laminated products, ridged tile and brick veneers, vinyl, aluminum m, or plywood).
7. Install extension rings for all electrical switches and outlets that will penetrate the enclosure.
8. If enclosing floors, remove all dirt with a HEPA vacuum to avoid small lumps in the new flooring.
9. Seal and back-caulk all seams and joints. Back-caulk means applying caulk to the underside of the enclosure.
10. When installing enclosure directly to painted surfaces, use adhesive and then anchor with mechanical fasteners (screws or nails).
11. Conduct clean up and clearance activities.
12. Maintain proper records and submit a Statement of Lead-Based Paint Compliance.

G. Final Cleaning Procedures

1. Use the following step-by-step procedures



- a. Assign responsibilities to specific workers for cleaning and for maintaining the cleaning equipment.
 - b. Have sufficient cleaning equipment and supplies before beginning work.
 - c. If contamination is extensive, conduct precleaning of the dwelling unit.
 - d. Conduct ongoing cleaning during the job, including regular removal of large and small debris and dust. Decontamination of all tools, equipment and worker protection gear is required before it leaves contaminated areas. Electrical equipment should be wiped and high-efficiency particulate air (HEPA) vacuumed, not wetted down, to minimize electrocution hazards.
 - e. Schedule sufficient time (usually 30 minutes to an hour) for complete daily cleaning, starting at the same time near the end of every workday after lead hazard control activity has stopped.
 - f. For final cleaning, wait at least 1 hour after active lead hazard control activity has ceased to let dust particles settle.
 - g. Use a vacuum cleaner equipped with a HEPA exhaust filter. HEPA vacuum all surfaces in the room (ceilings, walls, trim, and floors). Start with the ceiling and work down, moving toward the entry door. Completely clean each room before moving on.
 - h. Wash all surfaces with lead-specific detergent, high-phosphate detergent, or other suitable cleaning agent to dislodge any ground-in contamination, then rinse. Change the cleaning solution after every room is cleaned.
 - i. Repeat step g above. To meet clearance standards consistently, a HEPA vacuum, wet wash, and HEPA vacuum cycle is recommended. For interim control projects involving dust removal only, the final HEPA vacuuming step is usually not needed. Other cleaning methods are acceptable, as long as clearance criteria are met and workers are not over exposed.
 - j. After final cleaning perform visual examination to ensure that all surfaces requiring lead hazard control have been addressed and all visible dust and debris have been removed. Record findings and correct any incomplete work.
 - k. If other construction work will disturb the lead-based paint surfaces, it should be completed at this point. If those surfaces are disturbed, repeat the final cleaning step after construction work has been completed.
 - l. Paint and otherwise seal treated surfaces and interior floors.
 - m. Conduct clearance examination.
 - n. If clearance is not achieved, repeat final cleaning.
 - o. Continue clearance testing and repeated cleanings until dwelling unit achieves compliance with all clearance standards. The cost of repeated cleaning, after failure to achieve clearance is to be borne by the contractor.
 - p. Do not allow residents to enter work area until final cleaning is completed and clearance is established.
 - q. Cleaning equipment list is as follows:
 - 1) HEPA Vacuums
 - 2) Detergent
 - 3) Waterproof gloves
 - 4) Rags
 - 5) Sponges
 - 6) Mops
 - 7) Buckets
 - 8) HEPA vacuum attachments (crevice tools, beater bar for cleaning rugs)
 - 9) 6-mil plastic bags
 - 10) Debris containers
 - 11) Waste water containers
 - 12) Shovels
 - 13) Rakes
 - 14) Water-misting sprayers
 - 15) 6-mil polyethylene sheeting (or equivalent)
2. Order of execution for final cleaning steps should be as follows:



- a. As the first stage in final cleaning, floor plastic shall be misted and swept.
- b. Upper level plastic, such as on cabinets and counters should be removed first, after it has been misted and cleaned. All plastic should be carefully folded from the corners/ends to the middle to trap any remaining dust. Next remove both layers of plastic from the floor.
- c. Plastic sheets used to isolate contaminated rooms from noncontaminated rooms should remain in place until after cleaning and removal of other plastic sheeting, these sheets may then be misted, cleaned and removed last.
- d. Removed plastic should be placed into double 4-mil or single 6-mil plastic bags, or plastic bags with equivalent (or better) performance characteristics, which are sealed and removed from the premises. As with daily cleanings, this plastic removal process usually requires workers to use protective clothing and respirators.
- e. After plastic has been removed from the contaminated area, the entire area should be cleaned using the HEPA/wet wash/HEPA cycle.

H. Waste Testing And Disposal

1. General: All materials, whether hazardous or non-hazardous shall be properly disposed of. the Owner may hire an independent Monitoring Consultant to perform TCLP test to determine which of the wastes are hazardous. Contractor shall cooperate in this test. If less than 100kg (200 lbs) or 1/2 of a 55 gallon drum of hazardous waste per month will be generated, it is considered "conditionally exempt" abatement waste, and may be managed as solid non-hazardous waste. The RCRA hazardous waste manifest is not required when shipping this waste to an offsite disposal facility.
2. Separate Abatement Waste into The Following Four Categories:
 - a. Category I. Low lead waste (typically non-hazardous) e.g. Filtered personal and commercial wash water.
 - b. Category II. Architectural components - (painted finish carpentry items) e.g. Doors, windows, window trim and sills, baseboards, railings, moldings. (May do a TCLP to determine if they are hazardous).
 - c. Category III. Concentrated lead waste e.g. sludge from stripping, lead-base paint chip and dust, HEPA vacuum debris and filter, unfiltered wash waste, any waste included in EPA's list of hazardous waste.
 - d. Category IV. Material that cannot be determined to be either hazardous or non-hazardous must be tested by TCLP.

If the hazardous waste generated is greater than 100kg per month, dispose according to the referenced guidelines and RCRA hazardous waste management requirements including those listed below.

3. Disposal Requirements: Contact the regional EPA, state, local and all other pertinent authorities to determine lead-based paint debris disposal requirements. Comply with requirements of the Resource Conservation and Recovery Act (RCRA) and with applicable federal, state, county, or local waste requirements.
4. EPA ID Numbers: Obtain a Generator RCRA Hazardous Material ID number and coordinate this action through the State and secure any additional number as required.
5. Storage Requirements: Keep all hazardous items in a secure area or lockable container that is inaccessible to all persons other than the Contractor's personnel. Label all hazardous waste "Hazardous Waste" with the date that the Contractor began to collect the waste in that container. Keep hazardous and non-hazardous waste in separate containers. Until TCLP testing is completed, considered all items hazardous and store in a secured area or lockable container.
6. Waste Transportation: Transport hazardous waste using a RCRA/DOT/EPA certified Hazardous Waste Transporter. Submit names and qualifications of certified transporter/hauler for the Owner approval. The Contractor shall be responsible for all actions of the waste hauler as pertaining to waste removal and disposal under these procedures and all EPA, DOT and other applicable regulations.
7. Disposal Facility: Supply documents that detail the site(s) to be used for ultimate disposal. Submit documents from these sites proving that they are licensed/permitted to accept such waste and shall accept the waste proposed by the Contractor for treatment or ultimate disposal.



8. Waste Containers: Comply with EPA and DOT regulations for waste containers. Contact the state and local authorities to determine their criteria for containers. In the case of any conflict in regulations, the more stringent shall apply.
 9. Emergencies: Contact local fire, police, hospitals or local emergency response teams and inform them of the type of hazardous waste activity and ask for assistance in the event of any accident. Additionally, the container shall provide the following:
 - a. Keep and properly maintain a suitable fire extinguisher(s) on site.
 - b. Have a immediate means of communication with the regulatory agency in the event of an emergency.
 - c. Keep a list of phone numbers of regulatory agencies on site.
 - d. Appoint an emergency coordinator and ensure the coordinator is on site to supervise emergency procedures to be carried out in the event of an emergency.
 - e. Keep and maintain a "right to know" manual that is in an easily accessible location and in an area that is known to all employees.
 10. Transporting Waste: Provide certifications that the transporter is registered with the U.S. Department of Transportation is required by 49 CFR Part 107(a) transport hazardous waste.
 - a. Provide certifications that each vehicle dedicated to haul hazardous waste has been assigned a "U.S. DOT Hazardous Material Registration Number" as required by 49 CFR Part 107.
 - b. Be responsible for all other applicable permits pertaining to hauling, transport, reduction, and disposal of hazardous waste as they may apply to this project.
 - c. Vehicle: Ensure that all non-hazardous waste is transported in covered vehicles to a landfill, or lined landfill, if required.
 - d. Container Handling: Carefully place the containers into the truck or dumpster used for disposal. At no time shall debris or containers be thrown or dropped.
 - e. Liquid Wastes: Contain and properly dispose of all liquid wastes, including lead-contaminated wash water.
 - f. Containers: HEPA vacuum the exterior of all waste containers prior to removing the waste containers from the work area. Wet wipe the containers to ensure that there is no residual contamination. Then move containers out of the work area into the designated storage area.
- I. Clearance
1. Clearance on all abatement projects must be done by an independent certified risk assessor or inspector technician. Follow all jurisdictional law with regard to licensure requirements for personnel conducting clearance activities.
 2. Clearance step-by-step procedures are as follows:
 - a. Finish the lead hazard control clean-up effort. Seal floors before clearance (if necessary).
 - b. Wait 1 hour to allow any airborne dust to settle. Do not enter work area during that hour.
 - c. Conduct visual examination
 - 1) Determine if all required work has been completed and all lead-based paint hazards have been controlled.
 - 2) Determine if there is visible settled dust, paint chips, or debris in the interior or around the exterior.
 - d. Complete the Visual Clearance Form required by the the Owner; if all work is not completed inform the the Owner and order completion of the work and repeat cleanup, if necessary.
 - e. Conduct clearance dust sampling of the floors, interior window sills, and window troughs using approved protocol.
 - f. Conduct soil sampling if bare soil is present that was not sampled previously, or if exterior paint work was completed as part of the lead hazard control effort. Whenever exterior work has been don, it may be necessary to take samples from the soil that is not bare to determine if contamination has occurred. If results are above 1,000 µg/g (or 400 µg/g in high contact play area), compare the results to baseline soil sampling results to determine what additional measures are needed.
 - g. Complete the Dust and Soil Sampling Clearance Form required by the the Owner.



- h. Submit samples to a U.S. Environmental Protection Agency (EPA) recognized laboratory participating in the National Lead Laboratory Accreditation program (NLLAP) for analysis.
- i. Interpret results by comparing them to Interim Clearance Standards as listed below:
 - 1) Floors 400 µg/ft²
 - 2) Window sills 250 µg/ft²
 - 3) Window Troughs 800 µg/ft²
 - 4) Soils (Play area with children under 6 years of age) 400 µg/gram
- j. If clearance is achieved go to step N.
- k. Order repeated cleanings or soil treatments if results are above applicable standards. Clean all surfaces the sample represents.
- l. Continue sampling and repeated cleanings until the dwelling achieves compliance with all applicable clearance standards.
- m. Complete any related construction work that does not disturb a surface with lead-based paint (all work that does disturb painted surfaces or that could generate lead dust should be completed as part of the lead hazard control effort).
- n. Issue any necessary statements of lead-based paint compliance or releases and maintain appropriate records.

J. Labels

- 1. Use the following labels on drums used for disposal.

HAZARDOUS WASTE	
FEDERAL LAW PROHIBITS IMPROPER DISPOSAL.	
IF FOUND, CONTACT THE NEAREST POLICE OR PUBLIC SAFETY AUTHORITY OR THE U.S. ENVIRONMENTAL PROTECTION AGENCY.	
GENERATOR INFORMATION:	
NAME _____	
ADDRESS _____ PHONE _____	
CITY _____ STATE _____ ZIP _____	
EPA- / MANIFEST ID NO. / DOCUMENT NO. _____ / _____	
ACCUMULATION START DATE _____ EPA WASTE NO. _____	
[HAZARDOUS WASTE, SOLID, N.O.S.]	
[_____]	
NA3077	
<small>D.O.T. PROPER SHIPPING NAME AND UN OR NA NO. WITH PREFIX</small>	
HANDLE WITH CARE!	
<small>STYLE HMM12</small>	



WORKPLACE ACCUMULATION CONTAINER		
Proper D.O.T. Shipping Name: _____	HAZARDOUS WASTE	Workplace Accumulation Start Date: <input type="text"/>
UN or NA# _____		
Generator Information: Name: _____	FEDERAL LAW PROHIBITS IMPROPER DISPOSAL. IF FOUND, CONTACT THE NEAREST POLICE OR PUBLIC SAFETY AUTHORITY OR THE U.S. ENVIRONMENTAL PROTECTION AGENCY. HANDLE WITH CARE!	Waste Accumulation Area: <input type="text"/>
Facility: _____		
Address: _____		
Phone: _____		
City: _____		
State: _____ Zip: _____		
EPA / Manifest ID No. / Document No. _____		
State Manifest Document No. _____ EPA Waste No. _____		MANEJESE CON CUIDADO CONTIENE DESPERDICIOS TOXICOS



K. Disposal of lead-based paint waste.

1. Follow the RCRA and HUD recommended practices as defined in the table below:

Waste Management Practices	Category I: Low Lead Waste	Category II: Architectural Components	Category III: Concentrated Lead Waste	Category IV: Other waste
RCRA Requirements	Manage as nonhazardous Waste	Depending upon knowledge or TCLP testing results, manage as solid hazardous or nonhazardous waste	If more than 100 kg/ month, manage as hazardous waste. If less than 100 kg/month manage as solid waste.	Use TCP to determine if waste is hazardous.
HUD Recommended Practices	Applicable	Applicable, if knowledge or TCLP testing indicates that it is nonhazardous.	Applicable if less than 100 kg/month otherwise subject to full RCRA regulations	Only applicable if TCLP testing shows waste is nonhazardous
Wrapped in plastic; seal all seams with tape (if acceptable to the disposal facility).	X	X	X	X
Stored in designated, secure area.	X	X	X	X
Covered During Transport	X	X	X	X
Prohibit cutting/breaking outside work area.	X	X	X	X
Cover ground with 6-mil plastic if handling outside.	X	X	X	X
Prohibit disposal in solid waste incinerators and reuse recycling for mulch	X	X	X	X
Recommended disposal in State licensed/permitted	X	X	If appropriate.	X



solid waste landfill.				
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L. Safety Requirements

1. To protect the health and safety of all persons involved, it is of the utmost importance that deleading is safely and correctly done in a timely manner. The following specific safety requirements are the responsibility of the Deleading Contractor.

K. General Safety:

1. General
 - a. NO ONE is to be allowed in the work area without an approved respirator except for methods that have been documented not requiring a respirator.
 - b. Each work area must be sealed from the remainder of the dwelling by taping plastic sheets (6 mil thick). Work areas must remain sealed off until both work and clean-up are completed.
 - c. Cover all floors, carpets, furniture and appliances with 6 mil plastic within the work area. Use automotive masking tape (2 inches wide) to seal all edges and seams.
 - d. Make certain all electrical connections are properly grounded.
 - e. At least three days prior to the start of any deleading work, post appropriate warning signs at all entrances and exits of work areas and leave in place until all clearance testing indicates that these areas are safe for re-occupancy. The signs must include the following phrase: "CAUTION LEAD HAZARD-KEEP OUT". Post bilingual signs when necessary.
2. Worker Safety: The Deleading Contractor shall take the following minimum precautions to protect the health of all individuals involved in the deleading process.
 - a. Pre-Abatement Medical Exam: Each employee shall undergo a medical examination to determine both respiratory fitness capability and also pre-existing/current blood lead level. Said results shall be provided to the employee and also to the Owner within 3 days of receipt of same, and in all cases, prior to employee's commencement to active abatement. Records of same are required to be kept by the Contractor for 40 years.
 - b. Medical Surveillance is the monitoring of worker blood levels. It is required that the Contractor have blood level monitoring of all active abatement and clean-up workmen and on-site supervisors performed and said results provided to the Owner.
 - 1) Before assignment to active abatement activity for each worker.
 - 2) 30 days after active abatement has begun.
 - 3) At least every two months during the first six months and every six months throughout the deleading job.
 - 4) At least every two months for each employee whose blood lead analysis indicated a blood lead level at or above 25 micrograms per deciliter. (20 micrograms per deciliter for women of child bearing age).
 - 5) At termination of employment.
 - 6) Contractor shall reassign any employee whose blood lead has reached 25 µg/dl (20 µg/dl for women of child bearing age) to a job function deemed safe from lead exposure. Said employee shall remain away from active abatement until such time as 2 consecutive months' blood tests indicate µg/dl below 20 µg/dl.
 - c. Respiratory Protection Programs must be established by the Contractor in accordance with OSHA regulations and qualitative respirator fit testing must be conducted daily by the on-site supervisor. Medical examinations must be performed by a physician prior to fit testing and at anytime when a worker demonstrates any difficulty breathing during the use of or the fit testing of respirators. The following are minimal acceptable respiratory protection program requirements as set up and administered by the Contractor:
 - 1) Written standard operating procedures which oversees the selection and use of respirators.
 - 2) Selection of respirators on the basis of hazards to which the worker is exposed.
 - 3) Worker training on the limitations and use of respirators (includes fit testing).
 - 4) Individual workers assigned respirators for their exclusive use only.



- 5) Daily cleaning and disinfecting of respirators.
- 6) Proper storage of all respirators.
- 7) Proper inspection of all respirators for wear and tear.
- 8) Continual surveillance of work area conditions and level of worker exposure or stress.
- 9) Use of approved respirators only, modified as needed by the weekly exposure monitoring results.
- 10) Supply weekly report covering items 1-9 to the Owner or its Lead Consultant.
- d. Exposure Monitoring is the measured concentration of lead in the workers breathing zones. The Contractor shall perform personnel monitoring during active abatement using the NIOSH 7072 method and shall be responsible for:
 - 1) Monitoring the level of worker protection needed during the abatement process;
 - 2) Evaluating, modifying and improving any engineering and work practice control(s) as needed;
 - 3) Evaluating each employee's personal quality of work and any need for additional worker training or safety instruction;
 - 4) Providing the Owner results of all personnel monitoring tests within 10 days of testing; and
 - 5) Providing half-face APR respirators with HEPA filters unless said monitoring test results dictate differently. OSHA guidelines shall be used to determine respirator PEL protection factors.
- e. Protective Clothing Equipment must be provided to all workers to help assure that lead dust is contained to the work areas. The following must be supplied/enforced by the Deleading Contractor:
 - 1) Full body protective clothing and shoe covers of appropriate sizes on a daily basis or as needed.
 - 2) Clean changing areas separated from the dirty/contaminated clothes storage area.
 - 3) Water and wash facilities for washing of hands and face and shower facilities if deemed necessary by the Owner's Lead Advisor.
 - 4) Instructing worker on proper maintenance of clothing and equipment.
 - 5) Proper disposal of disposable clothing and proper permanent work clothes.
 - 6) Enforcing the removal of protective clothing at the end of each work day and before eating, drinking and smoking.
 - 7) Enforcement of the removal of protective shoe covers before leaving work area.
3. Contractor/Worker Daily Safe-Work Procedures
 - a. Daily Start-Up:
 - 1) Workers to put on protective gear prior to entering work areas.
 - 2) All garment seams to be sealed with duct tape.
 - 3) All non-working garments must be stored in designated changing area.
 - 4) Respirators, as required, must be properly fitted before entering work area. Perform qualitative fit test.
 - b. Temporary depart:
 - 1) All protective clothing to be HEPA vacuumed while still being worn.
 - 2) All shoe covers to be removed and left in the work area (immediate departure upon removing).
 - 3) Remove all protective gear in designated "contaminated" changing area before eating, drinking, and smoking or before leaving work site.
 - 4) Wash hands and face.
 - 5) Clean respirators.
 - c. Daily Shut-Down:
 - 1) Dispose of protective clothing with abatement waste by sealing in a 6 mil poly bag.
 - 2) Laundered clothes must be placed in closed container.
 - 3) Wash hands and face.
 - 4) Shower if facilities allow and circumstances dictate.
 - 5) Clean all protective gear (respirators included).



4. Tenant's Safety: Temporary relocation of the tenants is necessary if the lead paint surface is broken. Temporary relocation of the tenants and their belongings is the responsibility of the Owner. However, the Contractor has the joint responsibility to administer and enforce the following safety practices on behalf of the occupants:
 - a. Adults
 - 1) NO OCCUPANT is allowed to enter the work area during paint removal and initial clean-up. A three day clean-up and settlement period may be imposed depending upon the abatement procedures used, at the discretion of the Owner or their Lead Consultant.
 - 2) the Owner shall notify all occupants in writing when they are allowed to return to their post-abated residence. Contractor shall abide by these notices.
 - 3) Every resident who has received prior notice of abatement is responsible for placing all personal items (clothing, dishes, linens, etc.) in closed, easy to handle containers; and move such items to the center of each room as requested.
 - 4) As long as visible dust remains, occupants may not occupy dwelling, and all surfaces within the dwelling must be re-washed with trisodium phosphate and HEPA vacuumed by deleading contractor.
 - 5) Persons reoccupying dwellings following abatement are required to report any visible dust or debris to the Owner immediately for additional Contractor clean-up.
 - b. Pregnant Women and Children
 - 1) Absolutely no pregnant women nor children under the age of twelve years of age may be allowed in the building while any part of the abatement process is going on.

END OF SECTION 02 83 19 13a



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SECTION 02 83 19 13b - XRF TESTING FOR LEAD-BASED PAINT**1.1 DESCRIPTION OF WORK**

- A. This specification covers the furnishing and installation of materials for XRF testing for lead-based paint. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

1.2 GENERAL

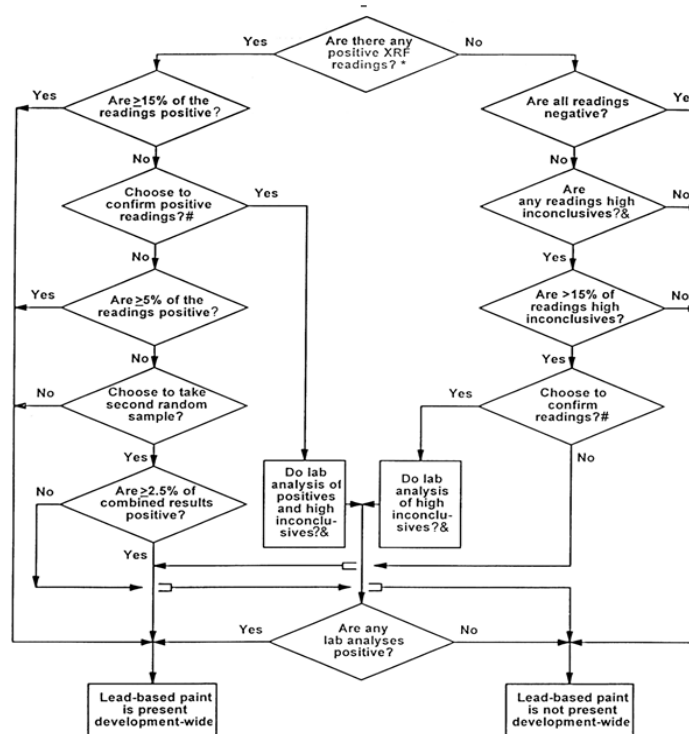
- A. Inspection Rules: The Contractor will be required to comply with the following inspection rules. These inspection rules (the "Inspection Rules"), which appear in this section for the various XRF machines, are also known as "IP-4". The Inspection rules are subject to modification upon written notice by the Owner.
1. Random Sampling Program - Multi-family housing testing rules.
 - a. In order to use the Multi-family housing testing rules, there must be:
 - 1) 21 or more units (pre-1960 construction) and all must have a similar construction and original painting history, or
 - 2) 10 or more units (construction from 1960-1977) and all must have a similar construction and original painting history.
 - b. Determine the number of randomly selected units to be tested from Table 7.3, Chapter 7, in the HUD guidelines. Chapter 7 of the HUD Guidelines also describes how to select the units randomly. If a unit or units which were selected as part of the original random sample cannot be entered for a particular reason, a replacement unit(s) must be randomly selected in accordance with the HUD Guidelines.
 - c. All testing must be done in strict accordance with the HUD guidelines except as such Guidelines are modified by the Owner in writing in this Agreement. As per the HUD Guidelines, an assessment on each tested component must note four attributes, also called a testing combination.
 - 1) The room equivalent (where the testing took place i.e. bedroom, bathroom, etc.)
 - 2) The component type (door, wall #1 - upper left, etc.)
 - 3) The substrate (brick, wood, concrete, drywall, plaster or metal).
 - 4) The color of the paint.
 - d. These attributes must be included as part of the report.
 - e. For each testing combination, the condition of the painted surfaces should be noted as either intact, fair or poor.
 - f. One reading with the X-ray fluorescence (XRF) instrument on each testing combination is all that is required.
 - g. At least 40 components of a given type must be tested to obtain the desired level of confidence in the results throughout the multi-family development. If less than 40 components of a given type exist in the buildings to be tested i.e. they are unique components, then the measurement should be taken using single family testing rules (described below). If less than 40 components of a given type exist in the units to be tested, additional components of this type can be identified in other units in the complex and tested to bring the total up to 40 so that multi-family testing rules can be used. The decision of which option the Contractor should use will be made by the the Owner.
 - h. To increase the number of tested components of a given type, testing combinations with different colors on the same component and substrate may be combined into a single component type. For example, if "wood doors" is the component type, all wood doors tested for lead-based paint could belong to the same component type, regardless of color.
 - i. A component type may be differentiated by color as long as there are 40 tested and there is a good reason for differentiation.



-
- j. The XRF measurements, corrected for substrate contribution, if required by the Performance Characteristic Sheet ("PCS") for the particular type of instrument being used, should be sorted by the inspector by component type into the following categories:
- 1) Positive- A positive XRF reading in accordance with the XRF's Performance Characteristic Sheet.
 - 2) Negative- A negative XRF reading in accordance with the XRF's Performance Characteristic Sheet.
 - 3) High Inconclusive- An inconclusive XRF reading equal to or greater than the midpoint of the XRF's inconclusive range, in accordance with the XRF's Performance Characteristic Sheet.



k. The following Decision analyses will be used to determine which components are positive or negative:



* "Positive," "negative," and "inconclusive" XRF readings are determined in accordance with the XRF instrument's Performance Characteristics Sheet as described in the HUD Guidelines for the Evaluation and Control of Lead Hazards in Housing, chapter 7.
 & A high inconclusive reading is an XRF reading at or above the midpoint of the inconclusive range. For example, if the inconclusive range is 0.41 to 1.39, its midpoint (average) is 0.90; a reading in the range from 0.90 to 1.39 would be a high inconclusive reading.
 # Any paint or coating may be assumed to be lead-based paint, even without XRF or laboratory analysis. Similarly, any XRF reading may be confirmed by laboratory analysis.

- i. If there are readings on a component type(s) equal to or greater than 1.0 mg/cm² and paint chip samples are submitted to the laboratory, there are two possible results:
 - 1) If all lab samples on a component type are below 0.5% lead by weight, the component type can be classified as negative throughout the development.
 - 2) If one or more lab results are positive, (equal to or greater than 0.5% lead by weight for a component) the the Owner will take one of three options:
 - a) Treat the component type as positive throughout the development, or
 - b) Test the component type throughout the development, or
 - c) If 5% or less of the component type are positive, take a second random sample, just testing that component type.
 - 3) If option 2)c) above is selected by the Owner and the combined results of the first and second random sample are less than 2½% positive, the following additional options are available depending on the results.
 - a) If no positives are found in the second sample, no further testing is necessary. Those positives in the first random sample will be monitored/abated (not by this Agreement), but the rest of the component type can be classified as negative.
 - b) If positives are found on a component type in the second sample, the the Owner has the option to classify the component type as positive throughout the development or comprehensively test it.



- c) If the combined results of the two random samples are equal to or greater than 2½%, the the Owner also has the option to comprehensively test the remaining components of that type or classify them as positive.
- m. Paint Chip Sample Size: The Paint chip samples should be taken from a 4 square inch (25 square centimeter) area that is representative of the paint on the testing combination, as close as possible to any XRF reading locations and, if possible, unobtrusive. This area may be a 2" x 2" (5 x 5 centimeters) square, or a 1" x 4" (2.5 x 10 centimeters) rectangle, or have any other dimensions that equal at least 4 square inches (25 square centimeters). Regardless of shape, the dimensions of the surface area must be accurately measured (to the nearest millimeter or 1/16th of an inch) so that the laboratory results can be reported in mg/cm². Results should be reported as percent by weight if the surface area cannot be measured accurately or if all paint within the sampled area cannot be removed. In these cases, lead should be reported in ppm or percent weight, not in mg/cm². Smaller surface area can be used if acceptable to the laboratory. (See ASTM E 1729). In all cases those who take the samples should consult with the NLAAP recognized laboratory selected regarding the requirements for the submission samples for lead-based paint analysis.
- n. If the the Owner decides to test in search of these hard-to-find components coated with lead based paint, the inspector must use the single family testing rules described in the next section.
2. Single Family Testing Rules
- a. If the housing development has less
- 1) than 10 units built between 1960-1970 or
 - 2) 20 units built before 1960 or
 - 3) the random testing rules in a multi-family development are not being used
- then single family testing rules must be followed.
- b. All inconclusive results must be confirmed with laboratory analysis, or as an alternative must be classified as positive. the Owner may also wish to confirm positive XRF results with laboratory analysis. Therefore the Contractor must make a field determination of which XRF readings falls in the inconclusive or positive ranges and take paint chip samples during the XRF testing for possible laboratory analysis. If the majority of XRF readings are positive in the first few units, the inspector must consult with the Owner on whether to continue taking paint chip samples.
Only the Owner may determine whether to submit collected paint chip samples for laboratory analysis or to classify the element as positive.
3. Similar common areas and similar exterior sites must always be tested, but in some cases they can be sampled in much the same way that dwelling units are. Common areas and building exteriors typically have a similar painting history from one building to the next. In multifamily housing, each common area (such as building lobby, laundry room, or hallway) can be treated as a dwelling unit. If there are multiple similar common areas, they may be grouped for sampling purposes I exactly the same way as regular dwelling units. However, dwelling units, common areas and exterior sites cannot be all mixed together in a single group. All testing combinations within each common area or building exteriors selected for testing must be inspected. This includes playground equipment, benches and miscellaneous testing combinations located throughout the development. The specific common areas and building exteriors to test should be randomly selected, in much the same way as specific units are selected using random numbers. The number of common areas to be tested should be taken from table 7.3 (HUD Guidelines). In this instance, common areas and building exteriors can be treated in the same way as housing units (although they are not to be confused with true housing units).
4. Unit and common area drawings
- a. Mark-ups of as built drawings depicting room equivalents that are tested must be provided as part of the report.
- b. The Contractor should test in a clockwise path starting from the door through the space and room equivalents so that the approximate location of each component tested can be easily established by referencing the room equivalent and sides.



- c. Each space must have a reference point (side A, B, C, D or wall 1, 2, 3 or 4). The wall with the door should always be referenced as wall 1 or side A. If there is more than one door, wall 1 or side A should be used to refer to the wall with the door through which the room is first entered when moving in a clockwise fashion through the unit.
 5. XRF Instruments and testing protocols
 - a. The Contractor has the option to use any of the following instruments for the XRF testing: Scitec MAP 4 Spectrum analyzer, Princeton Gamma-Tech XK-3, Warrington MicroLead 1, Revision4, TN Technologies (TN Spectrace) PB analyzer, Radiation Monitoring Devices LPA-1, Advanced Detector-Leadstar, or the Niton XL-309 Spectrum analyzer.
 - b. Chapter 7 of the HUD guidelines 1997 Revision, assumes that the standard for classifying paint as toxic for lead is 1.0 mg/cm². The PCS of these instruments have established inconclusive ranges/thresholds by substrate type based on the 1.0 mg/cm² standard. These ranges/thresholds are interim ranges/thresholds which are subject to review by HUD; however they must be used by the Contractor unless and until the Contractor is notified otherwise in writing by the Owner. Therefore the following table should be used to determine which readings falls in the inconclusive ranges/thresholds. the Owner reserves the right to modify these inconclusive ranges/thresholds by notice in writing to the Contractor.
 6. Evaluation of the Inspection by the the Owner
 - a. The Contractor will be required to carry out retesting at no additional cost to the the Owner, after completion of the Inspection at each the Owner development as described in the HUD Guidelines on page 7-17, section H, and page 7-28, section H, for single family housing and multi-family housing respectively. As per the HUD Guidelines, the the Owner shall randomly select the testing combinations to be retested and the Contractor shall perform the retesting using the same XRF instrument(s) which was/were used to take the original readings. A the Owner inspector shall be present to observe all retesting. The retesting shall be limited to ten (10) testing combinations, and if necessary to repeat the retest, the testing combinations randomly selected for repeating the retest shall also be limited to ten.
 - b. If the retest tolerance limit computed from the information provided in the XRF Performance Characteristics Sheet is exceeded, the retest will be repeated as described in the HUD Guidelines page 7-18, section H both for single family and multi-family housing. If the retest tolerance limit is exceeded again, the the Owner may require the Contractor to retest the entire development at no additional cost to the the Owner, or the the Owner may withhold all payments and terminate its agreement with the Contractor.
 7. Option to do Laboratory Testing only
 - a. The the Owner may, for a specific testing assignment, request in writing that the Contractor, when utilizing the multi-family housing testing rules for random sampling, or the single family housing testing rules, do all testing through laboratory analysis of paint chips rather than through XRF Spectrum Analyzer testing with laboratory confirmation as needed. Please note that under the single family housing testing rules, only one paint chip must be taken and analyzed for each component type.
- B. Scope Of Work: The work shall consist of furnishing all labor, material, insurance and all other incidental items required to do the following:
1. XRF Testing
 - a. Random or comprehensive testing of various components in apartments in various Projects using any of the X-ray Fluorescence ("XRF") machines listed in section IIID, to determine if the lead-based paint concentration is within permissible limits.
Note: Testing may be for entire apartments or selected rooms or components within the apartment.
 - b. The permissible limit shall be defined as a final reading showing a lead concentration of less than 1.0 mg/cm².
 - c. Refer to the Manufacturer's manual, as well as the "XRF Performance Characteristic Sheet" when determining calibration check tolerance, and other instrument specific information. Use the adjusted "XRF Performance Characteristic Sheets" in this contract when determining the inconclusive range.



- d. In addition to the manufacturer's recommended warm up and quality control procedures, a set of three nominal XRF calibration check readings must be taken before the inspection begins and after the inspection has been completed in a particular unit, or every 4 hours, whichever occurs first. All reference material values and calibration check readings must be included in the report provided to the Owner.
 - e. Do not use the XRF to test highly curved or ornate surfaces, or surfaces inaccessible to the XRF, due to poor reliability of results. For such surfaces, laboratory analysis of paint chips must be done.
 - f. Only one XRF reading is required per testing combination. A unique testing combination is characterized by the room equivalent, the component, the substrate and the visible color of the paint. However, testing combinations with different colors on the same component and substrate may be combined into a single component type.
 - g. All inconclusive results must be treated according to the inspection rules using multi-family inspection or single family inspection rules as appropriate.
 - h. XRF field data sheets shall be filled out as they appear on completed Form 7.1 and 7.5 Guidelines.
 - i. Room equivalents or sections thereof that are not accessible for testing (i.e. locked bedrooms) shall be noted in the final report to the Owner.
2. Laboratory testing of paint chips.
 - a. Collection of paint chips from various painted components in various Projects for laboratory analysis due to XRF substrate corrected inconclusive and/or positive readings as directed by the the Owner.
 - b. Laboratory preparation and testing by Flame Atomic Absorption Spectrometry (FAAS) or Graphite Furnace Atomic Absorption Spectrometry (GFAAS) to determine if the lead paint concentration is within permissible limits.
 - c. The permissible limit shall be defined as a lead concentration less than 0.5% by weight.
 - d. Collect paint chips in accordance with ASTM ES28-94.
 - e. Prepare paint chips in the laboratory for testing in accordance with ASTM ES37-94.
 - f. Repair and repaint areas from which paint chips have been collected, to match adjacent areas, unless notified by the the Owner in writing to utilize a temporary covering for the tested surfaces. The Contractor shall provide water based latex paint for this purpose. Colors shall be limited to white and off-white; and other colors if provided by the tenant.
 - g. Only one paint chip is required per testing combination. A unique testing combination is characterized by the room equivalent, the component, the substrate, and the visible color of the paint. However, testing combinations with different colors on the same component and substrate may be combined into a single component type.
 - h. Field data sheets and signed chain of custodies must be attached to the final report to the Owner.
 3. The Contractor shall send notices to the Project Superintendent, Residents, and the Department of Planning and Development 48 hours before the scheduled start of work. The Contractor shall make three (3) attempts to gain entry to each apartment, with proper 48 hour notification to the resident each time.
 4. The Contractor shall begin work no later than 48 hours after receiving a work proceed order.
 5. The Contractor shall perform work in accordance with the latest HUD Guidelines, except as such guidelines are modified by the Owner in writing in this contract or any contract pursuant to this contract, and in accordance with all applicable Federal, State and Local regulations.
 6. Workmanship required in the execution of the work herein specified shall be of good quality and subject to the approval of the the Owner.
- C. XRF Testing Report Format
1. All XRF report must be made after a formal submittal and approval by the Owner.
 2. A faxed summary report must be provided to the the Owner within 48 hours after completion of testing for a work Authorization. For XRF testing requiring confirmation by laboratory analysis of paint chip samples, the faxed summary report must be provided within 48 hours after the the Owner gives approval for testing of the collected paint chip samples.



3. A detailed report must be provided to the the Owner within 5 business days after completion of the testing.

D. General Provisions

1. Some of the work of this contract will be in occupied apartments. The Contractor shall perform all of the work of this contract with the least inconvenience to the tenants.
2. The Contractor shall take all necessary precautions to protect the property of the the Owner, its residents and the public. The contractor must repair any damaged property, whether of the the Owner, its residents, or the public, and restore such property to its original condition. If the damage is beyond repair, the Contractor shall replace it with new, that in the judgement of the the Owner, match the existing materials and are of equal quality and workmanship. All such repairs shall be at the Contractor's expense.
3. The Contractor shall begin work no later than 48 hours after receiving a work proceed order.
4. The Contractor shall perform work in accordance with the latest HUD Guidelines, except as such guidelines are modified by the Owner in writing in this Contract, or any Contract pursuant to this Contract, and in accordance with all applicable Federal, State and Local regulations.
5. The Contractor shall include in the bid price all supplementary miscellaneous items not specified but implied or required in order to complete the work.

E. Applicable Regulations

1. All work of this contract shall be in strict accordance with the HUD Guidelines.
2. All work of this contract shall also be in accordance with applicable regulations of the Environmental Protection Agency (EPA), Occupational Safety & Health Agency (OSHA) and any applicable State or Local standards that may be more stringent than the Federal Standards.
3. OSHA Standards (without limitation), include:
 - 29 CFR 1926.20 - General safety and health provisions;
 - 29 CFR 1926.21 - Safety training and education;
 - 29 CFR 1925.25 - Housekeeping;
 - 29 CFR 1926.28 - Personal protective equipment;
 - 29 CFR 1926.51(f) - Washing facilities;
 - 29 CFR 1926.55 - Gases, vapors, fumes, dusts, and mists;
 - 29 CFR 1926.57 - Ventilations;
 - 29 CFR 1926.59 - Hazardous Communication Standards;
 - 29 CFR 1926.103 - Respiratory protection; and
 - 29 CFR 1926.62 - Lead in Construction
4. The Contractor must comply with all applicable requirements of the Resource Conservation & Recovery Act (RCRA) of 1976 as amended in 1980 and 1984 by the Hazardous & Solid Waste Amendments (HSWA).

F. Qualification Requirements

1. Copies of the submissions listed below must be tendered with the bid:
 - a. Ability to perform XRF testing and paint chip sampling by submitting evidence of the successful completion of lead inspector training by all staff to be assigned to the job including inspector technicians. Training must be provided through a State approved EPA-Model program. All staff assigned to the Contract must also demonstrate training in the use of the XRF testing machines to be dedicated to this contract. The serial number of such XRF machine shall be provided to the the Owner.
 - 1) Contractor or Subcontractor performing the work must have at least 3 years of satisfactory experience (documented) in performing XRF testing for a City, State or Federal Agency.
 - b. Laboratory certification by the State Department of Health (or other responsible agency) and by the USEPA through the EPA's National Lead Laboratory Accreditation Program ("NLLAP"), or as an alternative having accreditation application pending before NLLAP, and having acceptable performance on five consecutive rounds of the EPA, Environmental Laboratory Proficiency Analytical Testing (ELPAT) program, including the most recent



round; evidence of such accreditation must be provided. Indicate if the laboratory is an independent entity from the Contractor.

- c. If a subcontractor will be used for any of the laboratory work of this contract, evidence of certification stated above must also be provided for the subcontractor.

G. Waste Disposal

- 1. All waste generated must be legally disposed in accordance with Federal, State and Local regulations.

END OF SECTION 02 83 19 13b



SECTION 02 83 19 13c - LEAD DUST WIPE, AIR AND TCLP SAMPLING AND ANALYSIS**1.1 DESCRIPTION OF WORK**

- A. This specification covers the furnishing and installation of materials for lead dust wipe, air and TCLP sampling and analysis. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

1.2 GENERAL

- A. Definitions: Unless otherwise specified the following definitions shall apply:
1. **"Approved"**: shall mean approved by all public agencies having jurisdiction, and the Owner.
 2. **"The Owner"**: shall mean the Owner and its designated authorized representatives.
 3. **"Contractor"**: shall mean the firm that is awarded this contract and is responsible to ensure compliance with Federal, State and City regulations as well as these Contract documents.
 4. **"Development or Project"**: a group of buildings in one or more designated geographical locations, owned or operated by the Owner and referred to by a common name by the Owner.
 5. **"Dust Cleaning Firm"**: shall mean the contractor under a separate contract or the Owner responsible for cleaning of lead dust, as directed by the Owner, until the clearance levels are achieved, as defined in the "Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing, June 1995" or latest edition published by the United States Department of Housing and Urban Development (HUD).
 6. **"Equal or Approved Equal"**: shall mean equal in the opinion of the Owner.
 7. **"HUD"**: the United States Department of Housing and Urban Development.
 8. **"HUD Guidelines"**: shall mean Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing issued by HUD'S Office of Lead-Based Paint Abatement and Poisoning Prevention in June 1995 except as such guidelines are later modified by HUD and/or modified by the Owner in writing pursuant to this contract.
 9. **"Inspector"**: an individual who has completed training from an accredited program and been licensed or certified by the appropriate State or local agency to (1) perform inspections to determine and report the presence of lead-based paint on a surface-by-surface basis through on-site testing, (2) report the findings of such an inspection, (3) collect environmental samples for laboratory analysis, (4) perform clearance testing, and (5) document successful compliance with lead-based paint hazard control requirements or standards.
 10. **"Lead-Based Paint"**: any paint, varnish, shellac, or other coating that contains lead equal to or greater than 1.0 mg/cm² as measured by XRF or laboratory analysis, or 0.5 percent by weight (5,000 µg/g, 5,000 PPM, or 5,000 mg/kg) as measured by laboratory analysis.
 11. **"Lead-Based Paint Hazard"**: a condition in which exposure to lead from lead-contaminated dust, lead-contaminated soil or deteriorated lead-based paint would have an adverse effect on human health (as established by the EPA Administrator under Title IV of the Toxic Substance Control Act). Lead-based paint hazards include for example, deteriorated lead-based paint, leaded dust levels above applicable standards and bare leaded soil above applicable standards.
 12. **"Lead-Based Paint Hazard Control"**: activities to control or eliminate lead-based paint hazards, including interim controls and complete abatement.
 13. **"Lead-Contaminated Dust"**: surface dust in residences that contain an area or mass concentration of lead in excess of the standard established by the EPA Administrator, pursuant to Title IV of the Toxic Substance Control Act. Until the EPA standards are set, the HUD recommended clearance and risk assessment standards for leaded dust are 40 µg/ft² on floors, 250 µg/ft² on interior window sills, and 800 µg/ft² on window troughs.



14. **"Monitoring"**: shall refer to inspection to ensure compliance with all Federal, State and City Standards or guidelines, and contractual specifications.
15. **"Provide"**: shall mean furnish and install.
16. **"Risk Assessor"**: a certified individual who has completed training with an accredited training program and who has been certified to (1) perform risk assessments, (2) identify acceptable abatement and interim control strategies for reducing identified lead-based paint hazards, (3) perform clearance testing and reevaluations, and (4) document the successful completion of lead-based paint hazard control activities.

B. Applicable Regulations/References

1. The work conducted shall comply with all applicable Federal, State and City regulations. Applicable guidelines and standards listed in the scope of work include, but are not limited to:

<p>24 CFR Parts 35,36,37 Guidelines for the Evaluation and Control of Lead-Based Paint in Housing (HUD Guidelines June 1995) & 1997 Revisions</p> <p>29 CFR 1910 29 CFR 1910.1025 29 CFR 1910.134 29 CFR 1910.1200 29 CFR 1910.245 29 CFR 1926 29 CFR 1926.20 29 CFR 1926.21 29 CFR 1926.25 29 CFR 1926.28 29 CFR 1926.51 29 CFR 1926.55 29 CFR 1926.59 29 CFR 1926.62 29 CFR 1926.103 40 CFR 61 Subpart A 40 CFR 241</p> <p>40 CFR 257 40 CFR 261/262 American National Standards Institute (ANSI) Z87.1 ANSI Z88.2-80 American Society For Testing Materials (ASTM)</p>	<p>HUD Lead-Based Paint Regulations</p> <p>General Industry Standard Lead Standard for General Industry Respiratory Protection Hazard Communication Specification for Accident Prevention Construction Industry Standards General Safety & Health Provisions Safety Training & Education Housekeeping Personal Protective Equipment Washing Facilities Gases, Vapors, Fumes, Dusts & Mists Hazard Communication Standard Construction Industry Lead Standard Respiratory Protection General Provisions Guidelines for the Land Disposal of Solid Waste Criteria for the Land Disposal of Solid Waste Waste Disposal Facilities & Practices Eye Protection</p> <p>Practices for Respiratory Protection All Applicable Standards</p>
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2. The contractor shall ensure that any programs, certifications, licenses or other documentation in accordance with the above and/or any other applicable Federal, State, and Local Regulations/Guidelines are provided.

C. Scope Of Work

1. The work shall consist of furnishing labor, materials, insurance and all other incidental items required to perform the following:
 - a. Dust wipe sampling and analysis
 - 1) Collect dust wipe samples from various horizontal surfaces, such as floors, window sills, window troughs, etc., as directed by the Owner.
 - 2) Dust wipe samples shall be collected in accordance with ASTM ES30-94.



- 3) Analyze dust wipe sample in the laboratory using Flame Atomic Absorption Spectrometry ("FAAS") or Graphite Furnace Atomic Absorption Spectrometry("GFAAS").
 - 4) Provide result of analysis in micrograms per square foot.
 - 5) A faxed summary of results must be provided to the Owner within 24 hours after the Owner authorizes the Contractor to perform the laboratory analysis of the collected dust wipe sample. Contractor shall also have the ability to provide results in 4 hours for clearance, following lead-based paint abatement work, if requested by the Owner. The sampling result must be provided in a form approved by the Owner and must include for each dust wipe sample, the Project, the building address, the sample number, the room or room equivalent, the surface type, dimensions of sample areas, total micrograms, micrograms per square feet, and an indication of pass or fail.
 - 6) Turn-around time for results shall be counted from the time the Contractor performs collection of dust wipe samples to the time the results are actually presented to the Owner. This includes travel time from the site to the laboratory of the Contractor and back to the site.
 - 7) A detailed final report covering the results of all dust wipe samples taken and analyzed must be submitted within 5 days from the time the Owner authorizes the performance of the laboratory analysis. The sampling report must include for each dust wipe sample, the Project, the building address, the sample number, the room or room equivalent, the surface type, dimensions of sample areas, total micrograms, micrograms per square feet, and indicate pass or fail in a form approved by the Owner. Also include in the report the method of analysis, i.e. "FAAS" or "GFAAS", and the detection limits. The laboratory test results in the final report must be signed by the Laboratory Director.
 - 8) The sampling data report must contain all required data fields as specified by the Owner. The sampling data report shall be provided to the Owner on 3.5 inch high density diskettes in ASCII file form. The required data fields will be provided by the Owner to the Contractor.
 - 9) The laboratory used for the analysis of the dust wipe samples must be certified by the State Department of Health (or other responsible agency) and by the USEPA through the EPA's National Lead Laboratory Accreditation Program ("NLLAP"), or as an alternative having accreditation application pending before NLLAP, and having acceptable performance on five consecutive rounds of the EPA, Environmental Laboratory Proficiency Analytical Testing (ELPAT) program, including the most recent round; evidence of such accreditation must be provided. Indicate if the laboratory is an independent entity from the Contractor.
- b. Dust Spiked Samples
- 1) Provide dust spiked samples to the Owner. Dust spiked samples shall be prepared in accordance with the HUD Guidelines.
NOTE: These samples are separate from the ones required by the Contractor for its own QA/QC
 - 2) Prepare dust spiked samples in a manner such that they are indistinguishable from the field samples.
 - 3) Prepare dust spiked samples using the same lot as that to be used in the field.
 - 4) Dust spiked samples shall be inserted into the sample stream, randomly, by the Owner Inspector.
 - 5) Blind analysis of dust spiked samples must fall within 80%-120% of the true value. If the laboratory fails to obtain readings within these limits, two more spiked samples shall be sent immediately to the lab for analysis.
 - 6) If the two additional spiked samples fail, the sample batch shall be considered invalid, and the Owner may, at its sole discretion, terminate this contract as well as withhold payment for services already rendered.
- c. Air Sampling and Analysis



- 1) Collect area air samples at various locations and various projects for personal exposure assessment as directed by the Owner.
 - 2) Air samples shall be collected in accordance with ASTM E1553-93.
 - 3) Prepare air samples for analysis in accordance with ASTM E33-94
 - 4) Analyze air samples using FAAS or GFAAS.
 - 5) All equipment required for personal air sampling, including pumps shall be provided by the Contractor at no extra cost to the Owner.
 - 6) Provide results of air samples in micrograms per cubic meter.
 - 7) A faxed summary of result must be provided to the Owner within 24 hours after the Owner authorizes the Contractor to perform the laboratory analysis of the collected air sample. The sampling result must include for each air sample taken the Project, the building address, the sample number, the room or room equivalent, and the reading.
 - 8) Turn-around time shall start after collection of the air samples, and includes travel time to and from the laboratory.
 - 9) A detailed final report covering the results of all air samples taken and analyzed must be submitted within 5 days from the time the Owner authorizes the performance of the laboratory analysis. The sampling report must include for each air sample, the Project, the building address, the sample number, the room or room equivalent, and the reading. The laboratory report contained in the final report must be signed by the Laboratory Director.
 - 10) The sampling data report must contain all required data fields as specified by the Owner. The sampling data report shall be provided to the Owner on 3.5 inch high density diskettes in ASCII file form. The required data fields will be provided by the Owner to the Contractor.
 - 11) The laboratory used for the analysis of the dust wipe samples must be certified by the State Department of Health (or other responsible agency) and by the USEPA through the EPA's National Lead Laboratory Accreditation Program ("NLLAP"), or as an alternative having accreditation application pending before NLLAP, and having acceptable performance on five consecutive rounds of the EPA, Environmental Laboratory Proficiency Analytical Testing (ELPAT) program, including the most recent round; evidence of such accreditation must be provided. Indicate if the laboratory is an independent entity from the Contractor.
 - 12) Air sampling technician shall be present during the entire shift of the air sampling.
- d. TCLP Sampling and Analysis
- 1) Take core samples of construction waste as directed by the Owner and analyze by TCLP testing to determine if waste is hazardous.
 - 2) Waste shall be classified as hazardous if the concentration of lead is greater than 5 parts per million by TCLP testing.
 - 3) The laboratory used for the analysis of the TCLP samples must be certified by the State Department of Health (or other responsible agency) and by the USEPA through the EPA's National Lead Laboratory Accreditation Program ("NLLAP"), or as an alternative having accreditation application pending before NLLAP, and having acceptable performance on five consecutive rounds of the EPA, Environmental Laboratory Proficiency Analytical Testing (ELPAT) program, including the most recent round; evidence of such accreditation must be provided. Indicate if the laboratory is an independent entity from the Contractor.
 - 4) A faxed summary of result must be provided to the Owner within 48 hours after the Owner authorizes the Contractor to perform the TCLP analysis of the waste. Provide results in parts per million (ppm).
 - 5) Final results provided to the Owner by the Contractor must include written sample preparation procedure and laboratory specific written procedures for performing TCLP, including quality control procedures used for performing the TCLP, and a table listing the sample numbers, description of the construction waste, and the



result of the TCLP. The laboratory report contained in the final report must be signed by the Laboratory Director.

- 6) Final report must also specify detection limits.
- 7) Final report must be provided within 5 days from the time the authorization to perform the TCLP is given by the Owner.

D. General Provisions

1. Some of the work of this contract may be in occupied apartments. The Contractor shall perform all of the work of this contract with the least inconvenience to the tenants.
2. The Contractor shall take all necessary precautions to protect the property of the Owner, its residents, and the public. The Contractor must repair any damaged property, whether of the Owner, its residents, or the public, and restore such property to its original condition. If the damage is beyond repair, the Contractor shall replace it with new, that in the judgment of the Owner, match the existing materials and/or of equal quality and workmanship. All such repairs shall be at the Contractor's expense.
3. The Contractor shall develop a work plan to be performed as requested by the Department of Planning and Development. The detailed plan shall include coordination of the monitoring and sampling work with the Contractor in a manner that will be least disruptive to the normal use of the non-work areas in the building. The plan should also include emergency procedures in case of fire.
4. The Contractor shall perform work in accordance with the latest HUD Guidelines, except as such Guidelines are modified by the Owner in writing in this Contract, or any Contract pursuant to this Contract, and in accordance with all applicable Federal, State and Local regulations.
5. The Contractor shall include in the bid price all supplementary miscellaneous items not specified but implied or required in order to complete the work.

E. Submissions

1. Six (6) copies of the submissions listed below must be submitted to the Owner by the Contractor or Subcontractor performing the Work:
 - a. Ability to perform lead dust wipe sampling by submitting evidence of the successful completion of lead inspector and/or risk assessor training by all staff to be assigned to the job including inspector technicians. As stated previously, training must be provided through an approved program.
 - b. Laboratory certification by the State Department of Health (or other responsible agency) through its ELAP program and by the USEPA through the EPA's National Lead Laboratory Accreditation Program ("NLLAP"), or as an alternative having accreditation application pending before NLLAP and having acceptable performance on five consecutive rounds of the EPA, Environmental Laboratory Proficiency Analytical Testing (ELPAT) program, including the most recent round; evidence of such accreditation must be provided.
 - c. If a subcontractor will be used for any of the laboratory work of this contract, evidence of certification stated in (2) above must also be provided for the subcontractor.

F. Waste Disposal

1. All waste generated must be legally disposed in accordance with the Federal, State and Local Regulations.

END OF SECTION 02 83 19 13c



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Task	Specification	Specification Description
02 83 33 13	02 83 19 13	Removal And Disposal Of Lead-Containing Paint
02 83 33 13	02 83 19 13a	Lead Paint Related Abatement Procedures
02 83 33 13	02 83 19 13b	XRF Testing For Lead-Based Paint
02 83 33 13	02 83 19 13c	Lead Dust Wipe, Air And Tc1p Sampling And Analysis



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SECTION 02 84 16 00 - REMOVAL OF FLUORESCENT LIGHT BALLASTS/CAPACITORS AND FLUORESCENT LIGHT TUBES**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for removal of fluorescent light ballasts/capacitors and fluorescent light tubes. Products shall be as follows or as directed by the the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Before Start of Work: Submit the following to the Owner's Representative for review. Do not start work until these submittals are returned with Owner's Representative's approval.
 - a. Copy of State or local license for hazardous waste hauler;
 - b. Certification of at least one on-site supervisor which has satisfactorily completed the OSHA 40 Hour Health and Safety Course for Handling Hazardous Materials;
 - c. Certificates of workers which have successfully completed at least the OSHA 40-Hour Health and Safety Course for Hazardous Materials;
 - d. List of employees scheduled to perform this work;
 - e. Schedule of start and finish times and dates for this work;
 - f. Name and address of landfill where these waste materials are to be deposited (include contact person and telephone numbers);
 - g. Material Safety Data Sheets for all materials requiring removal;
 - h. If contractor introduces any chemical into the work environmental, a MSDS for that chemical is required before use;
 - i. Transporter must have notified the EPA and/or the appropriate local government agency in advance of its intentions to transport PCB's, mercury and cadmium, and receive an identification number pursuant to the Toxic Substance Control Act (TSCA); and
 - j. Contingency Plan for handling emergency spills or leaks.

1.2 PRODUCTS**A. Materials**

1. Polyethylene Sheet: A single polyethylene film in the largest sheet size possible to minimize seams, 4.0 and 6.0 mil thick, clear, frosted, or black.
2. Duct Tape: Provide duct tape in 3" widths, with an adhesive which is formulated to stick aggressively to sheet polyethylene.
3. Spray Cement: Provide spray adhesive in aerosol cans which is specifically formulated to stick tenaciously to sheet polyethylene.
4. Disposal Bays: Provide 6 mil thick leak-tight polyethylene bags.
5. Labels: As required by the EPA and OSHA for handling, transportation, and disposal of hazardous waste.
6. **Drums:** Recovery or salvage drums acceptable for disposal of hazardous waste. Prior approval of drums is required. Drums or containers must meet the required OSHA EPA (40 CFR Parts 264-265 and 300), and DOT regulations (49 CFR Parts 171-178). Use of damaged drums will not be allowed.

1.3 EXECUTION**A. General**



1. Where necessary, scaffolding shall be erected to fully access all applicable fluorescent light ballasts/capacitors and tubes. At no time will the ballasts/capacitors and tubes be allowed to drop onto the floor. Contractor must take care to protect from dropping the ballasts/capacitors and fluorescent tubes.
2. Prior to removing ballasts/capacitors and fluorescent tubes, contractor shall ensure that all electrical service to lights has been shut off, and locked out. Temporary lighting shall be erected to adequately illuminate work areas.
3. Depending on height of light fixtures, contractor shall utilize at least a 2-person per team system. The fluorescent light tubes shall be removed and passed to the appropriate number of workers required to lower the tubes to the floor without breaking them.
4. The worker on the floor shall lay the tubes in cardboard boxes large enough to hold a small quantity of tubes. Worker shall take care to not damage the tubes while they are lowered into the box. Once the box is full, it shall be wrapped with two layers of 6 mil thick polyethylene sheeting and sealed with duct tape.
5. Contractor may choose to either remove the fluorescent light ballasts/capacitors in-place or lower the lighting fixtures for easy access. The ballasts/capacitors shall be removed from the fixtures. Electrical wiring leading from the ballasts/capacitors shall be cut away. Ballasts/capacitors shall be placed in 55-gallon drums lined with at least two 6 mil thick polyethylene bags. Be careful not to overfill the drums so that they remain manageable. Once the drums have been filled to the acceptable level, seal the lid onto the top of the drum, and affix appropriate labels. Transport drums via hand dollies.

B. Worker Protection

1. As a minimum, while working with the ballasts/capacitors and light tubes, workers shall utilize impervious gloves adequate for the use with hazardous materials. If light ballasts/capacitors and/or light tubes are damaged, and/or exposure to these materials may reach the OSHA PEL or AGGIH threshold limit value (TLV), the contractor shall be required to provide impervious full body protection and respiratory protection. However, contractor is required to verify the type of protection required prior to working with these materials, and have written approval by Owner's Representative prior to beginning.
2. In addition, workers shall not smoke, drink or eat in these areas during work activities.

C. Storage Of Fluorescent Light Ballasts/Capacitors And Light Tubes

1. Once the containers holding the ballasts/capacitors and light tubes have been filled and sealed, they shall be stored in designated areas as agreed upon by the Owners Representative and Contractor. They shall not be allowed to be stored on-site in transportation vehicles until the time for them to be transported to the hazardous waste incinerators or landfill facility.

END OF SECTION 02 84 16 00



SECTION 02 84 16 00a - EXTERIOR LIGHTING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for exterior lighting. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Exterior luminaires with lamps and ballasts.
 - b. Luminaire-mounted photoelectric relays.
 - c. Poles and accessories.
 - d. Luminaire lowering devices.

C. Definitions

1. CCT: Correlated color temperature.
2. CRI: Color-rendering index.
3. HID: High-intensity discharge.
4. LER: Luminaire efficacy rating.
5. Luminaire: Complete lighting fixture, including ballast housing if provided.
6. Pole: Luminaire support structure, including tower used for large area illumination.
7. Standard: Same definition as "Pole" above.

D. Structural Analysis Criteria For Pole Selection

1. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied as stated in AASHTO LTS-4-M.
2. Live Load: Single load of 500 lbf (2224 N), distributed as stated in AASHTO LTS-4-M.
3. Ice Load: Load of 3 lbf/sq. ft. (145 Pa), applied as stated in AASHTO LTS-4-M Ice Load Map.
4. Wind Load: Pressure of wind on pole and luminaire and banners and banner arms, calculated and applied as stated in AASHTO LTS-4-M.
 - a. Basic wind speed for calculating wind load for poles exceeding 49.2 feet (15 m) in height is 100 mph (45 m/s) **OR** 90 mph (40 m/s), **as directed**.
 - 1) Wind Importance Factor: 1.0.
 - 2) Minimum Design Life: 50 years.
 - 3) Velocity Conversion Factors: 1.0.
 - b. Basic wind speed for calculating wind load for poles 50 feet (15 m) high or less is 100 mph (45 m/s) **OR** 90 mph (40 m/s).
 - 1) Wind Importance Factor: 1.0.
 - 2) Minimum Design Life: 25 years.
 - 3) Velocity Conversion Factors: 1.0.

E. Submittals

1. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:
 - a. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
 - b. Details of attaching luminaires and accessories.
 - c. Details of installation and construction.
 - d. Luminaire materials.
 - e. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories.



- 1) Testing Agency Certified Data: For indicated luminaires, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.

OR

Manufacturer Certified Data: Photometric data shall be certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

- f. Photoelectric relays.
- g. Ballasts, including energy-efficiency data.
- h. Lamps, including life, output, CCT, CRI, lumens, and energy-efficiency data.
- i. Materials, dimensions, and finishes of poles.
- j. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
- k. Anchor bolts for poles.
- l. Manufactured pole foundations.
2. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - a. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - b. Anchor-bolt templates keyed to specific poles and certified by manufacturer.
 - c. Design calculations, certified by a qualified professional engineer, indicating strength of screw foundations and soil conditions on which they are based.
 - d. Wiring Diagrams: For power, signal, and control wiring.
3. Samples: For products designated for sample submission in the Exterior Lighting Device Schedule. Each Sample shall include lamps and ballasts.
4. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements in AASHTO LTS-4-M and that load imposed by luminaire and attachments has been included in design. The certification shall be based on design calculations by a professional engineer.
5. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.
6. Field quality-control reports.
7. Operation and Maintenance Data: For luminaires and poles **OR** luminaire lowering devices, **as directed**, to include in emergency, operation, and maintenance manuals.
8. Warranty: Sample of special warranty.

F. Quality Assurance

1. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

OR

Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.
2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. Comply with IEEE C2, "National Electrical Safety Code."
4. Comply with NFPA 70.

G. Delivery, Storage, And Handling

1. Package aluminum poles for shipping according to ASTM B 660.
2. Store poles on decay-resistant-treated skids at least 12 inches (300 mm) above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.
3. Handle wood poles so they will not be damaged. Do not use pointed tools that can indent pole surface more than 1/4 inch (6 mm) deep. Do not apply tools to section of pole to be installed below ground line.



4. Retain factory-applied pole wrappings on fiberglass and laminated wood poles until right before pole installation. Handle poles with web fabric straps.
5. Retain factory-applied pole wrappings on metal poles until right before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

H. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.
 - a. Warranty Period for Luminaires: Five years from date of Final Completion.
 - b. Warranty Period for Metal Corrosion: Five years from date of Final Completion.
 - c. Warranty Period for Color Retention: Five years from date of Final Completion.
 - d. Warranty Period for Poles: Repair or replace lighting poles and standards that fail in finish, materials, and workmanship within manufacturer's standard warranty period, but not less than three years from date of Final Completion.

1.2 PRODUCTS

A. General Requirements For Luminaires

1. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.
 - a. LER Tests Incandescent Fixtures: Where LER is specified, test according to NEMA LE 5A.
 - b. LER Tests Fluorescent Fixtures: Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.
 - c. LER Tests HID Fixtures: Where LER is specified, test according to NEMA LE 5B.
2. Lateral Light Distribution Patterns: Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.
3. Metal Parts: Free of burrs and sharp corners and edges.
4. Sheet Metal Components: Corrosion-resistant aluminum unless otherwise indicated. Form and support to prevent warping and sagging.
5. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.
6. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.
7. Exposed Hardware Material: Stainless steel.
8. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
9. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.
10. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:
 - a. White Surfaces: 85 percent.
 - b. Specular Surfaces: 83 percent.
 - c. Diffusing Specular Surfaces: 75 percent.
11. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
12. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.
13. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.



- a. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
 - b. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
 - 1) Color: As selected from manufacturer's standard catalog of colors **OR** As selected from manufacturer's full range, **as directed**.
14. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- a. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
 - b. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax.
 - c. Class I, Clear Anodic Finish: AA-M32C22A41 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
 - d. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
 - 1) Color: Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black, **as directed**.
15. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
- a. Label shall include the following lamp and ballast characteristics:
 - 1) "USES ONLY" and include specific lamp type.
 - 2) Lamp diameter code (T-4, T-5, T-8, T-12), tube configuration (twin, quad, triple), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.
 - 3) Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.
 - 4) Start type (preheat, rapid start, instant start) for fluorescent and compact fluorescent luminaires.
 - 5) ANSI ballast type (M98, M57, etc.) for HID luminaires.
 - 6) CCT and CRI for all luminaires.
- B. Luminaire-Mounted Photoelectric Relays
- 1. Comply with UL 773 or UL 773A.
 - 2. Contact Relays: Factory mounted, single throw, designed to fail in the on position, and factory set to turn light unit on at 1.5 to 3 fc (16 to 32 lx) and off at 4.5 to 10 fc (48 to 108 lx) with 15-second minimum time delay. Relay shall have directional lens in front of photocell to prevent artificial light sources from causing false turnoff, **as directed**.
 - a. Relay with locking-type receptacle shall comply with ANSI C136.10.
 - b. Adjustable window slide for adjusting on-off set points.
- C. Fluorescent Ballasts And Lamps
- 1. Ballasts for Low-Temperature Environments:
 - a. Temperatures 0 Deg F (Minus 17 Deg C) and Higher: Electronic or electromagnetic type rated for 0 deg F (minus 17 deg C) starting and operating temperature with indicated lamp types.
 - b. Temperatures Minus 20 Deg F (Minus 29 Deg C) and Higher: Electromagnetic type designed for use with indicated lamp types.
 - 2. Ballast Characteristics:
 - a. Power Factor: 90 percent, minimum.



- b. Sound Rating: Class A **OR** Class A except Class B for T8/HO ballasts, **as directed**.
 - c. Total Harmonic Distortion Rating: Less than 10 **OR** 20, **as directed**, percent.
 - d. Electromagnetic Ballasts: Comply with ANSI C82.1, energy-saving, high power factor, Class P, automatic-reset thermal protection.
 - e. Case Temperature for Compact Lamp Ballasts: 65 deg C, maximum.
 - f. Transient-Voltage Protection: Comply with IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
3. Low-Temperature Lamp Capability: Rated for reliable starting and operation with ballast provided at temperatures 0 deg F (minus 18 deg C) **OR** minus 20 deg F (minus 29 deg C), **as directed**, and higher.
- D. Ballasts For HID Lamps
1. Comply with ANSI C82.4 and UL 1029 and capable of open-circuit operation without reduction of average lamp life. Include the following features unless otherwise indicated:
 - a. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
 - b. Minimum Starting Temperature: Minus 22 deg F (Minus 30 deg C).
 - c. Normal Ambient Operating Temperature: 104 deg F (40 deg C).
 - d. Ballast Fuses: One in each ungrounded power supply conductor. Voltage and current ratings as recommended by ballast manufacturer.
 2. Auxiliary, Instant-On, Quartz System: Factory-installed feature automatically switches quartz lamp on when fixture is initially energized and when momentary power outages occur. System automatically turns quartz lamp off when HID lamp reaches approximately 60 percent of light output.
 3. High-Pressure Sodium Ballasts: Electromagnetic type with solid-state igniter/starter and capable of open-circuit operation without reduction of average lamp life. Igniter/starter shall have an average life in pulsing mode of 10,000 hours at an igniter/starter-case temperature of 90 deg C.
 - a. Instant-Restrike Device: Integral with ballast, or solid-state potted module, factory installed within fixture and compatible with lamps, ballasts, and mogul sockets up to 150 W.
 - 1) Restrike Range: 105- to 130-V ac.
 - 2) Maximum Voltage: 250-V peak or 150-V ac rms.
 - b. Minimum Starting Temperature: Minus 40 deg F (Minus 40 deg C).
- E. HID Lamps
1. High-Pressure Sodium Lamps: ANSI C78.42, CRI 21 (minimum), CCT color temperature 1900 K, and average rated life of 24,000 hours, minimum.
 - a. Dual-Arc Tube Lamp: Arranged so only one of two arc tubes is lighted at one time and, when power is restored after an outage, the cooler arc tube, with lower internal pressure, lights instantly, providing an immediate 8 to 15 percent of normal light output.
 2. Low-Pressure Sodium Lamps: ANSI C78.43.
 3. Metal-Halide Lamps: ANSI C78.43, with minimum CRI 65, and CCT color temperature 4000 K.
 4. Pulse-Start, Metal-Halide Lamps: Minimum CRI 65, and CCT color temperature 4000 K.
 5. Ceramic, Pulse-Start, Metal-Halide Lamps: Minimum CRI 80, and CCT color temperature 4000 K.
- F. General Requirements For Poles And Support Components
1. Structural Characteristics: Comply with AASHTO LTS-4-M.
 - a. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in "Structural Analysis Criteria for Pole Selection" Article.
 - b. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.
 2. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.
 3. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.



- a. Materials: Shall not cause galvanic action at contact points.
- b. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.
- c. Anchor-Bolt Template: Plywood or steel.
4. Handhole: Oval-shaped, with minimum clear opening of 2-1/2 by 5 inches (65 by 130 mm), with cover secured by stainless-steel captive screws. Provide on all, except wood poles.
5. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Division 3 Section "Cast-in-Place Concrete."
6. Power-Installed Screw Foundations: Factory fabricated by pole manufacturer, with structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123M; and with top-plate and mounting bolts to match pole base flange and strength required to support pole, luminaire, and accessories.
7. Breakaway Supports: Frangible breakaway supports, tested by an independent testing agency acceptable to authorities having jurisdiction, according to AASHTO LTS-4-M.

G. Steel Poles

1. Poles: Comply with ASTM A 500, Grade B, carbon steel with a minimum yield of 46,000 psig (317 MPa); one-piece construction up to 40 feet (12 m) in height with access handhole in pole wall.
 - a. Shape: Round, tapered **OR** Round, straight **OR** Square, tapered **OR** Square, straight, **as directed**.
 - b. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.
2. Steel Mast Arms: Single-arm **OR** Truss **OR** Davit, **as directed**, type, continuously welded to pole attachment plate. Material and finish same as pole.
3. Brackets for Luminaires: Detachable, cantilever, without underbrace.
 - a. Adapter fitting welded to pole, allowing the bracket to be bolted to the pole mounted adapter, then bolted together with stainless **OR** galvanized, **as directed**,-steel bolts.
 - b. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire.
 - c. Match pole material and finish.
4. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.
5. Steps: Fixed steel, with nonslip treads, positioned for 15-inch (381-mm) vertical spacing, alternating on opposite sides of pole; first step at elevation 10 feet (3 m) above finished grade.
6. Intermediate Handhole and Cable Support: Weathertight, 3-by-5-inch (76-by-127-mm) handhole located at midpoint of pole with cover for access to internal welded attachment lug for electric cable support grip.
7. Grounding and Bonding Lugs: Welded 1/2-inch (13-mm) threaded lug, complying with requirements in Division 26 Section "Grounding And Bonding For Electrical Systems", listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.
8. Cable Support Grip: Wire-mesh type with rotating attachment eye, sized for diameter of cable and rated for a minimum load equal to weight of supported cable times a 5.0 safety factor.
9. Platform for Lamp and Ballast Servicing: Factory fabricated of steel with finish matching that of pole.
10. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.
11. Galvanized Finish: After fabrication, hot-dip galvanize complying with ASTM A 123/A 123M.
12. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - a. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or with SSPC-SP 8, "Pickling."



- b. Interior Surfaces of Pole: One coat of bituminous paint, or otherwise treat for equal corrosion protection.
- c. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
 - 1) Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

H. Aluminum Poles

- 1. Poles: Seamless, extruded structural tube complying with ASTM B 429/B 429M, Alloy 6063-T6 with access handhole in pole wall.
- 2. Poles: ASTM B 209 (ASTM B 209M), 5052-H34 marine sheet alloy with access handhole in pole wall.
 - a. Shape: Round, tapered **OR** Round, straight **OR** Square, tapered **OR** Square, straight, **as directed**.
 - b. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.
- 3. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.
- 4. Grounding and Bonding Lugs: Welded 1/2-inch (13-mm) threaded lug, complying with requirements in Division 26 Section "Grounding And Bonding For Electrical Systems", listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.
- 5. Brackets for Luminaires: Detachable, with pole and adapter fittings of cast aluminum. Adapter fitting welded to pole and bracket, then bolted together with stainless-steel bolts.
 - a. Tapered oval cross section, with straight tubular end section to accommodate luminaire.
 - b. Finish: Same as pole **OR** luminaire, **as directed**.
- 6. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.
- 7. Aluminum Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - a. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
 - b. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax.
 - c. Class I, Clear Anodic Finish: AA-M32C22A41 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
 - d. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
 - 1) Color: Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black **OR** As selected from manufacturer's full range, **as directed**.

I. Fiberglass Poles

- 1. Poles: Designed specifically for supporting luminaires, with factory-formed cable entrance and handhole. Not less than 65 percent fiberglass, with resin and pigment making up the remainder.
 - a. Resin Color: Dark bronze; provide uniform coloration throughout entire wall thickness.
 - b. Surface Finish: Pigmented polyurethane, with a minimum dry film thickness of 1.5 mils (0.04 mm). Polyurethane may be omitted if the surface layer of pole is inherently UV inhibited.

J. Decorative Poles

- 1. Pole Material:
 - a. Cast ductile iron.
 - b. Cast gray iron, according to ASTM A 48/A 48M, Class 30.
 - c. Cast aluminum.
 - d. Cast concrete.



- e. Spun concrete.
 - f. Steel tube, covered with closed-cell polyurethane foam, with a polyethylene exterior.
2. Mounting Provisions:
 - a. Bolted to concrete foundation.
 - b. Embedded.
 3. Fixture Brackets:
 - a. Cast ductile iron.
 - b. Cast gray iron.
 - c. Cast aluminum.
 4. Pole Finish: **<Insert finish>**.
- K. Laminated Wood Poles
1. Species and Grades for Structural Glulam Timber: Engineer and fabricate structural laminated wood poles, complying with ANSI A190.1. Use southern pine **OR** Douglas fir **OR** Alaska cedar **OR** any species listed in AITC 117, **as directed**, to withstand indicated structural loads without exceeding allowable design working stresses according to AITC 117.
 2. Features: Include wood bracket **OR** wood crossarm **OR** pole-top adapter, **as directed**, for mounting luminaire(s), metal pole cap, **as directed**, and concealed raceway path connected to access handhole.
 3. Mounting Provisions: Embedded.
 4. Appearance Grade: Architectural appearance grade complying with AITC 110.
 5. Preservative Treatment: Pressure treat lumber before gluing according to AWWA C28 for waterborne preservatives. After dressing and end-cutting each member to final size and shape, apply a field-treatment preservative to comply with AWWA M4 to surfaces cut to a depth of more than 1/16 inch (1.6 mm).
 6. Adhesive: Wet-use type complying with ASTM D 2559.
 7. End Sealer: Manufacturer's standard, transparent, colorless wood sealer that is effective in retarding the transmission of moisture at cross-grain cuts and is compatible with indicated finish.
 8. Penetrating Sealer: Manufacturer's standard, transparent, penetrating wood sealer that is compatible with indicated finish.
 9. Finish: Natural, unstained wood **OR** Semitransparent stain applied after erection **OR** Semitransparent stain applied at factory, **as directed**, color as selected.
- L. Wood Poles
1. Poles: Douglas fir **OR** Southern yellow pine, **as directed**, machine trimmed by turning, **as directed**, complying with ANSI O5.1 and with AWWA C4 for wood species used; and bored, roofed, and galled before treatment.
 - a. Mounting Provisions: Embedded.
 2. Preservative Treatment: Pressure treat poles with creosote **OR** pentachlorophenol **OR** ammoniacal copper arsenate, **as directed**, according to AWWA C1 and AWWA C4.
 3. Luminaire Brackets: Comply with ANSI C136.13.
- M. Prestressed Concrete Poles
1. Poles: Manufactured by centrifugal spin-casting process **OR** of cast concrete, **as directed**.
 - a. Shape: Round, tapered **OR** Round, straight **OR** Square, tapered **OR** Square, straight, **as directed**.
 - b. Mounting Provisions: Steel butt flange for bolted mounting to foundation or breakaway support **OR** Embedded, **as directed**.
 - c. Finishing: Capped at top and plugged at bottom. Seat each steel reinforcing strand with epoxy adhesive.
 - d. Grounding: Continuous copper ground wire cast into pole. Terminate at top of pole and attach to 24-inch (610-mm) lightning rod, **as directed**.
 2. Cure with wet steam and age for a minimum of 15 days before installation.
 3. Fabricate poles with a hard, nonporous surface that is resistant to water, frost, and road and soil chemicals and that has a maximum water-absorption rate of 3 percent.



4. Cast aluminum nameplate into pole wall at approximately 5 feet (1.5 m) above ground line, listing name of manufacturer, Project identifier, overall height, and approximate weight.
5. Pole Brackets: Comply with ANSI C136.13.
6. Finish Color: Provided by color material complying with ASTM C 979, uniformly impregnated throughout the pole concrete. Color material shall provide a uniform, stable, permanent color and be as follows:
 - a. Inert, and carbon free.
 - b. Unaffected by environmental conditions and contaminants including, but not limited to, UV solar radiation, salts, and alkalis.
7. Finish Texture: Standard form **OR** Polished exposed aggregate **OR** Etched exposed aggregate, **as directed**.
 - a. Exposed aggregate shall be of **<Insert aggregate type selected from manufacturers' lists>** type.

N. Pole Accessories

1. Duplex Receptacle: 120 V, 20 A in a weatherproof assembly complying with Division 16 Section "Wiring Devices" for ground-fault circuit-interrupter type.
 - a. Surface mounted **OR** Recessed, **as directed**, 12 inches (300 mm) above finished grade.
 - b. Nonmetallic polycarbonate plastic or reinforced fiberglass, weatherproof in use, cover, that when mounted results in NEMA 250, Type 3R **OR** Type 4X, **as directed**, enclosure.
 - c. With cord opening.
 - d. With lockable hasp and latch that complies with OSHA lockout and tag-out requirements.
2. Minimum 1800-W transformer, protected by replaceable fuses, mounted behind access cover.
3. Base Covers: Manufacturers' standard metal units, arranged to cover pole's mounting bolts and nuts. Finish same as pole.
4. Transformer Type Base: Same material and color as pole. Coordinate dimensions to suit pole's base flange and accept ballast(s) **OR** indicated accessories, **as directed**.
5. Decorative accessories, supplied by decorative pole manufacturer, include the following:
 - a. Banner Arms: **<Insert material>**.
 - b. Flag Holders: **<Insert material>**.
 - c. Ladder Rests: **<Insert material>**.

O. Lowering System For Luminaires

1. Arrange system to lower luminaire **OR** luminaire assembly, **as directed**, to a servicing position within 36 inches (900 mm) of finished grade in winds up to 30 mph (49 km/h) and to provide for manual plug connection to electrical power in the lowered position for testing.
2. Coordinate with luminaire and pole manufacturers for assembly details, wind-load and vibration analysis, and compatibility of materials for electrolysis-free attachment and connection for luminaire mounting assembly, lowering device, lowering cable, and portable winch.
3. Structural and Mechanical Design: Use a minimum safety factor of 5.0 for static and dynamic loads of load-bearing components, including cable.
4. Luminaire Mounting and Disconnect Arrangement: Multiple ring **OR** carriage, **as directed**, -mounted luminaires, arranged for lowering and rising as a group.
 - a. Electrical cable for normal operating power to luminaires manually disconnects inside pole base, using weatherproof multipin connector, and shall be arranged to move within the pole during lowering and rising of luminaire assembly.
OR
Electrical cable for normal operating power to luminaires automatically disconnects at a weatherproof multipin connector within the pole-top lowering head at the beginning of the lowering cycle and reconnects when luminaire or luminaire assembly is raised to the operating position.
5. Lowering Device: Weatherproof, cast-aluminum housing and multiple mechanical latches. Moving parts of latching assembly shall be located in the portion of the unit that is lowered to the servicing position. Positive latching in the operating position shall be indicated to the operator at the base of the pole by a clear visual signal, or by other means acceptable to the Owner or authorities having jurisdiction.



6. Lowering Cable: Zinc-electroplated- or stainless-steel aircraft cable.
7. Portable Winch: Manual **OR** 120-V electric, **as directed**, type. One required.
 - a. Winch Power Connection: Cord and plug.
 - b. Winch Raise-Lower Control: Remote-control station with 15 feet (5 m) of cable.
8. Winch Transformer: Portable, totally enclosed, encapsulated, single-phase, dry type. Primary rated at lighting-circuit voltage; secondary rated at 120 V. Permanent, primary and secondary, twist-locking plug connectors on pigtails shall match pole-base power outlet and winch plug.

1.3 EXECUTION

A. Luminaire Installation

1. Install lamps in each luminaire.
2. Fasten luminaire to indicated structural supports.
 - a. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
3. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation, **as directed**.

B. Pole Installation

1. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.
2. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on Drawings:
 - a. Fire Hydrants and Storm Drainage Piping: 60 inches (1520 mm).
 - b. Water, Gas, Electric, Communication, and Sewer Lines: 10 feet (3 m).
 - c. Trees: 15 feet (5 m) from tree trunk.
3. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Division 03 Section "Cast-in-place Concrete".
4. Foundation-Mounted Poles: Mount pole with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.
 - a. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.
 - b. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.
 - c. Install base covers unless otherwise indicated.
 - d. Use a short piece of 1/2-inch- (13-mm-) diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.
5. Embedded Poles with Tamped Earth Backfill: Set poles to depth below finished grade indicated on Drawings, but not less than one-sixth of pole height.
 - a. Dig holes large enough to permit use of tampers in the full depth of hole.
 - b. Backfill in 6-inch (150-mm) layers and thoroughly tamp each layer so compaction of backfill is equal to or greater than that of undisturbed earth.
6. Embedded Poles with Concrete Backfill: Set poles in augered holes to depth below finished grade indicated on Drawings, but not less than one-sixth of pole height.
 - a. Make holes 6 inches (150 mm) in diameter larger than pole diameter.
 - b. Fill augered hole around pole with air-entrained concrete having a minimum compressive strength of 3000 psi (20 MPa) at 28 days, and finish in a dome above finished grade.
 - c. Use a short piece of 1/2-inch- (13-mm-) diameter pipe to make a drain hole through concrete dome. Arrange to drain condensation from interior of pole.
 - d. Cure concrete a minimum of 72 hours before performing work on pole.
7. Poles and Pole Foundations Set in Concrete Paved Areas: Install poles with minimum of 6-inch- (150-mm-) wide, unpaved gap between the pole or pole foundation and the edge of adjacent



- concrete slab. Fill unpaved ring with pea gravel to a level 1 inch (25 mm) below top of concrete slab.
8. Raise and set poles using web fabric slings (not chain or cable).
- C. Bollard Luminaire Installation
1. Align units for optimum directional alignment of light distribution.
 2. Install on concrete base with top 4 inches (100 mm) above finished grade or surface at bollard location. Cast conduit into base, and shape base to match shape of bollard base. Finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Division 03 Section "Cast-in-place Concrete".
- D. Installation Of Individual Ground-Mounting Luminaires
1. Install on concrete base with top 4 inches (100 mm) above finished grade or surface at luminaire location. Cast conduit into base, and finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Division 03 Section "Cast-in-place Concrete".
- E. Corrosion Prevention
1. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.
 2. Steel Conduits: Comply with Division 26 Section "Raceway And Boxes For Electrical Systems". In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.
- F. Grounding
1. Ground metal poles and support structures according to Division 26 Section "Grounding And Bonding For Electrical Systems".
 - a. Install grounding electrode for each pole unless otherwise indicated.
 - b. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.
 2. Ground nonmetallic poles and support structures according to Division 26 Section "Grounding And Bonding For Electrical Systems".
 - a. Install grounding electrode for each pole.
 - b. Install grounding conductor and conductor protector.
 - c. Ground metallic components of pole accessories and foundations.
- G. Field Quality Control
1. Inspect each installed fixture for damage. Replace damaged fixtures and components.
 2. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.
 - a. Verify operation of photoelectric controls.
 3. Illumination Tests:
 - a. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IESNA testing guide(s):
 - 1) IESNA LM-5, "Photometric Measurements of Area and Sports Lighting Installations."
 - 2) IESNA LM-50, "Photometric Measurements of Roadway Lighting Installations."
 - 3) IESNA LM-52, "Photometric Measurements of Roadway Sign Installations."
 - 4) IESNA LM-64, "Photometric Measurements of Parking Areas."
 - 5) IESNA LM-72, "Directional Positioning of Photometric Data."
 4. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.
- H. Demonstration
1. Train the Owner's maintenance personnel to adjust, operate, and maintain luminaire lowering devices.



END OF SECTION 02 84 16 00a



Task	Specification	Specification Description
02 84 16 00	01 95 26 00a	Interior Lighting



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SECTION 02 85 33 00 - MOLD REMEDIATION

1.1 GENERAL

A. Description Of Work

1. This specification covers the removal and disposal of mold. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. List of all personnel to be involved in the work with their training and certifications.
2. List of all products and procedures proposed for use in performance of the work.
3. Test reports.
4. Certificates.

C. References

1. U.S. EPA "Mold Remediation in Schools and Commercial Buildings"
2. U.S. EPA "A Brief Guide to Mold, Moisture, and Your Home"

D. Quality Assurance

1. Conform to all Federal, State, and Local regulations which govern the handling and disposal of mold materials.

1.2 PRODUCT - (Not Used)

1.3 EXECUTION

- #### A. Environmental Assessment:
- The presence of mold, water damage, or musty odors shall be addressed immediately. In all instances, any source(s) of water must be stopped and the extent of water damaged determined. Water damaged materials shall be dried and repaired. Mold damaged materials shall be remediated in accordance with this document.

1. Visual Inspection: A visual inspection is the most important initial step in identifying a possible contamination problem. The extent of any water damage and mold growth shall be visually assessed. This assessment is important in determining remedial strategies. Ventilation systems shall also be visually checked, particularly for damp filters but also for damp conditions elsewhere in the system and overall cleanliness. Ceiling tiles, gypsum wallboard (sheetrock), cardboard, paper, and other cellulosic surfaces shall be given careful attention during a visual inspection. The use of equipment such as a boroscope, to view spaces in ductwork or behind walls, or a moisture meter, to detect moisture in building materials, may be helpful in identifying hidden sources of fungal growth and the extent of water damage.
2. Bulk/Surface Sampling
 - a. Bulk or surface sampling is not required to undertake a remediation. Remediation of visually identified fungal contamination shall proceed without further evaluation.
 - b. Bulk or surface samples may need to be collected to identify specific fungal contaminants as part of a medical evaluation if occupants are experiencing symptoms which may be related to fungal exposure or to identify the presence or absence of mold if a visual inspection is equivocal (e.g., discoloration, and staining).
 - c. An individual trained in appropriate sampling methodology shall perform bulk or surface sampling. Bulk samples shall be collected from visibly moldy surfaces by scraping or cutting materials with a clean tool into a clean plastic bag. Surface samples shall be collected by wiping a measured area with a sterile swab or by stripping the suspect surface



with clear tape. Surface sampling is less destructive than bulk sampling. Other sampling methods may also be available. A laboratory specializing in mycology shall be consulted for specific sampling and delivery instructions.

3. Air Monitoring
 - a. Air sampling for fungi shall not be part of a routine assessment. This is because decisions about appropriate remediation strategies can usually be made on the basis of a visual inspection. In addition, air-sampling methods for some fungi are prone to false negative results and therefore cannot be used to definitively rule out contamination.
 - b. Air monitoring may be necessary if an individual(s) has been diagnosed with a disease that is or may be associated with a fungal exposure (e.g., pulmonary hemorrhage/hemosiderosis, and aspergillosis).
 - c. Air monitoring may be necessary if there is evidence from a visual inspection or bulk sampling that ventilation systems may be contaminated. The purpose of such air monitoring is to assess the extent of contamination throughout a building. It is preferable to conduct sampling while ventilation systems are operating.
 - d. Air monitoring may be necessary if the presence of mold is suspected (e.g., musty odors) but cannot be identified by a visual inspection or bulk sampling (e.g., mold growth behind walls). The purpose of such air monitoring is to determine the location and/or extent of contamination.
 - e. If air monitoring is performed, for comparative purposes, outdoor air samples shall be collected concurrently at an air intake, if possible, and at a location representative of outdoor air. For additional information on air sampling, refer to the American Conference of Governmental Industrial Hygienists' document, "Bioaerosols: Assessment and Control."
 - f. Personnel conducting the sampling shall be trained in proper air sampling methods for microbial contaminants. A laboratory specializing in mycology shall be consulted for specific sampling and shipping instructions.
4. Analysis of Environmental Samples
 - a. Microscopic identification of the spores/colonies requires considerable expertise. These services are not routinely available from commercial laboratories. Documented quality control in the laboratories used for analysis of the bulk/surface and air samples is necessary. The American Industrial Hygiene Association (AIHA) offers accreditation to microbial laboratories (Environmental Microbiology Laboratory Accreditation Program (EMLAP)). Accredited laboratories must participate in quarterly proficiency testing (Environmental Microbiology Proficiency Analytical Testing Program (EMPAT)).
5. Evaluation of bulk/surface and air sampling data shall be performed by an experienced health professional. The presence of few or trace amounts of fungal spores in bulk/surface sampling shall be considered background. Amounts greater than this or the presence of fungal fragments (e.g., hyphae, and conidiophores) may suggest fungal colonization, growth, and/or accumulation at or near the sampled location. Air samples shall be evaluated by means of comparison (i.e., indoors to outdoors) and by fungal type (e.g., genera, and species). In general, the levels and types of fungi found should be similar indoors (in non-problem buildings) as compared to the outdoor air. Differences in the levels or types of fungi found in air samples may indicate that moisture sources and resultant fungal growth may be problematic.

B. Remediation

1. General
 - a. **In all situations, the underlying cause of water accumulation must be rectified or fungal growth will recur.** Any initial water infiltration shall be stopped and cleaned immediately. An immediate response (within 24 to 48 hours) and thorough clean up, drying, and/or removal of water damaged materials will prevent or limit mold growth. If the source of water is elevated humidity, relative humidity shall be maintained at levels below 60% to inhibit mold growth. Emphasis shall be on ensuring proper repairs of the building infrastructure, so that water damage and moisture buildup does not recur.
 - b. Five different levels of abatement are described below. The size of the area impacted by fungal contamination primarily determines the type of remediation. The sizing levels below



are based on professional judgment and practicality; currently there is not adequate data to relate the extent of contamination to frequency or severity of health effects. **The goal of remediation is to remove or clean contaminated materials in a way that prevents the emission of fungi and dust contaminated with fungi from leaving a work area and entering an occupied or non-abatement area, while protecting the health of workers performing the abatement.** The listed remediation methods were designed to achieve this goal, however, due to the general nature of these methods it is the responsibility of the people conducting remediation to ensure the methods enacted are adequate. The listed remediation methods are not meant to exclude other similarly effective methods. Any changes to the remediation methods listed in these guidelines, however, shall be carefully considered prior to implementation.

- c. Non-porous (e.g., metals, glass, and hard plastics) and semi-porous (e.g., wood, and concrete) materials that are structurally sound and are visibly moldy can be cleaned and reused. Cleaning shall be done using a detergent solution. Porous materials such as ceiling tiles and insulation, and wallboards with more than a small area of contamination shall be removed and discarded. Porous materials (e.g., wallboard, and fabrics) that can be cleaned, can be reused, but should be discarded if possible. A professional restoration consultant shall be contacted when restoring porous materials with more than a small area of fungal contamination. All materials to be reused shall be dry and visibly free from mold. Routine inspections shall be conducted to confirm the effectiveness of remediation work.
 - d. The use of gaseous, vapor-phase, or aerosolized biocides for remedial purposes is **not** recommended. The use of biocides in this manner can pose health concerns for people in occupied spaces of the building and for people returning to the treated space if used improperly. Furthermore, the effectiveness of these treatments is unproven and does not address the possible health concerns from the presence of the remaining non-viable mold. For additional information on the use of biocides for remedial purposes, refer to the American Conference of Governmental Industrial Hygienists' document, "Bioaerosols: Assessment and Control."
2. **Level I: Small Isolated Areas** (10 sq. ft or less) - e.g., ceiling tiles, small areas on walls
 - a. Remediation can be conducted by regular building maintenance staff. Such persons shall receive training on proper clean up methods, personal protection, and potential health hazards. This training can be performed as part of a program to comply with the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200).
 - b. Respiratory protection (e.g., N95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended. Gloves and eye protection shall be worn.
 - c. The work area shall be unoccupied. Vacating people from spaces adjacent to the work area is not necessary but is recommended in the presence of infants (less than 12 months old), persons recovering from recent surgery, immune suppressed people, or people with chronic inflammatory lung diseases (e.g., asthma, hypersensitivity, pneumonitis, and severe allergies).
 - d. Containment of the work area is not necessary. Dust suppression methods, such as misting (not soaking) surfaces prior to remediation, are recommended.
 - e. Contaminated materials that cannot be cleaned shall be removed from the building in a sealed plastic bag. There are no special requirements for the disposal of moldy materials.
 - f. The work area and areas used by remedial workers for egress shall be cleaned with a damp cloth and/or mop and a detergent solution.
 - g. All areas shall be left dry and visibly free from contamination and debris.
 3. **Level II: Mid-Sized Isolated Areas** (10 - 30 sq. ft.) - e.g., individual wallboard panels.
 - a. Remediation can be conducted by regular building maintenance staff. Such persons shall receive training on proper clean up methods, personal protection, and potential health hazards. This training can be performed as part of a program to comply with the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200).
 - b. Respiratory protection (e.g., N95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended. Gloves and eye protection shall be worn.



- c. The work area shall be unoccupied. Vacating people from spaces adjacent to the work area is not necessary but is recommended in the presence of infants (less than 12 months old), persons having undergone recent surgery, immune suppressed people, or people with chronic inflammatory lung diseases (e.g., asthma, hypersensitivity, pneumonitis, and severe allergies).
- d. The work area shall be covered with a plastic sheet(s) and sealed with tape before remediation, to contain dust/debris.
- e. Dust suppression methods, such as misting (not soaking) surfaces prior to remediation, are recommended.
- f. Contaminated materials that cannot be cleaned shall be removed from the building in sealed plastic bags. There are no special requirements for the disposal of moldy materials.
- g. The work area and areas used by remedial workers for egress shall be HEPA vacuumed (a vacuum equipped with a High-Efficiency Particulate Air filter) and cleaned with a damp cloth and/or mop and a detergent solution.
- h. All areas shall be left dry and visibly free from contamination and debris.
- 4. **Level III: Large Isolated Areas** (30 - 100 square feet) - e.g., several wallboard panels.
 - a. A health and safety professional with experience performing microbial investigations shall be consulted prior to remediation activities to provide oversight for the project.
 - b. The following procedures *at a minimum* are recommended:
 - 1) Personnel trained in the handling of hazardous materials and equipped with respiratory protection, (e.g., N95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended. Gloves and eye protection shall be worn.
 - 2) The work area and areas directly adjacent shall be covered with a plastic sheet(s) and taped before remediation, to contain dust/debris.
 - 3) Seal ventilation ducts/grills in the work area and areas directly adjacent with plastic sheeting.
 - 4) The work area and areas directly adjacent shall be unoccupied. Further vacating of people from spaces near the work area is recommended in the presence of infants (less than 12 months old), persons having undergone recent surgery, immune suppressed people, or people with chronic inflammatory lung diseases (e.g., asthma, hypersensitivity, pneumonitis, and severe allergies).
 - 5) Dust suppression methods, such as misting (not soaking) surfaces prior to remediation, are recommended.
 - 6) Contaminated materials that cannot be cleaned shall be removed from the building in sealed plastic bags. There are no special requirements for the disposal of moldy materials.
 - 7) The work area and surrounding areas shall be HEPA vacuumed and cleaned with a damp cloth and/or mop and a detergent solution.
 - 8) All areas shall be left dry and visibly free from contamination and debris.
 - c. If abatement procedures are expected to generate a lot of dust (e.g., abrasive cleaning of contaminated surfaces, demolition of plaster walls) or the visible concentration of the fungi is heavy (blanket coverage as opposed to patchy), then it is recommended that the remediation procedures for Level IV are followed.
- 5. **Level IV: Extensive Contamination** (greater than 100 contiguous square feet in an area)
 - a. A health and safety professional with experience performing microbial investigations shall be consulted prior to remediation activities to provide oversight for the project. The following procedures are recommended:
 - 1) Personnel trained in the handling of hazardous materials equipped with:
 - a) Full-face respirators with high efficiency particulate air (HEPA) cartridges
 - b) Disposable protective clothing covering both head and shoes
 - c) Gloves
 - 2) Containment of the affected area:



- a) Complete isolation of work area from occupied spaces using plastic sheeting sealed with duct tape (including ventilation ducts/grills, fixtures, and any other openings)
 - b) The use of an exhaust fan with a HEPA filter to generate negative pressurization
 - c) Airlocks and decontamination room
- 3) Vacating people from spaces adjacent to the work area is not necessary but is recommended in the presence of infants (less than 12 months old), persons having undergone recent surgery, immune suppressed people, or people with chronic inflammatory lung diseases (e.g., asthma, hypersensitivity, pneumonitis, and severe allergies).
 - 4) Contaminated materials that cannot be cleaned shall be removed from the building in sealed plastic bags. The outside of the bags shall be cleaned with a damp cloth and a detergent solution or HEPA vacuumed in the decontamination chamber prior to their transport to uncontaminated areas of the building. There are no special requirements for the disposal of moldy materials.
 - 5) The contained area and decontamination room shall be HEPA vacuumed and cleaned with a damp cloth and/or mop with a detergent solution and be visibly clean prior to the removal of isolation barriers.
 - 6) Air monitoring shall be conducted prior to occupancy to determine if the area is fit to reoccupy.
6. **Level V: Remediation of HVAC Systems**
- a. A Small Isolated Area of Contamination (<10 square feet) in the HVAC System
 - 1) Remediation can be conducted by regular building maintenance staff. Such persons shall receive training on proper clean up methods, personal protection, and potential health hazards. This training can be performed as part of a program to comply with the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200).
 - 2) Respiratory protection (e.g., N95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended. Gloves and eye protection shall be worn.
 - 3) The HVAC system shall be shut down prior to any remedial activities.
 - 4) The work area shall be covered with a plastic sheet(s) and sealed with tape before remediation, to contain dust/debris.
 - 5) Dust suppression methods, such as misting (not soaking) surfaces prior to remediation, are recommended.
 - 6) Growth supporting materials that are contaminated, such as the paper on the insulation of interior lined ducts and filters, shall be removed. Other contaminated materials that cannot be cleaned shall be removed in sealed plastic bags. There are no special requirements for the disposal of moldy materials.
 - 7) The work area and areas immediately surrounding the work area shall be HEPA vacuumed and cleaned with a damp cloth and/or mop and a detergent solution.
 - 8) All areas shall be left dry and visibly free from contamination and debris.
 - 9) A variety of biocides are recommended by HVAC manufacturers for use with HVAC components, such as, cooling coils and condensation pans. HVAC manufacturers shall be consulted for the products they recommend for use in their systems.
 - b. Areas of Contamination (>10 square feet) in the HVAC System: A health and safety professional with experience performing microbial investigations shall be consulted prior to remediation activities to provide oversight for remediation projects involving more than a small isolated area in an HVAC system. The following procedures are recommended:
 - 1) Personnel trained in the handling of hazardous materials equipped with:
 - a) Respiratory protection (e.g., N95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended.
 - b) Gloves and eye protection



- c) Full-face respirators with HEPA cartridges and disposable protective clothing covering both head and shoes shall be worn if contamination is greater than 30 square feet.
 - 2) The HVAC system shall be shut down prior to any remedial activities.
 - 3) Containment of the affected area:
 - a) Complete isolation of work area from the other areas of the HVAC system using plastic sheeting sealed with duct tape.
 - b) The use of an exhaust fan with a HEPA filter to generate negative pressurization.
 - c) Airlocks and decontamination room if contamination is greater than 30 square feet.
 - 4) Growth supporting materials that are contaminated, such as the paper on the insulation of interior lined ducts and filters, shall be removed. Other contaminated materials that cannot be cleaned should be removed in sealed plastic bags. When a decontamination chamber is present, the outside of the bags shall be cleaned with a damp cloth and a detergent solution or HEPA vacuumed prior to their transport to uncontaminated areas of the building. There are no special requirements for the disposal of moldy materials.
 - 5) The contained area and decontamination room shall be HEPA vacuumed and cleaned with a damp cloth and/or mop and a detergent solution prior to the removal of isolation barriers.
 - 6) All areas shall be left dry and visibly free from contamination and debris.
 - 7) Air monitoring shall be conducted prior to re-occupancy with the HVAC system in operation to determine if the area(s) served by the system are fit to reoccupy.
 - 8) A variety of biocides are recommended by HVAC manufacturers for use with HVAC components, such as, cooling coils and condensation pans. HVAC manufacturers shall be consulted for the products they recommend for use in their systems.
7. Hazard Communication: When fungal growth requiring large-scale remediation is found, the building owner, management, and/or employer shall notify occupants in the affected area(s) of its presence. Notification shall include a description of the remedial measures to be taken and a timetable for completion. Group meetings held before and after remediation with full disclosure of plans and results can be an effective communication mechanism. Individuals with persistent health problems that appear to be related to bioaerosol exposure should see their physicians for a referral to practitioners who are trained in occupational/environmental medicine or related specialties and are knowledgeable about these types of exposures. Individuals seeking medical attention shall be provided with a copy of all inspection results and interpretation to give to their medical practitioners.

END OF SECTION 02 85 33 00



Task	Specification	Specification Description
02 86 00 00	02 41 16 13	Selective Demolition
02 86 00 00	02 61 00 00	Excavation And Handling Of Contaminated Material
02 86 00 00	02 61 13 00	Underground Storage Tank Removal
02 86 00 00	02 61 13 00a	Precision Testing Of Underground Fuel Oil Tanks
02 86 00 00	02 61 13 00b	Hydrostatic Pressure Testing Of Air Receiving Tanks
02 86 00 00	02 81 00 00	Disposal Of Hazardous Materials



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SECTION 02 87 00 00 - BIRD AND BIRD WASTE ABATEMENT**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for bird and bird waste abatement. Products shall be as follows or as directed by the the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary Of Work

1. Work Included - Conventional Enclosure for Removal of Birds and Bird Waste
 - a. Seal off penetrations on perimeter walls into the work area (critical barriers) and establish a decontamination facility for workers.
 - b. Coordinate activities with the demolition and well capping activities.
2. Work Included - Removal and disposal of birds and bird waste.
 - a. Establish work area by installing construction barrier tape around removal area.
 - b. Remove and properly dispose of bulk contamination debris.
 - c. Mist bird waste and contaminated material with Biocide or the equivalent (i.e. Sanogene, Oxine, or Envirocon).
 - d. Remove and properly dispose of contaminated waste material from all building components.
 - e. Utilize low pressure washers or scrub brushes to clean all wall surfaces of bird waste.

C. Quality Criteria

1. Qualifications for Performance of Work
 - a. Contractor (or subcontractor engaged to perform the Work of this Section) shall:
 - 1) Be a licensed bird waste abatement contractor in accordance with the Statutes of the State in which the work is to be performed. Submit notarized documentation confirming current licensure.
 - 2) Have a record of not less than five years successful experience in bird waste removal or asbestos removal.
2. Reference Standards
 - a. Acknowledge, by the executing of the Contract, awareness and familiarity with the contents and requirements of the following regulations, codes, and standards, and assume responsibility for the performance of the Work in strict compliance therewith and for every instance of failure to comply therewith.
 - b. Where conflict among requirements or with the Contract Documents exists, the more stringent requirements shall apply.
 - 1) USEPA Regional National Emissions Standards for Hazardous Air Pollutants (NESHAPS)
 - 2) U.S. Occupational and Safety and Health Administration (OSHA)
 - 3) U.S. EPA Office of Pesticide and Toxic Substances Guidance Document
 - 4) U.S. Department of Transportation, Hazardous Substances: Final Rule (49 CFR 171 and 172), Federal Register November 21, 1986 and corrected February 17, 1987.
 - 5) Statutes of the State in which the Work is to be Performed: Licensure for Asbestos Consultants and Contractors.
 - 6) All state, county, and city codes and ordinances as applicable. Make available for review at the site one copy of EPA, OSHA, and applicable State, County, and City Regulations governing the Work.
3. Patent/Copyright Compliance: Contractor shall determine the applicability of any process patents that may be employed and shall be responsible for the payment of all fees, royalties and licenses that may be required for the use of any patented or licensed process. Contractor shall hold the Owner, Engineer and Testing Laboratory harmless for failure to obtain any licenses and to pay any applicable fees and royalties.



- D. Product Handling
1. Deliver all materials in the original packages, containers, or bundles bearing the name of the manufacturer and the brand name.
 2. Store all materials subject to damage off the ground, away from wet or damp surfaces, and under cover sufficient to prevent damage or contamination.
 3. Remove from the premises all damaged or deteriorating materials. Dispose of materials that become contaminated with waste in accordance with applicable regulatory standards.
- E. Worksite Conditions
1. Worker and Visitor Procedures: The Contractor is hereby advised that the birds and bird wastes have been determined to cause diseases by inhalation and Contractor shall provide workers and qualified visitors with respirators that, as a minimum, shall meet the requirements of current applicable OSHA regulations, and protective clothing during preparation of system of enclosures, prior to commencing, during actual removal, and until final clean-up is completed. Also all personnel assigned to work on this project shall attend a training/awareness class for the purpose of explaining the hazards of improperly handling these materials and proper control measures to take in order to protect themselves.
- F. Personnel Protection
1. General
 - a. Provide respiratory protection in accordance with OSHA regulations 29 CFR 1910-134 and in accordance with the following paragraphs.
 - 1) Prior to commencement of work, all workers shall be instructed by the Contractor and shall be knowledgeable in the appropriate procedures of personnel protection and waste removal.
 - 2) Where respirators with disposable filters are used, provide sufficient filters for replacement as necessary by the workers, or as required by applicable regulations.
 - 3) Permit no visitors, except for governmental inspectors having jurisdiction, or as authorized by Engineer or the Owner, in the work areas after commencement of waste disturbance or removal. Provide authorized visitors with suitable respirators.
 - 4) Provide workers with sufficient sets of protective disposable clothing, consisting of full-body coveralls, head covers, gloves, and foot covers, of sizes to properly fit individual workers.
 - 5) Provide authorized visitors with a set of suitable protective disposable clothing, headgear, eye protection, and/or footwear of sizes to properly fit visitors whenever they are required to enter the work area, to a maximum of six sets per day.
 - 6) Provide, in addition to respirators and protective clothing provided for authorized visitors, protective clothing and respirators for use by Testing Laboratory's representative. Furnish protective clothing in as many sets as required for full-time monitoring by Testing Laboratory.
 - 7) Provide and post the decontamination and work procedures to be followed by workers.
 2. Respiratory Protection Program
 - a. Maintain a respiratory protection program that contains all the elements of the OSHA regulations. Provide a copy to the Engineer for approval.
 - b. Appoint a respiratory protection program administrator, who shall be responsible for the program, maintaining all documentation, instructing workers and providing fit tests. Respiratory protection administrator is to be qualified under OSHA requirements and to have attended and passed, as a minimum, OSHA training institute 2-week course on respiratory protection or NIOSH course "Occupational Respiratory Protection." Respiratory protection program administrator is to be on-site daily during abatement activities. All written programs and directions are to be in English and/or the language of the abatement workers if they are not fluent in English.
 - c. The Contractor is advised that the minimum respiratory requirements as called for in this section and on any drawings/sketches shall be applied unless reported measures indicate



that a lower form of respiratory protection is acceptable according to the appropriate OSHA regulations and the more strict sections of the specification.

3. Respiratory Protection Requirements
 - a. Workers shall be provided with respiratory protection equipment. The respirators are to be sanitized and maintained in accordance with the manufacturer's specification. Appropriate respirator selection will be dependent upon the work to be performed and the level of exposure, as given below.
 - b. For the clean-up, as a minimum, the use of full-faced air-purifying respirators is required for all preparation, removal and cleaning work.
 - c. This specification requires that workers shall wear suitable respiratory protection at all times whenever a potential for exposure to bird and bird waste exists.

1.2 PRODUCTS

A. Materials

1. Polyethylene/Plastic sheeting shall be of the thicknesses specified, in sizes to minimize the frequency of joints. Utilize reinforced plastic sheeting in specified thicknesses on floors.
2. Tape shall be glass fiber or other type capable of sealing joints of adjacent sheets of plastic and for attachment of plastic sheet to finished or unfinished surfaces of dissimilar materials under both dry and wet conditions.
3. Sodium Hypochlorite ("bleach")
4. Impermeable Containers shall be suitable to receive and retain contaminated materials until disposal at an approved site and shall be labeled in accordance with U.S. DOT 49 CFR 171 and 172, and containers shall be both air- and water-tight. Use a minimum of two types of impermeable containers: 1) six millimeter-thick (mil) plastic bags sized to fit within the drum; and 2) metal or fiber drums with tightly fitting lids.
5. Other Materials: Provide all other materials, such as lumber, nails, and hardware, that may be required to construct and dismantle the decontamination area and the barriers that isolate the work area(s).
6. Caulking shall be non-shrinking caulk to be used where insulated pipes continue through areas such as walls and ceilings. Contractor shall determine and submit proof that caulk proposed for use is compatible with the temperature conditions of the surfaces to which it is to be applied.
 - a. Tools And Equipment
 - 1) Water Sprayer - utilize airless or other low pressure sprayer for amended water application.
 - 2) Air Purifying Equipment (for internal recirculation in the work area) shall be HEPA Filtration Systems or Electronic Precipitators. Ensure that no internal air movement system or purification equipment exhausts contaminated air from the work area(s) outside the work area.
 - 3) Diminished Air Pressure Equipment shall comply with ANSI 29.2-7, local exhaust ventilation.
 - 4) Scaffolding shall be as required to accomplish the specified work and shall meet all applicable safety regulations.
 - 5) Transportation - as required for loading, temporary storage, transit, and unloading of contaminated waste without exposure to persons or property.

1.3 EXECUTION

A. Procedures

1. All personnel assigned to perform the work shall attend a training/awareness class for the purpose of explaining the hazards of improperly handling the waste and the proper control measures to take in order to protect themselves. These work procedures shall be discussed with each individual followed by the individual acknowledging receipt of this training by completing the pertinent information on a Hazardous Awareness Training Form



2. The majority of diseases related to bird waste is related to the inhalation of the airborne dust released by the waste. All personnel performing removal/decontamination waste shall therefore wear Powered Air Purifying Respirators (PAPR) equipped with combination Organic Vapor and High Efficiency Particulate Air (HEPA) filters while handling the waste.
3. Workers shall wear non-porous gloves and boots during all preparatory and removal operations.
4. When entering the building, the removal/decontamination personnel shall mist all surfaces having visible remnants of waste, using a diluted sodium hypochlorite ("bleach") and water solution. This solution shall be diluted at a ratio of 10 parts water to 1 part bleach for a 10 to 1 ration (10:1). The waste shall be continuously misted during occupancy in order to keep airborne dust emissions from the waste to a minimum.
5. Remove all birds from the building and seal all openings into the building. The main purpose of this is to eliminate the availability for future bird access into the building. The openings may be temporarily sealed or closed up in many ways, including boarding up windows/doors, polyethylene sheeting, or other convenient and cost effective means. It is not the intention of this task to complete seal the building airtight.
6. Designate an area of the facility for the purpose of storing the waste prior to loading for transportation to the appropriate landfill. The area designated shall have easy access to the door which will be utilized as the waste load-out.

END OF SECTION 02 87 00 00



Task	Specification	Specification Description
02 89 00 00	01 22 16 00	No Specification Required
02 89 00 00	02 83 19 13	Removal And Disposal Of Lead-Containing Paint
02 89 00 00	02 83 19 13a	Lead Paint Related Abatement Procedures
02 89 00 00	02 83 19 13b	XRF Testing For Lead-Based Paint
02 89 00 00	02 83 19 13c	Lead Dust Wipe, Air And Tcpl Sampling And Analysis



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SECTION 03 01 30 71 - CONCRETE REHABILITATION

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for concrete rehabilitation. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Removal of deteriorated concrete and reinforcement and subsequent replacement and patching.
 - b. Floor joint repair.
 - c. Epoxy crack injection.
 - d. Corrosion-inhibiting treatment.
 - e. Polymer overlays.
 - f. Polymer sealers.
 - g. Steel structural reinforcement.
 - h. Composite structural reinforcement.

C. Submittals

1. Product Data: For each type of product indicated. Include material descriptions, chemical composition, physical properties, test data, and mixing, preparation, and application instructions.
2. Formwork and Shoring Drawings: Prepared by or under the supervision of a qualified professional engineer detailing formwork and temporary shoring and supports. Include schedule and sequence for erection and removal relative to removal of deteriorated concrete and reinforcement and subsequent repair and reinforcement.
3. Samples: Cured Samples of overlay and patching materials.
4. Rehabilitation Program: For each phase of rehabilitation process, including protection of surrounding materials and Project site during operations. Describe in detail materials, methods, equipment, and sequence of operations to be used for each phase of the Work.
 - a. If alternative materials and methods to those indicated are proposed for any phase of rehabilitation work, submit substitution request and provide a written description of proposed materials and methods, including evidence of successful use on other comparable projects, and a testing program to demonstrate their effectiveness for this Project.

D. Delivery, Storage, And Handling

1. Deliver materials to Project site in manufacturer's original and unopened containers, labeled with type and name of products and manufacturers.
2. Comply with manufacturer's written instructions for minimum and maximum temperature requirements and other conditions for storage.
3. Store cementitious materials off the ground, under cover, and in a dry location.
4. Store aggregates, covered and in a dry location, where grading and other required characteristics can be maintained and contamination avoided.

E. Project Conditions

1. Environmental Limitations for Epoxies: Do not apply when air and substrate temperatures are outside limits permitted by manufacturer. During hot weather, cool epoxy components before mixing, store mixed products in shade, and cool unused mixed products to retard setting. Do not apply to wet substrates unless approved by manufacturer.



- a. Use only Class A epoxies when substrate temperatures are below or are expected to go below 40 deg F (5 deg C) within 8 hours.
 - b. Use only Class A or B epoxies when substrate temperatures are below or are expected to go below 60 deg F (16 deg C) within 8 hours.
 - c. Use only Class C epoxies when substrate temperatures are above and are expected to stay above 60 deg F (16 deg C) for 8 hours.
2. Cold-Weather Requirements for Cementitious Materials:
 - a. Do not apply unless air temperature is above 40 deg F (5 deg C) and will remain so for at least 48 hours after completion of Work.
OR
Comply with the following procedures:
 - 1) When air temperature is below 40 deg F (5 deg C), heat patching material ingredients and existing concrete to produce temperatures between 40 and 90 deg F (5 and 32 deg C).
 - 2) When mean daily air temperature is between 25 and 40 deg F (minus 4 and plus 5 deg C), cover completed Work with weather-resistant insulating blankets for 48 hours after repair or provide enclosure and heat to maintain temperatures above 32 deg F (0 deg C) within the enclosure for 48 hours after repair.
 - 3) When mean daily air temperature is below 25 deg F (minus 4 deg C), provide enclosure and heat to maintain temperatures above 32 deg F (0 deg C) within the enclosure for 48 hours after repair.
 3. Hot-Weather Requirements for Cementitious Materials: Protect repair work when temperature and humidity conditions produce excessive evaporation of water from patching materials. Provide artificial shade and wind breaks, and use cooled materials as required. Do not apply to substrates with temperatures of 90 deg F (32 deg C) and above.
 4. Environmental Limitations for High-Molecular-Weight Methacrylate Sealers: Do not apply when concrete surface temperature is below 55 deg F (13 deg C) or above 75 deg F (24 deg C) **OR** 90 deg F (32 deg C), **as directed**. Apply only to dry substrates **OR** substrates that have been dry for at least 72 hours.

1.2 PRODUCTS

A. Bonding Agents

1. Epoxy-Modified, Cementitious Bonding and Anticorrosion Agent: Product that consists of water-insensitive epoxy adhesive, portland cement, and water-based solution of corrosion-inhibiting chemicals that forms a protective film on steel reinforcement.
2. Epoxy Bonding Agent: ASTM C 881/C 881M, Type II **OR** V, **as directed**.
 - a. Thin Film Open Time: Not less than two **OR** six **OR** 24, **as directed**, hours.
3. Latex Bonding Agent: ASTM C 1059, Type I **OR** II **OR** II at exterior locations and where indicated, Type I at other locations, **as directed**.
4. Mortar Scrub-Coat: 1 part portland cement complying with ASTM C 150, Type I, II, or III and 1 part fine aggregate complying with ASTM C 144, except 100 percent passing a No. 16 (1.18-mm) sieve.

B. Patching Mortar

1. Patching Mortar, General:
 - a. Overhead Patching Mortar: For overhead repairs, use patching mortar recommended by manufacturer for overhead use and as specified in this Article.
 - b. Coarse Aggregate for Adding to Patching Mortar: Washed aggregate complying with ASTM C 33, Size No. 8, Class 5S. Add only as permitted by patching mortar manufacturer.
2. Job-Mixed Patching Mortar: 1 part portland cement complying with ASTM C 150, Type I, II, or III and 2-1/2 parts fine aggregate complying with ASTM C 144, except 100 percent passing a No. 16 (1.18-mm) sieve.



3. Cementitious Patching Mortar: Packaged, dry mix complying with ASTM C 928.
4. Polymer-Modified, Cementitious Patching Mortar: Packaged, dry mix complying with ASTM C 928, that contains a non-redispersible latex additive as either a dry powder or a separate liquid that is added during mixing.
5. Polymer-Modified, Silica-Fume-Enhanced, Cementitious Patching Mortar: Packaged, dry mix complying with ASTM C 928, that contains silica fume complying with ASTM C 1240 and a non-redispersible latex additive as either a dry powder or a separate liquid that is added during mixing.

C. Concrete

1. Concrete Materials and Admixtures: Comply with Division 03 Section "Cast-in-place Concrete".
2. Steel and Fiber Reinforcement and Reinforcement Accessories: Comply with Division 03 Section "Cast-in-place Concrete".
3. Form-Facing Materials: Comply with Division 03 Section "Cast-in-place Concrete".
4. Shotcrete: Comply with Division 03 Section "Shotcrete".
5. Preplaced Aggregate: Washed aggregate complying with ASTM C 33, Class 5S, with 95 to 100 percent passing a 1-1/2-inch (37.5-mm) sieve, 40 to 80 percent passing a 1-inch (25-mm) sieve, 20 to 45 percent passing a 3/4-inch (19-mm) sieve, 0 to 10 percent passing a 1/2-inch (12.5-mm) sieve, and 0 to 2 percent passing a 3/8-inch (9.5-mm) sieve **OR** 100 percent passing a 1-1/2-inch (37.5-mm) sieve, 95 to 100 percent passing a 1-inch (25-mm) sieve, 40 to 80 percent passing a 3/4-inch (19-mm) sieve, 0 to 15 percent passing a 1/2-inch (12.5-mm) sieve, and 0 to 2 percent passing a 3/8-inch (9.5-mm) sieve, **as directed**.
6. Fine Aggregate for Grout Used with Preplaced Aggregate: Fine aggregate complying with ASTM C 33, but with 100 percent passing a No. 8 (2.36-mm) sieve, 95 to 100 percent passing a No. 16 (1.18-mm) sieve, 55 to 80 percent passing a No. 30 (0.6-mm) sieve, 30 to 55 percent passing a No. 50 (0.3-mm) sieve, 10 to 30 percent passing a No. 100 (0.15-mm) sieve, 0 to 10 percent passing a No. 200 (0.075-mm) sieve, and having a fineness modulus of 1.30 to 2.10.
7. Grout Fluidifier for Grout Used with Preplaced Aggregate: ASTM C 937.
8. Portland Cement for Grout Used with Preplaced Aggregate: ASTM C 150.
9. Pozzolans for Grout Used with Preplaced Aggregate: ASTM C 618.

D. Miscellaneous Materials

1. Epoxy Joint Filler: 2-component, semirigid, 100 percent solids, epoxy resin with a Type A Shore durometer hardness of at least 80 per ASTM D 2240.
2. Polyurea Joint Filler: 2-component, semirigid, 100 percent solids, polyurea resin with a Type A Shore durometer hardness of at least 80 per ASTM D 2240.
3. Epoxy Crack Injection Adhesive: ASTM C 881/C 881M, Type I **OR** IV, **as directed**, Grade 1, except for gel time **OR** solvent free, **as directed**.
4. Capping Adhesive: Product manufactured for use with crack injection adhesive by same manufacturer.
5. Corrosion-Inhibiting Treatment Materials: Water-based solution of alkaline corrosion-inhibiting chemicals that penetrates concrete by diffusion and forms a protective film on steel reinforcement.
6. Polymer Overlay: Epoxy adhesive complying with ASTM C 881/C 881M, Type III.
7. Aggregate for Use with Polymer Overlay: Oven-dried, washed silica sand complying with ACI 503.3.
8. Polymer Sealer: Low-viscosity epoxy or high-molecular-weight methacrylate penetrating sealer recommended by manufacturer for application to exterior concrete traffic surfaces.
9. Methylmethacrylate Sealer/Brighteners: Clear low-viscosity sealer recommended by manufacturer for sealing exterior exposed-aggregate concrete, and formulated to bring out color of aggregates and give concrete a wet look.
10. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
 - a. After fabricating, prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."



- b. For minimum protection to steel after preparation, apply one coat of lead- and chromate-free, modified-alkyd primer complying with MPI#76 and one coat of alkyd-gloss enamel complying with MPI#96.
- c. After preparation, apply two-coat high-performance coating system consisting of organic zinc-rich primer, complying with SSPC-Paint 20 or SSPC-Paint 29 and topcoat of high-build, urethane or epoxy coating recommended by manufacturer for application over specified zinc-rich primer. Comply with coating manufacturer's written directions and with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
11. Bolts, Nuts, and Washers: Carbon steel; ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6), for bolts; ASTM A 563 (ASTM A 563M), Grade A, for nuts; and ASTM F 436 (ASTM F 436M) for washers; hot-dip or mechanically zinc coated.
12. Postinstalled Anchors: Chemical or expansion anchors, made from stainless-steel components complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Alloy Group A1 or A4) for bolts and nuts; ASTM A 666 or ASTM A 276, Type 304 or 316, for anchors, with capability to sustain, without failure, a load equal to four times the load imposed, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
13. Composite Structural Reinforcement: Manufacturer's system consisting of carbon **OR** glass, **as directed**,-fiber reinforcement in the form of preimpregnated sheets or tow sheet with field-applied saturant, and epoxy primers, fillers, adhesives, saturants, and topcoats, designed for use as external structural reinforcement for concrete.

E. Mixes

1. Mix products, in clean containers, according to manufacturer's written instructions.
 - a. Add clean silica sand and coarse aggregates to products only as recommended by manufacturer.
 - b. Do not add water, thinners, or additives unless recommended by manufacturer.
 - c. When practical, use manufacturer's premeasured packages to ensure that materials are mixed in proper proportions. When premeasured packages are not used, measure ingredients using graduated measuring containers; do not estimate quantities or use shovel or trowel as unit of measure.
 - d. Do not mix more materials than can be used within recommended open time. Discard materials that have begun to set.
2. Mortar Scrub-Coat: Mix with enough water to provide consistency of thick cream.
3. Dry-Pack Mortar: Mix with just enough liquid to form damp cohesive mixture that can be squeezed by hand into a ball but is not plastic.
4. Concrete: Comply with Division 03 Section "Cast-in-place Concrete".
5. Shotcrete: Comply with Division 03 Section "Shotcrete".
6. Grout for Use with Preplaced Aggregate: Proportion according to ASTM C 938. Add grout fluidifier to mixing water followed by cementitious materials and then fine aggregate.

1.3 EXECUTION

A. Examination

1. Notify the Owner seven days in advance of dates when areas of deteriorated or delaminated concrete and deteriorated reinforcing bars will be located.
2. Locate areas of deteriorated or delaminated concrete using hammer or chain drag sounding and mark boundaries. Mark areas for removal by simplifying and squaring off boundaries. At columns and walls make boundaries level and plumb, unless otherwise indicated.
3. Locate at least three reinforcing bars using a pachometer, and drill test holes to determine depth of cover. Calibrate pachometer, using depth of cover measurements, and verify depth of cover in removal areas using pachometer.



B. Preparation

1. Protect people, motor vehicles, equipment, surrounding construction, Project site, plants, and surrounding buildings from injury resulting from concrete rehabilitation work.
 - a. Erect and maintain temporary protective covers over pedestrian walkways and at points of entrance and exit for people and vehicles, unless such areas are made inaccessible during the course of concrete rehabilitation work. Construct covers of tightly fitted, 3/4-inch (19-mm) exterior-grade plywood supported at 16 inches (405 mm) o.c. and covered with asphalt roll roofing.
 - b. Protect adjacent equipment and surfaces by covering them with heavy polyethylene film and waterproof masking tape or a liquid strippable masking agent. If practical, remove items, store, and reinstall after potentially damaging operations are complete.
 - c. Neutralize and collect alkaline and acid wastes according to requirements of authorities having jurisdiction, and dispose of by legal means off the Owner's property.
 - d. Dispose of runoff from wet operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.
 - e. Collect runoff from wet operations and dispose of by legal means off the Owner's property.
2. Shoring: Install temporary supports before beginning concrete removal.
3. Concrete Removal:
 - a. Saw-cut perimeter of areas indicated for removal to a depth of at least 1/2 inch (13 mm). Make cuts perpendicular to concrete surfaces and no deeper than cover on reinforcement.
 - b. Remove deteriorated and delaminated concrete by breaking up and dislodging from reinforcement.
 - c. Remove additional concrete, if necessary, to provide a depth of removal of at least 1/2 inch (13 mm) over entire removal area.
 - d. Where half or more of the perimeter of reinforcing bar is exposed, bond between reinforcing bar and surrounding concrete is broken, or reinforcing bar is corroded, remove concrete from entire perimeter of bar and to provide at least a 3/4-inch (19-mm) clearance around bar.
 - e. Test areas where concrete has been removed by tapping with hammer, and remove additional concrete until unsound and disbonded concrete is completely removed.
 - f. Provide fractured aggregate surfaces with a profile of at least 1/8 inch (3 mm) that are approximately perpendicular or parallel to original concrete surfaces. At columns and walls, make top and bottom surfaces level, unless otherwise directed.
 - g. Thoroughly clean removal areas of loose concrete, dust, and debris.
4. Reinforcing Bar Preparation: Remove loose and flaking rust from reinforcing bars by high-pressure water cleaning **OR** abrasive blast cleaning **OR** needle scaling **OR** wire brushing, **as directed**, until only tightly bonded light rust remains.
 - a. Where section loss of reinforcing bar is more than 25 percent, or 20 percent in 2 or more adjacent bars, cut bars and remove and replace. Remove additional concrete as necessary to provide at least 3/4-inch (19-mm) clearance at existing and replacement bars. Splice replacement bars to existing bars according to ACI 318 (ACI 318M), by lapping, welding, or using mechanical couplings.
5. Preparation of Floor Joints for Repair: Saw-cut joints full width to edges and depth of spalls, but not less than 3/4 inch (19 mm) **OR** 1 inch (25 mm) **OR** 2 inches (50 mm), **as directed**, deep. Clean out debris and loose concrete; vacuum or blow clear with compressed air.
6. Surface Preparation for Corrosion-Inhibiting Treatment: Clean concrete by low-pressure water cleaning **OR** detergent scrubbing **OR** sand blasting, **as directed**, to remove dirt, oils, films, and other materials detrimental to treatment application. Allow surface to dry before applying corrosion-inhibiting treatment.
7. Surface Preparation for Overlays: Remove delaminated material and deteriorated concrete surface material. Roughen surface of concrete by sand blasting **OR** shot blasting **OR** scarifying **OR** needle scaling **OR** high-pressure water jetting **OR** scabbling **OR** flame blasting **OR** milling, **as directed**, to produce a surface profile matching CSP 3 **OR** 4 **OR** 5 **OR** 6 **OR** 7 **OR** 8 **OR** 9, **as directed**, per ICRI 03732. Sweep and vacuum roughened surface to remove debris followed by low-pressure water cleaning.



8. Surface Preparation for Sealers: Clean concrete by shot blasting **OR** low-pressure water cleaning **OR** detergent scrubbing, **as directed**, to remove dirt, oils, films, and other materials detrimental to sealer application.
9. Surface Preparation for Sealers: Acid etch surface of concrete to produce a surface profile matching CSP 1 per ICRI 03732. Prepare surface for acid etching by detergent scrubbing to remove oils and films that may prevent acid penetration.
 - a. Remove excess acid solution, reaction products, and debris by squeegeeing or vacuuming.
 - b. Scrub surface with an alkaline detergent, rinse, and squeegee or vacuum.
 - c. Check acidity of surface with pH test paper and continue rinsing until pH is acceptable.
 - d. When pH is acceptable and surface is clean, vacuum dry.
10. Surface Preparation for Composite Structural Reinforcement: Remove delaminated material and deteriorated concrete surface material. Clean concrete where reinforcement and epoxy patching mortar is to be applied by low-pressure water cleaning **OR** detergent scrubbing, **as directed**, to remove dirt, oils, films, and other materials detrimental to epoxy application. Roughen surface of concrete by sand blasting.

C. Application

1. General: Comply with manufacturer's written instructions and recommendations for application of products, including surface preparation.
2. Epoxy-Modified, Cementitious Bonding and Anticorrosion Agent: Apply to reinforcing bars and concrete by stiff brush or hopper spray according to manufacturer's written instructions. Apply to reinforcing bars in two coats, allowing first coat to dry two to three hours before applying second coat. Allow to dry before placing patching mortar or concrete.
3. Epoxy Bonding Agent: Apply to reinforcing bars and concrete by brush, roller, or spray according to manufacturer's written instructions, leaving no pinholes or other uncoated areas. Apply to reinforcing bars in at least two coats, allowing first coat to dry before applying second coat. Apply patching mortar or concrete while epoxy is still tacky. If epoxy dries, recoat before placing patching mortar or concrete.
4. Latex Bonding Agent, Type II: Mix with portland cement and scrub into concrete surface according to manufacturer's written instructions. Apply patching mortar or concrete while bonding agent is still wet. If bonding agent dries, recoat before placing patching mortar or concrete.
5. Latex Bonding Agent, Type I: Apply to concrete by brush roller or spray. Allow to dry before placing patching mortar or concrete.
6. Mortar Scrub-Coat: Dampen repair area and surrounding concrete 6 inches (150 mm) beyond repair area. Remove standing water and apply scrub-coat with a brush, scrubbing it into surface and thoroughly coating repair area. If scrub-coat dries, recoat before applying patching mortar or concrete.
7. Patching Mortar: Unless otherwise recommended by manufacturer, apply as follows:
 - a. Wet substrate thoroughly and then remove standing water. Scrub a slurry of neat patching mortar mixed with latex bonding agent into substrate, filling pores and voids.
 - b. Place patching mortar by troweling toward edges of patch to force intimate contact with edge surfaces. For large patches, fill edges first and then work toward center, always troweling toward edges of patch. At fully exposed reinforcing bars, force patching mortar to fill space behind bars by compacting with trowel from sides of bars.
 - c. For vertical patching, place material in lifts of not more than 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, nor less than 1/8 inch (3 mm) **OR** 1/4 inch (6 mm), **as directed**. Do not feather edge.
 - d. For overhead patching, place material in lifts of not more than 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, nor less than 1/8 inch (3 mm) **OR** 1/4 inch (6 mm), **as directed**. Do not feather edge.
 - e. After each lift is placed, consolidate material and screed surface.
 - f. Where multiple lifts are used, score surface of lifts to provide a rough surface for application of subsequent lifts. Allow each lift to reach final set before placing subsequent lifts.



- e. Pump grout into place at bottom of preplaced aggregate, forcing grout upward. Release air from forms at top as grout is introduced. When formed space is full and grout flows from air vents, close vents and pressurize to 14 psi (96 kPa).
 - f. Wet-cure concrete for not less than seven days by leaving forms in place or keeping surfaces continuously wet by water-fog spray or water-saturated absorptive cover.
 - g. Repair voids with patching mortar and finish to match surrounding concrete.
12. Joint Filler: Install in nonmoving floor joints where indicated.
- a. Install filler to a depth of at least 3/4 inch (19 mm) **OR** 1 inch (25 mm) **OR** 2 inches (50 mm), **as directed**. Use fine silica sand no more than 1/4 inch (6 mm) deep to close base of joint. Do not use sealant backer rods or compressible fillers below joint filler.
 - b. Install filler so that when cured, it is flush at top surface of adjacent concrete. If necessary, overfill joint and remove excess when filler has cured.
13. Epoxy Crack Injection: Comply with manufacturer's written instructions and the following:
- a. Clean areas to receive capping adhesive of oil, dirt, and other substances that would interfere with bond, and clean cracks with oil-free compressed air or low-pressure water to remove loose particles.
 - b. Place injection ports as recommended by epoxy manufacturer, spacing no farther apart than thickness of member being injected. Seal injection ports in place with capping adhesive.
 - c. Seal cracks at exposed surfaces with a ribbon of capping adhesive at least 1/4 inch (6 mm) thick by 1 inch (25 mm) wider than crack.
 - d. Inject cracks wider than 0.003 inch (0.075 mm) to a depth of 8 inches (200 mm) or to a width of less than 0.003 inch (0.075 mm), whichever is less.
 - e. Inject epoxy adhesive, beginning at widest part of crack and working toward narrower parts. Inject adhesive into ports to refusal, capping adjacent ports when they extrude epoxy. Cap injected ports and inject through adjacent ports until crack is filled.
 - f. After epoxy adhesive has set, remove injection ports and grind surfaces smooth.
14. Corrosion-Inhibiting Treatment: Apply by brush, roller, or airless spray in two coats at manufacturer's recommended application rate. Remove film of excess treatment by high-pressure washing before patching treated concrete or applying a sealer or overlay.
15. Polymer Overlay: Apply according to ACI 503.3.
- a. Apply to traffic-bearing surfaces, including parking areas and walks.
16. Polymer Sealer: Apply by brush, roller, or airless spray at manufacturer's recommended application rate.
- a. Apply to traffic-bearing surfaces, including parking areas and walks.
17. Methylmethacrylate Sealer/Brighteners: Apply by brush, roller, or airless spray at manufacturer's recommended application rate.
- a. Apply to exterior concrete surfaces that are exposed to view, excluding traffic-bearing surfaces.
18. Composite Structural Reinforcement Using Preimpregnated Fiber Sheet: Unless otherwise recommended by manufacturer, apply as follows:
- a. Patch surface defects with epoxy mortar and allow to set before beginning reinforcement application.
 - b. Apply epoxy adhesive to a thickness of 1/16 inch (1.6 mm) to prepared concrete surfaces in areas where composite structural reinforcement will be applied.
 - c. Clean preimpregnated fiber sheet with acetone or other suitable solvent, and apply epoxy adhesive to a thickness of 1/16 inch (1.6 mm).
 - d. Apply adhesive-coated fiber sheet to adhesive-coated concrete within open time of epoxy adhesive, and roll with a hard rubber roller until fiber sheet is fully embedded in adhesive, air pockets are removed, and adhesive is forced out from beneath fiber sheet at edges.
 - e. Apply additional layers as indicated using same procedure.
19. Composite Structural Reinforcement Using Fiber Tow Sheet and Saturant: Unless otherwise recommended by manufacturer, apply as follows:
- a. Apply epoxy primer using brush or short nap roller to prepared concrete surfaces in areas where composite structural reinforcement will be applied.



- b. After primer has set, patch surface defects with epoxy filler and allow to set before beginning reinforcement application.
- c. Apply epoxy saturant to fiber tow sheet or primed and patched surface with 3/8-inch- (10-mm-) nap roller. Apply fiber tow sheet to primed and patched surface while saturant is still wet, using pressure roller to remove air pockets. Remove paper backing from fiber tow sheet and apply additional epoxy as needed to fully saturate tow sheet.
- d. Apply additional layers as indicated, fully saturating each with epoxy.
- e. After saturant has cured, apply protective topcoat by brush, roller or spray.

D. Field Quality Control

1. Testing Agency: Engage a qualified testing agency to sample materials and perform tests as follows:
 - a. Patching Mortar, Packaged Mixes: <Insert number> randomly selected samples tested according to ASTM C 928.
 - b. Patching Mortar, Field Mixed: <Insert number> randomly selected samples tested for compressive strength according to ASTM C 109/C 109M.
 - c. Concrete: As specified in Division 03 Section "Cast-in-place Concrete".
 - d. Shotcrete: As specified in Division 03 Section "Shotcrete".
 - e. Grouted Preplaced Aggregate: Tested for compressive strength of grout according to ASTM C 942.
 - 1) Testing Frequency: One sample for each 25 cu. yd. (19 cu. m) of grout or fraction thereof, but not less than one sample for each day's work.
 - f. Joint Filler: Core drilled samples to verify proper installation.
 - 1) Testing Frequency: One sample for each 100 feet (30 m) of joint filled.
 - 2) Where samples are taken, fill holes with joint filler.
 - g. Epoxy Crack Injection: Core drilled samples to verify proper installation.
 - 1) Testing Frequency: 3 samples from mockup and 1 sample for each 100 feet (30 m) of crack injected.
 - 2) Where samples are taken, fill holes with epoxy mortar.

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SECTION 03 01 30 71a - SELF-ADHERING SHEET WATERPROOFING

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for self-adhering sheet waterproofing. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Modified bituminous sheet waterproofing.
 - b. Modified bituminous sheet waterproofing, fabric reinforced.
 - c. Modified bituminous deck paving sheet waterproofing.
 - d. Modified bituminous composite panel waterproofing.
 - e. Adhesive-coated HDPE sheet waterproofing.
 - f. Molded-sheet drainage panels.
 - g. Insulation.
 - h. Plaza deck pavers and paver pedestals.

C. Submittals

1. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.
2. Shop Drawings: Show locations and extent of waterproofing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.
3. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for waterproofing.
4. Special warranties.
5. LEED Submittals:
 - a. Product Certificates for Credit MR 5: For products and materials required to comply with requirements for regional materials, certificates indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating distance to Project, cost for each regional material, and fraction by weight that is considered regional.
 - b. Shop Drawings: Show locations and extent of waterproofing and details of substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.
 - 1) Include setting drawings showing layout, sizes, sections, profiles, and joint details of pedestal-supported concrete pavers.
 - c. Samples: For each exposed product and for each color and texture specified, including the following products:
 - 1) 8-by-8-inch (200-by-200-mm) square of waterproofing and flashing sheet.
 - 2) 8-by-8-inch (200-by-200-mm) square of insulation.
 - 3) 4-by-4-inch (100-by-100-mm) square of drainage panel.
 - 4) Plaza-deck paver, 4-by-4-inch (100-by-100-mm) square **OR** full sized, **as directed**, in each color and texture required.
 - 5) Paver pedestal assembly.

D. Quality Assurance

1. Installer Qualifications: A firm that is approved or licensed by **OR** acceptable to, **as directed**, waterproofing manufacturer for installation of waterproofing required for this Project.
2. Preinstallation Conference: Conduct conference at Project site.



- a. Review waterproofing requirements including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

E. Delivery, Storage, And Handling

1. Deliver liquid materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.
2. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by waterproofing manufacturer.
3. Remove and replace liquid materials that cannot be applied within their stated shelf life.
4. Store rolls according to manufacturer's written instructions.
5. Protect stored materials from direct sunlight.

F. Project Conditions

1. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.

G. Warranty

1. Special Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to replace waterproofing material that does not comply with requirements or that fails to remain watertight within specified warranty period.
 - a. Warranty Period: Three **OR** Five, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Modified Bituminous Sheet Waterproofing

1. Modified Bituminous Sheet: Not less than 60-mil- (1.5-mm-) thick, self-adhering sheet consisting of 56 mils (1.4 mm) of rubberized asphalt laminated to a 4-mil- (0.10-mm-) thick, polyethylene film with release liner on adhesive side and formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction.
 - a. Physical Properties:
 - 1) Tensile Strength: 250 psi (1.7 MPa) minimum; ASTM D 412, Die C, modified.
 - 2) Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.
 - 3) Low-Temperature Flexibility: Pass at minus 20 deg F (minus 29 deg C); ASTM D 1970.
 - 4) Crack Cycling: Unaffected after 100 cycles of 1/8-inch (3-mm) movement; ASTM C 836.
 - 5) Puncture Resistance: 40 lbf (180 N) minimum; ASTM E 154.
 - 6) Hydrostatic-Head Resistance: 150 feet (45 m) minimum; ASTM D 5385.
 - 7) Water Absorption: 0.15 percent weight-gain maximum after 48-hour immersion at 70 deg F (21 deg C); ASTM D 570.
 - 8) Vapor Permeance: 0.05 perms (2.9 ng/Pa x s x sq. m); ASTM E 96, Water Method.
2. Modified Bituminous Sheet, Fabric Reinforced: 60-mil- (1.5-mm-) thick, self-adhering sheet consisting of rubberized-asphalt membrane embedded in spun-bonded polyester or fiberglass nonwoven fabric reinforcement laminated to a 0.50-mil- (0.01-mm-) thick polyester film with release liner on adhesive side.
 - a. Physical Properties:
 - 1) Pliability: No cracks when bent 180 degrees over a 1-inch (25-mm) mandrel at minus 25 deg F (minus 32 deg C); ASTM D 146.
 - 2) Hydrostatic-Head Resistance: 150 feet (45 m) minimum.
 - 3) Vapor Permeance: 0.05 perms (2.9 ng/Pa x s x sq. m); ASTM E 96, Water Method.



- B. Modified Bituminous Deck Paving Sheet Waterproofing
1. Modified Bituminous Deck Paving Sheet: Provide one of the products described below, **as directed**:
 - a. 65-mil- (1.6-mm-) thick, self-adhering sheets consisting of 53 to 56 mils (1.3 to 1.4 mm) of rubberized asphalt laminated to a heat-resisting, 9- to 12-mil- (0.2- to 0.3-mm-) thick, woven polypropylene geotextile reinforcement with release liner on adhesive side.
 - b. 70-mil- (1.8-mm-) thick, self-adhering sheets consisting of rubberized asphalt embedded in inert fabric reinforcement laminated to a reflective geotextile protective topping with release liner on adhesive side.
 - c. 60-mil- (1.5-mm-) thick, self-adhering sheets consisting of rubberized asphalt embedded in nonwoven **OR** woven, **as directed**, fiberglass fabric reinforcement laminated to a 0.50-mil- (0.01-mm-) thick polyester mat with release liner on adhesive side.
 - d. Physical Properties:
 - 1) Tensile Strength, Membrane: 50 lbf/in (8.75 kN/m) minimum; ASTM D 882.
 - 2) Pliability: Unaffected when bent 180 degrees over a 1/4-inch (6.4-mm) mandrel at minus 15 deg F (minus 26 deg C); ASTM D 146.
 - 3) Puncture Resistance, Mesh: 200 lbf (890 N) minimum; ASTM E 154.
- C. Modified Bituminous Composite Panel Waterproofing
1. Modified Bituminous Composite Panel: 90-mil- (2.2-mm-) thick, multilaminated panel consisting of a protection course bonded to an asphalt saturated carrier sheet bonded to a rubberized asphalt waterproofing self-adhering membrane with release liner.
- D. Adhesive-Coated HDPE Sheet Waterproofing
1. Adhesive-Coated HDPE Sheet for Vertical Applications: 32-mil- (0.8-mm-) thick, uniform, flexible sheets consisting of 16-mil- (0.4-mm-) thick, HDPE sheet coated with a pressure-sensitive rubber adhesive, a protective adhesive coating, and a release liner with the following physical properties:
 - a. Tensile Strength, Film: 4000 psi (27.6 MPa) minimum; ASTM D 412.
 - b. Low-Temperature Flexibility: Pass at minus 10 deg F (minus 23 deg C); ASTM D 1970.
 - c. Peel Adhesion to Concrete: 5 lbf/in. (875 N/m); ASTM D 903, modified.
 - d. Lap Adhesion: 2.5 lbf/in. (440 N/m); ASTM D 1876, modified.
 - e. Hydrostatic-Head Resistance: 231 feet (70 m); ASTM D 5385, modified.
 - f. Vapor Permeance: 0.01 perms (0.6 ng/Pa x s x sq. m); ASTM E 96, Water Method.
 - g. Water Absorption: 0.5 percent; ASTM D 570.
 2. Adhesive-Coated HDPE Sheet for Horizontal Applications: 46-mil- (1.2-mm-) thick, uniform, flexible sheets consisting of 30-mil- (0.76-mm-) thick, HDPE sheet coated with a pressure-sensitive rubber adhesive, a protective adhesive coating, a detackifying surface treatment, an uncoated self-adhering side lap strip, and a release liner with the following physical properties:
 - a. Tensile Strength, Film: 4000 psi (27.6 MPa) minimum; ASTM D 412.
 - b. Low-Temperature Flexibility: Pass at minus 10 deg F (minus 23 deg C); ASTM D 1970.
 - c. Peel Adhesion to Concrete: 5 lbf/in. (875 N/m); ASTM D 903, modified.
 - d. Lap Adhesion: 2.5 lbf/in. (440 N/m); ASTM D 1876, modified.
 - e. Hydrostatic-Head Resistance: 231 feet (70 m); ASTM D 5385, modified.
 - f. Vapor Permeance: 0.01 perms (0.6 ng/Pa x s x sq. m); ASTM E 96, Water Method.
 - g. Water Absorption: 0.5 percent; ASTM D 570.
- E. Auxiliary Materials
1. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
 - a. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.
 2. Primer: Liquid waterborne **OR** solvent-borne, **as directed**, primer recommended for substrate by manufacturer of sheet waterproofing material.
 3. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by manufacturer of sheet waterproofing material.



4. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, trowel grade or low viscosity.
 5. Substrate Patching Membrane: Low-viscosity, two-component, asphalt-modified coating.
 6. Sheet Strips: Self-adhering, rubberized-asphalt sheet strips of same material and thickness as sheet waterproofing.
 7. Mastic, Adhesives, and Tape: Liquid mastic and adhesives, and adhesive tapes recommended by waterproofing manufacturer.
 - a. Detail Tape: Two-sided, pressure-sensitive, self-adhering reinforced tape, 4-1/2 inches (114 mm) wide, with a tack-free protective adhesive coating on one side and release film on self-adhering side.
 - b. Detail Strips: 62.5-mil- (1.58-mm-) thick, felt-reinforced self-adhesive strip, 9 inches (229 mm) wide, with release film on adhesive side.
 8. Metal Termination Bars: Aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick, predrilled at 9-inch (229-mm) centers.
 9. Protection Course: ASTM D 6506, semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners and as follows:
 - a. Thickness: 1/8 inch (3 mm), nominal, for vertical applications; 1/4 inch (6 mm), nominal, elsewhere.
 - b. Adhesive: Rubber-based solvent type recommended by waterproofing manufacturer for type of protection course.
 10. Protection Course: Fan folded, with a core of extruded-polystyrene board insulation faced one side or both sides with plastic film, nominal thickness 1/4 inch (6 mm), with compressive strength of not less than 8 psi (55 kPa) per ASTM D 1621, and maximum water absorption by volume of 0.6 percent per ASTM C 272.
 11. Protection Course: Unfaced, fan-folded, extruded-polystyrene board insulation, nominal thickness 1/4 inch (6 mm) with compressive strength of not less than 8 psi (55 kPa) per ASTM D 1621.
 12. Protection Course: Extruded-polystyrene board insulation, unfaced, ASTM C 578, Type X, 1/2 inch (13 mm) thick.
 13. Protection Course: Molded-polystyrene board insulation, ASTM C 578, Type I, 0.90-lb/cu. ft. (15-kg/cu. m) minimum density, 1-inch (25-mm) minimum thickness.
- F. Molded-Sheet Drainage Panels
1. Molded-Sheet Drainage Panel: Comply with Division 33 Section "Subdrainage".
 2. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel: Manufactured composite subsurface drainage panels consisting of a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 (0.21-mm) sieve laminated to one side with or without a polymeric film bonded to the other side of a studded, nonbiodegradable, molded-plastic-sheet drainage core, with a vertical flow rate of 9 to 15 gpm per ft. (112 to 188 L/min. per m).
 3. Woven-Geotextile-Faced, Molded-Sheet Drainage Panel: Manufactured composite subsurface drainage panels consisting of a woven-geotextile facing with an apparent opening size not exceeding No. 40 (0.425-mm) sieve laminated to one side with or without a polymeric film bonded to the other side of a studded, nonbiodegradable, molded-plastic-sheet drainage core, with a horizontal flow rate not less than 2.8 gpm per ft. (35 L/min. per m).
- G. Insulation
1. Board Insulation: Extruded-polystyrene board insulation complying with ASTM C 578, square or shiplap edged.
 - a. Type IV, 25-psi (173-kPa) minimum compressive strength.
 - b. Type VI, 40-psi (276-kPa) minimum compressive strength.
 - c. Type VII, 60-psi (414-kPa) minimum compressive strength.
 - d. Type V, 100-psi (690-kPa) minimum compressive strength.
 2. Unfaced Wall Insulation Drainage Panels: Extruded-polystyrene board insulation complying with ASTM C 578, Type IV, 25-psi (173-kPa) or Type VI, 40-psi (276-kPa) minimum compressive



- strength; unfaced; fabricated with shiplap or channel edges and with 1 side having grooved drainage channels.
3. Geotextile-Faced Wall Insulation Drainage Panels: Extruded-polystyrene board insulation complying with ASTM C 578, Type IV, 25-psi (173-kPa) or Type VI, 40-psi (276-kPa) minimum compressive strength; fabricated with tongue-and-groove edges and with 1 side having grooved drainage channels faced with nonwoven geotextile filter fabric.
 4. Unfaced Plaza Deck Insulation Drainage Panels: Extruded-polystyrene board insulation complying with ASTM C 578, Type VI, 40-psi (276-kPa) **OR** Type VII, 60-psi (414-kPa), **as directed**, minimum compressive strength; unfaced; fabricated with shiplapped or channel edges and with 1 side having ribbed drainage channels.
 5. Geotextile-Faced Plaza Deck Insulation Drainage Panels: Extruded-polystyrene board insulation complying with ASTM C 578, Type VII, 60-psi (414-kPa) minimum compressive strength; fabricated with tongue-and-groove edges and with 1 side having grooved drainage channels faced with manufacturer's standard, nonwoven geotextile filter fabric.
- H. Plaza Deck Pavers
1. Plaza Deck Pavers: Brick **OR** Concrete **OR** Asphalt-Block, **as directed**, pavers specified in Division 32 Section "Unit Paving".
 2. Plaza Deck Pavers: Granite **OR** Limestone **OR** Marble **OR** Quartz-Based Stone **OR** Slate, **as directed**, pavers specified in Division 09 Section "Stone Flooring".
 3. Plaza Deck Pavers: Heavyweight, hydraulically pressed, concrete units, square edged **OR** with top edges beveled 3/16 inch (5 mm), **as directed**, manufactured for use as plaza deck pavers; minimum compressive strength 7500 psi (52 mpa) **or** 6500 psi (45 mpa), **as directed**, ASTM C 140; absorption not greater than 5 percent, ASTM C 140; no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance according to ASTM C 67.
 - a. Thickness: 1-5/8 inches (41 mm) **OR** 1-3/4 inches (45 mm) **OR** 2 inches (51 mm) **OR** 2-3/8 inches (60 mm), **as directed**.
 - b. Face Size: 8-7/8 inches (225 mm) square **OR** 9 inches (229 mm) square **OR** 9 by 18 inches (229 by 457 mm) **OR** 12 inches (305 mm) square **OR** 12 by 24 inches (305 by 610 mm) **OR** 18 inches (457 mm) square **OR** 24 inches (610 mm) square **OR** As indicated, **as directed**.
 - c. Color: As indicated by manufacturer's designations **OR** Match sample **OR** As selected from manufacturer's full range, **as directed**.
 4. Setting Bed: Provide aggregate **OR** mortar **OR** bituminous, **as directed**, setting-bed materials specified in Division 32 Section "Unit Paving".
 5. Paver Pedestals: Paver manufacturer's standard SBR rubber, HDPE, or polyurethane paver support assembly, including fixed-height **OR** adjustable or stackable, **as directed**, pedestals, shims, and spacer tabs for joint spacing of 1/8 inch (3 mm) **OR** 3/16 inch (5 mm) **OR** 1/8 to 3/16 inch (3 to 5 mm), **as directed**.
 - a. Concrete Fill: ACI 301, compressive strength of 5000 psi (34 MPa) at 28 days and air content of 6 percent.

1.3 EXECUTION

- A. Surface Preparation
1. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
 2. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
 3. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
 4. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.
 5. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.



- a. Install sheet strips and center over treated construction and contraction joints and cracks exceeding a width of 1/16 inch (1.6 mm) or 1/8 inch (3 mm) for modified bituminous deck paving waterproofing.
 6. Bridge and cover isolation joints, expansion joints, and discontinuous deck-to-wall and deck-to-deck joints with overlapping sheet strips.
 - a. Invert and loosely lay first sheet strip over center of joint. Firmly adhere second sheet strip to first and overlap to substrate.
 7. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.
 - a. Install membrane strips centered over vertical inside corners. Install 3/4-inch (19-mm) fillets of liquid membrane on horizontal inside corners and as follows:
 - 1) At footing-to-wall intersections, extend liquid membrane each direction from corner or install membrane strip centered over corner.
 - 2) At plaza deck-to-wall intersections, extend liquid membrane or sheet strips onto deck waterproofing and to finished height of sheet flashing.
 8. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D 6135.
- B. Modified Bituminous Sheet Waterproofing Application
1. Install modified bituminous sheets according to waterproofing manufacturer's written instructions and according to recommendations in ASTM D 6135.
 2. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.
 3. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch- (64-mm-) minimum lap widths and end laps. Overlap and seal seams and stagger end laps to ensure watertight installation.
 - a. When ambient and substrate temperatures range between 25 and 40 deg F (minus 4 and plus 5 deg C), install self-adhering, modified bituminous sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F (16 deg C).
 4. Two-Ply Application: Install sheets to form a membrane with lap widths not less than 50 percent of sheet widths to provide a minimum of 2 thicknesses of sheet membrane over areas to receive waterproofing.
 5. Horizontal Application: Apply sheets from low point to high point of decks to ensure that side laps shed water.
 6. Apply continuous sheets over sheet strips bridging substrate cracks, construction, and contraction joints.
 7. Seal exposed edges of sheets at terminations not concealed by metal counterflashings or ending in reglets with mastic.
 8. Install sheet waterproofing and auxiliary materials to tie into adjacent waterproofing.
 9. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending 6 inches (150 mm) beyond repaired areas in all directions.
 10. Install protection course with butted joints over waterproofing membrane immediately.
 - a. Molded-sheet drainage panels **OR** Insulation drainage panels **OR** Board insulation, **as directed**, may be used in place of a separate protection course to vertical applications when approved by waterproofing manufacturer and installed immediately.
 11. Correct deficiencies in or remove sheet waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.
- C. Modified Bituminous Deck Paving Sheet Waterproofing Application
1. Install modified bituminous deck paving sheets according to waterproofing manufacturer's written instructions.
 2. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.



3. Apply and firmly adhere sheets over areas to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch- (64-mm-) minimum lap widths and 6-inch (150-mm) end laps. Overlap and seal seams and stagger end laps to ensure watertight installation.
 4. Apply sheet waterproofing from low point to high point of decks to ensure that side laps shed water.
 5. Apply continuous sheets over sheet strips bridging substrate cracks, construction, and contraction joints.
 6. Seal edges of sheet waterproofing terminations with mastic.
 7. Install sheet waterproofing and auxiliary materials to tie into adjacent waterproofing.
 8. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending 6 inches (150 mm) beyond repaired areas in all directions.
 9. Correct deficiencies in or remove sheet waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.
- D. Modified Bituminous Composite Panel Waterproofing Application
1. Install modified bituminous composite panels according to waterproofing manufacturer's written instructions.
 2. Apply primer to substrate at required rate and allow to dry. Limit priming to areas that will be covered by waterproofing in same day. Reprime areas exposed for more than 24 hours.
 3. Install and firmly adhere composite panels over area to receive waterproofing. Accurately align and butt vertical and horizontal joints.
 4. Seal vertical and horizontal butt joints and exposed top, side, and bottom edges at composite panel waterproofing terminations with detail strips.
 5. Correct deficiencies in or remove composite panel waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair detail strips.
- E. Adhesive-Coated HDPE Sheet Waterproofing Application
1. Install adhesive-coated HDPE sheets according to manufacturer's written instructions.
 2. Place and secure molded-sheet drainage panels over substrate. Lap edges and ends of geotextile to maintain continuity.
 3. Vertical Applications: Install adhesive-coated HDPE sheet with HDPE face against substrate. Accurately align sheets and maintain uniform 3-inch- (75-mm-) minimum lap widths and end laps. Overlap and seal seams and stagger and tape end laps to ensure watertight installation. Mechanically fasten to substrate.
 - a. Securely fasten top termination of membrane with continuous metal termination bar anchored into substrate and cover with detailing tape.
 4. Horizontal Applications: Install adhesive-coated HDPE sheet with HDPE face against substrate. Accurately align sheets and maintain uniform 3-inch- (75-mm-) minimum lap widths and end laps. Overlap and seal seams. Overlap, stagger, and seal end laps with detail tape to ensure watertight installation.
 5. Corners: Seal lapped terminations and cut edges of sheet waterproofing at inside and outside corners with detail tape.
 6. Seal penetrations through sheet waterproofing to provide watertight seal with detail tape patches or wraps and a liquid-membrane troweling.
 7. Install sheet waterproofing and auxiliary materials to produce a continuous watertight tie into adjacent waterproofing.
 8. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Tape perimeter of damaged or nonconforming area extending 6 inches (150 mm) beyond repaired areas in all directions. Apply a patch of sheet waterproofing and firmly secure with detail tape.
 9. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.
- F. Molded-Sheet Drainage Panel Installation
1. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate, according to manufacturer's written instructions. Use adhesives or mechanical



fasteners that do not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.

- a. For vertical applications, install board insulation **OR** protection course, **as directed**, before installing drainage panels.

G. Insulation Installation

1. Install one or more layers of board insulation to achieve required thickness and insulation drainage panels over waterproofed surfaces. Cut and fit to within 3/4 inch (19 mm) of projections and penetrations.
2. On vertical surfaces, set insulation units in adhesive or tape applied according to manufacturer's written instructions.
3. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

H. Plaza Deck Paver Installation

1. Setting Bed: Install setting bed in locations and of thickness indicated to comply with requirements in Division 32 Section(s) "Unit Paving" OR Division 09 Section(s) "Stone Flooring", **as directed**.
2. Install concrete pavers in locations indicated according to manufacturer's written instructions.
3. Accurately install fixed **OR** adjustable, **as directed**, -height paver pedestals and accessories in locations and to elevations required. Adjust for final level and slope with shims.
 - a. Fill paver pedestal with concrete mix, strike smooth with top of pedestal, and cure according to ACI 301.
4. Loosely lay pavers on pedestals, maintaining a uniform open joint width. Tightly seat pavers against spacers to eliminate lateral movement or drift of paving assembly. Align joint patterns parallel in each direction.
 - a. Lay out pavers to avoid less-than-half-width pavers at perimeter or other terminations.
5. Install pavers to not vary more than 1/16 inch (1.6 mm) in elevation between adjacent pavers or more than 1/16 inch (1.6 mm) from surface plane elevation of individual paver.
6. Maintain tolerances of paving installation within 1/4 inch in 10 feet (1:48) of surface plane in any direction.

I. Field Quality Control

1. Flood Testing: Flood test each deck area for leaks, according to recommendations in ASTM D 5957, after completing waterproofing but before overlying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.
 - a. Flood to an average depth of 2-1/2 inches (64 mm) with a minimum depth of 1 inch (25 mm) and not exceeding a depth of 4 inches (100 mm). Maintain 2 inches (51 mm) of clearance from top of sheet flashings.
 - b. Flood each area for 24 **OR** 48 **OR** 72, **as directed**, hours.
 - c. After flood testing, repair leaks, repeat flood tests, and make further repairs until waterproofing installation is watertight.
2. Engage an independent testing agency to observe flood testing and examine underside of decks and terminations for evidence of leaks during flood testing.

J. Protection And Cleaning

1. Do not permit foot or vehicular traffic on unprotected membrane.
2. Protect waterproofing from damage and wear during remainder of construction period.
3. Protect installed board insulation **OR** insulation drainage panels, **as directed**, from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation will be subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
4. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.



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Task	Specification	Specification Description
03 01 30 71	01 22 16 00	No Specification Required



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SECTION 03 05 00 00 - CAST-IN-PLACE CONCRETE**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for cast-in-place concrete. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
 - a. Footings.
 - b. Foundation walls.
 - c. Slabs-on-grade.
 - d. Suspended slabs.
 - e. Concrete toppings.
 - f. Building frame members.
 - g. Building walls.

C. Definitions

1. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

D. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:
 - a. Product Data for Credit MR 4.1 and Credit MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - 1) Include statement indicating costs for each product having recycled content.
 - b. Design Mixtures for Credit ID 1.1: For each concrete mixture containing fly ash as a replacement for portland cement or other portland cement replacements and for equivalent concrete mixtures that do not contain portland cement replacements.
3. Design Mixtures: For each concrete mixture.
4. Shop Drawings: For steel reinforcement and formwork. Material test reports **OR** certificates, **as directed**.

E. Quality Assurance

1. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - a. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
2. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, **as directed**, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
3. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - a. ACI 301, "Specification for Structural Concrete," Sections 1 through 5 **OR** Sections 1 through 5 and Section 7, "Lightweight Concrete", **as directed**.
 - b. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
4. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.



5. Preinstallation Conference: Conduct conference at Project site.

F. Delivery, Storage, And Handling

1. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement, **as directed**.
2. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

1.2 PRODUCTS

A. Form-Facing Materials

1. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
2. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
3. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
4. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.
5. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.
6. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.
7. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
8. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
 - a. Formulate form-release agent with rust inhibitor for steel form-facing materials.
9. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - a. Furnish units that will leave no corrodible metal closer than 1 inch (25 mm) to the plane of exposed concrete surface.
 - b. Furnish ties that, when removed, will leave holes no larger than 1 inch (25 mm) in diameter in concrete surface.
 - c. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

B. Steel Reinforcement

1. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 **OR** 60, **as directed**, percent.
2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
3. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.
4. Galvanized Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420) **OR** ASTM A 706/A 706M, **as directed**, deformed bars, ASTM A 767/A 767M, Class I **OR** II, **as directed**, zinc coated after fabrication and bending.
5. Epoxy-Coated Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420) **OR** ASTM A 706/A 706M, **as directed**, deformed bars, ASTM A 775/A 775M **OR** ASTM A 934/A 934M, **as directed**, epoxy coated, with less than 2 percent damaged coating in each 12-inch (300-mm) bar length.
6. Stainless-Steel Reinforcing Bars: ASTM A 955/A 955M, Grade 60 (Grade 420), Type 304 **OR** 316L, **as directed**, deformed.



7. Steel Bar Mats: ASTM A 184/A 184M, fabricated from ASTM A 615/A 615M, Grade 60 (Grade 420) **OR** ASTM A 706/A 706M, **as directed**, deformed bars, assembled with clips.
8. Plain-Steel Wire: ASTM A 82, as drawn **OR** galvanized, **as directed**.
9. Deformed-Steel Wire: ASTM A 496.
10. Epoxy-Coated Wire: ASTM A 884/A 884M, Class A, Type 1 coated, as-drawn, plain-steel-wire **OR** deformed-steel wire, **as directed**, with less than 2 percent damaged coating in each 12-inch (300-mm) wire length.
11. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.
12. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.
13. Galvanized-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from galvanized steel wire into flat sheets.
14. Epoxy-Coated Welded Wire Reinforcement: ASTM A 884/A 884M, Class A coated, Type 1, plain **OR** deformed, **as directed**, steel.

C. Reinforcement Accessories

1. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, cut bars true to length with ends square and free of burrs.
2. Epoxy-Coated Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, ASTM A 775/A 775M epoxy coated.
3. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775/A 775M.
4. Zinc Repair Material: ASTM A 780, zinc-based solder, paint containing zinc dust, or sprayed zinc.
5. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - a. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
 - b. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
 - c. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

D. Concrete Materials

1. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 - a. Portland Cement: ASTM C 150, Type I **OR** II **OR** I/II **OR** III **OR** V, **as directed**, gray **OR** white, **as directed**. Supplement with the following:
 - 1) Fly Ash: ASTM C 618, Class C **OR** F, **as directed**.
 - 2) Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
 - b. Blended Hydraulic Cement: ASTM C 595, Type IS, portland blast-furnace slag **OR** IP, portland-pozzolan **OR** I (PM), pozzolan-modified portland **OR** I (SM), slag-modified Portland, **as directed**, cement.
2. Silica Fume: ASTM C 1240, amorphous silica.
3. Normal-Weight Aggregates: ASTM C 33, graded, 1-1/2-inch (38-mm) **OR** 1-inch (25-mm) **OR** 3/4-inch (19-mm), **as directed**, nominal maximum coarse-aggregate size.
 - a. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
4. Lightweight Aggregate: ASTM C 330, 1-inch (25-mm) **OR** 3/4-inch (19-mm) **OR** 1/2-inch (13-mm) **OR** 3/8-inch (10-mm), **as directed**, nominal maximum aggregate size.
5. Water: ASTM C 94/C 94M and potable, **as directed**.

E. Admixtures

1. Air-Entraining Admixture: ASTM C 260.



2. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - a. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - b. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - c. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - d. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - e. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 - f. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
 3. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494/C 494M, Type C.
 4. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.
 5. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, **as directed**, nonfading, and resistant to lime and other alkalis.
 - a. Color: As indicated by manufacturer's designation **OR** Match the Owner's sample **OR** As selected by the Owner from manufacturer's full range, **as directed**.
- F. Fiber Reinforcement
1. Carbon-Steel Fiber: ASTM A 820, deformed, minimum of 1.5 inches (38 mm) **OR** 2 inches (50 mm) **OR** 2.4 inches (60 mm), **as directed**, long, and aspect ratio of 35 to 40 **OR** 45 to 50 **OR** 60 to 65, **as directed**.
 - a. Fiber: Type 1, cold-drawn wire **OR** 2, cut sheet, **as directed**.
 2. Synthetic Micro-Fiber: Monofilament or fibrillated polypropylene micro-fibers engineered and designed for use in concrete, complying with ASTM C 1116/ C 1116M , Type III, 1/2 to 1-1/2 inches (13 to 38 mm) **OR** 1 to 2-1/4 inches (25 to 57 mm)long.
 3. Synthetic Macro-Fiber: Polyolefin macro-fibers engineered and designed for use in concrete, complying with ASTM C 1116/C 1116M, Type III, 1 to 2-1/4 inches (25 to 57 mm) long.
- G. Waterstops
1. Flexible Rubber Waterstops: CE CRD-C 513, with factory-installed metal eyelets, **as directed**, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
 - a. Profile: Flat, dumbbell with center bulb **OR** Flat, dumbbell without center bulb **OR** Ribbed with center bulb **OR** Ribbed without center bulb **OR** As indicated, **as directed**.
 - b. Dimensions: 4 inches by 3/16 inch thick (100 mm by 4.75 mm thick) **OR** 6 inches by 3/8 inch thick (150 mm by 10 mm thick) **OR** 9 inches by 3/8 inch thick (225 mm by 10 mm thick), **as directed**; nontapered.
 2. Chemically Resistant Flexible Waterstops: Thermoplastic elastomer rubber waterstops with factory-installed metal eyelets, **as directed**, for embedding in concrete to prevent passage of fluids through joints; resistant to oils, solvents, and chemicals. Factory fabricate corners, intersections, and directional changes.
 - a. Profile: Flat, dumbbell with center bulb **OR** Flat, dumbbell without center bulb **OR** Ribbed with center bulb **OR** Ribbed without center bulb **OR** As indicated, **as directed**.
 - b. Dimensions: 4 inches by 3/16 inch thick (100 mm by 4.75 mm thick) **OR** 6 inches by 3/16 inch thick (150 mm by 4.75 mm thick) **OR** 6 inches by 3/8 inch thick (150 mm by 10 mm thick) **OR** 9 inches by 3/16 inch thick (225 mm by 4.75 mm thick) **OR** 9 inches by 3/8 inch thick (225 mm by 10 mm thick), **as directed**; nontapered.
 3. Flexible PVC Waterstops: CE CRD-C 572, with factory-installed metal eyelets, **as directed**, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.



- a. Profile: Flat, dumbbell with center bulb **OR** Flat, dumbbell without center bulb **OR** Ribbed with center bulb **OR** Ribbed without center bulb **OR** As indicated, **as directed**.
 - b. Dimensions: 4 inches by 3/16 inch thick (100 mm by 4.75 mm thick) **OR** 6 inches by 3/8 inch thick (150 mm by 10 mm thick) **OR** 9 inches by 3/8 inch thick (225 mm by 10 mm thick), **as directed**; nontapered.
4. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch (19 by 25 mm).
 5. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer modified chloroprene rubber, for adhesive bonding to concrete, 3/8 by 3/4 inch (10 by 19 mm).
- H. Vapor Retarders
1. Plastic Vapor Retarder:
 - a. ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.
 - b. ASTM E 1745, Class B. Include manufacturer's recommended adhesive or pressure-sensitive tape.
 - c. ASTM E 1745, Class C, or polyethylene sheet, ASTM D 4397, not less than 10 mils (0.25 mm) thick, **as directed**. Include manufacturer's recommended adhesive or pressure-sensitive joint tape.
 2. Bituminous Vapor Retarder: 110-mil- (2.8-mm-) thick, semiflexible, 7-ply sheet membrane consisting of reinforced core and carrier sheet with fortified asphalt layers, protective weathercoating, and removable plastic release liner. Furnish manufacturer's accessories including bonding asphalt, pointing mastics, and self-adhering joint tape.
 - a. Water-Vapor Permeance: 0.00 grains/h x sq. ft. x inches Hg (0.00 ng/Pa x s x sq. m); ASTM E 154.
 - b. Tensile Strength: 140 lbf/in. (24.5 kN/m); ASTM E 154.
 - c. Puncture Resistance: 90 lbf (400N); ASTM E 154.
 3. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.
 4. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a 3/8-inch (9.5-mm) sieve, 10 to 30 percent passing a No. 100 (0.15-mm) sieve, and at least 5 percent passing No. 200 (0.075-mm) sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates.
- I. Floor And Slab Treatments
1. Slip-Resistive Emery Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive, crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials with 100 percent passing 3/8-inch (9.5-mm) **OR** No. 4 (4.75-mm) **OR** No. 8 (2.36-mm), **as directed**, sieve.
 2. Slip-Resistive Aluminum Granule Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of not less than 95 percent fused aluminum-oxide granules.
 3. Emery Dry-Shake Floor Hardener: Pigmented **OR** Unpigmented, **as directed**, factory-packaged, dry combination of portland cement, graded emery aggregate, and plasticizing admixture; with emery aggregate consisting of no less than 60 percent of total aggregate content.
 - a. Color: As indicated by manufacturer's designation **OR** Match the Owner's sample **OR** As selected by the Owner from manufacturer's full range, **as directed**.
 4. Metallic Dry-Shake Floor Hardener: Pigmented **OR** Unpigmented, **as directed**, factory-packaged, dry combination of portland cement, graded metallic aggregate, rust inhibitors, and plasticizing admixture; with metallic aggregate consisting of no less than 65 percent of total aggregate content.



- a. Color: As indicated by manufacturer's designation **OR** Match the Owner's sample **OR** As selected by the Owner from manufacturer's full range, **as directed**.
 5. Unpigmented Mineral Dry-Shake Floor Hardener: Factory-packaged dry combination of portland cement, graded quartz aggregate, and plasticizing admixture.
 6. Pigmented Mineral Dry-Shake Floor Hardener: Factory-packaged, dry combination of portland cement, graded quartz aggregate, color pigments, and plasticizing admixture. Use color pigments that are finely ground, nonfading mineral oxides interground with cement.
 - a. Color: As indicated by manufacturer's designation **OR** Match the Owner's sample **OR** As selected by the Owner from manufacturer's full range, **as directed**.
 7. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; colorless; that penetrates, hardens, and densifies concrete surfaces.
- J. Liquid Floor Treatments
1. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.
 2. Penetrating Liquid Floor Treatments for Polished Concrete Finish: Clear, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and is suitable for polished concrete surfaces.
- K. Curing Materials
1. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
 2. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.
 3. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
 4. Water: Potable.
 5. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
 6. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering, **as directed**.
 7. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, 18 to 25 percent solids, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering, **as directed**.
 8. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
 9. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
- L. Related Materials
1. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber **OR** ASTM D 1752, cork or self-expanding cork, **as directed**.
 2. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 **OR** aromatic polyurea with a Type A shore durometer hardness range of 90 to 95, **as directed**, per ASTM D 2240.
 3. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
 4. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
 - a. Types I and II, non-load bearing **OR** IV and V, load bearing, **as directed**, for bonding hardened or freshly mixed concrete to hardened concrete.
 5. Reglets: Fabricate reglets of not less than 0.0217-inch- (0.55-mm-) thick, galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.



6. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0336 inch (0.85 mm) thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

M. Repair Materials

1. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.
 - a. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - b. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 - c. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
 - d. Compressive Strength: Not less than 4100 psi (29 MPa) at 28 days when tested according to ASTM C 109/C 109M.
2. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.
 - a. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - b. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
 - c. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.
 - d. Compressive Strength: Not less than 5000 psi (34.5 MPa) at 28 days when tested according to ASTM C 109/C 109M.

N. Concrete Mixtures, General

1. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
 - a. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
2. Cementitious Materials: Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent **OR** Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows, **as directed**
 - a. Fly Ash: 25 percent.
 - b. Combined Fly Ash and Pozzolan: 25 percent.
 - c. Ground Granulated Blast-Furnace Slag: 50 percent.
 - d. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
 - e. Silica Fume: 10 percent.
 - f. Combined Fly Ash, Pozzolans, and Silica Fume: 35 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
 - g. Combined Fly Ash or Pozzolans, Ground Granulated Blast-Furnace Slag, and Silica Fume: 50 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
3. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 **OR** 0.15 **OR** 0.30 **OR** 1.00, **as directed**, percent by weight of cement.
4. Admixtures: Use admixtures according to manufacturer's written instructions.
 - a. Use water-reducing **OR** high-range water-reducing **OR** plasticizing, **as directed**, admixture in concrete, as required, for placement and workability.
 - b. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.



- c. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
 - d. Use corrosion-inhibiting admixture in concrete mixtures where indicated.
5. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

O. Concrete Mixtures For Building Elements

1. Footings: Proportion normal-weight concrete mixture as follows:
 - a. Minimum Compressive Strength: 5000 psi (34.5 MPa) **OR** 4500 psi (31 MPa) **OR** 4000 psi (27.6 MPa) **OR** 3500 psi (24.1 MPa) **OR** 3000 psi (20.7 MPa), **as directed**, at 28 days.
 - b. Maximum Water-Cementitious Materials Ratio: 0.50 **OR** 0.45 **OR** 0.40, **as directed**.
 - c. Slump Limit: 4 inches (100 mm) **OR** 5 inches (125 mm) **OR** 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, **as directed**, plus or minus 1 inch (25 mm).
 - d. Air Content:
 - 1) 5-1/2 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch (38-mm) nominal maximum aggregate size.
 - 2) 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch (25-mm) **OR** 3/4-inch (19-mm), **as directed**, nominal maximum aggregate size.
2. Foundation Walls: Proportion normal-weight concrete mixture as follows:
 - a. Minimum Compressive Strength: 5000 psi (34.5 MPa) **OR** 4500 psi (31 MPa) **OR** 4000 psi (27.6 MPa) **OR** 3500 psi (24.1 MPa) **OR** 3000 psi (20.7 MPa), **as directed**, at 28 days.
 - b. Maximum Water-Cementitious Materials Ratio: 0.50 **OR** 0.45 **OR** 0.40, **as directed**.
 - c. Slump Limit: 4 inches (100 mm) **OR** 5 inches (125 mm) **OR** 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, **as directed**, plus or minus 1 inch (25 mm).
 - d. Air Content:
 - 1) 5-1/2 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch (38-mm) nominal maximum aggregate size.
 - 2) 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch (25-mm) **OR** 3/4-inch (19-mm), **as directed**, nominal maximum aggregate size.
3. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:
 - a. Minimum Compressive Strength: 5000 psi (34.5 MPa) **OR** 4500 psi (31 MPa) **OR** 4000 psi (27.6 MPa) **OR** 3500 psi (24.1 MPa) **OR** 3000 psi (20.7 MPa), **as directed**, at 28 days.
 - b. Minimum Cementitious Materials Content: 470 lb/cu. yd. (279 kg/cu. m) **OR** 520 lb/cu. yd. (309 kg/cu. m) **OR** 540 lb/cu. yd. (320 kg/cu. m), **as directed**.
 - c. Slump Limit: 4 inches (100 mm) **OR** 5 inches (125 mm), **as directed**, plus or minus 1 inch (25 mm).
 - d. Air Content
 - 1) 5-1/2 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch (38-mm) nominal maximum aggregate size.
 - 2) 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch (25-mm) **OR** 3/4-inch (19-mm), **as directed**, nominal maximum aggregate size.
 - 3) Do not allow air content of troweled finished floors to exceed 3 percent.
 - e. Steel-Fiber Reinforcement: Add to concrete mixture, according to manufacturer's written instructions, at a rate of 50 lb/cu. yd. (29.7 kg/cu. m).
 - f. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd. (0.60 kg/cu. m) **OR** 1.5 lb/cu. yd. (0.90 kg/cu. m), **as directed**.
4. Suspended Slabs: Proportion normal-weight concrete mixture as follows:
 - a. Minimum Compressive Strength: 5000 psi (34.5 MPa) **OR** 4500 psi (31 MPa) **OR** 4000 psi (27.6 MPa) **OR** 3500 psi (24.1 MPa) **OR** 3000 psi (20.7 MPa), **as directed**, at 28 days.



- b. Minimum Cementitious Materials Content: 470 lb/cu. yd. (279 kg/cu. m) **OR** 520 lb/cu. yd. (309 kg/cu. m) **OR** 540 lb/cu. yd. (320 kg/cu. m), **as directed**.
 - c. Slump Limit: 4 inches (100 mm) **OR** 5 inches (125 mm), **as directed**, plus or minus 1 inch (25 mm).
 - d. Air Content:
 - 1) 5-1/2 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch (38-mm) nominal maximum aggregate size.
 - 2) 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch (25-mm) **OR** 3/4-inch (19-mm), **as directed**, nominal maximum aggregate size.
 - 3) Do not allow air content of troweled finished floors to exceed 3 percent.
 - e. Steel-Fiber Reinforcement: Add to concrete mixture, according to manufacturer's written instructions, at a rate of 50 lb/cu. yd. (29.7 kg/cu. m).
 - f. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd. (0.60 kg/cu. m) **OR** 1.5 lb/cu. yd. (0.90 kg/cu. m), **as directed**.
5. Suspended Slabs: Proportion structural lightweight concrete mixture as follows:
- a. Minimum Compressive Strength: 5000 psi (34.5 MPa) **OR** 4500 psi (31 MPa) **OR** 4000 psi (27.6 MPa) **OR** 3500 psi (24.1 MPa) **OR** 3000 psi (20.7 MPa), **as directed**, at 28 days.
 - b. Calculated Equilibrium Unit Weight: 115 lb/cu. ft. (1842 kg/cu. m) **OR** 110 lb/cu. ft. (1762 kg/cu. m) **OR** 105 lb/cu. ft. (1682 kg/cu. m), **as directed**, plus or minus 3 lb/cu. ft. (48.1 kg/cu. m) as determined by ASTM C 567.
 - c. Slump Limit: 4 inches (100 mm) **OR** 5 inches (125 mm), **as directed**, plus or minus 1 inch (25 mm).
 - d. Air Content:
 - 1) 6 percent, plus or minus 2 percent at point of delivery for nominal maximum aggregate size greater than 3/8 inch (10 mm).
 - 2) 7 percent, plus or minus 2 percent at point of delivery for nominal maximum aggregate size 3/8 inch (10 mm) or less.
 - 3) Do not allow air content of troweled finished floors to exceed 3 percent.
 - e. Steel-Fiber Reinforcement: Add to concrete mixture, according to manufacturer's written instructions, at a rate of 50 lb/cu. yd. (29.7 kg/cu. m).
 - f. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd. (0.60 kg/cu. m) **OR** 1.5 lb/cu. yd. (0.90 kg/cu. m), **as directed**.
6. Concrete Toppings: Proportion normal-weight concrete mixture as follows:
- a. Minimum Compressive Strength: 5000 psi (34.5 MPa) **OR** 4500 psi (31 MPa) **OR** 4000 psi (27.6 MPa) **OR** 3500 psi (24.1 MPa) **OR** 3000 psi (20.7 MPa), **as directed**, at 28 days.
 - b. Minimum Cementitious Materials Content: 470 lb/cu. yd. (279 kg/cu. m) **OR** 520 lb/cu. yd. (309 kg/cu. m) **OR** 540 lb/cu. yd. (320 kg/cu. m), **as directed**.
 - c. Slump Limit: 4 inches (100 mm) **OR** 5 inches (125 mm), **as directed**, plus or minus 1 inch (25 mm).
 - d. Air Content:
 - 1) 5-1/2 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch (38-mm) nominal maximum aggregate size.
 - 2) 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch (25-mm) **OR** 3/4-inch (19-mm), **as directed**, nominal maximum aggregate size.
 - 3) Do not allow air content of troweled finished toppings to exceed 3 percent.
 - e. Steel-Fiber Reinforcement: Add to concrete mixture, according to manufacturer's written instructions, at a rate of 50 lb/cu. yd. (29.7 kg/cu. m).
 - f. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd. (0.60 kg/cu. m) **OR** 1.5 lb/cu. yd. (0.90 kg/cu. m), **as directed**.
7. Building Frame Members: Proportion normal-weight concrete mixture as follows:
- a. Minimum Compressive Strength: 5000 psi (34.5 MPa) **OR** 4500 psi (31 MPa) **OR** 4000 psi (27.6 MPa) **OR** 3500 psi (24.1 MPa) **OR** 3000 psi (20.7 MPa), **as directed**, at 28 days.
 - b. Maximum Water-Cementitious Materials Ratio: 0.50 **OR** 0.45 **OR** 0.40, **as directed**.



- c. Slump Limit: 4 inches (100 mm) **OR** 5 inches (125 mm) **OR** 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, **as directed**, plus or minus 1 inch (25 mm).
 - d. Air Content:
 - 1) 5-1/2 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch (38-mm) nominal maximum aggregate size.
 - 2) 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch (25-mm) **OR** 3/4-inch (19-mm), **as directed**, nominal maximum aggregate size.
8. Building Walls: Proportion normal-weight concrete mixture as follows:
- a. Minimum Compressive Strength: 5000 psi (34.5 MPa) **OR** 4500 psi (31 MPa) **OR** 4000 psi (27.6 MPa) **OR** 3500 psi (24.1 MPa) **OR** 3000 psi (20.7 MPa), **as directed**, at 28 days.
 - b. Maximum Water-Cementitious Materials Ratio: 0.50 **OR** 0.45 **OR** 0.40, **as directed**.
 - c. Slump Limit: 4 inches (100 mm) **OR** 5 inches (125 mm) **OR** 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, **as directed**, plus or minus 1 inch (25 mm).
 - d. Air Content:
 - 1) 5-1/2 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch (38-mm) nominal maximum aggregate size.
 - 2) 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch (25-mm) **OR** 3/4-inch (19-mm), **as directed**, nominal maximum aggregate size.

P. Fabricating Reinforcement

- 1. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

Q. Concrete Mixing

- 1. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116, **as directed**, and furnish batch ticket information.
 - a. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.
- 2. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
 - a. For mixer capacity of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
 - b. For mixer capacity larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
 - c. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

1.3 EXECUTION

A. Formwork

- 1. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- 2. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- 3. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
 - a. Class A, 1/8 inch (3.2 mm) for smooth-formed finished surfaces.



- b. Class B, 1/4 inch (6 mm) **OR** Class C, 1/2 inch (13 mm) **OR** Class D, 1 inch (25 mm), **as directed**, for rough-formed finished surfaces.
 4. Construct forms tight enough to prevent loss of concrete mortar.
 5. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - a. Install keyways, reglets, recesses, and the like, for easy removal.
 - b. Do not use rust-stained steel form-facing material.
 6. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
 7. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
 8. Chamfer **OR** Do not chamfer, **as directed**, exterior corners and edges of permanently exposed concrete.
 9. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
 10. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
 11. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
 12. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.
- B. Embedded Items
1. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - a. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
 - b. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
 - c. Install dovetail anchor slots in concrete structures as indicated.
- C. Removing And Reusing Forms
1. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.
 - a. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of, **as directed**, its 28-day design compressive strength.
 - b. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
 2. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
 3. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by the Owner.
- D. Shores And Reshores



1. Comply with ACI 318 (ACI 318M) and ACI 301 for design, installation, and removal of shoring and reshoring.
 - a. Do not remove shoring or reshoring until measurement of slab tolerances is complete.
2. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.
3. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

E. Vapor Retarders

1. Plastic Vapor Retarders: Place, protect, and repair vapor retarders according to ASTM E 1643 and manufacturer's written instructions.
 - a. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.
2. Bituminous Vapor Retarders: Place, protect, and repair vapor retarders according to manufacturer's written instructions.
3. Granular Course: Cover vapor retarder with granular fill **OR** fine-graded granular material, **as directed**, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch (0 mm) or minus 3/4 inch (19 mm).
 - a. Place and compact a 1/2-inch- (13-mm-) thick layer of fine-graded granular material over granular fill.

F. Steel Reinforcement

1. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
 - a. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
2. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
3. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
 - a. Weld reinforcing bars according to AWS D1.4, where indicated.
4. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
5. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.
6. Epoxy-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M. Use epoxy-coated steel wire ties to fasten epoxy-coated steel reinforcement.
7. Zinc-Coated Reinforcement: Repair cut and damaged zinc coatings with zinc repair material according to ASTM A 780. Use galvanized steel wire ties to fasten zinc-coated steel reinforcement.

G. Joints

1. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
2. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by the Owner.
 - a. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 - b. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
 - c. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 - d. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.



- e. Space vertical joints in walls, **as directed**. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
 - f. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 - g. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
3. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
 - a. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 - b. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
 4. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - a. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
 - b. Terminate full-width joint-filler strips not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished concrete surface where joint sealants, specified in Division 07 Section "Joint Sealants", are indicated.
 - c. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
 5. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.
- H. Waterstops
1. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.
 2. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.
- I. Concrete Placement
1. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
 2. Do not add water to concrete during delivery, at Project site, or during placement unless approved by the Owner.
 3. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
 - a. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
 4. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 - a. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - b. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
 - c. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6



inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

5. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 - a. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - b. Maintain reinforcement in position on chairs during concrete placement.
 - c. Screed slab surfaces with a straightedge and strike off to correct elevations.
 - d. Slope surfaces uniformly to drains where required.
 - e. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
6. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - a. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 - b. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - c. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
7. Hot-Weather Placement: Comply with ACI 301 and as follows:
 - a. Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - b. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

J. Finishing Formed Surfaces

1. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - a. Apply to concrete surfaces not exposed to public view.
2. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - a. Apply to concrete surfaces exposed to public view, **OR** to receive a rubbed finish, **OR** to be covered with a coating or covering material applied directly to concrete, **as directed**.
3. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:
 - a. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
 - b. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.



7. Slip-Resistive Finish: Before final floating, apply slip-resistive aggregate **OR** aluminum granule, **as directed**, finish where indicated and to concrete stair treads, platforms, and ramps. Apply according to manufacturer's written instructions and as follows:
 - a. Uniformly spread 25 lb/100 sq. ft. (12 kg/10 sq. m) of dampened slip-resistive aggregate **OR** aluminum granules, **as directed**, over surface in 1 or 2 applications. Tamp aggregate flush with surface, but do not force below surface.
 - b. After broadcasting and tamping, apply float finish.
 - c. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive aggregate **OR** aluminum granules, **as directed**.
8. Dry-Shake Floor Hardener Finish: After initial floating, apply dry-shake floor hardener to surfaces according to manufacturer's written instructions and as follows:
 - a. Uniformly apply dry-shake floor hardener at a rate of 100 lb/100 sq. ft. (49 kg/10 sq. m), **as directed**, unless greater amount is recommended by manufacturer.
 - b. Uniformly distribute approximately two-thirds of dry-shake floor hardener over surface by hand or with mechanical spreader, and embed by power floating. Follow power floating with a second dry-shake floor hardener application, uniformly distributing remainder of material, and embed by power floating.
 - c. After final floating, apply a trowel finish. Cure concrete with curing compound recommended by dry-shake floor hardener manufacturer and apply immediately after final finishing.

L. Miscellaneous Concrete Items

1. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
2. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
3. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.
4. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.

M. Concrete Protecting And Curing

1. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
2. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
3. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.
4. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
5. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - a. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - 1) Water.
 - 2) Continuous water-fog spray.



- 3) Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
 - b. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - 1) Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - 2) Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - 3) Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.
 - c. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - 1) After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.
 - d. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.
- N. Liquid Floor Treatments
1. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.
 - a. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
 - b. Do not apply to concrete that is less than three **OR** seven **OR** 14 **OR** 28, **as directed**, days' old.
 - c. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.
 2. Polished Concrete Floor Treatment: Apply polished concrete finish system to cured and prepared slabs to match.
 - a. Machine grind floor surfaces to receive polished finishes level and smooth and to depth required to reveal aggregate to match.
 - b. Apply penetrating liquid floor treatment for polished concrete in polishing sequence and according to manufacturer's written instructions, allowing recommended drying time between successive coats.
 - c. Continue polishing with progressively finer grit diamond polishing pads to gloss level to match approved mockup.
 - d. Control and dispose of waste products produced by grinding and polishing operations.
 - e. Neutralize and clean polished floor surfaces.
 3. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.
- O. Joint Filling
1. Prepare, clean, and install joint filler according to manufacturer's written instructions.
 - a. Defer joint filling until concrete has aged at least one **OR** six, **as directed**, month(s). Do not fill joints until construction traffic has permanently ceased.



2. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
3. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

P. Concrete Surface Repairs

1. Defective Concrete: Repair and patch defective areas when approved by the Owner. Remove and replace concrete that cannot be repaired and patched to the Owner's approval.
2. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.
3. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 - a. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension in solid concrete, but not less than 1 inch (25 mm) in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 - b. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 - c. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by the Owner.
4. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 - a. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 - b. After concrete has cured at least 14 days, correct high areas by grinding.
 - c. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 - d. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 - e. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 - f. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 - g. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt,



and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

5. Perform structural repairs of concrete, subject to the Owner's approval, using epoxy adhesive and patching mortar.
6. Repair materials and installation not specified above may be used, subject to the Owner's approval.

Q. Field Quality Control

1. Testing and Inspecting: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
2. Inspections:
 - a. Steel reinforcement placement.
 - b. Steel reinforcement welding.
 - c. Headed bolts and studs.
 - d. Verification of use of required design mixture.
 - e. Concrete placement, including conveying and depositing.
 - f. Curing procedures and maintenance of curing temperature.
 - g. Verification of concrete strength before removal of shores and forms from beams and slabs.
3. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 - a. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. (76 cu. m) or fraction thereof of each concrete mixture placed each day.
 - 1) When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 - b. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 - c. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173/C 173M, volumetric method, for structural lightweight concrete, **as directed**; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - d. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
 - e. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - f. Compression Test Specimens: ASTM C 31/C 31M.
 - 1) Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
 - 2) Cast and field cure two sets of two standard cylinder specimens for each composite sample.
 - g. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
 - 1) Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
 - 2) A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
 - h. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
 - i. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength



and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).

- j. Test results shall be reported in writing to the Owner, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
 - k. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by the Owner but will not be used as sole basis for approval or rejection of concrete.
 - l. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by the Owner. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by the Owner.
 - m. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 - n. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
4. Measure floor and slab flatness and levelness according to ASTM E 1155 (ASTM E 1155M) within 24 **OR** 48, **as directed**, hours of finishing.
- R. Protection Of Liquid Floor Treatments
- 1. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION 03 05 00 00



Task	Specification	Specification Description
03 11 13 00	01 22 16 00	No Specification Required
03 11 13 00	03 05 00 00	Cast-In-Place Concrete



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SECTION 03 11 16 00 - CAST-IN-PLACE ARCHITECTURAL CONCRETE

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for cast-in-place architectural concrete. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section specifies cast-in-place architectural concrete including form facings, reinforcement accessories, concrete materials, concrete mixture design, placement procedures, and finishes.

C. Definitions

1. Cast-in-Place Architectural Concrete: Formed concrete that is exposed to view on surfaces of completed structure or building and that requires special concrete materials, formwork, placement, or finishes to obtain specified architectural appearance.
2. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.
3. Design Reference Sample: Sample designated by the Owner in the Contract Documents that reflects acceptable surface quality and appearance of cast-in-place architectural concrete.
4. Reveal: Projection of coarse aggregate from matrix or mortar after completion of exposure operations.

D. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:
 - a. Product Data for Credit MR 4.1 and Credit MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - 1) Include statement indicating costs for each product having recycled content.
 - b. Design Mixtures for Credit ID 1.1: For each concrete mixture containing fly ash as a replacement for portland cement or other portland cement replacements and for equivalent concrete mixtures that do not contain portland cement replacements.
3. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - a. Indicate amounts of mixing water to be withheld for later addition at Project site.
4. Formwork Shop Drawings: Show formwork construction including form-facing joints, rustications, construction and contraction joints, form joint-sealant details, form tie locations and patterns, inserts and embedments, cutouts, cleanout panels, and other items that visually affect cast-in-place architectural concrete.
5. Placement Schedule: Submit concrete placement schedule before start of placement operations. Include locations of all joints including construction joints.
6. Samples: For each of the following materials:
 - a. Form-facing panel.
 - b. Form ties.
 - c. Form liners.
 - d. Coarse- and fine-aggregate gradations.
 - e. Chamfers and rustications.
7. Material test reports **OR** certificates, **as directed**.



E. Quality Assurance

1. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - a. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
2. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
 - a. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
 - b. Personnel performing laboratory tests shall be an ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.
3. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - a. ACI 301, "Specification for Structural Concrete," Sections 1 through 5 **OR** Sections 1 through 5 and Section 6, "Architectural Concrete", **as directed**.
 - b. ACI 303.1, "Specification for Cast-in-Place Architectural Concrete."
4. Field Sample Panels: After approval of verification sample and before casting architectural concrete, produce field sample panels to demonstrate the approved range of selections made under sample submittals. Produce a minimum of 3 sets of full-scale panels, cast vertically, approximately 48 by 48 by 6 inches (1200 by 1200 by 150 mm) minimum, to demonstrate the expected range of finish, color, and texture variations.
5. Preinstallation Conference: Conduct conference at Project site.

1.2 PRODUCTS

A. Form-Facing Materials

1. General: Comply with Division 03 Section "Cast-in-place Concrete" for formwork and other form-facing material requirements.
2. Form-Facing Panels for As-Cast **OR** Exposed-Aggregate, **as directed**, Finishes: Steel, glass-fiber-reinforced plastic, or other approved nonabsorptive panel materials that will provide continuous, true, and smooth architectural concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
3. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will provide surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
4. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.
5. Form Liners: Units of face design, texture, arrangement, and configuration indicated **OR** to match design reference sample, **as directed**. Furnish with manufacturer's recommended liquid-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent surface treatments of concrete.
6. Rustication Strips: Metal, rigid plastic, or dressed wood with sides beveled and back kerfed; nonstaining; in longest practicable lengths.
7. Chamfer Strips: Metal, rigid plastic, elastomeric rubber, or dressed wood, 3/4 by 3/4 inch (19 by 19 mm), minimum; nonstaining; in longest practicable lengths.
8. Form Joint Tape: Compressible foam tape; pressure sensitive; AAMA 800, "Specification 810.1, Expanded Cellular Glazing Tape"; minimum 1/4 inch (6 mm) thick.
9. Form Joint Sealant: Elastomeric sealant complying with ASTM C 920, Type M or S, Grade NS, that adheres to form joint substrates.
10. Sealer: Penetrating, clear, polyurethane wood form sealer formulated to reduce absorption of bleed water and prevent migration of set-retarding chemicals from wood.



11. Form-Release Agent: Commercially formulated colorless form-release agent that will not bond with, stain, or adversely affect architectural concrete surfaces and will not impair subsequent treatments of those surfaces.
 - a. Formulate form-release agent with rust inhibitor for steel form-facing materials.
 12. Surface Retarder: Chemical liquid set retarder, for application on form-facing materials, capable of temporarily delaying final hardening of newly placed concrete surface to depth of reveal specified.
 13. Form Ties: Factory-fabricated, glass-fiber-reinforced plastic **OR** internally disconnecting **OR** removable, **as directed**, ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - a. Furnish ties with tapered tie cone spreaders, **as directed**, that, when removed, will leave holes 3/4 inch (19 mm) **OR** 1 inch (25 mm) **OR** 1-1/4 inches (32 mm) **OR** 1-1/2 inches (38 mm), **as directed**, in diameter on concrete surface.
 - b. Furnish internally disconnecting ties that will leave no metal closer than 1-1/2 inches (38 mm), after exposing aggregate, **as directed**, from the architectural concrete surface.
 - c. Furnish glass-fiber-reinforced plastic ties, not less than 1/2 inch (13 mm) in diameter, of color to match the Owner's sample **OR** selected by the Owner from manufacturer's full range, **as directed**.
 - d. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.
- B. Steel Reinforcement And Accessories
1. General: Comply with Division 03 Section "Cast-in-place Concrete" for steel reinforcement and other requirements for reinforcement accessories.
 2. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 **OR** 60, **as directed**, percent.
 3. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire fabric in place; manufacture according to CRSI's "Manual of Standard Practice."
 - a. Where legs of wire bar supports contact forms, use gray, all-plastic **OR** CRSI Class 1, gray, plastic-protected **OR** CRSI Class 2, stainless-steel, **as directed**, bar supports.
- C. Concrete Materials
1. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 - a. Portland Cement: ASTM C 150, Type I **OR** II **OR** I/II **OR** III, **as directed**, gray **OR** white, **as directed**. Supplement with the following:, **as directed**
 - 1) Fly Ash: ASTM C 618, Class C **OR** F, **as directed**.
 - 2) Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
 - 3) Silica Fume: ASTM C 1240, amorphous silica.
 - b. Blended Hydraulic Cement: ASTM C 595, Type IS, portland blast-furnace slag **OR** IP, portland-pozzolan **OR** (PM), pozzolan-modified Portland **OR** I (SM), slag-modified Portland, **as directed**, cement.
 2. Normal-Weight Aggregates: ASTM C 33, Class 5S **OR** 5M **OR** 1N, **as directed**, coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials, **as directed**.
 - a. Maximum Coarse Aggregate Size: 1 inch (25 mm) **OR** 3/4 inch (19 mm) **OR** 1/2 inch (13 mm) **OR** 3/8 inch (10 mm), **as directed**.
 - b. Gradation: Uniformly **OR** Gap, **as directed**, graded.
 3. Normal-Weight Fine Aggregate: ASTM C 33 **OR** ASTM C 144, **as directed**, manufactured or natural sand, from same source for entire Project.
 4. Water: Potable, complying with ASTM C 94/C 94M except free of wash water from mixer washout operations.



D. Admixtures

1. Air-Entraining Admixture: ASTM C 260.
2. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - a. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - b. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - c. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - d. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - e. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 - f. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
3. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, **as directed**, nonfading, and resistant to lime and other alkalis.
 - a. Color: As indicated by manufacturer's designation **OR** Match the Owner's sample **OR** As selected by the Owner from manufacturer's full range, **as directed**.

E. Curing Materials

1. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.
2. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
3. Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.
 - a. For integrally colored concrete, curing compound shall be pigmented type, **as directed**, approved by color pigment manufacturer.
 - b. For concrete indicated to be sealed, curing compound shall be compatible with sealer.

F. Repair Materials

1. Bonding Agent: ASTM C 1059, Type II, nonredispersible, acrylic emulsion or styrene butadiene.
2. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements.
 - a. Types I and II, non-load bearing **OR** IV and V, load bearing, **as directed**, for bonding hardened or freshly mixed concrete to hardened concrete.

G. Concrete Mixtures, General

1. Prepare design mixtures for each type and strength of cast-in-place architectural concrete proportioned on basis of laboratory trial mixture or field test data, or both, according to ACI 301.
 - a. Use a qualified independent testing agency for preparing and reporting proposed design mixtures based on laboratory trial mixtures.
2. Proportion concrete mixtures as follows:
 - a. Compressive Strength (28 Days): 5000 psi (34.5 MPa) **OR** 4500 psi (31 MPa) **OR** 4000 psi (27.6 MPa) **OR** 3500 psi (24.1 MPa) **OR** 3000 psi (20.7 MPa), **as directed**.
 - b. Maximum Water-Cementitious Materials Ratio: 0.46.
 - c. Slump Limit: 3 inches (75 mm) **OR** 4 inches (100 mm) **OR** 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, **as directed**, plus or minus 1 inch (25 mm).
 - d. Air Content:
 - 1) 5-1/2 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch (38-mm) nominal maximum aggregate size.
 - 2) 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch (25-mm) **OR** 3/4-inch (19-mm), **as directed**, nominal maximum aggregate size.
3. Cementitious Materials: For cast-in-place architectural concrete exposed to deicers, limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements. Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica



- fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent, **as directed**.
4. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 **OR** 0.15 **OR** 0.30 **OR** 1.00, **as directed**, percent by weight of cement.
 5. Admixtures: Use admixtures according to manufacturer's written instructions.
 6. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

H. Concrete Mixing

1. Ready-Mixed or Site-Mixed Architectural Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and furnish batch ticket information.
 - a. Clean equipment used to mix and deliver cast-in-place architectural concrete to prevent contamination from other concrete.
 - b. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

1.3 EXECUTION

A. Formwork

1. General: Comply with Division 03 Section "Cast-in-place Concrete" for formwork, embedded items, and shoring and reshoring.
2. Limit deflection of form-facing panels to not exceed ACI 303.1 requirements.
3. In addition to ACI 303.1 limits on form-facing panel deflection, limit cast-in-place architectural concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
 - a. Class A, 1/8 inch (3.2 mm) **OR** B, 1/4 inch (6 mm) **OR** C, 1/2 inch (13 mm), **as directed**.
4. Fabricate forms to result in cast-in-place architectural concrete that complies with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
 - a. In addition to ACI 117, comply with the following tolerances: **<Insert tolerances.>**
5. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-in-place surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood rustications, keyways, reglets, recesses, and the like, for easy removal.
 - a. Seal form joints and penetrations at form ties with form joint tape or form joint sealant to prevent cement paste leakage.
 - b. Do not use rust-stained steel form-facing material.
6. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
7. Chamfer **OR** Do not chamfer, **as directed**, exterior corners and edges of cast-in-place architectural concrete.
8. Coat contact surfaces of wood rustications and chamfer strips with sealer before placing reinforcement, anchoring devices, and embedded items.
9. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
10. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
11. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
12. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.
13. Coat contact surfaces of forms with surface retarder, according to manufacturer's written instructions, before placing reinforcement.
14. Place form liners accurately to provide finished surface texture indicated. Provide solid backing and attach securely to prevent deflection and maintain stability of liners during concreting.



Prevent form liners from sagging and stretching in hot weather. Seal joints of form liners and form liner accessories to prevent mortar leaks. Coat form liner with form-release agent.

B. Reinforcement And Inserts

1. General: Comply with Division 03 Section "Cast-in-place Concrete" for fabricating and installing steel reinforcement. Securely fasten steel reinforcement and wire ties against shifting during concrete placement.
2. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

C. Removing And Reusing Forms

1. Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.
 - a. Schedule form removal to maintain surface appearance that matches approved field sample panels.
 - b. Cut off and grind glass-fiber-reinforced plastic form ties flush with surface of concrete.
2. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved 28-day design compressive strength **OR** at least 70 percent of 28-day design compressive strength, **as directed**. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
3. Clean and repair surfaces of forms to be reused in the Work. Do not use split, frayed, delaminated, or otherwise damaged form-facing material. Apply new form-release agent.
4. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for cast-in-place architectural concrete surfaces.

D. Joints

1. Construction Joints: Install construction joints true to line with faces perpendicular to surface plane of cast-in-place architectural concrete so strength and appearance of concrete are not impaired, at locations indicated or as approved by the Owner.
 - a. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated.
 - b. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete, **as directed**. Align construction joint within rustications attached to form-facing material.
 - c. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 - d. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 - e. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
 - f. Use bonding agent **OR** epoxy-bonding adhesive, **as directed**, at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
2. Contraction Joints: Form weakened-plane contraction joints true to line with faces perpendicular to surface plane of cast-in-place architectural concrete so strength and appearance of concrete are not impaired, at locations indicated or as approved by the Owner.

E. Concrete Placement

1. Before placing concrete, verify that installation of formwork, form-release agent, reinforcement, and embedded items is complete and that required inspections have been performed.
2. Do not add water to concrete during delivery, at Project site, or during placement unless approved by the Owner.
3. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.



- a. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
 4. Deposit concrete continuously between construction joints. Deposit concrete to avoid segregation.
 - a. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - b. Consolidate placed concrete with mechanical vibrating equipment according to ACI 303.1.
 - c. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. Do not permit vibrators to contact forms.
 5. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - a. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 - b. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - c. Do not use calcium chloride, salt, or other materials containing antifreeze agents.
 - d. Do not use chemical accelerators unless otherwise specified and approved in design mixtures.
 6. Hot-Weather Placement: Comply with ACI 301 and as follows:
 - a. Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - b. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.
- F. Finishes, General
1. Architectural Concrete Finish: Match the Owner's design reference sample, identified and described as indicated, to satisfaction of the Owner.
 2. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces.
 - a. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.
 3. Maintain uniformity of special finishes over construction joints, unless otherwise indicated.
- G. As-Cast Formed Finishes
1. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections exceeding specified limits on formed-surface irregularities.
 2. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Remove fins and other projections exceeding specified limits on formed-surface irregularities. Repair **OR** Do not repair, **as directed**, and patch tie holes and defects.
 3. Rubbed Finish: Apply the following to smooth-form-finished as-cast concrete where indicated:
 - a. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
 - b. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland



cement in amounts determined by trial patches so color of dry grout will match surrounding concrete. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.

- c. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match surrounding concrete. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.
4. Form-Liner Finish: Produce a textured surface free of pockets, streaks, and honeycombs, and of uniform appearance, color, and texture.

H. Exposed-Aggregate Finishes

1. Scrubbed Finish: After concrete has achieved a compressive strength of from 1000 to 1500 psi (6.9 to 10.3 MPa), apply scrubbed finish. Wet concrete surfaces thoroughly and scrub with stiff fiber or wire brushes, using water freely, until top mortar surface is removed and aggregate is uniformly exposed. Rinse scrubbed surfaces with clean water. Maintain continuity of finish on each surface or area of Work. Remove only enough concrete mortar from surfaces to match design reference sample.
2. High-Pressure Water-Jet Finish: Perform high-pressure water jetting on concrete that has achieved a minimum compressive strength of 4500 psi (31 MPa). Coordinate with formwork removal to ensure that surfaces to be high-pressure water-jet finished are treated at same age for uniform results.
 - a. Surface Continuity: Perform high-pressure water-jet finishing in as continuous an operation as possible, maintaining continuity of finish on each surface or area of Work. Maintain required patterns or variances in reveal projection to match design reference sample.
3. Abrasive-Blast Finish: Perform abrasive blasting after compressive strength of concrete exceeds 2000 psi (13.8 MPa). Coordinate with formwork removal to ensure that surfaces to be abrasive blasted are treated at same age for uniform results.
 - a. Surface Continuity: Perform abrasive-blast finishing in as continuous an operation as possible, maintaining continuity of finish on each surface or area of Work. Maintain required patterns or variances in depths of blast to match design reference sample.
 - b. Abrasive Blasting: Abrasive blast corners and edges of patterns carefully, using backup boards, to maintain uniform corner or edge line. Determine type of nozzle, nozzle pressure, and blasting techniques required to match design reference sample.
 - c. Depth of Cut: Use an abrasive grit of proper type and gradation to expose aggregate and surrounding matrix surfaces to match design reference sample, as follows:
 - 1) Brush: Remove cement matrix to dull surface sheen and expose face of fine aggregate; with no significant reveal.
 - 2) Light: Expose fine aggregate with occasional exposure of coarse aggregate and uniform color; with maximum reveal of 1/16 inch (1.5 mm).
 - 3) Medium: Generally expose coarse aggregate; with slight reveal, a maximum of 1/4 inch (6 mm).
 - 4) Heavy: Expose and reveal coarse aggregate to a maximum projection of one-third its diameter; with reveal range of 1/4 to 1/2 inch (6 to 13 mm).
4. Bushhammer Finish: Allow concrete to cure at least 14 days before starting bushhammer surface finish operations.
 - a. Surface Continuity: Perform bushhammer finishing in as continuous an operation as possible, maintaining continuity of finish on each surface or area of Work. Maintain required patterns or variances of cut as shown on Drawings or to match design reference sample or mockup.
 - b. Surface Cut: Maintain required depth of cut and general aggregate exposure. Use power tool with hammer attachments for large, flat surfaces, and use hand hammers for small areas, at corners and edges, and for restricted locations where power tools cannot reach.
 - c. Remove impressions of formwork and form facings with exception of tie holes.



- I. Concrete Protecting And Curing
1. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with ACI 301 for hot-weather protection during curing.
 2. Begin curing cast-in-place architectural concrete immediately after removing forms from **OR** applying as-cast formed finishes to, **as directed**, concrete. Cure according to ACI 308.1, by one or a combination of the following methods that will not mottle, discolor, or stain concrete:
 - a. Moisture Curing: Keep exposed surfaces of cast-in-place architectural concrete continuously moist for not less than seven days with the following materials:
 - 1) Water.
 - 2) Continuous water-fog spray.
 - 3) Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
 - b. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period; use cover material and waterproof tape.
 - c. Curing Compound: Mist concrete surfaces with water. Apply curing compound uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
- J. Field Quality Control
1. General: Comply with Division 03 Section "Cast-in-place Concrete" for field quality-control requirements.
- K. Repairs, Protection, And Cleaning
1. Repair and cure damaged finished surfaces of cast-in-place architectural concrete when approved by the Owner. Match repairs to color, texture, and uniformity of surrounding surfaces and to repairs on approved mockups.
 - a. Remove and replace cast-in-place architectural concrete that cannot be repaired and cured to the Owner's approval.
 2. Protect corners, edges, and surfaces of cast-in-place architectural concrete from damage; use guards and barricades.
 3. Protect cast-in-place architectural concrete from staining, laitance, and contamination during remainder of construction period.
 4. Clean cast-in-place architectural concrete surfaces after finish treatment to remove stains, markings, dust, and debris.
 5. Wash and rinse surfaces according to concrete finish applicator's written recommendations. Protect other Work from staining or damage due to cleaning operations.
 - a. Do not use cleaning materials or processes that could change the appearance of cast-in-place architectural concrete finishes.

END OF SECTION 03 11 16 00



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Task	Specification	Specification Description
03 11 16 00	03 05 00 00	Cast-In-Place Concrete
03 11 23 00	01 22 16 00	No Specification Required
03 11 23 00	03 05 00 00	Cast-In-Place Concrete
03 15 13 13	03 05 00 00	Cast-In-Place Concrete
03 15 13 16	03 05 00 00	Cast-In-Place Concrete
03 15 16 00	03 05 00 00	Cast-In-Place Concrete
03 15 19 00	05 50 00 00	Metal Fabrications
03 21 11 00	03 05 00 00	Cast-In-Place Concrete
03 21 16 00	03 05 00 00	Cast-In-Place Concrete



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SECTION 03 31 13 00 - CEMENT CONCRETE PAVEMENT

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for cement concrete pavement. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Driveways.
 - b. Roadways.
 - c. Parking lots.
 - d. Curbs and gutters.
 - e. Walks.

C. Definitions

1. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

D. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:
 - a. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.
 - b. Design Mixtures for Credit ID 1.1: For each concrete mixture containing fly ash as a replacement for portland cement or other portland cement replacements. For each design mixture submitted, include an equivalent concrete mixture that does not contain portland cement replacements, to determine amount of portland cement replaced.
3. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.
4. Samples: For each type of product or exposed finish, prepared as Samples of size indicated below:
 - a. Exposed Aggregate: 10-lb (4.5-kg) Sample of each mix.
 - b. Wheel Stops: 6 inches (150 mm) long showing cross section; with fasteners.
 - c. Preformed Traffic-Calming Devices: 6 inches (150 mm) long showing cross section; with fasteners.
5. Other Action Submittals:
 - a. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
6. Qualification Data: For qualified Installer of detectable warnings, ready-mix concrete manufacturer and testing agency.
7. Material Certificates: For the following, from manufacturer:
 - a. Cementitious materials.
 - b. Steel reinforcement and reinforcement accessories.
 - c. Fiber reinforcement.
 - d. Admixtures.
 - e. Curing compounds.
 - f. Applied finish materials.



- g. Bonding agent or epoxy adhesive.
- h. Joint fillers.
- 8. Material Test Reports: For each of the following:
 - a. Aggregates. Include service-record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.
- 9. Field quality-control reports.

E. Quality Assurance

- 1. Detectable Warning Installer Qualifications: An employer of workers trained and approved by manufacturer of stamped concrete paving systems.
- 2. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - a. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").
- 3. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
 - a. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
- 4. Concrete Testing Service: Engage a qualified testing agency to perform material evaluation tests and to design concrete mixtures.
- 5. ACI Publications: Comply with ACI 301 (ACI 301M) unless otherwise indicated.
- 6. Preinstallation Conference: Conduct conference at Project site.

F. Project Conditions

- 1. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.
- 2. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F (4.4 deg C) for oil-based materials **OR** 55 deg F (12.8 deg C) for water-based materials, **as directed**, and not exceeding 95 deg F (35 deg C).

1.2 PRODUCTS

A. Forms

- 1. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.
 - a. Use flexible or uniformly curved forms for curves with a radius of 100 feet (30.5 m) or less. Do not use notched and bent forms.
- 2. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

B. Steel Reinforcement

- 1. Recycled Content: Provide steel reinforcement with an average recycled content of steel so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
- 2. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, fabricated from as-drawn steel **OR** galvanized-steel, **as directed**, wire into flat sheets.
- 3. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.
- 4. Epoxy-Coated Welded Wire Reinforcement: ASTM A 884/A 884M, Class A, plain steel.
- 5. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420); deformed.
- 6. Galvanized Reinforcing Bars: ASTM A 767/A 767M, Class II zinc coated, hot-dip galvanized after fabrication and bending; with ASTM A 615/A 615M, Grade 60 (Grade 420) deformed bars.



7. Epoxy-Coated Reinforcing Bars: ASTM A 775/A 775M or ASTM A 934/A 934M; with ASTM A 615/A 615M, Grade 60 (Grade 420) deformed bars.
8. Steel Bar Mats: ASTM A 184/A 184M; with ASTM A 615/A 615M, Grade 60 (Grade 420), deformed bars; assembled with clips.
9. Plain-Steel Wire: ASTM A 82/A 82M, as drawn **OR** galvanized, **as directed**.
10. Deformed-Steel Wire: ASTM A 496/A 496M.
11. Epoxy-Coated-Steel Wire: ASTM A 884/A 884M, Class A coated, plain **OR** deformed, **as directed**.
12. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420) plain-steel bars; zinc coated (galvanized) after fabrication according to ASTM A 767/A 767M, Class I coating, **as directed**. Cut bars true to length with ends square and free of burrs.
13. Epoxy-Coated, Joint Dowel Bars: ASTM A 775/A 775M; with ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars.
14. Tie Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
OR
Hook Bolts: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6), internally and externally threaded. Design hook-bolt joint assembly to hold coupling against paving form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.
15. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:
 - a. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
 - b. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
16. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating, compatible with epoxy coating on reinforcement.
17. Zinc Repair Material: ASTM A 780.

C. Concrete Materials

1. Cementitious Material: Use the following cementitious materials, of same type, brand, and source throughout Project:
 - a. Portland Cement: ASTM C 150, gray **OR** white, **as directed**, portland cement Type I **OR** Type II **OR** Type I/II **OR** Type III **OR** Type V, **as directed**. Supplement with the following, **as directed**:
 - 1) Fly Ash: ASTM C 618, Class C or Class F.
 - 2) Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
 - b. Blended Hydraulic Cement: ASTM C 595, Type IS, portland blast-furnace slag **OR** Type IP, portland-pozzolan, **as directed**, cement.
2. Normal-Weight Aggregates: ASTM C 33, Class 4S **OR** Class 4M **OR** Class 1N, **as directed**, uniformly graded. Provide aggregates from a single source with documented service-record data of at least 10 years' satisfactory service in similar paving applications and service conditions using similar aggregates and cementitious materials, **as directed**.
 - a. Maximum Coarse-Aggregate Size: 1-1/2 inches (38 mm) **OR** 1 inch (25 mm) **OR** 3/4 inch (19 mm), **as directed**, nominal.
 - b. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
3. Exposed Aggregate: Selected, hard, and durable; washed; free of materials with deleterious reactivity to cement or that cause staining; from a single source, with gap-graded coarse aggregate as follows:
 - a. Aggregate Sizes: 3/4 to 1 inch (19 to 25 mm) **OR** 1/2 to 3/4 inch (13 to 19 mm) **OR** 3/8 to 5/8 inch (10 to 16 mm), **as directed**, nominal.
 - b. Aggregate Source, Shape, and Color: **As required to meet Project requirements**.
4. Water: Potable and complying with ASTM C 94/C 94M.
5. Air-Entraining Admixture: ASTM C 260.



6. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
 - a. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - b. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - c. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - d. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - e. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 - f. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
 7. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, **as directed**, nonfading, and resistant to lime and other alkalis.
- D. Fiber Reinforcement
1. Synthetic Fiber: Monofilament or fibrillated polypropylene fibers engineered and designed for use in concrete paving, complying with ASTM C 1116/C 1116M, Type III, 1/2 to 1-1/2 inches (13 to 38 mm) long.
- E. Curing Materials
1. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry or cotton mats.
 2. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
 3. Water: Potable.
 4. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.
 5. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
 6. White, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B, dissipating.
- F. Related Materials
1. Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork in preformed strips.
 2. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.
 3. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
 4. Epoxy Bonding Adhesive: ASTM C 881/C 881M, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements, and of the following types:
 - a. Types I and II, non-load bearing **OR** Types IV and V, load bearing, **as directed**, for bonding hardened or freshly mixed concrete to hardened concrete.
 5. Chemical Surface Retarder: Water-soluble, liquid, set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch (3 to 6 mm).
 6. Pigmented Mineral Dry-Shake Hardener: Factory-packaged, dry combination of portland cement, graded quartz aggregate, color pigments, and plasticizing admixture. Use color pigments that are finely ground, nonfading mineral oxides interground with cement.
 7. Rock Salt: Sodium chloride crystals, kiln dried, coarse gradation with 100 percent passing 3/8-inch (9.5-mm) sieve and 85 percent retained on a No. 8 (2.36-mm) sieve.
- G. Detectable Warning Materials



1. Detectable Warning Stamp: Semirigid polyurethane mats with formed underside capable of imprinting detectable warning pattern on plastic concrete; perforated with a vent hole at each dome.
 - a. Size of Stamp: One piece matching detectable warning area shown on Drawings **OR** 24 by 24 inches (610 by 610 mm) **OR** 24 by 36 inches (610 by 914 mm) **OR** 24 by 48 inches (610 by 1220 mm) **OR** 26 by 26 inches (660 by 660 mm) **OR** 26 by 36 inches (660 by 914 mm), **as directed**.
 2. Liquid Release Agent: Manufacturer's standard, clear, evaporating formulation designed to facilitate release of stamp mats.
- H. Pavement Markings
1. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248, Type N **OR** Type F **OR** Type S, **as directed**; colors complying with FS TT-P-1952.
 - a. Color: White **OR** Yellow **OR** Blue **OR** As indicated, **as directed**.
 2. Pavement-Marking Paint: MPI #32 Alkyd Traffic Marking Paint.
 - a. Color: White **OR** Yellow **OR** Blue **OR** As indicated, **as directed**.
 3. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, Type II, with drying time of less than three **OR** 45, **as directed**, minutes.
 - a. Color: White **OR** Yellow **OR** Blue **OR** As indicated, **as directed**.
 4. Pavement-Marking Paint: MPI #97 Latex Traffic Marking Paint.
 - a. Color: White **OR** Yellow **OR** Blue **OR** As indicated, **as directed**.
 5. Glass Beads: AASHTO M 247, Type 1 **OR** FS TT-B-1325, Type 1A, **as directed**.
- I. Wheel Stops
1. Wheel Stops: Precast, air-entrained concrete, 2500-psi (17.2-MPa) minimum compressive strength, 4-1/2 inches (115 mm) high by 9 inches (225 mm) wide by 72 inches (1820 mm) long. Provide chamfered corners and drainage slots on underside and holes for anchoring to substrate.
 - a. Dowels: Galvanized steel, 3/4 inch (19 mm) in diameter, 10-inch (254-mm) minimum length.
 2. Wheel Stops: Solid, integrally colored, 96 percent recycled HDPE, or commingled postconsumer and postindustrial recycled rubber or plastic; UV stabilized; 4 inches (100 mm) high by 6 inches (150 mm) wide by 72 inches (1820 mm) long. Provide chamfered corners and drainage slots on underside and holes for anchoring to substrate.
 - a. Color: Black **OR** Yellow **OR** Gray **OR** Green **OR** Blue, **as directed**.
 - b. Dowels: Galvanized steel, 3/4 inch (19 mm) in diameter, 10-inch (254-mm) minimum length.
 - c. Adhesive: As recommended by wheel stop manufacturer for application to concrete pavement.
- J. Preformed Traffic-Calming Devices
1. Speed Bumps **OR** Humps **OR** Cushions, **as directed**: Solid, integrally colored, 100 percent postconsumer or commingled postconsumer and postindustrial recycled rubber or plastic; UV stabilized. Provide holes for anchoring to substrate.
 - a. Bump Size: Modular 2 inches (50 mm) high by 10 inches (254 mm) wide by 72 inches (1800 mm) long, with overall length as dimensioned on Drawings.
 - b. Hump **OR** Cushion, **as directed**, Size: Modular assemblies 3 inches (75 mm) high by 12 feet (3.7 m) in overall width **OR** 4 inches (100 mm) high by 14 feet (4.3 m) in overall width, **as directed**, with overall length as dimensioned on Drawings.
 - c. Color: Black **OR** Yellow, **as directed**.
 - d. Mounting Hardware: Galvanized-steel lag screw, shield, and washers; 1/2-inch (13-mm) diameter, 8-inch (200-mm) minimum length **OR** hardware as standard with device manufacturer for use with concrete paving, **as directed**.
 - e. Adhesive: As recommended by device manufacturer.



K. Concrete Mixtures

1. Prepare design mixtures, proportioned according to ACI 301 (ACI 301M), for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.
 - a. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
 - b. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that meet or exceed requirements.
2. Proportion mixtures to provide normal-weight concrete with the following properties:
 - a. Compressive Strength (28 Days): 4500 psi (31 MPa) **OR** 4000 psi (27.6 MPa) **OR** 3500 psi (24.1 MPa) **OR** 3000 psi (20.7 MPa), **as directed**.
 - b. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.45 **OR** 0.50, **as directed**.
 - c. Slump Limit: 4 inches (100 mm) **OR** 5 inches (125 mm) **OR** 8 inches (200 mm), **as directed**, plus or minus 1 inch (25 mm).
3. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
 - a. Air Content: 5-1/2 **OR** 4-1/2 **OR** 2-1/2, **as directed**, percent plus or minus 1.5 percent for 1-1/2-inch (38-mm) nominal maximum aggregate size.
 - b. Air Content: 6 **OR** 4-1/2 **OR** 3, **as directed**, percent plus or minus 1.5 percent for 1-inch (25-mm) nominal maximum aggregate size.
 - c. Air Content: 6 **OR** 5 **OR** 3-1/2, **as directed**, percent plus or minus 1.5 percent for 3/4-inch (19-mm) nominal maximum aggregate size.
4. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 **OR** 0.30, **as directed**, percent by weight of cement.
5. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
 - a. Use water-reducing admixture **OR** high-range, water-reducing admixture **OR** high-range, water-reducing and retarding admixture **OR** plasticizing and retarding admixture, **as directed**, in concrete as required for placement and workability.
 - b. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
6. Cementitious Materials: Limit percentage by weight of cementitious materials other than portland cement according to ACI 301 (ACI 301M) requirements for concrete exposed to deicing chemicals **OR** as follows, **as directed**:
 - a. Fly Ash or Pozzolan: 25 percent.
 - b. Ground Granulated Blast-Furnace Slag: 50 percent.
 - c. Combined Fly Ash or Pozzolan, and Ground Granulated Blast-Furnace Slag: 50 percent, with fly ash or pozzolan not exceeding 25 percent.
7. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd. (0.60 kg/cu. m) **OR** 1.5 lb/cu. yd. (0.90 kg/cu. m), **as directed**.
8. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

L. Concrete Mixing

1. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, **as directed**. Furnish batch certificates for each batch discharged and used in the Work.
 - a. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.
2. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
 - a. For concrete batches of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.



- b. For concrete batches larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
- c. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

1.3 EXECUTION

A. Examination

1. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.
2. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.
 - a. Completely proof-roll subbase in one direction and repeat in perpendicular direction, **as directed**. Limit vehicle speed to 3 mph (5 km/h).
 - b. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes).
 - c. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch (13 mm) according to requirements in Division 31 Section "Earth Moving".
3. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Preparation

1. Remove loose material from compacted subbase surface immediately before placing concrete.

C. Edge Forms And Screed Construction

1. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
2. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

D. Steel Reinforcement

1. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
2. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
3. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
4. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
5. Zinc-Coated Reinforcement: Use galvanized-steel wire ties to fasten zinc-coated reinforcement. Repair cut and damaged zinc coatings with zinc repair material.
6. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M.
7. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch (50-mm) overlap of adjacent mats.

E. Joints

1. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.
 - a. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.



2. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.
 - a. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
 - b. Provide tie bars at sides of paving strips where indicated.
 - c. Butt Joints: Use bonding agent **OR** epoxy bonding adhesive, **as directed**, at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 - d. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
 - e. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.
 3. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.
 - a. Locate expansion joints at intervals of 50 feet (15.25 m) unless otherwise indicated.
 - b. Extend joint fillers full width and depth of joint.
 - c. Terminate joint filler not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished surface if joint sealant is indicated.
 - d. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
 - e. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
 - f. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
 4. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows, to match jointing of existing adjacent concrete paving:
 - a. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch (6-mm) **OR** 3/8-inch (10-mm), **as directed**, radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate grooving-tool marks on concrete surfaces, **as directed**.
 - 1) Tolerance: Ensure that grooved joints are within 3 inches (75 mm) either way from centers of dowels.
 - b. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
 - 1) Tolerance: Ensure that sawed joints are within 3 inches (75 mm) either way from centers of dowels.
 - c. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.
 - d. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch (6-mm) **OR** 3/8-inch (10-mm), **as directed**, radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces, **as directed**.
- F. Concrete Placement
1. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.
 2. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.



3. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
4. Comply with ACI 301 (ACI 301M) requirements for measuring, mixing, transporting, and placing concrete.
5. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.
6. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
7. Consolidate concrete according to ACI 301 (ACI 301M) by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
 - a. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.
8. Screed paving surface with a straightedge and strike off.
9. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.
10. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.
11. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.
 - a. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.
12. Cold-Weather Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:
 - a. When air temperature has fallen to or is expected to fall below 40 deg F (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
 - b. Do not use frozen materials or materials containing ice or snow.
 - c. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.
13. Hot-Weather Placement: Comply with ACI 301 (ACI 301M) and as follows when hot-weather conditions exist:
 - a. Cool ingredients before mixing to maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - b. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
 - c. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

G. Float Finishing

1. General: Do not add water to concrete surfaces during finishing operations.
2. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
 - a. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.



- b. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.
- c. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch (1.6 to 3 mm) deep with a stiff-bristled broom, perpendicular to line of traffic.

H. Special Finishes

1. Monolithic Exposed-Aggregate Finish: Expose coarse aggregate in paving surface as follows:
 - a. Immediately after float finishing, spray-apply chemical surface retarder to paving according to manufacturer's written instructions.
 - b. Cover paving surface with plastic sheeting, sealing laps with tape, and remove when ready to continue finishing operations.
 - c. Without dislodging aggregate, remove mortar concealing the aggregate by lightly brushing surface with a stiff, nylon-bristle broom. Do not expose more than one-third of the average diameter of the aggregate and not more than one-half of the diameter of the smallest aggregate.
 - d. Fine-spray surface with water and brush. Repeat cycle of water flushing and brushing until cement film is removed from aggregate surfaces to depth required.
2. Seeded Exposed-Aggregate Finish: Immediately after initial floating, spread a single layer of aggregate uniformly on paving surface. Tamp aggregate into plastic concrete and float finish to entirely embed aggregate with mortar cover of 1/16 inch (1.6 mm).
 - a. Spray-apply chemical surface retarder to paving according to manufacturer's written instructions.
 - b. Cover paving surface with plastic sheeting, sealing laps with tape, and remove sheeting when ready to continue finishing operations.
 - c. Without dislodging aggregate, remove mortar concealing the aggregate by lightly brushing surface with a stiff, nylon-bristle broom. Do not expose more than one-third of the average diameter of the aggregate and not more than one-half of the diameter of the smallest aggregate.
 - d. Fine-spray surface with water and brush. Repeat cycle of water flushing and brushing until cement film is removed from aggregate surfaces to depth required.
3. Slip-Resistive Aggregate Finish: Before final floating, spread slip-resistive aggregate finish on paving surface according to manufacturer's written instructions and as follows:
 - a. Uniformly spread 25 lb/100 sq. ft. (12 kg/10 sq. m) **OR** 40 lb/100 sq. ft. (19.5 kg/10 sq. m) **OR** 60 lb/100 sq. ft. (29 kg/10 sq. m), **as directed**, of dampened, slip-resistive aggregate over paving surface in two applications. Tamp aggregate flush with surface using a steel trowel, but do not force below surface.
 - b. Uniformly distribute approximately two-thirds of slip-resistive aggregate over paving surface with mechanical spreader, allow to absorb moisture, and embed by power floating. Follow power floating with a second slip-resistive aggregate application, uniformly distributing remainder of material at right angles to first application to ensure uniform coverage, and embed by power floating.
 - c. Cure concrete with curing compound recommended by slip-resistive aggregate manufacturer. Apply curing compound immediately after final finishing.
 - d. After curing, lightly work surface with a steel wire brush or abrasive stone and water to expose nonslip aggregate.
4. Rock-Salt Finish: After initial floating **OR** troweling **OR** brooming, **as directed**, uniformly spread rock salt over paving surface at the rate of 5 lb/100 sq. ft. (0.2 kg/10 sq. m).
 - a. Embed rock salt into plastic concrete with roller or magnesium float.
 - b. Cover paving surface with 1-mil- (0.025-mm-) thick polyethylene sheet and remove sheet when concrete has hardened and seven-day curing period has elapsed.
 - c. After seven-day curing period, saturate concrete with water and broom-sweep surface to dissolve remaining rock salt, thereby leaving pits and holes.
5. Pigmented Mineral Dry-Shake Hardener Finish: After initial floating, apply dry-shake materials to paving surface according to manufacturer's written instructions and as follows:



- a. Uniformly spread dry-shake hardener at a rate of 100 lb/100 sq. ft. (49 kg/10 sq. m), unless greater amount is recommended by manufacturer to match paving color required.
 - b. Uniformly distribute approximately two-thirds of dry-shake hardener over the concrete surface with mechanical spreader; allow hardener to absorb moisture and embed it by power floating. Follow power floating with a second application of pigmented mineral dry-shake hardener, uniformly distributing remainder of material at right angles to first application to ensure uniform color, and embed hardener by final power floating.
 - c. After final power floating, apply a hand-trowel finish followed by a broom finish.
 - d. Cure concrete with curing compound recommended by dry-shake hardener manufacturer. Apply curing compound immediately after final finishing.
- I. Detectable Warnings
1. Blockouts: Form blockouts in concrete for installation of detectable paving units specified in Division 32 Section "Unit Paving".
 - a. Tolerance for Opening Size: Plus 1/4 inch (6 mm), no minus.
 2. Stamped Detectable Warnings: Install stamped detectable warnings as part of a continuous concrete paving placement and according to stamp-mat manufacturer's written instructions.
 - a. Before using stamp mats, verify that the vent holes are unobstructed.
 - b. Apply liquid release agent to the concrete surface and the stamp mat.
 - c. Stamping: While initially finished concrete is plastic **OR** After application and final floating of pigmented mineral dry-shake hardener, **as directed**, accurately align and place stamp mats in sequence. Uniformly load, gently vibrate, and press mats into concrete to produce imprint pattern on concrete surface. Load and tamp mats directly perpendicular to the stamp-mat surface to prevent distortion in shape of domes. Press and tamp until mortar begins to come through all of the vent holes. Gently remove stamp mats.
 - d. Trimming: After 24 hours, cut off the tips of mortar formed by the vent holes.
 - e. Remove residual release agent according to manufacturer's written instructions, but no fewer than three days after stamping concrete. High-pressure-wash surface and joint patterns, taking care not to damage stamped concrete. Control, collect, and legally dispose of runoff.
- J. Concrete Protection And Curing
1. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
 2. Comply with ACI 306.1 for cold-weather protection.
 3. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.
 4. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
 5. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:
 - a. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - 1) Water.
 - 2) Continuous water-fog spray.
 - 3) Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
 - b. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm) and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period using cover material and waterproof tape.
 - c. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas that have been subjected to



heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

K. Paving Tolerances

1. Comply with tolerances in ACI 117 and as follows:
 - a. Elevation: 3/4 inch (19 mm).
 - b. Thickness: Plus 3/8 inch (10 mm), minus 1/4 inch (6 mm).
 - c. Surface: Gap below 10-foot- (3-m-) long, unlevelled straightedge not to exceed 1/2 inch (13 mm).
 - d. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches (13 mm per 300 mm) of tie bar.
 - e. Lateral Alignment and Spacing of Dowels: 1 inch (25 mm).
 - f. Vertical Alignment of Dowels: 1/4 inch (6 mm).
 - g. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches (6 mm per 300 mm) of dowel.
 - h. Joint Spacing: 3 inches (75 mm).
 - i. Contraction Joint Depth: Plus 1/4 inch (6 mm), no minus.
 - j. Joint Width: Plus 1/8 inch (3 mm), no minus.

L. Pavement Marking

1. Do not apply pavement-marking paint until layout, colors, and placement have been verified with the Owner.
2. Allow concrete paving to cure for a minimum of 28 days and be dry before starting pavement marking.
3. Sweep and clean surface to eliminate loose material and dust.
4. Apply paint with mechanical equipment to produce markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils (0.4 mm).
 - a. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to concrete surface. Mask an extended area beyond edges of each stencil to prevent paint application beyond stencil. Apply paint so that it cannot run beneath stencil.
 - b. Broadcast glass beads uniformly into wet markings at a rate of 6 lb/gal. (0.72 kg/L).

M. Wheel Stops

1. Install wheel stops in bed of adhesive applied as recommended by manufacturer.
2. Securely attach wheel stops to paving with not less than two steel **OR** galvanized-steel, **as directed**, dowels located at one-quarter to one-third points. Install dowels in drilled holes in the paving and bond dowels to wheel stop. Recess head of dowel beneath top of wheel stop.

N. Preformed Traffic-Calming Devices

1. Install preformed speed bumps **OR** humps **OR** cushions, **as directed**, in bed of adhesive applied as recommended by manufacturer for heavy traffic.
2. Securely attach preformed speed bumps **OR** humps **OR** cushions, **as directed**, to paving with hardware spaced as recommended by manufacturer for heavy traffic. Recess head of hardware beneath top surface.

O. Field Quality Control

1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
2. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 - a. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. (76 cu. m) **OR** 5000 sq. ft. (465 sq. m), **as directed**, or fraction thereof of each concrete mixture placed each day.



- 1) When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 - b. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 - c. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - d. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when it is 80 deg F (27 deg C) and above, and one test for each composite sample.
 - e. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
 - f. Compressive-Strength Tests: ASTM C 39/C 39M; test one specimen at seven days and two specimens at 28 days.
 - 1) A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.
3. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
 4. Test results shall be reported in writing to the Owner, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
 5. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by the Owner but will not be used as sole basis for approval or rejection of concrete.
 6. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by the Owner.
 7. Concrete paving will be considered defective if it does not pass tests and inspections.
 8. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 9. Prepare test and inspection reports.
- P. Repairs And Protection
1. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by the Owner.
 2. Drill test cores, where directed by the Owner, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.
 3. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
 4. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Final Completion inspections.

END OF SECTION 03 31 13 00



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SECTION 03 31 13 00a - ROLLER COMPACTED CONCRETE PAVEMENT

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of roller compacted concrete pavement. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: For each type of product indicated.

1.2 PRODUCTS

A. Cementitious Materials:

1. Portland cement shall conform to ASTM C 150, Type I. Low alkali is to be used with aggregates when directed. In lieu of low-alkali cement, the Contractor may use a combination of Portland cement that does not meet the low-alkali requirement with a suitable pozzolan or ground granulated blast-furnace slag (GGBFS) provided the following requirement is met. The expansion of the proposed combination shall be equal to or less than the expansion of a low-alkali cement meeting the requirements of ASTM C 150 when tested in conformance with ASTM C 441. These two tests shall be performed concurrently at an independent certified laboratory at the Contractor's expense. the Owner reserves the right to confirm the test results and to adjust the percentage of pozzolan or GGBFS in the combination to suit other requirements at no additional cost to the Owner. Portland cement shall be furnished in bulk.
2. Pozzolan shall conform to ASTM C 618, and, in addition, limits in Table 2A, Uniformity Requirements (for air content) shall apply to all fly ash. Table 1A, Supplementary Optional Chemical Requirement for Maximum Alkalies, shall apply when it is to be used with aggregates listed to require low-alkali cement. Pozzolan shall be furnished in bulk.
3. The temperature of the cementitious materials as delivered to the site shall not exceed 150 degrees F.

B. Admixtures: All chemical admixtures furnished as liquids shall be in a solution of suitable viscosity and dilution for field use as determined by the Owner.

1. Water-Reducing Admixture (WRA) shall meet the requirements of ASTM C 494, Type D.
2. Air-entraining admixture shall conform to ASTM C 260.

C. Water for washing aggregates and for mixing and curing concrete shall be free from injurious amounts of oil, acid, salt, alkali, organic matter, or other deleterious substances and shall comply with COE CRD-C 400.

D. Aggregates

1. Composition: Fine aggregate shall consist of natural sand, manufactured sand, or a combination of natural and manufactured sands. Coarse aggregate shall consist of gravel, crushed gravel, crushed stone, air-cooled blast-furnace slag, or a combination thereof.

OR

All concrete mixtures will be proportioned by the Owner except that proportions for the slipformed facing concrete mixture will be selected by the Contractor. RCC shall be composed of cementitious materials, water, fine and coarse aggregates, and possibly admixtures. The cementitious material shall be portland cement, or portland cement in combination with pozzolan. An admixture when approved or directed will be a water-reducing/retarding admixture. Air-entraining admixture will be used in the bedding concrete and other conventional concrete.



1.3 EXECUTION

- A. **Concrete Mixing Plant:** A continuous mixing plant(s) shall be capable of producing RCC of the same quality and uniformity as would be produced in a conventional redi-mix batch plant and shall be capable of producing a uniform continuous product (at both maximum and minimum production rates) that is mixed so that complete intermingling of all ingredients occurs without balling, segregation, and wet or dry portions.
- B. **Trucks:** Truck mixers or agitators used for transporting central-mixed conventional concrete shall conform to the applicable requirements of ASTM C 94. Truck mixers shall not be used to transport concrete with larger than 37.5 mm (1-1/2-inch) nominal maximum size aggregate (NMSA) or 2 inch slump, or less. Nonagitator trucks may be used for transporting conventional central-mixed concrete over a smooth road when the hauling time is less than 15 minutes and the slump is less than 3 inches. Bodies of nonagitator trucks shall be smooth, water-tight, metal containers specifically designed to transport concrete, shaped with rounded corners to minimize segregation.
- C. **Belt Conveyors:** Belt conveyors shall be designed and operated to assure a uniform flow of concrete from mixer or delivery truck to final place of deposit without segregation of ingredients or loss of mortar and shall be provided with positive means for preventing segregation of the concrete or loss of mortar at transfer points and the point of placing. The NMSA required in mixture proportions furnished by the Owner will not be changed to accommodate the belt width.
- D. **Spreading and Remixing Equipment:** The primary spreading procedure shall be accomplished by dozer. Graders or other equipment not specified may be used to facilitate the RCC spreading process only when approved. For open, unrestricted areas, the dozer shall be a minimum size and weight equivalent to a Caterpillar D-6. For restricted placement areas, such as placement of RCC near the dam crest or next to abutments, the dozer shall have as a minimum a size and weight equivalent to a Caterpillar D-4. There shall be a minimum of one operating dozer for each 200 cubic yards of RCC placed each hour. The dozers shall be equipped with well-maintained grousers. A front-end loader with operator shall be available to assist with deposition and spreading of RCC as needed in confined areas. The equipment shall be maintained in good operating condition. The equipment shall not leak or drip oil, grease, or other visible contaminants onto the RCC surface. All equipment used for spreading and remixing that leaves the surface of the structure for maintenance or repairs or, for any other reason, must be cleaned of all contaminants by an approved method before returning to the structure surface. Under no conditions shall a dozer or other tracked vehicle be operated on other than fresh uncompacted RCC except to facilitate startup operations for each lift and by approved procedures.
- E. **Compaction Equipment:**
1. Self-propelled vibratory rollers shall be used for primary rolling and shall be double-drum. They shall transmit a dynamic impact to the surface through a smooth steel drum by means of revolving weights, eccentric shafts, or other equivalent methods. The compactor shall have a minimum gross mass of 20,000 pounds and shall produce a minimum dynamic force of 350 pounds per linear inch of drum width. The operating frequency shall be variable in the approximate range of 1,700 to 3,000 cycles per minute. The amplitude shall be adjustable between 0.015 and 0.04 inches. The roller shall be capable of full compaction in both forward and reverse directions. The roller shall be operated at speeds not exceeding 2.2 ft/s. Within the range of the operating capability of the equipment, the Owner may direct or approve variations to the frequency, amplitude, and speed of operation which result in the specified density at the fastest production rate.
 2. Small vibratory rollers shall be used to compact the RCC where the larger vibratory rollers specified above cannot maneuver. The rollers shall compact the RCC to the required density and shall be so demonstrated during construction of the test section. Small vibratory rollers cannot compact the RCC to the same density and thickness as the primary rollers. When small rollers are used, total lift thickness of the RCC layer or lift shall be reduced to not over 6 inches



- uncompacted thickness to permit adequate compaction. Rollers shall have independent speed and vibration controls and shall be capable of a wide range of speed adjustments.
3. The tampers shall compact the RCC to the required density and shall be so demonstrated during construction of the test section. Tampers cannot compact the RCC to the same density and thickness as the primary rollers. When tampers are used, thickness of each RCC layer that is to be compacted shall be reduced to not more than 6 inches uncompacted thickness to assure adequate compaction.
- F. **Placing During Rain:** RCC shall not be placed during rainfall of 0.1 inch/hr or more. During periods of lesser rainfall, placement of RCC may continue if, in the opinion of the Owner, no damage to the RCC is occurring. Work shall commence only after excess free surface water and contaminated paste or RCC have been removed. The surface shall have gained sufficient strength (no less than 4 hours after the RCC placement was suspended) to prevent rutting, pumping, intermixing of rainwater with the RCC, or other damage to the RCC. When the RCC surface has been contaminated or damaged in any manner, the RCC surface shall be washed to break up and remove laitance and/or mud-like coatings from the surface. Any undercut coarse aggregate shall be removed. All waste shall be removed and disposed of in an approved manner.
- G. **Hot-Weather Placement:** In hot-weather placement the temperature of the RCC shall be controlled so that it does not exceed 75.0 degrees F when placed. Placement shall be suspended as soon as the RCC temperature exceeds 75 degrees F. Measures that can be taken to prevent temperatures exceeding 75 degrees F include, but are not limited to; 1.) chilling mixing water, 2.) sprinkling aggregate stockpiles, 3.) use of a canopy to shade the RCC placement areas, 4.) placing during nighttime and early morning hours, or 5.) restricting placements to cloudy days. Use of any of these systems shall not be reason for extension of completion dates specified in these specifications. In addition, to prevent potential damage to the RCC due to hot-weather related placement conditions, all RCC operation shall be suspended between June 15 and October 31, unless directed otherwise.

END OF SECTION 03 31 13 00a



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**SECTION 03 31 13 00b - PORTLAND CEMENT CONCRETE OVERLAYS****1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of Portland cement concrete overlays. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: For each type of product indicated.

1.2 PRODUCTS**A. Coarse Aggregate:**

1. Composition: Coarse aggregate shall consist of gravel, crushed gravel, crushed stone, a combination thereof, or crushed blast-furnace slag.
2. Particle Shape: Particles of the coarse aggregate shall be generally spherical or cubical in shape. The quantity of flat and elongated particles in any size group shall not exceed 20 percent by weight as determined by ASTM D 3398.
3. Gradation: The maximum size of coarse aggregate shall be the lesser of 1/4 of the pavement thickness or 2 inches nominal size. Gradation limits are specified in ASTM C 136.
4. Deleterious Substances: The amount of deleterious substances in the coarse aggregate shall not exceed the limits, defined in ASTM C 117 and C 123.

- B. Fine Aggregate shall consist of natural sand, manufactured sand, or a combination of natural and manufactured sand and shall be composed of clean, hard, durable particles. Particles of the fine aggregate shall be generally spherical or cubical in shape. Gradation limits are specified in ASTM C 136.

- C. Portland Cement shall be Type I in compliance with ASTM C 150.

- D. Air-Entraining Admixture shall be in compliance with ASTM C 260. Concrete mixtures shall have air content by volume of concrete of 4 to 7 percent based on measurements made immediately after discharge from the mixer.

- E. Concrete Mixture shall have a nominal slump of 2 inches with a maximum of 3 inches and a 28-day flexural strength of not less than 650 psi.

- F. Joint and Crack Sealing Materials: Joint filler, joint sealant, and crack sealant shall comply with the following:

1. Expansion Joint Fillers shall comply with ASTM D 1751 or D 1752 or shall be resin impregnated fiberboard in compliance with the physical requirements of ASTM D 1752.
2. Type I Sealant shall comply with Fed. Spec. SS-S-200, except that sealant may be furnished as a ready-mixed liquid.
3. Type II Sealant shall comply with Fed. Spec. SS-S-1401.
4. Type V Sealant shall comply with COE CRD-C-527 and may be either a single- or multiple-component material.

- G. Epoxy-Resin Materials: Materials used in epoxy-resin grout, mortar, and concrete shall comply with the following:

1. Epoxy-Resin Grout shall be a two-compound material formulated to comply with ASTM C 881.



2. Epoxy-Resin Concrete shall be composed of epoxy-resin binder and uniformly graded aggregate in compliance with ASTM C 144. The maximum size of aggregate shall be 3/8 or 1/2 inch.

H. Dowels shall be plain steel bars complying with ASTM A 499.

1.3 EXECUTION

- A. Preparation of Existing Surface: The Contractor shall raise and reset all structures such as manhole frames, valve boxes, drainage structures, etc. to meet the required grade. Bonding course shall be applied to the area prepared to receive overlay and shall be of epoxy-resin grout and Portland cement mortar.
- B. Concrete Placement: Concrete shall be placed within 45 minutes from the time all ingredients are charged into the mixing drum.
- C. Vibration: In the final phases of placing, surface vibrating equipment shall be used, and the duration of vibration shall not exceed 20 seconds.
- D. Joints shall be saw cut and in alignment with underlying existing joints.
- E. Finishing:
 1. Transverse Finishing: Immediately after placement, concrete shall be accurately struck off and screeded to such elevation that when consolidated and finished, the surface of the pavement will be free from porous places and will be at the required grade. The finishing machine shall make at least two trips over each area of pavement to compact the concrete and produce a surface of uniform texture, true to grade.
 2. Longitudinal Floating: After completion of the transverse finishing, the longitudinal mechanical float shall be operated to smooth and finish the pavement to grade.
 3. Hand Finishing shall be with an approved strike and tamping template and a longitudinal float.
 4. Straightedge Finishing: After the longitudinal floating is completed but while the concrete is still plastic, minor irregularities and score marks in the pavement surface shall be eliminated by means of long-handled wood floats and straightedges. The final finish shall be made with the straightedges, which shall be used to float the entire pavement surface.
 5. Burlap Drag Finishing: When most of the water glaze or sheen has disappeared and before the concrete becomes nonplastic, drag the surface of the pavement in the direction of the concrete placement with a multiple-ply burlap drag.
 6. Edging: After other finishing has been completed, the edges of slabs along the forms and at the joints shall be carefully finished with an edging tool to form a smooth rounded surface of the required radius.
- F. Concrete Curing and Protection:
 1. Concrete Curing Methods shall consist of mat method, impervious sheeting method, or liquid membrane curing method.
 2. Concrete Protection: Protect repaired areas against damage prior to final acceptance. Traffic shall be excluded from repaired areas.

END OF SECTION 03 31 13 00b

**SECTION 03 31 13 00c - STEEL REINFORCED PORTLAND CEMENT CONCRETE OVERLAYS**

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of steel reinforced Portland cement concrete overlays. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: For each type of product indicated.

1.2 PRODUCTS

A. Coarse Aggregate:

1. Composition: Coarse aggregate shall consist of gravel, crushed gravel, crushed stone, a combination thereof, or crushed blast-furnace slag.
2. Particle Shape: Particles of the coarse aggregate shall be generally spherical or cubical in shape. The quantity of flat and elongated particles in any size group shall not exceed 20 percent by weight as determined by ASTM D 3398.
3. Gradation: The maximum size of coarse aggregate shall be the lesser of 1/4 of the pavement thickness or 2 inches nominal size. Gradation limits are specified in ASTM C 136.
4. Deleterious Substances: The amount of deleterious substances in the coarse aggregate shall not exceed the limits, defined in ASTM C 117 and C 123.

- B. Fine Aggregate shall consist of natural sand, manufactured sand, or a combination of natural and manufactured sand and shall be composed of clean, hard, durable particles. Particles of the fine aggregate shall be generally spherical or cubical in shape. Gradation limits are specified in ASTM C 136.

- C. Portland Cement shall be Type I in compliance with ASTM C 150.

- D. Air-Entraining Admixture shall be in compliance with ASTM C 260. Concrete mixtures shall have air content by volume of concrete of 4 to 7 percent based on measurements made immediately after discharge from the mixer.

- E. Concrete Mixture shall have a nominal slump of 2 inches with a maximum of 3 inches and a 28-day flexural strength of not less than 650 psi.

- F. Joint and Crack Sealing Materials: Joint filler, joint sealant, and crack sealant shall comply with the following:

1. Expansion Joint Fillers shall comply with ASTM D 1751 or D 1752 or shall be resin impregnated fiberboard in compliance with the physical requirements of ASTM D 1752.
2. Type I Sealant shall comply with Fed. Spec. SS-S-200, except that sealant may be furnished as a ready-mixed liquid.
3. Type II Sealant shall comply with Fed. Spec. SS-S-1401.
4. Type V Sealant shall comply with COE CRD-C-527 and may be either a single- or multiple-component material.

- G. Epoxy-Resin Materials: Materials used in epoxy-resin grout, mortar, and concrete shall comply with the following:



1. Epoxy-Resin Grout shall be a two-compound material formulated to comply with ASTM C 881.
2. Epoxy-Resin Concrete shall be composed of epoxy-resin binder and uniformly graded aggregate in compliance with ASTM C 144. The maximum size of aggregate shall be 3/8 or 1/2 inch.

H. Steel Reinforcement: All reinforcement shall be free from loose flaky rust, loose scale, oil, grease, mud, or other coatings that might reduce bond. Bar mats shall comply with ASTM A 184. Welded steel wire fabric shall comply with ASTM A 185. Tie bars shall be deformed bars in compliance with ASTM A 615, A 616, or A 617. Dowels shall be plain steel bars complying with ASTM A 499.

1.3 EXECUTION

- A. Preparation of Existing Surface: The Contractor shall raise and reset all structures such as manhole frames, valve boxes, drainage structures, etc. to meet the required grade. Bonding course shall be applied to the area prepared to receive overlay and shall be of epoxy-resin grout and Portland cement mortar.
- B. Reinforcement Steel shall be installed by the strike-off method wherein the concrete is deposited on the subgrade and struck to the indicated elevation of the steel. The reinforcement shall be laid upon the prestruck surface.
- C. Concrete Placement: Concrete shall be placed within 45 minutes from the time all ingredients are charged into the mixing drum.
- D. Vibration: In the final phases of placing, surface vibrating equipment shall be used, and the duration of vibration shall not exceed 20 seconds.
- E. Joints shall be saw cut and in alignment with underlying existing joints.
- F. Finishing:
1. Transverse Finishing: Immediately after placement, concrete shall be accurately struck off and screeded to such elevation that when consolidated and finished, the surface of the pavement will be free from porous places and will be at the required grade. The finishing machine shall make at least two trips over each area of pavement to compact the concrete and produce a surface of uniform texture, true to grade.
 2. Longitudinal Floating: After completion of the transverse finishing, the longitudinal mechanical float shall be operated to smooth and finish the pavement to grade.
 3. Hand Finishing shall be with an approved strike and tamping template and a longitudinal float.
 4. Straightedge Finishing: After the longitudinal floating is completed but while the concrete is still plastic, minor irregularities and score marks in the pavement surface shall be eliminated by means of long-handled wood floats and straightedges. The final finish shall be made with the straightedges, which shall be used to float the entire pavement surface.
 5. Burlap Drag Finishing: When most of the water glaze or sheen has disappeared and before the concrete becomes nonplastic, drag the surface of the pavement in the direction of the concrete placement with a multiple-ply burlap drag.
 6. Edging: After other finishing has been completed, the edges of slabs along the forms and at the joints shall be carefully finished with an edging tool to form a smooth rounded surface of the required radius.
- G. Concrete Curing and Protection:
1. Concrete Curing Methods shall consist of mat method, impervious sheeting method, or liquid membrane curing method.
 2. Concrete Protection: Protect repaired areas against damage prior to final acceptance. Traffic shall be excluded from repaired areas.



END OF SECTION 03 31 13 00c



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**SECTION 03 31 13 00d - FIBER REINFORCED PORTLAND CEMENT CONCRETE OVERLAYS****1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of fiber reinforced Portland cement concrete overlays. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: For each type of product indicated.

1.2 PRODUCTS**A. Coarse Aggregate:**

1. Composition: Coarse aggregate shall consist of gravel, crushed gravel, crushed stone, a combination thereof, or crushed blast-furnace slag.
2. Particle Shape: Particles of the coarse aggregate shall be generally spherical or cubical in shape. The quantity of flat and elongated particles in any size group shall not exceed 20 percent by weight as determined by ASTM D 3398.
3. Gradation: The maximum size of coarse aggregate shall be the lesser of 1/4 of the pavement thickness or 2 inches nominal size. Gradation limits are specified in ASTM C 136.
4. Deleterious Substances: The amount of deleterious substances in the coarse aggregate shall not exceed the limits, defined in ASTM C 117 and C 123.

- B. Fine Aggregate shall consist of natural sand, manufactured sand, or a combination of natural and manufactured sand and shall be composed of clean, hard, durable particles. Particles of the fine aggregate shall be generally spherical or cubical in shape. Gradation limits are specified in ASTM C 136.

- C. Portland Cement shall be Type I in compliance with ASTM C 150.

- D. Air-Entraining Admixture shall be in compliance with ASTM C 260. Concrete mixtures shall have air content by volume of concrete of 4 to 7 percent based on measurements made immediately after discharge from the mixer.

- E. Concrete Mixture shall have a nominal slump of 2 inches with a maximum of 3 inches and a 28-day flexural strength of not less than 650 psi.

- F. Joint and Crack Sealing Materials: Joint filler, joint sealant, and crack sealant shall comply with the following:

1. Expansion Joint Fillers shall comply with ASTM D 1751 or D 1752 or shall be resin impregnated fiberboard in compliance with the physical requirements of ASTM D 1752.
2. Type I Sealant shall comply with Fed. Spec. SS-S-200, except that sealant may be furnished as a ready-mixed liquid.
3. Type II Sealant shall comply with Fed. Spec. SS-S-1401.
4. Type V Sealant shall comply with COE CRD-C-527 and may be either a single- or multiple-component material.

- G. Epoxy-Resin Materials: Materials used in epoxy-resin grout, mortar, and concrete shall comply with the following:



1. Epoxy-Resin Grout shall be a two-compound material formulated to comply with ASTM C 881.
2. Epoxy-Resin Concrete shall be composed of epoxy-resin binder and uniformly graded aggregate in compliance with ASTM C 144. The maximum size of aggregate shall be 3/8 or 1/2 inch.

H. Steel Fibers: The fibers shall be made from low carbon steel. The following sizes of steel are acceptable:

1. 0.010-inch x 0.022-inch flat steel fiber,
2. 0.010-inch x 0.50-inch round steel fiber,
3. 0.016-inch x 1.0-inch round steel fiber,
4. 0.016-inch x 0.75-inch round steel fiber with 0.010-inch x 0.020-inch flat section along the length of the fiber
5. 2.5-inch x 0.025-inch round steel fibers.

1.3 EXECUTION

A. Preparation of Existing Surface: The Contractor shall raise and reset all structures such as manhole frames, valve boxes, drainage structures, etc. to meet the required grade. Bonding course shall be applied to the area prepared to receive overlay and shall be of epoxy-resin grout and Portland cement mortar.

B. Reinforcement Steel shall be installed by the strike-off method wherein the concrete is deposited on the subgrade and struck to the indicated elevation of the steel. The reinforcement shall be laid upon the prestruck surface.

C. Concrete Placement: Concrete shall be placed within 45 minutes from the time all ingredients are charged into the mixing drum.

D. Vibration: In the final phases of placing, surface vibrating equipment shall be used, and the duration of vibration shall not exceed 20 seconds.

E. Joints shall be saw cut and in alignment with underlying existing joints.

F. Finishing:

1. Transverse Finishing: Immediately after placement, concrete shall be accurately struck off and screeded to such elevation that when consolidated and finished, the surface of the pavement will be free from porous places and will be at the required grade. The finishing machine shall make at least two trips over each area of pavement to compact the concrete and produce a surface of uniform texture, true to grade.
2. Longitudinal Floating: After completion of the transverse finishing, the longitudinal mechanical float shall be operated to smooth and finish the pavement to grade.
3. Hand Finishing shall be with an approved strike and tamping template and a longitudinal float.
4. Straightedge Finishing: After the longitudinal floating is completed but while the concrete is still plastic, minor irregularities and score marks in the pavement surface shall be eliminated by means of long-handled wood floats and straightedges. The final finish shall be made with the straightedges, which shall be used to float the entire pavement surface.
5. Broom Finishing: Burlap drag finishing will not be allowed as this brings the steel fibers to the surface. Finishing shall be accomplished using a stiff broom.
6. Edging: After other finishing has been completed, the edges of slabs along the forms and at the joints shall be carefully finished with an edging tool to form a smooth rounded surface of the required radius.

G. Concrete Curing and Protection:

1. Concrete Curing Methods shall consist of mat method, impervious sheeting method, or liquid membrane curing method.



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2. Concrete Protection: Protect repaired areas against damage prior to final acceptance. Traffic shall be excluded from repaired areas.

END OF SECTION 03 31 13 00d



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Task	Specification	Specification Description
03 31 13 00	03 05 00 00	Cast-In-Place Concrete
03 31 13 00	03 11 16 00	Cast-In-Place Architectural Concrete
03 35 16 00	03 05 00 00	Cast-In-Place Concrete



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SECTION 03 35 23 00 - EXPOSED AGGREGATE SURFACE CONCRETE WALLS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of exposed aggregate surface concrete walls. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Submit product data and manufacturer's application instruction.
2. Shop drawings shall be submitted for approval.

1.2 PRODUCTS

A. Concrete Materials and Mixing

1. Portland Cement: ASTM C 150, Type 1 or 1A.
 - a. Shrinkage-Compensating Cement: Portland cement containing a stable expansive chemical compound such as calcium sulfoaluminate.
 - b. Aggregate: ASTM C 33; aggregate for exposed aggregate concrete shall match existing, if appropriate.
 - c. Admixtures: Submit manufacturer's literature for all admixtures proposed for the work.
 - d. Curing Compounds: ASTM C 309, Type 1.
 - e. Epoxy Bonding Agent: Sika or approved equal.

B. Concrete Formwork, Reinforcement, and Accessories

1. Formwork: Plywood form and liners shall be minimum grade B-B High Density Concrete Form Overlay, Class I, complying with ANSI A199.1.
2. Reinforcement:
 - a. Reinforcement Bars: ASTM A 615, Grade 40 or Grade 60.
 - b. Welded Wire Fabric: ASTM A 185. Where welded wire fabric is needed, use No. 6 gauge wire at 6-inch spacing in each direction.
 - c. Accessories for proper installation of reinforcement shall comply with CRSI "Manual of Standard Practice for Reinforced Concrete Construction."
 - d. Reinforcement fabrication shall comply with ACI 318 and ACI 315.

C. Curing and Climatic Conditions

1. Comply with ACI 306 and ACI 305 for protecting and curing concrete in cold and hot weather.
2. Immediately after finishing, begin curing flatwork by covering with constantly saturated moisture retaining fabrics, impervious sheeting, or membrane curing compounds.
3. Apply membrane curing compounds as required.

1.3 EXECUTION

A. Preparation when attaching to existing surfaces:

1. Remove all defective material by chipping and cutting to sound concrete in order to secure a solid foundation.
2. Square cut or undercut the edges to a minimum depth of one inch to form key.
3. Cut concrete out from behind exposed reinforcing bars and rods.
4. All exposed reinforcing shall be cleaned of rust and primed.



B. Installation

1. Formwork requirements:
 - a. Formwork shall comply with ACI 347. Joints in forms shall be horizontal or vertical.
 - b. Use plywood, fiberglass, or metal forms.
2. Reinforcement shall be repaired when rusted through. Rods at least 12 inches long shall be wired to the failed rods. In closing gaps, rods shall lap existing rods by at least 12 inches or 30 diameters, whichever is greater.
3. Mixing and transporting concrete: Ready-mixed concrete shall be mixed and delivered to the project in compliance with ASTM C 94. Job-mixed concrete shall comply with the requirements of ACI 318.
4. Mixing epoxy-resin patching mortar: Mix thoroughly with a power mixer at low speeds (150 - 400 rpm) until material attains uniform color and consistency (minimum time of two to three minutes at 70 F).

END OF SECTION 03 35 23 00



Task	Specification	Specification Description
03 35 23 00	03 05 00 00	Cast-In-Place Concrete
03 35 26 00	03 05 00 00	Cast-In-Place Concrete
03 35 33 00	03 05 00 00	Cast-In-Place Concrete



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SECTION 03 35 39 00 - RUSTICATED CONCRETE FINISHES**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of rusticated concrete finishes. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: For each type of product indicated.
2. Sample: A sample of finish expected shall be erected on site. Completed work shall approximate the sample. Work determined by the contracting officer not to be similar shall be removed and replaced without further expense to the Owner.

1.2 PRODUCTS

- A. Overlaid Plywood: DOC PS 1, B-B High Density Overlaid Concrete Form, Class I.
- B. Plywood: DOC PS 1, B-B (Concrete Form) Plywood, Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection mark.
- C. Chamfer Strips: Clear white pine with surface against concrete to be planed, metal, PVC, or rubber.
- D. Form Liners: Provide commercially available molds and form-facing materials of metal, plastic, mood, or another material that is nonreactive with concrete and dimensionally stable to produce repetitive concrete surfaces.

1.3 EXECUTION

- A. Form Construction: Forms shall be constructed to provide required sizes, shapes, lines, and dimensions and to provide continuous, straight, smooth exposed surfaces. Forms shall be fabricated for easy removal without hammering or prying against concrete surfaces. The number of joints shall be minimized. Joints shall be made watertight to prevent leakage of cement paste. Provisions shall be made for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, inserts, and other features required in the work.
- B. Form Coatings: Forms shall be oiled with form-coating compounds that will not bond with, stain, nor adversely effect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.
- C. Finish: Fins and other projections shall be completely removed and smoothed. A smooth rubbed finish shall be provided not less than one day after form removal.

END OF SECTION 03 35 39 00



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Task	Specification	Specification Description
03 35 63 00	03 05 00 00	Cast-In-Place Concrete
03 35 66 00	03 05 00 00	Cast-In-Place Concrete
03 35 83 00	03 05 00 00	Cast-In-Place Concrete



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SECTION 03 37 13 00 - SHOTCRETE

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for shotcrete. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes shotcrete applied by dry-mix or wet-mix process.

C. Definitions

1. Shotcrete: Mortar or concrete pneumatically projected onto a surface at high velocity.
2. Dry-Mix Shotcrete: Shotcrete with most of the water added at nozzle.
3. Wet-Mix Shotcrete: Shotcrete with ingredients, including mixing water, mixed before introduction into delivery hose.

D. Submittals

1. Product Data: For manufactured materials and products including reinforcement and forming accessories, shotcrete materials, admixtures, and curing compounds.
2. LEED Submittal:
 - a. Product Data for Credit MR 4.1 and Credit MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - 1) Include statement indicating costs for each product having recycled content.
3. Shop Drawings: For details of fabricating, bending, and placing reinforcement. Include support and anchor details, number and location of splices, and special reinforcement required for openings through shotcrete structures.
4. Samples: Approximately 24 by 24 by 2 inches (600 by 600 by 50 mm), to illustrate quality of finishes, colors, and textures of exposed surfaces of shotcrete.
5. Design Mixes: For each shotcrete mix.
6. Material Test Reports: For shotcrete materials.
7. Material Certificates: For each material item, signed by manufacturers.
8. Field quality-control test reports.

E. Quality Assurance

1. Installer Qualifications: A qualified installer employing nozzle operators for the Project, each of whom attains mean core grades not exceeding 2.5, according to ACI 506.2, on preconstruction tests **OR** is ACI Shotcrete Nozzleman certified in Dry-Mix Process for Vertical Position **OR** is ACI Shotcrete Nozzleman certified in Dry-Mix Process for Vertical and Overhead Positions **OR** is ACI Shotcrete Nozzleman certified in Wet-Mix Process for Vertical Position **OR** is ACI Shotcrete Nozzleman certified in Wet-Mix Process for Vertical and Overhead Positions as appropriate to the required shotcrete work, **as directed**.
2. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, and acceptable to authorities having jurisdiction, **as directed**.
3. Comply with provisions of the following, unless more stringent requirements are indicated:
 - a. ACI 301, "Specifications for Structural Concrete."
 - b. ACI 506.2, "Specification for Shotcrete."
4. Preinstallation Conference: Conduct conference at Project site.
5. Shotcrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design shotcrete mixtures.



F. Project Conditions

1. Cold-Weather Shotcreting: Protect shotcrete work from physical damage or reduced strength caused by frost, freezing, or low temperatures according to ACI 306.1 and as follows:
 - a. Discontinue shotcreting when ambient temperature is 40 deg F (4.4 deg C) and falling. Uniformly heat water and aggregates before mixing to obtain a shotcrete shooting temperature of not less than 50 deg F (10 deg C) and not more than 90 deg F (32 deg C).
 - b. Do not use frozen materials or materials containing ice or snow.
 - c. Do not place shotcrete on frozen surfaces or surfaces containing frozen materials.
 - d. Do not use calcium chloride, salt, or other materials containing antifreeze agents.
2. Hot-Weather Shotcreting: Mix, place, and protect shotcrete according to ACI 305R when hot-weather conditions and high temperatures would seriously impair quality and strength of shotcrete, and as follows:
 - a. Cool ingredients before mixing to maintain shotcrete temperature at time of placement below 100 deg F (38 deg C) for dry mix or 90 deg F (32 deg C) for wet mix.
 - b. Reduce temperature of reinforcing steel and receiving surfaces below 100 deg F (38 deg C) before shotcreting.

1.2 PRODUCTS

A. Form Materials

1. Forms: Form-facing panels that will provide continuous, straight, smooth, concrete surfaces. Furnish panels in largest practicable sizes to minimize number of joints.

B. Reinforcing Materials

1. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 **OR** 60, **as directed** percent.
2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
3. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.
4. Galvanized Reinforcing Bars: ASTM A 767/A 767M, Class II, zinc coated, hot-dip galvanized after fabrication and bending, as follows:
 - a. Steel Reinforcement: ASTM A 615/A 615M, Grade 60 (Grade 420) **OR** ASTM A 706/A 706M, **as directed**, deformed.
5. Plain-Steel Wire: ASTM A 82, as drawn **OR** galvanized, **as directed**.
6. Plain-Steel-Welded Wire Fabric: ASTM A 185, fabricated from as-drawn **OR** galvanized, **as directed**, steel wire into flat sheets.
7. Deformed-Steel-Welded Wire Fabric: ASTM A 497, flat sheet.
8. Supports: Bolsters, chairs, spacers, ties, and other devices for spacing, supporting, and fastening reinforcing steel in place according to CRSI's "Manual of Standard Practice" and as follows:
 - a. For uncoated reinforcement, use all-plastic **OR** CRSI Class 1, plastic-protected **OR** CRSI Class 2, stainless-steel, **as directed**, bar supports.
 - b. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire **OR** all-plastic, **as directed**, bar supports.
 - c. Retain paragraph and subparagraph below if devices are required to anchor, support, or space steel reinforcement.
9. Reinforcing Anchors: ASTM A 36/A 36M, unheaded rods or ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6), hex-head bolts; carbon steel; and carbon-steel nuts.
 - a. Finish: Plain, uncoated **OR** Hot-dip zinc coating, ASTM A 153/A 153M, Class C, **as directed**.

C. Shotcrete Materials

1. Portland Cement: ASTM C 150, Type I **OR** III, **as directed**. Use only one brand and type of cement for Project.



- a. Fly Ash: ASTM C 618, Class C or F.
 - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
 2. Blended Hydraulic Cement: ASTM C 595, Type IS **OR** IP **OR** I(PM) **OR** I(SM), **as directed**.
 3. Silica Fume: ASTM C 1240, amorphous silica.
 4. Normal-Weight Aggregates: ASTM C 33, from a single source, and as follows:
 - a. Aggregate Gradation: ACI 506R, Gradation No. 1 with 100 percent passing 3/8-inch (10-mm) **OR** 2 with 100 percent passing 1/2-inch (13-mm), **as directed**, sieve.
 - b. Coarse-Aggregate Class: 3S **OR** 3M **OR** 1N, **as directed**.
 5. Lightweight Aggregates: ASTM C 330.
 - a. Aggregate Gradation: ACI 506R, Gradation No. 1 with 100 percent passing 3/8-inch (10-mm) **OR** 2 with 100 percent passing 1/2-inch (13-mm), **as directed** sieve.
 6. Coloring Agent: ASTM C 979, synthetic mineral-oxide pigments or colored, water-reducing admixtures, free of carbon black; color stable, nonfading, and resistant to lime and other alkalis.
 - a. Color: As indicated by manufacturer's designation **OR** Match the Owner's sample **OR** As selected by the Owner from manufacturer's full range, **as directed**.
 7. Water: Potable, complying with ASTM C 94/C 94M, free from deleterious materials that may affect color stability, setting, or strength of shotcrete.
 8. Carbon-Steel Fiber: ASTM C 1116, Type 1, carbon-steel fiber and ASTM A 820, Type 1, cold-drawn wire **OR** cut sheet, **as directed**, not less than 1 inch (25 mm) long.
 9. Synthetic Fiber: Fibrillated polypropylene fibers engineered and designed for use in shotcrete, complying with ASTM C 1116, Type III, not less than 3/4 inch (19 mm) long.
 10. Ground Wire: High-strength steel wire, 0.8 to 1 mm in diameter.
 11. Joint Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.
- D. Chemical Admixtures
1. General: ASTM C 1141, Class A or B, but limited to the following admixture materials. Provide admixtures for shotcrete that contains not more than 0.1 percent chloride ions. Certify compatibility of admixtures with each other and with other cementitious materials.
 - a. Air-Entraining Admixture: ASTM C 260.
 - b. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - c. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - d. Water-Reducing and Accelerating Admixture: ASTM C 494/C 494M, Type E.
 - e. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - f. Accelerating Admixture: ASTM C 494/C 494M, Type C.
- E. Curing Materials
1. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry.
 2. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
 3. Water: Potable.
 4. Clear, Waterborne **OR** Solvent-Borne, **as directed**, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.
- F. Shotcrete Mixtures, General
1. Prepare design mixes for each type and strength of shotcrete.
 - a. Limit use of fly ash **OR** ground granulated blast-furnace slag **OR** silica fume, **as directed**, to not exceed, in combination, 25 percent of portland cement by weight.
 2. Limit water-soluble chloride ions to maximum percentage by weight of cement or cementitious materials permitted by ACI 301.
 3. Admixtures: When included in shotcrete design mixes, use admixtures and retarding admixtures according to manufacturer's written instructions.
 4. Carbon-Steel Fiber: Uniformly disperse in shotcrete mix, according to manufacturer's written instructions, at a rate of 50 lb/cu. yd. (30 kg/cu. m) **OR** 100 lb/cu. yd. (60 kg/cu. m), **as directed**.
 5. Synthetic Fiber: Uniformly disperse in shotcrete mix, according to manufacturer's written instructions, at a rate of 1.5 lb/cu. yd. (0.90 kg/cu. m) **OR** 5 lb/cu. yd. (3 kg/cu. m), **as directed**.



6. Design-Mix Adjustments: Subject to compliance with requirements, shotcrete design-mix adjustments may be proposed when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant.

G. Shotcrete Mixtures

1. Proportion dry mixtures by field test data methods and wet mixtures according to ACI 211.1 and ACI 301, using materials to be used on Project, to provide shotcrete with the following properties:
 - a. Compressive Strength (28 Days): 5000 psi (34.5 MPa) **OR** 4500 psi (31 MPa) **OR** 4000 psi (27.6 MPa) **OR** 3500 psi (24.1 MPa), **as directed**.
 - b. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight, wet-mix shotcrete having an air content before pumping of 7 **OR** 8, **as directed**, percent with a tolerance of plus or minus 1-1/2 percent.

H. Shotcrete Equipment

1. Mixing Equipment: Capable of thoroughly mixing shotcrete materials in sufficient quantities to maintain continuous placement.
2. Dry-Mix Delivery Equipment: Capable of discharging aggregate-cement mixture into delivery hose under close control and maintaining continuous stream of uniformly mixed materials at required velocity to discharge nozzle. Equip discharge nozzle with manually operated water-injection system for directing even distribution of water to aggregate-cement mixture.
 - a. Provide uniform, steady supply of clean, compressed air to maintain constant nozzle velocity while simultaneously operating blow pipe for cleaning away rebound.
 - b. Provide water supply with uniform pressure at discharge nozzle to ensure uniform mixing with aggregate-cement mix. Provide water pump to system if line water pressure is inadequate.
3. Wet-Mix Delivery Equipment: Capable of discharging aggregate-cement-water mixture accurately, uniformly, and continuously.

I. Batching And Mixing

1. Dry-Mix Process: Measure mix proportions by weight batching according to ASTM C 94/C 94M or by volume batching complying with ASTM C 685/C 685M requirements.
 - a. In volume batching, adjust fine-aggregate volume for bulking. Test fine-aggregate moisture content at least once daily to determine extent of bulking.
 - b. Prepackaged shotcrete materials may be used at Contractor's option. Predampen prepackaged shotcrete materials and mix before use.
2. Wet-Mix Process: Measure, batch, mix, and deliver shotcrete according to ASTM C 94/C 94M and ASTM C 1116, **as directed**, and furnish batch ticket information.
 - a. Comply with ASTM C 685/C 685M when shotcrete ingredients are delivered dry and proportioned and mixed on-site.

1.3 EXECUTION

A. Preparation

1. Concrete or Masonry: Before applying shotcrete, remove unsound or loose materials and contaminants that may inhibit shotcrete bonding. Chip or scarify areas to be repaired to extent necessary to provide sound substrate. Cut edges square and 1/2 inch (13 mm) deep at perimeter of work, tapering remaining shoulder at 1:1 slope into cavity to eliminate square shoulders. Dampen surfaces before shotcreting.
 - a. Abrasive blast or hydroblast existing surfaces that do not require chipping to remove paint, oil, grease, or other contaminants and to provide roughened surface for proper shotcrete bonding.
2. Earth: Compact and trim to line and grade before placing shotcrete. Do not place shotcrete on frozen surfaces. Dampen surfaces before shotcreting.



3. Rock: Clean rock surfaces of loose materials, mud, and other foreign matter that might weaken shotcrete bonding.
 4. Steel: Clean steel surfaces by abrasive blasting according to SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- B. Forms
1. General: Design, erect, support, brace, and maintain forms, according to ACI 301, to support shotcrete and construction loads and to facilitate shotcreting. Construct forms so shotcrete members and structures are secured to prevent excessive vibration or deflection during shotcreting.
 - a. Fabricate forms to be readily removable without impact, shock, or damage to shotcrete surfaces and adjacent materials.
 - b. Construct forms to required sizes, shapes, lines, and dimensions using ground wires and depth gages to obtain accurate alignment, location, and grades in finished structures. Construct forms to prevent mortar leakage but permit escape of air and rebound during shotcreting. Provide for openings, offsets, blocking, screeds, anchorages, inserts, and other features required in the Work.
 2. Form openings, chases, recesses, bulkheads, keyways, and screeds in formwork. Determine sizes and locations from trades providing such items. Accurately place and securely support items built into forms.
- C. Steel Reinforcement
1. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
 2. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that weaken shotcrete bonding.
 3. Securely embed reinforcing anchors into existing substrates, located as required.
 4. Accurately position, support, and rigidly secure reinforcement against displacement by formwork, construction, or shotcreting. Locate and support reinforcement by metal chairs, runners, bolsters, spacers, and hangers, as required.
 5. Place reinforcement to obtain minimum coverage for shotcrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during shotcreting. Set wire ties with ends directed into shotcrete, not toward exposed shotcrete surfaces.
 6. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
- D. Joints
1. Construction Joints: Locate and install construction joints tapered to a 1:1 slope where joint is not subject to compression loads and square where joint is perpendicular to main reinforcement. Continue reinforcement through construction joints, unless otherwise indicated.
 2. Contraction Joints: Construct contraction joints in shotcrete using saw cuts 1/8-inch- (3-mm-) wide-by-1/3 slab depth or joint-filler strips 1/4-inch- (6-mm-) wide-by-1/3 shotcrete depth, unless otherwise indicated.
 - a. After shotcrete has cured, remove strip inserts and clean groove of loose debris.
 - b. Space joints at 15 feet (4.5 m) o.c. **OR** centers indicated, **as directed**, horizontally and vertically.
 - c. Tool edges round on each side of strip inserts if floated or troweled finishes are required.
- E. Alignment Control
1. Ground Wires: Install ground wires to establish thickness and planes of shotcrete surfaces. Install ground wires at corners and offsets not established by forms. Pull ground wires taut and position adjustment devices to permit additional tightening.
- F. Embedded Items



1. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by shotcrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

G. Application

1. Apply temporary protective coverings and protect adjacent surfaces against deposit of rebound and overspray or impact from nozzle stream.
2. Moisten wood forms immediately before placing shotcrete where form coatings are not used.
3. Apply shotcrete according to ACI 506.2.
4. Apply dry-mix shotcrete materials within 45 minutes after predampening and wet-mix shotcrete materials within 90 minutes after batching.
5. Deposit shotcrete continuously in multiple passes, to required thickness, without cold joints and laminations developing. Place shotcrete with nozzle held perpendicular to receiving surface. Begin shotcreting in corners and recesses.
6. Remove and dispose of rebound and overspray materials during shotcreting to maintain clean surfaces and to prevent rebound entrapment.
7. Maintain reinforcement in position during shotcreting. Place shotcrete to completely encase reinforcement and other embedded items. Maintain steel reinforcement free of overspray and prevent buildup against front face during shotcreting.
8. Do not place subsequent lifts until previous lift of shotcrete is capable of supporting new shotcrete.
9. Do not permit shotcrete to sag, slough, or dislodge.
10. Remove hardened overspray, rebound, and laitance from shotcrete surfaces to receive additional layers of shotcrete; dampen surfaces before shotcreting.
11. Do not disturb shotcrete surfaces before beginning finishing operations.
12. Remove ground wires or other alignment control devices after shotcrete placement.
13. Shotcrete Core Grade: Apply shotcrete to achieve mean core grades not exceeding 2.5 according to ACI 506.2, with no single core grade exceeding 3.0.
14. Installation Tolerances: Place shotcrete without exceeding installation tolerances permitted by ACI 117R, increased by a factor of 2.

H. Surface Finishes

1. General: Finish shotcrete according to descriptions in ACI 506R for the following finishes:
2. Natural Finish:
 - a. Gun Finish: Natural undisturbed finish.
 - b. Rod Finish: Rough-textured finish obtained by cutting or screeding exposed face of shotcrete to plane by rod or straightedge after initial set, and wood-float finished **OR** and steel-trowel finished **as directed**.
 - c. Broom Finish: Rough-textured finish obtained by screeding exposed face of shotcrete to required plane by rod, cutting screed, or trowel, and brooming after initial set.
3. Flash-Coat Finish: After screeding and rodding surface, apply up to 1/4-inch (6-mm) coat of shotcrete using ACI 506R, Gradation No. 1, fine-screened sand modified with maximum aggregate size not exceeding No. 4 (4.75-mm) sieve to provide a finely textured finish.
4. Flash-Coat and Final Finish: After screeding and rodding surface, apply up to 1/4-inch (6-mm) coat of shotcrete using ACI 506R, Gradation No. 1, fine-screened sand modified with maximum aggregate size not exceeding No. 4 (4.75-mm) sieve and apply wood-float **OR** rubber-float **OR** brush-float **OR** steel-trowel, **as directed**, finish.
5. Finish-Coat Finish: After screeding and rodding surface, apply shotcrete finish coat, 1/4 to 1 inch (6 to 25 mm) thick, using ACI 506R, Gradation No. 1, fine-screened sand modified with maximum aggregate size not exceeding No. 4 (4.75-mm) sieve to provide a finish of uniform texture and appearance.
6. Finish-Coat and Final Finish: After screeding and rodding surface, apply shotcrete finish coat, 1/4 to 1 inch (6 to 25 mm) thick, using ACI 506R, Gradation No. 1, fine-screened sand modified with



maximum aggregate size not exceeding No. 4 (4.75-mm) sieve and apply wood-float **OR** rubber-float **OR** brush-float **OR** steel-trowel, **as directed**, finish.

I. Curing

1. Protect freshly placed shotcrete from premature drying and excessive cold or hot temperatures.
2. Start initial curing as soon as free water has disappeared from shotcrete surface after placing and finishing.
3. Curing Exposed Surfaces: Cure shotcrete by one of the following methods:
 - a. Moisture Curing: Keep surfaces continuously moist for at least seven days with water, continuous water-fog spray, water-saturated absorptive covers, or moisture-retaining covers. Lap and seal sides and ends of covers.
 - b. Curing Compound: Apply curing compound uniformly in continuous operation by power spray according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - 1) Apply curing compound to natural- or gun-finished shotcrete at rate of 1 gal./100 sq. ft. (1 L/2.5 sq. m).
4. Curing Formed Surfaces: Cure formed shotcrete surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

J. Form Removal

1. Forms not supporting weight of shotcrete may be removed after curing at not less than 50 deg F (10 deg C) for 24 consecutive hours after gunning, provided shotcrete is hard enough not to be damaged by form-removal operations and provided curing and protecting operations are maintained.
 - a. Leave forms supporting weight of shotcrete in place until shotcrete has attained design compressive strength. Determine compressive strength of in-place shotcrete by testing representative field-cured specimens of shotcrete.
 - b. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
2. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing materials are unacceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork.

K. Field Quality Control

1. Engage a qualified independent testing agency to sample materials, visually grade cores, perform tests, and submit reports during shotcreting.
2. Air Content: ASTM C 173/C 173M, volumetric method or ASTM C 231, pressure method; 1 test for each compressive-strength test for each mix of air-entrained, wet-mix shotcrete measured before pumping.
3. Shotcrete Temperature: ASTM C 1064/C 1064M; 1 test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and 1 test for each set of compressive-strength specimens.
4. Test Panels: Make a test panel, reinforced as in structure, for each shotcrete mix and for each workday or for every 50 cu. yd. (38 cu. m) of shotcrete placed; whichever is less. Produce test panels with dimensions of 24 by 24 inches (600 by 600 mm) minimum and of average thickness of shotcrete, but not less than 4-1/2 inches (115 mm). From each test panel, testing agency will obtain six test specimens: one set of three specimens unreinforced and one set of three specimens reinforced.
 - a. Test each set of unreinforced specimens for compressive strength according to ASTM C 1140 and construction testing requirements in ACI 506.2.
 - b. Visually inspect each set of reinforced shotcrete cores taken from test panels and determine mean core grades according to ACI 506.2.



5. In-Place Shotcrete: Take a set of 3 unreinforced cores for each mix and for each workday or for every 50 cu. yd. (38 cu. m) of shotcrete placed; whichever is less. Test cores for compressive strength according to ACI 506.2 and ASTM C 42. Do not cut steel reinforcement.
6. Strength of shotcrete will be considered satisfactory when mean compressive strength of each set of 3 unreinforced cores equals or exceeds 85 percent of specified compressive strength, with no individual core less than 75 percent of specified compressive strength.
 - a. Mean compressive strength of each set of 3 unreinforced cubes shall equal or exceed design compressive strength with no individual cube less than 88 percent of specified compressive strength.

L. Repairs

1. Remove and replace shotcrete that is delaminated or exhibits laminations, voids, or sand/rock pockets exceeding limits for specified core grade of shotcrete.
 - a. Remove unsound or loose materials and contaminants that may inhibit bond of shotcrete repairs. Chip or scarify areas to be repaired to extent necessary to provide sound substrate. Cut edges square and 1/2 inch (13 mm) deep at perimeter of work, tapering remaining shoulder at 1:1 slope into cavity to eliminate square shoulders. Dampen surfaces and apply new shotcrete.
2. Repair core holes from in-place testing according to repair provisions in ACI 301 and match adjacent finish, texture, and color.

M. Cleaning

1. Remove and dispose of rebound and overspray materials from final shotcrete surfaces and areas not intended for shotcrete placement.

END OF SECTION 03 37 13 00



SECTION 03 37 13 00a - GLASS FIBER REINFORCED CONCRETE

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for glass-fiber-reinforced precast concrete panels. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes glass-fiber-reinforced concrete (GFRC) panels consisting of GFRC panel frames, anchors, and connection hardware.
 - a. GFRC panels include wall units, window wall units, mullions, column covers, fascia units, cornices, and soffits.

C. Definitions

1. Design Reference Sample: Sample of approved GFRC color, finish, and texture; preapproved by the Owner.

D. Performance Requirements

1. Structural Performance: Provide GFRC panels, including panel frames, anchors, and connections, capable of withstanding the following design loads as well as the effects of thermal- and moisture-induced volume changes, according to load factors and combinations established in PCI MNL 128, "Recommended Practice for Glass Fiber Reinforced Concrete Panels."
 - a. Design Loads: As required to meet Project requirements.
 - b. Deflection Limits: Design panel frames to withstand design loads without lateral deflections greater than 1/240 of wall span.
 - c. Thermal Movements: Provide for thermal movements resulting from annual ambient temperature changes of 100 deg F (56 deg C).
 - d. Design panel frames and connections to accommodate deflections and other building movements.
 - e. Design panel frames to transfer window loads to building structure.

E. Submittals

1. Product Data: For each type of product indicated. Include GFRC design mixes.
2. Shop Drawings: Show fabrication and installation details for GFRC panels including the following:
 - a. Structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - b. Panel elevations, sections, and dimensions.
 - c. Thickness of facing mix, GFRC backing, and bonding pads for typical panels.
 - d. Finishes.
 - e. Joint and connection details.
 - f. Erection details.
 - g. Panel frame details for typical panels including sizes, spacings, thickness, and yield strength of various members.
 - h. Location and details of connection hardware attached to structure.
 - i. Size, location, and details of flex, gravity, and seismic anchors for typical panels.
 - j. Other items sprayed into panels.
 - k. Erection sequence for special conditions.
 - l. Relationship to adjacent materials.
 - m. Description of loose, cast-in, and field hardware.



3. Samples: Representative of finished exposed face of GFRC showing the full range of colors and textures specified, 12 by 12 inches (305 by 305 mm) and of actual thickness.
4. Qualification Data: For qualified GFRC manufacturer, including proof of current Precast/Prestressed Concrete Institute (PCI) or Architectural Precast Association (APA) Plant Certification.
5. Welding certificates.
6. Steel Sheet Certification: For steel sheet used in cold-formed steel panel framing.
7. Mill Certificates: For structural-steel shapes and hollow structural sections used in panel framing.
8. Source Quality-Control Program: For GFRC manufacturer.
9. Source Quality-Control Test Reports: For GFRC, inserts, and anchors.

F. Quality Assurance

1. Manufacturer Qualifications: A qualified manufacturer that participates in PCI's Plant Certification Program and is designated a PCI-Certified Plant for Group G - Glass Fiber Reinforced Concrete or that participates in APA's Plant Certification Program and is certified for GFRC production.
 - a. Manufacturer's responsibility includes fabricating and installing GFRC panels and providing professional engineering services needed to assume engineering responsibility for GFRC panels.
 - b. Engineering responsibility includes preparation of Shop Drawings and comprehensive engineering analysis, based on GFRC production test values, by a qualified professional engineer experienced in GFRC design.
2. Steel Sheet Certifications: Obtain mill certificates signed by manufacturers of steel sheet, or test reports from a qualified testing agency, indicating that steel sheet used in cold-formed metal panel framing complies with requirements including uncoated steel thickness, yield strength, tensile strength, total elongation, chemical requirements, and galvanized-coating thickness.
3. Mill Certificates: Obtain certified mill test reports from manufacturer of structural-steel shapes and hollow structural sections used in panel framing indicating compliance of these products with requirements.
4. Source Limitations: Obtain GFRC panels from single source from single manufacturer.
5. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," and AWS D1.3, "Structural Welding Code - Sheet Steel."
6. PCI Manuals: Comply with requirements and recommendations in the following PCI manuals unless more stringent requirements are indicated:
 - a. PCI MNL 128, "Recommended Practice for Glass Fiber Reinforced Concrete Panels."
 - b. PCI MNL 130, "Manual for Quality Control for Plants and Production of Glass Fiber Reinforced Concrete Products."
7. AISC Specifications: Comply with AISC's "Specification for Structural Steel Buildings - Allowable Stress Design and Plastic Design" **OR** "Load and Resistance Factor Design Specification for Structural Steel Buildings" **OR** "Specification for the Design of Steel Hollow Structural Sections," **as directed**, if using structural-steel shapes or hollow structural sections for panel frames.
8. Preinstallation Conference: Conduct conference at Project site.

G. Delivery, Storage, And Handling

1. Handle and transport GFRC panels to avoid damage.
 - a. Place nonstaining resilient spacers between panels.
 - b. Support panels on nonstaining material during shipment.
 - c. Protect panels from dirt and damage during handling and transport.
2. Store GFRC panels to protect from contact with soil, staining, and physical damage.
 - a. Store panels with nonstaining resilient supports in same positions as when transported.
 - b. Store panels on firm, level, and smooth surfaces.
 - c. Place stored panels so identification marks are clearly visible.



1.2 PRODUCTS

A. Mold Materials

1. Molds: Rigid, dimensionally stable, nonabsorptive material, warp and buckle free, that will provide continuous and true GFRC surfaces; nonreactive with GFRC and capable of producing required finish surfaces.
 - a. Mold-Release Agent: Commercially produced liquid-release agent that will not bond with, stain, or adversely affect GFRC surfaces and will not impair subsequent surface or joint treatments of GFRC.
2. Form Liners: Units of face design, texture, arrangement, and configuration indicated **OR** to match GFRC design reference sample, **as directed**. Provide solid backing and form supports to ensure that form liners remain in place during GFRC application. Use with manufacturer's recommended liquid-release agent that will not bond with, stain, or adversely affect GFRC surfaces and will not impair subsequent surface or joint treatments of GFRC.
3. Surface Retarder: Chemical liquid set retarder capable of temporarily delaying hardening of newly placed GFRC face mix to depth of reveal specified.

B. GFRC Materials

1. Portland Cement: ASTM C 150; Type I, II, or III.
 - a. For surfaces exposed to view in finished structure, use gray **OR** white, **as directed**, of same type, brand, and source throughout GFRC production.
 - b. Metakaolin: ASTM C 618, Class N.
2. Glass Fibers: Alkali resistant, with a minimum zirconia content of 16 percent, 1 to 2 inches (25 to 50 mm) long, specifically produced for use in GFRC, and complying with PCI MNL 130.
3. Sand: Washed and dried silica, complying with composition requirements in ASTM C 144; passing No. 20 (0.85-mm) sieve with a maximum of 2 percent passing No. 100 (0.15-mm) sieve.
4. Facing Aggregate: ASTM C 33, except for gradation, and PCI MNL 130, 1/4-inch (6-mm) maximum size.
 - a. Aggregates: Selected, hard, and durable; free of material that reacts with cement or causes staining; to match sample.
5. Coloring Admixture: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures, temperature stable, nonfading, and alkali resistant.
6. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of GFRC and complying with chemical limits of PCI MNL 130.
7. Polymer-Curing Admixture: Acrylic thermoplastic copolymer dispersion complying with PCI MNL 130.
8. Air-Entraining Admixture: ASTM C 260, containing not more than 0.1 percent chloride ions.
9. Chemical Admixtures: ASTM C 494/C 494M, containing not more than 0.1 percent chloride ions.

C. Anchors, Connectors, And Miscellaneous Materials

1. Stainless-Steel Plates: ASTM A 240/A 240M or ASTM A 666, Type 304.
2. Carbon-Steel Shapes and Plates: ASTM A 36/A 36M. Finish steel shapes and plates less than 3/16 inch (4.76 mm) thick as follows:
 - a. Finish: Zinc coated by hot-dip process according to ASTM A 123/A 123M, after fabrication, or ASTM A 153/A 153M, as applicable **OR** electrodeposition according to ASTM B 633, SC 3, **as directed**.
OR
Finish: Shop primed with MPI#79 **OR** SSPC-Paint 25, **as directed**, on surfaces prepared to comply with SSPC-SP 2, "Hand Tool Cleaning," or better.
3. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.
4. Carbon-Steel Bars: ASTM A 108, AISI Grade 1018. Finish steel bars less than 3/16 inch (4.76 mm) thick as follows:
 - a. Finish: Zinc coated by hot-dip process according to ASTM A 123/A 123M, after fabrication, or ASTM A 153/A 153M, as applicable **OR** electrodeposition according to ASTM B 633, SC 3, **as directed**.



- b. Finish: Shop primed with MPI#79 **OR** SSPC-Paint 25, **as directed**, on surfaces prepared to comply with SSPC-SP 2, "Hand Tool Cleaning," or better.
- 5. Malleable-Iron Castings: ASTM A 47/ A 47M, Grade 32510 (Grade 22010).
- 6. Carbon-Steel Castings: ASTM A 27/A 27M, Grade 60-30 (Grade 415-205).
- 7. Bolts: ASTM A 307 or ASTM A 325 (ASTM F 568M or ASTM A 325M).
 - a. Finish: Zinc coated by hot-dip process according to ASTM A 123/A 123M, after fabrication, and ASTM A 153/A 153M, as applicable **OR** electrodeposition according to ASTM B 633, SC 3, **as directed**.
- 8. Reglets: PVC extrusions **OR** Stainless steel, ASTM A 240/A 240M, Type 304, 0.016 inch (0.40 mm) thick, **as directed**.

D. Panel Frame Materials

- 1. Cold-Formed Steel Framing: Manufacturer's standard C-shaped steel studs, complying with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members," minimum uncoated steel thickness of 0.053 inch (1.34 mm) of web depth indicated, with stiffened flanges, U-shaped steel track, and of the following steel sheet:
 - a. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, structural-steel sheet, G60 (Z180) **OR** G90 (Z275), **as directed**, zinc coating, of grade required by structural performance of framing.
 - b. Painted, Nonmetallic-Coated Steel Sheet: ASTM A 1011/A 1011M, hot rolled; or ASTM A 1008/A 1008M, cold rolled; nonmetallic coated according to ASTM A 1003/A 1003M; of grade required by structural performance of framing.
- 2. Hollow Structural Sections: Steel tubing, ASTM A 500, Grade B, or ASTM A 513. Finish hollow structural sections with wall thickness less than 3/16 inch (4.76 mm) as follows:
 - a. Organic Zinc-Rich Primer: SSPC-Paint 20 on surfaces prepared to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - b. Primer: MPI#79 **OR** SSPC-Paint 25, **as directed**, on surfaces prepared to comply with SSPC-SP 2, "Hand Tool Cleaning," or better.
- 3. Steel Channels and Angles: ASTM A 36/A 36M, finished as follows:
 - a. Organic Zinc-Rich Primer: SSPC-Paint 20 on surfaces prepared to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - b. Primer: MPI#79 **OR** SSPC-Paint 25, **as directed**, on surfaces prepared to comply with SSPC-SP 2, "Hand Tool Cleaning," or better.

E. GFRC Mixes

- 1. Backing Mix: Proportion backing mix of portland cement, glass fibers, sand, and admixtures to comply with design requirements. Provide nominal glass-fiber content of not less than 5 percent by weight of total mix.
- 2. Face Mix: Proportion face mix of portland cement, sand, facing aggregates, and admixtures to comply with design requirements.
- 3. Mist Coat: Portland cement, sand slurry, and admixtures; of same proportions as backing mix without glass fibers.
- 4. Polymer-Curing Admixture: 6 to 7 percent by weight of polymer-curing admixture solids to dry portland cement.
- 5. Air Content: 8 to 10 percent; ASTM C 185.
- 6. Coloring Admixture: Not to exceed 10 percent of cement weight.

F. Panel Frame Fabrication

- 1. Fabricate panel frames and accessories plumb, square, true to line, and with components securely fastened, according to Shop Drawings and requirements in this Section.
 - a. Fabricate panel frames using jigs or templates.
 - b. Cut cold-formed metal framing members by sawing or shearing; do not torch cut.
 - c. Fasten cold-formed metal framing members by welding. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.



- d. Fasten framing members of hollow structural sections, steel channels, or steel angles by welding. Comply with AWS D1.1/D1.1M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - e. Weld flex, gravity, and seismic anchors to panel frames.
 2. Reinforce, stiffen, and brace framing assemblies, if necessary, to withstand handling, delivery, and erection stresses. Lift fabricated assemblies in a manner that prevents damage or significant distortion.
 3. Galvanizing Repair: Touch up accessible damaged galvanized surfaces according to ASTM A 780.
 4. Painting Repair: Touch up accessible damaged painted surfaces using same primer.
- G. Mold Fabrication
1. Construct molds that will result in finished GFRC complying with profiles, dimensions, and tolerances indicated, without damaging GFRC during stripping. Construct molds to prevent water leakage and loss of cement paste.
 - a. Coat contact surfaces of molds with form-release agent.
 - b. Coat contact surfaces of molds with surface retarder.
 2. Place form liners accurately to provide finished surface texture indicated. Provide solid backing and supports to maintain stability of liners during GFRC application. Coat form liner with form-release agent.
 3. Locate, place, and secure flashing reglets accurately.
- H. GFRC Fabrication
1. Proportioning and Mixing: For backing mix, meter sand/cement slurry and glass fibers to spray head at rates to achieve design mix proportions and glass-fiber content according to PCI MNL 130 procedures.
 2. Spray Application: Comply with general procedures as follows:
 - a. Spray mist coat over molds to a nominal thickness of 1/8 inch (3 mm) on planar surfaces.
 - b. Spray or place face mix in thickness indicated on Shop Drawings.
 - c. Proceed with spraying backing mix before face mix **OR** mist coat, **as directed**, has set, using procedures that produce a uniform thickness and even distribution of glass fibers and matrix.
 - d. Consolidate backing mix by rolling or other technique to achieve complete encapsulation of glass fibers and compaction.
 - e. Measure thickness with a pin gage or other acceptable method at least once for each 5 sq. ft. (0.5 sq. m) of panel surface. Take not less than six measurements per panel.
 3. Hand form and consolidate intricate details, incorporate formers or infill materials, and over spray before material reaches initial set to ensure complete bonding.
 4. Attach panel frame to GFRC before initial set of GFRC backing, maintaining a minimum clearance of 1/2 inch (13 mm) from GFRC backing, and without anchors protruding into GFRC backing.
 5. Build up homogeneous GFRC bonding pads over anchor feet, maintaining a minimum thickness of 1/2 inch (13 mm) over tops of anchor feet, before initial set of GFRC backing.
 6. Inserts and Embedments: Build up homogeneous GFRC bosses or bonding pads over inserts and embedments to provide sufficient anchorage and embedment to comply with design requirements.
 7. Curing: Employ initial curing method that will ensure sufficient strength for removing units from mold. Comply with PCI MNL 130 procedures.
 8. Panel Identification: Mark each GFRC panel to correspond with identification mark on Shop Drawings. Mark each panel with its casting date.
- I. Fabrication Tolerances
1. Manufacturing Tolerances: Manufacture GFRC panels so each finished unit complies with PCI MNL 130 for dimension, position, and tolerances.
OR



Manufacturing Tolerances: Manufacture GFRC panels so each finished unit complies with the following dimensional tolerances. For dimensional tolerances not listed below, comply with PCI MNL 130.

- a. Overall Height and Width of Units, Measured at the Face Adjacent to Mold: As follows:
 - 1) 10 feet (3 m) or less, plus or minus 1/8 inch (3 mm).
 - 2) More than 10 feet (3 m), plus or minus 1/8 inch per 10 feet (3 mm per 3 m); 1/4 inch (6 mm) maximum.
 - b. Edge Return Thickness: Plus 1/2 inch (13 mm), minus 0 inch (0 mm).
 - c. Architectural Facing Thickness: Plus 1/8 inch (3 mm), minus 0 inch (0 mm).
 - d. Backing Thickness: Plus 1/4 inch (6 mm), minus 0 inch (0 mm).
 - e. Panel Depth from Face of Skin to Back of Panel Frame or Integral Rib: Plus 3/8 inch (10 mm), minus 1/4 inch (6 mm).
 - f. Angular Variation of Plane of Side Mold: Plus or minus 1/32 inch per 3 inches (0.8 mm per 75 mm) of depth or plus or minus 1/16 inch (1.5 mm) total, whichever is greater.
 - g. Variation from Square or Designated Skew (Difference in Length of Two Diagonal Measurements): Plus or minus 1/8 inch per 72 inches (3 mm per 1800 mm) or plus or minus 1/4 inch (6 mm) total, whichever is greater.
 - h. Local Smoothness: 1/4 inch per 10 feet (6 mm per 3 m).
 - i. Bowing: Not to exceed L/240 unless unit meets erection tolerances using connection adjustments.
 - j. Length and Width of Block Outs and Openings within One Unit: Plus or minus 1/4 inch (6 mm).
 - k. Location of Window Opening within Panel: Plus or minus 1/4 inch (6 mm).
 - l. Maximum Permissible Warpage of One Corner out of the Plane of the Other Three: 1/16 inch per 12 inches (1.5 mm per 305 mm) of distance from nearest adjacent corner.
2. Position Tolerances: Measured from datum line locations, as indicated on Shop Drawings.
 - a. Panel Frame and Track: Plus or minus 1/4 inch (6 mm).
 - b. Flashing Reglets at Edge of Panel: Plus or minus 1/4 inch (6 mm).
 - c. Inserts: Plus or minus 1/2 inch (13 mm).
 - d. Special Handling Devices: Plus or minus 3 inches (75 mm).
 - e. Location of Bearing Devices: Plus or minus 1/4 inch (6 mm).
 - f. Blockouts: Plus or minus 3/8 inch (10 mm).
 3. Panel Frame Tolerances: As follows:
 - a. Vertical and Horizontal Alignment: 1/4 inch per 10 feet (6 mm per 3 m).
 - b. Spacing of Framing Member: Plus or minus 3/8 inch (10 mm).
 - c. Squareness of Frame: Difference in length of diagonals of 3/8 inch (10 mm).
 - d. Overall Size of Frame: Plus or minus 3/8 inch (10 mm).

J. Finishes

1. Finish exposed-face surfaces of GFRC as follows to match approved design reference sample. Panel faces shall be free of joint marks, grain, or other obvious defects.
 - a. Design Reference Sample: <Insert description and identify manufacturer and code number of sample>.
 - b. As-Cast-Surface Finish: Provide free of sand streaks, honeycombs, and excessive air voids, with uniform color and texture.
 - c. Textured-Surface Finish: Impart by form liners to provide surfaces free of sand streaks, honeycombs, and excessive air voids, with uniform color and texture.
 - d. Retarded Finish: Use chemical-retarding agents applied to concrete forms and washing and brushing procedures to expose aggregate and surrounding matrix surfaces after form removal.
 - e. Sand- or Abrasive-Blast Finish: Use abrasive grit, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces.
 - f. Acid-Etched Finish: Use acid and hot-water solution equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces.

**K. Source Quality Control**

1. Quality-Control Testing: Establish and maintain a quality-control program for manufacturing GFRC panels according to PCI MNL 130.
 - a. Test materials and inspect production techniques.
 - b. Quality-control program shall monitor glass-fiber content, spray rate, unit weight, product physical properties, anchor pull-off and shear strength, and curing period and conditions.
 - c. Prepare test specimens and test according to ASTM C 1228, PCI MNL 130, and PCI MNL 128 procedures.
 - d. Test GFRC inserts and anchors according to ASTM C 1230 to validate design values.
 - e. Produce test boards at a rate not less than one per work shift per operator for each spray machine and for each mix design.
 - 1) For each test board, determine glass-fiber content according to ASTM C 1229, and flexural yield and ultimate strength according to ASTM C 947.

1.3 EXECUTION**A. Examination**

1. Examine structure and conditions for compliance with requirements for installation tolerances, true and level bearing surfaces, and other conditions affecting performance of the Work.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Erection

1. Install clips, hangers, and other accessories required for connecting GFRC panels to supporting members and backup materials.
2. Lift GFRC panels and install without damage.
3. Install GFRC panels level, plumb, square, and in alignment. Provide temporary supports and bracing as required to maintain position, stability, and alignment of panels until permanent connections are completed.
 - a. Maintain horizontal and vertical joint alignment and uniform joint width.
 - b. Remove projecting hoisting devices.
4. Connect GFRC panels in position by bolting or welding, or both, as indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as possible after connecting is completed.
5. Welding: Comply with applicable AWS D1.1/D1.1M and AWS D1.3 requirements for welding, appearance, quality of welds, and methods used in correcting welding work.
 - a. Protect GFRC panels from damage by field welding or cutting operations, and provide noncombustible shields as required.
6. At bolted connections, use lock washers or other acceptable means to prevent loosening of nuts.

C. Erection Tolerances

1. Erect GFRC panels to comply with the following noncumulative tolerances:
 - a. Plan Location from Building Grid Datum: Plus or minus 1/2 inch (13 mm).
 - b. Top Elevation from Nominal Top Elevation: As follows:
 - 1) Exposed Individual Panel: Plus or minus 1/4 inch (6 mm).
 - 2) Nonexposed Individual Panel: Plus or minus 1/2 inch (13 mm).
 - 3) Exposed Panel Relative to Adjacent Panel: 1/4 inch (6 mm).
 - 4) Nonexposed Panel Relative to Adjacent Panel: 1/2 inch (13 mm).
 - c. Support Elevation from Nominal Elevation: As follows:
 - 1) Maximum Low: 1/2 inch (13 mm).
 - 2) Maximum High: 1/4 inch (6 mm).
 - d. Maximum Plumb Variation over the Lesser of Height of Structure or 100 Feet (30 m): 1 inch (25 mm).
 - e. Plumb in Any 10 Feet (3 m) of Element Height: 1/4 inch (6 mm).
 - f. Maximum Jog in Alignment of Matching Edges: 1/4 inch (6 mm).
 - g. Maximum Jog in Alignment of Matching Faces: 1/4 inch (6 mm).



- h. Face Width of Joint: As follows (governs over joint taper):
 - 1) Panel Dimension 20 Feet (6 m) or Less: Plus or minus 1/4 inch (6 mm).
 - 2) Panel Dimension More Than 20 Feet (6 m): Plus or minus 5/16 inch (8 mm).
- i. Maximum Joint Taper: 3/8 inch (10 mm).
- j. Joint Taper in 10 Feet (3 m): 1/4 inch (6 mm).
- k. Differential Bowing, as Erected, between Adjacent Members of Same Design: 1/4 inch (6 mm).

D. Repairs

- 1. Repairs will be permitted provided structural adequacy of GFRC panel and appearance are not impaired, as approved by the Owner.
- 2. Mix patching materials and repair GFRC so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces.
- 3. Prepare and repair accessible damaged galvanized coatings with galvanizing repair paint according to ASTM A 780.
- 4. Wire brush, clean, and paint accessible weld areas on prime-painted components with same type of shop primer.
- 5. Remove and replace damaged GFRC panels when repairs do not comply with requirements.

E. Cleaning And Protection

- 1. Perform cleaning procedures, if necessary, according to GFRC manufacturer's written instructions. Clean soiled GFRC surfaces with detergent and water, using soft fiber brushes and sponges, and rinse with clean water. Prevent damage to GFRC surfaces and staining of adjacent materials.

END OF SECTION 03 37 13 00a



Task	Specification	Specification Description
03 39 13 00	03 05 00 00	Cast-In-Place Concrete
03 39 23 23	03 05 00 00	Cast-In-Place Concrete
03 39 33 00	03 05 00 00	Cast-In-Place Concrete



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SECTION 03 48 29 00 - PLANT-PRECAST STRUCTURAL CONCRETE

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for plant-precast structural concrete. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Precast structural concrete.
 - b. Precast structural concrete with thin-brick or stone facings.
 - c. Precast structural concrete with commercial architectural finish.

C. Definition

1. Design Reference Sample: Sample of approved precast structural concrete color, finish, and texture, preapproved by the Owner.

D. Performance Requirements

1. Delegated Design: Design precast structural concrete, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2. Structural Performance: Precast structural concrete units and connections shall withstand design loads indicated within limits and under conditions indicated.
 - a. Fire-Resistance Rating: Select material and minimum thicknesses to provide indicated fire rating.

E. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:
 - a. Product Data for Credit MR 4.1 and Credit MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - 1) Include statement indicating costs for each product having recycled content.
 - b. Design Mixtures for Credit ID 1.1: For each concrete mixture containing fly ash as a replacement for portland cement or other portland cement replacements and for equivalent concrete mixtures that do not contain portland cement replacements.
3. Design Mixtures: For each precast concrete mixture. Include compressive strength and water-absorption tests.
4. Shop Drawings: Include member locations, plans, elevations, dimensions, shapes and sections, openings, support conditions, and types of reinforcement, including special reinforcement. Detail fabrication and installation of precast structural concrete units.
5. Delegated-Design Submittal: For precast structural concrete indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
6. Qualification Data: For Installer **OR** fabricator **OR** testing agency, **as directed**.
7. Welding certificates.
8. Material Certificates.
9. Material Test Reports.
10. Source quality-control reports.
11. Field quality-control and special inspection, **as directed**, reports.



F. Quality Assurance

1. Fabricator Qualifications: A firm that assumes responsibility for engineering precast structural concrete units to comply with performance requirements. Responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
 - a. Participates in PCI's Plant Certification program and is designated a PCI-certified plant as follows:
 - 1) Group C, Category C1 - Precast Concrete Products (no prestressed reinforcement) **OR** Category C2 - Prestressed Hollowcore and Repetitively Produced Products **OR** Category C3 - Prestressed Straight Strand Structural Members **OR** Category C4 - Prestressed Deflected Strand Structural Members, **as directed**.
 - 2) Group CA, Category C1A - Precast Concrete Products (no prestressed reinforcement) **OR** Category C2A - Prestressed Hollowcore and Repetitively Produced Products **OR** Category C3A - Prestressed Straight-Strand Structural Members **OR** Category C4A - Prestressed Deflected-Strand Structural Members, **as directed**.
2. Design Standards: Comply with ACI 318 (ACI 318M) and design recommendations in PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of precast structural concrete units indicated.
3. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 116, "Manual for Quality Control for Plants and Production of Structural Precast Concrete Products."
4. Welding Qualifications: Qualify procedures and personnel according to the following:
 - a. AWS D1.1/D.1.1M, "Structural Welding Code - Steel."
 - b. AWS D1.4, "Structural Welding Code - Reinforcing Steel."
5. Fire-Resistance Calculations: Where indicated, provide precast structural concrete units whose fire resistance meets the prescriptive requirements of authorities having jurisdiction or has been calculated according to ACI 216.1/TMS 0216.1, "Standard Method for Determining Fire Resistance of Concrete and Masonry Construction Assemblies," **OR** PCI MNL 124, "Design for Fire Resistance of Precast Prestressed Concrete," **as directed**, and is acceptable to authorities having jurisdiction.
6. Preinstallation Conference: Conduct conference at Project site.

G. Delivery, Storage, And Handling

1. Support units during shipment on nonstaining shock-absorbing material in same position as during storage.
2. Store units with adequate bracing and protect units to prevent contact with soil, to prevent staining, and to prevent cracking, distortion, warping or other physical damage.
 - a. Store units with dunnage across full width of each bearing point unless otherwise indicated.
 - b. Place adequate dunnage of even thickness between each unit.
 - c. Place stored units so identification marks are clearly visible, and units can be inspected.
3. Handle and transport units in a position consistent with their shape and design in order to avoid excessive stresses that would cause cracking or damage.
4. Lift and support units only at designated points shown on Shop Drawings.

H. Coordination

1. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction before starting that Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

1.2 PRODUCTS

A. Mold Materials



1. Molds: Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that will provide continuous and true precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required finishes.
 - a. Mold-Release Agent: Commercially produced liquid-release agent that will not bond with, stain or adversely affect precast concrete surfaces and will not impair subsequent surface or joint treatments of precast concrete.
 2. Form Liners: Units of face design, texture, arrangement, and configuration indicated **OR** to match those used for precast concrete design reference sample, **as directed**. Furnish with manufacturer's recommended liquid-release agent that will not bond with, stain, or adversely affect precast concrete surfaces and will not impair subsequent surface or joint treatments of precast concrete.
 3. Surface Retarder: Chemical set retarder, capable of temporarily delaying final hardening of newly placed concrete mixture to depth of reveal specified.
- B. Reinforcing Materials
1. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 **OR** 60, **as directed**, percent.
 2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
 3. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.
 4. Galvanized Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420) **OR** ASTM A 706/A 706M, **as directed**, deformed bars, ASTM A 767/A 767M, Class II zinc coated, hot-dip galvanized, and chromate wash treated after fabrication and bending, **as directed**.
 5. Epoxy-Coated Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420) **OR** ASTM A 706/A 706M, **as directed**, deformed bars, ASTM A 775/A 775M **OR** ASTM A 934/A 934M, **as directed**, epoxy coated, with less than 2 percent damaged coating in each 12-inch (300-mm) bar length.
 6. Steel Bar Mats: ASTM A 184/A 184M, fabricated from ASTM A 615/A 615M, Grade 60 (Grade 420) **OR** ASTM A 706/A 706M, **as directed**, deformed bars, assembled with clips.
 7. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel **OR** galvanized-steel, **as directed**, wire into flat sheets.
 8. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.
 9. Epoxy-Coated-Steel Wire: ASTM A 884/A 884M, Class A coated, plain **OR** deformed, **as directed**, flat sheet, Type 1 bendable **OR** Type 2 nonbendable, **as directed**, coating.
 10. Supports: Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 116.
- C. Prestressing Tendons
1. Pretensioning Strand: ASTM A 416/A 416M, Grade 250 (Grade 1720) or Grade 270 (Grade 1860), uncoated, 7-wire **OR** ASTM A 886/A 886M, Grade 270 (Grade 1860), indented, 7-wire, **as directed**, low-relaxation strand.
 2. Unbonded Post-Tensioning Strand: ASTM A 416/A 416M, Grade 270 (Grade 1860), uncoated, 7-wire, low-relaxation strand.
 - a. Coat unbonded post-tensioning strand with post-tensioning coating complying with ACI 423.6 and sheath with polypropylene tendon sheathing complying with ACI 423.6. Include anchorage devices and coupler assemblies.
 3. Post-Tensioning Bars: ASTM A 722, uncoated high-strength steel bar.
- D. Concrete Materials
1. Portland Cement: ASTM C 150, Type I or Type III, gray, unless otherwise indicated.
 - a. For surfaces exposed to view in finished structure, mix gray with white cement, of same type, brand, and mill source.
 2. Supplementary Cementitious Materials:
 - a. Fly Ash: ASTM C 618, Class C or F, with maximum loss on ignition of 3 percent.
 - b. Metakaolin Admixture: ASTM C 618, Class N.



- c. Silica Fume Admixture: ASTM C 1240, with optional chemical and physical requirement.
 - d. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
 3. Normal-Weight Aggregates: Except as modified by PCI MNL 116, ASTM C 33, with coarse aggregates complying with Class 5S **OR** Class 5M **OR** Class 4S **OR** Class 4M, **as directed**. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.
 - a. Face-Mixture-Coarse Aggregates: Selected, hard, and durable; free of material that reacts with cement or causes staining; to match selected finish sample.
 - 1) Gradation: Uniformly graded **OR** Gap graded **OR** To match design reference sample, **as directed**.
 - b. Face-Mixture-Fine Aggregates: Selected, natural or manufactured sand of same material as coarse aggregate unless otherwise approved by the Owner.
 4. Lightweight Aggregates: Except as modified by PCI MNL 116, ASTM C 330, with absorption less than 11 percent.
 5. Coloring Admixture: ASTM C 979, synthetic or natural mineral-oxide pigments or colored water-reducing admixtures, temperature stable, and nonfading.
 6. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 116.
 7. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.
 8. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture.
 - a. Water-Reducing Admixtures: ASTM C 494/C 494M, Type A.
 - b. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - c. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - d. Water-Reducing and Accelerating Admixture: ASTM C 494/C 494M, Type E.
 - e. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - f. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 - g. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M.
 9. Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.
- E. Steel Connection Materials
1. Carbon-Steel Shapes and Plates: ASTM A 36/A 36M.
 2. Carbon-Steel-Headed Studs: ASTM A 108, AISI 1018 through AISI 1020, cold finished, AWS D1.1/D1.1M, Type A or B, with arc shields and with minimum mechanical properties of PCI MNL 116.
 3. Carbon-Steel Plate: ASTM A 283/A 283M.
 4. Malleable-Iron Castings: ASTM A 47/A 47M.
 5. Carbon-Steel Castings: ASTM A 27/A 27M, Grade 60-30 (Grade 415-205).
 6. High-Strength, Low-Alloy Structural Steel: ASTM A 572/A 572M.
 7. Carbon-Steel Structural Tubing: ASTM A 500, Grade B.
 8. Wrought Carbon-Steel Bars: ASTM A 675/A 675M, Grade 65 (Grade 450).
 9. Deformed-Steel Wire or Bar Anchors: ASTM A 496 or ASTM A 706/A 706M.
 10. Carbon-Steel Bolts and Studs: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); carbon-steel, hex-head bolts and studs; carbon-steel nuts, ASTM A 563 (ASTM A 563M); and flat, unhardened steel washers, ASTM F 844.
 11. High-Strength Bolts and Nuts: ASTM A 325 (ASTM A 325M) or ASTM A 490 (ASTM A 490M), Type 1, heavy hex steel structural bolts; heavy hex carbon-steel nuts, ASTM A 563 (ASTM A 563M); and hardened carbon-steel washers, ASTM F 436 (ASTM F 436M).
 - a. Do not zinc coat ASTM A 490 (ASTM A 490M) bolts.
 12. Zinc-Coated Finish: For exterior steel items, steel in exterior walls, **as directed**, and items indicated for galvanizing, apply zinc coating by hot-dip process according to ASTM A 123/A 123M



or ASTM A 153/A 153M **OR** electrodeposition according to ASTM B 633, SC 3, Types 1 and 2, **as directed**.

- a. For steel shapes, plates, and tubing to be galvanized, limit silicon content of steel to less than 0.03 percent or to between 0.15 and 0.25 percent or limit sum of silicon and 2.5 times phosphorous content to 0.09 percent.
 - b. Galvanizing Repair Paint: High-zinc-dust-content paint with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035B or SSPC-Paint 20.
13. Shop-Primed Finish: Prepare surfaces of nongalvanized-steel items, except those surfaces to be embedded in concrete, according to requirements in SSPC-SP 3, and shop apply lead- and chromate-free, rust-inhibitive primer, complying with performance requirements in MPI 79 **OR** SSPC-Paint 25, **as directed**, according to SSPC-PA 1.
14. Welding Electrodes: Comply with AWS standards.
15. Precast Accessories: Provide clips, hangers, plastic or steel shims, and other accessories required to install precast structural concrete units.

F. Stainless-Steel Connection Materials

1. Stainless-Steel Plate: ASTM A 666, Type 304, of grade suitable for application.
2. Stainless-Steel Bolts and Studs: ASTM F 593, Alloy 304 or 316, hex-head bolts and studs; stainless-steel nuts; and flat, stainless-steel washers. Lubricate threaded parts of stainless-steel bolts with an antiseize thread lubricant during assembly.
3. Stainless-Steel-Headed Studs: ASTM A 276, with minimum mechanical properties of PCI MNL 116.

G. Bearing Pads

1. Provide one of the following bearing pads for precast structural concrete units as recommended by precast fabricator for application, **as directed**:
 - a. Elastomeric Pads: AASHTO M 251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, 50 to 70 Shore, Type A durometer hardness, ASTM D 2240; minimum tensile strength 2250 psi (15.5 MPa), ASTM D 412.
 - b. Random-Oriented, Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer. 70 to 90 Shore, Type A durometer hardness, ASTM D 2240; capable of supporting a compressive stress of 3000 psi (20.7 MPa) with no cracking, splitting, or delaminating in the internal portions of pad. Test 1 specimen for every 200 pads used in Project.
 - c. Cotton-Duck-Fabric-Reinforced Elastomeric Pads: Preformed, horizontally layered cotton-duck fabric bonded to an elastomer; 80 to 100 Shore, Type A durometer hardness, ASTM D 2240; complying with AASHTO's "AASHTO Load and Resistance Factor Design (LRFD) Bridge Specifications," Division II, Section 18.10.2; or with MIL-C-882E.
 - d. Frictionless Pads: Tetrafluoroethylene, glass-fiber reinforced, bonded to stainless- or mild-steel plate, of type required for in-service stress.
 - e. High-Density Plastic: Multimonomer, nonleaching, plastic strip.

H. Grout Materials

1. Sand-Cement Grout: Portland cement, ASTM C 150, Type I, and clean, natural sand, ASTM C 144 or ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
2. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, Grade A for drypack and Grades B and C for flowable grout and of consistency suitable for application within a 30-minute working time.
3. Epoxy-Resin Grout: Two-component, mineral-filled epoxy resin; ASTM C 881/C 881M, of type, grade, and class to suit requirements.

I. Thin-Brick Units And Accessories



1. Thin-Brick Units: ASTM C 216, Type FBX or ASTM C 1088, Grade Exterior, Type TBX, not less than 1/2 inch (13 mm) **OR** 3/4 inch (19 mm) **OR** 1 inch (25 mm), **as directed**, thick with a tolerance of plus or minus 1/16 inch (1.6 mm), and as follows:
 - a. Face Color and Texture: Match the Owner's samples **OR** Medium brown, wire cut **OR** Full-range red, sand molded **OR** Gray, velour, **as directed**.
 - b. Face Size:
 - 1) 2-1/4 inches (57 mm) high by 8 inches (203 mm) long.
 - 2) 2-1/4 inches (57 mm) high by 7-1/2 to 7-5/8 inches (190 to 194 mm) long.
 - 3) 2-3/4 to 2-13/16 inches (70 to 71 mm) high by 7-1/2 to 7-5/8 inches (190 to 194 mm) long.
 - 4) 3-1/2 to 3-5/8 inches (89 to 92 mm) high by 7-1/2 to 7-5/8 inches (190 to 194 mm) long.
 - 5) 3-1/2 to 3-5/8 inches (89 to 92 mm) high by 11-1/2 to 11-5/8 inches (292 to 295 mm) long.
 - c. Where indicated to "match existing," provide thin brick matching color, texture, and face size of existing adjacent brick work.
 - d. Face Size:
 - 1) 57 mm high by 190 mm long.
 - 2) 70 mm high by 190 mm long.
 - 3) 90 mm high by 190 mm long.
 - 4) 90 mm high by 290 mm long.
 - e. Special Shapes: Include corners, edge corners, and end edge corners.
 - f. Initial Rate of Absorption: Less than 30 g/30 sq. in. (30 g/194 sq. cm) per minute; ASTM C 67.
 - g. Efflorescence: Tested according to ASTM C 67 and rated "not effloresced."
 - h. Surface Coating: Thin brick with colors or textures applied as coatings shall withstand 50 cycles of freezing and thawing; ASTM C 67 with no observable difference in applied finish when viewed from 10 feet (3 m).
 - i. Back Surface Texture: Scored, combed, wire roughened, ribbed, keybacked, or dovetailed.
2. Sand-Cement Mortar: Portland cement, ASTM C 150, Type I, and clean, natural sand, ASTM C 144. Mix at ratio of 1 part cement to 4 parts sand, by volume, with minimum water required for placement.
3. Latex-Portland Cement Pointing Grout: ANSI A118.6 and as follows:
 - a. Dry-grout mixture, factory prepared, of portland cement, graded aggregate, and dry, redispersible, ethylene-vinyl-acetate additive for mixing with water; uniformly colored.
 - b. Commercial portland cement grout, factory prepared, with liquid styrene-butadiene rubber or acrylic-resin latex additive; uniformly colored.
 - c. Colors: As indicated by manufacturer's designations **OR** Match the Owner's samples **OR** As selected by the Owner from manufacturer's full range, **as directed**.

J. Stone Materials And Accessories

1. Stone facing for precast structural concrete is specified in Division 04 Section "Exterior Stone Cladding".
2. Anchors: Stainless steel, ASTM A 666, Type 304, of temper and diameter required to support loads without exceeding allowable design stresses.
 - a. Fit each anchor leg with neoprene grommet collar of width at least twice the diameter and of length at least five times the diameter of anchor.
3. Sealant Filler: ASTM C 920, low-modulus, multicomponent, nonsag urethane sealant complying with requirements in Division 07 Section "Joint Sealants" and that is nonstaining to stone substrate.
4. Epoxy Filler: ASTM C 881/C 881M, 100 percent solids, sand-filled nonshrinking, nonstaining of type, class, and grade to suit application.
 - a. Elastomeric Anchor Sleeve: 1/2 inch (13 mm) long; 60 Shore, Type A durometer hardness; ASTM D 2240.



5. Bond Breaker: Preformed, compressible, resilient, nonstaining, nonwaxing, closed-cell polyethylene foam pad, nonabsorbent to liquid and gas, 1/8 inch (3.2 mm) thick **OR** Polyethylene sheet, ASTM D 4397, 6 to 10 mils (0.15 to 0.25 mm) thick, **as directed**.
- K. Insulated Flat Wall Panel Accessories
1. Molded-Polystyrene Board Insulation: ASTM C 578, Type I, 0.90 lb/cu. ft. (15 kg/cu. m) **OR** Type VIII, 1.15 lb/cu. ft. (18 kg/cu. m) **OR** Type II, 1.35 lb/cu. ft. (22 kg/cu. m), **as directed**; square **OR** ship-lap, **as directed**, edges; with R-value and thickness as directed by the Owner.
 2. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, 1.60 lb/cu. ft. (26 kg/cu. m) **OR** Type X, 1.30 lb/cu. ft. (21 kg/cu. m) **OR** Type VI, 1.80 lb/cu. ft. (29 kg/cu. m), **as directed**; square **OR** ship-lap, **as directed**, edges; with R-value and thickness as directed by the Owner.
 3. Polyisocyanurate Board Insulation: ASTM C 591, Type I, 1.8 lb/cu. ft. (29 kg/cu. m) **OR** Type IV, 2 lb/cu. ft. (32 kg/cu. m) **OR** Type II, 2.5 lb/cu. ft. (40 kg/cu. m), **as directed**, unfaced, with R-value and thickness as directed by the Owner.
 4. Wythe Connectors: Glass-fiber connectors **OR** Vinyl-ester polymer connectors **OR** Polypropylene pin connectors **OR** Stainless-steel pin connectors **OR** Bent galvanized reinforcing bars **OR** Galvanized welded wire trusses **OR** Galvanized bent wire connectors **OR** Cylindrical metal sleeve anchors, **as directed**, manufactured to connect wythes of precast concrete panels.
- L. Concrete Mixtures
1. Prepare design mixtures for each type of precast concrete required.
 - a. Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.
 - b. Limit use of fly ash to 25 percent replacement of portland cement by weight and granulated blast-furnace slag to 40 percent of portland cement by weight; metakaolin and silica fume to 10 percent of portland cement by weight.
 2. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at precast structural concrete fabricator's option.
 3. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 318 (ACI 318M) or PCI MNL 116 when tested according to ASTM C 1218/C 1218M.
 4. Normal-Weight Concrete Mixtures: Proportion face mixtures **OR** face and backup mixtures **OR** full-depth mixture, **as directed**, by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:
 - a. Compressive Strength (28 Days): 5000 psi (34.5 MPa).
 - b. Maximum Water-Cementitious Materials Ratio: 0.45.
 5. Water Absorption: 6 percent by weight or 14 percent by volume, tested according to PCI MNL 116.
 6. Lightweight Concrete Backup Mixtures: Proportion mixtures by either laboratory trial batch or field test data methods according to ACI 211.2, with materials to be used on Project, to provide lightweight concrete with the following properties:
 - a. Compressive Strength (28 Days): 5000 psi (34.5 MPa).
 - b. Unit Weight: Calculated equilibrium unit weight of 115 lb/cu. ft. (1842 kg/cu. m), plus or minus 3 lb/cu. ft. (48 kg/cu. m), according to ASTM C 567.
 7. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 116.
 8. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.
 9. Concrete Mix Adjustments: Concrete mix design adjustments may be proposed if characteristics of materials, Project conditions, weather, test results, or other circumstances warrant.
- M. Mold Fabrication
1. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for prestressing and



denstening operations. Coat contact surfaces of molds with release agent before reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.

- a. Place form liners accurately to provide finished surface texture indicated. Provide solid backing and supports to maintain stability of liners during concrete placement. Coat form liner with form-release agent.
2. Maintain molds to provide completed precast structural concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.
 - a. Form joints are not permitted on faces exposed to view in the finished work.
 - b. Edge and Corner Treatment: Uniformly chamfered **OR** radiused, **as directed**.

N. Thin-Brick Facings

1. Place form-liner templates accurately to provide grid for thin-brick facings. Provide solid backing and supports to maintain stability of liners while placing thin bricks and during concrete placement.
2. Securely place thin-brick units face down into form-liner pockets and place concrete backing mixture.
3. Completely fill joint cavities between thin-brick units with sand-cement mortar, and place precast concrete backing mixture while sand-cement mortar is still fluid enough to ensure bond.
4. Mix and install pointing grout according to ANSI A108.10. Completely fill joint cavities between thin-brick units with pointing grout, and compress into place without spreading pointing grout onto faces of thin-brick units. Remove excess pointing grout immediately to prevent staining of brick.
 - a. Tool joints to a slightly concave shape **OR** grapevine shape **OR** V-shape, **as directed**, when pointing grout is thumbprint hard.
5. Clean faces and joints of brick facing.

O. Stone Facings

1. Clean stone surfaces before placing in molds to remove soil, stains, and foreign materials. Use cleaning methods and materials recommended by stone supplier.
2. Accurately position stone facings to comply with requirements and in locations indicated on Shop Drawings. Install anchors, supports, and other attachments indicated or necessary to secure stone in place. Keep concrete reinforcement a minimum of 3/4 inch (19 mm) from the back surface of stone. Use continuous spacers to obtain uniform joints of widths indicated and with edges and faces aligned according to established relationships and indicated tolerances.
 - a. Stone to Precast Anchorages: Provide anchors in numbers, types and locations required to satisfy specified performance criteria, but not less than 2 anchors per stone unit of less than 2 sq. ft. (0.19 sq. m) in area and 4 anchors per unit of less than 12 sq. ft. (1.1 sq. m) in area; for units larger than 12 sq. ft. (1.1 sq. m) in area, provide anchors spaced not more than 24 inches (600 mm) o.c. horizontally and vertically. Locate anchors a minimum of 6 inches (150 mm) from stone edge.
3. Fill anchor holes with sealant filler and install anchors **OR** epoxy filler and install anchors with elastomeric anchor sleeve at back surface of stone, **as directed**.
 - a. Install polyethylene sheet to prevent bond between back of stone facing and concrete substrate and to ensure no passage of precast matrix to stone surface.
 - b. Install 1/8-inch (3-mm) polyethylene-foam bond breaker to prevent bond between back of stone facing and concrete substrate and to ensure no passage of precast matrix to stone surface. Maintain minimum projection requirements of stone anchors into concrete substrate.

P. Fabrication

1. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.



- a. Weld-headed studs and deformed bar anchors used for anchorage according to AWS D1.1/D1.1M and AWS C5.4, "Recommended Practices for Stud Welding."
2. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing precast structural concrete units to supporting and adjacent construction.
3. Cast-in reglets, slots, holes, and other accessories in precast structural concrete units as indicated on the Contract Drawings.
4. Cast-in openings larger than 10 inches (250 mm) in any dimension. Do not drill or cut openings or prestressing strand without the Owner's approval.
5. Reinforcement: Comply with recommendations in PCI MNL 116 for fabricating, placing, and supporting reinforcement.
 - a. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete. When damage to epoxy-coated reinforcement exceeds limits specified, repair with patching material compatible with coating material and epoxy coat bar ends after cutting.
 - b. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Completely conceal support devices to prevent exposure on finished surfaces.
 - c. Place reinforcement to maintain at least 3/4-inch (19-mm) minimum coverage. Increase cover requirements according to ACI 318 (ACI 318M) when units are exposed to corrosive environment or severe exposure conditions. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
 - d. Place reinforcing steel and prestressing strand to maintain at least 3/4-inch (19-mm) minimum concrete cover. Increase cover requirements for reinforcing steel to 1-1/2 inches (38 mm) when units are exposed to corrosive environment or severe exposure conditions. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
 - e. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh spacing and wire tie laps, where required by design. Offset laps of adjoining widths to prevent continuous laps in either direction.
6. Reinforce precast structural concrete units to resist handling, transportation, and erection stresses.
7. Prestress tendons for precast structural concrete units by either pretensioning or post-tensioning methods. Comply with PCI MNL 116.
 - a. Delay detensioning or post-tensioning of precast, prestressed structural concrete units until concrete has reached its indicated minimum design release compressive strength as established by test cylinders cured under same conditions as concrete.
 - b. Detension pretensioned tendons either by gradually releasing tensioning jacks or by heat cutting tendons, using a sequence and pattern to prevent shock or unbalanced loading.
 - c. If concrete has been heat cured, detension while concrete is still warm and moist to avoid dimensional changes that may cause cracking or undesirable stresses.
 - d. Protect strand ends and anchorages with bituminous, zinc-rich, or epoxy paint to avoid corrosion and possible rust spots.
 - e. Protect strand ends and anchorages with a minimum of 1-inch- (25-mm-) thick, nonmetallic, nonshrink, grout mortar and sack rub surface. Coat or spray the inside surfaces of pocket with bonding agent before installing grout.
8. Comply with requirements in PCI MNL 116 and in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.
9. Place face mixture to a minimum thickness after consolidation of the greater of 1 inch (25 mm) or 1.5 times the maximum aggregate size, but not less than the minimum reinforcing cover specified.
10. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast concrete units.
 - a. Place backup concrete mixture to ensure bond with face-mixture concrete.



11. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air on surfaces. Use equipment and procedures complying with PCI MNL 116.
 - a. Place self-consolidating concrete without vibration according to PCI TR-6, "Interim Guidelines for the Use of Self-Consolidating Concrete in Precast/Prestressed Concrete Institute Member Plants."
12. Comply with ACI 306.1 procedures for cold-weather concrete placement.
13. Comply with PCI MNL 116 procedures for hot-weather concrete placement.
14. Identify pickup points of precast structural concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each precast structural concrete unit on a surface that will not show in finished structure.
15. Cure concrete, according to requirements in PCI MNL 116, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture. Cure units until compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.
16. Discard and replace precast structural concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs meet requirements in PCI MNL 116 and meet the Owner's approval.

Q. Casting Insulated Wall Panels

1. Cast and screed wythe supported by mold.
2. Place insulation boards abutting edges and ends of adjacent boards. Insert wythe connectors through insulation, and consolidate concrete around connectors according to connector manufacturer's written instructions.
3. Cast and screed top wythe to meet required finish.

R. Fabrication Tolerances

1. Fabricate precast structural concrete units straight and true to size and shape with exposed edges and corners precise and true so each finished unit complies with PCI MNL 116 product dimension tolerances.
2. Brick-Faced Precast Structural Concrete Units: Restrict the following misalignments to 2 percent of number of bricks in a unit:
 - a. Alignment of Mortar Joints:
 - 1) Jog in Alignment: 1/8 inch (3 mm).
 - 2) Alignment with Panel Centerline: Plus or minus 1/8 inch (3 mm).
 - b. Variation in Width of Exposed Mortar Joints: Plus or minus 1/8 inch (3 mm).
 - c. Tipping of Individual Bricks from the Panel Plane of Exposed Brick Surface: Plus 1/16 inch (1.6 mm); minus 1/4 inch (6 mm) less than or equal to depth of form-liner joint.
 - d. Exposed Brick Surface Parallel to Primary Control Surface of Panel: Plus 1/4 inch (6 mm); minus 1/8 inch (3 mm).
 - e. Individual Brick Step in Face from Panel Plane of Exposed Brick Surface: Plus 1/16 inch (1.6 mm); minus 1/4 inch (6 mm) less than or equal to depth of form-liner joint.
3. Stone Veneer-Faced Precast Structural Concrete Units:
 - a. Variation in Cross-Sectional Dimensions: For thickness of walls from dimensions indicated: Plus or minus 1/4 inch (6 mm).
 - b. Variation in Joint Width: 1/8 inch in 36 inches (3 mm in 900 mm) or a quarter of nominal joint width, whichever is less.
 - c. Variation in Plane between Adjacent Stone Units (Lipping): 1/16-inch (1.6-mm) difference between planes of adjacent units.

S. Commercial Finishes

1. Commercial Grade: Remove fins and large protrusions and fill large holes. Rub or grind ragged edges. Faces must have true, well-defined surfaces. Air holes, water marks, and color variations are permitted. Limit form joint offsets to 3/16 inch (5 mm).



2. Standard Grade: Normal plant-run finish produced in molds that impart a smooth finish to concrete. Surface holes smaller than 1/2 inch (13 mm) caused by air bubbles, normal color variations, form joint marks, and minor chips and spalls are permitted. Fill air holes greater than 1/4 inch (6 mm) in width that occur more than once per 2 sq. in. (1300 sq. mm). Major or unsightly imperfections, honeycombs, or structural defects are not permitted. Limit joint offsets to 1/8 inch (3 mm).
3. Grade B Finish: Fill air pockets and holes larger than 1/4 inch (6 mm) in diameter with sand-cement paste matching color of adjacent surfaces. Fill air holes greater than 1/8 inch (3 mm) in width that occur more than once per 2 sq. in. (1300 sq. mm). Grind smooth form offsets or fins larger than 1/8 inch (3 mm). Repair surface blemishes due to holes or dents in molds. Discoloration at form joints is permitted.
4. Grade A Finish: Fill surface blemishes with the exception of air holes 1/16 inch (1.6 mm) in width or smaller, and form marks where the surface deviation is less than 1/16 inch (1.6 mm). Float apply a neat cement-paste coating to exposed surfaces. Rub dried paste coat with burlap to remove loose particles. Discoloration at form joints is permitted. Grind smooth all form joints.
5. Screed or float finish unformed surfaces. Strike off and consolidate concrete with vibrating screeds to a uniform finish. Hand screed at projections. Normal color variations, minor indentations, minor chips, and spalls are permitted. Major imperfections, honeycombing, or defects are not permitted.
6. Smooth, steel trowel finish unformed surfaces. Consolidate concrete, bring to proper level with straightedge, float, and trowel to a smooth, uniform finish.
7. Apply roughened surface finish according to ACI 318 (ACI 318M) to precast concrete units that will receive concrete topping after installation.

T. Commercial Architectural Finishes

1. Manufacture member faces free of joint marks, grain, and other obvious defects with corners, including false joints, uniform, straight, and sharp. Finish exposed-face surfaces of precast concrete units to match approved design reference sample **OR** sample panels, **as directed**, and as follows:
 - a. PCI's "Architectural Precast Concrete - Color and Texture Selection Guide," of plate numbers indicated.
 - b. Smooth-Surface Finish: Provide surfaces free of excessive air voids, sand streaks, and honeycombs, with uniform color and texture.
 - c. Textured-Surface Finish: Impart by form liners or inserts to provide surfaces free of pockets, streaks, and honeycombs, with uniform color and texture.
 - d. Bushhammer Finish: Use power or hand tools to remove matrix and fracture coarse aggregates.
 - e. Exposed-Aggregate Finish: Use chemical-retarding agents applied to concrete molds and washing and brushing procedures to expose aggregate and surrounding matrix surfaces after form removal.
 - f. Abrasive-Blast Finish: Use abrasive grit, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces.
 - g. Acid-Etched Finish: Use acid and hot-water solution, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces. Protect hardware, connections, and insulation from acid attack.
 - h. Honed Finish: Use continuous mechanical abrasion with fine grit, followed by filling and rubbing procedures.
 - i. Polished Finish: Use continuous mechanical abrasion with fine grit, followed by filling and rubbing procedures.
 - j. Sand-Embedment Finish: Use selected stones placed in a sand bed in bottom of mold, with sand removed after curing.

U. Source Quality Control

1. Testing: Test and inspect precast structural concrete according to PCI MNL 116 requirements.
 - a. Test and inspect self-consolidating concrete according to PCI TR-6.



2. Strength of precast structural concrete units will be considered deficient if units fail to comply with ACI 318 (ACI 318M) requirements for concrete strength.
3. If there is evidence that strength of precast concrete units may be deficient or may not comply with ACI 318 (ACI 318M) requirements, employ a qualified testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C 42/C 42M.
 - a. A minimum of three representative cores will be taken from units of suspect strength, from locations directed by the Owner.
 - b. Cores will be tested in an air-dry condition or, if units will be wet under service conditions, test cores after immersion in water in a wet condition.
 - c. Strength of concrete for each series of 3 cores will be considered satisfactory if average compressive strength is equal to at least 85 percent of 28-day design compressive strength and no single core is less than 75 percent of 28-day design compressive strength.
 - d. Test results will be made in writing on same day that tests are performed, with copies to the Owner, Contractor, and precast concrete fabricator. Test reports will include the following:
 - 1) Project identification name and number.
 - 2) Date when tests were performed.
 - 3) Name of precast concrete fabricator.
 - 4) Name of concrete testing agency.
 - 5) Identification letter, name, and type of precast concrete unit(s) represented by core tests; design compressive strength; type of break; compressive strength at breaks, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.
4. Patching: If core test results are satisfactory and precast structural concrete units comply with requirements, clean and dampen core holes and solidly fill with same precast concrete mixture that has no coarse aggregate, and finish to match adjacent precast concrete surfaces.
5. Defective Units: Discard and replace precast structural concrete units that do not comply with requirements, including strength, manufacturing tolerances, and color and texture range. Chipped, spalled, or cracked units may be repaired, subject to the Owner's approval. the Owner reserves the right to reject precast units that do not match approved samples and sample panels.

1.3 EXECUTION

A. Installation

1. Install clips, hangers, bearing pads, and other accessories required for connecting precast structural concrete units to supporting members and backup materials.
2. Erect precast structural concrete level, plumb, and square within specified allowable tolerances. Provide temporary structural framing, supports, and bracing as required to maintain position, stability, and alignment of units until permanent connection.
 - a. Install temporary steel or plastic spacing shims or bearing pads as precast structural concrete units are being erected. Tack weld steel shims to each other to prevent shims from separating.
 - b. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
 - c. Remove projecting lifting devices and grout fill voids within recessed lifting devices flush with surface of adjacent precast surfaces when recess is exposed.
 - d. For hollow-core slab voids used as electrical raceways or mechanical ducts, align voids between units and tape butt joint at end of slabs.
3. Connect precast structural concrete units in position by bolting, welding, grouting, or as otherwise indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and grouting are completed.
 - a. Do not permit connections to disrupt continuity of roof flashing.
4. Field cutting of precast units is not permitted without approval of the the Owner.



5. Fasteners: Do not use drilled or powder-actuated fasteners for attaching accessory items to precast, prestressed concrete units.
 6. Welding: Comply with applicable AWS D1.1/D1.1M and AWS D1.4 for welding, welding electrodes, appearance, quality of welds, and methods used in correcting welding work.
 - a. Protect precast structural concrete units and bearing pads from damage by field welding or cutting operations, and provide noncombustible shields as required.
 - b. Clean weld-affected steel surfaces with chipping hammer followed by brushing, and apply a minimum 4.0-mil- (0.1-mm-) thick coat of galvanized repair paint to galvanized surfaces according to ASTM A 780.
 - c. Clean weld-affected steel surfaces with chipping hammer followed by brushing, and reprime damaged painted surfaces.
 - d. Remove, reweld, or repair incomplete and defective welds.
 7. At bolted connections, use lock washers, tack welding, or other approved means to prevent loosening of nuts after final adjustment.
 - a. Where slotted connections are used, verify bolt position and tightness. For sliding connections, properly secure bolt but allow bolt to move within connection slot. For friction connections, apply specified bolt torque and check 25 percent of bolts at random by calibrated torque wrench.
 8. Grouting: Grout connections and joints and open spaces at keyways, connections, and joints where required or indicated on Shop Drawings. Retain grout in place until hard enough to support itself. Pack spaces with stiff grout material, tamping until voids are completely filled.
 - a. Place grout to finish smooth, level, and plumb with adjacent concrete surfaces.
 - b. Fill joints completely without seepage to other surfaces.
 - c. Trowel top of grout joints on roofs smooth and uniform. Finish transitions between different surface levels not steeper than 1 to 12.
 - d. Place grout end cap or dam in voids at ends of hollow-core slabs.
 - e. Promptly remove grout material from exposed surfaces before it affects finishes or hardens.
 - f. Keep grouted joints damp for not less than 24 hours after initial set.
- B. Erection Tolerances
1. Erect precast structural concrete units level, plumb, square, true, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 135.
 2. Minimize variations between adjacent slab members by jacking, loading, or other method recommended by fabricator and approved by the Owner.
- C. Field Quality Control
1. Special Inspections: Engage a qualified special inspector to perform the following special inspections:
 - a. Erection of precast structural concrete members.
 2. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
 3. Field welds will be visually inspected and nondestructive tested according to ASTM E 165 or ASTM E 709. High-strength bolted connections will be subject to inspections.
 4. Testing agency will report test results promptly and in writing to Contractor and the Owner.
 5. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
 6. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 7. Prepare test and inspection reports.
- D. Repairs
1. Repair precast structural concrete units if permitted by the Owner.
 - a. Repairs may be permitted if structural adequacy, serviceability, durability, and appearance of units has not been impaired.



2. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet (6 m).
3. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A 780.
4. Wire brush, clean, and paint damaged prime-painted components with same type of shop primer.
5. Remove and replace damaged precast structural concrete units that cannot be repaired or when repairs do not comply with requirements as determined by the Owner.

E. Cleaning

1. Clean mortar, plaster, fireproofing, weld slag, and other deleterious material from concrete surfaces and adjacent materials immediately.
2. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.
 - a. Perform cleaning procedures, if necessary, according to precast concrete fabricator's written recommendations. Clean soiled precast concrete surfaces with detergent and water, using stiff fiber brushes and sponges, and rinse with clean water. Protect other work from staining or damage due to cleaning operations.
 - b. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

END OF SECTION 03 48 29 00



Task	Specification	Specification Description
03 48 49 00	03 48 29 00	Plant-Precast Structural Concrete



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SECTION 03 51 13 00 - CEMENTITIOUS WOOD-FIBER DECK

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for cementitious wood-fiber deck. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Monolithic cementitious wood-fiber units.
 - b. Composite cementitious wood-fiber units.
 - c. Insulated composite cementitious wood-fiber units.
 - d. Subpurlin tees.

C. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: Show fabrication and installation details for cementitious wood-fiber deck. Include details at supports, reinforcement at openings, and attachment to other work.
3. Samples: Show texture, finish, and edge and end configurations of monolithic **OR** composite **OR** insulated composite, **as directed**, cementitious wood-fiber units, 12 inches (305 mm) **OR** 24 inches (610 mm), **as directed**, long by width of unit.
 - a. Include unit with galvanized steel edge channel.

D. Quality Assurance

1. Fire-Test-Response Characteristics: Provide cementitious wood-fiber units that comply with the following requirements:
 - a. Fire-response testing performed by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction and that performs testing and follow-up services.
 - b. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indices of 25 and 50, respectively, as determined by testing identical products per ASTM E 84.
 - c. Fire-resistance-rated assemblies indicated by design designations from UL's "Fire Resistance Directory," ITS's "Directory of Listed Products," or the listings of another testing and inspecting agency are identical in materials and construction to those tested per ASTM E 119.
 - d. Products are identified with appropriate markings of applicable testing and inspecting agency.

E. Delivery, Storage, And Handling

1. Protect cementitious wood-fiber units from moisture.
2. Store units on elevated platforms at the Project site in a dry, well-ventilated, covered space and stack according to manufacturer's written recommendations.
3. Handle units to prevent chipping, breaking, cracking, staining, soiling, warping, or other physical damage. Discard damaged units at time of installation.

1.2 PRODUCTS

A. Materials

1. Cementitious Wood-Fiber Units, General: Manufacturer's standard factory-cast structural units complying with the following requirements:



- a. Composition: Chemically processed long wood fibers mixed with Portland cement, ASTM C 150, Type III or magnesium oxysulfate hydraulic cement, pressure bonded to produce units of thicknesses and sizes indicated:
 - b. Properties: As follows, determined according to test method indicated:
 - 1) Noise Reduction Coefficient: NRC 0.55 **OR** 0.60 **OR** 0.65 **OR** 0.70 **OR** 0.75 **OR** 0.80, **as directed**; ASTM C 423.
 - 2) Light Reflectance: 60 percent; ASTM E 1349.
 - c. Finish: Manufacturer's standard natural or prime-painted finish.
2. Oriented-Strand-Board Sheathing: APA-rated sheathing, Exposure 1 complying with DOC PS 2.
 3. Polyisocyanurate-Foam Insulation: 2 lb/cu. ft. (32 kg/cu. m) nominal density, 35 lbf/sq. in. (240 kPa) compressive strength per ASTM D 1621.
 4. Extruded-Polystyrene Insulation: ASTM C 578, Type IV.
 5. Expanded-Polystyrene Insulation: ASTM C 578, Type I.
- B. Monolithic Cementitious Wood-Fiber Units
1. Tile: Manufacturer's standard rabbet-edged, cementitious wood-fiber units.
 2. Plank: Manufacturer's standard tongue-and-groove-edged, cementitious wood-fiber units.
 3. Channel-Reinforced Plank: Manufacturer's standard tongue-and-groove-edged, cementitious wood-fiber planks with factory-installed, cold-formed, 0.0598-inch- (1.52-mm-) thick, galvanized steel channel set in grooved edge.
 4. Concealed-Tee Plank: Manufacturer's standard cementitious wood-fiber units, with edges kerfed, back rabbeted, and beveled.
- C. Composite Cementitious Wood-Fiber Units
1. Composite Tile: Manufacturer's standard factory-laminated composite deck units consisting of a rabbet-edged, cementitious wood-fiber tile base and top layer of oriented-strand-board sheathing, 7/16 inch (11 mm) thick.
 2. Composite Plank: Manufacturer's standard factory-laminated composite deck units consisting of a standard tongue-and-groove-edged, cementitious wood-fiber plank base and top layer of oriented-strand-board sheathing, 7/16 inch (11 mm) thick.
 3. Composite Channel-Reinforced Plank: Manufacturer's standard factory-laminated composite deck units consisting of a standard tongue-and-groove-edged, cementitious wood-fiber plank base with factory-installed, cold-formed, 0.0598-inch- (1.52-mm-) thick, galvanized steel channel set in grooved edge, and top layer of oriented-strand-board sheathing, 7/16 inch (11 mm) thick.
- D. Insulated Composite Cementitious Wood-Fiber Units
1. Insulated Composite Tile: Manufacturer's standard factory-laminated composite deck units consisting of a rabbet-edged, cementitious wood-fiber tile base, insulation, and top layer; and as follows:
 - a. Insulation: Polyisocyanurate **OR** Extruded polystyrene **OR** Expanded polystyrene, **as directed**.
 - b. Top Layer: Manufacturer's standard asphalt-free, glass-fiber-reinforced, black felt facing **OR** 7/16-inch- (11-mm-) thick, oriented-strand board, **as directed**.
 2. Insulated Composite Plank: Manufacturer's standard factory-laminated composite deck units consisting of a standard tongue-and-groove-edged, cementitious wood-fiber plank base, insulation, and top layer; and as follows:
 - a. Insulation: Polyisocyanurate **OR** Extruded polystyrene **OR** Expanded polystyrene, **as directed**.
 - b. Top Layer: Manufacturer's standard asphalt-free, glass-fiber-reinforced, black felt facing **OR** 7/16-inch- (11-mm-) thick, oriented-strand-board, **as directed**.
 3. Insulated Composite Channel-Reinforced Plank: Manufacturer's standard factory-laminated composite deck units consisting of a standard tongue-and-groove-edged, cementitious wood-fiber plank base with factory-installed, cold-formed, 0.0598-inch- (1.52-mm-) thick, galvanized steel channel set in grooved edge, insulation, and top layer; and as follows:



- a. Insulation: Polyisocyanurate **OR** Extruded polystyrene **OR** Expanded polystyrene, **as directed**.
 - b. Top Layer: Manufacturer's standard asphalt-free, glass-fiber-reinforced, black felt facing **OR** 7/16-inch- (11-mm-) thick, oriented-strand board, **as directed**.
- E. Subpurlins
1. Bulb-Tee Subpurlins: Hot-rolled steel bulb tees complying with ASTM A 499 of length required to span three support spacings; shop painted with metal primer.
- F. Accessories
1. Gypsum Concrete Grout: Factory-packaged, gypsum concrete grout formulation recommended by cementitious wood-fiber unit manufacturer with a minimum compressive strength of 500 psi (3.45 MPa).
 2. Anchor Clips: Manufacturer's standard formed anchor clips of 0.0478-inch- (1.21-mm-) thick minimum, galvanized steel sheet, of type and configuration required for deck system indicated.
 3. Screws: Manufacturer's recommended corrosion-resistant screw fasteners and washers, self-drilling, self-tapping, of length required for deck and structural framing indicated.
 4. Nails: Manufacturer's recommended corrosion-resistant nails of size and length required for deck and structural framing indicated.
 5. Adhesive: Manufacturer's recommended construction adhesive complying with APA AFG-01.
 6. Filler Strips: Insulation strips, same as used in manufacture of insulated composite cementitious wood-fiber units.
 7. Polyethylene Film: 0.004 inch (0.10 mm) thick, complying with ASTM D 4397.

1.3 EXECUTION

- A. Installation
1. Comply with manufacturer's written instructions for installing cementitious wood-fiber deck.
 - a. Install fastenings according to manufacturer's written instructions, unless otherwise indicated **OR** as indicated, **as directed**.
 2. Deck Interruptions: Provide barrier seals or blocking at overhangs to form wind seals and at partitions and walls to form sound seals, unless otherwise indicated.
- B. Form-Deck Installation
1. Tile and Subpurlin Form Deck: Space subpurlin members as indicated. Attach subpurlins to each support with 3/4-inch- (19-mm-) long minimum, fillet welds on both sides of flanges at ends of members and on alternate sides at intermediate structural supports.
 - a. Lay tile with rabbeted edges supported on subpurlins, and shim or block in place to prevent dislocation during placing of fill.
 - b. Lay tile with square-cut ends concealed and supported on cross subpurlins **OR** over supporting purlins or beams, **as directed**.
 - c. Lay tile with tongue-and-groove ends exposed in pattern indicated.
 - d. Fill void with gypsum concrete grout where edge joints meet subpurlins. Strike grout flush with top of tile and feather uneven top surfaces to a plane.
 - e. Provide shoring of sufficient strength to withstand weight of cast-in-place fill and construction traffic. Design, install, and remove shoring according to Division 03 Section "Cast-in-place Concrete".
 2. Plank Form Deck: Install planks progressively with long dimension perpendicular to supports and with end joints in alternate rows, staggered and centered over supports, unless otherwise indicated. Tightly nest tongue-and-groove edges and tightly butt end joints.
 - a. Cut panels to provide starter units.
 - b. Continuously support plank edges and ends at perimeter of building and at openings in deck.



- c. Provide shoring of sufficient strength to withstand weight of cast-in-place fill and construction traffic. Design, install, and remove shoring according to Division 03 Section "Cast-in-place Concrete".
 - d. Cover exposed edges and ends of form planks with polyethylene film before pouring cast-in-place fill to prevent paste or mixing water from penetrating deck and seeping through to bottom face. Remove exposed film after cast-in-place fill has set.
3. Concealed-Tee Plank Deck: Install planks progressively with long dimension perpendicular to supports and with end joints in alternate rows, staggered and centered over supports, unless otherwise indicated. Install flange of bulb tee into kerfed edge and tightly butt adjoining plank to engage other flange. Tightly nest tongue-and-groove **OR** butt square, **as directed**, end joints.
- a. Cut panels to provide starter units.
 - b. Continuously support plank edges and ends at perimeter of building and at openings in deck.
 - c. Fill void with gypsum concrete grout where edge joints meet subpurlins. Strike grout flush with top of plank and feather uneven top surfaces to a plane.
 - d. Provide shoring of sufficient strength to withstand weight of cast-in-place fill and construction traffic. Design, install, and remove shoring according to Division 03 Section "Cast-in-place Concrete".

C. Roof Deck Installation

1. Tile and Subpurlin Roof Deck: Space subpurlin members as indicated. Attach subpurlins to each support with 3/4-inch- (19-mm-) long minimum, fillet welds on both sides of flanges at ends of members and on alternate sides at intermediate structural supports.
- a. Lay tile with rabbeted edges supported on subpurlins.
 - b. Lay tile with square-cut ends concealed and supported on cross subpurlins **OR** over supporting purlins or beams, **as directed**.
 - c. Lay tile with tongue-and-groove ends exposed in pattern indicated.
 - d. Fill void with gypsum concrete grout where edge joints meet subpurlins. Strike grout flush with top of tile and feather uneven top surfaces to a plane.
 - e. Fill void with gypsum concrete grout where edge joints meet subpurlins. Strike grout flush with top surface of cementitious wood-fiber base. Fill remainder of joint with filler strips of insulation.
2. Plank Roof Deck: Install planks progressively with long dimension perpendicular to supports and with end joints in alternate rows, staggered and centered over supports, unless otherwise indicated. Tightly nest tongue-and-groove edges and tightly butt end joints.
- a. Cut panels to provide starter units.
 - b. Continuously support plank edges and ends at perimeter of building and at openings in deck.
 - c. Mechanically fasten planks to supports and perimeter members.
 - d. Adhesively and mechanically fasten planks to supports and perimeter members. Apply adhesive to tongue-and-groove edges.
3. Concealed-Tee Plank Roof Deck: Install planks progressively with long dimension perpendicular to supports and with end joints in alternate rows, staggered and centered over supports, unless otherwise indicated. Install flange of bulb tee into kerfed edge and tightly butt adjoining plank to engage other flange. Tightly nest tongue-and-groove **OR** butt square, **as directed**, end joints.
- a. Cut panels to provide starter units.
 - b. Continuously support plank edges and ends at perimeter of building and at openings in deck.
 - c. Mechanically fasten planks to supports and perimeter members.
 - d. Adhesively and mechanically fasten planks to supports and perimeter members. Apply adhesive to tongue-and-groove edges.
 - e. Fill void with gypsum concrete grout where edge joints meet subpurlins. Strike grout flush with top of plank and feather uneven top surfaces to a plane.

D. Cleaning And Protection



1. Protect top surfaces of deck from damage caused by construction operations.
2. Protect exposed bottom surfaces of deck from soiling and damage during handling and construction.
3. Clean exposed bottom surfaces of completed deck and touch up minor damage to surfaces as approved.
4. Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer that ensures that cementitious wood-fiber deck is without damage or deterioration at time of Final Completion.
5. Remove and replace deteriorated and damaged deck units.

END OF SECTION 03 51 13 00



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SECTION 03 51 16 00 - PRECAST LIGHTWEIGHT ROOF SLABS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of precast lightweight roof deck concrete channels, concrete planks, and gypsum planks. Products shall be as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

1.2 PRODUCTS

- A. Channel Slabs: Slabs shall be composed of Portland cement and lightweight aggregate with minimum compressive strength 3,750 psi. Legs shall be reinforced with deformed bars; web shall have welded wire fabric reinforcement. Channels shall support a 30 psf live load plus a 20 psf superimposed dead load.
- B. Concrete Planks: Planks shall be composed of Portland cement and lightweight aggregate with a minimum compressive strength of 3,750 psi. Planks shall be reinforced with welded wire fabric. Planks shall support a 30 psf live load plus a 20 psf superimposed dead load.
- C. Gypsum Planks shall conform to ASTM C 956, factory-laminated to 2-inch thickness, 2-foot wide panels. Planks shall be continuously supported along sides.
- D. Subpurlins shall be bulb-ties, ASTM A 440.
- E. Grout shall be lightweight concrete or gypsum concrete.

1.3 EXECUTION

- A. Concrete Channels and Planks shall be securely attached to support steel or concrete by metal clips or other approved attachments; minimum support bearing shall be 4 inches. Open joints between channels or planks shall be filled with lightweight concrete grout. Planks with tongue and groove edges may not require grouting.
- B. Gypsum Planks shall be snugly fit between bulb-tee subpurlins. Subpurlins shall be tack-welded or screw-attached to supporting steel or weld bar cast in supporting concrete. Joints at bulb-tees shall be grouted with gypsum grout.

END OF SECTION 03 51 16 00



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SECTION 03 51 16 00a - GYPSUM PLANK DECKING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for gypsum plank decking for interstitial decks **OR** fire rated interstitial decks, **as directed**, and roof decks. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Fire Tests: Fire tests, data and certifications substantiating that Gypsum Plank Decking complies with fire rating requirements.
2. Shop Drawings: Show typical plank layouts, perimeter and framed opening supports and details of construction, installation, fastenings and grouting.
3. Manufacturer's Literature and Data: Each item specified.
4. Load tables for sub-purlins.

C. Quality Control

1. Work performed by experienced, qualified installers approved by manufacturer of gypsum plank.
2. Gypsum materials products of one manufacturer.

D. Delivery And Storage

1. Deliver materials in original packages, containers, or bundles bearing brand name and name of manufacturer.
2. Store materials in a manner that prevents damage before use. When stored under tarpaulins, provide ventilation to prevent moisture accumulation under tarpaulin.
3. Store gypsum planks flat and off ground. Handle and stack in a manner to prevent damage to face, ends, and edges and keep dry until used.
4. Store gypsum concrete off ground and keep dry until used.

1.2 PRODUCTS

A. Materials

1. Structural Steel Tee Sub-purlins:
 - a. Open web truss-tees, hot-rolled bulb-tees or folded sheet metal tees as required by design loads, spans and fire ratings.
 - b. Flanges: Provide 5/8-inch (16 mm) minimum bearing for gypsum planks.
 - c. Galvanize or factory coat sub-purlins with manufacturer's standard primer.
 - d. Open web truss-tees: Fabricate from cold-formed steel wire conforming to ASTM A82.
 - e. Hot-rolled bulb-tees: Rail-shaped, fabricated from hot-rolled steel conforming to ASTM A36/A36M or ASTM A499.
 - f. Folded sheet metal tees: Fabricate from sheet steel conforming to ASTM A653 and ASTM A568/A568M.
2. Cross-Tees:
 - a. Cold-Formed, Fabrication from sheet steel conforming to ASTM A653/A653M or ASTM A568/A568M.
 - b. Size: 1-1/4-inches (30 mm) by 1/2-inch (13 mm) by 0.023-inch (0.6 mm) thick by 24-inches (600 mm) long.
 - c. Tees shall be galvanized or factory coated with manufacturer's standard primer.
3. Gypsum Deck Plank:
 - a. Fabricated of gypsum board: ASTM C442.



- b. Nominal Size: 2-inches (50 mm) **OR** 2-5/8-inches (65 mm), **as directed**, thick by 24-inches (600 mm) wide by main purlin span. Where possible, length should span two main purlin spans.
 - c. Factory laminate from two 1-inch (25 mm) thick gypsum panels with top panel edge set back along sub-purlin edge not more than 1/2-inch (13 mm).
 - d. Offset edges encased in water-resistant paper.
 4. Gypsum Deck Panels: ASTM C36, Type "X", 5/8-inch (16 mm) thick by 24-inches (600 mm) wide by main purlin span.
 5. Grout: Gypsum Concrete: ASTM C317, Class A, 500 psi (3.5 MPa) minimum compressive strength.
 6. Miscellaneous Materials: Adhesives, mastics, cements, tapes and primers shall be as recommended by the gypsum plank manufacturer and shall be compatible with the material to which they are to be bonded.
- B. Deck System
1. Interstitial deck: Provide two-hour fire rating as tested by gypsum plank manufacturer under ASTM E119.
 2. Roof Deck: Provide one hour **OR** 1-1/2 hour, **as directed**, fire rating per tested assembly by Underwriters' Laboratory Inc. or other testing.

1.3 EXECUTION

A. Installation

1. Weld per AWS D1.1.
2. Sub-purlins:
 - a. Space at approximately 24-5/8-inches (650 mm) on center to provide minimum 5/8 inch (16 mm) continuous bearing for gypsum plank or deck.
 - b. Install framing of openings.
 - c. Touch up welds with same type of rust-inhibitive paint used for primer.
 - d. Interstitial Decks: Use 3/4-inch (19 mm) fillet welds on both sides of sub-purlins at math purlin.
 - e. Roof Decks: Use minimum 1/2-inch (13 mm) fillet welds on alternate sides of sub-purlins, both sides at end joints to main purlins.
 - f. For fire rated roof decks weld per fire test assembly.
3. For Two Hour fire rated interstitial decks **OR** fire-rated roof decks, **as directed**.
 - a. Place gypsum deck panels on bottom flanges of sub-purlins with 5/8-inch (16 mm) minimum continuous bearing.
 - b. Place gypsum deck plank over gypsum deck panels, with off-set edges "up" to form a "T" receptacle for gypsum grout.
 - c. Cut to fit around openings shown.
 - d. Install plank to conform to fire test assembly.
4. Gypsum Deck Plank for Roof Decks:
 - a. Place plank on lower flanges of sub-purlins or other framing with ends and edges supported.
 - b. Stagger joints in adjacent courses.
 - c. Support end joints with cross-tees not supported by framing.
 - d. Cut plank to fit at ends and framed openings.
5. Provide continuous 5/8-inch (16 mm) minimum bearing for plank support at deck perimeter, plank ends and openings exceeding 8-inches (200 mm).
6. Grout:
 - a. Mix gypsum concrete thoroughly using a minimum amount of water to form a thick, pourable consistency.
 - b. Fill edge joints to slight excess with single pour at sub-purlins.
 - 1) Grout end joints on single span system against steel framing.



-
- 2) After initial set, strike of excess to form smooth, flush joint.
 - 3) Form cant strips and curbs where shown.
 - c. Fill joints at roof ridges, hips and valleys.
 7. Patching:
 - a. Fill with grout and smooth any surface damage to gypsum plank.
 - b. Remove and replace cracked, broken, and plank damaged beyond repair.
 8. Cleaning and Protection:
 - a. Upon completion of gypsum plank decking, remove, debris and sweep surface clean. Leave ready for subsequent work.
 - b. Protect finished deck from weather and subsequent construction operations.
 - c. Provide hardboard or plywood temporary protection over decking subject to repetitive impact or wheeled loads.

END OF SECTION 03 51 16 00a



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SECTION 03 51 16 00b - GYPSUM CONCRETE DECKS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of gypsum concrete decks. Products shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

1.2 PRODUCTS**A. Gypsum Concrete: ASTM C 317, Class A.****B. Formboards:**

1. Gypsum Board: ASTM C 318.
2. Mineral Fiber Board: ASTM C612.
3. Glass Fiber Board: Lightweight, rigid, composed of pressed glass fibers.

C. Bulb Tees: ASTM A 499, Grade 50.**D. Reinforcing Mesh:**

1. Welded Wire Fabric: ASTM A 185, galvanized, 12 x 48-W0.5 x W0.5.
2. Woven Wire Fabric: ASTM A 82, galvanized, 19 gauge wire, 2-inch hexagonal mesh.

1.3 EXECUTION

- A. Support System: Sub-purlins shall be spaced to support formboards and rigidly attached to main supports. Formboards shall fit snugly at sub-purlins and at wall, curbs, and openings.
- B. Reinforcement: Lay wire fabric continuously over sub-purlins. Do not lap side of reinforcement.
- C. Gypsum Concrete: Gypsum concrete shall be placed continuously without interruption until entire panel or section is complete. Immediately after placement, screed, level, and trowel smooth.

END OF SECTION 03 51 16 00b



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SECTION 03 52 16 00 - LIGHTWEIGHT INSULATING CONCRETE

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for lightweight insulating concrete. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes cast-in-place perlite aggregate-type, vermiculite aggregate-type, and cellular-type lightweight insulating concrete for roof decks.

C. Submittals

1. Product Data: For each type of product indicated. Include mixing and application instructions for each type of lightweight insulating concrete.
2. Shop Drawings: Include plans, sections, and details showing roof slopes, lightweight insulating concrete thicknesses, embedded insulation board, roof penetrations, roof perimeter terminations and curbs, control and expansion joints, and roof drains.
3. Design mixtures.
4. Qualification data.
5. Material Test Reports: For lightweight aggregates.
6. Research/evaluation reports.

D. Quality Assurance

1. Installer Qualifications: An Installer who employs and retains, throughout the project, supervisors who are trained and approved by manufacturer.
 - a. A firm that has been evaluated by UL and found to comply with requirements of the National Roof Deck Contractors Association Lightweight Insulating Concrete Roof Deck Contractors (LWIC) Accreditation Program.
2. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
3. Fire-Resistance Ratings: Where indicated, provide lightweight insulating concrete identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency.
 - a. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
4. FM Approvals Listing: Provide lightweight insulating concrete evaluated by FM Approvals as part of a roof assembly and listed in FM Approvals' "RoofNav" for Class 1 or noncombustible construction, as applicable.
5. Provide vermiculite aggregates containing no detectable asbestos as determined by method specified in 40 CFR 763, Subpart E, Appendix E, Section 1, "Polarized Light Microscopy."
6. Preinstallation Conference: Conduct conference at Project site.

E. Delivery, Storage, And Handling

1. Deliver materials in manufacturer's original undamaged packages or acceptable bulk containers.
2. Store packaged materials to protect them from elements or physical damage.
3. Do not use cement that shows indications of moisture damage, caking, or other deterioration.

F. Project Conditions

1. Do not place lightweight insulating concrete unless ambient temperature is 40 deg F (4.4 deg C) **OR** 32 deg F (0 deg C), **as directed**, and rising.
 - a. When air temperature has fallen or is expected to fall below 40 deg F (4.4 deg C), heat water to a maximum 120 deg F (49 deg C) before mixing so lightweight insulating concrete,



at point of placement, reaches a temperature of 50 deg F (10 deg C) minimum and 80 deg F (27 deg C) maximum.

2. Do not place lightweight insulating concrete during rain or snow or on surfaces covered with standing water, snow, or ice.

1.2 PRODUCTS

A. Materials

1. Cementitious Material: Portland cement, ASTM C 150, Type I **OR** II **OR** I/II **OR** III, **as directed**. Supplement with fly ash, ASTM C 618, Class C **OR** F, **as directed**.
2. Mineral Aggregate: ASTM C 332, Group I, vermiculite **OR** perlite, **as directed**.
3. Foaming Agent (for cellular-type lightweight insulating concrete): ASTM C 869.
4. Water: Clean, potable.
5. Air-Entraining Admixture: ASTM C 260.
6. Joint Filler: ASTM C 612, Class 2, glass-fiber type; compressing to one-half thickness under a load of 25 psi (172 kPa).
7. Steel Wire Mesh: Cold-drawn steel wire, galvanized, 0.041-inch (1.04-mm) diameter, woven into 2-inch (50-mm) hexagonal mesh, and reinforced with a longitudinal 0.062-inch- (1.57-mm-) diameter wire spaced 3 inches (75 mm) apart.
8. Galvanized Plain-Steel Welded Wire Reinforcement: ASTM A 185, 2 by 2 inches (50 by 50 mm), W0.5 by W0.5, fabricated from galvanized steel wire into flat sheets.
9. Molded-Polystyrene Insulation Board: ASTM C 578, Type I, 0.90-lb/cu. ft. (14.4-kg/cu. m) minimum density.
 - a. Provide units with keying slots of approximately 3 percent of board's gross surface area.

B. Design Mixtures

1. Prepare design mixtures for each type and strength of lightweight insulating concrete by laboratory trial batch method or by field-test data method. For trial batch method, use a qualified independent testing agency for preparing and reporting proposed mixture designs.
 - a. Limit use of fly ash to not exceed 25 percent of portland cement by weight.
2. Limit water-soluble chloride ions to the maximum percentage by weight of cement or cementitious material permitted by ACI 301.

C. Aggregate Lightweight Insulating Concrete

1. Produce lightweight insulating concrete using the minimum amount of water necessary to produce a workable mix.
 - a. Do not exceed maximum air content recommended by aggregate manufacturer.
2. Perlite Aggregate Mix: Lightweight insulating concrete produced from cementitious materials, water, air-entraining admixture, and perlite mineral aggregates with the following physical properties:
 - a. As-Cast Unit Weight: 38 to 44 lb/cu. ft. (610 to 705 kg/cu. m) at point of placement, when tested according to ASTM C 138/C 138M.
 - b. Oven-Dry Unit Weight: 24 to 30 lb/cu. ft. (385 to 480 kg/cu. m), when tested according to ASTM C 495.
 - c. Compressive Strength: Minimum 125 psi (860 kPa), when tested according to ASTM C 495.
 - d. Cement-to-Aggregate Ratio, by Volume: 1:6.
3. Vermiculite Aggregate Mix: Lightweight insulating concrete produced from cementitious materials, water, air-entraining admixture, and vermiculite mineral aggregates with the following physical properties:
 - a. Properties No. 1
 - 1) As-Cast Unit Weight: 45 to 49 lb/cu. ft. (720 to 785 kg/cu. m) at point of placement, when tested according to ASTM C 138/C 138M.



- 2) Oven-Dry Unit Weight: 23 to 26 lb/cu. ft. (370 to 416 kg/cu. m), when tested according to ASTM C 495.
 - 3) Compressive Strength: Minimum 140 psi (965 kPa), when tested according to ASTM C 495.
 - 4) Cement-to-Aggregate Ratio, by Volume: 1:6.
- b. Properties No. 2 based on Siplast's "ZIC System" for use over galvanized vented steel deck.
- 1) As-Cast Unit Weight: 44 to 60 lb/cu. ft. (705 to 960 kg/cu. m) at point of placement, when tested according to ASTM C 138/C 138M.
 - 2) Oven-Dry Unit Weight: 22 to 28 lb/cu. ft. (352 to 450 kg/cu. m), when tested according to ASTM C 495.
 - 3) Compressive Strength: Minimum 125 psi (860 kPa), when tested according to ASTM C 495.
 - 4) Cement-to-Aggregate Ratio, by Volume: 1:6.
- c. Properties No. 3 based on Siplast's "NVS System" for use over nonventing substrates.
- 1) As-Cast Unit Weight: 60 to 68 lb/cu. ft. (960 to 1090 kg/cu. m) at point of placement, when tested according to ASTM C 138/C 138M.
 - 2) Oven-Dry Unit Weight: 34 to 42 lb/cu. ft. (545 to 673 kg/cu. m), when tested according to ASTM C 495.
 - 3) Compressive Strength: Minimum 300 psi (2070 kPa), when tested according to ASTM C 495.
 - 4) Cement-to-Aggregate Ratio, by Volume: 1:3.5.

D. Cellular Lightweight Insulating Concrete

1. Produce cellular lightweight insulating concrete with the following minimum physical properties using cementitious materials, air-producing liquid-foaming agents, and the minimum amount of water necessary to produce a workable mix.
 - a. Properties No. 1
 - 1) As-Cast Unit Weight: 34 to 42 lb/cu. ft. (545 to 673 kg/cu. m) at point of placement, when tested according to ASTM C 138/C 138M.
 - 2) Oven-Dry Unit Weight: 26 to 32 lb/cu. ft. (416 to 513 kg/cu. m), when tested according to ASTM C 495.
 - 3) Compressive Strength: Minimum 190 psi (1310 kPa), when tested according to ASTM C 495.
 - b. Properties No. 2 based on Elastizell's "Range IIB."
 - 1) As-Cast Unit Weight: 34 to 42 lb/cu. ft. (545 to 673 kg/cu. m) at point of placement, when tested according to ASTM C 138/C 138M.
 - 2) Oven-Dry Unit Weight: 28 to 32 lb/cu. ft. (450 to 513 kg/cu. m), when tested according to ASTM C 495.
 - 3) Compressive Strength: Minimum 200 psi (1380 kPa), when tested according to ASTM C 495.
 - c. Properties No. 3 based on Siplast's "Insulcel."
 - 1) As-Cast Unit Weight: 38 to 48 lb/cu. ft. (610 to 770 kg/cu. m) at point of placement, when tested according to ASTM C 138/C 138M.
 - 2) Oven-Dry Unit Weight: 30 to 36 lb/cu. ft. (480 to 577 kg/cu. m), when tested according to ASTM C 495.
 - 3) Compressive Strength: Minimum 200 psi (1380 kPa), when tested according to ASTM C 495.

1.3 EXECUTION

A. Preparation

1. Control Joints: Install control joints at perimeter of roof deck and at junctures with vertical surfaces, including curbs, walls, and vents, for full depth of lightweight insulating concrete. Fill control joints with joint filler.



- a. Provide 1-inch- (25-mm-) wide control joints for roof dimensions up to 100 feet (30 m) in length; 1-1/2-inch- (38-mm-) wide control joints for roof dimensions exceeding 100 feet (30 m).
 2. Wire Mesh: Place steel wire mesh with longest dimension perpendicular to steel deck ribs. Cut mesh to fit around roof openings and projections. Terminate mesh at control joints. Lap sides and ends of mesh at least 6 inches (150 mm).
 3. Welded Wire Reinforcement: Place steel welded wire reinforcement with longest dimension perpendicular to steel deck ribs. Cut reinforcement to fit around roof openings and projections. Terminate reinforcement at control joints. Lap sides and ends of reinforcement at least 6 inches (150 mm).
- B. Mixing And Placing
1. Mix and place lightweight insulating concrete according to manufacturer's written instructions, using equipment and procedures to avoid segregation of mixture and loss of air content.
 2. Install insulation board according to lightweight insulating concrete manufacturer's written instructions. Place insulation board in wet, lightweight insulating concrete slurry poured a minimum of 1/8 inch (3 mm) over the structural substrate. Ensure full contact of insulation board with slurry. Stagger joints and tightly butt insulation boards.
 - a. Install insulation board in a stair-step configuration with a maximum step-down of 1 inch (25 mm).
 3. Deposit and screed lightweight insulating concrete in a continuous operation until an entire panel or section of roof area is completed. Do not vibrate or work mix except for screeding or floating. Place to depths and slopes indicated.
 4. Finish top surface smooth, free of ridges and depressions, and maintain surface in condition to receive subsequent roofing system.
 5. Begin curing operations immediately after placement, and air cure for not less than three days according to manufacturer's written instructions.
 6. If ambient temperature falls below 32 deg F (0 deg C), protect lightweight insulating concrete from freezing and maintain temperature recommended by manufacturer for 72 hours after placement.
- C. Field Quality Control
1. Testing Agency: Engage a qualified independent testing and inspecting agency to sample materials, perform field tests and inspections, and prepare test reports.
 2. Testing of samples of lightweight insulating concrete obtained according to ASTM C 172, except as modified by ASTM C 495, shall be performed according to the following requirements:
 - a. Determine as-cast unit weight during each hour of placement, according to ASTM C 138/C 138M.
 - b. Determine oven-dry unit weight and compressive strength according to ASTM C 495. Make a set of at least 6 molds for each day's placement, but not less than 1 set of molds for each 5000 sq. ft. (465 sq. m) of roof area.
 - c. Perform additional tests when test results indicate as-cast unit weight, oven-dry unit weight, compressive strength, or other requirements have not been met.
 - 1) Retest cast-in-place lightweight insulating concrete according to ASTM C 513 for oven-dry unit weight and compressive strength.
- D. Defective Work
1. Refinish, or remove and replace, lightweight insulating concrete if surfaces are excessively scaled or too rough to receive roofing according to roofing membrane manufacturer's written requirements.
 2. Remove and replace lightweight insulating concrete that fails to comply with requirements.

END OF SECTION 03 52 16 00



SECTION 03 53 00 00 - CONCRETE FLOOR TOPPING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for concrete floor topping. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Emery-aggregate concrete floor topping.
 - b. Iron-aggregate concrete floor topping.

C. Submittals

1. Product Data: For each type of product indicated.
2. Product Test Reports.
3. Field quality-control test reports.

D. Quality Assurance

1. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
2. Preinstallation Conference: Conduct conference at Project site.

E. Delivery, Storage, And Handling

1. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage, mixing with other components, and application.
2. Store materials to comply with manufacturer's written instructions to prevent deterioration from moisture or other detrimental effects.

F. Project Conditions

1. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature and moisture content, ambient temperature and humidity, ventilation, and other conditions affecting concrete floor topping performance.
 - a. Place concrete floor topping only when ambient temperature and temperature of base slabs are between 50 and 86 deg F (10 and 30 deg C).
2. Close areas to traffic during topping application and, after application, for time period recommended in writing by manufacturer.

1.2 PRODUCTS

A. Concrete Floor Toppings

1. Emery-Aggregate Concrete Floor Topping: Factory-prepared and dry-packaged mixture of graded, crushed emery aggregate containing not less than 50 percent aluminum oxide, not less than 24 percent ferric oxide, and not more than 8 percent silica; portland cement or blended hydraulic cement; plasticizers; and other admixtures to which only water needs to be added at Project site.
 - a. Compressive Strength (28 Days): 10,000 psi (69 MPa); ASTM C 109/C 109M.
2. Iron-Aggregate Concrete Floor Topping: Factory-prepared and dry-packaged mixture of graded iron aggregate, portland cement, plasticizers, and other admixtures to which only water needs to be added at Project site.



a. Compressive Strength (28 Days): 12,000 psi (83 MPa); ASTM C 109/C 109M.

B. Curing Materials

1. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.
2. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.
3. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
4. Water: Potable.
5. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, 25 percent solids content, minimum.

C. Related Materials

1. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A Shore durometer hardness of 80 **OR** aromatic polyurea with a Type A Shore durometer hardness range of 90 to 95, **as directed**, per ASTM D 2240.
2. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.
3. Portland Cement: ASTM C 150, Type I or II.
4. Sand: ASTM C 404, fine aggregate passing No. 16 (1.18-mm) sieve.
5. Water: Potable.
6. Acrylic-Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
7. Epoxy Adhesive: ASTM C 881/C 881M, Type V, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements.

D. Mixing

1. Bonding Slurry: Mix portland cement with water to a thick paint consistency.
OR
Bonding Slurry: Mix 1 part portland cement and 1-1/2 **OR** 2 **OR** 2-1/2, **as directed**, parts sand with water and an acrylic-bonding agent according to manufacturer's written instructions, **as directed**, to a thick paint consistency.
2. Floor Topping: Mix concrete floor topping materials and water in appropriate drum-type batch machine mixer or truck mixer according to manufacturer's written instructions.

1.3 EXECUTION

A. Examination

1. Examine substrates, with Installer present, for conditions affecting performance of concrete floor topping.
2. Verify that base concrete slabs comply with scratch finish requirements specified in Division 03 Section "Cast-in-place Concrete".
3. Verify that base slabs are visibly dry and free of moisture. Test for capillary moisture by the plastic sheet method according to ASTM D 4263.
4. Proceed with application only after unsatisfactory conditions have been corrected.

B. Preparation

1. Existing Concrete: Remove existing surface treatments and deteriorated and unsound concrete. Mechanically abrade base slabs to produce a heavily scarified surface profile with an amplitude of 1/4 inch (6 mm.)
 - a. Prepare and clean existing base slabs according to concrete floor topping manufacturer's written instructions. Fill voids, cracks, and cavities in base slabs.
 - b. Mechanically remove contaminants from existing concrete that might impair bond of floor topping.



- c. Saw cut contraction and construction joints in existing concrete to a depth of 1/2 inch (13 mm) and fill with semirigid joint filler.
 - d. To both sides of joint edges and at perimeter of existing base slab mechanically remove a 4-inch- (100-mm-) wide and 0- to 1-inch (0- to 25-mm-) deep, tapered wedge of concrete and retexture surface **OR** install concrete nails in manufacturer's recommended staggered pattern, **as directed**.
2. Install joint-filler strips where topping abuts vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - a. Extend joint-filler strips full width and depth of joint, terminating flush with topping surface, unless otherwise indicated.
 - b. Terminate full-width, joint-filler strips 1/2 inch (13 mm) below topping surface where joint sealants, specified in Division 07 Section "Joint Sealants", are indicated.
 - c. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- C. Floor Topping Application
1. Start floor topping application in presence of manufacturer's technical representative.
 2. Monolithic Floor Topping: After textured-float finish is applied to fresh concrete of base slabs specified in Division 03 Section "Cast-in-place Concrete", place concrete floor topping while concrete is still plastic.
 3. Deferred Floor Topping: Within 72 hours of placing base slabs, mix and scrub bonding slurry into dampened concrete to a thickness of 1/16 to 1/8 inch (1.6 to 3 mm), without puddling. Place floor topping while slurry is still tacky.
 4. Existing Concrete: Apply epoxy-bonding adhesive, mixed according to manufacturer's written instructions, and scrub into dry base slabs to a thickness of 1/16 to 1/8 inch (1.6 to 3 mm), without puddling. Place floor topping while adhesive is still tacky.
 5. Place concrete floor topping continuously in a single layer, tamping and consolidating to achieve tight contact with bonding surface. Do not permit cold joints or seams to develop within pour strip.
 - a. Screed surface with a straightedge and strike off to correct elevations.
 - b. Slope surfaces uniformly where indicated.
 - c. Begin initial floating using bull floats to form a uniform and open-textured surface plane free of humps or hollows.
 6. Finishing: Consolidate surface with power-driven floats as soon as concrete floor topping can support equipment and operator. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until concrete floor topping surface has a uniform, smooth, granular texture.
 - 1) Hard Trowel Finish: After floating surface, apply first trowel finish and consolidate concrete floor topping by power-driven trowel without allowing blisters to develop. Continue troweling passes and restraighten until surface is smooth and uniform in texture.
 - 2) Finish surfaces to specified overall values of flatness, F(F) 25; and levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and levelness, F(L) 15, and measure **OR** notify independent testing agency to permit measurement, **as directed**, within 24 hours according to ASTM E 1155 (ASTM E 1155M) for a randomly trafficked floor surface.
 - 3) Finish and measure surface so gap at any point between surface and an unlevelled freestanding 10-foot- (3-m-) long straightedge, resting on 2 high spots and placed anywhere on the surface, does not exceed 1/4 inch (6 mm).
 7. Construction Joints: Construct joints true to line with faces perpendicular to surface plane of concrete floor topping, at locations indicated or as approved by the Owner.
 - a. Coat face of construction joint with epoxy adhesive at locations where concrete floor topping is placed against hardened or partially hardened concrete floor topping.
 8. Contraction Joints: Form weakened-plane contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3-mm-) wide joints into concrete



floor topping when cutting action will not tear, abrade, or otherwise damage surface and before random contraction cracks develop.

- a. Form joints in concrete floor topping over contraction joints in base slabs, unless otherwise indicated.
- b. Construct contraction joints for a combined depth equal to topping thickness and not less than one-fourth of base-slab thickness.
- c. Construct contraction joints for a depth equal to one-half of concrete floor topping thickness, but not less than 1/2 inch (13 mm) deep.

D. Protecting And Curing

1. General: Protect freshly placed concrete floor topping from premature drying and excessive cold or hot temperatures.
2. Evaporation Retarder: Apply evaporation retarder to concrete floor topping surfaces in hot, dry, or windy conditions before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying floor topping, but before float finishing.
3. Begin curing immediately after finishing concrete floor topping. Cure by one or a combination of the following methods, according to concrete floor topping manufacturer's written instructions:
 - a. Moisture Curing: Keep surfaces continuously moist for not less than 7 days with water **OR** continuous water-fog spray **OR** absorptive cover, water saturated and kept continuously wet. Cover topping surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers, **as directed**.
 - b. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - c. Curing Compound: Apply uniformly in two coats in continuous operations by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

E. Joint Filling

1. Prepare and clean contraction joints and install semirigid joint filler, according to manufacturer's written instructions, once topping has fully cured.
2. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
3. Install semirigid joint filler full depth of contraction joints. Overfill joint and trim semirigid joint filler flush with top of joint after hardening.

F. Repairs

1. Defective Topping: Repair and patch defective concrete floor topping areas, including areas that have not bonded to concrete substrate.

G. Field Quality Control

1. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
2. Testing Services: Testing and inspecting of completed applications of concrete floor toppings shall take place in successive stages, in areas of extent and using methods as follows:
 - a. Sample Sets: At point of placement, a set of 3 molded-cube samples shall be taken from the topping mix for the first 1000 sq. ft. (93 sq. m), plus 1 set of samples for each subsequent 5000 sq. ft. (464 sq. m) of topping, or fraction thereof, but not less than 6 samples for each day's placement. Samples shall be tested according to ASTM C 109/C 109M for compliance with compressive-strength requirements.



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- b. Concrete floor topping shall be tested for delamination by dragging a steel chain over the surface.
 - c. Concrete floor topping shall be tested for compliance with surface flatness and levelness tolerances.
 3. Remove and replace applications of concrete floor topping where test results indicate that it does not comply with specified requirements.
 4. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

END OF SECTION 03 53 00 00



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SECTION 03 54 16 00 - CEMENT-BASED UNDERLAYMENT

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for hydraulic cement-based underlayment. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes hydraulic-cement-based, polymer-modified, self-leveling underlayment for application below interior floor coverings.

C. Action Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:
 - a. Product Data for Credit IEQ 4.2: For priming and sealing coatings, documentation including printed statement of VOC content.
3. Shop Drawings: Include plans indicating substrates, locations, and average depths of underlayment based on survey of substrate conditions.

D. Informational Submittals

1. Qualification Data: For qualified Installer.
2. Product Certificates: Signed by manufacturers of underlayment and floor-covering systems certifying that products are compatible.
3. Minutes of preinstallation conference.

E. Quality Assurance

1. Installer Qualifications: Installer who is approved by manufacturer for application of underlayment products required for this Project.
2. Product Compatibility: Manufacturers of underlayment and floor-covering systems certify in writing that products are compatible.
3. Fire-Resistance Ratings: Where indicated, provide hydraulic-cement underlayment systems identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
4. Sound Transmission Characteristics: Where indicated, provide hydraulic-cement underlayment systems identical to those of assemblies tested for STC and IIC ratings per ASTM E 90 and ASTM E 492 by a qualified testing agency.

F. Delivery, Storage, And Handling

1. Store materials to comply with manufacturer's written instructions to prevent deterioration from moisture or other detrimental effects.

G. Project Conditions

1. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ventilation, ambient temperature and humidity, and other conditions affecting underlayment performance.
 - a. Place hydraulic-cement-based underlayments only when ambient temperature and temperature of substrates are between 50 and 80 deg F (10 and 27 deg C).



1.2 PRODUCTS

A. Hydraulic-Cement-Based Underlayments

1. Underlayment: Hydraulic-cement-based, polymer-modified, self-leveling product that can be applied in minimum uniform thicknesses of 1/4 inch (6 mm) and that can be feathered at edges to match adjacent floor elevations.
 - a. Cement Binder: ASTM C 150, portland cement, or hydraulic or blended hydraulic cement as defined by ASTM C 219.
 - b. Compressive Strength: Not less than 4100 psi (28 MPa) at 28 days when tested according to ASTM C 109/C 109M.
 - c. Underlayment Additive: Resilient-emulsion product of underlayment manufacturer formulated for use with underlayment when applied to substrate and conditions indicated.
2. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3 to 6 mm); or coarse sand as recommended by underlayment manufacturer.
 - a. Provide aggregate when recommended in writing by underlayment manufacturer for underlayment thickness required.
3. Water: Potable and at a temperature of not more than 70 deg F (21 deg C).
4. Reinforcement: For underlayment applied to wood substrates, provide galvanized metal lath or other corrosion-resistant reinforcement recommended in writing by underlayment manufacturer.
5. Primer: Product of underlayment manufacturer recommended in writing for substrate, conditions, and application indicated.
6. Corrosion-Resistant Coating: Recommended in writing by underlayment manufacturer for metal substrates.

B. Accessories

1. Sound Mat
2. Sound Reduction Board

1.3 EXECUTION

A. Examination

1. Examine substrates, with Installer present, for conditions affecting performance.
 - a. Proceed with application only after unsatisfactory conditions have been corrected.

B. Preparation

1. General: Prepare and clean substrate according to manufacturer's written instructions.
 - a. Treat nonmoving substrate cracks according to manufacturer's written instructions to prevent cracks from telegraphing (reflecting) through underlayment.
 - b. Fill substrate voids to prevent underlayment from leaking.
2. Concrete Substrates: Mechanically remove, according to manufacturer's written instructions, laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants that might impair underlayment bond.
 - a. Moisture Testing: Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates do not exceed a maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/100 sq. m) in 24 hours.
3. Wood Substrates: Mechanically fasten loose boards and panels to eliminate substrate movement and squeaks. Sand to remove coatings that might impair underlayment bond and remove sanding dust.
 - a. Install underlayment reinforcement recommended in writing by manufacturer.
4. Metal Substrates: Mechanically remove, according to manufacturer's written instructions, rust, foreign matter, and other contaminants that might impair underlayment bond. Apply corrosion-resistant coating compatible with underlayment if recommended in writing by underlayment manufacturer.



5. Nonporous Substrates: For ceramic tile, quarry tile, and terrazzo substrates, remove waxes, sealants, and other contaminants that might impair underlayment bond, and prepare surfaces according to manufacturer's written instructions.
6. Adhesion Tests: After substrate preparation, test substrate for adhesion with underlayment according to manufacturer's written instructions.
7. Sound Control Mat and Board: Install sound control materials according to manufacturer's written instructions.
 - a. Do not install mechanical fasteners that penetrate through the sound control materials.

C. Application

1. General: Mix and apply underlayment components according to manufacturer's written instructions.
 - a. Close areas to traffic during underlayment application and for time period after application recommended in writing by manufacturer.
 - b. Coordinate application of components to provide optimum underlayment-to-substrate and intercoat adhesion.
 - c. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.
2. Apply primer over prepared substrate at manufacturer's recommended spreading rate.
3. Apply underlayment to produce uniform, level surface.
 - a. Apply a final layer without aggregate to product surface.
 - b. Feather edges to match adjacent floor elevations.
4. Cure underlayment according to manufacturer's written instructions. Prevent contamination during application and curing processes.
5. Do not install floor coverings over underlayment until after time period recommended in writing by underlayment manufacturer.
6. Remove and replace underlayment areas that evidence lack of bond with substrate, including areas that emit a "hollow" sound when tapped.

D. Protection

1. Protect underlayment from concentrated and rolling loads for remainder of construction period.

END OF SECTION 03 54 16 00



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Task	Specification	Specification Description
03 61 16 00	01 22 16 00	No Specification Required
03 62 13 00	03 48 29 00	Plant-Precast Structural Concrete
03 62 16 00	03 48 29 00	Plant-Precast Structural Concrete
03 64 23 00	03 48 29 00	Plant-Precast Structural Concrete
03 64 26 00	01 22 16 00	No Specification Required



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SECTION 04 01 20 52 - CLAY MASONRY RESTORATION AND CLEANING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for clay masonry restoration and cleaning. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes maintenance of unit masonry consisting of brick and terra cotta clay masonry restoration and cleaning as follows:
 - a. Unused anchor removal.
 - b. Repairing unit masonry, including replacing units.
 - c. Painting steel uncovered during the work.
 - d. Reanchoring veneers.
 - e. Repointing joints.
 - f. Preliminary cleaning, including removing plant growth.
 - g. Cleaning exposed unit masonry surfaces.
2. Owner-Furnished Material: Salvaged brick (if salvaged brick is available from the Owner for reuse).

C. Definitions

1. Very Low-Pressure Spray: Under 100 psi (690 kPa).
2. Low-Pressure Spray: 100 to 400 psi (690 to 2750 kPa); 4 to 6 gpm (0.25 to 0.4 L/s).
3. Medium-Pressure Spray: 400 to 800 psi (2750 to 5510 kPa); 4 to 6 gpm (0.25 to 0.4 L/s).
4. High-Pressure Spray: 800 to 1200 psi (5510 to 8250 kPa); 4 to 6 gpm (0.25 to 0.4 L/s).
5. Saturation Coefficient: Ratio of the weight of water absorbed during immersion in cold water to weight absorbed during immersion in boiling water; used as an indication of resistance of masonry units to freezing and thawing.

D. Preconstruction Testing

1. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on masonry units as follows.
 - a. Existing Brick and Terra Cotta: Test each type of existing masonry unit indicated for replacement, according to testing methods in ASTM C 67 for compressive strength, 24-hour cold-water absorption, 5-hour boil absorption, saturation coefficient, and initial rate of absorption (suction). Carefully remove five existing units from locations designated by the Owner. Take testing samples from these units.
 - b. Existing Mortar: Test according to ASTM C 295, modified as agreed by testing service and the Owner for Project requirements, to determine proportional composition of original ingredients, sizes and colors of aggregates, and approximate strength. Use X-ray diffraction, infrared spectroscopy, and differential thermal analysis as necessary to supplement microscopical methods. Carefully remove existing mortar from within joints at five locations designated by the Owner or testing service.
 - c. Temporary Patch: as directed by the Owner, provide temporary materials at locations from which existing samples were taken.
 - d. Replacement Brick and Terra Cotta: Test each proposed type of replacement masonry unit, according to sampling and testing methods in ASTM C 67 for compressive strength, 24-hour cold-water absorption, 5-hour boil absorption, saturation coefficient, and initial rate of absorption (suction).

E. Submittals



1. Product Data: For each type of product indicated.
2. Shop Drawings: For the following:
 - a. Full-size patterns with complete dimensions for new terra cotta units, specially molded brick shapes, and brick arches and their jointing, showing relation of existing to new units.
 - b. Setting number of each new terra cotta unit and its location on the structure in annotated plans and elevations.
 - c. Provisions for expansion joints or other sealant joints.
 - d. Provisions for flashing, lighting fixtures, conduits, and weep holes as required.
 - e. Replacement and repair anchors. Include details of anchors within individual masonry units, with locations of anchors and dimensions of holes and recesses in units required for anchors.
3. Samples: For each exposed product and for each color and texture specified.
4. Preconstruction Test Reports.

F. Quality Assurance

1. Restoration Specialist Qualifications: Engage an experienced, preapproved masonry restoration and cleaning firm to perform work of this Section. Firm shall have completed work similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance. Experience installing standard unit masonry is not sufficient experience for masonry restoration work.
 - a. At Contractor's option, work may be divided between two specialist firms: one for cleaning work and one for repair work.
 - b. Field Supervision: Restoration specialist firms shall maintain experienced full-time supervisors on Project site during times that clay masonry restoration and cleaning work is in progress. Supervisors shall not be changed during Project except for causes beyond the control of restoration specialist firm.
 - c. Restoration Worker Qualifications: Persons who are experienced and specialize in restoration work of types they will be performing. When masonry units are being patched, assign at least one worker among those performing patching work who is trained and certified by manufacturer of patching compound to apply its products.
2. Terra Cotta Manufacturer Qualifications: A firm regularly engaged in manufacturing custom architectural terra cotta units for building restoration purposes, of same type and of similar size, complexity, and tolerances as those required for the Work.
3. Mockups: Prepare mockups of restoration and cleaning to demonstrate aesthetic effects and set quality standards for materials and execution and for fabrication and installation.
 - a. Masonry Repair: Prepare sample areas for each type of masonry material indicated to have repair work performed. If not otherwise indicated, size each mockup not smaller than 2 adjacent whole units or approximately 48 inches (1200 mm) in least dimension. Erect sample areas in existing walls unless otherwise indicated, to demonstrate quality of materials, workmanship, and blending with existing work. Include the following as a minimum:
 - 1) Replacement:
 - a) Four brick units replaced.
 - b) Four terra cotta units replaced.
 - 2) Reanchoring Veneers: Install three masonry repair anchors in mockup wall assembly of each anchor type required.
 - 3) Patching: Three small holes at least 1 inch (25 mm) in diameter **OR** as directed, **as directed**, for each type of masonry material indicated to be patched, so as to leave no evidence of repair.
 - 4) Widening Joints: Widen a joint in 2 separate locations, each approximately 12 inches (300 mm) long **OR** as directed, **as directed**.
 - b. Repointing: Rake out joints in 2 separate areas, each approximately 36 inches (900 mm) high by 48 inches (1200 mm) wide **OR** as indicated, **as directed**, for each type of repointing required and repoint one of the areas.



- c. Cleaning: Clean an area approximately 25 sq. ft. (2.3 sq. m) **OR** as indicated, **as directed**, for each type of masonry and surface condition.
4. Preinstallation Conference: Conduct conference at Project site.

G. Delivery, Storage, And Handling

1. Deliver masonry units to Project site strapped together in suitable packs or pallets or in heavy-duty cartons.
2. Deliver each piece of terra cotta with code mark or setting number on unexposed face, corresponding to Shop Drawings, using nonstaining paint.
3. Deliver other materials to Project site in manufacturer's original and unopened containers, labeled with manufacturer's name and type of products.
4. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
5. Store hydrated lime in manufacturer's original and unopened containers. Discard lime if containers have been damaged or have been opened for more than two days.
6. Store lime putty covered with water in sealed containers.
7. Store sand where grading and other required characteristics can be maintained and contamination avoided.

H. Project Conditions

1. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit masonry restoration and cleaning work to be performed according to manufacturers' written instructions and specified requirements.
2. Repair masonry units and repoint mortar joints only when air temperature is between 40 and 90 deg F (4 and 32 deg C) and is predicted to remain so for at least 7 days after completion of the Work unless otherwise indicated.
3. Cold-Weather Requirements: Comply with the following procedures for masonry repair and mortar-joint pointing unless otherwise indicated:
 - a. When air temperature is below 40 deg F (4 deg C), heat mortar ingredients, masonry repair materials, and existing masonry walls to produce temperatures between 40 and 120 deg F (4 and 49 deg C).
 - b. When mean daily air temperature is below 40 deg F (4 deg C), provide enclosure and heat to maintain temperatures above 32 deg F (0 deg C) within the enclosure for 7 days after repair and pointing.
 - c. Hot-Weather Requirements: Protect masonry repair and mortar-joint pointing when temperature and humidity conditions produce excessive evaporation of water from mortar and repair materials. Provide artificial shade and wind breaks and use cooled materials as required to minimize evaporation. Do not apply mortar to substrates with temperatures of 90 deg F (32 deg C) and above unless otherwise indicated.
4. For manufactured repair materials, perform work within the environmental limits set by each manufacturer.
5. Clean masonry surfaces only when air temperature is 40 deg F (4 deg C) and above and is predicted to remain so for at least 7 days after completion of cleaning.

1.2 PRODUCTS

A. Masonry Materials

1. Face Brick: Provide face brick, including specially molded, ground, cut, or sawed shapes where required to complete masonry restoration work.
 - a. Provide units with physical properties, colors, color variation within units, surface texture, size, and shape to match existing brickwork.
 - 1) Physical Properties per ASTM C 67:
 - 2) For existing brickwork that exhibits a range of colors or color variation within units, provide brick that proportionally matches that range and variation rather than brick that matches an individual color within that range.



- b. Special Shapes:
 - 1) Provide specially molded, 100 percent solid shapes for applications where core holes or "frogs" could be exposed to view or weather when in final position and where shapes produced by sawing would result in sawed surfaces being exposed to view.
 - 2) Provide specially ground units, shaped to match patterns, for arches and where indicated.
 - 3) Mechanical chopping or breaking brick, or bonding pieces of brick together by adhesive, are not acceptable procedures for fabricating special shapes.
 - c. Tolerances as Fabricated: Comply with tolerance requirements in ASTM C 216, Type FBX **OR** Comply with tolerance requirements in ASTM C 216, Type FBS, **as directed**.
 2. Building Brick: Provide building brick complying with ASTM C 62, of same vertical dimension as face brick, for masonry work concealed from view.
 - a. Grade SW where in contact with earth.
 - b. Grade SW, MW, or NW for concealed backup.
 3. Salvaged Brick: Obtain salvaged brick from the Owner from location shown on Drawings. Clean off residual mortar.
 4. Glazed Terra Cotta: Provide new terra cotta units to match existing terra cotta units in body composition, physical properties, color, gloss, surface texture, thickness, profile, dimensions, and composition of surface glaze.
 - a. Physical Properties: Provide units with tested physical properties within 10 percent of those determined from preconstruction testing of selected existing units.
 - 1) Physical Properties per ASTM C 67:
 - b. Tolerances as Fabricated: Comply with tolerance requirements in ASTM C 212, Type FTX.
 5. Brownstone Terra Cotta: Provide new, unglazed, brownstone terra cotta units to match existing terra cotta units in body composition, physical properties, colors, color variation within units, surface texture, unit profile, and dimensions.
 - a. Physical Properties: Provide units with tested physical properties within 10 percent of those determined from preconstruction testing of selected existing units.
 - b. Physical Properties per ASTM C 67:
 - c. Tolerances as Fabricated: Comply with tolerance requirements in ASTM C 212, Type FTX.
 - d. For existing terra cotta that exhibits a range of colors or color variation within units, provide terra cotta that proportionally matches that range and variation rather than terra cotta that matches an individual color within that range.
- B. Mortar Materials
1. Portland Cement: ASTM C 150, Type I or Type II, white or gray or both where required for color matching of exposed mortar.
 - a. Provide cement containing not more than 0.60 percent total alkali when tested according to ASTM C 114.
 2. Hydrated Lime: ASTM C 207, Type S.
 3. Factory-Prepared Lime Putty: ASTM C 1489.
 4. Quicklime: ASTM C 5, pulverized lime.
 5. Mortar Sand: ASTM C 144 unless otherwise indicated.
 - a. Color: Provide natural sand or ground marble, granite, or other sound stone of color necessary to produce required mortar color.
 - b. For pointing mortar, provide sand with rounded edges.
 - c. Match size, texture, and gradation of existing mortar sand as closely as possible. Blend several sands if necessary to achieve suitable match.
 6. Mortar Pigments: Natural and synthetic iron oxides, compounded for mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortars.
 7. Water: Potable.



C. Manufactured Repair Materials

1. Masonry Patching Compound: Factory-mixed cementitious product that is custom manufactured for patching masonry.
 - a. Use formulation that is vapor- and water permeable (equal to or more than the masonry unit), exhibits low shrinkage, has lower modulus of elasticity than the masonry units being repaired, and develops high bond strength to all types of masonry.
 - b. Use formulation having working qualities and retardation control to permit forming and sculpturing where necessary.
 - c. Formulate patching compound used for patching brick and terra cotta in colors and textures to match each masonry unit being patched.
2. Terra Cotta Glaze Replacement: A high-solids, nonyellowing, fade-resistant, waterborne polyurethane or epoxy coating intended for exterior use as terra cotta glaze replacement. Product shall be custom mixed by manufacturer to match color and gloss of existing terra cotta glaze.

D. Paint Removers

1. Alkaline Paste Paint Remover: Manufacturer's standard alkaline paste formulation for removing paint coatings from masonry.
2. Covered or Skin-Forming Alkaline Paint Remover: Manufacturer's standard covered or skin-forming alkaline formulation for removing paint coatings from masonry.
3. Solvent-Type Paint Remover: Manufacturer's standard water-rinsable, solvent-type gel formulation for removing paint coatings from masonry.
4. Low-Odor, Solvent-Type Paint Remover: Manufacturer's standard low-odor, water-rinsable solvent-type gel formulation, containing no methanol or methylene chloride, for removing paint coatings from masonry.

E. Cleaning Materials

1. Water: Potable.
2. Hot Water: Water heated to a temperature of 140 to 160 deg F (60 to 71 deg C).
3. Job-Mixed Detergent Solution: Solution prepared by mixing 2 cups (0.5 L) of tetrasodium polyphosphate, 1/2 cup (125 mL) of laundry detergent, and 20 quarts (20 L) of hot water for every 5 gal. (20 L) of solution required.
4. Job-Mixed Mold, Mildew, and Algae Remover: Solution prepared by mixing 2 cups (0.5 L) of tetrasodium polyphosphate, 5 quarts (5 L) of 5 percent sodium hypochlorite (bleach), and 15 quarts (15 L) of hot water for every 5 gal. (20 L) of solution required.
5. Nonacidic Gel Cleaner: Manufacturer's standard gel formulation, with pH between 6 and 9, that contains detergents with chelating agents and is specifically formulated for cleaning masonry surfaces.
6. Nonacidic Liquid Cleaner: Manufacturer's standard mildly alkaline liquid cleaner formulated for removing mold, mildew, and other organic soiling from ordinary building materials, including polished stone, brick, aluminum, plastics, and wood.
7. Mild Acidic Cleaner: Manufacturer's standard mildly acidic cleaner containing no muriatic (hydrochloric), hydrofluoric, or sulfuric acid; or ammonium bifluoride or chlorine bleaches.
8. Acidic Cleaner: Manufacturer's standard acidic masonry cleaner composed of hydrofluoric acid or ammonium bifluoride blended with other acids, detergents, wetting agents, and inhibitors.
9. Two-Part Chemical Cleaner: Manufacturer's standard system consisting of potassium or sodium hydroxide based, alkaline prewash cleaner and acidic afterwash cleaner that does not contain hydrofluoric acid.

F. Accessory Materials

1. Liquid Strippable Masking Agent: Manufacturer's standard liquid, film-forming, strippable masking material for protecting glass, metal, and polished stone surfaces from damaging effects of acidic and alkaline masonry cleaners.
2. Terra Cotta Anchors: Type and size indicated or, if not indicated, to match existing anchors in size and type. Fabricate anchors from Type 304 **OR** Type 316, **as directed**, stainless steel.



3. Masonry Repair Anchors, Expansion Type: Mechanical fasteners designed for masonry veneer stabilization consisting of 1/4-inch- (6-mm-) diameter, Type 304 **OR** Type 316, **as directed**, stainless-steel rod with brass expanding shells at each end and water-shedding washer in the middle. Expanding shells shall be designed to provide positive mechanical anchorage to veneer on one end and backup masonry on the other.
4. Masonry Repair Anchors, Spiral Type: Type 304 **OR** Type 316, **as directed**, stainless-steel spiral rods designed to anchor to backing and veneer. Anchors are flexible in plane of veneer but rigid perpendicular to it.
 - a. Provide adhesive-installed anchors complete with manufacturer's standard epoxy adhesive and injection tubes, or other devices required for installation.
 - b. Provide driven-in anchors designed to be installed in drilled holes and relying on screw effect rather than adhesive to secure them to backup and veneer.
5. Masonry Repair Anchors, Rod/Screen Tube Type: Stainless-steel screen tube with or without Type 304 **OR** Type 316, **as directed**, stainless-steel rod, adhesive installed by injection with manufacturer's standard epoxy adhesive, complete with other devices required for installation.
6. Sealant Materials:
 - a. Provide manufacturer's standard chemically curing, elastomeric sealant(s) of base polymer and characteristics indicated below that comply with applicable requirements in Division 07 Section "Joint Sealants".
 - 1) Single-component, nonsag urethane sealant.
 - b. Colors: Provide colors of exposed sealants to match colors of masonry adjoining installed sealant unless otherwise indicated.
 - c. Ground-Mortar Aggregate: Custom crushed and ground pointing mortar sand or existing mortar retrieved from joints. Grind to a particle size that matches the adjacent mortar aggregate and color. Remove all fines passing the 100 sieve.
7. Joint-Sealant Backing:
 - a. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) or Type B (bicellular material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
 - b. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where acceptable.
8. Setting Buttons: Resilient plastic buttons, nonstaining to masonry, sized to suit joint thicknesses and bed depths of masonry units without intruding into required depths of pointing materials.
9. Masking Tape: Nonstaining, nonabsorbent material, compatible with pointing mortar, joint primers, sealants, and surfaces adjacent to joints; that will easily come off entirely, including adhesive.
10. Antirust Coating: Fast-curing, lead- and chromate-free, self-curing, universal modified-alkyd primer complying with MPI #79, Alkyd Anticorrosive Metal Primer or SSPC-Paint 20 or SSPC-Paint 29 zinc-rich coating.
 - a. Use coating requiring no better than SSPC-SP 2, "Hand Tool Cleaning" **OR** SSPC-SP 3, "Power Tool Cleaning" **OR** SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning", **as directed**, surface preparation according to manufacturer's literature or certified statement.
 - b. Use coating with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
11. Miscellaneous Products: Select materials and methods of use based on the following, subject to approval of a mockup:
 - a. Previous effectiveness in performing the work involved.
 - b. Little possibility of damaging exposed surfaces.
 - c. Consistency of each application.
 - d. Uniformity of the resulting overall appearance.
 - e. Do not use products or tools that could do the following:
 - 1) Remove, alter, or in any way harm the present condition or future preservation of existing surfaces, including surrounding surfaces not in contract.



- 2) Leave a residue on surfaces.

G. Mortar Mixes

1. Preparing Lime Putty: Slake quicklime and prepare lime putty according to appendix to ASTM C 5 and manufacturer's written instructions.
2. Measurement and Mixing: Measure cementitious materials and sand in a dry condition by volume or equivalent weight. Do not measure by shovel; use known measure. Mix materials in a clean, mechanical batch mixer.
 - a. Mixing Pointing Mortar: Thoroughly mix cementitious materials and sand together before adding any water. Then mix again adding only enough water to produce a damp, unworkable mix that will retain its form when pressed into a ball. Maintain mortar in this dampened condition for 15 to 30 minutes. Add remaining water in small portions until mortar reaches desired consistency. Use mortar within one hour of final mixing; do not retemper or use partially hardened material.
3. Colored Mortar: Produce mortar of color required by using specified ingredients. Do not alter specified proportions without the Owner's approval.
 - a. Mortar Pigments: Where mortar pigments are indicated, do not exceed a pigment-to-cement ratio of 1:10 by weight.
4. Do not use admixtures in mortar unless otherwise indicated.
5. Mortar Proportions: Mix mortar materials in the following proportions:
 - a. Pointing Mortar for Brick: 1 part portland cement, 2 parts lime, and 6 parts sand **OR** 1 part portland cement, 6 parts lime, and 12 parts sand, **as directed**.
 - 1) Add mortar pigments to produce mortar colors required.
 - b. Pointing Mortar for Terra Cotta: 1 part white portland cement, 1 part lime, and 6 parts sand.
 - 1) Add mortar pigments to produce mortar colors required.
 - c. Rebuilding (Setting) Mortar: Same as pointing mortar except mortar pigments are not required, **as directed**.
 - d. Rebuilding (Setting) Mortar: 1 part portland cement, 2 parts lime, and 6 parts sand **OR** 1 part portland cement, 6 parts lime, and 12 parts sand, **as directed**.
 - e. Rebuilding (Setting) Mortar: Comply with ASTM C 270, Proportion Specification, Type N unless otherwise indicated; with cementitious material limited to portland cement and lime.

H. Chemical Cleaning Solutions

1. Dilute chemical cleaners with water to produce solutions not exceeding concentration recommended by chemical-cleaner manufacturer.
2. Acidic Cleaner Solution for Brick and Brownstone Terra Cotta: Dilute with water to produce hydrofluoric acid content of 3 percent or less, but not greater than that recommended by chemical-cleaner manufacturer.
3. Acidic Cleaner Solution for Glazed Terra Cotta: Dilute with water to concentration demonstrated by testing that does not etch or otherwise damage terra cotta surface, but not greater than that recommended by chemical-cleaner manufacturer.

1.3 EXECUTION

A. Protection

1. Protect persons, motor vehicles, surrounding surfaces of building being restored, building site, plants, and surrounding buildings from harm resulting from masonry restoration work.
 - a. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during course of restoration and cleaning work.
2. Comply with chemical-cleaner manufacturer's written instructions for protecting building and other surfaces against damage from exposure to its products. Prevent chemical-cleaning solutions from coming into contact with people, motor vehicles, landscaping, buildings, and other surfaces that could be harmed by such contact.



- a. Cover adjacent surfaces with materials that are proven to resist chemical cleaners used unless chemical cleaners being used will not damage adjacent surfaces. Use materials that contain only waterproof, UV-resistant adhesives. Apply masking agents to comply with manufacturer's written instructions. Do not apply liquid masking agent to painted or porous surfaces. When no longer needed, promptly remove masking to prevent adhesive staining.
 - b. Keep wall wet below area being cleaned to prevent streaking from runoff.
 - c. Do not clean masonry during winds of sufficient force to spread cleaning solutions to unprotected surfaces.
 - d. Neutralize and collect alkaline and acid wastes for disposal off the Owner's property.
 - e. Dispose of runoff from cleaning operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.
3. Prevent mortar from staining face of surrounding masonry and other surfaces.
 - a. Cover sills, ledges, and projections to protect from mortar droppings.
 - b. Keep wall area wet below rebuilding and pointing work to discourage mortar from adhering.
 - c. Immediately remove mortar in contact with exposed masonry and other surfaces.
 - d. Clean mortar splatters from scaffolding at end of each day.
 4. Remove gutters and downspouts adjacent to masonry and store where indicated during masonry restoration and cleaning. Reinstall when masonry restoration and cleaning are complete.
 - a. Provide temporary rain drainage during work as indicated to direct water away from building.
- B. Unused Anchor Removal**
1. Remove masonry anchors, brackets, wood nailers, and other extraneous items no longer in use unless identified as historically significant or indicated to remain.
 - a. Remove items carefully to avoid spalling or cracking masonry.
 - b. Where directed, if an item cannot be removed without damaging surrounding masonry, do the following:
 - 1) Cut or grind off item approximately 3/4 inch (20 mm) beneath surface and core drill a recess of same depth in surrounding masonry as close around item as practical.
 - 2) Immediately paint exposed end of item with two coats of antirust coating, following coating manufacturer's written instructions and without exceeding manufacturer's recommended dry film thickness per coat. Keep paint off sides of recess.
 - c. Patch the hole where each item was removed unless directed to remove and replace the masonry unit.
- C. Brick Removal And Replacement**
1. At locations indicated, remove bricks that are damaged, spalled, or deteriorated or are to be reused. Carefully demolish or remove entire units from joint to joint, without damaging surrounding masonry, in a manner that permits replacement with full-size units.
 - a. When removing single bricks, remove material from center of brick and work toward outside edges.
 2. Support and protect remaining masonry that surrounds removal area. Maintain flashing, reinforcement, lintels, and adjoining construction in an undamaged condition.
 3. Notify the Owner of unforeseen detrimental conditions including voids, cracks, bulges, and loose units in existing masonry backup, rotted wood, rusted metal, and other deteriorated items.
 4. Remove in an undamaged condition as many whole bricks as possible.
 - a. Remove mortar, loose particles, and soil from brick by cleaning with hand chisels, brushes, and water.
 - b. Remove sealants by cutting close to brick with utility knife and cleaning with solvents.
 - c. Store brick for reuse. Store off ground, on skids, and protected from weather.
 - d. Deliver cleaned brick not required for reuse to the Owner unless otherwise indicated.
 5. Clean bricks surrounding removal areas by removing mortar, dust, and loose particles in preparation for replacement.



6. Replace removed damaged brick with other removed brick and salvaged brick in good quality, where possible, or with new brick matching existing brick, including size. Do not use broken units unless they can be cut to usable size.
 7. Install replacement brick into bonding and coursing pattern of existing brick. If cutting is required, use a motor-driven saw designed to cut masonry with clean, sharp, unchipped edges.
 - a. Maintain joint width for replacement units to match existing joints.
 - b. Use setting buttons or shims to set units accurately spaced with uniform joints.
 8. Lay replacement brick with completely filled bed, head, and collar joints. Butter ends with sufficient mortar to fill head joints and shove into place. Wet both replacement and surrounding bricks that have ASTM C 67 initial rates of absorption (suction) of more than 30 g/30 sq. in. per min. (30 g/194 sq. cm per min.). Use wetting methods that ensure that units are nearly saturated but surface is dry when laid.
 - a. Tool exposed mortar joints in repaired areas to match joints of surrounding existing brickwork.
 - b. Rake out mortar used for laying brick before mortar sets and point new mortar joints in repaired area to comply with requirements for repointing existing masonry, and at same time as repointing of surrounding area.
 - c. When mortar is sufficiently hard to support units, remove shims and other devices interfering with pointing of joints.
- D. Terra Cotta Removal And Replacement
1. At locations indicated, remove terra cotta units that are damaged, spalled, or deteriorated. Carefully demolish or remove entire units from joint to joint, without damaging surrounding masonry, in a manner that permits replacement with full-size units.
 2. Support and protect remaining masonry that was supported by removed units. Maintain flashing, reinforcement, lintels, and adjoining construction in an undamaged condition.
 3. Notify the Owner of unforeseen detrimental conditions including voids, cracks, bulges, and loose units in existing masonry backup, rotted wood, rusted metal, and other deteriorated items.
 4. Clean masonry surrounding removal areas by removing mortar, dust, and loose particles in preparation for replacement.
 5. Install replacement units into bonding and coursing pattern of existing units.
 - a. Do not cut or grind glazed terra cotta.
 - b. If minor cutting of replacement brownstone terra cotta is required, use a motor-driven grinder or saw designed to cut masonry with clean, sharp, unchipped edges. Do not cut or grind more than 1/8 inch (3 mm) along any edge.
 - c. Use setting buttons or shims to set units accurately spaced with uniform joints.
 6. Set replacement units in a full bed of mortar. Replace existing anchors with new anchors of size and type indicated.
 - a. Embed anchors in mortar and fill voids behind units with mortar.
 - b. Tool exposed mortar joints in repaired areas to match joints of surrounding existing terra cotta.
 - c. Rake out mortar used for laying terra cotta before mortar sets and point new mortar joints in repaired area to comply with requirements for repointing existing masonry, and at same time as repointing of surrounding area.
 - d. When mortar is sufficiently hard to support units, remove shims and other devices interfering with pointing of joints.
- E. Reanchoring Veneers
1. Install masonry repair anchors in horizontal mortar joints and according to manufacturer's written instructions. Install at not more than 16 inches (400 mm) o.c. vertically and 32 inches (800 mm) o.c. horizontally unless otherwise indicated. Install at locations to avoid penetrating flashing.
 2. Recess anchors at least 5/8 inch (16 mm) from surface of mortar joint and fill recess with pointing mortar.
- F. Painting Steel Uncovered During The Work



1. Inspect steel exposed during masonry removal. Where the Owner determines that it is structural, or for other reasons cannot be totally removed, prepare and paint it as follows:
 - a. Remove paint, rust, and other contaminants according to SSPC-SP 2, "Hand Tool Cleaning" **OR** SSPC-SP 3, "Power Tool Cleaning" **OR** SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning", **as directed**, as applicable to meet paint manufacturer's recommended preparation.
 - b. Immediately paint exposed steel with two coats of antirust coating, following coating manufacturer's written instructions and without exceeding manufacturer's recommended rate of application (dry film thickness per coat).
2. If on inspection and rust removal, the cross section of a steel member is found to be reduced from rust by more than 1/16 inch (1.6 mm), notify the Owner before proceeding.

G. Masonry Unit Patching

1. Patch the following masonry units unless another type of replacement or repair is indicated:
 - a. Units indicated to be patched.
 - b. Units with holes.
 - c. Units with chipped edges or corners.
 - d. Units with small areas of deep deterioration.
2. Remove and replace existing patches unless otherwise indicated or approved by the Owner.
3. Patching Bricks:
 - a. Remove loose material from masonry surface. Carefully remove additional material so patch will not have feathered edges but will have square or slightly undercut edges on area to be patched and will be at least 1/4 inch (6 mm) thick, but not less than recommended by patching compound manufacturer.
 - b. Mask adjacent mortar joint or rake out for repointing if patch will extend to edge of masonry unit.
 - c. Mix patching compound in individual batches to match each unit being patched. Combine one or more colors of patching compound, as needed, to produce exact match.
 - d. Rinse surface to be patched and leave damp, but without standing water.
 - e. Brush-coat surfaces with slurry coat of patching compound according to manufacturer's written instructions.
 - f. Place patching compound in layers as recommended by patching compound manufacturer, but not less than 1/4 inch (6 mm) or more than 2 inches (50 mm) thick. Roughen surface of each layer to provide a key for next layer.
 - g. Trowel, scrape, or carve surface of patch to match texture and surrounding surface plane or contour of the masonry unit. Shape and finish surface before or after curing, as determined by testing, to best match existing masonry unit.
 - h. Keep each layer damp for 72 hours or until patching compound has set.
4. Patching Terra Cotta:
 - a. Remove deteriorated material as determined by sounding gently with a small hammer. Carefully remove additional material so patch will not have feathered edges but will have square or slightly undercut edges on area to be patched and will be at least 1/4 inch (6 mm) thick, but not less than recommended by patching compound manufacturer.
 - b. Where mortar joints adjacent to patch are open, fill back of joints with pointing mortar and allow to cure before patching terra cotta. Leave space for pointing joints according to "Repointing Masonry" Article.
 - c. Mask adjacent mortar joint or rake out for repointing if patch will extend to edge of unit.
 - d. Rinse surface to be patched and leave damp, but without standing water.
 - e. Brush-coat surfaces with slurry coat of patching compound according to manufacturer's written instructions.
 - f. Place patching compound in layers as recommended by patching compound manufacturer, but not less than 1/4 inch (6 mm) or more than 2 inches (50 mm) thick. Roughen surface of each layer to provide a key for next layer.
 - g. Do not apply patching compound over mortar joints. If patching compound bridges mortar joints, cut out joints after patching compound hardens.



- h. Trowel, scrape, or carve surface of patch to match texture, details, and surrounding surface plane or contour of terra cotta. Shape and finish surface before or after curing, as determined by testing to best match existing terra cotta.
 - i. Keep each layer damp for 72 hours or until patching compound has set.
 - j. After final layer of patching compound has cured, apply glaze replacement according to manufacturer's written instructions. Apply two or more coats, as needed, to match glaze of adjacent terra cotta units.
- H. Widening Joints
- 1. Do not widen a joint, except where indicated or approved by the Owner.
 - 2. Location Guideline: Where an existing masonry unit abuts another or the joint is less than 1/8 inch (3 mm), widen the joint for length indicated and to depth required for repointing after obtaining the Owner's approval.
 - 3. Carefully perform widening by cutting, grinding, routing, or filing procedures demonstrated in an approved mockup.
 - 4. Widen joint to width equal to or less than predominant width of other joints on building. Make sides of widened joint uniform and parallel. Ensure that edges of units along widened joint are in alignment with joint edges at unaltered joints.
- I. Cleaning Masonry, General
- 1. Proceed with cleaning in an orderly manner; work from bottom to top **OR** top to bottom, **as directed**, of each scaffold width and from one end of each elevation to the other. Ensure that dirty residues and rinse water will not wash over cleaned, dry surfaces.
 - 2. Use only those cleaning methods indicated for each masonry material and location.
 - a. Do not use wire brushes or brushes that are not resistant to chemical cleaner being used. Do not use plastic-bristle brushes if natural-fiber brushes will resist chemical cleaner being used.
 - b. Use spray equipment that provides controlled application at volume and pressure indicated, measured at spray tip. Adjust pressure and volume to ensure that cleaning methods do not damage masonry.
 - 1) Equip units with pressure gages.
 - c. For chemical-cleaner spray application, use low-pressure tank or chemical pump suitable for chemical cleaner indicated, equipped with cone-shaped spray tip.
 - d. For water-spray application, use fan-shaped spray tip that disperses water at an angle of 25 to 50 degrees.
 - e. For high-pressure water-spray application, use fan-shaped spray tip that disperses water at an angle of at least 40 degrees.
 - f. For heated water-spray application, use equipment capable of maintaining temperature between 140 and 160 deg F (60 and 71 deg C) at flow rates indicated.
 - g. For steam application, use steam generator capable of delivering live steam at nozzle.
 - 3. Perform each cleaning method indicated in a manner that results in uniform coverage of all surfaces, including corners, moldings, and interstices, and that produces an even effect without streaking or damaging masonry surfaces.
 - 4. Water Application Methods:
 - a. Water-Soak Application: Soak masonry surfaces by applying water continuously and uniformly to limited area for time indicated. Apply water at low pressures and low volumes in multiple fine sprays using perforated hoses or multiple spray nozzles. Erect a protective enclosure constructed of polyethylene sheeting to cover area being sprayed.
 - b. Water-Spray Applications: Unless otherwise indicated, hold spray nozzle at least 6 inches (150 mm) from surface of masonry and apply water in horizontal back and forth sweeping motion, overlapping previous strokes to produce uniform coverage.
 - 5. Steam Cleaning: Apply steam to masonry surfaces at the very low pressures indicated for each type of masonry material. Hold nozzle at least 6 inches (150 mm) from surface of masonry and apply steam in horizontal back and forth sweeping motion, overlapping previous strokes to produce uniform coverage.



6. Chemical-Cleaner Application Methods: Apply chemical cleaners to masonry surfaces to comply with chemical-cleaner manufacturer's written instructions; use brush or spray application. Do not spray apply at pressures exceeding 50 psi (345 kPa). Do not allow chemicals to remain on surface for periods longer than those indicated or recommended by manufacturer.
 7. Rinse off chemical residue and soil by working upward from bottom to top of each treated area at each stage or scaffold setting. Periodically during each rinse, test pH of rinse water running off of cleaned area to determine that chemical cleaner is completely removed.
 - a. Apply neutralizing agent and repeat rinse if necessary to produce tested pH of between 6.7 and 7.5.
 8. After cleaning is complete, remove protection no longer required. Remove tape and adhesive marks.
- J. Preliminary Cleaning
1. Removing Plant Growth: Completely remove visible plant, moss, and shrub growth from masonry surfaces. Carefully remove plants, creepers, and vegetation by cutting at roots and allowing to dry as long as possible before removal. Remove loose soil and debris from open masonry joints to whatever depth they occur.
 2. Preliminary Cleaning: Before beginning general cleaning, remove extraneous substances that are resistant to cleaning methods being used. Extraneous substances include paint, calking, asphalt, and tar.
 - a. Carefully remove heavy accumulations of material from surface of masonry with a sharp chisel. Do not scratch or chip masonry surface.
 - b. Remove paint and calking with alkaline paint remover.
 - 1) Comply with requirements in "Paint Removal" Article.
 - 2) Repeat application up to two times if needed.
 - c. Remove asphalt and tar with solvent-type paint remover.
 - 1) Comply with requirements in "Paint Removal" Article.
 - 2) Apply paint remover only to asphalt and tar by brush without prewetting.
 - 3) Allow paint remover to remain on surface for 10 to 30 minutes.
 - 4) Repeat application if needed.
- K. Paint Removal
1. Paint Removal with Alkaline Paste Paint Remover:
 - a. Remove loose and peeling paint using low **OR** medium **OR** high, **as directed**, -pressure spray, scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
 - b. Apply paint remover to dry, painted masonry with brushes.
 - c. Allow paint remover to remain on surface for period recommended by manufacturer.
 - d. Rinse with cold **OR** hot, **as directed**, water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove chemicals and paint residue.
 - e. Repeat process if necessary to remove all paint.
 - f. Apply acidic cleaner or manufacturer's recommended afterwash to masonry, while surface is still wet, using low-pressure spray equipment or soft-fiber brush. Let cleaner or afterwash remain on surface as a neutralizing agent for period recommended by chemical cleaner or afterwash manufacturer.
 - g. Rinse with cold water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove chemicals and soil.
 2. Paint Removal with Covered or Skin-Forming Alkaline Paint Remover:
 - a. Remove loose and peeling paint using low **OR** medium **OR** high, **as directed**, -pressure spray, scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
 - b. Apply paint remover to dry, painted masonry with trowel, spatula, or as recommended by manufacturer.
 - c. Apply cover, if required by manufacturer, per manufacturer's written instructions.
 - d. Allow paint remover to remain on surface for period recommended by manufacturer or as determined in test panels.
 - e. Scrape off paint and remover and collect for disposal.



- f. Rinse with cold **OR** hot, **as directed**, water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove chemicals and paint residue.
 - g. Use alkaline paste paint remover, according to "Paint Removal with Alkaline Paste Paint Remover" Paragraph, if necessary to remove remaining paint.
 - h. Apply acidic cleaner or manufacturer's recommended afterwash to masonry, while surface is still wet, using low-pressure spray equipment or soft-fiber brush. Let cleaner or afterwash remain on surface as a neutralizing agent for period recommended by chemical-cleaner or afterwash manufacturer.
 - i. Rinse with cold water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove chemicals and soil.
3. Paint Removal with Solvent-Type Paint Remover:
- a. Remove loose and peeling paint using low **OR** medium **OR** high, **as directed**, -pressure spray, scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
 - b. Apply thick coating of paint remover to painted masonry with natural-fiber cleaning brush, deep-nap roller, or large paint brush.
 - c. Allow paint remover to remain on surface for period recommended by manufacturer. Agitate periodically with stiff-fiber brush.
 - d. Rinse with cold **OR** hot, **as directed**, water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove chemicals and paint residue.
- L. Cleaning Brickwork
1. Cold-Water Soak:
 - a. Apply cold water by intermittent spraying to keep surface moist.
 - b. Use perforated hoses or other means that will apply a fine water mist to entire surface being cleaned.
 - c. Apply water in cycles with at least 30 minutes between cycles.
 - d. Continue spraying until surface encrustation has softened sufficiently to permit its removal by water wash, as indicated by cleaning tests.
 - e. Continue spraying for 72 hours.
 - f. Remove soil and softened surface encrustation from masonry with cold water applied by low-pressure spray.
 2. Cold-Water Wash: Use cold water applied by low **OR** medium **OR** high, **as directed**, -pressure spray.
 3. Hot-Water Wash: Use hot water applied by low **OR** medium **OR** high, **as directed**, -pressure spray.
 4. Steam Cleaning: Apply steam at very low pressures not exceeding 30 psi (207 kPa) **OR** 80 psi (550 kPa), **as directed**. Remove dirt softened by steam with wood scrapers, stiff-nylon or -fiber brushes, or cold-water wash, as indicated by cleaning tests.
 5. Detergent Cleaning:
 - a. Wet masonry with cold **OR** hot, **as directed**, water applied by low-pressure spray.
 - b. Scrub masonry with detergent solution using medium-soft brushes until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes to remove soil from mortar joints and crevices. Dip brush in solution often to ensure that adequate fresh detergent is used and that masonry surface remains wet.
 - c. Rinse with cold **OR** hot, **as directed**, water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove detergent solution and soil.
 - d. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.
 6. Mold, Mildew, and Algae Removal:
 - a. Wet masonry with cold **OR** hot, **as directed**, water applied by low-pressure spray.
 - b. Apply mold, mildew, and algae remover by brush or low-pressure spray.
 - c. Scrub masonry with medium-soft brushes until mold, mildew, and algae are thoroughly dislodged and can be removed by rinsing. Use small brushes for mortar joints and crevices. Dip brush in mold, mildew, and algae remover often to ensure that adequate fresh cleaner is used and that masonry surface remains wet.



- d. Rinse with cold **OR** hot, **as directed**, water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove mold, mildew, and algae remover and soil.
 - e. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.
7. Nonacidic Gel Chemical Cleaning:
- a. Wet masonry with cold **OR** hot, **as directed**, water applied by low-pressure spray.
 - b. Apply nonacidic gel cleaner in 1/8-inch (3-mm) thickness by brush, working into joints and crevices. Apply quickly and do not brush out excessively so area will be uniformly covered with fresh cleaner and dwell time will be uniform throughout area being cleaned.
 - c. Let cleaner remain on surface for period indicated below:
 - 1) As recommended by chemical-cleaner manufacturer.
 - 2) As established by mockup.
 - d. Remove bulk of nonacidic gel cleaner by squeegeeing into containers for disposal.
 - e. Rinse with cold **OR** hot, **as directed**, water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove chemicals and soil.
 - f. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.
8. Nonacidic Liquid Chemical Cleaning:
- a. Wet masonry with cold **OR** hot, **as directed**, water applied by low-pressure spray.
 - b. Apply cleaner to masonry in two applications, **as directed**, by brush or low-pressure spray. Let cleaner remain on surface for period indicated below:
 - 1) As recommended by chemical-cleaner manufacturer.
 - 2) As established by mockup.
 - 3) Two to three minutes.
 - c. Rinse with cold **OR** hot, **as directed**, water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove chemicals and soil.
 - d. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.
9. Mild Acidic **OR** Acidic, **as directed**, Chemical Cleaning:
- a. Wet masonry with cold water applied by low-pressure spray.
 - b. Apply cleaner to masonry in two applications, **as directed**, by brush or low-pressure spray. Let cleaner remain on surface for period indicated below:
 - 1) As recommended by chemical-cleaner manufacturer.
 - 2) As established by mockup.
 - 3) Two to three minutes.
 - c. Rinse with cold water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove chemicals and soil.
 - d. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use a steam cleaning.
- M. Cleaning Brownstone Terra Cotta
1. Cold-Water Soak:
 - a. Apply cold water by intermittent spraying to keep surface moist.
 - b. Use perforated hoses or other means that will apply a fine water mist to entire surface being cleaned.
 - c. Apply water in cycles with at least 30 minutes between cycles.
 - d. Continue spraying until surface encrustation has softened sufficiently to permit its removal by water wash, as indicated by cleaning tests.
 - e. Continue spraying for 72 hours.
 - f. Remove soil and softened surface encrustation from masonry with cold water applied by low-pressure spray.



2. Cold-Water Wash: Use cold water applied by low **OR** medium **OR** high, **as directed**, -pressure spray.
3. Hot-Water Wash: Use hot water applied by low **OR** medium **OR** high, **as directed**, -pressure spray.
4. Steam Cleaning: Apply steam at very low pressures not exceeding 30 psi (207 kPa) **OR** 80 psi (550 kPa), **as directed**. Remove dirt softened by steam with wood scrapers, stiff-nylon or -fiber brushes, or cold-water wash, as indicated by cleaning tests.
5. Detergent Cleaning:
 - a. Wet masonry with cold **OR** hot, **as directed**, water applied by low-pressure spray.
 - b. Scrub masonry with detergent solution using medium-soft brushes until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes to remove soil from mortar joints and crevices. Dip brush in solution often to ensure that adequate fresh detergent is used and that masonry surface remains wet.
 - c. Rinse with cold **OR** hot, **as directed**, water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove detergent solution and soil.
 - d. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.
6. Mold, Mildew, and Algae Removal:
 - a. Wet masonry with cold **OR** hot, **as directed**, water applied by low-pressure spray.
 - b. Apply mold, mildew, and algae remover by brush or low-pressure spray.
 - c. Scrub masonry with medium-soft brushes until mold, mildew, and algae are thoroughly dislodged and can be removed by rinsing. Use small brushes for mortar joints and crevices. Dip brush in mold, mildew, and algae remover often to ensure that adequate fresh cleaner is used and that masonry surface remains wet.
 - d. Rinse with cold **OR** hot, **as directed**, water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove mold, mildew, and algae remover and soil.
 - e. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.
7. Nonacidic Gel Chemical Cleaning:
 - a. Wet masonry with cold **OR** hot, **as directed**, water applied by low-pressure spray.
 - b. Apply nonacidic gel cleaner in 1/8-inch (3-mm) thickness by brush, working into joints and crevices. Apply quickly and do not brush out excessively so area will be uniformly covered with fresh cleaner and dwell time will be uniform throughout area being cleaned.
 - c. Let cleaner remain on surface for period indicated below:
 - 1) As recommended by chemical-cleaner manufacturer.
 - 2) As established by mockup.
 - d. Remove bulk of nonacidic gel cleaner by squeegeeing into containers for disposal.
 - e. Rinse with cold **OR** hot, **as directed**, water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove chemicals and soil.
 - f. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.
8. Nonacidic Liquid Chemical Cleaning:
 - a. Wet masonry with cold **OR** hot, **as directed**, water applied by low-pressure spray.
 - b. Apply cleaner to masonry in two applications, **as directed**, by brush or low-pressure spray. Let cleaner remain on surface for period indicated below:
 - 1) As recommended by chemical-cleaner manufacturer.
 - 2) As established by mockup.
 - 3) Two to three minutes.
 - c. Rinse with cold **OR** hot, **as directed**, water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove chemicals and soil.
 - d. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.
9. Mild Acidic **OR** Acidic, **as directed**, Chemical Cleaning:
 - a. Wet masonry with cold water applied by low-pressure spray.



- b. Apply cleaner to masonry in two applications, **as directed**, by brush or low-pressure spray. Let cleaner remain on surface for period indicated below:
 - 1) As recommended by chemical-cleaner manufacturer.
 - 2) As established by mockup.
 - 3) Two to three minutes.
- c. Rinse with cold water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove chemicals and soil.
- d. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use a steam cleaning.

N. Cleaning Glazed Terra Cotta

1. Hot-Water Wash: Use hot water applied by low **OR** medium **OR** high, **as directed**, -pressure spray.
2. Steam Cleaning: Apply steam at very low pressures not exceeding 30 psi (207 kPa) **OR** 80 psi (550 kPa), **as directed**. Remove dirt softened by steam with wood scrapers, stiff-nylon or -fiber brushes, or cold-water wash, as indicated by cleaning tests.
3. Nonacidic Gel Chemical Cleaning:
 - a. Wet terra cotta with cold **OR** hot, **as directed**, water applied by low-pressure spray.
 - b. Apply nonacidic gel cleaner in 1/8-inch (3-mm) thickness by brush, working into joints and crevices. Apply quickly and do not brush out excessively so area will be uniformly covered with fresh cleaner and dwell time will be uniform throughout area being cleaned.
 - c. Let cleaner remain on surface for period indicated below:
 - 1) As recommended by chemical-cleaner manufacturer.
 - 2) As established by mockup.
 - d. Remove bulk of nonacidic gel cleaner by squeegeeing into containers for disposal.
 - e. Rinse with cold **OR** hot, **as directed**, water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove chemicals and soil.
 - f. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.
4. Nonacidic Liquid Chemical Cleaning:
 - a. Wet terra cotta with cold **OR** hot, **as directed**, water applied by low-pressure spray.
 - b. Apply cleaner to terra cotta in two applications, **as directed**. Let cleaner remain on surface for period indicated below:
 - 1) As recommended by chemical-cleaner manufacturer.
 - 2) As established by mockup.
 - 3) Two to three minutes.
 - c. Rinse with cold **OR** hot, **as directed**, water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove chemicals and soil.
 - d. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.
5. Mild Acidic Chemical Cleaning:
 - a. Wet terra cotta with cold water applied by low-pressure spray.
 - b. Apply cleaner to terra cotta in two applications, **as directed**. Let cleaner remain on surface for period indicated below:
 - 1) As recommended by chemical-cleaner manufacturer.
 - 2) As established by mockup.
 - 3) Two to three minutes.
 - c. Rinse with cold water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove chemicals and soil.
 - d. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.



6. Two-Part Chemical Cleaning:
 - a. Wet terra cotta with cold **OR** hot, **as directed**, water applied by low-pressure spray.
 - b. Apply alkaline prewash cleaner to terra cotta by brush or roller. Let cleaner remain on surface for period recommended by chemical-cleaner manufacturer unless otherwise indicated.
 - c. Rinse with cold **OR** hot, **as directed**, water applied by medium-pressure spray to remove chemicals and soil.
 - d. Apply acidic afterwash cleaner to terra cotta in two applications, **as directed**, while surface is still wet, using low-pressure spray equipment, deep-nap roller or soft-fiber brush. Let neutralizer remain on surface for period recommended by manufacturer unless otherwise indicated.
 - e. Rinse with cold water applied by medium-pressure spray to remove chemicals and soil.
 - f. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.

- O. Repointing Masonry
 1. Rake out and repoint joints to the following extent:
 - a. All joints in areas indicated.
 - b. Joints where mortar is missing or where they contain holes.
 - c. Cracked joints where cracks can be penetrated at least 1/4 inch (6 mm) by a knife blade 0.027 inch (0.7 mm) thick.
 - d. Cracked joints where cracks are 1/16 inch (1.6 mm) **OR** 1/8 inch (3 mm), **as directed**, or more in width and of any depth.
 - e. Joints where they sound hollow when tapped by metal object.
 - f. Joints where they are worn back 1/4 inch (6 mm) or more from surface.
 - g. Joints where they are deteriorated to point that mortar can be easily removed by hand, without tools.
 - h. Joints where they have been filled with substances other than mortar.
 - i. Joints indicated as sealant-filled joints.
 2. Do not rake out and repoint joints where not required.
 3. Rake out joints as follows, according to procedures demonstrated in approved mockup:
 - a. Remove mortar from joints to depth of joint width plus 1/8 inch (3 mm) **OR** 2 times joint width **OR** 2-1/2 times joint width, **as directed**, but not less than 1/2 inch (13 mm) or not less than that required to expose sound, unweathered mortar.
 - b. Remove mortar from masonry surfaces within raked-out joints to provide reveals with square backs and to expose masonry for contact with pointing mortar. Brush, vacuum, or flush joints to remove dirt and loose debris.
 - c. Do not spall edges of masonry units or widen joints. Replace or patch damaged masonry units as directed by the Owner.
 - 1) Cut out mortar by hand with chisel and resilient mallet. Do not use power-operated grinders without the Owner's written approval based on approved quality-control program.
 - 2) Cut out center of mortar bed joints using angle grinders with diamond-impregnated metal blades. Remove remaining mortar by hand with chisel and resilient mallet. Strictly adhere to approved quality-control program.
 4. Notify the Owner of unforeseen detrimental conditions including voids in mortar joints, cracks, loose masonry units, rotted wood, rusted metal, and other deteriorated items.
 5. Pointing with Mortar:
 - a. Rinse joint surfaces with water to remove dust and mortar particles. Time rinsing application so, at time of pointing, joint surfaces are damp but free of standing water. If rinse water dries, dampen joint surfaces before pointing.
 - b. Apply pointing mortar first to areas where existing mortar was removed to depths greater than surrounding areas. Apply in layers not greater than 3/8 inch (9 mm) until a uniform depth is formed. Fully compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.



- c. After low areas have been filled to same depth as remaining joints, point all joints by placing mortar in layers not greater than 3/8 inch (9 mm). Fully compact each layer and allow to become thumbprint hard before applying next layer. Where existing masonry units have worn or rounded edges, slightly recess finished mortar surface below face of masonry to avoid widened joint faces. Take care not to spread mortar beyond joint edges onto exposed masonry surfaces or to featheredge the mortar.
 - d. When mortar is thumbprint hard, tool joints to match original appearance of joints as demonstrated in approved mockup. Remove excess mortar from edge of joint by brushing.
 - e. Cure mortar by maintaining in thoroughly damp condition for at least 72 consecutive hours including weekends and holidays.
 - 1) Acceptable curing methods include covering with wet burlap and plastic sheeting, periodic hand misting, and periodic mist spraying using system of pipes, mist heads, and timers.
 - 2) Adjust curing methods to ensure that pointing mortar is damp throughout its depth without eroding surface mortar.
 - f. Hairline cracking within the mortar or mortar separation at edge of a joint is unacceptable. Completely remove such mortar and repoint.
6. Pointing with Sealant:
- a. After raking out, keep joints dry and free of mortar and debris.
 - b. Clean and prepare joint surfaces according to Division 07 Section "Joint Sealants". Prime joint surfaces unless sealant manufacturer recommends against priming. Do not allow primer to spill or migrate onto adjoining surfaces.
 - c. Fill sealant joints with specified joint sealant according to Division 07 Section "Joint Sealants" and the following:
 - 1) Install cylindrical sealant backing beneath the sealant, except where space is insufficient. There, install bond-breaker tape.
 - 2) Install sealant using only proven installation techniques that will ensure that sealant will be deposited in a uniform, continuous ribbon, without gaps or air pockets, and with complete wetting of the joint bond surfaces equally on both sides. Fill joint flush with surrounding masonry and matching the contour of adjoining mortar joints.
 - 3) Install sealant as recommended by sealant manufacturer but within the following general limitations, measured at the center (thin) section of the bead:
 - a) Fill joints to a depth equal to joint width, but not more than 1/2 inch (13 mm) deep or less than 1/4 inch (6 mm) deep.
 - 4) Immediately after first tooling, apply ground-mortar aggregate to sealant, gently pushing aggregate into the surface of sealant. Retool sealant to form smooth, uniform beads, slightly concave. Remove excess sealant and aggregate from surfaces adjacent to joint.
 - 5) Do not allow sealant to overflow or spill onto adjoining surfaces, or to migrate into the voids of adjoining surfaces, particularly rough textures. Remove excess and spillage of sealant promptly as the work progresses. Clean adjoining surfaces by the means necessary to eliminate evidence of spillage, without damage to adjoining surfaces or finishes, as demonstrated in an approved mockup.
 - d. Cure sealant according to Division 07 Section "Joint Sealants".
7. Where repointing work precedes cleaning of existing masonry, allow mortar to harden at least 30 days before beginning cleaning work.

P. Final Cleaning

1. After mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water, spray applied at low pressure.
 - a. Do not use metal scrapers or brushes.
 - b. Do not use acidic or alkaline cleaners.
2. Wash adjacent woodwork and other nonmasonry surfaces. Use detergent and soft brushes or cloths.



3. Clean mortar and debris from roof; remove debris from gutters and downspouts. Rinse off roof and flush gutters and downspouts.
4. Sweep and rake adjacent pavement and grounds to remove mortar and debris. Where necessary, pressure wash pavement surfaces to remove mortar, dust, dirt, and stains.

Q. Field Quality Control

1. Inspectors: Engage qualified independent inspectors to perform inspections and prepare test reports. Allow inspectors use of lift devices and scaffolding, as needed, to perform inspections.
2. the Owner's Project Representatives: the Owner will assign Project representatives to help carry out the Owner's responsibilities at the site, including observing progress and quality of portion of the Work completed. Allow the Owner's Project representatives use of lift devices and scaffolding, as needed, to observe progress and quality of portion of the Work completed.
3. Notify inspectors and the Owner's Project representatives in advance of times when lift devices and scaffolding will be relocated. Do not relocate lift devices and scaffolding until inspectors and the Owner's Project representatives have had reasonable opportunity to make inspections and observations of work areas at lift device or scaffold location.

END OF SECTION 04 01 20 52



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SECTION 04 01 20 91 - UNIT MASONRY ASSEMBLIES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for unit masonry assemblies. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes unit masonry assemblies consisting of the following:
 - a. Concrete masonry units (CMUs).
 - b. Decorative concrete masonry units.
 - c. Pre-faced concrete masonry units.
 - d. Concrete brick.
 - e. Face brick.
 - f. Building (common) brick.
 - g. Hollow brick.
 - h. Glazed brick.
 - i. Structural-clay facing tile.
 - j. Firebox brick.
 - k. Clay flue lining units.
 - l. Stone trim units.
 - m. Mortar and grout.
 - n. Reinforcing steel.
 - o. Masonry joint reinforcement.
 - p. Ties and anchors.
 - q. Embedded flashing.
 - r. Miscellaneous masonry accessories.
 - s. Masonry-cell insulation.
 - t. Cavity-wall insulation.

C. Definitions

1. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

D. Performance Requirements

1. Provide structural unit masonry that develops indicated net-area compressive strengths (f'_m) at 28 days.
2. Determine net-area compressive strength (f'_m) of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602 **OR** Tables 2105.2 in the International Building Code, **as directed.**
OR
Determine net-area compressive strength (f'_m) of masonry by testing masonry prisms according to ASTM C 1314 **OR** IBC Standard, **as directed.**

E. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: For reinforcing steel. Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.
3. Samples for each type and color of exposed masonry units and colored mortars.



4. Material Certificates: For each type of product indicated. Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards.
5. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
 - a. For masonry units include material test reports substantiating compliance with requirements.
6. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

F. Quality Assurance

1. Preconstruction Testing Service: the Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Payment for these services will be made by the Owner.
 - a. Clay Masonry Unit Test: For each type of unit required, per ASTM C 67.
 - b. Concrete Masonry Unit Test: For each type of unit required, per ASTM C 140.
 - c. Mortar Test (Property Specification): For each mix required, per ASTM C 780 **OR** IBC Standard, **as directed**.
 - d. Grout Test (Compressive Strength): For each mix required, per ASTM C 1019 **OR** IBC Standard, **as directed**.
2. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by other means, as acceptable to authorities having jurisdiction.
3. Sample Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects.
 - a. Build sample panels for each type of exposed unit masonry construction **OR** typical exterior wall, **as directed**, in sizes approximately 48 inches (1200 mm) long by 48 inches (1200 mm) high.

G. Delivery, Storage, And Handling

1. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
2. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
3. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
4. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.
5. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

H. Project Conditions

1. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602 **OR** Section 2104.3 in the International Building Code, **as directed**.
2. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.



1.2 PRODUCTS

A. Concrete Masonry Units (CMUs)

1. Shapes: Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Integral Water Repellent: Provide units made with liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength for exposed units and where indicated.
3. Concrete Masonry Units: ASTM C 90 **OR** IBC Standard, **as directed**.
 - a. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi (13.1 MPa) **OR** 2150 psi (14.8 MPa) **OR** 2800 psi (19.3 MPa) **OR** 3050 psi (21.0 MPa), **as directed**.
 - b. Weight Classification: Lightweight **OR** Medium weight **OR** Normal weight, **as directed**.
4. Decorative Concrete Masonry Units: ASTM C 90 **OR** IBC Standard, **as directed**.
 - a. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi (13.1 MPa) **OR** 2150 psi (14.8 MPa) **OR** 2800 psi (19.3 MPa) **OR** 3050 psi (21.0 MPa), **as directed**.
 - b. Weight Classification: Lightweight **OR** Medium weight **OR** Normal weight, **as directed**.
 - c. Pattern and Texture:
 - 1) Standard pattern, ground finish.
 - 2) Standard pattern, split-face finish.
 - 3) Standard pattern, split-ribbed finish.
 - 4) Scored vertically, standard finish.
 - 5) Triple scored vertically, standard finish.
5. Pre-faced Concrete Masonry Units: Lightweight hollow **OR** solid, **as directed**, concrete units complying with ASTM C 90 **OR** IBC Standard, **as directed**, with manufacturer's standard smooth resinous facing complying with ASTM C 744.
 - a. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi (13.1 MPa) **OR** 2150 psi (14.8 MPa) **OR** 2800 psi (19.3 MPa) **OR** 3050 psi (21.0 MPa), **as directed**.
 - b. Size: Manufactured with pre-faced surfaces having 1/16-inch- (1.5-mm-) wide returns of facing to create 1/4-inch- (6.5-mm-) wide mortar joints with modular coursing.
6. Concrete Building Brick: ASTM C 55 **OR** IBC Standard, **as directed**.
 - a. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2500 psi (17.3 MPa) **OR** 3500 psi (24.1 MPa), **as directed**.
 - b. Weight Classification: Lightweight **OR** Medium weight **OR** Normal weight, **as directed**.

B. Concrete And Masonry Lintels

1. General: Provide either concrete or masonry lintels, at Contractor's option, complying with requirements below.
2. Concrete Lintels:
 - a. Precast units matching concrete masonry units and with reinforcing bars indicated or required to support loads indicated.
OR
Precast or formed-in-place concrete lintels complying with requirements in Division 03 Section "Cast-in-place Concrete".
3. Masonry Lintels: Made from bond beam concrete masonry units with reinforcing bars placed as indicated and filled with coarse grout.

C. Brick

1. General: Provide shapes indicated and as follows:
 - a. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
 - b. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.



2. Face Brick: ASTM C 216 **OR** IBC Standard, **as directed**, Grade SW **OR** MW or SW, **as directed**, Type FBX **OR** FBS **OR** FBA, **as directed**.
 - a. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3000 psi (20.7 MPa) **OR** 4400 psi (30.3 MPa) **OR** 5500 psi (37.9 MPa) **OR** 6400 psi (44.1 MPa) **OR** 8000 psi (55.2 MPa) **OR** 8400 psi (57.9 MPa), **as directed**.
 - b. Initial Rate of Absorption: Less than 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67.
 - c. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
 - d. Surface Coating: Brick with colors or textures produced by application of coatings shall withstand 50 cycles of freezing and thawing per ASTM C 67 with no observable difference in the applied finish when viewed from 10 feet (3 m).
 - e. Size: **As directed**.
3. Building (Common) Brick: ASTM C 62 **OR** IBC Standard, **as directed**, Grade SW **OR** MW or SW **OR** NW, MW, or SW, **as directed**.
 - a. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3000 psi (20.7 MPa) **OR** 4400 psi (30.3 MPa) **OR** 5500 psi (37.9 MPa) **OR** 6400 psi (44.1 MPa) **OR** 8000 psi (55.2 MPa) **OR** 8400 psi (57.9 MPa), **as directed**.
 - b. Size: Match size of face brick.
4. Hollow Brick: ASTM C 652 **OR** IBC Standard, **as directed**, Grade SW **OR** MW or SW, **as directed**, Class H40V (void areas between 25 and 40 percent of gross cross-sectional area) **OR** H60V (void areas between 40 and 60 percent of gross cross-sectional area) , **as directed**, Type HBX **OR** HBS **OR** HBA **OR** HBB, **as directed**.
 - a. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3000 psi (20.7 MPa) **OR** 4400 psi (30.3 MPa) **OR** 5500 psi (37.9 MPa) **OR** 6400 psi (44.1 MPa) **OR** 8000 psi (55.2 MPa) **OR** 8400 psi (57.9 MPa), **as directed**.
 - b. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
 - c. Surface Coating: Brick with colors or textures produced by application of coatings shall withstand 50 cycles of freezing and thawing per ASTM C 67 with no observable difference in the applied finish when viewed from 10 feet (3 m).
 - d. Size: **As directed**.
5. Glazed Face Brick: ASTM C 216 **OR** IBC Standard, **as directed**, Grade SW **OR** MW or SW, **as directed**, Type FBX **OR** FBS **OR** FBA, **as directed**; with glaze complying with ASTM C 126.
6. Glazed Face Brick: ASTM C 1405, Class Exterior **OR** Interior, **as directed**, Grade S (Select) **OR** SS (Select Sized or Ground Edge), **as directed**.
7. Glazed Face Brick: Either ASTM C 1405, Class Exterior **OR** Interior, **as directed**, Grade S (Select) or ASTM C 216 **OR** IBC Standard, **as directed**, Grade SW **OR** MW or SW, **as directed**, Type FBX; with glaze complying with ASTM C 126.
8. Glazed Hollow Brick: Hollow brick complying with ASTM C 652 **OR** IBC , **as directed**, Grade SW **OR** MW or SW, **as directed**, Class H40V (void areas between 25 and 40 percent of gross cross-sectional area) **OR** H60V (void areas between 40 and 60 percent of gross cross-sectional area), **as directed**, Type HBX **OR** HBS **OR** HBA, **as directed**; with glaze complying with ASTM C 126.
 - a. Size: **As directed**.
 - b. Provide Type I (single-faced units) where only one finished face is exposed when units are installed, and Type II (double-faced units) where two opposite finished faces are exposed when units are installed.

D. Structural-Clay Facing Tile

1. General:
 - a. Provide solid, multicolored, or hollow units, with shape and direction of cores optional, unless otherwise indicated.
 - b. Provide multicolored units designed for use in reinforced, grouted masonry.
 - c. Provide special shapes where required for corners, jambs, coved bases, sills, and other special conditions indicated that cannot be produced by sawing standard units.



2. Glazed Structural-Clay Facing Tile: ASTM C 126, Grade S (Select) **OR** SS (Select Sized or Ground Edged), **as directed**.
 - a. Size: **As directed**.
 - b. Provide Type I (single-faced units) where only one finished face is exposed when units are installed, and Type II (double-faced units) where two opposite finished faces are exposed when units are installed.
 3. Unglazed Structural-Clay Facing Tile: ASTM C 212, Type FTX **OR** FTS, **as directed**, Standard **OR** Special-Duty, **as directed**, class.
 - a. Number of Faces: Single faced where only one finished face is exposed when units are installed **OR** Double faced where both finished faces are exposed when units are installed, **as directed**.
- E. Fireplace And Chimney Lining Units
1. Firebox Brick: ASTM C 1261, size required to produce lining thickness indicated.
 2. Clay Flue Lining Units: ASTM C 315.
- F. Stone Trim Units
1. Granite: ASTM C 615.
 - a. Description: Fine **OR** Medium, **as directed**,-grained, white **OR** pink **OR** gray **OR** black, **as directed**, stone. Uniform pattern, without veining.
 2. Limestone: ASTM C 568, Classification I Low **OR** II Medium **OR** III High, **as directed**,-Density.
 3. Marble: ASTM C 503, Classification I Calcite **OR** II Dolomite **OR** III Serpentine **OR** IV Travertine, **as directed**.
 - a. Description: Uniform, fine- to medium-grained, white stone with only slight veining.
 4. Quartz-Based Stone: ASTM C 616, Classification I Sandstone **OR** II Quartzitic Sandstone **OR** III Quartzite, **as directed**.
 5. Finish: Polished **OR** Honed **OR** Smooth **OR** Machine tooled, 4 bats per 1 inch (25 mm) **OR** Machine tooled, 6 bats per 1 inch (25 mm) **OR** Machine tooled, 8 bats per 1 inch (25 mm) **OR** Chat sawed **OR** Split face **OR** Rock face (pitched face), **as directed**.
 - a. Finish for Tops of Sills and Soffits of Lintels: Sand rubbed **OR** Split face, **as directed**.
 6. Provide stone units accurately shaped, with exposed faces dressed true, and with beds and joints at right angles to faces.
 - a. For granite, comply with recommendations in NBGQA's "Specifications for Architectural Granite."
 - b. For limestone, comply with recommendations in ILI's "Indiana Limestone Handbook."
 - c. For marble, comply with recommendations in MIA's "Dimensional Stone--Design Manual IV."
- G. Mortar And Grout Materials
1. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction.
 2. Hydrated Lime: ASTM C 207 **OR** IBC Standard, **as directed**, Type S.
 3. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207, Type S.
 4. Masonry Cement: ASTM C 91 **OR** IBC Standard, **as directed**.
 5. Mortar Cement: ASTM C 1329 **OR** IBC Standard, **as directed**.
 6. Mortar Pigments: Iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortar.
 7. Colored Cement Product: Packaged blend made from portland cement and lime or masonry cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.
 - a. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
 - b. Pigments shall not exceed 10 percent of portland cement by weight.
 - c. Pigments shall not exceed 5 percent of masonry cement or mortar cement by weight.
 8. Aggregate for Mortar: ASTM C 144.



- a. For joints less than 1/4 inch (6.5 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.
 - b. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
 - c. White-Mortar Aggregates: Natural white sand or crushed white stone.
 - d. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
9. Aggregate for Grout: ASTM C 404.
 10. Epoxy Pointing Mortar: ASTM C 395, epoxy-resin-based material formulated for use as pointing mortar for structural-clay tile facing units.
 11. Refractory Mortar Mix: Ground fireclay or non-water-soluble, calcium aluminate, medium-duty refractory mortar that passes ASTM C 199 test; or an equivalent product acceptable to authorities having jurisdiction.
 12. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
 13. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with concrete masonry units, containing integral water repellent by same manufacturer.
 14. Water: Potable.

H. Reinforcement

1. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 (Grade 420).
2. Masonry Joint Reinforcement, General: ASTM A 951 **OR** IBC Standard, **as directed**.
 - a. Interior Walls: Mill- **OR** Hot-dip, **as directed**, galvanized, carbon steel.
 - b. Exterior Walls: Hot-dip galvanized, carbon **OR** Stainless, **as directed**, steel.
 - c. Wire Size for Side Rods: W1.7 or 0.148-inch (3.8-mm) **OR** W2.8 or 0.188-inch (4.8-mm), **as directed**, diameter.
 - d. Wire Size for Cross Rods: W1.7 or 0.148-inch (3.8-mm) **OR** W2.8 or 0.188-inch (4.8-mm), **as directed** diameter.
 - e. Wire Size for Veneer Ties: W1.7 or 0.148-inch (3.8-mm) **OR** W2.8 or 0.188-inch (4.8-mm), **as directed** diameter.
 - f. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches (407 mm) o.c.
 - g. Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.
 - h. Multiwythe Masonry:
 - 1) Ladder type with 1 side rod at each face shell of hollow masonry units more than 4 inches (100 mm) in width, plus 1 side rod at each wythe of masonry 4 inches (100 mm) or less in width.
 - 2) Tab type, with 1 side rod at each face shell of backing wythe and with rectangular tabs sized to extend at least halfway through facing wythe but with at least 5/8-inch (16-mm) cover on outside face.
 - 3) Adjustable (two-piece) type, with one side rod at each face shell of backing wythe and with ties that extend into facing wythe. Ties engage eyes or slots in reinforcement and extend at least halfway through facing wythe but with at least 5/8-inch (16-mm) cover on outside face. Ties have hooks or clips to engage a continuous wire in the facing wythe.
 - i. Veneers Anchored with Seismic Masonry-Veneer Anchors: Single 0.188-inch- (4.8-mm-) diameter, hot-dip galvanized, carbon-steel continuous wire.

I. Ties And Anchors

1. Materials:
 - a. Mill-Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 641/A 641M, Class 1 coating.
 - b. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 153/A 153M, Class B-2 coating.



- c. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304 **OR** 316, **as directed**.
 - d. Galvanized Steel Sheet: ASTM A 653/A 653M, Commercial Steel, G60 (Z180) zinc coating.
 - e. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, hot-dip galvanized after fabrication to comply with ASTM A 153/A 153M.
 - f. Stainless-Steel Sheet: ASTM A 666, Type 304 **OR** 316, **as directed**.
 - g. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
 - h. Stainless Steel bars: ASTM A 276 or ASTM a 666, Type 304.
2. Corrugated Metal Ties: Metal strips not less than 7/8 inch (22 mm) wide with corrugations having a wavelength of 0.3 to 0.5 inch (7.6 to 12.7 mm) and an amplitude of 0.06 to 0.10 inch (1.5 to 2.5 mm) made from steel sheet, galvanized after fabrication **OR** stainless-steel sheet, **as directed**, not less than 0.043 inch (1.1 mm) **OR** 0.053 inch (1.3 mm) **OR** 0.067 inch (1.7 mm) **OR** 0.097 inch (2.5 mm), **as directed**, thick. Ties made from galvanized steel sheet may be used in interior walls, unless otherwise indicated.
 3. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch (16-mm) cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches (50 mm) parallel to face of veneer.
 4. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches (100 mm) wide.
 - a. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches (50 mm) long may be used for masonry constructed from solid units or hollow units laid with cells horizontal.
 - b. Where wythes do not align **OR** are of different materials, **as directed**, use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches (32 mm).
 - c. Wire: Fabricate from 3/16-inch- (4.8-mm-) **OR** 1/4-inch- (6.4-mm-), **as directed**, diameter, hot-dip galvanized steel **OR** stainless-steel, **as directed**, wire. Mill-galvanized wire ties may be used in interior walls, unless otherwise indicated.
 5. Adjustable Anchors for Connecting to Structure: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
 - a. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- (6.4-mm-) diameter, hot-dip galvanized steel **OR** stainless-steel, **as directed**, wire. Mill-galvanized wire may be used at interior walls, unless otherwise indicated.
 - b. Tie Section for Steel Frame: Triangular-shaped wire tie, sized to extend within 1 inch (25 mm) of masonry face, made from 0.188-inch- (4.8-mm-) **OR** 0.25-inch- (6.4-mm-), **as directed**, diameter, hot-dip galvanized steel **OR** stainless-steel, **as directed** wire. Mill-galvanized wire may be used at interior walls, unless otherwise indicated.
 - c. Connector Section for Concrete: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from 0.053-inch- (1.3-mm-) thick, steel sheet, galvanized after fabrication **OR** 0.097-inch- (2.5-mm-) thick, steel sheet, galvanized after fabrication **OR** 0.062-inch- (1.6-mm-) thick, stainless-steel sheet **OR** 0.109-inch- (2.8-mm-) thick, stainless-steel sheet, **as directed**. 0.064-inch- (1.6-mm-) **OR** 0.108-inch- (2.7-mm-), **as directed**, thick, galvanized sheet may be used at interior walls, unless otherwise indicated.
 - d. Tie Section for Concrete: Corrugated metal ties with dovetail tabs for inserting into dovetail slots in concrete and sized to extend to within 1 inch (25 mm) of masonry face.
 6. Partition Top anchors: 0.097-inch- (2.5-mm-) thick metal plate with 3/8-inch- (10-mm-) diameter metal rod 6 inches (150 mm) long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication **OR** stainless-steel, **as directed**.
 7. Rigid Anchors: Fabricate from steel bars 1-1/2 inches (38 mm) wide by 1/4 inch (6.4 mm) thick by 24 inches (600 mm) long, with ends turned up 2 inches (50 mm) or with cross pins.
 - a. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M **OR** Epoxy coating 0.020 inch (0.51 mm) thick **OR** Rust-inhibitive paint, **as directed**.
 8. Stone Anchors: Fabricate dowels, cramps, and other stone anchors from stainless steel.
 9. Adjustable Masonry-Veneer Anchors



- a. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:
- 1) Structural Performance Characteristics: Capable of withstanding a 100-lbf (445-N) load in both tension and compression without deforming or developing play in excess of 0.05 inch (1.3 mm).
- b. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section.
- 1) Anchor Section:
 - a) Rib-stiffened, sheet metal plate with screw holes top and bottom, and slotted holes for inserting wire tie.
 - b) Sheet metal plate with screw holes top and bottom and with raised rib-stiffened strap, stamped into center to provide a slot between strap and plate for inserting wire tie.
 - c) Gasketed sheet metal plate with screw holes top and bottom; top and bottom ends bent to form pronged legs of length to match thickness of insulation or sheathing; and raised rib-stiffened strap, stamped into center to provide a slot between strap and plate for inserting wire tie. Provide anchor manufacturer's standard, self-adhering, modified bituminous gaskets manufactured to fit behind anchor plate and extend beyond pronged legs.
 - 2) Fabricate sheet metal anchor sections and other sheet metal parts from 0.067-inch- (1.7-mm-) thick, steel sheet, galvanized after fabrication **OR** 0.097-inch- (2.5-mm-) thick, steel sheet, galvanized after fabrication **OR** 0.078-inch- (2.0-mm-) thick, stainless-steel sheet **OR** 0.109-inch- (2.8-mm-) thick, stainless-steel sheet, **as directed**.
 - 3) Wire Ties: Triangular-, rectangular-, or T-shaped wire ties fabricated from 0.188-inch- (4.8-mm-) **OR** 0.25-inch- (6.4-mm-), **as directed**, diameter, hot-dip galvanized steel **OR** stainless-steel, **as directed**, wire.
- c. Slip-in, Masonry-Veneer Anchors: Units consisting of a wire tie section and an anchor section designed to interlock with metal studs and be slipped into place as sheathing is installed.
- 1) Wire-Type Anchor: Bent wire anchor section with an eye to receive the wire tie. Wire tie has a vertical leg that slips into the eye of anchor section and allows vertical adjustment. Both sections are made from 3/16-inch (4.8-mm), hot-dip galvanized wire.
 - 2) Strap-and-Wire Type Anchor: Flat metal strap with notch to interlock with flange of metal stud and two holes for inserting vertical legs of wire tie specially formed to fit anchor section. Strap is made from 0.067-inch- (1.7-mm-) thick, steel sheet, galvanized after fabrication; anchor wire tie is made from 3/16-inch (4.8-mm), hot-dip galvanized wire.
- d. Seismic Masonry-Veneer Anchors: Units consisting of a metal anchor section and a connector section designed to engage a continuous wire embedded in the veneer mortar joint.
- 1) Anchor Section: Rib-stiffened, sheet metal plate with screw holes top and bottom, and slotted holes for inserting connector section.
 - 2) Connector Section: Rib-stiffened, sheet metal bent plate; sheet metal clip; or wire tie and rigid extruded vinyl clip designed to engage continuous wire. Size connector to extend at least halfway through veneer but with at least 5/8-inch (16-mm) cover on outside face.
 - 3) Fabricate sheet metal anchor sections and other sheet metal parts from 0.067-inch- (1.7-mm-) thick, steel sheet, galvanized after fabrication **OR** 0.097-inch- (2.5-mm-) thick, steel sheet, galvanized after fabrication **OR** 0.078-inch- (2.0-mm-) thick, stainless-steel sheet **OR** 0.109-inch- (2.8-mm-) thick, stainless-steel sheet, **as directed**.



- 4) Fabricate wire connector sections from 0.188-inch- (4.8-mm-) **-OR** 0.25-inch- (6.4-mm-), **as directed**, diameter, hot-dip galvanized, carbon **OR** stainless, **as directed**, steel wire.
 - e. Polymer-Coated, Steel Drill Screws for Steel Studs: ASTM C 954 except manufactured with hex washer head and neoprene washer, No. 10 (4.8-mm) diameter by length required to penetrate steel stud flange with not less than 3 exposed threads, and with organic polymer coating with salt-spray resistance to red rust of more than 800 hours per ASTM B 117.
 - f. Stainless-Steel Drill Screws for Steel Studs: Proprietary fastener consisting of carbon-steel drill point and 300 Series stainless-steel shank, complying with ASTM C 954 except manufactured with hex washer head and neoprene washer, No. 10 (4.8-mm) diameter by length required to penetrate steel stud flange with not less than three exposed threads.
- J. Miscellaneous Anchors
1. Unit Type Inserts in Concrete: Cast-iron or malleable-iron wedge-type inserts.
 2. Dovetail Slots in Concrete: Furnish dovetail slots with filler strips, of slot size indicated, fabricated from 0.034-inch (0.9-mm), galvanized steel sheet.
 3. Anchor Bolts: Headed or L-shaped steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.
 4. Postinstalled Anchors: Provide chemical or torque-controlled expansion anchors, with capability to sustain, without failure, a load equal to six times the load imposed when installed in solid or grouted unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
 - a. Corrosion Protection:
 - 1) Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (5 microns) for Class SC 1 service condition (mild).
 - 2) Stainless-steel components complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Alloy Group 1 or 4) for bolts and nuts; ASTM A 666 or ASTM A 276, Type 304 or 316, for anchors.
- K. Embedded Flashing Materials
1. Metal Flashing: Provide metal flashing, where flashing is exposed or partly exposed and where indicated, complying with SMACNA's "Architectural Sheet Metal Manual OR Division 07 Section "Sheet Metal Flashing And Trim" as directed.
 - a. Stainless Steel: ASTM A 240/A 240M, Type 304, 0.016 inch (0.4 mm) thick.
 - b. Copper: ASTM B 370, Temper H00 or H01, cold-rolled copper sheet, 10-oz./sq. ft. (3-kg/sq. m) weight or 0.0135 inch (0.34 mm) thick for fully concealed flashing; 16-oz./sq. ft. (5-kg/sq. m) weight or 0.0216 inch (0.55 mm) thick elsewhere.
 - c. Fabricate continuous flashings in sections 96 inches (2400 mm) long minimum, but not exceeding 12 feet (3.6 m). Provide splice plates at joints of formed, smooth metal flashing.
 - d. Fabricate through-wall metal flashing embedded in masonry from stainless steel **OR** copper, **as directed**, with ribs at 3-inch (75-mm) intervals along length of flashing to provide an integral mortar bond.
 - e. Metal Drip Edges: Fabricate from stainless steel. Extend at least 3 inches (75 mm) into wall and 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees and hemmed.
 - f. Metal Flashing Terminations: Fabricate from stainless steel. Extend at least 3 inches (75 mm) into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch (19 mm) and down into joint 3/8 inch (10 mm) to form a stop for retaining sealant backer rod.
 - g. Metal Expansion-Joint Strips: Fabricate from stainless steel **OR** copper, **as directed**, to shapes indicated.
 2. Flexible Flashing: For flashing not exposed to the exterior, use one of the following, unless otherwise indicated:



- a. Copper-Laminated Flashing: 5-oz./sq. ft. (1.5-kg/sq. m) **OR** 7-oz./sq. ft. (2-kg/sq. m), **as directed**, copper sheet bonded with asphalt between 2 layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.
 - b. Asphalt-Coated Copper Flashing: 5-oz./sq. ft. (1.5-kg/sq. m) **OR** 7-oz./sq. ft. (2-kg/sq. m), **as directed**, copper sheet coated with flexible asphalt. Use only where flashing is fully concealed in masonry.
 - c. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.030 inch (0.8 mm) **OR** 0.040 inch (1.0 mm), **as directed**.
 - d. Elastomeric Thermoplastic Flashing: Composite flashing product consisting of a polyester-reinforced ethylene interpolymer alloy 0.025 inch (0.6 mm) thick, with a 0.015-inch- (0.4-mm-) thick coating of rubberized-asphalt adhesive.
 - e. EPDM Flashing: Sheet flashing product made from ethylene-propylene-diene terpolymer, complying with ASTM D 4637, 0.040 inch (1.0 mm) thick.
3. Single-Wythe CMU Flashing System: System of CMU cell flashing pans and interlocking CMU web covers made from high-density polyethylene incorporating chemical stabilizers that prevent UV degradation. Cell flashing pans have integral weep spouts that are designed to be built into mortar bed joints and weep collected moisture to the exterior of CMU walls and that extend into the cell to prevent clogging with mortar.
 4. Solder and Sealants for Sheet Metal Flashings:
 - a. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
 - b. Solder for Copper: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.
 - c. Elastomeric Sealant: ASTM C 920, chemically curing urethane **OR** polysulfide silicone **as directed**, sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
 5. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer.
- L. Miscellaneous Masonry Accessories
1. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; formulated from neoprene, urethane or PVC.
 2. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall.
 3. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
 4. Weep/Vent Products: Use one of the following, unless otherwise indicated:
 - a. Wicking Material: Absorbent rope, made from cotton or UV-resistant synthetic fiber, 1/4 to 3/8 inch (6 to 10 mm) in diameter, in length required to produce 2-inch (50-mm) exposure on exterior and 18 inches (450 mm) in cavity between wythes. Use only for weeps.
 - b. Round Plastic Weep/Vent Tubing: Medium-density polyethylene, 3/8-inch (9-mm) OD by 4 inches (100 mm) long.
 - c. Rectangular Plastic Weep/Vent Tubing: Clear butyrate, 3/8 by 1-1/2 by 3-1/2 inches (9 by 38 by 89 mm) long.
 - d. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch (3 mm) less than depth of outer wythe, in color selected from manufacturer's standard.
 - e. Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth 1/8 inch (3 mm) less than depth of outer wythe; in color selected from manufacturer's standard.
 - f. Aluminum Weep Hole/Vent: One-piece, L-shaped units made from sheet aluminum, designed to fit into a head joint and consisting of a vertical channel with louvers stamped in web and with a top flap to keep mortar out of the head joint; painted before installation to



- comply with Division 09 Section(s) "Exterior Painting" OR "Interior Painting", in color approved to match that of mortar.
- g. Vinyl Weep Hole/Vent: One-piece, offset, T-shaped units made from flexible, injection-molded PVC, designed to fit into a head joint and consisting of a louvered vertical leg, flexible wings to seal against ends of masonry units, and a top flap to keep mortar out of the head joint; in color approved by Architect to match that of mortar.
5. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
- a. Provide one of the following configurations:
 - 1) Strips, full-depth of cavity and 10 inches (250 mm) wide, with dovetail shaped notches 7 inches (175 mm) deep.
 - 2) Strips, not less than 1-1/2 inches (38 mm) thick and 10 inches (250 mm) wide, with dimpled surface designed to catch mortar droppings and prevent weep holes from being clogged with mortar.
 - 3) Sheets or strips full depth of cavity and installed to full height of cavity.
6. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.142-inch (3.6-mm) steel wire, hot-dip galvanized after fabrication. Provide units with either two loops or four loops as needed for number of bars indicated.

M. Insulation

- 1. Loose-Granular Fill Insulation: Perlite complying with ASTM C 549, Type II (surface treated for water repellency and limited moisture absorption) or Type IV (surface treated for water repellency and to limit dust generation).
- 2. Molded-Polystyrene Insulation Units: Rigid, cellular thermal insulation formed by the expansion of polystyrene-resin beads or granules in a closed mold to comply with ASTM C 578, Type I. Provide specially shaped units designed for installing in cores of masonry units.
- 3. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV **OR X, as directed**, closed-cell product extruded with an integral skin.
- 4. Molded-Polystyrene Board Insulation: ASTM C 578, Type I.
- 5. Polyisocyanurate Board Insulation: ASTM C 1289, Type I (aluminum-foil-faced), Class 2 (glass-fiber-reinforced).
- 6. Adhesive: Type recommended by insulation board manufacturer for application indicated.

N. Masonry Cleaners

- 1. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains from new masonry without damaging masonry. Use product approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

O. Mortar And Grout Mixes

- 1. General: Do not use admixtures, unless otherwise indicated.
 - a. Do not use calcium chloride in mortar or grout.
 - b. Limit cementitious materials in mortar for exterior and reinforced masonry to portland cement and lime.
 - c. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- 2. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- 3. Mortar for Unit Masonry: Comply with ASTM C 270 **OR** BIA Technical Notes 8A **OR** IBC Standard, **as directed**, Proportion Specification.
- 4. Mortar for Unit Masonry: Comply with ASTM C 270 **OR** BIA Technical Notes 8A **OR** IBC Standard, **as directed**, Property Specification.
 - a. For masonry below grade or in contact with earth, use Type M **OR** S, **as directed**.
 - b. For reinforced masonry, use Type S **OR** N, **as directed**.
 - c. For mortar parge coats, use Type S or N.



- d. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
- e. For interior non-load-bearing partitions, Type O may be used instead of Type N.
5. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.
 - a. Pigments shall not exceed 10 percent of portland cement by weight.
 - b. Pigments shall not exceed 5 percent of masonry cement or mortar cement by weight.
6. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.
7. Grout for Unit Masonry: Comply with ASTM C 476 **OR** IBC Standard, **as directed**.
 - a. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 **OR** Table 21-C in the International Building Code, **as directed**, for dimensions of grout spaces and pour height.
 - b. Provide grout with a slump of 8 to 11 inches (200 to 280 mm) as measured according to ASTM C 143/C 143M.
8. Epoxy Pointing Mortar: Mix epoxy pointing mortar to comply with mortar manufacturer's written instructions.

1.3 EXECUTION

A. Installation, General

1. Use full-size units without cutting if possible. If cutting is required, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
2. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
3. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.
4. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.
5. Comply with tolerances in ACI 530.1/ASCE 6/TMS 602 and with the following:
 - a. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
 - b. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.

B. Laying Masonry Walls

1. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
2. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.
3. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
4. Fill space between steel frames and masonry solidly with mortar, unless otherwise indicated.
5. Fill cores in hollow concrete masonry units with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

C. Mortar Bedding And Jointing



1. Lay hollow brick and concrete masonry units as follows:
 - a. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
 - b. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
 - c. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
 - d. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.
2. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
3. Lay structural-clay tile as follows:
 - a. Lay vertical-cell units with full head joints, unless otherwise indicated. Provide bed joints with full mortar coverage on face shells and webs.
 - b. Lay horizontal-cell units with full bed joints, unless otherwise indicated. Keep drainage channels, if any, free of mortar. Form head joints with sufficient mortar so excess will be squeezed out as units are placed in position.
 - c. Maintain joint thicknesses indicated except for minor variations required to maintain bond alignment. If not indicated, lay walls with 1/4- to 3/8-inch- (6- to 10-mm-) thick joints.
 - d. Where epoxy-mortar pointed joints are indicated, rake out setting mortar to a uniform depth of 1/4 inch (6 mm) and point with epoxy mortar.
4. Set firebox brick in full bed of refractory mortar with full head joints. Form joints by buttering both surfaces of adjoining brick and sliding it into place. Make joints just wide enough to accommodate variations in size of brick, approximately 1/8 inch (3 mm). Tool joints smooth on surfaces exposed to fire or smoke.
5. Install clay flue liners to comply with ASTM C 1283. Install flue liners ahead of surrounding masonry. Set clay flue liners in full bed of refractory mortar 1/16 to 1/8 inch (1.6 to 3 mm) thick. Strike joints flush on inside of flue to provide smooth surface. Maintain expansion space between flue liner and surrounding masonry except where surrounding masonry is required to provide lateral support for flue liners.
6. Set stone **OR** cast-stone, **as directed**, trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.
7. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.
8. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

D. Composite Masonry

1. Bond wythes of composite masonry together using one of the following methods:
 - a. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 4.5 sq. ft. (0.42 sq. m) **OR** 2.67 sq. ft. (0.25 sq. m), **as directed**, of wall area spaced not to exceed 36 inches (914 mm) **OR** 24 inches (610 mm), **as directed**, o.c. horizontally and 16 inches (406 mm) o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches (305 mm) of openings and space not more than 36 inches (915 mm) apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches (610 mm) o.c. vertically.
 - 1) Where bed joints of wythes do not align, use adjustable (two-piece) type ties.
 - b. Masonry Joint Reinforcement: Installed in horizontal mortar joints.
 - 1) Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes **OR** tab-type reinforcement, **as directed**.
 - 2) Where bed joints of wythes do not align, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties.
2. Collar Joints: Solidly fill collar joints by parging face of first wythe that is laid and shoving units of other wythe into place.
3. Collar Joints in Clay Tile Masonry: After each course is laid, fill the vertical, longitudinal joint between wythes solidly with mortar at exterior walls, except cavity walls, and interior walls and partitions.



4. Corners: Provide interlocking masonry unit bond in each wythe and course at corners, unless otherwise indicated.
5. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, bond walls together as follows:
 - a. Provide individual metal ties not more than 8 inches (203 mm) **OR** 16 inches (406 mm), **as directed**, o.c.
 - b. Provide continuity with masonry joint reinforcement by using prefabricated T-shaped units.
 - c. Provide rigid metal anchors not more than 24 inches (610 mm) **OR** 48 inches (1220 mm), **as directed**, o.c. If used with hollow masonry units, embed ends in mortar-filled cores.

E. Cavity Walls

1. Bond wythes of cavity walls together using one of the following methods:
 - a. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 4.5 sq. ft. (0.42 sq. m) **OR** 2.67 sq. ft. (0.25 sq. m), **as directed**, of wall area spaced not to exceed 36 inches (914 mm) **OR** 24 inches (610 mm), **as directed**, o.c. horizontally and 16 inches (406 mm) o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches (305 mm) of openings and space not more than 36 inches (915 mm) apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches (610 mm) o.c. vertically.
 - b. Masonry Joint Reinforcement: Installed in horizontal mortar joints.
 - 1) Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes **OR** tab-type reinforcement, **as directed**.
 - 2) Where bed joints of wythes do not align, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties.
 - 3) Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties to allow for differential movement regardless of whether bed joints align.
 - c. Masonry Veneer Anchors: Comply with requirements for anchoring masonry veneers.
2. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.
3. Parge cavity face of backup wythe in a single coat approximately 3/8 inch (10 mm) thick. Trowel face of parge coat smooth.
OR
Coat cavity face of backup wythe to comply with Division 07 Section "Bituminous Dampproofing".

- F. Installing Cavity-Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches (300 mm) o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit insulation between wall ties and other confining obstructions, with edges butted tightly. Press units firmly against inside wythe of masonry.

G. Masonry-Cell Insulation

1. Pour granular insulation into cavities to fill void spaces. Maintain inspection ports to show presence of insulation at extremities of each pour area. Close the ports after filling has been confirmed. Limit the fall of insulation to 1 story in height, but not more than 20 feet (6 m).
2. Install molded-polystyrene insulation units into masonry unit cells before laying units.

H. Masonry Joint Reinforcement

1. General: Install in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).
2. Interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
3. Provide continuity at wall intersections by using prefabricated T-shaped units.
4. Provide continuity at corners by using prefabricated L-shaped units.



- I. Anchoing Masonry To Structural Members
1. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:
 - a. Provide an open space not less than 1/2 inch (13 mm) **OR** 1 inch (25 mm), **as directed**, in width between masonry and structural member, unless otherwise indicated.
 - b. Anchor masonry to structural members with anchors embedded in masonry joints and attached to structure.
 - c. Space anchors as indicated, but not more than 24 inches (610 mm) o.c. vertically and 36 inches (915 mm) o.c. horizontally.
- J. Anchoing Masonry Veneers
1. Anchor masonry veneers to wall framing **OR** concrete and masonry backup, **as directed**, with seismic masonry-veneer anchors to comply with the following requirements:
 - a. Fasten screw-attached and seismic anchors through sheathing to wall framing and to concrete and masonry backup with metal fasteners of type indicated. Use two fasteners.
 - b. Insert slip-in anchors in metal studs as sheathing is installed. Provide one anchor at each stud in each horizontal joint between sheathing boards.
 - c. Embed tie sections **OR** connector sections and continuous wire, **as directed**, in masonry joints. Provide not less than 2 inches (50 mm) of air space between back of masonry veneer and face of sheathing.
 - d. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
 - e. Space anchors as indicated, but not more than 16 inches (406 mm) o.c. vertically and 32 inches (813 mm) **OR** 24 inches (610 mm), **as directed**, o.c. horizontally with not less than 1 anchor for each 3.5 sq. ft. (0.33 sq. m) **OR** 2.67 sq. ft. (0.25 sq. m), **as directed**, of wall area. Install additional anchors within 12 inches (305 mm) of openings and at intervals, not exceeding 36 inches (914 mm), around perimeter.
- K. Control And Expansion Joints
1. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
 2. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Division 07 Section "Joint Sealants", but not less than 3/8 inch (10 mm).
 - a. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.
- L. Lintels
1. Provide concrete or masonry lintels where shown and where openings of more than 12 inches (305 mm) for brick-size units and 24 inches (610 mm) for block-size units are shown without structural steel or other supporting lintels.
 2. Provide minimum bearing of 8 inches (200 mm) at each jamb, unless otherwise indicated.
- M. Flashing, Weep Holes, Cavity Drainage, And Vents
1. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.
 2. Install flashing as follows, unless otherwise indicated:
 - a. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing as recommended by flashing manufacturer.
 - b. At lintels and shelf angles, extend flashing a minimum of 6 inches (150 mm) into masonry at each end. At heads and sills, extend flashing 6 inches (150 mm) at ends and turn up not less than 2 inches (50 mm) to form end dams.



- c. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall and adhere flexible flashing to top of metal drip edge.
- d. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall and adhere flexible flashing to top of metal flashing termination.
3. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.
4. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.
5. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:
 - a. Use specified weep/vent products or open head joints to form weep holes.
 - b. Space weep holes 24 inches (600 mm) o.c., unless otherwise indicated.
 - c. Cover cavity side of weep holes with plastic insect screening at cavities insulated with loose-fill insulation.
6. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in Part 2 "Miscellaneous Masonry Accessories" Article.
7. Install vents in head joints in exterior wythes at spacing indicated. Use specified weep/vent products or open head joints to form vents.
 - a. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

N. Reinforced Unit Masonry Installation

1. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
 - a. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 - b. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.
2. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602 **OR** Section 2104.5 in the International Building Code, **as directed**.
 - a. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
 - b. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 **OR** Section 2104.6 in the International Building Code, **as directed**, for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 - c. Limit height of vertical grout pours to not more than 60 inches (1520 mm).

O. Field Quality Control

1. Inspectors: the Owner will engage qualified independent inspectors to perform inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform inspections.
 - a. Place grout only after inspectors have verified compliance of grout spaces and grades, sizes, and locations of reinforcement.
2. Testing Agency: the Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections indicated below and prepare test reports:
 - a. Payment for these services will be made by the Owner.



3. Testing Frequency: One set of tests for each 5000 sq. ft. (465 sq. m) of wall area or portion thereof.
 4. Clay Masonry Unit Test: For each type of unit provided, per ASTM C 67.
 5. Concrete Masonry Unit Test: For each type of unit provided, per ASTM C 140.
 6. Mortar Test (Property Specification): For each mix provided, per ASTM C 780 **OR** IBC Standard, **as directed**. Test mortar for mortar air content and compressive strength.
 7. Grout Test (Compressive Strength): For each mix provided, per ASTM C 1019 **OR** IBC Standard, **as directed**.
- P. Parging
1. Parge exterior faces of below-grade masonry walls, where indicated, in 2 uniform coats to a total thickness of 3/4 inch (19 mm) with a steel-trowel finish. Form a wash at top of parging and a cove at bottom. Damp-cure parging for at least 24 hours and protect parging until cured.
- Q. Cleaning
1. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
 2. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - a. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.
 - b. Protect adjacent surfaces from contact with cleaner.
 - c. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 - d. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
 - e. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
 - f. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.
- R. Masonry Waste Disposal
1. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
 - a. Do not dispose of masonry waste as fill within 18 inches (450 mm) of finished grade.
 - b. Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off the Owner's property.

END OF SECTION 04 01 20 91



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Task	Specification	Specification Description
04 01 20 91	03 01 30 71	Concrete Rehabilitation
04 01 20 91	04 01 20 52	Clay Masonry Restoration And Cleaning



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SECTION 04 01 40 52 - STONE RESTORATION AND CLEANING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for stone restoration and cleaning. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes maintenance of stone assemblies consisting of stone restoration and cleaning as follows:
 - a. Unused anchor removal.
 - b. Repairing stone masonry, including replacing whole and partial units.
 - c. Painting steel uncovered during the work.
 - d. Repointing joints.
 - e. Preliminary cleaning, including removing plant growth.
 - f. Cleaning exposed stone surfaces.
 - g. Stone consolidation treatment.

C. Definitions

1. Very Low-Pressure Spray: Under 100 psi (690 kPa).
2. Low-Pressure Spray: 100 to 400 psi (690 to 2750 kPa); 4 to 6 gpm (0.25 to 0.4 L/s).
3. Medium-Pressure Spray: 400 to 800 psi (2750 to 5510 kPa); 4 to 6 gpm (0.25 to 0.4 L/s).
4. High-Pressure Spray: 800 to 1200 psi (5510 to 8250 kPa); 4 to 6 gpm (0.25 to 0.4 L/s).
5. Stone Terminology: ASTM C 119.
6. Face Bedding: Setting of stone with the natural bedding planes (strata) vertical and parallel to the wall plane rather than horizontal or "naturally bedded," which holds bedding planes together by gravity.

D. Preconstruction Testing

1. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on stone units as follows:
 - a. Existing Stone: Test each type of existing stone indicated for replacement, according to ASTM C 170 for compressive strength, wet and dry, perpendicular and parallel to rift; ASTM C 99 for modulus of rupture, wet and dry, perpendicular and parallel to rift; and ASTM C 97 for absorption and bulk specific gravity. Carefully remove five existing stones from locations designated by the Owner. Take testing samples from these stones.
 - b. Existing Mortar: Test according to ASTM C 295, modified as agreed by testing service and the Owner for Project requirements, to determine proportional composition of original ingredients, sizes and colors of aggregates, and approximate strength. Use X-ray diffraction, infrared spectroscopy, and differential thermal analysis as necessary to supplement microscopical methods. Carefully remove existing mortar from within joints at five locations designated by the Owner or testing service.
 - c. Temporary Patch: as directed by the Owner, provide temporary materials at locations from which existing samples were taken.
 - d. Replacement Stone: Test each proposed type of replacement stone, according to ASTM C 170 for compressive strength, ASTM C 99 for modulus of rupture, and ASTM C 97 for absorption and bulk specific gravity.

E. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: For the following:



- a. Replacement stone units and their jointing, showing relation of existing to new units.
 - b. Partial replacement stone units (dutchmen).
 - c. Setting number of each new stone unit and its location on the structure in annotated plans and elevations.
 - d. Provisions for expansion joints or other sealant joints.
 - e. Provisions for flashing, lighting fixtures, conduits, and weep holes as required.
 - f. Replacement and repair anchors, including drilled-in pins. Include details of anchors within individual stone units, with locations of anchors and dimensions of holes and recesses in stone required for anchors, including direction and angle of holes for pins.
3. Samples: For each exposed product and for each color and texture specified.
 4. Preconstruction Test Reports.

F. Quality Assurance

1. Restoration Specialist Qualifications: Engage an experienced, preapproved stone restoration and cleaning firm to perform work of this Section. Firm shall have completed work similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance. Experience installing standard unit masonry or new stone masonry is not sufficient experience for stone restoration work.
 - a. At Contractor's option, work may be divided between two specialist firms: one for cleaning work and one for repair work.
 - b. Field Supervision: Restoration specialist firms shall maintain experienced full-time supervisors on Project site during times that stone restoration and cleaning work is in progress. Supervisors shall not be changed during Project except for causes beyond control of restoration specialist firm.
 - c. Restoration Worker Qualifications: Persons who are experienced and specialize in restoration work of types they will be performing. When stone units are being patched, assign at least one worker among those performing patching work who is trained and certified by manufacturer of patching compound to apply its products.
2. Mockups: Prepare mockups of restoration and cleaning to demonstrate aesthetic effects and set quality standards for materials and execution and for fabrication and installation.
 - a. Stone Repair: Prepare sample areas for each type of stone indicated to have repair work performed. If not otherwise indicated, size each mockup not smaller than 2 adjacent whole units or approximately 48 inches (1200 mm) in least dimension. Erect sample areas in existing walls unless otherwise indicated, to demonstrate quality of materials, workmanship, and blending with existing work. Include the following as a minimum:
 - 1) Replacement: Four stone units replaced.
 - 2) Partial Stone Replacement: Two partial stone replacements (dutchman repairs).
 - 3) Stone Plug Repair: Two stone plug repairs for each type of stone indicated to be plugged.
 - 4) Crack Injection: Apply crack injection in 2 separate areas, each approximately 36 inches (900 mm) long.
 - 5) Patching: Three small holes at least 1 inch (25 mm) in diameter.
 - b. Repointing: Rake out joints in 2 separate areas, each approximately 36 inches (900 mm) high by 48 inches (1200 mm) wide, for each type of repointing required and repoint one of the areas.
 - c. Consolidation: Apply stone consolidation treatment to an area approximately 4 sq. ft. (0.4 sq. m).
 - d. Cleaning: Clean an area approximately 25 sq. ft. (2.3 sq. m) for each type of stone and surface condition.
3. Preinstallation Conference: Conduct conference at Project site.

G. Delivery, Storage, And Handling

1. Deliver stone units to Project site strapped together in suitable packs or pallets or in heavy-duty crates.



2. Deliver each piece of granite with code mark or setting number on unexposed face, corresponding to Shop Drawings, using nonstaining paint.
3. Deliver other materials to Project site in manufacturer's original and unopened containers, labeled with manufacturer's name and type of products.
4. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
5. Store hydrated lime in manufacturer's original and unopened containers. Discard lime if containers have been damaged or have been opened for more than two days.
6. Store lime putty covered with water in sealed containers.
7. Store sand where grading and other required characteristics can be maintained and contamination avoided.

H. Project Conditions

1. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit stone restoration and cleaning work to be performed according to manufacturers' written instructions and specified requirements.
2. Repair stone units and repoint mortar joints only when air temperature is between 40 and 90 deg F (4 and 32 deg C) and is predicted to remain so for at least 7 days after completion of the Work unless otherwise indicated.
3. Cold-Weather Requirements: Comply with the following procedures for stone repair and mortar-joint pointing unless otherwise indicated:
 - a. When air temperature is below 40 deg F (4 deg C), heat mortar ingredients, repair materials, and existing stone to produce temperatures between 40 and 120 deg F (4 and 49 deg C).
 - b. When mean daily air temperature is below 40 deg F (4 deg C), provide enclosure and heat to maintain temperatures above 32 deg F (0 deg C) within the enclosure for 7 days after repair and pointing.
4. Hot-Weather Requirements: Protect stone repair and mortar-joint pointing when temperature and humidity conditions produce excessive evaporation of water from mortar and patching materials. Provide artificial shade and wind breaks and use cooled materials as required to minimize evaporation. Do not apply mortar to substrates with temperatures of 90 deg F (32 deg C) and above unless otherwise indicated.
5. For manufactured repair materials, perform work within the environmental limits set by each manufacturer.
6. Clean stone surfaces only when air temperature is 40 deg F (4 deg C) and above and is predicted to remain so for at least 7 days after completion of cleaning.
7. Apply stone consolidation treatment only when surface and air temperatures are between 50 and 90 deg F (10 and 32 deg C) and rain is not expected within 24 hours.

1.2 PRODUCTS

A. Stone Materials

1. Stone: Provide natural building stone of variety, color, texture, grain, veining, finish, size, and shape to match existing stone and with physical properties within 10 percent of those determined from preconstruction testing of selected existing stone.
 - a. For existing stone that exhibits a range of colors, texture, grain, veining, finishes, sizes, or shapes, provide stone that proportionally matches that range rather than stone that matches an individual color, texture, grain, veining, finish, size, or shape within that range.
2. Stone: Provide natural building stone of variety, color, texture, grain, veining, finish, and physical properties to match the Owner's sample. Match existing stone in size and shape.
 - a. For the Owner's sample that exhibits a range of colors, texture, grain, veining, finishes, sizes, or shapes, provide stone that proportionally matches that range rather than stone that matches an individual color, texture, grain, veining, finish, size, or shape within that range.



3. Quarrying New Stone: Have quarry clearly label the direction of bedding planes when rough stone is quarried, to facilitate cutting stones so that natural bedding planes will be as required in "Cutting New Stone" Paragraph.
4. Cutting New Stone: Regardless of how existing stone was cut and set, cut each new stone so that, when it is set in final position, natural bedding planes are essentially horizontal except for arches, where bedding planes are essentially radial or vertical, but perpendicular to the wall plane.
5. Salvaged Stone: Obtain salvaged stone from the Owner from location shown on Drawings. Clean off residual mortar.

B. Mortar Materials

1. Portland Cement: ASTM C 150, Type I or Type II, white or gray or both where required for color matching of exposed mortar.
 - a. Provide cement containing not more than 0.60 percent total alkali when tested according to ASTM C 114.
2. Hydrated Lime: ASTM C 207, Type S.
3. Factory-Prepared Lime Putty: ASTM C 1489.
4. Quicklime: ASTM C 5, pulverized lime.
5. Mortar Sand: ASTM C 144 unless otherwise indicated.
 - a. Color: Provide natural sand or ground marble, granite, or other sound stone of color necessary to produce required mortar color.
 - b. For pointing mortar, provide sand with rounded edges.
 - c. Match size, texture, and gradation of existing mortar sand as closely as possible. Blend several sands if necessary to achieve suitable match.
6. Mortar Pigments: Natural and synthetic iron oxides, compounded for mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortars.
7. Water: Potable.

C. Manufactured Repair Materials

1. Stone Patching Compound: Factory-mixed cementitious product that is custom manufactured for patching stone.
 - a. Use formulation that is vapor- and water permeable (equal to or more than the stone), exhibits low shrinkage, has lower modulus of elasticity than the stone units being repaired, and develops high bond strength to all types of stone.
 - b. Use formulation having working qualities and retardation control to permit forming and sculpturing where necessary.
 - c. Formulate patching compound in colors, textures, and grain to match stone being patched. Provide sufficient number of **OR** not less than three, **as directed**, colors to enable matching each piece of stone.
2. Cementitious Crack Filler: An ultrafine superplasticized grout that can be injected into cracks, is suitable for application to wet or dry cracks, exhibits low shrinkage, and develops high bond strength to all types of stone.
3. Stone-to-Stone Adhesive: 2-part polyester or epoxy-resin stone adhesive with a 15- to 45-minute cure at 70 deg F (21 deg C) or 1-part cementitious stone adhesive, recommended by adhesive manufacturer for type of stone repair indicated, and matching stone color.
4. Stone Consolidation Treatment: Ready-to-use product designed for consolidation of stone that has deteriorated due to weathering and exposure to pollutants. Treatment shall be composed of silicic-ethyl esters, a neutral catalyst, and solvents.
5. Stone Consolidation and Water-Repellent Treatment: Ready-to-use product designed for consolidation and water-repellent treatment of stone that has deteriorated due to weathering and exposure to pollutants. Treatment shall be composed of silicic-ethyl esters, a neutral catalyst, a silane water repellent, and solvents.

D. Paint Removers



1. Alkaline Paste Paint Remover: Manufacturer's standard alkaline paste formulation for removing paint coatings from masonry.
2. Covered or Skin-Forming Alkaline Paint Remover: Manufacturer's standard covered or skin-forming alkaline formulation for removing paint coatings from masonry.
3. Solvent-Type Paint Remover: Manufacturer's standard water-rinsable, solvent-type gel formulation for removing paint coatings from masonry.
4. Low-Odor, Solvent-Type Paint Remover: Manufacturer's standard low-odor, water-rinsable solvent-type gel formulation, containing no methanol or methylene chloride, for removing paint coatings from masonry.

E. Cleaning Materials

1. Water: Potable.
2. Hot Water: Water heated to a temperature of 140 to 160 deg F (60 to 71 deg C).
3. Job-Mixed Detergent Solution: Solution prepared by mixing 2 cups (0.5 L) of tetrasodium polyphosphate, 1/2 cup (125 mL) of laundry detergent, and 20 quarts (20 L) of hot water for every 5 gal. (20 L) of solution required.
4. Job-Mixed Mold, Mildew, and Algae Remover: Solution prepared by mixing 2 cups (0.5 L) of tetrasodium polyphosphate, 5 quarts (5 L) of 5 percent sodium hypochlorite (bleach), and 15 quarts (15 L) of hot water for every 5 gal. (20 L) of solution required.
5. Nonacidic Gel Cleaner: Manufacturer's standard gel formulation, with pH between 6 and 9, that contains detergents with chelating agents and is specifically formulated for cleaning masonry surfaces.
6. Nonacidic Liquid Cleaner: Manufacturer's standard mildly alkaline liquid cleaner formulated for removing mold, mildew, and other organic soiling from ordinary building materials, including polished stone, brick, aluminum, plastics, and wood.
7. Mild Acidic Cleaner: Manufacturer's standard mildly acidic cleaner containing no muriatic (hydrochloric), hydrofluoric, or sulfuric acid; or ammonium bifluoride or chlorine bleaches.
8. Acidic Cleaner: Manufacturer's standard acidic masonry cleaner composed of hydrofluoric acid or ammonium bifluoride blended with other acids, detergents, wetting agents, and inhibitors.
9. One-Part Limestone Cleaner: Manufacturer's standard one-part acidic formulation for cleaning limestone.
10. Two-Part Limestone Cleaner: Manufacturer's standard system consisting of potassium or sodium hydroxide based, alkaline prewash cleaner and acidic afterwash cleaner that does not contain hydrofluoric acid.

F. Accessory Materials

1. Liquid Strippable Masking Agent: Manufacturer's standard liquid, film-forming, strippable masking material for protecting glass, metal, and polished stone surfaces from damaging effects of acidic and alkaline masonry cleaners.
2. Stone Anchors and Pins: Type and size indicated or, if not indicated, to match existing anchors in size and type. Fabricate anchors and pins from Type 304 **OR** Type 316, **as directed**, stainless steel.
3. Sealant Materials:
 - a. Provide manufacturer's standard chemically curing, elastomeric sealant(s) of base polymer and characteristics indicated below that comply with applicable requirements in Division 07 Section "Joint Sealants".
 - 1) Single-component, nonsag urethane sealant.
 - b. Colors: Provide colors of exposed sealants to match colors of stonework adjoining installed sealant unless otherwise indicated.
 - c. Ground-Mortar Aggregate: Custom crushed and ground pointing mortar sand or existing mortar retrieved from joints. Grind to a particle size that matches the adjacent mortar aggregate and color. Remove all fines passing the 100 sieve.
4. Joint-Sealant Backing:
 - a. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) or Type B (bicellular material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.



- b. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.
- 5. Setting Buttons: Resilient plastic buttons, nonstaining to stone, sized to suit joint thicknesses and bed depths of stone units without intruding into required depths of pointing materials.
- 6. Masking Tape: Nonstaining, nonabsorbent material, compatible with pointing mortar, joint primers, sealants, and surfaces adjacent to joints; that will easily come off entirely, including adhesive.
- 7. Antirust Coating: Fast-curing, lead- and chromate-free, self-curing, universal modified-alkyd primer complying with MPI #79, Alkyd Anticorrosive Metal Primer **OR** SSPC-Paint 20 **OR** SSPC-Paint 29 zinc-rich coating, **as directed**.
 - a. Use coating requiring no better than SSPC-SP 2, "Hand Tool Cleaning" **OR** SSPC-SP 3, "Power Tool Cleaning" **OR** SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning", **as directed**, surface preparation according to manufacturer's literature or certified statement.
 - b. Use coating with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- 8. Miscellaneous Products: Select materials and methods of use based on the following, subject to approval of a mockup:
 - a. Previous effectiveness in performing the work involved.
 - b. Little possibility of damaging exposed surfaces.
 - c. Consistency of each application.
 - d. Uniformity of the resulting overall appearance.
 - e. Do not use products or tools that could do the following:
 - 1) Remove, alter, or in any way harm the present condition or future preservation of existing surfaces, including surrounding surfaces not in contract.
 - 2) Leave a residue on surfaces.

G. Mortar Mixes

- 1. Preparing Lime Putty: Slake quicklime and prepare lime putty according to appendix to ASTM C 5 and manufacturer's written instructions.
- 2. Measurement and Mixing: Measure cementitious materials and sand in a dry condition by volume or equivalent weight. Do not measure by shovel; use known measure. Mix materials in a clean, mechanical batch mixer.
 - a. Mixing Pointing Mortar: Thoroughly mix cementitious materials and sand together before adding any water. Then mix again adding only enough water to produce a damp, unworkable mix that will retain its form when pressed into a ball. Maintain mortar in this dampened condition for 15 to 30 minutes. Add remaining water in small portions until mortar reaches desired consistency. Use mortar within one hour of final mixing; do not retemper or use partially hardened material.
- 3. Colored Mortar: Produce mortar of color required by using specified ingredients. Do not alter specified proportions without the Owner's approval.
 - a. Mortar Pigments: Where mortar pigments are indicated, do not exceed a pigment-to-cement ratio of 1:10 by weight.
- 4. Do not use admixtures in mortar unless otherwise indicated.
- 5. Mortar Proportions: Mix mortar materials in the following proportions:
 - a. Pointing Mortar for Stone: 1 part white portland cement, 1 part lime, and 6 parts sand **OR** 1 part white portland cement, 2 parts lime, and 6 parts sand **OR** 1 part white portland cement, 6 parts lime, and 12 parts sand, **as directed**.
 - 1) Add mortar pigments to produce mortar colors required.
 - b. Rebuilding (Setting) Mortar: Same as pointing mortar except mortar pigments are not required, **as directed**.
 - c. Rebuilding (Setting) Mortar: 1 part white portland cement, 1 part lime, and 6 parts sand **OR** 1 part white portland cement, 2 parts lime, and 6 parts sand **OR** 1 part white portland cement, 6 parts lime, and 12 parts sand, **as directed**.



- d. Rebuilding (Setting) Mortar: Comply with ASTM C 270, Proportion Specification, Type N unless otherwise indicated, with cementitious material limited to portland cement and lime.

H. Chemical Cleaning Solutions

1. Dilute chemical cleaners with water to produce solutions not exceeding concentration recommended by chemical-cleaner manufacturer.
2. Acidic Cleaner Solution for Unpolished Stone: Dilute with water to produce hydrofluoric acid content of 3 percent or less, but not greater than that recommended by chemical-cleaner manufacturer.
 - a. Use only on unpolished granite, unpolished dolomite marble, and siliceous sandstone.
3. Acidic Cleaner for Polished Stone: Dilute with water to concentration demonstrated by testing that does not etch or otherwise damage polished surface, but not greater than that recommended by chemical-cleaner manufacturer.
 - a. Use only on polished granite and polished dolomite marble.

1.3 EXECUTION

A. Protection

1. Protect persons, motor vehicles, surrounding surfaces of building being restored, building site, plants, and surrounding buildings from harm resulting from stone restoration work.
 - a. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during course of restoration and cleaning work.
2. Comply with chemical-cleaner manufacturer's written instructions for protecting building and other surfaces against damage from exposure to its products. Prevent chemical cleaning solutions from coming into contact with people, motor vehicles, landscaping, buildings, and other surfaces that could be harmed by such contact.
 - a. Cover adjacent surfaces with materials that are proven to resist chemical cleaners used unless chemical cleaners being used will not damage adjacent surfaces. Use materials that contain only waterproof, UV-resistant adhesives. Apply masking agents to comply with manufacturer's written instructions. Do not apply liquid masking agent to painted or porous surfaces. When no longer needed, promptly remove masking to prevent adhesive staining.
 - b. Keep wall wet below area being cleaned to prevent streaking from runoff.
 - c. Do not clean stone during winds of sufficient force to spread cleaning solutions to unprotected surfaces.
 - d. Neutralize and collect alkaline and acid wastes for disposal off the Owner's property.
 - e. Dispose of runoff from cleaning operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.
3. Prevent mortar from staining face of surrounding stone and other surfaces.
 - a. Cover sills, ledges, and projections to protect from mortar droppings.
 - b. Keep wall area wet below rebuilding and pointing work to discourage mortar from adhering.
 - c. Immediately remove mortar in contact with exposed stone and other surfaces.
 - d. Clean mortar splatters from scaffolding at end of each day.
4. Remove gutters and downspouts adjacent to stone and store where indicated during stone restoration and cleaning. Reinstall when stone restoration and cleaning are complete.
 - a. Provide temporary rain drainage during work as indicated to direct water away from building.

B. Unused Anchor Removal

1. Remove stone anchors, brackets, wood nailers, and other extraneous items no longer in use unless identified as historically significant or indicated to remain.
 - a. Remove items carefully to avoid spalling or cracking stone.



- b. Where directed, if an item cannot be removed without damaging surrounding stone, do the following:
 - 1) Cut or grind off item approximately 3/4 inch (20 mm) beneath surface and core drill a recess of same depth in surrounding stone as close around item as practical.
 - 2) Immediately paint exposed end of item with two coats of antirust coating, following coating manufacturer's written instructions and without exceeding manufacturer's recommended dry film thickness per coat. Keep paint off sides of recess.
- c. Patch **OR** Plug, **as directed**, the hole where each item was removed unless directed to remove and replace the stone unit.

C. Stone Removal And Replacement

1. At locations indicated, remove stone that has deteriorated or is damaged beyond repair or is to be reused. Carefully demolish or remove entire units from joint to joint, without damaging surrounding stone, in a manner that permits replacement with full-size units.
2. Support and protect remaining stonework that surrounds removal area. Maintain flashing, reinforcement, lintels, and adjoining construction in an undamaged condition.
3. Notify the Owner of unforeseen detrimental conditions including voids, cracks, bulges, and loose units in existing stone or unit masonry backup, rotted wood, rusted metal, and other deteriorated items.
4. Remove in an undamaged condition as many whole stone units as possible.
 - a. Remove mortar, loose particles, and soil from stone by cleaning with hand chisels, brushes, and water.
 - b. Remove sealants by cutting close to stone with utility knife and cleaning with solvents.
 - c. Store stone for reuse. Store off ground, on skids, and protected from weather.
 - d. Deliver cleaned stone not required for reuse to the Owner unless otherwise indicated.
5. Clean stone surrounding removal areas by removing mortar, dust, and loose particles in preparation for replacement.
6. Replace removed damaged stone with other removed stone and salvaged stone in good quality, where possible, or with new stone matching existing stone, including size. Do not use broken units unless they can be cut to usable size.
7. Do not allow face bedding of stone. Before setting, inspect to verify that each stone has been cut so that, when it is set in final position, natural bedding planes are essentially horizontal except for arches, where bedding planes are essentially radial or vertical, but perpendicular to the wall. Reject and replace stone with vertical bedding planes except as required for arches, lintels, and copings.
8. Install replacement stone into bonding and coursing pattern of existing stone. If cutting is required, use a motor-driven saw designed to cut stone with clean, sharp, unchipped edges. Finish edges to blend with appearance of edges of existing stone.
 - a. Maintain joint width for replacement stone to match existing joints.
 - b. Use setting buttons or shims to set stone accurately spaced with uniform joints.
9. Set replacement stone with completely filled bed, head, and collar joints. Butter vertical joints for full width before setting and set units in full bed of mortar unless otherwise indicated. Replace existing anchors with new anchors of size and type indicated.
 - a. Tool exposed mortar joints in repaired areas to match joints of surrounding existing stonework.
 - b. Rake out mortar used for laying stone before mortar sets and point new mortar joints in repaired area to comply with requirements for repointing existing stone, and at same time as repointing of surrounding area.
 - c. When mortar is sufficiently hard to support units, remove shims and other devices interfering with pointing of joints.

D. Painting Steel Uncovered During The Work

1. Inspect steel exposed during stone removal. Where the Owner determines that it is structural, or for other reasons cannot be totally removed, prepare and paint it as follows:



- a. Remove paint, rust, and other contaminants according to SSPC-SP 2, "Hand Tool Cleaning" **OR** SSPC-SP 3, "Power Tool Cleaning" **OR** SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning", **as directed**, as applicable to meet paint manufacturer's recommended preparation.
- b. Immediately paint exposed steel with two coats of antirust coating, following coating manufacturer's written instructions and without exceeding manufacturer's recommended rate of application (dry film thickness per coat).
2. If on inspection and rust removal, the cross section of a steel member is found to be reduced from rust by more than 1/16 inch (1.6 mm), notify the Owner before proceeding.

E. Partial Stone Replacement

1. Remove defective portion of existing stone unit (backing stone). Carefully remove defective portion of stone by making vertical and horizontal saw cuts at face of backing stone and demolishing defective material to depth required for fitting partial replacement (dutchman).
 - a. Make edges of backing stone at cuts smooth and square to each other and to finished surface; essentially rectangular. Make back of removal area flat and parallel to stone face.
 - b. Do not overcut at corners and intersections. Hand trim to produce clean sharp corners with no rounding and no damage to existing work to remain.
 - c. If existing stone that is to remain becomes damaged, remove damaged area and enlarge partial replacement as required.
2. Remove mortar from joints that abut area of stone removal to same depth as stone was removed. Remove loose mortar particles and other debris from surfaces to be bonded and surfaces of adjacent stone units that will receive mortar by cleaning with stiff-fiber brush.
3. Cut and trim partial replacement to accurately fit area where material was removed from backing stone. Fabricate to size required to produce joints between partial replacement and backing stone of no more than 1/16 inch (1.6 mm) in width, and joints between partial replacement and other stones that match existing joints between stones. Cut partial replacement so that, when it is set in final position, natural bedding planes will match the orientation of bedding planes of the backing stone unless otherwise indicated.
4. Pinning: Before applying adhesive, prepare for mechanical anchorage consisting of 1/4-inch- (6-mm-) diameter, plain **OR** threaded, **as directed**, stainless-steel pins set into 1/4-inch- (6-mm-) diameter holes drilled at a 45-degree downward angle through face of partial replacement and into backing stone. Center and space pins between 3 and 5 inches (75 and 125 mm) apart and at least 2 inches (50 mm) from any edge. Insert pins at least 2 inches (50 mm) into backing stone and 2 inches (50 mm) into partial replacement with end countersunk at least 3/4 inch (19 mm) from exposed face of partial replacement.
5. Concealed Pinning: Before applying adhesive, prepare for concealed mechanical anchorage consisting of 1/4-inch- (6-mm-) diameter, plain **OR** threaded, **as directed**, stainless-steel pins set into 1/4-inch- (6-mm-) diameter holes drilled into backing stone and into, but not through, the partial replacement. Center and space pins between 3 and 5 inches (75 and 125 mm) apart and at least 2 inches (50 mm) from any edge. Insert pins at least 2 inches (50 mm) into backing stone and 2 inches (50 mm) into partial replacement, but no closer than 3/4 inch (19 mm) from exposed face of partial replacement.
6. Apply stone-to-stone adhesive to comply with adhesive manufacturer's written instructions. Coat bonding surfaces of backing stone and partial replacement, completely filling all crevices and voids.
7. Apply partial replacement while adhesive is still tacky and hold securely in place until adhesive has cured. Use shims, clamps, wedges, or other devices as necessary to align face of partial replacement with face of backing stone.
8. Clean adhesive residue from exposed surfaces and patch chipped areas and exposed drill holes as specified in "Stone Patching" Article.

F. Stone Plug Repair

1. Remove cylindrical piece of damaged stone by core-drilling perpendicular to stone surface.
2. Prepare a replacement plug by core-drilling replacement stone. Use a drill sized to produce a core that will fit into hole drilled in damaged stone with only minimum gap necessary for



adhesive. Cut and install plug so that, when it is set in final position, natural bedding planes will match the orientation of bedding planes of the backing stone unless otherwise indicated.

3. Apply stone-to-stone adhesive to comply with adhesive manufacturer's written instructions. Coat bonding surfaces of existing stone and plug, completely filling all crevices and voids.
4. Apply plug while adhesive is still tacky and hold securely in place until adhesive has cured.
5. Clean adhesive residue from exposed surfaces.

G. Stone-Fragment Repair

1. Carefully remove cracked or fallen stone fragment indicated to be repaired. Reuse only stone fragment that is in sound condition.
2. Remove soil, loose particles, mortar, and other debris or foreign material, from fragment surfaces to be bonded and from parent stone where fragment had broken off, by cleaning with stiff-fiber brush.
3. Pinning: Before applying adhesive, prepare for mechanical anchorage consisting of 1/4-inch- (6-mm-) diameter, plain **OR** threaded, **as directed**, stainless-steel pins set into 1/4-inch- (6-mm-) diameter holes drilled at a 45-degree downward angle through face of fragment and into parent stone. Center and space pins between 3 and 5 inches (75 and 125 mm) apart and at least 2 inches (50 mm) from any edge. Insert pins at least 2 inches (50 mm) into parent stone and 2 inches (50 mm) into fragment with end countersunk at least 3/4 inch (19 mm) from exposed face of fragment.
4. Concealed Pinning: Before applying adhesive, prepare for concealed mechanical anchorage consisting of 1/4-inch- (6-mm-) diameter, plain **OR** threaded, **as directed**, stainless-steel pins set into 1/4-inch- (6-mm-) diameter holes drilled into parent stone and into, but not through, the fragment. Center and space pins between 3 and 5 inches (75 and 125 mm) apart and at least 2 inches (50 mm) from any edge. Insert pins at least 2 inches (50 mm) into parent stone and 2 inches (50 mm) into fragment, but no closer than 3/4 inch (19 mm) from exposed face of fragment.
5. Apply stone-to-stone adhesive to comply with adhesive manufacturer's written instructions. Coat bonding surfaces of fragment and parent stone, completely filling all crevices and voids.
6. Fit stone fragment onto parent stone while adhesive is still tacky and hold fragment securely in place until adhesive has cured. Use shims, clamps, wedges, or other devices as necessary to align face of fragment with face of parent stone.
7. Clean adhesive residue from exposed surfaces and patch chipped areas and exposed drill holes as specified in "Stone Patching" Article.

H. Crack Injection

1. General: Comply with cementitious crack-filler manufacturer's written instructions.
2. Drill 1/4-inch- (6-mm-) diameter injection holes as follows:
 - a. Transverse Cracks Less Than 3/8 inch (9 mm) Wide: Drill holes through center of crack at 12 to 18 inches (300 to 500 mm) o.c.
 - b. Transverse Cracks More Than 3/8 inch (9 mm) Wide: Drill holes through center of crack at 18 to 36 inches (500 to 900 mm) o.c.
 - c. Delaminations: Drill holes at approximately 18 inches (500 mm) o.c. both vertically and horizontally.
 - d. Drill holes 2 inches (50 mm) deep. Where possible drill holes in mortar joints.
3. Clean out drill holes and cracks with compressed air and water. Remove dirt and organic matter, loose material, sealants, and failed crack repair materials.
4. Place plastic injection ports in drilled holes and seal face of cracks between injection ports with clay or other nonstaining, removable plugging material. Leave openings at upper ends of cracks for air release.
5. Inject cementitious crack filler through ports sequentially, beginning at one end of area and working to opposite end; where possible, begin at lower end of injection area and work upward. Inject filler until it extrudes from adjacent ports. After port has been injected, plug with clay or other suitable material and begin injecting filler at adjacent port, repeating process until all ports have been injected.



6. Clean cementitious crack filler from face of stone before it sets by scrubbing with water.
7. After cementitious crack filler has set, remove injection ports, plugging material, and excess filler. Patch injection holes and surface of cracks as specified in "Stone Patching" Article.

I. Stone Patching

1. Patch the following stone units unless another type of replacement or repair is indicated:
 - a. Units indicated to be patched.
 - b. Units with holes.
 - c. Units with chipped edges or corners.
 - d. Units with small areas of deep deterioration.
2. Remove and replace existing patches unless otherwise indicated or approved by the Owner.
3. Remove deteriorated material and remove adjacent material that has begun to deteriorate. Carefully remove additional material so patch will not have feathered edges but will have square or slightly undercut edges on area to be patched and will be at least 1/4 inch (6 mm) thick, but not less than recommended by patching compound manufacturer.
4. Mask adjacent mortar joint or rake out for repointing if patch will extend to edge of stone unit.
5. Mix patching compound in individual batches to match each stone unit being patched. Combine one or more colors of patching compound, as needed, to produce exact match.
6. Brush-coat stone surfaces with slurry coat of patching compound according to manufacturer's written instructions.
7. Place patching compound in layers as recommended by patching compound manufacturer, but not less than 1/4 inch (6 mm) or more than 2 inches (50 mm) thick. Roughen surface of each layer to provide a key for next layer.
 - a. Trowel, scrape, or carve surface of patch to match texture and surrounding surface plane or contour of the stone. Shape and finish surface before or after curing, as determined by testing, to best match existing stone.
 - b. Build patch up 1/4 inch (6 mm) above surrounding stone and carve surface to match adjoining stone after patching compound has hardened.
8. Keep each layer damp for 72 hours or until patching compound has set.
9. Remove and replace patches with hairline cracks or that show separation from stone at edges, and those that do not match adjoining stone in color or texture.

J. Cleaning Stone, General

1. Proceed with cleaning in an orderly manner; work from bottom to top **OR** top to bottom, **as directed**, of each scaffold width and from one end of each elevation to the other. Ensure that dirty residues and rinse water will not wash over cleaned, dry surfaces.
2. Use only those cleaning methods indicated for each stone material and location.
 - a. Do not use wire brushes or brushes that are not resistant to chemical cleaner being used. Do not use plastic-bristle brushes if natural-fiber brushes will resist chemical cleaner being used.
 - b. Use spray equipment that provides controlled application at volume and pressure indicated, measured at spray tip. Adjust pressure and volume to ensure that cleaning methods do not damage stone.
 - 1) Equip units with pressure gages.
 - c. For chemical-cleaner spray application, use low-pressure tank or chemical pump suitable for chemical cleaner indicated, equipped with cone-shaped spray tip.
 - d. For water-spray application, use fan-shaped spray tip that disperses water at an angle of 25 to 50 degrees.
 - e. For high-pressure water-spray application, use fan-shaped spray tip that disperses water at an angle of at least 40 degrees.
 - f. For heated water-spray application, use equipment capable of maintaining temperature between 140 and 160 deg F (60 and 71 deg C) at flow rates indicated.
 - g. For steam application, use steam generator capable of delivering live steam at nozzle.
3. Perform each cleaning method indicated in a manner that results in uniform coverage of all surfaces, including corners, moldings, and interstices, and that produces an even effect without streaking or damaging stone surfaces.



4. Water Application Methods:
 - a. Water-Soak Application: Soak stone surfaces by applying water continuously and uniformly to limited area for time indicated. Apply water at low pressures and low volumes in multiple fine sprays using perforated hoses or multiple spray nozzles. Erect a protective enclosure constructed of polyethylene sheeting to cover area being sprayed.
 - b. Water-Spray Applications: Unless otherwise indicated, hold spray nozzle at least 6 inches (150 mm) from surface of stone and apply water in horizontal back and forth sweeping motion, overlapping previous strokes to produce uniform coverage.
 5. Steam Cleaning: Apply steam to stone surfaces at the very low pressures indicated for each type of stonework. Hold nozzle at least 6 inches (150 mm) from surface of stone and apply steam in horizontal back and forth sweeping motion, overlapping previous strokes to produce uniform coverage.
 6. Chemical-Cleaner Application Methods: Apply chemical cleaners to stone surfaces to comply with chemical-cleaner manufacturer's written instructions; use brush or spray application. Do not spray apply at pressures exceeding 50 psi (345 kPa), **unless directed otherwise**. Do not allow chemicals to remain on surface for periods longer than those indicated or recommended by manufacturer.
 7. Rinse off chemical residue and soil by working upward from bottom to top of each treated area at each stage or scaffold setting. Periodically during each rinse, test pH of rinse water running off of cleaned area to determine that chemical cleaner is completely removed.
 - a. Apply neutralizing agent and repeat rinse if necessary to produce tested pH of between 6.7 and 7.5.
 8. After cleaning is complete, remove protection no longer required. Remove tape and adhesive marks.
- K. Preliminary Cleaning
1. Removing Plant Growth: Completely remove visible plant, moss, and shrub growth from stone surfaces. Carefully remove plants, creepers, and vegetation by cutting at roots and allowing to dry as long as possible before removal. Remove loose soil or debris from open joints to whatever depth they occur.
 2. Preliminary Cleaning: Before beginning general cleaning, remove extraneous substances that are resistant to cleaning methods being used. Extraneous substances include paint, calking, asphalt, and tar.
 - a. Carefully remove heavy accumulations of material from surface of stone with sharp chisel. Do not scratch or chip stone surface.
 - b. Remove paint and calking with alkaline paint remover.
 - 1) Comply with requirements in "Paint Removal" Article.
 - 2) Repeat application up to two times if needed.
 - c. Remove asphalt and tar with solvent-type paint remover.
 - 1) Comply with requirements in "Paint Removal" Article.
 - 2) Apply paint remover only to asphalt and tar by brush without prewetting.
 - 3) Allow paint remover to remain on surface for 10 to 30 minutes.
 - 4) Repeat application if needed.
- L. Paint Removal
1. Paint Removal with Alkaline Paste Paint Remover:
 - a. Remove loose and peeling paint using low **OR** medium **OR** high, **as directed**,-pressure spray, scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
 - b. Apply paint remover to dry, painted stone with brushes.
 - c. Allow paint remover to remain on surface for period recommended by manufacturer.
 - d. Rinse with cold **OR** hot, **as directed**, water applied by low **OR** medium **OR** high, **as directed**,-pressure spray to remove chemicals and paint residue.
 - e. Repeat process if necessary to remove all paint.
 - f. Apply acidic cleaner or manufacturer's recommended afterwash to stone, while surface is still wet, using low-pressure spray equipment or soft-fiber brush. Let cleaner or afterwash



- remain on surface as a neutralizing agent for period recommended by chemical-cleaner or afterwash manufacturer.
- g. Rinse with cold water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove chemicals and soil.
2. Paint Removal with Covered or Skin-Forming Alkaline Paint Remover:
 - a. Remove loose and peeling paint using low **OR** medium **OR** high, **as directed**, -pressure spray, scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
 - b. Apply paint remover to dry, painted stone with trowel, spatula, or as recommended by manufacturer.
 - c. Apply cover, if required by manufacturer, per manufacturer's written instructions.
 - d. Allow paint remover to remain on surface for period recommended by manufacturer or as determined in test panels.
 - e. Scrape off paint and remover and collect for disposal.
 - f. Rinse with cold **OR** hot, **as directed**, water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove chemicals and paint residue.
 - g. Use alkaline paste paint remover, according to "Paint Removal with Alkaline Paste Paint Remover" Paragraph, if necessary to remove remaining paint.
 - h. Apply acidic cleaner or manufacturer's recommended afterwash to stone, while surface is still wet, using low-pressure spray equipment or soft-fiber brush. Let cleaner or afterwash remain on surface as a neutralizing agent for period recommended by chemical-cleaner or afterwash manufacturer.
 - i. Rinse with cold water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove chemicals and soil.
 3. Paint Removal with Solvent-Type Paint Remover:
 - a. Remove loose and peeling paint using low **OR** medium **OR** high, **as directed**, -pressure spray, scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
 - b. Apply thick coating of paint remover to painted stone with natural-fiber cleaning brush, deep-nap roller, or large paint brush.
 - c. Allow paint remover to remain on surface for period recommended by manufacturer. Agitate periodically with stiff-fiber brush.
 - d. Rinse with cold **OR** hot, **as directed**, water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove chemicals and paint residue.
- M. Cleaning Stonework
1. Cold-Water Soak:
 - a. Apply cold water by intermittent spraying to keep surface moist.
 - b. Use perforated hoses or other means that will apply a fine water mist to entire surface being cleaned.
 - c. Apply water in cycles with at least 30 minutes between cycles.
 - d. Continue spraying until surface encrustation has softened sufficiently to permit its removal by water wash, as indicated by cleaning tests.
 - e. Continue spraying for 72 hours.
 - f. Remove soil and softened surface encrustation from stone with cold water applied by low-pressure spray.
 2. Cold-Water Wash: Use cold water applied by low **OR** medium **OR** high, **as directed**, -pressure spray.
 3. Hot-Water Wash: Use hot water applied by low **OR** medium **OR** high, **as directed**, -pressure spray.
 4. Steam Cleaning: Apply steam at very low pressures not exceeding 30 psi (207 kPa) **OR** 80 psi (550 kPa), **as directed**. Remove dirt softened by steam with wood scrapers, stiff-nylon or -fiber brushes, or cold-water wash, as indicated by cleaning tests.
 5. Detergent Cleaning:
 - a. Wet stone with cold **OR** hot, **as directed**, water applied by low-pressure spray.
 - b. Scrub stone with detergent solution using medium-soft brushes until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes to remove soil from mortar



- joints and crevices. Dip brush in solution often to ensure that adequate fresh detergent is used and that stone surface remains wet.
- c. Rinse with cold **OR** hot, **as directed**, water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove detergent solution and soil.
 - d. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.
6. Mold, Mildew, and Algae Removal:
- a. Wet stone with cold **OR** hot, **as directed**, water applied by low-pressure spray.
 - b. Apply mold, mildew, and algae remover by brush or low-pressure spray.
 - c. Scrub stone with medium-soft brushes until mold, mildew, and algae are thoroughly dislodged and can be removed by rinsing. Use small brushes for mortar joints and crevices. Dip brush in mold, mildew, and algae remover often to ensure that adequate fresh cleaner is used and that stone surface remains wet.
 - d. Rinse with cold **OR** hot, **as directed**, water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove mold, mildew, and algae remover and soil.
 - e. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.
7. Nonacidic Gel Chemical Cleaning:
- a. Wet stone with cold **OR** hot, **as directed**, water applied by low-pressure spray.
 - b. Apply nonacidic gel cleaner in 1/8-inch (3-mm) thickness by brush, working into joints and crevices. Apply quickly and do not brush out excessively so area will be uniformly covered with fresh cleaner and dwell time will be uniform throughout area being cleaned.
 - c. Let cleaner remain on surface for period indicated below:
 - 1) As recommended by chemical-cleaner manufacturer.
 - 2) As established by mockup.
 - d. Remove bulk of nonacidic gel cleaner by squeegeeing into containers for disposal.
 - e. Rinse with cold **OR** hot, **as directed**, water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove chemicals and soil.
 - f. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.
8. Nonacidic Liquid Chemical Cleaning:
- a. Wet stone with cold **OR** hot, **as directed**, water applied by low-pressure spray.
 - b. Apply cleaner to stone in two applications, **as directed**, by brush or low-pressure spray. Let cleaner remain on surface for period indicated below:
 - 1) As recommended by chemical-cleaner manufacturer.
 - 2) As established by mockup.
 - 3) Two to three minutes.
 - c. Rinse with cold **OR** hot, **as directed**, water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove chemicals and soil.
 - d. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.
9. Mild Acidic **OR** Acidic, **as directed**, Chemical Cleaning:
- a. Wet stone with cold water applied by low-pressure spray.
 - b. Apply cleaner to stone in two applications, **as directed**, by brush or low-pressure spray. Let cleaner remain on surface for period indicated below:
 - 1) As recommended by chemical-cleaner manufacturer.
 - 2) As established by mockup.
 - 3) Two to three minutes.
 - c. Rinse with cold water applied by low **OR** medium **OR** high, **as directed**, -pressure spray to remove chemicals and soil.
 - d. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.



10. One-Part Limestone Chemical Cleaning:
 - a. Wet stone with cold **OR** hot, **as directed**, water applied by low-pressure spray.
 - b. Apply cleaner to stone by brush or low-pressure spray. Let cleaner remain on surface for period recommended by chemical-cleaner manufacturer.
 - c. Immediately repeat application of one-part limestone cleaner as indicated above over the same area.
 - d. Rinse with cold **OR** hot, **as directed**, water applied by medium-pressure spray to remove chemicals and soil.
11. Two-Part Limestone Chemical Cleaning:
 - a. Wet stone with cold **OR** hot, **as directed**, water applied by low-pressure spray.
 - b. Apply alkaline prewash cleaner to stone by brush or roller. Let cleaner remain on surface for period recommended by chemical-cleaner manufacturer unless otherwise indicated.
 - c. Rinse with cold **OR** hot, **as directed**, water applied by medium-pressure spray to remove chemicals and soil.
 - d. Apply acidic afterwash cleaner to stone in two applications, **as directed**, while surface is still wet, using low-pressure spray equipment, deep-nap roller or soft-fiber brush. Let neutralizer remain on surface for period recommended by manufacturer unless otherwise indicated.
 - e. Rinse with cold water applied by medium-pressure spray to remove chemicals and soil.
 - f. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once.

N. Repointing Stonework

1. Rake out and repoint joints to the following extent:
 - a. All joints in areas indicated.
 - b. Joints where mortar is missing or where they contain holes.
 - c. Cracked joints where cracks can be penetrated at least 1/4 inch (6 mm) by a knife blade 0.027 inch (0.7 mm) thick.
 - d. Cracked joints where cracks are 1/16 inch (1.6 mm) **OR** 1/8 inch (3 mm), **as directed**, or more in width and of any depth.
 - e. Joints where they sound hollow when tapped by metal object.
 - f. Joints where they are worn back 1/4 inch (6 mm) or more from surface.
 - g. Joints where they are deteriorated to point that mortar can be easily removed by hand, without tools.
 - h. Joints where they have been filled with substances other than mortar.
 - i. Joints indicated as sealant-filled joints.
2. Do not rake out and repoint joints where not required.
3. Rake out joints as follows, according to procedures demonstrated in approved mockup:
 - a. Remove mortar from joints to depth of joint width plus 1/8 inch (3 mm) **OR** 2 times joint width **OR** 2-1/2 times joint width, **as directed**, but not less than 1/2 inch (13 mm) or not less than that required to expose sound, unweathered mortar.
 - b. Remove mortar from stone surfaces within raked-out joints to provide reveals with square backs and to expose stone for contact with pointing mortar. Brush, vacuum, or flush joints to remove dirt and loose debris.
 - c. Do not spall edges of stone units or widen joints. Replace or patch damaged stone units as directed by the Owner.
 - 1) Cut out mortar by hand with chisel and resilient mallet. Do not use power-operated grinders without the Owner's written approval based on approved quality-control program.
 - 2) Cut out center of mortar bed joints using angle grinders with diamond-impregnated metal blades. Remove remaining mortar by hand with chisel and resilient mallet. Strictly adhere to approved quality-control program.
4. Notify the Owner of unforeseen detrimental conditions including voids in mortar joints, cracks, loose stone, rotted wood, rusted metal, and other deteriorated items.
5. Pointing with Mortar:



- a. Rinse joint surfaces with water to remove dust and mortar particles. Time rinsing application so, at time of pointing, joint surfaces are damp but free of standing water. If rinse water dries, dampen joint surfaces before pointing.
 - b. Apply pointing mortar first to areas where existing mortar was removed to depths greater than surrounding areas. Apply in layers not greater than 3/8 inch (9 mm) until a uniform depth is formed. Fully compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.
 - c. After low areas have been filled to same depth as remaining joints, point all joints by placing mortar in layers not greater than 3/8 inch (9 mm). Fully compact each layer and allow to become thumbprint hard before applying next layer. Where existing stone has worn or rounded edges, slightly recess finished mortar surface below face of stone to avoid widened joint faces. Take care not to spread mortar beyond joint edges onto exposed stone surfaces or to featheredge the mortar.
 - d. When mortar is thumbprint hard, tool joints to match original appearance of joints as demonstrated in approved mockup. Remove excess mortar from edge of joint by brushing.
 - e. Cure mortar by maintaining in thoroughly damp condition for at least 72 consecutive hours, including weekends and holidays.
 - 1) Acceptable curing methods include covering with wet burlap and plastic sheeting, periodic hand misting, and periodic mist spraying using system of pipes, mist heads, and timers.
 - 2) Adjust curing methods to ensure that pointing mortar is damp throughout its depth without eroding surface mortar.
 - f. Hairline cracking within the mortar or mortar separation at edge of a joint is unacceptable. Completely remove such mortar and repoint.
6. Pointing with Sealant:
- a. After raking out, keep joints dry and free of mortar and debris.
 - b. Clean and prepare joint surfaces according to Division 07 Section "Joint Sealants". Prime joint surfaces unless sealant manufacturer recommends against priming. Do not allow primer to spill or migrate onto adjoining surfaces.
 - c. Fill sealant joints with specified joint sealant according to Division 07 Section "Joint Sealants" and the following:
 - 1) Install cylindrical sealant backing beneath the sealant except where space is insufficient. There, install bond-breaker tape.
 - 2) Install sealant using only proven installation techniques that will ensure that sealant will be deposited in a uniform, continuous ribbon, without gaps or air pockets, and with complete wetting of the joint bond surfaces equally on both sides. Fill joint flush with surrounding stonework and matching the contour of adjoining mortar joints.
 - 3) Install sealant as recommended by sealant manufacturer but within the following general limitations, measured at the center (thin) section of the bead:
 - a) Fill joints to a depth equal to joint width, but not more than 1/2 inch (13 mm) deep or less than 1/4 inch (6 mm) deep.
 - 4) Immediately after first tooling, apply ground-mortar aggregate to sealant, gently pushing aggregate into the surface of sealant. Retool sealant to form smooth, uniform beads, slightly concave. Remove excess sealant and aggregate from surfaces adjacent to joint.
 - 5) Do not allow sealant to overflow or spill onto adjoining surfaces, or to migrate into the voids of adjoining surfaces, particularly rough textures. Remove excess and spillage of sealant promptly as the work progresses. Clean adjoining surfaces by the means necessary to eliminate evidence of spillage, without damage to adjoining surfaces or finishes, as demonstrated in an approved mockup.
 - d. Cure sealant according to Division 07 Section "Joint Sealants".
7. Where repointing work precedes cleaning of existing stone, allow mortar to harden at least 30 days before beginning cleaning work.

O. Stone Consolidation Treatment



1. Apply treatment to clean, dry surfaces according to manufacturer's written instructions. Remove areas of blind exfoliation, delamination, and flaking before applying.
 2. Apply in cycles to small sections of stonework, not more than 100 sq. ft. (9 sq. m) in area. Each cycle shall consist of 3 successive saturating applications, applied at 5- to 15-minute intervals depending on drying conditions.
 3. Apply by low-pressure spray to point of rejection in each application. Apply from bottom of section to top.
 4. Apply 3 cycles, allowing treated surface to dry for 60 to 90 minutes between cycles.
 5. Protect treated surfaces from rain for 48 hours after treatment.
 6. Allow treated surfaces to dry for at least 21 days before repointing, patching, or applying water repellents or sealants.
- P. Final Cleaning
1. After mortar has fully hardened, thoroughly clean exposed stone surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water, spray applied at low pressure.
 - a. Do not use metal scrapers or brushes.
 - b. Do not use acidic or alkaline cleaners.
 2. Wash adjacent woodwork and other nonstone surfaces. Use detergent and soft brushes or cloths.
 3. Clean mortar and debris from roof; remove debris from gutters and downspouts. Rinse off roof and flush gutters and downspouts.
 4. Sweep and rake adjacent pavement and grounds to remove mortar and debris. Where necessary, pressure wash pavement surfaces to remove mortar, dust, dirt, and stains.
- Q. Field Quality Control
1. Inspectors: Engage qualified independent inspectors to perform inspections and prepare test reports. Allow inspectors use of lift devices and scaffolding, as needed, to perform inspections.
 2. the Owner's Project Representatives: the Owner will assign Project representatives to help carry out the Owner's responsibilities at the site, including observing progress and quality of portion of the Work completed. Allow the Owner's Project representatives use of lift devices and scaffolding, as needed, to observe progress and quality of portion of the Work completed.
 3. Notify inspectors and the Owner's Project representatives in advance of times when lift devices and scaffolding will be relocated. Do not relocate lift devices and scaffolding until inspectors and the Owner's Project representatives have had reasonable opportunity to make inspections and observations of work areas at lift device or scaffold location.

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Task	Specification	Specification Description
04 01 40 52	04 01 20 52	Clay Masonry Restoration And Cleaning



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SECTION 04 01 40 91 - STONE MASONRY

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for stone masonry. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes the following applications of stone masonry:
 - a. Anchored or Adhered to concrete backup.
 - b. Anchored or Adhered to unit masonry backup.
 - c. Anchored or Adhered to wood framing and sheathing.
 - d. Anchored or Adhered to cold-formed metal framing and sheathing.

C. Submittals

1. Product Data: For each type of product indicated.
 - a. For stone varieties proposed for use on Project, include test data indicating compliance with physical properties specified or required by referenced ASTM standards.
2. Samples:
 - a. For each stone type indicated.
 - b. For each color of mortar required.

D. Delivery, Storage, And Handling

1. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
2. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
3. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.
4. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

E. Project Conditions

1. Protection of Stone Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed stone masonry when construction is not in progress.
 - a. Extend cover a minimum of 24 inches (600 mm) down both sides and hold cover securely in place.
2. Stain Prevention: Immediately remove mortar and soil to prevent them from staining the face of stone masonry.
 - a. Protect base of walls from rain-splashed mud and mortar splatter by coverings spread on the ground and over the wall surface.
 - b. Protect sills, ledges, and projections from mortar droppings.
 - c. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - d. Turn scaffold boards near the wall on edge at end of each day to prevent rain from splashing mortar and dirt on completed stone masonry.
3. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace stone masonry damaged by



frost or freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

- a. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
4. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1.2 PRODUCTS

A. Granite

1. Granite: Comply with ASTM C 615.

B. Limestone

1. Limestone: Comply with ASTM C 568.

C. Quartz-Based Stone

1. Quartz-Based Stone: Comply with ASTM C 616, Classification I Sandstone **OR** II Quartzitic Sandstone **OR** III Quartzite, **as directed**.

D. Mortar Materials

1. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
 - a. Low-Alkali Cement: Not more than 0.60 percent total alkali when tested according to ASTM C 114.
2. Hydrated Lime: ASTM C 207, Type S.
3. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or III, and hydrated lime complying with ASTM C 207.
4. Mortar Cement: ASTM C 1329.
5. Masonry Cement: ASTM C 91.
6. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in stone masonry mortar.
7. Colored Cement Product: Packaged blend made from portland cement and lime **OR** masonry cement **OR** mortar cement, **as directed**, and mortar pigments, all complying with specified requirements, and containing no other ingredients.
 - a. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
8. Aggregate: ASTM C 144 and as follows:
 - a. For pointing mortar, use aggregate graded with 100 percent passing No. 16 (1.18-mm) sieve.
 - b. White Aggregates: Natural white sand or ground white stone.
 - c. Colored Aggregates: Natural-colored sand or ground marble, granite, or other sound stone; of color necessary to produce required mortar color.
9. Latex Additive: Manufacturer's standard **OR** acrylic-resin **OR** styrene-butadiene-rubber, **as directed**, water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement mortar bed, and not containing a retarder.
10. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
11. Water: Potable.

E. Veneer Anchors



1. Materials:
 - a. Hot-Dip Galvanized-Steel Wire: ASTM A 82, with ASTM A 153/A 153M, Class B-2.
 - b. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304 **OR** Type 316, **as directed**.
 - c. Hot-Dip Galvanized-Steel Sheet: ASTM A 1008/A 1008M, cold-rolled, carbon-steel sheet hot-dip galvanized after fabrication to comply with ASTM A 153/A 153M, Class B-2.
 - d. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304 **OR** Type 316, **as directed**.
2. Size: Sufficient to extend at least halfway, but not less than 1-1/2 inches (38 mm), through stone masonry and with at least 5/8-inch (16-mm) cover on outside face.
3. Wire Veneer Anchors: Wire ties formed from W1.7 or 0.148-inch- (3.8-mm-) diameter, hot-dip galvanized **OR** stainless, **as directed**, -steel wire.
4. Corrugated-Metal Veneer Anchors: Not less than 0.030-inch- (0.76-mm-) thick by 7/8-inch- (22-mm-) wide hot-dip galvanized **OR** stainless, **as directed**, -steel sheet with corrugations having a wavelength of 0.3 to 0.5 inch (7.6 to 13 mm) and an amplitude of 0.06 to 0.10 inch (1.5 to 2.5 mm).
5. Adjustable, Screw-Attached Veneer Anchors: Units consisting of a wire tie section and a metal anchor section that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:
 - a. Structural Performance Characteristics: Capable of withstanding a 100-lbf (445-N) load in both tension and compression without deforming or developing play in excess of 0.05 inch (1.3 mm).
 - b. Anchor Section: Rib-stiffened, sheet metal plate with screw holes top and bottom, 2-3/4 inches (70 mm) wide by 3 inches (75 mm) high; with projecting tabs having slotted holes for inserting vertical legs of wire tie specially formed to fit veneer anchor section.
 - c. Anchor Section: Sheet metal plate, 1-1/4 inches (32 mm) wide by 6 inches (150 mm) **OR** 9 inches (225 mm), **as directed**, long, with screw holes top and bottom and with raised rib-stiffened strap, 5/8 inch (16 mm) wide by 3-5/8 inches (92 mm) **OR** 5-1/2 inches (140 mm), **as directed**, long, stamped into center to provide a slot between strap and plate for inserting wire tie.
 - d. Anchor Section: Gasketed sheet metal plate, 1-1/4 inches (32 mm) wide by 6 inches (150 mm) long, with screw holes top and bottom; top and bottom ends bent to form pronged legs of length to match thickness of insulation or sheathing; and raised rib-stiffened strap, 5/8 inch (16 mm) wide by 6 inches (150 mm) long, stamped into center to provide a slot between strap and plate for inserting wire tie. Provide anchor manufacturer's standard, self-adhering, modified bituminous gaskets manufactured to fit behind anchor plate and extend beyond pronged legs.
 - e. Anchor Section: Zinc-alloy barrel section with flanged head with eye and corrosion-resistant, self-drilling screw. Eye designed to receive wire tie and to serve as head for drilling fastener into framing. Barrel length to suit sheathing thickness, allowing screw to seat directly against framing with flanged head covering hole in sheathing.
 - f. Fabricate sheet metal anchor sections and other sheet metal parts from 0.067-inch- (1.7-mm-) thick, steel sheet, galvanized after fabrication **OR** 0.097-inch- (2.5-mm-) thick, steel sheet, galvanized after fabrication **OR** 0.078-inch- (2.0-mm-) thick, stainless-steel sheet **OR** 0.109-inch- (2.8-mm-) thick, stainless-steel sheet, **as directed**.
 - g. Wire Ties: Triangular-, rectangular-, or T-shaped wire ties fabricated from 0.188-inch- (4.8-mm-) **OR** 0.25-inch- (6.4-mm-), **as directed**, diameter, hot-dip galvanized **OR** stainless, **as directed**, -steel wire.
6. Seismic Veneer Anchors: Units consisting of a metal anchor section and a connector section designed to engage a continuous wire embedded in stone masonry mortar joint.
 - a. Structural Performance Characteristics: Capable of withstanding a 100-lbf (445-N) load in both tension and compression without deforming or developing play in excess of 0.05 inch (1.3 mm).
 - b. Anchor Section: Rib-stiffened, sheet metal plate with screw holes top and bottom, 2-3/4 inches (70 mm) wide by 3 inches (75 mm) high; with projecting tabs having slotted holes for inserting vertical leg of connector section.



- c. Connector Section: Rib-stiffened, sheet metal bent plate with down-turned leg designed to fit in anchor section slot and with integral tabs designed to engage continuous wire. Size connector to extend at least halfway through stone masonry but with at least 5/8-inch (16-mm) cover on outside face.
 - d. Anchor Section: Rib-stiffened, sheet metal plate with screw holes top and bottom, 2-3/4 inches (70 mm) wide by 3 inches (75 mm) high; with projecting tabs having slotted holes for inserting vertical legs of wire tie specially formed to fit anchor section. Size wire tie to extend at least 1-1/2 inches (38 mm) into stone masonry but with at least 5/8-inch (16-mm) cover on outside face.
 - e. Connector Section: Sheet metal clip welded to wire tie with integral tabs designed to engage continuous wire.
 - f. Anchor Section: Gasketed sheet metal plate, 1-1/4 inches (32 mm) wide by 6 inches (150 mm) long, with screw holes top and bottom; top and bottom ends bent to form pronged legs to bridge insulation or sheathing and contact studs; and raised rib-stiffened strap, 5/8 inch (16 mm) wide by 6 inches (150 mm) long, stamped into center to provide a slot between strap and plate for inserting wire tie. Provide anchor manufacturer's standard, self-adhering, modified bituminous gaskets manufactured to fit behind anchor plate and extend beyond pronged legs.
 - g. Connector Section: Triangular wire tie and rigid PVC extrusion with snap-in grooves for inserting continuous wire.
 - h. Fabricate sheet metal anchor sections and other sheet metal parts from 0.067-inch- (1.7-mm-) thick, steel sheet, galvanized after fabrication **OR** 0.097-inch- (2.5-mm-) thick, steel sheet, galvanized after fabrication **OR** 0.078-inch- (2.0-mm-) thick, stainless-steel sheet **OR** 0.109-inch- (2.8-mm-) thick, stainless-steel sheet, **as directed**.
 - i. Fabricate wire connector sections from 0.188-inch- (4.8-mm-) **OR** 0.25-inch- (6.4-mm-), **as directed**, diameter, hot-dip galvanized, carbon **OR** stainless, **as directed**, -steel wire.
 - j. Continuous Wire: 0.188-inch- (4.8-mm-) diameter, hot-dip galvanized **OR** stainless, **as directed**, -steel wire.
7. Polymer-Coated, Steel Drill Screws for Steel Studs: ASTM C 954 except manufactured with hex washer head and neoprene washer, No. 10 (4.8-mm diameter) by length required to penetrate steel stud flange with not less than 3 exposed threads, and with organic polymer coating with salt-spray resistance to red rust of more than 800 hours per ASTM B 117.
 8. Stainless-Steel Drill Screws for Steel Studs: Proprietary fastener consisting of carbon-steel drill point and 300 Series stainless-steel shank, complying with ASTM C 954 except manufactured with hex washer head and neoprene washer, No. 10 (4.8-mm diameter) by length required to penetrate steel stud flange with not less than three exposed threads.
 9. Polymer-Coated, Steel Drill Screws for Wood Studs: Self-drilling, bugle-head or wafer-head wood screws recommended by veneer anchor manufacturer for fastening to wood studs; not less than No. 10 (4.8-mm diameter), 1-1/2 inches (38 mm) long, and with organic polymer coating with salt-spray resistance to red rust of more than 500 hours per ASTM B 117.
 10. Polymer-Coated, Steel Tapping Screws for Concrete Masonry: Self-tapping screws with specially designed threads for tapping and wedging into masonry, with hex washer head and neoprene washer, 3/16-inch (4.8-mm) diameter by 1-1/2-inch (38-mm) length, and with organic polymer coating with salt-spray resistance to red rust of more than 800 hours per ASTM B 117.

F. Stone Trim Anchors

1. Stone Trim Anchors: Units fabricated with tabs or dowels designed to engage kerfs or holes in stone trim units and holes for fasteners or postinstalled anchor bolts for fastening to substrates or framing as indicated.
2. Materials: Fabricate anchors from stainless steel, ASTM A 240/A 240M, Type 304. Fabricate dowels from stainless steel, ASTM A 276, Type 304.
3. Fasteners for Stone Trim Anchors: Annealed stainless-steel bolts, nuts, and washers; ASTM F 593 (ASTM F 738M) for bolts and ASTM F 594 (ASTM F 836M) for nuts, Alloy Group 1 (A1).



4. Postinstalled Anchor Bolts for Fastening Stone Trim Anchors: Chemical anchors **OR** torque-controlled expansion anchors **OR** undercut anchors, **as directed**, made from stainless-steel components complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Alloy Group A1 or A4) for bolts and nuts; ASTM A 666 or ASTM A 276, Type 304 or 316, for anchors.
- G. Embedded Flashing Materials
1. Metal Flashing: Provide metal flashing, where flashing is exposed or partly exposed and where indicated, complying with SMACNA's "Architectural Sheet Metal Manual **OR** Division 07 Section "Sheet Metal Flashing And Trim", **as directed**, and as follows:
 - a. Stainless Steel: ASTM A 240/A 240M, Type 304, 0.016 inch (0.4 mm) thick.
 - b. Copper: ASTM B 370, Temper H00 or H01, cold-rolled copper sheet, 10-oz./sq. ft. (3-kg/sq. m) weight or 0.0135 inch (0.34 mm) thick for fully concealed flashing; 16-oz./sq. ft. (5-kg/sq. m) weight or 0.0216 inch (0.55 mm) thick elsewhere.
 - c. Fabricate continuous flashings in sections 96 inches (2400 mm) long minimum, but not exceeding 12 feet (3.6 m). Provide splice plates at joints of formed, smooth metal flashing.
 - d. Fabricate through-wall metal flashing embedded in masonry from stainless steel **OR** copper, **as directed**, with ribs at 3-inch (75-mm) intervals along length of flashing to provide an integral mortar bond.
 - e. Fabricate through-wall flashing with snaplock receiver on exterior face where indicated to receive counterflashing.
 - f. Fabricate through-wall flashing with drip edge where **OR** unless otherwise, **as directed**, indicated. Fabricate by extending flashing 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees and hemmed, **as directed**.
 - g. Fabricate through-wall flashing with sealant stop where **OR** unless otherwise, **as directed**, indicated. Fabricate by bending metal back on itself 3/4 inch (19 mm) at exterior face of wall and down into joint 3/8 inch (10 mm) to form a stop for retaining sealant backer rod.
 - h. Fabricate metal drip edges and sealant stops for ribbed metal flashing from plain metal flashing of same metal as ribbed flashing and extending at least 3 inches (75 mm) into wall with hemmed inner edge to receive ribbed flashing and form a hooked seam. Form hem on upper surface of metal so that completed seam will shed water.
 - i. Metal Drip Edges: Fabricate from stainless steel. Extend at least 3 inches (75 mm) into wall and 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees and hemmed, **as directed**.
 - j. Metal Flashing Terminations: Fabricate from stainless steel. Extend at least 3 inches (75 mm) into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch (19 mm) and down into joint 3/8 inch (10 mm) to form a stop for retaining sealant backer rod.
 - k. Metal Expansion-Joint Strips: Fabricate from stainless steel **OR** copper, **as directed**, to shapes indicated.
 2. Flexible Flashing: For flashing not exposed to the exterior, use one of the following unless otherwise indicated:
 - a. Copper-Laminated Flashing: 5-oz./sq. ft. (1.5-kg/sq. m) **OR** 7-oz./sq. ft. (2-kg/sq. m), **as directed**, copper sheet bonded with asphalt between 2 layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.
 - b. Asphalt-Coated Copper Flashing: 5-oz./sq. ft. (1.5-kg/sq. m) **OR** 7-oz./sq. ft. (2-kg/sq. m), **as directed**, copper sheet coated with flexible asphalt. Use only where flashing is fully concealed in masonry.
 - c. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.030 inch (0.8 mm) **OR** 0.040 inch (1.0 mm), **as directed**.
 - d. Elastomeric Thermoplastic Flashing: Composite flashing product consisting of a polyester-reinforced ethylene interpolymers alloy as follows:
 - 1) Monolithic Sheet: Elastomeric thermoplastic flashing, 0.040 inch (1.0 mm) thick.



- 2) Self-Adhesive Sheet: Elastomeric thermoplastic flashing, 0.025 inch (0.6 mm) thick, with a 0.015-inch- (0.4-mm-) thick coating of rubberized-asphalt adhesive.
- 3) Self-Adhesive Sheet with Drip Edge: Elastomeric thermoplastic flashing, 0.025 inch (0.6 mm) thick, with a 0.015-inch- (0.4-mm-) thick coating of rubberized-asphalt adhesive. Where flashing extends to face of masonry, rubberized-asphalt coating is held back approximately 1-1/2 inches (38 mm) from edge.
 - a) Color: Gray **OR** White **OR** Tan/buff **OR** Black, **as directed**.
- 4) Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.
- e. EPDM Flashing: Sheet flashing product made from ethylene-propylene-diene terpolymer, complying with ASTM D 4637, 0.040 inch (1.0 mm) thick.
3. Solder and Sealants for Sheet Metal Flashings
 - a. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
 - b. Solder for Copper: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.
 - c. Elastomeric Sealant: ASTM C 920, chemically curing urethane **OR** polysulfide **OR** silicone, **as directed**, sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
4. Adhesives, Primers, and Seam Tapes for Flexible Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

H. Miscellaneous Masonry Accessories

1. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene **OR** urethane **OR** PVC, **as directed**.
2. Cementitious Dampproofing: Cementitious formulations that are recommended by ILI and that are nonstaining to stone, compatible with joint sealants, and noncorrosive to veneer anchors and attachments.
3. Asphalt Dampproofing: Cut-back asphalt complying with ASTM D 4479, Type I **OR** asphalt emulsion complying with ASTM D 1227, Type III or IV, **as directed**.
4. Weep Hole/Vent Products: Use one of the following unless otherwise indicated:
 - a. Wicking Material: Absorbent rope, made from cotton **OR** UV-resistant synthetic fiber, **as directed**, 1/4 to 3/8 inch (6 to 10 mm) in diameter, in length required to produce 2-inch (50-mm) exposure on exterior and 18 inches (450 mm) in cavity behind stone masonry. Use only for weep holes.
 - b. Round Plastic Tubing: Medium-density polyethylene, 3/8-inch (10-mm) OD by thickness of stone masonry.
 - c. Rectangular Plastic Tubing: Clear butyrate, 3/8 by 1-1/2 inches (10 by 38 mm) by thickness of stone masonry.
 - d. Mesh Weep Holes/Vents: Free-draining mesh; made from polyethylene strands, full width of head joint and 2 inches (50 mm) high by thickness of stone masonry; in color selected from manufacturer's standard.
 - e. Aluminum Weep Holes/Vents: One-piece, L-shaped units made from sheet aluminum, designed to fit into head joint and consisting of vertical channel with louvers stamped in web and with top flap to keep mortar out of head joint; painted to comply with Division 07, before installation, in color approved to match that of mortar.
 - f. Vinyl Weep Holes/Vents: One-piece, offset, T-shaped units made from flexible, injection-molded PVC, designed to fit into head joint and consisting of louvered vertical leg, flexible wings to seal against ends of stone units, and top flap to keep mortar out of head joint; in color approved to match that of mortar.
5. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
 - a. Provide one of the following configurations:



- 1) Strips, full-depth of cavity and 10 inches (250 mm) wide, with dovetail shaped notches 7 inches (175 mm) deep that prevent mesh from being clogged with mortar droppings.
 - 2) Strips, not less than 3/4 inch (19 mm) **OR** 1-1/2 inches (38 mm), **as directed**, thick and 10 inches (250 mm) wide, with dimpled surface designed to catch mortar droppings and prevent weep holes from being clogged with mortar.
 - 3) Sheets or strips full depth of cavity and installed to full height of cavity.
 - 4) Sheets or strips not less than 3/4 inch (19 mm) **OR** 1 inch (25 mm), **as directed**, thick and installed to full height of cavity with additional strips 4 inches (100 mm) high at weep holes and thick enough to fill entire depth of cavity and prevent weep holes from being clogged with mortar.
6. Expanded Metal Lath: 3.4 lb/sq. yd. (1.8 kg/sq. m), self-furring, diamond-mesh lath complying with ASTM C 847. Fabricate from structural-quality, zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G60 (Z180).
 7. Woven-Wire Lath: ASTM C 1032, fabricated into 1-1/2-inch (38-mm) hexagonal-shaped mesh with minimum 0.0510-inch- (1.3-mm-) diameter, galvanized-steel wire.
 8. Welded-Wire Lath: ASTM C 933, fabricated into 2-by-2-inch (50-by-50-mm) mesh with minimum 0.0625-inch- (1.6-mm-) diameter, galvanized-steel wire.
 9. Lath Attachment Devices: Material and type required by ASTM C 1063 for installations indicated.
- I. Cavity-Wall Insulation
1. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV **OR** Type X, **as directed**, closed-cell product extruded with an integral skin.
 2. Extruded-Polystyrene Board Insulation with Increased R-Value: ASTM C 578, Type IV, but with an aged thermal resistance (R-value) for 1-inch (25-mm) thickness of 5.6 deg F x h x sq. ft./Btu at 75 deg F (1.0 K x sq. m/W at 24 deg C) at 5 years; closed-cell product with a carbon-black filler and extruded with an integral skin.
 3. Molded-Polystyrene Board Insulation: ASTM C 578, Type I.
 4. Polyisocyanurate Board Insulation: ASTM C 1289, Type I (aluminum-foil faced), Class 2 (glass-fiber reinforced).
 5. Adhesive: Type recommended by insulation board manufacturer for application indicated.
- J. Masonry Cleaners
1. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar and grout stains, efflorescence, and other new construction stains from stone masonry surfaces without discoloring or damaging masonry surfaces; expressly approved for intended use by cleaner manufacturer and stone producer.
- K. Mortar Mixes
1. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
 - a. Do not use calcium chloride.
 - b. Limit cementitious materials in mortar to portland cement **OR** mortar cement, **as directed**, and lime.
 - c. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
 - d. Mixing Pointing Mortar: Thoroughly mix cementitious and aggregate materials together before adding water. Then mix again, adding only enough water to produce a damp, unworkable mix that will retain its form when pressed into a ball. Maintain mortar in this dampened condition for one to two hours. Add remaining water in small portions until mortar reaches desired consistency. Use mortar within 30 minutes of final mixing; do not retemper or use partially hardened material.
 2. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in the form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.



3. Mortar for Stone Masonry: Comply with ASTM C 270, Proportion **OR** Property, **as directed**, Specification.
 - a. Mortar for Setting Stone: Type S **OR** Type N, **as directed**.
 - b. Mortar for Pointing Stone: Type N **OR** Type O, **as directed**.
4. Latex-Modified Portland Cement Setting Mortar: Proportion and mix portland cement, aggregate, and latex additive to comply with latex-additive manufacturer's written instructions.
5. Cement-Paste Bond Coat: Mix either neat cement and water or cement, sand, and water to a consistency similar to that of thick cream.
 - a. For latex-modified portland cement setting-bed mortar, substitute latex admixture for part or all of water, according to latex-additive manufacturer's written instructions.
6. Mortar for Scratch Coat over Metal Lath: 1 part portland cement, 1/2 part lime, 5 parts loose damp sand, and enough water to produce a workable consistency.
7. Mortar for Scratch Coat over Unit Masonry: 1 part portland cement, 1 part lime, 7 parts loose damp sand, and enough water to produce a workable consistency.
8. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.
 - a. Pigments shall not exceed 10 percent of portland cement by weight.
 - b. Pigments shall not exceed 5 percent of masonry cement **OR** mortar cement, **as directed**, by weight.
 - c. Mix to match sample.
9. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.
 - a. Mix to match sample.

L. Fabrication

1. Fabricate stone to comply with sizes, shapes, and tolerances recommended by applicable stone association or, if none, by stone source, for faces, edges, beds, and backs.
 - a. For granite, comply with recommendations in NBGQA's "Specifications for Architectural Granite."
 - b. For limestone, comply with recommendations in ILI's "Indiana Limestone Handbook."
2. Cut **OR** Select, **as directed**, stone to produce pieces of thickness, size, and shape indicated, including details on Drawings. Dress joints (bed and vertical) straight and at right angle to face unless otherwise indicated.
3. Cut and drill sinkages and holes in stone for anchors and supports.
4. Carefully inspect stone at quarry or fabrication plant for compliance with requirements for appearance, material, and fabrication. Replace defective units before shipment.
 - a. Clean sawed backs of stone to remove rust stains and iron particles.
5. Gage backs of stones for adhered veneer if more than 81 sq. in. (522 sq. cm) in area.
6. Thickness of Stone: Provide thickness indicated, but not less than the following:
 - a. Thickness for anchored veneer: 4 inches (100 mm) plus or minus 1/4 inch (6 mm) **OR** 1/2 inch (13 mm), **as directed**. Thickness does not include projection of pitched faces.
 - b. Thickness for adhered veneer: 1 inch (25 mm) plus or minus 1/8 inch (3 mm) **OR** 1/4 inch (6 mm), **as directed**.
7. Shape stone for type of masonry (pattern) as follows:
 - a. Sawed-bed, range ashlar with uniform course heights and uniform lengths as indicated on Drawings.
 - b. Sawed-bed, range ashlar with uniform course heights as indicated on Drawings and with random lengths.
 - c. Sawed-bed, broken-range ashlar with uniform course heights as indicated on Drawings and with random lengths.
 - d. Sawed **OR** Split, **as directed**, -bed, random-range ashlar with random course heights and random lengths (interrupted coursed).
 - e. Coursed rubble.
 - f. Uncoursed rubble (fieldstone).
 - g. Polygonal or mosaic.



8. Finish exposed faces and edges of stone to comply with requirements indicated for finish and to match approved samples and mockups.
 - a. Finish: Split face **OR** Rock face (pitched face) **OR** Natural cleft **OR** Mixed split face and seam face **OR** Mixed split face, seam face, and rock face (pitched face) **OR** Smooth **OR** Sand rubbed **OR** As indicated, **as directed**.
 - b. Finish for Sills: Smooth **OR** Sand rubbed **OR** Split face with sand-rubbed washes **OR** Rock face (pitched face) with sand-rubbed washes **OR** Rock face (pitched face) with tooled (boasted) washes, **as directed**
 - c. Finish for Lintels: Smooth **OR** Sand rubbed **OR** Split face **OR** Rock face (pitched face), **as directed**.
 - d. Finish for Copings: Smooth **OR** Sand rubbed **OR** Split faces **OR** Rock face (pitched face), front and back; sand-rubbed top **OR** Rock face (pitched face), front and back; tooled (boasted) top, **as directed**.
 - 1) Finish exposed ends of copings same as front and back faces.

1.3 EXECUTION

A. Preparation

1. Accurately mark stud centerlines on face of weather-resistant sheathing paper before beginning stone installation.
2. Coat concrete and unit masonry backup with asphalt dampproofing.
3. Clean dirty or stained stone surfaces by removing soil, stains, and foreign materials before setting. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.

B. Setting Of Stone Masonry, General

1. Perform necessary field cutting and trimming as stone is set.
 - a. Use power saws to cut stone that is fabricated with saw-cut surfaces. Cut lines straight and true, with edges eased slightly to prevent snipping.
 - b. Use hammer and chisel to split stone that is fabricated with split surfaces. Make edges straight and true, matching similar surfaces that were shop or quarry fabricated.
 - c. Pitch face at field-split edges as needed to match stones that are not field split.
2. Sort stone before it is placed in wall to remove stone that does not comply with requirements relating to aesthetic effects, physical properties, or fabrication, or that is otherwise unsuitable for intended use.
3. Arrange stones in range ashlar pattern with course heights as indicated, uniform **OR** random, **as directed** lengths, and uniform joint widths, with offset between vertical joints as indicated.
4. Arrange stones in broken-range ashlar pattern with uniform course heights, random lengths, and uniform joint widths.
5. Arrange stones in three-course, random-range ashlar pattern with random course heights, random lengths (interrupted coursed), and uniform joint widths.
6. Arrange stones in coursed **OR** uncoursed, **as directed**, rubble pattern with joint widths within tolerances indicated. Insert small stones into spaces between larger stones as needed to produce joints as uniform in width as practical, **as directed**.
7. Arrange stones in polygonal (mosaic) pattern with uniform joint widths.
8. Arrange stones with color and size variations uniformly dispersed for an evenly blended appearance.
9. Set stone to comply with requirements indicated on Drawings. Install supports, fasteners, and other attachments indicated or necessary to secure stone masonry in place. Set stone accurately in locations indicated with edges and faces aligned according to established relationships and indicated tolerances.
10. Maintain uniform joint widths except for variations due to different stone sizes and where minor variations are required to maintain bond alignment if any. Lay walls with joints not less than 1/4 inch (6 mm) **OR** 3/8 inch (10 mm), **as directed**, at narrowest points or more than 3/8 inch (10



- mm) **OR** 1/2 inch (13 mm) **OR** 5/8 inch (16 mm) **OR** 1 inch (25 mm) **OR** 1-1/2 inches (38 mm), **as directed**, at widest points.
11. Provide sealant joints of widths and at locations indicated.
 - a. Keep sealant joints free of mortar and other rigid materials.
 - b. Sealing joints is specified in Division 07 Section "Joint Sealants".
 12. Install metal expansion strips in sealant joints at locations indicated. Build flanges of expansion strips into masonry by embedding in mortar between stone masonry and backup wythe. Lap each joint 4 inches (100 mm) in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.
 13. Install embedded flashing and weep holes, **as directed**, at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.
 - a. At stud-framed walls, extend flashing through stone masonry, up the face of sheathing at least 8 inches (200 mm) **OR** 12 inches (300 mm) **OR** 16 inches (400 mm), **as directed**, and behind weather-resistant sheathing paper.
 - b. At multiwythe masonry walls, including cavity walls, extend flashing through stone masonry, turned up a minimum of 4 inches (100 mm) **OR** 8 inches (200 mm) **OR** 12 inches (300 mm) **OR** 16 inches (400 mm), **as directed**, and extend into or through inner wythe to comply with requirements in Division 04 Section "Unit Masonry".
 - c. At concrete backing, extend flashing through stone masonry, turned up a minimum of 4 inches (100 mm) **OR** 6 inches (150 mm) **OR** 8 inches (200 mm) **OR** 12 inches (300 mm), **as directed**, and insert in reglet. Reglets are specified Division 07 Section "Sheet Metal Flashing And Trim".
 - d. At lintels and shelf angles, extend flashing full length of angles but not less than 6 inches (150 mm) into masonry at each end.
 - e. At sills, extend flashing not less than 4 inches (100 mm) at ends.
 - f. At ends of head and sill flashing turn up not less than 2 inches (50 mm) to form end dams.
 - g. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches (38 mm) or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Division 07 Section "Joint Sealants" for application indicated.
 - h. Install metal drip edges and sealant stops with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Division 07 Section "Joint Sealants" for application indicated.
 - i. Extend sheet metal flashing 1/2 inch (13 mm) beyond face of masonry at exterior and turn flashing down to form a drip.
 - j. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall and adhere flexible flashing to top of metal drip edge.
 - k. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall and adhere flexible flashing to top of metal flashing termination.
 - l. Cut flexible flashing flush with face of wall after masonry wall construction is completed.
 14. Coat limestone with cementitious dampproofing as follows:
 - a. Stone at Grade: Beds, joints, and back surfaces to at least 12 inches (300 mm) above finish-grade elevations.
 - b. Stone Extending below Grade: Beds, joints, back surfaces, and face surfaces below grade.
 - c. Allow cementitious dampproofing formulations to cure before setting dampproofed stone. Do not damage or remove dampproofing in the course of handling and setting stone.
 15. Place weep holes and vents in joints where moisture may accumulate, including at base of cavity walls, above shelf angles, and at flashing.
 - a. Use wicking material **OR** round plastic tubing **OR** rectangular plastic tubing **OR** mesh weep holes/vents **OR** aluminum weep holes/vents **OR** vinyl weep holes/vents **OR** open head joints, **as directed**, to form weep holes.



- b. Use wicking material to form weep holes above flashing in stone sills. Turn wicking down at lip of sill to be as inconspicuous as possible.
 - c. Space weep holes 16 inches (400 mm) **OR** 24 inches (600 mm), **as directed**, o.c.
 - d. Space weep holes formed from plastic tubing **OR** wicking material, **as directed**, 16 inches (400 mm) o.c.
 - e. Trim wicking material used in weep holes flush with outside face of wall after mortar has set.
 - f. Place pea gravel in cavities as soon as practical to a height of not less than 2 inches (50 mm) above top of flashing, to maintain drainage.
 - g. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.
16. Install vents in vertical head joints at the top of each continuous cavity at spacing indicated. Use round plastic tubing **OR** rectangular plastic tubing **OR** mesh weep holes/vents **OR** aluminum weep holes/vents **OR** vinyl weep holes/vents **OR** open head joints, **as directed**, to form vents.
- a. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

C. Construction Tolerances

1. Variation from Plumb: For vertical lines and surfaces, do not exceed 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (10 mm in 6 m), or 1/2 inch in 40 feet (13 mm in 12 m) or more. For external corners, expansion joints, control joints, and other conspicuous lines, do not exceed 1/4 inch in 20 feet (6 mm in 6 m) or 1/2 inch in 40 feet (13 mm in 12 m) or more.
2. Variation from Level: For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines, do not exceed 1/4 inch in 20 feet (6 mm in 6 m) or 1/2 inch in 40 feet (13 mm in 12 m) or more.
3. Variation of Linear Building Line: For position shown in plan, do not exceed 1/2 inch in 20 feet (13 mm in 6 m) or 3/4 inch in 40 feet (19 mm in 12 m) or more.
4. For rough stone, measure variation from level, plumb, and position shown in plan as variation of the average plane of the face of each stone from level, plumb, or dimensioned plane.
5. Variation in Mortar-Joint Thickness: Do not vary from joint size range indicated.
6. Variation in Plane between Adjacent Stones for Rough Stone: Do not exceed one-half of tolerance specified for thickness of stone.

D. Installation Of Anchored Stone Masonry

1. Anchor stone masonry to concrete with corrugated-metal veneer anchors unless otherwise indicated. Secure anchors by inserting dovetailed ends into dovetail slots in concrete.
2. Anchor stone masonry to unit masonry with corrugated-metal **OR** individual wire, **as directed**, veneer anchors unless otherwise indicated. Embed anchors in unit masonry mortar joints or grouted cells for distance at least one-half of unit masonry thickness.
3. Anchor stone masonry to unit masonry with wire anchors unless otherwise indicated. Connect anchors to masonry joint reinforcement by inserting pintles into eyes of masonry joint reinforcement projecting from unit masonry.
4. Anchor stone masonry to unit masonry with wire anchors unless otherwise indicated. Connect anchors to masonry joint reinforcement with vertical rods inserted through anchors and through eyes of masonry joint reinforcement projecting from unit masonry.
5. Anchor stone masonry to unit masonry with adjustable, screw-attached **OR** seismic, **as directed**, veneer anchors unless otherwise indicated. Fasten anchors to unit masonry with two screws.
6. Anchor stone masonry to stud framing with adjustable, screw-attached **OR** seismic, **as directed**, veneer anchors unless otherwise indicated. Fasten anchors through sheathing to framing with two screws.
7. Anchor stone masonry to stud framing with screw-attached veneer anchors unless otherwise indicated.
8. Anchor stone masonry to wood stud framing with corrugated-metal veneer anchors unless otherwise indicated. Fasten anchors through sheathing to studs with corrosion-resistant roofing nails.



9. Anchor stone masonry to wood stud framing with wire anchors unless otherwise indicated. Fasten anchors through sheathing to wood studs with corrosion-resistant roofing nails.
10. Anchor stone masonry to metal stud framing with wire anchors unless otherwise indicated. Tie anchors to studs.
11. Embed veneer anchors in mortar joints of stone masonry at least halfway, but not less than 1-1/2 inches (38 mm), through stone masonry and with at least 5/8-inch (16-mm) cover on outside face.
 - a. Install continuous wire reinforcement in horizontal joints and attach to seismic veneer anchors as stone is set.
12. Space anchors to provide not less than 1 anchor per 2 sq. ft. (0.2 sq. m) of wall area. Install additional anchors within 12 inches (300 mm) of openings, sealant joints, and perimeter at intervals not exceeding 12 inches (300 mm).
13. Space anchors not more than 16 inches (400 mm) o.c. vertically and 24 inches (600 mm) o.c. horizontally. Install additional anchors within 12 inches (300 mm) of openings, sealant joints, and perimeter at intervals not exceeding 12 inches (300 mm).
14. Anchor stone trim with stone trim anchors where indicated. Install anchors by fastening to substrate and inserting tabs and dowels into kerfs and holes in stone units. Provide compressible filler in ends of dowel holes and bottoms of kerfs to prevent end bearing of dowels and anchor tabs on stone. Fill remainder of anchor holes and kerfs with mortar.
15. Set stone in full bed of mortar with full head joints unless otherwise indicated. Build anchors into mortar joints as stone is set.
16. Fill collar joint **OR** space between back of stone masonry and weather-resistant sheathing paper, **as directed**, with mortar as stone is set.
17. Provide 1-inch (25-mm) **OR** 2-inch (50-mm), **as directed**, cavity between stone masonry and backup construction unless otherwise indicated. Keep cavity free of mortar droppings and debris.
 - a. Place mortar spots in cavity at veneer anchors to maintain spacing.
 - b. Slope beds toward cavity to minimize mortar protrusions into cavity.
 - c. Do not attempt to trowel or remove mortar fins protruding into cavity.
18. Rake out joints for pointing with mortar to depth of not less than 1/2 inch (13 mm) **OR** 3/4 inch (19 mm), **as directed**, before setting mortar has hardened. Rake joints to uniform depths with square bottoms and clean sides.

E. Installation Of Adhered Stone Masonry Veneer

1. Install flashing over sheathing and behind weather-resistant sheathing paper by fastening through sheathing into framing.
2. Install lath over weather-resistant sheathing paper by fastening through sheathing into framing to comply with ASTM C 1063.
3. Install lath over unit masonry and concrete to comply with ASTM C 1063.
4. Install scratch coat over metal lath 3/8 inch (10 mm) thick to comply with ASTM C 926.
5. Coat backs of stone units and face of scratch coat **OR** masonry backup, **as directed**, with cement-paste bond coat, then butter both surfaces with setting mortar. Use sufficient setting mortar so a slight excess will be forced out the edges of stone units as they are set. Tap units into place, completely filling space between units and scratch coat **OR** masonry backup, **as directed**.
6. Rake out joints for pointing with mortar to depth of not less than 1/2 inch (13 mm) **OR** 3/4 inch (19 mm), **as directed**, before setting mortar has hardened. Rake joints to uniform depths with square bottoms and clean sides.

F. Pointing

1. Prepare stone-joint surfaces for pointing with mortar by removing dust and mortar particles. Where setting mortar was removed to depths greater than surrounding areas, apply pointing mortar in layers not more than 3/8 inch (10 mm) deep until a uniform depth is formed.
2. Point stone joints by placing and compacting pointing mortar in layers not more than 3/8 inch (10 mm) deep. Compact each layer thoroughly and allow to become thumbprint hard before applying next layer.



3. Tool joints, when pointing mortar is thumbprint hard, with a smooth jointing tool to produce the following joint profile:
 - a. Joint Profile: Concave **OR** Smooth, flat face slightly below edges of stone **OR** Smooth, flat face recessed 1/4 inch (6 mm) below edges of stone (raked joint) **OR** Flush, with a 3/8-inch (10-mm) half-round raised bead in middle of joint **OR** As indicated, **as directed**.

G. Adjusting And Cleaning

1. Remove and replace stone masonry of the following description:
 - a. Broken, chipped, stained, or otherwise damaged stone. Stone may be repaired if methods and results are approved.
 - b. Defective joints.
 - c. Stone masonry not matching approved samples and mockups.
 - d. Stone masonry not complying with other requirements indicated.
2. Replace in a manner that results in stone masonry matching approved samples and mockups, complying with other requirements, and showing no evidence of replacement.
3. In-Progress Cleaning: Clean stone masonry as work progresses. Remove mortar fins and smears before tooling joints.
4. Final Cleaning: After mortar is thoroughly set and cured, clean stone masonry as follows:
 - a. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - b. Test cleaning methods on mockup; leave one-half of panel uncleaned for comparison purposes. Obtain approval of sample cleaning before cleaning stone masonry.
 - c. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
 - d. Wet wall surfaces with water before applying cleaner; remove cleaner promptly by rinsing thoroughly with clear water.
 - e. Clean stone masonry by bucket and brush hand-cleaning method described in BIA Technical Note No. 20 Revised II, using job-mixed detergent solution.
 - f. Clean stone masonry with proprietary acidic cleaner applied according to manufacturer's written instructions.
 - g. Clean limestone masonry to comply with recommendations in ILI's "Indiana Limestone Handbook."

H. Excess Materials And Waste

1. Disposal as Fill Material: Dispose of clean masonry waste, including mortar and excess or soil-contaminated sand, by crushing and mixing with fill material as fill is placed.
 - a. Crush masonry waste to less than 4 inches (100 mm) in greatest dimension.
 - b. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Division 31 Section "Earth Moving".
 - c. Do not dispose of masonry waste as fill within 18 inches (450 mm) of finished grade.
2. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other waste, and legally dispose of off the Owner's property.

END OF SECTION 04 01 40 91



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Task	Specification	Specification Description
04 01 40 91	04 01 20 52	Clay Masonry Restoration And Cleaning
04 01 40 91	04 01 40 52	Stone Restoration And Cleaning
04 01 50 52	04 01 20 52	Clay Masonry Restoration And Cleaning
04 05 13 26	04 01 20 91	Unit Masonry Assemblies
04 05 16 26	04 01 20 91	Unit Masonry Assemblies
04 05 19 13	04 01 20 91	Unit Masonry Assemblies
04 05 19 16	04 01 20 91	Unit Masonry Assemblies
04 05 23 13	04 01 20 91	Unit Masonry Assemblies
04 05 23 16	01 22 16 00	No Specification Required
04 05 23 16	07 62 00 00	Sheet Metal Flashing And Trim



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SECTION 04 05 26 00 - SCAFFOLDING TUBULAR STEEL

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of scaffolding-tubular steel. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: For each type of product indicated.

1.2 PRODUCTS

- A. Tubular steel or aluminum scaffolding system shall comply with OSHA Safety and Health Standards, Section 29 CFR, 1926/1910.

1.3 EXECUTION - (Section not used.)

END OF SECTION 04 05 26 00



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Task	Specification	Specification Description
04 05 26 00	04 01 20 91	Unit Masonry Assemblies
04 21 13 00	04 01 20 91	Unit Masonry Assemblies
04 21 19 00	04 01 20 91	Unit Masonry Assemblies
04 21 26 00	04 01 20 91	Unit Masonry Assemblies
04 21 29 00	04 01 20 91	Unit Masonry Assemblies
04 22 23 13	04 01 20 91	Unit Masonry Assemblies
04 22 23 23	04 01 20 91	Unit Masonry Assemblies
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04 22 23 29	04 01 20 91	Unit Masonry Assemblies
04 22 23 31	04 01 20 91	Unit Masonry Assemblies



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SECTION 04 23 13 00 - GLASS UNIT MASONRY ASSEMBLIES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for glass unit masonry assemblies. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes
 - a. Glass block set in mortar.
 - b. Glass block set in silicone sealant.
 - c. Glass block set in glass-block grid systems.

C. Performance Requirements

1. Structural Performance: Provide glass-block grid systems capable of withstanding the effects of gravity loads and the loads and stresses within limits and under conditions indicated.

D. Action Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:
 - a. Product Data for Credit IEQ 4.1: For sealants used inside the weatherproofing system, documentation including printed statement of VOC content.
 - b. Laboratory Test Reports for Credit IEQ 4: For sealants used inside the weatherproofing system, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
3. Shop Drawings: Show fabrication and installation details for glass unit masonry, including vertical and horizontal coursing, anchors, reinforcement, and expansion strips and glass-block grid systems.
4. Provide Samples for each form, pattern, and color of glass block and color of joint material and glass-block grid material indicated or selected by the Owner.
5. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, documentation including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

E. Informational Submittals

1. Qualification Data: For qualified professional engineer.

F. Quality Assurance

1. Fire-Rated Glass Unit Masonry Assemblies: Assemblies listed by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 **OR** IBC Standard 715, **as directed**.
 - a. Test Pressure: Test at atmospheric pressure **OR** After 10 minutes into the test, neutral pressure level in furnace shall be located so that at least two-thirds of test specimen is above the neutral pressure plane, **as directed**.

G. Delivery, Storage, And Handling

1. Store glass block in unopened cartons on elevated platforms, under cover, and in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied.



2. Store glass-block grid materials in unopened cartons in an enclosed, dry location.
3. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
4. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
5. Store accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

H. Project Conditions

1. Environmental Limitations for Sealants: Do not install sealants when ambient and substrate temperatures are outside limits permitted by sealant manufacturer or below 40 deg F (5 deg C) or when joint substrates are wet.
2. Weather Limitations: Proceed with installation of glass unit masonry assemblies only when ambient and material temperatures are 40 deg F (5 deg C) or higher.
 - a. Maintain temperature in installation areas at 40 deg F (5 deg C) or above for 48 hours after installing.

I. Sequencing And Scheduling

1. Sequence and coordinate completion of glass unit masonry assemblies so sealants can be installed immediately after mortar has attained final set.

1.2 PRODUCTS

A. Glass Block

1. Hollow Glass Block: Hollow units made from transparent glass, with manufacturer's standard edge coating.
 - a. Glass Color: As selected from manufacturer's full range.
 - b. Pattern:
 - 1) Smooth, undistorted inner and outer faces.
 - 2) Wavy, light-diffusive design on inner faces, and smooth outer faces.
 - 3) Fluted, light-diffusive design, horizontal on one inner face, vertical on other; and smooth outer faces.
 - 4) Linear prismatic design, horizontal on one inner face, vertical on other; and smooth outer faces.
 - 5) Prismatic pyramid, light-diffusive design on inner faces, and smooth outer faces.
 - 6) As indicated by manufacturer's designation.
 - 7) Manufacturer's standard decorative pattern to match sample.
 - 8) As selected from manufacturer's full range.
 - 9) Custom decorative pattern to match design.
 - c. Edge-Coating Color: As selected from manufacturer's full range.
 - d. Sizes: Manufacturer's standard sizes corresponding to nominal sizes indicated on Drawings.
 - e. Thick-Faced Units: Units with faces at least 3/4 inch (19 mm) thick.
2. Solid Glass Block: Colorless, transparent, solid glass blocks with smooth **OR** stippled, **as directed**, faces and manufacturer's standard edge coating.
 - a. Square-Block Size: 5-3/4 inches (146 mm) **OR** 7-3/4 inches (197 mm) **OR** 11-3/4 inches (299 mm) **as directed**, square by 1-1/2 inches (38 mm) **OR** 3 inches (76 mm) thick, actual size, **as directed**.
 - b. Rectangular-Block Size: 3 by 7-3/4 inches (76 by 197 mm) **OR** 5-3/4 by 7-3/4 inches (146 by 197 mm), **as directed by** 1-1/2 inches (38 mm) **OR** 3 inches (76 mm) thick, actual size, **as directed**.
3. Glass Paver Block: Transparent, colorless, pressed glass units, with a smooth top surface and a decorative, light-diffusing, patterned bottom surface; **6 inches (152 mm) square by 1 inch (25 mm) OR 4-3/4 inches (120 mm) square by 1-9/16 inches (40 mm) OR 6-5/16 inches (160 mm) square by 1-3/16 inches (30 mm) OR 7-1/2 inches (190 mm) square by 1-1-15/16**



inches (50 mm) OR 7-1/2 inches (190 mm) square by 2-3/4 inches (70 mm) OR 7-7/8 inches (200 mm) square by 7/8 inch (22 mm) OR 7-7/8 inches (200 mm) square by 1-15/16 inches (50 mm) OR 4-5/8 inches (117 mm) in diameter by 2-3/8 inches (60 mm) thick, actual size, as directed.

a.

B. Glass-Block Grid Systems

1. General: Aluminum extrusions complying with ASTM B 221 (ASTM B 221M), Alloy 6063-T6 or Alloy 6463-T6, forming a grid system and frame designed for application indicated.
2. Window and Wall System: Aluminum T-bar grid with tubular frame and vinyl glass-block boots.
 - a. Finish: As selected from manufacturer's full range.
 - b. Glass-Block Size: 7-3/4 inches (197 mm) square by 3-1/8 inches (79 mm) thick.
 - c. Provide self-flashing, **as directed**, aluminum exterior frame covers with vinyl thermal break.
 - d. Provide extruded-aluminum frame receivers (corner starters) at heads, jambs, and sills.
 - e. Provide extruded-aluminum mullions where indicated.
 - f. Provide aluminum trim and closures as indicated.
3. Skylight System: Aluminum T-bar grid with tubular frame; vinyl thermal break; extruded-aluminum, curb-mounting frame and counterflashing; and vinyl glass-block boots.
 - a. Finish: As selected from manufacturer's full range.
 - b. Glass-Block Size: 7-3/4 inches (197 mm) square by 3-1/8 inches (79 mm) thick.
4. Floor System: Aluminum tubular grid and frame with glass-block boots made from UV- and oil-resistant EPDM.
 - a. Finish: Class II, clear-anodized finish; complying with AAMA 611.
 - b. Glass-Paver-Block Size: 6 inches (152 mm) square by 1 inch (25 mm) thick.
5. Sealant: Product recommended by glass-block grid system manufacturer.
 - a. Provide sealants for use inside the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Mortar Materials

1. Portland Cement: ASTM C 150, Type I or Type II, natural color or white cement as required to produce mortar color indicated.
 - a. Where joints are indicated to be raked out and pointed, gray cement may be used for setting mortar.
2. Hydrated Lime: ASTM C 207, Type S.
3. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207, Type S.
4. Masonry Cement: ASTM C 91.
5. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortar.
6. Colored Cement Product: Packaged blend made from portland cement and lime **OR** masonry cement, **as directed**, and mortar pigments, all complying with specified requirements, and containing no other ingredients.
 - a. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
 - b. Pigments shall not exceed 10 percent of portland cement **OR** 5 percent of masonry cement, **as directed**, by weight.
7. Aggregate: ASTM C 144, with 100 percent passing No. 8 (2.36-mm) sieve.
 - a. For pointing mortar and joints narrower than 1/4 inch (6 mm), use aggregate graded with 100 percent passing No. 16 (1.18-mm) sieve.
 - b. White Aggregates: Natural white sand or crushed white stone.
 - c. Colored Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
8. Water-Repellent Admixture: Manufacturer's standard dry mixture of stearates, water-reducing agents, and fine aggregates intended to reduce capillarity in mortar.



9. Water-Repellent Admixture: Liquid polymeric water-repellent mortar admixture that does not reduce flexural bond strength of mortar.
10. Water: Potable.

D. Glass Unit Masonry Accessories

1. Panel Reinforcement: Ladder-type units, butt welded, not lapped and welded; complying with ASTM A 951 in straight lengths of not less than 10 feet (3 m), and as follows:
 - a. Interior Walls: Hot-dip galvanized, carbon-steel wire.
 - b. Exterior Walls: Hot-dip galvanized, carbon-steel **OR** Stainless-steel, **as directed**, wire.
 - c. Wire Size: W1.7 or 0.148-inch (3.8-mm) diameter.
 - d. Width: 2 inches (50 mm) **OR** 1-5/8 inches (40 mm), **as directed**.
 - e. Spacing of Cross Rods: Not more than 16 inches (407 mm) apart.
2. Panel Anchors: Glass-block manufacturer's standard perforated steel strips, 0.0359 inch (0.9 mm) by 1-3/4 inches (44 mm) wide by 24 inches (600 mm) long, hot-dip galvanized after fabrication to comply with ASTM A 153/A 153M.
3. Mortarless Installation System: System of aluminum or plastic perimeter framing, anchors, and spacers designed for installing glass block with sealant-filled joints.
4. Fasteners, General: Unless otherwise indicated, provide Type 304 or Type 316 stainless-steel fasteners at exterior walls and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at interior walls. Select fasteners for type, grade, and class required.
5. Carbon-Steel Bolts: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6) with hex nuts, ASTM A 563 (ASTM A 563M), if applicable.
6. Stainless-Steel Bolts: ASTM F 593 (ASTM F 738M), Alloy Group 1 or 2 (A1 or A4) with hex nuts, ASTM F 594 (ASTM F 836M), if applicable.
7. Postinstalled Anchors: Provide powder-actuated fasteners **OR** metal expansion sleeve anchors **OR** metal impact expansion anchors, **as directed**, of type and size necessary for installation indicated, as recommended by manufacturer, unless otherwise indicated.
8. Asphalt Emulsion: Cold-applied asphalt emulsion complying with ASTM D 1187 or ASTM D 1227.
9. Mineral-Fiber Expansion Strips: Mineral-fiber strips, complying with requirements of fire-rated assembly listing and glass-block manufacturer.
 - a. Use for fire-rated assemblies.
10. Plastic-Foam Expansion Strips: Polyethylene foam complying with requirements of glass-block manufacturer; 3/8 inch (9 mm) thick by 4 inches (100 mm) **OR** 3-1/2 inches (89 mm) **OR** 2-1/2 inches (63 mm) wide, **as directed**.
 - a. Use plastic-foam expansion strips for non-fire-rated assemblies **OR** fire-rated and non-fire-rated assemblies, **as directed**.
11. Sealants: Manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated below that comply with applicable requirements in Division 07 Section "Joint Sealants".
 - a. Single-component, neutral-curing **OR** acid-curing, **as directed**, silicone sealant.
 - b. Single-component, nonsag urethane sealant.
 - c. Multicomponent, nonsag polysulfide sealant.
 - d. Provide sealants for use inside the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - e. Sealant Accessories: Provide sealant accessories, including primers, bond-breaker tape, and cylindrical sealant backing, that comply with applicable requirements in Division 07 Section "Joint Sealants".

E. Mortar Mixes

1. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, or antifreeze compounds, unless otherwise indicated.
 - a. Do not use calcium chloride in mortar.
 - b. For mortar in exterior panels, use water-repellent admixture according to admixture manufacturer's written instructions.



- c. For pointing mortar in exterior panels, use water-repellent admixture according to admixture manufacturer's written instructions.
- d. Limit cementitious materials in mortar to portland cement and lime.
2. Mortar for Glass Unit Masonry Assemblies: Provide mortar, mixed according to glass-block manufacturer's listing with testing and inspecting agency, for fire-resistance rating indicated.
OR
Mortar for Glass Unit Masonry Assemblies: Comply with ASTM C 270, Proportion Specification for Type S mortar.
 - a. Combine and thoroughly mix cementitious materials, water, and aggregates in a mechanical batch mixer, unless otherwise indicated. Mix mortar to produce a stiff but workable consistency that is drier than mortar for brick or concrete masonry. Discard mortar when it has reached initial set.
3. Pigmented Mortar: Use colored cement product **OR** Select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products, **as directed**.
 - a. Pigments shall not exceed 10 percent of portland cement by weight.
 - b. Pigments shall not exceed 5 percent of masonry cement by weight.
 - c. Mix to match sample.
4. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.
 - a. Mix to match sample.

1.3 EXECUTION

A. Examination

1. Examine sills, jambs, and heads surrounding glass unit masonry assemblies for compliance with requirements for installation tolerances and other conditions affecting performance.
 - a. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Installing Glass Block With Mortar

1. Apply a heavy coat of asphalt emulsion to sill and adhere expansion strips to jambs and heads with asphalt emulsion. Allow asphalt emulsion to dry before placing mortar. Trim expansion strips to width required to fit glass block and to full lengths of heads and jambs.
2. Set glass block with completely filled bed and head joints, with no furrowing, accurately spaced and coordinated with other construction. Maintain 1/4-inch (6-mm) **OR** 3/8-inch (10-mm), **as directed**, exposed joint widths, unless otherwise indicated.
3. Install panel reinforcement in horizontal joints at spacing indicated and continuously from end to end of panels; comply with the following requirements:
 - a. Vertical Spacing of Panel Reinforcement for Exterior Panels: Every other course but not more than 16 inches (407 mm) o.c., starting with first course above sill **OR** As indicated on Drawings, **as directed**.
 - b. Vertical Spacing of Panel Reinforcement for Interior Panels: Not more than 16 inches (407 mm) o.c. **OR** As indicated on Drawings, **as directed**.
 - c. Do not bridge expansion joints with panel reinforcement.
 - d. Place panel reinforcement in joints immediately above and below all openings within glass unit masonry assemblies.
 - e. Lap panel reinforcement not less than 6 inches (150 mm) if more than 1 length is necessary.
 - f. Embed panel reinforcement in mortar bed by placing lower half of mortar bed first, pressing panel reinforcement into place and covering with upper half of mortar bed.
4. Install panel anchors at locations indicated and in same horizontal joints where panel reinforcement occurs. Extend panel anchors at least 12 inches (300 mm) into joints, and bend within expansion joints at edges of panels and across the head. Attach panel anchors as follows:
 - a. For in-place unit masonry assemblies and concrete, attach panel anchors with 1/4-inch- (6-mm-) diameter bolt-size, postinstalled anchors, 2 per panel anchor.



- b. For new unit masonry assemblies, embed other ends of panel anchors, after bending portions crossing expansion joint, in horizontal mortar joints closest in elevation to joints in glass unit masonry assemblies containing panel anchors.
 - c. For steel members, attach panel anchors with 1/4-inch- (6-mm-) diameter through bolts and nuts or bolts in tapped holes in steel members.
 5. Use rubber mallet to tap units into position. Do not use steel tools, and do not allow units to come into contact with metal accessories and frames.
 6. Use plastic spacers **OR** temporary wedges, **as directed**, in mortar joints to produce uniform joint widths and to prevent mortar from being squeezed out of joints.
 - a. If temporary wedges are used, remove them after mortar has set and fill voids with mortar.
 7. Keep expansion joints free of mortar.
 8. Rake out joints indicated to be pointed to a uniform depth sufficient to accommodate pointing material, but not less than joint width.
 - a. If temporary wedges are used, remove them before raking out and pointing joints.
 - b. Point joints at exterior face **OR** both faces, **as directed**, of exterior panels with mortar.
 - c. Point joints at exterior face **OR** both faces, **as directed**, of exterior panels with sealant.
 - d. Point joints at both faces of exterior and interior panels with sealant.
 9. Point joints with mortar by filling raked joints and voids. Place and compact pointing mortar in layers not more than 3/8 inch (10 mm) thick. Compact each layer thoroughly and allow to become thumbprint hard before applying next layer.
 - a. Tool exposed joints slightly concave when pointing mortar is thumbprint hard. Use a smooth plastic jointer larger than joint width.
 10. Point joints by filling with sealant to comply with requirements in Division 07 Section "Joint Sealants".
 11. Clean glass unit masonry assemblies as work progresses. Remove mortar fins and smears immediately, using a clean, wet sponge or a scrub brush with stiff fiber bristles. Do not use harsh cleaners, acids, abrasives, steel wool, or wire brushes when removing mortar or cleaning glass unit masonry assemblies.
 12. Install sealant at jambs, heads, mullions and other locations indicated. Prepare joints, including installation of primer and bond-breaker tape or cylindrical sealant backing, and apply elastomeric sealants to comply with requirements in Division 07 Section "Joint Sealants".
 13. Construction Tolerances: Set glass block to comply with the following tolerances:
 - a. Variation from Plumb: For lines and surfaces of vertical elements and arris, do not exceed 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2 inch in 40 feet (12 mm in 12 m) or more.
 - b. Variation from Level: For bed joints, and other conspicuous lines, do not exceed 1/8 inch in 10 feet (3 mm in 3 m) , 1/4 inch in 20 feet (6 mm in 6 m) or 1/2 inch in 40 feet (12 mm in 12 m) or more.
 - c. Variation of Location in Plan: For location of elements in plan do not vary from that indicated by more than plus or minus 1/4 inch (6 mm).
 - d. Variation in Mortar-Joint Thickness: Do not vary from joint thickness indicated by more than plus or minus 1/16 inch (1.5 mm).
 - e. For faces of adjacent exposed units, do not vary from flush alignment by more than 1/16 inch (1.5 mm).
- C. Installing Glass Block With Sealant
1. General: Install mortarless glass-block systems according to manufacturer's written instructions.
 - a. Fasten frames and anchors or clips securely to surrounding construction.
 - b. Shim starting track as needed to make it level.
 - c. Adhere glass block to starting track and spacers with silicone sealant.
 2. After glass blocks are installed, apply sealant to completely fill channel around each glass block, and tool flush with exterior surface. Remove excess sealant and smears.
- D. Glass-Block Grid System Installation
1. General: Install glass-block grid systems according to manufacturer's written instructions.



2. Window and Wall System Installation: Assemble grid system, apply continuous sealant bead to back of window Z-bar, place in position, adjust as needed to make grid level and plumb, and fasten to substrate.
 - a. Insert glass blocks into vinyl glass-block boots and carefully insert into grid from exterior side. Install blocks firmly against T-bars without deforming boots.
 - b. Apply sealant to completely fill channel around each glass block, and tool flush with exterior surface. Remove excess sealant and smears.
3. Skylight System Installation: Assemble grid system, apply continuous sealant bead to top of supporting curb, place in position, adjust as needed to bring grid true to line, and fasten to substrate.
 - a. Insert glass blocks into vinyl glass-block boots and carefully insert into grid from exterior side. Install blocks firmly against T-bars without deforming boots.
 - b. Apply sealant to completely fill channel around each glass block, and tool flush with exterior surface. Remove excess sealant and smears.
4. Floor System Installation: Assemble grid system in position, adjusting supports as needed to level grid as system is assembled, and fasten to substrate.
 - a. Insert glass blocks into glass-block boots and install in grid. Install blocks flush with adjoining floor surfaces and aluminum grid.
 - b. Apply sealant to completely fill channel around each glass block and joints of aluminum grid. Tool sealant flush with exterior surface and remove excess sealant and smears.

E. Cleaning

1. On surfaces adjacent to glass unit masonry assemblies, remove mortar, sealants, and other residue resulting from glass-block installation, in a manner approved by manufacturers of materials involved.
2. Remove excess sealants with commercial solvents of type recommended by sealant manufacturer. Exercise care not to damage sealant in joints.
3. Perform final cleaning of glass unit masonry assemblies when surface is not exposed to direct sunlight. Start at top of panel using generous amounts of clean water. Remove water with clean, dry, soft cloths; change cloths frequently to eliminate dried mortar particles and aggregate.

END OF SECTION 04 23 13 00



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Task	Specification	Specification Description
04 23 13 00	04 01 20 91	Unit Masonry Assemblies
04 26 13 00	04 01 20 91	Unit Masonry Assemblies



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SECTION 04 41 00 00 - DIMENSION STONE CLADDING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for dimension stone cladding. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following types of dimension stone:
 - a. Panels set with individual anchors.
 - b. Panels mechanically anchored on prefabricated steel trusses.
 - c. Panels mechanically anchored on prefabricated steel strongback frames.
 - d. Panels mechanically anchored on prefabricated steel stud frames.
 - e. Panels mechanically anchored (field installed) on a metal-grid system.
 - f. Panels set in architectural precast concrete.
 - g. Panels glazed into aluminum curtain-wall framing system.
 - h. Trim units, including bands, copings, sills, jambs and soffits.
 - i. Units with carving or inscriptions.

C. Definitions

1. Definitions contained in ASTM C 119 apply to this Section.
2. Dimension Stone Cladding System: An exterior wall covering system consisting of dimension stone panels and trim together with anchors, backup structure, secondary weather barrier (sheathing), mortar, adhesives, fasteners, and sealants used to secure the stone to building structure and to produce a weather-resistant covering.
 - a. Backup structure includes prefabricated steel trusses **OR** prefabricated steel strongback frames **OR** prefabricated steel stud frames **OR** metal-grid system **OR** miscellaneous steel framing required to secure stone to building structure, **as directed**.

D. Performance Requirements

1. General: Design stone anchors and anchoring systems according to ASTM C 1242.
2. Structural Performance: Provide dimension stone cladding system capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - a. Wind Loads: Determine loads based on the following minimum design wind pressures:
 - 1) Uniform pressure of 20 lbf/sq. ft. (957 Pa) **OR** 30 lbf/sq. ft. (1436 Pa), **as directed**, acting inward or outward.
 - b. Equipment Loads: Allow for loads due to window cleaning and maintenance equipment.
3. Seismic Performance: Provide dimension stone cladding system capable of withstanding the effects of earthquake motions determined according to ASCE 7.
4. Safety Factors for Stone: Design dimension stone cladding system to withstand loads indicated without exceeding allowable working stress of stone determined by dividing stone's average ultimate strength, as established by testing, by the following safety factors:
 - a. Safety Factor for Granite: 3, **as directed**.
 - b. Safety Factor for Oolitic Limestone: 8, **as directed**.
 - c. Safety Factor for Dolomitic Limestone: 6, **as directed**.
 - d. Safety Factor for Marble: 5, **as directed**.
 - e. Safety Factor for Quartz-Based Stone: 6, **as directed**.
 - f. Safety Factor for Serpentine: 6, **as directed**.
 - g. Safety Factor for Slate: 5, **as directed**.
 - h. Safety Factor for Travertine: 8, **as directed**.



- i. Safety Factor for Concentrated Stresses: 4 for granite and 10 for stone varieties other than granite.

E. Submittals

1. Product Data: For each variety of stone, stone accessory, and other manufactured products indicated.
2. Shop Drawings: Show fabrication and installation details for dimension stone cladding system, including dimensions and profiles of stone units.
 - a. Show locations and details of joints both within dimension stone cladding system and between dimension stone cladding system and other construction.
 - b. Show locations and details of anchors and backup structure.
 - c. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
3. Stone Samples: Sets for each color, grade, finish, and variety of stone required; not less than 12 inches (300 mm) square.
4. Colored Pointing Mortar Samples: For each color required.
5. Sealant Samples for Verification: For each type and color of joint sealant required.
6. Material Test Reports: From a qualified independent testing agency, as follows:
 - a. Stone Test Reports: For each stone variety proposed for use on Project, provide test data indicating compliance with required physical properties, other than abrasion resistance, according to referenced ASTM standards. Base reports on testing done within previous five **OR** three, **as directed**, years.
7. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

F. Quality Assurance

1. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated.
2. Source Limitations for Stone: Obtain each variety of stone, regardless of finish, from a single quarry.
3. Preconstruction Stone Testing: Engage a qualified independent testing agency to perform preconstruction testing indicated below.
 - a. Furnish test specimens that are representative of materials proposed for incorporation into the Work.
 - b. Physical Property Tests: For each stone variety proposed for use on Project, tested for compliance with physical property requirements, other than abrasion resistance, according to referenced ASTM standards.
 - c. Flexural Strength Tests: For each combination of stone variety, thickness, orientation of cut, and finish, proposed for use on Project, tested according to ASTM C 880, in both wet and dry conditions.
 - d. Anchorage Tests: For each combination of stone variety, orientation of cut, finish, and anchor type proposed for use on Project, tested according to ASTM C 1354.
4. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - a. Build mockups of typical exterior wall with dimension stone cladding, approximately 72 inches (1800 mm) long by 48 inches (1200 mm) high **OR** 15 feet (4.5 m) long by 10 feet (3 m) high, **as directed**.

G. Delivery, Storage, And Handling

1. Store and handle stone and related materials to prevent deterioration or damage due to moisture, temperature changes, contaminants, corrosion, breaking, chipping, and other causes.
 - a. Lift stone with wide-belt slings; do not use wire rope or ropes that might cause staining. Move stone, if required, using dollies with cushioned wood supports.



- b. Store stone on wood skids or pallets with nonstaining, waterproof covers. Arrange to distribute weight evenly and to prevent damage to stone. Ventilate under covers to prevent condensation.
 2. Mark stone units, on surface that will be concealed after installation, with designations used on Shop Drawings to identify individual stone units. Orient markings on vertical panels so that they are right side up when units are installed.
 3. Deliver sealants to Project site in original unopened containers labeled with manufacturer's name, product name and designation, color, expiration period, pot life, curing time, and mixing instructions for multicomponent materials.
 4. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
 5. Store aggregates in locations where grading and other required characteristics can be maintained and where contamination can be avoided.
- H. Project Conditions
1. Environmental Limitations for Mortar: Do not use frozen materials or materials mixed or coated with ice or frost. Remove and replace dimension stone cladding damaged by frost or freezing conditions. Comply with cold- and hot-weather construction and protection requirements for masonry contained in ACI 530.1/ASCE 6/TMS 602.
 2. Environmental Limitations for Sealants: Do not install sealants when ambient and substrate temperatures are outside limits permitted by sealant manufacturer or below 40 deg F (5 deg C) or when joint substrates are wet.

1.2 PRODUCTS

A. Granite

1. Granite: Comply with ASTM C 615.
2. Finish: Polished **OR** Honed **OR** Thermal **OR** As indicated **OR** Match sample, **as directed**.
3. Match samples for color, finish, and other stone characteristics relating to aesthetic effects.

B. Limestone

1. Limestone: Comply with ASTM C 568.
 - a. Classification: I Low-Density **OR** II Medium-Density **OR** II Medium-Density, except change requirements per ASTM C 568 for absorption by weight, density, compressive strength, and modulus of rupture to, respectively, 5 percent maximum, 150 lb/cu. ft. (2400 kg/cu. m) minimum, 8000 psi (55 MPa), and 800 psi (5.5 MPa) minimum **OR** III High-Density, **as directed**.
 - b. Description: Dolomitic **OR** Oolitic **OR** Shell, **as directed**, limestone.
2. Indiana Oolitic Limestone Grade and Color: Select, buff **OR** Select, gray **OR** Standard, buff **OR** Standard, gray **OR** Rustic, buff **OR** Rustic, gray **OR** Variegated, **as directed**, according to grade and color classification established by ILI.
3. Finish: Smooth **OR** Sand rubbed **OR** Machine tooled, 4 bats per 1 inch (25 mm) **OR** Machine tooled, 6 bats per 1 inch (25 mm) **OR** Machine tooled, 8 bats per 1 inch (25 mm) **OR** As indicated **OR** Match sample, **as directed**.
4. Match samples for color, finish, and other stone characteristics relating to aesthetic effects.

C. Marble

1. Marble: Comply with ASTM C 503, Classification I Calcite **OR** II Dolomite, **as directed**.
2. Finish: Polished **OR** Honed **OR** As indicated **OR** Match sample, **as directed**.
3. Match samples for color, finish, and other stone characteristics relating to aesthetic effects.

D. Quartz-Based Stone

1. Quartz-Based Stone: Comply with ASTM C 616, Classification I Sandstone **OR** II Quartzitic Sandstone **OR** III Quartzite, **as directed**.



2. Finish: Sand rubbed **OR** Natural cleft **OR** Thermal **OR** As indicated **OR** Match sample, **as directed**.
3. Match samples for color, finish, and other stone characteristics relating to aesthetic effects.

E. Serpentine

1. Serpentine: Comply with ASTM C 1526, Classification I Exterior **OR** II Interior, **as directed**.
2. Finish: Polished **OR** Honed **OR** As indicated **OR** Match sample, **as directed**.
3. Match samples for color, finish, and other stone characteristics relating to aesthetic effects.

F. Slate

1. Slate: Comply with ASTM C 629, Classification I Exterior **OR** II Interior, **as directed**, with a fine, even grain and unfading color, **as directed**, from clear, sound stock.
2. Finish: Honed **OR** Sand rubbed **OR** Natural cleft **OR** As indicated **OR** Match sample, **as directed**.
3. Match samples for color, finish, and other stone characteristics relating to aesthetic effects.

G. Travertine

1. Travertine: Comply with ASTM C 1527, Classification I Exterior **OR** II Interior, **as directed**.
2. Finish: Polished **OR** Honed **OR** As indicated **OR** Match sample, **as directed**.
3. Match samples for color, finish, and other stone characteristics relating to aesthetic effects.
4. Mortar Materials
5. Portland Cement: ASTM C 150, Type I or Type II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
 - a. Low-Alkali Cement: Portland cement for use with limestone shall contain not more than 0.60 percent total alkali when tested according to ASTM C 114.
6. Hydrated Lime: ASTM C 207.
7. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207.
8. Colored Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III; hydrated lime complying with ASTM C 207; and mortar pigments. Use a mix of formulation required to produce color indicated or, if not indicated, as selected from manufacturer's standard formulations. Pigments shall not exceed 10 percent of portland cement by weight.
9. Aggregate: ASTM C 144; except for joints narrower than 1/4 inch (6 mm) and pointing mortar, use aggregate graded with 100 percent passing No. 16 (1.18-mm) sieve.
 - a. White Aggregates: Natural white sand or ground white stone.
 - b. Colored Aggregates: Natural-colored sand or ground marble, granite, or other durable stone; of color necessary to produce required mortar color.
10. Mortar Pigments: Natural and synthetic iron oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in mortar and containing no carbon black.
11. Water: Potable.

H. Anchors And Fasteners

1. Fabricate anchors, including shelf angles, **as directed**, from stainless steel, ASTM A 666, Type 304 **OR** 316, **as directed**. Fabricate dowels and pins from stainless steel, ASTM A 276, Type 304 **OR** 316, **as directed**.
2. Fabricate shelf angles for limestone from hot-dip galvanized steel, ASTM A 36/A 36M for materials and ASTM A 123/A 123M for galvanizing.
3. Cast-in-Place Concrete Inserts: Steel, cast iron, or malleable iron adjustable inserts, with bolts, nuts, washers, and shims; all hot-dip galvanized or mechanically zinc coated, with capability to sustain, without failure, a load equal to 4 times the loads imposed as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
4. Postinstalled Anchor Bolts for Concrete and Masonry: Chemical anchors **OR** torque-controlled expansion anchors **OR** undercut anchors, **as directed**, made from stainless-steel components complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and



- ASTM F 836M, Alloy Group A1 or A4) for bolts and nuts; ASTM A 666 or ASTM A 276, Type 304 or 316, for anchors, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
5. Threaded Fasteners: Heavy hexagon structural bolts, heavy hexagon nuts, and hardened washers.
 - a. For stainless steel, use stainless-steel bolts, nuts, and washers; ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Alloy Group A1 or A4).
 - b. For galvanized steel shelf angles and backup structure, use carbon steel bolts, nuts, and washers; ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6), for bolts; ASTM A 563 (ASTM A 563M), Grade A, for nuts; and ASTM F 436 (ASTM F 436M) for washers; all hot-dip or mechanically zinc coated.
 6. Weld Plates for Installation in Concrete: Comply with Division 05 Section "Metal Fabrications".
- I. Framing For Backup Structure
1. Steel Trusses **OR** Strongback Frames **OR** Miscellaneous Steel Framing, **as directed**: For framing members in contact with stone fabricate from same material and finish specified for anchors. For framing members not in contact with stone, comply with requirements indicated below:
 - a. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M, minimum thickness of 3/16 inch (5 mm).
 - b. Steel Tubing: ASTM A 500 (cold formed), or ASTM A 513, Type 5 (mandrel drawn), minimum thickness of 3/16 inch (5 mm).
 - c. Slotted Channel Framing: Cold-formed metal channels with continuous slot complying with MFMA-3, made from galvanized steel complying with ASTM A 653/A 653M, structural steel, Grade 33 (Grade 230), with G90 (Z275) coating, and not less than 0.108-inch (2.74-mm) nominal thickness **OR** steel sheet complying with ASTM A 1008/A 1008M, structural steel, Grade 33 (Grade 230), not less than 0.105-inch (2.66-mm) nominal thickness, hot-dip galvanized after fabrication to comply with ASTM A 123/A 123M, **as directed**.
 2. Prefabricated Steel Stud Frames: Galvanized steel wall framing complying with Division 05 Section "Cold-formed Metal Framing".
 - a. Secondary Weather Barrier (Sheathing): Galvanized steel sheet complying with ASTM A 653/A 653M, commercial steel, coating designation G90 (Z275).
 3. Metal-Grid Systems: Provide manufacturer's standard integrated system that combines metal struts, fittings, fasteners, and stone anchors and that is engineered expressly for mechanically installing dimension stone cladding and that complies with the following requirements:
 - a. Struts: Cold-formed metal channels with continuous slot complying with MFMA-3, of size and shape required for application indicated, made from galvanized steel complying with ASTM A 653/A 653M, with G90 (Z275) coating, and not less than 0.108-inch (2.74-mm) nominal thickness **OR** steel sheet complying with ASTM A 1008/A 1008M, not less than 0.105-inch (2.66-mm) nominal thickness, hot-dip galvanized after fabrication to comply with ASTM A 123/A 123M, **as directed**.
 - b. Fittings and Fasteners: System manufacturer's standard components of design, size, and material required to securely attach struts to building structure, by method indicated or selected, and stone anchors to struts, as well as to prevent galvanic corrosion. Fabricate components in contact with stone from same material specified for anchors.
 - c. Stone Anchors: Shapes and sizes standard with system manufacturer, complying with "Anchors and Fasteners" Article.
- J. Stone Accessories
1. Setting Shims: Strips of resilient plastic or vulcanized neoprene, Type A Shore durometer hardness of 50 to 70, nonstaining to stone, of thickness needed to prevent point loading of stone on anchors and of depths to suit anchors without intruding into required depths of pointing materials.



2. Setting Buttons: Resilient plastic buttons, nonstaining to stone, sized to suit joint thicknesses and bed depths of stone units without intruding into required depths of pointing materials.
3. Concealed Sheet Metal Flashing: Fabricate from zinc-tin alloy-coated, **as directed**, stainless steel in thicknesses indicated, but not less than 0.0156 inch (0.4 mm) thick. Comply with requirements specified in Division 07 Section "Sheet Metal Flashing And Trim".
4. Cementitious Dampproofing for Limestone: Provide cementitious formulations that are recommended by ILI and that are nonstaining to stone, compatible with joint sealants, and noncorrosive to anchors and attachments.
5. Weep and Vent Tubes: Medium-density polyethylene tubing, 1/4-inch (6-mm) OD **OR** Rectangular, cellular, polypropylene or clear butyrate extrusion, 3/8 by 1-1/2 inches (9 by 38 mm), **as directed**, and of length required to extend from exterior face of stone to cavity behind.
6. Plastic Weep Hole/Vents: One-piece, flexible extrusion manufactured from UV-resistant polypropylene copolymer, designed to weep moisture in masonry cavity to exterior, in color selected from manufacturer's standard.
7. Wicking Material: Absorbent rope, made from cotton or UV-resistant synthetic fiber, 1/4 to 3/8 inch (6 to 10 mm) in diameter, in length required to produce 2-inch (50-mm) exposure on exterior and 18 inches (450 mm) in cavity between wythes.
8. Sealants for Joints in Dimension Stone Cladding: Manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated below that comply with applicable requirements in Division 07 Section "Joint Sealants" and do not stain stone.
 - a. Multicomponent **OR** Single-component, **as directed**, nonsag, polysulfide sealant.
 - b. Multicomponent **OR** Single-component, **as directed**, nonsag, urethane sealant.
 - c. Single-component, neutral-curing silicone sealant.
 - d. Colors: Provide colors of exposed sealants to comply with the following requirement:
 - 1) Match color of sample **OR** Match color of stone **OR** Provide color as indicated by manufacturer's designations **OR** Provide color as selected from manufacturer's full range, **as directed**.
9. Sealant for Filling Kerfs: Same sealant used for joints in dimension stone **OR** Manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated below that comply with applicable requirements in Division 07 Section "Joint Sealants" and that do not stain stone, **as directed**.
 - a. Single-component, nonsag, urethane sealant; Class 25, Use T (traffic), and Use M (masonry).
 - b. Single-component, nonsag, neutral-curing, medium to high modulus, silicone sealant; Class 25, Use NT (nontraffic), and Use M (masonry).

K. Stone Fabrication

1. General: Fabricate stone units in sizes and shapes required to comply with requirements indicated, including details on Drawings and Shop Drawings.
 - a. For granite, comply with recommendations in NBGQA's "Specifications for Architectural Granite."
 - b. For limestone, comply with recommendations in ILI's "Indiana Limestone Handbook."
 - c. For marble, comply with recommendations in MIA's "Dimensional Stone--Design Manual IV."
2. Control depth of stone and back check to maintain minimum clearance of 1 inch (25 mm) **OR** 1-1/2 inches (38 mm), **as directed**, between backs of stone units and surfaces or projections of structural members, fireproofing (if any), backup walls, and other work behind stone.
3. Dress joints (bed and vertical) straight and at right angle to face, unless otherwise indicated. Shape beds to fit supports.
4. Cut and drill sinkages and holes in stone for anchors, fasteners, supports, and lifting devices as indicated or needed to set stone securely in place.
5. Finish exposed faces and edges of stone, except sawed reveals, to comply with requirements indicated for finish and to match approved samples and mockups.
6. Cut stone to produce uniform joints 3/8 inch (10 mm) **OR** 1/2 inch (13 mm), **as directed**, wide and in locations indicated.



7. Contiguous Work: Provide chases, reveals, reglets, openings, and similar features as required to accommodate contiguous work.
 8. Fabricate molded work, including washes and drips, to produce stone shapes with a uniform profile throughout entire unit length, with precisely formed arris slightly eased to prevent snipping, and with matching profile at joints between units.
- L. Fabrication Of Backup Structure
1. Fabrication of Steel Trusses **OR** Strongback Frames **OR** Miscellaneous Steel Framing, **as directed**: Fabricate in shop to comply with AISC's "Specification for Structural Steel Buildings - Allowable Stress Design and Plastic Design," to accommodate construction tolerances specified, and as indicated on Shop Drawings.
 - a. Weld shop connections to comply with applicable provisions of AWS D1.1/D1.1M.
 - b. Fabricate joints to exclude water or to permit its escape to building exterior, at locations where water could accumulate because of condensation or other causes.
 - c. Hot-dip galvanize backup structure after fabrication to comply with ASTM A 123/A 123M.
 2. Fabrication of Prefabricated Steel Stud Frames: Fabricate and assemble by welding to comply with requirements in Division 05 Section "Cold-formed Metal Framing".
 - a. Weld secondary weather barrier (sheathing) to outside face of steel stud frames. Use continuous welds at all four edges of sheets to provide continuous weather seal.
 - b. For assemblies made from galvanized steel, clean welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.
- M. Shop-Painted Steel Finishes
1. General: Paint uncoated steel backup structure before delivering to Project site to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel."
 2. Surface Preparation: After completing fabrication of steel items, prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 3. Apply two-coat high-performance coating system consisting of organic zinc-rich primer, complying with SSPC-Paint 20 or SSPC-Paint 29 and topcoat of high-build urethane or epoxy coating recommended by manufacturer for application over specified zinc-rich primer.
- N. Mortar Mixes
1. General: Comply with referenced standards and with manufacturers' written instructions for mix proportions, mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures needed to produce mortar of uniform quality and with optimum performance characteristics.
 - a. Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated. Do not use calcium chloride.
 - b. Combine and thoroughly mix cementitious materials, water, and aggregates in a mechanical batch mixer, unless otherwise indicated. Discard mortar when it has reached initial set.
 2. Portland Cement-Lime Setting Mortar: Comply with ASTM C 270, Proportion Specification, for types of mortar indicated below:
 - a. Set granite with Type S mortar.
 - b. Set limestone with Type N mortar.
 - c. Set marble with Type S mortar.
 - d. Set quartz-based stone with Type S **OR** N, **as directed**, mortar.
 - e. Set serpentine with Type S mortar.
 - f. Set slate with Type S mortar.
 - g. Set travertine with Type N mortar.
 - h. Backparge travertine with Type O mortar.
 3. Pointing Mortar: Comply with ASTM C 270, Proportion Specification, for types of mortar indicated. Provide pointing mortar mixed to match sample and complying with the following:



- a. Pigmented Pointing Mortar: Select and proportion pigments with other ingredients to produce color required. Do not exceed pigment-to-cement ratio of 1:10, by weight.
- b. Packaged Portland Cement-Lime Mix Mortar: Use portland cement-lime mix of selected color.
- c. Colored-Aggregate Pointing Mortar: Produce color required by combining colored aggregates with portland cement of selected color.
- d. Point granite with Type S **OR** N, **as directed**, mortar.
- e. Point limestone with Type N **OR** O, **as directed**, mortar.
- f. Point marble with Type N **OR** O, **as directed**, mortar.
- g. Point quartz-based stone with Type N **OR** O, **as directed**, mortar.
- h. Point serpentine with Type N **OR** O, **as directed**, mortar.
- i. Point slate with Type N mortar.
- j. Point travertine with Type N **OR** O, **as directed**, mortar.

1.3 EXECUTION

A. Installing Backup Structure

1. Installing Steel Trusses **OR** Strongback Frames **OR** Miscellaneous Steel Framing, **as directed**: Comply with AISC's "Specification for Structural Steel Buildings - Allowable Stress Design and Plastic Design," and install to accommodate construction tolerances specified and as indicated on Shop Drawings.
 - a. Maintain erection tolerances of backup structure within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
 - b. For prefabricated units to which stone has been installed before erection, maintain tolerances of stone faces and edges as specified in "Installation Tolerances" Article.
2. Installing Prefabricated Steel Stud Frames: Install by welding to steel weld-plates anchored in concrete **OR** by welding to structural-steel frame **OR** by bolting to structural-steel frame, **as directed**, to comply with requirements in Division 05 Section "Cold-formed Metal Framing".
 - a. Install prefabricated steel stud frames level, plumb, and true to line with no variation in plane or alignment exceeding 1/16 inch (1.5 mm) and no variation in position exceeding 1/8 inch (3 mm).
 - b. For prefabricated frames to which stone has been installed before erection, maintain tolerances of stone faces and edges as specified in "Installation Tolerances" Article.
3. Installing Metal-Grid Systems: Comply with manufacturer's written instructions to provide integrated system that combines metal struts, fittings, fasteners, and stone anchors.
 - a. Fasten struts by bolting to inserts in concrete or steel angle clips bolted to steel framing.
 - b. Fasten stone supports and anchors by bolting to struts.
 - c. Shim and adjust struts and stone supports and anchors to provide grid that is level, plumb, and true to line with no variation in plane or alignment exceeding 1/16 inch (1.5 mm) and no variation in position exceeding 1/8 inch (3 mm).

B. Setting Dimension Stone Cladding, General

1. Before setting stone clean surfaces that are dirty or stained by removing soil, stains, and foreign materials. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.
2. Coat limestone with dampproofing to extent indicated below:
 - a. Stone at Grade: Beds, joints, and back surfaces to at least 12 inches (300 mm) above finish-grade elevations.
 - b. Stone Extending below Grade: Beds, joints, back surfaces, and face surfaces below grade.
 - c. Allow cementitious dampproofing formulations to cure before setting dampproofed stone. Do not damage or remove dampproofing while handling and setting stone.
3. Parge back side of travertine panels with mortar not less than 3/8 inch (10 mm) thick.



4. Execute dimension stone cladding installation by skilled mechanics and employ skilled stone fitters at Project site to do necessary field cutting as stone is set.
 - a. Use power saws with diamond blades to cut stone. Produce lines cut straight and true, with edges eased slightly to prevent snipping.
 5. Contiguous Work: Provide reveals, reglets, and openings as required to accommodate contiguous work.
 6. Set stone to comply with requirements indicated on Drawings and Shop Drawings. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure dimension stone cladding in place. Shim and adjust anchors, supports, and accessories to set stone accurately in locations indicated with uniform joints of widths indicated and with edges and faces aligned according to established relationships and indicated tolerances.
 7. Provide expansion, control, and pressure-relieving joints of widths and at locations indicated.
 - a. Sealing expansion and other joints is specified in Division 07 Section "Joint Sealants".
 - b. Keep expansion joints free of mortar and other rigid materials.
 8. Install concealed flashing at continuous shelf angles, lintels, ledges, and similar obstructions to downward flow of water to divert water to building exterior.
 9. Keep cavities open where unfilled space is indicated between back of stone units and backup wall; do not fill cavities with mortar or grout.
 - a. Place weep holes in joints where moisture may accumulate, including base of cavity walls, above shelf angles, and flashing. Locate weep holes at intervals not exceeding 24 inches (600 mm). Use weep and vent tubes **OR** plastic weep hole/vents **OR** wicking material, **as directed**.
 - b. Place vents in cavity walls at tops of cavities, below shelf angles and flashing, and at intervals not exceeding 20 feet (6 m) vertically. Locate vents in joints at intervals not exceeding 60 inches (1500 mm) horizontally. Use weep and vent tubes **OR** plastic weep hole/vents, **as directed**.
- C. Setting Mechanically Anchored Dimension Stone Cladding
1. Attach anchors securely to stone and to backup surfaces. Comply with recommendations in ASTM C 1242.
 2. Provide compressible filler in ends of dowel holes and bottoms of kerfs to prevent end bearing of dowels and anchor tabs on stone. Fill remainder of anchor holes and kerfs with sealant indicated for filling kerfs.
 3. Set stone supported on clips or continuous angles on resilient setting shims. Use material of thickness required to maintain uniform joint widths and to prevent point loading of stone on anchors. Hold shims back from face of stone a distance at least equal to width of joint.
- D. Setting Dimension Stone Cladding With Mortar
1. Set stone in full bed of mortar with head joints filled, unless otherwise indicated.
 - a. Use setting buttons of adequate size, in sufficient quantity, and of thickness required to maintain uniform joint width and to prevent mortar from extruding. Hold buttons back from face of stone a distance at least equal to width of joint, but not less than depth of pointing materials.
 - b. Do not set heavy units or projecting courses until mortar in courses below has hardened enough to resist being squeezed out of joint.
 - c. Support and brace projecting stones until wall above is in place and mortar has set.
 - d. Provide compressible filler in ends of dowel holes and bottoms of kerfs to prevent end bearing of dowels and anchor tabs on stone. Fill remainder of anchor holes and kerfs with mortar.
 2. Embed ends of sills in mortar; leave remainder of joint open until final pointing.
 3. Rake out joints for pointing with mortar to depths of not less than 1/2 inch (12 mm). Rake joints to uniform depths with square bottoms and clean sides.
 4. Prepare stone-joint surfaces for pointing with mortar by removing dust and mortar particles. Where setting mortar was removed to depths greater than surrounding areas, apply first layer of pointing mortar in layers not more than 3/8 inch (10 mm) until a uniform depth is formed.



5. Point stone joints by placing pointing mortar in layers not more than 3/8 inch (10 mm). Compact each layer thoroughly and allow to become thumbprint hard before applying next layer.
 6. Tool joints with a round jointer having a diameter 1/8 inch (3 mm) larger than width of joint, when pointing mortar is thumbprint hard.
 7. Rake out mortar from sealant-pointed joints to depths of not less than 1/2 inch (12 mm) nor less than that required for sealant and sealant backing. Rake joints to uniform depths with square bottoms and clean sides.
 8. Set the following dimension stone cladding with unfilled head joints for installing joint sealants:
 - a. Cornices.
 - b. Copings.
 - c. Belt and other projecting courses.
- E. Joint-Sealant Installation
1. Prepare joints and apply sealants of type and at locations indicated to comply with applicable requirements in Division 07 Section "Joint Sealants".
- F. Installation Tolerances
1. Variation from Plumb: For vertical lines and surfaces of walls, do not exceed 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (10 mm in 6 m), or 1/2 inch in 40 feet (12 mm in 12 m) or more. For external corners, corners and jambs within 20 feet (6 m) of an entrance, expansion joints, and other conspicuous lines, do not exceed 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 3/8 inch in 40 feet (10 mm in 12 m) or more.
 2. Variation from Level: For lintels, sills, water tables, parapets, horizontal bands, horizontal grooves, and other conspicuous lines, do not exceed 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 3/8 inch (10 mm) maximum.
 3. Variation of Linear Building Line: For positions shown in plan and related portions of walls and partitions, do not exceed 1/4 inch in 20 feet (6 mm in 6 m) or 1/2 inch in 40 feet (12 mm in 12 m) or more.
 4. Variation in Cross-Sectional Dimensions: For thickness of walls from dimensions indicated, do not exceed plus or minus 1/4 inch (6 mm).
 5. Variation in Joint Width: Do not vary from average joint width more than plus or minus 1/8 inch (3 mm) or a quarter of nominal joint width, whichever is less. For joints within 60 inches (1500 mm) of each other, do not vary more than 1/8 inch (3 mm) or a quarter of nominal joint width, whichever is less from one to the other.
 6. Variation in Plane between Adjacent Stone Units (Lipping): Do not exceed 1/16-inch (1.5-mm) difference between planes of adjacent units.
- G. Adjusting And Cleaning
1. Remove and replace broken, chipped, stained, or otherwise damaged stone, defective joints, and dimension stone cladding that does not match approved samples and mockups. Damaged stone may be repaired if the Owner approves methods and results.
 2. Replace in a manner that results in dimension stone cladding's matching approved samples and mockups, complying with other requirements, and showing no evidence of replacement.
 3. In-Progress Cleaning: Clean dimension stone cladding as work progresses. Remove mortar fins and smears before tooling joints. Remove excess sealant and smears as sealant is installed.
 4. Final Cleaning: Clean dimension stone cladding no fewer than six days after completion of pointing and sealing, using clean water and stiff-bristle fiber brushes. Do not use wire brushes, acid-type cleaning agents, cleaning agents containing caustic compounds or abrasives, or other materials or methods that could damage stone.

END OF SECTION 04 41 00 00



SECTION 04 41 00 00a - INTERIOR STONE FACING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for interior stone facing. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following interior applications of dimension stone:
 - a. Wall paneling.
 - b. Wainscot paneling.
 - c. Column facing.
 - d. Window stools.
 - e. Base.
 - f. Trim.
 - g. Benches.

C. Performance Requirements

1. General: Design stone anchors and anchoring systems according to ASTM C 1242.
2. Seismic Performance: Provide interior stone facing system capable of withstanding the effects of earthquake motions determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures."

D. Submittals

1. Product Data: For each variety of stone, installation materials, and other manufactured products.
2. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - a. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
3. Samples:
 - a. For Each Stone Type: Include two **OR** three **OR** four **OR** five, **as directed**, or more Samples in each set and show the full range of variations in appearance characteristics expected in completed Work.
 - b. For each color of grout and pointing mortar required.
4. LEED Submittal:
 - a. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.
5. Sealant Compatibility Test Report: From sealant manufacturer, complying with requirements in Division 07 Section "Joint Sealants" and indicating that sealants will not stain or damage stone.
6. Maintenance data.

E. Quality Assurance

1. Installer Qualifications: An installer who employs experienced stone setters who are skilled in installing interior stone facing similar in material, design, and extent to that indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.
 - a. Installer's responsibilities include fabricating and installing interior stone facing, including anchoring system, and providing professional engineering services needed to assume engineering responsibility.
 - b. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.



2. Source Limitations for Stone: Obtain each variety of stone, regardless of finish, from a single quarry, whether specified in this Section or in another Section, with resources to provide materials of consistent quality in appearance and physical properties.

F. Delivery, Storage, And Handling

1. Lift stone with wide-belt slings; do not use wire rope or ropes that might cause staining. Move stone, if required, using dollies with cushioned wood supports.
2. Store stone on wood A-frames or pallets with nonstaining separators and nonstaining, waterproof covers. Ventilate under covers to prevent condensation.
3. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

1.2 PRODUCTS

A. Granite

1. Granite: Comply with ASTM C 615.
2. Description: Uniform, fine-grained **OR** medium-grained, **as directed**, white **OR** pink **OR** gray **OR** black, **as directed**, stone with **OR** without, **as directed**, veining.
3. Cut: Vein **OR** Fleuri, **as directed**, cut.
 - a. Orientation of Veining: Horizontal **OR** Vertical **OR** As indicated, **as directed**.
4. Cut stone from one block or contiguous, matched blocks in which natural markings occur.
5. Finish: polished **OR** Honed **OR** Thermal **OR** As indicated **OR** Match sample, **as directed**.

B. Limestone

1. Limestone: Comply with ASTM C 568.
 - a. Classification: I Low-Density **OR** II Medium-Density **OR** III High-Density, **as directed**.
 - b. Description: Dolomitic **OR** Oolitic **OR** Shell, **as directed**, limestone.
2. Cut: Vein **OR** Fleuri, **as directed**, cut.
 - a. Orientation of Veining: Horizontal **OR** Vertical **OR** As indicated, **as directed**.
3. Cut stone from one block or contiguous, matched blocks in which natural markings occur.
4. Finish: Smooth **OR** Sand rubbed **OR** Machine tooled, 4 bats per 1 inch (25 mm) **OR** Machine tooled, 6 bats per 1 inch (25 mm) **OR** Machine tooled, 8 bats per 1 inch (25 mm) **OR** As indicated **OR** Match sample, **as directed**.

C. Marble

1. Marble: Comply with ASTM C 503.
2. Description: Uniform, fine- to medium-grained, white stone with only slight veining.
3. Cut: Vein **OR** Fleuri, **as directed**, cut.
 - a. Orientation of Veining: Horizontal **OR** Vertical **OR** As indicated, **as directed**.
4. Cut stone from one block or contiguous, matched blocks in which natural markings occur.
5. Finish: Polished **OR** Honed **OR** As indicated **OR** Match sample, **as directed**.

D. Quartz-Based Stone

1. Quartz-Based Stone: Comply with ASTM C 616, Classification I Sandstone **OR** II Quartzitic Sandstone **OR** III Quartzite, **as directed**.
2. Finish: Sand rubbed **OR** Natural cleft **OR** Thermal **OR** As indicated **OR** Match sample, **as directed**.

E. Serpentine

1. Serpentine: Comply with ASTM C 1526, Classification I Exterior **OR** II Interior, **as directed**.
2. Cut stone from one block or contiguous, matched blocks in which natural markings occur.
3. Finish: Polished **OR** Honed **OR** As indicated **OR** Match sample, **as directed**.

F. Slate



1. Slate: Comply with ASTM C 629, Classification I Exterior **OR** II Interior, **as directed**, with a fine, even grain and unfading color, from clear, sound stock.
 - a. Color: Black **OR** Blue-black **OR** Gray **OR** Blue-gray **OR** Green **OR** Purple **OR** Mottled purple and green **OR** Red, **as directed**.
 2. Finish: Honed **OR** Sand rubbed **OR** Natural cleft **OR** As indicated **OR** Match sample, **as directed**.
- G. Travertine
1. Travertine: Comply with ASTM C 1527, Classification I Exterior **OR** II Interior, **as directed**.
 2. Cut: Vein **OR** Fleuri, **as directed**, cut.
 - a. Orientation of Veining: Horizontal **OR** Vertical **OR** As indicated, **as directed**.
 3. Cut stone from one block or contiguous, matched blocks in which natural markings occur.
 4. Filling: Fill pores on faces of stone with cementitious filler of color selected **OR** matching sample, **as directed**.
 5. Finish: Polished **OR** Honed **OR** As indicated **OR** Match sample, **as directed**.
- H. Setting Materials
1. Molding Plaster: ASTM C 59/C 59M.
 2. Portland Cement: ASTM C 150, Type I or II.
 - a. Low-Alkali Cement: Not more than 0.60 percent total alkali when tested according to ASTM C 114.
 3. Hydrated Lime: ASTM C 207, Type S.
 4. Aggregate: ASTM C 144.
 5. Water: Potable.
 6. Adhesives, General: Use only adhesives formulated for stone and ceramic tile and recommended by their manufacturer for the application indicated.
 7. Organic Adhesive: ANSI A136.1, Type I, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 8. Water-Cleanable Epoxy Adhesive: ANSI A118.3, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 9. Stone Adhesive: 2-part, epoxy-resin or polyester-resin stone adhesive with an initial set time of not more than 2 hours at 70 deg F (21 deg C), and with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - a. Color: Clear **OR** Match stone, **as directed**.
- I. Grout
1. Grout Colors: Match stone **OR** As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 2. Sand-Portland Cement Grout: ANSI A108.10, composed of white or gray cement and white or colored aggregate as required to produce required color.
 3. Standard Sanded Cement Grout: ANSI A118.6.
 4. Standard Unsanded Cement Grout: ANSI A118.6.
 5. Polymer-Modified Tile Grout: ANSI A118.7.
 - a. Polymer Type: Ethylene vinyl acetate, in dry, redispersible form, prepackaged with other dry ingredients.
 - b. Polymer Type: Acrylic resin or styrene-butadiene rubber in liquid-latex form for addition to prepackaged dry-grout mix.
 - c. Polymer Type: Either ethylene vinyl acetate, in dry, redispersible form, prepackaged with other dry ingredients, or acrylic resin or styrene-butadiene rubber in liquid-latex form for addition to prepackaged dry-grout mix.
 - d. Grout Type: Sanded **OR** Unsanded, **as directed**.
 6. Water-Cleanable Epoxy Grout: ANSI A118.3, chemical-resistant, water-cleanable, tile-setting and -grouting epoxy.
- J. Pointing Mortar Materials



1. Portland Cement: ASTM C 150, Type I or II. Provide natural color or white cement as required to produce mortar color indicated.
 - a. Low-Alkali Cement: Not more than 0.60 percent total alkali when tested according to ASTM C 114.
2. Hydrated Lime: ASTM C 207, Type S.
3. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or III, and hydrated lime complying with ASTM C 207, Type S.
4. Colored Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III; hydrated lime complying with ASTM C 207, Type S; and mortar pigments. Use a mix of formulation required to produce color indicated or, if not indicated, as selected from manufacturer's standard formulations. Pigments shall not exceed 10 percent of portland cement by weight.
5. Aggregate: ASTM C 144, except with 100 percent passing No. 16 (1.18-mm) sieve.
 - a. White Aggregates: Natural white sand or ground white stone.
 - b. Colored Aggregates: Natural-colored sand or ground marble, granite, or other durable stone; of color necessary to produce required mortar color.
6. Mortar Pigments: Natural and synthetic iron oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in mortar and containing no carbon black.
7. Water: Potable.

K. Sealants

1. Joint Sealants: Manufacturer's standard sealants of characteristics indicated below that comply with applicable requirements in Division 07 Section "Joint Sealants" and will not stain the stone they are applied to.
 - a. Single-component, mildew-resistant, neutral-curing **OR** acid-curing, **as directed**, silicone sealant.
 - b. Single-component, nonsag urethane sealant.
 - c. Latex Sealant.
 - d. VOC Content: 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - e. Colors: Provide colors of exposed sealants to match colors of grout in stone adjoining sealed joints, unless otherwise indicated.
2. Sealant for Filling Kerfs: Same sealant used for joints in dimension stone **OR** Manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated below that comply with applicable requirements in Division 07 Section "Joint Sealants" and that do not stain stone, **as directed**.
 - a. Single-component, nonsag, urethane sealant; Class 25, Use T (traffic), and Use M (masonry).
 - b. Single-component, nonsag, neutral-curing, medium to high modulus, silicone sealant; Class 25, Use NT (nontraffic), and Use M (masonry).
 - c. VOC Content: 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

L. Stone Anchors And Attachments

1. Fabricate anchors from stainless steel, ASTM A 240/A 240M, Type 304.
 - a. Fasteners for Stainless-Steel Anchors: Annealed stainless-steel bolts, nuts, and washers; ASTM F 593 (ASTM F 738M) for bolts and ASTM F 594 (ASTM F 836M) for nuts, Alloy Group 1 (A1).
2. Fabricate dowels from stainless steel, ASTM A 276, Type 304.
3. Fabricate anchors from extruded aluminum, ASTM B 221 (ASTM B 221M), alloy and temper as required to support loads imposed without exceeding allowable design stresses, but not less than strength and durability properties of Alloy 6063-T6.
 - a. Fasteners for Extruded-Aluminum Anchors: Annealed stainless-steel bolts, nuts, and washers; ASTM F 593 (ASTM F 738M) for bolts and ASTM F 594 (ASTM F 836M) for nuts, Alloy Group 1 (A1).



4. Anchor Support Grids: Roll-formed steel channels, of size and shape required for application indicated, formed from galvanized steel sheet not less than 0.108 inch (2.8 mm) thick and complying with ASTM A 653/A 653M, G90 (Z275).
 - a. Fittings and Fasteners: System manufacturer's standard components of design, size, and material required to securely attach grids to building structure and stone anchors to grids. Fabricate components in contact with stone from same material specified for anchors.
5. Wire Tiebacks: No. 9 AWG copper or copper-alloy or 0.120-inch- (3.0-mm-) diameter, stainless-steel wire.
6. Dovetail Slots: Furnish dovetail slots with filler strips of slot size required to receive anchors provided, fabricated from 0.0336-inch- (0.85-mm-) thick, galvanized steel sheet complying with ASTM A 653/A 653M, G90 (Z275).
7. Direct-Mount Anchoring Systems: Stainless-steel or aluminum stone anchors designed to be applied directly to wall surfaces or to metal grids. System is secured to wall framing, furring, or sheet-metal reinforcing strips built into wall with stainless-steel self-drilling screws. Anchors fit into kerfs or holes in edges of interior stone facing panels and do not need setting spots.

M. Stone Accessories

1. Temporary Setting Shims: Rigid plastic shims, nonstaining to stone, sized to suit joint thickness.
2. Setting Shims for Direct-Mount Anchoring Systems: Strips of resilient plastic or neoprene, nonstaining to stone, of thickness needed to prevent point loading of stone on anchors and of depths to suit anchors without intruding into required depths of pointing materials.
3. Cleaner: Stone cleaner specifically formulated for stone types, finishes, and applications indicated, as recommended by stone producer. Do not use cleaning compounds containing acids, caustics, harsh fillers, or abrasives.
4. Stone Sealer: Colorless, stain-resistant sealer that does not affect color or physical properties of stone surfaces, as recommended by stone producer for application indicated.

N. Stone Fabrication, General

1. Select stone for intended use to prevent fabricated units from containing cracks, seams, and starts that could impair structural integrity or function.
 - a. Repairs that are characteristic of the varieties specified are acceptable provided they do not impair structural integrity or function and are not aesthetically unpleasing, as judged by the Owner.
2. Fabricate interior stone facing in sizes and shapes required to comply with requirements indicated, including details on Drawings and Shop Drawings.
 - a. For granite, comply with recommendations in NBGQA's "Specifications for Architectural Granite."
 - b. For marble, comply with recommendations in MIA's "Dimension Stone--Design Manual."
 - c. For limestone, comply with recommendations in ILI's "Indiana Limestone Handbook."
3. Cut stone to produce pieces of thickness, size, and shape indicated and to comply with fabrication and construction tolerances recommended by applicable stone association.
 - a. Where items are installed with adhesive or where edges of stone is visible in the finished work, make items uniform in thickness and of identical thickness for each type of item; gage back of stone if necessary.
 - b. Clean sawed backs of stones to remove rust stains and iron particles.
 - c. Dress joints straight and at right angle to face, unless otherwise indicated.
 - d. Cut and drill sinkages and holes in stone for anchors, supports, and lifting devices as indicated or needed to set stone securely in place; shape beds to fit supports.
 - e. Provide openings, reveals, and similar features as needed to accommodate adjacent work.
4. Fabricate molded work to produce stone shapes with a uniform profile throughout entire unit length and with precisely formed arris slightly eased to prevent snipping, and matched at joints between units.
 - a. Produce moldings with machines having abrasive shaping wheels made to reverse contour of molding shape; do not sculpt moldings.
 - b. Miter moldings at corners, unless otherwise indicated, with edges of miters slightly eased at outside corners.



5. Finish exposed faces and edges of stone to comply with requirements indicated for finish of each type of stone required and to match approved Samples.
 6. Carefully inspect finished stone units at fabrication plant for compliance with requirements for appearance, material, and fabrication. Replace defective units.
 - a. Grade and mark stone for overall uniform appearance when assembled in place. Natural variations in appearance are acceptable if installed stone units match range of colors and other appearance characteristics represented in approved Samples.
- O. Stone Paneling And Column Facing
1. Arrange panels in shop or other suitable space in proposed orientation and sequence for examination by the Owner. Mark units with temporary sequence numbers to indicate position in proposed layout.
 - a. Lay out one elevation at a time if approved by the Owner.
 - b. Notify the Owner seven days in advance of date and time when layout will be available for viewing.
 - c. Provide lighting of similar type and level as that of final installation for viewing layout, unless otherwise approved by the Owner.
 - d. Rearrange panels as directed by the Owner until layout is approved.
 - e. Do not trim nonmodular-size units to less than modular size until after the Owner's approval of layout, unless otherwise approved by the Owner.
 - f. Mark backs of units and Shop Drawings with sequence numbers based on approved layout. Mark backs of units to indicate orientation of units in completed Work.
 2. Nominal Thickness: 3/4 inch (20 mm) **OR** 7/8 inch (21 mm) **OR** 1 inch (25 mm) **OR** 1-1/4 inches (32 mm) **OR** 2 inches (50 mm), **as directed**, unless otherwise indicated.
 3. Maintain minimum clearances of 3/4 inch (20 mm) **OR** 1 inch (25 mm), **as directed**, between backs of panels and structural members, fireproofing if any, backup walls, and other work behind stone. Do not back check stone less than 1 inch (25 mm) thick.
 4. Joints: 1/16-inch- (1.5-mm-) wide grouted **OR** 1/8-inch- (3-mm-) wide grouted **OR** 1/8-inch- (3-mm-) wide, sealant-filled **OR** 1/4-inch- (6-mm-) wide, mortar-pointed **OR** 1/4-inch- (6-mm-) wide, sealant-filled **OR** 3/8-inch- (10-mm-) wide, mortar-pointed **OR** 3/8-inch- (10-mm-) wide, sealant-filled, **as directed**, joints.
 5. Quirk-miter corners, unless otherwise indicated. Install anchorage in top and bottom bed joints of corner units.
 6. Carve and cut inscriptions and decorative surfaces according to Shop Drawings. Use skilled stone carvers experienced in the successful performance of work similar to that indicated.
 7. Abrasively etch inscriptions and decorative surfaces according to Shop Drawings.
 8. Laser etch inscriptions and decorative surfaces according to Shop Drawings.
 9. Pattern Arrangement: Fabricate and arrange panels with veining and other natural markings to comply with the following requirements:
 - a. Arrange panels with veining horizontal.
 - b. Arrange panels with veining vertical.
 - c. Arrange panels with veining as indicated on Drawings.
 - d. Arrange panels in blend pattern.
 - e. Book match units, single-course height.
 - f. Book match units, both vertically and horizontally.
 - g. Book match units in each course. No matching is required between successive courses.
 - h. Slip match units, single-course height.
 - i. Slip match units, both vertically and horizontally.
 - j. Slip match units in each course. No matching is required between successive courses.
- P. Stone Window Stools, Base, And Trim
1. Window Stools:
 - a. Nominal Thickness: 3/4 inch (20 mm) **OR** 7/8 inch (22 mm) **OR** 1-1/4 inches (32 mm), **as directed**, unless otherwise indicated.



- b. Edge Detail: Straight, slightly eased at corners **OR** 3/8-inch (10-mm) bevel at top edge, bottom corner slightly eased **OR** 3/8-inch (10-mm) radius at top edge, bottom corner slightly eased **OR** 3/4-inch (20-mm) bullnose **OR** 1-1/2-inch (40-mm) laminated bullnose **OR** As indicated, **as directed**.
 - c. Ends: Extend stools beyond opening same distance as stool overhang and finish ends to match exposed edge.
 - d. Joints: 1/16-inch- (1.5-mm-) wide grouted joints **OR** 1/8-inch- (3-mm-) wide grouted joints **OR** 1/8-inch- (3-mm-) wide, sealant-filled joints **OR** Bonded joints, 1/32 inch (0.8 mm) or less in width, **as directed**.
 - e. Assemble window stools by bonding joints with stone adhesive. Mask areas adjacent to joints to prevent adhesive smears. Clamp units to temporary bracing to ensure that window stools are properly aligned and joints are minimum width.
2. Base:
- a. Nominal Thickness: 3/4 inch (20 mm) **OR** 7/8 inch (22 mm) **OR** 1-1/4 inches (32 mm), **as directed**, unless otherwise indicated.
 - b. Top-Edge Detail: Straight, slightly eased at corner **OR** 3/8-inch (10-mm) bevel **OR** 3/4-inch (20-mm) radius **OR** 3/8-inch (10-mm) radius **OR** As indicated, **as directed**.
 - c. Ends: Butt ends into casings **OR** Butt ends into opening frames **OR** Return ends to depth of adjacent finish with edge detail same as top edge, **as directed**, unless otherwise indicated.
 - d. Joints: 1/16-inch- (1.5-mm-) wide grouted joints **OR** 1/8-inch- (3-mm-) wide grouted joints **OR** 1/8-inch- (3-mm-) wide, sealant-filled joints **OR** Bonded joints, 1/32 inch (0.8 mm) or less in width, **as directed**.
 - 1) Locate joints at midpoints between adjacent paneling joints, unless otherwise indicated.
3. Flat Trim:
- a. Nominal Thickness: 3/4 inch (20 mm) **OR** 7/8 inch (22 mm) **OR** 1-1/4 inches (32 mm) **OR** 1-1/2 inches (40 mm), **as directed**, unless otherwise indicated.
 - b. Edge Detail: Straight, slightly eased at corners **OR** 3/8-inch (10-mm) bevels **OR** 3/4-inch (20-mm) radii **OR** 3/8-inch (10-mm) radii **OR** As indicated, **as directed**.
 - c. Joints: 1/16-inch- (1.5-mm-) wide grouted joints **OR** 1/8-inch- (3-mm-) wide grouted joints **OR** 1/8-inch- (3-mm-) wide, sealant-filled joints **OR** Bonded joints, 1/32 inch (0.8 mm) or less in width, **as directed**.
4. Molded Trim:
- a. Profile: Match profiles indicated on Drawings **OR** existing, **as directed**.
 - b. Joints: 1/16-inch- (1.5-mm-) wide grouted joints **OR** 1/8-inch- (3-mm-) wide grouted joints **OR** 1/8-inch- (3-mm-) wide, sealant-filled joints **OR** Bonded joints, 1/32 inch (0.8 mm) or less in width, **as directed**.
- Q. Stone Benches
1. Tops:
- a. Nominal Thickness: 3/4 inch (20 mm) **OR** 7/8 inch (22 mm) **OR** 1-1/4 inches (32 mm) **OR** 1-1/2 inches (40 mm) **OR** 2 inches (50 mm), **as directed**, unless otherwise indicated.
 - b. Edge Detail: Straight, slightly eased at corners **OR** 3/8-inch (10-mm) bevel at top edge, bottom corner slightly eased **OR** 3/8-inch (10-mm) radius at top edge, bottom corner slightly eased **OR** 3/8-inch (10-mm) bevel at top and bottom edges **OR** full bullnose **OR** As indicated, **as directed**.
 - c. Corner Detail: Match top edge **OR** Square, slightly eased **OR** As indicated, **as directed**.
 - d. Bottom Surface Finish: Smooth.
2. Pedestals:
- a. Nominal Thickness: 4 inches (100 mm), unless otherwise indicated.
 - b. Edge Detail: Straight, slightly eased at corners **OR** 3/8-inch (10-mm) bevel at corners **OR** 3/8-inch (10-mm) radius at corners **OR** full bullnose **OR** As indicated, **as directed**.
3. Base: Stone facing applied to concrete **OR** masonry, **as directed**.
- a. Nominal Stone Thickness: 3/4 inch (20 mm) **OR** 7/8 inch (22 mm) **OR** 1-1/4 inches (32 mm), **as directed**, unless otherwise indicated.



- b. Joints: 1/16-inch- (1.5-mm-) wide grouted **OR** 1/8-inch- (3-mm-) wide grouted **OR** 1/4-inch- (6-mm-) wide, mortar-pointed **OR** 3/8-inch- (10-mm-) wide, mortar-pointed, **as directed**, joints.

R. Mixes

1. Spotting Plaster: Stiff mix of molding plaster and water.
2. Mortar: Comply with referenced standards and with manufacturers' written instructions for mix proportions, mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures needed to produce mortar of uniform quality and with optimum performance characteristics.
 - a. Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated. Do not use calcium chloride.
 - b. Combine and thoroughly mix cementitious materials, water, and aggregates in a mechanical batch mixer, unless otherwise indicated. Discard mortar when it has reached initial set.
3. Setting Mortar: Comply with ASTM C 270, Proportion Specification.
 - a. Type: **N OR O, as directed.**
 - b. Mix Proportions: 1 part portland cement and 2-1/2 to 4 parts lime with aggregate ratio of 2-1/4 to 3 times volume of cement and lime.
4. Pointing Mortar: Comply with ASTM C 270, Proportion Specification, for types of mortar indicated. Provide pointing mortar mixed to match the Owner's sample and complying with the following:
 - a. Pigmented Pointing Mortar: Select and proportion pigments with other ingredients to produce color required. Do not exceed pigment-to-cement ratio of 1:10, by weight.
 - b. Packaged Portland Cement-Lime Mix Mortar: Use portland cement-lime mix of selected color.
 - c. Colored-Aggregate Pointing Mortar: Produce color required by combining colored aggregates with portland cement of selected color.
 - d. Type: **N OR O, as directed.**
 - e. Mix Proportions: 1 part portland cement and 2-1/2 to 4 parts lime with aggregate ratio of 2-1/4 to 3 times volume of cement and lime.
5. Grout: Comply with mixing requirements of referenced ANSI standards and with manufacturer's written instructions.

1.3 EXECUTION

A. Preparation

1. Clean dirty or stained stone surfaces by removing soil, stains, and foreign materials before setting. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.

B. Setting Of Stone, General

1. Do necessary field cutting as stone is set. Use power saws with diamond blades to cut stone. Cut lines straight and true, with edges eased slightly to prevent snipping.
2. Contiguous Work: Provide reveals and openings as required to accommodate contiguous work.
3. Set stone to comply with requirements indicated on Drawings and Shop Drawings. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure stone in place. Shim and adjust anchors, supports, and accessories to set stone accurately in locations indicated, with edges and faces aligned according to established relationships and indicated tolerances.
4. Erect stone units level, plumb, and true with uniform joint widths. Use temporary shims to maintain joint width.



5. Provide expansion, control, and pressure-relieving joints of widths and at locations indicated.
 - a. Sealing of expansion, control, and pressure-relieving joints is specified in Division 07 Section "Joint Sealants".
 - b. Keep expansion, control, and pressure-relieving joints free of plaster, mortar, grout, and other rigid materials.
- C. Construction Tolerances
 1. Variation from Plumb: For vertical lines and surfaces, do not exceed 1/8 inch in 96 inches (3 mm in 2400 mm), 1/4 inch (6 mm) maximum.
 2. Variation from Level: For lintels, sills, chair rails, horizontal bands, horizontal grooves, and other conspicuous lines, do not exceed 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), 3/8 inch (10 mm) maximum.
 3. Variation of Linear Building Line: For position shown in plan and related portion of walls and partitions, do not exceed 1/8 inch in 96 inches (3 mm in 2400 mm), 1/4 inch in 20 feet (6 mm in 6 m), 3/8 inch (10 mm) maximum.
 4. Variation in Cross-Sectional Dimensions: For thickness of walls from dimensions indicated, do not exceed plus or minus 1/8 inch (3 mm).
 5. Variation in Joint Width: Do not vary joint thickness more than 1/16 inch (1.5 mm) or 1/4 of nominal joint width, whichever is less.
 6. Variation in Plane between Adjacent Stone Units (Lipping): Do not exceed 1/32-inch (0.8-mm) difference between planes of adjacent units.
- D. Installation Of Stone Paneling And Column Facing
 1. Set units firmly against setting spots. Locate setting spots at anchors and spaced not more than 18 inches (450 mm) apart across back of unit, but provide no fewer than 1 setting spot per 2 sq. ft. (0.18 sq. m), unless otherwise indicated.
 - a. Moisture Exposure: Use portland cement mortar for setting spots where stone is applied to inside face of exterior walls and at other locations where stone or cavity will be exposed to moisture.
 2. Set units on direct-mount anchoring system with anchors securely attached to stone and to backup surfaces. Comply with recommendations in ASTM C 1242.
 - a. Provide compressible filler in ends of dowel holes and bottoms of kerfs to prevent end bearing of dowels and anchor tabs on stone. Fill remainder of anchor holes and kerfs with sealant indicated for filling kerfs.
 - b. Set stone supported on clips or continuous angles on resilient setting shims. Use material of thickness required to maintain uniform joint widths and to prevent point loading of stone on anchors. Hold shims back from face of stone a distance at least equal to width of joint.
 3. Minimum Anchors: Provide anchors at a maximum of 24 inches (600 mm) o.c. around perimeter of interior stone facing panels with a minimum of 4 anchors per panel.
 4. Minimum Anchors: Provide a minimum of 4 anchors per panel up to 12 sq. ft. (1.1 sq. m) in face area, plus a minimum of 2 additional anchors for each additional 8 sq. ft. (0.7 sq. m).
 5. Grout **OR** Point, **as directed**, joints after setting.
- E. Installation Of Stone Window Stools, Base, And Trim
 1. Stone Window Stools: Set stone window stools on masonry in a full bed of mortar.
OR
Stone Window Stools: Set stone window stools on wood or metal framing or wood blocking in a full bed of organic **OR** water-cleanable epoxy, **as directed**, adhesive. Hold adhesive back from exposed edges of joints to allow for grouting **OR** pointing with sealant, **as directed**.
 2. Where window stools are too long to be installed in one piece, assemble by bonding joints with stone adhesive as units are set. Mask areas adjacent to joints to prevent adhesive smears. Clamp units in place to ensure that window stools are properly aligned and joints are minimum width.
 3. Where joints are indicated in window stools maintain alignment across joints. Use temporary shims as necessary to maintain joint width.



4. Stone Base and Trim at Walls with Stone Paneling: Set units by adhering to interior stone facing with water-cleanable epoxy adhesive. Hold adhesive back from exposed edges of joints to allow for grouting.
OR
Stone Base and Trim at Walls with Stone Paneling: Set units firmly against setting spots. Located setting spots at anchors and spaced not more than 18 inches (450 mm) apart, unless otherwise indicated. Provide no fewer than 2 anchors per piece for stone trim up to 48 inches (1200 mm) in length, plus 1 additional anchor for each additional 24 inches (600 mm) of length.
5. Stone Base and Trim at Walls without Stone Paneling: Adhere units to plywood backing with full spread of water-cleanable epoxy adhesive. Hold adhesive back from exposed edges of joints to allow for grouting.
OR
Stone Base and Trim at Walls without Stone Paneling: Adhere units to gypsum board with full spread of organic **OR** water-cleanable epoxy, **as directed**, adhesive. Hold adhesive back from exposed edges of joints to allow for grouting.
6. Assemble stone base and trim by bonding joints with stone adhesive as units are set. Mask areas adjacent to joints to prevent adhesive smears. Clamp units in place to ensure that surfaces are properly aligned and joints are minimum width.
7. Grout **OR** Point, **as directed**, joints after setting.

F. Installation Of Stone Benches

1. Stone Pedestals: Set pedestals on concrete subfloor **OR** stone flooring, **as directed**, in a full bed of mortar. Anchor pedestals with no fewer than two 1/4-inch (6-mm) **OR** 3/8-inch (10-mm), **as directed**, dowels, extending not less than 2 inches (50 mm) into pedestals and 2 inches (50 mm) **OR** 4 inches (100 mm), **as directed**, into floor construction. Solidly fill space around dowels with mortar.
OR
Stone Pedestals: Set pedestals on stone flooring in a full bed of water-cleanable epoxy adhesive. Anchor pedestals with no fewer than two 1/4-inch (6-mm) **OR** 3/8-inch (10-mm), **as directed**, dowels, extending not less than 2 inches (50 mm) into pedestals and 2 inches (50 mm) into floor construction. Solidly fill space around dowels with adhesive. Hold adhesive back from exposed edges to allow for grouting.
2. Stone Bench Tops: Set tops on pedestals **OR** concrete or masonry bases, **as directed**, in a full bed of mortar. Anchor tops with no fewer than two 1/4-inch (6-mm) **OR** 3/8-inch (10-mm), **as directed**, dowels, extending not less than 2 inches (50 mm) into pedestals **OR** bases, **as directed**, and half of thickness into the tops. Solidly fill space around dowels with mortar.
OR
Stone Bench Tops: Set stone bench tops on pedestals **OR** concrete or masonry bases, **as directed**, in a full bed of water-cleanable epoxy adhesive. Anchor tops with no fewer than two 1/4-inch (6-mm) **OR** 3/8-inch (10-mm), **as directed**, dowels, extending not less than 2 inches (50 mm) into pedestals **OR** bases, **as directed**, and half of thickness into the tops. Solidly fill space around dowels with adhesive. Hold adhesive back from exposed edges of joints to allow for grouting.
3. Stone Base: Apply stone facing to concrete or masonry bases by setting in a full spread of mortar **OR** water-cleanable epoxy adhesive, **as directed**.
 - a. Provide no fewer than 2 anchors per piece for stone base up to 48 inches (1200 mm) in length, plus 1 additional anchor for each additional 24 inches (600 mm) of length.
 - b. Hold adhesive back from exposed edges of joints to allow for grouting.

G. Grouting Joints

1. Grout stone to comply with ANSI A108.10.
 - a. Use sanded grout mixture for joints wider than 1/8 inch (3 mm).
 - b. Use unsanded grout mixture for joints 1/8 inch (3 mm) and narrower.
2. Remove temporary shims before grouting.
3. Tool joints uniformly and smoothly with plastic tool.



- H. Pointing Joints With Mortar
1. Prepare stone-joint surfaces for pointing with mortar by removing temporary shims, dust, and mortar particles. Where setting spots occur at joints, rake out excess setting mortar or plaster to a depth of not less than 1/2 inch (13 mm).
 2. Point stone joints by placing pointing mortar in layers not more than 3/8 inch (10 mm). Compact each layer thoroughly and allow to become thumbprint hard before applying next layer. Apply mortar first to areas where depths are greater than surrounding areas until a uniform depth is formed.
 3. Tool joints when pointing mortar is thumbprint hard. Use a round jointer having a diameter 1/8 inch (3 mm) larger than width of joint.
- I. Joint-Sealant Installation
1. Prepare joints and apply sealants of type and at locations indicated to comply with applicable requirements in Division 07 Section "Joint Sealants". Remove temporary shims before applying sealants.
- J. Adjusting And Cleaning
1. In-Progress Cleaning: Clean interior stone facing as work progresses. Remove adhesive, grout, mortar, and sealant smears immediately.
 2. Remove and replace interior stone facing of the following description:
 - a. Broken, chipped, stained, or otherwise damaged stone. Stone may be repaired if methods and results are approved by the Owner.
 - b. Defective stone facing.
 - c. Defective joints, including misaligned joints.
 - d. Interior stone facing and joints not matching approved Samples.
 - e. Interior stone facing not complying with other requirements indicated.
 3. Replace in a manner that results in interior stone facing's matching approved Samples, complying with other requirements, and showing no evidence of replacement.
 4. Clean interior stone facing no fewer than six days after completion of grouting and pointing, using clean water and soft rags or stiff-bristle fiber brushes. Do not use wire brushes, acid-type cleaning agents, cleaning compounds with caustic or harsh fillers, or other materials or methods that could damage stone.
 5. Sealer Application: Apply stone sealer to comply with stone producer's and sealer manufacturer's written instructions and recommendations.
- K. Protection
1. Protect stone surfaces, edges, and corners from construction damage. Use securely fastened untreated wood, plywood, or heavy cardboard to prevent damage.
 2. Before inspection for Final Completion, remove protective coverings and clean surfaces.

END OF SECTION 04 41 00 00a



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Task	Specification	Specification Description
04 42 43 00	04 41 00 00	Dimension Stone Cladding
04 42 43 00	04 01 40 91	Stone Masonry
04 42 43 00	04 41 00 00a	Interior Stone Facing
04 43 00 00	01 22 16 00	No Specification Required
04 43 00 00	04 41 00 00	Dimension Stone Cladding
04 43 00 00	04 01 40 91	Stone Masonry
04 43 00 00	04 41 00 00a	Interior Stone Facing



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SECTION 04 72 00 00 - ARCHITECTURAL PRECAST CONCRETE

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for architectural precast concrete. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Architectural precast concrete cladding and load-bearing units.
 - b. Insulated, architectural precast concrete units.
 - c. Brick-faced, architectural precast concrete units.
 - d. Stone-faced, architectural precast concrete units.

C. Definition

1. Design Reference Sample: Sample of approved architectural precast concrete color, finish and texture, preapproved by the Owner.

D. Performance Requirements

1. Structural Performance: Provide architectural precast concrete units and connections capable of withstanding the following design loads within limits and under conditions indicated:
 - a. Loads: As indicated.

E. Submittals

1. Product Data: For each type of product indicated.
2. Design Mixtures: For each precast concrete mixture. Include compressive strength and water-absorption tests.
3. Shop Drawings: Detail fabrication and installation of architectural precast concrete units. Indicate locations, plans, elevations, dimensions, shapes, and cross sections of each unit. Indicate joints, reveals, and extent and location of each surface finish. Indicate details at building corners.

NOTE: The following paragraph is not required if Architect or Engineer assumes or is required by law to assume design responsibility.

 - a. Comprehensive engineering analysis signed and sealed **OR** certified, **as directed**, by the qualified professional engineer responsible for its preparation. Show governing panel types, connections, and types of reinforcement, including special reinforcement. Indicate location, type, magnitude, and direction of loads imposed on the building structural frame from architectural precast concrete.
4. Samples: For each type of finish indicated on exposed surfaces of architectural precast concrete units, in sets of 3, illustrating full range of finish, color, and texture variations expected; approximately 12 by 12 by 2 inches (300 by 300 by 50 mm).
5. Welding certificates.
6. Material Test Reports: For aggregates.
7. Material Certificates: Signed by manufacturers:
8. Field quality-control test and special inspection reports.

F. Quality Assurance

1. Fabricator Qualifications: A firm that assumes responsibility for engineering architectural precast concrete units to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.



- a. Participates in PCI's plant certification program and is designated a PCI-certified plant for Group A, Category A1 - Architectural Cladding and Load Bearing Units or participates in APA's "Plant Certification Program for Production of Architectural Precast Concrete Products" and is designated an APA-certified plant.
2. Design Standards: Comply with ACI 318 (ACI 318M) and design recommendations of PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of architectural precast concrete units indicated.
3. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 117, "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products."
4. Welding: Qualify procedures and personnel according to AWS D1.1/D.1.1M, "Structural Welding Code - Steel"; and AWS D1.4, "Structural Welding Code - Reinforcing Steel."
5. Calculated Fire-Test-Response Characteristics: Where indicated, provide architectural precast concrete units whose fire resistance has been calculated according to ACI 216.1/TMS 0216.1, "Standard Method for Determining Fire Resistance of Concrete and Masonry Construction Assemblies," **OR** PCI MNL 124, "Design for Fire Resistance of Precast Prestressed Concrete," **as directed**, and is acceptable to authorities having jurisdiction.
6. Sample Panels: After sample approval and before fabricating architectural precast concrete units, produce a minimum of 2 sample panels approximately 16 sq. ft. (1.5 sq. m) in area for review by the Owner. Incorporate full-scale details of architectural features, finishes, textures, and transitions in sample panels.

G. Delivery, Storage, And Handling

1. Deliver architectural precast concrete units in such quantities and at such times to limit unloading units temporarily on the ground.
2. Support units during shipment on nonstaining shock-absorbing material.
3. Store units with adequate dunnage and bracing and protect units to prevent contact with soil, to prevent staining, and to prevent cracking, distortion, warping or other physical damage.
4. Place stored units so identification marks are clearly visible, and units can be inspected.
5. Handle and transport units in a position consistent with their shape and design in order to avoid excessive stresses which would cause cracking or damage.
6. Lift and support units only at designated points shown on Shop Drawings.

1.2 PRODUCTS

A. Mold Materials

1. Molds: Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that will provide continuous and true precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required finishes.
 - a. Mold-Release Agent: Commercially produced liquid-release agent that will not bond with, stain or adversely affect precast concrete surfaces and will not impair subsequent surface or joint treatments of precast concrete.
2. Form Liners: Units of face design, texture, arrangement, and configuration indicated **OR** to match those used for precast concrete design reference sample, **as directed**. Furnish with manufacturer's recommended liquid-release agent that will not bond with, stain, or adversely affect precast concrete surfaces and will not impair subsequent surface or joint treatments of precast concrete.
3. Surface Retarder: Chemical set retarder, capable of temporarily delaying final hardening of newly placed concrete mixture to depth of reveal specified.

B. Reinforcing Materials

1. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
2. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.



3. Galvanized Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420) **OR** ASTM A 706/A 706M, **as directed**, deformed bars, ASTM A 767/A 767M, Class II zinc coated, hot-dip galvanized, and chromate wash treated after fabrication and bending, **as directed**.
 4. Epoxy-Coated Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420) **OR** ASTM A 706/A 706M, **as directed**, deformed bars, ASTM A 775/A 775M or ASTM A 934/A 934M epoxy coated.
 5. Steel Bar Mats: ASTM A 184/A 184M, fabricated from ASTM A 615/A 615M, Grade 60 (Grade 420) **OR** ASTM A 706/A 706M, **as directed**, deformed bars, assembled with clips.
 6. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn **OR** galvanized, **as directed**, steel wire into flat sheets.
 7. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.
 8. Epoxy-Coated-Steel Wire: ASTM A 884/A 884M, Class A coated, plain **OR** deformed, **as directed**, flat sheet, Type 1 bendable **OR** 2 nonbendable, **as directed**, coating.
 9. Supports: Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 117.
- C. Prestressing Tendons
1. Prestressing Strand: ASTM A 416/A 416M, Grade 270 (Grade 1860), uncoated, 7-wire, low-relaxation strand.
 - a. Coat unbonded post-tensioning strand with corrosion inhibitor passing ASTM D 1743 and sheath with polypropylene tendon sheathing. Include anchorage devices and coupler assemblies.
- D. Concrete Materials
1. Portland Cement: ASTM C 150, Type I or Type III, gray, unless otherwise indicated.
 - a. For surfaces exposed to view in finished structure, mix gray with white cement, of same type, brand, and mill source.
 2. Supplementary Cementitious Materials:
 - a. Fly Ash: ASTM C 618, Class C or F, with maximum loss on ignition of 3 percent.
 - b. Metakaolin Admixture: ASTM C 618, Class N.
 - c. Silica Fume Admixture: ASTM C 1240, with optional chemical and physical requirement.
 - d. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
 3. Normal-Weight Aggregates: Except as modified by PCI MNL 117, ASTM C 33, with coarse aggregates complying with Class 5S. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.
 - a. Face-Mixture-Coarse Aggregates: Selected, hard, and durable; free of material that reacts with cement or causes staining; to match selected finish sample.
 - 1) Gradation: Uniformly graded **OR** Gap graded **OR** To match design reference sample, **as directed**.
 - b. Face-Mixture-Fine Aggregates: Selected, natural or manufactured sand of same material as coarse aggregate, unless otherwise approved by the Owner.
 4. Lightweight Aggregates: Except as modified by PCI MNL 117, ASTM C 330, with absorption less than 11 percent.
 5. Coloring Admixture: ASTM C 979, synthetic or natural mineral-oxide pigments or colored water-reducing admixtures, temperature stable, and nonfading.
 6. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 117.
 7. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.
 8. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture.
 - a. Water-Reducing Admixtures: ASTM C 494/C 494M, Type A.
 - b. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - c. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.



- d. Water-Reducing and Accelerating Admixture: ASTM C 494/C 494M, Type E.
- e. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
- f. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
- g. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017 M.

E. Steel Connection Materials

1. Carbon-Steel Shapes and Plates: ASTM A 36/A 36M.
2. Carbon-Steel-Headed Studs: ASTM A 108, AISI 1018 through AISI 1020, cold finished, AWS D1.1/D1.1M, Type A or B, with arc shields and with minimum mechanical properties of PCI MNL 117, Table 3.2.3.
3. Carbon-Steel Plate: ASTM A 283/A 283M.
4. Malleable Iron Castings: ASTM A 47/A 47M.
5. Carbon-Steel Castings: ASTM A 27/A 27M, Grade 60-30 (Grade 415-205).
6. High-Strength, Low-Alloy Structural Steel: ASTM A 572/A 572M.
7. Carbon-Steel Structural Tubing: ASTM A 500, Grade B.
8. Wrought Carbon-Steel Bars: ASTM A 675/A 675M, Grade 65 (Grade 450).
9. Deformed-Steel Wire or Bar Anchors: ASTM A 496 or ASTM A 706/A 706M.
10. Carbon-Steel Bolts and Studs: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); carbon-steel, hex-head bolts and studs; carbon-steel nuts, ASTM A 563 (ASTM A 563M); and flat, unhardened steel washers, ASTM F 844.
11. High-Strength Bolts and Nuts: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts; heavy hex carbon-steel nuts, ASTM A 563 (ASTM A 563M); and hardened carbon-steel washers, ASTM F 436 (ASTM F 436M).
12. Zinc-Coated Finish: For exterior steel items, steel in exterior walls, and items indicated for galvanizing, apply zinc coating by hot-dip process according to ASTM A 123/A 123M or ASTM A 153/A 153M **OR** electrodeposition according to ASTM B 633, SC 3, Types 1 and 2, **as directed**.
 - a. For steel shapes, plates, and tubing to be galvanized, limit silicon content of steel to less than 0.03 percent or to between 0.15 and 0.25 percent or limit sum of silicon and 2.5 times phosphorous content to 0.09 percent.
 - b. Galvanizing Repair Paint: High-zinc-dust-content paint with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035A or SSPC-Paint 20.
13. Shop-Primed Finish: Prepare surfaces of nongalvanized steel items, except those surfaces to be embedded in concrete, according to requirements in SSPC-SP 3 and shop-apply lead- and chromate-free, rust-inhibitive primer, complying with performance requirements in MPI 79 **OR** SSPC-Paint 25, **as directed**, according to SSPC-PA 1.
14. Welding Electrodes: Comply with AWS standards.

F. Stainless-Steel Connection Materials

1. Stainless-Steel Plate: ASTM A 666, Type 304, of grade suitable for application.
2. Stainless-Steel Bolts and Studs: ASTM F 593, Alloy 304 or 316, hex-head bolts and studs; stainless-steel nuts; and flat, stainless-steel washers.
 - a. Lubricate threaded parts of stainless-steel bolts with an antiseize thread lubricant during assembly.
3. Stainless-Steel-Headed Studs: ASTM A 276, with minimum mechanical properties of PCI MNL 117, Table 3.2.3.

G. Bearing Pads

1. Provide one of the following bearing pads for architectural precast concrete units as recommended by precast fabricator for application:
 - a. Elastomeric Pads: AASHTO M 251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, Type A durometer hardness of 50 to 70, ASTM D 2240, minimum tensile strength 2250 psi (15.5 MPa), ASTM D 412.



- b. Random-Oriented, Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer. Type A durometer hardness of 70 to 90, ASTM D 2240; capable of supporting a compressive stress of 3000 psi (20.7 MPa) with no cracking, splitting, or delaminating in the internal portions of pad. Test one specimen for every 200 pads used in Project.
 - c. Cotton-Duck-Fabric-Reinforced Elastomeric Pads: Preformed, horizontally layered cotton-duck fabric bonded to an elastomer; Type A durometer hardness of 80 to 100, ASTM D 2240; complying with AASHTO's "AASHTO Load and Resistance Factor Design (LRFD) Bridge Design Specifications, Division II, Section 18.10.2, or with MIL-C-882E.
 - d. Frictionless Pads: Tetrafluoroethylene (Teflon), glass-fiber reinforced, bonded to stainless or mild-steel plate, of type required for in-service stress.
 - e. High-Density Plastic: Multimonomer, nonleaching, plastic strip.
- H. Accessories
1. Reglets: Specified in Division 07 Section "Sheet Metal Flashing And Trim".
OR
Reglets: PVC extrusions, **OR** Stainless steel, Type 302 or 304, **OR** Copper, **as directed**, felt or fiber filled, or with face opening of slots covered.
 2. Precast Accessories: Provide clips, hangers, plastic or steel shims, and other accessories required to install architectural precast concrete units.
- I. Grout Materials
1. Sand-Cement Grout: Portland cement, ASTM C 150, Type I, and clean, natural sand, ASTM C 144 or ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
 2. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, Grade A for drypack and Grades B and C for flowable grout and of consistency suitable for application within a 30-minute working time.
 3. Epoxy-Resin Grout: Two-component, mineral-filled epoxy resin; ASTM C 881/C 881M, of type, grade, and class to suit requirements.
- J. Thin Brick Units And Accessories
1. Thin Brick Units: ASTM C 216, Type FBX or ASTM C 1088, Grade Exterior, Type TBX, not less than 1/2 inch (13 mm) **OR** 3/4 inch (19 mm) **OR** 1 inch (25 mm), **as directed**, thick with a tolerance of plus or minus 1/16 inch (1.6 mm), and as follows:
 - a. Face Size: 2-1/4 inches (57 mm) high by 8 inches (203 mm) long.
 - b. Face Size: 2-1/4 inches (57 mm) high by 7-1/2 to 7-5/8 inches (190 to 194 mm) long.
 - c. Face Size: 2-3/4 to 2-13/16 inches (70 to 71 mm) high by 7-1/2 to 7-5/8 inches (190 to 194 mm) long.
 - d. Face Size: 3-1/2 to 3-5/8 inches (89 to 92 mm) high by 7-1/2 to 7-5/8 inches (190 to 194 mm) long.
 - e. Face Size: 3-1/2 to 3-5/8 inches (89 to 92 mm) high by 11-1/2 to 11-5/8 inches (292 to 295 mm) long.
 - f. Where indicated to "match existing," provide thin brick matching color, texture, and face size of existing adjacent brick work.
 - g. Face Size: 57 mm high by 190 mm long.
 - h. Face Size: 70 mm high by 190 mm long.
 - i. Face Size: 90 mm high by 190 mm long.
 - j. Face Size: 90 mm high by 290 mm long.
 - k. Special Shapes: Include corners, edge corners, and end edge corners.
 - l. Initial Rate of Absorption: Less than 30 g/30 sq. in. (30 g/194 sq. cm) per minute; ASTM C 67.
 - m. Efflorescence: Tested according to ASTM C 67 and rated "not effloresced."



- n. Surface Coating: Thin brick with colors or textures applied as coatings shall withstand 50 cycles of freezing and thawing; ASTM C 67 with no observable difference in applied finish when viewed from 10 feet (3 m).
 - o. Face Color and Texture: Match approved samples **OR** Medium brown, wire cut **OR** Full-range red, sand molded **OR** Gray, velour, **as directed**.
 - p. Back Surface Texture: Scored, combed, wire roughened, ribbed, keybacked, or dovetailed.
2. Sand-Cement Mortar: Portland cement, ASTM C 150, Type I, and clean, natural sand, ASTM C 144. Mix at ratio of 1 part cement to 4 parts sand, by volume, with minimum water required for placement.
 3. Latex-Portland Cement Pointing Grout: ANSI A118.6 and as follows:
 - a. Dry-grout mixture, factory prepared, of portland cement, graded aggregate, and dry, redispersible, ethylene-vinyl-acetate additive for mixing with water; uniformly colored.
 - b. Commercial portland cement grout, factory prepared, with liquid styrene-butadiene rubber or acrylic-resin latex additive; uniformly colored.
 - c. Colors: As selected by the Owner from manufacturer's full range.
- K. Stone Materials And Accessories
1. Stone facing for architectural precast concrete is specified in Division 04 Section "Exterior Stone Cladding".
 2. Anchors: Stainless steel, ASTM A 666, Type 304, of temper and diameter required to support loads without exceeding allowable design stresses.
 - a. Fit each anchor leg with neoprene grommet collar of width at least twice the diameter and of length at least five times the diameter of anchor.
 3. Sealant Filler: ASTM C 920, low-modulus, multicomponent, nonsag urethane sealant complying with requirements in Division 07 Section "Joint Sealants" and that is nonstaining to stone substrate.
 4. Epoxy Filler: ASTM C 881/C 881M, 100 percent solids, sand-filled nonshrinking, nonstaining of type, class, and grade to suit application.
 - a. Elastomeric Anchor Sleeve: 1/2 inch (13 mm) long, Type A durometer hardness of 60, ASTM D 2240.
 5. Bond Breaker: Preformed, compressible, resilient, nonstaining, nonwaxing, closed-cell polyethylene foam pad, nonabsorbent to liquid and gas, 1/8 inch (3.2 mm) thick **OR** Polyethylene sheet, ASTM D 4397, 6 to 10 mils (0.15 to 0.25 mm) thick, **as directed**.
- L. Insulated Panel Accessories
1. Molded-Polystyrene Board Insulation: ASTM C 578, Type I, 0.90 lb/cu. ft. (15 kg/cu. m) **OR** VIII, 1.15 lb/cu. ft. (18 kg/cu. m) **OR** II, 1.35 lb/cu. ft. (22 kg/cu. m), **as directed**; square **OR** ship-lap, **as directed**, edges; with R-value and thickness as required to meet Project requirements.
 2. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, 1.60 lb/cu. ft. (26 kg/cu. m) **OR** X, 1.30 lb/cu. ft. (21 kg/cu. m) **OR** VI, 1.80 lb/cu. ft. (29 kg/cu. m), **as directed**; square **OR** ship-lap, **as directed**, edges; with R-value and thickness as required to meet Project requirements.
 3. Polyisocyanurate Board Insulation: ASTM C 591, Type I, 1.8 lb/cu. ft. (29 kg/cu. m) **OR** IV, 2 lb/cu. ft. (32 kg/cu. m) **OR** II, 2.5 lb/cu. ft. (40 kg/cu. m), **as directed**, unfaced, with R-value and thickness as required to meet Project requirements.
 4. Wythe Connectors: Glass-fiber and vinyl-ester polymer connectors **OR** Polypropylene pin connectors **OR** Stainless-steel pin connectors **OR** Bent galvanized reinforcing bars or galvanized welded wire trusses **OR** Cylindrical metal sleeve anchors, **as directed**, manufactured to connect wythes of precast concrete panels.
- M. Concrete Mixtures
1. Prepare design mixtures for each type of precast concrete required.
 - a. Limit use of fly ash and silica fume to 20 percent of portland cement by weight; limit metakaolin and silica fume to 10 percent of portland cement by weight.



2. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at architectural precast concrete fabricator's option.
3. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 318 (ACI 318M) or PCI MNL 117 when tested according to ASTM C 1218/C 1218M.
4. Normal-Weight Concrete Mixtures: Proportion mixtures by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:
 - a. Compressive Strength (28 Days): 5000 psi (34.5 MPa) minimum.
 - b. Maximum Water-Cementitious Materials Ratio: 0.45.
5. Water Absorption: 6 percent by weight or 14 percent by volume, tested according to PCI MNL 117.
6. Lightweight Concrete Backup Mixtures: Proportion mixtures by either laboratory trial batch or field test data methods according to ACI 211.2, with materials to be used on Project, to provide lightweight concrete with the following properties:
 - a. Compressive Strength (28 Days): 5000 psi (34.5 MPa).
 - b. Unit Weight: Calculated equilibrium unit weight of 115 lb/cu. ft. (1842 kg/cu. m), plus or minus 3 lb/cu. ft. (48 kg/cu. m), according to ASTM C 567.
7. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 117.
8. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.

N. Mold Fabrication

1. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for prestressing and detensioning operations. Coat contact surfaces of molds with release agent before reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.
 - a. Place form liners accurately to provide finished surface texture indicated. Provide solid backing and supports to maintain stability of liners during concrete placement. Coat form liner with form-release agent.
2. Maintain molds to provide completed architectural precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.
 - a. Form joints are not permitted on faces exposed to view in the finished work.
 - b. Edge and Corner Treatment: Uniformly chamfered **OR** radiused, **as directed**.

O. Thin Brick Facings

NOTE: The following 2 paragraphs are not applicable if bonding back of thin brick directly to concrete instead of using mortar.

1. Place form liner templates accurately to provide grid for thin brick facings. Provide solid backing and supports to maintain stability of liners while placing thin bricks and during concrete placement.
2. Securely place thin brick units face down into form liner pockets and place concrete backing mixture.
3. Completely fill joint cavities between thin brick units with sand-cement mortar, and place precast concrete backing mixture while sand-cement mortar is still fluid enough to ensure bond.
4. Mix and install grout according to ANSI A108.10. Completely fill joint cavities between thin brick units with grout, and compress into place without spreading grout onto faces of thin brick units. Remove excess grout immediately to prevent staining of brick.
 - a. Tool joints to a slightly concave **OR** grapevine **OR** V-, **as directed**, shape when pointing grout is thumbprint hard.
5. Clean faces and joints of brick facing.

P. Stone Facings

1. Accurately position stone facings to comply with requirements and in locations indicated on Shop Drawings. Install anchors, supports, and other attachments indicated or necessary to secure



stone in place. Keep concrete reinforcement a minimum of 3/4 inch (19 mm) from the back surface of stone. Use continuous spacers to obtain uniform joints of widths indicated and with edges and faces aligned according to established relationships and indicated tolerances.

- a. Stone to Precast Anchorages: Provide anchors in numbers, types and locations required to satisfy specified performance criteria, but not less than 2 anchors per stone unit of less than 2 sq. ft. (0.19 sq. m) in area and 4 anchors per unit of less than 12 sq. ft. (1.1 sq. m) in area; for units larger than 12 sq. ft. (1.1 sq. m) in area, provide anchors spaced not more than 24 inches (600 mm) o.c. horizontally and vertically. Locate anchors a minimum of 6 inches (150 mm) from stone edge.
2. Fill anchor holes with sealant filler and install anchors **OR** epoxy filler and install anchors with elastomeric anchor sleeve at back surface of stone, **as directed**.
 - a. Install polyethylene sheet to prevent bond between back of stone facing and concrete substrate and to ensure no passage of precast matrix to stone surface.
OR
Install 1/8-inch (3-mm) polyethylene-foam bond breaker to prevent bond between back of stone facing and concrete substrate and to ensure no passage of precast matrix to stone surface. Maintain minimum projection requirements of stone anchors into concrete substrate.

Q. Fabrication

1. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.
 - a. Weld-headed studs and deformed bar anchors used for anchorage according to AWS D1.1/D1.1M and AWS C5.4, "Recommended Practices for Stud Welding."
2. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing architectural precast concrete units to supporting and adjacent construction.
3. Cast-in reglets, slots, holes, and other accessories in architectural precast concrete units as indicated on the Contract Drawings.
4. Cast-in openings larger than 10 inches (250 mm) in any dimension. Do not drill or cut openings or prestressing strand without the Owner's approval.
5. Reinforcement: Comply with recommendations in PCI MNL 117 for fabricating, placing, and supporting reinforcement.
 - a. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete. When damage to epoxy-coated reinforcing exceeds limits specified in ASTM A 775/A 775M, repair with patching material compatible with coating material and epoxy coat bar ends after cutting.
 - b. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Completely conceal support devices to prevent exposure on finished surfaces.
 - c. Place reinforcement to maintain at least 3/4-inch (19-mm) minimum coverage. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
 - d. Place reinforcing steel and prestressing strand to maintain at least 3/4-inch (19-mm) minimum concrete cover. Increase cover requirements for reinforcing steel to 1-1/2 inches (38 mm) when units are exposed to corrosive environment or severe exposure conditions. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
 - e. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh spacing and wire tie laps, where required by design. Offset laps of adjoining widths to prevent continuous laps in either direction.



6. Reinforce architectural precast concrete units to resist handling, transportation, and erection stresses.
 7. Prestress tendons for architectural precast concrete units by either pretensioning or post-tensioning methods. Comply with PCI MNL 117.
 - a. Delay detensioning or post-tensioning of precast, prestressed architectural concrete units until concrete has reached its indicated minimum design release compressive strength as established by test cylinders cured under same conditions as concrete.
 - b. Detension pretensioned tendons either by gradually releasing tensioning jacks or by heat-cutting tendons, using a sequence and pattern to prevent shock or unbalanced loading.
 - c. If concrete has been heat cured, detension while concrete is still warm and moist to avoid dimensional changes that may cause cracking or undesirable stresses.
 - d. Protect strand ends and anchorages with bituminous, zinc-rich, or epoxy paint to avoid corrosion and possible rust spots.
 8. Comply with requirements in PCI MNL 117 and requirements in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.
 9. Place face mixture to a minimum thickness after consolidation of the greater of 1 inch (25 mm) or 1.5 times the maximum aggregate size, but not less than the minimum reinforcing cover specified.
 10. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast concrete units.
 - a. Place backup concrete mixture to ensure bond with face-mixture concrete.
 11. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air on surfaces. Use equipment and procedures complying with PCI MNL 117.
 - a. Place self-consolidating concrete without vibration according to PCI TR-6, "Interim Guidelines for the Use of Self-Consolidating Concrete in Precast/Prestressed Concrete Institute Member Plants."
 12. Comply with PCI MNL 117 for hot- and cold-weather concrete placement.
 13. Identify pickup points of architectural precast concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each architectural precast concrete unit on a surface that will not show in finished structure.
 14. Cure concrete, according to requirements in PCI MNL 117, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture. Cure units until compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.
 15. Discard and replace architectural precast concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs meet requirements in PCI MNL 117 and the Owner's approval.
- R. Insulated Panel Casting
1. Cast and screed supported wythe over mold.
 2. Place insulation boards abutting edges and ends of adjacent boards. Insert wythe connectors through insulation, and consolidate concrete around connectors according to connector manufacturer's written instructions.
 3. Cast and screed top wythe to meet required finish.
- S. Fabrication Tolerances
1. Fabricate architectural precast concrete units straight and true to size and shape with exposed edges and corners precise and true so each finished panel complies with PCI MNL 117 product tolerances as well as position tolerances for cast-in items.
OR
Fabricate architectural precast concrete units straight and true to size and shape with exposed edges and corners precise and true so each finished panel complies with the following product tolerances:



- a. Overall Height and Width of Units, Measured at the Face Exposed to View: As follows:
 - 1) 10 feet (3 m) or under, plus or minus 1/8 inch (3 mm).
 - 2) 10 to 20 feet (3 to 6 m), plus 1/8 inch (3 mm), minus 3/16 inch (5 mm).
 - 3) 20 to 40 feet (6 to 12 m), plus or minus 1/4 inch (6 mm).
 - 4) Each additional 10 feet (3 m), plus or minus 1/16 inch (1.5 mm).
- b. Overall Height and Width of Units, Measured at the Face Not Exposed to View: As follows:
 - 1) 10 feet (3 m) or under, plus or minus 1/4 inch (6 mm).
 - 2) 10 to 20 feet (3 to 6 m), plus 1/4 inch (6 mm), minus 3/8 inch (10 mm).
 - 3) 20 to 40 feet (6 to 12 m), plus or minus 3/8 inch (10 mm).
 - 4) Each additional 10 feet (3 m), plus or minus 1/8 inch (3 mm).
- c. Total Thickness or Flange Thickness: Plus 1/4 inch (6 mm), minus 1/8 inch (3 mm).
- d. Rib Thickness: Plus or minus 1/8 inch (3 mm).
- e. Rib to Edge of Flange: Plus or minus 1/8 inch (3 mm).
- f. Distance between Ribs: Plus or minus 1/8 inch (3 mm).
- g. Variation from Square or Designated Skew (Difference in Length of the Two Diagonal Measurements): Plus or minus 1/8 inch per 72 inches (3 mm per 1830 mm) or 1/2 inch (13 mm) total, whichever is greater.
- h. Length and Width of Block-outs and Openings within One Unit: Plus or minus 1/4 inch (6 mm).
- i. Location and Dimension of Block-outs Hidden from View and Used for HVAC and Utility Penetrations: Plus or minus 3/4 inch (19 mm).
- j. Dimensions of Haunches: Plus or minus 1/4 inch (6 mm).
- k. Haunch Bearing Surface Deviation from Specified Plane: Plus or minus 1/8 inch (3 mm).
- l. Difference in Relative Position of Adjacent Haunch Bearing Surfaces from Specified Relative Position: Plus or minus 1/4 inch (6 mm).
- m. Bowing: Plus or minus L/360, maximum 1 inch (25 mm).
- n. Local Smoothness: 1/4 inch per 10 feet (6 mm per 3 m).
- o. Warping: 1/16 inch per 12 inches (1.5 mm per 300 mm) of distance from nearest adjacent corner.
- p. Tipping and Flushness of Plates: Plus or minus 1/4 inch (6 mm).
- q. Dimensions of Architectural Features and Rustications: Plus or minus 1/8 inch (3 mm).
2. Position Tolerances: For cast-in items measured from datum line location, as indicated on Shop Drawings.
 - a. Weld Plates: Plus or minus 1 inch (25 mm).
 - b. Inserts: Plus or minus 1/2 inch (13 mm).
 - c. Handling Devices: Plus or minus 3 inches (75 mm).
 - d. Reinforcing Steel and Welded Wire Fabric: Plus or minus 1/4 inch (6 mm) where position has structural implications or affects concrete cover; otherwise, plus or minus 1/2 inch (13 mm).
 - e. Reinforcing Steel Extending out of Member: Plus or minus 1/2 inch (13 mm) of plan dimensions.
 - f. Tendons: Plus or minus 1/4 inch (6 mm), vertical; plus or minus 1 inch (25 mm), horizontal.
 - g. Location of Rustication Joints: Plus or minus 1/8 inch (3 mm).
 - h. Location of Opening within Panel: Plus or minus 1/4 inch (6 mm).
 - i. Location of Flashing Reglets: Plus or minus 1/4 inch (6 mm).
 - j. Location of Flashing Reglets at Edge of Panel: Plus or minus 1/8 inch (3 mm).
 - k. Reglets for Glazing Gaskets: Plus or minus 1/8 inch (3 mm).
 - l. Electrical Outlets, Hose Bibs: Plus or minus 1/2 inch (13 mm).
 - m. Location of Bearing Surface from End of Member: Plus or minus 1/4 inch (6 mm).
 - n. Allowable Rotation of Plate, Channel Inserts, and Electrical Boxes: 2-degree rotation or 1/4 inch (6 mm) maximum over the full dimension of unit.
 - o. Position of Sleeve: Plus or minus 1/2 inch (13 mm).
 - p. Location of Window Washer Track or Buttons: Plus or minus 1/8 inch (3 mm).



3. Brick-Faced Architectural Precast Concrete Units: Restrict the following misalignments to 2 percent of number of bricks in a unit.
 - a. Alignment of Mortar Joints:
 - 1) Jog in Alignment: 1/8 inch (3 mm).
 - 2) Alignment with Panel Centerline: Plus or minus 1/8 inch (3 mm).
 - b. Variation in Width of Exposed Mortar Joints: Plus or minus 1/8 inch (3 mm).
 - c. Tipping of Individual Bricks from the Panel Plane of Exposed Brick Surface: Plus 1/16 inch (1.5 mm); minus 1/4 inch (6 mm) less than or equal to depth of form liner joint.
 - d. Exposed Brick Surface Parallel to Primary Control Surface of Panel: Plus 1/4 inch (6 mm); minus 1/8 inch (3 mm).
 - e. Individual Brick Step in Face from Panel Plane of Exposed Brick Surface: Plus 1/16 inch (1.5 mm); minus 1/4 inch (6 mm) less than or equal to depth of form liner joint.
4. Stone Veneer-Faced Architectural Precast Concrete Units (for smooth-finished stone):
 - a. Variation in Cross-Sectional Dimensions: For thickness of walls from dimensions indicated: Plus or minus 1/4 inch (6 mm).
 - b. Variation in Joint Width: 1/8 inch in 36 inches (3 mm in 900 mm) or a quarter of nominal joint width, whichever is less.
 - c. Variation in Plane between Adjacent Stone Units (Lipping): 1/16 inch (1.5 mm) difference between planes of adjacent units.

T. Finishes

1. Panel faces shall be free of joint marks, grain, and other obvious defects. Corners, including false joints shall be uniform, straight, and sharp. Finish exposed-face surfaces of architectural precast concrete units to match approved design reference sample **OR** sample panels, **as directed**, and as follows:
 - a. PCI's "Architectural Precast Concrete - Color and Texture Selection Guide," of plate numbers indicated.
 - b. As-Cast Surface Finish: Provide surfaces free of pockets, sand streaks, and honeycombs.
 - c. Textured-Surface Finish: Impart by form liners or inserts to provide surfaces free of pockets, streaks, and honeycombs, with uniform color and texture.
 - d. Bushhammer Finish: Use power or hand tools to remove matrix and fracture coarse aggregates.
 - e. Exposed-Aggregate Finish: Use chemical retarding agents applied to concrete forms and washing and brushing procedures to expose aggregate and surrounding matrix surfaces after form removal.
 - f. Abrasive-Blast Finish: Use abrasive grit, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces.
 - g. Acid-Etched Finish: Use acid and hot-water solution, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces. Protect hardware, connections, and insulation from acid attack.
 - h. Honed Finish: Use continuous mechanical abrasion with fine grit, followed by filling and rubbing procedures.
 - i. Polished Finish: Use continuous mechanical abrasion with fine grit, followed by filling and rubbing procedures.
 - j. Sand-Embedment Finish: Use selected stones placed in a sand bed in bottom of mold, with sand removed after curing.
2. Finish exposed top **OR** bottom, **as directed**, and back, **as directed**, surfaces of architectural precast concrete units to match face-surface finish.
OR
Finish exposed top **OR** bottom, **as directed**, and back, **as directed**, surfaces of architectural precast concrete units by smooth, steel-trowel finish.
3. Finish unexposed surfaces of architectural precast concrete units by float finish.

U. Source Quality Control

1. Quality-Control Testing: Test and inspect precast concrete according to PCI MNL 117 requirements. If using self-consolidating concrete, also test and inspect according to PCI TR-6,



"Interim Guidelines for the Use of Self-Consolidating Concrete in Precast/Prestressed Concrete Institute Member Plants."

2. Strength of precast concrete units will be considered deficient if units fail to comply with ACI 318 (ACI 318M) requirements for concrete strength.
3. Testing: If there is evidence that strength of precast concrete units may be deficient or may not comply with ACI 318 (ACI 318M) requirements, precaster will employ an independent testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C 42/C 42M.
 - a. A minimum of three representative cores will be taken from units of suspect strength, from locations directed by the Owner.
 - b. Cores will be tested in an air-dry condition.
 - c. Strength of concrete for each series of 3 cores will be considered satisfactory if average compressive strength is equal to at least 85 percent of 28-day design compressive strength and no single core is less than 75 percent of 28-day design compressive strength.
 - d. Test results will be made in writing on same day that tests are performed, with copies to the Owner, Contractor, and precast concrete fabricator. Test reports will include the following:
 - 1) Project identification name and number.
 - 2) Date when tests were performed.
 - 3) Name of precast concrete fabricator.
 - 4) Name of concrete testing agency.
 - 5) Identification letter, name, and type of precast concrete unit(s) represented by core tests; design compressive strength; type of break; compressive strength at breaks, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.
4. Patching: If core test results are satisfactory and precast concrete units comply with requirements, clean and dampen core holes and solidly fill with precast concrete mixture that has no coarse aggregate, and finish to match adjacent precast concrete surfaces.

1.3 EXECUTION

A. Installation

1. Install clips, hangers, bearing pads, and other accessories required for connecting architectural precast concrete units to supporting members and backup materials.
2. Erect architectural precast concrete level, plumb, and square within specified allowable tolerances. Provide temporary supports and bracing as required to maintain position, stability, and alignment as units are being permanently connected.
 - a. Install temporary steel or plastic spacing shims or bearing pads as precast concrete units are being erected. Tack weld steel shims to each other to prevent shims from separating.
 - b. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
 - c. Remove projecting lifting devices and grout fill voids within recessed lifting devices flush with surface of adjacent precast surfaces when recess is exposed.
 - d. Unless otherwise indicated, maintain uniform joint widths of 3/4 inch (19 mm).
3. Connect architectural precast concrete units in position by bolting, welding, grouting, or as otherwise indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and grouting are completed.
 - a. Do not permit connections to disrupt continuity of roof flashing.
4. Welding: Comply with applicable AWS D1.1/D1.1M and AWS D1.4 for welding, welding electrodes, appearance, quality of welds, and methods used in correcting welding work.
 - a. Protect architectural precast concrete units and bearing pads from damage by field welding or cutting operations, and provide noncombustible shields as required.
 - b. Welds not specified shall be continuous fillet welds, using no less than the minimum fillet as specified by AWS.



- c. Clean weld-affected metal surfaces with chipping hammer followed by brushing, and apply a minimum 4.0-mil- (0.1-mm-) thick coat of galvanized repair paint to galvanized surfaces according to ASTM A 780.
OR
Clean weld-affected metal surfaces with chipping hammer followed by brushing, and reprime damaged painted surfaces.
 - d. Remove, reweld, or repair incomplete and defective welds.
 5. At bolted connections, use lock washers, tack welding, or other approved means to prevent loosening of nuts after final adjustment.
 - a. Where slotted connections are used, verify bolt position and tightness. For sliding connections, properly secure bolt but allow bolt to move within connection slot. For friction connections, apply specified bolt torque and check 25 percent of bolts at random by calibrated torque wrench.
 6. Grouting Connections: Grout connections where required or indicated. Retain grout in place until hard enough to support itself. Pack spaces with stiff grout material, tamping until voids are completely filled. Place grout to finish smooth, level, and plumb with adjacent concrete surfaces. Keep grouted joints damp for not less than 24 hours after initial set. Promptly remove grout material from exposed surfaces before it affects finishes or hardens.
- B. Erection Tolerances
1. Erect architectural precast concrete units level, plumb, square, true, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 117, Appendix I.
- C. Field Quality Control
1. Special Inspections: Engage a qualified special inspector to perform the following special inspections and prepare reports:
 - a. Erection of precast concrete members.
 2. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.
 3. Field welds will be subject to visual inspections and nondestructive testing according to ASTM E 165 or ASTM E 709. High-strength bolted connections will be subject to inspections.
 4. Testing agency will report test results promptly and in writing to Contractor and the Owner.
 5. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
 6. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- D. Repairs
1. Repair architectural precast concrete units if permitted by the Owner. the Owner reserves the right to reject repaired units that do not comply with requirements.
 2. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet (6 m).
 3. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A 780.
 4. Wire brush, clean, and paint damaged prime-painted components with same type of shop primer.
 5. Remove and replace damaged architectural precast concrete units when repairs do not comply with requirements.
- E. Cleaning
1. Clean surfaces of precast concrete units exposed to view.
 2. Clean mortar, plaster, fireproofing, weld slag, and other deleterious material from concrete surfaces and adjacent materials immediately.
 3. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.



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- a. Perform cleaning procedures, if necessary, according to precast concrete fabricator's recommendations. Clean soiled precast concrete surfaces with detergent and water, using stiff fiber brushes and sponges, and rinse with clean water. Protect other work from staining or damage due to cleaning operations.
 - b. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

END OF SECTION 04 72 00 00



SECTION 04 72 00 00a - CAST STONE

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for cast stone. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Cast stone trim including the following:
 - 1) Window sills.
 - 2) Lintels.
 - 3) Surrounds.
 - 4) Coping.
 - 5) Wall caps.
 - 6) Belt courses.
 - 7) Water tables.
 - 8) Quoins.
 - 9) Pilasters.
 - 10) Column covers.
 - 11) Medallions.
 - b. Cast stone steps.
 - c. Cast stone bollards.
 - d. Cast stone benches.
 - e. Cast stone curbing.

C. Definitions

1. Cast Stone: Architectural precast concrete building units intended to simulate natural cut stone.

D. Submittals

1. Product Data: Include dimensions of individual components.
2. Shop Drawings: Show fabrication and installation details for cast stone units. Include dimensions, details of reinforcement and anchorages if any, and indication of finished faces.
3. Samples: For each color and texture of cast stone required.
4. Colored Mortar Samples: For each mortar color required.
5. Qualification Data: For manufacturer.
6. Material Test Reports.

E. Quality Assurance

1. Manufacturer Qualifications: A qualified manufacturer of cast stone units similar to those indicated for this Project, with sufficient production capacity to manufacture required units.
 - a. Manufacturer is a producing member of the Cast Stone Institute.

F. Delivery, Storage, And Handling

1. Coordinate delivery of cast stone with unit masonry work to minimize the need for on-site storage and to avoid delaying the Work.
2. Pack, handle, and ship cast stone units in suitable packs or pallets.
 - a. Lift with wide-belt slings; do not use wire rope or ropes that might cause staining. Move cast stone units, if required, using dollies with wood supports.



- b. Store cast stone units on wood skids or pallets with nonstaining, waterproof covers. Arrange to distribute weight evenly and to prevent damage to units. Ventilate under covers to prevent condensation.
 3. Store installation materials on elevated platforms, under cover, and in a dry location.
 4. Store mortar aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

G. Project Conditions

1. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
 - a. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and above and will remain so until cast stone has dried, but not less than 7 days after completing cleaning.
2. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1.2 PRODUCTS

A. Cast Stone Materials

1. General: Comply with ASTM C 1364 and the following:
2. Portland Cement: ASTM C 150, Type I, containing not more than 0.60 percent total alkali when tested according to ASTM C 114.
3. Coarse Aggregates: Granite, quartz, or limestone complying with ASTM C 33; gradation as needed to produce required textures and colors as needed to produce required cast stone colors.
4. Fine Aggregates: Natural sand or crushed stone complying with ASTM C 33, gradation as needed to produce required textures and colors as needed to produce required cast stone colors.
5. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.
6. Admixtures: Do not use admixtures unless specified or approved in writing.
 - a. Do not use admixtures that contain more than 0.1 percent water-soluble chloride ions by mass of cementitious materials. Do not use admixtures containing calcium chloride.
 - b. Use only admixtures that are certified by manufacturer to be compatible with cement and other admixtures used.
 - c. Air-Entraining Admixture: ASTM C 260. Add to mixes for units exposed to the exterior at manufacturer's prescribed rate to result in an air content of 4 to 6 percent, except do not add to zero-slump concrete mixes.
 - d. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - e. Water-Reducing, Retarding Admixture: ASTM C 494/C 494M, Type D.
 - f. Water-Reducing, Accelerating Admixture: ASTM C 494/C 494M, Type E.

B. Cast Stone Units

1. Provide cast stone units complying with ASTM C 1364 using the vibrant dry tamp or wet-cast method.
 - a. Provide units that are resistant to freezing and thawing.
 - b. Slope exposed horizontal surfaces 1:12, unless otherwise indicated.
 - c. Provide raised fillets at backs of sills and at ends indicated to be built into jambs.
 - d. Provide drips on projecting elements, unless otherwise indicated.
2. Cure units by one of the following methods:
 - a. Cure units with steam in enclosed curing room at temperature of 105 deg F (41 deg C) or above and 95 to 100 percent relative humidity for 6 hours.
 - b. Cure units with dense fog and water spray in enclosed warm curing room at 95 to 100 percent relative humidity for 24 hours.
 - c. Cure units to comply with one of the following:



- 1) Not less than 5 days at mean daily temperature of 70 deg F (21 deg C) or above.
 - 2) Not less than 6 days at mean daily temperature of 60 deg F (16 deg C) or above.
 - 3) Not less than 7 days at mean daily temperature of 50 deg F (10 deg C) or above.
 - 4) Not less than 8 days at mean daily temperature of 45 deg F (7 deg C) or above.
3. Acid etch units after curing to remove cement film from surfaces to be exposed to view.
 4. Colors and Textures: As selected from manufacturer's full range.

C. Mortar Materials

1. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
2. Hydrated Lime: ASTM C 207, Type S.
3. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207, Type S.
4. Masonry Cement: ASTM C 91.
5. Mortar Cement: ASTM C 1329.
6. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortar.
7. Colored Cement Product: Packaged blend made from portland cement and lime masonry cement or mortar cement and mortar pigments, all complying with specified requirements and containing no other ingredients.
8. Aggregate for Mortar: ASTM C 144.
9. Water: Potable.

D. Accessories

1. Anchors: Type and size indicated, fabricated from stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666, Type 304 **OR** fabricated from steel complying with ASTM A 36/A 36M, and hot-dip galvanized to comply with ASTM A 123/A 123M, **as directed**.
2. Dowels: Round stainless-steel bars complying with ASTM A 276, Type 304, and 1/2-inch (12-mm) diameter, **OR** Round steel bars complying with ASTM A 36/A 36M or ASTM A 615/A 615M, 1/2-inch (12-mm) diameter, and hot-dip galvanized to comply with ASTM A 123/A 123M, **as directed**.
3. Proprietary Acidic Cleaner: Manufacturer's standard-strength, general-purpose cleaner designed for removing mortar/grout stains, efflorescence, and other construction stains from new masonry surfaces without discoloring or damaging masonry surfaces; expressly approved for intended use by cast stone manufacturer and expressly approved by cleaner manufacturer for use on cast stone and adjacent masonry materials.

E. Mortar Mixes

1. Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
 - a. Do not use calcium chloride in mortar.
 - b. Limit cementitious materials in mortar to portland cement, mortar cement, and lime.
2. Comply with ASTM C 270, Proportion Specification.
 - a. For setting mortar, use Type S **OR** N, **as directed**.
 - b. For pointing mortar, use Type N **OR** O, **as directed**.
3. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.
 - a. Pigments shall not exceed 10 percent of portland cement by weight.
 - b. Pigments shall not exceed 5 percent of masonry cement or mortar cement by weight.
4. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.

F. Source Quality Control

1. Employ an independent testing agency to sample and test cast stone units according to ASTM C 1364.



1.3 EXECUTION

A. Setting Cast Stone In Mortar

1. Wet joint surfaces thoroughly before applying mortar or setting in mortar.
2. Set units in full bed of mortar with full head joints, unless otherwise indicated.
 - a. Fill dowel holes and anchor slots with mortar.
 - b. Fill collar joints solid as units are set.
 - c. Build concealed flashing into mortar joints as units are set.
 - d. Keep head joints in coping and other units with exposed horizontal surfaces open to receive sealant.
 - e. Keep joints at shelf angles open to receive sealant.
3. Rake out joints for pointing with mortar to depths of not less than 3/4 inch (19 mm). Rake joints to uniform depths with square bottoms and clean sides. Scrub faces of units to remove excess mortar as joints are raked.
4. Point mortar joints by placing and compacting mortar in layers not greater than 3/8 inch (10 mm). Compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.
5. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.
6. Provide expansion, control, and pressure-relieving joints of widths and at locations indicated. Keep joints free of mortar and other rigid materials.
7. Prepare joints indicated to receive sealant and apply sealant of type and at locations indicated to comply with applicable requirements in Division 07 Section "Joint Sealants".

B. Setting Anchored Cast Stone With Sealant-Filled Joints

1. Set cast stone units accurately in locations indicated with edges and faces aligned.
 - a. Install anchors, supports, fasteners, and other attachments to secure units in place.
 - b. Shim and adjust anchors, supports, and accessories.
2. Fill anchor holes with sealant. Where dowel holes occur at pressure-relieving joints, provide compressible material at ends of dowels.
3. Set cast stone supported on clip or continuous angles on resilient setting shims. Hold shims back from face of cast stone a distance at least equal to width of joint.
4. Keep joints free of mortar and other rigid materials. Remove temporary spacers from joints after anchors and supports are secured in place and cast stone units are anchored.
5. Prepare joints and apply sealant of type and at locations indicated to comply with applicable requirements in Division 07 Section "Joint Sealants".

C. Installation Tolerances

1. Variation from Plumb: Do not exceed 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
2. Variation from Level: Do not exceed 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
3. Variation in Joint Width: Do not vary joint thickness more than 1/8 inch in 36 inches (3 mm in 900 mm) or one-fourth of nominal joint width, whichever is less.
4. Variation in Plane between Adjacent Surfaces (Lipping): Do not vary from flush alignment with adjacent units or adjacent surfaces indicated to be flush with units by more than 1/16 inch (1.5 mm), except due to warpage of units.

D. Adjusting And Cleaning

1. Remove and replace stained and otherwise damaged units and units not matching approved Samples. Cast stone may be repaired if methods and results are approved by the Owner.
 - a. Replace units in a manner that shows no evidence of replacement.
2. In-Progress Cleaning: Clean cast stone as work progresses.
 - a. Remove mortar fins and smears before tooling joints.
 - b. Remove excess sealant immediately, including spills, smears, and spatter.



3. Final Cleaning: After mortar is thoroughly set and cured, clean exposed cast stone as follows:
 - a. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - b. Test cleaning methods on sample; leave one sample uncleaned for comparison purposes. Obtain approval of sample cleaning before proceeding with cleaning of cast stone.
 - c. Protect adjacent surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 - d. Wet surfaces with water before applying cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
 - e. Clean cast stone by bucket-and-brush hand-cleaning method described in BIA Technical Notes No. 20 **OR** Clean cast stone with proprietary acidic cleaner applied according to manufacturer's written instructions, **as directed**.

END OF SECTION 04 72 00 00a



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Task	Specification	Specification Description
04 72 00 00	03 48 29 00	Plant-Precast Structural Concrete
04 72 00 00	04 01 20 91	Unit Masonry Assemblies



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Task	Specification	Specification Description
05 05 19 00	01 22 16 00	No Specification Required
05 05 19 00	05 50 00 00	Metal Fabrications



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SECTION 05 05 23 00 - STRUCTURAL STEEL

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for structural steel. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Structural steel.
 - b. Prefabricated building columns.
 - c. Grout.

C. Definitions

1. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
2. Seismic-Load-Resisting System: Elements of structural-steel frame designated as "SLRS" or along grid lines designated as "SLRS" on Drawings, including columns, beams, and braces and their connections.
3. Heavy Sections: Rolled and built-up sections as follows:
 - a. Shapes included in ASTM A 6/A 6M with flanges thicker than 1-1/2 inches (38 mm).
 - b. Welded built-up members with plates thicker than 2 inches (50 mm).
 - c. Column base plates thicker than 2 inches (50 mm).
4. Protected Zone: Structural members or portions of structural members indicated as "Protected Zone" on Drawings. Connections of structural and nonstructural elements to protected zones are limited.
5. Demand Critical Welds: Those welds, the failure of which would result in significant degradation of the strength and stiffness of the Seismic-Load-Resisting System and which are indicated as "Demand Critical" or "Seismic Critical" on Drawings.

D. Performance Requirements

1. Connections: Provide details of connections **OR** simple shear connections, **as directed**, required by the Contract Documents to be selected or completed by structural-steel fabricator, including comprehensive engineering design by a qualified professional engineer, **as directed**, to withstand loads indicated and comply with other information and restrictions indicated.
 - a. Select and complete connections using schematic details indicated and AISC 360.
 - b. Use LRFD; data are given at factored-load level **OR** ASD; data are given at service-load level, **as directed**.
2. Moment Connections: Type PR, partially **OR** FR, fully, **as directed**, restrained.
3. Construction: Moment frame **OR** Braced frame **OR** Shear wall system **OR** Combined system of moment frame and braced frame **OR** Combined system of moment frame and shear walls **OR** Combined system of braced frame and shear walls **OR** Combined system of moment frame, braced frame, and shear walls, **as directed**.

E. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittal:
 - a. Product Data for Credit MR 4.1 and Credit MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.



3. Shop Drawings: Show fabrication of structural-steel components.
 - a. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 - b. Include embedment drawings.
 - c. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
 - d. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
 - e. Identify members and connections of the seismic-load-resisting system.
 - f. Indicate locations and dimensions of protected zones.
 - g. Identify demand critical welds.
 - h. For structural-steel connections indicated to comply with design loads, include structural design data signed and sealed by the qualified professional engineer responsible for their preparation, **as directed**.
4. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for each welded joint whether prequalified or qualified by testing **OR** qualified by testing, **as directed**, including the following:
 - a. Power source (constant current or constant voltage).
 - b. Electrode manufacturer and trade name, for demand critical welds.
5. Qualification Data: For qualified Installer **OR** fabricator **OR** professional engineer **OR** testing agency, **as directed**.
6. Welding certificates.
7. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
8. Mill test reports for structural steel, including chemical and physical properties.
9. Product Test Reports: For the following:
 - a. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 - b. Direct-tension indicators.
 - c. Tension-control, high-strength bolt-nut-washer assemblies.
 - d. Shear stud connectors.
 - e. Shop primers.
 - f. Nonshrink grout.
10. Source quality-control reports.

F. Quality Assurance

1. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.
2. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category ACSE **OR** CSE, **as directed**.
3. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P1 **OR** P2 **OR** P3, **as directed**, or SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."
4. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - a. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.
5. Comply with applicable provisions of the following specifications and documents:
 - a. AISC 303.
 - b. AISC 341 and AISC 341s1.
 - c. AISC 360.
 - d. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
6. Preinstallation Conference: Conduct conference at Project site.



G. Delivery, Storage, And Handling

1. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
 - a. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
2. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
 - a. Fasteners may be repackaged provided the Owner's testing and inspecting agency observes repackaging and seals containers.
 - b. Clean and relubricate bolts and nuts that become dry or rusty before use.
 - c. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

H. Coordination

1. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.
2. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.2 PRODUCTS

A. Structural-Steel Materials

1. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 **OR** 50, **as directed**, percent.
OR
Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than the following:
 - a. W-Shapes: 60 percent.
 - b. Channels, Angles, M **OR** S, **as directed**, -Shapes: 60 percent.
 - c. Plate and Bar: 25 percent.
 - d. Cold-Formed Hollow Structural Sections: 25 percent.
 - e. Steel Pipe: 25 percent.
 - f. All Other Steel Materials: 25 percent.
2. W-Shapes: ASTM A 992/A 992M **OR** ASTM A 572/A 572M, Grade 50 (345) **OR** ASTM A 529/A 529M, Grade 50 (345) **OR** ASTM A 913/A 913M, Grade 50 (345), **as directed**.
3. Channels, Angles, M **OR** S, **as directed**, -Shapes: ASTM A 36/A 36M **OR** ASTM A 572/A 572M, Grade 50 (345) **OR** ASTM A 529/A 529M, Grade 50 (345) **OR** ASTM A 913/A 913M, Grade 50 (345), **as directed**.
4. Plate and Bar: ASTM A 36/A 36M **OR** ASTM A 572/A 572M, Grade 50 (345) **OR** ASTM A 529/A 529M, Grade 50 (345), **as directed**.
5. Corrosion-Resisting Structural-Steel Shapes, Plates, and Bars: ASTM A 588/A 588M, Grade 50 (345).
6. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B **OR** C, **as directed**, structural tubing.
7. Corrosion-Resisting Cold-Formed Hollow Structural Sections: ASTM A 847/A 847M, structural tubing.
8. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.
 - a. Weight Class: Standard **OR** Extra strong **OR** Double-extra strong, **as directed**.
 - b. Finish: Black **OR** Galvanized **OR** Black except where indicated to be galvanized, **as directed**.



9. Steel Castings: ASTM A 216/A 216M, Grade WCB with supplementary requirement S11.
10. Steel Forgings: ASTM A 668/A 668M.
11. Welding Electrodes: Comply with AWS requirements.

B. Bolts, Connectors, And Anchors

1. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, (ASTM A 563M, Class 8S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers; all with plain finish.
 - a. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with plain finish.
2. High-Strength Bolts, Nuts, and Washers: ASTM A 490 (ASTM A 490M), Type 1, heavy-hex steel structural bolts or tension-control, bolt-nut-washer assemblies with splined ends, **as directed**; ASTM A 563, Grade DH, (ASTM A 563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers with plain finish.
 - a. Direct-Tension Indicators: ASTM F 959, Type 490 (ASTM F 959M, Type 10.9), compressible-washer type with plain finish.
3. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH (ASTM A 563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers.
 - a. Finish: Hot-dip zinc coating **OR** Mechanically deposited zinc coating, **as directed**.
 - b. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with mechanically deposited zinc coating **OR** mechanically deposited zinc coating, baked epoxy-coated, **as directed**, finish.
4. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex **OR** round, **as directed**, head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
 - a. Finish: Plain **OR** Mechanically deposited zinc coating, **as directed**.
5. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.
6. Unheaded Anchor Rods: ASTM F 1554, Grade 36 **OR** ASTM F 1554, Grade 55, weldable **OR** ASTM A 354 **OR** ASTM A 449 **OR** ASTM A 572/A 572M, Grade 50 (345) **OR** ASTM A 36/A 36M, **as directed**.
 - a. Configuration: Straight **OR** Hooked, **as directed**.
 - b. Nuts: ASTM A 563 (ASTM A 563M) hex **OR** heavy-hex, **as directed**, carbon steel.
 - c. Plate Washers: ASTM A 36/A 36M carbon steel.
 - d. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
 - e. Finish: Plain **OR** Hot-dip zinc coating, ASTM A 153/A 153M, Class C **OR** Mechanically deposited zinc coating, ASTM B 695, Class 50, **as directed**.
7. Headed Anchor Rods: ASTM F 1554, Grade 36 **OR** ASTM F 1554, Grade 55, weldable **OR** ASTM A 354 **OR** ASTM A 449, **as directed**, straight.
 - a. Nuts: ASTM A 563 (ASTM A 563M) hex **OR** heavy-hex, **as directed**, carbon steel.
 - b. Plate Washers: ASTM A 36/A 36M carbon steel.
 - c. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
 - d. Finish: Plain **OR** Hot-dip zinc coating, ASTM A 153/A 153M, Class C **OR** Mechanically deposited zinc coating, ASTM B 695, Class 50, **as directed**.
8. Threaded Rods: ASTM A 36/A 36M **OR** ASTM A 193/A 193M, Grade B7 **OR** ASTM A 354, Grade BD **OR** ASTM A 449 **OR** ASTM A 572/A 572M, Grade 50 (345), **as directed**.
 - a. Nuts: ASTM A 563 (ASTM A 563M) hex **OR** heavy-hex, **as directed**, carbon steel.
 - b. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened **OR** ASTM A 36/A 36M, **as directed**, carbon steel.
 - c. Finish: Plain **OR** Hot-dip zinc coating, ASTM A 153/A 153M, Class C **OR** Mechanically deposited zinc coating, ASTM B 695, Class 50, **as directed**.
9. Clevises and Turnbuckles: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1035.
10. Eye Bolts and Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1030.



11. Sleeve Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1018.
 12. Structural Slide Bearings: Low-friction assemblies, of configuration indicated, that provide vertical transfer of loads and allow horizontal movement perpendicular to plane of expansion joint while resisting movement within plane of expansion joint.
 - a. Mating Surfaces: PTFE and PTFE **OR** PTFE and mirror-finished stainless steel, **as directed**.
 - b. Coefficient of Friction: Not more than 0.03 **OR** 0.04 **OR** 0.05 **OR** 0.06 **OR** 0.10 **OR** 0.12, **as directed**.
 - c. Design Load: Not less than 2,000 psi (13.7 MPa) **OR** 5,000 psi (34 MPa) **OR** 6,000 psi (41 MPa), **as directed**.
 - d. Total Movement Capability: 2 inches (50 mm).
- C. Primer
1. Primer: Comply with Division 07 **OR** Division 09 Section(s) "High-performance Coatings" **OR** Division 07 **AND** Division 09 Section(s) "High-performance Coatings", **as directed**.
OR
Primer: SSPC-Paint 25, Type I **OR** Type II, **as directed**, zinc oxide, alkyd, linseed oil primer.
OR
Primer: SSPC-Paint 25 BCS, Type I **OR** Type II, **as directed**, zinc oxide, alkyd, linseed oil primer.
OR
Primer: SSPC-Paint 23, latex primer.
OR
Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat, **as directed**.
 2. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20 **OR** ASTM A 780, **as directed**.
- D. Grout
1. Metallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, metallic aggregate grout, mixed with water to consistency suitable for application and a 30-minute working time.
 2. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.
- E. Fabrication
1. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.
 - a. Camber structural-steel members where indicated.
 - b. Fabricate beams with rolling camber up.
 - c. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
 - d. Mark and match-mark materials for field assembly.
 - e. If shop priming is required, complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
 2. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 - a. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
 3. Bolt Holes: Cut, drill, mechanically thermal cut, **as directed**, or punch standard bolt holes perpendicular to metal surfaces.
 4. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
 5. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 1, "Solvent Cleaning" **OR** SSPC-SP 2, "Hand Tool Cleaning" **OR** SSPC-SP 3, "Power Tool Cleaning", **as directed**.
 6. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.



7. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural steel. Straighten as required to provide uniform, square, and true members in completed wall framing.
 8. Welded Door Frames: Build up welded door frames attached to structural steel. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk machine screws, uniformly spaced not more than 10 inches (250 mm) o.c. unless otherwise indicated.
 9. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.
 - a. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning, **unless directed otherwise**.
 - b. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 - c. Weld threaded nuts to framing and other specialty items indicated to receive other work.
- F. Shop Connections
1. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - a. Joint Type: Snug tightened **OR** Pretensioned **OR** Slip critical, **as directed**.
 2. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M, **as directed**, for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - a. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.
- G. Prefabricated Building Columns
1. Prefabricated building columns consisting of load-bearing structural-steel members protected by concrete fireproofing encased in an outer non-load-bearing steel shell.
 2. Fire-Resistance Ratings: Provide prefabricated building column listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for ratings indicated, based on testing according to ASTM E 119.
 - a. Fire-Resistance Rating: 4 hours **OR** 3 hours **OR** 2 hours **OR** As indicated, **as directed**.
- H. Shop Priming
1. If shop priming is required, shop prime steel surfaces except the following:
 - a. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
 - b. Surfaces to be field welded.
 - c. Surfaces to be high-strength bolted with slip-critical connections.
 - d. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
 - e. Galvanized surfaces.
 2. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
 - a. SSPC-SP 2, "Hand Tool Cleaning."
 - b. SSPC-SP 3, "Power Tool Cleaning."
 - c. SSPC-SP 7/NACE No. 4, "Brush-Off Blast Cleaning."
 - d. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."
 - e. SSPC-SP 14/NACE No. 8, "Industrial Blast Cleaning."
 - f. SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - g. SSPC-SP 10/NACE No. 2, "Near-White Blast Cleaning."
 - h. SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning."
 - i. SSPC-SP 8, "Pickling."
 3. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5



- mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
- a. Stripe paint corners, crevices, bolts, welds, and sharp edges.
 - b. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.
4. Painting: Prepare steel and apply a one-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils (0.038 mm).
- I. Galvanizing
1. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.
 - a. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.
 - b. Galvanize lintels, shelf angles, and welded door frames attached to structural-steel frame and located in exterior walls.
- J. Source Quality Control
1. Testing Agency: the Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.
 - a. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
 2. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
 3. Bolted Connections: Shop-bolted connections will be inspected **OR** tested and inspected, **as directed**, according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
 4. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E 165.
 - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - c. Ultrasonic Inspection: ASTM E 164.
 - d. Radiographic Inspection: ASTM E 94.
 5. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
 - a. Bend tests will be performed if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
 - b. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.

1.3 EXECUTION

A. Examination

1. Verify, with steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
 - a. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Preparation

1. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in



intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

- a. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

C. Erection

1. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
2. Base Bearing and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - a. Set plates for structural members on wedges, shims, or setting nuts as required.
 - b. Weld plate washers to top of baseplate.
 - c. Snug-tighten **OR** Pretension, **as directed**, anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - d. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts, **as directed**.
3. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
4. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - a. Level and plumb individual members of structure.
 - b. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
5. Splice members only where indicated.
6. Do not use thermal cutting during erection unless approved by the Owner. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.
7. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
8. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

D. Field Connections

1. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - a. Joint Type: Snug tightened **OR** Pretensioned **OR** Slip critical, **as directed**.
2. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M, **as directed**, for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - a. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
 - b. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.
 - c. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

E. Prefabricated Building Columns

1. Install prefabricated building columns to comply with AISC 360, manufacturer's written recommendations, and requirements of testing and inspecting agency that apply to the fire-resistance rating indicated.

**F. Field Quality Control**

1. Testing Agency: Engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.
2. Bolted Connections: Bolted connections will be inspected **OR** tested and inspected, **as directed**, according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
3. Welded Connections: Field welds will be visually inspected according to AWS D1.1/D1.1M.
 - a. In addition to visual inspection, field welds will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - 1) Liquid Penetrant Inspection: ASTM E 165.
 - 2) Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - 3) Ultrasonic Inspection: ASTM E 164.
 - 4) Radiographic Inspection: ASTM E 94.
4. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
 - a. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
 - b. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.
5. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

G. Repairs And Protection

1. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.
2. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - a. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

OR

Touchup Painting: Cleaning and touchup painting are specified in Division 07.

END OF SECTION 05 05 23 00



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Task	Specification	Specification Description
05 05 23 00	01 22 16 00	No Specification Required
05 05 23 00	05 50 00 00	Metal Fabrications



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SECTION 05 12 23 00 - COLD-FORMED METAL FRAMING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for cold-formed metal framing. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Exterior load-bearing wall framing.
 - b. Interior load-bearing wall framing.
 - c. Exterior non-load-bearing wall framing.
 - d. Floor joist framing.
 - e. Roof trusses.
 - f. Roof rafter framing.
 - g. Ceiling joist framing.

C. Performance Requirements

1. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.
 - a. Design Loads: **As directed.**
 - b. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
 - 1) Exterior Load-Bearing Wall Framing: Horizontal deflection of 1/240 **OR** 1/360 **OR** 1/600 **OR** 1/720, **as directed**, of the wall height.
 - 2) Interior Load-Bearing Wall Framing: Horizontal deflection of 1/240 **OR** 1/360, **as directed**, of the wall height under a horizontal load of 5 lbf/sq. ft. (239 Pa).
 - 3) Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/240 **OR** 1/360 **OR** 1/600 **OR** 1/720, **as directed**, of the wall height.
 - 4) Floor Joist Framing: Vertical deflection of 1/480 for live loads and 1/360 for total loads of the span.
 - 5) Roof Trusses: Vertical deflection of 1/240 **OR** 1/360, **as directed**, of the span.
 - 6) Scissor Roof Trusses: Horizontal deflection of 1-1/4 inches (32 mm) <Insert dimension> at reactions.
 - 7) Roof Rafter Framing: Horizontal deflection of 1/240 **OR** 1/360, **as directed**, of the horizontally projected span.
 - 8) Ceiling Joist Framing: Vertical deflection of 1/240 **OR** 1/360, **as directed**, of the span.
 - c. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F (67 deg C).
 - d. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
 - 1) Upward and downward movement of 1/2 inch (13 mm) **OR** 3/4 inch (19 mm) **OR** 1 inch (25 mm) **OR** 1-1/2 inches (38 mm), **as directed.**
2. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."
 - a. Headers: Design according to AISI's "Standard for Cold-Formed Steel Framing - Header Design."



- b. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.
- c. Roof Trusses: Design according to AISI's "Standard for Cold-Formed Steel Framing - Truss Design."

D. Submittals

1. Product Data: For each type of product and accessory indicated.
2. LEED Submittal:
 - a. Product Data for Credit MR 4.1 and Credit MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - 1) Include statement indicating costs for each product having recycled content.
3. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
 - a. For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
4. Welding certificates.
5. Qualification data.
6. Product test reports.
7. Research/evaluation reports.

E. Quality Assurance

1. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.
2. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.
3. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated.
4. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment, **as directed**, indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, ductility, and metallic-coating thickness.
5. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."
6. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
7. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."
 - a. Comply with AISI's "Standard for Cold-Formed Steel Framing - Truss Design."
 - b. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."
8. Comply with AISI's "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings" as applicable.
9. Preinstallation Conference: Conduct conference at Project site.

F. Delivery, Storage, And Handling

1. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.
2. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.



1.2 PRODUCTS

A. Materials

1. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
2. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
 - a. Grade: ST33H (ST230H) **OR** ST50H (ST340H) **OR** As required by structural performance, **as directed**.
 - b. Coating: G60 (Z180), A60 (ZF180), AZ50 (AZ150), or GF30 (ZGF90) **OR** G90 (Z275) or equivalent, **as directed**.
3. Steel Sheet for Vertical Deflection **OR** Drift, **as directed**, Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
 - a. Grade: 50 (340), Class 1 or 2 **OR** As required by structural performance, **as directed**.
 - b. Coating: G90 (Z275).

B. Load-Bearing Wall Framing

1. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges.
2. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges.
3. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, punched, with stiffened flanges.
4. Steel Double-L Headers: Manufacturer's standard L-shapes used to form header beams, of web depths indicated.

C. Exterior Non-Load-Bearing Wall Framing

1. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges.
2. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges.
3. Vertical Deflection Clips: Manufacturer's standard bypass **OR** head, **as directed**, clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
4. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure.
5. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
 - a. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure.
 - b. Inner Track: Of web depth indicated, and as follows:
6. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure.

D. Floor Joist Framing

1. Steel Joists: Manufacturer's standard C-shaped steel joists, of web depths indicated, unpunched, **OR** punched, **OR** punched, with enlarged service holes, **as directed**, with stiffened flanges, and as follows:
2. Steel Joist Track: Manufacturer's standard U-shaped steel joist track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

E. Roof Trusses

1. Roof Truss Members:



- a. Manufacturer's standard-shape steel sections.
OR
Manufacturer's standard C-shaped steel sections, of web depths indicated, unpunched, with stiffened flanges.
- F. Roof-Rafter Framing
- 1. Steel Rafters: Manufacturer's standard C-shaped steel sections, of web depths indicated, unpunched, with stiffened flanges.
 - 2. Built-up Members: Built-up members of manufacturer's standard C-shaped steel section, with stiffened flanges, nested into a U-shaped steel section joist track, with unstiffened flanges; unpunched; of web depths indicated.
- G. Ceiling Joist Framing
- 1. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, unpunched, **OR** punched with enlarged service holes, **as directed**, with stiffened flanges, and as follows:
- H. Framing Accessories
- 1. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.
 - 2. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
 - a. Supplementary framing.
 - b. Bracing, bridging, and solid blocking.
 - c. Web stiffeners.
 - d. Anchor clips.
 - e. End clips.
 - f. Foundation clips.
 - g. Gusset plates.
 - h. Stud kickers, knee braces, and girts.
 - i. Joist hangers and end closures.
 - j. Hole reinforcing plates.
 - k. Backer plates.
- I. Anchors, Clips, And Fasteners
- 1. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.
 - 2. Anchor Bolts: ASTM F 1554, Grade 36 **OR** 55, **as directed**, threaded carbon-steel hex-headed bolts **OR** headless, hooked bolts **OR** headless bolts, with encased end threaded, **as directed**, and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C **OR** mechanically deposition according to ASTM B 695, Class 50, **as directed**.
 - 3. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
 - 4. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.
 - 5. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.
 - a. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.
 - 6. Welding Electrodes: Comply with AWS standards.
- J. Miscellaneous Materials



1. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035 **OR** ASTM A 780, **as directed**.
2. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
3. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.
4. Shims: Load bearing, high-density multimonomer plastic, nonleaching.
5. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

K. Fabrication

1. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
 - a. Fabricate framing assemblies using jigs or templates.
 - b. Cut framing members by sawing or shearing; do not torch cut.
 - c. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
 - 1) Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - 2) Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.
 - d. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.
2. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.
3. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
 - a. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 - b. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).

1.3 EXECUTION

A. Preparation

1. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
2. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.
3. Install load bearing shims or grout between the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations to ensure a uniform bearing surface on supporting concrete or masonry construction.
4. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

B. Installation, General

1. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.



2. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.
3. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
 - a. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.6 mm).
4. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.
 - a. Cut framing members by sawing or shearing; do not torch cut.
 - b. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - 1) Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - 2) Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.
5. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
6. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
7. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.
8. Install insulation, specified in Division 07 Section "Thermal Insulation", in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
9. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.
10. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
 - a. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

C. Load-Bearing Wall Installation

1. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:
 - a. Anchor Spacing: 24 inches (610 mm) **OR** 32 inches (813 mm) **OR** To match stud spacing **OR** As shown on Shop Drawings, **as directed**.
2. Squarely seat studs against top and bottom tracks with gap not exceeding of 1/8 inch (3 mm) between the end of wall framing member and the web of track. Fasten both flanges of studs to top and bottom tracks. Space studs as follows:
 - a. Stud Spacing:
 - 1) 12 inches (305 mm) **OR** 16 inches (406 mm) **OR** 19.2 inches (488 mm) **OR** 24 inches (610 mm) **OR** As indicated, **as directed**.
 - 2) 300 mm **OR** 400 mm **OR** 600 mm **OR** As indicated, **as directed**.
3. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.
4. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.
5. Align floor and roof framing over studs. Where framing cannot be aligned, continuously reinforce track to transfer loads.
6. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated.



7. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.
 - a. Frame wall openings with not less than a double stud at each jamb of frame as indicated on Shop Drawings. Fasten jamb members together to uniformly distribute loads.
 - b. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.
 8. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.
 - a. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.
 9. Install horizontal bridging in stud system, spaced 48 inches (1220 mm) **OR** as indicated **OR** as indicated on Shop Drawings, **as directed**. Fasten at each stud intersection.
 - a. Bridging:
 - 1) Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of 2 screws into each flange of the clip angle for framing members up to 6 inches (150 mm) deep.
OR
Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
OR
Proprietary bridging bars installed according to manufacturer's written instructions.
 10. Install steel sheet diagonal bracing straps to both stud flanges, terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.
 11. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.
- D. Exterior Non-Load-Bearing Wall Installation
1. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.
 2. Fasten both flanges of studs to bottom **OR** top and bottom, **as directed**, track, unless otherwise indicated. Space studs as follows:
 - a. Stud Spacing:
 - 1) 12 inches (305 mm) **OR** 16 inches (406 mm) **OR** 19.2 inches (488 mm) **OR** 24 inches (610 mm) **OR** As indicated, **as directed**.
 - 2) 300 mm **OR** 400 mm **OR** 480 mm **OR** 600 mm **OR** As indicated, **as directed**.
 3. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
 4. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 - a. Install single-leg deflection tracks and anchor to building structure.
 - b. Install double deep-leg deflection tracks and anchor outer track to building structure.
 - c. Connect vertical deflection clips to bypassing **OR** infill, **as directed**, studs and anchor to building structure.
 - d. Connect drift clips to cold formed metal framing and anchor to building structure.
 5. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches (1220 mm) apart. Fasten at each stud intersection.
 - a. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches (305 mm) **OR** 18 inches (450 mm), **as directed**, of single deflection track. Install a combination of flat, taut, steel sheet straps of width and thickness indicated and stud or



stud-track solid blocking of width and thickness matching studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.

- 1) Install solid blocking at 96-inch (2440-mm) centers **OR** centers indicated **OR** centers indicated on Shop Drawings, **as directed**.
- b. Bridging:
 - 1) Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.

OR

 Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.

OR

 Proprietary bridging bars installed according to manufacturer's written instructions.
6. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

E. Joist Installation

1. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.
2. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.
 - a. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm).
 - b. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections as indicated on Shop Drawings.
3. Space joists not more than 2 inches (51 mm) from abutting walls, and as follows:
 - a. Joist Spacing:
 - 1) 12 inches (305 mm) **OR** 16 inches (406 mm) **OR** 19.2 inches (488 mm) **OR** 24 inches (610 mm) **OR** As indicated, **as directed**.
 - 2) 300 mm **OR** 400 mm **OR** 480 mm **OR** 600 mm **OR** As indicated, **as directed**.
4. Frame openings with built-up joist headers consisting of joist and joist track, nesting joists, or another combination of connected joists if indicated.
5. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement, or as indicated **OR** as indicated on Shop Drawings, **as directed**.
 - a. Install web stiffeners to transfer axial loads of walls above.
6. Install bridging at intervals indicated **OR** indicated on Shop Drawings, **as directed**. Fasten bridging at each joist intersection as follows:
 - a. Bridging:
 - 1) Joist-track solid blocking of width and thickness indicated, secured to joist webs.

OR

 Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.
7. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.
8. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

F. Truss Installation

1. Install, bridge, and brace trusses according to Shop Drawings and requirements in this Section.
2. Truss Spacing:
 - a. 16 inches (406 mm) **OR** 19.2 inches (488 mm) **OR** 24 inches (610 mm) **OR** 32 inches (813 mm) **OR** 48 inches (1220 mm) **OR** As indicated, **as directed**.
 - b. 400 mm **OR** 480 mm **OR** 600 mm **OR** 800 mm **OR** 1200 mm, **as directed**.



3. Do not alter, cut, or remove framing members or connections of trusses.
4. Erect trusses with plane of truss webs plumb and parallel to each other, align, and accurately position at spacings indicated.
5. Erect trusses without damaging framing members or connections.
6. Align webs of bottom chords and load-bearing studs or continuously reinforce track to transfer loads to structure. Anchor trusses securely at all bearing points.
7. Install continuous bridging and permanently brace trusses as indicated on Shop Drawings and designed according to LGSEA's Technical Note 551e, "Design Guide for Permanent Bracing of Cold-Formed Steel Trusses," **as directed**.

G. Field Quality Control

1. Testing: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
2. Field and shop welds will be subject to testing and inspecting.
3. Testing agency will report test results promptly and in writing to Contractor and the Owner.
4. Remove and replace work where test results indicate that it does not comply with specified requirements.
5. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

H. Repairs And Protection

1. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
2. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed metal framing is without damage or deterioration at time of Final Completion.

END OF SECTION 05 12 23 00



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Task	Specification	Specification Description
05 12 23 00	05 05 23 00	Structural Steel
05 12 23 00	05 50 00 00	Metal Fabrications
05 13 00 00	05 50 00 00	Metal Fabrications



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SECTION 05 14 16 00 - STRUCTURAL ALUMINUM

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for structural aluminum. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Performance Requirements

1. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-aluminum fabricator to withstand loads indicated and comply with other information and restrictions indicated.
 - a. Select and complete connections using schematic details indicated and in accordance with minimum mechanical properties and applicable buckling formula constants published by The Aluminum Association's "Aluminum Construction Manual."

C. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: Show fabrication of structural-aluminum components.
3. Welding certificates.
4. Mill test reports.
5. Source quality-control test reports.

D. Quality Assurance

1. Fabricator Qualifications: A qualified fabricator who has provided successful structural aluminum fabrication for a minimum of 5 years.
2. Welding: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code--Aluminum."
3. Comply with applicable provisions of The Aluminum Association's "Aluminum Construction Manual."
4. Preinstallation Conference: Conduct conference at Project site.

1.2 PRODUCTS

A. Structural-Aluminum Materials

1. W-Shapes, Channels, Angles, Plate and Bar, Cold-Formed Hollow Structural Sections, and Pipe: Structural shapes indicating minimum mechanical properties and applicable buckling formula constants are listed in Table 3.3.1, Section 3, of "Specifications for Aluminum Structures," Construction Manual Series Section 1, as published by The Aluminum Association. Applicable ASTM Designations include B209, B210, B211, B221, B241, B247, B308, and B429
2. Allowable Stresses:
 - a. Building Type Structures: Basic allowable tensile stresses for buildings, structural supports for highway signs, luminaires, traffic signals and similar structures shall be the lesser of the minimum yield strength divided by a factor of safety of 1.65, or the minimum ultimate tensile strength divided by a factor of safety of 1.95. Other allowable stresses for buildings and similar structures shall be based upon the factors of safety shown in Table 3.3.3 of "Specifications for Aluminum Structures."
 - b. Bridge Type Structures: Basic allowable tensile stresses for bridge type structures shall be the lesser of the minimum yield strength divided by a factor of safety of 1.85, or the minimum ultimate tensile strength divided by a factor of safety of 2.2. Other allowable



stresses for bridge and similar structures shall be based upon the factors of safety shown in Table 3.3.3 of "Specifications for Aluminum Structures."

3. Welding Electrodes: Comply with AWS requirements.

B. Bolts and Connectors

1. Rivets and Bolts:
 - a. Aluminum alloys used for rivets and bolts shall be those listed in Tables 5.1.1b and 5.1.1c of "Specifications for Aluminum Structures."
 - b. Nuts:
 - 1) For bolts 1/4" and smaller: Alloy 2024-T4. For improved corrosion resistance, apply 0.0002" minimum thickness anodic coating.
 - 2) For bolts larger than 1/4": 6061-T6 or 6262-T9.
 - 3) Flat Washers: Alclad 2024-T4.
 - 4) Spring Lock Washers: Alloy 7075-T6.
 - c. Steel Bolts: Hot-dip galvanized, electro-galvanized, cadmium plated or aluminized steel bolts and Series 300 stainless steel bolts may be used instead of aluminum bolts. Plating thickness on steel shall be adequate to provide corrosion protection for the anticipated environ and service life.

C. Grout

1. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404, Size No. 2. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
2. Metallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, metallic aggregate grout, mixed with water to consistency suitable for application and a 30-minute working time.
3. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

D. Fabrication

1. Structural Aluminum: Fabricate and assemble in shop to greatest extent possible. Fabricate according to The Aluminum Association's "Aluminum Construction Manual."

E. Source Quality Control

1. Engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports. Comply with testing and inspection requirements of Part 1.3, Article "Field Quality Control."
2. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

1.3 EXECUTION

A. Erection

1. Examination: Verify elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments, with erector present, for compliance with requirements.
 - a. Proceed with installation only after unsatisfactory conditions have been corrected.
2. Set structural aluminum accurately in locations and to elevations indicated and according to The Aluminum Association's "Aluminum Construction Manual."
3. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.
 - a. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.



- b. Weld plate washers to top of base plate.
 - c. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate before packing with grout.
 - d. Promptly pack grout solidly between bearing surfaces and base or bearing plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
4. Maintain erection tolerances of structural aluminum within The Aluminum Association's "Aluminum Construction Manual."
- B. Field Connections
1. Bolts: Shop install bolts according to The Aluminum Association's "Aluminum Construction Manual" for type of bolt and type of joint specified.
 2. Weld Connections: Comply with AWS D1.2 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
 - a. Comply with The Aluminum Association's "Aluminum Construction Manual" for bearing, adequacy of temporary connections, and alignment.
- C. Field Quality Control
1. Testing Agency: Engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.
 2. Bolted Connections: Shop-bolted connections shall be tested and inspected according to The Aluminum Association's "Aluminum Construction Manual."
 3. Welded Connections: Field welds shall be visually inspected according to AWS D1.2.
 - a. In addition to visual inspection, field welds shall be tested according to AWS D1.2.
 4. Correct deficiencies in Work that test reports and inspections indicate are not in compliance with the Contract Documents.

END OF SECTION 05 14 16 00



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Task	Specification	Specification Description
05 14 16 00	01 22 16 00	No Specification Required
05 41 00 00	05 12 23 00	Cold-Formed Metal Framing
05 43 00 00	01 22 16 00	No Specification Required
05 43 00 00	05 12 23 00	Cold-Formed Metal Framing
05 43 00 00	05 50 00 00	Metal Fabrications



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SECTION 05 50 00 00 - METAL FABRICATIONS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for metal fabrications. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Steel framing and supports for ceiling-hung toilet compartments.
 - b. Steel framing and supports for operable partitions.
 - c. Steel framing and supports for overhead doors and grilles.
 - d. Steel framing and supports for countertops.
 - e. Steel framing and supports for mechanical and electrical equipment.
 - f. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 - g. Steel framing and supports (outriggers) for window-washing equipment including mounting brackets and anchorages.
OR
Mounting brackets and anchorages for window-washing equipment.
 - h. Elevator machine beams, hoist beams, and divider beams.
 - i. Steel shapes for supporting elevator door sills.
 - j. Steel girders for supporting wood frame construction.
 - k. Steel pipe columns for supporting wood frame construction.
 - l. Prefabricated building columns.
 - m. Shelf angles.
 - n. Metal ladders.
 - o. Ladder safety cages.
 - p. Alternating tread devices.
 - q. Metal ships' ladders and pipe crossovers.
 - r. Metal floor plate and supports.
 - s. Structural-steel door frames.
 - t. Miscellaneous steel trim including steel angle corner guards, steel edgings, and loading-dock edge angles.
 - u. Metal bollards.
 - v. Pipe **OR** Downspout, **as directed**, guards.
 - w. Abrasive metal nosings, treads, and thresholds.
 - x. Cast-iron wheel guards.
 - y. Metal downspout boots.
 - z. Loose bearing and leveling plates for applications where they are not specified in other Sections.
2. Products furnished, but not installed, under this Section:
 - a. Loose steel lintels.
 - b. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
 - c. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

C. Performance Requirements



1. Delegated Design: Design ladders and alternating tread devices, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2. Structural Performance of Aluminum Ladders: Aluminum ladders, including landings, shall withstand the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.
3. Structural Performance of Alternating Tread Devices: Alternating tread devices shall withstand the effects of loads and stresses within limits and under conditions specified in ICC's International Building Code.
4. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
 - a. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

D. Submittals

1. Product Data: For the following:
 - a. Nonslip aggregates and nonslip-aggregate surface finishes.
 - b. Prefabricated building columns.
 - c. Metal nosings and treads.
 - d. Paint products.
 - e. Grout.
2. LEED Submittals:
 - a. Product Data for Credit MR 4.1 and Credit MR 4.2, **as directed**: Indicating percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.
3. Shop Drawings: Show fabrication and installation details for metal fabrications.
 - a. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
4. Samples: For each type and finish of extruded nosing and tread.
5. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
6. Qualification Data: For qualified professional engineer.
7. Mill Certificates: Signed by manufacturers of stainless-steel certifying that products furnished comply with requirements.
8. Welding certificates.
9. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

E. Quality Assurance

1. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. Welding Qualifications: Qualify procedures and personnel according to the following:
 - a. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - b. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 - c. AWS D1.6, "Structural Welding Code - Stainless Steel."

F. Project Conditions

1. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

G. Coordination



1. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
2. Coordinate installation of anchorages and steel weld plates and angles for casting into concrete. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.2 PRODUCTS

A. Metals, General

1. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Ferrous Metals

1. Recycled Content of Steel Products: Provide products with average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
2. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
3. Stainless-Steel Sheet, Strip, and Plate: ASTM A 240/A 240M or ASTM A 666, Type 304 **OR** Type 316L, **as directed**.
4. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304 **OR** Type 316L, **as directed**.
5. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
6. Rolled-Stainless-Steel Floor Plate: ASTM A 793.
7. Abrasive-Surface Floor Plate: Steel plate with abrasive granules rolled into surface or with abrasive material metallurgically bonded to steel.
8. Steel Tubing: ASTM A 500, cold-formed steel tubing.
9. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless otherwise indicated.
10. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
 - a. Size of Channels: 1-5/8 by 1-5/8 inches (41 by 41 mm) **OR** As indicated, **as directed**.
 - b. Material: Galvanized steel, ASTM A 653/A 653M, commercial steel, Type B **OR** structural steel, Grade 33 (Grade 230), **as directed**, with G90 (Z275) coating; 0.108-inch (2.8-mm) (12 gage) **OR** 0.079-inch (2-mm) (14 gage) **OR** 0.064-inch (1.6-mm) (16 gage), **as directed**, nominal thickness.
OR
Material: Cold-rolled steel, ASTM A 1008/A 1008M, commercial steel, Type B **OR** structural steel, Grade 33 (Grade 230), **as directed**; 0.0966-inch (2.5-mm) (12 gage) **OR** 0.0677-inch (1.7-mm) (14 gage) **OR** 0.0528-inch (1.35-mm) (16 gage), **as directed**, minimum thickness; unfinished **OR** coated with rust-inhibitive, baked-on, acrylic enamel **OR** hot-dip galvanized after fabrication, **as directed**.
11. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

C. Nonferrous Metals

1. Aluminum Plate and Sheet: ASTM B 209 (ASTM B 209M), Alloy 6061-T6.
2. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T6.
3. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.
4. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.
5. Bronze Plate, Sheet, Strip, and Bars: ASTM B 36/B 36M, Alloy UNS No. C28000 (muntz metal, 60 percent copper).
6. Bronze Extrusions: ASTM B 455, Alloy UNS No. C38500 (extruded architectural bronze).
7. Bronze Castings: ASTM B 584, Alloy UNS No. C83600 (leaded red brass) or No. C84400 (leaded semired brass).



8. Nickel Silver Extrusions: ASTM B 151/B 151M, Alloy UNS No. C74500.
9. Nickel Silver Castings: ASTM B 584, Alloy UNS No. C97600 (20 percent leaded nickel bronze).

D. Fasteners

1. General: Unless otherwise indicated, provide Type 304 **OR** Type 316, **as directed**, stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
 - a. Provide stainless-steel fasteners for fastening aluminum.
 - b. Provide stainless-steel fasteners for fastening stainless steel.
 - c. Provide stainless-steel fasteners for fastening nickel silver.
 - d. Provide bronze fasteners for fastening bronze.
2. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
3. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 325, Type 3 (ASTM A 325M, Type 3); with hex nuts, ASTM A 563, Grade C3 (ASTM A 563M, Class 8S3); and, where indicated, flat washers.
4. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593 (ASTM F 738M); with hex nuts, ASTM F 594 (ASTM F 836M); and, where indicated, flat washers; Alloy Group 1 (A1) **OR** Group 2 (A4), **as directed**.
5. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
 - a. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
6. Eyebolts: ASTM A 489.
7. Machine Screws: ASME B18.6.3 (ASME B18.6.7M).
8. Lag Screws: ASME B18.2.1 (ASME B18.2.3.8M).
9. Wood Screws: Flat head, ASME B18.6.1.
10. Plain Washers: Round, ASME B18.22.1 (ASME B18.22M).
11. Lock Washers: Helical, spring type, ASME B18.21.1 (ASME B18.21.2M).
12. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
13. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.
14. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
 - a. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
 - b. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 (A1) **OR** Group 2 (A4), **as directed**, stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).
15. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches (41 by 22 mm) by length indicated with anchor straps or studs not less than 3 inches (75 mm) long at not more than 8 inches (200 mm) o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

E. Miscellaneous Materials

1. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.



2. Shop Primers: Provide primers that comply with Division 07 OR Division 09 Section(s) "High-performance Coatings" **OR** Division 07 AND Division 09 Section(s) "High-performance Coatings", **as directed**.
3. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - a. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
4. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
5. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
6. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
7. Nonshrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C 1107, specifically recommended by manufacturer for heavy-duty loading applications.
8. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
9. Concrete: Comply with requirements in Division 03 Section "Cast-in-place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa).

F. Fabrication, General

1. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
2. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
3. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
4. Form exposed work with accurate angles and surfaces and straight edges.
5. Weld corners and seams continuously to comply with the following:
 - a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - b. Obtain fusion without undercut or overlap.
 - c. Remove welding flux immediately.
 - d. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
6. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
7. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
8. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
9. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
 - a. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (3.2 by 38 mm), with a minimum 6-inch (150-mm) embedment and 2-inch (50-mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

G. Miscellaneous Framing And Supports

1. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.



2. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
 - a. Fabricate units from slotted channel framing where indicated.
 - b. Furnish inserts for units installed after concrete is placed.
3. Fabricate supports for operable partitions from continuous steel beams of sizes indicated **OR** recommended by partition manufacturer, **as directed**, with attached bearing plates, anchors, and braces as indicated **OR** recommended by partition manufacturer, **as directed**. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.
4. Fabricate steel girders for wood frame construction from continuous steel shapes of sizes indicated.
 - a. Provide bearing plates welded to beams where indicated.
 - b. Drill or punch girders and plates for field-bolted connections where indicated.
 - c. Where wood nailers are attached to girders with bolts or lag screws, drill or punch holes at 24 inches (600 mm) o.c.
5. Fabricate steel pipe columns for supporting wood frame construction from steel pipe with steel baseplates and top plates as indicated. Drill or punch baseplates and top plates for anchor and connection bolts and weld to pipe with fillet welds all around. Make welds the same size as pipe wall thickness unless otherwise indicated.
 - a. Unless otherwise indicated, fabricate from Schedule 40 steel pipe.
 - b. Unless otherwise indicated, provide 1/2-inch (12.7-mm) baseplates with four 5/8-inch (16-mm) anchor bolts and 1/4-inch (6.4-mm) top plates.
6. Galvanize miscellaneous framing and supports where indicated.
OR
Prime miscellaneous framing and supports with zinc-rich primer **OR** primer specified in Division 09 Section "High-performance Coatings", **as directed**, where indicated.

H. Prefabricated Building Columns

1. General: Provide prefabricated building columns consisting of load-bearing structural-steel members protected by concrete fireproofing encased in an outer non-load-bearing steel shell. Fabricate connections to comply with details shown or as needed to suit type of structure indicated.
2. Fire-Resistance Ratings: Provide prefabricated building columns listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for ratings indicated, based on testing according to ASTM E 119.
 - a. Fire-Resistance Rating: 4 hours **OR** 3 hours **OR** 2 hours **OR** As indicated, **as directed**.

I. Shelf Angles

1. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch (19-mm) bolts, spaced not more than 6 inches (150 mm) from ends and 24 inches (600 mm) o.c., unless otherwise indicated.
 - a. Provide mitered and welded units at corners.
 - b. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches (50 mm) larger than expansion or control joint.
2. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.
3. Galvanize shelf angles located in exterior walls.
OR
Prime shelf angles located in exterior walls with zinc-rich primer **OR** primer specified in Division 09 Section "High-performance Coatings", **as directed**.
4. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

J. Metal Ladders



1. General:
 - a. Comply with ANSI A14.3 unless otherwise indicated.
 - b. For elevator pit ladders, comply with ASME A17.1.
 2. Steel Ladders:
 - a. Space siderails 16 inches (406 mm) **OR** 18 inches (457 mm), **as directed**, apart unless otherwise indicated.
 - b. Space siderails of elevator pit ladders 12 inches (300 mm) apart.
 - c. Siderails: Continuous, 3/8-by-2-1/2-inch (9.5-by-64-mm) **OR** 1/2-by-2-1/2-inch (12.7-by-64-mm), **as directed**, steel flat bars, with eased edges.
 - d. Rungs: 3/4-inch- (19-mm-) diameter **OR** 3/4-inch- (19-mm-) square **OR** 1-inch- (25-mm-) diameter **OR** 1-inch- (25-mm-) square, **as directed**, steel bars.
 - e. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
 - f. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
 - g. Provide nonslip surfaces on top of each rung by coating with abrasive material metallically bonded to rung.
 - h. Provide platforms as indicated fabricated from welded or pressure-locked steel bar grating, supported by steel angles. Limit openings in gratings to no more than 1/2 inch (12 mm) **OR** 3/4 inch (19 mm), **as directed**, in least dimension.
 - i. Support each ladder at top and bottom and not more than 60 inches (1500 mm) o.c. with welded or bolted steel brackets.
 - j. Galvanize ladders **OR** exterior ladders, **as directed**, including brackets and fasteners.
OR
Prime ladders **OR** exterior ladders, **as directed**, including brackets and fasteners, with zinc-rich primer **OR** primer specified in Division 09 Section "High-performance Coatings", **as directed**.
 3. Aluminum Ladders:
 - a. Space siderails 16 inches (406 mm) **OR** 18 inches (457 mm), **as directed**, apart unless otherwise indicated.
 - b. Siderails: Continuous extruded-aluminum channels or tubes, not less than 2-1/2 inches (64 mm) deep, 3/4 inch (19 mm) wide, and 1/8 inch (3.2 mm) thick.
 - c. Rungs: Extruded-aluminum tubes, not less than 3/4 inch (19 mm) deep and not less than 1/8 inch (3.2 mm) thick, with ribbed tread surfaces.
 - d. Fit rungs in centerline of siderails; fasten by welding or with stainless-steel fasteners or brackets and aluminum rivets.
 - e. Provide platforms as indicated fabricated from pressure-locked aluminum bar grating or extruded-aluminum plank grating, supported by extruded-aluminum framing. Limit openings in gratings to no more than 1/2 inch (12 mm) **OR** 3/4 inch (19 mm), **as directed**, in least dimension.
 - f. Support each ladder at top and bottom and not more than 60 inches (1500 mm) o.c. with welded or bolted aluminum brackets.
 - g. Provide minimum 72-inch- (1830-mm-) high, hinged security door with padlock hasp at foot of ladder to prevent unauthorized ladder use.
- K. Ladder Safety Cages
1. General:
 - a. Fabricate ladder safety cages to comply with ANSI A14.3 **OR** OSHA regulations, **as directed**. Assemble by welding or with stainless-steel fasteners.
 - b. Provide primary hoops at tops and bottoms of cages and spaced not more than 20 feet (6 m) o.c. Provide secondary intermediate hoops spaced not more than 48 inches (1200 mm) o.c. between primary hoops.
 - c. Fasten assembled safety cage to ladder rails and adjacent construction by welding or with stainless-steel fasteners unless otherwise indicated.
 2. Steel Ladder Safety Cages:
 - a. Primary Hoops: 1/4-by-4-inch (6.4-by-100-mm) flat bar hoops.



- b. Secondary Intermediate Hoops: 1/4-by-2-inch (6.4-by-50-mm) flat bar hoops.
 - c. Vertical Bars: 3/16-by-1-1/2-inch (4.8-by-38-mm) flat bars secured to each hoop.
 - d. Galvanize ladder safety cages, including brackets and fasteners.
OR
Prime ladder safety cages, including brackets and fasteners, with zinc-rich primer **OR** primer specified in Division 09 Section "High-performance Coatings", **as directed**.
 - 3. Aluminum Ladder Safety Cages:
 - a. Primary Hoops: 1/4-by-4-inch (6.4-by-100-mm) flat bar hoops.
 - b. Secondary Intermediate Hoops: 1/4-by-2-inch (6.4-by-50-mm) flat bar hoops.
 - c. Vertical Bars: 1/4-by-2-inch (6.4-by-50-mm) flat bars secured to each hoop.
- L. Alternating Tread Devices
- 1. Alternating Tread Devices: Fabricate alternating tread devices to comply with ICC's International Building Code. Fabricate of open-type construction with channel or plate stringers and pipe and tube railings unless otherwise indicated. Provide brackets and fittings for installation.
 - a. Fabricate from steel **OR** stainless steel **OR** aluminum, **as directed**, and assemble by welding or with stainless-steel fasteners.
 - b. Comply with applicable railing requirements in Division 05 Section "Pipe And Tube Railings".
 - 2. Galvanize steel **OR** exterior steel, **as directed**, alternating tread devices, including treads, railings, brackets, and fasteners.
OR
Prime steel **OR** exterior steel, **as directed**, alternating tread devices, including treads, railings, brackets, and fasteners, with zinc-rich primer **OR** primer specified in Division 09 Section "High-performance Coatings", **as directed**.
- M. Metal Ships' Ladders And Pipe Crossovers
- 1. Provide metal ships' ladders and pipe crossovers where indicated. Fabricate of open-type construction with channel or plate stringers and pipe and tube railings unless otherwise indicated. Provide brackets and fittings for installation.
 - a. Fabricate ships' ladders and pipe crossovers, including railings from steel **OR** stainless steel **OR** aluminum, **as directed**.
 - b. Fabricate treads **OR** treads and platforms, **as directed**, from welded or pressure-locked steel bar grating **OR** pressure-locked stainless-steel bar grating **OR** pressure-locked aluminum bar grating **OR** extruded-aluminum plank grating, **as directed**. Limit openings in gratings to no more than 1/2 inch (12 mm) **OR** 3/4 inch (19 mm), **as directed**, in least dimension.
 - c. Fabricate treads **OR** treads and platforms, **as directed**, from rolled-steel floor plate **OR** rolled-stainless-steel floor plate **OR** rolled-aluminum-alloy tread plate **OR** abrasive-surface floor plate, **as directed**.
 - d. Comply with applicable railing requirements in Division 5 Section "Pipe and Tube Railings."
 - 2. Galvanize steel **OR** exterior steel, **as directed**, ships' ladders and pipe crossovers, including treads, railings, brackets, and fasteners.
OR
Prime steel **OR** exterior steel, **as directed**, ships' ladders and pipe crossovers, including treads, railings, brackets, and fasteners, with zinc-rich primer **OR** primer specified in Division 09 Section "High-performance Coatings", **as directed**.
- N. Metal Floor Plate
- 1. Fabricate from rolled-steel floor **OR** rolled-stainless-steel floor **OR** rolled-aluminum-alloy tread **OR** abrasive-surface floor, **as directed**, plate of thickness indicated below:
 - a. Thickness: 1/8 inch (3.2 mm) **OR** 3/16 inch (4.8 mm) **OR** 1/4 inch (6.4 mm) **OR** 5/16 inch (8 mm) **OR** 3/8 inch (9.5 mm) **OR** As indicated, **as directed**.
 - 2. Provide grating sections where indicated fabricated from welded or pressure-locked steel bar grating **OR** pressure-locked stainless steel bar grating **OR** pressure-locked aluminum bar grating



- OR** extruded-aluminum plank grating, **as directed**. Limit openings in gratings to no more than 1/2 inch (12 mm) **OR** 3/4 inch (19 mm) **OR** 1 inch (25 mm), **as directed**, in least dimension.
3. Provide steel **OR** stainless-steel **OR** aluminum, **as directed**, angle supports as indicated.
 4. Include steel **OR** stainless-steel **OR** aluminum, **as directed**, angle stiffeners, and fixed and removable sections as indicated.
 5. Provide flush steel **OR** stainless-steel **OR** aluminum, **as directed**, bar drop handles for lifting removable sections, one at each end of each section.
- O. Structural-Steel Door Frames
1. Fabricate structural-steel door frames from steel shapes, plates, and bars of size and to dimensions indicated, fully welded together, with 5/8-by-1-1/2-inch (16-by-38-mm) steel channel stops, unless otherwise indicated. Plug-weld built-up members and continuously weld exposed joints. Secure removable stops to frame with countersunk machine screws, uniformly spaced at not more than 10 inches (250 mm) o.c. Reinforce frames and drill and tap as necessary to accept finish hardware.
 - a. Provide with integrally welded steel strap anchors for securing door frames into adjoining concrete or masonry.
 2. Extend bottom of frames to floor elevation indicated with steel angle clips welded to frames for anchoring frame to floor with expansion shields and bolts.
 3. Galvanize steel **OR** exterior steel, **as directed**, frames.
OR
Prime steel **OR** exterior steel, **as directed**, frames with zinc-rich primer **OR** primer specified in Division 09 Section "High-performance Coatings", **as directed**.
- P. Miscellaneous Steel Trim
1. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
 2. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
 - a. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.
 3. Galvanize miscellaneous steel **OR** exterior miscellaneous steel, **as directed**, trim.
OR
Prime miscellaneous steel **OR** exterior miscellaneous steel, **as directed**, trim with zinc-rich primer **OR** primer specified in Division 09 Section "High-performance Coatings", **as directed**.
- Q. Metal Bollards
1. Fabricate metal bollards from Schedule 40 steel pipe **OR** Schedule 80 steel pipe **OR** 1/4-inch (6.4-mm) wall-thickness rectangular steel tubing **OR** steel shapes, as indicated, **as directed**.
 - a. Cap bollards with 1/4-inch- (6.4-mm-) thick steel plate (not required if bollards are concrete filled).
 - b. Where bollards are indicated to receive controls for door operators, provide necessary cutouts for controls and holes for wire.
 - c. Where bollards are indicated to receive light fixtures, provide necessary cutouts for fixtures and holes for wire.
 2. Fabricate bollards with 3/8-inch- (9.5-mm-) thick steel baseplates for bolting to concrete slab (for mounting bollards on structural slab or on existing pavement). Drill baseplates at all four corners for 3/4-inch (19-mm) anchor bolts.
 - a. Where bollards are to be anchored to sloping concrete slabs, angle baseplates for plumb alignment of bollards.
 3. Fabricate sleeves for bollard anchorage from steel pipe or tubing with 1/4-inch- (6.4-mm-) thick steel plate welded to bottom of sleeve. Make sleeves not less than 8 inches (200 mm) deep and 3/4 inch (19 mm) larger than OD of bollard.



4. Fabricate internal sleeves for removable bollards from Schedule 40 steel pipe or 1/4-inch (6.4-mm) wall-thickness steel tubing with an OD approximately 1/16 inch (1.5 mm) less than ID of bollards. Match drill sleeve and bollard for 3/4 inch (19 mm) steel machine bolt.
 5. Prime bollards with zinc-rich primer **OR** primer specified in Division 09 Section "High-performance Coatings", **as directed**.
- R. Pipe Or Downspout Guards
1. Fabricate pipe **OR** downspout, **as directed**, guards from 3/8-inch- (9.5-mm-) thick by 12-inch- (300-mm-) wide steel plate, bent to fit flat against the wall or column at both ends and to fit around pipe with 2-inch (50-mm) clearance between pipe and pipe guard. Drill each end for two 3/4-inch (19-mm) anchor bolts.
 2. Galvanize pipe **OR** downspout, **as directed**, guards.
OR
Prime pipe **OR** downspout, **as directed**, guards with zinc-rich primer **OR** primer specified in Division 09 Section "High-performance Coatings", **as directed**.
- S. Abrasive Metal Nosings, Treads And Thresholds
1. Cast-Metal Units: Cast iron **OR** aluminum **OR** bronze (leaded red or semired brass) **OR** nickel silver (leaded nickel bronze), **as directed**, with an integral-abrasive, as-cast finish consisting of aluminum oxide, silicon carbide, or a combination of both. Fabricate units in lengths necessary to accurately fit openings or conditions.
 - a. Nosings: Cross-hatched units, 4 inches (100 mm) wide with 1/4-inch (6-mm) **OR** 1-inch (25-mm), **as directed**, lip, for casting into concrete steps.
OR
Nosings: Cross-hatched units, 1-1/2 by 1-1/2 inches (38 by 38 mm), for casting into concrete curbs.
 - b. Treads: Cross-hatched units, full depth of tread with 3/4-by-3/4-inch (19-by-19-mm) nosing, for application over bent plate treads or existing stairs.
 - c. Thresholds: Fluted-saddle-type units, 5 inches (125 mm) wide by 1/2 inch (12 mm) high, with tapered edges.
OR
Thresholds: Fluted-interlocking- (hook-strip-) type units, 5 inches (125 mm) wide by 5/8 inch (16 mm) high, with tapered edge.
OR
Thresholds: Plain-stepped- (stop-) type units, 5 inches (125 mm) wide by 1/2 inch (12 mm) high, with 1/2-inch (12-mm) step.
 2. Extruded Units: Aluminum **OR** Bronze, **as directed**, with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Fabricate units in lengths necessary to accurately fit openings or conditions.
 - a. Provide ribbed units, with abrasive filler strips projecting 1/16 inch (1.5 mm) above aluminum extrusion.
OR
Provide solid-abrasive-type units without ribs.
 - b. Nosings: Square-back units, 1-7/8 inches (48 mm) **OR** 3 inches (75 mm) **OR** 4 inches (100 mm), **as directed**, wide, for casting into concrete steps.
OR
Nosings: Beveled-back units, 3 inches (75 mm) **OR** 4 inches (100 mm), **as directed**, wide with 1-3/8-inch (35-mm) lip, for surface mounting on existing stairs.
OR
Nosings: Two-piece units, 3 inches (75 mm) wide, with subchannel for casting into concrete steps.
 - c. Treads: Square **OR** Beveled, **as directed**, -back units, full depth of tread with 1-3/8-inch (35-mm) lip, for application over existing stairs.
 3. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.



4. Drill for mechanical anchors and countersink. Locate holes not more than 4 inches (100 mm) from ends and not more than 12 inches (300 mm) o.c., evenly spaced between ends, unless otherwise indicated. Provide closer spacing if recommended by manufacturer.
 - a. Provide two rows of holes for units more than 5 inches (125 mm) wide, with two holes aligned at ends and intermediate holes staggered.
 5. Apply bituminous paint to concealed surfaces of cast-metal units.
 6. Apply clear lacquer to concealed surfaces of extruded units.
- T. Cast-Iron Wheel Guards
1. Provide wheel guards made from cast iron, 3/4 inch (19 mm) thick, hollow-core construction, of size and shape indicated. Provide holes for countersunk anchor bolts and grouting.
 2. Prime cast iron wheel guards with zinc-rich primer **OR** primer specified in Division 09 Section "High-performance Coatings", **as directed**.
- U. Metal Downspout Boots
1. Provide downspout boots made from cast iron **OR** cast aluminum, **as directed**, in heights indicated with inlets of size and shape to suit downspouts. Provide units with flanges and holes for countersunk anchor bolts.
 - a. Outlet: Vertical, to discharge into pipe **OR** Horizontal, to discharge into pipe **OR** At 35 degrees from horizontal, to discharge onto splash block or pavement, **as directed**.
 2. Prime cast iron downspout boots with zinc-rich primer **OR** primer specified in Division 09 Section "High-performance Coatings", **as directed**.
- V. Loose Bearing And Leveling Plates
1. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
 2. Galvanize plates.
OR
Prime plates with zinc-rich primer **OR** primer specified in Division 09 Section "High-performance Coatings", **as directed**.
- W. Loose Steel Lintels
1. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.
 2. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches (200 mm) unless otherwise indicated.
 3. Galvanize loose steel lintels located in exterior walls.
 4. Prime loose steel lintels located in exterior walls with zinc-rich primer **OR** primer specified in Division 09 Section "High-performance Coatings", **as directed**.
- X. Steel Weld Plates And Angles
1. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.
- Y. Finishes, General
1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 2. Finish metal fabrications after assembly.
 3. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.
- Z. Steel And Iron Finishes



1. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
 - a. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
2. Shop prime iron and steel items not indicated to be galvanized, **as directed**, unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
 - a. Shop prime with universal shop primer **OR** primers specified in Division 07, **as directed**, unless zinc-rich primer is **OR** primers specified in Division 09 Section "High-performance Coatings" are, **as directed**, indicated.
3. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning" **OR** SSPC-SP 3, "Power Tool Cleaning" **OR** requirements indicated below, **as directed**:
 - a. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - b. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - c. Items Indicated to Receive Primers Specified in Division 9 Section "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - d. Other Items: SSPC-SP 3, "Power Tool Cleaning."
4. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - a. Stripe paint corners, crevices, bolts, welds, and sharp edges.

AA. Aluminum Finishes

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
2. As-Fabricated Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).
3. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

1.3 EXECUTION

A. Installation, General

1. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
2. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
3. Field Welding: Comply with the following requirements:
 - a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - b. Obtain fusion without undercut or overlap.
 - c. Remove welding flux immediately.
 - d. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
4. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
5. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.



6. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
 - a. Cast Aluminum: Heavy coat of bituminous paint.
 - b. Extruded Aluminum: Two coats of clear lacquer.

- B. Installing Miscellaneous Framing And Supports
 1. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
 2. Anchor supports for operable partitions securely to and rigidly brace from building structure.
 3. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.
 - a. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.
 4. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.
 - a. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

- C. Installing Prefabricated Building Columns
 1. Install prefabricated building columns to comply with AISC's "Specification for Structural Steel Buildings" and with requirements applicable to listing and labeling for fire-resistance rating indicated.

- D. Installing Metal Bollards
 1. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.
 - a. Do not fill removable bollards with concrete.
 2. Anchor bollards to existing construction with expansion anchors **OR** anchor bolts **OR** through bolts, **as directed**. Provide four 3/4-inch (19-mm) bolts at each bollard unless otherwise indicated.
 - a. Embed anchor bolts at least 4 inches (100 mm) in concrete.
 3. Anchor bollards in concrete with pipe sleeves preset and anchored into concrete **OR** in formed or core-drilled holes not less than 8 inches (200 mm) deep and 3/4 inch (19 mm) larger than OD of bollard, **as directed**. Fill annular space around bollard solidly with nonshrink, nonmetallic grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch (3 mm) toward bollard.
 4. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches (75 mm) above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.
 5. Anchor internal sleeves for removable bollards in concrete by inserting into pipe sleeves preset into concrete **OR** formed or core-drilled holes not less than 8 inches (200 mm) deep and 3/4 inch (19 mm) larger than OD of sleeve, **as directed**. Fill annular space around internal sleeves solidly with nonshrink, nonmetallic grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch (3 mm) toward internal sleeve.
 6. Anchor internal sleeves for removable bollards in place with concrete footings. Center and align sleeves in holes 3 inches (75 mm) above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace sleeves in position until concrete has cured.
 7. Place removable bollards over internal sleeves and secure with 3/4-inch (19-mm) machine bolts and nuts. After tightening nuts, drill holes in bolts for inserting padlocks. the Owner will furnish padlocks.
 8. Fill bollards solidly with concrete, mounding top surface to shed water.
 - a. Do not fill removable bollards with concrete.

- E. Installing Pipe Guards



1. Provide pipe guards at exposed vertical pipes in parking garage where not protected by curbs or other barriers. Install by bolting to wall or column with expansion anchors. Provide four 3/4-inch (19-mm) bolts at each pipe guard. Mount pipe guards with top edge 26 inches (660 mm) above driving surface.
- F. Installing Nosings, Treads, And Thresholds
1. Center nosings on tread widths unless otherwise indicated.
 2. For nosings embedded in concrete steps or curbs, align nosings flush with riser faces and level with tread surfaces.
 3. Seal thresholds exposed to exterior with elastomeric sealant complying with Division 07 Section "Joint Sealants" to provide a watertight installation.
- G. Installing Cast-Iron Wheel Guards
1. Anchor wheel guards to concrete or masonry construction to comply with manufacturer's written instructions. Fill cores solidly with concrete.
- H. Installing Bearing And Leveling Plates
1. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
 2. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
 - a. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations unless otherwise indicated.
 - b. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.
- I. Adjusting And Cleaning
1. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - a. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

OR

Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 07.
 2. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05 50 00 00



SECTION 05 51 13 00 - METAL STAIRS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for metal stairs. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Preassembled steel stairs with concrete-filled, precast concrete, epoxy-resin-filled, and abrasive-coating-finished formed-metal treads.
 - b. Industrial-type stairs with steel floor plate and grating treads.
 - c. Ornamental steel-framed stairs.
 - d. Railings and Steel tube railings attached to metal stairs.
 - e. Handrails and Steel tube handrails attached to walls adjacent to metal stairs.
 - f. Railing gates at the level of exit discharge.

C. Performance Requirements

1. Delegated Design: Design metal stairs, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.
 - a. The following are based on the 2006 International Building Code (IBC):
 - 1) Uniform Load: 100 lbf/sq. ft. (4.79 kN/sq. m).
 - 2) Concentrated Load: 300 lbf (1.33 kN) applied on an area of 4 sq. in. (2580 sq. mm).
 - 3) Uniform and concentrated loads need not be assumed to act concurrently.
 - b. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above, **as applicable**.
 - c. Limit deflection of treads, platforms, and framing members to L/240 **OR** L/360, **as directed**, or 1/4 inch (6.4 mm), whichever is less. Preassembled steel stair manufacturers usually design stairs to L/240; retaining L/360 will decrease bounce and may be required to prevent cracking of plaster or gypsum board soffits. If brittle materials such as marble, granite, or ceramic tiles are used on treads and platforms, deflection limit should be reduced to L/720.
3. Structural Performance of Railings: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated. The following loads are based on the 2006 IBC.
 - a. Handrails and Top Rails of Guards:
 - 1) Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
 - 2) Concentrated load of 200 lbf (0.89 kN) applied in any direction.
 - 3) Uniform and concentrated loads need not be assumed to act concurrently.
 - b. Infill of Guards:
 - 1) Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
 - 2) Infill load and other loads need not be assumed to act concurrently.
4. Seismic Performance: Metal stairs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - a. Component Importance Factor is 1.5.

D. Submittals

1. Product Data: For metal stairs and the following:



- a. Prefilled metal-pan stair treads.
 - b. Precast concrete treads.
 - c. Epoxy-resin-filled stair treads.
 - d. Nonslip aggregates and nonslip-aggregate finishes.
 - e. Abrasive nosings.
 - f. Metal floor plate treads.
 - g. Paint products.
 - h. Grout.
2. LEED Submittals:
 - a. Product Data for Credit MR 4.1 and Credit MR 4.2, **as directed**: Indicating percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.
3. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 4. Samples: For the following products, in manufacturer's standard sizes:
 - a. Precast concrete treads.
 - b. Epoxy-resin-filled stair treads.
 - c. Stair treads with nonslip-aggregate surface finish.
 - d. Metal floor plate treads.
 - e. Grating treads.
 - f. Abrasive nosings.
 5. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 6. Qualification Data: For qualified professional engineer **OR** testing agency, **as directed**.
 7. Welding certificates.
 8. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.
 9. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for stairs and railings.
 - a. Test railings according ASTM E 894 and ASTM E 935.
- E. Quality Assurance
1. Installer Qualifications: Fabricator of products.
 2. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.
 - a. Preassembled Stairs:
 - 1) Commercial class - typical enclosed stair (welds are required to be smooth).
 - 2) Service class - economy enclosed stair.
 - b. Industrial-Type Stairs: Industrial class - typical for exposed locations in industrial facilities or for exterior stairs.
 - c. Ornamental Stairs: Architectural class - ornamental stairs in exposed locations (joints are required to be concealed to maximum extent possible).
 3. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 4. Welding Qualifications: Qualify procedures and personnel according to the following:
 - a. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - b. AWS D1.3, "Structural Welding Code - Sheet Steel."
- F. Coordination
1. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
 2. Coordinate installation of anchorages for metal stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items



with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

3. Coordinate locations of hanger rods and struts with other work so that they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.

1.2 PRODUCTS

A. Metals, General

1. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Ferrous Metals

1. Recycled Content of Steel Products: Provide products with average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
2. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
3. Steel Tubing: ASTM A 500 (cold formed) **OR** ASTM A 513, **as directed**.
4. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
5. Abrasive-Surface Floor Plate: Steel plate with abrasive granules rolled into surface or with abrasive material metallurgically bonded to steel.
6. Steel Bars for Grating Treads: ASTM A 36/A 36M or steel strip, ASTM A 1011/A 1011M or ASTM A 1018/A 1018M.
7. Wire Rod for Grating Crossbars: ASTM A 510 (ASTM A 510M).
8. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.
9. Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, either commercial steel, Type B, or structural steel, Grade 25 (Grade 170), unless another grade is required by design loads; exposed.
10. Uncoated, Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, either commercial steel, Type B, or structural steel, Grade 30 (Grade 205), unless another grade is required by design loads.
11. Galvanized-Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating, either commercial steel, Type B, or structural steel, Grade 33 (Grade 230), unless another grade is required by design loads.
12. Expanded-Metal, Carbon Steel: ASTM F 1267, Type I (expanded) **OR** Type II (expanded and flattened), **as directed**, Class 1 (uncoated).
 - a. Style Designation: 3/4 number 13 **OR** 1-1/2 number 10, **as directed**.
13. Perforated Metal: Cold-rolled steel sheet, ASTM A 1008/A 1008M, or hot-rolled steel sheet, ASTM A 1011/A 1011M, commercial steel Type B, 0.060 inch (1.52 mm) thick, with 1/4-inch (6.4-mm) holes 3/8 inch (9.5 mm) o.c. in staggered rows **OR** with 1/8-by-1-inch (3.2-by-25.4-mm) round end slotted holes in staggered rows, **as directed**.
14. Perforated Metal: Galvanized-steel sheet, ASTM A 653/A 653M, G90 (Z275) coating, commercial steel Type B, 0.064 inch (1.63 mm) thick, with 1/4-inch (6.4-mm) holes 3/8 inch (9.5 mm) o.c. in staggered rows.
15. Woven-Wire Mesh: Intermediate-crimp, diamond **OR** square, **as directed**, pattern, 2-inch (50-mm) woven-wire mesh, made from 0.135-inch (3.5-mm) nominal diameter wire complying with ASTM A 510 (ASTM A 510M).

C. Nonferrous Metals

1. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T6.
2. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.
3. Bronze Extrusions: ASTM B 455, Alloy UNS No. C38500 (extruded architectural bronze).
4. Bronze Castings: ASTM B 584, Alloy UNS No. C83600 (leaded red brass) or No. C84400 (leaded semired brass).



5. Nickel Silver Castings: ASTM B 584, Alloy UNS No. C97600 (20 percent leaded nickel bronze).

D. Abrasive Nosings

1. Cast-Metal Units: Cast iron **OR** aluminum **OR** bronze **OR** nickel silver, **as directed**, with an integral abrasive, as-cast finish consisting of aluminum oxide, silicon carbide, or a combination of both. Fabricate units in lengths necessary to accurately fit openings or conditions.
 - a. Configuration: Cross-hatched units, 3 inches (75 mm) **OR** 4 inches (100 mm), **as directed**, wide without lip.

OR

 Configuration: Cross-hatched angle-shaped units, same depth as bar-grating treads and 1 to 1-1/2 inches (25 to 38 mm) wide.
2. Extruded Units: Aluminum **OR** Bronze, **as directed**, units with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Fabricate units in lengths necessary to accurately fit openings or conditions.
 - a. Provide ribbed units, with abrasive filler strips projecting 1/16 inch (1.5 mm) above aluminum extrusion.

OR

 Provide solid-abrasive-type units without ribs.
 - b. Nosings: Square-back units, 1-7/8 inches (48 mm) **OR** 3 inches (75 mm) **OR** 4 inches (100 mm), **as directed**, wide, without lip.

OR

 Nosings: Two-piece units, 3 inches (75 mm) wide, with subchannel for casting into concrete.
3. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.
4. Apply bituminous paint to concealed surfaces of cast-metal units set into concrete.
5. Apply clear lacquer to concealed surfaces of extruded units set into concrete.

E. Fasteners

1. General: Provide zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.
2. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
3. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
 - a. Provide mechanically deposited or hot-dip, zinc-coated anchor bolts for exterior stairs **OR** stairs indicated to be galvanized **OR** stairs indicated to be shop primed with zinc-rich primer, **as directed**.
4. Machine Screws: ASME B18.6.3 (ASME B18.6.7M).
5. Lag Screws: ASME B18.2.1 (ASME B18.2.3.8M).
6. Plain Washers: Round, ASME B18.22.1 (ASME B18.22M).
7. Lock Washers: Helical, spring type, ASME B18.21.1 (ASME B18.21.2M).
8. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
 - a. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
 - b. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 (A1) **OR** Group 2 (A4), **as directed**, stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

F. Miscellaneous Materials



1. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
2. Shop Primers: Provide primers that comply with Division 07 OR Division 09 Section(s) "High-performance Coatings" **OR** Division 07 AND Division 09 Section(s) "High-performance Coatings", **as directed**.
3. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - a. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
4. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
5. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
6. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
7. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
8. Concrete Materials and Properties: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa) unless otherwise indicated.
9. Nonslip-Aggregate Concrete Finish: Factory-packaged abrasive aggregate made from fused, aluminum-oxide grits or crushed emery; rustproof and nonglazing; unaffected by freezing, moisture, or cleaning materials.
10. Welded Wire Fabric: ASTM A 185/A 185M, 6 by 6 inches (152 by 152 mm), W1.4 by W1.4, unless otherwise indicated.

G. Precast Concrete Treads

1. Concrete Materials and Properties: Comply with requirements in Division 03 Section "Cast-in-place Concrete" for normal-weight, ready-mixed concrete with a minimum 28-day compressive strength of 5000 psi (35 MPa) and a total air content of not less than 4 percent or more than 6 percent.
2. Reinforcing Wire Fabric: Galvanized, welded wire fabric, 2 by 2 inches (50 by 50 mm) by 0.062-inch- (1.6-mm-) diameter wire; comply with ASTM A 185/A 185M and ASTM A 82/A 82M, except for minimum wire size.

H. Fabrication, General

1. Provide complete stair assemblies, including metal framing, hangers, struts, railings, **as directed**, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
 - a. Join components by welding unless otherwise indicated.
 - b. Use connections that maintain structural value of joined pieces.
 - c. Fabricate treads and platforms of exterior stairs so finished walking surfaces slope to drain.
2. Preassembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
3. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
4. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
5. Form exposed work with accurate angles and surfaces and straight edges.
6. Weld connections to comply with the following:
 - a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - b. Obtain fusion without undercut or overlap.
 - c. Remove welding flux immediately.
 - d. Weld exposed corners and seams continuously unless otherwise indicated.



- e. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 welds: no evidence of a welded joint **OR** Type 2 welds: completely sanded joint, some undercutting and pinholes okay **OR** Type 3 welds: partially dressed weld with spatter removed **OR** Type 4 welds: good quality, uniform undressed weld with minimal splatter, **as directed**.
7. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.
8. Fabricate joints that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- I. Steel-Framed Stairs
1. Stair Framing:
- a. Fabricate stringers of steel plates **OR** channels **OR** tubes, **as directed**.
 1) Provide closures for exposed ends of channel **OR** tube, **as directed**, stringers.
- b. Construct platforms of steel plate **OR** channel **OR** tube, **as directed**, headers and miscellaneous framing members as needed to comply with performance requirements **OR** indicated, **as directed**.
- c. Weld or bolt, **as directed**, stringers to headers; weld or bolt, **as directed**, framing members to stringers and headers. If using bolts, fabricate and join so bolts are not exposed on finished surfaces.
- d. Where stairs are enclosed by gypsum board **OR** gypsum board shaft-wall, **as directed**, assemblies, provide hanger rods or struts to support landings from floor construction above or below. Locate hanger rods and struts where they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.
- e. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.
2. Metal-Pan Stairs: Form risers, subreads pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements but not less than 0.067 inch (1.7 mm) **OR** indicated, **as directed**.
- a. Steel Sheet: Uncoated cold **OR** hot, **as directed**,-rolled steel sheet unless otherwise indicated.
OR
 Steel Sheet: Galvanized-steel sheet, where indicated.
- b. Directly weld metal pans to stringers; locate welds on top of subreads where they will be concealed by concrete fill. Do not weld risers to stringers.
OR
 Attach risers and subreads to stringers with brackets made of steel angles or bars. Weld brackets to stringers and attach metal pans to brackets by welding, riveting, or bolting.
- c. Shape metal pans to include nosing integral with riser.
- d. Attach abrasive nosings to risers.
- e. At Contractor's option, provide stair assemblies with metal-pan subreads filled with reinforced concrete during fabrication.
- f. Provide epoxy-resin-filled treads, reinforced with glass fibers, with slip-resistant, abrasive surface.
- g. Provide subplatforms of configuration indicated or, if not indicated, the same as subreads. Weld subplatforms to platform framing.
 1) Smooth Soffit Construction: Construct subplatforms with flat metal under surfaces to produce smooth soffits.
3. Abrasive-Coating-Finished, Formed-Metal Stairs: Form risers, treads, and platforms to configurations shown from steel sheet of thickness needed to comply with performance requirements but not less than 0.097 inch (2.5 mm) **OR** indicated, **as directed**.
- a. Steel Sheet: Uncoated hot-rolled steel sheet unless otherwise indicated.
- b. Directly weld risers and treads to stringers; locate welds on underside of stairs.



- c. Provide platforms of configuration indicated or, if not indicated, the same as treads. Weld platforms to platform framing.
 - d. Finish tread and platform surfaces with manufacturer's standard epoxy-bonded abrasive finish.
 4. Metal Floor Plate Stairs: Form treads and platforms to configurations shown from rolled-steel **OR** abrasive-surface, **as directed**, floor plate of thickness needed to comply with performance requirements, but not less than 1/4 inch (6.4 mm) **OR** needed to comply with performance requirements, but not less than 3/16 inch (4.8 mm) **OR** needed to comply with performance requirements, but not less than 1/8 inch (3.2 mm) **OR** indicated, **as directed**.
 - a. Form treads with integral nosing and back edge stiffener. Form risers of same material as treads.
OR
Form treads with integral nosing and back edge stiffener. Form risers from steel sheet not less than 0.097 inch (2.5 mm) thick, welded to tread nosings and stiffeners and to platforms.
OR
Form treads with integral nosing and back edge stiffener, and with open risers.
 - b. Weld steel supporting brackets to stringers and weld treads to brackets.
 - c. Fabricate platforms with integral nosings matching treads and weld to platform framing.
 5. Metal Bar-Grating Stairs: Form treads and platforms to configurations shown from metal bar grating; fabricate to comply with NAAMM MBG 531, "Metal Bar Grating Manual."
 - a. Fabricate treads and platforms from welded or pressure-locked steel grating with 1-1/4-by-3/16-inch (32-by-5-mm) bearing bars at 15/16 inch (24 mm) o.c. **OR** 1-by-3/16-inch (25-by-5-mm) bearing bars at 11/16 inch (17 mm) o.c. **OR** 1-by-1/8-inch (25-by-3-mm) bearing bars at 7/16 inch (11 mm) o.c., **as directed**, and crossbars at 4 inches (100 mm) o.c.
OR
Fabricate treads and platforms from welded or pressure-locked steel grating with openings in gratings no more than 5/16 inch (8 mm) **OR** 1/2 inch (12 mm) **OR** 3/4 inch (19 mm), **as directed**, in least dimension.
 - b. Surface: Plain **OR** Serrated, **as directed**.
 - c. Finish: Shop primed **OR** Painted **OR** Galvanized, **as directed**.
 - d. Fabricate grating treads with rolled-steel floor plate **OR** cast abrasive, **as directed**, nosing and with steel angle or steel plate carrier at each end for stringer connections. Secure treads to stringers with bolts.
 - e. Fabricate grating platforms with nosing matching that on grating treads. Provide toeplates at open-sided edges of grating platforms. Weld grating to platform framing.
- J. Stair Railings
 1. Comply with applicable requirements in Division 05 Section(s) "Pipe And Tube Railings" OR "Decorative Metal Railings", **as directed**.
 - a. Fabricate newels of square steel tubing and provide newel caps of pressed steel **OR** gray-iron castings, **as directed**, as shown.
 - b. Rails may be bent at corners, rail returns, and wall returns, instead of using prefabricated fittings.
 - c. Connect posts to stair framing by direct welding unless otherwise indicated.
 2. Steel Tube Railings: Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand indicated loads.
 - a. Rails and Posts: 1-5/8-inch- (41-mm-) diameter **OR** 1-1/2-inch- (38-mm-) square, **as directed**, top and bottom rails and 1-1/2-inch- (38-mm-) square posts.
 - b. Picket Infill: 1/2-inch- (13-mm-) square pickets spaced less than 4 inches (100 mm) clear.
 - c. Expanded-Metal Infill: Expanded-metal panels edged with U-shaped channels made from steel sheet not less than 0.043 inch (1.1 mm) thick. Orient expanded metal with long dimension of diamonds parallel to top rail **OR** perpendicular to top rail **OR** vertical, **as directed**.



- d. Perforated-Metal Infill: Perforated-metal panels edged with U-shaped channels made from metal sheet, of same metal as perforated metal and not less than 0.043 inch (1.1 mm) thick. Orient perforated metal with pattern parallel to top rail **OR** perpendicular to top rail **OR** horizontal **OR** vertical **OR** as indicated on Drawings, **as directed**.
 - e. Mesh Infill: Woven wire mesh crimped into 1-by-1/2-by-1/8-inch (25-by-13-by-3-mm) steel channel frames. Orient wire mesh with diamonds vertical **OR** wires perpendicular and parallel to top rail **OR** wires horizontal and vertical, **as directed**.
 - f. Intermediate Rails Infill: 1-5/8-inch- (41-mm-) diameter **OR** 1-1/2-inch- (38-mm-) square, **as directed**, intermediate rails spaced less than 12 inches (305 mm) **OR** 21 inches (533 mm), **as directed**, clear.
 - g. Gates: Form gates from steel tube of same size and shape as top rails, with infill to match guards. Provide with cam-type, self-closing **OR** spring, **as directed**, hinges for fastening to wall and overlapping stop with rubber bumper to prevent gate from opening in direction opposite egress.
3. Welded Connections: Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - a. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 welds: no evidence of a welded joint **OR** Type 2 welds: completely sanded joint, some undercutting and pinholes okay **OR** Type 3 welds: partially dressed weld with spatter removed **OR** Type 4 welds: good quality, uniform undressed weld with minimal splatter, **as directed**.
 4. Form changes in direction of railings as follows:
 - a. As detailed.
OR
By bending or by inserting prefabricated elbow fittings.
OR
By flush bends or by inserting prefabricated flush-elbow fittings.
OR
By radius bends of radius indicated or by inserting prefabricated elbow fittings of radius indicated.
OR
By inserting prefabricated elbow fittings **OR** flush-elbow fittings **OR** elbow fittings of radius indicated, **as directed**.
 5. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
 6. Close exposed ends of railing members with prefabricated end fittings.
 7. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch (6 mm) or less.
 8. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.
 - a. Connect posts to stair framing by direct welding unless otherwise indicated.
 - b. For galvanized railings, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous-metal components.
 - c. For nongalvanized railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.
 9. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

K. Finishes



1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Finish metal stairs after assembly.
3. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
 - a. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
 - b. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
4. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning" **OR** SSPC-SP 3, "Power Tool Cleaning" **OR** minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed products, **as directed**:
 - a. Exterior Stairs: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - b. Interior Stairs: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning" for stairs that are to receive zinc-rich primer or primer specified in Division 09 Section "High-performance Coatings".
OR
Interior Stairs: SSPC-SP 3, "Power Tool Cleaning."
5. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - a. Stripe paint corners, crevices, bolts, welds, and sharp edges.

1.3 EXECUTION

A. Installation, General

1. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
2. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
3. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.
4. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
5. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
6. Field Welding: Comply with requirements for welding in "Fabrication, General" Article.
7. Place and finish concrete fill for treads and platforms to comply with Division 03 Section "Cast-in-place Concrete"
 - a. Install abrasive nosings with anchors fully embedded in concrete. Center nosings on tread width.
8. Install precast concrete treads with adhesive supplied by manufacturer.

B. Installing Metal Stairs With Grouted Baseplates

1. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of baseplates.
2. Set steel stair baseplates on wedges, shims, or leveling nuts. After stairs have been positioned and aligned, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.



- a. Use nonmetallic, nonshrink grout unless otherwise indicated.
- b. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

C. Installing Railings

1. Adjust railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loads. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:
 - a. Anchor posts to steel by welding directly to steel supporting members.
 - b. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with postinstalled anchors and bolts.
2. Attach handrails to wall with wall brackets. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt **OR** with predrilled hole for exposed bolt anchorage, **as directed**. Provide bracket with 1-1/2-inch (38-mm) clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets to building construction as required to comply with performance requirements **OR** as follows, **as directed**:
 - a. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 - b. For hollow masonry anchorage, use toggle bolts.
 - c. For wood stud partitions, use hanger or lag bolts set into studs or wood backing between studs. Coordinate with carpentry work to locate backing members.
 - d. For steel-framed partitions, use hanger or lag bolts set into fire-retardant-treated, **as directed**, wood backing between studs. Coordinate with stud installation to locate backing members.

OR

For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.

OR

For steel-framed partitions, use toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

D. Adjusting And Cleaning

1. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - a. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

OR

Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 07 OR Division 09 Section(s) "High-performance Coatings" **OR** Division 07 AND Division 09 Section(s) "High-performance Coatings", **as directed**.
2. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05 51 13 00



SECTION 05 51 13 00a - FABRICATED SPIRAL STAIRS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for fabricated spiral stairs. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes fabricated spiral stairs with steel central-supporting columns and radiating treads.

C. Performance Requirements

1. Delegated Design: Design fabricated spiral stairs, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2. Structural Performance of Stairs: Fabricated spiral stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to SEI/ASCE 7:
 - a. Uniform Load: 40 lbf/sq. ft. (1.92 kN/sq. m) **OR** 100 lbf/sq. ft. (4.79 kN/sq. m), **as directed**.
 - b. Concentrated Load: 300 lbf (1.33 kN) applied on an area of 4 sq. in. (2580 sq. mm).
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - d. Railing Loads: Stairs shall withstand stresses resulting from railing loads in addition to loads specified above.
3. Structural Performance of Railings: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to SEI/ASCE 7:
 - a. Handrails:
 - 1) Uniform load of 20 lbf/ft. (0.29 kN/m) **OR** 50 lbf/ft. (0.73 kN/m), **as directed**, applied in any direction.
 - 2) Concentrated load of 200 lbf (0.89 kN) applied in any direction.
 - 3) Uniform and concentrated loads need not be assumed to act concurrently.
 - b. Top Rails of Guards:
 - 1) Uniform load of 20 lbf/ft. (0.29 kN/m) applied in any direction **OR** 50 lbf/ft. (0.73 kN/m) applied in any direction **OR** 50 lbf/ft. (0.73 kN/m) applied horizontally and concurrently, with 100 lbf/ft. (1.46 kN/m) applied vertically downward, **as directed**.
 - 2) Concentrated load of 200 lbf (0.89 kN) applied in any direction.
 - 3) Uniform and concentrated loads need not be assumed to act concurrently.
 - c. Infill of Guards:
 - 1) Concentrated load of 50 lbf (0.22 kN) **OR** 200 lbf (0.89 kN), **as directed**, applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
 - 2) Uniform load of 25 lbf/sq. ft. (1.2 kN/sq. m) applied horizontally.
 - 3) Infill load and other loads need not be assumed to act concurrently.
4. Seismic Performance: Fabricated spiral stairs shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
 - a. Component Importance Factor is 1.5 **OR** 1.0, **as directed**.
5. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

D. Submittals

1. Product Data: For each type of product indicated.



2. LEED Submittal:
 - a. Product Data for Credit MR 4.1 and Credit MR 4.2, **as directed:** For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - 1) Include statement indicating costs for each product having recycled content.
3. Shop Drawings.
4. Samples: For the following products, in manufacturer's standard sizes:
 - a. Treads.
 - b. Metal with painted finish.
 - c. Railing members.
5. Delegated-Design Submittal: For fabricated spiral stairs indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
6. Welding certificates.

E. Quality Assurance

1. Welding Qualifications: Qualify procedures and personnel according to the following:
 - a. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - b. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 - c. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.2 PRODUCTS

A. Materials

1. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
2. Brackets, Flanges, and Anchors: Same metal and finish as supported item unless otherwise indicated.
3. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
4. Steel Bars for Grating Treads and Platforms: ASTM A 36/A 36M or ASTM A 1011/A 1011M.
5. Wire Rod for Grating Crossbars: ASTM A 510 (ASTM A 510M).
6. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or Grade D.
7. Steel Pipe Columns: ASTM A 53/A 53M, Schedule 40. Provide Schedule 80 for columns larger than NPS 4 (DN 100) and where required to support loads.
8. Steel Pipe Railings: ASTM A 53/A 53M, Schedule 40.
9. Steel Tubing: Either cold-formed steel tubing complying with ASTM A 500 or mandrel-drawn mechanical tubing complying with ASTM A 513, Type 5.
10. Iron Castings: Either gray iron complying with ASTM A 48/A 48M or malleable iron complying with ASTM A 47/A 47M unless otherwise indicated or required by structural loads.
11. Aluminum Sheet and Plate: ASTM B 209 (ASTM B 209M), Alloy 6061-T6.
12. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.
13. Aluminum Pipe and Structural Round Tubing: ASTM B 429, Alloy 6063-T6.
14. Extruded-Aluminum Tubing: ASTM B 221 (ASTM B 221M), Alloy 6063-T5/T52.
15. Aluminum Castings: ASTM B 26/B 26M, Alloy 319.0-F.
16. Extruded-Bronze Handrails: ASTM B 455, Alloy UNS No. C38500 (architectural bronze).
17. Seamless Bronze Tubing: ASTM B 135 (ASTM B 135M), Alloy UNS No. C23000 (red brass, 85 percent copper).
18. Seamless Brass Tubing: ASTM B 135 (ASTM B 135M), Alloy UNS No. C26000 (cartridge brass, 70 percent copper).
19. Stainless-Steel Tubing: ASTM A 554, Grade MT 304.

B. Miscellaneous Materials



1. Fasteners: For connecting stair components and for anchoring stairs to other construction, select fasteners of the type, grade, and class required to produce connections capable of withstanding design loadings.
 - a. For aluminum, provide fasteners fabricated from Type 304 stainless steel.
 - b. For steel and cast iron, use plated steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.
2. Lacquer for Copper Alloys: Clear, air-drying, acrylic lacquer specially developed for coating copper-alloy products.
3. Shop Primers: Provide primers that comply with Division 09 Section(s) "Exterior Painting" OR "Interior Painting" **as directed**.
4. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with finish paint systems indicated.
5. Shop Primer for Galvanized Steel: Primer formulated for use over zinc-coated metal and compatible with finish paint systems indicated.
6. Shop Primer for Aluminum: Primer formulated for use over aluminum and compatible with finish paint systems indicated.
7. Wood for Stair Treads, Handrails, and Platforms: Unless directed otherwise, laminated red oak, sanded to 120-grit smoothness. Apply uniform coat of manufacturer's standard clear sealer.
8. Rubber Wearing Surfaces: Manufacturer's standard, 1/4-inch- (6-mm-) thick, molded-rubber covering in pattern and color indicated or, if not indicated, as selected by the Owner from manufacturer's standard colors and patterns.

C. Fabrication

1. Assemble spiral stairs in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
2. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
3. Form work true to line and level with accurate angles and surfaces.
4. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
5. Cut, reinforce, drill, and tap as needed to receive hardware, screws, and similar items.
6. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - b. Obtain fusion without undercut or overlap.
 - c. Remove flux immediately.
 - d. Provide Type 1 **OR** Type 2 **OR** Type 3, **as directed**, welds according to NOMMA Guideline 1, "Joint Finishes."
 - e. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and, except for fillet welds, welded surface matches contours of adjoining surfaces.
7. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.
8. Fabricate center column from steel **OR** aluminum, **as directed**, pipe welded to baseplate for anchorage to floor structure. Brace column at upper floors by means of landings attached to column and floor structure unless otherwise indicated. Provide cap for column if top is exposed.
9. Provide cast-aluminum **OR** cast-iron, **as directed**, treads and platforms, **as directed**, with integral frames, legs, and hubs.
 - a. Provide treads and platforms, **as directed**, with abrasive surfaces.
10. Provide steel-bar grating treads and platforms, **as directed**, with welded hubs and as follows:
 - a. Radial grating treads.



- OR**
Abrasive **OR** Rolled-steel, floor-plate, **as directed**, nosings.
- OR**
Straight flanges and welded-on legs.
- OR**
Tapered flanges without legs.
11. Provide formed steel **OR** aluminum, **as directed**, -plate treads and platforms, **as directed**, welded to hubs or center column and as follows:
- a. Straight flanges and welded-on legs.
- OR**
Tapered flanges without legs.
- OR**
Pan treads without legs.
- OR**
One-piece treads and risers, without legs.
- OR**
Rolled-steel, floor-plate wearing surfaces.
- OR**
Aluminum-alloy, rolled tread-plate wearing surfaces.
- OR**
Smooth steel-plate wearing surfaces.
- OR**
Rubber wearing surfaces.
- OR**
Plywood subread for covering with finish flooring specified in another Section.
12. Provide steel-framed treads and platforms, **as directed**, welded to hubs or center column and without legs; wearing surface as follows:
- a. Cast iron with integral abrasive.
- OR**
Smooth steel plate with integral abrasive.
- OR**
Wood.
- OR**
Plywood insert for covering with finish flooring specified in another Section.
13. Railings: Provide railing system indicated, uniformly bent to spiral shape, and continuing at top to form guardrail around floor opening.
- a. Space balusters less than 4 inches (102 mm), clear.
- OR**
Space balusters to provide one baluster per tread, but spaced less than 21 inches (533 mm), clear.
- b. Space intermediate rails less than 4 inches (101 mm) **OR** 21 inches (533 mm), **as directed**, clear.
- c. Locate bottom rail so that a 6-inch- (152-mm-) diameter sphere cannot pass between the stair and rail.
- d. Fabricate top rail from 1-1/4- to 2-inch- (32- to 51-mm-) OD steel pipe or round tubing.
- OR**
Fabricate top rail from steel of shape and size indicated.
- OR**
Fabricate top rail from 1-1/4- to 2-inch- (32- to 51-mm-) OD round aluminum **OR** bronze **OR** brass **OR** stainless-steel, **as directed**, tubing.
- OR**
Fabricate top rail from extruded bronze of shape and size indicated.
- OR**
Fabricate top rail from wood of shape and size indicated.



- e. Fabricate balusters from 7/8-inch- (22-mm-) OD **OR** 1-inch- (25-mm-) OD **OR** 1-1/4-inch- (32-mm-) OD steel pipe or round tubing.
OR
Fabricate balusters from 1/2-inch- (13-mm-) OD **OR** 5/8-inch- (16-mm-) OD round steel bars **OR** tubing, **as directed**.
OR
Fabricate balusters from 1/2-inch- (13-mm-) **OR** 5/8-inch- (16-mm-) **OR** 3/4-inch- (19-mm-), **as directed**, square steel bars **OR** tubing, **as directed**.
OR
Fabricate balusters from 5/8-inch- (16-mm-) OD **OR** 3/4-inch- (19-mm-) OD, **as directed**, round aluminum tubing.
- f. Fabricate intermediate rails from 7/8-inch- (22-mm-) OD **OR** 1-inch- (25-mm-) OD **OR** 1-1/4-inch- (32-mm-) OD, **as directed**, steel pipe or round tubing.
OR
Fabricate intermediate rails from steel pipe or round tubing same size as top rail.
OR
Fabricate intermediate rails from 5/8-inch- (16-mm-) OD **OR** 3/4-inch- (19-mm-) OD, **as directed**, round steel bars **OR** tubing, **as directed**.
OR
Fabricate intermediate rails from 5/8-inch- (16-mm-) OD **OR** 3/4-inch- (19-mm-) OD **OR** 1-inch- (25-mm-) OD **OR** 1-1/4-inch- (32-mm-) OD, **as directed**, round aluminum tubing.
OR
Fabricate intermediate rails from round aluminum tubing same size as top rail.

D. Steel And Iron Finishes

1. Galvanized Finish: Hot-dip galvanize stairs after fabrication to comply with ASTM A 123/A 123M.
2. Preparation for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.
3. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC's surface-preparation specifications and environmental exposure conditions of installed stairs:
 - a. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - b. Interiors (SSPC Zone 1A): SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
4. Apply shop primer to prepared surfaces of handrails and railing components unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

E. Aluminum Finishes

1. Conversion-Coated and Factory-Primed Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid chromate-fluoride-phosphate conversion coating; Organic Coating: shop primer).
 - a. Apply shop primer with a minimum dry film thickness of 1.5 mils (0.04 mm).
2. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - a. Color and Gloss: As selected by the Owner from manufacturer's full range.

F. Stainless-Steel Finishes

1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. Polished Finishes: Grind and polish surfaces to produce uniform finish indicated, free of cross scratches.
 - a. Run grain of directional finishes with long dimension of each piece.
 - b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - c. Directional Satin Finish: No. 4.
 - d. Reflective, Directional Polish: No. 7.



e. Mirrorlike Reflective, Nondirectional Polish: No. 8.

G. Copper-Alloy Finishes

1. Finish designations for copper alloys comply with the system established for designating copper-alloy finish systems defined in NAAMM's "Metal Finishes Manual for Architectural and Metal Products."
2. Buffed Finish: M21 (Mechanical Finish: buffed, smooth specular).
3. Buffed Finish, Lacquered: M21-O6x (Mechanical Finish: buffed, smooth specular; Coating: clear organic, air drying, as specified below).
4. Medium-Satin Finish, Lacquered: M32-O6x (Mechanical Finish: directionally textured, medium satin; Coating: clear organic, air drying, as specified below).
 - a. Clear Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).
5. Statuary Conversion Coating over Satin Finish: M31-C55 (Mechanical Finish: directionally textured, fine satin; Chemical Finish: conversion coating, sulfide).
 - a. Color: Match the Owner's sample.

1.3 EXECUTION

A. Installation

1. Fastening to In-Place Construction: Provide anchorage devices and fasteners where needed for securing fabricated spiral stairs to in-place construction; include threaded fasteners for concrete and masonry inserts, through bolts, lag bolts, wood screws, and other connectors as required.
2. Assemble fabricated spiral stair components to comply with manufacturer's written instructions, with each component aligned and in correct relation to each other, securely anchored to the supporting column and adjacent structure.
3. Do not cut, alter, or drill stair components in the field that do not fit properly. Return components that do not fit to manufacturer for adjustment.
4. Install fabricated spiral stairs accurately in location, alignment, and elevation; level and plumb; and according to manufacturer's written instructions.
5. Install fabricated spiral stairs by welding to steel structure or to weld plates cast into concrete unless otherwise indicated.
6. Field Welding:
 - a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - b. Obtain fusion without undercut or overlap.
 - c. Remove welding flux immediately.
 - d. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

B. Cleaning And Protection

1. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint and paint exposed areas with same material.
2. For galvanized surfaces, clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780.
 - a. Paint repaired areas with same material used for shop painting.
3. Protect finished tread surfaces during construction by covering with 1/2-inch- (13-mm-) thick plywood secured with plastic strapping or another nonmarring fastening method.

END OF SECTION 05 51 13 00a



Task	Specification	Specification Description
05 51 13 00	05 50 00 00	Metal Fabrications
05 51 19 00	05 50 00 00	Metal Fabrications
05 51 19 00	05 51 13 00	Metal Stairs
05 51 19 00	05 51 13 00a	Fabricated Spiral Stairs
05 51 33 13	05 50 00 00	Metal Fabrications
05 51 33 13	05 52 13 00	Pipe And Tube Railings
05 51 33 16	05 50 00 00	Metal Fabrications
05 51 33 23	05 50 00 00	Metal Fabrications
05 51 33 23	05 52 13 00	Pipe And Tube Railings



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SECTION 05 52 13 00 - PIPE AND TUBE RAILINGS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for pipe and tube railings. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Steel pipe and tube railings.
 - b. Aluminum pipe and tube railings.
 - c. Stainless-steel pipe and tube railings.

C. Performance Requirements

1. Delegated Design: Design railings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
 - a. Steel: 72 percent of minimum yield strength.
 - b. Aluminum: The lesser of minimum yield strength divided by 1.65 or minimum ultimate tensile strength divided by 1.95.
 - c. Stainless Steel: 60 percent of minimum yield strength.
3. Structural Performance: Railings shall withstand the effects of gravity loads and loads and stresses within limits and under conditions indicated. Following loads are examples only and are based on the 2006 International Building Code (IBC).
 - a. Handrails and Top Rails of Guards:
 - 1) Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
 - 2) Concentrated load of 200 lbf (0.89 kN) applied in any direction.
 - 3) Uniform and concentrated loads need not be assumed to act concurrently.
 - b. Infill of Guards:
 - 1) Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
 - 2) Infill load and other loads need not be assumed to act concurrently.
4. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
 - a. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
5. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

D. Submittals

1. Product Data: For the following:
 - a. Manufacturer's product lines of mechanically connected railings.
 - b. Railing brackets.
 - c. Grout, anchoring cement, and paint products.
2. LEED Submittals:
 - a. Product Data for Credit MR 4.1 and Credit MR 4.2, **as directed**: Indicating percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.
3. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.



4. Samples: For each type of exposed finish required.
 - a. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
 - b. Fittings and brackets.
 - c. Assembled Sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Sample need not be full height.
 - 1) Show method of finishing **OR** connecting, **as directed**, members at intersections.
5. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
6. Qualification Data: For qualified professional engineer **OR** testing agency, .
7. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.
8. Welding certificates.
9. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.
10. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

E. Quality Assurance

1. Source Limitations: Obtain each type of railing from single source from single manufacturer.
2. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
3. Welding Qualifications: Qualify procedures and personnel according to the following:
 - a. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - b. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 - c. AWS D1.6, "Structural Welding Code - Stainless Steel."

F. Project Conditions

1. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

G. Coordination And Scheduling

1. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
2. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
3. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.2 PRODUCTS

A. Metals, General

1. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
2. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

B. Steel And Iron



1. Recycled Content of Steel Products: Provide products with average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
2. Tubing: ASTM A 500 (cold formed) or ASTM A 513.
3. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
 - a. Provide galvanized finish for exterior installations and where indicated.
4. Plates, Shapes, and Bars: ASTM A 36/A 36M.
5. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.
6. Expanded Metal: ASTM F 1267, Type I (expanded) **OR** Type II (expanded and flattened), **as directed**, Class 1 (uncoated).
 - a. Style Designation: 3/4 number 13 **OR** 1-1/2 number 10, **as directed**.
7. Perforated Metal: Cold-rolled steel sheet, ASTM A 1008/A 1008M, or hot-rolled steel sheet, ASTM A 1011/A 1011M, commercial steel Type B, 0.060 inch (1.52 mm) thick, with 1/4-inch (6.4-mm) holes 3/8 inch (9.5 mm) o.c. in staggered rows.
8. Perforated Metal: Galvanized-steel sheet, ASTM A 653/A 653M, G90 (Z275) coating, commercial steel Type B, 0.064 inch (1.63 mm) thick, with 1/4-inch (6.4-mm) holes 3/8 inch (9.5 mm) o.c. in staggered rows **OR** with 1/8-by-1-inch (3.2-by-25.4-mm) round end slotted holes in staggered rows, **as directed**.
9. Woven-Wire Mesh: Intermediate-crimp, diamond **OR** square, **as directed**, pattern, 2-inch (50-mm) woven-wire mesh, made from 0.135-inch (3.5-mm) nominal diameter wire complying with ASTM A 510 (ASTM A 510M).

C. Aluminum

1. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.
2. Extruded Bars and Tubing: ASTM B 221 (ASTM B 221M), Alloy 6063-T5/T52.
3. Extruded Structural Pipe and Round Tubing: ASTM B 429/B 429M, Alloy 6063-T6.
 - a. Provide Standard Weight (Schedule 40) pipe, unless otherwise indicated.
4. Drawn Seamless Tubing: ASTM B 210 (ASTM B 210M), Alloy 6063-T832.
5. Plate and Sheet: ASTM B 209 (ASTM B 209M), Alloy 6061-T6.
6. Die and Hand Forgings: ASTM B 247 (ASTM B 247M), Alloy 6061-T6.
7. Castings: ASTM B 26/B 26M, Alloy A356.0-T6.
8. Perforated Metal: Aluminum sheet, ASTM B 209 (ASTM B 209M), Alloy 6061-T6, 0.063 inch (1.60 mm) thick, with 1/4-inch (6.4-mm) holes 3/8 inch (9.5 mm) o.c. in staggered rows.
9. Woven-Wire Mesh: Intermediate-crimp, diamond **OR** square, **as directed**, pattern, 2-inch (50-mm) woven-wire mesh, made from 0.162-inch (4.1-mm) nominal diameter wire complying with ASTM B 211 (ASTM B 211M), Alloy 6061-T94.

D. Stainless Steel

1. Tubing: ASTM A 554, Grade MT 304 **OR** Grade MT 316L, **as directed**.
2. Pipe: ASTM A 312/A 312M, Grade TP 304 **OR** Grade TP 316L, **as directed**.
3. Castings: ASTM A 743/A 743M, Grade CF 8 or CF 20 **OR** Grade CF 8M or CF 3M, **as directed**.
4. Plate and Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304 **OR** Type 316L, **as directed**.
5. Expanded Metal: ASTM F 1267, Type I (expanded) **OR** Type II (expanded and flattened), **as directed**, Class 3 (corrosion-resistant steel), made from stainless-steel sheet, ASTM A 240/A 240M or ASTM A 666, Type 304 **OR** Type 316, **as directed**.
 - a. Style Designation: 3/4 number 13 **OR** 1-1/2 number 10, **as directed**.
6. Perforated Metal: Stainless-steel sheet, ASTM A 240/A 240M or ASTM A 666, Type 304 **OR** Type 316L, **as directed**, 0.062 inch (1.59 mm) thick, with 1/4-inch (6.4-mm) holes 3/8 inch (9.5 mm) o.c. in staggered rows.
7. Woven-Wire Mesh: Intermediate-crimp, diamond **OR** square, **as directed**, pattern, 2-inch (50-mm) woven-wire mesh, made from 0.135-inch (3.5-mm) nominal diameter wire complying with ASTM A 580/A 580M, Type 304 **OR** Type 316, **as directed**.



E. Fasteners

1. General: Provide the following:
 - a. Ungalvanized-Steel Railings: Plated steel fasteners complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5 for zinc coating.
 - b. Hot-Dip Galvanized Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A 153/A 153M or ASTM F 2329 for zinc coating.
 - c. Aluminum Railings: Type 304 **OR** Type 316, **as directed**, stainless-steel fasteners.
 - d. Stainless-Steel Railings: Type 304 **OR** Type 316, **as directed**, stainless-steel fasteners.
2. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads, **as directed**.
3. Fasteners for Interconnecting Railing Components:
 - a. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.
OR
Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
 - b. Provide Phillips **OR** tamper-resistant **OR** square or hex socket, **as directed**, flat-head machine screws for exposed fasteners unless otherwise indicated.
4. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
 - a. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
 - b. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 (A1) **OR** Group 2 (A4), **as directed**, stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

F. Miscellaneous Materials

1. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
 - a. For aluminum and stainless-steel railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.
2. Etching Cleaner for Galvanized Metal: Complying with MPI#25.
3. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
4. Shop Primers: Provide primers that comply with Division 07 **OR** Division 09 Section(s) "High-performance Coatings" **OR** Division 07 **AND** Division 09 Section(s) "High-performance Coatings", **as directed**.
5. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - a. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
6. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
7. Shop Primer for Galvanized Steel: Cementitious galvanized metal primer complying with MPI#26 **OR** Vinyl wash primer complying with MPI#80 **OR** Water based galvanized metal primer complying with MPI#134, **as directed**.
8. Intermediate Coats and Topcoats: Provide products that comply with Division 07 **OR** Division 09 Section(s) "High-performance Coatings" **OR** Division 07 **AND** Division 09 Section(s) "High-performance Coatings", **as directed**.
9. Epoxy Intermediate Coat: Complying with MPI #77 and compatible with primer and topcoat.
10. Polyurethane Topcoat: Complying with MPI #72 and compatible with undercoat.



11. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
12. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
13. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
 - a. Water-Resistant Product: At exterior locations and where indicated provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

G. Fabrication

1. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
2. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
3. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
4. Form work true to line and level with accurate angles and surfaces.
5. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
6. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
7. Connections: Fabricate railings with welded **OR** nonwelded, **as directed**, connections unless otherwise indicated.
8. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - b. Obtain fusion without undercut or overlap.
 - c. Remove flux immediately.
 - d. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
9. Welded Connections for Aluminum Pipe: Fabricate railings to interconnect members with concealed internal welds that eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.
10. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
 - a. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.
11. Form changes in direction as follows:
 - a. As detailed.
OR
By bending or by inserting prefabricated elbow fittings.
OR
By flush bends or by inserting prefabricated flush-elbow fittings.
OR
By radius bends of radius indicated or by inserting prefabricated elbow fittings of radius indicated.
12. Bend members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
13. Close exposed ends of railing members with prefabricated end fittings.



14. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch (6 mm) or less.
15. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
 - a. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers, or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
16. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.
17. For railing posts set in concrete, provide steel **OR** stainless-steel, **as directed**, sleeves not less than 6 inches (150 mm) long with inside dimensions not less than 1/2 inch (13 mm) greater than outside dimensions of post, with metal plate forming bottom closure.
18. For removable railing posts, fabricate slip-fit sockets from steel **OR** stainless-steel, **as directed**, tube or pipe whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height. Provide socket covers designed and fabricated to resist being dislodged.
 - a. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings.
19. Expanded-Metal Infill Panels: Fabricate infill panels from expanded metal made from same metal as railings in which they are installed.
 - a. Edge panels with U-shaped channels made from metal sheet, of same metal as expanded metal and not less than 0.043 inch (1.1 mm) thick.
 - b. Orient expanded metal with long dimension of diamonds parallel to top rail **OR** perpendicular to top rail **OR** horizontal **OR** vertical, **as directed**.
20. Perforated-Metal Infill Panels: Fabricate infill panels from perforated metal made from steel **OR** galvanized steel **OR** aluminum **OR** stainless steel **OR** same metal as railings in which they are installed, **as directed**.
 - a. Edge panels with U-shaped channels made from metal sheet, of same metal as perforated metal and not less than 0.043 inch (1.1 mm) thick.
 - b. Orient perforated metal with pattern parallel to top rail **OR** perpendicular to top rail **OR** horizontal **OR** vertical **OR** as indicated on Drawings, **as directed**.
21. Woven-Wire Mesh Infill Panels: Fabricate infill panels from woven-wire mesh crimped into 1-by-1/2-by-1/8-inch (25-by-13-by-3-mm) metal channel frames. Make wire mesh and frames from same metal as railings in which they are installed.
 - a. Orient wire mesh with diamonds vertical **OR** wires perpendicular and parallel to top rail **OR** wires horizontal and vertical, **as directed**.
22. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

H. Finishes, General

1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
3. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
4. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

I. Steel And Iron Finishes

1. Galvanized Railings:



- a. Hot-dip galvanize steel **OR** exterior steel, **as directed**, and iron railings, including hardware, after fabrication.
OR
Hot-dip galvanize indicated steel and iron railings, including hardware, after fabrication.
 - b. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
 - c. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.
 - d. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
 - e. Fill vent and drain holes that will be exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
 2. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
 3. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.
 4. For nongalvanized steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors to be embedded in exterior concrete or masonry.
 5. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning" **OR** SSPC-SP 3, "Power Tool Cleaning" **OR** requirements indicated below, **as directed**:
 - a. Exterior Railings: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - b. Railings Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - c. Railings Indicated to Receive Primers Specified in Division 9 Section "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - d. Other Railings: SSPC-SP 3, "Power Tool Cleaning."
 6. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
 - a. Shop prime uncoated railings with universal shop primer **OR** primers specified in Division 07, **as directed**, unless zinc-rich primer is **OR** primers specified in Division 09 Section "High-performance Coatings" are, **as directed**, indicated.
 - b. Do not apply primer to galvanized surfaces.
 7. Shop-Painted Finish: Comply with Division 09 Section(s) "Exterior Painting" **OR** "High-performance Coatings", **as directed**.
 - a. Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 8. High-Performance Coating: Apply epoxy intermediate and polyurethane topcoats to prime-coated surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Apply at spreading rates recommended by coating manufacturer.
 - a. Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
- J. Aluminum Finishes
1. Mechanical Finish: AA-M12 (Mechanical Finish: nonspecular as fabricated).
 2. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm **OR** AA-M12C22A31, Class II, 0.010 mm, **as directed**, or thicker.
 3. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm **OR** AA-M12C22A32/A34, Class II, 0.010 mm, **as directed**, or thicker.
 - a. Color: Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black **OR** As selected from full range of industry colors and color densities, **as directed**.
 4. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.



- a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
5. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2604 **OR** AAMA 2605, **as directed**, and containing not less than 50 **OR** 70, **as directed**, percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

OR

 High-Performance Organic Finish: Three **OR** Four, **as directed**, -coat fluoropolymer finish complying with AAMA 2605 and containing not less than 50 **OR** 70, **as directed**, percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - b. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

K. Stainless-Steel Finishes

1. Remove tool and die marks and stretch lines, or blend into finish.
2. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
3. 180-Grit Polished Finish: Oil-ground, uniform, directionally textured finish.
4. 320-Grit Polished Finish: Oil-ground, uniform, fine, directionally textured finish.
5. Polished and Buffed Finish: Oil-ground, 180-grit finish followed by buffing.
6. Directional Satin Finish: No. 4.
7. Dull Satin Finish: No. 6.
8. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

1.3 EXECUTION

A. Examination

1. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

B. Installation, General

1. Fit exposed connections together to form tight, hairline joints.
2. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
 - a. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 - b. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
 - c. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (5 mm in 3 m).
3. Corrosion Protection: Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
4. Adjust railings before anchoring to ensure matching alignment at abutting joints.
5. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

C. Railing Connections



1. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.
 2. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.
 3. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches (50 mm) beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches (150 mm) of post.
- D. Anchoring Posts
1. Use metal sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.
 2. Form or core-drill holes not less than 5 inches (125 mm) deep and 3/4 inch (20 mm) larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.
 3. Cover anchorage joint with flange of same metal as post, welded to post after placing anchoring material **OR** attached to post with set screws, **as directed**.
OR
Leave anchorage joint exposed with 1/8-inch (3-mm) buildup, sloped away from post **OR** anchoring material flush with adjacent surface, **as directed**.
 4. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
 - a. For aluminum pipe railings, attach posts using fittings designed and engineered for this purpose.
 - b. For stainless-steel pipe railings, weld flanges to post and bolt to supporting surfaces.
 - c. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.
 5. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.
- E. Attaching Railings
1. Anchor railing ends at walls with round flanges anchored to wall construction and welded to railing ends or connected to railing ends using nonwelded connections.
 2. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends or connected to railing ends using nonwelded connections.
 3. Attach railings to wall with wall brackets, except where end flanges are used. Provide brackets with 1-1/2-inch (38-mm) clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
 - a. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt **OR** predrilled hole for exposed bolt anchorage, **as directed**.
 - b. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
 4. Secure wall brackets and railing end flanges to building construction as follows:
 - a. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 - b. For hollow masonry anchorage, use toggle bolts.
 - c. For wood stud partitions, use hanger or lag bolts set into studs or wood backing between studs. Coordinate with carpentry work to locate backing members.
 - d. For steel-framed partitions, use hanger or lag bolts set into fire-retardant-treated, **as directed**, wood backing between studs. Coordinate with stud installation to locate backing members.**OR**



For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.

OR

For steel-framed partitions, use toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

F. Adjusting And Cleaning

1. Clean aluminum and stainless steel by washing thoroughly with clean water and soap and rinsing with clean water.
2. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - a. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.
3. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 07 OR Division 09 Section(s) "High-performance Coatings" **OR** Division 07 AND Division 09 Section(s) "High-performance Coatings", **as directed**.
4. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

G. Protection

1. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Final Completion.

END OF SECTION 05 52 13 00



Task	Specification	Specification Description
05 52 13 00	05 50 00 00	Metal Fabrications



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SECTION 05 53 13 00 - GRATINGS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for gratings. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Metal bar gratings.
 - b. Expanded-metal gratings.
 - c. Formed-metal plank gratings.
 - d. Extruded-aluminum plank gratings.
 - e. Glass-fiber-reinforced plastic gratings.
 - f. Metal frames and supports for gratings.

C. Performance Requirements

1. Delegated Design: Design gratings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2. Structural Performance: Gratings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.
 - a. Loads in subparagraphs below are examples based on the 2006 International Building Code and ASCE/SEI 7. Adjust to local Project requirements.
 - 1) Floors (light manufacturing): Uniform load of 125 lbf/sq. ft. (6.00 kN/sq. m) or concentrated load of 2000 lbf (8.90 kN), whichever produces the greater stress.
 - 2) Floors (heavy manufacturing): Uniform load of 250 lbf/sq. ft. (11.97 kN/sq. m) or concentrated load of 3000 lbf (13.40 kN), whichever produces the greater stress.
 - 3) Walkways and Elevated Platforms Other Than Exits: Uniform load of 60 lbf/sq. ft. (2.87 kN/sq. m).
 - 4) Walkways and Elevated Platforms Used as Exits: Uniform load of 100 lbf/sq. ft. (4.79 kN/sq. m).
 - 5) Sidewalks and Vehicular Driveways, Subject to Trucking: Uniform load of 250 lbf/sq. ft. (11.97 kN/sq. m) or concentrated load of 8000 lbf (35.60 kN), whichever produces the greater stress.
 - 6) Limit deflection to L/240 **OR** L/360, **as directed**, or 1/4 inch (6.4 mm), whichever is less.
3. Seismic Performance: Provide gratings capable of withstanding the effects of earthquake motions determined according to ASCE/SEI 7.

D. Submittals

1. Product Data: For the following:
 - a. Formed-metal plank gratings.
 - b. Extruded-aluminum plank gratings.
 - c. Glass-fiber-reinforced plastic gratings.
 - d. Clips and anchorage devices for gratings.
 - e. Paint products.
2. LEED Submittals:
 - a. Product Data for Credit MR 4.1 and Credit MR 4.2, **as directed**: Indicating percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.
3. Shop Drawings: Include plans, sections, details, and attachments to other work.



4. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
5. Qualification Data: For qualified professional engineer.
6. Mill Certificates: Signed by manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.
7. Welding certificates.
8. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

E. Quality Assurance

1. Metal Bar Grating Standards: Comply with NAAMM MBG 531, "Metal Bar Grating Manual" and NAAMM MBG 532, "Heavy-Duty Metal Bar Grating Manual."
2. Welding Qualifications: Qualify procedures and personnel according to the following:
 - a. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - b. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 - c. AWS D1.3, "Structural Welding Code - Sheet Steel."
 - d. AWS D1.6, "Structural Welding Code - Stainless Steel."

F. Project Conditions

1. Field Measurements: Verify actual locations of walls and other construction contiguous with gratings by field measurements before fabrication.

G. Coordination

1. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
2. Coordinate installation of anchorages for gratings, grating frames, and supports. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.2 PRODUCTS

A. Ferrous Metals

1. Recycled Content of Steel Products: Provide products with average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
2. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
3. Steel Bars for Bar Gratings: ASTM A 36/A 36M or steel strip, ASTM A 1011/A 1011M or ASTM A 1018/A 1018M.
4. Wire Rod for Bar Grating Crossbars: ASTM A 510 (ASTM A 510M).
5. Uncoated Steel Sheet: ASTM A 1011/A 1011M, structural steel, Grade 30 (Grade 205).
6. Galvanized-Steel Sheet: ASTM A 653/A 653M, structural quality, Grade 33 (Grade 230), with G90 (Z275) coating.
7. Expanded-Metal Carbon Steel: ASTM F 1267, Class 1.
8. Expanded-Metal Galvanized Steel: ASTM F 1267, Class 2, Grade A.
9. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304 **OR** Type 316, **as directed**.
10. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304 **OR** Type 316, **as directed**.
11. Expanded-Metal Stainless Steel: ASTM F 1267, Class 3, made from stainless-steel sheet, ASTM A 666, Type 304 **OR** Type 316, **as directed**.

B. Aluminum



1. Aluminum, General: Provide alloy and temper recommended by aluminum producer for type of use indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.
 2. Extruded Bars and Shapes: ASTM B 221 (ASTM B 221M), alloys as follows:
 - a. 6061-T6 or 6063-T6, for bearing bars of gratings and shapes.
 - b. 6061-T1, for grating crossbars.
 3. Aluminum Sheet: ASTM B 209 (ASTM B 209M), Alloy 5052-H32.
- C. Fasteners
1. General: Unless otherwise indicated, provide Type 304 **OR** Type 316, **as directed**, stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
 - a. Provide stainless-steel fasteners for fastening aluminum.
 - b. Provide stainless steel fasteners for fastening stainless steel.
 2. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
 3. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts, and, where indicated, flat washers; ASTM F 593 (ASTM F 738M) for bolts and ASTM F 594 (ASTM F 836M) for nuts, Alloy Group 1 (A1) **OR** Group 2 (A4), **as directed**.
 4. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
 - a. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
 5. Plain Washers: Round, ASME B18.22.1 (ASME B18.22M).
 6. Lock Washers: Helical, spring type, ASME B18.21.1 (ASME B18.21.2M).
 7. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
 - a. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
 - b. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 (A1) **OR** Group 2 (A4), **as directed**, stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).
- D. Miscellaneous Materials
1. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy that is welded.
 2. Shop Primers: Provide primers that comply with Division 07 **OR** Division 09 Section(s) "High-performance Coatings" **OR** Division 07 **AND** Division 09 Section(s) "High-performance Coatings", **as directed**.
 3. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - a. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
 4. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
 5. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
 6. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- E. Fabrication
1. Shop Assembly: Fabricate grating sections in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling



limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

2. Cut, drill, and punch material cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
3. Form from materials of size, thickness, and shapes indicated, but not less than that needed to support indicated loads.
4. Fit exposed connections accurately together to form hairline joints.
5. Welding: Comply with AWS recommendations and the following:
 - a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - b. Obtain fusion without undercut or overlap.
 - c. Remove welding flux immediately.
6. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space the anchoring devices to secure gratings, frames, and supports rigidly in place and to support indicated loads.
 - a. Fabricate toeplates to fit grating units and weld to units in shop unless otherwise indicated.
OR
Fabricate toeplates for attaching in the field.
 - b. Toeplate Height: 4 inches (100 mm) unless otherwise indicated.

F. Metal Bar Gratings

1. Welded Steel Grating:
 - a. Bearing Bar Spacing: 7/16 or 1/2 inch (11 or 13 mm) **OR** 11/16 inch (17 mm) **OR** 15/16 inch (24 mm) **OR** 1-3/16 inches (30 mm) **OR** 1-3/8 inches (35 mm) **OR** 1-7/8 inches (48 mm) **OR** 2-3/8 inches (60 mm), **as directed**, o.c.
 - b. Bearing Bar Depth: 3/4 inch (19 mm) **OR** 1 inch (25 mm) **OR** 1-1/4 inches (32 mm) **OR** 1-1/2 inches (38 mm) **OR** 1-3/4 inches (44 mm) **OR** 2 inches (51 mm) **OR** 2-1/4 inches (57 mm) **OR** 2-1/2 inches (64 mm) **OR** 3 inches (76 mm) **OR** 3-1/2 inches (89 mm) **OR** 4 inches (102 mm) **OR** 4-1/2 inches (114 mm) **OR** 5 inches (127 mm) **OR** As required to comply with structural performance requirements, **as directed**.
 - c. Bearing Bar Thickness: 1/8 inch (3.2 mm) **OR** 3/16 inch (4.8 mm) **OR** 1/4 inch (6.4 mm) **OR** 3/8 inch (9.5 mm) **OR** As required to comply with structural performance requirements, **as directed**.
 - d. Crossbar Spacing: 2 inches (51 mm) **OR** 4 inches (102 mm), **as directed**, o.c.
 - e. Grating Mark W-11-4 (1 x 3/16) STEEL: 1-by-3/16-inch (25-by-4.8-mm) bearing bars at 11/16 inch (18 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
 - f. Grating Mark W-15-4 (1 x 1/8) STEEL: 1-by-1/8-inch (25-by-3.2-mm) bearing bars at 15/16 inch (24 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
 - g. Grating Mark W-19-4 (1-1/4 x 3/16) STEEL: 1-1/4-by-3/16-inch (32-by-4.8-mm) bearing bars at 1-3/16 inches (30 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
 - h. Grating Mark W-19-4 (1-1/2 x 3/16) STEEL: 1-1/2-by-3/16-inch (38-by-4.8-mm) bearing bars at 1-3/16 inches (30 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
 - i. Grating Mark W-19-4 (2 x 1/4) STEEL: 2-by-1/4-inch (51-by-6.4-mm) bearing bars at 1-3/16 inches (30 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
 - j. Grating Mark W-30-4 (5 x 3/8) STEEL: 5-by-3/8-inch (127-by-9.5-mm) bearing bars at 1-7/8 inches (60 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
 - k. Grating Mark: As indicated.
 - l. Traffic Surface: Plain **OR** Serrated **OR** Knurled **OR** Applied abrasive finish consisting of aluminum-oxide aggregate in an epoxy-resin adhesive **OR** As indicated, **as directed**.
 - m. Steel Finish: Shop primed **OR** Hot-dip galvanized with a coating weight of not less than 1.8 oz./sq. ft. (550 g/sq. m) of coated surface, **as directed**.
2. Pressure-Locked Steel Grating: Fabricated by pressing rectangular flush-top crossbars into slotted bearing bars or swaging crossbars between bearing bars.



- a. Bearing Bar Spacing: 7/16 or 1/2 inch (11 or 13 mm) **OR** 11/16 inch (17 mm) **OR** 15/16 inch (24 mm) **OR** 1-3/16 inches (30 mm), **as directed**, o.c.
 - b. Bearing Bar Depth: 3/4 inch (19 mm) **OR** 1 inch (25 mm) **OR** 1-1/4 inches (32 mm) **OR** 1-1/2 inches (38 mm) **OR** 1-3/4 inches (44 mm) **OR** 2 inches (51 mm) **OR** 2-1/4 inches (57 mm) **OR** 2-1/2 inches (64 mm) **OR** As required to comply with structural performance requirements, **as directed**.
 - c. Bearing Bar Thickness: 1/8 inch (3.2 mm) **OR** 3/16 inch (4.8 mm) **OR** As required to comply with structural performance requirements, **as directed**.
 - d. Crossbar Spacing: 2 inches (51 mm) **OR** 4 inches (102 mm), **as directed**, o.c.
 - e. Grating Mark P-11-4 (1 x 3/16) STEEL: 1-by-3/16-inch (25-by-4.8-mm) bearing bars at 11/16 inch (18 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
 - f. Grating Mark P-15-4 (1-1/4 x 1/8) STEEL: 1-1/4-by-1/8-inch (32-by-3.2-mm) bearing bars at 15/16 inch (24 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
 - g. Grating Mark P-19-4 (1-1/2 x 3/16) STEEL: 1-1/2-by-3/16-inch (38-by-4.8-mm) bearing bars at 1-3/16 inches (30 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
 - h. Grating Mark: As indicated.
 - i. Traffic Surface: Plain **OR** Serrated **OR** Knurled **OR** Applied abrasive finish consisting of aluminum-oxide aggregate in an epoxy-resin adhesive **OR** As indicated, **as directed**.
 - j. Steel Finish: Shop primed **OR** Hot-dip galvanized with a coating weight of not less than 1.8 oz./sq. ft. (550 g/sq. m) of coated surface, **as directed**.
3. Riveted Steel Grating:
- a. Bearing Bar Spacing: 3/4 inch (19 mm) **OR** 1-1/8 inches (29 mm) **OR** 2-5/16 inches (59 mm), **as directed**, clear.
 - b. Bearing Bar Depth: 3/4 inch (19 mm) **OR** 1 inch (25 mm) **OR** 1-1/4 inches (32 mm) **OR** 1-1/2 inches (38 mm) **OR** 1-3/4 inches (44 mm) **OR** 2 inches (51 mm) **OR** 2-1/4 inches (57 mm) **OR** 2-1/2 inches (64 mm) **OR** 3 inches (76 mm) **OR** 3-1/2 inches (89 mm) **OR** 4 inches (102 mm) **OR** 4-1/2 inches (114 mm) **OR** 5 inches (127 mm) **OR** As required to comply with structural performance requirements, **as directed**.
 - c. Bearing Bar Thickness: 1/8 inch (3.2 mm) **OR** 3/16 inch (4.8 mm) **OR** 1/4 inch (6.4 mm) **OR** 3/8 inch (9.5 mm) **OR** As required to comply with structural performance requirements, **as directed**.
 - d. Rivet Spacing: 3-1/2 inches (89 mm) **OR** 5 inches (127 mm) **OR** 7 inches (178 mm), **as directed**, o.c. along bearing bar.
 - e. Grating Mark R-12-3-1/2 (1 x 1/8) STEEL: 1-by-1/8-inch (25-by-3.2-mm) bearing bars with 3/4-inch (19-mm) clear space between bearing bars, and rivets at 3-1/2 inches (89 mm) o.c. along bearing bar.
 - f. Grating Mark R-18-7 (1-1/2 x 3/16) STEEL: 1-1/2-by-3/16-inch (38-by-4.8-mm) bearing bars with 1-1/8-inch (29-mm) clear space between bearing bars, and rivets at 7 inches (178 mm) o.c. along bearing bar.
 - g. Grating Mark R-37-5 (4 x 1/4) STEEL: 4-by-1/4-inch (102-by-6.4-mm) bearing bars with 2-5/16-inch (59-mm) clear space between bearing bars, and rivets at 5 inches (127 mm) o.c. along bearing bar.
 - h. Grating Mark R-37-5 (5 x 3/8) STEEL: 5-by-3/8-inch (127-by-9.5-mm) bearing bars with 2-5/16-inch (59-mm) clear space between bearing bars, and rivets at 5 inches (127 mm) o.c. along bearing bar.
 - i. Grating Mark: As indicated.
 - j. Traffic Surface: Plain **OR** Serrated **OR** Knurled **OR** Applied abrasive finish consisting of aluminum-oxide aggregate in an epoxy-resin adhesive **OR** As indicated, **as directed**.
 - k. Steel Finish: Shop primed **OR** Hot-dip galvanized with a coating weight of not less than 1.8 oz./sq. ft. (550 g/sq. m) of coated surface, **as directed**.
4. Pressure-Locked, Stainless-Steel Grating: Fabricated by pressing rectangular flush-top crossbars into slotted bearing bars or swaging crossbars between bearing bars, **as directed**.
- a. Bearing Bar Spacing: 7/16 or 1/2 inch (11 or 13 mm) **OR** 11/16 inch (17 mm) **OR** 15/16 inch (24 mm) **OR** 1-3/16 inches (30 mm) **OR** 1-3/8 inches (35 mm) **OR** 1-7/8 inches (48 mm) **OR** 2-3/8 inches (60 mm), **as directed**, o.c.



- b. Bearing Bar Depth: 3/4 inch (19 mm) **OR** 1 inch (25 mm) **OR** 1-1/4 inches (32 mm) **OR** 1-1/2 inches (38 mm) **OR** 1-3/4 inches (44 mm) **OR** 2 inches (51 mm) **OR** 2-1/4 inches (57 mm) **OR** 2-1/2 inches (64 mm) **OR** 3 inches (76 mm) **OR** 3-1/2 inches (89 mm) **OR** 4 inches (102 mm) **OR** 4-1/2 inches (114 mm) **OR** 5 inches (127 mm) **OR** As required to comply with structural performance requirements, **as directed**.
 - c. Bearing Bar Thickness: 1/8 inch (3.2 mm) **OR** 3/16 inch (4.8 mm) **OR** 1/4 inch (6.4 mm) **OR** 3/8 inch (9.5 mm) **OR** As required to comply with structural performance requirements, **as directed**.
 - d. Crossbar Spacing: 2 inches (51 mm) **OR** 4 inches (102 mm), **as directed**, o.c.
 - e. Grating Mark P-11-4 (1 x 3/16) STAINLESS STEEL: 1-by-3/16-inch (25-by-4.8-mm) bearing bars at 11/16 inch (18 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
 - f. Grating Mark P-15-2 (1 x 1/8) STAINLESS STEEL: 1-by-1/8-inch (25-by-3.2-mm) bearing bars at 15/16 inch (24 mm) o.c., and crossbars at 2 inches (51 mm) o.c.
 - g. Grating Mark P-19-4 (1-1/2 x 3/16) STAINLESS STEEL: 1-1/2-by-3/16-inch (38-by-4.8-mm) bearing bars at 1-3/16 inches (30 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
 - h. Grating Mark P-30-4 (3 x 3/8) STAINLESS STEEL: 3-by-3/8-inch (76-by-9.5-mm) bearing bars at 1-7/8 inches (48 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
 - i. Grating Mark: As indicated.
 - j. Traffic Surface: Plain **OR** Serrated **OR** Knurled **OR** Applied abrasive finish consisting of aluminum-oxide aggregate in an epoxy-resin adhesive **OR** As indicated, **as directed**.
 - k. Finish: Mill finish **OR** Abrasive blasted **OR** Electropolished, **as directed**.
5. Pressure-Locked, Rectangular Bar Aluminum Grating: Fabricated by pressing rectangular flush-top crossbars into slotted bearing bars or swaging crossbars between bearing bars.
- a. Bearing Bar Spacing: 7/16 or 1/2 inch (11 or 13 mm) **OR** 11/16 inch (17.5 mm) **OR** 15/16 inch (24 mm) **OR** 1-3/16 inches (30 mm), **as directed**, o.c.
 - b. Bearing Bar Depth: 1 inch (25 mm) **OR** 1-1/4 inches (32 mm) **OR** 1-1/2 inches (38 mm) **OR** 1-3/4 inches (44 mm) **OR** 2 inches (51 mm) **OR** 2-1/4 inches (57 mm) **OR** 2-1/2 inches (64 mm) **OR** As required to comply with structural performance requirements, **as directed**.
 - c. Bearing Bar Thickness: 1/8 inch (3.2 mm) **OR** 3/16 inch (4.8 mm) **OR** 1/4 inch (6.4 mm) **OR** As required to comply with structural performance requirements, **as directed**.
 - d. Crossbar Spacing: 2 inches (51 mm) **OR** 4 inches (102 mm), **as directed**, o.c.
 - e. Grating Mark P-7-4 (1 x 1/8) ALUMINUM: 1-by-1/8-inch (25-by-3.2-mm) bearing bars at 7/16 inch (11 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
 - f. Grating Mark P-11-4 (1 x 3/16) ALUMINUM: 1-by-3/16-inch (25-by-4.8-mm) bearing bars at 11/16 inch (18 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
 - g. Grating Mark P-15-4 (1-1/2 x 3/16) ALUMINUM: 1-1/2-by-3/16-inch (38-by-4.8-mm) bearing bars at 15/16 inch (24 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
 - h. Grating Mark P-19-4 (2 x 3/16) ALUMINUM: 2-by-3/16-inch (51-by-4.8-mm) bearing bars at 1-3/16 inches (30 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
 - i. Grating Mark: As indicated.
 - j. Traffic Surface: Plain **OR** Applied abrasive finish consisting of aluminum-oxide aggregate in an epoxy-resin adhesive **OR** As indicated, **as directed**.
 - k. Aluminum Finish: Mill finish **OR** Class I, clear, anodized finish, **as directed**.
6. Pressure-Locked, Aluminum I-Bar Grating: Fabricated by swaging crossbars between bearing bars.
- a. Bearing Bar Spacing: 7/16 or 1/2 inch (11 or 13 mm) **OR** 11/16 inch (17 mm) **OR** 15/16 inch (24 mm) **OR** 1-3/16 inches (30 mm), **as directed**, o.c.
 - b. Bearing Bar Depth: 1 inch (25 mm) **OR** 1-1/4 inches (32 mm) **OR** 1-1/2 inches (38 mm) **OR** 1-3/4 inches (44 mm) **OR** 2 inches (51 mm) **OR** 2-1/4 inches (57 mm) **OR** 2-1/2 inches (64 mm) **OR** As required to comply with structural performance requirements, **as directed**.
 - c. Bearing Bar Flange Width: 1/4 inch (6.4 mm).
 - d. Crossbar Spacing: 2 inches (51 mm) **OR** 4 inches (102 mm), **as directed**, o.c.
 - e. Grating Mark P-11-4 (1 I-Bar) ALUMINUM: 1-inch (25-mm) I-bar bearing bars at 11/16 inch (18 mm) o.c., and crossbars at 4 inches (102 mm) o.c.



- f. Grating Mark P-15-2 (1 I-Bar) ALUMINUM: 1-inch (25-mm) I-bar bearing bars at 15/16 inch (24 mm) o.c., and crossbars at 2 inches (51 mm) o.c.
 - g. Grating Mark P-19-4 (1-1/2 I-Bar) ALUMINUM: 1-1/2-inch (38-mm) I-bar bearing bars at 1-3/16 inches (30 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
 - h. Grating Mark: As indicated.
 - i. Traffic Surface: Plain **OR** Grooved **OR** Applied abrasive finish consisting of aluminum-oxide aggregate in an epoxy-resin adhesive **OR** As indicated, **as directed**.
 - j. Aluminum Finish: Mill finish **OR** Class I, clear, anodized finish, **as directed**.
7. Removable Grating Sections: Fabricate with banding bars attached by welding to entire perimeter of each section. Include anchors and fasteners of type indicated or, if not indicated, as recommended by manufacturer for attaching to supports.
- a. Provide no fewer than four weld lugs for each heavy-duty grating section, with each lug shop welded to two bearing bars.
 - b. Provide no fewer than four saddle clips for each grating section composed of rectangular bearing bars 3/16 inch (4.8 mm) or less in thickness and spaced 15/16 inch (24 mm) or more o.c., with each clip designed and fabricated to fit over two bearing bars.
 - c. Provide no fewer than four weld lugs for each grating section composed of rectangular bearing bars 3/16 inch (4.8 mm) or less in thickness and spaced less than 15/16 inch (24 mm) o.c., with each lug shop welded to three or more bearing bars. Interrupt intermediate bearing bars as necessary for fasteners securing grating to supports.
 - d. Provide no fewer than four flange blocks for each section of aluminum I-bar grating, with block designed to fit over lower flange of I-shaped bearing bars.
 - e. Furnish threaded bolts with nuts and washers for securing grating to supports.
 - f. Furnish self-drilling fasteners with washers for securing grating to supports.
 - g. Furnish galvanized malleable-iron flange clamp with galvanized bolt for securing grating to supports. Furnish as a system designed to be installed from above grating by one person.
8. Fabricate cutouts in grating sections for penetrations indicated. Arrange cutouts to permit grating removal without disturbing items penetrating gratings.
- a. Edge-band openings in grating that interrupt four or more bearing bars with bars of same size and material as bearing bars.
9. Do not notch bearing bars at supports to maintain elevation.
- G. Expanded-Metal Gratings
1. Provide expanded-metal gratings in material, finish, style, size, thickness, weight, and type indicated or, if not indicated, as recommended by manufacturer for indicated applications and as needed to support indicated loads.
 - a. Material: Steel **OR** Stainless steel **OR** Aluminum, **as directed**.
 - b. Steel Finish: Unfinished, oiled **OR** Shop primed **OR** Galvanized, **as directed**.
 - c. Stainless-Steel Finish: Mill finish, as fabricated.
 - d. Aluminum Finish: Mill finish, as fabricated.
 - e. Style Designation (for steel): 4.27 lb **OR** 3/4 number 9, **as directed**.
 - f. Style Designation (for stainless steel): 1-1/2 number 9 **OR** 3/4 number 9, **as directed**.
 - g. Size (for aluminum): 2 lb **OR** 3/4 0.188 **OR** 1-1/2 0.125, **as directed**.
 - h. Type: I, expanded **OR** II, expanded and flattened, **as directed**.
 2. Fabricate cutouts in grating sections for penetrations of sizes and at locations indicated. Cut openings neatly and accurately to size. Edge-band openings with bars having a thickness not less than overall grating thickness at contact points.
 3. Where gratings are pierced by pipes, ducts, and structural members, cut openings neatly and accurately to size and weld a strap collar not less than 1/8 inch (3 mm) thick to the cut ends. Divide panels into sections only to extent required for installation where grating platforms and runways are to be placed around previously installed pipe, ducts, and structural members.
- H. Formed-Metal Plank Gratings
1. C-shaped channels rolled from heavy sheet metal of thickness indicated, and punched in serrated diamond shape to produce raised slip-resistant surface and drainage holes.



- a. Channel Width: 4-3/4 inches (121 mm) **OR** 7 inches (178 mm) **OR** 9-1/2 inches (241 mm) **OR** 11-3/4 inches (298 mm) **OR** 18-3/4 inches (476 mm) **OR** 24 inches (610 mm) **OR** As indicated **OR** As required to comply with structural performance requirements, **as directed**.
 - b. Channel Depth: 1-1/2 inches (38 mm) **OR** 2 inches (51 mm) **OR** 2-1/2 inches (64 mm) **OR** 3 inches (76 mm) **OR** As indicated **OR** As required to comply with structural performance requirements, **as directed**.
 - c. Material: 0.074-inch- (1.9-mm-) thick steel sheet, shop primed **OR** 0.104-inch- (2.65-mm-) thick steel sheet, shop primed **OR** 0.079-inch- (2.0-mm-) thick, hot-dip galvanized-steel sheet **OR** 0.108-inch- (2.8-mm-) thick, hot-dip galvanized-steel sheet **OR** 0.074-inch- (1.9-mm-) thick steel sheet, hot-dip galvanized after fabrication **OR** 0.104-inch- (2.65-mm-) thick steel sheet, hot-dip galvanized after fabrication **OR** 0.062-inch- (1.6-mm-) thick, stainless-steel sheet **OR** 0.078-inch- (2.0-mm-) thick, stainless-steel sheet **OR** 0.080-inch- (2.0-mm-) thick aluminum sheet **OR** 0.100-inch- (2.5-mm-) thick aluminum sheet, **as directed**.
2. Fabricate cutouts in grating sections for penetrations of sizes and at locations indicated. Cut openings neatly and accurately to size. Edge-band openings with metal sheet or bars having a thickness not less than grating material.
 3. Where gratings are pierced by pipes, ducts, and structural members, cut openings neatly and accurately to size and weld a strap collar not less than 1/8 inch (3 mm) thick to the cut ends. Divide panels into sections only to extent required for installation where grating platforms and runways are to be placed around previously installed pipe, ducts, and structural members.
- I. Extruded-Aluminum Plank Gratings
1. Provide extruded-aluminum plank gratings in type, size, and finish indicated or, if not indicated, as recommended by manufacturer for indicated applications and as needed to support indicated loads.
 - a. Type: Extruded-aluminum planks approximately 6 inches (152 mm) wide with multiple flanges approximately 1.2 inches (30 mm) o.c., acting as bearing bars connected by a web that serves as a walking surface. Top surface has raised ribs to increase slip resistance.
 - b. Depth: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (51 mm) **OR** As required to comply with structural performance requirements, **as directed**.
 - c. Perforations: None **OR** Rectangular, 19/32 by 3 inches (15 by 76 mm), with adjacent rows staggered **OR** 19/32 inch (15 mm) square, with adjacent rows aligned, **as directed**.
 - d. Finish: Mill finish, as fabricated.
 2. Fabricate cutouts in grating sections for penetrations indicated. Arrange cutouts to permit grating removal without disturbing items penetrating gratings.
- J. Glass-Fiber-Reinforced Plastic Gratings
1. Molded Glass-Fiber-Reinforced Gratings: Bar gratings made by placing glass-fiber strands that have been saturated with thermosetting plastic resin in molds in alternating directions to form interlocking bars without voids and with a high resin content.
 - a. Configuration: 1-1/2-inch- (38-mm-) square mesh, 1 inch (25 mm) thick **OR** 1-1/2-inch- (38-mm-) square mesh, 1-1/4 inches (32 mm) thick **OR** 1-1/2-inch- (38-mm-) square mesh, 1-1/2 inches (38 mm) thick **OR** 2-inch- (51-mm-) square mesh, 2 inches (51 mm) thick **OR** 1-1/2-inch- (38-mm-) square mesh, thickness as required to comply with structural performance requirements **OR** As required to comply with structural performance requirements, **as directed**.
 - b. Weight: 2.5 lb/sq. ft. (12.2 kg/sq. m) **OR** 2.7 lb/sq. ft. (13.2 kg/sq. m) **OR** 3.2 lb/sq. ft. (15.6 kg/sq. m) **OR** 3.5 lb/sq. ft. (17.1 kg/sq. m) **OR** 3.7 lb/sq. ft. (18.1 kg/sq. m) **OR** 4.1 lb/sq. ft. (20.0 kg/sq. m) **OR** 5.0 lb/sq. ft. (24.4 kg/sq. m), **as directed**.
 - c. Resin: Polyester **OR** Vinylester, **as directed**.
 - 1) Flame-Spread Index: 25 or less when tested according to ASTM E 84.
 - 2) U.S.D.A. Acceptance: Accepted for food-processing applications.
 - d. Color: Beige **OR** Gray **OR** Green **OR** Orange **OR** Yellow **OR** Manufacturer's standard, **as directed**.
 - e. Traffic Surface: Plain, meniscus **OR** Applied abrasive finish **OR** As indicated, **as directed**.



2. Pultruded Glass-Fiber-Reinforced Gratings: Bar gratings assembled from components made by simultaneously pulling glass fibers and extruding thermosetting plastic resin through a heated die under pressure to produce a product without voids and with a high glass-fiber content.
 - a. Configuration: I4010; 1-inch (25-mm) I-bars spaced 1 inch (25 mm) o.c. (40 percent open) **OR** I6010; 1-inch (25-mm) I-bars spaced 1-1/2 inches (38 mm) o.c. (60 percent open) **OR** I4015; 1-1/2-inch (38-mm) I-bars spaced 1 inch (25 mm) o.c. (40 percent open) **OR** I6015; 1-1/2-inch (38-mm) I-bars spaced 1-1/2 inches (38 mm) o.c. (60 percent open) **OR** T3320; 2-inch (51-mm) T-bars spaced 1-1/2 inches (38 mm) o.c. (33 percent open) **OR** T5020; 2-inch (51-mm) T-bars spaced 2 inches (51 mm) o.c. (50 percent open) **OR** As required to comply with structural performance requirements, **as directed**.
 - b. Weight: 2.35 lb/sq. ft. (11.5 kg/sq. m) **OR** 2.83 lb/sq. ft. (13.8 kg/sq. m) **OR** 3.10 lb/sq. ft. (15.1 kg/sq. m) **OR** 3.41 lb/sq. ft. (16.6 kg/sq. m) **OR** 4.10 lb/sq. ft. (20.0 kg/sq. m) **OR** 4.13 lb/sq. ft. (20.2 kg/sq. m), **as directed**.
 - c. Resin Type: Polyester **OR** Vinylester, **as directed**.
 - 1) Flame-Spread Index: 25 or less when tested according to ASTM E 84.
 - 2) U.S.D.A. Acceptance: Accepted for food processing applications.
 - d. Color: Beige **OR** Gray **OR** Green **OR** Orange **OR** Yellow **OR** Manufacturer's standard, **as directed**.
 - e. Traffic Surface: Plain, grooved **OR** Applied abrasive finish **OR** As indicated, **as directed**.
3. Fabricate cutouts in grating sections for penetrations indicated. Arrange cutouts to permit grating removal without disturbing items penetrating gratings.

K. Grating Frames And Supports

1. Frames and Supports for Metal Gratings: Fabricate from metal shapes, plates, and bars of welded construction to sizes, shapes, and profiles indicated and as necessary to receive gratings. Miter and weld connections for perimeter angle frames. Cut, drill, and tap units to receive hardware and similar items.
 - a. Unless otherwise indicated, fabricate from same basic metal as gratings.
 - b. Equip units indicated to be cast into concrete or built into masonry with integrally welded anchors. Unless otherwise indicated, space anchors 24 inches (600 mm) o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inches (32 mm) wide by 1/4 inch (6 mm) thick by 8 inches (200 mm) long.
2. Frames and Supports for Glass-Fiber-Reinforced Plastic Gratings: Fabricate from glass-fiber-reinforced plastic shapes of sizes, shapes, and profiles indicated and as necessary to receive gratings. Miter connections for perimeter angle frames. Cut, drill, and tap units to receive hardware and similar items.
 - a. Unless otherwise indicated, use shapes made from same resin as gratings.
 - b. Equip units indicated to be cast into concrete or built into masonry with integral anchors.
3. Galvanize steel frames and supports in the following locations:
 - a. Exterior.
 - b. Interior, where indicated.

L. Aluminum Finishes

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
2. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

M. Steel Finishes

1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Finish gratings, frames, and supports after assembly.
3. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.



- a. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
4. Shop prime gratings, frames and supports not indicated to be galvanized unless otherwise indicated.
 - a. Shop prime with universal shop primer **OR** primers specified in Division 07, **as directed**, unless zinc-rich primer is **OR** primers specified in Division 09 Section "High-performance Coatings" are, **as directed**, indicated.
5. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning" **OR** SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning" **OR** requirements indicated below, **as directed**:
 - a. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - b. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - c. Items Indicated to Receive Primers Specified in Division 9 Section "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - d. Other Items: SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
6. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1.3 EXECUTION

A. Installation, General

1. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing gratings to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
2. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing gratings. Set units accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
3. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or masonry.
4. Fit exposed connections accurately together to form hairline joints.
 - a. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
5. Attach toeplates to gratings by welding at locations indicated.
6. Field Welding: Comply with the following requirements:
 - a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - b. Obtain fusion without undercut or overlap.
 - c. Remove welding flux immediately.
7. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Installing Metal Bar Gratings

1. General: Install gratings to comply with recommendations of referenced metal bar grating standards that apply to grating types and bar sizes indicated, including installation clearances and standard anchoring details.
2. Attach removable units to supporting members with type and size of clips and fasteners indicated or, if not indicated, as recommended by grating manufacturer for type of installation conditions shown.
3. Attach nonremovable units to supporting members by welding where both materials are same; otherwise, fasten by bolting as indicated above.



- C. Installing Expanded-Metal Gratings
1. General: Comply with manufacturer's written instructions for installing gratings.
 2. Place units with straight edge of bond up and with long direction of diamond-shaped openings parallel to direction of span.
 3. Attach removable units to supporting members by bolting at 6-inch (150-mm) intervals.
 4. Attach nonremovable units to supporting members by welding unless otherwise indicated. Space welds at 6-inch (150-mm) intervals.
 5. Attach aluminum units to steel supporting members by bolting at 6-inch (150-mm) intervals.
 6. Butt edges parallel to long direction of diamond-shaped openings and weld at every second bond point. Place individual grating sections so diamonds of one piece are aligned with those of adjacent sections.
- D. Installing Metal Plank Gratings
1. General: Comply with manufacturer's written instructions for installing gratings. Use manufacturer's standard anchor clips and hold-down devices for bolted connections.
 2. Attach removable units to supporting members by bolting at every point of contact.
 3. Attach nonremovable units to supporting members by welding unless otherwise indicated. Comply with manufacturer's written instructions for size and spacing of welds.
 4. Attach aluminum units to steel supporting members by bolting at side channels at every point of contact and by bolting intermediate planks at each end on alternate sides. Bolt adjacent planks together at midspan.
- E. Installing Glass-Fiber-Reinforced Plastic Gratings
1. Comply with manufacturer's written instructions for installing gratings. Use manufacturer's standard stainless-steel anchor clips and hold-down devices for bolted connections.
- F. Adjusting And Cleaning
1. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.
 - a. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

OR

Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 07.
 2. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05 53 13 00



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Task	Specification	Specification Description
05 53 13 00	01 22 16 00	No Specification Required
05 53 13 00	05 50 00 00	Metal Fabrications
05 54 00 00	05 50 00 00	Metal Fabrications
05 55 13 00	05 50 00 00	Metal Fabrications
05 55 13 00	05 51 13 00	Metal Stairs
05 55 13 00	05 51 13 00a	Fabricated Spiral Stairs
05 55 16 00	05 50 00 00	Metal Fabrications
05 55 16 00	05 51 13 00	Metal Stairs
05 55 16 00	05 51 13 00a	Fabricated Spiral Stairs
05 56 00 00	05 50 00 00	Metal Fabrications



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SECTION 05 58 16 00 - ORNAMENTAL METAL

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for ornamental metal. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Decorative window security bars.
 - b. Decorative mechanical grilles and frames.
 - c. Decorative-metal-clad, hollow-metal doors and frames.
 - d. Custom door pulls.
 - e. Combination hall push-button stations.
 - f. Metal reveals at wood paneling.
 - g. Cast-metal rosettes at marble joints.

C. Submittals

1. Product Data: For each type of product indicated, including finishing materials.
2. LEED Submittals:
 - a. Product Data for Credit MR 4.1 and Credit MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.
3. Shop Drawings: Show fabrication and installation details for decorative metal.
 - a. Include plans, elevations, component details, and attachments to other work.
 - b. Indicate materials and profiles of each decorative metal member, fittings, joinery, finishes, fasteners, anchorages, and accessory items.
4. Patterns, Models, or Plaster Castings: Made from proposed patterns for each design of custom casting required.
5. Samples: For each type of exposed finish required.
 - a. Sections of linear shapes.
 - b. Full-size Samples of castings and forgings.
 - 1) For custom castings, submit finished Samples showing ability to reproduce detail, cast-metal color, and quality of finish. Samples may be of similar previous work.
 - c. Samples of welded and brazed joints showing quality of workmanship and color matching of materials.
6. Qualification Data: For qualified fabricator **OR** organic-coating applicator **OR** anodic finisher **OR** powder-coating applicator, **as directed**.
7. Mill Certificates: Signed by manufacturers of stainless-steel certifying that products furnished comply with requirements.
8. Welding certificates.

D. Quality Assurance

1. Fabricator Qualifications: A firm experienced in producing decorative metal similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
2. Installer Qualifications: Fabricator of products.



3. Organic-Coating Applicator Qualifications: A firm experienced in successfully applying organic coatings, of type indicated, to aluminum extrusions and employing competent control personnel to conduct continuing, effective quality-control program to ensure compliance with requirements.
4. Anodic Finisher Qualifications: A firm experienced in successfully applying anodic finishes of type indicated and employing competent control personnel to conduct continuing, effective quality-control program to ensure compliance with requirements.
5. Powder-Coating Applicator Qualifications: A firm experienced in successfully applying powder coatings of type indicated and employing competent control personnel to conduct continuing, effective quality-control program to ensure compliance with requirements.
6. Welding Qualifications: Qualify procedures and personnel according to the following:
 - a. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - b. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 - c. AWS D1.3, "Structural Welding Code - Sheet Steel."
 - d. AWS D1.6, "Structural Welding Code - Stainless Steel."
7. Preinstallation Conference: Conduct conference at Project site.

E. Delivery, Storage, And Handling

1. Store decorative metal in a well-ventilated area, away from uncured concrete and masonry, and protected from weather, moisture, soiling, abrasion, extreme temperatures, and humidity.
2. Deliver and store cast-metal products in wooden crates surrounded by sufficient packing material to ensure that products will not be cracked or otherwise damaged.

F. Project Conditions

1. Field Measurements: Verify actual locations of walls and other construction contiguous with decorative metal by field measurements before fabrication and indicate measurements on Shop Drawings.

G. Coordination

1. Coordinate installation of anchorages for decorative metal items. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.2 PRODUCTS

A. Metals, General

1. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. Provide materials without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Aluminum

1. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with strength and durability properties for each aluminum form required not less than that of alloy and temper designated below.
 - a. Extruded Bars and Shapes: ASTM B 221 (ASTM B 221M), Alloy 6063-T5/T52.
 - b. Extruded Structural Pipe and Round Tubing: ASTM B 429/B 429M, Alloy 6063-T6.
 - c. Drawn Seamless Tubing: ASTM B 210 (ASTM B 210M) or ASTM B 483/B 483M, Alloy 6063-T832.
 - d. Plate and Sheet: ASTM B 209 (ASTM B 209M), Alloy 3003-H14 **OR** Alloy 5005-H32 **OR** Alloy 6061-T6, **as directed**.
 - e. Die and Hand Forgings: ASTM B 247 (ASTM B 247M), Alloy 6061-T6.
 - f. Castings: ASTM B 26/B 26M, Alloy A356.0-T6.

C. Copper Alloys



1. Copper and Copper Alloys, General: Provide alloys indicated and temper to suit application and forming methods but with strength and stiffness not less than H01 (quarter-hard) for plate, sheet, strip, and bars and H55 (light-drawn) for tube and pipe.
 2. Extruded Shapes, Bronze: ASTM B 455, Alloy UNS No. C38500 (architectural bronze).
 3. Extruded Shapes, Brass: ASTM B 249/B 249M, Alloy UNS No. C36000 (free-cutting brass).
 4. Extruded Shapes, Nickel Silver: ASTM B 249/B 249M, Alloy UNS No. C79600.
 5. Seamless Pipe, Bronze: ASTM B 43, Alloy UNS No. C23000 (red brass, 85 percent copper).
 6. Seamless Tube, Bronze: ASTM B 135 (ASTM B 135M), Alloy UNS No. C23000 (red brass, 85 percent copper).
 7. Seamless Tube, Brass: ASTM B 135 (ASTM B 135M), Alloy UNS No. C26000 (cartridge brass, 70 percent copper).
 8. Seamless Tube, Copper: ASTM B 75 (ASTM B 75M), Alloy UNS No. C12200 (phosphorous deoxidized, high residual phosphorous copper).
 9. Castings, Bronze: ASTM B 62, Alloy UNS No. C83600 (85-5-5-5 or No. 1 composition commercial red brass) or ASTM B 584, Alloy UNS No. C86500 (No. 1 manganese bronze).
 10. Castings, Brass: ASTM B 584, Alloy UNS No. C85200 (high-copper yellow brass).
 11. Castings, Copper: ASTM B 824, with a minimum of 99.9 percent copper.
 12. Castings, Nickel Silver: ASTM B 584, Alloy UNS No. C97300 (12 percent leaded nickel silver).
 13. Plate, Sheet, Strip, and Bars; Bronze: ASTM B 36/B 36M, Alloy UNS No. C28000 (muntz metal, 60 percent copper).
 14. Plate, Sheet, Strip, and Bars; Brass: ASTM B 36/B 36M, Alloy UNS No. C26000 (cartridge brass, 70 percent copper).
 15. Plate, Sheet, Strip, and Bars; Copper: ASTM B 152/B 152M, Alloy UNS No. C11000 (electrolytic tough pitch copper) or UNS No. C12200 (phosphorous deoxidized, high-residual phosphorous copper).
- D. Stainless Steel
1. Tubing: ASTM A 554, Grade MT 304 **OR** Grade MT 316 **OR** Grade MT 316L, **as directed**.
 2. Pipe: ASTM A 312/A 312M, Grade TP 304 **OR** Grade TP 316 **OR** Grade TP 316L, **as directed**.
 3. Castings: ASTM A 743/A 743M, Grade CF 8 or CF 20 **OR** Grade CF 8M or CF 3M, **as directed**.
 4. Sheet, Strip, Plate, and Flat Bar: ASTM A 666, Type 304 **OR** Type 316 **OR** Type 316L, **as directed**.
 5. Bars and Shapes: ASTM A 276, Type 304 **OR** Type 316 **OR** Type 316L, **as directed**.
 6. Wire Rope and Fittings:
 - a. Wire Rope: 1-by-19 **OR** 7-by-7 **OR** 7-by-19, **as directed**, wire rope made from wire complying with ASTM A 492, Type 316.
 - b. Wire-Rope Fittings: Connectors of types indicated, fabricated from stainless steel, and with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.
- E. Steel And Iron
1. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
 2. Tubing: ASTM A 500 (cold formed) or ASTM A 513, Type 5 (mandrel drawn).
 3. Bars: Hot-rolled, carbon steel complying with ASTM A 29/A 29M, Grade 1010.
 4. Plates, Shapes, and Bars: ASTM A 36/A 36M.
 5. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M unless otherwise indicated.
 6. Steel Sheet, Cold Rolled: ASTM A 1008/A 1008M, either commercial steel or structural steel, exposed.
- F. Titanium
1. Titanium Strip, Sheet, and Plate: ASTM B 265, Grade 1.
 2. Titanium Bars: ASTM B 348, Grade 1.



G. Fasteners

1. Fastener Materials: Unless otherwise indicated, provide the following:
 - a. Aluminum Items: Aluminum **OR** Type 304 stainless-steel **OR** Type 316 stainless-steel, **as directed**, fasteners.
 - b. Copper-Alloy (Bronze) Items: Silicon bronze (Alloy 651 or Alloy 655) fasteners where concealed, muntz metal (Alloy 280) fasteners where exposed.
 - c. Copper-Alloy (Brass) Items: Silicon bronze (Alloy 651 or Alloy 655) fasteners where concealed, brass (Alloy 260 or 360) fasteners where exposed.
 - d. Stainless-Steel Items: Type 304 **OR** Type 316, **as directed**, stainless-steel fasteners.
 - e. Titanium Items: Type 304 **OR** Type 316, **as directed**, stainless-steel fasteners.
 - f. Uncoated-Steel Items: Plated steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating where concealed, Type 304 stainless-steel fasteners where exposed.
 - g. Galvanized-Steel Items: Plated steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.
 - h. Dissimilar Metals: Type 304 **OR** Type 316, **as directed**, stainless-steel fasteners.
2. Fasteners for Anchoring to Other Construction: Unless otherwise indicated, select fasteners of type, grade, and class required to produce connections suitable for anchoring indicated items to other types of construction indicated.
3. Provide concealed fasteners for interconnecting components and for attaching decorative metal items to other work unless otherwise indicated **OR** exposed fasteners are unavoidable, **as directed**.
 - a. Provide Phillips **OR** tamper-resistant **OR** square or hex socket, **as directed**, flat-head machine screws for exposed fasteners unless otherwise indicated.
4. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
5. Post-Installed Anchors: Torque-controlled expansion type or chemical type.
 - a. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5 unless otherwise indicated.
 - b. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) **OR** Group 2 (A4), **as directed**, stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

H. Miscellaneous Materials

1. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
 - a. For aluminum, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.
2. Brazing Rods: For copper alloys, provide type and alloy as recommended by producer of metal to be brazed and as required for color match, strength, and compatibility in fabricated items.
3. Etching Cleaner for Galvanized Metal: Complying with MPI#25.
4. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
5. Lacquer for Copper Alloys: Clear, acrylic lacquer specially developed for coating copper-alloy products.
6. Shop Primers: Provide primers that comply with Division 07 **OR** Division 09 Section(s) "High-performance Coatings", **as directed**.
7. Universal Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - a. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
8. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.



9. Shop Primer for Galvanized Steel: Cementitious galvanized metal primer complying with MPI#26 **OR** Vinyl wash primer complying with MPI#80 **OR** Water-based galvanized metal primer complying with MPI#134, **as directed**.
 10. Intermediate Coats and Topcoats for Steel: Provide products that comply with Division 07 **OR** Division 09 Section(s) "High-performance Coatings" **OR** Division 07 **AND** Division 09 Section(s) "High-performance Coatings", **as directed**.
 11. Epoxy Intermediate Coat for Steel: Complying with MPI#77 and compatible with primer and topcoat.
 12. Polyurethane Topcoat for Steel: Complying with MPI#72 and compatible with undercoat.
 13. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- I. Fabrication, General
1. Assemble items in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
 2. Make up wire-rope assemblies in the shop to field-measured dimensions with fittings machine swaged. Minimize amount of turnbuckle take-up used for dimensional adjustment so maximum amount is available for tensioning wire ropes. Tag wire-rope assemblies and fittings to identify installation locations and orientations for coordinated installation.
 3. Form decorative metal to required shapes and sizes, true to line and level with true curves and accurate angles and surfaces. Finish exposed surfaces to smooth, sharp, well-defined lines and arris.
 4. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing the Work.
 5. Form simple and compound curves in bars, pipe, tubing, and extruded shapes by bending members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces.
 6. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
 7. Mill joints to a tight, hairline fit. Cope or miter corner joints. Fabricate connections that will be exposed to weather in a manner to exclude water.
 8. Provide weep holes where water may accumulate. Locate weep holes in inconspicuous locations.
 9. Provide necessary rebates, lugs, and brackets to assemble units and to attach to other work. Cut, reinforce, drill, and tap as needed to receive finish hardware, screws, and similar items unless otherwise indicated.
 10. Comply with AWS for recommended practices in shop welding and brazing. Weld and braze behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed joints of flux, and dress exposed and contact surfaces.
 - a. Where welding and brazing cannot be concealed behind finished surfaces, finish joints to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 Welds: no evidence of a welded joint **OR** Type 2 Welds: completely sanded joint, some undercutting and pinholes okay **OR** Type 3 Welds: partially dressed weld with spatter removed **OR** Type 4 Welds: good quality, uniform undressed weld with minimal splatter, **as directed**.
 11. Provide castings that are sound and free of warp, cracks, blowholes, or other defects that impair strength or appearance. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks.
- J. Decorative Window Security Bars
1. General: Fabricate decorative window grilles to designs indicated from steel bars and shapes of sizes and profiles indicated. Form steel bars by bending, forging, coping, mitering, and welding.
 2. Welding: Interconnect grille members with full-length, full-penetration welds unless otherwise indicated. Use welding method that is appropriate for metal and finish indicated and that



develops full strength of members joined. Finish exposed welds and surfaces smooth, flush, and blended to match adjoining surfaces.

3. Brackets, Fittings, and Anchors: Provide wall brackets, fittings, and anchors to connect decorative window grilles to other work unless otherwise indicated.
 - a. Furnish inserts and other anchorage devices to connect decorative window grilles to concrete and masonry work. Coordinate anchorage devices with supporting structure.
 - b. Fabricate anchorage devices that are capable of withstanding loads indicated.

K. Decorative Mechanical Grilles

1. Fabricate decorative grilles from perforated aluminum **OR** brass **OR** bronze **OR** stainless-steel **OR** steel, **as directed**, sheet or plate of thickness, size, and pattern indicated. Form perforations by punching, cutting, or drilling to produce openings of sizes and shapes indicated. Roll, press, and grind perforated metal to flatten and to remove burrs and deformations.
 - a. Form perforations to match existing grilles.
OR
Drawings indicate perforated metal patterns required and are based on products of one manufacturer. Perforated metal patterns produced by other manufacturers may be considered, provided deviations are minor and do not change design concept as judged solely by the Owner.
2. Drill and countersink grilles for mounting screws at 2 inches (50 mm) from corners and at 10 inches (250 mm) or less o.c. Provide units with oval-head wood **OR** self-tapping machine, **as directed**, screws.
3. Fabricate grille frames from extruded aluminum **OR** brass **OR** bronze, **as directed**, of profiles, and to sizes and shapes indicated. Miter frame members at corners and connect with concealed splice plates welded **OR** brazed, **as directed**, to back of frames.
 - a. Secure grilles in frames with 0.5-inch- (12-mm-) long welds **OR** brazing, **as directed**, along perimeter of grilles at 4 inches (100 mm) o.c.
 - b. Provide frame profiles to match existing frames.
OR
Drawings indicate frame profiles required and are based on products of one manufacturer. Similar frame profiles produced by other manufacturers may be considered, provided deviations are minor and do not change design concept as judged solely by the Owner.
4. Drill and countersink frames for mounting screws at 4 inches (100 mm) from corners and at 16 inches (400 mm) or less o.c. Provide units with oval-head wood **OR** self-tapping machine, **as directed**, screws.

L. Decorative-Metal-Clad Doors And Frames

1. Laminate 0.0403-inch- (1.0-mm-) thick, muntz-metal **OR** 0.0403-inch- (1.0-mm-) thick, brass **OR** 0.0375-inch- (0.95-mm-) thick, stainless-steel **OR** 0.024-inch- (0.6-mm-) thick, titanium, **as directed**, sheets to outside face of hollow-metal doors and frames at locations and to comply with details indicated. Use adhesive recommended by metal fabricator that will fully bond metal to metal and that will prevent telegraphing and oil canning.
 - a. Hollow-metal doors and frames are specified in Division 8 Section "Steel Doors and Frames."

M. Custom Door Pulls

1. Fabricate custom door pulls from brass **OR** bronze **OR** stainless-steel, **as directed**, bar stock of profile indicated, fabricated to shapes indicated. Form curves by bending to produce uniform curvature of radii indicated; maintain profile of member throughout entire bend without buckling, twisting, or otherwise deforming exposed surfaces. Where radii of bends are too small to avoid buckling, grind bars after bending to restore original profile. Drill and tap door pulls to receive through bolts for attachment to doors.
2. Fabricate backing plates for custom door pulls from 1/8-inch (3.2-mm) brass **OR** bronze **OR** stainless-steel, **as directed**, sheet. Cut to shape indicated and bevel edges at a 45-degree angle for one-half thickness of metal. Drill and countersink holes where indicated for screws and bolts.



3. Provide units with oval-head through bolts for mounting pulls and with oval-head wood screws for mounting backing plates.
- N. Combination Hall Push-Button Stations
1. Fabricate units of brass **OR** bronze **OR** stainless steel, **as directed**, to comply with details indicated. Coordinate with requirements in Division 14 Section "Electric Traction Elevators" to provide integrated, closely fitted assemblies.
 - a. Fabricate faceplates from 1/8-inch- (3.2-mm-) thick sheet with edges beveled at a 45-degree angle for one-half thickness of metal.
 - b. Provide units with rectangular, split-bowl trash receptacle, designed for recess mounting in nominal 4-inch (100-mm) wall depth. Fabricate recessed cabinets, top rings, and split bowls of same metal as face of units; fabricate removable receptacles of drawn aluminum. Nominal dimensions of units are 10 by 10 by 3-1/2 inches (250 by 250 by 90 mm) in depth.
 - c. Provide units with emergency pictorial signs and text, complying with requirements of authorities having jurisdiction, indicating that in fire emergency, elevators should not be used and that stairways should be used instead. Engrave pictorial sign and text into front surface of faceplates to a depth of 1/16 inch (1.6 mm) with engraving painted red. Make signs 5 inches (125 mm) wide by 8 inches (200 mm) high.
 - d. Provide cutouts in faceplates of units for push buttons of elevator hall push-button station, card reader, **as directed**, and elevator key switches. Coordinate locations and sizes of cutouts so additional faceplate is not required and so faces of push buttons are flush with fronts of faceplates and key switches project beyond faceplate only by depth of bezel.
- O. Metal Reveals
1. Fabricate metal reveals for wood paneling from 3/4-by-3/4-by-1/16-inch (19-by-19-by-3-mm) extruded-bronze **OR** 3/4-by-3/4-by-0.025-inch (19-by-19-by-0.6-mm) brake-formed, stainless-steel **OR** 3/4-by-3/4-by-0.015-inch (19-by-19-by-0.4-mm) brake-formed titanium, **as directed**, channels. Drill for mounting screws 6 inches (150 mm) from ends of channels and not more than 24 inches (600 mm) o.c. Locate mounting screws at same heights for all channels. Provide black-finished, **as directed**, hex-socket, wafer-head screws for mounting reveals.
- P. Cast-Metal Rosettes
1. Fabricate cast-metal rosettes to design indicated from aluminum **OR** brass **OR** bronze **OR** nickel silver, **as directed**. Drill and tap castings for threaded mounting studs.
 - a. Provide custom castings to match design indicated.
 - b. Manufacturer's stock castings may be considered, provided deviations are minor and do not change design concept as judged solely by the Owner.
 - c. Drawings indicate cast-metal rosette designs required and are based on products of one manufacturer. Castings produced by other manufacturers may be considered, provided deviations are minor and do not change design concept as judged solely by the Owner.
- Q. Finishes, General
1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 2. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- R. Aluminum Finishes
1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
 2. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm **OR** AA-M12C22A31, Class II, 0.010 mm, **as directed**, or thicker.
 3. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm **OR** AA-M12C22A32/A34, Class II, 0.010 mm, **as directed**, or thicker.



- a. Color: Champagne **OR** Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black **OR** As selected from full range of industry colors and color densities, **as directed**.
4. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
5. Siliconized Polyester Finish: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
 - a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
6. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2604 **OR** AAMA 2605, **as directed**, and containing not less than 50 **OR** 70, **as directed**, percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

OR

High-Performance Organic Finish: Three **OR** Four, **as directed**, -coat fluoropolymer finish complying with AAMA 2605 and containing not less than 50 **OR** 70, **as directed**, percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

- b. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

S. Copper-Alloy Finishes

1. Finish designations for copper alloys comply with the system established for designating copper-alloy finish systems defined in NAAMM's "Metal Finishes Manual for Architectural and Metal Products."
2. Buffed Finish: M21 (Mechanical Finish: buffed, smooth specular).
3. Hand-Rubbed Finish: M31-M34 (Mechanical Finish: directionally textured, fine satin; Mechanical Finish: directionally textured, hand rubbed).
4. Medium-Satin Finish: M32 (Mechanical Finish: directionally textured, medium satin).
5. Fine-Matte Finish: M42 (Mechanical Finish: nondirectional finish, fine matte).
6. Buffed Finish, Lacquered: M21-O6x (Mechanical Finish: buffed, smooth specular; Coating: clear organic, air drying, as specified below):
 - a. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).
7. Hand-Rubbed Finish, Lacquered: M31-M34-O6x (Mechanical Finish: directionally textured, fine satin; Mechanical Finish: directionally textured, hand rubbed; Coating: clear organic, air drying, as specified below):
 - a. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).
8. Medium-Satin Finish, Lacquered: M32-O6x (Mechanical Finish: directionally textured, medium satin; Coating: clear organic, air drying, as specified below):
 - a. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).
9. Fine-Matte Finish, Lacquered: M42-O6x (Mechanical Finish: nondirectional finish, fine matte; Coating: clear organic, air drying, as specified below):



- a. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).
 10. Statuary Conversion Coating over Satin Finish: M31-C55 (Mechanical Finish: directionally textured, fine satin; Chemical Finish: conversion coating, sulfide), with color matching the Owner's sample.
 11. Patina Conversion Coating: M36-C12-C52 (Mechanical Finish: directionally textured, uniform; Chemical Finish: nonetched cleaned, degreased; Chemical Finish: conversion coating, ammonium sulfate), with color matching the Owner's sample.
 12. Statuary Conversion Coating, Bright Relieved and Lacquered: M12-C55-M2x-O6x (Mechanical Finish: matte finish, as cast; Chemical Finish: conversion coating, sulfide; Mechanical Finish: buffed, as specified; Coating: clear, organic, air drying, as specified below), with color matching the Owner's sample:
 - a. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).
 13. Blackened, Bright Relieved, and Lacquered: M33-O60-M2x-O6x (Mechanical Finish: directionally textured, coarse satin; Coating: black, air drying; Mechanical Finish: buffed, as specified; Coating: clear, organic, air drying, as specified below), with blackening and buffing matching the Owner's sample:
 - a. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).
- T. Stainless-Steel Finishes
1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
 2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - a. Run grain of directional finishes with long dimension of each piece.
 3. Bright, Cold-Rolled, Unpolished Finish: No. 2B.
 4. Directional Satin Finish: No. 4.
 5. Dull Satin Finish: No. 6.
 6. Reflective, Directional Polish: No. 7.
 7. Mirrorlike Reflective, Nondirectional Polish: No. 8.
 8. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 9. Sputter-Coated Finish: Titanium nitride coating deposited by magnetic sputter-coating process over indicated mechanical finish.
 10. Colored, Oxide-Film Finish: Clear, oxide interference film produced by degreasing and then immersing in a mixture of chromic and sulfuric acids.
 - a. Product: Subject to compliance with requirements, provide INCO colored stainless-steel finish as developed and licensed by International Nickel Co., Ltd.
 - b. Color: Match the Owner's sample **OR** As selected from finisher's full range, **as directed**.
- U. Steel And Iron Finishes
1. Galvanizing: Hot-dip galvanize products made from rolled, pressed, and forged steel shapes, castings, plates, bars, and strips indicated to be galvanized to comply with ASTM A 123/A 123M.
 - a. Hot-dip galvanize steel and iron hardware indicated to be galvanized to comply with ASTM A 153/A 153M.
 - b. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
 - c. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
 2. Preparing Galvanized Items for Shop Priming: After galvanizing, thoroughly clean decorative metal of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.



3. Preparing Nongalvanized Items for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning" **OR** SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning" **OR** requirements indicated below, **as directed**:
 - a. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - b. Interiors (SSPC Zone 1A): SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
4. Primer Application: Apply shop primer to prepared surfaces of items unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
 - a. Shop prime uncoated ferrous-metal surfaces with universal shop primer **OR** primers specified in Division 07, **as directed**, unless zinc-rich primer is **OR** primers specified in Division 09 Section "High-performance Coatings" are, **as directed**, indicated.
 - b. Do not apply primer to galvanized surfaces.
5. Shop-Painted Finish: Comply with Division 09 Section(s) "Exterior Painting" **OR** "High-performance Coatings", **as directed**.
 - a. Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
6. High-Performance Coating: Apply epoxy intermediate and polyurethane topcoats to prime-coated surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Apply at spreading rates recommended by coating manufacturer.
 - a. Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
7. Powder-Coat Finish: Prepare, treat, and coat nongalvanized ferrous metal to comply with resin manufacturer's written instructions and as follows:
 - a. Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - b. Treat prepared metal with iron-phosphate pretreatment, rinse, and seal surfaces.
 - c. Apply thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils (0.04 mm).
 - d. Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
8. Powder-Coat Finish: Prepare, treat, and coat galvanized metal to comply with resin manufacturer's written instructions and as follows:
 - a. Prepare galvanized metal by thoroughly removing grease, dirt, oil, flux, and other foreign matter.
 - b. Treat prepared metal with zinc-phosphate pretreatment, rinse, and seal surfaces.
 - c. Apply thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils (0.04 mm).
 - d. Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

V. Titanium Finishes

1. General: Fabricate items from finished titanium stock, taking care not to damage finish during fabrication. Protect finish as needed during fabrication by applying a strippable, temporary protective covering.
2. Dull Matte Finish: Pickled and annealed.
3. Bright Matte Finish: Vacuum annealed.

1.3 EXECUTION

A. Examination

1. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of decorative metal.



2. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Installation, General
1. Provide anchorage devices and fasteners where needed to secure decorative metal to in-place construction.
 2. Perform cutting, drilling, and fitting required to install decorative metal. Set products accurately in location, alignment, and elevation, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items to be built into concrete, masonry, or similar construction.
 3. Fit exposed connections accurately together to form tight, hairline joints or, where indicated, uniform reveals and spaces for sealants and joint fillers. Where cutting, welding, and grinding are required for proper shop fitting and jointing of decorative metal, restore finishes to eliminate evidence of such corrective work.
 4. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.
 5. Install concealed gaskets, joint fillers, insulation, and flashings as work progresses.
 6. Restore protective coverings that have been damaged during shipment or installation. Remove protective coverings only when there is no possibility of damage from other work yet to be performed at same location.
 - a. Retain protective coverings intact; remove coverings simultaneously from similarly finished items to preclude nonuniform oxidation and discoloration.
 7. Field Welding: Comply with applicable AWS specification for procedures of manual shielded metal arc welding and requirements for welding and for finishing welded connections in "Fabrication, General" Article. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
 8. Field Brazing: Comply with requirements for brazing and for finishing brazed connections in "Fabrication, General" Article. Braze connections that are not to be left as exposed joints but cannot be shop brazed because of shipping size limitations.
 9. Corrosion Protection: Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- C. Installing Decorative Window Security Bars
1. Fasten security bar frames to concrete and masonry walls with cast-in-place or postinstalled anchors. Peen exposed threads of anchors to prevent removal of security bars.
- D. Installing Decorative Mechanical Grilles
1. Mount decorative grilles at heights and in positions indicated, adjusting ductwork to be centered on grilles if any.
 - a. Secure to framing and blocking with specified fasteners.
 - b. On marble, brick, and other solid surfaces, secure with wood screws in lead plugs.
- E. Installing Decorative-Metal-Clad, Hollow-Metal Doors And Frames
1. Install doors and frames to comply with requirements specified in Division 08 Section "Hollow Metal Doors And Frames".
- F. Installing Custom Door Pulls
1. Install door pulls at heights and locations shown. Install with backing plates on both sides of doors. Fasten backing plates to doors with oval-head wood **OR** self-tapping metal, **as directed**, screws and secure pulls through doors and backing plates with oval-head machine screws.
- G. Installing Combination Hall Push-Button Stations
1. Coordinate installation of combination hall push-button stations with installation of related elevator signal equipment components specified in Division 14 Section "Electric Traction Elevators". Secure units in place with faceplate overlapping surrounding wall finish and drawn into contact with surrounding wall finish at entire perimeter of faceplate.



- H. Installing Metal Reveals At Wood Paneling
1. Install metal reveals between wood panels as paneling is installed. Secure to wood grounds with specified screws.
- I. Installing Cast-Metal Rosettes At Marble Joints
1. Install cast-metal rosettes at intersections of marble joints where indicated. Install only after marble work is complete and joints are grouted. Secure to wall by drilling a 3/4-inch- (19-mm-) round hole at intersection of marble joints and by filling hole with molding plaster into which threaded stud is embedded. Angle drill and rotate so bottom of hole is larger than at surface.
 - a. Secure rosettes in place with masking tape until plaster sets. After plaster has set, remove masking tape and adhesive residue.
- J. Cleaning And Protection
1. Unless otherwise indicated, clean metals by washing thoroughly with clean water and soap, rinsing with clean water, and drying with soft cloths.
 2. Clean copper alloys according to metal finisher's written instructions in a manner that leaves an undamaged and uniform finish matching approved Sample.
 3. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - a. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

OR

Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 07 OR Division 09 Section(s) "High-performance Coatings" **OR** Division 07 AND Division 09 Section(s) "High-performance Coatings", **as directed**.
 4. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.
 5. Protect finishes of decorative metal from damage during construction period with temporary protective coverings approved by decorative metal fabricator. Remove protective covering at time of Final Completion.
 6. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 05 58 16 00



SECTION 05 58 16 00a - ORNAMENTAL FORMED METAL

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for ornamental formed metal. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Beam wraps.
 - b. Closures and trim.
 - c. Column covers.
 - d. Decorative-metal-clad, hollow-metal doors and frames.
 - e. Elevator cab and entrance finishes.
 - f. Escalator enclosures.
 - g. Filler panels at demountable partitions and/or between dissimilar construction.
 - h. Heating-cooling unit enclosures.
 - i. Lighting coves.
 - j. Metal base.
 - k. Mullion cladding.
 - l. Pipe system covers.
 - m. Pockets for window treatment.
 - n. Window stools.
 - o. Exterior fins.
 - p. Exterior formed-metal-shaped panels.
 - q. Exterior sunshades.
 - r. Exterior trellises.
 - s. Exterior window covers.
 - t. Metal shapes as part of roof construction.

C. Performance Requirements

1. Delegated Design: Design exterior decorative formed metal items, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2. Structural Performance: Decorative formed metal items, including anchors and connections, shall withstand the effects of gravity loads and the following loads and stresses without exceeding the allowable design working stress of materials involved and without exhibiting permanent deformation in any components:
 - a. Wind Loads on Exterior Items: As indicated on Drawings **OR** 20 lbf/sq. ft. (957 Pa) **OR** 30 lbf/sq. ft. (1436 Pa) **OR** As required to meet local Project requirements.
 - b. Live Loads on Heating-Cooling Unit Enclosures: 100 lbf/sq. ft. (4.8 kN/sq. m) or a concentrated load of 300 lbf (1.3 kN) on an area of 4 sq. in. (26 sq. cm), whichever produces the greater stress.
3. Seismic Performance: Exterior decorative formed metal items, including anchors and connections, shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - a. Component Importance Factor is 1.0.
4. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.



- a. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
5. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

D. Submittals

1. Product Data: For each type of product indicated. Include finishing materials.
2. LEED Submittals:
 - a. Product Data for Credit MR 4.1 and Credit MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.
 - b. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.
3. Shop Drawings: Show fabrication and installation details for decorative formed metal.
 - a. Include plans, elevations, component details, and attachments to other work.
 - b. Indicate materials and profiles of each decorative formed metal member, fittings, joinery, finishes, fasteners, anchorages, and accessory items.
4. Samples: For each type of exposed finish required, prepared on 6-inch- (150-mm-) square Samples of metal of same thickness and material indicated for the Work.
5. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
6. Coordination Drawings: For decorative formed metal elements that house items specified in other Sections. Show dimensions of housed items, including locations of housing penetrations and attachments, and necessary clearances.
7. Qualification Data: For qualified Installer, fabricator, organic-coating applicator, anodic finisher, powder-coating applicator and professional engineer.
8. Mill Certificates: Signed by stainless-steel manufacturers certifying that products furnished comply with requirements.
9. Welding certificates.
10. Maintenance Data: For mirrorlike stainless-steel finish and statuary conversion coating copper-alloy finish to include in maintenance manuals.

E. Quality Assurance

1. Fabricator Qualifications: A firm experienced in producing decorative formed metal similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
2. Organic-Coating Applicator Qualifications: A firm experienced in successfully applying organic coatings of type indicated to metals of types indicated and that employs competent control personnel to conduct continuing, effective quality-control program to ensure compliance with requirements.
3. Anodic Finisher Qualifications: A firm experienced in successfully applying anodic finishes of type indicated and that employs competent control personnel to conduct continuing, effective quality-control program to ensure compliance with requirements.
4. Powder-Coating Applicator Qualifications: A firm experienced in successfully applying powder coatings of type indicated to metals of types indicated and that employs competent control personnel to conduct continuing, effective quality-control program to ensure compliance with requirements.
5. Installer Qualifications: Fabricator of products.
6. Welding Qualifications: Qualify procedures and personnel according to the following:
 - a. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - b. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 - c. AWS D1.3, "Structural Welding Code - Sheet Steel."
 - d. AWS D1.6, "Structural Welding Code - Stainless Steel."



7. Preinstallation Conference: Conduct conference at Project site.
- F. Delivery, Storage, And Handling
1. Deliver decorative formed metal products wrapped in protective coverings and strapped together in suitable packs or in heavy-duty cartons. Remove protective coverings before they stain or bond to finished surfaces.
 2. Store products on elevated platforms in a dry location.
- G. Project Conditions
1. Field Measurements: Verify actual locations of walls, columns, beams, and other construction contiguous with decorative formed metal by field measurements before fabrication and indicate measurements on Shop Drawings.
- H. Coordination
1. Coordinate installation of anchorages for decorative formed metal items. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
 2. Coordinate installation of decorative formed metal with adjacent construction to ensure that wall assemblies, flashings, trim, and joint sealants, are protected against damage from the effects of weather, age, corrosion, and other causes.

1.2 PRODUCTS

- A. Sheet Metal
1. General: Provide sheet metal without pitting, seam marks, roller marks, stains, discolorations, or other imperfections where exposed to view on finished units.
 2. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
 3. Aluminum Sheet: Flat sheet complying with ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than strength and durability properties of Alloy 5005-H32.
 4. Galvanized-Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating, either commercial steel or forming steel.
 5. Steel Sheet: Uncoated, cold-rolled, ASTM A 1008/A 1008M, commercial steel, exposed or electrolytic zinc-coated, ASTM A 879/A 879M, with steel sheet substrate complying with ASTM A 1008/A 1008M, commercial steel, exposed.
 6. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304 **OR** Type 316, **as directed**, stretcher-leveled standard of flatness.
 7. Bronze Sheet: ASTM B 36/B 36M, Alloy UNS No. C28000 (muntz metal, 60 percent copper) or Alloy UNS No. C23000 (red brass, 85 percent copper).
 8. Brass Sheet: ASTM B 36/B 36M, Alloy UNS No. C26000 (cartridge brass, 70 percent copper).
 9. Copper Sheet: ASTM B 370, cold-rolled copper sheet, H00 temper.
 10. Titanium Sheet: ASTM B 265, Grade 1.
- B. Miscellaneous Materials
1. Gaskets: As required to seal joints in decorative formed metal and remain airtight **OR** weathertight, **as directed**; as recommended in writing by decorative formed metal manufacturer.
 - a. ASTM D 1056, Type 1, Class A, grade as recommended by gasket manufacturer to obtain seal for application indicated.
 - b. Closed-cell polyurethane foam, adhesive on two sides, release paper protected.
 2. Sealants, Exterior: ASTM C 920; elastomeric silicone **OR** polyurethane **OR** polysulfide, **as directed**, sealant; of type, grade, class, and use classifications required to seal joints in



- decorative formed metal and remain weathertight; and as recommended in writing by decorative formed metal manufacturer.
3. Sealants, Interior: Nonsag, paintable, nonstaining, latex sealant complying with ASTM C 834; of type and grade required to seal joints in decorative formed metal; and as recommended in writing by decorative formed metal manufacturer.
 - a. Use sealant that has a VOC content of not more than 250 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 4. Filler Metal and Electrodes: Provide type and alloy of filler metal and electrodes as recommended by producer of metal to be welded or brazed and as necessary for strength, corrosion resistance, and compatibility in fabricated items.
 - a. Use filler metals that will match the color of metal being joined and will not cause discoloration.
 5. Fasteners: Fabricated from same basic metal and alloy as fastened metal unless otherwise indicated. Do not use metals that are incompatible with materials joined.
 - a. Provide concealed fasteners for interconnecting decorative formed metal items and for attaching them to other work unless otherwise indicated **OR** exposed fasteners are unavoidable or are the standard fastening method, **as directed**.
 - b. Provide Phillips **OR** tamper-resistant **OR** square or hex socket, **as directed**, flat-head machine screws for exposed fasteners unless otherwise indicated.
 6. Structural Anchors: For applications indicated to comply with certain design loads, provide chemical or torque-controlled expansion anchors with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
 7. Nonstructural Anchors: For applications not indicated to comply with design loads, provide powder-actuated fasteners **OR** metal expansion sleeve anchors **OR** metal-impact expansion anchors, **as directed**, of type, size, and material necessary for type of load and installation indicated, as recommended by manufacturer, unless otherwise indicated.
 8. Anchor Materials:
 - a. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
 - b. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) **OR** Group 2 (A4), **as directed**, stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).
 9. Sound-Deadening Materials:
 - a. Insulation: Unfaced, mineral-fiber blanket insulation complying with ASTM C 665, Type I, and passing ASTM E 136 test.
 - b. Mastic: Cold-applied asphalt emulsion complying with ASTM D 1187.
 10. Backing Materials: Provided or recommended by decorative formed metal manufacturer.
 11. Laminating Adhesive: Adhesive recommended by metal fabricator that will fully bond metal to metal and that will prevent telegraphing and oil canning and is compatible with substrate and noncombustible after curing.
 - a. Contact Adhesive: VOC content of not more than 80 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Metal-to-Metal Adhesive: VOC content of not more than 30 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - c. Multipurpose Construction Adhesive: VOC content of not more than 70 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - d. Special-Purpose Contact Adhesive: (Contact adhesive used to bond melamine-covered board, metal, unsupported vinyl, ultrahigh molecular weight polyethylene, and rubber or wood veneer, 1/16 inch thick or less, to any surface): 250 g/L.
 12. Isolation Coating: Manufacturer's standard alkali-resistant coating **OR** bituminous paint **OR** epoxy coating, **as directed**.



C. Paints And Coatings

1. Etching Cleaner for Galvanized Metal: Complying with MPI#25.
2. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
3. Lacquer for Copper Alloys: Clear, acrylic lacquer specially developed for coating copper-alloy products.
4. Shop Primers: Comply with Division 07 OR Division 09 Section(s) "High-performance Coatings", **as directed**.
5. Universal Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - a. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
6. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
7. Shop Primer for Galvanized Steel: Cementitious galvanized metal primer complying with MPI#26 **OR** Vinyl wash primer complying with MPI#80 **OR** Water-based galvanized metal primer complying with MPI#134, **as directed**.
8. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

D. Fabrication, General

1. Shop Assembly: Preassemble decorative formed metal items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
2. Coordinate dimensions and attachment methods of decorative formed metal items with those of adjoining construction to produce integrated assemblies with closely fitting joints and with edges and surfaces aligned unless otherwise indicated.
3. Form metal to profiles indicated, in maximum lengths to minimize joints. Produce flat, flush surfaces without cracking or grain separation at bends. Fold back exposed edges of unsupported sheet metal to form a 1/2-inch- (12-mm-) wide hem on the concealed side, or ease edges to a radius of approximately 1/32 inch (1 mm) and support with concealed stiffeners.
4. Increase metal thickness or reinforce with concealed stiffeners, backing materials, or both, as needed to provide surface flatness equivalent to stretcher-leveled standard of flatness and sufficient strength for indicated use.
 - a. Support joints with concealed stiffeners as needed to hold exposed faces of adjoining sheets in flush alignment.
5. Build in straps, plates, and brackets as needed to support and anchor fabricated items to adjoining construction. Reinforce decorative formed metal items as needed to attach and support other construction.
6. Provide support framing, mounting and attachment clips, splice sleeves, fasteners, and accessories needed to install decorative formed metal items.
7. Where welding or brazing is indicated, weld or braze joints and seams continuously. Grind, fill, and dress to produce smooth, flush, exposed surfaces in which joints are not visible after finishing is completed.
 - a. Use welding and brazing procedures that will blend with and not cause discoloration of metal being joined.

E. Beam Wraps

1. Form beam wraps from metal of type and thickness indicated below. Fabricate to fit tightly to adjoining construction.
 - a. Aluminum Sheet: 0.063 inch (1.60 mm) **OR** Thickness required to comply with performance requirements, **as directed**.
 - 1) Finish: Baked enamel or powder coat **OR** Siliconized polyester **OR** High-performance organic coating **OR** Mill **OR** Clear anodic **OR** Color anodic, **as directed**.
 - b. Steel Sheet: 0.060 inch (1.52 mm) **OR** Thickness required to comply with performance requirements, **as directed**.
 - 1) Finish: Factory primed **OR** Baked enamel **OR** Powder coat, **as directed**.



- c. Stainless-Steel Sheet: 0.050 inch (1.27 mm) **OR** Thickness required to comply with performance requirements, **as directed**.
 - 1) Finish: No. 2B **OR** No. 4 **OR** No. 6 **OR** No. 7 **OR** No. 8, **as directed**.
2. Fabricate with calk stop angle to retain backer rod and sealant.

F. Closures And Trim

1. Form closures and trim from metal of type and thickness indicated below. Fabricate to fit tightly to adjoining construction, with weathertight joints at exterior installations.
 - a. Aluminum Sheet: 0.063 inch (1.60 mm) **OR** Thickness required to comply with performance requirements, **as directed**.
 - 1) Finish: Baked enamel or powder coat **OR** Siliconized polyester **OR** High-performance organic coating **OR** Mill **OR** Clear anodic **OR** Color anodic, **as directed**.
 - b. Galvanized-Steel Sheet: 0.052 inch (1.32 mm) **OR** Thickness required to comply with performance requirements, **as directed**.
 - 1) Finish: Factory primed **OR** Baked enamel **OR** Siliconized polyester **OR** High-performance organic coating **OR** Powder coat, **as directed**.
 - c. Steel Sheet: 0.048 inch (1.21 mm) **OR** Thickness required to comply with performance requirements, **as directed**.
 - 1) Finish: Factory primed **OR** Baked enamel **OR** Powder coat, **as directed**.
 - d. Closures and trim may be fabricated from prefinished metal sheet in lieu of finishing after fabrication provided unfinished edges are concealed from view and not exposed to weather.
2. Conceal fasteners where possible; otherwise, locate where they are as inconspicuous as possible. Size fasteners to support closures and trim, with fasteners spaced to prevent buckling or waviness in finished surfaces.
3. Drill and tap holes needed for securing closures and trim to other surfaces.
4. Incorporate gaskets where indicated or needed for concealed, continuous seal at abutting surfaces.
5. Miter or cope trim members at corners and reinforce with bent metal splice plates to form tight joints.

G. Column Covers

1. Spackled-Seam Type: Form column covers from 0.125-inch (3.2-mm) aluminum, rolled to radii indicated. Taper edges of adjoining pieces of column covers, for taping and spackling, to 0.094-inch (2.4-mm) thickness in approximately 1 inch (25 mm) of width. Punch tapered edges for gypsum board screws at 1/2 inch (12 mm) o.c., and mill grooves in tapered edge to improve bond with joint compound.
 - a. Support Framing: At vertical joints, provide 1-1/2-by-3-5/8-inch (38-by-89-mm) steel channel support posts formed from 0.040-inch (1.0-mm) galvanized steel.
 - b. Joint Treatment Materials: Provide joint treatment compounds and reinforcing tape complying with requirements in Division 9 Section "Gypsum Board."
2. Snap-Together Type: Form column covers to shapes indicated from metal of type and minimum thickness indicated below. Return vertical edges and bend to form hook that will engage continuous mounting clips.
 - a. Aluminum Sheet: 0.063 inch (1.60 mm) **OR** Thickness required to comply with performance requirements, **as directed**.
 - 1) Finish: Baked enamel or powder coat **OR** Siliconized polyester **OR** High-performance organic coating **OR** Mill **OR** Clear anodic **OR** Color anodic, **as directed**.
 - b. Steel Sheet: 0.060 inch (1.52 mm) **OR** Thickness required to comply with performance requirements, **as directed**.
 - 1) Finish: Factory primed **OR** Baked enamel **OR** Powder coat, **as directed**.
 - c. Stainless-Steel Sheet: 0.050 inch (1.27 mm) **OR** Thickness required to comply with performance requirements, **as directed**.



- 1) Finish: No. 2B **OR** No. 4 **OR** No. 6 **OR** No. 7 **OR** No. 8, **as directed**.
 - d. Bronze Sheet: 0.051 inch (1.29 mm) **OR** Thickness required to comply with performance requirements, **as directed**.
 - 1) Finish: Buffed finish, lacquered **OR** Hand-rubbed finish, lacquered **OR** Statuary conversion coating over satin finish, **as directed**.
 - e. Brass Sheet: 0.051 inch (1.29 mm) **OR** Thickness required to comply with performance requirements, **as directed**.
 - 1) Finish: Buffed **OR** Hand-rubbed, **as directed**, finish, lacquered.
 - f. Column covers may be fabricated from prefinished metal sheet in lieu of finishing after fabrication provided unfinished edges are concealed from view.
 - g. Form returns at vertical joints to provide hairline V-joints.
OR
Form returns at vertical joints to provide 1/2-inch- (12-mm-) **OR** 3/4-inch- (18-mm-), **as directed**, wide reveal at joints. Provide snap-in metal filler strips at reveals that leave reveals 1/2 inch (12 mm) deep **OR** flush, **as directed**.
OR
Form returns at vertical joints to accommodate backer rod and sealant.
 - h. Fabricate column covers with hairline horizontal V-joints produced by forming returns on mating ends of column cover sections. Locate horizontal joints as indicated.
OR
Fabricate column covers without horizontal joints.
OR
Fabricate column covers with horizontal butt joints, tightly fitted and backed with a sleeve for field splicing with adhesive.
OR
Fabricate column covers with 1/2-inch- (12-mm-) wide, **as directed**, reveals at horizontal joints produced by forming returns on mating ends of column cover sections. Provide snap-in metal filler strips at reveals matching reveals at vertical joints. Locate horizontal joints as indicated.
 - i. Fabricate base **OR** ceiling, **as directed**, ring to match **OR** contrast with, **as directed**, column covers.
 - j. Fabricate with calk stop/stiffener ring.
 - k. Apply manufacturer's recommended sound-deadening insulation **OR** mastic, **as directed**, to backs of column covers.
- H. Decorative-Metal-Clad Doors And Frames
 - 1. Laminate metal sheets, of type and thickness indicated below, to faces of hollow-metal doors and frames and elevator entrances where indicated:
 - a. Bronze Sheet: 0.040 inch (1.02 mm).
 - 1) Finish: Buffed finish, lacquered **OR** Hand-rubbed finish, lacquered **OR** Statuary conversion coating over satin finish, lacquered, **as directed**.
 - b. Brass Sheet: 0.040 inch (1.02 mm).
 - 1) Finish: Buffed **OR** Hand-rubbed, **as directed**, finish lacquered.
 - c. Stainless-Steel Sheet: 0.038 inch (0.95 mm).
 - 1) Finish: No. 2B **OR** No. 4 **OR** No. 6 **OR** No. 7 **OR** No. 8, **as directed**.
 - d. Titanium Sheet: 0.025 inch (0.64 mm).
 - 1) Finish: Dull **OR** Bright, **as directed**, matte.
- I. Escalator Enclosures
 - 1. Form escalator enclosures from metal of type and thickness indicated below. Coordinate size of enclosures, location of cutouts, and method of attachment to adjoining construction.
 - a. Stainless-Steel Sheet: 0.062 inch (1.59 mm) **OR** Thickness required to comply with performance requirements, **as directed**.
 - 1) Finish: No. 2B **OR** No. 4 **OR** No. 6 **OR** No. 7 **OR** No. 8, **as directed**.
 - b. Bronze Sheet: 0.081 inch (2.05 mm) **OR** Thickness required to comply with performance requirements, **as directed**.



- 1) Finish: Buffed finish, lacquered **OR** Hand-rubbed finish, lacquered **OR** Statuary conversion coating over satin finish, **as directed**.

J. Filler Panels

1. Form filler panels for closing ends of partition systems and for other applications indicated. Form from two sheets of metal of type and thickness indicated below, separated by channels formed from the same material, producing a panel of same thickness as partitions **OR** mullions, **as directed**, unless otherwise indicated. Incorporate reveals, trim, and concealed anchorages for attaching to adjacent surfaces.
 - a. Galvanized-Steel Sheet: 0.064 inch (1.63 mm).
 - 1) Finish: Factory primed **OR** Baked enamel **OR** Siliconized polyester **OR** High-performance organic coating **OR** Powder coat, **as directed**.
 - b. Steel Sheet: 0.060 inch (1.52 mm).
 - 1) Finish: Factory primed **OR** Baked enamel **OR** Powder coat, **as directed**.
 - c. Filler panels may be fabricated from prefinished metal sheet in lieu of finishing after fabrication provided unfinished edges are concealed from view.
2. Fill interior of panel with sound-deadening insulation permanently attached to inside panel faces.
3. Adhesively attach gaskets to filler panel edges where they abut mullions or glazing. Use 1-inch- (25-mm-) square material, unless otherwise indicated, set approximately 1/4 inch (6 mm) into channeled edge of filler panel.

OR

Attach gaskets to all edges of panels that abut adjacent surfaces to form a continuous seal. Use compressible gaskets or mastic sealing tape, applied to center of panel edges to be concealed from view, unless otherwise indicated.
4. Do not mechanically fasten filler panels to mullions.

K. Heating-Cooling Unit Enclosures

1. Fabricate heating-cooling unit enclosures from metal of type and thickness indicated below:
 - a. Galvanized-Steel Sheet:
 - 1) Framing: 0.108 inch (2.74 mm) **OR** Thickness required to comply with performance requirements.
 - 2) Sills and Stools: 0.079 inch (2.01 mm) **OR** Thickness required to comply with performance requirements, **as directed**.
 - 3) Front Panels and Bases: 0.064 inch (1.63 mm).
 - 4) Concealed Panels and Trim: 0.040 inch (1.02 mm).
 - 5) Finish: Factory primed **OR** Baked enamel **OR** Siliconized polyester **OR** High-performance organic coating **OR** Powder coat, **as directed**.
 - b. Steel Sheet:
 - 1) Framing: 0.105 inch (2.66 mm) **OR** Thickness required to comply with performance requirements, **as directed**.
 - 2) Sills and Stools: 0.075 inch (1.90 mm) **OR** Thickness required to comply with performance requirements, **as directed**.
 - 3) Front Panels and Bases: 0.060 inch (1.52 mm).
 - 4) Concealed Panels and Trim: 0.036 inch (0.91 mm).
 - 5) Finish: Factory primed **OR** Baked enamel **OR** Powder coat, **as directed**.
2. Weld seams and connections unless otherwise indicated or unless other methods are necessary for access to heating and cooling equipment.
3. Incorporate stiffeners or laminated backing using noncombustible materials as needed for strength and rigidity.
 - a. Fill space between stiffeners with sound-deadening insulation attached to face sheet with insulation adhesive unless otherwise indicated.

OR

Coat concealed faces of metal panels more than 6 inches (150 mm) wide with a heavy coating of sound-deadening mastic applied at the minimum rate of 20 sq. ft./gal. (0.5 sq. m/L).



4. Provide louvers and grilles of size, type, and materials indicated.
 - a. For removable grilles, use modular units with recessed openings formed into surfaces of enclosures and without blank filler panels between grilles, so face panels and stools are continuous. Fabricate removable grilles and openings to precise tolerances to produce well-fitted assemblies free of warp or rattle, with grilles supported continuously along parallel edges and with tops flush with top of enclosure.
 5. Incorporate removable tops and fronts where indicated or needed for access to heating-cooling units and to piping, ductwork, controls, and electrical service, with panels and openings as follows:
 - a. Fabricate with a fitting tolerance of not less than 1/32 inch (0.8 mm) and not more than 1/16 inch (1.6 mm) at each edge, with face of panels flush with adjoining fixed surfaces of enclosure.
 - b. Form panels for easy removal without interfering with adjoining construction or furniture. Hold panels in place with concealed clips and hardware that prevent warp and rattle.
 6. Incorporate hinged access panels in enclosures for access to heating-cooling unit controls, as either separate elements or integrated with grille openings, as indicated or needed.
 7. Coordinate construction, configuration, and dimensions of enclosures with those of heating-cooling units. Provide support for heating-cooling units and controls where indicated. Provide blind knockouts and supports for piping, ductwork, control lines, electrical conduit, and wiring where indicated or needed.
 8. Locate fixed surfaces of enclosure to coincide precisely with window mullions and partition system terminations. Provide closures at ends of units, at recessed openings in base of units, and at other locations where needed to conceal unfinished wall or floor surfaces, piping, conduit, ductwork, or heating-cooling units.
 - a. Provide built-in partitions (bulkheads) within enclosures between heating-cooling units, located to coincide with mullions and partition system terminations. Seal partitions to faces of enclosures with compressible gaskets or mastic sealing tape, and cover both sides of partitions with sound-deadening insulation attached to partitions with insulation adhesive.
- L. Lighting Coves
1. Form lighting coves from metal of type and thickness indicated below. Coordinate size of coves, location of cutouts for electrical wiring, and method of attachment to adjoining construction.
 - a. Aluminum Sheet: 0.063 inch (1.60 mm).
 - 1) Finish: Baked enamel or powder coat **OR** Siliconized polyester **OR** High-performance organic coating **OR** Mill **OR** Clear anodic **OR** Color anodic, **as directed**.
 - b. Galvanized-Steel Sheet: 0.052 inch (1.32 mm).
 - 1) Finish: Factory primed **OR** Baked enamel **OR** Siliconized polyester **OR** High-performance organic coating **OR** Powder coat, **as directed**.
 - c. Steel Sheet: 0.048 inch (1.21 mm).
 - 1) Finish: Factory primed **OR** Baked enamel **OR** Powder coat, **as directed**.
 - d. Fabricate light coves with hairline butt joints **OR** tapered edges for taping and spackling, **as directed**.
 - e. Provide mitered corners, factory welded with backplates **OR** factory endcaps, **as directed**.
 - f. Lighting coves may be fabricated from prefinished metal sheet in lieu of finishing after fabrication provided unfinished edges are concealed from view.
- M. Metal Base
1. Form metal base from metal of type and thickness indicated below:
 - a. Aluminum Sheet: 0.063 inch (1.60 mm).
 - 1) Finish: Baked enamel or powder coat **OR** Siliconized polyester **OR** High-performance organic coating **OR** Mill **OR** Clear anodic **OR** Color anodic, **as directed**.
 - b. Stainless-Steel Sheet: 0.050 inch (1.27 mm).
 - 1) Finish: No. 2B **OR** No. 4 **OR** No. 6 **OR** No. 7 **OR** No. 8, **as directed**.



N. Mullion Cladding

1. Form mullion cladding from metal of type and thickness indicated below. Fabricate to fit tightly to adjoining construction.
 - a. Aluminum Sheet: 0.063 inch (1.60 mm).
 - 1) Finish: Baked enamel or powder coat **OR** Siliconized polyester **OR** High-performance organic coating **OR** Mill **OR** Clear anodic **OR** Color anodic, **as directed**.
 - b. Galvanized-Steel Sheet: 0.052 inch (1.32 mm).
 - 1) Finish: Factory primed **OR** Baked enamel **OR** Siliconized polyester **OR** High-performance organic coating **OR** Powder coat, **as directed**.
 - c. Stainless-Steel Sheet: 0.050 inch (1.27 mm).
 - 1) Finish: No. 2B **OR** No. 4 **OR** No. 6 **OR** No. 7 **OR** No. 8, **as directed**.

O. Pipe System Covers

1. Form pipe system covers from metal of type and thickness indicated below. Coordinate size of covers, location of cutouts for piping, and method of attachment to adjoining construction.
 - a. Galvanized-Steel Sheet: 0.052 inch (1.32 mm).
 - 1) Finish: Factory primed **OR** Baked enamel **OR** Siliconized polyester **OR** High-performance organic coating **OR** Powder coat, **as directed**.
 - b. Steel Sheet: 0.048 inch (1.21 mm).
 - 1) Finish: Factory primed **OR** Baked enamel **OR** Powder coat, **as directed**.

P. Pockets For Window Treatment

1. Form pockets from metal of type and thickness indicated below, with end closures. Coordinate dimensions and attachment methods with window treatment equipment, window frames, ceiling suspension system, and other related construction to produce a coordinated, closely fitting assembly.
 - a. Aluminum Sheet: 0.063 inch (1.60 mm).
 - 1) Finish: Baked enamel or powder coat **OR** Siliconized polyester **OR** High-performance organic coating **OR** Mill **OR** Clear anodic **OR** Color anodic, **as directed**.
 - b. Galvanized-Steel Sheet: 0.052 inch (1.32 mm).
 - 1) Finish: Factory primed **OR** Baked enamel **OR** Siliconized polyester **OR** High-performance organic coating **OR** Powder coat, **as directed**.
 - c. Steel Sheet: 0.048 inch (1.21 mm).
 - 1) Finish: Factory primed **OR** Baked enamel **OR** Powder coat, **as directed**.
 - d. Pockets for window treatment may be fabricated from prefinished metal sheet in lieu of finishing after fabrication provided unfinished edges are concealed from view.
2. Reinforce pockets for attaching window treatment equipment and hardware, or increase metal thickness.
3. Divide continuous pockets with built-in partitions located to separate adjoining drapery and blind units, to coincide with window mullions, and to receive filler panels at ends of partitions.

Q. Window Stools

1. Form window stools from metal of type and thickness indicated below, with end closures:
 - a. Aluminum Sheet: 0.063 inch (1.60 mm).
 - 1) Finish: Baked enamel or powder coat **OR** Siliconized polyester **OR** High-performance organic coating **OR** Mill **OR** Clear anodic **OR** Color anodic, **as directed**.
 - b. Galvanized-Steel Sheet: 0.052 inch (1.32 mm).
 - 1) Finish: Factory primed **OR** Baked enamel **OR** Siliconized polyester **OR** High-performance organic coating **OR** Powder coat, **as directed**.
 - c. Stainless-Steel Sheet: 0.050 inch (1.27 mm) **OR** 1.3 mm, **as directed**.
 - 1) Finish: No. 2B **OR** No. 4 **OR** No. 6 **OR** No. 7 **OR** No. 8, **as directed**.
 - d. Bronze Sheet: 0.051 inch (1.29 mm).



- 1) Finish: Buffed finish, lacquered **OR** Hand-rubbed finish, lacquered **OR** Statuary conversion coating over satin finish, **as directed**.
2. Weld seams at end closures.
OR
Braze seams at end closures.
3. Apply sound-deadening insulation **OR** mastic, **as directed**, to underside of window stools.

R. General Finish Requirements

1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Complete mechanical finishes of flat sheet metal surfaces before fabrication where possible. After fabrication, finish all joints, bends, abrasions, and other surface blemishes to match sheet finish.
3. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
4. Apply organic and anodic finishes to formed metal after fabrication unless otherwise indicated.
5. Finish items indicated on Drawings after assembly.
6. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

S. Aluminum Finishes

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
2. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm **OR** AA-M12C22A31, Class II, 0.010 mm, **as directed**, or thicker.
3. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm **OR** AA-M12C22A32/A34, Class II, 0.010 mm, **as directed**, or thicker.
 - a. Color: Champagne **OR** Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black **OR** As selected from full range of industry colors and color densities, **as directed**.
4. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
5. Siliconized Polyester Finish: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
 - a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
6. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2604 **OR** AAMA 2605, **as directed**, and containing not less than 50 **OR** 70, **as directed**, percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

OR

High-Performance Organic Finish: Three **OR** Four, **as directed**, -coat fluoropolymer finish complying with AAMA 2605 and containing not less than 50 **OR** 70, **as directed**, percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
- b. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.



T. Galvanized-Steel Sheet Finishes

1. Preparing Galvanized Items for Factory Priming: Thoroughly clean galvanized decorative formed metal of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.
2. Preparing Galvanized Items for Factory Finishing: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it.
3. Repairing Galvanized Surfaces: Clean welds and abraded areas and repair galvanizing to comply with ASTM A 780.
4. Factory Priming for Field-Painted Finish: Where field painting after installation is indicated, apply shop primer to prepared surfaces of items unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
5. Factory-Painted Finish: Comply with Division 09 Section(s) "Exterior Painting" OR "High-performance Coatings", **as directed**.
 - a. Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
6. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil (0.025 mm) for topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).
 - a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
7. Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils (0.04 mm). Prepare, treat, and coat metal to comply with resin manufacturer's written instructions.
 - a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
8. Siliconized-Polyester Coating: Immediately after cleaning and pretreating, apply manufacturer's standard epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
 - a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
9. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2604 **OR** AAMA 2605, **as directed**, and containing not less than 50 **OR** 70, **as directed**, percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

OR

High-Performance Organic Finish: Three **OR** Four, **as directed**, -coat fluoropolymer finish complying with AAMA 2605 and containing not less than 50 **OR** 70, **as directed**, percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

- a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

U. Steel Sheet Finishes

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or with SSPC-SP 8, "Pickling."
2. Pretreatment: Immediately after cleaning, apply a conversion coating of type suited to organic coating applied over it.



3. Factory Priming for Field-Painted Finish: Where field painting after installation is indicated, apply shop primer to prepared surfaces of items unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
4. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).
 - a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
5. Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils (0.04 mm). Prepare, treat, and coat metal to comply with resin manufacturer's written instructions.
 - a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

V. Stainless-Steel Finishes

1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - a. Run grain of directional finishes with long dimension of each piece.
3. Bright, Cold-Rolled, Unpolished Finish: No. 2B.
4. Directional Satin Finish: No. 4.
5. Dull Satin Finish: No. 6.
6. Satin, Reflective, Directional Polish: No. 7.
7. Mirrorlike Reflective, Nondirectional Polish: No. 8 finish.
8. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

W. Copper-Alloy Finishes

1. Finish designations for copper alloys comply with the system established for designating copper-alloy finish systems defined in NAAMM's "Metal Finishes Manual for Architectural and Metal Products."
2. Buffed Finish: M21 (Mechanical Finish: buffed, smooth specular).
3. Hand-Rubbed Finish: M31-M34 (Mechanical Finish: directionally textured, fine satin; Mechanical Finish: directionally textured, hand rubbed).
4. Medium-Satin Finish: M32 (Mechanical Finish: directionally textured, medium satin).
5. Fine-Matte Finish: M42 (Mechanical Finish: nondirectional finish, fine matte).
6. Buffed Finish, Lacquered: M21-O6x (Mechanical Finish: buffed, smooth specular; Coating: clear organic, air drying, as specified below).
 - a. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).
7. Hand-Rubbed Finish, Lacquered: M31-M34-O6x (Mechanical Finish: directionally textured, fine satin; Mechanical Finish: directionally textured, hand rubbed; Coating: clear organic, air drying, as specified below).
 - a. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).
8. Medium-Satin Finish, Lacquered: M32-O6x (Mechanical Finish: directionally textured, medium satin; Coating: clear organic, air drying, as specified below).
 - a. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).
9. Fine-Matte Finish, Lacquered: M42-O6x (Mechanical Finish: nondirectional finish, fine matte; Coating: clear organic, air drying, as specified below).



- a. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).
10. Statuary Conversion Coating over Satin Finish: M31-C55 (Mechanical Finish: directionally textured, fine satin; Chemical Finish: conversion coating, sulfide), with color matching the Owner's sample.
11. Statuary Conversion Coating over Satin Finish, Lacquered: M31-C55-O6x (Mechanical Finish: directionally textured, fine satin; Chemical Finish: conversion coating, sulfide; Coating: clear, organic, air drying, as specified below) , with color matching the Owner's sample:
 - a. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).

X. Titanium Finishes

1. General: Fabricate items from finished titanium sheet, taking care not to damage finish during fabrication. Protect finish as needed during fabrication by applying a strippable, temporary protective covering.
2. Dull Matte Finish: Pickled and annealed.
3. Bright Matte Finish: Vacuum annealed.

1.3 EXECUTION

A. Examination

1. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of decorative formed metal.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Installation

1. Locate and place decorative formed metal items level and plumb and in alignment with adjacent construction. Perform cutting, drilling, and fitting required to install decorative formed metal.
 - a. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.
2. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where needed to protect metal surfaces and to make a weathertight connection.
3. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joint fillers as indicated.
4. Install concealed gaskets, joint fillers, insulation, sealants, and flashings, as the Work progresses, to make exterior decorative formed metal items weatherproof.
5. Install concealed gaskets, joint fillers, sealants, and insulation, as the Work progresses, to make interior decorative formed metal items soundproof or lightproof as applicable to type of fabrication indicated.
6. Corrosion Protection: Apply bituminous paint or other permanent separation materials on concealed surfaces where metals would otherwise be in direct contact with substrate materials that are incompatible or could result in corrosion or deterioration of either material or finish.
7. Install decorative-formed-metal-clad doors and frames to comply with requirements specified in Division 08 Section "Hollow Metal Doors And Frames".
8. Apply joint treatment at joints of spackled-seam-type metal column covers. Comply with requirements in Division 09 Section "Gypsum Board".

C. Adjusting And Cleaning

1. Unless otherwise indicated, clean metals by washing thoroughly with clean water and soap, rinsing with clean water, and drying with soft cloths.



2. Clean copper alloys according to metal finisher's written instructions in a manner that leaves an undamaged and uniform finish matching approved Sample.
 3. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - a. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.
 4. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 07 OR Division 09 Section(s) "High-performance Coatings" **OR** Division 07 AND Division 09 Section(s) "High-performance Coatings", **as directed**.
 5. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.
- D. Protection
1. Protect finishes of decorative formed metal items from damage during construction period. Remove temporary protective coverings at time of Final Completion.

END OF SECTION 05 58 16 00a



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Task	Specification	Specification Description
05 59 65 00	01 22 16 00	No Specification Required



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SECTION 05 73 00 00 - MISCELLANEOUS ORNAMENTAL METALS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of Trap Pit Doors; Access to Pipe Trenches; Subway Type Gratings; Manhole, Catch and Retention Basins, Hoods; Iron Fences and Railways, Wicket Guard and Fence; Pipe Railings; Chimney Caps; Cast Iron Sills; Expansion Joints; Chimney Cleanout Doors; Ladders; Ladder Rungs; Retractable Ladders and Balconies, Staircases and Counter-Balanced Stairs; Vent Back Frames in Exhaust Opening of Toilet Rooms; Grilles in Exhaust Openings in Toilet Rooms; Access Doors, Dressing Compartment Seat Frames; Stainless Steel; Lumber Rack; Ganging Rods; Auditorium Loudspeaker Grilles; Bronze Saddles (Exterior), Bronze Expansion Saddles (Interior); Bronze Pipe and Tubes; Aluminum Hat and Coat Racks and Hook Strips; Aluminum Angles for Showers; Aluminum Railings; Miscellaneous Ornamental Metal Work; Hardware.

B. Submittals/Shop Drawings

1. Show all locations, markings, quantities, materials, sizes and shapes.
2. Indicate all methods of connecting, anchoring, fastening, bracing and attaching work of other trades.
3. Do not fabricate until approval of Shop Drawing.
4. Product Design Data: For each type of product indicated in 1.2.

C. Quality Assurance

1. Retractable Ladders, Balconies, and Staircases: For use as a supplemental escape device up to 30 feet (9144 mm), comply with requirements of:
 - a. Underwriters Laboratories Inc. for use as a supplementary means of egress; provide UL listing data.
 - b. ICC International Building Code.
 - c. ICC International Fire Code.
2. For use as a mechanical equipment ladder, comply with requirements of ICC International Mechanical Code.
3. Provide Evaluation Reports showing compliance.

D. Product Handling

1. Before shipment to the job, all finished shall be adequately protected for transporting and erecting periods.
2. Replace damaged items with the approval of the Owner and at no additional cost to the Owner.

1.2 PRODUCTS

A. Frame and Covers

1. Aluminum: ASTM B 221, 6063-T6.
2. Bronze: ASTM B 455, Alloy C 38500.
3. Stainless Steel: ASTM A 167, Type 304.

B. Gratings

1. Aluminum Grating, Banding, and Kick Plate: Rectangular, pressure-locked bearing bars, ASTM B 221, 6063-T6, mill finish.
2. Steel Grating:
3. Grating: Rectangular, welded, ASTM A 569.
4. Bands and Kick Plate: ASTM A 36.
5. Finish: Galvanized, ASTM A 386, or painted with fabricator's standard shop primer.



- C. Castings (Frames, Covers, Steps, and Sills)
1. Gray Iron: ASTM A 48, Class 30. Malleable Iron, ASTM A 47.
 2. Steel: ASTM A 36; Galvanized, ASTM A 386.
 3. Aluminum: ASTM B 26, 356-T6.
 4. Stainless Steel: ASTM A 743, Grade CF8 or CF20
 5. Bronze: ASTM B 455, Alloy C38500 and ASTM B 135, Alloy C2800.
 6. Corner Protection: Steel angles with anchors, ASTM A 36; Galvanized, ASTM A 386.
 7. Ventilation Boxes: Extruded Aluminum, ASTM B 221, 6063-T6.
- D. Pipe and Tube Railings and Ladders
1. Post and rails: Steel pipe, ASTM A 53, Type E or S, Grade B, Schedule 40.
 2. Bars and Rungs: ASTM A 36.
 3. Finish: Galvanized, ASTM A 386 or shop primer, Fed. Spec. TT-P-86, Type I or II; TT-P-615, Type I, II, or V; TT-P-645.
 4. Aluminum: ASTM B 221, 6063-T6, T-52.
 5. Steel: ASTM A 36, A 500, A 501.
 6. Stainless Steel: ASTM A 544, Grade MT304; ASTM A 312, Grade TP304; ASTM A 167, Type 304.
- E. Retractable Ladders and Balconies
1. Ladders
 - a. Maintenance-free, aluminum and stainless steel construction.
 - b. Rungs: Extruded aluminum, 6005-T5 and 6005-T6 alloy.
 - c. Stiles: Extruded aluminum, 6063-T6 alloy.
 - d. Support 1,000 pounds (454 kg) per rung individually and 200 pounds per 6 feet (90 kg per 1.83 m) of length simultaneously.
 - e. Ground support of gravity loads; building wall support for lateral stability.
 - f. Provide deployment handle at each access level.
 - g. Provide removable deployment handle at lower access point; provide locking hub and padlock.
 - h. Provide dual safety rails at ladders with access from both sides.
 - i. Provide reinforcement channel where ladders extend beyond wall support, such as at parapets and roof tops, or where ladder spans open areas in excess of 5 feet (1524 mm) between attachment points.
 - j. Height: As directed.
 2. Balconies
 - a. Aluminum, 6063-T6 alloy.
 - b. Provide aluminum access balconies at locations as directed.
 - c. Size: As directed.
 - d. Railing: 42-inch (1,067 mm) rail 2 sides, restraining chain 1 side.
 - e. Platform Capacity: 100 pounds per square foot (488 kg/square m), unless directed otherwise.
 - f. Railing Capacity: Uniform load of not less than 50 pounds per lineal foot (74.5 kg per lineal m), unless directed otherwise.
 - g. Balustrade: Not less than 36 inches (914 mm) high.
 - h. Pickets and Rails: Configured not to pass a sphere 4 inches (100 mm) in diameter. Exception; triangular openings formed by riser, tread, and rail, configured not to pass a sphere 6 inches (150 mm) in diameter.
 3. Factory Finish: Clear anodized **OR** Manufacturer's standard shop-applied enamel **OR** As selected from manufacturer's standard colors **OR** Match paint sample supplied by the Owner, **as directed**.
- F. Staircases and Counter-Balanced Stairs
1. Provide aluminum staircases, platforms, and counter-balanced stairs at locations indicated on the drawings.
 2. Platform Capacity: 100 pounds per square foot (488 kg/square m), unless directed otherwise.



3. Railing Capacity: Uniform load of not less than 50 pounds per lineal foot (74.5 kg per lineal m), unless directed otherwise.
4. Required Width: Minimum 36 inches (914 mm).
5. Stair Rise: 4 inches (102 mm) minimum, 10 inches (254 mm) maximum.
6. Treads: 10 inches (254 mm) in depth.
7. Balustrade: Not less than 36 inches (914 mm) high.
8. Pickets and Rails: Configured not to pass a sphere 4 inches (101.6 mm) in diameter.
 - a. Exception: Triangular openings formed by riser, tread, and rail configured not to pass a sphere 6 inches (152.4 mm) in diameter.
 - b. Rail Projection: 3-1/2 inches (89 mm) maximum from each side of stairway into required width.

1.3 EXECUTION

A. Trap Pit Doors

1. Furnish and set trap pit doors and frames flush with the finish floors, pavement, grade or as otherwise required. Doors for interior pits shall be of 1/4 inch checkered steel plate set in angle frames having mitered and welded corners and angle seat for covers, provided with bronze lifting handles. Doors and frames for exterior pits shall be of cast iron and hinged with 3-1/2 x 5 inch extra heavy bronze hinges. All doors shall be provided with locking devices.

B. Access to Pipe Trenches

1. Checkered or flat steel plate access doors to pipe trenches below cellar floors shall be made in accordance with detail. Include angle iron frame, anchors, hardware, etc., complete. The steel plate access doors shall be flush with the adjoining floors. Hinges shall be approved bronze flush type. Provide bronze lift handle and approved locking device for each access door.
2. Doors shall be covered with resilient tile where required. Where cement floors occur, top of steel cover shall be flush, but depressed for other finishes as required by the thickness of floor finish.
See other Sections of Specifications for Finish.
3. All doors under this section unless otherwise specified, shall be secured in place with bronze square shank locking device and brass deck plate with slot and socket holes. Furnish six (6) wrenches for brass deck plates for each different size of locking device.

C. Manhole, Catch and Retention Basins, Hoods

1. Furnish cast iron manhole covers, catch basin covers and cast iron hoods for masonry, manholes, catch basins and retention basins furnished and installed under Division 22 OR Division 28.
2. Manhole covers and frames for catch basins shall be of cast iron, with locking device and key, equal to Flockhart Company No. 35-139.
3. Covers and frames for catch basins shall be of cast iron, with locking device and key, equal to Flockhart Company No. 35-328.
4. Covers and frames for catch basins shall be of cast iron, with locking device and key, equal to Flockhart Company No. 18-919.
5. Cast iron hoods for catch basins and manhole shall be equal to Flockhart Company pattern number indicated.

D. Iron Fences and Railings

1. Furnish and erect iron railings, fences, and gates. Materials of fences and railings shall be medium steel, shapes as required.
2. Posts and braces shall be leaded into cast-iron shoes, which shall be embedded in the concrete pavements or blocks. Center picket of each panel of 6 foot fence shall be leaded 2 inches into curb or pavement. Fences and railings on stone copings, platforms, steps or check blocks shall be leaded into sockets cut in same. Gates shall be hung with hinges. Provide all hasps required for locking gates in both open and closed positions. Double and quadruple gates shall also be furnished with sliding lever bolts and galvanized, malleable iron catches having pipe anchor and



drain embedded in concrete. Gates shall be locked open or closed with Type C Padlocks. Rivet the padlocks to the gates as required. Single gates require 1 padlock; double gates, 2 padlocks; quadruple gates, 4 padlocks.

3. Furnish cast-iron shoes for fence posts and set them at the proper time so that they may be cast into the concrete footing and pavements with top flush with finished surfaces.
4. Folding swing gates shall have fast pin to hold in closed position.
5. Unless otherwise required center rails and side rails on outside steps shall be made of 1-1/4 inch solid posts with 2-1/2 inch by 1/2 inch horizontal flats spaced as required, with top rail of two bronze, aluminum or steel channels and steel stiffener. Post at upper level of center railings shall be of malleable cast iron of height required, tapering from 1-3/4 inches at bottom to 1-1/4 inches at top, with finial. All posts shall be leaded-in 4 inches in cheeks and steps.

E. Wicket Guard and Fence

1. Furnish and install wicket guard fence 12 inches high constructed of 1/2 inch round bent steel rods welded together, to form a continuous wicket fence around the concrete curbing at seeded and planted areas. This guard fence shall be set in concrete footing specified under Division 03 Section "Cast-in-place Concrete".

F. Pipe Railings

1. Furnish and erect wrought iron or steel pipe railings and hand rails together with all fittings, flanges, collars, brackets, bolts, etc. of sizes required, all put together and secured in place in a thorough manner. All pipe railings shall be welded assembly, with continuous "V" joints, full thickness of pipe wall, welds filled solid and ground smooth. All radii, curves, sweeps, bends, etc., as indicated on details for pipe fitting assembly shall be maintained in the welded assembly. For pipe handrails in connection with stairs, see Division 05 Section "Pipe And Tube Railings".
2. Center pipe rails and free standing end pipe railings on outside concrete steps shall be made of 1-1/2 inch nominal diameter pipe and have pipe uprights with cast-iron collar and cap fittings secured in place with tap screws. The uprights shall be leaded-in pipe sleeves. Upright at upper level of center radii shall be of 2 inch nominal diameter pipe with approved cap.
3. Handrails at side of outside steps against walls shall be 1 inch nominal diameter pipes, with returns against wall at ends, and supported on galvanized cast-iron brackets and wall plates same as specified for egress stair.
4. Handrails at side of outside steps against iron fences shall be 1 inch nominal diameter, with returns at ends and supported on wrought iron brackets and plates. Handrails at area walls shall be 1-1/4 inch nominal diameter.
5. All outside pipe railings and handrails including fittings, etc., shall be galvanized after fabrication.
6. Furnish the combined pipe sleeve and base plate and turn over same for setting in concrete work.
7. Exterior barrier rails (at areaways, etc.) shall be of 1-1/2 inch nominal diameter pipe; interior barrier rails (at pits, changes in floor levels, etc.) shall be 1-1/4 inch nominal diameter.

G. Chimney Caps

1. Chimneys shall be provided with cast-iron caps.

H. Cast-Iron Sills

1. Furnish cast-iron sills for exterior doors of bulkheads, etc. The sills shall be set in a bed of cement and be substantially secured with bolts or expansion bolts.

I. Expansion Joints

1. Furnish and install all rolled steel members with required anchors at structural expansion joints through slabs. Items cast in concrete shall be furnished when required for setting. Provide bronze plates as required; top surfaces of plates shall be "BRONZOGRIT" or approved equal.

J. Chimney Cleanout Doors



1. Furnish to the mason proper cleanout doors of sizes indicated for chimneys, of 10 gauge steel plate and steel flats. The doors shall have angle-iron frames with strap anchors. Hang door with two 4 x 4 inch steel hinges and secure door with a latch.
- K. Ladders
1. Furnish and set ladders 18 inches wide, constructed with steel plate stringers, 3/4 inch diameter single rung treads let in and welded to stringers, angle and flat braces, and when required shall have pipe hand rails all riveted together. Secure ladders with angle clip and expansion bolts at top, bottom and elsewhere as required.
- L. Ladder Rungs
1. When ladder rungs are indicated built into mason work, furnish to the mason 5/8 inch galvanized wrought-iron ladder rungs.
 2. Ladder rungs in concrete shall be 15 inches wide and shall be built into concrete every 14 inches in height projecting into walls 4 inches on each side.
 3. Ladder rungs in brickwork of chimney shall be 18 inches wide, and shall be built into brickwork every 5 courses in height, project 8 inches beyond face of wall and continue 8 inches into wall with a 2 inch return. First rung shall start 10 feet above roof level at chimney.
- M. Retractable Ladders, Staircases and Counter-Balanced Stairs
1. Fabrication: Shop fabricate and assemble to maximum extent practicable for installation on-site with minimal labor.
 2. Accessories
 - a. Provide brackets, spacers, etc, necessary for a complete installation.
 - 1) Brackets: 6063-T6 aluminum alloy.
 - 2) Pivot Pins, Springs, Masonry Bolts, Fasteners, and Base Plates: Stainless steel.
 - b. Provide removable deployment handle at lower access point of retractable ladders.
OR
Provide removable deployment handle at lower access point of retractable ladders and locking hub and padlock.
 - c. Fasteners for securement to wood construction: Stainless steel lag bolts; 3/8-inch (9.5 mm) diameter, 4-inches (100 mm) minimum embedment.
 - d. Fasteners for securement to steel construction: Stainless steel bolts, nuts, and washers; 3/8-inch (9.5 mm) diameter.
 3. Footing: Install concrete footing in accordance with manufacturer's requirements, and in compliance with Division 03 Section "Cast-in-place Concrete".
 4. Install components in strict compliance with manufacturer's instructions.
 5. Adjust And Clean
 - a. Adjust operating parts for smooth deployment and storage.
 - b. Remove scraps and debris; leave project site in clean and orderly condition.
 - c. Instruct Owner's representative in proper operation.
- N. Vent Back Frames in Exhaust Opening of Toilet Rooms
1. Furnish and install 12 gauge bent steel frames in exhaust openings in partitions of toilet rooms. Frames shall be set plumb in partitions to receive the vent grilles. Baffle plates are not required.
- O. Grilles in Exhaust Openings
1. Furnish and set in frames at exhaust openings in toilet partitions, approved pressed steel bar type grilles with baked on primer, as manufactured by Tuttle and Bailey, Catalog No. T-80, or approved equal. Grilles shall be secured with tap screws to the frame. The bars of grilles shall be fixed and of rigid construction and shall be set at the angle required. Submit sample of grille for approval.
 2. Furnish and install individually adjustable shutters attached to grille frames, in certain toilets where required. Grilles shall be bar type, equal to Register and Grille Mfg. Co. No. 3311 or Tuttle and Bailey No. A-77.



3. In general, vent openings are provided in partitions of all toilet rooms back of water closets; however, certain smaller toilets, are mechanically vented by means of vent openings in ceiling or in partitions close to ceilings.

P. Access Doors

1. Access doors and frames that are to be furnished and installed as part of the work of this Contract shall be furnished and installed under Division 08 Section "Access Doors And Frames".
2. Access doors and frames that are to be furnished and installed in metal lath and plaster walls and ceilings as part of the work of this Contract shall be constructed of high grade sheet steel with 16 gauge frames and 14 gauge doors. Doors shall be equipped with concealed hinges and cylinder locks all keyed alike (furnish six (6) keys); doors in ceilings may have screwdriver operated type of lock. Doors shall have one piece plain trim set flush with finish surface. Stock doors manufactured by Columbia Metal Product Co., Karp Metal Products Co., or approved equal complying with the specifications, may be accepted. Submit sample for approval if not already approved.

Q. Dressing Compartment Seat Frames

1. Where seats are indicated in dressing compartments, furnish and set 1/4 x 1-1/2 inch flat galvanized bent steel brackets.

R. Stainless Steel

1. Stainless Steel and Cabinet Top Supports: Furnish and install adjustable, stainless steel tubing forming legs to support the tops of sinks and cabinets together with the stainless steel screens, collars, plates, etc., of sizes required. The screens shall be wrapped around and tap screwed to the legs of sink tubing.
2. Stainless Steel Jambs at Dressing Compartments: Furnish and install 14 gauge stainless steel tube jambs at doors to dressing compartments adjoining shower stalls. These jambs shall be anchored to the structural facing tile partition with 14 gauge stainless steel straps.
3. Package Slide: Furnish and install stainless steel half round strips and anchors (type 304 (18-8)) for package slide to Receiving Room. Strips shall be plug welded to anchors.
4. Angle and Channel Guards: Furnish and install angle and channel guards in the kitchen and auxiliary areas. Guards shall be 12 gauge stainless steel satin finish of length and dimensions required, secured in place with oval head stainless steel bolts in expansion shields.
5. Stainless Steel Shelf: Furnish and install stainless steel shelves complete with brackets, of gauges required, generally in helps' locker room, over sinks in locker rooms, in eraser cleaning closets, art room and medical office.
Note: All stainless steel shall be chrome nickel cold rolled alloy designated by trade name Stainless Steel 18-8, No. 4 Finish; it shall contain a minimum of 18% chromium, 8% nickel, and not more than 0.12% carbon, non-magnetic (straight chrome iron not accepted).

S. Lumber Rack

1. Furnish a lumber rack for the woodworking room and general crafts shop, constructed with angles and provided with chains and hoods as required.

T. Hanging Rods

1. Furnish and erect hanging rods of diameters required of wrought-iron or steel pipe supported on approved hangers, brackets or flanges cabinets, closets and elsewhere throughout the building where required.

U. Auditorium Loudspeaker Grilles

1. Furnish and install complete, two (2) loudspeaker grilles in Auditorium. Grilles shall be equal to Blumcraft Deluxe-Line. Grille facets shall have a bronze anodized finish on faces and brushed finish on backs. Supporting bars #258 to have dull black anodized finish.
2. Frame of grilles shall be equal to Blumcraft's trim section WF-4, anodized black, and be secured to masonry with stainless steel screws (slack painted heads) in expansion shields.



3. Sub-frame shall be formed from 1/4" thick aluminum bar with corners mitered, continuously welded and ground smooth and firmly secured in place. Provide continuous piano hinge with 3/16" stop angle.
 4. The inside surface of grille shall be entirely covered with black grille cloth equal to "Acousticloth", as manufactured by Merlang or "Lumite", as manufactured by Chicopee. Grille cloth shall be fastened in place. Submit samples for approval.
 5. Include continuous angles and all other angles, plates, bars and reinforcing channels, all as required.
 6. Contractor is to verify all dimensions at job before fabricating any of the work.
 7. Loudspeaker enclosure and sound absorbing blanket will be furnished and installed as part of the work of Division 27 Section "Public Address And Mass Notification Systems".
- V. Bronze Saddles (Exterior)
1. All exterior door saddles shall be of bronze unless otherwise indicated. White bronze shall be provided for aluminum doors. Finish shall be "Bronzogrit" or an approved equal.
- W. Bronze Expansion Saddles (Interior)
1. Furnish and install bronze expansion saddles generally in the following areas: doors opening off auditorium platform or stage; gymnasium; dance room. None required in store room. Saddles shall consist of bronze flats, plates, and angle clips. Installation shall allow for 3/4 inch expansion. Exposed surfaces of plates and flats shall be "Bronzogrit" or approved equal.
- X. Bronze Pipe and Tubes
1. Furnish 1 inch square bronze tubes in toilet rooms and pipe spaces. Tubes shall be turned over to mason for installation. Tubes shall be of proper length (not less than full thickness of wall) and provided with bronze wire bars at one end.
- Y. Aluminum Hat and Coat Racks and Hook Strips
1. Furnish and install hat and coat racks and hook strips in locations required. Racks and hook strips shall be constructed of aluminum channels, flats and tubing of sizes required, toggle or expansion bolted to walls to suit conditions. Aluminum shall have alumilite finish.
 2. Submit shop drawings for approval.
- Z. Aluminum Angles for Showers
1. Furnish and install aluminum angle bracing as required. Angles shall have alumilite finish. Submit shop drawings for approval prior to fabrication.
- AA. Aluminum Railings
1. Center and side rails and wall handrails shall be of aluminum when required. Posts and horizontal members shall be solid. Posts shall be 1-1/2 inches square, extend through intermediate rails, secured to top rail with 3/8 inch stud bolts; posts at upper level shall be of height indicated, tapering from 1-3/4 inches at bottom to 1-1/4 inches at top, with finial. Posts shall be solidly set with molten sulphur or other approved non-electrolytic material into a combination 1/4 inch pipe sleeve and base plate welded to same, sleeve shall be welded to stair stringer or tread to suit condition, or set in concrete sub-stair.
 2. Exterior Aluminum Railings shall be constructed required. Aluminum posts shall be solid 1-1/2 inches square, extend through bottom rail, let into top rail and continuously welded. Center railing shall have tapered aluminum post of size and taper as required for "center rail". Rails shall be formed to shape indicated from, 3" x 1" solid aluminum flats with rounded edges.
 3. Roof railing shall be as required.
 4. Grab bars in toilets where indicated.
 5. All aluminum railings shall have finish equal to 204-C2 Aluminum Co. of America.
- BB. Miscellaneous Ornamental Metal Work
1. Include all other ornamental metal work. Submit shop drawings for approval.



CC. Hardware

1. All hardware specified under Ornamental Metal Work shall match the approved samples in the office of the Owner. One sample of each item shall be submitted for approval of the Owner.
2. The key to all locks furnished under Ornamental Metal Work shall be provided with brass tags attached to the key with a strong metal ring or link and be similar to the tags specified under Hardware. The tags shall have stamped upon them the letters the Owner and the name or number of the room, closets, etc., for which the keys are intended.
3. All type C padlocks mentioned in this Section will be furnished as specified under Hardware. The Contractor for Ornamental Metal Work shall rivet padlock chains referred to in this Section in place.

DD. Painting

1. All Ornamental Metal Work and cast-iron work excepting cast-iron work to be set in concrete and galvanized items shall be thoroughly cleaned and painted one shop coat specified in Division 07.
2. After installation, all damaged surfaces of shop coat and all rough surfaces shall be scraped or sanded smooth and then touched up.

END OF SECTION 05 73 00 00



SECTION 05 73 00 00a - ORNAMENTAL RAILINGS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for ornamental railings. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Aluminum decorative railings with stainless-steel, wire-rope guard infill, **as directed**.
 - b. Copper-alloy decorative railings.
 - c. Stainless-steel decorative railings with stainless-steel, wire-rope guard infill, **as directed**.
 - d. Steel and iron decorative railings with stainless-steel, wire-rope guard infill, **as directed**.
 - e. Glass- and plastic-supported railings.
 - f. Post-supported railings with glass infill.
 - g. Illuminated decorative railings.

C. Definitions

1. Railings: Guards, handrails, and similar devices used for protection of occupants at open-sided floor areas, pedestrian guidance and support, visual separation, or wall protection.

D. Performance Requirements

1. Delegated Design: Design railings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
 - a. Aluminum: The lesser of minimum yield strength divided by 1.65 or minimum ultimate tensile strength divided by 1.95.
 - b. Copper Alloys: 60 percent of minimum yield strength.
 - c. Stainless Steel: 60 percent of minimum yield strength.
 - d. Steel: 72 percent of minimum yield strength.
 - e. Glass: 25 percent of mean modulus of rupture (50 percent probability of breakage), as listed in "Mechanical Properties" in AAMA's Aluminum Curtain Wall Series No. 12, "Structural Properties of Glass."
 - 1) Requirement above is based on the 2006 International Building Code (IBC) for safety factor of 4.
3. Structural Performance: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - a. Loads below are based on the 2006 International Building Code (IBC).
 - 1) Handrails and Top Rails of Guards:
 - a) Uniform load of 50 lbf/ft. (0.73 kN/m) applied in any direction.
 - b) Concentrated load of 200 lbf (0.89 kN) applied in any direction.
 - c) Uniform and concentrated loads need not be assumed to act concurrently.
 - 2) Infill of Guards:
 - a) Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
 - b) Infill load and other loads need not be assumed to act concurrently.
 - 3) Glass-Supported Railings: Support each section of top rail by a minimum of three glass panels or by other means so top rail will remain in place if any one panel fails.



4. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
 - a. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
5. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

E. Submittals

1. Product Data: For the following:
 - a. Manufacturer's product lines of railings assembled from standard components.
 - b. Grout, anchoring cement, and paint products.
2. LEED Submittals:
 - a. Product Data for Credit MR 4.1 and Credit MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.
3. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - a. For illuminated railings, include wiring diagrams and roughing-in details.
4. Samples: For each type of exposed finish required.
 - a. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
 - b. Each type of glass required.
 - c. Fittings and brackets.
 - d. Welded connections.
 - e. Brazed connections.
 - f. Assembled Samples of railing systems, made from full-size components, including top rail, post, handrail, and infill. Show method of finishing members at intersections. Samples need not be full height.
5. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
6. Qualification Data: For qualified professional engineer **OR** testing agency, **as directed**.
7. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.
8. Welding certificates.
9. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

F. Quality Assurance

1. Source Limitations: Obtain each type of railing from single source from single manufacturer.
2. Product Options: Information on Drawings and in Specifications establishes requirements for system's aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including structural analysis, preconstruction testing, field testing, and in-service performance.
 - a. Do not modify intended aesthetic effects, as judged solely by the Owner, except with the Owner's approval. If modifications are proposed, submit comprehensive explanatory data to the Owner for review.
3. Welding Qualifications: Qualify procedures and personnel according to the following:
 - a. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - b. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 - c. AWS D1.6, "Structural Welding Code - Stainless Steel."



4. Safety Glazing Labeling: Permanently mark glass with certification label of the SGCC **OR** the SGCC or another certification agency acceptable to authorities having jurisdiction **OR** manufacturer, **as directed**. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
5. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
6. Preinstallation Conference: Conduct conference at Project site.

G. Project Conditions

1. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.

H. Coordination And Scheduling

1. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
2. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
3. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not suit structural performance requirements.

1.2 PRODUCTS

A. Metals, General

1. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
2. Brackets, Flanges, and Anchors: Same metal and finish as supported rails unless otherwise indicated.
 - a. Provide cast-metal brackets with flange tapped for concealed anchorage to threaded hanger bolt.
 - b. Provide either formed- or cast-metal brackets with predrilled hole for exposed bolt anchorage.
 - c. Provide formed-steel brackets with predrilled hole for bolted anchorage and with snap-on cover that matches rail finish and conceals bracket base and bolt head.
 - d. Provide extruded-aluminum brackets with interlocking pieces that conceal anchorage. Locate set screws on bottom of bracket.

B. Aluminum

1. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with strength and durability properties for each aluminum form required not less than that of alloy and temper designated below.
2. Extruded Bars and Shapes, Including Extruded Tubing: ASTM B 221 (ASTM B 221M), Alloy 6063-T5/T52.
3. Extruded Structural Pipe and Round Tubing: ASTM B 429/B 429M, Alloy 6063-T6.
 - a. Provide Standard Weight (Schedule 40) pipe unless otherwise indicated.
4. Drawn Seamless Tubing: ASTM B 210 (ASTM B 210M), Alloy 6063-T832.
5. Plate and Sheet: ASTM B 209 (ASTM B 209M), Alloy 5005-H32 **OR** Alloy 6061-T6, **as directed**.
6. Die and Hand Forgings: ASTM B 247 (ASTM B 247M), Alloy 6061-T6.
7. Castings: ASTM B 26/B 26M, Alloy A356.0-T6.
8. Perforated Metal: Aluminum sheet, ASTM B 209 (ASTM B 209M), Alloy 6061-T6, 0.063 inch (1.60 mm) thick, with 1/4-inch (6.4-mm) holes 3/8 inch (9.5 mm) o.c. in staggered rows.



9. Woven-Wire Mesh: Intermediate-crimp, diamond **OR** square, **as directed**, pattern, 2-inch (50-mm) woven-wire mesh, made from 0.162-inch (4.1-mm) nominal diameter wire complying with ASTM B 211 (ASTM B 211M), Alloy 6061-T94.

C. Copper Alloys

1. Copper and Copper Alloys, General: Provide alloys indicated and with temper to suit application and forming methods, but with strength and stiffness not less than Temper H01 (quarter hard) for plate, sheet, strip, and bars and Temper H55 (light drawn) for tube and pipe.
2. Extruded Shapes, Bronze: ASTM B 455, Alloy UNS No. C38500 (architectural bronze).
3. Extruded Shapes, Brass: ASTM B 249/B 249M, Alloy UNS No. C36000 (free-cutting brass).
4. Extruded Shapes, Nickel Silver: ASTM B 249/B 249M, Alloy UNS No. C79600.
5. Seamless Pipe, Bronze: ASTM B 43, Alloy UNS No. C23000 (red brass, 85 percent copper).
6. Seamless Tube, Bronze: ASTM B 135 (ASTM B 135M), Alloy UNS No. C23000 (red brass, 85 percent copper).
7. Seamless Tube, Brass: ASTM B 135 (ASTM B 135M), Alloy UNS No. C26000 (cartridge brass, 70 percent copper).
8. Seamless Tube, Copper: ASTM B 75 (ASTM B 75M), Alloy UNS No. C12200 (phosphorous deoxidized, high residual phosphorous copper).
9. Castings, Bronze: Composition bronze castings complying with ASTM B 62, Alloy UNS No. C83600 (85-5-5-5 or No. 1 composition commercial red brass) or sand castings complying with ASTM B 584, Alloy UNS No. C86500 (No. 1 manganese bronze).
10. Castings, Brass: Sand castings complying with ASTM B 584, Alloy UNS No. C85200 (high-copper yellow brass).
11. Castings, Copper: ASTM B 824, with a minimum of 99.9 percent copper.
12. Castings, Nickel Silver: ASTM B 584, Alloy UNS No. C97300 (12 percent leaded nickel silver).
13. Plate, Sheet, Strip, and Bars; Bronze: ASTM B 36/B 36M, Alloy UNS No. C28000 (muntz metal, 60 percent copper).
14. Plate, Sheet, Strip, and Bars; Brass: ASTM B 36/B 36M, Alloy UNS No. C26000 (cartridge brass, 70 percent copper).
15. Plate, Sheet, Strip, and Bars; Copper: ASTM B 152/B 152M, Alloy UNS No. C11000 (electrolytic tough pitch copper) or Alloy UNS No. C12200 (phosphorous deoxidized, high-residual phosphorous copper).

D. Stainless Steel

1. Tubing: ASTM A 554, Grade MT 304 **OR** Grade MT 316 **OR** Grade MT 316L, **as directed**.
2. Pipe: ASTM A 312/A 312M, Grade TP 304 **OR** Grade TP 316 **OR** Grade TP 316L, **as directed**.
3. Castings: ASTM A 743/A 743M, Grade CF 8 or CF 20 **OR** Grade CF 8M or CF 3M, **as directed**.
4. Sheet, Strip, Plate, and Flat Bar: ASTM A 666, Type 304 **OR** Type 316 **OR** Type 316L, **as directed**.
5. Bars and Shapes: ASTM A 276, Type 304 **OR** Type 316 **OR** Type 316L, **as directed**.
6. Wire Rope and Fittings:
 - a. Wire Rope: 1-by-19 **OR** 7-by-7 **OR** 7-by-19, **as directed**, wire rope made from wire complying with ASTM A 492, Type 316.
 - b. Wire-Rope Fittings: Connectors of types indicated, fabricated from stainless steel, and with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.
7. Expanded Metal: ASTM F 1267, Type I (expanded) **OR** Type II (expanded and flattened), **as directed**, Class 3 (corrosion-resisting steel), made from stainless-steel sheet complying with ASTM A 666, Type 304 **OR** Type 316, **as directed**.
 - a. Style Designation: 3/4 number 13 **OR** 1-1/2 number 10, **as directed**.
8. Perforated Metal: Stainless-steel sheet, ASTM A 240/A 240M or ASTM A 666, Type 304 **OR** Type 316L, **as directed**, 0.062 inch (1.59 mm) thick, with 1/4-inch (6.4-mm) holes 3/8 inch (9.5 mm) o.c. in staggered rows.



9. Woven-Wire Mesh: Intermediate-crimp, diamond **OR** square, **as directed**, pattern, 2-inch (50-mm) woven-wire mesh, made from 0.135-inch (3.5-mm) nominal diameter wire complying with ASTM A 580/A 580M, Type 304 **OR** Type 316, **as directed**.
- E. Steel And Iron
1. Recycled Content of Steel Products: Provide products with average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
 2. Tubing: ASTM A 500 (cold formed) or ASTM A 513.
 3. Bars: Hot-rolled, carbon steel complying with ASTM A 29/A 29M, Grade 1010.
 4. Plates, Shapes, and Bars: ASTM A 36/A 36M.
 5. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.
 6. Expanded Metal: ASTM F 1267, Type I (expanded) **OR** Type II (expanded and flattened), **as directed**, Class 1 (uncoated).
 - a. Style Designation: 3/4 number 13 **OR** 1-1/2 number 10, **as directed**.
 7. Perforated Metal: Cold-rolled steel sheet, ASTM A 1008/A 1008M, or hot-rolled steel sheet, ASTM A 1011/A 1011M, commercial steel Type B, 0.060 inch (1.52 mm) thick, with 1/4-inch (6.4-mm) holes 3/8 inch (9.5 mm) o.c. in staggered rows.
OR
Perforated Metal: Galvanized-steel sheet, ASTM A 653/A 653M, G90 (Z275) coating, commercial steel Type B, 0.064 inch (1.63 mm) thick, with 1/4-inch (6.4-mm) holes 3/8 inch (9.5 mm) o.c. in staggered rows **OR** with 1/8-by-1-inch (3.2-by-25.4-mm) round end slotted holes in staggered rows, **as directed**.
 8. Woven-Wire Mesh: Intermediate-crimp, diamond **OR** square, **as directed**, pattern, 2-inch (50-mm) woven-wire mesh, made from 0.135-inch (3.5-mm) nominal diameter wire complying with ASTM A 510 (ASTM A 510M).
- F. Glass And Glazing Materials
1. Tempered Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated), Type 1 (transparent flat glass), Quality-Q3. Provide products that have been tested for surface and edge compression according to ASTM C 1048 and for impact strength according to 16 CFR 1201 for Category II materials.
 - a. Glass Color: Clear **OR** Blue **OR** Blue-green **OR** Bronze **OR** Green **OR** Gray, **as directed**.
 - b. Thickness for Structural Glass Balusters: As required by structural loads, but not less than 12.0 **OR** 19.0, **as directed**, mm.
 - c. Thickness for Glass Infill Panels: As required by structural loads, but not less than 6.0 **OR** 10.0, **as directed**, mm.
OR
Thickness: As indicated on Drawings.
 2. Laminated Glass: ASTM C 1172, Condition A (uncoated), Type I (transparent flat glass), Quality-Q3 with two plies of glass and polyvinyl butyral interlayer not less than 0.060 inch (1.52 mm) thick.
 - a. Kind: LA (laminated annealed) **OR** LHS (laminated heat strengthened) **OR** LT (laminated tempered) **OR** As indicated, **as directed**.
 - b. Glass Color: Clear **OR** Blue **OR** Blue-green **OR** Bronze **OR** Green **OR** Gray, **as directed**.
 - c. Interlayer Color: Clear **OR** Blue-green **OR** Bronze light **OR** Gray **OR** As selected from manufacturer's full range, **as directed**.
 - d. Glass Plies for Structural Glass Balusters: Thickness required by structural loads, but not less than 6.0 **OR** 8.0, **as directed**, mm thick, each.
 - e. Glass Plies for Glass Infill Panels: Thickness required by structural loads, but not less than 3.0 **OR** 4.0 **OR** 5.0, **as directed**, mm, each.
 3. Ceramic-Coated Glass: Heat-treated float glass, Condition C; with ceramic enamel applied by silk-screened process; complying with Specification No. 95-1-31 in GANA's "Engineering Standards Manual" and with other requirements specified.



- a. Glass Color: Clear **OR** Blue **OR** Blue-green **OR** Bronze **OR** Green **OR** Gray **OR** As selected from manufacturer's full range, **as directed**.
4. Plastic Structural Glazing: Uncoated, transparent, monolithic acrylic sheet complying with ASTM D 4802, Category A-1 or A-2 (cell cast or continuous cast), Finish 1 (smooth or polished), and as follows:
 - a. Color: Colorless (clear) **OR** Blue **OR** Blue-green **OR** Bronze **OR** Gray **OR** Green **OR** Match glass, **as directed**.
 - b. Thickness: 12.0 mm **OR** Match glass thickness, **as directed**.
5. Glazing Cement and Accessories for Structural Glazing: Glazing cement, setting blocks, shims, and related accessories as recommended or supplied by railing manufacturer for installing structural glazing in metal subrails.
 - a. Glazing Cement: Nonshrinking organic cement designed for curing by passing an electric current through metal subrail holding glass panel, as standard with manufacturer.
6. Glazing Gaskets for Glass Infill Panels: Glazing gaskets and related accessories recommended or supplied by railing manufacturer for installing glass infill panels in post-supported railings.

G. Fasteners

1. Fastener Materials: Unless otherwise indicated, provide the following:
 - a. Aluminum Components: Type 304 **OR** Type 316, **as directed**, stainless-steel fasteners.
 - b. Copper-Alloy (Bronze) Components: Silicon bronze (Alloy 651 or Alloy 655) fasteners where concealed; muntz metal (Alloy 280) fasteners where exposed.
 - c. Copper-Alloy (Brass) Components: Silicon bronze (Alloy 651 or Alloy 655) fasteners where concealed; brass (Alloy 260 or Alloy 360) fasteners where exposed.
 - d. Stainless-Steel Components: Type 304 **OR** Type 316, **as directed**, stainless-steel fasteners.
 - e. Uncoated Steel Components: Plated-steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating where concealed; Type 304 stainless-steel fasteners where exposed.
 - f. Galvanized-Steel Components: Plated-steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.
 - g. Dissimilar Metals: Type 304 **OR** Type 316, **as directed**, stainless-steel fasteners.
2. Fasteners for Anchoring to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads, **as directed**.
3. Provide concealed fasteners for interconnecting railing components and for attaching railings to other work unless otherwise indicated **OR** exposed fasteners are unavoidable **OR** exposed fasteners are the standard fastening method for railings indicated, **as directed**.
 - a. Provide Phillips **OR** tamper-resistant **OR** square or hex socket, **as directed**, flat-head machine screws for exposed fasteners unless otherwise indicated.
4. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
5. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
 - a. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
 - b. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) **OR** Group 2 (A4), **as directed**, stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

H. Miscellaneous Materials

1. Wood Rails: Clear, straight-grained hardwood rails secured to recessed **OR** exposed, **as directed**, metal subrail.
 - a. Species: Ash **OR** Cherry **OR** Red oak **OR** Walnut **OR** White oak, **as directed**.



- b. Finish: Manufacturer's standard **OR** Transparent polyurethane **OR** Penetrating oil **OR** Acrylic impregnated, **as directed**.
- c. Staining: None **OR** Match the Owner's sample **OR** As selected from manufacturer's full range, **as directed**.
- d. Profile: Square, 1-3/4 by 1-3/4 inches (45 by 45 mm) with edges eased to 1/4-inch (6-mm) radius **OR** Rectangular, 1-3/4 by 5 inches (45 by 127 mm) with edges eased to 1/4-inch (6-mm) radius **OR** Round, 2-inch (50-mm) diameter **OR** As indicated, **as directed**.

OR

Wood Rails: Hardwood rails complying with Division 06 Section "Interior Architectural Woodwork"

- 2. Electrical Components: Provide internal, fluorescent light fixtures and electrical components, required as part of illuminated railings, that comply with NFPA 70 and that are listed and labeled by UL.
- 3. Plastic Handrail Caps: Thermoplastic rail covering, color as indicated or, if not indicated, as selected by the Owner from manufacturer's standard colors.
- 4. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
 - a. For aluminum railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.
- 5. Brazing Rods: For copper-alloy railings, provide type and alloy as recommended by producer of metal to be brazed and as required for color match, strength, and compatibility in fabricated items.
- 6. Lacquer for Copper Alloys: Clear acrylic lacquer specially developed for coating copper-alloy products.
- 7. Etching Cleaner for Galvanized Metal: Complying with MPI#25.
- 8. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- 9. Shop Primers: Provide primers that comply with Division 07 **OR** Division 09 Section(s) "High-performance Coatings" **OR** Division 07 **AND** Division 09 Section(s) "High-performance Coatings", **as directed**.
- 10. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - a. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- 11. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- 12. Shop Primer for Galvanized Steel: Cementitious galvanized metal primer complying with MPI#26 **OR** Vinyl wash primer complying with MPI#80 **OR** Water-based galvanized metal primer complying with MPI#134, **as directed**.
- 13. Intermediate Coats and Topcoats: Provide products that comply with Division 07 **OR** Division 09 Section(s) "High-performance Coatings" **OR** Division 07 **AND** Division 09 Section(s) "High-performance Coatings", **as directed**.
- 14. Epoxy Intermediate Coat: Complying with MPI#77 and compatible with primer and topcoat.
- 15. Polyurethane Topcoat: Complying with MPI#72 and compatible with undercoat.
- 16. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- 17. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- 18. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
 - a. Water-Resistant Product: At exterior locations and where indicated provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

I. Fabrication

- 1. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.



2. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
3. Make up wire-rope assemblies in the shop to field-measured dimensions with fittings machine swaged. Minimize amount of turnbuckle take-up used for dimensional adjustment so maximum amount is available for tensioning wire ropes. Tag wire-rope assemblies and fittings to identify installation locations and orientations for coordinated installation.
4. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
5. Form work true to line and level with accurate angles and surfaces.
6. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate. Locate weep holes in inconspicuous locations.
7. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
8. Connections: Fabricate railings with welded or nonwelded connections unless otherwise indicated.
9. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - b. Obtain fusion without undercut or overlap.
 - c. Remove flux immediately.
 - d. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 welds: no evidence of a welded joint.
10. Welded Connections for Aluminum Pipe: Fabricate railings to interconnect members with concealed internal welds that eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.
11. Brazed Connections: Connect copper-alloy railings by brazing. Cope components at connections to provide close fit, or use fittings designed for this purpose. Braze corners and seams continuously.
 - a. Use materials and methods that match color of base metal, minimize distortion, and develop maximum strength and corrosion resistance.
 - b. Remove flux immediately.
 - c. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and brazed surface matches contours of adjoining surfaces.
12. Mechanical Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
 - a. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.
13. Form changes in direction as follows:
 - a. As detailed.
OR
By bending or by inserting prefabricated elbow fittings.
OR
By flush bends or by inserting prefabricated flush-elbow fittings.
OR
By radius bends of radius indicated or by inserting prefabricated elbow fittings of radius indicated.
OR
By bending to smallest radius that will not result in distortion of railing member.
14. Bend members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
15. Close exposed ends of hollow railing members with prefabricated end fittings.



16. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns, unless clearance between end of rail and wall is 1/4 inch (6 mm) or less.
 17. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
 - a. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers, or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
 18. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.
 19. For railing posts set in concrete, provide steel **OR** stainless-steel, **as directed**, sleeves not less than 6 inches (150 mm) long with inside dimensions not less than 1/2 inch (13 mm) greater than outside dimensions of post, with metal plate forming bottom closure.
 20. For removable railing posts, fabricate slip-fit sockets from steel **OR** stainless-steel, **as directed**, tube or pipe whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height. Provide socket covers designed and fabricated to resist being dislodged.
 - a. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings.
 21. Expanded-Metal Infill Panels: Fabricate infill panels from stainless-steel **OR** steel, **as directed**, expanded metal unless otherwise indicated.
 - a. Edge panels with U-shaped channels made from same metal as infill; not less than 0.043 inch (1.1 mm) thick.
 - b. Orient expanded metal with long dimension of diamonds parallel to top rail **OR** perpendicular to top rail **OR** horizontal **OR** vertical, **as directed**.
 22. Perforated-Metal Infill Panels: Fabricate infill panels from perforated metal made from steel **OR** galvanized steel **OR** aluminum **OR** stainless steel **OR** same metal as railings in which they are installed, **as directed**.
 - a. Edge panels with U-shaped channels made from metal sheet, of same metal as perforated metal and not less than 0.043 inch (1.1 mm) thick.
 - b. Orient perforated metal with pattern parallel to top rail **OR** perpendicular to top rail **OR** horizontal **OR** vertical **OR** as indicated on Drawings, **as directed**.
 23. Woven-Wire Mesh Infill Panels: Fabricate infill panels from woven-wire mesh crimped into 1-by-1/2-by-1/8-inch (25-by-13-by-3-mm) metal channel frames.
 - a. Make wire mesh and frames from aluminum **OR** stainless steel **OR** steel, **as directed**, unless otherwise indicated.
 - b. Orient wire mesh with diamonds vertical **OR** wires perpendicular and parallel to top rail **OR** wires horizontal and vertical, **as directed**.
 24. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.
- J. Glazing Panel Fabrication
1. General: Fabricate to sizes and shapes required; provide for proper edge clearance and bite on glazing panels.
 - a. Clean-cut or flat-grind edges at butt-glazed sealant joints to produce square edges with slight chamfers at junctions of edges and faces
 - b. Grind smooth exposed edges, including those at open joints, to produce square edges with slight chamfers at junctions of edges and faces.
 2. Structural Glass Balusters: Factory-bond glass to aluminum base and top-rail channels in railing manufacturer's plant using glazing cement to comply with manufacturer's written specifications, unless field glazing is standard with manufacturer.
 3. Structural Balusters: Provide tempered **OR** laminated, heat-strengthened **OR** laminated, tempered, **as directed**, glass panels for both straight and curved sections, **as directed**.
OR



Structural Balusters: Provide thermoformed, curved, plastic glazing panels for curved sections and tempered **OR** laminated, heat-strengthened **OR** laminated, tempered, **as directed**, glass panels for straight sections.

OR

Infill Panels: Provide tempered **OR** laminated, annealed **OR** laminated, heat-strengthened **OR** laminated, tempered, **as directed**, glass panels for both straight and curved sections, **as directed**.

K. Illuminated Railings

1. General: Comply with requirements in this Section for aluminum railings with welded connections.
2. Illuminated Units: Provide internal illumination using concealed, internally wired, fluorescent-strip fixture system to illuminate walking surfaces adjacent to railings without light leaks. Make provisions for servicing and for concealed connection to electric service. Coordinate electrical characteristics with those of the power supply provided.
 - a. Fluorescent Tubes: Provide number of tubes indicated or required by railing length.
 - b. Diffusers: UV-stabilized acrylic diffusers matching profile of railings.
 - c. Ballasts: Energy-saving, high power factor, Class P, electromagnetic type; designed for use with high-output lamps, and with automatic-reset thermal protection. Ballasts comply with ANSI C82.1, bear Certified Ballast Manufacturer Certification labels, and are rated for 0 deg F (minus 17 deg C) **OR** minus 20 deg F (minus 29 deg C), **as directed**, starting temperature.

L. General Finish Requirements

1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.
3. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
4. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

M. Aluminum Finishes

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
2. Mechanical Finish: AA-M3x (Mechanical Finish: as specified); sand top rails, handrails, and intermediate rails in one direction only, parallel to length of railing, with 120- and 320-grit abrasive. After installation, polish railings with No. 0 steel wool immersed in paste wax, then rub to a luster with a soft dry cloth.
3. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm **OR** AA-M12C22A31, Class II, 0.010 mm, **as directed**, or thicker.
4. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm **OR** AA-M12C22A32/A34, Class II, 0.010 mm, **as directed**, or thicker.
 - a. Color: Champagne **OR** Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black **OR** As selected from full range of industry colors and color densities, **as directed**.
5. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.



6. Siliconized Polyester Finish: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
 - a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
7. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2604 **OR** AAMA 2605, **as directed**, and containing not less than 50 **OR** 70, **as directed**, percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

OR

High-Performance Organic Finish: Three **OR** Four, **as directed**,-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 50 **OR** 70, **as directed**, percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

- b. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

N. Copper-Alloy Finishes

1. Finish designations for copper alloys comply with the system for designating copper-alloy finish systems defined in NAAMM's "Metal Finishes Manual for Architectural and Metal Products."
2. Buffed Finish: M21 (Mechanical Finish: buffed, smooth specular).
3. Hand-Rubbed Finish: M31-M34 (Mechanical Finish: directionally textured, fine satin; Mechanical Finish: directionally textured, hand rubbed).
4. Medium-Satin Finish: M32 (Mechanical Finish: directionally textured, medium satin).
5. Fine-Matte Finish: M42 (Mechanical Finish: nondirectional finish, fine matte).
6. Buffed Finish, Lacquered: M21-O6x (Mechanical Finish: buffed, smooth specular; Coating: clear organic, air drying, as specified below).
 - a. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).
7. Hand-Rubbed Finish, Lacquered: M31-M34-O6x (Mechanical Finish: directionally textured, fine satin; Mechanical Finish: directionally textured, hand rubbed; Coating: clear organic, air drying, as specified below).
 - a. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).
8. Medium-Satin Finish, Lacquered: M32-O6x (Mechanical Finish: directionally textured, medium satin; Coating: clear organic, air drying, as specified below).
 - a. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).
9. Fine-Matte Finish, Lacquered: M42-O6x (Mechanical Finish: nondirectional finish, fine matte; Coating: clear organic, air drying, as specified below).
 - a. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).
10. Statuary Conversion Coating over Satin Finish: M31-C55 (Mechanical Finish: directionally textured, fine satin; Chemical Finish: conversion coating, sulfide), with color matching the Owner's sample.
11. Patina Conversion Coating: M36-C12-C52 (Mechanical Finish: directionally textured, uniform; Chemical Finish: nonetched cleaned, degreased; Chemical Finish: conversion coating, ammonium sulfate), with color matching the Owner's sample.

O. Stainless-Steel Finishes



1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - a. Run grain of directional finishes with long dimension of each piece.
3. Directional Satin Finish: No. 4.
4. Dull Satin Finish: No. 6.
5. Satin, Reflective, Directional Polish: No. 7.
6. Mirrorlike Reflective, Nondirectional Polish: No. 8.
7. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
8. Sputter-Coated Finish: Titanium nitride coating deposited by magnetic sputter-coating process over indicated mechanical finish.

P. Steel And Iron Finishes

1. Galvanized Railings:
 - a. Hot-dip galvanize steel **OR** exterior steel, **as directed**, and iron railings, including hardware, after fabrication.
 - b. Hot-dip galvanize indicated steel and iron railings, including hardware, after fabrication.
 - c. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
 - d. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.
 - e. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
 - f. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
2. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
3. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.
4. For nongalvanized-steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors to be embedded in exterior concrete or masonry.
5. Preparing Nongalvanized Items for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning" **OR** SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning" **OR** requirements indicated below, **as directed**:
 - a. Exterior Railings: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - b. Railings Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - c. Railings Indicated to Receive Primers Specified in Division 9 Section "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - d. Other Railings: SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
6. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
 - a. Shop prime uncoated railings with universal shop primer **OR** primers specified in Division 07, **as directed**, unless zinc-rich primer is **OR** primers specified in Division 09 Section "High-performance Coatings" are, **as directed**, indicated.
 - b. Do not apply primer to galvanized surfaces.
7. Shop-Painted Finish: Comply with Division 09 Section(s) "Exterior Painting" **OR** "High-performance Coatings", **as directed**.
 - a. Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
8. High-Performance Coating: Apply epoxy intermediate and polyurethane topcoats to prime-coated surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Apply at spreading rates recommended by coating manufacturer.



- a. Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
9. Powder-Coat Finish: Prepare, treat, and coat nongalvanized ferrous metal to comply with resin manufacturer's written instructions and as follows:
 - a. Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - b. Treat prepared metal with iron-phosphate pretreatment, rinse, and seal surfaces.
 - c. Apply thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils (0.04 mm).
 - d. Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
10. Powder-Coat Finish: Prepare, treat, and coat galvanized metal to comply with resin manufacturer's written instructions and as follows:
 - a. Prepare galvanized metal by thoroughly removing grease, dirt, oil, flux, and other foreign matter.
 - b. Treat prepared metal with zinc-phosphate pretreatment, rinse, and seal surfaces.
 - c. Apply thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils (0.04 mm).
 - d. Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

1.3 EXECUTION

A. Examination

1. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

B. Installation, General

1. Fit exposed connections together to form tight, hairline joints.
2. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
 - a. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 - b. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
 - c. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (5 mm in 3 m).
3. Corrosion Protection: Coat concealed surfaces of aluminum and copper alloys that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
4. Adjust railings before anchoring to ensure matching alignment at abutting joints.
5. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

C. Railing Connections

1. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.
2. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.



3. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches (50 mm) beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches (150 mm) of post.

D. Anchoring Posts

1. Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.
2. Form or core-drill holes not less than 5 inches (125 mm) deep and 3/4 inch (20 mm) larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.
3. Cover anchorage joint with flange of same metal as post, welded to post after placing anchoring material **OR** attached to post with set screws, **as directed**.
OR
Leave anchorage joint exposed with 1/8-inch (3-mm) buildup, sloped away from post **OR** anchoring material flush with adjacent surface, **as directed**.
4. Anchor posts to metal surfaces with flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
 - a. For aluminum railings, attach posts as indicated using fittings designed and engineered for this purpose.
 - b. For copper-alloy railings, attach posts as indicated using fittings designed and engineered for this purpose.
 - c. For stainless-steel railings, weld flanges to posts and bolt to metal-supporting surfaces.
 - d. For steel railings, weld flanges to posts and bolt to metal-supporting surfaces.
5. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.

E. Attaching Railings

1. Anchor railing ends to concrete and masonry with sleeves concealed within **OR** flanges connected to **OR** brackets on underside of rails connected to, **as directed**, railing ends and anchored to wall construction with anchors and bolts.
2. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends or connected to railing ends using nonwelded connections.
3. Attach handrails to walls with wall brackets except where end flanges are used. Provide brackets with 1-1/2-inch (38-mm) clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
 - a. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt **OR** predrilled hole for exposed bolt anchorage, **as directed**.
 - b. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
4. Secure wall brackets and railing end flanges to building construction as follows:
 - a. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 - b. For hollow masonry anchorage, use toggle bolts.
 - c. For wood stud partitions, use hanger or lag bolts set into wood backing between studs. Coordinate with carpentry work to locate backing members.
 - d. For steel-framed partitions, use hanger or lag bolts set into fire-retardant-treated, **as directed**, wood backing between studs. Coordinate with stud installation to locate backing members.
OR
For steel-framed partitions, fasten brackets directly to steel framing or concealed steel reinforcements using self-tapping screws of size and type required to support structural loads.

**OR**

For steel-framed partitions, fasten brackets with toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

F. Installing Glass Panels

1. Glass-Supported Railings: Install assembly to comply with railing manufacturer's written instructions.
 - a. Attach base channel to building structure, then insert and connect factory-fabricated and -assembled glass panels if glass was bonded to base and top rail channels in factory.
 - b. Attach base channel to building structure, then insert glass into base channel and bond with glazing cement unless glass was bonded to base and top rail channels in factory.
 - 1) Support glass panels in base channel at quarter points with channel-shaped setting blocks that also act as shims to maintain uniform space for glazing cement. Fill remaining space in base channel with glazing cement for uniform support of glass.
 - c. Adjust spacing of glass panels so gaps between panels are equal before securing in position.
 - d. Erect glass railings under direct supervision of manufacturer's authorized technical personnel.
2. Post-Supported Glass Railings: Install assembly to comply with railing manufacturer's written instructions and with requirements in other Part 1.3 articles. Erect posts and other metal railing components, then set factory-cut glass panels. Do not cut, drill, or alter glass panels in field. Protect edges from damage.

G. Installing Plastic Handrail Caps

1. Apply plastic handrail caps to top rails and handrails, where indicated, complying with manufacturer's written instructions for cutting, mounting, forming, welding, cleaning, applying end caps, and finishing.
2. Minimize number of joints in plastic caps by installing in lengths as long as possible. Allow for shortening of plastic cap caused by welding and splicing process; butt ends together to produce hairline joint.
 - a. Continuously weld, splice, miter, and end-cap joints using cap manufacturer's electric welding iron designed for this purpose. Remove welding flash while material is still soft.
 - b. Weld only prongs on underside of plastic cap at splice, miter, and end-cap joints. After cutting plastic cap, dress ends with file to produce a hairline fit between abutting sections. After mounting cap, polish top surface with cap manufacturer's solvent designed for this purpose until joint becomes almost invisible.

H. Field Quality Control

1. Testing Agency: Perform field tests and inspections and prepare test reports.
2. Extent and Testing Methodology: Randomly select completed railing assemblies for testing that are representative of different railing designs and conditions in the completed Work. Railings will be tested according to ASTM E 894 and ASTM E 935 for compliance with performance requirements.
3. Remove and replace railings where test results indicate that they do not comply with specified requirements unless they can be repaired in a manner satisfactory to the Owner and will comply with specified requirements.
4. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

I. Cleaning

1. Clean aluminum and stainless steel by washing thoroughly with clean water and soap, rinsing with clean water, and wiping dry.
2. Clean copper alloys according to metal finisher's written instructions in a manner that leaves an undamaged and uniform finish matching approved Sample.



3. Clean and polish glass and plastic glazing as recommended in writing by manufacturer. Wash both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Final Completion.
4. Clean wood rails and plastic handrail caps by wiping with a damp cloth and then wiping dry.
5. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - a. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

OR

Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 07 OR Division 09 Section(s) "High-performance Coatings" **OR** Division 07 AND Division 09 Section(s) "High-performance Coatings", **as directed**.
6. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

J. Protection

1. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Final Completion.
2. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 05 73 00 00a



Task	Specification	Specification Description
05 73 00 00	05 58 16 00	Ornamental Metal
05 75 00 00	05 58 16 00	Ornamental Metal
05 75 00 00	05 58 16 00a	Ornamental Formed Metal



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SECTION 06 05 23 00 - TIMBER BRIDGE COMPONENTS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of timber bridge components. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: For each type of product indicated.

1.2 PRODUCTS

- #### A. Timber for Bridges shall comply with the specifications for timber bridges contained in the standard specifications of the state in which the work occurs, AASHTO's "Standard Specifications for Highway Bridges," and National Forest Products Association's "National Design Specification for Wood Construction."

- #### B. Preservative Treatment shall comply with the specifications for preservative treatment contained in the standard specifications of the state in which the work occurs, and American Wood-Preservers' Association's "Book of Standards." All timber shall be treated unless specified otherwise.

C. Hardware and Castings:

1. Castings: Cast steel shall comply with ASTM A 27, Grade 70-36, or gray iron castings shall comply with AASHTO M105 Class No. 30, unless otherwise specified.
2. Hardware:
 - a. Machine Bolts, Drift-Bolts, and Dowels may be either wrought iron or rolled steel. Machine bolts shall have the square heads and nuts unless otherwise specified.
 - b. Cast Washers shall be made of malleable or gray iron. The outside diameter shall not be less than 3 1/2 times the bolt diameter and its thickness equal to the bolt diameter. Plate washers shall be made of wrought iron or rolled steel. The outside diameter shall not be less than 3 1/2 times the bolt diameter, and they shall not be less than 1/4 inch thick.
 - c. Nails and Spikes shall be hot-dip zinc coated per ASTM A 153 or of Type 304 stainless steel.
 - d. Finish: Unless otherwise specified, all hardware for treated timber bridges shall be galvanized or cadmium-plated. Galvanizing shall comply with ASTM A 123 or A 153. Cadmium plating of steel shall comply with ASTM B 766.

- #### D. Timber Connectors shall be ring type or plate type and shall be galvanized in compliance with ASTM A 123 or A 153.

1. Split Ring: Fabricated from hot rolled steel sheet complying with ASTM A 570 (ASTM A 570M), Grade 33 of standard manufacture.
2. Tooth Ring: Stamped cold form 16-gauge steel sheet fabricated from hot rolled steel sheet complying with ASTM A 570 (ASTM A 570M), Grade 33 standard manufacture.
3. Shear-Plate Timber Connectors:
 - a. Pressed Steel Type shall be fabricated from hot rolled steel sheet complying with ASTM A 570 (ASTM A 570M), Grade 33. Shear plates shall be of standard manufacture.
 - b. Malleable Iron Type shall be ASTM A 47, Grade No. 32510 (ASTM A 47M, Grade 22010). Casting shall be of standard manufacture.



- E. Structural Glue-Laminated Timber shall comply with DOC PS 20, American Structural Lumber Standard, AITC 190.1 and AITC 111. Lumber for laminating shall be of such stress grade as to provide glue-laminated members with allowable stress values of 2,000 psi in bending, 1,600 psi in tension, 1,500 psi in compression parallel to grain, and 385 psi in compression perpendicular to grain for dry condition of service.
1. Adhesives shall meet requirements for wet condition of service.
 2. Surfaces of Members shall be sealed with a penetration sealer or sealed with a sealer coat.
- F. Ties: Fabricate strap ties from hot-rolled steel sheet complying with ASTM A 570 (ASTM A 570M). Hot dip galvanize after fabrication to comply with ASTM A 123 or ASTM A 153 (ASTM A 153M).
- G. Asphalt Cement shall comply with ASTM D946 for penetration-graded material.
- H. Surface Coarse Aggregate shall be ASTM D 692, except the gradation shall be as follows:
- | <u>Sieve Percent</u> | <u>Size Passing (Wt.)</u> |
|----------------------|---------------------------|
| 1/2 in. | 100 |
| 3/8 in. | 94-100 |
| No. 4 | 15-45 |
| No. 16 | 0-4 |

1.3 EXECUTION

A. Preparation:

1. Traffic Control: When traffic is maintained on bridge under repair or is directed over a temporary run-around, furnish, erect, and maintain all barricades, flags, torches, lights, guardrails, temporary pavement markings, and traffic control signs required for the protection of the public and for the direction of traffic. Number, type, color, size and placement of all traffic control color, size, and placement of all traffic control devices and the use of a flagman shall comply with USDOT FHA MUTCD "Traffic Controls for Highway Construction and Maintenance Operations." All traffic control devices in advance of the construction limits shall also be the responsibility of the Contractor.
2. Treated Timber: Give all cuts, abrasions, and holes made after treatment 2 applications of 60 percent creosote oil and 40 percent roofing pitch or brush coat with 2 applications of hot creosote oil and covered with hot roofing pitch. Any unfilled holes, after being treated with preservative oil, shall be plugged with treated plugs.

B. Erection:

1. Holes:
 - a. Drift Bolts and Dowels: Bore holes for round drift bolts and dowels with a bit 1/16 inch less in diameter than the bolt or dowel to be used. The diameter of holes for square drift bolts or dowels shall be equal to the least dimension of the bolt or dowel.
 - b. Machine Bolts and Rods: Bore holes for field fabrication with a bit the same diameter as the bolt. Holes for fabrication prior to treatment shall be 1/16 inch larger than the bolt diameter.
 - c. Lag Screws: Bore hole with a bit not larger than the body of the screw at the base of the thread.
2. Nuts and Washers: Use a washer of the size and type specified under all bolt heads and nuts except carriage bolts. The nuts of all bolts shall be locked by scoring threads after they have been finally tightened.
3. Countersinking: Paint all recesses in treated timber formed for countersinking with hot creosote oil. Fill recesses likely to collect injurious materials with hot pitch.
4. Framing: All lumber and timber shall be accurately cut and framed to a close fit in such manner that the joints will have even bearing over the entire contact surfaces. Place stringers in position so that knots near edges will be in the top portions of the stringer. Screw type fastenings shall be



screwed into place for the entire length of the fastener. Install the split ring and the shear plate in grooves cut by the Contractor. Force the toothed ring into the contact surfaces of the timbers jointed by means of pressure equipment.

5. Nailing: Nails and spikes shall be driven with just sufficient force to set the heads flush with the surface of the wood.

C. Maintenance and Repair Methods:

1. Timber Deck:
 - a. Remove Existing Plank Floor Deck and Fasteners and replace with new planks and fasteners. Lay the floor planks at 45 degrees to centerline of roadway. When more than one length of plank is required, stagger joints between abutting ends at least 3 feet in any two adjacent lines of plank.
 - b. Standard Wrought Washers shall be used under the heads of all lag screws and under the heads or nuts of all machine bolts. Where machine bolts are used for fastening the floor plank all nuts used shall be locknuts. Countersink heads of all lag screws and bolts in the surface of the floor. Fill recesses formed for countersinking with hot pitch.
 - c. Bituminous Surface Coat: Clean the floor of foreign materials. Apply asphalt cement at a temperature of 275 F to 350 F and at a rate of approximately 1/4 gallon per square yard of surface. The deck shall be dry at the time of bitumen application. Cover the entire surface with a thin coating of aggregate in a sufficient quantity to take up any free bitumen.
2. Hardware: Remove all corrosion by sandblasting or wire brushing. Replace all loose bolts and screws, adding washers as required. Replace deteriorated hardware.
3. Metal Tread Plates: Remove and replace treads as directed. Before installing treads, remove high spots and rough spots in the plank floor so that the treads will be in contact with the floor for their full length and width. Treads shall be laid in a heavy mop coat of asphalt filler. Treads shall be laid with a space of 1/4 inch between adjacent ends and shall be fastened by means of 3/8-inch galvanized bolts. Where bolts cannot be used, use 3/8-inch by 3-inch galvanized lag screws.
4. Timber Railroad Bridge Deck: Remove defective ties and guardrail, including fasteners, and replace with similar ties, guardrail, and fasteners as directed.
5. Repair of Structural Timber Members: Repair, including removal and replacement, shall be as directed.

END OF SECTION 06 05 23 00



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SECTION 06 05 23 00a - HEAVY TIMBER CONSTRUCTION

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for heavy timber construction. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes framing using timbers and round wood poles.

C. Definitions

1. Timbers: Lumber of 5 inches nominal (114 mm actual) or greater in least dimension.
2. Poles: Round wood members, called either "poles" or "posts" in the referenced standards.
3. Inspection agencies, and the abbreviations used to reference them, include the following:
 - a. NeLMA - Northeastern Lumber Manufacturers Association.
 - b. NHLA - National Hardwood Lumber Association.
 - c. NLGA - National Lumber Grades Authority.
 - d. SPIB - Southern Pine Inspection Bureau.
 - e. WCLIB - West Coast Lumber Inspection Bureau.
 - f. WWPA - Western Wood Products Association.

D. Submittals

1. Product Data: For preservative-treated wood products and timber connectors.
 - a. For preservative-treated wood products, include chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.
 - b. For timber connectors, include installation instructions.
2. LEED Submittals:
 - a. Certificates for Credit MR 7: Chain-of-custody certificates certifying that wood products comply with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.
 - 1) Include statement indicating costs for each certified wood product.
3. Shop Drawings: For heavy timber construction. Show layout, dimensions of each member, and details of connections.
4. Certificates of Inspection: Issued by lumber grading agency for exposed timber not marked with grade stamp.

E. Quality Assurance

1. Timber Standard: Comply with AITC 108, "Standard for Heavy Timber Construction."
2. Forest Certification: Provide wood products obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

F. Delivery, Storage, And Handling

1. Schedule delivery of heavy timber construction to avoid extended on-site storage and to avoid delaying the Work.
2. Store materials under cover and protected from weather and contact with damp or wet surfaces. Provide for air circulation within and around stacks and under temporary coverings.



1.2 PRODUCTS

A. Timber

1. General: Comply with DOC PS 20 and with grading rules of lumber grading agencies certified by ALSC's Board of Review as applicable.
 - a. Factory mark each item of timber with grade stamp of grading agency.
 - b. For exposed timber indicated to receive a stained or natural finish, apply grade stamps to surfaces that will not be exposed to view, or omit grade stamps and provide certificates of grade compliance issued by grading agency.
2. Timber Species and Grade: Any species and grade that, for moisture content provided, complies with required structural properties.
 - a. Allowable Stress Ratings for 12-Inch Nominal (286-mm Actual) Depth: Fb 1500 psi (10.3 MPa) and E 1,500,000 psi (10 340 MPa) **OR** Fb 1300 psi (9.0 MPa) and E 1,300,000 psi (8 960 MPa) **OR** As indicated on Drawings, **as directed**.
3. Moisture Content: Provide timber with 19 percent maximum moisture content at time of dressing or provide timber that is unseasoned at time of dressing but with 19 percent maximum moisture content at time of installation, **as directed**.
4. Dressing: Provide dressed timber (S4S) **OR** timber that is rough sawn (Rgh), **as directed**, unless otherwise indicated.
5. End Sealer: Manufacturer's standard, transparent, colorless wood sealer that is effective in retarding the transmission of moisture at cross-grain cuts and is compatible with indicated finish.
6. Penetrating Sealer: Manufacturer's standard, transparent, penetrating wood sealer that is compatible with indicated finish.

B. Round Wood Poles

1. Round Wood Poles: Clean-peeled wood poles complying with ASTM D 3200; with at least 80 percent of inner bark removed and with knots and limbs cut flush with the surface.

C. Preservative Treatment

1. Pressure treat timber with waterborne preservative according to AWPAC15 requirements for "sawn building poles and posts as structural members."
 - a. Timber that is not in contact with the ground and is continuously protected from liquid water may be treated with inorganic boron (SBX) according to AWPAC31 instead of AWPAC15.
 - b. Treatment with CCA shall include post-treatment fixation process.
2. Pressure treat poles with waterborne preservative to comply with AWPAC4.
 - a. Treatment with CCA shall include post-treatment fixation process.
3. Preservative Chemicals: Acceptable to authorities having jurisdiction.
 - a. Do not use chemicals containing arsenic or chromium except for marine (saltwater) applications.
4. Use process that includes water-repellent treatment.
5. Use process that does not include water repellents or other substances that might interfere with application of indicated finishes.
6. After treatment, redry timber and poles to 19 percent maximum moisture content.
7. Mark treated timber and poles with treatment quality mark of an inspection agency approved by ALSC's Board of Review.
 - a. For exposed items indicated to receive a stained or natural finish, mark each piece on surface that will not be exposed or omit marking and provide certificates of treatment compliance issued by inspection agency.
8. Application: Treat all heavy timber construction unless otherwise indicated **OR** Treat items indicated on Drawings and the following, **as directed**:
 - a. Sills and similar members in contact with masonry or concrete.
 - b. Timber framing members less than 18 inches (460 mm) above grade.

D. Timber Connectors

1. General: Unless otherwise indicated, fabricate from the following materials:



- a. Structural-steel shapes, plates, and flat bars complying with ASTM A 36/A 36M.
 - b. Round steel bars complying with ASTM A 575, Grade M 1020.
 - c. Hot-rolled steel sheet complying with ASTM A 1011/A 1011M, Structural Steel, Type SS, Grade 33.
 - d. Stainless-steel plate and flat bars complying with ASTM A 666, Type 304 **OR** Type 316, **as directed**.
 - e. Stainless-steel bars and shapes complying with ASTM A 276, Type 304 **OR** Type 316, **as directed**.
 - f. Stainless-steel sheet complying with ASTM A 666, Type 304 **OR** Type 316, **as directed**.
2. Fabricate beam seats from steel **OR** stainless steel, **as directed**, with 0.239-inch (6-mm) **OR** 3/16-inch (8-mm) **OR** 3/8-inch (9.5-mm), **as directed**, bearing plates, 3/4-inch- (19-mm-) diameter-by-12-inch- (300-mm-) long deformed bar anchors, and 0.239-inch (6-mm) side plates.
 3. Fabricate beam hangers from steel **OR** stainless steel, **as directed**, with 0.179-inch (4.6-mm) stirrups and 0.239-inch (6-mm) top plates.
 4. Fabricate strap ties from steel **OR** stainless steel, **as directed**, 2-1/2 inches (63 mm) wide by 0.179 inch (4.6 mm) **OR** 3 inches (75 mm) wide by 0.239 inch (6 mm), **as directed**, thick.
 5. Fabricate tie rods from round steel bars with upset threads connected with forged-steel turnbuckles complying with ASTM A 668/A 668M.
 6. Provide bolts, 3/4 inch (19 mm) unless otherwise indicated, complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); provide nuts complying with ASTM A 563 (ASTM A 563M); and, where indicated, provide flat washers.
 7. Provide shear plates, 2-5/8 inches (66.7 mm) **OR** 4 inches (102 mm), **as directed**, in diameter, complying with ASTM D 5933.
 8. Finish steel assemblies and fasteners with rust-inhibitive primer, 2-mil (0.05-mm) dry film thickness.
 9. Hot-dip galvanize steel assemblies and fasteners after fabrication to comply with ASTM A 123/A 123M or ASTM A 153/A 153M.

E. Fabrication

1. Camber: Fabricate horizontal members and inclined members with a slope of less than 1:1, with natural convex bow (crown) up, to provide camber.
2. Shop fabricate members by cutting and restoring exposed surfaces to match specified surfacing. Finish exposed surfaces to remove planing or surfacing marks, and to provide a finish equivalent to that produced by machine sanding with No. 120 grit sandpaper.
3. Pre-drill for fasteners and assembly of units.
4. Where preservative-treated members are indicated, fabricate (cut, drill, surface, and sand) before treatment to greatest extent possible. Where fabrication must be done after treatment, apply a field-treatment preservative to comply with AWPA M4.
 - a. Use inorganic boron (SBX) treatment for members not in contact with the ground and continuously protected from liquid water.
 - b. Use copper naphthenate treatment for members in contact with the ground or not continuously protected from liquid water.
5. Coat crosscuts with end sealer.
6. Seal Coat: After fabricating and surfacing each unit, apply a saturation coat of penetrating sealer on surfaces of each unit except for treated wood where the treatment included a water repellent.

1.3 EXECUTION

A. Installation

1. General: Erect heavy timber construction true and plumb. Provide temporary bracing to maintain lines and levels until permanent supporting members are in place.
 - a. Install heavy timber construction to comply with Shop Drawings.
 - b. Install horizontal and sloping members with crown edge up and provide not less than 4 inches (102 mm) of bearing on supports. Provide continuous members unless otherwise indicated; tie together over supports if not continuous.



- c. Handle and temporarily support heavy timber construction to prevent surface damage, compression, and other effects that might interfere with indicated finish.
2. Framing Built into Masonry: Provide 1/2-inch (13-mm) clearance at tops, sides, and ends of members built into masonry, bevel cut ends 3 inches (76 mm); do not embed more than 4 inches (102 mm) unless otherwise indicated.
3. Cutting: Avoid extra cutting after fabrication. Where field fitting is unavoidable, comply with requirements for shop fabrication.

OR

Fit members by cutting and restoring exposed surfaces to match specified surfacing. Predrill for fasteners and assembly of units.

- a. Finish exposed surfaces to remove planing or surfacing marks, and to provide a finish equivalent to that produced by machine sanding with No. 120 grit sandpaper.
- b. Coat crosscuts with end sealer.
- c. Where preservative-treated members must be cut during erection, apply a field-treatment preservative to comply with AWPA M4.
 - 1) Use inorganic boron (SBX) treatment for members not in contact with the ground and continuously protected from liquid water.
 - 2) Use copper naphthenate treatment for members in contact with the ground or not continuously protected from liquid water.
4. Install timber connectors as indicated.
 - a. Unless otherwise indicated, install bolts with same orientation within each connection and in similar connections.
 - b. Install bolts with orientation as indicated or, if not indicated, as directed by the Owner.

B. Adjusting

1. Repair damaged surfaces and finishes after completing erection. Replace damaged heavy timber construction if repairs are not approved by the Owner.

END OF SECTION 06 05 23 00a



Task	Specification	Specification Description
06 05 23 00	06 10 00 00	Rough Carpentry
06 05 23 00	01 95 06 00	Miscellaneous Carpentry



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SECTION 06 10 00 00 - ROUGH CARPENTRY

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for rough carpentry. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Framing with dimension lumber.
 - b. Framing with timber.
 - c. Framing with engineered wood products.
 - d. Rooftop equipment bases and support curbs.
 - e. Wood blocking, cants, and nailers.
 - f. Wood furring and grounds.
 - g. Wood sleepers.
 - h. Utility shelving.
 - i. Plywood backing panels.

C. Definitions

1. Exposed Framing: Framing not concealed by other construction.
2. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater but less than 5 inches nominal (114 mm actual) in least dimension.
3. Timber: Lumber of 5 inches nominal (114 mm actual) or greater in least dimension.
4. Lumber grading agencies, and the abbreviations used to reference them, include the following:
 - a. NeLMA: Northeastern Lumber Manufacturers' Association.
 - b. NLGA: National Lumber Grades Authority.
 - c. RIS: Redwood Inspection Service.
 - d. SPIB: The Southern Pine Inspection Bureau.
 - e. WCLIB: West Coast Lumber Inspection Bureau.
 - f. WWPA: Western Wood Products Association.

D. Submittals

1. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - a. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 - b. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
 - c. For fire-retardant treatments specified to be High-Temperature (HT) type, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
 - d. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
 - e. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
2. LEED Submittals:



- a. Product Data for Credit EQ 4.1: For adhesives, including printed statement of VOC content.
- b. Product Data for Credit EQ 4.4: For composite-wood products, documentation indicating that product contains no urea formaldehyde.
- c. Certificates for Credit MR 7: Chain-of-custody certificates certifying that products specified to be made from certified wood comply with forest certification requirements. Include evidence that mill is certified for chain of custody by an FSC-accredited certification body.
 - 1) Include statement indicating costs for each certified wood product.
3. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
4. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:
 - a. Wood-preservative-treated wood.
 - b. Fire-retardant-treated wood.
 - c. Engineered wood products.
 - d. Power-driven fasteners.
 - e. Powder-actuated fasteners.
 - f. Expansion anchors.
 - g. Metal framing anchors.

E. Quality Assurance

1. Forest Certification: For the following wood products, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship":
 - a. Dimension lumber framing.
 - b. Timber.
 - c. Laminated-veneer lumber.
 - d. Parallel-strand lumber.
 - e. Prefabricated wood I-joists.
 - f. Rim boards.
 - g. Miscellaneous lumber.

F. Delivery, Storage, And Handling

1. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

1.2 PRODUCTS

A. Wood Products, General

1. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - a. Factory mark each piece of lumber with grade stamp of grading agency.
 - b. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
 - c. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
 - d. Provide dressed lumber, S4S, unless otherwise indicated.



2. Engineered Wood Products: Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.
 - a. Allowable Design Stresses: Provide engineered wood products with allowable design stresses, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.
- B. Wood-Preservative-Treated Lumber
1. Preservative Treatment by Pressure Process: AWPA C2, except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).
 - a. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
 - b. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
 2. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
 3. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
 - a. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.
 4. Application: Treat all rough carpentry, unless otherwise indicated, **OR** items indicated on Drawings, and the following, **as directed**:
 - a. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - b. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
 - c. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
 - d. Wood framing members that are less than 18 inches (460 mm) above the ground in crawlspaces or unexcavated areas.
 - e. Wood floor plates that are installed over concrete slabs-on-grade.
- C. Fire-Retardant-Treated Materials
1. General: Comply with performance requirements in AWPA C20 (lumber) and AWPA C27 (plywood).
 - a. Use Exterior type for exterior locations and where indicated.
 - b. Use Interior Type A, High Temperature (HT) for enclosed roof framing, framing in attic spaces, and where indicated.
 - c. Use Interior Type A, unless otherwise indicated.
 2. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
 - a. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.
 3. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.
 4. Application: Treat all rough carpentry, unless otherwise indicated, **OR** items indicated on Drawings, and the following, **as directed**:
 - a. Framing for raised platforms.
 - b. Concealed blocking.
 - c. Framing for non-load-bearing partitions.



- d. Framing for non-load-bearing exterior walls.
- e. Roof construction.
- f. Plywood backing panels.

D. Dimension Lumber Framing

1. Maximum Moisture Content: 15 percent **OR** 19 percent **OR** 15 percent for 2-inch nominal (38-mm actual) thickness or less, 19 percent for more than 2-inch nominal (38-mm actual) thickness **OR** 15 percent for 2-inch nominal (38-mm actual) thickness or less, no limit for more than 2-inch nominal (38-mm actual) thickness **OR** 19 percent for 2-inch nominal (38-mm actual) thickness or less, no limit for more than 2-inch nominal (38-mm actual) thickness, **as directed**.
2. Non-Load-Bearing Interior Partitions: Construction or No. 2 **OR** Construction, Stud, or No. 3 **OR** Standard, Stud, or No. 3, **as directed**, grade of any species.
3. Exterior and Load-Bearing Walls **OR** Framing Other Than Non-Load-Bearing Interior Partitions **OR** Framing Other Than Interior Partitions, **as directed**: Any species and grade with a modulus of elasticity of at least 1,500,000 psi (10 350 MPa) **OR** 1,300,000 psi (8970 MPa) **OR** 1,100,000 psi (7590 MPa) **OR** 1,000,000 psi (6900 MPa) **OR** 900,000 psi (6210 MPa), **as directed**, and an extreme fiber stress in bending of at least 1000 psi (6.9 MPa) **OR** 850 psi (5.86 MPa) **OR** 700 psi (4.83 MPa) **OR** 600 psi (4.14 MPa) **OR** 500 psi (3.45 MPa), **as directed**, for 2-inch nominal (38-mm actual) thickness and 12-inch nominal (286-mm actual) width for single-member use.
4. Ceiling Joists (Non-Load-Bearing): Construction or No. 2 **OR** Construction, Stud, or No. 3 **OR** Standard, Stud, or No. 3, **as directed**, grade of any species.
5. Joists, Rafters, and Other Framing Not Listed Above: Any species and grade with a modulus of elasticity of at least 1,500,000 psi (10 350 MPa) **OR** 1,300,000 psi (8970 MPa) **OR** 1,100,000 psi (7590 MPa) **OR** 1,000,000 psi (6900 MPa) **OR** 900,000 psi (6210 MPa), **as directed**, and an extreme fiber stress in bending of at least 1000 psi (6.9 MPa) **OR** 850 psi (5.86 MPa) **OR** 700 psi (4.83 MPa) **OR** 600 psi (4.14 MPa) **OR** 500 psi (3.45 MPa), **as directed**, for 2-inch nominal (38-mm actual) thickness and 12-inch nominal (286-mm actual) width for single-member use.
6. Exposed Exterior **OR** Interior, **as directed**, Framing Indicated to Receive a Stained or Natural Finish: Provide material hand-selected for uniformity of appearance and freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot-holes, shake, splits, torn grain, and wane.
 - a. Species and Grade: As indicated above for load-bearing construction of same type.
 - b. Species and Grade: Hem-fir (north), Select Structural **OR** No. 1, **as directed**, grade; NLGA.
 - c. Species and Grade: Southern pine, Select Structural **OR** No. 1 **OR** No. 2, **as directed**, grade; SPIB.
 - d. Species and Grade: Douglas fir-larch; Select Structural **OR** No. 1, **as directed**, grade; WCLIB, or WWPA.
 - e. Species and Grade: Mixed southern pine, Select Structural **OR** No. 1 **OR** No. 2, **as directed**, grade; SPIB.
 - f. Species and Grade: Spruce-pine-fir, Select Structural **OR** No. 1, **as directed**, grade; NLGA.
 - g. Species and Grade: Douglas fir-south; Select Structural **OR** No. 1, **as directed**, grade; WWPA.
 - h. Species and Grade: Hem-fir; Select Structural **OR** No. 1, **as directed**, grade; WCLIB, or WWPA.
 - i. Species and Grade: Douglas fir-larch (north); Select Structural **OR** No. 1, **as directed**, grade; NLGA.
 - j. Species and Grade: Spruce-pine-fir (south), Select Structural **OR** No. 1, **as directed**, grade; NeLMA, WCLIB, or WWPA.
 - k. Species and Grade: Eastern hemlock-balsam fir or eastern hemlock-tamarack; Select Structural **OR** No. 1, **as directed**, grade; NeLMA.
 - l. Species and Grade: Beech-birch-hickory, Select Structural **OR** No. 1, **as directed**, grade; NeLMA.



- m. Species and Grade: Northern red oak, Select Structural **OR** No. 1, **as directed**, grade; NeLMA.
- n. Species and Grade: Redwood, Clear Heart Structural **OR** Clear Structural **OR** Select Structural **OR** No. 1, **as directed**, grade; RIS.
- o. Species and Grade: Mixed oak, Select Structural **OR** No. 1, **as directed**, grade; NeLMA.
- p. Species and Grade: Mixed maple, Select Structural **OR** No. 1, **as directed**, grade; NeLMA.
- q. Species and Grade: Western cedars, Select Structural **OR** No. 1, **as directed**, grade; WCLIB, or WWPA.

E. Timber Framing

- 1. Provide timber framing complying with the following requirements, according to grading rules of grading agency indicated:
 - a. Species and Grade: Douglas fir-larch, Douglas fir-larch (north), or Douglas fir-south; Select Structural **OR** No. 1, **as directed**, grade; NLGA, WCLIB, or WWPA.
 - b. Species and Grade: Eastern hemlock, eastern hemlock-tamarack, or eastern hemlock-tamarack (north); Select Structural **OR** No. 1, **as directed**, grade; NeLMA or NLGA.
 - c. Species and Grade: Hem-fir or hem-fir (north), Select Structural **OR** No. 1, **as directed**, grade; NLGA, WCLIB, or WWPA.
 - d. Species and Grade: Mixed maple, Select Structural **OR** No. 1, **as directed**, grade; NeLMA.
 - e. Species and Grade: Mixed oak, Select Structural **OR** No. 1, **as directed**, grade; NeLMA.
 - f. Species and Grade: Southern pine, Select Structural **OR** No. 1, **as directed**, grade; SPIB.
 - g. Maximum Moisture Content: 20 **OR** 23, **as directed**, percent.
 - h. Additional Restriction: Free of heart centers.

F. Engineered Wood Products

- 1. Laminated-Veneer Lumber: Structural composite lumber made from wood veneers with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D 5456 and manufactured with an exterior-type adhesive complying with ASTM D 2559 and containing no urea formaldehyde.
 - a. Extreme Fiber Stress in Bending, Edgewise: 3100 psi (21.3 MPa) **OR** 2900 psi (20.0 MPa) **OR** 2600 psi (17.9 MPa) **OR** 2250 psi (15.5 MPa), **as directed**, for 12-inch nominal- (286-mm actual-) depth members.
 - b. Modulus of Elasticity, Edgewise: 2,000,000 psi (13 700 MPa) **OR** 1,800,000 psi (12 400 MPa) **OR** 1,500,000 psi (10 300 MPa), **as directed**.
- 2. Parallel-Strand Lumber: Structural composite lumber made from wood strand elements with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D 5456 and manufactured with an exterior-type adhesive complying with ASTM D 2559 and containing no urea formaldehyde.
 - a. Extreme Fiber Stress in Bending, Edgewise: 2900 psi (20 MPa) for 12-inch nominal- (286-mm actual-) depth members.
 - b. Modulus of Elasticity, Edgewise: 2,200,000 psi (15 100 MPa).
- 3. Wood I-Joists: Prefabricated units, I-shaped in cross section, made with solid or structural composite lumber flanges and wood-based structural panel webs, let into and bonded to flanges. Provide units complying with material requirements of and with structural capacities established and monitored according to ASTM D 5055.
 - a. Provide I-joists manufactured without urea formaldehyde.
 - b. Web Material: Either oriented strand board or plywood, complying with DOC PS 1 or DOC PS 2, Exposure 1 **OR** Plywood, complying with DOC PS 1 or DOC PS 2, Exposure 1 **OR** Plywood, complying with DOC PS 1, Exterior grade, **as directed**.
 - c. Structural Properties: Provide units with depths and design values not less than those indicated.
 - d. Provide units complying with APA PRI-400, factory marked with APA trademark indicating nominal joist depth, joist class, span ratings, mill identification, and compliance with APA standard.



4. Rim Boards: Product designed to be used as a load-bearing member and to brace wood I-joists at bearing ends, complying with research/evaluation report for I-joists.
 - a. Manufacturer: Provide products by same manufacturer as I-joists.
 - b. Material: All-veneer product **OR** glued-laminated wood **OR** product made from any combination solid lumber, wood strands, and veneers, **as directed**. Provide rim boards made without urea formaldehyde.
 - c. Thickness: 1 inch (25 mm) **OR** 1-1/8 inches (28 mm) **OR** 1-1/4 inches (32 mm), **as directed**.
 - d. Provide performance-rated product complying with APA PRR-401, rim board **OR** rim board plus, **as directed**, grade, factory marked with APA trademark indicating thickness, grade, and compliance with APA standard.

G. Miscellaneous Lumber

1. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - a. Blocking.
 - b. Nailers.
 - c. Rooftop equipment bases and support curbs.
 - d. Cants.
 - e. Furring.
 - f. Grounds.
 - g. Utility shelving.
2. For items of dimension lumber size, provide Construction or No. 2 **OR** Standard, Stud, or No. 3, **as directed**, grade lumber with 15 **OR** 19, **as directed**, percent maximum moisture content of any species.
3. For items of dimension lumber size, provide Construction or No. 2 **OR** Standard, Stud, or No. 3, **as directed**, grade lumber with 15 **OR** 19, **as directed**, percent maximum moisture content and any of the following species:
 - a. Hem-fir (north); NLGA.
 - b. Mixed southern pine; SPIB.
 - c. Spruce-pine-fir; NLGA.
 - d. Hem-fir; WCLIB, or WWPA.
 - e. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
 - f. Western woods; WCLIB or WWPA.
 - g. Northern species; NLGA.
 - h. Eastern softwoods; NeLMA.
4. For exposed boards, provide lumber with 15 **OR** 19, **as directed**, percent maximum moisture content and any of the following species and grades:
 - a. Eastern white pine, Idaho white, lodgepole, ponderosa, or sugar pine; Premium or 2 Common (Sterling) **OR** Standard or No. 3 Common, **as directed**, grade; NeLMA, NLGA, WCLIB, or WWPA.
 - b. Mixed southern pine, No. 1 **OR** 2, **as directed**, grade; SPIB.
 - c. Hem-fir or hem-fir (north), Select Merchantable or No. 1 Common **OR** Construction or No. 2 Common, **as directed**, grade; NLGA, WCLIB, or WWPA.
 - d. Spruce-pine-fir (south) or spruce-pine-fir, Select Merchantable or No. 1 Common **OR** Construction or No. 2 Common, **as directed**, grade; NeLMA, NLGA, WCLIB, or WWPA.
5. For concealed boards, provide lumber with 15 **OR** 19, **as directed**, percent maximum moisture content and any of the following species and grades:
 - a. Mixed southern pine, No. 2 **OR** 3, **as directed**, grade; SPIB.
 - b. Hem-fir or hem-fir (north), Construction or 2 Common **OR** Standard or 3 Common, **as directed**, grade; NLGA, WCLIB, or WWPA.
 - c. Spruce-pine-fir (south) or spruce-pine-fir, Construction or 2 Common **OR** Standard or 3 Common, **as directed**, grade; NeLMA, NLGA, WCLIB, or WWPA.
 - d. Eastern softwoods, No. 2 **OR** 3, **as directed**, Common grade; NeLMA.
 - e. Northern species, No. 2 **OR** 3, **as directed**, Common grade; NLGA.



- f. Western woods, Construction or No. 2 Common **OR** Standard or No. 3 Common, **as directed**, grade; WCLIB or WWPA.
 6. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
 7. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
 8. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.
- H. Plywood Backing Panels
1. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, **as directed**, in thickness indicated or, if not indicated, not less than 1/2-inch (13-mm) nominal thickness.
- I. Fasteners
1. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
 - a. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M **OR** of Type 304 stainless steel, **as directed**.
 2. Nails, Brads, and Staples: ASTM F 1667.
 3. Power-Driven Fasteners: NES NER-272.
 4. Wood Screws: ASME B18.6.1.
 5. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).
 6. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.
 7. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
 - a. Material:
 - 1) Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
OR
Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).
- J. Metal Framing Anchors
1. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those indicated **OR** of basis-of-design products, **as directed**. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.
 2. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.
 - a. Use for interior locations where stainless steel is not indicated.
 3. Stainless-Steel Sheet: ASTM A 666, Type 304 **OR** 316, **as directed**.
 - a. Use for exterior locations and where indicated.
 4. Joist Hangers: U-shaped joist hangers with 2-inch- (50-mm-) long seat and 1-1/4-inch- (32-mm-) wide nailing flanges at least 85 percent of joist depth.
 5. I-Joist Hangers: U-shaped joist hangers with 2-inch- (50-mm-) long seat and 1-1/4-inch- (32-mm-) wide nailing flanges full depth of joist. Nailing flanges provide lateral support at joist top chord.
 6. Top Flange Hangers: U-shaped joist hangers, full depth of joist, formed from metal strap with tabs bent to extend over and be fastened to supporting member.
 7. Bridging: Rigid, V-section, nailless type, 0.050 inch (1.3 mm) thick, length to suit joist size and spacing.



8. Post Bases: Adjustable-socket type for bolting in place with standoff plate to raise post 1 inch (25 mm) above base and with 2-inch- (50-mm-) minimum side cover, socket 0.062 inch (1.6 mm) thick, and standoff and adjustment plates 0.108 inch (2.8 mm) thick.
9. Joist Ties: Flat straps, with holes for fasteners, for tying joists together over supports.
10. Rafter Tie-Downs: Bent strap tie for fastening rafters or roof trusses to wall studs below, 1-1/2 inches (38 mm) wide by 0.050 inch (1.3 mm) thick. Tie fastens to side of rafter or truss, face of top plates, and side of stud below.
11. Rafter Tie-Downs (Hurricane or Seismic Ties): Bent strap tie for fastening rafters or roof trusses to wall studs below, 2-1/4 inches (57 mm) wide by 0.062 inch (1.6 mm) thick. Tie fits over top of rafter or truss and fastens to both sides of rafter or truss, face of top plates, and side of stud below.
12. Floor-to-Floor Ties: Flat straps, with holes for fasteners, for tying upper floor wall studs to band joists and lower floor studs, 1-1/4 inches (32 mm) wide by 0.050 inch (1.3 mm) thick by 36 inches (914 mm) long.
13. Hold-Downs: Brackets for bolting to wall studs and securing to foundation walls with anchor bolts or to other hold-downs with threaded rods and designed with first of two bolts placed seven bolt diameters from reinforced base.
14. Wall Bracing:
 - a. T-shaped bracing made for letting into studs in saw kerf, 1-1/8 inches (29 mm) wide by 9/16 inch (14 mm) deep by 0.034 inch (0.85 mm) thick with hemmed edges.

OR

Wall Bracing: Angle bracing made for letting into studs in saw kerf, 15/16 by 15/16 by 0.040 inch (24 by 24 by 1 mm) thick with hemmed edges.

K. Miscellaneous Materials

1. Sill-Sealer Gaskets:
 - a. Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch (25-mm) nominal thickness, compressible to 1/32 inch (0.8 mm); selected from manufacturer's standard widths to suit width of sill members indicated.

OR

Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to suit width of sill members indicated.
2. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.
 - a. Use adhesives that have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chloropyrifos as its active ingredient.

1.3 EXECUTION

A. Installation, General

1. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
2. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.
3. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.
4. Metal Framing Anchors: Install metal framing to comply with manufacturer's written instructions.
5. Do not splice structural members between supports, unless otherwise indicated.



6. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
 - a. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches (406 mm) o.c.
 7. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
 - a. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches (2438 mm) o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
 - b. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches (2438 mm) o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal- (38-mm actual-) thickness.
 - c. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. (9.3 sq. m) and to solidly fill space below partitions.
 - d. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet (6 m) o.c.
 8. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
 9. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 - a. Use inorganic boron for items that are continuously protected from liquid water.
 - b. Use copper naphthenate for items not continuously protected from liquid water.
 10. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - a. NES NER-272 for power-driven fasteners.
 - b. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
 - c. "Nailing Schedule," and Tables in Section 2304, of ICC's International Building Code.
 - d. Table 2306.1, "Fastening Schedule," in SBCCI's Standard Building Code.
 - e. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
 - f. Table 602.3(1), "Fastener Schedule for Structural Members," and Table 602.3(2), "Alternate Attachments," in ICC's International One- and Two-Family Dwelling Code.
 11. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads, unless otherwise indicated.
 12. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.
 - a. Comply with approved **OR** indicated, **as directed**, fastener patterns where applicable. Before fastening, mark fastener locations, using a template made of sheet metal, plastic, or cardboard.
 - b. Use finishing nails, unless otherwise indicated. Do not countersink nail heads **OR** Countersink nail heads and fill holes with wood filler, **as directed**.
- B. Wood Ground, Sleeper, Blocking, And Nailer Installation
1. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
 2. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.



3. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches (38 mm) wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

C. Wood Furring Installation

1. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.
2. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal- (19-by-63-mm actual-) size furring horizontally **OR** vertically **OR** horizontally and vertically, **as directed**, at 24 inches (610 mm) **OR** 600 mm, **as directed**, o.c.
3. Furring to Receive Gypsum Board **OR** Plaster Lath, **as directed**: Install 1-by-2-inch nominal- (19-by-38-mm actual-) size furring vertically at 16 inches (406 mm) **OR** 400 mm, **as directed**, o.c.

D. Wall And Partition Framing Installation

1. General: Provide single bottom plate and double top plates using members of 2-inch nominal (38-mm actual) thickness whose widths equal that of studs, except single top plate may be used for non-load-bearing partitions and for load-bearing partitions where framing members bearing on partition are located directly over studs. Fasten plates to supporting construction, unless otherwise indicated.
 - a. For exterior walls, provide 2-by-6-inch nominal- (38-by-140-mm actual-) **OR** 2-by-4-inch nominal- (38-by-89-mm actual-), **as directed**, size wood studs spaced 24 inches (610 mm) **OR** 16 inches (406 mm) **OR** 600 mm **OR** 400 mm, **as directed**, o.c., unless otherwise indicated.
 - b. For interior partitions and walls, provide 2-by-6-inch nominal- (38-by-140-mm actual-) **OR** 2-by-4-inch nominal- (38-by-89-mm actual-) **OR** 2-by-3-inch nominal- (38-by-64-mm actual-), **as directed**, size wood studs spaced 24 inches (610 mm) **OR** 16 inches (406 mm) **OR** 600 mm **OR** 400 mm, **as directed**, o.c., unless otherwise indicated.
 - c. Provide continuous horizontal blocking at midheight of partitions more than 96 inches (2438 mm) high, using members of 2-inch nominal (38-mm actual) thickness and of same width as wall or partitions.
2. Construct corners and intersections with three or more studs, except that two studs may be used for interior non-load-bearing partitions.
3. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.
 - a. For non-load-bearing partitions, provide double-jamb studs and headers not less than 4-inch nominal (89-mm actual) depth for openings 48 inches (1200 mm) and less in width, 6-inch nominal (140-mm actual) depth for openings 48 to 72 inches (1200 to 1800 mm) in width, 8-inch nominal (184-mm actual) depth for openings 72 to 120 inches (1800 to 3000 mm) in width, and not less than 10-inch nominal (235-mm actual) depth for openings 10 to 12 feet (3 to 3.6 m) in width.
 - b. For load-bearing walls, provide double-jamb studs for openings 60 inches (1500 mm) and less in width, and triple-jamb studs for wider openings. Provide headers of depth indicated or, if not indicated, according to Table R502.5(1) or Table R502.5(2), as applicable, in ICC's International Residential Code for One- and Two-Family Dwellings.
4. Provide diagonal bracing in exterior walls, at both walls of each external corner **OR** walls, at locations indicated, **as directed**, at 45-degree angle, full-story height, unless otherwise indicated. Use 1-by-4-inch nominal- (19-by-89-mm actual-) size boards, let-in flush with faces of studs **OR** metal wall bracing, let into studs in saw kerf, **as directed**.

E. Floor Joist Framing Installation

1. General: Install floor joists with crown edge up and support ends of each member with not less than 1-1/2 inches (38 mm) of bearing on wood or metal, or 3 inches (76 mm) on masonry. Attach floor joists as follows:
 - a. Where supported on wood members, by toe nailing or by using metal framing anchors.



- b. Where framed into wood supporting members, by using wood ledgers as indicated or, if not indicated, by using metal joist hangers.
 2. Fire Cuts: At joists built into masonry, bevel cut ends 3 inches (76 mm) and do not embed more than 4 inches (102 mm).
 3. Frame openings with headers and trimmers supported by metal joist hangers; double headers and trimmers where span of header exceeds 48 inches (1200 mm).
 4. Do not notch in middle third of joists; limit notches to one-sixth depth of joist, one-third at ends. Do not bore holes larger than 1/3 depth of joist; do not locate closer than 2 inches (50 mm) from top or bottom.
 5. Provide solid blocking of 2-inch nominal (38-mm actual) thickness by depth of joist at ends of joists unless nailed to header or band.
 6. Lap members framing from opposite sides of beams, girders, or partitions not less than 4 inches (102 mm) or securely tie opposing members together. Provide solid blocking of 2-inch nominal (38-mm actual) thickness by depth of joist over supports.
 7. Anchor members paralleling masonry with 1/4-by-1-1/4-inch (6.4-by-32-mm) metal strap anchors spaced not more than 96 inches (2438 mm) o.c., extending over and fastening to 3 joists. Embed anchors at least 4 inches (102 mm) into grouted masonry with ends bent at right angles and extending 4 inches (102 mm) beyond bend.
 8. Provide solid blocking between joists under jamb studs for openings.
 9. Under non-load-bearing partitions, provide double joists separated by solid blocking equal to depth of studs above.
 - a. Provide triple joists separated as above, under partitions receiving ceramic tile and similar heavy finishes or fixtures.
 10. Provide bridging of type indicated below, at intervals of 96 inches (2438 mm) o.c., between joists.
 - a. Diagonal wood bridging formed from bevel-cut, 1-by-3-inch nominal- (19-by-64-mm actual-) size lumber, double-crossed and nailed at both ends to joists.
 - b. Steel bridging installed to comply with bridging manufacturer's written instructions.
- F. Ceiling Joist And Rafter Framing Installation
 1. Ceiling Joists: Install ceiling joists with crown edge up and complying with requirements specified above for floor joists. Face nail to ends of parallel rafters.
 - a. Where ceiling joists are at right angles to rafters, provide additional short joists parallel to rafters from wall plate to first joist; nail to ends of rafters and to top plate and nail to first joist or anchor with framing anchors or metal straps. Provide 1-by-8-inch nominal- (19-by-184-mm actual-) size or 2-by-4-inch nominal- (38-by-89-mm actual-) size stringers spaced 48 inches (1200 mm) o.c. crosswise over main ceiling joists.
 2. Rafters: Notch to fit exterior wall plates and toe nail or use metal framing anchors. Double rafters to form headers and trimmers at openings in roof framing, if any, and support with metal hangers. Where rafters abut at ridge, place directly opposite each other and nail to ridge member or use metal ridge hangers.
 - a. At valleys, provide double-valley rafters of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches (50 mm) deeper. Bevel ends of jack rafters for full bearing against valley rafters.
 - b. At hips, provide hip rafter of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches (50 mm) deeper. Bevel ends of jack rafters for full bearing against hip rafter.
 3. Provide collar beams (ties) as indicated or, if not indicated, provide 1-by-6-inch nominal- (19-by-140-mm actual-) size boards between every third pair of rafters, but not more than 48 inches (1219 mm) o.c. Locate below ridge member, at third point of rafter span. Cut ends to fit roof slope and nail to rafters.
 4. Provide special framing as indicated for eaves, overhangs, dormers, and similar conditions, if any.
- G. Timber Framing Installation



1. Install timber with crown edge up and provide not less than 4 inches (102 mm) of bearing on supports. Provide continuous members, unless otherwise indicated; tie together over supports as indicated if not continuous.
2. Where beams or girders are framed into pockets of exterior concrete or masonry walls, provide 1/2-inch (13-mm) air space at sides and ends of wood members.
3. Install wood posts using metal anchors indicated.
4. Treat ends of timber beams and posts exposed to weather by dipping in water-repellent preservative for 15 minutes.

H. Stair Framing Installation

1. Provide stair framing members of size, space, and configuration indicated or, if not indicated, to comply with the following requirements:
 - a. Stringer Size: 2-by-12-inch nominal- (38-by-286-mm actual-) size, minimum.
 - b. Stringer Material: Laminated-veneer lumber **OR** parallel-strand lumber **OR** solid lumber, **as directed**.
 - c. Notching: Notch stringers to receive treads, risers, and supports; leave at least 3-1/2 inches (89 mm) of effective depth.
 - d. Stringer Spacing: At least 3 stringers for each 36-inch (914-mm) clear width of stair.
2. Provide stair framing with no more than 3/16-inch (4.7-mm) variation between adjacent treads and risers and no more than 3/8-inch (9.5-mm) variation between largest and smallest treads and risers within each flight.

I. Protection

1. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
2. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06 10 00 00



Task	Specification	Specification Description
06 11 13 00	06 10 00 00	Rough Carpentry
06 11 13 00	01 95 06 00	Miscellaneous Carpentry



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SECTION 06 11 16 00 - ROUGH CARPENTRY RENOVATION

1.1 DESCRIPTION OF WORK

- A. This specification covers the furnishing and installation of materials for rough carpentry renovation. Products shall be as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

1.2 GENERAL

A. Quality Assurance

1. Regulatory Requirements:

- a. Fire Retardant Treated Lumber and Plywood: Bear UL FR-S classification label.
- b. Preservative Treated Wood: Provide all heart redwood, cedar, or cyprus; or preservative-treated wood at following conditions in accordance with applicable building code:
 - 1) Wood framing, woodwork, and plywood up to and including subflooring at first-floor level of structures having crawl spaces, when bottoms of such items are 150 mm (6 inches) or less from earth underneath.
 - 2) Exterior wood steps, platforms, and railings.
 - 3) Wood sills, soles, plates, furring, and sleepers that are less than 150 mm (6 inches) from earth, furring and nailers that are set into or in contact with concrete or masonry.
 - 4) Nailers, edge strips, crickets, curbs, and cants for roof decks.
 - 5) Furring strips used on walls or partitions below grade and exterior walls above grade.
 - 6) Wood members used for rough framing of openings in exterior concrete or masonry walls.

B. Delivery, Storage, And Handling

1. General: Deliver material to site, off-load, and handle in manner that will not damage material. Store material off ground and cover with waterproof covering. Provide adequate ventilation.
 - a. Interior Fire-Retardant Treated Wood: Keep dry at all times. Replace material that has become wet. Store off ground, in building, or covered with unbroken water-tight cover in storage yard, during transit, and at job site. Keep ventilated to avoid moisture condensation.

C. Project Conditions

1. Environmental Requirements: Execute demolition and renovation in manner to limit unnecessary dust and noise, and in compliance with applicable codes and federal or state requirements. Burning of materials on site not allowed.
2. Existing Conditions: See Detailed Scope of Work. Do not interfere with use of occupied buildings or portions of buildings. Maintain free and safe passage to and from occupied areas.
3. Protection:
 - a. Provide necessary temporary shoring and bracing to support and protect portions of existing buildings during demolition operations. Leave such shoring in place until permanent supports have been installed. Be solely responsible for design, safety, and adequacy of temporary shoring and bracing and its ability to carry load for which intended.
 - b. Contractor: Protect grounds, plantings, buildings, and any other facilities or property from damage caused by construction operations.
4. Safety: Cease operations at endangered area, and notify the Owner immediately if safety of structure appears to be endangered. Take precautions to properly support structure. Do not resume work in endangered area until safety is restored.

D. Scheduling And Sequencing



1. Scheduling and Completion: Comply with requirements of Detailed Scope of Work.

1.3 PRODUCTS

A. Materials

1. Materials for Patching, Extending, and Matching:
 - a. Provide same products or types of construction as in existing structure, as needed to patch, extend, or match existing work.
 - 1) Generally, Contract Documents will not define products or standards of workmanship present in existing construction. Determine products by inspection and testing as necessary, and required workmanship by reference to existing as sample of comparison.
 - 2) Patching, extending, and matching existing work and systems shall result in complete, finished system.
 - b. Presence of product, finish, or type of construction requires that patching, extending, or matching be performed as necessary to make work complete and consistent.
2. Lumber: Each Piece of Lumber: Grade stamped by recognized association or independent inspection agency certified by American Lumber Standards Committee's Board of Review.
 - a. New Replacement Studs and Joists: Match existing and complies with Reference Standards.
 - b. Wood Studs and Joists: No. 2 Grade or better.
 - c. Sill Plates on Concrete: All heart redwood, cedar, or cyprus: or preservative-treated wood.
 - d. Blocking and Furring: Standard Grade or Better.
 - e. Preservative-Treated: AWPB LP-2, pressure-treated with waterborne preservative. Penta or creosote not allowed.
 - 1) Treat drilled holes and cuts across grain in accordance with AWPA M4.
 - f. Fire-Retardant Treated:
 - 1) Lumber: AWPA C20 Interior Type A.
 - 2) Plywood: AWPA C27 Interior Type A.
 - 3) Bear UL FR-S classification label.
 - g. Pressure-Treated Lumber: Bear AWPA Quality Mark C-2.
 - h. Seasoning: Kiln dry to following (including treated material):
 - i. Lumber Up to 50 mm (2 inches): 19 percent or less moisture content.
 - j. Preservative- and Fire-Retardant Treated Material: Mill or rip material parallel to grain prior to treatment.
3. Plywood: PS-1: Each panel identified with APA grade trademark.
 - a. Subfloor: APA Rated Sheathing, Tongue and groove, Exposure 1 (interior with exterior glue).
 - 1) Span Rating: Not less than spacing of framing members.
 - 2) Thickness: In accordance with APA Recommendations.
 - b. Roof Sheathing: APA Rated Sheathing, Exposure 1 (interior with exterior glue).
 - 1) Span Rating: Not less than spacing of framing members.
 - 2) Thickness: In accordance with APA Recommendations.
 - c. Wall Sheathing: APA CD, Exposure 1 (Interior with exterior glue).
 - 1) Span Rating: Not less than spacing of framing members.
 - 2) Thickness: As indicated.
 - d. Panel Edge Clips: Extruded aluminum or hot-dipped galvanized steel, H-shaped clips to prevent differential deflection of roof sheathing.
 - e. Fire-Retardant Treated Plywood: Bear UL FR-S classification label.
 - 1) Interior Plywood Fire Retardant Treatment: AWPA C27 Interior Type A.
 - 2) Exterior Plywood Fire Retardant Treatment: AWPA C27 Exterior Type.
 - f. Seasoning: Kiln dry plywood to 15 percent or less moisture content.
 - 1) Pressure Treated Plywood: Kiln dry lumber after treatment.
 - g. Nails: Type and size as recommended by APA.



4. Metal Framing Anchors: Punched and formed for nailing so that nails will be stressed in shear only.
 - a. General: Provide with nails and bolts according to manufacturers requirements.
 - 1) Nails: Zinc coated.
 - b. Types: As indicated and as required to accommodate framing.
 - c. Sizes: Of sufficient size and strength to develop full strength of supported member in accordance with applicable building code.
 - d. Metal Bridging: Minimum No. 16 U.S. Standard gage.
 - e. Finish: Hot-dipped galvanized.
5. Anchor Bolts: Furnish anchors to be built into concrete and masonry for anchorage of wood.
6. Rough Hardware: Provide necessary bolts, screws, nails, clips, plates, straps, hangers, etc., necessary for completion of renovation work. Provide correct material of proper size and strength for purpose intended, conforming to Reference Standards and applicable building codes.
 - a. Exterior Locations and for Fire-Retardant- and Preservative-Treated Wood: Provide galvanized rough hardware.
7. Vapor Barrier at Crawl Spaces: ASTM D 2103, 0.15 mm (6 mil) polyethylene sheeting.
8. Insulation: Type and R-value to comply with applicable codes and regulations.
 - a. Blanket Insulation: ASTM C 665 fiberglass blankets. Exposed insulation shall be foil-faced with flame-spread rating of 25 or less in accordance with ASTM E 84, where required by applicable codes and regulations.

1.4 EXECUTION

A. Examination

1. Units, Spaces, and Areas to be Renovated: Comply with Detailed Scope of Work.
 - a. Verify that surfaces to receive rough carpentry are prepared to require grades and dimensions.

B. Preparation

1. Dust Protection: Comply with Detailed Scope of Work.
2. Building Occupation: Carry out demolition and renovation work to cause as little inconvenience to occupants as possible. See Detailed Scope of Work.
3. Protection: See Detailed Scope of Work.
4. Selective Demolition: Comply with Detailed Scope of Work.

C. Laying Out Work

1. Discrepancies: Verify dimensions and elevations indicated in layout of existing work.
 - a. Prior to commencing work, carefully compare and check Drawings (if any) for discrepancies in locations or elevations of work to be executed.
 - b. Refer discrepancies among Drawings (if any), Specifications, and existing conditions to the Owner for adjustment before work affected is performed.
 - 1) Failure to make such notification shall place responsibility on Contractor to carry out work in satisfactory, workmanlike manner.
2. Contractor: Responsible for location and elevation of construction contemplated by Construction Documents.

D. Performance

1. Patching: Patch and extend existing work using skilled mechanics who are capable of matching existing quality of workmanship.
 - a. Quality of Patched or Extended Work: Not less than specified for new work. If similar new work is not specified, equal to existing work.
2. General: Perform in accordance with AF&PA National Design Specification for Wood Construction, latest Edition.
 - a. Framing: Erect plumb, level and true and rigidly anchor in place. Cut framing square on bearings, closely fit, accurately set to required lines and levels.



- b. Nail or spike members in accordance with applicable codes.
 - c. Framing: 400 mm (16 inches) OC unless otherwise indicated.
 - d. Shims: Do not use shims for leveling on wood or metal bearings. Use steel or slate shims with full bearing on masonry or concrete.
 - e. Do not splice framing members between bearing points.
 - f. Metal Framing Anchors: Install where required for proper connections in accordance with manufacturer recommendations. Drive nail in each nail hole provided in anchor.
3. Wood Framing:
- a. Openings: Frame members for passage of pipes and ducts to avoid cutting structural members. Do not cut, notch, or bore framing members for passage of pipes or conduits without the Owner's permission. Reinforce framing members as directed where damaged by cuffing.
 - b. Firestopping: Firestop concealed spaces in framing. No shutoff by framing members to prevent drafts from one space to another. Use 50 mm (2 inch) nominal thick accurately fit wood blocking to fill opening.
 - c. Joists and Beams: Sizes and spacing as indicated.
 - 1) Set crown edge-up with 90 mm (3-1/2 inch) bearing unless noted otherwise.
 - 2) Toe nail joists to wood sills with 16d nails both sides or secure with metal connectors. Lap and spike joists over supports.
 - 3) Double joists to form headers and trimmers at openings over 1,200 mm (4 feet) and support with metal joist hangers.
 - 4) Provide joist hangers at joists framing into flush wood beams.
 - d. Provide blocking or suitable edge support between members as necessary to support edges of sheathing.
 - e. Replace warped lumber in walls and joists prior to installation of finish surface.
4. Anchors: Unless otherwise indicated, bolt plates firmly to concrete or masonry with anchor bolts in accordance with applicable code.
- a. In Masonry: Embed anchor bolts minimum 400 mm (16 inches) and provide each with nut and 50 mm (2 inch) diameter washer at bottom end. Grout bolts with mortar.
 - b. In Concrete: Embed anchor bolts minimum 200 mm (8 inches) and provide each with nut and 50 mm (2 inch) diameter washer at bottom end. 90 degree bent end may be substituted for nut and washer.
5. Wood Studs: Install at 400 mm (16 inches) OC with single bottom plate and double top plate with joints staggered.
- a. Double studs at openings and triple at corners and intersections. Double headers with double trimmers over openings.
6. Plywood Sheathing: Install in accordance with APA Recommendations.
- a. Provide space at end and side joints as recommended by APA.
 - b. Install panels with face grain perpendicular to supports with end-joints supported. Stagger ends of adjacent sheets 1 200 mm (4 feet) where possible.
 - c. Where support spacing exceeds maximum span for unsupported edge, provide adequate blocking, tongue and groove edges, or panel edge clips, in accordance with APA E30-L.
 - d. Nail in accordance with APA's Recommendations.
7. Preservative- and Fire-Retardant Material: Milling or ripping material parallel to grain not allowed unless material is treated after milling or ripping.
- a. Preservative-Treated Material: Treat drilled holes and cuts across grain in accordance with AWPA M4.

E. Flooring Work

- 1. Defective Joists and Subfloor: Remove defective joists and subfloor which no longer satisfy structural requirements with new material to fulfill their structural function.
 - a. Remove ceiling, subfloor, and joists in safe manner and at minimum inconvenience to residents.
 - b. Splice, strengthen, support, or replace rotted or otherwise defective joists to fulfill their anticipated structural function.



- c. New Replacement Joists: Comply with requirements of appropriate section specifying new flooring, including flooring manufacturer's recommendations.
 - d. Ceiling Replacement: Include removal and replacement of ceiling finish to match existing.
 - 1) Glue and screw new ceiling material to bottom of joists.
 - 2) Paint entire ceiling of space affected by replacement matching color of existing walls in accordance with Division 9 Section "Painting."
 - e. Crawl-Space Insulation: Replace insulation damaged by or removed during construction operations. If there is no existing insulation, provide new insulation, where required.
 - 1) Insulation: Type and R-value to comply with applicable codes and regulations.
 - f. New Replacement Subfloor: Install in accordance with APA Recommendations and with requirements of appropriate section specifying new flooring, including flooring manufacturer's recommendations.
 - 1) Glue and nail new subfloor to joists.
 - 2) Nail in accordance with APA's Recommendations and sufficiently to avoid squeaking floors.
 - g. Base at walls: Replace wood base (including coves and corner rounds) with new wood base to match existing.
2. Above-Grade Floors to Receive Resilient Flooring: Examine to ensure that vapor-barrier sheet is laid over ground, sheets lapped, edge joints sealed and sufficient cross ventilation exists to insure dryness.
 - a. If vapor barrier does not cover ground in crawl space, install vapor barrier in accordance with applicable codes and regulations.
 - 1) Completely cover ground at crawl spaces with minimum 150 mm (6 inch) lapped joints.
 - 2) Tape all lapped joints with water-resistive tape in accordance with manufacturer's recommendations.
 - 3) Protect vapor barrier from puncture and displacement. Lay heavy objects such as pieces of masonry at intervals not over 1 200 mm (4 feet) OC at lapped joints to hold in place. If punctures occur in vapor barrier, repair by placing patches of vapor-barrier material over punctures and taping all lapped joints.
 - b. If crawl space does not have enough ventilation, install additional vents in accordance with applicable codes and regulations.
 3. Floors Damaged by Construction Operations: Patch floor damage to match existing floor surfaces, and comply with requirements for new flooring.
- F. Roofing Work
1. Removal of Existing Roofing: Roofing may contain asbestos fibers. Comply with applicable codes, laws, and regulations regarding asbestos materials.
 2. Defective Rafters and Sheathing: Remove defective rafters and sheathing which no longer satisfy structural requirements with new material to match existing.
 - a. Remove sheathing and rafters in safe manner and at minimum inconvenience to residents.
 - b. Splice, strengthen, support, or replace rotted or otherwise defective rafters to fulfill their anticipated structural function.
 - c. New Replacement Sheathing: Install in accordance with APA Recommendations and with requirements of applicable Division 7 roofing Sections.
 - 1) Nail in accordance with APA's Recommendations.
- G. Blocking And Furring
1. Blocking: Install wood blocking as required for proper support of hardware, bath accessories, cabinets, and other wall-mounted items.
 - a. Set true to line, level, or plumb, well-secured in stud wall and flush with back of drywall or other wall finish.
 - b. Coordinate exact locations with other sections.
 2. Rough Wood Bucks: Set true and plumb and anchor to concrete or masonry with steel straps extending into wall minimum 200 mm (8 inches). Place anchors near top and bottom of buck and space uniformly at maximum 600 mm (24 inches) OC. Provide nominal 50 mm (2 inch) thick if not indicated.



3. Wood Furring: Install wood furring on masonry or concrete walls in sizes and spacing as indicated on Drawings (if any). Provide minimum 25 mm by 75-mm (1 inch by 3 inch) nominal furring strips spaced at maximum of 400 mm (16 inches) OC if not indicated.
 - a. Securely fasten wood furring at maximum 900 mm (3 feet) OC with toggle or expansion bolts, cut concrete nails or ramset anchors as required. Do not use wood plugs.
 - b. Install furring around openings and at corners.
 - c. Erect furring plumb and level, and shim out as required to provide true, even plane with surfaces suitable to receive required finish.

END OF SECTION 06 11 16 00



Task	Specification	Specification Description
06 11 16 00	01 22 16 00	No Specification Required
06 11 16 00	06 10 00 00	Rough Carpentry
06 11 16 00	01 95 06 00	Miscellaneous Carpentry



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SECTION 06 15 13 00 - EXTERIOR ROUGH CARPENTRY

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for exterior rough carpentry. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Elevated decks including wood decking, plastic decking, stairs, railings, and support framing.
 - b. Wood benches.

C. Definitions

1. Boards: Lumber of less than 2 inches nominal (38 mm actual) in thickness and 2 inches nominal (38 mm actual) or greater width.
2. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater but less than 5 inches nominal (114 mm actual) in least dimension.
3. Timber: Lumber of 5 inches nominal (114 mm actual) or greater in least dimension.
4. Lumber grading agencies, and the abbreviations used to reference them, include the following:
 - a. NeLMA: Northeastern Lumber Manufacturers' Association.
 - b. NLGA: National Lumber Grades Authority.
 - c. RIS: Redwood Inspection Service.
 - d. SPIB: The Southern Pine Inspection Bureau.
 - e. WCLIB: West Coast Lumber Inspection Bureau.
 - f. WWPA: Western Wood Products Association.

D. Submittals

1. Product Data: For preservative-treated wood products, plastic decking, and metal framing anchors.
2. LEED Submittal:
 - a. Certificates for Credit MR 7: Chain-of-custody certificates certifying that wood products comply with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.
3. Material Certificates:
 - a. For lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by ALSC's Board of Review.
 - b. For preservative-treated wood products. Indicate type of preservative used and net amount of preservative retained.
4. Evaluation Reports: For the following, from an approved organization/model code, as directed by the Owner:
 - a. Preservative-treated wood products.
 - b. Plastic decking.
 - c. Expansion anchors.
 - d. Metal framing anchors.
 - e. Decking fasteners.

E. Quality Assurance

1. Forest Certification: Provide wood products obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."



F. Delivery, Storage, And Handling

1. Store materials under cover and protected from weather and contact with damp or wet surfaces. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.
2. Handle and store plastic lumber to comply with manufacturer's written instructions.

1.2 PRODUCTS

A. Lumber, General

1. Lumber: Comply with DOC PS 20 and with applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by ALSC's Board of Review. Provide lumber graded by an agency certified by ALSC's Board of Review to inspect and grade lumber under the rules indicated.
 - a. Factory mark each item with grade stamp of grading agency.
 - b. For items that are exposed to view in the completed Work, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
 - c. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry wood products.
 - d. Provide dressed lumber, S4S, unless otherwise indicated.

B. Dimension Lumber

1. Maximum Moisture Content: 15 percent **OR** 19 percent **OR** 15 percent for 2-inch nominal (38-mm actual) thickness or less; 19 percent for more than 2-inch nominal (38-mm actual) thickness **OR** 15 percent for 2-inch nominal (38-mm actual) thickness or less; no limit for more than 2-inch nominal (38-mm actual) thickness **OR** 19 percent for 2-inch nominal (38-mm actual) thickness or less; no limit for more than 2-inch nominal (38-mm actual) thickness, **as directed**.
2. Deck and Stair Framing: Select Structural **OR** No. 1 **OR** No. 2 **OR** Construction or No. 2 **OR** Construction, Stud, or No. 3, **as directed**, grade and as selected from the following species:
 - a. Hem-fir (North); NLGA.
 - b. Southern pine; SPIB.
 - c. Douglas fir-larch; WCLIB or WWPA.
 - d. Mixed southern pine; SPIB.
 - e. Spruce-pine-fir; NLGA.
 - f. Douglas fir-south; WWPA.
 - g. Hem-fir; WCLIB or WWPA.
 - h. Douglas fir-larch (North); NLGA.
 - i. Spruce-pine-fir (South); NeLMA, WCLIB, or WWPA.

OR

Deck and Stair Framing: Any species and grade with a modulus of elasticity of at least 1,500,000 psi (10 350 MPa) **OR** 1,300,000 psi (8970 MPa) **OR** 1,100,000 psi (7590 MPa) **OR** 1,000,000 psi (6900 MPa) **OR** 900,000 psi (6210 MPa), **as directed**, and an extreme fiber stress in bending of at least 1000 psi (6.9 MPa) **OR** 850 psi (5.86 MPa) **OR** 700 psi (4.83 MPa) **OR** 600 psi (4.14 MPa) **OR** 500 psi (3.45 MPa), **as directed**, for 2-inch nominal (38-mm actual) thickness and 12-inch nominal (286-mm actual) width for single-member use.

3. Dimension Lumber Posts: No. 2 **OR** Construction or No. 2 **OR** Construction, Stud, or No. 3, **as directed**, grade and as selected from the following species:
 - a. Hem-fir or hem-fir (North); NLGA, WCLIB, or WWPA.
 - b. Douglas fir-larch, Douglas fir-larch (North), or Douglas fir-south; NLGA, WCLIB, or WWPA.
 - c. Mixed southern pine; SPIB.
 - d. Spruce-pine-fir or spruce-pine-fir (South); NeLMA, NLGA, WCLIB, or WWPA.
 - e. Northern species; NLGA.
 - f. Eastern softwoods; NeLMA.



- g. Western woods; WCLIB or WWPA.
4. Dimension Lumber Decking and Stair Treads: No. 2 **OR** Construction or No. 2, **as directed**, grade and as selected from the following species:
- a. Hem-fir or hem-fir (North); NLGA, WCLIB, or WWPA.
 - b. Douglas fir-larch, Douglas fir-larch (North), or Douglas fir-south; NLGA, WCLIB, or WWPA.
 - c. Mixed southern pine; SPIB.
 - d. Redwood; RIS.
- OR**
- Dimension Lumber Decking and Stair Treads: Deck Heart or Construction Heart **OR** Deck Common or Construction Common, **as directed**, redwood; RIS.
5. Dimension Lumber Railing Members: Select Structural **OR** No. 1 **OR** No. 2 **OR** Construction or No. 2, **as directed**, grade and as selected from the following species:
- a. Hem-fir or hem-fir (North); NLGA, WCLIB, or WWPA.
 - b. Douglas fir-larch, Douglas fir-larch (North), or Douglas fir-south; NLGA, WCLIB, or WWPA.
 - c. Mixed southern pine; SPIB.
 - d. Redwood; RIS.
 - e. Spruce-pine-fir or spruce-pine-fir (South); NeLMA, NLGA, WCLIB, or WWPA.
- OR**
- Dimension Lumber Railing Members: Heart Clear **OR** Heart B or Select Heart, **as directed**, redwood; RIS.
6. Dimension Lumber for Benches: Select Structural **OR** No. 1, **as directed**, grade and as selected from the following species:
- a. Hem-fir or hem-fir (North); NLGA, WCLIB, or WWPA.
 - b. Douglas fir-larch, Douglas fir-larch (North), or Douglas fir-south; NLGA, WCLIB, or WWPA.
 - c. Mixed southern pine; SPIB.
 - d. Redwood; RIS.
 - e. Spruce-pine-fir or spruce-pine-fir (South); NeLMA, NLGA, WCLIB, or WWPA.
- OR**
- Dimension Lumber for Benches: Heart Clear **OR** Heart B or Select Heart, **as directed**, redwood; RIS.
- C. Boards
1. Maximum Moisture Content: 15 **OR** 19, **as directed**, percent.
2. Board Decking and Stair Treads: 1-1/4-inch- (32-mm-) thick radius-edged decking of any of the following species and grades:
- a. Douglas fir-larch or Douglas fir-south, Patio 1 **OR** Patio 2, **as directed**, WWPA.
 - b. Douglas fir-larch, Select Dex **OR** Commercial Dex, **as directed**, WCLIB.
 - c. Douglas fir-larch (North), Select Patio **OR** Commercial Patio, **as directed**, NLGA.
 - d. Hem-fir, Patio 1 **OR** Patio 2, **as directed**, WWPA.
 - e. Hem-fir, Select Dex **OR** Commercial Dex, **as directed**, WCLIB.
 - f. Hem-fir (North), Select Patio **OR** Commercial Patio, **as directed**, NLGA.
 - g. Redwood, Heart Clear **OR** Heart B or Select Heart, **as directed**; RIS.
 - h. Southern pine, Premium **OR** Standard, **as directed**, SPIB.
 - i. Western red cedar, Patio 1 **OR** Patio 2, **as directed**, WWPA.
 - j. Western red cedar, Select Dex **OR** Commercial Dex, **as directed**, WCLIB.
 - k. Western red cedar (North), Select Patio **OR** Commercial Patio, **as directed**, NLGA.
3. Railing Boards: Any of the following species and grades:
- a. Douglas fir, C & Btr finish or C Select; NLGA, WCLIB, or WWPA.
 - b. Hem-fir, C & Btr finish or C Select; NLGA, WCLIB, or WWPA.
 - c. Redwood, Heart Clear **OR** Heart B or Select Heart, **as directed**; RIS.
 - d. Southern pine, B & B finish; SPIB.
4. Boards for Benches: Any of the following species and grades:
- a. Douglas fir, C & Btr finish or C Select; NLGA, WCLIB, or WWPA.
 - b. Hem-fir, C & Btr finish or C Select; NLGA, WCLIB, or WWPA.
 - c. Redwood, Heart Clear **OR** Heart B or Select Heart, **as directed**; RIS.



- d. Southern pine, Edge Grain B & B finish **OR** Near Rift B & B finish **OR** B & B finish, **as directed**; SPIB.

D. Timber

1. Maximum Moisture Content: 19 percent **OR** No limit, **as directed**.
2. Dressing: Provide dressed timber (S4S) or timber that is rough sawn (Rgh) unless otherwise indicated.
3. Timber Posts:
 - a. Balsam fir, Douglas fir-larch, Douglas fir-larch (North), eastern hemlock tamarack (North), hem-fir, southern pine, western hemlock, or western hemlock (North); No. 1 **OR** No. 2, **as directed**, NeLMA, NLGA, SPIB, WCLIB, or WWPA.
 - b. Alaska cedar; No. 1 **OR** No. 2, **as directed**, WCLIB.
 - c. Southern pine; No. 1 **OR** No. 2, **as directed**, SPIB.

E. Round Wood Poles

1. Round Wood Poles: Clean-peeled wood poles complying with ASTM D 3200; with at least 80 percent of inner bark removed and with knots and limbs cut flush with the surface.
2. Species: as directed by the Owner.

F. Preservative Treatment

1. Pressure treat boards and dimension lumber with waterborne preservative according to AWPA C2.
2. Pressure treat timber with waterborne preservative according to AWPA C15 requirements for "sawn building poles and posts as structural members."
 - a. Treatment with CCA shall include post-treatment fixation process.
3. Pressure treat poles with waterborne preservative to comply with AWPA C4.
 - a. Treatment with CCA shall include post-treatment fixation process.
4. Preservative Chemicals: Acceptable to authorities having jurisdiction.
 - a. Do not use chemicals containing arsenic or chromium except for timber posts **OR** except for poles, **as directed**.
5. Use process that includes water-repellent treatment.

OR

Use process that does not include water repellents or other substances that might interfere with application of indicated finishes.
6. After treatment, redry boards, dimension lumber, timber, and poles to 19 percent maximum moisture content.
7. Mark treated wood with treatment quality mark of an inspection agency approved by ALSC's Board of Review.
 - a. For items indicated to receive a stained or natural finish, mark each piece on surface that will not be exposed or omit marking and provide certificates of treatment compliance issued by inspection agency.
8. Application: Treat all exterior rough carpentry unless otherwise indicated **OR** Treat items indicated on Drawings and the following, **as directed**:
 - a. Framing members less than 18 inches (460 mm) above grade.
 - b. Sills and ledgers.
 - c. Members in contact with masonry or concrete.
 - d. Posts.
 - e. Round wood poles.
 - f. Decking.
 - g. Stair treads.

G. Plastic Decking

1. Plastic Lumber, General: Products acceptable to authorities having jurisdiction and for which current model code evaluation reports exist that show compliance with building code in effect for Project for indicated occupancy and type of construction.



- a. Allowable loads and spans, as documented in evaluation reports or in information referenced in evaluation reports, shall not be less than design loads and spans indicated.
2. Composite Plastic Lumber: Solid or hollow shapes made from a mixture of cellulose fiber and polyethylene or polypropylene.
 - a. Configuration: Provide product with grooved edges designed for fastening with concealed splines.
 - b. Surface Texture: Woodgrain **OR** Smooth **OR** Manufacturer's standard, **as directed**.
 - c. Color: As selected from manufacturer's full range.
3. All-Plastic Lumber: Solid or hollow shapes made from high-density polyethylene (HDPE) **OR** PVC **OR** polystyrene **OR** cellular PVC, **as directed**, with no cellulose fiber.
 - a. Configuration: Provide product with grooved edges designed for fastening with concealed splines **OR** tongue-and-groove edges designed for concealed fastening, **as directed**.
 - b. Surface Texture: Woodgrain **OR** Smooth **OR** Manufacturer's standard, **as directed**.
 - c. Color: As selected from manufacturer's full range.

H. Fasteners

1. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches (38 mm) into wood substrate.
 - a. Use stainless steel **OR** fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M or ASTM F 2329, **as directed**, unless otherwise indicated.
 - b. For pressure-preservative-treated wood, use stainless-steel fasteners.
 - c. For plastic **OR** wood, **as directed**, decking, use stainless-steel fasteners where fasteners are exposed to view.
 - d. For redwood, use brass/bronze **OR** stainless-steel **OR** hot-dip galvanized-steel, **as directed**, fasteners.
2. Nails: ASTM F 1667.
3. Power-Driven Fasteners: NES NER-272.
4. Wood Screws: ASME B18.6.1.
5. Lag Screws: ASME B18.2.1 (ASME B18.2.3.8M).
6. Carbon-Steel Bolts: ASTM A 307 (ASTM F 568M) with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers all hot-dip zinc coated.
7. Stainless-Steel Bolts: ASTM F 593, Alloy Group 1 or 2 (ASTM F 738M, Grade A1 or A4); with ASTM F 594, Alloy Group 1 or 2 (ASTM F 836M, Grade A1 or A4) hex nuts and, where indicated, flat washers.
8. Postinstalled Anchors: Stainless-steel, chemical or torque-controlled expansion anchors with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
 - a. Stainless-steel bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).

I. Metal Framing Anchors

1. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those indicated on Drawings **OR** of basis-of-design products, **as directed**. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.
2. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) **OR** G90 (Z270) **OR** G185 (Z550), **as directed**, coating designation.
3. Stainless-Steel Sheet: ASTM A 666, Type 304 **OR** Type 316, **as directed**.
4. Joist Hangers: U-shaped, with 2-inch- (50-mm-) long seat and 1-1/4-inch- (32-mm-) wide nailing flanges at least 85 percent of joist depth.
5. Top Flange Hangers: U-shaped joist hangers, full depth of joist, formed from metal strap with tabs bent to extend over and be fastened to supporting member.



6. Post Bases: Adjustable-socket type for bolting in place with standoff plate to raise post 1 inch (25 mm) above base and with 2-inch- (50-mm-) minimum side cover, socket 0.062 inch (1.6 mm) thick, and standoff and adjustment plates 0.108 inch (2.8 mm) thick.
7. Joist Ties: Flat straps, with holes for fasteners, for tying joists together over supports.

J. Concealed Decking Fasteners

1. Deck Splines: Plastic splines designed to fit in grooves routed into the sides of decking material and be fastened to deck framing with screws. Splines provide uniform spacing of decking material. Splines are made from UV-resistant polypropylene.
2. Deck Clips: Black oxide coated stainless-steel clips designed to be fastened to deck framing with screws, and to secure decking material with teeth that also provide uniform spacing of decking material.
3. Deck Tracks: Formed metal strips designed to be fastened to deck framing and to secure decking material from underside with screws. Made from epoxy powder-coated, hot-dip galvanized steel **OR** stainless steel, **as directed**.

1.3 EXECUTION

A. Preparation

1. Clean substrates of projections and substances detrimental to application.
2. Prime lumber to be painted, including both faces and edges. Cut to required lengths and prime ends. Comply with requirements in Division 09 Section "Exterior Painting".

B. Installation, General

1. Set exterior rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit exterior rough carpentry to other construction; scribe and cope as needed for accurate fit.
2. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction" unless otherwise indicated.
3. Install wood decking and stair treads with crown up (bark side down).
4. Install plastic lumber to comply with manufacturer's written instructions.
5. Secure decking to framing with concealed decking fasteners.
6. Install metal framing anchors to comply with manufacturer's written instructions.
7. Do not splice structural members between supports unless otherwise indicated.
8. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
9. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
10. Comply with AWWA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 - a. Use inorganic boron (SBX) for items that are continuously protected from liquid water.
 - b. Use copper naphthenate for items not continuously protected from liquid water.
11. Securely attach exterior rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - a. NES NER-272 for power-driven fasteners.
 - b. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
 - c. "Nailing Schedule," and Tables in Section 2304 of the ICC's International Building Code.
 - d. Table 2306.1, "Fastening Schedule," in SBCCI's Standard Building Code.
 - e. Table R602.3(1), "Fastener Schedule for Structural Members" and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
12. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view. Make tight connections



between members. Install fasteners without splitting wood; do not countersink nail heads unless otherwise indicated.

13. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.

C. Elevated Deck Joist Framing Installation

1. General: Install joists with crown edge up and support ends of each member with not less than 1-1/2 inches (38 mm) of bearing on wood or metal, or 3 inches (76 mm) on masonry. Attach floor joists where framed into wood supporting members by using wood ledgers as indicated or, if not indicated, by using metal joist hangers. Do not notch joists.
2. Frame openings with headers and trimmers supported by metal joist hangers; double headers and trimmers where span of header exceeds 48 inches (1200 mm).
3. Lap members framing from opposite sides of beams or girders not less than 4 inches (102 mm) or securely tie opposing members together. Provide solid blocking of 2-inch nominal (38-mm actual) thickness by depth of joist over supports.
4. Provide solid blocking of 2-inch nominal (38-mm actual) thickness by depth of joist at intervals of 96 inches (2438 mm) o.c., between joists.

D. Stair Installation

1. Provide stair framing members of size, space, and configuration indicated or, if not indicated, to comply with the following requirements:
 - a. Stringer Size: 2 by 12 inches nominal (38 by 286 mm actual), minimum.
 - b. Notching: Notch stringers to receive treads, risers, and supports; leave at least 3-1/2 inches (89 mm) of effective depth.
 - c. Stringer Spacing: At least three stringers for each 36-inch (914-mm) clear width of stair.
2. Provide stair framing with no more than 3/16-inch (4.7-mm) variation between adjacent treads and risers and no more than 3/8-inch (9.5-mm) variation between largest and smallest treads and risers within each flight.
3. Treads and Risers: Secure by gluing and nailing **OR** screwing, **as directed**, to carriages. Countersink fastener heads, fill flush, and sand filler. Extend treads over carriages and finish with bullnose edge.

E. Railing Installation

1. Balusters: Fit to railings, glue, and nail **OR** screw, **as directed**, in place. Countersink fastener heads, fill flush, and sand filler.
2. Newel Posts: Secure to stringers and risers with through bolts **OR** lag screws **OR** countersunk-head wood screws and glue, **as directed**.
3. Railings: Secure wall rails with metal brackets. Fasten freestanding railings to newel posts and to trim at walls with countersunk-head wood screws or rail bolts and glue.

END OF SECTION 06 15 13 00



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SECTION 06 15 13 00a - WOOD DECKING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for wood decking. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Solid-sawn wood roof and floor decking.
 - b. Glued-laminated wood roof and floor decking.

C. Submittals

1. Product Data: For each type of product indicated.
 - a. For glued-laminated wood decking, include installation instructions and data on lumber, adhesives, and fabrication.
 - b. For preservative-treated wood products, include chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.
2. LEED Submittals:
 - a. Certificates for Credit MR 7: Chain-of-custody certificates certifying that wood used for decking complies with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.
 - 1) Include statement indicating costs for each certified wood product.
 - b. Product Data for Credit EQ 4.1: For sealants and installation adhesives, including printed statement of VOC content.
 - c. Product Data for Credit EQ 4.4: For laminating adhesive used for glued-laminated decking, indicating that product contains no urea formaldehyde.

D. Quality Assurance

1. Standard for Solid-Sawn Wood Decking: Comply with AITC 112.
2. Forest Certification: Provide wood decking produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

E. Delivery, Storage, And Handling

1. Schedule delivery of wood decking to avoid extended on-site storage and to avoid delaying the Work.
2. Store materials under cover and protected from weather and contact with damp or wet surfaces. Provide for air circulation within and around stacks and under temporary coverings. Stack wood decking with surfaces that are to be exposed in the final Work protected from exposure to sunlight.

1.2 PRODUCTS

A. Wood Decking, General

1. General: Comply with DOC PS 20 and with applicable grading rules of inspection agencies certified by ALSC's Board of Review.
2. Moisture Content: Provide wood decking with 15 **OR** 19, **as directed**, percent maximum moisture content at time of dressing.



B. Solid-Sawn Wood Decking

1. Decking Species: Alaska cedar **OR** Balsam fir **OR** Douglas fir-larch or Douglas fir-larch (North) **OR** Eastern spruce **OR** Hem-fir or hem-fir (North) **OR** Southern pine, **as directed**.
2. Decking Nominal Size: 2x6 **OR** 2x8 **OR** 3x6 **OR** 4x6, **as directed**.
3. Decking Grade:
 - a. Select(ed) **OR** Commercial, **as directed**, Decking.
OR
Dense Standard **OR** Dense Select **OR** Select **OR** Dense Commercial **OR** Commercial, **as directed**, Decking.
OR
Select(ed) Decking or Select Dex **OR** Commercial Decking or Commercial Dex, **as directed**.
4. Grade Stamps: Factory mark each item with grade stamp of grading agency. Apply grade stamp to surfaces that will not be exposed to view.
5. Face Surface: Rough sanded or wire brushed **OR** Saw textured **OR** Smooth, **as directed**.
6. Edge Pattern: Beaded edge **OR** Bullnosed **OR** Channel grooved **OR** Vee grooved, **as directed**.
7. Preservative Treatment: Pressure treat solid-sawn wood decking according to AWPAC31 with inorganic boron (SBX) and redry wood to 15 **OR** 19, **as directed**, percent maximum moisture content.

C. Glued-Laminated Wood Decking

1. Face Species: Alaska cedar **OR** Douglas fir-larch or Douglas fir-larch (North) **OR** Ponderosa pine **OR** Southern pine **OR** Western cedars or western cedars (North), **as directed**.
2. Decking Nominal Size: 2x6 **OR** 2x8 **OR** 3x6 **OR** 3x8 **OR** 4x6 **OR** 4x8 **OR** 5x6 **OR** 5x8, **as directed**.
3. Decking Configuration: For glued-laminated wood decking indicated to be of diaphragm design and construction, provide tongue-and-groove configuration that complies with research/evaluation report.
4. Face Grade:
 - a. Custom or Supreme: Clear face is required. Occasional pieces may contain a small knot or minor characteristic that does not detract from the overall appearance.
OR
Decorative: Sound knots and natural characteristics are allowed, including chipped edge knots, short end splits, seasoning checks, and some pin holes. Face knot holes, stain, end splits, skip, roller split, and planer burn are not allowed.
OR
Service: Face knot holes, stain, end splits, skip, roller split, planer burn, and other nonstrength-reducing characteristics are allowed. Strength-reducing characteristics are not allowed.
5. Face Surface: Rough sanded or wire brushed **OR** Saw textured **OR** Smooth, **as directed**.
6. Edge Pattern: Beaded edge **OR** Bullnosed **OR** Channel grooved **OR** Vee grooved, **as directed**.
7. Laminating Adhesive: Wet-use type complying with ASTM D 2559.
 - a. Use adhesive that contains no urea-formaldehyde resins.
8. Preservative Treatment: Pressure treat lumber before gluing according to AWPAC28 for aboveground use.
 - a. Use oxine copper (copper-8-quinolinolate) in a light petroleum solvent.
OR
Use copper naphthenate in a light petroleum solvent.
OR
Use waterborne preservative that is acceptable to authorities having jurisdiction and that contains no arsenic or chromium. After treating, redry wood to 15 **OR** 19, **as directed**, percent maximum moisture content.
OR
Use preservative solution without water repellents or substances that might interfere with application of indicated finishes.

**OR**

After dressing and fabricating decking, apply copper naphthenate according to AWPA M4 to surfaces cut to a depth of more than 1/16 inch (1.5 mm).

D. Accessory Materials

1. Fasteners for Solid-Sawn Decking: Provide fastener size and type complying with decking standard for thickness of deck used.
2. Fasteners for Glued-Laminated Decking: Provide fastener size and type complying with requirements in "Installation" Article for installing laminated decking.
3. Nails: Common; complying with ASTM F 1667, Type I, Style 10.
4. Spikes: Round; complying with ASTM F 1667, Type III, Style 3.
5. Fastener Material: Hot-dip galvanized **OR** Stainless, **as directed**, steel.
6. Bolts for Anchoring Decking to Walls:
 - a. Carbon steel; complying with ASTM A 307 (ASTM F 568M) with ASTM A 563/A 563M hex nuts and, where indicated, flat washers, all hot-dip zinc coated, **as directed**.

OR

Stainless steel; complying with ASTM F 593, Alloy Group 1 or 2 (ASTM F 738M, Grade A1 or A4); with ASTM F 594, Alloy Group 1 or 2 (ASTM F 836M, Grade A1 or A4) hex nuts and, where indicated, flat washers.

7. Installation Adhesive: For glued-laminated wood decking indicated to be of diaphragm design and construction, provide adhesive that complies with research/evaluation report.
 - a. Use adhesive that has a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
8. Sealant: Latex sealant compatible with substrates **OR** Elastomeric joint sealant complying with requirements in Division 07 Section "Joint Sealants" for Use NT (nontraffic) and for Uses M, G, A, and, as applicable to joint substrates indicated, O joint substrates, **as directed**.
 - a. Use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
9. Penetrating Sealer: Clear sanding sealer complying with Division 09 Section "Staining And Transparent Finishing" and compatible with topcoats specified for use over it.

E. Fabrication

1. Shop Fabrication: Where preservative-treated decking is indicated, complete cutting, trimming, surfacing, and sanding before treating.
2. Pre-drill decking for lateral spiking to adjacent units to comply with referenced decking standard.
3. Seal Coat: After fabricating and surfacing decking, apply a saturation coat of penetrating sealer in fabrication shop, **as directed**.

1.3 EXECUTION**A. Installation**

1. Install solid-sawn wood decking to comply with referenced decking standard.
 - a. Locate end joints for two-span continuous lay-up **OR** combination simple and two-span continuous lay-up **OR** controlled random lay-up **OR** lay-up indicated, **as directed**.
2. Install laminated wood decking to comply with manufacturer's written instructions.
 - a. Locate end joints for two-span continuous lay-up **OR** combination simple and two-span continuous lay-up **OR** controlled random lay-up **OR** lay-up indicated, **as directed**.
 - b. Nail each course of glued-laminated wood decking at each support with one nail slant nailed above the tongue and one nail straight nailed through the face.
 - 1) Use 12d nails for 2x6 and 2x8 decking.
 - 2) Use 30d nails for 3x6 and 3x8 decking.
 - 3) Use 60d nails for 4x6 and 4x8 decking. Pre-drill decking to prevent splitting.
 - 4) Use 30d tongue nails in bottom tongue and 3/8-inch (10-mm) face spikes for 5x6 and 5x8 decking. Pre-drill decking at spikes to prevent splitting.



- c. Slant nail each course of glued-laminated wood decking to the tongue of the adjacent course at 30 inches (750 mm) o.c. and within 12 inches (300 mm) of the end of each unit. Stagger nailing in adjacent courses 15 inches (380 mm).
 - 1) Use 6d nails for 2x6 and 2x8 decking.
 - 2) Use 8d nails for 3x6 and 3x8 decking.
 - 3) Use 10d nails for 4x6 and 4x8 decking.
 - 4) Use 16d nails for 5x6 and 5x8 decking.
 - d. Glue adjoining decking courses together by applying a 3/8-inch (10-mm) bead of adhesive on the top of tongues according to research/evaluation report.
3. Anchor wood roof decking, where supported on walls, with bolts as indicated.
 4. Where preservative-treated decking must be cut during erection, apply a field-treatment preservative to comply with AWP A M4.
 - a. For solid-sawn decking, use inorganic boron (SBX).
 - b. For laminated decking, use copper naphthenate.
 5. Apply joint sealant to seal roof decking at exterior walls at the following locations:
 - a. Between decking and supports located at exterior walls.
 - b. Between decking and exterior walls that butt against underside of decking.
 - c. Between tongues and grooves of decking over exterior walls and supports at exterior walls.
- B. Adjusting
1. Repair damaged surfaces and finishes after completing erection. Replace damaged decking if repairs are not approved by the Owner.
- C. Protection
1. Provide temporary waterproof covering as the Work progresses to protect roof decking until roofing is applied.

END OF SECTION 06 15 13 00a



Task	Specification	Specification Description
06 15 13 00	06 10 00 00	Rough Carpentry
06 15 13 00	01 95 06 00	Miscellaneous Carpentry
06 15 13 00	06 11 16 00	Rough Carpentry Renovation



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**SECTION 06 16 23 00 - SHEATHING****1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for sheathing. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Wall sheathing.
 - b. Roof sheathing.
 - c. Composite nail base insulated roof sheathing.
 - d. Subflooring.
 - e. Underlayment.
 - f. Building paper.
 - g. Building wrap.
 - h. Sheathing joint-and-penetration treatment.
 - i. Flexible flashing at openings in sheathing.

C. Submittals

1. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - a. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
 - b. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
 - c. For fire-retardant treatments specified to be High-Temperature (HT) type, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5516.
 - d. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
 - e. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
 - f. For building wrap, include data on air-/moisture-infiltration protection based on testing according to referenced standards.
2. LEED Submittals:
 - a. Product Data for Credit EQ 4.1: For adhesives, including printed statement of VOC content.
 - b. Product Data for Credit EQ 4.4: For composite-wood products, documentation indicating that product contains no urea formaldehyde.
 - c. Certificates for Credit MR 7: Chain-of-custody certificates certifying that products specified to be made from certified wood comply with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.
 - 1) Include statement indicating costs for each certified wood product.
3. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:
 - a. Preservative-treated plywood.
 - b. Fire-retardant-treated plywood.



- c. Foam-plastic sheathing.
- d. Building wrap.

D. Quality Assurance

1. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
2. Forest Certification: For the following wood products, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship":
 - a. Plywood.
 - b. Oriented strand board.
 - c. Fiberboard wall sheathing.
 - d. Particleboard underlayment.
 - e. Hardboard underlayment.

E. Delivery, Storage, And Handling

1. Stack plywood and other panels flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

1.2 PRODUCTS

A. Wood Panel Products, General

1. Plywood: DOC PS 1 **OR** Either DOC PS 1 or DOC PS 2, unless otherwise indicated, **as directed**.
2. Oriented Strand Board: DOC PS 2.
3. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
4. Factory mark panels to indicate compliance with applicable standard.

B. Preservative-Treated Plywood

1. Preservative Treatment by Pressure Process: AWWA C9.
 - a. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
2. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
3. Application: Treat all plywood, unless otherwise indicated **OR** Treat items indicated on Drawings, **as directed**, and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

C. Fire-Retardant-Treated Plywood

1. General: Comply with performance requirements in AWWA C27.
 - a. Use treatment that does not promote corrosion of metal fasteners.
 - b. Use Exterior type for exterior locations and where indicated.
 - c. Use Interior Type A, High Temperature (HT) for roof sheathing and where indicated.
 - d. Use Interior Type A, unless otherwise indicated.
2. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.
3. Identify fire-retardant-treated plywood with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.
4. Application: Treat all plywood, unless otherwise indicated **OR** Treat plywood indicated on Drawings, and the following, **as directed**:
 - a. Roof and wall sheathing within 48 inches (1220 mm) of fire **OR** party, **as directed**, walls.



- b. Roof sheathing.
- c. Subflooring and underlayment for raised platforms.

D. Wall Sheathing

- 1. Plywood Wall Sheathing: Exterior, Structural I **OR** Exterior **OR** Exposure 1, Structural I **OR** Exposure 1, **as directed**, sheathing.
- 2. Oriented-Strand-Board Wall Sheathing: Exposure 1, Structural I **OR** Exposure 1, **as directed**, sheathing.
- 3. Paper-Surfaced Gypsum Wall Sheathing: ASTM C 79/C 79M or ASTM C 1396/C 1396M, gypsum sheathing; with water-resistant-treated core and with water-repellent paper bonded to core's face, back, and long edges.
 - a. Type and Thickness: Regular, 1/2 inch (13 mm) **OR** Type X, 5/8 inch (15.9 mm), **as directed**, thick.
- 4. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.
 - a. Type and Thickness: Regular, 1/2 inch (13 mm) **OR** Type X, 5/8 inch (15.9 mm), **as directed**, thick.
- 5. Cellulose Fiber-Reinforced Gypsum Sheathing: ASTM C 1278/C 1278M, gypsum sheathing.
 - a. Type and Thickness: Regular, 1/2 inch (13 mm) **OR** Type X, 5/8 inch (15.9 mm), **as directed**, thick.
- 6. Fiberboard Wall Sheathing: ASTM C 208, Type IV, Grade 1 (Regular) **OR** 2 (Structural), **as directed**, cellulosic fiberboard sheathing with square edges, 1/2 inch (13 mm) **OR** 25/32 inch (20 mm), **as directed**, thick.
- 7. Extruded-Polystyrene-Foam Wall Sheathing: ASTM C 578, Type IV, in manufacturer's standard lengths and widths with tongue-and-groove or shiplap long edges as standard with manufacturer.
 - a. Thickness: 3/4 inch (19 mm) **OR** 1 inch (25 mm) **OR** As indicated, **as directed**.
- 8. Foil-Faced, Polyisocyanurate-Foam Wall Sheathing: ASTM C 1289, Type I, Class 2, aluminum-foil-faced, glass-fiber-reinforced, rigid, cellular, polyisocyanurate thermal insulation. Foam-plastic core and facings shall have a flame-spread index of 25 or less when tested individually.
 - a. Thickness: 7/16 inch (11.1 mm) **OR** 1/2 inch (13 mm) **OR** 5/8 inch (15.9 mm) **OR** 3/4 inch (19 mm) **OR** 1 inch (25 mm) **OR** As indicated, **as directed**.

E. Roof Sheathing

- 1. Plywood Roof Sheathing: Exterior, Structural I **OR** Exterior **OR** Exposure 1, Structural I **OR** Exposure 1, **as directed**, sheathing.
- 2. Oriented-Strand-Board Roof Sheathing: Exposure 1, Structural I **OR** Exposure 1, **as directed**, sheathing.

F. Composite Nail Base Insulated Roof Sheathing

- 1. Oriented-Strand-Board-Surfaced, Polyisocyanurate-Foam Sheathing: Rigid, cellular, polyisocyanurate thermal insulation with oriented strand board laminated to one face complying with ASTM C 1289, Type V.
- 2. Vented, Oriented-Strand-Board-Surfaced, Polyisocyanurate-Foam Sheathing:
 - a. Rigid, cellular, polyisocyanurate thermal insulation complying with ASTM C 1289, Type II, Class 1, with oriented strand board adhered to spacers on one face.
OR
Rigid, cellular, polyisocyanurate thermal insulation with oriented strand board laminated to one face complying with ASTM C 1289, Type V. Oriented-strand-board face has a second layer of oriented strand board adhered to it with spacers between.
 - 1) Polyisocyanurate-Foam Thickness: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 2-1/2 inches (64 mm) **OR** 3 inches (76 mm) **OR** 3-1/2 inches (89 mm) **OR** 4 inches (102 mm), **as directed**.
 - 2) Oriented-Strand-Board Nominal Thickness: 7/16 inch (11.1 mm) **OR** 5/8 inch (15.9 mm), **as directed**.
 - 3) Spacers: Wood furring strips or blocks not less than 3/4 inch (19 mm) thick and spaced not more than 12 inches (300 mm) **OR** 16 inches (400 mm) **OR** 24 inches (600 mm), **as directed**, o.c.



G. Subflooring And Underlayment

1. Plywood Combination Subfloor-Underlayment: DOC PS 1, Exterior, Structural I, C-C Plugged **OR** Exterior, C-C Plugged **OR** Exposure 1, Structural I, Underlayment **OR** Exposure 1, Underlayment, **as directed**, single-floor panels.
2. Oriented-Strand-Board Combination Subfloor-Underlayment: Exposure 1 single-floor panels.
3. Plywood Subflooring: Exterior, Structural I **OR** Exterior **OR** Exposure 1, Structural I **OR** Exposure 1, **as directed**, single-floor panels or sheathing.
4. Oriented-Strand-Board Subflooring: Exposure 1, Structural I sheathing **OR** single-floor panels or sheathing, **as directed**.
5. Underlayment, General: Provide underlayment in nominal thicknesses indicated or, if not indicated, not less than 1/4 inch (6.4 mm) over smooth subfloors and not less than 3/8 inch (9.5 mm) over board or uneven subfloors.
6. Plywood Underlayment for Resilient Flooring: DOC PS 1, Exterior A-C **OR** Exterior B-C **OR** Exterior, C-C Plugged **OR** Exposure 1 Underlayment, **as directed**, with fully sanded face.
7. Plywood Underlayment for Ceramic Tile: DOC PS 1, Exterior, C-C Plugged, not less than 5/8-inch (15.9-mm) nominal thickness, for ceramic tile set in organic **OR** epoxy, **as directed**, adhesive.
8. Plywood Underlayment for Carpet: DOC PS 1, Exterior, C-C Plugged **OR** Exposure 1, Underlayment **OR** Interior, Underlayment, **as directed**.
9. Particleboard Underlayment: ANSI A208.1, Grade PBU **OR** M-2, Exterior Glue, complying with dimensional tolerances and thickness swell requirements of Grade PBU, **as directed**.
10. Hardboard Underlayment: AHA A135.4, Class 4 (Service), Surface S1S; with back side sanded.

H. Fasteners

1. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
 - a. For roof and wall, **as directed**, sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M **OR** of Type 304 stainless steel, **as directed**.
2. Nails, Brads, and Staples: ASTM F 1667.
3. Power-Driven Fasteners: NES NER-272.
4. Wood Screws: ASME B18.6.1.
5. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
 - a. For wall and roof sheathing panels, provide screws with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
6. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
 - a. For steel framing less than 0.0329 inch (0.835 mm) thick, attach sheathing to comply with ASTM C 1002.
 - b. For steel framing from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick, attach sheathing to comply with ASTM C 954.
7. Screws for Fastening Oriented-Strand-Board-Surfaced, Polyisocyanurate-Foam Sheathing to Metal Roof Deck: Steel drill screws, in type and length recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117. Provide washers or plates if recommended by sheathing manufacturer.

I. Weather-Resistant Sheathing Paper

1. Building Paper:
 - a. ASTM D 226, Type 1 (No. 15 asphalt-saturated organic felt), unperforated.

OR



- IBC Standard 1404.2, Grade D (water-vapor-permeable, kraft building paper), except that water resistance shall be not less than 1 hour and water-vapor transmission shall be not less than 75 g/sq. m x 24 h.
2. Building Wrap: ASTM E 1677, Type I air retarder; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.
 - a. Water-Vapor Permeance: Not less than 535 **OR** 152 **OR** 125 **OR** 63, **as directed**, g through 1 sq. m of surface in 24 hours per ASTM E 96, Desiccant Method (Procedure A).
 - b. Allowable UV Exposure Time: Not less than three months.
 3. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.
- J. Sheathing Joint-And-Penetration Treatment Materials
1. Sealant for Paper-Surfaced **OR** Glass-Mat, **as directed**, Gypsum Sheathing Board:
 - a. Elastomeric, medium-modulus, neutral-curing silicone joint sealant compatible with joint substrates formed by gypsum sheathing and other materials, recommended by sheathing manufacturer for application indicated, and complying with requirements for elastomeric sealants specified in Division 07 Section "Joint Sealants".
OR
Silicone emulsion sealant complying with ASTM C 834, compatible with sheathing tape and sheathing, and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.
 2. Sheathing Tape for Glass-Mat Gypsum Sheathing Board: Self-adhering glass-fiber tape, minimum 2 inches (50 mm) wide, 10 by 10 or 10 by 20 threads/inch (390 by 390 or 390 by 780 threads/m), of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing board and with a history of successful in-service use.
 3. Sheathing Tape for Foam-Plastic Sheathing: Pressure-sensitive plastic tape recommended by sheathing manufacturer for sealing joints and penetrations in sheathing.
- K. Miscellaneous Materials
1. Adhesives for Field Gluing Panels to Framing: Formulation complying with APA AFG-01 **OR** ASTM D 3498, **as directed**, that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.
 - a. Use adhesives that have a VOC content of 50 **OR** 70, **as directed**, g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.025 inch (0.6 mm) **OR** 0.030 inch (0.8 mm) **OR** 0.040 inch (1.0 mm), **as directed**.
 3. Primer for Flexible Flashing: Product recommended by manufacturer of flexible flashing for substrate.

1.3 EXECUTION

- A. Installation, General
1. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
 2. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.
 3. Securely attach to substrate by fastening as indicated, complying with the following:
 - a. NES NER-272 for power-driven fasteners.
 - b. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."
 - c. "Nailing Schedule," and Tables in Section 2304 of the ICC's International Building Code.
 - d. Table 2306.1, "Fastening Schedule," in SBCCI's "Standard Building Code."



- e. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's "International Residential Code for One- and Two-Family Dwellings."
- f. Table 602.3(1), "Fastener Schedule for Structural Members," and Table 602.3(2), "Alternate Attachments," in ICC's "International One- and Two-Family Dwelling Code."
- 4. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.
- 5. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- 6. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- 7. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

B. Wood Structural Panel Installation

- 1. General: Comply with applicable recommendations in APA Form No. E30S, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
- 2. Fastening Methods: Fasten panels as indicated below:
 - a. Combination Subfloor-Underlayment:
 - 1) Glue and nail **OR** Nail, **as directed**, to wood framing.
 - 2) Screw to cold-formed metal framing.
 - 3) Space panels 1/8 inch (3 mm) apart at edges and ends.
 - b. Subflooring:
 - 1) Glue and nail **OR** Nail **OR** Nail or staple, **as directed**, to wood framing.
 - 2) Screw to cold-formed metal framing.
 - 3) Space panels 1/8 inch (3 mm) apart at edges and ends.
 - c. Wall and Roof Sheathing:
 - 1) Nail **OR** Nail or staple, **as directed**, to wood framing. Apply a continuous bead of glue to framing members at edges of wall sheathing panels.
 - 2) Screw to cold-formed metal framing.
 - 3) Space panels 1/8 inch (3 mm) apart at edges and ends.
 - d. Underlayment:
 - 1) Nail **OR** Nail or staple, **as directed**, to subflooring.
 - 2) Space panels 1/32 inch (0.8 mm) apart at edges and ends.
 - 3) Fill and sand edge joints of underlayment receiving resilient flooring right before installing flooring.

C. Gypsum Sheathing Installation

- 1. Comply with GA-253 and with manufacturer's written instructions.
 - a. Fasten gypsum sheathing to wood framing with nails **OR** screws, **as directed**.
 - b. Fasten gypsum sheathing to cold-formed metal framing with screws.
 - c. Install boards with a 3/8-inch (9.5-mm) gap where non-load-bearing construction abuts structural elements.
 - d. Install boards with a 1/4-inch (6.4-mm) gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.
- 2. Apply fasteners so heads bear tightly against face of sheathing boards but do not cut into facing.
- 3. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent boards without forcing. Abut ends of boards over centers of studs, and stagger end joints of adjacent boards not less than one stud spacing. Attach boards at perimeter and within field of board to each steel stud.



- a. Space fasteners approximately 8 inches (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of boards.
 - b. For sheathing under stucco cladding, boards may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.
 4. Vertical Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud.
 - a. Space fasteners approximately 8 inches (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of boards.
 - b. For sheathing under stucco cladding, boards may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.
- D. Fiberboard Sheathing Installation
 1. Comply with ASTM C 846 and with manufacturer's written instructions.
 2. Fasten fiberboard sheathing panels to intermediate supports and then at edges and ends. Use galvanized roofing nails or galvanized staples, **as directed**; comply with manufacturer's recommended spacing and referenced fastening schedule. Drive fasteners flush with surface of sheathing and locate perimeter fasteners at least 3/8 inch (9.5 mm) from edges and ends.
 3. Install sheathing vertically with long edges parallel to, and centered over, studs. Install solid wood blocking where end joints do not occur over framing. Allow 1/8-inch (3-mm) open space between edges and ends of adjacent units. Stagger horizontal joints if any.
 4. Cover sheathing as soon as practical after installation to prevent deterioration from wetting.
- E. Foam-Plastic Sheathing Installation
 1. Comply with manufacturer's written instructions.
 2. Foam-Plastic Wall Sheathing: Install vapor-relief strips or equivalent for permitting escape of moisture vapor that otherwise would be trapped in stud cavity behind sheathing.
- F. Particleboard Underlayment Installation
 1. Comply with the National Particleboard Association's recommendations for type of subfloor indicated. Fill and sand gouges, gaps, and chipped edges. Sand uneven joints flush.
 - a. Fastening Method: Glue and nail **OR** Nail **OR** Nail or staple, **as directed**, underlayment to subflooring.
- G. Hardboard Underlayment Installation
 1. Comply with AHA's "Application Instructions for Basic Hardboard Products" and with hardboard manufacturer's written instructions for preparing and applying hardboard underlayment.
 - a. Fastening Method: Nail **OR** Nail or staple, **as directed**, underlayment to subflooring.
- H. Weather-Resistant Sheathing-Paper Installation
 1. General: Cover sheathing with weather-resistant sheathing paper as follows:
 - a. Cut back barrier 1/2 inch (13 mm) on each side of the break in supporting members at expansion- or control-joint locations.
 - b. Apply barrier to cover vertical flashing with a minimum 4-inch (100-mm) overlap, unless otherwise indicated.
 2. Building Paper: Apply horizontally with a 2-inch (50-mm) overlap and a 6-inch (150-mm) end lap; fasten to sheathing with galvanized staples or roofing nails.
 3. Building Wrap: Comply with manufacturer's written instructions.
 - a. Seal seams, edges, fasteners, and penetrations with tape.
 - b. Extend into jambs of openings and seal corners with tape.
- I. Sheathing Joint-And-Penetration Treatment
 1. Seal sheathing joints according to sheathing manufacturer's written instructions.



- a. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient quantity of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
- b. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing board joints, and apply and trowel silicone emulsion sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.
- c. Apply sheathing tape to joints between foam-plastic sheathing panels and at items penetrating sheathing. Apply at upstanding flashing to overlap both flashing and sheathing.

J. Flexible Flashing Installation

1. Apply flexible flashing where indicated to comply with manufacturers written instructions.
 - a. Prime substrates as recommended by flashing manufacturer.
 - b. Lap seams and junctures with other materials at least 4 inches (100 mm), except that at flashing flanges of other construction, laps need not exceed flange width.
 - c. Lap flashing over weather-resistant building paper at bottom and sides of openings.
 - d. Lap weather-resistant building paper over flashing at heads of openings.
 - e. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

K. Protection

1. Paper-Surfaced Gypsum Sheathing: Protect sheathing by covering exposed exterior surface of sheathing with weather-resistant sheathing paper securely fastened to framing. Apply covering immediately after sheathing is installed.

END OF SECTION 06 16 23 00



Task	Specification	Specification Description
06 16 23 00	06 10 00 00	Rough Carpentry
06 16 23 00	01 95 06 00	Miscellaneous Carpentry
06 16 33 00	06 10 00 00	Rough Carpentry
06 16 33 00	01 95 06 00	Miscellaneous Carpentry
06 16 33 00	06 16 23 00	Sheathing
06 16 43 00	06 10 00 00	Rough Carpentry
06 16 43 00	01 95 06 00	Miscellaneous Carpentry
06 16 43 00	06 16 23 00	Sheathing
06 16 43 00	06 11 16 00	Rough Carpentry Renovation



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SECTION 06 17 13 00 - STRUCTURAL GLUED-LAMINATED TIMBER

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for structural glued-laminated timber. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes framing using structural glued-laminated timber.

C. Definitions

1. Structural Glued-Laminated (Glulam) Timber: An engineered, stress-rated timber product assembled from selected and prepared wood laminations bonded together with adhesives and with the grain of the laminations approximately parallel longitudinally.

D. Performance Requirements

1. Delegated Design: Design structural glued-laminated timber and connectors, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2. Structural Performance: Structural glued-laminated timber and connectors shall withstand the effects of structural loads shown on Drawings without exceeding allowable design working stresses listed in AITC 117 or determined according to ASTM D 3737 and acceptable to authorities having jurisdiction.
3. Seismic Performance: Structural glued-laminated timber and connectors shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

E. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:
 - a. Certificates for Credit MR 7: Chain-of-custody certificates certifying that wood used for structural glued-laminated timber complies with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.
 - 1) Include statement indicating costs for each certified wood product.
 - b. Product Data for Credit EQ 4.4: For laminating adhesive used for structural glued-laminated timber, indicating that product contains no urea formaldehyde.
3. Delegated-Design Submittal: For structural glued-laminated timber and timber connectors indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
4. Certificates of Conformance: Issued by a qualified testing and inspecting agency indicating that structural glued-laminated timber complies with requirements in AITC A190.1.

F. Quality Assurance

1. Manufacturer Qualifications: Provide factory-glued structural units produced by an AITC- or APA-licensed firm that is certified for chain of custody by an FSC-accredited certification body.
 - a. Factory mark each piece of structural glued-laminated timber with AITC Quality Mark or APA-EWS trademark. Place mark on surfaces that will not be exposed in the completed Work.
2. Quality Standard: Comply with AITC A190.1.



3. Forest Certification: Provide structural glued-laminated timber produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

G. Delivery, Storage, And Handling

1. General: Comply with provisions in AITC 111.
2. Individually wrap members using plastic-coated paper covering with water-resistant seams.

1.2 PRODUCTS

A. Structural Glued-Laminated Timber

1. General: Provide structural glued-laminated timber that complies with AITC 117 or research/evaluation reports acceptable to authorities having jurisdiction.
 - a. Provide structural glued-laminated timber made from solid lumber laminations; do not use laminated veneer lumber.
 - b. Provide structural glued-laminated timber made with wet-use adhesive complying with ASTM D 2559.
 - 1) Use adhesive that contains no urea-formaldehyde resins.
2. Species and Grades for Structural Glued-Laminated Timber:
 - a. Alaska cedar **OR** Douglas fir-larch **OR** Southern pine **OR** Any species, **as directed**, in grades needed to comply with "Performance Requirements" Article.
OR
Alaska cedar **OR** Douglas fir-larch **OR** Southern pine **OR** Any species, **as directed**, that complies with structural properties **OR** combination symbols **OR** beam stress classifications, **as directed**, indicated.
3. Species and Grades for Beams and Purlins:
 - a. Species and Beam Stress Classification: Ponderosa pine, 16F-1.3E **OR** Alaska cedar, 20F-1.5E **OR** Eastern spruce, 20F-1.5E **OR** Any species, 20F-1.5E **OR** Any species, 24F-1.7E **OR** Douglas fir-larch, 24F-1.8E **OR** Southern pine, 24F-1.8E **OR** Douglas fir-larch or southern pine, 24F-1.8E **OR** Southern pine, 30F-2.1E, **as directed**.
 - b. Lay-up: Balanced **OR** Either balanced or unbalanced, **as directed**.
4. Species and Grades for Columns and Truss Members:
 - a. Species and Combination Symbol: Alaska cedar, 70 **OR** Douglas fir-larch, 1 **OR** Douglas fir-larch, 3 **OR** Southern pine, 47 **OR** Southern pine, 50, **as directed**.
5. Appearance Grade: Premium **OR** Architectural **OR** Industrial **OR** Framing, **as directed**, complying with AITC 110.
6. Preservative Treatment after Fabrication: Where preservative-treated structural glued-laminated timber is indicated, pressure treat after fabrication according to AWPA C28.
 - a. Use oxine copper (copper-8-quinolinolate) in a light petroleum solvent.
OR
Use copper naphthenate in a light petroleum solvent.
OR
Use preservative solution without water repellents or substances that might interfere with application of indicated finishes.
OR
Do not incise structural glued-laminated timber.
7. Preservative Treatment before Fabrication: Where preservative-treated structural glued-laminated timber is indicated, pressure treat lumber before gluing according to AWPA C28.
 - a. Use oxine copper (copper-8-quinolinolate) in a light petroleum solvent.
OR
Use copper naphthenate in a light petroleum solvent.
OR
Use a waterborne preservative that is acceptable to authorities having jurisdiction and that contains no arsenic or chromium.

**OR**

Use preservative solution without water repellents or substances that might interfere with application of indicated finishes.

OR

Do not incise wood used for producing structural glued-laminated timber.

OR

After dressing and fabricating members, apply a field-treatment preservative to comply with AWPA M4 to surfaces cut to a depth of more than 1/16 inch (1.5 mm).

1) Use inorganic boron (SBX) treatment for members not in contact with the ground and continuously protected from liquid water.

OR

Use copper naphthenate treatment for members in contact with the ground or not continuously protected from liquid water.

8. End Sealer: Manufacturer's standard, transparent, colorless wood sealer that is effective in retarding the transmission of moisture at cross-grain cuts and is compatible with indicated finish.
9. Penetrating Sealer: Manufacturer's standard, transparent, penetrating wood sealer that is compatible with indicated finish.

B. Timber Connectors

1. General: Unless otherwise indicated, fabricate from the following materials:
 - a. Structural-steel shapes, plates, and flat bars complying with ASTM A 36/A 36M.
 - b. Round steel bars complying with ASTM A 575, Grade M 1020.
 - c. Hot-rolled steel sheet complying with ASTM A 1011/A 1011M, Structural Steel, Type SS, Grade 33.
 - d. Stainless-steel plate and flat bars complying with ASTM A 666, Type 304 **OR** Type 316, **as directed**.
 - e. Stainless-steel bars and shapes complying with ASTM A 276, Type 304 **OR** Type 316, **as directed**.
 - f. Stainless-steel sheet complying with ASTM A 666, Type 304 **OR** Type 316, **as directed**.
2. Fabricate beam seats from steel **OR** stainless steel, **as directed**, with 0.239-inch (6-mm) **OR** 3/16-inch (5-mm) **OR** 3/8-inch (9.5-mm), **as directed**, bearing plates, 3/4-inch- (19-mm-) diameter-by-12-inch- (300-mm-) long deformed bar anchors, and 0.239-inch (6-mm) side plates.
3. Fabricate arch base shoes from steel **OR** stainless steel, **as directed**, with 1-inch (25-mm) base plates and 3/8-inch (9.5-mm) side plates.
4. Fabricate beam hangers from steel **OR** stainless steel, **as directed**, with 0.179-inch (4.6-mm) stirrups and 0.239-inch (6-mm) top plates.
5. Fabricate hinge connectors from steel **OR** stainless steel, **as directed**, with 0.179-inch (4.6-mm) side plates and 3/4-inch (19-mm) **OR** 1-inch (25-mm), **as directed**, top and bottom plates.
6. Fabricate strap ties from steel **OR** stainless steel, **as directed**, 2-1/2 inches (63 mm) wide by 0.179 inch (4.6 mm) **OR** 3 inches (75 mm) wide by 0.239 inch (6 mm), **as directed**, thick.
7. Fabricate tie rods from round steel bars with upset threads connected with forged-steel turnbuckles complying with ASTM A 668/A 668M.
8. Provide bolts, 3/4 inch (19 mm) unless otherwise indicated, complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); nuts complying with ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
9. Provide shear plates, 2-5/8 inches (66.7 mm) **OR** 4 inches (102 mm), **as directed**, in diameter, complying with ASTM D 5933.
10. Finish steel assemblies and fasteners with rust-inhibitive primer, 2-mil (0.05-mm) dry film thickness.
11. Hot-dip galvanize steel assemblies and fasteners after fabrication to comply with ASTM A 123/A 123M or ASTM A 153/A 153M.

C. Fabrication

1. Shop fabricate for connections to greatest extent possible, including cutting to length and drilling bolt holes.



- a. Dress exposed surfaces to remove planing or surfacing marks and to provide a finish equivalent to that produced by machine sanding with No. 120 grit sandpaper.
2. Camber: Fabricate horizontal and inclined members of less than 1:1 slope with either circular or parabolic camber equal to 1/500 of span.
3. End-Cut Sealing: Immediately after end cutting each member to final length and after preservative treatment, apply a saturation coat of end sealer to ends and other cross-cut surfaces, keeping surfaces flood coated for not less than 10 minutes.
4. Seal Coat: After fabricating, sanding, and end-coat sealing, apply a heavy saturation coat of penetrating sealer on surfaces of each unit, except for preservative-treated wood where treatment included a water repellent.

D. Factory Finishing

1. Wiped Stain Finish: Manufacturer's standard, dry-appearance, penetrating acrylic stain and sealer; oven dried and resistant to mildew and fungus.
 - a. Color: As selected by the Owner from manufacturer's full range.
2. Clear Finish: Manufacturer's standard, two-coat, clear conversion varnish finish; oven dried and resistant to mildew and fungus.

1.3 EXECUTION

A. Installation

1. General: Erect structural glued-laminated timber true and plumb, and with uniform, close-fitting joints. Provide temporary bracing to maintain lines and levels until permanent supporting members are in place.
 - a. Lift with padded slings and protect corners with wood blocking.
 - b. Install structural glued-laminated timber to comply with Shop Drawings.
 - c. Install timber connectors as indicated.
2. Framing Built into Masonry: Provide 1/2-inch (13-mm) clearance at tops, sides, and ends of members built into masonry; bevel cut ends 3 inches (76 mm); and do not embed more than 4 inches (102 mm) unless otherwise indicated.
3. Fit structural glued-laminated timber by cutting and restoring exposed surfaces to match specified surfacing and finishing.
 - a. Predrill for fasteners using timber connectors as templates.
 - b. Dress exposed surfaces to remove planing or surfacing marks and to provide a finish equivalent to that produced by machine sanding with No. 120 grit sandpaper.
 - c. Coat cross cuts with end sealer.
 - d. Where preservative-treated members must be cut during erection, apply a field-treatment preservative to comply with AWPA M4.
 - 1) Use inorganic boron (SBX) treatment for members not in contact with the ground and continuously protected from liquid water.

OR

 Use copper naphthenate treatment for members in contact with the ground or not continuously protected from liquid water.
4. Cutting: Avoid cutting after fabrication. Where field fitting is unavoidable, comply with requirements for shop fabrication.
 - a. Where preservative-treated members must be cut during erection, apply a field-treatment preservative to comply with AWPA M4.
 - 1) Use inorganic boron (SBX) treatment for members not in contact with the ground and continuously protected from liquid water.

OR

 Use copper naphthenate treatment for members in contact with the ground or not continuously protected from liquid water.

B. Adjusting



1. Repair damaged surfaces and finishes after completing erection. Replace damaged structural glued-laminated timber if repairs are not approved by the Owner.
- C. Protection
1. Do not remove wrappings on individually wrapped members until they no longer serve a useful purpose including protection from weather, sunlight, soiling, and damage from work of other trades.
 - a. Coordinate wrapping removal with finishing work specified in Division 07. Retain wrapping where it can serve as a painting shield.

END OF SECTION 06 17 13 00



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Task	Specification	Specification Description
06 17 13 00	06 05 23 00	Timber Bridge Components
06 17 13 00	06 10 00 00	Rough Carpentry
06 17 23 00	06 10 00 00	Rough Carpentry
06 17 23 00	01 95 06 00	Miscellaneous Carpentry
06 17 23 00	06 11 16 00	Rough Carpentry Renovation



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SECTION 06 17 33 00 - METAL-PLATE-CONNECTED WOOD TRUSSES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for metal-plate-connected wood trusses. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Wood roof trusses.
 - b. Wood floor trusses.
 - c. Wood girder trusses.
 - d. Wood truss bracing.
 - e. Metal truss accessories.

C. Definitions

1. Metal-Plate-Connected Wood Trusses: Planar structural units consisting of metal-plate-connected members fabricated from dimension lumber and cut and assembled before delivery to Project site.
2. TPI: Truss Plate Institute, Inc.
3. Lumber grading agencies, and the abbreviations used to reference them, include the following:
 - a. NeLMA: Northeastern Lumber Manufacturers' Association.
 - b. NLGA: National Lumber Grades Authority.
 - c. SPIB: The Southern Pine Inspection Bureau.
 - d. WCLIB: West Coast Lumber Inspection Bureau.
 - e. WWPA: Western Wood Products Association.

D. Performance Requirements

1. Structural Performance: Provide metal-plate-connected wood trusses capable of withstanding design loads within limits and under conditions indicated. Comply with requirements in TPI 1 unless more stringent requirements are specified below.
 - a. Design Loads: As indicated.
 - b. Maximum Deflection Under Design Loads:
 - 1) Roof Trusses: Vertical deflection of 1/180 **OR** 1/240 **OR** 1/360, **as directed**, of span.
 - 2) Floor Trusses: Vertical deflection of 1/360 **OR** 1/480 **OR** 1/600, **as directed**, of span.

E. Submittals

1. Product Data: For wood-preservative-treated lumber, fire-retardant treated lumber, metal-plate connectors, metal truss accessories, and fasteners.
 - a. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 - b. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
 - c. For fire-retardant treatments specified to be High-Temperature (HT) type, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.



- d. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to truss fabricator.
- e. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
2. Shop Drawings: Prepared by or under the supervision of a qualified professional engineer. Show fabrication and installation details for trusses.
 - a. Show location, pitch, span, camber, configuration, and spacing for each type of truss required.
 - b. Indicate sizes, stress grades, and species of lumber.
 - c. Indicate locations of permanent bracing required to prevent buckling of individual truss members due to design loads.
 - d. Indicate type, size, material, finish, design values, orientation, and location of metal connector plates.
 - e. Show splice details and bearing details.
 - f. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
3. LEED Submittal:
 - a. Certificates for Credit MR 7: Chain-of-custody certificates certifying that wood used to produce metal-plate-connected wood trusses complies with forest certification requirements. Include evidence that mill is certified for chain of custody by an FSC-accredited certification body.
 - 1) Include statement indicating costs for each certified wood product.
4. Qualification Data: For metal-plate manufacturer, professional engineer, fabricator, and Installer.
5. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:
 - a. Wood-preservative-treated lumber.
 - b. Fire-retardant-treated wood.
 - c. Metal-plate connectors.
 - d. Metal truss accessories.

F. Quality Assurance

1. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with quality-control procedures in TPI 1 for manufacture of connector plates.
 - a. Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.
 - b. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
2. Fabricator Qualifications: Shop that participates in a recognized quality-assurance program that complies with quality-control procedures in TPI 1 and that involves third-party inspection by an independent testing and inspecting agency acceptable to the Owner and authorities having jurisdiction.
3. Comply with applicable requirements and recommendations of the following publications:
 - a. TPI 1, "National Design Standard for Metal Plate Connected Wood Truss Construction."
 - b. TPI DSB, "Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses."
 - c. TPI HIB, "Commentary and Recommendations for Handling, Installing & Bracing Metal Plate Connected Wood Trusses."
4. Wood Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."
5. Forest Certification: Provide metal-plate-connected wood trusses produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

G. Delivery, Storage, And Handling



1. Handle and store trusses to comply with recommendations of TPI HIB, "Commentary and Recommendations for Handling, Installing & Bracing Metal Plate Connected Wood Trusses."
 - a. Store trusses flat, off of ground, and adequately supported to prevent lateral bending.
 - b. Protect trusses from weather by covering with waterproof sheeting, securely anchored.
 - c. Provide for air circulation around stacks and under coverings.
2. Inspect trusses showing discoloration, corrosion, or other evidence of deterioration. Discard and replace trusses that are damaged or defective.

1.2 PRODUCTS

A. Dimension Lumber

1. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - a. Factory mark each piece of lumber with grade stamp of grading agency.
 - b. For exposed lumber indicated to receive a stained or natural finish, omit grade stamp and provide certificates of grade compliance issued by grading agency.
 - c. Provide dressed lumber, S4S.
 - d. Provide dry lumber with 19 **OR** 15, **as directed**, percent maximum moisture content at time of dressing.
2. Grade and Species: For truss chord and web members, provide dimension lumber of any species, graded visually or mechanically, and capable of supporting required loads without exceeding allowable design values according to AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."
3. Permanent Bracing: Provide wood bracing that complies with requirements for miscellaneous lumber in Division 06 Section(s) "Rough Carpentry" OR "Miscellaneous Rough Carpentry", **as directed**.

B. Wood-Preservative-Treated Lumber

1. Preservative Treatment by Pressure Process: AWWA C2, except that trusses that are not in contact with the ground and are continuously protected from liquid water may be made from lumber treated according to AWWA C31 with inorganic boron (SBX).
 - a. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
 - b. For exposed trusses indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
2. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
3. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
 - a. For exposed trusses indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.
4. Application: Treat all trusses, unless otherwise indicated **OR** trusses where indicated on Drawings, **as directed**.

C. Fire-Retardant-Treated Wood

1. General: Comply with performance requirements in AWWA C20.
 - a. Use Exterior type for exterior locations and where indicated.
 - b. Use Interior Type A, High Temperature (HT) for enclosed roof trusses and where indicated.
 - c. Use Interior Type A, unless otherwise indicated.
2. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.



- a. For exposed trusses and bracing indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.
 3. For exposed trusses indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.
 4. Application: Treat all trusses, unless otherwise indicated **OR** items indicated on Drawings, and the following, **as directed**:
 - a. Floor trusses for bowling lanes and raised platforms.
 - b. Roof trusses.
- D. Metal Connector Plates
1. General: Fabricate connector plates to comply with TPI 1.
 2. Hot-Dip Galvanized Steel Sheet: ASTM A 653/A 653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G60 (Z180) coating designation; and not less than 0.036 inch (0.9 mm) thick.
 - a. Use for interior locations where stainless steel is not indicated.
 3. Stainless-Steel Sheet: ASTM A 666, Type 304 **OR** 316, **as directed**, and not less than 0.035 inch (0.88 mm) thick.
 - a. Use for exterior locations and where indicated.
- E. Fasteners
1. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
 - a. Where trusses are exposed to weather, in ground contact, made from pressure-preservative treated wood, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M **OR** of Type 304 stainless steel, **as directed**.
 2. Nails, Brads, and Staples: ASTM F 1667.
 3. Power-Driven Fasteners: NES NER-272.
 4. Wood Screws: ASME B18.6.1.
 5. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).
 6. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.
 7. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
 - a. Material:
 - 1) Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
OR
Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).
- F. Metal Truss Accessories
1. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those indicated **OR** of basis-of-design products, **as directed**. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.
 2. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.
 - a. Use for interior locations where stainless steel is not indicated.
 3. Stainless-Steel Sheet: ASTM A 666, Type 304 **OR** 316, **as directed**.
 - a. Use for exterior locations and where indicated.



4. Truss Tie-Downs: Bent strap tie for fastening roof trusses to wall studs below, 1-1/2 inches (38 mm) wide by 0.050 inch (1.3 mm) thick. Tie fastens to one side of truss, top plates, and side of stud below.
5. Truss Tie-Downs (Hurricane or Seismic Ties):
 - a. Bent strap tie for fastening roof trusses to wall studs below, 2-1/4 inches (57 mm) wide by 0.062 inch (1.6 mm) thick. Tie fits over top of truss and fastens to both sides of truss, top plates, and one side of stud below.
OR
Bent strap tie for fastening roof trusses to wall studs below, 2-1/2 inches (63 mm) wide by 0.062 inch (1.6 mm) thick. Tie fits over top of truss and fastens to both sides of truss, inside face of top plates, and both sides of stud below.
6. Roof Truss Clips: Angle clips for bracing bottom chord of roof trusses at non-load-bearing walls, 1-1/4 inches (32 mm) wide by 0.050 inch (1.3 mm) thick. Clip is fastened to truss through slotted holes to allow for truss deflection.
7. Floor Truss Hangers: U-shaped hangers, full depth of floor truss, with 1-3/4-inch- (44-mm-) long seat; formed from metal strap 0.062 inch (1.6 mm) thick with tabs bent to extend over and be fastened to supporting member.
8. Roof Truss Bracing/Spacers: U-shaped channels, 1-1/2 inches (38 mm) wide by 1 inch (25 mm) deep by 0.040 inch (1.0 mm) thick, made to fit between 2 adjacent trusses and accurately space them apart, and with tabs having metal teeth for fastening to trusses.

G. Miscellaneous Materials

1. Galvanizing Repair Paint: SSPC-Paint 20, with dry film containing a minimum of 94 percent zinc dust by weight.
2. Protective Coatings: SSPC-Paint 22, epoxy-polyamide primer **OR** SSPC-Paint 16, coal-tar epoxy-polyamide paint, **as directed**.

H. Fabrication

1. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints.
2. Fabricate metal connector plates to sizes, configurations, thicknesses, and anchorage details required to withstand design loads for types of joint designs indicated.
3. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.
 - a. Fabricate wood trusses within manufacturing tolerances in TPI 1.
4. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.

1.3 EXECUTION

A. Installation

1. Install wood trusses only after supporting construction is in place and is braced and secured.
2. If trusses are delivered to Project site in more than one piece, assemble trusses before installing.
3. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.
4. Install and brace trusses according to TPI recommendations and as indicated.
5. Install trusses plumb, square, and true to line and securely fasten to supporting construction.
6. Space trusses 16 inches (406 mm) o.c. **OR** 24 inches (610 mm) o.c. **OR** as indicated, **as directed**; adjust and align trusses in location before permanently fastening.
7. Anchor trusses securely at bearing points; use metal truss tie-downs or floor truss hangers as applicable. Install fasteners through each fastener hole in truss accessories according to manufacturer's fastening schedules and written instructions.
8. Securely connect each truss ply required for forming built-up girder trusses.
 - a. Anchor trusses to girder trusses as indicated.



9. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.
 - a. Install bracing to comply with Division 06 Section(s) "Rough Carpentry" OR "Miscellaneous Rough Carpentry", **as directed**.
 - b. Install and fasten strongback bracing vertically against vertical web of parallel-chord floor trusses at centers indicated.
 10. Install wood trusses within installation tolerances in TPI 1.
 11. Do not cut or remove truss members.
 12. Replace wood trusses that are damaged or do not meet requirements.
 - a. Do not alter trusses in field.
- B. Repairs And Protection
1. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
 2. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
 3. Repair damaged galvanized coatings on exposed surfaces with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
 4. Protective Coating: Clean and prepare exposed surfaces of metal connector plates. Brush apply primer, when part of coating system, and one coat of protective coating.
 - a. Apply materials to provide minimum dry film thickness recommended by coating system manufacturer.

END OF SECTION 06 17 33 00



Task	Specification	Specification Description
06 17 43 00	06 05 23 00	Timber Bridge Components
06 17 43 00	06 10 00 00	Rough Carpentry
06 17 43 00	06 17 13 00	Structural Glued-Laminated Timber
06 17 53 00	06 17 33 00	Metal-Plate-Connected Wood Trusses
06 18 13 00	06 15 13 00a	Wood Decking
06 18 13 00	06 17 13 00	Structural Glued-Laminated Timber
06 18 16 00	06 05 23 00	Timber Bridge Components
06 18 16 00	06 10 00 00	Rough Carpentry
06 18 16 00	06 17 13 00	Structural Glued-Laminated Timber
06 22 13 00	01 95 06 00	Miscellaneous Carpentry
06 22 13 00	01 95 06 00a	Exterior Finish Carpentry
06 22 13 00	01 95 06 00b	Interior Finish Carpentry



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SECTION 06 25 16 00 - PANELING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for paneling. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Board paneling.
 - b. Flush wood paneling.
 - c. Plastic-laminate-clad flush paneling.
 - d. Stile and rail wood paneling.

C. Definitions

1. Paneling includes wood furring, blocking, and shims for installing paneling, unless concealed within other construction before paneling installation.

D. Submittals

1. Product Data: For each type of product indicated, including finishing materials and processes.
 - a. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.
2. Shop Drawings: Show location of paneling, large-scale details, attachment devices, and other components. Include dimensioned plans and elevations.
 - a. For paneling produced from premanufactured sets, show finished panel sizes, set numbers, sequence numbers within sets, and method of cutting panels to produce indicated sizes.
 - b. For paneling veneered in fabrication shop, show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.
 - c. Apply WI-certified compliance label to first page of Shop Drawings, **as directed**.
3. Samples:
 - a. Lumber and panel products for transparent finish, for each species and cut, finished on one side and one edge.
 - b. Veneer leaves representative of and selected from flitches to be used for transparent-finished paneling.
 - c. Veneer-faced panel products with or for transparent finish, for each species and cut. Include at least one face-veneer seam and finish as specified.
 - d. Lumber and panel products with shop-applied opaque finish, for each finish system and color, with 1/2 of exposed surface finished.
 - e. Plastic laminates, 8 by 10 inches (200 by 250 mm), for each type, color, pattern, and surface finish, with 1 sample applied to core material.
 - f. Corner pieces for stile and rail paneling, 18 inches (450 mm) high by 18 inches (450 mm) wide by 6 inches (150 mm) deep.
4. LEED Submittals:
 - a. Product Data for Credit EQ 4.1: For installation adhesives, including printed statement of VOC content.
 - b. Product Data for Credit EQ 4.4: For composite-wood products and fabrication adhesives, documentation indicating that products contain no urea formaldehyde.



- c. Product Data for Credit(s) MR 4.1 and MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - 1) Include statement indicating costs for each product having recycled content.
 - d. Certificates for Credit MR 7: Chain-of-custody certificates certifying that products specified to be made from certified wood comply with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.
 - 1) Include statement indicating costs for each certified wood product.
5. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates **OR** WI-certified compliance certificates, **as directed**.

E. Quality Assurance

- 1. Installer Qualifications: Fabricator of products.
- 2. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" **OR** WIC's "Manual of Millwork," **as directed**.
 - a. Provide AWI Quality Certification Program labels and certificates for woodwork, including installation.
 - b. Provide WIC-certified compliance labels and certificates for woodwork, including installation.
- 3. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.
- 4. Forest Certification: Provide paneling produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
- 5. Preinstallation Conference: Conduct conference at Project site.

F. Delivery, Storage, And Handling

- 1. Do not deliver paneling until painting and similar operations that could damage paneling have been completed in installation areas. If paneling must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

G. Project Conditions

- 1. Environmental Limitations: Do not deliver or install paneling until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.2 PRODUCTS

A. Materials

- 1. General: Provide materials that comply with requirements of AWI's **OR** WI's, **as directed**, quality standard for quality grade specified, unless otherwise indicated.
- 2. Wood Products: Comply with the following:
 - a. Medium-Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.
 - b. Particleboard: ANSI A208.1, Grade M-2 **OR** M-2-Exterior Glue, **as directed**.
 - c. Particleboard: Straw-based particleboard complying with requirements in ANSI A208.1, Grade M-2, except for density.



- d. Softwood Plywood: DOC PS 1, Medium Density Overlay.
 - e. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no urea formaldehyde.
 3. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated, or if not indicated, as required by woodwork quality standard.
 4. Adhesives: Do not use adhesives that contain urea formaldehyde.
 5. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement **OR** Contact cement **OR** PVA **OR** Urea formaldehyde **OR** Resorcinol, **as directed**.
 - a. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.
 6. VOC Limits for installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Wood Glues: 30 g/L.
 - b. Panel Adhesives: 50 g/L.
 - c. Contact Adhesive: 80 g/L.
 - d. Special Purpose Contact Adhesive (contact adhesive that is used to bond melamine covered board, metal, unsupported vinyl, Teflon, ultra-high molecular weight polyethylene, rubber or wood veneer 1/16 inch or less in thickness to any surface): 250 g/L.
- B. Fire-Retardant-Treated Materials
1. General: Where fire-retardant-treated materials are indicated, use materials that are acceptable to authorities having jurisdiction and that comply with requirements in this Article and with fire-test-response characteristics specified.
 - a. Do not use treated materials that do not comply with requirements of referenced woodworking standard or that are warped, discolored, or otherwise defective.
 - b. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
 - c. Identify fire-retardant-treated materials with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.
 2. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Comply with performance requirements of AWWA C20 (lumber) and AWWA C27 (plywood). Use the following treatment type:
 - a. Exterior Type: Organic-resin-based formulation thermally set in wood by kiln drying.
 - b. Interior Type A: Low-hygroscopic formulation.
 - c. Mill lumber after treatment, within limits set for wood removal that do not affect listed fire-test-response characteristics, using a woodworking plant certified by testing and inspecting agency.
 - d. Mill lumber before treatment and implement special procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.
 - e. Kiln-dry materials before and after treatment to levels required for untreated materials.
 3. Fire-Retardant Particleboard: Panels complying with the following requirements, made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 25 or less per ASTM E 84.
 4. Fire-Retardant Fiberboard: Medium-density fiberboard panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 200 or less per ASTM E 84.
- C. Installation Materials
1. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, fire-retardant-treated, **as directed**, kiln-dried to less than 15 percent moisture content.



2. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

D. Fabrication, General

1. Paneling Grade: Provide Premium **OR** Custom **OR** Economy, **as directed**, grade paneling complying with referenced quality standard.
2. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.
3. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
4. Arrange paneling in shop or other suitable space in proposed sequence for examination by the Owner. Mark units with temporary sequence numbers to indicate position in proposed layout.
 - a. Lay out one elevation at a time if approved by the Owner.
 - b. Notify the Owner seven days in advance of the date and time when layout will be available for viewing.
 - c. Provide lighting of similar type and level as that of final installation for viewing layout, unless otherwise approved by the Owner.
 - d. Rearrange paneling as directed by the Owner until layout is approved.
 - e. Do not trim end units and other nonmodular size units to less than modular size until after the Owner's approval of layout. Indicate trimming by masking edges of units with nonmarking material.
 - f. Obtain the Owner's approval of layout before start of assembly. Mark units and Shop Drawings with assembly sequence numbers based on approved layout.
5. Complete fabrication, including assembly and finishing, **as directed**, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
6. Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

E. Board Paneling For Transparent Finish

1. Grade: Provide Premium **OR** Custom **OR** Economy, **as directed**.
2. Wood Species and Cut: Hickory, quarter sawn **OR** Red gum, plain sawn **OR** Western white pine, plain sawn **OR** Cypress, plain sawn, **as directed**.
3. Pattern: 1-by-6, vee joint, tongue and groove, 5-1/16-inch (129-mm) coverage **OR** 1-by-8, pickwick paneling (WWPA Pattern WP-2), 6-3/4-inch (172-mm) coverage **OR** 1-by-4, beaded ceiling, 3-3/16-inch (81-mm) coverage **OR** As indicated, **as directed**.
4. Shop fabricate board paneling in lengths to provide pieces that are uninterrupted by joints **OR** random-lengths, **as directed**. Machine edges of boards to provide joint profiles indicated.
5. Preassemble board paneling into largest units that can be delivered into installation areas using permanent or temporary backing members as indicated. To maximum extent possible, fabricate units in sizes determined by field measurements of existing conditions and that will avoid fitting in the field; make provision for separate scribing pieces to be fitted to adjoining finished surfaces. Provide shop-prepared detachable pieces for forming joints with other units at Project site and with other types of architectural woodwork.

F. Board Paneling For Opaque Finish

1. Grade: Provide Premium **OR** Custom **OR** Economy, **as directed**.
2. Wood Species: Eastern white pine, sugar pine, or western white pine **OR** Any closed-grain hardwood, **as directed**.



3. Pattern: 1-by-6, vee joint, tongue and groove, 5-1/16-inch (129-mm) coverage **OR** 1-by-8, pickwick paneling (WWPA Pattern WP-2), 6-3/4-inch (172-mm) coverage **OR** 1-by-4, beaded ceiling, 3-3/16-inch (81-mm) coverage **OR** As indicated, **as directed**.
 4. Shop fabricate board paneling in lengths to provide pieces that are uninterrupted by joints **OR** random-lengths, **as directed**. Machine edges of boards to provide joint profiles indicated.
 5. Preassemble board paneling into largest units that can be delivered into installation areas using permanent or temporary backing members as indicated. To maximum extent possible, fabricate units in sizes determined by field measurements of existing conditions and that will avoid fitting in the field; make provision for separate scribing pieces to be fitted to adjoining finished surfaces. Provide shop-prepared detachable pieces for forming joints with other units at Project site and with other types of architectural woodwork.
- G. Flush Wood Paneling For Transparent Finish
1. Grade: Provide Premium **OR** Custom **OR** Economy, **as directed**.
 2. Wood Species and Cut: White oak, rift sliced **OR** Cherry, plain sliced **OR** Butternut, plain sliced **OR** Avodire, quarter sliced, **as directed**.
 - a. Lumber Trim and Edges: At paneling fabricator's option, trim and edges indicated as solid wood (except moldings) may be either lumber or veneered construction of same species and cut as panel faces and compatible with grain and color of panel faces.
 3. Matching of Adjacent Veneer Leaves: Book **OR** Slip **OR** Random, **as directed** match.
 4. Matching within Panel Face: Running **OR** Balance **OR** Center-balance, **as directed**, match.
 5. Panel-Matching Method:
 - a. No matching is required between panels. Select and arrange panels for similarity of grain pattern and color between adjacent panels.
OR
Premanufactured sets used full width **OR** Premanufactured sets selectively reduced in width **OR** Sequence-matched, uniform-size sets **OR** Blueprint-matched panels and components, **as directed**, within each separate area.
 6. Vertical Panel-Matching Method: Continuous match; veneer leaves of upper panels are continuations of veneer leaves of lower panels **OR** Vertical book match; veneer leaves are individually book matched from lower panels to upper panels **OR** Vertical slip match; veneer leaves are individually slip matched from lower panels to upper panels **OR** Panel vertical book match; panels are book matched from lower panels to upper panels **OR** Panel vertical slip match; panels are slip matched from lower panels to upper panels, **as directed**.
 7. Panel Core Construction: Hardwood veneer-core plywood **OR** Particleboard or medium-density fiberboard **OR** Fire-retardant particleboard or fire-retardant, medium-density fiberboard, **as directed**.
 8. Exposed Panel Edges: Solid wood or wood veneer matching faces **OR** Legs of metal channels forming reveals **OR** Bronze flat bars 1/16 inch (1.6 mm) thick by depth of panels, **as directed**.
 9. Panel Reveals: Matte black plastic laminate **OR** Bronze sheet **OR** Stainless-steel sheet **OR** Bronze channels, 1 by 1 by 1/8 inch (25.4 by 25.4 by 3.2 mm) thick **OR** Stainless-steel channels, 1 by 1 by 1/16 inch (25.4 by 25.4 by 1.6 mm) thick, **as directed**.
 10. Fire-Retardant-Treated Paneling: Provide panels consisting of wood-veneer and fire-retardant particleboard or fire-retardant, medium-density fiberboard. Panels shall have a flame-spread index of 75 **OR** 25, **as directed**, or less and a smoke-developed index of 450 or less per ASTM E 84.
 - a. Provide paneling of 3/4-inch (19-mm) minimum thickness.
- H. Plastic-Laminate-Clad Flush Paneling
1. Grade: Provide Premium **OR** Custom **OR** Economy, **as directed**.
 2. Plastic-Laminate Cladding: High-pressure decorative laminate, in the following grades:
 - a. Faces: Grade HGS **OR** VGS **OR** SGF **OR** HGF **OR** VGF, **as directed**.
 - b. Backs: Grade BKH **OR** BKV **OR** BKL, **as directed**.
 - c. Exposed Edges: Same as faces or Grade VGS.
 3. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed surfaces complying with the following requirements:



- a. As indicated by manufacturer's designations.
 - b. Match the Owner's samples.
 - c. As selected by the Owner from laminate manufacturer's full range in the following categories:
 - 1) Solid colors, gloss **OR** matte, **as directed**, finish.
 - 2) Solid colors with core same color as surface, gloss **OR** matte, **as directed**, finish.
 - 3) Wood grains, gloss **OR** matte, **as directed**, finish.
 - 4) Patterns, gloss **OR** matte, **as directed**, finish.
 4. Panel Core Construction: Particleboard or medium-density fiberboard **OR** Fire-retardant particleboard or fire-retardant, medium-density fiberboard, **as directed**.
 5. Fire-Retardant-Treated Paneling: Provide panels consisting of fire-retardant plastic laminate and fire-retardant particleboard or fire-retardant, medium-density fiberboard. Panels shall have a flame-spread index of 75 **OR** 25, **as directed**, or less and a smoke-developed index of 450 or less per ASTM E 84.
 - a. Provide paneling of 3/4-inch (19-mm) minimum thickness.
- I. Stile And Rail Wood Paneling For Transparent Finish
1. Grade: Premium **OR** Custom **OR** Economy, **as directed**.
 2. Wood Species: White oak, rift sawn/sliced **OR** Figured English ash, quarter sawn/sliced **OR** Butternut, plain sawn/sliced **OR** Figured red gum, plain-sawn/sliced panels, quarter-sawn/sliced stiles and rails, **as directed**.
 3. Stiles and Rails: At fabricator's option, stiles and rails may be either lumber or veneered construction with edges banded or with lumber moldings, as indicated, to conceal core and veneer joints.
 4. Panels: Flat panels **OR** Raised panels with veneered faces and solid lumber rims **OR** Raised panels with veneered faces extending across rims **OR** Raised panels made from edge-glued solid lumber, **as directed**.
 5. Insert Panels:
 - a. Blueprint matched in a horizontal sequence for adjacent panels and doors, with continuous vertical matching between adjacent panels. Book and balance **OR** Book, balance, and center, **as directed**, match face-veneer leaves within each panel.

OR

 Cut panels from premanufactured, sequence-matched sets of book-matched veneered panels. Cut panels with an even **OR** even or odd, **as directed**, number of veneer leaves centered in each panel and with each of the remainders at least half as wide as the full veneer leaves, **as directed**. Cut panels with continuous matching between vertically adjacent panels; veneer leaves of upper panels are continuations of veneer leaves of panels below them.

OR

 Book and balance match face veneers within panels. No matching is required between adjacent panels; select and arrange panels for similarity of grain pattern and color between adjacent panels.
 6. Shop assemble stile and rail paneling into largest units practical for delivery and installation. Provide shop-prepared detachable joints for necessary field connections. Sand and pull joints tight in shop so field joints will comply with joint tolerances for specified grade. Unless otherwise indicated, provide continuous mortise-and-tenon joints between panel units and provide removable temporary protection for joints during handling and delivery.
 - a. Outside Corner of Stile and Rail Paneling: Shop prepare using lock-mitered or mitered-and-splined construction. Assemble, sand, and glue in shop, if site conditions permit.
- J. Stile And Rail Wood Paneling For Opaque Finish
1. Grade: Premium **OR** Custom **OR** Economy, **as directed**.
 2. Wood Species: Any closed-grain hardwood **OR** Eastern white pine, ponderosa pine, sugar pine, or western white pine, **as directed**.



3. Stiles and Rails: Either solid lumber or particleboard, shop filled on face, with veneered or lumber-banded edges, at paneling fabricator's option.
4. Flat Insert Panels: Medium-density fiberboard or particleboard with shop-filled face.
5. Raised Insert Panels: Medium-density overlaid softwood plywood (Exterior) APA MDO EXT, machined to profile indicated and shop filled on exposed machined surfaces **OR** Medium-density fiberboard, machined to profile indicated, **as directed**.
6. Provide fire-retardant treatment of stile and rail paneling as indicated below. For components of paneling fabricated from solid lumber, mill pieces before treatment.
 - a. For stiles and rails, use fire-retardant-treated lumber or fire-retardant medium-density fiberboard.
 - b. For built-up stiles and rails, use fire-retardant particleboard with fire-retardant lumber edge-bands or fire-retardant medium-density fiberboard.
 - c. For insert panels, use fire-retardant medium-density fiberboard.
OR
For insert panels, use fire-retardant particleboard with closed-grain hardwood veneer on face and back.
7. Shop assemble stile and rail paneling into largest units practical for delivery and installation. Provide shop-prepared detachable joints for necessary field connections. Sand and pull joints tight in shop so field joints will comply with joint tolerances for specified grade. Unless otherwise indicated, provide continuous mortise-and-tenon joints between panel units and provide removable temporary protection for joints during handling and delivery.
 - a. Outside Corner of Stile and Rail Paneling: Shop prepare using lock-mitered or mitered-and-splined construction. Assemble, sand, and glue in shop, if site conditions permit.

K. Shop Finishing

1. Grade: Provide finishes of same grades as paneling to be finished.
2. General:
 - a. Finish paneling at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.
OR
Shop finish transparent-finished paneling at fabrication shop as specified in this Section. Refer to Division 07 for finishing of opaque-finished paneling.
OR
Drawings indicate paneling that is required to be shop finished. Finish such paneling at fabrication shop as specified in this Section. Refer to Division 07 for finishing paneling not indicated to be shop finished.
3. Shop Priming: Shop apply the prime coat including backpriming, if any, for transparent-finished paneling specified to be field finished. Refer to Division 07 for material and application requirements.
4. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing paneling, as applicable to each unit of work.
 - a. Backpriming: Apply two coats of sealer or primer, compatible with finish coats, to concealed surfaces of paneling. Concealed surfaces of plastic-laminate-clad paneling do not require backpriming when surfaced with plastic laminate.
5. Transparent Finish:
 - a. Grade: Premium **OR** Custom **OR** Economy, **as directed**.
 - b. AWI Finish System: TR-0, synthetic penetrating oil **OR** TR-3, cellulose acetate butyrate or water-reducible acrylic lacquer **OR** TR-4, conversion varnish **OR** TR-5, catalyzed vinyl lacquer, **as directed**.
 - c. WIC Finish System: 2, water-reducible acrylic lacquer **OR** 3b., catalyzed vinyl lacquer **OR** 4, conversion varnish **OR** 6, penetrating oil, **as directed**.
 - d. Staining: None required **OR** Match approved sample for color **OR** Match the Owner's sample, **as directed**.
 - e. Wash Coat for Stained Finish: Apply wash-coat sealer to woodwork made from closed-grain wood before staining and finishing.



- f. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.
- g. Filled Finish for Open-Grain Woods: After staining (if any), apply paste wood filler to open-grain woods and wipe off excess. Tint filler to match stained wood.
 - 1) Apply wash-coat sealer after staining and before filling.
- h. Sheen: Flat, 15-30 **OR** Satin, 31-45 **OR** Semigloss, 46-60 **OR** Gloss, 61-100, **as directed**, gloss units measured on 60-degree gloss meter per ASTM D 523.
- 6. Opaque Finish: Comply with requirements indicated below for grade, finish system, color, effect, and sheen, with sheen measured on 60-degree gloss meter per ASTM D 523.
 - a. Grade: Premium **OR** Custom **OR** Economy, **as directed**.
 - b. AWI Finish System: OP-4, conversion varnish **OR** OP-5, catalyzed vinyl, **as directed**.
 - c. WIC Finish System: 3b., catalyzed vinyl lacquer **OR** 4, conversion varnish **OR** 7a., synthetic enamel, **as directed**.
 - d. Color: As indicated by manufacturer's designations **OR** Match sample **OR** As selected from manufacturer's full range, **as directed**.
 - e. Sheen: Flat, 10-25 **OR** Satin, 30-50 **OR** Semigloss, 55-75 **OR** Gloss, 80-100, **as directed**, gloss units.

1.3 EXECUTION

A. Preparation

1. Before installation, condition paneling to average prevailing humidity conditions in installation areas.
2. Before installing paneling, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

B. Installation

1. Grade: Install paneling to comply with requirements for same grade specified in Part 1.2 for fabrication of type of paneling involved.
2. Install paneling level, plumb, true, and straight with no distortions. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm). Install with no more than 1/16 inch in 96-inch (1.6 mm in 2400-mm) vertical cup or bow and 1/8 inch in 96-inch (3 mm in 2400-mm) horizontal variation from a true plane.
 - a. For flush paneling with revealed joints, install with variations in reveal width, alignment of top and bottom edges, and flushness between adjacent panels not exceeding 1/32 inch (0.8 mm) **OR** 1/16 inch (1.5 mm), **as directed**.
3. Scribe and cut paneling to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
4. Anchor paneling to supporting substrate with concealed panel-hanger clips **OR** splined connection strips **OR** blind nailing, **as directed**. Do not use face fastening unless covered by trim **OR** otherwise indicated, **as directed**.
5. Complete finishing work specified in this Section to extent not completed at shop or before installation of paneling. Fill nail holes with matching filler where exposed. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are applied in shop.
6. Refer to Division 07 for final finishing of installed paneling.

C. Adjusting And Cleaning

1. Repair damaged and defective paneling, where possible, to eliminate functional and visual defects; where not possible to repair, replace paneling. Adjust for uniform appearance.
2. Clean paneling on exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 06 25 16 00

**SECTION 06 41 13 00 - RESIDENTIAL CABINETS**

DESCRIPTION OF WORK

This specification covers the furnishing and installation of materials for residential cabinets. Products shall be as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

GENERAL

Definitions

1. Supply and Delivery Only: Include supply and delivery to site(s) FOB destination freight prepaid. Unless otherwise specified or scheduled, unloading and handling at site is by Owner.

System Description

2. Performance Requirements:
 - a. Comply with test procedures and required performances of ANSI/KCMA A161.1.
 - 1) Tests: Performed on standard 760 mm (30 inch) wall and base cabinets.
 - b. Drawers and Drawer Hardware for HUD Severe Use: Apply 330 N (75 pound) point load to exterior edge of drawer extended 150 mm (6 inches) from its closed position for period of 15 minutes.
 - 1) Successful Test: No failure in any part of drawer assembly or operating system and drawer remain operable with no mechanical interference with any part of cabinet assembly.

Submittals

3. Product Data: Submit product data for cabinets and countertops.
4. Shop Drawings: Submit Shop Drawings for cabinets and countertops for each type of kitchen.
5. Samples: Submit samples of following for selection:
 - a. Wood veneers with stain finishes.
 - b. Plastic laminate patterns and colors.
6. Quality Assurance/Control Submittals:
 - a. Certificates: Manufacturer's written certification that cabinets and countertops meet or exceed specified requirements.

Quality Assurance

7. Certifications:
 - a. Cabinets: Continuously tested, certified and display label or seal of Kitchen Cabinet Manufacturer's Association (KCMA) or Southern California Association of Cabinet Manufacturers Association in accordance with ANSI Z34.1.
 - 1) HUD Severe Use Cabinets: Bear KCMA Certification Seal and additional label indicating conformance to HUD Severe Use specifications.
 - 2) Normal/Elderly Use: Bear KCMA Certification Seal.
8. Regulatory Requirements: Comply with following:
 - a. Accessibility:
 - 1) Architectural Barriers Act of 1968 as amended (42 USC 4152-4157) and HUD implementing - regulations (24 CFR Part 40).
 - a) Uniform Federal Accessibility Standards (UFAS).
 - 2) Section 504 of the Rehabilitation Act of 1973 as amended (29 USC 794) and HUD implementing regulations 24 CFR Part 8.
 - 3) Fair Housing Accessibility Guidelines (24 CFR Chapter 1).
 - 4) Americans with Disabilities Act of 1990 (ADA) (28 CFR Part 35).



9. Mock-ups:
 - a. Install mock-up of cabinets and countertops in kitchen as part of kitchen renovation mock-up.
 - b. Install mock-up of cabinets and countertops in bathroom as part of bathroom renovation mock-up.
 - c. Locations: As directed.
 - d. Approved Mock-up: Standard for rest of work.
 - e. Approved Mock-up: May remain part of completed project.

Delivery, Storage, And Handling

10. Packing, Shipping, Handling, and Unloading:
 - a. Do not deliver cabinets until building or storage area is enclosed and sufficiently dry to prevent damage from excessive changes in moisture content.
 - b. Protect casework and equipment from damage during delivery, storage, installation and subsequent building operations.

Scheduling

11. Scheduling and Completion: Comply with requirements of Detailed Scope of Work.

Project Conditions

12. Field Measurements: Field measure spaces to receive cabinets before beginning fabrication.
 - a. Cabinets: Conform to building lines and neatly fitted around openings, pipes, and other obstructions.

PRODUCTS

Normal/Elderly Use Cabinets

13. Cabinets: Standard size factory manufactured, assembled and finished for normal/elderly and severe use as scheduled. Comply with:
 - a. HUD Minimum Property Standards for Housing, Paragraph 611-1.
 - b. ANSI/KCMA A161.1.
14. Cabinet Construction: Hardwood face frames and reveal overlay construction.
 - a. Base and Wall Cabinets: Same construction and same appearance.
15. Cabinet Materials:
 - a. Plywood: ANSI/HPMA HP and PS 1.
 - b. Particleboard, ANSI A208.1, medium density.
 - c. Pressure Treated Lumber: AWPA C2.
 - d. Cabinet Hardware: ANSI/BHMA A1 56.9.
 - 1) Cabinet Hardware: Finishing requirements of ANSI/BHMA A156, corrosion resisting.
16. Vanity Cabinets: Sizes as indicated.
 - a. Size if Not Indicated: 460 mm (18 inches) to 610 mm (24 inches) wide and 410 mm (16 inches) to 530 mm (21 inches) deep.
17. Cabinet Finish: Comply with ANSI/KCMA A161.1 finish test and performance requirements.
 - a. Exposed Surfaces and Interior of Cabinet: Factory finished consisting of stain, sealer and top coat, lightly sanded between application.
 - 1) Sealer and Top Coats: Oven dried.
 - 2) Stain Color: Selected from manufacturer's standard colors.
 - b. Toe Kick: Painted as directed.
 - c. Alternate Finish: High-pressure Decorative Laminates (HPDL) may be supplied in lieu of finish described above.
 - 1) HPDL: Comply with NEMA LD 3, Type GP 28, 0.7 mm (0.028 inch) thickness.
18. Fillers and Molding: Use scribe mould and fillers to assure accurate job fit.
 - a. Molding and Fillers: Outside corners, scribes, cove molding, and trim molding.
 - b. Fillers: Include comer base fillers, base fillers, and wall fillers.



- c. Cove Molding: Hardwood.
- d. Finish: Match cabinet finish.
- 19. Joint Sealant: Mildew resistant one-component silicone; FS TT-S-001543A, Class A; ASTM C 920, Type S, Grade NS. Class 25, Uses NT, G, and A.
 - a. Color: As selected from manufacturer's standard line.

HUD Severe Use Cabinets

- 20. Wall and Base Cabinets: Comply with requirements under Cabinets - General above.
 - a. Construct to produce sturdy and rigid construction.
 - b. Wall and Base Cabinets and Countertops: Constructed of solid lumber and/or exterior grade plywood with wood veneer core.
 - 1) Particleboard, flakeboard, fiberboard, or hardboard not allowed.
 - c. Base Cabinets:
 - 1) Parts Touching Floor: Pressure treated solid lumber.
 - 2) Provide integral toe space of minimum 75 mm (3 inches) by 75 mm (3 inches).
 - 3) Toe Kicks: 19.1 mm (3/4 inch) net thickness, pressure treated solid lumber.
- 21. Face Frames: 19.1 mm (3/4 inches) net thick kiln dried solid hardwood, free of knots and selected for light uniform color suitable for stain finish.
 - a. Frames: Mortised and tenoned, dovetailed or doweled. glued and stapled under pressure and filled and sanded.
 - b. Vertical End Members (Stiles): Minimum 38 mm (1-1/2 inch) net width.
 - c. Vertical Center Members between Doors and Drawers (Mulls): Minimum 50 mm (2 inches) net width.
 - d. Horizontal Members (Rails): 44 mm (1-3/4 inches) net width.
 - e. Stiles and Top and Bottom Rails: Dadoed to receive ends, bottoms and tops.
- 22. Doors and Door Hardware:
 - a. Doors: 19.1 mm (3/4 inch) thick 7-ply A-D grade exterior hardwood plywood with no more than one veneer joint on face.
 - b. Edges: Reversed shaped to form continuous finger grip around sides.
 - c. Edges: Filled and sanded smooth prior to finish.
 - d. Edges: May be treated with hot foil transfer.
 - e. Edges: May be covered with 9.5 mm (3/8 inch) by 19.1 mm (3/4 inch) reverse shaped hardwood bands.
 - f. Acceptable Hardwoods: Beech, birch, maple or oak suitable for stain finish.
 - g. Hinges: Manufacturer's standard heavy duty with self closing feature, face mount or semi concealed type.
- 23. Drawers and Drawer Hardware:
 - a. Fronts Construction and Finish: Same as doors.
 - b. Sides and Backs: Minimum 17.4 mm (11/16 inch) net thickness Grade C solid lumber with sides dovetailed or mortised and tenoned into fronts.
 - c. Backs: Dadoed into sides.
 - d. Bottoms: Minimum 6.4 mm (1/4 inch) softwood or hardwood exterior plywood let into front, sides and back.
 - e. Drawer Parts: Glued and nailed or stapled together.
 - f. Mount drawers on metal side rails with 34 kg (75 pound) loading capacity.
 - g. Cabinet Members or Guides: Attached at rear to 19.1 mm (3/4 inch) solid lumber hanging rail or 12.7 mm (1/2 inch) solid lumber or plywood block which is attached to 19.1 mm (3/4 inch) solid lumber hanging rail by use of metal rear mount brackets or by continuous wraparound method.
- 24. Installation Cleats: Minimum 19.1 mm (3/4 inch) by 89 mm (3-1/2 inches) net thickness S4S, Grade C, kiln dried solid lumber, dadoed to receive bottoms and tops.
 - a. Provide two horizontal members running full length of cabinet at top and bottom.
 - b. Base Cabinets with Drawers: Side mount drawer slide bracket(s) rigidly attached to 12.7 mm (1/2 inch) thick plywood or wood block which is rigidly attached to top cleat. See "Drawers" paragraph above for alternate mounting.
- 25. End Panels:



- a. Exposed End Panels: Minimum 2-2 Grade, 12.7 mm (1/2 inch) thick 5-ply exterior hardwood plywood, selected for light uniform color.
 - b. Ends Not Exposed : May be 12.7 mm (1/2 inch) exterior softwood plywood, Grade A-D, with Grade A side to inside of cabinet.
 - c. Ends: Dadoed minimum of 6 mm (1/4 inch) deep to receive shelves, bottoms and tops.
 - d. Ends: Let into dado in face frame.
 - e. Base Cabinet End Panels: Stop 89 mm (3-1/2 inches) above floor and supported by 19.1 mm (3/4 inch) by 89 mm (3-1/2 inch) pressure treated solid lumber member.
26. Shelves and Wall Cabinet Bottoms: 12.7 mm (1/2 inch) thick Grade 2-2 exterior hardwood plywood or Grade A-D exterior softwood plywood with wood banded front edge or 19.1 mm (3/4 inch) net thickness solid lumber.
- a. Shelves: Let into dados of end panels and braced behind mulls.
 - b. Bottoms: Let into (rabbet or dado, manufacturer's choice) ends, cleats and front frames.
 - c. Shelves and Bottoms: Glued and stapled.
 - d. Optional Adjustable Shelves: 19.1 mm (3/4 inch) thick Grade 2-2 exterior hardwood plywood of Grade A-D exterior softwood plywood with wood banded front edge or 19.1 mm (3/4 inch) net thickness solid lumber.
 - 1) Shelves: Support as necessary to comply with shelf deflection provisions of ANSI/KCMA A161.1.
 - 2) Shelves: When loaded at 73.3 kg/sq. m (15 PSF) for seven days shall not deflect more than 1.6 mm (1/16 inch) per 305 mm (linear foot) between supports.
 - 3) Maximum Deflection: 6.4 mm (1/4 inch) between supports.
27. Backs: Provide on cabinets (optional on sink bases depending on job conditions).
- a. Backs: Minimum 6.4 mm (1/4 inch) thick Grade 2-2 exterior hardwood plywood or A-D grade exterior softwood plywood.
 - b. Backs: Securely glued and stapled to ends, 89 mm (3-1/2 inch) cleats and shelves of cabinet.
 - c. Backs: May be let into dado of ends and cleats or may be applied flush with ends and cleats.
28. Base Bottoms: 12.7 mm (1/2 inch) thick Grade 2-2 exterior hardwood plywood or A-C Grade exterior softwood plywood.
- a. Bottoms: Let into (rabbet or dado, manufacturer's choice) end panels, front rails and installation cleats.
 - b. Bottom: Supported by 19.1 mm (3/4 inch) net thickness pressure treated solid lumber braces 610 mm (24 inches) OC running front to rear of cabinet and resting on finished floor.

Countertops

29. Plastic Laminate Countertops: ANSI A161.2.
- a. Type: Post-formed with integral backsplashes.
 - 1) Front Edges: No-drip.
 - 2) Backsplashes: Minimum 100 mm (4 inches) high with cove beveled molding with Type A curved top and scribe edge.
 - 3) Provide backsplashes at juncture of countertop with back and side walls.
 - b. Materials: High pressure plastic laminated to 19.1 mm (3/4 inch) thick exterior plywood.
 - 1) Particleboard, flakeboard, fiberboard, or hardboard not allowed.
 - c. Plastic Laminate: NEMA LD 3, Type PF42, 1.1 mm. (0.042 inch) thickness.
 - 1) Colors, patterns, finishes as selected from manufacturer's standard offering.
 - d. Perimeter of Bottom of Countertops and Sink Cut-outs: Sealed with varnish.
30. Cultured Marble Countertops: ANSI Z124.3 and HUD UM 73a.
- a. Cast in molds with integral lavatory bowls to achieve required shape and configuration in coordination with vanity cabinets and plumbing trim.
 - b. Integral Lavatory Bowls: Recessed oval shape.
 - c. Holes for Plumbing Trim: Coordinate with Division 15 Section "Plumbing."
 - d. Provide radius corners and edges.
 - e. Backsplashes: Provide where counters meet walls including at back and at sides.
 - f. Finish: Polished.



Metal Grease Splash Material

31. Stainless Steel: AISI Type 304, nonmagnetic sheets, free of buckles, waves, and surface imperfections, No. 4 polished finish on exposed surfaces, 24 gage, sanded edges.

Wall Cabinet Soffit Material

32. Gypsum Board or Plaster.
33. Wood:
 - a. Exposed Wood Soffit Face: 6.4 mm (1/4 inch) 3-ply birch-faced cabinet grade plywood.
 - b. Blocking: Hemlock-Fir No. 2.

Source Quality Control

34. Testing: Performed under Third Party Administrator who is in compliance with ANSI Z34.1.

EXECUTION

Examination

35. Site Verification of Conditions:
 - a. Existing Conditions: Examine spaces to verify that they are ready to receive cabinets and countertops.
 - b. Verify grounds, blocking and supports for proper location and support of cabinets before beginning installation. Verify location of mechanical and electrical rough-ins to assure proper match with installed equipment.
 - c. Survey each kitchen and bath to verify dimensions for cabinets and countertops.

Preparation

36. Protection: Protect adjacent elements from damage and disfiguration.
 - a. Repair or replace damaged elements.
37. Remove and dispose of existing cabinets and countertops.

Installation

38. General: Deliver, uncrate, place in proper location and assemble cabinets and countertops in accordance with manufacturer's recommendations and approved Shop Drawings.
39. Cabinets: Set cabinets accurately in place, level, and plumb.
 - a. Maintain distance between bottom of wall cabinets and top of countertop between 380 and 455 mm (15 and 18 inches).
 - b. Scribe and secure to floor and walls.
 - c. Provide connecting and attaching devices, closures, and trim members as required for complete installation.
 - d. Install items complete and adjust moving parts to operate smoothly.
 - e. Wall Cabinets: Hang from masonry walls or secure directly to wall studs.
 - f. Scribe and closely fit casework to adjacent work.
 - g. Vanity Cabinet: Seal joint between cabinets and walls with joint sealant.
40. Countertops: Secure to casework and walls with concealed fasteners.
 - a. Plastic Laminate Post-Formed Countertops: Miter inside corner joints. a. Seal cut edge of plywood at sink opening with spar varnish.
 - b. Seal joints between countertops and walls with joint sealant.
41. Sinks, Lavatories, and Trim: Provided and installed under Division 15 Section "Plumbing."
42. Metal Grease Splash: Install on wall full width of range from top of range to bottom of range hood. Secure to wall with appropriate rounded head fasteners at perimeter.
43. Wall Cabinet Soffits:
 - a. Gypsum Board or Plaster.
 - b. Wood: Provide plywood soffit with backup blocking above cabinets where existing drywall drop soffit does not exist.
 - 1) Blocking: Provide blocking required to secure drop soffit plywood material in its intended location above new wall cabinets.



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- 2) Plywood Facing: Trim butt edge conditions with solid wood strip pieces to match. Trim comer conditions with solid wood premilled comer to match. Secure facing materials with fine finish nails and fill nail holes.
 - 3) Finish to match cabinet finish.

Adjusting And Cleaning

44. Adjusting: Adjust and lubricate moving parts to operate smoothly.
45. Cleaning: Comply with requirements of Detailed Scope of Work.

END OF SECTION 06 41 13 00



Task	Specification	Specification Description
06 41 13 00	01 95 06 00c	Interior Architectural Woodwork
06 41 93 00	08 71 21 00	Door Hardware
06 42 13 00	06 25 16 00	Paneling
06 42 16 00	06 25 16 00	Paneling



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**SECTION 06 42 19 00 - PLASTIC PANELING**

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for plastic paneling. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes glass-fiber reinforced plastic (FRP) wall paneling and trim accessories.

C. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:
 - a. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content and chemical components.
 - b. Product Data for Credit EQ 4.4: For laminating adhesive and composite wood products used in factory-laminated plastic panels, indicating that product contains no urea formaldehyde.
3. Samples: For plastic paneling and trim accessories.

D. Quality Assurance

1. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 **OR** 200, **as directed**, or less.
 - b. Smoke-Developed Index: 450 or less.
 - c. Testing Agency: Acceptable to authorities having jurisdiction **OR** FM Approvals **OR** UL, **as directed**.

1.2 PRODUCTS

A. Plastic Sheet Paneling

1. General: Gelcoat-finished, glass-fiber reinforced plastic panels complying with ASTM D 5319.
 - a. Nominal Thickness: Not less than 0.075 inch (1.9 mm) **OR** 0.09 inch (2.3 mm) **OR** 0.12 inch (3.0 mm), **as directed**.
 - b. Surface Finish: Smooth **OR** Molded pebble texture **OR** Smooth surface with filled grooves at 4 inches (102 mm) o.c. to resemble tile **OR** As selected by the Owner from manufacturer's full range, **as directed**.
 - c. Color: White **OR** As selected by the Owner from manufacturer's full range, **as directed**.

B. Factory-Laminated Plastic Panels

1. General: Gelcoat-finished, glass-fiber reinforced plastic panels complying with ASTM D 5319, laminated to plywood **OR** oriented strand board **OR** fire-retardant particleboard **OR** gypsum board **OR** high-impact gypsum board **OR** moisture- and mold-resistant gypsum board, **as directed**.
 - a. Glass-Fiber Reinforced Plastic Panel Nominal Thickness: Not less than 0.03 inch (0.76 mm) **OR** 0.05 inch (1.3 mm) **OR** 0.075 inch (1.9 mm) **OR** 0.09 inch (2.3 mm), **as directed**.
 - b. Surface Finish: Smooth **OR** Molded pebble texture **OR** Smooth surface with filled grooves at 4 inches (102 mm) o.c. to resemble tile **OR** As selected by the Owner from manufacturer's full range, **as directed**.
 - c. Color: White **OR** As selected by the Owner from manufacturer's full range, **as directed**.



- d. Plywood: DOC PS 1, Exterior B-C, 1/4 inch (6.4 mm) **OR** 3/8 inch (9.5 mm) **OR** 1/2 inch (12.7 mm) **OR** 5/8 inch (15.9 mm) **OR** 3/4 inch (19.1 mm), **as directed**, thick.
- e. Oriented Strand Board: DOC PS 2, 1/4 inch (6.4 mm) **OR** 3/8 inch (9.5 mm) **OR** 1/2 inch (12.7 mm) **OR** 3/4 inch (19.1 mm), **as directed**, thick.
- f. Fire-Retardant Particleboard: Product complying with ANSI A208.1, Grade M-S, except for modulus of rupture; with flame-spread index of 25 or less per ASTM E 84; and 3/8 inch (9.5 mm) **OR** 1/2 inch (12.7 mm), **as directed**, thick.
- g. Gypsum Board: ASTM C 1396/C 1396M, Regular, 1/2 inch (12.7 mm) **OR** Type X, 5/8 inch (15.9 mm), **as directed**.
- h. High-Impact Gypsum Board: ASTM C 1396/C 1396M, 5/8 inch (15.9 mm), with Type X core, and 0.010-inch (0.254-mm) **OR** 0.020-inch (0.508-mm) **OR** 0.030-inch (0.762-mm) **OR** 0.081-inch (2.057-mm), **as directed**, plastic film laminated to back side for greater resistance to through penetration (impact resistance).
- i. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M or ASTM C 1178/C 1178M, 5/8 inch (15.9 mm), Type X, with moisture- and mold-resistant core and surfaces.
- j. Laminating Adhesive: Manufacturers standard adhesive that does not contain urea formaldehyde.

C. Accessories

- 1. Trim Accessories: Manufacturer's standard one-piece **OR** two-piece, snap-on, **as directed**, vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.
 - a. Color: White **OR** Match panels **OR** As selected by the Owner from manufacturer's full range, **as directed**.
- 2. Exposed Fasteners: Nylon drive rivets recommended by panel manufacturer.
- 3. Concealed Mounting Splines: Continuous, H-shaped aluminum extrusions designed to fit into grooves routed in edges of factory-laminated panels and to be fastened to substrate.
- 4. Adhesive: As recommended by plastic paneling manufacturer.
 - a. VOC Content: 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- 5. Sealant: Single-component, mildew-resistant, neutral-curing silicone **OR** Single-component, mildew-resistant, acid-curing silicone **OR** Latex, **as directed**, sealant recommended by plastic paneling manufacturer and complying with requirements in Division 07 Section "Joint Sealants".
 - a. VOC Content: 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1.3 EXECUTION

A. Preparation

- 1. Remove wallpaper, vinyl wall covering, loose or soluble paint, and other materials that might interfere with adhesive bond.
- 2. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.
- 3. Clean substrates of substances that could impair bond of adhesive, including oil, grease, dirt, and dust.
- 4. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.
- 5. Lay out paneling before installing. Locate panel joints where indicated **OR** to provide equal panels at ends of walls not less than half the width of full panels **OR** so that trimmed panels at corners are not less than 12 inches (300 mm) wide, **as directed**.
 - a. Mark plumb lines on substrate at trim accessory **OR** panel joint, **as directed**, locations for accurate installation.



- b. Locate trim accessories **OR** panel joints, **as directed**, to allow clearance at panel edges according to manufacturer's written instructions.

B. Installation

1. Install plastic paneling according to manufacturer's written instructions.
OR
Install panels in a full spread of adhesive.
OR
Install panels with fasteners. Layout fastener locations and mark on face of panels so that fasteners are accurately aligned.
 - a. Drill oversized fastener holes in panels and center fasteners in holes.
 - b. Apply sealant to fastener holes before installing fasteners.
2. Install factory-laminated panels using concealed mounting splines in panel joints.
3. Install trim accessories with adhesive and nails or staples. Do not fasten through panels.
4. Fill grooves in trim accessories with sealant before installing panels and bed inside corner trim in a bead of sealant.
5. Maintain uniform space between panels and wall fixtures. Fill space with sealant.
6. Maintain uniform space between adjacent panels and between panels and floors, ceilings, and fixtures. Fill space with sealant.
7. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION 06 42 19 00



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Task	Specification	Specification Description
06 42 19 00	06 25 16 00	Paneling
06 43 16 00	01 95 06 00c	Interior Architectural Woodwork
06 44 39 00	01 95 06 00c	Interior Architectural Woodwork
06 46 13 00	01 95 06 00	Miscellaneous Carpentry
06 46 13 00	01 95 06 00a	Exterior Finish Carpentry
06 46 13 00	01 95 06 00b	Interior Finish Carpentry
06 46 19 00	01 22 16 00	No Specification Required
06 46 19 00	01 95 06 00	Miscellaneous Carpentry
06 46 19 00	01 95 06 00a	Exterior Finish Carpentry
06 46 19 00	01 95 06 00b	Interior Finish Carpentry
06 46 19 00	01 95 06 00c	Interior Architectural Woodwork
06 46 23 00	01 95 06 00c	Interior Architectural Woodwork
06 46 26 00	01 95 06 00c	Interior Architectural Woodwork



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SECTION 06 46 29 00 - EXTERIOR ARCHITECTURAL WOODWORK

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for exterior architectural woodwork. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Exterior standing and running trim.
 - b. Exterior frames and jambs.
 - c. Exterior shutters.
 - d. Exterior ornamental work.
 - e. Shop priming exterior woodwork.
 - f. Shop finishing exterior woodwork.

C. Submittals

1. Product Data: For each type of product and process indicated and incorporated into items of exterior architectural woodwork during fabrication, finishing, and installation.
 - a. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.
 - b. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.
2. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
3. Samples: For lumber for exterior wood stain finish and lumber and panel products for shop-applied opaque finish, for each finish system and color, with one-half of exposed surface finished.
4. LEED Submittal:
 - a. Certificates for Credit MR 7: Chain-of-custody certificates certifying that products specified to be made from certified wood comply with forest certification requirements. Include evidence that mill is certified for chain of custody by an FSC-accredited certification body.
 - 1) Include statement indicating costs for each certified wood product.
5. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates **OR** WI-certified compliance certificates, **as directed**.

D. Quality Assurance

1. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" **OR** WI's "Manual of Millwork", **as directed**.
 - a. Provide AWI Quality Certification Program labels and certificates indicating that woodwork, including installation.
 - b. Provide WI-certified compliance labels and certificates indicating that woodwork, including installation.
2. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.



3. Forest Certification: Provide exterior architectural woodwork produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

1.2 PRODUCTS

A. Materials

1. General: Provide materials that comply with requirements of AWI's **OR** WI's, **as directed**, quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.
2. Wood Products: Comply with the following:
 - a. Hardboard: AHA A135.4.
 - b. Softwood Plywood: DOC PS 1, Exterior **OR** Medium Density Overlay, **as directed**.

B. Wood-Preservative-Treated Materials

1. Preservative Treatment by Nonpressure Process: Comply with AWPA N1 using the following preservative for woodwork items indicated to receive water-repellent preservative treatment:
 - a. Water-Repellent Preservative: Formulation made specifically for dip treatment of woodwork items and containing 3-iodo-2-propynyl butyl carbamate (IPBC) complying with AWPA P8 as its active ingredient.
 - b. Water-Repellent Preservative/Insecticide: Formulation made specifically for dip treatment of woodwork items and containing 3-iodo-2-propynyl butyl carbamate (IPBC) as its active ingredient, combined with an insecticide containing chlorpyrifos as its active ingredient, both complying with AWPA P8.
2. Preservative Treatment by Pressure Process: AWPA C2 (lumber) and AWPA C9 (plywood) and the following:
 - a. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Use chemical formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
 - b. Kiln-dry lumber and plywood after treatment to a maximum moisture content, respectively, of 19 and 15 percent. Do not use materials that are warped or do not comply with requirements for untreated materials.
 - c. Mark each treated item with treatment quality mark of an inspection agency approved by the American Lumber Standards Committee Board of Review.
3. Extent of Treatment: Treat blocking and nailers by pressure process and treat other exterior architectural woodwork either by pressure or nonpressure process.
 - a. Items fabricated from the following wood species need not be treated:
 - 1) Redwood **OR** All-heart redwood, **as directed**.
 - 2) Western red cedar **OR** All-heart western red cedar, **as directed**.
 - 3) Teak.
 - 4) African mahogany.

C. Fire-Retardant-Treated Materials

1. General: Where fire-retardant-treated materials are indicated, provide materials that comply with performance requirements of AWPA C20 (lumber) and AWPA C27 (plywood), exterior type.
 - a. Fire-Retardant Chemicals: Use chemical formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
 - b. Mill lumber before treatment and implement special procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.
 - c. Kiln-dry materials before and after treatment to levels required for untreated materials.



- d. Do not use treated materials that do not comply with requirements of referenced woodworking standard or that are warped, discolored, or otherwise defective.
 - e. Identify fire-retardant-treated materials with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.
- D. Installation Materials
1. Blocking, Shims, and Nailers: Softwood or hardwood lumber, pressure-preservative treated **OR** fire-retardant treated, **as directed**, kiln dried to less than 15 percent moisture content.
 2. Nails: Aluminum **OR** Hot-dip galvanized **OR** Stainless steel, **as directed**.
 3. Screws: Aluminum **OR** Bronze **OR** Hot-dip galvanized **OR** Stainless steel, **as directed**.
 - a. Provide self-drilling screws for metal framing supports, as recommended by metal-framing manufacturer.
 4. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts, unless otherwise indicated. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.
- E. Fabrication
1. Wood Moisture Content: 9 to 15 **OR** 10 to 15 **OR** 7 to 12, **as directed**, percent.
 2. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
 - a. Edges of Solid-Wood (Lumber) Members 3/4 Inch (19 mm) Thick or Less: 1/16 inch (1.6 mm).
 - b. Edges of Rails and Similar Members More Than 3/4 Inch (19 mm) Thick: 1/8 inch (3 mm).
 3. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
 4. Shop cut openings, to maximum extent possible, to receive hardware, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Smooth edges of cutouts and seal with a water-resistant coating suitable for exterior applications.
 5. Woodwork for Transparent Finish:
 - a. Grade: Premium **OR** Custom **OR** Economy, **as directed**.
 - b. Wood Species: Teak **OR** African mahogany **OR** White oak **OR** All-heart redwood **OR** Western red cedar **OR** Eastern white pine, **as directed**.
 6. Woodwork for Opaque Finish:
 - a. Grade: Premium **OR** Custom **OR** Economy, **as directed**.
 - b. Wood Species: All-heart redwood **OR** Western red cedar **OR** Ponderosa pine **OR** Eastern white pine, sugar pine, or western white pine **OR** Any closed-grain hardwood, **as directed**.
 7. Backout or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work.
 8. Shop Priming: Shop prime woodwork for paint finish with one coat of wood primer specified in Division 07.
 - a. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to surfaces installed in contact with concrete or masonry and to end-grain surfaces.
 9. Shop Finishing: Entire finish of exterior architectural woodwork is specified in this Section. To greatest extent possible, finish architectural woodwork at fabrication shop. Defer only final touchup and cleaning until after installation.
 - a. Grade: Same grade as item to be finished **OR** Premium **OR** Custom **OR** Economy, **as directed**.
 - b. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to surfaces installed in contact with concrete or masonry and to end-grain surfaces.
 - c. AWI Finish System: Conversion varnish **OR** Catalyzed polyurethane, **as directed**.



- d. WI Finish System: 4, conversion varnish **OR** 5, catalyzed polyurethane **OR** 7a., synthetic enamel, **OR as directed**.
- e. Sheen: Satin 31-45 **OR** Semigloss 46-60 **OR** Gloss 61-100, **as directed**, gloss units measured on 60-degree gloss meter per ASTM D 523.

1.3 EXECUTION

A. Preparation

1. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.
2. Deliver concrete inserts and similar anchoring devices to be built into substrates well in advance of time substrates are to be built.
3. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

B. Installation

1. Quality Standard: Install woodwork to comply with same grade specified in Part 1.2 for type of woodwork involved.
2. Install woodwork true and straight with no distortions. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).
3. Scribe and cut woodwork to fit adjoining work, and refinish cut surfaces or repair damaged finish at cuts.
4. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.
5. Preservative-Treated Wood: Where cut or drilled in field, treat cut ends and drilled holes according to AWP A M4.
6. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk concealed fasteners and blind nailing. Use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork.
7. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 36 inches (900 mm) long, except where shorter single-length pieces are necessary. Scarf running joints and stagger in adjacent and related members.
 - a. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches (3 mm in 2400 mm).
8. Complete finishing work specified in this Section to extent not completed at shop or before installation of woodwork. Fill nail and screw holes with matching filler where exposed.
9. Refer to Division 07 for final finishing of installed architectural woodwork.

C. Adjusting And Cleaning

1. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; replace woodwork where not possible to repair. Adjust joinery for uniform appearance.
2. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 06 46 29 00



Task	Specification	Specification Description
06 46 29 00	01 95 06 00c	Interior Architectural Woodwork
06 46 36 00	01 95 06 00c	Interior Architectural Woodwork



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SECTION 06 48 13 00 - WOOD DOORS

1.1 DESCRIPTION OF WORK

- A. This specification covers the furnishing and installation of materials for wood doors. Products shall be as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

1.2 GENERAL

A. Definitions

1. Supply-and-Delivery-Only Contract: Includes supply and delivery to site FOB destination. Freight prepaid. Unless otherwise specified or scheduled, unloading and handling at site is by the Owner.
2. Supply-and-Install Contract: Includes supply, delivery to site FOB destination, freight prepaid, unloading and handling at site, and installation.

B. System Description

1. Door Assemblies: Include doors, frames, and hardware.
 - a. Provide with fire rating as indicated or specified.
2. Security Entry Door System (Assembly) Performance Requirements:
 - a. Forced Entry: ASTM F 476, Grade 40.

C. Submittals

1. Shop Drawings:
 - a. Indicate location, size, elevation, details of construction, marks used to identify doors, location and extent of hardware blocking, fire rating, factory preparation requirements for each door type. Drawings shall include catalog cuts or descriptive data for weatherstripping and thresholds to be used.
2. Quality Assurance/Control Submittals:
 - a. Test Reports: Results of testing by accredited independent laboratory demonstrating compliance of door systems with specified performance requirements.
 - 1) Indicate that tests were performed in accordance with standard referenced.
 - b. Certificates: Manufacturer's written certification that door systems meet or exceed specified requirements.
 - c. Manufacturer's installation instructions.
3. Closeout Submittals:
 - a. Operation and maintenance data.
 - b. Special warranty.

D. Quality Assurance

1. Regulatory Requirements: Comply with following:
 - a. Fire-Rated Label: Determined using ASTM E 152, and bear label of UL or other recognized fire-rating program acceptable to authorities having jurisdiction,
 - 1) If any door or frame scheduled to be fire-rated cannot qualify for appropriate labeling because of its design, hardware, or any other reason, advise the Owner prior to submission of bids.
 - b. Accessibility: (Required for accessible units only, including main building entrances.)
 - 1) Architectural Barriers Act of 1968 as amended (42 USC 4152-4157) and HUD implementing regulations (24 CFR Part 40).
 - a) Uniform Federal Accessibility Standards (UFAS).
 - 2) Section 504 of the Rehabilitation Act of 1973 as amended (29 USC 794) and HUD implementing regulations (24 CFR Part 8).



- 3) Fair Housing Accessibility Guidelines (24 CFR Chapter 1).
- 4) Americans with Disabilities Act of 1990 (ADA) (28 CFR Part 35).
2. Mock-ups: Install one mock-up of each type of door system, including doors, frames, hardware, thresholds, and accessories.
 - a. Location: As directed.
 - b. Approved Mock-up: Standard for rest of work, and may remain part of completed project.
- E. Delivery, Storage, And Handling
 1. Packing, Shipping, Handling, and Unloading: Pack materials at manufacturing plant to prevent damage during shipping.
 - a. Delivery: Do not deliver doors to building until it is entirely enclosed, drywall and concrete work is completed, and humidity in building has reached average relative humidity of locality.
 - b. Storage: Stack doors flat and off floor in manner to prevent warping or twisting, and to provide ventilation. Do not drag doors across one another.
 - c. Protection: Protect doors during transit, storage, and handling to prevent damage, soiling, and deterioration, and from extremes in temperature and humidity. Comply with "On-site Care" recommendations of NWWDA Care and Finishing of Wood Doors, and with manufacturer's recommendations.
 2. Acceptance at Site: Inspect door systems upon delivery. Replace damaged or defective materials before installation.
- F. Project Conditions
 1. Field Measurements: Field measure openings for door systems before start of fabrication.
- G. Scheduling And Sequencing
 1. Scheduling and Completion: Comply with requirements of Detailed Scope of Work.
- H. Warranty
 1. Special Warranty:
 - a. Swinging Doors and Standard Closet Doors Warranty: Provide one-year written warranty covering materials and installation for wood doors.
 - 1) Include coverage of hardware.
 - 2) Cover warping (bow, cup, or twist), photographing of construction below face veneers, tolerance limitations of NWWDA I.S. 1-A.
 - 3) Cover delamination.
 - 4) Glazing not included.
 - 5) Defects resulting from vandalism not included.
 - b. Heavy-Duty Closet Doors Warranty: Provide manufacturer's five-year written warranty covering materials and installation for bifold closet doors.
 - c. For Supply-and-Delivery-Only Contract:
 - 1) Contractor: Agrees to supply and deliver to the Owner, free of charge, any required replacement parts that can be readily installed by the Owner without special tools.
 - 2) Contractor: Agrees to supply and deliver to the Owner, free of charge, complete replacement door, when defective part or parts cannot be installed without use of special tools.
 - d. For Supply-and-Install Contract: Contractor: Agrees to supply and install. free of charge, any required replacement parts or complete replacement door.

1.3 PRODUCTS

A. Door Frames

1. Wood Frames: Kiln dried Ponderosa Pine, toxic-treated, and primed.
 - a. Applied stops are permitted, unless otherwise indicated.



2. Steel Frames:
 - a. Steel: ASTM A 366 cold rolled steel.
 - b. Steel Frames and/or Adapter Frames: Minimum of 18 gage (1.07 mm) galvanized bonderized steel, pre-drilled and reinforced for hinges as required.
 - 1) Shape of Frame: Generally L-shaped.
 - c. Heavy-Duty Door Frames: 16 gage (1.35 mm) minimum thickness.
 - 1) When required, provide B-Label, 1-1 /2 hour fire rating.
 - d. Security Door Frames: Comply with SDI 100, minimum of 14 gage (1.70 mm) galvanized bonderized steel, pre-drilled and reinforced for hinges as required.
 - 1) When required, provide B-Label, 1-1 /2 hour fire rating.
 - 2) Comply with Performance Requirements in this Section.
 - e. Preparation for Hardware: Machine and reinforce frames for attachment of hardware, including mortising, drilling, and tapping for hinges and mortised hardware.
 - f. Frame Anchors: Provide jamb anchors as suitable for wall conditions and floor anchors, minimum 18 gage.
 - 1) Provide welded type frames with temporary spreader bars.

B. Interior Wood Swinging Doors

1. Standard Products: Doors shall be of type, size, and design indicated, and shall be standard products of manufacturers regularly engaged in manufacture of wood doors.
 - a. Marking: Each door shall bear stamp, brand. or other identifying mark indicating quality and construction of door. Identifying mark or separate certification shall include identification of standard on which construction of door is based, and identity of manufacturing plant.
2. Interior Wood Doors: NWWDA I.S. 1-A.
 - a. Thickness: 44.4 mm (1-3/4 inch) unless otherwise indicated or scheduled.
 - b. Adhesives: NWWDA I.S. 1-A, Type II.
 - c. Prefitting: Provide doors prefitted or unfitted at option of Contractor.
 - d. Faces, stiles, and rails bonded to cores.
3. Core Construction:
 - a. Solid Core Door NWWDA Construction Type: One of following (as specified):
 - 1) PC-5 or PC-7 (5- or 7-ply) with particleboard core, bonded.
 - a) Stiles: Full core thickness and minimum 34 mm (1-3/8 inch) face width.
 - 2) SLC-5 or SLC-7 (5- or 7-ply) provide with glued wood-block core, bonded.
 - a) Stiles: Full core thickness and minimum 19 mm (3/4 inch) face width.
 - 3) Stiles and Rails: Top and bottom rails for particleboard and wood-block core doors shall have minimum 29 mm (1-1/8 inch) face width by full core thickness.
 - b. Hollow-Core Doors: NWWDA IHC (Institutional Hollow Core) or SHC (Standard Hollow Core), as specified.
 - 1) Provide with heavy-duty wood stiles, rails, lock blocks and other reinforcement inside core as required to allow for secure screw attachment of hardware.
 - 2) Hinge Stile: Minimum 25 mm (1 inch) minimum thick.
 - c. Stile Edge Bands: Mill option specie.
 - 1) No visible finger-joints acceptable in stile edge bands.
 - 2) When used, locate finger-joints under hardware.
 - d. Fire-Rated Door NWWDA Construction Type: As required for fire rating indicated or scheduled.
 - 1) Mineral Core Doors: Provide with heavy duty wood stiles, rails, lock blocks, and other reinforcement inside core as required to allow for secure screw attachment of hardware including closers and exit devices.
 - a) Reinforcement Blocking: In compliance with manufacturer's labeling requirements.
 - 2) Provide factory prefitting and premachining as required for fire-rated labels.
 - 3) Means of Egress Fire Doors: Provide doors with maximum 232 degrees C (450 degree F) temperature rise rating in 30 minutes of fire exposure.
 - e. Wood Stiles, Rails, Lock Blocks, and Other Reinforcement: Wood:
 - 1) Rail Blocks: Not less than 125 mm (5 inches) wide by full core thickness.



- 2) Split Resistance: NWWDA TM-5, average of ten test samples shall be not less than 225 load kilograms (500 load pounds).
 - 3) Direct Screw Withdrawal: NWWDA TM-10, average of ten test samples shall be not less than 315 load kilograms (700 load pounds) when tested for direct screw withdrawal using steel, fully threaded wood screw.
 - 4) Cycle/Swing: NWWDA TM-7. 200,000 cycles with no loose hinge screws or other visible signs of failure.
 - f. Under Cutting: Preserve full bottom rail.
4. Face Panels:
- a. Painted Finish: NWWDA I.S. 1-A, minimum 3 mm (1/8 inch) thick hardboard.
 - b. Plastic Laminate Finish: NEMA LD 3, high pressure decorative laminate, Grade GP50, 1.3 mm (0.050 inch) thick.
 - 1) Faces: Adhesively apply over minimum 3 mm (1/8 inch) thick hardboard.
 - 2) Edges: Adhesively apply plastic laminate matching face panels.
 - 3) Color and Pattern: As selected.

C. Hardware

1. General: Comply with ANSI/BHMA A156.1 and applicable accessibility regulatory requirements and perform functions for which it was intended.
2. Butts and Hinges: ANSI/BHMA A156.1, as scheduled.
 - a. Install non-rising pins (NRP) on out-swing residential unit entry doors.
 - b. Self Closing: ANSI/BHMA A156.17.
 - c. Security Door: Comply with Performance Requirements in this Section.
3. Fire-Rated Door Hardware: Comply with NFPA 80.
 - a. Exit Doors: Comply with NFPA 101 (Life Safety Code) for exit doors, as well as other requirements specified.
 - b. Labeling and Listing: Listed in UL Building Materials Directory.
 - 1) In Lieu of UL Labeling and Listing: Test reports from nationally recognized testing agency showing that hardware has been tested in accordance with UL test methods and conforms to NFPA requirements.
 - c. Install minimum latch throw as specified on label of individual door.
 - d. Provide hardware listed by UL, except where heavier materials, larger sizes, or higher grades are specified.
 - e. Closers: ANSI/BHMA A156.4.
4. Lock Sets and Passage Sets: As scheduled. Comply with following standards:
 - a. Bored and Preassembled Locks and Latches: ANSI/BHMA A156.2, Grade 2.
 - b. Dead Bolt: ANSI/BHMA A156.5.
 - c. Mortise Locks and Latches: ANSI/BHMA A156.13, Grade 1 or Security Grade, single or multiple throw.
 - d. Interconnected Deadlock and Passage Set: ANSI/BHMA A156.12, Grade 2.
 - e. Cylindrical Lock: Grade 2 cylindrical deadbolt lock/passage set combination.
 - f. Security Door Locksets: ANSI/BHMA A156.13 Security Grade or UL 437 Key locks.
 - 1) Comply with Performance Requirements in this Section.
 - g. Keys: Provide two keys for each lock provided. Provide master keying and keying alike on any locks as directed at no additional charge.
 - h. Locks: Provide with interchangeable cores.
5. Door Viewers: ANSI/BHMA A156.16.

D. Factory Fitting And Machining

1. Doors: Prefit, bevel, mortise, and machine doors at factory in accordance with NWWDA I.S. 1-A.
 - a. Comply with hardware schedules and door frame Shop Drawings with hardware templates to ensure proper fit of doors and hardware.
 - 1) Take accurate field measurements of hardware mortises in metal frames to verify dimensions and alignment before proceeding with machining in factory.
 - b. Machine doors for hardware requiring cutting of doors.
 - c. Fit doors to frame bevel lock edge of doors (1/8 inch) for each (2 inches) of door thickness.



- d. Finish all surfaces, including both faces, top and bottom and edges of doors smooth to touch.
 2. Edge Sealing: Seal wood end grain exposed at edges and cutouts of doors against moisture penetration prior to shipment.
 - a. Sealer: Two coats of spar varnish or other sealer recommended by door manufacturer.
 3. Tolerances: Comply with NWWDA tolerance requirements for prefitting.
- E. Door Assemblies
1. Prehung Swinging Doors: Prehung door with matching wood frame complete with hinges, lockset or passage set, and other hardware, as indicated or specified.
 2. Fire-Rated Doors and Frames: NFPA 80 and bear identifying label of UL or nationally recognized testing agency qualified to perform certification programs indicating that units conform to requirements for class indicated.
 - a. Labels: Metal with raised or incised markings.
 - b. Hardware: As required to maintain fire rating and receive label.
 3. Security Entry Frames and Doors:
 - a. Comply with Performance Requirements in this Section.
 - b. Fire Rating: When required, provide B-Label, 1-1/2 hour fire rating.
- F. Closet Doors
1. Heavy-Duty Bifold Closet Doors: Particleboard bifold doors, prime painted, factory premachined, complete with manufacturer's standard hardware to provide complete operating bifold doors.
 - a. Panels: 721 kg/ cubic m (45 PCF) industrial-grade particle board, 19.1 mm (3/4 inch) thick.
 - 1) Long Edges: Plasticized.
 - 2) Room Side: Filled and prime painted.
 - 3) Closet Side: Prime painted.
 - 4) Exposed Surfaces Finish: Painted or plastic laminate as indicated or scheduled.
 - b. Track: No. 6063-T6 extruded aluminum, 20.5 mm (13/16 inch) by 32 mm (1-1/4 inch).
 - 1) Track Guides: Delrin.
 - c. Hardware: Factory-applied to doors and track.
 - 1) Pivot and Mounting Hardware: 14 gage cold-rolled steel, carbonized for strength and durability.
 - 2) Top Pivot and Guide Pins: 75 mm (3 inch) removable compensating pins.
 - 3) Toggle Pivot: Ensure doors remain in place.
 - 4) Spring Enclosure: Provide positive closing with little effort and keep doors closed.
 - 5) Bottom Pivot: Carry weight of door, floor-mounted, and designed for vertical and horizontal adjustment.
 - 6) Panel Brackets: Wrap-around feature to eliminate unnecessary stress on screws.
 - 7) Panels: Hinged together with continuous piano hinges inserted into routed grooves and secured with tempered pins.
 - 8) Pulls: As selected from manufacturer's standards.
 - d. Doors: Comply with accessibility requirements (as specified).
 2. Standard Bifold Closet Doors: Provide complete manufacturer's standard hardware, including tracks, hinges, guides, and pulls to provide complete operating bifold doors.
 - a. Hollow-Core Doors: NWWDA I.S. 1-A and NWWDA IHC (Institutional Hollow Core).
 - 1) Provide with heavy-duty wood stiles, rails, lock blocks and other reinforcement inside core as required to allow for secure screw attachment of hardware.
 - b. Doors: 34.9 mm (1-3/8 inch) thick unless otherwise indicated.
 - c. Surface-Mounted Pulls: As selected from manufacturer standards.
 3. Standard Sliding Closet Doors: Provide complete manufacturer's standard hardware, including tracks, guides, and pulls to provide complete operating sliding doors.
 - a. Hollow-Core Doors: NWWDA I.S. 1-A and NWWDA IHC (Institutional Hollow Core).
 - 1) Provide with heavy-duty wood stiles, rails, lock blocks and other reinforcement inside core as required to allow for secure screw attachment of hardware.
 - b. Doors: 34.9 mm (1-3/8 inch) thick unless otherwise indicated.
 - c. Recessed Pulls: As selected from manufacturer standards.
 4. Standard Closet Door Face Panels:



- a. Painted Finish: NWWDA I.S. 1-A, minimum 3 mm (1/8 inch) thick hardboard.
- b. Plastic Laminate Finish: NEMA LD 3, high-pressure decorative laminate, Grade GP50, 1.3 mm (0.050 inch) thick.
 - 1) Faces: Adhesively apply over minimum 3 mm (1/8 inch) thick hardboard.
 - 2) Edges: Adhesively apply plastic laminate matching face panels.
 - 3) Color and Pattern: As selected.

G. Finishes

- 1. Painted Wood Finish: One of following as indicated or scheduled:
 - a. Factory Finish: NWWDA System No. 10-Conversion Varnish.
 - 1) Color: As selected.
 - b. Field Finish: Factory primed for field paint under Division 9 Section "Painting."
- 2. Painted Steel Finish: Clean and free from serious surface blemishes.
 - a. Exposed Surfaces: ASTM A 591 electrolytic zinc-coated steel, Class A.
 - b. Primer: ANSI A224.1, factory-applied primer.
 - c. Finish Coat: One of following as specified or scheduled:
 - 1) Factory Finish: Electrostatically factory applied baked-on enamel finish.
 - a) Color: As selected from manufacturer's list of colors.
 - 2) Field Finish: Factory-primed for field paint under Division 9 Section "Painting."

1.4 EXECUTION

A. Examination

- 1. Site Verification of Conditions:
 - a. Existing Conditions: Examine openings before beginning installation.
 - b. Field Measurements: Verify field measurements are as indicated on Shop Drawings.
 - c. Before installation of doors, verify that frames are proper size, location, type, and swing characteristics for door, and are installed with plumb jambs and level heads as required for proper installation of doors.
 - d. Reject doors with defects.
 - e. Do not proceed with installation until conditions are satisfactory.

B. Preparation

- 1. Protection: Protect adjacent elements from damage and disfiguration in accordance with Detailed Scope of Work.
 - a. Contractor: Responsible for damage to buildings and any other facilities or property caused by construction operations.
 - b. Repair or replace damaged elements in accordance with Detailed Scope of Work.
- 2. Existing Doors: Remove existing doors and debris from site in accordance with Detailed Scope of Work.
- 3. Preparation: Prepare existing openings in accordance with ASTM E 737, manufacturer's recommendations, and approved Shop Drawings.
- 4. Wood Door Preparation:
 - a. Conditioning: Condition wood doors to average humidity in installation area prior to hanging.
 - b. Prefitting: Prefit wood doors to frames and machine for hardware to whatever extent not previously worked at factory as required for proper fit and uniform clearance at each edge.
 - c. Sealing: Before installation of hardware on wood doors, brush apply sealer to all job site cut or planed surfaces.

C. Door Frame Installation

- 1. Door Frames: Install in accordance with ASTM E 737, manufacturer's recommendations, and approved Shop Drawings.



- a. Set frames accurately in accordance with details, straight and free of twist with head level, jambs plumb, and without distortion. Rigidly anchor to walls and partitions and securely brace until surrounding work is completed.
 2. Wood Frames: Set plumb and square, and rigidly anchor in place using finish type nails. Provide double wedge blocking near top, bottom, and midpoint of each jamb.
 3. Steel Frames: Comply with SDI 105:
 - a. Fire-Rated Openings: Place frames and provide clearances in accordance with NFPA 80 and GA 253.
 - b. Field Welds: Make welds full length of joints. Remove splatter, and grind exposed welds to match adjacent surfaces. Provide the Owner with ample notice to review welds before finish operations begin.
 - c. Wherever possible, leave spreader bars in place until frames are securely anchored.
- D. Wood Door Installation
1. General: Install doors in accordance with NWWDA I.S. 1-A, ASTM E 737, manufacturer's recommendations, and approved Shop Drawings.
 - a. Install doors and frames securely, straight, plumb, and level without distortion.
 2. Wood Doors: Install wood doors in accordance with manufacturers recommendations.
 - a. Prefit Doors: Fit to frames for uniform clearance at each edge.
 - b. Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted with fire-rated doors.
 - c. Hanging: After sizing doors, fit and machine for hardware as scheduled.
 - 1) Hang doors to be free of binding, with hardware functioning properly.
 - d. Clearances for Nonfire-Rated Doors:
 - 1) Jamb: 3 mm (1/8 inch), 3 mm (1/8 inch) bevel in 50 mm (2 inches).
 - 2) Head: 3 mm (1/8 inch).
 - 3) Bottom at Decorative Floor Finish or Covering: 13 mm (1/2 inch).
 - 4) Bottom at Threshold: 6 mm (1/4 inch) between bottom of door and top of threshold.
 - e. Clearances for Fire Rated Doors: Comply with NFPA 80 and local code.
 - 1) Bevel fire-rated doors 3 mm in 50 mm (1/8 inch in 2 inches) at lock edge; trim stiles and rails only to extent permitted by labeling agency.
 - f. Seal cut surfaces after fitting and machining as specified above.
 3. Fire-Rated Doors:
 - a. Installation, Hardware, and Operational Characteristics: Comply with NFPA 80, NFPA 101, and manufacturer's recommendations.
 - b. Factory-Applied Labels: Remain intact where installed. Do not trim labeled hinge stile edge and top edge of door.
 - 1) Do not paint over labels.
 - c. Clearances for Fire-Rated Doors: Comply with NFPA 80 and local code.
 - 1) Lockstile Edge and Bottom Edge: May be trimmed only to extent recommended by door manufacturer.
 - 2) Bevel fire-rated doors 3 mm in 50 mm (1/8 inch in 2 inches) at lock edge; trim stiles and rails only to extent permitted by labeling agency.
 - d. Seal cut surfaces after fitting and machining as specified above.

E. Hardware Installation

 1. General: Install hardware in accordance with SDI 109, DHI recommended locations, and manufacturers recommendations.
 2. Fastening: Furnish items of hardware with attachment screws, bolts, nuts, etc., as required to attach hardware to type of material involved and with finish to match adjacent hardware.
 - a. Make attachments to metal by template machine screws.
 - b. Through-bolt hardware such as door closers, forearm shoes of closers, holding devices, and panic hardware mounted on doors or panels.
 - c. Attach hardware to masonry or concrete with expansion bolts or similar drilled anchors to develop full strength of attached device. Set expansion anchors in solid masonry, not mortar joints.



3. Accessories:
 - a. Smoke Seals and Sound-stripping: Run full height of both jambs and full width of head.
 - b. Thresholds: Run full width of opening. Install thresholds with continuous threshold anchors cast into slab and set in sealant.

F. Door Assemblies Installation

1. Prehung Wood Doors in Frames with Hardware: Install in accordance with manufacturer's recommendations.
2. Bifold Closet Doors with Hardware: Install in accordance with manufacturers recommendations.
3. Sliding Closet Doors with Hardware: Install in accordance with manufacturer's recommendations.

G. Adjusting And Cleaning

1. Adjusting: At completion of job, check, adjust, and lubricate hardware as required, and leave doors and hardware in proper operating condition.
 - a. Operation: Rehang or replace doors which do not swing or operate freely.
2. Cleaning: Comply with requirements of Detailed Scope of Work.
 - a. Clean doors after installation to remove foreign matter and surface blemishes.
 - b. Scratched or Abraded Painted Surfaces: Touch-up with primer and enamel paint compatible with factory finish.

H. Protection

1. Installed Work: Protect doors from damage after installation. as recommended by door manufacturer. to ensure that doors will be without damage or deterioration at project completion.
2. Replacement: Refinish or replace doors damaged during installation.
 - a. Causes for Rejection of Wood Doors: Include warp, chips, scratches, or gouges of veneer. and finish defects.

END OF SECTION 06 48 13 00



Task	Specification	Specification Description
06 48 16 00	06 48 13 00	Wood Doors



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SECTION 06 51 13 00 - PLASTIC LUMBER

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of plastic lumber. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Basic Uses

1. For both residential and municipal applications, high-density polyethylene (HDPE) products are well suited for decking, porch flooring, docks, piers, furnishings, fencing, and lawn and garden items. HDPE products are cost-effective alternatives for ground contact and animal contact, wet, and environmentally harsh conditions.

C. Submittals

1. Product Data and Certificates: For each product indicated.
 - a. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
2. Shop Drawings: Show location of paneling, large-scale details, attachment devices, and other components. Include dimensioned plans and elevations.
 - a. Show details full size.
 - b. Show locations and sizes of furring and blocking, including concealed blocking specified in other Sections.
 - c. Apply WI Certified Compliance Program label to first page of Shop Drawings.
3. Samples for initial selection for high-pressure decorative laminates.
4. Samples for verification for plastic laminates, 8 by 10 inches (200 by 250 mm) **OR** 12 by 12 inches (300 by 300 mm), **as directed**, for each type, color, pattern, and surface finish, with one sample applied to core material and specified edge material applied to one edge.
5. Qualification Data: For Installer **OR** Fabricator, **as directed**.
6. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates **OR** WI Certified Compliance Program certificates, **as directed**.
7. Evaluation Reports: For fire-retardant-treated materials from ICC-ES.

D. Limitations

1. Plastic lumber has less rigidity (modulus of elasticity) and greater elongation than wood lumber. Therefore, it is not recommended for use as a true structural member. Examples of applications that are inappropriate would be load-bearing walls, deck framing, and floor joists. It is recommended that an engineering study be performed prior to use of HDPE products if the application involves structural requirements. For commercial applications where the system design calls for concentrated loads, structural plastic lumber should be considered.
2. When utilizing HDPE products for decking or flooring, pay careful attention to joist spacing and joist spans. Consult manufacturer for allowable live loads, deflection limits, joist spacing, and joist spans.

E. Quality Assurance

1. Plastic lumber shall meet applicable standards established by ASTM for recycled plastic lumber and hygrothermal testing.
2. Plastic lumber shall pass testing by UL and meet flammability standards established by ASTM.

1.2 PRODUCTS



A. Materials

1. High-density polyethylene (HDPE), UV-inhibited pigment systems, foaming compounds, and selected process additives, shall be derived from post-consumer bottle waste, such as milk and detergent bottles, then compounded into a rigid board stock material, with the resulting finished product containing minimum 75% recycled plastic by weight.
2. Plastic lumber shall have exceptional resistance to corrosive substances, oil and fuels, insects, fungi, salt spray, and other environmental stresses. They shall not absorb moisture; nor shall they rot, splinter, or crack.
3. HDPE products shall be manufactured in standard dimensional lumber sizes, and shapes.
4. Color of plastic lumber shall be selected from manufacturer's standard colors.

1.3 EXECUTION

A. Installation

1. HDPE products shall have the capability of being fabricated and installed with the same tools used to work wood lumber. The product shall cut and drill very cleanly, as there is no grain to split or chip. It shall not be necessary to pre-drill the plastic lumber when fastening. Stainless steel or coated decking nails and screws are recommended for use with HDPE products. Screws offer the best form of attachment; however, nails and staples may also be utilized in some applications.
2. The use of full length boards is suggested to avoid unattractive butt-to-butt joints.
3. HDPE products offer multiple deck board attachment options to accommodate expansion and contraction concerns in different climatic conditions and to address specific installation parameters. These options include:
 - a. Tongue and groove deck board attachment with toe screwing options.
 - b. Direct screw attachment with feature strip options.
 - c. Floating attachment with clip options.
 - d. Floating attachment with groove & groove options.

B. Maintenance

1. HDPE products are unaffected by most corrosive substances and will not absorb moisture. To maintain the original finish, clean the lumber with soap and water. No sealing or painting is required; as a general rule, paint will not adhere to HDPE products.
2. Clean graffiti from the plastic lumber with the use of a conventional all-purpose cleaner or petroleum-based cleaner.
3. If the skin or surface layer of an HDPE product becomes marred or blemished, sand off the top skin. The surface can also be buffed to eliminate abrasions.

END OF SECTION 06 51 13 00



SECTION 06 51 13 00a - COMPOSITE PLASTIC LUMBER

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of composite plastic lumber. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Basic Uses

1. Composite plastic lumber or boards are well designed for deck, porch, boardwalk, dock, and similar applications. These boards may also be used for many lumber applications, where a non-load bearing member is required. This material is particularly well suited for outdoor uses due to its durability characteristics. Composite boards have many beneficial properties for decking applications, including:
 - a. Low moisture absorption.
 - b. No rotting, splitting or splintering.
 - c. Inherent termite and UV resistance.
 - d. Excellent dimensional stability and wet/dry traction.
 - e. No toxic compounds (CCA) to leach into soil or groundwater.
 - f. Workability and appearance of natural lumber products.

C. Submittals

1. Product Data and Certificates: For each product indicated.
 - a. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
2. Shop Drawings: Show location of paneling, large-scale details, attachment devices, and other components. Include dimensioned plans and elevations.
 - a. Show details full size.
 - b. Show locations and sizes of furring and blocking, including concealed blocking specified in other Sections.
 - c. Apply WI Certified Compliance Program label to first page of Shop Drawings.
3. Samples for initial selection for high-pressure decorative laminates.
4. Samples for verification for plastic laminates, 8 by 10 inches (200 by 250 mm) **OR** 12 by 12 inches (300 by 300 mm), **as directed**, for each type, color, pattern, and surface finish, with one sample applied to core material and specified edge material applied to one edge.
5. Qualification Data: For Installer **OR** Fabricator, **as directed**.
6. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates **OR** WI Certified Compliance Program certificates, **as directed**.
7. Evaluation Reports: For fire-retardant-treated materials from ICC-ES.

D. Limitations

1. Composite plastic lumber has less rigidity (modulus of elasticity) than wood lumber and is more flexible. Therefore, this material should not be employed as a structural component unless an engineering study indicates that its use is appropriate. These boards are not intended to be used as joists, beams, studs, columns or stringers.
2. When utilizing composite plastic lumber products for decking, pay careful attention to joist spacing and joist spans. Consult manufacturer for allowable live loads, deflection limits, joist spacing, and joist spans.

E. Quality Assurance

1. Composite plastic lumber shall meet applicable standards established by ASTM for recycled plastic lumber.



2. Plastic lumber shall meet flammability standards established by ASTM.

F. Handling

1. This material is more flexible and more dense than wood, which should be considered when handling boards.
2. Storing boards on uneven or unsupported surfaces may lead to deformation of the material. Therefore, always store boards on a flat surface, or support with dunnage on centers of 24" or less.

1.2 PRODUCTS

A. Materials

1. Composite plastic lumber products shall be composed of approximately 65% recycled wood/natural fiber and 35% recycled plastic, with selected process additives. The plastic raw material utilized in this product is recycled plastic. It shall be processed to a uniform feedstock, compounded with recovered fibers and extruded into a rigid board product.
2. Colors and sizes of composite plastic lumber shall be selected from manufacturer's standard.

1.3 EXECUTION

A. Installation

1. Composite plastic lumber products shall have the capability of being fabricated and installed with the same tools used to work wood lumber. The product shall cut and drill very cleanly, as there is no grain to split or chip. For best results, use carbide-tipped blades and bits.
2. For optimum water drainage, allow a gap of 3/16" to 1/4" between boards.
3. Both nails and screws may be used to attach USPL composite boards; stainless steel or coated screw type fasteners are recommended.
4. #8, 2 1/2" stainless steel or ceramic-coated deck screws are recommended for 5/4x6 boards, and #10, 3" stainless steel or ceramic-coated deck screws are recommended for 2x6 boards for best results.
5. In cold weather, consider pre-drilling screw holes. Do not use fasteners within 3/4" of the edge of a board. Pneumatic nail guns work with this material.

B. Maintenance

1. Composite boards will weather to a lighter hue during the first few months; fading may take much longer in shaded areas.
2. To clean dirt and most stains from the deck boards, use common deck cleaners available in hardware stores, home centers and lumberyards. Oil stains from grills and foods may require the use of a degreasing cleaner or light sanding to remove the stain. Mold and mildew are common on many exterior surfaces, and they may form on composite plastic lumber. Use common deck washes that contain sodium hypochlorite for best cleaning results.

END OF SECTION 06 51 13 00a



SECTION 06 51 13 00b - STRUCTURAL PLASTIC LUMBER

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of structural plastic lumber. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Basic Uses

1. Structural plastic lumber products are used in a variety of commercial and marine applications and are often the product of choice for exterior applications where resistance to salt and fresh water, marine borers, and other environmentally harsh conditions is required. Due to the unique composition of structural plastic lumber, the product can be used for a number of structural members in commercial and shoreline timberwork.
2. It is well suited for:
 - a. Dock and deck planks
 - b. Wale timbers
 - c. Sheet piling
 - d. Camels
 - e. Pilings
 - f. Fenders
 - g. Channel markers
 - h. Posts, beams, and joists

C. Submittals

1. Product Data and Certificates: For each product indicated.
 - a. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
2. Shop Drawings: Show location of paneling, large-scale details, attachment devices, and other components. Include dimensioned plans and elevations.
 - a. Show details full size.
 - b. Show locations and sizes of furring and blocking, including concealed blocking specified in other Sections.
 - c. Apply WI Certified Compliance Program label to first page of Shop Drawings.
3. Samples for initial selection for high-pressure decorative laminates.
4. Samples for verification for plastic laminates, 8 by 10 inches (200 by 250 mm) **OR** 12 by 12 inches (300 by 300 mm), **as directed**, for each type, color, pattern, and surface finish, with one sample applied to core material and specified edge material applied to one edge.
5. Qualification Data: For Installer **OR** Fabricator, **as directed**.
6. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates **OR** WI Certified Compliance Program certificates, **as directed**.
7. Evaluation Reports: For fire-retardant-treated materials from ICC-ES.

D. Limitations

1. This type of plastic lumber product has a significantly higher modulus of elasticity (MOE) than conventional forms of plastic lumber. However, the MOE of structural plastic lumber is lower than wood timber in good condition; therefore, it is important to evaluate the suitability of this product for specific uses. It is recommended that an engineering study be performed prior to use of structural plastic lumber products for structural applications. Building code regulations vary by region, so all users should consult local building and safety codes prior to installation for specific requirements.



E. Quality Assurance

1. Structural plastic lumber shall meet applicable standards established by ASTM for recycled plastic lumber and hygrothermal testing.
2. Plastic lumber shall meet flammability standards established by ASTM.

1.2 PRODUCTS

A. Materials

1. Structural plastic lumber shall be a high-performance construction material consisting of a patented formula of recycled plastic, fiberglass, and selected additives. The plastic raw material utilized in structural plastic lumber is derived from post-consumer bottle waste such as milk and detergent bottles. This material is compounded into a consistent, reinforced plastic timber product using reactive compatibilizers, creating a strong and stable plastic/fiber matrix.
2. Colors, sizes, and shapes of structural plastic lumber shall be selected from manufacturer's standard.

1.3 EXECUTION

A. Installation

1. Structural plastic lumber can be fabricated and installed with the same tools used to work wood lumber. The product will cut and drill very cleanly, as there is no grain to split or chip, or knots to bind tools and bend fasteners. It is reinforced with glass fibers, and precautions should be taken when fabricating this product. Maintain adequate ventilation when generating fabrication dust, and personal respiratory protection such as dust masks should be employed during fabrication, as well as safety glasses or goggles.
2. Pilings and sheet piling products can be driven with piledriving equipment such as vibratory hammers, land-based or barge-mounted drop hammers, or waterjets. For sheet piling installations, backfill soils should always be analyzed to determine that the proper amount of force would be exerted on the sheet piling system. For shoreline timberwork applications, structural plastic lumber is used with conventional hardware such as stainless or galvanized bolts, tie rods, nuts, washers, and anchor systems.
3. When utilizing structural plastic lumber products for decking, pay careful attention to joist spacing and joist spans. Consult manufacturer for allowable live loads, deflection limits, joist spacing, and joist spans.

B. Maintenance

1. Structural plastic lumber products are unaffected by most corrosive substances and will not absorb moisture. To maintain the original finish, clean the lumber with soap and water. No sealing or painting is required; as a general rule, paint will not adhere well to these products.
2. Clean graffiti from the plastic lumber with the use of a conventional all-purpose cleaner or petroleum-based cleaner. If the skin or surface layer of plastic lumber becomes marred or blemished, sand off the top skin. The surface can also be buffed to eliminate abrasions.

END OF SECTION 06 51 13 00b



Task	Specification	Specification Description
06 65 00 00	01 95 06 00	Miscellaneous Carpentry



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SECTION 06 74 13 00 - PULTRUDED FIBERGLASS INDUSTRIAL GRATING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for pultruded fiberglass industrial grating. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Shop drawings of all fabricated gratings and accessories in accordance with the provisions of this Section.
2. Manufacturer's shop drawings clearly showing material sizes, types, styles, part or catalog numbers, complete details for the fabrication of and erection of components including, but not limited to, location, lengths, type and sizes of fasteners, clip angles, member sizes, and connection details.
3. Manufacturer's published literature including structural design data, structural properties data, grating load/deflection tables, corrosion resistance tables, certificates of compliance, test reports as applicable, concrete anchor systems and their allowable load tables, and design calculations for systems not sized or designed in the contract documents.
4. Sample pieces of each item specified herein for acceptance as to quality and color. Sample pieces shall be manufactured by the method to be used in the work.

C. Quality Assurance

1. All items to be provided under this Section shall be furnished only by manufacturers having experience in the design and manufacture of similar products and systems. If requested, experience shall be demonstrated by a record of at least five (5) previous, separate, similar successful installations in the last five (5) years.

D. Product Delivery And Storage

1. Delivery of Materials: Manufactured materials shall be delivered in original, unbroken pallets, packages, containers, or bundles bearing the label of the manufacturer. Adhesives, resins and their catalysts and hardeners shall be crated or boxed separately and noted as such to facilitate their movement to a dry indoor storage facility.
2. Storage of Products: All materials shall be carefully handled to prevent them from abrasion, cracking, chipping, twisting, other deformations, and other types of damage. Store items in an enclosed area and free from contact with soil and water. Store adhesives, resins and their catalysts and hardeners in dry indoor storage facilities between 70 and 85 degrees Fahrenheit (21 to 29 degrees Celsius) until they are required.

1.2 PRODUCTS

A. General

1. All FRP items furnished under this Section shall be composed of fiberglass reinforcement and resin in qualities, quantities, properties, arrangements and dimensions as necessary to meet the design requirements and dimensions as specified or required.
2. Fiberglass reinforcement shall be a combination of continuous roving, continuous strand mat, and surfacing veil in sufficient quantities as needed by the application and/or physical properties required.
3. Resins shall be vinyl ester or isophthalic with chemical formulations as necessary to provide the corrosion resistance, strength and other physical properties as required.



4. All finished surfaces of FRP items and fabrications shall be smooth, resin-rich, free of voids and without dry spots, cracks, crazes or unreinforced areas. All glass fibers shall be well covered with resin to protect against their exposure due to wear or weathering.
5. All pultruded structural shapes shall be further protected from ultraviolet (UV) light with 1) integral UV inhibitors in the resin and 2) a synthetic surfacing veil to help produce a resin rich surface.
6. All FRP products shall have a tested flame spread rating of 15 or less per ASTM E-84 Tunnel Test. Gratings shall also have a tested burn time of less than 30 seconds and an extent of burn rate of less than or equal to 10 millimeters per ASTM D-635.
7. All grating clips shall be manufactured of Type 316SS (stainless steel).

B. Pultruded Grating

1. **Manufacture:** Grating components shall be high strength and high stiffness pultruded elements having a maximum of 70% and a minimum of 60% glass content (by weight) of continuous roving and continuous strand mat fiberglass reinforcements. The finished surface of the product shall be provided with a surfacing veil to provide a resin rich surface which improves corrosion resistance and resistance to ultraviolet degradation. Bearing bars shall be interlocked and epoxied in place with a two piece cross rod system to provide a mechanical and chemical lock.
2. **Non-slip surfacing:** Grating shall be provided with a quartz grit bonded and baked to the top surface of the finished grating product.
3. **Fire rating:** Grating shall be fire retardant with a tested flame spread rating of 15 or less when tested in accordance with ASTM E 84. Manufacturer may be required to provide certification of ASTM E84 test on grating panels from an independent testing laboratory. Certification shall be dated within the past two years. Test data shall be from full scale testing of actual production grating, of the same type and material supplied on the project. Test data performed only on the base resin shall not be acceptable.
4. **Resin system:** The resin system used in the manufacture of the grating shall be VEFR, vinyl ester or ISOFR, isophthalic. Manufacturer may be required to submit corrosion data from tests performed on actual grating products in standard chemical environments. Corrosion resistance data of the base resin from the manufacturer is not a true indicator of grating corrosion resistance and shall not be accepted.
5. **Color:** Gray or Yellow.
6. **Depth:** 2" deep load bars with a tolerance of plus or minus 1/32".
7. **Mesh Configuration:** 2" load bar spacing, 6" tie bar spacing on centers.
8. **Load/Deflection:** Grating shall meet manufacturer's published safe recommended loadings with deflection not to exceed the following:
 - a. Uniform distributed load over a 66" span: 50 pounds per square foot, with a maximum deflection of 0.13".
9. **Substitutions:** Other products of equal strength, stiffness, corrosion resistance and overall quality may be submitted with the proper supporting data to the engineer for approval.

C. Grating Fabrication

1. **Measurements:** Grating supplied shall meet the minimum dimensional requirements as shown or specified. The Contractor shall provide and/or verify measurements in field for work fabricated to fit field conditions as required by grating manufacturer to complete the work.
 - a. Determine correct size and locations of required holes or cutouts from field dimensions before grating fabrication.
2. **Layout:** Each grating section shall be readily removable, except where indicated on drawings. Manufacturer to provide openings and holes where located on the contract drawings. Grating supports shall be provided at openings in the grating by contractor where necessary to meet load/deflection requirements specified herein. Grating openings which fit around protrusions (pipes, cables, machinery, etc.) shall be discontinuous at approximately the centerline of opening so each section of grating is readily removable. Gratings shall be fabricated free from warps, twists, or other defects which affect appearance and serviceability.



3. Sealing: All shop fabricated grating cuts shall be coated with vinyl ester resin to provide maximum corrosion resistance. All field fabricated grating cuts shall be coated similarly by the contractor in accordance with the manufacturer's instructions.
4. Hardware: Type 316 stainless steel hold-down clips shall be provided and spaced at a maximum of four feet apart with a minimum of four per piece of grating, or as recommended by the manufacturer.

1.3 EXECUTION

A. Inspection

1. Shop inspection is authorized as required by the Owner and shall be at Owner's expense. The fabricator shall give ample notice to Contractor prior to the beginning of any fabrication work so that inspection may be provided.
2. The grating shall be as free, as commercially possible, from visual defects such as foreign inclusions, delamination, blisters, resin burns, air bubbles and pits.

B. Installation

1. Contractor shall install gratings in accordance with manufacturer's assembly drawings. Lock grating panels securely in place with hold-down fasteners as specified herein. Field cut and drill fiberglass reinforced plastic products with carbide or diamond tipped bits and blades. Seal cut or drilled surfaces in accordance with manufacturer's instructions. Follow manufacturer's instructions when cutting or drilling fiberglass products or using resin products; provide adequate ventilation.

END OF SECTION 06 74 13 00



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Task	Specification	Specification Description
06 74 13 00	05 53 13 00	Gratings



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SECTION 06 82 00 00 - PULTRUDED FIBERGLASS STRUCTURAL SHAPES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of pultruded fiberglass structural shapes. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Shop drawings of all fabricated structural systems and accessories.
2. Manufacturer's shop drawings clearly showing material sizes, types, styles, part or catalog numbers, complete details for the fabrication of and erection of components including, but not limited to, location, lengths, type and sizes of fasteners, clip angles, member sizes, and connection details.
3. Manufacturer's published literature including structural design data, structural properties data, corrosion resistance tables, certificates of compliance, test reports as applicable, and design calculations for systems not sized or designed in the contract documents, sealed by a Professional Engineer.
4. Sample pieces of each item specified herein for acceptance as to quality and color. Sample pieces shall be manufactured by the method to be used in the work.

C. Quality Assurance

1. All items to be provided under this Section shall be furnished only by manufacturers having experience in the design and manufacture of similar products and systems. If requested, experience shall be demonstrated by a record of at least five (5) previous, separate, similar successful installations in the last five (5) years.

D. Product Delivery and Storage

1. Delivery of Materials: Manufactured materials shall be delivered in original, unbroken pallets, packages, containers, or bundles bearing the label of the manufacturer. Adhesives, resins and their catalysts and hardeners shall be crated or boxed separately and noted as such to facilitate their movement to a dry indoor storage facility.
2. Storage of Products: All materials shall be carefully handled to prevent them from abrasion, cracking, chipping, twisting, other deformations, and other types of damage. Store items in an enclosed area and free from contact with soil and water. Store adhesives, resins and their catalysts and hardeners in dry indoor storage facilities between 70 and 85 degrees Fahrenheit (21 to 29 degrees Celsius) until they are required.

1.2 PRODUCTS

A. Materials

1. All structural shapes shall be manufactured by the pultrusion process with a glass content minimum of 45%, maximum of 55% by weight for maximum sunlight and chemical resistance. The structural shapes shall be composed of fiberglass reinforcement and resin in qualities, quantities, properties, arrangements and dimensions as necessary to meet the design requirements and dimensions as specified in the Contract Documents.
2. Fiberglass reinforcement shall be a combination of continuous roving, continuous strand mat, and surfacing veil in sufficient quantities as needed by the application and/or physical properties required.
3. Resins shall be ISO, non-fire retardant isophthalic polyester; ISOFR, fire retardant isophthalic polyester or VEFR, vinyl ester, with chemical formulation necessary to provide the corrosion resistance, strength and other physical properties as required.



4. All finished surfaces of FRP items and fabrications shall be smooth, resin-rich, free of voids and without dry spots, cracks, crazes or unreinforced areas. All glass fibers shall be well covered with resin to protect against their exposure due to wear or weathering.
5. All pultruded structural shapes shall be further protected from ultraviolet (UV) attack with 1) integral UV inhibitors in the resin and 2) a synthetic surfacing veil to help produce a resin rich surface.
6. All FRP products shall have a tested flame spread rating of 25 or less per ASTM E-84 Tunnel Test.

B. Pultruded structural shapes shall have the minimum longitudinal mechanical properties listed below:

Property	ASTM Method	Value	Units
Tensile Strength	D-638	30,000 (206)	psi (MPa)
Tensile Modulus	D-638	2.5×10^6 (17.2)	psi (GPa)
Flexural Strength	D-790	30,000 (206)	psi (MPa)
Flexural Modulus	D-790	1.8×10^6 (12.4)	psi (GPa)
Flexural Modulus (Full Section)	N/A	2.8×10^6 (19.3)	psi (GPa)
Short Beam Shear (Transverse)	D-2344	4,500 (31)	psi (MPa)
Shear Modulus (Transverse)	N/A	4.5×10^5 (3.1)	psi (GPa)
Coefficient of Thermal Expansion	D-696	8.0×10^{-6} (1.4×10^{-6})	in/in/°F (cm/cm/°C)
Flame Spread	E-84	25 or less	N/A

1.3 EXECUTION

A. Fabrication

1. Measurements: Structural Shapes supplied shall meet the minimum dimensional requirements as shown or specified. The Contractor shall provide and/or verify measurements in field for work fabricated to fit field conditions as required by manufacturer to complete the work. Determine correct size and locations of required holes or coping from field dimensions before structural shape fabrication.
2. Sealing: All shop fabricated cuts or drilling shall be coated with vinyl ester resin to provide maximum corrosion resistance. All field fabricated cuts or drilling shall be coated similarly by the contractor in accordance with the manufacturer's instructions.
3. Hardware: Type 316 stainless steel connection hardware shall be provided.

B. Inspection

1. Shop inspection shall be authorized as required by the Owner and shall be at Owner's expense. The fabricator shall give ample notice to Contractor prior to the beginning of any fabrication work so that inspection may be provided.
2. The structural shapes shall be as free, as commercially possible, from visual defects such as foreign inclusions, delamination, blisters, resin burns, air bubbles and pits.

END OF SECTION 06 82 00 00

**SECTION 07 05 13 00 - BUILT-UP COAL-TAR ROOFING**

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for built-up coal-tar roofing. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Built-up coal-tar roofing.
 - b. Vapor retarder.
 - c. Roof insulation.
2. Section includes the installation of insulation strips in ribs of acoustical roof deck. Insulation strips are furnished under Division 05 Section "Steel Decking".

C. Definitions

1. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to built-up roofing.
2. Bitumen: A generic term for either asphalt or coal-tar pitch.
3. Hot Coal-Tar Pitch: Coal-tar pitch heated to its equiviscous temperature, the temperature at which its viscosity is 25 centipoise for either mopping or mechanical application, within a range of plus or minus 25 deg F (14 deg C), measured at the mop cart or mechanical spreader immediately before application.
4. Hot Roofing Asphalt: Roofing asphalt heated to its equiviscous temperature, the temperature at which its viscosity is 125 centipoise for mop-applied roofing asphalt and 75 centipoise for mechanical spreader-applied roofing asphalt, within a range of plus or minus 25 deg F (14 deg C), measured at the mop cart or mechanical spreader immediately before application.

D. Performance Requirements

1. General Performance: Installed built-up roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Built-up roofing and base flashings shall remain watertight.
2. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by built-up roofing manufacturer based on testing and field experience.
3. Roofing System Design (if built-up roofing system is to be designed to withstand uplift pressure established by ASCE/SEI 7): Provide built-up roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7.
 - a. Corner Uplift Pressure: as directed by the Owner.
 - b. Perimeter Uplift Pressure: as directed by the Owner.
 - c. Field-of-Roof Uplift Pressure: as directed by the Owner.
4. FM Approvals Listing (if Project is FM Global insured or if FM Approvals requirements will set a minimum quality standard): Provide built-up roofing, base flashings, and component materials that comply with requirements in FM Approvals 4450 and FM Approvals 4470 as part of a built-up roofing system, and that are listed in FM Approvals' "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals markings.
 - a. Fire/Windstorm Classification: Class 1A-60 **OR** Class 1A-75 **OR** Class 1A-90 **OR** Class 1A-105 **OR** Class 1A-120, **as directed**.
 - b. Hail Resistance Rating: MH **OR** SH, **as directed**.



5. Energy Performance (if required for LEED-NC Credit SS 7.2): Provide roofing system with initial Solar Reflectance Index not less than 78 when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency.
6. Energy Performance (for roofs that must comply with the DOE's ENERGY STAR requirements): Provide roofing system that is listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.
7. Energy Performance (for roofs that must comply with California Energy Commission's CEC-Title 24): Provide roofing system with initial solar reflectance not less than 0.70 and emissivity not less than 0.75 when tested according to CRRC-1.

E. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:
 - a. Product Test Reports for Credit SS 7.2: For roof materials, indicating that roof materials comply with Solar Reflectance Index requirement.
 - b. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.
3. Shop Drawings: For built-up roofing. Include plans, elevations, sections, details, and attachments to other work.
 - a. Base flashings and built-up terminations.
 - b. Tapered insulation, including slopes.
 - c. Crickets, saddles, and tapered edge strips, including slopes.
 - d. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
4. Samples: For the following products:
 - a. Built-up roofing materials, including base sheet, ply sheet and flashing sheet, of color specified.
 - b. Roof insulation.
 - c. 3 lb (1.5 kg) of aggregate surfacing material in gradation and color indicated.
 - d. Walkway pads.
 - e. Six insulation fasteners of each type, length, and finish.
5. Qualification Data: For qualified Installer and manufacturer.
6. Manufacturer Certificates: Signed by roofing manufacturer certifying that built-up roofing complies with requirements specified in "Performance Requirements" Article.
 - a. Submit evidence of compliance with performance requirements.
7. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of built-up roofing.
8. Research/Evaluation Reports: For components of built-up roofing, from the ICC-ES **OR** other applicable model code organization, **as directed**.
9. Maintenance Data: For built-up roofing to include in maintenance manuals.
10. Warranties: Sample of special warranties.

F. Quality Assurance

1. Manufacturer Qualifications: A qualified manufacturer that is UL listed **OR** FM Approvals approved, **as directed**, for built-up roofing identical to that used for this Project.
2. Installer Qualifications (if Project is FM Global insured and if a certified roofing installer is required): A qualified firm that is approved, authorized, or licensed by built-up roofing manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.
3. Source Limitations (if required to comply with FM Approvals, UL, or another building code, or to comply with provisions of manufacturer's special warranty): Obtain components including roof insulation and fasteners for built-up roofing from same manufacturer as built-up roofing or approved by built-up roofing manufacturer.
4. Exterior Fire-Test Exposure: ASTM E 108, Class A **OR** Class B **OR** Class C, **as directed**; for application and roof slopes indicated, as determined by testing identical built-up roofing materials



- by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.
5. Fire-Resistance Ratings: Where indicated, provide fire-resistance-rated roof assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 6. Preinstallation Roofing Conference: Conduct conference at Project site.
- G. Delivery, Storage, And Handling
1. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
 2. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing manufacturer. Protect stored liquid material from direct sunlight.
 - a. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
 3. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
 4. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.
- H. Project Conditions
1. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing to be installed according to manufacturer's written instructions and warranty requirements.
- I. Warranty
1. Special Warranty: Manufacturer's standard or customized form, without monetary limitation, in which manufacturer agrees to repair or replace components of built-up roofing that fail in materials or workmanship within specified warranty period.
 - a. Special warranty includes built-up roofing membrane, base flashings, roof insulation, fasteners, cover boards, substrate board, roofing accessories, roof pavers, and other components of built-up roofing.
 - b. Warranty Period: 10 **OR** 15 **OR** 20 **OR** 25 **OR** 30, **as directed**, years from date of Final Completion.
- 1.2 PRODUCTS
- A. Base-Sheet Materials
1. Sheathing Paper: Red-rosin type, minimum 3 lb/100 sq. ft. (0.16 kg/sq. m).
 2. Base Sheet: ASTM D 4601, Type I **OR** II, **as directed**, nonperforated, asphalt-impregnated and -coated, glass-fiber sheet, dusted with fine mineral surfacing on both sides.
OR
Base Sheet: ASTM D 4897, Type II, venting, nonperforated, heavyweight, asphalt-impregnated and -coated, glass-fiber base sheet with coarse granular surfacing or embossed venting channels on bottom surface.
OR
Base Sheet: ASTM D 2626, asphalt-saturated and -coated organic felt, dusted with fine mineral surfacing on both sides.
- B. Roofing Membrane Plies
1. Ply Sheet: ASTM D 227, coal-tar-saturated organic felt.
OR



Ply Sheet: ASTM D 4990, Type I, coal-tar-impregnated, glass-fiber felt and the physical properties of ASTM D 2178, Type IV **OR** VI, **as directed**.

C. Base Flashing Sheet Materials

1. Backer Sheet: ASTM D 2178, Type IV, asphalt-impregnated, glass-fiber felt.
OR
Backer Sheet: Roofing manufacturer's standard spun-bonded, nonwoven, polyester-reinforced fabric, of standard color and weight, suitable for application method specified.
2. Granule-Surfaced Flashing Sheet: ASTM D 6164, Grade G, Type I or II, polyester-reinforced, SBS-modified asphalt sheet; granular surfaced base flashing; suitable for application method specified, and as follows:
 - a. Granule Color: White **OR** Gray **OR** Tan, **as directed**.
3. Polyester Flashing Sheet: Roofing manufacturer's standard asphalt-coated, polyester-reinforced fabric, base flashing, suitable for application method specified.
4. Fabric Termination: Roofing manufacturer's standard polyester cloth, suitable for application and for reinforcing top seal of base flashing.

D. Bitumen Materials

1. Asphalt Primer: ASTM D 41.
OR
Coal-Tar Primer: ASTM D 43.
2. Coal-Tar Pitch: ASTM D 450, Type I.
3. Roofing Asphalt: ASTM D 312, Type III **OR** IV **OR** III or IV as recommended by built-up roofing manufacturer for application, **as directed**.
OR
Roofing Asphalt: ASTM D 6152, SEBS modified.

E. Auxiliary Built-Up Roofing Materials

1. General: Auxiliary materials recommended by built-up roofing manufacturer for intended use and compatible with built-up roofing.
 - a. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
 - b. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1) Plastic Foam Adhesives: 50 g/L.
 - 2) Gypsum Board and Panel Adhesives: 50 g/L.
 - 3) Multipurpose Construction Adhesives: 70 g/L.
 - 4) Fiberglass Adhesives: 80 g/L.
 - 5) Contact Adhesives: 80 g/L.
 - 6) Other Adhesives: 250 g/L.
 - 7) Nonmembrane Roof Sealants: 300 g/L.
 - 8) Sealant Primers for Nonporous Substrates: 250 g/L.
 - 9) Sealant Primers for Porous Substrates: 775 g/L.
2. Cold-Applied Adhesive: Roofing manufacturer's standard asphalt-based, one- or two-part, asbestos-free, cold-applied adhesive specially formulated for compatibility and use with built-up base flashings.
3. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required by roofing manufacturer for application.
4. SBS-Modified Asphalt Flashing Cement: Roofing manufacturer's standard, asbestos free, of consistency required for application.
5. Coal-Tar Roofing Cement: ASTM D 5643, coal-tar-based roofing cement, asbestos free.
6. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening built-up roofing components



- to substrate, tested by manufacturer for required pullout strength, and acceptable to roofing manufacturer.
7. Metal Flashing Sheet: Metal flashing sheet is specified in Division 07 Section "Sheet Metal Flashing And Trim".
 8. Metal Termination Bars: Roofing manufacturer's standard predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.
 9. Roof Coatings: ASTM D 2824, Type I, nonfibered **OR** III, fibered, asbestos-free, **as directed**, aluminum-pigmented asphaltic coating.
OR
Roof Coatings: ASTM D 6083, acrylic elastomer emulsion coating, formulated for use on bituminous roof surfaces.
 - a. Color: White **OR** Gray **OR** Buff, **as directed**.
 10. Aggregate Surfacing: ASTM D 1863, No. 6 or No. 67, clean, dry, opaque, water-worn gravel or crushed stone, free of sharp edges **OR** crushed slag, free of sharp edges, **as directed**.
 11. Walkway Pads: Mineral-granule-surfaced, reinforced asphaltic composition **OR** Polymer-modified, reconstituted solid-rubber, surface-textured, **as directed**, slip-resisting pads, manufactured as a traffic pad for foot traffic and acceptable to built-up roofing manufacturer, 3/8 inch (10 mm) **OR** 1/2 inch (13 mm) **OR** 3/4 inch (19 mm), **as directed**, thick, minimum.
 12. Miscellaneous Accessories: Provide miscellaneous accessories recommended by built-up roofing manufacturer.
- F. Substrate Boards
1. Substrate Board: ASTM C 1396/C 1396M, Type X gypsum board, 5/8 inch (16 mm) thick.
OR
Substrate Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/4 inch (6 mm) **OR** 1/2 inch (13 mm) **OR** Type X, 5/8 inch (16 mm), **as directed**, thick, factory primed, **as directed**.
OR
Substrate Board: ASTM C 1278/C 1278M, cellulosic-fiber-reinforced, water-resistant gypsum substrate, 1/4 inch (6 mm) **OR** 3/8 inch (10 mm) **OR** 1/2 inch (13 mm) **OR** 5/8 inch (16 mm), **as directed**, thick.
OR
Substrate Board: ASTM C 728, perlite board, 3/4 inch (19 mm) **OR** 1 inch (25 mm), **as directed**, thick, seal coated.
 2. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate board to roof deck.
- G. Vapor Retarder
1. Polyethylene Film: ASTM D 4397, 6 mils (0.15 mm) thick, minimum, with maximum permeance rating of 0.13 perm (7.5 ng/Pa x s x sq. m).
 - a. Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
OR
Adhesive: Manufacturer's standard lap adhesive, FM Approvals approved for vapor-retarder application.
 2. Laminated Sheet: Kraft paper/polyethylene laminate, two layers, reinforced with woven fiberglass yarn, laminated and edge reinforced, with maximum permeance rating of 0.50 perm (29 ng/Pa x s x sq. m) and with manufacturer's standard adhesive, **as directed**.
 3. Self-Adhering Sheet Vapor Retarder: ASTM D 1970, minimum of 40-mil- (1.0-mm-) thick, polyethylene film laminated to layer of rubberized asphalt adhesive; maximum permeance rating of 0.1 perm (6 ng/Pa x s x sq. m); cold-applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor-retarder manufacturer.
OR
Self-Adhering Sheet Vapor Retarder: 30- to 40-mil- (0.76- to 1.0-mm-) thick, polyethylene film laminated to layer of butyl rubber adhesive; maximum permeance rating of 0.1 perm (6 ng/Pa x s



x sq. m); cold-applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor-retarder manufacturer.

4. Glass-Fiber Felts: ASTM D 2178, Type IV, asphalt impregnated.

H. Roof Insulation

1. General: Preformed roof insulation boards manufactured or approved by roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated and that produce FM Approvals-approved roof insulation, **as directed**.
2. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2 **OR** Type II, Class I, Grade 3, **as directed**, felt or glass-fiber mat facer on both major surfaces.
3. Composite Polyisocyanurate Board Insulation: ASTM C 1289, with factory-applied facing board on one major surface, as indicated below by type, and felt or glass-fiber mat facer on the other surface.
 - a. Type IV, cellulosic-fiber-insulating-board facer, Grade 2, 1/2 inch (13 mm) thick.
 - b. Type V, OSB facer, 7/16 inch (11 mm) thick.
 - c. Type VII, glass mat faced gypsum board facer, 1/4 inch (6 mm) thick.
4. Perlite Board Insulation: ASTM C 728, rigid, mineral-aggregate thermal insulation board composed of expanded perlite, cellulosic fibers, binders, and waterproofing agents with top surface seal coated.
5. Cellulosic-Fiber Board Insulation: ASTM C 208, Type II, Grade 1, fibrous-felted, rigid insulation boards of wood fiber or other cellulosic-fiber and water-resistant binders, asphalt impregnated, chemically treated for deterioration.
6. Cellular-Glass Board Insulation: ASTM C 552, Type IV, rigid, cellular-glass thermal board insulation faced with manufacturer's standard kraft-paper sheets.
7. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/8 inch per 12 inches (1:96) **OR** 1/4 inch per 12 inches (1:48), **as directed**, unless otherwise indicated.
8. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

I. Insulation Accessories

1. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with built-up roofing.
2. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation to substrate and acceptable to roofing manufacturer.
3. Modified Asphaltic Insulation Adhesive: Insulation manufacturer's recommended modified asphaltic, asbestos-free, cold-applied adhesive formulated to attach roof insulation to substrate or to another insulation layer.
4. Bead-Applied Insulation Adhesive: Insulation manufacturer's recommended bead-applied, low-rise, one- or multicomponent urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.
5. Full-Spread Applied Insulation Adhesive: Insulation manufacturer's recommended spray-applied, low-rise, two-component urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.
6. Insulation Cant Strips: ASTM C 728, perlite insulation board.
OR
Insulation Cant Strips: ASTM C 208, Type II, Grade 1, cellulosic-fiber insulation board.
7. Wood Nailer Strips: Comply with requirements in Division 6 Section "Rough Carpentry" **OR** "Miscellaneous Carpentry", **as directed**.
8. Tapered Edge Strips: ASTM C 728, perlite insulation board.
OR
Tapered Edge Strips: ASTM C 208, Type II, Grade 1, cellulosic-fiber insulation board.
9. Cover Board: ASTM C 208, Type II, Grade 2, cellulosic-fiber insulation board, 1/2 inch (13 mm) thick.
OR



Cover Board: DOC PS 2, Exposure 1, OSB, 7/16 inch (11 mm) thick.

OR

Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/4 inch (6 mm) **OR** 1/2 inch (13 mm) **OR** 5/8 inch (16 mm), **as directed**, thick, factory primed, **as directed**.

OR

Cover Board: ASTM C 1278/C 1278M, cellulosic-fiber-reinforced, water-resistant gypsum substrate, 1/4 inch (6 mm) **OR** 3/8 inch (10 mm) **OR** 1/2 inch (13 mm) **OR** 5/8 inch (16 mm), **as directed**, thick.

10. Substrate Joint Tape: 6- or 8-inch- (150- or 200-mm-) wide, coated, glass fiber.

1.3 EXECUTION

A. Examination

1. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
 - a. Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.
 - b. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 - c. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Division 5 Section "Steel Deck."
 - d. Verify that deck is securely fastened with no projecting fasteners and with no adjacent units in excess of 1/16 inch (1.6 mm) out of plane relative to adjoining deck.
 - e. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
 - f. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 - 1) Test for moisture by pouring 1 pint (0.5 L) of hot roofing asphalt on deck at start of each day's work and at start of each roof area or plane. Do not proceed with roofing work if test sample foams or can be easily and cleanly stripped after cooling.
 - g. Verify that concrete curing compounds that will impair adhesion of roofing components to roof deck have been removed.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Preparation

1. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing manufacturer's written instructions. Remove sharp projections.
2. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
3. Prime surface of concrete deck with asphalt **OR** coal-tar, **as directed**, primer at a rate of 3/4 gal./100 sq. ft. (0.3 L/sq. m) and allow primer to dry.
4. Install insulation strips in ribs of acoustical roof decks according to acoustical roof deck manufacturer's written instructions.

C. Substrate Board Installation

1. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.
 - a. Fasten substrate board to top flanges of steel deck according to recommendations in FM Approvals' "RoofNav" and FM Global Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification.

OR

Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to built-up roofing manufacturers' written instructions.



D. Vapor-Retarder Installation

1. Polyethylene Film: Loosely lay polyethylene-film vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 inches (50 mm) and 6 inches (150 mm), respectively.
 - a. Continuously seal side and end laps with tape **OR** adhesive, **as directed**.
2. Laminate Sheet: Install laminate-sheet vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 inches (50 mm) and 6 inches (150 mm), respectively. Bond vapor retarder to substrate as follows:
 - a. Apply adhesive at rate recommended by vapor-retarder manufacturer. Seal laps with adhesive.
OR
Apply ribbons of hot roofing asphalt at spacing, temperature, and rate recommended by vapor-retarder manufacturer. Seal laps with hot roofing asphalt.
3. Self-Adhering Sheet Vapor Retarder: Prime substrate if required by manufacturer. Install self-adhering sheet vapor retarder over area to receive vapor retarder, side and end lapping each sheet a minimum of 3-1/2 inches (90 mm) and 6 inches (150 mm), respectively. Seal laps by rolling.
4. Built-up Vapor Retarder: Install two glass-fiber felt plies lapping each felt 19 inches (483 mm) over preceding felt. Embed each felt in a solid mopping of hot roofing asphalt. Glaze-coat completed surface with hot roofing asphalt. Apply hot roofing asphalt within plus or minus 25 deg F (14 deg C) of equiviscous temperature.
5. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into built-up roofing system.

E. Insulation Installation

1. Comply with built-up roofing manufacturer's written instructions for installing roof insulation.
2. Install one lapped base sheet course and mechanically fasten to substrate according to built-up roofing manufacturer's written instructions.
3. Nailer Strips: Mechanically fasten 4-inch nominal- (89-mm actual-) width wood nailer strips of same thickness as insulation perpendicular to sloped roof deck, spaced 16 feet (4.88 m) apart for roof slopes greater than 1/4 inch per 12 inches (1:48) **OR** 1/2 inch per 12 inches (1:24), **as directed**.
4. Insulation Cant Strips: Install and secure preformed 45-degree insulation cant strips at junctures of built-up roofing with vertical surfaces or angle changes greater than 45 degrees.
5. Install tapered insulation under area of roofing to conform to slopes indicated.
6. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
 - a. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
7. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches (68 mm) or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.
 - a. Where installing composite and noncomposite board insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
8. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
9. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.
10. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:
 - a. Prime surface of concrete deck with asphalt primer at rate of 3/4 gal./100 sq. ft. (0.3 L/sq. m) and allow primer to dry.
 - b. Set each layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F (14 deg C) of equiviscous temperature.
OR



Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.

OR

Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

11. Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
 - a. If Project is FM Global insured or if FM Approvals requirements are proposed as a performance standard, fasten insulation according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.
 - b. If number of fasteners will be based on ASCE/SEI 7's uplift pressure, fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.
12. Mechanically Fastened and Adhered Insulation: Install first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
 - a. If Project is FM Global insured or if FM Approvals requirements are proposed as a performance standard, fasten first layer of insulation according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.
 - b. If fastening is calculated from ASCE/SEI 7's uplift pressure, fasten first layer of insulation to resist uplift pressure at corners, perimeter, and field of roof.
 - c. Set each subsequent layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F (14 deg C) of equiviscous temperature.

OR

Set each subsequent layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.

OR

Set each subsequent layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

13. If cover boards will be field installed over roof insulation and immediately below built-up roofing, install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches (150 mm) in each direction. Loosely butt cover boards together and fasten to roof deck, **as directed**. Tape joints if required by roofing manufacturer.
 - a. Fasten cover boards according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.

OR

 - b. Fasten cover boards to resist uplift pressure at corners, perimeter, and field of roof.
 - b. Apply hot roofing asphalt to underside and immediately bond cover board to substrate.

F. Built-Up Roofing Installation, General

1. If referencing NRCA's roof assembly identification matrix system, install roofing membrane according to roofing manufacturer's written instructions and applicable recommendations of ARMA/NRCA's "Quality Control Guidelines for the Application of Built-up Roofing."
 - a. Install roofing system BU-3 **OR** 4 **OR** 5, **as directed**, -N **OR** I **OR** C, **as directed**, -A-A, according to roof assembly identification matrix and roof assembly layout illustrations in NRCA's "The NRCA Roofing and Waterproofing Manual" and requirements in this Section.
2. For roofing that exceeds requirements of NRCA's roof assemblies, install built-up roofing membrane according to roofing manufacturer's written instructions and applicable recommendations of ARMA/NRCA's "Quality Control Guidelines for the Application of Built-up Roofing" and as follows:
 - a. Deck Type: N (nailable) **OR** I (insulated) **OR** C (concrete or nonnailable), **as directed**.
 - b. Base Sheet: 1 **OR** 1, installed over sheathing paper, **as directed**.
 - c. Number of Organic Felt Ply Sheets: 2 **OR** 3 **OR** 4, **as directed**.
 - d. Number of Glass Fiber Ply Sheets: 1, top ply **OR** 2 **OR** 3 **OR** 4, **as directed**.
 - e. Surfacing Type: A (aggregate).



3. Start installation of built-up roofing in presence of manufacturer's technical personnel.
 4. Where roof slope exceeds 1/4 inch per 12 inches (1:48) **OR** 1/2 inch per 12 inches (1:24), **as directed**, install built-up roofing sheets parallel with slope.
 - a. Backnail built-up roofing sheets to nailer strips **OR** substrate, **as directed**, according to roofing manufacturer's written instructions.
 5. Cooperate with testing agencies engaged or required to perform services for installing roofing system.
 6. Coordinate installation of built-up roofing so insulation and other components of built-up roofing not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.
 - a. Provide tie-offs at end of each day's work to cover exposed built-up roofing sheets and insulation with a course of coated felt set in roofing cement or hot roofing asphalt with joints and edges sealed.
 - b. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.
 - c. Remove and discard temporary seals before beginning work on adjoining roofing.
 7. Bitumen Heating: Do not raise bitumen temperature above equiviscous temperature range more than one hour before time of application. Do not exceed bitumen manufacturer's recommended temperature limits during bitumen heating. Do not heat bitumen within 25 deg F (14 deg C) of flash point. Discard bitumen maintained for more than 4 hours at a temperature exceeding 325 deg F (163 deg C) for coal-tar pitch or finished blowing temperature for roofing asphalt, **as directed**.
 - a. Mopping Weights: For interply and other moppings, unless otherwise indicated, apply solid moppings of hot coal-tar pitch between ply sheets at a minimum rate of 20 lb/100 sq. ft. (1 kg/sq. m).
 8. SEBS-Asphalt Heating: Heat and apply SEBS-modified roofing asphalt according to roofing manufacturer's written instructions.
 9. Substrate-Joint Penetrations: Prevent bitumen and adhesives from penetrating substrate joints, entering building, or damaging built-up roofing components or adjacent building construction.
- G. Roofing Membrane Installation
1. If sheathing paper is required over wood decks by built-up roofing manufacturer, loosely lay one course of sheathing paper, lapping edges and ends a minimum of 2 inches (50 mm) and 6 inches (150 mm), respectively.
 2. Install lapped base sheet course, extending sheet over and terminating beyond cants. Attach base sheet as follows:
 - a. Mechanically fasten to substrate, for nailable substrate.
OR
Spot- or strip-mop to substrate with hot roofing asphalt.
OR
Adhere to substrate in a solid mopping of hot roofing asphalt **OR** uniform coating of cold-applied adhesive, **as directed**, for nonnailable or insulated substrates.
 3. Monolithic Membrane: Install two **OR** three **OR** four, **as directed**, ply sheets starting at low point of roofing system. Align ply sheets without stretching. Shingle side laps of ply sheets uniformly to achieve required number of plies throughout thickness of roofing membrane. Shingle in direction to shed water. Extend ply sheets over and terminate beyond cants. Embed each ply sheet in a solid mopping of hot coal-tar pitch to form a uniform membrane without ply sheets touching.
OR
Composite Membrane: Install two **OR** three **OR** four, **as directed**, organic felt ply sheets starting at low point of roofing system. Align organic felt ply sheets without stretching. Shingle side laps of organic felt ply sheets uniformly to achieve required number of plies throughout thickness of roofing membrane. Shingle in direction to shed water.
 - a. Install finish layer of one lapped coal-tar, glass-fiber ply sheet course over shingled organic felt ply sheets, starting at low point of built-up roofing. Offset laps from laps of preceding



- ply sheets and align coal-tar, glass-fiber ply sheet without stretching. Lap in direction to shed water.
- b. Extend ply sheets over and terminate beyond cants.
 - c. Embed each ply sheet in a solid mopping of hot coal-tar pitch applied at rate required by built-up roofing manufacturer, to form a uniform membrane without ply sheets touching.
4. If delayed flood coating and aggregate surfacing of coal-tar, glass-fiber membrane or finish layer are permitted, glaze-coat roofing membrane surface with hot coal-tar pitch applied at a rate of 10 to 15 lb/100 sq. ft. (0.5 to 0.75 kg/sq. m) if aggregate surfacing is not applied immediately.
 5. Aggregate Surfacing: If surfacing roofing membrane with aggregate, promptly after installing and testing roofing membrane, base flashing, and stripping, flood-coat roof surface with 70 lb/100 sq. ft. (3.5 kg/sq. m) of hot coal-tar pitch. While flood coat is hot and fluid, cast the following average weight of aggregate in a uniform course:
 - a. Aggregate Weight: 400 lb/100 sq. ft. (20 kg/sq. m) for gravel or crushed stone or 300 lb/100 sq. ft. (15 kg/sq. m) for slag.
 - b. Sweep loose aggregate from roof surface and apply another flood coat of not less than 85 lb/100 sq. ft. (4.15 kg/sq. m) of hot coal-tar pitch. While flood coat is hot and fluid, apply a uniform course of aggregate at the following rate. Sweep away loose aggregate and fully embed aggregate by lightly rolling into finished roof surface.
 - 1) Aggregate Weight: 300 lb/100 sq. ft. (15 kg/sq. m) for gravel or crushed stone 200 lb/100 sq. ft. (10 kg/sq. m) for slag, average.
 6. Walkway Pads: Install walkway pads using units of size indicated or, if not indicated, of manufacturer's standard size according to walkway pad manufacturer's written instructions.
 - a. Sweep away loose aggregate surfacing and set walkway pads in additional flood coat of hot coal-tar pitch.

H. Flashing And Stripping Installation

1. Install base flashing over cant strips and other sloping and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrates according to built-up roofing manufacturer's written instructions and as follows:
 - a. Prime substrates with asphalt primer if required by built-up roofing manufacturer.
 - b. Backer Sheet Application: Install single backer sheet and adhere to substrate in a solid mopping of hot roofing asphalt **OR** asphalt roofing cement **OR** SBS-modified asphalt roofing cement **OR** cold-applied adhesive, **as directed**.
OR
Backer Sheet Application: Install two **OR** three, **as directed**, backer sheets and adhere to substrate in a solid mopping of hot roofing asphalt **OR** asphalt roofing cement, **as directed**.
 - c. Flashing Sheet Application: Adhere flashing sheet to substrate in a solid mopping of hot roofing asphalt applied at not less than 425 deg F (218 deg C). Apply hot roofing asphalt to back of flashing sheet if recommended by roofing manufacturer.
OR
Flashing Sheet Application: Adhere flashing sheet to substrate in SBS-modified asphalt roofing cement **OR** asphalt roofing cement, **as directed**.
2. Extend base flashing up walls or parapets a minimum of 8 inches (200 mm) above built-up roofing and 4 inches (100 mm) onto field of built-up roofing.
3. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.
 - a. Securely fasten top termination of base flashing with continuous metal termination bar anchored into substrate.
 - b. Seal top termination of base flashing with a strip of glass-fiber fabric set in asphalt roofing cement, **as directed**.
4. Apply roof coatings to smooth base flashings according to manufacturer's written instructions, by spray, roller, or other suitable application method.
5. Install stripping, according to roofing system manufacturer's written instructions, where metal flanges and edgings are set on built-up roofing.
 - a. Flashing-Sheet Stripping: Install flashing-sheet stripping in a cold-applied adhesive or in a solid mopping of hot coal-tar pitch and extend onto roofing membrane.

**OR**

Built-up Stripping: Install stripping of not less than two roofing membrane ply sheets, setting each ply in a continuous coal-tar roofing cement or in a solid mopping of hot coal-tar pitch, and extend onto roofing membrane 4 inches (100 mm) and 6 inches (150 mm), respectively.

6. Roof Drains: Set 30-by-30-inch (760-by-760-mm) metal flashing in bed of asphalt roofing cement on completed built-up roofing. Cover metal flashing with built-up roofing cap-sheet stripping and extend a minimum of 4 inches (100 mm) **OR** 6 inches (150 mm), **as directed**, beyond edge of metal flashing onto field of built-up roofing. Clamp built-up roofing, metal flashing, and stripping into roof-drain clamping ring.

- a. Flashing-Sheet Stripping: Install flashing-sheet stripping in cold-applied adhesive or in a solid mopping of hot coal-tar pitch and extend onto roofing membrane.

OR

Built-up Stripping: Install stripping of not less than 2 roofing membrane ply sheets, setting each ply in a continuous coating of coal-tar roofing cement or in a solid mopping of hot coal-tar pitch, and extend onto roofing membrane 4 inches (100 mm) and 6 inches (150 mm), respectively.

I. Field Quality Control

1. Testing Agency: Perform roof tests and inspections, observe flood tests, and prepare test reports.
2. Test Cuts: Test specimens will be removed to evaluate problems observed during quality-assurance inspections of built-up roofing as follows:
 - a. Approximate quantities of components within built-up roofing will be determined according to ASTM D 3617.
 - b. Test specimens will be examined for interply voids according to ASTM D 3617 and to comply with criteria established in Appendix 3 of ARMA/NRCA's "Quality Control Guidelines for the Application of Built-up Roofing."
 - c. Repair areas where test cuts were made according to built-up roofing manufacturer's written instructions.
3. Flood Testing: Flood test each roofing membrane area for leaks, according to recommendations in ASTM D 5957, after completing roofing and flashing but before overlying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.
 - a. Flood to an average depth of 2-1/2 inches (65 mm) with a minimum depth of 1 inch (25 mm) and not exceeding a depth of 4 inches (100 mm). Maintain 2 inches (50 mm) of clearance from top of base flashing.
 - b. Flood each area for 24 **OR** 48 **OR** 72, **as directed**, hours.
 - c. After flood testing, repair leaks, repeat flood tests, and make further repairs until roofing and flashing installations are watertight.
4. Repair or remove and replace components of roofing system where test results or inspections indicate that they do not comply with specified requirements.
 - a. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

J. Protecting And Cleaning

1. Protect built-up roofing from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to the Owner.
2. Correct deficiencies in or remove built-up roofing that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Final Completion and according to warranty requirements.
3. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.



END OF SECTION 07 05 13 00



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SECTION 07 05 13 00a - CSPE MEMBRANE ROOFING

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for chlorosulfonate-polyethylene (CSPE) roofing. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Adhered CSPE membrane roofing system.
 - b. Mechanically fastened CSPE membrane roofing system.
 - c. Loosely laid and ballasted CSPE membrane roofing system.
 - d. Vapor retarder.
 - e. Roof insulation.
2. Section includes the installation of acoustical roof deck rib insulation strips furnished under Division 05 Section "Steel Decking".

C. Definitions

1. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

D. Performance Requirements

1. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.
2. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.
3. Roofing System Design: Provide membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7.
4. FM Approvals Listing, **as directed**: Provide membrane roofing, base flashings, and component materials that comply with requirements in FM Approvals 4450 and FM Approvals 4470 as part of a membrane roofing system, and that are listed in FM Approvals' "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals markings.
 - a. Fire/Windstorm Classification: Class 1A-60 **OR** Class 1A-75 **OR** Class 1A-90 **OR** Class 1A-105 **OR** Class 1A-120 **OR** Class 1A-135 **OR** Class 1A-150 **OR** Class 1A-165, **as directed**.
 - b. Hail Resistance: MH **OR** SH, **as directed**.
5. Energy Performance: Provide roofing system with initial Solar Reflectance Index not less than 78 **OR** 29, **as directed**, when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency.
6. Energy Performance: Provide roofing system that is listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low **OR** steep, **as directed**, -slope roof products.
7. Energy Performance (for roofs that must comply with California Energy Commission's CEC-Title 24): Provide roofing system with initial solar reflectance not less than 0.70 and emissivity not less than 0.75 when tested according to CRRC-1.

E. Submittals

1. Product Data: For each type of product indicated.



2. LEED Submittals:
 - a. Product Test Reports for Credit SS 7.2: For roof materials, documentation indicating that roof materials comply with Solar Reflectance Index requirement.
 - b. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.
 3. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.
 4. Samples: For each product included in the roofing system.
 5. Research/evaluation reports.
 6. Field quality-control reports.
 7. Maintenance data.
 8. Warranties: Sample of special warranties.
- F. Quality Assurance
1. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by membrane roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.
 2. Source Limitations: Obtain components for membrane roofing system from same manufacturer as membrane roofing or approved by membrane roofing manufacturer.
 3. Exterior Fire-Test Exposure: ASTM E 108, Class A **OR** Class B **OR** Class C, **as directed**; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.
 4. Fire-Resistance Ratings: Where indicated, provide fire-resistance-rated roof assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 5. Preinstallation Roofing Conference: Conduct conference at Project site.
- G. Delivery, Storage, And Handling
1. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
 2. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
 - a. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
 3. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
 4. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.
- H. Project Conditions
1. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.
- I. Warranty
1. Special Warranty: Manufacturer's standard or customized form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within 10 **OR** 15, **as directed**, years from date of Final Completion.



1.2 PRODUCTS

- A. CSPE Membrane Roofing
1. CSPE: ASTM D 5019, Type 1, Grade 2, 45-mil- (1.1-mm-) thick, reinforced, flexible uncured sheet formed from CSPE, and as follows:
 - a. Exposed Face Color: White **OR** Blue **OR** Light gray **OR** Tan, **as directed**.
- B. Auxiliary Membrane Roofing Materials
1. General: Auxiliary membrane roofing materials recommended by roofing system manufacturer for intended use, and compatible with membrane roofing.
 - a. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
 - b. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1) Plastic Foam Adhesives: 50 g/L.
 - 2) Gypsum Board and Panel Adhesives: 50 g/L.
 - 3) Multipurpose Construction Adhesives: 70 g/L.
 - 4) Fiberglass Adhesives: 80 g/L.
 - 5) Contact Adhesive: 80 g/L.
 - 6) Single-Ply Roof Membrane Sealants: 450 g/L.
 - 7) Nonmembrane Roof Sealants: 300 g/L.
 - 8) Sealant Primers for Nonporous Substrates: 250 g/L.
 - 9) Sealant Primers for Porous Substrates: 775 g/L.
 - 10) Other Adhesives and Sealants: 250 g/L.
 2. Sheet Flashing: 45-mil- (1.1-mm-) thick, reinforced and 55-mil- (1.4-mm-) thick, non-reinforced CSPE as recommended by roofing system manufacturer for intended use.
 3. Bonding Adhesive: Manufacturer's standard, water based, **as directed**.
 4. Slip Sheet: Manufacturer's standard, of thickness required for application.
 5. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.
 6. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick (25 mm wide by 1.3 mm thick), prepunched.
 7. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.
 8. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.
- C. Substrate Boards
1. Substrate Board: ASTM C 1396/C 1396M, Type X gypsum board, 5/8 inch (16 mm) thick.
OR
Substrate Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/4 inch (6 mm) **OR** 1/2 inch (13 mm) **OR** Type X, 5/8 inch (16 mm), **as directed**, thick.
OR
Substrate Board: ASTM C 1278/C 1278M, cellulosic-fiber-reinforced, water-resistant gypsum substrate, 1/4 inch (6 mm) **OR** 3/8 inch (10 mm) **OR** 1/2 inch (13 mm) **OR** 5/8 inch (16 mm), **as directed**, thick.
OR
Substrate Board: ASTM C 728, perlite board, 3/4 inch (19 mm) **OR** 1 inch (25 mm), **as directed**, thick, seal coated.
 2. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate board to roof deck.
- D. Vapor Retarder



1. Polyethylene Film: ASTM D 4397, 6 mils (0.15 mm) thick, minimum, with maximum permeance rating of 0.13 perm (7.5 ng/Pa x s x sq. m).
 - a. Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
 - b. Adhesive: Manufacturer's standard lap adhesive, FM Approvals approved for vapor-retarder application.
2. Laminated Sheet: Kraft paper, two layers, laminated with asphalt and edge reinforced with woven fiberglass yarn with maximum permeance rating of 0.50 perm (29 ng/Pa x s x sq. m) and with manufacturer's standard adhesive, **as directed**.
3. Glass-Fiber Felts: ASTM D 2178, Type IV, asphalt impregnated.

E. Roof Insulation

1. General: Preformed roof insulation boards manufactured or approved by CSPE membrane roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated and that produce FM Approvals-approved roof insulation, **as directed**.
2. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, 1.6-lb/cu. ft. (26-kg/cu. m) **OR** Type X, 1.3-lb/cu. ft. (21-kg/cu. m), **as directed**, minimum density, square edged.
3. Molded-Polystyrene Board Insulation: ASTM C 578, Type II, 1.35-lb/cu. ft. (22-kg/cu. m) **OR** Type VIII, 1.15-lb/cu. ft. (18-kg/cu. m) **OR** Type IX, 1.8-lb/cu. ft. (29-kg/cu. m), **as directed**, minimum density.
4. Composite Molded-Polystyrene Board Insulation: ASTM C 578, Type II, 1.35-lb/cu. ft. (22-kg/cu. m) **OR** Type VIII, 1.15-lb/cu. ft. (18-kg/cu. m) **OR** Type IX, 1.8-lb/cu. ft. (29-kg/cu. m), **as directed**, minimum density, with factory-applied facings, as follows:
 - a. Facer: ASTM C 208, Type II, Grade 2, cellulosic-fiber insulation board, asphalt coated, 1/2 inch (13 mm) thick.
OR
Facer: DOC PS 2, Exposure 1, OSB, 7/16 inch (11 mm) thick.
5. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2 **OR** Type II, Class I, Grade 3, **as directed**, felt or glass-fiber mat facer on both major surfaces.
6. Composite Polyisocyanurate Board Insulation: ASTM C 1289, with factory-applied facing board on one major surface, as indicated below by type, and felt or glass-fiber mat facer on the other.
 - a. Type IV, cellulosic-fiber-insulating-board facer, Grade 2, 1/2 inch (13 mm) thick.
 - b. Type V, OSB facer, 7/16 inch (11 mm) thick.
 - c. Type VII, glass mat faced gypsum board facer, 1/4 inch (6 mm) thick.
7. Perlite Board Insulation: ASTM C 728, rigid, mineral-aggregate thermal insulation board composed of expanded perlite, cellulosic fibers, binders, and waterproofing agents with top surface seal coated.
8. Cellulosic-Fiber Board Insulation: ASTM C 208, Type II, Grade 2, fibrous-felted, rigid insulation boards of wood fiber or other cellulosic-fiber and water-resistant binders, asphalt impregnated, chemically treated for deterioration.
9. Cellular-Glass Board Insulation: ASTM C 552, Type IV, rigid, cellular-glass thermal board insulation faced with manufacturer's standard kraft-paper sheets.
10. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48) unless otherwise indicated.
11. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

F. Insulation Accessories

1. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with membrane roofing.
2. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards, **as directed**, to substrate, and acceptable to roofing system manufacturer.



3. Modified Asphaltic Insulation Adhesive: Insulation manufacturer's recommended modified asphalt, asbestos-free, cold-applied adhesive formulated to attach roof insulation to substrate or to another insulation layer.
 4. Bead-Applied Insulation Adhesive: Insulation manufacturer's recommended bead-applied, low-rise, one- or multicomponent urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.
 5. Full-Spread Applied Insulation Adhesive: Insulation manufacturer's recommended spray-applied, low-rise, two-component urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.
 6. Cover Board: ASTM C 208, Type II, Grade 2, cellulosic-fiber insulation board, 1/2 inch (13 mm) thick.
OR
Cover Board: DOC PS 2, Exposure 1, OSB, 7/16 inch (11 mm) thick.
OR
Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/4 inch (6 mm) **OR** 1/2 inch (13 mm) **OR** 5/8 inch (16 mm), **as directed**, thick, factory primed, **as directed**.
OR
Cover Board: ASTM C 1278/C 1278M, cellulosic-fiber-reinforced, water-resistant gypsum substrate, 1/4 inch (6 mm) **OR** 3/8 inch (10 mm) **OR** 1/2 inch (13 mm) **OR** 5/8 inch (16 mm), **as directed**, thick.
 7. Protection Mat: Woven or nonwoven polypropylene, polyolefin, or polyester fabric, water permeable and resistant to UV degradation, type and weight as recommended by roofing system manufacturer for application.
- G. Asphalt Materials
1. Roofing Asphalt: ASTM D 312, Type III or Type IV **OR** ASTM D 6152, SEBS modified, **as directed**.
 2. Asphalt Primer: ASTM D 41.
- H. Aggregate Ballast (for loosely laid and aggregate-ballasted installations)
1. Aggregate Ballast: Provide aggregate ballast that will withstand weather exposure without significant deterioration and will not contribute to membrane degradation, of the following type and size:
 - a. Aggregate Type: Smooth, washed, riverbed gravel or other acceptable smooth-faced stone **OR** Crushed gravel or crushed stone, **as directed**.
 - b. Size: ASTM D 448, Size 4, ranging in size from 3/4 to 1-1/2 inches (19 to 38 mm).
OR
Size: ASTM D 448, Size 2, ranging in size from 1-1/2 to 2-1/2 inches (38 to 63 mm).
OR
Size: ASTM D 448, Size 3, ranging in size from 1 to 2 inches (25 to 50 mm).
- I. Roof Pavers
1. Lightweight Roof Pavers: Interlocking, lightweight concrete units, specially factory cast for use as roof ballast; grooved back, with four-way drainage capability; beveled, doweled, or otherwise profiled; and as follows:
 - a. Size: 8 by 16 inches (200 by 400 mm) **OR** 12 by 12 inches (300 by 300 mm) **OR** 12 by 16-1/2 inches (300 by 420 mm) **OR** 12 by 18 inches (300 by 450 mm), **as directed**.
 - b. Weight: At least 10 lb/sq. ft. (50 kg/sq. m) but not exceeding 18 lb/sq. ft. (90 kg/sq. m).
 - c. Compressive Strength: 2500 psi (17 MPa) **OR** 5000 psi (34 MPa), **as directed**, minimum.
 - d. Colors and Textures: As selected from manufacturer's full range.
 2. Heavyweight Roof Pavers: Heavyweight, hydraulically pressed, concrete units, square edged **OR** with top edges beveled 3/16 inch (5 mm), **as directed**, factory cast for use as roof pavers; absorption not greater than 5 percent, ASTM C 140; no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance, ASTM C 67; and as follows:



- a. Size: 12 by 12 inches (300 by 300 mm) **OR** 18 by 18 inches (450 by 450 mm) **OR** 24 by 24 inches (600 by 600 mm), **as directed**. Manufacture pavers to dimensional tolerances of plus or minus 1/16 inch (1.6 mm) in length, height, and thickness.
- b. Weight: 18 lb/sq. ft. (90 kg/sq. m) **OR** 22 lb/sq. ft. (110 kg/sq. m), **as directed**.
- c. Compressive Strength: 7500 psi (52 MPa) **OR** 6500 psi (45 MPa), **as directed**, minimum.
- d. Colors and Textures: As selected from manufacturer's full range.

J. Walkways

1. Flexible Walkways: Factory-formed, nonporous, heavy-duty, solid-rubber, slip-resisting, surface-textured walkway pads **OR** rolls, **as directed**, approximately 3/16 inch (5 mm) thick, and acceptable to membrane roofing system manufacturer.
2. Walkway Roof Pavers: Heavyweight, hydraulically pressed, concrete units, square edged **OR** with top edges beveled 3/16 inch (5 mm), **as directed**, factory cast for use as roof pavers; absorption not greater than 5 percent, ASTM C 140; no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance, ASTM C 67; and as follows:
 - a. Size: 12 by 12 inches (300 by 300 mm) **OR** 18 by 18 inches (450 by 450 mm) **OR** 24 by 24 inches (600 by 600 mm), **as directed**. Manufacture pavers to dimensional tolerances of plus or minus 1/16 inch (1.6 mm) in length, height, and thickness.
 - b. Weight: 18 lb/sq. ft. (90 kg/sq. m) **OR** 22 lb/sq. ft. (110 kg/sq. m), **as directed**.
 - c. Compressive Strength: 7500 psi (52 MPa) **OR** 6500 psi (45 MPa), **as directed**, minimum.
 - d. Colors and Textures: As selected from manufacturer's full range.

1.3 EXECUTION

A. Preparation

1. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
2. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
3. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
4. Install acoustical roof deck rib insulation strips, specified in Division 05 Section "Steel Decking", according to acoustical roof deck manufacturer's written instructions, immediately before installation of overlying construction and to remain dry.

B. Substrate Board

1. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.
 - a. Fasten substrate board to top flanges of steel deck according to recommendations in FM Approvals' "RoofNav" and FM Global Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification.
OR
Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to membrane roofing system manufacturers' written instructions.

C. Vapor-Retarder Installation

1. Polyethylene Film: Loosely lay polyethylene-film vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 inches (50 mm) and 6 inches (150 mm), respectively.
 - a. Continuously seal side and end laps with tape **OR** adhesive, **as directed**.



2. Laminate Sheet: Install laminate-sheet vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 inches (50 mm) and 6 inches (150 mm), respectively. Bond vapor retarder to substrate as follows:
 - a. Apply adhesive at rate recommended by vapor-retarder manufacturer. Seal laps with adhesive.
OR
Apply ribbons of hot roofing asphalt at spacing, temperature, and rate recommended by vapor-retarder manufacturer. Seal laps with hot roofing asphalt.
3. Built-Up Vapor Retarder: Install two glass-fiber felt plies lapping each felt 19 inches (483 mm) over preceding felt. Embed each felt in a solid mopping of hot roofing asphalt. Glaze-coat completed surface with hot roofing asphalt. Apply hot roofing asphalt within plus or minus 25 deg F (14 deg C) of equiviscous temperature.
4. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into membrane roofing system.

D. Insulation Installation

1. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
2. Comply with membrane roofing system and insulation manufacturer's written instructions for installing roof insulation.
3. Install tapered insulation under area of roofing to conform to slopes indicated.
4. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches (68 mm) or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.
 - a. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
5. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
6. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
 - a. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
7. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:
 - a. Prime surface of concrete deck with asphalt primer at rate of 3/4 gal./100 sq. ft. (0.3 L/sq. m) and allow primer to dry.
 - b. Set each layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F (14 deg C) of equiviscous temperature.
 - c. Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
OR
Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.
8. Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
 - a. Fasten insulation according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.
OR
Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.
9. Mechanically Fastened and Adhered Insulation: Install each layer of insulation and secure first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
 - a. Fasten first layer of insulation according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.

**OR**

Fasten first layer of insulation to resist uplift pressure at corners, perimeter, and field of roof.

- b. Set each subsequent layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F (14 deg C) of equiviscous temperature.

OR

Set each subsequent layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.

OR

Set each subsequent layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

- 10. Loosely Laid Insulation: Loosely lay insulation units over substrate.
- 11. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches (150 mm) in each direction. Loosely butt cover boards together and fasten to roof deck, **as directed**.
 - a. Fasten cover boards according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.
- OR**
- 12. Fasten cover boards to resist uplift pressure at corners, perimeter, and field of roof.
- 12. Install slip sheet over insulation **OR** cover board, **as directed**, and immediately beneath membrane roofing.

E. Adhered Membrane Roofing Installation

- 1. Adhere membrane **OR** fabric-backed membrane, **as directed**, roofing over area to receive roofing according to membrane roofing system manufacturer's written instructions. Unroll membrane roofing and allow to relax before installing.
- 2. Start installation of membrane roofing in presence of membrane roofing system manufacturer's technical personnel.
- 3. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- 4. Bonding Adhesive: Apply to substrate and underside of membrane roofing at rate required by manufacturer and allow to partially dry before installing membrane roofing. Do not apply to splice area of membrane roofing.
- 5. In addition to adhering, mechanically fasten membrane roofing securely at terminations, penetrations, and perimeter of roofing.
- 6. Apply membrane roofing with side laps shingled with slope of roof deck where possible.
- 7. Seams: Clean seam areas, overlap membrane roofing, and weld side and end laps of membrane roofing and sheet flashings according to manufacturer's written instructions to ensure a watertight seam installation. Complete welding of seams within 24 hours of exposing CSPE sheet or before curing of CSPE sheet has begun. Weld seams as follows:
 - a. Weld Method: Hot air **OR** Solvent, **as directed**.
 - b. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet membrane.
 - c. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
 - d. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.
- 8. Spread sealant bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.
- 9. Install membrane roofing and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition and to not void warranty for existing membrane roofing system.

F. Mechanically Fastened Membrane Roofing Installation

- 1. Mechanically fasten membrane roofing over area to receive roofing and install according to roofing system manufacturer's written instructions.
 - a. For in-splice attachment, install membranes roofing with long dimension perpendicular to steel roof deck flutes.



2. Start installation of membrane roofing in presence of roofing system manufacturer's technical personnel.
3. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
4. Mechanically fasten or adhere membrane roofing securely at terminations, penetrations, and perimeter of roofing.
5. Apply membrane roofing with side laps shingled with slope of roof deck where possible.
6. In-Seam Attachment: Secure one edge of CSPE sheet using fastening plates or metal battens centered within membrane seam and mechanically fasten CSPE sheet to roof deck.
7. Seams: Clean seam areas, overlap membrane roofing, and weld side and end laps of membrane roofing and sheet flashings according to manufacturer's written instructions to ensure a watertight seam installation. Complete welding of seams within 24 hours of exposing CSPE sheet or before curing of CSPE sheet has begun. Weld seams as follows:
 - a. Weld Method: Hot air **OR** Solvent, **as directed**.
 - b. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet membrane.
 - c. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
 - d. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.
8. Spread sealant bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.
9. Install membrane roofing and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition and to not void warranty for existing membrane roofing system.

G. Loosely Laid And Ballasted Membrane Roofing Installation

1. Loosely lay membrane roofing over area to receive roofing and install according to roofing system manufacturer's written instructions.
 - a. Comply with requirements in SPRI RP-4 for System 1 **OR** System 2 **OR** System 3, **as directed**.
2. Start installation of membrane roofing in presence of roofing system manufacturer's technical personnel.
3. Accurately align membrane roofing, without stretching, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
4. Mechanically fasten or adhere perimeter of membrane roofing according to requirements in SPRI RP-4.
OR
Mechanically fasten **OR** adhere, **as directed**, membrane roofing at corners, perimeters, and transitions according to requirements in SPRI RP-4.
 - a. At corners and perimeters, omit aggregate ballast leaving membrane roofing exposed.
 - b. At corners and perimeters, adhere a second layer of membrane roofing.
5. Apply membrane roofing with side laps shingled with slope of deck where possible.
6. Seams: Clean seam areas, overlap membrane roofing, and weld side and end laps of membrane roofing and sheet flashings according to manufacturer's written instructions to ensure a watertight seam installation. Complete welding of seams within 24 hours of exposing CSPE sheet or before curing of CSPE sheet has begun. Weld seams as follows:
 - a. Weld Method: Hot air **OR** Solvent, **as directed**.
 - b. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet membrane.
 - c. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
 - d. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.
7. Spread sealant bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.
8. Install membrane roofing and auxiliary materials to tie in to existing roofing.
9. Install protection mat over membrane roofing, overlapping a minimum of 6 inches (150 mm). Install an additional protection mat layer at projections, pipes, vents, and drains, overlapping a minimum of 12 inches (300 mm).



10. Aggregate Ballast: Apply uniformly over membrane roofing at the rate required by membrane roofing system manufacturer, but not less than the following, spreading with care to minimize possibility of damage to membrane roofing system. Lay ballast as membrane roofing is installed, leaving membrane roofing ballasted at the end of the workday.
- a. Ballast Weight: Size 4 aggregate, 10 lb/sq. ft. (50 kg/sq. m).
OR
 Ballast Weight: Size 2 aggregate, 13 lb/sq. ft. (65 kg/sq. m), at corners and perimeter; Size 4 aggregate, 10 lb/sq. ft. (50 kg/sq. m), elsewhere.
OR
 Ballast Weight: Size 2 aggregate, 13 lb/sq. ft. (65 kg/sq. m).
11. Roof-Paver Ballast: Install lightweight **OR** heavyweight, **as directed**, roof-paver ballast according to manufacturer's written instructions.
- OR**
- Roof-Paver and Aggregate Ballast: Install heavyweight roof pavers according to manufacturer's written instructions on roof corners and perimeter.
- a. Install Size 4 aggregate ballast elsewhere on roofing at a minimum rate of 10 lb/sq. ft. (50 kg/sq. m).
OR
 Install Size 2 aggregate ballast elsewhere on roofing at a minimum rate of 13 lb/sq. ft. (65 kg/sq. m).
- H. Base Flashing Installation
1. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.
 2. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply to seam area of flashing.
 3. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
 4. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Weld side and end laps to ensure a watertight seam installation. Complete welding of seams within 24 hours of exposing CSPE sheet or before curing of CSPE sheet has begun.
 5. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars, **as directed**.
- I. Walkway Installation
1. Flexible Walkways: Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.
 2. Roof-Paver Walkways: Install walkway roof pavers according to manufacturer's written instructions in locations indicated, to form walkways. Leave 3 inches (75 mm) of space between adjacent roof pavers.
- J. Field Quality Control
1. Testing Agency: Engage a qualified testing agency to perform inspections.
 2. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
 3. Repair or remove and replace components of membrane roofing system where inspections indicate that they do not comply with specified requirements.
 4. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- K. Protecting And Cleaning
1. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for



- deterioration and damage, describing its nature and extent in a written report, with copies to Owner.
2. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Final Completion and according to warranty requirements.
 3. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 05 13 00a



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**SECTION 07 05 13 00b - APP-MODIFIED BITUMINOUS MEMBRANE ROOFING**

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for atactic-polypropylene (APP) modified bituminous membrane roofing. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Atactic-polypropylene (APP) modified bituminous membrane roofing.
 - b. Hybrid roofing system that combines built-up ply sheets with APP-modified bituminous membrane.
 - c. Vapor retarder.
 - d. Roof insulation.
2. Section includes the installation of insulation strips in ribs of acoustical roof deck. Insulation strips are furnished under Division 05 Section "Steel Decking".

C. Definitions

1. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.
2. Hot Roofing Asphalt: Roofing asphalt heated to its equiviscous temperature, the temperature at which its viscosity is 125 centipoise for mop-applied roofing asphalt and 75 centipoise for mechanical spreader-applied roofing asphalt, within a range of plus or minus 25 deg F (14 deg C), measured at the mop cart or mechanical spreader immediately before application.

D. Performance Requirements

1. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.
2. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.
3. Roofing System Design: If membrane roofing system is to be designed to withstand uplift pressure established by ASCE/SEI 7, provide membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7.
 - a. Corner Uplift Pressure: as directed by the Owner.
 - b. Perimeter Uplift Pressure: as directed by the Owner.
 - c. Field-of-Roof Uplift Pressure: as directed by the Owner.
4. FM Approvals Listing: If Project is FM Global insured or if FM Approvals requirements will set a minimum quality standard, provide membrane roofing, base flashings, and component materials that comply with requirements in FM Approvals 4450 and FM Approvals 4470 as part of a membrane roofing system, and that are listed in FM Approvals' "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals markings.
 - a. Fire/Windstorm Classification: Class 1A-60 **OR** Class 1A-75 **OR** Class 1A-90 **OR** Class 1A-105 **OR** Class 1A-120, **as directed**.
 - b. Hail Resistance Rating: MH **OR** SH, **as directed**.
5. Energy Performance (if required for LEED-NC Credit SS 7.2): Provide roofing system with initial Solar Reflectance Index not less than 78 when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency.

**OR**

Energy Performance(for roofs that must comply with DOE's ENERGY STAR requirements): Provide roofing system that is listed on DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.

OR

Energy Performance(for roofs that must comply with California Energy Commission's CEC-Title 24): Provide roofing system with initial Solar Reflectance not less than 0.70 and Thermal Emittance not less than 0.75 when tested according to Cool Roof Rating Council's CRRC-1.

E. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:
 - a. Product Test Reports for Credit SS 7.2: For roof materials, indicating that roof materials comply with Solar Reflectance Index requirement.
 - b. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.
3. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.
 - a. Base flashings and membrane terminations.
 - b. Tapered insulation, including slopes.
 - c. Crickets, saddles, and tapered edge strips, including slopes.
 - d. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
4. Samples: For the following products:
 - a. Sheet roofing materials, including base sheet, base-ply sheet, roofing membrane sheet, flashing backer sheet, membrane cap sheet and flashing sheet, of color specified.
 - b. Roof insulation.
 - c. Walkway pads or rolls.
 - d. Six insulation fasteners of each type, length, and finish.
5. Qualification Data: For qualified Installer, manufacturer and testing agency.
6. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - a. Submit evidence of complying with performance requirements.
7. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of membrane roofing system.
8. Research/Evaluation Reports: For components of membrane roofing system, from the ICC-ES **OR** applicable model code organization, **as directed**.
9. Maintenance Data: For roofing system to include in maintenance manuals.
10. Warranties: Sample of special warranties.

F. Quality Assurance

1. Manufacturer Qualifications: A qualified manufacturer that is UL listed **OR** FM Approvals approved, **as directed**, for membrane roofing system identical to that used for this Project.
2. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by membrane roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.
3. Source Limitations: Obtain components including roof insulation and fasteners for membrane roofing system from same manufacturer as membrane roofing or approved by membrane roofing manufacturer.
4. Exterior Fire-Test Exposure: ASTM E 108, Class A **OR** Class B **OR** Class C, **as directed**; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.
5. Fire-Resistance Ratings: Where indicated, provide fire-resistance-rated roof assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.



6. Preinstallation Roofing Conference: Conduct conference at Project site.

G. Delivery, Storage, And Handling

1. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
2. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
 - a. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
3. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
4. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

H. Project Conditions

1. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

I. Warranty

1. Special Warranty: Manufacturer's standard or customized form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period.
 - a. Special warranty includes membrane roofing, base flashings, roof insulation, fasteners, cover boards, substrate board, roofing accessories, and other components of membrane roofing system.
 - b. Warranty Period: 10 **OR** 15 **OR** 20 **OR** 25 **OR** 30, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. APP-Modified Asphalt-Sheet Materials

1. Roofing Membrane Sheet: ASTM D 6222, Grade S, Type I or II, APP-modified asphalt sheet (reinforced with polyester fabric) **OR** ASTM D 6223, Grade S, Type I or II, APP-modified asphalt sheet (reinforced with a combination of polyester fabric and glass fibers), **as directed**; smooth surfaced; suitable for application method specified.
2. Smooth-Surfaced Roofing Membrane Cap Sheet: ASTM D 6222, Grade S, Type I or II, APP-modified asphalt sheet (reinforced with polyester fabric) **OR** ASTM D 6223, Grade S, Type I or II, APP-modified asphalt sheet (reinforced with a combination of polyester fabric and glass fibers), **as directed**; smooth surfaced; suitable for application method specified.
OR
Granule-Surfaced Roofing Membrane Cap Sheet: ASTM D 6222, Grade G, Type I or II, APP-modified asphalt sheet (reinforced with polyester fabric) **OR** ASTM D 6223, Grade G, Type I or II, APP-modified asphalt sheet (reinforced with a combination of polyester fabric and glass fibers), **as directed**; granular surfaced; suitable for application method specified, and as follows:
 - a. Granule Material: Mineral ceramic coated **OR** slate, **as directed**.
 - b. Granule Color: White **OR** Gray **OR** Tan, **as directed**.

B. Base-Sheet Materials

1. Sheathing Paper: Red-rosin type, minimum 3 lb/100 sq. ft. (0.16 kg/sq. m).
2. Base Sheet: ASTM D 4601, Type II, SBS-modified, asphalt-impregnated and -coated sheet, with glass-fiber-reinforcing mat, dusted with fine mineral surfacing on both sides.



- a. Weight: 25 lb/100 sq. ft. (1.2 kg/sq. m) **OR** 40 lb/100 sq. ft. (1.95 kg/sq. m) **OR** 50 lb/100 sq. ft. (2.4 kg/sq. m) **OR** 60 lb/100 sq. ft. (2.9 kg/sq. m) **OR** 75 lb/100 sq. ft. (3.7 kg/sq. m), **as directed**, minimum.

OR

Base Sheet: ASTM D 4601, Type I **OR** Type II, **as directed**, nonperforated, asphalt-impregnated and -coated, glass-fiber sheet, dusted with fine mineral surfacing on both sides.

OR

Base Sheet: ASTM D 4897, Type II, venting, nonperforated, heavyweight, asphalt-impregnated and -coated, glass-fiber base sheet with coarse granular surfacing or embossed venting channels on bottom surface.

OR

Base Sheet: ASTM D 2626, asphalt-saturated and -coated organic felt, dusted with fine mineral surfacing on both sides.

C. Base-Ply Sheet Materials

1. Glass-Fiber Base-Ply Sheet: ASTM D 2178, Type IV **OR** Type VI, **as directed**, asphalt-impregnated, glass-fiber felt.

D. Base Flashing Sheet Materials

1. Backer Sheet: ASTM D 4601, Type I **OR** Type II, **a directed**, asphalt-impregnated and -coated, glass-fiber sheet, dusted with fine mineral surfacing on both sides.

OR

Backer Sheet: ASTM D 2626, asphalt-saturated and -coated organic felt, dusted with fine mineral surfacing on both sides.

OR

Backer Sheet: ASTM D 6222, Grade S, Type I or II, APP-modified asphalt sheet (reinforced with polyester fabric) **OR** ASTM D 6223, Grade S, Type I or II, APP-modified asphalt sheet (reinforced with a combination of polyester fabric and glass fibers), **as directed**; smooth surfaced; suitable for application method specified.

2. Smooth-Surfaced Flashing Sheet: ASTM D 6222, Grade S, Type I or II, APP-modified asphalt sheet (reinforced with polyester fabric) **OR** ASTM D 6223, Grade S, Type I or II, APP-modified asphalt sheet (reinforced with a combination of polyester fabric and glass fibers), **as directed**; smooth surfaced; suitable for application method specified.

OR

Granule-Surfaced Flashing Sheet: ASTM D 6222, Grade G, Type I or II, APP-modified asphalt sheet (reinforced with polyester fabric) **OR** ASTM D 6223, Grade G, Type I or II, APP-modified asphalt sheet (reinforced with a combination of polyester fabric and glass fibers), **as directed**; granular surfaced; suitable for application method specified, and as follows:

- a. Granule Color: White **OR** Gray **OR** Tan, **as directed**.
3. Glass-Fiber Fabric: Woven glass-fiber cloth, treated with asphalt, complying with ASTM D 1668, Type I.

E. Auxiliary Roofing Membrane Materials

1. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing membrane.
- a. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
- b. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
- 1) Plastic Foam Adhesives: 50 g/L.
 - 2) Gypsum Board and Panel Adhesives: 50 g/L.
 - 3) Multipurpose Construction Adhesives: 70 g/L.
 - 4) Fiberglass Adhesives: 80 g/L.
 - 5) Contact Adhesive: 80 g/L.



- 6) Other Adhesives: 250 g/L.
 - 7) Nonmembrane Roof Sealants: 300 g/L.
 - 8) Sealant Primers for Nonporous Substrates: 250 g/L.
 - 9) Sealant Primers for Porous Substrates: 775 g/L.
2. Asphalt Primer: ASTM D 41.
 3. Roofing Asphalt: ASTM D 312, Type III **OR** Type IV **OR** Type III or IV as recommended by roofing system manufacturer for application, **as directed**.
OR
Roofing Asphalt: ASTM D 6152, SEBS modified.
 4. Cold-Applied Adhesive: Roofing system manufacturer's standard asphalt-based, one- or two-part, asbestos-free, cold-applied adhesive specially formulated for compatibility and use with roofing membrane and base flashings.
 5. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required by roofing system manufacturer for application.
 6. Mastic Sealant: Polyisobutylene, plain or modified bitumen; nonhardening, nonmigrating, nonskinning, and nondrying.
 7. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing membrane components to substrate; tested by manufacturer for required pullout strength, and acceptable to roofing system manufacturer.
 8. Metal Flashing Sheet: As specified in Division 07 Section "Sheet Metal Flashing And Trim".
 9. Roofing Granules: Ceramic-coated **OR** Slate, **as directed**, roofing granules, No. 11 screen size with 100 percent passing No. 8 (2.36-mm) sieve and 98 percent of mass retained on No. 40 (0.425-mm) sieve, color to match roofing membrane.
 10. Miscellaneous Accessories: Provide those recommended by roofing system manufacturer.
- F. Substrate Boards
1. Substrate Board: ASTM C 1396/C 1396M, Type X gypsum board, 5/8 inch (16 mm) thick.
OR
Substrate Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/4 inch (6 mm) **OR** 1/2 inch (13 mm) **OR** Type X, 5/8 inch (16 mm), **as directed**, thick, factory primed, **as directed**.
OR
Substrate Board: ASTM C 1278/C 1278M, cellulosic-fiber-reinforced, water-resistant gypsum substrate, 1/4 inch (6 mm) **OR** 3/8 inch (10 mm) **OR** 1/2 inch (13 mm) **OR** 5/8 inch (16 mm), **as directed**, thick.
OR
Substrate Board: ASTM C 728, perlite board, 3/4 inch (19 mm) **OR** 1 inch (25 mm), **as directed**, thick, seal coated.
 2. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate board to roof deck.
- G. Vapor Retarder
1. Polyethylene Film: ASTM D 4397, 6 mils (0.15 mm) thick, minimum, with maximum permeance rating of 0.13 perm (7.5 ng/Pa x s x sq. m).
 - a. Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
OR
Adhesive: Manufacturer's standard lap adhesive, FM Approvals approved for vapor-retarder application.
 2. Laminated Sheet: Kraft paper, two layers, laminated with asphalt and edge reinforced with woven fiberglass yarn, with maximum permeance rating of 0.50 perm (29 ng/Pa x s x sq. m) and with manufacturer's standard adhesive, **as directed**.
 3. Self-Adhering Sheet Vapor Retarder: ASTM D 1970, minimum of 40-mil- (1.0-mm-) thick, polyethylene film laminated to layer of rubberized asphalt adhesive; maximum permeance rating



of 0.1 perm (6 ng/Pa x s x sq. m); cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor-retarder manufacturer.

OR

Self-Adhering Sheet Vapor Retarder: 30- to 40-mil- (0.76- to 1.0-mm-) thick, polyethylene film laminated to layer of butyl rubber adhesive; maximum permeance rating of 0.1 perm (6 ng/Pa x s x sq. m); cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor-retarder manufacturer.

4. Glass-Fiber Felt: ASTM D 2178, Type IV, asphalt impregnated.

H. Roof Insulation

1. General: Preformed roof insulation boards manufactured or approved by roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated and that produce FM Approvals-approved roof insulation, **as directed**.
2. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, 1.6-lb/cu. ft. (26-kg/cu. m) **OR** Type X, 1.3-lb/cu. ft. (21-kg/cu. m), **as directed**, minimum density, square edged.
3. Molded-Polystyrene Board Insulation: ASTM C 578, Type II, 1.35-lb/cu. ft. (22-kg/cu. m) **OR** Type VIII, 1.15-lb/cu. ft. (18-kg/cu. m) **OR** Type IX, 1.8-lb/cu. ft. (29-kg/cu. m), **as directed**, minimum density.
4. Composite Molded-Polystyrene Board Insulation: ASTM C 578, Type II, 1.35-lb/cu. ft. (22-kg/cu. m) **OR** Type VIII, 1.15-lb/cu. ft. (18-kg/cu. m) **OR** Type IX, 1.8-lb/cu. ft. (29-kg/cu. m), **as directed**, minimum density, with factory-applied facings, as follows:
 - a. Facer: ASTM C 208, Type II, Grade 2, cellulosic-fiber insulation board, asphalt coated, 1/2 inch (13 mm) thick.

OR

Facer: DOC PS 2, Exposure 1, OSB, 7/16 inch (11 mm) thick.
5. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2 **OR** Type II, Class I, Grade 3, **as directed**, felt or glass-fiber mat facer on both major surfaces.
6. Composite Polyisocyanurate Board Insulation: ASTM C 1289, with factory-applied facing board, as indicated below by type, on one major surface and felt or glass-fiber mat facer on the other surface.
 - a. Type IV, cellulosic-fiber-insulating-board facer, Grade 2, 1/2 inch (13 mm) thick.
 - b. Type V, OSB facer, 7/16 inch (11 mm) thick.
 - c. Type VII, glass-mat-faced gypsum board facer, 1/4 inch (6 mm) thick.
7. Perlite Board Insulation: ASTM C 728, rigid, mineral-aggregate thermal insulation board composed of expanded perlite, cellulosic fibers, binders, and waterproofing agents with top surface seal coated.
8. Cellulosic-Fiber Board Insulation: ASTM C 208, Type II, Grade 2, fibrous-felted, rigid insulation boards of wood fiber or other cellulosic-fiber and water-resistant binders, asphalt impregnated, chemically treated for deterioration.
9. Cellular-Glass Board Insulation: ASTM C 552, Type IV, rigid, cellular-glass thermal board insulation faced with manufacturer's standard kraft-paper sheets.
10. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48) unless otherwise indicated.
11. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

I. Insulation Accessories

1. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with membrane roofing.
2. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards, **as directed**, to substrate, and acceptable to roofing system manufacturer.
3. Modified Asphaltic Insulation Adhesive: Insulation manufacturer's recommended modified asphaltic, asbestos-free, cold-applied adhesive formulated to attach roof insulation to substrate or to another insulation layer.

**OR**

Bead-Applied Insulation Adhesive: Insulation manufacturer's recommended bead-applied, low-rise, one-component or multicomponent urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.

OR

Full-Spread Applied Insulation Adhesive: Insulation manufacturer's recommended spray-applied, low-rise, two-component urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.

4. Insulation Cant Strips: ASTM C 728, perlite insulation board.

OR

Insulation Cant Strips: ASTM C 208, Type II, Grade 1, cellulosic-fiber insulation board.

5. Wood Nailer Strips: Comply with requirements in Division 06 Section(s) "Rough Carpentry" OR "Miscellaneous Rough Carpentry", **as directed**.
6. Tapered Edge Strips: ASTM C 728, perlite insulation board.

OR

Tapered Edge Strips: ASTM C 208, Type II, Grade 1, cellulosic-fiber insulation board.

7. Cover Board: ASTM C 208, Type II, Grade 2, cellulosic-fiber insulation board, 1/2 inch (13 mm) thick.

OR

Cover Board: DOC PS 2, Exposure 1, OSB, 7/16 inch (11 mm) thick.

OR

Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/4 inch (6 mm) **OR** 1/2 inch (13 mm) **OR** 5/8 inch (16 mm), **as directed**, thick, factory primed, **as directed**.

OR

Cover Board: ASTM C 1278/C 1278M, cellulosic-fiber-reinforced, water-resistant gypsum substrate, 1/4 inch (6 mm) **OR** 3/8 inch (10 mm) **OR** 1/2 inch (13 mm) **OR** 5/8 inch (16 mm), **as directed**, thick.

8. Substrate Joint Tape: 6- or 8-inch- (150- or 200-mm-) wide, coated, glass-fiber joint tape.

J. Coating Materials

1. Roof Coating: ASTM D 1227, Type II, Class 1, mineral-colloid-emulsified, fibered **OR** Class 2, chemically emulsified, filled or fibered, **as directed**, asphalt emulsion, asbestos free.
2. Roof Coating: ASTM D 1227, Type III, Class 1, mineral-colloid-emulsified **OR** Class 2, chemically emulsified, **as directed**, asphalt emulsion, nonfibered.
3. Roof Coating: ASTM D 2824, Type I, nonfibered **OR** Type III, fibered, asbestos-free, **as directed**, aluminum-pigmented asphaltic coating.
4. Roof Coating: Acrylic elastomer emulsion coating, formulated for use on bituminous roof surfaces and complying with ASTM D 6083.
 - a. Color: White **OR** Gray **OR** Buff, **as directed**.

K. Walkways

1. Walkway Pads: Reinforced asphaltic composition pads with slip-resisting mineral-granule surface **OR** Polymer-modified, reconstituted rubber pads with slip-resisting textured surface, **as directed**, manufactured as a traffic pad for foot traffic and acceptable to roofing system manufacturer, 3/8 inch (10 mm) **OR** 1/2 inch (13 mm) **OR** 3/4 inch (19 mm), **as directed**, thick, minimum.
2. Walkway Backer Strips: ASTM D 6222, Grade S, Type I or II, APP-modified asphalt sheet (reinforced with polyester fabric) **OR** ASTM D 6223, Grade S, Type I or II, APP-modified asphalt sheet (reinforced with a combination of polyester fabric and glass fibers), **as directed**; smooth surfaced; suitable for application method specified.
3. Walkway Cap Sheet Strips: ASTM D 6222, Grade G, Type I or II, APP-modified asphalt sheet (reinforced with polyester fabric) **OR** ASTM D 6223, Grade G, Type I or II, APP-modified asphalt sheet (reinforced with a combination of polyester fabric and glass fibers), **as directed**; granular surfaced; suitable for application method specified, and as follows:
 - a. Granule Material: Mineral ceramic coated **OR** slate, **as directed**.
 - b. Granule Color: White **OR** Gray **OR** Tan, **as directed**.



1.3 EXECUTION

A. Examination

1. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
 - a. Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.
 - b. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 - c. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Division 05 Section "Steel Decking".
 - d. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
 - e. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 - 1) Test for moisture by pouring 1 pint (0.5 L) of hot roofing asphalt on deck at start of each day's work and at start of each roof area or plane. Do not proceed with roofing work if test sample foams or can be easily and cleanly stripped after cooling.
 - f. Verify that concrete-curing compounds that will impair adhesion of roofing components to roof deck have been removed.
 - g. Verify that deck is securely fastened with no projecting fasteners and with no adjacent units in excess of 1/16 inch (1.6 mm) out of plane relative to adjoining deck.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Preparation

1. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
2. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
3. Prime surface of concrete deck with asphalt primer at a rate of 3/4 gal./100 sq. ft. (0.3 L/sq. m) and allow primer to dry.
4. Install insulation strips in ribs of acoustical roof deck according to acoustical roof deck manufacturer's written instructions.

C. Substrate Board Installation

1. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.
 - a. Fasten substrate board to top flanges of steel deck according to recommendations in FM Approvals' "RoofNav" and FM Global Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification.

OR

Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to membrane roofing system manufacturers' written instructions.

D. Vapor-Retarder Installation

1. Polyethylene Film: Loosely lay polyethylene-film vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 inches (50 mm) and 6 inches (150 mm), respectively.
 - a. Continuously seal side and end laps with tape **OR** adhesive, **as directed**.
2. Laminate Sheet: Install laminate-sheet vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 inches (50 mm) and 6 inches (150 mm), respectively. Bond vapor retarder to substrate as follows:



- a. Apply adhesive at rate recommended by vapor-retarder manufacturer. Seal laps with adhesive.
OR
Apply ribbons of hot roofing asphalt at spacing, temperature, and rate recommended by vapor-retarder manufacturer. Seal laps with hot roofing asphalt.
 3. Self-Adhering Sheet Vapor Retarder: Prime substrate if required by manufacturer. Install self-adhering sheet vapor retarder over area to receive vapor retarder, side and end lapping each sheet a minimum of 3-1/2 inches (90 mm) and 6 inches (150 mm), respectively. Seal laps by rolling.
 4. Built-up Vapor Retarder: Install two glass-fiber felt plies lapping each felt 19 inches (483 mm) over preceding felt. Embed each felt in a solid mopping of hot roofing asphalt. Glaze-coat completed surface with hot roofing asphalt. Apply hot roofing asphalt within plus or minus 25 deg F (14 deg C) of equiviscous temperature.
 5. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into membrane roofing system.
- E. Insulation Installation
1. Comply with roofing system manufacturer's written instructions for installing roof insulation.
 2. If mechanically fastening base sheet to substrate before adhering first layer of insulation, install one lapped base-sheet course and mechanically fasten to substrate according to roofing system manufacturer's written instructions.
 3. Nailer Strips: Mechanically fasten 4-inch nominal- (89-mm actual-) width wood nailer strips of same thickness as insulation perpendicular to sloped roof deck at the following spacing:
 - a. 16 feet (4.88 m) apart for roof slopes steeper than 1 inch per 12 inches (1:12) but less than 3 inches per 12 inches (3:12).
 - b. 48 inches (1220 mm) apart for roof slopes steeper than 3 inches per 12 inches (3:12).
 4. Insulation Cant Strips: Install and secure preformed 45-degree insulation cant strips at junctures of roofing membrane system with vertical surfaces or angle changes more than 45 degrees.
 5. Install tapered insulation under area of roofing to conform to slopes indicated.
 6. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
 - a. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
 7. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches (68 mm) or more, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.
 - a. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
 8. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
 9. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.
 10. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:
 - a. Prime surface of concrete deck with asphalt primer at rate of 3/4 gal./100 sq. ft. (0.3 L/sq. m) and allow primer to dry.
 - b. Set each layer of insulation in a solid mopping of hot roofing asphalt applied within plus or minus 25 deg F (14 deg C) of equiviscous temperature.
OR
Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
OR
Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.
 11. Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.



- a. If Project is FM Global insured or if FM Approvals requirements are proposed as a performance standard, fasten insulation according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.
 - b. If number of fasteners will be based on ASCE/SEI 7's uplift pressure or SPRI's factored-design uplift pressure, fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.
12. Mechanically Fastened and Adhered Insulation: Install first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
- a. If Project is FM Global insured or if FM Approvals requirements are proposed as a performance standard, fasten first layer of insulation according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.
 - b. If fastening is calculated from ASCE/SEI 7's uplift pressure or SPRI's factored-design uplift pressure, fasten first layer of insulation to resist uplift pressure at corners, perimeter, and field of roof.
 - 1) Set each subsequent layer of insulation in a solid mopping of hot roofing asphalt applied within plus or minus 25 deg F (14 deg C) of equiviscous temperature.
OR
Set each subsequent layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
OR
Set each subsequent layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.
 - c. If cover boards will be field installed over roof insulation and immediately below roofing membrane, install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints a minimum of 6 inches (150 mm) in each direction from joints of insulation below. Loosely butt cover boards together and fasten to roof deck, **as directed**. Tape joints if required by roofing system manufacturer.
 - 1) Fasten cover boards according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.
OR
Fasten cover boards to resist uplift pressure at corners, perimeter, and field of roof.
 - 2) Apply hot roofing asphalt to underside, and immediately bond cover board to substrate.

F. Roofing Membrane Installation, General

1. If referencing NRCA's roof assembly identification matrix system, install roofing membrane system according to roofing system manufacturer's written instructions and applicable recommendations in ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing."
 - a. Install roofing system MBA **OR** MBAH, **as directed**,-3 **OR** 4, **as directed**,-N **OR** I **OR** C, **as directed**,-T **OR** L, **as directed**,-S **OR** M, **as directed**, according to roof assembly identification matrix and roof assembly layout illustrations in NRCA's "The NRCA Roofing and Waterproofing Manual" and to requirements in this Section.
2. For roof system that exceeds requirements of NRCA's roof assemblies, install roofing membrane system according to roofing system manufacturer's written instructions and applicable recommendations in ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing" and as follows:
 - a. Deck Type: N (nailable) **OR** I (insulated) **OR** C (concrete or nonnailable), **as directed**.
 - b. Adhering Method: T (torched) **OR** L (cold-applied adhesive), **as directed**.
 - c. Base Sheet: One **OR** One, installed over sheathing paper, **as directed**.
 - d. Number of Glass-Fiber Base-Ply Sheets: One **OR** Two, **as directed**.
 - e. Number of APP-Modified Asphalt Sheets: One **OR** Two, **as directed**.
 - f. Surfacing Type: S (smooth) **OR** M (mineral-granule-surfaced cap sheet), **as directed**.



3. Start installation of roofing membrane in presence of roofing system manufacturer's technical personnel.
 4. Where roof slope exceeds 1/2 inch per 12 inches (1:24) **OR** 3/4 inch per 12 inches (1:18), **as directed**, install roofing membrane sheets parallel with slope.
 - a. Backnail roofing membrane sheets to nailer strips **OR** substrate, **as directed**, according to roofing system manufacturer's written instructions.
 5. Cooperate with testing agencies engaged or required to perform services for installing roofing system.
 6. Coordinate installation of roofing system so insulation and other components of the roofing membrane system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.
 - a. At end of each day's work, provide tie-offs to cover exposed roofing membrane sheets and insulation with a course of coated felt set in roofing cement or hot roofing asphalt, with joints and edges sealed.
 - b. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.
 - c. Remove and discard temporary seals before beginning work on adjoining roofing.
 7. Asphalt Heating: Do not raise roofing asphalt temperature above equiviscous temperature range more than one hour before time of application. Do not exceed roofing asphalt manufacturer's recommended temperature limits during roofing asphalt heating. Do not heat roofing asphalt within 25 deg F (14 deg C) of flash point. Discard roofing asphalt maintained at a temperature exceeding finished blowing temperature for more than four hours.

OR

Asphalt Heating: Heat and apply SEBS-modified roofing asphalt according to roofing system manufacturer's written instructions.
 8. Substrate-Joint Penetrations: Prevent roofing asphalt and adhesives from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.
- G. Base-Sheet Installation
1. If sheathing paper is required over wood decks by roofing system manufacturer, loosely lay one course of sheathing paper, lapping edges and ends a minimum of 2 inches (50 mm) and 6 inches (150 mm), respectively.
 2. Install lapped base-sheet course, extending sheet over and terminating beyond cants. Attach base sheet as follows:
 - a. Mechanically fasten to substrate, for nailable substrate.

OR

Spot- or strip-mop to substrate with hot roofing asphalt.

OR

Adhere to substrate in a solid mopping of hot roofing asphalt **OR** uniform coating of cold-applied adhesive, **as directed**, for nonnailable or insulated substrates.
- H. Base-Ply Sheet Installation
1. Install glass-fiber base-ply sheets according to roofing system manufacturer's written instructions starting at low point of roofing system. Align glass-fiber base-ply sheets without stretching. Extend sheets over and terminate beyond cants.
 - a. Shingle side laps of glass-fiber base-ply sheets uniformly to ensure that required number of glass-fiber base-ply sheets covers substrate at any point. Shingle in direction to shed water.
 - b. Embed each glass-fiber base-ply sheet in a continuous void-free mopping of hot roofing asphalt to form a uniform membrane without glass-fiber base-ply sheets touching.
- I. APP-Modified Bituminous Membrane Installation
1. Install modified bituminous roofing membrane cap sheet **OR** sheet and cap sheet, **as directed**, according to roofing manufacturer's written instructions, starting at low point of roofing system. Extend roofing membrane sheets over and terminate beyond cants, installing as follows:



- a. Adhere to substrate in cold-applied adhesive.
OR
Torch apply to substrate.
- b. Unroll roofing membrane sheets and allow them to relax for minimum time period required by manufacturer.
2. Laps: Accurately align roofing membrane sheets, without stretching, and maintain uniform side and end laps. Stagger end laps. Completely bond and seal laps, leaving no voids.
 - a. Repair tears and voids in laps and lapped seams not completely sealed.
 - b. Apply roofing granules to cover exuded bead at laps while bead is hot.
3. Install roofing membrane sheets so side and end laps shed water.

J. Flashing And Stripping Installation

1. Install base flashing over cant strips and other sloped and vertical surfaces, at roof edges, and at penetrations through roof; secure to substrates according to roofing system manufacturer's written instructions, and as follows:
 - a. Prime substrates with asphalt primer if required by roofing system manufacturer.
 - b. Backer Sheet Application: Mechanically fasten backer sheet to walls or parapets. Adhere backer sheet over roofing membrane at cants in cold-applied adhesive, **as directed**.
OR
Backer Sheet Application: Adhere backer sheet to substrate in a solid mopping of hot roofing asphalt **OR** cold-applied adhesive at rate required by roofing system manufacturer, **as directed**.
 - c. Flashing Sheet Application: Adhere flashing sheet to substrate in cold-applied adhesive at rate required by roofing system manufacturer.
OR
Flashing Sheet Application: Adhere flashing sheet to substrate in asphalt roofing cement at rate required by roofing system manufacturer.
OR
Flashing Sheet Application: Torch apply flashing sheet to substrate.
2. Extend base flashing up walls or parapets a minimum of 8 inches (200 mm) above roofing membrane and 4 inches (100 mm) onto field of roofing membrane.
3. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.
 - a. Seal top termination of base flashing with a strip of glass-fiber fabric set in asphalt roofing cement, **as directed**.
4. Install roofing membrane cap-sheet stripping where metal flanges and edgings are set on membrane roofing according to roofing system manufacturer's written instructions.
5. Roof Drains: Set 30-by-30-inch- (760-by-760-mm-) square metal flashing in bed of roofing-manufacturer-approved asphaltic adhesive on completed roofing membrane. Cover metal flashing with roofing membrane cap-sheet stripping and extend a minimum of 4 inches (100 mm) **OR** 6 inches (150 mm), **as directed**, beyond edge of metal flashing onto field of roofing membrane. Clamp roofing membrane, metal flashing, and stripping into roof-drain clamping ring.
 - a. Install stripping according to roofing system manufacturer's written instructions.

K. Coating Installation

1. Apply coating to roofing membrane **OR** roofing membrane and base flashings, **as directed**, according to manufacturer's written instructions, by spray, roller, or other suitable application method to provide a dry film thickness of not less than 20 mils (0.5 mm), **as directed**.

L. Walkway Installation

1. Walkway Pads: Install walkway pads in cold-applied adhesive, using units of size indicated or, if not indicated, of manufacturer's standard size according to walkway pad manufacturer's written instructions.
2. Walkway Strips: Install walkway cap sheet **OR** backer and cap sheet, **as directed**, strips over roofing membrane using same application method as used for roofing membrane cap sheet.



M. Field Quality Control

1. Testing Agency: Perform tests and inspections and to prepare test reports.
2. Test Cuts: Test specimens will be removed to evaluate problems observed during quality-assurance inspections of roofing membrane as follows:
 - a. Approximate quantities of components within roofing membrane will be determined according to ASTM D 3617.
 - b. Test specimens will be examined for interply voids according to ASTM D 3617 and to comply with criteria established in Appendix 3 in ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing."
 - c. Repair areas where test cuts were made according to roofing system manufacturer's written instructions.
3. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
 - a. Notify the Owner 48 hours in advance of date and time of inspection.
4. Roofing system will be considered defective if it does not pass tests and inspections.
 - a. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

N. Protecting And Cleaning

1. Protect roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to the Owner.
2. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Final Completion and according to warranty requirements.
3. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 05 13 00b



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**SECTION 07 05 13 00c - SBS-MODIFIED BITUMINOUS MEMBRANE ROOFING**

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for styrene-butadiene-styrene (SBS) modified bituminous membrane roofing. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Styrene-butadiene-styrene (SBS) modified bituminous membrane roofing.
 - b. Hybrid roofing system that combines built-up ply sheets with SBS-modified bituminous membrane roofing.
 - c. Vapor retarder.
 - d. Roof insulation.
2. Section includes the installation of insulation strips in ribs of acoustical roof deck. Insulation strips are furnished under Division 05 Section "Steel Decking".

C. Definitions

1. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.
2. Hot Roofing Asphalt: Roofing asphalt heated to its equiviscous temperature, the temperature at which its viscosity is 125 centipoise for mop-applied roofing asphalt and 75 centipoise for mechanical spreader-applied roofing asphalt, within a range of plus or minus 25 deg F (14 deg C), measured at the mop cart or mechanical spreader immediately before application.

D. Performance Requirements

1. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.
2. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.
3. Roofing System Design: If membrane roofing system is to be designed to withstand uplift pressure established by ASCE/SEI 7, provide membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7.
 - a. Corner Uplift Pressure: <Insert **lbf/sq. ft. (kPa/sq. m)**>.
 - b. Perimeter Uplift Pressure: <Insert **lbf/sq. ft. (kPa/sq. m)**>.
 - c. Field-of-Roof Uplift Pressure: <Insert **lbf/sq. ft. (kPa/sq. m)**>.
4. FM Approvals Listing: If Project is FM Global insured or if FM Approvals requirements will set a minimum quality standard, provide membrane roofing, base flashings, and component materials that comply with requirements in FM Approvals 4450 and FM Approvals 4470 as part of a membrane roofing system, and that are listed in FM Approvals' "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals markings.
 - a. Fire/Windstorm Classification: Class 1A-60 **OR** Class 1A-75 **OR** Class 1A-90 **OR** Class 1A-105 **OR** Class 1A-120, **as directed**.
 - b. Hail Resistance Rating: MH **OR** SH, **as directed**.
5. Energy Performance (if required for LEED-NC Credit SS 7.2): Provide roofing system with initial Solar Reflectance Index not less than 78 when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency.



6. Energy Performance (for roofs that must comply with DOE's ENERGY STAR requirements): Provide roofing system that is listed on DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.
7. Energy Performance (for roofs that must comply with California Energy Commission's CEC-Title 24): Provide roofing system with initial Solar Reflectance not less than 0.70 and Thermal Emittance not less than 0.75 when tested according to Cool Roof Rating Council's CRRC-1.

E. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:
 - a. Product Test Reports for Credit SS 7.2: For roof materials, indicating that roof materials comply with Solar Reflectance Index requirement.
 - b. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.
3. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.
 - a. Base flashings and membrane terminations.
 - b. Tapered insulation, including slopes.
 - c. Crickets, saddles, and tapered edge strips, including slopes.
 - d. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
4. Samples: For the following products:
 - a. Sheet roofing materials, including base sheet, base-ply sheet, roofing membrane sheet, flashing backer sheet, membrane cap sheet and flashing sheet, of color specified.
 - b. Roof insulation.
 - c. 3 lb (1.5 kg) of aggregate surfacing material in gradation and color indicated.
 - d. Walkway pads or rolls.
 - e. Six insulation fasteners of each type, length, and finish.
5. Qualification Data: For qualified Installer, manufacturer and testing agency.
6. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - a. Submit evidence of complying with performance requirements.
7. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of membrane roofing system.
8. Research/Evaluation Reports: For components of membrane roofing system, from the ICC-ES **OR** applicable model code organization, **as directed**.
9. Maintenance Data: For roofing system to include in maintenance manuals.
10. Warranties: Sample of special warranties.

F. Quality Assurance

1. Manufacturer Qualifications: A qualified manufacturer that is UL listed **OR** FM Approvals approved, **as directed**, for membrane roofing system identical to that used for this Project.
2. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by membrane roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.
3. Source Limitations: Obtain components including roof insulation and fasteners for membrane roofing system from same manufacturer as membrane roofing or approved by membrane roofing manufacturer.
4. Exterior Fire-Test Exposure: ASTM E 108, Class A **OR** Class B **OR** Class C, **as directed**; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.
5. Fire-Resistance Ratings: Where indicated, provide fire-resistance-rated roof assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
6. Preinstallation Roofing Conference: Conduct conference at Project site.



G. Delivery, Storage, And Handling

1. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
2. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
 - a. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
3. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
4. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

H. Project Conditions

1. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

I. Warranty

1. Special Warranty: Manufacturer's standard or customized form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period.
 - a. Special warranty includes membrane roofing, base flashings, roof insulation, fasteners, cover boards, substrate board, roofing accessories, and other components of membrane roofing system.
 - b. Warranty Period: 10 **OR** 15 **OR** 20 **OR** 25 **OR** 30, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. SBS-Modified Asphalt-Sheet Materials

1. Roofing Membrane Sheet: ASTM D 6164, Grade S, Type I or II, SBS-modified asphalt sheet (reinforced with polyester fabric) **OR** ASTM D 6163, Grade S, Type I or II, SBS-modified asphalt sheet (reinforced with glass fibers) **OR** ASTM D 6162, Grade S, Type I or II, SBS-modified asphalt sheet (reinforced with a combination of polyester fabric and glass fibers), **as directed**; smooth surfaced; suitable for application method specified.
2. Smooth-Surfaced Roofing Membrane Cap Sheet: ASTM D 6164, Grade S, Type I or II, SBS-modified asphalt sheet (reinforced with polyester fabric) **OR** ASTM D 6163, Grade S, Type I or II, SBS-modified asphalt sheet (reinforced with glass fibers) **OR** ASTM D 6162, Grade S, Type I or II, SBS-modified asphalt sheet (reinforced with a combination of polyester fabric and glass fibers), **as directed**; smooth surfaced; suitable for application method specified.
OR
Granule-Surface Roofing Membrane Cap Sheet: ASTM D 6164, Grade G, Type I or II, SBS-modified asphalt sheet (reinforced with polyester fabric) **OR** ASTM D 6163, Grade G, Type I or II, SBS-modified asphalt sheet (reinforced with glass fibers) **OR** ASTM D 6162, Grade G, Type I or II, SBS-modified asphalt sheet (reinforced with a combination of polyester fabric and glass fibers), **as directed**; granular surfaced; suitable for application method specified, and as follows:
 - a. Granule Color: White **OR** Gray **OR** Tan, **as directed**.
3. Metal-Foil-Surfaced Roofing Membrane Cap Sheet: ASTM D 6298, metal-foil surfaced SBS-modified asphalt sheet (reinforced with glass fibers); suitable for application method specified, and as follows:
 - a. Foil Surfacing: Aluminum **OR** Copper **OR** Stainless steel **OR** Aluminum, fluoropolymer-coated finish, of color and gloss selected from manufacturer's full range, **as directed**.



B. Base-Sheet Materials

1. Sheathing Paper: Red-rosin type, minimum 3 lb/100 sq. ft. (0.16 kg/sq. m).
2. Base Sheet: ASTM D 4601, Type II, SBS-modified, asphalt-impregnated and -coated sheet, with glass-fiber-reinforcing mat, dusted with fine mineral surfacing on both sides.
 - a. Weight: 25 lb/100 sq. ft. (1.2 kg/sq. m) **OR** 40 lb/100 sq. ft. (1.95 kg/sq. m) **OR** 50 lb/100 sq. ft. (2.4 kg/sq. m) **OR** 60 lb/100 sq. ft. (2.9 kg/sq. m) **OR** 75 lb/100 sq. ft. (3.7 kg/sq. m), **as directed**, minimum.

OR

Base Sheet: ASTM D 4601, Type I **OR** Type II, **as directed**, nonperforated, asphalt-impregnated and -coated, glass-fiber sheet, dusted with fine mineral surfacing on both sides.

OR

Base Sheet: ASTM D 4897, Type II, venting, nonperforated, heavyweight, asphalt-impregnated and -coated, glass-fiber base sheet with coarse granular surfacing or embossed venting channels on bottom surface.

OR

Base Sheet: ASTM D 2626, asphalt-saturated and -coated organic felt, dusted with fine mineral surfacing on both sides.

C. Base-Ply Sheet Materials

1. Glass-Fiber Base-Ply Sheet: ASTM D 2178, Type IV **OR** Type VI, **as directed**, asphalt-impregnated, glass-fiber felt.

D. Base Flashing Sheet Materials

1. Backer Sheet: ASTM D 4601, Type I **OR** Type II, **as directed**, asphalt-impregnated and -coated, glass-fiber sheet, dusted with fine mineral surfacing on both sides.

OR

Backer Sheet: ASTM D 2626, asphalt-saturated and -coated organic felt, dusted with fine mineral surfacing on both sides.

OR

Backer Sheet: ASTM D 6164, Grade S, Type I or II, SBS-modified asphalt sheet (reinforced with polyester fabric) **OR** ASTM D 6163, Grade S, Type I or II, SBS-modified asphalt sheet (reinforced with glass fibers) **OR** ASTM D 6162, Grade S, Type I or II, SBS-modified asphalt sheet (reinforced with a combination of polyester fabric and glass fibers), **as directed**; smooth surfaced; suitable for application method specified.

2. Granule-Surfaced Flashing Sheet: ASTM D 6164, Grade G, Type I or II, SBS-modified asphalt sheet (reinforced with polyester fabric) **OR** ASTM D 6163, Grade G, Type I or II, SBS-modified asphalt sheet (reinforced with glass fibers) **OR** ASTM D 6162, Grade G, Type I or II, SBS-modified asphalt sheet (reinforced with a combination of polyester fabric and glass fibers), **as directed**; granular surfaced; suitable for application method specified, and as follows:
 - a. Granule Color: White **OR** Gray **OR** Tan, **as directed**.

OR

Metal-Foil-Surfaced Flashing Sheet: ASTM D 6298, metal-foil surfaced SBS-modified asphalt sheet (reinforced with glass fibers); suitable for application method specified, and as follows:

- a. Foil Surfacing: Aluminum **OR** Copper **OR** Stainless steel **OR** Aluminum, fluoropolymer-coated finish, of color and gloss selected from manufacturer's full range, **as directed**.
3. Glass-Fiber Fabric: Woven glass-fiber cloth, treated with asphalt, complying with ASTM D 1668, Type I.

E. Auxiliary Roofing Membrane Materials

1. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing membrane.
 - a. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.



- b. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
- 1) Plastic Foam Adhesives: 50 g/L.
 - 2) Gypsum Board and Panel Adhesives: 50 g/L.
 - 3) Multipurpose Construction Adhesives: 70 g/L.
 - 4) Fiberglass Adhesives: 80 g/L.
 - 5) Contact Adhesive: 80 g/L.
 - 6) Other Adhesives: 250 g/L.
 - 7) Nonmembrane Roof Sealants: 300 g/L.
 - 8) Sealant Primers for Nonporous Substrates: 250 g/L.
 - 9) Sealant Primers for Porous Substrates: 775 g/L.
2. Asphalt Primer: ASTM D 41.
3. Roofing Asphalt: ASTM D 312, Type III **OR** Type IV **OR** Type III or IV as recommended by roofing system manufacturer for application, **as directed**.
OR
Roofing Asphalt: ASTM D 6152, SEBS modified.
4. Cold-Applied Adhesive: Roofing system manufacturer's standard asphalt-based, one- or two-part, asbestos-free, cold-applied adhesive specially formulated for compatibility and use with roofing membrane and base flashings.
5. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required by roofing system manufacturer for application.
6. Mastic Sealant: Polyisobutylene, plain or modified bitumen; nonhardening, nonmigrating, nonskinning, and nondrying.
7. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing membrane components to substrate; tested by manufacturer for required pullout strength, and acceptable to roofing system manufacturer.
8. Metal Flashing Sheet: As specified in Division 07 Section "Sheet Metal Flashing And Trim".
9. Roofing Granules: Ceramic-coated roofing granules, No. 11 screen size with 100 percent passing No. 8 (2.36-mm) sieve and 98 percent of mass retained on No. 40 (0.425-mm) sieve, color to match roofing membrane.
10. Aggregate Surfacing: ASTM D 1863, No. 6 or No. 67, clean, dry, opaque, water-worn gravel or crushed stone, free of sharp edges **OR** crushed slag, free of sharp edges, **as directed**.
11. Miscellaneous Accessories: Provide those recommended by roofing system manufacturer.
- F. Substrate Boards
1. Substrate Board: ASTM C 1396/C 1396M, Type X gypsum board, 5/8 inch (16 mm) thick.
OR
Substrate Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/4 inch (6 mm) **OR** 1/2 inch (13 mm) **OR** Type X, 5/8 inch (16 mm), **as directed**, thick, factory primed, **as directed**.
OR
Substrate Board: ASTM C 1278/C 1278M, cellulosic-fiber-reinforced, water-resistant gypsum substrate, 1/4 inch (6 mm) **OR** 3/8 inch (10 mm) **OR** 1/2 inch (13 mm) **OR** 5/8 inch (16 mm), **as directed**, thick.
OR
Substrate Board: ASTM C 728, perlite board, 3/4 inch (19 mm) **OR** 1 inch (25 mm), **as directed**, thick, seal coated.
2. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate board to roof deck.
- G. Vapor Retarder
1. Polyethylene Film: ASTM D 4397, 6 mils (0.15 mm) thick, minimum, with maximum permeance rating of 0.13 perm (7.5 ng/Pa x s x sq. m).



- a. Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

OR

Adhesive: Manufacturer's standard lap adhesive, FM Approvals approved for vapor-retarder application.

2. Laminated Sheet: Kraft paper, two layers, laminated with asphalt and edge reinforced with woven fiberglass yarn, with maximum permeance rating of 0.50 perm (29 ng/Pa x s x sq. m) and with manufacturer's standard adhesive, **as directed**.
3. Self-Adhering Sheet Vapor Retarder: ASTM D 1970, minimum of 40-mil- (1.0-mm-) thick, polyethylene film laminated to layer of rubberized asphalt adhesive; maximum permeance rating of 0.1 perm (6 ng/Pa x s x sq. m); cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor-retarder manufacturer.

OR

Self-Adhering Sheet Vapor Retarder: 30- to 40-mil- (0.76- to 1.0-mm-) thick, polyethylene film laminated to layer of butyl rubber adhesive; maximum permeance rating of 0.1 perm (6 ng/Pa x s x sq. m); cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor-retarder manufacturer.

4. Glass-Fiber Felt: ASTM D 2178, Type IV, asphalt impregnated.

H. Roof Insulation

1. General: Preformed roof insulation boards manufactured or approved by roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated and that produce FM Approvals-approved roof insulation, **as directed**.
2. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, 1.6-lb/cu. ft. (26-kg/cu. m) **OR** Type X, 1.3-lb/cu. ft. (21-kg/cu. m), **as directed**, minimum density, square edged.
3. Molded-Polystyrene Board Insulation: ASTM C 578, Type II, 1.35-lb/cu. ft. (22-kg/cu. m) **OR** Type VIII, 1.15-lb/cu. ft. (18-kg/cu. m) **OR** Type IX, 1.8-lb/cu. ft. (29-kg/cu. m), **as directed**, minimum density.
4. Composite Molded-Polystyrene Board Insulation: ASTM C 578, Type II, 1.35-lb/cu. ft. (22-kg/cu. m) **OR** Type VIII, 1.15-lb/cu. ft. (18-kg/cu. m) **OR** Type IX, 1.8-lb/cu. ft. (29-kg/cu. m), **as directed**, minimum density, with factory-applied facings, as follows:
 - a. Facer: ASTM C 208, Type II, Grade 2, cellulosic-fiber insulation board, asphalt coated, 1/2 inch (13 mm) thick.

OR

Facer: DOC PS 2, Exposure 1, OSB, 7/16 inch (11 mm) thick.
5. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2 **OR** Type II, Class I, Grade 3, **as directed**, felt or glass-fiber mat facer on both major surfaces.
6. Composite Polyisocyanurate Board Insulation: ASTM C 1289, with factory-applied facing board, as indicated below by type, on one major surface and felt or glass-fiber mat facer on the other surface.
 - a. Type IV, cellulosic-fiber-insulating-board facer, Grade 2, 1/2 inch (13 mm) thick.
 - b. Type V, OSB facer, 7/16 inch (11 mm) thick.
 - c. Type VII, glass-mat-faced gypsum board facer, 1/4 inch (6 mm) thick.
7. Perlite Board Insulation: ASTM C 728, rigid, mineral-aggregate thermal insulation board composed of expanded perlite, cellulosic fibers, binders, and waterproofing agents with top surface seal coated.
8. Cellulosic-Fiber Board Insulation: ASTM C 208, Type II, Grade 2, fibrous-felted, rigid insulation boards of wood fiber or other cellulosic-fiber and water-resistant binders, asphalt impregnated, chemically treated for deterioration.
9. Cellular-Glass Board Insulation: ASTM C 552, Type IV, rigid, cellular-glass thermal board insulation faced with manufacturer's standard kraft-paper sheets.
10. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48) unless otherwise indicated.
11. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.



I. Insulation Accessories

1. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with membrane roofing.
2. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.
3. Modified Asphaltic Insulation Adhesive: Insulation manufacturer's recommended modified asphaltic, asbestos-free, cold-applied adhesive formulated to attach roof insulation to substrate or to another insulation layer.
OR
Bead-Applied Insulation Adhesive: Insulation manufacturer's recommended bead-applied, low-rise, one-component or multicomponent urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.
OR
Full-Spread Applied Insulation Adhesive: Insulation manufacturer's recommended spray-applied, low-rise, two-component urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.
4. Insulation Cant Strips: ASTM C 728, perlite insulation board.
OR
Insulation Cant Strips: ASTM C 208, Type II, Grade 1, cellulosic-fiber insulation board.
5. Wood Nailer Strips: Comply with requirements in Division 06 Section(s) "Rough Carpentry" OR "Miscellaneous Rough Carpentry", **as directed**.
6. Tapered Edge Strips: ASTM C 728, perlite insulation board.
OR
Tapered Edge Strips: ASTM C 208, Type II, Grade 1, cellulosic-fiber insulation board.
7. Cover Board: ASTM C 208, Type II, Grade 2, cellulosic-fiber insulation board, 1/2 inch (13 mm) thick.
OR
Cover Board: DOC PS 2, Exposure 1, OSB, 7/16 inch (11 mm) thick.
OR
Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/4 inch (6 mm) **OR** 1/2 inch (13 mm) **OR** 5/8 inch (16 mm), **as directed**, thick, factory primed, **as directed**.
OR
Cover Board: ASTM C 1278/C 1278M, cellulosic-fiber-reinforced, water-resistant gypsum substrate, 1/4 inch (6 mm) **OR** 3/8 inch (10 mm) **OR** 1/2 inch (13 mm) **OR** 5/8 inch (16 mm), **as directed**, thick.
8. Substrate Joint Tape: 6- or 8-inch- (150- or 200-mm-) wide, coated, glass-fiber joint tape.

J. Walkways

1. Walkway Pads: Reinforced asphaltic composition pads with slip-resisting mineral-granule surface **OR** Polymer-modified, reconstituted rubber pads with slip-resisting textured surface, **as directed**, manufactured as a traffic pad for foot traffic and acceptable to roofing system manufacturer, 3/8 inch (10 mm) **OR** 1/2 inch (13 mm) **OR** 3/4 inch (19 mm), **as directed**, thick, minimum.
2. Walkway Cap Sheet Strips: ASTM D 6164, Grade G, Type I or II, SBS-modified asphalt sheet (reinforced with polyester fabric) **OR** ASTM D 6163, Grade G, Type I or II, SBS-modified asphalt sheet (reinforced with glass fibers) **OR** ASTM D 6162, Grade G, Type I or II, SBS-modified asphalt sheet (reinforced with a combination of polyester fabric and glass fibers), **as directed**; granular surfaced; suitable for application method specified, and as follows:
 - a. Granule Color: White **OR** Gray **OR** Tan, **as directed**.

1.3 EXECUTION

A. Examination

1. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:



- a. Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.
 - b. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 - c. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Division 5 Section "Steel Deck."
 - d. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
 - e. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 - 1) Test for moisture by pouring 1 pint (0.5 L) of hot roofing asphalt on deck at start of each day's work and at start of each roof area or plane. Do not proceed with roofing work if test sample foams or can be easily and cleanly stripped after cooling.
 - f. Verify that concrete-curing compounds that will impair adhesion of roofing components to roof deck have been removed.
 - g. Verify that deck is securely fastened with no projecting fasteners and with no adjacent units in excess of 1/16 inch (1.6 mm) out of plane relative to adjoining deck.
2. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Preparation
1. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
 2. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
 3. Prime surface of concrete deck with asphalt primer at a rate of 3/4 gal./100 sq. ft. (0.3 L/sq. m) and allow primer to dry.
 4. Install insulation strips in ribs of acoustical roof decks according to acoustical roof deck manufacturer's written instructions.
- C. Substrate Board Installation
1. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.
 - a. Fasten substrate board to top flanges of steel deck according to recommendations in FM Approvals' "RoofNav" and FM Global Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification.
OR
Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to membrane roofing system manufacturers' written instructions.
- D. Vapor-Retarder Installation
1. Polyethylene Film: Loosely lay polyethylene-film vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 inches (50 mm) and 6 inches (150 mm), respectively.
 - a. Continuously seal side and end laps with tape **OR** adhesive, **as directed**.
 2. Laminate Sheet: Install laminate-sheet vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 inches (50 mm) and 6 inches (150 mm), respectively. Bond vapor retarder to substrate as follows:
 - a. Apply adhesive at rate recommended by vapor-retarder manufacturer. Seal laps with adhesive.
OR
Apply ribbons of hot roofing asphalt at spacing, temperature, and rate recommended by vapor-retarder manufacturer. Seal laps with hot roofing asphalt.



3. Self-Adhering Sheet Vapor Retarder: Prime substrate if required by manufacturer. Install self-adhering sheet vapor retarder over area to receive vapor retarder, side and end lapping each sheet a minimum of 3-1/2 inches (90 mm) and 6 inches (150 mm), respectively. Seal laps by rolling.
4. Built-up Vapor Retarder: Install two glass-fiber felt plies lapping each felt 19 inches (483 mm) over preceding felt. Embed each felt in a solid mopping of hot roofing asphalt. Glaze-coat completed surface with hot roofing asphalt. Apply hot roofing asphalt within plus or minus 25 deg F (14 deg C) of equiviscous temperature.
5. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into membrane roofing system.

E. Insulation Installation

1. Comply with roofing system manufacturer's written instructions for installing roof insulation.
2. Install one lapped base-sheet course and mechanically fasten to substrate according to roofing system manufacturer's written instructions.
3. Nailer Strips: Mechanically fasten 4-inch nominal- (89-mm actual-) width wood nailer strips of same thickness as insulation perpendicular to sloped roof deck at the following spacing:
 - a. 16 feet (4.88 m) apart for roof slopes steeper than 1 inch per 12 inches (1:12) but less than 3 inches per 12 inches (3:12).
 - b. 48 inches (1220 mm) apart for roof slopes steeper than 3 inches per 12 inches (3:12).
4. Insulation Cant Strips: Install and secure preformed 45-degree insulation cant strips at junctures of roofing membrane system with vertical surfaces or angle changes more than 45 degrees.
5. Install tapered insulation under area of roofing to conform to slopes indicated.
6. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
 - a. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
7. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches (68 mm) or more, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.
 - a. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
8. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
9. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.
10. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:
 - a. Prime surface of concrete deck with asphalt primer at rate of 3/4 gal./100 sq. ft. (0.3 L/sq. m) and allow primer to dry.
 - b. Set each layer of insulation in a solid mopping of hot roofing asphalt applied within plus or minus 25 deg F (14 deg C) of equiviscous temperature.

OR

Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.

OR

Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.
11. Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
 - a. If Project is FM Global insured or if FM Approvals requirements are proposed as a performance standard, fasten insulation according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.
 - b. If number of fasteners will be based on ASCE/SEI 7's uplift pressure or SPRI's factored design uplift pressure, fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.



12. Mechanically Fastened and Adhered Insulation: Install first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
 13. If Project is FM Global insured or if FM Approvals requirements are proposed as a performance standard, fasten first layer of insulation according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.
 14. If fastening is calculated from ASCE/SEI 7's uplift pressure or SPRI's factored design uplift pressure, fasten first layer of insulation to resist uplift pressure at corners, perimeter, and field of roof.
 - a. Set each subsequent layer of insulation in a solid mopping of hot roofing asphalt applied within plus or minus 25 deg F (14 deg C) of equiviscous temperature.
OR
Set each subsequent layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
OR
Set each subsequent layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.
- F. If cover boards will be field installed over roof insulation and immediately below roofing membrane, install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints a minimum of 6 inches (150 mm) in each direction from joints of insulation below. Loosely butt cover boards together and fasten to roof deck, **as directed**. Tape joints if required by roofing system manufacturer.
- a. Fasten cover boards according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.
OR
Fasten cover boards to resist uplift pressure at corners, perimeter, and field of roof.
 - b. Apply hot roofing asphalt to underside, and immediately bond cover board to substrate.
- G. Roofing Membrane Installation, General
1. If referencing NRCA's roof assembly identification matrix system, install roofing membrane system according to roofing system manufacturer's written instructions and applicable recommendations in ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing."
 - a. Install roofing system MBS **OR** MBSH, **as directed**, -2 **OR** 3 **OR** 4, **as directed**, -N **OR** I **OR** C, **as directed**, -T **OR** M **OR** L, **as directed**, -A **OR** M **OR** F, **as directed**, according to roof assembly identification matrix and roof assembly layout illustrations in NRCA's "The NRCA Roofing and Waterproofing Manual" and to requirements in this Section.
 2. For roof system that exceeds requirements of NRCA's roof assemblies, install roofing membrane system according to roofing system manufacturer's written instructions and applicable recommendations in ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing" and as follows:
 - a. Deck Type: N (nailable) **OR** I (insulated) **OR** C (concrete or nonnailable), **as directed**.
 - b. Adhering Method: T (torched) **OR** M (mopped) **OR** L (cold-applied adhesive), **as directed**.
 - c. Base Sheet: One **OR** One, installed over sheathing paper, **as directed**.
 - d. Number of Glass-Fiber Base-Ply Sheets: One **OR** Two, **as directed**.
 - e. Number of SBS-Modified Asphalt Sheets: One **OR** Two, **as directed**.
 - f. Surfacing Type: A (aggregate) **OR** M (mineral-granule-surfaced cap sheet) **OR** F (foil-surfaced cap sheet), **as directed**.
 3. Start installation of roofing membrane in presence of roofing system manufacturer's technical personnel.
 4. Where roof slope exceeds 1/2 inch per 12 inches (1:24) **OR** 3/4 inch per 12 inches (1:18), **as directed**, install roofing membrane sheets parallel with slope.



- a. Backnail roofing membrane sheets to nailer strips **OR** substrate, **as directed**, according to roofing system manufacturer's written instructions.
 5. Cooperate with testing agencies engaged or required to perform services for installing roofing system.
 6. Coordinate installation of roofing system so insulation and other components of the roofing membrane system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.
 - a. At end of each day's work, provide tie-offs to cover exposed roofing membrane sheets and insulation with a course of coated felt set in roofing cement or hot roofing asphalt, with joints and edges sealed.
 - b. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.
 - c. Remove and discard temporary seals before beginning work on adjoining roofing.
 7. Asphalt Heating: Do not raise roofing asphalt temperature above equiviscous temperature range more than one hour before time of application. Do not exceed roofing asphalt manufacturer's recommended temperature limits during roofing asphalt heating. Do not heat roofing asphalt within 25 deg F (14 deg C) of flash point. Discard roofing asphalt maintained at a temperature exceeding finished blowing temperature for more than four hours.

OR

Asphalt Heating: Heat and apply SEBS-modified roofing asphalt according to roofing system manufacturer's written instructions.
 8. Substrate-Joint Penetrations: Prevent roofing asphalt and adhesives from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.
- H. Base-Sheet Installation
 1. Loosely lay one course of sheathing paper, lapping edges and ends a minimum of 2 inches (50 mm) and 6 inches (150 mm), respectively.
 2. Install lapped base-sheet course, extending sheet over and terminating beyond cants. Attach base sheet as follows:
 - a. Mechanically fasten to substrate, for nailable substrate.

OR

Spot- or strip-mop to substrate with hot roofing asphalt.

OR

Adhere to substrate in a solid mopping of hot roofing asphalt **OR** uniform coating of cold-applied adhesive, **as directed**, for nonnailable or insulated substrates.
- I. Base-Ply Sheet Installation
 1. Install glass-fiber base-ply sheets according to roofing system manufacturer's written instructions starting at low point of roofing system. Align glass-fiber base-ply sheets without stretching. Extend sheets over and terminate beyond cants.
 - a. Shingle side laps of glass-fiber base-ply sheets uniformly to ensure that required number of glass-fiber base-ply sheets covers substrate at any point. Shingle in direction to shed water.
 - b. Embed each glass-fiber base-ply sheet in a continuous void-free mopping of hot roofing asphalt to form a uniform membrane without glass-fiber base-ply sheets touching.
- J. SBS-Modified Bituminous Membrane Installation
 1. Install modified bituminous roofing membrane cap sheet **OR** sheet and cap sheet, **as directed**, according to roofing manufacturer's written instructions, starting at low point of roofing system. Extend roofing membrane sheets over and terminate beyond cants, installing as follows:
 - a. Adhere to substrate in a solid mopping of hot roofing asphalt applied at not less than 425 deg F (218 deg C).

OR

Adhere to substrate in cold-applied adhesive.

OR



- Torch apply to substrate.
- b. Unroll roofing membrane sheets and allow them to relax for minimum time period required by manufacturer.
2. Laps: Accurately align roofing membrane sheets, without stretching, and maintain uniform side and end laps. Stagger end laps. Completely bond and seal laps, leaving no voids.
 - a. Repair tears and voids in laps and lapped seams not completely sealed.
 - b. Apply roofing granules to cover exuded bead at laps while bead is hot.
 3. Install roofing membrane sheets so side and end laps shed water.
 4. Aggregate Surfacing: Promptly after installing and testing roofing membrane, base flashing, and stripping, flood-coat roof surface with 60 lb/100 sq. ft. (3 kg/sq. m) of hot roofing asphalt. While flood coat is hot and fluid, cast the following average weight of aggregate in a uniform course:
 - a. Aggregate Weight: 400 lb/100 sq. ft. (20 kg/sq. m) for gravel or crushed stone or 300 lb/100 sq. ft. (15 kg/sq. m) for slag.
- K. Flashing And Stripping Installation
1. Install base flashing over cant strips and other sloped and vertical surfaces, at roof edges, and at penetrations through roof; secure to substrates according to roofing system manufacturer's written instructions, and as follows:
 - a. Prime substrates with asphalt primer if required by roofing system manufacturer.
 - b. Backer Sheet Application: Mechanically fasten backer sheet to walls or parapets. Adhere backer sheet over roofing membrane at cants in a solid mopping of hot roofing asphalt **OR** cold-applied adhesive, **as directed**.
OR
Backer Sheet Application: Adhere backer sheet to substrate in a solid mopping of hot roofing asphalt **OR** cold-applied adhesive at rate required by roofing system manufacturer, **as directed**.
 - c. Flashing Sheet Application: Adhere flashing sheet to substrate in a solid mopping of hot roofing asphalt applied at not less than 425 deg F (218 deg C). Apply hot roofing asphalt to back of flashing sheet if recommended by roofing system manufacturer.
OR
Flashing Sheet Application: Adhere flashing sheet to substrate in cold-applied adhesive at rate required by roofing system manufacturer.
OR
Flashing Sheet Application: Adhere flashing sheet to substrate in asphalt roofing cement at rate required by roofing system manufacturer.
OR
Flashing Sheet Application: Torch apply flashing sheet to substrate.
 2. Extend base flashing up walls or parapets a minimum of 8 inches (200 mm) above roofing membrane and 4 inches (100 mm) onto field of roofing membrane.
 3. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.
 - a. Seal top termination of base flashing with a strip of glass-fiber fabric set in asphalt roofing cement, **as directed**.
 4. Install roofing membrane cap-sheet stripping where metal flanges and edgings are set on membrane roofing according to roofing system manufacturer's written instructions.
 5. Roof Drains: Set 30-by-30-inch- (760-by-760-mm-) square metal flashing in bed of asphalt roofing cement on completed roofing membrane. Cover metal flashing with roofing membrane cap-sheet stripping and extend a minimum of 4 inches (100 mm) **OR** 6 inches (150 mm), **as directed**, beyond edge of metal flashing onto field of roofing membrane. Clamp roofing membrane, metal flashing, and stripping into roof-drain clamping ring.
 - a. Install stripping according to roofing system manufacturer's written instructions.
- L. Walkway Installation
1. Walkway Pads: Install walkway pads using units of size indicated or, if not indicated, of manufacturer's standard size according to walkway pad manufacturer's written instructions.
 - a. Set walkway pads in cold-applied adhesive.



OR

Set walkway pads in additional pour coat of hot roofing asphalt after aggregate surfacing of modified bituminous roofing membrane.

2. Walkway Cap Sheet Strips: Install walkway cap sheet strips over roofing membrane using same application method as used for roofing membrane cap sheet. Install walkway cap sheet strips before flood coat and aggregate surface is applied, **as directed**.

M. Field Quality Control

1. Testing Agency: Perform tests and inspections and to prepare test reports.
2. Test Cuts: Test specimens will be removed to evaluate problems observed during quality-assurance inspections of roofing membrane as follows:
 - a. Approximate quantities of components within roofing membrane will be determined according to ASTM D 3617.
 - b. Test specimens will be examined for interply voids according to ASTM D 3617 and to comply with criteria established in Appendix 3 in ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing."
 - c. Repair areas where test cuts were made according to roofing system manufacturer's written instructions.
3. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
 - a. Notify the Owner 48 hours in advance of date and time of inspection.
4. Roofing system will be considered defective if it does not pass tests and inspections.
 - a. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

N. Protecting And Cleaning

1. Protect roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to the Owner.
2. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Final Completion and according to warranty requirements.
3. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 05 13 00c



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SECTION 07 05 13 00d - PREPARATION FOR RE-ROOFING

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for preparation for re-roofing. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Roof tear-off.
 - b. Partial roof tear-off.
 - c. Temporary roofing membrane.
 - d. Roof re-cover preparation.
 - e. Removal of base flashings.

C. Materials Ownership

1. Except for items or materials indicated to be reused, reinstalled, or otherwise indicated to remain the Owner's property, demolished materials shall become Contractor's property and shall be removed from Project site.

D. Definitions

1. Roofing Terminology: Refer to ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.
2. Existing Membrane Roofing System: Built-up asphalt, Built-up coal-tar, EPDM, CSPE, PVC, TPO, APP-modified bituminous, or SBS-modified bituminous roofing membrane, roof insulation, surfacing, and components and accessories between deck and roofing membrane.
3. Roof Re-Cover Preparation: Existing roofing membrane that is to remain and be prepared for reuse.
4. Roof Tear-Off: Removal of existing membrane roofing system from deck.
5. Partial Roof Tear-Off: Removal of a portion of existing membrane roofing system from deck or removal of selected components and accessories from existing membrane roofing system.
6. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and reinstalled.
7. Existing to Remain: Existing items of construction that are not indicated to be removed.

E. Submittals

1. Product Data: For each type of product indicated.
2. Temporary Roofing: Include Product Data and description of temporary roofing system. If temporary roof will remain in place, submit surface preparation requirements needed to receive permanent roof, and submit a letter from roofing membrane manufacturer stating acceptance of the temporary membrane and that its inclusion will not adversely affect the roofing system's resistance to fire and wind or its FM Global rating, **as directed**.
3. Coal tar roofs can't be mixed with asphalt roofs. Test materials in accordance with the American Society for Testing and Materials (ASTM).
4. Fastener pull-out test report.
5. Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including exterior and interior finish surfaces that might be misconstrued as having been damaged by reroofing operations. Submit before Work begins.
6. Landfill Records: Indicate receipt and acceptance of hazardous wastes, such as asbestos-containing material, by a landfill facility licensed to accept hazardous wastes.



7. Qualification Data: For Installer including certificate that Installer is licensed to perform asbestos abatement and is approved by warrantor of existing roofing system.

F. Quality Assurance

1. Installer Qualifications: Installer of new membrane roofing system, licensed to perform asbestos abatement in the State or jurisdiction where Project is located, **as directed**, and approved by warrantor of existing roofing system to work on existing roofing, **as directed**.
2. Regulatory Requirements: Comply with governing EPA notification regulations before beginning membrane roofing removal. Comply with hauling and disposal regulations of authorities having jurisdiction.
3. Reroofing Conference: Conduct conference at Project site.

G. Project Conditions

1. the Owner will occupy portions of building immediately below reroofing area. Conduct reroofing so the Owner's operations will not be disrupted. Provide the Owner with not less than 72 hours' notice of activities that may affect the Owner's operations.
 - a. Coordinate work activities daily with the Owner so the Owner can place protective dust or water leakage covers over sensitive equipment or furnishings, shut down HVAC and fire-alarm or -detection equipment if needed, and evacuate occupants from below the work area.
 - b. Before working over structurally impaired areas of deck, notify the Owner to evacuate occupants from below the affected area. Verify that occupants below the work area have been evacuated before proceeding with work over the impaired deck area.
2. Protect building to be reroofed, adjacent buildings, walkways, site improvements, exterior plantings, and landscaping from damage or soiling from reroofing operations.
3. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.
4. Conditions existing at time of inspection for bidding will be maintained by the Owner as far as practical.
 - a. A roof moisture survey of existing membrane roofing system is available for Contractor's reference.
 - b. The results of an analysis of test cores from existing membrane roofing system are available for Contractor's reference.
 - c. Construction Drawings and Project Manual for existing roofing system are provided for Contractor's reference. Contractor is responsible for conclusions derived from existing documents.
5. Limit construction loads on roof, as directed by the Owner. Rooftop equipment wheel loads and for uniformly distributed loads.
6. Weather Limitations: Proceed with reroofing preparation only when existing and forecasted weather conditions permit Work to proceed without water entering existing roofing system or building.
7. Hazardous Materials: It is not expected that hazardous materials such as asbestos-containing materials will be encountered in the Work.
 - a. Hazardous materials will be removed by the Owner before start of the Work. Existing roof will be left no less watertight than before removal.
 - b. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify the Owner. Hazardous materials will be removed by the Owner under a separate contract.

OR

Hazardous Materials: Present in building to be reroofed. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.

- a. Hazardous material remediation is specified elsewhere in the Contract Documents.
- b. Do not disturb hazardous materials or items suspected of containing hazardous materials except according to procedures specified elsewhere in the Contract Documents.



- c. Coordinate with hazardous material remediation subcontractor to prevent water from entering existing roofing system or building.

H. Warranty

1. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during reroofing, by methods and with materials so as not to void existing roofing system warranty. Notify warrantor before proceeding.
 - a. Notify warrantor of existing roofing system on completion of reroofing, and obtain documentation verifying that existing roofing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

1.2 PRODUCTS

A. Infill Materials

1. Use infill materials matching existing membrane roofing system materials unless otherwise indicated.
 - a. Infill materials are specified in a Division 07.

B. Temporary Roofing Materials

1. Design and selection of materials for temporary roofing are responsibilities of Contractor.
2. Sheathing Paper: Red-rosin type, minimum 3 lb/100 sq. ft. (0.16 kg/sq. m).
3. Base Sheet: ASTM D 4601, Type II, nonperforated, asphalt-impregnated and -coated, glass-fiber sheet.
4. Glass-Fiber Felts: ASTM D 2178, Type IV, asphalt-impregnated, glass-fiber felt.
5. Asphalt Primer: ASTM D 41.
6. Roofing Asphalt: ASTM D 312, Type III or IV.

C. Recover Boards

1. Recover Board: ASTM C 208, Type II, Grade 1 **OR** 2, **as directed**, cellulosic-fiber insulation board; 1/2 inch (13 mm) thick.
OR
Recover Board: Fan-folded, unfaced, extruded-polystyrene board insulation; 3/16-inch (5-mm) **OR** 1/4-inch (6-mm) **OR** 3/8-inch (10-mm), **as directed**, nominal thickness.
OR
Recover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate; 1/4 inch (6 mm) **OR** 1/2 inch (13 mm) **OR** Type X, 5/8 inch (16 mm), **as directed**, thick.
OR
Recover Board: ASTM C 1278/C 1278M, cellulosic-fiber-reinforced, water-resistant gypsum substrate; 1/4 inch (6 mm) **OR** 3/8 inch (10 mm) **OR** 1/2 inch (13 mm) **OR** 5/8 inch (16 mm), **as directed**, thick.
OR
Recover Board: ASTM C 728, perlite board; 1/2 inch (13 mm) **OR** 3/4 inch (19 mm) **OR** 1 inch (25 mm), **as directed**, thick.
2. Fasteners: Factory-coated steel fasteners, No. 12 or 14, and metal or plastic plates listed in FM Approval's "Approval Guide," designed for fastening recover boards to deck.

D. Auxiliary Reroofing Materials

1. General: Auxiliary reroofing preparation materials recommended by roofing system manufacturer for intended use and compatible with components of existing and new membrane roofing system.
2. Base Sheet Fasteners: Capped head, factory-coated steel fasteners, listed in FM Approval's "Approval Guide."
3. Metal Flashing Sheet: Metal flashing sheet is specified in Division 07 Section "Sheet Metal Flashing And Trim".



1.3 EXECUTION

A. Preparation

1. Protect existing membrane roofing system that is indicated not to be reroofed.
 - a. Loosely lay 1-inch- (25-mm-) minimum thick, molded expanded polystyrene (MEPS) insulation over the roofing membrane in areas indicated. Loosely lay 15/32-inch (12-mm) plywood or OSB panels over MEPS. Extend MEPS past edges of plywood or OSB panels a minimum of 1 inch (25 mm).
 - b. Limit traffic and material storage to areas of existing roofing membrane that have been protected.
 - c. Maintain temporary protection and leave in place until replacement roofing has been completed. Remove temporary protection on completion of reroofing.
2. Coordinate with the Owner to shut down air-intake equipment in the vicinity of the Work. Cover air-intake louvers before proceeding with reroofing work that could affect indoor air quality or activate smoke detectors in the ductwork.
3. During removal operations, have sufficient and suitable materials on-site to facilitate rapid installation of temporary protection in the event of unexpected rain.
4. Maintain roof drains in functioning condition to ensure roof drainage at end of each workday. Prevent debris from entering or blocking roof drains and conductors. Use roof-drain plugs specifically designed for this purpose. Remove roof-drain plugs at end of each workday, when no work is taking place, or when rain is forecast.
 - a. If roof drains are temporarily blocked or unserviceable due to roofing system removal or partial installation of new membrane roofing system, provide alternative drainage method to remove water and eliminate ponding. Do not permit water to enter into or under existing membrane roofing system components that are to remain.
5. Verify that rooftop utilities and service piping have been shut off before beginning the Work.

B. Roof Tear-Off

1. General: Notify the Owner each day of extent of roof tear-off proposed for that day and obtain authorization to proceed.
2. Remove aggregate ballast from roofing membrane. Store aggregate ballast for reuse, **as directed**.
3. Remove loose aggregate from aggregate-surfaced built-up bituminous roofing using a power broom.
4. Remove pavers and accessories from roofing membrane. Store and protect pavers and accessories for reuse, **as directed**. Discard cracked pavers, **as directed**.
5. Remove protection mat and extruded-polystyrene insulation from protected roofing membrane.
 - a. Discard extruded-polystyrene insulation that is wet and exceeds 8 lb/cu. ft. (128 kg/cu. m).
 - b. Store extruded-polystyrene insulation for reuse and protect from physical damage.
6. Roof Tear-Off: Remove existing roofing membrane and other membrane roofing system components down to the deck.
 - a. Remove cover boards **OR** roof insulation **OR** substrate boards, **as directed**.
 - b. Bitumen and felts that are firmly bonded to concrete decks are permitted to remain if felts are dry. Remove unadhered bitumen and felts and wet felts.
 - c. Remove excess asphalt from steel deck. A maximum of 15 lb/100 sq. ft. (0.72 kg/sq. m) of asphalt is permitted to remain on steel decks.
 - d. Remove fasteners from deck or cut fasteners off slightly above deck surface, **as directed**.
7. Partial Roof Tear-Off: Where indicated, remove existing roofing membrane and other membrane roofing system components down to the deck.
 - a. Remove cover boards **OR** roof insulation **OR** substrate boards, **as directed**.
 - b. Bitumen and felts that are firmly bonded to concrete decks are permitted to remain if felts are dry. Remove unadhered bitumen and felts and wet felts.
 - c. Remove excess asphalt from steel deck. A maximum of 15 lb/100 sq. ft. (0.72 kg/sq. m) of asphalt is permitted to remain on steel decks.
 - d. Remove fasteners from deck or cut fasteners off slightly above deck surface, **as directed**.

**OR**

Partial Roof Tear-Off: Remove existing roofing membrane and immediately check for presence of moisture by visually observing cover boards **OR** roof insulation **OR** substrate boards, **as directed**, that will remain.

- a. Coordinate with the Owner's inspector to schedule times for tests and inspections immediately after membrane removal.
- b. With an electrical capacitance moisture-detection meter, spot check cover boards **OR** roof insulation **OR** substrate boards, **as directed**, that will remain.
- c. Remove wet or damp boards and roof insulation. Removal will be paid for by adjusting the Contract Sum according to unit prices included in the Contract Documents, **as directed**.
- d. Bitumen and felts that are firmly bonded to concrete decks are permitted to remain if felts are dry. Remove unadhered bitumen and felts and wet felts.
- e. Remove excess asphalt from steel deck. A maximum of 15 lb/100 sq. ft. (0.72 kg/sq. m) of asphalt is permitted to remain on steel decks.
- f. Remove fasteners from deck or cut fasteners off slightly above deck surface, **as directed**.

C. Deck Preparation

1. Inspect deck after tear-off **OR** partial tear-off, **as directed**, of membrane roofing system.
2. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263 or by pouring 1 pint (0.5 L) of hot roofing asphalt on deck at start of each day's work and at start of each roof area or plane. Do not proceed with roofing work if moisture condenses under the plastic sheet or if asphalt test sample foams or can be easily and cleanly stripped after cooling.
3. If broken or loose fasteners that secure deck panels to one another or to structure are observed or if deck appears or feels inadequately attached, immediately notify the Owner. Do not proceed with installation until directed by the Owner.
4. If deck surface is not suitable for receiving new roofing or if structural integrity of deck is suspect, immediately notify the Owner. Do not proceed with installation until directed by the Owner.
5. Provide additional deck securement as indicated on Drawings.
6. Replace deck as indicated on Drawings. Replacement deck is specified in Division 31 **OR** Division 03 **OR** Division 21 Section(s) "Fire-suppression Standpipes".

D. Infill Materials Installation

1. Immediately after removal of selected portions of existing membrane roofing system, and inspection and repair, if needed, of deck, fill in the tear-off areas to match existing membrane roofing system construction.
 - a. Installation of infill materials is specified in Division 07.
 - b. Install new roofing membrane patch over roof infill area. If new roofing membrane is installed the same day tear-off is made, roofing membrane patch is not required.

E. Temporary Roofing Membrane

1. Install approved temporary roofing membrane over area to be reroofed.
OR
Install temporary roofing membrane over area to be reroofed. Install two glass-fiber felts **OR** Mechanically fasten base sheet and install a glass-fiber felt, **as directed**, lapping each sheet 19 inches (483 mm) over preceding sheet. Embed glass-fiber felt in a solid mopping of hot roofing asphalt applied within equiviscous temperature range. Glaze-coat completed surface with hot roofing asphalt.
2. Remove temporary roofing membrane before installing new roofing membrane.
OR
Prepare the temporary roof to receive new roofing membrane according to approved temporary roofing membrane proposal **OR** by patching and repairing temporary roofing membrane, **as directed**. Restore temporary roofing membrane to watertight condition. Obtain approval for temporary roof substrate from roofing membrane manufacturer and the Owner before installing new roof.



F. Roof Re-Cover Preparation

1. Remove blisters, ridges, buckles, mechanically attached roofing membrane fastener buttons projecting above the membrane, **as directed**, and other substrate irregularities from existing roofing membrane that inhibit new recover boards from conforming to substrate.
 - a. Remove loose aggregate from aggregate-surfaced built-up bituminous roofing with a power broom.
 - b. Scarify the surface of sprayed polyurethane foam as necessary to achieve a sufficiently uniform plane to receive new recover boards.
 - c. Broom clean existing substrate.
 - d. Coordinate with the Owner's inspector to schedule times for tests and inspections before proceeding with installation of recover boards.
 - e. Verify that existing substrate is dry before proceeding with installation of recover boards. Spot check substrates with an electrical capacitance moisture-detection meter.
 - f. Remove materials that are wet or damp. Removal will be paid for by adjusting the Contract Sum according to unit prices included in the Contract Documents.
2. Remove blisters, ridges, buckles, mechanically attached roofing membrane fastener buttons projecting above the membrane, **as directed**, and other substrate irregularities from existing roofing membrane that inhibit new recover boards **OR** roofing membrane, **as directed**, from conforming to substrate.
 - a. Remove loose aggregate from aggregate-surfaced built-up bituminous roofing with a power broom.
 - b. Scarify the surface of sprayed polyurethane foam as necessary to achieve a sufficiently uniform plane to receive new recover boards **OR** roofing membrane, **as directed**.
 - c. Broom clean existing substrate.
 - d. Coordinate with the Owner's inspector to schedule times for tests and inspections.
 - e. Verify that existing substrate is dry before proceeding with installation. Spot check substrates with an electrical capacitance moisture-detection meter.
 - f. Remove materials that are wet and damp. Removal will be paid for by adjusting the Contract Sum according to unit prices included in the Contract Documents.
3. Remove blisters and areas of membrane not fully adhered.

OR

Remove mechanically attached roofing membrane fastener buttons projecting above the membrane and other, **as directed**, substrate irregularities that inhibit new recover boards from conforming to substrate.

 - a. Remove loose aggregate from aggregate-surfaced built-up bituminous roofing with a power broom.
 - b. Clean substrate of contaminants such as dirt, debris, oil, and grease that can affect adhesion of coated foamed roofing.
 - c. Power vacuum the existing roof surface. If recommended by foam manufacturer, prime dried surface at recommended rate with recommended primer.
 - d. Scarify the surface of coated polyurethane roofing as necessary to achieve a suitable substrate for new roofing.
 - e. Provide additional uplift securement for existing roofing system with new screws and plates applied to each roof zone at the following densities:
 - 1) Field of roof, one fastener for each.
 - 2) Corners of roof, one fastener for each.
 - 3) Perimeters of roof, one fastener for each. Width of perimeter zone of roof as directed by the Owner.
 - f. Verify that surface is dry by pressing litmus paper to surface areas most likely to retain moisture, such as shaded areas and low spots. If paper changes color, surface is too wet to apply foam.
 - g. Build up isolated low spots on existing roofing membrane with sprayed foam specified in Division 07 Section "Coated Foamed Roofing" to prevent ponding.

G. Existing Base Flashings



1. Remove existing base flashings around parapets, curbs, walls, and penetrations.
 - a. Clean substrates of contaminants such as asphalt, sheet materials, dirt, and debris.
 2. Do not damage metal counterflashings that are to remain. Replace metal counterflashings damaged during removal with counterflashings of same metal, weight or thickness, and finish **OR** specified in Division 07 Section "Sheet Metal Flashing And Trim" **OR** specified in Division 07 Section "Roof Specialties", **as directed**.
 3. Inspect parapet sheathing for deterioration and damage. If parapet sheathing has deteriorated, immediately notify the Owner.
 4. Remove existing parapet sheathing and replace with new pressure-preservative **OR** exterior fire-retardant, **as directed**, -treated plywood sheathing, 19/32 inch (15 mm) thick. If parapet framing has deteriorated, immediately notify the Owner.
 - a. Plywood parapet sheathing is specified in Division 06 Section(s) "Rough Carpentry" **OR** "Miscellaneous Rough Carpentry", **as directed**.
- H. Fastener Pull-Out Testing
1. Perform **OR** Retain independent testing and inspecting agency to conduct, **as directed**, fastener pull-out tests according to SPRI FX-1, and submit test report to the Owner **OR** roofing membrane manufacturer, **as directed**, before installing new membrane roofing system.
 - a. Obtain the Owner's **OR** roofing membrane manufacturer's, **as directed**, approval to proceed with specified fastening pattern. the Owner **OR** Roofing membrane manufacturer, **as directed**, may furnish revised fastening pattern commensurate with pull-out test results.
- I. Recover Board Installation
1. Install recover boards over roof insulation **OR** roofing membrane, **as directed**, with long joints in continuous straight lines and end joints staggered between rows. Loosely butt recover boards together and fasten to deck, **as directed**.
 - a. Tape joints of recover boards if required by roofing membrane manufacturer.
 - b. Fasten recover boards to resist wind-uplift pressure at corners, perimeter, and field of roof specified in Division 07 Section "Built-up Asphalt Roofing".
 - c. Install additional fasteners near board corners and edges as necessary to conform boards to substrate and to adjacent boards.
- J. Disposal
1. Collect demolished materials and place in containers. Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.
 - a. Storage or sale of demolished items or materials on-site is not permitted.
 2. Transport and legally dispose of demolished materials off the Owner's property.

END OF SECTION 07 05 13 00d



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Task	Specification	Specification Description
07 05 13 00	07 53 16 00	EPDM Membrane Roofing



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SECTION 07 11 13 00 - BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. This specification covers the furnishing and installation of materials for bituminous dampproofing. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

1.2 SUMMARY

- A. Section Includes:
 - 1. Hot-applied asphalt dampproofing.
 - 2. Cold-applied, cut-back-asphalt dampproofing.
 - 3. Cold-applied, emulsified-asphalt dampproofing.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. LEED Submittals:
 - 1. Product Data for Credit IEQ 4.2: For dampproofing, documentation including printed statement of VOC content.
 - 2. Laboratory Test Reports for Credit IEQ 4: For dampproofing, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

1.4 FIELD CONDITIONS

- A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit dampproofing to be performed according to manufacturers' written instructions.
- B. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has cured.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Source Limitations: Obtain primary dampproofing materials and primers from single source from single manufacturer. Provide protection course, molded-sheet drainage panels and auxiliary materials recommended in writing by manufacturer of primary materials.



- B. VOC Content: Products shall comply with VOC content limits of authorities having jurisdiction unless otherwise required.

2.2 HOT-APPLIED ASPHALT DAMPPROOFING

- A. Hot-Applied Asphalt: ASTM D 449, Type II **OR** Type III, **as directed**.
- B. VOC Content: 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Low-Emitting Materials: Dampproofing shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 COLD-APPLIED, CUT-BACK-ASPHALT DAMPPROOFING

- A. Trowel Coats: ASTM D 4586, Type I, Class 1, fibered.
- B. Brush and Spray Coats: ASTM D 4479, Type I, fibered or nonfibered.
- C. VOC Content: 250 **OR** 300, **as directed**, g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. Low-Emitting Materials: Dampproofing shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

- A. Trowel Coats: ASTM D 1227, Type II, Class 1.
- B. Fibered Brush and Spray Coats: ASTM D 1227, Type II, Class 1.
- C. Brush and Spray Coats: ASTM D 1227, Type III, Class 1.
- D. VOC Content: Zero **OR** 30 g/L or less, **as directed**.
- E. Low-Emitting Materials: Dampproofing shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.5 AUXILIARY MATERIALS

- A. General: Furnish auxiliary materials recommended in writing by dampproofing manufacturer for intended use and compatible with bituminous dampproofing.
- B. Cut-Back-Asphalt Primer: ASTM D 41.
- C. Emulsified-Asphalt Primer: ASTM D 1227, Type III, Class 1, except diluted with water as recommended in writing by manufacturer.



1. Primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

- D. Asphalt-Coated Glass Fabric: ASTM D 1668, Type I.
- E. Patching Compound: Epoxy or latex-modified repair mortar **OR** Asbestos-free fibered mastic, **as directed**, of type recommended in writing by dampproofing manufacturer.
- F. Protection Course: ASTM D 6506, 1/8-inch- (3-mm-) thick, semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners.
- G. Protection Course: Fan folded, with a core of extruded-polystyrene board insulation faced on one side or both sides with plastic film, nominal thickness 1/4 inch (6 mm), with a compressive strength of not less than 8 psi (55 kPa) per ASTM D 1621, and maximum water absorption by volume of 0.6 percent per ASTM C 272.
- H. Protection Course: Extruded-polystyrene board insulation, unfaced, ASTM C 578, Type X, 1/2 inch (13 mm) thick.
- I. Protection Course: Smooth-surfaced roll roofing complying with ASTM D 6380, Class S, Type III.

2.6 MOLDED-SHEET DRAINAGE PANELS

- A. Molded-Sheet Drainage Panel: Comply with Section 334600 "Subdrainage."
- B. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel: Composite subsurface drainage panel consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 (0.21-mm) sieve laminated to one side of the core; and with a vertical flow rate of 9 to 15 gpm per ft. (112 to 188 L/min. per m).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions with Applicator present, for compliance with requirements for surface smoothness, surface moisture, and other conditions affecting performance of bituminous dampproofing work.
 1. Test for surface moisture according to ASTM D 4263.
- B. Proceed with application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.



- B. Clean substrates of projections and substances detrimental to the dampproofing work; fill voids, seal joints, and remove bond breakers if any, as recommended in writing by prime material manufacturer.
- C. Apply patching compound to patch and fill tie holes, honeycombs, reveals, and other imperfections; cover with asphalt-coated glass fabric.

3.3 APPLICATION, GENERAL

- A. Comply with manufacturer's written instructions for dampproofing application, cure time between coats, and drying time before backfilling unless more stringent requirements are indicated.
 - 1. Apply dampproofing to provide continuous plane of protection.
 - 2. Apply additional coats if recommended in writing by manufacturer or to achieve a smooth surface and uninterrupted coverage.
- B. Where dampproofing footings and foundation walls, apply from finished-grade line to top of footing; extend over top of footing and down a minimum of 6 inches (150 mm) over outside face of footing.
 - 1. Extend dampproofing 12 inches (300 mm) onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.
 - 2. Install flashings and corner protection stripping at internal and external corners, changes in plane, construction joints, cracks, and where shown as "reinforced," by embedding an 8-inch- (200-mm-) wide strip of asphalt-coated glass fabric in a heavy coat of dampproofing. Dampproofing coat for embedding fabric is in addition to other coats required.
- C. Where dampproofing exterior face of inner wythe of exterior masonry cavity walls, lap dampproofing at least 1/4 inch (6 mm) onto flashing, masonry reinforcement, veneer ties, and other items that penetrate inner wythe.
 - 1. Extend dampproofing over outer face of structural members and concrete slabs that interrupt inner wythe.
 - 2. Lap dampproofing at least 1/4 inch (6 mm) onto shelf angles supporting veneer.
- D. Where dampproofing interior face of above-grade, exterior concrete and masonry single-wythe masonry walls, continue dampproofing through intersecting walls by keeping vertical mortar joints at intersection temporarily open or by dampproofing wall before constructing intersecting walls.

3.4 HOT-APPLIED ASPHALT DAMPPROOFING

- A. Do not apply hot asphalt when substrate condition causes foaming.
- B. Kettle Temperature: Comply with dampproofing-material manufacturer's written instructions, and keep at least 25 deg F (14 deg C) below the flash point.
- C. Prime masonry and other porous substrates.
- D. Apply a uniform coat of hot asphalt by mopping or spraying at not less than 20 lb or 2.5 gal./100 sq. ft. (1 kg or 1 L/sq. m).
 - 1. Apply a second coat to below-grade foundation walls and where first application has failed to produce a smooth surface and uninterrupted coverage. Apply second coat at the rate specified for first coat.



3.5 COLD-APPLIED, CUT-BACK-ASPHALT DAMPPROOFING

- A. Concrete Foundations and Parged Masonry Foundation Walls: Apply two brush or spray coats at not less than 1.25 gal./100 sq. ft. (0.5 L/sq. m) for first coat and 1 gal./100 sq. ft. (0.4 L/sq. m) for second coat or one trowel coat at not less than 4 gal./100 sq. ft. (1.6 L/sq. m).
- B. Unparged Masonry Foundation Walls: Apply primer and two brush or spray coats at not less than 1.25 gal./100 sq. ft. (0.5 L/sq. m) for first coat and 1 gal./100 sq. ft. (0.4 L/sq. m) for second coat or primer and one trowel coat at not less than 4 gal./100 sq. ft. (1.6 L/sq. m).
- C. Unexposed Face of Concrete Retaining Walls: Apply one brush or spray coat at not less than 1.25 gal./100 sq. ft. (0.5 L/sq. m).
- D. Unexposed Face of Masonry Retaining Walls: Apply primer and one brush or spray coat at not less than 1.25 gal./100 sq. ft. (0.5 L/sq. m).
- E. Concrete Backup for Brick Veneer Assemblies, Stone Veneer Assemblies and Dimension Stone Cladding: Apply one brush or spray coat at not less than 1 gal./100 sq. ft. (0.4 L/sq. m).
- F. Masonry Backup for Brick Veneer Assemblies, Stone Veneer Assemblies and Dimension Stone Cladding: Apply primer and one brush or spray coat at not less than 1 gal./100 sq. ft. (0.4 L/sq. m).
- G. Exterior Face of Inner Wythe of Cavity Walls: Apply primer and one brush or spray coat at not less than 1 gal./100 sq. ft. (0.4 L/sq. m).

3.6 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

- A. Concrete Foundations and Parged Masonry Foundation Walls: Apply two brush or spray coats at not less than 1.5 gal./100 sq. ft. (0.6 L/sq. m) for first coat and 1 gal./100 sq. ft. (0.4 L/sq. m) for second coat one fibered brush or spray coat at not less than 3 gal./100 sq. ft. (1.2 L/sq. m) or one trowel coat at not less than 4 gal./100 sq. ft. (1.6 L/sq. m).
- B. Unparged Masonry Foundation Walls: Apply primer and two brush or spray coats at not less than 1.5 gal./100 sq. ft. (0.6 L/sq. m) for first coat and 1 gal./100 sq. ft. (0.4 L/sq. m) for second coat primer and one fibered brush or spray coat at not less than 3 gal./100 sq. ft. (1.2 L/sq. m) or primer and one trowel coat at not less than 5 gal./100 sq. ft. (2 L/sq. m).
- C. Unexposed Face of Concrete Retaining Walls: Apply one brush or spray coat at not less than 1.25 gal./100 sq. ft. (0.5 L/sq. m).
- D. Unexposed Face of Masonry Retaining Walls: Apply primer and one brush or spray coat at not less than 1.25 gal./100 sq. ft. (0.5 L/sq. m).
- E. Concrete Backup for Brick Veneer Assemblies, Stone Veneer Assemblies and Dimension Stone Cladding: Apply one brush or spray coat at not less than 1 gal./100 sq. ft. (0.4 L/sq. m).
- F. Masonry Backup for Brick Veneer Assemblies, Stone Veneer Assemblies and Dimension Stone Cladding: Apply primer and one brush or spray coat at not less than 1 gal./100 sq. ft. (0.4 L/sq. m).
- G. Exterior Face of Inner Wythe of Cavity Walls: Apply primer and one brush or spray coat at not less than 1 gal./100 sq. ft. (0.4 L/sq. m).
- H. Interior Face of Exterior Concrete Walls: Where above grade and indicated to be furred and finished, apply one brush or spray coat at not less than 1 gal./100 sq. ft. (0.4 L/sq. m).



- I. Interior Face of Single-Wythe Exterior Masonry Walls: Where above grade and indicated to be furred and finished, apply primer and one brush or spray coat at not less than 1 gal./100 sq. ft. (0.4 L/sq. m).

3.7 INSTALLATION OF PROTECTION COURSE

- A. Where indicated, install protection course over completed-and-cured dampproofing. Comply with dampproofing-material and protection-course manufacturers' written instructions for attaching protection course.
 - 1. Support protection course over cured coating with spot application of adhesive type recommended in writing by protection-board manufacturer.
 - 2. Install protection course on same day **OR** within 24 hours, **as directed**, of installation of dampproofing (while coating is tacky) to ensure adhesion.

3.8 INSTALLATION OF MOLDED-SHEET DRAINAGE PANELS

- A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall substrate, according to manufacturer's written instructions. Use adhesives or other methods that do not penetrate dampproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.
 - 1. Install protection course before installing drainage panels.

3.9 CLEANING

- A. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION 07 11 13 00



SECTION 07 11 13 00a - COLD FLUID-APPLIED WATERPROOFING

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for cold fluid-applied waterproofing. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Single-component polyurethane waterproofing.
 - b. Two-component polyurethane waterproofing.
 - c. Polyester waterproofing.
 - d. Latex-rubber waterproofing.
 - e. Molded-sheet drainage panels.
 - f. Insulation.
 - g. Plaza deck pavers.

C. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: Show locations and extent of waterproofing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.
3. Product test reports.

D. Quality Assurance

1. Installer Qualifications: A firm that is approved or licensed by **OR** acceptable to, **as directed**, waterproofing manufacturer for installation of waterproofing required for this Project.
2. Preinstallation Conference: Conduct conference at Project site.
 - a. Review waterproofing requirements including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and flashings, installation procedures, testing and inspection procedures, and protection and repairs.

E. Delivery, Storage, And Handling

1. Deliver liquid materials to Project site in original containers with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, shelf life, and directions for storing and mixing with other components.
2. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by waterproofing manufacturer.
3. Remove and replace liquid materials that cannot be applied within their stated shelf life.
4. Protect stored materials from direct sunlight.

F. Project Conditions

1. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate, when relative humidity exceeds 85 percent, or when temperatures are less than 5 deg F (3 deg C) above dew point.

G. Warranty



1. Special Manufacturer's Warranty: Manufacturer's standard form in which waterproofing manufacturer and Installer agree to repair or replace waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.
 - a. Warranty Period: Five years from date of Final Completion.

1.2 PRODUCTS

- A. Single-Component Polyurethane Waterproofing
 1. Single-Component, Modified Polyurethane Waterproofing: Comply with ASTM C 836 and with manufacturer's written physical requirements.
 2. Single-Component, Reinforced, Modified Polyurethane Waterproofing: Comply with ASTM C 836 and with manufacturer's written physical requirements.
 3. Single-Component, Unmodified Polyurethane Waterproofing: Comply with ASTM C 836 and with manufacturer's written physical requirements.
- B. Two-Component Polyurethane Waterproofing
 1. Two-Component, Modified Polyurethane Waterproofing: Comply with ASTM C 836 and with manufacturer's written physical requirements.
 2. Two-Component, Unmodified Polyurethane Waterproofing: Comply with ASTM C 836 and with manufacturer's written physical requirements.
 3. Two-Component, Reinforced, Unmodified Polyurethane Waterproofing: Comply with ASTM C 836 and with manufacturer's written physical requirements.
- C. Polyester Waterproofing
 1. Two-Component, Reinforced, Unsaturated Polyester Waterproofing: Comply with ASTM C 836 and with manufacturer's written physical requirements.
- D. Latex-Rubber Waterproofing
 1. Two-Component, Unreinforced, Latex-Rubber Waterproofing: Comply with ASTM C 836 and with manufacturer's written physical requirements.
 2. Two-Component, Reinforced, Latex-Rubber Waterproofing: Comply with ASTM C 836 and with manufacturer's written physical requirements.
- E. Auxiliary Materials
 1. General: Provide auxiliary materials recommended by manufacturer to be compatible with one another and with waterproofing, as demonstrated by waterproofing manufacturer, based on testing and field experience.
 2. Primer: Manufacturer's standard, factory-formulated polyurethane or epoxy primer.
 3. Sheet Flashing: 50-mil- (1.3-mm-) minimum, nonstaining, uncured sheet neoprene.
 - a. Adhesive: Manufacturer's recommended contact adhesive.
 4. Membrane-Reinforcing Fabric: Nonwoven, needle-punched white polyester fabric, 6-oz./sq. yd. (200-g/sq. m) **OR** 5-oz./sq. yd. (169-g/sq. m) **OR** 3.2-oz./sq. yd. (109-g/sq. m) **OR** manufacturer's standard, **as directed**, weight.
 5. Joint Reinforcing Strip: Manufacturer's recommended fiberglass mesh or polyester fabric.
 6. Joint Sealant: Multicomponent polyurethane sealant, compatible with waterproofing, complying with ASTM C 920 Type M, Class 25; Grade NS for sloping and vertical applications or Grade P for deck applications; Use NT exposure; and as recommended by manufacturer for substrate and joint conditions.
 - a. Backer Rod: Closed-cell polyethylene foam.
- F. Protection Course
 1. Protection Course: ASTM D 6506, semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners and as follows:



- a. Thickness: 1/8 inch (3 mm), nominal, for vertical applications; 1/4 inch (6 mm), nominal, elsewhere.
 - b. Adhesive: Rubber-based solvent type recommended by waterproofing manufacturer for type of protection course.
 2. Protection Course: Fan folded, with a core of extruded-polystyrene board insulation faced one or both side(s) with plastic film, nominal thickness of 1/4 inch (6 mm), with compressive strength not less than 8 psi (55 kPa) per ASTM D 1621 and maximum water absorption by volume of 0.6 percent per ASTM C 272.
 3. Protection Course: Unfaced, fan-folded, rigid, extruded-polystyrene board insulation; nominal thickness of 1/4 inch (6 mm) with compressive strength of not less than 8 psi (55 kPa) per ASTM D 1621.
 4. Protection Course: Fan folded, with a core of molded-polystyrene board insulation faced both sides with plastic film, nominal thickness of 1/4 inch (6 mm) **OR** 3/8 inch (9.5 mm) **OR** 1/2 inch (13 mm), **as directed**, with compressive strength not less than 12 psi (83 kPa) per ASTM D 1621 and water absorption by volume of less than 1 percent per ASTM C 272.
 5. Protection Course: Unfaced, extruded-polystyrene board insulation; ASTM C 578, Type X, 1/2 inch (13 mm) thick.
 6. Protection Course: Molded-polystyrene board insulation, ASTM C 578, Type I, 0.90-lb/cu. ft. (15-kg/cu. m) minimum density, 1-inch (25-mm) minimum thickness.
- G. Molded-Sheet Drainage Panels
1. Molded-Sheet Drainage Panel: Comply with Division 33 Section "Subdrainage".
 2. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel: Manufactured composite subsurface drainage panels consisting of a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 (0.21-mm) sieve laminated to one side with or without a polymeric film bonded to the other side of a studded, nonbiodegradable, molded-plastic-sheet drainage core, with a vertical flow rate of 9 to 15 gpm per ft. (112 to 188 L/min. per m).
 3. Woven-Geotextile-Faced, Molded-Sheet Drainage Panel: Manufactured composite subsurface drainage panels consisting of a woven-geotextile facing with an apparent opening size not exceeding No. 40 (0.43-mm) sieve, laminated to one side with or without a polymeric film bonded to the other side of a studded, nonbiodegradable, molded-plastic-sheet drainage core, with a horizontal flow rate not less than 2.8 gpm per ft. (35 L/min. per m).
- H. Insulation
1. Board Insulation: Extruded-polystyrene board insulation complying with ASTM C 578, square or shiplap edged.
 - a. Type IV, 25-psi (173-kPa) minimum compressive strength.
 - b. Type VI, 40-psi (276-kPa) minimum compressive strength.
 - c. Type VII, 60-psi (414-kPa) minimum compressive strength.
 - d. Type V, 100-psi (690-kPa) minimum compressive strength.
 2. Unfaced, Wall Insulation Drainage Panels: Extruded-polystyrene board insulation complying with ASTM C 578, Type IV, 25-psi (173-kPa) **OR** Type VI, 40-psi (276-kPa), **as directed**, minimum compressive strength; unfaced; fabricated with shiplap or channel edges and with one side having grooved drainage channels.
 3. Geotextile-Faced, Wall Insulation Drainage Panels: Extruded-polystyrene board insulation complying with ASTM C 578, Type IV, 25-psi (173-kPa) **OR** Type VI, 40-psi (276-kPa), **as directed**, minimum compressive strength; fabricated with tongue-and-groove edges and with one side having grooved drainage channels faced with a nonwoven-geotextile filter fabric.
 4. Unfaced, Plaza Deck, Insulation Drainage Panels: Extruded-polystyrene board insulation complying with ASTM C 578, Type VI, 40-psi (276-kPa) **OR** Type VII, 60-psi (414-kPa), **as directed**, minimum compressive strength; unfaced; fabricated with shiplapped or channel edges and with one side having ribbed drainage channels.
 5. Geotextile-Faced, Plaza Deck, Insulation Drainage Panels: Extruded-polystyrene board insulation complying with ASTM C 578, Type VII, 60-psi (414-kPa) minimum compressive strength; fabricated with tongue-and-groove edges and with one side having grooved drainage channels faced with manufacturer's standard, nonwoven-geotextile filter fabric.



- I. Plaza Deck Pavers
 1. Plaza Deck Pavers: Brick **OR** Concrete **OR** Asphalt-block, **as directed**, pavers specified in Division 32 Section "Unit Paving".
 2. Plaza Deck Pavers: Granite **OR** Limestone **OR** Marble **OR** Quartz-based stone **OR** Slate, **as directed**, pavers specified in Division 09 Section "Stone Flooring".
 3. Plaza Deck Pavers: Heavyweight, hydraulically pressed, concrete units, square edged **OR** with top edges beveled 3/16 inch (5 mm), **as directed**, manufactured for use as plaza deck pavers; minimum compressive strength of 7500 psi (52 MPa) **OR** 6500 psi (45 MPa), **as directed**, ASTM C 140; absorption not greater than 5 percent, ASTM C 140; no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance according to ASTM C 67.
 - a. Thickness: 1-5/8 inches (41 mm) **OR** 1-3/4 inches (45 mm) **OR** 2 inches (51 mm) **OR** 2-3/8 inches (60 mm), **as directed**.
 - b. Face Size: 8-7/8 inches (225 mm) square **OR** 9 inches (229 mm) square **OR** 9-by-18 inches (229-by-457 mm) **OR** 12 inches (305 mm) square **OR** 12-by-24 inches (305-by-610 mm) **OR** 18 inches (457 mm) square **OR** 24 inches (610 mm) square **OR** As indicated, **as directed**.
 - c. Color: As indicated by manufacturer's designations **OR** Match sample **OR** As selected from manufacturer's full range, **as directed**.
 4. Setting Bed: Provide aggregate **OR** mortar **OR** bituminous, **as directed**, setting-bed materials specified in Division 32 Section "Unit Paving".
 5. Paver Pedestals: Paver manufacturer's standard SBR rubber, high-density polyethylene, or polyurethane paver support assembly, including fixed-height **OR** adjustable or stackable, **as directed**, pedestals, shims, and spacer tabs for joint spacing of 1/8 inch (3 mm) **OR** 3/16 inch (5 mm) **OR** 1/8 to 3/16 inch (3 to 5 mm), **as directed**.
 - a. Concrete Fill: ACI 301, compressive strength of 5000 psi (34 MPa) at 28 days and air content of 6 percent.

1.3 EXECUTION

- A. Surface Preparation
 1. Clean and prepare substrate according to manufacturer's written recommendations. Provide clean, dust-free, and dry substrate for waterproofing application.
 2. Mask off adjoining surfaces not receiving waterproofing to prevent spillage or overspray affecting other construction.
 3. Close off deck drains and other deck penetrations to prevent spillage and migration of waterproofing fluids.
 4. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, acid residues, and other penetrating contaminants or film-forming coatings from concrete.
 - a. Abrasive blast clean concrete surfaces uniformly to expose top surface of fine aggregate according to ASTM D 4259 with a self-contained, recirculating, blast-cleaning apparatus. Remove material to provide a sound surface free of laitance, glaze, efflorescence, curing compounds, concrete hardeners, or form-release agents. Remove remaining loose material and clean surfaces according to ASTM D 4258.
 5. Remove fins, ridges, and other projections and fill honeycomb, aggregate pockets, and other voids.
- B. Preparation At Terminations And Penetrations
 1. Prepare vertical and horizontal surfaces at terminations and penetrations through waterproofing and at expansion joints, drains, and sleeves according to ASTM C 898 **OR** ASTM C 1471, **as directed**, and manufacturer's written instructions.
 2. Prime substrate unless otherwise instructed by waterproofing manufacturer.
 3. Apply waterproofing in two separate applications, and embed a joint reinforcing strip in the first preparation coat when recommended by waterproofing manufacturer.



- a. Provide sealant cants around penetrations and at inside corners of deck-to-wall butt joints when recommended by waterproofing manufacturer.
- C. Joint And Crack Treatment
1. Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C 898 **OR** ASTM C 1471, **as directed**, and waterproofing manufacturer's written instructions. Remove dust and dirt from joints and cracks, complying with ASTM D 4258, before coating surfaces.
 - a. Comply with ASTM C 1193 for joint-sealant installation.
 - b. Apply bond breaker between sealant and preparation strip.
 - c. Prime substrate and apply a single thickness of preparation strip extending a minimum of 3 inches (75 mm) along each side of joint. Apply waterproofing in two separate applications and embed a joint reinforcing strip in the first preparation coat.
 2. Install sheet flashing and bond to deck and wall substrates where indicated or required according to waterproofing manufacturer's written instructions.
 - a. Extend sheet flashings onto perpendicular surfaces and other work penetrating substrate according to ASTM C 898.
- D. Waterproofing Application
1. Apply waterproofing according to ASTM C 898 **OR** ASTM C 1471, **as directed**, and manufacturer's written instructions.
 2. Start installing waterproofing in presence of manufacturer's technical representative.
 3. Apply primer over prepared substrate.
 4. Unreinforced Waterproofing Applications: Mix materials and apply waterproofing by spray, roller, notched squeegee, trowel, or other application method suitable to slope of substrate.
 - a. Apply one or more coats of waterproofing to obtain a seamless membrane free of entrapped gases, with an average dry film thickness of 60 mils (1.5 mm) and a minimum dry film thickness of 50 mils (1.3 mm) at any point **OR** 120 mils (3 mm), **as directed**.
 - b. Apply waterproofing to prepared wall terminations and vertical surfaces.
 - c. Verify wet film thickness of waterproofing every 100 sq. ft. (9.3 sq. m).
 5. Reinforced Waterproofing Applications: Mix materials and apply waterproofing by roller, notched squeegee, trowel, or other suitable application method.
 - a. Apply first coat of waterproofing, embed membrane-reinforcing fabric, and apply second coat of waterproofing to completely saturate reinforcing fabric and to obtain a seamless reinforced membrane free of entrapped gases, with an average dry film total thickness of 70 mils (1.8 mm) **OR** 80 mils (2 mm) **OR** 120 mils (3 mm) **as directed**.
 - b. Apply reinforced waterproofing to prepared wall terminations and vertical surfaces.
 - c. Verify wet film thickness of waterproofing every 100 sq. ft. (9.3 sq. m).
 6. Install protection course with butted joints over nominally cured membrane before starting subsequent construction operations.
 - a. Molded-sheet drainage panels **OR** Insulation drainage panels **OR** Board insulation, **as directed**, may be used in place of a separate protection course to vertical applications when approved by waterproofing manufacturer.
- E. Molded-Sheet Drainage Panel Installation
1. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate, according to manufacturer's written instructions. Use adhesives or mechanical fasteners that do not penetrate waterproofing. Lap edges and ends of geotextile fabric to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.
 - a. For vertical applications, install board insulation **OR** protection course, **as directed**, before installing drainage panels.
- F. Insulation Installation
1. Install one or more layers of board insulation to achieve required thickness **OR** insulation drainage panels, **as directed**, over waterproofed surfaces. Cut and fit to within 3/4 inch (19 mm) of projections and penetrations.



2. On vertical surfaces, set insulation units in adhesive applied according to manufacturer's written instructions. Use type of adhesive recommended in writing by insulation manufacturer.
3. On horizontal surfaces, place insulation units unadhered according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

G. Plaza Deck Paver Installation

1. Setting Bed: Install setting bed in locations and of thickness indicated to comply with requirements in Division 32 Section(s) "Unit Paving" OR Division 09 Section(s) "Stone Flooring", **as directed**.
2. Install concrete pavers, in locations indicated, according to manufacturer's written instructions.
3. Accurately install fixed **OR** adjustable, **as directed**, -height paver pedestals in locations and to elevations required. Adjust for final level and slope with shims.
 - a. Fill paver pedestal with concrete mix, strike smooth with top of pedestal, and cure according to ACI 301.
4. Loosely lay pavers on pedestals, maintaining a uniform open joint width. Tightly seat pavers against spacers to eliminate lateral movement or drift of paving assembly. Align joint patterns parallel in each direction.
 - a. Lay out pavers to avoid less-than-half-width pavers at perimeter or other terminations.
5. Install pavers to not vary more than 1/16 inch (1.6 mm) in elevation between adjacent pavers or more than 1/16 inch (1.6 mm) from surface plane elevation of individual paver.
6. Maintain tolerances of paving installation within 1/4 inch in 10 feet (1:48) of surface plane in any direction.

H. Field Quality Control

1. Flood Testing: Flood test each deck area for leaks, according to recommendations in ASTM D 5957, after completing waterproofing but before overlaying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.
 - a. Flood to an average depth of 2-1/2 inches (64 mm) with a minimum depth of 1 inch (25 mm) and not exceeding a depth of 4 inches (100 mm). Maintain 2 inches (50 mm) of clearance from top of sheet flashings.
 - b. Flood each area for 24 **OR** 48 **OR** 72, **as directed**, hours.
 - c. After flood testing, repair leaks, repeat flood tests, and make further repairs until waterproofing installation is watertight.
2. Engage an independent testing agency to observe flood testing and examine underside of decks and terminations for evidence of leaks during flood testing.

I. Curing, Protection, And Cleaning

1. Cure waterproofing according to manufacturer's written recommendations, taking care to prevent contamination and damage during application stages and curing.
 - a. Do not permit foot or vehicular traffic on unprotected membrane.
2. Protect waterproofing from damage and wear during remainder of construction period.
3. Protect installed board insulation **OR** insulation drainage panels, **as directed**, from damage due to ultraviolet light, harmful weather exposures, physical abuse, and other causes. Immediately after installation, provide temporary coverings where insulation will be subject to abuse and cannot be concealed and protected by permanent construction.
4. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 11 13 00a

**SECTION 07 13 13 00 - BITUMINOUS WATERPROOFING****1.1 GENERAL****A. Description Of Work:**

1. This specification covers the furnishing and installation of materials for bituminous waterproofing. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: For each type of product indicated. Include recommendations for method of application, primer, number of coats, coverage or thickness, and protection course.

C. Delivery, Storage And Handling

1. Waterproofing materials shall be delivered to the project site in the original sealed containers bearing the name of the manufacturer, contents and brand name. Asphalt shall be protected from freezing in a weathertight enclosure. Reinforcement fabrics shall be protected from moisture damage and moisture absorption in a weathertight enclosure or shall be stored off the ground on pallets, and covered on top and all sides with breathable-type canvas tarpaulins. Plastic sheets cause condensation buildup and therefore shall not be used to cover waterproofing materials. Damaged or deteriorated materials shall be removed from project site.

D. Project Conditions

1. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit waterproofing to be performed according to manufacturers' written instructions.
2. Ventilation: Provide adequate ventilation during application of waterproofing in enclosed spaces. Maintain ventilation until waterproofing has cured.

1.2 PRODUCTS**A. Asphalt Waterproofing**

1. Primer: Primer for hot-applied asphalt waterproofing shall conform to ASTM D41, asbestos-free, non-fibrated, manufactured with highly ductile soft asphalts and selected hydrocarbons.
2. Above-Grade Hot-Applied Asphalt: For above-grade applications where asphalt will not be exposed to temperatures exceeding 122 degrees F (50 degrees C), hot-applied asphalt for membrane waterproofing system shall conform to ASTM D449, Type II. For above-grade applications where asphalt will be exposed to sunlight and temperatures exceeding 122 degrees F (50 degrees C), hot-applied asphalt shall conform to ASTM D449, Type III.
3. Below-Grade Hot-Applied Asphalt: Hot-applied asphalt for below-grade applications shall conform to ASTM D449, Type I, asbestos-free, manufactured from crude petroleum, suitable for use with membrane waterproofing systems.
4. Reinforcement Fabrics
 - a. Cotton Fabrics: Cotton fabrics shall be woven entirely of cotton conforming with ASTM D173, thoroughly and uniformly saturated with asphalt.
 - b. Woven Burlap Fabrics: Woven burlap fabrics shall be composed of 100 percent jute fiber and two cotton threads at each selvage conforming with ASTM D1327, thoroughly and uniformly saturated with asphalt. The fabric mesh shall not be completely closed or sealed by the process of saturation. Sufficient porosity shall be maintained to allow successive moppings of the plying asphalt to seep through. The surface shall not be coated or covered with talc or any other substances that will interfere with the adhesion between fabric and plying asphalt. The fabric surface shall be uniformly smooth and free of



irregularities, folds and knots. The finished woven burlap fabrics shall be free of ragged edges, untrue edges, breaks or cracks, and other visible external defects.

- c. Glass Fabrics: Glass fabrics shall conform to ASTM D1668 Type I, asphalt-treated woven glass waterproofing fabrics coated with asphalt.
- d. Flashing Cement: Flashing cement shall conform to ASTM D4586, Type I, trowel grade, asbestos free, manufactured from asphalts characterized as adhesive, healing and ductile.

B. Insulation Boards

- 1. Insulation boards shall conform to ASTM C208 cellulosic fiber boards, construction grade, 1/2 inch (13 mm) thick, fibrous-felted homogeneous panel. Insulation boards shall be manufactured from ligno-cellulosic fibers (wood or cane) by a felting or molding process, asphalt-saturated or coated, with a density of 10 to 31 psf (49 to 151 kg/square meter). Surfaces of insulation boards shall be free of cracks, lumps, excessive departure from planeness, or other defects that adversely affect performance.

1.3 EXECUTION

A. Surface Preparation

- 1. Surfaces scheduled for bituminous waterproofing shall be prepared in accordance with waterproofing manufacturer's recommendations. Surface preparation shall be approved prior to waterproofing application.
- 2. Protection of Surrounding Areas: Before starting the waterproofing work, the surrounding areas and surfaces shall be protected from spillage and migration of asphalt onto other work. Drains and conductors shall be protected from clogging with asphalt.
- 3. Masonry Surfaces: Surfaces shall be free of oil, grease, dirt, laitance, loose material, frost, debris and other contaminants. Mortar joints shall be flush and free of extraneous mortar and chipped or broken masonry.
- 4. Concrete Surfaces: Surfaces shall be properly cured, free of form release agents, oil, grease, dirt, laitance, loose material, frost, debris and other contaminants. Form ties shall be cut flush with surface. Sharp protrusions and form match lines shall be removed. Holes, voids, spalled areas and cracks which can damage waterproofing materials shall be repaired. Rough surfaces shall be parged with a well-adhering coat of cement mortar.
- 5. Metal Surfaces: Surfaces shall be dry and be free of rust, scale, loose paint, oil, grease, dirt, frost and debris.

B. Hot-Applied Asphalt Waterproofing

- 1. Asphalt waterproofing shall be applied when the ambient temperature is 40 degrees F (4 degrees C) or above. Heating kettles and tanks shall be provided with automatic thermostatic control capable of maintaining asphalt temperature. Controls shall be calibrated and maintained in working order for duration of work. At time of application, asphalt shall not be heated above the equiviscous temperature (EVT) recommended by manufacturer. Immediately before use, temperature shall be measured with a portable thermometer at the point of application. EVT and flashpoint temperatures of asphalt in kettle shall be conspicuously posted on kettle. Asphalt with a temperature not conforming to the manufacturer's recommendations shall be returned to the kettle. Asphalt overheated by more than 50 degrees F (10 degrees C) for more than 1 hour shall be removed from site.
- 2. Below-Grade Wall Waterproofing: Waterproofing for foundation walls shall consist of a 1-ply **OR** 2-ply **OR** 3-ply **OR** 4-ply **OR** 5-ply, **as directed**, hot-applied asphalt membrane system. Fabrics shall be installed using the "shingle" method. Joints shall be caulked prior to primer applications. Primer shall be applied at a rate of 1/2 gallon per 100 square feet (0.2 L/square meter). Fabrics shall be overlapped at ends and staggered a minimum 10 inch (250 mm) for 1-ply **OR** 19 inch (480 mm) for 2-ply **OR** 24 inch (610 mm) for 3-ply **OR** 27 inch (685 mm) for 4-ply **OR** 30 inch (750 mm) for 5-ply, **as directed**, system. End-to-end taping is not acceptable. Each fabric shall be firmly embedded into a solid uniform coating of hot asphalt at a rate of 20 pounds per 100 square



feet (0.98 kg/square meter) by pressing with broom. Fabrics shall not touch fabrics. Hot asphalt shall penetrate each fabric to provide the required adhesion. Asphalt between fabrics shall not be excessive to prevent slippage. Waterproofing system consisting of two or more fabrics shall be provided with fabric reinforcement at corners, angles, over construction joints, and in locations where waterproofing fabrics are subject to unusual stress.

3. Floor Waterproofing: Primer shall be applied at a rate of 1/2 gallon per 100 square feet (0.2 L/square meter). Primer shall not be left in puddles. Primer shall be dry to the touch before application of asphalt. Where slab abuts walls, first reinforcing fabric shall extend 6 inches (150 mm) minimum on slab and 8 inches (200 mm) on wall. At vertical corners, first fabric shall extend minimum 5 inches (125 mm) from corner on each side. Second fabric shall lap the first fabric 2 inches (50 mm) minimum. At floor drains, and elsewhere as indicated, the fabric shall extend into a clamping device, set in a heavy coating of flashing cement, and securely clamped.

C. Flood Testing

1. Prior to concealment, waterproofed floors over occupied spaces shall be tested for watertightness. Drains shall be plugged and floors shall be submerged with 3 inches (75 mm) of clean water. Water shall be permitted to stand for a minimum of 24 hours. If leaks occur, water shall be drained and repairs made. Upon completion of repairs, floors shall be flooded with 3 inches (75 mm) of clean water and flood testing shall be repeated for minimum of 24 hours from the time each leak is repaired. Waterproofing system shall be completely watertight, and shall be approved in writing before covering up with other materials. Additional coats of asphalt are not an acceptable method for repairing leaks.

D. Clean-Up

1. Surfaces of other work which are stained with waterproofing materials shall be cleaned with a cleaner recommended by waterproofing manufacturer.

E. Protection Of Completed Work

1. Floor Waterproofing: The completed waterproofing work shall be protected from damage during and after construction. Protective covering shall be placed immediately before proceeding with the work which will conceal the waterproofing.
2. Wall Waterproofing: Waterproofing against which backfill is to be placed shall be protected with a single layer of insulation board. Insulation boards shall be pressed into the final mopping while the asphalt is still hot, with edges of boards placed into moderate contact and joints staggered. For two-layer installation, joints in second layer shall be staggered over joints in first layer. Where surfaced insulation board is used, the surfaced side shall face outward. Boards shall be carefully and neatly fitted around projections, and shall cover the entire surface of the waterproofing materials. Waterproofing system not covered with protection board shall be protected to prevent damage from subsequent building operations. Installed boards shall not remain exposed at the end of a work day.

END OF SECTION 07 13 13 00



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Task	Specification	Specification Description
07 13 13 00	07 11 13 00	Bituminous Dampproofing



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SECTION 07 13 53 00 - ELASTOMERIC SHEET WATERPROOFING

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for elastomeric sheet waterproofing. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Butyl rubber sheet waterproofing.
 - b. EPDM rubber sheet waterproofing.
 - c. Molded-sheet drainage panels.
 - d. Insulation.
 - e. Plaza deck pavers and paver pedestals.

C. Submittals

1. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.
2. Shop Drawings: Show locations and extent of waterproofing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.
3. Product test reports.
4. Special warranties.

D. Quality Assurance

1. Installer Qualifications: A firm that is approved or licensed by **OR** acceptable to, **as directed**, waterproofing manufacturer for installation of units required for this Project.
2. Preinstallation Conference: Conduct conference at Project site.
 - a. Review waterproofing requirements including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

E. Delivery, Storage, And Handling

1. Deliver liquid materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.
2. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by waterproofing manufacturer.
3. Remove and replace liquid materials that cannot be applied within their stated shelf life.
4. Store rolls according to manufacturer's written instructions.
5. Protect stored materials from direct sunlight.

F. Project Conditions

1. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.

G. Warranty



1. Special Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to replace waterproofing material that does not comply with requirements or that fails to remain watertight within 10 **OR** 20, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Sheet Waterproofing

1. Butyl Rubber Sheet: ASTM D 6134, Type II, 60-mil- (1.5-mm-) **OR** 90-mil- (2.3-mm-) **OR** 120-mil- (3.0-mm-), **as directed**, thick flexible sheet, unreinforced, formed from isobutylene-isoprene rubber.
2. EPDM Rubber Sheet: ASTM D 6134, Type I, 60-mil- (1.5-mm-) thick flexible sheet, unreinforced, formed from EPDM.

B. Auxiliary Materials

1. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
 - a. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.
2. Concealed Sheet Flashing: Same material, construction, and thickness as sheet waterproofing or 60-mil- (1.5-mm-) thick, uncured EPDM as required by manufacturer.
3. Exposed Sheet Flashing: 60-mil- (1.5-mm-) thick EPDM, cured or uncured, as required by manufacturer.
4. Bonding Adhesives: Adhesive for bonding polymeric sheets and sheet flashings to substrates and projections.
5. Splicing Cement and Cleaner: Single-component butyl splicing cement and solvent-based splice cleaner.
 - a. Butyl Gum Tape: 30-mil- (0.76-mm-) thick-by-6-1/4-inch- (160-mm-) wide, uncured butyl with polyethylene release film.
6. Lap Sealant: Single-component sealant.
7. In-Seam Sealant: Single-component sealant.
8. Water Cutoff Mastic: Butyl mastic sealant.
9. Waterproofing and Sheet Flashing Accessories: Provide sealants, pourable sealers, cone and vent flashings, inside and outside corner flashings, termination reglets, and other accessories recommended by waterproofing manufacturer for intended use.
10. Metal Termination Bars: Manufacturer's standard aluminum bars, approximately 1 inch (25 mm) wide, prepunched, with zinc-alloy-body fasteners and stainless-steel pins.
11. Protection Course: ASTM D 6506, semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners and as follows:
 - a. Thickness: 1/8 inch (3 mm), nominal, for vertical applications; 1/4 inch (6 mm), nominal, elsewhere.
 - b. Adhesive: Rubber-based solvent type recommended by waterproofing manufacturer for type of protection course.
12. Protection Course:
 - a. Faced, fan folded, with a core of extruded-polystyrene board insulation sandwiched between 2 sheets of plastic film, nominal thickness 1/4 inch (6 mm), with compressive strength of not less than 8 psi (55 kPa) per ASTM D 1621, and maximum water absorption by volume of 0.6 percent per ASTM C 272.
 - b. Unfaced, fan-folded, extruded-polystyrene board insulation, nominal thickness 1/4 inch (6 mm) with compressive strength of not less than 8 psi (55 kPa) per ASTM D 1621.
 - c. Extruded-polystyrene board insulation, unfaced, ASTM C 578, Type X, 1/2 inch (13 mm) thick.
 - d. Molded-polystyrene board insulation, ASTM C 578, Type I, 0.90-lb/cu. ft. (15-kg/cu. m) minimum density, 1-inch (25-mm) minimum thickness.



C. Molded-Sheet Drainage Panels

1. Molded-Sheet Drainage Panel: Comply with Division 33 Section "Subdrainage".
2. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel: Manufactured composite subsurface drainage panels consisting of a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 (0.21-mm) sieve laminated to one side with or without a polymeric film bonded to the other side of a studded, nonbiodegradable, molded-plastic-sheet drainage core, with a vertical flow rate of 9 to 15 gpm per ft. (112 to 188 L/min. per m).
3. Woven-Geotextile-Faced, Molded-Sheet Drainage Panel: Manufactured composite subsurface drainage panels consisting of a woven-geotextile facing with an apparent opening size not exceeding No. 40 (0.425-mm) sieve laminated to one side with or without a polymeric film bonded to the other side of a studded, nonbiodegradable, molded-plastic-sheet drainage core, with a horizontal flow rate not less than 2.8 gpm per ft. (35 L/min. per m).

D. Insulation

1. Board Insulation: Extruded-polystyrene board insulation complying with ASTM C 578, square or shiplap edged.
 - a. Type IV, 25-psi (173-kPa) minimum compressive strength.
 - b. Type VI, 40-psi (276-kPa) minimum compressive strength.
 - c. Type VII, 60-psi (414-kPa) minimum compressive strength.
 - d. Type V, 100-psi (690-kPa) minimum compressive strength.
2. Unfaced Wall Insulation Drainage Panels: Extruded-polystyrene board insulation complying with ASTM C 578, Type IV, 25-psi (173-kPa) or Type VI, 40-psi (276-kPa) minimum compressive strength; unfaced; fabricated with shiplap or channel edges and with 1 side having grooved drainage channels.
3. Geotextile-Faced Wall Insulation Drainage Panels: Extruded-polystyrene board insulation complying with ASTM C 578, Type IV, 25-psi (173-kPa) or Type VI, 40-psi (276-kPa) minimum compressive strength; fabricated with tongue-and-groove edges and with 1 side having grooved drainage channels faced with nonwoven geotextile filter fabric.
4. Unfaced Plaza Deck Insulation Drainage Panels: Extruded-polystyrene board insulation complying with ASTM C 578, Type VI, 40-psi (276-kPa) **OR** Type VII, 60-psi (414-kPa), **as directed**, minimum compressive strength; unfaced; fabricated with shiplapped or channel edges and with 1 side having ribbed drainage channels.
5. Geotextile-Faced Plaza Deck Insulation Drainage Panels: Extruded-polystyrene board insulation complying with ASTM C 578, Type VII, 60-psi (414-kPa) minimum compressive strength; fabricated with tongue-and-groove edges and with 1 side having grooved drainage channels faced with manufacturer's standard, nonwoven geotextile filter fabric.

E. Plaza Deck Pavers

1. Plaza Deck Pavers: Brick **OR** Concrete **OR** Asphalt-block, **as directed**, pavers specified in Division 32 Section "Unit Paving".
2. Plaza Deck Pavers: Granite **OR** Limestone **OR** Marble **OR** Quartz-based stone **OR** Slate, **as directed**, pavers specified in Division 09 Section "Stone Flooring".
3. Plaza Deck Pavers: Heavyweight, hydraulically pressed, concrete units, square edged **OR** with top edges beveled 3/16 inch (5 mm), **as directed**, manufactured for use as plaza deck pavers; minimum compressive strength 7500 psi (52 MPa) **OR** 6500 psi (45 MPa), **as directed**, ASTM C 140; absorption not greater than 5 percent, ASTM C 140; no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance according to ASTM C 67.
 - a. Color: As selected from manufacturer's full range.
4. Setting Bed: Provide aggregate **OR** mortar **OR** bituminous, **as directed**, setting-bed materials specified in Division 32 Section "Unit Paving".
5. Paver Pedestals: Paver manufacturer's standard SBR rubber, HDPE, or polyurethane paver support assembly, including fixed-height **OR** adjustable or stackable, **as directed**, pedestals, shims, and spacer tabs for joint spacing of 1/8 inch (3 mm) **OR** 3/16 inch (5 mm) **OR** 1/8 to 3/16 inch (3 to 5 mm), **as directed**.
 - a. Concrete Fill: ACI 301, compressive strength of 5000 psi (34 MPa) at 28 days and air content of 6 percent.



1.3 EXECUTION

A. Surface Preparation

1. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
2. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
3. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
4. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.
5. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.
6. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions.

B. Fully Adhered Sheet Installation

1. Install fully adhered sheets over entire area to receive waterproofing according to manufacturer's written instructions and recommendations in ASTM D 5843.
2. Accurately align sheets and maintain uniform side and end laps of minimum dimensions required. Stagger end laps.
3. Apply bonding adhesive to substrates at required rate and allow to partially dry.
4. Apply bonding adhesive to sheets and firmly adhere sheets to substrates. Do not apply bonding adhesive to splice area of sheet.
5. Install fully adhered sheets and auxiliary materials to tie into existing waterproofing.
6. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending beyond repaired areas in all directions.
7. Horizontal Application: Apply sheets with side laps shingled with slope of deck where possible.
 - a. Spread sealant bed over deck drain flange at deck drains and securely seal sheet waterproofing in place with clamping ring.

C. Partially Adhered Sheet Installation

1. Install partially adhered sheets over entire area to receive waterproofing according to manufacturer's written instructions.
2. Accurately align sheets and maintain uniform side and end laps of minimum dimensions required. Stagger end laps.
3. Apply bonding adhesive to the following areas of substrates and to each sheet at required rate and allow to partially dry:
 - a. Upper 25 percent of length of each sheet and 18 inches (457 mm) around perimeter of each sheet.
4. Firmly adhere sheets to substrate. Do not apply bonding adhesive to splice area of sheet.
5. Install partially adhered sheets and auxiliary materials to tie into existing waterproofing.
6. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending beyond repaired areas in all directions.

D. Compartmented, Loosely Laid Sheet Installation

1. Install compartmented, loosely laid sheets over entire area to receive waterproofing according to manufacturer's written instructions.
2. Accurately align sheets and maintain uniform side and end laps of minimum dimensions required. Stagger end laps.
3. Apply continuous beads of water cutoff mastic, of size recommended by waterproofing manufacturer, to substrates in a 60-by-60-inch (1500-by-1500-mm) grid pattern before installing sheet.



4. Apply sheets with side laps shingled with slope of deck where possible.
 5. Spread sealant bed over deck drain flange at deck drains and securely seal sheet waterproofing in place with clamping ring.
 6. Install compartmented, loosely laid sheets and auxiliary materials to tie into existing waterproofing.
 7. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending beyond repaired areas in all directions.
- E. Seam Installation
1. Cement Splice: Clean splice areas, apply splicing cement and in-seam sealant, and firmly roll side and end laps of overlapping sheets according to manufacturer's written instructions to produce a splice not less than 6 inches (150 mm) wide and to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet terminations.
 2. Cement and Tape Splice: Clean splice areas, apply splicing cement and butyl gum tape, and firmly roll side and end laps of overlapping sheets according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet terminations.
- F. Sheet Flashing Installation
1. Install sheet flashings and preformed flashing accessories and adhere to substrates according to waterproofing manufacturer's written instructions.
 2. Form wall flashings using exposed sheet flashing.
 3. Extend deck sheet waterproofing to form wall flashings.
 - a. Flash penetrations and field-formed inside and outside corners with uncured sheet flashing.
 - b. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.
 4. Cover expansion joints and discontinuous deck-to-wall or deck-to-deck joints by extending deck sheet waterproofing over joints.
 5. Terminate and seal top of sheet flashings with mechanically anchored termination bars.
- G. Protection Course Installation
1. Install protection course over waterproofing membrane according to manufacturer's written instructions and before beginning subsequent construction operations. Minimize exposure of membrane.
 - a. Molded-sheet drainage panels **OR** Insulation drainage panels **OR** Board insulation, **as directed**, may be used in place of a separate protection course to vertical applications when approved by waterproofing manufacturer.
- H. Molded-Sheet Drainage Panel Installation
1. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate, according to manufacturer's written instructions. Use adhesives or mechanical fasteners that do not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.
 - a. For vertical applications, install board insulation **OR** protection course, **as directed**, before installing drainage panels.
- I. Insulation Installation
1. Install one or more layers of board insulation to achieve required thickness and insulation drainage panels over waterproofed surfaces. Cut and fit to within 3/4 inch (19 mm) of projections and penetrations.
 2. On vertical surfaces, place and secure insulation units according to manufacturer's written instructions.



3. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

J. Plaza Deck Paver Installation

1. Setting Bed: Install setting bed in locations and of thickness indicated to comply with requirements in Division 32 Section(s) "Unit Paving" OR Division 09 Section(s) "Stone Flooring", **as directed**.
2. Install concrete pavers in locations indicated according to manufacturer's written instructions.
3. Accurately install fixed **OR** adjustable, **as directed**, -height paver pedestals and accessories in locations and to elevations required. Adjust for final level and slope with shims.
 - a. Fill paver pedestal with concrete mix, strike smooth with top of pedestal, and cure according to ACI 301.
4. Loosely lay pavers on pedestals, maintaining a uniform open joint width. Tightly seat pavers against spacers to eliminate lateral movement or drift of paving assembly. Align joint patterns parallel in each direction.
 - a. Lay out pavers to avoid less-than-half-width pavers at perimeter or other terminations.
5. Install pavers to not vary more than 1/16 inch (1.6 mm) in elevation between adjacent pavers or more than 1/16 inch (1.6 mm) from surface plane elevation of individual paver.
6. Maintain tolerances of paving installation within 1/4 inch in 10 feet (1:48) of surface plane in any direction.

K. Protection And Cleaning

1. Do not permit foot or vehicular traffic on unprotected membrane.
2. Protect waterproofing from damage and wear during remainder of construction period.
3. Protect installed board insulation **OR** insulation drainage panels, **as directed**, from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation will be subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
4. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 13 53 00



Task	Specification	Specification Description
07 13 53 00	03 01 30 71a	Self-Adhering Sheet Waterproofing



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SECTION 07 14 13 00 - HOT FLUID-APPLIED RUBBERIZED ASPHALT WATERPROOFING

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for hot fluid-applied rubberized asphalt waterproofing. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Rubberized-asphalt waterproofing membrane, unreinforced and reinforced.
 - b. Molded-sheet drainage panels.
 - c. Insulation.
 - d. Plaza deck pavers.

C. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: Show locations and extent of waterproofing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins to adjoining waterproofing, and other termination conditions.
 - a. Include setting drawings showing layout, sizes, sections, profiles, and joint details of pedestal-supported concrete pavers.
3. Product test reports.
4. Sample warranties

D. Quality Assurance

1. Installer Qualifications: A firm that is approved or licensed by **OR** acceptable to, **as directed**, manufacturer for installation of waterproofing required for this Project and is eligible to receive special warranties specified.
2. Preinstallation Conference: Conduct conference at Project site.

E. Delivery, Storage, And Handling

1. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by waterproofing manufacturer.
2. Remove and replace liquid materials that cannot be applied within their stated shelf life.
3. Protect stored materials from direct sunlight.

F. Project Conditions

1. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate, or when temperature is below 0 deg F (minus 18 deg C).
 - a. Do not apply waterproofing in snow, rain, fog, or mist.
2. Maintain adequate ventilation during application and curing of waterproofing materials.

G. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace waterproofing and sheet flashings that do not comply with requirements or that fail to remain watertight within five **OR** 10, **as directed**, years from date of Final Completion.



1.2 PRODUCTS

A. Waterproofing Membrane

1. Hot Fluid-Applied, Rubberized-Asphalt Waterproofing Membrane: Single component; 100 percent solids; hot fluid-applied, rubberized asphalt.

B. Flashing Sheet Materials

1. Elastomeric Flashing Sheet: 50-mil- (1.3-mm-) minimum, uncured sheet neoprene as follows:
 - a. Tensile Strength: 1400 psi (9.6 MPa) minimum; ASTM D 412, Die C.
 - b. Elongation: 300 percent minimum; ASTM D 412.
 - c. Tear Resistance: 125 psi (860 kPa) minimum; ASTM D 624, Die C.
 - d. Brittleness: Does not break at minus 30 deg F (34 deg C); ASTM D 2137.

C. Auxiliary Materials

1. Primer: ASTM D 41, asphaltic primer.
2. Elastomeric Sheet: 50-mil- (1.3-mm-) minimum, uncured sheet neoprene as follows:
 - a. Tensile Strength: 1400 psi (9.6 MPa) minimum; ASTM D 412, Die C.
 - b. Elongation: 300 percent minimum; ASTM D 412.
 - c. Tear Resistance: 125 psi (860 kPa) minimum; ASTM D 624, Die C.
 - d. Brittleness: Does not break at minus 30 deg F (34 deg C); ASTM D 2137.
3. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum termination bars; approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.
4. Sealants and Accessories: Manufacturer's recommended sealants and accessories.
5. Reinforcing Fabric: Manufacturer's recommended, spun-bonded polyester fabric.
6. Protection Course: ASTM D 6506, semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners and nominal thickness of 1/8 inch (3 mm) **OR** 1/4 inch (6 mm), **as directed**.
7. Protection Course: Manufacturer's standard, 80- to 90-mil- (2.0- to 2.3-mm-) thick, fiberglass-reinforced rubberized asphalt or modified bituminous sheet.

D. Molded-Sheet Drainage Panels

1. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel: Manufactured composite subsurface drainage panels consisting of a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 (0.21-mm) sieve, laminated to one side with **OR** without, **as directed**, a polymeric film bonded to the other side of a studded, nonbiodegradable, molded-plastic-sheet drainage core, with a vertical flow rate of 9 to 15 gpm/ft. (112 to 188 L/min. per m).
2. Woven-Geotextile-Faced, Molded-Sheet Drainage Panel: Manufactured composite subsurface drainage panels consisting of a woven-geotextile facing with an apparent opening size not exceeding No. 40 (0.43-mm) sieve, laminated to one side with **OR** without, **as directed**, a polymeric film bonded to the other side of a studded, nonbiodegradable, molded-plastic-sheet drainage core, with a horizontal flow rate not less than 2.8 gpm/ft. (35 L/min. per m).

E. Insulation

1. Board Insulation: Extruded-polystyrene board insulation complying with ASTM C 578, square **OR** shiplap, **as directed**, edged.
 - a. Type IV, 25-psi (173-kPa) minimum compressive strength.
 - b. Type VI, 40-psi (276-kPa) minimum compressive strength.
 - c. Type VII, 60-psi (414-kPa) minimum compressive strength.
 - d. Type V, 100-psi (690-kPa) minimum compressive strength.
2. Unfaced Wall Insulation Drainage Panels: Extruded-polystyrene board insulation complying with ASTM C 578, Type IV, 25-psi (173-kPa) **OR** Type VI, 40-psi (276-kPa), **as directed**, minimum compressive strength; unfaced; fabricated with shiplap or channel edges and with one side having grooved drainage channels.



3. Geotextile-Faced Wall Insulation Drainage Panels: Extruded-polystyrene board insulation complying with ASTM C 578, Type IV, 25-psi (173-kPa) **OR** Type VI, 40-psi (276-kPa), **as directed**, minimum compressive strength; fabricated with tongue-and-groove edges and with one side having grooved drainage channels faced with a nonwoven, geotextile filter fabric.
4. Unfaced Plaza Deck Insulation Drainage Panels: Extruded-polystyrene board insulation complying with ASTM C 578, Type VI, 40-psi (276-kPa) **OR** Type VII, 60-psi (414-kPa), **as directed**, minimum compressive strength; unfaced; fabricated with shiplapped or channel edges and with one side having ribbed drainage channels.
5. Geotextile-Faced Plaza Deck Insulation Drainage Panels: Extruded-polystyrene board insulation complying with ASTM C 578, Type VII, 60-psi (414-kPa) minimum compressive strength; fabricated with tongue-and-groove edges and with one side having grooved drainage channels faced with a nonwoven, geotextile filter fabric.

F. Plaza Deck Pavers

1. Plaza Deck Pavers:
 - a. Brick **OR** Concrete **OR** Asphalt-block, **as directed**, pavers specified in Division 32 Section "Unit Paving".
OR
Granite **OR** Limestone **OR** Marble **OR** Quartz-based stone **OR** Slate, **as directed**, pavers specified in Division 09 Section "Stone Flooring".
OR
Heavyweight, hydraulically pressed, concrete units, square edged **OR** with top edges beveled 3/16 inch (5 mm), **as directed**, manufactured for use as plaza deck pavers; minimum compressive strength 7500 psi (52 MPa) **OR** 6500 psi (45 MPa), **as directed**, ASTM C 140; absorption not greater than 5 percent, ASTM C 140; no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance according to ASTM C 67.
 - 1) Thickness: 1-5/8 inches (41 mm) **OR** 1-3/4 inches (45 mm) **OR** 2 inches (51 mm) **OR** 2-3/8 inches (60 mm), **as directed**.
 - 2) Face Size: 8-7/8 inches (225 mm) square **OR** 9 inches (229 mm) square **OR** 9 by 18 inches (229 by 457 mm) **OR** 12 inches (305 mm) square **OR** 12 by 24 inches (305 by 610 mm) **OR** 18 inches (457 mm) square **OR** 24 inches (610 mm) square, **as directed**.
 - 3) Color: As selected from manufacturer's full range.
2. Setting Bed: Provide aggregate **OR** mortar **OR** bituminous, **as directed**, setting-bed materials specified in Division 32 Section "Unit Paving".
3. Paver Supports: Paver manufacturer's standard SBR rubber, high-density polyethylene, or polyurethane paver support assembly, including fixed-height **OR** adjustable or stackable, **as directed**, pedestals, shims, and spacer tabs for joint spacing of 1/8 inch (3 mm) **OR** 3/16 inch (5 mm), **as directed**.
 - a. Concrete Fill: ACI 301, compressive strength of 5000 psi (34 MPa) at 28 days, and air content of 6 percent.

1.3 EXECUTION

A. Preparation

1. Clean and prepare substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for waterproofing application.
2. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
3. Close off deck drains and other deck penetrations to prevent spillage and migration of waterproofing fluids.
4. Remove grease, oil, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.



- a. Abrasive blast clean concrete surfaces uniformly to expose top surface of fine aggregate according to ASTM D 4259 with a self-contained, recirculating, blast-cleaning apparatus. Remove material to provide a sound surface free of laitance, glaze, efflorescence, curing compounds, concrete hardeners, or form-release agents. Remove remaining loose material and clean surfaces according to ASTM D 4258.
 5. Remove fins, ridges, and other projections and fill honeycomb, aggregate pockets, and other voids.
- B. Joints, Cracks, And Terminations
1. Prepare and treat substrates to receive waterproofing membrane, including joints and cracks, deck drains, corners, and penetrations according to manufacturer's written instructions.
 - a. Rout and fill joints and cracks in substrate. Before filling, remove dust and dirt according to ASTM D 4258.
 - b. Adhere strip of elastomeric sheet to substrate in a layer of hot rubberized asphalt. Extend elastomeric sheet a minimum of 6 inches (150 mm) on each side of moving joints and cracks or joints and cracks exceeding 1/8 inch (3 mm) thick, and beyond deck drains and penetrations. Apply second layer of hot fluid-applied, rubberized asphalt over elastomeric sheet.
 - c. Embed strip of reinforcing fabric into a layer of hot rubberized asphalt. Extend reinforcing fabric a minimum of 6 inches (150 mm) on each side of nonmoving joints and cracks not exceeding 1/8 inch (3 mm) thick, and beyond roof drains and penetrations.
 - 1) Apply second layer of hot fluid-applied, rubberized asphalt over reinforcing fabric.
 2. At expansion joints and discontinuous deck-to-wall or deck-to-deck joints, bridge joints with elastomeric sheet extended a minimum of 6 inches (150 mm) on each side of joints and adhere to substrates in a layer of hot rubberized asphalt. Apply second layer of hot fluid-applied, rubberized asphalt over elastomeric sheet.
- C. Flashing Installation
1. Install elastomeric flashing sheets at terminations of waterproofing membrane according to manufacturer's written instructions.
 2. Prime substrate with asphalt primer.
 3. Install elastomeric flashing sheet and adhere to deck and wall substrates in a layer of hot rubberized asphalt.
 4. Extend elastomeric flashing sheet up walls or parapets a minimum of 8 inches (200 mm) above plaza deck pavers and 6 inches (150 mm) onto deck to be waterproofed.
 5. Install termination bars and mechanically fasten to top of elastomeric flashing sheet at terminations and perimeter of roofing.
- D. Membrane Application
1. Apply primer, at manufacturer's recommended rate, over prepared substrate and allow to dry.
 2. Heat and apply rubberized asphalt according to manufacturer's written instructions.
 - a. Heat rubberized asphalt in an oil- or air-jacketed melter with mechanical agitator specifically designed for heating rubberized asphalt.
 3. Start application with manufacturer's authorized representative present.
 4. Unreinforced Membrane: Apply hot rubberized asphalt to substrates and adjoining surfaces indicated. Spread to form a uniform, unreinforced, seamless membrane, 180-mil (4.5-mm) minimum thickness **OR** 180-mil (4.5-mm) average thickness, but not less than 125 mil (3.2 mm) thick, **as directed**.
 5. Reinforced Membrane: Apply hot rubberized asphalt to substrates and adjoining surfaces indicated. Spread to a thickness of 90 mils (2.3 mm); embed reinforcing fabric, overlapping sheets 2 inches (50 mm); spread another 125-mil- (3.2-mm-) thick layer to provide a uniform, reinforced, seamless membrane 215 mils (5.5 mm) thick.
 6. Apply waterproofing over prepared joints and up wall terminations and vertical surfaces to heights indicated or required by manufacturer.



7. Cover waterproofing with protection course with overlapped joints before membrane is subject to backfilling **OR** construction or vehicular traffic, **as directed**.
- E. Molded-Sheet Drainage Panel Installation
1. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate according to manufacturer's written instructions. Use methods that do not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.
 - a. For vertical applications, install board insulation **OR** protection course, **as directed**, before installing drainage panels.
- F. Insulation Installation
1. Install one or more layers of board insulation to achieve required thickness and insulation drainage panels over waterproofed surfaces. Cut and fit to within 3/4 inch (19 mm) of projections and penetrations.
 2. On vertical surfaces, set insulation units into rubberized asphalt according to manufacturer's written instructions.
 3. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
- G. Plaza Deck Paver Installation
1. Setting Bed: Install setting bed in locations and of thickness indicated to comply with requirements in Division 32 Section(s) "Unit Paving" **OR** Division 09 Section(s) "Stone Flooring", **as directed**.
 2. Install concrete pavers in locations indicated according to manufacturer's written instructions.
 3. Accurately install fixed-height **OR** adjustable-height, **as directed**, paver pedestals and accessories in locations and to elevations required. Adjust for final level and slope with shims.
 - a. Fill paver pedestal with concrete mix, strike smooth with top of pedestal, and cure according to ACI 301.
 4. Loosely lay pavers on pedestals, maintaining a uniform open joint width. Tightly seat pavers against spacers to eliminate lateral movement or drift of paving assembly. Align joint patterns parallel in each direction.
 - a. Lay out pavers to avoid less-than-half-width pavers at perimeter or other terminations.
 5. Install pavers to not vary more than 1/16 inch (1.6 mm) in elevation between adjacent pavers or more than 1/16 inch (1.6 mm) from surface plane elevation of individual paver.
 6. Maintain tolerances of paving installation within 1/4 inch in 10 feet (1:48) of surface plane in any direction.
- H. Cleaning And Protection
1. Protect waterproofing from damage and wear during remainder of construction period.
 2. Protect installed board insulation **OR** insulation drainage panels, **as directed**, from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation will be subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
 3. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 14 13 00



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SECTION 07 16 13 00 - MODIFIED CEMENT WATERPROOFING

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for modified cement waterproofing. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes polymer-modified cement waterproofing for positive or negative-side application to concrete, concrete unit masonry, and clay masonry.

C. Submittals

1. Product Data: For each type of product indicated. Include construction details, material descriptions and installation instructions for polymer-modified cement waterproofing.
2. Samples: For each type of polymer-modified cement waterproofing indicated.
3. Qualification Data: For Applicator.
4. Product Certificates: For waterproofing, patching, and plugging materials, from manufacturer.
5. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for each type of polymer-modified cement waterproofing.
6. Field quality-control reports.

D. Quality Assurance

1. Applicator Qualifications: A firm experienced in applying polymer-modified cement waterproofing similar in material, design, and extent to that indicated for this Project, whose work has resulted in applications with a record of successful in-service performance, and that employs workers trained and approved by manufacturer.
2. Preinstallation Conference: Conduct conference at Project site.

E. Project Conditions

1. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit polymer-modified cement waterproofing to be performed according to manufacturer's written instructions.
2. Proceed with waterproofing work only after pipe sleeves, vents, curbs, inserts, drains, and other projections through the substrate to be waterproofed have been completed. Proceed only after substrate defects, including honeycombs, voids, and cracks, have been repaired to provide a sound substrate free of forming materials, including reveal inserts.
3. Ambient Conditions: Proceed with waterproofing work only if temperature is maintained at 40 deg F (4.4 deg C) or above during work and cure period, and space is well ventilated and kept free of water.

1.2 PRODUCTS

A. Field-Mixed, Polymer-Modified Cement Waterproofing

1. Admixture for Field Mixing: Manufacturer's standard polymer admixture for mixing with portland cement and sand to produce a waterproof coating that is suitable for vertical and horizontal applications below or above grade, is breathable, resists positive-side **OR** negative-side, **as directed**, hydrostatic pressure, has VOC content complying with limits of authorities having jurisdiction, and has properties meeting or exceeding the criteria specified below.



- a. Water Permeability: Maximum zero for water at 30 feet (9 m) when tested according to CE CRD-C 48.
 - b. Compressive Strength: Minimum 4000 psi (27.6 MPa) at 28 days when tested according to ASTM C 109/C 109M.
 - c. Flexural Strength: Minimum 710 psi (4.8 MPa) at 28 days when tested according to ASTM C 348.
 - d. Bond Strength: Minimum 220 psi (1.5 MPa) at 14 days when tested according to ASTM C 321.
- B. Prepackaged, Polymer-Modified Cement Waterproofing
1. Negative-Side, Polymer-Modified Cement Waterproofing: Manufacturer's proprietary blend of dry cementitious and other ingredients for mixing with potable water **OR** polymer admixture, **as directed**, to produce a waterproof coating that is suitable for vertical and horizontal applications below or above grade, is breathable, resists negative-side hydrostatic pressure, has VOC content complying with limits of authorities having jurisdiction, and has properties meeting or exceeding the criteria specified below.
 - a. Water Permeability: Maximum zero for water at 30 feet (9 m) when tested according to CE CRD-C 48.
 - b. Compressive Strength: Minimum 4000 psi (27.6 MPa) at 28 days when tested according to ASTM C 109/C 109M.
 - c. Flexural Strength: Minimum 710 psi (4.8 MPa) at 28 days when tested according to ASTM C 348.
 - d. Bond Strength: Minimum 220 psi (1.5 MPa) at 14 days when tested according to ASTM C 321.
 - e. Color: White **OR** Gray **OR** As selected from full range **OR** As indicated in a color schedule, **as directed**.
 2. Positive-Side, Polymer-Modified Cement Waterproofing: Manufacturer's proprietary blend of dry cementitious and other ingredients for mixing with potable water or polymer admixture to produce a waterproof coating that is suitable for vertical and horizontal applications below or above grade, is breathable, resists positive-side hydrostatic pressure, has VOC content complying with limits of authorities having jurisdiction, and has properties meeting or exceeding the criteria specified below.
 - a. Water Permeability: Maximum zero for water at 30 feet (9 m) when tested according to CE CRD-C 48.
 - b. Compressive Strength: Minimum 4000 psi (27.6 MPa) at 28 days when tested according to ASTM C 109/C 109M.
 - c. Flexural Strength: Minimum 710 psi (4.8 MPa) at 28 days when tested according to ASTM C 348.
 - d. Bond Strength: Minimum 220 psi (1.5 MPa) at 14 days when tested according to ASTM C 321.
 - e. Color: White **OR** Gray **OR** As selected from full range **OR** As indicated in a color schedule, **as directed**.
- C. Accessory Materials
1. Patching Compound: Factory-premixed cementitious repair mortar, crack filler, or sealant recommended by waterproofing manufacturer for filling and patching tie holes, honeycombs, reveals, and other imperfections; compatible with substrate and other materials indicated; and VOC content complying with limits of authorities having jurisdiction.
 2. Plugging Compound: Factory-premixed cementitious compound with hydrophobic properties and recommended by waterproofing manufacturer; resistant to water and moisture but vapor permeable for all standard applications (vertical, overhead, and horizontal surfaces not exposed to vehicular traffic); compatible with substrate and other materials indicated; and VOC content complying with limits of authorities having jurisdiction.
 3. Portland Cement: ASTM C 150, Type I.
 4. Slurry-Coat and Protective-Topping Sand: ASTM C 144.



5. Trowel-Coat Sand: ASTM C 33, fine aggregate.
6. Polymer Admixture for Protective Topping: Polymer bonding agent and admixture designed to improve adhesion to prepared substrates and to not create a vapor barrier.
7. Water: Potable.

D. Mixes

1. Field-Mixed, Polymer-Modified Cement Waterproofing: Add polymer admixture to portland cement and sand according to manufacturer's written instructions. Blend together with mechanical mixer or by hand to required consistency.
OR
Prepackaged, Polymer-Modified Cement Waterproofing: Add prepackaged dry ingredients to mixing liquid according to manufacturer's written instructions. Mix together with mechanical mixer or by hand to required consistency.
2. Protective Topping: Measure, batch, and mix portland cement and sand in the proportion of 1:3 and water gaged with a polymer admixture. Blend together with mechanical mixer to required consistency.

1.3 EXECUTION

A. Examination

1. Examine substrates, areas, and conditions, with Applicator present, for suitable conditions where waterproofing is to be applied.
2. Proceed with application only after unsatisfactory conditions have been corrected.
3. Notify the Owner in writing of active leaks or defects that would affect system performance.

B. Preparation

1. Protect other work from damage caused by cleaning, preparation, and application of waterproofing. Provide temporary enclosure to confine spraying operation and to ensure adequate ambient temperatures and ventilation conditions for application.
2. Do not allow waterproofing, patching, and plugging materials to enter reveals or annular spaces intended for resilient sealants or gaskets, such as joint spaces between pipes and pipe sleeves.
3. Stop active water leaks with plugging compound according to waterproofing manufacturer's written instructions.
4. Repair damaged or unsatisfactory substrate with patching compound according to manufacturer's written instructions.
 - a. At holes and cracks in substrate, remove loosened chips and cut reveal with sides perpendicular to surface, not tapered, and approximately 1 inch (25.4 mm) deep. Fill reveal with patching compound flush with surface.
5. Surface Preparation: Comply with waterproofing manufacturer's written instructions to remove efflorescence, chalk, dust, dirt, mortar spatter, grease, oils, paint, curing compounds, and form-release agents to ensure that waterproofing bonds to surfaces.
 - a. Clean concrete surfaces according to ASTM D 4258.
 - 1) Scratch- and Float-Finished Concrete: Etch with 10 percent muriatic (hydrochloric) acid solution according to ASTM D 4260.
 - 2) Prepare smooth-formed and trowel-finished concrete by mechanical abrading or abrasive-blast cleaning according to ASTM D 4259.
 - b. Clean concrete unit masonry surfaces according to ASTM D 4261.
 - 1) Lightweight Concrete Unit Masonry: Etch with 10 percent muriatic (hydrochloric) acid solution or abrade surface by wire brushing. Remove acid residue until pH readings of water after rinse are not more than 1.0 pH lower or 2.0 pH higher than pH of water before rinse.
 - 2) Medium- and Normal-Weight Concrete Unit Masonry: Sandblast or bushhammer to a depth of 1/16 inch (1.6 mm).
 - c. Clean clay masonry surfaces according to ASTM D 5703.



- d. Concrete Joints: Clean reveals according to waterproofing manufacturer's written instructions.

C. Application

1. General: Comply with waterproofing manufacturer's written instructions for application and curing.
 - a. Saturate surface with water for several hours prior to application with water and maintain damp condition until applying waterproofing. Remove standing water.
 - b. Apply waterproofing to surfaces indicated on Drawings.
 - c. Number of Coats: Number required for specified water permeability **OR** Two **OR** Three, **as directed**.
 - 1) Coating Thickness: Maximum application thickness of 47 mils (1.2 mm) per coat for total thickness as required for specified water permeability **OR** of 100 mils (2.5 mm), **as directed**.
 - 2) Apply first coat as a slurry with brush or roller, and apply subsequent coats with brush, roller, spray, or trowel.
 - 3) Vigorously work first coat onto the substrate, forcing the material into surface voids. Apply each subsequent coat into full contact with previous coat.
 - 4) Allow manufacturer's recommended time between coats. Dampen surface between coats.
2. Final Coat Finish: Smooth troweled **OR** Brushed **OR** Textured, **as directed**.
3. Curing: Air-cure waterproofing for not less than five days immediately after application and prior to being placed in service.
4. Curing: Moist-cure waterproofing for not less than three days immediately after application has set, followed by air drying prior to being placed in service unless otherwise recommended in writing by manufacturer.
5. Waterproofing Treatment Extensions: Extend waterproofing treatment as follows:
 - a. Onto columns integral with treated walls.
 - b. Onto interior nontreated walls intersecting exterior treated walls, for a distance of 24 inches (600 mm) for cast-in-place concrete and 48 inches (1200 mm) for masonry.
 - c. Onto exterior walls and onto both exterior and interior columns, for a height of 12 inches (300 mm), where floors, but not walls, are treated.
 - d. Onto every substrate in areas indicated for treatment, including pipe trenches, pipe chases, pits, sumps, and similar offsets and features.
6. Protective Floor Topping: Apply 1-inch- (25.4-mm-) thick, protective topping over floor surfaces.

D. Field Quality Control

1. Inspection: Engage manufacturer's representative to inspect completed application and provide a written report that application complies with manufacturer's written instructions.

END OF SECTION 07 16 13 00



SECTION 07 16 16 00 - CRYSTALLINE WATERPROOFING

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for crystalline waterproofing. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes crystalline waterproofing for positive or negative-side application to concrete and concrete unit masonry.

C. Submittals

1. Product Data: For each type of product indicated. Include construction details, material descriptions and installation instructions for crystalline waterproofing.
2. Qualification Data: For Applicator.
3. Product Certificates: For waterproofing, patching, and plugging materials, from manufacturer.
4. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for crystalline waterproofing.
5. Field quality-control reports.

D. Quality Assurance

1. Applicator Qualifications: A firm experienced in applying crystalline waterproofing similar in material, design, and extent to that indicated for this Project, whose work has resulted in applications with a record of successful in-service performance, and that employs workers trained and approved by manufacturer.
2. Preinstallation Conference: Conduct conference at Project site.

E. Project Conditions

1. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit crystalline waterproofing to be performed according to manufacturer's written instructions.
2. Proceed with waterproofing work only after pipe sleeves, vents, curbs, inserts, drains, and other projections through the substrate to be waterproofed have been completed. Proceed only after substrate defects, including honeycombs, voids, and cracks, have been repaired to provide a sound substrate free of forming materials, including reveal inserts.
3. Ambient Conditions: Proceed with waterproofing work only if temperature is maintained at 40 deg F (4.4 deg C) or above during work and cure period, and space is well ventilated and kept free of water.

1.2 PRODUCTS

A. Waterproofing Materials

1. Crystalline Waterproofing: Prepackaged, gray-colored **OR** white-colored, **as directed**, proprietary blend of portland cement, specially treated sand, and active chemicals that, when mixed with water and applied, penetrates into concrete and concrete unit masonry and reacts chemically with the byproducts of cement hydration in the presence of water to develop crystalline growth within substrate capillaries to produce an impervious, dense, waterproof substrate; that has VOC content complying with limits of authorities having jurisdiction; with properties meeting or exceeding the criteria specified below.



- a. Water Permeability: Maximum zero for water at 30 feet (9 m) when tested according to CE CRD-C 48.
- b. Compressive Strength: Minimum 4000 psi (27.6 MPa) at 28 days when tested according to ASTM C 109/C 109M.

B. Accessory Materials

1. Patching Compound: Factory-premixed cementitious repair mortar, crack filler, or sealant recommended by waterproofing manufacturer for filling and patching tie holes, honeycombs, reveals, and other imperfections; compatible with substrate and other materials indicated; and VOC content complying with limits of authorities having jurisdiction.
2. Plugging Compound: Factory-premixed cementitious compound with hydrophobic properties and recommended by waterproofing manufacturer; resistant to water and moisture but vapor permeable for all standard applications (vertical, overhead, and horizontal surfaces not exposed to vehicular traffic); compatible with substrate and other materials indicated; and VOC content complying with limits of authorities having jurisdiction.
3. Portland Cement: ASTM C 150, Type I.
4. Sand: ASTM C 144.
5. Polymer Admixture for Protective Topping: Polymer bonding agent and admixture designed to improve adhesion to prepared substrates and not to create a vapor barrier.
6. Water: Potable.

C. Mixes

1. Crystalline Waterproofing: Add prepackaged dry ingredients to water according to manufacturer's written instructions. Mix together with mechanical mixer or by hand to required consistency.
2. Protective Topping: Measure, batch, and mix portland cement and sand in the proportion of 1:3 and water gaged with a polymer admixture. Blend together with mechanical mixer to required consistency.

1.3 EXECUTION

A. Examination

1. Examine substrates, areas, and conditions, with Applicator present, for suitable conditions where waterproofing is to be applied.
2. Proceed with application only after unsatisfactory conditions have been corrected.
3. Notify the Owner in writing of active leaks or defects that would affect system performance.

B. Preparation

1. Protect other work from damage caused by cleaning, preparation, and application of waterproofing. Provide temporary enclosure to confine spraying operation and to ensure adequate ambient temperatures and ventilation conditions for application.
2. Do not allow waterproofing, patching, and plugging materials to enter reveals or annular spaces intended for resilient sealants or gaskets, such as joint spaces between pipes and pipe sleeves.
3. Stop active water leaks with plugging compound according to waterproofing manufacturer's written instructions.
4. Repair damaged or unsatisfactory substrate with patching compound according to manufacturer's written instructions.
 - a. At holes and cracks in substrate, remove loosened chips and cut reveal with sides perpendicular to surface, not tapered, and approximately 1 inch (25.4 mm) deep. Fill reveal with patching compound flush with surface.
5. Surface Preparation: Comply with waterproofing manufacturer's written instructions to remove efflorescence, chalk, dust, dirt, mortar spatter, grease, oils, paint, curing compounds, and form-release agents to ensure that waterproofing bonds to surfaces.
 - a. Clean concrete surfaces according to ASTM D 4258.



- 1) Scratch- and Float-Finished Concrete: Etch with 10 percent muriatic (hydrochloric) acid solution according to ASTM D 4260.
 - 2) Prepare smooth-formed and trowel-finished concrete by mechanical abrading or abrasive-blast cleaning according to ASTM D 4259.
 - b. Clean concrete unit masonry surfaces according to ASTM D 4261.
 - 1) Lightweight Concrete Unit Masonry: Etch with 10 percent muriatic (hydrochloric) acid solution or abrade surface by wire brushing. Remove acid residue until pH readings of water after rinse are not more than 1.0 pH lower or 2.0 pH higher than pH of water before rinse.
 - 2) Medium- and Normal-Weight Concrete Unit Masonry: Sandblast or bushhammer to a depth of 1/16 inch (1.6 mm).
 - c. Concrete Joints: Clean reveals according to waterproofing manufacturer's written instructions.
- C. Application
1. General: Comply with waterproofing manufacturer's written instructions for application and curing.
 - a. Saturate surface with water for several hours prior to application and maintain damp condition until applying waterproofing. Remove standing water.
 - b. Apply waterproofing to surfaces indicated on Drawings.
 - c. Number of Coats: Number required for specified water permeability **OR Two OR Three, as directed.**
 - d. Application Method: Brush **OR Spray, as directed.** Apply to ensure that each coat fills voids and is in full contact with substrate or previous coat.
 - e. Dampen surface between coats.
 2. Final Coat Finish: Smooth **OR Brushed OR Spray Textured, as directed.**
 3. Curing: Moist-cure waterproofing for three, **as directed,** days immediately after final coat has set, followed by air drying, unless otherwise recommended in writing by manufacturer.
 4. Waterproofing Treatment Extensions: Extend waterproofing treatment as follows:
 - a. Onto columns integral with treated walls.
 - 1) Onto interior nontreated walls intersecting exterior treated walls, for a distance of 24 inches (600 mm) for cast-in-place concrete and 48 inches (1200 mm) for masonry.
 - 2) Onto exterior walls and onto both exterior and interior columns, for a height of 12 inches (300 mm), where floors, but not walls, are treated.
 - 3) Onto every substrate in areas indicated for treatment, including pipe trenches, pipe chases, pits, sumps, and similar offsets and features.
 5. Protective Topping: Apply 1-inch- (25.4-mm-) thick, protective topping over floor surfaces.
- D. Field Quality Control
1. Inspection: Engage manufacturer's representative to inspect completed application and provide a written report that application complies with manufacturer's written instructions.

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SECTION 07 16 19 00 - METAL-OXIDE WATERPROOFING

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for metal-oxide waterproofing. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes metal-oxide waterproofing for positive or negative-side application to concrete, concrete unit masonry, and clay masonry.

C. Submittals

1. Product Data: For each type of product indicated. Include construction details, material descriptions and installation instructions for metal-oxide waterproofing.
2. Qualification Data: For Applicator.
3. Product Certificates: For waterproofing, patching, and plugging materials, from manufacturer.
4. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for metal-oxide waterproofing.
5. Field quality-control reports.

D. Quality Assurance

1. Applicator Qualifications: A firm experienced in applying metal-oxide waterproofing similar in material, design, and extent to that indicated for this Project, whose work has resulted in applications with a record of successful in-service performance, and that employs workers trained and approved by manufacturer.
2. Preinstallation Conference: Conduct conference at Project site.

E. Project Conditions

1. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit metal-oxide waterproofing to be performed according to manufacturer's written instructions.
2. Proceed with waterproofing work only after pipe sleeves, vents, curbs, inserts, drains, and other projections through the substrate to be waterproofed have been completed. Proceed only after substrate defects, including honeycombs, voids, and cracks, have been repaired to provide a sound substrate free of forming materials, including reveal inserts.
3. Ambient Conditions: Proceed with waterproofing work only if temperature is maintained at 40 deg F (4.4 deg C) or above during work and cure period, and space is well ventilated and kept free of water.

1.2 PRODUCTS

A. Waterproofing Materials

1. Metal-Oxide Waterproofing Compound: A product specifically formulated for waterproofing concrete and masonry substrates; containing pulverized iron and a chemical oxidizing agent to cause the iron particles to rust and grow in size in the presence of water; with VOC content complying with limits of authorities having jurisdiction.

B. Accessory Materials

1. Patching Compound: Factory-premixed cementitious repair mortar, crack filler, or sealant recommended by waterproofing manufacturer for filling and patching tie holes, honeycombs,



reveals, and other imperfections; compatible with substrate and other materials indicated; and VOC content complying with limits of authorities having jurisdiction.

2. Plugging Compound: Factory-premixed cementitious compound with hydrophobic properties and recommended by waterproofing manufacturer; resistant to water and moisture but vapor permeable for all standard applications (vertical, overhead, and horizontal surfaces not exposed to vehicular traffic); compatible with substrate and other materials indicated; and VOC content complying with limits of authorities having jurisdiction.
3. Portland Cement: ASTM C 150, Type I.
4. Sand: ASTM C 144.
5. Water: Potable.

C. Mixes

1. Metal-Oxide Coats: Add metal-oxide waterproofing compound to portland cement, sand, and water according to manufacturer's written instructions. Blend together with mechanical mixer or by hand to required consistency for each coat.
2. Protection Coat: Field mix protection coat consisting of portland cement and sand as recommended by same manufacturer as metal-oxide waterproofing according to manufacturer's written instructions for application over waterproofing. Measure, batch, and mix materials with potable water. Blend together with mechanical mixer to required consistency.

1.3 EXECUTION

A. Examination

1. Examine substrates, areas, and conditions, with Applicator present, for suitable conditions where waterproofing is to be applied.
2. Proceed with application only after unsatisfactory conditions have been corrected.
3. Notify the Owner in writing of active leaks or defects that would affect system performance.

B. Preparation

1. Protect other work from damage caused by cleaning, preparation, and application of waterproofing. Provide temporary enclosure to confine spraying operation and to ensure adequate ambient temperatures and ventilation conditions for application.
2. Do not allow waterproofing, patching, and plugging materials to enter reveals or annular spaces intended for resilient sealants or gaskets, such as joint spaces between pipes and pipe sleeves.
3. Stop active water leaks with plugging compound according to waterproofing manufacturer's written instructions.
4. Repair damaged or unsatisfactory substrate with patching compound according to manufacturer's written instructions.
 - a. At holes and cracks in substrate, remove loosened chips and cut reveal with sides perpendicular to surface, not tapered, and approximately 1 inch (25.4 mm) deep. Fill reveal with patching compound flush with surface.
5. Surface Preparation: Comply with waterproofing manufacturer's written instructions to remove efflorescence, chalk, dust, dirt, mortar spatter, grease, oils, paint, curing compounds, and form-release agents to ensure that waterproofing bonds to surfaces.
 - a. Clean concrete surfaces according to ASTM D 4258.
 - 1) Scratch- and Float-Finished Concrete: Etch with 10 percent muriatic (hydrochloric) acid solution according to ASTM D 4260.
 - 2) Prepare smooth-formed and trowel-finished concrete by mechanical abrading or abrasive-blast cleaning according to ASTM D 4259.
 - b. Clean concrete unit masonry surfaces according to ASTM D 4261.
 - 1) Lightweight Concrete Unit Masonry: Etch with 10 percent muriatic (hydrochloric) acid solution or abrade surface by wire brushing. Remove acid residue until pH readings of water after rinse are not more than 1.0 pH lower or 2.0 pH higher than pH of water before rinse.



- 2) Medium- and Normal-Weight Concrete Unit Masonry: Sandblast or bushhammer to a depth of 1/16 inch (1.6 mm).
- c. Clean clay masonry surfaces according to ASTM D 5703.
- d. Concrete Joints: Clean reveals according to waterproofing manufacturer's written instructions.

C. Application

1. General: Comply with waterproofing manufacturer's written instructions for application and curing.
 - a. Saturate surface for several hours prior to application with water and maintain damp condition until applying waterproofing. Remove standing water.
 - b. Apply waterproofing to surfaces indicated on Drawings.
 - c. Number of Metal-Oxide Coats: Number required for specified water permeability **OR Two OR Three, as directed.**
 - d. Application Method: Brush apply the waterproofing, vigorously working first coat onto the substrate and forcing the material into surface voids. Brush each subsequent coat into full contact with previous coat.
 - e. Dampen surface between coats.
 - f. Allow each coat to set for 24 hours between coats.
 - g. Protection Coat: Apply to a thickness of 1/8 inch (3 mm) **OR** 1/4 inch (6 mm), **as directed**, for walls and 1 inch (25 mm) for floors.
2. Final Coat Finish: Smooth **OR** Brushed **OR** Textured, **as directed.**
3. Curing: Moist-cure waterproofing for three days immediately after final coat has set, followed by air drying prior to being placed in service, unless otherwise recommended in writing by manufacturer.
4. Waterproofing Treatment Extensions: Extend waterproofing treatment as follows:
 - a. Onto columns integral with treated walls.
 - b. Onto interior nontreated walls intersecting exterior treated walls, for a distance of 24 inches (600 mm) for cast-in-place concrete and 48 inches (1200 mm) for masonry.
 - c. Onto exterior walls and onto both exterior and interior columns, for a height of 12 inches (300 mm), where floors, but not walls, are treated.
 - d. Onto every substrate in areas indicated for treatment, including pipe trenches, pipe chases, pits, sumps, and similar offsets and features.

D. Field Quality Control

1. Inspection: Engage manufacturer's representative to inspect completed application and provide a written report that application complies with manufacturer's written instructions.

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SECTION 07 17 13 00 - BENTONITE WATERPROOFING

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for bentonite waterproofing. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Bentonite waterproofing.
 - b. Molded-sheet drainage panels.
 - c. Insulation.

C. Submittals

1. Product Data: For each type of product indicated. Include product specifications and manufacturer's written installation instructions.
2. Shop Drawings: Show installation details for interface with other work.
3. Samples: For each of the following products, in sizes indicated:
 - a. Waterproofing: 6 inches (150 mm) square.
 - b. Drainage Panels: 6 inches (150 mm) square.
 - c. Insulation: 6 inches (150 mm) square.
4. Material Certificates: For each type of bentonite waterproofing, from manufacturer.
5. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency **OR** a qualified testing agency, **as directed**, for bentonite waterproofing.
6. Field quality-control reports.
7. Warranty: Sample of special warranty.

D. Quality Assurance

1. Source Limitations: Obtain bentonite waterproofing system from single source from single manufacturer. Obtain accessory products used with bentonite waterproofing from sources acceptable to bentonite waterproofing manufacturer.
2. Preinstallation Conference: Conduct conference at Project site.

E. Delivery, Storage, And Handling

1. Deliver materials to Project site in manufacturer's original unopened and undamaged containers.
2. Store materials in a dry, well-ventilated space.
3. Remove and replace bentonite materials that have been prematurely exposed to moisture.

F. Project Conditions

1. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit bentonite waterproofing to be installed according to manufacturers' written instructions and warranty requirements.
 - a. Do not apply waterproofing materials to surfaces where ice or frost is visible. Do not apply bentonite waterproofing materials in areas with standing water.
 - b. Placing bentonite clay products in panel or composite form on damp surfaces is allowed if approved in writing by manufacturer.

G. Warranty



1. Special Warranty: Manufacturer's standard form in which manufacturer and Installer agree(s) to repair or replace components of bentonite waterproofing system that fail in materials or workmanship within specified warranty period.
 - a. Warranty Period: Five years from date of Final Completion.

1.2 PRODUCTS

A. Geotextile/Bentonite Sheets

1. Geotextile/Bentonite Waterproofing: Minimum of 1.0 lb/sq. ft. (5 kg/sq. m) of bentonite clay granules between two layers of geotextile polypropylene fabric, one woven and one nonwoven, needle punched and heat fused together.
 - a. Grab Tensile Strength: 95 lbf (422 N) according to ASTM D 4632.
2. Contaminant-Resistant Geotextile/Bentonite Waterproofing: Minimum of 1.0 lb/sq. ft. (5 kg/sq. m) of bentonite clay granules specially formulated for use in saltwater or contaminated ground water, between two layers of geotextile polypropylene fabric, one woven and one nonwoven, needle punched and heat fused together.
 - a. Grab Tensile Strength: 95 lbf (422 N) according to ASTM D 4632.
3. Geotextile-Geomembrane/Bentonite Waterproofing: Minimum of 1.0 lb/sq. ft. (5 kg/sq. m) of bentonite clay granules between two layers of geotextile polypropylene fabric, one woven and one nonwoven, needle punched and heat fused together; and the woven fabric coated with a low-permeable polypropylene geomembrane.
 - a. Grab Tensile Strength: 95 lbf (422 N) according to ASTM D 4632.
4. Composite Geotextile-HDPE/Bentonite Membrane: Minimum of 1.1 lb/sq. ft. (5.4 kg/sq. m) of bentonite clay granules bonded to nonwoven geotextile polypropylene fabric, with HDPE bonded to surface of nonwoven fabric.
 - a. Grab Tensile Strength: 120 lbf (534 N) according to ASTM D 4632.
 - b. Puncture Resistance: 140 lbf (620 N) according to ASTM D 4833.
 - c. Vapor Permeance: 0.03 perms according to ASTM E 96.
5. Contaminant-Resistant Composite Geotextile-HDPE/Bentonite Membrane: Minimum of 1.1 lb/sq. ft. (5.4 kg/sq. m) of bentonite clay granules specially formulated for use in saltwater or contaminated ground water, bonded to nonwoven geotextile polypropylene fabric, with HDPE bonded to surface of nonwoven fabric.
 - a. Grab Tensile Strength: 120 lbf (534 N) according to ASTM D 4632.
 - b. Puncture Resistance: 140 lbf (620 N) according to ASTM D 4833.
 - c. Vapor Permeance: 0.03 perms according to ASTM E 96.

B. Composite HDPE/Bentonite Membrane

1. Composite HDPE/Bentonite Membrane: Minimum 90-mil- (2.3-mm-) thick membrane consisting of a 12-mil- (0.5-mm-) thick, HDPE geomembrane liner bonded to a layer of bentonite clay granules 78 mils (1.9 mm) thick.
 - a. Puncture Resistance: 169 lbf (752 N) according to ASTM E 154.
 - b. Vapor Permeance: 0.03 perms according to ASTM E 96.
2. Composite HDPE/Bentonite Membrane with Protective Facing: Minimum 170-mil- (4.3-mm-) thick membrane consisting of HDPE geomembrane liner bonded to a layer of bentonite clay granules and with a spun polypropylene facing.
 - a. Puncture Resistance: 169 lbf (752 N) according to ASTM E 154.
 - b. Vapor Permeance: 0.03 perms according to ASTM E 96.
3. Composite HDPE/Bentonite-Polymer Membrane: Minimum 200-mil- (5-mm-) thick membrane consisting of HDPE geomembrane liner bonded to a layer of bentonite-polymer clay granules.
 - a. Puncture Resistance: 75 lbf (334 N) according to ASTM D 4833.
 - b. Vapor Permeance: 0.005 perms according to ASTM E 96.
4. Composite Gastight HDPE/Bentonite Membrane: Minimum 150-mil- (3.8-mm-) thick membrane consisting of a 60-mil- (1.5-mm-) thick, HDPE geomembrane liner bonded to a layer of bentonite clay.



- a. Puncture Resistance: 169 lbf (752 N) according to ASTM E 154.
 - b. Vapor Permeance: 0.03 perms according to ASTM E 96.
5. Composite Saline/Alkaline HDPE/Bentonite Membrane: Minimum 150-mil- (3.8-mm-) thick membrane consisting of a 60-mil- (1.5-mm-) thick, HDPE geomembrane liner bonded to a layer of bentonite clay granules.
 - a. Puncture Resistance: 169 lbf (752 N) according to ASTM E 154.
 - b. Vapor Permeance: 0.03 perms according to ASTM E 96.
- C. Composite Geotextile-HDPE/Bentonite Membrane
 1. Geotextile/Bentonite-Polymer Waterproofing: Minimum 250-mil- (6.4-mm-) thick membrane of bentonite-polymer clay granules between two layers of geotextile polypropylene fabric, one woven and one nonwoven, needle punched and heat fused together.
 - a. Puncture Resistance: 75 lbf (334 N) according to ASTM D 4833.
 - b. Vapor Permeance: 0.005 perms according to ASTM E 96.
- D. Bentonite Panels
 1. Standard Panels: 3/16-inch- (5-mm-) thick, corrugated kraft-paper panels with a minimum of 1.0 lb/sq. ft. (5 kg/sq. m) of bentonite confined in corrugations of boards.
 2. Coated Panels: 3/16-inch- (5-mm-) thick, corrugated kraft-paper panels specially coated to resist premature hydration due to incidental moisture; filled with a minimum of 1.0 lb/sq. ft. (5 kg/sq. m) of bentonite.
 3. Contaminant-Resistant Panels: 3/16-inch- (5-mm-) thick, corrugated kraft-paper panels with a minimum of 1.0 lb/sq. ft. (5 kg/sq. m) of contaminant-resistant granular bentonite specially formulated for use in contaminated ground-water conditions; confined in corrugations of boards.
- E. Installation Accessories
 1. Granular Bentonite: Sodium bentonite clay containing a minimum of 90 percent montmorillonite (hydrated aluminum silicate), with a minimum of 90 percent passing a No. 20 (0.85-mm) sieve.
 2. Bentonite Mastic: Trowelable consistency, bentonite compound, specifically formulated for application at joints and penetrations.
 3. Granular Bentonite Tubes: Manufacturer's standard 2-inch- (50-mm-) diameter, water-soluble tube containing approximately 1.5 lb/ft. (2.2 kg/m) of bentonite; hermetically sealed; designed specifically for placing on wall footings at line of joint with exterior base of wall.
 4. Termination Bar: Extruded-aluminum or formed-stainless-steel bars with upper flange to receive sealant.
 5. Plastic Protection Sheet: Polyethylene sheeting complying with ASTM D 4397; thickness recommended by waterproofing manufacturer to suit application but at least 6 mils (0.15 mm) thick.
 6. Cement Grout Patching Material: Manufacturer's recommended grout mix compatible with substrate being patched.
 7. Masonry Fasteners: Case-hardened nails or hardened-steel, powder-actuated fasteners. Depending on manufacturer's written requirements, provide 1/2- or 1-inch- (13- or 25-mm-) diameter washers under fastener heads.
 8. Sealants: As recommended in writing by waterproofing manufacturer. Comply with requirements specified in Division 7 Section "Joint Sealants."
 9. Tapes: Waterproofing manufacturer's recommended tape for joints between sheets, membranes, or panels.
 10. Adhesive: Water-based adhesive used to secure waterproofing to both vertical and horizontal surfaces.
 11. Protection Course: ASTM D 6506, semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners, and as follows:
 - a. Thickness: 1/8 inch (3 mm), nominal, for vertical applications; 1/4 inch (6 mm), nominal, elsewhere.
 12. Geotextile Protection Course: As recommended by waterproofing manufacturer.
 13. Molded-Sheet Drainage Panel: Comply with Division 33 Section "Subdrainage".



14. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel: Manufactured composite subsurface drainage panels consisting of a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 (0.21-mm) sieve laminated to one side with **OR** without, **as directed**, a polymeric film bonded to the other side of a studded, nonbiodegradable, molded-plastic-sheet drainage core, with a vertical flow rate of 9 to 15 gpm per foot (112 to 188 L/min. per m).
15. Woven-Geotextile-Faced, Molded-Sheet Drainage Panel: Manufactured composite subsurface drainage panels consisting of a woven-geotextile facing with an apparent opening size not exceeding No. 40 (0.425-mm) sieve laminated to one side with **OR** without, **as directed**, a polymeric film bonded to the other side of a studded, nonbiodegradable, molded-plastic-sheet drainage core, with a horizontal flow rate not less than 2.8 gpm per foot (35 L/min. per m).
16. Board Insulation: Extruded-polystyrene board insulation complying with ASTM C 578, square **OR** shiplap, **as directed**, edged.
 - a. Type VI, 40-psi (276-kPa) minimum compressive strength.
 - b. Type VII, 60-psi (414-kPa) minimum compressive strength.
 - c. Type V, 100-psi (690-kPa) minimum compressive strength.
17. Unfaced Wall Insulation Drainage Panels: Extruded-polystyrene board insulation complying with ASTM C 578, Type VI, 40-psi (276-kPa) minimum compressive strength; unfaced; fabricated with shiplap or channel edges and with one side having grooved drainage channels.
18. Geotextile-Faced Wall Insulation Drainage Panels: Extruded-polystyrene board insulation complying with ASTM C 578, Type VI, 40-psi (276-kPa) minimum compressive strength; fabricated with tongue-and-groove edges and with one side having grooved drainage channels faced with nonwoven geotextile filter fabric.
19. Unfaced Plaza Deck Insulation Drainage Panels: Extruded-polystyrene board insulation complying with ASTM C 578, Type VI, 40-psi (276-kPa) **OR** Type VII, 60-psi (414-kPa), **as directed**, minimum compressive strength; unfaced; fabricated with shiplapped or channel edges and with one side having ribbed drainage channels.

1.3 EXECUTION

A. Examination

1. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate preparations affecting performance of bentonite waterproofing.
2. Verify that substrate is complete and that work that will penetrate waterproofing is complete and rigidly installed.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Preparation

1. Coordinate work in the vicinity of waterproofing to ensure proper conditions for installing the waterproofing system and to prevent damage to waterproofing after installation.
2. Formed Concrete Surfaces: Remove fins and projections. Fill voids, rock pockets, form-tie holes, and other defects with bentonite mastic or cement grout patching material according to manufacturer's written instructions.
3. Horizontal Concrete Surfaces: Remove debris, standing water, oily substances, mud, and similar substances that could impair the bonding ability of concrete or the effectiveness of waterproofing. Fill voids, cracks greater than 1/8 inch (3 mm), honeycomb areas, and other defects with bentonite mastic or cement grout patching material according to manufacturer's written instructions.
4. Excavation Support and Protection System: If water is seeping, use plastic protection sheets or other suitable means to prevent wetting the bentonite waterproofing. Fill minor gaps and spaces 1/8 inch (3 mm) wide or wider with wood, metal, concrete, or other appropriate filling material. Cover or fill large voids and crevices with cement mortar according to manufacturer's written instructions.

**C. Installation, General**

1. Install waterproofing and accessories according to manufacturer's written instructions.
 - a. Apply granular bentonite around penetrations in horizontal surfaces and changes in plane according to manufacturer's details in preparation for granular bentonite tubes and mastic.
 - b. Apply granular bentonite tubes, bentonite mastic, or both at changes of plane, construction joints in substrate, projections, and penetrations.
2. Apply granular bentonite tubes continuously on footing against base of wall to be waterproofed according to manufacturer's written instructions.
3. Protect waterproofing from damage and wetting before and during subsequent construction operations. Repair punctures, tears, and cuts according to manufacturer's written instructions.
4. Install protection course before backfilling or placing overburden when recommended by waterproofing manufacturer.

D. Geotextile/Bentonite Sheet Installation

1. General: Install a continuous layer of waterproofing sheets directly against concrete to be waterproofed. Lap ends and edges a minimum of 4 inches (100 mm) on horizontal and vertical substrates. Stagger end joints between sheets a minimum of 24 inches (600 mm). Fasten seams by stapling to adjacent sheet or nailing to substrate.
2. Below Structural Slabs-on-Grade: Place waterproofing sheets on compacted substrate with ends and edges lapped and stapled.
 - a. Install a layer of waterproofing sheets under footings, grade beams, and pile caps; or continue waterproofing through key joints between footings and foundation walls, and extend a minimum of 8 inches (200 mm) up or beyond perimeter slab forms.
3. Concrete Walls: Starting at bottom of wall, apply waterproofing sheets horizontally with primary backing side against wall. Secure with masonry fasteners spaced according to manufacturer's written instructions. Extend to bottom of footing, grade beam, or wall, and secure.
 - a. Termination at Grade: Extend waterproofing sheets to within 2 inches (50 mm) of finish grade unless otherwise indicated. Secure top edge with termination bar. Apply sealant to top edge of termination bar.
OR
Termination at Grade: Fasten top edge of waterproofing sheets to wall and protect top edge with sheet metal counterflashing. Cover waterproofing with a lapped course of plastic protection sheets if backfilling does not proceed immediately.
4. Excavation Support and Protection (Permanent Shoring): Encase tieback rods, nuts, and plates, using bentonite mastic and waterproofing sheets, according to waterproofing manufacturer's written instructions for each configuration.
 - a. Install a layer of waterproofing sheets, with ends and edges lapped and nailed to shoring. Cover waterproofing with plastic protection sheets if needed for protection from precipitation; remove plastic sheets before placing concrete.
 - b. Inspect and repair waterproofing after reinforcing steel has been placed. Coordinate and control concrete placement to avoid damage to waterproofing.

E. Composite HDPE/Bentonite Membrane Installation

1. General: Install a continuous layer of waterproofing membrane with ends and edges lapped a minimum of 3 inches (75 mm). Stagger end joints between membranes. Seal joints with permanent seam tape.
2. Below Structural Slabs-on-Grade: Apply waterproofing membrane with HDPE side down and staple ends and edges.
 - a. Install under footings, grade beams, and pile caps; or continue waterproofing through key joints between footings and foundation walls, and extend a minimum of 8 inches (200 mm) up or beyond perimeter slab forms.
 - b. Protect waterproofing from damage caused by reinforcing bar supports with sharp edges.
3. Slabs: Starting at lowest point, install a continuous layer of waterproofing membrane, with ends and edges lapped a minimum of 2 inches (50 mm).
4. Vertical Concrete or Masonry Walls: Apply mastic around penetrations and form continuous 2-inch (50-mm) cant at intersection of footings and walls with mastic.



- a. Starting at lowest point, install a layer of waterproofing membrane horizontally, extending a minimum of 6 inches (150 mm) onto the footing. Lap membrane ends and edges a minimum of 2 inches (50 mm).
 - b. Secure membrane to wall with adhesive or washer-headed fasteners, and tape terminations of membrane at grade.
5. Excavation Support and Protection: Cut, clean, and treat tiebacks and similar projections. Encase tieback rods, nuts, and plates. If water is present, cover shoring and lagging with plastic protection sheets.
 - a. Starting at lowest point, install a layer of waterproofing membrane, with ends and edges lapped and nailed to shoring.
 6. Horizontal Roofs, Plazas, and between Slabs: Starting at lowest point, install a layer of waterproofing membrane, with ends and edges lapped and taped a minimum of 3 inches (75 mm).
 - a. Prime concrete substrates. Primer may be omitted on concrete surfaces that comply with requirements for dryness, surface texture, and freedom from imperfections.
 - b. Install bentonite side of membrane against the material to be waterproofed.
 - c. Terminations at Vertical Surfaces: Provide a fillet or cant at intersection of horizontal and vertical substrates. Extend waterproofing membrane to top of curb or to a minimum of 6 inches (150 mm) above plane of waterproofing; secure with manufacturer's recommended tape.
 - d. Cover waterproofing with a plastic slip-sheet.
- F. Composite Geotextile-HDPE/Bentonite Membrane Installation
1. General: Install a continuous layer of waterproofing membrane with ends and edges lapped a minimum of 3 inches (75 mm). Stagger end joints between membranes. Seal joints with permanent seam tape.
 2. Below Structural Slabs-on-Grade: Apply waterproofing membrane with HDPE side down and staple ends and edges.
 - a. Install under footings, grade beams, and pile caps; or continue waterproofing through key joints between footings and foundation walls, and extend a minimum of 8 inches (200 mm) up or beyond perimeter slab forms.
 - b. Protect waterproofing from damage caused by reinforcing bar supports with sharp edges.
 3. Concrete Walls: Starting at bottom of wall, apply waterproofing membrane with HDPE side facing Installer; overlap sheets 3 inches (75 mm). Secure with powder-actuated fasteners or case-hardened nails. Extend to bottom of footing, grade beam, or wall, and secure.
 - a. Termination at Grade: Extend waterproofing membrane to within 2 inches (50 mm) of finish grade unless otherwise indicated. Secure top edge with termination bar. Apply sealant to top edge of termination bar.
 4. Excavation Support and Protection (Permanent Shoring): Cut, clean, and treat tiebacks and similar projections. Encase tieback rods, nuts, and plates. If water is present, cover shoring and lagging with plastic protection sheets; remove plastic sheets before placing concrete.
 - a. Starting at lowest point, install a layer of waterproofing membrane, with ends and edges lapped and mechanically secured to shoring.
 - b. Inspect and repair waterproofing membrane after reinforcing steel has been placed. Coordinate and control concrete placement to avoid damage to waterproofing.
 5. Horizontal Slabs, Roofs, and Plazas: Starting at lowest point, install a layer of waterproofing membrane, with ends and edges lapped and taped a minimum of 3 inches (75 mm).
 - a. Clean overlap area and apply waterproof tape, rolling the exposed edge to seal to sheet below.
 - b. Turn edges up and seal to vertical surfaces.
 - c. Cover waterproofing with a plastic slip-sheet.
- G. Bentonite Panel Installation



1. General: Install a continuous layer of bentonite waterproofing panels with ends and edges lapped a minimum of 1-1/2 inches (38 mm) unless otherwise indicated. Stagger joints in adjoining panel rows.
 - a. Install a double layer of waterproofing panels, with ends and edges butted instead of lapped and with second layer of joints staggered over first. Staple panels together to hold them in place.
 2. Concrete Walls: Starting at bottom of wall, apply waterproofing panels with ends and edges lapped and with vertical joints staggered. Secure with fasteners or adhesive recommended in writing by manufacturer. Extend to bottom of footing, grade beam, or wall.
 - a. Horizontal-to-Vertical Transitions: Install granular bentonite tubes immediately before backfilling and compact backfill over the joint.
 - b. Termination at Grade: Extend waterproofing panels to within 2 inches (50 mm) of finish grade unless otherwise indicated. Secure top edge with termination bar. Apply sealant to top edge of termination bar.
OR
Termination at Grade: Fasten top edge of waterproofing panels to wall and protect top edge with sheet metal counterflashing.
 - c. Cover waterproofing panels with a lapped course of plastic protection sheets; remove plastic sheets before backfilling.
- H. Molded-Sheet Drainage Panel Installation
1. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate. Use adhesives or mechanical fasteners that do not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.
 - a. For vertical applications, install board insulation **OR** protection course, **as directed**, before installing drainage panels.
- I. Insulation Installation
1. Install one or more layers of board insulation to achieve required thickness and insulation drainage panels over waterproofed surfaces. Cut and fit to within 3/4 inch (19 mm) of projections and penetrations.
 2. On vertical surfaces, set insulation units in adhesive or tape applied according to manufacturer's written instructions.
 3. On horizontal surfaces, loosely lay insulation units. Stagger end joints and tightly abut insulation units.
- J. Field Quality Control
1. Inspection: Arrange for manufacturer's representative to inspect completed waterproofing installation before covering with other construction and provide written report that installation complies with manufacturer's written instructions.
 - a. Remove and replace applications of bentonite waterproofing where inspection indicates that it does not comply with specified requirements.
 2. Flood Testing: Flood test each deck area for leaks, according to recommendations in ASTM D 5957, after completing waterproofing but before overlaying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.
 - a. Flood to an average depth of 2-1/2 inches (64 mm) with a minimum depth of 1 inch (25 mm) but not exceeding a depth of 4 inches (100 mm). Maintain 2 inches (50 mm) of clearance from top of membrane flashings.
 - b. Flood each area for 24 **OR** 48, **as directed**, hours.
 - c. After flood testing, repair leaks, repeat flood test, and make further repairs until waterproofing installation is watertight.
 3. Perform additional testing and inspecting, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.



END OF SECTION 07 17 13 00



SECTION 07 19 13 00 - WATER REPELLENTS

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for water repellents. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes penetrating and film-forming water-repellent coatings for the following vertical and horizontal surfaces:
 - a. Concrete (unpainted).
 - b. Cast stone.
 - c. Brick masonry.
 - d. Concrete unit masonry (unpainted and unglazed).
 - e. Portland cement plaster (stucco).
 - f. Stonework.

C. Performance Requirements

1. Performance Testing: Provide water repellents that comply with test-performance requirements indicated, as evidenced by reports of tests performed by manufacturer **OR** based on Project-specific preconstruction testing, **as directed**, by a qualified independent testing agency on manufacturer's standard products applied to substrates simulating those on Project using same application methods to be used for Project.
 - a. Engage testing agency to perform preconstruction tests on laboratory mockups.
 - b. Select sizes and configurations of assemblies to adequately demonstrate capability of water repellents to comply with performance requirements.
 - c. Notify the Owner seven days in advance of the dates and times when assemblies will be constructed.
2. Absorption: Minimum 80 **OR** 90, **as directed**, percent reduction of absorption after 24 hours in comparison of treated and untreated specimens.
 - a. Brick: ASTM C 67.
 - b. Stone: ASTM C 97.
 - c. Concrete Unit Masonry: ASTM C 140.
 - d. Hardened Concrete: ASTM C 642.
3. Water-Vapor Transmission: Maximum 10 percent reduction in rate of vapor transmission in comparison of treated and untreated specimens, per ASTM E 96.
4. Permeability: Minimum 80 percent water-vapor transmission in comparison of treated and untreated specimens, per ASTM D 1653.
5. Water Penetration and Leakage through Masonry: Maximum 90 percent reduction in leakage rate in comparison of treated and untreated specimens, per ASTM E 514.
6. Durability: Maximum 5 percent loss of water repellency after 2500 hours of weathering in comparison to specimens before weathering, per ASTM G 154.
 - a. Reduction of Water Absorption: 80 percent.
 - b. Reduction in Chloride Content: 80 percent.

D. Submittals

1. Product Data: For each type of product indicated.
2. Product test reports.

E. Quality Assurance

1. Installer Qualifications: An employer of workers trained and approved by manufacturer.



F. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer and Applicator agree(s) to repair or replace materials that fail to maintain water repellency specified in Part 1.1 "Performance Requirements" Article within specified warranty period.
 - a. Warranty Period: Two **OR** Five, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Penetrating Water Repellents

1. Silane, Penetrating Water Repellent: Clear, monomeric compound containing 20 percent or more solids of alkyltrialkoxysilanes; with alcohol, mineral spirits, water, or other proprietary solvent carrier; and with 3.3 lb/gal. (400 g/L) or less of VOCs.
2. Silane, Penetrating Water Repellent: Clear, monomeric compound containing 20 percent or more solids of alkyltrialkoxysilanes; with alcohol, mineral spirits, water, or other proprietary solvent carrier; and with 5 lb/gal. (600 g/L) or less of VOCs.
3. Silane, Penetrating Water Repellent: Pigmented, monomeric compound containing 20 percent or more solids of alkyltrialkoxysilanes; with alcohol, mineral spirits, water, or other proprietary solvent carrier; and with 5 lb/gal. (600 g/L) or less of VOCs.
4. Silane, Penetrating Water Repellent: Clear, monomeric compound containing 20 percent or more solids of alkyltrialkoxysilanes; with alcohol, mineral spirits, water, or other proprietary solvent carrier; and with more than 5 lb/gal. (600 g/L) of VOCs.
5. Siloxane, Penetrating Water Repellent: Clear, oligomeric alkylalkoxysiloxanes containing 10 percent or more solids; with alcohol, ethanol, mineral spirits, water, or other proprietary solvent carrier; and with 3.3 lb/gal. (400 g/L) or less of VOCs.
6. Siloxane, Penetrating Water Repellent: Clear, oligomeric alkylalkoxysiloxanes containing 10 percent or more solids; with alcohol, ethanol, mineral spirits, water, or other proprietary solvent carrier; and with 5 lb/gal. (600 g/L) or less of VOCs.
7. Siloxane, Penetrating Water Repellent: Clear, oligomeric alkylalkoxysiloxanes containing 10 percent or more solids; with alcohol, ethanol, mineral spirits, water, or other proprietary solvent carrier; and with more than 5 lb/gal. (600 g/L) of VOCs.
8. Silane/Siloxane-Blend, Penetrating Water Repellent: Clear, silane and siloxane blends with 3.3 lb/gal. (400 g/L) or less of VOCs.
9. Silane/Siloxane-Blend, Penetrating Water Repellent: Clear, silane and siloxane blends with 5 lb/gal. (600 g/L) or less of VOCs.
10. Proprietary-Blend, Penetrating Water Repellent: Clear, consisting of 1 or several different resins (silanes or siloxanes), polymers, stearates, or oils plus other compounds or products of components; and with 3.3 lb/gal. (400 g/L) or less of VOCs.
11. Proprietary-Blend, Penetrating Water Repellent: Clear, consisting of 1 or several different resins (silanes or siloxanes), polymers, stearates, or oils plus other compounds or products of components; and with 5 lb/gal. (600 g/L) or less of VOCs.

B. Film-Forming Water Repellents

1. Silicone Sealer, Film-Forming Water Repellent: Clear, polymerized, silicone-resin water repellent for dense substrates; with a solvent- or water-based solution containing not less than 3 and up to 5 percent solids by weight; and with 3.3 lb/gal. (400 g/L) or less of VOCs.
2. Silicone-Sealer, Film-Forming Water Repellent: Clear, polymerized, silicone-resin water repellent for dense substrates; with a solvent- or water-based solution containing not less than 3 and up to 5 percent solids by weight; and with 5 lb/gal. (600 g/L) or less of VOCs.
3. Proprietary-Blend, Film-Forming Water Repellent: Clear, consisting of 1 or several different resins, acrylics, polymers, stearates, or oils plus other compounds or products of components; and with 3.3 lb/gal. (400 g/L) or less of VOCs.
4. Proprietary-Blend, Film-Forming Water Repellent: Clear, consisting of 1 or several different resins, acrylics, polymers, stearates, or oils plus other compounds or products of components; and with 5 lb/gal. (600 g/L) or less of VOCs.



5. Siliconate, Film-Forming Water Repellent: Clear, with 3.3 lb/gal. (400 g/L) or less of VOCs.
6. Acrylic, Film-Forming Water Repellent: Clear **OR** Pigmented, **as directed**, breathing coating of acrylic resins; with a water-based, solvent-based, or acrylic emulsion solution containing less than 15 percent solids by volume; and with 3.3 lb/gal. (400 g/L) or less of VOCs.
 - a. Colors: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
7. Acrylic, Film-Forming Water Repellent: Pigmented, with 5 lb/gal. (600 g/L) or less of VOCs.
 - a. Colors: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.

1.3 EXECUTION

A. Preparation

1. Clean substrate of substances that might interfere with penetration or performance of water repellents. Test for moisture content, according to water-repellent manufacturer's written instructions, to ensure that surface is dry enough.
 - a. Cast-in-Place Concrete: Remove oil, curing compounds, laitance, and other substances that could prevent adhesion or penetration of water repellents.
 - b. Clay Brick Masonry: Clean clay brick masonry per ASTM D 5703.
2. Test for pH level, according to water-repellent manufacturer's written instructions, to ensure chemical bond to silicate minerals.
3. Protect adjoining work, including sealant bond surfaces, from spillage or blow-over of water repellent. Cover adjoining and nearby surfaces of aluminum and glass if there is the possibility of water repellent being deposited on surfaces. Cover live plants and grass.
4. Coordination with Sealants: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.
 - a. Water-repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those used in the work.
5. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Application

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect the substrate before application of water repellent and to instruct Applicator on the product and application method to be used.
2. Apply a heavy-saturation spray coating of water repellent on surfaces indicated for treatment using low-pressure spray equipment. Comply with manufacturer's written instructions for using airless spraying procedure, unless otherwise indicated.
 - a. Precast Concrete: At Contractor's option, first application of water repellent on precast concrete units may be completed before installing units. Mask sealant-bond surfaces to prevent water repellent from migrating onto joint surfaces.
3. Apply a second saturation spray coating, as directed, repeating first application. Comply with manufacturer's written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if written instructions are not applicable to Project conditions.

C. Cleaning

1. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Repair damage caused by water-repellent application. Comply with manufacturer's written cleaning instructions.

END OF SECTION 07 19 13 00



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Task	Specification	Specification Description
07 19 16 00	07 19 13 00	Water Repellents



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SECTION 07 21 13 13 - BUILDING INSULATION

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for building insulation. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Perimeter insulation under slabs-on-grade.
 - b. Perimeter wall insulation (supporting backfill).
 - c. Cavity-wall insulation.
 - d. Concealed building insulation.
 - e. Exposed building insulation.
 - f. Loose-fill building insulation.
 - g. Self-supported, spray-applied cellulosic insulation.
 - h. Radiant barriers.
 - i. Vapor retarders.
 - j. Sound attenuation insulation.

C. Definitions

1. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers; produced in boards and blanket with latter formed into batts (flat-cut lengths) or rolls.

D. Performance Requirements

1. Plenum Rating: Provide glass-fiber **OR** slag-wool-fiber/rock-wool-fiber, **as directed**, insulation where indicated in ceiling plenums whose test performance is rated as follows for use in plenums as determined by testing identical products per "Erosion Test" and "Mold Growth and Humidity Test" described in UL 181, or on comparable tests from another standard acceptable to authorities having jurisdiction.
 - a. Erosion Test Results: Insulation shows no visible evidence of cracking, flaking, peeling, or delamination of interior surface of duct assembly, after testing for 4 hours at 2500-fpm (13-m/s) air velocity.
 - b. Mold Growth and Humidity Test Results: Insulation shows no evidence of mold growth, delamination, or other deterioration due to the effects of high humidity, after inoculation with Chaetomium globosum on all surfaces and storing for 60 days at 100 percent relative humidity in the dark.

E. Submittals

1. Product Data: For each type of product indicated.
2. Samples: Full-size units for each type of exposed insulation indicated.
3. LEED Submittal:
 - a. Product Data for Credit MR 4.1 and MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - 1) Include statement indicating costs for each product having recycled content.
4. Product test reports.
5. Research/Evaluation Reports: For foam-plastic insulation.

F. Quality Assurance



1. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
 - a. Surface-Burning Characteristics: ASTM E 84.
 - b. Fire-Resistance Ratings: ASTM E 119.
 - c. Combustion Characteristics: ASTM E 136.

G. Delivery, Storage, And Handling

1. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
2. Protect plastic insulation as follows:
 - a. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
 - b. Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
 - c. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.2 PRODUCTS

A. Foam-Plastic Board Insulation

1. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and density indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively:
 - a. Type IV, 1.60 lb/cu. ft. (26 kg/cu. m), unless otherwise indicated.
 - b. Type X, 1.30 lb/cu. ft. (21 kg/cu. m).
 - c. Type VI, 1.80 lb/cu. ft. (29 kg/cu. m).
 - d. Type VII, 2.20 lb/cu. ft. (35 kg/cu. m).
 - e. Type V, 3.00 lb/cu. ft. (48 kg/cu. m).
2. Extruded-Polystyrene Drainage Panels: ASTM C 578, of type and density indicated below and fabricated with one side having a matrix of drainage and edge channels.
 - a. Type IV, 1.60 lb/cu. ft. (26 kg/cu. m).
 - b. Type VI, 1.80 lb/cu. ft. (29 kg/cu. m).
 - c. Type VII, 2.20 lb/cu. ft. (35 kg/cu. m).
3. Fabric-Faced, Extruded-Polystyrene Drainage Panels: ASTM C 578, Type VI, with a density of 1.80 lb/cu. ft. (29 kg/cu. m), faced with insulation manufacturer's standard nonwoven filtration fabric and fabricated with 1 side having a matrix of drainage and edge channels.
4. Molded-Polystyrene Board Insulation: ASTM C 578, of type and density indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively:
 - a. Type I, 0.90 lb/cu. ft. (15 kg/cu. m).
 - b. Type VIII, 1.15 lb/cu. ft. (18 kg/cu. m).
 - c. Type II, 1.35 lb/cu. ft. (22 kg/cu. m).
5. Foil-Faced, Polyisocyanurate Board Insulation: ASTM C 1289, Type I, Class 1 **OR** 2, **as directed**, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, based on tests performed on unfaced core on thicknesses up to 4 inches (101 mm).

B. Cellular-Glass Insulation

1. Cellular-Glass Insulation: ASTM C 552 Type I (flat block) **OR** IV (board) faced on both sides with manufacturer's special kraft-paper sheets laminated to glass block with asphalt, **as directed**, with unfaced insulation passing ASTM E 136 for combustion characteristics.

C. Glass-Fiber Board Insulation



1. Unfaced, Flexible Glass-Fiber Board Insulation: ASTM C 612, Type IA; ASTM C 553, Types I, II, and III; or ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, passing ASTM E 136 for combustion characteristics; and of the following nominal density and thermal resistivity:
 - a. Nominal density of 1.0 lb/cu. ft. (16 kg/cu. m), thermal resistivity of 3.7 deg F x h x sq. ft./Btu x in. at 75 deg F (25.7 K x m/W at 24 deg C).
 - b. Nominal density of not less than 1.5 lb/cu. ft. (24 kg/cu. m) nor more than 1.7 lb/cu. ft. (27 kg/cu. m), thermal resistivity of 4 deg F x h x sq. ft./Btu x in. at 75 deg F (27.7 K x m/W at 24 deg C).
2. Foil-Faced, Flexible Glass-Fiber Board Insulation: ASTM C 612, Type IA or ASTM C 553, Types I, II, and III; faced on 1 side with foil-scrim-kraft vapor retarder; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; and of the following nominal density and thermal resistivity:
 - a. Nominal density of 1.0 lb/cu. ft. (16 kg/cu. m), thermal resistivity of 3.7 deg F x h x sq. ft./Btu x in. at 75 deg F (25.7 K x m/W at 24 deg C).
 - b. Nominal density of not less than 1.5 lb/cu. ft. (24 kg/cu. m) nor more than 1.7 lb/cu. ft. (27 kg/cu. m), thermal resistivity of 4 deg F x h x sq. ft./Btu x in. at 75 deg F (27.7 K x m/W at 24 deg C).
3. Unfaced, Glass-Fiber Board Insulation: ASTM C 612, Type IA or Types IA and IB; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics; and of the following nominal density and thermal resistivity:
 - a. Nominal density of 2.25 lb/cu. ft. (36 kg/cu. m), thermal resistivity of 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F (29.8 K x m/W at 24 deg C).
 - b. Nominal density of 3 lb/cu. ft. (48 kg/cu. m), thermal resistivity of 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F (29.8 K x m/W at 24 deg C).
 - c. Nominal density of 4.25 lb/cu. ft. (68 kg/cu. m), thermal resistivity of 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F (29.8 K x m/W at 24 deg C).
 - d. Nominal density of 6 lb/cu. ft. (96 kg/cu. m), thermal resistivity of 4.4 deg F x h x sq. ft./Btu x in. at 75 deg F (30.5 K x m/W at 24 deg C).
4. Foil-Faced, Glass-Fiber Board Insulation: ASTM C 612, Type IA or Types IA and IB; faced on 1 side with foil-scrim-kraft or foil-scrim-polyethylene vapor retarder, with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; and of the following nominal density and thermal resistivity:
 - a. Nominal density of 2.25 lb/cu. ft. (36 kg/cu. m), thermal resistivity of 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F (29.8 K x m/W at 24 deg C).
 - b. Nominal density of 3 lb/cu. ft. (48 kg/cu. m), thermal resistivity of 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F (29.8 K x m/W at 24 deg C).
 - c. Nominal density of 4.25 lb/cu. ft. (68 kg/cu. m), thermal resistivity of 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F (29.8 K x m/W at 24 deg C).
 - d. Nominal density of 6 lb/cu. ft. (96 kg/cu. m), thermal resistivity of not less than 4.34 deg F x h x sq. ft./Btu x in. at 75 deg F (30.1 K x m/W at 24 deg C).
5. Glass-Mat-Faced, Glass-Fiber Board Insulation: ASTM C 612, Type IA or Types IA and IB; faced on 1 side with black glass-fiber mat or black polymer finish; maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; and of the following nominal density and thermal resistivity:
 - a. Nominal density of 1.5 lb/cu. ft. (24 kg/cu. m), thermal resistivity of 4.2 deg F x h x sq. ft./Btu x in. at 75 deg F (29.1 K x m/W at 24 deg C).
 - b. Nominal density of 2.25 lb/cu. ft. (36 kg/cu. m), thermal resistivity of 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F (29.8 K x m/W at 24 deg C).
 - c. Nominal density of 3 lb/cu. ft. (48 kg/cu. m), thermal resistivity of 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F (29.8 K x m/W at 24 deg C).
 - d. Nominal density of 6 lb/cu. ft. (96 kg/cu. m), thermal resistivity of 4.5 deg F x h x sq. ft./Btu x in. at 75 deg F (31.2 K x m/W at 24 deg C).

D. Slag-Wool-Fiber/Rock-Wool-Fiber Board Insulation



1. Unfaced, Slag-Wool-Fiber/Rock-Wool-Fiber Board Insulation: ASTM C 612, maximum flame-spread and smoke-developed indexes of 15 and 0, respectively; passing ASTM E 136 for combustion characteristics; and of the following nominal density and thermal resistivity:
 - a. Nominal density of 4 lb/cu. ft. (64 kg/cu. m), Types IA and IB, thermal resistivity of 4 deg F x h x sq. ft./Btu x in. at 75 deg F (27.7 K x m/W at 24 deg C).
 - b. Nominal density of 6 lb/cu. ft. (96 kg/cu. m), Type II, thermal resistivity of 4.16 deg F x h x sq. ft./Btu x in. at 75 deg F (28.8 K x m/W at 24 deg C).
 - c. Nominal density of 8 lb/cu. ft. (128 kg/cu. m), Type III, thermal resistivity of 4.35 deg F x h x sq. ft./Btu x in. at 75 deg F (30.2 K x m/W at 24 deg C).
 - d. Fiber Color: Regular color, unless otherwise indicated.
 - e. Fiber Color: Darkened, where indicated.
2. Foil-Faced, Slag-Wool-Fiber/Rock-Wool-Fiber Board Insulation: ASTM C 612; faced on 1 side with foil-scrim or foil-scrim-polyethylene vapor retarder; with maximum flame-spread and smoke-developed indexes of 25 and 5, respectively; and of the following nominal density and thermal resistivity:
 - a. Nominal density of 4 lb/cu. ft. (64 kg/cu. m), Types IA and IB, thermal resistivity of 4 deg F x h x sq. ft./Btu x in. at 75 deg F (27.7 K x m/W at 24 deg C).
 - b. Nominal density of 6 lb/cu. ft. (96 kg/cu. m), Type II, thermal resistivity of 4.16 deg F x h x sq. ft./Btu x in. at 75 deg F (28.8 K x m/W at 24 deg C).
 - c. Nominal density of 8 lb/cu. ft. (128 kg/cu. m), Type III, thermal resistivity of 4.35 deg F x h x sq. ft./Btu x in. at 75 deg F (30.2 K x m/W at 24 deg C).

E. Glass-Fiber Blanket Insulation

1. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
2. Faced, Glass-Fiber Blanket Insulation: ASTM C 665, Type III (blankets with reflective membrane facing), Class A (membrane-faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil-scrim-kraft, foil-scrim, or foil-scrim-polyethylene **OR** polypropylene-scrim-kraft, **as directed**, vapor-retarder membrane on 1 face.
3. Where glass-fiber blanket insulation is indicated by the following thicknesses, provide blankets in batt or roll form with thermal resistances indicated:
 - a. 3-1/2 inches (89 mm) thick with a thermal resistance of 11 deg F x h x sq. ft./Btu at 75 deg F (1.9 K x sq. m/W at 24 deg C) **OR** 13 deg F x h x sq. ft./Btu at 75 deg F (2.3 K x sq. m/W at 24 deg C), **as directed**.
 - b. 3-5/8 inches (92 mm) thick with a thermal resistance of 11 deg F x h x sq. ft./Btu at 75 deg F (1.9 K x sq. m/W at 24 deg C).
 - c. 5-1/2 inches (140 mm) thick with a thermal resistance of 19 deg F x h x sq. ft./Btu at 75 deg F (3.3 K x sq. m/W at 24 deg C).
 - d. 6-1/2 inches (165 mm) thick with a thermal resistance of 21 deg F x h x sq. ft./Btu at 75 deg F (3.7 K x sq. m/W at 24 deg C).
 - e. 9-1/2 inches (241 mm) **OR** 10 inches (254 mm) **OR** 10-1/4 inches (260 mm), **as directed**, thick with a thermal resistance of 30 deg F x h x sq. ft./Btu at 75 deg F (5.2 K x sq. m/W at 24 deg C).

F. Slag-Wool-Fiber/Rock-Wool-Fiber Blanket Insulation

1. Unfaced, Slag-Wool-Fiber/Rock-Wool-Fiber Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
2. Faced, Slag-Wool-Fiber/Rock-Wool-Fiber Blanket Insulation: ASTM C 665, Type III (blankets with reflective membrane facing), Class A (membrane-faced surface with a flame spread of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil-scrim-kraft, foil-scrim, or foil-scrim-polyethylene vapor-retarder membrane on 1 face.



3. Where slag-wool-fiber/rock-wool-fiber blanket insulation is indicated by the following thicknesses, provide blankets in batt form with thermal resistances indicated:
 - a. 1-1/2 inches (38 mm) thick with a thermal resistance of 6 deg F x h x sq. ft./Btu at 75 deg F (1 K x sq. m/W at 24 deg C).
 - b. 3-1/2 inches (89 mm) thick with a thermal resistance of 13 deg F x h x sq. ft./Btu at 75 deg F (2.3 K x sq. m/W at 24 deg C).
 - c. 4 inches (101 mm) thick with a thermal resistance of 16 deg F x h x sq. ft./Btu at 75 deg F (2.8 K x sq. m/W at 24 deg C).
 - d. 5-1/4 inches (133 mm) thick with a thermal resistance of 19 deg F x h x sq. ft./Btu at 75 deg F (3.3 K x sq. m/W at 24 deg C).
 - e. 6 inches (152 mm) thick with a thermal resistance of 22 deg F x h x sq. ft./Btu at 75 deg F (3.9 K x sq. m/W at 24 deg C).
- G. Loose-Fill Insulation
 1. Cellulosic-Fiber Loose-Fill Insulation: ASTM C 739, chemically treated for flame-resistance, processing, and handling characteristics.
 2. Glass-Fiber Loose-Fill Insulation: ASTM C 764, Type I for pneumatic application or Type II for poured application; with maximum flame-spread and smoke-developed indexes of 5.
- H. Spray-Applied Cellulosic Insulation
 1. Self-Supported, Spray-Applied Cellulosic Insulation: ASTM C 1149, Type I (materials applied with liquid adhesive; suitable for either exposed or enclosed applications), **OR** Type II (materials containing a dry adhesive activated by water during installation; intended only for enclosed or covered applications), **OR** Type III (materials containing an adhesive mixed with water during application; intended for application on attic floors), **as directed**, chemically treated for flame-resistance, processing, and handling characteristics.
- I. Radiant Barriers
 1. Interior Radiation Control Coating: ASTM C 1321. Silver-colored, not thickness-dependent, low-emissivity solvent-based **OR** water-based, **as directed**, coating, formulated for adherence to substrates indicated and with a surface emittance value of 0.25 or less as measured per ASTM C 1371.
 2. Sheet Radiant Barriers: ASTM C 1313 and as follows:
 - a. Sheet Construction: Foil on one side of substrate **OR** Foil on both sides of substrate **OR** Vacuum metallizing on substrate, **as directed**.
 - b. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indexes of 5 and 10, respectively.
 - c. Water-Vapor Transmission: 1 perm, maximum **OR** 5 perms or greater, **as directed**.
- J. Vapor Retarders
 1. Polyethylene Vapor Retarders: ASTM D 4397, 6 mils (0.15 mm) thick, with maximum permeance rating of 0.13 perm (7.5 ng/Pa x s x sq. m).
 2. Reinforced-Polyethylene Vapor Retarders: 2 outer layers of polyethylene film laminated to an inner reinforcing layer consisting of either nylon cord or polyester scrim and weighing not less than 25 lb/1000 sq. ft. (12 kg/100 sq. m), with maximum permeance rating of 0.0507 perm (2.9 ng/Pa x s x sq. m).
 3. Fire-Retardant, Reinforced-Polyethylene Vapor Retarders: 2 outer layers of polyethylene film laminated to an inner reinforcing layer consisting of either nonwoven grid of nylon cord or polyester scrim and weighing not less than 22 lb/1000 sq. ft. (10 kg/100 sq. m), with maximum permeance rating of 0.1317 perm (7.56 ng/Pa x s x sq. m) and with flame-spread and smoke-developed indexes of not more than 5 and 60, respectively.
 4. Foil-Polyester-Film Vapor Retarders: 2 layers of 0.5-mil- (0.013-mm-) thick polyester film laminated to an inner layer of 1-mil- (0.025-mm-) thick aluminum foil, with maximum water-vapor transmission rate in flat condition of 0.0 g/h x sq. m and with maximum flame-spread and smoke-developed indexes of 5.



5. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
6. Vapor-Retarder Fasteners: Pancake-head, self-tapping steel drill screws; with fender washers.
7. Single-Component Nonsag Urethane Sealant: ASTM C 920, Type I, Grade NS, Class 25, Use NT related to exposure, and Use O related to vapor-barrier-related substrates.
8. Adhesive for Vapor Retarders: Product recommended by vapor-retarder manufacturer and with demonstrated capability to bond vapor retarders securely to substrates indicated.

K. Auxiliary Insulating Materials

1. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by insulation manufacturers for sealing joints and penetrations in vapor-retarder facings.
2. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.
3. Asphalt Coating for Cellular-Glass Block Insulation: Cutback asphalt or asphalt emulsion of type recommended by manufacturer of cellular-glass block insulation.
4. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide cross ventilation between insulated attic spaces and vented eaves.

L. Insulation Fasteners

1. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of thickness indicated securely in position indicated with self-locking washer in place; and complying with the following requirements:
 - a. Plate: Perforated galvanized carbon-steel sheet, 0.030 inch (0.762 mm) thick by 2 inches (50 mm) square.
 - b. Spindle: Copper-coated, low carbon steel; fully annealed; 0.105 inch (2.67 mm) in diameter; length to suit depth of insulation indicated.
2. Adhesively Attached, Angle-Shaped, Spindle-Type Anchors: Angle welded to projecting spindle; capable of holding insulation of thickness indicated securely in position indicated with self-locking washer in place; and complying with the following requirements:
 - a. Angle: Formed from 0.030-inch- (0.762-mm-) thick, perforated, galvanized carbon-steel sheet with each leg 2 inches (50 mm) square.
 - b. Spindle: Copper-coated, low carbon steel; fully annealed; 0.105 inch (2.67 mm) in diameter; length to suit depth of insulation indicated.
3. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick galvanized steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches (38 mm) square or in diameter.
 - a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:
 - 1) Crawlspace.
 - 2) Ceiling plenums.
 - 3) Attic spaces.
 - 4) Where indicated.
4. Insulation Standoff: Spacer fabricated from galvanized mild-steel sheet for fitting over spindle of insulation anchor to maintain air space of 1 inch (25 mm) **OR** 2 inches (50 mm) **OR** 3 inches (76 mm), **as directed**, between face of insulation and substrate to which anchor is attached.
5. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.

1.3 EXECUTION

A. Preparation

1. Clean substrates of substances harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.



- B. Installation, General
1. Comply with insulation manufacturer's written instructions applicable to products and application indicated.
 2. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain, and snow.
 3. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
 4. Water-Piping Coordination: If water piping is located within insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.
 5. For preformed insulating units, provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.
- C. Installation Of Perimeter And Under-Slab Insulation
1. On vertical surfaces, set insulation units in adhesive applied according to manufacturer's written instructions. Use adhesive recommended by insulation manufacturer.
 - a. If not otherwise indicated, extend insulation a minimum of 24 inches (610 mm) below exterior grade line.
 2. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
 3. Protect below-grade insulation on vertical surfaces from damage during backfilling by applying protection course with joints butted. Set in adhesive according to insulation manufacturer's written instructions.
 4. Protect top surface of horizontal insulation from damage during concrete work by applying protection course with joints butted.
- D. Installation Of Cavity-Wall Insulation
1. On units of foam-plastic board insulation, install pads of adhesive spaced approximately 24 inches (610 mm) o.c. both ways on inside face, and as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates indicated.
 - a. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Division 04 Section "Unit Masonry".
 2. Install units of cellular-glass insulation with closely fitting joints using method indicated:
 - a. Gob Method: Apply 4 gobs of adhesive per unit and set units firmly against inside wythe of masonry or other construction as shown. Apply gobs at each corner; spread gobs to form pads 4 inches (101 mm) in diameter by 1/4 inch (6 mm) thick.
 - b. Serrated-Trowel Method: Apply adhesive to entire surface of each cellular-glass insulation unit with serrated trowel complying with insulation manufacturer's written instructions.
 - c. Coat edges of insulation units with full bed of adhesive to seal joints between insulation and between insulation and adjoining construction.
 - d. Coat exterior face (cold face) of installed cellular-glass block insulation course with asphalt coating.
- E. Installation Of General Building Insulation
1. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
 2. Seal joints between foam-plastic insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.
 3. Set vapor-retarder-faced units with vapor retarder to warm-in-winter side **OR** in location indicated, **as directed**, of construction, unless otherwise indicated.



- a. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.
4. Install mineral-fiber insulation in cavities formed by framing members according to the following requirements:
 - a. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
 - b. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - c. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures.
 - d. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
 - e. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
 - f. For wood-framed construction, install mineral-fiber blankets according to ASTM C 1320 and as follows:
 - 1) With faced blankets having stapling flanges, secure insulation by inset, stapling flanges to sides of framing members.
 - OR**
 - With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.
5. Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:
 - a. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application indicated.
 - b. Apply insulation standoffs to each spindle to create cavity width indicated between concrete substrate and insulation.
 - c. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation below indicated thickness.
 - d. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.
6. Install board insulation in curtain-wall construction where indicated on Drawings according to curtain-wall manufacturer's written instructions.
 - a. Retain insulation in place by metal clips and straps or integral pockets within window frames, spaced at intervals recommended in writing by insulation manufacturer to hold insulation securely in place without touching spandrel glass. Maintain cavity width of dimension indicated between insulation and glass.
 - b. Install insulation where it contacts perimeter fire-containment system to prevent insulation from bowing under pressure from perimeter fire-containment system.
7. Place loose-fill insulation into spaces indicated, by pouring **OR** by machine blowing, **as directed**, to comply with ASTM C 1015. Level horizontal applications to uniform thickness as indicated, lightly settle to uniform density, but do not compact excessively.
 - a. For cellulosic-fiber loose-fill insulation, comply with the Cellulose Insulation Manufacturers Association's Special Report #3, "Standard Practice for Installing Cellulose Insulation."
8. Apply self-supported, spray-applied cellulosic insulation according to manufacturer's written instructions. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked. After insulation is applied, make it flush with face of studs by using method recommended by insulation manufacturer.



9. Stuff glass-fiber loose-fill insulation into miscellaneous voids and cavity spaces where shown. Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).
- F. Installation Of Insulation In Ceilings For Sound Attenuation
1. Install 3-inch- (76-mm-) thick, unfaced glass-fiber **OR** slag-wool-fiber/rock-wool-fiber, **as directed**, blanket insulation over suspended ceilings at partitions in a width that extends insulation 48 inches (1219 mm) on either side of partition.
OR
Install 1-1/2-inch- (38-mm-) thick, unfaced glass-fiber **OR** slag-wool-fiber/rock-wool-fiber, **as directed**, blanket insulation over suspended ceilings so that insulation extends over entire ceiling.
- G. Installation Of Radiant Barriers
1. Install interior radiation control coating system according to ASTM C 1321.
 2. Install sheet radiant barriers in locations indicated according to ASTM C 1158.
- H. Installation Of Vapor Retarders
1. General: Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage system as indicated. Extend vapor retarder to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.
 2. Seal vertical joints in vapor retarders over framing by lapping not less than two wall studs. Fasten vapor retarders to wood framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space fasteners 16 inches (400 mm) o.c.
 3. Before installing vapor retarder, apply urethane sealant to flanges of metal framing including runner tracks, metal studs, and framing around door and window openings. Seal overlapping joints in vapor retarders with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Seal butt joints with vapor-retarder tape. Locate all joints over framing members or other solid substrates.
 4. Firmly attach vapor retarders to metal framing and solid substrates with vapor-retarder fasteners as recommended by vapor-retarder manufacturer.
 5. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarder.
 6. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarder.
- I. Protection
1. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07 21 13 13



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**SECTION 07 21 13 13a - MODIFIED BITUMOUS PROTECTED MEMBRANE ROOFING**

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for modified bituminous protected membrane roofing. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes APP-modified and SBS-modified bituminous protected membrane roofing.

C. Definitions

1. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.
2. Hot Roofing Asphalt: Roofing asphalt heated to its equiviscous temperature, the temperature at which its viscosity is 125 centipoise for mop-applied roofing asphalt and 75 centipoise for mechanical spreader-applied roofing asphalt, within a range of plus or minus 25 deg F (14 deg C), measured at the mop cart or mechanical spreader immediately before application.

D. Performance Requirements

1. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.
2. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.
3. Roofing System Design: If membrane roofing system is to be designed to withstand uplift pressure established by ASCE/SEI 7, provide membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7.
 - a. Corner Uplift Pressure: as directed by the Owner.
 - b. Perimeter Uplift Pressure: as directed by the Owner.
 - c. Field-of-Roof Uplift Pressure: as directed by the Owner.
4. FM Approvals Listing: If Project is FM Global insured or if FM Approvals requirements will set a minimum quality standard, provide membrane roofing, base flashings, and component materials that comply with requirements in FM Approvals 4450 and FM Approvals 4470 as part of a membrane roofing system, and that are listed in FM Approvals' "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals markings.
 - a. Fire/Windstorm Classification: Class 1A-60 **OR** Class 1A-75 **OR** Class 1A-90 **OR** Class 1A-105 **OR** Class 1A-120, **as directed.**
 - b. Hail Resistance Rating: MH **OR** SH, **as directed.**
5. Energy Performance (if required for LEED-NC Credit SS 7.2): Provide roofing system with initial Solar Reflectance Index not less than 78 when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency.
OR
Energy Performance (for roofs that must comply with the DOE's ENERGY STAR requirements): Provide roofing system that is listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.
OR



Energy Performance (for roofs that must comply with California Energy Commission's CEC-Title 24): Provide roofing system with initial Solar Reflectance not less than 0.70 and Thermal Emittance not less than 0.75 when tested according to CRRC-1.

E. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:
 - a. Product Test Reports for Credit SS 7.2: For roof materials, indicating that roof materials comply with Solar Reflectance Index requirement.
 - b. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.
3. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.
 - a. Base flashings and membrane terminations.
 - b. Tapered insulation, including slopes.
 - c. Crickets, saddles, and tapered edge strips, including slopes.
4. Samples: For the following products:
 - a. Sheet roofing materials, including base sheet, base-ply sheet, roofing membrane sheet, flashing backer sheet, membrane cap sheet and flashing sheet, of color specified.
 - b. Roof insulation.
 - c. 10 lb (4.5 kg) of aggregate ballast in gradation and color indicated.
 - d. Roof paver, full sized, in each color and texture required.
5. Qualification Data: For qualified Installer and manufacturer.
6. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - a. Submit evidence of compliance with performance requirements.
7. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of membrane roofing system.
8. Research/Evaluation Reports: For components of membrane roofing system, from the ICC-ES or applicable model code organization.
9. Maintenance Data: For roofing system to include in maintenance manuals.
10. Warranties: Sample of special warranties.

F. Quality Assurance

1. Manufacturer Qualifications: A qualified manufacturer that is UL listed **OR** FM Approvals approved, **as directed**, for membrane roofing system identical to that used for this Project.
2. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by membrane roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.
3. Source Limitations: Obtain components including roof insulation and fasteners for membrane roofing system from same manufacturer as membrane roofing or approved by membrane roofing manufacturer.
4. Exterior Fire-Test Exposure: ASTM E 108, Class A **OR** Class B **OR** Class C, **as directed**; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.
5. Fire-Resistance Ratings: Where indicated, provide fire-resistance-rated roof assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
6. Preinstallation Roofing Conference: Conduct conference at Project site.

G. Delivery, Storage, And Handling

1. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.



2. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing manufacturer. Protect stored liquid material from direct sunlight.
 - a. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
3. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
4. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

H. Project Conditions

1. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

I. Warranty

1. Special Warranty: Manufacturer's standard or customized form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period.
 - a. Special warranty includes membrane roofing, base flashings, roof insulation, fasteners, cover boards, substrate board, roofing accessories, roof pavers, and other components of membrane roofing system.
 - b. Warranty Period: 10 **OR** 15, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. APP-Modified Asphalt-Sheet Materials

1. Roofing Membrane Sheet: ASTM D 6222, Grade S, Type I or II, APP-modified asphalt sheet (reinforced with polyester fabric) **OR** ASTM D 6223, Grade S, Type I or II, APP-modified asphalt sheet (reinforced with a combination of polyester fabric and glass fibers), **as directed**; smooth surfaced; suitable for application method specified.
2. Smooth-Surfaced Roofing Membrane Cap Sheet: ASTM D 6222, Grade S, Type I or II, APP-modified asphalt sheet (reinforced with polyester fabric) **OR** ASTM D 6223, Grade S, Type I or II, APP-modified asphalt sheet (reinforced with a combination of polyester fabric and glass fibers), **as directed**; smooth surfaced; suitable for application method specified.
OR
Granule-Surfaced Roofing Membrane Cap Sheet: ASTM D 6222, Grade G, Type I or II, APP-modified asphalt sheet (reinforced with polyester fabric) **OR** ASTM D 6223, Grade G, Type I or II, APP-modified asphalt sheet (reinforced with a combination of polyester fabric and glass fibers), **as directed**; granular surfaced; suitable for application method specified.

B. SBS-Modified Asphalt-Sheet Materials

1. Roofing Membrane Sheet: ASTM D 6164, Grade S, Type I or II, SBS-modified asphalt sheet (reinforced with polyester fabric) **OR** ASTM D 6163, Grade S, Type I or II, SBS-modified asphalt sheet (reinforced with glass fibers) **OR** ASTM D 6162, Grade S, Type I or II, SBS-modified asphalt sheet (reinforced with a combination of polyester fabric and glass fibers), **as directed**; smooth surfaced; suitable for application method specified.
2. Smooth-Surfaced Roofing Membrane Cap Sheet: ASTM D 6164, Grade S, Type I or II, SBS-modified asphalt sheet (reinforced with polyester fabric) **OR** ASTM D 6163, Grade S, Type I or II, SBS-modified asphalt sheet (reinforced with glass fibers) **OR** ASTM D 6162, Grade S, Type I or II, SBS-modified asphalt sheet (reinforced with a combination of polyester fabric and glass fibers), **as directed**; smooth surfaced; suitable for application method specified.
OR



Granule-Surface Roofing Membrane Cap Sheet: ASTM D 6164, Grade G, Type I or II, SBS-modified asphalt sheet (reinforced with polyester fabric) **OR** ASTM D 6163, Grade G, Type I or II, SBS-modified asphalt sheet (reinforced with glass fibers) **OR** ASTM D 6162, Grade G, Type I or II, SBS-modified asphalt sheet (reinforced with a combination of polyester fabric and glass fibers), **as directed**; granular surfaced; suitable for application method specified.

OR

Metal-Foil-Surfaced Roofing Membrane Cap Sheet: ASTM D 6298, metal-foil surfaced SBS-modified asphalt sheet (reinforced with glass fibers); suitable for application method specified, and as follows:

a. Foil Surfacing: Aluminum **OR** Copper **OR** Stainless steel, **as directed**.

C. Base-Sheet Materials

1. Base Sheet: ASTM D 4601, Type II, SBS-modified asphalt-impregnated and -coated sheet, with glass-fiber-reinforcing mat, dusted with fine mineral surfacing on both sides.

a. Weight: 25 lb/100 sq. ft. (1.2 kg/sq. m) **OR** 40 lb/100 sq. ft. (1.95 kg/sq. m) **OR** 50 lb/100 sq. ft. (2.4 kg/sq. m) **OR** 60 lb/100 sq. ft. (2.9 kg/sq. m) **OR** 75 lb/100 sq. ft. (3.7 kg/sq. m), **as directed**, minimum.

OR

Base Sheet: ASTM D 4601, Type I **OR** Type II, **as directed**, nonperforated, asphalt-impregnated and -coated, glass-fiber sheet, dusted with fine mineral surfacing on both sides.

OR

Base Sheet: ASTM D 4897, Type II, venting, nonperforated, heavyweight, asphalt-impregnated and -coated, glass-fiber base sheet with coarse granular surfacing or embossed venting channels on bottom surface.

OR

Base Sheet: ASTM D 2626, asphalt-saturated and -coated organic felt, dusted with fine mineral surfacing on both sides.

D. Base-Ply Sheet Materials

1. Glass-Fiber Base-Ply Sheet: ASTM D 2178, Type IV **OR** Type VI, **as directed**, asphalt-impregnated, glass-fiber felt.

E. Base Flashing Sheet Materials

1. Backer Sheet: ASTM D 4601, Type I **OR** Type II, **as directed**, asphalt-impregnated and -coated, glass-fiber sheet, dusted with fine mineral surfacing on both sides.

OR

Backer Sheet: ASTM D 2626, asphalt-saturated and -coated organic felt, dusted with fine mineral surfacing on both sides.

OR

Backer Sheet: ASTM D 6222, Grade S, Type I or II, APP-modified asphalt sheet (reinforced with polyester fabric) **OR** ASTM D 6223, Grade S, Type I or II, APP-modified asphalt sheet (reinforced with a combination of polyester fabric and glass fibers), **as directed**; smooth surfaced; suitable for application method specified.

OR

Backer Sheet: ASTM D 6164, Grade S, Type I or II, SBS-modified asphalt sheet (reinforced with polyester fabric) **OR** ASTM D 6163, Grade S, Type I or II, SBS-modified asphalt sheet (reinforced with glass fibers) **OR** ASTM D 6162, Grade S, Type I or II, SBS-modified asphalt sheet (reinforced with a combination of polyester fabric and glass fibers), **as directed**; smooth surfaced; suitable for application method specified.

2. Smooth-Surfaced Flashing Sheet: ASTM D 6222, Grade S, Type I or II, APP-modified asphalt sheet (reinforced with polyester fabric) **OR** ASTM D 6223, Grade S, Type I or II, APP-modified asphalt sheet (reinforced with a combination of polyester fabric and glass fibers), **as directed**; smooth surfaced; suitable for application method specified.

3. Granule-Surfaced Flashing Sheet (for use with APP-modified roofing membranes): ASTM D 6222, Grade G, Type I or II, APP-modified asphalt sheet (reinforced with polyester



- fabric) **OR** ASTM D 6223, Grade G, Type I or II, APP-modified asphalt sheet (reinforced with a combination of polyester fabric and glass fibers), **as directed**; granular surfaced; suitable for application method specified, and as follows:
- a. Granule Color: White **OR** Gray **OR** Tan, **as directed**.
4. Granule-Surfaced Flashing Sheet (for use with SBS-modified roofing membranes): ASTM D 6164, Grade G, Type I or II, SBS-modified asphalt sheet (reinforced with polyester fabric) **OR** ASTM D 6163, Grade G, Type I or II, SBS-modified asphalt sheet (reinforced with glass fibers) **OR** ASTM D 6162, Grade G, Type I or II, SBS-modified asphalt sheet (reinforced with a combination of polyester fabric and glass fibers), **as directed**; granular surfaced; suitable for application method specified, and as follows:
 - a. Granule Color: White **OR** Gray **OR** Tan, **as directed**.
 5. Metal-Foil-Surfaced Flashing Sheet: ASTM D 6298, metal-foil surfaced SBS-modified asphalt sheet (reinforced with glass fibers); suitable for application method specified, and as follows:
 - a. Foil Surfacing: Aluminum **OR** Copper **OR** Stainless steel **OR** Aluminum, fluoropolymer coated finish, of color and gloss selected from manufacturer's full range, **as directed**.
 6. Glass-Fiber Fabric: Woven glass-fiber cloth, treated with asphalt, complying with ASTM D 1668, Type I.
- F. Auxiliary Roofing Membrane Materials
1. General: Auxiliary materials recommended by roofing manufacturer for intended use and compatible with roofing membrane.
 - a. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
 - b. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1) Plastic Foam Adhesives: 50 g/L.
 - 2) Multipurpose Construction Adhesives: 70 g/L.
 - 3) Fiberglass Adhesives: 80 g/L.
 - 4) Contact Adhesives: 80 g/L.
 - 5) Other Adhesives: 250 g/L.
 - 6) Nonmembrane Roof Sealants: 300 g/L.
 - 7) Sealant Primers for Nonporous Substrates: 250 g/L.
 - 8) Sealant Primers for Porous Substrates: 775 g/L.
 2. Asphalt Primer: ASTM D 41.
 3. Roofing Asphalt: ASTM D 312, Type III **OR** Type IV **OR** Type III or IV as recommended by roofing manufacturer for application, **as directed**.
OR
Roofing Asphalt: ASTM D 6152, SEBS modified.
 4. Cold-Applied Adhesive: Roofing manufacturer's standard asphalt-based, one- or two-part, asbestos-free, cold-applied adhesive specially formulated for compatibility and use with roofing membrane and base flashings.
 5. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required by roofing manufacturer for application.
 6. Mastic Sealant: Polyisobutylene, plain or modified bitumen, nonhardening, nonmigrating, nonskinning, and nondrying.
 7. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing membrane components to substrate, tested by manufacturer for required pullout strength, and acceptable to roofing system manufacturer.
 8. Insulation Cant Strips: ASTM C 728, perlite insulation board.
OR
Insulation Cant Strips: ASTM C 208, Type II, Grade 1, cellulosic-fiber insulation board.
 9. Metal Flashing Sheet: As specified in Division 7 Section "Sheet Metal Flashing and Trim."



10. Roofing Granules: Ceramic-coated **OR** Slate, **as directed**, roofing granules, No. 11 screen size with 100 percent passing No. 8 (2.36-mm) sieve and 98 percent of mass retained on No. 40 (0.425-mm) sieve, color to match roofing membrane.
11. Separator Sheet: Polyethylene sheet, 4 mils (0.1 mm) thick, minimum.
12. Miscellaneous Accessories: Provide those recommended by roofing system manufacturer.

G. Coating Materials

1. Roof Coating: ASTM D 1227, Type II, Class 1, mineral-colloid-emulsified, fibered **OR** Class 2, chemically emulsified, filled or fibered, **as directed**, asphalt emulsion, asbestos free.
OR
Roof Coating: ASTM D 1227, Type III, Class 1, mineral-colloid-emulsified **OR** Class 2, chemically emulsified, **as directed**, asphalt emulsion, nonfibered.
OR
Roof Coating: ASTM D 2824, Type I, nonfibered **OR** Type III, fibered, asbestos-free, **as directed**, aluminum-pigmented asphaltic coating.
OR
Roof Coating: Acrylic elastomer emulsion coating, formulated for use on bituminous roof surfaces and complying with ASTM D 6083.
 - a. Color: White **OR** Gray **OR** Buff, **as directed**.

H. Roof Insulation

1. General: Preformed roof insulation boards manufactured or approved by roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated and that produce FM Approvals-approved roof insulation, **as directed**.
2. Extruded-Polystyrene Board Insulation: ASTM C 578, Type VI, 1.8 lb/cu. ft. (29 kg/cu. m) **OR** Type VII, 2.2 lb/cu. ft. (35 kg/cu. m), **as directed**, with two or four edges rabbeted.
3. Mortar-Faced, Extruded-Polystyrene Board Insulation: ASTM C 578, Type VI, 1.8-lb/cu. ft. (29-kg/cu. m) minimum density, with tongue-and-groove edges on long dimension, and latex-modified cement mortar topping, 3/8 inch (9 mm) thick, 4.5 lb/sq. ft. (19.5 kg/sq. m) **OR** 15/16 inch (23 mm) thick, 11 lb/sq. ft. (53.7 kg/sq. m), **as directed**.

I. Insulation Accessories

1. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with membrane roofing.
2. Protection Mat: Woven or nonwoven polypropylene, polyolefin, or polyester fabric, water permeable and resistant to UV degradation, type and weight as recommended by roofing system manufacturer for application.
3. Metal Securement System: Perimeter securement flashing and strapping fabricated from stainless steel, a minimum of 0.031 inch (0.8 mm) thick. Provide fasteners as recommended by mortar-faced insulation manufacturer.

J. Ballast

1. Aggregate Ballast: Washed, crushed stone or smooth stone that will withstand weather exposure without significant deterioration and will not contribute to membrane degradation; of the following size:
 - a. Size: ASTM D 448, Size 5, ranging in size from 1/2 to 1 inch (13 to 25 mm).
 - b. Size: ASTM D 448, Size 4, ranging in size from 3/4 to 1-1/2 inches (19 to 38 mm).
 - c. Size: ASTM D 448, Size 2, ranging in size from 1-1/2 to 2-1/2 inches (38 to 63 mm).
2. Interlocking Roof Pavers: Interlocking, lightweight concrete units, specially factory cast for use as roof ballast; grooved back, with four-way drainage capability; beveled, doweled, or otherwise profiled. Size and weight shall be as directed.
 - a. Compressive Strength: 2500 psi (17 MPa) **OR** 5000 psi (34 MPa), **as directed**, minimum.
 - b. Colors and Textures: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.



3. Roof Pavers: Heavyweight, hydraulically pressed, concrete units, square edged **OR** with top edges beveled 3/16 inch (5 mm), **as directed**, factory cast for use as roof pavers; absorption not greater than 5 percent, ASTM C 140; no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance, ASTM C 67; and as follows:
 - a. Size: 24 by 24 inches (600 by 600 mm). Manufacture pavers to dimensional tolerances of plus or minus 1/16 inch (1.6 mm) in length, height, and thickness.
 - b. Weight: Weight shall be as directed.
 - c. Compressive Strength: 7500 psi (52 MPa) **OR** 6500 psi (45 MPa), **as directed**, minimum; ASTM C 140.
 - d. Colors and Textures: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - e. Paver Supports: Integral corner pedestals.
OR
Paver Supports: Paver manufacturer's standard SBR rubber, high-density polyethylene, or polyurethane paver support assembly, including fixed-height **OR** adjustable or stackable, **as directed**, pedestals, shims, and spacer tabs for joint spacing of 1/8 inch (3 mm) **OR** 3/16 inch (5 mm) **OR** 1/8 to 3/16 inch (3 to 5 mm), **as directed**.

1.3 EXECUTION

A. Examination

1. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
 - a. Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.
 - b. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations.
 - c. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
 - d. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 - 1) Test for moisture by pouring 1 pint (0.5 L) of hot roofing asphalt on deck at start of each day's work and at start of each roof area or plane. Do not proceed with roofing work if test sample foams or can be easily and cleanly stripped after cooling.
 - e. Verify that concrete curing compounds that will impair adhesion of roofing components to roof deck have been removed.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Preparation

1. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
2. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
3. Prime surface of concrete deck with asphalt primer at a rate of 3/4 gal./100 sq. ft. (0.3 L/sq. m) and allow primer to dry.

C. Roofing Membrane Installation, General

1. If referencing NRCA's roof assembly identification matrix system, install roofing membrane system according to roofing system manufacturer's written instructions and applicable recommendations in ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing."
 - a. Install roofing system MBA **OR** S, **as directed**,-4-C-T **OR** M **OR** L, **as directed**,-P, according to roof assembly identification matrix and roof assembly layout illustrations in NRCA's "The NRCA Roofing and Waterproofing Manual" and requirements in this Section.



2. For roof system that exceeds requirements of NRCA's roof assemblies, install roofing membrane system according to roofing system manufacturer's written instructions and applicable recommendations in ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing" and as follows:
 - a. Membrane: A (APP) **OR** S (SBS), **as directed**.
 - b. Deck Type: C (concrete or nonnailable).
 - c. Adhering Method: T (torched) **OR** M (mopped) **OR** L (cold-applied adhesive), **as directed**.
 - d. Base Sheet: One.
 - e. Number of Glass-Fiber Base-Ply Sheets: One.
 - f. Number of Modified Asphalt Sheets: Two.
 - g. Surfacing Type: P (protected).
 3. Start installation of roofing membrane in presence of roofing system manufacturer's technical personnel.
 4. Where roof slope exceeds 1/2 inch per 12 inches (1:24) **OR** 3/4 inch per 12 inches (1:18), **as directed**, install roofing membrane sheets parallel with slope.
 - a. Backnail roofing membrane sheets to nailer strips according to roofing system manufacturer's written instructions.
 5. Cooperate with testing agencies engaged or required to perform services for installing roofing system.
 6. Coordinate installing roofing system so components of the roofing membrane system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.
 - a. Provide tie-offs at end of each day's work to cover exposed roofing membrane sheets with a course of coated felt set in roofing cement or hot roofing asphalt with joints and edges sealed.
 - b. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.
 - c. Remove and discard temporary seals before beginning work on adjoining roofing.
 7. Asphalt Heating: Do not raise roofing asphalt temperature above equiviscous temperature range more than one hour before time of application. Do not exceed roofing asphalt manufacturer's recommended temperature limits during roofing asphalt heating. Do not heat roofing asphalt within 25 deg F (14 deg C) of flash point. Discard roofing asphalt maintained at a temperature exceeding finished blowing temperature for more than four hours.
OR
 Asphalt Heating: Heat and apply SEBS-modified roofing asphalt according to roofing system manufacturer's written instructions.
 8. Substrate-Joint Penetrations: Prevent roofing asphalt from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.
- D. Base-Sheet Installation
1. Install lapped base sheet course, extending sheet over and terminating beyond cants. Attach base sheet as follows:
 - a. Spot- or strip-mop to substrate with hot roofing asphalt.
OR
 Adhere to substrate in a solid mopping of hot roofing asphalt **OR** uniform coating of cold-applied adhesive, **as directed**.
- E. Base-Ply Sheet Installation
1. Install glass-fiber base-ply sheets according to roofing system manufacturer's written instructions starting at low point of roofing system. Align glass-fiber base-ply sheets without stretching. Extend glass-fiber base-ply sheets over and terminate beyond cants. Embed each glass-fiber base-ply sheet in a continuous void-free mopping of hot roofing asphalt, to form a uniform membrane without glass-fiber base-ply sheets touching.
- F. Modified Bituminous Membrane Installation



1. Install modified bituminous roofing membrane sheet and cap sheet according to roofing manufacturer's written instructions, starting at low point of roofing system. Extend roofing membrane sheets over and terminate beyond cants.
 - a. Unroll roofing membrane sheets and allow them to relax for minimum time period required by manufacturer.
 2. Laps: Accurately align roofing membrane sheets, without stretching, and maintain uniform side and end laps. Stagger end laps. Completely bond and seal laps, leaving no voids.
 - a. Repair tears and voids in laps and lapped seams not completely sealed.
 - b. Apply roofing granules to cover exuded bead at laps while bead is hot.
 3. Install roofing membrane sheets so side and end laps shed water.
- G. Flashing And Stripping Installation
1. Install base flashing over cant strips and other sloping and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrates according to roofing system manufacturer's written instructions and as follows:
 - a. Prime substrates with asphalt primer if required by roofing system manufacturer.
 - b. Backer Sheet Application: Mechanically fasten backer sheet to walls or parapets. Adhere backer sheet over roofing membrane at cants in a solid mopping of hot roofing asphalt **OR** cold-applied adhesive, **as directed**.
OR
Backer Sheet Application: Adhere backer sheet to substrate in a solid mopping of hot roofing asphalt **OR** cold-applied adhesive at rate required by roofing system manufacturer, **as directed**.
 - c. Flashing Sheet Application: Adhere flashing sheet to substrate in cold-applied adhesive at rate required by roofing system manufacturer.
OR
Flashing Sheet Application: Adhere flashing sheet to substrate in asphalt roofing cement at rate required by roofing system manufacturer.
OR
Flashing Sheet Application: Torch apply flashing sheet to substrate.
OR
Flashing Sheet Application: Adhere flashing sheet to substrate in a solid mopping of hot roofing asphalt applied at not less than 425 deg F (218 deg C). Apply hot roofing asphalt to back of flashing sheet if recommended by roofing system manufacturer.
 2. Extend base flashing up walls or parapets a minimum of 8 inches (200 mm) above roofing membrane and 4 inches (100 mm) onto field of roofing membrane.
 3. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.
 - a. Seal top termination of base flashing with a strip of glass-fiber fabric set in asphalt roofing cement, **as directed**.
 4. Install roofing membrane cap-sheet stripping where metal flanges and edgings are set on membrane roofing according to roofing system manufacturer's written instructions.
 5. Roof Drains: Set 30-by-30-inch (760-by-760-mm) metal flashing in bed of roofing-manufacturer-approved asphaltic adhesive on completed roofing membrane. Cover metal flashing with roofing membrane cap-sheet stripping and extend a minimum of 4 inches (100 mm) **OR** 6 inches (150 mm), **as directed**, beyond edge of metal flashing onto field of roofing membrane. Clamp roofing membrane, metal flashing, and stripping into roof-drain clamping ring.
 - a. Install stripping according to roofing system manufacturer's written instructions.
- H. Coating Installation
1. Apply coatings to base flashings according to manufacturer's written instructions, by spray, roller, or other suitable application method.
- I. Insulation Installation
1. Loosely lay separator sheet over cooled roofing membrane, with minimum 2-inch (50-mm) side laps and 4-inch (100-mm) end laps.



2. Loosely lay board insulation units over roofing membrane, with long joints of insulation in continuous straight lines and with end joints staggered between rows. Abut edges and ends between units.
3. Install one or more layers of insulation to achieve required thickness over roofing membrane. Cut and fit to within 3/4 inch (19 mm) of projections and penetrations.
 - a. Where overall insulation thickness is 2 inches (50 mm) or more, install required thickness in two or more layers with joints of each succeeding layer staggered over joints of previous layer a minimum of 6 inches (150 mm) in each direction.
4. Install geotextile fabric over insulation, overlapping edges and ends at least 12 inches (300 mm). Do not lap ends of fabric sheets within 72 inches (1800 mm) of roof perimeter. Extend fabric 2 to 3 inches (50 to 75 mm) above ballast at perimeter and penetrations. Apply additional layer of fabric around penetrations to prevent aggregate from getting between penetration and insulation. Do not cover drains or restrict water flow to drains.

J. Ballast Installation

1. To roofed area, apply aggregate ballast uniformly over geotextile fabric at rate required by insulation manufacturer, but not less than the following, carefully spreading aggregate to not damage roofing membrane and base flashings. Install roof-paver ballast according to insulation manufacturer's written instructions, **as directed**. Apply ballast as insulation is installed, leaving roofing membrane insulated and ballasted at end of workday.
 - a. Ballast (Dow's "Standard Design"): 15 lb/sq. ft. (75 kg/sq. m) **OR** 20 lb/sq. ft. (100 kg/sq. m), **as directed**, Size 5 aggregate within 102 inches (2600 mm) of roof perimeter and corners and 24 inches (600 mm) of roof penetrations; 10 lb/sq. ft. (50 kg/sq. m), Size 5 aggregate elsewhere.
 - 1) If partially replacing aggregate ballast with roof pavers, install one row of roof pavers in lieu of aggregate ballast at roof perimeter, corners, and penetrations.
 - b. Ballast (for Dow's "Design #1"): 15 lb/sq. ft. (75 kg/sq. m) **OR** 20 lb/sq. ft. (100 kg/sq. m), **as directed**, Size 4 aggregate within 102 inches (2600 mm) of roof perimeter and corners and 24 inches (600 mm) of roof penetrations; 12 lb/sq. ft. (60 kg/sq. m), Size 4 aggregate elsewhere.
 - c. Ballast (for Dow's "Design #1") (if combining aggregate ballast with roof pavers): 12 lb/sq. ft. (60 kg/sq. m), Size 4 aggregate to field of roof; install two rows of roof pavers at roof perimeter, corners, and penetrations according to insulation manufacturer's written instructions.
 - d. Ballast (for Dow's "Design #2") (for aggregate ballast with roof pavers at corners): 15 lb/sq. ft. (75 kg/sq. m) **OR** 20 lb/sq. ft. (100 kg/sq. m), **as directed**, Size 2 aggregate within 102 inches (2600 mm) of roof perimeter and 24 inches (600 mm) of roof penetrations; 13 lb/sq. ft. (65 kg/sq. m), Size 2 aggregate to field of roof; and install three rows of roof pavers at corners of roof according to insulation manufacturer's written instructions. Mechanically fasten securement strapping to center of first perimeter corner row of roof pavers.
 - e. Ballast (for Dow's "Design #2") (if combining aggregate ballast with roof pavers at roof perimeters, corners, and penetrations): 13 lb/sq. ft. (65 kg/sq. m), Size 2 aggregate to field of roof and install three rows of concrete pavers at roof perimeter, corners, and penetrations according to insulation manufacturer's written instructions. Mechanically fasten securement strapping to center of first perimeter and perimeter corner row of roof pavers.
 - f. Ballast (for Dow's "Design #3"): 15 lb/sq. ft. (75 kg/sq. m) **OR** 20 lb/sq. ft. (100 kg/sq. m), **as directed**, Size 2 aggregate within 24 inches (600 mm) of roof penetrations; 13 lb/sq. ft. (65 kg/sq. m), Size 2 aggregate to field of roof; and install four rows of roof pavers at roof perimeter and corners according to insulation manufacturer's written instructions. Mechanically fasten securement strapping to center of first two perimeter and perimeter corner rows of roof pavers.
2. Walkway Pavers: Install walkways formed from one row **OR** two rows, **as directed**, of roof pavers, loosely laid and butted.



K. Roof-Paver Installation

1. Interlocking Roof Pavers: Install interlocking roof pavers over roofed area according to manufacturer's written instructions.
2. For Dow's Technote 508 "Standard Design" and "Design #1", install roof pavers over roofed area according to insulation manufacturer's written instructions.
3. For Dow's Technote 508 "Standard Design" and "Design #2", install roof pavers over roofed area according to insulation manufacturer's written instructions. Mechanically fasten roof-paver metal straps to center of first perimeter and first perimeter corner row of roof pavers.
4. For Dow's Technote 508 "Standard Design" and "Design #3", install roof pavers over roofed area according to insulation manufacturer's written instructions. Mechanically fasten roof-paver metal straps to center of first two perimeters and first two perimeter corner rows of roof pavers.
5. Install roof pavers on pedestals set according to pedestal manufacturer's written instructions.

L. Mortar-Faced Board Insulation Installation

1. Install mortar-faced board insulation loosely laid, according to manufacturer's written instructions, with tongue-and-groove joints nested. Stagger end joints of adjoining rows and abut insulation.
 - a. Mechanically fasten metal securement strapping at penetrations and at perimeter edges of mortar-faced board insulation.
 - b. Over mortar-faced board insulation, install roof pavers on roof perimeter and corners according to manufacturer's written instructions.
2. Install one row **OR** two rows, **as directed**, of 24-inch- (600-mm-) wide roof pavers to roof perimeter, corners, and penetrations according to mortar-faced board insulation manufacturer's written instructions.

M. Field Quality Control

1. Testing Agency: Perform tests and inspections and to prepare reports.
2. Test Cuts: Test specimens will be removed to evaluate problems observed during quality-assurance inspections of roofing membrane as follows:
 - a. Approximate quantities of components within roofing membrane will be determined according to ASTM D 3617.
 - b. Test specimens will be examined for interply voids according to ASTM D 3617 and to comply with criteria established in Appendix 3 in ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing."
 - c. Repair areas where test cuts were made according to roofing system manufacturer's written instructions.
3. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
 - a. Notify the Owner and Owner 48 hours in advance of date and time of inspection.
4. Roofing system will be considered defective if it does not pass tests and inspections.
 - a. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

N. Protecting And Cleaning

1. Protect roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to the Owner and Owner.
2. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Final Completion and according to warranty requirements.
3. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 21 13 13a



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Task	Specification	Specification Description
07 21 13 13	07 51 13 00	Built-Up Asphalt Roofing
07 21 13 13	07 05 13 00	Built-Up Coal-Tar Roofing
07 21 13 13	07 53 16 00	EPDM Membrane Roofing
07 21 13 13	07 05 13 00a	CSPE Membrane Roofing
07 21 13 13	07 05 13 00b	APP-Modified Bituminous Membrane Roofing
07 21 13 13	07 05 13 00c	SBS-Modified Bituminous Membrane Roofing
07 21 13 16	07 21 13 13	Building Insulation
07 21 13 16	07 51 13 00	Built-Up Asphalt Roofing
07 21 13 16	07 05 13 00	Built-Up Coal-Tar Roofing
07 21 13 16	07 53 16 00	EPDM Membrane Roofing
07 21 13 16	07 05 13 00a	CSPE Membrane Roofing
07 21 13 16	07 05 13 00b	APP-Modified Bituminous Membrane Roofing
07 21 13 16	07 05 13 00c	SBS-Modified Bituminous Membrane Roofing
07 21 13 19	07 21 13 13	Building Insulation
07 21 13 19	07 51 13 00	Built-Up Asphalt Roofing
07 21 13 19	07 05 13 00	Built-Up Coal-Tar Roofing
07 21 13 19	07 53 16 00	EPDM Membrane Roofing
07 21 13 19	07 05 13 00a	CSPE Membrane Roofing
07 21 13 19	07 05 13 00b	APP-Modified Bituminous Membrane Roofing
07 21 13 19	07 05 13 00c	SBS-Modified Bituminous Membrane Roofing
07 21 16 00	07 21 13 13	Building Insulation
07 21 23 00	07 21 13 13	Building Insulation
07 21 26 00	07 21 13 13	Building Insulation



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SECTION 07 22 16 00 - FLUID-APPLIED PROTECTED MEMBRANE ROOFING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for fluid-applied protected membrane roofing. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: Show locations and extent of roofing.
 - a. Show locations, extent, and details of roof pavers.
3. Maintenance data.
4. Sample warranties.

C. Quality Assurance

1. Fire-Test-Response Characteristics: Provide hot fluid-applied roofing identical to assemblies tested for fire-test-response characteristics indicated by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Exterior Fire-Test Exposure: Class A; complying with ASTM E 108, for application and slopes indicated.
2. Preinstallation Conference: Conduct conference at Project site.

D. Delivery, Storage, And Handling

1. Deliver materials to Project site in original containers with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.
 - a. Handle and store roofing materials and place equipment in a manner to avoid significant or permanent damage to deck or structural supporting members.
2. Protect roofing insulation materials from damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location.

E. Project Conditions

1. Environmental Limitations: Apply roofing within the range of ambient and substrate temperatures recommended by roofing system manufacturer. Do not apply roofing to a damp or wet substrate or when temperature is below 0 deg F (minus 18 deg C).
 - a. Do not apply roofing in snow, rain, fog, or mist.

F. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace roofing that does not remain watertight and base flashing that does not within 10 **OR** 15 **OR** 20, **as directed**, years from date of Final Completion.
 - a. Warranty also includes insulation and roof pavers.

1.2 PRODUCTS

A. Roofing Membrane

1. Hot Fluid-Applied, Rubberized-Asphalt Roofing Membrane: Single component; 100 percent solids; hot fluid-applied, rubberized asphalt.

B. Base Flashing Sheet Materials



1. Elastomeric Flashing Sheet: 50-mil- (1.3-mm-) thick, minimum, uncured sheet neoprene with manufacturer's recommended contact adhesives as follows:
 - a. Tensile Strength: 1400 psi (9.6 MPa) minimum; ASTM D 412, Die C.
 - b. Elongation: 300 percent minimum; ASTM D 412.
 - c. Tear Resistance: 125 psi (860 kPa) minimum; ASTM D 624, Die C.
 - d. Brittleness: Does not break at minus 30 deg F (16 deg C); ASTM D 2137.
2. SBS-Modified Bituminous Flashing Sheet: ASTM D 6164, Grade G, Type I or Type II, polyester-reinforced, SBS-modified asphalt sheet; granular surfaced; suitable for application method specified, white **OR** gray **OR** tan, **as directed**.
 - a. Backer Sheet: ASTM D 6164, Grade S, Type I or Type II, polyester-reinforced, SBS-modified asphalt sheet; smooth surfaced; suitable for application method specified.
3. APP-Modified Bituminous Flashing Sheet: ASTM D 6222, Grade S, smooth **OR** Grade G, granular, **as directed**, surfaced, Type I or Type II, polyester-reinforced, APP-modified asphalt sheet; suitable for application method specified.
 - a. Granule Color: White **OR** Gray **OR** Tan, **as directed**.

C. Auxiliary Materials

1. General: Furnish auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing.
 - a. Furnish liquid-type auxiliary materials that meet VOC limits of authorities having jurisdiction.
2. Primer: ASTM D 41, asphaltic primer.
3. Elastomeric Sheet: 50-mil- (1.3-mm-) thick, minimum, uncured sheet neoprene with manufacturer's recommended contact adhesives as follows:
 - a. Tensile Strength: 1400 psi (9.6 MPa) minimum; ASTM D 412, Die C.
 - b. Elongation: 300 percent minimum; ASTM D 412.
 - c. Tear Resistance: 125 psi (860 kPa) minimum; ASTM D 624, Die C.
 - d. Brittleness: Does not break at minus 30 deg F (16 deg C); ASTM D 2137.
4. Metal Termination Bars: Manufacturer's standard, predrilled, stainless-steel or aluminum termination bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.
5. Reinforcing Fabric: Manufacturer's recommended, spun-bonded polyester fabric.
6. Protection Course: Manufacturer's standard, 80-to-90-mil- (2.0-to-2.3-mm-) thick, fiberglass-reinforced rubberized asphalt or modified bituminous sheet.
7. Geotextile Fabric: Woven or nonwoven polypropylene, polyolefin, or polyester geotextile fabric; water permeable and resistant to UV-light degradation; of type and weight recommended by insulation manufacturer for application.
8. Roof-Paver Metal Straps: Securement strapping fabricated from stainless steel, a minimum of 3 inches (75 mm) wide by 0.031 inch (0.8 mm) thick with stainless-steel anchors or other corrosion-resistant, postinstalled expansion anchors approved by insulation manufacturer.

D. Board Insulation

1. Extruded-Polystyrene Board Insulation: ASTM C 578, Type VI, 1.8 lb/cu. ft. (29 kg/cu. m) **OR** Type VII, 2.2 lb/cu. ft. (35 kg/cu. m), **as directed**, with two or four edges rabbeted.
2. Extruded-Polystyrene Board Insulation: ASTM C 578, Type VI, 1.8 lb/cu. ft. (29 kg/cu. m) **OR** Type VII, 2.2 lb/cu. ft. (35 kg/cu. m), **as directed**, with rabbeted edges and with one side having ribbed drainage channels.

E. Mortar-Faced Board Insulation

1. Mortar-Faced, Extruded-Polystyrene Board Insulation: ASTM C 578, Type VI, 1.8-lb/cu. ft. (29-kg/cu. m) minimum density, with tongue-and-groove edges on long dimension, and latex-modified cement mortar topping, 3/8 inch (9 mm) thick, 4 lb/sq. ft. (19.5 kg/sq. m) **OR** 15/16 inch (23 mm) thick, 11 lb/sq. ft. (53.7 kg/sq. m), **as directed**.
 - a. Metal Securement System: Perimeter securement flashing and strapping fabricated from stainless steel, a minimum of 0.031 inch (0.8 mm) thick, with stainless-steel anchors or



other corrosion-resistant, postinstalled expansion anchors approved by insulation manufacturer.

F. Aggregate Ballast

1. Aggregate Ballast: Washed, crushed stone or smooth stone that will withstand weather exposure without significant deterioration and will not contribute to membrane degradation; of the following size:
 - a. Size:
 - 1) ASTM D 448, Size 5, ranging in size from 1/2 to 1 inch (13 to 25 mm).
 - 2) ASTM D 448, Size 4, ranging in size from 3/4 to 1-1/2 inches (19 to 38 mm).
 - 3) ASTM D 448, Size 2, ranging in size from 1-1/2 to 2-1/2 inches (38 to 63 mm).

G. Roof Pavers

1. Interlocking Roof Pavers: Interlocking, lightweight concrete units, specially factory cast for use as roof ballast; grooved back, with four-way drainage capability; beveled, doweled, or otherwise profiled; and as follows:
 - a. Size: 8 by 16 inches (200 by 400 mm) 12 by 12 inches (300 by 300 mm) 12 by 16-1/2 inches (300 by 420 mm) 12 by 18 inches (300 by 450 mm)
 - b. Weight: At least 10 lb/sq. ft. (50 kg/sq. m) but not exceeding 18 lb/sq. ft. (90 kg/sq. m).
 - c. Compressive Strength: 2500 psi (17 MPa) **OR** 5000 psi (34 MPa), **as directed**, minimum.
 - d. Colors and Textures: As selected from manufacturer's full range.
2. Roof Pavers: Heavyweight, hydraulically pressed, concrete units, square edged **OR** with top edges beveled 3/16 inch (5 mm), **as directed**, factory cast for use as roof pavers; absorption not greater than 5 percent, ASTM C 140; no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance, ASTM C 67; and as follows:
 - a. Size: 24 by 24 inches (600 by 600 mm). Manufacture pavers to dimensional tolerances of plus or minus 1/16 inch (1.6 mm) in length, height, and thickness.
 - b. Weight: 18 lb/sq. ft. (90 kg/sq. m) **OR** 20 lb/sq. ft. (100 kg/sq. m) **OR** 22 lb/sq. ft. (110 kg/sq. m) **OR** 24 lb/sq. ft. (120 kg/sq. m), **as directed**, minimum.
 - c. Compressive Strength: 7500 psi (52 MPa) **OR** 6500 psi (45 MPa), **as directed**, minimum; ASTM C 140.
 - d. Colors and Textures: As selected from manufacturer's full range.
 - e. Paver Supports:
 - 1) Integral corner pedestals.
OR
Paver manufacturer's standard SBR rubber, high-density polyethylene, or polyurethane paver support assembly, including fixed-height **OR** adjustable or stackable, **as directed**, pedestals, shims, and spacer tabs for joint spacing of 1/8 inch (3 mm) **OR** 3/16 inch (5 mm), **as directed**.

1.3 EXECUTION

A. Preparation

1. Clean and prepare substrate according to manufacturer's written recommendations. Provide clean, dust-free, and dry substrate for roofing application.
2. Mask off adjoining surfaces not receiving roofing to prevent spillage from affecting other construction.
3. Protect roof drains and other deck penetrations to prevent spillage and migration of roofing fluids.
4. Remove grease, oil, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
5. Remove fins, ridges, and other projections and fill honeycomb, aggregate pockets, and other voids.

B. Joints, Cracks, And Terminations



1. Prepare and treat substrates to receive roofing membrane, including joints and cracks, roof drains, and penetrations, according roofing system manufacturer's written instructions.
 - a. Rout and fill joints and cracks in substrate. Before filling, remove dust and dirt according to ASTM D 4258.
 - b. Adhere strip of elastomeric sheet to substrate in a layer of hot fluid-applied, rubberized asphalt. Extend elastomeric sheet a minimum of 6 inches (150 mm) on each side of moving joints and cracks or joints and cracks exceeding 1/8 inch (3 mm) thick, and beyond roof drains and penetrations. Apply second layer of hot fluid-applied, rubberized asphalt over elastomeric sheet.
 - c. Embed strip of reinforcing fabric into a layer of hot fluid-applied, rubberized asphalt. Extend reinforcing fabric a minimum of 6 inches (150 mm) on each side of nonmoving joints and cracks not exceeding 1/8 inch (3 mm) thick, and beyond roof drains and penetrations.
 - 1) Apply second layer of hot fluid-applied, rubberized asphalt over reinforcing fabric.
2. At expansion joints and discontinuous deck-to-wall or deck-to-deck joints, bridge joints with elastomeric sheet extended a minimum of 6 inches (150 mm) on each side of joints and adhere to substrates in a layer of hot fluid-applied, rubberized asphalt. Apply second layer of hot fluid-applied, rubberized asphalt over elastomeric sheet.

C. Base Flashing Installation

1. Install base flashing at terminations of roofing membrane according to manufacturer's written instructions.
2. Prime substrate with asphalt primer if required by manufacturer.
3. Bond elastomeric flashing sheet in contact adhesive against wall substrate to within 3 inches (75 mm) of deck. Adhere remaining vertical leg and horizontal leg of flashing sheet in a layer of hot fluid-applied, rubberized asphalt.
4. Bond modified bituminous flashing sheet to substrate as follows:
 - a. Adhere SBS-modified bituminous backer sheet and flashing sheet to substrate in a layer of hot fluid-applied, rubberized asphalt.
 - b. Torch apply APP-modified bituminous flashing sheet to substrate.
 - c. Adhere SBS-modified bituminous backer sheet and flashing sheet to substrate in a layer of hot fluid-applied, rubberized asphalt or torch apply APP-modified bituminous flashing sheet to substrate as standard with manufacturer.
5. Extend flashing sheet up walls or parapets a minimum of 8 inches (200 mm) above insulation and 6 inches (150 mm) onto roof deck.
6. Install termination bars and mechanically fasten to top of flashing sheet at terminations and perimeter of roofing.

D. Roofing Membrane Application

1. Apply primer, at manufacturer's recommended rate, over prepared substrate and allow to dry.
2. Heat and apply rubberized asphalt according to manufacturer's written instructions.
 - a. Heat rubberized asphalt in an oil- or air-jacketed melter with mechanical agitator specifically designed for heating rubberized asphalt.
3. Start application with manufacturer's authorized representative present.
4. Unreinforced Membrane: Apply hot rubberized asphalt to area to receive roofing. Spread hot rubberized asphalt to form a uniform, unreinforced, seamless membrane, 180-mil (4.5-mm) minimum thickness **OR** 180-mil (4.5-mm) average thickness, but not less than 125 mil (3.2 mm) thick, **as directed**.
5. Reinforced Membrane: Apply hot fluid-applied, rubberized asphalt to area to receive roofing. Spread a 90-mil- (2.3-mm-) thick layer of hot fluid-applied, rubberized asphalt; embed reinforcing fabric, overlapping sheets 2 inches (50 mm); spread another 125-mil- (3.2-mm-) thick layer of hot fluid-applied, rubberized asphalt to form a uniform, reinforced, seamless membrane, 215 mils (5.5 mm) thick.
6. Apply hot fluid-applied, rubberized asphalt over prepared joints and up wall terminations and vertical surfaces to heights indicated or required by manufacturer.



7. Cover waterproofing with protection course with overlapped joints before membrane is subject construction traffic.

E. Insulation Installation

1. Loosely lay board insulation units over roofing membrane, with long joints of insulation in continuous straight lines and with end joints staggered between rows. Abut edges and ends between units.
2. Install one or more layers of insulation to achieve required thickness over roofing membrane. Cut and fit to within 3/4 inch (19 mm) of projections and penetrations.
 - a. Where overall insulation thickness is 2 inches (50 mm) or more, install required thickness in two or more layers with joints of each succeeding layer staggered over joints of previous layer a minimum of 6 inches (150 mm) in each direction.
3. Install geotextile fabric over insulation, overlapping edges and ends at least 12 inches (300 mm). Do not lap ends of fabric sheets within 72 inches (1800 mm) of roof perimeter. Extend fabric 2 to 3 inches (50 to 75 mm) above ballast at perimeter and penetrations. Apply additional layer of fabric around penetrations to prevent aggregate from getting between penetration and insulation. Do not cover drains or restrict water flow to drains.

F. Ballast Installation

1. To roofed area, apply aggregate ballast uniformly over geotextile fabric at rate required by insulation manufacturer, but not less than the following, carefully spreading aggregate to not damage roofing membrane and base flashings. Install roof-paver ballast according to insulation manufacturer's written instructions. Apply ballast as insulation is installed, leaving roofing membrane insulated and ballasted at end of workday.
 - a. Ballast for Dow's Standard Design: 15 lb/sq. ft. (75 kg/sq. m), Size 5 aggregate within 102 inches (2600 mm) of roof perimeter and corners and 24 inches (600 mm) of roof penetrations; 10 lb/sq. ft. (50 kg/sq. m), Size 5 aggregate elsewhere. Revise ballast loads for roof perimeter, corners, and penetration loads below to 20 lb/sq. ft. (100 kg/sq. m) for insulation 3 inches (75 mm) or thicker.
 - 1) Install one row of roof pavers in lieu of aggregate ballast at roof perimeter, corners, and penetrations if combining aggregate ballast with roof pavers.
 - b. Ballast for Dow's Design #1:
 - 1) 15 lb/sq. ft. (75 kg/sq. m), Size 4 aggregate within 102 inches (2600 mm) of roof perimeter and corners and 24 inches (600 mm) of roof penetrations; 12 lb/sq. ft. (60 kg/sq. m), Size 4 aggregate elsewhere. Revise ballast loads for roof perimeter, corners, and penetration loads below to 20 lb/sq. ft. (100 kg/sq. m) for insulation 3 inches (75 mm) or thicker.

OR

12 lb/sq. ft. (60 kg/sq. m), Size 4 aggregate to field of roof; install two rows of roof pavers at roof perimeter, corners, and penetrations according to insulation manufacturer's written instructions if combining aggregate ballast with roof pavers.
 - c. Ballast for Dow's Design #2:
 - 1) 15 lb/sq. ft. (75 kg/sq. m), Size 2 aggregate within 102 inches (2600 mm) of roof perimeter and 24 inches (600 mm) of roof penetrations; 13 lb/sq. ft. (65 kg/sq. m), Size 2 aggregate to field of roof; and install three rows of roof pavers at corners of roof according to insulation manufacturer's written instructions. Mechanically fasten securement strapping to center of first perimeter corner row of roof pavers. Revise ballast loads for roof perimeter, corners, and penetration loads below to 20 lb/sq. ft. (100 kg/sq. m) for insulation 3 inches (75 mm) or thicker.

OR

13 lb/sq. ft. (65 kg/sq. m), Size 2 aggregate to field of roof and install three rows of concrete pavers at roof perimeter, corners, and penetrations according to insulation manufacturer's written instructions if combining aggregate ballast with roof pavers at roof perimeters, corners, and penetrations. Mechanically fasten securement strapping to center of first perimeter and perimeter corner row of roof pavers.
 - d. Ballast for Dow's Design #3:



- 1) 15 lb/sq. ft. (75 kg/sq. m), Size 2 aggregate within 24 inches (600 mm) of roof penetrations; 13 lb/sq. ft. (65 kg/sq. m), Size 2 aggregate to field of roof; and install four rows of roof pavers at roof perimeter and corners according to insulation manufacturer's written instructions. Mechanically fasten securement strapping to center of first two perimeter and perimeter corner rows of roof pavers. Revise ballast loads for roof perimeter, corners, and penetration loads below to 20 lb/sq. ft. (100 kg/sq. m) for insulation 3 inches (75 mm) or thicker.
- 2) Walkway Pavers: Install walkways formed from one row **OR** two rows, **as directed**, of roof pavers, loosely laid and butted.

G. Roof-Paver Installation

1. Interlocking Roof Pavers: Install interlocking roof pavers over roofed area according to manufacturer's written instructions.
2. Install roof pavers over roofed area according to insulation manufacturer's written instructions.
3. Install roof pavers over roofed area according to insulation manufacturer's written instructions. Mechanically fasten roof-paver metal straps to center of first perimeter and first perimeter corner row of roof pavers.
4. Install roof pavers over roofed area according to insulation manufacturer's written instructions. Mechanically fasten roof-paver metal straps to center of first two perimeters and first two perimeter corner rows of roof pavers.
5. Install roof pavers on pedestals set according to pedestal manufacturer's written instructions.

H. Mortar-Faced Board Insulation Installation

1. Install mortar-faced board insulation loosely laid, according to manufacturer's written instructions, with tongue-and-groove joints nested. Stagger end joints of adjoining rows and abut insulation.
 - a. Mechanically fasten metal securement strapping at penetrations and at perimeter edges of mortar-faced board insulation.
 - b. Over mortar-faced board insulation, install roof pavers on roof perimeter and corners according to manufacturer's written instructions.
2. Install one row **OR** two rows, **as directed**, of 24-inch- (600-mm-) wide roof pavers to roof perimeter, corners, and penetrations according to mortar-faced board insulation manufacturer's written instructions.

I. Cleaning And Protection

1. Protect roofing from damage and wear during remainder of construction period.
2. Protect installed insulation from damage due to UV light, physical abuse, and other causes. Provide temporary coverings where insulation will be subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
3. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

1.4 ROOFING INSTALLER'S WARRANTY

Warranty shall be submitted in the following format:

- A. WHEREAS <Insert name> of <Insert address>, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:
 1. Owner:
 2. Address:
 3. Building Name/Type:
 4. Address:
 5. Area of Work:
 6. Acceptance Date:
 7. Warranty Period:



8. Expiration Date:

- B. AND WHEREAS Roofing Installer has contracted (either directly with the Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period it will, at its own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.
- D. This Warranty is made subject to the following terms and conditions:
 - 1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
 - a. lightning;
 - b. peak gust wind speeds, as directed by the Owner;
 - c. fire;
 - d. failure of roofing system substrate, including settlement, excessive deflection, deterioration, decomposition, and cracking wider than 1/8 inch (3 mm);
 - e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
 - f. vapor condensation on bottom of roofing; and
 - g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by the Owner.
 - 2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by the Owner or by another responsible party so designated.
 - 3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
 - 4. During Warranty Period, if the Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If the Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void, unless Roofing Installer, before starting said work, shall have notified the Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
 - 5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
 - 6. the Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
 - 7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off the Owner from other remedies and resources lawfully available to the Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with the Owner or a subcontract with the Owner's General Contractor.



E. IN WITNESS THEREOF, this instrument has been duly executed this **<Insert day>** day of **<Insert month>**, **<Insert year>**.

1. Authorized Signature:
2. Name:
3. Title:

END OF SECTION 07 22 16 00



Task	Specification	Specification Description
07 22 16 00	07 51 13 00	Built-Up Asphalt Roofing
07 22 16 00	07 05 13 00	Built-Up Coal-Tar Roofing
07 22 16 00	07 53 16 00	EPDM Membrane Roofing
07 22 16 00	07 05 13 00a	CSPE Membrane Roofing
07 22 16 00	07 05 13 00b	APP-Modified Bituminous Membrane Roofing
07 22 16 00	07 05 13 00c	SBS-Modified Bituminous Membrane Roofing



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**SECTION 07 24 13 00 - POLYMER-BASED EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)**

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for polymer-based exterior insulation and finish systems (EIFS). Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Exterior insulation and finish system (EIFS) applied over concrete, masonry, exterior cement board, gypsum sheathing, and plywood sheathing.
 - b. Prefabricated panels consisting of EIFS applied over exterior cement board and gypsum sheathing on metal framing.
2. Products furnished, but not installed under this Section, include anchors and other attachment devices to be cast in concrete and embedded in masonry assemblies.

C. System Description

1. Class PB EIFS: A non-load-bearing, exterior wall cladding system that consists of an insulation board attached adhesively, mechanically, or both to the substrate; an integrally reinforced base coat; and a textured protective finish coat.

D. Performance Requirements

1. EIFS Performance: Comply with the following:
 - a. Bond Integrity: Free from bond failure within EIFS components or between system and supporting wall construction, resulting from exposure to fire, wind loads, weather, or other in-service conditions.
 - b. Weathertightness: Resistant to water penetration from exterior into EIFS and assemblies behind it or through them into interior of building that results in deterioration of thermal-insulating effectiveness or other degradation of EIFS and assemblies behind it, including substrates, supporting wall construction, and interior finish.
2. Class PB EIFS: Provide EIFS having physical properties and structural performance that comply with the following:
 - a. Abrasion Resistance: Sample consisting of 1-inch- (25.4-mm-) thick EIFS mounted on 1/2-inch- (12.7-mm-) thick gypsum board; cured for a minimum of 28 days; and showing no cracking, checking, or loss of film integrity after exposure to 528 quarts (500 L) of sand when tested per ASTM D 968, Method A.
 - b. Absorption-Freeze Resistance: No visible deleterious effects and negligible weight loss after 60 cycles per EIMA 101.01.
 - c. Accelerated Weathering: Five samples per ICC-ES AC219 showing no cracking, checking, crazing, erosion, rusting, blistering, peeling, delamination, or other characteristics that might affect performance as a wall cladding after testing for 2000 hours when viewed under 5 times magnification per ASTM G 153 or ASTM G 154 **OR** ASTM G 153 or ASTM G 155, **as directed**.
 - d. Freeze-Thaw: No surface changes, cracking, checking, crazing, erosion, rusting, blistering, peeling, or delamination, or indications of delamination between components when viewed under 5 times magnification after 60 cycles per EIMA 101.01 **OR** 10 cycles per ICC-ES AC219, **as directed**.
 - e. Mildew Resistance of Finish Coat: Sample applied to 2-by-2-inch (50.8-by-50.8-mm) clean glass substrate, cured for 28 days, and showing no growth when tested per ASTM D 3273 and evaluated according to ASTM D 3274.

Polymer-Based Exterior Insulation And Finish System
(EIFS)



- f. Salt-Spray Resistance: No deleterious affects when tested according to ICC-ES AC219.
 - g. Tensile Adhesion: No failure in the EIFS, adhesive, base coat, or finish coat when tested per EIMA 101.03 **OR** ICC-ES AC219, **as directed**.
 - h. Water Penetration: Sample consisting of 1-inch- (25.4-mm-) thick EIFS mounted on 1/2-inch- (12.7-mm-)thick gypsum board, cured for 28 days, and showing no water penetration into the plane of the base coat to expanded-polystyrene board interface of the test specimen after 15 minutes at 6.24 lbf/sq. ft. (299 Pa) of air pressure difference or 20 percent of positive design wind pressure, whichever is greater, across the specimen during a test period when tested per EIMA 101.02.
 - i. Water Resistance: Three samples, each consisting of 1-inch- (25.4-mm-) thick EIFS mounted on 1/2-inch- (12.7-mm-) thick gypsum board; cured for 28 days; and showing no cracking, checking, crazing, erosion, rusting, blistering, peeling, or delamination after testing for 14 days per ASTM D 2247.
 - j. Wind-Driven-Rain Resistance: Resist wind-driven rain according to ICC-ES AC219.
 - k. Impact Resistance: Sample consisting of 1-inch- (25.4-mm-) thick EIFS when constructed, conditioned, and tested per EIMA 101.86; and meeting or exceeding the following:
 - 1) Standard Impact Resistance: 25 to 49 inch-lb (2.8 to 5.6 J).
 - 2) Medium Impact Resistance: 50 to 89 inch-lb (5.7 to 10.1 J).
 - 3) High Impact Resistance: 90 to 150 inch-lb (10.2 to 17 J).
 - 4) Ultra-High Impact Resistance: More than 150 inch-lb (17 J).
 - l. Structural Performance Testing: EIFS assembly and components shall comply with ICC-ES AC219 when tested per ASTM E 330.
3. Performance of Prefabricated Panels: Prefabricated panels shall be designed as follows and withstand the structural performance indicated for Class PB EIFS and thermal movement limits indicated below without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- a. Delegated Design: Design prefabricated panels, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
 - b. Structural Performance: EIFS shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to SEI/ASCE 7.
 - 1) Wind Loads: Uniform pressure as indicated on Drawings.
 - c. Deflection Limits: Design prefabricated panels to withstand design loads without deflections greater than 1/240.
 - d. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1) Temperature Change (Range): 100 deg F (55 deg C).

E. Submittals

1. Product Data: For each type and component of EIFS indicated.
2. LEED Submittal:
 - a. Product Data for Credit EQ 4.1: For adhesives and sealants used inside the weatherproofing system, including printed statement of VOC content.
3. Shop Drawings: For EIFS. Include plans, elevations, sections, details of components, details of penetration and termination, flashing details, joint locations and configurations, lifting points for prefabricated panels, fastening and anchorage details including mechanical fasteners, and connections and attachments to other work.
4. Panel Schedule: For prefabricated panel fabrication.
5. Samples: For each exposed product and for each color and texture specified.
6. Delegated-Design Submittal: For prefabricated panels indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
7. Material or product certificates.



8. Product test reports.
9. Compatibility and Adhesion Test Reports: For joint sealants from sealant manufacturer indicating the following:
 - a. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
 - b. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
10. Field quality-control reports and special inspection reports.
11. Evaluation reports
12. Maintenance data.

F. Quality Assurance

1. Installer Qualifications: An installer who is certified in writing by EIFS manufacturer as qualified to install manufacturer's system using trained workers.
2. Source Limitations: Obtain EIFS from single source from single EIFS manufacturer and from sources approved by EIFS manufacturer as compatible with system components.
3. Fire-Test-Response Characteristics: Provide EIFS and system components with the following fire-test-response characteristics as determined by testing identical EIFS and system components per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.
 - a. Fire-Resistance Characteristics: Per ASTM E 119.
 - b. Full-Scale Multistory Fire Test: Per IBC Standard.
 - c. Full-Scale Diversified Fire Test: Per ASTM E 108 modified for testing vertical walls.
 - d. Intermediate-Scale Multistory Fire Test: Per NFPA 285 **OR** IBC Standard, **as directed**.
 - e. Radiant Heat Exposure: No ignition of EIFS when tested according to NFPA 268.
 - f. Potential Heat: Acceptable level when tested according to NFPA 259.
 - g. Surface-Burning Characteristics: Provide insulation board, adhesives, base coats, and finish coats with flame-spread index of 25 or less and smoke-developed index of 450 or less, per ASTM E 84 **OR** IBC Standard, **as directed**.
4. Preinstallation Conference: Conduct conference at Project site.

G. Delivery, Storage, And Handling

1. Deliver materials in original, unopened packages with manufacturers' labels intact and clearly identifying products.
2. Store materials inside and under cover; keep them dry and protected from weather, direct sunlight, surface contamination, aging, corrosion, damaging temperatures, construction traffic, and other causes.
 - a. Stack insulation board flat and off the ground.
 - b. Protect plastic insulation against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
 - c. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

H. Project Conditions

1. Weather Limitations: Maintain ambient temperatures above 40 deg F (4.4 deg C) for a minimum of 24 hours before, during, and after adhesives or coatings are applied. Do not apply EIFS adhesives or coatings during rainfall. Proceed with installation only when existing and forecasted weather conditions and ambient outdoor air, humidity, and substrate temperatures permit EIFS to be applied, dried, and cured according to manufacturers' written instructions and warranty requirements.



1.2 PRODUCTS

A. Materials

1. Compatibility: Provide adhesive, fasteners, board insulation, reinforcing meshes, base- and finish-coat systems, sealants, and accessories that are compatible with one another and with substrates and approved for use by EIFS manufacturer for Project.
2. Prefabricated Panels: Comply with requirements in Division 05 Section "Cold-formed Metal Framing" for metal framing and with requirements in Division 06 Section "Sheathing" for gypsum sheathing and weather-resistant sheathing paper.
3. Exterior Cement Board: Not less than 5/16-inch- (8-mm-) **OR** 7/16-inch- (11-mm-), **as directed**, thick, fiber cement board complying with ASTM C 1186, Type A, for exterior applications.
 - a. Fasteners: Wafer-head or flat-head steel drill screws complying with ASTM C 954, with an organic-polymer coating or other corrosion-protective coating having a salt-spray resistance of more than 500 hours per ASTM B 117.
 - 1) Size and Length: As recommended by sheathing manufacturer for type and thickness of sheathing board to be attached.
4. Primer/Sealer: EIFS manufacturer's standard substrate conditioner with VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), designed to seal substrates from moisture penetration and to improve the bond between substrate of type indicated and adhesive used for application of insulation.
5. Flexible-Membrane Flashing: Cold-applied, fully self-adhering, self-healing, rubberized-asphalt and polyethylene-film composite sheet or tape and primer; EIFS manufacturer's standard or product recommended in writing by EIFS manufacturer.
6. Insulation Adhesive: EIFS manufacturer's standard formulation designed for indicated use; compatible with substrate; with VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24); and complying with one of the following:
 - a. Job-mixed formulation of portland cement complying with ASTM C 150, Type I, and polymer-based adhesive specified for base coat.
 - b. Factory-blended dry formulation of portland cement, dry polymer admixture, and fillers specified for base coat.
 - c. Factory-mixed noncementitious formulation designed for adhesive attachment of insulation to substrates of type indicated, as recommended by EIFS manufacturer.
7. Molded, Rigid Cellular Polystyrene Board Insulation: Comply with ASTM C 578, Type I; EIFS manufacturer's requirements; and EIMA's "EIMA Guideline Specification for Expanded Polystyrene (EPS) Insulation Board" for most stringent requirements for material performance and qualities of insulation, including dimensions and permissible variations, and the following:
 - a. Aging: Before cutting and shipping, age insulation in block form by air drying for not less than six weeks or by another method approved by EIMA that produces equivalent results.
 - b. Flame-Spread and Smoke-Developed Indexes: 25 and 450 or less, respectively, per ASTM E 84.
 - c. Dimensions: Provide insulation boards not more than 24 by 48 inches (610 by 1219 mm) and in thickness indicated, but not more than 4 inches (102 mm) thick or less than thickness allowed by ASTM C 1397.
 - d. Foam Shapes: Provide with profiles and dimensions indicated on Drawings.
8. Reinforcing Mesh: Balanced, alkali-resistant, open-weave, glass-fiber mesh treated for compatibility with other EIFS materials, complying with ASTM D 578 and the following:
 - a. Standard-Impact Reinforcing Mesh: Not less than 4.0 oz./sq. yd. (136 g/sq. m).
 - b. Intermediate-Impact Reinforcing Mesh: Not less than 10 oz./sq. yd. (339 g/sq. m) **OR** 12.0 oz./sq. yd. (407 g/sq. m), **as directed**.
 - c. High-Impact Reinforcing Mesh: Not less than 15 oz./sq. yd. (509 g/sq. m).
 - d. Heavy-Duty Reinforcing Mesh: Not less than 20 oz./sq. yd. (678 g/sq. m).
 - e. Strip Reinforcing Mesh: Not less than 3.75 oz./sq. yd. (127 g/sq. m).
 - f. Detail Reinforcing Mesh: Not less than 4.0 oz./sq. yd. (136 g/sq. m).
 - g. Corner Reinforcing Mesh: Not less than 7.2 oz./sq. yd. (244 g/sq. m).



9. Base-Coat Materials: EIFS manufacturer's standard mixture complying with one of the following:
 - a. Job-mixed formulation of portland cement complying with ASTM C 150, Type I, white or natural color; and manufacturer's standard polymer-emulsion adhesive designed for use with portland cement.
 - b. Job-combined formulation of manufacturer's standard polymer-emulsion adhesive and manufacturer's standard dry mix containing portland cement.
 - c. Factory-blended dry formulation of portland cement, dry polymer admixture, and inert fillers to which only water is added at Project site.
 - d. Factory-mixed noncementitious formulation of polymer-emulsion adhesive and inert fillers that is ready to use without adding other materials.
10. Waterproof Adhesive/Base-Coat Materials: EIFS manufacturer's standard waterproof formulation with VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24) complying with one of the following:
 - a. Job-mixed formulation of portland cement complying with ASTM C 150, Type I, white or natural color; and manufacturer's standard polymer-emulsion adhesive designed for use with portland cement.
 - b. Job-combined formulation of manufacturer's standard polymer-emulsion adhesive and manufacturer's standard dry mix containing portland cement.
11. Primer: EIFS manufacturer's standard factory-mixed, elastomeric-polymer primer for preparing base-coat surface for application of finish coat.
12. Finish-Coat Materials: EIFS manufacturer's standard acrylic-based coating **OR** standard acrylic-based coating with enhanced mildew resistance **OR** siliconized acrylic-based coating, **as directed**, complying with the following:
 - a. Factory-mixed formulation of polymer-emulsion binder, colorfast mineral pigments, sound stone particles, and fillers.
 - b. Factory-mixed formulation of polymer-emulsion binder, colorfast mineral pigments, and fillers used with stone particles for embedding in finish coat to produce an applied-aggregate finish.
 - 1) Aggregate: Marble chips of size and color as selected by the Owner from manufacturer's full range.
 - c. Sealer: Manufacturer's waterproof, clear acrylic-based sealer for protecting finish coat.
 - d. Colors: As selected by the Owner from manufacturer's full range.
13. Water: Potable.
14. Mechanical Fasteners: EIFS manufacturer's standard corrosion-resistant fasteners consisting of thermal cap, standard washer and shaft attachments, and fastener indicated below; selected for properties of pullout, tensile, and shear strength required to resist design loads of application indicated; capable of pulling fastener head below surface of insulation board; and of the following description:
 - a. For attachment to steel studs from 0.033 to 0.112 inch (0.84 to 2.84 mm) in thickness, provide steel drill screws complying with ASTM C 954.
 - b. For attachment to light-gage steel framing members not less than 0.0179 inch (0.45 mm) in thickness, provide steel drill screws complying with ASTM C 1002.
 - c. For attachment to wood framing members and plywood sheathing, provide steel drill screws complying with ASTM C 1002, Type W.
 - d. For attachment to masonry and concrete substrates, provide sheathing dowel in form of a plastic wing-tipped fastener with thermal cap, sized to fit insulation thickness indicated and to penetrate substrate to depth required to secure anchorage.
 - e. For attachment, provide manufacturer's standard fasteners suitable for substrate.
15. Trim Accessories: Type as designated or required to suit conditions indicated and to comply with EIFS manufacturer's written instructions; manufactured from UV-stabilized PVC; and complying with ASTM D 1784, manufacturer's standard Cell Class for use intended, and ASTM C 1063.
 - a. Casing Bead: Prefabricated, one-piece type for attachment behind insulation, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg.



- b. Drip Screed/Track: Prefabricated, one-piece type for attachment behind insulation with face leg extended to form a drip, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg.
- c. Expansion Joint: Prefabricated, one-piece V profile; designed to relieve stress of movement.
- d. Window Sill Flashing: Prefabricated type for both flashing and sloping sill over framing beneath windows; with end and back dams; designed to direct water to exterior.
- e. Parapet Cap Flashing: Type for both flashing and covering parapet top with design complying with ASTM C 1397.

B. Elastomeric Sealants

1. Elastomeric Sealant Products: Provide EIFS manufacturer's listed and recommended chemically curing, elastomeric sealant that is compatible with joint fillers, joint substrates, and other related materials, and complies with requirements for products and testing indicated in ASTM C 1481 and with requirements in Division 07 Section "Joint Sealants" for products corresponding to description indicated below:
 - a. Multicomponent, nonsag urethane sealant.
 - b. Single-component, nonsag, neutral-curing silicone sealant.
 - c. Provide sealants, used inside the weatherproofing system, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Preformed Foam Sealant Products: Provide sealant compatible with adjacent materials and complying with requirements in Division 07 Section "Joint Sealants".
3. Sealant Color: As selected by the Owner from manufacturer's full range.

C. Mixing

1. General: Comply with EIFS manufacturer's requirements for combining and mixing materials. Do not introduce admixtures, water, or other materials except as recommended by EIFS manufacturer. Mix materials in clean containers. Use materials within time period specified by EIFS manufacturer or discard.

D. Panel Fabrication

1. Panel Framing: Fabricate panel framing to comply with requirements in Division 05 Section "Cold-formed Metal Framing".
 - a. Connect panel framing by welding unless otherwise indicated.
 - b. Connections: Provide connections capable of adjustment, complying with erection tolerance requirements, to anchor panels to structure.
2. Exterior Cement Board: Install on metal framing to comply with requirements in "Exterior Cement-Board Installation" Article.
3. EIFS Application: Apply EIFS to sheathed metal-framed panels to comply with requirements in "Trim Installation," "Insulation Installation," "Base-Coat Installation," and "Finish-Coat Installation" articles and as follows:
 - a. Wrap base coat and reinforcing mesh at edges of panels and extend coverage not less than 4 inches (100 mm) over backs of panels unless otherwise indicated.
 - b. Wrap base coat and reinforcing mesh at edges of panels and extend coverage not less than full thickness to cover edges of metal framing unless otherwise indicated.
 - c. Continue finish coat around corners at edges of panels, unless otherwise indicated, and extend to location indicated for sealant application. Do not extend finish coat over surfaces where sealant will be applied.
 - d. Continue finish coat around corners at edges of panels and extend over edges to cover base coat unless otherwise indicated.
4. Panel Fabrication Tolerances: Comply with the following:
 - a. Overall Height and Width: Plus or minus 1/8 inch (3.2 mm).
 - b. Cumulative Height and Width over Length of Building: Not more than 3/8 inch (9.6 mm).
 - c. Openings within One Unit: Plus or minus 1/8 inch (3.2 mm) for window and door frames.



- d. Out of Square: Plus or minus 1/8 inch (3.2 mm).
- e. Locations of Reveals and Architectural Features: Plus or minus 1/8 inch (3.2 mm).
- f. Thickness: Plus or minus 1/16 inch (1.6 mm).
- g. Flatness: Not more than 1/8 inch in 8 feet (3.2 mm in 2.4 m) across face of panel.

1.3 EXECUTION

A. Preparation

- 1. Protect contiguous work from moisture deterioration and soiling caused by application of EIFS. Provide temporary covering and other protection needed to prevent spattering of exterior finish coats on other work.
- 2. Protect EIFS, substrates, and wall construction behind them from inclement weather during installation. Prevent penetration of moisture behind EIFS and deterioration of substrates.
- 3. Prepare and clean substrates to comply with EIFS manufacturer's written instructions to obtain optimum bond between substrate and adhesive for insulation.
 - a. Concrete Substrates: Provide clean, dry, neutral-pH substrate for insulation installation. Verify suitability of substrate by performing bond and moisture tests recommended by EIFS manufacturer.

B. Exterior Cement-Board Installation

- 1. Exterior Cement Board: Install on metal framing to comply with cement-board manufacturer's written instructions and evaluation report acceptable to authorities having jurisdiction. Install board with steel drill screws spaced no more than 8 inches (203 mm) o.c. along framing with perimeter fasteners at least 3/8 inch (9.6 mm) but less than 5/8 inch (15.9 mm) from edges of boards.

C. EIFS Installation, General

- 1. Comply with ASTM C 1397 and EIFS manufacturer's written instructions for installation of EIFS as applicable to each type of substrate indicated.

D. Substrate Protection Application

- 1. Primer/Sealer: Apply over gypsum sheathing substrates to protect substrates from degradation and where required by EIFS manufacturer for improving adhesion of insulation to substrate.
- 2. Waterproof Adhesive/Base Coat: Apply over sloped surfaces **OR** window sills **OR** parapets **OR** where indicated on Drawings, **as directed**, to protect substrates from degradation.
- 3. Flexible-Membrane Flashing: Install over weather-resistive barrier, applied and lapped to shed water; seal at openings, penetrations, terminations, and where indicated by EIFS manufacturer's written instructions to protect wall assembly from degradation. Prime substrates, if required, and install flashing to comply with EIFS manufacturer's written instructions and details.

E. Trim Installation

- 1. Trim: Apply trim accessories at perimeter of EIFS, at expansion joints, at window sills, and elsewhere as indicated, according to EIFS manufacturer's written instructions. Coordinate with installation of insulation.
 - a. Drip Screed/Track: Use at bottom edges of EIFS unless otherwise indicated.
 - b. Window Sill Flashing: Use at windows unless otherwise indicated.
 - c. Expansion Joint: Use where indicated on Drawings.
 - d. Casing Bead: Use at other locations.
 - e. Parapet Cap Flashing: Use where indicated on Drawings.

F. Insulation Installation

- 1. Board Insulation: Adhesively **OR** Mechanically **OR** Adhesively and mechanically, **as directed**, attach insulation to substrate in compliance with ASTM C 1397, EIFS manufacturer's written instructions, and the following:

Polymer-Based Exterior Insulation And Finish System
(EIFS)



- a. Apply adhesive to insulation by notched-trowel method in a manner that results in coating the entire surface of sheathing with adhesive once insulation is adhered to sheathing unless EIFS manufacturer's written instructions specify using primer/sealer with ribbon-and-dab method. Apply adhesive to a thickness of not less than 1/4 inch (6.4 mm) for factory mixed and not less than 3/8 inch (9.6 mm) for field mixed, measured from surface of insulation before placement.
- b. Press and slide insulation into place. Apply pressure over the entire surface of insulation to accomplish uniform contact, high initial grab, and overall level surface.
- c. Allow adhered insulation to remain undisturbed for period recommended by EIFS manufacturer, but not less than 24 hours, before installing mechanical fasteners, beginning rasping and sanding insulation, or applying base coat and reinforcing mesh.
- d. Mechanically attach insulation to substrate by method complying with EIFS manufacturer's written instructions. Install top surface of fastener heads flush with plane of insulation. Install fasteners into or through substrates with the following minimum penetration:
 - 1) Steel Framing: 5/16 inch (8 mm).
 - 2) Wood Framing: 1 inch (25 mm).
 - 3) Concrete and Masonry: 1 inch (25 mm).
- e. Apply insulation over dry substrates in courses with long edges of boards oriented horizontally.
- f. Begin first course of insulation from a level base line and work upward.
- g. Begin first course of insulation from screed/track and work upward. Work from perimeter casing beads toward interior of panels if possible.
- h. Stagger vertical joints of insulation boards in successive courses to produce running bond pattern. Locate joints so no piece of insulation is less than 12 inches (300 mm) wide or 6 inches (150 mm) high. Offset joints not less than 6 inches (150 mm) from corners of window and door openings and not less than 4 inches (100 mm) from aesthetic reveals.
 - 1) Adhesive Attachment: Offset joints of insulation not less than 6 inches (150 mm) from horizontal and 4 inches (100 mm) from vertical joints in sheathing.
 - 2) Mechanical Attachment: Offset joints of insulation from horizontal joints in sheathing.
- i. Interlock ends at internal and external corners.
- j. Abut insulation tightly at joints within and between each course to produce flush, continuously even surfaces without gaps or raised edges between boards. If gaps greater than 1/16 inch (1.6 mm) occur, fill with insulation cut to fit gaps exactly; insert insulation without using adhesive or other material.
- k. Cut insulation to fit openings, corners, and projections precisely and to produce edges and shapes complying with details indicated.
- l. Rasp or sand flush entire surface of insulation to remove irregularities projecting more than 1/32 inch (0.8 mm) **OR** 1/16 inch (1.6 mm), **as directed**, from surface of insulation and to remove yellowed areas due to sun exposure; do not create depressions deeper than 1/16 inch (1.6 mm).
- m. Cut aesthetic reveals in outside face of insulation with high-speed router and bit configured to produce grooves, rabbets, and other features that comply with profiles and locations indicated. Do not reduce insulation thickness at aesthetic reveals to less than 3/4 inch (19 mm).
- n. Install foam shapes and attach to sheathing **OR** structure, **as directed**.
- o. Interrupt insulation for expansion joints where indicated.
- p. Form joints for sealant application by leaving gaps between adjoining insulation edges and between insulation edges and dissimilar adjoining surfaces. Make gaps wide enough to produce joint widths indicated after encapsulating joint substrates with base coat and reinforcing mesh.
- q. Form joints for sealant application with back-to-back casing beads for joints within EIFS and with perimeter casing beads at dissimilar adjoining surfaces. Make gaps between



- casing beads and between perimeter casing beads and adjoining surfaces of width indicated.
- r. After installing insulation and before applying reinforcing mesh, fully wrap board edges with strip reinforcing mesh. Cover edges of board and extend encapsulating mesh not less than 2-1/2 inches (64 mm) over front and back face unless otherwise indicated on Drawings.
 - s. Treat exposed edges of insulation as follows:
 - 1) Except for edges forming substrates of sealant joints, encapsulate with base coat, reinforcing mesh, and finish coat.
 - 2) Encapsulate edges forming substrates of sealant joints within EIFS or between EIFS and other work with base coat and reinforcing mesh.
 - 3) At edges trimmed by accessories, extend base coat, reinforcing mesh, and finish coat over face leg of accessories.
 - t. Coordinate installation of flashing and insulation to produce wall assembly that does not allow water to penetrate behind flashing and EIFS protective-coating lamina.
2. Expansion Joints: Install at locations indicated, where required by EIFS manufacturer, and as follows:
- a. At expansion joints in substrates behind EIFS.
 - b. Where EIFS adjoin dissimilar substrates, materials, and construction, including other EIFS.
 - c. At floor lines in multilevel wood-framed construction.
 - d. Where wall height or building shape changes.
 - e. Where EIFS manufacturer requires joints in long continuous elevations.
 - f. Where panels abut one another.

G. Base-Coat Installation

- 1. Base Coat: Apply to exposed surfaces of insulation and foam shapes in minimum thickness recommended in writing by EIFS manufacturer, but not less than 1/16-inch (1.6-mm) dry-coat thickness.
- 2. Reinforcing Mesh: Embed type indicated below in wet base coat to produce wrinkle-free installation with mesh continuous at corners and overlapped not less than 2-1/2 inches (64 mm) or otherwise treated at joints to comply with ASTM C 1397 and EIFS manufacturer's written instructions. Do not lap reinforcing mesh within 8 inches (204 mm) of corners. Completely embed mesh, applying additional base-coat material if necessary, so reinforcing-mesh color and pattern are not visible.
 - a. Standard-impact reinforcing mesh unless otherwise indicated.
 - b. Intermediate-impact reinforcing mesh where indicated.
 - c. High-impact reinforcing mesh where indicated.
 - d. Heavy-duty reinforcing mesh where indicated.
- 3. Double-Layer Reinforcing Mesh Application: Where indicated, apply second base coat and second layer of standard-impact **OR** intermediate-impact, **as directed**, reinforcing mesh, overlapped not less than 2-1/2 inches (64 mm) or otherwise treated at joints to comply with ASTM C 1397 and EIFS manufacturer's written instructions in same manner as first application. Do not apply until first base coat has cured.
- 4. Additional Reinforcing Mesh: Apply strip reinforcing mesh around openings extending 4 inches (100 mm) beyond perimeter. Apply additional 9-by-12-inch (230-by-300-mm) strip reinforcing mesh diagonally at corners of openings (re-entrant corners). Apply 8-inch- (200-mm-) wide strip reinforcing mesh at both inside and outside corners unless base layer of mesh is lapped not less than 4 inches (100 mm) on each side of corners.
 - a. At aesthetic reveals, apply strip reinforcing mesh not less than 8 inches (200 mm) wide.
 - b. Embed strip reinforcing mesh in base coat before applying first layer of reinforcing mesh.
- 5. Foam Shapes: Fully embed reinforcing mesh in base coat.
- 6. Double Base-Coat Application: Where indicated, apply second base coat in same manner and thickness as first application except without reinforcing mesh. Do not apply until first base coat has cured.



- H. Finish-Coat Installation
1. Primer: Apply over dry base coat according to EIFS manufacturer's written instructions.
 2. Finish Coat: Apply over dry primed base coat, maintaining a wet edge at all times for uniform appearance, in thickness required by EIFS manufacturer to produce a uniform finish of color and texture matching approved sample and free of cold joints, shadow lines, and texture variations.
 - a. Texture: As selected by the Owner from manufacturer's full range.
 - b. Embed aggregate in finish coat according to EIFS manufacturer's written instructions to produce a uniform applied-aggregate finish of color and texture matching approved sample.
 3. Sealer Coat: Apply over dry finish coat, in number of coats and thickness required by EIFS manufacturer.
- I. Installation Of Prefabricated Panels
1. General: Install panels according to Shop Drawings. Install by welding metal framing to structural-steel frame **OR** by welding to steel-weld plates anchored in concrete, **as directed**, to comply with requirements in Division 05 Section "Cold-formed Metal Framing" unless otherwise indicated.
 - a. Lift panels only as indicated on Shop Drawings.
 - b. Do not warp or stress panels by forcing alignment.
 - c. Adjust connections to align panels and maintain correct and uniform joint widths.
 - d. Install bracing as panels are erected. Weld securely to panel framing and to structure.
 2. Erection Tolerances: Install panels level, plumb, and true to line with no variation in plane or alignment exceeding 1/16 inch (1.6 mm) and no variation in position exceeding 1/8 inch (3.2 mm).
 - a. Maintain clearance between panels required for installing joint sealants.
- J. Installation Of Joint Sealants
1. Prepare joints and apply sealants, of type and at locations indicated, to comply with applicable requirements in Division 07 Section "Joint Sealants" and in ASTM C 1481.
 - a. Apply joint sealants after base coat has cured but before applying finish coat.
 - b. Clean surfaces to receive sealants to comply with indicated requirements and EIFS manufacturer's written instructions.
 - c. Apply primer recommended in writing by sealant manufacturer for surfaces to be sealed.
 - d. Install sealant backing to control depth and configuration of sealant joint and to prevent sealant from adhering to back of joint.
 - e. Apply masking tape to protect areas adjacent to sealant joints. Remove tape immediately after tooling joints, without disturbing joint seal.
 - f. Recess sealant sufficiently from surface of EIFS so an additional sealant application, including cylindrical sealant backing, can be installed without protruding beyond EIFS surface.
- K. Field Quality Control
1. Special Inspections: Engage a qualified special inspector to perform the following special inspections:
 - a. According to ICC-ES AC24 **OR** ICC-ES AC219, **as directed**.
 2. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
 3. EIFS Tests and Inspections: For the following:
 - a. According to ICC-ES AC24 **OR** ICC-ES AC219, **as directed**.
 4. Prefabricated Panels: Test and inspect field welds.
 5. Remove and replace EIFS where test results indicate that EIFS do not comply with specified requirements.
 6. Prepare test and inspection reports.
- L. Cleaning And Protection



1. Remove temporary covering and protection of other work. Promptly remove coating materials from window and door frames and other surfaces outside areas indicated to receive EIFS coatings.

END OF SECTION 07 24 13 00



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**SECTION 07 24 13 00a - WATER-DRAINAGE EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)**

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for water drainage exterior insulation and finish system (EIFS). Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes water-drainage exterior insulation and finish system (EIFS) applied over water-resistant coating over sheathing, weather-resistant sheathing paper over sheathing, weather-resistant sheathing paper over exterior cement board, and exterior cement board over weather-resistant sheathing paper.

C. System Description

1. Class PB EIFS: A non-load-bearing, exterior wall cladding system that consists of an insulation board attached adhesively, mechanically, or both to the substrate; an integrally reinforced base coat; and a textured protective finish coat.
2. Water-Drainage EIFS: EIFS with a means that allows water entering into an EIFS assembly to drain to the exterior.

D. Performance Requirements

1. EIFS Performance: Comply with the following:
 - a. Bond Integrity: Free from bond failure within EIFS components or between system and supporting wall construction, resulting from exposure to fire, wind loads, weather, or other in-service conditions.
 - b. Weathertightness: Resistant to water penetration from exterior into water-drainage EIFS and assemblies behind it or through them into interior of building that results in deterioration of thermal-insulating effectiveness or other degradation of EIFS and assemblies behind it, including substrates, supporting wall construction, and interior finish, and including a means that allows water entering into an EIFS assembly to drain to the exterior.
2. Class PB EIFS: Provide EIFS having physical properties and structural performance that comply with the following:
 - a. Abrasion Resistance: Sample consisting of 1-inch- (25.4-mm-) thick EIFS mounted on 1/2-inch- (12.7-mm-) thick gypsum board; cured for a minimum of 28 days; and showing no cracking, checking, or loss of film integrity after exposure to 528 quarts (500 L) of sand when tested per ASTM D 968, Method A.
 - b. Absorption-Freeze Resistance: No visible deleterious effects and negligible weight loss after 60 cycles per EIMA 101.01.
 - c. Accelerated Weathering: Five samples per ICC-ES AC235 showing no cracking, checking, crazing, erosion, rusting, blistering, peeling, delamination, or other characteristics that might affect performance as a wall cladding after testing for 2000 hours when viewed under 5 times magnification per ASTM G 153 or ASTM G 154 **OR** ASTM G 153 or ASTM G 155, **as directed**.
 - d. Freeze-Thaw: No surface changes, cracking, checking, crazing, erosion, rusting, blistering, peeling, or delamination, or indications of delamination between components when viewed under 5 times magnification after 60 cycles per EIMA 101.01 **OR** 10 cycles per ICC-ES AC235, **as directed**.



- e. Mildew Resistance of Finish Coat: Sample applied to 2-by-2-inch (50.8-by-50.8-mm) clean glass substrate, cured for 28 days, and showing no growth when tested per ASTM D 3273 and evaluated according to ASTM D 3274.
- f. Salt-Spray Resistance: No deleterious affects when tested according to ICC-ES AC235.
- g. Tensile Adhesion: No failure in the EIFS, adhesive, base coat, or finish coat when tested per EIMA 101.03 **OR** ICC-ES AC235, **as directed**.
- h. Water Penetration: Sample consisting of 1-inch- (25.4-mm-) thick EIFS mounted on 1/2-inch- (12.7-mm-) thick gypsum board, cured for 28 days, and showing no water penetration into the plane of the base coat to expanded polystyrene board interface of the test specimen after 15 minutes at 6.24 lbf/sq. ft. (299 Pa) of air pressure difference or 20 percent of positive design wind pressure, whichever is greater, across the specimen during a test period when tested per EIMA 101.02.
- i. Water Resistance: Three samples, each consisting of 1-inch- (25.4-mm-) thick EIFS mounted on 1/2-inch- (12.7-mm-) thick gypsum board; cured for 28 days; and showing no cracking, checking, crazing, erosion, rusting, blistering, peeling, or delamination after testing for 14 days per ASTM D 2247.
- j. Impact Resistance: Sample consisting of 1-inch- (25.4-mm-) thick EIFS when constructed, conditioned, and tested per EIMA 101.86; and meeting or exceeding the following:
 - 1) Standard Impact Resistance: 25 to 49 inch-lb (2.8 to 5.6 J).
 - 2) Medium Impact Resistance: 50 to 89 inch-lb (5.7 to 10.1 J).
 - 3) High Impact Resistance: 90 to 150 inch-lb (10.2 to 17 J).
 - 4) Ultra-High Impact Resistance: More than 150 inch-lb (17 J).
- k. Drainage: According to ICC-ES AC24 **OR** ICC-ES AC235, **as directed**.
- l. Structural Performance Testing: EIFS assembly and components shall comply with ICC-ES AC235 when tested per ASTM E 330.

E. Submittals

- 1. Product Data: For each type and component of EIFS indicated.
- 2. LEED Submittal:
 - a. Product Data for Credit EQ 4.1: For adhesives and sealants used inside the weatherproofing system, including printed statement of VOC content.
- 3. Shop Drawings: For EIFS. Include plans, elevations, sections, details of components, details of penetration and termination, flashing details, joint locations and configurations, fastening and anchorage details including mechanical fasteners, and connections and attachments to other work.
- 4. Samples: For each exposed product and for each color and texture specified.
- 5. Material or product certificates.
- 6. Product test reports.
- 7. Compatibility and Adhesion Test Reports: For joint sealants from sealant manufacturer indicating the following:
 - a. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
 - b. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- 8. Field quality-control reports and special inspection reports.
- 9. Evaluation reports
- 10. Maintenance data.

F. Quality Assurance

- 1. Installer Qualifications: An installer who is certified in writing by EIFS manufacturer as qualified to install manufacturer's system using trained workers.
- 2. Source Limitations: Obtain EIFS from single source from single EIFS manufacturer and from sources approved by EIFS manufacturer as compatible with system components.



3. Fire-Test-Response Characteristics: Provide EIFS and system components with the following fire-test-response characteristics as determined by testing identical EIFS and system components per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.
 - a. Fire-Resistance Characteristics: Per ASTM E 119.
 - b. Full-Scale Multistory Fire Test: Per IBC Standard.
 - c. Full-Scale Diversified Fire Test: Per ASTM E 108 modified for testing vertical walls.
 - d. Intermediate-Scale Multistory Fire Test: Per FPA 285 **OR** IBC Standard, **as directed**.
 - e. Radiant Heat Exposure: No ignition of EIFS when tested according to NFPA 268.
 - f. Potential Heat: Acceptable level when tested according to NFPA 259.
 - g. Surface-Burning Characteristics: Provide insulation board, adhesives, base coats, and finish coats with flame-spread index of 25 or less and smoke-developed index of 450 or less, per ASTM E 84 **OR** IBC Standard, **as directed**.
4. Preinstallation Conference: Conduct conference at Project site.

G. Delivery, Storage, And Handling

1. Deliver materials in original, unopened packages with manufacturers' labels intact and clearly identifying products.
2. Store materials inside and under cover; keep them dry and protected from weather, direct sunlight, surface contamination, aging, corrosion, damaging temperatures, construction traffic, and other causes.
 - a. Stack insulation board flat and off the ground.
 - b. Protect plastic insulation against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
 - c. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

H. Project Conditions

1. Weather Limitations: Maintain ambient temperatures above 40 deg F (4.4 deg C) for a minimum of 24 hours before, during, and after adhesives or coatings are applied. Do not apply EIFS adhesives or coatings during rainfall. Proceed with installation only when existing and forecasted weather conditions and ambient outdoor air, humidity, and substrate temperatures permit EIFS to be applied, dried, and cured according to manufacturers' written instructions and warranty requirements.

1.2 PRODUCTS

A. Materials

1. Compatibility: Provide water-resistive coating, adhesive, fasteners, board insulation, reinforcing meshes, base- and finish-coat systems, sealants, and accessories that are compatible with one another and with substrates and approved for use by EIFS manufacturer for Project.
2. Exterior Cement Board: Not less than 5/16-inch- (8-mm-) **OR** 7/16-inch- (11-mm-), **as directed** thick, fiber cement board complying with ASTM C 1186, Type A, for exterior applications.
 - a. Fasteners: Wafer-head or flat-head steel drill screws complying with ASTM C 954, with an organic-polymer coating or other corrosion-protective coating having a salt-spray resistance of more than 500 hours per ASTM B 117.
 - 1) Size and Length: As recommended by sheathing manufacturer for type and thickness of sheathing board to be attached.
3. Water-Resistive Coatings: EIFS manufacturer's standard formulation and accessories for use as water/weather-resistive barriers, compatible with substrate, and complying with physical and performance criteria of ICC-ES AC209 **OR** ICC-ES AC212, **as directed**.
 - a. Sheathing Joint Tape **OR** Compound and Tape, **as directed**: Type recommended by EIFS manufacturer for sealing joints between and penetrations through sheathing.



- b. VOC Content of Coatings Used as Insulation Adhesive: 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
4. Primer/Sealer: EIFS manufacturer's standard substrate conditioner with VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), designed to seal substrates from moisture penetration and to improve the bond between substrate of type indicated and adhesive used for application of insulation.
5. Flexible-Membrane Flashing: Cold-applied, fully self-adhering, self-healing, rubberized-asphalt and polyethylene-film composite sheet or tape and primer; EIFS manufacturer's standard or product recommended in writing by EIFS manufacturer.
6. Drainage Mat: Three-dimensional, nonwoven, entangled filament, nylon or plastic **OR** Woven or fused, self-furring, PVC mesh lath, **as directed**, mat designed to drain incidental moisture by gravity; EIFS manufacturer's standard or product recommended in writing by EIFS manufacturer with manufacturer's standard corrosion-resistant mechanical fasteners suitable for intended substrate.
7. Spacers: Closed-cell polyethylene **OR** Woven or fused, self-furring, PVC mesh lath, **as directed** furring strips; EIFS manufacturer's standard or product recommended in writing by EIFS manufacturer with manufacturer's standard corrosion-resistant mechanical fasteners suitable for intended substrate.
8. Insulation Adhesive: EIFS manufacturer's standard formulation designed for indicated use; compatible with substrate; with VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24); and complying with one of the following:
 - a. Job-mixed formulation of portland cement complying with ASTM C 150, Type I, and polymer-based adhesive specified for base coat.
 - b. Factory-blended dry formulation of portland cement, dry polymer admixture, and fillers specified for base coat.
 - c. Factory-mixed noncementitious formulation designed for adhesive attachment of insulation to substrates of type indicated, as recommended by EIFS manufacturer.
9. Molded, Rigid Cellular Polystyrene Board Insulation: Comply with ASTM C 578, Type I; EIFS manufacturer's requirements; and EIMA's "EIMA Guideline Specification for Expanded Polystyrene (EPS) Insulation Board" for most stringent requirements for material performance and qualities of insulation, including dimensions and permissible variations, and the following:
 - a. Aging: Before cutting and shipping, age insulation in block form by air drying for not less than six weeks or by another method approved by EIMA that produces equivalent results.
 - b. Flame-Spread and Smoke-Developed Indexes: 25 and 450 or less, respectively, per ASTM E 84.
 - c. Dimensions: Provide insulation boards not more than 24 by 48 inches (610 by 1219 mm) and in thickness indicated but not more than 4 inches (102 mm) thick or less than thickness allowed by ASTM C 1397.
 - d. Channeled Board Insulation: EIFS manufacturer's standard factory-fabricated profile with linear, vertical drainage channels, slots, or waves on the back side of board.
 - e. Board Insulation Closure Blocks: EIFS manufacturer's standard density, size, and configuration.
 - f. Foam Shapes: Provide with profiles and dimensions indicated on Drawings.
10. Reinforcing Mesh: Balanced, alkali-resistant, open-weave, glass-fiber mesh treated for compatibility with other EIFS materials, made from continuous multiend strands with retained mesh tensile strength of not less than 120 lbf/in. (21 dN/cm) per ASTM E 2098 **OR** EIMA 105.01, **as directed**; complying with ASTM D 578 and the following:
 - a. Standard-Impact Reinforcing Mesh: Not less than 4.0 oz./sq. yd. (136 g/sq. m).
 - b. Intermediate-Impact Reinforcing Mesh: Not less than 10 oz./sq. yd. (339 g/sq. m) **OR** 12.0 oz./sq. yd. (407 g/sq. m), **as directed**.
 - c. High-Impact Reinforcing Mesh: Not less than 15 oz./sq. yd. (509 g/sq. m).
 - d. Heavy-Duty Reinforcing Mesh: Not less than 20 oz./sq. yd. (678 g/sq. m).
 - e. Strip Reinforcing Mesh: Not less than 3.75 oz./sq. yd. (127 g/sq. m).
 - f. Detail Reinforcing Mesh: Not less than 4.0 oz./sq. yd. (136 g/sq. m).



- g. Corner Reinforcing Mesh: Not less than 7.2 oz./sq. yd. (244 g/sq. m).
11. Base-Coat Materials: EIFS manufacturer's standard mixture complying with one of the following requirements:
- Job-mixed formulation of portland cement complying with ASTM C 150, Type I, white or natural color; and manufacturer's standard polymer-emulsion adhesive designed for use with portland cement.
 - Job-combined formulation of manufacturer's standard polymer-emulsion adhesive and manufacturer's standard dry mix containing portland cement.
 - Factory-blended dry formulation of portland cement, dry polymer admixture, and inert fillers to which only water is added at Project site.
 - Factory-mixed noncementitious formulation of polymer-emulsion adhesive and inert fillers that is ready to use without adding other materials.
12. Waterproof Adhesive/Base-Coat Materials: EIFS manufacturer's standard waterproof formulation with VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), complying with one of the following:
- Job-mixed formulation of portland cement complying with ASTM C 150, Type I, white or natural color; and manufacturer's standard polymer-emulsion adhesive designed for use with portland cement.
 - Job-combined formulation of manufacturer's standard polymer-emulsion adhesive and manufacturer's standard dry mix containing portland cement.
13. Primer: EIFS manufacturer's standard factory-mixed, elastomeric-polymer primer for preparing base-coat surface for application of finish coat.
14. Finish-Coat Materials: EIFS manufacturer's standard acrylic-based coating **OR** standard acrylic-based coating with enhanced mildew resistance **OR** siliconized acrylic-based coating, **as directed**, complying with the following:
- Factory-mixed formulation of polymer-emulsion binder, colorfast mineral pigments, sound stone particles, and fillers.
 - Factory-mixed formulation of polymer-emulsion binder, colorfast mineral pigments, and fillers used with stone particles for embedding in finish coat to produce an applied-aggregate finish.
 - Aggregate: Marble chips of size and as selected by the Owner from manufacturer's full range.
 - Sealer: Manufacturer's waterproof, clear acrylic-based sealer for protecting finish coat.
 - Colors: As selected by the Owner from manufacturer's full range.
15. Water: Potable.
16. Mechanical Fasteners: EIFS manufacturer's standard corrosion-resistant fasteners consisting of thermal cap, standard washer and shaft attachments, and fastener indicated below; selected for properties of pullout, tensile, and shear strength required to resist design loads of application indicated; capable of pulling fastener head below surface of insulation board; and of the following description:
- For attachment to steel studs from 0.033 to 0.112 inch (0.84 to 2.84 mm) in thickness, provide steel drill screws complying with ASTM C 954.
 - For attachment to light-gage steel framing members not less than 0.0179 inch (0.45 mm) in thickness, provide steel drill screws complying with ASTM C 1002.
 - For attachment to wood framing members and plywood sheathing, provide steel drill screws complying with ASTM C 1002, Type W.
 - For attachment to masonry and concrete substrates, provide sheathing dowel in form of a plastic wing-tipped fastener with thermal cap, sized to fit insulation thickness indicated and to penetrate substrate to depth required to secure anchorage.
 - For attachment, provide manufacturer's standard fasteners suitable for substrate.
17. Trim Accessories: Type as designated or required to suit conditions indicated and to comply with EIFS manufacturer's written instructions; manufactured from UV-stabilized PVC; and complying with ASTM D 1784, manufacturer's standard Cell Class for use intended, and ASTM C 1063.



- a. Casing Bead: Prefabricated, one-piece type for attachment behind insulation, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg.
- b. Drip Screed/Track: Prefabricated, one-piece type for attachment behind insulation with face leg extended to form a drip, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg.
- c. Weep Screed/Track: Prefabricated, one-piece type for attachment behind insulation with perforated face leg extended to form a drip and weep holes in track bottom, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg; designed to drain incidental moisture that gets into wall construction to the exterior at terminations of EIFS with drainage.
- d. Expansion Joint: Prefabricated, one-piece V profile; designed to relieve stress of movement.
- e. Window Sill Flashing: Prefabricated type for both flashing and sloping sill over framing beneath windows; with end and back dams; designed to direct water to exterior.
- f. Parapet Cap Flashing: Type for both flashing and covering parapet top with design complying with ASTM C 1397.

B. Elastomeric Sealants

1. Elastomeric Sealant Products: Provide EIFS manufacturer's listed and recommended chemically curing, elastomeric sealant that is compatible with joint fillers, joint substrates, and other related materials, and complies with requirements for products and testing indicated in ASTM C 1481 and with requirements in Division 07 Section "Joint Sealants" for products corresponding to description indicated below:
 - a. Multicomponent, nonsag urethane sealant.
 - b. Single-component, nonsag, neutral-curing silicone sealant.
 - c. Provide sealants, for use inside the weatherproofing system, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Preformed Foam Sealant Products: Provide sealant compatible with adjacent materials and complying with requirements in Division 07 Section "Joint Sealants".
3. Sealant Color: As selected by the Owner from manufacturer's full range.

C. Mixing

1. General: Comply with EIFS manufacturer's requirements for combining and mixing materials. Do not introduce admixtures, water, or other materials except as recommended by EIFS manufacturer. Mix materials in clean containers. Use materials within time period specified by EIFS manufacturer or discard.

1.3 EXECUTION

A. Preparation

1. Protect contiguous work from moisture deterioration and soiling caused by application of EIFS. Provide temporary covering and other protection needed to prevent spattering of exterior finish coats on other work.
2. Protect EIFS, substrates, and wall construction behind them from inclement weather during installation. Prevent penetration of moisture behind drainage plane of EIFS and deterioration of substrates.
3. Prepare and clean substrates to comply with EIFS manufacturer's written instructions to obtain optimum bond between substrate and adhesive for insulation.

B. Exterior Cement-Board Installation

1. Exterior Cement Board: Install on metal framing to comply with cement-board manufacturer's written instructions and evaluation report acceptable to authorities having jurisdiction. Install



board with steel drill screws spaced no more than 8 inches (203 mm) o.c. along framing with perimeter fasteners at least 3/8 inch (9.6 mm) but less than 5/8 inch (15.9 mm) from edges of boards.

C. EIFS Installation, General

1. Comply with EIFS manufacturer's written instructions for installation of EIFS as applicable to each type of substrate indicated.

D. Substrate Protection Application

1. Primer/Sealer: Apply over gypsum sheathing substrates to protect substrates from degradation and where required by EIFS manufacturer for improving adhesion of insulation to substrate.
2. Water-Resistive Coatings: Apply over substrates to protect substrates from degradation and to provide water-/weather-resistive barrier.
 - a. Tape and seal joints, exposed edges, terminations, and inside and outside corners of sheathing unless otherwise indicated by EIFS manufacturer's written instructions.
3. Waterproof Adhesive/Base Coat: Apply over sloped surfaces **OR** window sills **OR** parapets **OR** where indicated on Drawings, **as directed**, to protect substrates from degradation.
4. Flexible-Membrane Flashing: Install over weather-resistive barrier, applied and lapped to shed water; seal at openings, penetrations, terminations, and where indicated by EIFS manufacturer's written instructions to protect wall assembly from degradation. Prime substrates, if required, and install flashing to comply with EIFS manufacturer's written instructions and details.

E. Trim Installation

1. Trim: Apply trim accessories at perimeter of EIFS, at expansion joints, at window sills, and elsewhere as indicated, according to EIFS manufacturer's written instructions. Coordinate with installation of insulation.
 - a. Weep Screed/Track: Use at bottom termination edges, at window and door heads, and at floor line expansion joints of water-drainage EIFS unless otherwise indicated.
 - b. Window Sill Flashing: Use at windows unless otherwise indicated.
 - c. Expansion Joint: Use where indicated on Drawings.
 - d. Casing Bead: Use at other locations.
 - e. Parapet Cap Flashing: Use where indicated on Drawings.

F. Drainage Mat Installation

1. Drainage Mat: Apply wrinkle free, continuously, with edges butted **OR** overlapped, **as directed**, and adhesively secured **OR** mechanically secured with fasteners, **as directed**, over water-/weather-resistive barrier according to manufacturer's written instructions.

G. Insulation Installation

1. Board Insulation: Adhesively **OR** Mechanically **OR** Adhesively and mechanically, **as directed**, attach insulation to substrate in compliance with ASTM C 1397, EIFS manufacturer's written instructions, and the following:
 - a. Apply adhesive to insulation by notched-trowel method in a manner that results in coating the entire surface of sheathing with adhesive once insulation is adhered to sheathing unless EIFS manufacturer's written instructions specify using primer/sealer with ribbon-and-dab method. Apply adhesive to a thickness of not less than 1/4 inch (6.4 mm) for factory mixed and not less than 3/8 inch (9.6 mm) for field mixed, measured from surface of insulation before placement.
 - b. Apply adhesive to insulation by notched-trowel method in a manner that results in coating the entire surface of drainage mat with adhesive once insulation is adhered to drainage mat.
 - c. Apply adhesive to ridges on back of insulation by notched-trowel method in a manner that results in full adhesive contact over the entire surface of ridges, leaving channels free of adhesive once insulation is adhered to substrate.



- d. Press and slide insulation into place. Apply pressure over the entire surface of insulation to accomplish uniform contact, high initial grab, and overall level surface.
- e. Allow adhered insulation to remain undisturbed for period recommended by EIFS manufacturer, but not less than 24 hours, before installing mechanical fasteners, beginning rasping and sanding insulation, or applying base coat and reinforcing mesh.
- f. Mechanically attach insulation to substrate by method complying with EIFS manufacturer's written instructions. Install top surface of fastener heads flush with plane of insulation. Install fasteners into or through substrates with the following minimum penetration:
 - 1) Steel Framing: 5/16 inch (8 mm).
 - 2) Wood Framing: 1 inch (25 mm).
 - 3) Concrete and Masonry: 1 inch (25 mm).
- g. Apply insulation over drainage mat and dry substrates in courses with long edges of boards oriented horizontally.
- h. Begin first course of insulation from a level base line and work upward.
- i. Begin first course of insulation from screed/track and work upward. Work from perimeter casing beads toward interior of panels if possible.
- j. Stagger vertical joints of insulation boards in successive courses to produce running bond pattern. Locate joints so no piece of insulation is less than 12 inches (300 mm) wide or 6 inches (150 mm) high. Offset joints not less than 6 inches (150 mm) from corners of window and door openings and not less than 4 inches (100 mm) from aesthetic reveals.
 - 1) Adhesive Attachment: Offset joints of insulation not less than 6 inches (150 mm) from horizontal and 4 inches (100 mm) from vertical joints in sheathing.
 - 2) Mechanical Attachment: Offset joints of insulation from horizontal joints in sheathing.
- k. Place insulation with adhesive strips and channels, slots, or waves aligned in the vertical position for drainage. Align drainage channels, slots, or waves with channels, slots, or waves in insulation boards above and below.
- l. Interlock ends at internal and external corners.
- m. Abut insulation tightly at joints within and between each course to produce flush, continuously even surfaces without gaps or raised edges between boards. If gaps greater than 1/16 inch (1.6 mm) occur, fill with insulation cut to fit gaps exactly; insert insulation without using adhesive or other material.
- n. Cut insulation to fit openings, corners, and projections precisely and to produce edges and shapes complying with details indicated.
- o. Rasp or sand flush entire surface of insulation to remove irregularities projecting more than 1/32 inch (0.8 mm) **OR** 1/16 inch (1.6 mm), **as directed**, from surface of insulation and to remove yellowed areas due to sun exposure; do not create depressions deeper than 1/16 inch (1.6 mm).
- p. Cut aesthetic reveals in outside face of insulation with high-speed router and bit configured to produce grooves, rabbets, and other features that comply with profiles and locations indicated. Do not reduce insulation thickness at aesthetic reveals to less than 3/4 inch (19 mm).
- q. Install foam shapes and attach to sheathing **OR** structure, **as directed**.
- r. Interrupt insulation for expansion joints where indicated.
- s. Install insulation closure blocks using ribbon-and-dab method to create air zones where indicated.
- t. Form joints for sealant application by leaving gaps between adjoining insulation edges and between insulation edges and dissimilar adjoining surfaces. Make gaps wide enough to produce joint widths indicated after encapsulating joint substrates with base coat and reinforcing mesh.
- u. Form joints for sealant application with back-to-back casing beads for joints within EIFS and with perimeter casing beads at dissimilar adjoining surfaces. Make gaps between casing beads and between perimeter casing beads and adjoining surfaces of width indicated.



- v. After installing insulation and before applying field-applied reinforcing mesh, fully wrap board edges. Cover edges of board and extend encapsulating mesh not less than 2-1/2 inches (64 mm) over front and back face unless otherwise indicated on Drawings.
 - w. Treat exposed edges of insulation as follows:
 - 1) Except for edges forming substrates of sealant joints, encapsulate with base coat, reinforcing mesh, and finish coat.
 - 2) Encapsulate edges forming substrates of sealant joints within EIFS or between EIFS and other work with base coat and reinforcing mesh.
 - 3) At edges trimmed by accessories, extend base coat, reinforcing mesh, and finish coat over face leg of accessories.
 - x. Coordinate installation of flashing and insulation to produce wall assembly that does not allow water to penetrate behind flashing and water-/weather-resistive barrier.
2. Expansion Joints: Install at locations indicated, where required by EIFS manufacturer, and as follows:
- a. At expansion joints in substrates behind EIFS.
 - b. Where EIFS adjoin dissimilar substrates, materials, and construction, including other EIFS.
 - c. At floor lines in multilevel wood-framed construction.
 - d. Where wall height or building shape changes.
 - e. Where EIFS manufacturer requires joints in long continuous elevations.

H. Base-Coat Installation

- 1. Base Coat: Apply to exposed surfaces of insulation and foam shapes in minimum thickness recommended in writing by EIFS manufacturer, but not less than 1/16-inch (1.6-mm) dry-coat thickness.
- 2. Reinforcing Mesh: Embed type indicated below in wet base coat to produce wrinkle-free installation with mesh continuous at corners and overlapped not less than 2-1/2 inches (64 mm) or otherwise treated at joints to comply with ASTM C 1397 and EIFS manufacturer's written instructions. Do not lap reinforcing mesh within 8 inches (204 mm) of corners. Completely embed mesh, applying additional base-coat material if necessary, so reinforcing-mesh color and pattern are not visible.
 - a. Standard-impact reinforcing mesh unless otherwise indicated.
 - b. Intermediate-impact reinforcing mesh where indicated.
 - c. High-impact reinforcing mesh where indicated.
 - d. Heavy-duty reinforcing mesh where indicated.
- 3. Double-Layer Reinforcing Mesh Application: Where indicated, apply second base coat and second layer of standard-impact **OR** intermediate-impact, **as directed**, reinforcing mesh, overlapped not less than 2-1/2 inches (64 mm) or otherwise treated at joints to comply with ASTM C 1397 and EIFS manufacturer's written instructions in same manner as first application. Do not apply until first base coat has cured.
- 4. Additional Reinforcing Mesh: Apply strip reinforcing mesh around openings extending 4 inches (100 mm) beyond perimeter. Apply additional 9-by-12-inch (230-by-300-mm) strip reinforcing mesh diagonally at corners of openings (re-entrant corners). Apply 8-inch- (200-mm-) wide strip reinforcing mesh at both inside and outside corners unless base layer of mesh is lapped not less than 4 inches (100 mm) on each side of corners.
 - a. At aesthetic reveals, apply strip reinforcing mesh not less than 8 inches (200 mm) wide.
 - b. Embed strip reinforcing mesh in base coat before applying first layer of reinforcing mesh.
- 5. Foam Shapes: Fully embed reinforcing mesh in base coat.
- 6. Double Base-Coat Application: Where indicated, apply second base coat in same manner and thickness as first application except without reinforcing mesh. Do not apply until first base coat has cured.

I. Finish-Coat Installation

- 1. Primer: Apply over dry base coat according to EIFS manufacturer's written instructions.



2. Finish Coat: Apply over dry primed base coat, maintaining a wet edge at all times for uniform appearance, in thickness required by EIFS manufacturer to produce a uniform finish of color and texture matching approved sample and free of cold joints, shadow lines, and texture variations.
 - a. Texture: As selected by the Owner from manufacturer's full range.
 - b. Embed aggregate in finish coat according to EIFS manufacturer's written instructions to produce a uniform applied-aggregate finish of color and texture matching approved sample.
3. Sealer Coat: Apply over dry finish coat, in number of coats and thickness required by EIFS manufacturer.

J. Installation Of Joint Sealants

1. Prepare joints and apply sealants, of type and at locations indicated, to comply with applicable requirements in Division 07 Section "Joint Sealants" and in ASTM C 1481.
 - a. Apply joint sealants after base coat has cured but before applying finish coat.
 - b. Clean surfaces to receive sealants to comply with indicated requirements and EIFS manufacturer's written instructions.
 - c. Apply primer recommended in writing by sealant manufacturer for surfaces to be sealed.
 - d. Install sealant backing to control depth and configuration of sealant joint and to prevent sealant from adhering to back of joint.
 - e. Apply masking tape to protect areas adjacent to sealant joints. Remove tape immediately after tooling joints, without disturbing joint seal.
 - f. Recess sealant sufficiently from surface of EIFS so an additional sealant application, including cylindrical sealant backing, can be installed without protruding beyond EIFS surface.

K. Field Quality Control

1. Special Inspections: Engage a qualified special inspector to perform the following special inspections:
 - a. According to ICC-ES AC24 **OR** ICC-ES AC235, **as directed**.
2. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
3. EIFS Tests and Inspections: For the following:
 - a. According to ICC-ES AC24 **OR** ICC-ES AC235, **as directed**.
4. Remove and replace EIFS where test results indicate that EIFS do not comply with specified requirements.
5. Prepare test and inspection reports.

L. Cleaning And Protection

1. Remove temporary covering and protection of other work. Promptly remove coating materials from window and door frames and other surfaces outside areas indicated to receive EIFS coatings.

END OF SECTION 07 24 13 00a



Task	Specification	Specification Description
07 26 13 00	06 10 00 00	Rough Carpentry



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SECTION 07 31 13 00 - ASPHALT SHINGLES

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for asphalt shingles. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Asphalt shingles.
 - b. Underlayment.

C. Definition

1. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

D. Submittals

1. Product Data: For each type of product indicated.
2. Samples: For each exposed product and for each color and blend specified.
3. Product test reports.
4. Research/evaluation reports.
5. Maintenance data.
6. Warranties: Sample of special warranties.

E. Quality Assurance

1. Fire-Resistance Characteristics: Where indicated, provide asphalt shingles and related roofing materials identical to those of assemblies tested for fire resistance per test method below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.
 - a. Exterior Fire-Test Exposure: Class A **OR** Class C, **as directed**; ASTM E 108 or UL 790, for application and roof slopes indicated.
2. Preinstallation Conference: Conduct conference at Project site.

F. Delivery, Storage, And Handling

1. Store roofing materials in a dry, well-ventilated, weathertight location according to asphalt shingle manufacturer's written instructions. Store underlayment rolls on end on pallets or other raised surfaces. Do not double stack rolls.
 - a. Handle, store, and place roofing materials in a manner to avoid significant or permanent damage to roof deck or structural supporting members.
2. Protect unused underlayment from weather, sunlight, and moisture when left overnight or when roofing work is not in progress.

G. Warranty

1. Special Warranty: Standard form in which manufacturer agrees to repair or replace asphalt shingles that fail in materials or workmanship within specified warranty period.
 - a. Material Warranty Period: 25 **OR** 30 **OR** 35 **OR** 40, **as directed**, years from date of Final Completion, prorated, with first three **OR** five **OR** 12, **as directed**, years nonprorated.
 - b. Wind-Speed Warranty Period: Asphalt shingles will resist blow-off or damage caused by wind speeds up to 60 mph (27 m/s) **OR** 75 mph (33 m/s) **OR** 80 mph (36 m/s) **OR** 100 mph (45 m/s), **as directed**, for five **OR** 10, **as directed**, years from date of Final Completion.



- c. Algae-Discoloration Warranty Period: Asphalt shingles will not discolor five **OR** 10, **as directed**, years from date of Final Completion.
- d. Workmanship Warranty Period: 10 **OR** 12, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Glass-Fiber-Reinforced Asphalt Shingles

1. Laminated-Strip Asphalt Shingles: ASTM D 3462, laminated, multi-ply overlay construction, glass-fiber reinforced, mineral-granule surfaced, and self-sealing.
 - a. Butt Edge: Straight **OR** Notched **OR** Crenelated, **as directed**, cut.
 - b. Strip Size: Manufacturer's standard.
 - c. Algae Resistance: Granules treated to resist algae discoloration.
 - d. Color and Blends: As selected by the Owner from manufacturer's full range.
2. Laminated-Strip, SBS-Modified Asphalt Shingles: ASTM D 3462, laminated, multi-ply overlay construction, glass-fiber reinforced, mineral-granule surfaced, and self-sealing; complying with UL 2218, Class IV.
 - a. Butt Edge: Straight **OR** Notched **OR** Crenelated, **as directed**, cut.
 - b. Strip Size: Manufacturer's standard.
 - c. Algae Resistance: Granules treated to resist algae discoloration.
 - d. Color and Blends: As selected by the Owner from manufacturer's full range.
3. Multitab-Strip Asphalt Shingles: ASTM D 3462, glass-fiber reinforced, mineral-granule surfaced, and self-sealing.
 - a. Tab Arrangement: Three tabs, regularly spaced **OR** Four tabs, regularly spaced **OR** Five tabs, randomly spaced, **as directed**.
 - b. Cutout Shape: Square **OR** Tapered, **as directed**.
 - c. Butt Edge: Straight **OR** Stagger, **as directed**, cut.
 - d. Strip Size: Manufacturer's standard.
 - e. Algae Resistance: Granules treated to resist algae discoloration.
 - f. Color and Blends: As selected by the Owner from manufacturer's full range.
4. Three-Tab-Strip, SBS-Modified Asphalt Shingles: ASTM D 3462, glass-fiber reinforced, mineral-granule surfaced, and self-sealing; complying with UL 2218, Class IV.
 - a. Strip Size: Manufacturer's standard.
 - b. Algae Resistance: Granules treated to resist algae discoloration.
 - c. Color and Blends: As selected by the Owner from manufacturer's full range.
5. No-Cutout-Strip Asphalt Shingles: ASTM D 3462, glass-fiber reinforced, mineral-granule surfaced, self-sealing, square, and single tab.
 - a. Butt Edge: Stagger **OR** Straight, **as directed**, cut.
 - b. Strip Size: Manufacturer's standard.
 - c. Algae Resistance: Granules treated to resist algae discoloration.
 - d. Color and Blends: As selected by the Owner from manufacturer's full range.
6. Hip and Ridge Shingles: Manufacturer's standard units to match asphalt shingles **OR** Site-fabricated units cut from asphalt shingle strips. Trim each side of lapped portion of unit to taper approximately 1 inch (25 mm), **as directed**.

B. Organic-Felt-Reinforced Asphalt Shingles

1. Laminated-Strip Asphalt Shingles: ASTM D 225, laminated, multi-ply overlay construction, organic-felt reinforced, mineral-granule surfaced, and self-sealing; complying with requirements in ASTM D 3161 for wind resistance.
 - a. Butt Edge: Straight **OR** Notched **OR** Crenelated, **as directed**, cut.
 - b. Strip Size: Manufacturer's standard.
 - c. Algae Resistance: Granules treated to resist algae discoloration.
 - d. Color and Blends: As selected by the Owner from manufacturer's full range.



2. Multitab-Strip Asphalt Shingles: ASTM D 225, organic-felt reinforced, mineral-granule surfaced, and self-sealing; complying with requirements in ASTM D 3161 for wind resistance.
 - a. Tab Arrangement: Three tabs, regularly spaced **OR** Four tabs, regularly spaced **OR** Six tabs, regularly spaced, scalloped edge, **as directed**.
 - b. Strip Size: Manufacturer's standard.
 - c. Algae Resistance: Granules treated to resist algae discoloration.
 - d. Color and Blends: As selected by the Owner from manufacturer's full range.
 3. No-Cutout-Strip Asphalt Shingles: ASTM D 225, organic-felt reinforced, mineral-granule surfaced, self-sealing, square, and single tab; complying with requirements in ASTM D 3161 for wind resistance.
 - a. Butt Edge: Stagger **OR** Straight, **as directed**, cut.
 - b. Strip Size: Manufacturer's standard.
 - c. Color and Blends: As selected by the Owner from manufacturer's full range.
 4. Hip and Ridge Shingles: Manufacturer's standard units to match asphalt shingles **OR** Site-fabricated units cut from asphalt shingle strips. Trim each side of lapped portion of unit to taper approximately 1 inch (25 mm), **as directed**.
- C. Underlayment Materials
1. Felt: ASTM D 226 **OR** ASTM D 4869, **as directed**, Type I **OR** Type II, **as directed**, asphalt-saturated organic felts, nonperforated.
 2. Self-Adhering Sheet Underlayment, Granular Surfaced: ASTM D 1970, minimum of 55-mil- (1.4-mm-) thick sheet; glass-fiber-mat-reinforced, SBS-modified asphalt; mineral-granule surfaced; with release paper backing; cold applied. Provide primer for adjoining concrete or masonry surfaces to receive underlayment.
 3. Self-Adhering Sheet Underlayment, Polyethylene Faced: ASTM D 1970, minimum of 40-mil- (1.0-mm-) thick, slip-resisting, polyethylene-film-reinforced top surface laminated to SBS-modified asphalt adhesive, with release paper backing; cold applied. Provide primer for adjoining concrete or masonry surfaces to receive underlayment.
 4. Self-Adhering Sheet Underlayment, High Temperature: Minimum of 30- to 40-mil- (0.76- to 1.0-mm-) thick, slip-resisting, polyethylene-film-reinforced top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release paper backing; cold applied. Provide primer for adjoining concrete or masonry surfaces to receive underlayment.
 - a. Thermal Stability: Stable after testing at 240 deg F (116 deg C); ASTM D 1970.
 - b. Low-Temperature Flexibility: Passes after testing at minus 20 deg F (29 deg C); ASTM D 1970.
 5. Granular-Surfaced Valley Lining: ASTM D 6380, Class M, organic-felt-based **OR** ASTM D 3909, mineral-granular-surfaced, glass-felt-based, **as directed**, asphalt roll roofing; 36 inches (914 mm) wide.
- D. Ridge Vents
1. Rigid Ridge Vent: Manufacturer's standard, rigid section high-density polypropylene or other UV-stabilized plastic ridge vent with nonwoven geotextile filter strips and external deflector baffles; for use under ridge shingles.
 2. Flexible Ridge Vent: Manufacturer's standard, compression-resisting, three-dimensional, open-nylon or polyester-mat filter bonded to a nonwoven, nonwicking, geotextile fabric cover.
- E. Accessories
1. Asphalt Roofing Cement: ASTM D 4586, Type II, asbestos free.
 2. Roofing Nails: ASTM F 1667; aluminum, stainless-steel, copper, or hot-dip galvanized-steel wire shingle nails, minimum 0.120-inch- (3-mm-) diameter, barbed **OR** smooth, **as directed**, shank, sharp-pointed, with a minimum 3/8-inch- (9.5-mm-) diameter flat head and of sufficient length to penetrate 3/4 inch (19 mm) into solid wood decking or extend at least 1/8 inch (3 mm) through OSB or plywood sheathing.
 - a. Where nails are in contact with metal flashing, use nails made from same metal as flashing.



3. Felt Underlayment Nails: Aluminum, stainless-steel, or hot-dip galvanized-steel wire with low-profile capped heads or disc caps, 1-inch (25-mm) minimum diameter.

F. Metal Flashing And Trim

1. General: Comply with requirements in Division 07 Section "Sheet Metal Flashing And Trim".
 - a. Sheet Metal: Copper **OR** Stainless steel **OR** Zinc-tin alloy-coated stainless steel **OR** Zinc-tin alloy-coated steel **OR** Zinc-tin alloy-coated copper **OR** Anodized aluminum **OR** Aluminum, mill finished, **as directed**.
2. Fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of the item.
 - a. Apron Flashings: Fabricate with lower flange a minimum of 4 inches (100 mm) **OR** 5 inches (125 mm), **as directed**, over and 4 inches (100 mm) beyond each side of downslope asphalt shingles and 6 inches (150 mm) up the vertical surface.
 - b. Step Flashings: Fabricate with a headlap of 2 inches (50 mm) and a minimum extension of 4 inches (100 mm) **OR** 5 inches (125 mm), **as directed**, over the underlying asphalt shingle and up the vertical surface.
 - c. Cricket **OR** Backer, **as directed**, Flashings: Fabricate with concealed flange extending a minimum of 18 inches (450 mm) **OR** 24 inches (600 mm), **as directed**, beneath upslope asphalt shingles and 6 inches (150 mm) beyond each side of chimney **OR** skylight, **as directed**, and 6 inches (150 mm) above the roof plane.
 - d. Open-Valley Flashings: Fabricate in lengths not exceeding 10 feet (3 m) with 1-inch- (25-mm-) high, inverted-V profile at center of valley and equal flange widths of 10 inches (250 mm) **OR** 12 inches (300 mm), **as directed**.
 - e. Drip Edges: Fabricate in lengths not exceeding 10 feet (3 m) with 2-inch (50-mm) roof-deck flange and 1-1/2-inch (38-mm) fascia flange with 3/8-inch (9.6-mm) drip at lower edge.
3. Vent Pipe Flashings: ASTM B 749, Type L51121, at least 1/16 inch (1.6 mm) thick. Provide lead sleeve sized to slip over and turn down into pipe, soldered to skirt at slope of roof, and extending at least 4 inches (100 mm) from pipe onto roof.

1.3 EXECUTION

A. Underlayment Installation

1. General: Comply with underlayment manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
2. Single-Layer Felt Underlayment: Install on roof deck parallel with and starting at the eaves. Lap sides a minimum of 2 inches (50 mm) over underlying course. Lap ends a minimum of 4 inches (100 mm). Stagger end laps between succeeding courses at least 72 inches (1830 mm). Fasten with felt underlayment **OR** roofing, **as directed**, nails.
 - a. Install felt underlayment on roof deck not covered by self-adhering sheet underlayment. Lap sides of felt over self-adhering sheet underlayment not less than 3 inches (75 mm) in direction to shed water. Lap ends of felt not less than 6 inches (150 mm) over self-adhering sheet underlayment.
 - b. Install fasteners at no more than 36 inch (900 mm) o.c. where the basic wind speed is equal to or greater than 110 mph (176 km/h).
3. Double-Layer Felt Underlayment: Install on roof deck parallel with and starting at the eaves. Install a 19-inch- (485-mm-) wide starter course at eaves and completely cover with full-width second course. Install succeeding courses lapping previous courses 19 inches (485 mm) in shingle fashion. Lap ends a minimum of 6 inches (150 mm). Stagger end laps between succeeding courses at least 72 inches (1830 mm). Fasten with felt underlayment **OR** roofing, **as directed**, nails.



- a. Apply a continuous layer of asphalt roofing cement over starter course and on felt underlayment surface to be concealed by succeeding courses as each felt course is installed. Apply over entire roof **OR** at locations indicated on Drawings, **as directed**.
 - b. Install felt underlayment on roof sheathing not covered by self-adhering sheet underlayment. Lap edges over self-adhering sheet underlayment not less than 3 inches (75 mm) in direction to shed water.
 - c. Terminate felt underlayment flush **OR** extended up not less than 4 inches (100 mm), **as directed**, against sidewalls, curbs, chimneys, and other roof projections.
 - d. Install fasteners at no more than 36 inch (900 mm) o.c. where the basic wind speed is equal to or greater than 110 mph (176 km/h).
4. Self-Adhering Sheet Underlayment: Install, wrinkle free, on roof deck. Comply with low-temperature installation restrictions of underlayment manufacturer if applicable. Install at locations indicated below **OR** on Drawings, **as directed**, lapped in direction to shed water. Lap sides not less than 3-1/2 inches (89 mm). Lap ends not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Roll laps with roller. Cover underlayment within seven days.
- a. Prime concrete and masonry surfaces to receive self-adhering sheet underlayment.
 - b. Eaves: Extend from edges of eaves 24 inches (600 mm) **OR** 36 inches (914 mm), **as directed**, beyond interior face of exterior wall.
 - c. Rakes: Extend from edges of rake 24 inches (600 mm) **OR** 36 inches (914 mm), **as directed**, beyond interior face of exterior wall.
 - d. Valleys: Extend from lowest to highest point 18 inches (450 mm) on each side.
 - e. Hips: Extend 18 inches (450 mm) on each side.
 - f. Ridges: Extend 36 inches (914 mm) on each side without obstructing continuous ridge vent slot.
 - g. Sidewalls: Extend beyond sidewall 18 inches (450 mm), and return vertically against sidewall not less than 4 inches (100 mm).
 - h. Dormers, Chimneys, Skylights, and Other Roof-Penetrating Elements: Extend beyond penetrating element 18 inches (450 mm), and return vertically against penetrating element not less than 4 inches (100 mm).
 - i. Roof Slope Transitions: Extend 18 inches (450 mm) on each roof slope.
5. Concealed, Woven **OR** Closed-Cut, **as directed**, Valley Lining: Comply with NRCA's recommendations. Install a 36-inch- (914-mm-) wide felt underlayment centered in valley. Fasten to roof deck with felt underlayment **OR** roofing, **as directed**, nails.
- a. Lap roof-deck felt underlayment over valley felt underlayment at least 6 inches (150 mm).
 - b. Install a 36-inch- (914-mm-) wide strip of granular-surfaced valley lining centered in valley, with granular-surface face up. Lap ends of strips at least 12 inches (300 mm) in direction to shed water, and seal with asphalt roofing cement. Fasten to roof deck with roofing nails.
6. Metal-Flushed, Open-Valley Underlayment: Install two layers of 36-inch- (914-mm-) wide felt underlayment centered in valley. Stagger end laps between layers at least 72 inches (1830 mm). Lap ends of each layer at least 12 inches (300 mm) in direction to shed water, and seal with asphalt roofing cement. Fasten each layer to roof deck with felt underlayment **OR** roofing, **as directed**, nails.
- a. Lap roof-deck felt underlayment over first layer of valley felt underlayment at least 6 inches (150 mm).
7. Granular-Surfaced, Open-Valley Lining: Comply with NRCA's recommendations. Install a 36-inch- (914-mm-) wide felt underlayment centered in valley. Fasten to roof deck with felt underlayment **OR** roofing, **as directed**, nails.
- a. Lap roof-deck felt underlayment over valley felt underlayment at least 6 inches (150 mm).
 - b. Install an 18-inch- (450-mm-) wide strip of valley lining centered in valley, with granular-surface face down. Install a second 36-inch- (914-mm-) wide strip of valley lining centered in valley, with granular-surface face up. Lap ends of each strip at least 12 inches (300 mm) in direction to shed water, and seal with asphalt roofing cement. Stagger end laps between succeeding strips at least 72 inches (1830 mm). Fasten each strip to roof deck with roofing nails.



B. Metal Flashing Installation

1. General: Install metal flashings and other sheet metal to comply with requirements in Division 07 Section "Sheet Metal Flashing And Trim".
 - a. Install metal flashings according to recommendations in ARMA's "Residential Asphalt Roofing Manual" and asphalt shingle recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."
2. Apron Flashings: Extend lower flange over and beyond each side of downslope asphalt shingles and up the vertical surface.
3. Step Flashings: Install with a headlap of 2 inches (50 mm) and extend over the underlying asphalt shingle and up the vertical surface. Fasten to roof deck only.
4. Cricket **OR** Backer, **as directed**, Flashings: Install against the roof-penetrating element extending concealed flange beneath upslope asphalt shingles and beyond each side.
5. Open-Valley Flashings: Install centered in valleys, lapping ends at least 8 inches (200 mm) in direction to shed water. Fasten upper end of each length to roof deck beneath overlap.
 - a. Secure hemmed flange edges into metal cleats spaced 12 inches (300 mm) apart and fastened to roof deck.
 - b. Adhere 9-inch- (225-mm-) wide strip of self-adhering sheet to metal flanges and to self-adhering sheet underlayment.
6. Rake Drip Edges: Install rake drip edge flashings over underlayment and fasten to roof deck.
7. Eave Drip Edges: Install eave drip edge flashings below underlayment and fasten to roof sheathing.
8. Pipe Flashings: Form flashing around pipe penetrations and asphalt shingles. Fasten and seal to asphalt shingles as recommended by manufacturer.

C. Asphalt Shingle Installation

1. General: Install asphalt shingles according to manufacturer's written instructions, recommendations in ARMA's "Residential Asphalt Roofing Manual," and asphalt shingle recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."
2. Install starter strip along lowest roof edge, consisting of an asphalt shingle strip with tabs removed **OR** at least 7 inches (175 mm) wide, **as directed**, with self-sealing strip face up at roof edge.
 - a. Extend asphalt shingles 1/2 inch (13 mm) **OR** 3/4 inch (19 mm), **as directed**, over fasciae at eaves and rakes.
 - b. Install starter strip along rake edge.
3. For Three-Tab- And Other Multitab-Strip Asphalt Shingles: Install first and remaining courses of asphalt shingles stair-stepping diagonally across roof deck with 4-inch (100-mm) **OR** 5-inch (125-mm) **OR** 6-inch (150-mm) **OR** 1/2-tab **OR** 1/3-tab **OR** manufacturer's recommended, **as directed**, offset pattern at succeeding courses, maintaining uniform exposure.
4. For Laminated-Strip And No-Cutout-Strip Asphalt Shingles: Install first and remaining courses of asphalt shingles stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.
5. Install asphalt shingles by single-strip column or racking method, maintaining uniform exposure. Install full-length first course followed by cut second course, repeating alternating pattern in succeeding courses.
6. Fasten asphalt shingle strips with a minimum of four **OR** five **OR** six, **as directed**, roofing nails located according to manufacturer's written instructions.
 - a. Where roof slope exceeds 20:12, seal asphalt shingles with asphalt roofing cement spots after fastening with additional roofing nails.
 - b. Where roof slope is less than 4:12, seal asphalt shingles with asphalt roofing cement spots.
 - c. When ambient temperature during installation is below 50 deg F (10 deg C), seal asphalt shingles with asphalt roofing cement spots.
7. Woven Valleys: Extend succeeding asphalt shingle courses from both sides of valley 12 inches (300 mm) beyond center of valley, weaving intersecting shingle-strip courses over each other. Use one-piece shingle strips without joints in valley.



- a. Do not nail asphalt shingles within 6 inches (150 mm) of valley center.
8. Closed-Cut Valleys: Extend asphalt shingle strips from one side of valley 12 inches (300 mm) beyond center of valley. Use one-piece shingle strips without joints in valley. Fasten with extra nail in upper end of shingle. Install asphalt shingle courses from other side of valley and cut back to a straight line 2 inches (50 mm) short of valley centerline. Trim upper concealed corners of cut-back shingle strips.
 - a. Do not nail asphalt shingles within 6 inches (150 mm) of valley center.
 - b. Set trimmed, concealed-corner asphalt shingles in a 3-inch- (75-mm-) wide bed of asphalt roofing cement.
9. Open Valleys: Cut and fit asphalt shingles at open valleys, trimming upper concealed corners of shingle strips. Maintain uniform width of exposed open valley **OR** Widen exposed portion of open valley 1/8 inch in 12 inches (1:96), **as directed**, from highest to lowest point.
 - a. Set valley edge of asphalt shingles in a 3-inch- (75-mm-) wide bed of asphalt roofing cement.
 - b. Do not nail asphalt shingles to metal open-valley flashings.
10. Ridge Vents: Install continuous ridge vents over asphalt shingles according to manufacturer's written instructions. Fasten with roofing nails of sufficient length to penetrate sheathing.
11. Ridge and Hip Cap Shingles: Maintain same exposure of cap shingles as roofing shingle exposure. Lap cap shingles at ridges to shed water away from direction of prevailing winds. Fasten with roofing nails of sufficient length to penetrate sheathing.
 - a. Fasten ridge cap asphalt shingles to cover ridge vent without obstructing airflow.

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SECTION 07 31 16 00 - METAL SHINGLES

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for metal shingles. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Metal-shingle panels.
 - b. Individual metal shingles.
 - c. Underlayment.
 - d. Ridge vents.
 - e. Snow guards.

C. Definitions

1. Roofing Terminology: See ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

D. Performance Requirements

1. General Performance: Metal shingles shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
2. Wind-Uplift Resistance: Provide metal-shingle assemblies that comply with the following wind-uplift requirements.
 - a. Class: 15 **OR** 30 **OR** 60 **OR** 90, **as directed**, when tested according to UL 580.
 - b. Uplift Resistance: 75 lbf/sq. ft. (3.6 kPa) **OR** 120 lbf/sq. ft. (5.75 kPa) **OR** 165 lbf/sq. ft. (7.9 kPa), **as directed**, when tested according to UL 1897.
3. Impact Resistance: Class 3 **OR** Class 4, **as directed**, when tested according to UL 2218.
4. Energy Performance, Solar Reflectance (for LEED-NC Credit SS 7.2): Provide shingles with Solar Reflectance Index not less than 29 when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.
5. Energy Performance, ENERGY STAR: Provide roofing system that is listed on the DOE's "Roof Products Qualified Product List" for steep-slope roof products.
6. Recycled Content: Provide metal shingles with recycled content so that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 50 percent by weight.

E. Submittals

1. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.
2. LEED Submittals:
 - a. Product Test Reports for Credit SS 7.2: For metal shingles, documentation indicating compliance with Solar Reflectance Index requirement.
 - b. Product Data for Credit(s) MR 4.1 and MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.



3. Shop Drawings: For metal shingles. Show roof plans and wall elevations, **as directed**; sections at hips, gables, ridges, valleys, and eaves; details of metal shingles, flashing, trim, and accessories; and attachments to other work.
4. Samples: Full-size components of each type of metal shingle indicated, including visible accessories.
5. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency or performed by a qualified testing agency, for metal shingles, demonstrating compliance with requirements specified in "Performance Requirements" Article.
6. Warranty: Sample of special warranties.

F. Quality Assurance

1. Source Limitations: Obtain metal shingles from single source from single manufacturer.
2. Fire-Test Exposure Rating: Class A **OR** Class B **OR** Class C, **as directed**; for application and roof slopes indicated, as determined by testing identical products per test method UL 790 or ASTM E 108 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
3. Preinstallation Conference: Conduct conference at Project site.

G. Delivery, Storage, And Handling

1. Do not store metal-shingle materials in contact with other materials that might cause staining, denting, or other surface damage. Store metal-shingle materials away from uncured concrete and masonry.
2. Protect strippable protective covering on metal shingles from exposure to sunlight and high humidity, except to the extent necessary for the period of metal-shingle installation.

H. Project Conditions

1. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing to be performed according to manufacturer's written instructions and warranty requirements.
 - a. Install self-adhering sheet underlayment within the range of ambient and substrate temperatures recommended by manufacturer.

I. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace metal shingles and accessories that fail in materials within specified warranty period.
 - a. Failures include, but are not limited to, the following:
 - 1) Structural failures including wind uplift.
 - 2) Water penetration and hail perforation.
 - 3) Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - b. Materials-Only Warranty Period: 15 **OR** 25 **OR** 50, **as directed**, years from date of Final Completion.
2. Special Project Warranty: Roofing Installer's Warranty, signed by roofing Installer, covering Work of this Section, in which Installer agrees to repair or replace components of roofing that fail in materials or workmanship within the following warranty period:
 - a. Warranty Period: Two **OR** Five, **as directed**, years from date of Final Completion.
3. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal shingles that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - a. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
 - 1) Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - 2) Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - 3) Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - b. Warranty Period: 10 **OR** 20, **as directed**, years from date of Final Completion.



1.2 PRODUCTS

A. Sheet Metal Materials

1. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.
 - a. Mill Finish: Uncoated aluminum sheet.
 - b. High-Performance Organic Coating (Coil-Coated Finishes): Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1) Two-Coat Fluoropolymer: AAMA 620. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.
 - 2) Three-Coat Fluoropolymer: AAMA 620. System consisting of primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent PVDF resin by weight.
 - 3) Concealed Surface: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat and with a minimum total dry film thickness of 0.5 mil (0.013 mm).
2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coating designation, Grade 37 (Class AZM150 coating designation, Grade 255); structural quality.
 - a. Mill Finish: Satin-finish, aluminum-zinc alloy-coated steel sheet without additional coating.
 - b. Granular-Coating Finish: Entire upper surface of shingle, including flange edges, coated with ceramic-colored quartz granules or crushed stone chips bonded to shingle with a resin adhesive and sealed with a clear overglaze.
3. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.
 - a. Mill Finish: Zinc-coated (galvanized) steel sheet without additional coating **OR** with manufacturer's standard mill-phosphatized finish, **as directed**.
 - b. High-Performance Organic Coating, (Coil-Coated Finishes): Prepainted by the coil-coating process to comply with ASTM A 755/A 755M. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1) Two-Coat Fluoropolymer: AAMA 621. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.
 - 2) Three-Coat Fluoropolymer: AAMA 621. System consisting of primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent PVDF resin by weight.
4. Copper Sheet: ASTM B 370; Temper H00, cold rolled, unless Temper 060 is required for forming.
 - a. Mill Finish: Nonpatinated and exposed.
 - b. Pre-Patinated Finish: Dark brown **OR** Verdigris, **as directed**, pre-patinated according to ASTM B 882.
5. Zinc-Alloy Sheet: Alloy of 99.995 percent pure electrolytic high-grade zinc with alloy additives of copper (0.08 to 0.20 percent), titanium (0.07 to 0.12 percent), and aluminum (0.015 percent) **OR** Zinc alloy consisting of 99 percent pure zinc with 0.08 to 1.00 percent copper, 0.06 to 0.20 percent titanium, and up to 0.015 percent aluminum, **as directed**; with manufacturer's standard factory-applied, flexible, protective back coating.
 - a. Bright-Rolled Finish: Uncoated, bright-rolled zinc-alloy sheet.
 - b. Preweathered Finish: Factory-applied preweathering to uniform color.

B. Metal Shingles

1. Aluminum Shingles: Factory-formed, interlocking shingle panels **OR** individual shingles, **as directed**.
 - a. Shingle Panels: Stamped panels resembling multiple shakes **OR** shingles **OR** Spanish tiles **OR** flat tiles **OR** scalloped tiles, **as directed**.



- 1) Material: Formed aluminum, 0.020 inch (0.51 mm) thick **OR** 0.032 inch (0.81 mm) thick **OR** thickness as needed to meet performance requirements, **as directed**.
 - 2) Reinforcement: Manufacturer's standard insert material in units to increase rigidity.
 - 3) Exposure: 48 by 12 inches (1219 by 305 mm).
 - 4) Finish: Mill **OR** High-performance organic coating.
 - 5) Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
- b. Individual Shingles: Rectangular **OR** Diamond, **as directed**, shingle units.
- 1) Material: Formed aluminum, 0.020 inch (0.51 mm) thick **OR** 0.032 inch (0.81 mm) thick **OR** thickness as needed to meet performance requirements, **as directed**.
 - 2) Reinforcement: Manufacturer's standard insert material in units to increase rigidity.
 - 3) Exposure: 14 by 14 inches (356 by 356 mm).
 - 4) Finish: Mill **OR** High-performance organic coating, **as directed**.
 - 5) Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
2. Steel Shingles: Factory-formed, interlocking shingle panels **OR** individual shingles, **as directed**.
- a. Shingle Panels: Stamped panels resembling multiple shakes **OR** shingles **OR** Spanish tiles **OR** flat tiles **OR** scalloped tiles, **as directed**.
- 1) Material: Aluminum-zinc alloy-coated **OR** Zinc-coated (galvanized), **as directed**, steel sheet, nominal 0.022 inch (0.56 mm) thick **OR** 0.028 inch (0.71 mm) thick **OR** thickness as needed to meet performance requirements, **as directed**.
 - 2) Exposure: 47-1/4 by 15-13/16 inches (1200 by 402 mm).
 - 3) Finish: Mill **OR** Granular coating **OR** High-performance organic coating, **as directed**.
 - 4) Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
- b. Individual Shingles: Rectangular shingle units.
- 1) Material: Aluminum-zinc alloy coated **OR** Zinc-coated (galvanized), **as directed**, steel sheet, nominal 0.022 inch (0.56 mm) thick **OR** 0.028 inch (0.71 mm) thick **OR** thickness as needed to meet performance requirements, **as directed**.
 - 2) Exposure: 9 by 12 inches (229 by 305 mm).
 - 3) Finish: Mill **OR** Granular coating **OR** High-performance organic coating, **as directed**.
 - 4) Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
3. Copper Shingles: Factory-formed, interlocking shingle panels **OR** individual shingles, **as directed**.
- a. Shingle Panels: Stamped panels resembling multiple shakes **OR** shingles, **as directed**.
- 1) Material: Copper sheet, 12 oz./sq. ft. (0.41 mm thick) **OR** 16 oz./sq. ft. (0.55 mm thick) **OR** weight (thickness) as needed to meet performance requirements, **as directed**.
 - 2) Exposure: 33-1/4 by 10 inches (845 by 254 mm).
 - 3) Finish: Mill **OR** Pre-patinated dark brown **OR** Pre-patinated verdigris, **as directed**.
- b. Individual Shingles: Rectangular **OR** Diamond, **as directed**, shingle units.
- 1) Material: Copper sheet, 12 oz./sq. ft. (0.41 mm thick) **OR** 16 oz./sq. ft. (0.55 mm-thick) **OR** weight (thickness) as needed to meet performance requirements, **as directed**.
 - 2) Exposure: 9-1/2 by 7-1/4 inches (241 by 184 mm).
 - 3) Finish: Mill **OR** Pre-patinated dark brown **OR** Pre-patinated verdigris, **as directed**.
4. Zinc Shingles: Factory-formed, interlocking shingle panels **OR** individual shingles, **as directed**.
- a. Shingle Panels: Stamped panels resembling multiple shakes **OR** shingles, **as directed**.
- 1) Material: Zinc-alloy sheet, 0.027 inch (0.70 mm) thick **OR** thickness as needed to meet performance requirements, **as directed**.
 - 2) Exposure: 47-1/4 by 15-13/16 inches (1200 by 402 mm), **as directed**.
 - 3) Finish: Bright rolled **OR** Preweathered gray **OR** Preweathered black, **as directed**.



- b. Individual Shingles: Rectangular **OR** Diamond, **as directed**, shingle units.
- 1) Material: Zinc-alloy sheet, 0.027 inch (0.70 mm) thick **OR** thickness as needed to meet performance requirements, **as directed**.
 - 2) Exposure: 14 by 14 inches (356 by 356 mm).
 - 3) Finish: Bright rolled **OR** Preweathered gray **OR** Preweathered black, **as directed**.
- C. Underlayment
1. Felt Underlayment: ASTM D 226 or ASTM D 4869, Type I **OR** Type II, **as directed**, asphalt-saturated organic felt, nonperforated.
 2. Self-Adhering Sheet Underlayment, Polyethylene Faced: ASTM D 1970, a minimum of 40-mil- (1.0-mm-) thick, slip-resisting, polyethylene-film-reinforced top surface laminated to SBS-modified asphalt adhesive, with release paper backing; cold applied. Provide primer for adjoining concrete or masonry surfaces to receive underlayment.
 3. Self-Adhering Sheet Underlayment, High Temperature: A minimum of 30- to 40-mil- (0.76- to 1.0-mm-) thick, slip-resisting, polyethylene-film-reinforced top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release paper backing; cold applied. Provide primer for adjoining concrete or masonry surfaces to receive underlayment and when recommended by underlayment manufacturer.
 - a. Thermal Stability: Stable after testing at 240 deg F (116 deg C); ASTM D 1970.
 - b. Low-Temperature Flexibility: Passes after testing at minus 20 deg F (29 deg C); ASTM D 1970.
 4. Slip Sheet: Building paper, 3-lb/100 sq. ft. (0.16-kg/sq. m) minimum, rosin sized.
- D. Accessories
1. General: Provide materials and types of fasteners, protective coatings, separators, sealants, and other accessory items as required for a complete roofing system and as recommended by metal-shingle manufacturer unless otherwise indicated.
 2. Sheet Metal Flashing and Trim: Metal-shingle manufacturer's flashing and trim components matching shingle material, color, and finish unless otherwise indicated or recommended in writing by metal-shingle manufacturer. Fabricate to sizes and configurations shown or required. Unless otherwise indicated, fabricate sheet metal flashing and trim to comply with recommendations that apply to design, dimensions, metal, and other characteristics of the item in SMACNA's "Architectural Sheet Metal Manual."
 3. Ridge Vents: Metal-shingle manufacturer's continuous vented ridge caps matching material and finish of metal shingles with insect screen or insect-resisting geotextile filter strips and with external deflector baffles; for use with specified metal shingles.
 - a. Minimum Net Free Area: As required to satisfy Project requirements.
 - b. Accessories: Splices, end caps, and other accessories matching metal and finish.
 4. Snow Guards: Stop-type **OR** Bar-type, **as directed**, prefabricated aluminum **OR** copper **OR** cast-bronze **OR** zinc **OR** stainless-steel, **as directed**, units, designed to be installed without penetrating metal shingles.
 - a. Attachment: Designed to be attached to surface of metal shingles using construction adhesive, silicone or polyurethane sealant, or adhesive tape **OR** mechanically anchored through predrilled holes concealed by the metal shingles, **as directed**.
 - b. Finish: Matching the metal shingles.
 5. Wood Battens: Pressure-preservative-treated wood complying with requirements in Division 6 Section "Rough Carpentry" **OR** "Miscellaneous Carpentry", **as directed**.
 - a. Contoured Rigid Foam: Manufacturers standard rigid foam formed to match underside contour of metal shingles.
 6. Metal Battens: Hat channels formed from zinc-coated (galvanized) steel sheet; ASTM A 653/A 653M, G90 (Z275) coating designation, not less than 0.025-inch (0.64-mm) nominal thickness, and complying with requirements in Division 5 Section Cold-Formed Metal Framing."
 7. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.
 8. Asphalt Roofing Cement: ASTM D 4586, Type II, asbestos free.



9. Sealant: ASTM C 920, one-part elastomeric polymer joint sealant as recommended by metal-shingle manufacturer for installation indicated; of type, grade, class, and use classifications required to seal joints in metal shingles and remain watertight. Where sealant will be exposed, provide in color matching shingle.
10. Sheet Metal Fasteners: Noncorrosive screws, nails, and anchors designed to withstand design loads as recommended in writing by metal-shingle manufacturer.
 - a. Exposed Fasteners: Heads matching color of metal shingles using plastic caps or factory-applied coating. Provide metal-backed neoprene or EPDM washers under heads of exposed fasteners bearing on weather side of shingles.
 - b. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - c. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
 - d. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
 - e. Fasteners for Aluminum-Zinc Alloy-Coated **OR** Zinc-Coated, **as directed**, Steel Sheet: Hot-dip galvanized steel according to ASTM A 153/A 153M, ASTM F 2329, or Series 300 stainless steel.
 - f. Fasteners for Copper Sheet: Copper, hardware bronze, or Series 300 stainless steel.
 - g. Fasteners for Zinc Sheet: Hot-dip galvanized steel according to ASTM A 153/A 153M, ASTM F 2329, or Series 300 stainless steel.
11. Felt Underlayment Nails: Aluminum, stainless-steel, or hot-dip galvanized-steel wire with low-profile capped heads or disc caps, 1-inch (25-mm) minimum diameter.
 - a. Where nails are in contact with metal shingles or flashing, use nails made from same metal as metal shingles.
12. Wood Batten Nails: ASTM F 1667; common or box, steel wire, flat head, and smooth shank; hot-dip galvanized.

E. General Finish Requirements

1. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
2. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

1.3 EXECUTION

A. Examination

1. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - a. Examine roof sheathing to verify that sheathing joints are supported by framing and blocking, that tops of fasteners are flush with surface, and that installation is within flatness tolerances.
 - b. Verify that substrate is sound, dry to the maximum moisture content recommended by metal-shingle manufacturer, smooth, clean, sloped for drainage, and completely anchored and that provision has been made for flashings and penetrations through metal shingles.
 - c. Verify that vent stacks and other penetrations through metal shingles have been installed and are securely fastened.
2. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Underlayment Installation



1. General: Comply with metal-shingle and underlayment manufacturers' written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
2. Single-Layer Felt Underlayment: Install on roof deck parallel with and starting at the eaves. Lap sides a minimum of 2 inches (50 mm) over underlying course. Lap ends a minimum of 4 inches (100 mm). Stagger end laps between succeeding courses at least 72 inches (1830 mm). Fasten with felt underlayment nails.
 - a. Install felt underlayment on roof deck not covered by self-adhering sheet underlayment. Lap sides of felt over self-adhering sheet underlayment not less than 3 inches (75 mm) in direction to shed water. Lap ends of felt not less than 6 inches (152 mm) over self-adhering sheet underlayment.
3. Double-Layer Felt Underlayment: Install on roof deck parallel with and starting at the eaves. Install a 19-inch- (485-mm-) wide starter course at eaves and completely cover with full-width second course. Install succeeding courses lapping previous courses 19 inches (485 mm) in shingle fashion. Lap ends a minimum of 6 inches (152 mm). Stagger end laps between succeeding courses at least 72 inches (1830 mm). Fasten with felt underlayment nails.
 - a. Apply a continuous layer of asphalt roofing cement over starter course and on felt underlayment surface to be concealed by succeeding courses as each felt course is installed. Apply over entire roof **OR** at locations indicated on Drawings, **as directed**.
 - b. Install felt underlayment on roof sheathing not covered by self-adhering sheet underlayment. Lap edges over self-adhering sheet underlayment not less than 3 inches (75 mm) in direction to shed water.
 - c. Terminate felt underlayment flush **OR** extended up not less than 4 inches (100 mm), **as directed**, against sidewalls, curbs, chimneys, and other roof projections.
4. Self-Adhering Sheet Underlayment: Install wrinkle free; comply with low-temperature installation restrictions of underlayment manufacturer if applicable. Install at locations indicated below **OR** on Drawings, **as directed**, lapped in direction to shed water. Lap sides not less than 3-1/2 inches (89 mm). Lap ends not less than 6 inches (152 mm), staggered 24 inches (610 mm) between courses. Roll laps with roller. Cover underlayment within seven days.
 - a. Prime concrete and masonry surfaces to receive self-adhering sheet underlayment.
 - b. Eaves: Extend from edges of eaves 24 inches (610 mm) **OR** 36 inches (914 mm), **as directed**, beyond interior face of exterior wall.
 - c. Rakes: Extend from edges of rakes 24 inches (610 mm) **OR** 36 inches (914 mm), **as directed**, beyond interior face of exterior wall.
 - d. Valleys: Extend from lowest to highest point 18 inches (455 mm) on each side.
 - e. Hips: Extend 18 inches (455 mm) on each side.
 - f. Ridges: Extend 36 inches (914 mm) on each side without obstructing continuous ridge vent slot.
 - g. Sidewalls: Extend 18 inches (455 mm) beyond sidewalls and return vertically against sidewalls not less than 4 inches (100 mm).
 - h. Dormers, Chimneys, Skylights, and Other Roof-Penetrating Elements: Extend 18 inches (455 mm) beyond penetrating elements and return vertically against penetrating elements not less than 4 inches (100 mm).
 - i. Roof-Slope Transitions: Extend 18 inches (455 mm) on each roof slope.
5. Metal-Flushed, Open-Valley Underlayment: Install one layer of 36-inch- (914-mm-) wide felt underlayment or self-adhering sheet underlayment centered in valley and running the full length of valley in addition to the underlayment required for metal shingles. Stagger end laps between layers and lap ends of each layer at least 12 inches (305 mm) in direction to shed water.
 - a. Solidly cement valley felt underlayment with asphalt roofing cement to the underlayment required for metal shingles.
6. Apply slip sheet with adhesive or tape before installing metal flashing and shingles.

C. Metal-Shingle Installation

1. General: Install metal shingles according to manufacturer's written instructions applicable to products and applications indicated; install level, plumb, and true to line.



2. Felt Interlayment: Install 18-inch- (455-mm-) wide strip of felt underlayment over top portion of first and each succeeding course. Stagger fasten to roof deck with felt underlayment nails.
3. Maintain uniform exposure and coursing of metal shingles throughout roof.
4. Apply sealant between shingles, flashing, trim, and exposed fasteners to achieve a weathertight system.
5. Interlock and overlap shingles and stagger end joints from **OR** align joints of tile-form, **as directed**, shingle courses above and below.
6. Metal Protection: Where dissimilar metals will contact each other, protect against galvanic action by painting contact surfaces with bituminous coating, by applying self-adhering sheet underlayment to each contact surface, or by other permanent separation as recommended by manufacturer of metal shingles or of the metals in contact.
 - a. Do not use graphite pencils to mark metal surfaces.

D. Accessory Installation

1. General: Install accessories according to manufacturers' written instructions unless more stringent requirements are indicated.
2. Metal Flashings and Trim: Install metal flashings and trim according to recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual" unless more stringent requirements are indicated.
3. Ridge Vents: Install ridge vents with end closures at locations indicated.
4. Stop-Type Snow Guards: Install rows of snow guards at locations indicated. Space rows apart horizontally, beginning from gutter. Space snow guards apart in each row, offsetting by half this dimension between succeeding rows.
5. Bar-Type Snow Guards: Install rows of snow guards at locations indicated. Space rows apart horizontally, beginning from gutter.
6. Battens: Install battens according to metal-shingle manufacturer's written instructions and as needed to meet performance requirements.
 - a. Wood Battens: Install nominal 2-by-2-inch (38-by-38-mm) wood battens horizontally over installed underlayment with ends separated by 1/2 inch (13 mm), at spacing required by metal-shingle manufacturer, and securely fasten to roof deck with wood batten nails.
 - b. Metal Battens: Install 1-1/2-inch (38-mm) metal battens horizontally over installed underlayment with ends separated by 1/2 inch (13 mm), at spacing required by metal-shingle manufacturer, and securely fasten to roof deck with sheet metal fasteners.
 - c. Intermediate Battens: Install nominal 1-inch- (19-mm-) thick wood battens with double strip of contoured rigid foam horizontally with ends separated by 1/2 inch (13 mm), at spacing required by metal-shingle manufacturer to uniformly support underside of metal shingles between main battens, and securely fasten to roof deck with wood batten nails.
7. Metal Protection: Where dissimilar metals will contact each other, protect against galvanic action by painting contact surfaces with bituminous coating, by applying self-adhering sheet underlayment to each contact surface, or by other permanent separation as recommended by manufacturer of metal shingles or of the metals in contact.

E. Erection Tolerances

1. Installation Tolerances: Shim and align metal shingles within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.
OR
Installation Tolerances: Shim and align metal shingles within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

F. Adjusting And Cleaning

1. Remove and replace damaged or deformed metal shingles or metal shingles that do not comply with specified requirements. Replace shingles with damaged or deteriorated finishes and other components of the Work that cannot be successfully repaired by finish touchup or similar minor repair procedures.



2. Remove temporary protective coverings and strippable films as metal shingles are installed unless otherwise indicated in manufacturer's written installation instructions.
3. On completion of installation, clean exposed surfaces of metal shingles according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Remove excess sealants. Maintain metal shingles in a clean condition during construction.
4. Remove excess metal shingles and debris from Project site.

END OF SECTION 07 31 16 00



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SECTION 07 31 26 00 - SLATE SHINGLES

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for slate shingles. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Slate shingles.
 - b. Underlayment.
 - c. Snow guards.

C. Definitions

1. Roofing Terminology: See ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

D. Submittals

1. Product Data: For each type of product indicated.
2. Samples
 - a. Slate Shingle: Full size, of each color, size, texture, and shape.
 - b. Ridge Cap **OR** Vent, **as directed**: 12-inch- (305-mm-) long Sample.
 - c. Fasteners: Three fasteners of each type, length, and finish.
 - d. Exposed Valley Lining: 12 inches (305 mm) square.
 - e. Snow Guard: Full-size unit **OR** Base, bracket, and 12-inch- (300-mm-) long rail, **as directed**.
3. Warranty: Sample of special warranty.

E. Quality Assurance

1. Source Limitations: Obtain each color of slate shingle from single quarry capable of producing slate of consistent quality in appearance and physical properties.
2. Preinstallation Conference: Conduct conference at Project site.

F. Delivery, Storage, And Handling

1. Store underlayment rolls on end, on pallets or other raised surfaces. Do not double stack rolls.
 - a. Handle, store, and place roofing materials in a manner to avoid significant or permanent damage to roof deck or structural supporting members.
2. Protect unused underlayment from weather, sunlight, and moisture when left overnight or when roofing work is not in progress.

G. Warranty

1. Special Warranty: Standard form in which roofing Installer agrees to repair or replace slate roofing that fails in materials or workmanship within two **OR** five, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Slate Shingles

1. Slate Shingles: ASTM C 406, Grade S1 **OR** Grade S2, **as directed**; hard, dense, and sound; chamfered edges, with nail holes machine punched or drilled and countersunk. No broken or



cracked slates, no broken exposed corners, and no broken corners on covered ends that could sacrifice nailing strength or laying of a watertight roof.

- a. Thickness: Nominal 3/16 inch (5 mm) **OR** 3/16 to 1/4 inch (5 to 6 mm) **OR** 1/4 to 3/8 inch (6 to 10 mm) **OR** 3/8 to 1/2 inch (10 to 13 mm), **as directed**.
 - b. Surface Texture: Smooth **OR** Rough, **as directed**.
 - c. Size: 24 inches (610 mm) long by 14 inches (355 mm) **OR** 12 inches (305 mm) **OR** random widths, but not less than one-half-length, **as directed**, wide.
 - d. Size: 22 inches (560 mm) long by 14 inches (355 mm) **OR** 12 inches (305 mm) **OR** 11 inches (280 mm) **OR** random widths, but not less than one-half-length, **as directed**, wide.
 - e. Size: 20 inches (510 mm) long by 14 inches (355 mm) **OR** 12 inches (305 mm) **OR** 11 inches (280 mm) **OR** 10 inches (255 mm) **OR** random widths, but not less than one-half-length, **as directed**, wide.
 - f. Size: 18 inches (455 mm) long by 14 inches (355 mm) **OR** 12 inches (305 mm) **OR** 11 inches (280 mm) **OR** 10 inches (255 mm) **OR** 9 inches (230 mm) **OR** random widths, but not less than one-half-length, **as directed**, wide.
 - g. Size: 16 inches (405 mm) long by 14 inches (355 mm) **OR** 12 inches (305 mm) **OR** 11 inches (280 mm) **OR** 10 inches (255 mm) **OR** 9 inches (230 mm) **OR** 8 inches (205 mm) **OR** random widths, but not less than one-half-length, **as directed**, wide.
 - h. Size: 14 inches (355 mm) long by 12 inches (305 mm) **OR** 11 inches (280 mm) **OR** 10 inches (255 mm) **OR** 9 inches (230 mm) **OR** 8 inches (205 mm) **OR** 7 inches (180 mm) **OR** random widths, but not less than one-half-length, **as directed** wide.
 - i. Size: 12 inches (305 mm) long by 12 inches (305 mm) **OR** 10 inches (255 mm) **OR** 9 inches (230 mm) **OR** 8 inches (205 mm) **OR** 7 inches (180 mm) **OR** 6 inches (152 mm) **OR** random widths, but not less than one-half-length, **as directed**, wide.
 - j. Size: 10 inches (255 mm) by 10 inches (255 mm) **OR** 9 inches (230 mm) **OR** 8 inches (205 mm) **OR** 7 inches (180 mm) **OR** 6 inches (152 mm) **OR** random widths, but not less than one-half-length, **as directed**, wide.
 - k. Nail Holes: Two **OR** Four, **as directed**, per shingle.
 - l. Butt Shape: Standard square cut.
 - m. Cut Butt Shape: Standard square cut and pointed **OR** deep bevel **OR** shallow bevel **OR** deep scallop **OR** shallow scallop **OR** round, **as directed**.
 - n. Color: Black **OR** Gray **OR** Purple **OR** Green **OR** Blue black **OR** Blue gray **OR** Mottled purple and green **OR** Red **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - o. Weather-Exposure Color Change: Unfading **OR** Weathering, **as directed**.
2. Starter Slate: Slate shingles with chamfered nail holes front-side punched.
 - a. Length: Exposure of slate shingle plus head lap.
 3. Ridge Slate: Slate shingles fabricated with vertical **OR** horizontal, **as directed**, grain orientation.

B. Underlayment Materials

1. Felt Underlayment: ASTM D 226, Type I **OR** Type II, **as directed**, asphalt-saturated organic felt, unperforated.
2. Felt Underlayment: ASTM D 2626, asphalt-saturated and -coated organic felt, mineral surfaced, unperforated.
3. Self-Adhering Sheet Underlayment, Granular Surfaced: ASTM D 1970, minimum of 55-mil- (1.4-mm-) thick sheet; glass-fiber-mat-reinforced, SBS-modified asphalt; mineral-granule surfaced; with release paper backing; cold applied. Provide primer for adjoining concrete or masonry surfaces to receive underlayment, **as directed**.
4. Self-Adhering Sheet Underlayment, Polyethylene Faced: ASTM D 1970, minimum of 40-mil- (1.0-mm-) thick, slip-resisting, polyethylene-film-reinforced top surface laminated to SBS-modified asphalt adhesive, with release paper backing; cold applied. Provide primer for adjoining concrete or masonry surfaces to receive underlayment, **as directed**.
5. Self-Adhering Sheet Underlayment, High Temperature: Minimum of 30- to 40-mil- (0.76- to 1.0-mm-) thick, slip-resisting, polyethylene-film-reinforced top surface laminated to layer of butyl or



SBS-modified asphalt adhesive, with release paper backing; cold applied. Provide primer for adjoining concrete or masonry surfaces to receive underlayment, **as directed**.

- a. Thermal Stability: Stable after testing at 240 deg F (116 deg C); ASTM D 1970.
- b. Low-Temperature Flexibility: Passes after testing at minus 20 deg F (29 deg C); ASTM D 1970.

C. Snow Guards

1. Snow-Guard Pads: Fabricated copper **OR** cast-bronze **OR** zinc **OR** stainless-steel **OR** aluminum, **as directed**, units, designed to be installed without penetrating slate shingles, and complete with predrilled holes or hooks for anchoring.
2. Snow-Guard Rails: Units fabricated from metal baseplate anchored to adjustable **OR** fixed, **as directed**, bracket and equipped with two **OR** three, **as directed**, bars.
 - a. Brackets and Baseplate: Aluminum **OR** Bronze or brass **OR** Stainless steel, **as directed**.
 - b. Bars: Aluminum, mill finished **OR** Aluminum, clear anodized **OR** Stainless steel, mill finished, **as directed**.

D. Accessories

1. Asphalt Roofing Cement: ASTM D 4586, Type II, asbestos free.
2. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied.
3. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane **OR** polysulfide **OR** silicone, **as directed**, polymer sealant; of type, grade, class, and use classifications required to seal joints in slate-shingle roofing and remain watertight.
4. Slating Nails: ASTM F 1667, copper, **OR** aluminum-alloy, **OR** stainless-steel, **OR** cut-brass, **as directed**, smooth shanked, wire nails; 0.135-inch (3.4-mm) minimum thickness; sharp pointed; with 3/8-inch- (10-mm-) minimum diameter flat head; of sufficient length to penetrate a minimum of 3/4 inch (19 mm) into sheathing.
 - a. Where nails are in contact with metal flashing, use nails made from same metal as flashing.
5. Felt Underlayment Nails: Aluminum, stainless-steel, or hot-dip galvanized-steel wire nails with low-profile capped heads or disc caps, 1-inch (25-mm) minimum diameter.
6. Wood Nailer Strips and Eave Cants: Comply with requirements in Division 06 Section(s) "Rough Carpentry" **OR** "Miscellaneous Rough Carpentry", **as directed**.
7. Ridge Cap **OR** Vent, **as directed**: Custom-fabricated metal covers with noncorrosive components complete with internal anchoring lag screws, compression plates, and snap-on caps and slate retention channels, **as directed**.
 - a. Type: Cap, nonventilating **OR** Vent, with ventilating mesh providing net-free area of 18 sq. in./ft. (380 sq. cm/m) **OR** Vent, with ventilating mesh providing net-free area of 18 sq. in./ft. (380 sq. cm/m) and external baffles, **as directed**.
 - b. Metal Components: Copper, 20-oz./sq. ft.- (0.7-mm-) thick sheet **OR** Aluminum, 0.050-inch- (1.3-mm-) thick sheet, with manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin on exposed surfaces, **as directed**.
 - c. Accessories: Splices, end caps, and other accessories of matching metal and finish.
8. Track- and Clip-Attachment System: Custom-fabricated slate-shingle attachment system designed for use with notched-slate shingles consisting of extruded-aluminum, **OR** formed stainless-steel, **as directed**, perforated Z-track, screws, and spring clips for anchoring slate to roof deck.

E. Metal Flashing And Trim

1. General: Comply with requirements in Division 07 Section "Sheet Metal Flashing And Trim".
 - a. Sheet Metal: Copper **OR** Stainless steel **OR** Zinc-tin alloy-coated stainless steel **OR** Zinc-tin alloy-coated steel **OR** Zinc-tin alloy-coated copper **OR** Anodized aluminum **OR** Aluminum, mill finished, **as directed**.



2. Fabricate sheet metal flashing and trim to comply with recommendations that apply to design, dimensions, metal, and other characteristics of the item in SMACNA's "Architectural Sheet Metal Manual."
 - a. Apron Flashings: Fabricate with lower flange extending a minimum of 4 inches (100 mm) **OR** 6 inches (152 mm), **as directed**, over and 4 inches (100 mm) beyond each side of downslope slate shingles and 6 inches (152 mm) up the vertical surface.
 - b. Step Flashings: Fabricate with a head lap of 3 inches (75 mm) and a minimum extension of 4 inches (100 mm) **OR** 5 inches (127 mm), **as directed**, both horizontally and vertically.
 - c. Cricket **OR** Backer, **as directed**, Flashings: Fabricate with concealed flange extending a minimum of 18 inches (455 mm) **OR** 24 inches (610 mm), **as directed**, beneath upslope slate shingles and 6 inches (152 mm) beyond each side of chimney **OR** skylight, **as directed**, and 6 inches (152 mm) above the roof plane.
 - d. Hip Flashings: Fabricate to length of slate shingle and to extend 3 inches (75 mm), **as directed**, beyond joint of hip shingle with adjoining roof shingle.
 - e. Open-Valley Flashings: Fabricate in lengths not exceeding 10 feet (3 m) with 1-inch- (25-mm-) high, inverted-V profile at center of valley and equal flange widths of 10 inches (255 mm) **OR** 12 inches (305 mm), **as directed**.
 - f. Closed-Valley Flashings: Fabricate in lengths not exceeding 10 feet (3 m) and equal flange widths of 10 inches (255 mm) **OR** 12 inches (305 mm), **as directed**.
 - g. Drip Edges: Fabricate in lengths not exceeding 10 feet (3 m) with 2-inch (50-mm) roof-deck flange and 1-1/2-inch (38-mm) fascia flange with 3/8-inch (10-mm) drip at lower edge.
3. Vent-Pipe Flashings: ASTM B 749, Type L51121, at least 1/16 inch (1.6 mm) thick. Provide lead sleeve sized to slip over and turn down into pipe, soldered to skirt at slope of roof and extending at least 4 inches (100 mm) from pipe onto roof.

1.3 EXECUTION

A. Underlayment Installation

1. General: Comply with underlayment manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
2. Single-Layer Felt Underlayment: Install on roof deck parallel with and starting at the eaves. Lap sides a minimum of 2 inches (50 mm) over underlying course. Lap ends a minimum of 4 inches (100 mm). Stagger end laps between succeeding courses at least 72 inches (1830 mm). Fasten with felt underlayment nails.
 - a. Install felt underlayment on roof deck not covered by self-adhering sheet underlayment. Lap sides of felt over self-adhering sheet underlayment not less than 3 inches (75 mm) in direction to shed water. Lap ends of felt not less than 6 inches (152 mm) over self-adhering sheet underlayment.
3. Double-Layer Felt Underlayment: Install on roof deck parallel with and starting at the eaves. Install a 19-inch- (485-mm-) wide starter course at eaves and completely cover with full-width second course. Install succeeding courses lapping previous courses 19 inches (485 mm) in shingle fashion. Lap ends a minimum of 6 inches (152 mm). Stagger end laps between succeeding courses at least 72 inches (1830 mm). Fasten with felt underlayment nails.
 - a. Apply a continuous layer of asphalt roofing cement over starter course and on felt underlayment surface to be concealed by succeeding courses as each felt course is installed. Apply over entire roof **OR** at locations indicated on Drawings, **as directed**.
 - b. Install felt underlayment on roof sheathing not covered by self-adhering sheet underlayment. Lap edges over self-adhering sheet underlayment not less than 3 inches (75 mm) in direction to shed water.
 - c. Terminate felt underlayment flush **OR** extended up not less than 4 inches (100 mm), **as directed**, against sidewalls, curbs, chimneys, and other roof projections.
4. Self-Adhering Sheet Underlayment: Install, wrinkle free, on roof deck. Comply with low-temperature installation restrictions of underlayment manufacturer if applicable. Install at locations indicated below **OR** on Drawings, **as directed**, lapped in direction to shed water. Lap



sides not less than 3-1/2 inches (89 mm). Lap ends not less than 6 inches (152 mm), staggered 24 inches (600 mm) between courses. Roll laps with roller. Cover underlayment within seven days.

- a. Prime concrete and masonry surfaces to receive self-adhering sheet underlayment.
 - b. Eaves: Extend from edges of eaves 24 inches (610 mm) **OR** 36 inches (914 mm), **as directed**, beyond interior face of exterior wall.
 - c. Rakes: Extend from edges of rakes 24 inches (610 mm) **OR** 36 inches (914 mm), **as directed**, beyond interior face of exterior wall.
 - d. Valleys: Extend from lowest to highest point 18 inches (455 mm) on each side.
 - e. Hips: Extend 18 inches (455 mm) on each side.
 - f. Ridges: Extend 36 inches (914 mm) on each side without obstructing continuous ridge vent slot, **as directed**.
 - g. Sidewalls: Extend 18 inches (455 mm) beyond sidewalls and return vertically against sidewalls not less than 4 inches (100 mm).
 - h. Dormers, Chimneys, Skylights, and Other Roof-Penetrating Elements: Extend 18 inches (455 mm) beyond penetrating elements and return vertically against penetrating elements not less than 4 inches (100 mm).
 - i. Roof-Slope Transitions: Extend 18 inches (455 mm) on each roof slope.
5. Metal-Flashed, Open-Valley Underlayment: Install two layers of 36-inch- (914-mm-) wide felt underlayment centered in valley. Stagger end laps between layers at least 72 inches (1830 mm). Lap ends of each layer at least 12 inches (305 mm) in direction to shed water, and seal with asphalt roofing cement. Fasten each layer to roof deck with felt underlayment nails.
- a. Lap roof-deck felt underlayment over first layer of valley felt underlayment at least 6 inches (152 mm).

B. Metal Flashing Installation

1. General: Install metal flashings and other sheet metal to comply with requirements in Division 07 Section "Sheet Metal Flashing And Trim".
 - a. Install metal flashings according to recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."
2. Apron Flashings: Extend lower flange over and beyond each side of downslope slate shingles and up the vertical surface.
3. Step Flashings: Install with a head lap of 3 inches (75 mm) and extend both horizontally and vertically. Install with lower edge of flashing just upslope of, and concealed by, butt of overlying slate shingle. Fasten to roof deck only.
4. Cricket **OR** Backer, **as directed**, Flashings: Install against the roof-penetrating element, extending concealed flange beneath upslope slate shingles and beyond each side.
5. Hip Flashings: Install centrally over hip with lower edge of flashing concealed by butt of overlying slate shingle. Fasten to roof deck.
6. Open **OR** Closed, **as directed**, -Valley Flashings: Install centrally in valleys, lapping ends at least 8 inches (205 mm) in direction to shed water. Fasten upper end of each length to roof deck beneath overlap.
 - a. Secure hemmed flange edges into metal cleats spaced 12 inches (305 mm) apart and fastened to roof deck.
 - b. Adhere 9-inch- (230-mm-) wide strips of self-adhering sheet to metal flanges and to self-adhering sheet underlayment.
7. Rake Drip Edges: Install over underlayment and fasten to roof deck.
8. Eave Drip Edges: Install beneath underlayment and fasten to roof deck.
9. Pipe Flashings: Form flashing around pipe penetrations and slate shingles. Fasten and seal to slate shingles.

C. Slate-Shingle Installation

1. General: Beginning at eaves, install slate shingles according to manufacturer's written instructions and to details and recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual".
 - a. Install wood nailer strip cant at eave edges.



- b. Install shingle starter course chamfered face down.
2. Install first and succeeding shingle courses with chamfered face up. Install full-width first course at rake edge.
 - a. Offset joints of uniform-width slate shingles by half the shingle width in succeeding courses.
 - b. Offset joints of random-width slate shingles a minimum of 3 inches (75 mm) in succeeding courses.
3. Maintain a 3-inch- (75-mm-) **OR** 4-inch- (100-mm-), **as directed**, minimum head lap between succeeding shingle courses.
4. Maintain uniform exposure of shingle courses between eaves and ridge **OR** midway between eaves and ridge and increase head lap of succeeding shingle courses to ensure uniform exposure on remaining shingle courses, **as directed**.
5. Extend shingle starter course and first course 1 inch (25 mm) **OR** 2 inches (50 mm), **as directed**, over fascia at eaves.
6. Extend shingle starter course and succeeding courses 1 inch (25 mm) over fascia at rakes.
7. Cut and fit slate neatly around roof vents, pipes, ventilators, and other projections through roof.
8. Hang slate with two **OR** four, **as directed**, slating nails for each shingle with nail heads lightly touching slate. Do not drive nails home drawing slates downward or leave nail head protruding enough to interfere with overlapping shingle above.
 - a. For vented ridge, terminate slate shingles leaving uniform air space on each side of ridge apex.
9. Ridges: Install ridge slate in saddle **OR** strip saddle **OR** combing, **as directed**, configuration.
 - a. Install and anchor wood nailer strips of thicknesses to match abutting courses of slate shingles, terminating nailer strip 3 to 4 inches (75 to 100 mm) from the eave. Cover with felt underlayment strip, extending to underlying slate but concealed by ridge slate.
 - b. Lay ridge slate in bed of asphalt roofing cement **OR** butyl sealant, **as directed**.
 - c. Anchor ridge slate to supporting wood nailer strip with two **OR** four, **as directed**, nails for each slate shingle without nails penetrating underlying slate.
 - d. Extend combing slate over leeward ridge slate by 1/8 to 1/4 inch (3 to 6 mm). Seal ridge joint with elastomeric sealant.
 - e. Cover heads of exposed nails at final ridge shingle with asphalt roofing cement **OR** butyl sealant, **as directed**.
10. Hips: Install and anchor slate hips in saddle **OR** mitered **OR** fantail, **as directed**, configuration.
 - a. Install and anchor wood nailer strips of thickness to match abutting courses of slate shingles. Cover nailer strip with felt underlayment strip, extending on to underlying slate but concealed by hip slate. Anchor hip slate to nailer strip with two nails located in upper third of hip-slate length.
 - b. Notch starter shingle and first shingle course at hip to fit around nailer strips so no wood is exposed at ridge eave.
 - c. Lay hip slate in bed of asphalt roofing cement **OR** butyl sealant, **as directed**.
 - d. Seal hip centerline joint with elastomeric sealant.
11. Open Valleys: Cut slate shingles to form straight lines at open valleys, trimming upper concealed corners of shingles. Maintain uniform width of exposed open valley **OR** Widen exposed portion of open valley 1/8 inch in 12 inches (1:96), **as directed**, from highest to lowest point.
 - a. Do not nail shingles to valley metal flashings.
12. Closed Valleys: Cut slate shingles to form straight lines at closed valleys, trimming upper concealed corners of shingles. Maintain uniform gap at centerline of valley of 1/2 to 3/4 inch (13 to 19 mm) **OR** 3/4 to 1 inch (19 to 25 mm), **as directed**.
 - a. Do not nail shingles to valley metal flashings.

D. Snow-Guard Installation

1. Snow-Guard Pads: Install rows of snow-guard pads at locations indicated according to manufacturer's written installation instructions. Space rows apart horizontally, beginning from gutter. Space snow guards apart in each row, offsetting by half this dimension between succeeding rows.



2. Snow-Guard Rails: Install rows of snow-guard rails at locations indicated according to manufacturer's written installation instructions. Space rows apart horizontally, beginning from gutter.
- E. Accessories Installation
1. Ridge Caps **OR** Vents, **as directed**: Install units according to manufacturer's written instructions.
 - a. Install slate shingles into retention channels, butting adjacent shingles.
- F. Adjusting And Cleaning
1. Remove and replace damaged or broken slate shingles.
 2. Remove excess slate and debris from Project site.

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SECTION 07 31 29 13 - WOOD SHINGLES AND SHAKES

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for wood shingles and shakes. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Wood roof shingles and shakes.
 - b. Wood wall shingles and shakes.
 - c. Wood-shingle-clad panels.
 - d. Underlayment.

C. Definitions

1. CSSB: Cedar Shake & Shingle Bureau.
2. Roofing Terminology: See ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

D. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittal:
 - a. Certificates for Credit MR 7: Chain-of-custody certificates certifying that wood shingles and shakes comply with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body. Include statement indicating costs for each certified wood product.
3. Samples: For each type of wood shingle, shake, ridge and hip unit, and ridge vent indicated.
4. Research/Evaluation Reports: For wood shingles and shakes, from the ICC, **as directed**.
5. Maintenance Data: For wood shingles and shakes to include in maintenance manuals.
6. Warranties: Sample of special warranties.

E. Quality Assurance

1. Grading Agency Qualifications: An independent testing and inspecting agency recognized by authorities having jurisdiction as qualified to label wood shingles and shakes for compliance with referenced grading rules.
2. Forest Certification: Provide shingles and shakes produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
3. Fire-Resistance Characteristics: Where indicated, provide wood shingles and shakes and related roofing materials identical to those of assemblies tested for fire resistance per test method below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.
 - a. Exterior Fire-Test Exposure: Class B **OR** Class C, **as directed**; UL 790 or ASTM E 108 with ASTM D 2898, for application and roof slopes indicated.
4. Preinstallation Conference: Conduct conference at Project site.

F. Delivery, Storage, And Handling

1. Store underlayment rolls on end, on pallets or other raised surfaces. Do not double stack rolls.
 - a. Handle, store, and place roofing materials in a manner to avoid significant or permanent damage to roof deck or structural supporting members.



2. Protect unused underlayment from weather, sunlight, and moisture when left overnight or when roofing work is not in progress.

G. Warranty

1. Special Warranty: CSSB's standard form in which CSSB agrees to repair or replace wood shingles and shakes that fail in materials within specified warranty period. Material failures include manufacturing defects that result in leaks.
 - a. Materials-Only Warranty Period: 20 **OR** 25, **as directed**, years for shingles and shakes, and 20 years for manufactured ridge and hip units, from date of Final Completion.

1.2 PRODUCTS

A. Roof Shingles

1. Cedar Roof Shingles: Smooth-sawn western red cedar shingles.
 - a. Grading Standards: CSSB's "Grading Rules for Certigrade Red Cedar Shingles."
 - b. Grade: No. 1, with starter courses of No. 1 **OR** No. 2 **OR** No. 3, **as directed**.
 - c. Size: 16 inches (405 mm) long; 0.40 inch (10 mm) thick **OR** 18 inches (455 mm) long; 0.45 inch (11 mm) thick **OR** 24 inches (610 mm) long; 0.50 inch (13 mm) thick, **as directed**, at butt.
2. Ridge and Hip, **as directed**, Units: Manufactured **OR** Site-fabricated, **as directed**, units of same thickness as roof shingle, 7 inches (180 mm) wide; beveled, alternately overlapped, and nailed.
 - a. Grade: No. 1.
 - b. Length: 16 inches (405 mm) **OR** 18 inches (455 mm), **as directed**.
3. Fancy-Butt Roof Shingles: Clear heartwood red cedar, No. 1 grade, with butt shape indicated.
 - a. Butt Shape: Diagonal **OR** Half Cove **OR** Diamond **OR** Round **OR** Hexagonal **OR** Octagonal **OR** Arrow **OR** Square **OR** Fish Scale, **as directed**.
 - b. Grading Standards: CSSB's "Grading Rules for Certigrade Red Cedar Shingles."
 - c. Size: 16 inches (405 mm) long; 5 inches (127 mm) wide **OR** 18 inches (455 mm) long; 5 inches (127 mm) wide, **as directed**, by manufacturer's standard thickness.

B. Roof Shakes

1. Cedar Roof Shakes: Handsplit and resawn western red cedar shakes; split face and sawn back.
 - a. Grading Standard: CSSB's "Grading Rules for Certi-Split Resawn Cedar Shakes."
 - b. Grade: Premium, **OR** No. 1, **as directed**, with starter courses of Premium **OR** No. 1, **as directed**.
 - c. Length: 18 inches (455 mm), **OR** 24 inches (610 mm), **as directed**, with 15-inch- (380-mm-) long starter course.
 - d. Thickness: 1/2 inch (13 mm) **OR** 3/4 inch (19 mm), **as directed**, at butt.
2. Cedar Roof Shakes: Tapersawn western red cedar shakes; sawn both sides.
 - a. Grading Standard: CSSB's "Grading Rules for Certi-Sawn Tapersawn Cedar Shakes."
 - b. Grade: Premium, **OR** No. 1, **as directed**, with starter courses of Premium **OR** No. 1 **OR** No. 2, **as directed**.
 - c. Length: 18 inches (455 mm), **OR** 24 inches (610 mm), **as directed**, with 15-inch- (380-mm-) long starter course.
 - d. Thickness: 5/8 inch (16 mm) **OR** 3/4 inch (19 mm), **as directed**, at butt.
3. Cedar Roof Shakes: Tapersplit western red cedar shakes; handsplit.
 - a. Grading Standard: CSSB's "Grading Rules for Certi-Split Resawn Cedar Shakes."
 - b. Grade: Premium, with premium starter courses.
 - c. Length: 24 inches (610 mm), with 15-inch- (380-mm-) long starter course.
 - d. Thickness: 1/2 inch (13 mm) at butt.
4. Cedar Roof Shakes: Straightsplit western red cedar shakes; machine split or handsplit.
 - a. Grading Standard: CSSB's "Grading Rules for Certi-Split Resawn Cedar Shakes."
 - b. Grade: Premium, with premium starter courses.



- c. Length: 18 inches (455 mm) **OR** 24 inches (610 mm), **as directed**, with 15-inch- (380-mm-) long starter course.
- d. Thickness: 3/8 to 1/2 inch (10 to 13 mm) at butt.
5. Ridge and Hip, **as directed**, Units: Manufactured **OR** Site-fabricated, **as directed**, units of same grade as shake, 9 inches (230 mm) wide; beveled, alternately overlapped, and nailed.
 - a. Type: Handsplit and resawn **OR** Tapersawn, **as directed**.
 - b. Length: 18 inches (455 mm) **OR** 24 inches (610 mm), **as directed**.
 - c. Thickness: 5/8 inch (16 mm) **OR** 3/4 inch (19 mm), **as directed**, at butt.

C. Wall Shingles

1. Cedar Wall Shingles: Smooth-sawn western red cedar shingles.
 - a. Grading Standards: CSSB's "Grading Rules for Certigrade Red Cedar Shingles."
 - b. Grade: No. 1 **OR** No. 2 **OR** No. 3, **as directed**.
 - c. Size: 16 inches (405 mm) long; 0.40 inch (10 mm) thick **OR** 18 inches (455 mm) long; 0.45 inch (11 mm) thick **OR** 24 inches (610 mm) long; 0.50 inch (13 mm) thick, **as directed**, at butt.
 - d. Undercourse Shingle Grade: No. 3 **OR** Undercoursing, **as directed**.
 - e. Undercourse Shingle Size: 16 inches (405 mm) long; 0.40 inch (10 mm) thick **OR** 18 inches (455 mm) long; 0.45 inch (11 mm) thick, **as directed**, at butt.
2. Cedar Wall Shingles: Rebuted and rejoined, smooth-sawn **OR** sanded, **as directed**, western red cedar shingles.
 - a. Grading Standards: CSSB's "Grading Rules for Certigrade Red Cedar Shingles."
 - b. Grade: No. 1 **OR** No. 2, **as directed**.
 - c. Size: 16 inches (405 mm) long; 0.40 inch (10 mm) thick **OR** 18 inches (455 mm) long; 0.45 inch (11 mm) thick **OR** 24 inches (610 mm) long; 0.50 inch (13 mm) thick, **as directed**, at butt.
 - d. Undercourse Shingle Grade: No. 3 **OR** Undercoursing, **as directed**.
 - e. Undercourse Shingle Size: 16 inches (405 mm) long; 0.40 inch (10 mm) thick **OR** 18 inches (455 mm) long; 0.45 inch (11 mm) thick, **as directed**, at butt.
3. Cedar Wall Shingles: Rebuted and rejoined, machine-grooved, smooth-sawn western red cedar.
 - a. Grading Standards: CSSB's "Grading Rules for Certigrade Red Cedar Shingles."
 - b. Grade: No. 1.
 - c. Size: 16 inches (405 mm) long; 0.40 inch (10 mm) thick **OR** 18 inches (455 mm) long; 0.45 inch (11 mm) thick **OR** 24 inches (610 mm) long; 0.50 inch (13 mm) thick, **as directed**, at butt.
 - d. Undercourse Shingle Grade: No. 3 **OR** Undercoursing, **as directed**.
 - e. Undercourse Shingle Size: 16 inches (405 mm) long; 0.40 inch (10 mm) thick **OR** 18 inches (455 mm) long; 0.45 inch (11 mm) thick, **as directed**, at butt.
4. Fancy-Butt Wall Shingles: Clear heartwood red cedar, No. 1 grade, with butt shape indicated.
 - a. Butt Shape: Diagonal **OR** Half Cove **OR** Diamond **OR** Round **OR** Hexagonal **OR** Octagonal **OR** Arrow **OR** Square **OR** Fish Scale, **as directed**.
 - b. Grading Standards: CSSB's "Grading Rules for Certigrade Red Cedar Shingles."
 - c. Size: 16 inches (405 mm) long; 5 inches (127 mm) wide **OR** 18 inches (455 mm) long; 5 inches (127 mm) wide, **as directed**, by manufacturer's standard thickness.
5. Cedar Wall Shingle Finish: Unfinished **OR** Semitransparent penetrating stain, oil based, factory applied **OR** Semisolid penetrating stain, oil based, factory applied **OR** Oil-based primer, stain blocking, factory applied, **as directed**.

D. Wall Shakes

1. Cedar Wall Shakes: Handsplit and resawn western red cedar shakes; split face and sawn back.
 - a. Grading Standard: CSSB's "Grading Rules for Certi-Split Resawn Cedar Shakes."
 - b. Outer Course Grade: Premium **OR** No. 1, **as directed**.
 - c. Starter Course **OR** Undercourse, **as directed**, Grade: No. 1 **OR** Standard, **as directed**.
 - d. Length: 18 inches (455 mm) **OR** 24 inches (610 mm), **as directed**.
 - e. Thickness: 1/2 inch (13 mm) **OR** 3/4 inch (19 mm), **as directed**, at butt.
2. Cedar Wall Shakes: Tapersawn western red cedar shakes; sawn both sides.



- a. Grading Standard: CSSB's "Grading Rules for Certi-Sawn Tapersawn Cedar Shakes."
 - b. Outer Course Grade: Premium **OR** No. 1 **OR** No. 2, **as directed**.
 - c. Starter Course **OR** Undercourse, **as directed**, Grade: No. 1 **OR** No. 2 **OR** No. 3, **as directed**.
 - d. Length: 18 inches (455 mm) **OR** 24 inches (610 mm), **as directed**.
 - e. Thickness: 5/8 inch (16 mm) **OR** 3/4 inch (19 mm), **as directed**, at butt.
3. Cedar Wall Shakes: Tapersplit western red cedar shakes; handsplit.
 - a. Grading Standard: CSSB's "Grading Rules for Certi-Split Resawn Cedar Shakes."
 - b. Grade: Premium.
 - c. Length: 24 inches (610 mm).
 - d. Thickness: 1/2 inch (13 mm) at butt.
 - e. Undercourse Shingle Grade: No. 3 **OR** Undercoursing, **as directed**.
 - f. Undercourse Shingle Size: 16 inches (405 mm) long; 0.40 inch (10 mm) thick **OR** 18 inches (455 mm) long; 0.45 inch (11 mm) thick, **as directed**, at butt.
 4. Cedar Wall Shakes: Straightsplit western red cedar shakes; machine split or handsplit.
 - a. Grading Standard: CSSB's "Grading Rules for Certi-Split Resawn Cedar Shakes."
 - b. Grade: Premium.
 - c. Length: 18 inches (455 mm) **OR** 24 inches (610 mm), **as directed**.
 - d. Thickness: 3/8 to 1/2 inch (10 to 13 mm) at butt.
 - e. Undercourse Shingle Grade: No. 3 **OR** Undercoursing, **as directed**.
 - f. Undercourse Shingle Size: 16 inches (405 mm) long; 0.40 inch (10 mm) thick **OR** 18 inches (455 mm) long; 0.45 inch (11 mm) thick, **as directed**, at butt.
 5. Cedar Wall Shake Finish: Unfinished **OR** Semitransparent penetrating stain, oil based, factory applied **OR** Semisolid penetrating stain, oil based, factory applied **OR** Oil-based primer, stain blocking, factory applied, **as directed**.
- E. Wood-Shingle-Clad Panels
1. Cedar Shingle Panels: Clear, vertical-grain, western red cedar shingles bonded with exterior-type adhesives to 5/16-inch- (8-mm-) thick, 96-inch- (2400-mm-) long, DOC PS 1 Exterior C-D plywood panels.
 - a. Number of Courses per Panel: One **OR** Two **OR** Three **OR** Four, **as directed**.
 - b. Butt Style: Straight line **OR** Staggered, **as directed**.
 - c. Fancy-Butt Style: Diagonal **OR** Half Cove **OR** Diamond **OR** Round **OR** Hexagonal **OR** Octagonal **OR** Arrow **OR** Square **OR** Fish Scale, **as directed**.
 - d. Exposure: 4-1/2 inches (115 mm) **OR** 5 inches (127 mm) **OR** 7 inches (180 mm), **as directed**, per course.
 2. Prefabricated Corners: Flush **OR** Flush, with staggered ends **OR** Add-on, **as directed**, type.
- F. Wood Treatments
1. Fire-Retardant Treatment: Exterior-type pressure treatment complying with AWPA C1, **as directed**.
 2. Pressure-Preservative Treatment: AWPA C34, chromated copper arsenate (CCA) pressure treatment; a minimum of 0.40 lb/cu. ft. (6.4 kg/cu. m).
 3. Identification: Attach a label to each bundle of wood shingles or shakes; identify manufacturer, references to model-code approval, type of product, grade, dimensions, and approved grading agency.
 - a. Include chemical treatment, method of application, purpose of treatment, and warranties available.
- G. Underlayment Materials
1. Felt Underlayment: ASTM D 226 **OR** ASTM D 4869, **as directed**, Type I **OR** Type II, **as directed**, asphalt-saturated organic felt.
 2. Felt Interlayment: ASTM D 226 **OR** ASTM D 4869, **as directed**, Type I **OR** Type II, **as directed**, asphalt-saturated organic felt.



3. Self-Adhering Sheet Underlayment, Granular Surfaced: ASTM D 1970, a minimum of 55-mil- (1.4-mm-) thick sheet; glass-fiber-mat-reinforced, SBS-modified asphalt; mineral-granule surfaced; with release paper backing; cold applied. Provide primer for adjoining concrete or masonry surfaces to receive underlayment, **as directed**.
 4. Self-Adhering Sheet Underlayment, Polyethylene Faced: ASTM D 1970, a minimum of 40-mil- (1.0-mm-) thick, slip-resisting, polyethylene-film-reinforced top surface laminated to SBS-modified asphalt adhesive, with release paper backing; cold applied. Provide primer for adjoining concrete or masonry surfaces to receive underlayment, **as directed**.
- H. Ridge Vents
1. Rigid Ridge Vent: Manufacturer's standard rigid section, high-density polypropylene or other UV-stabilized plastic ridge vent with nonwoven geotextile filter strips and external deflector baffles, **as directed**; for use under ridge shingles and shakes.
 2. Flexible Ridge Vent: Manufacturer's standard, compression-resisting, three-dimensional, open-nylon or polyester-mat filter bonded to a nonwoven, nonwicking, geotextile fabric cover, **as directed**; for use under roof shingles and shakes.
- I. Accessories
1. Asphalt Roofing Cement: ASTM D 4586, Type II, asbestos free.
 2. Drainage Mat: Manufacturer's standard, compression-resisting, three-dimensional, nonwoven, entangled filament, nylon mat designed to permit air movement and drain incidental moisture by gravity.
 3. Roofing Nails: ASTM F 1667, aluminum **OR** stainless-steel **OR** hot-dip galvanized-steel, **as directed**, wire nails, sharp pointed, and of sufficient length to penetrate a minimum of 3/4 inch (19 mm) into sheathing.
 - a. Use box **OR** shingle, **as directed**, -type nails for wood shingles.
 - b. Use box-type nails for wood shakes.
 - c. Where nails are in contact with metal flashing, use nails made from same metal as flashing.
 4. Roofing Staples: Type 304 or Type 316, stainless-steel staples, 0.05-inch (1.3-mm) thick, with a minimum of 7/16-inch (11-mm) crown width, of sufficient length to penetrate a minimum of 3/4 inch (19 mm) into sheathing.
 5. Felt Underlayment and Interlayment, **as directed**, Nails: Aluminum, stainless-steel, or hot-dip galvanized-steel wire nails; with 1-inch- (25-mm-) minimum diameter, low-profile capped heads or disc caps.
 6. Wood Lath Strip: Western red cedar, clear heartwood, a minimum of 1-1/2 inches (38 mm) wide.
- J. Metal Flashing And Trim
1. General: Comply with requirements in Division 07 Section "Sheet Metal Flashing And Trim"
 - a. Sheet Metal: Copper **OR** Stainless steel **OR** Zinc-tin alloy-coated stainless steel **OR** Zinc-tin alloy-coated steel **OR** Zinc-tin alloy-coated copper **OR** Anodized aluminum **OR** Aluminum, mill finished, **as directed**.
 2. Fabricate sheet metal flashing and trim to comply with recommendations that apply to design, dimensions, metal, and other characteristics of the item in SMACNA's "Architectural Sheet Metal Manual."
 - a. Apron Flashings: Fabricate with lower flange extending a minimum of 4 inches (100 mm) **OR** 6 inches (152 mm), **as directed**, over and 4 inches (100 mm) beyond each side of downslope wood roofing and 6 inches (152 mm) up the vertical surface.
 - b. Step Flashings: Fabricate with a head lap of 3 inches (75 mm) and a minimum extension of 4 inches (100 mm) **OR** 5 inches (127 mm), **as directed**, both horizontally and vertically.
 - c. Cricket **OR** Backer, **as directed**, Flashings: Fabricate with concealed flange extending a minimum of 18 inches (455 mm) **OR** 24 inches (610 mm), **as directed**, beneath upslope wood roofing and 6 inches (152 mm) beyond each side of chimney **OR** skylight, **as directed**, and 6 inches (152 mm) above the roof plane.



- d. Open-Valley Flashings: Fabricate in lengths not exceeding 10 feet (3 m) with 1-inch- (25-mm-) high, inverted-V profile at center of valley and equal flange widths of 10 inches (255 mm) **OR** 12 inches (305 mm), **as directed**.
 - e. Drip Edges: Fabricate in lengths not exceeding 10 feet (3 m) with 2-inch (50-mm) roof-deck flange and 1-1/2-inch (38-mm) fascia flange with 3/8-inch (10-mm) drip at lower edge.
3. Vent-Pipe Flashings: ASTM B 749, Type L51121, at least 1/16 inch (1.6 mm) thick. Provide lead sleeve sized to slip over and turn down into pipe, soldered to skirt at slope of roof and extending at least 4 inches (100 mm) from pipe onto roof.

1.3 EXECUTION

A. Underlayment Installation

1. General: Comply with underlayment manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
2. Single-Layer Felt Underlayment: Install on roof deck parallel with and starting at the eaves. Lap sides a minimum of 2 inches (50 mm) over underlying course. Lap ends a minimum of 4 inches (100 mm). Stagger end laps between succeeding courses at least 72 inches (1830 mm). Fasten with felt underlayment nails.
 - a. Install felt underlayment on roof deck not covered by self-adhering sheet underlayment. Lap sides of felt over self-adhering sheet underlayment not less than 3 inches (75 mm) in direction to shed water. Lap ends of felt not less than 6 inches (152 mm) over self-adhering sheet underlayment.
3. Double-Layer Felt Underlayment: Install on roof deck parallel with and starting at the eaves. Install a 19-inch- (485-mm-) wide starter course at eaves and completely cover with full-width second course. Install succeeding courses lapping previous courses 19 inches (485 mm) in shingle fashion. Lap ends a minimum of 6 inches (152 mm). Stagger end laps between succeeding courses at least 72 inches (1830 mm). Fasten with felt underlayment nails.
 - a. Apply a continuous layer of asphalt roofing cement over starter course and on felt underlayment surface to be concealed by succeeding courses as each felt course is installed. Apply over entire roof **OR** at locations indicated on Drawings, **as directed**.
 - b. Install felt underlayment on roof sheathing not covered by self-adhering sheet underlayment. Lap edges over self-adhering sheet underlayment not less than 3 inches (75 mm) in direction to shed water.
 - c. Terminate felt underlayment flush **OR** extended up not less than 4 inches (100 mm), **as directed**, against sidewalls, curbs, chimneys, and other roof projections.
4. Self-Adhering Sheet Underlayment: Install, wrinkle free, on roof deck. Comply with low-temperature installation restrictions of underlayment manufacturer if applicable. Install at locations indicated below **OR** on Drawings, **as directed**, lapped in direction to shed water. Lap sides not less than 3-1/2 inches (89 mm). Lap ends not less than 6 inches (152 mm), staggered 24 inches (610 mm) between courses. Roll laps with roller. Cover underlayment within seven days.
 - a. Prime concrete and masonry surfaces to receive self-adhering sheet underlayment.
 - b. Eaves: Extend from edges of eaves 24 inches (610 mm) **OR** 36 inches (914 mm), **as directed**, beyond interior face of exterior wall.
 - c. Rakes: Extend from edges of rakes 24 inches (610 mm) **OR** 36 inches (914 mm), **as directed**, beyond interior face of exterior wall.
 - d. Valleys: Extend from lowest to highest point 18 inches (455 mm) on each side.
 - e. Hips: Extend 18 inches (455 mm) on each side.
 - f. Ridges: Extend 36 inches (914 mm) on each side without obstructing continuous ridge vent slot, **as directed**.
 - g. Sidewalls: Extend 18 inches (455 mm) beyond sidewalls and return vertically against sidewalls not less than 4 inches (100 mm).



- h. Dormers, Chimneys, Skylights, and Other Roof-Penetrating Elements: Extend 18 inches (455 mm) beyond penetrating elements and return vertically against penetrating elements not less than 4 inches (100 mm).
 - i. Roof-Slope Transitions: Extend 18 inches (455 mm) on each roof slope.
 5. Metal-Flashed, Open-Valley Underlayment: Install two layers of 36-inch- (914-mm-) wide felt underlayment centered in valley. Stagger end laps between layers at least 72 inches (1830 mm). Lap ends of each layer at least 12 inches (305 mm) in direction to shed water, and seal with asphalt roofing cement. Fasten each layer to roof deck with felt underlayment nails.
 - a. Lap roof-deck felt underlayment over first layer of valley felt underlayment at least 6 inches (152 mm).
- B. Metal Flashing Installation
 1. General: Install metal flashings and other sheet metal to comply with requirements in Division 07 Section "Sheet Metal Flashing And Trim".
 - a. Install metal flashings according to recommendations for wood roofing in NRCA's "The NRCA Roofing and Waterproofing Manual."
 2. Apron Flashings: Extend lower flange over and beyond each side of downslope wood roofing and up the vertical surface.
 3. Step Flashings: Install with a head lap of 3 inches (75 mm) and extend both horizontally and vertically. Install with lower edge of flashing just upslope of, and concealed by, butt of overlying shingle or shake. Fasten to roof deck only.
 4. Cricket **OR** Backer, **as directed**, Flashings: Install against the roof-penetrating element, extending concealed flange beneath upslope wood roofing and beyond each side.
 5. Open-Valley Flashings: Install centrally in valleys, lapping ends at least 8 inches (205 mm) in direction to shed water. Fasten upper end of each length to roof deck beneath overlap.
 - a. Secure hemmed flange edges into metal cleats spaced 12 inches (305 mm) apart and fastened to roof deck.
 - b. Adhere 9-inch- (230-mm-) wide strip of self-adhering sheet to metal flanges and to self-adhering sheet underlayment.
 6. Rake Drip Edges: Install over underlayment and fasten to roof deck.
 7. Eave Drip Edges: Install beneath underlayment and fasten to roof deck.
 8. Pipe Flashings: Form flashing around pipe penetrations and wood roofing. Fasten and seal to wood roofing.
- C. Roof-Shingle Installation
 1. General: Install wood-shingle roofing according to manufacturer's written instructions and to recommendations in CSSB's "New Roof Construction Manual" and NRCA's "The NRCA Roofing and Waterproofing Manual."
 2. Install drainage mat perpendicular to roof slope in parallel courses, butting edges and ends to form a continuous layer, and fasten to roof deck.
 3. Install single **OR** double, **as directed**, -layer wood-shingle starter course along lowest roof edge. Extend starter course 1 inch (25 mm) **OR** 1-1/2 inches (38 mm), **as directed**, over fascia and 1 inch (25 mm) **OR** 1-1/2 inches (38 mm), **as directed**, over rake edge.
 - a. Offset joints of double-layer starter course a minimum of 1-1/2 inches (38 mm).
 4. Install first course of wood shingles directly over starter course and in continuous straight-line courses across roof deck. Install second and succeeding courses of wood shingles in continuous straight-line courses across roof deck. Extend 1 inch (25 mm) **OR** 1-1/2 inches (38 mm), **as directed**, over rake edge.
 - a. Offset joints between shingles in succeeding courses a minimum of 1-1/2 inches (38 mm). Limit alignment of vertical joints in every third course to not exceed 10 percent of joints.
 - b. Space shingles a minimum of 1/4 inch (6 mm) and a maximum of 3/8 inch (10 mm) apart.
 - c. Fasten each shingle with two nails **OR** staples, **as directed**, spaced 3/4 to 1 inch (19 to 25 mm) from edge of shingle and 1-1/2 to 2 inches (38 to 50 mm) above butt line of succeeding course. Drive fasteners flush with top surface of shingles without crushing wood.



- d. Maintain weather exposure of 5 inches (127 mm) for 16-inch- (405-mm-) **OR** 5-1/2 inches (140 mm) for 18-inch- (455-mm-) **OR** 7-1/2 inches (190 mm) for 24-inch- (610-mm-), **as directed**, long shingles.
5. Open Valleys: Cut and fit wood shingles at open valleys, trimming upper concealed corners of shingles. Maintain uniform width of exposed open valley **OR** Widen exposed portion of open valley 1/8 inch in 12 inches (1:96), **as directed**, from highest to lowest point.
6. Fancy-Butt Shingles: Install one **OR** two **OR** three, **as directed**, courses of fancy-butt shingles in continuous straight-line courses across roof deck. Center each shingle in succeeding courses between the two shingles below it with 1/8-inch (3-mm) space between shingles.
 - a. Maintain weather exposure of 5 inches (127 mm).
7. Ridge Vents: Install continuous ridge vents over wood shingles according to manufacturer's written instructions. Fasten with roofing nails of sufficient length to penetrate roof sheathing.
8. Ridge and Hip, **as directed**, Units: Install units over wood shingles trimmed at apex. Maintain same exposure dimension of units as roof-shingle exposure. Lap units at ridges to shed water away from direction of prevailing winds. Alternate overlaps of units and fasten with concealed roofing nails of sufficient length to penetrate sheathing.
 - a. Install concealed strip of felt underlayment over apex shingles and fasten with felt underlayment nails.
 - b. Fasten ridge units to cover ridge vent without obstructing airflow.

D. Roof-Shake Installation

1. General: Install wood-shake roofing according to manufacturer's written instructions and to recommendations in CSSB's "New Roof Construction Manual" and NRCA's "The NRCA Roofing and Waterproofing Manual."
2. Install drainage mat perpendicular to roof slope in parallel courses, butting edges and ends to form a continuous layer, and fasten to roof deck.
3. Install single **OR** double, **as directed**, -layer wood-shake starter course along lowest roof edge. Extend starter course 1 inch (25 mm) **OR** 1-1/2 inches (38 mm), **as directed**, over fascia and 1 inch (25 mm) **OR** 1-1/2 inches (38 mm), **as directed**, over rake edge.
 - a. Offset joints of double-layer starter course a minimum of 1-1/2 inches (38 mm).
4. Install first course of wood shakes directly over starter course and in continuous straight-line courses across roof deck. Install second and succeeding courses of wood shakes in continuous straight-line courses across roof deck. Extend 1 inch (25 mm) **OR** 1-1/2 inches (38 mm), **as directed**, over rake edge.
 - a. Install 18-inch- (455-mm-) wide strip of felt interlayment over top portion of first and each succeeding course. Set bottom edge of felt interlayment at a distance of twice the weather-exposure dimension above the shake butt. Stagger fasten to roof deck with felt underlayment nails.
 - b. Offset joints between shakes in succeeding courses a minimum of 1-1/2 inches (38 mm).
 - c. Space shakes a minimum of 3/8 inch (10 mm) and a maximum of 5/8 inch (16 mm) apart.
 - d. Fasten each shake with two nails **OR** staples, **as directed**, spaced 3/4 to 1 inch (19 to 25 mm) from edge of shake and 1-1/2 to 2 inches (38 to 50 mm) above butt line of succeeding course. Drive fasteners flush with top surface of shakes without crushing wood.
 - e. Maintain weather exposure of 5-1/2 inches (140 mm) for 18-inch- (455-mm-) **OR** 7-1/2 inches (190 mm) for 18-inch- (455-mm-) **OR** 7-1/2 inches (190 mm) for 24-inch- (610-mm-) **OR** 10 inches (255 mm) for 24-inch- (610-mm-), **as directed**, long shakes.
5. Open Valleys: Cut and fit wood shakes at open valleys, trimming upper concealed corners of shakes. Maintain uniform width of exposed open valley **OR** Widen exposed portion of open valley 1/8 inch in 12 inches (1:96), **as directed**, from highest to lowest point.
6. Ridge Vents: Install continuous ridge vents over wood shakes according to manufacturer's written instructions. Fasten with roofing nails of sufficient length to penetrate sheathing.
7. Ridge and Hip, **as directed**, Units: Install units over wood shakes trimmed at apex. Maintain same exposure dimension of units as roof-shake exposure. Lap units at ridges to shed water away from direction of prevailing winds. Alternate overlaps of units and fasten with concealed roofing nails of sufficient length to penetrate sheathing.



- a. Install concealed strip of felt underlayment over apex shakes and fasten with felt underlayment nails.
 - b. Fasten ridge units to cover ridge vent without obstructing airflow.
- E. Wall-Shingle Installation, Single Coursed
1. Install wood wall shingles according to manufacturer's written instructions and recommendations in CSSB's "Exterior and Interior Wall Manual."
 2. Install drainage mat horizontally, in parallel courses, over surface to receive wood shingles, butting edges and ends to form a continuous layer; fasten to wall sheathing.
 3. Install wood shingles, beginning at base of wall, with a double-layer starter course in a continuous straight line. Offset joints of double-layer starter course a minimum of 1-1/2 inches (38 mm).
 - a. Extend starter course 1 inch (25 mm) **OR** 1-1/2 inches (38 mm), **as directed**, below top of foundation wall.
 4. Install first course of wood shingles over starter course. Install second and succeeding courses of wood shingles. Offset joints between shingles in succeeding courses a minimum of 1-1/2 inches (38 mm).
 - a. Install shingles in continuous straight-line courses.
OR
Install shingle courses with butt lines staggered 1 inch (25 mm) **OR** 1-1/2 inches (38 mm), **as directed**, from true butt line.
 - b. Install primed shingles with sides abutting **OR** Space shingles 1/8 to 1/4 inch (3 to 6 mm) apart, **as directed**.
 - c. Fasten each shingle with two concealed nails **OR** staples driven parallel to butt, **as directed**, spaced 3/4 to 1 inch (19 to 25 mm) from edge of shingle and 1 inch (25 mm) above butt line of succeeding course. For shingles wider than 8 inches (205 mm), add two concealed fasteners, spaced 1 inch (25 mm) apart, to the center of shingle. Drive fasteners flush with top surface of shingles without crushing wood.
 - d. Maintain weather exposure of 7-1/2 inches (190 mm) for 16-inch- (405-mm-) **OR** 8-1/2 inches (215 mm) for 18-inch- (455-mm-) **OR** 11-1/2 inches (290 mm) for 24-inch- (610-mm-), **as directed**, long shingles.
 - e. Interior Corner Treatment: Butted against wood stop **OR** Laced with flashing behind, **as directed**.
 - f. Exterior Corner Treatment: Butted against corner boards **OR** Laced **OR** Mitered, **as directed**.
 5. Fancy-Butt Shingles: Install fancy-butt shingles where indicated, in continuous straight-line courses along wall. Center each shingle in succeeding courses between the two shingles below it with primed shingles abutting **OR** 1/8-inch (3-mm) space between shingles, **as directed**.
 - a. Maintain weather exposure of 7-1/2 inches (190 mm).
 - b. Interior Corner Treatment: Butted against wood stop.
 - c. Exterior Corner Treatment: Butted against corner boards **OR** Mitered, **as directed**.
- F. Wall-Shingle Installation, Double Coursed
1. Install wood wall shingles in continuous straight-line courses according to manufacturer's written instructions and recommendations in CSSB's "Exterior and Interior Wall Manual."
 2. Install drainage mat horizontally, in parallel courses, over surface to receive wood shingles, butting edges and ends to form a continuous layer; fasten to wall sheathing.
 3. Install double-layer undercourse of wood shingles beginning at base of wall. Offset joints of each undercourse layer a minimum of 1-1/2 inches (38 mm). Fasten with a single center-and-top nail **OR** staple driven parallel to butt, **as directed**.
 - a. Extend undercourse 1 inch (25 mm) **OR** 1-1/2 inches (38 mm), **as directed**, below top of foundation wall.
 - b. Fasten two layers of lath wood strips at base of undercourse to match thickness of double-layer undercourse. Extend 1 inch (25 mm) **OR** 1-1/2 inches (38 mm), **as directed**, below top of foundation wall.
 4. Install succeeding undercourse layers against wood lath strip, **as directed**. Offset joints between undercourse and outer course a minimum of 1-1/2 inches (38 mm).



- a. Fasten with a single center-and-top nail **OR** staple driven parallel to butt, **as directed**.
 5. Install single wood lath strip on first and succeeding outer courses to match thickness of undercourse and at height that results in specified outer course weather exposure.
 6. Install first and succeeding outer courses of wood shingles directly over undercourses, projecting 1/2 inch (13 mm) below undercourse **OR** lath strips, **as directed**. Offset joints between shingles and undercourse a minimum of 1-1/2 inches (38 mm). Offset joints between shingles in succeeding outer courses a minimum of 1-1/2 inches (38 mm).
 - a. Install primed outer shingles with sides abutting **OR** Space outer shingles 1/8 to 1/4 inch (3 to 6 mm) apart, **as directed**.
 - b. Fasten each shingle with two exposed nails **OR** staples driven parallel to butt, **as directed**, spaced 3/4 to 1 inch (19 to 25 mm) from edge of shingle and 2 inches (50 mm) above butt line of succeeding course. For outer course shingles wider than 8 inches (205 mm), add two concealed fasteners, spaced 1 inch (25 mm) apart, to the center of shingle. Drive fasteners flush with top surface of shingles without crushing wood.
 - c. Maintain weather exposure of 12 inches (305 mm) for 16-inch- (405-mm-) **OR** 14 inches (355 mm) for 18-inch- (455-mm-) **OR** 16 inches (405 mm) for 24-inch- (610-mm-), **as directed**, long shingles.
 - d. Interior Corner Treatment: Butted against wood stop **OR** Laced with flashing behind, **as directed**.
 - e. Exterior Corner Treatment: Butted against corner boards **OR** Laced **OR** Mitered, **as directed**.
- G. Wall-Shake Installation, Single Coursed
1. Install wood wall shakes according to manufacturer's written instructions and recommendations in CSSB's "Exterior and Interior Wall Manual."
 2. Install drainage mat horizontally, in parallel courses, over surface to receive wood shakes, butting edges and ends to form a continuous layer; fasten to wall sheathing.
 3. Install wood shakes, beginning at base of wall, with a double-layer starter course in a continuous straight line. Offset joints of double-layer starter course a minimum of 1-1/2 inches (38 mm).
 - a. Extend starter course 1 inch (25 mm) **OR** 1-1/2 inches (38 mm), **as directed**, below top of foundation wall.
 4. Install first course of wood shakes over starter course. Install second and succeeding course of wood shakes. Offset joints between shakes in succeeding courses a minimum of 1-1/2 inches (38 mm).
 - a. Install shakes in continuous straight-line courses.
OR
Install shake courses with butt lines staggered 1 inch (25 mm) **OR** 1-1/2 inches (38 mm), **as directed**, from true butt line.
 - b. Install primed shakes with sides abutting **OR** Space shingles 1/8 to 1/4 inch (3 to 6 mm) apart, **as directed**.
 - c. Fasten each shake with two concealed nails **OR** staples driven parallel to butt, **as directed**, spaced 3/4 to 1 inch (19 to 25 mm) from edge of shake and 1 inch (25 mm) above butt line of succeeding course. For shakes wider than 8 inches (205 mm), add two concealed fasteners, spaced 1 inch (25 mm) apart, to the center of shake. Drive fasteners flush with top surface of shakes without crushing wood.
 - d. Maintain weather exposure of 7-1/2 inches (190 mm) for 16-inch- (405-mm-) **OR** 8-1/2 inches (215 mm) for 18-inch- (455-mm-) **OR** 11-1/2 inches (290 mm) for 24-inch- (610-mm-), **as directed**, long shakes.
 - e. Interior Corner Treatment: Butted against wood stop **OR** Laced with flashing behind, **as directed**.
 - f. Exterior Corner Treatment: Butted against corner boards **OR** Laced **OR** Mitered, **as directed**.
- H. Wall-Shake Installation, Double Coursed



1. Install wood wall shakes in continuous straight-line courses according to manufacturer's written instructions and recommendations in CSSB's "Exterior and Interior Wall Manual."
 2. Install drainage mat horizontally, in parallel courses, over surface to receive wood shakes, butting edges and ends to form a continuous layer; fasten to wall sheathing.
 3. Install double-layer undercourse of wood shingles beginning at base of wall. Offset joints of each undercourse layer a minimum of 1-1/2 inches (38 mm). Fasten with a single center-and-top nail **OR** staple driven parallel to butt, **as directed**.
 - a. Extend undercourse 1 inch (25 mm) **OR** 1-1/2 inches (38 mm), **as directed**, below top of foundation wall.
 - b. Fasten two layers of lath wood strips at base of undercourse to match thickness of double-layer undercourse. Extend 1 inch (25 mm) **OR** 1-1/2 inches (38 mm), **as directed**, below top of foundation wall.
 4. Install succeeding undercourse layers against wood lath strip, **as directed**. Offset joints between undercourse and outer course a minimum of 1-1/2 inches (38 mm).
 - a. Fasten with a single center-and-top nail **OR** staple driven parallel to butt, **as directed**.
 5. Install single wood lath strip on first and succeeding outer courses to match thickness of undercourse and at height that results in specified outer course weather exposure.
 6. Install first and succeeding outer courses of wood shakes directly over undercourses, projecting 1/2 inch (13 mm) below undercourse **OR** lath strips, **as directed**. Offset joints between shakes and undercourse shingles a minimum of 1-1/2 inches (38 mm). Offset joints between shakes in succeeding outer courses a minimum of 1-1/2 inches (38 mm).
 - a. Install primed outer shakes with sides abutting **OR** Space outer shakes 1/4 to 3/8 inch (6 to 10 mm) apart, **as directed**.
 - b. Fasten each shake with two exposed nails **OR** staples driven parallel to butt, **as directed**, spaced 3/4 to 1 inch (19 to 25 mm) from edge of shake and 2 inches (50 mm) above butt line of succeeding course. For shakes wider than 8 inches (205 mm), add two concealed fasteners, spaced 1 inch (25 mm) apart, to the center of shake. Drive fasteners flush with top surface of shake without crushing wood.
 - c. Maintain weather exposure of 12 inches (305 mm) for 16-inch- (405-mm-) **OR** 14 inches (355 mm) for 18-inch- (455-mm-) **OR** 18 inches (455 mm) for 24-inch- (610-mm-), **as directed**, long shakes.
 - d. Interior Corner Treatment: Butted against wood stop **OR** Laced with flashing behind, **as directed**.
 - e. Exterior Corner Treatment: Butted against corner boards **OR** Laced **OR** Mitered, **as directed**.
- I. Wood-Shingle-Clad Panel Installation
1. Install wood-shingle-clad panels and corner units, **as directed**, according to manufacturer's written instructions.
 2. Install panels level, plumb, true, and aligned with adjacent materials.
 3. Install panels working from the lowest level to the top of the wall area.

END OF SECTION 07 31 29 13



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Task	Specification	Specification Description
07 31 29 16	07 31 29 13	Wood Shingles And Shakes
07 31 29 17	01 22 16 00	No Specification Required



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**SECTION 07 31 33 00 - COMPOSITE RUBBER SHINGLES**

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for composite rubber shingles. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.
2. Furnish and install this Majestic Slate Tile Roof System in strict accordance with specifications and drawings approved by EcoStar.
3. Metal flashing work is not covered in this specification since EcoStar does **NOT** warrant metal flashing. EcoStar advises that metal flashing and securement of metal should be to industry standards (SMACNA) to prevent the metal from pulling free or buckling. EcoStar also suggests that all flashing metal be copper, stainless steel or an equally long-term material.
4. EcoStar Attic Guard Ridge Ventilation product must be used on those projects that will be using a ridge ventilation system. If a ridge ventilation system is not to be used on the project, another form of ventilation may be used, but will not be covered by any EcoStar warranties. EcoStar advises that a ridge style venting system be utilized to insure the best possible air movement and to provide the best aesthetic appearance to the roofing system.

B. Definitions

1. Roofing Terminology: Refer to ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

C. Submittals

1. Submit an "EcoStar Gold Star Project Survey" to EcoStar Technical Department for approval **PRIOR** to the job start to enable the Technical Department to approve and assign a job number to the project.
2. The "EcoStar Gold Star Project Survey Form" must be filled out completely and accurately to include any prior deviations approved from this specification, including a roof drawing showing all dimensions, all penetrations, and roof slope.
3. When an EcoStar Gold Star Warranty is desired, EcoStar must be contacted **PRIOR** to project bid and installation. Information may be required for wind design and slope requirements.
4. Product Data: For each type of product indicated.
5. Samples: For the following products, of sizes indicated.
 - a. Composite Rubber Shingle: Full size, of each color, size, texture, and shape.
 - b. Ridge Vent System: 12 inches (300 mm) long.
 - c. Fasteners: Three fasteners of each type, length, and finish.
 - d. Underlayment: 12 inches (300 mm) square.

D. Quality Assurance

1. To qualify for an EcoStar Gold Star Warranty, an authorized EcoStar Gold Star Applicator must install system.
2. There shall be no deviation made from this specification without written approval from EcoStar prior to the start of the roofing project.
3. For an EcoStar Gold Star Warranty, upon completion of the installation, an inspection must be conducted by a Technical Representative of EcoStar to ascertain that the roofing system has been installed according to EcoStar's most current published specifications and details. This inspection is not intended to be a Final Inspection for the benefit of the Owner, but for the benefit of EcoStar to determine whether a warranty shall be issued.
4. Class C Testing Requirements:
 - a. Fire Resistance - UL 790 Test Standard
 - b. Class 4 Impact Resistance - UL 2218 Test Standard



- c. 110 mph wind load - PA100-95 Test Standard
- d. Wind uplift - 105 lbs / sq ft - UL 1897 Test Standard
- 5. Class A Testing Requirements:
 - a. Fire Resistance - UL 790 Test Standard
 - b. Class 4 Impact Resistance - UL 2218 Test Standard

E. Product Delivery, Storage And Handling

- 1. Deliver materials in original unopened packages.
- 2. Packages shall be labeled with manufacturer's name, brand name, installation instructions and identification of various items.
- 3. All tile materials must be stored between 45° F. and 80° F. If exposed to lower temperatures, restore to 45° F minimum temperature before using.
- 4. Store all materials in a dry protected area. Damaged materials must **NOT** be used. Installed materials found to be damaged shall be replaced at Gold Star Authorized Applicator's expense.

F. Job Conditions (Cautions And Warnings)

- 1. Contact EcoStar Technical Department for procedures when installing a Majestic Slate Tile Roof System during temperatures less than 45° F.
- 2. Do not install the Majestic Slate Tile Roof System directly over existing asphalt shingles or existing tile roof systems. All existing roof materials **MUST** be removed prior to installation of the Majestic Slate Tile System.
- 3. Roofing surface must be free of ice, water, or snow prior to and during the roofing project.

G. Warranty

- 1. Roofing materials manufacturer will provide the warranty for those materials supplied by the manufacturer when the project is completed by a manufacturer's authorized applicator and all required materials have been utilized within the roof system.
- 2. Only when a manufacturer's technical representative has inspected and approved the completed installation will a warranty be issued.
- 3. The warranty is available for all types of buildings and structures.
- 4. The warranty period is expressed on the warranty certificate, which reflects the inclusive dates of coverage.
- 5. The warranty does **NOT** cover the aesthetic appearance of the Majestic Slate - Tiles. Care should be taken by the authorized applicator to ensure that proper blending of the tiles occurs. When improper blending occurs the aesthetic appearance of the roof can be effected negatively. Blending should occur from a minimum of seven bundles from each pallet. It is highly suggested that all material be on site to blend from.
- 6. Only products supplied by EcoStar, a Division of Carlisle SynTec Incorporated, are included in the warranty unless otherwise specified and approved in writing by EcoStar, a Division of Carlisle SynTec Incorporated.

1.2 PRODUCTS

A. Manufacturer

- 1. All Components of the Majestic Slate - Tile Roof System are to be products manufactured or supplied by EcoStar, a Division of Carlisle SynTec Incorporated, or approved equivalent.

B. Class C Tile Roofing System

- 1. Slate Tiles/Shingles: Tiles made of Starloy™, 100% recycled rubber and plastic compound, 12" wide by 18" long with a nominal thickness of 1/4". Weight shall be determined by the following acceptable tile exposures:

7"	241 - 258 lbs per square
6-1/2"	259 - 278 lbs per square
6"	280 - 300 lbs per square



- a. Color: As selected from manufacturer's standard colors, unless directed otherwise.
- 2. Underlayment
 - a. AquaGuard - a roofing underlayment recognized for use as an alternative to Type 30 roofing underlayment, consisting of spunbonded polypropylene coated with a layer of U.V. stabilized polypropylene on both sides, meeting requirements of ASTM D2626, referred to as 30 lb and without perforations.
 - b. Glacier Guard ice and water underlayment - Granular Surface (55 mil), Smooth Surface (40 mil), or Smooth Surface High Temperature (40 mil), a composite membrane consisting of fiberglass reinforced rubberized asphalt laminated to an impermeable polyethylene film layer (Smooth Surface and Smooth Surface High Temperature) or coated with a granular surface providing maximum skid resistance (Granular Surface).
- C. Class A Tile Roofing System
 - 1. Slate Tiles/Shingles: Tiles made of Starloy™, 100% recycled rubber and plastic compound, 12" wide by 18" long with a nominal thickness of 1/4". Weight shall be determined by the following acceptable tile exposures:
 - 7" 258 - 276 lbs per square
 - 6-1/2" 278 - 294 lbs per square
 - 6" 300 - 321 lbs per square
 - a. Color: As selected from manufacturer's standard colors, unless directed otherwise.
 - 2. Underlayment
 - a. VersaShield - One layer of Elk VersaShield meeting or exceeding the requirements of ASTM D226.
 - b. Glacier Guard ice & water underlayment - Granular Surface (55 mil), Smooth Surface (40 mil), or Smooth Surface High Temperature (40 mil), a composite membrane consisting of fiberglass reinforced rubberized asphalt laminated to an impermeable polyethylene film layer (Smooth Surface and Smooth Surface High Temperature) or coated with a granular surface providing maximum skid resistance (Granular Surface).
- D. Fasteners
 - 1. AquaGuard/VersaShield
 - a. Roofing nails with one inch (1") diameter round or square head, plastic or metal, and 3/4" long shank. Metal parts of fastener are to be corrosion resistant.
 - 2. Tile Fasteners
 - a. EcoStar Roofing Nail with a 3/8" diameter head and a minimum of 1-1/2" long shank made from stainless steel. Nails can be supplied either as a hand drive style or in coils for use in pneumatic tools.

1.3 EXECUTION

- A. Substrate Criteria
 - 1. The Building owner or the Owner's Representative is responsible for providing and determining that the substrate is suitable to receive the Majestic Slate Tile Roof System and the authorized EcoStar Gold Star Applicator should not proceed until all defects have been corrected.
 - 2. The Majestic Slate Roof System may only be applied over:
 - a. Minimum 1/2" plywood or OSB decking
 - b. Minimum 1" tongue and groove wood decking
 - c. Approved metal deck systems - for specifics contact roofing materials manufacturer.
 - 3. Minimum slope of substrate for installation of Majestic Slate Roof System shall be a minimum of 3/12 for 6" exposure installation and a minimum of 6/12 for 7" exposure installation. Contact the EcoStar Technical Department for approval of applications on lower slopes or exceptions to this requirement.
- B. Substrate Preparation



1. The Building Owner or the Owner's Representative is responsible for ensuring that all wet or damaged substrate has been removed in a re-roofing application.
2. Existing roof material **MUST** be removed and a clean substrate free of foreign material be provided prior to the installation of the Majestic Slate Tile Roof System. Majestic Slate Tiles may **NOT** be installed directly over any existing roof material or system.

C. Installation

1. Flashing and Sheet Metal:
 - a. Install sheet metal and flashing metal in all valleys and where required on projections furnish in accordance with Division 07 Section "Sheet Metal Flashing And Trim".
 - b. Where required, install metal starter strip at all eaves and roof edges. Furnish metal in accordance with Division 07 Section "Sheet Metal Flashing And Trim".
 - c. The roofing materials manufacturer suggests that all metal work be made from copper, stainless steel or an equally long-term material.
2. Underlayment:
 - a. AquaGuard:
 - 1) Apply 41.5" wide sheet over complete deck, lapping the area covered with Glacier Guard ice and water underlayment. Lap end joints 6" and side joints 4" and double through valleys.
 - 2) Do not leave exposed to weather more than 90 days after beginning of installation without written approval of the Owner.
 - 3) Do not leave any fastener heads exposed. Nail only in areas to be covered by lapping of underlayment.
 - b. VersaShield:
 - 1) Apply 42" wide sheet over complete deck, covering the entire roof deck **INCLUDING** those areas with Glacier Guard Ice & Water underlayment. Lap end joints 4" and side joints 6".
 - 2) Lap the VersaShield 6" from both sides over all hips, valleys, and ridges.
 - 3) Where the roof meets a vertical surface, carry the VersaShield 3" to 4" up the surface.
 - 4) Do not leave exposed to weather more than **60** days after beginning of installation without written approval of the Owner.
 - 5) Do not leave any fastener heads exposed. Nail only in areas to be covered by lapping of underlayment.
 - c. Glacier Guard Ice and water underlayment:
 - 1) Lap end joints 6" and side joints 3.5"
 - 2) Apply continuous 36" wide sheet in valley centered over valley.
 - 3) Apply rows of 36" wide sheets along all eaves and rakes. Lap end joints 6" and side joints 3.5".
 - 4) Apply rows of 36" wide sheets along and around all dormers and roof projections. Lap end joints 6" and side joints 3.5".
 - 5) When applicable install as far as it can be installed on any head walls or vertical walls a minimum of 12".
 - 6) Do not leave Glacier Guard Granular Surface exposed to weather more than 14 days after beginning of installation. Do not leave Glacier Guard Smooth Surface exposed to weather more than 30 days after beginning of installation. Do not leave Glacier Guard Smooth Surface High Temp exposed to the weather more than 60 days after the beginning of installation.
3. Tile/Shingle Installation
 - a. After installing underlayment and before installing the tiles, clean the surface of debris and dirt.
 - b. Beginning at the eave, install a layer of tiles gapped a minimum of 3/8" between tiles and any projections, with two roofing fasteners per tile (in location shown on tiles). This layer of tiles will become the starter row. Install another layer of tiles in the same manner as the first with the exception of the second layer having a 1/2 tile offset to the first layer.



- c. Continue installing tiles per the chosen exposure.
- d. Care must be taken to place tiles so color variations are evenly distributed over the entire roof area. Tiles between bundles and pallets **MUST** be shuffled to insure even distribution of color variations. "Patchy" or "Blotching" in appearance is not acceptable and the applicator will be required to correct. It is recommended that work not begin until all roofing materials have been delivered to the job site.
- e. It is the responsibility of the applicator to ensure that all tiles are bent back in a downward curve prior to installation. **Do not install tiles with an upward curve.**
- f. Either an open or closed valley design may be used.
 - 1) With an open valley design leave a minimum of 2" on each side of the center of the valley exposed and uncovered by the roof tiles. A V-Style or W-Style Valley metal may be used.
 - 2) With a closed valley design cut the tiles in a straight line to fit no closer than 3/8" against tile of adjoining roof slope.
- g. Minimum Fastening - No less than 2 approved fasteners per tile, with a minimum length of 1-1/2", shall be used.
- h. CAUTION: When using a pneumatic nailer, care shall be taken to ensure that nails are not over driven causing the tiles to curl upward. If tiles have been installed with over-driven nails causing the ends of the tile to curve upward, tiles will never lay flat. Over-driven tiles must be removed and re-nailed properly.
- i. Install EcoStar Attic Guard ridge vent system per the manufacturer's application instructions, and then place the Majestic Slate - Universal Hip/Ridge Tile over the ridge vent. A minimum 2.5" stainless steel, hand-driven EcoStar fastener should be used on a ventilated hip/ridge to fasten the hip/ridge tile to the deck. A minimum 2" stainless steel, hand-driven EcoStar fastener should be used on an unventilated hip/ridge to fasten the hip/ridge tile to the deck. Place fasteners in the location marked on the tile. Majestic Slate - Universal Hip/Ridge Tile must be installed with 6" exposure.
- j. Tiles may not be installed if the tiles have been stored in temperatures lower than 45° F. If tiles have been stored in temperatures below 45° F., tiles must be brought back to an ambient material temperature of 45° F. As the temperature rises, tiles will expand beyond the designed installation pattern if the product is installed while cold or frozen.
- k. Do not install tiles directly adjacent to each other. A minimum gap of 3/8" must be maintained between installed tiles.
- l. After the initial row of tiles has been installed, it is recommended that a chalk line be placed parallel to the roof edge and running perpendicular to the first row of tiles. This chalk line will ensure that the tiles stay true and plumb to the roof edge throughout installation.
- m. Care must be taken to minimize foot traffic over completed areas of the roof. Tiles will show mud and dirt and cause appearance problems. The removal of dirt and debris is the responsibility of the applicator.
- n. Tiles can be slippery when wet, caution should be exhibited with early morning dew and after rain. The tile manufacturer suggests the use of toe boards and OSHA approved harnesses and safety equipment at all time.
- o. Upon completion of the roof system installation, inspect and remove all debris from roof, sweep clean and wash with a mild, non-bleaching detergent.

END OF SECTION 07 31 33 00



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Task	Specification	Specification Description
07 31 33 00	01 22 16 00	No Specification Required



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SECTION 07 32 13 00 - CLAY ROOF TILES

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for clay roof tiles. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Clay roof tiles.
 - b. Underlayment.
 - c. Snow guards.

C. Definitions

1. Roofing Terminology: See ASTM D 1079, glossaries in TRI/WSRCA's "Concrete and Clay Roof Tile Design Criteria Installation Manual for Moderate Climate Regions," and NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

D. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittal:
 - a. Product Test Reports for Credit SS 7.2: For clay roof tiles, documentation indicating compliance with Solar Reflectance Index requirement.
3. Samples: For each type of clay roof tile and accessory tile indicated.
4. Material test reports.
5. Research/evaluation reports.
6. Maintenance data.
7. Warranties: Sample of special warranties.

E. Quality Assurance

1. Fire-Test-Response Characteristics: Provide clay roof tiles and related roofing materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
 - a. Exterior Fire-Test Exposure: Class A **OR** Class B **OR** Class C, **as directed**; UL 790 or ASTM E 108, for application and roof slopes indicated.
2. Preinstallation Conference: Conduct conference at Project site.

F. Delivery, Storage, And Handling

1. Store underlayment rolls on end, on pallets or other raised surfaces. Do not double stack rolls.
 - a. Handle, store, and place roofing materials in a manner to avoid significant or permanent damage to roof deck or structural supporting members.
2. Protect unused underlayment from weather, sunlight, and moisture when left overnight or when roofing work is not in progress.

G. Warranty

1. Special Warranty: Standard form in which manufacturer agrees to repair or replace clay roof tiles that fail in materials within specified warranty period.
 - a. Materials-Only Warranty Period: 50 years from date of Final Completion.



1.2 PRODUCTS

A. Clay Roof Tiles

1. Clay Roof Tiles: ASTM C 1167, molded- or extruded-clay roof tile units of shape and configuration indicated, kiln fired to vitrification, and free of surface imperfections. Provide with fastening holes prepunched at factory before firing.
 - a. Durability: Grade 1 **OR** Grade 2 **OR** Grade 3, **as directed**.
 - b. High-Profile Shape: Type I, Spanish or "S" **OR** Type I, tapered mission, two piece **OR** Type I, straight mission, two piece **OR** Type I, straight barrel mission, two piece **OR** Type I, Greek, two piece **OR** Type I, Roman, two piece, **as directed**.
 - c. Low-Profile Shape: Type II, French interlocking.
 - d. Flat Shape: Type III, flat shingle **OR** Type III, flat interlocking, **as directed**.
 - 1) Provide clay roof tiles of diminishing widths for circular bays or round towers.
 - e. Solar Reflectance Index: Provide clay roof tile with Solar Reflectance Index not less than 29 when calculated according to ASTM E 1980, based on testing of identical products by a qualified testing agency.
 - f. Finish and Texture: Matte, smooth **OR** Matte, striated **OR** Glazed, smooth, **as directed**.
 - g. Color: Terra cotta **OR** Brown **OR** Red **OR** Blended red **OR** Buff, **as directed**.
 - h. High **OR** Low, **as directed**, -Profile-Shape Accessory Tiles: Ridge, ridge vent, ridge end, hip and hip starter, header course, L-shaped rake edge, roll rake edge, starter, end band, terminal, eave closure, and top fixture, **as directed**, units, in color matching clay roof tiles.
 - i. Flat-Shape Accessory Tiles: Ridge and closed ridge end, hip and hip starter, header course, L-shaped rake edge, starter, end band, and terminal, **as directed**, units, in color matching clay roof tiles.

B. Accessories

1. Asphalt Roofing Cement: ASTM D 4586, Type II, asbestos free.
2. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied.
3. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane **OR** silicone, **as directed**, -based joint sealant; Type M **OR** Type S, **as directed**, Grade NS, Class 25, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O.
4. Roofing Asphalt: ASTM D 312, Type IV.
5. Cold-Applied Adhesive: Manufacturer's standard asphalt-based, one- or two-part, asbestos-free, cold-applied adhesive specially formulated for compatibility and use with underlayments.
6. Foam Adhesive: Two-component, polyurethane expanding adhesive recommended for application by clay roof tile manufacturer.
OR
Mortar: ASTM C 270, Type M, natural color **OR** with ASTM C 979, pigmented mortar matching the color of clay roof tiles for exposed-to-view mortar, and natural color for concealed-from-view mortar, **as directed**.
7. Eave Closure: Manufacturer's standard EPDM **OR** copper **OR** stainless-steel **OR** galvanized-steel **OR** aluminum, mill finish, **as directed**, eave closure formed to shape of clay roof tile.
8. Wood Nailers, Beveled Cant Strips and Wood Battens: Comply with requirements for pressure-preservative-treated wood in Division 06 Section(s) "Rough Carpentry" **OR** "Miscellaneous Rough Carpentry", **as directed**.
9. Mesh Fabric: 18-by-14 (1.1-by-1.4-mm) mesh of PVC-coated, glass-fiber thread.

C. Fasteners

1. Roofing Nails: ASTM F 1667, copper, 0.135-inch- (3.4-mm-) **OR** aluminum, 0.1055-inch- (2.7-mm-) **OR** hot-dip galvanized-steel, 0.1055-inch- (2.7-mm-), **as directed**, diameter shank, sharp-pointed, conventional roofing nails with barbed shanks; minimum 3/8-inch- (10-mm-) diameter head; of sufficient length to penetrate 3/4 inch (19 mm) into wood battens **OR** solid wood decking **OR** roof-deck sheathing, **as directed**.



- a. Where nails are in contact with metal flashing, use nails made from same metal as flashing.
 2. Felt Underlayment Nails: Aluminum, stainless-steel, or hot-dip galvanized-steel wire with low-profile capped heads or disc caps, 1-inch (25-mm) minimum diameter.
 3. Wood Batten Nails: ASTM F 1667; common or box, steel wire, flat head, and smooth shank.
 4. Wire Ties: Copper **OR** Brass **OR** Stainless steel, **as directed**, 0.083-inch (2.1-mm) minimum diameter.
 5. Twisted-Wire-Tie System: Continuously twisted, two-wire unit with loops formed 6 inches (152 mm) apart, minimum 0.1-inch- (2.5-mm-) diameter brass wire and 0.06-inch- (1.5-mm-) diameter brass tie wires **OR** 0.1-inch- (2.5-mm-) diameter copper wire and 0.06-inch- (1.5-mm-) diameter brass tie wires **OR** 0.083-inch- (2.1-mm-) diameter stainless-steel wire and 0.037-inch- (0.94-mm-) diameter stainless-steel tie wires **OR** 0.083-inch- (2.1-mm-) diameter galvanized-steel wire and 0.037-inch- (0.94-mm-) diameter galvanized-steel tie wires, **as directed**, with matching-metal folding clip anchors.
 6. Single-Line, Wire-Tie System: Interconnecting eave-to-ridge system, minimum 0.1-inch- (2.5-mm-) diameter brass **OR** 0.09-inch- (2.3-mm-) diameter galvanized-steel, **as directed**, wire, preformed to accommodate clay roof tile type and application indicated.
 7. Hook Nails: One-piece wind lock and clay roof tile fastener system, minimum 0.1-inch- (2.5-mm-) diameter brass **OR** 0.09-inch- (2.3-mm-) diameter galvanized-steel, **as directed**, wire, for direct deck nailing.
 8. Tile Locks: Brass **OR** Copper **OR** Stainless-steel **OR** Hot-dip galvanized-steel, **as directed**, 0.1-inch- (2.5-mm-) diameter wire device designed to secure butt edges of overlaid clay roof tiles.
 9. Storm Clips: Brass **OR** Stainless-steel **OR** Hot-dip galvanized-steel, **as directed**, strap-type, 0.04-by-1/2-inch (1.0-by-13-mm), L-shaped retainer clips designed to secure side edges of clay roof tiles. Provide with two fastener holes in base flange.
- D. Underlayment Materials
1. Felt Underlayment: ASTM D 226, Type II, asphalt-saturated organic felt, unperforated.
 2. Felt Underlayment: ASTM D 2626, asphalt-saturated and -coated organic felt, dusted with fine mineral surfacing on both sides, unperforated.
 3. Roll Roofing Underlayment: ASTM D 6380, Class M, Type II, asphalt-saturated and -coated organic felt, mineral-granule surfaced.
 4. Self-Adhering Sheet Underlayment, Granular Surfaced: ASTM D 1970, a minimum of 55-mil- (1.4-mm-) thick sheet; glass-fiber-mat-reinforced, SBS-modified asphalt; mineral-granule surfaced; with release paper backing; cold applied. Provide primer for adjoining concrete or masonry surfaces to receive underlayment, **as directed**.
 5. Self-Adhering Sheet Underlayment, Polyethylene Faced: ASTM D 1970, a minimum of 40-mil- (1.0-mm-) thick, slip-resisting, polyethylene-film-reinforced top surface laminated to SBS-modified asphalt adhesive, with release paper backing; cold applied. Provide primer for adjoining concrete or masonry surfaces to receive underlayment, **as directed**.
- E. Snow Guards
1. Snow-Guard Pads: Fabricated copper **OR** cast-bronze **OR** zinc **OR** stainless-steel **OR** aluminum, **as directed**, units, designed to be installed without penetrating roof tiles, and complete with predrilled holes or hooks for anchoring.
 2. Snow-Guard Rails: Units fabricated from metal baseplate anchored to adjustable **OR** fixed, **as directed**, bracket and equipped with two **OR** three, **as directed**, bars.
 - a. Brackets and Baseplate: Aluminum **OR** Bronze or brass **OR** Stainless steel, **as directed**.
 - b. Bars: Aluminum, mill finished **OR** Aluminum, clear anodized **OR** Stainless steel, mill finished, **as directed**.
- F. Metal Flashing And Trim
1. General: Comply with requirements in Division 07 Section "Sheet Metal Flashing And Trim".
 - a. Sheet Metal: Copper **OR** Stainless steel **OR** Zinc-tin alloy-coated stainless steel **OR** Zinc-tin alloy-coated steel **OR** Zinc-tin alloy-coated copper **OR** Anodized aluminum **OR** Aluminum, mill finished, **as directed**.



2. Fabricate sheet metal flashing and trim to comply with recommendations that apply to design, dimensions, metal, and other characteristics of the item in SMACNA's "Architectural Sheet Metal Manual."
 - a. Apron Flashings: Fabricate with lower flange extending a minimum of 4 inches (100 mm) **OR** 6 inches (152 mm), **as directed**, over and 4 inches (100 mm) beyond each side of downslope tile roofing and 6 inches (152 mm) up the vertical surface.
 - b. Step Flashings: Fabricate with a head lap of 3 inches (75 mm) and a minimum extension of 4 inches (100 mm) **OR** 5 inches (127 mm), **as directed**, both horizontally and vertically.
 - c. Channel Flashings: Fabricate with vertical surface extending a minimum of 4 inches (100 mm) **OR** 5 inches (127 mm), **as directed**, above the clay roof tile and 4 inches (100 mm) **OR** 6 inches (152 mm), **as directed**, beneath the tile roofing, with a 1-inch- (25-mm-) high vertical return to form a runoff channel.
 - d. Rake Pan Flashings: Fabricate with vertical surface extending over fasciae and 6 inches (152 mm) beneath the tile roofing, with a 1-inch- (25-mm-) high vertical return to form a runoff channel.
 - e. Cricket **OR** Backer, **as directed**, Flashings: Fabricate with concealed flange extending a minimum of 18 inches (455 mm) **OR** 24 inches (610 mm), **as directed**, beneath upslope tile roofing, 6 inches (152 mm) beyond each side of chimney **OR** skylight, **as directed**, and 6 inches (152 mm) above the roof plane.
 - f. Closed **OR** Open, **as directed**, -Valley Flashings: Fabricate in lengths not exceeding 10 feet (3 m), with 1-inch- (25-mm-) high, inverted-V profile at center of valley and with equal flange widths of 10 inches (255 mm) **OR** 12 inches (305 mm), **as directed**.
 - g. Drip Edges: Fabricate in lengths not exceeding 10 feet (3 m), with 2-inch (50-mm) roof-deck flange and 1-1/2-inch (38-mm) fascia flange with 3/8-inch (10-mm) drip at lower edge.
3. Sheet Metal Ridge Vent: Fabricate from 16-oz./sq. ft.- (0.55-mm-) thick copper sheet, terminating each side in V-shaped external baffles with venting holes producing net-free ventilating area of 2.65 sq. in./ft. (56 sq. cm/m).
4. Vent-Pipe Flashings: ASTM B 749, Type L51121, at least 1/16 inch (1.6 mm) thick. Provide lead sleeve sized to slip over and turn down into pipe, soldered to skirt at slope of roof and extending at least 4 inches (100 mm) from pipe onto roof.

1.3 EXECUTION

A. Underlayment Installation

1. General: Comply with clay roof tile manufacturer's written instructions and recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."
 - a. Cover ridge **OR** hip, **as directed**, wood nailers with underlayment strips.
2. Single-Layer Felt Underlayment: Install on roof deck parallel with and starting at the eaves. Lap sides a minimum of 2 inches (50 mm) over underlying course. Lap ends a minimum of 4 inches (100 mm). Stagger end laps between succeeding courses at least 72 inches (1830 mm). Fasten with felt underlayment **OR** roofing, **as directed**, nails.
 - a. Install felt underlayment on roof deck not covered by self-adhering sheet underlayment. Lap sides of felt over self-adhering sheet underlayment not less than 3 inches (75 mm) in direction to shed water. Lap ends of felt not less than 6 inches (152 mm) over self-adhering sheet underlayment.
3. Double-Layer Felt Underlayment: Install on roof deck parallel with and starting at the eaves. Install a 19-inch- (485-mm-) wide starter course at eaves and completely cover with full-width second course. Install succeeding courses lapping previous courses 19 inches (485 mm) in shingle fashion. Lap ends a minimum of 6 inches (152 mm). Stagger end laps between succeeding courses at least 72 inches (1830 mm). Fasten with felt underlayment **OR** roofing, **as directed**, nails.
 - a. Apply a continuous layer of asphalt roofing cement over starter course and on felt underlayment surface to be concealed by succeeding courses as each felt course is installed. Apply over entire roof **OR** at locations indicated on Drawings, **as directed**.



- b. Install felt underlayment on roof sheathing not covered by self-adhering sheet underlayment. Lap edges over self-adhering sheet underlayment not less than 3 inches (75 mm) in direction to shed water.
4. Double-Layer Felt/Roll Roofing Underlayment:
 - a. Install single layer of felt underlayment on roof deck parallel with and starting at the eaves. Lap sides a minimum of 2 inches (50 mm) over underlying course. Lap ends a minimum of 4 inches (100 mm). Stagger end laps between succeeding courses at least 72 inches (1830 mm). Fasten with felt underlayment **OR** roofing, **as directed**, nails.
 - b. Install roll roofing underlayment, in parallel courses, in same direction as felt underlayment. Lap ends a minimum of 6 inches (152 mm). Stagger end laps between succeeding courses at least 72 inches (1830 mm).
 - 1) Mechanically fasten over felt underlayment.
 - 2) Adhere to felt underlayment with solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F (14 deg C) of equiviscous temperature **OR** uniform coating of cold-applied adhesive **OR** uniform coating of asphalt roofing cement, **as directed**.
 - c. Terminate felt underlayment flush **OR** extended up not less than 4 inches (100 mm), **as directed**, against chimneys, sidewalls, curbs, and other projections.
5. Self-Adhering Sheet Underlayment: Install wrinkle free; comply with low-temperature installation restrictions of underlayment manufacturer if applicable. Install at locations indicated below **OR** on Drawings, **as directed**, lapped in direction to shed water. Lap sides not less than 3-1/2 inches (89 mm). Lap ends not less than 6 inches (152 mm), staggered 24 inches (610 mm) between succeeding courses. Roll laps with roller. Cover underlayment within seven days.
 - a. Prime concrete and masonry surfaces to receive self-adhering sheet underlayment.
 - b. Extend self-adhering sheet underlayment over entire roof deck.
OR
Extend self-adhering sheet underlayment over roof deck as follows:
 - 1) Eaves: Extend from edges of eaves 24 inches (610 mm) **OR** 36 inches (914 mm), **as directed**, beyond interior face of exterior wall.
 - 2) Rakes: Extend from edges of rakes 24 inches (610 mm) **OR** 36 inches (914 mm), **as directed**, beyond interior face of exterior wall.
 - 3) Valleys: Extend from lowest to highest point 18 inches (455 mm) on each side.
 - 4) Hips: Extend 18 inches (455 mm) on each side.
 - 5) Ridges: Extend 36 inches (914 mm) on each side without obstructing continuous ridge vent slot, **as directed**.
 - 6) Sidewalls: Extend 18 inches (455 mm) beyond sidewalls and return vertically against sidewalls not less than 4 inches (100 mm).
 - 7) Dormers, Chimneys, Skylights, and Other Roof-Penetrating Elements: Extend 18 inches (455 mm) beyond penetrating elements and return vertically against penetrating elements not less than 4 inches (100 mm).
 - 8) Roof-Slope Transitions: Extend 18 inches (455 mm) on each roof slope.
6. Double-Layer Felt/Self-Adhering Sheet Underlayment:
 - a. Install single layer of felt underlayment on roof deck parallel with and starting at the eaves. Lap sides a minimum of 2 inches (50 mm) over underlying course. Lap ends a minimum of 4 inches (100 mm). Stagger end laps between succeeding courses at least 72 inches (1830 mm). Fasten with felt underlayment **OR** roofing, **as directed**, nails.
 - b. Install self-adhering sheet underlayment, wrinkle free, on felt underlayment. Comply with low-temperature installation restrictions of underlayment manufacturer if applicable. Lap sides not less than 3-1/2 inches (89 mm) in direction to shed water. Lap ends not less than 6 inches (152 mm), staggered 24 inches (610 mm) between succeeding courses. Roll laps with roller. Cover underlayment within seven days.
7. Metal-Flushed, Open-Valley Underlayment: Install two layers of 36-inch- (914-mm-) wide felt underlayment centered in valley. Stagger end laps between layers at least 72 inches (1830 mm). Lap ends of each layer at least 12 inches (305 mm) in direction to shed water, and seal with asphalt roofing cement. Fasten each layer to roof deck with felt underlayment nails.
 - a. Lap roof-deck felt underlayment over first layer of valley felt underlayment at least 6 inches (152 mm).



B. Metal Flashing Installation

1. General: Install metal flashings and other sheet metal to comply with requirements in Division 07 Section "Sheet Metal Flashing And Trim".
 - a. Install metal flashings according to clay roof tile manufacturer's written instructions and recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."
2. Apron Flashings: Extend lower flange over and beyond each side of downslope tile roofing and up the vertical surface.
3. Step Flashings: Install with a head lap of 3 inches (75 mm) and extend both horizontally and vertically. Install with lower edge of flashing just upslope of, and concealed by, butt of overlying tile. Fasten to roof deck only.
4. Cricket **OR** Backer, **as directed**, Flashings: Install against roof-penetrating elements, extending concealed flange beneath upslope tile roofing and beyond each side.
5. Open-Valley Flashings: Install centrally in valleys, lapping ends at least 8 inches (205 mm) in direction to shed water. Fasten upper end of each length to roof deck beneath overlap.
 - a. Secure hemmed flange edges into metal cleats spaced 12 inches (305 mm) apart and fastened to roof deck.
 - b. Adhere 9-inch- (230-mm-) wide strips of self-adhering sheet to metal flanges and to self-adhering sheet underlayment.
6. Channel Flashings: Install over underlayment and fasten to roof deck.
7. Rake Pan Flashings: Install over underlayment and fasten to roof deck.
8. Rake Drip Edges: Install over underlayment and fasten to roof deck.
9. Eave Drip Edges: Install beneath underlayment and fasten to roof deck.
10. Pipe Flashings: Form flashing around pipe penetrations and tile roofing. Fasten and seal to tile roofing.
11. Sheet Metal Ridge Vents: Install centrally, and mechanically fasten to wood ridge. Adhere each side to clay roof tile with elastomeric sealant.
 - a. Install fabric mesh over roof-deck air ventilation gaps to prevent insect entry.

C. Wood Nailers And Battens, **as directed**

1. Install wood nailers at ridges **OR** hips **OR** rakes, **as directed**, and securely fasten to roof deck.
2. Install beveled wood cant at eaves and securely fasten to roof deck.
3. Install nominal 1-by-2-inch (25-by-50-mm) wood battens horizontally over 1/2-inch- (13-mm-) high, pressure-preservative-treated wood lath strips **OR** in 48-inch (1200-mm) lengths with ends separated by 1/2 inch (13 mm), **as directed**, at spacing required by clay roof tile manufacturer, and securely fasten to roof deck.
 - a. Install nominal 1-by-2-inch (25-by-50-mm) wood counter battens vertically spaced 24 inches (610 mm) apart and securely fasten to roof deck.

D. Clay Roof Tile Installation

1. General: Install clay roof tiles according to manufacturer's written instructions, to recommendations in TRI/WSRCA's "Concrete and Clay Roof Tile Design Criteria Installation Manual for Moderate Climate Regions," and to NRCA's "The NRCA Roofing and Waterproofing Manual."
 - a. Maintain uniform exposure and coursing of clay roof tiles throughout roof.
 - b. Extend tiles 2 inches (50 mm) over eave fasciae.
 - c. Nail Fastening: Drive nails to clear the clay roof tile so the tile hangs from the nail and is not drawn up.
 - 1) Install wire through nail holes of cut tiles that cannot be nailed directly to roof deck, and fasten to nails driven into deck.
 - d. Wire-Tie Fastening: Install wire-tie systems and fasten clay roof tiles according to manufacturer's written instructions.
 - e. Foam-Adhesive **OR** Mortar, **as directed**, Setting: Install clay roof tile according to TRI/FRSA's "Concrete and Clay Roof Tile Installation Manual."
 - f. Install storm clips to capture edges of longitudinal sides of clay roof tiles and securely fasten to roof deck.



- g. Install clay roof tile locks to support and lock overlying tile butts to underlying tiles.
 - h. Cut and fit clay roof tiles neatly around roof vents, pipes, ventilators, and other projections through roof. Fill voids with mortar.
 - i. Install clay roof tiles with color blend approved by the Owner.
2. Flat Shingle Clay Roof Tile Installation:
- a. Maintain 2-inch (50-mm) head lap between succeeding courses of clay roof tiles.
 - b. Offset joints by half the clay roof tile width in succeeding courses.
 - c. Extend clay roof tiles 1 inch (25 mm) over fasciae at rakes.
 - d. Install ridge tiles in V-ridge **OR** saddle **OR** mitered, **as directed**, configuration with laps facing away from prevailing wind. Seal laps with asphalt roofing cement **OR** butyl sealant **OR** elastomeric sealant, **as directed**.
 - 1) Close voids where ridge tiles meet clay roof tiles with ridge closure tiles **OR** mortar struck with face of ridge cover tiles, **as directed**.
 - e. Install hip tiles in V-ridge **OR** saddle **OR** mitered, **as directed**, configuration. Seal laps with asphalt roofing cement **OR** butyl sealant **OR** elastomeric sealant, **as directed**.
 - 1) Fill voids with mortar where hip tiles meet clay roof tiles, and strike mortar flush with face of hip cover tiles.
3. Flat Interlocking Clay Roof Tile Installation:
- a. Provide minimum 3-inch (75-mm) lap between succeeding courses of clay roof tiles.
 - b. Offset joints by half the clay roof tile width in succeeding courses.
 - c. Install L-shaped rake tiles.
 - d. Install ridge tiles in V-ridge **OR** saddle **OR** mitered, **as directed**, configuration with laps facing away from prevailing wind. Seal laps with asphalt roofing cement **OR** butyl sealant **OR** elastomeric sealant, **as directed**.
 - 1) Close voids where ridge tiles meet clay roof tiles with ridge closure tiles **OR** mortar struck with face of ridge cover tiles, **as directed**.
 - e. Install hip tiles in V-ridge **OR** saddle **OR** mitered, **as directed**, configuration. Seal laps with asphalt roofing cement **OR** butyl sealant **OR** elastomeric sealant, **as directed**.
 - 1) Fill voids with mortar where hip tiles meet clay roof tiles, and strike mortar flush with face of hip cover tiles.
4. Low-Profile, Interlocking Clay Roof Tile Installation:
- a. Provide minimum 3-inch (75-mm) lap between succeeding courses of clay roof tiles.
 - b. Install L-shaped rake tiles.
 - c. Install ridge tiles with laps facing away from prevailing wind. Seal laps with asphalt roofing cement **OR** butyl sealant **OR** elastomeric sealant, **as directed**.
5. High-Profile Clay Roof Tile Installation:
- a. Install tile **OR** sheet metal **OR** EPDM, **as directed**, eave closure.
 - b. Provide minimum 3-inch (75-mm) lap between succeeding courses of clay roof tiles.
 - c. Install L-shaped **OR** roll, **as directed**, rake tiles.
 - d. Install ridge tiles with laps facing away from prevailing wind. Seal laps with asphalt roofing cement **OR** butyl sealant **OR** elastomeric sealant, **as directed**.
6. Open Valleys: Cut clay roof tiles at open valleys to form straight lines. Maintain uniform width of exposed open valley **OR** Widen exposed portion of open valley 1/8 inch in 12 inches (1:96), **as directed**, from highest to lowest point.
- a. Drill or notch cut valley tiles and wire-tie to fastener placed clear of valley metal flashings.
 - b. Do not nail tiles to metal flashings.
7. Closed Valleys: Cut clay roof tiles at closed valleys to form straight lines, trimming upper concealed corners of tiles. Maintain uniform gap at centerline of valley of 1/2 to 3/4 inch (13 to 19 mm) **OR** 3/4 to 1 inch (19 to 25 mm), **as directed**.
- a. Drill or notch cut valley tiles and wire-tie to fastener placed clear of valley metal flashings.
 - b. Do not nail tiles to metal flashings.
- E. Snow-Guard Installation
- 1. Snow-Guard Pads: Install rows of snow-guard pads at locations indicated, according to manufacturer's written installation instructions. Space rows apart horizontally, beginning from



gutter. Space snow guards apart in each row, offsetting by half this dimension between succeeding rows.

2. Snow-Guard Rails: Install rows of snow-guard rails at locations indicated, according to manufacturer's written installation instructions. Space rows apart horizontally, beginning from gutter.

F. Adjusting And Cleaning

1. Remove and replace damaged or broken clay roof tiles.
2. Remove excess clay roof tiles and debris from Project site.

END OF SECTION 07 32 13 00



SECTION 07 32 16 00 - CONCRETE ROOF TILES

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for concrete roof tiles. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Concrete roof tiles.
 - b. Underlayment.
 - c. Snow guards.

C. Definitions

1. Roofing Terminology: See ASTM D 1079, glossaries in TRI/WSRCA's "Concrete and Clay Roof Tile Design Criteria Installation Manual for Moderate Climate Regions," and NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

D. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittal:
 - a. Product Test Reports for Credit SS 7.2: For concrete roof tiles, documentation indicating compliance with Solar Reflectance Index requirement.
3. Samples: For each type of concrete roof tile and accessory tile indicated.
4. Material test reports.
5. Research/evaluation reports.
6. Maintenance data.
7. Warranties: Sample of special warranties.

E. Quality Assurance

1. Fire-Test-Response Characteristics: Provide concrete roof tiles and related roofing materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
 - a. Exterior Fire-Test Exposure: Class A **OR** Class B **OR** Class C, **as directed**; UL 790 or ASTM E 108, for application and roof slopes indicated.
2. Preinstallation Conference: Conduct conference at Project site.

F. Delivery, Storage, And Handling

1. Store underlayment rolls on end, on pallets or other raised surfaces. Do not double stack rolls.
 - a. Handle, store, and place roofing materials in a manner to avoid significant or permanent damage to roof deck or structural supporting members.
2. Protect unused underlayment from weather, sunlight, and moisture when left overnight or when roofing work is not in progress.

G. Warranty

1. Special Warranty: Standard form in which manufacturer agrees to repair or replace concrete roof tiles that fail in materials within specified warranty period.
 - a. Materials-Only Warranty Period: 50 years from date of Final Completion.



1.2 PRODUCTS

A. Concrete Roof Tiles

1. Concrete Roof Tiles: ASTM C 1492, molded- or extruded-concrete roof tile units of shape and configuration indicated, with integral color, and free of surface imperfections. Provide with fastening holes prepunched at factory.
 - a. Weight: Normal **OR** Medium **OR** Light, **as directed**.
 - b. High-Profile Shape: Type I, Spanish or "S".
 - c. Medium-Profile Shape: Type II, French interlocking.
 - d. Low-Profile Shape: Type III, flat shingle **OR** Type III, flat interlocking, **as directed**.
 - e. Side Configuration: Interlocking **OR** Noninterlocking, **as directed**.
 - f. Solar Reflectance Index: Provide concrete roof tiles with Solar Reflectance Index not less than 29 when calculated according to ASTM E 1980, based on testing of identical products by a qualified testing agency.
 - g. Colors, Blends, and Patterns: As selected from manufacturer's full range.
 - h. Finish and Texture: Matte, smooth **OR** Matte, striated **OR** Glazed, smooth, **as directed**.
 - i. Color: Brown **OR** White **OR** Red **OR** Pale red **OR** Green **OR** Gray **OR** Buff, **as directed**.
 - j. High **OR** Medium, **as directed**, -Profile-Shape Accessory Tiles: Ridge, ridge vent, ridge end, hip and hip starter, header course, L-shaped rake edge, roll rake edge, starter, end band, and terminal, **as directed**, units, in color matching concrete roof tiles.
 - k. Low-Profile-Shape Accessory Tiles: Ridge and closed ridge end, hip and hip starter, header course, L-shaped rake edge, starter, end band, and terminal, **as directed**, units, in color matching concrete roof tiles.

B. Accessories

1. Asphalt Roofing Cement: ASTM D 4586, Type II, asbestos free.
2. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied.
3. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane **OR** silicone, **as directed**, -based joint sealant; Type M **OR** Type S, **as directed**, Grade NS, Class 25, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O.
4. Roofing Asphalt: ASTM D 312, Type IV.
5. Cold-Applied Adhesive: Manufacturer's standard asphalt-based, one- or two-part, asbestos-free, cold-applied adhesive specially formulated for compatibility and use with underlayments.
6. Foam Adhesive: Two-component, polyurethane expanding adhesive recommended for application by concrete roof tile manufacturer.
OR
Mortar: ASTM C 270, Type M, natural color **OR** with ASTM C 979, pigmented mortar matching the color of concrete roof tiles for exposed-to-view mortar, and natural color for concealed-from-view mortar, **as directed**.
7. Eave Closure: Manufacturer's standard EPDM **OR** copper **OR** stainless-steel **OR** galvanized-steel **OR** aluminum, mill finish, **as directed**, eave closure formed to shape of concrete roof tiles.
8. Ridge Closure: Manufacturer's standard EPDM ridge closure, formed to shape of concrete roof tiles.
9. Wood Nailers, Beveled Cant Strips and Wood Battens: Comply with requirements for pressure-preservative-treated wood in Division 06 Section(s) "Rough Carpentry" **OR** "Miscellaneous Rough Carpentry", **as directed**.
10. Mesh Fabric: 18-by-14 (1.1-by-1.4-mm) mesh of PVC-coated, glass-fiber thread.

C. Fasteners

1. Roofing Nails: ASTM F 1667, copper, 0.135-inch- (3.4-mm-) **OR** aluminum, 0.1055-inch- (2.7-mm-) **OR** hot-dip galvanized-steel, 0.1055-inch- (2.7-mm-), **as directed**, diameter shank, sharp-pointed, conventional roofing nails with barbed shanks; minimum 3/8-inch- (10-mm-) diameter head; of sufficient length to penetrate 3/4 inch (19 mm) into wood battens **OR** solid-wood decking **OR** roof-deck sheathing, **as directed**.



- a. Where nails are in contact with metal flashing, use nails made from same metal as flashing.
 2. Felt Underlayment Nails: Aluminum, stainless-steel, or hot-dip galvanized-steel wire with low-profile capped heads or disc caps, 1-inch (25-mm) minimum diameter.
 3. Wood Batten Nails: ASTM F 1667; common or box, steel wire, flat head, and smooth shank.
 4. Wire Ties: Copper **OR** Brass **OR** Stainless steel, **as directed**, 0.083-inch (2.1-mm) minimum diameter.
 5. Twisted-Wire-Tie System: Continuously twisted, two-wire unit with loops formed 6 inches (152 mm) apart, minimum 0.1-inch- (2.5-mm-) diameter brass wire and 0.06-inch- (1.5-mm-) diameter brass tie wires **OR** 0.1-inch- (2.5-mm-) diameter copper wire and 0.06-inch- (1.5-mm-) diameter brass tie wires **OR** 0.083-inch- (2.1-mm-) diameter stainless-steel wire and 0.037-inch- (0.94-mm-) diameter stainless-steel tie wires **OR** 0.083-inch- (2.1-mm-) diameter galvanized-steel wire and 0.037-inch- (0.94-mm-) diameter galvanized-steel tie wires, **as directed**, with matching-metal folding clip anchors.
 6. Hook Nails: One-piece wind lock and concrete roof tile fastener system, minimum 0.1-inch- (2.5-mm-) diameter brass **OR** 0.09-inch- (2.3-mm-) diameter galvanized-steel, **as directed**, wire, for direct deck nailing.
 7. Tile Locks: Brass **OR** Copper **OR** Stainless-steel **OR** Hot-dip galvanized-steel, **as directed**, 0.1-inch- (2.5-mm-) diameter wire device designed to secure butt edges of overlaid concrete roof tiles.
 8. Storm Clips: Brass **OR** Stainless-steel **OR** Hot-dip galvanized-steel, **as directed**, strap-type, 0.04-by-1/2-inch (1.0-by-13-mm), L-shaped retainer clips designed to secure side edges of concrete roof tiles. Provide with two fastener holes in base flange.
- D. Underlayment Materials
1. Felt Underlayment: ASTM D 226, Type II, asphalt-saturated organic felt, unperforated.
 2. Felt Underlayment: ASTM D 2626, asphalt-saturated and -coated organic felt, dusted with fine mineral surfacing on both sides, unperforated.
 3. Roll Roofing Underlayment: ASTM D 6380, Class M, Type II, asphalt-saturated and -coated organic felt, mineral-granule surfaced.
 4. Self-Adhering Sheet Underlayment, Granular Surfaced: ASTM D 1970, a minimum of 55-mil- (1.4-mm-) thick sheet; glass-fiber-mat-reinforced, SBS-modified asphalt; mineral-granule surfaced; with release paper backing; cold applied. Provide primer for adjoining concrete or masonry surfaces to receive underlayment, **as directed**.
 5. Self-Adhering Sheet Underlayment, Polyethylene Faced: ASTM D 1970, minimum of 40-mil- (1.0-mm-) thick, slip-resisting, polyethylene-film-reinforced top surface laminated to SBS-modified asphalt adhesive, with release paper backing; cold applied. Provide primer for adjoining concrete or masonry surfaces to receive underlayment, **as directed**.
- E. Snow Guards
1. Snow-Guard Pads: Fabricated copper **OR** cast-bronze **OR** zinc **OR** stainless-steel **OR** aluminum, **as directed**, units, designed to be installed without penetrating roof tiles, and complete with predrilled holes or hooks for anchoring.
 2. Snow-Guard Rails: Units fabricated from metal baseplate anchored to adjustable **OR** fixed, **as directed**, bracket and equipped with two **OR** three, **as directed**, bars.
 - a. Brackets and Baseplate: Aluminum **OR** Bronze or brass **OR** Stainless steel, **as directed**.
 - b. Bars: Aluminum, mill finished **OR** Aluminum, clear anodized **OR** Stainless steel, mill finished, **as directed**.
- F. Metal Flashing And Trim
1. General: Comply with requirements in Division 07 Section "Sheet Metal Flashing And Trim".
 - a. Sheet Metal: Copper **OR** Stainless steel **OR** Zinc-tin alloy-coated stainless steel **OR** Zinc-tin alloy-coated steel **OR** Zinc-tin alloy-coated copper **OR** Anodized aluminum **OR** Aluminum, mill finished, **as directed**.



2. Fabricate sheet metal flashing and trim to comply with recommendations that apply to design, dimensions, metal, and other characteristics of the item in SMACNA's "Architectural Sheet Metal Manual."
 - a. Apron Flashings: Fabricate with lower flange extending a minimum of 4 inches (100 mm) **OR** 6 inches (152 mm), **as directed**, over and 4 inches (100 mm) beyond each side of downslope tile roofing and 6 inches (152 mm) up the vertical surface.
 - b. Step Flashings: Fabricate with a head lap of 3 inches (75 mm) and a minimum extension of 4 inches (100 mm) **OR** 5 inches (127 mm), **as directed**, both horizontally and vertically.
 - c. Channel Flashings: Fabricate with vertical surface extending a minimum of 4 inches (100 mm) **OR** 5 inches (127 mm), **as directed**, above the concrete roof tile and 4 inches (100 mm) **OR** 6 inches (152 mm), **as directed**, beneath the tile roofing, with a 1-inch- (25-mm-) high vertical return to form a runoff channel.
 - d. Rake Pan Flashings: Fabricate with vertical surface extending over fasciae and 6 inches (152 mm) beneath the tile roofing, with a 1-inch- (25-mm-) high vertical return to form a runoff channel.
 - e. Cricket **OR** Backer, **as directed**, Flashings: Fabricate with concealed flange extending a minimum of 18 inches (455 mm) **OR** 24 inches (610 mm), **as directed**, beneath upslope tile roofing, 6 inches (152 mm) beyond each side of chimney **OR** skylight, **as directed**, and 6 inches (152 mm) above the roof plane.
 - f. Closed **OR** Open, **as directed**, -Valley Flashings: Fabricate in lengths not exceeding 10 feet (3 m), with 1-inch- (25-mm-) high, inverted-V profile at center of valley and with equal flange widths of 10 inches (255 mm) **OR** 12 inches (305 mm), **as directed**.
 - g. Drip Edges: Fabricate in lengths not exceeding 10 feet (3 m), with 2-inch (50-mm) roof-deck flange and 1-1/2-inch (38-mm) fascia flange with 3/8-inch (10-mm) drip at lower edge.
3. Vent-Pipe Flashings: ASTM B 749, Type L51121, at least 1/16 inch (1.6 mm) thick. Provide lead sleeve sized to slip over and turn down into pipe, soldered to skirt at slope of roof and extending at least 4 inches (100 mm) from pipe onto roof.

1.3 EXECUTION

A. Underlayment Installation

1. General: Comply with concrete roof tile manufacturer's written instructions and recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."
 - a. Cover ridge **OR** hip, **as directed**, wood nailers with underlayment strips.
2. Single-Layer Felt Underlayment: Install on roof deck parallel with and starting at the eaves. Lap sides a minimum of 2 inches (50 mm) over underlying course. Lap ends a minimum of 4 inches (100 mm). Stagger end laps between succeeding courses at least 72 inches (1830 mm). Fasten with felt underlayment **OR** roofing, **as directed**, nails.
 - a. Install felt underlayment on roof deck not covered by self-adhering sheet underlayment. Lap sides of felt over self-adhering sheet underlayment not less than 3 inches (75 mm) in direction to shed water. Lap ends of felt not less than 6 inches (152 mm) over self-adhering sheet underlayment.
3. Double-Layer Felt Underlayment: Install on roof deck parallel with and starting at the eaves. Install a 19-inch- (485-mm-) wide starter course at eaves and completely cover with full-width second course. Install succeeding courses lapping previous courses 19 inches (485 mm) in shingle fashion. Lap ends a minimum of 6 inches (152 mm). Stagger end laps between succeeding courses at least 72 inches (1830 mm). Fasten with felt underlayment **OR** roofing, **as directed**, nails.
 - a. Apply a continuous layer of asphalt roofing cement over starter course and on felt underlayment surface to be concealed by succeeding courses as each felt course is installed. Apply over entire roof **OR** at locations indicated on Drawings, **as directed**.
 - b. Install felt underlayment on roof sheathing not covered by self-adhering sheet underlayment. Lap edges over self-adhering sheet underlayment not less than 3 inches (75 mm) in direction to shed water.



4. Double-Layer Felt/Roll Roofing Underlayment:
 - a. Install single layer of felt underlayment on roof deck parallel with and starting at the eaves. Lap sides a minimum of 2 inches (50 mm) over underlying course. Lap ends a minimum of 4 inches (100 mm). Stagger end laps between succeeding courses at least 72 inches (1830 mm). Fasten with felt underlayment **OR** roofing, **as directed**, nails.
 - b. Install roll roofing underlayment, in parallel courses, in same direction as felt underlayment. Lap ends a minimum of 6 inches (152 mm). Stagger end laps between succeeding courses at least 72 inches (1830 mm).
 - 1) Mechanically fasten over felt underlayment.
 - 2) Adhere to felt underlayment with solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F (14 deg C) of equiviscous temperature **OR** uniform coating of cold-applied adhesive **OR** uniform coating of asphalt roofing cement, **as directed**.
 - c. Terminate felt underlayment flush **OR** extended up not less than 4 inches (100 mm), **as directed**, against chimneys, sidewalls, curbs, and other projections.
5. Self-Adhering Sheet Underlayment: Install wrinkle free; comply with low-temperature installation restrictions of underlayment manufacturer if applicable. Install at locations indicated below **OR** on Drawings, **as directed**, lapped in direction to shed water. Lap sides not less than 3-1/2 inches (89 mm). Lap ends not less than 6 inches (152 mm), staggered 24 inches (610 mm) between succeeding courses. Roll laps with roller. Cover underlayment within seven days.
 - a. Prime concrete and masonry surfaces to receive self-adhering sheet underlayment.
 - b. Extend self-adhering sheet underlayment over entire roof deck.
OR
Extend self-adhering sheet underlayment over roof deck as follows:
 - 1) Eaves: Extend from edges of eaves 24 inches (610 mm) **OR** 36 inches (914 mm), **as directed**, beyond interior face of exterior wall.
 - 2) Rakes: Extend from edges of rakes 24 inches (610 mm) **OR** 36 inches (914 mm), **as directed**, beyond interior face of exterior wall.
 - 3) Valleys: Extend from lowest to highest point 18 inches (455 mm) on each side.
 - 4) Hips: Extend 18 inches (455 mm) on each side.
 - 5) Ridges: Extend 36 inches (914 mm) on each side without obstructing continuous ridge vent slot, **as directed**.
 - 6) Sidewalls: Extend 18 inches (455 mm) beyond sidewalls and return vertically against sidewalls not less than 4 inches (100 mm).
 - 7) Dormers, Chimneys, Skylights, and Other Roof-Penetrating Elements: Extend 18 inches (455 mm) beyond penetrating elements and return vertically against penetrating elements not less than 4 inches (100 mm).
 - 8) Roof-Slope Transitions: Extend 18 inches (455 mm) on each roof slope.
6. Double-Layer Felt/Self-Adhering Sheet Underlayment:
 - a. Install single layer of felt underlayment on roof deck parallel with and starting at the eaves. Lap sides a minimum of 2 inches (50 mm) over underlying course. Lap ends a minimum of 4 inches (100 mm). Stagger end laps between succeeding courses at least 72 inches (1830 mm). Fasten with felt underlayment **OR** roofing, **as directed**, nails.
 - b. Install self-adhering sheet underlayment, wrinkle free, on felt underlayment. Comply with low-temperature installation restrictions of underlayment manufacturer if applicable. Lap sides not less than 3-1/2 inches (89 mm) in direction to shed water. Lap ends not less than 6 inches (152 mm), staggered 24 inches (610 mm) between succeeding courses. Roll laps with roller. Cover underlayment within seven days.
7. Metal-Flushed, Open-Valley Underlayment: Install two layers of 36-inch- (914-mm-) wide felt underlayment centered in valley. Stagger end laps between layers at least 72 inches (1830 mm). Lap ends of each layer at least 12 inches (305 mm) in direction to shed water, and seal with asphalt roofing cement. Fasten each layer to roof deck with felt underlayment nails.
 - a. Lap roof-deck felt underlayment over first layer of valley felt underlayment at least 6 inches (152 mm).

B. Metal Flashing Installation



1. General: Install metal flashings and other sheet metal to comply with requirements in Division 07 Section "Sheet Metal Flashing And Trim".
 - a. Install metal flashings according to concrete roof tile manufacturer's written instructions and recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."
 2. Apron Flashings: Extend lower flange over and beyond each side of downslope tile roofing and up the vertical surface.
 3. Step Flashings: Install with a head lap of 3 inches (75 mm) and extend both horizontally and vertically. Install with lower edge of flashing just upslope of, and concealed by, butt of overlying tile. Fasten to roof deck only.
 4. Cricket **OR** Backer, **as directed**, Flashings: Install against roof-penetrating elements, extending concealed flange beneath upslope tile roofing and beyond each side.
 5. Open-Valley Flashings: Install centrally in valleys, lapping ends at least 8 inches (205 mm) in direction to shed water. Fasten upper end of each length to roof deck beneath overlap.
 - a. Secure hemmed flange edges into metal cleats spaced 12 inches (305 mm) apart and fastened to roof deck.
 - b. Adhere 9-inch- (230-mm-) wide strips of self-adhering sheet to metal flanges and to self-adhering sheet underlayment.
 6. Channel Flashings: Install over underlayment and fasten to roof deck.
 7. Rake Pan Flashings: Install over underlayment and fasten to roof deck.
 8. Rake Drip Edges: Install over underlayment and fasten to roof deck.
 9. Eave Drip Edges: Install beneath underlayment and fasten to roof deck.
 10. Pipe Flashings: Form flashing around pipe penetrations and tile roofing. Fasten and seal to tile roofing.
 11. Sheet Metal Ridge Vents: Install centrally, and mechanically fasten to wood ridge. Adhere each side to concrete roof tile with elastomeric sealant.
 - a. Install fabric mesh over roof-deck air ventilation gaps to prevent insect entry.
- C. Wood Nailers And Battens, **as directed**
1. Install wood nailers at ridges **OR** hips **OR** rakes, **as directed**, and securely fasten to roof deck.
 2. Install beveled wood cant at eaves and securely fasten to roof deck.
 3. Install nominal 1-by-2-inch (25-by-50-mm) wood battens horizontally over 1/2-inch- (13-mm-) high, pressure-preservative-treated wood lath strips **OR** in 48-inch (1200-mm) lengths with ends separated by 1/2 inch (13 mm), **as directed**, at spacing required by concrete roof tile manufacturer, and securely fasten to roof deck.
 - a. Install nominal 1-by-2-inch (25-by-50-mm) wood counter battens vertically spaced 24 inches (610 mm) apart and securely fasten to roof deck.
- D. Concrete Roof Tile Installation
1. General: Install concrete roof tiles according to manufacturer's written instructions, to recommendations in TRI/WSRCA's "Concrete and Clay Roof Tile Design Criteria Installation Manual for Moderate Climate Regions," and to NRCA's "The NRCA Roofing and Waterproofing Manual."
 - a. Maintain uniform exposure and coursing of concrete roof tiles throughout roof.
 - b. Extend tiles 2 inches (50 mm) over eave fasciae.
 - c. Nail Fastening: Drive nails to clear the concrete roof tile so the tile hangs from the nail and is not drawn up.
 - 1) Install wire through nail holes of cut tiles that cannot be nailed directly to roof deck, and fasten to nails driven into deck.
 - d. Wire-Tie Fastening: Install wire-tie systems and fasten concrete roof tiles according to manufacturer's written instructions.
 - e. Foam-Adhesive **OR** Mortar, **as directed**, Setting: Install concrete roof tiles according to TRI/FRSA's "Concrete and Clay Roof Tile Installation Manual."
 - f. Install storm clips to capture edges of longitudinal sides of concrete roof tiles and securely fasten to roof deck.
 - g. Install concrete roof tile locks to support and lock overlying tile butts to underlying tiles.



2. Snow-Guard Rails: Install rows of snow-guard rails at locations indicated, according to manufacturer's written installation instructions. Space rows apart horizontally, beginning from gutter.

F. Adjusting And Cleaning

1. Remove and replace damaged or broken concrete roof tiles.
2. Remove excess concrete roof tiles and debris from Project site.

END OF SECTION 07 32 16 00



Task	Specification	Specification Description
07 34 00 00	07 31 13 00	Asphalt Shingles
07 34 00 00	07 31 16 00	Metal Shingles
07 34 00 00	07 31 26 00	Slate Shingles
07 34 00 00	07 31 29 13	Wood Shingles And Shakes
07 34 00 00	07 32 13 00	Clay Roof Tiles



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SECTION 07 41 13 00 - METAL ROOF PANELS

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for metal roof panels. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Exposed-fastener, lap-seam metal roof panels.
 - b. Concealed-fastener, lap-seam metal roof panels.
 - c. Standing-seam metal roof panels.
 - d. Batten-seam metal roof panels.
 - e. Horizontal-seam (Bermuda-type) metal roof panels.
 - f. Foamed-insulation-core metal roof panels.
 - g. Metal soffit panels.

C. Definitions

1. Metal Roof Panel Assembly: Metal roof panels, attachment system components, miscellaneous metal framing, thermal insulation, and accessories necessary for a complete weathertight roofing system.

D. Performance Requirements

1. General Performance: Metal roof panels shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.
2. Delegated Design: Design metal roof panel assembly, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
3. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) of roof area when tested according to ASTM E 1680 at the following test-pressure difference:
 - a. Test-Pressure Difference (for roofs with slopes of 30 degrees or less): Negative 1.57 lbf/sq. ft. (75 Pa).
 - b. Test-Pressure Difference (for roofs with slopes steeper than 30 degrees): Positive and negative 1.57 lbf/sq. ft. (75 Pa).
 - c. Positive Preload Test-Pressure Difference: Greater than or equal to 15.0 lbf/sq. ft. (720 Pa) and the greater of 75 percent of building live load or 50 percent of building design positive wind-pressure difference.
 - d. Negative Preload Test-Pressure Difference: 50 percent of design wind-uplift-pressure difference.
4. Water Penetration: No water penetration when tested according to ASTM E 1646 at the following test-pressure difference:
 - a. Test-Pressure Difference (for roofs with slopes of 30 degrees or less): 2.86 lbf/sq. ft. (137 Pa).
 - b. Test-Pressure Difference (for roofs with slopes steeper than 30 degrees): 20 percent of positive design wind pressure, but not less than 6.24 lbf/sq. ft. (300 Pa) and not more than 12.0 lbf/sq. ft. (575 Pa).
 - c. Positive Preload Test-Pressure Difference: Greater than or equal to 15.0 lbf/sq. ft. (720 Pa) and the greater of 75 percent of building live load or 50 percent of building design positive wind-pressure difference.
 - d. Negative Preload Test-Pressure Difference: 50 percent of design wind-uplift-pressure difference.



5. Hydrostatic-Head Resistance: No water penetration when tested according to ASTM E 2140.
6. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
 - a. Uplift Rating: UL 30 **OR** UL 60 **OR** UL 90, **as directed**.
7. FMG Listing: Provide metal roof panels and component materials that comply with requirements in FMG 4471 as part of a panel roofing system and that are listed in FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.
 - a. Fire/Windstorm Classification: Class 1A-60 **OR** Class 1A-75 **OR** Class 1A-90 **OR** Class 1A-105 **OR** Class 1A-120, **as directed**.
 - b. Hail Resistance: MH **OR** SH, **as directed**.
8. Structural Performance: Provide metal roof panel assemblies capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 1592:
 - a. Wind Loads: Determine loads based on the following minimum design wind pressures:
 - 1) Uniform pressure of 20 lbf/sq. ft. (957 Pa) **OR** 30 lbf/sq. ft. (1436 Pa), **as directed**, acting inward or outward.
OR
Uniform pressure as indicated on Drawings.
 - b. Snow Loads: 25 lbf/sq. ft. (1197 Pa) **OR** 30 lbf/sq. ft. (1436 Pa) **OR** 35 lbf/sq. ft. (1676 Pa), **as directed**.
 - c. Deflection Limits: Metal roof panel assemblies shall withstand wind and snow loads with vertical deflections no greater than 1/180 **OR** 1/240, **as directed**, of the span.
9. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
10. Thermal Performance: Provide insulated metal roof panel assemblies with thermal-resistance value (R-value) indicated when tested according to ASTM C 518.
11. Energy Performance
 - a. Provide roof panels with solar reflectance index not less than 78 **OR** 29, **as directed**, when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency.
OR
Energy Performance: Provide roof panels that are listed on the U.S. Department of Energy's ENERGY STAR Roof Products Qualified Product List for low-slope **OR** steep-slope, **as directed**, roof products.
OR
Energy Performance: Provide roof panels with initial solar reflectance not less than 0.70 and emissivity not less than 0.75 when tested according to CRRC-1.

E. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:
 - a. Product Test Reports for Credit SS 7.2: For roof panels, indicating that panels comply with solar reflectance index requirement.
 - b. Product Data for Credit MR 4.1 and Credit MR 4.2, **as directed**: Indicating percentages by weight of postconsumer and preconsumer recycled content for products having recycled content.
 - 1) Include statement indicating costs for each product having recycled content.
3. Shop Drawings: Show fabrication and installation layouts of metal roof panels; details of edge conditions, side-seam and endlap joints, panel profiles, corners, anchorages, trim, flashings, closures, and accessories; and special details. Distinguish between factory- and field-assembled work.
4. Samples: For each type of exposed finish required.



5. Delegated-Design Submittal: For metal roof panel assembly indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - a. Snow Retention System Calculations: Include calculation of number and location of snow guards based on snow load, roof slope, panel length and finish, and seam type and spacing.
 6. Coordination Drawings: Roof plans, drawn to scale, based on input from installers of the items involved.
 7. Manufacturer Certificates: Signed by manufacturer certifying that roof panels comply with energy performance requirements specified in "Performance Requirements" Article.
 - a. Submit evidence of meeting performance requirements.
 8. Product test reports.
 9. Field quality-control reports.
 10. Maintenance data.
 11. Warranties: Samples of special warranties.
- F. Quality Assurance
1. Installer Qualifications: An employer of workers trained and approved by manufacturer.
 2. Surface-Burning Characteristics: Provide metal roof panels having insulation core material with the following surface-burning characteristics as determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
 3. Fire-Resistance Ratings: Where indicated, provide metal roof panels identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
 - b. Combustion Characteristics: ASTM E 136.
 4. Preinstallation Conference: Conduct conference at Project site.
- G. Delivery, Storage, And Handling
1. Deliver components, sheets, metal roof panels, and other manufactured items so as not to be damaged or deformed. Package metal roof panels for protection during transportation and handling.
 2. Unload, store, and erect metal roof panels in a manner to prevent bending, warping, twisting, and surface damage.
 3. Stack metal roof panels on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal roof panels to ensure dryness. Do not store metal roof panels in contact with other materials that might cause staining, denting, or other surface damage.
 4. Protect strippable protective covering on metal roof panels from exposure to sunlight and high humidity, except to extent necessary for period of metal roof panel installation.
 5. Protect foam-plastic insulation as follows:
 - a. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
 - b. Protect against ignition at all times. Do not deliver foam-plastic insulation materials to Project site before installation time.
 - c. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.
- H. Warranty
1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace metal roof panel assemblies that fail in materials or workmanship within two years from date of Final Completion.



2. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal roof panels that show evidence of deterioration of factory-applied finishes within 10 **OR** 20, **as directed**, years from date of Final Completion.
3. Special Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace metal roof panel assemblies that fail to remain weathertight, including leaks, within five **OR** 10, **as directed**, years from date of Final Completion.
4. Special Weathertightness Warranty for Standing-Seam Metal Roof Panels: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within 20 years from date of Final Completion.

1.2 PRODUCTS

A. Panel Materials

1. Metallic-Coated Steel Sheet: Restricted flatness steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Recycled Content: Provide steel sheet with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
 - b. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.
 - c. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40 (Class AZM150 coating designation, Grade 275); structural quality.
 - d. Surface: Smooth, flat **OR** Embossed, **as directed**, finish.
 - e. Exposed Coil-Coated Finish:
 - 1) 2-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2) 3-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 3) 4-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat and clear coats. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 4) Mica Fluoropolymer: AAMA 621. 2-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 5) Metallic Fluoropolymer: AAMA 621. 3-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 6) FEVE Fluoropolymer: AAMA 621. 2-coat fluoropolymer finish containing 100 percent fluorinated ethylene vinyl ether resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 7) Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
 - 8) Plastisol: Epoxy primer and vinyl plastisol topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 3.8 mil (0.97 mm) for topcoat.



- f. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).
2. Aluminum Sheet: Coil-coated sheet, ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
 - a. Surface: Smooth, flat **OR** Embossed, **as directed**, finish.
 - b. Exposed Coil-Coated Finish:
 - 1) 2-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2) 3-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 3) 4-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat and clear coats. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 4) Mica Fluoropolymer: AAMA 620. 2-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 5) Metallic Fluoropolymer: AAMA 620. 3-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 6) FEVE Fluoropolymer: AAMA 620. 2-coat fluoropolymer finish containing 100 percent fluorinated ethylene vinyl ether resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 7) Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
 - 8) Plastisol: Epoxy primer and vinyl plastisol topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 3.8 mil (0.97 mm) for topcoat.
 - c. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).
3. Copper Sheet: ASTM B 370, cold-rolled copper sheet, H00 temper.
 - a. Exposed Finish: Apply the following finish, as specified or indicated on Drawings:
 - 1) Natural finish.
 - 2) Brushed Satin: CDA M32-06x (Mechanical Finish: directionally textured, medium satin; Coating: clear organic, air drying, as specified below):
 - 3) Mirror Polished: CDA M22-06x (Mechanical Finish: buffed, specular; Coating: clear organic, air drying, as specified below):
 - a) Clear, Organic Coating: Clear, air-drying, acrylic lacquer specially developed for coating copper-alloy products, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).
 - 4) Pre-patinated: ASTM B 882. Copper sheets artificially aged by chemical reaction to convert surface to inorganic crystalline structure with color range and durability of naturally formed patina.
4. Panel Sealants:



- a. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
- b. Joint Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal roof panels and remain weathertight; and as recommended in writing by metal roof panel manufacturer.
- c. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

B. Field-Installed Thermal Insulation

1. Polyethylene Vapor Retarders: ASTM D 4397, 6 mils (0.15 mm) thick, with maximum permeance rating of 0.13 perm (7.5 ng/Pa x s x sq. m).
2. Unfaced, Polyisocyanurate Board Insulation: ASTM C 591, Type II, compressive strength of 35 psi (240 kPa), with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, based on tests performed.
3. Faced, Polyisocyanurate Board Insulation: ASTM C 1289, Type I, Class 1 aluminum foil **OR** Type II, Class 1 or 2 felt or glass-fiber mat, Grade 3 **OR** Type V, oriented-strand-board facing, **as directed**, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, based on tests performed on unfaced core.
4. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, 1.60-lb/cu. ft. (26-kg/cu. m) minimum density unless otherwise indicated; with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively.
5. Molded-Polystyrene Board Insulation: ASTM C 578, Type I, 0.9 lb/cu. ft. (15 kg/cu. m) **OR** Type II, 1.35 lb/cu. ft. (22 kg/cu. m), **as directed**, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively.
6. Unfaced, Glass-Fiber Board Insulation: ASTM C 612, Type IA or Types IA and IB; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; and with a nominal density of 3 lb/cu. ft. (48 kg/cu. m).
7. Mineral-Fiber-Blanket Insulation: ASTM C 665, type indicated below; consisting of fibers manufactured from glass, slag wool, or rock wool.
 - a. Type I (blankets without membrane covering), passing ASTM E 136 for combustion characteristics.
 - b. Type II (blankets with nonreflective membrane covering), Category 1 (membrane is a vapor retarder), Class A (membrane-faced surface with a flame-spread index of 25 or less).
 - c. Type III (blankets with reflective membrane covering), Category 1 (membrane is a vapor retarder), Class A (membrane-faced surface with a flame-spread index of 25 or less).
8. Metal Building Insulation: ASTM C 991, Type I, or NAIMA 202 **OR** ASTM C 991, Type II, **as directed**, glass-fiber-blanket insulation; 0.5-lb/cu. ft. (8-kg/cu. m) density; 2-inch- (50-mm-) wide, continuous, vapor-tight edge tabs; and with a flame-spread index of 25 or less.
 - a. Vapor-Retarder Facing: ASTM C 1136, with permeance not greater than 0.02 perm (1.15 ng/Pa x s x sq. m) when tested according to ASTM E 96, Desiccant Method:
 - 1) Composition: Polypropylene faced, scrim reinforced, and kraft-paper backing **OR** Foil faced, scrim reinforced, and kraft-paper backing with vapor-retarder coating **OR** Polypropylene faced, scrim reinforced, and foil backing **OR** Vinyl faced, scrim reinforced, and foil backing **OR** Vinyl faced, scrim reinforced, and polyester backing, **as directed**.
 - b. Insulation Retainer Strips: 0.019-inch- (0.48-mm-) thick, formed, galvanized-steel or PVC retainer clips colored to match insulation facing.
 - c. Thermal Spacer Blocks: Fabricated from extruded polystyrene, 1 inch (25 mm) thick.

C. Underlayment Materials

1. Self-Adhering, High-Temperature Sheet: 30 to 40 mils (0.76 to 1.0 mm) thick minimum, consisting of slip-resisting, polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
 - a. Thermal Stability: Stable after testing at 240 deg F (116 deg C); ASTM D 1970.



- b. Low-Temperature Flexibility: Passes after testing at minus 20 deg F (29 deg C); ASTM D 1970.
 2. Felts: ASTM D 226, Type II (No. 30) **OR** Type I (No. 15), **as directed**, asphalt-saturated organic felts.
 3. Slip Sheet: Manufacturer's recommended slip sheet, of type required for application.
- D. Substrate Boards
1. Gypsum Board: Type X, of thickness indicated, with water-resistant-treated core and with water-repellent paper bonded to core's face, back, and long edges. ASTM C 1396/C 1396M.
 2. Glass-Mat Gypsum Sheathing Board: ASTM C 1177/C 1177M; Regular, 1/2 inch (13 mm) **OR** Type X, 5/8 inch (16 mm), **as directed**.
 3. Perlite Board: ASTM C 728, 1 inch (25 mm) thick.
 4. Substrate-Board Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FMG 4470, designed for fastening substrate board to substrate.
- E. Miscellaneous Metal Framing
1. Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, ASTM A 653/A 653M, G40 (Z120) hot-dip galvanized **OR** ASTM A 653/A 653M, G60 (Z180) hot-dip galvanized, **as directed**, or coating with equivalent corrosion resistance unless otherwise indicated.
 2. Hat-Shaped, Rigid Furring Channels:
 - a. Nominal Thickness: As indicated **OR** As required to meet performance requirements **OR** 0.025 inch (0.64 mm) **OR** 0.040 inch (1.02 mm), **as directed**.
 - b. Depth: As indicated **OR** 7/8 inch (22 mm) **OR** 1-1/2 inches (38 mm), **as directed**.
 3. Cold-Rolled Furring Channels: Minimum 1/2-inch- (13-mm-) wide flange.
 - a. Nominal Thickness: As indicated **OR** As required to meet performance requirements **OR** 0.064 inch (1.63 mm), **as directed**.
 - b. Depth: As indicated **OR** 3/4 inch (19 mm), **as directed**.
 - c. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with nominal thickness of 0.040 inch (1.02 mm).
 - d. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.57-mm-) diameter wire, or double strand of 0.048-inch- (1.22-mm-) diameter wire.
 4. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (32 mm), wall attachment flange of 7/8 inch (22 mm), and depth required to fit insulation thickness indicated.
 - a. Nominal Thickness: As indicated **OR** As required to meet performance requirements **OR** 0.025 inch (0.64 mm), **as directed**.
 5. Fasteners for Miscellaneous Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.
- F. Miscellaneous Materials
1. Panel Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal roof panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.
 2. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- G. Exposed-Fastener, Lap-Seam Metal Roof Panels
1. General: Provide factory-formed metal roof panels designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps. Include accessories required for weathertight installation.
 2. Corrugated-Profile, Exposed-Fastener Metal Roof Panels: Formed with alternating curved ribs spaced at 2.67 inches (68 mm) o.c. across width of panel.



- a. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As selected by the Owner from manufacturer's full range.
 - b. Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As selected by Architect from manufacturer's full range.
 - c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As selected by Architect from manufacturer's full range.
 - d. Panel Coverage: 21.3 inches (541 mm) **OR** 29.3 inches (744 mm) **OR** 34.67 inches (881 mm) **OR** 37.3 inches (947 mm) **OR** 42.67 inches (1084 mm) **OR** 45.3 inches (1151 mm), **as directed**.
 - e. Panel Height: 0.5 inch (13 mm) **OR** 0.875 inch (22 mm), **as directed**.
3. Tapered-Rib-Profile, Exposed-Fastener Metal Roof Panels: Formed with raised, trapezoidal major ribs and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between major ribs.
- a. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As selected by the Owner from manufacturer's full range.
 - b. Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As selected by the Owner from manufacturer's full range.
 - c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As selected by the Owner from manufacturer's full range.
 - d. Material: Copper sheet, 16-oz./sq. ft. weight (0.55-mm thickness) **OR** 20-oz./sq. ft. weight (0.68-mm thickness), **as directed**.
 - 1) Exterior Finish: Brushed satin (lacquered) **OR** Mirror polished, **as directed**.
 - e. Major-Rib Spacing: 6 inches (152 mm) **OR** 8 inches (203 mm) **OR** 9 inches (229 mm) **OR** 12 inches (305 mm), **as directed**, o.c.
 - f. Panel Coverage: 24 inches (610 mm) **OR** 36 inches (914 mm), **as directed**.
 - g. Panel Height: 0.625 inch (16 mm) **OR** 0.75 inch (19 mm) **OR** 1.0 inch (25 mm) **OR** 1.25 inches (32 mm) **OR** 1.5 inches (38 mm), **as directed**.



4. Vee-Rib-Profile, Exposed-Fastener Metal Roof Panels: Formed with raised, V-shaped ribs and recesses that are approximately same size, evenly spaced across panel width, and with rib/recess sides angled at approximately 45 degrees.
- a. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm) **OR** 0.064-inch (1.63-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As selected by the Owner from manufacturer's full range.
 - b. Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm) **OR** 0.064-inch (1.63-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As selected by the Owner from manufacturer's full range.
 - c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.050 inch (1.27 mm), **as directed**, thick.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As selected by the Owner from manufacturer's full range.
 - d. Rib Spacing: 5.3 inches (135 mm) **OR** 7.2 inches (183 mm) **OR** 12 inches (305 mm), **as directed**, o.c.
 - e. Panel Coverage: 30 inches (762 mm) **OR** 32 inches (813 mm) **OR** 36 inches (914 mm) **OR** 40 inches (1016 mm), **as directed**.
 - f. Panel Height: 1.375 inches (35 mm) **OR** 1.5 inches (38 mm) **OR** 1.75 inches (44 mm) **OR** 2.0 inches (51 mm) **OR** 3.0 inches (76 mm), **as directed**.
5. Box-Rib-Profile, Exposed-Fastener Metal Roof Panels: Formed with raised, box-shaped ribs that are wider than recesses, evenly spaced across panel width, and with rib/recess sides angled 60 degrees or more.
- a. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As selected by the Owner from manufacturer's full range.
 - b. Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As selected by the Owner from manufacturer's full range.
 - c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As selected by the Owner from manufacturer's full range.
 - d. Rib Spacing: 2.67 inches (68 mm) **OR** 4.0 inches (102 mm) **OR** 5.3 inches (135 mm) **OR** 6.0 inches (152 mm), **as directed**, o.c.
 - e. Panel Coverage: 24 inches (610 mm) **OR** 28 inches (711 mm) **OR** 30 inches (762 mm) **OR** 32 inches (813 mm) **OR** 36 inches (914 mm), **as directed**.



- f. Panel Height: 0.625 inch (16 mm) **OR** 1.0 inch (25 mm) **OR** 1.5 inches (38 mm) **OR** 2.0 inches (51 mm), **as directed**.
6. Deep-Box-Rib-Profile, Exposed-Fastener Metal Roof Panels: Formed with raised, box-shaped ribs that are wider than recesses, evenly spaced across panel width, and with rib/recess sides angled more than 60 degrees.
- a. Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm) **OR** 0.064-inch (1.63-mm), **as directed**, nominal thickness.
- 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As selected by the Owner from manufacturer's full range.
- b. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm) **OR** 0.064-inch (1.63-mm), **as directed**, nominal thickness.
- 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As selected by the Owner from manufacturer's full range.
- c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.050 inch (1.27 mm), **as directed**, thick.
- 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As selected by the Owner from manufacturer's full range.
- d. Rib Spacing: 12 inches (305 mm), **as directed**, o.c.
- e. Panel Coverage: 24 inches (610 mm), **as directed**.
- f. Panel Height: 3 inches (76 mm) **OR** 4 inches (102 mm), **as directed**.
- H. Concealed-Fastener, Lap-Seam Metal Roof Panels
1. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps. Include accessories required for weathertight installation.
 2. Tapered-Rib-Profile, Concealed-Fastener Metal Roof Panels: Formed with raised, trapezoidal major rib at panel edge and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between major rib and panel edge.
- a. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
- 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As selected by the Owner from manufacturer's full range.
- b. Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
- 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As selected by the Owner from manufacturer's full range.
- c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
- 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As selected by the Owner from manufacturer's full range.



- d. Panel Coverage: 12 inches (305 mm) **OR** 16 inches (406 mm) **OR** 18 inches (457 mm), **as directed**.
- e. Panel Height: 1.0 inch (25 mm) **OR** 1.5 inches (38 mm) **OR** 1.75 inches (44 mm), **as directed**.
- 3. Standing-Seam-Profile, Concealed-Fastener Metal Roof Panels: Formed with raised, curved-top, standing-seam-shaped major rib at panel edge and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between major rib and panel edge.
 - a. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As selected by the Owner from manufacturer's full range.
 - b. Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As selected by the Owner from manufacturer's full range.
 - c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As selected by the Owner from manufacturer's full range.
 - d. Material: Copper sheet, 16-oz./sq. ft. weight (0.55-mm thickness) **OR** 20-oz./sq. ft. weight (0.68-mm thickness), **as directed**.
 - 1) Exterior Finish: Brushed satin (lacquered) **OR** Mirror polished, **as directed**.
 - e. Panel Coverage: 10 inches (254 mm) **OR** 12 inches (305 mm) **OR** 16 inches (406 mm) **OR** 18 inches (457 mm), **as directed**.
 - f. Panel Height: 1.0 inch (25 mm) **OR** 1.25 inches (32 mm) **OR** 1.5 inches (38 mm), **as directed**.
- 4. Batten-Seam-Profile, Concealed-Fastener Metal Roof Panels: Formed with raised, batten-seam-shaped major rib at panel edge and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between major rib and panel edge.
 - a. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As selected by the Owner from manufacturer's full range.
 - b. Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As selected by the Owner from manufacturer's full range.
 - c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As selected by the Owner from manufacturer's full range.
 - d. Panel Coverage: 10 inches (254 mm) **OR** 12 inches (305 mm) **OR** 14 inches (356 mm) **OR** 15 inches (381 mm) **OR** 18 inches (457 mm) **OR** 24 inches (610 mm) **OR** 36 inches (914 mm), **as directed**.



- e. Panel Height: 0.75 inch (19 mm) **OR** 1.25 inches (32 mm) **OR** 1.5 inches (38 mm), **as directed**.
- f. Batten Width: 1.5 inches (38 mm) **OR** 2.0 inches (51 mm), **as directed**.

I. Standing-Seam Metal Roof Panels

1. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.
 - a. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1514.
 - b. Aluminum Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1637.
2. Vertical-Rib, Snap-Joint, Standing-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels, and snapping panels together.
 - a. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As selected by the Owner from manufacturer's full range.
 - b. Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As selected by the Owner from manufacturer's full range.
 - c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As selected by the Owner from manufacturer's full range.
 - d. Material: Copper sheet, 16-oz./sq. ft. weight (0.55-mm thickness) **OR** 20-oz./sq. ft. weight (0.68-mm thickness), **as directed**,.
 - 1) Exterior Finish: Brushed satin (lacquered) **OR** Mirror polished, **as directed**.
 - e. Batten: Same material, finish, and color as roof panels.
 - f. Clips: Fixed **OR** Floating to accommodate thermal movement, **as directed**.
 - 1) Material: 0.028-inch- (0.71-mm-) **OR** 0.064-inch- (1.63-mm-), **as directed**, nominal thickness, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.
 - 2) Material: 0.025-inch- (0.64-mm-) **OR** 0.062-inch- (1.59-mm-), **as directed**, thick, stainless-steel sheet.
 - g. Panel Coverage: 10 inches (254 mm) **OR** 12 inches (305 mm) **OR** 14 inches (356 mm) **OR** 16 inches (406 mm) **OR** 18 inches (457 mm) **OR** 24 inches (610 mm), **as directed**.
 - h. Panel Height: 1.0 inch (25 mm) **OR** 1.5 inches (38 mm) **OR** 1.75 inches (44 mm), **as directed**.
3. Vertical-Rib, Seamed-Joint, Standing-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels, and mechanically seaming panels together.



- a. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As selected by the Owner from manufacturer's full range.
 - b. Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As selected by the Owner from manufacturer's full range.
 - c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As selected by the Owner from manufacturer's full range.
 - d. Material: Copper sheet, 16-oz./sq. ft. weight (0.55-mm thickness) **OR** 20-oz./sq. ft. weight (0.68-mm thickness), **as directed**.
 - 1) Exterior Finish: Brushed satin (lacquered) **OR** Mirror polished, **as directed**.
 - e. Batten: Same material, finish, and color as roof panels.
 - f. Clips: Fixed **OR** Floating to accommodate thermal movement, **as directed**.
 - 1) Material: 0.028-inch- (0.71-mm-) **OR** 0.064-inch- (1.63-mm-), **as directed**, nominal thickness, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.
 - 2) Material: 0.025-inch- (0.64-mm-) **OR** 0.062-inch- (1.59-mm-), **as directed**, thick, stainless-steel sheet.
 - g. Joint Type: Single folded **OR** Double folded **OR** As standard with manufacturer, **as directed**.
 - h. Panel Coverage: 12 inches (305 mm) **OR** 14 inches (356 mm) **OR** 16 inches (406 mm) **OR** 18 inches (457 mm) **OR** 20 inches (508 mm) **OR** 24 inches (610 mm), **as directed**.
 - i. Panel Height: 1.5 inches (38 mm) **OR** 2.0 inches (51 mm) **OR** 2.5 inches (64 mm), **as directed**.
4. Trapezoidal-Rib, Snap-Joint, Standing-Seam Metal Roof Panels: Formed with raised trapezoidal ribs at panel edges and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels, and snapping panels together.
- a. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As selected by the Owner from manufacturer's full range.
 - b. Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 28-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As selected by the Owner from manufacturer's full range.
 - c. Clips: Fixed **OR** Floating to accommodate thermal movement, **as directed**.
 - 1) Material: 0.028-inch- (0.71-mm-) **OR** 0.064-inch- (1.63-mm-), **as directed**, nominal thickness, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.



- d. Panel Coverage: 12 inches (305 mm) **OR** 18 inches (457 mm) **OR** 24 inches (610 mm), **as directed**.
- e. Panel Height: 3 inches (76 mm).
- 5. Trapezoidal-Rib, Seamed-Joint, Standing-Seam Metal Roof Panels: Formed with raised trapezoidal ribs at panel edges and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels, and mechanically seaming panels together.
 - a. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As selected by the Owner from manufacturer's full range.
 - b. Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As selected by the Owner from manufacturer's full range.
 - c. Clips: Fixed **OR** Floating to accommodate thermal movement, **as directed**.
 - 1) Material: 0.028-inch- (0.71-mm-) **OR** 0.064-inch- (1.63-mm-), **as directed**, nominal thickness, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.
 - d. Joint Type: Single folded **OR** Double folded **OR** As standard with manufacturer, **as directed**.
 - e. Panel Coverage: 12 inches (305 mm) **OR** 18 inches (457 mm) **OR** 24 inches (610 mm), **as directed**.
 - f. Panel Height: 2.7 inches (69 mm) **OR** 3.0 inches (76 mm), **as directed**.
- 6. Integral-Standing-Seam Metal Roof Panels: Formed with integral ribs at panel edges and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and lapping and interconnecting side edges of adjacent panels.
 - a. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As selected by the Owner from manufacturer's full range.
 - b. Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As selected by the Owner from manufacturer's full range.
 - c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As selected by the Owner from manufacturer's full range.
 - d. Material: Copper sheet, 16-oz./sq. ft. weight (0.55-mm thickness) **OR** 20-oz./sq. ft. weight (0.68-mm thickness), **as directed**.
 - 1) Exterior Finish: Brushed satin (lacquered) **OR** Mirror polished, **as directed**.
 - e. Clips: Fixed **OR** Floating to accommodate thermal movement, **as directed**.



- 1) Material: 0.028-inch- (0.71-mm-) **OR** 0.064-inch- (1.63-mm-), **as directed**, nominal thickness, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.
 - 2) Material: 0.025-inch- (0.64-mm-) **OR** 0.062-inch- (1.59-mm-), **as directed**, thick, stainless-steel sheet.
 - f. Panel Coverage: 12 inches (305 mm) **OR** 16 inches (406 mm) **OR** 18 inches (457 mm), **as directed**.
 - g. Panel Height: 1.0 inch (25 mm) **OR** 1.5 inches (38 mm) **OR** 2.0 inches (51 mm), **as directed**.
- J. Batten-Seam Metal Roof Panels
1. General: Provide factory-formed metal roof panel assembly designed to be installed by covering vertical side edges of adjacent panels with battens and mechanically attaching panels to supports using concealed clips. Include battens and accessories required for weathertight installation.
 2. Narrow-Profile, Snap-on-Batten-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between ribs; designed for independent installation by mechanically attaching panels to supports using concealed clips located under 1 side of panels and engaging opposite edge of adjacent panels, and installation of 3/8-to-1/2-inch- (10-to-13-mm-) wide, snap-on battens over panel joints.
 - a. Panel Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As selected by the Owner from manufacturer's full range.
 - b. Panel Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As selected by the Owner from manufacturer's full range.
 - c. Panel Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As selected by the Owner from manufacturer's full range.
 - d. Panel Material: Copper sheet, 16-oz./sq. ft. weight (0.55-mm thickness) **OR** 20-oz./sq. ft. weight (0.68-mm thickness), **as directed**.
 - 1) Exterior Finish: Brushed satin (lacquered) **OR** Mirror polished, **as directed**.
 - e. Batten Material: Same material, finish, and color as roof panels.
 - f. Clips: One **OR** Two, **as directed**, piece.
 - 1) Material: 0.028-inch- (0.71-mm-) **OR** 0.064-inch- (1.63-mm-), **as directed**, nominal thickness, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.
 - 2) Material: 0.025-inch- (0.64-mm-) **OR** 0.062-inch- (1.59-mm-), **as directed**, thick, stainless-steel sheet.
 - g. Sealant: Factory applied in top **OR** on each side, **as directed**, of battens.
 - h. Panel Coverage: 12 inches (305 mm) **OR** 14 inches (356 mm) **OR** 16 inches (406 mm) **OR** 18 inches (457 mm) **OR** 20 inches (508 mm), **as directed**.
 - i. Batten Height: 1.0 inch (25 mm) **OR** 1.25 inches (32 mm) **OR** 1.5 inches (38 mm) **OR** 1.75 inches (44 mm) **OR** 2.0 inches (51 mm), **as directed**.
 3. Wide-Profile, Snap-on-Batten-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between ribs; designed for independent installation by mechanically attaching panels to supports using concealed clips located between and engaging edges of adjacent panels, and installing snap-on battens over panel joints.



- a. Panel Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As selected by the Owner from manufacturer's full range.
 - b. Panel Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As selected by the Owner from manufacturer's full range.
 - c. Panel Material: Aluminum sheet, 0.024 inch (0.061 mm) **OR** 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.050 inch (1.27 mm), **as directed**, thick.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As selected by the Owner from manufacturer's full range.
 - d. Panel Material: Copper sheet, 16-oz./sq. ft. weight (0.55-mm thickness) **OR** 20-oz./sq. ft. weight (0.68-mm thickness), **as directed**.
 - 1) Exterior Finish: Brushed satin (lacquered) **OR** Mirror polished, **as directed**.
 - e. Batten Material: Same material, finish, and color as roof panels.
 - f. Clips: One piece.
 - 1) Material: 0.028-inch- (0.71-mm-) **OR** 0.064-inch- (1.63-mm-), **as directed**, nominal thickness, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.
 - 2) Material: 0.025-inch- (0.64-mm-) **OR** 0.062-inch- (1.59-mm-), **as directed**, thick, stainless-steel sheet.
 - g. Sealant: Factory applied on each side of battens.
 - h. Panel Coverage: 12 inches (305 mm) **OR** 14 inches (356 mm) **OR** 16 inches (406 mm) **OR** 18 inches (457 mm) **OR** 22 inches (559 mm) **OR** 24 inches (610 mm), **as directed**.
 - i. Batten Height: 1.0 inch (25 mm) **OR** 1.5 inches (38 mm) **OR** 1.75 inches (44 mm) **OR** 1.88 inches (48 mm) **OR** 2.0 inches (51 mm), **as directed**.
4. Seamed-Batten Metal Roof Panels: Formed with vertical ribs at panel edges and intermediate stiffening ribs symmetrically spaced **OR** smooth, flat pan, **as directed**, between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels, and installing mechanically seamed battens over panel joints.
- a. Panel Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As selected by the Owner from manufacturer's full range.
 - b. Panel Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As selected by the Owner from manufacturer's full range.
 - c. Panel Material: Aluminum sheet, 0.024 inch (0.061 mm) **OR** 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.050 inch (1.27 mm), **as directed**, thick.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As selected by the Owner from manufacturer's full range.



- d. Panel Material: Copper sheet, 16-oz./sq. ft. weight (0.55-mm thickness) **OR** 20-oz./sq. ft. weight (0.68-mm thickness), **as directed**.
 - 1) Exterior Finish: Brushed satin (lacquered) **OR** Mirror polished, **as directed**.
 - e. Batten Material: Same material, finish, and color as roof panels.
 - f. Clips: One **OR** Two, **as directed**, piece.
 - 1) Material: 0.028-inch- (0.71-mm-) **OR** 0.064-inch- (1.63-mm-), **as directed**, nominal thickness, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.
 - 2) Material: 0.025-inch- (0.64-mm-) **OR** 0.062-inch- (1.59-mm-), **as directed**, thick, stainless-steel sheet.
 - g. Sealant: Factory applied on each side of clips under battens.
 - h. Panel Coverage: 12 inches (305 mm) **OR** 16 inches (406 mm) **OR** 18 inches (457 mm), **as directed**.
 - i. Batten Height: 2.0 inches (51 mm) **OR** 2.375 inches (60 mm) **OR** 3.0 inches (76 mm), **as directed**.
- K. Horizontal-Seam (Bermuda-Type) Metal Roof Panels
- 1. Horizontal-Seam (Bermuda-Type) Metal Roof Panels: Formed with horizontal seam at panel edges and smooth, flat pan; designed to be installed in sequential installation by engaging lower edge of each panel to upper edge of panel below and mechanically attaching panels to supports using concealed clips located under upper edge of panels.
 - a. Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer, **as directed**.
 - 2) Color: As selected by the Owner from manufacturer's full range.
 - b. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer, **as directed**.
 - 2) Color: As selected by the Owner from manufacturer's full range.
 - c. Material: Aluminum sheet, 0.032 inch (0.81 mm) thick.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer, **as directed**.
 - 2) Color: As selected by the Owner from manufacturer's full range.
 - d. Material: Copper sheet, 16-oz./sq. ft. weight (0.55-mm thickness) **OR** 20-oz./sq. ft. weight (0.68-mm thickness), **as directed**.
 - 1) Exterior Finish: Brushed satin (lacquered) **OR** Mirror polished, **as directed**.
 - e. Clips: One piece.
 - 1) Material: 0.028-inch- (0.71-mm-) nominal thickness, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.
 - 2) Material: 0.025-inch- (0.64-mm-) thick, stainless-steel sheet.
 - f. Seal: Factory-applied sealant or vinyl weatherseal in seam.
 - g. Exposure: 9.5 inches (241 mm) **OR** 11 inches (279 mm), **as directed**, nominal.
 - h. Seam Height: 1.0 inch (25 mm) **OR** 1.5 inches (38 mm), **as directed**.
- L. Foamed-Insulation-Core Metal Roof Panels
- 1. General: Provide factory-formed and -assembled metal roof panels fabricated from two sheets of metal with insulation core foamed-in-place during fabrication with joints between panels designed to form weathertight seals. Include accessories required for weathertight installation.
 - a. Panel Performance:
 - 1) Flatwise Tensile Strength: 30 psi (200 kPa) when tested according to ASTM C 297/C 297M.



- 2) Humid Aging: Volume increase not greater than 6.0 percent and no delamination or metal corrosion when tested for 7 days at 140 deg F (60 deg C) and 100 percent relative humidity according to ASTM D 2126.
- 3) Heat Aging: Volume increase not greater than 2.0 percent and no delamination, surface blistering, or permanent bowing when tested for 7 days at 200 deg F (93 deg C) according to ASTM D 2126.
- 4) Cold Aging: Volume decrease not more than 1.0 percent and no delamination, surface blistering, or permanent bowing when tested for 7 days at minus 20 deg F (29 deg C) according to ASTM D 2126.
- 5) Fatigue: No evidence of delamination, core cracking, or permanent bowing when tested to a 20-lbf/sq. ft. (958-kPa) positive and negative wind load and with deflection of L/180 for 2 million cycles.
- 6) Autoclave: No delamination when exposed to 2-psi (13.8-kPa) pressure at a temperature of 212 deg F (100 deg C) for 2-1/2 hours.
- 7) Fire-Test-Response Characteristics: Class A according to ASTM E 108.
- b. Insulation Core: Modified isocyanurate or polyurethane foam using a non-CFC blowing agent, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively.
 - 1) Closed-Cell Content: 90 percent when tested according to ASTM D 2856.
 - 2) Density: 2.0 to 2.6 lb/cu. ft. (32 to 42 kg/cu. m) when tested according to ASTM D 1622.
 - 3) Compressive Strength: Minimum 20 psi (140 kPa) when tested according to ASTM D 1621.
 - 4) Shear Strength: 26 psi (179 kPa) when tested according to ASTM C 273.
2. Lap-Seam-Profile, Foamed-Insulation-Core Metal Roof Panels: Formed for lapping side edges of adjacent panels and mechanically attaching to supports using exposed fasteners in side laps.
 - a. Facings: Fabricate panel with exterior and interior facings of same material and thickness.
 - 1) Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
 - 2) Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
 - 3) Exterior Facing Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - a) Color: As selected by the Owner from manufacturer's full range.
 - 4) Interior Facing Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - a) Color: As selected by the Owner from manufacturer's full range.
 - b. Batten: Same material, finish, and color as exterior facings of roof panels.
 - c. Panel Coverage: 24 inches (610 mm) **OR** 30 inches (762 mm) **OR** 36 inches (914 mm) **OR** 39.6 inches (1000 mm) **OR** 40 inches (1016 mm) **OR** 44.5 inches (1130 mm), **as directed**.
 - d. Panel Thickness: 1.0 inch (25 mm) **OR** 1.5 inches (38 mm) **OR** 2.0 inches (51 mm) **OR** 2.5 inches (64 mm) **OR** 3.0 inches (76 mm) **OR** 4.0 inches (102 mm) **OR** 5.0 inches (127 mm) **OR** 6.0 inches (152 mm), **as directed**.
3. Standing-Seam-Profile, Foamed-Insulation-Core Metal Roof Panels: Formed with vertical tongue-and-groove ribs at panel edges and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between ribs; designed for sequential installation by interlocking tongue-and-groove panel edges and mechanically attaching panels to supports using concealed clips located between and engaging edges of adjacent panels, and mechanically seaming panels together.
 - a. Facings: Fabricate panel with exterior and interior facings of same material and thickness.
 - 1) Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.



- 2) Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
 - 3) Exterior Facing Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - a) Color: As selected by the Owner from manufacturer's full range.
 - 4) Interior Facing Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - a) Color: As selected by the Owner from manufacturer's full range.
 - b. Joint Type: Single folded **OR** Double folded **OR** As standard with manufacturer, **as directed**.
 - c. Panel Coverage: 36 inches (914 mm) **OR** 42 inches (1067 mm), **as directed**.
 - d. Panel Thickness: 2.0 inches (51 mm) **OR** 2.5 inches (64 mm) **OR** 3.0 inches (76 mm) **OR** 4.0 inches (102 mm) **OR** 5.0 inches (127 mm) **OR** 6.0 inches (152 mm), **as directed**.
4. Batten-Seam-Profile, Foamed-Insulation-Core Metal Roof Panels: Formed with vertical or tapered tongue-and-groove ribs at panel edges and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between ribs; designed for sequential installation by interlocking tongue-and-groove panel edges and mechanically attaching panels to supports using concealed clips located between and engaging edges of adjacent panels, and installing snap-on battens over panel joints.
- a. Facings: Fabricate panel with exterior and interior facings of same material and thickness.
 - 1) Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) nominal thickness.
 - 2) Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) nominal thickness.
 - 3) Exterior Facing Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - a) Color: As selected by the Owner from manufacturer's full range.
 - 4) Interior Facing Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - a) Color: As selected by the Owner from manufacturer's full range.
 - b. Batten: Same material, finish, and color as exterior facings of roof panels.
 - c. Clips: One piece; 0.064-inch- (1.63-mm-) **OR** 0.097-inch- (2.50-mm-), **as directed**, nominal thickness, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.
 - d. Panel Coverage: 36 inches (914 mm) **OR** 39.6 inches (1000 mm), **as directed**.
 - e. Panel Thickness: 1.75 inches (44 mm) **OR** 2.0 inches (51 mm) **OR** 2.5 inches (64 mm) **OR** 3.0 inches (76 mm) **OR** 4.0 inches (102 mm) **OR** 5.0 inches (127 mm) **OR** 6.0 inches (152 mm), **as directed**.

M. Metal Soffit Panels

1. General: Provide factory-formed metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps. Include accessories required for weathertight installation.
2. Metal Soffit Panels: Match profile and material of metal roof panels.
 - a. Finish: Match finish and color of metal roof panels **OR** Match finish and color of metal wall panels **OR** As indicated on Drawings, **as directed**.
 - b. Sealant: Factory applied within interlocking joint.
3. Flush-Profile Metal Soffit Panels: Solid **OR** Perforated, **as directed**, panels formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between panel edges; with flush joint between panels.
 - a. Material: Same material, finish, and color as metal roof panels.



- b. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
- 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: Match finish and color of metal roof panels **OR** Match finish and color of metal wall panels **OR** As selected by the Owner from manufacturer's full range, **as directed**.
- c. Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
- 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: Match finish and color of metal roof panels **OR** Match finish and color of metal wall panels **OR** As selected by the Owner from manufacturer's full range, **as directed**.
- d. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
- 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: Match finish and color of metal roof panels **OR** Match finish and color of metal wall panels **OR** As selected by the Owner from manufacturer's full range, **as directed**.
- e. Material: Copper sheet, 16-oz./sq. ft. weight (0.55-mm thickness) **OR** 20-oz./sq. ft. weight (0.68-mm thickness), **as directed**.
- 1) Exterior Finish: Brushed satin (lacquered) **OR** Mirror polished, **as directed**.
- f. Panel Coverage: 8 inches (203 mm) **OR** 12 inches (305 mm) **OR** 16 inches (406 mm) **OR** 20 inches (508 mm), **as directed**.
- g. Panel Height: 0.875 inch (22 mm) **OR** 1.0 inch (25 mm) **OR** 1.5 inches (38 mm) **OR** 3.0 inches (76 mm), **as directed**.
- h. Sealant: Factory applied within interlocking joint.
4. Reveal-Joint-Profile Metal Soffit Panels: Solid **OR** Perforated, **as directed**, panels formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between panel edges; with recessed reveal joint between panels.
- a. Material: Same material, finish, and color as metal roof panels.
 - b. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: Match finish and color of metal roof panels **OR** Match finish and color of metal wall panels **OR** As selected by the Owner from manufacturer's full range, **as directed**.
 - c. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: Match finish and color of metal roof panels **OR** Match finish and color of metal wall panels **OR** As selected by the Owner from manufacturer's full range, **as directed**.



- d. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: Match finish and color of metal roof panels **OR** Match finish and color of metal wall panels **OR** As selected by the Owner from manufacturer's full range, **as directed**.
 - e. Material: Copper sheet, 16-oz./sq. ft. weight (0.55-mm thickness) **OR** 20-oz./sq. ft. weight (0.68-mm thickness), **as directed**.
 - 1) Exterior Finish: Brushed satin (lacquered) **OR** Mirror polished, **as directed**.
 - f. Panel Coverage: 8 inches (203 mm) **OR** 12 inches (305 mm) **OR** 16 inches (406 mm) **OR** 20 inches (508 mm), **as directed**.
 - g. Panel Height: 0.75 inch (19 mm) **OR** 1.0 inch (25 mm) **OR** 1.5 inches (38 mm), **as directed**.
5. V-Groove-Profile Metal Soffit Panels: Solid **OR** Perforated, **as directed**, panels formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), flat pan, **as directed**, between panel edges; with V-groove joint between panels.
- a. Material: Same material, finish, and color as metal roof panels.
 - b. Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: Match finish and color of metal roof panels **OR** Match finish and color of metal wall panels **OR** As selected by the Owner from manufacturer's full range, **as directed**.
 - c. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: Match finish and color of metal roof panels **OR** Match finish and color of metal wall panels **OR** As selected by the Owner from manufacturer's full range, **as directed**.
 - d. Material: Aluminum sheet, 0.024 inch (0.65 mm) **OR** 0.032 inch (0.81 mm), **as directed**, thick.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: Match finish and color of metal roof panels **OR** Match finish and color of metal wall panels **OR** As selected by the Owner from manufacturer's full range, **as directed**.
 - e. Panel Coverage: 6 inches (152 mm) **OR** 12 inches (305 mm) **OR** 14 inches (356 mm), **as directed**.
 - f. Panel Height: 0.375 inch (10 mm) **OR** 0.44 inch (11 mm) **OR** 0.50 inch (13 mm) **OR** 0.625 inch (16 mm), **as directed**.

N. Accessories

1. Roof Panel Accessories: Provide components approved by roof panel manufacturer and as required for a complete metal roof panel assembly including trim, copings, fasciae, corner units, ridge closures, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.
 - a. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal roof panels.



- b. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
 - c. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 2. Flashing and Trim: Formed from same material as roof panels, prepainted with coil coating, minimum 0.018 inch (0.45 mm) thick. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal roof panels.
 3. Gutters: Formed from same material as roof panels. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch- (2400-mm-) long sections, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Furnish gutter supports spaced a maximum of 36 inches (900 mm) o.c., fabricated from same metal as gutters. Provide wire ball strainers of compatible metal at outlets. Finish gutters to match metal roof panels **OR** roof fascia and rake trim, **as directed**.
 4. Downspouts: Formed from same material as roof panels. Fabricate in 10-foot- (3-m-) long sections, complete with formed elbows and offsets, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual". Finish downspouts to match gutters.
 5. Roof Curbs: Fabricated from same material as roof panels, minimum 0.048 inch (1.2 mm) thick; with bottom of skirt profiled to match roof panel profiles, and welded top box and integral full-length cricket. Fabricate curb subframing of minimum 0.0598-inch- (1.5-mm-) thick, angle-, C-, or Z-shaped steel sheet. Fabricate curb and subframing to withstand indicated loads, of size and height indicated. Finish roof curbs to match metal roof panels.
 - a. Insulate roof curb with 1-inch- (25-mm-) thick, rigid insulation.
- O. Snow Guards
1. Snow Guards: Prefabricated, noncorrosive units designed to be installed without penetrating metal roof panels, and complete with predrilled holes, clamps, or hooks for anchoring.
 - a. Surface-Mounted, Plastic, Stop-Type Snow Guards: Clear **OR** Integral color, **as directed**, polycarbonate stops designed for attachment to pan surface of metal roof panels using construction adhesive, silicone or polyurethane sealant, or adhesive tape.
 - b. Surface-Mounted, Metal, Stop-Type Snow Guards: Cast-aluminum stops designed for attachment to pan surface of metal roof panel using construction adhesive, silicone or polyurethane sealant, or adhesive tape.
 - c. Surface-Mounted, Copper, Stop-Type Snow Guards: Bronze-alloy stops designed for attachment to pan surface of copper roof panel using solder.
 - d. Seam-Mounted, Stop-Type Snow Guards: Cast-aluminum **OR** Malleable-iron **OR** Clear polycarbonate **OR** Colored polycarbonate, **as directed**, stops designed for attachment to vertical ribs of standing-seam metal roof panels with stainless-steel set screws.
 - e. Seam-Mounted, Bar-Type Snow Guards: Aluminum **OR** stainless-steel, **as directed**, rods or bars held in place by stainless-steel clamps attached to vertical ribs of standing-seam metal roof panels.
 - 1) Aluminum Finish: Mill **OR** Clear anodized, **as directed**.
 - 2) Stainless-Steel Finish: Mill **OR** No. 2B **OR** No. 4, **as directed**.
- P. Fabrication
1. Fabricate and finish metal roof panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes and as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.
 2. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.



3. Fabricate metal roof panel side laps with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will seal weathertight and minimize noise from movements within panel assembly.
4. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.
 - a. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - b. End Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 - c. End Seams for Other Than Aluminum: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 - d. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
 - e. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 - f. Fabricate cleats and attachment devices of size and metal thickness recommended by SMACNA's "Architectural Sheet Metal Manual" or by metal roof panel manufacturer for application, but not less than thickness of metal being secured.

Q. Finishes

1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
3. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

1.3 EXECUTION

A. Preparation

1. Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment.
2. Substrate Board: Install substrate boards over roof deck **OR** sheathing, **as directed**, on entire roof surface. Attach with substrate-board fasteners.
 - a. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.
 - b. Comply with UL **OR** FMG, **as directed**, requirements for fire-rated construction.
3. Miscellaneous Framing: Install subpurlins, eave angles, furring, and other miscellaneous roof panel support members and anchorage according to metal roof panel manufacturer's written instructions.
 - a. Soffit Framing: Wire tie or clip furring channels to supports, as required to comply with requirements for assemblies indicated.

B. Underlayment Installation

1. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated below **OR** on Drawings, **as directed**, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Extend underlayment into gutter trough. Roll laps with roller. Cover underlayment within 14 days.
 - a. Roof perimeter for a distance up from eaves of 24 inches (600 mm) **OR** 36 inches (914 mm), **as directed**, beyond interior wall line.



- b. Valleys, from lowest point to highest point, for a distance on each side of 18 inches (460 mm), **as directed**. Overlap ends of sheets not less than 6 inches (150 mm).
 - c. Rake edges for a distance of 18 inches (460 mm).
 - d. Hips and ridges for a distance on each side of 12 inches (300 mm).
 - e. Roof to wall intersections for a distance from wall of 18 inches (460 mm).
 - f. Around dormers, chimneys, skylights, and other penetrating elements for a distance from element of 18 inches (460 mm).
2. Felt Underlayment: Apply at locations indicated below **OR** on Drawings, **as directed**, in shingle fashion to shed water, and with lapped joints of not less than 2 inches (50 mm).
 - a. Apply over entire roof surface.
 - b. Apply on roof not covered by self-adhering sheet underlayment. Lap over edges of self-adhering sheet underlayment not less than 3 inches (75 mm), in shingle fashion to shed water.
 3. Apply slip sheet over underlayment before installing metal roof panels.
 4. Install flashings to cover underlayment to comply with requirements specified in Division 07 Section "Sheet Metal Flashing And Trim".

C. Thermal Insulation Installation

1. Polyethylene Vapor Retarder: Extend vapor retarder to extremities of areas to be protected from vapor transmission. Repair tears or punctures immediately before concealment by other work.
2. Board Insulation: Extend insulation in thickness indicated to cover entire roof. Comply with installation requirements in Division 07 Section "Thermal Insulation".
 - a. Erect insulation and hold in place with Z-shaped furring members spaced 24 inches (610 mm) **OR** 600 mm, **as directed**, o.c. Securely attach narrow flanges of furring members to roof deck with screws spaced 24 inches (600 mm) o.c.
3. Blanket Insulation: Install insulation concurrently with metal roof panel installation, in thickness indicated to cover entire roof, according to manufacturer's written instructions and as follows:
 - a. Set vapor-retarder-faced units with vapor retarder to warm side **OR** in location indicated, **as directed**, of construction unless otherwise indicated. Do not obstruct ventilation spaces.
 - b. Tape joints and ruptures in vapor retarder and seal each continuous area of insulation to surrounding construction to ensure airtight installation.
 - c. Install blankets straight and true in one-piece lengths with both sets of facing tabs sealed. Comply with the following installation method:
 - 1) Over-Framing Installation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing members. Hold in place by panels fastened to secondary framing.
 - 2) Between-Purlin Installation: Extend insulation and vapor retarder between purlins. Carry vapor-retarder facing tabs up and over purlin, overlapping adjoining facing of next insulation course maintaining continuity of retarder. Hold in place with bands and crossbands below insulation.
 - 3) Over-Purlin-with-Spacer-Block Installation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing members. Install layer of filler insulation over first layer to fill space formed by roof panel standoffs. Hold in place by panels fastened to standoffs.
 - 4) Two-Layers-between-Purlin-with-Spacer-Block Installation: Extend insulation and vapor retarder between purlins. Carry vapor-retarder facing tabs up and over purlins, overlapping adjoining facing of next insulation course maintaining continuity of retarder. Install layer of filler insulation over first layer to fill space between purlins formed by thermal spacer blocks. Hold in place with bands and crossbands below insulation.
 - d. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.
 - e. Thermal Spacer Blocks: Where metal roof panels attach directly to purlins, install thermal spacer blocks.



D. Metal Roof Panel Installation, General

1. Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.
2. Thermal Movement. Rigidly fasten metal roof panels to structure at one and only one location for each panel. Allow remainder of panel to move freely for thermal expansion and contraction. Predrill panels for fasteners.
 - a. Point of Fixity: Fasten each panel along a single line of fixing located at eave **OR** ridge **OR** center of panel length **OR** locations indicated on Drawings, **as directed**.
 - b. Avoid attaching accessories through roof panels in a manner that will inhibit thermal movement.
3. Install metal roof panels as follows:
 - a. Commence metal roof panel installation and install minimum of 300 sq. ft. (27.8 sq. m.) in presence of factory-authorized representative.
 - b. Field cutting of metal panels by torch is not permitted.
 - c. Install panels perpendicular to purlins.
 - d. Locate and space fastenings in uniform vertical and horizontal alignment.
 - e. Provide metal closures at rake edges **OR** rake walls, **as directed**, and each side of ridge **OR** ridge and hip, **as directed**, caps.
 - f. Flash and seal metal roof panels with weather closures at eaves, rakes, and perimeter of all openings.
 - g. Install ridge **OR** ridge and hip, **as directed**, caps as metal roof panel work proceeds.
 - h. End Splices: Locate panel end splices over, but not attached to, structural supports. Stagger panel end splices to avoid a four-panel splice condition.
 - i. Install metal flashing to allow moisture to run over and off metal roof panels.
4. Fasteners:
 - a. Steel Roof Panels: Use stainless-steel fasteners for surfaces exposed to the exterior and galvanized-steel fasteners for surfaces exposed to the interior.
 - b. Aluminum Roof Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior and aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
 - c. Copper Roof Panels: Use copper, stainless-steel, or hardware-bronze fasteners.
5. Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.
6. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.
 - a. Coat back side of roof panels with bituminous coating where roof panels will contact wood, ferrous metal, or cementitious construction.
7. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal roof panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal roof panel manufacturer.
 - a. Seal metal roof panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal roof panel manufacturer.
 - b. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants".

E. Metal Roof Panel Installation

1. Lap-Seam Metal Roof Panels: Fasten metal roof panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
 - a. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
 - b. Lap ribbed or fluted sheets one full rib corrugation.
 - c. Provide metal-backed neoprene or EPDM washers under heads of exposed fasteners bearing on weather side of metal roof panels.



- d. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
 - e. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
 - f. Provide sealant tape at lapped joints of metal roof panels and between panels and protruding equipment, vents, and accessories.
 - g. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps, and on side laps of nesting-type panels; on side laps of corrugated nesting-type, ribbed, or fluted panels; and elsewhere as needed to make panels weatherproof to driving rains.
 - h. At panel end splices, nest panels with minimum 6-inch (150-mm) end lap, sealed with butyl-rubber sealant and fastened together by interlocking clamping plates.
2. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended by manufacturer.
 - a. Install clips to supports with self-tapping fasteners.
 - b. Install pressure plates at locations indicated in manufacturer's written installation instructions.
 - c. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
 - d. Seamed Joint: Crimp standing seams with manufacturer-approved, motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.
 3. Batten-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each batten-seam joint at location, spacing, and with fasteners recommended by manufacturer.
 - a. Install clips to supports with self-drilling fasteners.
 - b. Apply battens to metal roof panel seams, fully engaged to provide weathertight joints.
 4. Horizontal-Seam (Bermuda-Type) Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each horizontal-seam joint at location, spacing, and with fasteners recommended by manufacturer. Start at eave and work upward toward ridge.
 - a. Install clips to supports with self-drilling fasteners.
- F. Foamed-Insulation-Core Metal Roof Panel Installation
1. General: Apply continuous ribbon of sealant to panel joint on concealed side of insulated metal roof panels as vapor seal; apply sealant to panel joint on exposed side of panels for weather seal.
 2. Lap-Seam, Foamed-Insulation-Core Metal Roof Panels: Fasten insulated metal roof panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
 - a. Lap ribbed or fluted sheets one full rib corrugation. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
 - b. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of insulated metal roof panels.
 - c. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
 - d. Provide sealant tape at lapped joints of insulated metal roof panels and between panels and protruding equipment, vents, and accessories.
 - e. Apply a continuous ribbon of sealant tape to panel side laps and elsewhere as needed to make panels weatherproof to driving rains.
 - f. Apply snap-on battens to insulated metal roof panel seams to conceal fasteners.
 3. Standing-Seam, Foamed-Insulation-Core Metal Roof Panels: Fasten insulated metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended by manufacturer.
 - a. Install clips to supports with self-tapping fasteners.



1. Stop-Type Snow Guards: Attach snow guards to metal roof panels with adhesive, sealant, or adhesive tape, as recommended by manufacturer. Do not use fasteners that will penetrate metal roof panels.
 - a. Provide rows of snow guards, at locations indicated on Drawings, spaced apart, beginning from gutter, with each snow guard centered between panel ribs.
 2. Bar-Type Snow Guards: Attach bar supports to vertical ribs of standing-seam metal roof panels with clamps or set screws. Do not use fasteners that will penetrate metal roof panels.
 - a. Provide rows of snow guards, at locations indicated on Drawings, spaced apart, beginning from gutter.
- J. Erection Tolerances
1. Installation Tolerances: Shim and align metal roof panel units within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.
- K. Field Quality Control
1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect metal roof panel installation, including accessories. Report results in writing.
 2. Remove and replace applications of metal roof panels where inspections indicate that they do not comply with specified requirements.
 3. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- L. Cleaning
1. Remove temporary protective coverings and strippable films, if any, as metal roof panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal roof panel installation, clean finished surfaces as recommended by metal roof panel manufacturer. Maintain in a clean condition during construction.
 2. Replace metal roof panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 41 13 00



SECTION 07 41 13 00a - SHEET METAL ROOFING

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for sheet metal roofing. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Flat-seam metal roofing, custom fabricated.
 - b. Standing-seam metal roofing, custom fabricated **OR** on-site, roll formed, **as directed**.
 - c. Batten-seam metal roofing, custom fabricated **OR** on-site, roll formed, **as directed**.
 - d. Horizontal-seam (Bermuda-type) metal roofing, custom fabricated.

C. Performance Requirements

1. General Performance: Sheet metal roofing system including, but not limited to, metal roof panels, cleats, clips, anchors and fasteners, sheet metal flashing integral with sheet metal roofing, fascia panels, trim, battens, **as directed**, underlayment, and accessories shall comply with requirements indicated without failure due to defective manufacture, fabrication, installation, or other defects in construction. Sheet metal roofing shall remain watertight.
2. Thermal Movements: Provide sheet metal roofing that allows for thermal movements from ambient and surface temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
3. Energy Performance: Provide metal roofing with solar reflectance index not less than 78 **OR** 29, **as directed**, when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency.

D. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittal:
 - a. Product Test Reports for Credit SS 7.2: For roof panels, indicating that panels comply with Solar Reflectance Index requirement.
3. Shop Drawings: Show fabrication and installation layouts of sheet metal roofing, including plans, elevations, expansion joint locations, and keyed details. Distinguish between shop- and field-assembled work.
 - a. Include details for forming, joining, and securing sheet metal roofing, including pattern of seams, termination points, fixed points, expansion joints, roof penetrations, edge conditions, special conditions, connections to adjoining work, and details of accessory items.
4. Samples: For each exposed product and for each finish specified.
5. Coordination Drawings: Roof plans drawn to scale with coordinated details for penetrations and roof-mounted items.
6. Portable Roll-Forming Equipment Certificate: Issued by UL for equipment manufacturer's portable roll-forming equipment capable of producing panels that comply with UL requirements.
7. Product test reports.
8. Maintenance data.
9. Warranties: Sample of special warranties.

E. Quality Assurance



1. Roll-Formed Sheet Metal Roofing Fabricator Qualifications: Fabricator authorized by portable roll-forming equipment manufacturer to fabricate and install sheet metal roofing units required for this Project, and who maintains current UL certification of its portable roll-forming equipment.
2. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing roofing panels for sheet metal roofing assemblies that comply with UL 580 for Class 30 **OR** Class 60 **OR** Class 90, **as directed**, wind-uplift resistance. Maintain UL certification of portable roll-forming equipment for duration of sheet metal roofing work.
3. Sheet Metal Roofing Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.
4. Copper Roofing Standard: Comply with CDA's "Copper in Architecture Handbook." Conform to dimensions and profiles shown unless more stringent requirements are indicated.
5. Preinstallation Conference: Conduct conference at Project site.

F. Delivery, Storage, And Handling

1. Do not store sheet metal roofing materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal roofing materials away from uncured concrete and masonry.
2. Protect strippable protective covering on sheet metal roofing from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal roofing installation.

G. Warranty

1. Special Warranty: Warranty form at the end of this Section in which Installer agrees to repair or replace components of sheet metal roofing that fail in materials or workmanship within two years from date of Final Completion.
2. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal roofing that shows evidence of deterioration of factory-applied finishes within 20 **OR** 10, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Roofing Sheet Metals

1. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.
2. Metallic-Coated Steel Sheet: Restricted flatness steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.
 - b. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40 (Class AZM150 coating designation, Grade 275); structural quality.
 - c. Thickness: Nominal 0.022 inch (0.56 mm) **OR** 0.028 inch (0.71 mm), **as directed**, unless otherwise indicated.
 - 1) Batten Caps: Nominal 0.028 inch (0.71 mm) thick.
 - d. Surface: Smooth, flat **OR** Embossed, **as directed**.
 - e. Exposed Coil-Coated Finish:
 - 1) Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2) Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 3) Four-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat and clear coats. Prepare, pretreat,



- and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
- 4) Mica Fluoropolymer: AAMA 621. Two-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 5) Metallic Fluoropolymer: AAMA 621. Three-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 6) FEVE Fluoropolymer: AAMA 621. Two-coat fluoropolymer finish containing 100 percent fluorinated ethylene vinyl ether resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 7) Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
 - 8) Plastisol: Epoxy primer and vinyl plastisol topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 3.8 mils (0.97 mm) for topcoat.
- f. Color: As selected from manufacturer's full range.
 - g. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).
3. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required.
- a. Thickness: 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, unless otherwise indicated.
 - 1) Batten Caps: 0.050 inch (1.27 mm) thick.
 - b. As-Milled Finish: Mill **OR** One-side bright mill **OR** Standard one-side bright **OR** Standard two-side bright, **as directed**, finish.
 - c. Alclad Finish: Metallurgically bonded surfacing to both sides, forming a composite aluminum sheet with reflective luster.
 - d. Surface: Smooth, flat **OR** Embossed, **as directed**.
 - e. Factory Prime Coating: Where painting after installation is indicated, pretreat with white or light-colored, factory-applied, baked-on epoxy primer coat; minimum dry film thickness of 0.2 mil (0.005 mm).
 - f. Exposed Coil-Coated Finish:
 - 1) Two-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2) Three-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 3) Four-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat and clear coats. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 4) Mica Fluoropolymer: AAMA 620. Two-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 5) Metallic Fluoropolymer: AAMA 620. Three-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight



- in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
- 6) FEVE Fluoropolymer: AAMA 620. Two-coat fluoropolymer finish containing 100 percent fluorinated ethylene vinyl ether resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 7) Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
 - 8) Plastisol: Epoxy primer and vinyl plastisol topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 3.8 mil (0.97 mm) for topcoat.
- g. Color: As selected from manufacturer's full range.
 - h. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).
4. Copper Sheet: ASTM B 370, cold-rolled copper sheet, H00 temper, 16 oz./sq. ft. (0.55 mm thick) **OR** 20 oz./sq. ft. (0.70 mm thick), **as directed**, unless otherwise indicated.
 - a. Batten Caps: 20 oz./sq. ft. (0.70 mm thick).
 - b. Non-Patinated Exposed Finish: Mill
 - c. Non-Patinated Exposed, Lacquered Finish: Finish designations for copper alloys comply with the system defined in NAAMM's "Metal Finishes Manual for Architectural and Metal Products."
 - 1) Brushed Satin (Lacquered): M32-06x (Mechanical Finish: directionally textured, medium satin; with clear organic coating); coating of "Incralac" waterborne **OR** solvent-borne, **as directed**, methyl methacrylate copolymer lacquer with UV inhibitor, applied by air spray in two coats per manufacturer's written instructions to a total thickness of 1 mil (0.025 mm).
 - 2) Mirror Polished (Lacquered): M22-06x (Mechanical Finish: buffed, specular; with clear organic coating); coating of "Incralac" waterborne **OR** solvent-borne, **as directed**, air-drying, methyl methacrylate copolymer lacquer with UV inhibitor, applied by air spray in two coats per manufacturer's written instructions to a total thickness of 1 mil (0.025 mm).
 - d. Pre-Patinated Copper-Sheet Finish: Dark brown **OR** Verdigris, **as directed**, pre-patinated according to ASTM B 882.
 5. Zinc-Tin Alloy-Coated Copper Sheet: ASTM B 370, cold-rolled copper sheet, H00 temper, coated on both sides with a zinc-tin alloy (50 percent zinc, 50 percent tin).
 - a. Weight (Thickness): 16-oz./sq. ft. (0.55-mm) **OR** 20-oz./sq. ft. (0.70-mm), **as directed**, uncoated weight (thickness), with 0.787-mil (0.020-mm) coating thickness applied to each side.
 - 1) Batten Caps: 20-oz./sq. ft. (0.70-mm) uncoated weight (thickness), with 0.787-mil (0.020-mm) coating thickness applied to each side unless otherwise indicated.
 6. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304, dead soft, fully annealed.
 - a. Thickness: 0.016 inch (0.40 mm) **OR** 0.019 inch (0.48 mm), **as directed**, unless otherwise indicated.
 - 1) Batten Caps: 0.019 inch (0.48 mm) thick.
 - b. Surface: Smooth, flat **OR** Embossed, **as directed**.
 - c. Finish: 2D (dull, cold rolled) **OR** 2B (bright, cold rolled) **OR** 3 (coarse, polished directional satin) **OR** 4 (polished directional satin), **as directed**.
 - 1) Remove tool and die marks and stretch lines or blend into finish.
 - 2) Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
 - 3) When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.



7. Zinc-Tin Alloy-Coated Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, dead-soft, fully annealed stainless-steel sheet, coated on both sides with a zinc-tin alloy (50 percent zinc, 50 percent tin), with factory-applied gray preweathering.
 - a. Thickness: 0.015-inch (0.38-mm) **OR** 0.018-inch (0.46-mm) **OR** 0.024-inch (0.61-mm), **as directed**, minimum uncoated thickness, with 0.787-mil (0.020-mm) coating thickness applied to each side.
 - 1) Batten Caps: 0.018-inch- (0.46-mm-) minimum uncoated thickness, with 0.787-mil (0.020-mm) coating thickness applied to each side unless otherwise indicated.
 8. Zinc-Tin Alloy-Coated Steel Sheet: ASTM A 625/A 625M; single-reduced, black-steel sheet, coated on both sides with a zinc-tin alloy (50 percent zinc, 50 percent tin), with factory-applied shop coat, **as directed**.
 - a. Thickness: 0.012-inch (0.31-mm) **OR** 0.014-inch (0.36-mm), **as directed**, uncoated thickness, with 0.787-mil (0.020-mm) coating thickness applied to each side.
 - 1) Batten Caps: 0.014-inch (0.36-mm) uncoated thickness, with 0.787-mil (0.020-mm) coating thickness applied to each side unless otherwise indicated.
 - b. Exposed Coil-Coated Finish: Manufacturer's standard two-coat fluoropolymer complying with performance requirements in AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1) Color: As selected from manufacturer's full range.
 - c. Field-Applied Finish: Manufacturer's standard waterborne acrylic emulsion paint primer and finish coat.
 - 1) Color: As selected from manufacturer's full range.
 9. Zinc Sheet: Zinc, 99 percent pure, alloyed with a maximum of 1 percent copper and titanium; with manufacturer's standard factory-applied, flexible, protective back coating.
 - a. Thickness: 0.027 inch (0.70 mm) **OR** 0.032 inch (0.80 mm), **as directed**, unless otherwise indicated.
 - 1) Batten Caps: 0.032 inch (0.80 mm) thick.
 - b. Finish: Bright rolled **OR** Preweathered gray **OR** Preweathered black, **as directed**.
 10. Titanium Sheet: ASTM B 265, Grade 1.
 - a. Thickness: 0.015 inch (0.38 mm) **OR** 0.020 inch (0.51 mm), **as directed**, unless otherwise indicated.
 - 1) Batten Caps: 0.020 inch (0.51 mm) thick.
 - b. Surface: Smooth, flat **OR** Embossed, **as directed**.
 - c. Finish: Low **OR** Medium, **as directed**, matte.
 - d. Color Anodic Finish (Light-Interference Phenomenon): Silver **OR** Gold **OR** Purple **OR** Blue **OR** Match sample **OR** As selected from manufacturer's full range of colors and color densities, **as directed**.
- B. Underlayment Materials
1. Polyethylene Sheet: 6-mil- (0.15-mm-) thick polyethylene sheet complying with ASTM D 4397.
 2. Felts: ASTM D 226, Type II (No. 30) **OR** Type I (No. 15), **as directed**, asphalt-saturated organic felts.
 3. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils (0.76 to 1.0 mm) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
 - a. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F (116 deg C).
 - b. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F (29 deg C).
 4. Slip Sheet: Building paper, 3-lb/100 sq. ft. (0.16-kg/sq. m) minimum, rosin sized.
- C. Miscellaneous Materials



1. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for a complete roofing system and as recommended by fabricator for sheet metal roofing.
2. Wood Battens: Lumber complying with requirements in Division 05 Section(s) "Maintenance Of Decorative Metal" OR Division 06 Section(s) "Miscellaneous Rough Carpentry", **as directed**, and treated with exterior-type fire retardant.
3. Snap-On Seams: Provide snap-on seams integrated with panel-edge profile as recommended by portable roll-forming equipment manufacturer to produce sheet metal roofing assemblies that comply with UL 580 for wind-uplift resistance classification specified in "Quality Assurance" Article.
4. Snap-on Batten Caps: Provide batten clips integrated with snap-on caps as recommended by portable roll-forming equipment manufacturer to produce sheet metal roofing assemblies that comply with UL 580 for wind-uplift resistance classification specified in "Quality Assurance" Article.
5. Fasteners: Wood screws, annular-threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.
 - a. General:
 - 1) Exposed Fasteners: Heads matching color of sheet metal roofing using plastic caps or factory-applied coating.
 - 2) Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - 3) Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
 - b. Fasteners for Zinc-Coated **OR** Aluminum-Zinc Alloy-Coated, **as directed**, Steel Sheet: Hot-dip galvanized steel according to ASTM A 153/A 153M, ASTM F 2329, or Series 300 stainless steel.
 - c. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
 - d. Fasteners for Copper **OR** Zinc-Tin Alloy-Coated Copper, **as directed**, Sheet: Copper, hardware bronze, or Series 300 stainless steel.
 - e. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
 - f. Fasteners for Zinc-Tin Alloy-Coated Steel **OR** Stainless-Steel, **as directed**, Sheet: Series 300 stainless steel.
 - g. Fasteners for Zinc Sheet: Hot-dip galvanized steel according to ASTM A 153/A 153M, ASTM F 2329, or Series 300 stainless steel.
 - h. Fasteners for Titanium Sheet: Titanium or Series 300 stainless steel.
6. Solder:
 - a. For Zinc-Coated (Galvanized) Steel: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead.
 - b. For Copper: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.
 - c. For Stainless Steel: ASTM B 32, Grade Sn60, with an acid flux of type recommended by stainless-steel sheet manufacturer.
 - d. For Zinc-Tin Alloy-Coated Steel **OR** Stainless Steel **OR** Copper, **as directed**: ASTM B 32, 100 percent tin.
 - e. For Zinc: ASTM B 32, 40 percent tin and 60 percent lead with low antimony, as recommended by manufacturer.
7. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
8. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane **OR** polysulfide **OR** silicone, **as directed**, polymer sealant as recommended by portable roll-forming equipment manufacturer for installation indicated, **as directed**; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal roofing and remain watertight.
9. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.



10. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

D. Accessories

1. Sheet Metal Accessories: Provide components required for a complete sheet metal roofing assembly including trim, copings, fasciae, corner units, clips, flashings, sealants, gaskets, fillers, metal closures, closure strips, and similar items. Match material and finish of sheet metal roofing unless otherwise indicated.
 - a. Provide accessories as recommended by portable roll-forming equipment manufacturer to produce sheet metal roofing assemblies that comply with UL 580 for wind-uplift resistance classification specified in "Quality Assurance" Article.
 - b. Cleats: For mechanically seaming into joints and formed from the following materials:
 - 1) Metallic-Coated Steel **OR** Aluminum, **as directed**, Roofing: 0.0250-inch- (0.64-mm-), **as directed**, thick stainless steel.
 - 2) Copper **OR** Zinc-Tin Alloy-Coated Copper, **as directed**, Roofing: 16-oz./sq. ft. (0.55-mm), **as directed**, copper sheet.
 - 3) Stainless-Steel **OR** Titanium, **as directed**, Roofing: 0.0250-inch- (0.64-mm-), **as directed**, thick stainless steel.
 - 4) Zinc-Tin Alloy-Coated Stainless-Steel **OR** Zinc-Tin Alloy-Coated Steel, **as directed**, Roofing: Manufacturer's preformed cleats or cleats fabricated from manufacturer's thickest flat-stock sheet.
 - 5) Zinc Roofing: Manufacturer's preformed stainless-steel cleats.
 - c. Clips: Minimum 0.0625-inch- (1.6-mm-) thick, stainless-steel panel clips designed to withstand negative-load requirements.
 - d. Backing Plates: Plates at roofing splices, fabricated from material recommended by SMACNA.
 - e. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible-closure strips; cut or premolded to match sheet metal roofing profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
 - f. Flashing and Trim: Formed from same material and with same finish as sheet metal roofing, minimum 0.018 inch (0.46 mm) thick.
2. Pipe Flashing: Premolded, EPDM pipe collar with flexible aluminum ring bonded to base.
3. Roof Curbs: Fabricated from same material and finish as sheet metal roofing, minimum thickness matching the sheet metal roofing; with bottom of skirt profiled to match roof panel profiles; with weatherproof top box and integral full-length cricket. Fabricate curb subframing of nominal 0.062-inch- (1.59-mm-) thick, angle-, C-, or Z-shaped galvanized steel or stainless-steel sheet. Fabricate curb and subframing to withstand indicated loads of size and height indicated. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.
 - a. Insulate curbs with 1-inch- (25-mm-) thick, rigid insulation.
 - b. Install wood nailers at tops of curbs.

E. Snow Guards

1. Snow Guards, General: Prefabricated, noncorrosive units designed to be installed without penetrating sheet metal roofing; complete with predrilled holes, clamps, or hooks for anchoring.
2. Surface-Mounted, Plastic, Stop-Type Snow Guards: Clear **OR** Integral-color, **as directed**, polycarbonate stops designed for attachment to panel surface of sheet metal roofing using construction adhesive, silicone or polyurethane sealant, or adhesive tape.
3. Surface-Mounted, Metal, Stop-Type Snow Guards: Cast-aluminum stops designed for attachment to panel surface of sheet metal roofing using construction adhesive, silicone or polyurethane sealant, or adhesive tape.
4. Surface-Mounted, Copper, Stop-Type Snow Guards: Bronze-alloy stops designed for attachment to panel surface of copper roofing using solder.
5. Seam-Mounted, Stop-Type Snow Guards: Cast-aluminum **OR** Malleable-iron **OR** Clear polycarbonate **OR** Colored polycarbonate, **as directed**, stops designed for attachment to vertical ribs of standing-seam sheet metal roofing with stainless-steel set screws.



6. Seam-Mounted, Bar-Type Snow Guards: Rail- or fence-type assembly consisting of aluminum or stainless-steel rods, bars, or pipe held in place by stainless-steel clamps attached to vertical ribs of standing-seam sheet metal roofing.
 - a. Aluminum Finish: Mill **OR** Clear anodized, **as directed**.
 - b. Stainless-Steel Finish: Mill **OR** Enamel, **as directed**.

F. Fabrication

1. General: Custom fabricate sheet metal roofing to comply with details shown and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions (panel width and seam height), geometry, metal thickness, and other characteristics of installation indicated. Fabricate sheet metal roofing and accessories at the shop to greatest extent possible.
 - a. Flat-Seam Roofing: Form flat-seam panels from metal sheets 20 by 28 inches (510 by 710 mm) with 1/2-inch (13-mm) notched and folded edges.
 - b. Standing-Seam Roofing: Form standing-seam panels with finished seam height of 1 inch (25 mm) **OR** of 1-1/2 inches (38 mm) **OR** as indicated, **as directed**.
 - c. Batten-Seam Roofing: Form batten-seam panels with sides turned up 2-1/8 inches (54 mm) **OR** as indicated, **as directed**, with 1/2-inch (13-mm) flange turned toward center of pan.
 - d. Horizontal-Seam (Bermuda-Type) Roofing: Form horizontal-seam (Bermuda-type) panels with upper edges turned up and extending above batten 1/2 inch (13 mm).
2. General: Fabricate roll-formed sheet metal roofing panels with UL-certified, portable roll-forming equipment capable of producing roofing panels for sheet metal roofing assemblies that comply with UL 580 for wind-uplift resistance classification specified in "Quality Assurance" Article. Fabricate roll-formed sheet metal according to equipment manufacturer's written instructions and to comply with details shown.
3. Fabrication Tolerances: Fabricate sheet metal roofing that is capable of installation to a tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.
4. Fabrication Tolerances: Fabricate sheet metal roofing that is capable of installation to tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."
5. Form exposed sheet metal work to fit substrates without excessive oil canning, buckling, and tool marks; true to line and levels indicated; and with exposed edges folded back to form hems.
 - a. Lay out sheet metal roofing so transverse seams, if required, are made in direction of flow with higher panels overlapping lower panels.
 - b. Offset transverse seams from each other 12 inches (300 mm) minimum.
 - c. Fold and cleat eaves and transverse seams in the shop.
 - d. Form and fabricate sheets, seams, strips, cleats, valleys, ridges, edge treatments, integral flashings, and other components of metal roofing to profiles, patterns, and drainage arrangements shown on Drawings and as required for leakproof construction.
6. Expansion Provisions: Fabricate sheet metal roofing to allow for expansion in running work sufficient to prevent leakage, damage, and deterioration of the Work. Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.
7. Sealant Joints: Where movable, nonexpansion-type joints are indicated or required to produce weathertight seams, form metal to provide for proper installation of elastomeric sealant in compliance with SMACNA standards.
8. Metal Protection: Where dissimilar metals will contact each other, protect against galvanic action by painting contact surfaces with bituminous coating, by applying self-adhering sheet underlayment to each contact surface, or by other permanent separation as recommended by fabricator of sheet metal roofing or manufacturers of the metals in contact.
9. Sheet Metal Accessories: Custom fabricate flashings and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Obtain field measurements for accurate fit before shop fabrication.



- a. Form exposed sheet metal accessories without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
 - b. Seams:
 - 1) Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
OR
Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength, **as directed**.
 - c. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.
 - d. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 - e. Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" for application, but not less than thickness of metal being secured.
10. Do not use graphite pencils to mark metal surfaces.

1.3 EXECUTION

A. Preparation

1. Lay out and nail battens to wood sheathing **OR** screw battens to wood sheathing **OR** screw battens to metal deck, **as directed**, before installation of sheet metal roofing.
 - a. Space fasteners not more than 18 inches (457 mm) o.c.
 - b. Space fasteners as required by portable roll-forming equipment manufacturer for specified UL classification for wind-uplift resistance.
2. Zinc-Tin Alloy-Coated Steel Roofing: For roofing with 3:12 slopes or less, paint underside of shop-coated, zinc-tin alloy-coated steel, before installation, with zinc-tin alloy-coated steel primer, applied at a dry film thickness of not less than 2.5 mils (0.06 mm). Comply with manufacturer's written instructions. This is in addition to the shop coating.

B. Underlayment Installation

1. Polyethylene Sheet: Install polyethylene sheet on roof sheathing under sheet metal roofing. Use adhesive for anchorage to minimize use of mechanical fasteners under sheet metal roofing. Apply at locations indicated on Drawings, in shingle fashion to shed water, with lapped and taped joints of not less than 2 inches (50 mm).
2. Felt Underlayment: Install felt underlayment on roof sheathing under sheet metal roofing. Use adhesive for temporary anchorage to minimize use of mechanical fasteners under sheet metal roofing. Apply at locations indicated, in shingle fashion to shed water, with lapped joints of not less than 2 inches (50 mm).
 - a. Apply from eave to ridge.
OR
Apply on roof not covered by self-adhering sheet underlayment. Lap edges of self-adhering sheet underlayment not less than 3 inches (75 mm), in shingle fashion to shed water.
3. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free, on roof sheathing under sheet metal roofing. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply over entire roof **OR** at locations indicated, **as directed**, in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps with roller. Cover underlayment within 14 days.
 - a. Roof perimeter for a distance up from eaves of 24 inches (600 mm) **OR** 36 inches (900 mm), **as directed**, beyond interior wall line.



- b. Valleys, from lowest to highest point, for a distance on each side of 18 inches (460 mm). Overlap ends of sheets not less than 6 inches (150 mm).
 - c. Rake edges for a distance of 18 inches (460 mm).
 - d. Hips and ridges for a distance on each side of 12 inches (300 mm).
 - e. Roof to wall intersections for a distance from wall of 18 inches (460 mm).
 - f. Around dormers, chimneys, skylights, and other penetrating elements for a distance from element of 18 inches (460 mm).
4. Install flashings to cover underlayment to comply with requirements in Division 07 Section "Sheet Metal Flashing And Trim".
 5. Apply slip sheet before installing sheet metal roofing.

C. Installation, General

1. General: Anchor sheet metal roofing and other components of the Work securely in place, with provisions for thermal and structural movement. Install fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for a complete roofing system and as recommended by fabricator for sheet metal roofing.
 - a. Field cutting of sheet metal roofing by torch is not permitted.
 - b. Provide metal closures at peaks, rake edges, rake walls, eaves, and each side of ridge and hip caps, **as directed**.
 - c. Flash and seal sheet metal roofing with closure strips at eaves, rakes, and perimeter of all openings. Fasten with self-tapping screws.
 - d. Locate and space fastenings in uniform vertical and horizontal alignment. Predrill panels for fasteners.
 - e. Install ridge **OR** ridge and hip, **as directed**, caps as sheet metal roofing work proceeds.
 - f. Locate roofing splices over, but not attached to, structural supports. Stagger roofing splices and end laps to avoid a four-panel lap splice condition. Install backing plates at roofing splices.
 - g. Install sealant tape where indicated.
 - h. Lap metal flashing over sheet metal roofing to allow moisture to run over and off the material.
 - i. Do not use graphite pencils to mark metal surfaces.
2. Thermal Movement. Rigidly fasten metal roof panels to structure at only one location for each panel. Allow remainder of panel to move freely for thermal expansion and contraction.
 - a. Point of Fixity: Fasten each panel along a single line of fixing located at eave **OR** ridge **OR** center of panel length **OR** locations indicated on Drawings, **as directed**.
 - b. Avoid attaching accessories through roof panels in a manner that will inhibit thermal movement.
3. Fasteners: Use fasteners of sizes that will penetrate wood sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws **OR** metal decking not less than recommended by fastener manufacturer to achieve maximum pull-out resistance, **as directed**.
4. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying self-adhering sheet underlayment to each contact surface, or by other permanent separation as recommended by SMACNA.
 - a. Coat back side of uncoated aluminum and stainless-steel sheet metal roofing with bituminous coating where roofing will contact wood, ferrous metal, or cementitious construction.
5. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
6. Fasciae: Align bottom of sheet metal roofing and fasten with blind rivets, bolts, or self-tapping screws. Flash and seal sheet metal roofing with closure strips where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.



D. Custom-Fabricated Sheet Metal Roofing Installation

1. Fabricate and install work with lines and corners of exposed units true and accurate. Form exposed faces flat and free of buckles, excessive waves, and avoidable tool marks, considering temper and reflectivity of metal. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant. Fold back sheet metal to form a hem on concealed side of exposed edges unless otherwise indicated.
 - a. Install cleats to hold sheet metal panels in position. Attach each cleat with two fasteners to prevent rotation.
 - b. Fasten cleats not more than 12 inches (300 mm) o.c. Bend tabs over fastener head.
 - c. Provide expansion-type cleats and clips for roof panels that exceed 30 feet (9.1 m) in length.
2. Seal joints as shown and as required for watertight construction. For roofing with 3:12 slopes or less, use cleats at transverse seams.
 - a. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).
 - b. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants".
3. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches (38 mm), except reduce pre-tinning where pre-tinned surface would show in completed Work.
 - a. Do not solder metallic-coated steel **OR** aluminum **OR** titanium sheet.
 - b. Do not pre-tin zinc-tin alloy-coated stainless steel **OR** zinc-tin alloy-coated copper.
 - c. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
 - d. Stainless-Steel Roofing: Tin edges of uncoated sheets, using solder for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.
 - e. Copper Roofing: Tin edges of uncoated copper sheets, using solder for copper.
4. Rivets: Rivet joints in uncoated aluminum **OR** zinc, **as directed**, where indicated and where necessary for strength.
5. Flat-Seam Roofing: Attach flat-seam metal panels to substrate with cleats, starting at eave and working upward toward ridge. After panels are in place, mallet seams and solder.
 - a. Attach roofing panels with cleats spaced not more than 24 inches (610 mm) o.c.. Lock and solder panels to base flashing.
 - b. Attach edge flashing to face of roof edge with continuous cleat fastened to roof substrate at 12 inches (305 mm) o.c. Lock panels to edge flashing and solder **OR** apply sealant, **as directed**.
6. Standing-Seam Roofing: Attach standing-seam metal panels to substrate with cleats, double fastened at 12 inches (305 mm) o.c. Install panels reaching from eave to ridge before moving to adjacent panels. Before panels are interlocked, apply continuous bead of sealant to top of flange of lower panel. Lock standing seams by folding over twice so cleat and panel edges are completely engaged.
 - a. Lock each panel to panel below with soldered **OR** sealed, **as directed**, transverse seam.
 - b. Loose-lock panels at eave edges to continuous cleats and flanges at roof edge at gutters.
OR
Loose-lock panels at eave edges to continuous edge flashing exposed 24 inches (610 mm) from roof edge. Attach edge flashing to face of roof edge with continuous cleat fastened to roof substrate at 12 inches (305 mm) o.c. Lock panels to edge flashing.
 - c. Leave seams upright **OR** Fold over seams, **as directed**, after locking at ridges and hips.
7. Batten-Seam Roofing: Attach batten-seam metal panels to substrate with cleats, starting at eave and working upward toward ridge. Hold cleats in place with battens and fold edges of cleats over to hold panels. After panels are in place and before batten cap is installed, apply continuous



bead of sealant to top of flanges of each panel. Install batten cap covering batten and panel edges and fold batten cap and panel together so batten cap and panel edges are completely engaged.

- a. Hook each panel to panel below with soldered **OR** sealed, **as directed**, transverse seam.
- b. Splay upturned edges of panels away from base of battens to provide expansion capability.
- c. Close batten ends with metal closures. Fold together with panel edges and end of batten cap.
- d. Loose-lock panels at eave edges to continuous cleats and flanges at roof edge at gutters.

OR

Loose-lock panels at eave edges to continuous edge flashing exposed 24 inches (610 mm) from roof edge. Attach edge flashing to face of roof edge with continuous cleat fastened to roof substrate at 12 inches (305 mm) o.c. Lock panels to edge flashing.

8. Horizontal-Seam (Bermuda-Type) Roofing: Attach horizontal-seam metal panels to substrate with cleats, starting at eave and working upward toward ridge. Attach cleats to battens, spaced at 8 inches (203 mm) o.c. Lock lower edge of each panel to upper edge of panel below, folding seam over to engage cleat and panel edges. After first fold, mallet seams against batten, leaving joint slightly angled to form drip.
 - a. Hook end of each panel to adjacent panel with soldered **OR** sealed, **as directed**, cross seam.
 - b. Hook panel at eave edge to continuous cleat.
 - c. Join ridges and hips with a standing seam and leave seams upright **OR** fold over seams, **as directed**, after locking.
9. Field Painting: Paint exposed surfaces of zinc-tin alloy-coated steel with one coat of zinc-tin alloy-coated steel primer and one coat of zinc-tin alloy-coated steel finish coat as soon as possible after installation; apply each coat at a dry film thickness of not less than 2.5 mils (0.06 mm). Comply with manufacturer's written instructions.

E. On-Site, Roll-Formed Sheet Metal Roofing Installation

1. General: Install on-site, roll-formed sheet metal roofing fabricated from UL-certified equipment to comply with equipment manufacturer's written instructions for UL wind-uplift resistance class indicated. Provide sheet metal roofing of full length from eave to ridge unless otherwise restricted by on-site or shipping limitations.
2. Standing-Seam Sheet Metal Roofing: Fasten sheet metal roofing to supports with concealed clips at each standing-seam joint at location, at spacing, and with fasteners recommended by manufacturer of portable roll-forming equipment.
 - a. Install clips to substrate with self-tapping fasteners.
 - b. Install pressure plates at locations indicated in equipment manufacturer's written installation instructions.
 - c. Before panels are joined, apply continuous bead of sealant to top of flange of lower panel.
 - d. Snap-On Seam: Nest standing seams and fasten together by interlocking and completely engaging field-applied sealant.

OR

Seamed Joint: Crimp standing seams with manufacturer-approved motorized seamer tool so cleat, sheet metal roofing, and field-applied sealant are completely engaged.
3. Batten-Seam Sheet Metal Roofing: Fasten sheet metal roofing to supports with concealed clips at each batten-seam joint at location, at spacing, and with fasteners recommended by manufacturer of portable roll-forming equipment.
 - a. Install clips to substrate with self-drilling fasteners.
 - b. After panels are in place and before batten cap is installed, apply continuous bead of sealant to top of flange of each panel.
 - c. Apply snap-on batten caps to sheet metal roofing seams, fully engaged to provide weathertight joints.
4. Seal joints as shown and as required for watertight construction. For roofing with 3:12 slopes or less, use cleats at transverse seams.



- a. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).
- b. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants".

F. Accessory Installation

1. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
 - a. Install components required for a complete sheet metal roofing assembly including trim, copings, seam covers, flashings, sealants, gaskets, fillers, metal closures, closure strips, and similar items.
 - b. Install accessories integral to sheet metal roofing that are specified in Division 07 Section "Sheet Metal Flashing And Trim" to comply with that Section's requirements.
2. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
 - a. Install flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers.
 - b. Install continuous strip of self-adhering underlayment at edge of continuous flashing overlapping self-adhering underlayment, where "continuous seal strip" is indicated in SMACNA's "Architectural Sheet Metal Manual," and where indicated on Drawings.
 - c. Install exposed flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
 - d. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, and filled with butyl sealant concealed within joints.
3. Pipe Flashing: Form flashing around pipe penetration and sheet metal roofing. Fasten and seal to sheet metal roofing as recommended by SMACNA.
4. Roof Curbs: Install curbs at locations indicated on Drawings. Install flashing around bases where they meet sheet metal roofing.
5. Stop-Type Snow Guards: Attach snow guards to sheet metal roofing with adhesive or adhesive tape, as recommended by manufacturer. Do not use fasteners that will penetrate sheet metal roofing.
 - a. Provide rows of snow guards, at locations indicated on Drawings, spaced apart, beginning up from roof edge at gutter, with each snow guard centered between sheet metal roofing ribs, **as directed**.
6. Bar-Type Snow Guards: Attach bar supports to vertical ribs of standing-seam sheet metal roofing with clamps or set screws. Do not use fasteners that will penetrate sheet metal roofing.
 - a. Provide rows of snow guards, at locations indicated on Drawings, spaced apart, beginning up from roof edge at gutter.

G. Erection Tolerances

1. Installation Tolerances: Shim and align sheet metal roofing within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.



OR

Installation Tolerances: Shim and align sheet metal roofing within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

H. Cleaning And Protection

1. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
2. Clean and neutralize flux materials. Clean off excess solder.
3. Clean off excess sealants.
4. Remove temporary protective coverings and strippable films as sheet metal roofing is installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal roofing installation, clean finished surfaces as recommended by sheet metal roofing manufacturer. Maintain sheet metal roofing in a clean condition during construction.
5. Replace sheet metal roofing components that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 41 13 00a



Task	Specification	Specification Description
07 41 33 00	07 41 13 00	Metal Roof Panels



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**SECTION 07 46 16 00 - METAL WALL PANELS**

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for metal wall panels. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Exposed-fastener, lap-seam metal wall panels.
 - b. Concealed-fastener, lap-seam metal wall panels.
 - c. Metal liner panels.
 - d. Metal soffit panels.

C. Definition

1. Metal Wall Panel Assembly: Metal wall panels, attachment system components, miscellaneous metal framing, thermal insulation, and accessories necessary for a complete weathertight wall system.

D. Performance Requirements

1. General Performance: Metal wall panel assemblies shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.
2. Delegated Design: Design metal wall panel assembly, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
3. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) of wall area when tested according to ASTM E 283 at the following test-pressure difference:
 - a. Test-Pressure Difference: 1.57 lbf/sq. ft. (75 Pa).
4. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:
 - a. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa) which is equivalent to a 50-mph (80-km/h) wind.
5. Water Penetration under Dynamic Pressure: No evidence of water leakage when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of inward-acting, wind-load design pressure of not less than 6.24 lbf/sq. ft. (300 Pa) (which is equivalent to a 50-mph (80-km/h) wind) and not more than 12 lbf/sq. ft. (575 Pa).
 - a. Water Leakage: As defined according to AAMA 501.1.
OR
Water Leakage: Uncontrolled water infiltrating the system or appearing on system's normally exposed interior surfaces from sources other than condensation. Water controlled by flashing and gutters that is drained back to the exterior and cannot damage adjacent materials or finishes is not water leakage.
6. Structural Performance: Provide metal wall panel assemblies capable of withstanding the effects the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 1592:
 - a. Wind Loads: Determine loads based on the following minimum design wind pressures:
 - 1) Uniform pressure of 20 lbf/sq. ft. (957 Pa) **OR** 30 lbf/sq. ft. (1436 Pa), **as directed**, acting inward or outward.
OR
Uniform pressure as indicated on Drawings.



- b. Deflection Limits: Metal wall panel assemblies shall withstand wind loads with horizontal deflections no greater than 1/180 **OR** 1/240, **as directed**, of the span.
7. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

E. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: Show fabrication and installation layouts of metal wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish between factory-, shop- and field-assembled work.
3. Samples: For each type of exposed finish required.
4. Delegated-Design Submittal: For metal wall panel assembly indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
5. Coordination Drawings: Exterior elevations drawn to scale and coordinating penetrations and wall-mounted items.
6. Product Test Reports.
7. Field quality-control reports.
8. Maintenance Data.
9. Warranties: Sample of special warranties.

F. Quality Assurance

1. Installer Qualifications: An employer of workers trained and approved by manufacturer.
2. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
3. Fire-Resistance Ratings: Where indicated, provide metal wall panels identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
4. Preinstallation Conference: Conduct conference at Project site.

G. Delivery, Storage, And Handling

1. Deliver components, sheets, metal wall panels, and other manufactured items so as not to be damaged or deformed. Package metal wall panels for protection during transportation and handling.
2. Unload, store, and erect metal wall panels in a manner to prevent bending, warping, twisting, and surface damage.
3. Stack metal wall panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal wall panels in contact with other materials that might cause staining, denting, or other surface damage.
4. Retain strippable protective covering on metal wall panel for period of metal wall panel installation.
5. Protect foam-plastic insulation as follows:
 - a. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
 - b. Protect against ignition at all times. Do not deliver foam-plastic insulation materials to Project site before installation time.
 - c. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

H. Warranty



1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal wall panel assemblies that fail in materials or workmanship within specified warranty period.
 - a. Warranty Period: Two years from date of Final Completion.
2. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - a. Finish Warranty Period:
 - 1) 20 years from date of Final Completion for fluoropolymer finish.
 - 2) 10 years from date of Final Completion for siliconized polyester.

1.2 PRODUCTS

A. Panel Materials

1. Metallic-Coated Steel Sheet: Restricted flatness steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.
 - b. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40 (Class AZM150 coating designation, Grade 275); structural quality.
 - c. Surface: Smooth, flat **OR** Embossed, **as directed**, finish.
 - d. Exposed Coil-Coated Finish:
 - 1) 2-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2) 3-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 3) 4-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat and clear coats. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 4) Mica Fluoropolymer: AAMA 621. 2-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 5) Metallic Fluoropolymer: AAMA 621. 3-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 6) FEVE Fluoropolymer: AAMA 621. 2-coat fluoropolymer finish containing 100 percent fluorinated ethylene vinyl ether resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 7) Siliconized-Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
 - 8) Plastisol: Epoxy primer and vinyl plastisol topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 3.8 mil (0.97 mm) for topcoat.
 - e. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).



2. Aluminum Sheet: Coil-coated sheet, ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
 - a. Surface: Smooth, flat **OR** Embossed, **as directed**, finish.
 - b. Exposed Coil-Coated Finish:
 - 1) 2-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2) 3-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 3) 4-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat and clear coats. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 4) Mica Fluoropolymer: AAMA 620. 2-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 5) Metallic Fluoropolymer: AAMA 620. 3-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 6) FEVE Fluoropolymer: AAMA 620. 2-coat fluoropolymer finish containing 100 percent fluorinated ethylene vinyl ether resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 7) Siliconized-Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
 - 8) Plastisol: Epoxy primer and vinyl plastisol topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 3.8 mil (0.97 mm) for topcoat.
 - c. Exposed Anodized Finish:
 - 1) Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm **OR** AA-M12C22A31, Class II, 0.010 mm, **as directed**, or thicker.
 - 2) Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm **OR** AA-M12C22A32/A34, Class II, 0.010 mm, **as directed**, or thicker.
 - d. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).
3. Copper Sheet: ASTM B 370, cold-rolled copper sheet, H00 temper.
 - a. Exposed Finish: Apply the following finish, as specified or indicated on Drawings.
 - 1) Natural finish.
 - 2) Brushed Satin: CDA M32-06x (Mechanical Finish: directionally textured, medium satin; Coating: clear organic, air drying, as specified below):
 - a) Clear, Organic Coating: Clear, air-drying, acrylic lacquer specially developed for coating copper-alloy products, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).
 - 3) Mirror Polished: CDA M22-06x (Mechanical Finish: buffed, specular; Coating: clear organic, air drying, as specified below):
 - a) Clear, Organic Coating: Clear, air-drying, acrylic lacquer specially developed for coating copper-alloy products, applied by air spray in two coats per



- manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).
- 4) Pre-patinated: ASTM B 882. Copper sheets artificially aged by chemical reaction to convert surface to inorganic crystalline structure with color range and durability of naturally-formed patina.
4. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304 **OR** 316, **as directed**, fully annealed.
 - a. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
 - b. Polished Finish: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1) Run grain of directional finishes with long dimension of each piece.
 - 2) When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - 3) Directional Satin Finish: No. 4.
 - c. Bright, Cold-Rolled, Unpolished Finish: No. 2B.
 5. Panel Sealants:
 - a. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
 - b. Joint Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal wall panels and remain weathertight; and as recommended in writing by metal wall panel manufacturer.
 - c. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.
- B. Field-Installed Thermal Insulation
1. Unfaced, Polyisocyanurate Board Insulation: ASTM C 591, Type II, compressive strength of 35 psi (241 kPa), with maximum flame-spread index of 75 and smoke-developed index of 450.
 2. Faced, Polyisocyanurate Board Insulation: ASTM C 1289, Type I (foil facing), Class 1 or 2 **OR** Type II (asphalt felt or glass-fiber mat facing), Class 2 or 3, Grade 3, **as directed**, with maximum flame-spread index of 75 and smoke-developed index of 450, based on tests performed on unfaced core.
 3. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, 1.60-lb/cu. ft. (26-kg/cu. m), with maximum flame-spread index of 75 and smoke-developed index of 450.
 4. Molded-Polystyrene Board Insulation: ASTM C 578, Type I, 0.9 lb/cu. ft. (15 kg/cu. m) **OR** Type II, 1.35 lb/cu. ft. (22 kg/cu. m), **as directed**, with maximum flame-spread index of 75 and smoke-developed index of 450.
 5. Unfaced, Glass-Fiber Board Insulation: ASTM C 612, Type IA or Types IA and IB; with maximum flame-spread index of 25 and smoke-developed index of 50, and with a nominal density of 3 lb/cu. ft. (48 kg/cu. m).
 6. Mineral-Fiber-Blanket Insulation: ASTM C 665, type indicated below; consisting of fibers manufactured from glass **OR** slag or rock wool, **as directed**.
 - a. Type I (blankets without membrane covering), passing ASTM E 136 for combustion characteristics.
 - b. Type II (blankets with nonreflective membrane covering), Category 1 (membrane is a vapor retarder), Class A (membrane-faced surface with a flame-spread index of 25 or less).
 - c. Type III (blankets with reflective membrane covering), Category 1 (membrane is a vapor retarder), Class A (membrane-faced surface with a flame-spread index of 25 or less).
 7. Metal Building Insulation: ASTM C 991, Type I; or NAIMA 202 **OR** ASTM C 991, Type II, **as directed**, glass-fiber-blanket insulation; 0.5-lb/cu. ft. (8-kg/cu. m) density; 2-inch- (50-mm-) wide, continuous, vapor-tight edge tabs; and with a flame-spread index of 25 or less.
 - a. Vapor-Retarder Facing: ASTM C 1136, with permeance not greater than 0.02 perm (1.15 ng/Pa x s x sq. m) when tested according to ASTM E 96, Desiccant Method:
 - 1) Composition: Polypropylene faced, scrim reinforced, and kraft-paper backing **OR** Foil faced, scrim reinforced, and kraft-paper backing with vapor-retarder coating **OR** Polypropylene faced, scrim reinforced, and foil backing **OR** Vinyl faced, scrim reinforced, and foil backing **OR** Vinyl faced, scrim reinforced, and polyester backing, **as directed**.



- b. Insulation Retainer Strips: 0.019-inch- (0.48-mm-) thick, formed galvanized steel or PVC retainer clips colored to match insulation facing.

C. Miscellaneous Metal Framing

1. Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, ASTM A 653/A 653M, G40 (Z120) hot-dip galvanized **OR** ASTM A 653/A 653M, G60 (Z180) hot-dip galvanized, **as directed**, or coating with equivalent corrosion resistance unless otherwise indicated.
2. Subgirts: Manufacturer's standard C- or Z-shaped sections, 0.064-inch (1.63-mm) nominal thickness.
3. Zee Clips: 0.079-inch (2.01-mm) nominal thickness.
4. Base or Sill Angles **OR** Channels, **as directed**: 0.079-inch (2.01-mm) nominal thickness.
5. Hat-Shaped, Rigid Furring Channels:
 - a. Nominal Thickness: As indicated **OR** As required to meet performance requirements **OR** 0.025 inch (0.64 mm) **OR** 0.040 inch (1.02 mm), **as directed**.
 - b. Depth: As indicated **OR** 7/8 inch (22 mm) **OR** 1-1/2 inches (38 mm), **as directed**.
6. Cold-Rolled Furring Channels: Minimum 1/2-inch- (13-mm-) wide flange.
 - a. Nominal Thickness: As indicated **OR** As required to meet performance requirements **OR** 0.064 inch (1.63 mm), **as directed**.
 - b. Depth: As indicated **OR** 3/4 inch (19 mm), **as directed**.
 - c. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with 0.040-inch (1.02-mm) nominal thickness.
 - d. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.57-mm-) diameter wire, or double strand of 0.048-inch- (1.22-mm-) diameter wire.
7. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (32 mm), wall attachment flange of 7/8 inch (22 mm), and depth required to fit insulation thickness indicated.
 - a. Nominal Thickness: As indicated **OR** As required to meet performance requirements **OR** 0.025 inch (0.64 mm), **as directed**.
8. Fasteners for Miscellaneous Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.

D. Miscellaneous Materials

1. Panel Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal wall panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.

E. Exposed-Fastener, Lap-Seam Metal Wall Panels

1. General: Provide factory-formed metal wall panels designed to be field assembled by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps. Include accessories required for weathertight installation.
2. Corrugated-Profile, Exposed-Fastener Metal Wall Panels: Formed with alternating curved ribs spaced at 2.67 inches (68 mm) o.c. across width of panel.
 - a. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - b. Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.



- 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
- 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
- c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
- d. Panel Coverage: 21.3 inches (541 mm) **OR** 29.3 inches (744 mm) **OR** 34.6 inches (881 mm) **OR** 37.3 inches (947 mm) **OR** 42.6 inches (1084 mm) **OR** 45.3 inches (1151 mm), **as directed**.
- e. Panel Height: 0.5 inch (13 mm) **OR** 0.875 inch (22 mm), **as directed**.
3. Tapered-Rib-Profile, Exposed-Fastener Metal Wall Panels: Formed with raised, trapezoidal major ribs and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between major ribs.
 - a. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - b. Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - d. Major-Rib Spacing: 6 inches (152 mm) **OR** 8 inches (203 mm) **OR** 9 inches (229 mm) **OR** 12 inches (305 mm), **as directed**, o.c.
 - e. Panel Coverage: 24 inches (610 mm) **OR** 36 inches (914 mm), **as directed**.
 - f. Panel Height: 0.625 inch (16 mm) **OR** 0.75 inch (19 mm) **OR** 1.0 inch (25 mm) **OR** 1.25 inches (32 mm) **OR** 1.5 inches (38 mm), **as directed**.
4. Reverse-Rib-Profile, Exposed-Fastener Metal Wall Panels: Formed with recessed, trapezoidal major valleys and intermediate stiffening valleys symmetrically spaced **OR** flat pan, **as directed**, between major valleys.
 - a. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.



- 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
- 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
- b. Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
- c. Major-Rib Spacing: 12 inches (305 mm) o.c.
- d. Panel Coverage: 36 inches (914 mm).
- e. Panel Height: 1.25 inches (32 mm).
5. Vee-Rib-Profile, Exposed-Fastener Metal Wall Panels: Formed with raised, V-shaped ribs and recesses that are approximately same size, evenly spaced across panel width, and with rib/recess sides angled at approximately 45 degrees.
 - a. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm) **OR** 0.064-inch (1.63-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - b. Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm) **OR** 0.064-inch (1.63-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.050 inch (1.27 mm), **as directed**, thick.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - d. Rib Spacing: 5.3 inches (135 mm) **OR** 7.2 inches (183 mm) **OR** 12 inches (305 mm), **as directed**, o.c.
 - e. Panel Coverage: 30 inches (762 mm) **OR** 32 inches (813 mm) **OR** 36 inches (914 mm) **OR** 40 inches (1016 mm), **as directed**.
 - f. Panel Height: 1.375 inches (35 mm) **OR** 1.5 inches (38 mm) **OR** 1.75 inches (44 mm) **OR** 2.0 inches (51 mm) **OR** 3.0 inches (76 mm), **as directed**.
6. Box-Rib-Profile, Exposed-Fastener Metal Wall Panels: Formed with raised, box-shaped ribs, evenly spaced across panel width, and with rib/recess sides angled 60 degrees or more.
 - a. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.



- 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
- 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
- b. Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
- c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
- d. Rib Spacing: 2.67 inches (68 mm) **OR** 4.0 inches (102 mm) **OR** 5.3 inches (135 mm) **OR** 6.0 inches (152 mm), **as directed**, o.c.
- e. Panel Coverage: 24 inches (610 mm) **OR** 28 inches (711 mm) **OR** 30 inches (762 mm) **OR** 32 inches (813 mm) **OR** 36 inches (914 mm), **as directed**.
- f. Panel Height: 0.625 inch (16 mm) **OR** 1.0 inch (25 mm) **OR** 1.5 inches (38 mm) **OR** 2.0 inches (51 mm), **as directed**.
7. Deep-Box-Rib-Profile, Exposed-Fastener Metal Wall Panels: Formed with raised, box-shaped ribs, evenly spaced across panel width, and with rib/recess sides angled more than 60 degrees.
 - a. Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm) **OR** 0.064-inch (1.63-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - b. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm) **OR** 0.064-inch (1.63-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.050 inch (1.27 mm), **as directed**, thick.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - d. Rib Spacing: 12 inches (305 mm) o.c.
 - e. Panel Coverage: 24 inches (610 mm).
 - f. Panel Height: 3.0 inches (76 mm) **OR** 4.0 inches (102 mm), **as directed**.



- F. Concealed-Fastener, Lap-Seam Metal Wall Panels
1. General: Provide factory-formed metal wall panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps. Include accessories required for weathertight installation.
 2. Flush-Profile, Concealed-Fastener Metal Wall Panels: Formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between panel edges; with flush joint between panels.
 - a. Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - b. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.050 inch (1.27 mm), **as directed**, thick.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - d. Panel Coverage: 12 inches (305 mm), **as directed**.
 - e. Panel Height: 1.0 inch (25 mm) **OR** 1.5 inches (38 mm), **as directed**.
 3. Reveal-Joint, Concealed-Fastener Metal Wall Panels: Formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between panel edges; with narrow reveal joint between panels.
 - a. Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - b. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.050 inch (1.27 mm), **as directed**, thick.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.



- fluoropolymer **OR** Siliconized polyester **OR** Platisol **OR** Clear anodized **OR** Color anodized, **as directed**.
- 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
- d. Panel Coverage: 12 inches (305 mm).
- e. Panel Height: 1.0 inch (25 mm) **OR** 1.5 inches (38 mm), **as directed**.
4. Wide-Reveal-Joint, Concealed-Fastener Metal Wall Panels: Formed with vertical panel edges and stepped profile between panel edges resulting in wide reveal joint between panels.
- a. Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
- 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Platisol, **as directed**.
- 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
- b. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
- 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Platisol, **as directed**.
- 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
- c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.050 inch (1.27 mm), **as directed**, thick.
- 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Platisol **OR** Clear anodized **OR** Color anodized, **as directed**.
- 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
- d. Panel Coverage: 12 inches (305 mm).
- e. Panel Height: 1.5 inches (38 mm).
5. V-Groove-Profile, Concealed-Fastener Metal Wall Panels: Formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between panel edges.
- a. Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
- 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Platisol, **as directed**.
- 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
- b. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) nominal thickness.
- 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Platisol, **as directed**.
- 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
- c. Panel Coverage: 6 inches (152 mm) **OR** 8 inches (203 mm) **OR** 12 inches (305 mm), **as directed**.
- d. Panel Height: 0.625 inch (16 mm) **OR** 1.25 inches (32 mm), **as directed**.
6. Tapered-Rib-Profile, Concealed-Fastener Metal Wall Panels: Formed with raised, trapezoidal major ribs and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between major ribs.



- a. Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - b. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - c. Panel Coverage: 12 inches (305 mm) **OR** 14 inches (356 mm), **as directed**.
 - d. Panel Height: 1.0 inch (25 mm) **OR** 1.5 inches (38 mm), **as directed**.
7. Curved-Rib-Profile, Concealed-Fastener Metal Wall Panels: Formed with raised, curved-side major ribs and flat pan between major ribs; with reveal joint between panels.
- a. Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - b. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.050 inch (1.27 mm), **as directed**, thick.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - d. Panel Coverage: 12 inches (305 mm).
 - e. Panel Height: 0.875 inch (22 mm) **OR** 1.5 inches (38 mm), **as directed**.
8. Creased-Profile, Concealed-Fastener Metal Wall Panels: Formed with vertical panel edges and center-creased pan between panel edges; with flush joint between panels.
- a. Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - b. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.



- 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
- 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
- c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
- d. Panel Coverage: 12 inches (305 mm).
- e. Panel Height: 1.5 inches (38 mm).
9. Creased-Rib-Profile, Concealed-Fastener Metal Wall Panels: Formed with raised, center-creased, trapezoidal major ribs; with reveal joint between panels.
 - a. Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - b. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - d. Panel Coverage: 12 inches (305 mm).
 - e. Panel Height: 0.875 inch (22 mm) **OR** 1.5 inches (38 mm), **as directed**.
- G. Metal Liner Panels
 1. General: Provide factory-formed metal liner panels designed for interior side of metal wall panel assemblies and field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps. Include accessories required for a complete installation.
 2. Flush-Profile Metal Liner Panels: Solid **OR** Perforated, **as directed**, panels formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between panel edges; with flush joint between panels.
 - a. Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.



- 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
- b. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
- c. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
- d. Panel Coverage: 12 inches (305 mm) **OR** 16 inches (406 mm) **OR** 24 inches (610 mm) **OR** 36 inches (914 mm), **as directed**.
- e. Panel Height: 1.5 inches (38 mm) **OR** 2.0 inches (51 mm) **OR** 3.0 inches (76 mm), **as directed**.
- f. Acoustical Performance: Where sound-absorption requirement is indicated, fabricate interior liner panels with 1/8-inch- (3-mm-) diameter holes uniformly spaced approximately 1000 holes/sq. ft. (10 750 holes/sq. m).
 - 1) NRC of not less than 0.65 **OR** 0.85 **OR** 1.00, **as directed**, when tested according to ASTM C 423.

H. Metal Soffit Panels

1. General: Provide factory-formed metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps. Include accessories required for weathertight installation.
2. Metal Soffit Panels: Match profile and material of metal wall panels.
 - a. Finish: Match finish and color of metal wall panels **OR** As indicated on Drawings, **as directed**.
 - b. Sealant: Factory applied within interlocking joint.
3. Flush-Profile Metal Soffit Panels: Solid **OR** Perforated, **as directed**, panels formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between panel edges; with flush joint between panels.
 - a. Material: Same material, finish, and color as metal wall panels.
 - b. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: Match finish and color of metal wall panels **OR** As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - c. Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.



- 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: Match finish and color of metal wall panels **OR** As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - d. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
 - 2) Color: Match finish and color of metal wall panels **OR** As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - e. Material: Copper sheet, 16-oz./sq. ft. weight (0.55-mm thickness) **OR** 20-oz./sq. ft. weight (0.68-mm thickness), **as directed**.
 - 1) Exterior Finish: Brushed satin (lacquered) **OR** Mirror polished, **as directed**.
 - f. Panel Coverage: 8 inches (203 mm) **OR** 12 inches (305 mm) **OR** 16 inches (406 mm) **OR** 20 inches (508 mm), **as directed**.
 - g. Panel Height: 0.875 inch (22 mm) **OR** 1.0 inch (25 mm) **OR** 1.5 inches (38 mm) **OR** 3.0 inches (76 mm), **as directed**.
 - h. Sealant: Factory applied within interlocking joint.
4. Reveal-Joint-Profile Metal Soffit Panels: Solid **OR** Perforated, **as directed**, panels formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between panel edges; with recessed reveal joint between panels.
- a. Material: Same material, finish, and color as metal wall panels.
 - b. Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: Match finish and color of metal wall panels **OR** As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - c. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) nominal thickness.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - 2) Color: Match finish and color of metal wall panels **OR** As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - d. Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
 - 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
 - 2) Color: Match finish and color of metal wall panels **OR** As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - e. Panel Coverage: 8 inches (203 mm) **OR** 12 inches (305 mm) **OR** 16 inches (406 mm) **OR** 20 inches (508 mm), **as directed**.



- f. Panel Height: 0.75 inch (19 mm) **OR** 1.0 inch (25 mm) **OR** 1.5 inches (38 mm), **as directed**.
5. V-Groove-Profile Metal Soffit Panels: Solid **OR** Perforated, **as directed**, panels formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between panel edges; with V-groove joint between panels.
- a. Material: Same material, finish, and color as metal wall panels.
- b. Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) nominal thickness.
- 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
- 2) Color: Match finish and color of metal wall panels **OR** As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
- c. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) nominal thickness.
- 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
- 2) Color: Match finish and color of metal wall panels **OR** As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
- d. Material: Aluminum sheet, 0.024 inch (0.65 mm) **OR** 0.032 inch (0.81 mm), **as directed**, thick.
- 1) Exterior Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**
- 2) Color: Match finish and color of metal wall panels **OR** As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
- e. Panel Coverage: 6 inches (152 mm) **OR** 12 inches (305 mm) **OR** 14 inches (356 mm), **as directed**.
- f. Panel Height: 0.375 inch (10 mm) **OR** 0.44 inch (11 mm) **OR** 0.50 inch (13 mm) **OR** 0.625 inch (16 mm), **as directed**.
- I. Accessories
1. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels, unless otherwise indicated.
- a. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal wall panels.
- b. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
- c. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
2. Flashing and Trim: Formed from 0.018-inch (0.46-mm) minimum thickness, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal wall panels.



J. Fabrication

1. General: Fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
2. Fabricate metal wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.
3. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
4. Fabricate metal wall panel joints with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, and that will minimize noise from movements within panel assembly.
5. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.
 - a. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - b. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 - c. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 - d. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
 - e. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 - f. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal wall panel manufacturer.
 - 1) Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

K. General Finish Requirements

1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
3. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

1.3 EXECUTION

A. Preparation

1. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorages according to ASTM C 754 and metal wall panel manufacturer's written recommendations.
 - a. Soffit Framing: Wire-tie or clip furring channels to supports, as required to comply with requirements for assemblies indicated.

B. Thermal Insulation Installation

1. Board Insulation: Extend insulation in thickness indicated to cover entire wall. Comply with installation requirements in Division 07 Section "Thermal Insulation".



- a. Erect insulation horizontally and hold in place with Z-shaped furring members spaced 24 inches (610 mm) o.c. Attach furring members to substrate with screws spaced 24 inches (610 mm) o.c.
- b. Retain insulation in place by metal clips and straps or integral pockets within panels, spaced at intervals according to insulation manufacturer's instructions. Maintain cavity width between insulation and metal liner panel of dimension indicated.
2. Blanket Insulation: Install insulation concurrently with metal wall panel installation, in thickness indicated to cover entire wall, according to manufacturer's written instructions and as follows:
 - a. Set vapor-retarder-faced insulation with vapor-retarder facing building exterior **OR** building interior **OR** as indicated on Drawings, **as directed**. Do not obstruct ventilation spaces, except for firestopping.
 - b. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.
 - c. Install insulation straight and true in one-piece lengths. Comply with the following installation method:
 - 1) Over-Framing Installation: Extend insulation over and perpendicular to top flange of framing members.
 - d. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with framing to hold insulation in place.

C. Metal Wall Panel Installation

1. General: Install metal wall panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - a. Commence metal wall panel installation and install minimum of 300 sq. ft. (27.8 sq. m.) in presence of factory-authorized representative.
 - b. Shim or otherwise plumb substrates receiving metal wall panels.
 - c. Flash and seal metal wall panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until weather barrier and flashings that will be concealed by metal wall panels are installed.
 - d. Install screw fasteners in predrilled holes.
 - e. Locate and space fastenings in uniform vertical and horizontal alignment.
 - f. Install flashing and trim as metal wall panel work proceeds.
 - g. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 - h. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete and elsewhere as indicated or, if not indicated, as necessary for waterproofing.
 - i. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 - j. Provide weathertight escutcheons for pipe and conduit penetrating exterior walls.
2. Fasteners:
 - a. Steel Wall Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized steel fasteners for surfaces exposed to the interior.
 - b. Aluminum Wall Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized steel fasteners for surfaces exposed to the interior.
 - c. Copper Wall Panels: Use copper, stainless-steel or hardware-bronze fasteners.
 - d. Stainless-Steel Wall Panels: Use stainless-steel fasteners.
3. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by metal wall panel manufacturer.
4. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal wall panel manufacturer.



- a. Seal metal wall panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal wall panel manufacturer.
 - b. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants".
5. Lap-Seam Metal Wall Panels: Fasten metal wall panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
- a. Lap ribbed or fluted sheets one full rib corrugation. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
 - b. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal wall panels.
 - c. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
 - d. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
 - e. Provide sealant tape at lapped joints of metal wall panels and between panels and protruding equipment, vents, and accessories.
 - f. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps; on side laps of nesting-type panels; on side laps of corrugated nesting-type, ribbed, or fluted panels; and elsewhere as needed to make panels weathertight.
 - g. At panel splices, nest panels with minimum 6-inch (152-mm) end lap, sealed with butyl-rubber sealant and fastened together by interlocking clamping plates.
6. Zee Clips: Provide Zee clips of size indicated or, if not indicated, as required to act as standoff from subgirts for thickness of insulation indicated. Attach to subgirts with fasteners.
7. Metal Liner Panels: Install panels on exterior side of girts with girts exposed to the interior **OR** interior side of girts with flush appearance on the inside **OR** girts as indicated on Drawings, **as directed**.
8. Fire-Rated Metal Wall Panel Assemblies: Install metal liner panels on exterior side of girts, fastening through faces of panels, with girts exposed to the interior. Install subgirts horizontally, fastened to legs of metal liner panels. Install substrate board as indicated in Division 06 Section "Sheathing", in number of layers required for fire rating, over subgirts, attached with board fasteners. Install second set of subgirts horizontally, fastened through substrate board into first set of subgirts. Install exterior metal wall panels, fastened to second set of subgirts.
- a. Comply with UL **OR** FMG, **as directed**, requirements for fire-rated construction.
- D. Metal Soffit Panel Installation
1. In addition to complying with requirements of "Metal Wall Panel Installation, General" Article, install metal soffit panels to comply with the requirements of this article.
 2. Metal Soffit Panels: Provide metal soffit panels full width of soffits. Install panels perpendicular to support framing.
 - a. Flash and seal panels with weather closures where metal soffit panels meet walls and at perimeter of all openings.
- E. Accessory Installation
1. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
 - a. Install components required for a complete metal wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
 2. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
 - a. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form



hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.

- b. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (605 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

F. Field Quality Control

1. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports, **as directed by the Owner**.
2. Water Penetration: Test areas of installed system indicated on Drawings for compliance with system performance requirements according to ASTM E 1105 at minimum differential pressure of 20 percent of inward-acting, wind-load design pressure as defined by SEI/ASCE 7, but not less than 6.24 lbf/sq. ft. (300 Pa).
3. Water-Spray Test: After completing the installation of 75-foot- (23-m-) by-2-story minimum area of metal wall panel assembly, test assembly for water penetration according to AAMA 501.2 in a 2-bay area directed by the Owner.
4. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect and test completed metal wall panel installation, including accessories.
5. Remove and replace metal wall panels where tests and inspections indicate that they do not comply with specified requirements.
6. Additional tests and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

G. Cleaning And Protection

1. Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal wall panel installation, clean finished surfaces as recommended by metal wall panel manufacturer. Maintain in a clean condition during construction.
2. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
3. Replace metal wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 46 16 00

**SECTION 07 46 16 00a - METAL PLATE WALL PANELS**

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for metal plate wall panels. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes metal plate wall panels.

C. Definition

1. Metal Plate Wall Panel Assembly: Metal plate wall panels, attachment system components, miscellaneous metal framing, and accessories necessary for a complete weathertight wall system.

D. Performance Requirements

1. General Performance: Metal plate wall panel assemblies shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.
2. Delegated Design: Design metal plate wall panel assembly, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
3. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) of wall area when tested according to ASTM E 283 at the following test-pressure difference:
 - a. Test-Pressure Difference: 1.57 lbf/sq. ft. (75 Pa) which is equivalent to a 25-mph (40-km/h) wind.
4. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:
 - a. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa) which is equivalent to a 50-mph (80-km/h) wind.
5. Water Penetration under Dynamic Pressure: No evidence of water leakage when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of inward-acting, wind-load design pressure of not less than 6.24 lbf/sq. ft. (300 Pa) {which is equivalent to a 50-mph (80-km/h) wind} and not more than 12 lbf/sq. ft. (575 Pa).
 - a. Water Leakage: As defined according to AAMA 501.1.
OR
Water Leakage: Uncontrolled water infiltrating the system or appearing on system's normally exposed interior surfaces from sources other than condensation. Water controlled by flashing and gutters that is drained back to the exterior and cannot damage adjacent materials or finishes is not water leakage.
6. Structural Performance: Provide metal plate wall panel assemblies capable of withstanding the effects of the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 330:
 - a. Wind Loads: Determine loads based on the following minimum design wind pressures:
 - 1) Uniform pressure of 20 lbf/sq. ft. (957 Pa) **OR** 30 lbf/sq. ft. (1436 Pa), **as directed**, acting inward or outward.
OR
Uniform pressure as indicated on Drawings.
 - b. Deflection Limits: Metal plate wall panel assemblies shall withstand wind loads with horizontal deflections no greater than 1/180 **OR** 1/240, **as directed**, of the span.



7. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

E. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: Show fabrication and installation layouts of metal plate wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish among factory-, shop-, and field-assembled work.
3. Samples: For each type of exposed finish required.
4. Delegated-Design Submittal: For metal plate wall panel assembly indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
5. Coordination Drawings: Exterior elevations, drawn to scale and coordinating penetrations and wall-mounted items.
6. Product Test Reports.
7. Field quality-control reports.
8. Maintenance Data.
9. Warranties: Sample of special warranties.

F. Quality Assurance

1. Installer Qualifications: An employer of workers trained and approved by manufacturer.
2. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
3. Fire-Resistance Ratings: Where indicated, provide metal plate wall panels identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
4. Preinstallation Conference: Conduct conference at Project site.

G. Delivery, Storage, And Handling

1. Deliver components, metal plate wall panels, and other manufactured items so as not to be damaged or deformed. Package panels for protection during transportation and handling.
2. Unload, store, and erect metal plate wall panels in a manner to prevent bending, warping, twisting, and surface damage.
3. Stack metal plate wall panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store panels to ensure dryness, with positive slope for drainage of water. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage.
4. Retain strippable protective covering on metal plate wall panel for period of installation.
5. Protect foam-plastic insulation as follows:
 - a. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
 - b. Protect against ignition at all times. Do not deliver foam-plastic insulation materials to Project site before installation time.
 - c. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

H. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal plate wall panel assemblies that fail in materials or workmanship within specified warranty period.
 - a. Warranty Period: Two years from date of Final Completion.



2. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal plate wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - a. Finish Warranty Period:
 - 1) 20 years from date of Final Completion for fluoropolymer finish.
 - 2) 10 years from date of Final Completion for siliconized polyester.

1.2 PRODUCTS

A. Panel Materials

1. Aluminum Plate: ASTM B 209 (ASTM B 209M). Alloy and temper as recommended by manufacturer for application.
2. Copper Plate: ASTM B 152/B 152M, solid copper alloy.
3. Panel Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal plate wall panels and remain weathertight; and as recommended in writing by panel manufacturer.

B. Miscellaneous Metal Framing

1. Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, ASTM A 653/A 653M, G40 (Z120) hot-dip galvanized **OR** ASTM A 653/A 653M, G60 (Z180) hot-dip galvanized, **as directed**, or coating with equivalent corrosion resistance unless otherwise indicated.
2. Subgirts: Manufacturer's standard C- or Z-shaped sections, 0.064-inch (1.63-mm) nominal thickness.
3. Zee Clips: 0.079-inch (2.01-mm) nominal thickness.
4. Base or Sill Angles **OR** Channels, **as directed**: 0.079-inch (2.01-mm) nominal thickness.
5. Hat-Shaped, Rigid Furring Channels:
 - a. Nominal Thickness: As indicated **OR** As required to meet performance requirements **OR** 0.025 inch (0.64 mm) **OR** 0.040 inch (1.02 mm), **as directed**.
 - b. Depth: As indicated **OR** 7/8 inch (22 mm) **OR** 1-1/2 inches (38 mm), **as directed**.
6. Cold-Rolled Furring Channels: Minimum 1/2-inch- (13-mm-) wide flange.
 - a. Nominal Thickness: As indicated **OR** As required to meet performance requirements **OR** 0.064 inch (1.63 mm), **as directed**.
 - b. Depth: As indicated **OR** 3/4 inch (19 mm), **as directed**.
 - c. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with nominal thickness of 0.040 inch (1.02 mm).
 - d. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.57-mm-) diameter wire, or double strand of 0.048-inch- (1.22-mm-) diameter wire.
7. Fasteners for Miscellaneous Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.

C. Miscellaneous Materials

1. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by manufacturer for type of use and finish indicated.
2. Panel Fasteners: Self-tapping screws; bolts and nuts; self-locking rivets and bolts; end-welded studs; and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal wall panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.

D. Metal Plate Wall Panels

1. Metal Plate Wall Panels: Provide factory-formed, metal plate wall panels fabricated from single sheets of metal formed into profile for installation method indicated. Include attachment system components, panel stiffeners, and accessories required for weathertight system.



- a. Material: Tension-leveled, smooth aluminum sheet, ASTM B 209 (ASTM B 209M), 0.120 inch (3.05 mm) **OR** 0.125 inch (3.18 mm) **OR** 0.1875 inch (4.76 mm) **OR** 0.190 inch (4.82 mm), **as directed**, thick.
 - b. Panel Depth: 2 inches (51 mm) **OR** As indicated on Drawings, **as directed**.
 - c. Exterior Finish: Two-coat fluoropolymer **OR** Three-coat fluoropolymer **OR** Four-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Clear anodized **OR** Color anodized, **as directed**.
 - 1) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
2. Attachment System Components: Formed from extruded aluminum.
 - a. Provide internal drainage system that allows individual panels to be installed and removed without disturbing adjacent panels.
 - b. Include manufacturer's standard subgirts, perimeter extrusions, tracks, and drainage channels, panel stiffeners, panel clips and anchor channels, **as applicable**.
 - c. Alignment Pins: Stainless steel.
- E. Accessories
1. Metal Plate Wall Panel Accessories: Provide components required for a complete metal plate wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of panels unless otherwise indicated.
 2. Flashing and Trim: Same material, finish, and color as adjacent metal plate wall panels, minimum 0.030 inch (0.76 mm) thick unless otherwise indicated.
- F. Fabrication
1. General: Fabricate and finish metal plate wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
 2. Fabricate metal plate wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.
 3. Metal Plate Wall Panels: Fabricate panels with panel stiffeners as required to comply with deflection limits. Weld and grind panel corners smooth. Fabricate panels to the following dimensional tolerances:
 - a. Length and Width: Plus or minus 0.032 inch (0.81 mm) up to 48 inches (1219 mm); 0.064 inch (1.63 mm) more than 48 inches (1219 mm).
 - b. Diagonal: Plus or minus 0.1875 inch (4.76 mm).
 - c. Panel Bow: Not more than 0.2 percent of panel width or length up to 0.1875 inch (4.76 mm) maximum.
 - d. Thickness: Plus or minus 0.008 inch (0.2 mm).
 - e. Squareness: 0.1875-inch (4.76-mm) difference between diagonal measurements.
 - f. Camber: 0.032 inch (0.81 mm).
 4. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
 - a. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - b. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 - c. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 - d. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.



- e. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
- f. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal plate wall panel manufacturer.
 - 1) Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal plate wall panel manufacturer for application, but not less than thickness of metal being secured.

G. General Finish Requirements

1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
3. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

H. Aluminum Finishes

1. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Three-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
3. Four-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat and clear coats. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
4. Mica Fluoropolymer: AAMA 2605. 2-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
5. Metallic Fluoropolymer: AAMA 2605. 3-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
6. FEVE Fluoropolymer: AAMA 2605. 2-coat fluoropolymer finish containing 100 percent fluorinated ethylene vinyl ether resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
7. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm **OR** AA-M12C22A31, Class II, 0.010 mm, **as directed**, or thicker.
8. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm **OR** AA-M12C22A32/A34, Class II, 0.010 mm, **as directed**, or thicker.
9. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

I. Copper-Alloy Finishes

1. Exposed Finish: Mill.
2. Exposed Finish: Finish designations prefixed by CDA comply with the system established by the Copper Development Association for designating copper-alloy finish systems.
 - a. Brushed Satin: CDA M32-06x (Mechanical Finish: directionally textured, medium satin; Coating: clear organic, air drying, as specified below):



- 1) Clear, Organic Coating: Clear, air-drying, acrylic lacquer specially developed for coating copper-alloy products, applied by air spray in 2 coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).
- b. Mirror Polished: CDA M22-06x (Mechanical Finish: buffed, specular; Coating: clear organic, air drying, as specified below):
 - 1) Clear, Organic Coating: Clear, air-drying, acrylic lacquer specially developed for coating copper-alloy products, applied by air spray in 2 coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).

1.3 EXECUTION

A. Preparation

1. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous metal plate wall panel support members and anchorage according to ASTM C 754 and panel manufacturer's written instructions.

B. Metal Plate Wall Panel Installation

1. General: Install metal plate wall panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts unless otherwise indicated. Anchor panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - a. Commence metal plate wall panel installation and install minimum of 300 sq. ft. (27.8 sq. m) in presence of factory-authorized representative.
 - b. Shim or otherwise plumb substrates receiving metal plate wall panels.
 - c. Flash and seal metal plate wall panels with weather closures at perimeter of all openings. Do not begin installation until weather barrier and flashings that will be concealed by panels are installed.
 - d. Install flashing and trim as metal plate wall panel work proceeds.
 - e. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated or, if not indicated, as necessary for waterproofing.
 - f. Provide weathertight escutcheons for pipe and conduit penetrating exterior walls.
2. Fasteners:
 - a. Aluminum Plate Wall Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior and aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
 - b. Copper Plate Wall Panels: Use copper, stainless-steel, or hardware-bronze fasteners.
3. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by metal plate wall panel manufacturer.
4. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal wall plate panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by panel manufacturer.
 - a. Seal metal plate wall panel end laps with double beads of sealant, full width of panel. Seal side joints where recommended by panel manufacturer.
 - b. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants".
5. Attachment System, General: Install attachment system required to support metal plate wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.
 - a. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.
6. Flange-Attachment Installation: Attach metal plate wall panels, formed with extended perimeter flanges, to supports at locations, spacings, and with fasteners recommended by manufacturer.



- a. Seal horizontal and vertical joints between adjacent panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Division 07 Section "Joint Sealants".
- b. Seal horizontal and vertical joints between adjacent panels with manufacturer's standard gaskets.
7. Clip Installation: Attach panel clips to supports at locations, spacings, and with fasteners recommended by manufacturer. Attach flanges of metal plate wall panels to panel clips with fasteners **OR** by welding, **as directed**, as recommended by manufacturer.
 - a. Seal horizontal and vertical joints between adjacent metal plate wall panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Division 07 Section "Joint Sealants".
 - b. Seal horizontal and vertical joints between adjacent metal plate wall panels with manufacturer's standard gaskets.
8. Subgirt-and-Spline Installation: Provide manufacturer's standard subgirts and splines that provide support and complete secondary drainage system, draining to the exterior at horizontal joints. Install support system at locations, spacings, and with fasteners recommended by manufacturer. Attach metal plate wall panels by interlocking perimeter extrusions attached to panels with subgirts and splines. Fully engage integral subgirt-and-spline gaskets and leave horizontal and vertical joints with open reveal. Terminate edge of panels flush with perimeter extrusions.
 - a. Install metal plate wall panels to allow individual panels to be installed and removed without disturbing adjacent panels.
 - b. Do not apply sealants to joints unless otherwise indicated on Drawings.
9. Track-Support Installation: Provide manufacturer's standard horizontal tracks and vertical tracks **OR** drain channels, **as directed**, that provide support and complete secondary drainage system, draining to the exterior at horizontal joints through drain tube. Install support system at locations, spacings, and with fasteners recommended by manufacturer. Attach metal plate wall panels to tracks by interlocking panel edges with manufacturer's standard "T" clips.
 - a. Install metal plate wall panels to allow individual panels to be installed and removed without disturbing adjacent panels.
 - b. Seal horizontal and vertical joints between adjacent metal plate wall panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Division 07 Section "Joint Sealants".
10. Rail-Support Installation: Provide manufacturer's standard interlocking rails that provide support and complete secondary drainage system, draining to the exterior at horizontal joints. Install rails at locations, spacings, and with fasteners recommended by manufacturer. Attach metal plate wall panels by overlapping and interlocking support rails with perimeter rails attached to panels. Apply sealant, foam sealant, and tape sealant at locations recommended by manufacturer. Leave horizontal and vertical joints with open reveal.
 - a. Install metal plate wall panels to allow individual panels to be installed and removed without disturbing adjacent panels.
 - b. Install backer plates before installing support rails.
 - c. Do not apply sealants to joints unless otherwise indicated on Drawings.
11. Rainscreen-Principle Installation: Provide manufacturer's standard pressure-equalized, rainscreen-principle system with vertical channel that provides support and complete secondary drainage system, draining at base of wall. Notch vertical channel to receive support pins. Install vertical channels supported by channel brackets or adjuster angles and at locations, spacings, and with fasteners recommended by manufacturer. Attach metal plate wall panels by engaging horizontal support pins into notches in vertical channels and into flanges of panels. Leave horizontal and vertical joints with open reveal.
 - a. Install metal plate wall panels to allow individual panels to be installed and removed without disturbing adjacent panels.
 - b. Do not apply sealants to joints unless otherwise indicated on Drawings.

C. Accessory Installation



1. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
 - a. Install components required for a complete metal plate wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
2. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
 - a. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
 - b. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

D. Erection Tolerances

1. Installation Tolerances: Shim and align metal plate wall panel units within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m), nonaccumulative, on level, plumb, and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

E. Field Quality Control

1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
2. Water Penetration: Test areas of installed system indicated on Drawings for compliance with system performance requirements according to ASTM E 1105 at minimum differential pressure of 20 percent of inward-acting, wind-load design pressure as defined by SEI/ASCE 7, but not less than 6.24 lbf/sq. ft. (300 Pa).
3. Water-Spray Test: After completing the installation of 75-foot- (23-m-) by-2-story minimum area of metal plate wall panel assembly, test assembly for water penetration according to AAMA 501.2 in a 2-bay area directed by the Owner.
4. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust completed metal plate wall panel installation, including accessories.
5. Metal plate wall panels will be considered defective if they do not pass tests and inspections.
6. Additional tests and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
7. Prepare test and inspection reports.

F. Cleaning

1. Remove temporary protective coverings and strippable films, if any, as metal plate wall panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal plate wall panel installation, clean finished surfaces as recommended by panel manufacturer. Maintain in a clean condition during construction.
2. After metal plate wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
3. Replace metal plate wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 46 16 00a



SECTION 07 46 16 00b - SIDING

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for siding. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Aluminum, Fiber-cement, and Vinyl siding.
 - b. Aluminum, Fiber-cement, and Vinyl soffit.

C. Submittals

1. Product Data: For each type of product indicated.
 - a. For vinyl siding, include VSI's official certification logo printed on product data.
2. Samples: For siding and soffit including related accessories.
3. Qualification Data: For qualified vinyl siding Installer.
4. Product certificates.
5. Product test reports.
6. Research/evaluation reports
7. Maintenance data.
8. Warranty: Sample of special warranty.

D. Quality Assurance

1. Labeling: Provide fiber-cement siding that is tested and labeled according to ASTM C 1186 by a qualified testing agency acceptable to authorities having jurisdiction.
2. Vinyl Siding Installer Qualifications: A qualified installer who employs a VSI-Certified Installer on Project.
3. Vinyl Siding Certification Program: Provide vinyl siding products that are listed in VSI's list of certified products.
4. Source Limitations: Obtain each type, color, texture, and pattern of siding and soffit, including related accessories, from single source from single manufacturer.
5. Preinstallation Conference: Conduct conference at Project site.

E. Delivery, Storage, And Handling

1. Store materials in a dry, well-ventilated, weathertight place.

F. Warranty

1. Special Warranty: Standard form in which manufacturer agrees to repair or replace siding and/or soffit that fail(s) in materials or workmanship within 10 **OR** 25 **OR** 50, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Aluminum Siding

1. General: Formed and coated aluminum siding complying with AAMA 1402.
2. Horizontal Pattern: 8-inch (203-mm) exposure in plain, single-board **OR** beaded-edge, single-board **OR** plain, double-board, 4-inch (102-mm), **as directed**, style.
3. Horizontal Pattern: 10-inch (254-mm) exposure in plain, **OR** Dutch-lap, **as directed**, double, 5-inch (127-mm) board style.



4. Vertical Pattern: 12-inch (300-mm) exposure in board-and-batten, single-board style.
5. Vertical Pattern: 16-inch (400-mm) exposure in V-grooved, triple, 5-1/3-inch (135-mm) board style.
6. Texture: Smooth **OR** Wood grain, **as directed**.
7. Nominal Thickness: 0.019 inch (0.5 mm) **OR** 0.024 inch (0.6 mm), **as directed**.
8. Insulation: Manufacturer's standard integral insulation panels.
9. Finish: Manufacturer's standard three-coat PVDF **OR** primer and baked-on acrylic **OR** primer and baked-on polyester, **as directed**.
 - a. Colors: As selected by the Owner from manufacturer's full range of industry colors.

B. Fiber-Cement Siding

1. General: ASTM C 1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E 136; with a flame-spread index of 25 or less when tested according to ASTM E 84.
 - a. Horizontal Pattern: Boards 5-1/4 inches (133 mm) **OR** 6-1/4 to 6-1/2 inches (159 to 165 mm) **OR** 7-1/4 to 7-1/2 inches (184 to 190 mm) **OR** 8-1/4 to 8-1/2 inches (210 to 216 mm) **OR** 9-1/4 to 9-1/2 inches (235 to 241 mm), **as directed**, wide in plain **OR** beaded-edge, **as directed**, style.
 - 1) Texture: Smooth **OR** Rough sawn **OR** Wood grain, **as directed**.
 - b. Vertical Pattern: 48-inch- (1200-mm-) wide sheets with wood-grain texture and grooves 8 inches (203 mm) **OR** 12 inches (300 mm), **as directed**, o.c.
 - c. Shingle Pattern: 48-inch- (1200-mm-) wide, straight-edge notched **OR** staggered-edge notched, **as directed**, sheets with wood-grain texture.
 - d. Panel Texture: 48-inch- (1200-mm-) wide sheets with smooth **OR** stucco **OR** wood-grain, **as directed**, texture.
 - e. Factory Priming: Manufacturer's standard acrylic primer.

C. Vinyl Siding

1. General: Integrally colored vinyl siding complying with ASTM D 3679.
2. Horizontal Pattern: 6-1/2- or 7-inch (165- or 178-mm) exposure in beaded-edge, single-board style.
3. Horizontal Pattern: 8-inch (203-mm) exposure in plain, single-board **OR** double board, 4-inch (102-mm) **OR** triple board, 2-2/3-inch (68-mm), **as directed**, style.
4. Horizontal Pattern: 8-inch (203-mm) exposure in Dutch-lap, double, 4-inch (102-mm) board style.
5. Horizontal Pattern: 9-inch (229-mm) exposure in plain, double board, 4-1/2-inch (114-mm) **OR** triple board, 3-inch (76-mm), **as directed**, style.
6. Horizontal Pattern: 9-inch (229-mm) exposure in Dutch-lap, double, 4-1/2-inch (114-mm) board style.
7. Horizontal Pattern: 10-inch (254-mm) exposure in plain, **OR** Dutch-lap, **as directed**, double, 5-inch (127-mm) board style.
8. Vertical Pattern: 6-inch (152-mm) exposure in V-grooved, single-board style.
9. Vertical Pattern: 8-inch (203-mm) exposure in beaded-edge, double, 4-inch (102-mm) board style.
10. Vertical Pattern: 10-inch (254-mm) exposure in V-grooved, double, 5-inch (127-mm) board style.
11. Vertical Pattern: 12-inch (300-mm) exposure in V-grooved, double board, 6-inch (152-mm) **OR** triple board, 4-inch (102-mm), **as directed**, style.
12. Shingle Pattern: 48-inch- (1200-mm-) wide, straight-edge notched **OR** staggered-edge notched **OR** half-round edge **OR** octagon edge, **as directed**, sheets with wood-grain texture.
13. Texture: Smooth **OR** Wood grain, **as directed**.
14. Nominal Thickness: 0.040 inch (1.0 mm) **OR** 0.044 inch (1.1 mm), **as directed**.
15. Minimum Profile Depth (Butt Thickness): 1/2 inch (13 mm) **OR** 5/8 inch (16 mm) **OR** 3/4 inch (19 mm), **as directed**.
16. Nailing Hem: Double thickness.
17. Finish: Wood-grain print with clear protective coating containing not less than 70 percent PVDF.
 - a. Colors: As selected by the Owner from manufacturer's full range of industry colors.



- D. Aluminum Soffit
1. General: Formed and coated aluminum soffit complying with AAMA 1402.
 2. Pattern: 6-inch (152-mm) exposure in V-grooved, single-board style.
 3. Pattern: 10-inch (254-mm) exposure in V-grooved, double, 5-inch (127-mm) board style.
 4. Pattern: 12-inch (300-mm) exposure in V-grooved, double, 6-inch (152-mm) board style.
 5. Pattern: 16-inch (400-mm) exposure in V-grooved, triple board, 5-1/3-inch (135-mm) **OR** quadruple board, 4-inch (102-mm), **as directed**, style.
 6. Texture: Smooth **OR** Wood grain, **as directed**.
 7. Ventilation: Provide perforated **OR** unperforated, **as directed**, soffit unless otherwise indicated.
 8. Nominal Thickness: 0.019 inch (0.5 mm) **OR** 0.024 inch (0.6 mm), **as directed**.
 9. Finish: Manufacturer's standard three-coat PVDF **OR** primer and baked-on acrylic **OR** primer and baked-on polyester, **as directed**.
 - a. Colors: As selected by the Owner from manufacturer's full range of industry colors **OR** Match adjacent siding, **as directed**.
- E. Fiber-Cement Soffit
1. General: ASTM C 1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E 136; with a flame-spread index of 25 or less when tested according to ASTM E 84.
 2. Pattern: 12-inch- (300-mm-) **OR** 16-inch- (400-mm-) **OR** 24-inch- (600-mm-), **as directed**, wide sheets with smooth **OR** wood-grain, **as directed**, texture.
 3. Ventilation: Provide perforated **OR** unperforated, **as directed**, soffit unless otherwise indicated.
 4. Factory Priming: Manufacturer's standard acrylic primer.
- F. Vinyl Soffit
1. General: Integrally colored vinyl soffit complying with ASTM D 4477.
 2. Pattern: 6-inch (152-mm) exposure in V-grooved, single-board **OR** beaded-edge, triple board, 2-inch (51-mm), **as directed**, style.
 3. Pattern: 8-inch (203-mm) exposure in V-grooved, double, 4-inch (102-mm) board style.
 4. Pattern: 10-inch (254-mm) exposure in V-grooved, double, 5-inch (127-mm) board style.
 5. Pattern: 12-inch (300-mm) exposure in V-grooved, double board, 6-inch (152-mm) **OR** triple board, 4-inch (102-mm), **as directed**, style.
 6. Texture: Smooth **OR** Wood grain, **as directed**.
 7. Ventilation: Provide perforated **OR** unperforated, **as directed**, soffit unless otherwise indicated.
 8. Nominal Thickness: 0.035 inch (0.9 mm) **OR** 0.040 inch (1.0 mm) **OR** 0.044 inch (1.1 mm), **as directed**.
 9. Minimum Profile Depth: 1/2 inch (13 mm) **OR** 5/8 inch (16 mm) **OR** 3/4 inch (19 mm), **as directed**.
 10. Colors: As selected by the Owner from manufacturer's full range of industry colors **OR** Match adjacent siding, **as directed**.
- G. Accessories
1. Siding Accessories, General: Provide starter strips, edge trim, outside and inside corner caps, and other items as recommended by siding manufacturer for building configuration.
 - a. Provide accessories made from same material as **OR** matching color and texture of, **as directed**, adjacent siding unless otherwise indicated.
 2. Aluminum Accessories: Where aluminum accessories are indicated, provide accessories complying with AAMA 1402.
 - a. Texture: Smooth **OR** Wood grain, **as directed**.
 - b. Nominal Thickness: 0.019 inch (0.5 mm) **OR** 0.024 inch (0.6 mm), **as directed**.
 - c. Finish: Manufacturer's standard three-coat PVDF **OR** primer and baked-on acrylic **OR** primer and baked-on polyester, **as directed**.
 3. Vinyl Accessories: Integrally colored vinyl accessories complying with ASTM D 3679 except for wind-load resistance.
 - a. Texture: Smooth **OR** Wood grain, **as directed**.



4. Decorative Accessories: Provide the following aluminum **OR** fiber-cement **OR** vinyl, **as directed**, decorative accessories as indicated:
 - a. Corner posts with fluted faces, **as directed**.
 - b. Door and window casings with fluted faces, **as directed**, and corner rosettes, **as directed**.
 - c. Entrance and window head pediments.
 - d. Pilasters with fluted faces, **as directed**.
 - e. Shutters with paneled **OR** louvered, **as directed**, faces.
 - f. Louvers.
 - g. Lattice.
 - h. Fasciae.
 - i. Moldings and trim.
5. Colors for Decorative Accessories: As selected by the Owner from manufacturer's full range of industry colors **OR** Match adjacent siding, **as directed**.
6. Flashing: Provide aluminum **OR** stainless-steel, **as directed**, flashing complying with Division 07 Section "Sheet Metal Flashing And Trim" at window and door heads and where indicated.
 - a. Finish for Aluminum Flashing: Same as aluminum siding **OR** Siliconized polyester coating, same color as siding **OR** High-performance organic finish, same color as siding **OR** Factory-prime coating, **as directed**.
7. Fasteners:
 - a. For fastening to wood, use siding nails **OR** ribbed bugle-head screws, **as directed**, of sufficient length to penetrate a minimum of 1 inch (25 mm) into substrate.
 - b. For fastening to metal, use ribbed bugle-head screws of sufficient length to penetrate a minimum of 1/4 inch (6 mm), or three screw-threads, into substrate.
 - c. For fastening aluminum, use aluminum fasteners. Where fasteners will be exposed to view, use prefinished aluminum fasteners in color to match item being fastened.
 - d. For fastening fiber cement, use hot-dip galvanized **OR** stainless-steel, **as directed**, fasteners.
 - e. For fastening vinyl, use aluminum **OR** hot-dip galvanized **OR** stainless-steel, **as directed**, fasteners. Where fasteners will be exposed to view, use prefinished aluminum fasteners in color to match item being fastened.
8. Insect Screening for Soffit Vents: Aluminum, 18-by-16 (1.4-by-1.6-mm) mesh **OR** PVC-coated, glass-fiber fabric, 18-by-14 or 18-by-16 (1.4-by-1.8- or 1.4-by-1.6-mm) mesh **OR** Stainless steel, 18-by-18 (1.4-by-1.4-mm) mesh, **as directed**.
9. Continuous Soffit Vents: Aluminum, hat-channel shape, with stamped louvers **OR** perforations, **as directed**; 2 inches (51 mm) wide and not less than 96 inches (2438 mm) long.
 - a. Net-Free Area: 4 sq. in./linear ft. (280 sq. cm/m) **OR** 6 sq. in./linear ft. (420 sq. cm/m) **OR** 8 sq. in./linear ft. (560 sq. cm/m), **as directed**.
 - b. Finish: Mill finish **OR** White paint **OR** Brown paint, **as directed**.
10. Round Soffit Vents: Stamped aluminum louvered vents, 2 inches (51 mm) **OR** 2-1/2 inches (64 mm) **OR** 3 inches (76 mm) **OR** 4 inches (102 mm), **as directed**, in diameter, made to be inserted into round holes cut into soffit.
 - a. Finish: Mill finish **OR** White paint **OR** Brown paint, **as directed**.

1.3 EXECUTION

A. Preparation

1. Clean substrates of projections and substances detrimental to application.

B. Installation

1. General: Comply with siding and soffit manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
 - a. Do not install damaged components.
 - b. Center nails in elongated nailing slots without binding siding to allow for thermal movement.



2. Install aluminum siding and soffit and related accessories according to AAMA 1402.
 - a. Install fasteners no more than 24 inches (600 mm) o.c.
 3. Install fiber-cement siding and soffit and related accessories.
 - a. Install fasteners no more than 24 inches (600 mm) o.c.
 4. Install vinyl siding and soffit and related accessories according to ASTM D 4756.
 - a. Install fasteners for horizontal vinyl siding no more than 16 inches (400 mm) o.c.
 - b. Install fasteners for vertical vinyl siding no more than 12 inches (300 mm) o.c.
 5. Install joint sealants as specified in Division 07 Section "Joint Sealants" and to produce a weathertight installation.
 6. Where aluminum siding will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.
- C. Adjusting And Cleaning
1. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.
 2. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION 07 46 16 00b



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Task	Specification	Specification Description
07 46 19 00	07 46 16 00	Metal Wall Panels
07 46 19 00	07 46 16 00a	Metal Plate Wall Panels
07 46 19 00	07 46 16 00b	Siding
07 46 23 00	06 10 00 00	Rough Carpentry
07 46 23 00	01 95 06 00	Miscellaneous Carpentry
07 46 23 00	06 16 23 00	Sheathing
07 46 29 00	06 10 00 00	Rough Carpentry
07 46 29 00	01 95 06 00	Miscellaneous Carpentry
07 46 29 00	06 16 23 00	Sheathing
07 46 33 00	07 46 16 00b	Siding
07 46 46 00	01 22 16 00	No Specification Required
07 46 46 00	06 46 29 00	Exterior Architectural Woodwork
07 46 46 00	01 95 06 00c	Interior Architectural Woodwork
07 46 46 00	07 46 16 00b	Siding



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**SECTION 07 46 63 00 - INSULATED-CORE METAL WALL PANELS**

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for insulated-core metal wall panels. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Foamed-insulation-core metal wall panels.
 - b. Laminated-insulation-core metal wall panels.
 - c. Honeycomb-core metal wall panels.

C. Definitions

1. Metal Wall Panel Assembly: Insulated-core metal wall panels, attachment system components, miscellaneous metal framing, and accessories necessary for a complete weathertight wall system.

D. Performance Requirements

1. General Performance: Metal wall panel assemblies shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.
2. Delegated Design: Design metal wall panel assembly, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
3. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) of wall area when tested according to ASTM E 283 at the following test-pressure difference:
 - a. Test-Pressure Difference: 1.57 lbf/sq. ft. (75 Pa) which is equivalent to a 25-mph (40-km/h) wind.
4. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:
 - a. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa) which is equivalent to a 50-mph (80-km/h) wind.
5. Water Penetration under Dynamic Pressure: No evidence of water leakage when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of inward-acting, wind-load design pressure of not less than 6.24 lbf/sq. ft. (299 Pa) and not more than 12 lbf/sq. ft. (575 Pa).
 - a. Water Leakage: As defined according to AAMA 501.1.
OR
Water Leakage: Uncontrolled water infiltrating the system or appearing on system's normally exposed interior surfaces from sources other than condensation. Water controlled by flashing and gutters that is drained back to the exterior and cannot damage adjacent materials or finishes is not water leakage.
6. Structural Performance: Metal wall panel assemblies shall withstand the effects the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 330:
 - a. Wind Loads: Determine loads based on the following minimum design wind pressures:
 - 1) Uniform pressure of 20 lbf/sq. ft. (958 Pa) **OR** 30 lbf/sq. ft. (1436 Pa), **as directed**, acting inward or outward.
OR
Uniform pressure as indicated on Drawings.



- b. Deflection Limits: Metal wall panel assemblies shall withstand wind loads with horizontal deflections no greater than 1/180 **OR** 1/240, **as directed**, of the span.
- 7. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- 8. Thermal Performance: Provide insulated metal wall panel assemblies with thermal-resistance value (R-value) indicated when tested according to ASTM C 518.

E. Submittals

- 1. Product Data: For each type of product indicated.
- 2. Shop Drawings: Show fabrication and installation layouts of metal wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish between factory-, shop-, and field-assembled work.
- 3. Samples: For each type of exposed finish required.
- 4. Delegated-Design Submittal: For metal wall panel assembly indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- 5. Coordination Drawings: Exterior elevations, drawn to scale, and coordinating penetrations and wall-mounted items.
- 6. Product Test Reports.
- 7. Field quality-control reports.
- 8. Maintenance Data.
- 9. Warranties: Sample of special warranties.

F. Quality Assurance

- 1. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- 2. Fire-Test-Response Characteristics: Provide metal wall panels and system components with the following fire-test-response characteristics as determined by testing identical panels and system components per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.
 - a. Fire-Resistance Characteristics: Provide materials and construction tested for fire resistance per ASTM E 119.
 - b. Intermediate-Scale Multistory Fire Test: Tested mockup, representative of completed multistory wall assembly of which wall panel is a part, complies with NFPA 285 for test method and required fire-test-response characteristics of exterior non-load-bearing wall panel assemblies.
 - c. Radiant Heat Exposure: No ignition when tested according to NFPA 268.
 - d. Potential Heat: Acceptable level when tested according to NFPA 259.
 - e. Surface-Burning Characteristics: Provide wall panels with flame-spread index of 25 or less and smoke-developed index of 450 or less, per ASTM E 84.
- 3. Preinstallation Conference: Conduct conference at Project site.

G. Delivery, Storage, And Handling

- 1. Deliver components, sheets, metal wall panels, and other manufactured items so as not to be damaged or deformed. Package metal wall panels for protection during transportation and handling.
- 2. Unload, store, and erect metal wall panels in a manner to prevent bending, warping, twisting, and surface damage.
- 3. Stack metal wall panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal wall panels to ensure dryness, with positive slope for



- drainage of water. Do not store metal wall panels in contact with other materials that might cause staining, denting, or other surface damage.
4. Retain strippable protective covering on metal wall panels for period of metal wall panel installation.

H. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal wall panel assemblies that fail in materials or workmanship within specified warranty period.
 - a. Warranty Period: Two years from date of Final Completion.
2. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - a. Finish Warranty Period:
 - 1) 20 years from date of Final Completion for fluoropolymer finish.
 - 2) 10 years from date of Final Completion for siliconized polyester.

1.2 PRODUCTS

A. Panel Materials

1. Metallic-Coated Steel Sheet: Restricted flatness steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.
 - b. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40 (Class AZM150 coating designation, Grade 275); structural quality.
 - c. Surface: Smooth, flat **OR** Embossed, **as directed**, finish.
 - d. Exposed Coil-Coated Finish:
 - 1) Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2) Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 3) Four-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat and clear coats. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 4) Mica Fluoropolymer: AAMA 621. Two-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 5) Metallic Fluoropolymer: AAMA 621. Three-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 6) FEVE Fluoropolymer: AAMA 621. Two-coat fluoropolymer finish containing 100 percent fluorinated ethylene vinyl ether resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.



- 7) Siliconized-Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
- 8) Plastisol: Epoxy primer and vinyl plastisol topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 3.8 mil (0.097 mm) for topcoat.
- e. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).
2. Aluminum Sheet: Coil-coated sheet, ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
 - a. Surface: Smooth, flat **OR** Embossed, **as directed**, finish.
 - b. Exposed Coil-Coated Finishes:
 - 1) Two-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2) Three-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 3) Four-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat and clear coats. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 4) Mica Fluoropolymer: AAMA 620. Two-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 5) Metallic Fluoropolymer: AAMA 620. Three-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 6) FEVE Fluoropolymer: AAMA 620. Two-coat fluoropolymer finish containing 100 percent fluorinated ethylene vinyl ether resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 7) Siliconized-Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
 - 8) Plastisol: Epoxy primer and vinyl plastisol topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 3.8 mil (0.097 mm) for topcoat.
 - c. Exposed Anodized Finish:
 - 1) Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm **OR** AA-M12C22A31, Class II, 0.010 mm, **as directed**, or thicker.
 - 2) Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm **OR** AA-M12C22A32/A34, Class II, 0.010 mm, **as directed**, or thicker.
 - d. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).
3. Copper Sheet: ASTM B 370, cold-rolled copper sheet, H00 temper.
 - a. Exposed Finish: Apply the following finish, as specified or indicated on Drawings.
 - 1) Natural finish.



- 2) Brushed Satin: CDA M32-06x (Mechanical Finish: directionally textured, medium satin; Coating: clear organic, air drying, as specified below):
 - a) Clear, Organic Coating: Clear, air-drying, acrylic lacquer specially developed for coating copper-alloy products, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).
 - 3) Mirror Polished: CDA M22-06x (Mechanical Finish: buffed, specular; Coating: clear organic, air drying, as specified below):
 - a) Clear, Organic Coating: Clear, air-drying, acrylic lacquer specially developed for coating copper-alloy products, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).
 - 4) Pre-patinated: ASTM B 882. Copper sheets artificially aged by chemical reaction to convert surface to inorganic crystalline structure with color range and durability of naturally-formed patina.
 4. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304 **OR** 316, **as directed**, fully annealed.
 - a. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
 - b. Polished Finish: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1) Run grain of directional finishes with long dimension of each piece.
 - 2) When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - 3) Directional Satin Finish: No. 4.
 - c. Bright, Cold-Rolled, Unpolished Finish: No. 2B.
 5. Panel Sealants:
 - a. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
 - b. Joint Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal wall panels and remain weathertight; and as recommended in writing by metal wall panel manufacturer.
 - c. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.
- B. Insulation For Panel Cores
1. Polyisocyanurate Insulation: Closed cell, modified polyisocyanurate foam using a non-CFC blowing agent, foamed-in-place **OR** board, **as directed**, type, with maximum flame-spread index of 25 and smoke-developed index of 450.
 - a. Closed-Cell Content: 90 percent when tested according to ASTM D 2856.
 2. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, 1.60-lb/cu. ft. (26-kg/cu. m) minimum density, unless otherwise indicated; with maximum flame-spread index of 25 and smoke-developed index of 450.
 3. Molded-Polystyrene Board Insulation: ASTM C 578, Type I, 0.9 lb/cu. ft. (14 kg/cu. m) **OR** Type II, 1.35 lb/cu. ft. (22 kg/cu. m), Class 2 or 3, Grade 3, **as directed**, with maximum flame-spread index of 25 and smoke-developed index of 450.
- C. Miscellaneous Metal Framing
1. Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, ASTM A 653/A 653M, G40 (Z120) hot-dip galvanized **OR** ASTM A 653/A 653M, G60 (Z180) hot-dip galvanized, **as directed**, or coating with equivalent corrosion resistance unless otherwise indicated.
 2. Subgirts: Manufacturer's standard C- or Z-shaped sections, 0.064-inch (1.63-mm) nominal thickness.
 3. Zee Clips: 0.079-inch (2.01-mm) nominal thickness.
 4. Base or Sill Angles **OR** Channels, **as directed**: 0.079-inch (2.01-mm) nominal thickness.
 5. Hat-Shaped, Rigid Furring Channels:



- a. Nominal Thickness: As indicated **OR** As required to meet performance requirements **OR** 0.025 inch (0.64 mm) **OR** 0.040 inch (1.02 mm), **as directed**.
 - b. Depth: As indicated **OR** 7/8 inch (21 mm) **OR** 1-1/2 inches (38 mm), **as directed**.
 6. Cold-Rolled Furring Channels: Minimum 1/2-inch- (13-mm-) wide flange.
 - a. Nominal Thickness: As indicated **OR** As required to meet performance requirements **OR** 0.064 inch (1.63 mm), **as directed**.
 - b. Depth: As indicated **OR** 3/4 inch (19 mm), **as directed**.
 - c. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with 0.040-inch (1.02-mm) nominal thickness.
 7. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.52-mm-) diameter wire, or double strand of 0.048-inch- (1.22-mm-) diameter wire.
 8. Fasteners for Miscellaneous Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.
- D. Miscellaneous Materials
1. Panel Fasteners: Self-tapping screws; bolts and nuts; self-locking rivets and bolts; end-welded studs; and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal wall panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.
 2. Backer Board: Hardboard complying with AHA A135.4, Class 1 tempered, 1/8 inch (3 mm) **OR** 1/4 inch (6 mm), **as directed**, thick unless otherwise indicated.
- E. Foamed-Insulation-Core Metal Wall Panels
1. General: Provide factory-formed and -assembled metal wall panels fabricated from two metal facing sheets and insulation core foamed in place during fabrication, and with joints between panels designed to form weathertight seals. Include accessories required for weathertight installation.
 - a. Panel Performance:
 - 1) Flatwise Tensile Strength: 30 psi (207 kPa) when tested according to ASTM C 297.
 - 2) Humid Aging: Volume increase not greater than 6.0 percent and no delamination or metal corrosion when tested for 7 days at 140 deg F (60 deg C) and 100 percent relative humidity according to ASTM D 2126.
 - 3) Heat Aging: Volume increase not greater than 2.0 percent and no delamination, surface blistering, or permanent bowing when tested for 7 days at 200 deg F (93 deg C) according to ASTM D 2126.
 - 4) Cold Aging: Volume decrease not more than 1.0 percent and no delamination, surface blistering, or permanent bowing when tested for 7 days at minus 20 deg F (29 deg C) according to ASTM D 2126.
 - 5) Fatigue: No evidence of delamination, core cracking, or permanent bowing when tested to a 20-lbf/sq. ft. (958-kPa) positive and negative wind load and with deflection of L/180 for 2 million cycles.
 - 6) Autoclave: No delamination when exposed to 2-psi (13.8-kPa) pressure at a temperature of 212 deg F (100 deg C) for 2-1/2 hours.
 - b. Polyisocyanurate Insulation-Core Performance:
 - 1) Density: 2.0 to 2.6 lb/cu. ft. (32 to 42 kg/cu. m) when tested according to ASTM D 1622.
 - 2) Compressive Strength: Minimum 20 psi (138 kPa) when tested according to ASTM D 1621.
 - 3) Shear Strength: 26 psi (179 kPa) when tested according to ASTM C 273.
 2. Exposed-Fastener, Foamed-Insulation-Core Metal Wall Panels: Formed with raised, trapezoidal major rib at panel edge and two intermediate stiffening ribs symmetrically spaced between major rib and panel edge; designed for lapping side edges of adjacent panels and mechanically attaching to supports using exposed fasteners in side laps.
 - a. Facings: Fabricate panel with exterior and interior facings of same material and thickness.



- 1) Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
 - 2) Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
 - 3) Backer Board: On back side of exterior facing.
 - 4) Exterior Facing Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - a) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - 5) Interior Facing Finish: Manufacturer's standard white polyester.
 - b. Snap-On Batten: Same material, finish, and color as exterior facings of wall panels.
 - c. Panel Coverage: 36 inches (914 mm) **OR** 40 inches (1016 mm), **as directed**, nominal.
 - d. Panel Thickness: 1.0 inch (25 mm) **OR** 1.5 inches (38 mm) **OR** 2.0 inches (51 mm) **OR** 2.5 inches (64 mm) **OR** 3.0 inches (76 mm) **OR** 4.0 inches (102 mm) **OR** 5.0 inches (127 mm), **as directed**.
 - e. Thermal-Resistance Value (R-Value): as directed by the Owner.
3. Concealed-Fastener, Foamed-Insulation-Core Metal Wall Panels: Formed with tongue-and-groove panel edges; designed for sequential installation by interlocking panel edges and mechanically attaching panels to supports using concealed clips or fasteners.
- a. Facings: Fabricate panel with exterior and interior facings of same material and thickness.
 - 1) Material: Zinc-coated (galvanized) steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
 - 2) Material: Aluminum-zinc alloy-coated steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
 - 3) Material: Stainless-steel sheet, 0.031 inch (0.79 mm) **OR** 0.038 inch (0.97 mm), **as directed**, thick with No. 4 **OR** 2B, **as directed**, finish.
 - 4) Backer Board: On back side of exterior facing.
 - 5) Exterior Facing Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol, **as directed**.
 - a) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - 6) Interior Facing Finish: Manufacturer's standard siliconized polyester.
 - 7) Exterior Surface: Smooth, flat **OR** Striated **OR** Shallow ribs **OR** Shallow V grooves, **as directed**.
 - b. Panel Coverage: 24 inches (610 mm) **OR** 30 inches (762 mm) **OR** 36 inches (914 mm) **OR** 39.37 inches (1000 mm) **OR** 42 inches (1067 mm), **as directed**, nominal.
 - c. Panel Thickness: 2.0 inches (51 mm) **OR** 2.5 inches (64 mm) **OR** 3.0 inches (76 mm) **OR** 4.0 inches (102 mm) **OR** 5.0 inches (127 mm) **OR** 6.0 inches (152 mm), **as directed**.
 - d. Thermal-Resistance Value (R-Value): as directed by the Owner.
- F. Laminated-Insulation-Core Metal Wall Panels
1. General: Provide factory-formed and -assembled metal wall panels fabricated from two metal facing sheets and core material laminated or otherwise securely bonded to facing sheets during fabrication without use of contact adhesives, and with joints between panels designed to form weathertight seals. Include accessories required for weathertight installation.
 - a. Panel Performance:
 - 1) Flatwise Tensile Strength: 27 psi (186 kPa) when tested according to ASTM C 297.
 - 2) Humid Aging: Volume increase not greater than 6.0 percent and no delamination or metal corrosion when tested for 7 days at 140 deg F (60 deg C) and 100 percent relative humidity according to ASTM D 2126.
 - 3) Heat Aging: Volume increase not greater than 2.0 percent and no delamination, surface blistering, or permanent bowing when tested for 7 days at 200 deg F (93 deg C) according to ASTM D 2126.



- 4) Cold Aging: Volume decrease not more than 1.0 percent and no delamination, surface blistering, or permanent bowing when tested for 7 days at minus 20 deg F (29 deg C) according to ASTM D 2126.
- 5) Fatigue: No evidence of delamination, core cracking, or permanent bowing when tested to a 20-lbf/sq. ft. (958-kPa) positive and negative wind load and with deflection of L/180 for 2 million cycles.
- 6) Autoclave: No delamination when exposed to 2-psi (13.8-kPa) pressure at a temperature of 212 deg F (100 deg C) for 2-1/2 hours.
- b. Polyisocyanurate Insulation-Core Performance:
 - 1) Density: 1.8 to 2.3 lb/cu. ft. (29 to 37 kg/cu. m) when tested according to ASTM D 1622.
 - 2) Compressive Strength: Minimum 20 psi (138 kPa) when tested according to ASTM D 1621.
 - 3) Shear Strength: 24 psi (164 kPa) when tested according to ASTM C 273.
2. Wrapped-Edge, Laminated-Insulation-Core Metal Wall Panels: Formed with flush exterior panel facing wrapped over panel edges; designed for independent installation by mechanically attaching panels to supports using staggered, concealed side clips engaging panel edges **OR** through extended panel edges to supports using concealed fasteners, **as directed**; with sealant **OR** gasketed, **as directed**, joints.
 - a. Exterior Facing:
 - 1) Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
 - 2) Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
 - 3) Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.050 inch (1.27 mm) **OR** 0.063 inch (1.60 mm) **OR** 0.080 inch (2.03 mm), **as directed**, thick.
 - 4) Surface: Smooth, flat **OR** Embossed, **as directed**.
 - 5) Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
 - a) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - b. Interior Facing:
 - 1) Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
 - 2) Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
 - 3) Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.050 inch (1.27 mm), **as directed**, thick.
 - 4) Finish: Manufacturer's standard primer or white polyester.
 - c. Core Material: Polyisocyanurate **OR** Extruded-polystyrene **OR** Expanded-polystyrene, **as directed**, board insulation.
 - 1) Backer Board: 0.125-inch- (3-mm-) **OR** 0.250-inch- (6-mm-), **as directed**, thick hardboard behind exterior facing for increased impact resistance.
 - d. Clips: Manufacturer's standard one piece, formed from zinc-coated (galvanized) steel **OR** aluminum-zinc alloy-coated steel **OR** stainless steel, **as directed**.
 - e. Gaskets: Extruded, dry seal silicone.
 - f. Sealant: Manufacturer's standard silicone.
 - g. Panel Thickness: 1.0 inch (25 mm) **OR** 2.0 inches (51 mm) **OR** 3.0 inches (76 mm) **OR** 4.0 inches (102 mm) **OR** 5.0 inches (127 mm) **OR** 6.0 inches (152 mm), **as directed**.
 - h. Thermal-Resistance Value (R-Value): as directed by the Owner.



3. Shiplap-Edge, Laminated-Insulation-Core Metal Wall Panels: Formed with flush exterior panel facing and with shiplap edges; designed for sequential installation by mechanically attaching panels to supports using concealed clips and fasteners; with factory-applied sealant **OR** gaskets, **as directed**, in side laps.
 - a. Exterior Facing:
 - 1) Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
 - 2) Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
 - 3) Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.050 inch (1.27 mm) **OR** 0.063 inch (1.60 mm), **as directed**, thick.
 - 4) Surface: Smooth, flat **OR** Embossed, **as directed**.
 - 5) Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
 - a) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - b. Interior Facing:
 - 1) Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
 - 2) Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
 - 3) Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
 - 4) Finish: Manufacturer's standard primer or white polyester.
 - c. Core Material: Polyisocyanurate **OR** Extruded-polystyrene **OR** Expanded-polystyrene, **as directed**, board insulation.
 - 1) Backer Board: 0.125-inch- (3-mm-) **OR** 0.250-inch- (6-mm-), **as directed**, thick hardboard behind exterior facing for increased impact resistance.
 - d. Clips: Manufacturer's standard one piece, formed from zinc-coated (galvanized) steel **OR** aluminum-zinc alloy-coated steel **OR** stainless steel, **as directed**.
 - e. Gaskets: Extruded, dry seal silicone.
 - f. Sealant: Manufacturer's standard silicone.
 - g. Panel Thickness: 1.0 inch (25 mm) **OR** 2.0 inches (51 mm) **OR** 3.0 inches (76 mm) **OR** 4.0 inches (102 mm) **OR** 5.0 inches (127 mm) **OR** 6.0 inches (152 mm), **as directed**.
 - h. Thermal-Resistance Value (R-Value): as directed by the Owner.
4. Framed-Edge, Laminated-Insulation-Core Metal Wall Panels: Formed with flush exterior panel facing and integral, extruded edge members; designed for independent installation by mechanically attaching panels to supports through edge framing using concealed fasteners; with gasketed joints.
 - a. Exterior Facing:
 - 1) Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
 - 2) Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71 mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
 - 3) Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.050 inch (1.27 mm) **OR** 0.063 inch (1.60 mm) **OR** 0.080 inch (2.03 mm), **as directed**, thick.
 - 4) Surface: Smooth, flat **OR** Embossed, **as directed**.
 - 5) Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
 - a) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.



- b. Interior Facing:
 - 1) Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
 - 2) Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
 - 3) Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
 - 4) Finish: Manufacturer's standard primer or white polyester.
 - c. Core Material: Polyisocyanurate **OR** Extruded-polystyrene **OR** Expanded-polystyrene, **as directed**, board insulation.
 - 1) Backer Board: 0.125-inch- (3.18-mm-) **OR** 0.250-inch- (6-mm-), **as directed**, thick hardboard behind exterior facing for increased impact resistance.
 - d. Edge Members: Extruded aluminum, not less than 0.063-inch (1.60-mm) wall thickness.
 - e. Gaskets: Extruded, dry seal silicone.
 - f. Panel Thickness: 1.0 inch (25 mm) **OR** 2.0 inches (51 mm) **OR** 3.0 inches (76 mm) **OR** 4.0 inches (102 mm) **OR** 5.0 inches (127 mm) **OR** 6.0 inches (152 mm), **as directed**.
 - g. Thermal-Resistance Value (R-Value): as directed by the Owner.
- G. Honeycomb-Core Metal Wall Panels
- 1. General: Provide factory-formed and -assembled metal wall panels fabricated from two metal facing sheets and honeycomb-core material laminated or otherwise securely bonded to facing sheets during fabrication without use of contact adhesives or pinch rollers, and with joints between panels designed to form weathertight seals. Include accessories required for weathertight installation.
 - a. Panel Performance:
 - 1) Fatigue: No evidence of delamination, core cracking, or permanent bowing when tested to a 20-lbf/sq. ft. (958-kPa) positive and negative wind load and with deflection of L/180 for 2 million cycles.
 - 2) Autoclave: No delamination when exposed to 2-psi (13.8-kPa) pressure at a temperature of 212 deg F (100 deg C) for 2-1/2 hours.
 - 2. Wrapped-Edge, Honeycomb-Core Metal Wall Panels: Formed with flush exterior panel facing wrapped over panel edges; designed for independent installation by mechanically attaching panels to supports using staggered, concealed side clips engaging panel edges **OR** through extended panel edges to supports using concealed fasteners, **as directed**; with sealant **OR** gasketed, **as directed**, joints.
 - a. Facings: Fabricate panel with exterior and interior facings of same material and thickness.
 - 1) Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
 - 2) Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
 - 3) Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.050 inch (1.27 mm) **OR** 0.063 inch (1.60 mm), **as directed**, thick.
 - 4) Exterior Facing Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
 - a) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - 5) Interior Facing Finish: Manufacturer's standard primer or polyester.
 - b. Kraft-Paper Honeycomb Core: Manufacturer's standard phenolic-resin impregnated paper, with not less than 15 percent resin content by weight and chemically treated for fire resistance; with maximum 1/2-inch (13-mm) cell size.
 - c. Aluminum Honeycomb Core: Manufacturer's standard 0.003-inch- (0.08-mm-) thick, commercial grade aluminum with maximum 3/4-inch (19-mm) cell size.



- d. Clips: Manufacturer's standard one piece, formed from zinc-coated (galvanized) steel **OR** aluminum-zinc alloy-coated steel **OR** stainless steel, **as directed**.
 - e. Gaskets: Extruded, dry seal silicone.
 - f. Sealant: Manufacturer's standard silicone.
 - g. Panel Thickness: 0.25 inch (6 mm) **OR** 1.0 inch (25 mm) **OR** 2.0 inches (51 mm) **OR** 3.0 inches (76 mm) **OR** 4.0 inches (102 mm), **as directed**.
3. Shiplap-Edge, Honeycomb-Core Metal Wall Panels: Formed with flush exterior panel facing and with shiplap edges; designed for sequential installation by mechanically attaching panels to supports using concealed clips and fasteners; with factory-applied sealant **OR** gaskets, **as directed**, in side laps.
- a. Facings: Fabricate panel with exterior and interior facings of same material and thickness.
 - 1) Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
 - 2) Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm), **as directed**, nominal thickness.
 - 3) Material: Aluminum sheet, 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.050 inch (1.27 mm) **OR** 0.063 inch (1.60 mm), **as directed**, thick.
 - 4) Exterior Facing Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
 - a) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - 5) Interior Facing Finish: Manufacturer's standard primer or polyester.
 - b. Kraft-Paper Honeycomb Core: Manufacturer's standard phenolic-resin-impregnated paper, with not less than 15 percent resin content by weight and chemically treated for fire resistance; with maximum 1/2-inch (13-mm) cell size.
 - c. Aluminum Honeycomb Core: Manufacturer's standard 0.003-inch- (0.08-mm-) thick, commercial grade aluminum with maximum 3/4-inch (19-mm) cell size.
 - d. Clips: Manufacturer's standard one piece, formed from zinc-coated (galvanized) steel **OR** aluminum-zinc alloy-coated steel **OR** stainless steel, **as directed**.
 - e. Gaskets: Extruded, dry seal silicone.
 - f. Sealant: Manufacturer's standard silicone.
 - g. Panel Thickness: 1.0 inch (25 mm) **OR** 1.25 inches (32 mm) **OR** 2.0 inches (51 mm), **as directed**.
4. Framed-Edge, Honeycomb-Core Metal Wall Panels: Formed with flush exterior panel facing and integral, extruded edge members; designed for independent installation by mechanically attaching panels to supports through edge framing using concealed fasteners; with gasketed joints.
- a. Facings: Fabricate panel with exterior and interior facings of same material and thickness.
 - 1) Material: Zinc-coated (galvanized) steel sheet, 0.028-inch (0.71-mm) nominal thickness.
 - 2) Material: Aluminum sheet, 0.040 inch (1.02 mm) **OR** 0.063 inch (1.60 mm), **as directed**, thick.
 - 3) Exterior Facing Finish: 2-coat fluoropolymer **OR** 3-coat fluoropolymer **OR** 4-coat fluoropolymer **OR** Mica fluoropolymer **OR** Metallic fluoropolymer **OR** FEVE fluoropolymer **OR** Siliconized polyester **OR** Plastisol **OR** Clear anodized **OR** Color anodized, **as directed**.
 - a) Color: As indicated by manufacturer's designations **OR** Match samples **OR** As selected from manufacturer's full range, **as directed**.
 - 4) Interior Facing Finish: Manufacturer's standard primer or polyester.
 - b. Kraft-Paper Honeycomb Core: Manufacturer's standard phenolic-resin-impregnated paper, with not less than 15 percent resin content by weight and chemically treated for fire resistance; with maximum 1/2-inch (13-mm) cell size.
 - c. Aluminum Honeycomb Core: Manufacturer's standard 0.003-inch- (0.08-mm-) thick, commercial grade aluminum with maximum 3/4-inch (19-mm) cell size.



- d. Edge Members: Extruded aluminum, not less than 0.063-inch (1.6-mm) wall thickness.
- e. Gaskets: Extruded, dry seal silicone.
- f. Panel Thickness: 1.0 inch (25 mm) **OR** 2.0 inches (51 mm) **OR** 3.0 inches (76 mm), **as directed**.

H. Accessories

1. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels unless otherwise indicated.
 - a. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal wall panels.
 - b. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 - c. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
2. Flashing and Trim: Formed from 0.018-inch- (0.46-mm-) minimum thickness, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal wall panels.

I. Fabrication

1. General: Fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
2. Fabricate metal wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.
3. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
4. Fabricate metal wall panel joints with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will minimize noise from movements within panel assembly.
5. Honeycomb-Core Metal Wall Panels: Fabricate panels using manufacturer's standard thermosetting structural adhesive in a lamination process that bonds panel under minimum 10-psi (69-kPa) pressure. Use of contact adhesives with pinch-roll process is not acceptable.
 - a. Panel Bow Tolerance: Not more than 0.5 percent of panel width or length.
6. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.
 - a. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - b. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 - c. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 - d. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
 - e. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.



- f. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal wall panel manufacturer.
 - 1) Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

J. General Finish Requirements

- 1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- 2. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- 3. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

1.3 EXECUTION

A. Preparation

- 1. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorages according to ASTM C 754 and metal wall panel manufacturer's written recommendations.

B. Metal Wall Panel Installation, General

- 1. General: Install metal wall panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - a. Commence metal wall panel installation and install minimum of 300 sq. ft. (27.9 sq. m.) in presence of factory-authorized representative.
 - b. Shim or otherwise plumb substrates receiving metal wall panels.
 - c. Flash and seal metal wall panels with weather closures at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until weather barrier and flashings that will be concealed by metal wall panels are installed.
 - d. Install screw fasteners in predrilled holes.
 - e. Locate and space fastenings in uniform vertical and horizontal alignment.
 - f. Install flashing and trim as metal wall panel work proceeds.
 - g. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 - h. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated or, if not indicated, as necessary for waterproofing.
 - i. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 - j. Provide weathertight escutcheons for pipe and conduit penetrating exterior walls.
- 2. Fasteners:
 - a. Steel Wall Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized steel fasteners for surfaces exposed to the interior.
 - b. Aluminum Wall Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized steel fasteners for surfaces exposed to the interior.
 - c. Copper Wall Panels: Use copper, stainless-steel, or hardware-bronze fasteners.
 - d. Stainless-Steel Wall Panels: Use stainless-steel fasteners.
- 3. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by metal wall panel manufacturer.



4. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal wall panel manufacturer.
 - a. Seal metal wall panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal wall panel manufacturer.
 - b. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants".
- C. Insulated-Core Metal Wall Panel Installation
1. General: Apply continuous ribbon of sealant to panel joint on concealed side of insulated-core metal wall panels as vapor seal; apply sealant to panel joint on exposed side of panels for weather seal.
 - a. Fasten insulated-core metal wall panels to supports with fasteners at each lapped joint at location and spacing and with fasteners recommended by manufacturer.
 - b. Lap ribbed or fluted sheets one full rib corrugation. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
 - c. Provide metal-backed washers under heads of exposed fasteners on weather side of insulated metal wall panels.
 - d. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
 - e. Provide sealant tape at lapped joints of insulated metal wall panels and between panels and protruding equipment, vents, and accessories.
 - f. Apply a continuous ribbon of sealant tape to panel side laps and elsewhere as needed to make panels weathertight.
 - g. Apply snap-on battens to exposed-fastener, insulated-core metal wall panel seams to conceal fasteners.
 2. Foamed-Insulation-Core Metal Wall Panels: Fasten metal wall panels to supports with concealed clips at each joint at location and spacing and with fasteners recommended by manufacturer. Fully engage tongue and groove of adjacent panels.
 - a. Install clips to supports with self-tapping fasteners.
 3. Laminated-Insulation-Core Metal Wall Panels:
 - a. Wrapped-Edge Panels: Mechanically attach wall panels to supports using staggered, concealed side clips engaging wrapped panel edges. Install clips to supports with self-tapping fasteners. Seal joints with backer rod and sealant **OR** manufacturer's standard gaskets, **as directed**.
 - b. Wrapped-Edge Panels: Mechanically attach wall panels through extended edge of panels to supports using self-tapping fasteners. Seal joints with backer rod and sealant **OR** manufacturer's standard gaskets, **as directed**.
 - c. Shiplap-Edge Panels: Mechanically attach wall panels to supports using staggered, concealed side clips engaging tongue-and-groove panel edges. Install clips to supports with self-tapping fasteners.
 - 1) Horizontal Joints: Maintain reveal joint of consistent width **OR** Seal joints with backer rod and sealant **OR** Seal joints with manufacturer's standard gaskets, **as directed**.
 - 2) Vertical Joints: Maintain reveal joint of consistent width **OR** Seal joints with backer rod and sealant **OR** Seal joints with manufacturer's standard gaskets, **as directed**.
 - d. Framed-Edge Panels: Mechanically attach wall panels through integral, extruded edge members to supports using self-tapping fasteners. Seal joints with manufacturer's standard gaskets.
 4. Honeycomb-Core Metal Wall Panels:
 - a. Wrapped-Edge Panels: Mechanically attach wall panels to supports using staggered, concealed side clips engaging wrapped panel edges. Install clips to supports with self-tapping fasteners. Seal joints with backer rod and sealant **OR** manufacturer's standard gaskets, **as directed**.



- b. Wrapped-Edge Panels: Mechanically attach wall panels through extended edge of panels to supports using self-tapping fasteners. Seal joints with backer rod and sealant **OR** manufacturer's standard gaskets, **as directed**.
- c. Shiplap-Edge Panels: Mechanically attach wall panels to supports using staggered, concealed side clips engaging tongue-and-groove panel edges. Install clips to supports with self-tapping fasteners.
 - 1) Horizontal Joints: Maintain reveal joint of consistent width **OR** Seal joints with backer rod and sealant **OR** Seal joints with manufacturer's standard gaskets, **as directed**.
 - 2) Vertical Joints: Maintain reveal joint of consistent width **OR** Seal joints with backer rod and sealant **OR** Seal joints with manufacturer's standard gaskets, **as directed**.
- d. Framed-Edge Panels: Mechanically attach wall panels through integral, extruded edge members to supports using self-tapping fasteners. Seal joints with manufacturer's standard gaskets.

D. Accessory Installation

- 1. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
 - a. Install components required for a complete metal wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
- 2. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
 - a. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
 - b. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (605 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

E. Field Quality Control

- 1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- 2. Water Penetration: Test areas of installed system indicated on Drawings for compliance with system performance requirements according to ASTM E 1105 at minimum differential pressure of 20 percent of inward-acting, wind-load design pressure as defined by SEI/ASCE 7, but not less than 6.24 lbf/sq. ft. (299 Pa).
- 3. Water-Spray Test: After completing the installation of 75-foot- (23-m-) by-2-story minimum area of metal wall panel assembly, test assembly for water penetration according to AAMA 501.2 in a 2-bay area directed by the Owner.
- 4. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect and test completed metal wall panel installation, including accessories.
- 5. Remove and replace metal wall panels where tests and inspections indicate that they do not comply with specified requirements.
- 6. Additional tests and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

F. Cleaning And Protection

- 1. Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed unless otherwise indicated in manufacturer's written installation instructions. On



-
- completion of metal wall panel installation, clean finished surfaces as recommended by metal wall panel manufacturer. Maintain in a clean condition during construction.
2. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
 3. Replace metal wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 46 63 00



Task	Specification	Specification Description
07 46 63 00	07 46 16 00	Metal Wall Panels



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SECTION 07 51 13 00 - BUILT-UP ASPHALT ROOFING

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for built-up asphalt roofing. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Built-up asphalt roofing.
 - b. Vapor retarder.
 - c. Roof insulation.
2. Section includes the installation of insulation strips in ribs of acoustical roof deck. Insulation strips are furnished under Division 5 Section "Steel Deck."

C. Definitions

1. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to built-up roofing.
2. Hot Roofing Asphalt: Roofing asphalt heated to its equiviscous temperature, the temperature at which its viscosity is 125 centipoise for mop-applied roofing asphalt and 75 centipoise for mechanical spreader-applied roofing asphalt, within a range of plus or minus 25 deg F (14 deg C), measured at the mop cart or mechanical spreader immediately before application.

D. Performance Requirements

1. General Performance: Installed built-up roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Built-up roofing and base flashings shall remain watertight.
2. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by built-up roofing manufacturer based on testing and field experience.
3. Roofing System Design: Provide built-up roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7.
4. FM Approvals Listing: Provide built-up roofing, base flashings, and component materials that comply with requirements in FM Approvals 4450 and FM Approvals 4470 as part of a built-up roofing system, and that are listed in FM Approvals' "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals markings.
 - a. Fire/Windstorm Classification: Class 1A-60 **OR** Class 1A-75 **OR** Class 1A-90 **OR** Class 1A-105 **OR** Class 1A-120, **as directed.**
 - b. Hail Resistance Rating: MH **OR** SH, **as directed.**
5. Energy Performance (for LEED-NC Credit SS 7.2): Provide roofing system with initial Solar Reflectance Index not less than 78 when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency.
6. Energy Performance: Provide roofing system that is listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.
7. Energy Performance (for roofs that must comply with California Energy Commission's CEC-Title 24): Provide roofing system with initial solar reflectance not less than 0.70 and emissivity not less than 0.75 when tested according to CRRC-1.

E. Submittals



1. Product Data: For each type of product indicated.
2. LEED Submittals:
 - a. Product Test Reports for Credit SS 7.2: For roof materials, indicating that roof materials comply with Solar Reflectance Index requirement.
 - b. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.
3. Shop Drawings: For built-up roofing. Include plans, elevations, sections, details, and attachments to other work.
 - a. Base flashings and built-up terminations.
 - b. Tapered insulation, including slopes.
 - c. Crickets, saddles, and tapered edge strips, including slopes.
 - d. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
4. Samples: For the following products:
 - a. Built-up roofing materials, including base sheet, ply sheet, cap sheet, and flashing sheet, of color specified.
 - b. Roof insulation.
 - c. 3 lb (1.5 kg) of aggregate surfacing material in gradation and color indicated.
 - d. Roof paver, full sized, in each color and texture required.
 - e. Walkway pads.
 - f. Six insulation fasteners of each type, length, and finish.
5. Qualification Data: For qualified Installer and manufacturer.
6. Manufacturer Certificates: Signed by roofing manufacturer certifying that built-up roofing complies with requirements specified in "Performance Requirements" Article.
 - a. Submit evidence of compliance with performance requirements.
7. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of built-up roofing.
8. Research/Evaluation Reports: For components of built-up roofing, from the ICC-ES.
9. Maintenance Data: For built-up roofing to include in maintenance manuals.
10. Warranties: Sample of special warranties.

F. Quality Assurance

1. Manufacturer Qualifications: A qualified manufacturer that is UL listed **OR** FM Approvals approved, **as directed**, for built-up roofing identical to that used for this Project.
2. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by built-up roofing manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.
3. Source Limitations: Obtain components including roof insulation and fasteners for built-up roofing from same manufacturer as built-up roofing or approved by built-up roofing manufacturer.
4. Exterior Fire-Test Exposure: ASTM E 108, Class A **OR** Class B **OR** Class C, **as directed**; for application and roof slopes indicated, as determined by testing identical built-up roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.
5. Fire-Resistance Ratings: Where indicated, provide fire-resistance-rated roof assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
6. Preinstallation Roofing Conference: Conduct conference at Project site.

G. Delivery, Storage, And Handling

1. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
2. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing manufacturer. Protect stored liquid material from direct sunlight.



- a. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
 3. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
 4. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.
- H. Project Conditions
1. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing to be installed according to manufacturer's written instructions and warranty requirements.
- I. Warranty
1. Special Warranty: Manufacturer's standard or customized form, without monetary limitation, in which manufacturer agrees to repair or replace components of built-up roofing that fail in materials or workmanship within specified warranty period.
 - a. Special warranty includes built-up roofing membrane, base flashings, roof insulation, fasteners, cover boards, substrate board, roofing accessories, roof pavers, and other components of built-up roofing.
 - b. Warranty Period: 10 **OR** 15 **OR** 20 **OR** 25 **OR** 30, **as directed**, years from date of Final Completion.
 2. Special Project Warranty: Submit roofing Installer's warranty, signed by Installer, covering the Work of this Section, including all components of built-up roofing such as built-up roofing membrane, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, roof pavers, and walkway products, for the following warranty period:
 - a. Warranty Period: Two years from date of Final Completion.

1.2 PRODUCTS

A. Built-Up Roofing Manufacturers

B. Base-Sheet Materials

1. Sheathing Paper: Red-rosin type, minimum 3 lb/100 sq. ft. (0.16 kg/sq. m).
2. Base Sheet: ASTM D 4601, Type II, SBS-modified, asphalt-impregnated and -coated sheet, with glass-fiber-reinforcing mat, dusted with fine mineral surfacing on both sides.
 - a. Weight: 25 lb/100 sq. ft. (1.2 kg/sq. m) **OR** 40 lb/100 sq. ft. (1.95 kg/sq. m) **OR** 50 lb/100 sq. ft. (2.4 kg/sq. m) **OR** 60 lb/100 sq. ft. (3.0 kg/sq. m) **OR** 75 lb/100 sq. ft. (3.7 kg/sq. m), **as directed**, minimum.

OR

Base Sheet: ASTM D 4601, Type I **OR** II, **as directed**, nonperforated, asphalt-impregnated and -coated, glass-fiber sheet, dusted with fine mineral surfacing on both sides.

OR

Base Sheet: ASTM D 4897, Type II, venting, nonperforated, heavyweight, asphalt-impregnated and -coated, glass-fiber base sheet with coarse granular surfacing or embossed venting channels on bottom surface.

OR

Base Sheet: ASTM D 2626, asphalt-saturated and -coated organic felt, dusted with fine mineral surfacing on both sides.

C. Roofing Membrane Plies

1. Ply Sheet: ASTM D 2178, Type IV **OR** VI, **as directed**, asphalt-impregnated, glass-fiber felt.
2. Cap Sheet: ASTM D 3909, asphalt-impregnated and -coated, glass-fiber cap sheet, with white coarse mineral-granule top surfacing and fine mineral surfacing on bottom surface.



D. Base Flashing Sheet Materials

1. Backer Sheet: ASTM D 2178, Type IV **OR** VI, **as directed**, asphalt-impregnated, glass-fiber felt.
OR
Backer Sheet: ASTM D 4601, Type I **OR** II, **as directed**, asphalt-impregnated and -coated, glass-fiber sheet, dusted with fine mineral surfacing on both sides.
OR
Backer Sheet: ASTM D 2626, asphalt-saturated and -coated organic felt, dusted with fine mineral surfacing on both sides.
2. Granule-Surfaced Flashing Sheet: ASTM D 6164, Grade G, Type I or II, polyester-reinforced **OR** ASTM D 6163, Grade G, Type I or II, glass-fiber-reinforced **OR** ASTM D 6162, Grade G, Type I or II, composite polyester-reinforced and glass-fiber-reinforced, **as directed**, SBS-modified asphalt sheet; granular surfaced; suitable for application method specified, and as follows:
 - a. Granule Color: White **OR** Gray **OR** Tan, **as directed**.
3. Metal-Foil-Surfaced Flashing Sheet: ASTM D 6298, glass-fiber-reinforced, SBS-modified asphalt sheet; metal-foil surfaced; suitable for application method specified, and as follows:
 - a. Foil Surfacing: Aluminum **OR** Copper **OR** Stainless steel **OR** Aluminum, fluoropolymer coated finish, of color and gloss selected from manufacturer's full range, **as directed**.
4. Smooth-Surfaced Flashing Sheet: ASTM D 6222, Grade S, Type I or II, polyester-reinforced **OR** ASTM D 6223, Grade S, Type I or II, composite polyester-reinforced and glass-fiber-reinforced, **as directed**, APP-modified asphalt sheet; smooth surfaced; suitable for application method specified.
OR
Granule-Surfaced Flashing Sheet: ASTM D 6222, Grade G, Type I or II, polyester-reinforced **OR** ASTM D 6223, Grade G, Type I or II, composite polyester-reinforced and glass-fiber-reinforced, **as directed**, APP-modified asphalt sheet; granular surfaced; suitable for application method specified, and as follows:
 - a. Granule Color: White **OR** Gray **OR** Tan, **as directed**.
5. Glass-Fiber Fabric: Woven glass-fiber cloth, treated with asphalt, complying with ASTM D 1668, Type I.

E. Asphalt Materials

1. Asphalt Primer: ASTM D 41.
2. Roofing Asphalt: ASTM D 312, Type III **OR** IV **OR** III or IV as recommended by built-up roofing manufacturer for application, **as directed**.
3. Roofing Asphalt: ASTM D 6152, SEBS modified.

F. Auxiliary Built-Up Roofing Materials

1. General: Auxiliary materials recommended by roofing manufacturer for intended use and compatible with built-up roofing.
 - a. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
 - b. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1) Plastic Foam Adhesives: 50 g/L.
 - 2) Gypsum Board and Panel Adhesives: 50 g/L.
 - 3) Multipurpose Construction Adhesives: 70 g/L.
 - 4) Fiberglass Adhesives: 80 g/L.
 - 5) Contact Adhesives: 80 g/L.
 - 6) Other Adhesives: 250 g/L.
 - 7) Nonmembrane Roof Sealants: 300 g/L.
 - 8) Sealant Primers for Nonporous Substrates: 250 g/L.
 - 9) Sealant Primers for Porous Substrates: 775 g/L.



2. Cold-Applied Adhesive: Roofing manufacturer's standard asphalt-based, one- or two-part, asbestos-free, cold-applied adhesive specially formulated for compatibility and use with built-up base flashings.
3. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required by roofing manufacturer for application.
4. Mastic Sealant: Polyisobutylene, plain or modified bitumen, nonhardening, nonmigrating, nonskinning, and nondrying.
5. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening built-up roofing components to substrate, tested by manufacturer for required pullout strength, and acceptable to roofing manufacturer.
6. Metal Flashing Sheet: Metal flashing sheet is specified in Division 7 Section "Sheet Metal Flashing and Trim."
7. Aggregate Surfacing: ASTM D 1863, No. 6 or No. 67, clean, dry, opaque, water-worn gravel or crushed stone, free of sharp edges **OR** crushed slag, free of sharp edges, **as directed**.
8. Miscellaneous Accessories: Provide miscellaneous accessories recommended by built-up roofing manufacturer.

G. Substrate Boards

1. Substrate Board: ASTM C 1396/C 1396M, Type X gypsum board, 5/8 inch (16 mm) thick.
OR
Substrate Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/4 inch (6 mm) **OR** 1/2 inch (13 mm) **OR** Type X, 5/8 inch (16 mm), **as directed**, thick, factory primed, **as directed**.
OR
Substrate Board: ASTM C 1278/C 1278M, cellulosic-fiber-reinforced, water-resistant gypsum substrate, 1/4 inch (6 mm) **OR** 3/8 inch (10 mm) **OR** 1/2 inch (13 mm) **OR** 5/8 inch (16 mm), **as directed**, thick.
OR
Substrate Board: ASTM C 728, perlite board, 3/4 inch (19 mm) **OR** 1 inch (25 mm), **as directed**, thick, seal coated.
2. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate board to roof deck.

H. Vapor Retarder

1. Polyethylene Film: ASTM D 4397, 6 mils (0.15 mm) thick, minimum, with maximum permeance rating of 0.13 perm (7.5 ng/Pa x s x sq. m).
 - a. Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
OR
Adhesive: Manufacturer's standard lap adhesive, FM Approvals approved for vapor-retarder application.
2. Laminated Sheet: Kraft paper/polyethylene laminate, two layers, reinforced with woven fiberglass yarn, laminated and edge reinforced, with maximum permeance rating of 0.50 perm (29 ng/Pa x s x sq. m) and with manufacturer's standard adhesive, **as directed**.
3. Self-Adhering Sheet Vapor Retarder: ASTM D 1970, minimum of 40-mil- (1.0-mm-) thick, polyethylene film laminated to layer of rubberized asphalt adhesive; maximum permeance rating of 0.1 perm (6 ng/Pa x s x sq. m); cold-applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor-retarder manufacturer.
OR
Self-Adhering Sheet Vapor Retarder: 30- to 40-mil- (0.76- to 1.0-mm-) thick, polyethylene film laminated to layer of butyl rubber adhesive; maximum permeance rating of 0.1 perm (6 ng/Pa x s x sq. m); cold-applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor-retarder manufacturer.
4. Glass-Fiber Felts: ASTM D 2178, Type IV, asphalt impregnated.



I. Roof Insulation

1. General: Preformed roof insulation boards manufactured or approved by roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated and that produce FM Approvals-approved roof insulation, **as directed**.
2. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, 1.6-lb/cu. ft. (26-kg/cu. m) **OR** X, 1.3-lb/cu. ft. (21-kg/cu. m), **as directed**, minimum density, square edged.
3. Molded-Polystyrene Board Insulation: ASTM C 578 Type II, 1.35-lb/cu. ft. (22-kg/cu. m) **OR** VIII, 1.15-lb/cu. ft. (18-kg/cu. m) **OR** IX, 1.8-lb/cu. ft. (29-kg/cu. m), **as directed**, minimum density.
4. Composite Molded-Polystyrene Board Insulation: ASTM C 578, Type II, 1.35-lb/cu. ft. (22-kg/cu. m) **OR** Type VIII, 1.15-lb/cu. ft. (18-kg/cu. m) **OR** Type IX, 1.8-lb/cu. ft. (29-kg/cu. m), **as directed**, minimum density, with factory-applied facings, as follows:
 - a. Facer: ASTM C 208, Type II, Grade 2, cellulosic-fiber insulation board, asphalt coated, 1/2 inch (13 mm) thick.

OR

 - Facer: DOC PS 2, Exposure 1, OSB, 7/16 inch (11 mm) thick.
5. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2 **OR** Type II, Class I, Grade 3, **as directed**, felt or glass-fiber mat facer on both major surfaces.
6. Composite Polyisocyanurate Board Insulation: ASTM C 1289, with factory-applied facing board on one major surface as indicated below by type, and felt or glass-fiber mat facer on the other surface.
 - a. Type IV, cellulosic-fiber-insulating-board facer, Grade 2, 1/2 inch (13 mm) thick.
 - b. Type V, OSB facer, 7/16 inch (11 mm) thick.
 - c. Type VII, glass mat faced gypsum board facer, 1/4 inch (6 mm) thick.
7. Perlite Board Insulation: ASTM C 728, rigid, mineral-aggregate thermal insulation board composed of expanded perlite, cellulosic fibers, binders, and waterproofing agents with top surface seal coated.
8. Cellulosic-Fiber Board Insulation: ASTM C 208, Type II, Grade 2, fibrous-felted, rigid insulation boards of wood fiber or other cellulosic-fiber and water-resistant binders, asphalt impregnated, chemically treated for deterioration.
9. Cellular-Glass Board Insulation: ASTM C 552, Type IV, rigid, cellular-glass thermal board insulation faced with manufacturer's standard kraft-paper sheets.
10. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48) unless otherwise indicated.
11. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

J. Insulation Accessories

1. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with built-up roofing.
2. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation to substrate and acceptable to roofing manufacturer.
3. Modified Asphaltic Insulation Adhesive: Insulation manufacturer's recommended modified asphaltic, asbestos-free, cold-applied adhesive formulated to attach roof insulation to substrate or to another insulation layer.

OR

Bead-Applied Insulation Adhesive: Insulation manufacturer's recommended bead-applied, low-rise, one- or multicomponent urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.

OR

Full-Spread Applied Insulation Adhesive: Insulation manufacturer's recommended spray-applied, low-rise, two-component urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.
4. Insulation Cant Strips: ASTM C 728, perlite insulation board.
5. Insulation Cant Strips: ASTM C 208, Type II, Grade 1, cellulosic-fiber insulation board.



6. Wood Nailer Strips: Comply with requirements in Division 6 Section "Rough Carpentry" **OR** "Miscellaneous Carpentry", **as directed**.
 7. Tapered Edge Strips: ASTM C 728, perlite insulation board.
OR
Tapered Edge Strips: ASTM C 208, Type II, Grade 1, cellulosic-fiber insulation board.
 8. Cover Board: ASTM C 208, Type II, Grade 2, cellulosic-fiber insulation board, 1/2 inch (13 mm) thick.
OR
Cover Board: DOC PS 2, Exposure 1, OSB, 7/16 inch (11 mm) thick.
OR
Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/4 inch (6 mm) **OR** 1/2 inch (13 mm) **OR** 5/8 inch (16 mm), **as directed**, thick, factory primed, **as directed**.
OR
Cover Board: ASTM C 1278/C 1278M, cellulosic-fiber-reinforced, water-resistant gypsum substrate, 1/4 inch (6 mm) **OR** 3/8 inch (10 mm) **OR** 1/2 inch (13 mm) **OR** 5/8 inch (16 mm), **as directed**, thick.
 9. Substrate Joint Tape: 6- or 8-inch- (150- or 200-mm-) wide, coated, glass fiber.
- K. Coating Materials
1. Roof Coating: ASTM D 1227, Type II Class 1, mineral-colloid-emulsified, fibered **OR** 2, chemically emulsified, filled or fibered, **as directed**, asphalt emulsion, asbestos free.
OR
Roof Coating: ASTM D 1227, Type III, Class 1, mineral-colloid-emulsified **OR** 2, chemically emulsified, **as directed**, asphalt emulsion, nonfibered.
OR
Roof Coating: ASTM D 2824, Type I, nonfibered **OR** III, fibered, asbestos-free, **as directed**, aluminum-pigmented asphaltic coating.
OR
Roof Coating: Acrylic elastomer emulsion coating, formulated for use on bituminous roof surfaces and complying with ASTM D 6083 **OR** the following, **as directed**:
 - a. Initial Percent Elongation (Break): Not less than 60 percent at 0 deg F (-18 deg C) and 200 percent at 73 deg F (23 deg C) when tested according to ASTM D 2370.
 - b. Initial Tensile Strength (Maximum Stress): Not less than 100 psi (1.38 MPa) at 73 deg F (23 deg C) and 200 psi (2.76 MPa) at 0 deg F (-18 deg C) when tested according to ASTM D 2370.
 - c. Final Percent Elongation (Break) after Accelerated Weathering 1000 hrs.: Not less than 40 percent at 0 deg F (-18 deg C) and 100 percent at 73 deg F (23 deg C) when tested according to ASTM D 2370.
 - d. Permeance: Not more than 50 perms when measured according to ASTM D 1653.
 - e. Accelerated Weathering 1000 hrs.: No cracking or checking when tested according to ASTM D 4798.
 - f. Color: White **OR** Gray **OR** Buff, **as directed**.
- L. Walkways
1. Walkway Pads: Mineral-granule-surfaced, reinforced asphaltic composition **OR** Polymer-modified, reconstituted solid-rubber, surface-textured, **as directed**, slip-resisting pads, manufactured as a traffic pad for foot traffic and acceptable to roofing manufacturer, 3/8 inch (10 mm) **OR** 1/2 inch (13 mm) **OR** 3/4 inch (19 mm), **as directed**, thick, minimum.
 2. Walkway Cap Sheet Strips: ASTM D 6164, Grade G, Type I or II, polyester-reinforced **OR** ASTM D 6163, Grade G, Type I or II, glass-fiber-reinforced **OR** ASTM D 6162, Grade G, Type I or II, composite polyester-reinforced and glass-fiber-reinforced, **as directed**, SBS-modified asphalt sheet; granular surfaced; suitable for application method specified, and as follows:
 - a. Granule Color: White **OR** Gray **OR** Tan, **as directed**.
 3. Roof Pavers: Heavyweight, hydraulically pressed, concrete units, square edged **OR** with top edges beveled 3/16 inch (5 mm), **as directed**, factory cast for use as roof pavers; absorption not



greater than 5 percent, ASTM C 140; no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance, ASTM C 67; and as follows:

- a. Size: 24 by 24 inches (600 by 600 mm). Manufacture pavers to dimensional tolerances of plus or minus 1/16 inch (1.6 mm) in length, height, and thickness.
- b. Compressive Strength: 7500 psi (52 MPa) **OR** 6500 psi (45 MPa), **as directed**, minimum; ASTM C 140.
- c. Colors and Textures: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

1.3 EXECUTION

A. Examination

1. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
 - a. Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.
 - b. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 - c. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Division 05 Section "Steel Decking".
 - d. Verify that deck is securely fastened with no projecting fasteners and with no adjacent units in excess of 1/16 inch (1.6 mm) out of plane relative to adjoining deck.
 - e. Verify that minimum concrete drying period recommended by roofing manufacturer has passed.
 - f. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 - 1) Test for moisture by pouring 1 pint (0.5 L) of hot roofing asphalt on deck at start of each day's work and at start of each roof area or plane. Do not proceed with roofing work if test sample foams or can be easily and cleanly stripped after cooling.
 - g. Verify that concrete curing compounds that will impair adhesion of roofing components to roof deck have been removed.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Preparation

1. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing manufacturer's written instructions. Remove sharp projections.
2. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
3. Prime surface of concrete deck with asphalt primer at a rate of 3/4 gal./100 sq. ft. (0.3 L/sq. m) and allow primer to dry.
4. Install insulation strips in ribs of acoustical roof decks according to acoustical roof deck manufacturer's written instructions.

C. Substrate Board Installation

1. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.
 - a. Fasten substrate board to top flanges of steel deck according to recommendations in FM Approvals' "RoofNav" and FM Global Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification.
OR
Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to built-up roofing manufacturer's written instructions.

**D. Vapor-Retarder Installation**

1. Polyethylene Film: Loosely lay polyethylene-film vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 inches (50 mm) and 6 inches (150 mm), respectively.
 - a. Continuously seal side and end laps with tape **OR** adhesive, **as directed**.

OR

Laminate Sheet: Install laminate-sheet vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 inches (50 mm) and 6 inches (150 mm), respectively. Bond vapor retarder to substrate as follows:

 - a. Apply adhesive at rate recommended by vapor-retarder manufacturer. Seal laps with adhesive.

OR

Apply ribbons of hot roofing asphalt at spacing, temperature, and rate recommended by vapor-retarder manufacturer. Seal laps with hot roofing asphalt.

OR

Self-Adhering Sheet Vapor Retarder: Prime substrate if required by manufacturer. Install self-adhering sheet vapor retarder over area to receive vapor retarder, side and end lapping each sheet a minimum of 3-1/2 inches (90 mm) and 6 inches (150 mm), respectively. Seal laps by rolling.

OR

Built-up Vapor Retarder: Install two glass-fiber felt plies lapping each felt 19 inches (483 mm) over preceding felt. Embed each felt in a solid mopping of hot roofing asphalt. Glaze-coat completed surface with hot roofing asphalt. Apply hot roofing asphalt within plus or minus 25 deg F (14 deg C) of equiviscous temperature.
2. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into built-up roofing.

E. Insulation Installation

1. Comply with built-up roofing manufacturer's written instructions for installing roof insulation.
2. Install one lapped base sheet course and mechanically fasten to substrate according to built-up roofing manufacturer's written instructions.
3. Nailers Strips: Mechanically fasten 4-inch nominal- (89-mm actual-) width wood nailer strips of same thickness as insulation perpendicular to sloped roof deck at the following spacing:
 - a. 16 feet (4.88 m) apart for roof slopes greater than 1 inch per 12 inches (1:12) but less than 3 inches per 12 inches (3:12).
 - b. 48 inches (1220 mm) apart for roof slopes greater 3 inches per 12 inches (3:12).
4. Insulation Cant Strips: Install and secure preformed 45-degree insulation cant strips at junctures of built-up roofing with vertical surfaces or angle changes greater than 45 degrees.
5. Install tapered insulation under area of roofing to conform to slopes indicated.
6. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
 - a. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
7. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches (68 mm) or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.
 - a. Where installing composite and noncomposite board insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
8. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
9. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.
10. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:
 - a. Prime surface of concrete deck with asphalt primer at rate of 3/4 gal./100 sq. ft. (0.3 L/sq. m) and allow primer to dry.



- b. Set each layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F (14 deg C) of equiviscous temperature.
- c. Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
OR
Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.
- 11. Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
 - a. If Project is FM Global insured or if FM Approvals requirements are proposed as a performance standard, fasten insulation according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.
 - b. If number of fasteners will be based on ASCE/SEI 7's uplift pressure, fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.
- 12. Mechanically Fastened and Adhered Insulation: Install first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
 - a. If Project is FM Global insured or if FM Approvals requirements are proposed as a performance standard, fasten first layer of insulation according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.
 - b. If number of fasteners will be based on ASCE/SEI 7's uplift pressure, fasten first layer of insulation to resist uplift pressure at corners, perimeter, and field of roof.
 - c. Set each subsequent layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F (14 deg C) of equiviscous temperature.
OR
Set each subsequent layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
OR
Set each subsequent layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.
- 13. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches (150 mm) in each direction. Loosely butt cover boards together and fasten to roof deck, **as directed**. Tape joints if required by roofing manufacturer.
 - a. Fasten cover boards according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.
 - b. Fasten cover boards to resist uplift pressure at corners, perimeter, and field of roof.
 - c. Apply hot roofing asphalt to underside and immediately bond cover board to substrate.

F. Built-Up Roofing Installation, General

- 1. Install roofing membrane according to roofing manufacturer's written instructions and applicable recommendations of ARMA/NRCA's "Quality Control Guidelines for the Application of Built-up Roofing."
 - a. Install roofing system BU-3 **OR** 4 **OR** 5, **as directed**, -N **OR** I **OR** C, **as directed**, -A-A **OR** S **OR** M, **as directed**, according to roof assembly identification matrix and roof assembly layout illustrations in NRCA's "The NRCA Roofing and Waterproofing Manual" and requirements in this Section.
OR
Install roofing membrane according to roofing manufacturer's written instructions and applicable recommendations of ARMA/NRCA's "Quality Control Guidelines for the Application of Built-up Roofing" and as follows:
 - a. Deck Type: N (nailable) **OR** I (insulated) **OR** C (concrete or nonnailable), **as directed**.
 - b. Base Sheet: 1 **OR** 1, installed over sheathing paper, **as directed**.
 - c. Number of Ply Sheets: 2 **OR** 3 **OR** 4, **as directed**.



- d. Surfacing Type: A (aggregate) **OR** S (asphalt surfacing or coating) **OR** M (mineral-granule-surfaced cap sheet), **as directed**.
 - 1) Mineral-granule-surfaced cap sheet is in addition to number of ply sheets specified.
 2. Start installation of built-up roofing in presence of manufacturer's technical personnel.
 3. Where roof slope exceeds 1/2 inch per 12 inches (1:24) **OR** 3/4 inch per 12 inches (1:18), **as directed**, install built-up roofing sheets parallel with slope.
 - a. Backnail built-up roofing sheets to nailer strips **OR** substrate, **as directed**, according to roofing manufacturer's written instructions.
 4. Cooperate with testing agencies engaged or required to perform services for installing roofing.
 5. Coordinate installation of roofing so insulation and other components of built-up roofing not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.
 - a. Provide tie-offs at end of each day's work to cover exposed built-up roofing sheets and insulation with a course of coated felt set in roofing cement or hot roofing asphalt with joints and edges sealed.
 - b. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing.
 - c. Remove and discard temporary seals before beginning work on adjoining roofing.
 6. Asphalt Heating: Do not raise roofing asphalt temperature above equiviscous temperature range more than one hour before time of application. Do not exceed roofing asphalt manufacturer's recommended temperature limits during roofing asphalt heating. Do not heat roofing asphalt within 25 deg F (14 deg C) of flash point. Discard roofing asphalt maintained at a temperature exceeding finished blowing temperature for more than 4 hours.

OR

Asphalt Heating: Heat and apply SEBS-modified roofing asphalt according to roofing manufacturer's written instructions.
 7. Substrate-Joint Penetrations: Prevent roofing asphalt and adhesives from penetrating substrate joints, entering building, or damaging built-up roofing components or adjacent building construction.
- G. Roofing Membrane Installation
1. Loosely lay one course of sheathing paper, lapping edges and ends a minimum of 2 inches (50 mm) and 6 inches (150 mm), respectively.
 2. Install lapped base sheet course, extending sheet over and terminating beyond cants. Attach base sheet as follows:
 - a. Mechanically fasten to substrate.

OR

Spot- or strip-mop to substrate with hot roofing asphalt.

OR

Adhere to substrate in a solid mopping of hot roofing asphalt, **as directed**.
 3. Install two **OR** three **OR** four, **as directed**, ply sheets starting at low point of roofing. Align ply sheets without stretching. Shingle side laps of ply sheets uniformly to achieve required number of plies throughout thickness of roofing membrane. Shingle in direction to shed water. Extend ply sheets over and terminate beyond cants.
 - a. Embed each ply sheet in a solid mopping of hot roofing asphalt applied at rate required by roofing manufacturer, to form a uniform membrane without ply sheets touching.
 4. Cap Sheet: Install lapped granulated cap sheet starting at low point of roofing. Offset laps from laps of preceding ply sheets and align cap sheet without stretching. Lap in direction to shed water. Extend cap sheet over and terminate beyond cants.
 - a. Embed cap sheet in a solid mopping of hot roofing asphalt applied at rate required by built-up roofing manufacturer.
 5. Aggregate Surfacing: Promptly after installing and testing roofing membrane, base flashing, and stripping, flood-coat roof surface with 60 lb/100 sq. ft. (3.0 kg/sq. m) of hot roofing asphalt. While flood coat is hot and fluid, cast the following average weight of aggregate in a uniform course:
 - a. Aggregate Weight: 400 lb/100 sq. ft. (20 kg/sq. m) **OR** 300 lb/100 sq. ft. (15 kg/sq. m), **as directed**.



- b. If aggregate surfacing is delayed, promptly apply glaze coat of hot roofing asphalt at a rate of 10 lb/100 sq. ft. (0.5 kg/sq. m).
- 6. Glaze-coat roofing membrane surface with hot roofing asphalt applied at a rate of 10 to 15 lb/100 sq. ft. (0.5 to 0.75 kg/sq. m).

H. Flashing And Stripping Installation

1. Install base flashing over cant strips and other sloping and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrates according to built-up roofing manufacturer's written instructions and as follows:
 - a. Prime substrates with asphalt primer if required by built-up roofing manufacturer.
 - b. Backer Sheet Application: Mechanically fasten backer sheet to walls or parapets. Adhere backer sheet over built-up roofing at cants in a solid mopping of hot roofing asphalt **OR** cold-applied adhesive, **as directed**.
OR
 Backer Sheet Application: Adhere backer sheet to substrate in a solid mopping of hot roofing asphalt **OR** cold-applied adhesive, **as directed**.
 - c. Flashing Sheet Application: Adhere flashing sheet to substrate in a solid mopping of hot roofing asphalt applied at not less than 425 deg F (218 deg C). Apply hot roofing asphalt to back of flashing sheet if recommended by roofing manufacturer.
OR
 Flashing Sheet Application: Adhere flashing sheet to substrate in cold-applied adhesive at rate required by roofing manufacturer.
OR
 Flashing Sheet Application: Adhere flashing sheet to substrate in asphalt roofing cement at rate required by roofing manufacturer.
OR
 Flashing Sheet Application: Torch apply flashing sheet to substrate.
2. Extend base flashing up walls or parapets a minimum of 8 inches (200 mm) above built-up roofing and 4 inches (100 mm) onto field of built-up roofing.
3. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.
 - a. Seal top termination of base flashing with a strip of glass-fiber fabric set in asphalt roofing cement.
4. Install stripping, according to roofing manufacturer's written instructions, where metal flanges and edgings are set on built-up roofing.
 - a. Flashing-Sheet Stripping: Install flashing-sheet stripping in a continuous coating of asphalt roofing cement or in a solid mopping of hot roofing asphalt applied at not less than 425 deg F (218 deg C), and extend onto roofing membrane.
OR
 Flashing-Sheet Stripping: Install flashing-sheet stripping by heat welding and extend onto roofing membrane.
OR
 Built-up Stripping: Install stripping of not less than two roofing membrane ply sheets, setting each ply in a continuous coating of asphalt roofing cement or in a solid mopping of hot roofing asphalt, and extend onto roofing membrane 4 inches (100 mm) and 6 inches (150 mm), respectively.
5. Roof Drains: Set 30-by-30-inch (760-by-760-mm) metal flashing in bed of asphalt roofing cement on completed built-up roofing. Cover metal flashing with built-up roofing cap-sheet stripping and extend a minimum of 4 inches (100 mm) **OR** 6 inches (150 mm), **as directed**, beyond edge of metal flashing onto field of built-up roofing. Clamp built-up roofing, metal flashing, and stripping into roof-drain clamping ring.
 - a. Install stripping according to roofing manufacturer's written instructions.

I. Coating Installation



1. Apply coating to built-up roofing and base flashings according to manufacturer's written instructions, by spray, roller, or other suitable application method to provide a dry film thickness of not less than 20 mils (0.5 mm).
- J. Walkway Installation
1. Walkway Pads: Install walkway pads using units of size indicated or, if not indicated, of manufacturer's standard size, according to walkway pad manufacturer's written instructions.
 - a. Set walkway pads in additional pour coat of hot roofing asphalt after sweeping away loose aggregate surfacing.
 2. Walkway Cap Sheet Strips: Install walkway cap sheet strips, approximately 36 inches (900 mm) wide and in lengths not exceeding 10 feet (3 m), leaving a space of 6 inches (150 mm) between strips, over built-up roofing. Adhere in hot roofing asphalt.
 3. Roof-Paver Walkways: Install walkway roof pavers according to roofing manufacturer's written instructions in locations indicated, to form walkways. Leave 3 inches (75 mm) of space between adjacent roof pavers.
- K. Field Quality Control
1. Testing Agency: Perform roof tests and inspections and to prepare test reports.
 2. Test Cuts: Test specimens will be removed to evaluate problems observed during quality-assurance inspections of built-up roofing as follows:
 - a. Approximate quantities of components within built-up roofing will be determined according to ASTM D 3617.
 - b. Test specimens will be examined for interply voids according to ASTM D 3617 and to comply with criteria established in Appendix 3 of ARMA/NRCA's "Quality Control Guidelines for the Application of Built-up Roofing."
 - c. Repair areas where test cuts were made according to roofing manufacturer's written instructions.
 3. Repair or remove and replace components of built-up roofing where test results or inspections indicate that they do not comply with specified requirements.
 - a. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- L. Protecting And Cleaning
1. Protect built-up roofing from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and the Owner.
 2. Correct deficiencies in or remove built-up roofing that does not comply with requirements, repair substrates, and repair or reinstall roofing to a condition free of damage and deterioration at time of Final Completion and according to warranty requirements.
 3. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 51 13 00



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Task	Specification	Specification Description
07 51 13 00	01 95 06 00	Miscellaneous Carpentry
07 51 13 00	07 05 13 00	Built-Up Coal-Tar Roofing
07 51 13 00	07 53 16 00	EPDM Membrane Roofing
07 51 13 00	07 05 13 00b	APP-Modified Bituminous Membrane Roofing
07 51 13 00	07 05 13 00c	SBS-Modified Bituminous Membrane Roofing
07 51 13 00	07 05 13 00d	Preparation for Re-Roofing
07 52 13 00	07 05 13 00b	APP-Modified Bituminous Membrane Roofing
07 52 13 00	07 05 13 00d	Preparation for Re-Roofing
07 52 16 00	07 05 13 00c	SBS-Modified Bituminous Membrane Roofing
07 52 16 00	07 05 13 00d	Preparation for Re-Roofing



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SECTION 07 53 16 00 - EPDM MEMBRANE ROOFING

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for ethylene-propylene-diene-monomer (EPDM) roofing. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Adhered EPDM membrane roofing system.
 - b. Mechanically fastened EPDM membrane roofing system.
 - c. Loosely laid and ballasted EPDM membrane roofing system.
 - d. Vapor retarder.
 - e. Roof insulation.
2. Section includes the installation of acoustical roof deck rib insulation strips furnished under Division 05 Section "Steel Decking".

C. Definitions

1. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

D. Performance Requirements

1. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.
2. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.
3. Roofing System Design: Provide membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7.
4. FM Approvals Listing: Provide membrane roofing, base flashings, and component materials that comply with requirements in FM Approvals 4450 and FM Approvals 4470 as part of a membrane roofing system, and that are listed in FM Approvals' "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals' markings.
 - a. Fire/Windstorm Classification: Class 1A-60 **OR** Class 1A-75 **OR** Class 1A-90 **OR** Class 1A-105 **OR** Class 1A-120 **OR** Class 1A-135 **OR** Class 1A-150 **OR** Class 1A-165, **as directed**.
 - b. Hail Resistance: MH **OR** SH, **as directed**.
5. Energy Performance (for "cool-roof" performance): Provide roofing system with initial Solar Reflectance Index not less than 78 **OR** 29, **as directed**, when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency, **as directed**.
6. Energy Performance: Provide roofing system that is listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low **OR** steep, **as directed**, -slope roof products, **as directed**.
7. Energy Performance: Provide roofing system with initial solar reflectance not less than 0.70 and emissivity not less than 0.75 when tested according to CRRC-1.

E. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:



- a. Product Test Reports for Credit SS 7.2: For roof materials, documentation indicating that roof materials comply with Solar Reflectance Index requirement.
 - b. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.
 3. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.
 4. Samples: For each product included in the roofing system.
 5. Manufacturer Certificate: Signed by roofing manufacturer certifying that membrane roofing system complies with requirements specified in "Performance Requirements" Article.
 - a. Submit evidence of complying with performance requirements.
 6. Research/evaluation reports.
 7. Field quality-control reports.
 8. Maintenance data.
 9. Warranties: Sample of special warranties.
- F. Quality Assurance
1. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by membrane roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.
 2. Source Limitations: Obtain components for membrane roofing system from same manufacturer as membrane roofing or approved by membrane roofing manufacturer.
 3. Exterior Fire-Test Exposure: ASTM E 108, Class A **OR** Class B **OR** Class C, **as directed**; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.
 4. Fire-Resistance Ratings: Where indicated, provide fire-resistance-rated roof assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 5. Preinstallation Roofing Conference: Conduct conference at Project site.
- G. Delivery, Storage, And Handling
1. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
 2. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
 - a. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
 3. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
 4. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.
- H. Project Conditions
1. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.
- I. Warranty
1. Special Warranty: Manufacturer's standard or customized form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within 10 **OR** 15 **OR** 20, **as directed**, years from date of Final Completion.



1.2 PRODUCTS

A. EPDM Membrane Roofing

1. EPDM: ASTM D 4637, Type I, non-reinforced, **OR** Type II, scrim or fabric internally reinforced, **as directed**, uniform, flexible EPDM sheet.
 - a. Thickness: 45 mils (1.1 mm) **OR** 60 mils (1.5 mm) **OR** 75 mils (1.9 mm) **OR** 90 mils (2.2 mm), **as directed**, nominal.
 - b. Exposed Face Color: Black **OR** White on black, **as directed**.
2. Fabric-Backed EPDM: ASTM D 4637, Type III, non-reinforced, uniform, flexible EPDM sheet, laminated to a nonwoven polyester fabric backing except at selvages.
 - a. Composite Thickness: 90 mils (2.3 mm) **OR** 100 mils (2.5 mm) **OR** 105 mils (2.7 mm) **OR** 115 mils (2.9 mm), **as directed**, nominal.
 - b. Exposed Face Color: Black **OR** White on black, **as directed**.

B. Auxiliary Membrane Roofing Materials

1. General: Auxiliary membrane roofing materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.
 - a. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
 - b. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1) Plastic Foam Adhesives: 50 g/L.
 - 2) Gypsum Board and Panel Adhesives: 50 g/L.
 - 3) Multipurpose Construction Adhesives: 70 g/L.
 - 4) Fiberglass Adhesives: 80 g/L.
 - 5) Contact Adhesive: 80 g/L.
 - 6) Single-Ply Roof Membrane Sealants: 450 g/L.
 - 7) Nonmembrane Roof Sealants: 300 g/L.
 - 8) Sealant Primers for Nonporous Substrates: 250 g/L.
 - 9) Sealant Primers for Porous Substrates: 775 g/L.
 - 10) Other Adhesives and Sealants: 250 g/L.
2. Sheet Flashing: 60-mil- (1.5-mm-) thick EPDM, partially cured or cured, according to application.
3. Protection Sheet: Epichlorohydrin or neoprene non-reinforced flexible sheet, 55- to 60-mil- (1.4- to 1.5-mm-) thick, recommended by EPDM manufacturer for resistance to hydrocarbons, non-aromatic solvents, grease, and oil.
4. Bonding Adhesive: Manufacturer's standard, water based, **as directed**.
5. Modified Asphaltic Fabric-Backed Membrane Adhesive: Roofing system manufacturer's standard modified asphalt, asbestos-free, cold-applied adhesive formulated for compatibility and use with fabric-backed membrane roofing.
6. Water-Based, Fabric-Backed Membrane Adhesive: Roofing system manufacturer's standard water-based, cold-applied adhesive formulated for compatibility and use with fabric-backed membrane roofing.
7. Low-Rise, Urethane, Fabric-Backed Membrane Adhesive: Roof system manufacturer's standard spray-applied, low-rise, two-component urethane adhesive formulated for compatibility and use with fabric-backed membrane roofing.
8. Seaming Material: Single-component, butyl splicing adhesive and splice cleaner **OR** Manufacturer's standard, synthetic-rubber polymer primer and 3-inch- (75-mm-) wide minimum, butyl splice tape with release film, **as directed**.
9. Lap Sealant: Manufacturer's standard, single-component sealant, colored to match membrane roofing, **as directed**.
10. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.
11. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.
12. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick (25 mm wide by 1.3 mm thick), prepunched.



13. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening membrane to substrate, and acceptable to roofing system manufacturer.
14. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, reinforced EPDM securement strips, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.
15. Liquid coating, specifically formulated for coating EPDM membrane roofing, as follows:
 - a. Type: Acrylic emulsion **OR** Hypalon, **as directed**.
 - b. Color: White **OR** Gray **OR** Tan **OR** As selected from manufacturer's full range, **as directed**.

C. Substrate Boards

1. Substrate Board: ASTM C 1396/C 1396M, Type X gypsum board, 5/8 inch (16 mm) thick.
OR
Substrate Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/4 inch (6 mm) **OR** 1/2 inch (13 mm) **OR** Type X, 5/8 inch (16 mm), **as directed**, thick.
OR
Substrate Board: ASTM C 1278/C 1278M, cellulosic-fiber-reinforced, water-resistant gypsum substrate, 1/4 inch (6 mm) **OR** 3/8 inch (10 mm) **OR** 1/2 inch (13 mm) **OR** 5/8 inch (16 mm), **as directed**, thick.
OR
Substrate Board: ASTM C 728, perlite board, 3/4 inch (19 mm) **OR** 1 inch (25 mm), **as directed**, thick, seal coated.
2. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate panel to roof deck.

D. Vapor Retarder

1. Polyethylene Film: ASTM D 4397, 6 mils (0.15 mm) thick, minimum, with maximum permeance rating of 0.13 perm (7.5 ng/Pa x s x sq. m).
 - a. Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
 - b. Adhesive: Manufacturer's standard lap adhesive, FM Approvals approved for vapor-retarder application.
2. Laminated Sheet: Kraft paper, two layers, laminated with asphalt and edge reinforced with woven fiberglass yarn with maximum permeance rating of 0.50 perm (29 ng/Pa x s x sq. m) and with manufacturer's standard adhesive, **as directed**.
3. Glass-Fiber Felts: ASTM D 2178, Type IV, asphalt impregnated.

E. Roof Insulation

1. General: Preformed roof insulation boards manufactured or approved by EPDM membrane roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated and that produce FM Approvals-approved roof insulation, **as directed**.
2. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, 1.6-lb/cu. ft. (26-kg/cu. m) **OR** Type X, 1.3-lb/cu. ft. (21-kg/cu. m), **as directed**, minimum density, square edged.
3. Molded-Polystyrene Board Insulation: ASTM C 578, Type II, 1.35-lb/cu. ft. (22-kg/cu. m) **OR** Type VIII, 1.15-lb/cu. ft. (18-kg/cu. m) **OR** Type IX, 1.8-lb/cu. ft. (29-kg/cu. m), **as directed**, minimum density.
4. Composite Molded-Polystyrene Board Insulation: ASTM C 578, Type II, 1.35-lb/cu. ft. (22-kg/cu. m) **OR** Type VIII, 1.15-lb/cu. ft. (18-kg/cu. m) **OR** Type IX, 1.8-lb/cu. ft. (29-kg/cu. m), **as directed**, minimum density, with factory-applied facings, as follows:
 - a. Facer: ASTM C 208, Type II, Grade 2, cellulosic-fiber insulation board, asphalt coated, 1/2 inch (13 mm) thick.
OR
Facer: DOC PS 2, Exposure 1, OSB, 7/16 inch (11 mm) thick.



5. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2 **OR** Type II, Class I, Grade 3, **as directed**, felt or glass-fiber mat facer on both major surfaces.
6. Composite Polyisocyanurate Board Insulation: ASTM C 1289, with factory-applied facing board on one major surface, as indicated below by type, and felt or glass-fiber mat facer on the other.
 - a. Type IV, cellulosic-fiber-insulation-board facer, Grade 2, 1/2 inch (13 mm) thick.
 - b. Type V, OSB facer, 7/16 inch (11 mm) thick.
 - c. Type VII, glass mat faced gypsum board facer, 1/4 inch (6 mm) thick.
7. Perlite Board Insulation: ASTM C 728, rigid, mineral-aggregate thermal insulation board composed of expanded perlite, cellulosic fibers, binders, and waterproofing agents with top surface seal coated.
8. Cellulosic-Fiber Board Insulation: ASTM C 208, Type II, Grade 2, fibrous-felted, rigid insulation boards of wood fiber or other cellulosic-fiber and water-resistant binders, asphalt impregnated, chemically treated for deterioration.
9. Cellular-Glass Board Insulation: ASTM C 552, Type IV, rigid, cellular-glass thermal board insulation faced with manufacturer's standard kraft-paper sheets.
10. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48) unless otherwise indicated.
11. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

F. Insulation Accessories

1. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with membrane roofing.
2. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards, **as directed**, to substrate, and acceptable to roofing system manufacturer.
3. Modified Asphaltic Insulation Adhesive: Insulation manufacturer's recommended modified asphalt, asbestos-free, cold-applied adhesive formulated to attach roof insulation to substrate or to another insulation layer.
4. Bead-Applied Insulation Adhesive: Insulation manufacturer's recommended bead-applied, low-rise, one- or multicomponent urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.
5. Full-Spread Applied Insulation Adhesive: Insulation manufacturer's recommended spray-applied, low-rise, two-component urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.
6. Cover Board: ASTM C 208, Type II, Grade 2, cellulosic-fiber insulation board, 1/2 inch (13 mm) thick.
OR
Cover Board: DOC PS 2, Exposure 1, OSB, 7/16 inch (11 mm) thick.
OR
Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/4 inch (6 mm) **OR** 1/2 inch (13 mm) **OR** 5/8 inch (16 mm), **as directed**, thick, factory primed, **as directed**.
OR
Cover Board: ASTM C 1278/C 1278M, cellulosic-fiber reinforced, water-resistant gypsum substrate, 1/4 inch (6 mm) **OR** 3/8 inch (10 mm) **OR** 1/2 inch (13 mm) **OR** 5/8 inch (16 mm), **as directed**, thick.
7. Protection Mat: Woven or nonwoven polypropylene, polyolefin, or polyester fabric, water permeable and resistant to UV degradation, type and weight as recommended by roofing system manufacturer for application.

G. Asphalt Materials

1. Roofing Asphalt: ASTM D 312, Type III or Type IV **OR** ASTM D 6152, SEBS modified, **as directed**.
2. Asphalt Primer: ASTM D 41.

H. Aggregate Ballast (for loosely laid and aggregate-ballasted installations)



1. Aggregate Ballast: Provide aggregate ballast that will withstand weather exposure without significant deterioration and will not contribute to membrane degradation, of the following type and size:
 - a. Aggregate Type: Smooth, washed, riverbed gravel or other acceptable smooth-faced stone **OR** Crushed gravel or crushed stone, **as directed**.
 - b. Size: ASTM D 448, Size 4, ranging in size from 3/4 to 1-1/2 inches (19 to 38 mm).
OR
Size: ASTM D 448, Size 2, ranging in size from 1-1/2 to 2-1/2 inches (38 to 63 mm).
OR
Size: ASTM D 448, Size 3, ranging in size from 1 to 2 inches (25 to 50 mm).
- I. Roof Pavers
1. Lightweight Roof Pavers: Interlocking, lightweight concrete units, specially factory cast for use as roof ballast; grooved back, with four-way drainage capability; beveled, doweled, or otherwise profiled; and as follows:
 - a. Size: 8 by 16 inches (200 by 400 mm) **OR** 12 by 12 inches (300 by 300 mm) **OR** 12 by 16-1/2 inches (300 by 420 mm) **OR** 12 by 18 inches (300 by 450 mm), **as directed**.
 - b. Weight: At least 10 lb/sq. ft. (50 kg/sq. m) but not exceeding 18 lb/sq. ft. (90 kg/sq. m).
 - c. Compressive Strength: 2500 psi (17 MPa) **OR** 5000 psi (34 MPa), **as directed**, minimum.
 - d. Colors and Textures: As selected from manufacturer's full range.
 2. Rubber Roof Pavers: Interlocking, lightweight rubber units, 24 by 24 by 2-1/4 inches (600 by 600 by 57 mm), 6 lb/sq. ft. (30 kg/sq. m) specially manufactured for use as roof ballast; with grooved back for four-way drainage, beveled and doweled; and as follows:
 - a. Perimeter Securement Strip: Manufacturer's standard coated steel sheet channel **OR** aluminum sheet channel **OR** mill-finish aluminum sheet hold down **OR** coated aluminum sheet hold down, color as selected, **as directed**, and fasteners.
 - b. Color: Black **OR** Gray **OR** Terra cotta, **as directed**.
 3. Heavyweight Roof Pavers: Heavyweight, hydraulically pressed, concrete units, square edged **OR** with top edges beveled 3/16 inch (5 mm), **as directed**, factory cast for use as roof pavers; absorption not greater than 5 percent, ASTM C 140; no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance, ASTM C 67; and as follows:
 - a. Size: 12 by 12 inches (300 by 300 mm) **OR** 18 by 18 inches (450 by 450 mm) **OR** 24 by 24 inches (600 by 600 mm), **as directed**. Manufacture pavers to dimensional tolerances of plus or minus 1/16 inch (1.6 mm) in length, height, and thickness.
 - b. Weight: 18 lb/sq. ft. (90 kg/sq. m) **OR** 22 lb/sq. ft. (110 kg/sq. m), **as directed**.
 - c. Compressive Strength: 7500 psi (52 MPa) **OR** 6500 psi (45 MPa), **as directed**, minimum.
 - d. Colors and Textures: As selected from manufacturer's full range.
- J. Walkways
1. Flexible Walkways: Factory-formed, nonporous, heavy-duty, solid-rubber, slip-resisting, surface-textured walkway pads **OR** rolls, **as directed**, approximately 3/16 inch (5 mm) thick, and acceptable to membrane roofing system manufacturer.
 2. Walkway Roof Pavers: Heavyweight, hydraulically pressed, concrete units, square edged **OR** with top edges beveled 3/16 inch (5 mm), **as directed**, factory cast for use as roof pavers; absorption not greater than 5 percent, ASTM C 140; no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance, ASTM C 67; and as follows:
 - a. Size: 12 by 12 inches (300 by 300 mm) **OR** 18 by 18 inches (450 by 450 mm) **OR** 24 by 24 inches (600 by 600 mm), **as directed**. Manufacture pavers to dimensional tolerances of plus or minus 1/16 inch (1.6 mm) in length, height, and thickness.
 - b. Weight: 18 lb/sq. ft. (90 kg/sq. m) **OR** 22 lb/sq. ft. (110 kg/sq. m), **as directed**.
 - c. Compressive Strength: 7500 psi (52 MPa) **OR** 6500 psi (45 MPa), **as directed**, minimum.
 - d. Colors and Textures: As selected from manufacturer's full range.



1.3 EXECUTION

A. Preparation

1. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
2. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
3. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
4. Install acoustical roof deck rib insulation strips, specified in Division 05 Section "Steel Decking", according to acoustical roof deck manufacturer's written instructions, immediately before installation of overlying construction and to remain dry.

B. Substrate Board

1. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.
 - a. Fasten substrate board to top flanges of steel deck according to recommendations in FM Approvals' "RoofNav" and FM Global Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification.
OR
Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to membrane roofing system manufacturers' written instructions.

C. Vapor-Retarder Installation

1. Polyethylene Film: Loosely lay polyethylene-film vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 inches (50 mm) and 6 inches (150 mm), respectively.
 - a. Continuously seal side and end laps with tape **OR** adhesive, **as directed**.
2. Laminate Sheet: Install laminate-sheet vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 inches (50 mm) and 6 inches (150 mm), respectively. Bond vapor retarder to substrate as follows:
 - a. Apply adhesive at rate recommended by vapor-retarder manufacturer. Seal laps with adhesive.
OR
Apply ribbons of hot roofing asphalt at spacing, temperature, and rate recommended by vapor-retarder manufacturer. Seal laps with hot roofing asphalt.
3. Built-Up Vapor Retarder: Install two glass-fiber felt plies lapping each felt 19 inches (483 mm) over preceding felt. Embed each felt in a solid mopping of hot roofing asphalt. Glaze-coat completed surface with hot roofing asphalt. Apply hot roofing asphalt within plus or minus 25 deg F (14 deg C) of equiviscous temperature.
4. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into membrane roofing system.

D. Insulation Installation

1. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
2. Comply with membrane roofing system and insulation manufacturer's written instructions for installing roof insulation.
3. Install tapered insulation under area of roofing to conform to slopes indicated.
4. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches (68 mm) or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.



- a. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
5. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
6. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
 - a. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
7. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:
 - a. Prime surface of concrete deck with asphalt primer at rate of 3/4 gal./100 sq. ft. (0.3 L/sq. m) and allow primer to dry.
 - b. Set each layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F (14 deg C) of equiviscous temperature.
 - c. Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.

OR

 Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.
8. Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
 - a. Fasten insulation according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.

OR

 Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.
9. Mechanically Fastened and Adhered Insulation: Install first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
 - a. Fasten first layer of insulation according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.

OR

 Fasten first layer of insulation to resist uplift pressure at corners, perimeter, and field of roof.
 - b. Set each subsequent layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F (14 deg C) of equiviscous temperature.

OR

 Set each subsequent layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.

OR

 Set each subsequent layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.
10. Loosely Laid Insulation: Loosely lay insulation units over substrate.
11. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches (150 mm) in each direction. Loosely butt cover boards together and fasten to roof deck, **as directed**.
 - a. Fasten cover boards according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.

OR

 Fasten cover boards to resist uplift pressure at corners, perimeter, and field of roof.

E. Adhered Membrane Roofing Installation

1. Adhere membrane **OR** fabric-backed membrane, **as directed**, roofing over area to receive roofing according to membrane roofing system manufacturer's written instructions. Unroll membrane roofing and allow to relax before installing.



2. Start installation of membrane roofing in presence of membrane roofing system manufacturer's technical personnel.
3. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
4. Bonding Adhesive: Apply to substrate and underside of membrane roofing at rate required by manufacturer and allow to partially dry before installing membrane roofing. Do not apply to splice area of membrane roofing.
5. Hot Roofing Asphalt: Apply a solid mopping of hot roofing asphalt to substrate at temperature and rate required by manufacturer and install fabric-backed membrane roofing. Do not apply to splice area of membrane roofing.

OR

Fabric-Backed Membrane Adhesive: Apply to substrate at rate required by manufacturer and install fabric-backed membrane roofing.

6. In addition to adhering, mechanically fasten membrane roofing securely at terminations, penetrations, and perimeters.
7. Apply membrane roofing with side laps shingled with slope of roof deck where possible.
8. Adhesive Seam Installation: Clean both faces of splice areas, apply splicing cement, and firmly roll side and end laps of overlapping membrane roofing according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of membrane roofing terminations.
 - a. Apply a continuous bead of in-seam sealant before closing splice if required by membrane roofing system manufacturer.
9. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape, and firmly roll side and end laps of overlapping membrane roofing according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of membrane roofing terminations.
10. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.
11. Spread sealant or mastic bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.
12. Install membrane roofing and auxiliary materials to tie in to existing membrane roofing to maintain weather-tightness of transition and to not void warranty for existing membrane roofing system.
13. Adhere protection sheet over membrane roofing at locations indicated.

F. Mechanically Fastened Membrane Roofing Installation

1. Mechanically fasten membrane roofing over area to receive roofing according to roofing system manufacturer's written instructions. Unroll membrane roofing and allow to relax before installing.
 - a. For in-splice attachment, install membrane roofing with long dimension perpendicular to steel roof deck flutes.
2. Start installation of membrane roofing in presence of roofing system manufacturer's technical personnel.
3. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
4. Mechanically fasten or adhere membrane roofing securely at terminations, penetrations, and perimeter of roofing.
5. Apply membrane roofing with side laps shingled with slope of roof deck where possible.
6. Adhesive Seam Installation: Clean both faces of splice areas, apply splicing cement, and firmly roll side and end laps of overlapping membrane roofing according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of membrane roofing terminations.
 - a. Apply a continuous bead of in-seam sealant before closing splice if required by membrane roofing system manufacturer.
7. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape, and firmly roll side and end laps of overlapping membrane roofing according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of membrane roofing terminations.
8. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.



9. Spread sealant or mastic bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.
10. In-Splice Attachment: Secure one edge of membrane roofing using fastening plates or metal battens centered within membrane splice and mechanically fasten membrane roofing to roof deck. Field splice seam.
OR
Through-Membrane Attachment: Secure membrane roofing using fastening plates or metal battens and mechanically fasten membrane roofing to roof deck. Cover battens and fasteners with a continuous cover strip.
11. Install membrane roofing and auxiliary materials to tie in to existing roofing to maintain weather-tightness of transition and to not void warranty for existing membrane roofing system.
12. Adhere protection sheet over membrane roofing at locations indicated.

G. Loosely Laid And Ballasted Membrane Roofing Installation

1. Loosely lay membrane roofing over area to receive roofing according to roofing system manufacturer's written instructions. Unroll membrane roofing and allow to relax before installing.
 - a. Comply with requirements in SPRI RP-4 for System 1 **OR** System 2 **OR** System 3, **as directed**.
2. Start installation of membrane roofing in presence of roofing system manufacturer's technical personnel.
3. Accurately align membrane roofing, without stretching, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
4. Mechanically fasten or adhere perimeter of membrane roofing according to requirements in SPRI RP-4.
OR
Mechanically fasten or adhere membrane roofing at corners, perimeters, and transitions according to requirements in SPRI RP-4.
 - a. At corners and perimeters, omit aggregate ballast leaving membrane roofing exposed.
 - b. At corners and perimeters, adhere a second layer of membrane roofing
5. Apply membrane roofing with side laps shingled with slope of deck where possible.
6. Adhesive Seam Installation: Clean both faces of splice areas, apply splicing cement, and firmly roll side and end laps of overlapping membrane roofing according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of membrane roofing terminations.
 - a. Apply a continuous bead of in-seam sealant before closing splice if required by membrane roofing system manufacturer.
7. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape, and firmly roll side and end laps of overlapping membrane roofing according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of membrane roofing terminations.
8. Leave seams uncovered until inspected by membrane roofing system manufacturer **OR** testing agency, **as directed**.
9. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.
10. Spread sealant or mastic bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.
11. Install membrane roofing and auxiliary materials to tie in to existing roofing to maintain weather-tightness of transition and to not void warranty for existing membrane roofing system.
12. Adhere protection sheet over membrane roofing at locations indicated.
13. Install protection mat over membrane roofing, overlapping a minimum of 6 inches (150 mm). Install an additional protection mat layer at projections, pipes, vents, and drains, overlapping a minimum of 12 inches (300 mm).
14. Aggregate Ballast, **as directed**: Apply uniformly over membrane roofing at the rate required by membrane roofing system manufacturer, but not less than the following, spreading with care to minimize possibility of damage to membrane roofing system. Lay ballast as membrane roofing is installed, leaving membrane roofing ballasted at the end of the workday.



- a. Ballast Weight: Size 4 aggregate, 10 lb/sq. ft. (50 kg/sq. m).
OR
Ballast Weight: Size 2 aggregate, 13 lb/sq. ft. (65 kg/sq. m), at corners and perimeter; Size 4 aggregate, 10 lb/sq. ft. (50 kg/sq. m), elsewhere.
OR
Ballast Weight: Size 2 aggregate, 13 lb/sq. ft. (65 kg/sq. m).
- 15. Roof-Paver Ballast: Install lightweight **OR** heavyweight, **as directed**, roof-paver ballast according to manufacturer's written instructions.
OR
Roof-Paver Ballast: Install rubber roof-paver ballast according to manufacturer's written instructions, in locations indicated.
 - a. Install perimeter paver edge securement.
OR
Roof-Paver and Aggregate Ballast: Install heavyweight roof pavers according to manufacturer's written instructions on roof corners and perimeter.
 - b. Install Size 4 aggregate ballast elsewhere on roofing at a minimum rate of 10 lb/sq. ft. (50 kg/sq. m).
OR
Install Size 2 aggregate ballast elsewhere on roofing at a minimum rate of 13 lb/sq. ft. (65 kg/sq. m).
- H. Base Flashing Installation
 - 1. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.
 - 2. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply to seam area of flashing.
 - 3. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
 - 4. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.
 - 5. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars, **as directed**.
- I. Coating Installation
 - 1. Apply coatings to membrane roofing **OR** base flashings, **as directed**, according to manufacturer's written recommendations, by spray, roller, or other suitable application method.
- J. Walkway Installation
 - 1. Flexible Walkways: Install walkway products in locations indicated. Adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.
 - 2. Roof-Paver Walkways: Install walkway roof pavers according to manufacturer's written instructions in locations indicated, to form walkways. Leave 3 inches (75 mm) of space between adjacent roof pavers.
- K. Field Quality Control
 - 1. Testing Agency: Engage a qualified independent testing agency to perform inspections.
 - 2. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
 - 3. Repair or remove and replace components of membrane roofing system where inspections indicate that they do not comply with specified requirements.
 - 4. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- L. Protecting And Cleaning



1. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to the Owner.
2. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Final Completion and according to warranty requirements.
3. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 53 16 00



Task	Specification	Specification Description
07 53 16 00	07 51 13 00	Built-Up Asphalt Roofing
07 53 16 00	07 05 13 00	Built-Up Coal-Tar Roofing
07 53 16 00	07 05 13 00a	CSPE Membrane Roofing
07 53 16 00	07 05 13 00d	Preparation for Re-Roofing
07 53 23 00	07 51 13 00	Built-Up Asphalt Roofing
07 53 23 00	07 05 13 00	Built-Up Coal-Tar Roofing
07 53 23 00	07 53 16 00	EPDM Membrane Roofing
07 53 23 00	07 05 13 00d	Preparation for Re-Roofing
07 53 29 00	07 51 13 00	Built-Up Asphalt Roofing
07 53 29 00	07 05 13 00	Built-Up Coal-Tar Roofing
07 53 29 00	07 53 16 00	EPDM Membrane Roofing
07 53 29 00	07 05 13 00d	Preparation for Re-Roofing



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**SECTION 07 54 19 00 - POLYVINYL-CHLORIDE (PVC) ROOFING**

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for polyvinyl-chloride (PVC) roofing. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Adhered PVC membrane roofing system.
 - b. Mechanically fastened PVC membrane roofing system.
 - c. Loosely laid and ballasted PVC membrane roofing system.
 - d. Vapor retarder.
 - e. Roof insulation.
2. Section includes the installation of acoustical roof deck rib insulation strips furnished under Division 05 Section "Steel Decking".

C. Definitions

1. Roofing Terminology: See ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

D. Performance Requirements

1. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.
2. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.
3. Roofing System Design: Provide membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7.
4. FM Approvals Listing, **as directed**: Provide membrane roofing, base flashings, and component materials that comply with requirements in FM Approvals 4450 and FM Approvals 4470 as part of a membrane roofing system, and that are listed in FM Approvals' "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals markings.
 - a. Fire/Windstorm Classification: Class 1A-60 **OR** Class 1A-75 **OR** Class 1A-90 **OR** Class 1A-105 **OR** Class 1A-120 **OR** Class 1A-135 **OR** Class 1A-150 **OR** Class 1A-165, **as directed**.
 - b. Hail Resistance: MH **OR** SH, **as directed**.
5. Energy Performance: Provide roofing system with initial Solar Reflectance Index not less than 78 **OR** 29, **as directed**, when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.
6. Energy Performance: Provide roofing system that is listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low **OR** steep, **as directed**, -slope roof products.
7. Energy Performance(for roofs that must comply with California Energy Commission's CEC-Title 24): Provide roofing system with initial solar reflectance not less than 0.70 and emissivity not less than 0.75 when tested according to CRRC-1.

E. Submittals

1. Product Data: For each type of product indicated.



2. LEED Submittals:
 - a. Product Data for Credit SS 7.2: For roof materials, indicating that roof materials comply with Solar Reflectance Index requirement.
 - b. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.
 3. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.
 4. Samples: For each product included in the roofing system.
 5. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - a. Submit evidence of compliance with performance requirements.
 6. Research/evaluation reports.
 7. Field quality-control reports.
 8. Maintenance data.
 9. Warranties: Sample of special warranties.
- F. Quality Assurance
1. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by membrane roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.
 2. Source Limitations: Obtain components for membrane roofing system from same manufacturer as membrane roofing or approved by membrane roofing manufacturer.
 3. Exterior Fire-Test Exposure: ASTM E 108, Class A **OR** Class B **OR** Class C, **as directed**; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.
 4. Fire-Resistance Ratings: Where indicated, provide fire-resistance-rated roof assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 5. Preinstallation Roofing Conference: Conduct conference at Project site.
- G. Delivery, Storage, And Handling
1. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
 2. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
 - a. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
 3. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
 4. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.
- H. Project Conditions
1. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.
- I. Warranty
1. Special Warranty: Manufacturer's standard or customized form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within 10 **OR** 15, **as directed**, years from date of Final Completion.



1.2 PRODUCTS

A. PVC Membrane Roofing

1. PVC Sheet: ASTM D 4434, Type II, Grade I, glass fiber reinforced, felt backed.
 - a. Thickness: 48 mils (1.2 mm), minimum **OR** 60 mils (1.5 mm), nominal **OR** 72 mils (1.8 mm) **OR** 80 mils (2.0 mm) **OR** 96 mils (2.4 mm), **as directed**.
 - b. Exposed Face Color: Gray.**OR**

PVC Sheet: ASTM D 4434, Type III, fabric reinforced and fabric backed, **as directed**.

 - a. Thickness: 45 mils (1.1 mm), minimum **OR** 48 mils (1.2 mm) **OR** 50 mils (1.27 mm) **OR** 60 mils (1.5 mm), nominal **OR** 72 mils (1.8 mm) **OR** 80 mils (2.0 mm) **OR** 100 mils (2.5 mm), **as directed**.
 - b. Exposed Face Color: White **OR** Gray, **as directed**.**OR**

PVC Sheet: ASTM D 4434, Type IV, fabric reinforced and fabric backed, **as directed**.

 - a. Thickness: 36 mils (0.9 mm), minimum **OR** 40 mils (1.0 mm), nominal **OR** 50 mils (1.27 mm) **OR** 60 mils (1.5 mm), nominal **OR** 72 mils (1.8 mm) **OR** 80 mils (2.0 mm) **OR** 100 mils (2.5 mm), **as directed**.
 - b. Exposed Face Color: White **OR** Gray, **as directed**.

B. Auxiliary Membrane Roofing Materials

1. General: Auxiliary membrane roofing materials recommended by roofing system manufacturer for intended use, and compatible with membrane roofing.
 - a. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
 - b. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1) Plastic Foam Adhesives: 50 g/L.
 - 2) Gypsum Board and Panel Adhesives: 50 g/L.
 - 3) Multipurpose Construction Adhesives: 70 g/L.
 - 4) Fiberglass Adhesives: 80 g/L.
 - 5) Contact Adhesive: 80 g/L.
 - 6) Other Adhesives: 250 g/L.
 - 7) PVC Welding Compounds: 510 g/L.
 - 8) Adhesive Primer for Plastic: 650 g/L.
 - 9) Single-Ply Roof Membrane Sealants: 450 g/L.
 - 10) Nonmembrane Roof Sealants: 300 g/L.
 - 11) Sealant Primers for Nonporous Substrates: 250 g/L.
 - 12) Sealant Primers for Porous Substrates: 775 g/L.
2. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as PVC sheet membrane.
3. Bonding Adhesive: Manufacturer's standard, water based, **as directed**.
4. Slip Sheet: Manufacturer's standard, of thickness required for application.
5. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.
6. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch (25 mm wide by 1.3 mm) thick, prepunched.
7. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.
8. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

C. Substrate Boards



1. Substrate Board: ASTM C 1396/C 1396M, Type X gypsum board, 5/8 inch (16 mm) thick.
OR
Substrate Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/4 inch (6 mm) **OR** 1/2 inch (13 mm) **OR** Type X, 5/8 inch (16 mm), **as directed**, thick.
OR
Substrate Board: ASTM C 1278/C 1278M, cellulosic-fiber-reinforced, water-resistant gypsum substrate, 1/4 inch (6 mm) **OR** 3/8 inch (10 mm) **OR** 1/2 inch (13 mm) **OR** 5/8 inch (16 mm), **as directed**, thick.
OR
Substrate Board: ASTM C 728, perlite board, 3/4 inch (19 mm) **OR** 1 inch (25 mm), **as directed**, thick, seal coated.
2. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate board to roof deck.

D. Vapor Retarder

1. Polyethylene Film: ASTM D 4397, 6 mils (0.15 mm) thick, minimum, with maximum permeance rating of 0.13 perm (7.5 ng/Pa x s x sq. m).
 - a. Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
OR
Adhesive: Manufacturer's standard lap adhesive, FM Approvals approved for vapor-retarder application.
2. Laminated Sheet: Kraft paper, two layers, laminated with asphalt and edge reinforced with woven fiberglass yarn with maximum permeance rating of 0.50 perm (29 ng/Pa x s x sq. m) and with manufacturer's standard adhesive, **as directed**.
3. Glass-Fiber Felts: ASTM D 2178, Type IV, asphalt impregnated.

E. Roof Insulation

1. General: Preformed roof insulation boards manufactured or approved by PVC membrane roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated and that produce FM Approvals-approved roof insulation, **as directed**.
2. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, 1.6-lb/cu. ft. (26-kg/cu. m) **OR** Type X, 1.3-lb/cu. ft. (21-kg/cu. m), **as directed**, minimum density, square edged.
3. Molded-Polystyrene Board Insulation: ASTM C 578, Type II, 1.35-lb/cu. ft. (22-kg/cu. m) **OR** Type VIII, 1.15-lb/cu. ft. (18-kg/cu. m) **OR** Type IX, 1.8-lb/cu. ft. (29-kg/cu. m), **as directed**, minimum density.
4. Composite Molded-Polystyrene Board Insulation: ASTM C 578, Type II, 1.35-lb/cu. ft. (22-kg/cu. m) **OR** Type VIII, 1.15-lb/cu. ft. (18-kg/cu. m) **OR** Type IX, 1.8-lb/cu. ft. (29-kg/cu. m), **as directed**, minimum density, with factory-applied facings, as follows:
 - a. Facer: ASTM C 208, Type II, Grade 2, cellulosic-fiber insulation board, asphalt coated, 1/2 inch (13 mm) thick.
OR
Facer: DOC PS 2, Exposure 1, OSB, 7/16 inch (11 mm) thick.
5. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2 **OR** Type II, Class I, Grade 3, **as directed**, felt or glass-fiber mat facer on both major surfaces.
6. Composite Polyisocyanurate Board Insulation: ASTM C 1289, with factory-applied facing board on one major surface, as indicated below by type, and felt or glass-fiber mat facer on the other.
 - a. Type IV, cellulosic-fiber-insulating-board facer, Grade 2, 1/2 inch (13 mm) thick.
 - b. Type V, OSB facer, 7/16 inch (11 mm) thick.
 - c. Type VII, glass mat faced gypsum board facer, 1/4 inch (6 mm) thick.
7. Perlite Board Insulation: ASTM C 728, rigid, mineral-aggregate thermal insulation board composed of expanded perlite, cellulosic fibers, binders, and waterproofing agents with top surface seal coated.



8. Cellulosic-Fiber Board Insulation: ASTM C 208, Type II, Grade 2, fibrous-felted, rigid insulation boards of wood fiber or other cellulosic-fiber and water-resistant binders, asphalt impregnated, chemically treated for deterioration.
 9. Cellular-Glass Board Insulation: ASTM C 552, Type IV, rigid, cellular-glass thermal board insulation faced with manufacturer's standard kraft-paper sheets.
 10. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48), **as directed**, unless otherwise indicated.
 11. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.
- F. Insulation Accessories
1. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with membrane roofing.
 2. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards, **as directed**, to substrate, and acceptable to roofing system manufacturer.
 3. Modified Asphaltic Insulation Adhesive: Insulation manufacturer's recommended modified asphalt, asbestos-free, cold-applied adhesive formulated to attach roof insulation to substrate or to another insulation layer.
 4. Bead-Applied Insulation Adhesive: Insulation manufacturer's recommended bead-applied, low-rise, one- or multicomponent urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.
 5. Full-Spread Applied Insulation Adhesive: Insulation manufacturer's recommended spray-applied, low-rise, two-component urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.
 6. Cover Board: ASTM C 208, Type II, Grade 2, cellulosic-fiber insulation board, 1/2 inch (13 mm) thick.
OR
Cover Board: DOC PS 2, Exposure 1, OSB, 7/16 inch (11 mm) thick.
OR
Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/4 inch (6 mm) **OR** 1/2 inch (13 mm) **OR** 5/8 inch (16 mm), **as directed**, thick, factory primed, **as directed**.
OR
Cover Board: ASTM C 1278/C 1278M, cellulosic-fiber-reinforced, water-resistant gypsum substrate, 1/4 inch (6 mm) **OR** 3/8 inch (10 mm) **OR** 1/2 inch (13 mm) **OR** 5/8 inch (16 mm), **as directed**, thick.
 7. Protection Mat: Woven or nonwoven polypropylene, polyolefin, or polyester fabric, water permeable and resistant to UV degradation, type and weight as recommended by roofing system manufacturer for application.
- G. Asphalt Materials
1. Roofing Asphalt: ASTM D 312, Type III or Type IV **OR** ASTM D 6152, SEBS modified, **as directed**.
 2. Asphalt Primer: ASTM D 41.
- H. Aggregate Ballast (for loosely laid and aggregate-ballasted installations)
1. Aggregate Ballast: Provide aggregate ballast that will withstand weather exposure without significant deterioration and will not contribute to membrane degradation, of the following type and size:
 - a. Aggregate Type: Smooth, washed, riverbed gravel or other acceptable smooth-faced stone **OR** Crushed gravel or crushed stone, **as directed**.
 - b. Size: ASTM D 448, Size 4, ranging in size from 3/4 to 1-1/2 inches (19 to 38 mm).
OR
Size: ASTM D 448, Size 2, ranging in size from 1-1/2 to 2-1/2 inches (38 to 63 mm).
OR
Size: ASTM D 448, Size 3, ranging in size from 1 to 2 inches (25 to 50 mm).



I. Roof Pavers

1. Lightweight Roof Pavers: Interlocking, lightweight concrete units, specially factory cast for use as roof ballast; grooved back, with four-way drainage capability; beveled, doweled, or otherwise profiled; and as follows:
 - a. Size: 8 by 16 inches (200 by 400 mm) **OR** 12 by 12 inches (300 by 300 mm) **OR** 12 by 16-1/2 inches (300 by 420 mm) **OR** 12 by 18 inches (300 by 450 mm), **as directed**.
 - b. Weight: At least 10 lb/sq. ft. (50 kg/sq. m) but not exceeding 18 lb/sq. ft. (90 kg/sq. m).
 - c. Compressive Strength: 2500 psi (17 MPa) **OR** 5000 psi (34 MPa), **as directed**, minimum.
 - d. Colors and Textures: As selected from manufacturer's full range.
2. Heavyweight Roof Pavers: Heavyweight, hydraulically pressed, concrete units, square edged **OR** with top edges beveled 3/16 inch (5 mm), **as directed**, factory cast for use as roof pavers; absorption not greater than 5 percent, ASTM C 140; no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance, ASTM C 67; and as follows:
 - a. Size: 12 by 12 inches (300 by 300 mm) **OR** 18 by 18 inches (450 by 450 mm) **OR** 24 by 24 inches (600 by 600 mm), **as directed**. Manufacture pavers to dimensional tolerances of plus or minus 1/16 inch (1.6 mm) in length, height, and thickness.
 - b. Weight: 18 lb/sq. ft. (90 kg/sq. m) **OR** 22 lb/sq. ft. (110 kg/sq. m), **as directed**.
 - c. Compressive Strength: 7500 psi (52 MPa) **OR** 6500 psi (45 MPa), **as directed**, minimum.
 - d. Colors and Textures: As selected from manufacturer's full range.

J. Walkways

1. Flexible Walkways: Factory-formed, nonporous, heavy-duty, solid-rubber, slip-resisting, surface-textured walkway pads **OR** rolls, **as directed**, approximately 3/16 inch (5 mm) thick, and acceptable to membrane roofing system manufacturer.
2. Walkway Roof Pavers: Heavyweight, hydraulically pressed, concrete units, square edged **OR** with top edges beveled 3/16 inch (5 mm), **as directed**, factory cast for use as roof pavers; absorption not greater than 5 percent, ASTM C 140; no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance, ASTM C 67; and as follows:
 - a. Size: 12 by 12 inches (300 by 300 mm) **OR** 18 by 18 inches (450 by 450 mm) **OR** 24 by 24 inches (600 by 600 mm), **as directed**. Manufacture pavers to dimensional tolerances of plus or minus 1/16 inch (1.6 mm) in length, height, and thickness.
 - b. Weight: 18 lb/sq. ft. (90 kg/sq. m) **OR** 22 lb/sq. ft. (110 kg/sq. m), **as directed**.
 - c. Compressive Strength: 7500 psi (52 MPa) **OR** 6500 psi (45 MPa), **as directed**, minimum.
 - d. Colors and Textures: As selected from manufacturer's full range.

1.3 EXECUTION

A. Preparation

1. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
2. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
3. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
4. Install acoustical roof deck rib insulation strips, specified in Division 05 Section "Steel Decking", according to acoustical roof deck manufacturer's written instructions, immediately before installation of overlying construction and to remain dry.

B. Substrate Board

1. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.



- a. Fasten substrate board to top flanges of steel deck according to recommendations in FM Approvals' "RoofNav" and FM Global Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification.

OR

Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to membrane roofing system manufacturers' written instructions.

C. Vapor-Retarder Installation

1. Polyethylene Film: Loosely lay polyethylene-film vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 inches (50 mm) and 6 inches (150 mm), respectively.
 - a. Continuously seal side and end laps with tape **OR** adhesive, **as directed**.
2. Laminate Sheet: Install laminate-sheet vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 inches (50 mm) and 6 inches (150 mm), respectively. Bond vapor retarder to substrate as follows:
 - a. Apply adhesive at rate recommended by vapor-retarder manufacturer. Seal laps with adhesive.
OR
Apply ribbons of hot roofing asphalt at spacing, temperature, and rate recommended by vapor-retarder manufacturer. Seal laps with hot roofing asphalt.
3. Built-up Vapor Retarder: Install two glass-fiber felt plies lapping each felt 19 inches (483 mm) over preceding felt. Embed each felt in a solid mopping of hot roofing asphalt. Glaze-coat completed surface with hot roofing asphalt. Apply hot roofing asphalt within plus or minus 25 deg F (14 deg C) of equiviscous temperature.
4. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into membrane roofing system.

D. Insulation Installation

1. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
2. Comply with membrane roofing system and insulation manufacturer's written instructions for installing roof insulation.
3. Install tapered insulation under area of roofing to conform to slopes indicated.
4. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches (68 mm) or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.
 - a. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
5. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
6. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
 - a. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
7. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:
 - a. Prime surface of concrete deck with asphalt primer at rate of 3/4 gal./100 sq. ft. (0.3 L/sq. m) and allow primer to dry.
 - b. Set each layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F (14 deg C) of equiviscous temperature.
 - c. Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
 - d. Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.



8. Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
 - a. Fasten insulation according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.
OR
Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.
 9. Mechanically Fastened and Adhered Insulation: Install each layer of insulation and secure first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
 - a. Fasten first layer of insulation according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.
OR
Fasten first layer of insulation to resist uplift pressure at corners, perimeter, and field of roof.
 - b. Set each subsequent layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F (14 deg C) of equiviscous temperature.
OR
Set each subsequent layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
OR
Set each subsequent layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.
 10. Loosely Laid Insulation: Loosely lay insulation units over substrate.
 11. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches (150 mm) in each direction. Loosely butt cover boards together and fasten to roof deck, **as directed**.
 - a. Fasten cover boards according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.
OR
Fasten cover boards to resist uplift pressure at corners, perimeter, and field of roof.
 12. Install slip sheet over insulation **OR** cover board, **as directed**, and immediately beneath membrane roofing.
- E. Adhered Membrane Roofing Installation
1. Adhere membrane roofing over area to receive roofing and install according to membrane roofing system manufacturer's written instructions.
 - a. Install sheet according to ASTM D 5036.
 2. Start installation of membrane roofing in presence of membrane roofing system manufacturer's technical personnel.
 3. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
 4. Bonding Adhesive: Apply to substrate and underside of membrane roofing at rate required by manufacturer and allow to partially dry before installing membrane roofing. Do not apply to splice area of membrane roofing.
 5. In addition to adhering, mechanically fasten membrane roofing securely at terminations, penetrations, and perimeter of roofing.
 6. Apply membrane roofing with side laps shingled with slope of roof deck where possible.
 7. Seams: Clean seam areas, overlap membrane roofing, and hot-air weld side and end laps of membrane roofing and sheet flashings according to manufacturer's written instructions to ensure a watertight seam installation.
 - a. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet membrane.
 - b. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
 - c. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.



8. Spread sealant bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.
9. Install membrane roofing and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition and to not void warranty for existing membrane roofing system.

F. Mechanically Fastened Membrane Roofing Installation

1. Mechanically fasten membrane roofing over area to receive roofing and install according to roofing system manufacturer's written instructions.
 - a. Install sheet according to ASTM D 5082.
 - b. For in-splice attachment, install membranes roofing with long dimension perpendicular to steel roof deck flutes.
2. Start installation of membrane roofing in presence of roofing system manufacturer's technical personnel.
3. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
4. Mechanically fasten or adhere membrane roofing securely at terminations, penetrations, and perimeter of roofing.
5. Apply membrane roofing with side laps shingled with slope of roof deck where possible.
6. In-Seam Attachment: Secure one edge of PVC sheet using fastening plates or metal battens centered within membrane seam and mechanically fasten PVC sheet to roof deck.
7. Seams: Clean seam areas, overlap membrane roofing, and hot-air weld side and end laps of membrane roofing and sheet flashings according to manufacturer's written instructions to ensure a watertight seam installation.
 - a. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet membrane.
 - b. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
 - c. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.
8. Spread sealant bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.
9. Install membrane roofing and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition and to not void warranty for existing membrane roofing system.

G. Loosely Laid And Ballasted Membrane Roofing Installation

1. Loosely lay membrane roofing over area to receive roofing and install according to roofing system manufacturer's written instructions.
 - a. Comply with requirements in SPRI RP-4 for System 1 **OR** System 2 **OR** System 3, **as directed**.
2. Start installation of membrane roofing in presence of roofing system manufacturer's technical personnel.
3. Accurately align membrane roofing, without stretching, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
4. Mechanically fasten or adhere perimeter of membrane roofing according to requirements in SPRI RP-4.

OR

Mechanically fasten **OR** adhere, **as directed**, membrane roofing at corners, perimeters, and transitions according to requirements in SPRI RP-4.
 - a. At corners and perimeters, omit aggregate ballast leaving membrane roofing exposed.

OR

At corners and perimeters, adhere a second layer of membrane roofing.
5. Apply membrane roofing with side laps shingled with slope of deck where possible.
6. Seams: Clean seam areas, overlap membrane roofing, and hot-air weld side and end laps of membrane roofing and sheet flashings according to manufacturer's written instructions to ensure a watertight seam installation.
 - a. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet membrane.
 - b. Verify field strength of seams a minimum of twice daily and repair seam sample areas.



- c. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.
 7. Spread sealant bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.
 8. Install membrane roofing and auxiliary materials to tie in to existing roofing.
 9. Install protection mat over membrane roofing, overlapping a minimum of 6 inches (150 mm). Install an additional protection mat layer at projections, pipes, vents, and drains, overlapping a minimum of 12 inches (300 mm).
 10. Aggregate Ballast: Apply uniformly over membrane roofing at the rate required by membrane roofing system manufacturer, but not less than the following, spreading with care to minimize possibility of damage to membrane roofing system. Lay ballast as membrane roofing is installed, leaving membrane roofing ballasted at the end of the workday.
 - a. Ballast Weight: Size 4 aggregate, 10 lb/sq. ft. (50 kg/sq. m).
OR
 Ballast Weight: Size 2 aggregate, 13 lb/sq. ft. (65 kg/sq. m), at corners and perimeter; Size 4 aggregate, 10 lb/sq. ft. (50 kg/sq. m), elsewhere.
OR
 Ballast Weight: Size 2 aggregate, 13 lb/sq. ft. (65 kg/sq. m).
 11. Roof-Paver Ballast: Install lightweight **OR** heavyweight, **as directed**, roof-paver ballast according to manufacturer's written instructions.
OR
 Roof-Paver and Aggregate Ballast: Install heavyweight roof pavers according to manufacturer's written instructions on roof corners and perimeter.
 - a. Install Size 4 aggregate ballast elsewhere on roofing at a minimum rate of 10 lb/sq. ft. (50 kg/sq. m).
OR
 Install Size 2 aggregate ballast elsewhere on roofing at a minimum rate of 13 lb/sq. ft. (65 kg/sq. m).
- H. Base Flashing Installation
1. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.
 2. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply to seam area of flashing.
 3. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
 4. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.
 5. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars, **as directed**.
- I. Walkway Installation
1. Flexible Walkways: Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.
 2. Roof-Paver Walkways: Install walkway roof pavers according to manufacturer's written instructions in locations indicated, to form walkways. Leave 3 inches (75 mm) of space between adjacent roof pavers.
- J. Field Quality Control
1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
 2. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
 3. Repair or remove and replace components of membrane roofing system where inspections indicate that they do not comply with specified requirements.



4. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

K. Protecting And Cleaning

1. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to the Owner.
2. Correct deficiencies in or remove membrane roofing system that does not comply with requirements; repair substrates; and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Final Completion and according to warranty requirements.
3. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 54 19 00



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Task	Specification	Specification Description
07 54 19 00	07 05 13 00d	Preparation for Re-Roofing



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**SECTION 07 54 23 00 - THERMOPLASTIC POLYOLEFIN (TPO) ROOFING**

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for thermoplastic polyolefin (TPO) roofing. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Adhered TPO membrane roofing system.
 - b. Mechanically fastened TPO membrane roofing system.
 - c. Loosely laid and ballasted TPO membrane roofing system.
 - d. Vapor retarder.
 - e. Roof insulation.
2. Section includes the installation of acoustical roof deck rib insulation strips furnished under Division 05 Section "Steel Decking".

C. Definitions

1. TPO: Thermoplastic polyolefin.
2. Roofing Terminology: See ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

D. Performance Requirements

1. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.
2. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.
3. Roofing System Design: Provide membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7.
4. FM Approvals Listing, **as directed**: Provide membrane roofing, base flashings, and component materials that comply with requirements in FM Approvals 4450 and FM Approvals 4470 as part of a membrane roofing system, and that are listed in FM Approvals' "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals markings.
 - a. Fire/Windstorm Classification: Class 1A-60 **OR** Class 1A-75 **OR** Class 1A-90 **OR** Class 1A-105 **OR** Class 1A-120 **OR** Class 1A-135 **OR** Class 1A-150 **OR** Class 1A-165, **as directed**.
 - b. Hail Resistance: MH **OR** SH, **as directed**.
5. Energy Performance: Provide roofing system with initial Solar Reflectance Index not less than 78 **OR** 29, **as directed**, when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.
6. Energy Performance: Provide roofing system that is listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low **OR** steep, **as directed**, -slope roof products.
7. Energy Performance (for roofs that must comply with California Energy Commission's CEC-Title 24): Provide roofing system with initial solar reflectance not less than 0.70 and emissivity not less than 0.75 when tested according to CRRC-1.

E. Submittals



1. Product Data: For each type of product indicated.
 2. LEED Submittals:
 - a. Product Data for Credit SS 7.2: For roof materials, indicating that roof materials comply with Solar Reflectance Index requirement.
 - b. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.
 3. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.
 4. Samples: For each product included in the roofing system.
 5. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - a. Submit evidence of compliance with performance requirements.
 6. Research/evaluation reports.
 7. Field quality-control reports.
 8. Maintenance data.
 9. Warranties: Sample of special warranties.
- F. Quality Assurance
1. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by membrane roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.
 2. Source Limitations: Obtain components for membrane roofing system from same manufacturer as membrane roofing or approved by membrane roofing manufacturer.
 3. Exterior Fire-Test Exposure: ASTM E 108, Class A **OR** Class B **OR** Class C, **as directed**; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.
 4. Fire-Resistance Ratings: Where indicated, provide fire-resistance-rated roof assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 5. Preinstallation Roofing Conference: Conduct conference at Project site.
- G. Delivery, Storage, And Handling
1. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
 2. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
 - a. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
 3. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
 4. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.
- H. Project Conditions
1. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.
- I. Warranty



1. Special Warranty: Manufacturer's standard or customized form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within 10 **OR** 15, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. TPO Membrane Roofing

1. Fabric-Reinforced Thermoplastic Polyolefin Sheet: ASTM D 6878, internally fabric or scrim reinforced, uniform, flexible fabric backed, **as directed**, TPO sheet.
 - a. Thickness: 45 mils (1.1 mm) **OR** 60 mils (1.5 mm), **as directed**, nominal.
 - b. Exposed Face Color: Black **OR** Gray **OR** Tan **OR** White, **as directed**.

B. Auxiliary Membrane Roofing Materials

1. General: Auxiliary membrane roofing materials recommended by roofing system manufacturer for intended use, and compatible with membrane roofing.
 - a. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
 - b. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1) Plastic Foam Adhesives: 50 g/L.
 - 2) Gypsum Board and Panel Adhesives: 50 g/L.
 - 3) Multipurpose Construction Adhesives: 70 g/L.
 - 4) Fiberglass Adhesives: 80 g/L.
 - 5) Contact Adhesive: 80 g/L.
 - 6) Other Adhesives: 250 g/L.
 - 7) Single-Ply Roof Membrane Sealants: 450 g/L.
 - 8) Nonmembrane Roof Sealants: 300 g/L.
 - 9) Sealant Primers for Nonporous Substrates: 250 g/L.
 - 10) Sealant Primers for Porous Substrates: 775 g/L.
2. Sheet Flashing: Manufacturer's standard unreinforced thermoplastic polyolefin sheet flashing, 55 mils (1.4 mm) thick, minimum, of same color as sheet membrane.
3. Bonding Adhesive: Manufacturer's standard, water based, **as directed**.
4. Slip Sheet: Manufacturer's standard, of thickness required for application.
5. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.
6. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick (25 mm wide by 1.3 mm thick), prepunched.
7. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.
8. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

C. Substrate Boards

1. Substrate Board: ASTM C 1396/C 1396M, Type X gypsum board, 5/8 inch (16 mm) thick.
OR
Substrate Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/4 inch (6 mm) **OR** 1/2 inch (13 mm) **OR** Type X, 5/8 inch (16 mm), **as directed**, thick.
OR
Substrate Board: ASTM C 1278/C 1278M, cellulosic-fiber-reinforced, water-resistant gypsum substrate, 1/4 inch (6 mm) **OR** 3/8 inch (10 mm) **OR** 1/2 inch (13 mm) **OR** 5/8 inch (16 mm), **as directed**, thick.
OR



Substrate Board: ASTM C 728, perlite board, 3/4 inch (19 mm) **OR** 1 inch (25 mm), **as directed**, thick, seal coated.

2. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate board to roof deck.

D. Vapor Retarder

1. Polyethylene Film: ASTM D 4397, 6 mils (0.15 mm) thick, minimum, with maximum permeance rating of 0.13 perm (7.5 ng/Pa x s x sq. m).
 - a. Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
OR
Adhesive: Manufacturer's standard lap adhesive, FM Approvals approved for vapor-retarder application.
2. Laminated Sheet: Kraft paper, two layers, laminated with asphalt and edge reinforced with woven fiberglass yarn with maximum permeance rating of 0.50 perm (29 ng/Pa x s x sq. m) and with manufacturer's standard adhesive, **as directed**.
3. Glass-Fiber Felts: ASTM D 2178, Type IV, asphalt impregnated.

E. Roof Insulation

1. General: Preformed roof insulation boards manufactured or approved by TPO membrane roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated and that produce FM Approvals-approved roof insulation, **as directed**.
2. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, 1.6-lb/cu. ft. (26-kg/cu. m) **OR** Type X, 1.3-lb/cu. ft. (21-kg/cu. m), **as directed**, minimum density, square edged.
3. Molded-Polystyrene Board Insulation: ASTM C 578, Type II, 1.35-lb/cu. ft. (22-kg/cu. m) **OR** Type VIII, 1.15-lb/cu. ft. (18-kg/cu. m) **OR** Type IX, 1.8-lb/cu. ft. (29-kg/cu. m), **as directed**, minimum density.
4. Composite Molded-Polystyrene Board Insulation: ASTM C 578, Type II, 1.35-lb/cu. ft. (22-kg/cu. m) **OR** Type VIII, 1.15-lb/cu. ft. (18-kg/cu. m) **OR** Type IX, 1.8-lb/cu. ft. (29-kg/cu. m), **as directed**, minimum density, with factory-applied facings, as follows:
 - a. Facer: ASTM C 208, Type II, Grade 2, cellulosic-fiber insulation board, asphalt coated, 1/2 inch (13 mm) thick.
OR
Facer: DOC PS 2, Exposure 1, OSB, 7/16 inch (11 mm) thick.
5. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2 **OR** Type II, Class I, Grade 3, **as directed**, felt or glass-fiber mat facer on both major surfaces.
6. Composite Polyisocyanurate Board Insulation: ASTM C 1289, with factory-applied facing board on one major surface, as indicated below by type, and felt or glass-fiber mat facer on the other.
 - a. Type IV, cellulosic-fiber-insulating-board facer, Grade 2, 1/2 inch (13 mm) thick.
 - b. Type V, OSB facer, 7/16 inch (11 mm) thick.
 - c. Type VII, glass mat faced gypsum board facer, 1/4 inch (6 mm) thick.
7. Perlite Board Insulation: ASTM C 728, rigid, mineral-aggregate thermal insulation board composed of expanded perlite, cellulosic fibers, binders, and waterproofing agents with top surface seal coated.
8. Cellulosic-Fiber Board Insulation: ASTM C 208, Type II, Grade 2, fibrous-felted, rigid insulation boards of wood fiber or other cellulosic-fiber and water-resistant binders, asphalt impregnated, chemically treated for deterioration.
9. Cellular-Glass Board Insulation: ASTM C 552, Type IV, rigid, cellular-glass thermal board insulation faced with manufacturer's standard kraft-paper sheets.
10. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48) unless otherwise indicated.
11. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

F. Insulation Accessories



1. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with membrane roofing.
 2. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards, **as directed**, to substrate, and acceptable to roofing system manufacturer.
 3. Modified Asphaltic Insulation Adhesive: Insulation manufacturer's recommended modified asphalt, asbestos-free, cold-applied adhesive formulated to attach roof insulation to substrate or to another insulation layer.
 4. Bead-Applied Insulation Adhesive: Insulation manufacturer's recommended bead-applied, low-rise, one- or multicomponent urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.
 5. Full-Spread Applied Insulation Adhesive: Insulation manufacturer's recommended spray-applied, low-rise, two-component urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.
 6. Cover Board: ASTM C 208, Type II, Grade 2, cellulosic-fiber insulation board, 1/2 inch (13 mm) thick.
OR
Cover Board: DOC PS 2, Exposure 1, OSB, 7/16 inch (11 mm) thick.
OR
Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/4 inch (6 mm) **OR** 1/2 inch (13 mm) **OR** 5/8 inch (16 mm), **as directed**, thick, factory primed, **as directed**.
OR
Cover Board: ASTM C 1278/C 1278M, cellulosic-fiber-reinforced, water-resistant gypsum substrate, 1/4 inch (6 mm) **OR** 3/8 inch (10 mm) **OR** 1/2 inch (13 mm) **OR** 5/8 inch (16 mm), **as directed**, thick.
 7. Protection Mat: Woven or nonwoven polypropylene, polyolefin, or polyester fabric, water permeable and resistant to UV degradation, type and weight as recommended by roofing system manufacturer for application.
- G. Asphalt Materials
1. Roofing Asphalt: ASTM D 312, Type III or Type IV **OR** ASTM D 6152, SEBS modified, **as directed**.
 2. Asphalt Primer: ASTM D 41.
- H. Aggregate Ballast (for loosely laid and aggregate-ballasted installations)
1. Aggregate Ballast: Provide aggregate ballast that will withstand weather exposure without significant deterioration and will not contribute to membrane degradation, of the following type and size:
 - a. Aggregate Type: Smooth, washed, riverbed gravel or other acceptable smooth-faced stone **OR** Crushed gravel or crushed stone, **as directed**.
 - b. Size: ASTM D 448, Size 4, ranging in size from 3/4 to 1-1/2 inches (19 to 38 mm).
OR
Size: ASTM D 448, Size 2, ranging in size from 1-1/2 to 2-1/2 inches (38 to 63 mm).
OR
Size: ASTM D 448, Size 3, ranging in size from 1 to 2 inches (25 to 50 mm).
- I. Roof Pavers
1. Lightweight Roof Pavers: Interlocking, lightweight concrete units, specially factory cast for use as roof ballast; grooved back, with four-way drainage capability; beveled, doweled, or otherwise profiled; and as follows:
 - a. Size: 8 by 16 inches (200 by 400 mm) **OR** 12 by 12 inches (300 by 300 mm) **OR** 12 by 16-1/2 inches (300 by 420 mm) **OR** 12 by 18 inches (300 by 450 mm), **as directed**.
 - b. Weight: At least 10 lb/sq. ft. (50 kg/sq. m) but not exceeding 18 lb/sq. ft. (90 kg/sq. m).
 - c. Compressive Strength: 2500 psi (17 MPa) **OR** 5000 psi (34 MPa), **as directed**, minimum.
 - d. Colors and Textures: As selected from manufacturer's full range.



2. Heavyweight Roof Pavers: Heavyweight, hydraulically pressed, concrete units, square edged **OR** with top edges beveled 3/16 inch (5 mm), **as directed**, factory cast for use as roof pavers; absorption not greater than 5 percent, ASTM C 140; no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance, ASTM C 67; and as follows:
 - a. Size: 12 by 12 inches (300 by 300 mm) **OR** 18 by 18 inches (450 by 450 mm) **OR** 24 by 24 inches (600 by 600 mm), **as directed**. Manufacture pavers to dimensional tolerances of plus or minus 1/16 inch (1.6 mm) in length, height, and thickness.
 - b. Weight: 18 lb/sq. ft. (90 kg/sq. m) **OR** 22 lb/sq. ft. (110 kg/sq. m), **as directed**.
 - c. Compressive Strength: 7500 psi (52 MPa) **OR** 6500 psi (45 MPa), **as directed**, minimum.
 - d. Colors and Textures: As selected from manufacturer's full range.

J. Walkways

1. Flexible Walkways: Factory-formed, nonporous, heavy-duty, solid-rubber, slip-resisting, surface-textured walkway pads **OR** rolls, **as directed**, approximately 3/16 inch (5 mm) thick, and acceptable to membrane roofing system manufacturer.
2. Walkway Roof Pavers: Heavyweight, hydraulically pressed, concrete units, square edged **OR** with top edges beveled 3/16 inch (5 mm), **as directed**, factory cast for use as roof pavers; absorption not greater than 5 percent, ASTM C 140; no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance, ASTM C 67; and as follows:
 - a. Size: 12 by 12 inches (300 by 300 mm) **OR** 18 by 18 inches (450 by 450 mm) **OR** 24 by 24 inches (600 by 600 mm), **as directed**. Manufacture pavers to dimensional tolerances of plus or minus 1/16 inch (1.6 mm) in length, height, and thickness.
 - b. Weight: 18 lb/sq. ft. (90 kg/sq. m) **OR** 22 lb/sq. ft. (110 kg/sq. m), **as directed**.
 - c. Compressive Strength: 7500 psi (52 MPa) **OR** 6500 psi (45 MPa), **as directed**, minimum.
 - d. Colors and Textures: As selected from manufacturer's full range.

1.3 EXECUTION

A. Preparation

1. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
2. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
3. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
4. Install acoustical roof deck rib insulation strips, specified in Division 05 Section "Steel Decking", according to acoustical roof deck manufacturer's written instructions, immediately before installation of overlying construction and to remain dry.

B. Substrate Board

1. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.
 - a. Fasten substrate board to top flanges of steel deck according to recommendations in FM Approvals' "RoofNav" and FM Global Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification.
OR
Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to membrane roofing system manufacturers' written instructions.

C. Vapor-Retarder Installation



1. Polyethylene Film: Loosely lay polyethylene-film vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 inches (50 mm) and 6 inches (150 mm), respectively.
 - a. Continuously seal side and end laps with tape **OR** adhesive, **as directed**.
2. Laminate Sheet: Install laminate-sheet vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 inches (50 mm) and 6 inches (150 mm), respectively. Bond vapor retarder to substrate as follows:
 - a. Apply adhesive at rate recommended by vapor-retarder manufacturer. Seal laps with adhesive.
OR
Apply ribbons of hot roofing asphalt at spacing, temperature, and rate recommended by vapor-retarder manufacturer. Seal laps with hot roofing asphalt.
3. Built-up Vapor Retarder: Install two glass-fiber felt plies lapping each felt 19 inches (483 mm) over preceding felt. Embed each felt in a solid mopping of hot roofing asphalt. Glaze-coat completed surface with hot roofing asphalt. Apply hot roofing asphalt within plus or minus 25 deg F (14 deg C) of equiviscous temperature.
4. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into membrane roofing system.

D. Insulation Installation

1. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
2. Comply with membrane roofing system and insulation manufacturer's written instructions for installing roof insulation.
3. Install tapered insulation under area of roofing to conform to slopes indicated.
4. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches (68 mm) or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.
 - a. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
5. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
6. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
 - a. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
7. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:
 - a. Prime surface of concrete deck with asphalt primer at rate of 3/4 gal./100 sq. ft. (0.3 L/sq. m) and allow primer to dry.
 - b. Set each layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F (14 deg C) of equiviscous temperature.
 - c. Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
 - d. Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.
8. Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
 - a. Fasten insulation according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.
OR
Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.



9. Mechanically Fastened and Adhered Insulation: Install each layer of insulation and secure first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
 - a. Fasten first layer of insulation according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.
OR
Fasten first layer of insulation to resist uplift pressure at corners, perimeter, and field of roof.
 - b. Set each subsequent layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F (14 deg C) of equiviscous temperature.
OR
Set each subsequent layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
OR
Set each subsequent layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.
10. Loosely Laid Insulation: Loosely lay insulation units over substrate.
11. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches (150 mm) in each direction. Loosely butt cover boards together and fasten to roof deck, **as directed**.
 - a. Fasten cover boards according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.
OR
Fasten cover boards to resist uplift pressure at corners, perimeter, and field of roof.
12. Install slip sheet over insulation **OR** cover board, **as directed**, and immediately beneath membrane roofing.

E. Adhered Membrane Roofing Installation

1. Adhere membrane roofing over area to receive roofing and install according to membrane roofing system manufacturer's written instructions.
2. Start installation of membrane roofing in presence of membrane roofing system manufacturer's technical personnel.
3. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
4. Bonding Adhesive: Apply to substrate and underside of membrane roofing at rate required by manufacturer and allow to partially dry before installing membrane roofing. Do not apply to splice area of membrane roofing.
5. In addition to adhering, mechanically fasten membrane roofing securely at terminations, penetrations, and perimeter of roofing.
6. Apply membrane roofing with side laps shingled with slope of roof deck where possible.
7. Seams: Clean seam areas, overlap membrane roofing, and hot-air weld side and end laps of membrane roofing and sheet flashings according to manufacturer's written instructions to ensure a watertight seam installation.
 - a. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet membrane.
 - b. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
 - c. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.
8. Spread sealant bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.
9. Install membrane roofing and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition and to not void warranty for existing membrane roofing system, **as directed**.

F. Mechanically Fastened Membrane Roofing Installation



1. Mechanically fasten membrane roofing over area to receive roofing and install according to roofing system manufacturer's written instructions.
 - a. For in-splice attachment, install membranes roofing with long dimension perpendicular to steel roof deck flutes.
2. Start installation of membrane roofing in presence of roofing system manufacturer's technical personnel.
3. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
4. Mechanically fasten or adhere membrane roofing securely at terminations, penetrations, and perimeter of roofing.
5. Apply membrane roofing with side laps shingled with slope of roof deck where possible.
6. In-Seam Attachment: Secure one edge of TPO sheet using fastening plates or metal battens centered within membrane seam and mechanically fasten TPO sheet to roof deck.
7. Seams: Clean seam areas, overlap membrane roofing, and hot-air weld side and end laps of membrane roofing and sheet flashings according to manufacturer's written instructions to ensure a watertight seam installation.
 - a. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet membrane.
 - b. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
 - c. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.
8. Spread sealant bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.
9. Install membrane roofing and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition and to not void warranty for existing membrane roofing system.

G. Loosely Laid And Ballasted Membrane Roofing Installation

1. Loosely lay membrane roofing over area to receive roofing and install according to roofing system manufacturer's written instructions.
 - a. Comply with requirements in SPRI RP-4 for System 1 **OR** System 2 **OR** System 3, **as directed**.
2. Start installation of membrane roofing in presence of roofing system manufacturer's technical personnel.
3. Accurately align membrane roofing, without stretching, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
4. Mechanically fasten or adhere perimeter of membrane roofing according to requirements in SPRI RP-4.
OR
Mechanically fasten **OR** adhere, **as directed**, membrane roofing at corners, perimeters, and transitions according to requirements in SPRI RP-4.
 - a. At corners and perimeters, omit aggregate ballast leaving membrane roofing exposed.
OR
At corners and perimeters, adhere a second layer of membrane roofing.
5. Apply membrane roofing with side laps shingled with slope of deck where possible.
6. Seams: Clean seam areas, overlap membrane roofing, and hot-air weld side and end laps of membrane roofing and sheet flashings according to manufacturer's written instructions to ensure a watertight seam installation.
 - a. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet membrane.
 - b. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
 - c. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.
7. Spread sealant bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.
8. Install membrane roofing and auxiliary materials to tie in to existing roofing.
9. Install protection mat over membrane roofing, overlapping a minimum of 6 inches (150 mm). Install an additional protection mat layer at projections, pipes, vents, and drains, overlapping a minimum of 12 inches (300 mm).



10. Aggregate Ballast: Apply uniformly over membrane roofing at the rate required by membrane roofing system manufacturer, but not less than the following, spreading with care to minimize possibility of damage to membrane roofing system. Lay ballast as membrane roofing is installed, leaving membrane roofing ballasted at the end of the workday.
- a. Ballast Weight: Size 4 aggregate, 10 lb/sq. ft. (50 kg/sq. m).
OR
 Ballast Weight: Size 2 aggregate, 13 lb/sq. ft. (65 kg/sq. m), at corners and perimeter; Size 4 aggregate, 10 lb/sq. ft. (50 kg/sq. m), elsewhere.
OR
 Ballast Weight: Size 2 aggregate, 13 lb/sq. ft. (65 kg/sq. m).
11. Roof-Paver Ballast: Install lightweight **OR** heavyweight, **as directed**, roof-paver ballast according to manufacturer's written instructions.
- OR**
- Roof-Paver and Aggregate Ballast: Install heavyweight roof pavers according to manufacturer's written instructions on roof corners and perimeter.
- a. Install Size 4 aggregate ballast elsewhere on roofing at a minimum rate of 10 lb/sq. ft. (50 kg/sq. m).
OR
 Install Size 2 aggregate ballast elsewhere on roofing at a minimum rate of 13 lb/sq. ft. (65 kg/sq. m).
- H. Base Flashing Installation
1. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.
 2. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply to seam area of flashing.
 3. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
 4. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.
 5. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars, **as directed**.
- I. Walkway Installation
1. Flexible Walkways: Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.
 2. Roof-Paver Walkways: Install walkway roof pavers according to manufacturer's written instructions in locations indicated, to form walkways. Leave 3 inches (75 mm) of space between adjacent roof pavers.
- J. Field Quality Control
1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
 2. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
 3. Repair or remove and replace components of membrane roofing system where inspections indicate that they do not comply with specified requirements.
 4. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- K. Protecting And Cleaning
1. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to the Owner.



2. Correct deficiencies in or remove membrane roofing system that does not comply with requirements; repair substrates; and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Final Completion and according to warranty requirements.
3. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 54 23 00



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Task	Specification	Specification Description
07 54 23 00	07 05 13 00d	Preparation for Re-Roofing



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SECTION 07 56 00 00 - COATED FOAMED ROOFING

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for coated foamed roofing. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Spray-applied, polyurethane foam insulation.
 - b. Elastomeric roof coatings.
 - c. Mineral granules.
 - d. Aggregate.
 - e. Walkways.

C. Performance Requirements

1. Watertightness: Provide coated foamed roofing that is watertight and will not permit the passage of water.
2. Material Compatibility: Provide polyurethane foam, elastomeric coatings, and miscellaneous roofing materials that are compatible with one another and able to bond to substrate under conditions of service and application required, as demonstrated by coated foamed roofing manufacturer based on testing and field experience.
3. Roofing System Design: Provide a coated foamed roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to SEI/ASCE 7.
4. FMG Listing: Provide roofing system and component materials that comply with requirements in FMG 4450 for steel roof decks and FMG 4470 for roof covers as part of a foamed roofing system and that are listed in FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.
 - a. Fire/Windstorm Classification: Class 1A-60 **OR 75 OR 90 OR 105 OR 120, as directed.**
 - b. Hail-Resistance Classification: MH **OR SH, as directed.**
5. Energy Performance: Provide roofing system with Solar Reflectance Index not less than 78 **OR 29, as directed**, when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency.

D. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittal:
 - a. Product Test Reports for Credit SS 7.2: For roof materials, documentation indicating that roof materials comply with Solar Reflectance Index requirement.
3. Samples: For each exposed product and for each color and texture specified.
4. Research/evaluation reports.
5. Maintenance data.
6. Warranty: Sample of special warranty.
7. Warranty: Sample of special warranty.

E. Quality Assurance

1. Installer Qualifications: A qualified installer who is approved, authorized, or licensed by roof coating manufacturer for installation of manufacturer's product over polyurethane foam.



- a. Engage an installer who participates in and who has fulfilled requirements of the SPFA Accreditation Program for company accreditation and individual applicator accreditation for personnel assigned to work on Project.
2. Source Limitations: Obtain polyurethane foam materials from single source or producer and coating products from single, coated foamed roofing manufacturer.
3. Fire-Test-Response Characteristics: Provide coated foamed roofing systems with the fire-test-response characteristics indicated, as determined by testing identical systems per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - a. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indexes of 75 and 450, respectively; ASTM E 84.
 - b. Exterior Fire-Test Exposure: ASTM E 108; Class A.
 - c. Fire-Resistance Ratings: ASTM E 119, determined for coated polyurethane foam roofing as part of a roof assembly.
4. Comply with recommendations in NRCA's "Quality Control Guidelines for the Application of Spray Polyurethane Foam Roofing."
5. Comply with recommendations in SPFA AY 104, "Spray Polyurethane Foam Systems for New and Remedial Roofing."
6. Preinstallation Conference: Conduct conference at Project site.

F. Delivery, Storage, And Handling

1. Deliver materials to Project site in original containers with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, shelf life, and directions for storing and mixing with other components.
2. Store materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by manufacturer. Protect stored materials from direct sunlight.
3. Remove and replace material that cannot be applied within its stated shelf life.

G. Warranty

1. Special Warranty: Coated foamed roofing manufacturer's standard form in which manufacturer agrees to repair or replace coated foamed roofing that does not comply with requirements or that does not remain watertight within five **OR 10, as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Polyurethane Foam

1. Polyurethane Foam: Rigid cellular polyurethane, spray applied, produced by the catalyzed chemical reaction of polyisocyanates with polyhydroxyls, with stabilizers, fire retardants, and blowing agents added; and complying with ASTM C 1029, Type III, as certified by a qualified independent testing agency.
 - a. In-Place Density: 2.8 to 3.0 lb/cu. ft. (44.9 to 48.1 kg/cu. m); ASTM D 1622.
 - b. Surface-Burning Characteristic: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1) Flame-Spread Index: 75 or less.

B. Urethane Coatings

1. Urethane Coatings: Liquid urethane elastomeric coating system, specifically formulated for coating spray polyurethane roofing, of the following composition, coat type, and topcoat color and complying with specified performance and physical requirements.
 - a. Base-Coat Composition and Type: One-component **OR** Two-component, **as directed**, aromatic urethane.



- b. Topcoat Composition and Type: One-component **OR** Two-component, **as directed**, aromatic **OR** aliphatic, **as directed**, urethane.
 - c. Topcoat Color: White **OR** Gray **OR** Tan **OR** Copper **OR** Black, **as directed**.
 - d. Topcoat Color at Walkways: White **OR** Gray **OR** Tan **OR** Copper **OR** Black, **as directed**.
 - e. Tensile Strength: 400 psi (2.8 MPa) per ASTM D 412.
 - f. Elongation: 300 percent at 75 deg F (24 deg C) per ASTM D 412.
 - g. Permanent Set at Break: 30 percent maximum per ASTM D 412.
 - h. Tear Resistance: 100 lbf/inch (17.5 kN/m) per ASTM D 1004.
 - i. Water Absorption: 3 percent maximum by weight, 168 hours at 75 deg F (24 deg C) per ASTM D 471.
 - j. Permeance:
 - 1) Minimum 0.7 perms (40.2 ng/Pa x s x sq. m) at 20 mils (0.5 mm) thick per ASTM E 96.
OR
Minimum 5.0 perms (286 ng/Pa x s x sq. m) at 20 mils (0.5 mm) thick per ASTM E 96.
- C. Silicone Coatings
- 1. Silicone Coatings: Liquid silicone elastomeric coating system, complying with ASTM D 6694 and specifically formulated for coating spray polyurethane roofing.
 - a. Base-Coat and Topcoat Composition: One-component **OR** Two-component, **as directed**, silicone.
 - b. Topcoat Color: White **OR** Gray, **as directed**.
 - c. Topcoat Color at Walkways: White **OR** Gray, **as directed**.
 - d. Permeance: Minimum 5.0 perms (286 ng/Pa x s x sq. m) at 20 mils (0.5 mm) thick per ASTM E 96.
- D. Acrylic Coatings
- 1. Acrylic Coatings: Liquid acrylic elastomeric emulsion coating system, complying with ASTM D 6083 and specifically formulated for coating spray polyurethane roofing.
 - a. Topcoat Color: White **OR** Gray **OR** Buff, **as directed**.
 - b. Topcoat Color at Walkways: White **OR** Gray **OR** Buff, **as directed**.
 - c. Permeance: Minimum 5.0 perms (286 ng/Pa x s x sq. m) at 20 mils (0.5 mm) thick per ASTM E 96.
- E. Substrate Board
- 1. Thermal Barrier:
 - a. Glass-mat, water-resistant gypsum board, ASTM C 1177/C 1177M, 1/4 inch (6 mm) **OR** 1/2 inch (13 mm) **OR** 5/8 inch (16 mm), Type X, **as directed**.
 - b. ASTM C 36/C 36M, 5/8-inch (16-mm) gypsum board base, Type X.
 - 2. Recovery Board and Fasteners: As recommended by polyurethane foam manufacturer, and meeting the requirements of Division 07 Section "Preparation For Re-roofing".
 - 3. Thermal-Barrier Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FMG 4470, and designed and sized for fastening thermal barrier to substrate.
- F. Auxiliary Materials
- 1. Primer: Polyurethane foam manufacturer's standard factory-formulated primer.
 - 2. Vapor Retarder: Fluid applied **OR** Bituminous membrane **OR** As recommended by coated foamed roofing manufacturer, **as directed**.
 - 3. Mineral Granules: Ceramic-coated roofing granules, No. 11 screen size with 100 percent passing No. 8 (2.36-mm) sieve and 98 percent of mass retained by No. 40 (0.42-mm) sieve.
 - a. Color: Buff white **OR** Gray **OR** Green **OR** Red, **as directed**.
 - 4. Aggregate: Coarse mineral aggregate, 3/4 inch (19 mm) maximum, ASTM D 1863, No. 7 or No. 67 gradation.



5. Reinforcement: Flexible polyester or fiberglass mat of weight, type, and composition recommended by roof coating manufacturer for embedment in liquid coating.
6. Walkway Pads: Factory formed of nonwoven PVC strands, porous, UV stabilized, of 5/16-inch (8-mm) nominal thickness, and approved by roof coating manufacturer. Provide pad sizes indicated.
 - a. Color: Yellow **OR** Gray **OR** Blue **OR** Orange **OR** Green, **as directed**.
7. Sealant: ASTM C 920, Class 25, Use NT, Grade NS, Type M, multicomponent urethane **OR** Type S, one-component, neutral- or acid-curing silicone, **as directed**, and as recommended by coated foamed roofing manufacturer for substrate and joint conditions and for compatibility with roofing materials.
8. Sheet Flashing and Accessories: Types recommended by coated foamed roofing manufacturer, provided at locations indicated and as recommended by coated foamed roofing manufacturer.

1.3 EXECUTION

A. Substrate Board

1. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.
 - a. Fasten thermal barrier to top flanges of steel deck according to recommendations in FMG's "Approval Guide" for specified Windstorm Resistance Classification.
 - b. Fasten thermal barrier to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to coated foamed roofing manufacturer's written instructions.
 - c. Install recovery board according to coated foamed roofing manufacturer's written instructions and the requirements of Division 07 Section "Preparation For Re-roofing". Fasten through existing roofing to roof structure as indicated. Space fasteners for wind-uplift conditions at Project site **OR** as indicated, **as directed**.

B. Surface Preparation

1. Clean and prepare substrate according to coated foamed roofing manufacturer's written instructions. Provide clean, dust-free, dew-free, and dry substrate for coated foamed roofing application.
2. Remove grease, oil, form-release agents, curing compounds, and other contaminants from substrate.
3. Prepare substrate for recovering according to Division 07 Section "Preparation For Re-roofing" and to coated foamed roofing manufacturer's written instructions.
4. Cover and mask adjoining surfaces not receiving coated foamed roofing to prevent overspray or spillage affecting other construction. Close off roof drains, removing roof-drain plugs when no work is being done or when rain is forecast.
 - a. Remove masking after polyurethane foam application and remask adjoining substrates before coating.
5. Prime substrate if recommended by coated foamed roofing manufacturer.
6. Fill, cover, or tape joints and cracks in substrate that exceed a width of 1/4 inch (6 mm). Remove dust and dirt from joints and cracks before applying polyurethane foam.
7. Install vapor retarder according to coated foamed roofing manufacturer's written instructions.

C. Polyurethane Foam Application

1. General: Mix and apply polyurethane foam according to ASTM D 5469 and coated foamed roofing manufacturer's written instructions.
 - a. Fill irregularities and areas of ponding.
 - b. Apply the required full thickness of polyurethane foam in any specific area on same day.
 - c. Apply only the area of polyurethane foam that can be covered on same day with required base coating.
 - d. Apply polyurethane foam to avoid overspray beyond immediate area of work.



2. Apply polyurethane foam in lift thicknesses not less than 1/2 inch (13 mm) and not more than 1-1/2 inches (38 mm).
3. Uniformly apply total thickness of polyurethane foam indicated, but not less than 1 inch (25 mm), to a surface tolerance of plus 1/4 inch (6 mm) and no minus.
4. Apply polyurethane foam to roof penetrations, terminations, and vertical surfaces as indicated. Unless otherwise indicated, extend polyurethane foam at least 4 inches (100 mm) above elevation of adjacent roof field.
5. Surface Finish: Provide finished surface of polyurethane foam within the following range of surface textures as defined by ASTM D 5469:
 - a. Texture: Smooth to orange peel **OR** coarse orange peel **OR** rippling verge of popcorn, **as directed**.
6. Remove and replace polyurethane foam not complying with minimum surface-texture limitations. Remove defective thickness and prepare and reapply polyurethane foam with acceptable, uniform results.

D. Coating Application

1. Allow polyurethane foam substrate to cure for a minimum of two hours and remove dust, dirt, water, and other contaminants before applying coating.
2. Apply coating system to polyurethane foam, in two or more coats and according to roof coating manufacturer's written instructions, by spray, roller, or other suitable application method.
3. Apply base coat and one or more topcoats to obtain a uniform, seamless membrane free of blisters and pinholes. Apply each coat at right angles to preceding coat, using contrasting colors for successive coats.
 - a. Apply base coat on same day as polyurethane foam is applied and allow it to cure.
 - b. Apply topcoat(s) after removing dust, dirt, water, and other contaminants from base coat.
 - c. Urethane Coating: Apply base coat and topcoat to a minimum dry film thickness recommend by coated foamed roofing manufacturer **OR** of 25 mils (0.64 mm) **OR** of 30 mils (0.76 mm) **OR** of 35 mils (0.89 mm), **as directed**.
 - d. Silicone Coating: Apply base coat and topcoat to a minimum dry film thickness recommend by coated foamed roofing manufacturer **OR** of 20 mils (0.50 mm) **OR** of 22 mils (0.56 mm) **OR** of 26 mils (0.66 mm) **OR** of 30 mils (0.76 mm), **as directed**.
 - e. Acrylic Coating: Apply base coat and topcoat to a minimum dry film thickness recommend by coated foamed roofing manufacturer **OR** of 25 mils (0.64 mm) **OR** of 28 mils (0.71 mm) **OR** of 32 mils (0.81 mm), **as directed**.
4. Apply coating system at wall terminations and vertical surfaces to extend beyond polyurethane foam by 4 inches (100 mm), minimum.
5. Mineral Granules: Apply mineral granules over wet topcoat using pressure equipment at the rate of 0.5 lb/sq. ft. (2.45 kg/sq. m). Remove excess granules after topcoat has cured.
6. Sealant: Apply sealant to perimeter and other terminations where indicated or required by coated foamed roofing manufacturer.
7. Walkways: Install roof walkways in pattern and locations indicated. Mask off completed roof coating adjacent to walkways and apply one or two additional topcoats to achieve a minimum dry film thickness recommended by coated foamed roofing manufacturer. Spread mineral granules uniformly at a rate of 0.5 lb/sq. ft. (2.45 kg/sq. m) into final wet coating. Remove masking and excess granules after topcoat has cured.
8. Walkways: Install roof walkways in pattern and locations indicated. Mask off completed roof coating adjacent to walkways and apply one additional topcoat to achieve a minimum dry film thickness recommended by coated foamed roofing manufacturer. Lay reinforcing fabric into wet coating and apply another topcoat, completely filling fabric. Spread mineral granules uniformly at a rate of 0.5 lb/sq. ft. (2.45 kg/sq. m) into final wet coating. Remove masking and excess granules after topcoat has cured.
9. Walkways: Install walkway pads in pattern and locations indicated. Adhere walkway pads to substrate with compatible adhesive according to coated foamed roofing manufacturer's written instructions.
10. Aggregate: Apply aggregate uniformly over coated polyurethane foam at coated foamed roofing manufacturer's recommended rate, but not less than 6 lb/sq. ft. (29 kg/sq. m) and a minimum



thickness of 3/4 inch (19 mm). Spread with care to prevent puncturing coating and to minimize damage to substrate foam.

- E. Field Quality Control
 - 1. Correct deficiencies in, or remove, foam or coatings that do not comply with requirements; fill and repair substrates and reapply materials.
 - 2. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with requirements.
 - 3. Refill cores, repair slits, and recoat test areas.
- F. Repair And Recoating
 - 1. Repair and recoat coated foamed roofing according to ASTM D 6705 and coated foamed roofing manufacturer's written instructions.
- G. Curing, Protecting, And Cleaning
 - 1. Cure coatings according to coated foamed roofing manufacturer's written instructions, taking care to prevent contamination and damage during application stages and curing. Do not permit traffic on uncured coatings.
 - 2. Protect coated foamed roofing from damage and wear during remainder of construction period.
 - 3. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 56 00 00



Task	Specification	Specification Description
07 56 00 00	07 51 13 00	Built-Up Asphalt Roofing
07 56 00 00	07 05 13 00	Built-Up Coal-Tar Roofing
07 56 00 00	07 53 16 00	EPDM Membrane Roofing
07 56 00 00	07 54 19 00	Polyvinyl-Chloride (PVC) Roofing
07 56 00 00	07 05 13 00d	Preparation for Re-Roofing
07 58 00 00	07 51 13 00	Built-Up Asphalt Roofing



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**SECTION 07 62 00 00 - SHEET METAL FLASHING AND TRIM****1.1 GENERAL****A. Description Of Work:**

1. This specification covers the furnishing and installation of materials for sheet metal flashing and trim. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Manufactured Products:
 - 1) Manufactured through-wall flashing and counterflashing.
 - 2) Manufactured reglets and counterflashing.
 - b. Formed Products:
 - 1) Formed roof drainage sheet metal fabrications.
 - 2) Formed low-slope roof sheet metal fabrications.
 - 3) Formed steep-slope roof sheet metal fabrications.
 - 4) Formed wall sheet metal fabrications.
 - 5) Formed equipment support flashing.
 - 6) Formed overhead-piping safety pans.

C. Performance Requirements

1. General: Sheet metal flashing and trim assemblies as indicated shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
2. Fabricate and install roof edge flashing and copings capable of resisting the following forces according to recommendations in FMG Loss Prevention Data Sheet 1-49:
 - a. Wind Zone 1: For velocity pressures of 10 to 20 lbf/sq. ft. (0.48 to 0.96 kPa): 40-lbf/sq. ft. (1.92-kPa) perimeter uplift force, 60-lbf/sq. ft. (2.87-kPa) corner uplift force, and 20-lbf/sq. ft. (0.96-kPa) outward force.
 - b. Wind Zone 1: For velocity pressures of 21 to 30 lbf/sq. ft. (1.00 to 1.44 kPa): 60-lbf/sq. ft. (2.87-kPa) perimeter uplift force, 90-lbf/sq. ft. (4.31-kPa) corner uplift force, and 30-lbf/sq. ft. (1.44-kPa) outward force.
 - c. Wind Zone 2: For velocity pressures of 31 to 45 lbf/sq. ft. (1.48 to 2.15 kPa): 90-lbf/sq. ft. (4.31-kPa) perimeter uplift force, 120-lbf/sq. ft. (5.74-kPa) corner uplift force, and 45-lbf/sq. ft. (2.15-kPa) outward force.
 - d. Wind Zone 3: For velocity pressures of 46 to 104 lbf/sq. ft. (2.20 to 4.98 kPa): 208-lbf/sq. ft. (9.96-kPa) perimeter uplift force, 312-lbf/sq. ft. (14.94-kPa) corner uplift force, and 104-lbf/sq. ft. (4.98-kPa) outward force.
3. Thermal Movements: Provide sheet metal flashing and trim that allows for thermal movements from ambient and surface temperature changes.
 - a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

D. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: Show installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.



- a. Include details for forming, joining, supporting, and securing sheet metal flashing and trim, including pattern of seams, termination points, fixed points, expansion joints, expansion-joint covers, edge conditions, special conditions, and connections to adjoining work.
3. Samples: For each exposed product and for each finish specified.
4. Maintenance data.
5. Warranty: Sample of special warranty.

E. Quality Assurance

1. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.
2. Copper Sheet Metal Standard: Comply with CDA's "Copper in Architecture Handbook." Conform to dimensions and profiles shown unless more stringent requirements are indicated.
3. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - a. Build mockup of typical roof eave, including built-in gutter, fascia, fascia trim, and apron flashing, approximately 10 feet (3.0 m) long, including supporting construction cleats, seams, attachments, underlayment, and accessories.
4. Preinstallation Conference: Conduct conference at Project site.

F. Delivery, Storage, And Handling

1. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
2. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

G. Warranty

1. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within 20 **OR** 10, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Sheet Metals

1. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.
2. Copper Sheet: ASTM B 370, cold-rolled copper sheet, H00 or H01 temper.
 - a. Non-Patinated Exposed Finish: Mill.
 - b. Non-Patinated, Exposed, Lacquered Finish: Finish designations for copper alloys comply with the system defined in NAAMM's "Metal Finishes Manual for Architectural and Metal Products."
 - 1) Brushed Satin (Lacquered): M32-06x (Mechanical Finish: directionally textured, medium satin; with clear organic coating); coating of "Incralac," waterborne **OR** solvent-borne, **as directed**, methyl methacrylate copolymer lacquer with UV inhibitor, applied by air spray in two coats per manufacturer's written instructions to a total thickness of 1 mil (0.025 mm).
 - 2) Mirror Polished (Lacquered): M22-06x (Mechanical Finish: buffed, specular; with clear organic coating); coating of "Incralac," waterborne **OR** solvent-borne, **as directed**, air-drying, methyl methacrylate copolymer lacquer with UV inhibitor, applied by air spray in two coats per manufacturer's written instructions to a total thickness of 1 mil (0.025 mm).
 - c. Pre-Patinated Copper-Sheet Finish: Dark brown **OR** Verdigris, **as directed**, pre-patinated according to ASTM B 882.



3. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required.
 - a. As-Milled Finish: Mill **OR** One-side bright mill **OR** Standard one-side bright **OR** Standard two-side bright, **as directed**, finish.
 - b. Alclad Finish: Metallurgically bonded surfacing to both sides, forming a composite aluminum sheet with reflective luster.
 - c. Surface: Smooth, flat **OR** Embossed, **as directed**.
 - d. Factory Prime Coating: Where painting after installation is indicated, pretreat with white or light-colored, factory-applied, baked-on epoxy primer coat; minimum dry film thickness of 0.2 mil (0.005 mm).
 - e. Clear Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
 - f. Color Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
 - 1) Color: Champagne **OR** Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black, **as directed**.
 - 2) Color Range: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
 - g. Exposed Coil-Coated Finishes:
 - 1) Two-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat.
 - 2) Three-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.
 - 3) Four-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat and clear coats.
 - 4) Mica Fluoropolymer: AAMA 620. Two-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat.
 - 5) Metallic Fluoropolymer: AAMA 620. Three-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.
 - 6) FEVE Fluoropolymer: AAMA 620. Two-coat fluoropolymer finish containing 100 percent fluorinated ethylene vinyl ether resin in color coat.
 - 7) Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
 - 8) Plastisol: Epoxy primer and vinyl plastisol topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 3.8 mils (0.97 mm) for topcoat.
 - h. Color: As selected from manufacturer's full range.
 - i. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).
4. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304, dead soft, fully annealed.
 - a. Finish: 2D (dull, cold rolled) **OR** 2B (bright, cold rolled) **OR** 3 (coarse, polished directional satin) **OR** 4 (polished directional satin), **as directed**.
 - b. Surface: Smooth, flat **OR** Embossed, **as directed**.
5. Zinc-Tin Alloy-Coated Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, dead-soft, fully annealed stainless-steel sheet of minimum uncoated thickness indicated; coated on both sides with a zinc-tin alloy (50 percent zinc, 50 percent tin), with factory-applied gray preweathering.
6. Zinc-Tin Alloy-Coated Copper Sheet: ASTM B 370, cold-rolled copper sheet, H00 temper, of minimum uncoated weight (thickness) indicated; coated on both sides with a zinc-tin alloy (50 percent zinc, 50 percent tin).
7. Metallic-Coated Steel Sheet: Restricted flatness steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.



- a. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.
 - b. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40 (Class AZM150 coating designation, Grade 275); structural quality.
 - c. Surface: Smooth, flat **OR** Embossed, **as directed**, and mill phosphatized for field painting **OR** and with manufacturer's standard clear acrylic coating on both sides, **as directed**.
 - d. Exposed Coil-Coated Finish:
 - 1) Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat.
 - 2) Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.
 - 3) Four-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat and clear coats.
 - 4) Mica Fluoropolymer: AAMA 621. Two-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat.
 - 5) Metallic Fluoropolymer: AAMA 621. Three-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.
 - 6) FEVE Fluoropolymer: AAMA 621. Two-coat fluoropolymer finish containing 100 percent fluorinated ethylene vinyl ether resin in color coat.
 - 7) Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
 - 8) Plastisol: Epoxy primer and vinyl plastisol topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 3.8 mils (0.97 mm) for topcoat.
 - e. Color: As selected from manufacturer's full range.
 - f. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).
8. Zinc Sheet: Zinc, 99 percent pure, alloyed with a maximum of 1 percent copper and titanium; with manufacturer's standard factory-applied, flexible, protective back coating.
- a. Finish: Bright rolled **OR** Preweathered gray **OR** Preweathered black, **as directed**.
- B. Underlayment Materials
1. Polyethylene Sheet: 6-mil- (0.15-mm-) thick polyethylene sheet complying with ASTM D 4397.
 2. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
 3. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils (0.76 to 1.0 mm) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
 - a. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F (116 deg C).
 - b. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F (29 deg C).
 4. Slip Sheet: Building paper, 3-lb/100 sq. ft. (0.16-kg/sq. m) minimum, rosin sized.
- C. Miscellaneous Materials
1. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.
 2. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
 - a. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.



- 1) Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating.
 - 2) Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
 - 3) Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
 - b. Fasteners for Copper **OR** Zinc-Tin Alloy-Coated Copper, **as directed**, Sheet: Copper, hardware bronze or Series 300 stainless steel.
 - c. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
 - d. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
 - e. Fasteners for Zinc-Tin Alloy-Coated Stainless-Steel Sheet: Series 300 stainless steel.
 - f. Fasteners for Zinc-Coated (Galvanized) **OR** Aluminum-Zinc Alloy-Coated, **as directed**, Steel Sheet: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329 or Series 300 stainless steel.
 - g. Fasteners for Zinc Sheet: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329 or Series 300 stainless steel.
 3. Solder:
 - a. For Copper: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.
 - b. For Stainless Steel: ASTM B 32, Grade Sn60, with an acid flux of type recommended by stainless-steel sheet manufacturer.
 - c. For Zinc-Tin Alloy-Coated Stainless Steel **OR** Copper, **as directed**: ASTM B 32, 100 percent tin.
 - d. For Zinc-Coated (Galvanized) Steel: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead.
 - e. For Zinc: ASTM B 32, 40 percent tin and 60 percent lead with low antimony, as recommended by manufacturer.
 4. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
 5. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane **OR** polysulfide **OR** silicone, **as directed**, polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
 6. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
 7. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.
 8. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.
 9. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.
- D. Manufactured Sheet Metal Flashing And Trim
1. Through-Wall Ribbed Sheet Metal Flashing: Manufacture through-wall sheet metal flashing for embedment in masonry with ribs at 3-inch (75-mm) intervals along length of flashing to provide an integral mortar bond. Manufacture through-wall flashing with snaplock receiver on exterior face to receive counterflashing **OR** interlocking counterflashing on exterior face, of same metal as reglet, **as directed**.
 - a. Copper: 10 oz. (0.34 mm thick) minimum for fully concealed flashing; 16 oz. (0.55 mm thick) elsewhere.
 - b. Stainless Steel: 0.016 inch (0.40 mm) thick.
 2. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and -welded corners and junctions **OR** with interlocking counterflashing on exterior face, of same metal as reglet, **as directed**.
 - a. Material: Stainless steel, 0.019 inch (0.48 mm) thick **OR** Copper, 16 oz./sq. ft. (0.55 mm thick) **OR** Aluminum, 0.024 inch (0.61 mm) thick **OR** Galvanized steel, 0.022 inch (0.56 mm) thick, **as directed**.



- b. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
- c. Stucco Type: Provide with upturned fastening flange and extension leg of length to match thickness of applied finish materials.
- d. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
- e. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
- f. Accessories:
 - 1) Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
 - 2) Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.
- g. Finish: Mill **OR** With manufacturer's standard color coating, **as directed**.

E. Fabrication, General

1. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.
 - a. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
 - b. Obtain field measurements for accurate fit before shop fabrication.
 - c. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
 - d. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.
2. Fabrication Tolerances:
 - a. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.
OR
Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."
3. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.
4. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.
5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
6. Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" and by FMG Loss Prevention Data Sheet 1-49, **as directed**, for application, but not less than thickness of metal being secured.
7. Seams:
 - a. Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
OR
Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
8. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.



9. Do not use graphite pencils to mark metal surfaces.

F. Roof Drainage Sheet Metal Fabrications

1. Hanging Gutters: Fabricate to cross section indicated, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch- (2400-mm-) long sections. Furnish flat-stock gutter spacers and gutter brackets fabricated from same metal as gutters, of size recommended by SMACNA but not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, gutter bead reinforcing bars, and gutter accessories from same metal as gutters.
 - a. Gutter Style: SMACNA designation A **OR** B **OR** C **OR** D **OR** E **OR** F **OR** G **OR** H **OR** I **OR** J **OR** K **OR** L, **as directed**.
 - b. Expansion Joints: Lap type **OR** Butt type **OR** Butt type with cover plate **OR** Built in, **as directed**.
 - c. Accessories: Continuous removable leaf screen with sheet metal frame and hardware cloth screen **OR** Wire ball downspout strainer **OR** Valley baffles, **as directed**.
 - d. Gutters with Girth up to 15 Inches (380 mm): Fabricate from the following materials:
 - 1) Copper: 16 oz./sq. ft. (0.55 mm thick).
 - 2) Aluminum: 0.032 inch (0.81 mm) thick.
 - 3) Stainless Steel: 0.016 inch (0.40 mm) thick.
 - 4) Zinc-Tin Alloy-Coated Stainless Steel: 0.015 inch (0.38 mm) thick.
 - 5) Zinc-Tin Alloy-Coated Copper: 16 oz./sq. ft. (0.55 mm thick).
 - 6) Galvanized Steel: 0.022 inch (0.56 mm) thick.
 - 7) Aluminum-Zinc Alloy-Coated Steel: 0.022 inch (0.56 mm) thick.
 - 8) Zinc: 0.032 inch (0.80 mm) **OR** 0.039 inch (1.00 mm), **as directed**, thick.
 - e. Gutters with Girth 16 to 20 Inches (410 to 510 mm): Fabricate from the following materials:
 - 1) Copper: 16 oz./sq. ft. (0.55 mm thick).
 - 2) Aluminum: 0.040 inch (1.02 mm) thick.
 - 3) Stainless Steel: 0.019 inch (0.48 mm) thick.
 - 4) Zinc-Tin Alloy-Coated Stainless Steel: 0.018 inch (0.46 mm) thick.
 - 5) Zinc-Tin Alloy-Coated Copper: 16 oz./sq. ft. (0.55 mm thick).
 - 6) Galvanized Steel: 0.028 inch (0.71 mm) thick.
 - 7) Aluminum-Zinc Alloy-Coated Steel: 0.028 inch (0.71 mm) thick.
 - 8) Zinc: 0.039 inch (1.00 mm) **OR** 0.048 inch (1.25 mm), **as directed**, thick.
 - f. Gutters with Girth 21 to 25 Inches (530 to 640 mm): Fabricate from the following materials:
 - 1) Copper: 20 oz./sq. ft. (0.68 mm thick).
 - 2) Aluminum: 0.050 inch (1.27 mm) thick.
 - 3) Stainless Steel: 0.025 inch (0.64 mm) thick.
 - 4) Zinc-Tin Alloy-Coated Stainless Steel: 0.024 inch (0.61 mm) thick.
 - 5) Zinc-Tin Alloy-Coated Copper: 20 oz./sq. ft. (0.68 mm thick).
 - 6) Galvanized Steel: 0.034 inch (0.86 mm) thick.
 - 7) Aluminum-Zinc Alloy-Coated Steel: 0.034 inch (0.86 mm) thick.
 - 8) Zinc: 0.048 inch (1.25 mm) **OR** 0.059 inch (1.50 mm), **as directed**, thick.
 - g. Gutters with Girth 26 to 30 Inches (660 to 760 mm): Fabricate from the following materials:
 - 1) Copper: 24 oz./sq. ft. (0.82 mm thick).
 - 2) Aluminum: 0.063 inch (1.60 mm) thick.
 - 3) Stainless Steel: 0.031 inch (0.79 mm) thick.
 - 4) Zinc-Tin Alloy-Coated Copper: 24 oz./sq. ft. (0.82 mm thick).
 - 5) Galvanized Steel: 0.040 inch (1.02 mm) thick.
 - 6) Aluminum-Zinc Alloy-Coated Steel: 0.040 inch (1.02 mm) thick.
 - h. Gutters with Girth 31 to 35 Inches (790 to 890 mm): Fabricate from the following materials:
 - 1) Copper: 24 oz./sq. ft. (0.82 mm thick).
 - 2) Stainless Steel: 0.038 inch (0.95 mm) thick.
 - 3) Zinc-Tin Alloy-Coated Copper: 25 oz./sq. ft. (0.87 mm thick).
 - 4) Galvanized Steel: 0.052 inch (1.32 mm) thick.
 - 5) Aluminum-Zinc Alloy-Coated Steel: 0.052 inch (1.32 mm) thick.



2. Built-in Gutters: Fabricate to cross section indicated, with riveted and soldered joints, complete with end pieces, outlet tubes, and other special accessories as required. Fabricate in minimum 96-inch- (2400-mm-) long sections. Fabricate expansion joints and accessories from same metal as gutters unless otherwise indicated.
 - a. Fabricate gutters with built-in expansion joints and gutter-end expansion joints at walls.
 - b. Accessories: Continuous removable leaf screen with sheet metal frame and hardware cloth screen **OR** Bronze wire ball downspout strainer **OR** Wire ball downspout strainer, **as directed**.
 - c. Fabricate from the following materials:
 - 1) Copper: 16 oz./sq. ft. (0.55 mm thick).
 - 2) Stainless Steel: 0.016 inch (0.40 mm) thick.
 - 3) Zinc-Tin Alloy-Coated Stainless Steel: 0.015 inch (0.38 mm) thick.
 - 4) Zinc-Tin Alloy-Coated Copper: 16 oz./sq. ft. (0.55 mm thick).
 - 5) Zinc: 0.032 inch (0.80 mm) **OR** 0.039 inch (1.00 mm), **as directed**, thick.
3. Downspouts: Fabricate round **OR** rectangular **OR** open-face, **as directed**, downspouts complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors.
 - a. Fabricated Hanger Style: SMACNA figure designation 1-35A **OR** 1-35B **OR** 1-35C **OR** 1-35D **OR** 1-35E **OR** 1-35F **OR** 1-35G **OR** 1-35H **OR** 1-35I **OR** 1-35J, **as directed**.
 - b. Manufactured Hanger Style: SMACNA figure designation 1-34A **OR** 1-34B **OR** 1-34C **OR** 1-34D **OR** 1-34E, **as directed**.
 - c. Hanger Style: **<Insert description>**.
 - d. Fabricate from the following materials:
 - 1) Copper: 16 oz./sq. ft. (0.55 mm thick).
 - 2) Aluminum: 0.024 inch (0.61 mm) thick.
 - 3) Stainless Steel: 0.016 inch (0.40 mm) thick.
 - 4) Zinc-Tin Alloy-Coated Stainless Steel: 0.015 inch (0.38 mm) thick.
 - 5) Zinc-Tin Alloy-Coated Copper: 16 oz./sq. ft. (0.55 mm thick).
 - 6) Galvanized Steel: 0.022 inch (0.56 mm) thick.
 - 7) Aluminum-Zinc Alloy-Coated Steel: 0.022 inch (0.56 mm) thick.
 - 8) Zinc: 0.032 inch (0.80 mm) **OR** 0.039 inch (1.00 mm), **as directed**, thick.
4. Parapet Scuppers: Fabricate scuppers of dimensions required with closure flange trim to exterior, 4-inch- (100-mm-) wide wall flanges to interior, and base extending 4 inches (100 mm) beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scupper. Fabricate from the following materials:
 - a. Copper: 16 oz./sq. ft. (0.55 mm thick).
 - b. Aluminum: 0.032 inch (0.81 mm) thick.
 - c. Stainless Steel: 0.019 inch (0.48 mm) thick.
 - d. Zinc-Tin Alloy-Coated Stainless Steel: 0.018 inch (0.46 mm) thick.
 - e. Zinc-Tin Alloy-Coated Copper: 16 oz./sq. ft. (0.55 mm thick).
 - f. Galvanized Steel: 0.028 inch (0.71 mm) thick.
 - g. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch (0.71 mm) thick.
 - h. Zinc: 0.032 inch (0.80 mm) **OR** 0.039 inch (1.00 mm), **as directed**, thick.
5. Conductor Heads: Fabricate conductor heads with flanged back and stiffened top edge and of dimensions and shape indicated complete with outlet tubes, exterior flange trim, and built-in overflows. Fabricate from the following materials:
 - a. Copper: 16 oz./sq. ft. (0.55 mm thick).
 - b. Aluminum: 0.032 inch (0.81 mm) thick.
 - c. Stainless Steel: 0.016 inch (0.40 mm) thick.
 - d. Zinc-Tin Alloy-Coated Stainless Steel: 0.015 inch (0.38 mm) thick.
 - e. Zinc-Tin Alloy-Coated Copper: 16 oz./sq. ft. (0.55 mm thick).
 - f. Galvanized Steel: 0.028 inch (0.71 mm) thick.
 - g. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch (0.71 mm) thick.
 - h. Zinc: 0.032 inch (0.80 mm) **OR** 0.039 inch (1.00 mm), **as directed**, thick.
6. Splash Pans: Fabricate from the following materials:



- a. Copper: 16 oz./sq. ft. (0.55 mm thick).
 - b. Aluminum: 0.040 inch (1.02 mm) thick.
 - c. Stainless Steel: 0.019 inch (0.48 mm) thick.
 - d. Zinc-Tin Alloy-Coated Stainless Steel: 0.018 inch (0.46 mm) thick.
 - e. Zinc-Tin Alloy-Coated Copper: 16 oz./sq. ft. (0.55 mm thick).
 - f. Zinc: 0.032 inch (0.80 mm) **OR** 0.039 inch (1.00 mm), **as directed**, thick.
- G. Low-Slope Roof Sheet Metal Fabrications
1. Roof-Edge Flashing (Gravel Stop) and Fascia Cap: Fabricate in minimum 96-inch- (2400-mm-) long, but not exceeding 10-foot- (3-m-) long, sections. Furnish with 6-inch- (150-mm-) wide, joint cover plates.
 - a. Joint Style: Lap, 4 inches (100 mm) wide **OR** Butt, with 12-inch- (300-mm-) wide, concealed backup plate **OR** Butt, with 6-inch- (150-mm-) wide, exposed cover plates **OR** Butt, with 12-inch- (300-mm-) wide, concealed backup plate and 6-inch- (150-mm-) wide, exposed cover plates, **as directed**.
 - b. Fabricate with scuppers spaced 10 feet (3 m) apart, of dimensions required with 4-inch- (100-mm-) wide flanges and base extending 4 inches (100 mm) beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scupper.
 - c. Fabricate from the following materials:
 - 1) Copper: 20 oz./sq. ft. (0.68 mm thick).
 - 2) Aluminum: 0.050 inch (1.27 mm) thick.
 - 3) Stainless Steel: 0.019 inch (0.48 mm) thick.
 - 4) Zinc-Tin Alloy-Coated Stainless Steel: 0.018 inch (0.46 mm) thick.
 - 5) Zinc-Tin Alloy-Coated Copper: 20 oz./sq. ft. (0.68 mm thick).
 - 6) Galvanized Steel: 0.028 inch (0.71 mm) thick.
 - 7) Aluminum-Zinc Alloy-Coated Steel: 0.028 inch (0.71 mm) thick.
 - 8) Zinc: 0.048 inch (1.25 mm) **OR** 0.059 inch (1.50 mm), **as directed**, thick.
 2. Copings: Fabricate in minimum 96-inch- (2400-mm-) long, but not exceeding 10-foot- (3-m-) long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, seal, and solder or weld watertight.
 - a. Coping Profile: SMACNA figure designation 3-4A **OR** 3-4B **OR** 3-4C **OR** 3-4D **OR** 3-4E **OR** 3-4F **OR** 3-4G, **as directed**.
 - b. Joint Style: Butt, with 12-inch- (300-mm-) wide, concealed backup plate **OR** Butt, with 6-inch- (150-mm-) wide, exposed cover plates **OR** Butt, with 12-inch- (300-mm-) wide, concealed backup plate and 6-inch- (150-mm-) wide, exposed cover plates, **as directed**.
 - c. Fabricate from the following materials:
 - 1) Copper: 24 oz./sq. ft. (0.82 mm thick).
 - 2) Aluminum: 0.050 inch (1.27 mm) thick.
 - 3) Stainless Steel: 0.025 inch (0.64 mm) thick.
 - 4) Zinc-Tin Alloy-Coated Stainless Steel: 0.024 inch (0.61 mm) thick.
 - 5) Zinc-Tin Alloy-Coated Copper: 24 oz./sq. ft. (0.82 mm thick).
 - 6) Galvanized Steel: 0.040 inch (1.02 mm) thick.
 - 7) Aluminum-Zinc Alloy-Coated Steel: 0.040 inch (1.02 mm) thick.
 - 8) Zinc: 0.048 inch (1.25 mm) **OR** 0.059 inch (1.50 mm), **as directed**, thick.
 3. Roof and Roof to Wall Transition **OR** Roof to Roof Edge Flashing (Gravel Stop) Transition **OR** Roof to Roof Edge Flashing (Gravel Stop) and Fascia Cap Transition, **as directed**, Expansion-Joint Cover: Fabricate from the following materials:
 - a. Copper: 16 oz./sq. ft. (0.55 mm thick).
 - b. Aluminum: 0.050 inch (1.27 mm) thick.
 - c. Stainless Steel: 0.025 inch (0.64 mm) thick.
 - d. Zinc-Tin Alloy-Coated Stainless Steel: 0.024 inch (0.61 mm) thick.
 - e. Zinc-Tin Alloy-Coated Copper: 16 oz./sq. ft. (0.55 mm thick)>.
 - f. Galvanized Steel: 0.034 inch (0.86 mm) thick.
 - g. Aluminum-Zinc Alloy-Coated Steel: 0.034 inch (0.86 mm) thick.
 - h. Zinc: 0.032 inch (0.80 mm) **OR** 0.039 inch (1.00 mm), **as directed**, thick.



4. Base Flashing: Fabricate from the following materials:
 - a. Copper: 20 oz./sq. ft. (0.68 mm thick)>.
 - b. Aluminum: 0.040 inch (1.02 mm) thick.
 - c. Stainless Steel: 0.019 inch (0.48 mm) thick.
 - d. Zinc-Tin Alloy-Coated Stainless Steel: 0.018 inch (0.46 mm) thick.
 - e. Zinc-Tin Alloy-Coated Copper: 20 oz./sq. ft. (0.68 mm thick)>.
 - f. Galvanized Steel: 0.028 inch (0.71 mm) thick.
 - g. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch (0.71 mm) thick.
 - h. Zinc: 0.032 inch (0.80 mm) **OR** 0.039 inch (1.00 mm), **as directed**, thick.
 5. Counterflashing: Fabricate from the following materials:
 - a. Copper: 16 oz./sq. ft. (0.55 mm thick).
 - b. Aluminum: 0.032 inch (0.81 mm) thick.
 - c. Stainless Steel: 0.019 inch (0.48 mm) thick.
 - d. Zinc-Tin Alloy-Coated Stainless Steel: 0.018 inch (0.46 mm) thick.
 - e. Zinc-Tin Alloy-Coated Copper: 16 oz./sq. ft. (0.55 mm thick)>.
 - f. Galvanized Steel: 0.022 inch (0.56 mm) thick.
 - g. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch (0.56 mm) thick.
 - h. Zinc: 0.032 inch (0.80 mm) **OR** 0.039 inch (1.00 mm), **as directed**, thick.
 6. Flashing Receivers: Fabricate from the following materials:
 - a. Copper: 16 oz./sq. ft. (0.55 mm thick).
 - b. Aluminum: 0.032 inch (0.81 mm) thick.
 - c. Stainless Steel: 0.016 inch (0.40 mm) thick.
 - d. Zinc-Tin Alloy-Coated Stainless Steel: 0.015 inch (0.38 mm) thick.
 - e. Zinc-Tin Alloy-Coated Copper: 16 oz./sq. ft. (0.55 mm thick).
 - f. Galvanized Steel: 0.022 inch (0.56 mm) thick.
 - g. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch (0.56 mm) thick.
 - h. Zinc: 0.032 inch (0.80 mm) **OR** 0.039 inch (1.00 mm), **as directed**, thick.
 7. Roof-Penetration Flashing: Fabricate from the following materials:
 - a. Copper: 16 oz./sq. ft. (0.55 mm thick).
 - b. Stainless Steel: 0.019 inch (0.48 mm) thick.
 - c. Zinc-Tin Alloy-Coated Stainless Steel: 0.018 inch (0.46 mm) thick.
 - d. Zinc-Tin Alloy-Coated Copper: 16 oz./sq. ft. (0.55 mm thick).
 - e. Galvanized Steel: 0.028 inch (0.71 mm) thick.
 - f. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch (0.71 mm) thick.
 - g. Zinc: 0.032 inch (0.80 mm) **OR** 0.039 inch (1.00 mm), **as directed**, thick.
 8. Roof-Drain Flashing: Fabricate from the following materials:
 - a. Copper: 12 oz./sq. ft. (0.41 mm thick).
 - b. Stainless Steel: 0.016 inch (0.40 mm) thick.
 - c. Zinc-Tin Alloy-Coated Stainless Steel: 0.015 inch (0.38 mm) thick.
- H. Steep-Slope Roof Sheet Metal Fabrications
1. Apron, Step, Cricket, and Backer Flashing: Fabricate from the following materials:
 - a. Copper: 16 oz./sq. ft. (0.55 mm thick).
 - b. Aluminum: 0.032 inch (0.81 mm) thick.
 - c. Stainless Steel: 0.016 inch (0.40 mm) thick.
 - d. Zinc-Tin Alloy-Coated Stainless Steel: 0.015 inch (0.38 mm) thick.
 - e. Zinc-Tin Alloy-Coated Copper: 16 oz./sq. ft. (0.55 mm thick).
 - f. Galvanized Steel: 0.022 inch (0.56 mm) thick.
 - g. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch (0.56 mm) thick.
 - h. Zinc: 0.032 inch (0.80 mm) **OR** 0.039 inch (1.00 mm), **as directed**, thick.
 2. Valley Flashing: Fabricate from the following materials:
 - a. Copper: 16 oz./sq. ft. (0.55 mm thick).
 - b. Stainless Steel: 0.019 inch (0.48 mm) thick.
 - c. Zinc-Tin Alloy-Coated Stainless Steel: 0.018 inch (0.46 mm) thick.
 - d. Zinc-Tin Alloy-Coated Copper: 16 oz./sq. ft. (0.55 mm thick).



- e. Galvanized Steel: 0.028 inch (0.71 mm) thick.
 - f. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch (0.71 mm) thick.
 - g. Zinc: 0.032 inch (0.80 mm) **OR** 0.039 inch (1.00 mm), **as directed**, thick.
 3. Drip Edges: Fabricate from the following materials:
 - a. Copper: 16 oz./sq. ft. (0.55 mm thick).
 - b. Aluminum: 0.032 inch (0.81 mm) thick.
 - c. Stainless Steel: 0.016 inch (0.40 mm) thick.
 - d. Zinc-Tin Alloy-Coated Stainless Steel: 0.015 inch (0.38 mm) thick.
 - e. Zinc-Tin Alloy-Coated Copper: 16 oz./sq. ft. (0.55 mm thick).
 - f. Galvanized Steel: 0.022 inch (0.56 mm) thick.
 - g. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch (0.56 mm) thick.
 - h. Zinc: 0.032 inch (0.80 mm) **OR** 0.039 inch (1.00 mm), **as directed**, thick.
 4. Eave, Rake, Ridge, and Hip Flashing: Fabricate from the following materials:
 - a. Copper: 16 oz./sq. ft. (0.55 mm thick).
 - b. Aluminum: 0.032 inch (0.81 mm) thick.
 - c. Stainless Steel: 0.016 inch (0.40 mm) thick.
 - d. Zinc-Tin Alloy-Coated Stainless Steel: 0.015 inch (0.38 mm) thick.
 - e. Zinc-Tin Alloy-Coated Copper: 16 oz./sq. ft. (0.55 mm thick).
 - f. Galvanized Steel: 0.022 inch (0.56 mm) thick.
 - g. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch (0.56 mm) thick.
 - h. Zinc: 0.032 inch (0.80 mm) **OR** 0.039 inch (1.00 mm), **as directed**, thick.
 5. Counterflashing: Fabricate from the following materials:
 - a. Copper: 16 oz./sq. ft. (0.55 mm thick).
 - b. Aluminum: 0.032 inch (0.81 mm) thick.
 - c. Stainless Steel: 0.019 inch (0.48 mm) thick.
 - d. Zinc-Tin Alloy-Coated Stainless Steel: 0.018 inch (0.46 mm) thick.
 - e. Zinc-Tin Alloy-Coated Copper: 16 oz./sq. ft. (0.55 mm thick).
 - f. Galvanized Steel: 0.022 inch (0.56 mm) thick.
 - g. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch (0.56 mm) thick.
 - h. Zinc: 0.032 inch (0.80 mm) **OR** 0.039 inch (1.00 mm), **as directed**, thick.
 6. Flashing Receivers: Fabricate from the following materials:
 - a. Copper: 16 oz./sq. ft. (0.55 mm thick).
 - b. Aluminum: 0.032 inch (0.81 mm) thick.
 - c. Stainless Steel: 0.016 inch (0.40 mm) thick.
 - d. Zinc-Tin Alloy-Coated Stainless Steel: 0.015 inch (0.38 mm) thick.
 - e. Zinc-Tin Alloy-Coated Copper: 16 oz./sq. ft. (0.55 mm thick).
 - f. Galvanized Steel: 0.022 inch (0.56 mm) thick.
 - g. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch (0.56 mm) thick.
 - h. Zinc: 0.032 inch (0.80 mm) **OR** 0.039 inch (1.00 mm), **as directed**, thick.
 7. Roof-Penetration Flashing: Fabricate from the following materials:
 - a. Copper: 16 oz./sq. ft. (0.55 mm thick).
 - b. Stainless Steel: 0.019 inch (0.48 mm) thick.
 - c. Zinc-Tin Alloy-Coated Stainless Steel: 0.018 inch (0.46 mm) thick.
 - d. Zinc-Tin Alloy-Coated Copper: 16 oz./sq. ft. (0.55 mm thick)>.
 - e. Galvanized Steel: 0.028 inch (0.71 mm) thick.
 - f. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch (0.71 mm) thick.
 - g. Zinc: 0.032 inch (0.80 mm) **OR** 0.039 inch (1.00 mm), **as directed**, thick.
- I. Wall Sheet Metal Fabrications
1. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch- (2400-mm-) long, but not exceeding 12-foot- (3.6-m-) long, sections, under copings, at shelf angles, and where indicated. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches (150 mm) beyond each side of wall openings. Form with 2-inch- (50-mm-) high, end dams where flashing is discontinuous. Fabricate from the following materials:
 - a. Copper: 16 oz./sq. ft. (0.55 mm thick).
 - b. Stainless Steel: 0.016 inch (0.40 mm) thick.



- c. Zinc-Tin Alloy-Coated Stainless Steel: 0.015 inch (0.38 mm) thick.
- d. Zinc-Tin Alloy-Coated Copper: 16 oz./sq. ft. (0.55 mm thick).
- e. Zinc: 0.032 inch (0.80 mm) **OR** 0.039 inch (1.00 mm), **as directed**, thick.
- 2. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches (100 mm) beyond wall openings. Form head and sill flashing with 2-inch- (50-mm-) high, end dams. Fabricate from the following materials:
 - a. Copper: 16 oz./sq. ft. (0.55 mm thick).
 - b. Aluminum: 0.032 inch (0.81 mm) thick.
 - c. Stainless Steel: 0.016 inch (0.40 mm) thick.
 - d. Zinc-Tin Alloy-Coated Stainless Steel: 0.015 inch (0.38 mm) thick.
 - e. Zinc-Tin Alloy-Coated Copper: 16 oz./sq. ft. (0.55 mm thick).
 - f. Galvanized Steel: 0.022 inch (0.56 mm) thick.
 - g. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch (0.56 mm) thick.
 - h. Zinc: 0.032 inch (0.80 mm) **OR** 0.039 inch (1.00 mm), **as directed**, thick.
- 3. Wall Expansion-Joint Cover: Fabricate from the following materials:
 - a. Copper: 16 oz./sq. ft. (0.55 mm thick).
 - b. Aluminum: 0.040 inch (1.02 mm) thick.
 - c. Stainless Steel: 0.019 inch (0.48 mm) thick.
 - d. Zinc-Tin Alloy-Coated Stainless Steel: 0.018 inch (0.46 mm) thick.
 - e. Zinc-Tin Alloy-Coated Copper: 16 oz./sq. ft. (0.55 mm thick).
 - f. Galvanized Steel: 0.028 inch (0.71 mm) thick.
 - g. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch (0.71 mm) thick.
 - h. Zinc: 0.032 inch (0.80 mm) **OR** 0.039 inch (1.00 mm), **as directed**, thick.

J. Miscellaneous Sheet Metal Fabrications

- 1. Equipment Support Flashing: Fabricate from the following materials:
 - a. Copper: 16 oz./sq. ft. (0.55 mm thick).
 - b. Stainless Steel: 0.019 inch (0.48 mm) thick.
 - c. Zinc-Tin Alloy-Coated Stainless Steel: 0.018 inch (0.46 mm) thick.
 - d. Zinc-Tin Alloy-Coated Copper: 16 oz./sq. ft. (0.55 mm thick).
 - e. Galvanized Steel: 0.028 inch (0.71 mm) thick.
 - f. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch (0.71 mm) thick.
- 2. Overhead-Piping Safety Pans: Fabricate from the following materials:
 - a. Copper: 24 oz./sq. ft. (0.82 mm thick).
 - b. Stainless Steel: 0.025 inch (0.64 mm) thick.
 - c. Zinc-Tin Alloy-Coated Stainless Steel: 0.024 inch (0.61 mm) thick.
 - d. Zinc-Tin Alloy-Coated Copper: 24 oz./sq. ft. (0.82 mm thick).
 - e. Galvanized Steel: 0.040 inch (1.02 mm) thick.
 - f. Aluminum-Zinc Alloy-Coated Steel: 0.040 inch (1.02 mm) thick.

1.3 EXECUTION

A. Underlayment Installation

- 1. General: Install underlayment as indicated on Drawings.
- 2. Polyethylene Sheet: Install polyethylene sheet with adhesive for anchorage to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped and taped joints of not less than 2 inches (50 mm).
- 3. Felt Underlayment: Install felt underlayment with adhesive for temporary anchorage to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches (50 mm).
- 4. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not



less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps with roller. Cover underlayment within 14 days.

B. Installation, General

1. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - a. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 - b. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 - c. Space cleats not more than 12 inches (300 mm) apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
 - d. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
 - e. Install sealant tape where indicated.
 - f. Torch cutting of sheet metal flashing and trim is not permitted.
 - g. Do not use graphite pencils to mark metal surfaces.
2. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.
 - a. Coat back side of uncoated aluminum and stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
 - b. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene sheet.
3. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant concealed within joints.
4. Fastener Sizes: Use fasteners of sizes that will penetrate wood sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws **OR** metal decking not less than recommended by fastener manufacturer to achieve maximum pull-out resistance, **as directed**.
5. Seal joints as shown and as required for watertight construction.
 - a. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).
 - b. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants".
6. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches (38 mm), except reduce pre-tinning where pre-tinned surface would show in completed Work.
 - a. Do not solder metallic-coated steel and aluminum sheet.
 - b. Pre-tinning is not required for zinc-tin alloy-coated stainless steel and zinc-tin alloy-coated copper.
 - c. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.



- d. Stainless-Steel Soldering: Tin edges of uncoated sheets using solder recommended for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.
- e. Copper Soldering: Tin edges of uncoated copper sheets using solder for copper.
- 7. Rivets: Rivet joints in uncoated aluminum **OR** zinc, **as directed**, where indicated and where necessary for strength.

C. Roof Drainage System Installation

1. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.
2. Hanging Gutters: Join sections with riveted and soldered joints or with lapped joints sealed with sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchored gutter brackets **OR** straps **OR** twisted straps, **as directed**, spaced not more than 36 inches (900 mm) apart. Provide end closures and seal watertight with sealant. Slope to downspouts.
 - a. Fasten gutter spacers to front and back of gutter.
 - b. Loosely lock straps to front gutter bead and anchor to roof deck.
 - c. Anchor and loosely lock back edge of gutter to continuous cleat **OR** eave or apron flashing, **as directed**.
 - d. Anchor back of gutter that extends onto roof deck with cleats spaced not more than 24 inches (600 mm) apart.
 - e. Anchor gutter with spikes and ferrules spaced not more than 24 inches (600 mm) **OR** 30 inches (750 mm), **as directed**, apart.
 - f. Install gutter with expansion joints at locations indicated, but not exceeding, 50 feet (15.24 m) apart. Install expansion-joint caps.
 - g. Install continuous gutter screens on gutters with noncorrosive fasteners, removable **OR** hinged to swing open, **as directed**, for cleaning gutters.
3. Built-in Gutters: Join sections with riveted and soldered or lapped joints sealed with sealant. Provide for thermal expansion. Slope to downspouts. Provide end closures and seal watertight with sealant.
 - a. Install felt underlayment layer in built-in gutter trough and extend to drip edge at eaves and under felt underlayment on roof sheathing. Lap sides a minimum of 2 inches (50 mm) over underlying course. Lap ends a minimum of 4 inches (100 mm). Stagger end laps between succeeding courses at least 72 inches (1830 mm). Fasten with roofing nails. Install slip sheet over felt underlayment.
 - b. Anchor and loosely lock back edge of gutter to continuous cleat **OR** eave or apron flashing, **as directed**.
 - c. Anchor back of gutter that extends onto roof deck with cleats spaced not more than 24 inches (600 mm) apart.
 - d. Install gutter with expansion joints at locations indicated, but not exceeding, 50 feet (15.24 m) apart. Install expansion-joint caps.
4. Downspouts: Join sections with 1-1/2-inch (38-mm) telescoping joints.
 - a. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches (1500 mm) o.c. in between.
 - b. Provide elbows at base of downspout to direct water away from building.
 - c. Connect downspouts to underground drainage system indicated.
5. Splash Pans: Install where downspouts discharge on low-slope roofs. Set in asphalt roofing cement **OR** elastomeric sealant, **as directed**, compatible with roofing membrane.
6. Parapet Scuppers: Install scuppers where indicated through parapet. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
 - a. Anchor scupper closure trim flange to exterior wall and solder or seal with elastomeric sealant to scupper.
 - b. Loosely lock front edge of scupper with conductor head.



- c. Solder or seal with elastomeric sealant exterior wall scupper flanges into back of conductor head.
 7. Conductor Heads: Anchor securely to wall with elevation of conductor head rim 1 inch (25 mm) below scupper **OR** gutter, **as directed**, discharge.
 8. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated. Lap joints a minimum of 4 inches (100 mm) in direction of water flow.
- D. Roof Flashing Installation
1. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
 2. Roof Edge Flashing:
 - a. Anchor to resist uplift and outward forces according to recommendations in SMACNA's "Architectural Sheet Metal Manual" and as indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch (75-mm) centers.
OR
Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at 24-inch (600-mm) **OR** 16-inch (400-mm), **as directed**, centers.
 3. Copings: Anchor to resist uplift and outward forces according to recommendations in SMACNA's "Architectural Sheet Metal Manual" and as indicated.
 - a. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 24-inch (600-mm) **OR** 16-inch (400-mm), **as directed**, centers.
 - b. Anchor interior leg of coping with washers and screw fasteners through slotted holes at 24-inch (600-mm) centers.
 4. Copings: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.
 - a. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 24-inch (600-mm) **OR** 16-inch (400-mm), **as directed**, centers.
 - b. Anchor interior leg of coping with screw fasteners and washers at 24-inch (600-mm) **OR** 20-inch (500-mm), **as directed**, centers.
 5. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches (100 mm) over base flashing. Install stainless-steel draw band and tighten.
 6. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches (100 mm) over base flashing. Lap counterflashing joints a minimum of 4 inches (100 mm) and bed with sealant. Secure in a waterproof manner by means of snap-in installation and sealant or lead wedges and sealant **OR** interlocking folded seam or blind rivets and sealant **OR** anchor and washer at 36-inch (900-mm) centers, **as directed**.
 7. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric **OR** butyl, **as directed**, sealant and clamp flashing to pipes that penetrate roof.
- E. Wall Flashing Installation
1. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
 2. Through-Wall Flashing: Installation of through-wall flashing is specified in Division 04 Section(s) "Unit Masonry" **OR** "Stone Masonry", **as directed**.
 3. Reglets: Installation of reglets is specified in Division 03 Section(s) "Cast-in-place Concrete" **OR** Division 04 Section(s) "Unit Masonry", **as directed**.



4. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches (100 mm) beyond wall openings.

F. Miscellaneous Flashing Installation

1. Overhead-Piping Safety Pans: Suspend pans independent from structure above as indicated on Drawings. Pipe and install drain line to plumbing waste or drainage system.
2. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

G. Erection Tolerances

1. Installation Tolerances:
 - a. Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

OR

Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

H. Cleaning And Protection

1. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
2. Clean and neutralize flux materials. Clean off excess solder.
3. Clean off excess sealants.
4. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, remove unused materials and clean finished surfaces. Maintain in a clean condition during construction.
5. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 62 00 00



SECTION 07 63 00 00 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for common work results for fire suppression. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Piping materials and installation instructions common to most piping systems.
 - b. Mechanical sleeve seals.
 - c. Sleeves.
 - d. Escutcheons.
 - e. Grout.
 - f. Fire-suppression equipment and piping demolition.
 - g. Equipment installation requirements common to equipment sections.
 - h. Painting and finishing.
 - i. Concrete bases.
 - j. Supports and anchorages.

C. Definitions

1. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
2. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
3. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
4. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
5. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
6. The following are industry abbreviations for plastic materials:
 - a. CPVC: Chlorinated polyvinyl chloride plastic.
7. The following are industry abbreviations for rubber materials:
 - a. EPDM: Ethylene-propylene-diene terpolymer rubber.
 - b. NBR: Acrylonitrile-butadiene rubber.

D. Submittals

1. Welding certificates.

E. Quality Assurance

1. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
2. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - a. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - b. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.



3. Electrical Characteristics for Fire-Suppression Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

F. Delivery, Storage, And Handling

1. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
2. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.2 PRODUCTS

A. Pipe, Tube, And Fittings

1. Refer to individual Division 28 for pipe, tube, and fitting materials and joining methods.
2. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

B. Joining Materials

1. Refer to individual Division 28 for special joining materials not listed below.
2. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - a. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
 - 1) Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - 2) Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 - b. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
3. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
4. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
5. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
6. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
7. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
8. Solvent Cements for Joining CPVC Plastic Piping: ASTM F 493.

C. Mechanical Sleeve Seals

1. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - a. Sealing Elements: EPDM **OR** NBR, **as directed**, interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - b. Pressure Plates: Plastic **OR** Carbon steel **OR** Stainless steel, **as directed**. Include two for each sealing element.
 - c. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating **OR** Stainless steel, **as directed**, of length required to secure pressure plates to sealing elements. Include one for each sealing element.

D. Sleeves

1. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
2. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.



3. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
4. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - a. Underdeck Clamp: Clamping ring with set screws.
5. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.
6. PVC Pipe: ASTM D 1785, Schedule 40.
7. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

E. Escutcheons

1. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
2. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
3. One-Piece, Cast-Brass Type: With set screw.
 - a. Finish: Polished chrome-plated **OR** Rough brass **OR** Polished chrome-plated and rough brass, **as directed**.
4. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 - a. Finish: Polished chrome-plated **OR** Rough brass **OR** Polished chrome-plated and rough brass, **as directed**.
5. One-Piece, Stamped-Steel Type: With set screw **OR** spring clips, **as directed**, and chrome-plated finish.
6. Split-Plate, Stamped-Steel Type: With concealed **OR** exposed-rivet, **as directed**, hinge, set screw **OR** spring clips, **as directed**, and chrome-plated finish.
7. One-Piece, Floor-Plate Type: Cast-iron floor plate.
8. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

F. Grout

1. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - a. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - b. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
 - c. Packaging: Premixed and factory packaged.

1.3 EXECUTION

A. Fire-Suppression Demolition

1. Refer to Division 01 Section(s) "Cutting And Patching" AND Division 02 Section(s) "Selective Structure Demolition" for general demolition requirements and procedures.
2. Disconnect, demolish, and remove fire-suppression systems, equipment, and components indicated to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to the Owner.
3. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.



B. Piping Systems - Common Requirements

1. Install piping according to the following requirements and Division 28 specifying piping systems.
2. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
3. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
4. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
5. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
6. Install piping to permit valve servicing.
7. Install piping at indicated slopes.
8. Install piping free of sags and bends.
9. Install fittings for changes in direction and branch connections.
10. Install piping to allow application of insulation.
11. Select system components with pressure rating equal to or greater than system operating pressure.
12. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - a. New Piping:
 - 1) Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - 2) Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
 - 3) Insulated Piping: One-piece, stamped-steel type with spring clips.
 - 4) Bare Piping at Wall and Floor Penetrations in Finished Spaces:
 - a) One-piece, cast-brass type with polished chrome-plated finish.
OR
One-piece, stamped-steel type.
 - 5) Bare Piping at Ceiling Penetrations in Finished Spaces:
 - a) One-piece **OR** Split-casting, **as directed**, cast-brass type with polished chrome-plated finish.
OR
One-piece, stamped-steel type **OR** Split-plate, stamped-steel type with concealed hinge, **as directed**, and set screw.
 - 6) Bare Piping in Unfinished Service Spaces:
 - a) One-piece, cast-brass type with polished chrome-plated **OR** rough-brass, **as directed**, finish.
OR
One-piece, stamped-steel type with concealed **OR** exposed-rivet, **as directed**, hinge and set screw **OR** spring clips, **as directed**.
 - 7) Bare Piping in Equipment Rooms:
 - a) One-piece, cast-brass type.

One-piece, stamped-steel type with set screw **OR** spring clips, **as directed**.
 - 8) Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
 - b. Existing Piping: Use the following:
 - c. Chrome-Plated Piping: Split-casting, cast-brass type with chrome-plated finish.
 - d. Insulated Piping: Split-plate, stamped-steel type with concealed **OR** exposed-rivet, **as directed**, hinge and spring clips.
 - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces:
 - 1) Split-casting, cast-brass type with chrome-plated finish.
OR
Split-plate, stamped-steel type with concealed hinge and spring clips.



- f. Bare Piping at Ceiling Penetrations in Finished Spaces:
 - 1) Split-casting, cast-brass type with chrome-plated finish.
OR
Split-plate, stamped-steel type with concealed hinge and set screw.
 - g. Bare Piping in Unfinished Service Spaces:
 - 1) Split-casting, cast-brass type with polished chrome-plated **OR** rough-brass, **as directed**, finish.
OR
Split-plate, stamped-steel type with concealed **OR** exposed-rivet, **as directed**, hinge and set screw or spring clips.
 - h. Bare Piping in Equipment Rooms:
 - 1) Split-casting, cast-brass type.
OR
Split-plate, stamped-steel type with set screw or spring clips.
 - i. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.
13. Sleeves are not required for core-drilled holes.
14. Permanent sleeves are not required for holes formed by removable PE sleeves.
15. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
16. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
- a. Cut sleeves to length for mounting flush with both surfaces.
 - 1) Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 - b. Install sleeves in new walls and slabs as new walls and slabs are constructed.
 - c. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - 1) PVC **OR** Steel, **as directed**, Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
 - 2) Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.
 - 3) Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing And Trim" for flashing.
 - a) Seal space outside of sleeve fittings with grout.
 - d. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
17. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- a. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
 - b. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) and larger in diameter.
 - c. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
18. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- a. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.



19. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
20. Verify final equipment locations for roughing-in.
21. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

C. Piping Joint Construction

1. Join pipe and fittings according to the following requirements and Division 28 specifying piping systems.
2. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
3. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
4. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
5. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
6. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
7. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Para. 1.1 "Quality Assurance" Article.
8. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
9. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - b. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
10. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

D. Painting

1. Painting of fire-suppression systems, equipment, and components is specified in Division 09 Section(s) "Exterior Painting" AND "Interior Painting".
2. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

E. Concrete Bases

1. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 - a. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
 - b. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of the base.
 - c. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - d. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - e. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - f. Install anchor bolts according to anchor-bolt manufacturer's written instructions.



- g. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-place Concrete".

F. Erection Of Metal Supports And Anchorages

1. Refer to Division 05 Section "Metal Fabrications" for structural steel.
2. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor fire-suppression materials and equipment.
3. Field Welding: Comply with AWS D1.1.

G. Erection Of Wood Supports And Anchorages

1. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor fire-suppression materials and equipment.
2. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
3. Attach to substrates as required to support applied loads.

H. Grouting

1. Mix and install grout for fire-suppression equipment base bearing surfaces, pump and other equipment base plates, and anchors.
2. Clean surfaces that will come into contact with grout.
3. Provide forms as required for placement of grout.
4. Avoid air entrapment during placement of grout.
5. Place grout, completely filling equipment bases.
6. Place grout on concrete bases and provide smooth bearing surface for equipment.
7. Place grout around anchors.
8. Cure placed grout.

END OF SECTION 07 63 00 00



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**SECTION 07 63 00 00a - COMMON WORK RESULTS FOR PLUMBING**

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for common work results for plumbing. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Piping materials and installation instructions common to most piping systems.
 - b. Transition fittings.
 - c. Dielectric fittings.
 - d. Mechanical sleeve seals.
 - e. Sleeves.
 - f. Escutcheons.
 - g. Grout.
 - h. Plumbing demolition.
 - i. Equipment installation requirements common to equipment sections.
 - j. Painting and finishing.
 - k. Concrete bases.
 - l. Supports and anchorages.

C. Definitions

1. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
2. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
3. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
4. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
5. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
6. The following are industry abbreviations for plastic materials:
 - a. ABS: Acrylonitrile-butadiene-styrene plastic.
 - b. CPVC: Chlorinated polyvinyl chloride plastic.
 - c. PE: Polyethylene plastic.
 - d. PVC: Polyvinyl chloride plastic.
7. The following are industry abbreviations for rubber materials:
 - a. EPDM: Ethylene-propylene-diene terpolymer rubber.
 - b. NBR: Acrylonitrile-butadiene rubber.

D. Submittals

1. Welding certificates.

E. Quality Assurance

1. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."



2. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - a. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - b. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
3. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

F. Delivery, Storage, And Handling

1. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
2. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.2 PRODUCTS

A. Pipe, Tube, And Fittings

1. Refer to individual Division 14 for pipe, tube, and fitting materials and joining methods.
2. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

B. Joining Materials

1. Refer to individual Division 14 for special joining materials not listed below.
2. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - a. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
 - 1) Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - 2) Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 - b. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
3. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
4. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
5. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
6. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
7. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
8. Solvent Cements for Joining Plastic Piping:
 - a. ABS Piping: ASTM D 2235.
 - b. CPVC Piping: ASTM F 493.
 - c. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 - d. PVC to ABS Piping Transition: ASTM D 3138.
9. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

C. Transition Fittings

1. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
 - a. Underground Piping NPS 1-1/2 (DN 40) and Smaller: Manufactured fitting or coupling.



- b. Underground Piping NPS 2 (DN 50) and Larger: AWWA C219, metal sleeve-type coupling.
 - c. Aboveground Pressure Piping: Pipe fitting.
 2. Plastic-to-Metal Transition Fittings: CPVC **OR** PVC, **as directed**, one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
 3. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
 4. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC **OR** PVC, **as directed**, four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.
 5. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.
- D. Dielectric Fittings
1. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
 2. Insulating Material: Suitable for system fluid, pressure, and temperature.
 3. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).
 4. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.
 5. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
 - a. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig (1035- or 2070-kPa) minimum working pressure where required to suit system pressures.
 6. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).
 7. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).
- E. Mechanical Sleeve Seals
1. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - a. Sealing Elements: EPDM **OR** NBR, **as directed**, interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - b. Pressure Plates: Plastic **OR** Carbon steel **OR** Stainless steel, **as directed**. Include two for each sealing element.
 - c. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating **OR** Stainless steel, **as directed**, of length required to secure pressure plates to sealing elements. Include one for each sealing element.
- F. Sleeves
1. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
 2. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
 3. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
 4. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - a. Underdeck Clamp: Clamping ring with set screws.
 5. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.
 6. PVC Pipe: ASTM D 1785, Schedule 40.



7. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

G. Escutcheons

1. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
2. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
3. One-Piece, Cast-Brass Type: With set screw.
 - a. Finish: Polished chrome-plated **OR** Rough brass **OR** Polished chrome-plated and rough brass, **as directed**.
4. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 - a. Finish: Polished chrome-plated **OR** Rough brass **OR** Polished chrome-plated and rough brass, **as directed**.
5. One-Piece, Stamped-Steel Type: With set screw **OR** spring clips, **as directed**, and chrome-plated finish.
6. Split-Plate, Stamped-Steel Type: With concealed **OR** exposed-rivet, **as directed**, hinge, set screw **OR** spring clips, **as directed**, and chrome-plated finish.
7. One-Piece, Floor-Plate Type: Cast-iron floor plate.
8. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

H. Grout

1. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - a. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - b. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
 - c. Packaging: Premixed and factory packaged.

1.3 EXECUTION

A. Plumbing Demolition

1. Refer to Division 01 Section(s) "Cutting And Patching" AND Division 02 Section(s) "Selective Structure Demolition" for general demolition requirements and procedures.
2. Disconnect, demolish, and remove plumbing systems, equipment, and components indicated to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to the Owner.
3. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

B. Piping Systems - Common Requirements

1. Install piping according to the following requirements and Division 14 specifying piping systems.
2. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.



3. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
4. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
5. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
6. Install piping to permit valve servicing.
7. Install piping at indicated slopes.
8. Install piping free of sags and bends.
9. Install fittings for changes in direction and branch connections.
10. Install piping to allow application of insulation.
11. Select system components with pressure rating equal to or greater than system operating pressure.
12. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - a. New Piping:
 - 1) Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - 2) Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
 - 3) Insulated Piping: One-piece, stamped-steel type with spring clips.
 - 4) Bare Piping at Wall and Floor Penetrations in Finished Spaces:
 - a) One-piece, cast-brass type with polished chrome-plated finish.
OR
One-piece, stamped-steel type.
 - 5) Bare Piping at Ceiling Penetrations in Finished Spaces:
 - a) One-piece **OR** Split-casting, **as directed**, cast-brass type with polished chrome-plated finish.
OR
One-piece, stamped-steel type **OR** Split-plate, stamped-steel type with concealed hinge, **as directed**, and set screw.
 - 6) Bare Piping in Unfinished Service Spaces:
 - a) One-piece, cast-brass type with polished chrome-plated **OR** rough-brass, **as directed**, finish.
OR
One-piece, stamped-steel type with concealed **OR** exposed-rivet, **as directed**, hinge and set screw **OR** spring clips, **as directed**.
 - 7) Bare Piping in Equipment Rooms:
 - a) One-piece, cast-brass type.
OR
One-piece, stamped-steel type with set screw **OR** spring clips, **as directed**.
 - 8) Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
 - b. Existing Piping: Use the following:
 - 1) Chrome-Plated Piping: Split-casting, cast-brass type with chrome-plated finish.
 - 2) Insulated Piping: Split-plate, stamped-steel type with concealed **OR** exposed-rivet, **as directed**, hinge and spring clips.
 - 3) Bare Piping at Wall and Floor Penetrations in Finished Spaces:
 - a) Split-casting, cast-brass type with chrome-plated finish.
OR
Split-plate, stamped-steel type with concealed hinge and spring clips.
 - 4) Bare Piping at Ceiling Penetrations in Finished Spaces:
 - a) Split-casting, cast-brass type with chrome-plated finish.
OR
Split-plate, stamped-steel type with concealed hinge and set screw.
 - 5) Bare Piping in Unfinished Service Spaces:
 - a) Split-casting, cast-brass type with polished chrome-plated **OR** rough-brass, **as directed**, finish.
OR



- Split-plate, stamped-steel type with concealed **OR** exposed-rivet, **as directed**, hinge and set screw or spring clips.
- 6) Bare Piping in Equipment Rooms:
 - a) Split-casting, cast-brass type.
OR
Split-plate, stamped-steel type with set screw or spring clips.
 - 7) Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.
13. Sleeves are not required for core-drilled holes.
 14. Permanent sleeves are not required for holes formed by removable PE sleeves.
 15. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
 16. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
 - a. Cut sleeves to length for mounting flush with both surfaces.
 - 1) Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 - b. Install sleeves in new walls and slabs as new walls and slabs are constructed.
 - c. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - 1) PVC **OR** Steel, **as directed**, Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
 - 2) Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.
 - 3) Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing And Trim" for flashing.
 - a) Seal space outside of sleeve fittings with grout.
 - d. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
 17. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - a. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
 - b. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) and larger in diameter.
 - c. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
 18. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - a. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
 19. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
 20. Verify final equipment locations for roughing-in.
 21. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

**C. Piping Joint Construction**

1. Join pipe and fittings according to the following requirements and Division 14 specifying piping systems.
2. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
3. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
4. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
5. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
6. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
7. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Para. 1.1 "Quality Assurance" Article.
8. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
9. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - b. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
 - c. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - d. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 - e. PVC Nonpressure Piping: Join according to ASTM D 2855.
 - f. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.
10. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
11. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
12. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 - a. Plain-End Pipe and Fittings: Use butt fusion.
 - b. Plain-End Pipe and Socket Fittings: Use socket fusion.
13. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

D. Piping Connections

1. Make connections according to the following, unless otherwise indicated:
 - a. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - b. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
 - c. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
 - d. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

E. Equipment Installation - Common Requirements

1. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.



2. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
3. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
4. Install equipment to allow right of way for piping installed at required slope.

F. Painting

1. Painting of plumbing systems, equipment, and components is specified in Division 09 Section(s) "Exterior Painting" AND "Interior Painting".
2. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

G. Concrete Bases

1. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 - a. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
 - b. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of the base.
 - c. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - d. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - e. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - f. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 - g. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-place Concrete".

H. Erection Of Metal Supports And Anchorages

1. Refer to Division 05 Section "Metal Fabrications" for structural steel.
2. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.
3. Field Welding: Comply with AWS D1.1.

I. Erection Of Wood Supports And Anchorages

1. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment.
2. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
3. Attach to substrates as required to support applied loads.

J. Grouting

1. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.
2. Clean surfaces that will come into contact with grout.
3. Provide forms as required for placement of grout.
4. Avoid air entrapment during placement of grout.
5. Place grout, completely filling equipment bases.
6. Place grout on concrete bases and provide smooth bearing surface for equipment.
7. Place grout around anchors.
8. Cure placed grout.



END OF SECTION 07 63 00 00a



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SECTION 07 63 00 00b - COMMON WORK RESULTS FOR HVAC

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for common work results for HVAC. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Piping materials and installation instructions common to most piping systems.
 - b. Transition fittings.
 - c. Dielectric fittings.
 - d. Mechanical sleeve seals.
 - e. Sleeves.
 - f. Escutcheons.
 - g. Grout.
 - h. HVAC demolition.
 - i. Equipment installation requirements common to equipment sections.
 - j. Painting and finishing.
 - k. Concrete bases.
 - l. Supports and anchorages.

C. Definitions

1. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
2. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
3. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
4. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
5. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
6. The following are industry abbreviations for plastic materials:
 - a. CPVC: Chlorinated polyvinyl chloride plastic.
 - b. PE: Polyethylene plastic.
 - c. PVC: Polyvinyl chloride plastic.
7. The following are industry abbreviations for rubber materials:
 - a. EPDM: Ethylene-propylene-diene terpolymer rubber.
 - b. NBR: Acrylonitrile-butadiene rubber.

D. Submittals

1. Welding certificates.

E. Quality Assurance

1. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
2. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."



- a. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - b. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
3. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

F. Delivery, Storage, And Handling

1. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
2. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.2 PRODUCTS

A. Pipe, Tube, And Fittings

1. Refer to individual Division 21 for pipe, tube, and fitting materials and joining methods.
2. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

B. Joining Materials

1. Refer to individual Division 21 for special joining materials not listed below.
2. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - a. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
 - 1) Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - 2) Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 - b. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
3. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
4. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
5. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
6. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
7. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
8. Solvent Cements for Joining Plastic Piping:
 - a. CPVC Piping: ASTM F 493.
 - b. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
9. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

C. Transition Fittings

1. Plastic-to-Metal Transition Fittings: CPVC **OR** PVC, **as directed**, one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
2. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
3. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC **OR** PVC, **as directed**, four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.

**D. Dielectric Fittings**

1. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
2. Insulating Material: Suitable for system fluid, pressure, and temperature.
3. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).
4. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.
5. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
 - a. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig (1035- or 2070-kPa) minimum working pressure where required to suit system pressures.
6. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).
7. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

E. Mechanical Sleeve Seals

1. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - a. Sealing Elements: EPDM **OR** NBR, **as directed**, interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - b. Pressure Plates: Plastic **OR** Carbon steel **OR** Stainless steel, **as directed**. Include two for each sealing element.
 - c. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating **OR** Stainless steel, **as directed**, of length required to secure pressure plates to sealing elements. Include one for each sealing element.

F. Sleeves

1. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
2. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
3. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
4. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - a. Underdeck Clamp: Clamping ring with set screws.
5. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.
6. PVC Pipe: ASTM D 1785, Schedule 40.
7. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

G. Escutcheons

1. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
2. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
3. One-Piece, Cast-Brass Type: With set screw.
 - a. Finish: Polished chrome-plated **OR** Rough brass **OR** Polished chrome-plated and rough brass, **as directed**.
4. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 - a. Finish: Polished chrome-plated **OR** Rough brass **OR** Polished chrome-plated and rough brass, **as directed**.



5. One-Piece, Stamped-Steel Type: With set screw **OR** spring clips, **as directed**, and chrome-plated finish.
6. Split-Plate, Stamped-Steel Type: With concealed **OR** exposed-rivet, **as directed**, hinge, set screw **OR** spring clips, **as directed**, and chrome-plated finish.
7. One-Piece, Floor-Plate Type: Cast-iron floor plate.
8. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

H. Grout

1. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - a. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - b. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
 - c. Packaging: Premixed and factory packaged.

1.3 EXECUTION

A. HVAC Demolition

1. Refer to Division 01 Section(s) "Cutting And Patching" AND Division 02 Section(s) "Selective Structure Demolition" for general demolition requirements and procedures.
2. Disconnect, demolish, and remove HVAC systems, equipment, and components indicated to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 - c. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 - d. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
 - e. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - f. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - g. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to the Owner.
3. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

B. Piping Systems - Common Requirements

1. Install piping according to the following requirements and Division 21 specifying piping systems.
2. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
3. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
4. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
5. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
6. Install piping to permit valve servicing.
7. Install piping at indicated slopes.
8. Install piping free of sags and bends.
9. Install fittings for changes in direction and branch connections.



10. Install piping to allow application of insulation.
11. Select system components with pressure rating equal to or greater than system operating pressure.
12. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - a. New Piping:
 - 1) Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - 2) Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
 - 3) Insulated Piping: One-piece, stamped-steel type with spring clips.
 - 4) Bare Piping at Wall and Floor Penetrations in Finished Spaces:
 - a) One-piece, cast-brass type with polished chrome-plated finish.
OR
One-piece, stamped-steel type.
 - 5) Bare Piping at Ceiling Penetrations in Finished Spaces:
 - a) One-piece **OR** Split-casting, **as directed**, cast-brass type with polished chrome-plated finish.
OR
One-piece, stamped-steel type **OR** Split-plate, stamped-steel type with concealed hinge, **as directed**, and set screw.
 - 6) Bare Piping in Unfinished Service Spaces:
 - a) One-piece, cast-brass type with polished chrome-plated **OR** rough-brass, **as directed**, finish.
OR
One-piece, stamped-steel type with concealed **OR** exposed-rivet, **as directed**, hinge and set screw **OR** spring clips, **as directed**.
 - 7) Bare Piping in Equipment Rooms:
 - a) One-piece, cast-brass type.
OR
One-piece, stamped-steel type with set screw **OR** spring clips, **as directed**.
 - 8) Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
 - b. Existing Piping: Use the following:
 - 1) Chrome-Plated Piping: Split-casting, cast-brass type with chrome-plated finish.
 - 2) Insulated Piping: Split-plate, stamped-steel type with concealed **OR** exposed-rivet, **as directed**, hinge and spring clips.
 - 3) Bare Piping at Wall and Floor Penetrations in Finished Spaces:
 - a) Split-casting, cast-brass type with chrome-plated finish.
OR
Split-plate, stamped-steel type with concealed hinge and spring clips.
 - 4) Bare Piping at Ceiling Penetrations in Finished Spaces:
 - a) Split-casting, cast-brass type with chrome-plated finish.
OR
Split-plate, stamped-steel type with concealed hinge and set screw.
 - 5) Bare Piping in Unfinished Service Spaces:
 - a) Split-casting, cast-brass type with polished chrome-plated **OR** rough-brass, **as directed**, finish.
OR
Split-plate, stamped-steel type with concealed **OR** exposed-rivet, **as directed**, hinge and set screw or spring clips.
 - 6) Bare Piping in Equipment Rooms:
 - a) Split-casting, cast-brass type.
OR
Split-plate, stamped-steel type with set screw or spring clips.
 - 7) Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.
13. Sleeves are not required for core-drilled holes.
14. Permanent sleeves are not required for holes formed by removable PE sleeves.



15. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
16. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
 - a. Cut sleeves to length for mounting flush with both surfaces.
 - 1) Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 - b. Install sleeves in new walls and slabs as new walls and slabs are constructed.
 - c. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - 1) PVC **OR** Steel, **as directed**, Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
 - 2) Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.
 - 3) Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing And Trim" for flashing.
 - a) Seal space outside of sleeve fittings with grout.
 - d. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
17. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - a. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
 - b. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) and larger in diameter.
 - c. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
18. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - a. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
19. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
20. Verify final equipment locations for roughing-in.
21. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

C. Piping Joint Construction

1. Join pipe and fittings according to the following requirements and Division 21 specifying piping systems.
2. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
3. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
4. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
5. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.



6. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
 7. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Para. 1.1 "Quality Assurance" Article.
 8. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
 9. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - b. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - c. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 - d. PVC Nonpressure Piping: Join according to ASTM D 2855.
 10. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
 11. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
 12. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 - a. Plain-End Pipe and Fittings: Use butt fusion.
 - b. Plain-End Pipe and Socket Fittings: Use socket fusion.
 13. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.
- D. Piping Connections
1. Make connections according to the following, unless otherwise indicated:
 - a. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - b. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
 - c. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
 - d. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.
- E. Equipment Installation - Common Requirements
1. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
 2. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
 3. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
 4. Install equipment to allow right of way for piping installed at required slope.
- F. Painting
1. Painting of HVAC systems, equipment, and components is specified in Division 09 Section(s) "Exterior Painting" AND "Interior Painting".
 2. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.



G. Concrete Bases

1. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 - a. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
 - b. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of the base.
 - c. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - d. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - e. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - f. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 - g. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-place Concrete".

H. Erection Of Metal Supports And Anchorages

1. Refer to Division 05 Section "Metal Fabrications" for structural steel.
2. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.
3. Field Welding: Comply with AWS D1.1.

I. Erection Of Wood Supports And Anchorages

1. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor HVAC materials and equipment.
2. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
3. Attach to substrates as required to support applied loads.

J. Grouting

1. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.
2. Clean surfaces that will come into contact with grout.
3. Provide forms as required for placement of grout.
4. Avoid air entrapment during placement of grout.
5. Place grout, completely filling equipment bases.
6. Place grout on concrete bases and provide smooth bearing surface for equipment.
7. Place grout around anchors.
8. Cure placed grout.

END OF SECTION 07 63 00 00b



Task	Specification	Specification Description
07 63 00 00	07 62 00 00	Sheet Metal Flashing And Trim
07 65 16 00	07 51 13 00	Built-Up Asphalt Roofing
07 65 16 00	07 05 13 00	Built-Up Coal-Tar Roofing
07 65 16 00	07 53 16 00	EPDM Membrane Roofing
07 65 16 00	07 56 00 00	Coated Foamed Roofing
07 71 13 00	07 62 00 00	Sheet Metal Flashing And Trim



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**SECTION 07 71 23 00 - MANUFACTURED ROOF SPECIALTIES**

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for manufactured roof specialties. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Copings.
 - b. Roof-edge flashings.
 - c. Roof-edge drainage systems.
 - d. Reglets and counterflashings.

C. Performance Requirements

1. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
2. FM Approvals' Listing (if Project is FM Global insured or if FM Approvals' requirements set a minimum quality standard): Manufacture and install copings and roof-edge flashings that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-60 **OR** Class 1-75 **OR** Class 1-90 **OR** Class 1-105 **OR** Class 1-120, **as directed**. Identify materials with FM Approvals' markings.
3. SPRI Wind Design Standard (if Project is governed by the IBC or if SPRI ES-1 sets a minimum quality standard): Manufacture and install copings and roof-edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressures:
 - a. Design Pressure: As indicated on Drawings **OR** As directed.
4. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

D. Submittals

1. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Shop Drawings: For roof specialties. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work. Include the following:
 - a. Details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
 - b. Pattern of seams and layout of fasteners, cleats, clips, and other attachments.
 - c. Details of termination points and assemblies, including fixed points.
 - d. Details of special conditions.
3. Samples: For copings **OR** roof-edge flashings **OR** roof-edge drainage systems **OR** reglets and counterflashings, **as directed**, made from 12-inch (300-mm) lengths of full-size components including fasteners, cover joints, accessories, and attachments.
4. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for copings and roof-edge flashings.



5. Maintenance Data: For roofing specialties to include in maintenance manuals.
6. Warranty: Sample of special warranty.

E. Quality Assurance

1. Preinstallation Conference: Conduct conference at Project site.

F. Delivery, Storage, And Handling

1. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.
2. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof specialties installation.

G. Warranty

1. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - a. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
 - 1) Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - 2) Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - 3) Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - b. Finish Warranty Period: **20 OR 10, as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Exposed Metals

1. Copper Sheet: ASTM B 370, cold-rolled copper sheet, H00 or H01 temper.
 - a. Non-Patinated Exposed Finish: Mill.
 - b. Pre-Patinated Copper-Sheet Finish: Pre-patinated according to ASTM B 882.
2. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.
 - a. Surface: Smooth, flat **OR** Embossed, **as directed**, finish.
 - b. Mill Finish: As manufactured.
 - c. Exposed Coil-Coated Finishes: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1) Two-Coat Fluoropolymer: AAMA 620. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.
 - 2) Three-Coat Fluoropolymer: AAMA 620. System consisting of primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent PVDF resin by weight.
 - 3) Concealed Surface: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).
 - d. Clear Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
 - e. Color Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
3. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by manufacturer for type of use and finish indicated, finished as follows:
 - a. Exposed High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.



- 1) Two-Coat Fluoropolymer: AAMA 2604 **OR** AAMA 2605, **as directed**. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.
 - 2) Three-Coat Fluoropolymer: AAMA 2605. System consisting of primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent PVDF resin by weight.
 - b. Clear Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
 - c. Color Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
 4. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304.
 5. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation.
 - a. Surface: Smooth, flat **OR** Embossed, **as directed**, finish.
 - b. Mill-Phosphatized Finish: Manufacturer's standard for field painting.
 - c. Exposed Coil-Coated Finishes: Prepainted by the coil-coating process to comply with ASTM A 755/A 755M. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1) Two-Coat Fluoropolymer: AAMA 621. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.
 - 2) Three-Coat Fluoropolymer: AAMA 621. System consisting of primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent PVDF resin by weight.
- B. Concealed Metals
1. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy and temper recommended by manufacturer for type of use and structural performance indicated, mill finished.
 2. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by manufacturer for type of use and structural performance indicated, mill finished.
 3. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304.
 4. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation.
- C. Underlayment Materials
1. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
 2. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils (0.76 to 1.0 mm) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
 - a. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F (116 deg C).
 - b. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F (29 deg C).
 3. Polyethylene Sheet: 6-mil- (0.15-mm-) thick polyethylene sheet complying with ASTM D 4397.
 4. Slip Sheet: Building paper, 3-lb/100 sq. ft. (0.16-kg/sq. m) minimum, rosin sized.
- D. Miscellaneous Materials
1. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
 2. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:
 - a. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
 - b. Fasteners for Copper Sheet: Copper, hardware bronze, or passivated Series 300 stainless steel.
 - c. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.
 - d. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.



- e. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.
- 3. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane **OR** silicone, **as directed**, polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.
- 4. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- 5. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.
- 6. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.
- 7. Solder for Copper: ASTM B 32, lead-free solder **OR** Grade Sn50, 50 percent tin and 50 percent lead, **as directed**.

E. Copings

- 1. Copings: Manufactured coping system consisting of formed-metal coping cap in section lengths not exceeding 12 feet (3.6 m), concealed anchorage; corner units, end cap units, and concealed splice plates with same finish as coping caps.
 - a. Coping-Cap Material: Copper, 20 oz./sq. ft. (0.68 mm thick) **OR** weight (thickness) as required to meet performance requirements, **as directed**.
 - 1) Finish: Non-patinated, mill **OR** Pre-patinated dark brown **OR** Pre-patinated verdigris, **as directed**.

OR

Coping-Cap Material: Formed **OR** Extruded, **as directed**, aluminum, 0.040 inch (1.02 mm) thick **OR** 0.050 inch (1.27 mm) thick **OR** 0.063 inch (1.60 mm) thick **OR** 0.080 inch (2.03 mm) thick **OR** 0.125 inch (3.18 mm) thick **OR** thickness as required to meet performance requirements, **as directed**.

 - 1) Finish: Mill **OR** Two-coat fluoropolymer **OR** Three-coat fluoropolymer **OR** Clear anodic **OR** Color anodic, **as directed**.
 - 2) Color: Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black **OR** As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

OR

Coping-Cap Material: Zinc-coated steel, nominal 0.028-inch (0.71-mm) thickness **OR** 0.034-inch (0.86-mm) thickness **OR** thickness as required to meet performance requirements, **as directed**.

 - 1) Finish: Mill phosphatized for field painting **OR** Two-coat fluoropolymer **OR** Three-coat fluoropolymer, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
- b. Corners: Factory mitered and soldered **OR** continuously welded **OR** mechanically clinched and sealed watertight, **as directed**.
- c. Special Fabrications: Radiussed sections **OR** Arched sections **OR** Bullnose face leg **OR** Two-way sloped coping cap, **as directed**.
- d. Coping-Cap Attachment Method: Snap-on **OR** Face leg hooked to continuous cleat with back leg fastener exposed, **as directed**, fabricated from coping-cap material.
- e. Snap-on-Coping Anchor Plates: Concealed, galvanized-steel sheet, 12 inches (300 mm) wide, with integral cleats.

OR

Face Leg Cleats: Concealed, continuous galvanized-steel sheet **OR** stainless steel, **as directed**.

F. Roof-Edge Flashings

- 1. Canted Roof-Edge and Fascia **OR** Fascia and Gravel Stop, **as directed**: Manufactured, two-piece, roof-edge fascia consisting of snap-on **OR** compression-clamped, **as directed**, metal fascia cover in section lengths not exceeding 12 feet (3.6 m) and a continuous formed



- galvanized-steel sheet cant, 0.028 inch (0.71 mm) thick, minimum, with extended vertical leg terminating in a drip-edge cleat. Provide matching corner units.
- a. Fascia Cover: Fabricated from the following exposed metal:
 - 1) Formed Aluminum: 0.040 inch (1.02 mm) thick **OR** 0.050 inch (1.27 mm) thick **OR** 0.063 inch (1.60 mm) thick **OR** Thickness as required to meet performance requirements, **as directed**.
 - 2) Extruded Aluminum: 0.080 inch (2.03 mm) thick **OR** Thickness as required to meet performance requirements, **as directed**.
 - 3) Zinc-Coated Steel: Nominal 0.028-inch (0.71-mm) thickness **OR** 0.034-inch (0.86-mm) thickness **OR** thickness as required to meet performance requirements, **as directed**.
 - b. Corners: Factory mitered and soldered **OR** continuously welded **OR** mechanically clinched and sealed watertight, **as directed**.
 - c. Splice Plates: Concealed **OR** Exposed, **as directed**, of same material, finish, and shape as fascia cover.
 - d. Special Fabrications: Radiussed sections **OR** Arched sections **OR** Bullnose fascia cover **OR** Cornice fascia cover **OR** Cove fascia cover, **as directed**.
 - e. Fascia Accessories: Fascia extenders with continuous hold-down cleats **OR** Wall cap **OR** Soffit trim **OR** Overflow scuppers **OR** Overflow scuppers with perforated screens **OR** Spillout scuppers **OR** Downspout scuppers with integral conductor head and downspout adapters **OR** Downspout scuppers with integral conductor head and downspout adapters and perforated screens, **as directed**.
2. Roof-Edge Fascia: Manufactured, two-piece, roof-edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding 12 feet (3.6 m) and a continuous formed- or extruded-aluminum anchor bar with integral drip-edge cleat to engage fascia cover. Provide matching corner units.
 - a. Fascia Cover: Fabricated from the following exposed metal:
 - 1) Formed Aluminum: 0.032 inch (0.81 mm) thick **OR** 0.040 inch (1.02 mm) thick **OR** 0.050 inch (1.27 mm) thick **OR** 0.063 inch (1.60 mm) thick **OR** Thickness as required to meet performance requirements, **as directed**.
 - 2) Zinc-Coated Steel: Nominal 0.028 inch (0.71 mm) thick **OR** 0.034 inch (0.86 mm) thick **OR** thickness as required to meet performance requirements, **as directed**.
 - b. Corners: Factory mitered and soldered **OR** continuously welded **OR** mechanically clinched and sealed watertight, **as directed**.
 - c. Splice Plates: Concealed **OR** Exposed, **as directed**, of same material, finish, and shape as fascia cover.
 - d. Special Fabrications: Radiussed sections **OR** Arched sections **OR** Bullnose fascia cover **OR** Cornice fascia cover **OR** Cove fascia cover, **as directed**.
 - e. Fascia Accessories: Fascia extenders with continuous hold-down cleats **OR** Wall cap **OR** Soffit trim **OR** Overflow scuppers **OR** Overflow scuppers with perforated screens **OR** Spillout scuppers **OR** Downspout scuppers with integral conductor head and downspout adapters **OR** Downspout scuppers with integral conductor head and downspout adapters and perforated screens, **as directed**.
 3. One-Piece Gravel Stops: Manufactured, one-piece, metal gravel stop in section lengths not exceeding 12 feet (3.6 m), with a horizontal flange and vertical leg, drain-through, **as directed**, fascia terminating in a drip edge, **as directed**, and concealed splice plates of same material, finish, and shape as gravel stop. Provide matching corner units.
 - a. Fabricate from the following exposed metal:
 - 1) Copper: 16 oz./sq. ft. (0.55 mm thick) **OR** Weight (thickness) as required to meet performance requirements, **as directed**.
 - 2) Formed Aluminum: 0.032 inch (0.81 mm) thick **OR** 0.040 inch (1.02 mm) thick **OR** 0.050 inch (1.27 mm) thick **OR** Thickness as required to meet performance requirements, **as directed**.
 - 3) Extruded Aluminum: 0.080 inch (2.03 mm) thick **OR** Thickness as required to meet performance requirements, **as directed**.



- 4) Stainless Steel: 0.025 inch (0.64 mm) thick **OR** Thickness as required to meet performance requirements, **as directed**.
- 5) Zinc-Coated Steel: Nominal 0.028-inch (0.71-mm) thickness **OR** 0.034-inch (0.86-mm) thickness **OR** thickness as required to meet performance requirements, **as directed**.
- b. Corners: Factory mitered and soldered **OR** continuously welded **OR** mechanically clinched and sealed watertight, **as directed**.
- c. Accessories: Fascia extenders with continuous hold-down cleats **OR** Wall cap **OR** Soffit trim, **as directed**.
4. Copper Finish: Non-patinated, mill **OR** Pre-patinated dark brown **OR** Pre-patinated verdigris, **as directed**.
5. Aluminum Finish: Mill **OR** Two-coat fluoropolymer **OR** Three-coat fluoropolymer **OR** Clear anodic **OR** Color anodic, **as directed**.
 - a. Color: Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black **OR** As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
6. Stainless-Steel Finish: No. 2B (bright, cold rolled) **OR** No. 3 (coarse, polished directional satin) **OR** No. 4 (bright, polished directional satin), **as directed**.
7. Zinc-Coated Steel Finish: Mill phosphatized for field painting **OR** Two-coat fluoropolymer **OR** Three-coat fluoropolymer, **as directed**.
 - a. Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

G. Roof-Edge Drainage Systems

1. Gutters: Manufactured in uniform section lengths not exceeding 12 feet (3.6 m), with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1 inch (25 mm) above front edge. Furnish flat-stock gutter straps, gutter brackets, expansion joints, and expansion-joint covers fabricated from same metal as gutters.
 - a. Fabricate from the following exposed metal:
 - 1) Copper: 16 oz./sq. ft. (0.55 mm thick) **OR** 20 oz./sq. ft. (0.68 mm thick), **as directed**.
 - 2) Formed Aluminum: 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.050 inch (1.27 mm) **OR** 0.063 inch (1.60 mm), **as directed**, thick.
 - 3) Zinc-Coated Steel: Nominal 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, thickness.
 - b. Gutter Profile: Style A **OR** Style B **OR** Style F **OR** Style G **OR** Style H **OR** Style I **OR** Style K **OR** Style K highback **OR** Half-round single bead **OR** Half-round highback **OR** Quarter round **OR** Ogee **OR** As indicated, **as directed**, according to SMACNA's "Architectural Sheet Metal Manual."
 - c. Embossed Surface: Embossed with design as indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - d. Applied Fascia Cover (Concealed Gutter): Exposed, formed copper, 16 oz./sq. ft. (0.55 mm thick) **OR** aluminum, 0.040 inch (1.02 mm) thick, **as directed**, with factory-mitered corners, ends, and concealed splice joints.
 - e. Corners: Factory mitered and soldered **OR** continuously welded **OR** mechanically clinched and sealed watertight, **as directed**.
 - f. Gutter Supports: Gutter brackets **OR** Straps **OR** Spikes and ferrules **OR** Manufacturer's standard supports as selected by the Owner, **as directed**, with finish matching the gutters.
 - g. Special Fabrications: Radiussed sections.
 - h. Gutter Accessories: Continuous screened leaf guard with sheet metal frame **OR** Continuous hinged leaf guard of solid metal designed to shed leaves **OR** Continuous snap-in plastic leaf guard **OR** Bronze wire ball downspout strainer **OR** Wire ball downspout strainer **OR** Flat ends **OR** Bullnose ends for half-round gutter, **as directed**.
2. Downspouts: Plain round **OR** Corrugated round **OR** Plain rectangular **OR** Corrugated rectangular **OR** Open-face rectangular, **as directed**, complete with machine-crimped **OR** mitered **OR**



- smooth-curve, **as directed**, elbows, manufactured from the following exposed metal. Furnish with metal hangers, from same material as downspouts, and anchors.
- a. Copper: 16 oz./sq. ft. (0.55 mm thick).
 - b. Formed Aluminum: 0.032 inch (0.81 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.050 inch (1.27 mm) **OR** 0.063 inch (1.60 mm), **as directed**, thick.
 - c. Extruded Aluminum: 0.125 inch (3.18 mm) thick.
 - d. Zinc-Coated Steel: Nominal 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, thickness.
3. Parapet Scuppers: Manufactured with closure flange trim to exterior, 4-inch- (100-mm-) wide wall flanges to interior, and base extending 4 inches (100 mm) beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scuppers, **as directed**.
- a. Fabricate from the following exposed metal:
 - 1) Copper: 16 oz./sq. ft. (0.55 mm thick).
 - 2) Formed Aluminum: 0.032 inch (0.81 mm) thick.
 - 3) Stainless Steel: 0.019 inch (0.48 mm) thick.
 - 4) Zinc-Coated Steel: Nominal 0.028-inch (0.71-mm) thickness.
4. Conductor Heads: Manufactured conductor heads, each with flanged back and stiffened top edge and of dimensions and shape indicated, complete with outlet tube that nests into upper end of downspout, exterior flange trim, **as directed**, and built-in overflow, **as directed**.
- a. Fabricate from the following exposed metal:
 - 1) Copper: 16 oz./sq. ft. (0.55 mm thick).
 - 2) Formed Aluminum: 0.032 inch (0.81 mm) thick.
 - 3) Stainless Steel: 0.016 inch (0.40 mm) thick.
 - 4) Zinc-Coated Steel: Nominal 0.028-inch (0.71-mm) thickness.
5. Splash Pans: Fabricate from the following exposed metal:
- a. Copper: 16 oz./sq. ft. (0.55 mm thick).
 - b. Formed Aluminum: 0.040 inch (1.02 mm) thick.
 - c. Stainless Steel: 0.019 inch (0.48 mm) thick.
 - d. Zinc-Coated Steel: Nominal 0.028-inch (0.71-mm) thickness.
6. Copper Finish: Non-patinated, mill **OR** Pre-patinated dark brown **OR** Pre-patinated verdigris, **as directed**.
7. Aluminum Finish: Mill **OR** Two-coat fluoropolymer **OR** Three-coat fluoropolymer **OR** Clear anodic **OR** Color anodic, **as directed**.
- a. Color: Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black **OR** As indicated by manufacturer's designations **OR** As selected from manufacturer's full rang, **as directed**.
8. Stainless-Steel Finish: No. 2B (bright, cold rolled, unpolished) **OR** No. 3 (coarse, polished directional satin) **OR** No. 4 (bright, polished directional satin), **as directed**.
9. Zinc-Coated Steel Finish: Mill phosphatized for field painting **OR** Two-coat fluoropolymer **OR** Three-coat fluoropolymer, **as directed**.
- a. Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
- H. Reglets And Counterflashings
1. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces, from the following exposed metal:
 - a. Copper: 16 oz./sq. ft. (0.55 mm thick).
 - b. Formed Aluminum: 0.024 inch (0.61 mm) **OR** 0.050 inch (1.27 mm), **as directed**, thick.
 - c. Stainless Steel: 0.019 inch (0.48 mm) **OR** 0.025 inch (0.64 mm), **as directed**, thick.
 - d. Zinc-Coated Steel: Nominal 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm), **as directed**, thickness.
 - e. Corners: Factory mitered and soldered **OR** continuously welded **OR** mechanically clinched and sealed watertight, **as directed**.
 - f. Surface-Mounted Type: Provide reglets with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.



- g. Stucco Type, Embedded: Provide reglets with upturned fastening flange and extension leg of length to match thickness of applied finish materials.
 - h. Concrete Type, Embedded: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
 - i. Masonry Type, Embedded: Provide reglets with offset top flange for embedment in masonry mortar joint.
 - j. Multiuse Type, Embedded: For multiuse embedment in cast-in-place concrete **OR** masonry mortar joints, **as directed**.
2. Counterflashings: Manufactured units of heights to overlap top edges of base flashings by 4 inches (100 mm) and in lengths not exceeding 12 feet (3.6 m) designed to snap into reglets or through-wall-flashing receiver and compress against base flashings with joints lapped, from the following exposed metal:
 - a. Copper: 16 oz./sq. ft. (0.55 mm thick).
 - b. Formed Aluminum: 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm), **as directed**, thick.
 - c. Stainless Steel: 0.019 inch (0.48 mm) **OR** 0.025 inch (0.64 mm), **as directed**, thick.
 - d. Zinc-Coated Steel: Nominal 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm), **as directed**, thickness.
 3. Accessories:
 - a. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where reglet is provided separate from metal counterflashing.
 - b. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.
 4. Copper Finish: Non-patinated, mill **OR** Pre-patinated dark brown **OR** Pre-patinated verdigris, **as directed**.
 5. Aluminum Finish: Mill **OR** Two-coat fluoropolymer **OR** Three-coat fluoropolymer **OR** Clear anodic **OR** Color anodic, **as directed**.
 - a. Color: Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black **OR** As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 6. Stainless-Steel Finish: No. 2B (bright, cold rolled, unpolished) **OR** No. 3 (coarse, polished directional satin) **OR** No. 4 (bright, polished directional satin), **as directed**.
 7. Zinc-Coated Steel Finish: Mill phosphatized for field painting **OR** Two-coat fluoropolymer **OR** Three-coat fluoropolymer, **as directed**.
 - a. Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
- I. General Finish Requirements
1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 2. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
 3. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

1.3 EXECUTION

A. Examination

1. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
2. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.
3. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
4. Proceed with installation only after unsatisfactory conditions have been corrected.

**B. Underlayment Installation**

1. Felt Underlayment: Install with adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches (50 mm).
2. Self-Adhering Sheet Underlayment: Install wrinkle free. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply in shingle fashion to shed water. Overlap edges not less than 3-1/2 inches (90 mm). Roll laps with roller. Cover underlayment within 14 days.
3. Polyethylene Sheet: Install with adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties. Apply in shingle fashion to shed water, with lapped and taped joints of not less than 2 inches (50 mm).
4. Slip Sheet: Install with tape or adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches (50 mm).

C. Installation, General

1. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete roof-specialty systems.
 - a. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
 - b. Provide uniform, neat seams with minimum exposure of solder and sealant.
 - c. Install roof specialties to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
 - d. Torch cutting of roof specialties is not permitted.
 - e. Do not use graphite pencils to mark metal surfaces.
2. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
 - a. Coat concealed side of uncoated aluminum and stainless-steel roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 - b. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet **OR** self-adhering, high-temperature sheet underlayment **OR** polyethylene sheet, **as directed**.
 - c. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.
3. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.
 - a. Space movement joints at a maximum of 12 feet (3.6 m) with no joints within 18 inches (450 mm) of corners or intersections unless otherwise shown on Drawings.
 - b. When ambient temperature at time of installation is between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.
4. Fastener Sizes: Use fasteners of sizes that will penetrate wood blocking or sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws **OR** substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance, **as directed**.
5. Seal joints with elastomeric **OR** butyl, **as directed**, sealant as required by roofing-specialty manufacturer.
6. Seal joints as required for watertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F (4 deg C).
7. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches (38 mm) except reduce pre-tinning where pre-tinned surface would show in completed Work. Tin edges of uncoated copper sheets using solder for copper. Do not use torches for soldering. Heat surfaces to receive solder and flow



solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

D. Coping Installation

1. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.
2. Anchor copings to meet performance requirements.
 - a. Interlock face and back leg drip edges of snap-on coping cap into cleated anchor plates anchored to substrate at 30-inch (760-mm) centers **OR** 40-inch (1015-mm) centers **OR** manufacturer's required spacing that meets performance requirements, **as directed**.
 - b. Interlock face leg drip edge into continuous cleat anchored to substrate at 24-inch (600-mm) centers **OR** 16-inch (400-mm) centers **OR** manufacturer's required spacing that meets performance requirements, **as directed**. Anchor back leg of coping with screw fasteners and elastomeric washers at 24-inch (600-mm) centers **OR** 16-inch (400-mm) centers **OR** manufacturer's required spacing that meets performance requirements, **as directed**.

E. Roof-Edge Flashing Installation

1. Install cleats, cants, and other anchoring and attachment accessories and devices with concealed fasteners.
2. Anchor roof edgings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

F. Roof-Edge Drainage-System Installation

1. General: Install components to produce a complete roof-edge drainage system according to manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof-edge drainage system.
2. Gutters: Join and seal gutter lengths. Allow for thermal expansion. Attach gutters to firmly anchored gutter supports spaced not more than 12 inches (305 mm) **OR** 24 inches (610 mm) **OR** 30 inches (762 mm), **as directed**, apart. Attach ends with rivets and seal with sealant **OR** solder, **as directed**, to make watertight. Slope to downspouts.
 - a. Install gutter with expansion joints at locations indicated but not exceeding 50 feet (15.2 m) apart. Install expansion joint caps.
 - b. Install continuous leaf guards on gutters with noncorrosive fasteners, removable **OR** hinged to swing open, **as directed**, for cleaning gutters.
3. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1500 mm) o.c.
 - a. Provide elbows at base of downspout to direct water away from building.
OR
Connect downspouts to underground drainage system indicated.
4. Splash Pans: Install where downspouts discharge on low-slope roofs. Set in asphalt roofing cement **OR** elastomeric sealant, **as directed**.
5. Parapet Scuppers: Install scuppers through parapet where indicated. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
 - a. Anchor scupper closure trim flange to exterior wall and seal or solder to scupper.
 - b. Loosely lock front edge of scupper with conductor head.
 - c. Seal or solder exterior wall scupper flanges into back of conductor head.
6. Conductor Heads: Anchor securely to wall with elevation of conductor top edge 1 inch (25 mm) below scupper **OR** gutter, **as directed**, discharge.

G. Reglet And Counterflashing Installation

1. General: Coordinate installation of reglets and counterflashings with installation of base flashings.



2. Embedded Reglets: See Division 03 Section "Cast-in-place Concrete" and Division 04 Section "Unit Masonry" for installation of reglets.
 3. Surface-Mounted Reglets: Install reglets to receive flashings where flashing without embedded reglets is indicated on Drawings. Install at height so that inserted counterflashings overlap 4 inches (100 mm) over top edge of base flashings.
 4. Counterflashings: Insert counterflashings into reglets or other indicated receivers; ensure that counterflashings overlap 4 inches (100 mm) over top edge of base flashings. Lap counterflashing joints a minimum of 4 inches (100 mm) and bed with elastomeric **OR** butyl, **as directed**, sealant. Fit counterflashings tightly to base flashings.
- H. Cleaning And Protection
1. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
 2. Clean and neutralize flux materials. Clean off excess solder and sealants.
 3. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.
 4. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 07 71 23 00



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Task	Specification	Specification Description
07 71 23 00	01 22 16 00	No Specification Required
07 71 23 00	05 73 00 00	Miscellaneous Ornamental Metals
07 71 23 00	07 62 00 00	Sheet Metal Flashing And Trim
07 71 26 00	07 62 00 00	Sheet Metal Flashing And Trim



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**SECTION 07 72 13 00 - PACKAGED, OUTDOOR, CENTRAL-STATION AIR-HANDLING UNITS**

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for packaged, outdoor, central-station air-handling units. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes packaged, outdoor, central-station air-handling units (rooftop units) with the following components and accessories:
 - a. Direct-expansion cooling.
 - b. Heat-pump refrigeration components.
 - c. Hot-gas reheat.
 - d. Electric-heating coils.
 - e. Gas furnace.
 - f. Economizer outdoor- and return-air damper section.
 - g. Integral, space temperature controls.
 - h. Roof curbs.

C. Definitions

1. DDC: Direct-digital controls.
2. ECM: Electrically commutated motor.
3. Outdoor-Air Refrigerant Coil: Refrigerant coil in the outdoor-air stream to reject heat during cooling operations and to absorb heat during heating operations. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.
4. Outdoor-Air Refrigerant-Coil Fan: The outdoor-air refrigerant-coil fan in RTUs. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.
5. RTU: Rooftop unit. As used in this Section, this abbreviation means packaged, outdoor, central-station air-handling units. This abbreviation is used regardless of whether the unit is mounted on the roof or on a concrete base on ground.
6. Supply-Air Fan: The fan providing supply air to conditioned space. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.
7. Supply-Air Refrigerant Coil: Refrigerant coil in the supply-air stream to absorb heat (provide cooling) during cooling operations and to reject heat (provide heating) during heating operations. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.
8. VVT: Variable-air volume and temperature.

D. Performance Requirements

1. Delegated Design: Design RTU supports to comply with wind and seismic, **as directed**, performance requirements, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2. Wind-Restraint Performance:
 - a. Basic Wind Speed: **<Insert value>**.
 - b. Building Classification Category: **I OR II OR III OR IV, as directed**.
 - c. Minimum 10 lb/sq. ft (48.8 kg/sq. m) multiplied by the maximum area of the mechanical component projected on a vertical plane that is normal to the wind direction, and 45 degrees either side of normal.
3. Seismic Performance: RTUs shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.



- a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

E. Submittals

1. Product Data: Include manufacturer's technical data for each RTU, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.
2. LEED Submittals:
 - a. Product Data for Credit EA 4: Documentation required by Credit EA 4 indicating that equipment and refrigerants comply.
 - b. Product Data for Prerequisite EQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
3. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - a. Wiring Diagrams: Power, signal, and control wiring.
4. Delegated-Design Submittal: For RTU supports indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - a. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints, **as directed**, and for designing vibration isolation bases.
 - b. Detail mounting, securing, and flashing of roof curb to roof structure. Indicate coordinating requirements with roof membrane system.
 - c. Wind- and Seismic-Restraint Details, **as directed**: Detail fabrication and attachment of wind and seismic restraints and snubbers. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.
5. Manufacturer Wind Loading Qualification Certification: Submit certification that specified equipment will withstand wind forces identified in "Performance Requirements" Article and in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of wind force and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
6. Manufacturer Seismic Qualification Certification: Submit certification that RTUs, accessories, and components will withstand seismic forces defined in "Performance Requirements" Article and in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
7. Field quality-control test reports.
8. Operation and maintenance data.
9. Warranty: Special warranty specified in this Section.

F. Quality Assurance

1. ARI Compliance:
 - a. Comply with ARI 210/240 and ARI 340/360 for testing and rating energy efficiencies for RTUs.
 - b. Comply with ARI 270 for testing and rating sound performance for RTUs.
2. ASHRAE Compliance:
 - a. Comply with ASHRAE 15 for refrigeration system safety.
 - b. Comply with ASHRAE 33 for methods of testing cooling and heating coils.



- c. Comply with applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
3. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
4. NFPA Compliance: Comply with NFPA 90A and NFPA 90B.
5. UL Compliance: Comply with UL 1995.
6. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

G. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace components of RTUs that fail in materials or workmanship within specified warranty period.
 - a. Warranty Period for Compressors: Manufacturer's standard, but not less than five **OR 10, as directed**, years from date of Final Completion.
 - b. Warranty Period for Gas Furnace Heat Exchangers: Manufacturer's standard, but not less than five **OR 10 OR 15 OR 20, as directed**, years from date of Final Completion.
 - c. Warranty Period for Solid-State Ignition Modules: Manufacturer's standard, but not less than three years from date of Final Completion.
 - d. Warranty Period for Control Boards: Manufacturer's standard, but not less than three years from date of Final Completion.

1.2 PRODUCTS

A. Casing

1. General Fabrication Requirements for Casings: Formed and reinforced double-wall insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed.
2. Exterior Casing Material: Galvanized steel with factory-painted finish, with pitched roof panels and knockouts with grommet seals for electrical and piping connections and lifting lugs.
 - a. Exterior Casing Thickness: 0.052 inch (1.3 mm) **OR** 0.0626 inch (1.6 mm) **OR** 0.079 inch (2.0 mm), **as directed**, thick.
3. Inner Casing Fabrication Requirements:
 - a. Inside Casing: Galvanized steel, 0.034 inch (0.86 mm) **OR** 0.028 inch (0.7 mm), **as directed**, thick, perforated 40 percent free area, **as directed**.
4. Casing Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.
 - a. Materials: ASTM C 1071, Type I.
 - b. Thickness: 1/2 inch (13 mm) **OR** 1 inch (25 mm), **as directed**.
 - c. Liner materials shall have air-stream surface coated with an erosion- and temperature-resistant coating or faced with a plain or coated fibrous mat or fabric.
 - d. Liner Adhesive: Comply with ASTM C 916, Type I.
5. Condensate Drain Pans: Formed sections of galvanized-steel **OR** stainless-steel, **as directed**, sheet, a minimum of 2 inches (50 mm) deep, and complying with ASHRAE 62.1, **as directed**.
 - a. Double-Wall Construction: Fill space between walls with foam insulation and seal moisture tight.
 - b. Drain Connections: Threaded nipple both sides of drain pan, **as directed**.
 - c. Pan-Top Surface Coating: Corrosion-resistant compound for galvanized-steel drain pans.
6. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

B. Fans

1. Direct-Driven Supply-Air Fans: Double width, forward curved **OR** backward inclined, **as directed**, centrifugal; with permanently lubricated, multispeed **OR** ECM, **as directed**, motor resiliently mounted in the fan inlet. Aluminum or painted-steel wheels, and galvanized- or painted-steel fan scrolls.

**OR**

Belt-Driven Supply-Air Fans: Double width, forward curved, centrifugal; with permanently lubricated, single-speed motor installed on an adjustable fan base resiliently mounted in the casing. Aluminum or painted-steel wheels, and galvanized- or painted-steel fan scrolls.

2. Condenser-Coil Fan: Propeller, mounted on shaft of permanently lubricated motor.
3. Relief-Air Fan: Propeller **OR** Forward curved **OR** Backward inclined, **as directed**, shaft mounted on permanently lubricated motor.
4. Seismic Fabrication Requirements: Fabricate fan section, internal mounting frame and attachment to fans, fan housings, motors, casings, accessories, and other fan section components with reinforcement strong enough to withstand seismic forces defined in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment" when fan-mounted frame and RTU-mounted frame are anchored to building structure.
5. Fan Motor: Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".

C. Coils

1. Supply-Air Refrigerant Coil:
 - a. Aluminum-plate **OR** Copper-plate, **as directed**, fin and seamless internally grooved, **as directed**, copper tube in steel casing with equalizing-type vertical distributor.
 - b. Polymer strip shall prevent all copper coil from contacting steel coil frame or condensate pan.
 - c. Coil Split: Interlaced.
 - d. Baked phenolic **OR** Cathodic epoxy, **as directed**, coating.
 - e. Condensate Drain Pan: Galvanized steel with corrosion-resistant coating **OR** Stainless steel, **as directed**, formed with pitch and drain connections complying with ASHRAE 62.1, **as directed**.
2. Outdoor-Air Refrigerant Coil:
 - a. Aluminum-plate **OR** Copper-plate, **as directed**, fin and seamless internally grooved, **as directed**, copper tube in steel casing with equalizing-type vertical distributor.
 - b. Polymer strip shall prevent all copper coil from contacting steel coil frame or condensate pan.
 - c. Baked phenolic **OR** Cathodic epoxy, **as directed**, coating.
3. Hot-Gas Reheat Refrigerant Coil:
 - a. Aluminum-plate **OR** Copper-plate, **as directed**, fin and seamless internally grooved, **as directed**, copper tube in steel casing with equalizing-type vertical distributor.
 - b. Polymer strip shall prevent all copper coil from contacting steel coil frame or condensate pan.
 - c. Baked phenolic **OR** Cathodic epoxy, **as directed**, coating.
4. Electric-Resistance Heating:
 - a. Open Heating Elements: Resistance wire of 80 percent nickel and 20 percent chromium, supported and insulated by floating ceramic bushings recessed into casing openings, fastened to supporting brackets, and mounted in galvanized-steel frame. Terminate elements in stainless-steel machine-staked terminals secured with stainless-steel hardware.
 - b. Overtemperature Protection: Disk-type, automatically reset, thermal-cutout, safety device; serviceable through terminal box.
 - c. Overcurrent Protection: Manual-reset thermal cutouts, factory wired in each heater stage.
 - d. Control Panel: Unit mounted with disconnecting means and overcurrent protection. Include the following controls:
 - 1) Magnetic **OR** Mercury, **as directed**, contactors.
 - 2) Step Controller: Pilot lights and override toggle switch for each step.
 - 3) SCR Controller: Pilot lights operate on load ratio, a minimum of five steps.
 - 4) Time-delay relay.
 - 5) Airflow proving switch.

**D. Refrigerant Circuit Components**

1. Number of Refrigerant Circuits: One **OR** Two, **as directed**.
2. Compressor: Hermetic, reciprocating **OR** Semihermetic, reciprocating **OR** Hermetic, scroll, **as directed**, mounted on vibration isolators; with internal overcurrent and high-temperature protection, internal pressure relief, and crankcase heater, **as directed**.
3. Refrigeration Specialties:
 - a. Refrigerant: R-407C **OR** R-410A, **as directed**.
 - b. Expansion valve with replaceable thermostatic element.
 - c. Refrigerant filter/dryer.
 - d. Manual-reset high-pressure safety switch.
 - e. Automatic-reset low-pressure safety switch.
 - f. Minimum off-time relay.
 - g. Automatic-reset compressor motor thermal overload.
 - h. Brass service valves installed in compressor suction and liquid lines.
 - i. Low-ambient kit high-pressure sensor.
 - j. Hot-gas reheat solenoid valve with a replaceable magnetic coil.
 - k. Hot-gas bypass solenoid valve with a replaceable magnetic coil.
 - l. Four-way reversing valve with a replaceable magnetic coil, thermostatic expansion valves with bypass check valves, and a suction line accumulator.

E. Air Filtration

1. Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
 - a. Glass Fiber: Minimum 80 percent arrestance, and MERV 5.
 - b. Pleated: Minimum 90 percent arrestance, and MERV 7.

F. Gas Furnace

1. Description: Factory assembled, piped, and wired; complying with ANSI Z21.47 and NFPA 54.
 - a. CSA Approval: Designed and certified by and bearing label of CSA.
2. Burners: Stainless steel.
 - a. Fuel: Natural **OR** Propane, **as directed**, gas.
 - b. Ignition: Electronically controlled electric spark or hot-surface igniter with flame sensor.
 - c. High-Altitude Model **OR** Kit, **as directed**: For Project elevations more than 2000 feet (610 m) above sea level.
3. Heat-Exchanger and Drain Pan: Stainless steel.
4. Venting: Gravity vented with vertical extension, **as directed**.
OR
Power Vent: Integral, motorized centrifugal fan interlocked with gas valve with vertical extension, **as directed**.
5. Safety Controls:
 - a. Gas Control Valve: Single stage **OR** Two stage **OR** Modulating, **as directed**.
 - b. Gas Train: Single-body, regulated, redundant, 24-V ac gas valve assembly containing pilot solenoid valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff.

G. Dampers

1. Outdoor-Air Damper: Linked damper blades, for 0 to 25 percent outdoor air, with manual **OR** motorized, **as directed**, damper filter.
2. Outdoor- and Return-Air Mixing Dampers: Parallel- or opposed-blade galvanized-steel dampers mechanically fastened to cadmium plated for galvanized-steel operating rod in reinforced cabinet. Connect operating rods with common linkage and interconnect linkages so dampers operate simultaneously.
 - a. Damper Motor: Modulating with adjustable minimum position.
 - b. Relief-Air Damper: Gravity actuated or motorized, as required by ASHRAE/IESNA 90.1, with bird screen and hood.

H. Electrical Power Connection



1. Provide for single connection of power to unit with unit-mounted disconnect switch accessible from outside unit, **as directed**, and control-circuit transformer with built-in overcurrent protection.

I. Controls

1. Control equipment and sequence of operation are specified in Division 23 Section "Instrumentation And Control For Hvac".
2. Basic Unit Controls:
 - a. Control-voltage transformer.
 - b. Wall-mounted thermostat or sensor with the following features:
 - 1) Heat-cool-off switch.
 - 2) Fan on-auto switch.
 - 3) Fan-speed switch.
 - 4) Manual **OR** Automatic, **as directed**, changeover.
 - 5) Adjustable deadband.
 - 6) Concealed **OR** Exposed, **as directed**, set point.
 - 7) Concealed **OR** Exposed, **as directed**, indication.
 - 8) Degree F **OR** Degree C, **as directed**, indication.
 - 9) Unoccupied-period-override push button.
 - 10) Data entry and access port to input temperature and humidity, **as directed**, set points, occupied and unoccupied periods, and output room temperature and humidity, **as directed**, supply-air temperature, operating mode, and status.
 - c. Wall-mounted humidistat or sensor with the following features:
 - 1) Concealed **OR** Exposed, **as directed**, set point.
 - 2) Concealed **OR** Exposed, **as directed**, indication.
 - d. Remote Wall **OR** Unit, **as directed**, -Mounted Annunciator Panel for Each Unit:
 - 1) Lights to indicate power on, cooling, heating, fan running, filter dirty, and unit alarm or failure.
 - 2) DDC controller or programmable timer and interface with HVAC instrumentation and control system.
 - 3) Digital display of outdoor-air temperature, supply-air temperature, return-air temperature, economizer damper position, indoor-air quality, and control parameters.
3. Electronic **OR** DDC, **as directed**, Controller:
 - a. Controller shall have volatile-memory backup.
 - b. Safety Control Operation:
 - 1) Smoke Detectors: Stop fan and close outdoor-air damper if smoke is detected. Provide additional contacts for alarm interface to fire alarm control panel.
 - 2) Firestats: Stop fan and close outdoor-air damper if air greater than 130 deg F (54 deg C) enters unit. Provide additional contacts for alarm interface to fire alarm control panel.
 - 3) Fire Alarm Control Panel Interface: Provide control interface to coordinate with operating sequence described in Division 28 Section(s) "Digital, Addressable Fire-alarm System" OR "Zoned (dc Loop) Fire-alarm System", **as directed**.
 - 4) Low-Discharge Temperature: Stop fan and close outdoor-air damper if supply air temperature is less than 40 deg F (4 deg C).
 - 5) Defrost Control for Condenser Coil: Pressure differential switch to initiate defrost sequence.
 - c. Scheduled Operation: Occupied and unoccupied periods on seven-day **OR** 365-day, **as directed**, clock with a minimum of two **OR** four, **as directed**, programmable periods per day.
 - d. Unoccupied Period:
 - 1) Heating Setback: 10 deg F (5.6 deg C).
 - 2) Cooling Setback: System off.
 - 3) Override Operation: Two hours.
 - e. Supply Fan Operation:



- 1) Occupied Periods: Run fan continuously.
 - 2) Unoccupied Periods: Cycle fan to maintain setback temperature.
 - f. Refrigerant Circuit Operation:
 - 1) Occupied Periods: Cycle or stage compressors, and operate hot-gas bypass, **as directed**, to match compressor output to cooling load to maintain room **OR** discharge, **as directed**, temperature and humidity, **as directed**. Cycle condenser fans to maintain maximum hot-gas pressure. Operate low-ambient control kit to maintain minimum hot-gas pressure.
 - 2) Unoccupied Periods: Compressors off **OR** Cycle compressors and condenser fans for heating to maintain setback temperature, **as directed**.
 - 3) Switch reversing valve for heating or cooling mode on air-to-air heat pump.
 - g. Hot-Gas Reheat-Coil Operation:
 - 1) Occupied Periods: Humidistat opens hot-gas valve to provide hot-gas reheat, and cycles compressor.
 - 2) Unoccupied Periods: Reheat not required.
 - h. Gas Furnace Operation:
 - 1) Occupied Periods: Cycle **OR** Stage **OR** Modulate, **as directed**, burner to maintain room **OR** discharge, **as directed**, temperature.
 - 2) Unoccupied Periods: Cycle burner to maintain setback temperature.
 - i. Electric-Heating-Coil Operation:
 - 1) Occupied Periods: Cycle **OR** Stage **OR** Modulate, **as directed**, coil to maintain room **OR** discharge, **as directed**, temperature.
 - 2) Unoccupied Periods: Energize coil to maintain setback temperature.
 - 3) Operate supplemental electric heating coil with compressor for heating with outdoor temperature below 25 deg F (minus 4 deg C).
 - j. Fixed Minimum Outdoor-Air Damper Operation:
 - 1) Occupied Periods: Open to 25 percent.
 - 2) Unoccupied Periods: Close the outdoor-air damper.
 - k. Economizer Outdoor-Air Damper Operation:
 - 1) Occupied Periods: Open to 10 **OR** 25, **as directed**, percent fixed minimum intake, and maximum 100 percent of the fan capacity to comply with ASHRAE Cycle II. Controller shall permit air-side economizer operation when outdoor air is less than 60 deg F (15 deg C). Use outdoor-air temperature **OR** mixed-air and outdoor-air temperature **OR** outdoor-air enthalpy **OR** mixed-air temperature and select between outdoor-air and return-air enthalpy, **as directed**, to adjust mixing dampers. Start relief-air fan with end switch on outdoor-air damper, **as directed**. During economizer cycle operation, lock out cooling.
 - 2) Unoccupied Periods: Close outdoor-air damper and open return-air damper.
 - 3) Outdoor-Airflow Monitor: Accuracy maximum plus or minus 5 percent within 15 and 100 percent of total outdoor air. Monitor microprocessor shall adjust for temperature, and output shall range from 2- to 10-V dc **OR** 4 to 20 mA, **as directed**.
 - l. Carbon Dioxide Sensor Operation:
 - 1) Occupied Periods: Reset minimum outdoor-air ratio down to minimum 10 percent to maintain maximum 1000-ppm concentration.
 - 2) Unoccupied Periods: Close outdoor-air damper and open return-air damper.
 - m. VVT Relays:
 - 1) Provide heating- and cooling-mode changeover relays compatible with VVT terminal control system required in Division 23 Section(s) "Air Terminal Units" AND "Instrumentation And Control For Hvac".
4. Interface Requirements for HVAC Instrumentation and Control System:
- a. Interface relay for scheduled operation.
 - b. Interface relay to provide indication of fault at the central workstation and diagnostic code storage.
 - c. Provide BACnet **OR** LonWorks, **as directed**, compatible interface for central HVAC control workstation for the following:
 - 1) Adjusting set points.



- 2) Monitoring supply fan start, stop, and operation.
- 3) Inquiring data to include outdoor-air damper position, **as directed**, supply- and room-air temperature and humidity, **as directed**.
- 4) Monitoring occupied and unoccupied operations.
- 5) Monitoring constant and variable motor loads.
- 6) Monitoring variable-frequency drive operation.
- 7) Monitoring cooling load.
- 8) Monitoring economizer cycles.
- 9) Monitoring air-distribution static pressure and ventilation air volume.

J. Accessories

1. Electric heater with integral thermostat maintains minimum 50 deg F (10 deg C) temperature in gas burner compartment.
2. Duplex, 115-V, ground-fault-interrupter outlet with 15-A overcurrent protection. Include transformer if required. Outlet shall be energized even if the unit main disconnect is open, **as directed**.
3. Low-ambient kit using staged **OR** damper on **OR** variable-speed, **as directed**, condenser fans for operation down to 35 deg F (1.7 deg C).
4. Filter differential pressure switch with sensor tubing on either side of filter. Set for final filter pressure loss.
5. Coil guards of painted, galvanized-steel wire.
6. Hail guards of galvanized steel, painted to match casing.
7. Concentric diffuser with white louvers and polished aluminum return grilles, insulated diffuser box with mounting flanges, and interior transition.

K. Roof Curbs

1. Roof curbs with vibration isolators and wind or seismic restraints are specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
OR
Materials: Galvanized steel with corrosion-protection coating, watertight gaskets, and factory-installed wood nailer; complying with NRCA standards.
 - a. Curb Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.
 - 1) Materials: ASTM C 1071, Type I or II.
 - 2) Thickness: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**.
 - b. Application: Factory applied with adhesive and mechanical fasteners to the internal surface of curb.
 - 1) Liner Adhesive: Comply with ASTM C 916, Type I.
 - 2) Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.
 - 3) Liner materials applied in this location shall have air-stream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service air velocity.
 - 4) Liner Adhesive: Comply with ASTM C 916, Type I.
2. Curb Height: 14 inches (355 mm) **OR** 24 inches (610 mm) **OR** 36 inches (910 mm), **as directed**.
3. Wind and Seismic Restraints: Metal brackets compatible with the curb and casing, painted to match RTU, used to anchor unit to the curb, and designed for loads at Project site. Comply with requirements in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment" for wind-load requirements.

1.3 EXECUTION

A. Installation



1. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 - a. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger than supported equipment and minimum 6 inches (150 mm) above finished ground elevation.
 - b. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - c. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - d. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 - e. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-place Concrete".
 2. Equipment Mounting: Install RTUs on concrete base using elastomeric pads **OR** elastomeric mounts **OR** restrained spring isolators, **as directed**. Comply with requirements for concrete base specified in Division 03 Section "Cast-in-place Concrete".
 - a. Minimum Deflection: 1/4 inch (6 mm) **OR** 1 inch (25 mm), **as directed**.
OR
Roof Curb: Install on roof structure or concrete base, level and secure, according to NRCA's "Low-Slope Membrane Roofing Construction Details Manual," Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts" **OR** ARI Guideline B, **as directed**. Install RTUs on curbs and coordinate roof penetrations and flashing with roof construction specified in Division 07 Section "Roof Accessories". Secure RTUs to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts.
 3. Unit Support: Install unit level on structural curbs **OR** pilings, **as directed**. Coordinate wall penetrations and flashing with wall construction. Secure RTUs to structural support with anchor bolts.
 4. Install wind and seismic restraints according to manufacturer's written instructions. Wind and seismically restrained vibration isolation roof-curb rails are specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
- B. Connections
1. Install condensate drain, minimum connection size, with trap and indirect connection to nearest roof drain or area drain.
 2. Install piping adjacent to RTUs to allow service and maintenance.
 - a. Gas Piping: Comply with applicable requirements in Division 23 Section(s) "Facility Natural-gas Piping" **OR** "Facility Liquefied-petroleum Gas Piping", **as directed**. Connect gas piping to burner, full size of gas train inlet, and connect with union and shutoff valve with sufficient clearance for burner removal and service.
 3. Duct installation requirements are specified in other Division 21. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:
 - a. Install ducts to termination at top of roof curb.
 - b. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
 - c. Connect supply ducts to RTUs with flexible duct connectors specified in Division 23 Section "Air Duct Accessories".
 - d. Install return-air duct continuously through roof structure.
 - e. Install normal-weight, 3000-psi (20.7-MPa), compressive strength (28-day) concrete mix inside roof curb, 4 inches (100 mm) thick. Concrete, formwork, and reinforcement are specified in Division 31.
- C. Field Quality Control
1. Perform tests and inspections and prepare test reports.
 2. Tests and Inspections:
 - a. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
 - b. Inspect for and remove shipping bolts, blocks, and tie-down straps.



- c. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - d. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Remove and replace malfunctioning units and retest as specified above.

D. Startup Service

1. Engage a factory-authorized service representative to perform startup service.
2. Complete installation and startup checks according to manufacturer's written instructions and do the following:
 - a. Inspect for visible damage to unit casing.
 - b. Inspect for visible damage to furnace combustion chamber.
 - c. Inspect for visible damage to compressor, coils, and fans.
 - d. Inspect internal insulation.
 - e. Verify that labels are clearly visible.
 - f. Verify that clearances have been provided for servicing.
 - g. Verify that controls are connected and operable.
 - h. Verify that filters are installed.
 - i. Clean condenser coil and inspect for construction debris.
 - j. Clean furnace flue and inspect for construction debris.
 - k. Connect and purge gas line.
 - l. Remove packing from vibration isolators.
 - m. Inspect operation of barometric relief dampers.
 - n. Verify lubrication on fan and motor bearings.
 - o. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
 - p. Adjust fan belts to proper alignment and tension.
 - q. Start unit according to manufacturer's written instructions.
 - 1) Start refrigeration system.
 - 2) Do not operate below recommended low-ambient temperature.
 - 3) Complete startup sheets and attach copy with Contractor's startup report.
 - r. Inspect and record performance of interlocks and protective devices; verify sequences.
 - s. Operate unit for an initial period as recommended or required by manufacturer.
 - t. Perform the following operations for both minimum and maximum firing. Adjust burner for peak efficiency.
 - 1) Measure gas pressure on manifold.
 - 2) Inspect operation of power vents.
 - 3) Measure combustion-air temperature at inlet to combustion chamber.
 - 4) Measure flue-gas temperature at furnace discharge.
 - 5) Perform flue-gas analysis. Measure and record flue-gas carbon dioxide and oxygen concentration.
 - 6) Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.
 - u. Calibrate thermostats.
 - v. Adjust and inspect high-temperature limits.
 - w. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.
 - x. Start refrigeration system and measure and record the following when ambient is a minimum of 15 deg F (8 deg C) above return-air temperature:
 - 1) Coil leaving-air, dry- and wet-bulb temperatures.
 - 2) Coil entering-air, dry- and wet-bulb temperatures.
 - 3) Outdoor-air, dry-bulb temperature.
 - 4) Outdoor-air-coil, discharge-air, dry-bulb temperature.
 - y. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
 - z. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.



- 1) Supply-air volume.
 - 2) Return-air volume.
 - 3) Relief-air volume.
 - 4) Outdoor-air intake volume.
 - aa. Simulate maximum cooling demand and inspect the following:
 - 1) Compressor refrigerant suction and hot-gas pressures.
 - 2) Short circuiting of air through condenser coil or from condenser fans to outdoor-air intake.
 - bb. Verify operation of remote panel including pilot-light operation and failure modes. Inspect the following:
 - 1) High-temperature limit on gas-fired heat exchanger.
 - 2) Low-temperature safety operation.
 - 3) Filter high-pressure differential alarm.
 - 4) Economizer to minimum outdoor-air changeover.
 - 5) Relief-air fan operation.
 - 6) Smoke and firestat alarms.
 - cc. After startup and performance testing and prior to Final Completion, replace existing filters with new filters.
- E. Cleaning And Adjusting
1. Occupancy Adjustments: When requested within 12 months of date of Final Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site during other-than-normal occupancy hours for this purpose.
 2. After completing system installation and testing, adjusting, and balancing RTU and air-distribution systems, clean filter housings and install new filters.
- F. Demonstration
- G. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain RTUs.

END OF SECTION 07 72 13 00



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**SECTION 07 72 13 00a - INTAKE AND RELIEF VENTILATORS**

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for intake and relief ventilators. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Louvered-penthouse ventilators.
 - b. Roof hoods.
 - c. Goosenecks.

C. Performance Requirements

1. Delegated Design: Design ventilators, including comprehensive engineering analysis by a qualified professional engineer, using structural and seismic performance requirements and design criteria indicated.
2. Structural Performance: Ventilators shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of ventilator components, noise or metal fatigue caused by ventilator blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
 - a. Wind Loads: Determine loads based on pressures as indicated on Drawings.
OR
Wind Loads: Determine loads based on a uniform pressure of 20 lbf/sq. ft. (960 Pa) **OR** 30 lbf/sq. ft. (1440 Pa), **as directed**, acting inward or outward.
OR
Wind Loads: Determine loads based on pressures indicated below:
 - 1) Corner Zone: Within **<Insert distance>** of building corners, uniform pressure of **<Insert design wind pressure>**, acting inward, and **<Insert design wind pressure>**, acting outward.
 - 2) Other Than Corner Zone: Uniform pressure of **<Insert design wind pressure>**, acting inward, and **<Insert design wind pressure>**, acting outward.
3. Seismic Performance: Ventilators, including attachments to other construction, shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
4. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes, without buckling, opening of joints, overstressing of components, failure of connections, or other detrimental effects.
 - a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
5. Water Entrainment: Limit water penetration through unit to comply with ASHRAE 62.1.

D. Submittals

1. Product Data: For each type of product indicated. For louvered-penthouse ventilators specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
2. LEED Submittal:



- a. Product Data for Prerequisite EQ 1: Documentation indicating that units comply with ASHRAE 62., Section 5 - "Systems and Equipment."
3. Shop Drawings: For gravity ventilators. Include plans, elevations, sections, details, ventilator attachments to curbs, and curb attachments to roof structure.
 - a. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.
4. Samples: For each exposed product and for each color and texture specified.
5. Delegated-Design Submittal: For shop-fabricated ventilators indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - a. Detail fabrication and assembly of shop-fabricated ventilators.
6. Coordination Drawings: Roof framing plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - a. Structural members to which roof curbs and ventilators will be attached.
 - b. Sizes and locations of roof openings.
7. Seismic Qualification Certificates: For ventilators, accessories, and components, from manufacturer.
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
8. Welding certificates.

E. Quality Assurance

1. Welding Qualifications: Qualify procedures and personnel according to the following:
 - a. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 - b. AWS D1.3, "Structural Welding Code - Sheet Steel."

F. Coordination

1. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.2 PRODUCTS

A. Materials

1. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T5 or T-52.
2. Aluminum Sheet: ASTM B 209 (ASTM B 209M), Alloy 3003 or 5005 with temper as required for forming or as otherwise recommended by metal producer for required finish.
3. Galvanized-Steel Sheet: ASTM A 653/A 653M, G90 (Z275) zinc coating, mill phosphatized.
4. Stainless-Steel Sheet: ASTM A 666, Type 304, with No. 4 **OR** 6, **as directed**, finish.
5. Fasteners: Same basic metal and alloy as fastened metal or 300 Series stainless steel unless otherwise indicated. Do not use metals that are incompatible with joined materials.
 - a. Use types and sizes to suit unit installation conditions.
 - b. Use Phillips flat **OR** hex-head or Phillips pan, **as directed**, -head screws for exposed fasteners unless otherwise indicated.
6. Post-Installed Fasteners for Concrete and Masonry: Torque-controlled expansion anchors made from stainless-steel components, with capability to sustain without failure a load equal to 4 times the loads imposed for concrete, or 6 times the load imposed for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
7. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

**B. Fabrication, General**

1. Factory or shop fabricate gravity ventilators to minimize field splicing and assembly. Disassemble units to the minimum extent as necessary for shipping and handling. Clearly mark units for reassembly and coordinated installation.
2. Fabricate frames, including integral bases, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
3. Fabricate units with closely fitted joints and exposed connections accurately located and secured.
4. Fabricate supports, anchorages, and accessories required for complete assembly.
5. Perform shop welding by AWS-certified procedures and personnel.

C. Louvered-Penthouse Ventilators

1. Construction: All-welded assembly with 4-inch (100-mm) **OR** 6-inch (150-mm), **as directed**, -deep louvers, mitered corners, and aluminum **OR** galvanized-steel **OR** stainless-steel, **as directed**, sheet roof with mineral-fiber insulation and vapor barrier, **as directed**.
2. Frame and Blade Material and Nominal Thickness: Extruded aluminum, of thickness required to comply with structural performance requirements, but not less than 0.080 inch (2.0 mm) for frames and 0.080 inch (2.0 mm) **OR** 0.060 inch (1.5 mm), **as directed**, for blades with condensate deflectors, **as directed**.
 - a. AMCA Seal: Mark units with the AMCA Certified Ratings Seal.
 - b. Exterior Corners: Prefabricated corner units with mitered and welded blades **OR** mitered blades with concealed close-fitting splices, **as directed**, and with fully recessed **OR** semirecessed, **as directed**, mullions at corners.
3. Frame and Blade Material and Nominal Thickness: Galvanized-steel sheet, of thickness required to comply with structural performance requirements, but not less than 0.052 inch (1.3 mm) for frames and 0.040 inch (1.0 mm) **OR** 0.052 inch (1.3 mm) **OR** 0.064 inch (1.6 mm), **as directed**, for blades with condensate deflectors, **as directed**.
 - a. AMCA Seal: Mark units with the AMCA Certified Ratings Seal.
 - b. Exterior Corners: Prefabricated corner units with mitered and welded blades **OR** mitered blades with concealed close-fitting splices, **as directed**, and with fully recessed **OR** semirecessed, **as directed**, mullions at corners.
4. Frame and Blade Material and Nominal Thickness: Stainless-steel sheet, of thickness required to comply with structural performance requirements, but not less than 0.050 inch (1.27 mm) **OR** 0.062 inch (1.57 mm), **as directed**, with grain running parallel **OR** perpendicular, **as directed**, to length of blades and frame members with condensate deflectors, **as directed**.
 - a. AMCA Seal: Mark units with the AMCA Certified Ratings Seal.
 - b. Exterior Corners: Prefabricated corner units with mitered and welded blades **OR** mitered blades with concealed close-fitting splices, **as directed**, and with fully recessed **OR** semirecessed, **as directed**, mullions at corners.
5. Roof Curbs: Galvanized-steel sheet; with mitered and welded corners; 1-1/2-inch- (40-mm-) thick, rigid fiberglass insulation adhered to inside walls; and 1-1/2-inch (40-mm) wood nailer. Size as required to fit roof opening and ventilator base.
 - a. Configuration: Self-flashing without a cant strip, with **OR** Built-in cant and **OR** Built-in raised cant and, **as directed**, mounting flange.
 - b. Overall Height: 8 inches (200 mm) **OR** 9-1/2 inches (240 mm) **OR** 12 inches (300 mm) **OR** 16 inches (400 mm) **OR** 18 inches (450 mm), **as directed**.
6. Bird Screening: Galvanized-steel, 1/2-inch- (12.7-mm-) square mesh, 0.041-inch (1.04-mm) wire **OR** Aluminum, 1/2-inch- (12.7-mm-) square mesh, 0.063-inch (1.6-mm) wire **OR** Flattened, expanded aluminum, 3/4 by 0.050 inch (19 by 1.27 mm) thick **OR** Stainless-steel, 1/2-inch- (12.7-mm-) square mesh, 0.047-inch (1.19-mm) wire, **as directed**.
OR
Insect Screening: Aluminum, 18-by-16 (1.4-by-1.6-mm) mesh, 0.012-inch (0.30-mm) **OR** Stainless-steel, 18-by-18 (1.4-by-1.4-mm) mesh, 0.009-inch (0.23-mm), **as directed**, wire.
7. Galvanized-Steel Sheet Finish:
 - a. Surface Preparation: Clean surfaces of dirt, grease, and other contaminants. Clean welds, mechanical connections, and abraded areas and repair galvanizing according to



ASTM A 780. Apply a conversion coating suited to the organic coating to be applied over it.

- b. Factory Priming for Field-Painted Finish: Where field painting after installation is indicated, apply an air-dried primer immediately after cleaning and pretreating.
- c. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil (0.025 mm) for topcoat and an overall minimum dry film thickness of 2 mils (0.05 mm).
 - 1) Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

8. Accessories:

a. Dampers:

- 1) Location: Penthouse neck **OR** Inside louver face, **as directed**.
- 2) Control: Manual **OR** Motorized, **as directed**.

D. Roof Hoods

- 1. Factory or shop fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figures 5-6 and 5-7.
- 2. Materials: Galvanized-steel sheet, minimum 0.064-inch- (1.62-mm-) thick base and 0.040-inch- (1.0-mm-) thick hood **OR** Aluminum sheet, minimum 0.063-inch- (1.6-mm-) thick base and 0.050-inch- (1.27-mm-) thick hood, **as directed**; suitably reinforced.
- 3. Roof Curbs: Galvanized-steel sheet; with mitered and welded corners; 1-1/2-inch- (40-mm-) thick, rigid fiberglass insulation adhered to inside walls; and 1-1/2-inch (40-mm) wood nailer. Size as required to fit roof opening and ventilator base.
 - a. Configuration: Self-flashing without a cant strip, with **OR** Built-in cant and **OR** Built-in raised cant and, **as directed**, mounting flange.
 - b. Overall Height: 8 inches (200 mm) **OR** 9-1/2 inches (240 mm) **OR** 12 inches (300 mm) **OR** 16 inches (400 mm) **OR** 18 inches (450 mm), **as directed**.
- 4. Bird Screening: Galvanized-steel, 1/2-inch- (12.7-mm-) square mesh, 0.041-inch (1.04-mm) wire **OR** Aluminum, 1/2-inch- (12.7-mm-) square mesh, 0.063-inch (1.6-mm) wire **OR** Flattened, expanded aluminum, 3/4 by 0.050 inch (19 by 1.27 mm) thick **OR** Stainless-steel, 1/2-inch- (12.7-mm-) square mesh, 0.047-inch (1.19-mm) wire, **as directed**.
OR
Insect Screening: Aluminum, 18-by-16 (1.4-by-1.6-mm) mesh, 0.012-inch (0.30-mm) **OR** Stainless-steel, 18-by-18 (1.4-by-1.4-mm) mesh, 0.009-inch (0.23-mm), **as directed**, wire.
- 5. Galvanized-Steel Sheet Finish:
 - a. Surface Preparation: Clean surfaces of dirt, grease, and other contaminants. Clean welds, mechanical connections, and abraded areas and repair galvanizing according to ASTM A 780. Apply a conversion coating suited to the organic coating to be applied over it.
 - b. Factory Priming for Field-Painted Finish: Where field painting after installation is indicated, apply an air-dried primer immediately after cleaning and pretreating.
 - c. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil (0.025 mm) for topcoat and an overall minimum dry film thickness of 2 mils (0.05 mm).
 - 1) Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

E. Goosenecks

- 1. Factory or shop fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 5-5; with a minimum of 0.052-inch- (1.3-mm-) thick, galvanized-steel sheet.
- 2. Roof Curbs: Galvanized-steel sheet; with mitered and welded corners; 1-1/2-inch- (40-mm-) thick, rigid fiberglass insulation adhered to inside walls; and 1-1/2-inch (40-mm) wood nailer. Size as required to fit roof opening and ventilator base.



- a. Configuration: Self-flashing without a cant strip, with **OR** Built-in cant and **OR** Built-in raised cant and, **as directed**, mounting flange.
- b. Overall Height: 8 inches (200 mm) **OR** 9-1/2 inches (240 mm) **OR** 12 inches (300 mm) **OR** 16 inches (400 mm) **OR** 18 inches (450 mm), **as directed**.
3. Bird Screening: Galvanized-steel, 1/2-inch- (12.7-mm-) square mesh, 0.041-inch (1.04-mm) wire **OR** Aluminum, 1/2-inch- (12.7-mm-) square mesh, 0.063-inch (1.6-mm) wire **OR** Flattened, expanded aluminum, 3/4 by 0.050 inch (19 by 1.27 mm) thick **OR** Stainless-steel, 1/2-inch- (12.7-mm-) square mesh, 0.047-inch (1.19-mm) wire, **as directed**.
OR
Insect Screening: Aluminum, 18-by-16 (1.4-by-1.6-mm) mesh, 0.012-inch (0.30-mm) **OR** Stainless-steel, 18-by-18 (1.4-by-1.4-mm) mesh, 0.009-inch (0.23-mm), **as directed**, wire.
4. Galvanized-Steel Sheet Finish:
 - a. Surface Preparation: Clean surfaces of dirt, grease, and other contaminants. Clean welds, mechanical connections, and abraded areas and repair galvanizing according to ASTM A 780. Apply a conversion coating suited to the organic coating to be applied over it.
 - b. Factory Priming for Field-Painted Finish: Where field painting after installation is indicated, apply an air-dried primer immediately after cleaning and pretreating.
 - c. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil (0.025 mm) for topcoat and an overall minimum dry film thickness of 2 mils (0.05 mm).
 - 1) Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

1.3 EXECUTION

A. Installation

1. Install gravity ventilators level, plumb, and at indicated alignment with adjacent work.
2. Install goosenecks on curb base where throat size exceeds 9 by 9 inches (230 by 230 mm).
3. Install gravity ventilators with clearances for service and maintenance.
4. Install perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
5. Install concealed gaskets, flashings, joint fillers, and insulation as installation progresses. Comply with Division 07 Section "Joint Sealants" for sealants applied during installation.
6. Label gravity ventilators according to requirements specified in Division 23 Section "Identification For Hvac Piping And Equipment".
7. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.
8. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

B. Connections

1. Duct installation and connection requirements are specified in other Division 21. Drawings indicate general arrangement of ducts and duct accessories.

C. Adjusting

1. Adjust damper linkages for proper damper operation.

END OF SECTION 07 72 13 00a



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Task	Specification	Specification Description
07 72 13 00	01 95 26 00	Power Ventilators



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SECTION 07 72 23 00 - ROOF ACCESSORIES

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for roof accessories. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Roof curbs.
 - b. Equipment supports.
 - c. Roof hatches.
 - d. Dropout-type heat and smoke vents.
 - e. Hatch-type heat and smoke vents.
 - f. Gravity ventilators.
 - g. Roof supports.
 - h. Roof walkways.
 - i. Preformed flashings.

C. Submittals

1. Product Data: For each type of roof accessory indicated.
2. Shop Drawings: Show fabrication and installation details for roof accessories.
3. Samples: For each type of exposed factory-applied color finish required and for each type of roof accessory indicated, prepared on Samples of size to adequately show color.

D. Quality Assurance

1. Sheet Metal Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.

E. Delivery, Storage, And Handling

1. Pack, handle, and ship roof accessories properly labeled in heavy-duty packaging to prevent damage.

F. Warranty

1. Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace roof accessories that show evidence of deterioration of factory-applied finishes within 20 years from date of Final Completion.

1.2 PRODUCTS

A. Metal Materials

1. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coated and mill phosphatized for field painting.
2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, AZ50 (AZM150) coated.
3. Prepainted, Metallic-Coated Steel Sheet: Steel sheet metallic coated by hot-dip process and prepainted by coil-coating process to comply with ASTM A 755/A 755M.
 - a. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coated.
 - b. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 (Class AZM150) coated.



- c. Exposed Finishes: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight.
4. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy and temper recommended by manufacturer for type of use and mill finish. Coil-coat finish as follows:
 - a. Factory-Prime Coating: Where painting after installation is indicated, provide pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat; with a minimum dry film thickness of 0.2 mil (0.005 mm).
 - b. Clear **OR** Color, **as directed**, Anodic Finish: Architectural Class II, complying with AAMA 611.
 - 1) Color: Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black **OR** Champagne, **as directed**.
 - c. Baked-Enamel Finish: Organic Coating: Thermosetting, modified-acrylic enamel primer/topcoat system complying with AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm), medium gloss.
 - 1) Color and Gloss: As selected from manufacturer's full range.
 - d. High-Performance Organic Finish: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight.
 - 1) Color and Gloss: As selected from manufacturer's full range.
 - e. Powder-Coat Finish: Immediately after cleaning and pretreating, electrostatically apply manufacturer's standard baked-polymer thermosetting powder finish.
 - 1) Color and Gloss: As selected from manufacturer's full range.
5. Stainless-Steel Shapes or Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304 or Type 316, No. 2D finish.
6. Aluminum Extrusions and Tubes: ASTM B 221 (ASTM B 221M), alloy and temper recommended by manufacturer for type of use, mill finished.
7. Steel Shapes: ASTM A 36/A 36M, hot-dip galvanized to comply with ASTM A 123/A 123M, unless otherwise indicated.
8. Steel Tube: ASTM A 500, round tube, baked-enamel finished.
9. Galvanized Steel Tube: ASTM A 500, round tube, hot-dip galvanized to comply with ASTM A 123/A 123M.
10. Galvanized Steel Pipe: ASTM A 53/A 53M.

B. Miscellaneous Materials

1. Acrylic Glazing: ASTM D 4802, thermoformable, monolithic sheet, category as standard with manufacturer, Type UVA (formulated with UV absorber), Finish 1 (smooth or polished).
2. Polycarbonate Glazing: Thermoformable, monolithic polycarbonate sheets manufactured by extrusion process, burglar-resistance rated per UL 972 with an average impact strength of 12 to 16 ft-lbf/in. (640 to 854 J/m) of width when tested according to ASTM D 256, Method A (Izod).
3. Cellulosic-Fiber Board Insulation: ASTM C 208, Type II, Grade 1, 1 inch (25 mm) thick.
4. Glass-Fiber Board Insulation: ASTM C 726, 1 inch (25 mm) thick.
5. Polyisocyanurate Board Insulation: ASTM C 1289, 1 inch (25 mm) thick.
6. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, complying with AWPA C2; not less than 1-1/2 inches (38 mm) thick.
7. Security Grilles: 3/4-inch- (19-mm-) diameter, ASTM A 1011/A 1011M steel bars spaced 6 inches (150 mm) o.c. in 1 direction and 12 inches (300 mm) o.c. in the other; factory primed.
 - a. Factory Finish:
 - 1) Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
 - 2) Factory Priming for Field-Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment.
 - 3) Shop Primer: Manufacturer's or fabricator's standard, fast-curing, lead- and chromate-free, universal primer; selected for resistance to normal atmospheric



corrosion, for compatibility with substrate and field-applied finish paint system indicated, and for capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

8. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
9. Polyethylene Sheet: 6-mil- (0.15-mm-) thick, polyethylene sheet complying with ASTM D 4397.
10. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
 - a. Slip Sheet: Rosin-sized paper, minimum 3 lb/100 sq. ft. (0.16 kg/sq. m).
11. Fasteners: Same metal as metals being fastened, or nonmagnetic stainless steel or other noncorrosive metal as recommended by roof accessory manufacturer. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners.
12. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, or PVC; or flat design of foam rubber, sponge neoprene, or cork.
13. Elastomeric Sealant: ASTM C 920, polyurethane **OR** polysulfide **OR** silicone, **as directed**, sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
14. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, and heavy bodied for hooked-type expansion joints with limited movement.
15. Roofing Cement: ASTM D 4586, nonasbestos, fibrated asphalt cement designed for trowel application or other adhesive compatible with roofing system.

C. Roof Curbs

1. Roof Curbs: Provide metal roof curbs, internally reinforced and capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported on roof curbs. Fabricate with welded or sealed mechanical corner joints, with integral metal cant, **OR** stepped integral metal cant raised the thickness of roof insulation, **as directed**, and integral formed mounting flange at perimeter bottom. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.
 - a. Load Requirements: As required to satisfy local code requirements.
 - b. Material:
 - 1) Galvanized **OR** Aluminum-zinc alloy-coated, **as directed**, steel sheet, 0.052 inch (1.32 mm) **OR** 0.079 inch (2.0 mm), **as directed**, thick.
 - 2) Aluminum sheet, 0.090 inch (2.28 mm) thick.
 - 3) Stainless-steel sheet, 0.078 inch (1.98 mm) thick.
 - c. Finish:
 - 1) Prime painted **OR** Baked enamel **OR** High-performance organic coating **OR** Powder coat, **as directed**.
 - 2) Mill **OR** Clear anodic **OR** Color anodic, **as directed**.
 - d. Liner: Same material as curb, of manufacturer's standard thickness and finish.
 - e. Factory install wood nailers at tops of curbs.
 - f. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
 - g. Factory insulate curbs with 1-1/2-inch- (38-mm-) thick, cellulosic-fiber **OR** glass-fiber, **as directed**, board insulation.
 - h. Curb height may be determined by adding thickness of roof insulation and minimum base flashing height recommended by roofing membrane manufacturer. Fabricate units to minimum height of 12 inches (300 mm), unless otherwise indicated.
 - i. Sloping Roofs: Where slope of roof deck exceeds 1:48, fabricate curb units with water diverter or cricket and with height tapered to match slope to level tops of units.

D. Equipment Supports

1. Equipment Supports: Provide metal equipment supports, internally reinforced and capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported. Fabricate with welded or sealed mechanical corner joints, with integral metal



cant **OR** stepped integral metal cant raised the thickness of roof insulation, **as directed**, and integral formed mounting flange at perimeter bottom. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

- a. Load Requirements: As required to satisfy local code requirements.
- b. Material:
 - 1) Galvanized **OR** Aluminum-zinc alloy-coated, **as directed**, steel sheet, 0.052 inch (1.32 mm) **OR** 0.079 inch (2.0 mm), **as directed**, thick.
 - 2) Aluminum sheet, 0.090 inch (2.28 mm) thick.
 - 3) Stainless-steel sheet, 0.078 inch (1.98 mm) thick.
- c. Finish:
 - 1) Prime painted **OR** Baked enamel **OR** High-performance organic coating **OR** Powder coat, **as directed**.
 - 2) Mill **OR** Clear anodic **OR** Color anodic, **as directed**.
- d. Factory-install continuous wood nailers 3-1/2 inches (90 mm) **OR** 5-1/2 inches (140 mm), **as directed**, wide at tops of equipment supports.
- e. Metal Counterflashing: Manufacturer's standard removable counterflashing, fabricated of same metal and finish as equipment support.
- f. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
- g. Fabricate units to minimum height of 12 inches (300 mm), unless otherwise indicated.
- h. Sloping Roofs: Where slope of roof deck exceeds 1:48, fabricate curb units with water diverter or cricket and with height tapered to match slope to level tops of units.

E. Roof Hatches

1. Roof Hatches: Fabricate roof hatches with insulated double-wall lids and insulated single-wall **OR** double-wall, **as directed**, curb frame with integral deck mounting flange and lid frame counterflashing. Fabricate with welded or mechanically fastened and sealed corner joints. Provide continuous weathertight perimeter gasketing and equip with corrosion-resistant or hot-dip galvanized hardware.
 - a. Loads: Fabricate roof hatches to withstand 40-lbf/sq. ft. (1.9-kPa) external and 20-lbf/sq. ft. (0.95-kPa) internal loads.
 - b. Type and Size: Single-leaf lid, 30 by 36 inches (750 by 900 mm) **OR** 30 by 54 inches (750 by 1370 mm) **OR** 30 by 96 inches (750 by 2440 mm), **as directed**.
 - c. Type and Size: Double-leaf lid, 72 by 96 inches (1830 by 2440 mm).
 - d. Curb and Lid Material:
 - 1) Galvanized **OR** Aluminum-zinc alloy-coated, **as directed**, steel sheet, 0.079 inch (2.0 mm) thick.
 - 2) Aluminum sheet, 0.090 inch (2.28 mm) thick.
 - 3) Stainless-steel sheet, 0.078 inch (1.98 mm) thick.
 - e. Finish:
 - 1) Prime painted **OR** Baked enamel **OR** High-performance organic coating **OR** Powder coat, **as directed**.
 - 2) Mill **OR** Clear anodic **OR** Color anodic, **as directed**.
 - f. Insulation: Cellulosic-fiber **OR** Glass-fiber **OR** Polyisocyanurate, **as directed**, board.
 - g. Interior Lid Liner: Manufacturer's standard metal liner of same material and finish as outer metal lid.
 - h. Exterior Curb Liner: Manufacturer's standard metal liner of same material and finish as metal curb.
 - i. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
 - j. Fabricate units to minimum height of 12 inches (300 mm), unless otherwise indicated.
 - k. Sloping Roofs: Where slope of roof deck exceeds 1:48, fabricate hatch curbs with height constant **OR** tapered to match slope to level tops of units, **as directed**.
 - l. Hardware: Galvanized steel **OR** Stainless-steel, **as directed**, spring latch with turn handles, butt- or pintle-type hinge system, and padlock hasps inside and outside.
 - 1) Provide 2-point latch on covers larger than 84 inches (2130 mm).
 - 2) Provide remote-control operation.



- m. Ladder Safety Post: Manufacturer's standard ladder safety post. Post to lock in place on full extension. Provide release mechanism to return post to closed position.
- n. Safety Railing System: Manufacturer's standard complete system including rails, clamps, fasteners, safety barrier at railing opening, and all accessories required for a complete installation.

F. Heat And Smoke Vents

1. Dropout-Type Heat and Smoke Vents: Manufacturer's standard gravity-operated, automatic smoke and heat vents with integral double-wall insulated curbs and frame with welded or sealed mechanical corner joints, integral condensation gutter, cap flashing, and heat-sensitive dome glazing that will deform and drop out of vent opening within 5 minutes of exposure to a simulated fire represented by a time-temperature gradient that reaches an air temperature of 500 deg F (260 deg C) within 5 minutes.
 - a. Loads: Fabricate heat and smoke vents to withstand a minimum 40-lbf/sq. ft. (1.9-kPa) external live load and 30-lbf/sq. ft. (1.4-kPa) uplift.
 - 1) Dome glazing shall have a thickness capable of resisting 40-lbf/sq. ft. (1.9-kPa) external and 20-lbf/sq. ft. (0.95-kPa) internal loads.
 - b. Regulatory Requirements: Comply with UL 793 and NFPA 204.
 - c. Heat and Smoke Vent Compliance: Provide units that have been tested and UL listed **OR** FMG approved, **as directed**.
 - d. Integral Curb and Framing Material:
 - 1) Galvanized **OR** Aluminum-zinc alloy-coated, **as directed**, steel sheet, 0.079 inch (2.0 mm) thick.
 - 2) Aluminum sheet, 0.090 inch (2.28 mm) thick.
 - 3) Stainless-steel sheet, 0.078 inch (1.98 mm) thick.
 - e. Finish:
 - 1) Prime painted **OR** Baked enamel **OR** High-performance organic coating **OR** Powder coat, **as directed**.
 - 2) Finish: Mill **OR** Clear anodic **OR** Color anodic, **as directed**.
 - f. Insulation: Cellulosic-fiber **OR** Glass-fiber **OR** Polyisocyanurate, **as directed**, board.
 - g. Exterior Curb Liner: Manufacturer's standard metal liner of same material and finish as metal curb.
 - h. Fabricate integral curbs to minimum height of 12 inches (300 mm), unless otherwise indicated.
 - i. Sloping Roofs: Where slope of roof deck exceeds 1:48, fabricate curbs with height constant **OR** tapered to match slope to level tops of units, **as directed**.
 - j. Dome Glazing: Single **OR** Double, **as directed**, acrylic **OR** polycarbonate, **as directed**, glazing.
 - 1) Single-Dome Color: Colorless, transparent **OR** White, translucent **OR** Gray tinted, transparent **OR** Bronze tinted, transparent, **as directed**.
 - 2) Outer Double-Dome Color: Colorless, transparent **OR** White, translucent **OR** Gray tinted, transparent **OR** Bronze tinted, transparent, **as directed**.
 - 3) Inner Double-Dome Color: Colorless, transparent **OR** White, translucent **OR** Gray tinted, transparent **OR** Bronze tinted, transparent, **as directed**.
2. Hatch-Type Heat and Smoke Vents: Manufacturer's standard single-leaf **OR** double-leaf, **as directed**, hatch-type heat and smoke vents with integral double-wall insulated curbs and frame, with welded or sealed mechanical corner joints, integral condensation gutter, and cap flashing. Fabricate with insulated double-wall lid, continuous weathertight perimeter lid gaskets, and equip with automatic self-lifting mechanisms, UL-listed fusible links rated at 165 deg F (74 deg C) **OR** fire-suppression system **OR** smoke-detection system, **as directed**, and corrosion-resistant or hot-dip galvanized hardware including hinges, hold-open devices, and independent manual-release devices for inside and outside operation of lids.
 - a. Loads: Fabricate heat and smoke vent to withstand a minimum 40-lbf/sq. ft. (1.9-kPa) external live load and 30-lbf/sq. ft. (1.4-kPa) uplift.
 - 1) When release is actuated, lid shall open against 10-lbf/sq. ft. (0.5-kPa) snow or wind load and lock in position.



- b. Regulatory Requirements: UL 793 and NFPA 204.
- c. Heat and Smoke Vent Compliance: Provide units that have been tested and UL listed **OR** FMG approved, **as directed**.
- d. Fire Resistance of Lids: UL Class A rating.
- e. Integral Curb, Framing, and Lid Material:
 - 1) Galvanized **OR** Aluminum-zinc alloy-coated, **as directed**, steel sheet, 0.079 inch (2.0 mm) thick.
 - 2) Aluminum sheet, 0.090 inch (2.28 mm) thick.
 - 3) Stainless-steel sheet, 0.078 inch (1.98 mm) thick.
- f. Finish:
 - 1) Prime painted **OR** Baked enamel **OR** High-performance organic coating **OR** Powder coat, **as directed**.
 - 2) Mill **OR** Clear anodic **OR** Color anodic, **as directed**.
- g. Insulation: Cellulosic-fiber **OR** Glass-fiber **OR** Polyisocyanurate, **as directed**, board.
- h. Fabricate integral curbs to minimum height of 12 inches (300 mm), unless otherwise indicated.
- i. Sloping Roofs: Where slope of roof deck exceeds 1:48, fabricate curbs with height constant **OR** tapered to match slope to level tops of units, **as directed**.

G. Gravity Ventilators

1. Low-Profile, Cylindrical-Style Gravity Ventilators: Manufacturer's standard unit fabricated from the following materials, with manufacturer's standard welded or sealed mechanical joints:
 - a. Provide integral base flange, vent cylinder, cylinder bird screen, and rain cap **OR** hood, **as directed**.
 - b. Dimensions: As indicated.
 - c. Style: As indicated.
 - d. Bird Screens: Manufacturer's standard mesh with rewireable frame.
 - e. Insect Screens: Manufacturer's standard mesh with rewireable frame.
 - f. Vent Cylinder, Base Flange, and Rain-Cap **OR** Hood, **as directed** Material: Galvanized steel **OR** Aluminum **OR** Stainless-steel, **as directed**, sheet, of manufacturer's standard thickness.
 - g. Finish:
 - 1) Prime painted **OR** Baked enamel **OR** High-performance organic coating **OR** Powder coat, **as directed**.
 - 2) Mill **OR** Clear anodic **OR** Color anodic, **as directed**.
2. Low-Profile, Louvered Penthouse-Style Gravity Ventilators: Manufacturer's standard unit fabricated from the following materials, with manufacturer's standard welded or sealed mechanical joints:
 - a. Provide integral frame with base flange, weathertight cap, louver bird screen, and weatherproof sidewall louvers.
 - b. Dimensions: As indicated.
 - c. Style: As indicated.
 - d. Bird Screens: Manufacturer's standard mesh with rewireable frame.
 - e. Insect Screens: Manufacturer's standard mesh with rewireable frame.
 - f. Integral Frame, Base Flange, Weathertight Cap, and Louver Material: Galvanized steel **OR** Aluminum **OR** Stainless-steel, **as directed**, sheet, of manufacturer's standard thickness.
 - g. Finish:
 - 1) Prime painted **OR** Baked enamel **OR** High-performance organic coating **OR** Powder coat, **as directed**.
 - 2) Mill **OR** Clear anodic **OR** Color anodic, **as directed**.
3. Directional Louvered Pedestal-Style Gravity Ventilators: Manufacturer's standard unit fabricated from the following materials, with manufacturer's standard welded or sealed mechanical joints:
 - a. Provide integral weathertight base cap, integral outlet duct, weathertight sidewalls, bird screen, and weatherproof sidewall louver.



- b. Dimensions: As indicated.
 - c. Style: As indicated.
 - d. Bird Screens: Manufacturer's standard mesh with rewireable frame.
 - e. Insect Screens: Manufacturer's standard mesh with rewireable frame.
 - f. Weathertight Base Cap, Outlet Duct, Sidewall, and Louver Material: Galvanized steel **OR** Aluminum **OR** Stainless-steel, **as directed**, sheet, of manufacturer's standard thickness.
 - g. Finish:
 - 1) Prime painted **OR** Baked enamel **OR** High-performance organic coating **OR** Powder coat, **as directed**.
 - 2) Mill **OR** Clear anodic **OR** Color anodic, **as directed**.
4. Turbine-Style Gravity Ventilators: Manufacturer's standard unit fabricated from the following materials, with manufacturer's standard welded or sealed mechanical joints:
- a. Provide integral weathertight base cap, outlet duct, and rotating louvered turbine.
 - b. Dimensions: As indicated.
 - c. Style: As indicated.
 - d. Bird Screens: Manufacturer's standard mesh with rewireable frame.
 - e. Insect Screens: Manufacturer's standard mesh with rewireable frame.
 - f. Weathertight Base Cap, Outlet Duct, and Turbine Material: Galvanized steel **OR** Aluminum, **as directed**, sheet, of manufacturer's standard thickness.
 - g. Finish:
 - 1) Prime painted **OR** Baked enamel **OR** High-performance organic coating **OR** Powder coat, **as directed**.
 - 2) Mill **OR** Clear anodic **OR** Color anodic, **as directed**.

H. Roof Supports

- 1. Pipe Roof Supports: Adjustable height, extruded-aluminum tube, urethane insulation filled, 2 inches (50 mm) in diameter, with aluminum base plates and manufacturer's recommended hardware for mounting to structure **OR** structural roof deck, **as directed**, and extruded-aluminum carrier assemblies, suitable for quantity of pipe runs and sizes, with EPDM end caps. Include manufacturer's standard hardware for mounting to structure or structural roof deck.
 - a. Pipe Support Height: As indicated.
 - b. Pipe Roller Assembly: Stainless-steel roller assembly sized for supported pipes with extruded aluminum.
 - c. Pipe Support Flashing: Insulated **OR** Uninsulated, **as directed**, sleeve flashings with integral base flange, and EPDM grommetted top seal and base seals.
 - 1) Metal: Aluminum sheet, 0.064 inch (1.6 mm) thick **OR** Copper sheet, 16 oz. (0.55 mm) thick, **as directed**.
- 2. Terrace Lighting Roof Supports: Epoxy-coated hollow structural section steel pipe support, urethane insulation filled, with epoxy-coated steel base plates and manufacturer's recommended hardware for mounting to structure **OR** structural roof deck, **as directed**, 14 inches (356 mm) **OR** 18 inches (457 mm), **as directed**, high, with galvanized threaded cap.
 - a. Lighting Pole Mounting: Stainless-steel lighting pole adapter **OR** Epoxy-coated steel plate with stainless-steel studs, **as directed**.
 - b. Pipe Support Flashing: Insulated **OR** Uninsulated, , metal sleeve flashings with integral base flange, and EPDM grommetted top seal and base seals.
 - 1) Metal: Aluminum sheet, 0.064 inch (1.6 mm) thick **OR** Copper sheet, 16 oz. (0.55 mm) thick, **as directed**.
- 3. Light-Duty Pipe Roof Supports: Extruded-aluminum base assembly and Type 304 stainless-steel roller assembly for pipe sizes indicated, including manufacturer's standard hardware for mounting to structure or structural roof deck.
- 4. Duct Roof Supports: 2-inch- (50-mm-) diameter, extruded-aluminum, urethane-insulated supports, including manufacturer's standard hardware for mounting to structure or structural roof deck.

I. Roof Walkways



1. Roof Walkway: Multiple C-shaped-channel formed-metal planks, as follows, with upper surface punched in serrated diamond or rectangular shapes to produce raised slip-resistant surface and drainage holes. Provide support framing, brackets, connectors, nosings, and other accessories and components needed for complete installation. Include step units for changes in elevation.
 - a. Plank Width: 4-3/4 inches (121 mm) **OR** 7 inches (178 mm) **OR** 9-1/2 inches (241 mm) **OR** 11-3/4 inches (298 mm) **OR** 18-3/4 inches (476 mm) **OR** 24 inches (610 mm) **OR** As indicated, **as directed**.
 - b. Walkway Width: As indicated.
 - c. Channel Depth: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 2-1/2 inches (64 mm) **OR** 3 inches (76 mm) **OR** As indicated., **as directed**
 - d. Metal Material: -0.079-inch- (2.0-mm-) thick, hot-dip galvanized steel sheet **OR** 0.108-inch- (2.8-mm-) thick, hot-dip galvanized steel sheet **OR** 0.062-inch- (1.6-mm-) thick, stainless-steel sheet **OR** 0.078-inch- (1.98-mm-) thick, stainless-steel sheet **OR** 0.080-inch- (2.03-mm-) thick, mill-finished aluminum sheet **OR** 0.100-inch- (2.5-mm-) thick, mill-finished aluminum sheet, **as directed**.
 - e. Provide isolation pads attached to supports so supports are completely isolated from roof membrane surface.

J. Preformed Flashings

1. Exhaust Vent Flashings: Double-wall metal flashing sleeve, urethane insulation filled, with integral deck flange, 12 inches (300 mm) high, with removable metal hood and slotted **OR** perforated, **as directed**, metal collar, and as follows:
 - a. Metal: Aluminum sheet, 0.064 inch (1.6 mm) thick, mill finished **OR** Copper sheet, 16 oz. (0.55 mm thick), **as directed**.
 - b. Diameter: As indicated.
2. Vent Stack Flashing: Metal flashing sleeve, with integral deck flange, uninsulated, and as follows:
 - a. Metal: Aluminum sheet, 0.064 inch (1.6 mm) thick, mill finished **OR** Copper sheet, 16 oz. (0.55 mm thick), **as directed**.
 - b. Height: As indicated..
 - c. Diameter: As indicated.

1.3 EXECUTION

A. Installation

1. General: Install roof accessories according to manufacturer's written instructions. Anchor roof accessories securely in place and capable of resisting forces specified. Use fasteners, separators, sealants, and other miscellaneous items as required for completing roof accessory installation. Install roof accessories to resist exposure to weather without failing, rattling, leaking, and fastener disengagement.
2. Install roof accessories to fit substrates and to result in watertight performance.
3. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
 - a. Coat concealed side of uncoated aluminum **OR** stainless-steel, **as directed**, roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 - b. Underlayment: Where installing exposed-to-view components of roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene underlayment.
 - c. Bed flanges in thick coat of asphalt roofing cement where required by roof accessory manufacturers for waterproof performance.
4. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.



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5. Seal joints with elastomeric **OR** butyl, **as directed**, sealant as required by manufacturer of roof accessories.

END OF SECTION 07 72 23 00



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Task	Specification	Specification Description
07 72 26 00	07 72 23 00	Roof Accessories
07 72 33 00	07 72 23 00	Roof Accessories
07 72 36 00	07 72 23 00	Roof Accessories
07 72 63 00	01 22 16 00	No Specification Required
07 73 00 00	07 51 13 00	Built-Up Asphalt Roofing
07 73 00 00	07 05 13 00	Built-Up Coal-Tar Roofing
07 73 00 00	07 53 16 00	EPDM Membrane Roofing
07 73 00 00	07 05 13 00a	CSPE Membrane Roofing
07 73 00 00	07 05 13 00b	APP-Modified Bituminous Membrane Roofing
07 73 00 00	07 05 13 00c	SBS-Modified Bituminous Membrane Roofing
07 73 00 00	07 22 16 00	Fluid-Applied Protected Membrane Roofing
07 76 16 00	01 22 16 00	No Specification Required



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SECTION 07 81 16 00 - SPRAYED FIRE-RESISTIVE MATERIALS**1.1 GENERAL****A. Description Of Work:**

1. This specification covers the furnishing and installation of materials for sprayed fire-resistive materials. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Concealed SFRM.
 - b. Exposed SFRM.
 - c. Exposed intumescent mastic fire-resistive coatings.

C. Definitions

1. SFRM: Sprayed fire-resistive material.
2. Concealed: Fire-resistive materials applied to surfaces that are concealed from view behind other construction when the Work is completed and have not been defined as exposed, **as directed**.
3. Exposed: Fire-resistive materials applied to surfaces that are exposed to view when the Work is completed, that are accessible through suspended ceilings **OR** that are in elevator shafts and machine rooms **OR** that are in mechanical rooms **OR** that are in air-handling plenums **OR** and that are identified as exposed on Drawings, **as directed**.

D. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: Show extent of sprayed fire-resistive material for each construction and fire-resistance rating, applicable fire-resistive design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction, and minimum thicknesses.
3. Product certificates **OR** test reports, **as directed**.
4. Compatibility and adhesion test reports.
5. Research/evaluation reports.
6. Field quality-control test and special inspection, **as directed**, reports.

E. Quality Assurance

1. Installer Qualifications: A qualified installer approved by SFRM manufacturer to install manufacturer's products. A manufacturer's willingness to sell its SFRM to Contractor or to an installer engaged by Contractor does not in itself confer qualification on the buyer.
2. SFRM Testing: By a qualified testing and inspecting agency engaged by Contractor or manufacturer to test for compliance with specified requirements for performance and test methods.
 - a. SFRMs are randomly selected for testing from bags bearing the applicable classification marking of UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - b. Testing is performed on specimens of SFRMs that comply with laboratory testing requirements specified in Part 2 and are otherwise identical to installed fire-resistive materials, including application of accelerant, sealers, topcoats, tamping, troweling, rolling, and water overspray, if any of these are used in final application.
 - c. Testing is performed on specimens whose application the independent testing and inspecting agency witnessed during preparation and conditioning. Include in test reports a full description of preparation and conditioning of laboratory test specimens.



3. Compatibility and Adhesion Testing: Engage a qualified testing and inspecting agency to test for compliance with requirements for specified performance and test methods.
 - a. Test for bond per ASTM E 736 and requirements in UL's "Fire Resistance Directory" for coating materials. Provide bond strength indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
 - b. Verify that manufacturer, through its own laboratory testing or field experience, has not found primers or coatings to be incompatible with SFRM.
4. Fire-Test-Response Characteristics: Where indicated, provide products identical to those tested for fire resistance per ASTM E 119 by a testing agency acceptable to authorities having jurisdiction.
 - a. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
 - b. Identify products with appropriate markings of applicable testing and inspecting agency.
5. Provide products containing no detectable asbestos as determined according to the method specified in 40 CFR 763, Subpart E, Appendix E, Section 1, "Polarized Light Microscopy."
6. Preinstallation Conference: Conduct conference at Project site.

F. Delivery, Storage, And Handling

1. Deliver products to Project site in original, unopened packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, shelf life if applicable, and fire-resistance ratings applicable to Project.
2. Use materials with limited shelf life within period indicated. Remove from Project site and discard materials whose shelf life has expired.
3. Store materials inside, under cover, and aboveground; keep dry until ready for use. Remove from Project site and discard wet or deteriorated materials.

G. Project Conditions

1. Environmental Limitations: Do not apply SFRM when ambient or substrate temperature is 40 deg F (4 deg C) or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.
2. Ventilation: Ventilate building spaces during and after application of SFRM. Use natural means or, if they are inadequate, forced-air circulation until fire-resistive material dries thoroughly.

H. Warranty

1. Special Warranty: Manufacturer's standard form, signed by Contractor and by Installer, in which manufacturer agrees to repair or replace SFRMs that fail in materials or workmanship within two years from date of Final Completion.

1.2 PRODUCTS

A. Concealed SFRM

1. Material Composition: Manufacturer's standard product, as follows **OR** either of the following, **as directed**:
 - a. Concealed Cementitious SFRM: Factory-mixed, dry formulation of gypsum or portland cement binders, additives, and lightweight mineral or synthetic aggregates mixed with water at Project site to form a slurry or mortar for conveyance and application.
 - b. Concealed Sprayed-Fiber Fire-Resistive Material: Factory-mixed, dry formulation of inorganic binders, mineral fibers, fillers, and additives conveyed in a dry state by pneumatic equipment and mixed with water at spray nozzle to form a damp, as-applied product.
2. Physical Properties: Minimum values, unless otherwise indicated, or higher values required to attain designated fire-resistance ratings, measured per standard test methods referenced with each property as follows:



- a. Dry Density: 15 lb/cu. ft. (240 kg/cu. m) for average and individual densities, or greater if required to attain fire-resistance ratings indicated, per ASTM E 605 or AWCI Technical Manual 12-A, Section 5.4.5, "Displacement Method."
 - b. Thickness: Minimum average thickness required for fire-resistance design indicated according to the following criteria, but not less than 0.375 inch (9 mm), per ASTM E 605:
 - 1) Where the referenced fire-resistance design lists a thickness of 1 inch (25 mm) or more, the minimum allowable individual thickness of SFRM is the design thickness minus 0.25 inch (6 mm).
 - 2) Where the referenced fire-resistance design lists a thickness of less than 1 inch (25 mm) but more than 0.375 inch (9 mm), the minimum allowable individual thickness of SFRM is the greater of 0.375 inch (9 mm) or 75 percent of the design thickness.
 - 3) No reduction in average thickness is permitted for those fire-resistance designs whose fire-resistance ratings were established at densities of less than 15 lb/cu. ft. (240 kg/cu. m).
 - c. Bond Strength: 150 lbf/sq. ft. (7.2 kPa) minimum per ASTM E 736 based on laboratory testing of 0.75-inch (19-mm) minimum thickness of SFRM.
 - d. Compressive Strength: 5.21 lbf/sq. in. (35.9 kPa) minimum per ASTM E 761. Minimum thickness of SFRM tested shall be 0.75 inch (19 mm) and minimum dry density shall be as specified but not less than 15 lb/cu. ft. (240 kg/cu. m).
 - e. Corrosion Resistance: No evidence of corrosion per ASTM E 937.
 - f. Deflection: No cracking, spalling, or delamination per ASTM E 759.
 - g. Effect of Impact on Bonding: No cracking, spalling, or delamination per ASTM E 760.
 - h. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. (0.270 g/sq. m) in 24 hours per ASTM E 859. For laboratory tests, minimum thickness of SFRM is 0.75 inch (19 mm), maximum dry density is 15 lb/cu. ft. (240 kg/cu. m), test specimens are not prepured by mechanically induced air velocities, and tests are terminated after 24 hours.
 - i. Fire-Test-Response Characteristics: Provide SFRM with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1) Flame-Spread Index: 10 or less.
 - 2) Smoke-Developed Index: 0.
 - j. Fungal Resistance: No observed growth on specimens per ASTM G 21.
- B. Exposed SFRM
1. Material Composition: Manufacturer's standard product, as follows:
 - a. Exposed Cementitious SFRM: Factory-mixed, dry, cement aggregate formulation; or chloride-free formulation of gypsum or portland cement binders, additives, and inorganic aggregates mixed with water at Project site to form a slurry or mortar for conveyance and application.
 - b. Exposed Sprayed-Fiber Fire-Resistive Material: Factory-mixed, dry formulation of inorganic binders, mineral fibers, fillers, and additives conveyed in a dry state by pneumatic equipment and mixed with water at spray nozzle to form a damp, as-applied product.
 2. Physical Properties: Minimum values, unless otherwise indicated, or higher values required to attain designated fire-resistance ratings, measured per standard test methods referenced with each property as follows:
 - a. Dry Density: Values for average and individual densities as required for fire-resistance ratings indicated, per ASTM E 605 or AWCI Technical Manual 12-A, Section 5.4.5, "Displacement Method," but with an average density of not less than 22 lb/cu. ft. (352 kg/cu. m).
 - b. Bond Strength: 434 lbf/sq. ft. (21 kPa) minimum per ASTM E 736.
 - c. Compressive Strength: 51 lbf/sq. in. (351 kPa) minimum per ASTM E 761.
 - d. Dry Density: Values for average and individual densities as required for fire-resistance ratings indicated, per ASTM E 605 or AWCI Technical Manual 12-A, Section 5.4.5, "Displacement Method," but with an average density of not less than 39 lb/cu. ft. (625 kg/cu. m).
 - e. Bond Strength: 1000 lbf/sq. ft. (48 kPa) minimum per ASTM E 736.



- f. Compressive Strength: 300 lbf/sq. in. (2067 kPa) minimum per ASTM E 761.
 - g. Corrosion Resistance: No evidence of corrosion per ASTM E 937.
 - h. Deflection: No cracking, spalling, or delamination per ASTM E 759.
 - i. Effect of Impact on Bonding: No cracking, spalling, or delamination per ASTM E 760.
 - j. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. (0.270 g/sq. m) per ASTM E 859.
 - k. Combustion Characteristics: Passes ASTM E 136.
 - l. Fire-Test-Response Characteristics: Provide SFRM with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1) Flame-Spread Index: 10 or less.
 - 2) Smoke-Developed Index: 0.
 - m. Fungal Resistance: No observed growth on specimens per ASTM G 21.
 - n. For exterior applications of SFRM, provide formulation listed and labeled by testing and inspecting agency acceptable to authorities having jurisdiction for surfaces exposed to exterior.
- C. Exposed Intumescent Mastic Fire-Resistive Coatings
- 1. Fire-Resistive, Intumescent Mastic Coating: Factory-mixed formulation.
 - a. Water-Based Formulation: Approved by manufacturer and authorities having jurisdiction and investigated for Interior General **OR** Conditioned Interior Space, **as directed**, Purpose by UL.
 - b. Non-Water-Based Formulation: Approved by manufacturer and UL or another testing and inspecting agency acceptable to authorities having jurisdiction and investigated for Interior General Purpose by UL **OR** investigated for Interior General Purpose and Exterior Use by UL **OR** tested per ASTM E 1529 **OR** tested per UL 1709, **as directed**.
 - c. Multicomponent system consisting of intumescent base coat and topcoat.
 - 2. Color and Gloss: As selected from manufacturer's full range.
- D. Auxiliary Fire-Resistive Materials
- 1. General: Provide auxiliary fire-resistive materials that are compatible with SFRM and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.
 - 2. Substrate Primers: For use on each substrate and with each sprayed fire-resistive product, provide primer that complies with one or more of the following requirements:
 - a. Primer's bond strength complies with requirements specified in UL's "Fire Resistance Directory" for coating materials based on a series of bond tests per ASTM E 736.
 - b. Primer is identical to those used in assemblies tested for fire-test-response characteristics of SFRM per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - 3. Adhesive for Bonding Fire-Resistive Material: Product approved by manufacturer of SFRM.
 - 4. Metal Lath: Expanded metal lath fabricated from material of weight, configuration, and finish required to comply with fire-resistance designs indicated and fire-resistive material manufacturer's written recommendations. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive SFRM.
 - 5. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by manufacturer of SFRM.
 - 6. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by manufacturer of intumescent mastic coating fire-resistive material. Include pins and attachment.
 - 7. Sealer for Sprayed-Fiber Fire-Resistive Material: Transparent-drying, water-dispersible, tinted protective coating recommended in writing by manufacturer of sprayed-fiber fire-resistive material.
 - 8. Topcoat: Type recommended in writing by manufacturer of each SFRM for application over concealed **OR** exposed, **as directed**, SFRM.



9. Cement-Based Topcoat: Factory-mixed, cementitious hardcoat formulation recommended in writing by manufacturer of SFRM for trowel or spray application over concealed **OR** exposed, **as directed**, SFRM.
10. Veneer-Plaster Topcoat: Factory-mixed formulation of a latex-modified, portland cement-based veneer plaster recommended in writing by manufacturer of SFRM for trowel or spray application over concealed **OR** exposed, **as directed**, SFRM.
11. Water-Based Permeable Topcoat: Factory-mixed formulation recommended in writing by manufacturer of SFRM for brush, roller, or spray application over concealed **OR** exposed, **as directed**, SFRM. Provide application at a rate of 120 sq. ft./gal. (3 sq. m/L) **OR** 60 sq. ft./gal. (1.5 sq. m/L) **OR** 30 sq. ft./gal. (0.75 sq. m/L), **as directed**.

1.3 EXECUTION

A. Preparation

1. Cover other work subject to damage from fallout or overspray of fire-resistive materials during application.
2. Clean substrates of substances that could impair bond of fire-resistive material, including dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, and incompatible primers, paints, and encapsulants.
3. Prime substrates where recommended in writing by SFRM manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive SFRM.
4. For exposed applications, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of SFRM. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

B. Application, General

1. Comply with fire-resistive material manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and spray on fire-resistive material, as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.
2. Apply SFRM that is identical to products tested as specified in Part 1.1 "Quality Assurance" Article and substantiated by test reports, with respect to rate of application, accelerator use, sealers, topcoats, tamping, troweling, water overspray, or other materials and procedures affecting test results.
3. Install metal lath and reinforcing fabric, as required, to comply with fire-resistance ratings and fire-resistive material manufacturer's written recommendations for conditions of exposure and intended use. Securely attach lath and fabric, as required, to substrate in position required for support and reinforcement of fire-resistive material. Use anchorage devices of type recommended in writing by SFRM manufacturer. Attach accessories where indicated or required for secure attachment of lath and fabric, as required, to substrate.
4. Coat substrates with bonding adhesive before applying fire-resistive material where required to achieve fire-resistance rating or as recommended in writing by SFRM manufacturer for material and application indicated.
5. Extend fire-resistive material in full thickness over entire area of each substrate to be protected. Unless otherwise recommended in writing by SFRM manufacturer, install body of fire-resistive covering in a single course.
6. Spray apply fire-resistive materials to maximum extent possible. Following the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by SFRM manufacturer.
7. For applications over encapsulant materials, including lockdown (post-removal) encapsulants, apply SFRM that differs in color from that of encapsulant over which it is applied.
8. Where sealers are used, apply products that are tinted to differentiate them from SFRM over which they are applied.

C. Application, Concealed SFRM



1. Apply concealed SFRM in thicknesses and densities not less than those required to achieve fire-resistance ratings designated for each condition, but apply in greater thicknesses and densities if specified in Part 1.2 "Concealed SFRM" Article.
2. Apply water overspray to concealed sprayed-fiber fire-resistive material as required to obtain designated fire-resistance rating and where indicated.
3. Cure concealed SFRM according to product manufacturer's written recommendations.
4. Apply sealer to concealed SFRM where indicated.
5. Apply topcoat to concealed SFRM where indicated.

D. Application, Exposed SFRM

1. Apply exposed SFRM in thicknesses and densities not less than those required to achieve fire-resistance ratings designated for each condition, but apply in greater thicknesses and densities if indicated.
 - a. For steel beams and bracing, provide a thickness of not less than 1 inch (25 mm).
 - b. For metal floor or roof decks, provide a thickness of not less than 1/2 inch (13 mm).
2. Provide a uniform finish complying with description indicated for each type of material and matching the Owner's sample or, if none, finish approved for field-erected mockup.
3. Apply exposed cementitious SFRM to produce the following finish:
 - a. Spray-textured finish with no further treatment.
 - b. Even, spray-textured finish, produced by rolling flat surfaces of fire-protected members with a damp paint roller to remove drippings and excessive roughness.
 - c. Skip-troweled finish with leveled surface, smoothed-out texture, and neat edges.
 - d. Smooth, troweled finish with surface markings eliminated and edges squared.
4. Apply exposed sprayed-fiber fire-resistive material to produce the following finish:
 - a. Spray-textured finish.
 - b. Sealer where indicated.
 - c. Topcoat where indicated.
5. Cure exposed SFRM according to product manufacturer's written recommendations.

E. Application, Exposed Intumescent Mastic Fire-Resistive Coatings

1. Apply exposed intumescent mastic fire-resistive coatings in thicknesses and densities not less than those required to achieve fire-resistance ratings designated for each condition.
2. Apply intumescent mastic fire-resistive coating as follows:
 - a. Install reinforcing fabric as required to obtain designated fire-resistance rating and where indicated.
 - b. Finish: Spray-textured finish with no further treatment.
 - c. Finish: Even, spray-textured finish produced by lightly rolling flat surfaces of fire-protected members before fire-resistive material dries, to smooth out surface irregularities and to seal in surface fibers.

F. Field Quality Control

1. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.
 - a. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.
2. Tests and Inspections: Testing and inspecting of completed applications of SFRM shall take place in successive stages, in areas of extent and using methods as follows. Do not proceed with application of SFRM for the next area until test results for previously completed applications of SFRM show compliance with requirements. Tested values must equal or exceed values indicated and required for approved fire-resistance design.
 - a. Thickness for Floor, Roof, and Wall Assemblies: For each 1000-sq. ft. (93-sq. m) area, or partial area, on each floor, from the average of 4 measurements from a 144-sq. in. (0.093-sq. m) sample area, with sample width of not less than 6 inches (152 mm) per ASTM E 605.



- b. Thickness for Structural Frame Members: From a sample of 25 percent of structural members per floor, taking 9 measurements at a single cross section for structural frame beams or girders, 7 measurements of a single cross section for joists and trusses, and 12 measurements of a single cross section for columns per ASTM E 605.
 - c. Density for Floors, Roofs, Walls, and Structural Frame Members: At frequency and from sample size indicated for determining thickness of each type of construction and structural framing member, per ASTM E 605 or AWC Technical Manual 12-A, Section 5.4.5, "Displacement Method."
 - d. Bond Strength for Floors, Roofs, Walls, and Structural Framing Members: For each 10,000-sq. ft. (929 sq. m) area, or partial area, on each floor, cohesion and adhesion from one sample of size indicated for determining thickness of each type of construction and structural framing member, per ASTM E 736.
 - 1) Field test SFRM that is applied to flanges of wide-flange, structural-steel members on surfaces matching those that will exist for remainder of steel receiving fire-resistive material.
 - 2) If surfaces of structural steel receiving SFRM are primed or otherwise painted for coating materials, perform series of bond tests specified in UL's "Fire Resistance Directory." Provide bond strength indicated in referenced UL fire-resistance criteria, but not less than 150 lbf/sq. ft. (7.2 kPa) minimum per ASTM E 736.
 - e. If testing finds applications of SFRM are not in compliance with requirements, testing and inspecting agency will perform additional random testing to determine extent of noncompliance.
3. Remove and replace applications of SFRM that do not pass tests and inspections for cohesion and adhesion, for density, or for both and retest as specified above.
 4. Apply additional SFRM, per manufacturer's written instructions, where test results indicate that thickness does not comply with specified requirements, and retest as specified above.
- G. Cleaning, Protecting, And Repair
1. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.
 2. Protect SFRM, according to advice of product manufacturer and Installer, from damage resulting from construction operations or other causes so fire protection will be without damage or deterioration at time of Final Completion.
 3. Coordinate application of SFRM with other construction to minimize need to cut or remove fire protection. As installation of other construction proceeds, inspect SFRM and patch any damaged or removed areas.
 4. Repair or replace work that has not successfully protected steel.

END OF SECTION 07 81 16 00



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Task	Specification	Specification Description
07 81 23 00	07 81 16 00	Sprayed Fire-Resistive Materials
07 81 33 00	07 81 16 00	Sprayed Fire-Resistive Materials



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SECTION 07 82 00 00 - BOARD FIRE PROTECTION

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for board fire protection. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Calcium silicate board fire protection.
 - b. Mineral-fiber board fire protection.

C. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: Structural framing plans indicating the following:
 - a. Locations and types of surface preparations required before applying board fire protection.
 - b. Extent of board fire protection for each construction and fire-resistance rating, including the following:
 - 1) Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
 - a) For steel joist assemblies, include applicable fire-resistance design designations, with each steel joist tested with same maximum tensile stress as each steel joist indicated on Drawings **OR** in a schedule, **as directed**. Design designations with steel joists tested at lower maximum tensile stress than those indicated are not permitted.
 - 2) Minimum thicknesses needed to achieve required fire-resistance ratings of structural components and assemblies.
 - 3) Treatment of sprayed fire-resistive material after application.
3. Product Certificates: For each type of board fire protection, from manufacturer.
4. Research/Evaluation Reports: For board fire protection.

D. Quality Assurance

1. Source Limitations: Obtain board fire-protection materials from single source from single manufacturer.
2. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" **OR** UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency, **as directed**, acceptable to authorities having jurisdiction, for board fireproofing serving as direct-applied protection tested per ASTM E 119.

E. Coordination

1. Coordinate installation of board fire protection with other construction specified in other Sections.
 - a. Do not install board fire protection on structural members until piping and other construction behind fire-resistive materials have been completed, uninterrupted coverage of fire-resistive materials can be provided, and the need for subsequent cutting and patching of fire-resistive materials has been eliminated.
 - b. Do not install enclosing or concealing construction until after board fire protection has been applied and inspected by authorities having jurisdiction.



1.2 PRODUCTS

A. Board Fire Protection

1. Calcium Silicate Board: Rigid board containing no asbestos and consisting primarily of lime, silica, inert fillers, and cellulosic reinforcing fibers; of thickness required to produce fire-resistance rating indicated; with flame-spread and smoke-developed indexes of zero per ASTM E 84; passing ASTM E 136 for combustion characteristics.
 - a. Finish: Sanded finish on both sides **OR** one side, **as directed**.
2. Mineral-Fiber Board: Unfaced **OR** Foil-faced **OR** Fiberglass mat-faced, **as directed**, rigid board produced by combining slag-wool/rock-wool fibers with thermosetting resin binders passing ASTM E 136 for combustion characteristics; of thickness required to produce fire-resistance rating indicated.
 - a. Maximum Density: 8 lb/cu. ft. (128 kg/cu. m) **OR** 10 lb/cu. ft. (160 kg/cu. m) **OR** 12 lb/cu. ft. (192 kg/cu. m), **as directed**, per ASTM C 612.
 - b. Surface-Burning Characteristics: Flame-spread and smoke-developed indexes of 15 **OR** zero, **as directed**, and 5 **OR** zero, **as directed**, respectively, per ASTM E 84.

B. Accessories

1. Anchorage Accessories: Provide manufacturer's standard board-anchorage components complying with related design of UL or of another testing and inspecting agency acceptable to authorities having jurisdiction.
2. Joint Treatment and Finishing Materials: For exposed calcium silicate board applications, provide joint treatment tape and joint compounds recommended in writing by board manufacturer for finishing surfaces.

1.3 EXECUTION

A. Preparation

1. Remove rust and scale from steel substrates at welded steel stud anchorage locations.

B. Installation

1. Install board fire protection according to manufacturer's written instructions.
2. Install board fire protection to comply with requirements for layer thicknesses and number, construction of joints and corners, and anchorage methods applicable to fire-resistance-rated assemblies indicated.
3. Finish exposed calcium silicate board to comply with board manufacturer's written instructions and as follows:
 - a. At joints in calcium silicate board, embed tape in joint compound and apply first, fill, and finish coats of joint compounds over tape, fastener heads, and accessories.
 - b. Apply a thin, uniform skim coat of joint compound over entire surface.
 - c. Touch up and sand between coats and after last coat as needed to produce a surface free of visual defects, tool marks, and ridges.

C. Protection

1. Replace or repair board fire protection that has been cut away to facilitate other construction. Maintain complete coverage of full thickness on members and substrates protected by board fire protection.
 - a. Provide final protection and maintain conditions in a manner acceptable to Installer, manufacturer, and authorities having jurisdiction to ensure that board fire protection is without damage or deterioration at time of Final Completion.

END OF SECTION 07 82 00 00



Task	Specification	Specification Description
07 82 00 00	07 81 16 00	Sprayed Fire-Resistive Materials



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SECTION 07 84 13 16 - THROUGH-PENETRATION FIRESTOP SYSTEMS

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for through-penetration firestop systems. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes through-penetration firestop systems for penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items.

C. Performance Requirements

1. General: For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
2. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per ASTM E 814 or UL 1479:
 - a. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
 - b. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:
 - 1) Penetrations located outside wall cavities.
 - 2) Penetrations located outside fire-resistance-rated shaft enclosures.
 - c. L-Rated Systems: Where through-penetration firestop systems are indicated in smoke barriers, provide **OR** Provide, **as directed**, through-penetration firestop systems with L-ratings indicated **OR** of not more than, **as directed**, 3.0 cfm/sq. ft (0.01524cu. m/s x sq. m) at both ambient temperatures and 400 deg F (204 deg C).
3. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
 - a. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
 - b. For floor penetrations with annular spaces exceeding 4 inches (100 mm) in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.
 - c. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.
4. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

D. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: For each through-penetration firestop system, submit documentation, including illustrations, from a qualified testing and inspecting agency, showing each type of construction condition penetrated, relationships to adjoining construction, and type of penetrating item.



- a. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular through-penetration firestop condition, submit illustration, with modifications marked, approved by through-penetration firestop system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

E. Quality Assurance

1. Installation Responsibility: Assign installation of through-penetration firestop systems and fire-resistive joint systems in Project to a single qualified installer.
2. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in Part 1.1 "Performance Requirements" Article:
 - a. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL **OR** OPL **OR** ITS, **as directed**, or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
 - b. Through-penetration firestop systems are identical to those tested per testing standard referenced in "Part 1.1 Performance Requirements" Article. Provide rated systems bearing classification marking of qualified testing and inspecting agency.
3. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
4. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until each installation has been examined by the Owner's inspecting agency and building inspector, if required by authorities having jurisdiction.

F. Delivery, Storage, And Handling

1. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life if applicable, qualified testing and inspecting agency's classification marking applicable to Project, curing time, and mixing instructions for multicomponent materials.
2. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.2 PRODUCTS

A. Firestopping

1. Compatibility: Provide through-penetration firestop systems that are compatible with one another; with the substrates forming openings; and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.
2. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with Part 1.1 "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to, the following items:
 - a. Permanent forming/damming/backing materials, including the following:
 - 1) Slag-/rock-wool-fiber insulation.
 - 2) Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
 - 3) Fire-rated form board.
 - 4) Fillers for sealants.
 - b. Temporary forming materials.
 - c. Substrate primers.



- d. Collars.
- e. Steel sleeves.

B. Fill Materials

1. General: Provide through-penetration firestop systems containing the types of fill materials indicated in the Through-Penetration Firestop System Schedule at the end of Part 1.3 by referencing the types of materials described in this Article. Fill materials are those referred to in directories of referenced testing and inspecting agencies as "fill," "void," or "cavity" materials.
 2. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
 3. Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.
 4. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
 5. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized steel sheet.
 6. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
 7. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
 8. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.
 9. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives.
 10. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
 11. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
 - a. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping, gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.
 - b. Grade for Horizontal Surfaces: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces.
 - c. Grade for Vertical Surfaces: Nonsag formulation for openings in vertical and other surfaces.
- C. Mixing: For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

1.3 EXECUTION

A. Through-Penetration Firestop System Installation

1. General: Install through-penetration firestop systems to comply with Part 1.1 "Performance Requirements" Article and with firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.



2. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - a. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
 3. Install fill materials for firestop systems by proven techniques to produce the following results:
 - a. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
 - b. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - c. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.
 4. Identification: Identify through-penetration firestop systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of edge of the firestop systems so that labels will be visible to anyone seeking to remove penetrating items or firestop systems. Use mechanical fasteners for metal labels. Include the following information on labels:
 - a. The words "Warning - Through-Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."
 - b. Contractor's name, address, and phone number.
 - c. Through-penetration firestop system designation of applicable testing and inspecting agency.
 - d. Date of installation.
 - e. Through-penetration firestop system manufacturer's name.
 - f. Installer's name.
- B. Field Quality Control
1. Inspecting Agency: the Owner will engage an independent inspecting agency to inspect through-penetration firestops. Independent inspecting agency shall comply with ASTM E 2174 requirements including those related to qualifications, conducting inspections, and preparing test reports.
 2. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.
 3. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued and firestop installations comply with requirements.
- C. Cleaning And Protecting
1. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not damage materials in which openings occur.
 2. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Final Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.
- D. Through-Penetration Firestop System Schedule
1. Choices in the following paragraphs which are contained within brackets shall be as required to satisfy building and local code requirements.
 2. Where UL-classified systems are indicated, they refer to alpha-alpha-numeric designations listed in UL's "Fire Resistance Directory" under product Category XHEZ.
 3. Where OPL-classified systems are indicated, they refer to alpha-numeric design numbers in OPL's "Directory of Listed Building Products, Materials, & Assemblies."



4. Where ITS-listed systems are indicated, they refer to design numbers listed in ITS's "Directory of Listed Products," "Firestop Systems" Section.
5. Firestop Systems with No Penetrating Items:
 - a. UL-Classified Systems: [C-AJ-] [C-BJ-] [F-A-] [W-J-] [W-L-] <Insert one or more four-digit numbers> [0001-0999].
 - b. OPL-Classified Systems: FS <Insert one or more OPL design numbers> [F] [W], Penetrating Item Type G.
 - c. ITS-Listed Systems: <Insert ITS design number(s).>
 - d. Type of Fill Materials: One or more of the following:
 - 1) Latex sealant.
 - 2) Silicone sealant.
 - 3) Intumescent putty.
 - 4) Mortar.
6. Firestop Systems for Metallic Pipes, Conduit, or Tubing:
 - a. UL-Classified Systems: [C-AJ-] [C-BJ-] [C-BK-] [F-A-] [F-B-] [F-C-] [W-J-] [W-K-] [W-L-] <Insert one or more four-digit numbers> [1001-1999].
 - b. OPL-Classified Systems: FS <Insert one or more OPL design numbers> [F] [W], Penetrating Item Type A.
 - c. ITS-Listed Systems: <Insert ITS design number(s).>
 - d. Type of Fill Materials: One or more of the following:
 - 1) Latex sealant.
 - 2) Silicone sealant.
 - 3) Intumescent putty.
 - 4) Mortar.
7. Firestop Systems for Nonmetallic Pipe, Conduit, or Tubing:
 - a. UL-Classified Systems: [C-AJ-] [C-BJ-] [F-A-] [F-B-] [F-C-] [W-J-] [W-L-] <Insert one or more four-digit numbers> [2001-2999].
 - b. OPL-Classified Systems: FS <Insert one or more OPL design numbers> [F] [W], Penetrating Item Type B.
 - c. ITS-Listed Systems: <Insert ITS design number(s).>
 - d. Type of Fill Materials: One or more of the following:
 - 1) Latex sealant.
 - 2) Silicone sealant.
 - 3) Intumescent putty.
 - 4) Intumescent wrap strips.
 - 5) Firestop device.
8. Firestop Systems for Electrical Cables:
 - a. UL-Classified Systems: [C-AJ-] [C-BJ-] [F-A-] [F-B-] [F-C-] [W-J-] [W-L-] <Insert one or more four-digit numbers> [3001-3999].
 - b. OPL-Classified Systems: FS <Insert one or more OPL design numbers> [F] [W], Penetrating Item Type D.
 - c. ITS-Listed Systems: <Insert ITS design number(s).>
 - d. Type of Fill Materials: One or more of the following:
 - 1) Latex sealant.
 - 2) Silicone sealant.
 - 3) Intumescent putty.
 - 4) Silicone foam.
 - 5) Pillows/bags.
9. Firestop Systems for Cable Trays:
 - a. UL-Classified Systems: [C-AJ-] [C-BJ-] [F-A-] [F-B-] [F-C-] [W-J-] [W-K-] [W-L-] <Insert one or more four-digit numbers> [4001-4999].
 - b. OPL-Classified Systems: FS <Insert one or more OPL design numbers> [F] [W], Penetrating Item Type D.
 - c. ITS-Listed Systems: <Insert ITS design number(s).>
 - d. Type of Fill Materials: One or more of the following:
 - 1) Latex sealant.



- 2) Intumescent putty.
 - 3) Silicone foam.
 - 4) Pillows/bags.
 - 5) Mortar.
10. Firestop Systems for Insulated Pipes:
 - a. UL-Classified Systems: [C-AJ-] [C-BJ-] [F-A-] [F-C-] [W-J-] [W-L-] <Insert one or more four-digit numbers> [5001-5999].
 - b. OPL-Classified Systems: FS <Insert one or more OPL design numbers> [F] [W], Penetrating Item Type C.
 - c. ITS-Listed Systems: <Insert ITS design number(s).>
 - d. Type of Fill Materials: One or more of the following:
 - 1) Latex sealant.
 - 2) Intumescent putty.
 - 3) Silicone foam.
 - 4) Intumescent wrap strips.
 11. Firestop Systems for Miscellaneous Electrical Penetrants:
 - a. UL-Classified Systems: [C-AJ-] [F-A-] [W-L-] <Insert one or more four-digit numbers> [6001-6999].
 - b. OPL-Classified Systems: FS <Insert one or more OPL design numbers> [F] [W], Penetrating Item Type E.
 - c. ITS-Listed Systems: <Insert ITS design number(s).>
 - d. Type of Fill Materials: One or more of the following:
 - 1) Latex sealant.
 - 2) Intumescent putty.
 - 3) Mortar.
 12. Firestop Systems for Miscellaneous Mechanical Penetrants:
 - a. UL-Classified Systems: [C-AJ-] [F-C-] [W-J-] [W-L-] <Insert one or more four-digit numbers> [7001-7999].
 - b. ITS-Listed Systems: <Insert ITS design number(s).>
 - c. Type of Fill Materials: One or both of the following:
 - 1) Latex sealant.
 - 2) Mortar.
 13. Firestop Systems for Groupings of Penetrants:
 - a. UL-Classified Systems: [C-AJ-] [C-BJ-] [F-A-] [F-C-] [W-J-] [W-L-] <Insert one or more four-digit numbers> [8001-8999].
 - b. ITS-Listed Systems: <Insert ITS design number(s).>
 - c. Type of Fill Materials: One or more of the following:
 - 1) Latex sealant.
 - 2) Mortar.
 - 3) Intumescent wrap strips.
 - 4) Firestop device.
 - 5) Intumescent composite sheet.

END OF SECTION 07 84 13 16



SECTION 07 84 13 16a - FIRE-RESISTIVE JOINT SYSTEMS

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for fire-resistive joint systems. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes fire-resistive joint systems for the following:
 - a. Floor-to-floor joints.
 - b. Floor-to-wall joints.
 - c. Head-of-wall joints.
 - d. Wall-to-wall joints.
 - e. Perimeter fire-resistive joint systems consisting of floor-to-wall joints between perimeter edge of fire-resistance-rated floor assemblies and exterior curtain walls.

C. Performance Requirements

1. General: Provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly in which fire-resistive joint systems are installed.
2. Joint Systems in and between Fire-Resistance-Rated Constructions: Provide systems with assembly ratings equaling or exceeding the fire-resistance ratings of construction that they join, and with movement capabilities and L-ratings indicated as determined by UL 2079.
 - a. Load-bearing capabilities as determined by evaluation during the time of test.
3. Perimeter Fire-Resistive Joint Systems: For joints between edges of fire-resistance-rated floor assemblies and exterior curtain walls, provide systems of type and with ratings indicated below and those indicated in the Fire-Resistive Joint System Schedule at the end of Part 1.3, as determined by IBC Standard **OR** NFPA 285, **as directed**, and UL 2079.
 - a. UL-Listed, Perimeter Fire-Containment Systems: Integrity ratings equaling or exceeding fire-resistance ratings of floor or floor/ceiling assembly forming one side of joint.
 - b. OPL-Listed, Perimeter Fire-Barrier Systems: F-ratings equaling or exceeding fire-resistance ratings of floor or floor/ceiling assembly forming one side of joint.
4. For fire-resistive systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

D. Submittals

1. Product Data: For each product indicated.
2. Shop Drawings: For each fire-resistive joint system.
3. Qualification Data: For Installer.
4. Field quality-control test reports.
5. Evaluation Reports: Evidence of fire-resistive joint systems' compliance with ICBO ES AC30, from the ICBO Evaluation Service.
6. Research/Evaluation Reports: For each type of fire-resistive joint system.

E. Quality Assurance

1. Installer Qualifications: A firm that has been approved by FMG according to FMG 4991, "Approval of Firestop Contractors."
2. Installation Responsibility: Assign installation of through-penetration firestop systems and fire-resistive joint systems in Project to a single qualified installer.
3. Fire-Test-Response Characteristics: Provide fire-resistive joint systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:



- a. Fire-resistance tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL **OR** OPL, **as directed**, or another agency performing testing and follow-up inspection services for fire-resistive joint systems acceptable to authorities having jurisdiction.
 - b. Fire-resistive joint systems are identical to those tested per methods indicated in Part 1 "Performance Requirements" Article and comply with the following:
 - 1) Fire-resistive joint system products bear classification marking of qualified testing and inspecting agency.
 - 2) Fire-resistive joint systems correspond to those indicated by referencing system designations of the qualified testing and inspecting agency.
4. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.
 5. Do not cover up fire-resistive joint system installations that will become concealed behind other construction until inspecting agency and building inspector of authorities having jurisdiction have examined each installation.

F. Delivery, Storage, And Handling

1. Deliver fire-resistive joint system products to Project site in original, unopened containers or packages with qualified testing and inspecting agency's classification marking applicable to Project and with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life, curing time, and mixing instructions for multicomponent materials.
2. Store and handle materials for fire-resistive joint systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.2 PRODUCTS

A. Fire-Resistive Joint Systems

1. Compatibility: Provide fire-resistive joint systems that are compatible with joint substrates, under conditions of service and application, as demonstrated by fire-resistive joint system manufacturer based on testing and field experience.
2. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing and inspecting agency for systems indicated.

1.3 EXECUTION

A. Installation

1. Install fire-resistive joint systems to comply with Part 1.1 "Performance Requirements" Article and fire-resistive joint system manufacturer's written installation instructions for products and applications indicated.
2. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

B. Field Quality Control

1. Inspecting Agency: Engage a qualified independent inspecting agency to inspect fire-resistive joint systems and prepare inspection reports.
2. Testing Services: Inspecting of completed installations of fire-resistive joint systems shall take place in successive stages as installation of fire-resistive joint systems proceeds. Do not proceed with installation of joint systems for the next area until inspecting agency determines completed work shows compliance with requirements.



- a. Inspecting agency shall state in each report whether inspected fire-resistive joint systems comply with or deviate from requirements.
 3. Remove and replace fire-resistive joint systems where inspections indicate that they do not comply with specified requirements.
 4. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and fire-resistive joint systems comply with requirements.
- C. Fire-Resistive Joint System Schedule
1. Designation System for Joints in or between Fire-Resistance-Rated Constructions: Alphanumeric systems listed in UL's "Fire Resistance Directory" under Product Category XHBN.
 2. Designation System for Joints at the Intersection of Fire-Resistance-Rated Floor or Floor/Ceiling Assembly and an Exterior Curtain-Wall Assembly: Alphanumeric systems listed in UL's "Fire Resistance Directory" under Product Category XHDG **OR** OPL's "Directory of Listed Building Products, Materials, & Assemblies" as perimeter fire-barrier systems, **as directed**.

END OF SECTION 07 84 13 16a



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SECTION 07 84 13 16b - FIRESTOPPING

1.1 DESCRIPTION OF WORK

- A. This specification covers the furnishing and installation of materials for firestopping. Products shall be as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

1.2 GENERAL

- A. System Description
1. Performance Requirements: Comply with following:
 - a. Firestopping: Consist of material or combination of materials to form effective barrier against spread of flame, smoke, and gases, and maintain integrity of fire-resistance rated walls, partitions, floors, and ceiling-floor assemblies at penetrations.
 - 1) Penetrations: Include annular space around pipes, ducts, chimneys, tubes, conduit, wires, cables, and vents.
- B. Submittals
1. Product Data:
 - a. Composition and performance characteristics.
 - b. List of FM, UL, or WH classification number of systems installed.
 2. Quality Assurance/Control Submittals:
 - a. Test Reports: If not FM, UL, or WH listed, submit certified test results for ASTM E 814 tests by UL, FM, WH, or other accredited independent laboratory demonstrating compliance of firestopping with specified requirements.
 - b. Manufacturers installation instructions.
- C. Quality Assurance
1. Regulatory Requirements: Comply with applicable building-code requirements for firestopping.
- D. Delivery, Storage, And Handling
1. Packing, Shipping, Handling, and Unloading: Deliver in original, unopened containers with manufacturer's labels.
 - a. Products: FM, UL, or WH labeled and FM, UL, or WHI listed.
 2. Storage and Protection: Store firestopping materials in accordance with manufacturer's recommendations.

1.3 PRODUCTS

- A. Fire-Rated Penetration Sealant Systems
1. Firestopping Materials: Commercially manufactured asbestos-free products complying with following minimum requirements:
 - a. Material:
 - 1) Flame Spread: ASTM E 84 or UL 723, 25 or less.
 - 2) Smoke Developed Rating: ASTM E 84 or UL 723, 50 or less.
 - 3) Material: Approved firestopping material as listed in UL 05, FM P7825, or WH Certified Listing.
 - b. Material Properties:
 - 1) Contain no flammable or toxic solvents and have no dangerous or flammable outgassing during the drying or curing of products.



- 2) Non-toxic to human beings at all stages of application and during fire conditions.
- 3) Water-resistant after drying or curing and unaffected by high humidity, condensation, or transient water exposure.
- c. Devices and systems requiring heat activation to seal opening created by burning or melting of penetrant shall exhibit demonstrated ability to function as required for floors and walls of construction and thickness similar to those to be firestopped.
2. Firestopping System Requirements: Materials from single manufacturer capable of maintaining effective barrier against flame, smoke, and gases in accordance with ASTM E 814 and UL 1479.
 - a. Fire-Resistance Rating: Equal or greater than fire-resistance rating of assembly in which it is being placed.
 - b. F Ratings: Equal to or greater than fire-resistance rating of assembly penetrated.
 - c. T Ratings: Equal to or greater than fire-resistance rating of assembly penetrated at following locations:
 - 1) Penetrations located outside of wall cavities.
 - 2) Penetrations located outside of fire-resistive shaft enclosures.
 - 3) Penetrations located in enclosures with doors required to have temperature-rise rating.
 - 4) Penetrations with penetrating hems larger than 100 mm (4 inch) diameter nominal pipe or 10 320 sq. mm (16 square inches) in cross-sectional area.
 - d. System: Listed in UL 05, FM 7825, or WH Certified Listing, or tested by approved laboratory in accordance with ASTM E 814.
 - e. System: Suitable for firestopping of penetrations made by steel, glass, plastic, and insulated pipe.
 - f. Penetration by Insulated Pipe: Does not require removal of insulation.

1.4 EXECUTION

A. Examination

1. Verification of Conditions:
 - a. Existing Conditions: Examine penetrations before beginning installation.
 - b. Do not proceed with installation until conditions are satisfactory.

B. Installation

1. Fire-Rated Penetration Sealant Systems: Install in accordance with UL 05, FM P7825, or WH systems and manufacturers recommendations to maintain required fire-separation rating.
 - a. Preparation: Clean surfaces in contact with firestopping materials that may affect proper fitting or required fire rating. Prime if required. Dam void if required.
 - b. Penetrations: Completely fill void with sealant materials to smooth surface, flush with adjacent surfaces and in contact with surfaces formed by openings and penetrating items ensuring adhesion. Provide sealant in thickness to achieve required fire rating and smoke barrier.
 - c. Firestopping at Voids 100 mm (4 inches) or More in Any Direction: Capable of supporting same load as floor is designed to support or protected by permanent barrier.
 - d. Remove any excess sealant from adjacent surfaces.
2. Firestopping: Provide at following locations:
 - a. Penetrations of duct, chimney, conduit, tubing, cable, and pipe through floors and through fire-resistance rated walls, partitions, and ceiling-floor assemblies.
 - b. Penetrations of vertical shafts such as pipe chases, elevator shafts, and utility chutes.
 - c. Gaps at intersection of fire-rated floor slabs and walls.
 - d. Gaps at perimeter of fire-rated walls and partitions, such as between top of walls and bottom of floor or roof decks.
 - e. Construction joints in fire-rated floors, walls, and partitions.
 - f. Other locations where required to maintain fire-resistance rating of the construction.
 - g. Other locations as indicated on Drawings (if any).



C. Field Quality Control

1. Inspection: Examine areas to be firestopped prior to concealing or enclosing to ensure proper installation.
 - a. Keep areas of firestopping work accessible until inspection by authorities having jurisdiction over work.

END OF SECTION 07 84 13 16b



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Task	Specification	Specification Description
07 84 13 19	07 84 13 16	Through-Penetration Firestop Systems
07 84 13 19	07 84 13 16a	Fire-Resistive Joint Systems
07 84 13 19	07 84 13 16b	Firestopping
07 84 16 00	03 05 00 00	Cast-In-Place Concrete
07 84 43 00	07 84 13 16	Through-Penetration Firestop Systems
07 84 43 00	07 84 13 16a	Fire-Resistive Joint Systems
07 84 43 00	07 84 13 16b	Firestopping
07 84 56 13	07 81 16 00	Sprayed Fire-Resistive Materials
07 84 56 13	07 82 00 00	Board Fire Protection



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SECTION 07 91 23 00 - JOINT SEALANTS

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for joint sealants. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Silicone joint sealants.
 - b. Urethane joint sealants.
 - c. Polysulfide joint sealants.
 - d. Latex joint sealants.
 - e. Solvent-release-curing joint sealants.
 - f. Preformed joint sealants.
 - g. Acoustical joint sealants.

C. Preconstruction Testing

1. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
 - a. Use ASTM C 1087 **OR** manufacturer's standard test method, **as directed**, to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
 - b. Submit not fewer than eight pieces of each kind of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
 - c. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 - d. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
 - e. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.
2. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:
 - a. Locate test joints where indicated on Project or, if not indicated, as directed by the Owner.
 - b. Conduct field tests for each application indicated below:
 - 1) Each kind of sealant and joint substrate indicated.
 - c. Notify the Owner seven days in advance of dates and times when test joints will be erected.
 - d. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
 - 1) Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
 - a) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 - e. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
 - f. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with



requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

D. Submittals

1. Product Data: For each joint-sealant product indicated.
2. LEED Submittal:
 - a. Product Data for Credit EQ 4.1: For sealants and sealant primers used inside the weatherproofing system, including printed statement of VOC content.
3. Samples: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
4. Joint-Sealant Schedule: Include the following information:
 - a. Joint-sealant application, joint location, and designation.
 - b. Joint-sealant manufacturer and product name.
 - c. Joint-sealant formulation.
 - d. Joint-sealant color.
5. Qualification Data: For qualified Installer and testing agency.
6. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.
7. Sealant, Waterproofing, and Restoration Institute (SWRI) Validation Certificate: For each sealant specified to be validated by SWRI's Sealant Validation Program.
8. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.
9. Preconstruction Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
 - a. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
 - b. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
10. Preconstruction Field-Adhesion Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.
11. Field-Adhesion Test Reports: For each sealant application tested.
12. Warranties: Sample of special warranties.

E. Quality Assurance

1. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
2. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.
3. Product Testing: Test joint sealants using a qualified testing agency.
 - a. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
 - b. Test according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.
4. Preinstallation Conference: Conduct conference at Project site.

F. Project Conditions

1. Do not proceed with installation of joint sealants under the following conditions:
 - a. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (5 deg C, **as directed**).
 - b. When joint substrates are wet.
 - c. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.



- d. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

G. Warranty

- 1. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - a. Warranty Period: Two years from date of Final Completion.
- 2. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
 - a. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 - b. Disintegration of joint substrates from natural causes exceeding design specifications.
 - c. Mechanical damage caused by individuals, tools, or other outside agents.
 - d. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

1.2 PRODUCTS

A. Materials, General

- 1. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- 2. VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Part 59, Subpart D (EPA Method 24):
 - a. Architectural Sealants: 250 g/L.
 - b. Sealant Primers for Nonporous Substrates: 250 g/L.
 - c. Sealant Primers for Porous Substrates: 775 g/L.
- 3. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
 - a. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.
- 4. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- 5. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.
- 6. Colors of Exposed Joint Sealants: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

B. Silicone Joint Sealants

- 1. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.
- 2. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, for Use NT.
- 3. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
- 4. Single-Component, Nonsag, Acid-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.



5. Single-Component, Nonsag, Traffic-Grade, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use T.
6. Single-Component, Pourable, Traffic-Grade, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade P, Class 100/50, for Use T.
7. Multicomponent, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type M, Grade NS, Class 50, for Use NT.
8. Multicomponent, Pourable, Traffic-Grade, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type M, Grade P, Class 100/50, for Use T.
9. Mildew-Resistant, Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
10. Mildew-Resistant, Single-Component, Acid-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.

C. Urethane Joint Sealants

1. Single-Component, Nonsag, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.
2. Single-Component, Nonsag, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, for Use NT.
3. Single-Component, Nonsag, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
4. Single-Component, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use T.
5. Single-Component, Pourable, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type S, Grade P, Class 25, for Use T.
6. Multicomponent, Nonsag, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 50, for Use NT.
7. Multicomponent, Nonsag, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use NT.
8. Multicomponent, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 50, for Use T.
9. Multicomponent, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use T.
10. Immersible, Single-Component, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Uses T and I.
11. Immersible, Single-Component, Pourable, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type S, Grade P, Class 25, for Uses T and I.
12. Immersible Multicomponent, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Uses T and I.
13. Immersible Multicomponent, Pourable, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade P, Class 25, for Use T and I.

D. Polysulfide Joint Sealants

1. Single-Component, Nonsag, Polysulfide Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
2. Multicomponent, Nonsag, Polysulfide Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use NT.
3. Multicomponent, Nonsag, Traffic-Grade, Polysulfide Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use T.
4. Multicomponent, Pourable, Traffic-Grade, Polysulfide Joint Sealant: ASTM C 920, Type M, Grade P, Class 25, for Use T.
5. Immersible, Multicomponent Nonsag, Traffic-Grade, Polysulfide Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use T and Use I.

E. Latex Joint Sealants

1. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.



- F. Solvent-Release-Curing Joint Sealants
1. Acrylic-Based Joint Sealant: ASTM C 1311.
 2. Butyl-Rubber-Based Joint Sealant: ASTM C 1311.
- G. Preformed Joint Sealants
1. Preformed Silicone Joint Sealants: Manufacturer's standard sealant consisting of precured low-modulus silicone extrusion, in sizes to fit joint widths indicated, combined with a neutral-curing silicone sealant for bonding extrusions to substrates.
 2. Preformed Foam Joint Sealant: Manufacturer's standard preformed, precompressed, open-cell foam sealant manufactured from urethane foam with minimum density of 10 lb/cu. ft. (160 kg/cu. m) and impregnated with a nondrying, water-repellent agent. Factory produce in precompressed sizes in roll or stick form to fit joint widths indicated; coated on one side with a pressure-sensitive adhesive and covered with protective wrapping.
- H. Acoustical Joint Sealants
1. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
- I. Joint Sealant Backing
1. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
 2. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) **OR** Type O (open-cell material) **OR** Type B (bicellular material with a surface skin) **OR** any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, **as directed**, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
 3. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.
- J. Miscellaneous Materials
1. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
 2. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
 3. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

1.3 EXECUTION

A. Examination

1. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Preparation

1. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:



- a. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
- b. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - 1) Concrete.
 - 2) Masonry.
 - 3) Unglazed surfaces of ceramic tile.
 - 4) Exterior insulation and finish systems.
- c. Remove laitance and form-release agents from concrete.
- d. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - 1) Metal.
 - 2) Glass.
 - 3) Porcelain enamel.
 - 4) Glazed surfaces of ceramic tile.
2. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
3. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

C. Installation Of Joint Sealants

1. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
2. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
3. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - a. Do not leave gaps between ends of sealant backings.
 - b. Do not stretch, twist, puncture, or tear sealant backings.
 - c. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
4. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
5. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - a. Place sealants so they directly contact and fully wet joint substrates.
 - b. Completely fill recesses in each joint configuration.
 - c. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
6. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - a. Remove excess sealant from surfaces adjacent to joints.



- b. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - c. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
 - d. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.
 - e. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.
 - 1) Use masking tape to protect surfaces adjacent to recessed tooled joints.
7. Installation of Preformed Silicone-Sealant System: Comply with the following requirements:
- a. Apply masking tape to each side of joint, outside of area to be covered by sealant system.
 - b. Apply silicone sealant to each side of joint to produce a bead of size complying with preformed silicone-sealant system manufacturer's written instructions and covering a bonding area of not less than 3/8 inch (10 mm). Hold edge of sealant bead 1/4 inch (6 mm) inside masking tape.
 - c. Within 10 minutes of sealant application, press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.
 - d. Complete installation of sealant system in horizontal joints before installing in vertical joints. Lap vertical joints over horizontal joints. At ends of joints, cut silicone extrusion with a razor knife.
8. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping. Do not pull or stretch material. Produce seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures, apply heat to sealant in compliance with sealant manufacturer's written instructions.
9. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations.
- D. Field Quality Control
1. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
 - a. Extent of Testing: Test completed and cured sealant joints as follows:
 - 1) Perform 10 tests for the first 1000 feet (300 m) of joint length for each kind of sealant and joint substrate.
 - 2) Perform 1 test for each 1000 feet (300 m) of joint length thereafter or 1 test per each floor per elevation.
 - b. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
 - 1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 - c. Inspect tested joints and report on the following:
 - 1) Whether sealants filled joint cavities and are free of voids.
 - 2) Whether sealant dimensions and configurations comply with specified requirements.
 - 3) Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
 - d. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
 - e. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.



2. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.
- E. Cleaning
1. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.
- F. Protection
1. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Final Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.
- G. Joint-Sealant Schedule
1. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.
 - a. Joint Locations:
 - 1) Control and expansion joints in brick pavers.
 - 2) Isolation and contraction joints in cast-in-place concrete slabs.
 - 3) Joints between plant-precast architectural concrete paving units.
 - 4) Joints in stone paving units, including steps.
 - 5) Tile control and expansion joints.
 - 6) Joints between different materials listed above.
 - 7) Other joints as indicated.
 - b. Silicone Joint Sealant: Single component, nonsag, traffic grade, neutral curing **OR** Single component, pourable, traffic grade, neutral curing **OR** Multicomponent, pourable, traffic grade, neutral curing, **as directed**.
 - c. Urethane Joint Sealant: Single component, nonsag, traffic grade **OR** Single component, pourable, traffic grade **OR** Multicomponent, nonsag, traffic grade, Class 50 **OR** Multicomponent, nonsag, traffic grade, Class 25, **as directed**.
 - d. Polysulfide Joint Sealant: Multicomponent, nonsag, traffic grade **OR** Multicomponent, pourable, traffic grade, **as directed**.
 - e. Preformed Joint Sealant: Preformed foam sealant.
 - f. Joint-Sealant Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range of colors, **as directed**.
 2. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces subject to water immersion.
 - a. Joint Locations:
 - 1) Joints in pedestrian plazas.
 - 2) Joints in swimming pool decks.
 - 3) Other joints as indicated.
 - b. Urethane Joint Sealant: Immersible, single component, nonsag, traffic grade **OR** Immersible, single component, pourable, traffic grade **OR** Immersible, multicomponent, nonsag, traffic grade **OR** Immersible, multicomponent, pourable, traffic grade, **as directed**.
 - c. Polysulfide Joint Sealant: Immersible, multicomponent, nonsag, traffic grade.
 - d. Joint-Sealant Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range of colors, **as directed**.
 3. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
 - a. Joint Locations:
 - 1) Construction joints in cast-in-place concrete.
 - 2) Joints between plant-precast architectural concrete units.
 - 3) Control and expansion joints in unit masonry.
 - 4) Joints in dimension stone cladding.



- 5) Joints in glass unit masonry assemblies.
- 6) Joints in exterior insulation and finish systems.
- 7) Joints between metal panels.
- 8) Joints between different materials listed above.
- 9) Perimeter joints between materials listed above and frames of doors, windows and louvers.
- 10) Control and expansion joints in ceilings and other overhead surfaces.
- 11) Other joints as indicated.
- b. Silicone Joint Sealant: Single component, nonsag, neutral curing, Class 100/50 **OR** Single component, nonsag, neutral curing, Class 50 **OR** Single component, nonsag, neutral curing, Class 25 **OR** Single component, nonsag, acid curing **OR** Multicomponent, nonsag, neutral curing, **as directed**.
- c. Urethane Joint Sealant: Single component, nonsag, Class 100/50 **OR** Single component, nonsag, Class 50 **OR** Single component, nonsag, Class 25 **OR** Multicomponent, nonsag,, Class 50 **OR** Multicomponent, nonsag,, Class 25, **as directed**.
- d. Polysulfide Joint Sealant: Single component, nonsag **OR** Multicomponent, nonsag, **as directed**.
- e. Preformed Joint Sealant: Preformed silicone **OR** Preformed foam, **as directed**.
- f. Joint-Sealant Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range of colors, **as directed**.
4. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.
 - a. Joint Locations:
 - 1) Isolation joints in cast-in-place concrete slabs.
 - 2) Control and expansion joints in stone flooring.
 - 3) Control and expansion joints in brick flooring.
 - 4) Control and expansion joints in tile flooring.
 - 5) Other joints as indicated.
 - b. Silicone Joint Sealant: Single component, nonsag, traffic grade, neutral curing **OR** Single component, pourable, traffic grade, neutral curing **OR** Multicomponent, pourable, traffic grade, neutral curing, **as directed**.
 - c. Urethane Joint Sealant: Single component, nonsag, traffic grade **OR** Single component, pourable, traffic grade **OR** Multicomponent, nonsag, traffic grade, Class 50 **OR** Multicomponent, nonsag, traffic grade, Class 25, **as directed**.
 - d. Polysulfide Joint Sealant: Multicomponent, nonsag, traffic grade **OR** Multicomponent, pourable, traffic grade, **as directed**.
 - e. Preformed Joint Sealant: Preformed foam.
 - f. Joint-Sealant Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range of colors, **as directed**.
5. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
 - a. Joint Locations:
 - 1) Control and expansion joints on exposed interior surfaces of exterior walls.
 - 2) Perimeter joints of exterior openings where indicated.
 - 3) Tile control and expansion joints.
 - 4) Vertical joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
 - 5) Joints on underside of plant-precast structural concrete beams and planks.
 - 6) Perimeter joints between interior wall surfaces and frames of interior doors, windows and elevator entrances.
 - 7) Other joints as indicated.
 - b. Joint Sealant: Latex **OR** Acrylic based **OR** Butyl rubber based, **as directed**.
 - c. Joint-Sealant Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range of colors, **as directed**.
6. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
 - a. Joint Sealant Location:
 - 1) Joints between plumbing fixtures and adjoining walls, floors, and counters.



-
- 2) Tile control and expansion joints where indicated.
 - 3) Other joints as indicated.
 - b. Joint Sealant: Mildew resistant, single component, nonsag, neutral curing, Silicone **OR** Single component, nonsag, mildew resistant, acid curing, **as directed**.
 - c. Joint-Sealant Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range of colors, **as directed**.
7. Joint-Sealant Application: Interior acoustical joints in vertical surfaces and horizontal nontraffic surfaces.
- a. Joint Location:
 - 1) Acoustical joints where indicated.
 - 2) Other joints as indicated.
 - b. Joint Sealant: Acoustical.
 - c. Joint-Sealant Color: As selected from manufacturer's full range.

END OF SECTION 07 91 23 00



Task	Specification	Specification Description
07 91 26 00	07 91 23 00	Joint Sealants
07 92 13 00	07 91 23 00	Joint Sealants
07 92 19 00	07 91 23 00	Joint Sealants



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SECTION 07 95 13 00 - ARCHITECTURAL JOINT SYSTEMS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for architectural joint systems. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.
2. See Division 03 Section "Cast-in-place Concrete" for cast-in architectural-joint-system frames furnished, but not installed, in this Section.

B. Definitions

1. Maximum Joint Width: Widest linear gap a joint system tolerates and in which it performs its designed function without damaging its functional capabilities.
2. Minimum Joint Width: Narrowest linear gap a joint system tolerates and in which it performs its designed function without damaging its functional capabilities.
3. Movement Capability: Value obtained from the difference between widest and narrowest widths of a joint opening typically expressed in numerical values (mm or inches) or a percentage (plus or minus) of nominal value of joint width.
4. Nominal Joint Width: The width of the linear opening specified in practice and in which the joint system is installed.

C. Submittals

1. Shop Drawings: Provide placement drawings, including line diagrams and details, and a tabular schedule of architectural joint systems.

D. Quality Assurance

1. Accessibility Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines (ADAAG)" and ICC A117.1.
2. Fire-Test-Response Characteristics: Where indicated, provide architectural joint system and fire-barrier assemblies identical to those of assemblies tested for fire resistance per UL 2079 or ASTM E 1966 by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - a. Hose Stream Test: Wall-to-wall and wall-to-ceiling assemblies shall be subjected to hose stream testing.

1.2 PRODUCTS

A. Materials

1. Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6063-T5 for extrusions; ASTM B 209 (ASTM B 209M), Alloy 6061-T6 for sheet and plate.
 - a. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.
 - b. Mill Finish.
 - c. Clear Anodic Finish: Class II, clear anodic coating **OR** Class I, clear anodic coating, **as directed**, complying with AAMA 611.
 - d. Color Anodic Finish: Class II, color anodic coating **OR** Class I, color anodic coating, **as directed**, complying with AAMA 611.
 - e. High-Performance Organic Finish (Two-Coat Fluoropolymer): Comply with AAMA 2604 and with coating and resin manufacturers' written instructions.
2. Stainless Steel: ASTM A 666, Type 304 for plates, sheet, and strips.
3. Brass: ASTM B 36/B 36M, UNS Alloy C26000 for half hard sheet and coil.



4. Bronze: ASTM B 455, Alloy C38500 for extrusions; Alloy C23000 red brass for plates.
5. Moisture Barrier: PVC , minimum 30 mils thick **OR** EPDM, minimum 45 mils thick **OR** Santoprene, **as directed**.
6. Elastomeric Seals: Preformed elastomeric membranes or extrusions to be installed in metal frames.
7. Compression Seals: ASTM E 1612; preformed rectangular elastomeric extrusions having internal baffle system and designed to function under compression.
8. Strip Seals: ASTM E 1783; preformed elastomeric membrane or tubular extrusions having an internal baffle system and secured in or over a joint by a metal locking rail.
9. Cellular Foam Seals: Extruded, compressible foam designed to function under compression.
10. Elastomeric Concrete: Modified epoxy or polyurethane extended into a prepackaged aggregate blend, specifically designed for bonding to concrete substrates.
11. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint and to meet performance criteria for required rating period.
12. Accessories: Manufacturer's standard anchors, fasteners, and other accessories as required for complete installations.

B. Architectural Joint Systems, General

1. General: Provide joint systems of design indicated.
 - a. Furnish in longest practicable lengths to minimize splicing. Install with hairline mitered corners where joint changes direction.
 - b. Include factory-fabricated closure materials and transition pieces to provide continuous joint systems.
2. Design architectural joint systems for the following size and movement characteristics:
 - a. Nominal Joint Width: As indicated on Drawings **OR** As scheduled, **as directed**.
 - b. Movement Capability: Plus or minus 25 percent **OR** Plus or minus 50 percent **OR** Plus or minus 100 percent **OR** As indicated on Drawings **OR** As scheduled, **as directed**.
 - c. Type of Movement: As indicated on Drawings **OR** As scheduled **OR** Thermal **OR** Seismic **OR** Wind sway, **as directed**.

C. Architectural Joint Systems For Building Interiors

1. Floor-to-Floor and Floor-to-Wall Joint Systems:
 - a. Type: Cover plate **OR** Center plate **OR** Glide plate **OR** Hidden sightline **OR** Pan **OR** Surface mounted, **as directed**.
 - 1) Exposed Metal: Aluminum **OR** Stainless steel **OR** Bronze **OR** Brass, **as directed**.
 - a) Finish: Manufacturer's standard finish **OR** Mill **OR** Class I, clear anodic **OR** Class II, clear anodic **OR** No. 2B **OR** No. 4, **as directed**.
 - b) Color: As selected from manufacturer's full range.
 - b. Type: Elastomeric **OR** Dual elastomeric, **as directed**, seal.
 - 1) Exposed Metal: Aluminum **OR** Stainless steel **OR** Bronze **OR** Brass, **as directed**.
 - a) Finish: Manufacturer's standard finish **OR** Mill **OR** Class I, clear anodic **OR** Class II, clear anodic **OR** No. 2B **OR** No. 4, **as directed**.
 - b) Color: As selected from manufacturer's full range.
 - 2) Seal Material: Santoprene.
 - a) Color: As selected from manufacturer's full range.
 - c. Cover-Plate Design:
 - 1) Plain **OR** Serrated **OR** Abrasive filled, **as directed**.
 - 2) Recessed to accept field-applied finish materials.
 - a) Recess Depth: To accommodate adjacent flooring.
 - d. Attachment Method: Mechanical anchors **OR** Cast in, **as directed**.
 - e. Load Capacity: Standard **OR** Heavy **OR** Extra heavy, **as directed**, duty.
 - f. Fire-Resistance Rating: Match adjacent construction.
 - g. Moisture Barrier: Manufacturer's standard.
2. Wall-to-Wall and Wall Corner Joint Systems:



- a. Type: Vertical cover plate **OR** Glide plate **OR** Hidden sightline **OR** Snap-on cover **OR** Clip-in cover, **as directed**.
 - 1) Exposed Metal: Aluminum **OR** Stainless steel **OR** Bronze **OR** Brass, **as directed**.
 - a) Finish: Manufacturer's standard finish **OR** Mill **OR** Class I, clear anodic **OR** Class II, clear anodic **OR** No. 2B **OR** No. 4, **as directed**.
 - b) Color: As selected from manufacturer's full range.
 - b. Type: Elastomeric seal **OR** Dual elastomeric seal **OR** Accordion, **as directed**.
 - 1) Exposed Metal: Aluminum **OR** Stainless steel **OR** Bronze **OR** Brass, **as directed**.
 - a) Finish: Manufacturer's standard finish **OR** Mill **OR** Class I, clear anodic **OR** Class II, clear anodic **OR** No. 2B **OR** No. 4, **as directed**.
 - b) Color: As selected from manufacturer's full range.
 - 2) Seal Material: Santoprene **OR** PVC, **as directed**.
 - a) Color: As selected from manufacturer's full range.
 - c. Type: Flat seal.
 - 1) Seal Material: Santoprene.
 - a) Color: As selected from manufacturer's full range.
 - d. Fire-Resistance Rating: Match adjacent construction.
 - e. Moisture Barrier: Manufacturer's standard.
3. Wall-to-Ceiling and Ceiling-to-Ceiling Joint Systems:
- a. Type: Cover plate **OR** Glide plate **OR** Snap-on cover **OR** Clip-in cover, **as directed**.
 - 1) Exposed Metal: Aluminum **OR** Stainless steel **OR** Bronze **OR** Brass, **as directed**.
 - a) Finish: Manufacturer's standard finish **OR** Mill **OR** Class I, clear anodic **OR** Class II, clear anodic **OR** No. 2B **OR** No. 4, **as directed**.
 - b) Color: As selected from manufacturer's full range.
 - b. Type: Elastomeric seal **OR** Dual elastomeric seal **OR** Accordion, **as directed**.
 - 1) Exposed Metal: Aluminum **OR** Stainless steel **OR** Bronze **OR** Brass, **as directed**.
 - a) Finish: Manufacturer's standard finish **OR** Mill **OR** Class I, clear Color: As selected from manufacturer's full range.
 - b) Seal Material: Santoprene **OR** PVC, **as directed**.
 - c) Color: As selected from manufacturer's full range.
 - c. Type: Flat seal.
 - 1) Seal Material: Santoprene.
 - a) Color: As selected from manufacturer's full range.
 - d. Fire-Resistance Rating: Match adjacent construction.
 - e. Moisture Barrier: Manufacturer's standard.
- D. Architectural Joint Systems For Building Exteriors
1. Architectural Joint Systems for Exterior Walls and Soffits:
- a. Type: Vertical cover-plate.
 - 1) Exposed Metal: Aluminum **OR** Stainless steel, **as directed**.
 - a) Finish: Manufacturer's standard finish **OR** Mill **OR** Class I, clear anodic **OR** Class II, clear anodic **OR** Class I, color anodic **OR** Class II, color anodic **OR** High-performance organic **OR** No. 2B **OR** No. 4, **as directed**.
 - b) Color: As selected from full range of industry colors and color densities.
 - 2) Secondary Seal: Manufacturer's standard extruded-elastomeric seal designed to prevent water and moisture infiltration.
 - b. Type: Flat seal.
 - 1) Seal Material: Santoprene.
 - a) Color: As selected from manufacturer's full range.
 - 2) Secondary Seal: Manufacturer's standard extruded-elastomeric seal designed to prevent water and moisture infiltration.
 - 3) Pantograph Mechanism: Manufacturer's standard nylon pantographic wind-load support mechanism with stainless-steel fasteners.
 - c. Type: Preformed cellular foam.



- 1) Foam Material: Manufacturer's standard **OR** Non-extruded, low-density, crosslinked, nitrogen-blown, ethylene-vinyl-acetate copolymer **OR** Polyurethane, **as directed**.
 - a) Color: As selected from manufacturer's full range.
 - d. Fire-Resistance Rating: Match adjacent construction.
- E. Architectural Joint Systems For Open-Air Structures
1. Slab-to-Slab Joint Systems for Parking Structures **OR** Plaza Decks **OR** Stadiums, **as directed**:
 - a. Type: Metal plate.
 - 1) Exposed Metal: Aluminum **OR** Stainless steel, **as directed**.
 - a) Finish: Manufacturer's standard finish **OR** Mill **OR** Class I, clear anodic **OR** Class II, clear anodic **OR** Class I, color anodic **OR** Class II, color anodic **OR** High-performance organic **OR** No. 2B **OR** No. 4, **as directed**.
 - b) Color: As selected from full range of industry colors and color densities.
 - b. Type: Sealant T-joint **OR** Rubber pad **OR** Compression seal **OR** Strip seal **OR** Winged seal **OR** Epoxy-bonded seal **OR** Split-slab membrane, **as directed**.
 - 1) Seal Material: Santoprene **OR** Neoprene **OR** Silicone **OR** EPDM **OR** PVC **OR** Manufacturer's standard, **as directed**.
 - a) Color: As selected from manufacturer's full range.
 - c. Attachment Method: Mechanical anchors **OR** Cast in **OR** Elastomeric concrete header **OR** Compressed, epoxy adhered **OR** Compressed, lubricant adhesive adhered, **as directed**.
 - d. Load Capacity: Heavy **OR** Extra heavy, **as directed**, duty.
 - e. Fire-Resistance Rating: Match adjacent construction.
 - f. Gutter: Flexible, fabric-reinforced neoprene gutter system with drain tubes.
 2. Slab-to-Wall Joint Systems for Parking Structures **OR** Plaza Decks **OR** Stadiums, **as directed**:
 - a. Type: Metal plate.
 - 1) Exposed Metal: Aluminum **OR** Stainless steel, **as directed**.
 - a) Finish: Manufacturer's standard finish **OR** Mill **OR** Class I, clear anodic **OR** Class II, clear anodic **OR** Class I, color anodic **OR** Class II, color anodic **OR** High-performance organic **OR** No. 2B **OR** No. 4, **as directed**.
 - b) Color: As selected from full range of industry colors and color densities.
 - b. Type: Sealant T-joint **OR** Rubber pad **OR** Compression seal **OR** Strip seal **OR** Winged seal **OR** Epoxy-bonded seal **OR** Split-slab membrane, **as directed**.
 - 1) Seal Material: Santoprene **OR** Neoprene **OR** Silicone **OR** EPDM **OR** PVC **OR** Manufacturer's standard, **as directed**.
 - a) Color: As selected from manufacturer's full range.
 - c. Attachment Method: Mechanical anchors **OR** Cast in **OR** Elastomeric concrete header **OR** Compressed, epoxy adhered **OR** Compressed, lubricant adhesive adhered, **as directed**.
 - d. Fire-Resistance Rating: Match adjacent construction.
 - e. Gutter: Flexible, fabric reinforced neoprene gutter system with drain tubes.
 3. Wall-to-Wall Joint Systems for Parking Structures **OR** Plaza Decks **OR** Stadiums, **as directed**:
 - a. Type: Compression seal.
 - 1) Seal Material: Santoprene **OR** Neoprene **OR** Silicone **OR** EPDM **OR** PVC **OR** Manufacturer's standard, **as directed**.
 - a) Color: As selected from manufacturer's full range.
 - b. Type: Preformed cellular foam.
 - 1) Foam Material: Manufacturer's standard **OR** Non-extruded, low-density, crosslinked, nitrogen-blown, ethylene-vinyl-acetate copolymer **OR** Polyurethane, **as directed**.
 - a) Color: As selected from manufacturer's full range.
 - c. Attachment Method: Mechanical anchors **OR** Cast in **OR** Compressed, epoxy adhered **OR** Compressed, lubricant adhesive adhered, **as directed**.
 - d. Fire-Resistance Rating: Match adjacent construction.
- F. Finishes



1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Appearance of Finished Work: Noticeable variations in same piece are not acceptable.

1.3 EXECUTION

A. Installation

1. Comply with manufacturer's written instructions for storing, handling, and installing architectural joint assemblies and materials unless more stringent requirements are indicated.
2. Metal Frames: Perform cutting, drilling, and fitting required to install joint systems.
 - a. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
 - b. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation.
 - c. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
 - d. Locate in continuous contact with adjacent surfaces.
 - e. Support underside of frames continuously to prevent vertical deflection when in service.
 - f. Locate anchors at interval recommended by manufacturer, but not less than 3 inches (75 mm) from each end and not more than 24 inches (600 mm) o.c.
3. Seals in Metal Frames: Install elastomeric seals in frames to comply with manufacturer's written instructions. Install with minimum number of end joints.
 - a. Provide in continuous lengths for straight sections.
 - b. Seal transitions according to manufacturer's written instructions.
4. Compression Seals: Apply adhesive or lubricant adhesive as recommended by manufacturer to both frame interfaces **OR** sides of slabs, **as directed**, before installing compression seals.
5. Foam Seals: Install with adhesive recommended by manufacturer.
6. Epoxy-Bonded Seals: Pressurize seal for time period and to pressure recommended by manufacturer. Do not overpressurize.
7. Terminate exposed ends of joint assemblies with field- or factory-fabricated termination devices.
8. Fire-Resistance-Rated Assemblies: Coordinate so complete assemblies comply with assembly performance requirements.
 - a. Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and field splices.
9. Water Barrier: Provide water barrier at exterior joints and where called for on Drawings.

B. Protection

1. Do not remove protective covering until finish work in adjacent areas is complete.
2. Protect the installation from damage by work of other Sections.

END OF SECTION 07 95 13 00



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SECTION 07 95 13 00a - ROOF EXPANSION ASSEMBLIES

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for roof expansion assemblies. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Metal-flanged, bellows-type roof expansion assemblies.
 - b. Aluminum roof expansion assemblies.
 - c. Seismic roof expansion assemblies.

C. Performance Requirements

1. General: Provide roof expansion assemblies that, when installed, remain watertight within movement limitations specified by manufacturer.

D. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: Include plans, elevations, sections, details, joints, splices, locations of joints and splices, intersections, transitions, fittings, and attachments to other work. Where joint assemblies change planes, provide isometric drawings depicting how components interconnect to achieve continuity.
3. Samples: For each type of exposed factory-applied finish required, prepared on Samples of size to adequately show color.
4. Research/Evaluation Reports: For roof expansion assemblies.
5. Warranties: Special warranties specified in this Section.

E. Quality Assurance

1. Fire-Test-Response Characteristics: Provide fire-barrier assemblies with fire-test-response characteristics not less than that of adjacent construction, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Assemblies shall be capable of anticipated movement while maintaining fire rating. Identify assemblies with appropriate markings of applicable testing and inspecting agency.
 - a. Fire-Resistance Ratings: UL 2079 **OR** ASTM E 119, **as directed**.

F. Warranty

1. Warranty: Manufacturer's standard form in which manufacturer and Installer agree to repair or replace roof expansion assemblies that leak, deteriorate in excess of rates specified in manufacturer's published product literature, or otherwise fail to perform within Two years from date of Final Completion.
2. Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied fluoropolymer finishes within 20 years from date of Final Completion.

1.2 PRODUCTS

A. Metals



1. Galvanized Steel Sheet: ASTM A 653/A 653M, hot-dip zinc-coating designation G90 (Z275), stretcher-leveled standard of flatness and either commercial or forming steel, minimum 0.019 inch (0.5 mm) thick.
2. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness, minimum 0.015 inch (0.4 mm) thick.
3. Copper Sheet: ASTM B 370, Temper H00 (cold rolled) unless Temper 060 is required for forming, minimum 16 oz./sq. ft. (0.55 mm thick).
4. Sheet Aluminum: ASTM B 209 (ASTM B 209M); Alloy 3003-H14, 5052-H32, or 6061-T6; minimum 0.032 inch (0.8 mm) thick.
5. Extruded Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6063-T5 or 6063-T52, minimum 0.040 inch (1.0 mm) thick.
6. Aluminum Finishes:
 - a. Mill Finish: AA-M10 (Mechanical Finish: as fabricated; no other applied finish unless buffing is required to removed scratches, welding, or grinding produced in fabrication process).
 - b. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.
 - c. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
 - d. Class II, Color Anodic Finish: AA-M12C22A32/A34 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, integrally colored or electrolytically deposited color coating 0.010 mm or thicker).
 - e. Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
 - 1) Color: As selected from manufacturer's full range.
 - f. High-Performance Organic Finish (2-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2604 and with coating and resin manufacturers' written instructions.
 - 1) Color and Gloss: As selected from manufacturer's full range.

B. Miscellaneous Materials

1. Roof Cement: ASTM D 4586, Type II.
2. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane **OR** polysulfide **OR** silicone, **as directed**, polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and to remain watertight.
3. Mineral-Fiber Blanket: ASTM C 665.
4. Flexible Cellular Sponge or Expanded Rubber: ASTM D 1056.
5. Silicone Extrusions: Classified according to ASTM D 2000, UV stabilized, and do not propagate flame.
6. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to withstand design loads.
 - a. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.

C. Fire Barriers

1. Fire Barriers: Devices complying with requirements specified in Part 1.1 "Quality Assurance" Article for fire-test-response characteristics and designed for dynamic structural movement



without material degradation or fatigue when tested according to ASTM E 1399. Provide roof expansion assemblies with manufacturer's continuous, standard, flexible fire-barrier seals in back of joint system at locations indicated to provide fire-resistance rating not less than rating of adjacent construction.

D. Bellows-Type Roof Expansion Assemblies

1. Metal-Flanged, Bellows-Type Roof Expansion Assemblies: Provide manufacturer's standard assemblies of sizes and types indicated, with prefabricated units for corner and joint intersections and horizontal and vertical transitions including those to other building expansion joints, splicing units, adhesives, coatings, and other components as recommended by roof expansion assembly manufacturer for complete installation. Fabricate assemblies specifically for roof-to-roof **OR** roof-to-wall **OR** curb-to-curb **OR** curb-to-wall, **as directed**, applications.
2. Provide assemblies consisting of exposed polymeric sheet over foam bellows, securely anchored at both edges to 3- to 4-inch- (76- to 100-mm-) wide sheet metal nailing flanges, either flat or angle formed to fit cant or curbs as required. Insulate bellows with closed-cell, flexible rubber or plastic foam not less than 5/16 inch (8 mm) thick; adhere bellows to underside of polymeric sheet.
 - a. Polymeric Sheet: Manufacturer's standard **OR** Neoprene, 60 mils (1.5 mm) thick **OR** EPDM, 60 mils (1.5 mm) thick, black **OR** EPDM, 60 mils (1.5 mm) thick, white **OR** Reinforced chlorinated polyethylene, 30 mils (0.8 mm) thick **OR** Chlorosulfonated polyethylene, 36 mils (0.9 mm) thick **OR** Glass-reinforced PVC, 40 to 50 mils (1.0 to 1.3 mm) thick, **as directed**.
 - b. Metal Flanges: Zinc-coated (galvanized) steel, minimum 0.019 inch (0.5 mm) thick **OR** Copper, minimum 16 oz./sq. ft. (0.55 mm thick) **OR** Stainless steel, minimum 0.015 inch (0.4 mm) thick **OR** Sheet aluminum, minimum 0.032 inch (0.8 mm) thick, mill finish, **as directed**.
 - 1) Mortar Flanges: Where flanges will be embedded in concrete or mortar, provide manufacturer's standard perforated-metal mortar flanges.
 - c. Moisture Barrier: Manufacturer's standard, flexible, continuous, polymeric moisture barrier looped under roof expansion assemblies at locations indicated. Fill space with blanket-type, mineral-fiber insulation.
 - d. Fire Barrier: Provide manufacturer's standard fire barrier.

E. Aluminum Roof Expansion Assemblies

1. Aluminum Roof Expansion Assemblies: Provide assemblies consisting of aluminum base members with sloped cants and provisions for anchoring and sealing to roofing membrane or flashing in a waterproof-sealed joint. Provide free-to-move, extruded-aluminum cover plate anchored against displacement and waterproofed by integral seals. Provide prefabricated units for corner and joint intersections and horizontal and vertical transitions, including those to other building expansion joints, splicing units, adhesives, coatings, and other components as recommended by roof expansion assembly manufacturer for complete installation. Fabricate assemblies specifically for curb-to-curb **OR** wall, **as directed**, applications.
 - a. Base Frame Members: Extruded aluminum with mill **OR** anodic **OR** high-performance organic, **as directed**, finish.
 - b. Extruded-Aluminum Covers: Minimum 0.080 inch (2.03 mm) **OR** 0.125 inch (3 mm), **as directed**, thick, with mill **OR** clear anodic **OR** color anodic **OR** high-performance organic, **as directed**, finish.
 - c. Formed-Aluminum Covers: Minimum 0.078 inch (2 mm) thick, with mill **OR** clear anodic **OR** color anodic **OR** high-performance organic, **as directed**, finish.
 - d. Moisture Barrier:
 - 1) Semiconcealed, captive, polymeric sheet bellows unit of neoprene, EPDM, reinforced chlorinated polyethylene, or PVC, not less than 30 mils (0.8 mm) thick.
 - 2) Semiconcealed, captive gaskets at both curb members, of neoprene, EPDM, or PVC, with spring-loaded mechanism to maintain positive pressure between gaskets and curb cap.
 - e. Fire Barrier: Provide manufacturer's standard fire barrier.



F. Seismic Roof Expansion Assemblies

1. General: Provide manufacturer's assemblies designed to accommodate seismic movement. Provide prefabricated units for corner and joint intersections and horizontal and vertical transitions including those to other building expansion joints, splicing units, inner seals, adhesives, coatings, and other components as recommended by roof expansion assembly manufacturer for complete installation. Fabricate assemblies specifically for roof-to-roof **OR** roof-to-wall **OR** curb-mounted, **as directed**, applications.
2. Extruded Seals: Two continuous, single-layered elastomeric profiles made of a vinyl inner seal and silicone **OR** neoprene **OR** Santoprene, **as directed**, outer seal, both seals retained in a pair of compatible extruded-aluminum frames.
 - a. Exterior Seal Color: As selected from manufacturer's full range.
3. Aluminum Roof Expansion Assemblies: Assemblies consisting of pairs of aluminum curb units with sloped cants and provisions for anchoring and sealing to roofing membrane or flashing in a waterproof-sealed joint. Provide free-to-move, extruded-aluminum curb cap anchored against displacement and waterproofed by integral seals, with interior of expansion joint filled with blanket-type mineral-fiber insulation.
 - a. Base Frame Members: Extruded aluminum with mill **OR** clear anodic **OR** color anodic **OR** high-performance organic, **as directed**, finish.
 - b. Extruded-Aluminum Covers: Minimum 0.080 inch (2.03 mm) **OR** 0.125 inch (3 mm), **as directed**, thick, with mill **OR** clear anodic **OR** color anodic **OR** high-performance organic, **as directed**, finish.
 - c. Formed-Aluminum Covers: Minimum 0.078 inch (2 mm) thick, with mill **OR** clear anodic **OR** color anodic **OR** high-performance organic, **as directed**, finish.
 - d. Moisture Barrier:
 - 1) Semiconcealed, captive, polymeric sheet bellows unit of neoprene, EPDM, reinforced chlorinated polyethylene, or PVC, not less than 30 mils (0.8 mm) thick.
 - 2) Semiconcealed, captive gaskets at both curb members, of neoprene, EPDM, or PVC, with spring-loaded mechanism to maintain positive pressure between gaskets and curb cap.
 - e. Fire Barrier: Provide manufacturer's standard fire barrier.

1.3 EXECUTION

A. Installation

1. Comply with manufacturer's written instructions for handling and installing roof expansion assemblies and materials unless more stringent requirements are indicated.
2. Coordinate installation of roof expansion assembly materials and associated work so complete assemblies comply with assembly performance requirements.
3. Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of roof expansion assembly, including transitions and end joints.
4. Extend roof expansion assemblies over curbs, parapets, cornices, gutters, valleys, fasciae, and other elements in the construction profile, with factory-fabricated intersections and transitions to provide continuous, uninterrupted, waterproof roof expansion assemblies.
 - a. Install factory-fabricated transitions between roof expansion assemblies and building architectural joint systems, specified in Division 07 Section "Expansion Control", to provide continuous, uninterrupted, watertight construction.
5. Splice roof expansion assemblies with materials provided by roof expansion assembly manufacturer for this purpose, according to manufacturer's written instructions, to provide continuous, uninterrupted, waterproof roof expansion assemblies.
6. Provide uniform profile of roof expansion assembly throughout length of each installation; do not stretch polymeric sheets.
7. Install mineral-fiber blanket insulation to fill joint space within joint and moisture barrier.
8. Bed anchorage flanges in cement or sealant recommended by manufacturer and securely nail to curbs and cant strips as recommended by manufacturer but not less than 6 inches (150 mm) o.c.



9. Anchor roof expansion assemblies complying with manufacturer's written instructions.
 10. Embed flanges not less than 4 inches (100 mm) in bituminous membranes, with hot bitumen or roof cement. Cover with stripping material and install according to requirements in roofing section.
 11. On single-ply roofing, install roof expansion assemblies complying with manufacturer's written instructions. Anchor to cants or curbs and seal to membrane with sealant compatible with roofing membrane and roof expansion assembly. Cover flanges with stripping or flashing and install according to requirements in roofing section.
- B. Protection
1. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensures that roof expansion assemblies are without damage or deterioration at time of Final Completion.

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SECTION 08 01 11 00 - STEEL DOORS AND FRAMES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of material for steel doors and frames. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Standard hollow metal doors and frames.
 - b. Custom hollow metal doors and frames.

C. Definitions

1. Minimum Thickness: Minimum thickness of base metal without coatings.
2. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.
3. Custom Hollow Metal Work: Hollow metal work fabricated according to ANSI/NAAMM-HMMA 861.

D. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: Include elevations, door edge details, frame profiles, metal thicknesses, preparations for hardware, and other details.
3. Samples for Verification: For each type of exposed finish required.
4. Schedule: Prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings.
5. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.
6. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of hollow metal door and frame assembly.

E. Quality Assurance

1. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure **OR** as close to neutral pressure as possible, **as directed**, according to NFPA 252 **OR** IBC Standard 716.5, **as directed**, or UL 10B **OR** UL 10C, **as directed**.
 - a. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
 - b. Temperature-Rise Limit: Where indicated **OR** At vertical exit enclosures and exit passageways, **as directed**, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
2. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9 **OR** IBC Standard 716.5, **as directed**. Label each individual glazed lite.
3. Smoke-Control Door Assemblies: Comply with NFPA 105 or UL 1784 **OR** IBC Standard 716.5, **as directed**.

F. Delivery, Storage, And Handling



1. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
 - a. Provide additional protection to prevent damage to finish of factory-finished units.
2. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
3. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch- (102-mm-) high wood blocking. Do not store in a manner that traps excess humidity.
 - a. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

1.2 PRODUCTS

A. Materials

1. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
2. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
3. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A40 (ZF120) **OR** G60 (Z180) or A60 (ZF180), **as directed**, metallic coating.
4. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z (12G) coating designation; mill phosphatized.
 - a. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
5. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
6. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.
7. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.
8. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. (96- to 192-kg/cu. m) density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
9. Glazing: Comply with requirements in Division 08 Section "Glazing".
10. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat.

B. Standard Hollow Metal Doors

1. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.
 - a. Design: Flush panel **OR** Embossed panel **OR** As indicated, **as directed**.
 - b. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core.
 - 1) Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
 - 2) Thermal-Rated (Insulated) Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 4.0 deg F x h x sq. ft./Btu (0.704 K x sq. m/W) **OR** 6.0 deg F x h x sq. ft./Btu (1.057 K x sq. m/W) **OR** 12.3 deg F x h x sq. ft./Btu (2.166 K x sq. m/W), **as directed**, when tested according to ASTM C 1363.
 - a) Locations: Exterior doors and interior doors where indicated, **as directed**.



- c. Vertical Edges for Single-Acting Doors: Beveled edge **OR** Square edge **OR** Manufacturer's standard, **as directed**.
 - 1) Beveled Edge: 1/8 inch in 2 inches (3 mm in 50 mm).
 - d. Vertical Edges for Double-Acting Doors: Round vertical edges with 2-1/8-inch (54-mm) radius.
 - e. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- (1.0-mm-) thick, end closures or channels of same material as face sheets.
 - f. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
2. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
 - a. Level 1 and Physical Performance Level C (Standard Duty), Model 1 (Full Flush) **OR** Model 2 (Seamless), **as directed**.
 - 1) Width: 1-3/4 inches (44.5 mm) **OR** 1-3/8 inches (34.9 mm) **OR** As indicated on Drawings, **as directed**.
 - b. Level 2 and Physical Performance Level B (Heavy Duty), Model 1 (Full Flush) **OR** Model 2 (Seamless), **as directed**.
 - c. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 1 (Full Flush) **OR** Model 2 (Seamless) **OR** Model 3 (Stile and Rail), **as directed**.
 - d. Level 4 and Physical Performance Level A (Maximum Duty), Model 1 (Full Flush) **OR** Model 2 (Seamless), **as directed**.
 3. Interior Doors: Face sheets fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
 - a. Level 1 and Physical Performance Level C (Standard Duty), Model 1 (Full Flush) **OR** Model 2 (Seamless), **as directed**.
 - 1) Width: 1-3/4 inches (44.5 mm) **OR** 1-3/8 inches (34.9 mm) **OR** As indicated on Drawings, **as directed**.
 - b. Level 2 and Physical Performance Level B (Heavy Duty), Model 1 (Full Flush) **OR** Model 2 (Seamless), **as directed**.
 - c. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 1 (Full Flush) **OR** Model 2 (Seamless) **OR** Model 3 (Stile and Rail), **as directed**.
 - d. Level 4 and Physical Performance Level A (Maximum Duty), Model 1 (Full Flush) **OR** Model 2 (Seamless), **as directed**.
 4. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
 5. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.
- C. Standard Hollow Metal Frames
1. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.
 2. Exterior Frames: Fabricated from metallic-coated steel sheet.
 - a. Fabricate frames with mitered or coped corners.
 - b. Fabricate frames as knocked down **OR** face welded **OR** full profile welded, **as directed**, unless otherwise indicated.
 - c. Frames for Level 1 Steel Doors: 0.042-inch- (1.0-mm-) thick steel sheet.
 - d. Frames for Level 2 Steel Doors: 0.053-inch- (1.3-mm-) thick steel sheet.
 - e. Frames for Level 3 Steel Doors: 0.053-inch- (1.3-mm-) thick steel sheet.
 - f. Frames for Level 4 Steel Doors: 0.067-inch- (1.7-mm-) thick steel sheet.
 3. Interior Frames: Fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated.
 - a. Fabricate frames with mitered or coped corners.
 - b. Fabricate frames as knocked down **OR** face welded **OR** full profile welded, **as directed**, unless otherwise indicated.
 - c. Fabricate knocked-down, drywall slip-on frames for in-place gypsum board partitions, **as directed**.



- d. Frames for Level 1 Steel Doors: 0.042-inch- (1.0-mm-) thick steel sheet.
 - e. Frames for Level 2 Steel Doors: 0.053-inch- (1.3-mm-) thick steel sheet.
 - f. Frames for Level 3 Steel Doors: 0.053-inch- (1.3-mm-) thick steel sheet.
 - g. Frames for Level 4 Steel Doors: 0.067-inch- (1.7-mm-) thick steel sheet.
 - h. Frames for Wood Doors: 0.042-inch- (1.0-mm-) **OR** 0.053-inch- (1.3-mm-) **OR** 0.067-inch- (1.7-mm-), **as directed**, thick steel sheet.
 - i. Frames for Borrowed Lights: 0.042-inch- (1.0-mm-) thick steel sheet **OR** 0.053-inch- (1.3-mm-) thick steel sheet **OR** 0.067-inch- (1.7-mm-) thick steel sheet **OR** Same as adjacent door frame, **as directed**.
4. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

D. Custom Hollow Metal Doors

- 1. General: Provide doors not less than 1-3/4 inches (44.5 mm) thick, of seamless hollow construction unless otherwise indicated. Construct doors with smooth surfaces without visible joints or seams on exposed faces. Comply with ANSI/NAAMM-HMMA 861.
- 2. Exterior Door Face Sheets: Fabricated from metallic-coated steel sheet, minimum 0.053 inch (1.3 mm) thick.
- 3. Interior Door Face Sheets: Fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated, minimum 0.042 inch (1.0 mm) thick.
- 4. Core Construction: Provide thermal-resistance-rated cores for exterior doors and interior doors where indicated, **as directed**.
 - a. Steel-Stiffened Core: 0.026-inch- (0.7-mm-) thick, steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches (152 mm) apart, spot welded to face sheets a maximum of 5 inches (127 mm) o.c. Spaces filled between stiffeners with glass- or mineral-fiber insulation.
 - 1) Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
 - 2) Thermal-Rated (Insulated) Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 4.0 deg F x h x sq. ft./Btu (0.704 K x sq. m/W) **OR** 6.0 deg F x h x sq. ft./Btu (1.057 K x sq. m/W), **as directed**, when tested according to ASTM C 1363.
- 5. Vertical Edges for Single-Acting Doors: Beveled 1/8 inch in 2 inches (3 mm in 50 mm).
- 6. Vertical Edges for Double-Acting Doors: Round vertical edges with 2-1/8-inch (54-mm) radius.
- 7. Top and Bottom Channels: Closed with continuous channels, minimum 0.053 inch (1.3 mm) thick, of same material as face sheets and spot welded to both face sheets.
- 8. Hardware Reinforcement: Fabricate according to ANSI/NAAMM-HMMA 861 with reinforcing plates from same material as door face sheets.

E. Custom Hollow Metal Frames

- 1. General: Fabricate frames of construction indicated. Close contact edges of corner joints tight with faces mitered and stops butted or mitered. Continuously weld faces and soffits and finish faces smooth. Comply with ANSI/NAAMM-HMMA 861.
 - a. Door Frames for Openings 48 Inches (1219 mm) Wide or Less: Fabricated from 0.053-inch- (1.3-mm-) thick steel sheet.
 - b. Door Frames for Openings More Than 48 Inches (1219 mm) Wide: Fabricated from 0.067-inch- (1.7-mm-) thick steel sheet.
 - c. Sidelight and Transom Frames: Fabricated from same thickness material as adjacent door frame.
 - d. Borrowed-Light Frames: Fabricated from 0.053-inch- (1.3-mm-) thick steel sheet.
- 2. Exterior Frames: Formed from metallic-coated steel sheet.
- 3. Interior Frames: Fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated.
- 4. Hardware Reinforcement: Fabricate according to ANSI/NAAMM-HMMA 861 with reinforcing plates from same material as frame.



5. Head Reinforcement: Provide minimum 0.093-inch- (2.3-mm-) thick, steel channel or angle stiffener for opening widths more than 48 inches (1219 mm).
- F. Frame Anchors
1. Jamb Anchors:
 - a. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick, with corrugated or perforated straps not less than 2 inches (50 mm) wide by 10 inches (250 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.
 - b. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.
 - c. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
 - d. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
 2. Floor Anchors: Formed from same material as frames, not less than 0.042 inch (1.0 mm) thick, and as follows:
 - a. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
 - b. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch (50-mm) height adjustment. Terminate bottom of frames at finish floor surface.
- G. Hollow Metal Panels
1. Provide hollow metal panels of same materials, construction, and finish as specified for adjoining hollow metal work.
- H. Stops And Moldings
1. Moldings for Glazed Lites in Doors: Minimum 0.032 inch (0.8 mm) thick, fabricated from same material as door face sheet in which they are installed.
 2. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated.
 3. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch (0.8 mm) thick, fabricated from same material as frames in which they are installed.
 4. Terminated Stops: Where indicated on interior door frames, terminate stops 6 inches (152 mm) above finish floor with a 45-degree **OR** 90-degree, **as directed**, angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.
- I. Louvers
1. Provide louvers for interior doors, where indicated, that comply with SDI 111C, with blades or baffles formed of 0.020-inch- (0.5-mm-) thick, cold-rolled steel sheet set into 0.032-inch- (0.8-mm-) thick steel frame.
 - a. Sightproof Louver: Stationary louvers constructed with inverted V-shaped or Y-shaped blades.
 - b. Lightproof Louver: Stationary louvers constructed with baffles to prevent light from passing from one side to the other, any angle.
 - c. Fire-Rated Automatic Louvers: Louvers constructed with movable blades closed by actuating fusible link, and listed and labeled for use in fire-rated door assemblies of type and fire-resistance rating indicated by same testing and inspecting agency that established fire-resistance rating of door assembly.
- J. Accessories
1. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
 2. Ceiling Struts: Minimum 1/4-inch-thick by 1-inch- (6.4-mm-thick by 25.4-mm-) wide steel.
 3. Grout Guards: Formed from same material as frames, not less than 0.016 inch (0.4 mm) thick.



K. Fabrication

1. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
2. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117 **OR** ANSI/NAAMM-HMMA 861, **as directed**.
3. Hollow Metal Doors:
 - a. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
 - b. Glazed Lites: Factory cut openings in doors.
 - c. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch (19 mm) beyond edge of door on which astragal is mounted.
4. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 - a. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
 - b. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
 - c. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 - d. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
 - e. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
 - f. Jamb Anchors: Provide number and spacing of anchors as follows:
 - 1) Masonry Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
 - a) Two anchors per jamb up to 60 inches (1524 mm) high.
 - b) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
 - c) Four anchors per jamb from 90 to 120 inches (2286 to 3048 mm) high.
 - d) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 120 inches (3048 mm) high.
 - 2) Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
 - a) Three anchors per jamb up to 60 inches (1524 mm) high.
 - b) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
 - c) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) high.
 - d) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 96 inches (2438 mm) high.
 - e) Two anchors per head for frames above 42 inches (1066 mm) wide and mounted in metal-stud partitions.
 - 3) Compression Type: Not less than two anchors in each jamb.
 - 4) Postinstalled Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.
 - g. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - 1) Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - 2) Double-Door Frames: Drill stop in head jamb to receive two door silencers.



5. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.
6. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware".
 - a. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8 **OR** ANSI/NAAMM-HMMA 861.
 - b. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
 - c. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
 - d. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26.
7. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
 - a. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
 - b. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
 - c. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
 - d. Provide loose stops and moldings on inside of hollow metal work.
 - e. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

L. Steel Finishes

1. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
 - a. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.
2. Factory-Applied Paint Finish: Manufacturer's standard, complying with ANSI/SDI A250.3 for performance and acceptance criteria.
 - a. Color and Gloss: As indicated by manufacturer's designations **OR** Match sample **OR** As selected from manufacturer's full range, **as directed**.

1.3 EXECUTION

A. Installation

1. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
2. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 **OR** HMMA 840, **as directed**.
 - a. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - 1) At fire-protection-rated openings, install frames according to NFPA 80.
 - 2) Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - 3) Install frames with removable glazing stops located on secure side of opening.
 - 4) Install door silencers in frames before grouting.
 - 5) Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - 6) Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.



- 7) Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.
- b. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - 1) Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
- c. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
- d. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
- e. Concrete Walls: Solidly fill space between frames and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
- f. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
- g. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
- h. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.
- i. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - 1) Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - 2) Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 - 3) Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - 4) Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.
3. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
 - a. Non-Fire-Rated Standard Steel Doors:
 - 1) Jambs and Head: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
 - 2) Between Edges of Pairs of Doors: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
 - 3) Between Bottom of Door and Top of Threshold: Maximum 3/8 inch (9.5 mm).
 - 4) Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch (19 mm).
 - b. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
 - c. Smoke-Control Doors: Install doors according to NFPA 105 **OR** IBC Standard 716.5, **as directed**.
4. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.
 - a. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (50 mm) o.c. from each corner.

B. Adjusting And Cleaning

1. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
2. Remove grout and other bonding material from hollow metal work immediately after installation.



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3. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
 4. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

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SECTION 08 01 52 61 - WOOD WINDOWS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of material for wood windows. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes fixed and operable wood-framed windows of the following type:
 - a. Unfinished.
 - b. Aluminum clad.
 - c. Vinyl clad.

C. Definitions

1. Performance class designations according to AAMA/WDMA 101/I.S.2/NAFS:
 - a. AW: Architectural.
 - b. HC: Heavy Commercial.
 - c. C: Commercial.
 - d. LC: Light Commercial.
 - e. R: Residential.
2. Performance grade number according to AAMA/WDMA 101/I.S.2/NAFS:
 - a. Design pressure number in pounds force per square foot (pascals) used to determine the structural test pressure and water test pressure.
3. Structural Test Pressure: For uniform load structural test, is equivalent to 150 percent of the design pressure.
4. Minimum Test Size: Smallest size permitted for performance class (gateway test size). Products must be tested at minimum test size or at a size larger than minimum test size to comply with requirements for performance class.

D. Performance Requirements

1. General: Provide wood windows capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified, and that are of test size required by AAMA/WDMA 101/I.S.2/NAFS.
2. Structural Performance: Provide wood windows capable of withstanding the effects of the following loads based on testing units representative of those indicated for Project that pass AAMA/WDMA 101/I.S.2/NAFS, Uniform Load Structural Test:
 - a. Design Wind Loads: Determine design wind loads applicable to Project from basic wind speed indicated in miles per hour (meters per second) at 33 feet (10 m) above grade, according to ASCE 7, Section 6.5, "Method 2-Analytical Procedure," based on mean roof heights above grade indicated on Drawings.
 - 1) Basic Wind Speed: 85 mph (38 m/s) **OR** 90 mph (40 m/s), **as directed**.
 - 2) Importance Factor: I **OR** II **OR** III **OR** IV, **as directed**.
 - 3) Exposure Category: A **OR** B **OR** C **OR** D, **as directed**.
 - b. Deflection: Design glass framing system to limit lateral deflections of glass edges to less than 1/175 of glass-edge length or 3/4 inch (19 mm), whichever is less, at design pressure based on testing performed according to AAMA/WDMA 101/I.S.2/NAFS, Uniform Load Deflection Test or structural computations.
3. Windborne-Debris Resistance: Provide glazed windows capable of resisting impact from windborne debris, based on the pass/fail criteria as determined from testing glazed windows identical to those specified, according to ASTM E 1886 and testing information in ASTM E 1996 **OR** AAMA 506, **as directed**, and requirements of authorities having jurisdiction.



E. Submittals

1. Product Data: For each type of wood window indicated.
2. LEED Submittal:
 - a. Certificates for Credit MR 7: Chain-of-custody certificates certifying that wood windows comply with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.
 - 1) Include statement indicating costs for each certified wood product.
3. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other work, operational clearances, installation details.
4. Samples: For each exposed finish.
5. Product Schedule: Use same designations indicated on Drawings.
6. Product test reports.
7. Maintenance data.

F. Quality Assurance

1. Installer: A qualified installer, approved by manufacturer to install manufacturer's products.
2. Manufacturer Qualifications: A qualified manufacturer who is certified for chain of custody by an FSC-accredited certification body.
3. Forest Certification: Provide windows made with not less than 70 percent of wood products **OR** all wood products, **as directed**, obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
4. Fenestration Standard: Comply with AAMA/WDMA 101/I.S.2/NAFS, "North American Fenestration Standard Voluntary Performance Specification for Windows, Skylights and Glass Doors," for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
 - a. Provide AAMA-certified **OR** WDMA-certified, **as directed**, wood windows with an attached label.
5. Glazing Publications: Comply with published recommendations of glass manufacturers and with GANA's "Glazing Manual" unless more stringent requirements are indicated.
6. Preinstallation Conference: Conduct conference at Project site.

G. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace wood windows that fail in materials or workmanship within specified warranty period.
 - a. Warranty Period:
 - 1) Window: Two **OR** Three, **as directed**, years from date of Final Completion.
 - 2) Glazing: Five **OR** 10, **as directed**, years from date of Final Completion.
 - 3) Metal Finish: Five years from date of Final Completion.

1.2 PRODUCTS

A. Materials

1. Wood: Clear ponderosa pine or another suitable fine-grained lumber; kiln dried to a moisture content of 6 to 12 percent at time of fabrication; free of visible finger joints, blue stain, knots, pitch pockets, and surface checks larger than 1/32 inch (0.8 mm) deep by 2 inches (51 mm) wide; water-repellent preservative treated.
2. Aluminum Extrusions and Rolled Aluminum for Cladding: Manufacturer's standard formed sheet or extruded-aluminum cladding, mechanically bonded to exterior exposed wood members. Provide aluminum alloy and temper recommended by wood window manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi (150-MPa) ultimate tensile strength, and not less than 16,000-psi (110-MPa) minimum yield strength.
 - a. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.



- b. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
 - c. Baked-Enamel Finish for Extrusions and Sheet: Manufacturer's standard baked enamel complying with AAMA 2603 and paint manufacturer's written specifications for cleaning, conversion coating, and painting.
 - 1) Color: White **OR** Bronze **OR** Brown **OR** Beige **OR** Gray **OR** Green **OR** As selected from manufacturer's full range **OR** Custom color as selected, **as directed**.
 - d. High-Performance Organic Finish for Extrusions and Sheet: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1) Fluoropolymer Two-Coat System: Manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2604.
 - a) Color and Gloss: As selected from manufacturer's full range.
 - e. Baked-Enamel Finish for Coil: Manufacturer's standard baked enamel complying with AAMA 620 and paint manufacturer's written specifications for cleaning, conversion coating, and painting.
 - 1) Color: White **OR** Bronze **OR** Brown **OR** Beige **OR** Gray **OR** Green **OR** As selected from manufacturer's full range **OR** Custom color as selected, **as directed**.
3. Vinyl for Cladding: Consisting of a rigid PVC sheath, made from PVC complying with ASTM D 4726, not less than 35-mil (0.9-mm) average thickness, in permanent, integral color, white **OR** bronze **OR** tan, **as directed**, finish, mechanically bonded to exterior wood sash and frame members.
 4. Wood Trim and Glazing Stops: Material and finish to match frame members.
 5. Clad Trim and Glazing Stops: Hollow extrusions **OR** Roll-formed sheet material **OR** Clad-wood material, **as directed**, and finish to match clad frame members.
 6. Fasteners: Aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with wood window members, cladding, trim, hardware, anchors, and other components.
 - a. Exposed Fasteners: Unless unavoidable for applying hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.
 7. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.
 8. Reinforcing Members: Aluminum, or nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.
 9. Compression-Type Weather Stripping: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action and for complete concealment when wood window is closed.
 - a. Weather-Stripping Material:
 - 1) Elastomeric cellular preformed gaskets complying with ASTM C 509.
 - 2) Dense elastomeric gaskets complying with ASTM C 864.
 - 3) Manufacturer's standard system and materials complying with AAMA/WDMA 101/I.S.2/NAFS.
 10. Sliding-Type Weather Stripping: Provide woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric. Comply with AAMA 701/702.
 - a. Weather Seals: Provide weather stripping with integral barrier fin or fins of semirigid, polypropylene sheet or polypropylene-coated material. Comply with AAMA 701/702.
 11. Replaceable Weather Seals: Comply with AAMA 701/702.



B. Window

1. Window Type: Casement **OR** Double hung **OR** Fixed **OR** Horizontal sliding **OR** Projected awning **OR** Single hung **OR** Bay **OR** Bow **OR** Specialty product **OR** As indicated on Drawings **OR** As indicated in a schedule, **as directed**.
2. AAMA/WDMA Performance Requirements: Provide wood windows of performance indicated that comply with AAMA/WDMA 101/I.S.2/NAFS unless more stringent performance requirements are indicated.
 - a. Performance Class and Grade: R15 **OR** 20 **OR** 25, **as directed**.
 - b. Performance Class and Grade: LC25 **OR** 30 **OR** 35, **as directed**.
 - c. Performance Class and Grade: C30 **OR** 35 **OR** 40, **as directed**.
 - d. Performance Class and Grade: HC40 **OR** 45 **OR** 50, **as directed**.
 - e. Performance Class and Grade: AW40 **OR** 45 **OR** 50, **as directed**.
 - f. Performance Class and Grade: As indicated.
3. Condensation-Resistance Factor (CRF): Provide wood windows tested for thermal performance according to AAMA 1503, showing a CRF of 45 **OR** 52, **as directed**.
4. Thermal Transmittance: Provide wood windows with a whole-window, U-factor maximum indicated at 15-mph (24-km/h) exterior wind velocity and winter condition temperatures when tested according to AAMA 1503 **OR** ASTM E 1423 **OR** NFRC 100, **as directed**.
 - a. U-Factor: 0.35 Btu/sq. ft. x h x deg F (2.0 W/sq. m x K) **OR** 0.40 Btu/sq. ft. x h x deg F (2.3 W/sq. m x K) **OR** 0.43 Btu/sq. ft. x h x deg F (2.5 W/sq. m x K) **OR** 0.60 Btu/sq. ft. x h x deg F (3.4 W/sq. m x K), **as directed**, or less.
5. Solar Heat-Gain Coefficient (SHGC): Provide wood windows with a whole-window SHGC maximum of 0.40 **OR** 0.50 **OR** 0.55, **as directed**, determined according to NFRC 200 procedures.
6. Sound Transmission Class (STC): Provide glazed windows rated for not less than 26 **OR** 30 **OR** 35, **as directed**, STC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 413.
7. Air Infiltration: Maximum rate not more than indicated when tested according to AAMA/WDMA 101/I.S.2/NAFS, Air Infiltration Test.
 - a. Maximum Rate:
 - 1) 0.3 cfm/sq. ft. (5 cu. m/h x sq. m) of area at an inward test pressure of 1.57 lbf/sq. ft. (75 Pa) which is equivalent to 25-mph (40-km/h) wind speed and is typically used to test R, C, and LC performance classes.
 - 2) 0.3 cfm/sq. ft. (5 cu. m/h x sq. m) of area at an inward test pressure of 6.24 lbf/sq. ft. (300 Pa) which is equivalent to a 50-mph (80-km/h) wind speed and is typically used to test HC and AW performance classes.
 - b. Water Resistance: No water leakage as defined in AAMA/WDMA referenced test methods at a water test pressure equaling that indicated, when tested according to AAMA/WDMA 101/I.S.2/NAFS, Water Resistance Test.
 - c. Test Pressure:
 - 1) 15 percent of positive design pressure, but not less than 2.86 lbf/sq. ft. (140 Pa) or more than 15 lbf/sq. ft. (720 Pa).
 - 2) 20 percent of positive design pressure, but not more than 15 lbf/sq. ft. (720 Pa).
8. Forced-Entry Resistance: Comply with Performance Grade 10 **OR** 20 **OR** 30 **OR** 40, **as directed**, requirements when tested according to ASTM F 588.
9. Life-Cycle Testing: Test according to AAMA 910 and comply with AAMA/WDMA 101/I.S.2/NAFS.
10. Operating Force and Auxiliary (Durability) Tests: Comply with AAMA/WDMA 101/I.S.2/NAFS for operating window types indicated.

C. Glazing

1. Glass and Glazing Materials: Refer to Division 08 Section "Glazing" for glass units and glazing requirements applicable to glazed wood window units.
2. Glass: Clear, insulating-glass units **OR** Clear, insulating-glass units, with low-E coating pyrolytic on second surface or sputtered on second or third surface, **OR** Clear, insulating-glass units,



- argon gas filled, with low-E coating pyrolytic on second surface or sputtered on second or third surface, **as directed**, complying with Division 08 Section "Glazing".
3. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal **OR** Manufacturer's standard factory-glazing system that produces weathertight seal and complies with requirements for windborne-debris resistance **OR** Manufacturer's standard factory-glazing system as indicated in Division 08 Section "Glazing", **as directed**.
 4. Dual-Glazing System for Venetian Blinds: Manufacturer's standard dual-glazing system with 2 lites of clear float glass, complying with ASTM C 1036, Type I, Quality q3, glazed independently into the sash and separated by a minimum dead-air space of 1-1/2 inches (38 mm).
 5. Triple-Glazing System for Venetian Blinds: Manufacturer's standard insulated glass of type specified, combined with an auxiliary lite of clear float glass, complying with ASTM C 1036, Type I, Quality q3, retained in a separate glazing channel or frame and separated from insulated-glass unit by a minimum dead-air space of 1-1/2 inches (38 mm).
- D. Hardware
1. General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with wood and aluminum cladding, **as directed**; designed to smoothly operate, tightly close, and securely lock wood windows, and sized to accommodate sash or ventilator weight and dimensions. Do not use aluminum in frictional contact with other metals. Where exposed, provide solid bronze **OR** extruded, cast, or wrought aluminum **OR** die-cast zinc with special coating finish **OR** nonmagnetic stainless steel, **as directed**.
 2. Counterbalancing Mechanism: Comply with AAMA 902.
 - a. Sash-Balance Type: Concealed, tape-spring **OR** spiral-tube **OR** spring-loaded, block-and-tackle, **as directed**, type, of size and capacity to hold sash stationary at any open position.
 3. Sill Cap/Track: Extruded-aluminum track with natural anodized finish **OR** Rigid PVC or other weather-resistant plastic track with manufacturer's standard integral color, **as directed**, of thickness, dimensions, and profile indicated; designed to comply with performance requirements indicated and to drain to the exterior.
 4. Locks and Latches: Designed to allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only. Provide custodial locks, **as directed**.
 5. Roller Assemblies: Low-friction design.
 6. Push-Bar Operators: Provide telescoping-type, push-bar operator designed to open and close ventilators with fixed screens.
 7. Gear-Type Rotary Operators: Comply with AAMA 901 when tested according to ASTM E 405, Method A.
 - a. Operation Function: All ventilators move simultaneously and securely close at both jambs without using additional manually controlled locking devices.
 8. Four- or Six-Bar Friction Hinges: Comply with AAMA 904.
 - a. Locking mechanism and handles for manual operation.
 - b. Friction Shoes: Provide friction shoes of nylon or other nonabrasive, nonstaining, noncorrosive, durable material.
 9. Limit Devices: Provide concealed friction adjustor, adjustable stay bar **OR** concealed support arms with adjustable, limited, hold-open, **as directed**, limit devices designed to restrict sash or ventilator opening.
 - a. Safety Devices: Limit clear opening to 4 inches (100 mm) **OR** 6 inches (150 mm), **as directed**, for ventilation; with custodial key release.
 10. Pole Operators: Tubular-shaped anodized aluminum; with rubber-capped lower end and standard push-pull hook at top to match hardware design; of sufficient length to operate window without reaching more than 60 inches (1500 mm) above floor; 1 pole operator and pole hanger per room that has operable windows more than 72 inches (1800 mm) above floor.
- E. Insect Screens
1. General: Design windows and hardware to accommodate screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches. Fabricate insect screens to fully



integrate with window frame. Locate screens on inside **OR** outside, **as directed**, of window and provide for each operable exterior sash or ventilator.

- a. Aluminum Tubular Frame Screens: Comply with SMA 1004, "Specifications for Aluminum Tubular Frame Screens for Windows," Residential R-20 **OR** Architectural C-24 **OR** Monumental M-32, **as directed**, class.
2. Aluminum Insect Screen Frames: Manufacturer's standard aluminum alloy complying with SMA 1004. Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners, adjustable rollers, **as directed**, and removable PVC spline/anchor concealing edge of frame.
 - a. Aluminum Tubular Framing Sections and Cross Braces: Roll formed from aluminum sheet with minimum wall thickness as required for class indicated.
 - b. Finish:
 - 1) Anodized aluminum **OR** Baked-on organic coating, **as directed**, in manufacturer's standard color **OR** in color selected from manufacturer's full range, **as directed**.
OR
Manufacturer's standard.
3. Glass-Fiber Mesh Fabric: 18-by-14 (1.1-by-1.4-mm) or 18-by-16 (1.0-by-1.1-mm) **OR** 20-by-20 (0.85-by-0.85-mm) or 20-by-30 (0.85-by-0.42-mm), **as directed**, mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration; in the following color. Comply with ASTM D 3656.
 - a. Mesh Color: Charcoal gray **OR** Silver gray **OR** Aquamarine, **as directed**.
4. Aluminum Wire Fabric: 18-by-16 (1.1-by-1.3-mm) mesh of 0.011-inch- (0.28-mm-) diameter, coated aluminum wire.
 - a. Wire-Fabric Finish: Natural bright **OR** Charcoal gray **OR** Black, **as directed**.
5. Wickets: Provide sliding **OR** hinged, **as directed**, wickets, framed and trimmed for a tight fit and for durability during handling.

F. Accessories

1. Dividers (False Muntins): Provide dividers in designs indicated for each sash lite, one per sash, removable from the exposed surface of interior lite of the sash **OR** two per sash, removable from the exposed surfaces of interior and exterior lites of the sash, **as directed**, and one permanently located between glazing lites in the airspace, **as directed**.
 - a. Material: Extruded, rigid PVC **OR** Prefinished wood, **as directed**.
 - b. Design: Rectangular **OR** Diamond, **as directed**.
 - c. Color: White **OR** Bronze, **as directed**.
2. Storm Panels: Provide removable auxiliary glazing panels of clear float glass for each fixed and operating sash of window units. Glass shall comply with ASTM C 1036, Type I, Quality q3. Provide glass of thickness required to comply with requirements in Division 08 Section "Glazing". Frame, preglaze, and attach storm windows to the sash according to manufacturer's published standards. Omit storm panels on sash glazed with insulating glass, **as directed**.
3. Integral Louver Blinds: Provide remotely operated horizontal louver blinds in the space between two panes of glass. Construct blinds of aluminum slats, approximately 1 inch (25 mm) wide, with polyester fiber cords, equipped for tilting, raising, and lowering by standard operating hardware located on inside face of sash.

G. Fabrication

1. Fabricate wood windows in sizes indicated. Include a complete system for assembling components and anchoring windows.
2. Fabricate wood windows that are reglazable without dismantling sash or ventilator framing.
3. Weather Stripping: Provide full-perimeter weather stripping for each operable sash and ventilator, unless otherwise indicated.
 - a. Double-Hung Windows: Provide weather stripping only at horizontal rails of operable sash.
4. Factory machine windows for openings and for hardware that is not surface applied.
5. Mullions: Provide mullions and cover plates as shown, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances



and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design loads of window units.

6. Factory-Glazed Fabrication: Except for light sizes in excess of 100 united inches (2500 mm width plus length), glaze wood windows in the factory where practical and possible for applications indicated. Comply with requirements in Division 08 Section "Glazing" and with AAMA/WDMA 101/I.S.2/NAFS.
7. Glazing Stops: Provide nailed or snap-on glazing stops coordinated with Division 08 Section "Glazing" and glazing system indicated. Provide glazing stops to match sash and ventilator frames.
8. Bow **OR** Bay, **as directed**, Windows: Provide wood windows in configuration indicated. Provide window frames, fixed and operating sash, operating hardware, and other trim and components necessary for a complete, secure, and weathertight installation, including the following:
 - a. Angled mullion posts with interior and exterior trim.
 - b. Angled interior and exterior extension and trim.
 - c. Clear pine head and seat boards.
 - d. Top and bottom plywood platforms.
 - e. Exterior head and sill casings and trim.
 - f. Support brackets.
9. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.

H. Wood Finishes

1. Factory-Primed Windows: Provide manufacturer's standard factory-prime coat complying with WDMA T.M. 11 on exposed exterior **OR** interior **OR** exterior and interior, **as directed**, wood surfaces.
2. Factory-Finished Windows: Provide manufacturer's standard factory finish complying with WDMA T.M. 12. Apply finish to exposed exterior and interior wood surfaces.
 - a. Color: White **OR** Brown **OR** Gray **OR** As selected from manufacturer's full range, **as directed**.

1.3 EXECUTION

A. Installation

1. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing windows, hardware, accessories, and other components.
2. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.
3. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.
4. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

B. Adjusting, Cleaning, And Protection

1. Adjust operating sashes and ventilators, screens, hardware, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.
2. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
3. Clean factory-glazed glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.
4. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.



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5. Protect window surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.

END OF SECTION 08 01 52 61



SECTION 08 01 81 00 - GLAZING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of material for glazing. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
 - a. Windows.
 - b. Doors.
 - c. Glazed curtain walls.
 - d. Storefront framing.
 - e. Glazed entrances.
 - f. Sloped glazing.
 - g. Skylights.
 - h. Interior borrowed lites.

C. Definitions

1. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
2. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
3. Interspace: Space between lites of an insulating-glass unit.

D. Performance Requirements

1. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
2. Delegated Design: Design glass, including comprehensive engineering analysis according to ASTM E 1300 **OR** ICC's 2003 International Building Code, **as directed**, by a qualified professional engineer, using the following design criteria:
 - a. Design Wind Pressures: As indicated on Drawings.
OR
Design Wind Pressures: Determine design wind pressures applicable to Project according to ASCE/SEI 7, based on heights above grade indicated on Drawings.
 - 1) Basic Wind Speed: 85 mph (38 m/s) **OR** 90 mph (40 m/s) **OR** 100 mph (44 m/s) **OR** 110 mph (49 m/s), **as directed**.
 - 2) Importance Factor.
 - 3) Exposure Category: **B OR C OR D, as directed**.
 - b. Design Snow Loads: As indicated on Drawings, **as directed**.
 - c. Vertical Glazing: For glass surfaces sloped 15 degrees or less from vertical, design glass to resist design wind pressure based on glass type factors for short-duration load.
 - d. Sloped Glazing: For glass surfaces sloped more than 15 degrees from vertical, design glass to resist each of the following combinations of loads:
 - 1) Outward design wind pressure minus the weight of the glass. Base design on glass type factors for short-duration load.
 - 2) Inward design wind pressure plus the weight of the glass plus half of the design snow load. Base design on glass type factors for short-duration load.



- 3) Half of the inward design wind pressure plus the weight of the glass plus the design snow load. Base design on glass type factors for long-duration load.
 - e. Glass Type Factors for Wired, Patterned, and Sandblasted Glass:
 - 1) Short-Duration Glass Type Factor for Wired Glass: 0.5.
 - 2) Long-Duration Glass Type Factor for Wired Glass: 0.3.
 - 3) Short-Duration Glass Type Factor for Patterned Glass: 1.0.
 - 4) Long-Duration Glass Type Factor for Patterned Glass: 0.6.
 - 5) Short-Duration Glass Type Factor for Sandblasted Glass: 0.5.
 - f. Thickness of Patterned Glass: Base design of patterned glass on thickness at thinnest part of the glass.
 - g. Probability of Breakage for Sloped Glazing: For glass surfaces sloped more than 15 degrees from vertical, design glass for a probability of breakage not greater than 0.001.
 - h. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch (25 mm), whichever is less.
 - i. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.
 3. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - a. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- E. Preconstruction Testing
1. Preconstruction Adhesion and Compatibility Testing: Test each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
 - a. Testing will not be required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
 - b. Use ASTM C 1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
 - c. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
 - d. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 - e. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.
- F. Submittals
1. Product Data: For each glass product and glazing material indicated.
 2. LEED Submittals:
 - a. Product Data for Credit EQ 4.1: For glazing sealants used inside of the weatherproofing system, including printed statement of VOC content.
 3. Glass Samples: For each type of glass product other than clear monolithic vision glass **OR** the following products, **as directed**; 12 inches (300 mm) square.
 - a. Tinted glass.
 - b. Patterned glass.
 - c. Coated glass.
 - d. Wired glass.
 - e. Fire-resistive glazing products.
 - f. Laminated glass with colored interlayer.
 - g. Insulating glass.
 4. Glazing Accessory Samples: For gaskets, sealants and colored spacers, in 12-inch (300-mm) lengths. Install sealant Samples between two strips of material representative in color of the adjoining framing system, **as directed**.



5. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
6. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
7. Qualification Data: For installers, manufacturers of insulating-glass units with sputter-coated, low-e coatings, glass testing agency and sealant testing agency.
8. Product Certificates: For glass and glazing products, from manufacturer.
9. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for tinted glass, coated glass, insulating glass, glazing sealants and glazing gaskets.
 - a. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.
10. Preconstruction adhesion and compatibility test report.
11. Warranties: Sample of special warranties.

G. Quality Assurance

1. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified, **as directed**, by coated-glass manufacturer.
2. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
3. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
4. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
5. Source Limitations for Glass: Obtain ultraclear float glass, tinted float glass, coated float glass, laminated glass and insulating glass from single source from single manufacturer for each glass type.
6. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.
7. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - a. GANA Publications: GANA's "Laminated Glazing Reference Manual" and GANA's "Glazing Manual."
 - b. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR-A7, "Sloped Glazing Guidelines."
 - c. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
 - d. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
8. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC **OR** the SGCC or another certification agency acceptable to authorities having jurisdiction **OR** the manufacturer, **as directed**. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
9. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, test standard, whether glazing is for use in fire doors or other openings, whether or not glazing passes hose-stream test, whether or not glazing has a temperature rise rating of 450 deg F (250 deg C), and the fire-resistance rating in minutes.
10. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
11. Preinstallation Conference: Conduct conference at Project site.

H. Delivery, Storage, And Handling



1. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
2. Comply with insulating-glass manufacturer's written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

I. Project Conditions

1. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 - a. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F (4.4 deg C).

J. Warranty

1. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
 - a. Warranty Period: 10 years from date of Final Completion.
2. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form in which laminated-glass manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
 - a. Warranty Period: Five **OR** 10, **as directed**, years from date of Final Completion.
3. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
 - a. Warranty Period: 10 years from date of Final Completion.

1.2 PRODUCTS

A. Glass Products, General

1. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.
 - a. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.
 - b. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.
2. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article, **as directed**. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article, **as directed**. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.
3. Windborne-Debris-Impact Resistance: Provide exterior glazing that passes basic **OR** enhanced, **as directed**, -protection testing requirements in ASTM E 1996 for Wind Zone 1 **OR** Wind Zone 2 **OR** Wind Zone 3 **OR** Wind Zone 4, **as directed**, when tested according to ASTM E 1886. Test



specimens shall be no smaller in width and length than glazing indicated for use on the Project and shall be installed in same manner as glazing indicated for use on the Project.

- a. Large-Missile Test: For glazing located within 30 feet (9.1 m) of grade.
- b. Small-Missile Test: For glazing located more than 30 feet (9.1 m) above grade.

OR

Large-Missile Test: For all glazing, regardless of height above grade.

4. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
 - a. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick **OR** of thickness indicated, **as directed**.
 - b. For laminated-glass lites, properties are based on products of construction indicated.
 - c. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
 - d. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
 - e. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
 - f. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

B. Glass Products

1. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.
2. Ultraclear Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I, complying with other requirements specified and with visible light transmission not less than 91 percent and solar heat gain coefficient not less than 0.87, **as directed**.
3. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.
 - a. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
 - b. For uncoated glass, comply with requirements for Condition A.
 - c. For coated vision glass, comply with requirements for Condition C (other coated glass).
4. Pyrolytic-Coated, Self-Cleaning, Low-Maintenance Glass: Clear float glass with a coating on first surface having both photocatalytic and hydrophilic properties that act to loosen dirt and to cause water to sheet evenly over the glass instead of beading.
5. Uncoated Tinted Float Glass: Class 2, complying with other requirements specified.
 - a. Tint Color: Blue **OR** Blue-green **OR** Bronze **OR** Green **OR** Gray, **as directed**.
 - b. Visible Light Transmittance: as directed by the Owner.
6. Polished Wired Glass: ASTM C 1036, Type II, Class 1 (clear), Form 1, Quality-Q6, complying with ANSI Z97.1, Class C.
 - a. Mesh: M1 (diamond) **OR** M2 (square), **as directed**.
7. Film-Faced Polished Wired Glass: ASTM C 1036, Type II, Class 1 (clear), Form 1, Quality-Q6 and complying with testing requirements in 16 CFR 1201 for Category II materials.
 - a. Mesh: M1 (diamond) **OR** M2 (square), **as directed**.
8. Patterned Glass: ASTM C 1036, Type II, Class 1 (clear), Form 3; Quality-Q6, Finish F1 (patterned one side) **OR** Finish F2 (patterned both sides), **as directed**, Pattern P1 (linear) **OR** Pattern P2 (geometric) **OR** Pattern P3 (random) **OR** Pattern P4 (special), **as directed**.
9. Tempered Patterned Glass: ASTM C 1048, Kind FT (fully tempered), Type II, Class 1 (clear), Form 3; Quality-Q6, Finish F1 (patterned one side) **OR** Finish F2 (patterned both sides), **as directed**, Pattern P1 (linear) **OR** Pattern P2 (geometric) **OR** Pattern P3 (random) **OR** Pattern P4 (special), **as directed**.
10. Patterned Wired Glass: ASTM C 1036, Type II, Class 1 (clear), Form 2, Quality-Q6, Finish F1 (patterned one side) **OR** Finish F2 (patterned both sides), **as directed**, Mesh M1 (diamond), Pattern P1 (linear) **OR** Pattern P2 (geometric) **OR** Pattern P3 (random) **OR** Pattern P4 (special), **as directed**.



11. Ceramic-Coated Vision Glass: Heat-treated float glass, Condition C; with ceramic enamel applied by silk-screened process; complying with Specification No. 95-1-31 in GANA's Tempering Division's "Engineering Standards Manual" and with other requirements specified.
 - a. Glass: Clear float **OR** Ultraclear float **OR** Tinted float, **as directed**.
 - b. Tint Color: Blue **OR** Blue-green **OR** Bronze **OR** Green **OR** Gray, **as directed**.
 - c. Ceramic Coating Color and Pattern: As selected from manufacturer's full range.
12. Reflective-Coated Vision Glass: ASTM C 1376, coated by pyrolytic process **OR** vacuum deposition (sputter-coating) process, **as directed**, and complying with other requirements specified.
 - a. Kind: Kind CV (coated vision glass), except that Kind CO (coated overhead glass) may be used where the lower edge of the glass is more than 6 feet (1.8 m) above the adjacent floor level or cannot be approached closer than 10 feet (3.0 m).
 - b. Coating Color: Gold **OR** Pewter **OR** Silver, **as directed**.
 - c. Glass: Clear float **OR** Tinted float, **as directed**.
 - d. Tint Color: Blue **OR** Blue-green **OR** Bronze **OR** Green **OR** Gray, **as directed**.
 - e. Visible Light Transmittance:
 - f. Outdoor Visible Reflectance: as directed by the Owner.
 - g. Self-Cleaning, Low-Maintenance Coating: Pyrolytic coating on first surface.
13. Ceramic-Coated Spandrel Glass: ASTM C 1048, Condition B, Type I, Quality-Q3, and complying with other requirements specified.
 - a. Glass: Clear float **OR** Ultraclear float **OR** Tinted float, **as directed**.
 - b. Tint Color: Blue **OR** Blue-green **OR** Bronze **OR** Green **OR** Gray, **as directed**.
 - c. Ceramic Coating Color: As selected from manufacturer's full range.
14. Silicone-Coated Spandrel Glass: ASTM C 1048, Condition C, Type I, Quality-Q3, and complying with other requirements specified.
 - a. Glass: Clear float **OR** Ultraclear float **OR** Tinted float, **as directed**.
 - b. Tint Color: Blue **OR** Blue-green **OR** Bronze **OR** Green **OR** Gray, **as directed**.
 - c. Silicone Coating Color: As selected from manufacturer's full range.
15. Reflective-Coated Spandrel Glass: ASTM C 1376, Kind CS; coated by pyrolytic process **OR** vacuum deposition (sputter-coating) process, **as directed**, and complying with other requirements specified.
 - a. Coating Color: Gold **OR** Pewter **OR** Silver, **as directed**.
 - b. Glass: Clear float **OR** Ultraclear float **OR** Tinted float, **as directed**.
 - c. Tint Color: Blue **OR** Blue-green **OR** Bronze **OR** Green **OR** Gray, **as directed**.
 - d. Visible Light Transmittance: as directed by the Owner.
 - e. Outdoor Visible Reflectance: as directed by the Owner.

C. Laminated Glass

1. Laminated Glass: ASTM C 1172, and complying with testing requirements in 16 CFR 1201 for Category II materials, and with other requirements specified. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
 - a. Construction: Laminate glass with polyvinyl butyral interlayer or cast-in-place and cured-transparent-resin interlayer to comply with interlayer manufacturer's written recommendations.
 - b. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
 - c. Interlayer Color: Clear unless otherwise indicated.
2. Windborne-Debris-Impact-Resistant Laminated Glass: ASTM C 1172, and complying with testing requirements in 16 CFR 1201 for Category II materials, with "Windborne-Debris-Impact Resistance" Paragraph in "Glass Products, General" Article, and with other requirements specified. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
 - a. Construction: Laminate glass with one of the following to comply with interlayer manufacturer's written recommendations:



- 1) Polyvinyl butyral interlayer.
 - 2) Polyvinyl butyral interlayers reinforced with polyethylene terephthalate film.
 - 3) Ionoplast interlayer.
 - 4) Cast-in-place and cured-transparent-resin interlayer.
 - 5) Cast-in-place and cured-transparent-resin interlayer reinforced with polyethylene terephthalate film.
- b. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
- c. Interlayer Color: Clear unless otherwise indicated.
3. Glass: Comply with applicable requirements in "Glass Products" Article as indicated by designations in "Laminated-Glass Types" Article.

D. Insulating Glass

1. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.
 - a. Sealing System: Dual seal, with manufacturer's standard **OR** polyisobutylene and polysulfide **OR** polyisobutylene and silicone **OR** polyisobutylene and hot-melt butyl **OR** polyisobutylene and polyurethane, **as directed**, primary and secondary.
 - b. Spacer: Manufacturer's standard spacer material and construction **OR** Aluminum with mill or clear anodic finish **OR** Aluminum with black, color anodic finish **OR** Aluminum with bronze, color anodic finish **OR** Aluminum with powdered metal paint finish in color selected **OR** Galvanized steel **OR** Stainless steel **OR** Polypropylene covered stainless steel in color selected **OR** Thermally broken aluminum **OR** Nonmetallic laminate **OR** Nonmetallic tube, **as directed**.
 - c. Desiccant: Molecular sieve or silica gel, or blend of both.
2. Glass: Comply with applicable requirements in "Glass Products" Article and in "Laminated Glass" Article, **as directed**, as indicated by designations in "Insulating-Glass Types" Article and in "Insulating-Laminated-Glass Types" Article, **as directed**.

E. Fire-Protection-Rated Glazing

1. Fire-Protection-Rated Glazing, General: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252 for door assemblies and NFPA 257 for window assemblies.
2. Monolithic Ceramic Glazing: Clear, ceramic flat glass; 3/16-inch (5-mm) nominal thickness.
3. Film-Faced Ceramic Glazing: Clear, ceramic flat glass; 3/16-inch (5-mm) nominal thickness; faced on one surface with a clear glazing film; complying with testing requirements in 16 CFR 1201 for Category II materials.
4. Laminated Ceramic Glazing: Laminated glass made from 2 plies of clear, ceramic flat glass; 5/16-inch (8-mm) total nominal thickness; complying with testing requirements in 16 CFR 1201 for Category II materials.
5. Fire-Protection-Rated Tempered Glass: 1/4-inch- (6.4-mm-) **OR** 3/8-inch- (9.5-mm-) **OR** 1/2-inch- (12.7-mm-), **as directed**, thick, fire-protection-rated tempered glass, complying with testing requirements in 16 CFR 1201 for Category II materials.
6. Fire-Protection-Rated Laminated Glass: 5/16-inch- (8-mm-) thick, fire-protection-rated laminated glass, complying with testing requirements in 16 CFR 1201 for Category II materials.
7. Laminated Glass with Intumescent Interlayers: Laminated glass made from multiple plies of uncoated, clear float glass; with intumescent interlayers; complying with testing requirements in 16 CFR 1201 for Category II materials.
8. Gel-Filled, Double Glazing Units: Double glazing units made from two lites of uncoated, clear, fully tempered float glass; with a perimeter metal spacer separating lites and dual-edge seal enclosing a cavity filled with clear, fully transparent, heat-absorbing gel; complying with testing requirements in 16 CFR 1201 for Category II materials.

F. Glazing Gaskets



1. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:
 - a. Neoprene complying with ASTM C 864.
 - b. EPDM complying with ASTM C 864.
 - c. Silicone complying with ASTM C 1115.
 - d. Thermoplastic polyolefin rubber complying with ASTM C 1115.
2. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned neoprene, EPDM, silicone or thermoplastic polyolefin rubber gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.
 - a. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.
3. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock-strips, complying with ASTM C 542, black.

G. Glazing Sealants

1. General:
 - a. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
 - b. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 - c. VOC Content: For sealants used inside of the weatherproofing system, not more than 250 g/L when calculated according to 40 CFR 59, Subpart D.
 - d. Colors of Exposed Glazing Sealants: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
2. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.
3. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT.
4. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use NT.
5. Glazing Sealant: Acid-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use NT.
6. Glazing Sealants for Fire-Rated Glazing Products: Products that are approved by testing agencies that listed and labeled fire-resistant glazing products with which they are used for applications and fire-protection ratings indicated.

H. Glazing Tapes

1. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
 - a. AAMA 804.3 tape, where indicated.
 - b. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 - c. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
2. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
 - a. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
 - b. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.



- I. Miscellaneous Glazing Materials
1. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
 2. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
 3. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
 4. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
 5. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
 6. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.
 7. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.
- J. Fabrication Of Glazing Units
1. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
 2. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
 3. Grind smooth and polish exposed glass edges and corners.
- K. Monolithic-Glass Types
1. Glass Type: Clear float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
 - a. Thickness: 6.0 mm.
 - b. Provide safety glazing labeling.
 2. Glass Type: Ultraclear float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
 - a. Thickness: 6.0 mm.
 - b. Provide safety glazing labeling.
 3. Glass Type: Pyrolytic-coated, self-cleaning, low-maintenance, clear float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
 - a. Thickness: 6.0 mm.
 - b. Provide safety glazing labeling.
 4. Glass Type: Tinted float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
 - a. Thickness: 6.0 mm.
 - b. Winter Nighttime U-Factor: as directed by the Owner.
 - c. Summer Daytime U-Factor: as directed by the Owner.
 - d. Solar Heat Gain Coefficient: as directed by the Owner.
 - e. Provide safety glazing labeling.
 5. Glass Type: Polished wired glass.
 - a. Thickness: 6.0 mm.
 6. Glass Type: Patterned glass.
 - a. Thickness: 4.0 **OR** 5.0 **OR** 6.0, **as directed**, mm.
 7. Glass Type: Tempered patterned glass.
 - a. Thickness: 4.0 **OR** 5.0 **OR** 6.0, **as directed**, mm.
 - b. Provide safety glazing labeling.
 8. Glass Type: Patterned wired glass.
 - a. Thickness: 6.0 mm.



9. Glass Type: Ceramic-coated vision glass, heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
 - a. Thickness: 6.0 mm.
 - b. Coating Location: Second surface.
 - c. Winter Nighttime U-Factor: as directed by the Owner.
 - d. Summer Daytime U-Factor: as directed by the Owner.
 - e. Solar Heat Gain Coefficient: as directed by the Owner.
 - f. Provide safety glazing labeling.
10. Glass Type: Reflective-coated vision glass, float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
 - a. Thickness: 6.0 mm.
 - b. Coating Location: First **OR** Second, **as directed**, surface.
 - c. Winter Nighttime U-Factor: as directed by the Owner.
 - d. Summer Daytime U-Factor: as directed by the Owner.
 - e. Solar Heat Gain Coefficient: as directed by the Owner.
 - f. Provide safety glazing labeling.
11. Glass Type: Ceramic-coated spandrel glass, heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
 - a. Thickness: 6.0 mm.
 - b. Coating Location: Second surface.
 - c. Winter Nighttime U-Factor: as directed by the Owner.
 - d. Summer Daytime U-Factor: as directed by the Owner.
 - e. Fallout Resistance: Passes fallout-resistance test in ASTM C 1048 for an assembly of glass and adhered reinforcing material.
12. Glass Type: Silicone-coated spandrel glass, heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
 - a. Thickness: 6.0 mm.
 - b. Coating Location: Second surface.
 - c. Winter Nighttime U-Factor: as directed by the Owner.
 - d. Summer Daytime U-Factor: as directed by the Owner.
 - e. Fallout Resistance: Passes fallout-resistance test in ASTM C 1048 for an assembly of glass and adhered reinforcing material.
13. Glass Type: Reflective-coated spandrel glass, heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
 - a. Thickness: 6.0 mm.
 - b. Coating Location: First **OR** Second, **as directed**, surface.
 - c. Winter Nighttime U-Factor: as directed by the Owner.
 - d. Summer Daytime U-Factor: as directed by the Owner.
 - e. Fallout Resistance: Passes fallout-resistance test in ASTM C 1048 for an assembly of glass and adhered reinforcing material.
 - f. Factory apply manufacturer's standard opacifier of the following material to coated second surface of lites, with resulting products complying with Specification No. 89-1-6 in GANA's Tempering Division's "Engineering Standards Manual":
 - 1) Manufacturer's standard opacifier material.

OR

 Polyester film laminated to glass with solvent-based adhesive.

L. Laminated-Glass Types

1. Glass Type: Clear laminated glass with two plies of float glass **OR** heat-strengthened float glass **OR** fully tempered float glass **OR** ultraclear float glass **OR** ultraclear heat-strengthened float glass **OR** ultraclear fully tempered float glass, **as directed**.
 - a. Thickness of Each Glass Ply: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm **OR** As indicated, **as directed**.
 - b. Interlayer Thickness: 0.030 inch (0.76 mm) **OR** 0.060 inch (1.52 mm) **OR** 0.090 inch (2.29 mm), **as directed**.



- c. Provide safety glazing labeling.
 2. Glass Type: Antireflective-coated clear laminated glass with two plies of float glass **OR** heat-strengthened float glass **OR** fully tempered float glass **OR** ultraclear float glass **OR** ultraclear heat-strengthened float glass **OR** ultraclear fully tempered float glass, **as directed**.
 - a. Thickness of Each Glass Ply: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm, **as directed**.
 - b. Interlayer Thickness: 0.030 inch (0.76 mm) **OR** 0.060 inch (1.52 mm) **OR** 0.090 inch (2.29 mm), **as directed**.
 - c. Visible Reflectance: Less than 2 percent.
 - d. Winter Nighttime U-Factor: as directed by the Owner.
 - e. Summer Daytime U-Factor: as directed by the Owner.
 - f.
 - g. Solar Heat Gain Coefficient: as directed by the Owner.
 - h.
 - i. Provide safety glazing labeling.
 3. Glass Type: Tinted laminated glass with two plies of float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**, with outer ply Class 2 (tinted) and inner ply Class 1 (clear).
 - a. Thickness of Each Glass Ply: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm **OR** As indicated, **as directed**.
 - b. Interlayer Thickness: 0.030 inch (0.76 mm) **OR** 0.060 inch (1.52 mm) **OR** 0.090 inch (2.29 mm), **as directed**.
 - c. Winter Nighttime U-Factor: as directed by the Owner.
 - d.
 - e. Summer Daytime U-Factor: as directed by the Owner.
 - f.
 - g. Solar Heat Gain Coefficient: as directed by the Owner.
 - h.
 - i. Provide safety glazing labeling.
 4. Glass Type: Tinted laminated glass with two plies of clear float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**, and tinted interlayer.
 - a. Thickness of Each Glass Ply: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm **OR** As indicated, **as directed**.
 - b. Interlayer Thickness: 0.030 inch (0.76 mm) **OR** 0.060 inch (1.52 mm) **OR** 0.090 inch (2.29 mm), **as directed**.
 - c. Interlayer Color: Blue-green **OR** Bronze light **OR** Gray, **as directed**.
 - d. Winter Nighttime U-Factor: as directed by the Owner.
 - e.
 - f. Summer Daytime U-Factor: as directed by the Owner.
 - g.
 - h. Solar Heat Gain Coefficient: as directed by the Owner.
 - i. Provide safety glazing labeling.
 5. Glass Type: Ceramic-coated, laminated vision glass with two plies of heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
 - a. Thickness of Each Glass Ply: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm **OR** As indicated, **as directed**.
 - b. Interlayer Thickness: 0.030 inch (0.76 mm) **OR** 0.060 inch (1.52 mm) **OR** 0.090 inch (2.29 mm), **as directed**.
 - c. Coating Location: Second **OR** Third **OR** Fourth, **as directed**, surface.
 - d. Winter Nighttime U-Factor: as directed by the Owner.
 - e.
 - f. Summer Daytime U-Factor: as directed by the Owner.
 - g.
 - h. Solar Heat Gain Coefficient: as directed by the Owner.
 - i.
 - j. Provide safety glazing labeling.



6. Glass Type: Reflective-coated, laminated vision glass with two plies of heat-strengthened float glass **OR** fully tempered float glass, **as directed**, with inner ply Class 1 (clear).
 - a. Thickness of Each Glass Ply: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm **OR** As indicated, **as directed**.
 - b. Interlayer Thickness: 0.030 inch (0.76 mm) **OR** 0.060 inch (1.52 mm) **OR** 0.090 inch (2.29 mm), **as directed**.
 - c. Coating Location: First **OR** Second **OR** Third, **as directed**, surface.
 - d. Winter Nighttime U-Factor: as directed by the Owner.
 - e.
 - f. Summer Daytime U-Factor: as directed by the Owner.
 - g.
 - h. Solar Heat Gain Coefficient: as directed by the Owner.
 - i. Provide safety glazing labeling.
7. Glass Type: Low-e-coated, laminated vision glass with two plies of clear float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
 - a. Thickness of Each Glass Ply: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm **OR** As indicated, **as directed**.
 - b. Interlayer Thickness: 0.030 inch (0.76 mm) **OR** 0.060 inch (1.52 mm) **OR** 0.090 inch (2.29 mm), **as directed**.
 - c. Low-E Coating: Pyrolytic on second **OR** Pyrolytic on third **OR** Sputtered on second **OR** Sputtered on third **OR** Pyrolytic or sputtered on second or third, **as directed**, surface.
 - d. Visible Light Transmittance: as directed by the Owner.
 - e.
 - f. Winter Nighttime U-Factor: as directed by the Owner.
 - g.
 - h. Summer Daytime U-Factor: as directed by the Owner.
 - i.
 - j. Solar Heat Gain Coefficient: as directed by the Owner.
 - k.
 - l. Provide safety glazing labeling.
8. Glass Type: Reflective-coated, laminated spandrel glass with two plies of heat-strengthened float glass **OR** fully tempered float glass, **as directed**, with inner ply Class 1 (clear).
 - a. Thickness of Each Glass Ply: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm **OR** As indicated, **as directed**.
 - b. Interlayer Thickness: 0.030 inch (0.76 mm) **OR** 0.060 inch (1.52 mm) **OR** 0.090 inch (2.29 mm), **as directed**.
 - c. Coating Location: First **OR** Second **OR** Third, **as directed**, surface.
 - d. Winter Nighttime U-Factor: as directed by the Owner.
 - e.
 - f. Summer Daytime U-Factor: as directed by the Owner.
 - g.

M. Insulating-Glass Types

1. Glass Type: Clear insulating glass.
 - a. Overall Unit Thickness: 1 inch (25 mm) **OR** 5/8 inch (16 mm), **as directed**.
 - b. Thickness of Each Glass Lite: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm, **as directed**.
 - c. Outdoor Lite: Float glass **OR** Heat-strengthened float glass **OR** Fully tempered float glass, **as directed**.
 - d. Interspace Content: Air **OR** Argon, **as directed**.
 - e. Indoor Lite: Float glass **OR** Heat-strengthened float glass **OR** Fully tempered float glass, **as directed**.
 - f. Winter Nighttime U-Factor: as directed by the Owner.
 - g.
 - h. Summer Daytime U-Factor: as directed by the Owner.
 - i. Provide safety glazing labeling.



2. Glass Type: Ultraclear insulating glass.
 - a. Overall Unit Thickness: 1 inch (25 mm) **OR** 5/8 inch (16 mm), **as directed**.
 - b. Thickness of Each Glass Lite: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm, **as directed**.
 - c. Outdoor Lite: Ultraclear float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
 - d. Interspace Content: Air **OR** Argon, **as directed**.
 - e. Indoor Lite: Ultraclear float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
 - f. Winter Nighttime U-Factor: as directed by the Owner.
 - g.
 - h. Summer Daytime U-Factor: as directed by the Owner.
 - i.
 - j. Provide safety glazing labeling.
3. Glass Type: Pyrolytic-coated, self-cleaning, low-maintenance, clear insulating glass.
 - a. Overall Unit Thickness: 1 inch (25 mm) **OR** 5/8 inch (16 mm), **as directed**.
 - b. Thickness of Each Glass Lite: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm, **as directed**.
 - c. Outdoor Lite: Pyrolytic-coated, self-cleaning, low-maintenance, clear float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
 - d. Interspace Content: Air **OR** Argon, **as directed**.
 - e. Indoor Lite: Float glass **OR** Heat-strengthened float glass **OR** Fully tempered float glass, **as directed**.
 - f. Winter Nighttime U-Factor: as directed by the Owner.
 - g. Summer Daytime U-Factor: as directed by the Owner.
 - h. Provide safety glazing labeling.
4. Glass Type: Low-e-coated, clear insulating glass.
 - a. Overall Unit Thickness: 1 inch (25 mm) **OR** 5/8 inch (16 mm), **as directed**.
 - b. Thickness of Each Glass Lite: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm, **as directed**.
 - c. Outdoor Lite: Float glass **OR** Heat-strengthened float glass **OR** Fully tempered float glass **OR** Ultraclear float glass **OR** Ultraclear heat-strengthened float glass **OR** Ultraclear fully tempered float glass, **as directed**.
 - d. Interspace Content: Air **OR** Argon, **as directed**.
 - e. Indoor Lite: Float glass **OR** Heat-strengthened float glass **OR** Fully tempered float glass **OR** Ultraclear float glass **OR** Ultraclear heat-strengthened float glass **OR** Ultraclear fully tempered float glass, **as directed**.
 - f. Low-E Coating: Pyrolytic on second **OR** Pyrolytic on third **OR** Sputtered on second **OR** Sputtered on third **OR** Pyrolytic or sputtered on second or third, **as directed**, surface.
 - g. Visible Light Transmittance: as directed by the Owner.
 - h. Winter Nighttime U-Factor: as directed by the Owner.
 - i. Summer Daytime U-Factor: as directed by the Owner.
 - j. Solar Heat Gain Coefficient: as directed by the Owner.
 - k. Provide safety glazing labeling.
5. Glass Type: Tinted insulating glass.
 - a. Overall Unit Thickness: 1 inch (25 mm) **OR** 5/8 inch (16 mm), **as directed**.
 - b. Thickness of Each Glass Lite: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm, **as directed**.
 - c. Outdoor Lite: Tinted float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
 - d. Interspace Content: Air **OR** Argon, **as directed**.
 - e. Indoor Lite: Clear float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
 - f. Winter Nighttime U-Factor: as directed by the Owner.
 - g. Summer Daytime U-Factor: as directed by the Owner.
 - h. Solar Heat Gain Coefficient: as directed by the Owner.
 - i. Provide safety glazing labeling.
6. Glass Type: Low-e-coated, tinted insulating glass.
 - a. Overall Unit Thickness: 1 inch (25 mm) **OR** 5/8 inch (16 mm), **as directed**.
 - b. Thickness of Each Glass Lite: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm, **as directed**.



- c. Outdoor Lite: Tinted float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
 - d. Interspace Content: Air **OR** Argon, **as directed**.
 - e. Indoor Lite: Clear float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
 - f. Low-E Coating: Pyrolytic on second **OR** Pyrolytic on third **OR** Sputtered on second **OR** Sputtered on third **OR** Pyrolytic or sputtered on second or third, **as directed**, surface.
 - g. Visible Light Transmittance: as directed by the Owner.
 - h. Winter Nighttime U-Factor: as directed by the Owner.
 - i. Summer Daytime U-Factor: as directed by the Owner.
 - j. Solar Heat Gain Coefficient: as directed by the Owner.
 - k. Provide safety glazing labeling.
7. Glass Type: Ceramic-coated, insulating vision glass.
- a. Overall Unit Thickness: 1 inch (25 mm) **OR** 5/8 inch (16 mm), **as directed**.
 - b. Thickness of Each Glass Lite: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm, **as directed**.
 - c. Outdoor Lite: Heat-strengthened float glass **OR** Fully tempered float glass **OR** Ultraclear heat-strengthened float glass **OR** Ultraclear fully tempered float glass, **as directed**.
 - d. Interspace Content: Air **OR** Argon, **as directed**.
 - e. Indoor Lite: Float glass **OR** Heat-strengthened float glass **OR** Fully tempered float glass **OR** Ultraclear float glass **OR** Ultraclear heat-strengthened float glass **OR** Ultraclear fully tempered float glass, **as directed**.
 - f. Coating Location: Second **OR** Third **OR** Fourth, **as directed**, surface.
 - g. Winter Nighttime U-Factor: as directed by the Owner.
 - h. Summer Daytime U-Factor: as directed by the Owner.
 - i. Solar Heat Gain Coefficient: as directed by the Owner.
 - j. Provide safety glazing labeling.
8. Glass Type: Reflective-coated, clear insulating glass.
- a. Overall Unit Thickness: 1 inch (25 mm) **OR** 5/8 inch (16 mm), **as directed**.
 - b. Thickness of Each Glass Lite: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm, **as directed**.
 - c. Outdoor Lite: Clear float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
 - d. Interspace Content: Air **OR** Argon, **as directed**.
 - e. Indoor Lite: Clear float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
 - f. Coating Location: First **OR** Second **OR** Third, **as directed**, surface.
 - g. Winter Nighttime U-Factor: as directed by the Owner.
 - h. Summer Daytime U-Factor: as directed by the Owner.
 - i. Solar Heat Gain Coefficient: as directed by the Owner.
 - j. Provide safety glazing labeling.
9. Glass Type: Reflective-coated, tinted insulating glass.
- a. Overall Unit Thickness: 1 inch (25 mm) **OR** 5/8 inch (16 mm), **as directed**.
 - b. Thickness of Each Glass Lite: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm, **as directed**.
 - c. Outdoor Lite: Tinted float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
 - d. Interspace Content: Air **OR** Argon, **as directed**.
 - e. Indoor Lite: Clear float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
 - f. Coating Location: First **OR** Second **OR** Third, **as directed**, surface.
 - g. Winter Nighttime U-Factor: as directed by the Owner.
 - h. Summer Daytime U-Factor: as directed by the Owner.
 - i. Solar Heat Gain Coefficient: as directed by the Owner.
 - j. Provide safety glazing labeling.
10. Glass Type: Ceramic-coated **OR** Silicone-coated, **as directed**, insulating spandrel glass.
- a. Overall Unit Thickness: 1 inch (25 mm).
 - b. Thickness of Each Glass Lite: 5.0 mm **OR** 6.0 mm, **as directed**.



- c. Outdoor Lite: Float glass **OR** Heat-strengthened float glass **OR** Fully tempered float glass **OR** Ultraclear float glass **OR** Ultraclear heat-strengthened float glass **OR** Ultraclear fully tempered float glass, **as directed**.
 - d. Interspace Content: Air **OR** Argon, **as directed**.
 - e. Indoor Lite: Float glass **OR** Heat-strengthened float glass **OR** Fully tempered float glass **OR** Ultraclear float glass **OR** Ultraclear heat-strengthened float glass **OR** Ultraclear fully tempered float glass, **as directed**.
 - f. Coating Location: Fourth surface.
 - g. Winter Nighttime U-Factor: as directed by the Owner.
 - h. Summer Daytime U-Factor: as directed by the Owner.
11. Glass Type: Ceramic-coated **OR** Silicone-coated, **as directed**, low-e, insulating spandrel glass.
- a. Overall Unit Thickness: 1 inch (25 mm).
 - b. Thickness of Each Glass Lite: 5.0 mm **OR** 6.0 mm, **as directed**.
 - c. Outdoor Lite: Float glass **OR** Heat-strengthened float glass **OR** Fully tempered float glass **OR** Ultraclear float glass **OR** Ultraclear heat-strengthened float glass **OR** Ultraclear fully tempered float glass, **as directed**.
 - d. Interspace Content: Air **OR** Argon, **as directed**.
 - e. Indoor Lite: Float glass **OR** Heat-strengthened float glass **OR** Fully tempered float glass **OR** Ultraclear float glass **OR** Ultraclear heat-strengthened float glass **OR** Ultraclear fully tempered float glass, **as directed**.
 - f. Low-E Coating: Pyrolytic on second **OR** Pyrolytic on third **OR** Sputtered on second **OR** Sputtered on third **OR** Pyrolytic or sputtered on second or third, **as directed**, surface.
 - g. Opaque Coating Location: Fourth surface.
 - h. Winter Nighttime U-Factor: as directed by the Owner.
 - i. Summer Daytime U-Factor: as directed by the Owner.
12. Glass Type: Ceramic-coated **OR** Silicone-coated, **as directed**, tinted, insulating spandrel glass.
- a. Overall Unit Thickness: 1 inch (25 mm).
 - b. Thickness of Each Glass Lite: 5.0 mm **OR** 6.0 mm.
 - c. Outdoor Lite: Tinted float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
 - d. Interspace Content: Air **OR** Argon, **as directed**.
 - e. Indoor Lite: Clear float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
 - f. Coating Location: Fourth surface.
 - g. Winter Nighttime U-Factor: as directed by the Owner.
 - h. Summer Daytime U-Factor: as directed by the Owner.
- N. Insulating-Laminated-Glass Types
- 1. Glass Type: Clear insulating laminated glass.
 - a. Overall Unit Thickness: 1-3/16 inch (30 mm) **OR** 1 inch (25 mm) **OR** 3/4 inch (19 mm), **as directed**.
 - b. Thickness of Outdoor Lite: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm, **as directed**.
 - c. Outdoor Lite: Heat-strengthened float glass **OR** Fully tempered float glass, **as directed**.
 - d. Interspace Content: Air **OR** Argon, **as directed**.
 - e. Indoor Lite: Clear laminated glass with two plies of float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
 - 1) Thickness of Each Glass Ply: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm **OR** As indicated, **as directed**.
 - 2) Interlayer Thickness: 0.030 inch (0.76 mm) **OR** 0.060 inch (1.52 mm) **OR** 0.090 inch (2.29 mm), **as directed**.
 - f. Winter Nighttime U-Factor: as directed by the Owner.
 - g. Summer Daytime U-Factor: as directed by the Owner.
 - h. Solar Heat Gain Coefficient: as directed by the Owner.
 - i. Provide safety glazing labeling.
 - 2. Glass Type: Low-e-coated, clear insulating laminated glass.



- a. Overall Unit Thickness: 1-3/16 inch (30 mm) **OR** 1 inch (25 mm) **OR** 3/4 inch (19 mm), **as directed**.
 - b. Thickness of Outdoor Lite: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm, **as directed**.
 - c. Outdoor Lite: Heat-strengthened float glass **OR** Fully tempered float glass, **as directed**.
 - d. Interspace Content: Air **OR** Argon, **as directed**.
 - e. Indoor Lite: Clear laminated glass with two plies of float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
 - 1) Thickness of Each Glass Ply: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm **OR** As indicated, **as directed**.
 - 2) Interlayer Thickness: 0.030 inch (0.76 mm) **OR** 0.060 inch (1.52 mm) **OR** 0.090 inch (2.29 mm), **as directed**.
 - f. Low-E Coating: Pyrolytic on second **OR** Pyrolytic on third **OR** Sputtered on second **OR** Sputtered on third **OR** Pyrolytic or sputtered on second or third, **as directed**, surface.
 - g. Visible Light Transmittance: as directed by the Owner.
 - h. Winter Nighttime U-Factor: as directed by the Owner.
 - i. Summer Daytime U-Factor: as directed by the Owner.
 - j. Solar Heat Gain Coefficient: as directed by the Owner.
 - k. Provide safety glazing labeling.
3. Glass Type: Tinted, insulating laminated glass.
- a. Overall Unit Thickness: 1-3/16 inch (30 mm) **OR** 1 inch (25 mm) **OR** 3/4 inch (19 mm), **as directed**.
 - b. Thickness of Outdoor Lite: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm, **as directed**.
 - c. Outdoor Lite: Tinted heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
 - d. Interspace Content: Air **OR** Argon, **as directed**.
 - e. Indoor Lite: Clear laminated glass with two plies of float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
 - 1) Thickness of Each Glass Ply: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm **OR** As indicated, **as directed**.
 - 2) Interlayer Thickness: 0.030 inch (0.76 mm) **OR** 0.060 inch (1.52 mm) **OR** 0.090 inch (2.29 mm), **as directed**.
 - f. Winter Nighttime U-Factor: as directed by the Owner.
 - g. Summer Daytime U-Factor: as directed by the Owner.
 - h. Solar Heat Gain Coefficient: as directed by the Owner.
 - i. Provide safety glazing labeling.
4. Glass Type: Low-e-coated, tinted, insulating laminated glass.
- a. Overall Unit Thickness: 1-3/16 inch (30 mm) **OR** 1 inch (25 mm) **OR** 3/4 inch (19 mm), **as directed**.
 - b. Thickness of Outdoor Lite: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm, **as directed**.
 - c. Outdoor Lite: Tinted heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
 - d. Interspace Content: Air **OR** Argon, **as directed**.
 - e. Indoor Lite: Clear laminated glass with two plies of float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
 - 1) Thickness of Each Glass Ply: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm **OR** As indicated, **as directed**.
 - 2) Interlayer Thickness: 0.030 inch (0.76 mm) **OR** 0.060 inch (1.52 mm) **OR** 0.090 inch (2.29 mm), **as directed**.
 - f. Low-E Coating: Pyrolytic on second **OR** Pyrolytic on third **OR** Sputtered on second **OR** Sputtered on third **OR** Pyrolytic or sputtered on second or third, **as directed**, surface.
 - g. Visible Light Transmittance: as directed by the Owner.
 - h. Winter Nighttime U-Factor: as directed by the Owner.
 - i. Summer Daytime U-Factor: as directed by the Owner.
 - j. Solar Heat Gain Coefficient: as directed by the Owner.
 - k. Provide safety glazing labeling.



5. Glass Type: Reflective-coated, clear, insulating laminated glass.
 - a. Overall Unit Thickness: 1-3/16 inch (30 mm) **OR** 1 inch (25 mm), **as directed**.
 - b. Thickness of Outdoor Lite: 6.0 mm.
 - c. Outdoor Lite: Clear heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
 - d. Interspace Content: Air **OR** Argon, **as directed**.
 - e. Indoor Lite: Clear laminated glass with two plies of float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
 - 1) Thickness of Each Glass Ply: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm **OR** As indicated, **as directed**.
 - 2) Interlayer Thickness: 0.030 inch (0.76 mm) **OR** 0.060 inch (1.52 mm) **OR** 0.090 inch (2.29 mm), **as directed**.
 - f. Coating Location: First **OR** Second **OR** Third, **as directed**, surface.
 - g. Winter Nighttime U-Factor: as directed by the Owner.
 - h. Summer Daytime U-Factor: as directed by the Owner.
 - i. Solar Heat Gain Coefficient: as directed by the Owner.
 - j. Provide safety glazing labeling.
 6. Glass Type: Reflective-coated, tinted, insulating laminated glass.
 - a. Overall Unit Thickness: 1-3/16 inch (30 mm) **OR** 1 inch (25 mm), **as directed**.
 - b. Thickness of Outdoor Lite: 6.0 mm.
 - c. Outdoor Lite: Tinted heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
 - d. Interspace Content: Air **OR** Argon, **as directed**.
 - e. Indoor Lite: Clear laminated glass with two plies of float glass **OR** heat-strengthened float glass **OR** fully tempered float glass, **as directed**.
 - 1) Thickness of Each Glass Ply: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm **OR** As indicated, **as directed**.
 - 2) Interlayer Thickness: 0.030 inch (0.76 mm) **OR** 0.060 inch (1.52 mm) **OR** 0.090 inch (2.29 mm), **as directed**.
 - f. Coating Location: First **OR** Second **OR** Third, **as directed**, surface.
 - g. Winter Nighttime U-Factor: as directed by the Owner.
 - h. Summer Daytime U-Factor: as directed by the Owner.
 - i. Solar Heat Gain Coefficient: as directed by the Owner.
 - j. Provide safety glazing labeling.
- O. Fire-Protection-Rated Glazing Types
1. Glass Type: 20-minute fire-rated glazing without hose-stream test; monolithic ceramic glazing **OR** film-faced ceramic glazing **OR** laminated ceramic glazing **OR** fire-protection-rated tempered glass **OR** fire-protection-rated laminated glass **OR** gel-filled, double glazing units, **as directed**.
 - a. Provide safety glazing labeling.
 2. Glass Type: 20-minute fire-rated glazing with hose-stream test; monolithic ceramic glazing **OR** film-faced ceramic glazing **OR** laminated ceramic glazing **OR** gel-filled, double glazing units, **as directed**.
 - a. Provide safety glazing labeling.
 3. Glass Type: 45-minute **OR** 60-minute **OR** 90-minute **OR** 120-minute, **as directed**, fire-rated glazing; monolithic ceramic glazing **OR** film-faced ceramic glazing **OR** laminated ceramic glazing **OR** laminated glass with intumescent interlayers **OR** gel-filled, double glazing units, **as directed**.
 - a. Provide safety glazing labeling.
 4. Glass Type: 45-minute **OR** 60-minute **OR** 90-minute **OR** 120-minute, **as directed**, fire-rated glazing with 450 deg F (250 deg C) temperature rise limitation; laminated glass with intumescent interlayers **OR** gel-filled, double glazing units, **as directed**.
 - a. Provide safety glazing labeling.



1.3 EXECUTION

A. Examination

1. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
 - a. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - b. Presence and functioning of weep systems.
 - c. Minimum required face and edge clearances.
 - d. Effective sealing between joints of glass-framing members.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Preparation

1. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
2. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

C. Glazing, General

1. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
2. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.
3. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
4. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
5. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
6. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
7. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).
 - a. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - b. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
8. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
9. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
10. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
11. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
12. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.



- D. Tape Glazing
1. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
 2. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
 3. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
 4. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
 5. Do not remove release paper from tape until right before each glazing unit is installed.
 6. Apply heel bead of elastomeric sealant.
 7. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
 8. Apply cap bead of elastomeric sealant over exposed edge of tape.
- E. Gasket Glazing (Dry)
1. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
 2. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
 3. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
 4. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
 5. Install gaskets so they protrude past face of glazing stops.
- F. Sealant Glazing (Wet)
1. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
 2. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
 3. Tool exposed surfaces of sealants to provide a substantial wash away from glass.
- G. Lock-Strip Gasket Glazing
1. Comply with ASTM C 716 and gasket manufacturer's written instructions. Provide supplementary wet seal and weep system unless otherwise indicated.
- H. Cleaning And Protection
1. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.
 2. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.



3. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.
4. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.
5. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Final Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 08 01 81 00



SECTION 08 05 13 00 - FLUSH WOOD DOORS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of material for flush wood doors. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Solid-core doors and transom panels with wood-veneer, medium-density-overlay, hardboard or MDF, and plastic-laminate faces.
 - b. Hollow-core doors with wood-veneer, hardboard or MDF, and plastic-laminate faces.
 - c. Shop priming and Factory finishing flush wood doors.
 - d. Factory fitting flush wood doors to frames and factory machining for hardware.

C. Submittals

1. Product Data: For each type of door indicated. Include factory-finishing specifications.
2. LEED Submittals:
 - a. Certificates for Credit MR 7: Chain-of-custody certificates certifying that flush wood doors comply with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.
 - 1) Include statement indicating costs for each certified wood product.
 - b. Product Data for Credit EQ 4.4: For adhesives and composite wood products, documentation indicating that product contains no urea formaldehyde.
3. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
 - a. Indicate dimensions and locations of mortises and holes for hardware.
 - b. Indicate dimensions and locations of cutouts.
 - c. Indicate requirements for veneer matching.
 - d. Indicate doors to be factory finished and finish requirements.
 - e. Indicate fire-protection ratings for fire-rated doors.
4. Samples: For plastic-laminate door faces and factory-finished doors.

D. Quality Assurance

1. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
2. Quality Standard: In addition to requirements specified, comply with AWI's "Architectural Woodwork Quality Standards Illustrated" **OR** WDMA I.S.1-A, "Architectural Wood Flush Doors" **OR** WI's "Manual of Millwork", **as directed**.
3. Forest Certification: Provide doors made with cores **OR** veneers **OR** not less than 70 percent of wood products **OR** all wood products, **as directed**, obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
4. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure **OR** as close to neutral pressure as possible, **as directed**, according to NFPA 252 **OR** IBC Standard 716.5 **OR** UL 10B **OR** UL 10C, **as directed**.
 - a. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.



- b. Temperature-Rise Limit: Where indicated **OR** At vertical exit enclosures and exit passageways, **as directed**, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
 5. Preinstallation Conference: Conduct conference at Project site.
- E. Delivery, Storage, And Handling
1. Comply with requirements of referenced standard and manufacturer's written instructions.
 2. Package doors individually in plastic bags or cardboard cartons **OR** cardboard cartons and wrap bundles of doors in plastic sheeting, **as directed**.
 3. Mark each door on bottom **OR** top and bottom, **as directed**, rail with opening number used on Shop Drawings.
- F. Warranty
1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
 - a. Warranty Period for Solid-Core Exterior Doors: Two **OR** Five, **as directed**, years from date of Final Completion.
 - b. Warranty Period for Solid-Core Interior Doors: Life of installation.
 - c. Warranty Period for Hollow-Core Interior Doors: One **OR** Two, **as directed**, year(s) from date of Final Completion.

1.2 PRODUCTS

- A. Door Construction, General
1. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.
 2. WDMA I.S.1-A Performance Grade:
 - a. Heavy Duty unless otherwise indicated.
 - b. Extra Heavy Duty: Classrooms, public toilets, janitor's closets, assembly spaces, exits, patient rooms, and where indicated.
 - c. Standard Duty: Closets (not including janitor's closets), private toilets, and where indicated.
 3. Particleboard-Core Doors:
 - a. Particleboard:
 - 1) ANSI A208.1, Grade LD-1 **OR** Grade LD-2, **as directed**, made with binder containing no urea-formaldehyde resin, **as directed**.
OR
Straw-based particleboard complying with ANSI A208.1, Grade LD-2 or M-2, except for density.
 - b. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.
 - c. Provide doors with glued-wood-stave **OR** structural-composite-lumber, **as directed**, cores instead of particleboard cores for doors indicated to receive exit devices.
 4. Structural-Composite-Lumber-Core Doors:
 - a. Structural Composite Lumber: WDMA I.S.10.
 - 1) Screw Withdrawal, Face: 700 lbf (3100 N).
 - 2) Screw Withdrawal, Edge: 400 lbf (1780 N).
 5. Fire-Protection-Rated Doors: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
 - a. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.



- b. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals, **as directed**. Comply with specified requirements for exposed edges.
OR
Pairs: Provide formed-steel edges and astragals with intumescent seals, **as directed**.
 - 1) Finish steel edges and astragals with baked enamel same color as doors, **as directed**.
OR
Finish steel edges and astragals to match door hardware (locksets or exit devices).
6. Mineral-Core Doors:
- a. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
 - b. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as needed to eliminate through-bolting hardware.
 - c. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
7. Hollow-Core Doors:
- a. Construction: Institutional **OR** Standard, **as directed**, hollow core.
- B. Veneered-Faced Doors For Transparent Finish
1. Exterior Solid-Core Doors:
- a. Grade: Premium, with Grade AA faces **OR** Premium, with Grade A faces **OR** Custom (Grade A faces) **OR** Economy (Grade B faces), **as directed**.
 - b. Species: Anigre **OR** Select white ash **OR** Figured select white ash **OR** Select white birch **OR** Cherry **OR** Select red gum **OR** Figured select red gum **OR** Select white maple **OR** Red oak **OR** Persimmon **OR** Sapele **OR** Sycamore **OR** Walnut **OR** White oak **OR** Ucuuba (Virola Duckei) **OR** Cupiuba (Goupia glabra), **as directed**.
 - c. Cut: Rotary cut **OR** Plain sliced (flat sliced) **OR** Quarter sliced **OR** Rift cut, **as directed**.
 - d. Match between Veneer Leaves: Book **OR** Slip **OR** Pleasing, **as directed**, match.
 - e. Assembly of Veneer Leaves on Door Faces: Center-balance **OR** Balance **OR** Running, **as directed**, match.
 - f. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions, **as directed**.
 - g. Exposed Vertical **OR** Vertical and Top, **as directed**, Edges: Same species as faces or a compatible species **OR** Same species as faces **OR** Applied wood-veneer edges of same species as faces and covering edges of faces **OR** Applied wood edges of same species as faces and covering edges of crossbands, **as directed**.
 - h. Core: Particleboard **OR** Glued wood stave **OR** Structural composite lumber, **as directed**.
 - i. Construction: Five **OR** Five or seven, **as directed**, plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering. Faces are bonded to core using a hot press, **as directed**.
 - j. Adhesives: Type I per WDMA TM-6.
2. Interior Solid-Core Doors:
- a. Grade: Premium, with Grade AA faces **OR** Premium, with Grade A faces **OR** Custom (Grade A faces) **OR** Economy (Grade B faces), **as directed**.
 - b. Species: Anigre **OR** Select white ash **OR** Figured select white ash **OR** Select white birch **OR** Cherry **OR** Select red gum **OR** Figured select red gum **OR** Select white maple **OR** Red oak **OR** Persimmon **OR** Sapele **OR** Sycamore **OR** Walnut **OR** White oak **OR** Ucuuba (Virola Duckei) **OR** Cupiuba (Goupia glabra), **as directed**.
 - c. Cut: Rotary cut **OR** Plain sliced (flat sliced) **OR** Quarter sliced **OR** Rift cut, **as directed**.
 - d. Match between Veneer Leaves: Book **OR** Slip **OR** Pleasing, **as directed**, match.
 - e. Assembly of Veneer Leaves on Door Faces: Center-balance **OR** Balance **OR** Running, **as directed**, match.



- f. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions, **as directed**.
 - g. Room Match:
 - 1) Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by 10 feet (3 m) **OR** 20 feet (6 m), **as directed**, or more.
 - OR**
 - Provide door faces of compatible color and grain within each separate room or area of building.
 - h. Transom Match: Continuous match **OR** End match **OR** As indicated, **as directed**.
 - i. Blueprint Match: Where indicated, provide doors with faces produced from same flitches as adjacent wood paneling and arranged to provide blueprint match with wood paneling. Comply with requirements in Division 06 Section(s) "Interior Architectural Woodwork" **OR** "Wood Paneling", **as directed**.
 - j. Exposed Vertical **OR** Vertical and Top, **as directed**, Edges: Same species as faces or a compatible species **OR** Same species as faces **OR** Applied wood-veneer edges of same species as faces and covering edges of faces **OR** Applied wood edges of same species as faces and covering edges of crossbands, **as directed**.
 - k. Core: Particleboard **OR** Glued wood stave **OR** Nonglued wood stave **OR** Structural composite lumber, **as directed**.
 - l. Construction:
 - 1) Five **OR** Five or seven, **as directed**, plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering. Faces are bonded to core using a hot press, **as directed**.
 - OR**
 - Seven plies, either bonded or nonbonded construction.
3. Interior Hollow-Core Doors:
- a. Grade: Premium, with Grade AA faces **OR** Premium, with Grade A faces **OR** Custom (Grade A faces) **OR** Economy (Grade B faces), **as directed**.
 - b. Species: Anigre **OR** Select white ash **OR** Figured select white ash **OR** Select white birch **OR** Cherry **OR** Select red gum **OR** Figured select red gum **OR** Select white maple **OR** Red oak **OR** Persimmon **OR** Sapele **OR** Sycamore **OR** Walnut **OR** White oak **OR** Ucuuba (Virola Duckei) **OR** Cupiuba (Goupia glabra), **as directed**.
 - c. Cut: Rotary cut **OR** Plain sliced (flat sliced) **OR** Quarter sliced **OR** Rift cut, **as directed**.
 - d. Match between Veneer Leaves: Book **OR** Slip **OR** Pleasing, **as directed**, match.
 - e. Assembly of Veneer Leaves on Door Faces: Center-balance **OR** Balance **OR** Running, **as directed**, match.
 - f. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions, **as directed**.
 - g. Exposed Vertical **OR** Vertical and Top, **as directed**, Edges: Same species as faces or a compatible species **OR** Same species as faces **OR** Applied wood-veneer edges of same species as faces and covering edges of faces **OR** Applied wood edges of same species as faces and covering edges of crossbands, **as directed**.
 - h. Construction: Seven plies.
- C. Doors For Opaque Finish
- 1. Exterior Solid-Core Doors:
 - a. Grade: Premium **OR** Custom **OR** Economy, **as directed**.
 - b. Faces: Medium-density overlay **OR** Any closed-grain hardwood of mill option, **as directed**.
 - 1) Apply medium-density overlay to standard-thickness, closed-grain, hardwood face veneers **OR** directly to high-density hardboard crossbands, **as directed**.
 - c. Exposed Vertical **OR** Vertical and Top, **as directed**, Edges: Any closed-grain hardwood.
 - d. Core: Particleboard **OR** Glued wood stave **OR** Structural composite lumber, **as directed**.



- e. Construction: Five **OR** Five or seven, **as directed**, plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering. Faces are bonded to core using a hot press, **as directed**.
 - f. Adhesives: Type I per WDMA TM-6.
 - 2. Interior Solid-Core Doors:
 - a. Grade: Premium **OR** Custom **OR** Economy, **as directed**.
 - b. Faces: Medium-density overlay **OR** Any closed-grain hardwood of mill option **OR** Hardboard or MDF, **as directed**.
 - 1) Apply medium-density overlay to standard-thickness, closed-grain, hardwood face veneers **OR** directly to high-density hardboard crossbands, **as directed**.
 - 2) Hardboard Faces: AHA A135.4, Class 1 (tempered) or Class 2 (standard).
 - 3) MDF Faces: ANSI A208.2, Grade 150 or 160.
 - c. Exposed Vertical **OR** Vertical and Top, **as directed**, Edges: Any closed-grain hardwood.
 - d. Core: Particleboard **OR** Glued wood stave **OR** Nonglued wood stave **OR** Structural composite lumber, **as directed**.
 - e. Construction:
 - 1) Three **OR** Five **OR** Five or seven, **as directed**, plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering. Faces are bonded to core using a hot press, **as directed**.
OR
Three **OR** Seven, **as directed**, plies, either bonded or nonbonded construction.
 - 3. Interior Hollow-Core Doors:
 - a. Grade: Premium **OR** Custom **OR** Economy, **as directed**.
 - b. Faces: Medium-density overlay **OR** Any closed-grain hardwood of mill option **OR** Hardboard or MDF, **as directed**.
 - 1) Hardboard Faces: AHA A135.4, Class 1 (tempered) or Class 2 (standard).
 - 2) MDF Faces: ANSI A208.2, Grade 150 or 160.
 - c. Exposed Vertical **OR** Vertical and Top, **as directed**, Edges: Any closed-grain hardwood.
 - d. Construction: Three **OR** Seven, **as directed**, plies.
- D. Plastic-Laminate-Faced Doors
- 1. Interior Solid-Core Doors:
 - a. Grade: Premium **OR** Custom **OR** Economy, **as directed**.
 - b. Plastic-Laminate Faces: High-pressure decorative laminates complying with NEMA LD 3, Grade HGS **OR** Grade HSH, **as directed**.
 - c. Colors, Patterns, and Finishes: As indicated **OR** As selected from laminate manufacturer's full range of products, **as directed**.
 - d. Exposed Vertical **OR** Vertical and Top, **as directed**, Edges: Hardwood edges for staining to match faces **OR** Hardwood edges for painting **OR** Plastic laminate that matches faces, applied before faces **OR** Impact-resistant polymer edging, applied after faces, **as directed**.
 - 1) Polymer Edging Color: Beige **OR** Brown **OR** Same color as faces, **as directed**.
 - e. Core: Particleboard **OR** Glued wood stave **OR** Structural composite lumber, **as directed**.
 - f. Construction:
 - 1) Three plies. Stiles and rails are bonded to core, then entire unit abrasive planed before faces are applied. Faces are bonded to core using a hot press, **as directed**.
OR
Five plies. Stiles and rails are bonded to core, then entire unit abrasive planed before faces and crossbands are applied. Faces are bonded to core using a hot press, **as directed**.
 - 2. Interior Hollow-Core Doors:
 - a. Grade: Premium **OR** Custom **OR** Economy, **as directed**.
 - b. Plastic-Laminate Faces: High-pressure decorative laminates complying with NEMA LD 3, Grade HGS **OR** Grade HSH, **as directed**.
 - c. Colors, Patterns, and Finishes: As indicated **OR** As selected from laminate manufacturer's full range of products, **as directed**.



- d. Exposed Vertical **OR** Vertical and Top, **as directed**, Edges: Hardwood edges for staining to match faces **OR** Hardwood edges for painting **OR** Plastic laminate that matches faces, applied before faces **OR** Impact-resistant polymer edging, applied after faces, **as directed**.
 - 1) Polymer Edging Color: Beige **OR** Brown **OR** Same color as faces, **as directed**.
 - e. Construction: Plastic-laminate faces glued directly to core.
- E. Louvers And Light Frames
1. Wood Louvers: Door manufacturer's standard solid-wood louvers unless otherwise indicated.
 - a. Wood Species: Same species as door faces **OR** Species compatible with door faces **OR** Any closed-grain hardwood, **as directed**.
 2. Metal Louvers:
 - a. Blade Type: Vision-proof, inverted V **OR** Vision-proof, inverted Y **OR** Darkroom-type, double inverted V, **as directed**.
 - b. Metal and Finish:
 - 1) Hot-dip galvanized steel, 0.040 inch (1.0 mm) thick, factory primed for paint finish **OR** with baked-enamel- or powder-coated finish, **as directed**.
OR
Extruded aluminum with Class II, clear anodic finish, AA-M12C22A31.
OR
Extruded aluminum with light bronze **OR** medium bronze **OR** dark bronze **OR** black, **as directed**, Class II, color anodic finish, AA-M12C22A32/A34.
 3. Louvers for Fire-Rated Doors: Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire-protection rating of 1-1/2 hours and less.
 - a. Metal and Finish: Hot-dip galvanized steel, 0.040 inch (1.0 mm) thick, factory primed for paint finish **OR** with baked-enamel- or powder-coated finish, **as directed**.
 4. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads as follows unless otherwise indicated.
 - a. Wood Species: Same species as door faces **OR** Species compatible with door faces **OR** Any closed-grain hardwood, **as directed**.
 - b. Profile: Flush rectangular beads **OR** Recessed tapered beads **OR** Recessed tapered beads with exposed banding **OR** Lipped tapered beads **OR** Manufacturer's standard shape, **as directed**.
 - c. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.
 5. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.
 6. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048-inch- (1.2-mm-) thick, cold-rolled steel sheet; factory primed for paint finish **OR** with baked-enamel- or powder-coated finish, **as directed**; and approved for use in doors of fire-protection rating indicated.
- F. Fabrication
1. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
 - a. Comply with requirements in NFPA 80 for fire-rated doors.
 2. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.
 - a. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
 - b. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.



3. Transom and Side Panels: Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.
 - a. Fabricate door and transom panels with full-width, solid-lumber, rabbeted, **as directed**, meeting rails. Provide factory-installed spring bolts for concealed attachment into jambs of metal door frames.
 4. Openings: Cut and trim openings through doors in factory.
 - a. Light Openings: Trim openings with moldings of material and profile indicated.
 - b. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Division 08 Section "Glazing".
 - c. Louvers: Factory install louvers in prepared openings.
 5. Exterior Doors: Factory treat exterior doors with water repellent after fabrication has been completed but before shop priming **OR** factory finishing, **as directed**.
 - a. Flash top of outswinging doors (with manufacturer's standard metal flashing).
- G. Shop Priming
1. Doors for Opaque Finish: Shop prime doors with one coat of wood primer specified in Division 09 Section(s) "Exterior Painting" OR "Interior Painting", **as directed**. Seal all four edges, edges of cutouts, and mortises with primer.
 2. Doors for Transparent Finish: Shop prime doors with stain (if required), other required pretreatments, and first coat of finish as specified in Division 09 Section(s) "Exterior Painting" OR "Interior Painting" OR "Staining And Transparent Finishing", **as directed**. Seal all four edges, edges of cutouts, and mortises with first coat of finish.
- H. Factory Finishing
1. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
 - a. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on bottom **OR** top and bottom, **as directed**, edges, edges of cutouts, and mortises.
 2. Finish doors at factory.
OR
Finish doors at factory that are indicated to receive transparent finish. Field finish doors indicated to receive opaque finish.
OR
Finish doors at factory where indicated in schedules or on Drawings as factory finished.
 3. Transparent Finish:
 - a. Grade: Premium **OR** Custom, **as directed**.
 - b. Finish:
 - 1) AWI conversion varnish **OR** catalyzed polyurethane, **as directed**, system.
OR
WDMA TR-4 conversion varnish **OR** TR-6 catalyzed polyurethane, **as directed**.
OR
WI System 4 clear conversion varnish **OR** 5 catalyzed polyurethane **OR** 8 UV-curable coating, **as directed**.
 - c. Staining: Match sample **OR** As selected from manufacturer's full range **OR** None required, **as directed**.
 - d. Effect: Open-grain finish **OR** Filled finish **OR** Semifilled finish, produced by applying an additional finish coat to partially fill the wood pores, **as directed**.
 - e. Sheen: Satin **OR** Semigloss, **as directed**.
 4. Opaque Finish:
 - a. Grade: Premium **OR** Custom, **as directed**.
 - b. Finish:
 - 1) AWI conversion varnish **OR** catalyzed polyurethane, **as directed**, system.
OR
WDMA OP-4 conversion varnish **OR** OP-6 catalyzed polyurethane, **as directed**.

**OR**

WI System 4 conversion varnish **OR** 5 catalyzed polyurethane **OR** 8 UV-curable coating, **as directed**.

- c. Color: Match sample **OR** As selected from manufacturer's full range, **as directed**.
- d. Sheen: Satin **OR** Semigloss **OR** Gloss, **as directed**.

1.3 EXECUTION

A. Installation

1. Hardware: For installation, see Division 08 Section "Door Hardware".
2. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.
 - a. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.
3. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
 - a. Clearances: Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors. Provide 1/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch (6.4 mm) from bottom of door to top of threshold unless otherwise indicated.
 - 1) Comply with NFPA 80 for fire-rated doors.
 - b. Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.
 - c. Bevel fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock edge; trim stiles and rails only to extent permitted by labeling agency.
4. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
5. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

B. Adjusting

1. Operation: Rehang or replace doors that do not swing or operate freely.
2. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 05 13 00



Task	Specification	Specification Description
08 05 13 00	01 22 16 00	No Specification Required
08 05 13 00	08 01 11 00	Steel Doors And Frames
08 05 13 00	06 48 13 00	Wood Doors
08 05 13 00	08 34 73 00	Sound Control Doors



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SECTION 08 11 63 13 - STEEL STORM DOORS

DESCRIPTION OF WORK

This specification covers the furnishing and installation of materials for steel storm doors. Products shall be as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

GENERAL

Definitions

1. Supply and Delivery only: Include supply and delivery to site(s) FOB destination freight prepaid. Unless otherwise specified or scheduled, unloading and handling at site is by Owner.

System Description

2. Performance Requirements: Comply with following:
 - a. Steel Storm Doors: Largest steel storm door size: Meet or exceed performance requirements of Section 2.1 (CSD-1) of ANSI/AAMA 1102.7 and ASTM B 117.
 - b. Steel Storm Doors: Completely assembled storm door measuring at least 914 mm (36 inches) wide x 2 032 mm (80 inches) high with necessary braces and hardware:
 - 1) Sag Test: Meet or exceed ANSI/AAMA 1102.7 Sag Test.
 - 2) Forced Entry Resistance Test: Meet or exceed ANSI/SMA 6001 Paragraph 4.2.4.3 for Heavy Type.
 - 3) Storm Door Screen Insert: Completely assembled screen of 914 mm (36 inches) by 1 524 mm (60 inches) size with necessary braces: Meet or exceed ANSI/SMA 6001 Paragraph 4.2.4.1 Impact Test performance requirements for Medium Type.
 - c. Steel Screen Doors: Completely assembled screen door measuring at least 914 mm (36 inches) wide by 2 032 mm (80 inches) high with necessary braces and hardware:
 - 1) Impact Test: Meet or exceed performance requirements of ANSI/SMA 6001 Paragraph 4.2.4.1 for Medium Type.
 - 2) Sag Test: Meet or exceed ANSI/AAMA 1102.7 Sag Test.
 - d. Door Finish: Subjected to ASTM B117 Salt Spray Fog Test for minimum of 250 hours. Cut tubular section open to check finish performance.

Submittals

3. Product Data.
4. Shop Drawings:
 - a. Include exploded view of manufactured door, similar to ANSI/AAMA 1102.7, page 12.
 - b. Indicate fabrication of all parts, metal thickness, installation details, fastening, and sealing.
 - c. Include sections of typical members and details of latching devices.
5. Samples: Submit full set of finish color samples for color selection.
 - a. For Supply and Deliver Only Contract: Submit one full size sample of each type of storm door with specified finish for acceptance.
6. Quality Assurance/Control Submittals:
 - a. Certificates: Manufacturer's written third party certification that storm doors meet or exceed ANSI/AAMA 1102.7 (CSD-1), Paragraph 2.1.6.5 of ANSI/SMA 6001, ASTM B117, and other specified requirements.
 - b. Manufacturer's installation instructions.
7. Closeout Submittals:
 - a. Operation and maintenance data.
 - b. Special warranty.

Quality Assurance



8. Regulatory Requirements: Comply with following:
 - a. Glazing Materials: Comply with CPSC 16 CFR 1201 or ANSI Z97.1.
 - b. Accessibility:
 - 1) Architectural Barriers Act of 1968 as amended (42 USC 4152-4157) and HUD implementing regulations (24 CFR Part 40).
 - a) Uniform Federal Accessibility Standards (UFAS).
 - 2) Section 504 of the Rehabilitation Act of 1973 as amended (29 USC 794) and HUD implementing regulations 24 CFR Part 8.
 - 3) Fair Housing Accessibility Guidelines (24 CFR Chapter 1).
 - 4) Americans with Disabilities Act of 1990 (ADA) (28 CFR Part 35).
9. Certifications: Comply with ANSI Z34.2.
10. Mock-ups: For Supply and Install Contract: Install one full size mock-up of each type of storm door with specified finish for acceptance.
 - a. Location: As directed.
 - b. Approved Mock-up: Standard for rest of work.
 - c. Approved Mock-up: May remain part of completed project.

Delivery, Storage, And Handling

11. Packing, Shipping, Handling, and Unloading: Pack materials at manufacturing plant to prevent damage during shipping.
 - a. Screens: Label attached signifying compliance with ANSI/AAMA 1102.7 (CSD-1), ANSI/SMA 6001, ASTM B 117 performance requirements.
 - 1) Labels: Include manufacturers name and code identifying plant location and validation date.
 - 2) Labels: Affixed to inside of vertical member of each door.
12. Acceptance at Site: Inspect storm doors upon delivery. Replace damaged or defective materials before installation.
13. Storage and Protection: Store storm doors in manner to protect from weather and other damage.

Project Conditions

14. Field Measurements: Field measure openings for storm doors before start of fabrication.

Scheduling And Sequencing

15. Scheduling and Completion: Comply with requirements of Detailed Scope of Work.

Warranty

16. Special Warranty: Provide one year written covering materials and installation for storm doors.
 - a. Warranty: Include coverage of inserts, closers, chains, hardware, and latches.
 - 1) Screening and glazing not included.
 - 2) Defects resulting from vandalism not included.
 - b. For Supply and Delivery Only Contract:
 - 1) Contractor: Agrees to supply and deliver to Owner, free of charge, any required replacement parts that can be readily installed by Owner without special tools.
 - 2) Contractor: Agrees to supply and deliver free of charge, complete replacement door, when defective part or parts cannot be installed without use of special tools.
 - c. For Supply and Install Contract:
 - 1) Contractor: Agrees to supply and install, free of charge, any required replacement parts or complete replacement door.

PRODUCTS

Steelstorm Doors

17. Storm Doors: Type(s) and size(s) indicated, specified, or scheduled manufactured of steel and provided with pro-hung aluminum frame liner (Z-bar) to fit entrance door apertures requiring frame



- sizes of 762 mm (30 inches) to 940 mm (37 inches) in width and 2 007 mm (79 inches) to 2 134 mm (84 inches) in height.
- a. Storm Doors: Complete with Z-bar frame liner, glazing, replaceable screen insert, durable steel kick plate, adjustable sill sweep, and necessary hardware.
 - b. Assembly: Secure and workmanlike manner permitting storm door to perform properly and assuring its neat and weather-resistant construction.
18. Materials:
- a. Master Frame: Minimum 22 gage (0.85 mm) roll formed steel, or 16 gage (1.6 mm) tubular steel as applicable to item specified.
 - b. Fasteners: Stainless, cadmium plated, or zinc-plated steel screws, nuts, washers, bolts and other miscellaneous fastening devices and hardware in accordance with ASTM B 633 or ASTM B 766.
 - c. Kick Plate: Minimum 18 gage (1.3 mm) embossed galvanized panel for roll formed frame or 16 gage (1.6 mm) flat galvanized steel sheet for tubular steel frame.
 - d. Screen Insert:
 - 1) Screening: ANSI/SMA 6001, Paragraph 4.2.4.1, Medium Type, 12 x 12 stainless steel, at least 0.58 mm (0.023 inch) diameter.
 - 2) Screen Frame: Roll formed or tubular lock seam type formed from not less than 25 gage (0.53 mm) hot dipped galvanized steel or extruded aluminum.
 - e. Glazing Bead, Storm Door Sweep and Screen Spline: Polyvinyl chloride (PVC) or equal material
 - f. Frame Liner (Z-bar): Extruded aluminum, 6063 J5.
 - g. Weatherstripping: Wool pile, or vinyl.
19. Glazing Materials: Comply with CPSC 16 CFR 1201 or ANSI Z97.1.
- a. Tempered Glass: ASTM C 1048, Kind FT. Condition A, Type 1, Class 1, Glazing B Quality.
 - b. Plastic: Extruded polycarbonate clear sheets, minimum 4.5 mm (0.177 inch) thick with following characteristics:
 - 1) Impact Resistance: ASTM D 256, Method A, 12-18 foot-pound per inch.
 - 2) Elongation/Modulus of Elasticity: ASTM D 638, 110 percent maximum 340,000 PSI.
 - 3) Heat Deflection: ASTM D 648, 132.2 degrees C (270 degrees F) at 264 PSI.
 - 4) Abrasion Resistance: Coated on both surfaces to produce abrasion resistance of 3-19 percent maximum haze increase for 500 revolutions of CS-1 OF wheel per ASTM D 1044.
 - c. Glass Thickness: In accordance with ANSI/AAMA 1002.10 Appendix, minimum 5 mm (3/16 inch).
 - 1) Design Wind Pressures: Determined in accordance with applicable codes and regulations.
 - d. Glass: Labeled to show name of manufacturer and type.
 - e. Glazing Material: Installed in rigid removable steel or extruded aluminum subframe.
20. Construction:
- a. Master Frame: Roll Formed tubular lock-seam construction formed from 22 gage (0.85 mm) hot dipped galvanized steel.
 - 1) Corners: Either mitered or butt-jointed and rigidly fastened together by brazing or welding. Insert steel gussets at corners of mitered or butt-jointed storm doors when edge brazing is used.
 - 2) Welded tubular galvanized steel of 16 gage (1.6 mm) wall thickness is not required to use corner blocks or gussets.
 - b. Transom Rail (mullion): Accurately machined or accurately fit frame and rigidly welded to side of stiles.
 - 1) Kick Plate: Rigidly retained in place by steel or aluminum spline.
 - c. Glazing Frames: Mitered joints with corner gussets securely staked or brazed at corners.
 - 1) Inserts: Securely held in door.
 - 2) Provide positive contact between inserts and master frame to stop passage of insects and to prevent rattling.
 - d. Screen Inserts: Constructed to withstand performance requirements of ANSI/SMA 6001, Heavy Type.
 - 1) Screen Frames: Rolled, tubular lock seam construction or extruded aluminum.



- e. Adjustable Expander: Installed at bottom of each storm door to receive vinyl sweep.
 - 1) Adjustment Limit: Minimum 7.9 mm (5/16 inch).
 - 2) Vinyl Door Sweep: Installed in entire length of expander.
- f. Frame Liner (Z-bar): Track to receive weather stripping and necessary installation holes.
 - 1) Head Section of Frame Liner: Formed to function as drip cap.
- 21. Dimensions:
 - a. Widths across Master Frames:
 - 1) For Roll Form Door Minimum 70 mm (2-3/4 inches).
 - 2) For Tubular Doors: Minimum 51 mm (2 inches) with 23.7 mm (15/16 inch) minimum thickness.
 - b. Mullion Bar Following minimum widths across:
 - 1) Roll Form Door 48 mm (1-7/8 inches).
 - 2) Tubular Door: 23.7 mm (15/16 inch). Frame Liner: Minimum 27 mm (1-1/16 inch) return offset on outside face for side flange width for bearing against door buck. Wall Thickness of Frame Liner: Minimum 1.57 mm (0.062 inch). Storm Door: Supported by adequate reinforcing ribs.
 - c. Insert Frame: Maximum 4.8 mm (1/8 inch) overall clearance in width and height and interchangeable in storm doors having same nominal size.
 - d. Master Frame Dimensions: Manufacturing tolerance of plus or minus 4.8 mm (1/8 inch).
- 22. Hardware: Stainless steel, aluminum or other non-corrosive material.
 - a. Cadmium or Zinc Plated Steel: ASTM B 633 or ASTM B 766.
 - b. Include latch equipped with exterior handle, interior locking mechanism with anti-lockout feature, adjustable heavy duty door closer, necessary screws, and hurricane chain with spring.
 - c. Hinges: Install one of following hinge types on each frame liner and storm door:
 - 1) At least 4 concealed 304 stainless steel hinges on bronze oilite bearings, each minimum 75 mm (3 inches) long.
 - 2) At least 3 surface-mounted (H) type galvanized steel hinges.

Accessories

- 23. Joint Sealant: AAMA 800, Type 808.3 Exterior Perimeter Sealing Compound.

Finishes

- 24. Finish: Baked enamel or polyester poly powder coat applied to phosphatized, zinc impregnated or coated hot dipped galvanized steel.
 - a. Finish: Not show fading or corrosion when exposed to salt-spray test specified in this Section.

Source Quality Control

- 25. Testing: Performed by accredited independent testing laboratory.

EXECUTION

Examination

- 26. Site Verification of Conditions:
 - a. Field Measurements: Verify field measurements are as indicated on Shop Drawings.
 - b. Existing Conditions: Examine openings before beginning installation.
 - c. Verify that surfaces to receive storm doors are clean.

Preparation

- 27. Protection: Protect adjacent elements from damage and disfiguration in accordance with Detailed Scope of Work.
 - a. Contractor: Responsible for damage to grounds, plantings, buildings and any other facilities or property caused by construction operations.



- b. Repair or replace damaged elements in accordance with Detailed Scope of Work.
- 28. Existing Storm Doors: Remove existing screen and storm doors and debris from site in accordance with Detailed Scope of Work.
- 29. Prime Door Jambs of Existing Prime Doors: Prepare as necessary to provide for straight, plumb, level, tight and aesthetically appealing installation of steel storm doors.
 - a. Preparatory Work: Include, but not limited to repair of iambs, filling holes and/or dents, removing peeling and scaling paint, etc.

Installation

- 30. General: Install in accordance with ASTM E 737, manufacturer's recommendations, Reference Standards, and approved Shop Drawings.
 - a. Securely fasten doors in place to straight, plumb and level condition, without distortion of door or door frame, and make final adjustments for proper operation and satisfactory weatherstrip contact and seal.
 - b. In high wind areas, install storm door hinges on side to prevailing wind as directed.
- 31. Joint Sealants: Apply in accordance with manufacturers recommendations.
 - a. Surfaces to be Sealed: Clean, dry and free of any foreign matter that would degrade adhesion. Remove existing caulking and joint sealants from areas to receive new joint sealant.
 - b. Prime cleaned surfaces in accordance with sealant manufacturers recommendations.
 - c. Protect surfaces adjacent to joints by masking tape before applying sealant. Remove tape upon finishing sealing work.
 - d. Seal joints between perimeter of door frame and underlying or surrounding construction with joint sealant to accomplish weather-tight installation.
 - e. Maximum Width of Sealed Joint: 13 mm (1/2 inch).
- 32. Dissimilar Materials: Isolate materials from incompatible materials as necessary to prevent deterioration.
 - a. Separate dissimilar metals with bituminous paint, suitable sealant, nonabsorptive plastic or elastomeric tape, or gasket between surfaces.

Adjusting And Cleaning

- 33. Adjusting: At completion of job, check, adjust, and lubricate hardware as required and leave storm doors and hardware in proper operating condition.
- 34. Cleaning: Comply with requirements of Detailed Scope of Work.
 - a. Clean storm doors after installation is completed to remove foreign matter and surface blemishes.
 - b. Scratched or Abraded Surfaces: Touch-up with rust inhibitor primer and enamel paint compatible with factory finish.

Protection

- 35. Installed Work: Protect storm doors from damage after installation.

END OF SECTION 08 11 63 13



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SECTION 08 11 63 13a - SECURITY WINDOW SCREENS AND DOORS

DESCRIPTION OF WORK

This specification covers the furnishing and installation of materials for security window screens and doors. Products shall be as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

GENERAL

Definitions

1. Type of Screens (Frames and Screening): Light, Medium, and Heavy Types: As defined by and comply with requirements of ANSI/SMA 6001.
2. Supply and Delivery Only: Include supply and delivery to site(s) FOB destination freight prepaid. Unless otherwise specified or scheduled, unloading and handling at site is by Owner.

System Description

3. Performance Requirements: Comply with following:
 - a. Screens: Comply with ANSI/SMA 6001 performance requirements for Type specified or scheduled.
 - 1) Sag Test Described in ANSI/SMA 6001 Paragraph 4.2.4.2: Applicable to vertical or side hinged operable window screens only.
 - b. Operable Screens: Tested with emergency egress locking system:
 - 1) Screens: Meet or exceed ANSI/SMA 6001 performance requirements for Type specified or scheduled.
 - c. Security Screen Insert for Storm Doors: Completely assembled screen of 914 mm (36 inches) by 1 524 mm (60 inches) size with necessary braces:
 - 1) Impact Test: Meet or exceed ANSI/SMA 6001 Paragraph 4.2.4.1 performance requirements for Heavy Type.
 - d. Security Screen Doors: Completely assembled screen door measuring at least 914 mm (36 inches) wide by 2 032 mm (80 inches) high with necessary braces and hardware:
 - 1) Impact Test: Meet or exceed performance requirements of ANSI/SMA 6001 Paragraph 4.2.4.1 for Heavy Type.
 - 2) Sag Test: Meet or exceed ANSI/AAMA 1102.7 Sag Test.

Submittals

4. Product Data
5. Shop Drawings: Include standard details showing recommendations for installation. Include size of fasteners, maximum dimensions from each end, center-to-center spacing on all four sides, minimum penetration of fasteners into loading material, and maximum clearance between frame and rough opening.
6. Samples: Submit full set of samples of finish colors for color selection.
 - a. For Supply and Deliver Only Contract: Submit one full size sample of each type of security window screen and screen door with specified finish for acceptance.
7. Quality Assurance/Control Submittals:
 - a. Certificates: Manufacturers written certification that security window screens and door screens meet or exceed ANSI/SMA 6001 and other specified requirements.
 - b. Manufacturer's installation instructions.
8. Closeout Submittals:
 - a. Operation and maintenance data.
 - b. Special warranty.



Quality Assurance

9. Regulatory Requirements:
 - a. Egress Requirements: Comply with applicable codes and regulations.
 - b. Provide emergency egress, single point locking release, and bit key lock fire entry from exterior as and where required by applicable codes and regulations.
 - c. Accessibility:
 - 1) Architectural Barriers Act of 1968 as amended (42 USC 4152-4157) and HUD implementing regulations (24 CFR Part 40).
 - a) Uniform Federal Accessibility Standards (UFAS).
 - 2) Section 504 of the Rehabilitation Act of 1973 as amended (29 USC 794) and HUD implementing regulations 24 CFR Part 8.
 - 3) Fair Housing Accessibility Guidelines (24 CFR Chapter 1).
 - 4) Americans with Disabilities Act of 1990 (ADA) (28 CFR Part 35).
10. Certifications: Comply with ANSI Z34.2.
11. Mock-ups: For Supply and Install Contract: Install one full size mock-up of each type of security window screen and screen door with specified finish for acceptance.
 - a. Locations: As directed.
 - b. Approved Mock-ups: Standard for rest of work.
 - c. Approved Mock-ups: May remain part of completed project.

Delivery, Storage, And Handling

12. Packing, Shipping, Handling, and Unloading: Pack materials at manufacturing plant to prevent damage during shipping.
 - a. Screens: Label attached signifying compliance with ANSI/SMA 6001 performance requirements.
13. Acceptance at Site: Inspect screens upon delivery. Replace damaged or defective materials before installation.
14. Storage and Protection: Store screens in manner to protect from weather and other damage.

Project Conditions

15. Field Measurements: Field measure openings for screens before start of fabrication.

Scheduling And Sequencing

16. Scheduling and Completion: Comply with requirements of Detailed Scope of Work.

Warranty

17. Special Warranty: Provide one year written covering materials and installation for security window screens and screen doors.
 - a. Warranty: Include coverage of inserts, hardware, and latches.
 - 1) Screening not included.
 - 2) Defects resulting from vandalism not included.
 - b. For Supply and Delivery Only Contract:
 - 1) Contractor: Agrees to supply and deliver to Owner, free of charge, any required replacement parts that can be readily installed by Owner without special tools.
 - 2) Contractor: Agrees to supply and deliver free of charge, complete replacement security window screen or screen door, when defective part or parts cannot be installed without use of special tools.
 - c. For Supply and Install Contract:
 - 1) Contractor: Agrees to supply and install, free of charge, any required replacement parts or complete replacement screen.

PRODUCTS

Security Window Screens And Screen Doors



18. General: Manufactured of commercially accepted materials, free from blemishes, dents, and scratches or any other defects, which are visible when viewed at distance of 1 800 mm (6 ft), or which might otherwise affect their serviceability or appearance.
 - a. Screens: Type(s) and size(s) indicated, specified, or scheduled with necessary hardware, anchors, and equipment.
 - b. Screens: Label attached signifying compliance with ANSI/SMA 6001 requirements.
19. Framing and Cross Brace Members: Made of material which will provide sufficient strength to meet performance requirements of ANSI/SMA 6001, Types as specified or scheduled.
 - a. Thickness: Thickness necessary to provide durability and meet performance requirements.
 - b. Material: Steel or aluminum as specified or scheduled complying with applicable Federal Specification or ASTM tests and specifications for chemical, physical or mechanical properties.
 - c. Light Type: Mechanical comers acceptable.
 - d. Medium and Heavy Type: Provide continuously face welded corner joints.
20. Screening: ANSI/SMA 6001 Section 4.3.1, type 304 stainless steel (carbon steel not allowed), Types as specified and scheduled.
 - a. Light Type: Minimum 16 by 16 mesh, 0.46 mm (0.018 inch) diameter.
 - b. Medium Type: Minimum 12 by 12 mesh, 0.58 mm (0.023 inch) diameter.
 - c. Heavy Type: Minimum 12 by 12 mesh, 0.71 mm (0.028 inch) diameter with tensile (high tensile) strength of 1.43 kg per lineal mm width (800 pounds per linear inch width).
 - d. Certification: Provide certificate of compliance with specified requirements.
 - e. Assembly: Assembled in secure manner to perform as specified to assure neat construction.
 - 1) Welding or Brazing Flux: Completely removed immediately upon completion of welding or brazing operation.
 - f. Window Screens: Include warning label indicating that screen will not stop child from falling out of window in accordance with SMA 7001.
21. Operable Screens: Frame, or frame and subframe assembly, as required, scribe angles (where required), hinged main frame as required, screening, egress locking system from interior, and concealed hinges.
 - a. Screening: Type as specified or scheduled.
 - b. Main and Subframes: Steel or extruded aluminum as specified or scheduled and shall conceal locking mechanism from exterior, Type as specified or scheduled.
 - 1) Aluminum: ANSI/SMA 1004, extruded aluminum.
 - c. Operable Screens: May be mounted with vertically or horizontally positioned hinge as indicated.
 - d. Operating Hardware: Releasable from interior but properly guarded to prevent access from exterior when window is open.
22. Fixed Screens:
 - a. Fixed Frame: Steel or extruded aluminum as specified or scheduled.
 - b. Screening: Type as specified or scheduled.
23. Storm Door Screen Inserts: Main frame for application to existing storm door.
 - a. Frames: Steel or extruded aluminum as specified or scheduled.
 - b. Screening: ANSI/SMA 6001 Heavy Type.
24. Security Screen Doors: Fully assembled pre-hung doors with Z-bar frame, sill expanders with necessary hardware.
 - a. Doors Frames: Steel or extruded aluminum as specified or scheduled, ANSI/SMA 6001 Heavy Type.
 - b. Screening: ANSI/SMA 6001 Heavy Type.

Aluminum Security Screen Doors

25. Aluminum Screen Doors: Type(s) and size(s) indicated, specified, or scheduled manufactured and provided with prehung aluminum frame line (Z-bar) to fit entrance door apertures requiring frame sizes of 762 mm (30 inches) to 940 mm (37 inches) in width and 2 007 mm (79 inches) to 2 134 mm (84 inches) in height.
 - a. Doors: Sized to fit existing openings.
26. Materials:



- a. Master Frame and Mullions: ANSI/SMA 3001, extruded aluminum and minimum 151 kPa (22,000 PSI) tensile strength.
 - b. Kick Plate: Embossed or Corrugated Aluminum: Minimum 1.27 mm (0.50 inch) embossed or corrugated thickness, fabricated of minimum 1.02 mm (0.040 inch) thick material.
 - c. Screening: Secure by use of aluminum spline integrally mounted and secured with fasteners.
27. Bottom of Door: Provide bottom expander door sweep of non-hardening rubber or extruded vinyl plastic, adjustable to 15.8 mm (5/8 inch).
- a. Bottom Expander: Minimum 1.4 mm (0.055 inch) wall thickness.
28. Door Master Frame Construction: Mitered joint construction and joined at corners by welding or mechanical joints.
- a. Frame Members: Minimum 60 mm (2-3/8 inch) width across flat surface and minimum 31 mm (1-1/4 inch) thickness.
 - b. Wall Thickness: Minimum 1.57 mm (0.062 inch).
 - c. Mitered Corner Joint Construction: inert gas tungsten arc or heliarc welding to provide screen doors to comply with performance requirements.
 - 1) Weld: Penetrate on both exterior and interior sides of joint.
 - 2) Dress weld beads and flat surfaces (edge surfaces not included) to smooth flush surface within satin finish.
 - 3) Minimum Width of Weld: 9.5 mm (3/8 inch) prior to dressing.
 - 4) Minimum Penetration of Weld Build-up: Minimum of 2.4 mm (3/32 inch).
 - d. Mechanical Corner Joints: Screw boss or gusset construction using screw fasteners standard to manufacturer to provide screen doors to comply with performance requirements.
 - e. Master Frame Dimensions: Manufacturing tolerance of plus/minus 4.8 mm (1/8 inch).
 - f. Extrusion Tolerances: In accordance with Aluminum Extruded Products Division of Aluminum Association standards.
29. Mullion Bars: Hollow extruded shape designed to permit being used as kick panel mullion or as upper mullion.
- a. Mullion Bars: Minimum 50 mm (2 inch) width across flat surface and minimum 31 mm (1-1/4 inch) thickness.
 - b. Wall Thickness: Minimum 1.57 mm (0.062 inch).
 - c. Mullions: Accurately machined to fit frame and joined to side stiles by inert gas tungsten arc or heliarc welding or by mechanical clip designed for compatibility.
 - d. Dress weld beads down to make smooth flush surface.
 - e. Provide main frame and mullion bar with 4.8 mm (3/16 inch) deep grooves to accommodate kick plate.
 - f. Utilize weather resisting cement utilized to provide maximum strength and rigidity.
30. Head and Side Z-bars: Designed to receive weatherstripping.
- a. Z-bars: Prepunched installation holes and hinges attached with machine screws.
 - b. Head Section: Formed to function as drip cap.
 - c. Frame Liner: Z-bar of extruded aluminum, minimum 1.57 mm (0.062 inch) wall thickness.
 - d. Weatherstripping: Wool pile or vinyl.
31. Each Door: Three hinges attached to pre-punched Z-bar.
- a. Hinges: Full or 1/2 surface hinges, with three bronze oilite bushings per hinge.

Steel Security Screen Doors

32. Steel Screen Doors: Type(s) and size(s) indicated, specified, or scheduled manufactured of steel and provided with pre-hung aluminum frame liner (Z-bar) to fit entrance door apertures requiring frame sizes of 762 mm (30 inches) to 940 mm (37 inches) in width and 2 007 mm (79 inches) to 2 134 mm (84 inches) in height.
33. Materials:
 - a. Master Frame: Not be less than 22 gage (0.85 mm) roll formed steel, or 16 gage (1.6 mm) tubular steel as applicable to hem specified.
 - b. Kick Plate: At least 18 gage (1.3 mm) embossed galvanized panel for roll formed frame or 16 gage (1.6 mm) flat galvanized steel sheet for tubular steel frame.



- c. Screen Insert:
 - 1) Screening: Secured with fasteners.
 - 2) Screen Frame: Roll formed or tubular lock seam type formed from not less than 25 gage (0.53 mm) hot dipped galvanized steel or extruded aluminum.
 - d. Door Sweep Spline: Polyvinyl chloride (PVC) or equal material
 - e. Frame Liner (Z-bar): Extruded aluminum, 6063 J5.
 - f. Weatherstripping: Wool pile, or vinyl.
34. Construction:
- a. Master Frame: Roll Formed tubular lock-seam construction formed from 22 gage (0.85 mm) hot dipped galvanized steel.
 - 1) Corners: Either mitered or butt-jointed and rigidly fastened together by brazing or welding. Insert steel gussets at corners of mitered or butt-jointed screen doors when edge brazing is used.
 - 2) Welded tubular galvanized steel of 16 gage (1.6 mm) wall thickness is not required to use corner blocks or gussets.
 - b. Transom Rail (mullion): Accurately machined or fit frame and rigidly welded to side of stiles.
 - 1) Kick Plate: Rigidly retained in place by steel or aluminum spline, or form fitted.
 - c. Adjustable Expander Installed at bottom of each screen door to receive vinyl sweep.
 - 1) Adjustment Limit: At least 7.9 mm (5/16 inch).
 - 2) Vinyl Door Sweep: Installed in entire length of expander.
 - d. Frame Liner (Z-bar): Track to receive weather stripping and necessary installation holes.
 - 1) Head Section of Frame Liner Formed to function as drip cap.
35. Dimensions:
- a. Widths across Master Frames:
 - 1) For Roll Form Door: Minimum 70 mm (2-3/4 inches).
 - 2) For Tubular Doors: Minimum 51 mm (2 inches) with 23.7 mm (15/16 inch) minimum thickness.
 - b. Mullion Bar: Following minimum widths across:
 - 1) Roll Form Door: 48 mm (1-7/8 inches).
 - 2) Tubular Door: 23.7 mm (15/16 inch). Frame Liner: Not less than 27 mm (1-1/16 inch) return offset on outside face for side flange width for bearing against door buck. Wall Thickness of Frame Liner: Minimum 1.57 mm (0.062 inch). Screen Door: Supported adequate reinforcing ribs.
 - c. Master Frame Dimensions: Manufacturing tolerance of plus or minus 4.8 mm (1/8 inch).
36. Hinges: Install one of following hinge types on each frame liner and screen door:
- a. At least four concealed 304 stainless steel hinges on bronze oilite bearings, each minimum 75 mm (3 inches) long.
 - b. At least three surface-mounted (H) type galvanized steel hinges.

Accessories

37. Hardware: Designed to afford ease of operation, perform functions for which it is intended, and securely attached to screen.
- a. Materials: Stainless steel, aluminum, or made corrosion resistant by plating.
 - 1) Material: Compatible with frame material.
 - 2) Stainless Steel: Alloys of 302, and 304.
 - 3) Aluminum: Extrusions from commercially produced 6063-T5 alloy.
 - 4) Cadmium or Zinc Plated Steel: ASTM B 633 or ASTM B 766.
 - 5) Plastic parts not allowed.
 - b. Fasteners: Stainless, cadmium plated, or zinc-plated steel screws, nuts, washers, bolts, and other miscellaneous fastening devices and hardware.
 - c. Hinges: Concealed from exterior, with compression guards, and of sufficient strength to comply with performance requirements of ANSI/SMA 6001.
 - d. Locking System: Non-corrosive materials permitting emergency egress and of sufficient strength to comply with performance requirements of ANSI/SMA 6001.
 - 1) Provide single point release as and where required by applicable codes and regulations.



- 2) Provide bit key lock fire entry from exterior if required by applicable codes and regulations.
 - 3) Locking Hardware: Remain completely concealed from exterior viewing and tampering with lock bolts positively locked when in thrown position, so that they cannot be operated from direct pressure on bolts.
38. Security Screen Door Hardware: Include latch with exterior handle, interior locking mechanism with anti-lockout feature, adjustable heavy duty door closer, necessary screws, and hurricane chain with spring.
 39. Window Screens: Include warning label that screen will not stop child from falling out of window in accordance with SMA 7001.
 40. Anchors: Non-magnetic stainless steel or other non-corrosive material compatible with screen.
 - a. Anchors Exposed when Screen is Closed and Locked: Non-removable security type.

Finishes

41. Screens: Factory applied baked on enamel or polyester powder coat finish.
 - a. Exposed Surfaces: Clean and free from serious surface blemishes.
 - b. Dress and finish exposed welded joints.
 - c. Color: As selected from manufacturers standard colors.

Source Quality Control

42. Testing: Performed by accredited independent testing laboratory.

EXECUTION

Examination

43. Site Verification of Conditions:
 - a. Field Measurements: Verify field measurements are as indicated on Shop Drawings.
 - b. Existing Conditions: Examine openings before beginning installation.
 - c. Verify that surfaces to receive security screens are clean.
 - d. Do not proceed with installation until conditions are satisfactory.

Preparation

44. Protection: Protect adjacent elements from damage and disfiguration in accordance with Detailed Scope of Work.
 - a. Contractor: Responsible for damage to grounds, plantings, buildings and any other facilities or property caused by construction operations.
 - b. Repair or replace damaged elements in accordance with Detailed Scope of Work.
45. Existing Window Screens and Screen Doors: Remove existing window screens and screen doors and debris from site in accordance with Detailed Scope of Work.
46. Preparation: Prepare openings and existing frames in accordance with ASTM E 737 for storm doors and storm windows.
 - a. Existing Window and Door Jambs: Prepare as necessary to provide for straight, plumb, level, tight and aesthetically appealing installation of new window screens and screen doors.
 - b. Preparatory Work: Include, but not limited to repair of jambs, filling holes and/or dents, removing peeling and scaling paint, etc.

Installation

47. General: Install in accordance with ASTM E 737 for storm doors and storm windows, manufacturers recommendations, Reference Standards, and approved Shop Drawings.
 - a. Window Screens and Screen Doors: Securely anchor in place to straight, plumb and level condition, without distortion.
 - b. Comply with applicable codes and regulations regarding egress requirements and fireman entry.



48. Dissimilar Materials: Isolate materials from incompatible materials as necessary to prevent deterioration.
 - a. Separate dissimilar metals with bituminous paint, suitable sealant, nonabsorptive plastic or elastomeric tape, or gasket between surfaces.
 - b. Coat aluminum in direct contact with concrete, masonry, steel, or other non-compatible materials with bituminous paint, zinc chromate primer, or other suitable insulating material.

Adjusting And Cleaning

49. Adjusting: At completion of job, check, adjust, and lubricate hardware as required and leave window screens, screen doors, and hardware in proper operating condition.
50. Cleaning: Comply with requirements of Detailed Scope of Work.
 - a. Clean window screens and screen doors after installation is completed to remove foreign matter and surface blemishes.
 - b. Scratched or Abraded Surfaces: Touch-up with rust inhibitor primer and enamel paint compatible with factory finish.

Protection

51. Installed Work: Protect window screens and screen doors from damage after installation.

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SECTION 08 11 63 23 - ALUMINUM STORM DOORS

DESCRIPTION OF WORK

This specification covers the furnishing and installation of materials for aluminum storm doors. Products shall be as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

GENERAL

Definitions

1. Supply and Delivery Only: Include supply and delivery to site(s) FOB destination freight prepaid. Unless otherwise specified or scheduled, unloading and handling at site is by Owner

System Description

2. Performance Requirements: Comply with following:
 - a. Aluminum Storm Doors: ANSI/AAMA 1102.7, Performance Class 25 - 1.2 kPa (25 PSF) Design Pressure, 1.8 kPa (37.5 PSF) Test Pressure.
 - b. Stainless Steel Screen Insert: Completely assembled screen of 914 mm (36 inches) by 1 524 mm (60 inches) size with necessary braces:
 - 1) Impact Test: Meet or exceed ANSI/SMA 6001 Paragraph 4.2.4.1 performance requirements for Medium Type.
 - c. Aluminum Screen Doors: Completely assembled screen door measuring at least 914 mm (36 inches) wide by 2 032 mm (80 inches) high with necessary braces and hardware:
 - 1) Impact Test: Meet or exceed performance requirements of ANSI/SMA 6001 Paragraph 4.2.4.1 for Medium Type.
 - 2) Sag Test: Meet or exceed ANSI/AAMA 1102.7 Sag Test.

Submittals

3. Product Data.
4. Shop Drawings:
 - a. Include exploded view of manufactured door, similar to AAMA 1102.7, page 12.
 - b. Indicate fabrication of all parts, metal thickness, installation details, fastening, and sealing.
 - c. Include sections of typical members and details of latching devices.
5. Samples: Submit full set of finish color samples for color selection.
 - a. For Supply and Deliver Only Contract: Submit one full size sample of each type of storm door with specified finish for acceptance.
6. Quality Assurance/Control Submittals:
 - a. Certificates: Manufacturers written third party certification that storm doors meet or exceed ANSI/AAMA 1102.7, HUD 39a, and other specified requirements.
 - b. Manufacturers installation instructions.
7. Closeout Submittals:
 - a. Operation and maintenance data.
 - b. Special warranty.

Quality Assurance

8. Regulatory Requirements: Comply with following:
 - a. Glazing Materials: Comply with CPSC 16 CFR 1201 or ANSI Z97.1.
 - b. Accessibility:
 - 1) Architectural Barriers Act of 1968 as amended (42 USC 4152-4157) and HUD implementing regulations (24 CFR Part 40).
 - a) Uniform Federal Accessibility Standards (UFAS).



- 2) Section 504 of the Rehabilitation Act of 1973 as amended (29 USC 794) and HUD implementing regulations 24 CFR Part 8.
 - 3) Fair Housing Accessibility Guidelines (24 CFR Chapter 1).
 - 4) Americans with Disabilities Act of 1990 (ADA) (28 CFR Part 35).
9. Certifications: Comply with HUD 39a, ANSI Z34.1, and HUD 24 CFR 200.935.
10. Mock-ups: For Supply and Install Contract: Install one full size mock-up of each type of storm door with specified finish for acceptance.
- a. Location: As directed.
 - b. Approved Mock-up: Standard for rest of work.
 - c. Approved Mock-up: May remain part of completed project.

Delivery, Storage, And Handling

11. Packing, Shipping, Handling, and Unloading: Pack materials at manufacturing plant to prevent damage during shipping.
 - a. Storm Doors: Label in accordance with HUD UM 39a signifying compliance with ANSI/AAMA 1102.7 performance requirements.
12. Acceptance at Site: Inspect storm doors upon delivery. Replace damaged or defective materials before installation.
13. Storage and Protection: Store storm doors in manner to protect from weather and other damage.

Project Conditions

14. Field Measurements: Field measure openings for storm doors before start of fabrication.

Scheduling And Sequencing

15. Scheduling and Completion: Comply with requirements of Detailed Scope of Work.

Warranty

16. Special Warranty: Provide one year written covering materials and installation for storm doors.
 - a. Warranty: Include coverage of inserts, closers, chains, hardware, and latches.
 - 1) Screening and glazing not included.
 - 2) Defects resulting from vandalism riot included.
 - b. For Supply and Delivery Only Contract:
 - 1) Contractor: Agrees to supply and deliver to Owner, free of charge, any required replacement parts that can be readily installed by Owner without special tools.
 - 2) Contractor: Agrees to supply and deliver free of charge, complete replacement door, when defective part or parts cannot be installed without use of special tools.
 - c. For Supply and Install Contract:
 - 1) Contractor: Agrees to supply and install, free of charge, any required replacement parts or complete replacement storm door.

PRODUCTS

Aluminum Storm And Screen Doors

17. Storm Doors: Type(s) and size(s) indicated, specified, or scheduled with mechanical or welded comer construction complete with tempered glass or plastic glazing inserts where storm glazing is specified or scheduled, screen inserts where specified or scheduled, durable metal kick panel, push plate, adjustable bottom expander with sill sweep, necessary hardware, fasteners, and miscellaneous equipment.
 - a. Screen Doors: Meet or exceed Performance Requirements in this Section.
 - b. Storm Doors: Meet or exceed applicable requirements of AAMA/ANSI 1102.7, Performance Class 60 and HUD UM 39a.
 - c. Storm Doors: Self-storing or seasonal replacement as specified or scheduled.
 - d. Door Construction: Not necessary to remove door from its installed position to reglaze, rescreen, or replace kick plate, push plate, or protective grille.



- e. Glazed Sash and Glazing Materials: Permit reglazing without special tools.
- f. Doors: Sized to fit existing openings.
- 18. Finished Master Frame, Extruded Screen Insert Frame and Z-bar: Minimum 1.4 mm (0.055 inch) wall thickness.
 - a. Z-bar: Adequate reinforcing ribs to support door.
- 19. Glazing Materials: Comply with CPSC 16 CFR 1201 or ANSI Z97.1.
 - a. Tempered Glass: ASTM C 1048, Kind FT, Condition A, Type 1, Class 1, Glazing B Quality.
 - b. Plastic: Extruded polycarbonate clear sheets, minimum 4.5 mm (0.177 inch) thick with following characteristics:
 - 1) Impact Resistance: ASTM D 256, Method A, 12-18 foot-pound per inch.
 - 2) Elongation/Modulus of Elasticity: ASTM D 638, 110 percent maximum/340,000 PSI.
 - 3) Heat Deflection: ASTM D 648, 132.2 degrees C (270 degrees F) at 264 PSI.
 - 4) Abrasion Resistance: Coated on both surfaces to produce abrasion resistance of 3-19 percent maximum haze increase for 500 revolutions of CS-1 OF wheel per ASTM D 1044.
 - c. Glass Thickness: In accordance with AAMA 1002.10 Appendix, minimum 5 mm (3/16 inch).
 - 1) Design Wind Pressures: Determined in accordance with applicable codes and regulations.
 - d. Glass: Labeled to show name of manufacturer and type.
 - e. Glazing Material: Installed in rigid removable aluminum sub-frame.
- 20. Screens: Manufacturer's standard design.
 - a. Screens Not Part of Door Frame: Extruded aluminum frames, of suitable alloy, and of sufficient rigidity, crossbraced as required, to lie flat against door and to prevent excessive bow in frame members and sag in screening.
 - 1) Screen Spline: Firmly jointed in secure manner.
 - b. Screening: Aluminum Wire Fabric: One of following as specified or scheduled:
 - 1) Regular Aluminum: FS RR-W-365, Type VII, 18 x 16 or 18 by 18 regular, 0.28 mm (0.011 inch) wire.
 - 2) Heavy Aluminum: FS RR-W-365, Type VII, 18 x 14 regular, 0.33 mm (0.013 inch) wire.
 - c. When screen is completely assembled with insect screening and spline in place, outside dimension as measured from midpoint of opposite framing members shall not vary more than 4.8 mm (3/16 inch) from outside dimension as measured at extreme ends of such framing members.
 - d. Screening: Fastened to frame in manner to permit replacement of screening.
- 21. Stainless Steel Screen: As specified or scheduled:
 - a. Screen Frames: Rolled, tubular lock seam construction formed from not less than 25 gage (0.53 mm) hot-dipped galvanized steel or 0.66 mm (0.026 inch) minimum aluminum extruded 6063-T5 alloy (with galvanic protection).
 - b. Screening: Stainless Steel: ANSI/SMA 6001 Medium Type, 12 x 12 mesh stainless steel with wire diameter of 0.58 mm (0.023 inch).
 - c. Provide screen with fastening devices for application to specific windows for which they are intended and of sufficient strength to perform satisfactorily.
- 22. Bottom of Door: Provide bottom expander door sweep of non-hardening rubber or extruded vinyl plastic, adjustable to 15.8 mm (5/8 inch).
 - a. Bottom Expander: Minimum 1.4 mm (0.055 inch) wall thickness.
- 23. Kick Plate: Embossed or Corrugated Aluminum: Minimum 1.27 mm (0.50 inch) embossed or corrugated thickness, fabricated of minimum 1.02 mm (0.040 inch) thick material.
- 24. Hardware: Aluminum, stainless steel, or other non-corrosive materials compatible with aluminum.
 - a. Cadmium or Zinc Plated Steel: ASTM B 633 or ASTM B 766.
 - b. Include latch with exterior handle and interior locking mechanism with anti-lockout feature, adjustable heavy duty door closer, necessary screws, hurricane chain with spring.
 - c. Each Door: 3 hinges attached to Z-bar.
 - d. Hinges: Full or 1/2 surface hinges, with 3 bronze bushings per hinge.
- 25. Optional Accessories:
 - a. Optional Protective Grille: Perforated aluminum sheet, 0.61 mm (0.24 inches) minimum thickness, riveted or screwed to door frame to completely cover exterior of screen.



- b. Optional Pushplate: Embossed aluminum strip 150 mm (6 inches) high, 1.02 mm (0.040 inch) minimum thickness.
 - 1) Overall Height of Mullions and Pushplate: Minimum of 200 mm (8 inches) and installed opposite and centered with latch.

Hollow Core Aluminum Storm Doors

- 26. Door: Hollow extruded smooth surface master frame, 2 hollow extruded smooth surface mullion or cross bars; 2 extruded screen frame inserts, extruded side and head Z-bars, and extruded external telescoping bottom expander.
 - a. Extrusions: Manufactured from 6063-T5 extruded aluminum alloy, minimum 1.57 mm (0.062 inch) thick, minimum 151 600 kPa (22,000 PSI) tensile strength.
 - b. Glazing Strip, Bottom Sweep, Screening Spline and Z-bar Seal: Virgin polyvinyl plastic.
- 27. Door Master Frame Comer Construction: Mitered joint construction and joined at comers by welding or mechanical joints.
 - a. Mitered Comer Joint Construction: Inert gas tungsten arc or heliarc welding to provide storm doors to comply with performance requirements.
 - 1) Weld: Penetrate on both exterior and interior sides of joint.
 - 2) Dress weld beads and flat surfaces (edge surfaces not included) to smooth flush surface within satin finish.
 - 3) Minimum Width of Weld: 9.5 mm (3/8 inch) prior to dressing.
 - 4) Minimum Penetration of Weld Build-up: Minimum of 2.4 mm (3/32 inch).
 - b. Mechanical Comer Joints: Screw boss or gusset construction using screw fasteners standard to manufacturer to provide storm doors to comply with Performance Requirements in this Section.
- 28. Mullion Bars: Hollow extruded shape designed to permit being used as kick panel mullion or as upper mullion.
 - a. Mullions: Accurately machined to fit frame and joined to side stiles by inert gas tungsten arc or heliarc welding.
 - b. Dress weld beads down to make smooth flush surface.
 - c. Provide top surface of extrusions for both center and bottom mullion bars with channel to accommodate inserts.
 - d. Provide main frame and mullion bar with 4.8 mm (3/16 inch) deep grooves to accommodate kick plate.
 - e. Utilize weather resisting cement utilized to provide maximum strength and rigidity and rattle proof operation.
 - f. Bottom Mullion Bar: Receive top of kick plate.
 - g. Mullion Bar: Same thickness as frame and have minimum 50 mm (2 inch) face.
- 29. Head and Side Z-bars: Designed to receive vinyl plastic closure strip for maximum seal against air and dust infiltration.
 - a. Head Z-bar: Designed and extruded to also function as drip cap over top of door.
 - b. Z-bars: Prepunched installation holes and hinges attached with machine screws.
- 30. Finished Master Frame: Minimum 60 mm (2-3/8 inch) width across flat surface and minimum 25 mm (1 inch) thickness.
 - a. Mullion Bars: Minimum 50 mm (2 inch) width across flat surface and minimum 25 mm (1 inch) thickness.
 - b. Wall Thickness: Minimum 1.4 mm (0.055 inch).
 - c. Extruded Screen Insert Frames: 19 mm (3/4 inch) wide, minimum 7.9 mm (5/16 inch) thick, and minimum 1.57 mm (0.062 inch) wall thickness.
 - d. Z-bars: Minimum 1.4 mm (0.055 inch) wall thickness plus adequate reinforcing ribs to support door.
 - e. Insert Frame: Fabricated to have minimum overall clearance of 4.8 mm (1/8 inch) in width and height, and interchangeable in doors of same nominal size.
 - f. Master Frame Dimensions: Manufacturing tolerance of plus/minus 4.8 mm (1/8 inch).
 - g. Extrusion Tolerances: In accordance with Aluminum Extruded Products Division of Aluminum Association standards.



31. Glazing Insert Frames: Extruded with mitered joint construction secured at comers by staking into comer gussets.
 - a. Inserts: Equal height making them interchangeable on doors with upper and lower openings.
 - b. Inserts: Held in door by aluminum clips and machine screws.
 - c. Install maximum of 6 rivnuts into door per insert.
 - d. Install rivnuts in master frame, 2 on each side and top of each insert, located not to interfere with installation of door closer or safety chain.
 - e. Insert: Positive contact with master frame to stop passage of insects and prevent rattling.
32. Screening Insert Frames: Extruded tubular with mitered joint construction and secured at comers by staking into comer gussets.
 - a. Make square comer gussets of 0.46 mm (0.180 inch) minimum extruded aluminum to fit firmly against extruded insert frames to minimize twist and distortion.
 - b. Insert screening into groove provided in frame and secure by vinyl spline.
 - c. Inserts in Doors with Upper and Lower Openings: Equal height making them interchangeable, and secured into master frame by same method as specified for glazed inserts.
33. Hinges: 3 knuckle construction, not less than 98 mm (3-7/8 inches) in length, with minimum of 3 prepunched screw holes in hinge leaf of minimum thickness 0.31 mm (0.120 inch) plus adequate longitudinal reinforcing ribs to support door.
 - a. Each Door: Supported with not less than 4 built-in type hinges employing raised knuckle on extruded Z-bar to receive half-extruded aluminum hinge leaf joined at knuckle by using 2 stainless steel or cadmium plated steel pins pivoting through oilite or nylon bushings.
 - b. Pins: Held securely in place by cadmium plated steel compression springs.
 - c. Hinge: Allow door to open 180 degrees.

Solid Core (Laminated) Storm Door

34. Materials:
 - a. Main Frame and Glass Edge Surround Members (if not part of main frame): Aluminum of sufficient strength to comply with performance requirements of ANSI/AAMA 1102.7.
 - b. Reinforcing Members: Aluminum or other non-corrosive materials compatible with aluminum.
 - 1) Carbon Steel: Cadmium or zinc-plated in accordance with ASTM B 633 or ASTM B 766.
35. Finished Master Frame: Extruded screen insert frame and Z-bar minimum 1.4 mm (0.055 inch) wall thickness.
 - a. Z-bar: Adequate reinforcing ribs to support door.
36. Door: Laminated construction consisting of minimum 19.1 mm (3/4 inch) thick particle board, grade 1-M-3 with seamless aluminum skins bonded together.
 - a. Particle Board Core Material: Completely sealed with polyurethane for moisture protection.
 - b. Ureaformaldehyde binders not allowed.
37. Screws, Nuts, Washers, Bolts, Rivets and Other Fastening Devices: Aluminum, stainless steel or other non-corrosive materials compatible with aluminum.
 - a. Cadmium or Zinc-plated Steel: ASTM B 633 or ASTM B 766.
38. Weatherstrip: Weatherstrip Z-bars with woven pile so that there is no metal to metal contact between main frame and Z-bar.
 - a. Install weatherstripping in specially extruded ports and in accordance with AAMA 701.2.
39. Anti-galling Devices: Non-corrosive materials compatible with aluminum and of sufficient strength to perform as designed.

Accessories

40. Joint Sealant: AAMA 800, Type 808.3 Exterior Perimeter Sealing Compound.

Finishes

41. Finish:
 - a. Aluminum Finish: Provide one of following as specified or scheduled:
 - 1) Factory applied pigmented organic coating, AAMA 603.8.



- a) Color: As selected from manufacturer's standard colors.
- 2) Clear Anodized: Factory applied anodic coating, AAMA 607.1, Class 1.
- b. Exposed Surfaces of Aluminum Members: Clean and free from serious surface blemishes.
- c. Dress and finish exposed welded joints.

Source Quality Control

- 42. Testing: Performed under Third Party Administrator in compliance with HUD 39a, ANSI Z34.1, and HUD 24 CFR 200.935.

EXECUTION

Examination

- 43. Site Verification of Conditions:
 - a. Field Measurements: Verify field measurements are as indicated on Shop Drawings.
 - b. Existing Conditions: Examine openings before beginning installation.
 - c. Verify that surfaces to receive storm doors are clean.
 - d. Do not proceed with installation until conditions are satisfactory.

Preparation

- 44. Protection: Protect adjacent elements from damage and disfiguration in accordance with Detailed Scope of Work.
 - a. Contractor: Responsible for damage to grounds, plantings, buildings and any other facilities or property caused by construction operations.
 - b. Repair or replace damaged elements in accordance with Detailed Scope of Work.
- 45. Existing Storm Doors: Remove existing screen and storm doors and debris from site in accordance with Detailed Scope of Work.
- 46. Preparation: Prepare openings and existing frames in accordance with ASTM E 737.
 - a. Prime Door Jambs of Existing Prime Doors: Prepare as necessary to provide for straight, plumb, level, tight and aesthetically appealing installation of new storm doors.
 - b. Preparatory Work: Include, but not limited to repair of jambs, filling holes and/or dents, removing peeling and scaling paint, etc.

Installation

- 47. General: Install in accordance with ASTM E 737, manufacturer's recommendations, Reference Standards, and approved Shop Drawings.
 - a. Securely fasten storm doors in place to straight, plumb and level condition, without distortion of door or door frame, and make final adjustments for proper operation and satisfactory weatherstrip contact and seal.
 - b. In high wind areas, install storm door hinges on side to prevailing wind as directed.
- 48. Joint Sealants: Apply in accordance with manufacturer's recommendations.
 - a. Surfaces to be Sealed: Clean, dry and free of any foreign matter that would degrade adhesion. Remove existing caulking and joint sealants from areas to receive new joint sealant.
 - b. Prime cleaned surfaces in accordance with sealant manufacturer's recommendations.
 - c. Protect surfaces adjacent to joints by masking tape before applying sealant. Remove tape upon finishing sealing work.
 - d. Seal joints between perimeter of storm door frame and underlying or surrounding construction with joint sealant to accomplish weather-tight installation.
 - e. Maximum Width of Sealed Joint: 13 mm (1/2 inch).
- 49. Dissimilar Materials: Isolate materials from incompatible materials as necessary to prevent deterioration.
 - a. Separate dissimilar metals with bituminous paint, suitable sealant, nonabsorptive plastic or elastomeric tape, or gasket between surfaces.



- b. Coat aluminum in direct contact with concrete, masonry, steel, or other non-compatible materials with bituminous paint, zinc chromate primer, or other suitable insulating material.

Adjusting And Cleaning

- 50. Adjusting: At completion of job, check, adjust, and lubricate hardware as required and leave storm doors and hardware in proper operating condition.
- 51. Cleaning: Comply with requirements of Detailed Scope of Work.
 - a. Clean storm doors after installation is completed to remove foreign matter and surface blemishes.
 - b. Scratched or Abraded Surfaces: Touch-up with rust inhibitor primer and enamel paint compatible with factory finish.

Protection

- 52. Installed Work: Protect storm doors from damage after installation.

END OF SECTION 08 11 63 23



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SECTION 08 11 73 00 - SLIDING METAL FIRE DOORS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of material for sliding metal fire doors. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Single-leaf, power-operated and manually operated sliding door with or without pass door.
 - b. Biparting, power-operated and manually operated sliding door with or without pass door.
 - c. Multiple-leaf, power-operated and manually operated sliding door with or without pass door.

C. Performance Requirements

1. Structural Performance: Provide horizontal sliding doors capable of withstanding the effects of gravity loads and the following loads and stresses without evidencing permanent deformation of door components:
 - a. Wind Load: Uniform pressure (velocity pressure) of 20 lbf/sq. ft. (960 Pa), **unless required otherwise by the location of the work**, acting inward or outward.

D. Submittals

1. Product Data: For each type of product indicated.
 - a. Fire-Rated Doors: Include description of fire-release system including testing and resetting instructions.
2. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
3. Product Certificates: For sliding metal fire doors, signed by product manufacturer.
4. Oversize Construction Certification: For door assemblies required to be fire rated and that exceed size limitations of labeled assemblies, signed by authorized representative of testing agency.
5. Operation and Maintenance Data: For sliding metal fire doors to include in emergency, operation, and maintenance manuals.

E. Quality Assurance

1. Fire-Rated Sliding Door Assemblies: Provide assemblies complying with NFPA 80 that are identical to door assemblies tested for fire-test-response characteristics according to NFPA 252 or UL 10B, and that are listed and labeled for fire ratings indicated by UL, FMG, ITS, or another testing agency acceptable to authorities having jurisdiction.
 - a. Test Pressure: Test at as close to neutral pressure as possible.
 - b. Oversize Fire-Rated Sliding Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a testing agency acceptable to authorities having jurisdiction that doors comply with all standard construction requirements of tested and labeled fire-rated door assemblies except for size.
 - c. Provide units with labels showing 250 deg F (139 deg C) **OR** 450 deg F (250 deg C) **OR** 650 deg F (361 deg C), **as directed**, temperature-rise ratings.
2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.



1.2 PRODUCTS

A. Materials

1. Cold-Rolled Steel Sheets: ASTM A 1008/A 1008M, Commercial Steel (CS), or Drawing Steel (DS), Type B, exposed, matte finish.
2. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B, with A60 (ZF180) **OR** A90 (ZF275), **as directed**, zinc-iron-alloy (galvannealed) coating or G90 (Z275) **OR** G60 (Z180), **as directed**, zinc coating; restricted flatness.
3. Stainless-Steel Sheets: ASTM A 240/A 240M, Type 304 **OR** 316, **as directed**; stretcher-leveled standard of flatness; No. 4 satin **OR** 6 dull, **as directed**, finish.
4. Hardware and Fasteners: Manufacturer's standard units **OR** Hot-dip galvanize per ASTM A 153/A 153M where items are used on galvanized steel exterior doors **OR** Stainless steel **OR** Stainless steel where indicated, **as directed**.

B. Sliding Metal Fire Doors

1. Overhead-Supported Doors: Provide composite **OR** hollow-metal **OR** tubular-frame, **as directed**, type construction fire door assemblies with wall-mounted overhead track support and the following fire-protection rating and panel facing sheet material and thickness:
2. Bottom-Support Doors: Provide bottom-support, tubular-frame-type construction fire door assemblies with floor track, top guides, and the following fire-protection rating, temperature-rise rating, and face sheet material and thickness:
 - a. Fire-Protection Rating: 4 hours **OR** 3 hours **OR** 1-1/2 hours **OR** 3/4 hour **OR** As indicated, **as directed**.
 - b. Panel Facing:
 - 1) Steel: 0.033-inch (0.8-mm) **OR** 0.043-inch (1.1-mm) **OR** 0.053-inch (1.35-mm) **OR** 0.067-inch (1.7-mm), **as directed**, minimum thickness.
 - 2) Metallic-Coated Steel: 0.040-inch (1.0-mm) **OR** 0.052-inch (1.3-mm) **OR** 0.064-inch (1.6-mm) **OR** 0.079-inch (2.0-mm), **as directed**, nominal thickness.
 - 3) Stainless Steel: 0.038-inch (0.96-mm) **OR** 0.050-inch (1.3-mm) **OR** 0.062-inch (1.57-mm) **OR** 0.078-inch (1.98-mm), **as directed**, nominal thickness.
3. Operating Hardware: Manufacturer's standard, labeled, automatic-closing-type, sliding fire door assemblies complete with track, adjustable roller guides, binders, floor stops, cables, sheaves, counterweights, and fusible links. Furnish necessary hangers, fittings, and fasteners required for attaching hardware to door and for door sliding operation, including latch or handle for manual operation. Provide hot-dip galvanized steel **OR** electrogalvanized steel **OR** factory-prime-painted steel **OR** stainless-steel, **as directed**, hardware.
4. Weight Boxes: 0.064-inch- (1.6-mm-) thick, metallic-coated steel counterweight boxes or guards; size as required for counterweights and clearance.
5. Crush Plates: 3/16-inch-thick by 6-inch-wide (4.8-mm-thick by 150-mm-wide), continuous steel plates on hollow concrete masonry walls.
6. Track Hood: Formed, metallic-coated steel sheet **OR** stainless-steel, **as directed**; size as required for clearance and to protect tracks on exterior installations.
7. Weather Stripping: UL-classified, brush-style weather stripping with attachments for mounting at head, jambs, and bottom surface of door.
8. Motorized Operator: UL-approved, high-starting torque, reversing motor and adjustable speed operator with thermal-overload protection. Include fusible-link release to disengage operator and to allow door to close automatically.
 - a. Design operator for current characteristics of electrical service supplied. Provide UL-listed, 1/2-hp, 208- to 230-V ac, single-phase **OR** 208-V ac, 3-phase **OR** 220-V ac, 3-phase **OR** 480-V ac, 3-phase, **as directed**, 60-cycle motor with NEMA 250, Type 1 enclosure and 24-V ac, secondary control voltage.
 - b. Equip door for completely automatic operation with clutch, speed reducer, brake, limit switches, electric reverse edge, brackets, bolts, and release for manual operation. Control equipment includes two pull cords **OR** two 3-button control stations with push buttons labeled "OPEN," "CLOSE," and "STOP" **OR** two motion detectors **OR** two loop detectors



OR two photoelectric obstruction detectors **OR** time delay for closing, **as directed**, and electric interlock for pass door.

9. Interconnecting Device: Device for connecting fusible links for doors on both sides of wall.
10. Door Release Devices: Electromagnetic release devices compatible with smoke detectors or building's fire alarm system.
11. Fire Detection: Provide early warning, photoelectric smoke detectors or ionization detectors to be coupled to electromagnetic door release devices.
12. Pass Door: UL-listed swing door and frame.
13. Pass Door Hardware: Factory installed with one and one-half pairs of mortise spring hinges **OR** butt hinges and closer, **as directed**, and mortise latchset **OR** mortise lock **OR** exit device **OR** panic device, **as directed**.
 - a. Provide hardware complying with Division 08 Section "Door Hardware".
14. Vision Panels: Factory fabricated in door with integral removable glass stops. Provide UL-approved, wired glass panels or other fire-resistive glazing product acceptable to authorities having jurisdiction; do not exceed area allowed for door rating.

C. Fabrication

1. Composite-Type Doors: Fabricate in modular panels. Bond face materials to both sides of core and reinforce perimeter with minimum 0.043-inch- (1.1-mm-) thick, internal steel channel. Encase panel edges with minimum 0.067-inch- (1.7-mm-) thick, steel channel. Back joints in face sheets with minimum 0.043-inch- (1.1-mm-) thick, steel H column. Connect panels with H column and cover plate. Attach armor edges and astragals to doors.
2. Hollow-Metal Doors: Bond face materials to both sides of core and reinforce perimeter with minimum 0.043-inch- (1.1-mm-) thick, internal steel channel. Back joints in face sheets with minimum 0.043-inch- (1.1-mm-) thick, steel H column. Weld and fill joints and grind exposed welds smooth. Attach armor edges and astragals to doors.
3. Tubular-Frame Doors: Fabricate perimeter frame and internal stiffeners of minimum 0.043-inch- (1.1-mm-) thick steel tubes. Miter corner joints in frame and weld frame and stiffener joints. Locate joints in face sheets over stiffeners. Weld and fill joints and grind exposed welds smooth. Attach armor edges and astragals to doors.
4. Core Construction: Provide core materials complying with fire-protection-rating and temperature-rise requirements.
 - a. Resin-impregnated honeycomb.
 - b. Mineral-fiber board.
 - c. Urethane.
 - d. Fiberglass.
 - e. Calcium silicate
 - f. Inorganic mineral.
 - g. Manufacturer's standard.

D. Steel Finishes

1. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Preparation for Shop Priming: After galvanizing, thoroughly clean metal of grease, dirt, oil, flux, and other foreign matter, and treat with metallic-phosphate pretreatment.
3. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of sliding metal fire doors:
 - a. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - b. Interiors (SSPC Zone 1A): SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
4. Prime Finish: Immediately after cleaning and pretreating, apply manufacturer's standard rust-inhibiting primer on **OR** zinc-rich primer on metallic-coated, **as directed**, steel doors for field painting.
5. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat. Comply with



paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).

- a. Color and Gloss: As selected from manufacturer's full range.

1.3 EXECUTION

A. Installation

1. Install sliding metal fire doors according to NFPA 80 and manufacturer's written instructions for type of door operation indicated and fire-protection rating required.
 - a. Interface fire-detection devices with building's fire alarm system.
2. Drill necessary holes cleanly, with no broken areas or spalls, for installation of fasteners in concrete or masonry. Remove and replace damaged masonry as directed.

B. Adjusting And Cleaning

1. Operate sliding metal fire doors on completion of installation to ensure satisfactory operation. Check moving parts for proper alignment and lubrication. Make adjustments for smooth, easy operation.
 - a. Test door closing when activated by detector or alarm-connected, fire-release system. Reset door-closing mechanism after successful test.
2. Clean surfaces and refinish abraded or damaged surfaces to match factory finish.

END OF SECTION 08 11 73 00



SECTION 08 12 13 13 - STAINLESS STEEL DOORS AND FRAMES

1.1 GENERAL

A. Description

1. This specification covers the furnishing and installation of stainless steel doors and frames. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Stainless-steel, hollow-metal doors and panels.
 - b. Stainless-steel, hollow-metal frames.

C. Submittals

1. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance rating, temperature-rise ratings, and finishes.
2. Shop Drawings: Include the following:
 - a. Elevations of each door design.
 - b. Details of doors, including vertical and horizontal edge details and metal thicknesses.
 - c. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - d. Locations of reinforcement and preparations for hardware.
 - e. Details of each different wall opening condition.
 - f. Details of anchorages, joints, field splices, and connections.
 - g. Details of accessories.
 - h. Details of moldings, removable stops, and glazing.
 - i. Details of conduit and preparations for power, signal, and control systems.
3. Samples:
 - a. Finishes: For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches (75 by 125 mm).
 - b. Doors: Include section of vertical-edge, top, and bottom construction; core construction; glazing; and hinge and other applied hardware reinforcement.
 - c. Frames: Show profile, corner joint, floor and wall anchors, and silencers. Include separate section showing fixed hollow-metal panels and glazing if applicable.
4. Schedule: Provide a schedule of stainless-steel, hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with a door hardware schedule.
5. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.
6. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of stainless-steel, hollow-metal door and frame assembly.

D. Quality Assurance

1. Source Limitations: Obtain stainless-steel, hollow-metal work from single source from single manufacturer.
2. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
 - a. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
 - b. Temperature-Rise Limit: Where indicated **OR** At vertical exit enclosures and exit passageways, **as directed**, provide doors that have a maximum transmitted temperature



end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.

3. Smoke- and Draft-Control Door Assemblies: Where indicated **OR** At corridors, smoke barriers, and smoke partitions, **as directed**, provide assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
 - a. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at the tested pressure differential of 0.3-inch wg (75 Pa) of water.
4. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies that are listed and labeled, by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9. Label each individual glazed lite. Install in compliance with NFPA 80.
5. Preinstallation Conference: Conduct conference at Project site.

E. Delivery, Storage, And Handling

1. Deliver doors and frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
2. Shipping Spreaders: Deliver welded frames with two removable spreader bars across bottom of frames, tack welded or mechanically attached to jambs and mullions.
3. Store doors and frames under cover at Project site. Place units in a vertical position with heads up, spaced by blocking, on minimum 4-inch- (100-mm-) high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber.
 - a. If wrappers on doors become wet, remove cartons immediately. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

F. Project Conditions

1. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

G. Coordination

1. Coordinate installation of anchorages for stainless-steel frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.2 PRODUCTS

A. Stainless-Steel Doors

1. Description: Stainless-steel doors, not less than 1-3/4 inches (44 mm) thick, of seamed **OR** seamless, **as directed**, hollow-metal construction. Construct doors with smooth, flush surfaces without visible joints or seams on faces.
 - a. Face Sheets: Fabricate from 0.050-inch- (1.27-mm-) **OR** 0.062-inch- (1.59-mm-) **OR** 0.078-inch- (1.98-mm-), **as directed**, thick, stainless-steel sheet.
 - b. Core Construction: Fabricate doors with core indicated.
 - 1) Welded Steel-Stiffened Core: 0.031-inch- (0.79-mm-) thick, stainless-steel **OR** 0.030-inch- (0.76-mm-) nominal thickness uncoated steel **OR** 0.034-inch- (0.86-mm-) nominal thickness metallic-coated steel, **as directed**, vertical stiffeners extending full-door height, spaced not more than 6 inches (152 mm) apart, spot welded to face sheets a maximum of 5 inches (127 mm) o.c. Fill spaces between stiffeners with mineral-fiber insulation.
 - 2) Laminated Core: Honeycomb of resin-impregnated kraft paper with maximum 1-inch (25.4-mm) cells or foam-plastic insulation fastened to face sheets with waterproof adhesive.
 - a) Foam-Plastic Insulated Doors: Thermal-resistance value (R-value) of not less than 4.0 deg F x h x sq. ft./Btu (0.704 K x sq. m/W) **OR** 6.0 deg F x h x sq.



- ft./Btu (1.057 K x sq. m/W) **OR** 12.3 deg F x h x sq. ft./Btu (2.166 K x sq. m/W), **as directed**, when tested according to ASTM C 1363.
- i. Locations: Exterior doors and interior doors, where indicated.
 - 3) Laminated Steel-Stiffened Core: 0.031-inch- (0.79-mm-) thick, stainless-steel **OR** 0.030-inch- (0.76-mm-) nominal thickness uncoated steel **OR** 0.034-inch- (0.86-mm-) nominal thickness metallic-coated steel, **as directed**, vertical stiffeners extending full-door height, spaced not more than 6 inches (152 mm) apart, fastened to face sheets with waterproof adhesive. Fill spaces between stiffeners with mineral-fiber insulation.
 - 4) Fire-Rated Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
- c. Vertical Edges for Single-Acting Doors: Beveled 1/8 inch in 2 inches (3 mm in 50 mm).
 - d. Vertical Edges for Double-Acting Doors: Round vertical edges with 2-1/8-inch (54-mm) radius.
 - e. Moldings for Glazed Lites in Doors: 0.038-inch- (0.95-mm-) thick stainless steel.
 - f. Loose Stops for Glazed Lites in Doors: 0.038-inch- (0.95-mm-) thick stainless steel.
 - g. Top and Bottom Channels: Closed with continuous channels, 0.062-inch- (1.59-mm-) thick stainless steel **OR** 0.060-inch- (1.52-mm-) nominal thickness uncoated steel **OR** 0.064-inch- (1.63-mm-) nominal thickness metallic-coated steel, **as directed**.
 - 1) Spot welded to both face sheets.
OR
Securely fastened using adhesive.
 - h. Hardware Reinforcement: Fabricate according to ANSI/NAAMM-HMMA 866 with reinforcing plates from stainless **OR** uncoated **OR** metallic-coated, **as directed**, steel.
 - i. Electrical Hardware Enclosures: Provide enclosures and junction boxes within doors for electrically operated door hardware, interconnected with UL-approved, 1/2-inch- (12.7-mm-) diameter conduit and connectors.
 - 1) Where indicated for installation of wiring, provide access plates to junction boxes, fabricate from same material and thickness as face sheet and fasten with at least four security fasteners spaced not more than 6 inches (152 mm) o.c.
2. Performance: Level A, ANSI A250.4.
 3. Materials:
 - a. Stainless-Steel Sheet: ASTM A 240/A 240M, austenitic stainless steel, Type 304 **OR** Type 316 **OR** Type 317LMN **OR** 904L, **as directed**.
 - b. Steel Sheet: ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, Commercial Steel (CS), Type B.
 - c. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
 - d. Foam-Plastic Insulation: Manufacturer's standard polystyrene **OR** urethane, **as directed**, board insulation with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within door.
 - e. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers.
 4. Stainless-Steel Finishes:
 - a. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
 - b. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1) Run grain of directional finishes with long dimension of each piece.
 - 2) When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - 3) Directional Satin Finish: No. 4.
 - 4) Dull Satin Finish: No. 6.
 - 5) Mirrorlike Reflective, Nondirectional Polish: No. 8.
 - c. Bright, Cold-Rolled, Unpolished Finish: No. 2B. Factory primed for field finish, **as directed**.



B. Stainless-Steel Panels

1. Provide stainless-steel panels of same construction, materials, and finish as specified for adjoining stainless-steel doors.

C. Stainless-Steel Frames

1. Description: Fabricate stainless-steel frames of construction indicated, with faces of corners mitered and contact edges closed tight.
 - a. Door Frames: Machine mitered, faces only welded **OR** Saw mitered and full (continuously) welded **OR** Machine mitered and full welded **OR** Knock down **OR** Slip on **OR** As indicated, **as directed**.
 - 1) Weld frames according to HMMA 820.
 - b. Sidelight, Transom and Borrowed-Light Frames: Machine mitered, faces only welded **OR** Saw mitered and full (continuously) welded **OR** Machine mitered and full welded, **as directed**.
 - c. Door Frames for Openings 48 Inches (1219 mm) Wide or Less: Fabricate from 0.062-inch- (1.59-mm-) **OR** 0.078-inch- (1.98-mm-) **OR** 0.109-inch- (2.78-mm-), **as directed**, thick, stainless-steel sheet.
 - d. Door Frames for Openings More Than 48 Inches (1219 mm) Wide: Fabricate from 0.078-inch- (1.98-mm-) **OR** 0.109-inch- (2.78-mm-), **as directed**, thick, stainless-steel sheet.
 - e. Borrowed-Light Frames: Fabricate from 0.062-inch- (1.59-mm-) **OR** 0.078-inch- (1.98-mm-) **OR** 0.109-inch- (2.78-mm-), **as directed**, thick, stainless-steel sheet.
 - f. Sidelight and Transom Frames: Fabricate from stainless-steel sheet of same thickness as adjacent door frame.
 - g. Glazing and Panel Stops: Formed integral with stainless-steel frames, minimum 5/8 inch (16 mm) high, unless otherwise indicated.
 - h. Loose Stops for Glazed Lites and Panels: 0.038-inch- (0.95-mm-) thick stainless steel.
 - i. Hardware Reinforcement: Fabricate according to ANSI/NAAMM-HMMA 866 with reinforcing plates from stainless **OR** uncoated **OR** metallic-coated, **as directed**, steel.
 - j. Head Reinforcement: 0.109-inch- (2.78-mm-) thick, stainless-steel channel or angle stiffener for openings widths more than 48 inches (1219 mm).
 - k. Jamb Anchors:
 - 1) Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.062-inch- (1.59-mm-) thick stainless steel **OR** 0.060-inch- (1.52-mm-) nominal thickness uncoated steel **OR** 0.064-inch- (1.63-mm-) nominal thickness metallic-coated steel, **as directed**, with corrugated or perforated straps not less than 2 inches (50 mm) wide by 10 inches (250 mm) long; or wire anchors not less than 0.156 inch (4.0 mm) thick.
 - 2) Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.050-inch- (1.27-mm-) thick stainless steel **OR** 0.048-inch- (1.21-mm-) nominal thickness uncoated steel **OR** 0.052-inch- (1.32-mm-) nominal thickness metallic-coated steel, **as directed**.
 - 3) Compression Type for Slip-on Frames: Fabricate adjustable compression anchors from stainless **OR** uncoated **OR** metallic-coated, **as directed**, steel.
 - 4) Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- (9.5-mm-) diameter, stainless-steel **OR** uncoated steel **OR** metallic-coated steel, **as directed**, bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
 - l. Floor Anchors: Not less than 0.078-inch- (1.98-mm-) thick stainless steel **OR** 0.075-inch- (1.90-mm-) nominal thickness uncoated steel **OR** 0.079-inch- (2.01-mm-) nominal thickness metallic-coated steel, **as directed**, and as follows:
 - 1) Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
 - 2) Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch (50-mm) height adjustment. Terminate bottom of frames at finish floor surface.



- m. Ceiling Struts: Minimum 3/8-inch-thick by 2-inch- (9.5-mm-thick by 50-mm-) wide from stainless **OR** uncoated **OR** metallic-coated, **as directed**, steel.
 - n. Plaster Guards: Not less than 0.019-inch- (0.48-mm-) thick stainless steel **OR** 0.018-inch- (0.46-mm-) nominal thickness uncoated steel **OR** 0.022-inch- (0.56-mm-) nominal thickness metallic-coated steel, **as directed**.
2. Performance: Level A, ANSI A250.4.
3. Materials:
- a. Stainless-Steel Sheet: ASTM A 240/A 240M, austenitic stainless steel, Type 304 **OR** Type 316 **OR** Type 317LMN **OR** 904L, **as directed**.
 - b. Steel Sheet: ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, Commercial Steel (CS), Type B.
 - c. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
 - d. Frame Anchors: Stainless-steel sheet. Same type as door face.
OR
Frame Anchors: Steel sheet **OR** Metallic-coated steel sheet, **as directed**, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
 - e. Inserts, Bolts, and Anchor Fasteners: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Alloy Group 1 or 4) for bolts and nuts.
OR
Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.
4. Finishes:
- a. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
 - b. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1) Run grain of directional finishes with long dimension of each piece.
 - 2) When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - 3) Directional Satin Finish: No. 4.
 - 4) Dull Satin Finish: No. 6.
 - 5) Mirrorlike Reflective, Nondirectional Polish: No. 8.
 - c. Bright, Cold-Rolled, Unpolished Finish: No. 2B. Factory primed for field finish, **as directed**.
- D. Accessories
- 1. Glazing: Comply with requirements in Division 08 Section "Glazing".
 - 2. Grout: Comply with ASTM C 476, with a slump of not more than 4 inches (102 mm) as measured according to ASTM C 143/C 143M.
 - 3. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
 - 4. Mineral Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers.
- E. Fabrication
- 1. Stainless-Steel Door Fabrication: Stainless-steel doors to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal.
 - a. Seamed Edge Construction: Both vertical door edges joined by visible, continuous interlocking seam (lock seam) full height of door.
OR
Seamed Edge Construction: Both vertical door edges joined by visible seam that is projection, spot, or tack welded on inside edges of door at minimum 6 inches (152 mm) o.c.



- b. Seamless Edge Construction: Door face sheets joined at vertical edges by continuous weld extending full height of door; with edges ground and polished, providing smooth, flush surfaces with no visible seams.
- c. Exterior Doors: Close top edges flush and seal joints against water penetration. Provide weep-hole openings in bottom of exterior doors to permit moisture to escape.
- d. Stops and Moldings: Factory cut openings in doors. Provide stops and moldings around glazed lites. Form corners of stops and moldings with butted or mitered hairline joints.
 - 1) Glazed Lites: Provide fixed stops and moldings welded on secure side of door.
 - 2) Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.
- e. Hardware Preparation: Factory prepare stainless-steel doors to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping, according to the Door Hardware Schedule and templates furnished as specified in Division 8 Section "Door Hardware".
 - 1) Reinforce doors to receive nontemplated mortised and surface-mounted door hardware.
- f. Locate hardware as indicated, or if not indicated, according to HMMA 831, "Recommended Hardware Locations for Custom Hollow Metal Doors and Frames."
- g. Tolerances: Fabricate doors to tolerances indicated in ANSI/NAAMM-HMMA 866.
2. Stainless-Steel Frame Fabrication: Fabricate stainless-steel frames to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
 - a. Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated from same thickness metal as frames.
 - b. Mullions, Rails and Transom Bars: Provide closed tubular members with no visible face seams or joints. Fasten members at crossings and to jambs by butt welding according to joint designs in HMMA 820.
 - 1) Provide false head member to receive lower ceiling where frames extend to finish ceilings of different heights.
 - c. Provide countersunk, flat-, or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 - d. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
 - e. Jamb Anchors: Provide number and spacing of anchors as follows:
 - 1) Masonry Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
 - a) Two anchors per jamb up to 60 inches (1524 mm) in height.
 - b) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) in height.
 - c) Four anchors per jamb from 90 to 96 inches (2286 to 2438 mm) in height.
 - d) Four anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof more than 96 inches (2438 mm) in height.
 - 2) Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
 - a) Three anchors per jamb up to 60 inches (1524 mm) in height.
 - b) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) in height.
 - c) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) in height.
 - d) Five anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof more than 96 inches (2438 mm) in height.
 - e) Two anchors per head for frames more than 42 inches (1066 mm) wide and mounted in metal-stud partitions.



- 3) Compression Type: Not less than two anchors in each jamb.
- 4) Postinstalled Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.
- f. Head Reinforcement: For frames more than 48 inches (1219 mm) wide, provide continuous head reinforcement for full width of opening, welded to back of frame at head.
- g. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Provide plastic plugs to keep holes clear during construction.
 - 1) Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - 2) Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- h. Stops and Moldings: Provide stops and moldings around glazed lites and solid panels where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
 - 1) Single Glazed Lites: Provide fixed stops and moldings welded on secure side of door or frame.
 - 2) Multiple Glazed Lites: Provide fixed and removable stops and moldings such that each lite is capable of being removed independently.
 - 3) Coordinate rabbet width between fixed and removable stops with type of glazing or panel and type of installation indicated.
 - 4) Terminated Stops: Where indicated for interior door frames, terminate stops 6 inches (152 mm) above finish floor with a 45 **OR** 90, **as directed**,-degree angle cut, and close open end of stop with stainless-steel sheet closure. Cover opening in extension of frame with welded-stainless-steel filler plate, with welds ground smooth and flush with frame.
- i. Hardware Preparation: Factory prepare stainless-steel frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping, according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware (scheduled By Describing Products)".
 - 1) Reinforce frames to receive nontemplated mortised and surface-mounted door hardware.
 - 2) Locate hardware as indicated, or if not indicated, according to HMMA 831, "Recommended Hardware Locations for Custom Hollow Metal Doors and Frames."
- j. Plaster Guards: Weld guards to frame at back of hardware mortises and mounting holes in frames to be grouted.
- k. Tolerances: Fabricate frames to tolerances indicated in ANSI/NAAMM-HMMA 866.

1.3 EXECUTION

A. Examination

1. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of stainless-steel doors and frames.
2. Examine roughing-in for embedded and built-in anchors to verify actual locations of stainless-steel, door-frame connections before frame installation.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Preparation

1. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
2. Prior to installation and with installation spreaders in place, adjust and securely brace stainless-steel door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.



- c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.
3. Drill and tap doors and frames to receive nontemplated mortised and surface-mounted door hardware.

C. Installation

1. General: Install stainless-steel doors and frames plumb, rigid, properly aligned, and securely fastened in place; comply with ANSI/NAAMM-HMMA 866 and manufacturer's written instructions.
2. Stainless-Steel Frames: Install stainless-steel frames of size and profile indicated.
 - a. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - 1) At fire-protection-rated openings, install frames according to NFPA 80.
 - 2) Where frames are fabricated in sections due to shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - 3) Install frames with removable glazing stops located on secure side of opening.
 - 4) Install door silencers in frames before grouting.
 - 5) Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - 6) Check plumb, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - 7) Apply corrosion-resistant coating to backs of grout-filled frames.
 - b. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor and secure with postinstalled expansion anchors.
 - 1) Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors, if so indicated and approved on Shop Drawings.
 - c. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
 - d. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 - e. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 - f. Ceiling Struts: Extend struts vertically from top of frame at each jamb to supporting construction above, unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction above. Provide adjustable wedged or bolted anchorage to frame jamb members.
 - g. Grouted Frames: Solidly fill space between frames and substrate with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
 - h. Installation Tolerances: Adjust stainless-steel frames for squareness, alignment, twist, and plumb to the following tolerances:
 - 1) Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - 2) Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 - 3) Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - 4) Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.
3. Stainless-Steel Doors: Fit non-fire-rated doors accurately in frames with the following clearances:
 - a. Non-Fire-Rated Doors:



- 1) Jambs and Head: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
 - 2) Between Edges of Pairs of Doors: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
 - 3) Between Bottom of Door and Top of Threshold: Maximum 3/8 inch (9.5 mm).
 - 4) Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch (19 mm).
- b. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
 - c. Smoke-Control Doors: Install doors according to NFPA 105.
4. Glazing: Install glazing in sidelights, transoms, and borrowed lights to comply with installation requirements in Division 08 Section "Glazing".
- a. Secure stops with countersunk, flat-, or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c., and not more than 2 inches (50 mm) o.c. from each corner.
- D. Adjusting And Cleaning
1. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work including stainless-steel doors or frames that are warped, bowed, or otherwise unacceptable.
 2. Clean grout and other bonding material off stainless-steel doors and frames immediately after installation.
 3. Stainless-Steel Touchup: Immediately after erection, smooth any abraded areas of stainless steel and polish to match undamaged finish.

END OF SECTION 08 12 13 13



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Task	Specification	Specification Description
08 12 13 13	08 01 11 00	Steel Doors And Frames
08 13 13 13	08 01 11 00	Steel Doors And Frames
08 13 13 13	08 12 13 13	Stainless Steel Doors And Frames



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SECTION 08 14 16 00 - STILE AND RAIL WOOD DOORS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of material for stile and rail wood doors. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Exterior stile and rail wood doors and sidelites.
 - b. Interior stile and rail wood doors.
 - c. Interior fire-rated, stile and rail wood doors.
 - d. Interior fire-rated, wood door and sidelite frames.
 - e. Priming and Finishing stile and rail wood doors.
 - f. Fitting stile and rail wood doors to frames and machining for hardware.
 - g. Prehanging doors in frames.

C. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:
 - a. Certificates for Credit MR 7: Chain-of-custody certificates certifying that wood used for stile and rail wood doors complies with forest certification requirements.
 - 1) Include statement indicating costs for each certified wood product.
 - b. Product Data for Credit EQ 4.4: For adhesives and composite wood materials, documentation indicating that products contain no urea formaldehyde.
3. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and other pertinent data.
4. Samples: Representing typical range of color and grain for each species of veneer and solid lumber required. Finish Sample with same materials proposed for factory-finished doors.

D. Quality Assurance

1. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
2. Forest Certification: Provide doors made with veneers **OR** not less than 70 percent of wood products **OR** all wood products, **as directed**, obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
3. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure **OR** as close to neutral pressure as possible, **as directed**, according to NFPA 252 **OR** IBC Standard 716.5 **OR** UL 10B **OR** UL 10C, **as directed**.
 - a. Temperature-Rise Limit: Where indicated **OR** At vertical exit enclosures and exit passageways, **as directed**, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
4. Safety Glass: Provide products complying with testing requirements in 16 CFR 1201, for Category II materials, unless those of Category I are expressly indicated and permitted.

E. Delivery, Storage, And Handling

1. Comply with manufacturer's written instructions and requirements of quality standard referenced in Part 1.2.



2. Package doors individually in opaque plastic bags or cardboard cartons.
3. Mark each door on top and bottom edge with opening number used on Shop Drawings.

F. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship, or have warped (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section.
 - a. Warranty shall be in effect during the following period of time from date of Final Completion:
 - 1) Exterior Doors: None **OR** One year **OR** Two years **OR** Five years, **as directed**.
 - 2) Interior Doors: One year **OR** Five years **OR** Life of installation, **as directed**.
 - 3) Insulated **OR** Insulating Leaded, **as directed**, Glass Vision Panels: Three **OR** Five, **as directed**, years.

1.2 PRODUCTS

A. Materials

1. General: Use only materials that comply with referenced standards and other requirements specified.
 - a. Assemble exterior doors and sidelites, including components, with wet-use adhesives complying with ASTM D 5572 for finger joints and with ASTM D 5751 for joints other than finger joints.
 - b. Assemble interior doors, frames, and sidelites, including components, with either dry-use or wet-use adhesives complying with ASTM D 5572 for finger joints and with ASTM D 5751 for joints other than finger joints.
2. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea-formaldehyde resins.
3. Panel Products: Any of the following:
 - a. Particleboard made from wood particles, with binder containing no urea-formaldehyde resin, complying with ANSI A208.1, Grade M-2.
OR
Particleboard made from straw, complying with ANSI A208.1, Grade M-2, except for density.
 - b. Medium-density fiberboard made from wood fiber, with binder containing no urea-formaldehyde resin, complying with ANSI A208.2, Grade 130.
 - c. Hardboard, complying with AHA A135.4.
 - d. Veneer core plywood, made with adhesive containing no urea-formaldehyde resin.

B. Exterior Stile And Rail Wood Doors

1. Exterior Stile and Rail Wood Doors: Stock exterior doors complying with WDMA I.S.6, "Industry Standard for Wood Stile and Rail Doors," and with other requirements specified.
 - a. Finish and Grade: Transparent and Premium or Select **OR** Opaque and Standard, **as directed**.
 - b. Wood Species: Idaho white, lodgepole, ponderosa, or sugar pine **OR** Manufacturer's standard softwood species and cut, **as directed**.
 - c. Stile and Rail Construction: Edge-glued solid lumber **OR** veneered, structural composite lumber **OR** veneered edge- and end-glued lumber, **as directed**.
 - d. Panel Construction: Edge-glued solid lumber **OR** veneered panel product, **as directed**.
 - e. Raised-Panel Thickness: Manufacturer's standard, but not less than that required by WDMA I.S.6 for design group indicated **OR** As indicated, **as directed**.
 - f. Molding Profile (Sticking): Manufacturer's standard **OR** As selected from manufacturer's full range, **as directed**.
 - g. Glass: Uncoated, clear, fully tempered float glass, 5.0 mm thick **OR** laminated glass made from two lites of 3.0-mm-thick annealed glass **OR** insulating-glass units made from two



- lites of 3.0-mm-thick, fully tempered glass with 1/4-inch (6.4-mm) interspace, **as directed**, complying with Division 08 Section "Glazing".
- h. WDMA Design Group: 1-3/4 Front Entrance Doors (Exterior) **OR** 1-3/4 Thermal (Insulated-Glass) Doors (Exterior) **OR** 8'-0" High Doors **OR** Side Lights **OR** 1-3/4 and 1-3/8 Entrance Doors (Exterior) **OR** Combination Doors **OR** Screen Doors, **as directed**.
 - i. Mark, label, or otherwise identify stile and rail wood doors as complying with WDMA I.S.6 and grade specified. Include panel design number if applicable.
2. Exterior Stile and Rail Wood Doors: Stock **OR** Custom, **as directed**, exterior doors complying with AWI's "Architectural Woodwork Quality Standards," **OR** WI's "Manual of Millwork," **OR** WDMA I.S.6A, "Industry Standard for Architectural Stile and Rail Doors," **as directed**, and with other requirements specified.
- a. Panel Designs: Indicated by Drawings. Do not modify intended aesthetic effects, as judged solely by the Owner, except with the Owner's approval. If modifications are proposed, submit comprehensive explanatory data to the Owner for review.
 - b. Grade: Premium **OR** Custom, **as directed**.
 - c. Finish: Transparent **OR** Opaque, **as directed**.
 - d. Wood Species and Cut for Transparent Finish: Idaho white, lodgepole, ponderosa, or sugar pine, plain sawed/sliced **OR** Douglas fir or western hemlock, quarter sawed/sliced (vertical grain) **OR** Red oak, quarter sawed/sliced stiles and rails, plain sawed/sliced panels **OR** Species indicated in schedule, plain sawed/sliced, **as directed**.
 - e. Door Construction for Transparent Finish:
 - 1) Stile and Rail Construction:
 - a) Clear lumber; may be edge glued for width. Select lumber for similarity of grain and color, and arrange for optimum match between adjacent pieces.
OR
Veneered, structural composite lumber or veneered, edge- and end-glued clear lumber, **as directed**. Select veneers for similarity of grain and color, and arrange for optimum match between adjacent pieces. Use veneers not less than 1/16 inch (1.6 mm) thick, **as directed**.
 - 2) Raised-Panel Construction:
 - a) Clear lumber; edge glued for width. Select lumber for similarity of grain and color, and arrange for optimum match between adjacent pieces.
OR
Edge-glued, clear lumber; glued to both sides of a wood-based panel product. Select lumber for similarity of grain and color, and arrange for optimum match between adjacent pieces.
OR
Veneered, wood-based panel product with mitered, raised rims made from matching clear lumber.
OR
Veneered, shaped, wood-based panel product with veneer conforming to raised-panel shape.
 - f. Door Construction for Opaque Finish:
 - 1) Stile and Rail Construction: Clear softwood; may be edge glued for width and finger jointed.
OR
Stile and Rail Construction: Veneered, structural composite lumber or veneered edge- and end-glued lumber, **as directed**.
 - 2) Raised-Panel Construction: Clear softwood lumber; edge glued for width.
OR
Raised-Panel Construction: Veneered, wood-based panel product.
 - g. Stile and Rail Widths: As indicated **OR** Manufacturer's standard, but not less than the following, **as directed**:
 - 1) Stiles, Top and Intermediate Rails: 5-3/8 inches (137 mm).
 - 2) Bottom Rails: 11-3/8 inches (289 mm).



- h. Raised-Panel Thickness: As indicated **OR** 1-3/4 inches (44 mm) **OR** 1-3/8 inches (35 mm) **OR** Manufacturer's standard, but not less than 1-1/8 inches (29 mm), **as directed**.
- i. Molding Profile (Sticking): Bead and cove **OR** Ogee **OR** Ovalo **OR** Recessed bevel **OR** Recessed square **OR** Manufacturer's standard **OR** As selected from manufacturer's full range, **as directed**.
- j. Glass: Uncoated, clear, fully tempered float glass, 5.0 mm thick **OR** laminated glass made from two lites of 3.0-mm-thick annealed glass **OR** insulating-glass units made from two lites of 3.0-mm-thick, fully tempered glass with 1/4-inch (6.4-mm) interspace, **as directed**, complying with Division 08 Section "Glazing".
- k. Provide AWI Quality Certification Labels or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.
OR
Provide WI-Certified Compliance Certificate indicating that doors comply with requirements of grades specified.
- l. Mark, label, or otherwise identify stile and rail wood doors as complying with WDMA I.S.6A and grade specified.

C. Interior Stile And Rail Wood Doors

1. Interior Stile and Rail Wood Doors: Stock interior doors complying with WDMA I.S.6, "Industry Standard for Wood Stile and Rail Doors," and with other requirements specified.
 - a. Finish and Grade: Transparent and Premium or Select **OR** Opaque and Standard, **as directed**.
 - b. Wood Species: Idaho white, lodgepole, ponderosa, or sugar pine **OR** Douglas fir or western hemlock, vertical sawed/sliced **OR** Red oak, quarter sawed/sliced **OR** Manufacturer's standard softwood species and cut, **as directed**.
 - c. Stile and Rail Construction: Edge-glued solid lumber **OR** veneered, structural composite lumber **OR** veneered edge- and end-glued lumber, **as directed**.
 - d. Raised-Panel Construction: Edge-glued solid lumber **OR** Veneered panel product **OR** shaped, medium-density fiberboard, **as directed**.
 - e. Flat-Panel Construction: Veneered panel product **OR** hardboard or medium-density fiberboard, **as directed**.
 - f. Raised-Panel Thickness: Manufacturer's standard, but not less than that required by WDMA I.S.6 for design group indicated **OR** As indicated, **as directed**.
 - g. Flat-Panel Thickness: Manufacturer's standard, but not less than that required by WDMA I.S.6 for design group indicated **OR** As indicated, **as directed**.
 - h. Molding Profile (Sticking): Manufacturer's standard **OR** As selected from manufacturer's full range, **as directed**.
 - i. Glass: Uncoated, clear, fully tempered float glass, 5.0 mm thick **OR** laminated glass made from two lites of 3.0-mm-thick annealed glass, **as directed**, complying with Division 08 Section "Glazing".
 - j. WDMA Design Group: 1-3/8 Interior Panel Doors **OR** French Doors **OR** 8'-0" High Doors **OR** Bifold Doors, **as directed**.
 - k. Mark, label, or otherwise identify stile and rail wood doors as complying with WDMA I.S.6 and grade specified. Include panel design number if applicable.
2. Interior Stile and Rail Wood Doors: Stock **OR** Custom, **as directed**, interior doors complying with AWI's "Architectural Woodwork Quality Standards," **OR** WI's "Manual of Millwork," **OR** WDMA I.S.6A, "Industry Standard for Architectural Stile and Rail Doors," **as directed**, and with other requirements specified.
 - a. Panel Designs: Indicated by Drawings. Do not modify intended aesthetic effects, as judged solely by the Owner, except with the Owner's approval. If modifications are proposed, submit comprehensive explanatory data to the Owner for review.
 - b. Grade: Premium **OR** Custom, **as directed**.
 - c. Finish: Transparent **OR** Opaque, **as directed**.
 - d. Wood Species and Cut for Transparent Finish: Idaho white, lodgepole, ponderosa, or sugar pine, plain sawed/sliced **OR** Douglas fir or western hemlock, quarter sawed/sliced



- (vertical grain) **OR** Red oak, quarter sawed/sliced stiles and rails, plain sawed/sliced panels **OR** Species indicated in schedule, plain sawed/sliced, **as directed**.
- e. Door Construction for Transparent Finish:
- 1) Stile and Rail Construction: Clear lumber; may be edge glued for width. Select lumber for similarity of grain and color, and arrange for optimum match between adjacent pieces.
OR
Stile and Rail Construction: Veneered, structural composite lumber **OR** veneered, edge- and end-glued clear lumber, **as directed**. Select veneers for similarity of grain and color, and arrange for optimum match between adjacent pieces. Use veneers not less than 1/16 inch (1.6 mm) thick, **as directed**.
 - 2) Raised-Panel Construction: Clear lumber; edge glued for width. Select lumber for similarity of grain and color, and arrange for optimum match between adjacent pieces.
OR
Raised-Panel Construction: Edge-glued, clear lumber; glued to both sides of a wood-based panel product. Select lumber for similarity of grain and color, and arrange for optimum match between adjacent pieces.
OR
Raised-Panel Construction: Veneered, wood-based panel product with mitered, raised rims made from matching clear lumber.
OR
Raised-Panel Construction: Veneered, shaped, wood-based panel product with veneer conforming to raised-panel shape.
 - 3) Flat-Panel Construction: Veneered, wood-based panel product.
- f. Door Construction for Opaque Finish:
- 1) Stile and Rail Construction: Clear softwood; may be edge glued for width and finger jointed.
OR
Stile and Rail Construction: Veneered, structural composite lumber **OR** veneered edge- and end-glued lumber, **as directed**.
 - 2) Raised-Panel Construction: Clear softwood lumber; edge glued for width.
OR
Raised-Panel Construction: Shaped, medium-density fiberboard.
 - 3) Flat-Panel Construction: Veneered, wood-based panel product **OR** Medium-density fiberboard, **as directed**.
- g. Stile and Rail Widths: As indicated **OR** Manufacturer's standard, but not less than the following, **as directed**:
- 1) Stiles, Top and Intermediate Rails: 4-1/2 inches (114 mm).
 - 2) Bottom Rails: 9 inches (229 mm).
- h. Raised-Panel Thickness: As indicated **OR** 1-3/4 inches (44 mm) **OR** 1-3/8 inches (35 mm) **OR** Manufacturer's standard, but not less than 1-1/8 inches (29 mm) **OR** Manufacturer's standard, but not less than 3/4 inch (19 mm), **as directed**.
- i. Flat-Panel Thickness: As indicated **OR** 1/2 inch (13 mm) **OR** 3/8 inch (10 mm) **OR** 1/4 inch (6.4 mm), **as directed**.
- j. Molding Profile (Sticking): Bead and cove **OR** Ogee **OR** Ovalo **OR** Recessed bevel **OR** Recessed square **OR** Manufacturer's standard **OR** As selected from manufacturer's full range, **as directed**.
- k. Glass: Uncoated, clear, fully tempered float glass, 5.0 mm thick **OR** laminated glass made from two lites of 3.0-mm-thick annealed glass, **as directed**, complying with Division 08 Section "Glazing".
- l. Provide AWI Quality Certification Labels or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.
OR
Provide WI-Certified Compliance Certificate indicating that doors comply with requirements of grades specified.



- m. Mark, label, or otherwise identify stile and rail wood doors as complying with WDMA I.S.6A and grade specified.
3. Interior Stile and Rail Wood Doors: Fire-rated (20-minute rating) doors complying with AWI's "Architectural Woodwork Quality Standards," **OR** WI's "Manual of Millwork," **OR** WDMA I.S.6A, "Industry Standard for Architectural Stile and Rail Doors," **as directed**, and with other requirements specified.
- a. Panel Designs: Indicated by Drawings. Do not modify intended aesthetic effects, as judged solely by the Owner, except with the Owner's approval. If modifications are proposed, submit comprehensive explanatory data to the Owner for review.
 - b. Grade: Premium **OR** Custom, **as directed**.
 - c. Finish: Transparent **OR** Opaque, **as directed**.
 - d. Wood Species and Cut for Transparent Finish: Idaho white, lodgepole, ponderosa, or sugar pine, plain sawed/sliced **OR** Douglas fir or western hemlock, quarter sawed/sliced (vertical grain) **OR** Red oak, quarter sawed/sliced stiles and rails, plain sawed/sliced panels **OR** Species indicated in schedule, plain sawed/sliced, **as directed**.
 - e. Door Construction for Transparent Finish: 1-3/4-inch- (44-mm-) thick stiles and rails and veneered flat panels not less than 5/8 inch (16 mm) thick **OR** raised panels not less than 1-1/8 inches (29 mm) thick, **as directed**.
 - 1) Stile and Rail Construction: Veneered, structural composite lumber **OR** veneered, edge- and end-glued clear lumber, **as directed**. Select veneers for similarity of grain and color, and arrange for optimum match between adjacent pieces. Use veneers not less than 1/16 inch (1.6 mm) thick, **as directed**.
 - 2) Raised-Panel Construction: Veneered, shaped, wood-based panel product with veneer conforming to raised-panel shape.
 - 3) Flat-Panel Construction: Veneered, wood-based panel product.
 - f. Door Construction for Opaque Finish: 1-3/4-inch- (44-mm-) thick stiles and rails and veneered flat panels not less than 5/8 inch (16 mm) thick **OR** raised panels not less than 1-1/8 inches (29 mm) thick, **as directed**.
 - 1) Stile and Rail Construction: Veneered, structural composite lumber **OR** veneered edge- and end-glued lumber, **as directed**.
 - 2) Raised-Panel Construction: Shaped, medium-density fiberboard.
 - 3) Flat-Panel Construction: Veneered, wood-based panel product **OR** Medium-density fiberboard, **as directed**.
 - g. Stile and Rail Widths: As indicated **OR** Manufacturer's standard, but not less than the following, **as directed**:
 - 1) Stiles, Top and Intermediate Rails: 4-1/2 inches (114 mm).
 - 2) Bottom Rails: 9 inches (229 mm).
 - h. Molding Profile (Sticking): Bead and cove **OR** Ogee **OR** Ovalo **OR** Recessed bevel **OR** Recessed square **OR** Manufacturer's standard **OR** As selected from manufacturer's full range, **as directed**.
 - i. Provide AWI Quality Certification Labels or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.
OR
Provide WI-Certified Compliance Certificate indicating that doors comply with requirements of grades specified.
 - j. Mark, label, or otherwise identify stile and rail wood doors as complying with WDMA I.S.6A and grade specified.
4. Interior Stile and Rail Wood Doors: Fire-rated (45-minute rating) doors complying with AWI's "Architectural Woodwork Quality Standards," **OR** WI's "Manual of Millwork," **as directed**, and with other requirements specified.
- a. Panel Designs: Indicate by Drawings. Do not modify intended aesthetic effects, as judged solely by the Owner, except with the Owner's approval. If modifications are proposed, submit comprehensive explanatory data to the Owner for review.
 - b. Grade: Premium **OR** Custom, **as directed**.
 - c. Finish: Transparent **OR** Opaque, **as directed**.



- d. Wood Species and Cut for Transparent Finish: Idaho white, lodgepole, ponderosa, or sugar pine, plain sawed/sliced **OR** Douglas fir or western hemlock, quarter sawed/sliced (vertical grain) **OR** Red oak, quarter sawed/sliced stiles and rails, plain sawed/sliced panels **OR** Species indicated in schedule, plain sawed/sliced, **as directed**.
- e. Interior Fire-Rated Door Construction: 1-3/4-inch- (44-mm-) thick, edged and veneered mineral-core stiles and rails and 1-1/8-inch- (29-mm-) thick, veneered mineral-core raised panels.
- f. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
 - 1) Screw-Holding Capability: 550 lbf (2440 N) **OR** 475 lbf (2110 N) **OR** 400 lbf (1780 N), **as directed**, per NWWDA T.M.-10.
- g. Stile and Rail Widths: As indicated **OR** Manufacturer's standard, but not less than the following, **as directed**:
 - 1) Stiles, Top and Intermediate Rails: 4-1/2 inches (114 mm).
 - 2) Bottom Rails: 9 inches (229 mm).
- h. Molding Profile (Sticking): Bead and cove **OR** Ogee **OR** Ovalo **OR** Recessed bevel **OR** Recessed square **OR** Manufacturer's standard **OR** As selected from manufacturer's full range, **as directed**.
- i. Provide AWI Quality Certification Labels or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.
OR
Provide WI-Certified Compliance Certificate indicating that doors comply with requirements of grades specified.

D. Interior Fire-Rated Wood Door Frames

1. Interior Fire-Rated Wood Door Frames: Frames, complete with casings **OR** sidelite frames and casings, **as directed**, fabricated from solid fire-retardant-treated wood or from veneered fire-retardant particleboard, fire-retardant medium-density fiberboard, or mineral board.
2. Species: Red oak **OR** White oak **OR** White maple **OR** Cherry, **as directed**.

E. Stile And Rail Wood Door Fabrication

1. Fabricate stile and rail wood doors in sizes indicated for field fitting.
2. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels unless otherwise indicated:
 - a. Clearances: Provide 1/8 inch (3 mm) at heads, jambs, and between pairs of doors. Provide 1/2 inch (13 mm) from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide not more than 3/8 inch (10 mm) from bottom of door to top of threshold.
 - 1) Comply with NFPA 80 for fire-rated doors.
 - b. Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.
 - c. Bevel fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) on lock edge; trim stiles and rails only to extent permitted by labeling agency.
3. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W Series standards, and hardware templates.
4. Glazed Openings: Trim openings indicated for glazing with solid wood moldings, with one side removable. Miter wood moldings at corner joints.
OR
Glazed Openings: Glaze doors at factory with glass of type and thickness indicated, complying with Division 08 Section "Glazing". Install glass using manufacturer's standard elastomeric glazing sealant complying with ASTM C 920. Secure glass in place with removable wood moldings. Miter wood moldings at corner joints.
5. Transom and Side Panels: Fabricate panels to match adjoining doors in materials, finish, and quality of construction.



6. Exterior Doors: Factory treat exterior doors after fabrication with water-repellent preservative to comply with WDMA I.S.4. Flash top of outswinging doors with manufacturer's standard metal flashing.
 7. Prehung Doors: Provide stile and rail doors as prehung units including doors, frames, weather stripping, **as directed**, and hardware.
 - a. Provide wood door frames, other than fire-rated wood door frames, that comply with Division 06 Section(s) "Interior Finish Carpentry" OR "Interior Architectural Woodwork", **as directed**.
 - b. Provide hardware, including weather stripping and thresholds, that complies with Division 08 Section "Door Hardware".
- F. Shop Priming
1. Doors for Opaque Finish: Shop prime doors with one coat of wood primer specified in Division 09 Section(s) "Exterior Painting" OR "Interior Painting", **as directed**. Seal all four edges, edges of cutouts, and mortises with primer.
 2. Doors for Transparent Finish: Shop prime doors with stain (if required), other required pretreatments, and first coat of finish as specified in Division 09 Section "Staining And Transparent Finishing". Seal all four edges, edges of cutouts, and mortises with first coat of finish.
- G. Finishing
1. Finish wood doors at factory **OR** woodworking shop, **as directed**.
OR
 Finish wood doors at factory **OR** woodworking shop, **as directed**, that are indicated to receive transparent finish. Wood doors that are indicated to receive opaque finish may be field finished.
OR
 Finish wood doors at factory **OR** woodworking shop, **as directed**, where indicated in schedules or on Drawings. Wood doors that are not indicated to be factory **OR** shop, **as directed**, finished may be field finished.
 2. For doors indicated to be factory **OR** shop, **as directed**, finished, comply with AWI's "Architectural Woodwork Quality Standards," **OR** WI's "Manual of Millwork," **OR** WDMA I.S.6A, "Industry Standard for Architectural Stile and Rail Doors," **as directed**, and with other requirements specified.
 - a. Finish faces and all four edges of doors, including mortises and cutouts. Stains and fillers may be omitted on bottom **OR** top and bottom, **as directed**, edges, edges of cutouts, and mortises.
 3. Transparent Finish:
 - a. Grade: Premium **OR** Custom, **as directed**.
 - b. Finish: AWI conversion varnish **OR** AWI catalyzed polyurethane, **as directed**, system.
OR
 Finish: WDMA TR-4 conversion varnish **OR** WDMA TR-6 catalyzed polyurethane, **as directed**.
OR
 Finish: WI System 4 clear conversion varnish **OR** WI System 5 catalyzed polyurethane **OR** WI System 8 UV-curable coating, **as directed**.
 - c. Staining: Match sample **OR** As selected from manufacturer's full range **OR** None required, **as directed**.
 - d. Effect: Open-grain finish **OR** Filled finish **OR** Semifilled finish, produced by applying an additional finish coat to partially fill the wood pores, **as directed**.
 - e. Sheen: Satin **OR** Semigloss, **as directed**.
 4. Opaque Finish:
 - a. Grade: Premium **OR** Custom, **as directed**.
 - b. Finish: AWI conversion varnish **OR** AWI catalyzed polyurethane, **as directed**, system.
OR
 Finish: WDMA OP-4 conversion varnish **OR** WDMA OP-6 catalyzed polyurethane, **as directed**.

**OR**

Finish: WI System 4 conversion varnish **OR** WI System 5 catalyzed polyurethane **OR** WI System 8 UV-curable coating, **as directed**.

- c. Color: Match sample **OR** As selected from manufacturer's full range, **as directed**.
- d. Sheen: Satin **OR** Semigloss **OR** Gloss, **as directed**.

1.3 EXECUTION

A. Installation

1. Install fire-rated wood door frames level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.
 - a. Countersink fasteners, fill surface flush, and sand smooth.
2. Hardware: For installation, see Division 08 Section "Door Hardware".
3. Install wood doors to comply with manufacturer's written instructions, WDMA I.S.6, "Industry Standard for Wood Stile and Rail Doors," **OR** AWI's "Architectural Woodwork Quality Standards," **OR** WI's "Manual of Millwork," **OR** WDMA I.S.6A, "Industry Standard for Architectural Stile and Rail Doors," **as directed**, and other requirements specified.
 - a. Provide WI-Certified Compliance Certificate for Installation.
 - b. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.
4. Field-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted with fire-rated doors. Machine doors for hardware. Seal cut surfaces after fitting and machining.
 - a. Clearances: Provide 1/8 inch (3 mm) at heads, jambs, and between pairs of doors. Provide 1/8 inch (3 mm) **OR** 1/4 inch (6 mm) **OR** 3/8 inch (10 mm) **OR** 1/2 inch (13 mm), **as directed**, from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 1/4 inch (6 mm) **OR** 3/8 inch (10 mm), **as directed**, from bottom of door to top of threshold.
 - 1) Comply with NFPA 80 for fire-rated doors.
 - b. Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.
 - c. Bevel fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) on lock edge; trim stiles and rails only to extent permitted by labeling agency.
5. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
6. Factory-Finished **OR** Shop-Finished, **as directed**, Doors: Restore finish before installation if fitting or machining is required at Project site.

B. Adjusting

1. Operation: Rehang or replace doors that do not swing or operate freely.
2. Finished Doors: Replace doors that are damaged or do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 14 16 00



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Task	Specification	Specification Description
08 14 16 00	06 48 13 00	Wood Doors
08 14 16 00	08 05 13 00	Flush Wood Doors
08 14 66 00	01 22 16 00	No Specification Required
08 14 73 00	06 48 13 00	Wood Doors
08 14 73 00	08 05 13 00	Flush Wood Doors



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SECTION 08 16 13 00 - STEEL ENTRY DOORS

1.1 DESCRIPTION OF WORK

- A. This specification covers the furnishing and installation of materials for steel entry doors. Products shall be as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

1.2 GENERAL

A. Definitions

1. Supply and Delivery Only: Include supply and delivery to site(s) FOB destination freight prepaid. Unless otherwise specified or scheduled, unloading and handling at site is by Owner.

B. System Description

1. Door Assemblies: Include doors, frames, and hardware
 - a. Provide with fire rating as indicated or specified.
 - b. Door and Frame Assemblies: Comply with dimensional requirements of SDI 100.
 - c. Exterior Doors: Sealed, weatherstripped and provided with thresholds.
2. Insulated Entry Door System (Assembly) Performance Requirements:
 - a. Mechanical Properties: Comply with ANSI/SDI A151.1, Level C (250,000 cycles).
 - b. Air Infiltration: ANSI/ISDSI 101 and ASTM E 283, not exceed 0.029 cu m/s/mm (0.20 CFM/foot) of crack length at test pressure of 75 Pa (1.57 PSF).
 - c. Water Resistance: ANSI/ISDSI 104 and ASTM E 331, no leakage at test pressure of 75 Pa (1.57 PSF).
 - d. Thermal Performance: ANSI/ISDSI 107, minimum acceptance criteria as defined in standard except U-Value of 1.42 W/sq. m C (0.25 BTU/HR/SF degree F).
 - e. Acoustical Performance: ANSI/ISDSI 103, Minimum Sound Transmission Class (STC) of 24.
3. Hollow Core Heavy Duty System (Assembly) Performance Requirements:
 - a. Mechanical Properties: Comply with ANSI/SDI A151.1, Level B (500,000 cycles).
 - b. Air Infiltration: SDI 116 and ASTM E 283, not exceed 0.072 cu m/s/mm (0.50 CFM/foot) of crack length at test pressure of 75 Pa (1.57 PSF).
 - c. Water Resistance: ASTM E 331, no leakage at test pressure of 75 Pa (1.57 PSF).
4. Insulated Heavy Duty Door System (Assembly) Performance Requirements:
 - a. Mechanical Properties: Comply with ANSI/SDI A151.1, Level B (500,000 cycles).
 - b. Air Infiltration: ANSI/ISDSI 101/ASTM E 283, not exceed 0.029 cu m/s/mm (0.20 CFM/foot) of crack length at test pressure of 75 Pa (1.57 PSF).
 - c. Water Resistance: ANSI/ISDSI 104 and ASTM E 331, no leakage at test pressure of 75 Pa (1.57 PSF).
 - d. Thermal Performance: ANSI/ISDSI 107, minimum acceptance criteria as defined in standard except U-Value of 1.42 W/sq. m C (0.25 BTU/HR SF degree F) is required.
 - e. Acoustical Performance: ANSI/ISDSI 103, Minimum Sound Transmission Class (STC) of 24.
5. Security Door System (Assembly) Performance Requirements:
 - a. Mechanical Properties: Comply with ANSI/SDI A151.1, Level A (1,000,000 cycles).
 - b. Air Infiltration: SDI 116 and ASTM E 283, not exceed 0.72 cu m/s/mm (0.50 CFM/foot) of crack length at test pressure of 75 Pa (1.57 PSF).
 - c. Water Resistance: ASTM E 331, no leakage at test pressure of 75 Pa (1.57 PSF).
 - d. Forced Entry: ASTM F 476, Grade 40.

C. Submittals



1. Product Data.
2. Shop Drawings:
 - a. Include details showing recommendations for installation of doors. Include size of fasteners, spacing, minimum penetration of fasteners into load-bearing material and maximum clearance between frame and rough opening.
3. Samples: Submit full set of finish color samples for color selection.
 - a. For Supply and Deliver Only Contract: Submit one full size sample of each type of steel entry door with specified finish for acceptance.
4. Quality Assurance/Control Submittals:
 - a. Test Reports: Results of testing by accredited independent laboratory demonstrating compliance of door systems with specified performance requirements.
 - 1) Indicate that tests were performed in accordance with standard referenced.
 - 2) Weak Link Testing. Submit reports for each model door in its weakest condition in order to quality superior variations of same model.
 - b. Certificates: Manufacturer's written certification that door systems meet or exceed specified requirements.
 - c. Manufacturer's installation instructions.
5. Closeout Submittals:
 - a. Operation and maintenance data.
 - b. Special warranty.

D. Quality Assurance

1. Regulatory Requirements: Comply with following:
 - a. Fire Rated Label: Determined using ASTM E 152 and bear label of UL or other recognized fire rating program.
 - b. Glazing Materials: Comply with CPSC 16 CFR 1201 or ANSI Z97.1.
 - c. Accessibility:
 - 1) Architectural Barriers Act of 1968 as amended (42 USC 4152-4157) and HUD implementing regulations (24 CFR Part 40).
 - a) Uniform Federal Accessibility Standards (UFAS).
 - 2) Section 504 of the Rehabilitation Act of 1973 as amended (29 USC 794) and HUD implementing regulations 24 CFR Part 8.
 - 3) Fair Housing Accessibility Guidelines (24 CFR Chapter 1).
 - 4) Americans with Disabilities Act of 1990 (ADA) (28 CFR Part 35).
2. Certifications:
 - a. Door Systems: Meet or exceed performance requirements and other requirements specified and be labeled under HUD accepted Materials Releases.
 - b. Some Material Releases (MR) do not include all of performance requirements specified. Therefore, additional testing, certification may be required for submission with HUD Material Releases.
 - 1) Material Releases are part of HUD Technical Suitability of Building Products Program. Contact: Department of Housing and Urban Development, Manufactured Housing and Construction Standards, 451 7th Street, SW, Washington, D.C. 20410-8000.
3. Mock-ups: Install one mock-up of each type of entry door system including doors, frames, hardware, weatherstripping, thresholds, and accessories.
 - a. Location: As directed.
 - b. Approved Mock-up: Standard for rest of work.
 - c. Approved Mock-up: May remain part of completed project.

E. Delivery, Storage, And Handling

1. Packing, Shipping, Handling, and Unloading: Pack materials at manufacturing plant to prevent damage during shipping.
2. Acceptance at Site: Inspect door systems upon delivery. Replace damaged or defective materials before installation.



- F. Project Conditions
 - 1. Field Measurements: Field measure openings for door systems before start of fabrication.
- G. Scheduling And Sequencing
 - 1. Scheduling and Completion: Comply with requirements of Detailed Scope of Work.
- H. Warranty
 - 1. Special Warranty: Provide one year written warranty covering materials and installation for steel entry doors.
 - a. Warranty: Include coverage of hardware.
 - 1) Glazing not included.
 - 2) Defects resulting from vandalism not included.
 - b. For Supply and Delivery Only Contract:
 - 1) Contractor: Agrees to supply and deliver to Owner, free of charge, any required replacement parts that can be readily installed by Owner without special tools.
 - 2) Contractor: Agrees to supply and deliver free of charge, complete replacement door, when defective part or parts cannot be installed without use of special tools.
 - c. For Supply and Install Contract:
 - 1) Contractor: Agrees to supply and install, free of charge, any required replacement parts or complete replacement door.

1.3 PRODUCTS

- A. Doors
 - 1. Doors: Consist of two steel face sheets, wood or steel stiles and rails with full support lock reinforcement.
 - a. Thickness: Nominal 44.4 mm (1-3/4 inch)
 - b. Steel Face: Minimum of 24 gage (0.57 mm) galvanized and bonderized steel.
 - c. Wood Stiles and Rails: Kiln dried clear Ponderosa Pine, Douglas Fir, or equal.
 - d. Embossed Designs: Emboss 24 gage (0.57 mm) doors and 18 gage (1.07 mm) doors to achieve scheduled or indicated designs.
 - 2. Hollow Core Heavy Duty Doors: Fabricated of 18 gage (1.07 mm) minimum steel face sheets, stiles, top and bottom closures.
 - a. Comply with Performance Requirements in this Section.
 - b. Fire Rating: When required, provide B Label, 1-1/2 hour fire rating.
 - 3. Insulated Heavy Duty Doors: Fabricated of 18 gage (1.07 mm) minimum steel face sheets, stiles, top and bottom closures.
 - a. Comply with Performance Requirements in this Section.
 - b. Fire Rating: When required, provide B Label, 1-1/2 hour fire rating.
 - 4. Security Doors: Comply with SDI 100, Models 1, 1A, 2, or 2A, minimum 16 gage (1.35 mm) steel face sheets .
 - a. Comply with Performance Requirements in this Section.
 - b. Fire Rating: When required, provide B Label, 1-1/2 hour fire rating.
 - 5. Hardware Preparation:
 - a. Door System: Facilitate installation of standard cylindrical and/or full mortise locks with multiple point throw if specified.
 - b. 24 gage (0.57 mm) Doors: Prepare to receive three 102 mm (4 inch) full mortise or bun hinges flush with edge of door.
 - c. 18 Gage (1.07 mm) and Heavier Doors: Prepare to receive three 114 mm (4-1/2 inch) full mortise or butt hinges flush with edge of door.
 - 6. Insulated Doors: Solid foam core of polyurethane, or polystyrene.
 - a. Core: Fully adhere to steel face sheets, stiles, rails and lock block and completely fill void.
- B. Frames
 - 1. Wood Frames: Kiln dried Ponderosa Pine, toxic treated, and primed.



2. Steel Frames and/or Adapter Frames: Minimum of 18 gage (1.07 mm) galvanized bonderized steel, pre-drilled and reinforced for hinges as required.
 - a. Shape of Frame: Generally L-shaped.
3. Hollow Core Heavy Duty Door Frames: Fabricated of 16 gage (1.35 mm) minimum thickness.
 - a. When required, provide B Label, 1-1/2 hour fire rating.
4. Insulated Heavy Duty Door Frames: Fabricated of 16 gage (1.35 mm) minimum thickness.
 - a. When required, provide B Label, 1-1/2 hour fire rating.
5. Security Door Frames: Comply with SDI 100, minimum of 14 gage (1.70 mm) galvanized bonderized steel, pre-drilled and reinforced for hinges as required.
 - a. When required, provide B Label, 1-1/2 hour fire rating.
 - b. Comply with Performance Requirements in this Section.
6. Frames: Weatherstripped at head, jambs and threshold.

C. Hardware

1. General: Comply with ANSI/BHMA A156.1 and applicable accessibility regulatory requirements and perform functions for which it was intended.
2. Butts and Hinges: ANSI/BHMA A156.1, as scheduled.
 - a. Install non-rising pins (NRP) on out-swing doors.
 - b. Self Closing: ANSI/BHMA A156.17.
 - c. Security Door Comply with Performance Requirements in this Section.
3. Fire Rate Doors Hardware: Comply with NFPA 80.
 - a. Exit Doors: Comply with NFPA 101 (Life Safety Code) for exit doors, as well as other requirements specified.
 - b. Labeling and Listing: Listed in UL Building Materials Directory.
 - 1) In Lieu of UL Labeling and Listing: Test reports from nationally recognized testing agency showing that hardware has been tested in accordance with UL test methods and conforms to NFPA requirements.
 - c. Install minimum latch throw as specified on label of individual door.
 - d. Provide hardware listed by UL, except where heavier materials, larger sizes or higher grades are specified.
 - e. Closers: ANSI/BHMA A156.4.
4. Lock Sets: As scheduled. Comply with following standards:
 - a. Bored and Preassembled Locks and Latches: ANSI/BHMA A156.2, Grade 2.
 - b. Dead Bolt: ANSI/BHMA A156.5.
 - c. Mortise Locks and Latches: ANSI/BHMA A156.13, Grade 1 or Security Grade, single or multiple throw.
 - d. Interconnected Deadlock and Passage Set: ANSI/BHMA A156.12, Grade 2.
 - e. Cylindrical Lock: Grade 2, cylindrical deadbolt lock/passage set combination.
 - f. Security Door Locksets: ANSI/BHMA A156.13 Security Grade or UL 437 Key locks.
 - 1) Comply with Performance Requirements in this Section.
 - g. Keys: Provide two keys for each lock provided. Provide master keying and keying alike on any locks as directed at no additional charge.
 - h. Locks: Provide with interchangeable cores.
5. Door Viewers: ANSI/BHMA A156.16.

D. Accessories

1. Glazing Materials: Comply with CPSC 16 CFR 1201 or ANSI Z97.1.
 - a. Glass: ASTM C 1036, Type 1, Class 1, Glazing B Quality.
 - 1) Fire Rated Doors: ASTM C 1036, Type 11, Class 1, Glazing Quality, wired glass.
 - b. Tempered Glass: ASTM C 1048, Kind FT. Condition A, Type 1, Class 1, Glazing B Quality.
 - c. Plastic: Extruded polycarbonate clear sheets, minimum 3 mm (0.118 inch) thick with following characteristics:
 - 1) Impact Resistance: ASTM D 256, Method A, 12-18 foot-pound per inch.
 - 2) Elongation/Modulus of Elasticity: ASTM D 638, 110 percent maximum/340,000 PSI.
 - 3) Heat Deflection: ASTM D 648, 132.2 degrees C (270 degrees F) at 264 PSI.



- 4) Abrasion Resistance: Coated on both surfaces to produce abrasion resistance of 3-19 percent maximum haze increase for 500 revolutions of CS-1 OF wheel per ASTM D 1044.
 - d. Insulating Glass Units: HUD UM 82 and ASTM E 774, Class C.
 - 1) Provide insulating glass units in insulated doors and insulated heavy duty doors.
 - e. Glass Thickness: In accordance with AAMA 1002.10 Appendix, minimum 5 mm (3/16 inch).
 - 1) Design Wind Pressures: Determined in accordance with applicable codes and regulations.
 - f. Glass: Labeled to show name of manufacturer and type.
2. Joint Sealants:
- a. Exterior Joint Sealant: AAMA 800, Type 808.3 Exterior Perimeter Sealing Compound.
 - b. Back-up Material: Standard preformed and pre-compressed foam material, round rod or semi-circular type, permanently elastic, mildew resistant, nonmigratory, nonstaining, and compatible with joint substrates and with sealant.
 - 1) Materials impregnated with oil, solvents, or bituminous materials not allowed.
 - 2) Provide type as recommended by sealant manufacturer for particular installation.
 - 3) Material: Neoprene, butyl, polyurethane, vinyl, or polyethylene rod.
 - c. Interior Joint Sealant: ASTM C 834, latex acrylic.
3. Weatherstripping and Thresholds: Comply with FS 00-A-200-9D, Alloy 6063-T-5; ASTM D 2287, Grade as required; MIL-S-6855, Class 11, Grade 40 (Solid neoprene); and MIL-R-6130C, Type 11, Grade C (Sponge neoprene).
- a. Weatherstripping for Doors and Frames: Adjustable types with replaceable contact stops. Types are listed below:
 - 1) Type A1 (for bottom of door with threshold greater than 6 mm (1/4 inch)): Solid neoprene or vinyl strips mounted in extruded aluminum retainers.
 - 2) Type B (for bottom of door with thresholds less than 6 mm (1/4 inch) in height): Curved vinyl strips with extruded aluminum retainers.
 - 3) Type C (for door frame heads and jambs): Extruded aluminum retainer with extruded solid vinyl insert.
 - 4) Type D1 (for door frame heads and jambs): Closed cell sponge neoprene or vinyl strip with leveled edge mounted in extruded aluminum retainer.
 - b. Rain Drips: Extruded aluminum with sufficient projection.
 - c. Fasteners: Cad plated steel, brass plated steel, black oxide plated steel, or stainless steel.
 - 1) Threshold to Concrete: Provide lead expansion shields.
 - 2) Exposed Finish: Match finish of weatherstrip.
- E. Finishes
1. Entry Door System: Clean and free from serious surface blemishes.
 - a. Exposed Surfaces: ASTM A 525 hot dipped galvanized, minimum A40 (or G60) Electrolytic Class B coating weight.
 - b. Primer: Factory final finished including primer meeting performance requirements of ANSI A224.1.
 - c. Finish Coat: One of the following as specified or scheduled:
 - 1) Factory Finished: Electrostatically factory applied baked on enamel finish.
 - a) Color: As selected from manufacturers' list of colors.
 - 2) Field painted under Division 9 Section "Painting."
- F. Source Quality Control
1. Testing: Performed by accredited independent testing laboratory.
 2. Shop Tests:
 - a. Mechanical Properties Tests: ANSI/SDI A151.1, perform on lightest gage frame and leaf.
 - 1) Security Doors: ASTM F 476.
 - 2) Doors with Glass Lites: Mechanical test not required.
 - b. Air Infiltration and Water Resistance Tests: Perform on door with largest glass lite. Retest variations in frame to leaf sealing system.
 - 1) Air Infiltration Tests: ANSI/ISDSI 101, SDI 116, and ASTM E 283.
 - 2) Water Resistance Tests: ANSI/ISDSI 104 and ASTM E 331.



- c. Thermal Performance Tests: Perform on heaviest gage frame and leaf with largest area of glass. Retest variation in thermal design aspects of door such as different insulation, type of thermal break, or type of frame.
 - 1) Thermal Performance Tests: ANSI/ISDSI 107 and SDI 113.
- d. Test Sample Size for Door System: Minimum 914 mm (36 inches) by 1 727 mm (68 inches), complete with hardware and subframe.

1.4 EXECUTION

A. Examination

1. Site Verification of Conditions:
 - a. Field Measurements: Verify field measurements are as indicated on Shop Drawings.
 - b. Existing Conditions: Examine openings before beginning installation.
 - c. Do not proceed with installation until conditions are satisfactory.

B. Preparation

1. Protection: Protect adjacent elements from damage and disfiguration in accordance with Detailed Scope of Work.
 - a. Contractor: Responsible for damage to grounds, plantings, buildings and any other facilities or property caused by construction operations.
 - b. Adequately enclose and protect against weather any interior space where installation is incomplete at end of working day.
 - c. Repair or replace damaged elements in accordance with Detailed Scope of Work.
2. Existing Entry Doors: Remove existing entry doors and debris from site in accordance with Detailed Scope of Work.
3. Prepare existing openings in accordance with ANSI/ISDSI 102, SDI 105, ASTM E 737, manufacturer's recommendations, and approved Shop Drawings.

C. Installation

1. General: Install in accordance with ANSI/ISDSI 102, SDI 105, ASTM E 737, manufacturer's recommendations, and approved Shop Drawings.
 - a. Install doors and frames securely, water tight, straight, plumb and level without distortion.
2. Weatherstripping and Thresholds: Accurately cut, fit, align, and secure to maintain weatherproof seal without hampering operation of door.
 - a. Rain Drips: Install on door heads which are not protected by canopy or soffit.
 - b. Secure thresholds to concrete with stainless screws or equal and lead expansion shields.
 - c. Blocking: Provide as necessary to secure hardware. Prime cut wood surfaces with wood sealer before weatherstripping is installed.
3. Joint Sealants: Apply in accordance with manufacturers recommendations.
 - a. Surfaces to be Sealed: Clean, dry and free of any foreign matter that would degrade adhesion. Remove existing caulking and joint sealants from areas to receive new joint sealant.
 - b. Prime cleaned surfaces in accordance with sealant manufacturer's recommendations.
 - c. Protect surfaces adjacent to joints by masking tape before applying sealant. Remove tape upon finishing sealing work.
 - d. Seal door frames and thresholds where joining other materials on exterior and interior with joint sealant to accomplish weather-tight installation.
 - e. Maximum Width of Sealed Joint: 13 mm (1/2 inch).

D. Adjusting And Cleaning

1. Adjusting: At completion of job, check, adjust, and lubricate hardware as required and leave doors and hardware in proper operating condition.
2. Cleaning: Comply with requirements of Detailed Scope of Work.



-
- a. Clean doors, after installation is completed, to remove foreign matter and surface blemishes.
 - b. Scratched or Abraded Surfaces: Touch-up with rust inhibitor primer and enamel paint compatible with factory finish.

E. Protection

1. Installed Work: Protect doors from damage after installation.

END OF SECTION 08 16 13 00



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SECTION 08 16 13 00a - FIBERGLASS REINFORCED PLASTIC (FRP) DOORS AND FRAMES**1.1 GENERAL****A. Description of Work**

1. This specification covers the furnishing and installation of materials for fiberglass reinforced plastic (FRP) doors and frames. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Fire Rated Fiberglass reinforced Plastic (FRP) Doors certified by Intertek Testing Services for Warnock- Hersey in 45, 60 and 90-minute ratings, meeting all specifications of UL 10(c) fire door test standards. Category A and B.
 - 1) Category A doors are labeled for compliance with IBC Standard (Positive Pressure) and do not require the application of an additional edge sealing system.
 - 2) Category B doors are labeled to require the installation of a listed edge sealing system to meet the requirements of IBC Standard (Positive Pressure). This seal must be installed per the manufacturers instructions and may be factory or field applied.
 - 3) Category B constructed doors, if requested and with certain restrictions, may be provided with an UL 10 (b) label (Negative Pressure) and at a later date can be upgraded to a UL 10 (c) category B label (Positive Pressure) with the application of a listed seal system.
 - b. Fire Rated Fiberglass Resin Transfer Molded Door Frames certified by Intertek Testing Services for Warnock- Hersey in 45, 60 and 90-minute ratings, meeting all specifications of UL 10(c) fire door test standards, Category C.
 - c. Fire Rated Fiberglass reinforced Plastic (FRP) Doors and Fiberglass Resin Transfer Molded Door Frames certified by Intertek Testing Services for Warnock- Hersey in 20, 45, 60 and 90-minute ratings, meeting all specifications of UL 10(b) fire door test standards.

C. Quality Assurance

1. **Manufacturer Qualifications:** A company specialized in the manufacture of fiberglass reinforced plastic (FRP) doors and frames as specified herein with a minimum of 25 years documented experience and with a record of successful in-service performance for the applications as required for this project.
2. **Installer Qualifications:** An experienced installer who has completed fire rated fiberglass door and frame installations similar in material, design, and extent to those indicated and whose work has resulted in construction with a record of successful in-service performance.
3. **Source Limitations:** Obtain fiberglass reinforced plastic doors and frames through one source fabricated from a single manufacturer, including fire rated fiberglass frames.
4. **Source Limitations:** Hardware and accessories for all FRP doors as specified in Division 08 Section "Door Hardware" should be provided and installed by the fiberglass door and frame manufacturer.
5. **Source Limitations:** Glass for windows in doors shall be furnished and installed by door and frame manufacturer in accordance with related section, Division 08 Section "Glazing".

D. Submittals

1. Product technical data including:
 - a. Acknowledgment that products submitted meet requirements of standards referenced
 - b. Manufacturer shall provide certificate of compliance with current local and federal regulations as it applies to the manufacturing process.
 - c. Manufacturer's installation instructions.



- d. Schedule of doors and frames indicating the specific reference numbers as used on drawings, door type, frame type, size, handing and applicable hardware.
- e. Details of core and edge construction. Include factory-construction specifications.
- f. Certification of manufacturer's qualifications.
2. Submittal drawings for customer approval shall be submitted prior to manufacture and will include the following information and formatting.
 - a. Summary door schedule indicating the specific reference numbers as used on owner's drawings, with columns noting door type, frame type, size, handing, accessories and hardware.
 - b. A drawing depicting front and rear door elevations showing hardware with bill of material for each door.
 - c. Drawing showing dimensional location of each hardware item and size of each door.
 - d. Individual part drawing and specifications for each hardware item and FRP part or product.
 - e. Construction and mounting detail for each frame type.
3. Samples:
 - a. Provide one 21 x 18 inch completely assembled (hinged) door and frame corner section, with faces and edges representing typical color and finish. One edge should be exposed for view of interior door and frame composition.
4. Operation and Maintenance Manuals:
 - a. Include recommended methods and frequency for maintaining optimum condition of fiberglass doors and frames under anticipated traffic and use conditions.
 - b. Include one set of final as built drawings with the same requirements as mentioned above.
 - c. Include certificate of warranty for door and frame listing specific door registration numbers.
 - d. Include hardware data sheets and hardware manufacturer's warranties.

E. Delivery, Storage, And Handling

1. Each door and frame should be delivered individually crated for protection from damage in cardboard containers, clearly marked with project information, door location, specific reference number as shown on drawings, and shipping information. Each crate should contain all fasteners necessary for installation as well as complete installation instructions.
2. Doors should be stored in the original container out of inclement weather for protection against the elements.
3. Handle doors pursuant to the manufacturer's recommendations as posted on outside of crate.

F. Warranty

1. Warranty all fiberglass doors and frames for a period of 25 years against failure due to corrosion. Additionally, warranty all fiberglass doors and frames on materials and workmanship for a period of 10 years, including warp, separation or delamination, and expansion of the core.

1.2 PRODUCTS

A. Acceptable Manufacturers: Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Chem-Pruf Door Co., Ltd., P.O. Box 4560, Brownsville, Texas 78523 Phone: 1-800-444-6924, Fax: 956-544-7943, Website: www.chem-pruf.com
2. Substitutions may be considered, provided manufacturer can comply with the specifications as written herein. Requests for substitution must be submitted in writing no less than 10 days prior to bid date.

B. FRP Doors

1. Fire rated Fiberglass reinforced Plastic (FRP) Doors certified by Intertek Testing Services for Warnock-Hersey in 20, 45, 60 and 90 minute ratings meeting all specifications of UL 10(c) and UL 10(b) fire door test standards.



2. Doors shall be made of fiberglass reinforced plastic (FRP) using chemically proven fire retardant resins resistant to contaminants typically found in the environment for which these specifications are written. Doors shall be 1-3/4 inch thick and of flush construction, having no seams or cracks. All doors up to 4'-0 x 8'-0 shall have equal diagonal measurements with a maximum tolerance of +/-1/32 inch.
3. Door Plates shall be molded in one continuous piece, starting with a 25-mil gelcoat of the color specified, integrally molded with at least two layers of 1.5 ounce per square foot fiberglass. This will yield a plate ratio of 30/70 glass to resin.
4. Stiles and Rails Core shall be banded with firestop per factory drawings.
5. Core material shall be fire resistant mineral core placed within band structure allowing no voids within.
6. Finish of door and frame shall be identical in color and texture. At time of manufacture, 25 mil of resin rich gelcoat must be integrally molded into both the door and frame. Secondary painting to achieve color is not acceptable.
7. Window openings shall be provided for at time of manufacture and shall be completely sealed so that the interior of the door is not exposed to the environment. Window kits shall be fire rated per U.L. for rating of opening and function.

C. Frames

1. Frames shall be fiberglass and manufactured using the resin transfer method in closed rigid molds to assure uniformity in color and size. Beginning with a minimum 25-mil gel coat and a minimum of two layers continuous strand fiberglass mat saturated with fire retardant resin, the frame will be of one-piece construction with molded stop. All frame profiles shall have a core of firestop and mineral core. Frames must be fiberglass. Frames of dissimilar materials, such as metal or stainless steel will not be accepted.
2. Finish of frame shall be identical in color and texture to the door. 25-mil resin rich gel coat will be integrally molded into the frame at time of manufacture. Secondary painting to achieve color is not acceptable.
3. Jamb/Header connection shall be coped by CNC for tight fit.
4. Internal Reinforcement shall be continuous within the structure to allow for mounting of specified hardware.
5. Mortises for hardware shall be accurately machined by CNC to hold dimensions in all three axis.
6. Hinge pockets shall be accurately machined by CNC to facilitate heavy-duty hinges at all hinge locations, using spacers when standard weight hinges are used.

D. Hardware

1. See Division 08 Section "Door Hardware".
2. Due to the special nature of the material in this section, all related hardware as specified must be furnished and installed by the door and frame manufacturer.

1.3 EXECUTION

A. Installation Conditions

1. Verification of Conditions
 - a. Openings are correctly prepared to receive doors and frames.
 - b. Openings are correct size and depth in accordance with shop drawings or submittals.
2. Installer's Examination
 - a. Have the installer examine conditions under which construction activities of this section are to be performed and submit a written report if conditions are unacceptable.
 - b. Transmit two copies of the installer's report to the architect within 24 hours of receipt.
 - c. Beginning construction activities of this section before unacceptable conditions have been corrected is prohibited.

B. Installation



1. Install door-opening assemblies in accordance with shop drawings and manufacturer's printed installation instructions, using installation methods and materials specified in installation instructions.
 2. Field alteration of doors or frames to accommodate field conditions is strictly prohibited.
 3. Site tolerances: Maintain plumb and level tolerance specified in manufacturers printed installation instructions.
 4. Fire labeled doors and frames must be installed in strict accordance with manufacturer's instructions and the latest revision of NFPA 80.
 5. UL 10 (c) Category B doors require field-applied seal per manufacture's instructions.
- C. Adjusting
1. Adjust doors in accordance with door manufacturer's maintenance instructions to swing open and shut without binding and to remain in place at any angle without being moved by gravitational influence.
 2. Adjust door hardware to operate correctly in accordance with hardware manufacturer's maintenance instructions.
- D. Cleaning
1. Clean surfaces of door opening assemblies and exposed door hardware in accordance with respective manufacturer's maintenance instructions.
- E. Protection Of Installed Products
1. Protect door opening assemblies and door hardware from damage by subsequent construction activities until final inspection.

END OF SECTION 08 16 13 00a



Task	Specification	Specification Description
08 16 13 00	08 01 11 00	Steel Doors And Frames
08 16 13 00	08 12 13 13	Stainless Steel Doors And Frames
08 17 23 00	06 48 13 00	Wood Doors
08 17 23 00	08 05 13 00	Flush Wood Doors



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SECTION 08 31 13 00 - ACCESS DOORS AND FRAMES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of material for access doors and frames. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Access doors and frames for walls and ceilings.
 - b. Floor access doors and frames.

C. Submittals

1. Product Data: For each type of access door and frame indicated.
2. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
3. Samples: For each door face material in specified finish.
4. Schedule: Types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

D. Quality Assurance

1. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics per the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - a. NFPA 252 or UL 10B for vertical access doors and frames.
 - b. ASTM E 119 or UL 263 for horizontal access doors and frames.

1.2 PRODUCTS

A. Steel Materials

1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
 - a. ASTM A 123/A 123M, for galvanizing steel and iron products.
 - b. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
2. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
 - a. ASTM A 123/A 123M, for galvanizing steel and iron products
 - b. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
3. Steel Sheet: Uncoated or electrolytic zinc-coated, ASTM A 591/A 591M with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.
4. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS) with A60 (ZF180) zinc-iron-alloy (galvannealed) coating or G60 (Z180) mill-phosphatized zinc coating.
5. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - a. Surface Preparation for Steel Sheet: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
 - b. Surface Preparation for Metallic-Coated Steel Sheet: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds,



mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.

- 1) Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
 - c. Factory-Primed Finish: Apply shop primer immediately after cleaning and pretreating.
 - d. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).
 - e. Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils (0.04 mm). Prepare, treat, and coat metal to comply with resin manufacturer's written instructions.
6. Drywall Beads: Edge trim formed from 0.0299-inch (0.76-mm) zinc-coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board.
 7. Plaster Beads: Casing bead formed from 0.0299-inch (0.76-mm) zinc-coated steel sheet with flange formed out of expanded metal lath and in size to suit thickness of plaster.

B. Stainless-Steel Materials

1. Rolled-Stainless-Steel Floor Plate: ASTM A 793, manufacturer's standard finish.
2. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304 **OR** 316 **OR** Type 317LMN **OR** 904L, **as directed**. Remove tool and die marks and stretch lines or blend into finish.
 - a. Finish: Directional Satin Finish, No. 4 **OR** Manufacturer's standard, **as directed**.

C. Aluminum Materials

1. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T6, mill finish.
2. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6, mill finish.
3. Aluminum Sheet: ASTM B 209 (ASTM B 209M).
 - a. Mill Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).
 - b. Anodic Finish: Class II, clear anodic coating complying with AAMA 611 **OR** Class I, clear anodic coating complying with AAMA 611, **as directed**.
 - c. Baked-Enamel Finish: Manufacturer's standard.

D. Access Doors And Frames For Walls And Ceilings

1. Flush Access Doors and Frames with Exposed Trim: Fabricated from steel **OR** metallic-coated steel **OR** stainless-steel, **as directed**, sheet.
 - a. Locations: Wall **OR** Ceiling **OR** Wall and ceiling, **as directed**, surfaces.
 - b. Door: Minimum 0.060-inch- (1.5-mm-), **as directed**, thick sheet metal, set flush with exposed face flange of frame.
 - c. Frame: Minimum 0.060-inch- (1.5-mm-), **as directed**, thick sheet metal with 1-inch- (25-mm-) **OR** 1-1/4-inch- (32-mm-), **as directed**, wide, surface-mounted trim.
 - d. Hinges: Spring-loaded, concealed-pin type **OR** Continuous piano, **as directed**.
 - e. Latch: Cam latch **OR** Slam latch **OR** Self-latching bolt, **as directed**, operated by screwdriver **OR** knurled knob **OR** hex head wrench **OR** pinned hex head wrench **OR** spanner head wrench **OR** flush key **OR** ring turn, **as directed**, with interior release.
 - f. Lock: Cylinder **OR** Mortise cylinder, **as directed**.
 - 1) Lock Preparation: Prepare door panel to accept cylinder specified in Division 08 Section "Door Hardware".
2. Flush Access Doors and Trimless Frames: Fabricated from steel **OR** metallic-coated steel **OR** stainless-steel, **as directed**, sheet.
 - a. Locations: Wall **OR** Ceiling **OR** Wall and ceiling, **as directed**, surfaces.
 - b. Door: Minimum 0.060-inch- (1.5-mm-), **as directed**, thick sheet metal, set flush with surrounding finish surfaces.



- c. Frame: Minimum 0.060-inch- (1.5-mm-), **as directed**, thick sheet metal with drywall **OR** plaster, **as directed**, bead flange.
 - d. Hinges: Spring-loaded, concealed-pin type **OR** Continuous piano, **as directed**.
 - e. Latch: Cam latch **OR** Slam latch **OR** Self-latching bolt, **as directed**, operated by screwdriver **OR** knurled knob **OR** hex head wrench **OR** pinned hex head wrench **OR** spanner head wrench **OR** flush key **OR** ring turn, **as directed**, with interior release.
 - f. Lock: Cylinder **OR** Mortise cylinder, **as directed**.
 - 1) Lock Preparation: Prepare door panel to accept cylinder specified in Division 08 Section "Door Hardware".
3. Recessed Access Doors and Trimless Frames: Fabricated from steel **OR** metallic-coated steel **OR** stainless-steel, **as directed**, sheet.
- a. Locations: Wall **OR** Ceiling **OR** Wall and ceiling, **as directed**, surfaces.
 - b. Door: Minimum 0.060-inch- (1.5-mm-), **as directed**, thick sheet metal in the form of a pan recessed 5/8 inch (16 mm) **OR** 1 inch (25 mm), **as directed**, for gypsum board **OR** plaster **OR** acoustical tile, **as directed**, infill.
 - c. Frame: Minimum 0.060-inch- (1.5-mm-), **as directed**, thick sheet metal with drywall bead for gypsum board surfaces **OR** with plaster bead for plaster surfaces **OR** designed for insertion into acoustical tile ceiling, **as directed**.
 - d. Hinges: Spring-loaded, concealed-pin type **OR** Concealed pivoting rod hinge, **as directed**.
 - e. Latch: Cam latch **OR** Slam latch **OR** Self-latching bolt, **as directed**, operated by screwdriver **OR** knurled knob **OR** hex head wrench **OR** pinned hex head wrench **OR** spanner head wrench **OR** flush key **OR** ring turn, **as directed**, with interior release.
 - f. Lock: Cylinder **OR** Mortise cylinder, **as directed**.
 - 1) Lock Preparation: Prepare door panel to accept cylinder specified in Division 08 Section "Door Hardware".
4. Aluminum Flush Access Doors and Frames with Exposed Trim: Fabricated from aluminum sheet and extruded-aluminum shapes.
- a. Locations: Wall **OR** Ceiling **OR** Wall and ceiling, **as directed**, surfaces.
 - b. Door: Minimum 0.080-inch- (2.0-mm-), **as directed**, thick aluminum sheet.
 - c. Frame: Minimum 0.060-inch- (1.5-mm-), **as directed**, thick extruded aluminum with 1-1/4-inch- (32-mm-) wide rolled flange.
 - d. Hinges: Concealed continuous aluminum.
 - e. Latch: Screwdriver-operated cam latch.
5. Lightweight Flush Access Doors and Frames with Exposed Trim: Fabricated from lightweight metal.
- a. Locations: Wall **OR** Ceiling **OR** Wall and ceiling, **as directed**, surfaces.
 - b. Door: Minimum 0.018-inch- (0.45-mm-) thick steel sheet.
 - c. Frame: Minimum 0.045-inch- (1.1-mm-) thick extruded aluminum with 1-1/4-inch- (32-mm-) wide rolled flange.
 - d. Hinges: Continuous piano.
 - e. Latch: Screwdriver-operated cam latch.
6. Plastic Flush Access Doors and Frames with Exposed Trim: Fabricated from 1/8-inch- (3.2-mm-) thick high-impact plastic with UV stabilizer.
- a. Locations: Wall **OR** Ceiling **OR** Wall and ceiling, **as directed**, surfaces.
 - b. Door: Flush to frame with rounded corners.
 - c. Frame: 1 piece, 3/4 inch (19 mm) deep.
 - d. Latch: Snap latch.
 - e. Finish: White with textured exposed surfaces.
7. Exterior Flush Access Doors and Frames with Exposed Trim: Weatherproof with extruded door gasket.
- a. Locations: Wall **OR** Ceiling **OR** Wall and ceiling, **as directed**, surfaces.
 - b. Door: Minimum 0.040-inch- (1.0-mm-), **as directed**, thick, metallic-coated steel sheet; flush panel construction with manufacturer's standard 2-inch- (50-mm-) thick fiberglass insulation.
 - c. Frame: Minimum 0.060-inch- (1.5-mm-), **as directed**, thick extruded aluminum.
 - d. Hinges: Continuous piano, zinc plated.



- e. Lock: Dual-action handles with key lock.
8. Fire-Rated, Insulated, Flush Access Doors and Frames with Exposed Trim: Fabricated from steel **OR** metallic-coated steel **OR** stainless-steel, **as directed**, sheet.
- Locations: Wall **OR** Ceiling **OR** Wall and ceiling, **as directed**, surfaces.
 - Fire-Resistance Rating: Not less than that indicated **OR** that of adjacent construction **OR** 45 minutes **OR** 1 hour **OR** 1-1/2 hours **OR** 2 hours **OR** 3 hours, **as directed**.
 - Temperature Rise Rating: 250 deg F (139 deg C) at the end of 30 minutes.
 - Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.036 inch (0.9 mm), **as directed**.
 - Frame: Minimum 0.060-inch- (1.5-mm-), **as directed**, thick sheet metal with 1-inch- (25-mm-), **as directed**, wide, surface-mounted trim.
 - Hinges: Concealed-pin type **OR** Continuous piano, **as directed**.
 - Automatic Closer: Spring type.
 - Latch: Self-latching device operated by knurled knob **OR** flush key **OR** ring turn, **as directed**, with interior release.
 - Lock: Self-latching device with cylinder **OR** mortise cylinder, **as directed**, lock.
 - Lock Preparation: Prepare door panel to accept cylinder specified in Division 08 Section "Door Hardware".
9. Fire-Rated, Insulated, Flush Access Doors and Trimless Frames: Fabricated from steel **OR** metallic-coated steel **OR** stainless-steel, **as directed**, sheet.
- Locations: Wall **OR** Ceiling **OR** Wall and ceiling, **as directed**, surfaces.
 - Fire-Resistance Rating: Not less than that indicated **OR** that of adjacent construction **OR** 45 minutes **OR** 1 hour **OR** 1-1/2 hours **OR** 2 hours **OR** 3 hours, **as directed**.
 - Temperature Rise Rating: 250 deg F (139 deg C) at the end of 30 minutes.
 - Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.036 inch (0.9 mm), **as directed**.
 - Frame: Minimum 0.060-inch- (1.5-mm-), **as directed**, thick sheet metal with drywall **OR** plaster, **as directed**, bead.
 - Hinges: Concealed-pin type **OR** Continuous piano, **as directed**.
 - Automatic Closer: Spring type.
 - Latch: Self-latching device operated by knurled knob **OR** flush key **OR** ring turn, **as directed**, with interior release.
 - Lock: Self-latching device with cylinder **OR** mortise cylinder, **as directed**, lock.
 - Lock Preparation: Prepare door panel to accept cylinder specified in Division 08 Section "Door Hardware".
10. Fire Rated, Uninsulated, Flush Access Doors and Frames with Exposed Trim: Fabricated from steel **OR** metallic-coated steel **OR** stainless-steel, **as directed**, sheet.
- Locations: Wall surfaces.
 - Fire-Resistance Rating: Not less than that indicated **OR** that of adjacent construction **OR** 45 minutes **OR** 1 hour **OR** 1-1/2 hours **OR** 2 hours **OR** 3 hours, **as directed**.
 - Door: Minimum 0.060-inch- (1.5-mm-), **as directed**, thick sheet metal, flush construction.
 - Frame: Minimum 0.060-inch- (1.5-mm-), **as directed**, thick sheet metal with 1-inch- (25-mm-) **OR** 1-1/4-inch- (32-mm-), **as directed**, wide, surface-mounted trim.
 - Hinges: Concealed-pin type **OR** Continuous piano, **as directed**.
 - Automatic Closer: Spring type.
 - Latch: Self-latching device operated by knurled knob **OR** flush key **OR** ring turn, **as directed**, with interior release.
 - Lock: Self-latching device with cylinder **OR** mortise cylinder, **as directed**, lock.
 - Lock Preparation: Prepare door panel to accept cylinder specified in Division 08 Section "Door Hardware".
11. Medium-Security, Flush Access Doors and Frames with Exposed Trim: Fabricated from steel **OR** metallic-coated steel **OR** stainless-steel, **as directed**, sheet.
- Locations: Wall **OR** Ceiling **OR** Wall and ceiling, **as directed**, surfaces.
 - Door: Minimum 0.105-inch- (2.7-mm-) thick sheet metal, flush construction.



- c. Frame: Minimum 0.105-inch- (2.7-mm-) thick sheet metal with 1-inch- (25-mm-) **OR** 1-1/4-inch- (32-mm-), **as directed**, wide, surface-mounted trim.
 - d. Hinges: Concealed continuous piano.
 - e. Lock: Detention.
 - 1) Lock Preparation: Prepare door panel to accept cylinder specified in Division 08 Section "Door Hardware".
12. Medium-Security, Flush Access Doors with Trimless Frames: Fabricated from steel **OR** metallic-coated steel **OR** stainless-steel, **as directed**, sheet.
- a. Locations: Wall **OR** Ceiling **OR** Wall and ceiling, **as directed**, surfaces.
 - b. Door: Minimum 0.105-inch- (2.7-mm-) thick sheet metal, flush construction.
 - c. Frame: Minimum 0.105-inch- (2.7-mm-) thick sheet metal with drywall **OR** plaster, **as directed**, bead.
 - d. Hinges: Concealed continuous piano.
 - e. Lock: Detention.
 - 1) Lock Preparation: Prepare door panel to accept cylinder specified in Division 08 Section "Door Hardware".
13. High-Security, Flush Access Doors and Frames with Exposed Trim: Fabricated from steel **OR** metallic-coated steel **OR** stainless-steel, **as directed**, sheet and angles.
- a. Locations: Wall **OR** Ceiling **OR** Wall and ceiling, **as directed**, surfaces.
 - b. Door: Minimum 0.135-inch- (3.4-mm-) thick sheet metal, flush construction.
 - c. Frame: Minimum 3/16-by-2-by-2-inch (4.7-by-50-by-50-mm) angle welded with joints ground smooth.
 - d. Hinges: Heavy-duty steel welded to door and frame.
 - e. Lock: Heavy-duty, detention deadbolt.
 - 1) Lock Preparation: Prepare door panel to accept cylinder specified in Division 08 Section "Door Hardware".
14. Maximum-Security, Flush Access Doors and Frames with Exposed Trim: Fabricated from steel **OR** metallic-coated steel **OR** stainless-steel, **as directed**, sheet and angles.
- a. Locations: Wall **OR** Ceiling **OR** Wall and ceiling, **as directed**, surfaces.
 - b. Door: Minimum 0.180-inch- (4.55-mm-) thick sheet metal, flush construction.
 - c. Frame: Minimum 3/16-by-2-by-2-by-3-inch (4.7-by-50-by-50-by-76-mm) angle welded with joints ground smooth.
 - d. Hinges: Heavy-duty steel welded to door and frame.
 - e. Lock: Heavy-duty detention deadbolt.
 - 1) Lock Preparation: Prepare door panel to accept cylinder specified in Division 08 Section "Door Hardware".
15. Fire-Rated, Insulated, Medium-Security, Flush Access Doors and Frames with Exposed Trim: Fabricated from steel **OR** metallic-coated steel **OR** stainless-steel, **as directed**, sheet.
- a. Locations: Wall surfaces.
 - b. Fire-Resistance Rating: Not less than that indicated **OR** that of adjacent construction **OR** 45 minutes **OR** 1 hour **OR** 1-1/2 hours **OR** 2 hours **OR** 3 hours, **as directed**.
 - c. Temperature Rise Rating: 250 deg F (139 deg C) at the end of 30 minutes.
 - d. Door: Flush panel with a core of 2-inch- (50-mm-) thick, mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.075 inch (1.9 mm).
 - e. Frame: Minimum 0.060-inch- (1.5-mm-) thick sheet metal with 1-inch- (25-mm-) **OR** 1-1/4-inch- (32-mm-), **as directed**, wide, surface-mounted trim.
 - f. Hinges: Concealed-pin type **OR** Continuous piano, **as directed**.
 - g. Automatic Closer: Spring type.
 - h. Lock: Self-latching device with detention lock.
 - 1) Lock Preparation: Prepare door panel to accept cylinder specified in Division 08 Section "Door Hardware".
16. Fire-Rated, Insulated, Medium-Security, Flush Access Doors with Trimless Frames: Fabricated from steel **OR** metallic-coated steel **OR** stainless-steel, **as directed**, sheet.
- a. Locations: Wall surfaces.
 - b. Fire-Resistance Rating: Not less than that indicated **OR** that of adjacent construction **OR** 45 minutes **OR** 1 hour **OR** 1-1/2 hours **OR** 2 hours **OR** 3 hours, **as directed**.



- c. Temperature Rise Rating: 250 deg F (139 deg C) at the end of 30 minutes.
- d. Door: Flush panel with a core of 2-inch- (50-mm-) thick, mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.075 inch (1.9 mm).
- e. Frame: Minimum 0.060-inch- (1.5-mm-) thick sheet metal with drywall **OR** plaster, **as directed**, bead.
- f. Hinges: Concealed-pin type **OR** Continuous piano, **as directed**.
- g. Automatic Closer: Spring type.
- h. Lock: Self-latching device with detention lock.
 - 1) Lock Preparation: Prepare door panel to accept cylinder specified in Division 08 Section "Door Hardware".

E. Floor Access Doors And Frames

1. Floor Doors, General: Equip each door with adjustable counterbalancing springs, heavy-duty hold-open arm that automatically locks door open at 90 degrees, release handle with red vinyl grip that allows for one-handed closure, and recessed lift handle.
2. Aluminum Floor Door: Single **OR** Double, **as directed**, -leaf opening. Extruded-aluminum angle frame with 1/4-inch- (6.4-mm-) thick, diamond-pattern, aluminum tread plate door; nonwatertight; loading capacity to support 150-lbf/sq. ft. (7.2-kN/sq. m) pedestrian live load **OR** 300-lbf/sq. ft. (14.4-kN/sq. m) pedestrian live load **OR** AASHTO H20 concentrated wheel load, without impact, **as directed**.
3. Watertight Aluminum Floor Door: Single **OR** Double, **as directed**, -leaf opening. Extruded-aluminum gutter frame with NPS 1-1/2 (DN 40) drainage coupling and 1/4-inch- (6.4-mm-) thick, diamond-pattern, aluminum tread plate door; watertight; loading capacity to support 150-lbf/sq. ft. (7.2-kN/sq. m) pedestrian live load **OR** 300-lbf/sq. ft. (14.4-kN/sq. m) pedestrian live load **OR** AASHTO H20 concentrated wheel load, without impact, **as directed**.
4. Steel Angle-Frame Floor Door: Single **OR** Double, **as directed**, -leaf opening. Prime-painted structural **OR** Galvanized structural **OR** Stainless, **as directed**, -steel frame with 3/16- or 1/4-inch- (4.8- or 6.4-mm-) **OR** 3/16-inch- (4.8-mm-) **OR** 1/4-inch- (6.4-mm-), **as directed**, thick, diamond-pattern, prime-painted structural **OR** galvanized structural **OR** stainless, **as directed**, -steel tread plate door; nonwatertight; loading capacity to support 150-lbf/sq. ft. (7.2-kN/sq. m) pedestrian live load **OR** 300-lbf/sq. ft. (14.4-kN/sq. m) pedestrian live load **OR** AASHTO H20 concentrated wheel, **as directed**, load.
 - a. Fire-Resistance Rating: Not less than that indicated **OR** that of adjacent construction **OR** 45 minutes **OR** 1 hour **OR** 1-1/2 hours **OR** 2 hours **OR** 3 hours, **as directed**.
 - b. Finish painted in yellow with wording "FIRE DOOR - DO NOT STORE MATERIALS ON SURFACE."
5. Watertight Steel Gutter-Frame Floor Door: Single **OR** Double, **as directed**, -leaf opening. Prime-painted structural **OR** Galvanized structural **OR** Stainless, **as directed**, -steel channel frame forming gutter with NPS 1-1/2 (DN 40) drainage coupling and 3/16- or 1/4-inch- (4.8- or 6.4-mm-) **OR** 3/16-inch- (4.8-mm-) **OR** 1/4-inch- (6.4-mm-), **as directed**, thick, diamond-pattern, prime-painted structural **OR** galvanized structural **OR** stainless, **as directed**, -steel tread plate door; watertight; loading capacity to support 150-lbf/sq. ft. (7.2-kN/sq. m) pedestrian live load **OR** 300-lbf/sq. ft. (14.4-kN/sq. m) pedestrian live load **OR** AASHTO H20 concentrated wheel, **as directed**, load.
 - a. Fire-Resistance Rating: Not less than that indicated **OR** that of adjacent construction **OR** 45 minutes **OR** 1 hour **OR** 1-1/2 hours **OR** 2 hours **OR** 3 hours, **as directed**.
 - b. Finish painted in yellow with wording "FIRE DOOR - DO NOT STORE MATERIALS ON SURFACE."
6. Hardware: Provide the following:
 - a. Hinges: Heavy-duty, zinc-coated steel **OR** aluminum **OR** stainless-steel **OR** brass, **as directed**, butt hinges with stainless-steel pins.
 - b. Latch: Stainless-steel slam latch.
 - c. Lock: Staple for a padlock **OR** Recessed hasp **OR** Keyed deadlock bolt **OR** Hasp and staple, **as directed**.



- d. Hardware Material: Manufacturer's standard **OR** Stainless steel, including latch and lifting mechanism assemblies, hold-open arms, and all brackets, hinges, pins, and fasteners, **as directed**.
 7. Insulation: Fiberglass **OR** Urethane, **as directed**, with liner pan.
 8. Safety Accessories: Safety chains **OR** net **OR** railing, **as directed**.
- F. Fabrication
1. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
 2. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
 3. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.
 4. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling.
 5. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
 - a. For cylinder lock, furnish two keys per lock and key all locks alike.
 - b. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.
 6. Extruded Aluminum: After fabrication, apply manufacturer's standard protective coating on aluminum that will come in contact with concrete.

1.3 EXECUTION

- A. Installation
1. Comply with manufacturer's written instructions for installing access doors and frames.
 2. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.
 3. Install doors flush with adjacent finish surfaces or recessed to receive finish material.
- B. Adjusting And Cleaning
1. Adjust doors and hardware after installation for proper operation.
 2. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 08 31 13 00



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SECTION 08 32 13 00 - SLIDING ALUMINUM-FRAMED GLASS DOORS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of material for sliding aluminum-framed glass doors. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes sliding aluminum-framed glass doors for exterior locations.

C. Performance Requirements

1. General: Provide sliding aluminum-framed glass doors capable of complying with performance requirements indicated, based on testing manufacturer's sliding doors that are representative of those specified, and that are of minimum test size indicated below:
 - a. Size required by AAMA/WDMA/CSA 101/I.S.2/A440 for gateway performance **OR** optional performance grade **OR** gateway performance for both gateway performance and optional performance grade, **as directed**.
OR
Size indicated on Drawings **OR** in a schedule, **as directed**.
2. Structural Performance: Provide sliding aluminum-framed glass doors capable of withstanding the effects of the following loads, based on testing units representative of those indicated for Project that pass AAMA/WDMA/CSA 101/I.S.2/A440, Uniform Load Structural Test:
 - a. Design Wind Loads: Determine design wind loads under conditions indicated according to ASCE/SEI 7.
 - 1) Basic Wind Speed: 85 mph (38 m/s) **OR** 90 mph (40 m/s), **as directed**.
 - 2) Importance Factor.
 - 3) Exposure Category: **B OR C OR D, as directed**.
 - b. Deflection Limits: Design glass framing system to limit lateral deflections of glass edges to less than 1/175 of glass-edge length or 3/4 inch (19 mm), whichever is less, at design pressure based on testing performed according to AAMA/WDMA/CSA 101/I.S.2/A440, Uniform Load Deflection Test, or structural computations.
3. Windborne-Debris Resistance: Provide sliding aluminum-framed glass doors capable of resisting impact from windborne debris, based on the pass/fail criteria as determined from testing sliding aluminum-frames glass doors identical to those specified, according to ASTM E 1886 and testing information in ASTM E 1996 **OR** AAMA 506, **as directed**, and requirements of authorities having jurisdiction.
4. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

D. Submittals

1. Product Data: For each type of product indicated. Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions.
2. Shop Drawings: For sliding aluminum-framed glass doors. Include plans, elevations, sections, details, hardware, attachments to other work, operational clearances, and the following:
 - a. Mullion details for fenestration combinations including reinforcement and stiffeners.
 - b. Joinery details.
 - c. Expansion provisions.



- d. Flashing and drainage details.
- e. Weather-stripping details.
- f. Thermal-break details.
- g. Glazing details.
- h. Accessories.
3. Samples: For sliding aluminum-framed glass doors and components required, prepared on Samples of size indicated below:
 - a. Main Framing Member: 12-inch- (300-mm-) long section with weather stripping, **as directed**, glazing bead and factory-applied color finish.
 - b. Hardware: Full-size units with factory-applied finish.
4. Delegated-Design Submittal: For sliding aluminum-framed glass doors indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation and used to determine the following:
 - a. Structural test pressures and design pressures from wind loads indicated.
 - b. Deflection limitations of glass framing systems.
5. Qualification Data: For qualified Installer, manufacturer, professional engineer and testing agency.
6. Product Test Reports: Based on evaluation of comprehensive tests performed within the last four years by a qualified testing agency, for each class, grade, and size of sliding aluminum-framed glass door. Test results based on use of downsized test doors will not be accepted, **as directed**.
7. Field quality-control reports.
8. Maintenance Data: For finishes, weather stripping, operable panels, and operating hardware to include in maintenance manuals.
9. Warranty: Sample of special warranty.

E. Quality Assurance

1. Manufacturer Qualifications: A manufacturer capable of fabricating sliding aluminum-framed glass doors that meet or exceed performance requirements indicated and of documenting this performance by inclusion in lists and by labels, test reports, and calculations.
 2. Installer Qualifications: An installer acceptable to sliding door manufacturer for installation of units required for this Project.
 - a. Installer's responsibilities include providing professional engineering services needed to assume engineering responsibility including preparation of data for sliding aluminum-framed glass doors, including Shop Drawings and Designated-Design Submittal, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
 3. Source Limitations: Obtain sliding aluminum-framed glass doors from single source from single manufacturer.
 4. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of sliding aluminum-framed glass doors. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.
- OR**
- Product Options: Drawings indicate size, profiles, and dimensional requirements of sliding aluminum-framed glass doors and are based on the specific system indicated. Do not modify size and dimensional requirements.
- a. Do not modify intended aesthetic effects, as judged solely by the Owner, except with the Owner's approval. If modifications are proposed, submit comprehensive explanatory data to the Owner for review.
5. Fenestration Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440, "Standard/Specification for Windows, Doors, and Unit Skylights," for minimum standards of performance, materials, components, accessories, and fabrication. Comply with more stringent requirements if indicated.



- a. Provide AAMA **OR** WDMA, **as directed**, -certified, sliding aluminum-framed glass doors with an attached label.
 6. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201.
 - a. Subject to compliance with requirements, permanently mark safety glass with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction.
 7. Glazing Publications: Comply with published recommendations of glass manufacturers and with GANA's "Glazing Manual" unless more stringent requirements are indicated.
 8. Preinstallation Conference: Conduct conference at Project site.
- F. Project Conditions
1. Field Measurements: Verify actual dimensions of sliding aluminum-framed glass door openings by field measurements before fabrication.
- G. Warranty
1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of sliding aluminum-framed glass doors that fail in materials or workmanship within specified warranty period.
 - a. Failures include, but are not limited to, the following:
 - 1) Failure to meet performance requirements.
 - 2) Structural failures including excessive deflection.
 - 3) Water leakage or air infiltration.
 - 4) Faulty operation of movable sash and hardware.
 - 5) Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 6) Deterioration of insulating glass and laminated glass as defined in Division 8 Section "Glazing."
 - b. Warranty Period:
 - 1) Sliding Door: Three **OR** Five, **as directed**, years from date of Final Completion.
 - 2) Glazing: 10 **OR** 20, **as directed**, years from date of Final Completion.
 - 3) Metal Finish: Five **OR** 10 **OR** 15, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Materials

1. Aluminum Extrusions: Provide alloy and temper recommended by sliding aluminum-framed glass door manufacturer for strength, corrosion resistance, and application of required finish. Comply with AAMA/WDMA/CSA 101/I.S.2/A440.
2. Fasteners: Provide fasteners of aluminum, nonmagnetic stainless steel, or other materials warranted by manufacturer to be noncorrosive for SC 3 severe service conditions and compatible with members, trim, hardware, anchors, and other components of sliding aluminum-framed glass doors. Comply with AAMA/WDMA/CSA 101/I.S.2/A440.
 - a. Exposed Fasteners: Unless unavoidable for applying hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.
3. Anchors, Clips, and Accessories: Provide anchors, clips, and accessories of aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron for sliding aluminum-framed glass doors, complying with ASTM B 456 or ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.
4. Reinforcing Members: Provide aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel reinforcing members that are noncorrosive for SC 3 severe service conditions and that comply with AAMA/WDMA/CSA 101/I.S.2/A440; provide sufficient strength to withstand design pressure indicated.



5. Compression-Type Weather Stripping: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action, and completely concealed when sliding aluminum-framed glass door is closed.
 - a. Weather-Stripping Material: Closed-cell elastomeric, preformed gaskets complying with ASTM C 509.
OR
Weather-Stripping Material: Dense elastomeric gaskets complying with ASTM C 864.
OR
Weather-Stripping Material: Manufacturer's standard system and materials complying with AAMA/WDMA/CSA 101/I.S.2/A440.
6. Sliding-Type Weather Stripping: Provide woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric. Comply with AAMA 701.
 - a. Weather Seals: Provide weather stripping with integral barrier fin or fins of semirigid, polypropylene sheet or polypropylene-coated material. Comply with AAMA 702.
7. Sealant: For sealants required within fabricated sliding doors, provide sliding aluminum-framed glass door manufacturer's standard, permanently elastic, nonshrinking, and nonmigrating type recommended by sealant manufacturer for joint size and movement.

B. Sliding Door

1. AAMA/WDMA/CSA Performance Requirements: Provide sliding aluminum-framed glass doors of performance indicated that comply with AAMA/WDMA/CSA 101/I.S.2/A440 unless more stringent performance requirements are indicated.
 - a. Performance Class and Grade: R15 **OR** 20 **OR** 25, **as directed**.
 - b. Performance Class and Grade: LC25 **OR** 30 **OR** 35, **as directed**.
 - c. Performance Class and Grade: C30 **OR** 35 **OR** 40, **as directed**.
 - d. Performance Class and Grade: HC40 **OR** 45 **OR** 50, **as directed**.
 - e. Performance Class and Grade: AW40 **OR** 45 **OR** 50, **as directed**.
 - f. Performance Class and Grade: As indicated.
2. Condensation Resistance: Provide sliding aluminum-framed glass doors with a minimum CRF when tested according to AAMA 1503 **OR** CR determined according to NFRC 500, **as directed**, of 45 **OR** 52, **as directed**.
3. Thermal Transmittance: Provide sliding aluminum-framed glass doors with a maximum whole fenestration product U-factor indicated, when tested according to AAMA 1503 **OR** determined according to ASTM E 1423 **OR** determined according to NFRC 100, **as directed**.
 - a. U-Factor: 0.35 **OR** 0.40 **OR** 0.65, **as directed**, Btu/sq. ft. x h x deg F (W/sq. m x K).
4. Solar Heat-Gain Coefficient (SHGC): Provide sliding aluminum-framed glass doors with a whole-fenestration product SHGC maximum of 0.40 **OR** 0.55, **as directed**, determined according to NFRC 200.
5. Acoustical Performance: Provide sliding aluminum-framed glass doors with an STC **OR** OITC, **as directed**, rating of 29 **OR** 34, **as directed**, when tested according to and determined by ASTM E 90 and ASTM E 413 **OR** ASTM E 1425 and ASTM E 1332, **as directed**, respectively.
6. Air Leakage Resistance: Maximum rate not more than indicated when tested according to AAMA/WDMA/CSA 101/I.S.2/A440, Air Leakage Resistance Test.
 - a. Maximum Rate: 0.3 cfm/sq. ft. (1.5 L/s x sq. m) of area at an inward test pressure of 1.6 lbf/sq. ft. (75 Pa), [equivalent to 25-mph (11-m/s) wind speed and typically used to test R, C, LC, and HC (sliding seal units) performance classes].
OR
Maximum Rate: 0.3 cfm/sq. ft. (1.5 L/s x sq. m) of area at an inward test pressure of 6.2 lbf/sq. ft. (300 Pa), [equivalent to a 50-mph (22-m/s) wind speed and typically used to test AW (sliding seal units) performance classes].
7. Water Penetration Resistance: No water leakage as defined in the AAMA/WDMA/CSA referenced test methods at a water test pressure equaling that indicated, when tested according to AAMA/WDMA/CSA 101/I.S.2/A440, Water Penetration Resistance Test.



- a. Test Pressure: 15 percent of positive design pressure, but not less than 2.9 lbf/sq. ft. (140 Pa) or more than 12 lbf/sq. ft. (580 Pa), (if performance equal to minimum for all other classes set by AAMA/WDMA/CSA 101/I.S.2/A440 is required).
 - b. Test Pressure: 20 percent of positive design pressure, but not more than 12 lbf/sq. ft. (580 Pa), (if performance equal to minimum for AW class sliding doors set by AAMA/WDMA/CSA 101/I.S.2/A440 is required).
 8. Forced-Entry Resistance: Comply with Performance Grade 10 requirements when tested according to ASTM F 842 (if AAMA/WDMA/CSA 101/I.S.2/A440 is the method selected for specifying sliding door performance).
 9. Life-Cycle Testing (for AW class sliding doors only): Tested according to and complying with AAMA/WDMA/CSA 101/I.S.2/A440.
 10. Operating Force and Auxiliary (Durability) Tests: Tested according to and complying with AAMA/WDMA/CSA 101/I.S.2/A440.
- C. Glazing
1. Glass and Glazing System: Comply with Division 08 Section "Glazing" for safety glass, insulating-glass units, laminated glass, and glazing requirements applicable to glazed sliding aluminum-framed glass doors.
- D. Hardware
1. Comply with AAMA/WDMA/CSA 101/I.S.2/A440.
- E. Insect Screens
1. General: Design sliding aluminum-framed glass doors and hardware to accommodate screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches. Fabricate insect screens to fully integrate with door frame. Locate screens on the inside **OR** outside, **as directed**, of door and provide for each operable door panel. Comply with SMA 1201.
 2. Insect Screen Frames: Manufacturer's standard extruded-aluminum **OR** formed-tubular-aluminum, **as directed**, members, with mitered or coped joints, concealed fasteners, adjustable rollers, and removable PVC or PE spline/anchor concealing edge of mesh.
 - a. Finish: Anodized aluminum **OR** Baked-on organic coating, **as directed**, in manufacturer's standard color.
OR
Finish: Anodized aluminum **OR** Baked-on organic coating, **as directed**, in color selected from manufacturer's full range.
OR
Finish: Manufacturer's standard.
 3. Glass-Fiber Mesh Fabric: ASTM D 3656, 18-by-14 or 18-by-16 **OR** 20-by-20 or 20-by-30, **as directed**, count per sq. in. (645-sq. mm) mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration.
 - a. Mesh Color: Charcoal gray **OR** Silver gray **OR** Aquamarine, **as directed**.
 4. Aluminum Wire Fabric: 18-by-16 count per sq. in. (645-sq. mm) mesh of 0.011-inch- (0.28-mm-) diameter, coated aluminum wire.
 - a. Wire-Fabric Finish: Natural bright **OR** Charcoal gray **OR** Black, **as directed**.
 5. Hardware: Extruded, cast, or wrought aluminum **OR** Die-cast zinc with special coating finish **OR** Cadmium-plated steel **OR** Zinc-plated steel **OR** Nonmagnetic stainless steel, **as directed**.
 - a. Lock: Manufacturer's standard pull and keyless locking device on each movable panel, lockable from inside only. Adjust locking device to allow unobstructed movement of panel across adjacent panel in direction indicated.
- F. Fabrication
1. Fabricate sliding aluminum-framed glass doors in sizes indicated. Include a complete system for assembling components and anchoring doors.
 2. Fabricate sliding aluminum-framed glass doors that are reglazable without dismantling panel framing.



3. Thermally Improved Construction: Fabricate sliding aluminum-framed glass doors with an integral, concealed, low-conductance thermal barrier; locate between exterior materials and door members exposed on interior side, and in a manner that eliminates direct metal-to-metal contact.
 - a. Provide thermal-break construction that has been in use for not less than three years and has been tested to demonstrate resistance to thermal conductance and condensation and to show adequate strength and security of glass retention.
 - b. Provide thermal barriers tested according to AAMA 505; determine the allowable design shear flow per the appendix in AAMA 505.
 - c. Provide hardware with low conductivity, or provide nonmetallic material for hardware bridging thermal breaks at frame.
4. Weather Stripping: Provide operable panels with a double row of sliding weather stripping in horizontal rails and single-row **OR** double-row, **as directed**, weather stripping in meeting or jamb styles. Provide compression-type weather stripping at the perimeter of each movable panel where sliding-type weather stripping is not appropriate.
 - a. Provide weather stripping locked into extruded grooves in door panels or frames.
5. Weep Holes: Provide weep holes and internal drainage passages to conduct infiltrating water to exterior.
6. Factory-Glazed Fabrication: Glaze sliding aluminum-framed glass doors in the factory where practical and possible for applications indicated. Comply with requirements in Division 8 Section "Glazing" and with AAMA/WDMA/CSA 101/I.S.2/A440.
7. Glazing Stops: Provide snap-on glazing stops coordinated with Division 8 Section "Glazing" and with glazing system indicated. Provide glazing stops to match panel frames.

G. General Finish Requirements

1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
3. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

H. Aluminum Finishes

1. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm **OR** AA-M12C22A31, Class II, 0.010 mm, **as directed**, or thicker.
2. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm **OR** AA-M12C22A32/A34, Class II, 0.010 mm, **as directed**, or thicker.
 - a. Color: Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black **OR** As selected from full range of industry colors and color densities, **as directed**.
3. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
4. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2604 **OR** AAMA 2605, **as directed**, and containing not less than 50 **OR** 70, **as directed**, percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
5. High-Performance Organic Finish: Three **OR** Four, **as directed**, -coat fluoropolymer finish complying with AAMA 2605 and containing not less than 50 **OR** 70, **as directed**, percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.



- a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

1.3 EXECUTION

A. Examination

1. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
 - a. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
 - b. Wood Frame Walls: Dry, clean, sound, well nailed, free of voids, and without offsets at joints. Ensure that nail heads are driven flush with surfaces in opening and within 3 inches (76 mm) of opening.
 - c. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
2. Verify rough opening dimensions, levelness of threshold substrate, and operational clearances.
3. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weathertight sliding aluminum-framed glass door installation.
4. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Installation

1. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing doors, hardware, accessories, and other components.
2. Install sliding aluminum-framed glass doors level, plumb, square, true to line, without distortion, warp or rack of frames and panels, or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing, vapor retarders, air barriers, water/weather barriers, and other adjacent construction.
3. Set sill members in bed of sealant or with gaskets, as indicated, to provide weathertight construction.
4. Install sliding aluminum-framed glass doors and components to drain condensation, water penetrating joints, and moisture migrating within doors to the exterior.
5. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials according to ASTM E 2112, Section 5.12 "Dissimilar Materials."

C. Field Quality Control

1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
2. Tests and Inspections:
 - a. Testing Methodology: Testing of sliding aluminum-framed glass doors for air penetration resistance and water resistance will be performed according to AAMA 502, Test Method A **OR** Test Method B, **as directed**, by applying same test pressures required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440.
 - b. Testing Extent: Three sliding aluminum-framed glass doors as selected by the Owner and a qualified independent testing and inspecting agency. Sliding doors shall be tested immediately after installation.
3. Sliding aluminum-framed glass door will be considered defective if it does not pass tests and inspections.
4. Prepare test and inspection reports according to AAMA 502. Testing agency will interpret test results and state in each report whether tested work complies with or deviates from requirements.

D. Adjusting, Cleaning, And Protection

1. Lubricate hardware and moving parts.



2. Adjust operating panels and screens to provide a tight fit at contact points and weather stripping for smooth operation, without binding, and a weathertight closure.
3. Adjust hardware for proper alignment, smooth operation, and proper latching without unnecessary force or excessive clearance.
4. Clean aluminum surfaces immediately after installing sliding doors. Comply with manufacturer's written recommendations for final cleaning and maintenance. Avoid damaging protective coatings and finishes. Remove nonpermanent labels, and clean surfaces.
5. Clean glass immediately after installing sliding aluminum-framed glass doors. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels and clean surfaces.
6. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
7. Protect sliding door surfaces from contact with contaminating substances resulting from construction operations. During construction, monitor sliding door surfaces adjacent to and below exterior concrete and masonry surfaces for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact sliding door surfaces, remove contaminants immediately according to manufacturer's written instructions.
8. Refinish or replace sliding aluminum-framed glass doors with damaged finishes.
9. Replace damaged components.

END OF SECTION 08 32 13 00



SECTION 08 32 19 00 - SLIDING WOOD-FRAMED GLASS DOORS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of material for sliding wood-framed glass doors. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes sliding wood-framed glass doors for exterior locations with bare, unfinished **OR** prime-coated **OR** finish-coated **OR** aluminum-clad **OR** vinyl-clad, **as directed**, exterior exposed surfaces.

C. Performance Requirements

1. General: Provide sliding wood-framed glass doors capable of complying with performance requirements indicated based on testing manufacturers' sliding doors that are representative of those specified and that are of test size indicated below:
 - a. Size required by AAMA/WDMA/CSA 101/I.S.2/A440 for gateway performance **OR** optional performance grade **OR** gateway performance for both gateway performance and optional performance grade, **as directed**.
OR
Size indicated on Drawings **OR** in a schedule, **as directed**.
2. Structural Performance: Provide sliding wood-framed doors capable of withstanding the effects of the following loads and stresses within limits and under conditions indicated, based on testing units representative of those indicated for Project that pass AAMA/WDMA/CSA 101/I.S.2/A440, Uniform Load Structural Test:
 - a. Design Wind Loads: Determine design wind loads according to ASCE/SEI 7.
 - 1) Basic Wind Speed: 85 mph (38 m/s) **OR** 90 mph (40 m/s), **as directed**.
 - 2) Importance Factor.
 - 3) Exposure Category: **B OR C OR D, as directed**.
 - b. Deflection Limits: Design glass framing system to limit lateral deflections of glass edges to less than 1/175 of glass-edge length or 3/4 inch (19 mm), whichever is less, at design pressure based on testing performed according to AAMA/WDMA/CSA 101/I.S.2/A440, Uniform Load Deflection Test, or structural computations.
3. Windborne-Debris Resistance: Provide glazed sliding doors capable of resisting impact from windborne debris, based on the pass/fail criteria as determined from testing glazed sliding doors identical to those specified, according to ASTM E 1886 and testing information in ASTM E 1996 **OR** AAMA 506, **as directed**, and requirements of authorities having jurisdiction.

D. Submittals

1. Product Data: For each type of product indicated. Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions.
2. LEED Submittal:
 - a. Certificates for Credit MR 7: Chain-of-custody certificates certifying that sliding wood-framed glass doors comply with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body and statement indicating costs for each certified wood product.
3. Shop Drawings: For sliding wood-framed glass doors. Include plans, elevations, sections, details, hardware, attachments to other work, operational clearances, and the following:
 - a. Mullion details for fenestration combinations including reinforcement and stiffeners.
 - b. Joinery details.



- c. Expansion provisions.
- d. Flashing and drainage details.
- e. Weather-stripping details.
- f. Glazing details.
- g. Accessories.
4. Samples: For sliding wood-framed glass doors and components required, prepared on Samples of size indicated below:
 - a. Main Framing Member: 12-inch- (300-mm-) long section with weather stripping, **as directed**, glazing bead and factory-applied color finish.
 - b. Hardware: Full-size units with factory-applied finish.
5. Delegated-Design Submittal: For sliding wood-framed glass doors indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation and used to determine the following:
 - a. Structural test pressures and design pressures from wind loads indicated.
 - b. Deflection limitations of glass framing systems.
6. Qualification Data: For qualified Installer, manufacturer and professional engineer.
7. Product Test Reports: Based on evaluation of comprehensive tests performed within the last four years by a qualified testing agency, for each class, grade, and size of sliding wood-framed glass doors. Test results based on use of downsized test doors will not be accepted, **as directed**.
8. Maintenance Data: For finishes, weather stripping, operable panels, and operating hardware to include in maintenance manuals.
9. Warranty: Sample of special warranty.

E. Quality Assurance

1. Manufacturer Qualifications: A manufacturer capable of fabricating sliding wood-framed glass doors that meet or exceed performance requirements indicated and of documenting this performance by inclusion in lists and by labels, test reports, and calculations.
2. Installer Qualifications: An installer acceptable to sliding door manufacturer for installation of units required for this Project.
 - a. Installer's responsibilities include providing professional engineering services needed to assume engineering responsibility including preparation of data for sliding wood-framed glass doors, including Shop Drawings and Designated-Design Submittal, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
3. Source Limitations: Obtain sliding wood-framed glass doors from single source from single manufacturer.
4. Forest Certification: Fabricate products from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
5. Fenestration Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440, "Standard/Specification for Windows, Doors, and Unit Skylights," for minimum standards of performance, materials, components, accessories, and fabrication. Comply with more stringent requirements if indicated.
 - a. Provide AAMA **OR** WDMA, **as directed**, -certified, sliding wood-framed glass doors with an attached label.
6. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201.
 - a. Subject to compliance with requirements, permanently mark safety glass with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction.
7. Glazing Publications: Comply with published recommendations of glass manufacturers and with GANA's "Glazing Manual" unless more stringent requirements are indicated.

F. Delivery, Storage, And Handling



1. Protect sliding doors during transit, storage, and handling to prevent damage, soiling, and deterioration. Store off ground and covered in a clean, dry, well-ventilated, protected space. Comply with manufacturer's written instructions.

G. Project Conditions

1. Field Measurements: Verify sliding wood-framed glass door openings by field measurements before fabrication and indicate measurements on Shop Drawings.

H. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace sliding wood-framed glass doors that fail in materials or workmanship within specified warranty period.
 - a. Failures include, but are not limited to, the following:
 - 1) Failure to meet performance requirements.
 - 2) Structural failures including excessive deflection.
 - 3) Water leakage or air infiltration.
 - 4) Faulty operation of movable panels and hardware.
 - 5) Deterioration of wood, metals, vinyl, other materials, and finishes beyond normal weathering.
 - 6) Deterioration of insulating glass and laminated glass as defined in Division 08 Section "Glazing".
 - b. Warranty Period:
 - 1) Sliding Door: Two **OR** Three, **as directed**, years from date of Final Completion.
 - 2) Glazing: 10 **OR** 20, **as directed**, years from date of Final Completion.
 - 3) Metal Finish: Five years from date of Final Completion.

1.2 PRODUCTS

A. Materials

1. Wood: Clear fir or pine or another suitable fine-grained lumber; kiln-dried to a moisture content of 6 to 12 percent at time of fabrication; free of visible finger joints, blue stain, knots, pitch pockets, and surface checks larger than 1/32 inch (0.8 mm) deep by 2 inches (51 mm) wide; water-repellent preservative treated.
2. Aluminum Extrusions and Rolled Aluminum for Cladding: Manufacturer's standard formed sheet or extruded-aluminum cladding, mechanically bonded to exterior exposed wood members. Provide aluminum alloy and temper recommended by sliding wood-framed glass door manufacturer for strength, corrosion resistance, and application of required finish.
 - a. Baked-Enamel Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - 1) Color and Gloss: White **OR** Bronze **OR** Brown **OR** Beige **OR** Gray **OR** Green **OR** As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - b. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 620 **OR** AAMA 2604 **OR** AAMA 2605, **as directed**, and containing not less than 50 **OR** 70, **as directed**, percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1) Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
3. Vinyl Cladding: Consisting of a rigid PVC sheath made from PVC complying with ASTM D 4726, not less than 35-mil (0.9-mm) average thickness, in permanent, integral color, white **OR** bronze **OR** tan, **as directed**, finish, and mechanically bonded to exterior wood frame members.
4. Wood Trim and Glazing Stops: Material and finish to match frame members.
OR



Clad Trim and Glazing Stops: Hollow extrusions; **OR** Roll-formed sheet; **OR** Clad-wood material; **OR** Material and, **as directed**, finish to match clad frame members.

5. Fasteners: Aluminum, nonmagnetic stainless steel, or other materials warranted by manufacturer to be noncorrosive for SC 3 severe service conditions and compatible with sliding wood-framed glass door members, cladding, trim, hardware, anchors, and other components.
 - a. Exposed Fasteners: Unless unavoidable for applying hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.
6. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 456 or ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.
7. Integral Fin: PVC or extruded- or rolled-aluminum nailing fins for securing frame to structure; provide sufficient strength to withstand design pressure indicated.
8. Mullions: Provide mullions and mullion casing and cover plates as shown, matching door units, complete with anchors for support to structure and installation of sliding wood-framed glass door units. Allow for erection tolerances and provide for movement of door units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design loads of door units.
9. Reinforcing Members: Aluminum, nonmagnetic stainless steel, nickel/chrome-plated steel complying with ASTM B 456 or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.
10. Compression-Type Weather Stripping: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action, and completely concealed when sliding wood-framed glass door is closed.
 - a. Weather-Stripping Material: Closed-cell elastomeric, preformed gaskets complying with ASTM C 509.
OR
Weather-Stripping Material: Dense elastomeric gaskets complying with ASTM C 864.
OR
Weather-Stripping Material: Manufacturer's standard system and materials complying with AAMA/WDMA/CSA 101/I.S.2/A440.
11. Sliding-Type Weather Stripping: Provide woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric. Comply with AAMA 701.
 - a. Weather Seals: Provide weather stripping with integral barrier fin or fins of semirigid, polypropylene sheet or polypropylene-coated material. Comply with AAMA 702.
12. Drip Caps: Extruded aluminum, factory fabricated and finished to match aluminum cladding; designed to direct water away from building when installed horizontally at head of aluminum-clad sliding wood-framed glass door units.

B. Sliding Door

1. AAMA/WDMA/CSA Performance Requirements: Provide sliding wood-framed glass doors of performance indicated that comply with AAMA/WDMA/CSA 101/I.S.2/A440 unless more stringent performance requirements are indicated.
 - a. Performance Class and Grade: R15 **OR** 20 **OR** 25, **as directed**.
 - b. Performance Class and Grade: LC25 **OR** 30 **OR** 35, **as directed**.
 - c. Performance Class and Grade: C30 **OR** 35 **OR** 40, **as directed**.
 - d. Performance Class and Grade: As indicated.
2. Thermal Transmittance: Provide sliding wood-framed glass doors with a whole-fenestration-product U-factor maximum indicated, when tested according to AAMA 1503 **OR** determined according to ASTM E 1423 **OR** determined according to NFRC 100, **as directed**.
 - a. U-Factor: 0.54 Btu/sq. ft. x h x deg F (3.06 W/sq. m x K) for unfinished sliding wood-framed glass doors with clear, 3/4-inch (19-mm) insulating glass.
 - b. U-Factor: 0.56 Btu/sq. ft. x h x deg F (3.17 W/sq. m x K) for aluminum-clad sliding wood-framed glass doors with clear, 3/4-inch (19-mm) insulating glass.



- c. U-Factor: 0.38 Btu/sq. ft. x h x deg F (2.15 W/sq. m x K) for unfinished sliding wood-framed glass doors with low-E coated, clear, 3/4-inch (19-mm) insulating glass.
- d. U-Factor: 0.38 Btu/sq. ft. x h x deg F (2.15 W/sq. m x K) for aluminum-clad sliding wood-framed glass doors with low-E coated, clear, 3/4-inch (19-mm) insulating glass.
3. Solar Heat-Gain Coefficient (SHGC): Provide sliding wood-framed glass doors with a whole-window SHGC maximum of 0.40 **OR** 0.55, **as directed**, determined according to NFRC 200.
4. Air-Leakage Resistance: Maximum rate not more than indicated when tested according to AAMA/WDMA/CSA 101/I.S.2/A440, Air Leakage Resistance Test.
 - a. Maximum Rate: 0.3 cfm/sq. ft. (1.5 L/s x sq. m) of area at an inward test pressure of 1.6 lbf/sq. ft. (75 Pa), [equivalent to 25-mph (40-km/h) wind speed and is typically used to test R, C, and LC performance classes].
5. Water-Penetration Resistance: No water leakage as defined in AAMA/WDMA/CSA referenced test methods at a water test pressure equaling that indicated, when tested according to AAMA/WDMA/CSA 101/I.S.2/A440, Water Penetration Resistance Test.
 - a. Test Pressure: 15 percent of positive design pressure, but not less than 2.9 lbf/sq. ft. (140 Pa) or more than 12 lbf/sq. ft. (580 Pa).
6. Forced-Entry Resistance (if AAMA/WDMA/CSA 101/I.S.2/A440 is the method selected for specifying sliding door performance): Comply with Performance Grade 10 requirements when tested according to ASTM F 842.
7. Operating Force and Auxiliary (Durability) Tests: Tested according to and complying with AAMA/WDMA/CSA 101/I.S.2/A440.

C. Glazing

1. Glass and Glazing System: Comply with Division 08 Section "Glazing" for safety glass, insulating-glass units, laminated glass, and glazing requirements applicable to glazed sliding wood-framed glass doors.

D. Hardware

1. Comply with AAMA/WDMA/CSA 101/I.S.2/A440

E. Insect Screens

1. General: Design sliding doors and hardware to accommodate screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches. Fabricate insect screens to fully integrate with door frame. Locate screens on the inside **OR** outside, **as directed**, of door and provide for each operable door panel. Comply with SMA 1201.
2. Insect Screen Frames: Manufacturer's standard extruded-aluminum or formed-tubular-aluminum members, with mitered or coped joints, concealed fasteners, adjustable rollers, and removable PVC or PE spline/anchor concealing edge of mesh.
 - a. Finish: Anodized aluminum **OR** Baked-on organic coating, **as directed**, in manufacturer's standard color.
OR
Finish: Anodized aluminum **OR** Baked-on organic coating, **as directed**, in color selected by the Owner from manufacturer's full range.
OR
Finish: Manufacturer's standard.
3. Glass-Fiber Mesh Fabric: ASTM D 3656, 18-by-14 or 18-by-16 **OR** 20-by-20 or 20-by-30, **as directed**, count per sq. in. (645-sq. mm) mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration in the following color:
 - a. Mesh Color: Charcoal gray **OR** Silver gray **OR** Aquamarine, **as directed**.
4. Aluminum Wire Fabric: 18-by-16 count per sq. in. (645-sq. mm) mesh of 0.011-inch- (0.28-mm-) diameter, coated aluminum wire.
 - a. Wire-Fabric Finish: Natural bright **OR** Charcoal gray **OR** Black, **as directed**.
5. Hardware: Extruded, cast, or wrought aluminum **OR** Die-cast zinc with special coating finish **OR** Cadmium-plated steel **OR** Zinc-plated steel **OR** Nonmagnetic stainless steel, **as directed**.



- a. Lock: Manufacturer's standard pull and keyless locking device on each movable panel, lockable from inside only. Adjust locking device to allow unobstructed movement of panel across adjacent panel in direction indicated.

F. Accessories

1. Grilles (False Muntins): Provide grilles in designs indicated, for removable application to inside of each panel lite.
 - a. Material: Extruded, rigid PVC or cellular PVC **OR** Unfinished wood **OR** Prefinished wood, **as directed**.
 - b. Design: Rectangular **OR** Diamond, **as directed**.
 - c. Construction: Full-surround grille.
 - d. Bar Width: Not less than 3/4 inch (19 mm) **OR** 7/8 inch (22 mm) **OR** 1-1/8 inches (28 mm), **as directed**, wide.
 - e. Color: White **OR** Bronze **OR** As selected from manufacturer's full range, **as directed**.

G. Fabrication

1. Fabricate sliding wood-framed glass doors in sizes indicated. Include a complete system for assembling components and anchoring windows.
2. Fabricate sliding wood-framed glass doors that are reglazable without dismantling panel framing.
3. Weather Stripping: Provide full-perimeter weather stripping for each operable panel unless otherwise indicated.
4. Factory machine sliding wood-framed glass doors for openings and hardware that is not surface applied.
5. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.
6. Factory-Glazed Fabrication: Glaze sliding wood-framed glass doors in the factory. Comply with requirements in Division 08 Section "Glazing" and with AAMA/WDMA/CSA 101/I.S.2/A440.
7. Glazing Stops: Provide snap-on glazing stops coordinated with Division 08 Section "Glazing" and with glazing system indicated. Provide glazing stops to match panel frames.

H. Wood Finishes

1. Factory-Primed Sliding Wood-Framed Glass Doors: Provide manufacturer's standard factory-applied prime coat complying with WDMA T.M. 11. Follow manufacturer instructions for factory-applied prime coat, if any, on exposed exterior **OR** interior **OR** exterior and interior, **as directed**, wood surfaces.
2. Factory-Finished Sliding Wood-Framed Glass Doors: Provide manufacturer's standard factory finish complying with WDMA T.M. 12, **as directed**. Apply finish to exposed exterior **OR** interior **OR** exterior and interior, **as directed**, wood surfaces.
 - a. Color: White **OR** Brown **OR** Gray **OR** As selected from manufacturer's full range, **as directed**.

1.3 EXECUTION

A. Examination

1. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
2. Verify rough opening dimensions, levelness of threshold substrate, and operational clearances.
3. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weathertight sliding door installation.
 - a. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.



- b. Wood-Frame Walls: Dry, clean, sound, well nailed, free of voids, and without offsets at joints. Ensure that nail heads are driven flush with surfaces in opening and within 3 inches (76 mm) of opening.
 - c. Metal Surfaces: Dry and clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
4. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Installation
1. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing windows, hardware, accessories, and other components.
 2. Install sliding doors level, plumb, square, true to line, without distortion, warp or rack of frames and panels, or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing, vapor retarders, air barriers, water/weather barriers, and other adjacent construction.
 3. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.
 4. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials according to ASTM E 2112, Section 5.12 "Dissimilar Materials."
- C. Adjusting, Cleaning, And Protection
1. Lubricate hardware and moving parts.
 2. Adjust operating panels and screens to provide a tight fit at contact points and weather stripping for smooth operation, without binding, and weathertight closure.
 3. Adjust hardware for proper alignment, smooth operation, and proper latching without unnecessary force or excessive clearance.
 4. Clean frame surfaces immediately after installing sliding doors. Comply with manufacturer's written recommendations for final cleaning and maintenance. Avoid damaging protective coatings and finishes.
 5. Clean glass immediately after installing sliding doors. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels and clean surfaces.
 6. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
 7. Protect sliding door surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor sliding door surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact sliding door surfaces, remove contaminants immediately according to manufacturer's written instructions.
 8. Refinish or replace sliding doors with damaged finishes.
 9. Replace damaged components.

END OF SECTION 08 32 19 00



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SECTION 08 33 13 00 - OVERHEAD COILING DOORS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of material for overhead coiling doors. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Service doors with integral pass doors.
 - b. Insulated service doors with integral pass doors.
 - c. Counter doors.
 - d. Fire-rated service doors with integral pass doors.
 - e. Fire-rated, insulated service doors with integral pass doors.
 - f. Fire-rated counter doors.

C. Performance Requirements

1. Delegated Design: Design overhead coiling doors, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2. Structural Performance, Exterior Doors: Exterior overhead coiling doors shall withstand the wind loads, the effects of gravity loads, and loads and stresses within limits and under conditions indicated according to SEI/ASCE 7.
 - a. Wind Loads: As indicated on Drawings **OR** Uniform pressure (velocity pressure) of 20 lbf/sq. ft. (960 Pa), acting inward and outward, **as directed**.
 - 1) Basic Wind Speed: 85 mph (38 m/s) **OR** 90 mph (40 m/s) **OR** 100 mph (44 m/s) **OR** 110 mph (49 m/s), **as directed**.
 - 2) Importance Factor: **<Insert factor>**.
 - 3) Exposure Category: A **OR** B **OR** C **OR** D, **as directed**.
 - b. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.
3. Operability under Wind Load: Design overhead coiling doors to remain operable under design **OR** uniform pressure (velocity pressure) of 20 lbf/sq. ft. (960 Pa), **as directed**, wind load, acting inward and outward.
4. Windborne-Debris-Impact-Resistance Performance: Provide glazed and impact-protective overhead coiling doors that pass missile-impact and cyclic-pressure tests when tested according to ASTM E 1886 and ASTM E 1996.
 - a. Large Missile Test: For overhead coiling doors located within 30 feet (9.144 m) of grade.
 - b. Small Missile Test: For overhead coiling doors located more than 30 feet (9.144 m) above grade.
5. Seismic Performance: Overhead coiling doors shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
6. Operation Cycles: Provide overhead coiling door components and operators capable of operating for not less than number of cycles indicated for each door. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

D. Submittals

1. Product Data: For each type and size of overhead coiling door and accessory.



2. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data. Include plans, elevations, sections, details, and attachments to other work.
 - a. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - b. Show locations of replaceable fusible links.
 - c. Wiring Diagrams: For power, signal, and control wiring.
3. Samples: For each exposed product and for each color and texture specified.
4. Delegated-Design Submittal: For overhead coiling doors indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
5. Qualification Data: For qualified Installer.
6. Seismic Qualification Certificates: For overhead coiling doors, accessories, and components, from manufacturer.
7. Oversize Construction Certification: For door assemblies required to be fire-rated and that exceed size limitations of labeled assemblies.
8. Maintenance Data.

E. Quality Assurance

1. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.
2. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252 **OR** IBC Standard 716.5 **OR** UL 10B, **as directed**.
 - a. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
 - b. Temperature-Rise Limit: Where indicated **OR** At vertical exit enclosures and exit passageways, **as directed**, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
 - c. Smoke Control: Where indicated **OR** In corridors and smoke barriers, **as directed**, provide doors that are listed and labeled with the letter "S" on the fire-rating label by a qualified testing agency for smoke- and draft-control based on testing according to IBC Standard 716.5 **OR** UL 1784, **as directed**; with maximum air-leakage rate of 3.0 cfm/sq. ft. (0.01524 cu. m/s x sq. m) of door opening at 0.10 inch wg (24.9 Pa) for both ambient and elevated temperature tests.
3. Sound-Control Doors: Assemblies that have been fabricated and tested to control the passage of sound and have minimum certified STC rating according to ASTM E 413.
4. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
5. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines **OR** ICC/ANSI A117.1, **as directed**.

1.2 PRODUCTS

A. Door Curtain Materials And Construction

1. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:



- a. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural steel sheet; complying with ASTM A 653/A 653M, with G90 (Z275) zinc coating; nominal sheet thickness (coated) of 0.028 inch (0.71 mm) and as required to meet requirements.
 - b. Stainless-Steel Door Curtain Slats: ASTM A 666, Type 304; sheet thickness of 0.025 inch (0.64 mm) and as required to meet requirements.
 - c. Aluminum Door Curtain Slats: ASTM B 209 (ASTM B 209M) sheet or ASTM B 221 (ASTM B 221M) extrusions, alloy and temper standard with manufacturer for type of use and finish indicated; thickness of 0.050 inch (1.27 mm) and as required to meet requirements.
 - d. Vision-Panel Glazing: Manufacturer's standard clear glazing, fabricated from transparent acrylic sheet or fire-protection rated glass as required for type of door; set in glazing channel secured to curtain slats.
 - e. Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within slat faces.
 - f. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face.
 - g. Plastic Interior Curtain-Slat Facing: Extruded PVC plastic with maximum flame-spread index of 25 **OR** 75 **OR** 200, **as directed**, and smoke-developed index of 450, according to ASTM E 84.
 - h. Gasket Seal: Provide insulated slats with manufacturer's standard interior-to-exterior thermal break or with continuous gaskets between slats.
2. Endlocks and Windlocks for Service Doors: Malleable-iron casings galvanized after fabrication, secured to curtain slats with galvanized rivets or high-strength nylon. Provide locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.
 3. Endlocks for Counter Doors: Manufacturer's standard locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.
 4. Bottom Bar for Service Doors: Consisting of two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch (38 by 38 by 3 mm) thick; fabricated from manufacturer's standard hot-dip galvanized steel, stainless steel, or aluminum extrusions to match curtain slats and finish.
 5. Bottom Bar for Counter Doors: Manufacturer's standard continuous channel or tubular shape, fabricated from manufacturer's standard hot-dip galvanized steel, stainless steel, or aluminum extrusions to match curtain slats and finish.
 6. Astragal for Interior Doors: Equip each door bottom bar with a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene as a cushion bumper.
 7. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain, and a continuous bar for holding windlocks.
 - a. Removable Posts and Jamb Guides for Counter Doors: Manufacturer's standard.
 8. Pass Door(s): Door and frame assembly constructed integrally with the coiling-door assembly and bearing the same fire rating. Complying with egress and accessibility requirements of authorities having jurisdiction.
 - a. Door Frame and Integral Jamb Guide: Fabricate of angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading.
 - b. Hinged Frame: Hinged pass door and frame that swings out of the way, as a unit, to allow use of the full coiling-door opening width. One jamb of the pass-door frame is hinged and the other jamb includes a guide for the lower, narrower part of the coiling-door curtain.
 - c. Rigid Frame: Rigid pass door and frame that are built into the rigid, lower part of the door curtain and that raise with the curtain.
 - d. Locking Hardware:
 - 1) Lockset **OR** Exit Hardware: As specified in Division 08 Section "Door Hardware" **OR** As selected from manufacturer's full range, **as directed**.



- 2) Lock Cylinders: Provide cylinders specified in Division 08 Section "Door Hardware" **OR** standard with manufacturer, **as directed**, and keyed to building keying system, **as directed**.
- 3) Keys: Two **OR** Three, **as directed**, for each cylinder.
- e. Thresholds: Equip pass doors with integral thresholds that comply with egress and accessibility requirements of authorities having jurisdiction.

B. Hood

1. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
 - a. Galvanized Steel: Nominal 0.028-inch- (0.71-mm-) thick, hot-dip galvanized steel sheet with G90 (Z275) zinc coating, complying with ASTM A 653/A 653M.
 - b. Stainless Steel: 0.025-inch- (0.64-mm-) thick stainless-steel sheet, Type 304, complying with ASTM A 666.
 - c. Aluminum: 0.040-inch- (1.02-mm-) thick aluminum sheet complying with ASTM B 209 (ASTM B 209M), of alloy and temper recommended by manufacturer and finisher for type of use and finish indicated.
 - d. Include automatic drop baffle on fire-rated doors to guard against passage of smoke or flame.
 - e. Exterior-Mounted Doors: Fabricate hood to act as weather protection and with a perimeter sealant-joint-bead profile for applying joint sealant.

C. Counter Doors

1. Integral Frame, Hood, and Fascia for Counter Door: Welded sheet metal assembly of the following sheet metal:
 - a. Galvanized Steel: Nominal 0.064-inch- (1.63-mm-) thick, hot-dip galvanized steel sheet with G90 (Z275) zinc coating, complying with ASTM A 653/A 653M.
 - b. Stainless Steel: 0.062-inch- (1.59-mm-) thick stainless-steel sheet, Type 304, complying with ASTM A 666.
2. Integral Metal Sill for Counter Door: Fabricate sills as integral part of frame assembly of Type 304 stainless steel in manufacturer's standard thickness with No. 4 finish.
3. Fire-Rated, Laminate Counter: Fire-door manufacturer's high-pressure decorative laminate-covered countertop, UL or ITS tested and labeled for 1-1/2-hour fire rating for approved use with fire-door assembly.

D. Locking Devices

1. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.
2. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
 - a. Lock Cylinders: Provide cylinders specified in Division 08 Section "Door Hardware" **OR** standard with manufacturer, **as directed**, and keyed to building keying system, **as directed**.
 - b. Keys: Provide Two **OR** Three, **as directed**, for each cylinder.
3. Chain Lock Keeper: Suitable for padlock.
4. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

E. Curtain Accessories

1. Smoke Seals: Equip each fire-rated door with smoke-seal perimeter gaskets for smoke and draft control as required for door listing and labeling by a qualified testing agency.



2. Weatherseals: Equip each exterior door with weather-stripping gaskets fitted to entire perimeter of door for a weathertight installation, unless otherwise indicated.
 - a. At door head, use 1/8-inch- (3-mm-) thick, replaceable, continuous sheet secured to inside of hood.
 - b. At door jambs, use replaceable, adjustable, continuous, flexible, 1/8-inch- (3-mm-) thick seals of flexible vinyl, rubber, or neoprene.
3. Push/Pull Handles: Equip each push-up-operated or emergency-operated door with lifting handles on each side of door, finished to match door.
 - a. Provide pull-down straps or pole hooks for doors more than 84 inches (2130 mm) high.
4. Automatic-Closing Device for Fire-Rated Doors: Equip each fire-rated door with an automatic-closing device that is inoperative during normal door operations and that has a governor unit complying with NFPA 80 and an easily tested and reset release mechanism designed to be activated by the following:
 - a. Replaceable fusible links with temperature rise and melting point of 165 deg F (74 deg C) interconnected and mounted on both sides of door opening.
 - b. Manufacturer's standard UL-labeled smoke detector and door-holder-release devices.
 - c. Manufacturer's standard UL-labeled heat detector and door-holder-release devices.
 - d. Building fire-detection and -alarm systems and manufacturer's standard door-holder-release devices.

F. Counterbalancing Mechanism

1. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
2. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. (2.5 mm/m) of span under full load.
3. Spring Balance: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.
4. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
5. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

G. Manual Door Operators

1. Equip door with manufacturer's recommended manual door operator unless another type of door operator is indicated.
2. Push-up Door Operation: Design counterbalance mechanism so required lift or pull for door operation does not exceed 25 lbf (111 N).
3. Chain-Hoist Operator: Consisting of endless steel hand chain, chain-pocket wheel and guard, and gear-reduction unit with a maximum 25 lbf (111 N) **OR** 30 lbf (133 N), **as directed**, force for door operation. Provide alloy-steel hand chain with chain holder secured to operator guide.
4. Crank Operator: Consisting of crank and crank gearbox, steel crank drive shaft, and gear-reduction unit, of type indicated. Size gears to require not more than 25 lbf (111 N) **OR** 30 lbf (133 N), **as directed**, force to turn crank. Fabricate gearbox to be oil tight and to completely enclose operating mechanism. Provide manufacturer's standard crank-locking device.

H. Electric Door Operators

1. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
 - a. Comply with NFPA 70.



- b. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24 V, ac or dc.
 2. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.
 3. Door Operator Location(s): Operator location indicated for each door.
 - a. Top-of-Hood Mounted: Operator is mounted to the right or left door head plate with the operator on top of the door-hood assembly and connected to the door drive shaft with drive chain and sprockets. Headroom is required for this type of mounting.
 - b. Front-of-Hood Mounted: Operator is mounted to the right or left door head plate with the operator on coil side of the door-hood assembly and connected to the door drive shaft with drive chain and sprockets. Front clearance is required for this type of mounting.
 - c. Wall Mounted: Operator is mounted to the inside front wall on the left or right side of door and connected to door drive shaft with drive chain and sprockets. Side room is required for this type of mounting. Wall mounted operator can also be mounted above or below shaft; if above shaft, headroom is required.
 - d. Bench Mounted: Operator is mounted to the right or left door head plate and connected to the door drive shaft with drive chain and sprockets. Side room is required for this type of mounting.
 - e. Through-Wall Mounted: Operator is mounted on other side of wall from coil side of door.
 4. Electric Motors: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Division 11 Section "Common Motor Requirements For Equipment", unless otherwise indicated.
 - a. Electrical Characteristics:
 - 1) Phase: Single phase **OR** Polyphase, **as directed**.
 - 2) Volts: 115 **OR** 208 **OR** 230 **OR** 460, **as directed**, V.
 - 3) Hertz: 60.
 - b. Motor Type and Controller: Reversible motor and controller (disconnect switch) for motor exposure indicated.
 - c. Motor Size: Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. (203 mm/s) and not more than 12 in./sec. (305 mm/s), without exceeding nameplate ratings or service factor.
 - d. Operating Controls, Controllers (Disconnect Switches), Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
 - e. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.
 5. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
 6. Obstruction Detection Device: Equip motorized door with indicated external automatic safety sensor capable of protecting full width of door opening. For non-fire-rated doors, activation of device immediately stops and reverses downward door travel. For fire-rated doors, activation delays closing.
 - a. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in door opening without contact between door and obstruction.
 - 1) Self-Monitoring Type: Designed to interface with door operator control circuit to detect damage to or disconnection of sensing device. When self-monitoring feature is activated, door closes only with sustained pressure on close button.
 - b. Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
 - 1) Self-Monitoring Type: Four-wire configured device designed to interface with door operator control circuit to detect damage to or disconnection of sensor edge.
 7. Remote-Control Station: Momentary-contact, three-button control station with push-button controls labeled "Open," "Close," and "Stop."



- a. Interior units, full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
 - b. Exterior units, full-guarded, standard-duty, surface-mounted, weatherproof type, NEMA ICS 6, Type 4 enclosure, key operated.
 8. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf (111 N) **OR** 30 lbf (133 N), **as directed**.
 9. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
 10. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.
 11. Audible and Visual Signals: Audible alarm and visual indicator lights in compliance with regulatory requirements for accessibility.
 12. Radio-Control System: Consisting of the following:
 - a. Three-channel universal coaxial receiver to open, close, and stop door; one **OR** two, **as directed**, per operator.
 - b. Multifunction remote control.
 - c. Remote-antenna mounting kit.
- I. Door Assembly
1. Service **OR** Insulated Service **OR** Counter, **as directed**, Door: Overhead coiling door formed with curtain of interlocking metal slats.
 2. Operation Cycles: Not less than 10,000 **OR** 20,000 **OR** 50,000 **OR** 100,000, **as directed**.
 - a. Include tamperproof cycle counter.
 3. STC Rating: 26.
 4. Curtain R-Value: 4.5 deg F x h x sq. ft./Btu (0.792 K x sq. m/W) **OR** 5.0 deg F x h x sq. ft./Btu (0.881 K x sq. m/W) **OR** 6.0 deg F x h x sq. ft./Btu (1.057 K x sq. m/W), **as directed**.
 5. Door Curtain Material: Galvanized steel **OR** Stainless steel **OR** Aluminum, **as directed**.
 6. Door Curtain Slats: Curved **OR** Flat, **as directed**, profile slats of 1-1/4-inch (32-mm) **OR** 1-1/2-inch (38-mm) **OR** 1-7/8-inch (48-mm) **OR** 2-5/8-inch (67-mm) **OR** 3-1/4-inch (83-mm), **as directed**, center-to-center height.
 - a. Perforated Slats: Approximately 1/16-inch (1.6-mm) pinholes **OR** 3/32-inch (2.4-mm) pinholes **OR** 7/8-inch- (22-mm-) wide by 3/8-inch- (10-mm-) high slots, **as directed**.
 - b. Fenestrated Slats: Approximately 3- by 5/8-inch (76- by 16-mm) **OR** 4- by 5/8-inch (102- by 16-mm) **OR** 10- by 1-5/8-inch (254- by 41-mm), **as directed**, openings spaced approximately 1-1/2 inches (38 mm) apart and beginning 12 inches (305 mm) from jamb guides.
 - c. Vision Panels: Approximately 10- by 1-5/8-inch (254- by 41-mm) openings spaced approximately 2 inches (51 mm) apart and beginning 12 inches (305 mm) from end guides; in two **OR** three, **as directed**, rows of slats at height indicated on Drawings; installed with insulated, **as directed**, vision-panel glazing.
 - d. Insulated-Slat Interior Facing: Metal **OR** Plastic, **as directed**.
 7. Curtain Jamb Guides: Galvanized steel **OR** Stainless steel **OR** Aluminum, **as directed**, with exposed finish matching curtain slats. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise. Provide removable post(s) and jamb guides where shown on Drawings.
 8. Pass Door(s): Hinged **OR** Rigid, **as directed**, frame with lockset **OR** exit hardware, **as directed**.
 9. Hood: Match curtain material and finish **OR** Galvanized steel **OR** Stainless steel **OR** Aluminum, **as directed**.
 - a. Shape: Round **OR** Square **OR** As shown on Drawings, **as directed**.
 - b. Mounting: Face of wall **OR** Between jambs **OR** As shown on Drawings, **as directed**.
 10. Integral Frame, Hood, and Fascia for Counter Door: Galvanized steel **OR** Stainless steel, **as directed**.



- a. Mounting: Face of wall **OR** Between jambs **OR** As shown on Drawings, **as directed**.
 11. Sill Configuration for Counter Door: No sill **OR** Integral metal sill, **as directed**.
 12. Locking Devices: Equip door with slide bolt for padlock **OR** locking device assembly, **as directed**, and chain lock keeper, **as directed**.
 - a. Locking Device Assembly: Single-jamb side **OR** Cremone type, both jamb sides, **as directed**, locking bars, operable from inside with thumb turn **OR** outside with cylinder **OR** outside only, with cylinder **OR** inside and outside with cylinders, **as directed**.
 13. Manual Door Operator: Push-up operation **OR** Chain-hoist operator **OR** Manufacturer's standard crank operator **OR** Awning-crank operator **OR** Wall-crank operator, **as directed**.
 - a. Provide operator with through-wall shaft operation.
 - b. Provide operator with manufacturer's standard removable operating arm.
 14. Electric Door Operator:
 - a. Usage Classification: Heavy duty, 60 to 90 cycles per hour **OR** Standard duty, up to 60 cycles per hour **OR** Medium duty, up to 15 cycles per hour **OR** Light duty, up to 10 cycles per hour, **as directed**.
 - b. Operator Location: Top of hood **OR** Front of hood **OR** Wall **OR** Bench **OR** Through wall **OR** As shown on Drawings, **as directed**.
 - c. Motor Exposure: Interior **OR** Exterior, wet, and humid, **as directed**.
 - d. Emergency Manual Operation: Push-up **OR** Chain **OR** Crank, **as directed**, type.
 - e. Obstruction-Detection Device: Automatic photoelectric sensor **OR** electric sensor edge on bottom bar **OR** pneumatic sensor edge on bottom bar, **as directed**; self-monitoring type, **as directed**.
 - 1) Sensor Edge Bulb Color: Black **OR** As selected from manufacturer's full range, **as directed**.
 - f. Remote-Control Station: Interior **OR** Exterior **OR** Where shown on Drawings, **as directed**.
 - g. Other Equipment: Audible and visual signals **OR** Radio-control system, **as directed**.
 15. Door Finish:
 - a. Aluminum Finish: Mill **OR** Clear anodized **OR** Light bronze anodized **OR** Medium bronze anodized **OR** Dark bronze anodized **OR** Black anodized **OR** Anodized color matching sample **OR** Anodized color as selected from full range of industry colors and color densities, **as directed**.
 - b. Baked-Enamel or Powder-Coated Finish: Color as indicated by manufacturer's designations **OR** Color matching sample **OR** Color as selected from manufacturer's full range, **as directed**.
 - c. Factory Prime Finish: Manufacturer's standard color.
 - d. Stainless-Steel Finish: No. 2B (bright, cold rolled) **OR** No. 4 (polished directional satin), **as directed**.
 - e. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face **OR** PVC plastic, **as directed**.
- J. Fire-Rated Door Assembly
1. Fire-Rated Service **OR** Insulated Service **OR** Counter, **as directed**, Door: Overhead fire-rated coiling door formed with curtain of interlocking metal slats.
 2. Operation Cycles: Not less than 10,000 **OR** 20,000 **OR** 50,000 **OR** 100,000, **as directed**.
 - a. Include tamperproof cycle counter.
 3. Fire Rating: 3/4 hour **OR** 1 hour **OR** 1-1/2 hours **OR** 3 hours **OR** 4 hours, **as directed**, with temperature-rise limit, **as directed**, and with smoke control, **as directed**.
 4. STC Rating: 27.
 5. Curtain R-Value: 4.5 deg F x h x sq. ft./Btu (0.792 K x sq. m/W) **OR** 5.0 deg F x h x sq. ft./Btu (0.881 K x sq. m/W) **OR** 6.0 deg F x h x sq. ft./Btu (1.057 K x sq. m/W), **as directed**.
 6. Door Curtain Material: Galvanized steel **OR** Stainless steel, **as directed**.
 7. Door Curtain Slats: Curved **OR** Flat, **as directed**, profile slats of 1-1/4-inch (32-mm) **OR** 1-1/2-inch (38-mm) **OR** 1-7/8-inch (48-mm) **OR** 2-5/8-inch (67-mm) **OR** 3-1/4-inch (83-mm), **as directed**, center-to-center height.



- a. Vision Panels: Approximately 10- by 1-5/8-inch (254- by 41-mm) openings spaced approximately 2 inches (51 mm) apart and beginning 12 inches (305 mm) from end guides; in two **OR** three, **as directed**, rows of slats at height indicated on Drawings; installed with fire-rated vision-panel glazing.
- b. Insulated-Slat Interior Facing: Metal.
8. Curtain Jamb Guides: Galvanized steel **OR** Stainless steel, **as directed**, with exposed finish matching curtain slats.
9. Pass Door(s): Hinged **OR** Rigid, **as directed**, frame with lockset **OR** exit hardware, **as directed**.
10. Hood: Match curtain material and finish **OR** Galvanized steel **OR** Stainless steel, **as directed**.
 - a. Shape: Round **OR** Square **OR** As shown on Drawings, **as directed**.
 - b. Mounting: Face of wall **OR** Between jambs **OR** As shown on Drawings, **as directed**.
11. Integral Frame, Hood, and Fascia for Counter Door: Galvanized steel **OR** Stainless steel, **as directed**.
 - a. Mounting: Face of wall **OR** Between jambs **OR** As shown on Drawings, **as directed**.
12. Sill Configuration for Fire-Rated Counter Door: No sill **OR** Integral metal sill **OR** Fire-rated, laminate counter, **as directed**.
 - a. High-Pressure Decorative Laminate: Match color, pattern, and finish as indicated by manufacturer's designations **OR** of sample **OR** as selected from manufacturer's full range, **as directed**.
13. Locking Devices: Equip door with slide bolt for padlock **OR** locking device assembly, **as directed**, and chain lock keeper, **as directed**.
 - a. Locking Device Assembly: Single-jamb side **OR** Cremone type, both jamb sides, **as directed**, locking bars, operable from inside with thumbturn **OR** outside with cylinder **OR** outside only, with cylinder **OR** inside and outside with cylinders, **as directed**.
14. Manual Door Operator: Push-up operation **OR** Chain-hoist operator **OR** Manufacturer's standard crank operator **OR** Awning-crank operator **OR** Wall-crank operator, **as directed**.
 - a. Provide operator with through-wall shaft operation.
 - b. Provide operator with manufacturer's standard removable operating arm.
15. Electric Door Operator:
 - a. Usage Classification: Heavy duty, 60 to 90 cycles per hour **OR** Standard duty, up to 60 cycles per hour **OR** Medium duty, up to 15 cycles per hour **OR** Light duty, up to 10 cycles per hour, **as directed**.
 - b. Operator Location: Top of hood **OR** Front of hood **OR** Wall **OR** Bench **OR** Through wall **OR** As shown on Drawings, **as directed**.
 - c. Motor Exposure: Interior **OR** Exterior, wet, and humid, **as directed**.
 - d. Emergency Manual Operation: Push-up **OR** Chain **OR** Crank, **as directed**, type.
 - e. Obstruction Detection Device: Automatic photoelectric sensor **OR** electric sensor edge on bottom bar **OR** pneumatic sensor edge on bottom bar, **as directed**; self-monitoring type, **as directed**.
 - 1) Sensor Edge Bulb Color: Black **OR** As selected from manufacturer's full range, **as directed**.
 - f. Remote-Control Station: Interior **OR** Exterior **OR** Where shown on Drawings, **as directed**.
 - g. Other Equipment: Audible and visual signals **OR** Radio-control system, **as directed**.
16. Door Finish:
 - a. Baked-Enamel or Powder-Coated Finish: Color as indicated by manufacturer's designations **OR** Color matching sample **OR** Color as selected from manufacturer's full range, **as directed**.
 - b. Factory Prime Finish: Manufacturer's standard color.
 - c. Stainless-Steel Finish: No. 2B (bright, cold rolled) **OR** No. 4 (polished directional satin), **as directed**.
 - d. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.

K. General Finish Requirements

1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.



2. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

L. Aluminum Finishes

1. Mill Finish: Manufacturer's standard.
2. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm **OR** AA-M12C22A31, Class II, 0.010 mm, **as directed**, or thicker.
3. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm **OR** AA-M12C22A32/A34, Class II, 0.010 mm, **as directed**, or thicker.
4. Baked-Enamel or Powder-Coat Finish: AAMA 2603. Comply with coating manufacturer's written instructions for cleaning, conversion coating, application, and baking.

M. Steel And Galvanized-Steel Finishes

1. Factory Prime Finish: Manufacturer's standard primer, compatible with field-applied finish. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.
2. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

N. Stainless-Steel Finishes

1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - a. Run grain of directional finishes with long dimension of each piece.
 - b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - c. Directional Satin Finish: No. 4.
3. Bright, Cold-Rolled, Unpolished Finish: No. 2B.

1.3 EXECUTION

A. Installation

1. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
2. Install overhead coiling doors, hoods, and operators at the mounting locations indicated for each door.
3. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.
4. Fire-Rated Doors: Install according to NFPA 80.
5. Smoke-Control Doors: Install according to NFPA 80 and NFPA 105.

B. Startup Service

1. Engage a factory-authorized service representative to perform startup service.
 - a. Perform installation and startup checks according to manufacturer's written instructions.
 - b. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - c. Test door closing when activated by detector or alarm-connected fire-release system. Reset door-closing mechanism after successful test.

C. Adjusting

1. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.



2. Lubricate bearings and sliding parts as recommended by manufacturer.
3. Adjust seals to provide weathertight fit around entire perimeter.

END OF SECTION 08 33 13 00



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Task	Specification	Specification Description
08 33 23 00	08 33 13 00	Overhead Coiling Doors



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SECTION 08 33 26 00 - OVERHEAD COILING GRILLES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of material for overhead coiling grilles. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Open-curtain overhead coiling grilles.
 - b. Closed-curtain overhead coiling grilles.

C. Performance Requirements

1. Delegated Design: Design overhead coiling grilles, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2. Seismic Performance: Overhead coiling grilles shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
 - b. Seismic Component Importance Factor: 1.5 **OR** 1.0, **as directed**.
3. Operation Cycles: Provide overhead coiling grille components and operators capable of operating for not less than number of cycles indicated for each grille. One operation cycle is complete when a grille is opened from the closed position to the fully open position and returned to the closed position.

D. Submittals

1. Product Data: For each type and size of overhead coiling grille and accessory. Include the following:
 - a. Construction details, material descriptions, dimensions of individual components, profiles for curtain components, and finishes.
 - b. Rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
2. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data. Include plans, elevations, sections, details, and attachments to other work.
 - a. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - b. Wiring Diagrams: For power, signal, and control wiring.
3. Samples: For each type of exposed finish required, prepared on Samples of size indicated below.
 - a. Open-Curtain Grille: 18-inch- (457-mm-) square assembly with full-size components consisting of rods, spacers, and links as required to illustrate each assembly, including glazed inserts, **as directed**.
 - b. Closed-Curtain Grille: 18-inch- (457-mm-) square assembly with full-size components consisting of ribs and infill as required to illustrate each assembly.
 - c. Bottom Bar: 6 inches (150 mm) long with sensor edge, **as directed**.
 - d. Guides: 6 inches (150 mm) long.
 - e. Mounting Frame: 6 inches (150 mm) long.
 - f. Brackets: 6 inches (150 mm) square.
 - g. Hood: 6 inches (150 mm) square.



4. Delegated-Design Submittal: For overhead coiling grilles indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - a. Detail fabrication and assembly of seismic restraints.
 - b. Summary of forces and loads on walls and jambs.
5. Qualification Data: For qualified Installer.
6. Seismic Qualification Certificates: For overhead coiling grilles, accessories, and components, from manufacturer.
7. Maintenance Data: For overhead coiling grilles to include in maintenance manuals.

E. Quality Assurance

1. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.
2. Source Limitations: Obtain overhead coiling grilles from single source from single manufacturer.
 - a. Obtain operators and controls from overhead coiling grille manufacturer.
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
4. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.2 PRODUCTS

A. Grille Curtain Materials And Construction

1. Open-Curtain Grilles: Fabricate metal grille curtain as an open network of horizontal rods, spaced at regular intervals, that are interconnected with vertical links, which are formed and spaced as indicated and are free to rotate on the rods.
 - a. Aluminum Grille Curtain: ASTM B 221 (ASTM B 221M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
 - b. Stainless-Steel Grille Curtain: ASTM A 666, Type 300 series.
 - c. Steel Grille Curtain: Hot-dip zinc-coated (galvanized) complying with ASTM A 123/A 123M, or electrogalvanized complying with ASTM 653/A 653M, and phosphatized before fabrication.
 - d. Glazing Insert: Manufacturer's standard glazing of clear polycarbonate sheet secured by the curtain links.
2. Closed-Curtain Grilles: Fabricate curtain as a series of horizontal double-C ribs, spaced at regular intervals, that alternate with continuous horizontal infill panels secured by the ribs.
 - a. Aluminum Horizontal Ribs: ASTM B 221 (ASTM B 221M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
 - b. Glass Panels: Uncoated, clear, heat-treated, fully tempered float glass; complying with ASTM C 1048, Condition A, Type I, Class I, Quality q3, Kind FT; manufacturer's standard panel dimensions and thickness.
 - c. Plastic Panels: Fire-retardant polycarbonate sheet manufactured by the extrusion process; UV resistant; manufacturer's standard panel dimensions and thickness.
 - d. Aluminum Panels: ASTM B 209 (ASTM B 209M), alloy and temper standard with manufacturer for type of use and finish indicated; manufacturer's standard panel dimensions and thickness; finished to match ribs.
 - 1) Perforations: Manufacturer's standard pinholes.
3. Endlocks: Continuous end links, chains, or other devices at ends of rods; locking and retaining grille curtain in guides against excessive pressures, maintaining grille curtain alignment, and preventing lateral movement.
4. Bottom Bar: Manufacturer's standard continuous channel or tubular shape, finished to match grille.



- a. Astragal: Equip each grille bottom bar with a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene as a cushion bumper.
 - b. Provide motor-operated grilles with combination bottom astragal and sensor edge.
 5. Grille Curtain Jamb Guides: Manufacturer's standard shape having curtain groove with return lips or bars to retain curtain. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise; with removable stops on guides to prevent overtravel of curtain.
 - a. Removable Posts and Jamb Guides: Manufacturer's standard.
- B. Hoods And Accessories
 1. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
 - a. Galvanized Steel: Nominal 0.028-inch- (0.71-mm-) thick, hot-dip galvanized steel sheet with G90 (Z275) zinc coating, complying with ASTM A 653/A 653M.
 - b. Stainless Steel: 0.025-inch- (0.64-mm-) thick stainless-steel sheet, Type 304, complying with ASTM A 666.
 - c. Aluminum: 0.040-inch- (1.02-mm-) thick aluminum sheet complying with ASTM B 209 (ASTM B 209M), of alloy and temper recommended by manufacturer and finisher for type of use and finish indicated.
 2. Removable Metal Soffit: Formed or extruded from same metal and with same finish as curtain if hood is mounted above ceiling, unless otherwise indicated.
 3. Mounting Frame: Manufacturer's standard mounting frame designed to support grille; factory fabricated from ASTM A 36/A 36M structural-steel tubes or shapes, hot-dip galvanized per ASTM A 123/A 123M; fastened to floor and structure above grille; to be built into wall construction; and complete with anchors, connections, and fasteners.
 4. Push/Pull Handles: Equip each push-up-operated or emergency-operated grille with lifting handles on each side of grille, finished to match grille.
 - a. Provide pull-down straps or pole hooks for grilles more than 84 inches (2130 mm) high.
- C. Locking Devices
 1. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.
 2. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
 - a. Lock Cylinders: Provide cylinders specified in Division 08 Section "Door Hardware" **OR** standard with manufacturer, **as directed**, and keyed to building keying system, **as directed**.
 - b. Keys: Two **OR** Three, **as directed**, for each cylinder.
 3. Chain Lock Keeper: Suitable for padlock.
 4. Safety Interlock Switch: Equip power-operated grilles with safety interlock switch to disengage power supply when grille is locked.
- D. Counterbalancing Mechanism
 1. General: Counterbalance grilles by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
 2. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of parts and to limit barrel deflection to not more than 0.03 in./ft. (2.5 mm/m) of span under full load.



3. Spring Balance: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.
4. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
5. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

E. Manual Grille Operators

1. Equip grille with manufacturer's recommended manual grille operator unless another type of grille operator is indicated.
2. Push-up Grille Operation: Design counterbalance mechanism so required lift or pull for grille operation does not exceed 25 lbf (111 N).
3. Chain-Hoist Operator: Consisting of endless steel hand chain, chain-pocket wheel and guard, and gear-reduction unit with a maximum 25 lbf (111 N) **OR** 30 lbf (133 N), **as directed**, force for grille operation. Provide alloy-steel hand chain with chain holder secured to operator guide.
4. Crank Operator: Consisting of crank and crank gearbox, steel crank drive shaft, and gear-reduction unit, of type indicated. Size gears to require not more than 25 lbf (111 N) **OR** 30 lbf (133 N), **as directed**, force to turn crank. Fabricate gearbox to be oil tight and to completely enclose operating mechanism. Provide manufacturer's standard crank-locking device.

F. Electric Grille Operators

1. General: Electric grille operator assembly of size and capacity recommended and provided by grille manufacturer for grille and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking grille, and accessories required for proper operation.
 - a. Comply with NFPA 70.
 - b. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24 V, ac or dc.
2. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each grille.
3. Grille Operator Location(s): Operator location indicated for each grille.
 - a. Top-of-Hood Mounted: Operator is mounted to the right or left grille head plate with the operator on top of the grille-hood assembly and connected to the grille drive shaft with drive chain and sprockets. Headroom is required for this type of mounting.
 - b. Front-of-Hood Mounted: Operator is mounted to the right or left grille head plate with the operator on coil side of the grille-hood assembly and connected to the grille drive shaft with drive chain and sprockets. Front clearance is required for this type of mounting.
 - c. Wall Mounted: Operator is mounted to the inside front wall on the left or right side of grille and connected to grille drive shaft with drive chain and sprockets. Side room is required for this type of mounting. Wall mounted operator can also be mounted above or below shaft; if above shaft, headroom is required.
 - d. Bench Mounted: Operator is mounted to the right or left grille head plate and connected to the grille drive shaft with drive chain and sprockets. Side room is required for this type of mounting.
 - e. Through-Wall Mounted: Operator is mounted on other side of wall from coil-side of grille.
4. Electric Motors: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Division 11 Section "Common Motor Requirements For Equipment" unless otherwise indicated.
 - a. Electrical Characteristics:
 - 1) Phase: Single phase **OR** Polyphase, **as directed**.
 - 2) Volts: 115 **OR** 208 **OR** 230 **OR** 460, **as directed**, V.
 - 3) Hertz: 60.
 - b. Motor Type and Controller: Reversible motor and controller (disconnect switch) for motor exposure indicated.



- c. Motor Size: Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate grille in either direction from any position, at a speed not less than 8 in./sec. (203 mm/s) and not more than 12 in./sec. (305 mm/s), without exceeding nameplate ratings or service factor.
 - d. Operating Controls, Controllers (Disconnect Switches), Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
 - e. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.
 5. Limit Switches: Equip each motorized grille with adjustable switches interlocked with motor controls and set to automatically stop grille at fully opened and fully closed positions.
 6. Obstruction Detection Device: Equip motorized grille with indicated external automatic safety sensor capable of protecting full width of grille opening. Activation of sensor immediately stops and reverses downward grille travel.
 - a. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in grille opening without contact between grille and obstruction.
 - 1) Self-Monitoring Type: Designed to interface with grille operator control circuit to detect damage to or disconnection of sensing device. When self-monitoring feature is activated, grille closes only with sustained pressure on close button.
 - b. Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
 - 1) Self-Monitoring Type: Four-wire configured device designed to interface with grille operator control circuit to detect damage to or disconnection of sensing device.
 7. Remote-Control Station: Momentary-contact, three-button control station with push-button controls labeled "Open," "Close," and "Stop."
 - a. Interior units, full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
 - b. Exterior units, full-guarded, standard-duty, surface-mounted, weatherproof type; NEMA ICS 6, Type 4 enclosure, key operated.
 8. Emergency Manual Operation: Equip each electrically powered grille with capability for emergency manual operation. Design manual mechanism so required force for grille operation does not exceed 25 lbf (111 N) **OR** 30 lbf (133 N), **as directed**.
 9. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
 10. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.
 11. Audible and Visual Signals: Audible alarm and visual indicator lights in compliance with regulatory requirements for accessibility.
 12. Emergency-Egress Release: Flush, wall-mounted handle mechanism, for ADA-ABA-compliant egress feature, not dependent on electric power. The release allows an unlocked grille to partially open without affecting limit switches to permit passage, and it automatically resets motor drive upon return of handle to original position.
 13. Self-Opening Mechanism: Automatic release mechanism triggered by smoke detector, **OR** emergency push-button station, **as directed**, fire alarm or power failure. When activated, the grille self opens by means of a fail-safe operator to the fully open position without the need of power operation or battery backup systems. When the alarm is cleared **OR** emergency push-button is reset, and the alarm is cleared, **as directed**, and power is restored, the grille will operate normally.
- G. Open-Curtain Grille Assembly
1. Open-Curtain Grille: Overhead coiling grille with a curtain having a network of horizontal rods that interconnect with vertical links.
 2. Operation Cycles: Not less than 10,000 **OR** 20,000 **OR** 50,000 **OR** 100,000, **as directed**.



- a. Include tamperproof cycle counter.
3. Grille Curtain Material: Aluminum **OR** Stainless steel **OR** Galvanized steel, **as directed**.
 - a. Space rods at approximately 1-1/2 inches (38 mm) **OR** 2 inches (51 mm) **OR** 3 inches (76 mm), **as directed**, o.c.
 - b. Space links approximately 3 inches (76 mm) **OR** 6 inches (152 mm) **OR** 9 inches (228 mm), **as directed**, apart in a straight in-line **OR** brick (staggered), **as directed**, pattern.
 - c. Glazing Inserts: Manufacturer's standard.
 - d. Spacers: Metal tubes matching curtain material **OR** PVC, **as directed**.
4. Curtain Jamb Guides: Aluminum **OR** Stainless steel **OR** Galvanized steel, **as directed**, with exposed finish matching curtain slats. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise. Provide removable post(s) and jamb guides where shown on Drawings, **as directed**.
5. Hood: Match curtain material and finish **OR** Aluminum **OR** Stainless steel **OR** Galvanized steel, **as directed**.
 - a. Shape: Round **OR** Square **OR** As shown on Drawings, **as directed**.
 - b. Mounting: Face of wall **OR** Between jambs **OR** On mounting frame **OR** As shown on Drawings, **as directed**.
6. Locking Devices: Equip grille with slide bolt for padlock **OR** locking device assembly, **as directed**, and chain lock keeper, **as directed**.
 - a. Locking Device Assembly: Single-jamb side **OR** Cremone type, both jamb sides, **as directed**, locking bars, operable from inside with thumb turn **OR** outside with cylinder **OR** outside only, with cylinder **OR** inside and outside with cylinders, **as directed**.
7. Manual Grille Operator: Push-up operation **OR** Chain-hoist operator **OR** Manufacturer's standard crank operator **OR** Awning-crank operator **OR** Wall-crank operator, **as directed**.
 - a. Provide operator with through-wall shaft operation.
 - b. Provide operator with manufacturer's standard removable operating arm.
8. Electric Grille Operator:
 - a. Usage Classification: Heavy duty, 60 to 90 cycles per hour **OR** Standard duty, up to 60 cycles per hour **OR** Medium duty, up to 15 cycles per hour **OR** Light duty, up to 10 cycles per hour, **as directed**.
 - b. Operator Location: Top of hood **OR** Front of hood **OR** Wall **OR** Bench **OR** Through wall **OR** As shown on Drawings, **as directed**.
 - c. Motor Exposure: Interior **OR** Exterior, wet, and humid, **as directed**.
 - d. Emergency Manual Operation: Push-up **OR** Chain **OR** Crank, **as directed**, type.
 - e. Obstruction-Detection Device: Automatic photoelectric sensor **OR** electric sensor edge on bottom bar **OR** pneumatic sensor edge on bottom bar, **as directed**; self-monitoring type, **as directed**.
 - 1) Sensor Edge Bulb Color: Black **OR** As selected from manufacturer's full range, **as directed**.
 - f. Remote-Control Station: Interior **OR** Exterior **OR** Where shown on Drawings, **as directed**.
 - g. Other Equipment: Audible and visual signals **OR** Emergency-egress release **OR** Self-opening mechanism, **as directed**.
9. Grille Finish:
 - a. Aluminum Finish: Mill **OR** Clear anodized **OR** Light bronze anodized **OR** Medium bronze anodized **OR** Dark bronze anodized **OR** Black anodized **OR** Anodized color matching sample **OR** Anodized color as selected from full range of industry colors and color densities, **as directed**.
 - b. Baked-Enamel or Powder-Coated Finish: Color as indicated by manufacturer's designations **OR** Color matching sample **OR** Color as selected from manufacturer's full range, **as directed**.
 - c. Factory Prime Finish: Manufacturer's standard color.
 - d. Stainless-Steel Finish: No. 2B (bright, cold rolled) **OR** No. 4 (polished directional satin), **as directed**.
 - e. PVC Spacers: Color as indicated by manufacturer's designations **OR** Color as selected from manufacturer's full range, **as directed**.



H. Closed-Curtain Grille Assembly

1. Closed-Curtain Grille: Overhead coiling grille with a curtain having a series of horizontal ribs alternating with continuous horizontal infill panels secured by the ribs.
2. Operation Cycles: Not less than 10,000 **OR** 20,000 **OR** 50,000 **OR** 100,000, **as directed**.
 - a. Include tamperproof cycle counter.
3. Grille Curtain Material: Aluminum ribs with continuous inserts indicated.
 - a. Space ribs at approximately 3 inches (76 mm), **as directed**, o.c.
 - b. Inserts: Glass panels.
 - c. Inserts: Clear, transparent **OR** Translucent, **as directed**, plastic panels.
 - d. Inserts: Solid **OR** Perforated, **as directed**, aluminum panels.
4. Curtain Jamb Guides: Aluminum with exposed finish matching curtain slats. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise. Provide removable post(s) and jamb guides where shown on Drawings, **as directed**.
5. Hood: Match curtain material and finish **OR** Aluminum **OR** Stainless steel **OR** Galvanized steel, **as directed**.
 - a. Shape: Round **OR** Square **OR** As shown on Drawings, **as directed**.
 - b. Mounting: Face of wall **OR** Between jambs **OR** On mounting frame **OR** As shown on Drawings, **as directed**.
6. Locking Devices: Equip grille with slide bolt for padlock **OR** locking device assembly, **as directed**, and chain lock keeper, **as directed**.
 - a. Locking Device Assembly: Single-jamb side **OR** Cremone type, both jamb sides, **as directed**, locking bars, operable from inside with thumbturn **OR** outside with cylinder **OR** outside only, with cylinder **OR** inside and outside with cylinders, **as directed**.
7. Manual Grille Operator: Push-up operation **OR** Chain-hoist operator **OR** Manufacturer's standard crank operator **OR** Awning-crank operator **OR** Wall-crank operator, **as directed**.
 - a. Provide operator with through-wall shaft operation.
 - b. Provide operator with manufacturer's standard removable operating arm.
8. Electric Grille Operator:
 - a. Usage Classification: Heavy duty, 60 to 90 cycles per hour **OR** Standard duty, up to 60 cycles per hour **OR** Medium duty, up to 15 cycles per hour **OR** Light duty, up to 10 cycles per hour, **as directed**.
 - b. Operator Location: Top of hood **OR** Front of hood **OR** Wall **OR** Bench **OR** Through wall **OR** As shown on Drawings, **as directed**.
 - c. Motor Exposure: Interior **OR** Exterior, wet, and humid, **as directed**.
 - d. Emergency Manual Operation: Push-up **OR** Chain **OR** Crank, **as directed**, type.
 - e. Obstruction-Detection Device: Automatic photoelectric sensor **OR** electric sensor edge on bottom bar **OR** pneumatic sensor edge on bottom bar, **as directed**; self-monitoring type, **as directed**.
 - 1) Sensor Edge Bulb Color: Black **OR** As selected from manufacturer's full range, **as directed**.
 - f. Remote-Control Station: Interior **OR** Exterior **OR** Where shown on Drawings, **as directed**.
 - g. Other Equipment: Audible and visual signals **OR** Emergency-egress release **OR** Self-opening mechanism, **as directed**.
9. Grille Finish:
 - a. Aluminum Finish: Mill **OR** Clear anodized **OR** Light bronze anodized **OR** Medium bronze anodized **OR** Dark bronze anodized **OR** Black anodized **OR** Anodized color matching sample **OR** Anodized color as selected from full range of industry colors and color densities, **as directed**.
 - b. Baked-Enamel or Powder-Coated Finish: Color as indicated by manufacturer's designations **OR** Color matching sample **OR** Color as selected from manufacturer's full range, **as directed**.
 - c. Factory Prime Finish: Manufacturer's standard color.
 - d. Stainless-Steel Finish: No. 2B (bright, cold rolled) **OR** No. 4 (polished directional satin), **as directed**.

I. General Finish Requirements



1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

J. Aluminum Finishes

1. Mill Finish: Manufacturer's standard.
2. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm **OR** AA-M12C22A31, Class II, 0.010 mm, **as directed**, or thicker.
3. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm **OR** AA-M12C22A32/A34, Class II, 0.010 mm, **as directed**, or thicker.
4. Baked-Enamel or Powder-Coat Finish: AAMA 2603. Comply with coating manufacturer's written instructions for cleaning, conversion coating, application, and baking.

K. Steel And Galvanized-Steel Finishes

1. Factory Prime Finish: Manufacturer's standard primer, compatible with field-applied finish. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.
2. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

L. Stainless-Steel Finishes

1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - a. Run grain of directional finishes with long dimension of each piece.
 - b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - c. Directional Satin Finish: No. 4.
3. Bright, Cold-Rolled, Unpolished Finish: No. 2B.

1.3 EXECUTION

A. Examination

1. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
2. Examine locations of electrical connections.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Installation

1. Install overhead coiling grilles and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
2. Install overhead coiling grilles, hoods, and operators at the mounting locations indicated for each grille.
3. Accessibility: Install overhead coiling grilles, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

C. Startup Service

1. Engage a factory-authorized service representative to perform startup service.
 - a. Perform installation and startup checks according to manufacturer's written instructions.
 - b. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.



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- c. Test grille opening when activated by detector, fire-alarm system, emergency-egress release, or self-opening mechanism as required. Reset grille-opening mechanism after successful test.

 - D. Adjusting
 - 1. Adjust hardware and moving parts to function smoothly so that grilles operate easily, free of warp, twist, or distortion.
 - 2. Lubricate bearings and sliding parts as recommended by manufacturer.

 - E. Demonstration
 - 1. Train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling grilles.

END OF SECTION 08 33 26 00



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SECTION 08 33 36 00 - SIDE COILING GRILLES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of material for side coiling grilles. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Performance Requirements

1. Operation-Cycle Requirements: Provide side coiling grille components and operators capable of operating for not less than 10,000 **OR** 20,000, **as directed**, cycles and for 10 cycles per day.

C. Submittals

1. Product Data: For each type and size of side coiling grille and accessory.
2. Shop Drawings: Include plans, elevations, sections, details, and attachment to other work.
3. Samples: For each exposed finish.

D. Quality Assurance

1. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.
2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100.

1.2 PRODUCTS

A. Grille Curtain Materials And Construction

1. Grille Curtain: Network of 1/4-inch- (6-mm-) **OR** 5/16-inch- (8-mm-), **as directed**, minimum diameter horizontal rods, or rods covered with tube spacers. Interconnect rods by vertical links approximately 5/8 inch (16 mm) wide and rotating on rods.
 - a. Space rods at approximately 1-1/2 inches (38 mm) o.c.
 - b. Space links approximately 3 inches (76 mm) apart in a straight in-line **OR** staggered, **as directed**, pattern.
 - c. Steel Grille Curtain: Hot-dip zinc-coated (galvanized), complying with ASTM A 123/A 123M, or electrogalvanized complying with ASTM 653/A 653M, and phosphatized before fabrication.
 - d. Stainless-Steel Grille Curtain: ASTM A 666, Type 300 series.
 - e. Aluminum Grille Curtain: ASTM B 221 (ASTM B 221M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
2. Top Track: Extruded aluminum channel mechanically attached to a support angle with provisions for take-up bolts to compensate for a maximum deflection of 1/2-inch.
3. Bottom Track: Manufacturer's standard, finished to match grille.
4. Coil Box: Entirely enclose coiled grille, operating mechanism, supporting disk and the drum around which the grille will coil.
5. Power Operated Grille: Safety interlock switch to disengage power supply when grille is locked.
6. Manual Grille Operator: Crank or Push-Pull.
7. Electric Grille Operator: Manufacturer's standard type, size, and capacity for grille and operation-cycle requirements specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking grille, and accessories. Comply with NFPA 70.
 - a. Disconnect Device: Hand-operated for automatically engaging chain and sprocket operator and releasing brake for emergency manual operation while disconnecting motor,



without affecting timing of limit switch. Mount to be accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

- b. Grille-Operator Type: Wall- or bracket-mounted unit with electric motor, gear-reduction drive, and chain and sprocket secondary drive.
8. Electric Motors: High-starting torque, reversible, continuous-duty, polyphase, Class A insulated, electric motors complying with NEMA MG 1; with overload protection; sized to start, accelerate, and operate grille in either direction from any position, at not less than 2/3 fps (0.2 m/s) and not more than 1 fps (0.3 m/s), without exceeding nameplate ratings or service factor. Coordinate wiring requirements and electrical characteristics of motors with building electrical system.
 - a. Open dripproof-type motor, and controller with NEMA ICS 6, Type 1 enclosure.
 - b. Totally enclosed, nonventilated or fan-cooled motor, fitted with plugged drain, and controller with NEMA ICS 6, Type 4 enclosure where indicated.
9. Remote-Control Station: Momentary-contact **OR** Sustained-pressure, **as directed**, three-button control station; fully guarded, weatherproof (if for exterior location), key operated.
10. Obstruction Detection Device: External automatic safety sensor capable of protecting full width of grille opening. Activation of sensor immediately stops and reverses grille travel.
11. Provide electric operators with ADA-compliant audible alarm and visual indicator lights.

B. Finishes

1. Aluminum Anodic Finish: Mill finish **OR** Class II, clear anodic coating complying with AAMA 611, **as directed**.
2. Galvanized Steel Finish: Manufacturer's standard primer **OR** Powder-coat finish, **as directed**.
 - a. Color and Gloss: As selected from manufacturer's full range.
 - b. Painting is specified in Division 09 Section(s) "Interior Painting" **OR** "Staining And Transparent Finishing".
3. Stainless-Steel Finish: Bright, cold-rolled, unpolished finish: No. 2B finish **OR** Bright, directional polish: No. 4 finish, **as directed**.

1.3 EXECUTION

A. Installation

1. General: Install side coiling grilles and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports.
2. Lubricate bearings and sliding parts; adjust grilles to operate easily, free of warp, twist, or distortion.

END OF SECTION 08 33 36 00



Task	Specification	Specification Description
08 33 39 00	01 22 16 00	No Specification Required



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SECTION 08 34 53 00 - DETENTION DOORS AND FRAMES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of material for detention doors and frames. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Swinging detention doors.
 - b. Sliding detention doors.
 - c. Detention panels.
 - d. Detention frames.

C. Definitions

1. Minimum-Thickness Steel: Indicated as the specified minimum thicknesses for base metal without coatings, according to HMMA 803.
2. Nominal-Thickness Stainless Steel: Indicated as the specified thicknesses for which over- and under-thickness tolerances apply, according to ASTM A 480/A 480M.
3. Nominal Surface of Floor Covering: Top surface of floor; for resilient tile and carpet, nominal surface of floor covering is defined as top of concrete slab.

D. Performance Requirements

1. Detention Doors and Frame Assemblies: Provide detention doors and frames that comply with the following, based on testing manufacturer's standard units in assemblies similar to those indicated for this Project:
 - a. Security Grade: Comply with Grade 1 **OR** Grade 2 **OR** Grade 3 **OR** Grade 4, **as directed**, according to ASTM F 1450.
 - b. Bullet Resistance: Comply with Level 3 rating when tested according to UL 752.
 - 1) Listed and labeled, by a testing agency acceptable to authorities having jurisdiction, as bullet resisting.
 - c. Tool-Attack Resistance: Comply with small-tool-attack-resistance rating when tested according to UL 437 and UL 1034.
2. Detention Frames: Provide sidelight and borrowed-light detention frames that comply with ASTM F 1592 and removable stop test according to HMMA 863, based on testing manufacturer's standard units in assemblies similar to those indicated for this Project.

E. Submittals

1. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, label compliance, fire-resistance rating, and temperature-rise ratings, and finishes for each type of detention doors and frames specified.
2. Shop Drawings: In addition to requirements below, provide a schedule using same reference numbers for details and openings as those on Drawings:
 - a. Elevations of each door design.
 - b. Direction of swing **OR** slide, **as directed**.
 - c. Inmate and non-inmate sides.
 - d. Details of doors, including vertical and horizontal edge details, and metal thicknesses.
 - e. Details of frames, including dimensioned profiles, and metal thicknesses.
 - f. Locations of reinforcement and preparations for hardware.
 - g. Details of each different wall opening condition.
 - h. Details of anchorages, joints, field splices, and connections.



- i. Details of food-pass openings, louvers, speaking apertures, and gun ports.
 - j. Details of moldings, removable stops, and glazing.
 - k. Details of conduit, junction boxes, and preparations for electrified and pneumatic door hardware.
3. Samples:
- a. For each type of exposed finish required.
 - b. For the following items to demonstrate compliance with requirements for quality of materials and construction:
 - 1) Detention Doors: Show vertical-edge, top, and bottom construction; insulation; face stiffeners; and hinge and other applied hardware reinforcement. Include separate section showing glazing if applicable.
 - 2) Detention Frames: Show profile, welded corner joint, welded hinge reinforcement, grout-cover boxes, floor and wall anchors, and silencers. Include separate section showing fixed steel panels and glazing if applicable.
4. Coordination Drawings: Drawings of each detention door and frame, drawn to scale, on which connections and interface with electrified and pneumatic control systems are shown.
5. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.
6. Welding certificates.
7. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for detention doors and frames. Indicate metal thickness of each component of tested assembly and describe construction methods.
8. Field quality-control reports documenting inspections of installed products.

F. Quality Assurance

- 1. Welding Qualifications: Qualify procedures and personnel according to the following:
 - a. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - b. AWS D1.3, "Structural Welding Code - Sheet Steel."
 - c. AWS D1.6, "Structural Welding Code - Stainless Steel."
- 2. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure **OR** as close to neutral pressure as possible, **as directed**, according to NFPA 252 **OR** IBC Standard 716.5 **OR** UL 10B **OR** UL 10C, **as directed**.
 - a. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
 - b. Temperature-Rise Limit: Where indicated **OR** At vertical exit enclosures and exit passageways, **as directed**, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
- 3. Fire-Rated Detention Sidelight and Borrow-Light Frames: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 257.
- 4. Smoke-Control Detention Door Assemblies: Comply with NFPA 105.

G. Delivery, Storage, And Handling

- 1. Deliver detention doors and frames palleted, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
- 2. Deliver detention frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- 3. Inspect units, on delivery, for damage. Minor damage may be repaired provided refinished items match new work and are approved by Architect; otherwise, remove and replace damaged items as directed.



4. Store detention doors and frames under cover at building site. Place units in a vertical position with heads up, spaced by blocking, on minimum 4-inch- (102-mm-) high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber.
 - a. Provide minimum 1/4-inch (6-mm) space between each stacked unit to permit air circulation.

H. Maintenance Tools

1. Tool Kit: Provide six sets of tools for use with security fasteners, each packaged in a compartmented kit configured for easy handling and storage.

1.2 PRODUCTS

A. Materials

1. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, CS (Commercial Steel), Type B; free of scale, pitting, or surface defects; pickled and oiled.
2. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, CS (Commercial Steel), Type B.
3. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, CS (Commercial Steel), Type B; with G60 (Z180) zinc (galvanized) or A60 (ZF180) zinc-iron-alloy (galvannealed) coating designation.
4. Stainless-Steel Sheet: ASTM A 240/A 240M, austenitic stainless steel, Type 304.
5. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
6. Concealed Bolts: ASTM A 307, Grade A unless otherwise indicated.
7. Masonry Anchors: Fabricated from same steel sheet as door face.
8. Embedded Anchors: Fabricated from mild steel shapes and plates, hot-dip galvanized according to ASTM A 153/A 153M.
9. Postinstalled Expansion Anchors: With capability to sustain, without failure, a load equal to 4 times the load imposed, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
 - a. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition (mild).
 - b. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Alloy Group 1 or 4) for bolts and nuts; ASTM A 276 or ASTM A 666, Type 304 or 316, for anchors.
 - c. Corrosion Protection: Components fabricated from nickel-copper-alloy rods complying with ASTM B 164 for UNS No. N04400 alloy.
10. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
11. Glazing: Comply with Division 08 Section "Security Glazing".
12. Grout: Comply with ASTM C 476, with a slump of not more than 4 inches (102 mm) as measured according to ASTM C 143/C 143M.
13. Insulation: Slag-wool-fiber/rock-wool-fiber or glass-fiber blanket insulation. ASTM C 665, Type I (unfaced); with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics. Minimum 1.5-lb/cu. ft. (24-kg/cu. m) density.
14. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

B. Detention Doors

1. General: Provide flush-design detention doors of seamless hollow construction, 2 inches (51 mm) thick unless otherwise indicated. Construct detention doors with smooth, flush surfaces without visible joints or seams on exposed faces or stile edges.
 - a. For single-acting swinging detention doors, bevel both vertical edges 1/8 inch in 2 inches (3 mm in 51 mm).
 - b. For sliding detention doors, square both vertical edges.
2. Core Construction: Provide the following core construction of same material as detention door face sheets, welded to both detention door faces:



- a. Steel-Stiffened Core: 0.042-inch- (1.0-mm-) thick, steel vertical stiffeners extending full-door height, with vertical webs spaced not more than 4 inches (102 mm) apart, spot welded to face sheets a maximum of 3 inches (76 mm) o.c. Fill spaces between stiffeners with insulation.
- b. Truss-Stiffened Core: 0.013-inch- (0.3-mm-) thick, steel, truncated triangular stiffeners extending between face sheets and for full height and width of door; with stiffeners welded to face sheets not more than 3 inches (76 mm) o.c. vertically and 2-3/4 inches (70 mm) horizontally. Fill spaces between stiffeners with insulation.
3. Vertical Edge Channels: 0.123-inch- (3.1-mm-) thick, continuous channel of same material as detention door face sheets, extending full-door height at each vertical edge; welded to top and bottom channels to create a fully welded perimeter channel. Noncontiguous channel is permitted to accommodate lock-edge hardware only if lock reinforcement is welded to and made integral with channel.
4. Top and Bottom Channels: 0.123-inch- (3.1-mm-) thick metal channel of same material as detention door face sheets, spot welded, not more than 4 inches (102 mm) o.c., to face sheets.
 - a. Reinforce top edge of detention door with 0.053-inch- (1.3-mm-) thick closing channel, inverted and nesting in top channel; welded so channel web is flush with top door edges.
5. Hardware Reinforcement: Fabricate reinforcing plates from same material as detention door face sheets to comply with the following minimum thicknesses:
 - a. Full-Mortise Hinges and Pivots: 0.187 inch (4.7 mm) thick.
 - b. Maximum-Security Surface Hinges: 0.250 inch (6.3 mm) thick.
 - c. Strike Reinforcements: 0.187 inch (4.7 mm) thick.
 - d. Slide-Device Hanger Attachments: As recommended by device manufacturer.
 - e. Lock Fronts, Concealed Holders, and Surface-Mounted Closers: 0.093 inch (2.3 mm) thick.
 - f. All Other Surface-Mounted Hardware: 0.093 inch (2.3 mm) thick.
 - g. Lock Pockets: 0.123 inch (3.1 mm) thick at non-inmate side, welded to face sheet.
6. Hardware Enclosures: Provide enclosures and junction boxes for electrically operated detention door hardware of same material as detention door face sheets, interconnected with UL-approved, 1/2-inch- (13-mm-) diameter conduit and connectors.
 - a. Where indicated for installation of wiring, provide access plates to junction boxes, fabricated from same material and thickness as face sheet and fastened with at least 4 security fasteners spaced not more than 6 inches (152 mm) o.c.
7. Interior Detention Door Face Sheets: Fabricated from cold-rolled steel sheets **OR** metallic-coated steel sheets **OR** stainless-steel sheets, **as directed**.
 - a. Security Grade 1: 0.093-inch- (2.3-mm-) minimum-thickness steel **OR** 0.109-inch (2.8-mm) nominal-thickness stainless steel, **as directed**.
 - b. Security Grade 2: 0.093-inch- (2.3-mm-) minimum-thickness steel **OR** 0.109-inch (2.8-mm) nominal-thickness stainless steel, **as directed**.
 - c. Security Grade 3: 0.067-inch- (1.7-mm-) minimum-thickness steel **OR** 0.078-inch (2.0-mm) nominal-thickness stainless steel, **as directed**.
 - d. Security Grade 4: 0.067-inch- (1.7-mm-) minimum-thickness steel **OR** 0.078-inch (2.0-mm) nominal-thickness stainless steel, **as directed**.
8. Exterior Detention Door Face Sheets: Fabricated from metallic-coated steel sheets **OR** stainless-steel sheets, **as directed**.
 - a. Security Grade 1: 0.093-inch- (2.3-mm-) minimum-thickness steel **OR** 0.109-inch (2.8-mm) nominal-thickness stainless steel, **as directed**.
 - b. Security Grade 2: 0.093-inch- (2.3-mm-) minimum-thickness steel **OR** 0.109-inch (2.8-mm) nominal-thickness stainless steel, **as directed**.
 - c. Security Grade 3: 0.067-inch- (1.7-mm-) minimum-thickness steel **OR** 0.078-inch (2.0-mm) nominal-thickness stainless steel, **as directed**.
 - d. Security Grade 4: 0.067-inch- (1.7-mm-) minimum-thickness steel **OR** 0.078-inch (2.0-mm) nominal-thickness stainless steel, **as directed**.

C. Detention Panels



1. Provide fixed detention panels of same materials, construction, and finish as specified for adjoining detention frame.

D. Detention Frames

1. General: Provide fully welded detention frames with integral stops, of seamless construction without visible joints or seams. Fabricate detention frames with contact edges closed tight and corners mitered, reinforced, and continuously welded full depth and width of detention frame.
2. Provide two temporary steel spreaders spot welded to bottom of jambs to act as bracing during shipping and storage. Remove prior to installation.
3. Stop Height: Provide minimum stop height of 0.625 inch (16 mm) **OR** 0.750 inch (19 mm), **as directed**, for detention door openings and minimum stop height of 1-1/4 inches (32 mm) in security glazing or detention panel openings unless otherwise indicated.
4. Interior Detention Frames: Fabricated from cold-rolled steel sheets **OR** metallic-coated steel sheets where indicated **OR** stainless-steel sheets for stainless-steel detention doors, **as directed**.
 - a. Security Grade 1: 0.093-inch- (2.3-mm-) minimum-thickness steel **OR** 0.109-inch (2.8-mm) nominal-thickness stainless steel, **as directed**.
 - b. Security Grade 2: 0.093-inch- (2.3-mm-) minimum-thickness steel **OR** 0.109-inch (2.8-mm) nominal-thickness stainless steel, **as directed**.
 - c. Security Grade 3: 0.067-inch- (1.7-mm-) minimum-thickness steel **OR** 0.078-inch (2.0-mm) nominal-thickness stainless steel, **as directed**.
 - d. Security Grade 4: 0.067-inch- (1.7-mm-) minimum-thickness steel **OR** 0.078-inch (2.0-mm) nominal-thickness stainless steel, **as directed**.
5. Exterior Detention Frames: Fabricated from metallic-coated steel sheets **OR** stainless-steel sheets for stainless-steel detention doors, **as directed**.
 - a. Security Grade 1: 0.093-inch- (2.3-mm-) minimum-thickness steel **OR** 0.109-inch (2.8-mm) nominal-thickness stainless steel, **as directed**.
 - b. Security Grade 2: 0.093-inch- (2.3-mm-) minimum-thickness steel **OR** 0.109-inch (2.8-mm) nominal-thickness stainless steel, **as directed**.
 - c. Security Grade 3: 0.067-inch- (1.7-mm-) minimum-thickness steel **OR** 0.078-inch (2.0-mm) nominal-thickness stainless steel, **as directed**.
 - d. Security Grade 4: 0.067-inch- (1.7-mm-) minimum-thickness steel **OR** 0.078-inch (2.0-mm) nominal-thickness stainless steel, **as directed**.
6. Hardware Reinforcement: Fabricate reinforcing plates from same material as detention frame to comply with the following minimum thicknesses:
 - a. Hinges and Pivots: 0.187 inch (4.7 mm) thick by 1-1/2 inches (38 mm) wide by 10 inches (254 mm) long.
 - b. Strikes, Flush Bolts, and Closers: 0.187 inch (4.7 mm) thick.
 - c. Surface-Mounted Hardware: 0.093 inch (2.3 mm) thick.
 - d. Lock Pockets: 0.123 inch (3.1 mm) thick at non-inmate side, welded to face sheet. Provide 0.123-inch- (3.1-mm-) thick, lock protection plate for attachment to lock pocket with security fasteners.
7. Hardware Enclosures: Provide enclosures and junction boxes for electrically operated detention door hardware, interconnected with UL-approved, 1/2-inch- (13-mm-) diameter conduit and connectors.
 - a. Where indicated for installation of wiring, provide access plates to junction boxes, fabricated from same material and thickness as face sheet and fastened with at least 4 security fasteners spaced not more than 6 inches (152 mm) o.c.
8. Mullions and Transom Bars: Provide closed or tubular mullions and transom bars where indicated. Fasten mullions and transom bars at crossings and to jambs by butt welding. Reinforce joints between detention frame members with concealed clip angles or sleeves of same metal and thickness as detention frame.
9. Jamb Anchors: Weld jamb anchors to detention frames near hinges and directly opposite on strike jamb or as required to secure detention frames to adjacent construction.
 - a. Number of Anchors: Provide two anchors per jamb plus the following:
 - 1) Detention Door Frames: One additional anchor for each 18 inches (457 mm), or fraction thereof, above 54 inches (1372 mm) in height.



- 2) Detention Frames with Security Glazing or Detention Panels: One additional anchor for each 18 inches (457 mm), or fraction thereof, above 36 inches (914 mm) in height.
- b. Masonry Anchors: Adjustable, corrugated or perforated, strap-and-stirrup anchors to suit detention frame size; formed of same material and thickness as detention frame; with strap not less than 2 inches (51 mm) wide by 10 inches (254 mm) long.
- c. Embedded Anchors: Provide detention frames with removable faces at jambs where embedded anchors are indicated. Anchors consist of three parts:
 - 1) Embedded Plates: Steel plates, 0.188 inch thick by 4 inches wide by 6 inches (4.7 mm thick by 102 mm wide by 152 mm) long. Continuously weld 2 steel bars, 1/2 inch (13 mm) in diameter and 10 inches (254 mm) long with 2-inch (51-mm) 90-degree turndown on ends, to the embedded end of each plate. Weld steel angles, 0.188 inch thick by 2 by 2 by 4 inches (4.7 mm thick by 51 by 51 by 102 mm) long, to the exposed end of each plate. Embed at locations to match frame angles.
 - 2) Frame Angles: Steel angles, 0.188 inch thick by 2 by 2 by 4 inches (4.7 mm thick by 51 by 51 by 102 mm) long, welded to detention frames with 1-inch- (25-mm-) long welds at each end of angle.
 - 3) Connector Angles: Steel angles, of size required, to connect frame angles and embedded plates.
- d. Postinstalled Expansion Anchors: Minimum 1/2-inch- (13-mm-) diameter concealed bolts with expansion shields or inserts. Provide conduit spacer from detention frame to wall, welded to detention frame. Reinforce detention frames at anchor locations.
10. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, formed of same material and thickness as detention frame, and as follows:
 - a. Monolithic Concrete Slabs: Clip anchors, with two holes to receive fasteners, welded to bottom of jambs and mullions with at least four spot welds per anchor.
 - b. Separate Topping Concrete Slabs: Adjustable anchors with extension clips, allowing not less than 2-inch (51-mm) height adjustment, welded to jambs and mullions with at least 4 spot welds per anchor. Terminate bottom of detention frames at finish floor surface.
11. Rubber Door Silencers: Except on weather-stripped detention doors, drill stops in strike jambs to receive three silencers on single-detention-door frames and drill head jamb stop to receive two silencers on double-detention-door frames. Keep holes clear during construction.
12. Grout Guards: Provide factory-installed grout guards of same material as detention frame, welded to detention frame at back of hardware cutouts, silencers, and glazing-stop screw preparations to close off interior of openings and prevent mortar or other materials from obstructing hardware operation or installation.

E. Moldings And Stops

1. Provide fixed moldings on inmate side of glazed openings and removable stops on non-inmate side.
 - a. Height: As required to provide minimum 1-inch (25-mm) glass engagement, but not less than 1-1/4 inches (32 mm).
 - b. Fixed Moldings: Formed from same material as detention door and frame face sheets, but not less than 0.093-inch- (2.3-mm-) thick, spot welded to face sheets a maximum of 5 inches (127 mm) o.c.
 - c. Removable Stops: Formed from 0.123-inch- (3.1-mm-) thick angle, of same material as detention door face sheets. Secure with button head security fasteners spaced uniformly not more than 9 inches (229 mm) **OR** 6 inches (152 mm), **as directed**, o.c. and not more than 2 inches (51 mm) from each corner, and as necessary to satisfy performance requirements. Form corners with notched or mitered hairline joints.
2. Coordinate rabbet width between fixed and removable stops with type of glass or panel and type of installation indicated.

F. Accessories



1. Pass-Through Openings: Fabricate flush openings using 0.093-inch- (2.3-mm-) thick interior channels of same material as detention door faces, inverted to be flush with openings, welded to inside of both face sheets and with corners fully welded. Mount shutters on non-inmate side of detention doors. Reinforce for locks and food-pass hinges.
 - a. Inset Shutters: Fabricate from 2 steel plates, 0.123 inch (3.1 mm) thick, of same material as detention door face sheets, spot welded together and sized to inset inside opening and to prevent inmate tampering of lock and hinges.
 - b. Overlapping Shutters: For surface application on non-inmate side of door. Fabricate from a single steel plate, of same material as detention door face sheets, 0.187 inch (4.7 mm) thick, sized to overlap food-pass openings 1/2 inch (13 mm).
 2. Detention Door Louvers: Fabricate flush louver openings using 0.093-inch- (2.3-mm-) thick, interior steel channels of same material as detention door faces, welded to inside of both detention door face sheets and with corners fully welded. Provide welded, inverted V- or Y-shaped vanes allowing specified airflow, fabricated from same material as detention door face sheets, 0.093 inch (2.3 mm) thick, and spaced so no rigid flat instrument can pass through.
 - a. Reinforcement: Reinforce louvers that exceed 18 inches (457 mm) in height at louver midpoint with 1/4-by-1-1/2-inch- (6.3-by-38-mm-) square, vertical rectangular steel bar or 3/4-inch- (19-mm-) diameter, vertical steel bar.
 - b. Airflow: Airflow and static-pressure loss **as directed**.
 - c. Exterior Detention Door Insect Screens: Fabricated from 12-by-12 (2.1-by-2.1-mm) mesh of 0.028-inch- (0.71-mm-) diameter, stainless-steel wire or from perforated metal of same material and thickness as detention door face sheet with 1/8-inch- (3-mm-) diameter holes spaced 1 inch (25 mm) o.c.; where indicated.
 3. Speaking Apertures: Consisting of a rectangular pattern of holes, minimum 1 inch high by 4 inches wide (25 mm high by 102 mm wide), with holes 1/4 inch (6 mm) in diameter. Locate holes in both face sheets directly across from each other and spaced not more than 1 inch (25 mm) o.c. vertically and horizontally. Provide 0.067-inch- (1.7-mm-) thick, pressed-steel baffles in interior of detention door between hole patterns to prevent passage of objects.
 4. Gun Ports: Fabricate units to comply with UL 752 and to resist same security level as detention doors in which they are installed.
- G. Security Fasteners
1. Security Fasteners: Operable only by tools produced for use on specific type of fastener by fastener manufacturer or other licensed fabricator.
 2. Drive-System Type, Head Style, Material, and Protective Coating: Provide as required for assembly, installation, and strength, and as follows:
 - a. Drive-System Types: Pinned Torx-Plus **OR** Pinned Torx, **as directed**.
 - b. Fastener Strength: Grade 8 (Class 10.9).
 - c. Socket Button Head Fasteners:
 - 1) Heat-treated alloy steel, ASTM F 835 (ASTM F 835M).
 - 2) Stainless steel, ASTM F 879 (ASTM F 879M), Group 1 CW.
 - d. Socket Flat Countersunk Head Fasteners:
 - 1) Heat-treated alloy steel, ASTM F 835 (ASTM F 835M).
 - 2) Stainless steel, ASTM F 879 (ASTM F 879M), Group 1 CW.
 - e. Socket Head Cap Fasteners:
 - 1) Heat-treated alloy steel, ASTM A 574 (ASTM A 574M).
 - 2) Stainless steel, ASTM F 837 (ASTM F 837M), Group 1 CW.
 - f. Protective Coatings for Heat-Treated Alloy Steel:
 - 1) Zinc and clear trivalent chromium, for exterior applications and interior applications where indicated.
 - 2) Zinc phosphate with oil, ASTM F 1137, Grade I, or black oxide unless otherwise indicated.
- H. Fabrication
1. Fabricate detention doors and frames rigid, neat in appearance, and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of



metal. Weld exposed joints continuously; grind, fill, dress, and make smooth, flush, and invisible. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

2. Tolerances: Fabricate detention doors and frames to comply with manufacturing tolerances indicated in HMMA 863.
3. Fabricate multiple-opening detention frames with mullions that have closed tubular shapes and with no visible seams or joints.
4. Exterior Detention Doors: Provide weep-hole openings in bottom of detention doors to permit entrapped moisture to escape. Seal joints in top edges of detention doors against water penetration.
5. Hardware Preparation: Factory prepare detention doors and frames to receive mortised hardware, including cutouts, reinforcement, mortising, drilling, and tapping, according to final door hardware schedule and templates provided by detention door hardware supplier.
 - a. Reinforce detention doors and frames to receive surface-mounted door hardware. Drilling and tapping may be done at Project site.
 - b. Locate door hardware as indicated or, if not indicated, according to HMMA 831.
6. Factory cut openings in detention doors.
7. Weld components to comply with referenced AWS standard. Weld before finishing components to greatest extent possible. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

I. General Finish Requirements

1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Finish detention doors and frames after assembly.

J. Metallic-Coated Steel Sheet Finishes

1. Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas and apply galvanizing repair paint, complying with SPPC-Paint 20, to comply with ASTM A 780.
2. Factory Priming for Field-Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 0.7 mils (0.02 mm).
 - a. Shop Primer: Manufacturer's or fabricator's standard, fast-curing, lead- and chromate-free primer complying with ANSI A250.10 acceptance criteria; recommended by primer manufacturer for zinc-coated steel; compatible with substrate and field-applied finish paint system indicated; and providing a sound foundation for field-applied topcoats despite prolonged exposure.

K. Steel Sheet Finishes

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning"; remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 3, "Power Tool Cleaning," or SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Factory Priming for Field-Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 0.7 mils (0.02 mm).
 - a. Shop Primer: Manufacturer's or fabricator's standard, fast-curing, corrosion-inhibiting, lead- and chromate-free, universal primer complying with ANSI A250.10 acceptance criteria; compatible with substrate and field-applied finish paint system indicated; and providing a sound foundation for field-applied topcoats despite prolonged exposure.

L. Stainless-Steel Finishes

1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.



2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - a. Run grain of directional finishes with long dimension of each piece.
 - b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - c. Directional Satin Finish: No. 4.

1.3 EXECUTION

A. Preparation

1. Remove welded-in shipping spreaders installed at factory.
2. Prior to installation and with shipping spreaders removed, adjust detention frames for squareness, alignment, twist, and plumbness to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb and perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of face.
 - c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of door rabbet.
 - d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.

B. Installation

1. General: Install detention doors and frames plumb, rigid, properly aligned, and securely fastened in place, complying with Drawings, schedules, and manufacturer's written recommendations.
2. Anchorage: Set detention frame anchorage devices according to details on Shop Drawings and per anchorage device manufacturer's written instructions.
 - a. Masonry Anchors: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
 - b. Embedded Anchors: Install embedded plates in wall surrounding frame openings to match frame angle locations.
 - c. Postinstalled Expansion Anchors: Drill holes in existing construction at locations to match bolt locations and install bolt expansion shields or inserts.
3. Assemble detention frames fabricated in sections. Install angle splices at each corner, of same material and thickness as detention frame, and extend at least 4 inches (102 mm) on both sides of joint.
 - a. Field splice only at approved locations. Weld, grind, and finish as required to conceal evidence of splicing on exposed faces.
 - b. Continuously weld and finish smooth joints between faces of abutted, multiple-opening, detention frame members.
 - c. Field Welding: Comply with the following requirements:
 - 1) Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2) Obtain fusion without undercut or overlap.
 - 3) Remove welding flux immediately.
 - 4) At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
4. Apply bituminous coating to backs of frames prior to filling with grout.
5. Placing Detention Frames: Install detention frames of sizes and profiles indicated. Set detention frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.
 - a. Embedded Anchors: Remove jamb faces from detention frames and set detention frames into opening. Weld steel connector angle to frame angle and to embedded plate with 1-



inch- (25-mm-) long welds at each end of connector angle to form a rigid frame assembly solidly anchored. Reinstall jamb faces using security fasteners.

- b. Postinstalled Expansion Anchors: Install bolt. After bolt is tightened, weld bolt head to provide nonremovable condition. Grind, dress, and finish smooth welded bolt head.
 - c. At fire-rated openings, install detention frames according to NFPA 80.
 - d. Install detention frames with removable stops located on non-inmate side of opening.
6. Grout: Fully grout detention frame jambs and heads. Completely fill space between frames and adjacent substrates. Hand trowel grout and take other precautions, including bracing detention frames, to ensure that frames are not deformed or damaged by grout forces.
 7. Swinging Detention Doors: Fit non-fire-rated detention doors accurately in their frames, with the following clearances:
 - a. Between Doors and Frames at Jambs and Head: 1/8 inch (3.2 mm).
 - b. Between Edges of Pairs of Doors: 1/8 inch (3.2 mm).
 - c. At Door Sills with Threshold: 3/8 inch (9.5 mm).
 - d. At Door Sills without Threshold: 3/4 inch (19.1 mm).
 - e. Between Door Bottom and Nominal Surface of Floor Covering: 1/2 inch (12.7 mm).
 8. Sliding Detention Doors: Fit sliding detention doors in their frames according to manufacturer's written instructions and as required to allow doors to slide without binding.
 9. Fire-Rated Detention Doors: Install with clearances as specified in NFPA 80.
 10. Smoke-Control Detention Doors: Install according to NFPA 105.
 11. Installation Tolerances: Comply with installation tolerances indicated in HMMA 863.
 12. Glazing: Comply with installation requirements in Division 08 Section "Security Glazing", unless otherwise indicated.

C. Field Quality Control

1. Inspect installed products to verify compliance with requirements. Prepare inspection reports and indicate compliance with and deviations from the Contract Documents.
2. Remove and replace detention work where inspections indicate that work does not comply with specified requirements.
3. Perform additional inspections to determine compliance of replaced or additional work. Prepare inspection reports.
4. Prepare field quality-control certification that states installed products and their installation comply with requirements in the Contract Documents.
5. Select one detention door at random from detention doors delivered to Project and have it cut in half or otherwise taken apart for verification that construction complies with requirements.
6. Test Method: Verify weld strength by prying or chiseling door apart at edge seams, end channels, or stiffeners. Not more than five percent of welds may fail test.
 - a. If tested door fails, replace or rework all detention doors to bring them into compliance at Contractor's expense.
 - b. If tested door passes, replace tested door at Contractor's expense.

D. Adjusting And Cleaning

1. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including detention doors and frames that are warped, bowed, or otherwise unacceptable.
2. Clean grout and other bonding material off detention doors and frames immediately after installation.
3. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.
 - a. After finishing smooth field welds, apply air-drying primer.
4. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.
5. Stainless-Steel Surfaces: Clean surfaces according to manufacturer's written instructions.



END OF SECTION 08 34 53 00



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SECTION 08 34 53 00a - SECURITY GRILLES

DESCRIPTION OF WORK

This specification covers the furnishing and installation of materials for security grilles. Products shall be as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

GENERAL

System Description

1. Performance Requirements: Comply with following:
 - a. Performance Tests: Conducted by accredited independent testing laboratory in accordance with specified requirements in this Section.
 - 1) Source Quality Control Performance Tests: Conducted in shop or laboratory by accredited independent laboratory.
 - 2) Field Quality Performance Tests: Conducted in field.
 - b. Test Grilles: Completely assembled grille, including hardware, mounted vertically in accordance with manufacturer's recommendations.
 - 1) Test Grille Size: 914 mm (36 inches) wide by 1 219 mm (48 inches) high.
2. Bar Type Security Grilles:
 - a. Impact Test: Test Grille: Withstand impact force of 111 N (25 foot-pounds) with no breaking of welds or bar separation exceeding 127 mm (5 inches).
 - b. Bar Separation Test: Test Grille: Withstand bar separation test force of 227 kg (500 pounds) with no breaking of welds or bar separation exceeding 127 mm (5 inches).
 - c. Sag Test: If grille is equipped with side (jamb) hinges, Test Grille in Fully Extended Position: Withstand sag load of 34 kg (75 pounds) with permanent set after load removal not exceeding 1.6 mm (0.063 inch).
 - d. Forced Entry Resistance Test: If grille is equipped with side (jamb) hinges, test in closed position. Grille shall withstand forced entry loads and shall not be rendered openable throughout test.
3. Window Type Security Grilles:
 - a. Operating Force: Operating Panels: Operate with force exceeding 16 kg (35 pounds) after panel is in motion.
 - b. Impact Test: Test Grille: Withstand impact force of 111 N (25 foot-pounds). Sheet of double strength glass placed 76 mm (3 inches) behind grille material shall remain uncracked or unbroken after impact. No damage occurs that would allow entry through grille.
 - c. Forced Entry Resistance Test: If grille is operable, test grille in closed position. Grille shall withstand forced entry loads and shall not be rendered openable throughout test.
4. Child Guard Security Grilles:
 - a. Impact Test: Test Grille: Withstand impact force of 67 N (15 foot-pounds) with no weld or fastener breakage or bar separation exceeding 127 mm (5 inches).
 - b. Bar Separation Test: Withstand bar separation test force of 23 kg (50 pounds) with no weld or fastener breakage or bar separation exceeding 127 mm (5 inches).
5. Security Guard Security Grilles:
 - a. Impact Test: Test Grille in Fully Extended Position: Withstand impact force of 111 N (25 foot-pounds) with no weld or fastener breakage or bar separation exceeding 127 mm (5 inches).
 - b. Bar Separation Test: Withstand bar separation test force of 23 kg (50 pounds) with no breaking of welds or bar separation exceeding 127 mm (5 inches).
 - c. Sag Test: If grille is operable and equipped with side (jamb) hinges, test grille in fully extended position. Grille shall withstand sag load of 34 kg (75 pounds) with permanent set after load removal not exceeding 1.6 mm (0.063 inch).



- d. Forced Entry Resistance Test: If grille is operable, test grille in closed position. Grille shall withstand forced entry loads and shall not be rendered openable throughout test.

Submittals

6. Product Data:
7. Shop Drawings:
 - a. Include standard details showing recommendations for installation.
 - b. Include size of fasteners, maximum spacing from each end, center-to-center spacing on all four sides, minimum penetration of fasteners into load-bearing material and maximum clearance between frame and rough opening.
8. Samples: Submit full set of finish color samples for color selection.
9. Quality Assurance/Control Submittals:
 - a. Test Reports: Results of testing by accredited independent laboratory demonstrating compliance of security grilles with specified performance requirements.
 - b. Certificates: Manufacturer's written certification that security grilles meet or exceed specified performance requirements.
10. Closeout Submittals:
 - a. Special warranty.

Quality Assurance

11. Certifications: Comply with ANSI Z34.2.
12. Regulatory Requirements:
 - a. Egress Requirements and Fireman Access: Comply with applicable codes and regulations.
 - 1) Accessibility: Architectural Barriers Act of 1968 as amended (42 USC 4152-4157) and HUD implementing regulations (24 CFR Part 40).
 - a) Uniform Federal Accessibility Standards (UFAS).
 - 2) Section 504 of the Rehabilitation Act of 1973 as amended (29 USC 794) and HUD implementing regulations 24 CFR Part 8.
 - 3) Fair Housing Accessibility Guidelines (24 CFR Chapter 1).
 - 4) Americans with Disabilities Act of 1990 (ADA) (28 CFR Part 35).
13. Mock-ups: For Supply and Install Contract: Install one full size mock-up of each type of security grille with specified finish for acceptance.
 - a. Locations: As directed.
 - b. Approved Mock-ups: Standard for rest of work.
 - c. Approved Mock-ups: May remain part of completed project.

Delivery, Storage, And Handling

14. Packing, Shipping, Handling, and Unloading: Pack materials at manufacturing plant to prevent damage during shipping.
15. Acceptance at Site: Inspect security grilles upon delivery. Replace damaged or defective materials before installation.
16. Storage and Protection: Store security grilles in manner to protect from weather and other damage.

Project Conditions

17. Field Measurements: Field measure openings for security grilles before start of fabrication.

Scheduling And Sequencing

18. Scheduling and Completion: Comply with requirements of Detailed Scope of Work.

Warranty

19. Special Warranty: Provide one year written covering materials and installation for security grilles.
 - a. Warranty: Include coverage of hardware.
 - b. Contractor: Agrees to supply and install, free of charge, any required replacement parts or complete replacement security grille.



PRODUCTS

Security Grilles: KANE Screens, or approved equivalent.

20. General: Type(s) and size(s) indicated, specified, or scheduled with necessary hardware, anchors and equipment.
 - a. Egress Requirements and Fireman Access: Comply with applicable codes and regulations.
21. Materials:
 - a. Aluminum: ASTM B 221 commercial quality and of proper alloy for grille construction, free from defects impairing strength and/or durability.
 - 1) Zinc Limit: 3.0 percent in order to assure that cladding is anodic to core.
 - 2) Aluminum Extrusions: Minimum ultimate tensile strength of 151 600 kPa (22,000 PSI) and maximum yield strength of 110 300 kPa (16,000 PSI).
 - b. Steel :
 - 1) Shapes, Plates and Bars: ASTM A 36 or ASTM A 569.
 - 2) Steel Pipe: ASTM A 53.

Accessories

22. Hardware: Designed to perform functions for which it is intended and securely attached to grille.
 - a. Operable Grilles: Equipped with locks capable of meeting specified forced-entry requirements.
 - b. Locks: Releasable from interior but properly guarded to prevent access from exterior when window is open.
23. Anchoring Devices Used in Erection of Grilles: Nonmagnetic stainless steel or other noncorrosive material compatible with grille.
 - a. Anchors Exposed when Grille is Closed and Locked: Non-removable security type.
24. Fasteners:
 - a. Screws, Nuts, Washers, Bolts, Rivets, and Other Miscellaneous Fastening Devices Incorporated in Grilles: Nonmagnetic stainless steel or other corrosion resistant materials compatible with security grille and of sufficient strength to perform functions for which they are used.
 - b. Fasteners Concealed when Grille is installed and Closed: Magnetic stainless steel having chromium content of not less than 16 percent.
 - c. Fasteners Concealed when Grille is installed and Open: ASTM B 766 cadmium plated steel, ASTM B 633 zinc plated steel, or ASTM B 456 nickel or chrome plated steel.

Fabrication

25. Security Grilles: Fabricated of aluminum or steel and assembled in secure and workmanlike manner to perform as specified and to assure neat construction.
 - a. Welding or Brazing Flux: Completely removed immediately upon completion of welding or brazing operation.
 - b. Grilles: Constructed to reject passage of 102 mm (4 inch) diameter sphere at every space and interval when installed.
 - c. Grille Swing Width for Side Mounting: Maximum of 900 mm (3 feet). For opening in excess of 900 mm (3 feet), provide combination of fixed and operable grilles.
 - d. Grilles: Meet or exceed specified performance requirements in this Section.
 - e. Grilles: Comply with applicable fire codes.
26. Bar Type Security Grilles: Constructed of rigid aluminum or steel bars and of construction to meet or exceed specified performance requirements in this Section.
 - a. Fixed and Operable Bar Type Security Grilles: May be jamb or side hinged for egress.
27. Window Type Security Grilles: Constructed of aluminum or steel frame with two movable vent frames.
 - a. Vent Frames: Glazed with vinyl coated expanded carbon steel, No. 9 - 38 mm (1-1/2 inch) diamond pattern or equal.
 - b. Grilles: Constructed in manner to meet or exceed specified performance requirements in this Section.
28. Child Guard Security Grilles: Constructed of aluminum or steel bar or tubes and constructed to adjust and mount to exterior track of existing double or single hung windows.



- a. Grilles: Constructed in manner to meet or exceed specified performance requirements in this Section.
- 29. Security Guard Security Grilles: Constructed of aluminum or steel bars or tubes and constructed to adjust and mount to exterior of existing double or single hung window.
 - a. Fixed and Operable Window Guard Security Grilles: May be jamb or side hinged, or top hinged, for egress.
 - b. Grilles: Constructed in manner to meet or exceed specified performance requirements in this Section.

Finishes

- 30. Grilles: Factory applied baked on enamel painted finish.
 - a. Exposed Surfaces: Clean and free from serious surface blemishes.
 - b. Dress and finish exposed welded joints.
 - c. Steel: Rust resistive primer under baked on enamel.
 - d. Color: As selected from manufacturer's standard colors.

Source Quality Control

- 31. Testing: Performed by accredited independent testing laboratory. Use following HUD test procedures to determine if security grilles comply with specified performance requirements in this Section:
- 32. Sag Test for Side Mounted Grilles: Mount test grille into rigid frame to prevent movement of grille frame during loading.
 - a. Fully Assembled Grille: Opened to 90 degrees or to its open stop.
 - b. Test Load: Applied vertically at point 760mm (30 inches) from face of frame on operating portion of grille.
 - c. Load: Maintained for period of 3 minutes.
 - d. After removal of load, measure permanent sag at point of load application.
- 33. Impact Test: Mount test grille into rigid frame per manufacturer's recommendations.
 - a. One Impact: Made at center of grille or point deemed most susceptible to impact by testing agency.
 - b. Application of Impact Load: Made using 275 mm (11 inch) diameter sphere on free-swinging pendulum.
 - c. Impact: Made at bottom of pendulum arc.
 - d. Impact for Window Type Grille: Made at center of interior sash.
- 34. Bar Separation Test: Subject test grille to separation test at its weakest point of resistance.
 - a. Separation Load: Applied by means of pneumatic or hydraulic cylinder with adequate controls to apply load slowly to avoid quick impact.
 - b. Load: Maintained for period of 10 seconds before release.
- 35. Forced Entry Resistance Test: Mount test grille into rigid frame to prevent movement of grille during test.
 - a. Test Loads: Applied at point within 150 mm (6 inches) of locking mechanism in direction tending to open grille.
 - b. Load A of 34 kg (75 pounds) and Load B of 68 kg (150 pounds): Applied simultaneously, held for 10 seconds and released.
 - c. Load A of 34 kg (75 pounds): Applied vertically upward.
 - d. Load B of 68 kg (150 pounds): Applied perpendicular to face of grille in opening direction.
 - e. Load C of 34 kg (75 pounds): Applied horizontally from load point toward jamb opposite load.

EXECUTION

Examination

- 36. Site Verification of Conditions:
 - a. Field Measurements: Verify field measurements are as indicated on Shop Drawings.



- b. Existing Conditions: Examine openings before beginning installation.
- c. Do not proceed with installation until conditions are satisfactory.

Preparation

- 37. Protection: Protect adjacent elements from damage and disfiguration in accordance with Detailed Scope of Work.
 - a. Contractor: Responsible for damage to grounds, plantings, buildings and any other facilities or property caused by construction operations.
 - b. Repair or replace damaged elements in accordance with Detailed Scope of Work.
- 38. Existing Security Grilles: Remove existing grilles and debris from site in accordance with Detailed Scope of Work.
- 39. Preparation: Prepare openings and existing frames as required to comply with Performance Requirements.

Installation

- 40. General: Install in accordance with manufacturer's recommendations, Reference Standards, and approved Shop Drawings to comply with Performance Requirements.
 - a. Security Grilles: Securely anchor in place to straight, plumb and level condition, without distortion.
 - b. Egress Requirements and Fireman Access: Comply with applicable codes and regulations.
- 41. Dissimilar Materials: Isolate materials from incompatible materials as necessary to prevent deterioration.
 - a. Separate dissimilar metals with bituminous paint, suitable sealant, non-absorptive plastic or elastomeric tape, or gasket between surfaces.
 - 1) Coat aluminum in direct contact with concrete, masonry, steel, or other non-compatible materials with bituminous paint, zinc chromate primer, or other suitable insulating material.

Field Quality Control

- 42. Field Testing: Contractor shall have field testing of installed security grilles conducted by a testing agency in accordance with performance test described under Performance Requirements in this Section and Source Quality Control in this Section. Tests will be modified as required for field conditions.
 - a. Contractor: Provide incidental labor facilities necessary to facilitate inspections and tests.
 - b. Costs of Testing:
 - 1) By Contractor: Initial tests with failures and subsequent tests as required because of test failures. Costs shall include costs of Architect/Engineer and other consultants for observations of tests and corrective work.
 - c. Corrective Measures: Meet standards of quality of specified security grille and subject to acceptance of the Owner.

Adjusting And Cleaning

- 43. Adjusting: At completion of job, check, adjust, and lubricate hardware as required and leave security grilles and hardware in proper operating condition.
- 44. Cleaning: Comply with requirements of Detailed Scope of Work.
 - a. Clean security grilles after installation is completed to remove foreign matter and surface blemishes.
 - b. Scratched or Abraded Surfaces: Touch-up with rust inhibitor primer and enamel paint compatible with factory finish.

Protection

- 45. Installed Work: Protect security grilles from damage after installation.

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Task	Specification	Specification Description
08 34 53 00	08 11 63 13a	Security Window Screens and Doors



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SECTION 08 34 63 13 - DETENTION DOOR HARDWARE

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of material for detention door hardware. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Detention door hardware for the following:
 - 1) Swinging detention doors.
 - 2) Sliding detention doors.
 - b. Detention cylinders for doors specified in other Sections.

C. Performance Requirements

1. Swinging Detention Door Assemblies: Provide detention door hardware as part of a detention door assembly that complies with security grade indicated, when tested according to ASTM F 1450, based on testing manufacturer's standard units in assemblies similar to those indicated for this Project.
 - a. Bullet Resistance: Comply with Level 3 rating when tested according to UL 752; where indicated.
 - 1) Listed and labeled as bullet resisting by a testing agency acceptable to authorities having jurisdiction.
 - b. Tool-Attack Resistance: Comply with small-tool-attack-resistance rating when tested according to UL 1034 and UL 437.
2. Detention Door Hardware Functional Performance: Provide detention door hardware with features, functions, and internal equipment required to perform control and monitoring functions indicated in Division 28 Section "Plc Electronic Detention Monitoring And Control Systems".

D. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: For each type of detention door hardware.
 - a. Wiring Diagrams: For power, signal, and control wiring; differentiate between manufacturer-installed and field-installed wiring for electrified and pneumatic, **as directed**, detention door hardware.
 - b. Compressed-Air System Diagrams: For compressed-air piping for door control systems; differentiate between manufacturer-installed and field-installed piping for pneumatic detention door hardware.
 - c. Detail interface between electrified detention door hardware and perimeter security, detention monitoring and control, fire-alarm, and building control, **as directed**, system.
 - d. Detail interface between pneumatic detention door hardware and perimeter security, detention monitoring and control, fire-alarm, and building control, **as directed**, system.
3. Other Action Submittals:
 - a. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with detention doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - 1) Integrate detention door hardware indicated in "Detention Door Hardware Sets" Article into the Door Hardware Schedule, and indicate complete designations of every item required for each door and opening.



- b. Keying Schedule: Comply with requirements specified in Division 08 Section "Door Hardware". Coordinate detention keying with other door hardware in the final Keying Schedule.
 - 1) Indicate each lock and type of key using the following prefixes: "P" for paracentric, "M" for mogul, "HS" for high security, and "C" for commercial.
- c. Operation and Maintenance Data: For electrified and pneumatic, **as applicable**, detention door hardware to include in emergency, operation, and maintenance manuals.
- 4. Warranties: Sample of special warranties.

E. Quality Assurance

- 1. Installer Qualifications: An employer of workers trained and approved by manufacturer and an authorized representative of detention door hardware manufacturer for installation and maintenance of units required for this Project.
- 2. Supplier Qualifications: Detention door hardware supplier with warehousing facilities in Project's vicinity and who is or employs a qualified Architectural Hardware Consultant, available during the course of the Work to consult with Contractor, Architect, and the Owner about detention door hardware and keying.
 - a. Detention Door Hardware Supplier Qualifications: An experienced detention door hardware supplier who has completed projects with electrified and pneumatic, **as directed**, detention door hardware similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance, and who is acceptable to manufacturer of primary materials.
 - 1) Engineering Responsibility: Prepare data for electrified and pneumatic, **as directed**, detention door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
 - b. Scheduling Responsibility: Preparation of door hardware and keying schedules.
- 3. Architectural Hardware Consultant Qualifications: A person who is currently certified by DHI as an Architectural Hardware Consultant and who is experienced in providing consulting services for detention door hardware installations that are comparable in material, design, and extent to that indicated for this Project.
 - a. Detention Door Hardware Consultant Qualifications: Experienced in providing consulting services for electrified and pneumatic, **as directed**, detention door hardware installations.
- 4. Source Limitations for Detention Door Hardware: Obtain each type of detention door hardware from single source from single manufacturer.
 - a. Provide electrified and pneumatic, **as directed**, detention door hardware from same manufacturer as mechanical detention door hardware unless otherwise indicated.
- 5. Regulatory Requirements: Comply with provisions of the following:
 - a. Where indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1, **as directed**, as follows:
 - 1) Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
 - 2) Security Door Closers: Comply with the following maximum opening-force requirements indicated:
 - a) Interior Hinged Doors: 5 lbf (22 N) applied perpendicular to door.
 - b) Sliding Doors: 5 lbf (22 N) applied parallel to door at latch.
 - c) Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
 - b. NFPA 101: Comply with the following for means-of-egress doors:
 - 1) Latches and Locks: Not more than 15 lbf (67 N) to release the latch.
 - 2) Security Door Closers: Not more than 30 lbf (133 N) to set door in motion and not more than 15 lbf (67 N) to open door to minimum required width.



- 3) Sliding Detention Door Devices: Not more than 50 lbf (222 N) to slide door to its fully open position with a perpendicular force of 50 lbf (222 N) against door.
 - c. Electrified and Pneumatic, **as directed**, Door Hardware: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 6. Fire-Rated Detention Door Assemblies: Provide detention door hardware for assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure **OR** as close to neutral pressure as possible, **as directed**, according to NFPA 252 **OR** UBC Standard 7-2 **OR** UL 10B **OR** UL 10C, **as directed**.
 7. Keying Conference: Conduct conference at Project site Incorporate keying conference decisions into the final Keying Schedule after reviewing detention door hardware keying system including, but not limited to, the following:
 - a. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
 - b. Preliminary key system schematic diagram.
 - c. Requirements for key-control system including key exclusivity and duplication control.
 - d. Address for delivery of keys.
 8. Preinstallation Conference: Conduct conference at Project site.
- F. Delivery, Storage, And Handling
1. Inventory detention door hardware on receipt and provide secure lockup for detention door hardware delivered to Project site.
 2. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
 3. Deliver keys to the Owner by registered mail or overnight package service.
- G. Warranty
1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of detention door hardware that fail in materials or workmanship within specified warranty period.
 - a. Failures include, but are not limited to, the following:
 - 1) Structural failures including excessive deflection, cracking, or breakage.
 - 2) Faulty operation of operators and detention door hardware.
 - 3) Deterioration of metals, metal finishes, and other materials beyond normal weathering or detention use.
 2. Warranty Period: Three years from date of Final Completion.
 3. Warranty Period for Continuous-Pin Detention Hinges: 10 years from date of Final Completion.
 4. Warranty Period for Security Door Closers: 10 years from date of Final Completion.
- H. Maintenance Service
1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for the Owner's continued adjustment, maintenance, and removal and replacement of detention door hardware.
 2. Initial Maintenance Service: Beginning at Final Completion, provide three **OR** six **OR** nine **OR** 12, **as directed**, months' full maintenance by skilled employees of detention door hardware Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper detention door hardware operation. Provide parts and supplies the same as those used in the manufacture and installation of original equipment.

1.2 PRODUCTS

A. Security Fasteners



1. General: Operable only by tools produced for use on specific type of fastener by fastener manufacturer or other licensed fabricator. Drive-system type, head style, material, and protective coating as required for assembly, installation, and strength, and as follows:
 - a. Drive-System Types: Pinned Torx-Plus **OR** Pinned Torx, **as directed**.
 - b. Fastener Strength: 120,000 psi (827 MPa).
 - c. Socket Button Head Fasteners:
 - 1) Heat-treated alloy steel, ASTM F 835 (ASTM F 835M).
 - 2) Stainless steel, ASTM F 879 (ASTM F 879M), Group 1 CW.
 - d. Socket Flat Countersunk Head Fasteners:
 - 1) Heat-treated alloy steel, ASTM F 835 (ASTM F 835M).
 - 2) Stainless steel, ASTM F 879 (ASTM F 879M), Group 1 CW.
 - e. Socket Head Cap Fasteners:
 - 1) Heat-treated alloy steel, ASTM A 574 (ASTM A 574M).
 - 2) Stainless steel, ASTM F 837 (ASTM F 837M), Group 1 CW.
 - f. Protective Coatings for Heat-Treated Alloy Steel:
 - 1) Zinc and clear trivalent chromium where indicated.
 - 2) Zinc phosphate with oil, ASTM F 1137, Grade I, or black oxide unless otherwise indicated.

B. Detention Hinges, General

1. Standard for Electric Detention Hinges: UL 634.
2. Quantity: Provide the following unless otherwise indicated:
 - a. Two Detention Hinges: For detention doors with heights up to 60 inches (1524 mm).
 - b. Three Detention Hinges: For detention doors with heights 61 to 90 inches (1549 to 2286 mm).
 - c. Four Detention Hinges: For detention doors with heights 91 to 120 inches (2311 to 3048 mm).
 - d. For detention doors with heights more than 120 inches (3048 mm), provide four detention hinges, plus one detention hinge for every 30 inches (762 mm) of detention door height greater than 120 inches (3048 mm).
3. Size: Provide the following, unless otherwise indicated, with detention hinge widths sized for 2-inch (51-mm) detention door thickness and clearances required:
 - a. Doors up to 42 Inches (1067 mm) Wide: Minimum 4-1/2 inches (114 mm) wide by 0.180 inches (4.6 mm) thick or 5 inches (127 mm) wide by 0.190 inches (4.8 mm) thick.
 - b. Doors Greater Than 42 Inches (1067 mm) Wide: Minimum 6 inches (152 mm) wide by 0.203 inches (5.2 mm) thick.
4. Detention Doors with Security Closers: Unless otherwise indicated, provide antifriction-bearing detention hinges.
5. Detention Hinge Base Metal: Unless otherwise indicated, provide the following:
 - a. Exterior Detention Hinges: Stainless steel, with stainless-steel pin.
 - b. Interior Detention Hinges: Steel, with steel pin **OR** Stainless steel, with stainless-steel pin, **as directed**.
 - c. Detention Hinges for Fire-Rated Assemblies: Steel, with steel pin **OR** Stainless steel, with stainless-steel pin, **as directed**.
6. Electrified Functions for Detention Hinges: Comply with the following:
 - a. Electrical Contact: Exposed electrical contacts for transfer of power.
 - b. Power Transfer: Concealed PTFE-jacketed wires, secured at each leaf and continuous through detention hinge knuckle.
 - c. Monitoring: Concealed electrical monitoring switch.
7. Fastening: Comply with the following:
 - a. Welding: Where indicated, weld hinges to detention doors and frames with continuous fillet weld around three sides of hinge perimeter.
 - b. Security Fasteners: Provide socket flat countersunk head machine screws; finish screw heads to match surface of detention hinges. Install into drilled and tapped holes.



C. Detention Hinges

1. Utility-Door Detention Hinges DH-1: Heavy weight, plain bearing; fabricated from cast iron or steel; 3/8-inch- (9.5-mm-) diameter, case-hardened, fully welded, **as directed**, steel hinge pin; full surface.
 - a. Leaves: Drilled for countersunk security fasteners **OR Solid, as directed**.
 - b. Size: Minimum 3 by 4 inches by 0.200 inch (75 by 100 by 5 mm).
 - c. Security Grade: 1 **OR 2 OR 3 OR 4, as directed**, according to ASTM F 1758.
 - d. Finish: BHMA 600.
2. Food-Pass Detention Hinges DH-2: Heavy weight, plain bearing; fabricated from cast iron or steel; 3/8-inch- (9.5-mm-) diameter, case-hardened, fully welded, **as directed**, steel hinge pin; with applied stop preventing door from opening more than 90 degrees and supporting door in horizontal position as a shelf; full surface.
 - a. Leaves: Drilled for countersunk security fasteners **OR Solid, as directed**.
 - b. Size: Minimum 3 by 4 inches by 0.200 inch (75 by 100 by 5 mm).
 - c. Security Grade: 1 **OR 2 OR 3 OR 4, as directed**, according to ASTM F 1758.
 - d. Finish: BHMA 600.
3. Full-Surface Detention Hinges DH-3: Extra heavy weight; two heavy-duty thrust bearings with hardened-steel ball bearings; fabricated from steel plate; 3/4-inch- (19-mm-) diameter, case-hardened, fully welded, steel hinge pin.
 - a. Leaves: Drilled for countersunk security fasteners **OR Solid, as directed**.
 - b. Size: Minimum 5 by 5-1/4 inches by 1/2 inch (127 by 133 by 13 mm).
 - c. Security Grade: 1 **OR 2 OR 3 OR 4, as directed**, according to ASTM F 1758.
 - d. Finish: BHMA 600.
4. Half-Surface Detention Hinges DH-4: Extra heavy weight; two heavy-duty thrust bearings with hardened-steel ball bearings; fabricated from steel plate; 3/4-inch- (19-mm-) diameter, case-hardened, fully welded, steel hinge pin.
 - a. Leaves: Drilled for countersunk security fasteners **OR Solid, as directed**.
 - b. Size: Minimum 5 by 5-1/4 inches by 1/2 inch (127 by 133 by 13 mm).
 - c. Security Grade: 1 **OR 2 OR 3 OR 4, as directed**, according to ASTM F 1758.
 - d. Finish: BHMA 600.
5. Gap-Mounted Detention Hinges DH-5: Extra heavy weight; two heavy-duty thrust bearings with hardened-steel ball bearings; fabricated from steel plate; 3/4-inch- (19-mm-) diameter, case-hardened, fully welded, steel hinge pin.
 - a. Leaves: Drilled for countersunk security fasteners **OR Solid, as directed**.
 - b. Size: Minimum 5 by 6 inches by 1/2 inch (127 by 152 by 13 mm).
 - c. Security Grade: 1 **OR 2 OR 3 OR 4, as directed**, according to ASTM F 1758.
 - d. Finish: BHMA 600.
6. Continuous-Pin Detention Hinges DH-6: Minimum 0.109-inch- (2.78-mm-) thick, stainless-steel hinge leaves with minimum overall width of 4 inches (100 mm); with 1/4-inch- (6-mm-) diameter continuous pin; fabricated to full height of detention door and frame. Finish components after milling and drilling are complete. Fabricate continuous-pin detention hinges to template screw locations.
 - a. Security Grade: 1 **OR 2 OR 3 OR 4, as directed**, according to ASTM F 1758.

D. Detention Locks And Latches, General

1. Swinging Detention Door Lock and Latch Performance: Provide detention door locks and latches that comply with security grade indicated, when tested according to ASTM F 1577, based on testing manufacturer's standard units in assemblies similar to those indicated for this Project.
2. Detention Lock Functions: Provide function numbers and descriptions indicated in detention door hardware sets complying with ASTM F 1577.
3. Detention Lock Construction: Fabricate detention lock case and cover plate from steel plate. Fabricate bolts from solid sections; laminated construction unacceptable.
4. Detention Lock Throw: Comply with testing requirements for length of bolts to comply with labeled fire door requirements, and as follows:
 - a. Latchbolts for Detention Food Pass **OR Security Access Doors, as directed**: Minimum 5/8-inch (16-mm) latchbolt throw.



- b. Latchbolts: Minimum 3/4-inch (19-mm) latchbolt throw.
- c. Deadbolts: Minimum 1-inch (25-mm) bolt throw.
- 5. Detention Lock Trim:
 - a. Levers: Solid stainless steel.
 - b. Knobs: Stainless steel **OR** Brass, **as directed**.
 - c. Escutcheons for Paracentric Locks: 0.125-inch- (3.18-mm-) thick, 3-inch- (75-mm-) diameter stainless steel with BHMA 626 **OR** brass with BHMA 606, **as directed**, finish. Attach with security fasteners.
 - 1) Style: Single wing **OR** Double wing **OR** Single or double wing as required by lock function **OR** As indicated, **as directed**.
 - 2) Provide escutcheons unless otherwise **OR** where, **as directed**, indicated.
 - d. Cylinder Shields for Paracentric Locks: 0.125-inch- (3.18-mm-) thick, 3-inch- (75-mm-) diameter stainless steel with BHMA 626 **OR** brass with BHMA 606, **as directed**, finish and swinging cover to protect keyhole. Attach with security fasteners.
 - 1) Style: Single wing **OR** Double wing **OR** Single or double wing as required by lock function **OR** As indicated, **as directed**.
 - 2) Provide cylinder shields unless otherwise **OR** where, **as directed**, indicated.
- 6. Pneumatic Detention Locks and Latches: Operate when supplied with air between 40 psig (275 kPa) minimum and 100 psig (690 kPa) maximum. Factory install quick-connect air fitting and factory-wired plug connector with 6-inch (150-mm) wire pigtail.
 - a. Provide security ring for installation of pneumatic detention lock in hollow-metal detention frame, welded to frame or access cover unless otherwise **OR** where, **as directed**, indicated.

E. Mechanical Detention Locks And Latches

- 1. General: Provide mechanical detention lock mountings as follows:
 - a. Hollow-Metal Detention Doors: Mount detention lock to back of 0.179-inch (4.56-mm) nominal-thickness steel **OR** 0.183-inch (4.65-mm) nominal-thickness galvanized-steel, **as directed**, cover plate for installation in lock pocket fabricated into detention door. Attach cover plate to hollow-metal detention door with security fasteners.
 - b. Bar-Grille Detention Doors: Mount detention lock to back of galvanized, **as directed**, steel enclosure welded to flat horizontal bars of bar-grille detention door; cover with 0.179-inch (4.56-mm) nominal-thickness steel **OR** 0.183-inch (4.65-mm) nominal-thickness galvanized-steel, **as directed**, plate. Attach plate with security fasteners.
 - c. Steel-Plate Detention Doors: Mount detention lock to inside surface of 0.179-inch (4.56-mm) nominal-thickness steel **OR** 0.134-inch (3.42-mm) nominal-thickness steel **OR** 0.183-inch (4.65-mm) nominal-thickness galvanized-steel **OR** 0.138-inch (3.50-mm) nominal-thickness galvanized-steel, **as directed**, enclosure with integrally formed mounting flanges. Attach enclosure to steel-plate detention door with security fasteners **OR** rivets, **as directed**.
- 2. Utility-Door Mechanical Deadlocks, Paracentric ML-1: For use on small swinging doors, such as access panels, plumbing space doors, electric panel doors, and hatches that are infrequently used.
 - a. Function: Lockbolt retracted and extended by five **OR** six, **as directed**,-tumbler paracentric cylinder; keyed one side **OR** two sides, **as directed**.
 - b. Lockbolt: 1-1/2 inches high by 3/4 inch (38 mm high by 19 mm) thick; 5/8-inch (16-mm) throw.
 - c. Security Grade: 1 **OR** 2 **OR** 3 **OR** 4, **as directed**.
- 3. Utility-Door Mechanical Deadlocks, Mogul ML-2: For use on small swinging doors, such as access panels, plumbing space doors, electric panel doors, and hatches that are infrequently used.
 - a. Function: Lockbolt retracted and extended by mogul cylinder; keyed one side **OR** two sides, **as directed**.
 - b. Lockbolt: 1-1/2 inches high by 3/4 inch (38 mm high by 19 mm) thick; 5/8-inch (16-mm) throw.



- c. Security Grade: **1 OR 2 OR 3 OR 4, as directed.**
4. Mechanical Snaplatches, Paracentric ML-3: For use on small swinging doors, such as food-pass doors, observation panels, gun locker doors, and other small doors where snaplocking is needed and deadlocking is not required.
 - a. Function: Automatic snaplatch when door is closed; latchbolt retracted by five **OR** six, **as directed**,-tumbler paracentric cylinder; keyed one side **OR** two sides, **as directed.**
 - b. Latchbolt: 1 inch high by 7/16 inch (25 mm high by 11 mm) thick; 5/16-inch (8-mm) throw.
 - c. Security Grade: **1 OR 2 OR 3 OR 4, as directed.**
5. Mechanical Snaplatches, Mogul ML-4: For use on small swinging doors, such as food-pass doors, observation panels, gun locker doors, and other small doors where snaplocking is needed and deadlocking is not required
 - a. Function: Automatic snaplatch when door is closed; latchbolt retracted by mogul cylinder; keyed one side **OR** two sides, **as directed.**
 - b. Latchbolt: 1 inch high by 7/16 inch (25 mm high by 11 mm) thick; 5/16-inch (8-mm) throw.
 - c. Security Grade: **1 OR 2 OR 3 OR 4, as directed.**
6. Mechanical Concealed Snaplatches ML-5: For use on small swinging doors, such as observation panels, wickets, covers, and other small doors.
 - a. Function: Automatic snaplatch when door is closed; latchbolt retracted by five-tumbler paracentric cylinder; keyed one side. When closed, latch is concealed within lock case.
 - b. Latchbolt: 1 inch high by 7/16 inch (25 mm high by 11 mm) thick; 7/16-inch (11-mm) throw.
 - c. Provide angled strike.
 - d. Security Grade: **1 OR 2 OR 3 OR 4, as directed.**
7. Sliding Door Mechanical Deadlatches ML-6: For use on sliding doors, such as entrance, safety vestibule, and corridor doors.
 - a. Function: Hookbolt snaplatches and automatically deadlocks through action of plunger pin when door is closed (slam locking); hookbolt raised by five **OR** six, **as directed**,-tumbler paracentric cylinder; keyed one side **OR** two sides, **as directed.**
 - b. Hookbolt: 1/2-inch- (13-mm-) thick, case-hardened steel; 5/8-inch (16-mm) lift.
 - c. Provide case-hardened-steel deadlock plunger pin.
 - d. Security Grade: **1 OR 2 OR 3 OR 4, as directed.**
8. Sliding Door Mechanical Deadlocks ML-7: For use on sliding doors, such as entrance, safety vestibule, corridor, and inmate cell doors.
 - a. Function: Hookbolt raised and lowered by five **OR** six, **as directed**,-tumbler paracentric cylinder (no slam locking); keyed one side **OR** two sides, **as directed.**
 - b. Hookbolt: 1/2-inch- (13-mm-) thick, case-hardened steel; 5/8-inch (16-mm) lift.
 - c. Security Grade: **1 OR 2 OR 3 OR 4, as directed.**
9. Mechanical Snaplatches ML-8: For use on swinging doors, such as corridor, dining room, and recreational area doors.
 - a. Function: Automatic snaplatch when door is closed (slam locking); latchbolt retracted by half turn and extended by full turn in opposite direction of five **OR** six, **as directed**,-tumbler paracentric cylinder; keyed one side **OR** two sides, **as directed.**
 - 1) Knob operation retracts latchbolt unless deadlocked. Locate knobs on one side **OR** two sides, **as directed.**
 - b. Latchbolt: 2-inch-high by 3/4-inch- (50-mm-high by 19-mm-) thick steel, with two case-hardened-steel insert pins; 3/4-inch (19-mm) throw; 1/2-inch (13-mm) **OR** 1-1/4-inch (32-mm), **as directed**, bolt projection when retracted.
 - c. Listed and labeled for use on fire doors.
 - d. Security Grade: **1 OR 2 OR 3 OR 4, as directed.**
10. Mechanical Deadlatches/Deadlocks ML-9: For use on swinging doors, such as day room, dining room, and recreational area doors.
 - a. Function: Automatic snaplatch and automatic deadlock through action of actuator when door is closed (slam locking); latchbolt retracted by five **OR** six, **as directed**,-tumbler paracentric cylinder; keyed one side **OR** two sides, **as directed.**
 - b. Latchbolt: 2-inch-high by 3/4-inch- (50-mm-high by 19-mm-) thick steel, with two case-hardened-steel insert pins; 3/4-inch (19-mm) throw; 1/2-inch (13-mm) **OR** 1-1/4-inch (32-mm), **as directed**, bolt projection when retracted.



- c. Deadlock Actuator: 3/4-inch-high by 3/4-inch- (19-mm-high by 19-mm-) thick steel; 1/2-inch (13-mm) throw.
 - d. Listed and labeled for use on fire doors.
 - e. Security Grade: 1 **OR** 2 **OR** 3 **OR** 4, **as directed**.
11. Mechanical Deadlocks ML-10: For use on swinging doors where slam locking is not required, such as holding cell, segregation cell, control room, armory, key cabinet, storage, utility, and hollow-metal access doors.
- a. Function: Deadlocked in both locked and unlocked position; latchbolt retracted and extended by five **OR** six, **as directed**,-tumbler paracentric cylinder; keyed one side **OR** two sides, **as directed**.
 - b. Latchbolt: 2-inch-high by 3/4-inch- (50-mm-high by 19-mm-) thick steel, with two case-hardened-steel insert pins; 3/4-inch (19-mm) throw; 1/2-inch (13-mm) **OR** 1-1/4-inch (32-mm), **as directed**, bolt projection when retracted.
 - c. Security Grade: 1 **OR** 2 **OR** 3 **OR** 4, **as directed**.
12. Cremona Bolt Mechanical Snaplatches ML-11: For use on swinging doors or active leaf of pairs of swinging doors where slam locking is needed.
- a. Function: Automatic snaplatch and deadlocking when door is closed (slam locking); latchbolt retracted and extended by five-tumbler paracentric cylinder; keyed one side **OR** two sides, **as directed**. Lever operation one side **OR** two sides, **as directed**, retracts head and foot rods, unless deadlocked, for three-point locking.
 - b. Latchbolt: 2-inch-high by 3/4-inch- (50-mm-high by 19-mm-) thick steel, with two case-hardened-steel insert pins; 3/4-inch (19-mm) throw.
 - c. Security Grade: 1 **OR** 2 **OR** 3 **OR** 4, **as directed**.
13. Cremona Bolt Mechanical Deadlocks, Paracentric ML-12: For use on swinging doors or active leaf of pairs of swinging doors where doors may be subject to mass attack. Delete inactive leaf for single door.
- a. Function: Active leaf deadlocks when door is closed (no slam locking); active-leaf deadbolt retracted and extended by five **OR** six, **as directed**,-tumbler paracentric cylinder; keyed one side **OR** two sides, **as directed**. Active-leaf lever operation one side **OR** two sides, **as directed**, retracts active-leaf head and foot bolts unless deadlocked.
 - 1) Inactive Leaf: Head and foot bolts deadlocked by five **OR** six, **as directed**,-tumbler, inactive-leaf paracentric cylinder. Inactive-leaf lever operation one side **OR** two sides, **as directed**, retracts inactive-leaf head and foot bolts unless deadlocked.
 - b. Deadbolt: 2-inch-high by 3/4-inch- (50-mm-high by 19-mm-) thick steel, with two case-hardened-steel insert pins; 3/4-inch (19-mm) throw.
 - c. Head and Foot Bolts: 7/8-inch (22-mm) diameter; 3/4-inch (19-mm) throw.
 - d. Provide foot bolt receptacle(s).
 - e. Security Grade: 1 **OR** 2 **OR** 3 **OR** 4, **as directed**.
14. Mechanical Head and Foot Bolts ML-14: For use on the inactive leaf of pairs of swinging doors.
- a. Function: Bolt retracted and extended by spanner-type key **OR** five-tumbler paracentric cylinder, **as directed**; enclosed in iron or steel case with steel cover (not applicable for hollow-metal doors).
 - b. Latchbolt: 1-inch- (25-mm-) diameter steel; 3/4-inch (19-mm) throw.
 - c. Footbolt Receptacle: Spring-loaded mechanism; brass.
 - d. Security Grade: 1 **OR** 2 **OR** 3 **OR** 4, **as directed**.

F. Electromechanical Detention Locks And Latches

- 1. General: Provide electromechanical detention locks and latches with factory-wired plug connector with 6-inch (152-mm) wire pigtail.
 - a. Provide security ring for installation of electromechanical detention lock in hollow-metal detention frame, welded to frame or access cover, unless otherwise **OR** where, **as directed**, indicated.
 - b. Equip direct-current solenoid-operated detention locks and latches with diode transient voltage protection at each locking device.



2. Solenoid-Operated Deadlatches, Paracentric EL-1: For use on swinging doors, such as entrance, sally port, corridor, and inmate cell doors, that are to be unlocked from remote locations.
 - a. Function: Remote switch activates electric solenoid that retracts latchbolt; automatic latching and deadlocking when door is closed (slam locking). Latchbolt can be mechanically retracted by five **OR** six, **as directed**,-tumbler paracentric cylinder; keyed one side **OR** two sides, **as directed**; if latchbolt is retracted by key, it remains retracted until relocked by key.
 - 1) Latchback: Latchbolt remains retracted until door is opened 2 inches (50 mm), then releases **OR** as long as control switch is activated; latchbolt extends when power is discontinued, **as directed**.
 - 2) If power fails, latchbolt automatically deadlocks (fail secure).
 - b. Latchbolt: 2-inch-high by 3/4-inch- (50-mm-high by 19-mm-) thick hardened steel; 3/4-inch (19-mm) throw.
 - c. Provide internal deadlock indicator switch.
 - d. Provide roller-type deadlock actuator.
 - e. Voltage: 120-V ac.
 - f. Listed and labeled for use on fire doors.
 - g. Security Grade: 1 **OR** 2 **OR** 3 **OR** 4, **as directed**.
3. Motor-Operated Deadlatches, Paracentric EL-2: For use on swinging doors, such as entrance, sally port, corridor, and inmate cell doors, that are to be unlocked from remote locations.
 - a. Function: Remote switch activates electric motor that retracts latchbolt; automatic latching and deadlocking when door is closed (slam locking). Latchbolt can be mechanically retracted by five **OR** six, **as directed**,-tumbler paracentric cylinder; keyed one side **OR** two sides, **as directed**; if latchbolt is retracted by key, it remains retracted until relocked by key.
 - 1) Latchback: Latchbolt remains retracted until door is opened 2 inches (50 mm), then releases **OR** as long as control switch is activated; latchbolt extends when power is discontinued, **as directed**.
 - 2) If power fails, latchbolt automatically deadlocks (fail-secure).
 - b. Latchbolt: 2-inch-high by 3/4-inch- (50-mm-high by 19-mm-) thick hardened steel; 3/4-inch (19-mm) throw.
 - c. Provide internal deadlock indicator switch.
 - d. Provide roller-type deadlock actuator.
 - e. Voltage: 120-V ac **OR** 24-V dc, **as directed**.
 - f. Listed and labeled for use on fire doors.
 - g. Security Grade: 1 **OR** 2 **OR** 3 **OR** 4, **as directed**.
4. Sliding Door Motor-Operated Deadlatches EL-3: For use on sliding doors, such as entrance, sally port, corridor, and inmate cell doors, that are to be unlocked from remote locations.
 - a. Function: Remote switch activates electric motor that raises hookbolt; spring-loaded actuator pin pushes door open 1 to 3 inches (25 to 75 mm); automatic latching and deadlocking when door is closed (slam locking). Hookbolt can be mechanically raised by five **OR** six, **as directed**,-tumbler paracentric cylinder; keyed one side **OR** two sides, **as directed**; if hookbolt is raised by key, it remains raised until relocked by key.
 - 1) Latchback: Hookbolt remains raised until door is opened 2 inches (50 mm), then lowers **OR** as long as control switch is in open position; hookbolt lowers when control switch is moved to locked position, **as directed**.
 - 2) If power fails, hookbolt automatically deadlocks (fail-secure).
 - b. Hookbolt: 1-3/4- by 1/2-inch- (44- by 13-mm-) thick, case-hardened steel; 3/4-inch (19-mm) throw.
 - c. Provide internal deadlock indicator switch.
 - d. Provide case-hardened-steel deadlock actuator.
 - e. Voltage: 120-V ac.
 - f. Security Grade: 1 **OR** 2 **OR** 3 **OR** 4, **as directed**.
5. Solenoid-Operated Deadlatches, Mogul EL-4: For use on swinging doors, such as entrance, sally port, corridor, and inmate cell doors, that are to be unlocked from remote locations.



- a. Function: Remote switch activates electric solenoid that retracts latchbolt; automatic latching and deadlocking when door is closed (slam locking). Latchbolt can be mechanically retracted by mogul cylinder; keyed one side **OR** two sides, **as directed**.
 - 1) Latchback: Latchbolt remains retracted until door is opened 2 inches (50 mm), then releases **OR** as long as control switch is activated; latchbolt extends when power is discontinued, **as directed**.
 - 2) Local Electric Key (LEK): Inmate key operates lock electrically when enabled; staff key always operates lock manually and electrically; where indicated.
 - 3) Key Holdback: If latchbolt is retracted by key, it remains retracted until relocked by key (listing for use on fire doors is not available).
 - 4) Knob operation retracts latchbolt; always active.
 - 5) If power fails, latchbolt automatically deadlocks (fail-secure).
 - b. Latchbolt: 1-1/2-inch-high by 3/4-inch- (38-mm-high by 19-mm-) thick hardened steel; 1-inch (25-mm) throw.
 - c. Provide internal deadlock indicator switch.
 - d. Provide roller-type deadlock actuator.
 - e. Voltage: 120-V ac.
 - f. Listed and labeled for use on fire doors.
 - g. Security Grade: 1 **OR** 2 **OR** 3 **OR** 4, **as directed**.
6. Motor-Operated Deadlatches, Mogul EL-5: for use on swinging doors, such as entrance, sally port, corridor, and inmate cell doors, that are to be unlocked from remote locations.
- a. Function: Remote switch activates electric motor that retracts latchbolt; automatic latching and deadlocking when door is closed (slam locking). Latchbolt can be mechanically retracted by mogul cylinder; keyed one side **OR** two sides, **as directed**.
 - 1) Latchback: Latchbolt remains retracted until door is opened 2 inches (50 mm), then releases **OR** as long as control switch is in open position; latchbolt extends when control switch is moved to locked position, **as directed**.
 - 2) Local Electric Key (LEK): Inmate key operates lock electrically when enabled; staff key always operates lock manually and electrically; where indicated.
 - 3) Key Holdback: If latchbolt is retracted by key, it remains retracted until relocked by key (listing for use on fire doors is not available).
 - 4) Knob operation retracts latchbolt; always active.
 - 5) If power fails, latchbolt automatically deadlocks (fail-secure).
 - b. Latchbolt: 1-1/2-inch-high by 3/4-inch- (38-mm-high by 19-mm-) thick hardened steel; 1-inch (25-mm) throw.
 - c. Provide internal deadlock indicator switch.
 - d. Provide roller-type deadlock actuator.
 - e. Voltage: 120-V ac **OR** 24-V dc, **as directed**.
 - f. Listed and labeled for use on fire doors.
 - g. Security Grade: 1 **OR** 2 **OR** 3 **OR** 4, **as directed**.
7. Solenoid-Operated Deadlatches, Commercial EL-6: For use on swinging doors, hung in standard 2-inch (50-mm) hollow-metal frames, that are to be unlocked from remote locations.
- a. Function: Remote switch activates electric solenoid that retracts latchbolt; automatic latching and deadlocking when door is closed (slam locking). Latchbolt can be mechanically retracted by high-security, **as directed**, commercial cylinder; keyed one side **OR** two sides, **as directed**.
 - 1) Latchback: Latchbolt remains retracted until door is opened 2 inches (50 mm), then releases **OR** as long as control switch is activated; latchbolt extends when power is discontinued, **as directed**.
 - 2) Local Electric Key (LEK): Inmate key operates lock electrically when enabled; staff key always operates lock manually and electrically; where indicated.
 - 3) If power fails, latchbolt automatically deadlocks (fail-secure).
 - b. Latchbolt: 1-1/2-inch-high by 5/8-inch- (38-mm-high by 16-mm-) thick hardened steel; 3/4-inch (19-mm) throw.
 - c. Provide internal deadlock indicator switch.



- d. Deadlock Actuator: Stainless steel.
 - e. Strike: Stainless steel.
 - f. Voltage: 24-V dc.
 - g. Listed and labeled for use on fire doors.
 - h. Security Grade: 1 **OR** 2 **OR** 3 **OR** 4, **as directed**.
8. Motor-Operated Deadlatches, Commercial EL-7: For use on swinging doors, hung in standard 2-inch (50-mm) hollow-metal frames, that are to be unlocked from remote locations.
- a. Function: Remote switch activates electric motor that retracts latchbolt; automatic latching and deadlocking when door is closed (slam locking). Latchbolt can be mechanically retracted by high-security, **as directed**, commercial cylinder; keyed one side **OR** two sides, **as directed**.
 - 1) Latchback: Latchbolt remains retracted until door is opened 2 inches (50 mm), then releases **OR** as long as control switch is in open position; latchbolt extends when control switch is moved to locked position, **as directed**.
 - 2) Local Electric Key (LEK): Inmate key operates lock electrically when enabled; staff key always operates lock manually and electrically; where indicated.
 - 3) If power fails, latchbolt automatically deadlocks (fail-secure).
 - b. Latchbolt: 1-1/2-inch-high by 5/8-inch- (38-mm-high by 16-mm-) thick hardened steel; 3/4-inch (19-mm) throw.
 - c. Provide internal deadlock indicator switch.
 - d. Deadlock Actuator: Stainless steel.
 - e. Strike: Stainless steel.
 - f. Voltage: 24-V dc.
 - g. Listed and labeled for use on fire doors.
 - h. Security Grade: 1 **OR** 2 **OR** 3 **OR** 4, **as directed**.
9. Solenoid-Operated Gate Locks, Paracentric EL-8: For use on swinging and sliding gates that are to be unlocked from remote locations.
- a. Function: Remote switch activates electric solenoid that raises an internal bolt; automatic deadlocking when gate is closed. Bolt can be mechanically retracted by five **OR** six, **as directed**,-tumbler paracentric cylinder; keyed one side **OR** two sides, **as directed**.
 - 1) Latchback: Bolt remains raised until gate is closed.
 - 2) If power fails, latchbolt automatically deadlocks (fail-secure).
 - b. Bolt: 5/8-inch- (16-mm-) diameter stainless steel; 1-inch (25-mm) throw.
 - c. Provide internal deadlock indicator switch.
 - d. Voltage: 120-V ac.
 - e. Finish: Galvanized.
 - f. Mounting: Mount lock to gate post; mount locking tongue to gate frame.
 - g. Security Grade: 1 **OR** 2 **OR** 3 **OR** 4, **as directed**.
- G. Pneumatic Detention Locks And Latches
- 1. General: Provide pneumatic detention locks and latches that operate when supplied with air between 40 psig (275 kPa) minimum and 100 psig (690 kPa) maximum.
 - 2. Factory install quick-connect air fitting and factory-wired plug connector with 6-inch (150-mm) wire pigtail.
 - a. Provide security ring for installation of pneumatic detention lock in hollow-metal detention frame, welded to frame or access cover, unless otherwise **OR** where, **as directed**, indicated.
 - 3. Pneumatic Deadlatches, Paracentric PL-1: For use on swinging doors, such as entrance, sally port, corridor, and inmate cell doors, that are to be unlocked from remote locations.
 - a. Function: Remote switch activates pneumatic cylinder that retracts latchbolt; latchbolt remains retracted until door is opened 2 inches (50 mm), then releases **OR** as long as control switch is activated, **as directed**; automatic latching and deadlocking when door is closed (slam locking). Latchbolt can be mechanically retracted by five **OR** six, **as directed**,-tumbler paracentric cylinder; keyed one side **OR** two sides, **as directed**.
 - 1) If power fails or compressed-air system fails, latchbolt automatically deadlocks (fail-secure).



- b. Latchbolt: 2-inch-high by 3/4-inch- (50-mm-high by 19-mm-) thick hardened steel; 3/4-inch (19-mm) throw.
 - c. Provide internal deadlock indicator switch.
 - d. Provide roller-type deadlock actuator.
 - e. Voltage: 24-V dc.
 - f. Security Grade: 1 **OR** 2 **OR** 3 **OR** 4, **as directed**.
4. Pneumatic Deadlatches, Mogul PL-2: For use on swinging doors, such as entrance, sally port, corridor, and inmate cell doors, that are to be unlocked from remote locations.
- a. Function: Remote switch activates pneumatic cylinder that retracts latchbolt; latchbolt remains retracted until door is opened 2 inches (50 mm), then releases **OR** as long as control switch is activated, **as directed**; automatic latching and deadlocking when door is closed (slam locking). Latchbolt can be mechanically retracted by mogul cylinder; keyed one side **OR** two sides, **as directed**.
 - 1) Local Electric Key (LEK): Inmate key operates lock electrically when enabled; staff key always operates lock manually and electrically; where indicated.
 - 2) Knob on opposite side of cylinder retracts latchbolt.
 - 3) If power fails or compressed-air system fails, latchbolt automatically deadlocks (fail-secure).
 - b. Latchbolt: 1-1/2-inch-high by 3/4-inch- (38-mm-high by 19-mm-) thick hardened steel; 1-inch (25-mm) throw.
 - c. Provide internal deadlock indicator switch.
 - d. Provide roller-type deadlock actuator.
 - e. Voltage: 24-V dc.
 - f. Listed and labeled for use on fire doors.
 - g. Security Grade: 1 **OR** 2 **OR** 3 **OR** 4, **as directed**.
5. Pneumatic Deadlatches, Commercial PL-3: For use on swinging doors, hung in standard 2-inch (50-mm) hollow-metal frames, that are to be unlocked from remote locations.
- a. Function: Remote switch activates pneumatic cylinder that retracts latchbolt; latchbolt remains retracted until door is opened 2 inches (50 mm), then releases **OR** as long as control switch is activated, **as directed**; automatic latching and deadlocking when door is closed (slam locking). Latchbolt can be mechanically retracted by high-security, **as directed**, commercial cylinder; keyed one side **OR** two sides, **as directed**.
 - 1) Local Electric Key (LEK): Inmate key operates lock electrically when enabled; staff key always operates lock manually and electrically; where indicated.
 - 2) If power fails or compressed-air system fails, latchbolt automatically deadlocks (fail-secure).
 - b. Latchbolt: 1-1/2-inch-high by 5/8-inch- (38-mm-high by 16-mm-) thick hardened steel; 3/4-inch (19-mm) throw.
 - c. Faceplate: Stainless steel.
 - d. Provide internal deadlock indicator switch.
 - e. Provide roller-type deadlock actuator.
 - f. Voltage: 24-V dc.
 - g. Listed and labeled for use on fire doors.
 - h. Security Grade: 1 **OR** 2 **OR** 3 **OR** 4, **as directed**.

H. Cylinders And Keying

- 1. General: Subject to compliance with requirements, provide cylinders and keying for paracentric and mogul cylinders by the same manufacturer as for detention locks and latches.
- 2. Commercial (Builders' Hardware) Cylinders: As specified in Division 08 Section "Door Hardware".
- 3. Paracentric Cylinders: Manufacturer's standard lever-tumbler type, constructed from one-piece spring-tempered brass; with tumblers activated by phosphor bronze springs; five tumblers per lock unless otherwise indicated.



4. Mogul Cylinders: Manufacturer's standard pin-tumbler type, minimum 2-inch (50-mm) diameter; body constructed from brass or bronze, stainless steel, or nickel silver; with stainless-steel tumblers and engaging cylinder balls; complying with the following:
 - a. Number of Pins: Five **OR** Six **OR** Seven, **as directed**.
 - b. Mortise Type: Threaded cylinders with rings and straight- or clover-type cam.
 - 1) High-Security Grade: Listed and labeled as complying with pick- and drill-resistant testing requirements in UL 437 (Suffix A); where indicated.
 - c. Finish: BHMA 606 **OR** BHMA 626, **as directed**.
 5. Keying System: Unless otherwise indicated, provide a factory-registered keying system complying with the following requirements:
 - a. Paracentric cylinders operated by change keys only.
 - b. No Master Key System: Mogul cylinders operated by change keys only.
OR
Master Key System: Mogul cylinders operated by a change key and a master key.
OR
Grand Master Key System: Mogul cylinders operated by a change key, a master key, and a grand master key.
OR
Great-Grand Master Key System: Mogul cylinders operated by a change key, a master key, a grand master key, and a great-grand master key.
 - c. Existing System: Master key or grand master key mogul-cylinder locks to the Owner's existing system.
 - d. Existing System: Re-key the Owner's existing master key system for mogul-cylinder locks into new keying system.
 6. Keys: Provide cast silicon-bronze copper alloy keys complying with the following:
 - a. Stamping: Permanently inscribe each key with a visual key-control number and include the following notation:
 - 1) Notation: "DO NOT DUPLICATE" **OR** Information to be furnished by the Owner, **as directed**.
 - b. Quantity: In addition to one extra blank key for each lock, provide the following:
 - 1) Cylinder Change Keys: Three.
OR
Master Key(s): One.
OR
Grand Master Key(s): One.
OR
Great-Grand Master Key(s): One.
- I. Switches
1. General: Provide switches configured with type of contacts required for functions indicated, including multiple circuiting where required by functional performance of Division 28 Section "Plc Electronic Detention Monitoring And Control Systems".
 2. Concealed, Magnetic Door Position Switches: Consisting of actuating magnet mortised into detention door and switch mortised into frame; with stainless-steel faceplates; 24-V dc, factory wired with plug connector. Wire in series with lock monitors. Attach with security fasteners.
 3. Concealed, Mechanical Door Position Switches: Consisting of metal track mortised into head of detention door connected by steel actuator arm to steel actuator mortised into frame; switch fully concealed when door is in closed position; with stainless-steel faceplate; 120-V ac; factory wired with plug connector. Action of door mechanically activates switch. Wire in series with lock monitors. Attach with security fasteners.
 4. Surface-Mounted Door Position Switches: Switch enclosed in 0.134-inch (3.42-mm) nominal-thickness steel enclosure, factory primed for painting; 120-V ac; factory wired with plug connector. Wire in series with lock monitors. Attach with security fasteners.
 - a. Galvanize enclosure for exterior locations and where indicated.



5. Strike Indicator Switches: Designed to be mortised behind strike and to indicate whether door is locked or unlocked; enclosed in metal strike box. Wire in series with door position switches. Attach with security fasteners.
 - a. Voltage: 120-V dc **OR** 240-V ac **OR** As indicated, **as directed**.
 - b. Locations: At doors with mechanical detention lock **OR** Where indicated, **as directed**.
 - c. Manufacturer: Same as detention lock.
 6. Inmate Door Control Switches, as directed: Momentary **OR** Maintained-contact, **as directed**, push-button switch with metal faceplate. Attach with security fasteners.
 - a. Material and Finish: Brass with BHMA 606 **OR** Brass with BHMA 626 **OR** Stainless steel with BHMA 630, **as directed**, finish.
 - b. Operation: When activated from remote location, switch allows inmate operation of electric cell door lock.
 7. Push-Button, Inmate Door Control Switches, as directed: Momentary **OR** Maintained-contact, **as directed**, push-button switch for installation without faceplate. Attach with security fasteners.
 - a. Material and Finish: Brass with BHMA 606 **OR** Brass with BHMA 626 **OR** Stainless steel with BHMA 630, **as directed**, finish.
 - b. Operation: When activated from remote location, switch allows inmate operation of electric cell door lock.
- J. Detention Operating Trim
1. Standard: BHMA A156.6, Grade 1.
 2. Surface-Mounted Door Pulls (not typically used inside cells): 8-3/4-inch (222-mm) overall length and 2-1/4-inch (57-mm) projection; attach to door with two security fasteners.
 - a. Material: Cast bronze with BHMA 606 **OR** BHMA 626, **as directed**, finish.
 - b. Material: Cast stainless steel with BHMA 630 finish.
 3. Round, Surface-Mounted Door Pulls (not typically used inside cells): 7-inch (178-mm) overall length by 1-inch- (25-mm-) diameter solid bar, with 2-1/4-inch (57-mm) projection; attach to door with two security through fasteners.
 - a. Material: Cast or extruded bronze with BHMA 606 **OR** BHMA 626, **as directed**, finish.
 - b. Material: Cast stainless steel with BHMA 630 finish.
 4. Flush Door Pulls: 5 inches high by 4 inches wide by 1 inch deep (127 mm high by 102 mm wide by 25 mm deep), with 1/8-inch- (3-mm-) thick faceplate; attach to door with four security fasteners.
 - a. Material: Formed, wrought, or cast brass/bronze with BHMA 606 **OR** BHMA 626, **as directed**, finish.
 - b. Material: Formed or cast stainless steel with BHMA 630 finish.
 5. Knob Pulls: 2-inch (50-mm) diameter; fabricated from solid brass with BHMA 606 **OR** BHMA 626, **as directed**, finish. Attach with security fasteners.
 6. Lever-Handle Guides: Guide track and escutcheon, **as directed**, that provides selective stopping of lever handle by use of an adjustable stop; fabricated from steel with BHMA 633 **OR** stainless steel with BHMA 630, **as directed**, finish. Attach with security fasteners.
- K. Security Door Closers
1. Standard: BHMA A156.4, Grade 1.
 - a. Certified Products: Provide security door closers listed in BHMA's "Directory of Certified Products."
 2. Surface-Mounted Security Door Closers:
 - a. Arms: Minimum 3/8-inch- (9.5-mm-) thick by 1-1/8-inch- (29-mm-) wide, rectangular steel main arm; 5/16-inch- (8-mm-) thick by 1-inch- (25-mm-) wide, rectangular steel secondary arm; full rack-and-pinion type; fabricated with orbital-riveted, pinned, or welded elbow and arm shoe/soffit plate joints designed to prevent disassembly with ordinary hand tools.
 - b. Cover: Heavy-duty metal, attached with four security fasteners.
 - c. Mounting: Attach security door closer with security fasteners.
 3. Concealed Security Door Closers:



- a. Construction: Forged-steel arm; security roller; with track concealed in head of detention door, designed to eject foreign objects during opening and closing; fabricated with joints designed to prevent disassembly with ordinary hand tools. Closer arm and track fully concealed when door is closed.
 - b. Cover Plates: Heavy-duty metal, attached with security fasteners.
 - c. Provide door position switch integral to closer.
4. Unit Size: Unless otherwise indicated, comply with manufacturer's written recommendations for size of security door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.
- L. Detention Door Stops
1. Detention Floor Stops: 1-1/2-inch-high by 2-inch- (38-mm-high by 50-mm-) diameter rubber bumper mounted on steel lag bolt; BHMA A156.16; install in floor with nonshrink grout; for detention doors unless wall or other type stops are indicated. Do not mount floor stops where they will impede traffic.
 2. Silencers for Detention Door Frames: BHMA A156.16, Grade 1; neoprene or rubber, minimum 1/2-inch (13-mm) diameter; fabricated for drilled-in application to detention door frame. Attach with security fasteners.
- M. Sliding Detention Door Device Assemblies
1. Performance Requirements: Provide sliding detention door device assemblies, including locking device, receiver, overhead door hanger, bottom door guide, lock column, and enclosure, as a complete assembly, complying with Grade 1 **OR** Grade 2, **as directed**, according to ASTM F 1643, as determined by testing manufacturers' standard units representing those indicated for Project.
 2. Assembly Construction: As follows:
 - a. Enclosure: Fabricated from 0.179-inch (4.56-mm) nominal-thickness steel plate, with 0.134-inch (3.42-mm) nominal-thickness steel removable **OR** hinged, **as directed**, cover. Baffle openings in enclosure. Provide closures for ends of housings.
 - 1) Provide sloping-top housings. Flat-top housings may be provided for operators mounted to ceiling, **as directed**.
 - b. Lock Column: Vertical tube enclosure fabricated from 0.134-inch (3.42-mm) nominal-thickness steel, providing mechanical locking control of detention sliding door at door location; operated by paracentric key. Doors shall be capable of being locked at top and bottom, at rear of door, in both open and closed positions, with no components projecting into door opening.
 - c. Receiver: Fabricated from 0.134-inch (3.42-mm) nominal-thickness steel plate.
 - d. Hanger Assembly: Extend steel carrier full width of door and door travel required for clear door opening. Provide antifriction ball-bearing steel rollers with hardened members and grease shield.
 - e. Finish: Factory prime painted.
 3. Mechanical-Locking, Manual-Door-Movement, Sliding Door Device Assemblies SDA-1: Doors are manually opened and closed and mechanically locked by means of jamb-mounted mechanical detention lock specified elsewhere in this Section.
 4. Electromechanical-Locking, Manual-Door-Movement, Sliding Door Device Assemblies SDA-2: Operated from remote-control panel that activates electric motors to unlock sliding doors. Doors spring open a small distance after unlocking and are manually opened and closed. Locks automatically deadlock when doors are moved to fully open or fully closed position. Provide factory-wired cable harness with plug connectors for each motor unit.
 - a. Single-Door Function: In an emergency or if power fails, individual doors can be unlocked using a manual-release tool and manually moved; doors relock in either fully open or fully closed position.
 - b. Multiple-Door Function: Each door can be individually unlocked locally or from a remote panel, or unlocked from a remote panel with other doors as a group. In an emergency or if power fails, door group can be manually operated from mechanical-release cabinet at end



- of cell line **OR** pilaster release adjacent to receiving jamb of each door operated by paracentric key, **as directed**; doors shall not relock in any position.
- c. Electric Key Switch: Operated by paracentric **OR** mogul, **as directed**, key and providing electric control of detention sliding door operation at door location; where indicated.
5. Electromechanical-Locking, Electromechanical-Door-Movement, Sliding Door Device Assemblies SDA-3: Operated from remote-control panel that activates electric motors to unlock sliding doors and motorized rack-and-pinion drive mechanisms to open and close doors. Doors lock in open position and deadlock when closed. Provide factory-wired cable harness with plug connectors for each motor unit.

NOTE: Paragraph above describes Southern Folger's "Southern Steel Model 3150LX" and "Southern Steel Model 3165LX." Only the 3150LX system offers multiple door functions, such as for cell doors; the 3165LX system is for individual doors, such as for vestibules, day rooms, and corridors.

 - 1) Single-Door Function: In an emergency or if power fails, individual doors can be unlocked using a manual-release tool and manually moved; doors relock in either fully open or fully closed position.
 - 2) Multiple-Door Function: Each door can be individually unlocked locally or from a remote panel, or unlocked from a remote panel with other doors as a group. In an emergency or if power fails, door group can be manually operated from mechanical-release cabinet at end of cell line **OR** pilaster release adjacent to receiving jamb of each door operated by paracentric key, **as directed**; doors shall not relock in any position.
 - b. Electric Key Switch: Operated by paracentric **OR** mogul, **as directed**, key and providing electric control of detention sliding door operation at door location; where indicated.
6. Electromechanical-Locking, Pneumatic-Door-Movement, Sliding Door Device Assemblies SDA-4 (for individual doors, such as for vestibules, day rooms, and corridors): Operated from remote-control panel that activates electric motors to unlock sliding doors and pneumatic system to open and close doors. Doors lock in open position and deadlock when closed. Factory install quick-connect air fitting and factory-wired cable harness with plug connectors for each motor unit; 24-V dc.
 - a. Single-Door Function: In an emergency or if pneumatic systems or electric power fails, individual doors can be unlocked using a manual-release tool and manually moved; doors relock in either fully open or fully closed position.
 - 1) Lock Control at Door: Mechanical key release adjacent to receiving jamb of each door, contained in pilaster and operated by paracentric key; where indicated.
 7. Pneumatic-Locking, Manual-Door-Movement, Sliding Door Device Assemblies SDA-5: Operated from remote-control panel that activates pneumatic cylinders to unlock doors. Doors spring open a small distance after unlocking and are manually opened and closed. Locks automatically deadlock when doors are moved to fully open or fully closed position. Factory install quick-connect air fitting and factory-wired cable harness with plug connectors for each motor unit.
 - a. Single-Door Function: In an emergency or if pneumatic systems or electric power fails, individual doors can be unlocked using a manual-release tool and manually moved; doors relock in either fully open or fully closed position.
 - 1) Lock Control at Door: Mechanical key release adjacent to receiving jamb of each door, contained in pilaster and operated by paracentric key; where indicated.
 - b. Multiple-Door Function: Each door can be individually unlocked locally or from a remote panel, or unlocked from a remote panel with other doors as a group. In an emergency or if pneumatic systems or electric power fails, door group can be operated from remotely located auxiliary pneumatic-release system **OR** pilaster release adjacent to receiving jamb of each door operated by paracentric key, **as directed**; doors shall not relock in any position.
 - c. Electric Key Switch: Operated by paracentric **OR** mogul, **as directed**, key and providing electric control of detention sliding door operation at door location; where indicated.
 8. Pneumatic-Locking, Pneumatic-Door-Movement, Sliding Door Device Assemblies SDA-6 (Paragraph below describes Southern Folger's "Southern Steel Model 8050L" and "Southern



Steel Model 8065L." Only the 8050L system offers multiple door functions, such as for cell doors; the 8065L system is for individual doors, such as for vestibules, day rooms, and corridors.); Operated from remote-control panel that activates pneumatic cylinder to unlock sliding doors and open and close doors. Doors lock in open position and deadlock when closed. Factory install quick-connect air fitting and factory-wired cable harness with plug connectors for each motor unit; 24-V dc.

- a. Single-Door Function: In an emergency or if pneumatic systems or electric power fails, individual doors can be unlocked using a manual-release tool and manually moved; doors relock in either fully open or fully closed position.
- b. Multiple-Door Function: Each door can be individually unlocked locally or from a remote panel, or unlocked from a remote panel with other doors as a group. In an emergency or if pneumatic systems or electric power fails, door group can be operated from remotely located auxiliary pneumatic-release system **OR** pilaster release adjacent to receiving jamb of each door operated by paracentric key, **as directed**; doors shall not relock in any position.
- c. Electric Key Switch: Operated by paracentric **OR** mogul, **as directed**, key and providing electric control of detention sliding door operation at door location; where indicated.
- d. Provide security ring for installation of pneumatic detention lock in hollow-metal detention frame, welded to frame or access cover, unless otherwise **OR** where, **as directed**, indicated.

N. Fabrication

1. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location (omit removable nameplates) except in conjunction with required fire-rated labels and as otherwise approved.
2. Base Metals: Produce detention door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified detention door hardware units and BHMA A156.18 finishes. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.
3. Fasteners: Provide flat-head security fasteners with finished heads to match surface of detention door hardware unless otherwise indicated.
 - a. Security Fasteners: Fabricate detention door hardware using security fasteners with head style appropriate for fabrication requirements, strength, and finish of adjacent materials. Provide stainless-steel security fasteners in stainless-steel materials, **as directed**.
 - b. Concealed Fasteners: For detention door hardware units that are exposed when detention door is closed except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching detention door hardware. Where through bolts are used on hollow-metal detention door and frame construction, provide sleeves for each through bolt.
 - c. Steel Machine Screws (for fire-rated detention door assemblies. NFPA 80 requires locks, latches, and surface-mounted top and bottom bolts to be secured with machine screws or through bolts.): For the following fire-rated applications:
 - 1) Mortise detention hinges to detention doors.
 - 2) Strike plates to detention frames.
 - 3) Security door closers to detention doors and frames.
 - d. Steel Through Bolts (for fire-rated detention door assemblies. NFPA 80 requires locks, latches, and surface-mounted top and bottom bolts to be secured with machine screws or through bolts.): For the following fire-rated applications unless door blocking is provided:
 - 1) Surface detention hinges to detention doors.
 - 2) Security door closers to detention doors and frames.
 - e. Spacers or Sex Bolts: For through bolting of hollow-metal detention doors.
 - f. Fasteners for Wood Detention Doors: Comply with DHI WDHS.2.



O. Finishes

1. Standard: Comply with BHMA A156.18.
2. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
3. BHMA Designations: Comply with base material and finish requirements indicated by the following:
 - a. BHMA 600: Primed for painting, over steel base metal.
 - b. BHMA 606: Satin brass, clear coated, over brass base metal.
 - c. BHMA 626: Satin chromium plated over nickel, over brass or bronze base metal.
 - d. BHMA 630: Stainless steel, satin, over stainless-steel base metal.
 - e. BHMA 652: Satin chromium plated over nickel, over steel base metal.

1.3 EXECUTION

A. Preparation

1. Steel Detention Doors and Frames: Comply with ANSI/DHI A115 Series.
 - a. Surface-Applied Detention Door Hardware: Drill and tap detention doors and frames according to ANSI/SDI A250.6.
2. Wood Detention Doors: Comply with DHI A115-W Series.

B. Installation

1. Mounting Heights: Mount detention door hardware units at heights indicated in the following applicable publications unless specifically indicated or required to comply with governing regulations:
 - a. Steel Detention Doors and Frames: DHI's "Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames."
 - b. Wood Detention Doors: DHI WDHS.3.
2. Install each detention door hardware item to comply with Shop Drawings and manufacturer's written instructions. Where cutting and fitting are required to install detention door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 09. Do not install surface-mounted items until finishes have been completed on substrates involved.
 - a. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 - b. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
3. Install interconnecting wiring and connectors between detention door hardware devices. Terminate device wiring for detention door hardware installed in swinging doors at a plug-type connector located in lock pocket or door frame junction box and for sliding doors at a junction box in door frame.
4. Security Fasteners: Install detention door hardware using security fasteners with head style appropriate for installation requirements, strength, and finish of adjacent materials.

C. Field Quality Control

1. Inspect installed products to verify compliance with requirements. Prepare inspection reports and indicate compliance with and deviations from the Contract Documents.
2. Perform the following field tests and inspections and prepare test reports:
 - a. After installing electrified and pneumatic, **as directed**, detention door hardware and after electrical circuitry has been energized and compressed-air system is functional, **as directed**, test detention door hardware for compliance with requirements.
 - 1) Test: Operate lock of each door and group of doors in normal remote, normal local, and emergency operating modes. Verify that remote controls operate correct door locks and in correct sequence.



- b. Verify that lock bolts engage strikes with required bolt projection.
- c. Verify that detention door hardware is installed, connected, and adjusted according to the Contract Documents.
- d. Verify that electrical wiring installation complies with manufacturer's submittal and written installation requirements.
- 3. Remove and replace detention work if inspections indicate that work does not comply with specified requirements. Remove malfunctioning units, replace with new units, and retest as specified above.
- 4. Perform additional inspections to determine compliance of replaced or additional work. Prepare inspection reports.
- 5. Prepare field quality-control certification endorsed by Detention Specialist, **as directed**, that states installed products and their installation comply with requirements in the Contract Documents.

D. Adjusting

- 1. Adjust and check each operating item of detention door hardware and each detention door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust detention door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
 - a. Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
 - b. Security Door Closers: Adjust sweep period so that, from an open position of 90 degrees, detention door will take at least five seconds to move to a position of 12 degrees.

E. Cleaning And Protection

- 1. Clean adjacent surfaces soiled by detention door hardware installation.
- 2. Clean operating items as necessary to restore proper function and finish.
- 3. Provide final protection and maintain conditions that ensure that detention door hardware is without damage or deterioration at time of Final Completion.

1.4 Detention Door Hardware Sets

- Note 1: Hanging devices below include detention hinges and sliding detention door device assemblies. Indicate whether detention hinges are attached to detention doors and frames by security fasteners or by welding.
- Note 2: Securing devices (inactive leaf) below include door position switches and strike indicator switches.
- Note 3: Securing devices (active leaf) below include detention locksets and latchsets, cylinders, door position switches, strike indicator switches, and inmate door control switches.\
- Note 4: Operating trim below includes detention door pulls, flush pulls, knob pulls, and lever-handle guides.
- Note 5: Closing devices below include security door closers.
- Note 6: Stops below include detention floor stops and door silencers if not specified with steel detention doors and frames.
- Note 7: Miscellaneous items that could be inserted at end of detention door hardware sets include key-control cabinets, software if not included in Division 08 Section "Door Hardware", and detention door hardware not otherwise listed.

- A. General: Provide detention door hardware for each detention door to comply with requirements in this Section and detention door hardware sets indicated in a door and frame schedule **OR** and detention door hardware sets indicated below, **as directed**.

Detention Door Hardware Set No. [#]

Single Door No. [#]; each to have the following:

*	Hanging Devices	<Insert description.>	<Insert manufacturer.>	<Insert finish.>
[#]	Securing Devices	<Insert description.>	<Insert manufacturer.>	<Insert finish.>



	(inactive leaf)			
<#>	Securing Devices	<Insert description.>	<Insert manufacturer.>	<Insert finish.>
	(active leaf)			
[#]	Operating Trim	<Insert description.>	<Insert manufacturer.>	<Insert finish.>
[#]	Closing Devices	<Insert description.>	<Insert manufacturer.>	<Insert finish.>
[#]	Stops	<Insert description.>	<Insert manufacturer.>	<Insert finish.>

* Number of Hinges,
as specified.

Note 8: Insert additional requirements and sequence of operation in schedule above for electrified and pneumatic detention door hardware if required.

END OF SECTION 08 34 63 13



SECTION 08 34 63 13a - DETENTION FURNITURE

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for detention furniture. Product shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Gun lockers.
 - b. Security key cabinets.
 - c. Detention bunks.
 - d. Detention mattresses.
 - e. Detention desks.
 - f. Detention tables.
 - g. Detention seating.

C. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittal:
 - a. Product Data for Credit EQ 4.1: For security sealants, including printed statement of VOC content.
3. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
4. Samples: For factory-applied color finishes.
5. Samples for Verification:
 - a. Furniture: Full-size units. Approved Samples may become part of the completed Work.
 - b. Detention Mattresses: Not less than 6 inches (152 mm) square by full depth, including core and cover fabric.
6. Welding certificates.
7. Product certificates.
8. Maintenance data.
9. Other Informational Submittals:
 - a. Field quality-control reports documenting inspections of installed products.
 - b. Field quality-control certification signed by Contractor and Detention Specialist, **as directed**.

D. Quality Assurance

1. Welding Qualifications: Qualify procedures and personnel according to the following:
 - a. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - b. AWS D1.3, "Structural Welding Code - Sheet Steel."
 - c. AWS D1.6, "Structural Welding Code - Stainless Steel."
2. Preinstallation Conference: Conduct conference at Project site.

E. Delivery, Storage And Handling

1. Detention Mattresses: Deliver wrapped to provide protection during transit and Project-site storage. Protect from contact with moisture.

1.2 PRODUCTS

A. Materials



1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
 2. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, CS (Commercial Steel), Type B; suitable for exposed applications.
 3. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, CS (Commercial Steel), Type B; free of scale, pitting, or surface defects; pickled and oiled.
 4. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666 or ASTM A 240/A 240M, austenitic stainless steel, Type 304.
 5. Steel Tubing: ASTM A 513, Type B unless otherwise indicated; thickness indicated or required by structural loads.
 6. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless another weight is indicated or required by structural loads.
 7. Concealed Bolts: ASTM A 307, Grade A unless otherwise indicated.
 8. Cast-in-Place Anchors in Concrete: Fabricated from corrosion-resistant materials capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency; of type indicated below.
 - a. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed; hot-dip galvanized per ASTM A 153/A 153M or ASTM F 2329.
 9. Embedded Plate Anchors: Fabricated from steel shapes and plates, minimum 3/16 inch (4.8 mm) thick; with minimum 1/2-inch- (12.7-mm-) diameter headed studs welded to back of plate.
 10. Proprietary Built-in Masonry Anchors: Fabricated from 0.134-inch (3.42-mm) nominal-thickness steel sheet **OR** 1/4-inch (6-mm) nominal-thickness steel plate **OR** 1/2-inch (12.7-mm) nominal-thickness steel plate, **as directed**, into 6-inch- (152-mm-) **OR** 8-inch- (203-mm-), **as directed**, deep blocks matching size of concrete masonry units; with weld nuts attached on inside to receive field-bolted attachments, **as directed**.
 - a. Finish: Factory primed for field painting for anchors with field-welded attachments **OR** Polyester powder coat for anchors with bolted attachments **OR** Epoxy paint for anchors with bolted attachments, **as directed**.
 11. Welding Rods and Bare Electrodes: Select according to AWS specifications.
- B. Security Sealants
1. Manufacturer's standard, high-modulus, nonsag, two-part, pick-proof, epoxy sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), recommended for sealing nonmoving interior joints in security applications.
- C. Security Fasteners
1. Fasteners operable only by tools produced by fastener manufacturer or other licensed fabricator for use on specific type of fastener.
 2. Provide drive-system type, head style, material, and protective coating as required for assembly, installation, and strength, and as follows:
 - a. Drive-System Type: Pinned Torx-Plus **OR** Pinned Torx, **as directed**.
 - b. Fastener Strength: 120,000 psi (827 MPa).
 - c. Socket Button Head Fasteners:
 - 1) Heat-treated alloy steel, ASTM F 835 (ASTM F 835M).
 - 2) Stainless steel, ASTM F 879 (ASTM F 879M), Group 1 CW.
 - d. Socket Flat Countersunk Head Fasteners:
 - 1) Heat-treated alloy steel, ASTM F 835 (ASTM F 835M).
 - 2) Stainless steel, ASTM F 879 (ASTM F 879M), Group 1 CW.
 - e. Socket Head Cap Fasteners:
 - 1) Heat-treated alloy steel, ASTM A 574 (ASTM A 574M).
 - 2) Stainless steel, ASTM F 837 (ASTM F 837M), Group 1 CW.
 - f. Protective Coatings for Heat-Treated Alloy Steel:
 - 1) Zinc and clear trivalent chromium where indicated.
 - 2) Zinc phosphate with oil, ASTM F 1137, Grade I, or black oxide unless otherwise indicated.



D. Gun Lockers

1. Pistol Lockers:
 - a. Cabinet: Minimum 20 inches (508 mm) wide by 15 inches (381 mm) high by 10 inches (254 mm) deep; formed from 0.134-inch (3.42-mm) **OR** 0.075-inch (1.90-mm), **as directed**, nominal-thickness steel sheet. Line each compartment with mothproofed felt or nonabsorbing, closed-cell padding.
 - 1) Compartments: Six.
 - b. Doors: Formed from same material as cabinet, supported by heavy-duty continuous bottom hinge.
 - c. Locks: Snap **OR** Cylinder, **as directed**, type, keyed differently and master keyed, **as directed**; provide one lock for each compartment.
 - d. Mounting: Surface **OR** Recessed, with mounting flange formed from same material as body, **as directed**.
 - e. Finish: Factory primed for field painting **OR** Baked enamel or powder coat, **as directed**.
2. Tilt-Out, Pistol Locker:
 - a. Cabinet: Minimum 39 inches (991 mm) wide by 15 inches (381 mm) high by 6 inches (152 mm) deep; formed from 0.134-inch (3.42-mm) **OR** 0.075-inch (1.90-mm), **as directed**, nominal-thickness steel sheet. Line each compartment with mothproofed felt or nonabsorbing, closed-cell padding.
 - 1) Compartments: Six.
 - b. Doors: Formed from same material as cabinet, supported by heavy-duty continuous bottom hinge, with attached tilt-out compartment with formed metal sides.
 - c. Locks: Snap **OR** Cylinder, **as directed**, type, keyed differently and master keyed, **as directed**; provide one lock for each compartment.
 - d. Mounting: Surface **OR** Recessed, with mounting flange formed from same material as body, **as directed**.
 - e. Finish: Factory primed for field painting **OR** Baked enamel or powder coat, **as directed**.

E. Security Key Cabinets

1. Cabinet: Minimum 16 inches (406 mm) wide by 24 inches (610 mm) high by 6-1/2 inches (165 mm) deep; formed from 0.134-inch (3.42-mm) nominal-thickness steel sheet. Provide 0.060-inch (1.52-mm) nominal-thickness, steel sheet interior panels, supported on pivots, for mounting 150 **OR** 300, **as directed**, paracentric or mogul keys.
2. Doors: Formed from same material as cabinet, supported by heavy-duty continuous side hinge welded to cabinet and door; with tumbler deadlock.
3. Cross-Index System: Set up by key control manufacturer; include labels, two sets of key tags with self-locking key holders, key-gathering envelopes, temporary and permanent markers, and the following:
 - a. Card Index: Furnish four sets of index cards for recording key information. Include three receipt forms for each key-holding hook.
 - b. Computer Software: Furnish cross-index software for recording and reporting key-holder listings, tracking keys and lock and key history, and printing receipts for transactions. Include instruction manual.
4. Finish: Factory primed for field painting **OR** Baked enamel or powder coat, **as directed**.

F. Detention Bunks

1. Freestanding Single Bunks:
 - a. Bunk Pan: Formed from 0.134-inch (3.42-mm) **OR** 0.105-inch (2.66-mm), **as directed** nominal-thickness steel sheet, perforated with at least six holes, **as directed**.
 - 1) Size: Minimum 27 inches (689 mm) wide by 76 inches (1930 mm) long with bunk pan 14 inches (356 mm) above floor.
 - 2) Turn up edges of back and sides and turn down edge of front **OR** back, sides, and front, **as directed**, with minimum 2-inch (51-mm) flanges.
 - b. Drawer: Minimum 21 inches (533 mm) wide by 24 inches (610 mm) deep by 5 inches (127 mm) high, with full-width integral pull formed from steel sheet **OR** solid-steel bar pull, **as directed**; formed from 0.134-inch (3.42-mm) nominal-thickness steel sheet.



- c. Legs and Frames: Formed from 2-by-2-by-3/16-inch (51-by-51-by-4.8-mm) steel angle welded at connections to each other and to bunk pan; provide four legs for each bunk.
 - d. Mounting Plates: Formed from 1/4-inch- (6-mm-) thick steel plate punched with one hole for floor anchorage; provide one mounting plate for each leg.
 - e. Finish: Factory primed for field painting **OR** Baked enamel or powder coat, **as directed**.
2. Freestanding Double Bunks:
- a. Bunk Pan: Formed from 0.134-inch (3.42-mm) **OR** 0.105-inch (2.66-mm), **as directed**, nominal-thickness steel sheet, each pan perforated with at least six holes, **as directed**.
 - 1) Size: Minimum 27 inches (689 mm) wide by 76 inches (1930 mm) long with lower bunk pan 14 inches (356 mm) above floor and upper bunk pan at least 49 inches (1245 mm) above floor.
 - 2) Upper and Lower Bunks: Turn up edges of back and sides and turn down edge of front **OR** back, sides, and front, **as directed**, with minimum 2-inch (51-mm) flanges.
 - 3) Upper Bunk: Turn up edges of back and sides and turn down edge of front **OR** back, sides, and front, **as directed**, with minimum 2-inch (51-mm) flanges.
 - 4) Lower Bunk: Turn up edges of back and sides and turn down edge of front, with minimum 2-inch (51-mm) flanges.
 - b. Drawers: Two; minimum 21 inches (533 mm) wide by 24 inches (610 mm) deep by 5 inches (127 mm) high, with full-width integral pull formed from steel sheet **OR** solid-steel bar pull, **as directed**; formed from 0.134-inch (3.42-mm) nominal-thickness steel sheet.
 - c. Legs and Frames: Formed from 2-by-2-by-3/16-inch (51-by-51-by-4.8-mm) steel angle welded at connections to each other and to bunk pan; provide four legs for each bunk.
 - d. Mounting Plates: Formed from 1/4-inch- (6-mm-) thick steel plate punched with one hole for floor anchorage; provide one mounting plate for each leg.
 - e. Assembly: Factory assembled **OR** Knocked down for field assembly, **as directed**.
 - f. Finish: Factory primed for field painting **OR** Baked enamel or powder coat, **as directed**.
3. Wall-Mounted Bunks:
- a. Bunk Pan: Formed from 0.134-inch (3.42-mm) **OR** 0.105-inch (2.66-mm), **as directed**, nominal-thickness steel sheet, perforated with at least six holes, **as directed**.
 - 1) Size: Minimum 27 inches (689 mm) wide by 76 inches (1930 mm) long with bunk pan 2 inches (51 mm) from wall.
 - 2) Turn up edges of back and sides and turn down edge of front **OR** back, sides, and front, **as directed**, with minimum 2-inch (51-mm) flanges.
 - b. Drawer: Minimum 21 inches (533 mm) wide by 24 inches (610 mm) deep by 5 inches (127 mm) high, with full-width integral pull formed from steel sheet **OR** solid-steel bar pull, **as directed**; formed from 0.134-inch (3.42-mm) nominal-thickness steel sheet.
 - c. Combination End Panel/Mounting Plate: Formed from 3/16-inch- (0.048-mm-) thick steel sheet welded at connections to bunk pan, with 2-inch (51-mm) flange for wall mounting; provide two end panel/mounting plates for each bunk.
 - d. Finish: Factory primed for field painting **OR** Baked enamel or powder coat, **as directed**.

G. Detention Mattresses

- 1. General: Comply with 16 CFR 1632 and California Technical Bulletin 121 as determined by testing identical products by a testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
- 2. Core: Fire-resistive solid foam **OR** Fire-resistive densified polyester **OR** Cotton, with 10 percent boric acid treatment, tufted to nylon netting to retain shape, **as directed**.
- 3. Cover Fabric: Vinyl bonded to nylon scrim; with a minimum total weight of 10 oz./sq. yd. (339 g/sq. m). Fabricate cover of four-corner box construction with seams facing inside of detention mattress except end closing seam located at foot of mattress; sew with nylon thread in a double-lock stitch.
- 4. Thickness: 4 inches (102 mm) **OR** 6 inches (152 mm), **as directed**.

H. Detention Desks



1. Single-Seat, Floor-Mounted Desks:
 - a. Desk Top: Formed from 0.134-inch (3.42-mm) nominal-thickness steel **OR** 0.105-inch (2.66-mm) nominal-thickness steel **OR** 0.141-inch- (3.57-mm-) thick, stainless-steel **OR** 0.062-inch- (1.59-mm-) thick, stainless-steel, **as directed**, sheet, with minimum 1-1/2-inch (38-mm) flanged edges.
 - b. Pedestal: Provide two storage shelves with sides and shelves formed from 0.134-inch (3.42-mm) nominal-thickness steel.
 - c. Legs: Formed from 1-1/2-inch-square by 3/16-inch- (38-mm-square by 4.8-mm-) thick steel tubing welded to desk top and mounting plate for an overall desk height of not less than 30 inches (762 mm).
 - d. Seat: 12-inch (305-mm) diameter, formed from 0.134-inch (3.42-mm) nominal-thickness steel **OR** 0.075-inch (1.90-mm) nominal-thickness steel **OR** 0.141-inch- (3.57-mm-) thick, stainless-steel **OR** 0.062-inch- (1.59-mm-) thick, stainless-steel, **as directed**, sheet; reinforced with 0.134-inch (3.42-mm) nominal-thickness steel sheet, with minimum 1-1/2-inch (38-mm) flanged edges.
 - e. Swivel Seat Support: Formed from 1-by-2-by-0.075-inch (25-by-51-by-1.90-mm) nominal-thickness steel tubing, 2-inch-OD-by-0.075-inch (51-mm-OD-by-1.90-mm) nominal-thickness steel tubing, or 3/8-inch- (9.5-mm-) thick, steel plate bar; with 1/2-inch (12.7-mm) pivot pin welded to legs.
 - f. Towel Bar: Formed from 1/4-by-1-1/2-inch (6-by-38-mm) steel **OR** stainless-steel, **as directed**, plate, mounted on one side of desk.
 - g. Mounting Plates: Formed from 1/4-inch- (6-mm-) thick steel plate punched with one hole for floor anchorage; provide one mounting plate for each leg.
 - h. Steel Finish: Factory primed for field painting **OR** Baked enamel or powder coat, **as directed**.
 - i. Stainless-Steel Finish: No. 3.
 - 1) Size: Minimum 36 inches (914 mm) wide by 15-1/2 inches (381 mm) deep.
 2. Wall-Mounted Desk and Seat:
 - a. Desk: Formed from 0.134-inch (3.42-mm) nominal-thickness steel **OR** 0.141-inch- (3.57-mm-) thick, stainless-steel, **as directed**, sheet, with minimum 1-1/2-inch (38-mm) flanged edges.
 - 1) Size: Minimum 12 inches (305 mm) wide by 18 inches (457 mm) deep **OR** 18 inches (457 mm) wide by 18 inches (457 mm) deep **OR** 24 inches (610 mm) wide by 18 inches (457 mm) deep **OR** 30 inches (762 mm) wide by 20 inches (508 mm) deep, **as directed**.
 - b. Seat: Minimum 12 inches (305 mm) wide by 16 inches (406 mm) **OR** 18 inches (457 mm), **as directed**, deep; formed from 0.134-inch (3.42-mm) nominal-thickness steel **OR** 0.141-inch- (3.57-mm-) thick, stainless-steel, **as directed**, sheet, with minimum 1-1/2-inch (38-mm) flanged edges.
 - c. Steel Finish: Factory primed for field painting **OR** Baked enamel or powder coat, **as directed**.
 - d. Stainless-Steel Finish: No. 3.
- I. Detention Tables
 1. Pedestal-Style Table:
 - a. Tabletop: Formed from 0.134-inch (3.42-mm) nominal-thickness steel **OR** 0.105-inch (2.66-mm) nominal-thickness steel **OR** 0.109-inch- (2.78-mm-) thick, stainless-steel **OR** 0.078-inch- (1.98-mm-) thick, stainless-steel **OR** 0.062-inch- (1.59-mm-) thick, stainless-steel, **as directed**, sheet; reinforced with steel shapes or steel plate, with minimum 1-1/2-inch (38-mm) flanged edges.
 - 1) Size: Minimum 30 inches (762 mm) **OR** 40 inches (1016 mm), **as directed**, wide by length required for capacity by 30 inches (762 mm) **OR** 35 inches (889 mm), **as directed**, high.
 - 2) Game Top: Engrave, or otherwise integrally incorporate, checkerboard into tabletop.



- b. Seats: 12-inch (305-mm) diameter, formed from 0.105-inch (2.66-mm) nominal-thickness steel **OR** 0.075-inch (1.90-mm) nominal-thickness steel **OR** 0.078-inch- (1.98-mm-) thick, stainless-steel **OR** 0.062-inch- (1.59-mm-) thick, stainless-steel, **as directed**, sheet; reinforced with 0.134-inch (3.42-mm) nominal-thickness steel plate, with minimum 1-1/2-inch (38-mm) flanged edges.
 - c. Pedestal Supports: Formed from 3-inch-square by 3/16-inch- (76-mm-square by 4.8-mm-) **OR** 4-inch-square by 0.134-inch- (102-mm-square by 3.42-mm-), **as directed**, thick steel tubing welded to top and base plate. Provide two pedestals for tables with capacity of more than four persons.
 - d. Seat Framing: Formed from 3-inch-square by 0.134-inch- (76-mm-square by 3.42-mm-) **OR** 3-by-2-by-3/16-inch- (76-by-51-by-4.8-mm-), **as directed**, thick steel tubing welded to pedestal supports.
 - e. Base Plate: Minimum 16-inch- (406-mm-) square, 1/4-inch- (6-mm-) thick steel plate punched with four holes for floor anchorage.
 - f. Capacity: Four persons **OR** Six persons **OR** Eight persons **OR** As indicated on Drawings, **as directed**.
 - g. Steel Finish: Factory primed for field painting **OR** Baked enamel or powder coat, **as directed**.
 - h. Stainless-Steel Finish: No. 3.
2. Bench-Style Table:
- a. Tabletop: Formed from 0.134-inch (3.42-mm) nominal-thickness steel **OR** 0.105-inch (2.66-mm) nominal-thickness steel **OR** 0.109-inch- (2.78-mm-) thick, stainless-steel, **as directed**, sheet; reinforced with steel channel frame or steel plate, with minimum 1-1/2-inch (38-mm) flanged edges.
 - 1) Size: Minimum 24 inches (610 mm) wide by length required for capacity by 30 inches (762 mm) **OR** 35 inches (889 mm), **as directed**, high.
 - b. Benches: 12 inches (305 mm) deep by length of tabletop, formed from 0.134-inch (3.42-mm) nominal-thickness steel **OR** 0.105-inch (2.66-mm) nominal-thickness steel **OR** 0.109-inch- (2.78-mm-) thick, stainless-steel **OR** 0.062-inch- (1.59-mm-) thick, stainless-steel, **as directed**, sheet, with minimum 1-1/2-inch (38-mm) flanged edges.
 - c. Vertical Supports: Formed from 8-inch (203-mm) hot-rolled steel channels or 0.164-inch- (4.18-mm-) thick, formed-steel channels; braced and welded, with steel base plates punched for floor anchorage. Provide three supports for tables with capacity of more than four persons.
 - d. Bench Supports: Formed from 2-by-2-1/2-by-1/4-inch- (51-by-64-by-6-mm-) thick steel angle or 2-inch-square by 1/4-inch- (51-mm-square by 6-mm-) thick steel tubing; welded to vertical supports.
 - e. Floor Anchor: Formed from steel angle punched for floor anchorage.
 - f. Capacity: Four persons **OR** Six persons **OR** Eight persons **OR** As indicated on Drawings, **as directed**.
 - g. Steel Finish: Factory primed for field painting **OR** Baked enamel or powder coat, **as directed**.
 - h. Stainless-Steel Finish: No. 3.
- J. Detention Seating
- 1. Floor-Mounted Stool:
 - a. Seats: Minimum 12-inch (305-mm) diameter, formed from 0.134-inch (3.42-mm) nominal-thickness steel **OR** 0.075-inch (1.90-mm) nominal-thickness steel **OR** 0.125-inch- (3.18-mm-) thick, stainless-steel **OR** 0.062-inch- (1.59-mm-) thick, stainless-steel, **as directed**, sheet; reinforced with 0.134-inch- (3.42-mm-) thick steel sheet cut to interior dimension of seat, with minimum 1-1/2-inch (38-mm) flanged edges.
 - b. Seat Support: Formed from steel pipe or 2-inch-OD-by-0.075-inch- (51-mm-OD-by-1.90-mm-) thick steel tubing welded to seat reinforcement and base plate for an overall stool height of not less than 18 inches (457 mm).



- c. Base Plate: Minimum 6-by-1/4-inch- (152-by-6-mm-) thick, square **OR** round, **as directed**, steel punched with four holes for floor anchorage.
 - d. Steel Finish: Factory primed for field painting **OR** Baked enamel or powder coat, **as directed**.
 - e. Stainless-Steel Finish: No. 3.
2. Wall-Mounted Stool:
- a. Seat: Minimum 12-inch (305-mm) diameter, formed from 0.134-inch (3.42-mm) nominal-thickness steel **OR** 0.075-inch (1.90-mm) nominal-thickness steel **OR** 0.125-inch- (3.18-mm-) thick, stainless-steel **OR** 0.078-inch- (1.98-mm-) thick, stainless-steel, **as directed**, sheet; reinforced with 0.134-inch- (3.42-mm-) thick steel sheet cut to interior dimension of seat, with minimum 1-1/2-inch (38-mm) flanged edges.
 - b. Seat Support: Formed from 1-by-2-by-0.075-inch- (25-by-51-by-1.90-mm-) thick steel tubing, 2-inch-OD-by-0.075-inch- (51-mm-OD-by-1.90-mm-) thick steel tubing or 3/8-inch- (9.5-mm-) thick, steel plate bar; welded to seat reinforcement and wall bracket.
 - c. Swivel Wall Bracket: Minimum 1/2-inch (12.7-mm) pivot pin, with 3/8-inch- (9.5-mm-) thick steel plate for welding to embedded steel plate **OR** for welding to steel wall **OR** punched with four holes for wall anchorage, **as directed**.
 - d. Steel Finish: Factory primed for field painting **OR** Baked enamel or powder coat, **as directed**.
 - e. Stainless-Steel Finish: No. 3.
3. Floor-Mounted Bench:
- a. Bench Top: Formed from 0.134-inch (3.42-mm) nominal-thickness steel **OR** 0.105-inch (2.66-mm) nominal-thickness steel **OR** 0.141-inch- (3.57-mm-) thick, stainless-steel **OR** 0.109-inch- (2.78-mm-) thick, stainless-steel, **as directed**, sheet, with minimum 1-1/2-inch (38-mm) flanged edges.
 - 1) Size: Minimum 12 inches (305 mm) deep by 48 inches (1219 mm) **OR** 60 inches (1524 mm) **OR** 72 inches (1829 mm) **OR** 96 inches (2438 mm), **as directed**, long.
 - b. Supports: Formed from 0.164-inch- (4.18-mm-) thick, formed-steel channels 2-1/2-inch-OD-by-0.0677-inch- (64-mm-OD-by-1.7-mm-) thick steel tubing; welded to bench and base plate for an overall bench height of not less than 18 inches (457 mm). Provide three supports for benches with length of more than 72 inches (1829 mm).
 - c. Base Plates: Minimum 8-inch-square by 1/4-inch- (203-mm-square by 6-mm-) thick steel plate punched with four holes for floor anchorage.
 - d. Capacity: Four persons **OR** Six persons **OR** Eight persons **OR** As indicated on Drawings, **as directed**.
 - e. Steel Finish: Factory primed for field painting **OR** Baked enamel or powder coat, **as directed**.
 - f. Stainless-Steel Finish: No. 3.

K. Fabrication

1. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
2. Coordinate dimensions and attachment methods of detention furniture with those of adjoining construction to produce integrated assemblies with closely fitting joints and with edges and surfaces aligned unless otherwise indicated.
3. Shear and punch metals cleanly and accurately. Remove burrs.
4. Form and grind edges and corners to be free of sharp edges or rough areas.
 - a. Fabricate detention furniture with no more than 1/32-inch (0.8-mm) gap between component materials. Weld edges that cannot be crimped to meet tolerance so as to provide a seamless joint with no place for concealment of contraband.
5. Form metal in maximum lengths to minimize joints. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing the Work.
6. Weld corners and seams continuously to comply with referenced AWS standard and the following:



- a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - b. Obtain fusion without undercut or overlap.
 - c. Remove welding flux immediately.
 - d. Finish exposed welds and surfaces smooth and blended at exposed connections so that no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
 - e. Weld before finishing components to greatest extent possible. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
7. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure detention furniture rigidly in place and to support expected loads. Build in straps, plates, and brackets as needed to support and anchor fabricated items to adjoining construction. Reinforce formed-metal units as needed to attach and support other construction.
 8. Cut, reinforce, drill, and tap detention furniture as indicated to receive hardware, security fasteners, and similar items.
 9. Form exposed work true to line and level with accurate angles, surfaces, and straight sharp edges.
 10. Form exposed connections with hairline joints, flush and smooth using concealed fasteners where possible. Use exposed security fasteners of type indicated or, if not indicated, flat-head (countersunk) security fasteners. Locate joints where least conspicuous.
 11. Attach drawer slides **OR** shelves, **as directed**, to furniture by welding **OR** with security fasteners, **as directed**.

L. Steel Finishes

1. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning" or SSPC-SP 8, "Pickling". After cleaning, apply a conversion coating suited to the organic coating to be applied over it.
2. Factory Prime Finish: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.
3. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).
 - a. Color and Gloss: As indicated by manufacturer's designations **OR** Match sample **OR** As selected from manufacturer's full range, **as directed**.

M. Stainless-Steel Finishes

1. General: Remove tool and die marks and stretch lines or blend into finish. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
2. Intermediate Polish Finish: No. 3 unless otherwise indicated.
3. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

1.3 EXECUTION

A. Installation

1. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing detention furniture to in-place construction. Include threaded fasteners for concrete and masonry inserts, security fasteners, and other connectors.
2. Cutting, Fitting, and Placement: Obtain manufacturer's written approval for cutting, drilling, and fitting required for installing detention furniture. Set detention furniture accurately in location,



- alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
3. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or masonry or similar construction.
 4. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
 5. Field Welding: Comply with the following requirements:
 - a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - b. Obtain fusion without undercut or overlap.
 - c. Remove welding flux immediately.
 - d. Finish exposed welds and surfaces smooth and blended at exposed connections so that no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
 - e. Fillet Welds: Minimum size of 1/8 inch by 1-1/2 inches (3 mm by 38 mm) long, spaced not greater than 12 inches (305 mm) o.c. Fill spaces between welds with security sealant **OR** auto body filler, **as directed**, where weld is exposed.
OR
Fillet Welds: Continuous.
 6. Adjust doors and latches of detention gun lockers and key cabinets to operate easily without binding. Verify that integral locking devices operate properly.
 7. Assemble detention furniture requiring field assembly with security fasteners with no exposed fasteners on exposed faces and frames.
 8. Anchor furniture with security fasteners **OR** by welding **OR** as indicated on Drawings, **as directed**, to floors and walls at intervals required by expected loads, but not more than 12 inches (305 mm) o.c.
 - a. Install anchors through backup reinforcing plates where necessary to avoid metal distortion.
 - b. Use security fasteners with head styles appropriate for installation requirements, strength, and finish of adjacent materials, except that a maximum of two different sets of tools shall be required to operate security fasteners for Project. Provide stainless-steel security fasteners in painted materials.
 - c. Weld nuts onto cast-in-place anchors after installation so as to be nonremovable.
 9. Apply security sealant **OR** auto body filler, **as directed**, at all exposed gaps between detention furniture and adjacent construction greater than 1/16 inch (1.6 mm).
 10. Install one detention mattress for each detention bunk.
- B. Field Quality Control
1. Detention Specialist shall inspect **OR** Inspect, **as directed**, installed products to verify compliance with requirements. Prepare inspection reports and indicate compliance with and deviations from the Contract Documents.
 2. Prepare field quality-control certification endorsed by Detention Specialist, **as directed**, that states installed products and their installation comply with requirements in the Contract Documents.
- C. Cleaning And Protection
1. Touchup Painting: Immediately after erection, clean bolted connections and abraded areas of shop paint, and paint exposed areas with same material used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

END OF SECTION 08 34 63 13a



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Task	Specification	Specification Description
08 34 63 13	08 34 53 00	Detention Doors And Frames



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SECTION 08 34 73 00 - SOUND CONTROL DOORS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of material for sound-control door assemblies. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Steel sound-control doors.
 - b. Wood sound-control doors.
 - c. Steel frames and sound-control seals.

C. Submittals

1. Product Data: For each type of product indicated. Include sound ratings, construction details, material descriptions, core descriptions, fire-resistance rating, temperature-rise ratings, and finishes.
2. LEED Submittals:
 - a. Certificates for Credit MR 7: Chain-of-custody certificates certifying that wood doors comply with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body, **as directed**.
 - b. Product Data for Credit EQ 4.4: For adhesives and composite wood products, indicating that product contains no urea formaldehyde.
3. Shop Drawings: Include the following:
 - a. Elevations of each door design.
 - b. Details of sound-control seals, door bottoms, and thresholds.
 - c. Details of doors, including vertical and horizontal edge details and metal thicknesses.
 - d. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - e. Locations of reinforcement and preparations for hardware.
 - f. Details of each different wall opening condition.
 - g. Details of anchorages, joints, field splices, and connections.
 - h. Details of accessories.
 - i. Details of moldings, removable stops, and glazing.
 - j. Details of conduit and preparations for power, signal, and control systems.
4. Samples:
 - a. Finishes: For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches (75 by 125 mm).
 - b. Doors: Include section of vertical-edge, top, and bottom construction; automatic door bottom or gasket; core construction; glazing; and hinge and other applied hardware reinforcement.
 - c. Frames: Include profile, corner joint, floor and wall anchors, and seals. Include separate section showing fixed sound panels if applicable.
5. Schedule: Provide a schedule of sound-control door assemblies prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with the Door Hardware Schedule.
6. Qualification Data: For qualified Installer, manufacturer, and acoustical testing agency.
7. Product Certificates: For each type of sound-control door assembly, from manufacturer.
8. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of sound-control door assembly.
9. Field quality-control reports.
10. Maintenance Data: For sound-control door assemblies to include in maintenance manuals.



11. Warranty: Samples of special warranty.

D. Quality Assurance

1. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
2. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
3. Acoustical Testing Agency Qualifications: An independent agency accredited as an acoustical laboratory according to the National Voluntary Laboratory Accreditation Program of NIST.
4. Source Limitations: Obtain sound-control door assemblies, including doors, frames, sound-control seals, hinges (when integral for sound control), thresholds, and other items essential for sound control, from single source from single manufacturer.
5. Sound Rating: Provide sound-control door assemblies identical to those of assemblies tested as sound-retardant units by an acoustical testing agency, and have the following minimum rating:
 - a. STC Rating: As indicated on Drawings **OR** As indicated in the Door Schedule, **as directed**, as determined by ASTM E 413 when tested in an operable condition according to ASTM E 90 and ASTM E 1408.
6. Forest Certification: Provide doors made with cores **OR** veneers **OR** not less than 70 percent of wood products **OR** all wood products, **as directed**, obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
7. Fire-Rated Door Assemblies: Assemblies listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
 - a. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
8. Smoke- and Draft-Control Door Assemblies: Where indicated **OR** At corridors, smoke barriers, and smoke partitions, **as directed**, provide assemblies tested according to UL 1784.
 - a. Air-Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m/m x sq. m) at the tested pressure differential of 0.3-inch wg (75 Pa) of water.
9. Preinstallation Conference: Conduct conference at Project site.

E. Delivery, Storage, And Handling

1. Deliver doors and frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
 - a. Provide additional protection to prevent damage to finish of factory-finished wood doors.
2. Shipping Spreaders: Deliver welded frames with two removable spreader bars across bottom of frames, tack welded or mechanically attached to jambs and mullions.
3. Store doors and frames under cover at Project site. Place units in a vertical position with heads up, spaced by blocking, on minimum 4-inch- (100-mm-) high, wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber.
 - a. If wrappers on doors become wet, remove cartons immediately. Provide a minimum of 1/4-inch (6-mm) space between each stacked door to permit air circulation.

F. Project Conditions

1. Environmental Limitations: Do not deliver or install wood sound-control wood doors until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
2. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

G. Coordination



1. Coordinate installation of anchorages for sound-control door assemblies. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

H. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of sound-control door assemblies that fail in materials or workmanship within specified warranty period.
 - a. Failures include, but are not limited to, the following:
 - 1) Failure to meet sound rating requirements.
 - 2) Faulty operation of sound seals.
 - 3) Deterioration of metals, metal finishes, and other materials beyond normal use or weathering.
 - 4) Wood doors that are warped (bow, cup, or twist) more than 1/4 inch (6 mm) in a 42-by-84-inch (1067-by-2134-mm) section, or show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 75-mm) span.
 - b. Warranty Period for Steel Doors: Five years from date of Final Completion.
 - c. Warranty Period for Wood Doors: Two years from date of Final Completion.

1.2 PRODUCTS

A. Steel Sound-Control Doors

1. Description: Provide flush-design sound-control doors, 1-3/4 inches (44 mm) thick, of seamless construction; with manufacturer's standard sound-retardant core as required to provide STC **OR** STC and fire, **as directed**, rating indicated. Construct doors with smooth, flush surfaces without visible joints or seams on exposed faces or stile edges. Fabricate according to ANSI/NAAMM-HMMA 865.
 - a. Exterior Doors: Fabricate from metallic-coated steel sheet 0.052-inch (1.32-mm) nominal thickness, or thicker as required to provide STC rating indicated.
 - b. Interior Doors: Fabricate from cold-rolled steel sheet unless otherwise indicated, 0.048-inch (1.21-mm) nominal thickness, or thicker as required to achieve STC rating indicated.
 - c. Loose Stops for Glazed Lites in Doors: Same material as face sheets.
 - d. Top and Bottom Channels: Closed with continuous channels of same material as face sheets, spot welded to face sheets not more than 6 inches (150 mm) o.c.
 - e. Hardware Reinforcement: Same material as face sheets.
2. Materials:
 - a. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
 - b. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
 - c. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B, with G60 (Z180) zinc (galvanized) or A40 (ZF120) zinc-iron-alloy (galvannealed) coating designation.
 - d. Glazing: As required by sound-control door assembly manufacturer to comply with sound-control **OR** sound-control and fire-rated-door labeling, **as directed**, requirements.
3. Finishes:
 - a. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
 - 1) Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.
 - b. Factory-Applied Paint Finish: Manufacturer's standard primer and finish coats, complying with ANSI/SDI A250.3 for performance and acceptance criteria.



- 1) Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

B. Wood Sound-Control Doors

1. Description: Provide flush-design sound-control doors, 1-3/4 inches (44 mm) thick; with manufacturer's standard sound-retardant core as required to provide STC **OR** STC and fire, **as directed**, rating indicated. Fabricate according to WDMA 1.S.1-A.
2. Materials: Comply with Division 08 Section(s) "Flush Wood Doors" **OR** "Stile And Rail Wood Doors", **as directed**, for grade, faces, veneer matching, fabrication, finishing, and other requirements unless otherwise indicated.
 - a. Glazing: As required by sound-control door assembly manufacturer to comply with sound-control **OR** sound-control and fire-rated-door labeling, **as directed**, requirements.
3. Finishes:
 - a. Factory finish sound-control wood doors to match doors specified in Division 08 Section(s) "Flush Wood Doors" **OR** "Stile And Rail Wood Doors", **as directed**.

C. Sound-Control Panels

1. Provide sound-control panels of same materials, construction, sound rating, and finish as specified for adjoining sound-control steel **OR** wood, **as directed**, doors.

D. Sound-Control Frames

1. Description: Fabricate sound-control door frames with corners mitered, reinforced, and continuously welded full depth and width of frame. Fabricate according to ANSI/NAAMM-HMMA 865.
 - a. Weld frames according to NAAMM-HMMA 820.
 - b. Exterior Frames: Fabricate from metallic-coated steel sheet 0.079-inch (2.01-mm) nominal thickness, or thicker as required to provide STC rating indicated.
 - c. Interior Frames: Fabricate from cold-rolled steel sheet unless otherwise indicated, 0.075-inch (1.90-mm) nominal thickness, or thicker as required to provide STC rating indicated.
 - d. Sound-Control Panel Stops: Formed integral with frames, a minimum of 5/8 inch (16 mm) high, unless otherwise indicated.
 - e. Hardware Reinforcement: Fabricate according to ANSI/NAAMM-HMMA 865 of same material as face sheets.
 - f. Head Reinforcement: Reinforce frames with metallic-coated steel channel or angle stiffener, 0.108-inch (2.74-mm) nominal thickness, welded to head.
 - g. Jamb Anchors:
 - 1) Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.064-inch (1.63-mm) nominal thickness metallic-coated steel with corrugated or perforated straps not less than 2 inches (50 mm) wide by 10 inches (250 mm) long; or wire anchors not less than 0.156 inch (4.0 mm) thick.
 - 2) Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.048-inch (1.21-mm) nominal thickness uncoated steel unless otherwise indicated.
 - 3) Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- (9.5-mm-) diameter, metallic-coated steel bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
 - h. Floor Anchors: Not less than 0.079-inch (2.01-mm) nominal thickness metallic-coated steel, and as follows:
 - 1) Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
 - 2) Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch (50-mm) height adjustment. Terminate bottom of frames at finish floor surface.
 - i. Ceiling Struts: Minimum 3/8-inch-thick by 2-inch- (9.5-mm-thick by 50-mm-) wide uncoated steel unless otherwise indicated.
 - j. Plaster Guards: Metallic-coated steel sheet, not less than 0.026 inch (0.6 mm) thick.



2. Materials:
 - a. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
 - b. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
 - c. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B, with G60 (Z180) zinc (galvanized) or A40 (ZF120) zinc-iron-alloy (galvannealed) coating designation.
 - d. Supports and Anchors: After fabricating, galvanize units to be built into exterior walls according to ASTM A 153/A 153M, Class B.
 - e. Inserts, Bolts, and Fasteners: Provide items to be built into exterior walls, hot-dip galvanized according to ASTM A 153/A 153M or ASTM F 2329.
 - f. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching sound-control door frames of type indicated.
 - g. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers.
3. Finishes:
 - a. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
 - 1) Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.
 - b. Factory-Applied Paint Finish: Manufacturer's standard primer and finish coats, complying with ANSI/SDI A250.3 for performance and acceptance criteria.
 - 1) Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

E. Sound-Control Hardware

1. Description: Provide manufacturer's standard sound-control system, including head and jamb seals, door bottoms, cam-lift hinges, and thresholds, as required by testing to achieve STC **OR** STC and fire, **as directed**, rating indicated.
 - a. Compression Seals: One-piece units; consisting of closed-cell sponge neoprene seal held in place by metal retainer; with retainer cover of same material as door frame; attached to door frame with concealed screws.
OR
Magnetic Seals: One-piece units; consisting of closed-cell sponge neoprene seal and resiliently mounted magnet held in place by metal retainer; with retainer cover of same material as door frame; attached to door frame with concealed screws.
 - b. Automatic Door Bottoms: Neoprene or silicone gasket, held in place by metal housing, that automatically drops to form seal when door is closed; mounted to bottom edge of door with screws.
 - 1) Mounting: Mortised or semimortised into bottom of door or surface mounted on face of door as required by testing to achieve STC rating indicated.
OR
Door Bottoms: Neoprene or silicone gasket held in place by metal housing; mortised into bottom edge of door.
 - c. Cam-Lift Hinges: Full-mortise template type that raises door 1/2 inch (13 mm) when door is fully open; with hardened pin; fabricated from stainless steel.
 - d. Thresholds: Flat, smooth, unfluted type as recommended by manufacturer; fabricated from aluminum **OR** stainless steel **OR** solid wood matching wood door faces, **as directed**.
 - 1) Finish: Clear **OR** Color, **as directed**, anodic finish.
 - 2) Color: Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black **OR** As selected from full range of industry colors and color densities, **as directed**.
2. Other Hardware: Comply with requirements in Division 08 Section "Door Hardware".



- F. Sound-Control Accessories
1. Glazing: Comply with requirements in Division 08 Section "Glazing"
 2. Grout: Comply with ASTM C 476, with a slump of not more than 4 inches (102 mm) as measured according to ASTM C 143/C 143M.
 3. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- G. Fabrication
1. Sound-Control Steel Door Fabrication: Sound-control doors to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal.
 - a. Seamless Edge Construction: Fabricate doors with faces joined at vertical edges by welding; welds shall be ground, filled, and dressed to make them invisible and to provide a smooth, flush surface.
 - b. Exterior Doors: Close top edges flush and seal joints against water penetration. Provide weep-hole openings in bottom of exterior doors to permit moisture to escape.
 - c. Glazed Lites: Factory install glazed lites according to requirements of tested assembly to achieve STC rating indicated. Provide fixed stops and moldings welded on secure side of door.
 - d. Hardware Preparation: Factory prepare sound-control doors to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping, according to the Door Hardware Schedule and templates furnished as specified in "Door Hardware".
 - 1) Reinforce doors to receive nontemplated mortised and surface-mounted door hardware.
 - 2) Locate door hardware as indicated, or if not indicated, according to NAAMM-HMMA 831, "Recommended Hardware Locations for Custom Hollow Metal Doors and Frames."
 - e. Tolerances: Fabricate doors to tolerances indicated in ANSI/NAAMM-HMMA 865.
 2. Sound-Control Wood Door Fabrication: Factory fit doors to suit frame-opening sizes indicated, with uniform clearances and bevels according to referenced quality standard, unless otherwise indicated. Comply with final door hardware schedules and hardware templates.
 - a. Comply with clearance requirements in NFPA 80 for fire-rated doors.
 - b. Locate door hardware as indicated, or if not indicated, according to DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
 - 1) Coordinate measurements of hardware mortises in steel frames to verify dimensions and alignment before factory machining.
 3. Sound-Control Frame Fabrication: Fabricate sound-control frames to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
 - a. Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated from same thickness metal as frames.
 - b. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 - c. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
 - d. Jamb Anchors: Provide number and spacing of anchors as follows:
 - 1) Masonry Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
 - a) Two anchors per jamb up to 60 inches (1524 mm) in height.
 - b) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) in height.



- c) Four anchors per jamb from 90 to 96 inches (2286 to 2438 mm) in height.
- d) Four anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof more than 96 inches (2438 mm) in height.
- 2) Stud Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
 - a) Three anchors per jamb up to 60 inches (1524 mm) in height.
 - b) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) in height.
 - c) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) in height.
 - d) Five anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof more than 96 inches (2438 mm) in height.
 - e) Two anchors per head for frames more than 42 inches (1066 mm) wide and mounted in metal stud partitions.
- 3) Postinstalled Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.
- e. Head Reinforcement: For frames more than 48 inches (1219 mm) wide, provide continuous head reinforcement for full width of opening, welded to back of frame at head.
- f. Hardware Preparation: Factory prepare sound-control frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping, according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware".
 - 1) Reinforce frames to receive nontemplated mortised and surface-mounted door hardware.
 - 2) Locate hardware as indicated, or if not indicated, according to NAAMM-HMMA 831, "Recommended Hardware Locations for Custom Hollow Metal Doors and Frames."
- g. Plaster Guards: Weld guards to frame at back of hardware cutouts and glazing-stop screw and sound-control seal preparations to close off interior of openings in frames to be grouted.
- h. Tolerances: Fabricate frames to tolerances indicated in ANSI/NAAMM-HMMA 865.

1.3 EXECUTION

A. Examination

- 1. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of sound-control door assemblies.
- 2. Examine roughing-in for embedded and built-in anchors to verify actual locations of sound-control door frame connections before frame installation.
- 3. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Preparation

- 1. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- 2. Prior to installation and with installation spreaders in place, adjust and securely brace sound-control door frames to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.



3. Drill and tap doors and frames to receive nontemplated mortised and surface-mounted door hardware.

C. Installation

1. General: Install sound-control door assemblies plumb, rigid, properly aligned, and securely fastened in place; comply with manufacturer's written instructions.
2. Frames: Install sound-control door frames in sizes and profiles indicated.
 - a. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - 1) At fire-rated openings, install frames according to NFPA 80.
 - 2) At openings requiring smoke and draft control, install frames according to NFPA 105.
 - 3) Where frames are fabricated in sections due to shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, and dress; make splice smooth, flush, and invisible on exposed faces.
 - 4) Install sound-control frames with removable glazing stops located on secure side of opening.
 - 5) Remove temporary braces only after frames or bucks have been properly set and secured.
 - 6) Check squareness, twist, and plumbness of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - 7) Apply corrosion-resistant coatings coating to backs of frames to be filled with mortar, grout, and plaster containing antifreezing agents.
 - b. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor and secure with postinstalled expansion anchors.
 - 1) Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors, if so indicated and approved on Shop Drawings.
 - c. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
 - d. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 - e. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 - f. Ceiling Struts: Extend struts vertically from top of frame at each jamb to supporting construction above, unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction above. Provide adjustable wedged or bolted anchorage to frame jamb members.
 - g. Grouted Frames: Solidly fill space between frames and substrate with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
 - h. Installation Tolerances: Adjust sound-control door frames for squareness, alignment, twist, and plumbness to the following tolerances:
 - 1) Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - 2) Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 - 3) Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - 4) Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.
3. Doors: Fit sound-control doors accurately in frames, within clearances indicated below. Shim as necessary.



- a. Non-Fire-Rated Doors: Fit non-fire-rated doors accurately in frames with the following clearances:
 - 1) Jamb: 1/8 inch (3 mm).
 - 2) Head with Butt Hinges: 1/8 inch (3 mm).
 - 3) Head with Cam-Lift Hinges: As required by manufacturer, but not more than 3/8 inch (9.5 mm).
 - 4) Sill: Manufacturer's standard.
 - 5) Between Edges of Pairs of Doors: 1/8 inch (3 mm).
 - b. Fire-Rated Doors: Install fire-rated doors with clearances according to NFPA 80.
 4. Sound-Control Seals: Where seals have been prefit and preinstalled in the factory and subsequently removed for shipping, reinstall seals and adjust according to manufacturer's written instructions.
 5. Cam-Lift Hinges: Install hinges according to manufacturer's written instructions.
 6. Thresholds: Set thresholds in full bed of sealant complying with requirements in Division 7 Section "Joint Sealants."
 7. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with sound-control door assembly manufacturer's written instructions.
 - a. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c., and not more than 2 inches (50 mm) o.c. from each corner.
- D. Field Quality Control
1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
 2. Testing Services: Acoustical testing and inspecting agency shall select one sound-control door at random from sound-control door assemblies that are completely installed and perform testing for verification that assembly complies with STC rating requirements.
 - a. Field tests shall be conducted according to ASTM E 336, with results calculated according to ASTM E 413. Acceptable field STC values shall be within 5 dB of laboratory STC values.
 - b. Inspection Report: Acoustical testing agency shall submit report in writing to the Owner and Contractor within 24 hours after testing.
 - c. If tested door fails, replace or rework all sound-control door assemblies to bring them into compliance at Contractor's expense.
 - 1) Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 3. Prepare test and inspection reports.
- E. Adjusting And Cleaning
1. Final Adjustments: Check and adjust seals, door bottoms, and other sound-control hardware items right before final inspection. Leave work in complete and proper operating condition.
 2. Remove and replace defective work, including defective or damaged sound seals and doors and frames that are warped, bowed, or otherwise unacceptable.
 - a. Adjust gaskets, gasket retainers, and retainer covers to provide contact required to achieve STC rating.
 3. Clean grout off sound-control door frames immediately after installation.
 4. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.
 5. Metallic-Coated Surfaces: Clean abraded areas of doors and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 08 34 73 00



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Task	Specification	Specification Description
08 34 73 00	08 01 11 00	Steel Doors And Frames
08 34 73 00	08 16 13 00	Steel Entry Doors
08 34 73 00	08 12 13 13	Stainless Steel Doors And Frames



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SECTION 08 35 13 13 - FOLDING DOORS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of material for folding doors. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Accordion folding doors.
 - b. Panel folding doors.
 - c. Bifold doors.
 - d. Bifold mirror doors.
 - e. Fire-rated folding doors.

C. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: Include plans, elevations, sections, details, attachments to other work.
 - a. Fire-Release System: Describe system, including testing and resetting instructions.
 - b. Wiring Diagrams: For power, signal, and control wiring.
3. Samples: For each exposed product and for each color and texture specified.
4. Product Schedule: For folding doors. Use same designations indicated on Drawings.
5. Product certificates.
6. Maintenance data.

D. Quality Assurance

1. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 50 **OR** 450, **as directed**, or less.
2. Fire-Rated Folding Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing according to NFPA 252 **OR** IBC Standard 716.5 **OR** UL 10B, **as directed**.
 - a. Oversize Fire-Rated Folding Doors: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
3. Project Conditions
 - a. Environmental Limitations: Do not deliver or install folding doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
 - b. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication

1.2 PRODUCTS

A. Accordion Folding Doors

1. General: Top-supported, horizontal-sliding, manually operated accordion folding doors, with chain controlling the spacing and extension of pantographic or X-type accordion folding frames.



- Inner and outer covers are continuous surface facings that attach to and completely cover the folding frames and are pleated as the door is retracted.
2. Outer Covering: Of type indicated below, complying with indicated surface-burning characteristics; attached to door support frames in a concealed manner at sufficient intervals to prevent sagging and separation and to permit on-site removal and repair, with vertical seams located in valleys and material hemmed at top and bottom.
 - a. Vinyl reinforced with woven backing weighing not less than 20 oz./linear yd. (567 g/m).
 - 1) Color, Texture, and Pattern: As selected from manufacturer's full range.
 - b. Fabric weighing not less than 16 oz./linear yd. (496 g/m), treated to resist stains.
 - 1) Color, Texture, and Pattern: As selected from manufacturer's full range.
 - c. Manufacturer's standard nonwoven carpet, needle punched with fused fibers to prevent unraveling.
 - 1) Color, Texture, and Pattern: As selected from manufacturer's full range.
 3. Sweep Seals: Manufacturer's standard top and bottom sweep seals on both **OR** one, **as directed**, side(s).
 4. Carriers: Four-wheel carriers at lead post and two-wheel carriers at intermediate spacing, as necessary for size and weight of partition, to ensure secure, easy, and quiet operation.
 - a. Doors 96 Inches (2438 mm) High or Less: Nylon wheels on steel shafts.
 - b. Doors More Than 96 Inches (2438 mm) High: Ball-bearing wheels with nylon tread and steel shafts.
 5. Tracks: Manufacturer's standard metal track made of extruded aluminum or formed steel with factory-applied, corrosion-resistant finish. Limit track deflection, independent of structural supporting system, to no more than 80 percent of bottom clearance. Design and fabricate track to support accordion folding doors and enable their operation without damage to track, folding unit, or adjacent surfaces; complying with the following requirements:
 - a. Head Trim: Prefinished wood molding for surface-mounted tracks.
 - b. Center stop for center-opening partitions.
 - c. Galvanized-steel sheet or aluminum subchannel for forming pocket for recessed suspension track.
 - d. Metal ceiling contact guard to protect finished ceiling surface from damage by moving top sweep seals; with finish matching other exposed metal.
 - e. Curved track sections with ceiling clips to accommodate configuration indicated.
 - f. Glide switch to divert door to auxiliary track.
 - g. Pivot switch to change track direction.
 - h. Cross-track switch to allow one door to cross another.
 6. Hardware: Manufacturer's standard heavy-duty, manually operated metal pulls and latches as follows:
 - a. Finish: Clear-anodized aluminum **OR** Satin stainless steel **OR** Dull chromium-finish brass **OR** Dull chromium-finish steel, **as directed**.
 - b. Latch: Operable from both **OR** one, **as directed**, side(s) of closed door with coin-slot release on opposite side, **as directed**.
 - c. Lock: Manufacturer's standard key-operated cylinder lock, operable from both sides **OR** Manufacturer's standard key-operated cylinder lock, operable from one side; privacy lock on other side **OR** Deadlock to receive cylinder, operable from both sides. Refer to Division 08 Section "Door Hardware" for cylinder requirements **OR** Deadlock to receive cylinder, operable from both sides, **as directed**.
 - d. Foot bolts on lead post where indicated. Secure to post to avoid interference with seals.
 7. Jamb Molding: Manufacturer's standard wood or metal molding at closing jamb as required for light-tight jamb closure.
 8. Lead Posts and Jamb Posts: Not less than 0.048-inch- (1.2-mm-) thick steel **OR** extruded aluminum, **as directed**, formed for rigidity and light seal at supporting construction.
 - a. Nonferrous jamb strip for single-operating partitions to ensure tight closure by engaging rubber bumper on lead post.
 9. Meeting Post: Fixed single jamb for single-stacked doors **OR** Center meeting post for center-opening doors, **as directed**.



10. Stacking: Tiebacks to maintain door in stacked position.
11. Stacking Configuration: Stack single doors at one end of opening **OR** center-opening doors at both ends of opening **OR** doors in pockets with hinged pocket doors, **as directed**.
12. Opening Size: As directed or as indicated on Drawings.

B. Panel Folding Doors

1. General: Top-supported, horizontal-sliding, manually operated panel folding doors, with panels joined by continuous hinge connectors for the full height of panels.
2. Core Material and Thickness: Manufacturer's standard.
3. Panel Width: 4-inch (100-mm) **OR** 5-inch (125-mm) **OR** 6-inch (150-mm) **OR** 8-inch (200-mm), **as directed**, nominal width.
4. Panel Facing: Facings that comply with indicated surface-burning characteristics.
 - a. Vinyl Facing: Vinyl not less than 7 mils (0.175 mm) thick, factory bonded to core.
 - 1) Color and Texture: As selected from manufacturer's full range.
 - b. Vinyl Facing with Woven Backing: Vinyl reinforced with woven backing weighing not less than 12 oz./linear yd. (372 g/m), factory bonded to core.
 - 1) Color and Texture: As selected from manufacturer's full range.
 - c. Plastic-Laminate Facing: Grade VGS, high-pressure plastic laminate complying with NEMA LD 3; adhesive applied under pressure to core.
 - 1) Color, Texture, and Pattern: As selected from manufacturer's full range.
 - d. Wood-Veneer Facing: as directed by the Owner, wood veneer, laminated to core, with manufacturer's standard clear **OR** stained, **as directed**, transparent finish.
 - 1) Stain Color: As selected from manufacturer's full range.
5. Carriers: Four-wheel carriers at lead post and two-wheel carriers at intermediate spacing, as necessary for size and weight of partition, to ensure secure, easy, and quiet operation.
 - a. Panels 5 Inches (125 mm) Wide or Less: Nylon wheels and axles.
 - b. Panels More Than 5 Inches (125 mm) Wide: Ball-bearing wheels with nylon tread and steel shafts.
6. Tracks: Manufacturer's standard surface-mounted **OR** recessed, **as directed**, extruded-aluminum or steel track with factory-applied, corrosion-resistant finish. Limit track deflection, independent of structural supporting system, to no more than 80 percent of bottom clearance. Design and fabricate track to support operation without damage to track, folding unit, or adjacent surfaces; complying with the following requirements:
 - a. Prefinished ceiling guard/channel for recessed tracks.
 - b. Center stop for biparting partitions.
 - c. Galvanized-steel sheet or aluminum subchannel for forming pocket for recessed suspension track.
 - d. Nonferrous jamb strip for single-operating partitions to ensure tight closure by engaging rubber bumper on lead post.
 - e. Curved track sections to accommodate configuration indicated.
 - f. Glide switch to divert door to auxiliary track.
 - g. Pivot switch to change track direction.
 - h. Cross-track switch to allow one door to cross another.
7. Hinge Connector: Manufacturer's standard extruded-vinyl hinge connector.
 - a. Color: As selected from manufacturer's full range **OR** Match or coordinate with facing color, **as directed**.
8. Hardware: Manufacturer's standard heavy-duty, manually operated metal pulls and latches as follows:
 - a. Finish: Clear-anodized aluminum **OR** Satin stainless steel **OR** Dull chromium-finish brass **OR** Dull chromium-finish steel, **as directed**.
 - b. Latch: Operable from both **OR** one, **as directed**, side(s) of closed door.
 - c. Lock: Manufacturer's standard key-operated cylinder lock, operable from both sides **OR** Manufacturer's standard key-operated cylinder lock, operable from one side; privacy lock on other side **OR** Deadlock to receive cylinder, operable from both sides. Refer to Division 08 Section "Door Hardware" for cylinder requirements **OR** Deadlock to receive cylinder, operable from both sides, **as directed**.



- d. Foot bolts on lead post where indicated. Secure to post to avoid interference with seals.
9. Jamb Molding: Manufacturer's standard wood or metal molding at closing jamb as required for light-tight jamb closure.
 - a. Wood: Match species and finish of panel facing.
 - b. Metal: Manufacturer's standard finish.
10. Wood Track Molding: Manufacturer's standard wood molding on each side of surface-mounted track to match species and finish of panel facings. Install with tight, hairline joints with all fasteners concealed.
11. Meeting Post: Fixed single jamb for single-stacked doors **OR** Center meeting post for biparting doors, **as directed**.
12. Stacking: Tiebacks to maintain door in stacked position.

C. Bifold Doors

1. General: Metal folding doors hinged together in pairs and supported on pivots at jamb, with floor and overhead track and door guide pins.
2. Metal Panels: Sizes as indicated, formed from nominal 0.024-inch- (0.6-mm-) thick, cold-rolled steel sheet. Channel form vertical edges and weld cross bracing to panel and channel-formed edges.
 - a. Surface Profile: Fully louvered **OR** Flush **OR** Paneled **OR** Louvered and paneled, **as directed**.
 - b. Configuration: Two **OR** Four, **as directed**, -panel bifold.
 - c. Sheet Metal Texture: Smooth **OR** Simulated leather, **as directed**.
 - d. Protective Finish: Hot-dip galvanized coating applied to panels, stiffeners, hinges, and decorative trim.
 - e. Baked Finish: Baked-enamel factory finish in white **OR** ivory **OR** custom color as selected, **as directed**.
3. Hardware: Manufacturer's standard felt pads, screws, and pulls in standard finish. Hinges, pivots, and manufacturer's standard wheels factory installed and as follows:
 - a. Hinges: 3 self-aligning hinges.
 - b. Guides and Pivots: Not less than 5/16-inch- (7.9-mm-) diameter, adjustable screw-type, weight-bearing, zinc-plated pivot rod held in place by nylon rod clamp assemblies; with not less than 1/4-inch- (6.4-mm-) diameter, spring-loaded, self-aligning, zinc-plated steel guide rods and top pivot rods held in place by nylon sleeves.
 - c. Track: Prefinished rolled steel with baked-enamel paint finish **OR** Aluminum extrusion, Alloy 6063-T5, 0.05 inch (1.3 mm) thick, with manufacturer's standard metal finish, **as directed**.

D. Bifold Mirror Doors

1. General: Folding doors hinged together in pairs and supported on pivots at jamb, with floor and overhead track and door guide pins.
2. Steel-Panel Door Construction: Sizes as indicated, flush profile, formed from nominal 0.024-inch- (0.6-mm-) thick, cold-rolled steel sheet. Channel form vertical edges and weld cross bracing to panel- and channel-formed edges. Attach mirrored glass facing to steel sheet by means of mechanically attached channels at top and bottom and by dual-faced cushion tape.
 - a. Configuration: Two **OR** Four, **as directed**, -panel bifold.
 - b. Protective Finish: Hot-dip galvanized coating applied to panels, stiffeners, hinges, and decorative trim.
 - c. Baked Finish: Baked-enamel factory finish in white **OR** custom color as selected, **as directed**.
3. Metal-Framed Door Construction: Aluminum **OR** Steel, **as directed**, stiles and mechanically fitted rails with screw-attached stiffeners and with mirrored-glass facing attached securely to frames.
 - a. Panel Style: Exposed **OR** Concealed, **as directed**, frame.
 - b. Configuration: Two **OR** Four, **as directed**, -panel bifold.



- c. Baked Finish: Electrostatically applied, baked-enamel factory finish in white **OR** custom color as selected, **as directed**.
- d. Bright, Reflective Metallic Finish: Chrome **OR** Gold **OR** Selected from manufacturer's full range, **as directed**.
4. Mirror Facing: Smooth **OR** Beveled, **as directed**, -edged, silvered, mirrored, film-backed safety glass complying with 16 CFR 1201 for Category II safety glass; with ASTM C 1036 for Type I (transparent, flat), Class 1 (clear), Quality q2 (mirror) annealed float glass; with the following:
 - a. Glass Thickness: 3 mm thick for doors up to 84 inches (2133 mm) in height **OR** 4 mm thick for doors with height more than 84 inches (2133 mm), **as directed**.
 - b. Edge Protection: Vertical mirror edges protected by metal **OR** Mylar, **as directed**, trim.
 - c. Film-Backed Safety Mirrors: Apply film backing with pressure-sensitive adhesive coating over mirror-backing paint as recommended in writing by film-backing manufacturer to produce a surface free of bubbles, blisters, and other imperfections.
5. Hardware: Manufacturer's standard felt pads, screws, and pulls in standard finish. Hinges, pivots, and manufacturer's standard wheels factory installed and as follows:
 - a. Hinges: 3 self-aligning hinges.
 - b. Guides and Pivots: Manufacturer's standard.
 - c. Guides and Pivots: Spring-loaded, zinc-plated steel guides and tops, and adjustable bottom pivot pins with nylon bushings and tips.
 - d. Guides and Pivots: Not less than 5/16-inch- (7.9-mm-) diameter, adjustable screw-type, weight-bearing, zinc-plated pivot rod held in place by nylon rod clamp assemblies; with not less than 1/4-inch- (6.4-mm-) diameter, spring-loaded, self-aligning, zinc-plated steel guide rods and top pivot rods held in place by nylon sleeves.
6. Track: Prefinished rolled steel with baked-enamel paint finish **OR** Aluminum extrusion, Alloy 6063-T5, 0.05 inch (1.3 mm) thick, with manufacturer's standard metal finish, **as directed**.

E. Fire-Rated Folding Doors

1. General: Electrically **OR** Gravity-, **as directed**, operated, automatic- or self-closing, UL- or ITS-listed, biparting folding fire-rated assembly; top supported from overhead track or dual tracks without floor guides; complete with hardware, seals, track, closing devices, releasing devices, controls, pocket doors, and accessories necessary for intended operation and complying with the following requirements:
 - a. Assembly remains in normal open (stacked) position. Signal from fire-alarm system initiates self-closing operation.
 - b. Controls allow manual operation in either conventional or emergency mode. When opened manually during emergency mode, control mechanism automatically closes assembly.
2. Fire Rating: 1 **OR** 1-1/2 **OR** 3, **as directed**, hour(s).
3. Panel Construction: Formed-steel **OR** Formed stainless-steel, **as directed**, sheet panels connected by formed-steel **OR** formed stainless-steel, **as directed**, hinges.
4. Fire Insulation:
 - a. Cover interior surface of both series of panels in parallel panel doors with continuous fire-resistant blanket secured to each panel with metal clip system.
 - b. Extend fire insulation from bottom edge of panels to tracks and meet at interior centers of fixed jamb and lead post, forming an effective fire barrier.
5. Perimeter Seals and Closures: Manufacturer's standard vinyl or neoprene vertical seals, horizontal top and bottom seals, and closures identical to products tested for fire rating indicated, and forming an effective smoke and draft seal.
6. Track and Trolley System: 1 track or 2 parallel steel tracks on 8-inch (200-mm) centers, with ball-bearing roller trolleys and adjustable steel hanger rods for overhead support; designed for type of operation, size, and weight of fire-rated folding door indicated. Provide a continuous system of track sections and accessories identical to products tested for fire rating indicated, to accommodate configuration and layout indicated for door operation and storage.
7. Lead Posts: Formed from not less than 0.026-inch (0.66-mm-) thick steel **OR** stainless-steel, **as directed**, sheet, connected to door panels by specially adapted panels and equipped with manufacturer's standard handle on each side.
8. Electric Operators and Controls:



- a. Operators: Factory-assembled power-drive unit consisting of motor, remote-located, **as directed**, control panel, limit switches, torque-limiting devices, clutch, reversing magnetic motor operator, leading-edge obstruction detectors, and key-switch control for conventional operation.
 - 1) Motor: 1/2 hp, controlled by reversing magnetic starter and equipped with overload protection.
 - 2) Limit Switches: To prevent overtravel.
 - 3) Roller Chain or Cable: Connected to lead posts by means of vertical stabilizer bar assembly.
 - 4) Drive Mechanism: Protected by torque limiter and emergency clutch.
 - 5) Travel Speed: 18 inches (450 mm) per second, maximum; 6 inches (150 mm) per second, minimum.
 - b. In case of fire, closing system is activated by building's fire- and smoke-detection equipment and automatically closes fire-rated folding doors.
 - c. Electrical Service: Equip for 120 V, single phase, 60-cycle ac.
 - d. Battery: Electrical current connects through relay to battery charger that continuously charges 12-V dc battery and automatically maintains battery at capacity. Automatic audible signal device sounds off if battery falls below or exceeds proper charge, power loss has occurred, or high-ac line voltage has been experienced.
 - e. Leading-Edge Obstruction Detector:
 - 1) Equip with pressure-sensitive leading edge that, on contact with an obstruction, causes door to stop and pause before attempting to re-close.
 - 2) Disable leading-edge obstruction detector until fire-rated folding door has opened pocket door.
 - f. Fire-rated folding doors can be manually opened at any time by pushing against leading edge.
 - g. Audible alarm sounds at automatic closing of door.
9. Accessories:
- a. Vision panels.
 - b. Exit Hardware: Located on both sides of fire-rated folding door. In emergency mode, slight pressure on hardware causes door to open a minimum of 32 inches (812 mm), pause for 3 seconds, and then automatically close. Furnish hardware that can be field programmable to allow automatic opening distances of up to the entire opening width. In conventional mode, hardware is used to operate door and move it back into storage pocket.
10. Finishes:
- a. Baked-enamel finish for panels and hinges in colors selected from manufacturer's full range.
 - b. Manufacturer's standard finish for handles.
11. Pocket Door:
- a. Solid-core pocket doors with reverse-action spring **OR** continuous, **as directed**, hinge; 90-degree minimum swing.
 - b. Face Finish: Match adjacent finishes.
 - c. Magnetic Catch: Holding force of no more than 30 lbf (133 N).
 - d. Maximum Opening Force: 50 lbf (222 N).
 - e. Bumper on interior side of pocket door as required by fire-rated folding door manufacturer to prevent interference with opening or retracting operation of fire-rated folding door.
 - f. Coordinate pocket door sizes with fire-rated folding door manufacturer.

1.3 EXECUTION

A. Preparation



1. For folding doors supported by or anchored to permanent construction, advise installers of specific requirements for placement of anchorage devices. Furnish installers of other work with templates and drawings showing locations of anchorage devices and similar items.
 2. In path of fire-rated folding doors, level floor with header to tolerance of plus or minus 1/16 inch (1.6 mm) across opening; grind or fill floor as necessary.
- B. Installation
1. General: Install folding doors complying with manufacturer's written installation instructions. Install track in one piece.
 - a. Comply with NFPA 80 for installing fire-rated folding doors.
 2. Standard Floor Clearances: 1/4 to 3/4 inch (6.4 to 19 mm) maximum (above floor finish).
 - a. Comply with NFPA 80 for clearances required for fire-rated folding doors.
 3. Coordinate provisions for electrical service, sensing devices, and final connections for fire-rated folding doors.
- C. Adjusting
1. Adjust units as necessary to ensure smooth, quiet operation without warping or binding. Adjust hardware to function smoothly. Confirm that latches engage accurately and securely without forcing or binding.
 - a. Fire-Rated Folding Doors: Verify that all operations are functional and comply with requirements of authorities having jurisdiction.
 2. Pocket Doors: Adjust to operate smoothly and easily, without binding or warping. Adjust hardware to function smoothly. Confirm that latches and locks engage accurately and securely without forcing or binding.
- D. Demonstration
1. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-rated folding doors.

END OF SECTION 08 35 13 13



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SECTION 08 36 13 00 - SECTIONAL OVERHEAD DOORS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of material for sectional overhead doors. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes manually **OR** electrically, **as directed**, operated sectional doors with integral pass doors, **as directed**.

C. Performance Requirements

1. General Performance: Sectional doors shall meet performance requirements specified without failure due to defective manufacture, fabrication, installation, or other defects in construction and without requiring temporary installation of reinforcing components.
2. Delegated Design: Design sectional doors, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
3. Structural Performance: Exterior sectional doors shall withstand the effects of gravity loads, and the following loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 - a. Wind Loads: As indicated on Drawings **OR** Uniform pressure (velocity pressure) of 20 lbf/sq. ft. (960 Pa), acting inward and outward, **as directed**.
 - 1) Basic Wind Speed: 85 mph (38 m/s) **OR** 90 mph (40 m/s) **OR** 100 mph (44 m/s) **OR** 110 mph (49 m/s), **as directed**.
 - 2) Exposure Category: A **OR** B **OR** C **OR** D, **as directed**.
 - b. Deflection Limits: Design sectional doors to withstand design wind loads without evidencing permanent deformation or disengagement of door components. Deflection of door in horizontal position (open) shall not exceed 1/120 of the door width.
4. Air Infiltration: Maximum rate not more than indicated when tested according to ASTM E 283 **OR** DASMA 105, **as directed**.
 - a. Air Infiltration: Maximum rate of 0.08 cfm/sq. ft. (0.406 L/s per sq. m) at 15 and 25 mph (24.1 and 40.2 km/h).
5. Windborne-Debris-Impact-Resistance Performance: Provide sectional doors **OR** glazed sectional doors, **as directed**, that pass large-missile-impact and cyclic-pressure tests when tested according to ASTM E 1886 and ASTM E 1996 **OR** DASMA 115, **as directed**.
6. Seismic Performance: Sectional doors shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
 - b. Seismic Component Importance Factor: 1.5 **OR** 1.0, **as directed**.
7. Operation Cycles: Provide sectional door components and operators capable of operating for not less than number of cycles indicated for each door. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

D. Submittals

1. Product Data: For each type and size of sectional door and accessory.
2. LEED Submittal:
 - a. Certificates for Credit MR 7: Chain-of-custody certificates certifying that flush wood doors comply with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body, **as directed**. Include statement indicating costs for each certified wood product.



3. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data. Include plans, elevations, sections, details, and attachments to other work.
 - a. Wiring Diagrams: For power, signal, and control wiring.
4. Samples: For each exposed product and for each color and texture specified.
5. Delegated-Design Submittal: For sectional doors indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
6. Seismic Qualification Certificates: For sectional doors, accessories, and components, from manufacturer.
7. Maintenance data.
8. Warranties: Sample of special warranties.

E. Quality Assurance

1. Wood Door Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
2. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.
3. Forest Certification: Provide wood doors made with not less than 70 percent of wood products **OR** all wood products, **as directed**, obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
4. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
5. Standard for Sectional Doors: Fabricate sectional doors to comply with DASMA 102 unless otherwise indicated.
6. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities" and ICC/ANSI A117.1, **as directed**.

F. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of sectional doors that fail in materials or workmanship within Two **OR** Five, **as directed**, years from date of Final Completion.
2. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within 10 years from date of Final Completion.

1.2 PRODUCTS

A. Steel Door Sections

1. Exterior Section Faces and Frames: Fabricate from zinc-coated (galvanized), cold-rolled, commercial steel (CS) sheet, complying with ASTM A 653/A 653M, with indicated zinc coating and thickness.
 - a. Fabricate section faces from single sheets to provide sections not more than 24 inches (610 mm) high and of indicated thickness. Roll horizontal meeting edges to a continuous, interlocking, keyed, rabbeted, shiplap, or tongue-in-groove weathertight seal, with a reinforcing flange return.
 - b. For insulated doors, provide sections with continuous thermal-break construction, separating the exterior and interior faces of door.
2. Section Ends and Intermediate Stiles: Enclose open ends of sections with channel end stiles formed from galvanized-steel sheet not less than 0.064-inch- (1.63-mm-) nominal coated thickness and welded to door section. Provide intermediate stiles formed from not less than



- 0.064-inch- (1.63-mm-) thick galvanized-steel sheet, cut to door section profile, and welded in place. Space stiles not more than 48 inches (1219 mm) apart.
3. Reinforce bottom section with a continuous channel or angle conforming to bottom-section profile and allowing installation of astragal, **as directed**.
 4. Reinforce sections with continuous horizontal and diagonal reinforcement, as required to stiffen door and for wind loading. Provide galvanized-steel bars, struts, trusses, or strip steel, formed to depth and bolted or welded in place. Ensure that reinforcement does not obstruct vision lites, **as directed**.
 5. Provide reinforcement for hardware attachment.
 6. Board Thermal Insulation: Insulate interior of steel sections with door manufacturer's standard CFC-free polystyrene or polyurethane board insulation, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84; or with glass-fiber-board insulation. Secure insulation to exterior face sheet. Enclose insulation completely within steel sections that incorporate the following interior facing material, with no exposed insulation:
 - a. Interior Facing Material:
 - 1) Zinc-coated (galvanized), cold-rolled, commercial steel (CS) sheet, complying with ASTM A 653/A 653M, with indicated thickness.
 - 2) Manufacturer's standard prefinished hardboard panel, 1/8 inch (3 mm) thick and complying with ANSI A135.5.
 7. Foamed-in-Place Thermal Insulation: Insulate interior of steel sections with door manufacturer's standard CFC-free polyurethane insulation, foamed in place to completely fill interior of section and pressure bonded to face sheets to prevent delamination under wind load, and with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within steel sections that incorporate the following interior facing material, with no exposed insulation:
 - a. Interior Facing Material:
 - 1) Zinc-coated (galvanized), cold-rolled, commercial steel (CS) sheet, complying with ASTM A 653/A 653M, with indicated thickness.
 - 2) Manufacturer's standard prefinished hardboard panel, 1/8 inch (3 mm) thick and complying with ANSI A135.5.
 8. Fabricate sections so finished door assembly is rigid and aligned, with tight hairline joints and free of warp, twist, and deformation.
- B. Wood Door Sections
1. Paneled Sections: Fabricate stiles and rails of clear, vertical-grain, straight, kiln-dried Douglas fir, West Coast hemlock, or Sitka spruce, not less than 1-3/4 inches (44 mm) thick. Form meeting rails to provide rabbeted, weathertight-seal joint.
 - a. Panel Inserts: Tempered hardboard, 1/4 inch (6 mm) thick, smooth on two sides, complying with ANSI A135.4.
 - b. Glazed Panel Inserts: 6-mm-thick, clear float glass, complying with ASTM C 1036, Type I, Class 1, Quality Q3, with removable glazing stops of same wood as stiles and rails.
 2. Flush Sections: Construct flush wood door sections with top, bottom, and end closures of clear, vertical-grain, straight, kiln-dried Douglas fir, West Coast hemlock, or Sitka spruce. Provide wood blocking to receive hardware, end stiles, and frames for glazing, glued and doweled in place. Form meeting rails to provide rabbeted weathertight-seal joint.
 - a. Core: Manufacturer's standard polystyrene or polyurethane board insulation or honeycomb core complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84. Bond to facing.
 - b. Facing: 1/8-inch- (3-mm-) thick, tempered hardboard complying with ANSI A135.4 and smooth on one side.
 3. Fabricate sections of mortise-and-tenon construction with waterproof glue and steel dowels, or of rabbeted construction with waterproof glue and steel dowels and pins.
 4. Reinforce sections with continuous horizontal and diagonal galvanized-steel members as required to stiffen door and for wind loading. Ensure that reinforcement does not obstruct vision lites.



5. Treat wood door members after machining with water-repellent preservative formulation according to WDMA I.S. 4.
6. Fabricate sections so finished door assembly is rigid and aligned, with tight hairline joints and free of warp, twist, deformation, and delamination.
7. Factory prime door sections with one coat of exterior primer compatible with field-applied finish, applied at a minimum dry film thickness of 1 mil (0.025 mm).

C. Aluminum Door Sections

1. Sections: Construct door sections with stiles and rails formed from extruded-aluminum shapes, complying with ASTM B 221 (ASTM B 221M), alloy and temper recommended by manufacturer for type of use and finish indicated, with wall thickness not less than 0.065 inch (1.7 mm) for door section 1-3/4 inches (44 mm) deep. Fabricate sections with stile and rail dimensions and profiles shown on Drawings. Join stiles and rails by welding or with concealed, 1/4-inch- (6-mm-) minimum diameter, aluminum or nonmagnetic stainless-steel through bolts, full height of door section. Form meeting rails to provide a weathertight-seal joint.
 - a. Reinforce sections with continuous horizontal and diagonal reinforcement, as required to stiffen door and for wind loading. Ensure that reinforcement does not obstruct vision lites.
 - b. Provide reinforcement for hardware attachment.
2. Solid Panels: Fabricate of aluminum sheet, complying with ASTM B 209 (ASTM B 209M), alloy and temper standard with manufacturer for type of use and finish indicated, not less than 0.040 inch (1.02 mm) thick, set in continuous vinyl channel retained with rigid, snap-in, extruded-vinyl moldings or with rubber or neoprene glazing gasket with aluminum stop.
3. Full-Vision Sections: Manufacturer's standard, tubular, aluminum-framed section fully glazed with 6-mm-thick, clear acrylic glazing set in vinyl, rubber, or neoprene glazing channel and with removable extruded-vinyl or aluminum stops.

D. Translucent Door Sections

1. Construct door sections of not less than 0.063-inch- (1.6-mm-) thick, extruded-aluminum stiles and rails complying with ASTM B 221 (ASTM B 221M) and with alloy and temper recommended by manufacturer for type of use and finish indicated, to provide door sections at least 1-3/4 inches (44 mm) deep. Fabricate units with overlapped or interlocked weathertight-seal joints at meeting rails. Reinforce or truss each section as required for strength and rigidity. Provide reinforcement for hardware attachment.
2. Provide translucent, ribbed, glass-fiber-reinforced plastic panels, secured and sealed watertight to framing, and reinforced to meet performance requirements.

E. Tracks, Supports, And Accessories

1. Tracks: Manufacturer's standard, galvanized-steel track system of configuration indicated, sized for door size and weight, designed for lift type indicated and clearances shown on Drawings, and complying with ASTM A 653/A 653M for minimum G60 (Z180) zinc coating. Provide complete track assembly including brackets, bracing, and reinforcement for rigid support of ball-bearing roller guides for required door type and size. Slot vertical sections of track spaced 2 inches (51 mm) apart for door-drop safety device. Slope tracks at proper angle from vertical or design tracks to ensure tight closure at jambs when door unit is closed.
2. Track Reinforcement and Supports: Galvanized-steel track reinforcement and support members, complying with ASTM A 36/A 36M and ASTM A 123/A 123M. Secure, reinforce, and support tracks as required for door size and weight to provide strength and rigidity without sag, sway, and vibration during opening and closing of doors.
 - a. Vertical Track Assembly: Track with continuous reinforcing angle attached to track and attached to wall with jamb brackets **OR** wall jamb brackets attached to track and attached to wall, **as directed**.
 - b. Horizontal Track Assembly: Track with continuous reinforcing angle attached to track and supported at points from curve in track to end of track by laterally braced attachments to overhead structural members.



3. Removable Center Posts: Manufacturer's standard carry-away **OR** roll-away **OR** swing-up, **as directed**, type for multiple doors in one opening.
 4. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom and top of sectional door unless otherwise indicated.
 5. Windows: Manufacturer's standard window units of type and size indicated and in arrangement shown. Set glazing in vinyl, rubber, or neoprene glazing channel for metal-framed doors and elastic glazing compound for wood doors, as required. Provide removable stops of same material as door-section frames.
 6. Pass Doors: Manufacturer's standard pass doors where indicated, complete with glazing, operating hardware, and mortise lock. Construct pass doors of same materials, design, and finish as sectional door assembly.
 - a. Lock Cylinders: Provide cylinders specified in Division 08 Section "Door Hardware" **OR** standard with manufacturer, **as directed**, and keyed to building keying system, **as directed**.
 - b. Keys: Two **OR** Three, **as directed**, for each cylinder.
- F. Hardware
1. General: Provide heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless-steel, or other corrosion-resistant fasteners, to suit door type.
 2. Hinges: Heavy-duty, galvanized-steel hinges of not less than 0.079-inch- (2.01-mm-) nominal coated thickness at each end stile and at each intermediate stile, according to manufacturer's written recommendations for door size. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is not possible. Provide double-end hinges where required, for doors over 16 feet (4.88 m) wide unless otherwise recommended by door manufacturer.
 3. Rollers: Heavy-duty rollers with steel ball-bearings in case-hardened steel races, mounted with varying projections to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Provide 3-inch- (76-mm-) diameter roller tires for 3-inch- (76-mm-) wide track and 2-inch- (51-mm-) diameter roller tires for 2-inch- (51-mm-) wide track.
 4. Push/Pull Handles: For push-up or emergency-operated doors, provide galvanized-steel lifting handles on each side of door.
- G. Locking Devices
1. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on single-jamb side, operable from inside only.
 2. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded deadbolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
 - a. Lock Cylinders: Provide cylinders specified in Division 08 Section "Door Hardware" **OR** standard with manufacturer, **as directed**, and keyed to building keying system, **as directed**.
 - b. Keys: Two **OR** Three, **as directed**, for each cylinder.
 3. Chain Lock Keeper: Suitable for padlock.
 4. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.
- H. Counterbalance Mechanism
1. Torsion Spring: Counterbalance mechanism consisting of adjustable-tension torsion springs fabricated from steel-spring wire complying with ASTM A 229/A 229M, mounted on torsion shaft made of steel tube or solid steel. Provide springs designed for number of operation cycles indicated.
 2. Weight Counterbalance: Counterbalance mechanism consisting of filled pipe weights that move vertically in a galvanized-steel weight pipe. Connect pipe weights with cable to weight-cable drums mounted on torsion shaft made of steel tube or solid steel.
 3. Cable Drums and Shaft for Doors: Cast-aluminum or gray-iron casting cable drums mounted on torsion shaft and grooved to receive door-lifting cables as door is raised. Mount counterbalance



mechanism with manufacturer's standard ball-bearing brackets at each end of torsion shaft. Provide one additional midpoint bracket for shafts up to 16 feet (4.88 m) long and two additional brackets at one-third points to support shafts more than 16 feet (4.88 m) long unless closer spacing is recommended by door manufacturer.

4. Cables: Galvanized-steel lifting cables with cable safety factor of at least 5 **OR** 7, **as directed**, to 1.
5. Cable Safety Device: Include a spring-loaded steel or spring-loaded bronze cam mounted to bottom door roller assembly on each side and designed to automatically stop door if either lifting cable breaks.
6. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level the shaft and prevent sag.
7. Provide a spring bumper at each horizontal track to cushion door at end of opening operation.

I. Manual Door Operators

1. Equip door with manufacturer's recommended manual door operator unless another type of door operator is indicated.
2. Push-up Operation: Lift handles and pull rope for raising and lowering doors, with counterbalance mechanism designed so that required lift or pull for door operation does not exceed 25 lbf (111 N).
3. Chain-Hoist Operator: Consisting of endless steel hand chain, chain-pocket wheel and guard, and gear-reduction unit with a maximum 25-lbf (111-N) **OR** 35-lbf (155-N), **as directed**, force for door operation. Provide alloy-steel hand chain with chain holder secured to operator guide.

J. Electric Door Operators

1. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and "operation cycles" requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
 - a. Comply with NFPA 70.
 - b. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6; with NFPA 70, Class 2 control circuit, maximum 24-V ac or dc.
2. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.
3. Door-Operator Type: Unit consisting of electric motor, gears, pulleys, belts, sprockets, chains, and controls needed to operate door and meet required usage classification.
 - a. Trolley: Trolley operator mounted to ceiling above and to rear of door in raised position and directly connected to door with drawbar.
 - b. Jackshaft, Center Mounted: Jackshaft operator mounted on the inside front wall above door and connected to torsion shaft with an adjustable coupling or drive chain.
 - c. Jackshaft, Side Mounted: Jackshaft operator mounted on the inside front wall on right or left side of door and connected to torsion shaft with an adjustable coupling or drive chain.
4. Electric Motors: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Division 11 Section "Common Motor Requirements For Equipment", unless otherwise indicated.
 - a. Electrical Characteristics:
 - 1) Phase: Single phase **OR** Polyphase, **as directed**.
 - 2) Volts: 115 **OR** 208 **OR** 230 **OR** 460, **as directed**, V.
 - 3) Hertz: 60.
 - b. Motor Type and Controller: Reversible motor and controller (disconnect switch) for motor exposure indicated.
 - c. Motor Size: Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. (203 mm/s) and not more than 12 in./sec. (305 mm/s), without exceeding nameplate ratings or service factor.



- d. Operating Controls, Controllers (Disconnect Switches), Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
 - e. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.
 - f. Use adjustable motor-mounting bases for belt-driven operators.
 5. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
 6. Obstruction Detection Device: Equip motorized door with indicated external automatic safety sensor capable of protecting full width of door opening. Activation of device immediately stops and reverses downward door travel.
 - a. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in door opening without contact between door and obstruction.
 - 1) Self-Monitoring Type: Designed to interface with door operator control circuit to detect damage to or disconnection of sensor device. When self-monitoring feature is activated, door closes only with sustained pressure on close button.
 - b. Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
 - 1) Self-Monitoring Type: Four-wire configured device designed to interface with door-operator control circuit to detect damage to or disconnection of sensor edge.
 7. Remote-Control Station: Momentary-contact, three-button control station with push-button controls labeled "Open," "Close," and "Stop."
 - a. Interior units, full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
 - b. Exterior units, full-guarded, standard-duty, surface-mounted, weatherproof type, NEMA ICS 6, Type 4 enclosure, key operated.
 8. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf (111 N) **OR** 35 lbf (155 N), **as directed**.
 9. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
 10. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.
 11. Audible and Visual Signals: Audible alarm and visual indicator lights in compliance with regulatory requirements for accessibility.
 12. Radio-Control System: Consisting of the following:
 - a. Three-channel universal coaxial receiver to open, close, and stop door; one **OR** two, **as directed**, per operator.
OR
Multifunction remote control.
OR
Remote antenna and mounting kit.
- K. Door Assembly
1. Steel **OR** Wood **OR** Aluminum **OR** Full-Vision Aluminum **OR** Translucent, **as directed**, Sectional Door: Sectional door formed with hinged sections.
 2. Operation Cycles: Not less than 10,000 **OR** 20,000 **OR** 50,000 **OR** 100,000, **as directed**.
 3. R-Value **OR** Installed R-Value, **as directed**: 4.5 deg F x h x sq. ft./Btu (0.792 K x sq. m/W) **OR** 6.0 deg F x h x sq. ft./Btu (1.057 K x sq. m/W) **OR** 12.0 deg F x h x sq. ft./Btu (2.113 K x sq. m/W) **OR** 15.0 deg F x h x sq. ft./Btu (2.642 K x sq. m/W) **OR** 17.5 deg F x h x sq. ft./Btu (3.082 K x sq. m/W), **as directed**.
 4. Steel Sections: Zinc-coated (galvanized) steel sheet with G60 (Z180) **OR** G90 (Z275), **as directed**, zinc coating.



- a. Section Thickness: 1-3/8 inches (35 mm) **OR** 1-3/4 inches (44 mm) **OR** 2 inches (51 mm), **as directed**.
 - b. Exterior-Face, Steel Sheet Thickness: 0.064-inch- (1.63-mm-) **OR** 0.040-inch- (1.02-mm-) **OR** 0.028-inch- (0.71-mm-) **OR** 0.022-inch- (0.56-mm-) **OR** 0.019-inch- (0.48-mm-), **as directed**, nominal coated thickness.
 - 1) Surface:
 - a) Flat.

OR
Manufacturer's standard, grooved **OR** ribbed **OR** paneled **OR** wood-grain embossed, **as directed**.
 - c. Insulation: Board **OR** Foamed in place, **as directed**.
 - d. Interior Facing Material: Zinc-coated (galvanized) steel sheet of 0.028-inch- (0.71-mm-) **OR** 0.022-inch- (0.56-mm-) **OR** 0.019-inch- (0.48-mm-) **OR** manufacturer's recommended thickness to meet performance requirements, **as directed**, nominal coated thickness.
 - e. Interior Facing Material: Hardboard panel.
5. Wood Sections: Paneled **OR** Flush, **as directed**, and with manufacturer's standard insulation, **as directed**.
 6. Aluminum Sections: Solid panels **OR** Full vision, **as directed**, with manufacturer's standard, nonglazed panels across bottom section of door, **as directed**.
 7. Translucent Sections: Manufacturer's standard with manufacturer's standard, nonglazed panels across bottom section of door, **as directed**.
 8. Track Configuration: Standard-lift **OR** Low-headroom **OR** High-lift **OR** Vertical-lift **OR** Contour, **as directed**, track with removable center post shared with adjacent door, **as directed**.
 9. Weatherseals: Fitted to bottom and top and around entire perimeter of door. Provide combination bottom weatherseal and sensor edge, **as directed**.
 10. Windows: Approximately 24 by 7 inches (610 by 178 mm) **OR** 24 by 11 inches (610 by 279 mm), **as directed**, with curved corners, **OR** with square corners, **as directed**, and spaced apart the approximate distance as indicated on Drawings; in one row **OR** two rows, **as directed**, at height indicated on Drawings; installed with glazing **OR** insulated glazing, **as directed**, of the following type:
 - a. Clear Float Glass: 3 mm thick and complying with ASTM C 1036, Type I, Class 1, Quality Q3.
 - b. Clear Acrylic Plastic: 3 mm thick, transparent, smooth or polished, and formulated to be UV resistant.
 - c. Clear Polycarbonate Plastic: 3-mm-thick, transparent, fire-retardant, UV-resistant, polycarbonate sheet manufactured by extrusion process.
 - d. Insulating Glass: Manufacturer's standard.
 11. Pass Door: As shown.
 12. Roller-Tire Material: Case-hardened steel **OR** Neoprene or bronze **OR** Manufacturer's standard, **as directed**.
 13. Locking Devices: Equip door with slide bolt for padlock **OR** locking device assembly, **as directed**, and chain lock keeper, **as directed**.
 - a. Locking Device Assembly: Single-jamb side **OR** Cremone type, both jamb sides, **as directed**, locking bars, operable from inside with thumbturn **OR** outside with cylinder **OR** outside only, with cylinder **OR** inside and outside, with cylinders, **as directed**.
 14. Counterbalance Type: Torsion spring **OR** Weight counterbalance, **as directed**.
 15. Manual Door Operator: Push-up operation **OR** Chain-hoist operator, **as directed**.
 16. Electric Door Operator:
 - a. Usage Classification: Heavy duty, 60 to 90 cycles per hour **OR** Standard duty, up to 60 cycles per hour **OR** Medium duty, up to 15 cycles per hour **OR** Light duty, up to 10 cycles per hour, **as directed**.
 - b. Operator Type: Trolley **OR** Jackshaft, center mounted **OR** Jackshaft, side mounted **OR** As shown on Drawings, **as directed**.
 - c. Motor Exposure: Interior, clean, and dry **OR** Exterior, dusty, wet, or humid, **as directed**.
 - d. Emergency Manual Operation: Push-up **OR** Chain, **as directed**, type.



- e. Obstruction-Detection Device: Automatic photoelectric sensor **OR** electric sensor edge on bottom bar **OR** pneumatic sensor edge on bottom bar, **as directed**; self-monitoring type, **as directed**.
 - 1) Sensor Edge Bulb Color: Black **OR** As selected from manufacturer's full range, **as directed**.
 - f. Remote-Control Station: Interior **OR** Exterior **OR** Where shown on Drawings, **as directed**.
 - g. Other Equipment: Audible and visual signals **OR** Radio-control system, **as directed**.
17. Door Finish:
- a. Aluminum Finish: Clear anodized **OR** Bronze anodized **OR** Anodized color matching sample **OR** Anodized color as selected from manufacturer's full range, **as directed**.
 - b. Baked-Enamel or Powder-Coated Finish: Color and gloss as selected from manufacturer's full range.
 - c. Factory Prime Finish: Manufacturer's standard color.
 - d. Finish of Interior Facing Material: Match finish of exterior section face **OR** Finish as selected from manufacturer's full range, **as directed**.
- L. General Finish Requirements
- 1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 2. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- M. Aluminum Finishes
- 1. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm **OR** AA-M12C22A31, Class II, 0.010 mm, **as directed**, or thicker.
 - 2. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm **OR** AA-M12C22A32/A34, Class II, 0.010 mm, **as directed**, or thicker.
 - 3. Baked-Enamel or Powder-Coat Finish: AAMA 2603. Comply with coating manufacturer's written instructions for cleaning, conversion coating, application, and baking.
- N. Steel And Galvanized-Steel Finishes
- 1. Factory Prime Finish: Manufacturer's standard primer, compatible with field-applied finish. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.
 - 2. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.
- 1.3 EXECUTION
- A. Installation
- 1. Install sectional doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
 - 2. Tracks:
 - a. Fasten vertical track assembly to opening jambs and framing, spaced not more than 24 inches (610 mm) apart.
 - b. Hang horizontal track assembly from structural overhead framing with angles or channel hangers attached to framing by welding or bolting, or both. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.
 - c. Repair galvanized coating on tracks according to ASTM A 780.
 - 3. Accessibility: Install sectional doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.



B. Startup Services

1. Engage a factory-authorized service representative to perform startup service.
 - a. Complete installation and startup checks according to manufacturer's written instructions.
 - b. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Adjusting

1. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
2. Lubricate bearings and sliding parts as recommended by manufacturer.
3. Adjust doors and seals to provide weathertight fit around entire perimeter.
4. Align and adjust motors, pulleys, belts, sprockets, chains, and controls according to manufacturer's written instructions.
5. Touch-up Painting: Immediately after welding galvanized materials, clean welds and abraded galvanized surfaces and repair galvanizing to comply with ASTM A 780.

END OF SECTION 08 36 13 00



Task	Specification	Specification Description
08 36 13 00	08 33 13 00	Overhead Coiling Doors



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SECTION 08 38 13 00 - FLEXIBLE DOORS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of flexible doors. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: For each type of product indicated.
2. Shop drawings shall be submitted for approval.

1.2 PRODUCTS

- A. General: Each new door unit shall be a complete unit produced by one manufacturer including hardware, accessories, mounting, and installation components.

B. Door Panels: Door panels shall be constructed of the following materials.

1. Heavy-Duty, Abrasive-Resistant Rubber, 60 durometer, roto-cured process, 2,200 psi tensile strength. Panel thickness shall be 1/2- inch. Lower door panel shall be reinforced with additional rubber extrusions bonded horizontally to the door facing on 8 inch centers.
2. Flexible Polycarbonate transparent panels 1/2 inch thick.
3. Flexible Polyvinylchloride (PVC) transparent panels min. 0.196 inch (5mm) thick.
4. Flexible Polyvinylchloride (PVC) opaque panels min. 0.196 inch (5mm) thick.

- C. Door Facings shall be high strength fabric reinforced vinyl bonded to door frame. Facing shall not be mechanically fastened.

- D. The Vision Panels shall be double glazed, damage resistant with optical clarity exceeding 90%. Vision Panels shall be mounted flush.

- E. Door Panels shall be single or double-acting, as required.

- F. Panel Frame: Framing materials to which door panels shall be secured shall be galvanized steel, ASTM A525, 11 gauge. Door panels shall be suspended between L-shaped rolled formed rails and stiles by removable bolt and nut connectors.

G. Hardware shall conform to the requirements of ASTM A 164 or ASTM A 386, as required.

1. Hinges shall be adjustable spring-type gravity self-lubricating hinges.
2. Magnetic Catch shall be provided at door overlap at pair of door panels to give positive closure.
3. Header and Jamb Seals shall be door mounted PVC seals at head and jamb.
4. Bumpers shall be center or bottom bumpers.
5. Jamb Guards shall be formed steel guards to enclose and protect lower hinge hardware and closures.

- H. Door Jamb shall be constructed of steel tube, ASTM A 500, with integral wall anchors, galvanized in compliance with ASTM A 386 or stainless steel bent plate, Type 304, with integral wall anchors, as required.

- I. Finish: All ferrous metal parts shall be finish-coated with polyurethane paint.



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- J. Fire Hazard Classification: All door material shall have a fire hazard classification determined by ASTM E 84. Provide materials with the following fire hazard classifications:
 - Flame spread not more than 25.
 - Smoke developed not more than 50.

 - K. Vertical PVC Vinyl Strip Doors
 - 1. Door shall consist of overlapping transparent minimum PVC strips with pre-punched galvanized hanger brackets which mate with formed metal arms on the universal hardware.
 - 2. Hardware shall provide full swivel action. A cover plate shall prevent accidental removal.
 - 3. End Strips shall be orange to frame opening. Strips shall have rounded edges and overlap to form a seal.

1.3 EXECUTION

- A. Products shall be installed per manufacturer's written instruction. Products shall be firmly attached to adjacent materials. Products shall be installed level and plumb and shall be demonstrated to operate properly and as intended for a complete installation.

END OF SECTION 08 38 13 00



Task	Specification	Specification Description
08 38 16 00	08 01 11 00	Steel Doors And Frames
08 38 16 00	08 16 13 00	Steel Entry Doors
08 38 16 00	08 12 13 13	Stainless Steel Doors And Frames
08 38 19 00	08 01 11 00	Steel Doors And Frames
08 38 19 00	08 16 13 00	Steel Entry Doors
08 38 19 00	08 12 13 13	Stainless Steel Doors And Frames



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SECTION 08 44 13 00 - GLAZED ALUMINUM CURTAIN WALLS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of material for glazed aluminum curtain walls. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes conventionally glazed aluminum curtain walls installed as stick, unitized, and unit-and-mullion assemblies.

C. Performance Requirements

1. General Performance: Comply with performance requirements specified, as determined by testing of manufacturer's standard glazed aluminum curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
 - a. Glazed aluminum curtain walls shall withstand movements of supporting structure indicated on Drawings **OR as directed**, including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 - b. Failure also includes the following:
 - 1) Thermal stresses transferring to building structure.
 - 2) Glass breakage.
 - 3) Noise or vibration created by wind and thermal and structural movements.
 - 4) Loosening or weakening of fasteners, attachments, and other components.
 - 5) Failure of operating units.
2. Delegated Design: Design glazed aluminum curtain walls, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
3. Structural Loads:
 - a. Wind Loads: As indicated on Drawings **OR as directed**.
 - 1) Basic Wind Speed: 85 mph (38 m/s) **OR** 90 mph (40 m/s) **OR** 100 mph (44 m/s) **OR** 110 mph (49 m/s), **as directed**.
 - 2) Exposure Category: A **OR** B **OR** C **OR** D, **as directed**.
 - b. Blast Loads: As indicated on Drawings **OR as directed**.
 - c. Periodic Maintenance-Equipment Loads: As indicated on Drawings **OR as directed**.
4. Structural-Test Performance: Test according to ASTM E 330 as follows:
 - a. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
 - b. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
 - c. Test Durations: As required by design wind velocity, but not less than 10 seconds.
5. Deflection of Framing Members: At design wind pressure, as follows:
 - a. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding L/175 of the glass edge length for each individual glazing lite **OR** 1/175 of clear span for spans up to 13 feet 6 inches (4.1 m) and to 1/240 of clear span plus 1/4 inch (6.35 mm) for spans greater than 13 feet 6 inches (4.1 m), **as directed**, or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19 mm), whichever is less.



- b. Deflection Parallel to Glazing Plane: Limited to L/360 of clear span or 1/8 inch (3.2 mm), whichever is smaller **OR** amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch (3.2 mm), **as directed**.
 - 1) Operable Units: Provide a minimum 1/16-inch (1.6-mm) clearance between framing members and operable units.
- c. Cantilever Deflection: Where framing members overhang an anchor point, limit deflection to two times the length of cantilevered member, divided by 175.
- 6. Windborne-Debris-Impact-Resistance Performance: Pass missile-impact and cyclic-pressure tests when tested according to ASTM E 1886 and testing information in ASTM E 1996 for Wind Zone 1 **OR** Zone 2 **OR** Zone 3 **OR** Zone 4, **as directed**.
 - a. Large-Missile Test: For glazed openings located within 30 feet (9.1 m) of grade.
 - b. Small-Missile Test: For glazed openings located more than 30 feet (9.1 m) above grade.
- 7. Seismic Performance: Glazed aluminum curtain walls shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
 - a. Component Importance Factor is 1.5 **OR** 1.0, **as directed**.
- 8. Story Drift: Accommodate design displacement of adjacent stories indicated.
 - a. Design Displacement: As indicated on Drawings **OR as directed**.
 - b. Test Performance: Meeting criteria for passing based on building occupancy type when tested according to AAMA 501.4 at design displacement and 1.5 times the design displacement, **as directed**.
- 9. Water Penetration under Static Pressure: No evidence of water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa) **OR** 10 lbf/sq. ft. (480 Pa) **OR** 15 lbf/sq. ft. (720 Pa), **as directed**.
- 10. Water Penetration under Dynamic Pressure: No evidence of water penetration through fixed glazing and framing areas when tested according to AAMA 501.1 at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa) **OR** 10 lbf/sq. ft. (480 Pa) **OR** 15 lbf/sq. ft. (720 Pa), **as directed**.
 - a. Maximum Water Leakage: According to AAMA 501.1 **OR** No uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces from sources other than condensation, **as directed**. Water leakage does not include water controlled by flashing and gutters that is drained to exterior.
- 11. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures:
 - a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
 - b. Test Interior Ambient-Air Temperature: 75 deg F (24 deg C).
 - c. Test Performance: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.
- 12. Energy Performance: Glazed aluminum curtain walls shall have certified and labeled energy performance ratings in accordance with NFRC.
 - a. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.45 Btu/sq. ft. x h x deg F (2.55 W/sq. m x K) **OR** 0.57 Btu/sq. ft. x h x deg F (3.23 W/sq. m x K) **OR** 0.69 Btu/sq. ft. x h x deg F (3.92 W/sq. m x K), **as directed**, as determined according to NFRC 100.
 - b. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.35 **OR** 0.40 **OR** 0.45, **as directed**, as determined according to NFRC 200.
 - c. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 0.30 cfm/sq. ft. (1.50 L/s per sq. m) of fixed wall area as determined according to ASTM E 283 at a minimum static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa) **OR** 6.24 lbf/sq. ft. (300 Pa), **as directed**.



- d. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC- certified condensation resistance rating of no less than 15 **OR** 25 **OR** 35 **OR** 45, **as directed**, as determined according to NFRC 500.
13. Sound Transmission: Provide glazed aluminum curtain walls with fixed glazing and framing areas having the following sound-transmission characteristics:
 - a. Outdoor-Indoor Transmission Class: Minimum 26 **OR** 30 **OR** 34, **as directed**, when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 1332.

D. Submittals

1. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. LEED Submittal:
 - a. Product Data for Credit EQ 4.1: For glazing sealants used inside of the weatherproofing system, including printed statement of VOC content.
3. Shop Drawings: For glazed aluminum curtain walls. Include plans, elevations, sections, full-size details, and attachments to other work.
 - a. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
 - b. Include full-size isometric details of each vertical-to-horizontal intersection of glazed aluminum curtain walls, showing the following:
 - 1) Joinery, including concealed welds.
 - 2) Anchorage.
 - 3) Expansion provisions.
 - 4) Glazing.
 - 5) Flashing and drainage.
4. Samples: For each type of exposed finish required.
5. Delegated-Design Submittal: For glazed aluminum curtain walls indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
6. Qualification Data: For qualified Installer and testing agency, **as directed**.
7. Seismic Qualification Certificates: For glazed aluminum curtain walls, accessories, and components, from manufacturer.
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
8. Welding certificates.
9. Energy Performance Certificates: For glazed aluminum curtain walls, accessories, and components, from manufacturer.
 - a. Basis for Certification: NFRC-certified energy performance values for each glazed aluminum curtain wall.
10. Product test reports.
11. Field quality-control reports.
12. Maintenance data.
13. Warranties: Sample of special warranties.

E. Quality Assurance

1. Manufacturer Qualifications: A manufacturer capable of fabricating glazed aluminum curtain walls that meet or exceed energy performance requirements indicated and of documenting this performance by certification, labeling, and inclusion in lists.
2. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
3. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.
4. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.



5. Welding Qualifications: Qualify procedures and personnel according to the following:
 - a. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - b. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
6. Energy Performance Standards: Comply with NFRC for minimum standards of energy performance, materials, components, accessories, and fabrication. Comply with more stringent requirements if indicated.
 - a. Provide NFRC-certified glazed aluminum curtain walls with an attached label.
7. Preinstallation Conference: Conduct conference at Project site.

F. Warranty

1. Special Assembly Warranty: Standard form in which manufacturer **OR** Installer, **as directed**, agrees to repair or replace components of glazed aluminum curtain walls that do not comply with requirements or that fail in materials or workmanship within Two **OR** Five **OR** 10, **as directed**, years from date of Final Completion.
2. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within Five **OR** 10 **OR** 20, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Materials

1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - a. Sheet and Plate: ASTM B 209 (ASTM B 209M).
 - b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
 - c. Extruded Structural Pipe and Tubes: ASTM B 429.
 - d. Structural Profiles: ASTM B 308/B 308M.
 - e. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.
2. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
 - a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
 - b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
 - c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

B. Framing

1. Framing Members: Manufacturer's standard extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
 - a. Construction: Nonthermal **OR** Thermally improved **OR** Thermally broken, **as directed**.
 - b. Glazing System: Retained mechanically with gaskets on four sides.
 - c. Glazing Plane: Front.
2. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
3. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
 - a. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 - b. Reinforce members as required to receive fastener threads.
 - c. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system **OR** fabricated from 300 series stainless steel, **as directed**.
4. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch (25.4 mm) that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.



- a. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.
 5. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials **OR** Dead-soft, 0.018-inch- (0.457-mm-) thick stainless steel, ASTM A 240/A 240M of type recommended by manufacturer, **as directed**.
 6. Framing Sealants: Manufacturer's standard sealants.
- C. Glazing
1. Glazing: Comply with Division 08 Section "Glazing".
 2. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers **OR** Comply with Division 08 Section "Glazing", **as directed**.
 3. Glazing Sealants: As recommended by manufacturer **OR** Comply with Division 08 Section "Glazing", **as directed**.
 - a. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. Insulated Spandrel Panels
1. Insulated Spandrel Panels: Laminated, metal-faced flat panels with no deviations in plane exceeding 0.8 percent of panel dimension in width or length.
 - a. Overall Panel Thickness: As indicated **OR** 1 inch (25.4 mm), **as directed**.
 - b. Exterior Skin: Aluminum.
 - 1) Thickness: Manufacturer's standard for finish and texture indicated.
 - 2) Finish: Matching framing system.
 - 3) Texture: Smooth **OR** Embossed, **as directed**.
 - 4) Backing Sheet: 1/8-inch- (3.2-mm-) thick, tempered hardboard **OR** 0.157-inch- (4-mm-) thick, cement board **OR** 0.125-inch- (3.2-mm-) thick, corrugated, high-density polyethylene, **as directed**.
 - c. Interior Skin: Aluminum **OR** Manufacturer's standard galvanized-steel sheet, **as directed**.
 - 1) Thickness: Manufacturer's standard for finish and texture indicated.
 - 2) Finish: Matching curtain-wall framing **OR** Low-gloss, white baked enamel **OR** Mill finish, **as directed**.
 - 3) Texture: Smooth **OR** Embossed, **as directed**.
 - 4) Backing Sheet: 1/8-inch- (3.2-mm-) thick, tempered hardboard **OR** 0.157-inch- (4-mm-) thick, cement board **OR** 1/2-inch- (12.7-mm-) thick, gypsum board with proprietary fire-resistance-rated core **OR** 0.125-inch- (3.2-mm-) thick, corrugated, high-density polyethylene, **as directed**.
 - d. Thermal Insulation Core: Manufacturer's standard rigid, closed-cell, polyisocyanurate board **OR** extruded-polystyrene board **OR** expanded-perlite, mineral-insulation board, **as directed**.
 - e. Surface-Burning Characteristics: For exposed interior surfaces of panels, when tested according to ASTM E 84 as follows:
 - 1) Flame-Spread Index: 25 or less.
 - 2) Smoke-Developed Index: 450 or less.
- E. Operable Units
1. Venting Windows: Comply with Division 08 Section "Aluminum Windows".
 2. Doors: Comply with Division 08 Section "Aluminum-framed Entrances And Storefronts".
- F. Accessory Materials
1. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.
- G. Fabrication
1. Form or extrude aluminum shapes before finishing.



2. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
3. Fabricate components that, when assembled, have the following characteristics:
 - a. Profiles that are sharp, straight, and free of defects or deformations.
 - b. Accurately fitted joints with ends coped or mitered.
 - c. Physical and thermal isolation of glazing from framing members.
 - d. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - e. Provisions for field replacement of glazing from exterior **OR** interior **OR** interior for vision glass and exterior for spandrel glazing or metal panels, **as directed**.
 - f. Provisions for safety railings mounted on interior face of mullions **OR** between mullions at interior, **as directed**.
 - g. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
 - h. Components curved to indicated radii.
4. Fabricate components that, when assembled, have the following characteristics:
 - a. Internal guttering system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
 - b. Pressure-equalized system or double barrier design with primary air and vapor barrier at interior side of glazed aluminum curtain wall and secondary seal weeped and vented to exterior.
5. Curtain-Wall Framing: Fabricate components for assembly using shear-block system **OR** screw-spline system **OR** head-and-sill-receptor system with shear blocks at intermediate horizontal members, **as directed**.
6. Factory-Assembled Frame Units:
 - a. Rigidly secure nonmovement joints.
 - b. Seal joints watertight unless otherwise indicated.
 - c. Install glazing to comply with requirements in Division 08 Section "Glazing".
7. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

H. Aluminum Finishes

1. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm **OR** AA-M12C22A31, Class II, 0.010 mm, **as directed**, or thicker.
2. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm **OR** AA-M12C22A32/A34, Class II, 0.010 mm, **as directed**, or thicker.
 - a. Color: Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Champagne **OR** Black **OR** Match sample **OR** As selected from full range of industry colors and color densities, **as directed**.
3. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - a. Color and Gloss: As indicated by manufacturer's designations **OR** Match sample **OR** As selected from manufacturer's full range, **as directed**.
4. High-Performance Organic Finish:
 - a. Two-coat fluoropolymer finish complying with AAMA 2604 **OR** AAMA 2605, **as directed**, and containing not less than 50 **OR** 70, **as directed**, percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
OR
Three-coat **OR** Four-coat, **as directed**, fluoropolymer finish complying with AAMA 2605 and containing not less than 50 **OR** 70, **as directed**, percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

**OR**

Two-coat fluoropolymer finish complying with AAMA 2604 and containing 100 percent FEVE resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

- b. Color and Gloss: As indicated by manufacturer's designations **OR** Match sample **OR** As selected from manufacturer's full range, **as directed**.

1.3 EXECUTION

A. Installation

1. General:
 - a. Comply with manufacturer's written instructions.
 - b. Do not install damaged components.
 - c. Fit joints to produce hairline joints free of burrs and distortion.
 - d. Rigidly secure nonmovement joints.
 - e. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
 - f. Weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
 - g. Seal joints watertight unless otherwise indicated.
2. Metal Protection:
 - a. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.
 - b. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
3. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
4. Install components plumb and true in alignment with established lines and grades.
5. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.
6. Install glazing as specified in Division 08 Section "Glazing".

B. Erection Tolerances

1. Erection Tolerances: Install glazed aluminum curtain walls to comply with the following maximum tolerances:
 - a. Plumb: 1/8 inch in 10 feet (3.2 mm in 3 m); 1/4 inch in 40 feet (6 mm in 12 m).
 - b. Level: 1/8 inch in 20 feet (3.2 mm in 6 m); 1/4 inch in 40 feet (6 mm in 12 m).
 - c. Alignment:
 - 1) Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch (12.7 mm) wide, limit offset from true alignment to 1/16 inch (1.6 mm).
 - 2) Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch (12.7 to 25.4 mm) wide, limit offset from true alignment to 1/8 inch (3.2 mm).
 - 3) Where surfaces are separated by reveal or protruding element of 1 inch (25.4 mm) wide or more, limit offset from true alignment to 1/4 inch (6 mm).
 - d. Location: Limit variation from plane to 1/8 inch in 12 feet (3.2 mm in 3.7 m); 1/2 inch (12.7 mm) over total length.

C. Field Quality Control

1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
2. Testing Services: Testing and inspecting of representative areas of glazed aluminum curtain walls shall take place as installation proceeds to determine compliance of installed assemblies with specified requirements.
 - a. Air Infiltration: Areas shall be tested for air leakage of 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article, but not more than 0.50 cfm/sq. ft.



- (2.25 L/s per sq. m), of fixed wall area when tested according to ASTM E 783 at a minimum static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa) **OR** 6.24 lbf/sq. ft. (300 Pa), **as directed**.
- 1) Test Area: One bay wide, but not less than 30 feet (9.1 m), by one story of glazed aluminum curtain wall.
 - 2) Perform a minimum of two **OR** three, **as directed**, tests in areas as directed by the Owner.
OR
Perform tests in each test area as directed by the Owner. Perform at least three tests, prior to 10, 35, and 70 percent completion.
- b. Water Penetration: Areas shall be tested according to ASTM E 1105 at a minimum uniform and cyclic static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft. (300 Pa), and shall not evidence water penetration.
- 1) Test Area: One bay wide, but not less than 30 feet (9.1 m), by one story of glazed aluminum curtain wall.
 - 2) Perform a minimum of two **OR** three, **as directed**, tests in areas as directed by the Owner.
OR
Perform tests in each test area as directed by the Owner. Perform at least three tests, prior to 10, 35, and 70 percent completion.
- c. Water Spray Test: Before installation of interior finishes has begun, areas designated by the Owner shall be tested according to AAMA 501.2 and shall not evidence water penetration.
- 1) Test Area: A minimum area of 75 feet (23 m) by one story of glazed aluminum curtain wall.
3. Glazed aluminum curtain walls will be considered defective if they do not pass tests and inspections.
 4. Prepare test and inspection reports.

END OF SECTION 08 44 13 00



SECTION 08 44 13 00a - STRUCTURAL-SEALANT-GLAZED CURTAIN WALLS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of material for structural-sealant-glazed curtain walls. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Factory-glazed **OR** Field-glazed, **as directed**, two-sided structural-sealant-glazed curtain-wall assemblies.
 - b. Factory-glazed, four-sided structural-sealant-glazed curtain-wall assemblies.

C. Performance Requirements

1. General Performance: Comply with performance requirements specified, as determined by testing manufacturer's standard of structural-sealant-glazed curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
 - a. Structural-sealant-glazed curtain walls shall withstand movements of supporting structure indicated on Drawings, **OR as directed**, including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 - b. Failure also includes the following:
 - 1) Thermal stresses transferring to building structure.
 - 2) Glass breakage.
 - 3) Noise or vibration created by wind and thermal and structural movements.
 - 4) Loosening or weakening of fasteners, attachments, and other components.
 - 5) Failure of operating units.
2. Delegated Design: Design structural-sealant-glazed curtain walls, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
3. Structural Loads:
 - a. Wind Loads: As indicated on Drawings **OR as directed**.
 - 1) Basic Wind Speed: 85 mph (38 m/s) **OR** 90 mph (40 m/s) **OR** 100 mph (44 m/s) **OR** 110 mph (49 m/s), **as directed**.
 - 2) Exposure Category: A **OR** B **OR** C **OR** D, **as directed**.
 - b. Blast Loads: As indicated on Drawings **OR as directed**.
 - c. Periodic Maintenance-Equipment Loads: As indicated on Drawings **OR as directed**.
4. Structural-Test Performance: Provide structural-sealant-glazed curtain walls tested according to ASTM E 330 as follows:
 - a. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
 - b. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
 - c. Test Durations: As required by design wind velocity, but not less than 10 seconds.
5. Deflection of Framing Members: At design wind pressure, as follows:
 - a. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding L/175 of the glass edge length for each individual glazing lite **OR** 1/175 of clear span for spans up to 13 feet 6 inches (4.1 m) and to 1/240 of clear span plus 1/4 inch (6.35 mm) for spans greater than 13 feet 6 inches (4.1 m), **as directed**, or an



- amount that restricts edge deflection of individual glazing lites to 3/4 inch (19 mm), whichever is less.
- b. Deflection Parallel to Glazing Plane: Limited to L/360 of clear span or 1/8 inch (3.2 mm), whichever is smaller **OR** amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch (3.2 mm), **as directed**.
 - 1) Operable Units: Provide a minimum 1/16-inch (1.6-mm) clearance between framing members and operable units.
 - c. Cantilever Deflection: Where framing members overhang an anchor point, limit deflection to 2 times the length of cantilevered member divided by 175.
6. Windborne-Debris-Impact-Resistance Performance: Pass missile-impact and cyclic-pressure tests when tested according to ASTM E 1886 and testing information in ASTM E 1996 for Wind Zone 1 **OR** Zone 2 **OR** Zone 3 **OR** Zone 4, **as directed**.
 - a. Large-Missile Test: For glazed openings located within 30 feet (9.1 m) of grade.
 - b. Small-Missile Test: For glazed openings located more than 30 feet (9.1 m) above grade.
 7. Seismic Performance: Structural-sealant-glazed curtain walls shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
 - a. Component Importance Factor is 1.5 **OR** 1.0, **as directed**.
 8. Story Drift: Accommodate design displacement of adjacent stories indicated.
 - a. Design Displacement: As indicated on Drawings **OR as directed**.
 - b. Test Performance: Meets criteria for passing based on building occupancy type when tested according to AAMA 501.4 at design displacement and 1.5 times the design displacement, **as directed**.
 9. Water Penetration under Static Pressure: No evidence of water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa) **OR** 10 lbf/sq. ft. (480 Pa) **OR** 15 lbf/sq. ft. (720 Pa), **as directed**.
 10. Water Penetration under Dynamic Pressure: No evidence of water penetration through fixed glazing and framing areas when tested according to AAMA 501.1 at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa) **OR** 10 lbf/sq. ft. (480 Pa) **OR** 15 lbf/sq. ft. (720 Pa), **as directed**.
 - a. Maximum Water Leakage: According to AAMA 501.1 **OR** No uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces from sources other than condensation, **as directed**. Water leakage does not include water controlled by flashing and gutters that is drained to exterior.
 11. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures:
 - a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
 - b. Test Interior Ambient-Air Temperature: 75 deg F (24 deg C).
 - c. Test Performance: No buckling, stress on glass, sealant failure, or excess stress on framing, anchors, and fasteners and no reduction of performance when tested according to AAMA 501.5.
 12. Energy Performance: Structural-sealant-glazed curtain walls shall have certified and labeled energy performance ratings according to NFRC.
 - a. Thermal Transmittance (U-Factor): Fixed glazing and framing areas shall have U-factor of not more than 0.45 Btu/sq. ft. x h x deg F (2.55 W/sq. m x K) **OR** 0.57 Btu/sq. ft. x h x deg F (3.23 W/sq. m x K) **OR** 0.69 Btu/sq. ft. x h x deg F (3.92 W/sq. m x K), **as directed**, as determined according to NFRC 100.
 - b. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a SHGC of no greater than 0.35 **OR** 0.40 **OR** 0.45, **as directed**, as determined according to NFRC 200.
 - c. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 0.30 cfm/sq. ft. (1.50 L/s per sq. m) of fixed wall area as determined according to ASTM E 283



- at a minimum static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa) **OR** 6.24 lbf/sq. ft. (300 Pa), **as directed**.
- d. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC-certified CR rating of no less than 15 **OR** 25 **OR** 35 **OR** 45, **as directed**, as determined according to NFRC 500
13. Sound Transmission: Fixed glazing and framing areas shall have the following sound-transmission characteristics:
 - a. Outdoor-Indoor Transmission Class: Minimum 26 **OR** 30 **OR** 34, **as directed**, when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 1332.
 14. Structural Sealant: Capable of withstanding tensile and shear stresses imposed by structural-sealant-glazed curtain walls without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.
 - a. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
 - b. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate because sealant-to-substrate bond strength exceeds sealant's internal strength.
 15. Structural-Sealant Joints:
 - a. Designed to carry gravity loads of glazing.
 - b. Designed to produce tensile or shear stress of less than 20 psi (138 kPa).
 - c. Design reviewed and approved by structural-sealant manufacturer.

D. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittal:
 - a. Product Data for Credit EQ 4.1: For glazing sealants used inside of the weatherproofing system, including printed statement of VOC content.
3. Shop Drawings: For structural-sealant-glazed curtain walls. Include plans, elevations, sections, full-size details, and attachments to other work.
 - a. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
 - b. Include full-size isometric details of each vertical-to-horizontal intersection of structural-sealant-glazed curtain walls, showing the following:
 - 1) Joinery, including concealed welds.
 - 2) Anchorage.
 - 3) Expansion provisions.
 - 4) Glazing.
 - 5) Flashing and drainage.
4. Samples: For each type of exposed finish required.
5. Delegated-Design Submittal: For structural-sealant-glazed curtain walls indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
6. Qualification Data: For qualified Installer and testing agency.
7. Seismic Qualification Certificates: For structural-sealant-glazed curtain walls, accessories, and components, from manufacturer.
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
8. Welding certificates.
9. Energy-Performance Certificates: For structural-sealant-glazed curtain walls, accessories, and components, from manufacturer.
 - a. Basis for Certification: NFRC-certified energy-performance values for each structural-sealant-glazed curtain wall.
10. Product test reports.
11. Preconstruction sealant test reports.



12. Quality-Control Program: Developed specifically for Project, including fabrication and installation, according to recommendations in ASTM C 1401. Include periodic quality-control reports.
13. Source quality-control reports.
14. Field quality-control reports.
15. Maintenance Data: For structural-sealant-glazed curtain walls to include in maintenance manuals. Include ASTM C 1401 recommendations for postinstallation-phase quality-control program.
16. Warranties: Sample of special warranties.

E. Quality Assurance

1. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
2. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.
3. Product Options: Information on Drawings and in Specifications establishes requirements for assemblies' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
4. Structural-Sealant Glazing: Comply with ASTM C 1401 for design and installation of structural-sealant-glazed curtain walls.
5. Welding Qualifications: Qualify procedures and personnel according to the following:
 - a. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - b. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
6. Energy-Performance Standards: Comply with NFRC for minimum standards of energy performance, materials, components, accessories, and fabrication. Comply with more stringent requirements if indicated.
 - a. Provide NFRC-certified, structural-sealant-glazed curtain walls with an attached label.
7. Preinstallation Conference: Conduct conference at Project site.

F. Warranty

1. Special Assembly Warranty: Standard form in which manufacturer **OR** Installer, **as directed** agrees to repair or replace components of structural-sealant-glazed curtain walls that do not comply with requirements or that fail in materials or workmanship within Two **OR** Five **OR** 10, **as directed**, years from date of Final Completion.
2. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within Five **OR** 10 **OR** 20, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Materials

1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - a. Sheet and Plate: ASTM B 209 (ASTM B 209M).
 - b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
 - c. Extruded Structural Pipe and Tubes: ASTM B 429.
 - d. Structural Profiles: ASTM B 308/B 308M.
 - e. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.
2. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
 - a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
 - b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
 - c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.



B. Framing

1. Framing Members: Manufacturer's standard formed- or extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.
2. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
 - a. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 - b. Reinforce members as required to receive fastener threads.
 - c. Use exposed fasteners with countersunk Phillips screw heads finished to match framing system **OR** fabricated from Series 300 stainless steel, **as directed**.
3. Anchors: Three-way adjustable anchors, with minimum adjustment of 1 inch (25.4 mm), that accommodate fabrication and installation tolerances in material and finish and are compatible with adjoining materials and recommended by manufacturer.
 - a. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.
4. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials **OR** Dead-soft, 0.018-inch- (0.457-mm-) thick stainless steel, ASTM A 240/A 240M of type recommended by manufacturer, **as directed**.
5. Framing Sealants: Manufacturer's standard sealants with VOC content of 250g/L or less when calculated according to 40 CFR 59, Subpart D (EPA method 24), **as directed**.

C. Glazing

1. Glazing: Comply with Division 08 Section "Glazing".
2. Glazing Gaskets, Spacers, Setting Blocks, Sealant Backings, and Bond Breakers: Manufacturer's standard permanent, nonmigrating types compatible with sealants and suitable for joint movement and assembly performance requirements.
3. Glazing Sealants: For structural-sealant-glazed curtain walls, as recommended by manufacturer for joint type, and as follows:
 - a. Structural Sealant: ASTM C 1184, chemically curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant and approved by structural-sealant manufacturer for use in curtain-wall assembly indicated.
 - 1) Provide sealants for use inside of the weatherproofing system that have a VOC content of 100 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2) Color: Black **OR** Gray **OR** As selected from manufacturer's full range of colors, **as directed**.
 - b. Weatherseal Sealant: ASTM C 920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and structural-sealant-glazed curtain-wall manufacturers for this use.
 - 1) Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2) Color: Matching structural sealant.

D. Operable Units

1. Venting Windows: Comply with Division 08 Section "Aluminum Windows".
2. Doors: Comply with Division 08 Section "Aluminum-framed Entrances And Storefronts".

E. Accessory Materials

1. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.
2. Cleaning Agent and Cloth: As recommended by structural-sealant manufacturer.



F. Fabrication

1. Form or extrude aluminum shapes before finishing.
2. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
3. Fabricate components that, when assembled, have the following characteristics:
 - a. Profiles that are sharp, straight, and free of defects or deformations.
 - b. Accurately fitted joints with ends coped or mitered.
 - c. Physical and thermal isolation of glazing from framing members.
 - d. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - e. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
 - f. Provisions for field replacement of glazing from exterior **OR** interior **OR** interior for vision glass and exterior for spandrel glazing or metal panels, **as directed**. Include accommodations for using temporary support device (dutchman) to retain glazing in place while sealant cures.
 - g. Provisions for safety railings mounted on interior face of mullions **OR** between mullions at interior, **as directed**.
 - h. Components curved to indicated radii.
 - i. Internal guttering systems or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within structural-sealant-glazed curtain wall to exterior.
4. Factory-Assembled Frame Units:
 - a. Rigidly secure nonmovement joints.
 - b. Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion.
 - c. Preparation includes, but is not limited to, cleaning and priming surfaces.
 - d. Seal joints watertight unless otherwise indicated.
 - e. Install glazing to comply with requirements in Division 08 Section "Glazing".
5. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

G. Aluminum Finishes

1. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm **OR** AA-M12C22A31, Class II, 0.010 mm, **as directed**, or thicker.
2. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm **OR** AA-M12C22A32/A34, Class II, 0.010 mm, **as directed**, or thicker.
 - a. Color: Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Champagne **OR** Black **OR** Match sample **OR** As selected from full range of industry colors and color densities, **as directed**.
3. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - a. Color and Gloss: As selected from manufacturer's full range, **as directed**.
4. High-Performance Organic Finish:
 - a. Two-coat fluoropolymer finish complying with AAMA 2604 **OR** AAMA 2605, **as directed**, and containing not less than 50 **OR** 70, **as directed**, percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
OR
Three-coat **OR** Four-coat, **as directed**, fluoropolymer finish complying with AAMA 2605 and containing not less than 50 **OR** 70, **as directed**, percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
OR



Two-coat fluoropolymer finish complying with AAMA 2604 and containing 100 percent FEVE resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

- b. Color and Gloss: As selected from manufacturer's full range.

H. Source Quality Control

1. Perform quality-control procedures complying with ASTM C 1401 recommendations including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.

1.3 EXECUTION

A. Installation

1. General:
 - a. Comply with manufacturer's written instructions.
 - b. Do not install damaged components.
 - c. Fit joints to produce hairline joints free of burrs and distortion.
 - d. Rigidly secure nonmoving joints.
 - e. Install anchors with separators and isolators to prevent metal corrosion, electrolytic deterioration, and impediments to movement of joints.
 - f. Weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
 - g. Seal joints watertight unless otherwise indicated.
2. Metal Protection:
 - a. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer, applying sealant or tape, or installing nonconductive spacers as recommended by manufacturer for this purpose.
 - b. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
3. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within structural-sealant-glazed curtain walls to exterior.
4. Install components plumb and true in alignment with established lines and grades.
5. Install operable units level and plumb, securely anchored, and without distortion. Adjust weatherstripping contact and hardware movement to produce proper operation.
6. Install glazing as specified in Division 08 Section "Glazing". Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
7. Install weatherseal sealant according to Division 07 Section "Joint Sealants" and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.

B. Erection Tolerances

1. Erection Tolerances: Install to comply with the following nonaccumulating maximum tolerances:
 - a. Plumb: 1/8 inch in 10 feet (3 mm in 3 m); 1/4 inch in 40 feet (6 mm in 12 m).
 - b. Level: 1/8 inch in 20 feet (3 mm in 6 m); 1/4 inch in 40 feet (6 mm in 12 m).
 - c. Alignment:
 - 1) Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch (12.7 mm) wide, limit offset from true alignment to 1/16 inch (1.6 mm).
 - 2) Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch (12.7 to 25.4 mm) wide, limit offset from true alignment to 1/8 inch (3.2 mm).
 - 3) Where surfaces are separated by reveal or protruding element of 1 inch (25.4 mm) wide or more, limit offset from true alignment to 1/4 inch (6 mm).
 - d. Location: Limit variation from plane to 1/8 inch in 12 feet (3 mm in 3.7 m); 1/2 inch (12.7 mm) over total length.



C. Field Quality Control

1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
2. Testing Services: Testing and inspecting of representative areas of structural-sealant-glazed curtain walls shall take place as installation proceeds to determine compliance of installed assemblies with specified requirements.
 - a. Structural-Sealant Adhesion: Test structural sealant according to recommendations in ASTM C 1401, Destructive Test Method A, "Hand Pull Tab (Destructive)," Appendix X2.
 - 1) Test a minimum of two **OR** four **OR** six, **as directed**, areas on each building facade.
 - 2) Repair installation areas damaged by testing.
 - b. Air Infiltration: Areas shall be tested for air leakage of 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article, but not more than 0.50 cfm/sq. ft. (2.25 L/s per sq. m), of fixed wall area when tested according to ASTM E 783 at a minimum static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa) **OR** 6.24 lbf/sq. ft. (300 Pa), **as directed**.
 - 1) Test Area: One bay wide, but not less than 30 feet (9.1 m), by one story of structural-sealant-glazed curtain wall.
 - 2) Perform a minimum of two **OR** three, **as directed**, tests in areas as directed by the Owner.
OR
Perform tests in each test area as directed by the Owner. Perform at least three tests, prior to 10, 35, and 70 percent completion.
 - c. Water Penetration: Areas shall be tested according to ASTM E 1105 at a minimum uniform and cyclic static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft. (300 Pa), and shall not evidence water penetration.
 - 1) Test Area: One bay wide, but not less than 30 feet (9.1 m), by one story of structural-sealant-glazed curtain wall.
 - 2) Perform a minimum of two **OR** three, **as directed**, tests in areas as directed by the Owner.
OR
Perform tests in each test area as directed by the Owner. Perform at least three tests, prior to 10, 35, and 70 percent completion.
 - d. Water Spray Test: Before installation of interior finishes has begun, areas designated by the Owner shall be tested according to AAMA 501.2 and shall not evidence water penetration.
 - 1) Test Area: A minimum area of 75 feet (23 m) by one story of structural-sealant-glazed curtain wall.
3. Structural-sealant-glazed curtain walls will be considered defective if they do not pass tests and inspections.
4. Prepare test and inspection reports.

END OF SECTION 08 44 13 00a



SECTION 08 44 13 00b - SLOPED GLAZING ASSEMBLIES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of material for sloped glazing systems. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Conventionally glazed sloped glazing assemblies.
 - b. Two-sided, structural-sealant-glazed sloped glazing assemblies.
 - c. Four-sided, structural-sealant-glazed sloped glazing assemblies.

C. Performance Requirements

1. General Performance: Sloped glazing assemblies shall withstand movements of supporting structure (where applicable) without failure due to defective manufacture, fabrication, installation, or other defects in construction.
 - a. Sloped Glazing Assemblies: Comply with performance requirements specified, as determined by testing manufacturer's standard assemblies representing those indicated for this Project.
 - b. Failures also include, but are not limited to, the following:
 - 1) Thermal stresses transferring to building structure.
 - 2) Glass breakage.
 - 3) Noise or vibration created by wind and thermal and structural movements.
 - 4) Loosening or weakening of fasteners, attachments, and other components.
 - 5) Failure of operating units.
 - 6) Glazing-to-glazing contact.
2. Delegated Design: Design sloped glazing assemblies, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
3. Structural Performance: Sloped glazing assemblies shall withstand the wind loads, the effects of gravity loads, and loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 - a. Wind Loads: As indicated on Drawings **OR as directed**.
 - 1) Basic Wind Speed: 85 mph (38 m/s) **OR** 90 mph (40 m/s) **OR** 100 mph (44 m/s) **OR** 110 mph (49 m/s), **as directed**.
 - 2) Exposure Category: A **OR** B **OR** C **OR** D, **as directed**.
 - b. Snow Loads: As indicated on Drawings **OR as directed**.
 - c. Concentrated Live Loads: As indicated on Drawings **OR as directed**, applied to framing members at locations that will produce greatest stress or deflection.
 - d. Uniform Live Loads: As indicated on Drawings **OR as directed**.
 - e. Load Combinations: Calculate according to requirements of applicable code indicated on Drawings **OR as directed**.
 - f. Blast Loads: As indicated on Drawings **OR as directed**.
 - g. Periodic Maintenance-Equipment Loads: As indicated on Drawings **OR as directed**.
4. Structural Performance: Provide sloped glazing assemblies tested according to ASTM E 330, as follows:
 - a. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.



- b. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
- c. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- 5. Deflection of Framing Members: At design wind pressure, as follows:
 - a. Deflection Normal to Glazing Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding $L/175$ of the glass edge length for each individual glazing lite **OR** $1/175$ of clear span for spans up to 13 feet 6 inches (4.1 m) and to $1/240$ of clear span plus $1/4$ inch (6.35 mm) for spans more than 13 feet 6 inches (4.1 m), **as directed**, or an amount that restricts edge deflection of individual glazing lites to $3/4$ inch (19.1 mm), whichever is less.
 - b. Deflection Parallel to Glazing Plane: Limited to $L/360$ of clear span or $1/8$ inch (3.2 mm), whichever is smaller **OR** amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than $1/8$ inch (3.2 mm), **as directed**.
- 6. Flexural Members: Design for lateral bracing of compression flanges by cross members with minimum depth equal to 50 percent of braced flexural member. Glazing does not provide lateral support.
- 7. Windborne-Debris-Impact-Resistance Performance: Pass missile-impact and cyclic-pressure tests when tested according to ASTM E 1886 and testing information in ASTM E 1996 for Wind Zone 1 **OR** Zone 2 **OR** Zone 3 **OR** Zone 4, **as directed**.
 - a. Large-Missile Test: For glazed openings located within 30 feet (9.1 m) of grade.
 - b. Small-Missile Test: For glazed openings located more than 30 feet (9.1 m) above grade.
- 8. Seismic Performance: Sloped glazing assemblies shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - a. Component Importance Factor is 1.5 **OR** 1.0, **as directed**.
- 9. Story Drift: Accommodate design displacement of adjacent stories indicated.
 - a. Design Displacement: As indicated on Drawings **OR as directed**.
 - b. Test Performance: Meet criteria for passing based on building occupancy type when tested according to AAMA 501.4 at design displacement and 1.5 times the design displacement.
- 10. Water Penetration under Static Pressure: No evidence of water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa) **OR** 10 lbf/sq. ft. (480 Pa) **OR** 15 lbf/sq. ft. (720 Pa), **as directed**.
- 11. Water Penetration under Dynamic Pressure: No evidence of water penetration through fixed glazing and framing areas when tested according to AAMA 501.1 at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa) **OR** 10 lbf/sq. ft. (480 Pa) **OR** 15 lbf/sq. ft. (720 Pa), **as directed**.
 - a. Maximum Water Leakage: According to AAMA 501.1 **OR** No uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces from sources other than condensation, **as directed**. Water leakage does not include water controlled by flashing and gutters that is drained to exterior.
- 12. Thermal Movements: Allow for thermal movements from the following maximum change (range) in ambient and surface temperature:
 - a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
 - b. Test Interior Ambient-Air Temperature: 75 deg F (24 deg C).
 - c. Test Performance: No buckling, stress on glass, sealant failure, or excess stress on framing, anchors, and fasteners and no reduction of performance when tested according to AAMA 501.5.
- 13. Energy Performance: Sloped glazing assemblies shall have certified and labeled energy-performance ratings according to the NFRC.



- a. Thermal Transmittance (U-Factor): Fixed glazing and framing areas shall have U-factor of not more than 0.45 Btu/sq. ft. x h x deg F (2.55 W/sq. m x K) **OR** 0.57 Btu/sq. ft. x h x deg F (3.23 W/sq. m x K) **OR** 0.69 Btu/sq. ft. x h x deg F (3.92 W/sq. m x K), **as directed**, as determined according to NFRC 100.
 - b. Solar Heat-Gain Coefficient: Fixed glazing and framing areas shall have an SHGC of not more than 0.35 **OR** 0.40 **OR** 0.45, **as directed**, as determined according to NFRC 200.
 - c. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 0.30 cfm/sq. ft. (1.50 L/s per sq. m) of fixed area as determined according to ASTM E 283 at a minimum static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa) **OR** 6.24 lbf/sq. ft. (300 Pa), **as directed**.
 - d. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC-certified CR rating of not less than 15 **OR** 25 **OR** 35 **OR** 45, **as directed**, as determined according to NFRC 500.
14. Sound Transmission: Fixed glazing and framing areas shall have the following characteristics:
- a. Outdoor-Indoor Transmission Class: Minimum 26 **OR** 30 **OR** 34, **as directed**, when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 1332.
15. Structural Sealant: Capable of withstanding tensile and shear stresses imposed by structural-sealant glazing without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.
- a. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
 - b. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate because sealant-to-substrate bond strength exceeds sealant's internal strength.
16. Structural-Sealant Joints:
- a. Designed to carry gravity loads of glazing.
 - b. Designed to produce tensile or shear stress of less than 20 psi (138 kPa).
 - c. Design reviewed and approved by structural-sealant manufacturer.
- D. Submittals
1. Product Data: For each type of product indicated.
 2. LEED Submittal:
 - a. Product Data for Credit EQ 4.1: For glazing sealants used inside the weatherproofing system, including printed statement of VOC content.
 3. Shop Drawings: For sloped glazing assemblies. Include plans, elevations, sections, details, and attachments to other work.
 - a. Include details of provisions for assembly expansion and contraction and for draining moisture within the assembly to the exterior.
 - b. Include full-size isometric details of each vertical-to-horizontal intersection of assembly, showing the following:
 - 1) Joinery including concealed welds.
 - 2) Anchorage.
 - 3) Expansion provisions.
 - 4) Glazing.
 - 5) Flashing and drainage.
 4. Samples: For each type of exposed finish required.
 5. Delegated-Design Submittal: For sloped glazing assemblies indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 6. Qualification Data: For qualified Installer and testing agency.
 7. Seismic Qualification Certificates: For sloped glazing assemblies, accessories, and components, from manufacturer.
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 8. Welding certificates.



9. Product test reports.
10. Preconstruction sealant test reports.
11. Quality-Control Program: Developed specifically for Project, including fabrication and installation, according to recommendations in ASTM C 1401. Include periodic quality-control reports.
12. Source quality-control reports.
13. Field quality-control reports.
14. Maintenance data.
15. Warranties: Sample of special warranties.

E. Quality Assurance

1. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
2. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.
3. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
4. Structural-Sealant Glazing: Comply with ASTM C 1401 for design and installation.
5. Welding Qualifications: Qualify procedures and personnel according to the following:
 - a. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - b. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
6. NFRC Certification: Provide NFRC-certified and -labeled sloped glazing assemblies.
7. Preinstallation Conference: Conduct conference at Project site.

F. Warranty

1. Special Assembly Warranty: Standard form in which manufacturer **OR** Installer, **as directed**, agrees to repair or replace components of sloped glazing assemblies that do not comply with requirements or that fail in materials or workmanship within Two **OR** Five **OR** 10, **as directed**, years from date of Final Completion.
2. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within Five **OR** 10 **OR** 20, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Materials

1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - a. Sheet and Plate: ASTM B 209 (ASTM B 209M).
 - b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
 - c. Extruded Structural Pipe and Tubes: ASTM B 429.
 - d. Structural Profiles: ASTM B 308/B 308M.
 - e. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.
2. Steel Reinforcement: With manufacturer's standard, zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
 - a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
 - b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
 - c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

B. Framing

1. Framing Members: Manufacturer's standard, formed- or extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.



- a. Framing-Member Type: Self-supporting **OR** Skin type, supported by structural-steel members indicated, **as directed**.
- b. Glass Retention: Field-installed pressure caps on four sides **OR** Field-installed structural sealant at horizontal members (purlins) and pressure caps at rafters **OR** Factory-installed structural sealant on four sides, **as directed**.
2. Pressure Caps: Manufacturer's standard aluminum components that mechanically retain glazing.
 - a. Include snap-on aluminum trim that conceals fasteners.
3. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning assembly components.
4. Fasteners and Accessories: Manufacturer's standard, corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
 - a. At pressure caps, use ASTM A 193/A 193M stainless-steel screws.
 - b. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 - c. Reinforce members as required to receive fastener threads.
 - d. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system **OR** fabricated from Series 300 stainless steel, **as directed**.
5. Anchors: Three-way adjustable anchors, with minimum adjustment of 1 inch (25 mm), that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials, and recommended by manufacturer.
 - a. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with requirements in ASTM A 123/A 123M or ASTM A 153/A 153M.
6. Anchor Bolts: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6), galvanized steel.
7. Concealed Flashing: Manufacturer's standard, corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials **OR** Dead-soft, 0.018-inch- (0.457-mm-) thick stainless steel, ASTM A 240/A 240M; of type recommended by manufacturer, **as directed**.
8. Exposed Flashing and Closures: Manufacturer's standard aluminum components not less than 0.040 inch (1.016 mm) **OR** 0.060 inch (1.524 mm), **as directed**, thick.
9. Framing Sealants: Manufacturer's standard.

C. Glazing

1. General: Comply with Division 08 Section "Glazing".
2. Glazing Gaskets: Manufacturer's standard resilient elastomeric glazing gaskets, setting blocks, and shims or spacers **OR** As specified in Division 08 Section "Glazing", **as directed**.
3. Glazing Sealants: As recommended by manufacturer **OR** Comply with Division 08 Section "Glazing", **as directed**.
 - a. Provide sealants for use inside the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
4. Glazing Sealants: For structural-sealant glazing, as recommended by manufacturer for joint type, and as follows:
 - a. Structural Sealant: ASTM C 1184, chemically curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant, and approved by structural-sealant manufacturer for use in sloped glazing assemblies indicated.
 - 1) Provide sealants for use inside the weatherproofing system that have a VOC content of 100 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2) Color: Black **OR** Gray **OR** As selected from manufacturer's full range of colors, **as directed**.
 - b. Weatherseal Sealant: ASTM C 920, Type S, Grade NS, Class 25, Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and sloped glazing assembly manufacturers for this use.
 - 1) Provide sealants for use inside the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).



- 2) Color: Matching structural sealant.
 5. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.
- D. Accessory Materials
1. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 33 requirements except containing no asbestos, formulated for 30-mil (0.76-mm) thickness per coat.
 2. Cleaning Agent and Cloth: As recommended by structural-sealant manufacturer.
- E. Fabrication
1. Form or extrude aluminum shapes before finishing.
 2. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
 3. Fabricate components that, when assembled, have the following characteristics:
 - a. Profiles that are sharp, straight, and free of defects or deformations.
 - b. Accurately fitted joints with ends coped or mitered.
 - c. Physical and thermal isolation of glazing from framing members.
 - d. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - e. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
 - f. Components curved to indicated radii.
 - g. Internal guttering systems or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
 4. Fabricate continuous, one-piece-type aluminum sill closures with weep holes.
 5. Four-Sided, Structural-Sealant-Glazed Frame Units:
 - a. Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion.
 - b. Preparation includes, but is not limited to, cleaning and priming surfaces.
 - c. Seal joints watertight unless otherwise indicated.
 - d. Factory install glazing to comply with requirements in Division 08 Section "Glazing".
 6. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.
- F. Aluminum Finishes
1. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm **OR** AA-M12C22A31, Class II, 0.010 mm, **as directed**, or thicker.
 2. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm **OR** AA-M12C22A32/A34, Class II, 0.010 mm, **as directed**, or thicker.
 - a. Color: Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Champagne **OR** Black **OR** Match sample **OR** As selected from full range of industry colors and color densities, **as directed**.
 3. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - a. Color and Gloss: As selected from manufacturer's full range, **as directed**.
 4. High-Performance Organic Finish:
 - a. Two-coat fluoropolymer finish complying with AAMA 2604 **OR** AAMA 2605, **as directed**, and containing not less than 50 **OR** 70, **as directed**, percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
OR
Three-coat **OR** Four-coat, **as directed**, fluoropolymer finish complying with AAMA 2605 and containing not less than 50 **OR** 70, **as directed**, percent PVDF resin by weight in both



color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

OR

Two-coat fluoropolymer finish complying with AAMA 2604 and containing 100 percent FEVE resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

- b. Color and Gloss: As selected from manufacturer's full range.

G. Source Quality Control

1. Four-Sided, Structural-Sealant Glazing: Perform quality-control procedures complying with recommendations in ASTM C 1401 including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.

1.3 EXECUTION

A. Installation

1. General:
 - a. Comply with manufacturer's written instructions.
 - b. Do not install damaged components.
 - c. Fit joints to produce hairline joints free of burrs and distortion.
 - d. Rigidly secure nonmovement joints.
 - e. Install anchors with separators and isolators to prevent metal corrosion, electrolytic deterioration, and impediments to movement of joints.
 - f. Weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
 - g. Seal joints watertight unless otherwise indicated.
2. Metal Protection:
 - a. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer, applying sealant or tape, or installing nonconductive spacers as recommended by manufacturer for this purpose.
 - b. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
 - c. Where aluminum will contact pressure-treated wood, separate dissimilar materials by method recommended by sloped glazing assembly manufacturer.
3. Install continuous sill closure with weatherproof expansion joints and locked and sealed or welded corners. Locate weep holes at rafters.
4. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the sloped glazing assembly to exterior.
5. Install components plumb and true in alignment with established lines and grades.
6. Install glazing as specified in Division 08 Section "Glazing".
 - a. Two-Sided, Structural-Sealant Glazing:
 - 1) Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
 - 2) Install weatherseal sealant according to Division 08 Section "Glazing" and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.

B. Erection Tolerances

1. General: Install sloped glazing assemblies to comply with the following maximum tolerances:
 - a. Level: 1/8 inch in 20 feet (3 mm in 6 m); 1/4 inch in 40 feet (6 mm in 12 m).
 - b. Alignment: Limit offset from true alignment to 1/32 inch (0.8 mm) where surfaces abut in line, edge to edge, at corners, or where a reveal or protruding element separates aligned surfaces by less than 3 inches (76 mm); otherwise limit offset to 1/8 inch (3 mm).



- c. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet (3 mm in 3.7 m); 1/2 inch (13 mm) over total length.

C. Field Quality Control

1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
2. Testing Services: Testing and inspecting of representative areas of sloped glazing assemblies shall take place as installation proceeds to determine compliance of installed assemblies with specified requirements.
 - a. Structural-Sealant Adhesion: Test structural sealant according to recommendations in ASTM C 1401, Destructive Test Method A, "Hand Pull Tab (Destructive)," Appendix X2.
 - 1) Test a minimum of two **OR** four **OR** six, **as directed**, areas on each assembly face.
 - 2) Repair installation areas damaged by testing.
 - b. Air Infiltration: Areas shall be tested for air leakage of 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article, but not more than 0.50 cfm/sq. ft. (2.25 L/s per sq. m), of assembly surface area when tested according to ASTM E 783 at a minimum static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa) **OR** 6.24 lbf/sq. ft. (300 Pa), **as directed**.
 - 1) Test Area: One bay wide, but not less than 30 by 30 feet (9.1 by 9.1 m) of sloped glazing assembly.
 - 2) Perform a minimum of two **OR** three, **as directed**, tests in areas as directed by the Owner.
OR
Perform tests in each test area as directed by the Owner. Perform at least three tests prior to 10, 35, and 70 percent completion.
 - c. Water Penetration: Areas shall be tested according to ASTM E 1105 at a minimum uniform and cyclic static-air-pressure difference of 0.67 times the static-air-pressure difference specified for laboratory testing in "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft. (300 Pa), and shall not evidence water penetration.
 - 1) Test Area: One bay wide, but not less than 30 by 30 feet (9.1 by 9.1 m) of sloped glazing assembly.
 - 2) Perform a minimum of two **OR** three tests in areas as directed by the Owner.
OR
Perform tests in each test area as directed by the Owner. Perform at least three tests prior to 10, 35, and 70 percent completion.
 - d. Water-Spray Test: Before installation of interior finishes has begun, areas designated by the Owner shall be tested according to AAMA 501.2 and shall not evidence water penetration.
 - 1) Test Area: A minimum area of 30 by 30 feet (9.1 by 9.1 m) of sloped glazing assembly.
3. Sloped glazing assemblies will be considered defective if they do not pass tests and inspections.
4. Prepare test and inspection reports.

END OF SECTION 08 44 13 00b



SECTION 08 45 23 00 - UNIT SKYLIGHTS

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for unit skylights. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Self-flashing unit skylights with integral curb.
 - b. Unit skylights mounted on prefabricated **OR** site-built, **as directed**, curbs.

C. Performance Requirements

1. AAMA/WDMA Performance Requirements: Provide unit skylights of performance class and grade indicated that comply with AAMA/WDMA 101/I.S.2/NAFS unless more stringent performance requirements are indicated.
 - a. Performance Class and Grade:
 - 1) SKG-R15/15-1200x1200 **OR** SKP-R15/15-1200x1200, **as directed**.
 - 2) SKG-C30/30-1200x1200 **OR** SKP-C30/30-1200x1200, **as directed**.
 - 3) SKG-HC40/40-1200x2500 **OR** SKP-HC40/40-1200x2500, **as directed**.
 - 4) As indicated.
2. Windborne-Debris-Impact-Resistance Performance: Provide unit skylights that pass missile-impact and cyclic-pressure tests when tested according to ASTM E 1886 and testing information in ASTM E 1996 **OR** AAMA 506, **as directed**.
 - a. Large-Missile Impact: For unit skylights located within 30 feet (9.1 m) of grade.
 - b. Small-Missile Impact: For unit skylights located more than 30 feet (9.1 m) above grade.

D. Submittals

1. Product Data: For each type of unit skylight indicated.
2. Shop Drawings: For unit skylight work. Include plans, elevations, sections, details, and connections to supporting structure and other adjoining work.
 - a. Unit Skylight Operating System: Show locations, mounting, and details for installing operator components and controls.
 - b. Unit Skylight Operating System: Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
 - c. Wiring Diagrams: For power, signal, and control wiring for electric motors of operable unit skylights.
3. Samples: For each type of exposed finish required, in a representative section of each unit skylight in manufacturer's standard size.
4. Qualification Data.
5. Product Test Reports.
6. Field quality-control reports.
7. Maintenance Data: For unit skylights and unit skylight operating system to include in maintenance manuals.
8. Warranty: Sample of special warranty.

E. Quality Assurance

1. Manufacturer Qualifications: A manufacturer capable of fabricating unit skylights that meet or exceed performance requirements indicated and of documenting this performance by inclusion in lists and by labels, test reports, and calculations.



2. Installer Qualifications: An installer acceptable to unit skylight manufacturer for installation of units required for this Project.
 3. Surface-Burning Characteristics of Plastic Glazing: Provide plastic glazing sheets identical to those tested for fire-exposure behavior per test method indicated below by a testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
 - a. Self-Ignition Temperature: 650 deg F (343 deg C) or more for plastic sheets in thickness indicated when tested per ASTM D 1929.
 - b. Smoke-Production Characteristics: Comply with either requirement below:
 - 1) Smoke-Developed Index: 450 or less when tested per ASTM E 84 on plastic sheets in manner indicated for use.
 - 2) Smoke Density: 75 or less when tested per ASTM D 2843 on plastic sheets in thickness indicated for use.
 - c. Burning Characteristics: Tested per ASTM D 635.
 - 1) Acrylic Glazing: Class CC2, burning rate of 2-1/2 inches (64 mm) per minute or less for nominal thickness of 0.060 inch (1.5 mm) or thickness indicated for use.
 - 2) Polycarbonate Glazing: Class CC1, burning extent of 1 inch (25 mm) or less for nominal thickness of 0.060 inch (1.5 mm) or thickness indicated for use.
 - 3) Polycarbonate-Insulating-Panel Glazing: Class CC2, burning rate of 2-1/2 inches (64 mm) per minute or less for nominal thickness of 0.060 inch (1.5 mm) or thickness indicated for use.
 4. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 5. Unit Skylight Standard: Comply with AAMA/WDMA 101/I.S.2/NAFS, "North American Fenestration Standard Voluntary Performance Specification for Windows, Skylights and Glass Doors," for minimum standards of performance, materials, components, accessories, and fabrication. Comply with more stringent requirements if indicated.
 - a. Provide AAMA-certified unit skylights with an attached label.
 6. Preinstallation Conference: Conduct conference at Project site.
- F. Warranty
1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of unit skylights that fail in materials or workmanship within five years from date of Final Completion.

1.2 PRODUCTS

A. Materials

1. Aluminum Components:
 - a. Sheets: ASTM B 209 (ASTM B 209M), alloy and temper to suit forming operations and finish requirements but with not less than the strength and durability of alclad Alloy 3005-H25.
 - b. Extruded Shapes: ASTM B 221 (ASTM B 221M), alloy and temper to suit structural and finish requirements but with not less than the strength and durability of Alloy 6063-T52.
2. Fasteners: Same metal as metal being fastened, nonmagnetic stainless steel, or other noncorrosive metal as recommended by manufacturer. Finish exposed fasteners to match material being fastened.
 - a. Where removal of exterior exposed fasteners might allow access to building, provide nonremovable fastener heads.

B. Glazing

1. Acrylic Glazing: ASTM D 4802, thermoformable, monolithic sheet, category as standard with manufacturer, Finish 1 (smooth or polished), Type UVF (formulated with UV absorber).
 - a. Single-Glazing Profile: Dome, 25 percent rise **OR** Pyramid, 30-degree slope, **as directed**.



- 1) Thickness: As indicated **OR** Not less than thickness required to exceed performance requirements, **as directed**.
- 2) Color: Colorless, transparent **OR** White, translucent **OR** Bronze-tinted, transparent **OR** Gray-tinted, transparent, **as directed**.
- b. Double-Glazing Profile: Dome, 25 percent rise **OR** Pyramid, 30-degree slope, **as directed**.
 - 1) Thicknesses: As indicated **OR** Not less than thicknesses required to exceed performance requirements, **as directed**.
 - 2) Outer Glazing Color: Colorless, transparent **OR** White, translucent **OR** Bronze-tinted, transparent **OR** Gray-tinted, transparent, **as directed**.
 - 3) Inner Glazing Color: Colorless, transparent **OR** White, translucent **OR** Bronze-tinted, transparent **OR** Gray-tinted, transparent, **as directed**.
2. Polycarbonate Glazing: Thermoformable, extruded monolithic sheets, UV resistant, burglar-resistance rated per UL 972, and with average impact strength of 12 to 16 ft-lb/in. (640 to 854 J/m) of width when tested per ASTM D 256, Test Method A (Izod).
 - a. Single-Glazing Profile: Dome, 25 percent rise **OR** Pyramid, 30-degree slope, **as directed**.
 - 1) Thickness: As indicated **OR** Not less than thickness required to exceed performance requirements, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** As selected from full range of industry colors, **as directed**.
 - b. Double-Glazing Profile: Dome, 25 percent rise **OR** Pyramid, 30-degree slope, **as directed**.
 - 1) Thicknesses: As indicated **OR** Not less than thicknesses required to exceed performance requirements, **as directed**.
 - 2) Inner Glazing Color: As indicated by manufacturer's designations **OR** As selected from full range of industry colors, **as directed**.
 - 3) Outer Glazing Color: As indicated by manufacturer's designations **OR** As selected from full range of industry colors, **as directed**.
3. Insulating Glass: Clear, sealed units that comply with Division 08 Section "Glazing", in manufacturer's standard overall thickness.
 - a. Exterior Lite: 1/4-inch (6-mm) clear **OR** tinted, **as directed**, heat-strengthened **OR** fully tempered, **as directed**, glass.
 - b. Interior Lite:
 - 1) Laminated glass; 2 plies of 1/8-inch (3-mm) clear heat-strengthened glass with 0.030-inch (0.762-mm) clear polyvinyl butyral interlayer.
 - 2) 1/4-inch (6-mm) clear **OR** tinted, **as directed**, heat-strengthened **OR** fully tempered **OR** wire, **as directed**, glass.
 - c. Interspace Content: Air **OR** Argon, **as directed**.
 - d. Low-Emissivity Coating: Manufacturer's standard.
4. Polycarbonate-Insulating-Panel Glazing: Manufacturer's standard polycarbonate sheet with cellular cross section that provides isolated airspaces and that is coextruded with a UV-protective layer.
 - a. Thickness: As indicated **OR** Not less than thickness required to exceed performance requirements, **as directed**.
 - b. Color: As indicated by manufacturer's designations **OR** As selected from full range of industry colors, **as directed**.
5. Fiberglass-Sandwich-Panel Glazing: Manufacturer's standard with uniformly colored, translucent, fiberglass-reinforced-polymer face sheets permanently adhered to a grid core.
 - a. Thickness: As indicated **OR** Not less than thickness required to exceed performance requirements, **as directed**.
 - b. Color: As indicated by manufacturer's designations **OR** As selected from full range of industry colors, **as directed**.
6. Glazing Gaskets: Manufacturer's standard **OR** EPDM, neoprene, partially vulcanized butyl tape, or liquid-applied elastomeric sealant, **as directed**.

C. Installation Materials

1. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic, nominally free of sulfur and containing no asbestos fibers, formulated for 15-mil (0.4-mm) dry film thickness per coating.



2. Joint Sealants: As specified in Division 07 Section "Joint Sealants".
3. Mastix Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.
4. Roofing Cement: ASTM D 4586, asbestos free, designed for trowel application or other adhesive compatible with roofing system.

D. Unit Skylights

1. General: Provide factory-assembled unit skylights that include glazing, extruded-aluminum glazing retainers, gaskets, and inner frames and that are capable of withstanding performance requirements indicated.
2. Integral Curb: Extruded-aluminum **OR** Vinyl **OR** Reinforced-thermoset-fiberglass profile, **as directed**, self-flashing type.
 - a. Height: As indicated **OR** 8 inches (200 mm) **OR** 9 inches (225 mm) **OR** 12 inches (300 mm), **as directed**.
 - b. Construction: Single **OR** Double, **as directed**, wall.
 - c. Insulation: Manufacturer's standard rigid or semirigid type.
3. Prefabricated Curb: As specified in Division 07 Section "Roof Accessories".
4. Site-Built Curb: As indicated.
5. Unit Shape and Size: As indicated **OR** Square, 40-by-40-inch (1016-by-1016-mm) inside curb **OR** Rectangular, 40-by-48-inch (1016-by-1220-mm) inside curb **OR** Circular, 40-inch- (1016-mm-) diameter inside curb, **as directed**.
6. Condensation Control: Fabricate unit skylights with integral internal gutters and non-clogging weeps to collect and drain condensation to the exterior.
7. Thermal Break: Fabricate unit skylights with thermal barrier separating exterior and interior metal framing.
8. Operable Unit Skylight System: Equip vent-type unit skylights with manufacturer's standard hinges, chain-driven operating hardware, and weather-sealing gaskets.
 - a. Manual Operator: Manufacturer's standard, rotary-crank extension device.
 - 1) Pole Operator: Manual, 60 inches (1524 mm) long **OR** Manual, telescoping to 144 inches (3658 mm) **OR** Rechargeable-motor power-driven type, telescoping to 144 inches (3658 mm), **as directed**.
 - b. Motor Operator: Manufacturer's standard electronic control, including switch, transformer, low-voltage motor, cover, and mounting hardware.
 - 1) Provide motor of size and capacity recommended by unit skylight manufacturer to suit unit skylight indicated.
 - 2) Provide rain sensor that automatically closes venting unit when water is detected.
 - 3) Provide motor operator with portable remote-control device.
9. Security Grilles: 1/2-inch- (13-mm-) diameter, hardened steel bars spaced not more than 5 inches (130 mm) o.c. in 1 direction and 16 inches (400 mm) o.c. in other direction **OR** 5 inches (130 mm) o.c. in both directions, **as directed**.
10. Protective Screens: Manufacturer's standard to protect interior glazing lite from breakage **OR** personnel from falls **OR** against windborne debris **OR** against hail, **as directed**.

E. General Finish Requirements

1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

F. Aluminum Finishes

1. Mill Finish: Manufacturer's standard.
2. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm **OR** AA-M12C22A31, Class II, 0.010 mm, **as directed**, or thicker.
3. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm **OR** AA-M12C22A32/A34, Class II, 0.010 mm, **as directed**, or thicker.



- a. Color: As selected from full range of industry colors and color densities.
4. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
5. High-Performance Organic Finish: 2-coat fluoropolymer finish complying with AAMA 2604 **OR** AAMA 2605, **as directed**, and containing not less than 50 **OR** 70, **as directed**, percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
6. High-Performance Organic Finish: 3 **OR** 4, **as directed**, -coat fluoropolymer finish complying with AAMA 2605 and containing not less than 50 **OR** 70, **as directed**, percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

1.3 EXECUTION

A. Installation

1. Coordinate installation of unit skylight with installation of substrates, vapor retarders, roof insulation, roofing membrane, and flashing as required to ensure that each element of the Work performs properly and that combined elements are waterproof and weathertight.
2. Comply with recommendations in AAMA 1607 and with manufacturer's written instructions for installing unit skylights.
3. Install unit skylights level, plumb, and true to line, without distortion.
4. Anchor unit skylights securely to supporting substrates.
5. Where metal surfaces of unit skylights will contact incompatible metal or corrosive substrates, including preservative-treated wood, apply bituminous coating on concealed metal surfaces, or provide other permanent separation recommended in writing by unit skylight manufacturer.
6. Set unit skylight flanges in thick bed of roofing cement to form a seal unless otherwise indicated.
7. Where cap flashing is indicated, install to produce waterproof overlap with roofing or roof flashing. Seal with thick bead of mastic sealant except where overlap is indicated to be left open for ventilation.

B. Field Quality Control

1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
2. After completion of installation and nominal curing of sealant and glazing compounds but before installation of interior finishes, test for water leaks according to AAMA 501.2.
3. Perform test for total area of each unit skylight.
4. Work will be considered defective if it does not pass tests and inspections.
5. Additional testing and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

C. Cleaning

1. Clean exposed unit skylight surfaces according to manufacturer's written instructions. Touch up damaged metal coatings and finishes.
2. Remove excess sealants, glazing materials, dirt, and other substances.
3. Remove and replace glazing that has been broken, chipped, cracked, abraded, or damaged during construction period.
4. Protect unit skylight surfaces from contact with contaminating substances resulting from construction operations.



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5. Unit Skylight Operating System: Clean and lubricate joints and hardware. Adjust for proper operation.

END OF SECTION 08 45 23 00



SECTION 08 45 23 00a - METAL-FRAMED SKYLIGHTS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of material for metal-framed skylights. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes aluminum-framed skylights with the following characteristics:
 - a. Glazing is glass **OR** plastic, **as directed**.
 - b. Glazing is retained by field-installed pressure caps on four sides **OR** field-installed structural sealant at horizontal members (purlins) and pressure caps at rafters **OR** factory-installed structural sealant on four sides, **as directed**.

C. Performance Requirements

1. Provide metal-framed skylights, including anchorage, capable of withstanding, without failure, the effects of the following:
 - a. Structural loads.
 - b. Thermal movements.
 - c. Movements of supporting structure.
 - d. Dimensional tolerances of building frame and other adjacent construction.
2. Failure includes the following:
 - a. Deflection exceeding specified limits.
 - b. Water leakage.
 - c. Thermal stresses transferred to building structure.
 - d. Noise or vibration created by wind and thermal and structural movements.
 - e. Framing members transferring stresses, including those caused by thermal and structural movements, to glazing.
 - f. Loosening or weakening of fasteners, attachments, and other components.
 - g. Sealant failure.
3. Structural Loads:
 - a. Wind Loads: As indicated by structural design data on Drawings **OR as directed**.
 - b. Snow Loads: As indicated by structural design data on Drawings **OR as directed**.
 - c. Concentrated Live Loads: 250 lbf (1112 N) applied to framing members at locations that will produce greatest stress or deflection.
 - d. Seismic Loads: As indicated by earthquake design data on Drawings **OR as directed**.
 - e. Load Combinations: Calculate according to requirements of applicable code indicated on Drawings **OR as directed**.
4. Deflection of Framing Members:
 - a. Deflection Normal to Glazing Plane:
 - 1) Spans Up to 20 Feet (6 m): Limited to 1/175 **OR** 1/180, **as directed**, of clear span or 1 inch (25.4 mm), whichever is smaller.
 - 2) Spans Exceeding 20 Feet (6 m): Limited to 1/240 of clear span.
 - 3) Glass Edge Deflection: Limit edge deflection of individual glass lites to 3/4 inch (19 mm).
 - b. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch (3.2 mm), whichever is smaller **OR** amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch (3.2 mm), **as directed**.



5. Lateral Bracing of Framing Members: Compression flanges of flexural members are laterally braced by cross members with minimum depth equal to 50 percent of flexural member that is braced. Glazing does not provide lateral support.
6. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
7. Structural-Sealant Glazing:
 - a. Structural Sealant: Capable of withstanding tensile and shear stresses imposed by metal-framed skylight assemblies without failing adhesively or cohesively. Sealant fails cohesively before sealant releases from substrate when tested for adhesive compatibility with each substrate and joint condition required.
 - 1) Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
 - 2) Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate because sealant-to-substrate bond strength exceeds sealant's internal strength.
 - b. Structural-Sealant Joints: Designed to produce tensile or shear stress in structural-sealant joints of less than 20 psi (138 kPa).
 - 1) Structural-sealant joints do not carry gravity loads of glazing.

D. Performance Testing

1. Provide metal-framed skylights that comply with test-performance requirements indicated, as evidenced by reports of tests performed on manufacturer's standard assemblies by a qualified independent testing agency.
2. Structural-Performance Test: ASTM E 330.
 - a. Performance at Design Load: When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
 - b. Performance at Maximum Test Load: When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main supporting members exceeding 0.2 percent of span.
 - c. Test Durations: As required by design wind velocity but not less than 10 seconds.
3. Air-Infiltration Test: ASTM E 283.
 - a. Minimum Static-Air-Pressure Difference: 1.57 lbf/sq. ft. (75 Pa) which is equivalent to a 25-mph (40-km/h) wind **OR** 6.24 lbf/sq. ft. (300 Pa) which is equivalent to a 50-mph (80-km/h) wind, **as directed**.
 - b. Maximum Air Leakage: 0.06 cfm/sq. ft. (0.30 L/s per sq. m).
4. Test for Water Penetration under Static Pressure: ASTM E 331.
 - a. Minimum Static-Air-Pressure Difference: 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).
 - b. Water Leakage: None.
5. Test for Water Penetration under Dynamic Pressure: AAMA 501.1.
 - a. Dynamic Pressure: 20 percent of positive wind-load design pressure, but not less than 12 lbf/sq. ft. (574 Pa).
 - b. Water Leakage: None, as defined by AAMA 501.1 **OR** No uncontrolled water penetrating systems or appearing on systems' normally exposed interior surfaces from sources other than condensation, **as directed**. Water controlled by flashing and gutters that is drained to exterior and cannot damage adjacent materials or finishes is not considered water leakage.

E. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittal:



- a. Product Data for Credit EQ 4.1: For sealants used inside of the weatherproofing system, including printed statement of VOC content.
 3. Shop Drawings: For metal-framed skylights. Include plans, elevations, sections, details, and attachments to other work.
 - a. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 4. Samples: For each exposed finish.
 5. Compatibility Test Reports: For structural-sealant-glazed skylights, preconstruction test reports from structural- and nonstructural-sealant manufacturer indicating that materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants. Include sealant manufacturer's interpretation of test results for sealant performance and written recommendations for primers and substrate preparation needed for adhesion.
 6. Field quality-control test and inspection reports.
 7. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for metal-framed skylights.
 8. Structural-Sealant-Glazing, Quality-Control Program: Developed specifically for Project.
 9. Structural-Sealant-Glazing, Quality-Control Program Reports: Documenting quality-control procedures and verifying results for metal-framed skylights.
 10. Maintenance Data: For metal-framed skylights to include in maintenance manuals.
 11. Warranties: Special warranties specified in this Section.
- F. Quality Assurance
1. Installer Qualifications: Entity capable of assuming engineering responsibility and performing work of this Section and who is acceptable to manufacturer.
 2. Compatibility Testing: For structural-sealant-glazed skylights, perform structural- and nonstructural-sealant manufacturer's standard preconstruction tests for compatibility and adhesion of sealants with each material that will come in contact with sealants and each condition required by metal-framed skylights.
 3. Welding: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code - Aluminum."
 4. Structural-Sealant Glazing: Comply with recommendations in ASTM C 1401, "Guide for Structural Sealant Glazing," for joint design and quality-control procedures.
 - a. Joint designs are reviewed and approved by structural-sealant manufacturer.
 5. Preinstallation Conference: Conduct conference at Project site.
- G. Warranty
1. Special Assembly Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal-framed skylights that fail in materials or workmanship within specified warranty period.
 - a. Failures include, but are not limited to, the following:
 - 1) Structural failures including, but not limited to, excessive deflection.
 - 2) Noise or vibration caused by thermal movements.
 - 3) Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 4) Adhesive or cohesive sealant failures.
 - 5) Water leakage.
 - b. Warranty Period: Two **OR** Five **OR** 10, **as directed**, years from date of Final Completion.
 2. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.
 - a. Failures include, but are not limited to, checking, crazing, peeling, chalking, and fading of finishes.
 - b. Warranty Period: Five **OR** 10 **OR** 20, **as directed**, years from date of Final Completion.



1.2 PRODUCTS

A. Framing Systems

1. Aluminum: Alloy and temper recommended in writing by manufacturer for type of use and finish indicated.
 - a. Sheet and Plate: ASTM B 209 (ASTM B 209M).
 - b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
 - c. Extruded Structural Pipe and Tubes: ASTM B 429.
2. Pressure Caps: Manufacturer's standard aluminum components that mechanically retain glazing.
 - a. Include snap-on aluminum trim that conceals fasteners.
3. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning skylight components.
4. Anchors, Fasteners, and Accessories: Manufacturer's standard, corrosion-resistant, nonstaining, and nonbleeding; compatible with adjacent materials.
 - a. At pressure caps, use ASTM A 193/A 193M, 300 series stainless-steel screws.
 - b. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
 - c. Exposed Fasteners:
 - 1) Use exposed fasteners with countersunk Phillips screw heads.
 - d. Finish exposed portions to match framing system.
 - e. At movement joints, use slip-joint linings, spacers, and sleeves of material and type recommended in writing by manufacturer.
5. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.
6. Anchor Bolts: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6), hot-dip zinc coating, ASTM A 153/A 153M, Class C **OR** mechanically deposited zinc coating, ASTM B 695, Class 50, **as directed**.
7. Concealed Flashing: Manufacturer's standard, corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials **OR** Dead-soft, 0.018-inch- (0.457-mm-) thick stainless steel, ASTM A 240/A 240M of type recommended in writing by manufacturer, **as directed**.
8. Exposed Flashing and Closures: Manufacturer's standard aluminum components not less than 0.030 inch (0.762 mm) **OR** 0.040 inch (1.016 mm) **OR** 0.060 inch (1.524 mm), **as directed**, thick.
9. Framing Gaskets: Manufacturer's standard.
10. Framing Sealants: As recommended in writing by manufacturer **OR** specified in Division 07 Section "Joint Sealants", **as directed**.
 - a. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Glazing Systems

1. Glazing: As specified in Division 08 Section(s) "Glazing" **OR** "Plastic Glazing", **as directed**.
2. Spacers, Setting Blocks, and Gaskets: Manufacturer's standard elastomeric types **OR** As specified in Division 08 Section "Glazing", **as directed**.
3. Bond-Breaker Tape: Manufacturer's standard tetrafluoroethylene-fluorocarbon or polyethylene material to which sealants will not develop adhesion.
4. Glazing Sealants: As recommended in writing by manufacturer **OR** specified in Division 07 Section "Joint Sealants", **as directed**.
 - a. Provide sealants for use inside of the weatherproofing system that have a VOC content as indicated when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Structural Sealant: ASTM C 1184, neutral-curing silicone formulation compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant, and approved by structural-sealant manufacturer for use in metal-framed skylights indicated.
 - 1) VOC Content: 100 g/L or less.
 - 2) Color: Black **OR** As selected from manufacturer's full range, **as directed**.



- c. Weatherseal Sealant: ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O; neutral-curing silicone formulation compatible with structural sealant and other components with which it comes in contact; and recommended in writing by structural- and weatherseal-sealant and metal-framed skylight manufacturers for this use.
 - 1) VOC Content: 250 g/L or less.
 - 2) Color: Matching structural sealant.
- C. Accessory Materials
 1. Insulating Materials: Specified in Division 07 Section "Thermal Insulation".
 2. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.
- D. Fabrication
 1. Fabricate aluminum components before finishing.
 2. Fabricate aluminum components that, when assembled, have the following characteristics:
 - a. Profiles that are sharp, straight, and free of defects or deformations.
 - b. Accurately fitted joints with ends coped or mitered.
 - c. Internal guttering systems or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within skylight to exterior.
 - d. Physical and thermal isolation of glazing from framing members.
 - e. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 3. Fabricate aluminum sill closures with weep holes and for installation as continuous component.
 4. Reinforce aluminum components as required to receive fastener threads.
 5. Weld aluminum components in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
 6. Factory-Glazed Units:
 - a. Factory install glazing to comply with requirements in Division 08 Section(s) "Glazing" OR "Plastic Glazing", **as directed**.
 - b. Prepare surfaces that will contact structural sealant according to structural-sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
 7. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.
- E. Aluminum Finishes
 1. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 2. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
 3. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.
 4. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
 5. Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
 - a. Color: Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black **OR** Match sample **OR** As selected from full range of industry colors and color densities, **as directed**.
 6. High-Performance Organic Finish (2-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive



primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2604 **OR** AAMA 2605, **as directed**, and with coating and resin manufacturers' written instructions.

7. High-Performance Organic Finish (3-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.
 - a. Color and Gloss: As selected from manufacturer's full range.

F. Source Quality Control

1. Structural-Sealant Glazing: Perform quality-control procedures complying with ASTM C 1401 recommendations including, but not limited to, material qualification procedures, sealant testing, and fabrication reviews and checks.

1.3 EXECUTION

A. Installation

1. General:
 - a. Comply with manufacturer's written instructions.
 - b. Do not install damaged components.
 - c. Fit joints between aluminum components to produce hairline joints free of burrs and distortion.
 - d. Rigidly secure nonmovement joints.
 - e. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
 - f. Weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
 - g. Seal joints watertight, unless otherwise indicated.
2. Metal Protection: Where aluminum will contact dissimilar materials, protect against galvanic action by painting contact surfaces with bituminous paint or by installing nonconductive spacers as recommended in writing by manufacturer for this purpose.
3. Install continuous aluminum sill closure with weatherproof expansion joints and locked and sealed or welded corners. Locate weep holes at rafters.
4. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within skylight to exterior.
5. Install components plumb and true in alignment with established lines and elevations.
6. Install glazing as specified in Division 08 Section(s) "Glazing" OR "Plastic Glazing", **as directed**.
 - a. Structural-Sealant Glazing:
 - 1) Prepare surfaces that will contact structural sealant according to structural-sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
 - 2) Install weatherseal sealant according to Division 07 Section "Joint Sealants" and according to weatherseal-sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind weatherseal sealant as recommended in writing by weatherseal-sealant manufacturer.
7. Install insulation materials as specified in Division 07 Section "Thermal Insulation".
8. Erection Tolerances: Install metal-framed skylights to comply with the following maximum tolerances:



- a. Alignment: Limit offset from true alignment to 1/32 inch (0.8 mm) where surfaces abut in line, edge to edge, at corners, or where a reveal or protruding element separates aligned surfaces by less than 3 inches (76 mm); otherwise, limit offset to 1/8 inch (3.2 mm).
 - b. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet (3.2 mm in 3.7 m) but no greater than 1/2 inch (13 mm) over total length.
- B. Field Quality Control
- a. Structural-Sealant Compatibility and Adhesion: Structural sealant shall be tested according to recommendations in ASTM C 1401.
 - 1) Destructive test method, Method A, Hand Pull Tab (Destructive) in ASTM C 1401, Appendix X2, shall be used.
 - a) A minimum of one **OR** two, **as directed**, area(s) on each skylight face shall be tested.
 - b) Repair installation areas damaged by testing.
 - b. Structural-Sealant Glazing Inspection: After installation of metal-framed skylights is complete, structural-sealant glazing shall be inspected and evaluated according to ASTM C 1401 recommendations for quality-control procedures.
 - c. Water Penetration under Static Pressure: Before installation of interior finishes has begun, areas shall be tested according to ASTM E 1105.
 - 1) Test Procedures: Test under uniform and cyclic static air pressure.
 - 2) Water Penetration: None.
 - d. Water-Spray Test: Before installation of interior finishes has begun, skylights shall be tested according to AAMA 501.2 and shall not evidence water penetration.
2. Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.
 3. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

END OF SECTION 08 45 23 00a



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SECTION 08 45 23 00b - STRUCTURED-POLYCARBONATE-PANEL ASSEMBLIES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of material for structured-polycarbonate-panel assemblies. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes aluminum-framed assemblies glazed with multiwalled (structured) polycarbonate panels as follows:
 - a. Wall assemblies.
 - b. Roof (sloped, overhead) assemblies.
 - c. Skylight assemblies.

C. Performance Requirements

1. Provide assemblies, including anchorage, capable of withstanding, without failure, the effects of the following:
 - a. Structural loads.
 - b. Thermal movements.
 - c. Movements of supporting structure.
 - d. Dimensional tolerances of building frame and other adjacent construction.
2. Failure includes the following:
 - a. Deflection exceeding specified limits.
 - b. Water leakage.
 - c. Thermal stresses transferred to building structure.
 - d. Noise or vibration created by wind and thermal and structural movements.
 - e. Loosening or weakening of fasteners, attachments, and other components.

D. Structural Loads:

- a. Wind Loads: As indicated by structural design data on Drawings **OR as directed**.
 - b. Snow Loads: As indicated by structural design data on Drawings **OR as directed**.
 - c. Concentrated Live Loads on Overhead Assemblies: 300 lbf (1334 N) applied to assemblies at locations that will produce greatest stress or deflection.
 - d. Seismic Loads: As indicated by earthquake design data on Drawings **OR as directed**.
 - e. Load Combinations: Calculate according to requirements of applicable code indicated on Drawings **OR as directed**.
2. Deflection of Assemblies:
 - a. Vertical Assemblies: Limited to 1/100 of clear span for each assembly component.
 - b. Overhead Assemblies: Limited to 1/100 **OR** 1/180, **as directed**, of clear span for each assembly component.
 3. Roof Assemblies: Class A **OR B OR C, as directed**, per ASTM E 108 or UL 790.
 4. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

E. Performance Testing

1. Provide assemblies that comply with test-performance requirements indicated, as evidenced by reports of tests performed on manufacturer's standard assemblies by a qualified independent testing agency.



2. Structural-Performance Test: ASTM E 330.
 - a. Performance at Design Load: When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
 - b. Performance at Maximum Test Load: When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main supporting members exceeding 0.2 percent of span.
 - c. Test Durations: As required by design wind velocity but not less than 10 seconds.
3. Air-Infiltration Test: ASTM E 283.
 - a. Minimum Static-Air-Pressure Difference: 1.57 lbf/sq. ft. (75 Pa) **OR** 6.24 lbf/sq. ft. (300 Pa), **as directed**.
 - b. Maximum Air Leakage: 0.06 cfm/sq. ft. (0.30 L/s per sq. m).
4. Test for Water Penetration under Static Pressure: ASTM E 331.
 - a. Minimum Static-Air-Pressure Difference: 20 percent of positive wind-load design pressure, but not less than 15 lbf/sq. ft. (718 Pa).
 - b. Water Leakage: None.
5. Test for Water Penetration under Dynamic Pressure: AAMA 501.1.
 - a. Dynamic Pressure: 20 percent of positive wind-load design pressure, but not less than 15 lbf/sq. ft. (718 Pa).
 - b. Water Leakage: None, as defined by AAMA 501.1 **OR** No uncontrolled water penetrating systems or appearing on systems' normally exposed interior surfaces from sources other than condensation, **as directed**. Water controlled by flashing and gutters that is drained to exterior and cannot damage adjacent materials or finishes is not considered water leakage.

F. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittal:
 - a. Product Data for Credit EQ 4.1: For sealants used inside of the weatherproofing system, documentation including printed statement of VOC content.
3. Shop Drawings: For assemblies. Include plans, elevations, sections, details, and attachments to other work.
 - a. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
4. Samples: For each exposed finish.
5. Field quality-control test reports.
6. Product test reports.
7. Maintenance data.
8. Special warranties specified in this Section.

G. Quality Assurance

1. Installer Qualifications: Entity capable of assuming engineering responsibility and performing work of this Section and who is acceptable to manufacturer.
2. Fire-Test-Response Characteristics: Where fire-test-response characteristics are indicated for assemblies and components, provide products identical to those tested per test method indicated by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
3. Welding: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code - Aluminum."
4. Preinstallation Conference: Conduct conference at Project site.

H. Warranty

1. Special Assembly Warranty: Manufacturer's standard form in which manufacturer and Installer agree to repair or replace components of assemblies that fail in materials or workmanship within specified warranty period.
 - a. Failures include, but are not limited to, the following:
 - 1) Structural failures including, but not limited to, excessive deflection.



- 2) Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 3) Water leakage.
 - b. Warranty Period: Two **OR** Five, **as directed**, years from date of Final Completion.
2. Special Structured-Polycarbonate-Panel Warranty: Manufacturer's standard form agreeing to replace polycarbonate sheet that breaks or develops defects from normal use that are attributed to manufacturing process and not to practices for maintaining and cleaning products contrary to manufacturer's written instructions.
 - a. Defects include, but are not limited to, the following:
 - 1) Delamination.
 - 2) Color changes from original in excess of 3.0 units Delta E when measured per ASTM D 2244.
 - 3) Losses in light transmission beyond 6 percent from original when measured per ASTM D 1003.
 - b. Warranty Period: 10 years from date of Final Completion.
3. Special Aluminum-Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.
 - a. Failures include, but are not limited to, checking, crazing, peeling, chalking, and fading of finishes.
 - b. Warranty Period: Five **OR** 10 **OR** 20, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Aluminum Framing Systems

1. Aluminum: Alloy and temper recommended in writing by manufacturer for type of use and finish indicated.
 - a. Sheet and Plate: ASTM B 209 (ASTM B 209M).
 - b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
 - c. Extruded Structural Pipe and Tubes: ASTM B 429.
2. Components: Manufacturer's standard extruded-aluminum members of thickness required and reinforced as required to support imposed loads.
 - a. Construction: One-piece extruded-aluminum components **OR** Thermally broken; framing members are composite assemblies of two separate extruded-aluminum components permanently bonded by a material of low thermal conductance, **as directed**.
3. Exposed Flashing and Closures: Manufacturer's standard aluminum components not less than 0.040 inch (1.016 mm) **OR** 0.060 inch (1.524 mm), **as directed**, thick.
4. Framing Gaskets: Manufacturer's standard.
5. Framing Sealants: As recommended in writing by manufacturer **OR** specified in Division 07 Section "Joint Sealants", **as directed**.
 - a. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Anchors, Fasteners, and Accessories: Manufacturer's standard, corrosion-resistant, nonstaining, and nonbleeding; compatible with adjacent materials.
 - a. At closures, retaining caps, or battens, use ASTM A 193/A 193M, 300 series stainless-steel screws.
 - b. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
 - c. At movement joints, use slip-joint linings, spacers, and sleeves of material and type recommended in writing by manufacturer.
7. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.
8. Anchor Bolts: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6), hot-dip zinc coating, ASTM A 153/A 153M, Class C **OR** mechanically deposited zinc coating, ASTM B 695, Class 50, **as directed**.



9. Framing System Fabrication:
 - a. Fabricate components before finishing.
 - b. Fabricate components that, when assembled, have the following characteristics:
 - 1) Profiles that are sharp, straight, and free of defects or deformations.
 - 2) Accurately fitted joints with ends coped or mitered.
 - 3) Internal guttering systems or other means to drain water passing joints, condensation occurring within components, and moisture migrating within assembly to exterior.
 - c. Fabricate sill closures with weep holes and for installation as continuous component.
 - d. Reinforce components as required to receive fastener threads.
 - e. Weld components in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- B. Structured Polycarbonate Panels
1. General: Translucent, extruded-polycarbonate sheet with cellular cross section that provides isolated airspaces and that is coextruded with a UV-protective layer.
 - a. Plastic Self-Ignition Temperature: 650 deg F (343 deg C) or more per ASTM D 1929.
 - b. Burning Extent: 1 inch (25 mm) or less per ASTM D 635.
 - c. Burning Rate: 2.5 in./min. (1.06 mm/s) or less per ASTM D 635.
 - d. Smoke-Developed Index: 450 or less per ASTM E 84, or 75 or less per ASTM D 2843.
 - e. Flame-Spread Index: Not more than 25 per ASTM E 84.
 - f. Exterior-Fire-Exposure Class: Class A **OR** B **OR** C, **as directed**, per ASTM E 108 or UL 790.
 2. Panel U-Factor: Not more than 0.73 (4.15) **OR** 0.63 (3.58) **OR** 0.48 (2.73) **OR** 0.38 (2.16) **OR** 0.24 (1.36) **OR** 0.22 (1.25), **as directed**, measured in Btu/sq. ft. x h x deg F (W/sq. m x K) according to ASTM C 1363 and using procedures described in ASTM C 1199 and ASTM E 1423.
 3. Color Stability: Not more than 3.0 units Delta E when measured according to ASTM D 2244 after outdoor weathering according to procedures in ASTM D 1435.
 - a. Outdoor Weathering Conditions: 60 months in Arizona or 120 months in a moderate North American climate.
 4. Impact Resistance: No failure at impact of 200 ft. x lbf (271 J) according to free-falling-ball impact test using a 3-1/2-inch- (89-mm-) diameter, 6.3-lb (2.9-kg) ball.
- C. Accessory Materials
1. Insulating Materials: Specified in Division 07 Section "Thermal Insulation".
 2. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.
- D. Aluminum Finishes
1. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 2. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
 3. Aluminum Anodic Finish: Class I, clear anodic coating complying with AAMA 611 **OR** Class I, color anodic coating complying with AAMA 611, **as directed**.
 - a. Color: Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black **OR** Match sample **OR** As selected from full range of industry colors and densities, **as directed**.
 4. Aluminum High-Performance Organic Finish: Two-coat **OR** Three-coat, **as directed**, thermocured system with fluoropolymer topcoats containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2604 **OR** AAMA 2605, **as directed**.
 - a. Color and Gloss: As selected from manufacturer's full range.



1.3 EXECUTION

A. Installation

1. General:
 - a. Comply with manufacturer's written instructions.
 - b. Do not install damaged components.
 - c. Fit joints between aluminum components to produce hairline joints free of burrs and distortion.
 - d. Rigidly secure nonmovement joints.
 - e. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
 - f. Weld aluminum components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
 - g. Seal joints watertight, unless otherwise indicated.
2. Metal Protection: Where aluminum components will contact dissimilar materials, protect against galvanic action by painting contact surfaces with bituminous paint or by installing nonconductive spacers as recommended in writing by manufacturer for this purpose.
3. Install continuous aluminum sill closures with weatherproof expansion joints and locked and sealed or welded corners. Locate weep holes at rafters.
4. Install components to drain water passing joints, condensation occurring within aluminum members, and moisture migrating within assembly to exterior.
5. Install components plumb and true in alignment with established lines and elevations.
6. Install insulation materials as specified in Division 07 Section "Thermal Insulation".
7. Erection Tolerances: Install assemblies to comply with the following maximum tolerances:
 - a. Alignment: Limit offset from true alignment to 1/32 inch (0.8 mm) where surfaces abut in line, edge to edge, at corners, or where a reveal or protruding element separates aligned surfaces by less than 3 inches (76 mm); otherwise, limit offset to 1/8 inch (3.2 mm).
 - b. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet (3.2 mm in 3.7 m); 1/2 inch (13 mm) over total length.

B. Field Quality Control

1. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
2. Testing Services: Testing and inspecting of representative areas to determine compliance of installed assemblies with specified requirements shall take place as follows and in successive stages as indicated on Drawings. Do not proceed with installation of the next area until test results for previously completed areas show compliance with requirements.
 - a. Water Penetration under Static Pressure: Before installation of interior finishes has begun, areas shall be tested according to ASTM E 1105.
 - 1) Test Procedures: Test under uniform and cyclic static air pressure.
 - 2) Static-Air-Pressure Difference: as directed by the Owner.
 - 3) Water Penetration: None.
 - b. Water-Spray Test: Before installation of interior finishes has begun, assemblies shall be tested according to AAMA 501.2 and shall not evidence water penetration.
3. Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.
4. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

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SECTION 08 45 23 00c - FIBERGLASS-SANDWICH-PANEL ASSEMBLIES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of material for fiberglass-sandwich-panel assemblies. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes assemblies incorporating fiberglass sandwich panels and aluminum frame systems as follows:
 - a. Wall assemblies.
 - b. Roof (sloped, overhead) assemblies.
 - c. Skylight assemblies.

C. Performance Requirements

1. Provide assemblies, including anchorage, capable of withstanding, without failure, the effects of the following:
 - a. Structural loads.
 - b. Thermal movements.
 - c. Movements of supporting structure.
 - d. Dimensional tolerances of building frame and other adjacent construction.
2. Failure includes the following:
 - a. Deflection exceeding specified limits.
 - b. Water leakage.
 - c. Thermal stresses transferred to building structure.
 - d. Noise or vibration created by wind and thermal and structural movements.
 - e. Loosening or weakening of fasteners, attachments, and other components.
 - f. Delamination of fiberglass-sandwich-panel faces from panel cores.
3. Structural Loads:
 - a. Wind Loads: As indicated by structural design data on Drawings **OR as directed**.
 - b. Snow Loads: As indicated by structural design data on Drawings **OR as directed**.
 - c. Concentrated Live Loads on Overhead Assemblies: 300 lbf (1334 N) applied to assemblies at locations that will produce greatest stress or deflection.
 - d. Seismic Loads: As indicated by earthquake design data on Drawings **OR as directed**.
 - e. Load Combinations: Calculate according to requirements of applicable code indicated on Drawings **OR as directed**.
4. Deflection of Assemblies:
 - a. Vertical Assemblies: Limited to 1/60 **OR** 1/90 **OR** 1/180, **as directed**, of clear span for each assembly component.
 - b. Overhead Assemblies: Limited to 1/60 **OR** 1/90 **OR** 1/180, **as directed**, of clear span for each assembly component.
5. Roof Assemblies: Class A per ASTM E 108 or UL 790.
6. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

D. Performance Testing



1. Provide assemblies that comply with test-performance requirements indicated, as evidenced by reports of tests performed on manufacturer's standard assemblies by a qualified independent testing agency.
2. Structural-Performance Test: ASTM E 330.
 - a. Performance at Design Load: When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
 - b. Performance at Maximum Test Load: When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main supporting members exceeding 0.2 percent of span.
 - c. Test Durations: As required by design wind velocity but not less than 10 seconds.
3. Air-Infiltration Test: ASTM E 283.
 - a. Minimum Static-Air-Pressure Difference: 1.57 lbf/sq. ft. (75 Pa) **OR** 6.24 lbf/sq. ft. (300 Pa), **as directed**.
 - b. Maximum Air Leakage: 0.06 cfm/sq. ft. (0.30 L/s per sq. m), **as directed**.
4. Test for Water Penetration under Static Pressure: ASTM E 331.
 - a. Minimum Static-Air-Pressure Difference: 20 percent of positive wind-load design pressure, but not less than 10 lbf/sq. ft. (479 Pa).
 - b. Water Leakage: None.
5. Test for Water Penetration under Dynamic Pressure: AAMA 501.1.
 - a. Dynamic Pressure: 20 percent of positive wind-load design pressure, but not less than 15 lbf/sq. ft. (718 Pa).
 - b. Water Leakage: None, as defined by AAMA 501.1 **OR** No uncontrolled water penetrating systems or appearing on systems' normally exposed interior surfaces from sources other than condensation, **as directed**. Water controlled by flashing and gutters that is drained to exterior and cannot damage adjacent materials or finishes is not considered water leakage.
6. Water-Penetration, Wind-Driven-Rain Test: Wind-driven-rain test in ICBO ES AC07, "Special Roofing Systems."
 - a. Water Leakage: None.

E. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittal:
 - a. Product Data for Credit EQ 4.1: For sealants used inside of the weatherproofing system, documentation including printed statement of VOC content.
3. Shop Drawings: For assemblies. Include plans, elevations, sections, details, and attachments to other work.
 - a. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
4. Field quality-control test reports.
5. Product test reports.
6. Maintenance data.
7. Special warranties specified in this Section.

F. Quality Assurance

1. Installer Qualifications: Entity capable of assuming engineering responsibility, including preparation of Shop Drawings, and performing work of this Section and who is acceptable to manufacturer.
2. Manufacturer Qualifications: For fiberglass sandwich panels, a qualified manufacturer whose facilities, processes, and products are monitored by an independent, accredited quality-control agency for compliance with applicable requirements in ICBO ES AC04, "Sandwich Panels."
3. Fire-Test-Response Characteristics: Where fire-test-response characteristics are indicated for assemblies and components, provide products identical to those tested per test method indicated by an independent testing and inspecting agency acceptable to authorities having jurisdiction.



4. Welding: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code - Aluminum."
5. NFRC Certification: Provide fiberglass sandwich panels that are certified for U-factors indicated according to NFRC 100 and listed in its "National Fenestration Council Incorporated - Certified Products Directory."
6. Preinstallation Conference: Conduct conference at Project site.

G. Warranty

1. Special Assembly Warranty: Manufacturer's standard form in which manufacturer and Installer agree to repair or replace components of assemblies that fail in materials or workmanship within specified warranty period.
 - a. Failures include, but are not limited to, the following:
 - 1) Structural failures including, but not limited to, excessive deflection.
 - 2) Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 3) Water leakage.
 - b. Warranty Period: Two **OR** Five, **as directed**, years from date of Final Completion.
2. Special Fiberglass-Sandwich-Panel Warranty: Manufacturer's standard form in which manufacturer agrees to replace panels that exhibit defects in materials or workmanship.
 - a. Defects include, but are not limited to, the following:
 - 1) Fiberbloom.
 - 2) Delamination of coating, if any, from exterior face sheet.
 - 3) Discoloration of exterior face sheet of more than 8.0 units Delta E when measured according ASTM D 2244.
 - 4) Delamination of panel face sheets from panel cores.
 - b. Warranty Period: 10 years from date of Final Completion.
3. Special Aluminum-Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.
 - a. Failures include, but are not limited to, checking, crazing, peeling, chalking, and fading of finishes.
 - b. Warranty Period: Five **OR** 10 **OR** 20, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Aluminum Frame Systems

1. Aluminum: Alloy and temper recommended in writing by manufacturer for type of use and finish indicated.
 - a. Sheet and Plate: ASTM B 209 (ASTM B 209M).
 - b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
 - c. Extruded Structural Pipe and Tubes: ASTM B 429.
2. Components: Manufacturer's standard extruded-aluminum members of thickness required and reinforced as required to support imposed loads.
 - a. Construction: One-piece extruded-aluminum components **OR** Thermally broken; framing members are composite assemblies of two separate extruded-aluminum components permanently bonded by a material of low thermal conductance, **as directed**.
3. Exposed Flashing and Closures: Manufacturer's standard aluminum components not less than 0.040 inch (1.016 mm) **OR** 0.060 inch (1.524 mm), **as directed**, thick.
4. Frame-System Gaskets: Manufacturer's standard.
5. Frame-System Sealants: As recommended in writing by manufacturer **OR** specified in Division 07 Section "Joint Sealants", **as directed**.
 - a. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Anchors, Fasteners, and Accessories: Manufacturer's standard, corrosion-resistant, nonstaining, and nonbleeding; compatible with adjacent materials.



- a. At closures, retaining caps, or battens, use ASTM A 193/A 193M, 300 series stainless-steel screws.
 - b. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
 - c. At movement joints, use slip-joint linings, spacers, and sleeves of material and type recommended in writing by manufacturer.
7. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.
 8. Anchor Bolts: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6), hot-dip zinc coating, ASTM A 153/A 153M, Class C **OR** mechanically deposited zinc coating, ASTM B 695, Class 50, **as directed**.
 9. Frame System Fabrication:
 - a. Fabricate components before finishing.
 - b. Fabricate components that, when assembled, have the following characteristics:
 - 1) Profiles that are sharp, straight, and free of defects or deformations.
 - 2) Accurately fitted joints with ends coped or mitered.
 - 3) Internal guttering systems or other means to drain water passing joints, condensation occurring within components, and moisture migrating within the assembly to exterior.
 - c. Fabricate sill closures with weep holes and for installation as continuous component.
 - d. Reinforce components as required to receive fastener threads.
 - e. Weld components in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- B. Fiberglass Sandwich Panels
1. Panel Construction: Assembly of uniformly colored, translucent, thermoset, fiberglass-reinforced-polymer face sheets bonded to both sides of a grid core and complying with requirements applicable to panel materials in ICBO ES AC04, "Sandwich Panels."
 - a. Face-Sheet, Self-Ignition Temperature: 650 deg F (343 deg C) or more per ASTM D 1929.
 - b. Face-Sheet Burning Extent: 1 inch (25 mm) or less per ASTM D 635.
 - c. Face-Sheet, Smoke-Developed Index: 450 or less per ASTM E 84.
 - d. Interior Face-Sheet, Flame-Spread Index: Not more than 25 **OR** 75, **as directed**, per ASTM E 84.
 - e. Roof-Covering Class: Class A **OR** Class A, burning brand test (only), **as directed**, per ASTM E 108 or UL 790.
 2. Panel Thickness: 2-3/4 inches (70 mm) **OR** 1-1/2 to 1-9/16 inches (38 to 40 mm), **as directed**.
 3. Panel U-Factor: Not more than 0.70 (3.97) **OR** 0.53 (3.01) **OR** 0.44 (2.50) **OR** 0.40 (2.27) **OR** 0.29 (1.65) **OR** 0.28 (1.59) **OR** 0.26 (1.48) **OR** 0.24 (1.36) **OR** 0.23 (1.31) **OR** 0.22 (1.25) **OR** 0.18 (1.02) **OR** 0.15 (0.85) **OR** 0.14 (0.79) **OR** 0.10 (0.57), **as directed**, measured in Btu/sq. ft. x h x deg F (W/sq. m x K) according to NFRC 100 or ASTM C 1363 using procedures described in ASTM C 1199 and ASTM E 1423.
 4. Panel Strength Characteristics:
 - a. Maximum Panel Deflection: 3-1/2 inches (89 mm) when a 4-by-12-foot (1.2-by-3.6-m) panel is tested according to ASTM E 72 at 34 lbf/ sq. ft. (1.6 kPa), with a maximum 0.090-inch (2.3-mm) set deflection after 5 minutes.
 - b. Panel Support Strength: Capable of supporting, without failure, a 300-lbf (1334 N) concentrated load when applied to a 3-inch- (76-mm-) diameter disk according to ASTM E 661.
 5. Grid Core: Mechanically interlocked extruded-aluminum I-beams, with a minimum flange width of 7/16 inch (11.1 mm).
 - a. Extruded Aluminum: ASTM B 221 (ASTM B 221M), in alloy and temper recommended in writing by manufacturer.



- b. I-Beam Construction: One-piece extruded-aluminum components **OR** Thermally broken; two separate extruded-aluminum components permanently bonded by a material of low thermal conductance, **as directed**.
 - c. Grid Pattern: Inline rectangle, nominal 12 by 24 inches (305 by 610 mm) **OR** Staggered rectangle, nominal 12 by 24 inches (305 by 610 mm) **OR** Square, nominal 12 inches (305 mm) **OR** As indicated on Drawings, **as directed**.
6. Exterior Face Sheet:
- a. Thickness: 0.070 inches (1.778 mm) **OR** 0.060 inches (1.524 mm) **OR** 0.052 inches (1.321 mm), **as directed**.
 - b. Color: White **OR** Crystal **OR** As selected from manufacturer's full range, **as directed**.
 - c. Color Stability: Not more than 3.0 **OR** 4.0 **OR** 7.0, **as directed**, units Delta E when measured according to ASTM D 2244 after outdoor weathering in southern Florida according to procedures in ASTM D 1435 with panels mounted facing south and as follows:
 - 1) Panel Mounting Angle: Not more than 5 **OR** 45, **as directed**, degrees from horizontal.
 - 2) Exposure Period: 60 months **OR** 30 months **OR** 60 months for vertical assemblies, 30 months for components of Class A roof assemblies, **as directed**.
 - d. Erosion Protection: Manufacturer's standard **OR** Integral, embedded glass erosion barrier **OR** Surface-applied, polyvinyl fluoride film not less than 1.0 mils (0.03 mm) thick, **as directed**.
 - e. Impact Resistance: No fracture or tear at impact of 60 ft. x lbf (81 J) **OR** 70 ft. x lbf (95 J) **OR** 230 ft. x lbf (312 J), **as directed**, by a 3-1/4-inch- (83-mm-) diameter, 5-lb (2.3-kg) free-falling ball according to test procedure in UL 972.
7. Interior Face Sheet:
- a. Thickness: 0.045 inch (1.143 mm) **OR** 0.060 inch (1.524 mm), **as directed**.
 - b. Color: White **OR** Crystal **OR** As selected from manufacturer's full range, **as directed**.
8. Fiberglass-Sandwich-Panel Adhesive: ASTM D 2559.
- a. Compatible with facing and core materials.
 - b. Tensile and shear bond strength of aged adhesive ensures permanent adhesion of facings to cores, as evidenced by testing according to ASTM C 297 and ASTM D 1002 after accelerated aging procedures that comply with aging requirements for adhesives with high resistance to moisture in ICBO ES AC05, "Sandwich Panel Adhesives."
9. Panel Fabrication: Factory assemble and seal panels.
- a. Laminate face sheets to grid core under a controlled process using heat and pressure to produce straight adhesive bonding lines that cover width of core members and that have sharp edges.
 - 1) White spots indicating lack of bond at intersections of grid-core members are limited in number to 4 for every 40 sq. ft. (3.7 sq. m) of panel and limited in diameter to 3/64 inch (1.2 mm).
 - b. Fabricate with grid pattern that is symmetrical about centerlines of each panel.
 - c. Fabricate panel to allow condensation within panel to escape.
 - d. Reinforce panel corners.
- C. Accessory Materials
1. Insulating Materials: Specified in Division 07 Section "Thermal Insulation".
 2. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.
- D. Aluminum Finishes
1. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 2. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
 3. Aluminum Anodic Finish: Class I, clear anodic coating complying with AAMA 611 **OR** Class I, color anodic coating complying with AAMA 611, **as directed**.



- a. Color: Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black **OR** Match sample **OR** As selected from full range of industry colors and densities, **as directed**.
- 4. Aluminum High-Performance Organic Finish: Two-coat **OR** Three-coat, **as directed**, thermocured system with fluoropolymer topcoats containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2604 **OR** AAMA 2605, **as directed**.
 - a. Color: Match sample **OR** As selected from manufacturer's full range, **as directed**.

1.3 EXECUTION

A. Installation

1. General:
 - a. Comply with manufacturer's written instructions.
 - b. Do not install damaged components.
 - c. Fit joints between aluminum components to produce hairline joints free of burrs and distortion.
 - d. Rigidly secure nonmovement joints.
 - e. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
 - f. Weld aluminum components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
 - g. Seal joints watertight, unless otherwise indicated.
2. Metal Protection: Where aluminum components will contact dissimilar materials, protect against galvanic action by painting contact surfaces with bituminous paint or by installing nonconductive spacers as recommended in writing by manufacturer for this purpose.
3. Install continuous aluminum sill closure with weatherproof expansion joints and locked and sealed or welded corners. Locate weep holes at rafters.
4. Install components to drain water passing joints, condensation occurring within aluminum members and panels, and moisture migrating within assembly to exterior.
5. Install components plumb and true in alignment with established lines and elevations.
6. Install insulation materials as specified in Division 07 Section "Thermal Insulation".
7. Erection Tolerances: Install assemblies to comply with the following maximum tolerances:
 - a. Alignment: Limit offset from true alignment to 1/32 inch (0.8 mm) where surfaces abut in line, edge to edge, at corners, or where a reveal or protruding element separates aligned surfaces by less than 3 inches (76 mm); otherwise, limit offset to 1/8 inch (3.2 mm).
 - b. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet (3.2 mm in 3.7 m); 1/2 inch (13 mm) over total length.

B. Field Quality Control

1. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
2. Testing Services: Testing and inspecting of representative areas to determine compliance of installed assemblies with specified requirements shall take place as follows and in successive stages as indicated on Drawings. Do not proceed with installation of the next area until test results for previously completed areas show compliance with requirements.
 - a. Water Penetration under Static Pressure: Before installation of interior finishes has begun, areas shall be tested according to ASTM E 1105.
 - 1) Test Procedures: Test under uniform and cyclic static air pressure.
 - 2) Static-Air-Pressure Difference: as directed by the Owner.
 - 3) Water Penetration: None.
 - b. Water-Spray Test: Before installation of interior finishes has begun, assemblies shall be tested according to AAMA 501.2 and shall not evidence water penetration.
3. Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.



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4. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

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SECTION 08 51 13 00 - ALUMINUM WINDOWS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of material for fixed and operable aluminum framed windows for exterior locations. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes fixed and operable aluminum-framed windows.

C. Definitions

1. Performance class designations according to AAMA/WDMA 101/I.S.2/NAFS:
 - a. AW: Architectural.
 - b. HC: Heavy Commercial.
 - c. C: Commercial.
 - d. LC: Light Commercial.
 - e. R: Residential.
2. Performance grade number according to AAMA/WDMA 101/I.S.2/NAFS:
 - a. Design pressure number in pounds force per square foot (pascals) used to determine the structural test pressure and water test pressure.
3. Structural Test Pressure: For uniform load structural test, is equivalent to 150 percent of the design pressure.
4. Minimum Test Size: Smallest size permitted for performance class (gateway test size). Products must be tested at minimum test size or at a size larger than minimum test size to comply with requirements for performance class.

D. Performance Requirements

1. General: Provide aluminum windows capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified, and that are of minimum test size indicated below:
 - a. Size required by AAMA/WDMA 101/I.S.2/NAFS for gateway performance **OR** optional performance grade **OR** gateway performance for both gateway performance and optional performance grade, **as directed**.
 - b. Size indicated on Drawings **OR** in a schedule, **as directed**.
2. Structural Performance: Provide aluminum windows capable of withstanding the effects of the following loads, based on testing units representative of those indicated for Project that pass AAMA/WDMA 101/I.S.2/NAFS, Uniform Load Structural Test:
 - a. Design Wind Loads: Determine design wind loads applicable to Project from basic wind speed indicated in miles per hour (meters per second) at 33 feet (10 m) above grade, according to ASCE 7, Section 6.5, "Method 2-Analytical Procedure," based on mean roof heights above grade indicated on Drawings.
 - 1) Basic Wind Speed: 85 mph (38 m/s) **OR** 90 mph (40 m/s), **as directed**.
 - 2) Importance Factor.
 - 3) Exposure Category: A **OR** B **OR** C **OR** D, **as directed**.
 - b. Deflection: Design glass framing system to limit lateral deflections of glass edges to less than 1/175 of glass-edge length or 3/4 inch (19 mm), whichever is less, at design pressure based on testing performed according to AAMA/WDMA 101/I.S.2/NAFS, Uniform Load Deflection Test or structural computations.
3. Windborne-Debris Resistance: Provide glazed windows capable of resisting impact from windborne debris, based on the pass/fail criteria as determined from testing glazed windows



identical to those specified, according to ASTM E 1886 and testing information in ASTM E 1996 or AAMA 506 and requirements of authorities having jurisdiction.

4. Thermal Movements: Provide aluminum windows, including anchorage, that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C) material surfaces.

E. Submittals

1. Product Data: For each type of aluminum window indicated.
2. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other work, operational clearances, and installation details
3. Samples: For each exposed finish.
4. Product Schedule: Use same designations indicated on Drawings.
5. Field quality-control test reports.
6. Product test reports.
7. Maintenance data.

F. Quality Assurance

1. Installer: A qualified installer, approved by manufacturer to install manufacturer's products.
2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
3. Fenestration Standard: Comply with AAMA/WDMA 101/I.S.2/NAFS, "North American Fenestration Standard Voluntary Performance Specification for Windows, Skylights and Glass Doors," for definitions and minimum standards of performance, materials, components, accessories, and fabrication. Comply with more stringent requirements if indicated.
 - a. Provide AAMA **OR** WDMA, **as directed**, -certified aluminum windows with an attached label.
4. Glazing Publications: Comply with published recommendations of glass manufacturers and with GANA's "Glazing Manual" unless more stringent requirements are indicated.
5. Preinstallation Conference: Conduct conference at Project site.

G. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.
 - a. Failures include, but are not limited to, the following:
 - 1) Failure to meet performance requirements.
 - 2) Structural failures including excessive deflection, water leakage, air infiltration, or condensation.
 - 3) Faulty operation of movable sash and hardware.
 - 4) Deterioration of metals, other materials, and metal finishes beyond normal weathering.
 - 5) Failure of insulating glass.
 - b. Warranty Period:
 - 1) Window: Two **OR** Three, **as directed**, years from date of Final Completion.
 - 2) Glazing: Five **OR** 10, **as directed**, years from date of Final Completion.
 - 3) Metal Finish: Five **OR** 10 **OR** 15, **as directed**, years from date of Final Completion.



1.2 PRODUCTS

A. Materials

1. Aluminum Extrusions: Alloy and temper recommended by aluminum window manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi (150-MPa) ultimate tensile strength, not less than 16,000-psi (110-MPa) minimum yield strength, and not less than 0.062-inch (1.6-mm) thickness at any location for the main frame and sash members.
2. Fasteners: Aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with aluminum window members, trim, hardware, anchors, and other components.
 - a. Reinforcement: Where fasteners screw anchor into aluminum less than 0.125 inch (3.2 mm) thick, reinforce interior with aluminum or nonmagnetic stainless steel to receive screw threads, or provide standard, noncorrosive, pressed-in, splined grommet nuts.
 - b. Exposed Fasteners: Unless unavoidable for applying hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.
3. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.
4. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.
5. Compression-Type Weather Stripping: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action and for complete concealment when aluminum window is closed.
 - a. Weather-Stripping Material: Elastomeric cellular preformed gaskets complying with ASTM C 509.
 - b. Weather-Stripping Material: Dense elastomeric gaskets complying with ASTM C 864.
 - c. Weather-Stripping Material: Manufacturer's standard system and materials complying with AAMA/WDMA 101/I.S.2/NAFS.
6. Sliding-Type Weather Stripping: Provide woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric. Comply with AAMA 701/702.
 - a. Weather Seals: Provide weather stripping with integral barrier fin or fins of semirigid, polypropylene sheet or polypropylene-coated material. Comply with AAMA 701/702.
7. Replaceable Weather Seals: Comply with AAMA 701/702.
8. Sealant: For sealants required within fabricated windows, provide window manufacturer's standard, permanently elastic, nonshrinking, and nonmigrating type recommended by sealant manufacturer for joint size and movement.

B. Window

1. Window Type: Casement **OR** Double hung **OR** Dual action **OR** Fixed **OR** Horizontal sliding **OR** Projected **OR** Projected awning **OR** Single hung **OR** Top-hinged inswinging **OR** Vertically pivoted **OR** As indicated on Drawings **OR** As indicated in a schedule, **as directed**.
2. AAMA/WDMA Performance Requirements: Provide aluminum windows of performance indicated that comply with AAMA/WDMA 101/I.S.2/NAFS unless more stringent performance requirements are indicated.
 - a. Performance Class and Grade: R15 **OR** R20 **OR** R25, **as directed**.
 - b. Performance Class and Grade: LC25 **OR** LC30 **OR** LC35, **as directed**.
 - c. Performance Class and Grade: C30 **OR** C35 **OR** C40, **as directed**.
 - d. Performance Class and Grade: HC40 **OR** HC45 **OR** HC50, **as directed**.
 - e. Performance Class and Grade: AW40 **OR** AW45 **OR** AW50, **as directed**.
 - f. Performance Class and Grade: As indicated.



- g. Performance Class (if test performance method is selected for specifying windows and designating a performance class does not conflict with basic wind speed and performance testing indicated): **R OR LC OR C OR HC OR AW, as directed.**
3. Condensation-Resistance Factor (CRF): Provide aluminum windows tested for thermal performance according to AAMA 1503, showing a CRF of 45 **OR** 52, **as directed.**
 4. Thermal Transmittance: Provide aluminum windows with a whole-window, U-factor maximum indicated at 15-mph (24-km/h) exterior wind velocity and winter condition temperatures when tested according to AAMA 1503 **OR** ASTM E 1423 **OR** NFRC 100, **as directed.**
 - a. U-Factor: 0.35 Btu/sq. ft. x h x deg F (2.0 W/sq. m x K) **OR** 0.40 Btu/sq. ft. x h x deg F (2.3 W/sq. m x K) **OR** 0.43 Btu/sq. ft. x h x deg F (2.5 W/sq. m x K) **OR** 0.60 Btu/sq. ft. x h x deg F (3.4 W/sq. m x K), **as directed**, or less.
 5. Solar Heat-Gain Coefficient (SHGC): Provide aluminum windows with a whole-window SHGC maximum of 0.40 **OR** 0.50 **OR** 0.55, **as directed**, determined according to NFRC 200 procedures.
 6. Sound Transmission Class (STC): Provide glazed windows rated for not less than 26 **OR** 30 **OR** 35, **as directed**, STC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 413.
 7. If test performance method is selected for specifying windows
 - a. Air Infiltration: Maximum rate not more than indicated when tested according to AAMA/WDMA 101/I.S.2/NAFS, Air Infiltration Test.
 - 1) Maximum Rate: 0.3 cfm/sq. ft. (5 cu. m/h x sq. m) of area at an inward test pressure of 1.57 lbf/sq. ft. (75 Pa).
 - 2) Maximum Rate: 0.3 cfm/sq. ft. (5 cu. m/h x sq. m) of area at an inward test pressure of 6.24 lbf/sq. ft. (300 Pa).
 - 3) Maximum Rate: 0.1 cfm/sq. ft. (2 cu. m/h x sq. m) of area at an inward test pressure of 6.24 lbf/sq. ft. (300 Pa).
 - b. Water Resistance: No water leakage as defined in AAMA/WDMA referenced test methods at a water test pressure equaling that indicated, when tested according to AAMA/WDMA 101/I.S.2/NAFS, Water Resistance Test.
 - 1) Test Pressure: 15 percent of positive design pressure, but not less than 2.86 lbf/sq. ft. (140 Pa) or more than 15 lbf/sq. ft. (720 Pa).
 - 2) Test Pressure: 20 percent of positive design pressure, but not more than 15 lbf/sq. ft. (720 Pa).
 8. Forced-Entry Resistance: Comply with Performance Grade 10 **OR** 20 **OR** 30 **OR** 40, **as directed**, requirements when tested according to ASTM F 588.
 9. Life-Cycle Testing: Test according to AAMA 910 and comply with AAMA/WDMA 101/I.S.2/NAFS.
 10. Operating Force and Auxiliary (Durability) Tests: Comply with AAMA/WDMA 101/I.S.2/NAFS for operating window types indicated.
- C. Glazing
1. Glass: Clear, insulating-glass units **OR** Clear, insulating-glass units, with low-E coating pyrolytic on second surface or sputtered on second or third surface, **OR** Clear, insulating-glass units, argon gas filled, with low-E coating pyrolytic on second surface or sputtered on second or third surface, **as directed**, complying with Division 08 Section "Glazing".
 2. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal. **OR** Manufacturer's standard factory-glazing system that produces weathertight seal and complies with requirements for windborne-debris resistance **OR** Manufacturer's standard factory-glazing system as indicated in Division 08 Section "Glazing", **as directed.**
 3. Dual-Action Windows: Provide pivoting unit for double glazing, constructed of one sheet of glass in a removable sash for access to interior of unit, installed with airtight gaskets.
- D. Hardware
1. General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with aluminum; designed to smoothly operate, tightly close, and securely lock aluminum windows, and



- sized to accommodate sash or ventilator weight and dimensions. Do not use aluminum in frictional contact with other metals. Where exposed, provide solid bronze **OR** extruded, cast, or wrought aluminum **OR** die-cast zinc with special coating finish **OR** nonmagnetic stainless steel, **as directed**.
2. Counterbalancing Mechanism: Comply with AAMA 902.
 - a. Sash Balance: Concealed, tape-spring type **OR** spiral-tube type **OR** spring-loaded, block-and-tackle type **OR** ultralift spring type capable of lifting 70 percent of sash weight, **as directed**, of size and capacity to hold sash stationary at any open position.
 3. Sill Cap/Track: Extruded-aluminum track with natural anodized finish **OR** Rigid PVC or other weather-resistant plastic track with manufacturer's standard integral color, **as directed**, of thickness, dimensions, and profile indicated; designed to comply with performance requirements indicated and to drain to the exterior.
 4. Locks and Latches: Designed to allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only.
 5. Roller Assemblies: Low-friction design.
 6. Push-Bar Operators: Provide telescoping-type, push-bar operator designed to open and close ventilators with fixed screens.
 7. Gear-Type Rotary Operators: Comply with AAMA 901 when tested according to ASTM E 405, Method A.
 - a. Operation Function: All ventilators move simultaneously and securely close at both jambs without using additional manually controlled locking devices.
 8. Four- or Six-Bar Friction Hinges: Comply with AAMA 904.
 - a. Locking mechanism and handles for manual operation.
 - b. Friction Shoes: Provide friction shoes of nylon or other nonabrasive, nonstaining, noncorrosive, durable material.
 9. Limit Devices: Provide limit devices designed to restrict sash or ventilator opening.
 - a. Safety Devices: Limit clear opening to 4 inches (100 mm) **OR** 6 inches (150 mm), **as directed**, for ventilation; with custodial key release.
 10. Pole Operators: Tubular-shaped anodized aluminum; with rubber-capped lower end and standard push-pull hook at top to match hardware design; of sufficient length to operate window without reaching more than 60 inches (1500 mm) above floor; 1 pole operator and pole hanger per room that has operable windows more than 72 inches (1800 mm) above floor.
 11. Casement Windows: Provide the following operating hardware:
 - a. Operator: Gear-type rotary single-arm operator located on jamb at sill **OR** Gear-type rotary dual-arm operator located on jamb at sill, **as directed**.
 - 1) Rating: Provide rotary operator rated C-R15 **OR** C-C20 **OR** C-HC40, **as directed**, according to AAMA 901.
 - 2) Handle: Standard crank **OR** Folding crank **OR** Removable crank **OR** Knob **OR** T-handle, **as directed**.
 - b. Hinge: Extension hinge or pivot, nonfriction type.
 - c. Hinge: Heavy-duty, three **OR** five, **as directed**,-knuckle butt hinge with nylon bushings.
 - d. Hinge: Standard **OR** Heavy, **as directed**,-duty, concealed, four- or six-bar friction hinge with adjustable-slide friction shoe; designed to permit ventilator operation for inside cleaning of outside glass face; two per ventilator.
 - e. Hinge: Standard **OR** Heavy, **as directed**,-duty, concealed, four- or six-bar friction egress hinge with adjustable-slide friction shoe; designed to achieve 90-degree ventilator opening and to permit ventilator operation for inside cleaning of outside glass face; two per ventilator.
 - f. Lock: Lift-type throw, cam-action lock with keeper; one **OR** two, **as directed**, per ventilator.
 - g. Lock: Combination lever handle and cam-action lock with keeper; one **OR** two, **as directed**, per ventilator.
 - h. Lock: Combination dual lever handles, tie rod, and cam-action lock with keepers.
 - i. Lock: Key-operated custodial lock and keeper with removable handle; one **OR** two, **as directed**, per ventilator.



- j. Lock: Concealed multipoint lock operated by single lever handle or lift-type throw; three per ventilator.
 - k. Limit Device: Concealed friction adjuster, adjustable stay bar **OR** support arms with adjustable, limited, hold-open, **as directed**, limit device.
12. Double **OR** Single, **as directed**, -Hung Windows: Provide the following operating hardware:
- a. Sash Balances: Two per sash.
 - b. Handles: Applied sash lift bar **OR** pull-downs, **as directed**, on bottom rail of forward-placed operating sash; two per sash.
 - c. Handle: Continuous, integral, sash lift bar **OR** pull-down, **as directed**, on bottom rail of forward-placed operating sash.
 - d. Sash Lock: Cam-action sweep lock and keeper on meeting rail; one **OR** two, **as directed**, per sash.
 - e. Sash Lock: Spring-loaded, snap-type lock on bottom rail of lower sash; two per sash.
 - f. Sash Lock: Spring-loaded plunger lock with keeper on meeting rail of lower sash; two per sash.
 - g. Sash Lock: Pole-operated, cam-action lock on meeting rail of windows with meeting rail more than 72 inches (1800 mm) above floor; with keeper.
 - h. Pole Socket: Provide a pole socket or groove on inside face of top rail of upper **OR** lower, **as directed**, sash on windows with meeting rails more than 72 inches (1800 mm) above floor.
 - i. Limit Device: Sash stop **OR** Keyed sash, **as directed**, limit device; for top **OR** bottom **OR** each operable, **as directed**, sash located at jamb; one **OR** two, **as directed**, per sash.
 - j. Removable Lift-Out Sash: Design windows and provide with tamperproof, key-operated, **as directed**, hardware to permit removal of sash from inside for cleaning.
 - k. Tilt Lock: Design windows and provide with tamperproof, key-operated, **as directed**, tilt latch and pivot bar hardware to permit tilting of sash inward for cleaning both sides of sash from interior.
13. Dual-Action Windows: Provide the following operating hardware:
- a. Operator: Two-position, combination lever handle and cam-type latch.
 - b. Operator: Concealed, internal, multipoint locking bar and combination locking handle mechanism.
 - c. Hinge: Combination three-knuckle **OR** five-knuckle butt, **as directed**, hinge and stay bar.
 - d. Lock: Key-operated, concealed **OR** exposed, **as directed**, custodial lock.
 - e. Stabilizing Arm: Aluminum.
14. Horizontal-Sliding Windows: Provide the following operating hardware:
- a. Sash Rollers: Nylon rollers **OR** Steel, lubricated ball-bearing rollers with nylon tires **OR** Stainless-steel, lubricated ball-bearing rollers with nylon tires, **as directed**.
 - b. Sash Lock: Cam-action sweep sash lock and keeper at meeting rails.
 - c. Sash Lock: Spring-loaded, snap-type lock at jambs; two per sash.
 - d. Sash Lock: Spring-loaded plunger lock with keeper on meeting rail; two per sash.
 - e. Limit Device: Sash stop limit device; mounted in bottom of pull stile.
 - f. Removable Lift-Out Sash: Design windows and provide with tamperproof, key-operated, **as directed**, hardware to permit removal of sash from inside for cleaning.
15. Projected Windows: Provide the following operating hardware:
- a. Operator: Underscreen push-bar **OR** Underscreen pivot-shoe-type, gear-type rotary operator, **as directed**.
 - b. Hinge: Five-knuckle butt hinge.
 - c. Hinge: Concealed four- or six-bar friction hinge with adjustable-slide friction shoe; two per ventilator.
 - d. Lock: Cam-action, sweep lock handle with strike; one **OR** two, **as directed**, per ventilator.
 - e. Lock: Combination lever handle and cam-action lock with concealed pawl and keeper.
 - f. Lock: Key-operated security lock and keeper.
 - g. Lock: Key-operated custodial lock and keeper with removable handle.
 - h. Lock: Pole-operated, spring-catch lock and keeper **OR** cam-action, sweep lock handle and strike, **as directed**.



- i. Limit Device: Concealed friction adjustor, adjustable stay bar **OR** support arms with adjustable, limited, hold-open, **as directed**, limit device; located on jamb of each ventilator.
 16. Projected Awning Windows: Provide the following operating hardware:
 - a. Operator: Push-bar **OR** Lever **OR** Gear-type rotary, **as directed**, operator located on jamb at sill.
 - 1) Handle: Standard crank **OR** Folding crank **OR** Removable crank **OR** Knob **OR** T-handle, **as directed**.
 - b. Window-Operating System: Wall-mounted, group or gang-type window operating system with chain-wheel **OR** rotary crank-type **OR** electric, **as directed**, operator.
 - c. Hinge: Concealed four- or six-bar friction hinge located on each jamb near top rail; two per ventilator.
 - d. Lock: Lift-type throw, cam-action lock with keeper; one **OR** two, **as directed**, per ventilator.
 - e. Lock: Combination lever handle and cam-action lock with concealed pawl and keeper; one **OR** two, **as directed**, per ventilator.
 - f. Lock: Pole-operated, combination handle and cam-action lock **OR** face-mounted transom latch, **as directed**, and keeper.
 - g. Lock: Key-operated custodial lock with removable handle.
 - h. Limit Device: Concealed friction adjustor, adjustable stay bar **OR** support arms with adjustable, limited, hold-open, **as directed**, limit device; located on jamb of each ventilator.
 17. Top-Hinged Inswinging Windows: Provide the following operating hardware:
 - a. Hinge: Exposed, applied butt hinge located at corners; two **OR** three, **as directed**, per ventilator.
 - b. Hinge: Exposed, applied continuous hinge.
 - c. Hinge: Concealed, applied pivot hinge located at corners; two **OR** three, **as directed**, per ventilator.
 - d. Hinge: Continuous, integrally extruded hinge.
 - e. Hinge: Four- or six-bar friction hinge with adjustable-slide friction shoe; two per ventilator.
 - f. Lock: Internal, key-operated, limited-access locks located not more than 48 inches (1220 mm) o.c. at jambs and sill.
 - g. Hold-Open Device: Automatic-locking hold-open arms **OR** stay bars, **as directed**,; designed to permit sash operation for inside cleaning of outside glass face; two per ventilator.
 18. Vertically Pivoted Windows: Provide the following operating hardware:
 - a. Pivot Assembly: Aluminum-alloy **OR** Manganese-bronze **OR** Stainless-steel, **as directed**, pivot assembly designed for center **OR** off-center, **as directed**, axis pivoting.
 - b. Lock: Internal, key-operated, limited-access lock; one **OR** two, **as directed**, per jamb.
 - c. Limit device.
- E. Group Or Gang-Type Window Operating Systems
1. Provide window operating system of the type and in groups as indicated. Coordinate operating system design with window fabrication and hardware selection to ensure smooth, durable operation of ventilators.
 2. Operation Function: All ventilators move simultaneously and securely close at sash frames without using additional manually controlled locking devices.
 3. Rack-and-Pinion **OR** Screw, **as directed**, -Type Operating System: Complete with shafts, brackets, levers, rods, oil-encased gear boxes, and standard fittings and accessories for operation indicated.
 4. Horizontal-Movement Operating System: Tension type; complete with mounting brackets, oil-encased gear boxes, steel rod or cable operating in conduit between sash operator units, and standard fittings and accessories for operation indicated.
 5. Operation: Manual, with chain-wheel operator on each gear box shaft; with chain loops terminated 24 inches (600 mm) above floor.
 6. Operation: Manual, with crank-type operator on each gear box shaft, with removable crank. Where necessary, extend crankshaft with universal joints and support brackets to a suitable



crank-mounting location not more than 44 inches (1115 mm) above floor, with an oil-encased miter gear box.

7. Operation: Electric, with factory-assembled electric operator designed for operating windows of type, size, weight, construction, use, and operating frequency indicated.
 - a. Electric Operator: Provide operating system complying with NFPA 70; of size and capacity and with features, characteristics, and accessories suitable for Project conditions, recommended in writing by window manufacturer; complete with operating system indicated, electric motor and factory-rewired motor controls with limit switches, remote-control stations, power disconnect switches, enclosures protecting controls and all operating parts, and accessories required for reliable operation. Include wiring from motor controls to motor. Coordinate operator wiring requirements and electrical characteristics with building electrical system.
 - 1) Control Equipment: Comply with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6.
 - 2) Electric Motor: Comply with NEMA MG 1; with thermal-overload protection; sized to start and operate size and weight of window sash ventilators under any conditions; one per each gear box shaft.
 - a) Motor Characteristics: Single phase, sized by electric operator manufacturer, 60 Hz.
 - 3) Remote Controls: Electric controls with NEMA ICS 6, Type 1 enclosure and momentary-contact, single push-button-operated control **OR** three-position, push-button-operated control with open, close, and stop functions, **as directed**.
 - 4) Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop sash ventilators at fully opened and fully closed positions.

F. Insect Screens

1. General: Design windows and hardware to accommodate screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches. Fabricate insect screens to fully integrate with window frame. Locate screens on inside **OR** outside, **as directed**, of window and provide for each operable exterior sash or ventilator.
 - a. Aluminum Tubular Frame Screens: Comply with SMA 1004, "Specifications for Aluminum Tubular Frame Screens for Windows," Residential R-20 **OR** Architectural C-24 **OR** Monumental M-32, **as directed**, class.
 - b. Comply with SMA 1004, "Specifications for Aluminum Tubular Frame Screens for Windows," for minimum standards of appearance, fabrication, attachment of screen fabric, hardware, and accessories unless more stringent requirements are indicated.
2. Stainless-Steel Insect Screen Frames: Fabricate frames of nonmagnetic stainless-steel members of 0.020-inch (0.5-mm) minimum wall thickness, with mitered or coped joints or corner extrusions, concealed fasteners, adjustable rollers, and removable PVC spline/anchor concealing edge of frame. Finish frames with No. 2B, bright mill finish.
3. Aluminum Insect Screen Frames: Manufacturer's standard aluminum alloy complying with SMA 1004. Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners, adjustable rollers, **as directed**, and removable PVC spline/anchor concealing edge of frame.
 - a. Aluminum Tubular Framing Sections and Cross Braces: Roll formed from aluminum sheet with minimum wall thickness as required for class indicated.
 - b. Extruded-Aluminum or Aluminum Tubular Framing Sections and Cross Braces: Not less than 0.040-inch (1.0-mm) **OR** 0.050-inch (1.3-mm), **as directed**, wall thickness.
 - c. Finish: Match aluminum window members.
 - d. Finish: Anodized aluminum **OR** Baked-on organic coating, **as directed**, in manufacturer's standard color.
 - e. Finish: Anodized aluminum **OR** Baked-on organic coating, **as directed**, in color selected from manufacturer's full range.
 - f. Finish: Manufacturer's standard.
4. Glass-Fiber Mesh Fabric: 18-by-14 (1.1-by-1.4-mm) or 18-by-16 (1.0-by-1.1-mm) **OR** 20-by-20 (0.85-by-0.85-mm) or 20-by-30 (0.85-by-0.42-mm), **as directed**, mesh of PVC-coated, glass-fiber



threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration; in the following color. Comply with ASTM D 3656.

- a. Mesh Color: Charcoal gray **OR** Silver gray **OR** Aquamarine, **as directed**.
5. Aluminum Wire Fabric: 18-by-16 (1.1-by-1.3-mm) mesh of 0.011-inch- (0.28-mm-) diameter, coated aluminum wire.
 - a. Wire-Fabric Finish: Natural bright **OR** Charcoal gray **OR** Black, **as directed**.
6. Copper Wire Fabric: 16-by-16 (1.3-by-1.3-mm) mesh of 0.011-inch- (0.28-mm-) diameter copper wire.
7. Bronze Wire Fabric: 18-by-14 (1.2-by-1.6-mm) mesh of 0.009-inch- (0.23-mm-) **OR** 18-by-14 (1.13-by-1.5-mm) mesh of 0.011-inch- (0.28-mm-), **as directed**, diameter bronze wire with a clear varnish finish.
8. Stainless-Steel Wire Fabric: 18-by-14 (1.2-by-1.6-mm) mesh of 0.009-inch- (0.23-mm-) **OR** 18-by-16 (1.2-by-1.4-mm) mesh of 0.009-inch- (0.23-mm-) **OR** 18-by-16 (1.13-by-1.3-mm) mesh of 0.011-inch- (0.28-mm-), **as directed**, diameter, nonmagnetic stainless-steel wire, Type 304 or 316, complying with FS RR-W-365, Type VI.
9. Solar-Screening Mesh Fabric: 17-by-15 (0.86-by-1.1-mm) **OR** 40-by-40 (0.3-by-0.3-mm), **as directed**, mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration. Comply with ASTM D 3656.
10. Wickets: Provide sliding **OR** hinged, **as directed**, wickets, framed and trimmed for a tight fit and for durability during handling.

G. Accessories

1. Integral Ventilating System/Device: Where indicated, provide weather-stripped, adjustable, horizontal fresh-air vent, with a free airflow slot, full width of window sash by approximately 1 inch (25 mm) **OR** 3 inches (75 mm), **as directed**, when open, complying with AAMA/WDMA 101/I.S.2/NAFS. Equip vent bar with an integral insect screen, removable for cleaning.
2. Window Cleaner Anchor Bolts: Provide window cleaner anchor bolts of standard design, complying with requirements of authorities having jurisdiction. Fabricate bolts of nonmagnetic stainless steel.
 - a. Reinforce window units or mullions to receive bolts and provide additional anchorage of units at bolt locations.
3. Integral Louver Blinds: Provide remotely operated horizontal louver blinds in the space between two panes of glass. Construct blinds of aluminum slats, approximately 1 inch (25 mm) wide, with polyester fiber cords, equipped for tilting, raising, and lowering by standard operating hardware located on inside face of sash.
4. Exterior Louver Units: Manually adjustable, extruded-aluminum, solar-shade louver units; of type recommended by manufacturer for application over operable or fixed windows. Provide main extrusion members of 0.062-inch (1.6-mm) minimum wall thickness.
 - a. Operator: Crank-type gang operator, operable from inside building, designed to rotate louver blades simultaneously at least 80 degrees and to lock units in closed position; one operator per each louver unit. Form unit framing or mounting without interfering with insect screens.

H. Fabrication

1. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.
2. Fabricate aluminum windows that are reglazable without dismantling sash or ventilator framing.
3. Thermally Improved Construction: Fabricate aluminum windows with an integral, concealed, low-conductance thermal barrier; located between exterior materials and window members exposed on interior side; in a manner that eliminates direct metal-to-metal contact.
 - a. Provide thermal-break construction that has been in use for not less than three years and has been tested to demonstrate resistance to thermal conductance and condensation and to show adequate strength and security of glass retention.



- b. Provide thermal barriers tested according to AAMA 505; determine the allowable design shear flow per the appendix in AAMA 505.
 - c. Provide hardware with low conductivity or nonmetallic material for hardware bridging thermal breaks at frame or vent sash.
 4. Weather Stripping: Provide full-perimeter weather stripping for each operable sash and ventilator.
 - a. Horizontal-Sliding Windows: Provide operable sash with a double row of sliding weather stripping in horizontal rails and single- or double-row weather stripping in meeting or jamb stiles, as required to meet specified performance requirements. Provide compression-type weather stripping at perimeter of each movable panel where sliding-type weather stripping is not appropriate.
 - b. Vertically Pivoted Windows: Provide double-row weather stripping.
 5. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.
 6. Provide water-shed members above side-hinged ventilators and similar lines of natural water penetration.
 7. Mullions: Provide mullions and cover plates as shown, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design loads of window units.
 8. Subframes: Provide subframes with anchors for window units as shown, of profile and dimensions indicated but not less than 0.062-inch- (1.6-mm-) thick extruded aluminum. Miter or cope corners, and weld and dress smooth with concealed mechanical joint fasteners. Finish to match window units. Provide subframes capable of withstanding design loads of window units.
 9. Factory-Glazed Fabrication: Glaze aluminum windows in the factory where practical and possible for applications indicated. Comply with requirements in Division 08 Section "Glazing" and with AAMA/WDMA 101/I.S.2/NAFS.
 10. Glazing Stops: Provide snap-on glazing stops coordinated with Division 08 Section "Glazing" and glazing system indicated. Provide glazing stops to match sash and ventilator frames.
- I. Finishes, General
 1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 2. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
 3. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- J. Aluminum Finishes
 1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
 2. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.
 3. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
 4. Class II, Color Anodic Finish: AA-M12C22A32/A34 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, integrally colored or electrolytically deposited color coating 0.010 mm or thicker) complying with AAMA 611.



5. Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
 - a. Color: Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black **OR** Match sample **OR** As selected from full range of industry colors and color densities, **as directed**.
6. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Apply baked enamel complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.
 - a. Organic Coating: Thermosetting, modified-acrylic or polyester enamel primer/topcoat system complying with AAMA 2603, except with a minimum dry film thickness of 1.5 mils (0.04 mm), medium gloss.
 - b. Color: As indicated by manufacturer's designations **OR** Match sample **OR** As selected from manufacturer's full range, **as directed**.
7. High-Performance Organic Finish (2-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 50 **OR** 70, **as directed**, percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2604 **OR** AAMA 2605, **as directed**, and with coating and resin manufacturers' written instructions.
8. High-Performance Organic Finish (3-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coatings; Organic Coating: manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.
 - a. Color and Gloss: As indicated by manufacturer's designations **OR** Match sample **OR** As selected from manufacturer's full range, **as directed**.

1.3 EXECUTION

A. Installation

1. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing windows, hardware, accessories, and other components.
2. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.
3. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.
4. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.
5. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.
6. Connect automatic operators to building electrical system.

B. Field Quality Control

1. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.
 - a. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.
2. Testing Services: Testing and inspecting of installed windows shall take place as follows:
 - a. Testing Methodology: Testing of windows for air infiltration and water resistance shall be performed according to AAMA 502, Test Method A **OR** B, **as directed**, by applying same



test pressures required to determine compliance with AAMA/WDMA 101/I.S.2/NAFS in Part 1 "Performance Requirements" Article.

- b. Testing Extent: Three windows as selected by the Owner and a qualified independent testing and inspecting agency. Windows shall be tested immediately after installation.
 - c. Test Reports: Shall be prepared according to AAMA 502.
3. Remove and replace noncomplying aluminum window and retest as specified above.
 4. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- C. Adjusting, Cleaning, And Protection
1. Adjust operating sashes and ventilators, screens, hardware, operators, **as directed**, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.
 2. Clean aluminum surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
 3. Clean factory-glazed glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.
 4. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
 5. Protect window surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.

END OF SECTION 08 51 13 00

**SECTION 08 51 13 00a - ALUMINUM REPLACEMENT WINDOWS**

DESCRIPTION OF WORK

This specification covers the furnishing and installation of materials for aluminum replacement windows. Products shall be as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

GENERAL

Definitions

1. Window Types: ANSI/AAMA 101.
 - a. Horizontal Slider (HS): Primary horizontally operating window.
 - b. Single Hung (SH): Primary vertically operating window with only one operable sash.
 - c. Double Hung (DH): Primary vertically operating window with two operable sashes.
 - d. Thermally Improved: Primary window with thermal break between interior and exterior metal surfaces both at frame and sash or panel members.
 - 1) Single Window Construction: Provide insulating glass.
 - 2) Thermally improved aluminum windows may use members with thermal breaks or be of dual window construction (i.e.. primary-secondary (storm) or primary-primary).
 - e. Dual Window Construction (DW):
 - 1) Primary-Secondary: Primary window with either interior or exterior secondary (storm) window.
 - 2) Primary-Primary: Combination of two primary windows employing common frame.
2. Type of Stainless Steel Screens (Frames and Screening): Medium, and Heavy Types: As defined by and comply with requirements of ANSI/SMA 6001.
3. Supply and Delivery Only: Include supply and delivery to site(s) FOB destination freight prepaid. Unless otherwise specified or scheduled, unloading and handling at site is by the Owner.

System Description

4. Performance Requirements: Comply with following:
 - a. Aluminum Replacement Windows: HUD UM 39a.
 - b. Aluminum Replacement Windows: ANSI/AAMA 101 (Including test size requirements):
 - 1) Horizontal Sliding Windows: HS C35.
 - a) Water Resistance: ASTM E 547, no leakage at 251.4 Pa (5.25 PSF) test pressure.
 - 2) Single Hung and Double Hung Windows: DH C35.
 - a) Water Resistance: ASTM E 547, no leakage at 251.4 Pa (5.25 PSF) test pressure.
 - 3) Single Hung and Double Hung Windows: DH C45.
 - a) Water Resistance: ASTM E 547, no leakage at 323.4 Pa (6.75 PSF) test pressure.
 - 4) Air Infiltration: ASTM E 283, Not exceed 0.049 cu m/s/mm (0.34 CFM/ft) of crack length of operable sash at 75 Pa (1.57 PSF) test pressure.
 - 5) Dual Window Construction: DW.
 - c. Aluminum Replacement Windows: ASTM F 588, Annex AI, forced entry resistance performance level 10.
 - d. Thermally Improved Windows: AAMA 1504:



- 1) Thermal Transmittance (U-Value): Maximum U70, 3.97 W/sq. m C (0.70 BTU/HR.FT.F) if not otherwise scheduled.
 - 2) Condensation Resistance Factor (CRF): Minimum CRF C50 if not otherwise scheduled.
- e. Sealed Insulating Glass: Tested and certified in accordance with HUD UM 82 complying with ASTM E 774, Class C.

Submittals

5. Product Data:
6. Shop Drawings:
 - a. Include window elevations, installation details, anchorage details, clearance between frame and rough opening, hardware, glazing, and accessories.
7. Samples: Submit full set of finish color samples for color selection.
 - a. For Supply and Deliver Only Contract: Submit one full size sample of each type of aluminum replacement window with specified finish for acceptance. Include sample of trickle ventilator.
8. Quality Assurance/Control Submittals:
 - a. Certificates: Manufacturer's written third party certification that aluminum windows meet or exceed HUD UM 39a, HUD 82, and ANSI/AAMA 101 and other specified requirements.
 - b. Manufacturer's installation instructions.
9. Closeout Submittals
 - a. Operation and maintenance data.
 - b. Special warranty.

Quality Assurance

10. Regulatory Requirements:
 - a. Glazing Materials: Comply with CPSC 16 CFR 1201 or ANSI Z97.1.
 - b. Egress Requirements: Comply with applicable codes and regulations.
 - c. Provide emergency egress, single point locking release, and bit key lock fire entry from exterior as and where required by applicable codes and regulations.
 - d. Accessibility:
 - 1) Architectural Barriers Act of 1968 as amended (42 USC 4152-4157) and HUD implementing regulations (24 CFR Part 40).
 - a) Uniform Federal Accessibility Standards (UFAS).
 - 2) Section 504 of the Rehabilitation Act of 1973 as amended (29 USC 794) and HUD implementing regulations 24 CFR Part 8.
 - 3) Fair Housing Accessibility Guidelines (24 CFR Chapter 1).
 - 4) Americans with Disabilities Act of 1990 (ADA) (28 CFR Part 35).
11. Certifications: Comply with HUD UM 39a, HUD UM 82, ANSI Z34.1 and HUD 24 CFR 200.935.
12. Mock-ups: For Supply and Install Contract: Install one full size mock-up of each type of aluminum replacement window with specified finish for acceptance.
 - a. Location
 - b. Approved Mock-up: Standard for rest of work.
 - c. Approved Mock-up: May remain part of completed project.

Delivery, Storage, And Handling

13. Packing, Shipping, Handling, and Unloading: Pack materials at manufacturing plant to prevent damage during shipping.
 - a. Aluminum Replacement Windows: Label in accordance with HUD UM 39a attached signifying compliance with ANSI/AAMA 101 performance requirements.
 - b. Thermally Improved Windows: Label in accordance with HUD UM 39a attached signifying compliance with specified AAMA 1504 performance requirements.
14. Acceptance at Site: Inspect aluminum replacement windows upon delivery. Replace damaged or defective materials before installation.
15. Storage and Protection: Store aluminum replacement windows in manner to protect from weather and other damage.



Project Conditions

16. Field Measurements: Field measure openings for aluminum replacement windows before start of fabrication.

Scheduling And Sequencing

17. Scheduling and Completion: Comply with requirements of Detailed Scope of Work.

Warranty

18. Special Warranty: Provide one year written covering materials and installation for aluminum replacement windows.
 - a. Warranty: Include coverage of inserts, hardware, and latches.
 - 1) Screening and glazing not included.
 - 2) Defects resulting from vandalism not included.
 - b. For Supply and Delivery Only Contract:
 - 1) Contractor: Agrees to supply and deliver to the Owner, free of charge, any required replacement parts that can be readily installed by the Owner without special tools.
 - 2) Contractor: Agrees to supply and deliver free of charge, complete replacement window, when defective part or parts cannot be installed without use of special tools.
 - c. For Supply and Install Contract:
 - 1) Contractor: Agrees to supply and install, free of charge, any required replacement parts or complete replacement window.

PRODUCTS

Aluminum Replacement Windows

19. General: Type(s) and size(s) indicated, specified, or scheduled with necessary hardware, anchors and equipment.

Materials

20. Aluminum Materials:
 - a. Extruded Aluminum: ASTM B 221, Alloy 6063-T5 or stronger.
 - b. Aluminum Alloys: Commercial quality and of proper alloy for window construction, free from defects impairing strength and/or durability.
 - 1) Wrought Aluminum Alloys: Alloying Elements: ANSI/AAMA 101.
 - c. Window Members, Including Muntins: Aluminum except as allowed by ANSI/AAMA 101.
 - 1) Sill Members: Minimum 2.0 mm (0.078 inch) thick.
 - d. Interlocks and mating fins may vary by tapering at maximum projected distance of 8 mm (5/16 inch) from edge.
 - 1) Other appendages may taper providing design results in net area of at least that calculated by using prescribed wall thickness for appendage length.
 - e. Edge or Corner: May be eased with radius not to exceed wall thickness permitted for member.
 - f. Glazing Legs, Channels or Glazing Bead Retainers, Serrated or Not: Minimum 1.3 mm (0.050 inch) thick for distance of not more than 13 mm (1/2 inch) each leg.
21. Other Metal Materials:
 - a. Carbon Steel (reinforcing members): ASTM A 36, zinc coated in accordance with ASTM B 633 or cadmium coated in accordance with ASTM B 766.
 - b. Stainless Steel: ASTM A 167, Type 302.
 - c. Welding Filler Rods: AWS A5.3.
22. Glazing Materials: Comply with CPSC 16 CFR 1201 or ANSI Z97.1.
 - a. Glass: ASTM C 1036, Type 1, Class 1, Glazing B Quality.
 - b. Tempered Glass: ASTM C 1048, Kind FT, Condition A, Type 1, Class 1, Glazing B Quality.
 - c. Plastic: Extruded polycarbonate clear sheets, minimum 4.5 mm (0.177 inch) thick with following characteristics:
 - 1) Impact Resistance: ASTM D 256, Method A, 12-18 foot-pound per inch.



- 2) Elongation/Modulus of Elasticity: ASTM D 638, 110 percent maximum/340,000 PSI.
 - 3) Heat Deflection: ASTM D 648, 132.2 degrees C (270 degrees F) at 264 PSI.
 - 4) Abrasion Resistance: Coated on both surfaces to produce abrasion resistance of 3-19 percent maximum haze increase for 500 revolutions of CS-1 OF wheel per ASTM D 1044.
 - d. Insulating Glass Units: HUD UM 82 and ASTM E 774, Class CBA.
 - e. Glass Thickness: Determined in accordance with ANSI/AAMA 101 Appendix, minimum 3 mm (1/8 inch) (DS).
 - 1) Design Wind Pressures: Determined in accordance with applicable codes and regulations.
 - f. Glass: Labeled to show name of manufacturer and type.
23. Glazing Materials: Particularly suited for use with aluminum and not require painting.
- a. Make adequate provisions for use of glazing compound, if applicable.
 - b. Remove material from glazing surfaces to which glazing compound will not readily adhere.
 - c. Windows: May be either factory or field glazed by either channel-type gaskets or back-bedding materials.
 - d. Glazing Clips: Not required when face stops are used.
24. Glazing Beads or Retainers: Material compatible with aluminum, and 6 required to retain glass, of sufficient strength and fixation to serve this purpose.
- a. Thickness of Glazing Beads: Optional except as otherwise specified.
25. Screens: Provide windows with screens as indicated, specified, or scheduled in manufacturer's standard approved design, applicable to specific aluminum windows.
- a. Screen Frames: Extruded aluminum frames of suitable alloy and of sufficient rigidity, crossbraces, as required, to lie flat against window and to prevent excessive bow in frame members and sag in screening.
 - 1) Frame Corners: Firmly joined in secure and rigid manner.
 - 2) Screen Spline: Aluminum or a material compatible with aluminum.
 - b. Screening: One of following as indicated, specified, or scheduled:
 - 1) Vinyl Coated Fibrous Glass Yam: ASTM D 3656, Class 1, 18 by 16 mesh, 0.29 mm (0.0115 inch) diameter yam.
 - 2) Polyvinylidene Chloride or Polypropylene Filament: FS L-S-12513, Type I or III, Class 1 or 2, 18 by 18 mesh, 0.31 mm (0.012 inch) or 0.38 mm (0.015 inch) diameter filament.
 - 3) Aluminum: FS RR-W-365, Type VII, 18 x 16 or 18 by 18 regular, 0.28 mm (0.011 inch) diameter wire.
 - 4) Stainless Steel: Type 304 stainless steel:
 - a) Medium: ANSI/SMA 6001 Medium Type, 12 x 12 mesh 0.58 mm (0.023 inch) diameter wire.
 - b) Heavy: ANSI/SMA 6001 Heavy Type, 12 x 12 mesh 0.71 mm (0.028 inch) diameter wire, high tensile strength.
 - c) Screen Frames: ANSI/SMA 6001 performance requirements, minimum 1.6 mm (0.062 inch) aluminum extruded 6063-T5 alloy designed to accept stainless steel wire cloth.
 - d) Emergency Egress Windows: Design screen to be opened from interior only (to allow for egress to exterior).
 - c. Screening: Fastened to frame in manner to permit replacement of screening.
 - d. Screens: Provide with fastening devices, suited particularly for application to specific window made of aluminum or materials compatible with aluminum and of sufficient strength to perform satisfactorily.
 - e. Assembled Screen with Insect Screening and Spline in Place: Outside dimension as measured from midpoint of opposite framing members shall not vary more than 4.8 mm (3/16 Inch) from outside dimension as measured at extreme ends of framing members.
 - f. Screens: Comply with applicable fire codes for egress and fireman access.
 - 1) Provide single point release as and where required by applicable codes and regulations.



- 2) Provide bit key lock fire entry from exterior if required by applicable codes and regulations.
- g. Window Screens: Include warning label indicating that screen will not stop child from falling out of window in accordance with SMA 7001.

Accessories

26. Hardware: Designed to perform functions for which it is intended and securely attached to window.
27. Thermal Break Material: Urethane, PVC, ISP, vinyl, or other material suitable for application that is compatible with aluminum.
28. Fasteners: Comply with ANSI/AAMA 101.
29. Panning and Receptor Systems: Extruded aluminum designed to fit existing openings, to receive windows, and to withstand wind forces as required by applicable codes and regulation.
 - a. Exterior Trim System: Designed to withstand expansion/contraction forces of trim material.
 - b. Interior Snap Trim: Provide manufacturer's standard interior trim package.
 - c. Extruded Aluminum Minimum Thickness: 1.57 mm (0.062 inches).
30. Thermal Insulation: Unfaced fiberglass batt insulation in accordance with ASTM C 665, Type 1.
 - a. Vapor Barrier: ASTM D 4397, 4 mil polyethylene sheeting with pressure sensitive adhesive sealing tape.
31. Joint Sealants:
 - a. Exterior Joint Sealant: AAMA 800, Type 808.3 Exterior Perimeter Sealing Compound.
 - b. Back-up Material: Standard preformed and precompressed foam material, round rod or semi-circular type, permanently elastic, mildew resistant, nonmigratory, nonstaining, and compatible with joint substrates and with sealant.
 - 1) Materials impregnated with oil, solvents, or bituminous materials not allowed.
 - 2) Provide type as recommended by sealant manufacturer for particular installation.
 - 3) Material: Neoprene, butyl, polyurethane, vinyl, or polyethylene rod.
 - c. Interior Joint Sealant: ASTM C 834, latex acrylic.

Fabrication

32. Windows: Assembled in secure manner to perform as specified and to provide neat, weather tight construction.
 - a. Make permanent watertight joints at junctions of sill and jamb members.
 - b. Joint Sealant at Mechanically Fixed Joints: AAMA 800, Type 803.3.
 - c. Welding or Brazing Flux: Completely removed immediately upon completion of welding or brazing operation.
33. Mullions and Structural Members: Mullion (whether joined by integral mullions, independent mullions, or by combination of frame members): Capable of withstanding load outlined under Uniform Load in ANSI/AAMA 101, Section 2 without deflecting more than 1/175th of its span.
34. Fin Trim or Installation Fins: Aluminum or other suitable material compatible with aluminum and of sufficient strength and thickness to assure satisfactory installation.
 - a. Nailing grooves and/or break off score lines in extrusions are acceptable.
 - b. Applied fins or fin trim may be assembled to windows by interlocking with frame members or with fasteners located not over 400 mm (16 inches) OC.
35. Thermally Improved Windows: Single window construction with thermal breaks and insulating glass units or dual window construction.
 - a. Thermal Break in Two Frame or One Frame Windows: Not bridged by any screws, fasteners, panning, etc., that would allow excessive heat transfer through window frame.
 - b. Do not make structural connection in loading bearing member into thermal break material.
36. Sills: Provide weep holes in sill of glazing pocket to provide means for water to flow to exterior.
37. Trickle Ventilators: Type which fits within glazing channels of sash frame, and contains gasketed channel to accept sealed insulating glass used in window sash.
 - a. Ventilator: Installed in top rail of upper sash, accurately sized to extend full width of sash, properly fit sash, and sash frame above and insulating glass below.
 - b. Ventilator: Consist of two piece aluminum housing connected by, and separated by, PVC extrusion forming thermal break.
 - c. Gasketed Shutter: Operate Internal flap to open and close ventilator.



- d. Unit: Complete with fly-screen.
- e. Color: Selected from manufacturers standard colors.
- 38. Secondary Windows (Storm Windows): Comply with Division 8 Section "Aluminum Storm Windows."
- 39. Windows: Comply with applicable fire codes for egress.

Finishes

- 40. Finish:
 - a. Aluminum: Provide one of following finishes as specified or scheduled:
 - 1) Pigmented Organic Coating: Factory applied pigmented organic coating, AAMA 603.8.
 - a) Color: As selected from manufacturers standard colors.
 - 2) High Performance Organic Coating: Factory applied pigmented organic coating, AAMA 605.2.
 - a) Color: As selected from manufacturer's standard colors.
 - 3) Color Anodized: Factory applied anodic coating, AAMA 608.1, Class 1.
 - a) Color: As scheduled.
 - 4) Clear Anodized: Factory applied anodic coating, AAMA 607.1, Class 1.
 - b. Exposed Surfaces of Aluminum Members: Clean and free from serious surface blemishes.
 - c. Dress and finish exposed welded joints.
- 41. Protective Coatings:
 - a. Steel Subframes: Insulate surfaces of steel from direct contact with aluminum surfaces by heavy coat or alkali-resistant bituminous paint or zinc-chromate prime coat, or other coating suitable for this purpose.
 - b. Wood Subframes: Properly treat with preservative which will not promote corrosion of aluminum.
 - c. Steel or Wood Subframes: Do not leave exposed on exterior of building.

Source Quality Control

- 42. Fabrication Tolerances: Wall Thickness, Cross-sectional Size and Overall Size: In accordance with ANSI/AAMA 101.
- 43. Testing: Performed under Third Party Administrator who is in compliance with HUD UM 39a, ANSI Z34.1, and HUD 24 CFR 200.935.

EXECUTION

Examination

- 44. Site Verification of Conditions:
 - a. Field Measurements: Verify field measurements are as indicated on Shop Drawings.
 - b. Existing Conditions: Examine openings before beginning installation.
 - c. Do not proceed with installation until conditions are satisfactory.

Preparation

- 45. Protection: Protect adjacent elements from damage and disfiguration in accordance with Detailed Scope of Work.
 - a. Contractor: Responsible for damage to grounds, plantings, buildings and any other facilities or property caused by construction operations.
 - b. Adequately enclose and protect against weather any interior space where installation is incomplete at end of working day.
 - c. Repair or replace damaged elements in accordance with Detailed Scope of Work.
- 46. Existing Widows: Remove existing windows and debris from site in accordance with Detailed Scope of Work.
- 47. Preparation: Prepare openings and existing frames in accordance with ASTM E 737.



- a. Existing Window Jambs: Prepare as necessary to provide for straight, plumb, level, tight and aesthetically appealing installation of new windows.
- b. Preparatory Work: Include, but not limited to repair of jambs, filling holes and/or dents, removing peeling and scaling paint, etc.

Installation

48. General: Install In accordance with ASTM E 737 except as modified by ANSI/AAMA 101 Appendix, manufacturer's recommendations, Reference Standards, and approved Shop Drawings.
 - a. Securely fasten windows in place to straight, plumb and level condition, without distortion of window or window frame, and make final adjustments for proper operation and satisfactory weatherstrip contact and seal.
 - b. Make proper allowance for expansion/contraction movement of aluminum.
 - c. Panning and Receptor Systems: Install to ensure watertight seal at joints with existing opening and with new replacement window.
 - 1) Thermal Insulation: Fill voids in panning system with thermal insulation.
 - 2) Vapor Barrier: Apply vapor barrier on inside between panning and existing opening. Seal laps and terminations with pressure sensitive tape.
 - d. Comply with applicable codes and regulations regarding egress requirements and fireman entry.
49. Joint Sealants: Apply in accordance with manufacturers recommendations.
 - a. Surfaces to be Sealed: Clean, dry and free of any foreign matter that would degrade adhesion. Remove existing caulking and joint sealants from areas to receive new joint sealant.
 - b. Prime cleaned surfaces in accordance with sealant manufacturer's recommendations.
 - c. Protect surfaces adjacent to joints by masking tape before applying sealant. Remove tape upon finishing sealing work.
 - d. Seal joints between perimeter of window frame and underlying or surrounding construction at
 - e. Exterior and interior with joint sealant to accomplish weather-tight installation. Maximum Width of Sealed Joint: 13 mm (1/2 inch).
50. Dissimilar Materials: Isolate materials from incompatible materials as necessary to prevent deterioration and galvanic action.
 - a. Separate dissimilar metals with bituminous paint, suitable sealant, nonabsorptive plastic or elastomeric tape. or gasket between surfaces.
 - b. Coat aluminum in direct contact with concrete, masonry, steel, or other non-compatible materials with bituminous paint, zinc chromate primer, or other suitable insulating material.

Field Quality Control

51. Owners Field Testing: the Owner may have field testing of windows conducted by its own testing agency in accordance with AAMA 502.
 - a. Tests: May include, but not limited to:
 - 1) Field Testing (Hose Test) for Water Leakage: AAMA 501.2.
 - 2) Field Testing (Air Pressure Difference) for Water Leakage: AAMA 502, Test Method B.
 - a) Field Testing for Air Leakage: ASTM E 783.
 - b) Field Testing for Water Determination: ASTM E 1105.
 - b. Test Pressures: Comply with specified performance requirements.
 - c. Contractor: Provide incidental labor facilities necessary to facilitate inspections and tests.
 - d. Costs of Testing:
 - 1) By the Owner: Successful initial tests.
 - 2) By Contractor: Initial tests with failures and subsequent tests as required because of test failures. Costs shall include costs of the Owner and other consultants for observations of tests and corrective work.
 - e. Corrective Measures: Meet standards of quality of specified window and subject to acceptance of the Owner.



Adjusting And Cleaning

52. Adjusting: At completion of job, check, adjust, and lubricate hardware as required and leave windows and hardware in proper operating condition.
53. Cleaning: Comply with requirements of Detailed Scope of Work.
 - a. Clean windows after installation is completed to remove foreign matter and surface blemishes.
 - b. Scratched or Abraded Surfaces: Touch-up with rust inhibitor primer and enamel paint compatible with factory finish.

Protection

54. Installed Work: Protect windows from damage after installation.

END OF SECTION 08 51 13 00a



Task	Specification	Specification Description
08 52 16 00	08 01 52 61	Wood Windows
08 52 19 00	08 01 52 61	Wood Windows
08 52 66 00	08 01 52 61	Wood Windows



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SECTION 08 53 13 00 - VINYL WINDOWS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of material for fixed and operable vinyl framed windows. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes fixed and operable vinyl-framed windows.

C. Definitions

1. Performance class designations according to AAMA/WDMA 101/I.S.2/NAFS:
 - a. AW: Architectural.
 - b. HC: Heavy Commercial.
 - c. C: Commercial.
 - d. LC: Light Commercial.
 - e. R: Residential.
2. Performance grade number according to AAMA/WDMA 101/I.S.2/NAFS:
 - a. Design pressure number in pounds force per square foot (pascals) used to determine the structural test pressure and water test pressure.
3. Structural Test Pressure: For uniform load structural test, is equivalent to 150 percent of the design pressure.
4. Minimum Test Size: Smallest size permitted for performance class (gateway test size). Products must be tested at minimum test size or at a size larger than minimum test size to comply with requirements for performance class.

D. Performance Requirements

1. General: Provide vinyl windows capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified, and that are of test size indicated below:
 - a. Size required by AAMA/WDMA 101/I.S.2/NAFS for gateway performance **OR** optional performance grade, **as directed**.
 - b. Size indicated on Drawings **OR** in a schedule, **as directed**.
2. Structural Performance: Provide vinyl windows capable of withstanding the effects of the following loads, based on testing units representative of those indicated for Project that pass AAMA/WDMA 101/I.S.2/NAFS, Uniform Load Structural Test:
 - a. Design Wind Loads: Determine design wind loads applicable to Project from basic wind speed indicated in miles per hour (meters per second) at 33 feet (10 m) above grade, according to ASCE 7, Section 6.5, "Method 2-Analytical Procedure," based on mean roof heights above grade indicated on Drawings.
 - 1) Basic Wind Speed: 85 mph (38 m/s) **OR** 90 mph (40 m/s), **as directed**.
 - 2) Importance Factor.
 - 3) Exposure Category: A **OR** B **OR** C **OR** D, **as directed**.
3. Windborne-Debris Resistance: Provide glazed windows capable of resisting impact from windborne debris, based on the pass/fail criteria as determined from testing glazed windows identical to those specified, according to ASTM E 1886 and testing information in ASTM E 1996 or AAMA 506 and requirements of authorities having jurisdiction.

E. Submittals

1. Product Data: For each type of vinyl window indicated.



2. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other work, operational clearances, and installation details.
3. Samples: For each exposed finish.
4. Product Schedule: Use same designations indicated on Drawings.
5. Product test reports.
6. Maintenance data.
7. Warranty: Special warranty specified in this Section.

F. Quality Assurance

1. Installer: A qualified installer, approved by manufacturer to install manufacturer's products.
2. Fenestration Standard: Comply with AAMA/WDMA 101/I.S.2/NAFS, "North American Fenestration Standard Voluntary Performance Specification for Windows, Skylights and Glass Doors," for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
 - a. Provide AAMA **OR** WDMA, **as directed**, -certified vinyl windows with an attached label.
3. Glazing Publications: Comply with published recommendations of glass manufacturers and with GANA's "Glazing Manual" unless more stringent requirements are indicated.
4. Preinstallation Conference: Conduct conference at Project site.

G. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace vinyl windows that fail in materials or workmanship within specified warranty period.
 - a. Failures include, but are not limited to, the following:
 - 1) Failure to meet performance requirements.
 - 2) Structural failures including excessive deflection, water leakage, air infiltration, or condensation.
 - 3) Faulty operation of movable sash and hardware.
 - 4) Deterioration of vinyl, other materials, and finishes beyond normal weathering.
 - 5) Failure of insulating glass.
 - b. Warranty Period:
 - 1) Window: Two **OR** Three **OR** 10, **as directed**, years from date of Final Completion.
 - 2) Glazing: Five **OR** 10, **as directed**, years from date of Final Completion.
 - 3) Vinyl Finish: Five years from date of Final Completion.

1.2 PRODUCTS

A. Materials

1. Vinyl Extrusions: Rigid (unplasticized) hollow PVC extrusions, formulated and extruded for exterior applications, complying with AAMA/WDMA 101/I.S.2/NAFS and the following:
 - a. PVC Resins: 100 percent virgin resin.
 - b. PVC Formulation: High impact, low heat buildup, lead free, nonchalking, and color and UV stabilized.
 - c. Extrusion Wall Thickness: Not less than 0.060 inch (1.5 mm) **OR** 0.090 inch (2.3 mm) **OR** 0.125 inch (3.2 mm), **as directed**.
 - d. Multichamber Extrusions: Profile designed with two chambers **OR** three chambers **OR** multichambers, **as directed**, between interior and exterior faces of the extrusions.
2. Vinyl Trim and Glazing Stops: Material and finish to match frame members.
3. Fasteners: Aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with vinyl window members, cladding, trim, hardware, anchors, and other components.
 - a. Exposed Fasteners: Unless unavoidable for applying hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.



4. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.
5. Reinforcing Members: Aluminum, or nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.
6. Compression-Type Weather Stripping: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action, and for complete concealment when vinyl window is closed.
 - a. Weather-Stripping Material: Elastomeric cellular preformed gaskets complying with ASTM C 509.
 - b. Weather-Stripping Material: Dense elastomeric gaskets complying with ASTM C 864.
 - c. Weather-Stripping Material: Manufacturer's standard system and materials complying with AAMA/WDMA 101/I.S.2/NAFS.
7. Sliding-Type Weather Stripping: Provide woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric. Comply with AAMA 701/702.
 - a. Weather Seals: Provide weather stripping with integral barrier fin or fins of semirigid, polypropylene sheet or polypropylene-coated material. Comply with AAMA 701/702.
8. Replaceable Weather Seals: Comply with AAMA 701/702.

B. Window

1. Window Type: Casement **OR** Double hung **OR** Fixed **OR** Horizontal sliding **OR** Projected awning **OR** Single hung **OR** Bay **OR** Bow **OR** Specialty product **OR** As indicated on Drawings **OR** As indicated on a schedule, **as directed**.
2. AAMA/WDMA Performance Requirements: Provide vinyl windows of performance indicated that comply with AAMA/WDMA 101/I.S.2/NAFS unless more stringent performance requirements are indicated.
 - a. Performance Class and Grade: R15 **OR** R20 **OR** R25, **as directed**.
 - b. Performance Class and Grade: LC25 **OR** LC30 **OR** LC35, **as directed**.
 - c. Performance Class and Grade: C30 **OR** C35 **OR** C40, **as directed**.
 - d. Performance Class and Grade: HC40 **OR** HC45 **OR** HC50, **as directed**.
 - e. Performance Class and Grade: AW40 **OR** AW45 **OR** AW50, **as directed**.
 - f. Performance Class and Grade: As indicated.
 - g. Performance Class (if test performance method is selected for specifying windows and designating a performance class does not conflict with basic wind speed and performance testing indicated): R **OR** LC **OR** C **OR** HC **OR** AW, **as directed**.
3. Condensation-Resistance Factor (CRF): Provide vinyl windows tested for thermal performance according to AAMA 1503, showing a CRF of 45 **OR** 52 **OR** 65, **as directed**.
4. Thermal Transmittance: Provide vinyl windows with a whole-window, U-factor maximum indicated at 15-mph (24-km/h) exterior wind velocity and winter condition temperatures when tested according to AAMA 1503 **OR** ASTM E 1423 **OR** NFRC 100, **as directed**.
 - a. U-Factor: 0.35 Btu/sq. ft. x h x deg F (2.0 W/sq. m x K) **OR** 0.40 Btu/sq. ft. x h x deg F (2.3 W/sq. m x K) **OR** 0.43 Btu/sq. ft. x h x deg F (2.5 W/sq. m x K) **OR** 0.60 Btu/sq. ft. x h x deg F (3.4 W/sq. m x K), **as directed**, or less.
5. Solar Heat-Gain Coefficient (SHGC): Provide vinyl windows with a whole-window SHGC maximum of 0.40 **OR** 0.50 **OR** 0.55, **as directed**, determined according to NFRC 200 procedures.
6. Sound Transmission Class (STC): Provide glazed windows rated for not less than 26 **OR** 30 **OR** 35, **as directed**, STC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 413.
7. AAMA/WDMA 101/I.S.2/NAFS, Air Infiltration Test.
 - a. Maximum Rate: 0.3 cfm/sq. ft. (5 cu. m/h x sq. m) of area at an inward test pressure of 1.57 lbf/sq. ft. (75 Pa) which is equivalent to 25-mph (40-km/h) wind speed and is typically used to test R, C, and LC performance classes.



- b. Maximum Rate: 0.3 cfm/sq. ft. (5 cu. m/h x sq. m) of area at an inward test pressure of 6.24 lbf/sq. ft. (300 Pa) which is equivalent to a 50-mph (80-km/h) wind speed and is typically used to test HC and AW performance classes.
 8. Water Resistance: No water leakage as defined in AAMA/WDMA referenced test methods at a water test pressure equaling that indicated, when tested according to AAMA/WDMA 101/I.S.2/NAFS, Water Resistance Test.
 - a. Test Pressure: 15 percent of positive design pressure, but not less than 2.86 lbf/sq. ft. (140 Pa) or more than 15 lbf/sq. ft. (720 Pa).
 - b. Test Pressure: 20 percent of positive design pressure, but not more than 15 lbf/sq. ft. (720 Pa).
 9. Forced-Entry Resistance: Comply with Performance Grade 10 **OR** 20 **OR** 30 **OR** 40, **as directed**, requirements when tested according to ASTM F 588.
 10. Life-Cycle Testing: Test according to AAMA 910 and comply with AAMA/WDMA 101/I.S.2/NAFS.
 11. Operating Force and Auxiliary (Durability) Tests: Comply with AAMA/WDMA 101/I.S.2/NAFS for operating window types indicated.
- C. Glazing
 1. Glass: Clear, insulating-glass units **OR** Clear, insulating-glass units, with low-E coating pyrolytic on second surface or sputtered on second or third surface, **OR** Clear, insulating-glass units, argon gas filled, with low-E coating pyrolytic on second surface or sputtered on second or third surface, **as directed**, complying with Division 08 Section "Glazing".
 2. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal **OR** Manufacturer's standard factory-glazing system that produces weathertight seal and complies with requirements for windborne-debris resistance **OR** Manufacturer's standard factory-glazing system as indicated in Division 08 Section "Glazing", **as directed**.
- D. Hardware
 1. General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with vinyl; designed to smoothly operate, tightly close, and securely lock vinyl windows, and sized to accommodate sash or ventilator weight and dimensions. Do not use aluminum in frictional contact with other metals. Where exposed, provide solid bronze **OR** extruded, cast, or wrought aluminum **OR** die-cast zinc with special coating finish **OR** nonmagnetic stainless steel, **as directed**.
 2. Counterbalancing Mechanism: Comply with AAMA 902.
 - a. Sash-Balance Type: Concealed, tape-spring **OR** spiral-tube **OR** spring-loaded, block-and-tackle, **as directed**, type, of size and capacity to hold sash stationary at any open position.
 3. Sill Cap/Track: Extruded-aluminum track with natural anodized finish **OR** Rigid PVC or other weather-resistant plastic track with manufacturer's standard integral color, **as directed**, of thickness, dimensions, and profile indicated; designed to comply with performance requirements indicated and to drain to the exterior.
 4. Locks and Latches: Designed to allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only. Provide custodial locks, **as directed**.
 5. Roller Assemblies: Low-friction design.
 6. Push-Bar Operators: Provide telescoping-type, push-bar operator designed to open and close ventilators with fixed screens.
 7. Gear-Type Rotary Operators: Comply with AAMA 901 when tested according to ASTM E 405, Method A.
 - a. Operation Function: All ventilators move simultaneously and securely close at both jambs without using additional manually controlled locking devices.
 8. Four- or Six-Bar Friction Hinges: Comply with AAMA 904.
 - a. Locking mechanism and handles for manual operation.
 - b. Friction Shoes: Provide friction shoes of nylon or other nonabrasive, nonstaining, noncorrosive, durable material.



9. Limit Devices: Provide concealed friction adjustor, adjustable stay bar **OR** concealed support arms with adjustable, limited, hold-open, **as directed**, limit devices designed to restrict sash or ventilator opening.
 - a. Safety Devices: Limit clear opening to 4 inches (100 mm) **OR** 6 inches (150 mm), **as directed**, for ventilation; with custodial key release.
 10. Pole Operators: Tubular-shaped anodized aluminum; with rubber-capped lower end and standard push-pull hook at top to match hardware design; of sufficient length to operate window without reaching more than 60 inches (1500 mm) above floor; 1 pole operator and pole hanger per room that has operable windows more than 72 inches (1800 mm) above floor.
- E. Insect Screens
1. General: Design windows and hardware to accommodate screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches. Fabricate insect screens to fully integrate with window frame. Locate screens on inside **OR** outside, **as directed**, of window and provide for each operable exterior sash or ventilator.
 - a. Aluminum Tubular Frame Screens: Comply with SMA 1004, "Specifications for Aluminum Tubular Frame Screens for Windows," Residential R-20 **OR** Architectural C-24 **OR** Monumental M-32, **as directed**, class.
 2. Aluminum Insect Screen Frames: Manufacturer's standard aluminum alloy complying with SMA 1004. Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners, adjustable rollers, **as directed**, and removable PVC spline/anchor concealing edge of frame.
 - a. Aluminum Tubular Framing Sections and Cross Braces: Roll formed from aluminum sheet with minimum wall thickness as required for class indicated.
 - b. Finish: Anodized aluminum **OR** Baked-on organic coating, **as directed**, in manufacturer's standard color.
 - c. Finish: Anodized aluminum **OR** Baked-on organic coating, **as directed**, in color selected from manufacturer's full range.
 - d. Finish: Manufacturer's standard.
 3. Glass-Fiber Mesh Fabric: 18-by-14 (1.1-by-1.4-mm) or 18-by-16 (1.0-by-1.1-mm) **OR** 20-by-20 (0.85-by-0.85-mm) or 20-by-30 (0.85-by-0.42-mm), **as directed**, mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration, in the following color. Comply with ASTM D 3656.
 - a. Mesh Color: Charcoal gray **OR** Silver gray **OR** Aquamarine, **as directed**.
 4. Aluminum Wire Fabric: 18-by-16 (1.1-by-1.3-mm) mesh of 0.011-inch- (0.28-mm-) diameter, coated aluminum wire.
 - a. Wire-Fabric Finish: Natural bright **OR** Charcoal gray **OR** Black, **as directed**.
 5. Wickets: Provide sliding **OR** hinged, **as directed**, wickets, framed and trimmed for a tight fit and for durability during handling.
- F. Accessories
1. Dividers (False Muntins): Provide dividers in designs indicated for each sash lite, one per sash, removable from the exposed surface of interior lite of the sash **OR** two per sash, removable from the exposed surfaces of interior and exterior lites of the sash **OR** one permanently located between glazing lites in the airspace, **as directed**.
 - a. Material: Extruded, rigid PVC **OR** Aluminum, **as directed**.
 - b. Design: Rectangular **OR** Diamond, **as directed**.
 - c. Color: White **OR** Beige, **as directed**.
- G. Fabrication
1. Fabricate vinyl windows in sizes indicated. Include a complete system for assembling components and anchoring windows.
 - a. Welded Frame and Sash/Ventilator Corners: Miter-cut and fusion **OR** chemically, **as directed**, welded.
 - b. Mechanically Fastened Frame and Sash/Ventilator Corners: Double-butt coped and fastened with concealed screws, **as directed**.



2. Fabricate vinyl windows that are reglazable without dismantling sash or ventilator framing.
3. Weather Stripping: Provide full-perimeter weather stripping for each operable sash and ventilator, unless otherwise indicated.
 - a. Double-Hung Windows: Provide weather stripping only at horizontal rails of operable sash.
4. Mullions: Provide mullions and cover plates as shown, compatible with window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design loads of window units. Provide manufacturer's standard finish to match window units.
5. Subframes: Provide subframes with anchors for window units as shown, of profile and dimensions indicated but not less than 0.062-inch- (1.6-mm-) thick extruded aluminum. Miter or cope corners, and weld and dress smooth with concealed mechanical joint fasteners. Provide manufacturer's standard finish to match window units. Provide subframes capable of withstanding design loads of window units.
6. Factory-Glazed Fabrication: Except for light sizes in excess of 100 unglazed inches (2500 mm width plus length), glaze vinyl windows in the factory where practical and possible for applications indicated. Comply with requirements in Division 08 Section "Glazing" and with AAMA/WDMA 101/I.S.2/NAFS.
7. Glazing Stops: Provide nailed or snap-on glazing stops coordinated with Division 08 Section "Glazing" and glazing system indicated. Provide glazing stops to match sash and ventilator frames.
8. Hardware: Mount hardware through double walls of vinyl extrusions or provide corrosion-resistant steel reinforcement complying with requirements for reinforcing members, or do both.
9. Bow **OR** Bay, **as directed**, Windows: Provide vinyl windows in configuration indicated. Provide window frames, fixed and operating sash, operating hardware, and other trim and components necessary for a complete, secure, and weathertight installation, including the following:
 - a. Angled mullion posts with interior and exterior trim.
 - b. Angled interior and exterior extension and trim.
 - c. Clear pine head and seat boards.
 - d. Top and bottom plywood platforms.
 - e. Exterior head and sill casings and trim.
 - f. Support brackets.
10. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.

H. Vinyl Finishes

1. Integral Finish and Color: Uniform, solid, homogeneous white **OR** beige, **as directed**, interior and exterior.
2. Organic Pigmented Finish: Manufacturer's standard finish, interior and exterior, complying with AAMA 613 **OR** AAMA 615, **as directed**, and paint manufacturer's written specifications for cleaning and painting.
 - a. Color: As indicated by manufacturer's designations **OR** Match sample **OR** As selected from manufacturer's full range, **as directed**.

1.3 EXECUTION

A. Installation

1. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing windows, hardware, accessories, and other components.
2. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.
3. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.



-
4. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.
- B. Adjusting, Cleaning, And Protection
1. Adjust operating sashes and ventilators, screens, hardware, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.
 2. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
 3. Clean factory-glazed glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.
 4. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
 5. Protect window surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.

END OF SECTION 08 53 13 00



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Task	Specification	Specification Description
08 53 66 00	08 53 13 00	Vinyl Windows



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SECTION 08 56 19 00 - SECURITY WINDOWS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of material for security windows. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Vision security windows.
 - b. Fixed, transaction security windows.
 - c. Sliding, transaction security windows.

C. Performance Requirements

1. Ballistics-Resistance Performance: Provide units identical to those tested for compliance with requirements indicated, and as follows:
 - a. Listed and labeled as bullet resisting according to UL 752.
 - b. Tested for ballistics resistance according to UL 752 **OR** ASTM F 1233 **OR** HPW-TP-0500.03 **OR** NIJ STD-0108.01, **as directed**, by a testing agency acceptable to authorities having jurisdiction.
 - c. Certified as complying with SD-STD-01.01, by the U.S. State Department, for ballistics resistance when tested by a qualified testing agency.
2. Forced-Entry-Resistance Performance: Provide units identical to those tested for compliance with requirements indicated, and as follows:
 - a. Tested for forced-entry resistance according to HPW-TP-0500.03 **OR** ASTM F 1233, **as directed**, by a testing agency acceptable to authorities having jurisdiction.
 - b. For Federal Government Work: Certified as complying with SD-STD-01.01, by the U.S. State Department, for forced-entry resistance when tested by a qualified testing agency.
3. Windborne-Debris-Impact-Resistance-Test Performance: Provide automatic entrances that pass large missile-impact and cyclic-pressure tests of ASTM E 1996 according to the IBC.
4. Structural Performance: Security windows shall withstand the effects of wind loads determined as follows, with no permanent deformation or breakage within window assembly when tested according to ASTM E 330:
 - a. Basic Wind Speed: As indicated in miles per hour (meters per second) at 33 feet (10 m) above grade. Determine wind loads and resulting design pressures applicable to Project according to SEI/ASCE 7, "Minimum Design Loads for Buildings and Other Structures," Section 6.4.2, "Analytic Procedure," based on mean roof heights above grade as indicated on Drawings.
5. Air Infiltration for Operable Windows: Not more than 0.370 cfm/ft. (0.573 L/s per m) **OR** 0.500 cfm/ft. (0.774 L/s per m), **as directed**, of operable sash joint at an inward test pressure of 1.56 lbf/sq. ft. (75 Pa) when tested according to ASTM E 283.
6. Air Infiltration for Fixed Windows: Not more than 0.010 cfm/ft. (0.015 L/s per m) **OR** 0.060 cfm/ft. (0.093 L/s per m), **as directed**, of crack length at an inward test pressure of 1.56 lbf/sq. ft. (75 Pa) when tested according to ASTM E 283.
7. Water Penetration: No water penetration as defined in test method at an inward test pressure of 1.56 lbf/sq. ft. (75 Pa) **OR** 2.86 lbf/sq. ft. (137 Pa) **OR** 6.24 lbf/sq. ft. (300 Pa), **as directed**, when tested according to ASTM E 331.

D. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings.



3. Samples: For each type of exposed finish required.
4. Welding certificates.
5. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of security window and accessory indicated as ballistics **OR** forced-entry, **as directed**, resistant.
6. Configuration Disclosure Drawing: For each type of forced-entry-resistant security window, complying with ASTM F 1233.
7. Warranty: Sample of special warranty.

E. Quality Assurance

1. Testing Agency Qualifications: Qualified according to ASTM E 699 and experienced in ballistics- and forced-entry-resistance testing.
2. Welding Qualifications: Qualify procedures and personnel according to the following:
 - a. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - b. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 - c. AWS D1.3, "Structural Welding Code - Sheet Steel."
 - d. AWS D1.6, "Structural Welding Code - Stainless Steel."
3. Preinstallation Conference: Conduct conference at Project site.

F. Delivery, Storage, And Handling

1. Pack security windows in wood crates for shipment. Crate glazing separate from frames unless factory glazed.
2. Label security window packaging with location in Project **OR** drawing designation, **as directed**.
3. Store crated security windows on raised blocks to prevent moisture damage.

G. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace security windows that fail in materials or workmanship within three years from date of Final Completion.

1.2 PRODUCTS

A. Materials

1. Aluminum Extrusions: ASTM B 221 (ASTM B 221M). Provide alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi (150-MPa) ultimate tensile strength and not less than 0.125 inch (3.2 mm) thick at any location for main frame and sash members.
2. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
3. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, CS (Commercial Steel), Type B; free of scale, pitting, or surface defects; pickled and oiled.
4. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, CS (Commercial Steel), Type B.
5. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, CS (Commercial Steel), Type B; with G60 (Z180) zinc (galvanized) or A60 (ZF180) zinc-iron-alloy (galvannealed) coating designation.
6. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 240/A 240M or ASTM A 666, austenitic stainless steel, Type 304 **OR** Type 316, **as directed**, stretcher-leveled standard of flatness.
7. Concealed Bolts: ASTM A 307, Grade A unless otherwise indicated.
8. Cast-in-Place Anchors in Concrete: Fabricated from corrosion-resistant materials capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing per ASTM E 488, conducted by a qualified testing agency.
 - a. Threaded or wedge type; galvanized ferrous castings, either ASTM A 27/A 27M cast steel or ASTM A 47/A 47M malleable iron. Provide bolts, washers, and shims as required; hot-dip galvanized per ASTM A 153/A 153M or ASTM F 2329.



9. Embedded Plate Anchors: Fabricated from steel shapes and plates, minimum 3/16 inch (4.8 mm) thick; with minimum 1/2-inch- (12.7-mm-) diameter, headed studs welded to back of plate.
 10. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
 11. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30-mil (0.76-mm) thickness per coat.
 12. Sealants: For sealants required within fabricated security windows, provide type recommended by manufacturer for joint size and movement. Sealant shall remain permanently elastic, nonshrinking, and nonmigrating.
- B. Window Components
1. Glazing: Comply with requirements in Division 08 Section "Security Glazing" for performance indicated.
 - a. Comply with requirements of UL listing for ballistics-resistance level.
 2. Compression-Type Glazing Strips and Weather Stripping: Unless otherwise indicated, provide compressible stripping for glazing and weather stripping, such as molded EPDM or neoprene gaskets complying with ASTM D 2000, Designations 2BC415 to 3BC620; molded PVC gaskets complying with ASTM D 2287; or molded, expanded EPDM or neoprene gaskets complying with ASTM C 509, Grade 4.
 3. Miscellaneous Glazing Materials: Provide material, size, and shape complying with requirements of glass manufacturers, and with a proven record of compatibility with surfaces contacted in installation.
 - a. Cleaners, Primers, and Sealers: Type recommended by sealant or gasket manufacturer.
 - b. Setting Blocks: Elastomeric material with a Type A Shore durometer hardness of 85, plus or minus 5.
 - c. Spacers: Elastomeric blocks or continuous extrusions with a Type A Shore durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
 - d. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
 4. Anchors, Clips, and Window Accessories: Stainless steel; hot-dip, zinc-coated steel or iron, complying with ASTM B 633; provide sufficient strength to withstand design pressure indicated.
- C. Vision Security Windows
1. Vision Security Windows: Provide fixed vision security windows with framing on four sides and no operable sash or ventilator.
 2. Ballistics Resistance:
 - a. Level 1 **OR** Level 2 **OR** Level 3 **OR** Level 4 **OR** Level 5 **OR** Level 6 **OR** Level 7 **OR** Level 8, **as directed**, when tested according to UL 752.
 - b. HG1 **OR** HG2 **OR** HG3 **OR** HG4 **OR** SMG **OR** R1 **OR** R2 **OR** R3 **OR** R4-AP **OR** SH1 **OR** SH2, **as directed**, when tested according to ASTM F 1233.
 - c. A **OR** B **OR** C **OR** D **OR** E, **as directed**, when tested according to HPW-TP-0500.03.
 - d. S **OR** R **OR** AP **OR** SH, **as directed**, when tested according to SD-STD-01.01.
 - e. Level I **OR** Level IIA **OR** Level II **OR** Level IIIA **OR** Level III **OR** Level IV, **as directed**, when tested according to NIJ STD-0108.01.
 3. Forced-Entry Resistance:
 - a. Level I **OR** Level II **OR** Level III **OR** Level IV **OR** Level V, **as directed**, when tested according to HPW-TP-0500.03.
 - b. Class I **OR** Class II **OR** Class III **OR** Class IV **OR** Class V, **as directed**, when tested according to ASTM F 1233.
 - c. Five **OR** 15 **OR** 60, **as directed**, -minute protection level when tested according to SD-STD-01.01.
 4. Framing: Fabricate perimeter framing, mullions, and glazing stops from metal sheet as follows:
 - a. Material:
 - 1) Cold-rolled steel sheet, factory primed for field-painted finish **OR** with baked-enamel finish, **as directed**.



- 2) Galvanized-steel sheet, factory primed for field-painted finish.
 - 3) Stainless-steel sheet with No. 4 finish.
 - 4) Aluminum-clad steel sheet with Class I, clear anodized **OR** Class II, clear anodized **OR** Class I, color anodized **OR** Class II, color anodized **OR** baked-enamel, **as directed**, finish.
 - 5) Material: Extruded aluminum with Class I, clear anodized **OR** Class II, clear anodized **OR** Class I, color anodized **OR** Class II, color anodized **OR** baked-enamel, **as directed**, finish.
- b. Profile: Manufacturer's standard **OR** Narrow, **as directed**, with minimum face dimension indicated.
 - c. Minimum Face Dimension: 2 inches (50 mm) **OR** 1-1/4 inches (32 mm) **OR** As indicated on Drawings, **as directed**.
 - d. Framing Depth:
 - 1) Manufacturer's standard.
 - 2) Adjustable for varying wall thicknesses by use of a two-piece, split frame that is attached to wall by clamping action induced by tightening screws.
 - 3) As indicated on Drawings.
 - e. Framing Orientation: Vertical **OR** Incline subframe 5 degrees to vertical, with top of frame slanted away from protected side of window, **as directed**.
- D. Fixed, Transaction Security Windows
1. Fixed, Transaction Security Windows: Provide fixed, framed transaction windows with operable sash or ventilator capable of allowing transfer of currency and documents.
 2. Configuration: One fixed-glazed panel **OR** Multiple fixed-glazed panels **OR** As indicated on Drawings, **as directed**.
 3. Ballistics Resistance:
 - a. Level 1 **OR** Level 2 **OR** Level 3 **OR** Level 4 **OR** Level 5 **OR** Level 6 **OR** Level 7 **OR** Level 8, **as directed**, when tested according to UL 752.
 - b. HG1 **OR** HG2 **OR** HG3 **OR** HG4 **OR** SMG **OR** R1 **OR** R2 **OR** R3 **OR** R4-AP **OR** SH1 **OR** SH2, **as directed**, when tested according to ASTM F 1233.
 - c. A **OR** B **OR** C **OR** D **OR** E, **as directed**, when tested according to HPW-TP-0500.03.
 - d. S **OR** R **OR** AP **OR** SH, **as directed**, when tested according to SD-STD-01.01.
 - e. Level I **OR** Level IIA **OR** Level II **OR** Level IIIA **OR** Level III **OR** Level IV, **as directed**, when tested according to NIJ STD-0108.01.
 4. Forced-Entry Resistance:
 - a. Level I **OR** Level II **OR** Level III **OR** Level IV **OR** Level V, **as directed**, when tested according to HPW-TP-0500.03.
 - b. Class I **OR** Class II **OR** Class III **OR** Class IV **OR** Class V, **as directed**, when tested according to ASTM F 1233.
 - c. Five **OR** 15 **OR** 60, **as directed**, -minute protection level when tested according to SD-STD-01.01.
 5. Framing: Fabricate perimeter framing, mullions, and glazing stops from metal sheet as follows:
 - a. Material:
 - 1) Cold-rolled steel sheet, factory primed for field-painted finish **OR** with baked-enamel finish, **as directed**.
 - 2) Stainless-steel sheet with No. 4 finish.
 - 3) Aluminum-clad steel sheet with Class I, clear anodized **OR** Class II, clear anodized **OR** Class I, color anodized **OR** Class II, color anodized **OR** baked-enamel, **as directed**, finish.
 - 4) Extruded aluminum with Class I, clear anodized **OR** Class II, clear anodized **OR** Class I, color anodized **OR** Class II, color anodized **OR** baked-enamel, **as directed**, finish.
 - b. Profile: Manufacturer's standard **OR** Narrow, **as directed**, with minimum face dimension indicated.



- c. Minimum Face Dimension: 2 inches (50 mm) **OR** 1-1/4 inches (32 mm) **OR** As indicated on Drawings, **as directed**.
 - d. Framing Depth:
 - 1) Manufacturer's standard.
 - 2) Adjustable for varying wall thicknesses by use of a two-piece, split frame that is attached to wall by clamping action induced by tightening screws.
 - 3) As indicated on Drawings.
 - e. Provide thermally improved construction for aluminum framing.
 6. Head and Jamb Framing: Designed for sealant glazing **OR** gasket glazing **OR** voice communication by speech at normal volume, **as directed**.
 7. Channel-Frame Sill: Formed from stainless steel and designed for sealant glazing.
 - a. Transaction Counter: Stainless steel, 12 inches (305 mm) **OR** 18 inches (457 mm), **as directed**, deep by width of security window, with integral deal tray centered in opening **OR** as indicated on Drawings, **as directed**.
 - b. Transaction Counter: Stainless steel, 21 inches (533 mm) deep by width of security window, with operable deal tray centered in opening **OR** as indicated on Drawings, **as directed**.
 8. Voice-Communication-Type Sill: Formed from stainless steel and designed to allow passage of speech at normal speaking volume without distortion.
 - a. Sill Depth: 12 inches (305 mm) deep **OR** 18 inches (457 mm) deep with 6-inch (152-mm) deep projection on nonsecure side **OR** 21 inches (533 mm) deep with 6-inch (152-mm) deep projection on both sides, **as directed**.
 - b. Transaction Counter: Stainless steel, 12 inches (305 mm) **OR** 18 inches (457 mm), **as directed**, deep by width of security window, with integral deal tray centered in opening **OR** as indicated on Drawings, **as directed**.
 - c. Integral Transaction-Drawer Sill: Formed from stainless steel **OR** framing to match head and jamb framing, **as directed**; with transaction drawer integrated into framing and contained in a stainless-steel housing that forms a transaction counter on secure side **OR** nonsecure side **OR** both sides, **as directed**, of opening. Drawer front shall be flush with housing when drawer is closed.
- E. Sliding, Transaction Security Windows
1. Sliding, Transaction Security Windows: Provide horizontal-sliding, transaction security windows.
 2. Configuration: One fixed-glazed panel and one horizontal-sliding glazed panel **OR** Two glazed panels that slide horizontally and meet at center of security window **OR** As indicated on Drawings, **as directed**.
 3. Ballistics Resistance:
 - a. Level 1 **OR** Level 2 **OR** Level 3 **OR** Level 4 **OR** Level 5 **OR** Level 6 **OR** Level 7 **OR** Level 8, **as directed**, when tested according to UL 752.
 - b. HG1 **OR** HG2 **OR** HG3 **OR** HG4 **OR** SMG **OR** R1 **OR** R2 **OR** R3 **OR** R4-AP **OR** SH1 **OR** SH2, **as directed**, when tested according to ASTM F 1233.
 - c. A **OR** B **OR** C **OR** D **OR** E, **as directed**, when tested according to HPW-TP-0500.03.
 - d. S **OR** R **OR** AP **OR** SH, **as directed**, when tested according to SD-STD-01.01.
 - e. Level I **OR** Level IIA **OR** Level II **OR** Level IIIA **OR** Level III **OR** Level IV, **as directed**, when tested according to NIJ STD-0108.01.
 4. Forced-Entry Resistance:
 - a. Level I **OR** Level II **OR** Level III **OR** Level IV **OR** Level V, **as directed**, when tested according to HPW-TP-0500.03.
 - b. Class I **OR** Class II **OR** Class III **OR** Class IV **OR** Class V, **as directed**, when tested according to ASTM F 1233.
 - c. Five **OR** 15 **OR** 60, **as directed**, -minute protection level when tested according to SD-STD-01.01.
 5. Framing: Fabricate perimeter framing, mullions, and glazing stops from metal sheet as follows:
 - a. Material:
 - 1) Cold-rolled steel sheet, factory primed for field-painted finish **OR** with baked-enamel finish, **as directed**.



- 2) Material: Stainless-steel sheet with No. 4 finish.
- 3) Material: Aluminum-clad steel sheet with Class I, clear anodized **OR** Class II, clear anodized **OR** Class I, color anodized **OR** Class II, color anodized **OR** baked-enamel, **as directed**, finish.
- 4) Material: Extruded aluminum with Class I, clear anodized **OR** Class II, clear anodized **OR** Class I, color anodized **OR** Class II, color anodized **OR** baked-enamel, **as directed**, finish.
- b. Profile: Manufacturer's standard **OR** Narrow, **as directed**, with minimum face dimension indicated.
- c. Minimum Face Dimension: 2 inches (50 mm) **OR** 1-1/4 inches (32 mm) **OR** As indicated on Drawings, **as directed**.
- d. Framing Depth:
 - 1) Manufacturer's standard.
 - 2) Adjustable for varying wall thicknesses by use of a two-piece, split frame that is attached to wall by clamping action induced by tightening screws.
 - 3) As indicated on Drawings.
- e. Provide thermally improved construction for aluminum framing.
6. Head and Jamb Framing: Designed for sealant **OR** gasket, **as directed**, glazing.
7. Glazing Meeting Edges: Polished glazing.
8. Sill: Stainless-steel channel frame designed for sealant **OR** gasket, **as directed**, glazing.
 - a. Shelf: Stainless steel, 12 inches (305 mm) **OR** 18 inches (457 mm), **as directed**, deep by width of security window, with integral deal tray.
9. Sliding Window Hardware: Provide roller track designed for overhead support of two- or four-wheel carriage supporting horizontal-sliding glazed panel. Provide manufacturer's standard pull and lock with two keys for each horizontal-sliding glazed panel.
 - a. Provide weather stripping for exterior horizontal-sliding, transaction security windows.

F. Accessories

1. Recessed Deal Trays: Formed from stainless steel with sliding stainless-steel cover, **as directed**; fabricated in curved shape with exposed flanges for recessed installation into horizontal surface.
 - a. Clear Opening Size: 12 inches wide by 8 inches deep by 1-1/2 inches high (305 mm wide by 203 mm deep by 38 mm high) **OR** 12 inches wide by 11 inches deep by 1-1/2 inches high (305 mm wide by 279 mm deep by 38 mm high) **OR** 16 inches wide by 11 inches deep by 1-1/2 inches high (406 mm wide by 279 mm deep by 38 mm high), **as directed**.
2. Recessed, Nonricochet Deal Trays: Formed from stainless steel; fabricated with recessed bullet trap to ricochet bullets away from secure side, with exposed flanges for recessed installation into horizontal surface, and with sliding stainless-steel cover, **as directed**.
 - a. Clear Opening Size: 10 inches wide by 7 inches deep by 1-1/2 inches high (254 mm wide by 178 mm deep by 38 mm high) **OR** 12 inches wide by 8 inches deep by 1-1/2 inches high (305 mm wide by 203 mm deep by 38 mm high) **OR** 12 inches wide by 11 inches deep by 1-1/2 inches high (305 mm wide by 279 mm deep by 38 mm high) **OR** 16 inches wide by 11 inches deep by 1-1/2 inches high (406 mm wide by 279 mm deep by 38 mm high), **as directed**.
 - b. Bullet Trap Location: Secure side **OR** Both sides, **as directed**.
 - c. Ballistics Resistance: UL Level 1 **OR** UL Level 3 **OR** Same as security window, **as directed**.
 - d. Listed and labeled as bullet resisting according to UL 752.
3. Rotating Deal Trays: Formed from stainless steel, with rotating recessed deal tray on each side of secure opening and with handle that rotates deal trays 180 degrees.
 - a. Mounting: Drop in **OR** Countertop, **as directed**.
 - b. Ballistics Resistance: UL Level 1 **OR** UL Level 3 **OR** Same as security window, **as directed**.
 - c. Listed and labeled as bullet resisting according to UL 752.



4. Transaction Drawers: Formed from stainless steel **OR** steel **OR** bullet-resistant armoring, **as directed**; with ball-bearing, telescoping sliding mechanism; with cover on secure side of top of drawer that automatically closes when drawer is extended to nonsecure side.
 - a. Inside Dimensions: 15-3/8 inches wide by 8-1/2 inches deep by 4-3/8 inches high (390 mm wide by 216 mm deep by 111 mm high) **OR** 13 inches wide by 22 inches deep by 6-1/2 inches high (330 mm wide by 559 mm deep by 165 mm high), **as directed**.
 - b. Operation:
 - 1) Manual.
 - 2) Electric, with sliding handle for emergency manual operation during lack of power. Provide individual switches for power and drawer movement on secure side and call button on nonsecure side.
 - c. Ballistics Resistance: UL Level 1 **OR** UL Level 3 **OR** Same as security window, **as directed**.
 - d. Listed and labeled as bullet resisting according to UL 752.
5. Speaking Apertures: Fabricate from stainless steel **OR** security glazing, **as directed**, designed to allow passage of speech at normal speaking volume without distortion.
 - a. Shape: Circular **OR** Square, **as directed**.
 - b. Ballistics Resistance: UL Level 1 **OR** UL Level 3 **OR** Same as security window, **as directed**.
 - c. Listed and labeled as bullet resisting according to UL 752.

G. Fabrication

1. General: Fabricate security windows to provide a complete system for assembly of components and anchorage of window units.
 - a. Provide units that are reglazable from the secure side without dismantling the nonsecure side of framing.
 - b. Prepare security windows for glazing unless preglazing at the factory is indicated.
2. Provide weep holes and internal water passages for exterior security windows to conduct infiltrating water to the exterior.
3. Framing: Miter or cope corners the full depth of framing; weld and dress smooth.
 - a. Fabricate framing with manufacturer's standard, internal opaque armoring in thicknesses required for security windows to comply with ballistics-resistance performance indicated.
4. Glazing Stops: Finish glazing stops to match security window framing.
 - a. Secure-Side (Exterior) Glazing Stops: Welded or integral to framing.
 - b. Nonsecure-Side (Interior) Glazing Stops: Removable, coordinated with glazing indicated.
5. Welding: Weld components to comply with referenced AWS standard. To greatest extent possible, weld before finishing and in concealed locations to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
6. Metal Protection: Separate dissimilar metals to protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
7. Factory-cut openings in glazing for speaking apertures.
8. Preglazed Fabrication: Preglaze window units at factory, where required for applications indicated. Comply with requirements in Division 08 Section "Security Glazing".
9. Weather Stripping: Factory applied.

H. Aluminum Finishes

1. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm **OR** AA-M12C22A31, Class II, 0.010 mm, **as directed**, or thicker.
2. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm **OR** AA-M12C22A32/A34, Class II, 0.010 mm, **as directed**, or thicker.
 - a. Color: Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black, **as directed**.
3. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.



- a. Color and Gloss: As selected from manufacturer's full range.

I. Metallic-Coated Steel Sheet Finishes

1. Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas and apply galvanizing repair paint, complying with SSPC-Paint 20, to comply with ASTM A 780.
2. Factory Prime Finish: Apply an air-dried primer, complying with SSPC-Paint 5, immediately after cleaning and pretreating.
3. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard 2-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil (0.025 mm) for topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).
 - a. Color and Gloss: As selected from manufacturer's full range.

J. Stainless-Steel Finishes

1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - a. Run grain of directional finishes with long dimension of each piece.
 - b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - c. Directional Satin Finish: No. 4.

1.3 EXECUTION

A. Installation

1. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing security windows to in-place construction. Include threaded fasteners for concrete and masonry inserts, security fasteners, and other connectors.
 - a. Install an attached or integral flange to secure side of security windows extending over rough-in opening gap so that gap has same forced-entry-resistance and ballistics-resistance performance as security window.
2. Voice-Communication-Type Framing: Attach removable glass spacers to jambs and head of glazing, located not more than 6 inches (152 mm) from each corner and spaced not more than 12 inches (305 mm) o.c.
3. Glazed Framing: Provide sealant **OR** gasket, **as directed**, glazed framing. Comply with installation requirements in Division 08 Section "Security Glazing".
4. Removable Glazing Stops and Trim: Fasten components with security fasteners.
5. Fasteners: Install security windows using fasteners recommended by manufacturer with head style appropriate for installation requirements, strength, and finish of adjacent materials. Provide stainless-steel fasteners in stainless-steel materials, **as directed**.
6. Sealants: Comply with requirements in Division 07 Section "Joint Sealants" for installing sealants, fillers, and gaskets.
 - a. Set continuous sill members and flashing in a full sealant bed to provide weathertight construction unless otherwise indicated.
 - b. Seal frame perimeter with sealant to provide weathertight construction unless otherwise indicated.
7. Metal Protection: Where dissimilar metals will contact each other, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended in writing by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

B. Adjusting



1. Adjust horizontal-sliding, transaction security windows to provide a tight fit at contact points for smooth operation and a secure enclosure.
2. Adjust transaction drawers to provide a tight fit at contact points and weather stripping for smooth operation and weathertight and secure enclosure.
3. Remove and replace defective work, including security windows that are warped, bowed, or otherwise unacceptable.

C. Cleaning And Protection

1. Clean surfaces promptly after installation of security windows. Take care to avoid damaging the finish. Remove excess glazing and sealant compounds, dirt, and other substances.
 - a. Lubricate sliding security window hardware.
 - b. Lubricate transaction drawer hardware.
2. Clean glass of preglazed security windows promptly after installation. Comply with requirements in Division 08 Section "Security Glazing" for cleaning and maintenance.
3. Provide temporary protection to ensure that security windows are without damage at time of Final Completion.

END OF SECTION 08 56 19 00



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Task	Specification	Specification Description
08 56 56 00	08 11 63 13a	Security Window Screens and Doors
08 56 56 00	08 34 53 00a	Security Grilles
08 56 59 00	01 22 16 00	No Specification Required
08 65 00 00	08 45 23 00	Unit Skylights



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SECTION 08 71 13 00 - AUTOMATIC DOOR OPERATORS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of material for automatic door operators. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Power door operators for swinging doors.
 - b. Low-energy door operators for swinging doors.
 - c. Power-assist door operators for swinging doors.

C. Definitions

1. Double Egress Doors: A pair of doors that simultaneously swing with the two doors moving in opposite directions with no mullion between them.
2. Double Swing Doors: A pair of doors that swing with the two doors moving in opposite directions with a mullion between them; each door functioning as a single swing door.

D. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: For automatic door operators. Include plans, elevations, sections, details, and attachments to other work.
3. Samples: For each exposed product and for each color and texture specified.
4. Product certificates
5. Field quality-control reports.
6. Maintenance data.
7. Warranty: Sample of special warranty.

E. Quality Assurance

1. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation and maintenance of units required for this Project and who employs a certified inspector, **as directed**.
2. Certified Inspector Qualifications: Certified by the AAADM.
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency, and marked for intended location and application.
4. Exit-Door Requirements: Comply with requirements of authorities having jurisdiction for doors with automatic door operators serving as a component of a required means of egress.
5. Preinstallation Conference: Conduct conference at Project site.

F. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of automatic door operators that fail in materials or workmanship within two years from date of Final Completion.

1.2 PRODUCTS

A. Materials

1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated, complying with standards indicated below:



- a. Sheet: ASTM B 209 (ASTM B 209M).
 - b. Extrusions: ASTM B 221 (ASTM B 221M).
 2. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304, stretcher-leveled standard of flatness, in manufacturer's standard thickness.
 3. Brass Sheet: ASTM B 36/B 36M, Alloy UNS No. C26000 (cartridge brass, 70 percent copper), in manufacturer's standard thickness.
 4. Bronze Sheet: ASTM B 36/B 36M, Alloy UNS No. C28000 (muntz metal, 60 percent copper) or Alloy UNS No. C23000 (red brass, 85 percent copper), in manufacturer's standard thickness.
 5. Expanded Aluminum Mesh: Manufacturer's standard expanded **OR** expanded and flattened, **as directed**, aluminum sheet in accordance with the geometry of ASTM F 1267.
 6. Polycarbonate: Manufacturer's standard monolithic polycarbonate sheet manufactured by extrusion process, with an average impact strength of 12 to 16 ft-lbf/in. (640 to 854 J/m) of width when tested according to ASTM D 256, Method A.
 7. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
- B. Automatic Door Operators, General
1. General: Provide operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated; and complying with UL 325. Coordinate operator mechanisms with door operation, hinges, and activation and safety devices.
 - a. Emergency Breakaway: Where indicated for center-pivoted doors, provide emergency breakaway feature for reverse swing of doors. Equip system to discontinue power to automatic door operator when door is in emergency breakaway position, and to return to closed position after breakaway and automatically reset.
 - b. Fire-Rated Doors: Provide door operators for fire-rated door assemblies that comply with NFPA 80 for fire-rated door components and are listed and labeled by a qualified testing agency.
 - c. Wind Load: Provide door operators on exterior doors that will open and close doors and maintain them in fully closed position when subjected to wind load of **<Insert wind load>**.
 2. Electromechanical Operating System: Self-contained unit powered by permanent-magnet dc motor; with closing speed controlled mechanically by gear train and dynamically by braking action of electric motor, connections for power and activation- and safety-device wiring, and manual operation including spring closing when power is off.
 3. Electrohydraulic Operating System: Self-contained low-pressure unit; with separate cylinders for power and checking, connections for power and activation- and safety-device wiring, manual operation including spring closing when power is off.
 4. Pneumatic Operating System: Pneumatic operator, air opened and spring closed, checking in both cycles, with doors manually operable when power is off.
 - a. Power Unit: Manufacturer's standard remote compressor unit, complete with tank, compressor, motor, regulator, safety valve, pressure cutoff switch, and automatic air-line filter drain.
OR
Power Unit: As specified in Division 22 Section(s) "General-service Compressed-air Piping" AND "General-service Packaged Air Compressors And Receivers".
 5. Hinges: See Division 08 Section "Door Hardware" for type of hinge for each door that door operator shall accommodate.
 6. Housing for Overhead Concealed Operators: Fabricated from minimum 0.125-inch- (3.2-mm-) thick, extruded or formed aluminum and extending full width of door opening including door jambs to conceal door operators and controls. Provide hinged or removable access panels for service and adjustment of door operators and controls. Secure panels to prevent unauthorized access.
 7. Cover for Surface-Mounted Operators: Fabricated from 0.125-inch- (3.2-mm-) thick extruded or formed aluminum; manufacturer's standard width; **OR** continuous over full width of operator-controlled door opening; **OR** continuous over full width of door opening including door jambs, **as**



- directed**; with enclosed end caps, provision for maintenance access, and fasteners concealed when door is in closed position.
8. Brackets and Reinforcements: Manufacturer's standard, fabricated from aluminum with nonstaining, nonferrous shims for aligning system components.
 9. Fire-Door Package: Consisting of UL-listed latch mechanism, power-reset box, and caution signage for fire-rated doors. Latch mechanism shall allow door to swing free during automatic operation; when fire is detected, latch actuator shall cause exit hardware to latch when door closes. Provide latch actuators with fail-secure design.
- C. Power Door Operators
1. Standard: BHMA A156.10.
 2. Performance Requirements:
 - a. Opening Force:
 - 1) Power-Operated Doors: Not more than 50 lbf (222 N) required to manually set door in motion if power fails; not more than 15 lbf (67 N) required to open door to minimum required width.
OR
Power-Operated Swinging Doors: Not more than 30 lbf (133 N) required to manually open door if power fails.
 - 2) Breakaway Device for Power-Operated Doors: Not more than 50 lbf (222 N) required for a door to open.
 - b. Entrapment Protection: Not more than 40 lbf (178 N) required to prevent stopped door in the last 10 degrees of opening from moving in the direction of opening; not more than 30 lbf (133 N) required to prevent stopped door from moving in direction of closing.
 3. Configuration: Operator to control single swinging door **OR** pair of swinging doors, **as directed**.
 - a. Traffic Pattern: One way **OR** Two way **OR** Double swing **OR** Double egress, **as directed**.
 - b. Operator Mounting: Surface **OR** Overhead concealed, **as directed**.
 4. Operation: Power opening and power-assisted, **as directed**, spring closing. Provide time delay for door to remain open before initiating closing cycle as required by BHMA A156.10.
 5. Operating System: Electromechanical **OR** Electrohydraulic **OR** Pneumatic, **as directed**.
 6. Microprocessor Control Unit: Solid-state controls.
 7. Features:
 - a. Adjustable opening **OR** closing **OR** opening and closing, **as directed**, speed.
 - b. Adjustable opening **OR** closing, **as directed**, force.
 - c. Adjustable backcheck.
 - d. Adjustable hold-open time from zero to 30 seconds.
 - e. Adjustable time delay.
 - f. Adjustable acceleration.
 - g. Adjustable limit switch.
 - h. Obstruction recycle.
 - i. On-off/hold-open switch to control electric power to operator; key operated, **as directed**.
 8. Exposed Finish: Finish exposed components with Class I, clear anodic finish **OR** Class II, clear anodic finish **OR** Class I, color anodic finish **OR** Class II, color anodic finish **OR** baked-enamel or powder coat **OR** metal cladding **OR** finish matching door and frame **OR** finish matching door hardware, **as directed**.
 - a. Color: As selected from full range of industry colors and color densities.
 - b. Metal Cladding: No. 4 directional-satin-finish stainless steel **OR** No. 8 mirrorlike reflective, nondirectional-polish-finish stainless steel **OR** Satin brass **OR** Polished brass **OR** Satin bronze **OR** Polished bronze, **as directed**.
- D. Low-Energy Door Operators
1. Standard: BHMA A156.19.
 2. Performance Requirements:
 - a. Opening Force if Power Fails: Not more than 15 lbf (67 N) required to release a latch if provided, not more than 30 lbf (133 N) required to manually set door in motion, and not more than 15 lbf (67 N) required to fully open door.



- b. Entrapment Protection: Not more than 15 lbf (67 N) required to prevent stopped door from closing or opening.
 3. Configuration: Operator to control single swinging door **OR** pair of swinging doors, **as directed**.
 - a. Traffic Pattern: One way **OR** Two way **OR** Double swing **OR** Double egress, **as directed**.
 - b. Operator Mounting: Surface **OR** Overhead concealed, **as directed**.
 4. Operation: Power opening and power-assisted, **as directed**, spring closing. Provide time delay for door to remain open before initiating closing cycle as required by BHMA A156.19. When not in automatic mode, door operator shall function as manual door closer, with or without electrical power.
 5. Operating System: Electromechanical **OR** Electrohydraulic **OR** Pneumatic, **as directed**.
 6. Microprocessor Control Unit: Solid-state controls.
 7. Features:
 - a. Adjustable opening **OR** closing **OR** opening and closing, **as directed**, speed.
 - b. Adjustable opening **OR** closing, **as directed**, force.
 - c. Adjustable backcheck.
 - d. Adjustable hold-open time from zero to 30 seconds.
 - e. Adjustable time delay.
 - f. Adjustable acceleration.
 - g. Obstruction recycle.
 - h. On-off/hold-open switch to control electric power to operator; key operated, **as directed**.
 8. Exposed Finish: Finish exposed components with Class I, clear anodic finish **OR** Class II, clear anodic finish **OR** Class I, color anodic finish **OR** Class II, color anodic finish **OR** baked-enamel or powder coat **OR** metal cladding **OR** finish matching door and frame **OR** finish matching door hardware, **as directed**.
 - a. Color: As selected from full range of industry colors and color densities.
 - b. Metal Cladding: No. 4 directional-satin-finish stainless steel **OR** No. 8 mirrorlike reflective, nondirectional-polish-finish stainless steel **OR** Satin brass **OR** Polished brass **OR** Satin bronze **OR** Polished bronze, **as directed**.
- E. Power-Assist Door Operators
1. Standard: BHMA A156.19.
 2. Performance Requirements:
 - a. Opening Force:
 - 1) If Power Fails: Not more than 15 lbf (67 N) required to release a latch if provided, not more than 30 lbf (133 N) required to manually set door in motion, and not more than 15 lbf (67 N) required to fully open door.
 - 2) Accessible Interior Doors: Not more than 5 lbf (22 N) to fully open door.
 - b. Entrapment Protection: Not more than 15 lbf (67 N) required to prevent stopped door from closing or opening.
 3. Configuration: Operator to control single swinging door **OR** pair of swinging doors, **as directed**.
 - a. Traffic Pattern: One way **OR** Two way **OR** Double swing **OR** Double egress, **as directed**.
 - b. Operator Mounting: Surface **OR** Overhead concealed, **as directed**.
 4. Operation: Power-assisted opening that reduces force to open door and power-assisted, **as directed**, spring closing. Pushing or pulling on door activates the operator. Provide time delay for door to remain open before initiating closing cycle as required by BHMA A156.19. When not in automatic mode, door operator shall function as manual door closer, with or without electrical power.
 5. Operating System: Electromechanical **OR** Electrohydraulic **OR** Pneumatic, **as directed**.
 6. Microprocessor Control Unit: Solid-state controls.
 7. Features:
 - a. Adjustable opening **OR** closing **OR** opening and closing, **as directed**, speed.
 - b. Adjustable opening **OR** closing, **as directed**, force.
 - c. Adjustable backcheck.
 - d. Adjustable latch speed.
 - e. Adjustable hold-open time from zero to 30 seconds.



- f. Adjustable time delay.
 - g. Adjustable acceleration.
 - h. Obstruction recycle.
 - i. On-off/hold-open switch to control electric power to operator; key operated, **as directed**.
8. Exposed Finish: Finish exposed components with Class I, clear anodic finish **OR** Class II, clear anodic finish **OR** Class I, color anodic finish **OR** Class II, color anodic finish **OR** baked-enamel or powder coat **OR** metal cladding **OR** finish matching door and frame **OR** finish matching door hardware, **as directed**.
- a. Color: As selected from full range of industry colors and color densities.
 - b. Metal Cladding: No. 4 directional-satin-finish stainless steel **OR** No. 8 mirrorlike reflective, nondirectional-polish-finish stainless steel **OR** Satin brass **OR** Polished brass **OR** Satin bronze **OR** Polished bronze, **as directed**.
- F. Activation And Safety Devices
- 1. General: Provide activation and safety devices in accordance with BHMA standards, for condition of exposure and for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated. Coordinate activation and safety devices with door operation and door operator mechanisms.
 - 2. Motion Sensors: Self-contained, K-band-frequency, microwave-scanner units; adjustable to provide detection field sizes and functions required by BHMA A156.10.
 - a. Provide capability for switching between bidirectional and unidirectional detection.
 - b. For one-way traffic, sensor on egress side shall not be active when doors are fully closed.
 - 3. Presence Sensors: Self-contained, infrared-scanner units; adjustable to provide detection field sizes and functions required by BHMA A156.10. Sensors shall remain active at all times.
 - 4. Combination Motion/Presence Sensors: Self-contained units consisting of both motion and presence sensors in a single housing; adjustable to provide detection field sizes and functions required by BHMA A156.10.
 - a. Motion Sensor: K-band-frequency, microwave-scanner units.
 - 1) Provide capability for switching between bidirectional and unidirectional detection.
 - 2) For one-way traffic, sensor on egress side shall not be active when doors are fully closed.
 - b. Presence Sensor: Infrared-scanner units that remain active at all times.
 - 5. Photoelectric Beams: Pulsed infrared, sender-receiver assembly for recessed mounting. Beams shall not be active when doors are fully closed.
 - 6. Control Mats: 1/2-inch- (13-mm-) thick, synthetic-rubber or flexible-plastic mat in safety-ribbed surface pattern, with extruded-aluminum frame; with pressure switches for low-voltage control wiring; and complying with performance requirements in BHMA A156.10.
 - a. Frame: Recessed to fit flush with floor, with concealed anchors **OR** Surface mounted, with tapered safety edge, **as directed**.
 - b. Size: As indicated, but not smaller than required by BHMA A156.10 including Appendix A.
 - c. Color: As selected from full range of industry colors and color densities.
 - 7. Push-Plate Switch: Momentary-contact door control switch with flat push-plate actuator with contrasting-colored, engraved message, **as directed**.
 - a. Configuration: Round **OR** Square, **as directed**, push plate with 4-by-4-inch (100-by-100-mm) junction box.
 - 1) Mounting: Recess mounted, semiflush in wall **OR** Surface mounted on wall **OR** As indicated on Drawings, **as directed**.
 - b. Configuration: Rectangular push plate with 2-by-4-inch (50-by-100-mm) junction box.
 - 1) Mounting: Recess mounted, semiflush in wall **OR** Recess mounted in door jamb **OR** Surface mounted on wall **OR** Surface mounted on post **OR** Surface mounted on guide rail **OR** As indicated on Drawings, **as directed**.
 - c. Push-Plate Material: Stainless steel **OR** Plastic, **as directed**, as selected from manufacturer's full range.
 - d. Message: Plain face with no message **OR** "Push to Open" **OR** International symbol of accessibility **OR** International symbol of accessibility and "Push to Open", **as directed**.



8. Push-Button Switch: Momentary-contact door control switch with one red-button actuator; enclosed in nominal 2-by-4-inch (50-by-100-mm) **OR** 4-by-4-inch (100-by-100-mm), **as directed**, junction box.
 - a. Provide faceplate engraved with "Press to Open" text and international symbol of accessibility, **as directed**, in contrasting color.
 - b. Provide blue plastic cover engraved with "Press Button to Open" in white text and international symbol of accessibility.
 - c. Mounting: Surface mounted on wall **OR** Surface mounted on post **OR** Surface mounted on guide rail **OR** Recess mounted in wall **OR** As indicated on Drawings, **as directed**.
 - d. Faceplate Material: Stainless steel **OR** Painted metal, **as directed**, as selected from manufacturer's full range.
9. Key Switch: Recess-mounted, door control switch with key-controlled actuator; enclosed in 2-by-4-inch (50-by-100-mm) junction box. Provide faceplate engraved with text indicating switch functions.
 - a. Faceplate Material: Stainless steel **OR** Painted metal, **as directed**, as selected from manufacturer's full range.
 - b. Functions: On-off, momentary contact **OR** On-off, maintained contact **OR** Two-way automatic, hold open, one-way exit, and off **OR** Two-way automatic, hold open, one-way exit, off, full open, and partial open, **as directed**.
 - c. Mounting: Recess mounted, semiflush in wall **OR** Recess mounted in door jamb **OR** Surface mounted on wall **OR** Surface mounted on post **OR** As indicated on Drawings, **as directed**.
10. Wireless or Remote Radio-Control Switch: Manufacturer's standard radio-control system consisting of header-mounted receiver and wall-mounted **OR** hand-held, battery-operated, **as directed**, transmitter switch.
 - a. Wall-Mounted Transmitter Switch: One red-button, momentary-contact actuator enclosed in 4-by-4-inch (100-by-100-mm) junction box. Provide blue plastic cover engraved with "Press Button to Open" in white text and international symbol of accessibility.
11. Electrical Interlocks: Unless units are equipped with self-protecting devices or circuits, provide electrical interlocks to prevent activation of operator when door is locked, latched, or bolted.

G. Fabrication

1. Factory fabricate automatic door operators to comply with indicated standards.
2. Fabricate exterior components to drain water passing joints and condensation and moisture occurring or migrating within operator enclosure to the exterior.
3. Form aluminum shapes before finishing.
4. Use concealed fasteners to greatest extent possible. Where exposed fasteners are required, use countersunk Phillips flat-head machine screws, finished to match operator.
5. Provide metal cladding, completely cladding visible surfaces before shipment to Project site. Fabricate cladding with concealed fasteners and connection devices, with accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion, and with allowance for thermal expansion at exterior doors.

H. Accessories

1. Signage: As required by cited BHMA standard for the type of operator.
 - a. Application Process: Decals **OR** Silk-screened **OR** Door manufacturer's standard process, **as directed**.
 - b. Provide sign materials with instructions for field application when operators are installed.
2. Guide Rails: Anodized aluminum **OR** Baked-enamel or powder-coated aluminum **OR** Stainless steel, **as directed**, fabricated from bars **OR** tubing, **as directed**, minimum 30 inches (762 mm) high, and finished to match doors unless otherwise indicated; positioned and projecting from face of door jamb for distance as indicated, but not less than that required by BHMA A156.10 for type of door and direction of travel; with filler panel.
 - a. Filler Panel: Expanded aluminum mesh **OR** Polycarbonate plastic, **as directed**.



- 1) Orient expanded aluminum mesh with long dimension of diamonds parallel to top rail **OR** perpendicular to top rail **OR** horizontal **OR** vertical, **as directed**.
- 2) Color: As selected from manufacturer's full range.
- b. Provide intermediate guide rail suitable for supporting photoelectric beams.
- c. Mounting: Jamb and floor **OR** Floor, freestanding, **as directed**.

OR

Guide Rails: See Division 05 Section(s) "Metal Fabrications" OR "Pipe And Tube Railings" OR "Decorative Metal", **as directed**.

I. General Finish Requirements

1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
3. Apply organic and anodic finishes to formed metal after fabrication unless otherwise indicated.
4. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

J. Aluminum Finishes

1. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm **OR** AA-M12C22A31, Class II, 0.010 mm, **as directed**, or thicker.
2. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm **OR** AA-M12C22A32/A34, Class II, 0.010 mm, **as directed**, or thicker.
3. Baked-Enamel or Powder-Coat Finish: AAMA 2603. Comply with coating manufacturer's written instructions for cleaning, conversion coating, application, and baking.

1.3 EXECUTION

A. Installation

1. General: Install complete automatic door operators according to manufacturer's written instructions, including activation and safety devices, control wiring, and remote power units if any; connection to the building's power supply; and signage.
 - a. Do not install damaged components. Fit joints to produce hairline joints free of burrs and distortion.
 - b. Install operators true in alignment with established lines and door geometry without warp or rack. Anchor securely in place.
 - c. Power Door Operator Installation Standard: BHMA A156.10.
 - d. Low-Energy Door Operator Installation Standard: BHMA A156.19.
2. Power Connection: See Division 26 for connection to electrical power distribution system and see Division 22 for connection to compressed-air distribution piping, **as directed**.
3. Activation and Safety Devices: Install devices and wiring according to manufacturer's written instructions and cited BHMA standard for type of operator and direction of pedestrian travel. Connect activation- and safety-device wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".
4. Access-Control System: Connect operators to access-control system as specified in Division 28 Section "Access Control".
5. Signage: Apply on both sides of each door as required by cited BHMA standard for type of door operator and direction of pedestrian travel.
6. Guide Rails: Install according to BHMA A156.10 including Appendix A and manufacturer's written instructions unless otherwise indicated.

B. Field Quality Control

1. Inspection: Engage Installer's certified inspector to test and inspect automatic door operators and prepare test and inspection reports.



- a. Certified inspector shall test and inspect each automatic door operator to determine compliance of installed systems with applicable BHMA standards.
- b. Inspection Report: Certified inspector shall submit report in writing to the Owner and Contractor within 24 hours after inspection.
2. Work will be considered defective if it does not pass tests and inspections.

C. Adjusting

1. Adjust automatic door operators to function smoothly, and lubricate as recommended by manufacturer; comply with requirements of applicable BHMA standards.
 - a. Adjust operators on exterior doors for weathertight closure.
2. After completing installation of exposed, factory-finished automatic door operators, inspect exposed finishes on doors and operators. Repair damaged finish to match original finish.
3. Readjust automatic door operators after repeated operation of completed installation equivalent to three days' use by normal traffic (100 to 300 cycles).
4. Occupancy Adjustment: When requested within 12 months of date of Final Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

END OF SECTION 08 71 13 00



Task	Specification	Specification Description
08 71 16 00	01 22 16 00	No Specification Required
08 71 16 00	08 71 21 00	Door Hardware
08 71 16 00	08 34 63 13	Detention Door Hardware
08 71 19 00	06 48 13 00	Wood Doors
08 71 19 00	08 05 13 00	Flush Wood Doors
08 71 19 00	08 71 21 00	Door Hardware



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SECTION 08 71 21 00 - DOOR HARDWARE

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of material for door hardware. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Mechanical door hardware for the following:
 - 1) Swinging doors.
 - 2) Sliding doors.
 - 3) Folding doors.
 - b. Cylinders for doors specified in other Sections.
 - c. Electrified door hardware.
2. Products furnished, but not installed, under this Section include the products listed below. Coordinating, purchasing, delivering, and scheduling remain requirements of this Section.
 - a. Pivots, thresholds, weather stripping, and cylinders for locks specified in other Sections.
 - b. Permanent cores to be installed by the Owner.

C. Action Submittals

1. Product Data: For each type of product indicated. Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Shop Drawings: Details of electrified door hardware, indicating the following:
 - a. Wiring Diagrams: For power, signal, and control wiring and including the following:
 - 1) Details of interface of electrified door hardware and building safety and security systems.
 - 2) Schematic diagram of systems that interface with electrified door hardware.
 - 3) Point-to-point wiring.
 - 4) Risers.
 - 5) Elevations doors controlled by electrified door hardware.
 - b. Operation Narrative: Describe the operation of doors controlled by electrified door hardware.
3. Samples for Initial Selection: For plastic protective trim units in each finish, color, and texture required for each type of trim unit indicated.
4. Samples for Verification: For exposed door hardware of each type required, in each finish specified, prepared on Samples of size indicated below. Tag Samples with full description for coordination with the door hardware schedule. Submit Samples before, or concurrent with, submission of door hardware schedule.
 - a. Sample Size: Full-size units or minimum 2-by-4-inch (51-by-102-mm) Samples for sheet and 4-inch (102-mm) long Samples for other products.
 - 1) Full-size Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.
5. Other Action Submittals:
 - a. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.



- 1) Submittal Sequence: Submit door hardware schedule after or concurrent with submissions of Product Data, Samples, and Shop Drawings, **as directed**. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
 - 2) Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page.
 - 3) Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
 - 4) Content: Include the following information:
 - a) Identification number, location, hand, fire rating, size, and material of each door and frame.
 - b) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
 - c) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
 - d) Description of electrified door hardware sequences of operation and interfaces with other building control systems.
 - e) Fastenings and other pertinent information.
 - f) Explanation of abbreviations, symbols, and codes contained in schedule.
 - g) Mounting locations for door hardware.
 - h) List of related door devices specified in other Sections for each door and frame.
- b. Keying Schedule: Prepared by or under the supervision of Installer, detailing the Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.
- D. Informational Submittals
1. Qualification Data: For Installer and Architectural Hardware Consultant.
 2. Product Certificates: For electrified door hardware, from the manufacturer.
 - a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
 3. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.
 4. Warranty: Special warranty specified in this Section.
- E. Closeout Submittals
1. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.
- F. Quality Assurance
1. Installer Qualifications: An employer of workers trained and approved by lock manufacturer.
 - a. Installer's responsibilities include supplying and installing door hardware and providing a qualified Architectural Hardware Consultant available during the course of the Work to consult with Contractor, Architect, and the Owner about door hardware and keying
 2. Architectural Hardware Consultant Qualifications: A person who is currently certified by DHI as an Architectural Hardware Consultant and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.
 3. Source Limitations: Obtain each type of door hardware from a single manufacturer.
 - a. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that



- are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.
4. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and labeled by a qualified testing, for fire protection ratings indicated, based on testing at positive pressure according to NFPA 252 **OR** UL 10C, unless otherwise indicated.
 5. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meet requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
 - a. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at the tested pressure differential of 0.3-inch wg (75 Pa) of water.
 6. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
 7. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.
 8. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines **OR** ICC/ANSI A117.1 **OR** HUD's "Fair Housing Accessibility Guidelines", **as directed**.
 - a. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22.2 N).
 - b. Comply with the following maximum opening-force requirements:
 - 1) Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
 - 2) Sliding or Folding Doors: 5 lbf (22.2 N) applied parallel to door at latch.
 - 3) Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
 - c. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high and 3/4 inch (19 mm) high for exterior sliding doors.
 - d. Adjust door closer sweep periods so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches (75 mm) from the latch, measured to the leading edge of the door.
 9. Keying Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management And Coordination". In addition to the Owner, Contractor, and Architect, conference participants shall also include Installer's Architectural Hardware Consultant and Owner's security consultant. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:
 - a. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
 - b. Preliminary key system schematic diagram.
 - c. Requirements for key control system.
 - d. Requirements for access control.
 - e. Address for delivery of keys.
 10. Preinstallation Conference: conduct conference at Project site.
 - a. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - b. Inspect and discuss preparatory work performed by other trades.
 - c. Inspect and discuss electrical roughing in for electrified door hardware.
 - d. Review sequence of operation for each type of electrified door hardware.
 - e. Review required testing, inspecting, and certifying procedures.
- G. Delivery, Storage, And Handling
1. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
 2. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
 3. Deliver keys to manufacturer of key control system for subsequent delivery to the Owner.
 4. Deliver keys and permanent cores to the Owner by registered mail or overnight package service.



H. Coordination

1. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 03.
2. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
3. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
4. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.
5. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

I. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
 - a. Failures include, but are not limited to, the following:
 - 1) Structural failures including excessive deflection, cracking, or breakage.
 - 2) Faulty operation of doors and door hardware.
 - 3) Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
 - b. Warranty Period: Three years from date of Final Completion, except as follows:
 - 1) Electromagnetic or Delayed-Egress Locks: Five years from date of Final Completion.
 - 2) Exit Devices: Two years from date of Final Completion.
 - 3) Manual Closers: 10 years from date of Final Completion.
 - 4) Concealed Floor Closers: Five **OR** 10 **OR** 25 years from date of Final Completion, **as directed**.

J. Maintenance Service

1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.
2. Maintenance Service: Beginning at Final Completion, provide six months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door and door hardware operation. Provide parts and supplies that are the same as those used in the manufacture and installation of original products.

1.2 PRODUCTS

A. Scheduled Door Hardware

1. General: Provide door hardware for each door indicated in Part 1.3 "Door Hardware Sets" Article to comply with requirements in this Section.
 - a. Door Hardware Sets: Provide quantity, item, size, finish or color indicated.
 - b. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
2. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 1.3 "Door Hardware Sets" Article. Products are identified by descriptive titles corresponding to requirements specified in Part 1.2.

**B. Hinges**

1. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.
2. Antifriction-Bearing Hinges:
 - a. Mounting: Full-Mortise (Butt) **OR** Half mortise **OR** Full surface **OR** Half surface, **as directed**.
 - b. Bearing Material: Manufacturer's standard antifriction bearing **OR** Ball bearing, **as directed**.
 - c. Grade: Grade 1 (heavy weight) **OR** Grade 2 (standard weight), **as directed**.
 - d. Base and Pin Metal:
 - 1) Exterior Hinges: Stainless steel with stainless-steel pin **OR** Brass with stainless-steel pin body and brass protruding heads, **as directed**.
 - 2) Interior Hinges: Brass with stainless-steel pin body and brass protruding heads **OR** Steel with steel pin **OR** Stainless steel with stainless-steel pin, **as directed**.
 - 3) Hinges for Fire-Rated Assemblies: Steel with steel pin **OR** Stainless steel with stainless-steel pin, **as directed**.
 - e. Pins: Non-rising loose unless otherwise indicated **OR** Maximum security **OR** Nonremovable, **as directed**.
 - 1) Outswinging Exterior Doors: Maximum security **OR** Nonremovable, **as directed**.
 - 2) Outswinging Corridor Doors with Locks: Maximum security **OR** Nonremovable, **as directed**.
 - f. Tips: Flat button **OR** Hospital **OR** Oval **OR** Ball **OR** Steeple **OR** Urn **OR** Acorn, **as directed**.
 - g. Corners: Square **OR** 5/32-inch (4-mm) radius **OR** 1/4-inch (6-mm) radius **OR** 5/8-inch (16-mm) radius, **as directed**.
 - h. Options: Raised barrel **OR** Reverse safety stud **OR** Safety stud, **as directed**.
3. Electrified Antifriction-Bearing Hinges: Full-mortise mounting.
 - a. Bearing Material: Manufacturer's standard antifriction bearing **OR** Ball bearing, **as directed**.
 - b. Grade: Grade 1 (heavy weight) **OR** Grade 2 (standard weight), **as directed**.
 - c. Base and Pin Metal:
 - 1) Exterior Hinges: Stainless steel with stainless-steel pin **OR** Brass with stainless-steel pin body and brass protruding heads, **as directed**.
 - 2) Interior Hinges: Brass with stainless-steel pin body and brass protruding heads **OR** Steel with steel pin **OR** Stainless steel with stainless-steel pin, **as directed**.
 - 3) Hinges for Fire-Rated Assemblies: Steel with steel pin **OR** Stainless steel with stainless-steel pin, **as directed**.
 - d. Pins: Non-rising loose unless otherwise indicated **OR** Maximum security **OR** Nonremovable, **as directed**.
 - 1) Outswinging Exterior Doors: Maximum security **OR** Nonremovable, **as directed**.
 - 2) Outswinging Corridor Doors with Locks: Maximum security **OR** Nonremovable, **as directed**.
 - e. Tips: Flat button **OR** Hospital **OR** Oval **OR** Ball **OR** Steeple **OR** Urn **OR** Acorn, **as directed**.
 - f. Corners: Square **OR** 5/32-inch (4-mm) radius **OR** 1/4-inch (6-mm) radius **OR** 5/8-inch (16-mm) radius, **as directed**.
 - g. Options: Raised barrel **OR** Reverse safety stud **OR** Safety stud, **as directed**.
 - h. Electric Option: Concealed electric through wires **OR** Concealed electric through wires with monitor **OR** Concealed electric monitor **OR** Concealed air transfer **OR** Concealed switch **OR** Exposed electric switch **OR** Exposed electric contacts, **as directed**.
4. Plain-Bearing Hinges: Grade 3 (standard weight).
 - a. Mounting: Full mortise (butts) **OR** Half mortise **OR** Full surface **OR** Half surface, **as directed**.
 - b. Base and Pin Metal: Brass with stainless-steel pin body and brass protruding heads **OR** Steel with steel pin, **as directed**.



- c. Pins: Non-rising loose unless otherwise indicated **OR** Maximum security **OR** Nonremovable, **as directed**.
 - 1) Outswinging Corridor Doors with Locks: Maximum security **OR** Nonremovable, **as directed**.
- d. Tips: Flat button **OR** Hospital **OR** Oval **OR** Ball **OR** Steeple **OR** Urn **OR** Acorn, **as directed**.
- e. Corners: Square **OR** 5/32-inch (4-mm) radius **OR** 1/4-inch (6-mm) radius **OR** 5/8-inch (16-mm) radius, **as directed**.
- f. Options: Raised barrel, **as directed**.
- 5. Electrified Plain-Bearing Hinges: Grade 3 (standard weight); full-mortise mounting.
 - a. Mounting: Full mortise (butts) **OR** Half mortise **OR** Full surface **OR** Half surface, **as directed**.
 - b. Pins: Non-rising loose unless otherwise indicated **OR** Maximum security **OR** Nonremovable, **as directed**.
 - 1) Outswinging Corridor Doors with Locks: Maximum security **OR** Nonremovable, **as directed**.
 - c. Tips: Flat button **OR** Hospital **OR** Oval **OR** Ball **OR** Steeple **OR** Urn **OR** Acorn, **as directed**.
 - d. Corners: Square **OR** 5/32-inch (4-mm) radius **OR** 1/4-inch (6-mm) radius **OR** 5/8-inch (16-mm) radius, **as directed**.
 - e. Options: Raised barrel, **as directed**.
 - f. Electric Option: Concealed electric through wires **OR** Concealed electric through wires with monitor **OR** Concealed electric monitor **OR** Concealed air transfer **OR** Concealed switch **OR** Exposed electric switch **OR** Exposed electric contacts, **as directed**.
- 6. Swing-Clear Hinges: Reversible.
 - a. Mounting: Full mortise (butts) **OR** Half mortise **OR** Full surface **OR** Half surface, **as directed**.
 - b. Bearing, and Grade: Antifriction bearing, Grade 1 (heavy weight) **OR** Antifriction bearing, Grade 2 (standard weight) **OR** Plain bearing, Grade 3 (standard weight), **as directed**.
 - c. Base Metal: Wrought brass or bronze **OR** Stainless steel **OR** Wrought, forged, or cast steel, or malleable iron, **as directed**.
 - d. Pins: Non-rising loose unless otherwise indicated **OR** Maximum security **OR** Nonremovable, **as directed**.
 - 1) Outswinging Exterior Doors: Maximum security **OR** Nonremovable, **as directed**.
 - 2) Outswinging Corridor Doors with Locks: Maximum security **OR** Nonremovable, **as directed**.
 - e. Tips: Flat button **OR** Hospital, **as directed**.
 - f. Corners: Square **OR** 5/32-inch (4-mm) radius **OR** 1/4-inch (6-mm) radius **OR** 5/8-inch (16-mm) radius, **as directed**.
 - g. Options: Raised barrel **OR** Reverse safety stud **OR** Safety stud, **as directed**.
- 7. Slip-in-Type Hinges: Full-mortise mounting.
 - a. Bearing and Grade: Antifriction, Grade 1 (heavy weight) **OR** Antifriction, Grade 2 (standard weight) **OR** Plain, Grade 3 (standard weight), **as directed**.
 - b. Base Metal: Wrought brass or bronze **OR** Stainless steel **OR** Wrought, forged, or cast steel, or malleable iron, **as directed**.
 - c. Swaging: 5/16-inch (7.9-mm) swaging **OR** 3/16-inch (4.8-mm) swaging, handed, **as directed**.
- 8. Anchor Hinge Set: Grade 1 (heavy weight); consisting of one anchor hinge plus two full-mortise hinges; antifriction bearing; handed; nonremovable pins; flat-button tips.
 - a. Base Metal: Wrought brass or bronze **OR** Stainless steel **OR** Wrought, forged, or cast steel, or malleable iron, **as directed**.
 - b. Electric Option for Center Hinge: Concealed electric through wires **OR** Concealed electric switch, **as directed**.



9. Pocket Hinges: Antifriction bearing; Grade 1 (heavy weight); jamb leaf visible when door is closed and both leaves concealed when door is in pocket; type required for application indicated; cast steel.
 10. Double-Acting Pivot-Hinge Set: Grade 2; wrought, forged, or cast steel or malleable iron base metal; consisting of a top pivot and a bottom pivot, each with jamb brackets, and bottom pivot with thrust steel bearing.
- C. Self-Closing Hinges And Pivots
1. Self-Closing Hinges and Pivots: BHMA A156.17.
 2. Spring Hinges: Grade 1 **OR** Grade 2, **as directed**; wrought steel, with torsion spring.
 - a. Type: Single **OR** Double, **as directed** acting.
 - b. Mounting: Full mortise (butts) **OR** Half mortise **OR** Full surface **OR** Half surface, **as directed**.
 3. Horizontal-Spring Pivot Sets: Grade 3; double acting; non-handed; consisting of wrought steel bottom pivot hinge with antifriction bearing and nylon top pivot and socket.
 - a. Type: Hold-open **OR** Non-hold open, **as directed**.
 - b. Tension: Adjustable **OR** Fixed, **as directed**.
 - c. Bottom Pivot Trim: Steel **OR** Brass, **as directed**.
 - d. Bottom Plate: For bottom hinge attachment to floor **OR** jamb, **as directed**.
 4. Gate-Spring Pivot Sets: Grade 1; double acting; non-handed; consisting of bottom pivot with door and jamb bracket and top pivot assembly with jamb bracket.
 - a. Mounting: Mortise **OR** Surface, **as directed**.
 - b. Tension: Adjustable **OR** Fixed, **as directed**.
 - c. Base Metal: Cast, forged, or extruded brass or bronze **OR** Malleable iron, **as directed**.
 5. Gravity Pivot Sets: Grade 3; double acting; surface mounting; non-handed; consisting of bottom pivot with door and jamb bracket and top pivot assembly with jamb bracket.
 - a. Tension: Adjustable **OR** Fixed, **as directed**.
 - b. Base Metal: Wrought brass or bronze **OR** Steel, **as directed**.
- D. Center-Hung And Offset Pivots
1. Center-Hung and Offset Pivots: BHMA A156.4.
 2. Center-Hung Pivot Sets: Grade 1.
 - a. Top Pivots: Walking-beam type with retractable pin and oil-impregnated bronze bearing; mortised into door and frame.
 - b. Bottom Pivots: Surface floor mounted, **OR** Recessed in floor in cement case, **OR** Mortised into jamb, **as directed** and mortised into door; with thrust ball **OR** needle bearings, **as directed**.
 - c. Base Metal: Brass **OR** Bronze **OR** Steel, **as directed**.
 3. Offset Pivot Sets: Grade 1 **OR** 2, **as directed**.
 - a. Offset: 3/4 inch (19 mm) **OR** 1-1/2 inches (38 mm), **as directed**.
 - b. Top Pivot: Full-mortise **OR** Half-surface **OR** Full-surface mounting, **as directed**; walking-beam type with retractable pin and oil-impregnated bronze bearing.
 - 1) Knuckle: Standard **OR** Asylum type, **as directed**.
 - 2) Option: With screw holes designed to straddle lead in the center of lead-lined door.
 - c. Bottom Pivot: Surface floor mounted, **OR** Recessed in floor in cement case, **OR** Mortised into jamb, **as directed** and mortised into door; with thrust ball **OR** needle, **as directed** bearing.
 - d. Base Metal: Brass **OR** Bronze **OR** Stainless steel **OR** Steel, **as directed**.
 4. Offset Intermediate Pivots: Grade 1; for use with offset pivot sets; with oil-impregnated bronze bearings.
 - a. Mounting: Full mortise, 3/4 inch (19 mm) offset **OR** Full mortise, 1-1/2 inches (38 mm) offset **OR** Half mortise **OR** Half surface **OR** Full surface, **as directed**.
 - b. Knuckle: Standard **OR** Asylum type, **as directed**.
 - c. Option: With screw holes designed to straddle lead in the center of lead-lined door.
 - d. Electric Option: Concealed monitoring **OR** Concealed power transfer **OR** Concealed power transfer for use with electrical panic devices and locks, **as directed**.



- e. Base Metal: Brass **OR** Bronze **OR** Stainless steel **OR** Steel, **as directed**.
 - 5. Pocket Pivots: Grade 1; full-mortise mounting; non-handed; allows door to nest in pocket with door surface flush with corridor wall when open; maximum 90-degree swing.
 - a. Base Metal: Bronze **OR** Stainless steel **OR** Steel, **as directed**.
 - b. Electric Option: Concealed power transfer in one hinge per door.
- E. Continuous Hinges
- 1. Continuous Hinges: BHMA A156.26; minimum 0.120-inch- (3.0-mm-) thick, hinge leaves with minimum overall width of 4 inches (102 mm); fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.
 - 2. Pin-and-Barrel-Type Hinges:
 - a. Grade: Grade 1-150 **OR** 1-300 **OR** 1-600 **OR** 2-150 **OR** 2-300 **OR** 2-600 **OR** 3-150 **OR** 3-300, **as directed**.
 - b. Exterior Hinges: Stainless steel.
 - c. Interior Hinges: Stainless steel **OR** Steel **OR** Aluminum, **as directed**.
 - d. Hinges for Fire-Rated Assemblies: Stainless steel with steel fire pins to hold fire-rated doors in place if required by tested listing **OR** Steel, **as directed**.
 - e. Type: Concealed leaf **OR** Swing clear **OR** Full surface with removable continuous caps over fasteners **OR** Half mortise, concealed door leaf and with removable continuous cap over fasteners on jamb leaf **OR** Half surface, concealed jamb leaf and with removable continuous cap over fasteners on door leaf, **as directed**.
 - f. Electric Option: Electric monitoring switch **OR** Electric through wires and monitor **OR** Electric through wires **OR** Concealed power transfer **OR** Exposed power transfer contact switch, **as directed**.
 - 3. Continuous, Gear-Type Hinges: Extruded-aluminum, pinless, geared hinge leaves joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings.
 - a. Grade: Grade 1-150 **OR** 1-300 **OR** 1-600 **OR** 2-150 **OR** 2-300 **OR** 2-600 **OR** 3-150 **OR** 3-300, **as directed**.
 - b. Hinges for Fire-Rated Assemblies: With steel fire pins to hold fire-rated doors in place if required by tested listing.
 - c. Mounting: Concealed leaf **OR** Swing clear **OR** Full surface, with removable continuous caps over fasteners **OR** Half surface, concealed jamb leaf and with removable continuous cap over fasteners on door leaf, **as directed**.
 - d. Electric Option: Electric monitor **OR** Electric through wires and monitor **OR** Electric through wires **OR** Electric power transfer **OR** Exposed switch **OR** Exposed contact **OR** Removable electric through wires, **as directed**.
- F. Mechanical Locks And Latches
- 1. Lock Functions: As indicated in door hardware schedule.
 - 2. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
 - a. Bored Locks: Minimum 1/2-inch (13-mm) latchbolt throw.
 - b. Mortise Locks: Minimum 3/4-inch (19-mm) latchbolt throw.
 - c. Deadbolts: Minimum 1-inch (25-mm) **OR** 1.25-inch (32-mm) bolt throw, **as directed**.
 - 3. Lock Backset: 2-3/4 inches (70 mm), unless otherwise indicated.
 - 4. Lock Trim:
 - a. Description: As indicated on Drawings, **as directed**.
 - b. Levers: Wrought **OR** Forged **OR** Cast, **as directed**.
 - c. Knobs: Wrought **OR** Forged **OR** Cast, **as directed**.
 - d. Escutcheons (Roses): Wrought **OR** Forged **OR** Cast, **as directed**.
 - e. Dummy Trim: Match knob **OR** lever, lock trim and escutcheons.
 - f. Operating Device: Lever **OR** Knob, **as directed** with escutcheons (roses).
 - 5. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.



- a. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
- b. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
- c. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.
- d. Rabbet Front and Strike: Provide on locksets for rabbeted meeting stiles.
6. Bored Locks: BHMA A156.2; Grade 1 **OR** 2, **as directed**; Series 4000.
7. Mortise Locks: BHMA A156.13; Operational **OR** Security, **as directed** Grade 1 **OR** 2, **as directed**; stamped steel case with steel or brass parts; Series 1000.
8. Interconnected Locks: BHMA A156.12; Grade 1 **OR** 2, **as directed**; Series 5000.
9. Roller Latches: BHMA A156.16; Grade 1; rolling plunger that engages socket or catch, with adjustable roller projection.
 - a. Material: Brass **OR** Bronze, **as directed**.
 - b. Mounting: Surface **OR** Mortise, **as directed**.
10. Push-Pull Latches: Bored, BHMA A156.2; Series 4000 **OR** Mortise, BHMA A156.13, **as directed**; Grade 1 **OR** 2, **as directed**; with paddle handles that retract latchbolt; capable of being mounted vertically or horizontally.
 - a. Lever and Escutcheon Material: Brass **OR** Bronze **OR** Stainless steel **OR** Aluminum, **as directed**.
 - b. Lettering: Engrave with the words "Pull" and "Push."
 - c. Lead Lining: 0.047 inch (1.2 mm) thick for escutcheon plate.

G. Auxiliary Locks

1. Bored Auxiliary Locks: BHMA A156.5: Grade 1 **OR** 2, **as directed**; with strike that suits frame.
 - a. Backset: 2-3/8 inches (60 mm) **OR** 2-3/4 inches (70 mm), **as directed**.
 - b. Material: Aluminum **OR** Brass **OR** Bronze **OR** Stainless steel **OR** Zinc alloy, **as directed**.
 - c. Deadlatches: Deadlocking latchbolt operated by key either side **OR** key outside and turn inside **OR** turn inside with no cylinder, **as directed**.
 - d. Deadlocks: Deadbolt operated by key either side **OR** key outside and turn inside **OR** turn inside with no cylinder **OR** key outside, no trim inside, **as directed**.
2. Mortise Auxiliary Locks: BHMA A156.5; Grade 1 **OR** 2, **as directed**; with strike that suits frame.
 - a. Backset: 2-3/4 inches (70 mm).
 - b. Material: Aluminum **OR** Brass **OR** Bronze **OR** Stainless steel **OR** Zinc alloy, **as directed**.
 - c. Deadlocks: Deadbolt operated by key either side **OR** outside and turn inside **OR** one side, **as directed**.
 - d. Deadlatches: Latchbolt and auxiliary deadlatch operated by key either side **OR** outside and turn inside, **as directed**.
 - e. Deadlocks for Sliding Doors: Expanding- or interlocking-type deadbolt operated by key either side **OR** outside and turn inside **OR** one side, **as directed**.
 - f. Deadlatches for Sliding Doors: Hook-type latchbolt operated by key either side **OR** outside and handle inside, **as directed**.
3. Narrow Stile Auxiliary Locks: BHMA A156.5; Grade 1 **OR** 2, **as directed**; with strike that suits frame.
 - a. Backset: 0.98 inch (25 mm) **OR** 1.125 inches (29 mm) **OR** 1.25 inches (32 mm) **OR** 1.5 inches (38 mm) **OR** 1.75 inches (44 mm) **OR** 2 inches (51 mm) **OR** 2.25 inches (57 mm) **OR** 2.5 inches (64 mm), **as directed**.
 - b. Strike: Flat **OR** Flat with extra-long lip **OR** Radius **OR** Radius with weatherstrip **OR** Bevel, **as directed**.
 - c. Case Material: Steel **OR** Stainless steel, **as directed**.
 - d. Armored Front and Strike Material: Aluminum **OR** Brass **OR** Bronze **OR** Stainless steel, **as directed**.
 - e. Deadlock: Deadlocking bolt.
 - 1) Operation: Key both sides **OR** outside and operating trim inside, **as directed**.
 - 2) Door Application: Swinging **OR** Sliding door, **as directed**.
 - f. Deadlatch: Latchbolt with auxiliary deadlatch operated by key outside and paddle or lever inside; for single swinging doors.



- g. Multipoint Lock: Deadlocking bolt for pairs of swinging doors.
 - 1) Operation: Key both sides **OR** outside and turn, lever, or knob inside, **as directed**.
 - 2) Type: Two **OR** Three point, **as directed**.
 - h. Latch/Lock: Deadbolt and latchbolt; both operated by key both sides; inside handle operates only latchbolt.
 - 4. Push-Button Combination Locks: BHMA A156.5; cylindrical; Grade 1 **OR** mortise; Grade 2, **as directed**; lock opens by entering a one- to five-digit code by pushing correct buttons in correct sequence; automatically relocks when door is closed; with strike that suits frame.
 - a. Lockset Configuration: Standard **OR** Privacy with inside push button, **as directed**.
 - b. Auxiliary Lock Configuration: Deadbolt **OR** Deadlocking latch **OR** Deadlocking rim latch, **as directed**.
 - c. Override: By key cylinder.
- H. Electric Strikes
- 1. Electric Strikes: BHMA A156.31; Grade 1 **OR** 2, **as directed**; with faceplate to suit lock and frame.
 - a. Material: Steel **OR** Stainless steel **OR** Zinc-aluminum alloy, **as directed**.
 - b. Mounting: Mortised **OR** Semirim mounted **OR** Rim mounted, **as directed**.
 - 2. Fire-Rated Door Assemblies: Use fail-secure electric strikes with fire-rated devices.
 - 3. Monitoring: Mechanical latchbolt **OR** Infrared latchbolt **OR** Mechanical strike **OR** Infrared strike, **as directed**.
 - 4. Options: Lip extension kit.
- I. Electromagnetic Locks
- 1. Electromagnetic Locks: BHMA A156.23; electrically powered; with electromagnet attached to frame and armature plate attached to door; full-exterior or full-interior type, as required by application indicated.
 - a. Direct-Hold Type: Lock mounted on bottom of header; strike flush mounted on door push side **OR** face of header; strike angle mounted on door pull side **OR** side of jamb; strike flush mounted on door push side, **as directed**.
 - b. Shear Type: Lock mounted on face of header; strike angle mounted on door **OR** mortised in header; strike mortised in top of door **OR** mortised in jamb; strike mortised in edge of door **OR** mortised in bottom of door; strike mortised in floor **OR** mortised in floor; strike mortised in bottom of door, **as directed**.
 - c. Strength Ranking: 1500 lbf (6672 N) **OR** 1000 lbf (4448 N) **OR** 500 lbf (2224 N), **as directed**.
 - d. Inductive Kickback Peak Voltage: Not more than 53 **OR** 0 V, **as directed**.
 - e. Residual Magnetism: Not more than 4 lbf (18 N) **OR** 0 lbf (0 N), **as directed** to separate door from magnet.
 - f. Options:
 - 1) Magnetic bond sensor.
 - 2) Continuous housing for full width of door.
 - 3) Continuous housing for full height of door.
 - 4) Single LED indicators.
 - 5) Double LED indicators.
 - 6) Adjustable time delay with automatic relock.
 - 7) Integral door position switch.
 - 2. Delayed-Egress Electromagnetic Locks: BHMA A156.24, electrically powered, with electromagnet attached to frame and armature plate attached to door; depressing push bar for more than 3 seconds initiates irreversible alarm and 15-second delay for egress. When integrated with fire alarm, fire alarm voids 15-second delay.
 - a. Grade: Security Grade, activated from secure side of door by initiating device **OR** Movement Grade, activated by door movement as initiating device, **as directed**.
- J. Electromechanical Locks



1. Electromechanical Locks: BHMA A156.25; Grade 1 **OR** 2, **as directed**; motor or solenoid driven; bored **OR** mortise latchbolt **OR** mortise deadbolt **OR** mortise deadlocking latchbolt, **as directed**; with strike that suits frame.
- K. Self-Contained Electronic Locks
1. Self-Contained Electronic Locks: BHMA A156.25, bored **OR** mortise, **as directed**; with internal, battery-powered, self-contained electronic locks; consisting of complete lockset, motor-driven lock mechanism, and actuating device; enclosed in zinc-dichromate-plated, wrought-steel case, and strike that suits frame. Provide key override, low-battery detection and warning, LED status indicators, and ability to program at the lock.
 - a. Actuating Device: Digital keypad **OR** Magnetic-stripe card reader, **as directed**.
 - 1) Card: Manufacturer's standard **OR** 0.030-inch- (0.76-mm-) thick PVC or polyester **OR** Custom, **as directed**.
 - 2) Accessory: Card encoder and software.
 - b. Faceplate Material: Wrought brass **OR** Wrought bronze **OR** Stainless steel, **as directed**.
 - c. Trim: Lever **OR** Knob **OR** Match trim specified for mechanical locks, **as directed**.
 - d. Function: Latch with **OR** Deadbolt with **OR** Latch without **OR** Deadbolt without, **as directed** key.
- L. Exit Locks And Exit Alarms
1. Exit Locks and Alarms: BHMA A156.29, Grade 1.
 2. Exit Locks: Surface mounted; battery powered, housed in metal case; with manufacturer's standard strike that suits frame; with red-and-white lettering reading "EMERGENCY EXIT PUSH TO OPEN--ALARM WILL SOUND."
 - a. Single-Door **OR** Pairs-of-Door Type, **as directed**: Activated by arm, push plate, or paddle **OR** horizontal bar, **as directed**.
 - b. Options:
 - 1) Low-battery alert.
 - 2) Outside key control.
 - 3) Audible alarm that sounds when unauthorized use of door occurs.
 - 4) Silent alarm with remote signal capability for connection to remote indicating panel.
 - 5) Strike: Surface **OR** Mortise, **as directed**.
 3. Stand-Alone Exit Alarms: Surface mounted on door **OR** Mounted separate from door and activated by door movement switch, **as directed**.
 - a. Options:
 - 1) Low-battery alert.
 - 2) Outside key control.
 - 3) Audible alarm that sounds when unauthorized use of door occurs.
 - 4) Automatic rearming after authorized use, with adjustable time delay, **as directed**.
 - 5) Remote signal capability for connection to remote indicating panel.
- M. Surface Bolts
1. Surface Bolts: BHMA A156.16.
 2. Half-Round Surface Bolts: Grade 1 **OR** 2, **as directed**, 6-inch (152-mm) polished-brass or burnished-steel, half-round rod and knob; minimum 7/8-inch (22-mm) throw; with universal strike.
 3. Interlocking Surface Bolts: Grade 1 **OR** 2, **as directed**, 6-inch (152-mm) extruded-brass or aluminum, interlocking track and rod; minimum 15/16-inch (24-mm) throw; with universal or mortise strike.
 4. Fire-Rated Surface Bolts: Grade 1 **OR** 2, **as directed**, 8-inch (203-mm) steel bolt with 2 steel guides; minimum 1-inch (25-mm) throw; listed and labeled for fire-rated doors; with universal strike.
 5. Dutch-Door Surface Bolts: Grade 1 **OR** 2, **as directed**, polished-brass bolt and knob, minimum 3/4-inch (19-mm) throw, with standard strike.
- N. Manual Flush Bolts



1. Manual Flush Bolts: BHMA A156.16; minimum 3/4-inch (19-mm) throw; designed for mortising into door edge.
 2. Manual-Extension Flush Bolts: Grade 1 **OR** 2, **as directed**, fabricated from extruded brass or aluminum, with 12-inch (305-mm) rod actuated by flat lever; listed and labeled for fire-rated doors, **as directed**. Provide with matching **OR** dustproof strike, **as directed**.
 3. Slide Flush Bolts: Grade 1 **OR** 2, **as directed**, cast brass, with rod actuated by slide. Provide with matching **OR** dustproof strike, **as directed**.
 4. Tubular Bolts: Grade 1 **OR** 2, **as directed**, polished-brass or polished-bronze, oval turn knob and escutcheon; minimum 9/16-inch (14-mm) steel bolt with 1/2-inch (13-mm) throw. Provide with matching **OR** dustproof strike, **as directed**.
 5. Dustproof Strikes: Locking type, Grade 1, polished wrought brass, with 3/4-inch- (19-mm-) diameter, spring-tension plunger.
- O. Automatic And Self-Latching Flush Bolts
1. Automatic and Self-Latching Flush Bolts: BHMA A156.16; minimum 3/4-inch (19-mm) throw; designed for mortising into door edge.
 2. Automatic Flush Bolts: Grade 1 **OR** 2, **as directed**, fabricated from steel and brass components, with spring-activated bolts that automatically retract when active leaf is opened and that automatically engage when active door depresses bolt trigger; listed and labeled for fire-rated doors, **as directed**. Provide brass or stainless-steel cover plate, top and bottom matching **OR** dustproof strikes, **as directed**, guides, guide supports, wear plates, and shims.
 3. Self-Latching Flush Bolts: Grade 1 **OR** 2, **as directed**, fabricated from steel and brass components, with spring-activated bolts that automatically engage when active door depresses trigger; listed and labeled for fire-rated doors, **as directed**. Bolts are manually retracted by a slide in the bolt face. Provide brass or stainless-steel cover plate, matching **OR** dustproof, **as directed** top and bottom strikes, guides, guide supports, wear plates, and shims.
 4. Dustproof Strikes: Locking type, Grade 1, polished wrought brass, with 3/4-inch- (19-mm-) diameter, spring-tension plunger.
- P. Exit Devices And Auxiliary Items
1. Exit Devices and Auxiliary Items: BHMA A156.3.
 2. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.
 3. Fire Exit Devices: Devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252.
 4. Rim Exit Devices: Grade 1 **OR** 2, **as directed**.
 - a. Type: Type 1, rim **OR** Type 4, narrow stile **OR** Type 28, incorporating a deadbolt, **as directed**.
 - b. Grade: Grade 1 **OR** 2, **as directed**.
 - c. Actuating Bar: Cross bar **OR** Push pad **OR** Narrow-stile push pad, **as directed**.
 - d. Material: Brass **OR** Bronze **OR** Stainless steel **OR** Aluminum **OR** Wrought steel, **as directed**.
 - e. Electrified Options:
 - 1) Pushpad monitor switch.
 - 2) Double-pushpad monitor switch.
 - 3) Electric locking and unlocking.
 - 4) Delayed egress.
 - 5) Alarm.
 5. Mortise Exit Devices: Grade 1 **OR** 2, **as directed**.
 - a. Type: Type 3 **OR** Type 10, narrow stile, **as directed**.
 - b. Grade: Grade 1 **OR** 2, **as directed**.
 - c. Actuating Bar: Cross bar **OR** Push pad **OR** Narrow-stile push pad, **as directed**.
 - d. Material: Brass **OR** Bronze **OR** Stainless steel **OR** Aluminum **OR** Wrought steel, **as directed**.



- e. Electrified Options:
 - 1) Pushpad monitor switch.
 - 2) Double-pushpad monitor switch.
 - 3) Electric locking and unlocking.
 - 4) Delayed egress.
 - 5) Alarm.
- 6. Surface Vertical-Rod Exit Devices: Grade 1 **OR 2, as directed.**
 - a. Type: Type 2 **OR** Type 5, narrow stile, **as directed.**
 - b. Grade: Grade 1 OR 2, as directed.
 - c. Actuating Bar: Cross bar **OR** Push pad **OR** Narrow-stile push pad, **as directed.**
 - d. Material: Brass **OR** Bronze **OR** Stainless steel **OR** Aluminum **OR** Wrought steel, **as directed.**
 - e. Configuration: Top and bottom rods **OR** Top rod, **as directed.**
 - f. Electrified Options:
 - 1) Pushpad monitor switch.
 - 2) Double-pushpad monitor switch.
 - 3) Electric locking and unlocking.
 - 4) Delayed egress.
 - 5) Alarm.
- 7. Concealed Vertical-Rod Exit Devices: Grade 1 **OR 2, as directed.**
 - a. Type: Type 6, narrow stile **OR** Type 7, for wood doors **OR** Type 8, for metal doors, **as directed.**
 - b. Grade: Grade 1 OR 2, as directed.
 - c. Actuating Bar: Cross bar **OR** Push pad **OR** Narrow-stile push pad, **as directed.**
 - d. Material: Brass **OR** Bronze **OR** Stainless steel **OR** Aluminum **OR** Wrought steel, **as directed.**
 - e. Electrified Options:
 - 1) Pushpad monitor switch.
 - 2) Double-pushpad monitor switch.
 - 3) Electric locking and unlocking.
 - 4) Delayed egress.
 - 5) Alarm.
- 8. Combination Exit Devices: Grade 1 **OR 2, as directed.**
 - a. Type: Type 9, rim and surface vertical rod **OR** Type 11, mortise and surface vertical rod **OR** Type 12, mortise and concealed vertical rod, **as directed.**
 - b. Grade: Grade 1 OR 2, as directed.
 - c. Actuating Bar: Cross bar **OR** Push pad **OR** Narrow-stile push pad, **as directed.**
 - d. Material: Brass **OR** Bronze **OR** Stainless steel **OR** Aluminum **OR** Wrought steel, **as directed.**
 - e. Electrified Options:
 - 1) Pushpad monitor switch.
 - 2) Double-pushpad monitor switch.
 - 3) Electric locking and unlocking.
 - 4) Delayed egress.
 - 5) Alarm.
- 9. Automatic Latching Two-Point Bolts: Grade 1.
 - a. Type: Type 23, concealed **OR** Type 24, surface, **as directed.**
 - b. Material: Brass **OR** Bronze **OR** Stainless steel, **as directed.**
- 10. Extension Flush Bolt Sets: BHMA A156.3; Grade 1.
 - a. Type: Type 25, automatic **OR** Type 27, self-latching, **as directed.**
 - b. Material: Brass **OR** Bronze **OR** Stainless steel, **as directed.**
- 11. Electronic Exit Bars: Nonlatching electronic actuating (releasing) device activated by an adjustable capacitance sensor and with no moving parts; listed and labeled as panic exit hardware. Fabricate bar from extruded aluminum, and provide door and frame transfer device and 16 feet (4.9 m) of cord to route wiring off the door frame.



12. Extruded-Aluminum Removable Mullions: With malleable-iron top and bottom retainers, and prepared for strikes as follows:
 - a. Strikes: Two standard recessed strikes **OR** Two monitor strikes **OR** One standard and one electric strike, **as directed**.
13. Tube-Steel Removable Mullions: With malleable-iron top and bottom retainers, and prepared for strikes as follows:
 - a. Strikes: Two standard recessed strikes **OR** Two monitor strikes **OR** One standard and one electric strike, **as directed**.
14. Fire-Exit Removable Mullions: Provide removable mullions for use with fire exit devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire and panic protection, based on testing according to UL 305 and NFPA 252. Use mullions only with exit devices for which they have been tested.
15. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
 - a. Operation: Rigid **OR** Movable **OR** Movable with monitor switch, **as directed**.
16. Exit Device Outside Trim: Lever **OR** Lever with cylinder **OR** Knob **OR** Knob with cylinder **OR** Pull **OR** Pull with cylinder **OR** Thumb turn with cylinder, **as directed**; material and finish to match locksets, unless otherwise indicated.
 - a. Match design for lock trim, unless otherwise indicated.
17. Through-Bolt Fasteners: For exit devices and trim on metal doors **OR** non-fire-rated wood doors **OR** fire-rated wood doors, **as directed**.

Q. Lock Cylinders

1. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.
2. Standard Lock Cylinders: BHMA A156.5; Grade 1 **OR** 1A **OR** 2, **as directed**; permanent cores that are interchangeable **OR** removable, **as directed**; face finished to match lockset.
 - a. Number of Pins: Five **OR** Six **OR** Seven, **as directed**.
 - b. Type: Mortise **OR** Rim **OR** Bored-lock, **as directed** type.
3. High-Security Lock Cylinders: BHMA A156.30; Grade 1 **OR** 2 **OR** 3, **as directed**; Type M, mechanical **OR** E, electrical, **as directed**; permanent cores that are removable; face finished to match lockset.
 - a. Number of Pins: Six **OR** Seven, **as directed**.
 - b. Type: Mortise **OR** Rim **OR** Bored-lock, **as directed** type.
4. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.
5. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

R. Keying

1. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference.
 - a. No Master Key System: Only change keys operate cylinder.
 - b. Master Key System: Change keys and a master key operate cylinders.
 - c. Grand Master Key System: Change keys, a master key, and a grand master key operate cylinders.
 - d. Great-Grand Master Key System: Change keys, a master key, a grand master key, and a great-grand master key operate cylinders.
 - e. Existing System:
 - 1) Master key or grand master key locks to Owner's existing system.
 - 2) Re-key Owner's existing master key system into new keying system.
 - f. Keyed Alike: Key all cylinders to same change key.
2. Keys: Nickel silver **OR** Brass, **as directed**.
 - a. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:



- 1) Notation: "DO NOT DUPLICATE." **OR** Information to be furnished by Owner., **as directed**
- b. Quantity: In addition to one extra key blank for each lock, provide the following:
 - 1) Cylinder Change Keys: Three.
 - 2) Master Keys: Five.
 - 3) Grand Master Keys: Five.
 - 4) Great-Grand Master Keys: Five.

S. Key Control System

1. Key Control Cabinet: BHMA A156.5; metal cabinet with baked-enamel finish; containing key-holding hooks, labels, 2 sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers; with key capacity of 150 percent of the number of locks.
 - a. Multiple-Drawer Cabinet: Cabinet with drawers equipped with key-holding panels and key envelope storage, and progressive-type ball-bearing suspension slides. Include single cylinder lock to lock all drawers.
 - b. Wall-Mounted Cabinet: Cabinet with hinged-panel door equipped with key-holding panels and pin-tumbler cylinder door lock.
 - c. Portable Cabinet: Tray for mounting in file cabinet, equipped with key-holding panels, envelopes, and cross-index system.
2. Key Lock Boxes: Designed for storage of two **OR** 10 keys, **as directed**, with tamper switches to connect to intrusion detection system, **as directed**.
3. Cross-Index System: Multiple **OR** Single, **as directed**-index system for recording key information. Include three receipt forms for each key-holding hook. Set up by key control manufacturer **OR** Installer, **as directed**.
4. Key Control System Software: BHMA A156.5, Grade 1; multiple-index system for recording and reporting key-holder listings, tracking keys and lock and key history, and printing receipts for transactions. Include instruction manual.

T. Operating Trim

1. Operating Trim: BHMA A156.6; aluminum **OR** brass **OR** bronze **OR** stainless steel, **as directed**, unless otherwise indicated.
2. Flat Push Plates: 0.050 inch (1.3 mm) **OR** 1/8 inch (3.2 mm) thick, **as directed**, 4 inches wide by 16 inches high (102 mm wide by 406 mm high), with square corners and beveled edges; secured with exposed screws.
3. Push-Pull Plates: 1/8 inch (3.2 mm) thick, 3-1/2 inches wide by 15-3/4 inches high (89 mm wide by 400 mm high), with square corners, beveled edges, and raised integral lip; secured with exposed screws.
4. Straight Door Pulls: With minimum clearance of 1-1/2 inches (38 mm) from face of door.
 - a. Type: 3/4-inch (19-mm) constant-diameter **OR** variable-diameter **OR** flattened-round **OR** hospital-type pull, **as directed**.
 - b. Mounting: Surface applied with concealed fasteners **OR** Through bolted with oval-head machine screws and countersunk washers **OR** Back to back with threaded sleeves, **as directed**.
 - c. Overall Length: 9 inches (229 mm), **as directed**.
5. Offset Door Pulls: 1-inch (25-mm) constant-diameter pull with minimum clearance of 2-1/4 inches (57 mm) from face of door and offset of 2 inches (51 mm).
 - a. Mounting: Surface applied with concealed fasteners **OR** Through bolted with oval-head machine screws and countersunk washers **OR** Back to back with threaded sleeves, **as directed**.
 - b. Overall Length: 9 inches (229 mm).
6. Flush Door Pulls: Mortised 1/2 inch (13 mm) deep; secured with screws.
 - a. Shape: Rectangular with rectangular recess.
 - b. Size: 3-1/2 inches wide by 4-3/4 inches high (89 mm wide by 121 mm high).
7. Straight Pull-Plate Door Pulls: 0.050-inch- (1.3-mm-) thick plate, 4 inches wide by 16 inches high (102 mm wide by 406 mm high) with square corners and beveled edges; pull with minimum clearance of 1-1/2 inches (38 mm) from face of door.



- a. Type: 3/4-inch (19-mm) constant-diameter **OR** variable-diameter **OR** flattened-round **OR** hospital-type pull, **as directed**.
 - b. Mounting: Surface applied with concealed fasteners **OR** Through bolted with oval-head machine screws and countersunk washers **OR** Back to back with threaded sleeves, **as directed**.
 - c. Overall Pull Length: 9 inches (229 mm).
8. Offset Push-Pull Door Pulls: 0.050-inch- (1.3-mm-) thick plate, 4 inches wide by 16 inches high (102 mm wide by 406 mm high) with square corners and beveled edges; 1-inch (25-mm) constant-diameter pull with minimum clearance of 2-1/4 inches (57 mm) from face of door and offset of 2 inches (51 mm).
- a. Overall Pull Length: 9 inches (229 mm).
9. Single Push Bar: Horizontal bar, with minimum clearance of 1-1/2 inches (38 mm) from face of door.
- a. Shape and Size: 1-inch (25-mm) constant-diameter round bar **OR** Minimum 3/8-by-1-1/4-inch (10-by-32-mm) flat bar, **as directed**.
 - b. Mounting: Surface applied with concealed fasteners **OR** Through bolted with oval-head machine screws and countersunk washers, **as directed**.
10. Double Pull Bar: Two horizontal bars connected by matching vertical pull bar and spaced at 8 inches (200 mm) o.c.; with minimum clearance of 1-1/2 inches (38 mm) from face of door.
- a. Shape and Size: 1-inch (25-mm) constant-diameter round bars **OR** Minimum 3/8-by- 1-1/4-inch (10-by-32-mm) flat bars, **as directed**.
 - b. Mounting: Surface applied with concealed fasteners **OR** Through bolted with oval-head machine screws and countersunk washers, **as directed**.

U. Accessories For Pairs Of Doors

1. Coordinators: BHMA A156.3; consisting of active-leaf, hold-open lever and inactive-leaf release trigger; fabricated from steel with nylon-coated strike plates; with built-in, adjustable safety release; and with internal override.
2. Carry-Open Bars: BHMA A156.3; prevent the inactive leaf from opening before the active leaf; provide polished brass or bronze carry-open bars with strike plate for inactive leaves of pairs of doors unless automatic or self-latching bolts are used.
3. Flat Overlapping Astragals: BHMA A156.22; flat primed steel **OR** zinc-plated steel **OR** aluminum **OR** stainless steel **OR** brass metal bar, **as directed**, surface mounted on face of door with screws; minimum 1/8 inch (3.2 mm) thick by 2 inches (51 mm) wide by full height of door.
4. Rigid, Housed Astragals: BHMA A156.22; gasket material held in place by metal housing; fastened to face of door with screws.
 - a. Gasket Material: Closed-cell sponge silicone **OR** Closed-cell sponge neoprene **OR** Neoprene **OR** Silicone bulb, **as directed**.
 - b. Housing Material: Aluminum **OR** Copper alloy (brass or bronze), **as directed**.
5. Overlapping-with-Gasket Astragals: BHMA A156.22; T-shaped metal, surface mounted on edge of door with screws; with integral gasket and base metal as follows:
 - a. Base Metal: Primed steel **OR** Zinc-plated steel **OR** Aluminum **OR** Stainless steel, **as directed**.
 - b. Gasket Material: Vinyl **OR** Silicone **OR** Sponge neoprene **OR** Brush pile **OR** Polypropylene, **as directed**.

V. Surface Closers

1. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.
2. Cast-Aluminum Surface Closers: Grade 1 **OR** 2, **as directed**; Traditional Type with mechanism enclosed in cast-aluminum alloy shell.
 - a. Mounting: Hinge side **OR** Opposite hinge side **OR** Parallel arm **OR** Bracket, **as directed**.



- b. Type: Regular arm **OR** Fusible-link holder arm **OR** Two-point hold-open arm **OR** Delayed action closing, **as directed**.
- c. Backcheck: Factory preset **OR** Adjustable, **as directed**, effective between 60 and 85 degrees of door opening.
3. Surface Closer without Cover: Grade 1 **OR** 2 Modern Type, **as directed**.
 - a. Mounting: Hinge side **OR** Opposite hinge side **OR** Parallel arm **OR** Bracket **OR** Hinge side top jamb **OR** Opposite side top jamb, **as directed**.
 - b. Type: Regular arm **OR** Hold open **OR** Fusible-link holder arm **OR** Slide track arm **OR** Dead stop **OR** Dead stop hold open **OR** Delayed action closing, **as directed**.
 - c. Backcheck: Factory preset **OR** Adjustable, **as directed**, effective between 60 and 85 degrees of door opening.
 - d. Closing Power Adjustment: At least 50 **OR** 35 **OR** 15 percent more than minimum tested value, **as directed**.
4. Surface Closer with Cover: Grade 1 **OR** 2 Modern Type, **as directed**; with mechanism enclosed in cover.
 - a. Mounting: Hinge side **OR** Opposite hinge side **OR** Parallel arm **OR** Bracket **OR** Hinge side, top jamb **OR** Opposite side, top jamb, **as directed**.
 - b. Type: Regular arm **OR** Hold open **OR** Fusible-link holder arm **OR** Slide track arm **OR** Dead stop **OR** Dead stop hold open **OR** Delayed action closing, **as directed**.
 - c. Backcheck: Factory preset **OR** Adjustable, **as directed**, effective between 60 and 85 degrees of door opening.
 - d. Cover Material: Aluminum **OR** Plated steel **OR** Molded plastic, **as directed**.
 - e. Closing Power Adjustment: At least 50 **OR** 35 **OR** 15 percent more than minimum tested value, **as directed**.

W. Concealed Closers

1. Concealed Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.
2. Concealed-in-Door Closer: Grade 1 **OR** 2, **as directed**; mortised into top rail of minimum 1-3/4-inch- (44-mm-) thick doors and track mortised into head frame; with double lever arm indicated.
 - a. Type: Surface shoe **OR** Mortised soffit plate, **as directed**.
 - b. Arm: Regular **OR** Hold open, **as directed**.
 - c. Closing Power Adjustment: At least 50 **OR** 35 **OR** 15 percent more than minimum tested value, **as directed**.
3. Concealed Overhead Closer: Grade 1 **OR** 2, **as directed**; mortised into head frame; with cast-metal body and exposed cover plate.
 - a. Type: Exposed arm with surface shoe, single acting **OR** Concealed arm and track, butt or pivot hung, single acting **OR** Concealed arm and track, center pivoted, single acting **OR** Concealed arm and track, center pivoted, double acting, **as directed**.
 - b. Arm: Regular **OR** Automatic hold open **OR** Manually selected hold open **OR** Fusible-link holder arm, **as directed**.
 - c. Track: Regular **OR** Automatic hold open **OR** Manually selected hold open, **as directed**.
 - d. Cover Plate Material: Aluminum **OR** Plated steel, **as directed**.
 - e. Backcheck: Factory preset **OR** Adjustable, **as directed**.
 - f. Closing Power Adjustment: At least 50 **OR** 35 percent more than minimum tested value, **as directed**.
4. Concealed Floor Closer: Grade 1 **OR** 2, **as directed**; with cement case and cast-iron closer body case and top pivot; for single **OR** double-acting doors, **as directed**.
 - a. Type: Center pivoted; include top pivot **OR** Offset pivoted; include top pivot **OR** Independently hung, **as directed**.
 - b. Fire Rated: Listed for use with labeled fire-rated doors where indicated.
 - c. Function: Regular **OR** Automatic hold open **OR** Manually selected hold open **OR** Delayed action closing, **as directed**.



- d. Backcheck: Factory preset **OR** Adjustable, **as directed**.
 - e. Closing Power Adjustment: At least 50 **OR** 35 percent more than minimum tested value, **as directed**.
 - f. Case Depth: Regular, 4 inches (100 mm) **OR** Shallow, 2 inches (50 mm), **as directed**.
 - g. Floor Plates: Provide flush cover plates matching door hardware finish **OR** recessed floor plates with insert of floor finish material and extended closer spindle to accommodate thickness of floor finish, **as directed** unless thresholds are indicated.
 - 1) Material: Aluminum **OR** Plated steel, **as directed**.
- X. Closer Holder Release Devices
- 1. Closer Holder Release Devices: BHMA A156.15; Grade 1; closer connected with separate or integral releasing and fire- or smoke-detecting devices. Door shall become self-closing on interruption of signal to release device. Automatic release is activated by smoke detection system **OR** loss of power, **as directed**.
 - a. Type: Single-point hold open **OR** Multiple-point hold open **OR** Free-swinging release, **as directed**.
 - b. Mounting: Surface mounted on face of door **OR** Surface mounted on face of top jamb **OR** Surface mounted on stop **OR** Mortised into top rail of door **OR** Mortised into top jamb **OR** Recessed into floor, **as directed**.
 - c. Options: Adjustable backcheck **OR** Integral smoke detector **OR** Adjustable spring power **OR** Adjustable hold-open manual release force, **as directed**.
- Y. Mechanical Stops And Holders
- 1. Wall- and Floor-Mounted Stops: BHMA A156.16; polished cast brass, bronze, or aluminum base metal, **as directed**.
 - 2. Rigid-Type Floor Stop: Grade 1 **OR** 2, **as directed**; with rubber bumper; for surface-screw **OR** expansion-shield, **as directed** application.
 - 3. Dome-Type Floor Stop: Grade 1 **OR** 2, **as directed**; with minimum 1-inch- (25-mm-) high bumper for doors without threshold and 1-3/8-inch- (35-mm-) high bumper for doors with threshold; provide with extruded aluminum riser for carpet installations.
 - 4. Combination Floor Stop and Holder: Grade 1 **OR** 2, **as directed**; for surface-screw **OR** expansion-shield application, **as directed**; with semiautomatic hold open **OR** automatic hold open and release by pushing door, **as directed**.
 - 5. Manual Combination Floor Stop and Holder: Grade 1 **OR** 2, **as directed**; 3-1/2 inches (89 mm) long, with holder, keeper, and rubber bumper; for surface-screw **OR** expansion-shield application, **as directed**.
 - 6. Chain Door Stops: Grade 2; welded chain, each end attached to compression springs, both covered with protective sleeve; for surface-screw application.
 - 7. Wall Bumpers: Grade 1 **OR** 2, **as directed**; with rubber bumper; 2-1/2-inch (64-mm) diameter, minimum 3/4-inch (19-mm) projection from wall; with backplate for concealed fastener installation; with convex **OR** concave, **as directed** bumper configuration.
 - 8. Roller-Type Wall Bumpers: Grade 1 **OR** 2, **as directed**; minimum 4-3/8-inch (111-mm) projection from wall; for surface-screw application.
 - 9. Lever-Type Door Holders: Grade 1 **OR** 2, **as directed**; minimum 4-inch- (102-mm-) long arm that swings up and remains in vertical position; with replaceable rubber tip; for surface-screw application.
 - 10. Plunger-Type Door Holders: Grade 1 **OR** 2, **as directed**; minimum 1-1/8-inch (29-mm) plunger throw; with replaceable rubber tip; for surface-screw application.
- Z. Electromagnetic Stops And Holders
- 1. Electromagnetic Door Holders: BHMA A156.15, Grade 1; wall-mounted electromagnetic single **OR** floor-mounted electromagnet single **OR** floor-mounted electromagnet double unit, **as directed** with strike plate attached to swinging door; coordinated with fire detectors and interface with fire alarm system for labeled fire-rated door assemblies.

**AA. Overhead Stops And Holders**

1. Overhead Stops and Holders: BHMA A156.8.
2. Overhead Concealed Slide Holders: Type 1; Grade 1 **OR 2, as directed**; hold open and release by push and pull of door unless control is set in inactive position; with stop, shock absorber, and adjustable holding pressure; for single **OR** double, **as directed**-acting doors opening 110 degrees.
3. Overhead Concealed Slide Stops: Type 1; Grade 1 **OR 2, as directed**; release by push and pull of door unless control is set in inactive position; with stop, shock absorber, and adjustable holding pressure; for single **OR** double, **as directed**-acting doors opening 110 degrees.
4. Overhead Surface-Mounted Slide Holders: Type 2; Grade 1 **OR 2, as directed**; hold open and release by push and pull of door unless control is set in inactive position; with stop, shock absorber, and adjustable holding pressure; for single-acting doors opening 110 degrees.
5. Overhead Surface-Mounted, Concealed Slide Stops: Type 2; Grade 1 **OR 2, as directed**; release by push and pull of door unless control is set in inactive position; with stop, shock absorber, and adjustable holding pressure; for single-acting doors opening 110 degrees.
6. Overhead Surface-Mounted, Jointed-Arm Holders: Type 3; Grade 1 **OR 2, as directed**; hold open and release by push and pull of door; control capable of being set in inactive position; with stop and shock absorber; for single-acting doors opening 110 degrees.
7. Overhead Surface-Mounted, Jointed-Arm Stops: Type 3; Grade 1 **OR 2, as directed**; release by push and pull of door; control capable of being set in inactive position; with stop and shock absorber; for single-acting doors opening 110 degrees.
8. Overhead Concealed, Friction Slide Holders: Type 4; Grade 1 **OR 2, as directed**; with frictional element held under adjustable pressure, free-acting shoulder pivots, and shock absorber; for single **OR** double, **as directed**-acting doors opening 110 degrees.
9. Overhead Concealed, Nonfriction Slide Stops: Type 4; Grade 1 **OR 2, as directed**; with nonfrictional element held under adjustable pressure and shock absorber; for single **OR** double, **as directed**-acting doors opening 110 degrees.
10. Overhead Concealed, Nonfriction Slide Holders: Type 4; Grade 1 **OR 2, as directed**; with nonfrictional element held under adjustable pressure, automatic hold-open, and shock absorber; for single **OR** double, **as directed**-acting doors opening 110 degrees.
11. Overhead Surface-Mounted, Friction Slide Holders: Type 5; Grade 1 **OR 2, as directed**; with frictional element held under adjustable pressure, free-acting shoulder pivots, and shock absorber; for single-acting doors opening 110 degrees.
12. Overhead Surface-Mounted, Nonfriction Slide Stops: Type 5; Grade 1 **OR 2, as directed**; with nonfrictional element held under adjustable pressure and shock absorber; for single-acting doors opening 110 degrees.
13. Overhead Surface-Mounted, Nonfriction Slide Holders: Type 5; Grade 1 **OR 2, as directed**; with nonfrictional element held under adjustable pressure, automatic hold-open, and shock absorber; for single-acting doors opening 110 degrees.
14. Overhead Surface-Mounted Rod Holders: Type 8; Grade 1 **OR 2, as directed**; hold open and release by push and pull of door unless roller cam is set in inactive position; with stop, shock absorber, and adjustable spring tension; for single-acting doors opening 110 degrees.
15. Overhead Surface-Mounted Rod Stops: Type 8; Grade 1 **OR 2, as directed**; release by push and pull of door unless roller cam is set in inactive position; with stop, shock absorber, and adjustable spring tension; for single-acting doors opening 110 degrees.
16. Overhead Surface-Mounted Cantilever Holders: Type 9; Grade 1 **OR 2, as directed**; hold open and release by push and pull of door or thumb turn; with stop and shock absorber; for single-acting doors opening 110 degrees.
17. Overhead Surface-Mounted Cantilever Stops: Type 9; Grade 1 **OR 2, as directed**; release by push and pull of door or thumb turn; with stop and shock absorber; for single-acting doors opening 110 degrees.

BB. Door Gasketing

1. Door Gasketing: BHMA A156.22; air leakage not to exceed 0.50 cfm per foot (0.000774 cu. m/s per m) of crack length for gasketing other than for smoke control, as tested according to



ASTM E 283; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

2. Adhesive-Backed Perimeter Gasketing: Vinyl bulb **OR** Sponge silicone **OR** Silicone **OR** Neoprene bulb **OR** Sponge neoprene gasket material, **as directed** applied to frame rabbet with self-adhesive.
3. Spring-Metal Perimeter Gasketing: Minimum 0.008-inch- (0.20-mm-) thick brass or bronze **OR** 0.008-inch- (0.20-mm-) thick stainless steel **OR** 0.012-inch- (0.30-mm-) thick aluminum gasket material, **as directed** fastened to frame rabbet with nails or screws.
4. Rigid, Housed, Perimeter Gasketing: Sponge silicone **OR** Sponge neoprene **OR** Silicone bulb **OR** Polyurethane bulb **OR** Vinyl bulb **OR** Vinyl brush **OR** Nylon brush **OR** Thermoplastic elastomer, **as directed** gasket material held in place by aluminum **OR** brass or bronze **OR** stainless steel, **as directed** housing; fastened to frame stop with screws.
5. Adjustable, Housed, Perimeter Gasketing: Screw-adjustable sponge silicone **OR** sponge neoprene **OR** silicone bulb **OR** polyurethane bulb **OR** vinyl bulb **OR** vinyl brush **OR** nylon brush **OR** thermoplastic elastomer gasket material, **as directed**, held in place by aluminum **OR** brass or bronze **OR** stainless steel housing, **as directed**; fastened to frame stop with screws.
6. Interlocking Perimeter Gasketing: Minimum 0.018-inch- (0.46-mm-) thick zinc **OR** 0.015-inch- (0.38-mm-) thick bronze gasket material, **as directed** consisting of two pieces, one fastened to door and one fastened to frame, that interlock when door is closed; mounted with screws.
7. Overlapping Astragals for Meeting Stiles: EPDM strip **OR** Vinyl strip **OR** Nylon brush gasket material, **as directed** held in place by aluminum **OR** bronze, **as directed** housing and overlapping when doors are closed; mounted to face of meeting stile with screws; surface mounted to each **OR** one door, **as directed**.
8. Meeting Astragals for Meeting Stiles: Silicone bulb **OR** Neoprene bulb **OR** Vinyl bulb **OR** Nylon brush **OR** Brush pile **OR** Thermoplastic elastomer gasket material, **as directed** held in place by aluminum **OR** bronze housing, **as directed** mounted with screws.
 - a. Mounting: Surface mounted on face of each door **OR** Surface mounted on face of one door **OR** Semimortised into edge of each door **OR** Semimortised into edge of one door **OR** Mortised into edge of each door **OR** Mortised into edge of one door, **as directed**.
9. Adjustable Astragals for Meeting Stiles: Screw-adjustable silicone **OR** neoprene **OR** vinyl **OR** vinyl-covered magnet **OR** brush pile **OR** thermoplastic elastomer gasket material, **as directed** held in place by aluminum **OR** bronze housing, **as directed** mounted with screws.
 - a. Mounting: Surface mounted on face **OR** Semimortised into edge **OR** Mortised into edge of each door, **as directed**.
10. Door Sweeps: Neoprene **OR** Vinyl **OR** Nylon brush **OR** Polyurethane **OR** Silicone gasket material, **as directed** held in place by flat aluminum **OR** bronze, **as directed** housing or flange; surface mounted to face of door with screws.
11. Door Shoes: Vinyl **OR** Thermoplastic elastomer **OR** Neoprene **OR** Brush pile gasket material, **as directed** held in place by aluminum **OR** bronze housing, **as directed**; mounted to bottom edge of door with screws.
 - a. Extended Housing: One side **OR** Both sides of door, **as directed**.
 - b. Mounting: Surface mounted on **OR** Mortised into bottom edge of door, **as directed**.
12. Automatic Door Bottoms: Sponge neoprene **OR** Sponge silicone **OR** Thermoplastic elastomer **OR** Nylon brush gasket material, **as directed** held in place by aluminum **OR** bronze **OR** aluminum lined with 0.047-inch (1.2-mm) thick lead housing, **as directed** that automatically drops to form seal when door is closed; mounted to bottom edge of door with screws.
 - a. Mounting: Surface mounted on face **OR** Semimortised into bottom **OR** Mortised into bottom of door, **as directed**.
 - b. Type: Low-closing-force type for doors required to meet accessibility requirements.

CC. Thresholds

1. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.
2. Compressing-Top Thresholds: Metal member with compressible vinyl seal on top of threshold that seals against bottom of door; and base metal of aluminum **OR** extruded bronze **OR** stainless steel, **as directed**.



3. Saddle Thresholds:
 - a. Type: Smooth top **OR** Fluted top **OR** Fluted top and offset **OR** Thermal break and fluted top **OR** Applied gasketed stop and fluted top **OR** Carpet separator with fluted top **OR** Fluted top, barrier free, **as directed**.
 - b. Base Metal: Aluminum **OR** Extruded bronze **OR** Stainless steel, **as directed**.
 4. Half-Saddle Thresholds: Fluted-top metal member; and base metal of aluminum **OR** extruded bronze, **as directed**.
 5. Interlocking Thresholds: Fluted-top metal member with integral lip designed to engage a hook strip applied to door.
 - a. Type: Single lip **OR** Double lip **OR** Double-lip water return **OR** Double-lip water return with aluminum pan **OR** Single lip with thermal barrier, **as directed**.
 - b. Base Metal: Aluminum **OR** Extruded bronze, **as directed**.
 6. Latching/Rabbeted Thresholds:
 - a. Type: Fluted **OR** Smooth **OR** Offset with fluted top, **as directed**.
 - b. Base Metal: Aluminum **OR** Extruded bronze, **as directed**.
 7. Latching/Rabbeted Thresholds with Gasket: Fluted-top metal member with gasket.
 - a. Type: Offset **OR** Thermal barrier, **as directed**.
 - b. Base Metal: Aluminum **OR** Extruded bronze, **as directed**.
 - c. Gasket Material: Vinyl **OR** Silicone **OR** Neoprene **OR** Brush pile **OR** Closed-cell sponge neoprene, **as directed**.
 8. Latching/Rabbeted Panic Thresholds:
 - a. Type: Fluted, barrier free **OR** Fluted with gasket top, **as directed**.
 - b. Base Metal: Aluminum **OR** Extruded bronze, **as directed**.
 9. Plate Thresholds: Solid metal plate.
 - a. Top Surface: Fluted **OR** Fluted with slip-resistant abrasive, **as directed**.
 - b. Base Metal: Aluminum **OR** Extruded brass or bronze **OR** Stainless steel, **as directed**.
 10. Ramped Thresholds: Modular, interlocking, sloped, fluted-top metal assemblies with closed return ends; 1:12 slope.
 - a. Top Surface: Fluted **OR** Fluted with slip-resistant abrasive, **as directed**.
 - b. Base Metal: Aluminum **OR** Extruded bronze, **as directed**.
 11. Saddle Thresholds for Floor Closers: Fluted top.
 - a. Type: Type A, for center-hung doors; ends not mitered **OR** Type B, for offset-hung doors; ends not mitered **OR** Type C, for center-hung doors; ends mitered **OR** Type D, for offset-hung doors; ends mitered, **as directed**.
 - b. Base Metal: Aluminum **OR** Extruded bronze, **as directed**.
- DD. Sliding Door Hardware
1. Sliding Door Hardware: BHMA A156.14; consisting of complete sets including rails, hangers, supports, bumpers, floor guides, and accessories indicated.
 2. Horizontal Sliding Door Hardware: Grade 1; rated for minimum door weight of 240 lb (109 kg) **OR** 320 lb (145 kg) **OR** 450 lb (205 kg) **OR** 560 lb (254 kg) **OR** 640 lb (290 kg) **OR** 800 lb (363 kg) **OR** 1000 lb (455 kg) **OR** 1500 lb (681 kg), **as directed**.
 - a. Material: Wrought steel **OR** Galvanized steel or anodized aluminum, **as directed**.
 - b. Rail: Box without mounting brackets **OR** Box with attached mounting brackets **OR** Box with attached flashing **OR** Round without mounting brackets **OR** Round with attached mounting brackets, **as directed**.
 - c. Rail Supports: Single sidewall **OR** Double sidewall **OR** Triple sidewall **OR** Single overhead **OR** Single overhead parallel **OR** Single overhead cross-ear **OR** Double overhead cross-ear **OR** Triple overhead cross-ear style, **as directed**.
 - 1) Provide intermediate, end, and splice type track supports as required by rail configuration and door weight indicated.
 - d. Hanger Configuration: Four-wheel truck **OR** hanger assembly with top mounting plate **OR** hanger assembly with drop bolt **OR** hanger assembly with single drop strap **OR** hanger assembly with double drop strap, **as directed**.
 - 1) Wheel Assembly: Steel wheels with ball bearings.
 - e. Accessories:



- 1) Continuous bottom guide.
 - 2) Guide rail and guide rail brackets as required by rail configuration.
 - 3) Bow handle, minimum 6 inches (150 mm) in overall length.
 - 4) Flush pull, minimum 4 by 5-1/2 by 3/4 inch (100 by 140 by 19 mm), mortised into door.
 - 5) Cane bolt, minimum 1/2-inch (13-mm) diameter by 12 inches (305 mm) long.
 - 6) Stay roller, minimum 2-inch- (50-mm-) diameter wheel.
 - 7) Floor center stop of cast iron.
 - 8) End guide and stop.
 - 9) Parallel door floor guides.
 - 10) Door stop.
 - 11) Sliding door latch.
 - 12) Bumper shoe, minimum 0.0598-inch (1.5-mm) thickness.
 - 13) Cremona bolt with lever handle, minimum 1/2-inch- (13-mm-) diameter oval or round rod, and rod guides at 24 inches (610 mm) o.c.
 - 14) Top spring bolt, minimum 6 inches (150 mm) **OR** 8 inches (200 mm), **as directed**; malleable iron and with angle or surface strike and 24-inch (610-mm) chain.
 - 15) Foot bolt minimum 6 inches (150 mm) **OR** 8 inches (200 mm), **as directed**; wrought steel, cast iron, or malleable iron.
3. Bypassing Sliding Door Hardware: Rails and door hardware that allow vertical adjustment and rated for doors weighing up to 120 lb (54 kg) (Grade 1) **OR** 80 lb (36 kg) (Grade 1) **OR** 40 lb (18 kg) (Grade 2), **as directed**.
- a. Rail Material: Galvanized wrought steel **OR** Extruded aluminum, **as directed**.
 - b. Rail Configuration: V-grooved double leg **OR** V-grooved double leg with fascia **OR** I-beam, **as directed**.
 - c. Mounting: Top hung **OR** Bottom supporting with overhead guide, **as directed**.
 - d. Wheel Assembly: Two wheel or four wheel, with roller bearings.
 - e. Pulls: Flush, mortised into door **OR** Cast, forged, or extruded brass or bronze surface-applied type **OR** Wrought brass or bronze edge type, mortised into edge of door **OR** Sliding door latch **OR** Sliding door lock with emergency release, **as directed**.
 - f. Accessories:
 - 1) Bumper stops; wrought steel.
 - 2) Floor guides.
4. Pocket Sliding Door Hardware: Grade 1; rated for doors weighing up to 120 lb (54 kg) **OR** 80 lb (36 kg), **as directed**, overhead box rails and door hardware that allows vertical adjustment.
- a. Rail Material: Galvanized wrought steel **OR** Extruded aluminum, **as directed**.
 - b. Door Type: Single **OR** Biparting, **as directed**.
 - c. Rail Configuration: V-grooved double leg **OR** I-beam, **as directed**.
 - d. Wheel Assembly: Two wheel or four wheel, roller bearings.
 - e. Pulls: Flush, mortised into door **OR** Cast, forged, or extruded brass or bronze surface-applied type **OR** Wrought brass or bronze edge type, mortised into edge of door **OR** Sliding door latch **OR** Sliding door lock with emergency release, **as directed**.
 - f. Accessories:
 - 1) Bumper stops; wrought steel.
 - 2) Floor guides installed within pocket.

EE. Folding Door Hardware

1. General: BHMA A156.14; complete sets including overhead rails, hangers, supports, bumpers, floor guides, and accessories indicated.
2. Bifolding Door Hardware: Rated for door panels weighing up to 50 lb (23 kg) (Grade 1) **OR** 30 lb (14 kg) (Grade 2), **as directed**; with rails and door hardware that allow horizontal and vertical adjustment.
 - a. Rail Material: Galvanized wrought steel **OR** Extruded aluminum, **as directed**.
 - b. Rail Configuration: V-grooved double leg **OR** V-grooved double leg with fascia **OR** I-beam, **as directed**.



- c. Mounting: Surface mounted overhead **OR** Top and bottom hung, **as directed**.
- d. Wheel Assembly: Two wheel or four wheel, with roller bearings.
3. Multiple Folding Door Hardware: Rated for door panels weighing up to 50 lb (23 kg) (Grade 1) **OR** 30 lb (14 kg) (Grade 2), **as directed**; with rails and door hardware that allows horizontal and vertical adjustment.
 - a. Rail Material: Galvanized wrought steel **OR** Extruded aluminum, **as directed**.
 - b. Rail Configuration: V-grooved double leg **OR** V-grooved double leg with fascia **OR** I-beam, **as directed**.
 - c. Mounting: Surface mounted overhead **OR** Top and bottom hung, **as directed**.
 - d. Wheel Assembly: Two wheel or four wheel, with roller bearing.

FF. Metal Protective Trim Units

1. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch- (1.3-mm-) thick aluminum **OR** brass **OR** bronze **OR** stainless steel, **as directed**; with manufacturer's standard machine or self-tapping screw fasteners.
2. Armor Plates: 36 inches (914 mm) **OR** 40 inches (1016 mm) **OR** 42 inches (1067 mm) high, **as directed by** door width with allowance for frame stops.
3. Kick Plates: 8 inches (203 mm) **OR** 10 inches (254 mm) **OR** 12 inches (305 mm) high, **as directed by** door width with allowance for frame stops.
4. Mop Plates: 4 inches (102 mm) **OR** 6 inches (152 mm) high, **as directed by** 1 inch (25 mm) less than door width.
5. Stretcher Plates: 6 inches (152 mm) **OR** 8 inches (203 mm) high, **as directed by** door width with allowance for frame stops.
6. Nonmortise Angle Door Edging: 48-inch- (1220-mm-) **OR** 42-inch- (1067-mm-) high, **as directed by** minimum 0.050-inch- (1.3-mm-) thick metal sheet formed into angle shape; with 1-1/4-inch (32-mm) length of leg on face of door; for surface mounting on door.
 - a. Leg Offset: To accommodate door protection plate of type indicated.
7. Mortise Angle Door Edging: 48-inch- (1220-mm) **OR** 42-inch- (1067-mm-) high, **as directed by** minimum 0.050-inch- (1.3-mm-) thick metal sheet formed into angle shape; with 7/8-inch (22-mm) length of leg on face of door; for mortise application into edge of door.
8. Nonmortise Cap Door Edging: 48-inch- (1220-mm) **OR** 42-inch- (1067-mm-) high, **as directed by** minimum 0.050-inch- (1.3-mm-) thick metal sheet formed into "U" shape; with 1-1/4-inch (32-mm) length of leg on faces of door; for surface mounting on door.
 - a. Leg Offset: To accommodate door protection plate of type indicated.
9. Mortise Cap Door Edging: 48-inch- (1220-mm) **OR** 42-inch- (1067-mm-) high, **as directed by** minimum 0.050-inch- (1.3-mm-) thick metal sheet formed into "U" shape; with 7/8-inch (22-mm) length of leg on faces of door; for mortise application into edge of door.

GG. Plastic Protection Plates

1. Plastic Protection Plates: BHMA A156.6; fabricated with four sides beveled; plastic laminate; 1/8 inch (3.2 mm) thick; NEMA LD 3, Grade HGS **OR** rigid plastic; 0.060-inch- (1.5-mm-) thick, PVC or acrylic-modified vinyl plastic **OR** acrylic; 1/8 inch (3.2 mm) thick, **as directed**.
2. Armor Plates: 36 inches (914 mm) **OR** 40 inches (1016 mm) **OR** 42 inches (1067 mm), high, **as directed by** door width with allowance for frame stops.
3. Kick Plates: 8 inches (203 mm) **OR** 10 inches (254 mm) **OR** 12 inches (305 mm) high **as directed by** door width with allowance for frame stops.
4. Mop Plates: 4 inches (102 mm) **OR** 6 inches (152 mm) high **as directed by** 1 inch (25 mm) less than door width.
5. Stretcher Plates: 6 inches (152 mm) **OR** 8 inches (203 mm) high **as directed by** door width with allowance for frame stops.
6. Colors and Textures: As selected by Architect from manufacturer's full range **OR** Match Architect's sample **OR** As indicated by manufacturer's designations in the door hardware schedule, **as directed**.

HH. Auxiliary Door Hardware

1. Auxiliary Hardware: BHMA A156.16.



2. Chain Door Guards: Grade 1 **OR** 2 **OR** 3, **as directed**; polished cast brass or bronze or extruded brass; with plate slotted to receive 6-inch- (150-mm-) long welded chain secured to an anchor plate. Guard allows door to be opened 3 inches (75 mm) with chain engaged in slotted plate. Equip with chain holder.
 3. Rod-Type Door Guards: Grade 1 **OR** 2 **OR** 3, **as directed**; straight door-mounted rod that engages U-shaped, jamb-mounted rod. U-shaped rod can swing 180 degrees away from door; rod limits door opening when engaged. Fabricated from polished cast brass **OR** bronze **OR** aluminum, **as directed**.
 4. Coat Hooks: Grade 1 **OR** 2 **OR** 3, **as directed**; two curved hooks with rounded ends; 3-inch (75-mm) projection from wall; for surface-screw application; fabricated from polished cast brass **OR** polished cast bronze **OR** burnished cast aluminum, **as directed**.
 5. Garment Hooks: Grade 1 **OR** 2 **OR** 3, **as directed**; one long hat hook and one small coat hook; 3-3/4-inch (95-mm) projection from wall with 7-inch (178-mm) overall height; for surface-screw application; fabricated from polished cast brass **OR** burnished cast aluminum, **as directed**.
 6. Door Knockers: Grade 1; solid brass with engraved number and nameplates, **as directed**.
 7. Wide-Angle Door Viewers: Grade 1 **OR** 2 **OR** 3, **as directed**; solid brass with optical glass lenses; adjustable to door thickness and permitting 1-way observation with minimum 190-degree viewing angle.
 8. Fire-Rated Door Viewers: Solid brass with optical glass lenses; listed and labeled for use in fire-rated door assemblies; adjustable to door thickness, and permitting 1-way observation with minimum 120 **OR** 150 **OR** 190-degree viewing angle **as directed**.
 9. House Numbers: Grade 1; wrought, cast, or forged brass; 4 inches (102 mm) high; for screw application.
 10. Letter Box Plates: Grade 1 **OR** 2 **OR** 3, **as directed**; with spring-loaded front plate with brass spring and inside covered gravity flap or hood; fabricated from wrought brass **OR** wrought bronze **OR** aluminum, **as directed**.
 - a. Regular Size, Inswinging: Minimum 0.036-inch (0.9-mm) metal thickness, with minimum 7-by-1-5/8-inch (178-by-41-mm) opening.
 - b. Regular Size, Outswinging: Minimum 0.036-inch (0.9-mm) metal thickness, with minimum 7-by-1-1/2-inch (178-by-38-mm) opening.
 - c. Magazine Size, Outswinging: Minimum 0.051-inch (1.3-mm) metal thickness, with minimum 11-by-1-7/8-inch (279-by-48-mm) opening.
 11. Silencers for Wood Door Frames: Grade 1; neoprene or rubber; minimum 5/8 by 3/4 inch (16 by 19 mm); fabricated for drilled-in application to frame.
 12. Silencers for Metal Door Frames: Grade 1; neoprene or rubber; minimum diameter 1/2 inch (13 mm); fabricated for drilled-in application to frame.
- II. Auxiliary Electrified Door Hardware
1. Boxed Power Supplies: Modular unit in NEMA ICS 6, Type 4 enclosure; filtered and regulated; voltage rating and type matching requirements of door hardware served; listed and labeled for use with fire alarm systems.
 2. Monitor Strikes: Cast strike with toggle **OR** Dustbox monitor for installation under standard strike, **as directed**.
 3. Door Position Switches: Magnetically operated reed switch designed for concealed mounting.
 4. Door and Frame Transfer Devices: Steel housing for mortise in hinge stile of door, with flexible tube for wiring bundle; accommodating doors that swing open to 120 degrees.
- JJ. FABRICATION
1. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by the Owner.
 - a. Manufacturer's identification is permitted on rim of lock cylinders only.
 2. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness.



- Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.
3. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
 - a. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
 4. Fire-Rated Applications:
 - a. Wood or Machine Screws: For the following:
 - 1) Hinges mortised to doors or frames; use threaded-to-the-head wood screws for wood doors and frames, as directed.
 - 2) Strike plates to frames.
 - 3) Closers to doors and frames.
 - b. Steel Through Bolts: For the following unless door blocking is provided:
 - 1) Surface hinges to doors.
 - 2) Closers to doors and frames.
 - 3) Surface-mounted exit devices.
 5. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
 6. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."
 7. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

KK. FINISHES

1. Provide finishes complying with BHMA A156.18.
2. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
3. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

1.3 EXECUTION

A. Examination

1. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.
2. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Preparation

1. Steel Doors and Frames: For Surface-Applied Door Hardware: Drill and tap doors and frames according to ANSI/SDI A250.6.
2. Wood Doors: Comply with DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."

C. Installation



1. Mounting Heights: Mount door hardware units at heights indicated on Drawings **OR** as follows, **as directed**, unless otherwise indicated or required to comply with governing regulations.
 - a. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 - b. Custom Steel Doors and Frames: HMMA 831.
 - c. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
2. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 09. Do not install surface-mounted items until finishes have been completed on substrates involved.
 - a. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 - b. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
3. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
4. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches (750 mm) of door height greater than 90 inches (2286 mm).
5. Lock Cylinders: Install construction cores to secure building and areas during construction period.
 - a. Replace construction cores with permanent cores as directed by the Owner.
 - b. Furnish permanent cores to the Owner for installation.
6. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
7. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings **OR** in equipment room, **as directed**. Verify location with the Owner.
 - a. Configuration: Provide one power supply for each door opening **OR** least number of power supplies required to adequately serve doors, **as directed**.
8. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants".
9. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.
10. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
11. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
12. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

D. Field Quality Control

1. Independent Architectural Hardware Consultant: Engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.
 - a. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

E. Adjusting

1. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
 - a. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.



- b. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
 - c. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
 - 2. Occupancy Adjustment: Approximately three **OR** six months, **as directed**, after date of Final Completion, Installer's Architectural Hardware Consultant shall examine and readjust, including adjusting operating forces, each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.
- F. Cleaning And Protection
- 1. Clean adjacent surfaces soiled by door hardware installation.
 - 2. Clean operating items as necessary to restore proper function and finish.
 - 3. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Final Completion.
- G. Demonstration
- 1. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Division 01 Section "Demonstration And Training".

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SECTION 08 74 16 00 - CLOCK AND PROGRAM CONTROL

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for clock and program control. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
2. Master clock and program control unit.
3. Secondary indicating clocks.
4. Program signal devices.
5. Clock circuit power boosters.
6. Interface with intercom and public-address system.
7. System wire and cable.

C. Definitions

1. NIST: The National Institute of Science and Technology.
2. PC: Personal computer.
3. UTC: Universal time coordinated. The precisely measured time at zero degrees longitude; a worldwide standard for time synchronization.

D. Performance Requirements

1. Seismic Performance: Master clock and housing shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
2. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

E. Submittals

1. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes (including available colors) for each product indicated and describe features and operating sequences, both automatic and manual.
2. Shop Drawings: For clock systems. Include plans, elevations, sections, details, and attachments to other work.
 - a. Wiring Diagrams: For power, signal, and control wiring and correction circuits.
 - 1) Identify terminals and wiring color codes to facilitate installation, operation, and maintenance.
 - 2) Indicate recommended wire types and sizes, and circuiting arrangements for field-installed system wiring. Show protection from overcurrent, static discharge, and voltage surge.
 - b. Details of seismic restraints including mounting, anchoring, and fastening devices for the following system components:
 - 1) Surface-mounted and semirecessed secondary indicating clocks.
 - 2) Master clock enclosures **OR** mounting racks, **as directed**.
 - 3) Clock circuit power boosters.
 - c. Details of seismic strengthening of master clock enclosures **OR** mounting racks, **as directed**.



- d. Dimensioned Outline Drawings of the Mounting Rack for the Master Clock: Show internal seismic bracing, and locate center of gravity of fully equipped and assembled unit. Locate and describe mounting and anchorage provisions.
 3. Delegated-Design Submittal: For the master clock and housing indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - a. Detail fabrication and assembly of the master clock and housing.
 - b. Design Calculations: Calculate requirements for selecting seismic restraints.
 4. Seismic Qualification Certificates: For the master clock, accessories, and components, from manufacturer.
 5. Field quality-control reports.
 6. Operation and maintenance data.
- F. Quality Assurance
1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Comply with NFPA 70.

1.2 PRODUCTS

A. Master And Secondary Clock System

1. System Functions and Features:
 - a. Supply power to remote indicating clocks except those indicated to have correction signals applied through a data circuit.
 - b. Maintain correct synchronized time and transmit time-correction signals over dedicated system wiring from a master clock to any one **OR** two, **as directed**, type(s) of secondary indicating clocks, including the following:
 - 1) Analog Synchronous Clocks: Correct for minute- and second-hand synchronization at least once each hour and for hour-hand synchronization at least once each day.
 - 2) Digital Clocks: Test clocks automatically for synchronization with master time control at least once every hour and automatically correct those not synchronized with the time reference unit. Automatically correct clocks immediately when power is restored after an outage of power to the master clock.
 - c. Initiate and execute programs for scheduled automatic operation of remote devices. Include audible signal devices and visual signal devices, **as directed**, and on and off switching of equipment and circuits, **as directed**.
 - d. Provide for manual control of programmed signal and equipment-switching circuits.
 - e. Communicate with remote PC for access to UTC time base and to permit programming from remote location, **as directed**.
 - f. Maintain system access security with a minimum of one level **OR** two levels **OR** three levels, **as directed**, of user-access control to restrict use of system controls to authorized personnel. Levels of access apply to both local access and access from a remote computer, **as directed**. Access to user programming and control functions is accomplished by entering a minimum three-digit code. Access levels include the following:
 - 1) Access to review existing programs only.
 - 2) Access to normal system operating controls.
 - 3) Access to all user-programming and control functions.
 - g. Regulate system timing functions using power-line frequency, backed up for power outages by an internal battery-powered, crystal-controlled oscillator.
OR
 Regulate system timing functions using power-line frequency, backed up for power outages by an internal battery-powered, crystal-controlled oscillator, and automated periodic reference to NIST or UTC time signals via internal telephone modem and automatic dialup connection **OR** internal modem and network or microcomputer Internet



access **OR** dedicated internal radio receiver tuned to NIST time signal broadcasts, **as directed**. Reference time signals shall be automatically accessed at programmable intervals.

- h. Provide for programming multiple independent event schedules into memory and running them simultaneously for different output circuits.
 - 1) Quantity of Programmable Schedules: Three **OR** Four **OR** Eight **OR** 18 **OR** 250, **as directed**, minimum.
 - 2) Number of Weekly Events That Can Be Programmed for Each Schedule: 64 **OR** 128 **OR** 300 **OR** 600 **OR** 2500, **as directed**, minimum.
 - 3) Simultaneous operation of independent schedules shall be limited only by the number of signal-device and equipment-switching output circuits.
 - 4) Advance Programming for Automatic Holiday Schedule Changes: Number of schedule changes that can be programmed to suit holidays and vacations shall be 10 **OR** 16 **OR** 50 **OR** 100, **as directed**, and each change may be programmed up to a year in advance to occur on any day of the calendar year.
- i. Automatically check functioning of LEDs, switches, input keys, central processor, read-only memory, random access memory, and output circuits. A display on the control panel or a remote computer with the proper access code, **as directed**, shall indicate failure by identifying faulty component or circuit and shall recommend corrective action.
- j. Provide manually initiated **OR** programming for automatic, **as directed**, daylight savings time correction.
- k. Provide for adjustments to master clock output signals. Duration of momentary signal shall be individually programmable for each signal and equipment-control output circuit from 1 to 99 seconds. Signals shall be programmable for either on or off switching to suit equipment-operation scheduling.

B. Master Clock

- 1. Description: Microprocessor-based, software-controlled unit complying with Class A device requirements in 47 CFR 15.
 - a. Programming and control switches.
 - b. Informational Display: LED or backlit LCD type.
 - 1) Normally shows current time, date, and day of week, **as directed**, display.
 - 2) Provides programming cues when system is being programmed.
 - c. Output Circuits for Power and Correction of Secondary Indicating Clocks:
 - 1) Wired Synchronous Clock Power-and-Correction Circuits: For analog and digital, **as directed**, clocks; a minimum of one **OR** two, **as directed**, required. Relay controlled.
OR
Wired Synchronous Digital Clock Power-and-Correction Circuits: One, **as directed**, required.
 - 2) Existing Clock Power-and-Correction Circuit: An output circuit suitable for the of existing power-and-correction circuit and number of clocks to be connected.
 - d. Data Output Port for Digital, **as directed**, Secondary Clock Correction Circuit: RS485 or similar circuit for scheduled periodic correction signals.
 - e. Modem and PC interface software suitable for remote programming and automatic NIST or UTC synchronization, **as directed**.
 - f. Circuits for Audible and Visual, **as directed**, Signal Devices: Relay controlled, manually switchable, using controls on the master clock. Rated 120-V ac, five **OR** 10, **as directed**, A minimum. A minimum of two **OR** four **OR** six **OR** eight, **as directed**, circuits.
 - g. Circuits for Programmable Switching of Remote Equipment and Circuits: Relay controlled, manually switchable, using controls on the master clock. Rated 120-V ac, 5 **OR** 10, **as directed**, A minimum. A minimum of two **OR** four **OR** six **OR** eight, **as directed**, circuits.
 - h. Power Supplies: Capacity for internal loads and power-and correction circuits of connected clocks.



- i. Enclosure: Metal cabinet with locking front panel. When cabinet is locked, display indication shall be visible on or through front panel face. Arrange cabinet for surface, semirecessed, or flush mounting as indicated.
OR
Housing: Rack-mounting metal enclosure with display indication visible on front panel face.
 - 1) Reinforce mounting and attachment capable of resisting seismic forces described in Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
- j. Battery Backup for Time Base: Lithium battery to maintain the timekeeping function and retain the programs in memory during outage of normal ac power supply for up to 10 years.
- k. Electrostatic Discharge Resistance: Master clock and secondary indicating clocks, **as directed**, shall be tested and certified according to IEC 61000-4-2 in both human-discharge and direct-injection modes.

C. Secondary Indicating Clocks

- 1. Analog Clock: Equipped with a sweep second hand. Movement shall be driven by self-starting, permanently lubricated, sealed synchronous motor equipped with a correcting solenoid actuator, or be a microprocessor-based, second impulse unit, compatible with the master clock.
- 2. Digital Clock: Microprocessor-controlled unit complying with Class A device requirements in 47 CFR 15, with red LED digital time display of hours and minutes **OR**, minutes, and seconds, **as directed**.
 - a. Display Height: 2-1/2-Inch (64-mm) Clock: Hour and minute numerals readable at 50 feet (15 m).
OR
Display Height: 4-Inch (102-mm) Clock: Hour and minute numerals readable at 100 feet (30 m).
 - b. Display Format: Selectable between 12-hour with "PM" LED display and 24-hour formats.
 - c. Connections for Power and Correction:
 - 1) Wired synchronous connection to the master clock for both operating power and correction.
 - a) Time-Base Backup: Internal alkaline battery shall back up internal time base to maintain timekeeping during power outages of up to six days' duration.
OR
Time-Base Backup: Internal capacitor shall back up internal time base to maintain timekeeping during power outages of up to 12 hours' duration.
 - b) Correction by RS485, Ethernet, or similar data line with operating power supplied over a separate connection.
 - c) Power Connection for Secondary Indicating Clocks: Plug connector **OR** Wire pigtail or compression splice, **as directed**.
- 3. Interval-Timer Clock: Digital microprocessor-controlled, 4-inch (102-mm) unit with 2-1/2-inch (64-mm), red LED digital display for hours and minutes and 1-5/16-inch (33-mm) display for seconds; a separately mounted, mode-control switch; and the following features:
 - a. Display Visibility: Hour and minute numerals readable at 30 feet (10 m) in normal ambient light.
 - b. Operating Modes:
 - 1) Normal: Clock operates as a regular secondary system clock, displaying corrected time in normal display configuration, selectable between 12- and 24-hour formats, with "PM" digital display for 12-hour format.
 - 2) Count-Down or Count-Up Timer: Selected by mode-control switch count-up and count-down positions, and capable of being preset at the mode-control station.
 - 3) Code Blue: Automatically selected by a signal through a wiring connection from the code-blue system. This signal captures control of the clock regardless of current mode or correction status and instantly initiates count-up operation, starting at time 00:00:00. While in this mode, other clock functions, including correction, shall run in



- the background. Clock shall revert to normal operating mode when the initiating-signal system is reset.
- c. Mode-Selector Switch: Push-button or rotary, multiposition type, flush mounted; with start, stop, and reset capability in both count-up and count-down modes.
 - d. Audible tone signal: Housed in clock or mode-selector-switch box. Sounds at end of preset up or down count.
4. Provision for Modular Panel Installation: Equip designated clock for panel mounting. Mount flush or semirecessed with arrangement and trim as indicated. Coordinate wiring with other modular panel components, including room lighting switches **OR** intercom devices **OR** convenience outlets **OR** data outlets **OR** speaker **OR** other similar devices, **as directed**.
 5. Provision for Time-Tone-Unit Installation: Equip indicated clocks for housing or mounting in an acoustically treated and baffled speaker compartment specified in Division 27 Section "Public Address And Mass Notification Systems".
- D. Secondary Indicating Clock Characteristics:
- a. Clock Type: Analog **OR** Digital, **as directed**.
 - b. Face Configuration: Single **OR** Double, **as directed**.
 - c. Mounting: Recessed **OR** Semirecessed **OR** Pendant **OR** Surface **OR** Suspended **OR** Within time-tone unit **OR** Within modular panel, **as directed**.
 - d. Nominal Dimensions: as directed by the Owner.
 - e. Casing Finish: Types and colors, as directed by the Owner.
 - f. Special Environmental Conditions: Describe conditions such as corrosive, damp, or wet locations, as directed by the Owner.
 - g. For analog clocks.
 - 1) Dial Face Color: as directed by the Owner.
 - 2) Analog Clock Crystal: Clear glass **OR** acrylic **OR** polycarbonate, **as directed**.
 - h. For digital clocks.
 - 1) Face Color: as directed by the Owner.
 - 2) Display Height: as directed by the Owner.
 - 3) Seconds Display: Yes **OR** No, **as directed**.
 - 4) Digital Clock Lens: Antiglare acrylic material.
 - 5) Battery Backup: Yes **OR** No, **as directed**.
 - 6) Interval-Timer Display: Yes **OR** No, **as directed**.
- E. Program Signal Devices
1. Bells: Heavy-duty, modular, vibrating type with the following sound-output ratings measured at 10 feet (3 m):
 - a. 4-Inch (100-mm) Bell: 90 dB.
 - b. 6-Inch (150-mm) Bell: 95 dB.
 - c. 10-Inch (250-mm) Bell: 104 dB.
 2. Chimes: Heavy-duty, modular, vibrating chimes with polished-chrome tone bar and enamel-finished housing. Minimum sound-output rating measured at 10 feet (3 m) shall be 75 dB.
 3. Clock Buzzers: Adjustable output signal device designed for mounting within clock housing or outlet box.
 - a. Sound-Output Rating Measured at 3 Feet (1 m): 75 dB.
 - b. Audible Tone Frequency: Manufacturer's standard between 120 Hz and 2 kHz.
 4. Horns: Modular, adjustable-output, vibrating type with minimum full-intensity-rated sound output of 103 dB measured at 10 feet (3 m).
 5. Projector Horns: Adjustable-output, vibrating type with single **OR** double, **as directed**, projector arranged to channel sound in the direction of the projector axis, and with minimum full-intensity-rated sound output of 104 dB measured at 10 feet (3 m).
 6. Loudspeakers for Audible Tones: See Division 27 Section "Public Address And Mass Notification Systems".
 7. Visible Signal Devices: Strobe lights with blue **OR** yellow, **as directed**, polycarbonate lens and xenon flash tube, with lens mounted on an aluminum faceplate and the word "Program" engraved



in letters at least 1 inch (25 mm) high on lens. Lamp unit shall have a minimum rated light output of 75 candela.

8. Combination Audible and Visible Signal Devices: Factory-integrated horn and strobe light in a single mounting assembly.
9. Outdoor Signal Equipment: Weatherproof models listed for outdoor use.
10. Mounting Arrangement for Signal Devices: Designed for attachment with screws on the mounting plate of a flush-mounted back box unless otherwise indicated.
11. Enclosures for Flush-Mounting Bells and Horns: Enclosure, mounting plate, and grille assembly shall be furnished by device manufacturer to match features of the device to be mounted. Enclosure shall be recessed in wall, completely enclosing the device, with grille mounting over the open side of the enclosure and flush with the wall.
12. Connection Provision for Signal-Indicating Devices: Plug connector **OR** Wire pigtail or compression splice, **as directed**.

F. Clock Circuit Power Booster

1. Description: Transformer power supply, mounted in steel cabinet with hinged door, and having fuse-protected input and output circuits.

G. Back Boxes For Secondary Indicating Clocks And Program Devices

1. Description: Box and cover-plate assembly shall be furnished by device manufacturer and be suitable for device to be mounted. Back boxes shall be equipped with knockouts and hanger straps or mounting adapters arranged for flush mounting the device unless otherwise indicated.

H. Guards

1. Description: Formed-steel wire, shaped to fit around guarded device, with 1-inch (25-mm) maximum clearance.
 - a. Mounting Provisions: Fixed tabs, welded to guard and arranged for screw attachment to mounting surface.
 - b. Finish for Indoor Devices: Clear epoxy lacquer over zinc plating.
 - c. Finish for Outdoor Devices: Black powder coat over zinc plating and primer.

I. Rack-Mounting Provision For Master Clock

1. Equipment Cabinet: Floor **OR** Wall, **as directed**, -mounted, rack type. Comply with EIA-310-D and the following:
 - a. Cabinet Housing: Constructed of steel, with front and rear, **as directed**, doors; with manufacturer's standard tumbler locks, keyed alike.
 - 1) Front door shall have a clear panel in front of the master clock display.
 - 2) Housing shall enclose master clock and auxiliary clock system components, plus a minimum of 20 percent spare capacity for future equipment.
 - b. Forced Ventilation: Internal low-noise fan with a filtered intake vent, connected to operate from 105- to 130-V ac, 60 Hz; separately fused and switchable and arranged to be powered when main cabinet power switch is on.

OR

Natural Ventilation: Ventilated rear and sides with louvers and solid top.
 - c. For freestanding, floor-mounting cabinet, arrange inputs, outputs, interconnections, and test points so they are accessible at rear of rack for maintenance and testing, with each item removable from rack without disturbing other items or connections.
 - d. Blank Panels: Cover empty space in equipment racks so entire front of rack is occupied by equipment or panels.
 - e. Finish: Uniform, baked-enamel, manufacturer's standard color finish over rust-inhibiting primer.
 - f. Power-Control Panel: On front of equipment housing; with master power on-off switch and pilot light, and socket for a 5-A, indicating, cartridge fuse for rack equipment power.
 - g. Vertical Plug Strip: Grounded receptacles, 12 inches (300 mm) o.c. the full height of rack, to supply rack-mounting equipment.



- h. Maintenance Receptacles: Duplex convenience outlet with supply terminals separate from equipment plug strip and located in front of rack.

J. Conductors And Cables

1. Conductors: Jacketed, twisted pair and twisted multipair, untinned solid copper. Sizes as recommended by system manufacturer, but not smaller than No. 22 AWG. Voltage drop for signal, control, and clock correction circuits shall not exceed 10 percent under peak load conditions. Comply with requirements in Division 27 Section "Communications Horizontal Cabling".
2. 120-V AC and Class 1 Signal and Control Circuits: Stranded, single conductors of size and type recommended by system manufacturer. Materials and installation requirements are specified in Division 26 Section "Low-voltage Electrical Power Conductors And Cables".
3. Class 2 and Class 3 Signal and Control Circuits: Single conductor or twisted-pair cable, unshielded, unless manufacturer recommends shielded cable.
4. Data Circuits: Category 6 minimum, unshielded, twisted-pair cable, unless manufacturer recommends shielded cable.
5. Insulation: Thermoplastic, not less than 1/32 inch (0.8 mm) thick.
6. Plenum Cable: Listed and labeled for plenum installation.
7. Conductor Color-Coding: Uniformly identified and coordinated with wiring diagrams.
8. Shielding: For speaker-microphone leads and at other locations recommended by manufacturer; No. 34 AWG tinned, soft-copper strands formed into a braid or equivalent foil.
 - a. Minimum Shielding Coverage on Conductors: 60 percent.

K. Pathways

1. Intercommunication and Program System Raceways and Boxes: Comply with requirements in Division 26 Section "Raceway And Boxes For Electrical Systems".
OR
Intercommunication and Program System Raceways and Boxes: Same as required for electrical branch circuits specified in Division 26 Section "Raceway And Boxes For Electrical Systems".
OR
Intercommunication and Program System Raceways and Boxes: Optical fiber/communications raceway and fittings **OR** Metal wireways **OR** Nonmetal wireways **OR** Surface metal raceways **OR** Surface nonmetal raceways, **as directed**.
2. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.
3. Flexible metal conduit is prohibited.

1.3 EXECUTION

A. Installation

1. Mount system components with fastening methods and devices designed to resist the seismic forces indicated in Division 26 Section "Vibration And Seismic Controls For Electrical Systems".

B. Wiring Methods

1. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces.
 - a. Install plenum cable in environmental air spaces, including plenum ceilings.
 - b. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceway And Boxes For Electrical Systems".

OR

Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.



2. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.
 3. Support cables not enclosed in raceways on J-Hooks. Install, size, and space J-Hooks to comply with TIA/EIA-568-B.
- C. Electrical Connections
1. Make splices, taps, and terminations on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.
 2. Use plug connectors **OR** splices, **as directed**, for connections to clocks and signal devices.
 3. Ground clocks, programming equipment, and conductor and cable shields to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
- D. Identification
1. Comply with Division 26 Section "Identification For Electrical Systems".
 2. Color-code wires, and apply wire and cable marking tape to designate wires and cables so they are uniformly identified and coordinated with wiring diagrams throughout the system.
- E. Field Quality Control
1. Perform tests and inspections.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
 2. Tests and Inspections:
 - a. Perform operational-system tests to verify compliance with the Specifications and make adjustments to bring system into compliance. Include operation of all modes of clock correction and all programming and manually programmed signal and relay operating functions.
 - b. Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.
 3. Clock system will be considered defective if it does not pass tests and inspections.
 4. Prepare test and inspection reports.
- F. Adjusting
1. Program system according to the Owner's requirements. Set system so signal devices operate on the Owner-required schedules and are activated for durations selected by the Owner. Program equipment-control output circuits to suit the Owner's operating schedule for equipment controlled.
 2. Adjust sound-output level of adjustable signal devices to suit the Owner's requirements.
 3. Occupancy Adjustments: When requested within 12 months of date of Final Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.
- G. Demonstration
1. Train the Owner's maintenance personnel to adjust, operate, and maintain clock-and-program-control system components.

END OF SECTION 08 74 16 00



Task	Specification	Specification Description
08 75 00 00	08 71 21 00	Door Hardware
08 75 00 00	08 71 13 00	Automatic Door Operators
08 79 00 00	08 34 63 13	Detention Door Hardware
08 81 23 00	08 01 81 00	Glazing
08 81 26 00	08 01 81 00	Glazing



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SECTION 08 83 13 00 - MIRRORS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of material for mirrors. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes the following types of silvered flat glass mirrors:
 - a. Annealed monolithic glass mirrors.
 - b. Film-backed, Laminated and Tempered glass mirrors qualifying as safety glazing.

C. Submittals

1. Product Data: For each type of product indicated.
 - a. Mirrors. Include description of materials and process used to produce each type of silvered flat glass mirror specified that indicates sources of glass, glass coating components, edge sealer, and quality-control provisions.
2. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachments to other work.
3. Samples: For each type of the following products:
 - a. Mirrors: 12 inches (300 mm) square, including edge treatment on two adjoining edges.
 - b. Mirror Clips: Full size.
 - c. Mirror Trim: 12 inches (300 mm) long.
4. Qualification Data: For qualified Installer.
5. Product Certificates: For each type of mirror and mirror mastic, from manufacturer.
6. Preconstruction Test Reports: From mirror manufacturer indicating that mirror mastic was tested for compatibility and adhesion with mirror backing paint **OR** film, **as directed**, and substrates on which mirrors are installed.
7. Maintenance Data: For mirrors to include in maintenance manuals.
8. Warranty: Sample of special warranty.

D. Quality Assurance

1. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
2. Source Limitations for Mirrors: Obtain mirrors from single source from single manufacturer.
3. Source Limitations for Mirror Accessories: Obtain mirror glazing accessories from single source.
4. Glazing Publications: Comply with the following published recommendations:
 - a. GANA's "Glazing Manual" unless more stringent requirements are indicated. Refer to this publication for definitions of glass and glazing terms not otherwise defined in this Section or in referenced standards.
 - b. GANA Mirror Division's "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors."
5. Safety Glazing Products: For film-backed, laminated and tempered mirrors, provide products complying with testing requirements in 16 CFR 1201 for Category II materials.
6. Preconstruction Mirror Mastic Compatibility Test: Submit mirror mastic products to mirror manufacturer for testing to determine compatibility of mastic with mirror backing paint **OR** film, **as directed**, and substrates on which mirrors are installed.

E. Delivery, Storage, And Handling



1. Protect mirrors according to mirror manufacturer's written instructions and as needed to prevent damage to mirrors from moisture, condensation, temperature changes, direct exposure to sun, or other causes.
2. Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors.

F. Project Conditions

1. Environmental Limitations: Do not install mirrors until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

G. Warranty

1. Special Warranty: Manufacturer's standard form in which mirror manufacturer agrees to replace mirrors that deteriorate within specified warranty period. Deterioration of mirrors is defined as defects developed from normal use that are not attributed to mirror breakage or to maintaining and cleaning mirrors contrary to manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.
 - a. Warranty Period: Five years from date of Final Completion.

1.2 PRODUCTS

A. Silvered Flat Glass Mirrors

1. Glass Mirrors, General: ASTM C 1503; manufactured using copper-free, low-lead mirror coating process, **as directed**.
2. Clear Glass: Mirror Select **OR** Glazing, **as directed**, Quality; ultraclear (low-iron) float glass with a minimum 91 percent visible light transmission, **as directed**.
 - a. Nominal Thickness: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm **OR** As indicated, **as directed**.
3. Tinted Glass: Mirror Glazing Quality.
 - a. Nominal Thickness: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm **OR** As indicated, **as directed**.
 - b. Tint Color: Blue **OR** Black **OR** Bronze **OR** Gold **OR** Gray **OR** Green **OR** Peach **OR** Pink, **as directed**.
4. Tempered Clear **OR** Tinted, **as directed**, Glass: Mirror Glazing Quality, for blemish requirements; and comply with ASTM C 1048 for Kind FT, Condition A, tempered float glass before silver coating is applied.
 - a. Nominal Thickness: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm **OR** As indicated, **as directed**.
 - b. Tint Color: Blue **OR** Black **OR** Bronze **OR** Gold **OR** Gray **OR** Green **OR** Peach **OR** Pink, **as directed**.
5. Laminated Mirrors: ASTM C 1172, Kind LM.
 - a. Clear Glass for Outer Lite: Mirror Select **OR** Glazing, **as directed**, Quality; ultraclear (low-iron) float glass with a minimum 91 percent visible light transmission, **as directed**.
 - b. Tinted Glass for Outer Lite: Mirror Glazing Quality.
 - 1) Tint Color: Blue **OR** Black **OR** Bronze **OR** Gold **OR** Gray **OR** Green **OR** Peach **OR** Pink, **as directed**.
 - c. Nominal Thickness for Outer Lite: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm **OR** As indicated, **as directed**.
 - d. Glass for Inner Lite: Annealed float glass; ASTM C 1036, Type I (transparent flat glass), Quality-Q3; Class 1 (clear).
OR
Glass for Inner Lite: Heat-treated float glass; ASTM C 1048 Type I; Quality-Q3; Class I (clear) Kind HS, Condition A.
OR



Glass for Inner Lite: Tempered float glass; ASTM C 1048 Type I; Quality-Q3; Class I (clear), Kind FT, Condition A.

- e. Nominal Thickness for Inner Lite: 3.0 mm **OR** 4.0 mm **OR** 5.0 mm **OR** 6.0 mm **OR** As indicated, **as directed**.
- f. Interlayer: Mirror manufacturer's standard 0.030-inch- (0.76-mm-) thick, clear polyvinyl-butylal interlayer with a proven record of showing no tendency to delaminate from, or cause damage to, silver coating.

B. Miscellaneous Materials

1. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
2. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.
3. Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors and certified by both mirror manufacturer and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.
4. Film Backing for Safety Mirrors: Film backing and pressure-sensitive adhesive; both compatible with mirror backing paint as certified by mirror manufacturer.

C. Mirror Hardware

1. Top and Bottom Aluminum J-Channels: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover bottom and top edges of each mirror in a single piece.
 - a. Bottom Trim: J-channels formed with front leg and back leg not less than 3/8 and 7/8 inch (9.5 and 22 mm) in height, respectively, and a thickness of not less than 0.04 inch (1.0 mm) **OR** 0.05 inch (1.3 mm), **as directed**.
 - b. Top Trim: J-channels formed with front leg and back leg not less than 5/8 and 1 inch (16 and 25 mm) in height, respectively, and a thickness of not less than 0.04 inch (1.0 mm) **OR** 0.062 inch (1.57 mm), **as directed**.
 - c. Finish: Clear **OR** Gold, **as directed**, bright anodized.
2. Top Channel/Cleat and Bottom Aluminum J-Channels: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover bottom and top edges of each mirror in a single piece.
 - a. Bottom Trim: J-channels formed with front leg and back leg not less than 5/16 and 3/4 inch (7.9 and 19 mm) in height, respectively.
 - b. Top Trim: Formed with front leg with a height of 5/16 inch (7.9 mm) and back leg designed to fit into the pocket created by wall-mounted aluminum cleat.
 - c. Finish: Clear **OR** Gold, **as directed**, bright anodized.
3. Mirror Bottom Clips: As indicated.
4. Mirror Top Clips: As indicated.
5. Plated Steel Hardware: Formed-steel shapes with plated finish indicated.
 - a. Profile: As indicated.
 - b. Finish: Selected from manufacturer's standards.
6. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.
7. Anchors and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield expansion-bolt devices for drilled-in-place anchors. Provide galvanized anchors and inserts for applications on inside face of exterior walls and where indicated.

D. Fabrication

1. Mirror Sizes: To suit Project conditions, and before tempering, **as directed**, cut mirrors to final sizes and shapes.
2. Cutouts: Fabricate cutouts before tempering, **as directed**, for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts so they fit closely around penetrations in mirrors.



3. Mirror Edge Treatment: Flat polished **OR** Rounded polished **OR** Flat high-polished **OR** Rounded high-polished **OR** Beveled polished edge of width shown, **as directed**.
 - a. Seal edges of mirrors with edge sealer after edge treatment to prevent chemical or atmospheric penetration of glass coating.
 - b. Require mirror manufacturer to perform edge treatment and sealing in factory immediately after cutting to final sizes.
4. Film-Backed Safety Mirrors: Apply film backing with adhesive coating over mirror backing paint as recommended in writing by film-backing manufacturer to produce a surface free of bubbles, blisters, and other imperfections.

1.3 EXECUTION

A. Examination

1. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance of the Work.
2. Verify compatibility with and suitability of substrates, including compatibility of mirror mastic with existing finishes or primers.
3. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are dry.

B. Preparation

1. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating substrates with mastic manufacturer's special bond coating where applicable.

C. Installation

1. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced GANA publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.
2. Provide a minimum air space of 1/8 inch (3 mm) between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.
3. Wall-Mounted Mirrors: Install mirrors with mirror hardware **OR** mastic and mirror hardware, **as directed**. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.
 - a. Top and Bottom Aluminum J-Channels: Provide setting blocks 1/8 inch (3 mm) thick by 4 inches (100 mm) long at quarter points. To prevent trapping water, provide, between setting blocks, two slotted weeps not less than 1/4 inch (6.4 mm) wide by 3/8 inch (9.5 mm) long at bottom channel.
 - b. Top Channel/Cleat and Bottom Aluminum J-Channels: Fasten J-channel directly to wall and attach top trim to continuous cleat fastened directly to wall.
 - c. Mirror Clips: Place a felt or plastic pad between mirror and each clip to prevent spalling of mirror edges. Locate clips where indicated **OR** so they are symmetrically placed and evenly spaced, **as directed**.
 - d. Install mastic as follows:
 - 1) Apply barrier coat to mirror backing where approved in writing by manufacturers of mirrors and backing material.
 - 2) Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.
 - 3) After mastic is applied, align mirrors and press into place while maintaining a minimum air space of 1/8 inch (3 mm) between back of mirrors and mounting surface.

D. Cleaning And Protection



1. Protect mirrors from breakage and contaminating substances resulting from construction operations.
2. Do not permit edges of mirrors to be exposed to standing water.
3. Maintain environmental conditions that will prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.
4. Wash exposed surface of mirrors not more than four days before date scheduled for inspections that establish date of Final Completion. Wash mirrors as recommended in writing by mirror manufacturer.

END OF SECTION 08 83 13 00



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Task	Specification	Specification Description
08 83 13 00	08 01 81 00	Glazing



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SECTION 08 84 00 00 - PLASTIC GLAZING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of material for plastic glazing. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Monolithic acrylic glazing.
 - b. Monolithic polycarbonate glazing.
 - c. Multiwalled structured polycarbonate glazing.

C. Performance Requirements

1. Provide plastic glazing sheets and glazing materials capable of withstanding normal temperature changes, wind, and impact loads without failure, including loss or breakage of plastic sheets attributable to the following: failure of sealants or gaskets to remain watertight and airtight, deterioration of plastic sheet and glazing materials, or other defects in materials and installation.
2. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on plastic glazing and glazing framing members.
 - a. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

D. Preconstruction Testing

1. Preconstruction Adhesion and Compatibility Testing: Test each plastic glazing type, tape sealant, gasket, glazing accessory, and glazing-framing member for adhesion to and compatibility with elastomeric glazing sealants.
 - a. Testing will not be required if data are submitted based on previous testing of current sealant products and plastic glazing matching those submitted.
 - b. Use ASTM C 1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glazing, tape sealants, gaskets, and glazing channel substrates.
 - c. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
 - d. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 - e. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.

E. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittal:
 - a. Product Data for Credit EQ 4.1: For glazing sealants used inside the weatherproofing system, including printed statement of VOC content.
3. Plastic Glazing Samples: For each color and finish of plastic glazing indicated, 12 inches (300 mm) square and of same thickness indicated for final Work.
4. Glazing Accessory Samples: For gaskets and sealants, in 12-inch (300-mm) lengths. Install sealant Samples between two strips of material representative in color of the adjoining framing system, **as directed**.
5. Plastic Glazing Schedule: List plastic glazing types and thicknesses for each size opening and location. Use same designations indicated on Drawings. Indicate coordinated dimensions of



plastic glazing and construction that receives plastic glazing, including clearances and glazing channel dimensions.

6. Qualification Data: For installers, plastic glazing testing agency and sealant testing agency.
7. Product Certificates: For plastic glazing and glazing products, from manufacturer.
8. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for plastic glazing, glazing sealants and glazing gaskets.
 - a. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.
9. Preconstruction adhesion and compatibility test report.
10. Research/Evaluation Reports: For plastic glazing.
11. Maintenance Data: For plastic glazing to include in maintenance manuals.
12. Warranty: Sample of special warranty.

F. Quality Assurance

1. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
2. Source Limitations: Obtain plastic glazing from single source from single manufacturer. Obtain sealants and gaskets from single source from single manufacturer for each product and installation method.
3. Glazing Publication: Comply with published recommendations of plastic glazing manufacturers and with GANA's "Glazing Manual" unless more stringent requirements are indicated. Refer to this publication for definitions of glazing terms not otherwise defined in this Section or in other referenced standards.
4. Plastic Glazing Labeling: Identify plastic sheets with appropriate markings of applicable testing and inspecting agency, indicating compliance with required fire-test-response characteristics.
5. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of a certification agency acceptable to authorities having jurisdiction or manufacturer. Label shall indicate manufacturer's name, type of plastic glazing, thickness, and safety glazing standard with which glass complies.

G. Delivery, Storage, And Handling

1. Protect plastic glazing materials according to manufacturer's written instructions. Prevent damage to plastic glazing and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
2. Maintain protective coverings on plastic glazing to avoid exposures to abrasive substances, excessive heat, and other sources of possible deterioration.

H. Project Conditions

1. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 - a. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F (4.4 deg C).

I. Coordination

1. Coordinate dimensions of plastic glazing with dimensions of construction that receives plastic glazing to ensure that glazing channels provide adequate face and edge clearance, bite, and allowance for expansion.

J. Warranty

1. Manufacturer's Special Warranty for Abrasion- and UV-Resistant, Monolithic **OR** Multiwalled Structured, **as directed**, Polycarbonate: Manufacturer's standard form, made out to the Owner and signed by polycarbonate manufacturer, in which manufacturer agrees to replace polycarbonate products that break or develop defects from normal use that are attributable to manufacturing process and not to practices for maintaining and cleaning plastic glazing contrary



to manufacturer's written instructions. Defects include coating delamination, haze, excessive yellowing, and loss of light transmission beyond the limits stated in plastic glazing manufacturer's standard form.

- a. Warranty Period: Five years from date of Final Completion.

1.2 PRODUCTS

A. Plastic Glazing, General

1. Sizes: Fabricate plastic glazing to sizes required for openings indicated. Allow for thermal expansion and contraction of plastic glazing without restraint and without withdrawal of edges from frames, with edge clearances and tolerances complying with plastic glazing manufacturer's written instructions.
2. Fire-Test-Response Characteristics of Plastic Glazing: As determined by testing plastic glazing by a qualified testing agency acceptable to authorities having jurisdiction.
 - a. Self-ignition temperature of 650 deg F (343 deg C) or higher when tested according to ASTM D 1929 on plastic sheets in thicknesses indicated for the Work.
 - b. Smoke-developed index of 450 or less when tested according to ASTM E 84, or smoke density of 75 or less when tested according to ASTM D 2843 on plastic sheets in thicknesses indicated for the Work.
 - c. Burning extent of 1 inch (25 mm) or less when tested according to ASTM D 635 at a nominal thickness of 0.060 inch (1.52 mm) or thickness indicated for the Work, where Class CC1 is indicated.
 - d. Burning rate of 2.5 in./min. (1.06 mm/s) or less when tested according to ASTM D 635 at a nominal thickness of 0.060 inch (1.52 mm) or thickness indicated for the Work, where Class CC2 is indicated.
 - e. Flame-spread index not less than that indicated when tested according to ASTM E 84.
3. Windborne-Debris-Impact Resistance: Provide exterior plastic glazing that passes basic **OR** enhanced, **as directed**, -protection testing requirements in ASTM E 1996 for Wind Zone 1 **OR** Wind Zone 2 **OR** Wind Zone 3 **OR** Wind Zone 4, **as directed**, when tested according to ASTM E 1886. Test specimens shall be no smaller in width and length than plastic glazing indicated for use on Project and shall be installed in same manner as indicated for use on Project.
 - a. Large-Missile Test: For plastic glazing located within 30 feet (9.1 m) of grade.
 - b. Small-Missile Test: For plastic glazing located more than 30 feet (9.1 m) above grade.
OR
Large-Missile Test: For all plastic glazing, regardless of height above grade.

B. Monolithic Acrylic Glazing

1. Plastic Glazing: Transparent acrylic sheet; ASTM D 4802, Category A-1 (cell cast) **OR** Category A-2 (continuously cast) **OR** Category B-1 (continuously manufactured), **as directed**, Finish 1 (smooth or polished), Type UVF (UV filtering).
 - a. Nominal Thickness: 0.093 inch (2.5 mm) **OR** 0.118 inch (3 mm) **OR** 0.177 inch (4.5 mm) **OR** 0.236 inch (6 mm), **as directed**.
 - b. Color: Colorless **OR** As selected from manufacturer's full range, **as directed**.
 - c. Combustibility Class: CC2.
 - d. Provide safety glazing labeling.
2. Plastic Glazing: Coated, transparent acrylic sheet; ASTM D 4802, Category A-1 (cell cast) **OR** Category B-1 (continuously manufactured), **as directed**, Finish 3 (abrasion-resistant coating) with coating on one side **OR** both sides, **as directed**, Type UVF (UV filtering).
 - a. Nominal Thickness: 0.093 inch (2.5 mm) **OR** 0.118 inch (3 mm) **OR** 0.177 inch (4.5 mm) **OR** 0.236 inch (6 mm), **as directed**.
 - b. Color: Colorless **OR** As selected from manufacturer's full range, **as directed**.
 - c. Combustibility Class: CC2.
 - d. Provide safety glazing labeling.



3. Plastic Glazing: Translucent acrylic sheet; ASTM D 4802, Category A-1 (cell cast) **OR** Category B-1 (continuously manufactured), **as directed**, Finish 1 (smooth or polished), Type UVF (UV filtering).
 - a. Nominal Thickness: 0.093 inch (2.5 mm) **OR** 0.118 inch (3 mm) **OR** 0.177 inch (4.5 mm) **OR** 0.236 inch (6 mm), **as directed**.
 - b. Color: White, with visible light transmittance of not more than 50 percent for 0.117-inch- (2.9-mm-) thick sheet, measured according to ASTM D 1003 **OR** As selected from manufacturer's full range, **as directed**.
 - c. Combustibility Class: CC2.
 - d. Provide safety glazing labeling.
 4. Plastic Glazing: Patterned acrylic sheet; ASTM D 4802, Category A-1 (cell cast), Finish 2 (patterned), Type UVF (UV filtering).
 - a. Nominal Thickness: 0.093 inch (2.5 mm) **OR** 0.118 inch (3 mm) **OR** 0.177 inch (4.5 mm) **OR** 0.236 inch (6 mm), **as directed**.
 - b. Pattern: Matte finish **OR** As selected from manufacturer's full range, **as directed**.
 - c. Color: Transparent colorless **OR** Translucent white **OR** As selected from manufacturer's full range, **as directed**.
 - d. Combustibility Class: CC2.
 - e. Provide safety glazing labeling.
- C. Monolithic Polycarbonate Glazing
1. Plastic Glazing: Polycarbonate sheet; ASTM C 1349, Appendix X1, Type I (standard, UV stabilized), with a polished finish.
 - a. Nominal Thickness: 0.093 inch (2.5 mm) **OR** 0.118 inch (3 mm) **OR** 0.177 inch (4.5 mm) **OR** 0.236 inch (6 mm), **as directed**.
 - b. Color: Transparent colorless **OR** As selected from manufacturer's full range, **as directed**.
 - c. Combustibility Class: CC1.
 - d. Flame-Spread Index: 25 **OR** 75 **OR** 200, **as directed**, or less.
 - e. Provide safety glazing labeling.
 2. Plastic Glazing: Coated polycarbonate sheet; ASTM C 1349, Appendix X1, Type II (coated mar-resistant, UV stabilized), with coating on both sides.
 - a. Nominal Thickness: 0.093 inch (2.5 mm) **OR** 0.118 inch (3 mm) **OR** 0.177 inch (4.5 mm) **OR** 0.236 inch (6 mm), **as directed**.
 - b. Color: Transparent colorless **OR** As selected from manufacturer's full range, **as directed**.
 - c. Combustibility Class: CC1.
 - d. Flame-Spread Index: 25 **OR** 75 **OR** 200, **as directed**, or less.
 - e. Provide safety glazing labeling.
- D. Multiwalled Structured Polycarbonate Glazing
1. Multiwalled Structured Polycarbonate Sheet: Manufacturer's standard polycarbonate extruded shape with smooth, flat exterior surfaces and internal ribbing.
 - a. Nominal Thickness: 5/16 inch (8 mm) **OR** 3/8 inch (10 mm) **OR** 5/8 inch (16 mm) **OR** 3/4 inch (20 mm) **OR** 1 inch (25 mm), **as directed**.
 - b. Color: Transparent colorless **OR** As selected from manufacturer's full range, **as directed**.
 - c. Combustibility Class: CC1 **OR** CC2, **as directed**.
 - d. Flame-Spread Index: 25 **OR** 75 **OR** 200, **as directed**, or less.
- E. Glazing Gaskets
1. Dense Compression Gaskets: Molded or extruded gaskets, EPDM, ASTM C 864 or silicone, ASTM C 1115; and of profile and hardness required to maintain watertight seal.
 2. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned EPDM or silicone gaskets complying with ASTM C 509, Type II, black; and of profile and hardness required to maintain watertight seal.
- F. Glazing Sealants



1. General:
 - a. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including plastic glazing products and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
 - b. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 - c. VOC Content: For sealants used inside the weatherproofing system, not more than 250 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - d. Colors of Exposed Glazing Sealants: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
2. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.
OR
Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT.
OR
Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use NT.
OR
Glazing Sealant: Acid-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use NT.

G. Glazing Tapes

1. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
 - a. AAMA 804.3 tape, where indicated.
 - b. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 - c. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
2. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
 - a. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
 - b. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

H. Miscellaneous Glazing Materials

1. Compatibility: Provide products of material, size, and shape complying with requirements of manufacturers of plastic glazing and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
2. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
3. Setting Blocks: EPDM or silicone as required for compatibility with glazing sealant and plastic glazing, and of hardness recommended by plastic glazing manufacturer for application indicated.
4. Compressible Filler Rods: Closed cell of waterproof-jacketed rod stock of synthetic rubber or plastic foam, flexible and resilient, with 5- to 10-psi (35- to 70-kPa) compression strength for 25 percent deflection.

1.3 EXECUTION

A. Examination

1. Examine plastic glazing framing, with glazing Installer present, for compliance with the following:



- a. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - b. Minimum required face or edge clearances.
 - c. Effective sealing between joints of plastic glazing framing members.
 2. Proceed with glazing only after unsatisfactory conditions have been corrected.
- B. Preparation
1. Clean glazing channels and other framing members immediately before glazing. Remove coatings not firmly bonded to substrates. Remove lacquer from metal surfaces where elastomeric sealants are indicated for use.
- C. Glazing, General
1. Comply with combined written instructions of manufacturers of plastic glazing materials, sealants, gaskets, and other glazing materials unless more stringent requirements are indicated, including those in referenced glazing publication.
 2. Glazing channel dimensions indicated on Drawings are designed to provide the necessary bite on plastic glazing, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust plastic glazing lites during installation to ensure that bite is equal on all sides.
 3. Sand or scrape cut edges of plastic glazing to provide smooth edges, free of chips and hairline cracks.
 4. Remove burrs and other projections from glazing channel surfaces.
 5. Protect plastic glazing surfaces from abrasion and other damage during handling and installation, according to the following requirements:
 - a. Retain plastic glazing manufacturer's protective covering or protect by other methods according to plastic glazing manufacturer's written instructions.
 - b. Remove covering at border of each piece before glazing; remove remainder of covering immediately after installation where plastic glazing will be exposed to sunlight or where other conditions make later removal difficult.
 - c. Remove damaged plastic glazing sheets from Project site and legally dispose of off-site. Damaged plastic glazing sheets are those containing imperfections that, when installed, result in weakened glazing and impaired performance and appearance.
 6. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.
 7. Install elastomeric setting blocks in sill channels, sized and located to comply with referenced glazing publication, unless otherwise instructed by plastic glazing manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
 8. Provide edge blocking to comply with referenced glazing publication unless otherwise instructed by plastic glazing manufacturer.
 9. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
 10. Square cut wedge-shaped gaskets at corners and install gaskets as recommended in writing by gasket manufacturer to prevent corners from pulling away; seal corner and butt joints with sealant recommended by gasket manufacturer.
- D. Tape Glazing
1. Install tapes continuously, but not in one continuous length. Do not stretch tapes to make them fit opening.
 2. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
 3. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant recommended by tape manufacturer.
 4. Do not remove release paper from tape until immediately before each lite is installed.
 5. Apply heel bead of glazing sealant.



6. Center plastic glazing lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
 7. Apply cap bead of glazing sealant over exposed edge of tape.
- E. Gasket Glazing (Dry)
1. Fabricate compression gaskets in lengths recommended in writing by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
 2. Insert soft compression gasket between plastic glazing and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
 3. Center plastic glazing lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in plastic glazing. Seal gasket joints with sealant recommended by gasket manufacturer.
 4. Install gaskets so they protrude past face of glazing stops.
- F. Sealant Glazing (Wet)
1. Install continuous spacers between plastic glazing lites and glazing stops to maintain plastic glazing face clearances and to prevent sealant from extruding into glazing channel weep systems until sealants cure. Secure spacers in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
 2. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to plastic glazing and channel surfaces.
 3. Tool exposed surfaces of sealants to provide a substantial wash away from plastic glazing.
- G. Protecting And Cleaning
1. Protect plastic glazing from contact with contaminating substances from construction operations. If, despite such protection, contaminating substances do come into contact with plastic glazing, remove immediately and wash plastic glazing according to plastic glazing manufacturer's written instructions.
 2. Remove and replace plastic glazing that is broken, chipped, cracked, abraded, or damaged in other ways during construction period, including natural causes, accidents, and vandalism.
 3. Wash plastic glazing on both faces before date scheduled for inspections intended to establish date of Final Completion in each area of Project. Wash plastic glazing according to plastic glazing manufacturer's written instructions.

END OF SECTION 08 84 00 00



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Task	Specification	Specification Description
08 85 00 00	08 01 81 00	Glazing
08 85 00 00	08 44 13 00	Glazed Aluminum Curtain Walls
08 85 00 00	08 44 13 00a	Structural-Sealant-Glazed Curtain Walls
08 85 00 00	08 44 13 00b	Sloped Glazing Assemblies
08 87 13 00	08 01 81 00	Glazing



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SECTION 08 87 23 16 - FRAGMENT RETENTION FILM FOR GLASS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of fragment retention film for glass. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: For each type of product indicated.
2. Samples: For each type of product indicated.
3. Test Reports: Certified test reports including analysis and interpretation of test results. Each report shall identify the manufacturer, the specific product name, the film thickness, the adhesive type and thickness, and the glass type and thickness. Test reports shall clearly identify the methods used and shall include the results recorded.
4. Certificates: On applications where the film will contact the glazing beads or gaskets, a certificate from the Contractor stating that the glazing compounds and gaskets are compatible with the fragment retention film and adhesive.

C. Delivery, Storage, And Handling

1. Deliver, store, and handle in accordance with the manufacturer's recommendations. Glass, including glass in windows or doors, that has the film factory applied shall be stored in a dry location free of dust, water, and other contaminants. Glass with factory applied film shall be delivered, stored, and handled so that the film is not damaged, scratched, or abraded and shall be stored in a manner which permits easy access for inspection and handling. Each roll of film shall have a tamperproof label containing full details of the roll and the batch number.

D. Warranty

1. Provide a 5 year warranty for fragment retention film material. The warranty shall provide for replacement of film if cracking, crazing, peeling, or inadequate adhesion occurs.

1.2 PRODUCTS

- #### A. Standard Products:
- Fragment retention film shall be the standard product of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

- #### B. Fragment Retention Film:
- Fragment retention film shall be polyester, polyethylene terephthalate, or a composite. Fragment retention film shall be optically clear and free of waves, distortions, impurities, and adhesive lines. The film may be a single layer or laminated. Lamination of the film shall only occur at the factory of the fragment retention film manufacturer. The film shall include an abrasion resistant coating on the surface that does not receive the film adhesive. Fragment retention film shall be a minimum thickness of 0.004 inch (0.10 mm), as required to meet Project requirements, and shall be clear **OR** tinted, **OR** reflective, **as directed**. The film shall be supplied with an optically clear weatherable pressure sensitive adhesive. The adhesive shall contain ultraviolet inhibitors to protect the film for its required life and shall limit ultraviolet transmission to not more than 8 percent of the radiation between 300 and 380 nanometers. The adhesive shall not be water activated.

1. Impact Performance: Test fragment retention film for impact in accordance with ANSI Z97.1 or 16 CFR 1201.



2. Tensile Strength: The fragment retention film samples tested shall exhibit a minimum tensile strength at break of 25,000 psi (172.4 MPa) when tested in accordance with ASTM D882, Method A.
3. Peel Strength: The fragment retention film shall exhibit a minimum peel strength of 5.3 pounds/inch (930 N/m) for 0.004 inch (0.10 mm) thick film when tested in accordance with ASTM D3330, Method A.
4. Surface Abrasion: The fragment retention film shall exhibit a change in haze not to exceed 3.2 percent following 100 turns, using 500-gram weights on a CS 10F abrasive wheel when tested in accordance with ASTM D1044.
5. Flame Spread and Smoke Density: The fragment retention film shall exhibit a flame spread index not exceeding 25 and a smoke density index not exceeding 100 when tested in accordance with ASTM E84.

1.3 EXECUTION

- A. Surface Preparation: The glass surface to which the fragment retention film is to be applied shall be cleaned of paint, foreign compounds, smears, and spatters. After the initial cleaning, the surface to receive the film shall be further cleaned in accordance with the film manufacturer's instructions.
- B. Application: Provide fragment retention film on window and door glass where indicated. After surface preparation, apply the fragment retention film in accordance with the manufacturer's recommendations and instructions. Apply film to the interior (room) side of the glass for both single and double glazed sheets, unless otherwise indicated. Multiple applications of film to achieve specified thicknesses will not be allowed. The film shall not be applied if there are visible dust particles in the air, if there is frost on the glazing, or if any room condition such as temperature and humidity do not meet the manufacturer's instructions. After film application, maintain room conditions as required by the manufacturer's instructions to allow for proper curing of the adhesive.
 1. Application to New Glass Before Glazing: Apply fragment retention film so that it extends edge to edge of the glass sheet. Set the film reinforced glass into the frame with glazing compounds or gaskets as specified in Division 08 Section "Glazing". When contact between the glazing compounds and/or gaskets and the film occurs, the Contractor shall ensure compatibility. The Contractor shall be responsible for delivery of the fragment retention film to the appropriate location for application. Coordinate fragment retention film application and curing with the glass supplier and window or door manufacturer prior to glazing installation.
 2. Application to Existing Glass Involving Dismantlement: Remove the existing glazing compound, gaskets, and/or stops as required to expose the existing glass pane. If necessary, remove the glass so that the film can be applied. Apply the film so that it extends edge to edge of the glass sheet. Install existing gaskets and/or stops and replace any removed glazing compounds with new glazing compounds. Scrap removed glazing compounds. Glazing compounds shall be in accordance with GANA Sealant Manual. Glazing methods shall be in accordance with GANA Glazing Manual. When contact between the glazing compounds and/or gaskets and the film occurs, the Contractor shall ensure compatibility. Replace and reinstall any damaged or broken glazing and gaskets in kind.
 3. Application to Existing Glass Without Dismantlement: Apply fragment retention film so that it extends to within 1/16-inch (1.6 mm), with a maximum of 1/8 inch (3 mm), of the edge of the visible glass area.
 4. Application to Existing Glass and Frame Without Dismantlement: Apply fragment retention film past the edge of the visible glass and extend onto the frame. Amount of film overlap, edge connection to the frame, and adhesive for adhering film to frame shall be as recommended by the film manufacturer. When contact between the glazing compounds and/or gaskets and the film occurs, the Contractor shall ensure compatibility.
 5. Splicing: Splices or seams in fragment retention film shall be permitted only when a sheet of glass has a dimension exceeding 58 inches (1.475 m) in both directions. All seams shall be



applied with a minimum overlap of 1/4 inch (6 mm) unless submitted test reports indicate impact performance is not diminished when seam is applied with a different overlap or a gap.

- C. Cleaning: Clean the fragment retention film in accordance with the manufacturer's instructions.

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SECTION 08 88 53 00 - SECURITY GLAZING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of material for security glazing. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes glazing for the following products and applications and of the following types:
 - a. Products and applications specified in other Sections where glazing requirements are specified by reference to this Section:
 - 1) Steel detention and Steel doors.
 - 2) Glazed entrances.
 - 3) Storefront framing.
 - 4) Interior borrowed lites.
 - 5) Glazed curtain walls.
 - 6) Sloped glazing.
 - 7) Security, Detention, Aluminum and Steel windows.
 - b. Security Glazing Types:
 - 1) Monolithic polycarbonate.
 - 2) Laminated glass.
 - 3) Laminated polycarbonate.
 - 4) Glass-clad polycarbonate.
 - 5) Laminated glass and polycarbonate.
 - 6) Insulating security glazing.
 - 7) Air-gap security glazing.

C. Definitions

1. Glazing Manufacturers: Firms that produce primary glass, monolithic plastic glazing, or fabricated security glazing, as defined in referenced glazing publications.
2. Interspace: Space between lites of air-gap security glazing or insulating security glazing.

D. Performance Requirements

1. General:
 - a. Installed security glazing shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing; or other defects in construction.
 - b. Installed security glazing shall withstand security-related loads and forces without damage to the glazing beyond that allowed by referenced standards.
2. Delegated Design: Design security glazing, including comprehensive engineering analysis by a qualified professional engineer.
 - a. Design Procedure for Glass: Design according to ASTM E 1300 **OR** ICC's 2003 International Building Code, **as directed**.
 - b. Design Wind Pressures: As indicated on Drawings.
OR
Design Wind Pressures: Determine design wind pressures applicable to Project according to ASCE/SEI 7, based on heights above grade indicated on Drawings.
 - 1) Basic Wind Speed: 85 mph (38 m/s) **OR** 90 mph (40 m/s) **OR** 100 mph (44 m/s) **OR** 110 mph (49 m/s), **as directed**.
 - 2) Importance Factor.



- 3) Exposure Category: **B OR C OR D, as directed.**
 - c. Design Snow Loads: As indicated on Drawings **OR as directed.**
 - d. Vertical Glazing: For glass surfaces sloped 15 degrees or less from vertical, design glass to resist design wind pressure based on glass type factors for short-duration load.
 - e. Sloped Glazing: For glass surfaces sloped more than 15 degrees from vertical, design glass to resist each of the following combinations of loads:
 - 1) Outward design wind pressure minus the weight of the glass. Base design on glass type factors for short-duration load.
 - 2) Inward design wind pressure plus the weight of the glass plus half of the design snow load. Base design on glass type factors for short-duration load.
 - 3) Half of the inward design wind pressure plus the weight of the glass plus the design snow load. Base design on glass type factors for long-duration load.
 - f. Probability of Breakage for Sloped Glazing: For glass surfaces sloped more than 15 degrees from vertical, design glass for a probability of breakage not greater than 0.001.
 - g. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch (25 mm), whichever is less.
3. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glazing framing members and glazing components.
- a. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- E. Preconstruction Testing
1. Preconstruction Adhesion and Compatibility Testing: Test each security glazing type, tape sealant, gasket, glazing accessory, and glazing-framing member for adhesion to and compatibility with elastomeric glazing sealants.
 - a. Testing will not be required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
 - b. Use ASTM C 1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to security glazing, tape sealants, gaskets, and glazing channel substrates.
 - c. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
 - d. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 - e. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.
- F. Submittals
1. Product Data: For each type of product indicated.
 2. LEED Submittal:
 - a. Product Data for Credit EQ 4.1: For glazing sealants used inside of the weatherproofing system, including printed statement of VOC content.
 3. Security Glazing Samples: For each type of security glazing; 12 inches (300 mm) square.
 4. Glazing Accessory Samples: For gaskets, sealants and colored spacers, in 12-inch (300-mm) lengths. Install sealant Samples between two strips of material representative in color of the adjoining framing system, **as directed.**
 5. Security Glazing Schedule: List security glazing types and thicknesses for each size opening and location. Use same designations indicated on Drawings. Indicate coordinated dimensions of security glazing and construction that receives security glazing, including clearances and glazing channel dimensions.
 6. Delegated-Design Submittal: For security glazing indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 7. Qualification Data: For installers, manufacturers of insulating security glazing with sputter-coated, low-e coatings, glazing testing agency and sealant testing agency.



8. Product Certificates: For each type of product indicated, from manufacturer.
9. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of security glazing, glazing sealant and glazing gasket.
 - a. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.
10. Preconstruction adhesion and compatibility test reports.
11. Warranties: Sample of special warranties.

G. Quality Assurance

1. Manufacturer Qualifications for Insulating Security Glazing Units with Sputter-Coated, Low-E Coatings: A qualified insulating glazing manufacturer who is approved and certified, **as directed**, by coated-glass manufacturer.
2. Installer Qualifications: A qualified installer who employs glazing installers for this Project who are certified under the National Glass Association Glazier Certification Program.
3. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
4. Source Limitations for Security Glazing: Obtain security glazing from single source from single manufacturer using the same type of lites, plies, interlayers, and spacers for each security glazing type indicated.
 - a. Source Limitations for Tinted Glass: Obtain tinted glass from single source from single primary glass manufacturer for each tint color indicated.
5. Source Limitations for Glazing Sealants and Gaskets: Obtain from single source from single manufacturer for each product and installation method.
6. Glazing Publications: Comply with published recommendations of security glazing and glazing material manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - a. GANA Publications: GANA's "Laminated Glazing Reference Manual" and GANA's "Glazing Manual."
 - b. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR-A7, "Sloped Glazing Guidelines."
 - c. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
 - d. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
7. Plastic Glazing Labeling: Identify plastic sheets with appropriate markings of applicable testing and inspecting agency, indicating compliance with required fire-test-response characteristics.
8. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC **OR** another certification agency acceptable to authorities having jurisdiction **OR** manufacturer, **as directed**. Label shall indicate manufacturer's name, type of glazing, thickness, and safety glazing standard with which glazing complies.
9. Insulating Glazing Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
10. Preinstallation Conference: Conduct conference at Project site.

H. Delivery, Storage, And Handling

1. Protect security glazing and glazing materials according to manufacturer's written instructions. Prevent damage from condensation, temperature changes, direct exposure to sun, or other causes.
2. Comply with insulating security glazing and with air-gap security glazing manufacturers' written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

I. Project Conditions

1. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.



- a. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F (4.4 deg C).

J. Coordination

1. Coordinate dimensions, including thickness, of security glazing with dimensions of construction that receives security glazing.

K. Warranty

1. Manufacturer's Special Warranty for Coated Glass: Manufacturer's standard form in which coated-glass manufacturer agrees to replace coated glass that deteriorates within specified warranty period. Deterioration is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
 - a. Warranty Period: 10 years from date of Final Completion.
2. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form in which laminated-glass manufacturer agrees to replace laminated glass that deteriorates within specified warranty period. Deterioration is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
 - a. Warranty Period: Five **OR** 10, **as directed**, years from date of Final Completion.
3. Manufacturer's Special Warranty for Polycarbonate Sheet: Manufacturer's standard form in which glazing manufacturer agrees to replace polycarbonate sheet that deteriorates within specified warranty period. Deterioration is defined as defects developed from normal use that are not attributed to maintaining and cleaning polycarbonate sheet contrary to manufacturer's written instructions. Defects include yellowing and loss of light transmission.
 - a. Warranty Period: 10 years from date of Final Completion.
4. Manufacturer's Special Warranty for Laminated Polycarbonate: Manufacturer's standard form in which laminated polycarbonate manufacturer agrees to replace laminated polycarbonate that deteriorates within specified warranty period. Deterioration is defined as defects developed from normal use that are not attributed to maintaining and cleaning laminated polycarbonate contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glazing, blemishes exceeding those allowed by referenced standard, yellowing, and loss of light transmission.
 - a. Warranty Period: Five **OR** 10, **as directed**, years from date of Final Completion.
5. Manufacturer's Special Warranty for Glass-Clad Polycarbonate: Manufacturer's standard form in which glass-clad polycarbonate manufacturer agrees to replace glass-clad polycarbonate that deteriorates within specified warranty period. Deterioration is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning glass-clad polycarbonate contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glazing, blemishes exceeding those allowed by referenced glass-clad polycarbonate standard, yellowing, and loss of light transmission.
 - a. Warranty Period: Five **OR** 10, **as directed**, years from date of Final Completion.
6. Manufacturer's Special Warranty for Laminated Glass and Polycarbonate: Manufacturer's standard form in which laminated-glass-and-polycarbonate manufacturer agrees to replace laminated glass and polycarbonate that deteriorates within specified warranty period. Deterioration is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass and polycarbonate contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glazing, blemishes exceeding those allowed by referenced glass-clad polycarbonate standard, yellowing, and loss of light transmission.
 - a. Warranty Period: Five **OR** 10, **as directed**, years from date of Final Completion.



7. Manufacturer's Special Warranty on Insulating Security Glazing: Manufacturer's standard form in which insulating security glazing manufacturer agrees to replace insulating security glazing that deteriorates within specified warranty period. Deterioration is defined as defects in individual lites developed from normal use or failure of hermetic seal under normal use. Deterioration does not include defects in individual lites or failure of hermetic seal that is attributed to glass breakage or to maintaining and cleaning insulating security glazing contrary to manufacturer's written instructions.
 - a. Defects in coated glass lites include peeling, cracking, and other indications of deterioration in coating.
 - b. Defects in laminated-glass lites include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
 - c. Defects in glass-clad polycarbonate lites include edge separation, delamination materially obstructing vision through glazing, blemishes exceeding those allowed by referenced glass-clad polycarbonate standard, yellowing, and loss of light transmission.
 - d. Evidence of hermetic seal failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glazing.
 - e. Warranty Period: Five **OR** 10, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Security Glazing, General

1. Thickness: Where thickness is indicated, it is a minimum. Provide security glazing in thicknesses as needed to comply with requirements indicated.
2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.
3. Fire-Test-Response Characteristics of Plastic Sheets: As determined by testing plastic sheets identical to those used in security glazing products by a qualified testing agency acceptable to authorities having jurisdiction.
 - a. Self-ignition temperature of 650 deg F (343 deg C) or more when tested per ASTM D 1929 on plastic sheets in thicknesses indicated for the Work.
 - b. Smoke-developed index of 450 or less when tested according to ASTM E 84, or smoke density of 75 or less when tested per ASTM D 2843 on plastic sheets in thicknesses indicated for the Work.
 - c. Burning extent of 1 inch (25 mm) **OR** rate of 2.5 in./min. (1.06 mm/s), **as directed**, or less when tested per ASTM D 635 at a nominal thickness of 0.060 inch (1.52 mm) or thickness indicated for the Work.
4. Windborne-Debris-Impact Resistance: Provide exterior security glazing that passes basic **OR** enhanced, **as directed**, -protection testing requirements in ASTM E 1996 for Wind Zone 1 **OR** Wind Zone 2 **OR** Wind Zone 3 **OR** Wind Zone 4, **as directed**, when tested according to ASTM E 1886. Test specimens shall be no smaller in width and length than security glazing indicated for use on the Project and shall be installed in same manner as indicated for use on the Project.
 - a. Large-Missile Test: For security glazing located within 30 feet (9.1 m) of grade.
 - b. Small-Missile Test: For security glazing located more than 30 feet (9.1 m) above grade.

OR

Large-Missile Test: For all security glazing, regardless of height above grade.
5. Thermal and Optical Performance Properties: Provide security glazing with performance properties specified, as indicated in manufacturer's published test data, based on products of construction indicated and on procedures indicated below:
 - a. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
 - b. Solar-Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
 - c. Visible Reflectance: Center-of-glazing values, according to NFRC 300.



B. Glass Products

1. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.
2. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.
 - a. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
 - b. For heat-strengthened float glass, comply with requirements for Kind HS.
 - c. For fully tempered float glass, comply with requirements for Kind FT.
 - d. For uncoated glass, comply with requirements for Condition A.
 - e. For coated vision glass, comply with requirements for Condition C (other coated glass).
3. Chemically Strengthened Glass: Annealed float glass chemically strengthened to comply with ASTM C 1422, Surface Compression Level 1 **OR** Level 2 **OR** Level 3 **OR** Level 4 **OR** Level 5, **as directed**, and Case Depth Level A **OR** Level B **OR** Level C **OR** Level D **OR** Level E **OR** Level F, **as directed**.
4. Reflective-Coated Vision Glass: ASTM C 1376, Kind CV (coated vision glass), coated by pyrolytic process **OR** vacuum deposition (sputter-coating) process, **as directed**, and complying with other requirements specified.

C. Laminated Glass

1. Laminated Glass: ASTM C 1172, and complying with testing requirements in 16 CFR 1201 for Category II materials, and with other requirements specified. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
 - a. Construction: Laminate glass with polyvinyl butyral interlayer or cast-in-place and cured-transparent-resin interlayer to comply with interlayer manufacturer's written recommendations.
 - b. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
 - c. Interlayer Color: Clear unless otherwise indicated.
2. Windborne-Debris-Impact-Resistant Laminated Glass: ASTM C 1172, and complying with testing requirements in 16 CFR 1201 for Category II materials, with "Windborne-Debris-Impact Resistance" Paragraph, and with other requirements specified.
 - a. Construction: Laminate glass with one of the following to comply with interlayer manufacturer's written recommendations:
 - 1) Polyvinyl butyral interlayer.
 - 2) Polyvinyl butyral interlayers reinforced with polyethylene terephthalate film.
 - 3) Ionoplast interlayer.
 - 4) Cast-in-place and cured-transparent-resin interlayer.
 - 5) Cast-in-place and cured-transparent-resin interlayer reinforced with polyethylene terephthalate film.
 - b. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
 - c. Interlayer Color: Clear unless otherwise indicated.

D. Polycarbonate Security Glazing

1. Polycarbonate Sheet: ASTM C 1349, Appendix X1, Type II, coated, mar-resistant, UV-stabilized polycarbonate with coating on exposed surfaces and Type I, standard, UV-stabilized polycarbonate where no surfaces are exposed.
2. Laminated Polycarbonate: Polycarbonate sheets laminated with clear urethane interlayer that complies with ASTM C 1349, Appendix X2, and has a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation. Provide laminated units that comply with requirements of ASTM C 1349 for maximum allowable laminating process blemishes and haze.
3. Glass-Clad Polycarbonate: ASTM C 1349, and other requirements specified.



- a. Provide glass-clad polycarbonate that complies with testing requirements in 16 CFR 1201 for Category II materials, and with other requirements specified.
4. Laminated Glass and Polycarbonate: ASTM C 1349, and other requirements specified.
 - a. Provide laminated glass and polycarbonate that complies with testing requirements in 16 CFR 1201 for Category II materials, and with other requirements specified.
- E. Spall-Resistant Film
 1. Spall-Resistant Film: Composite of clear polyvinyl butyral film and clear abrasion-resistant polyester film.
 2. Laminating Process: Laminate spall-resistant film to glazing assemblies in factory to produce laminated lites free of foreign substances, air, and glass pockets.
- F. Insulating Security Glazing
 1. Insulating Security Glazing: Factory-assembled units consisting of sealed lites separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.
 - a. Sealing System: Dual seal, with manufacturer's standard **OR** polyisobutylene and polysulfide **OR** polyisobutylene and silicone **OR** polyisobutylene and hot-melt butyl **OR** polyisobutylene and polyurethane, **as directed**, primary and secondary.
 - b. Spacer: Manufacturer's standard spacer material and construction **OR** Aluminum with mill or clear anodic finish **OR** Aluminum with black, color anodic finish **OR** Aluminum with bronze, color anodic finish **OR** Aluminum with powdered metal paint finish in color selected **OR** Galvanized steel **OR** Stainless steel **OR** Polypropylene-covered stainless steel in color selected **OR** Thermally broken aluminum **OR** Nonmetallic laminate **OR** Nonmetallic tube, **as directed**.
 - c. Desiccant: Molecular sieve or silica gel, or blend of both.
- G. Air-Gap Security Glazing
 1. Air-Gap Security Glazing: Factory-assembled units consisting of sealed lites separated by a dehydrated interspace and complying with other requirements specified.
 - a. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
 - b. Spacer Specifications: Manufacturer's standard rigid, **as directed**, spacer material and construction.
- H. Glazing Gaskets
 1. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:
 - a. Neoprene complying with ASTM C 864.
 - b. EPDM complying with ASTM C 864.
 - c. Silicone complying with ASTM C 1115.
 - d. Thermoplastic polyolefin rubber complying with ASTM C 1115.
 2. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned neoprene, EPDM, silicone or thermoplastic polyolefin rubber gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.
 - a. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.
- I. Glazing Sealants
 1. General:
 - a. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including security glazing, seals of insulating security glazing and air-gap security glazing, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.



- b. Suitability: Comply with sealant and security glazing manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 - c. VOC Content: For sealants used inside of the weatherproofing system, not more than 250 g/L when calculated according to 40 CFR 59, Subpart D.
 - d. Colors of Exposed Glazing Sealants: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
2. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.
 3. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT.
 4. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use NT.
 5. Glazing Sealant: Acid-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use NT.
- J. Glazing Tapes
1. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and security glazing manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
 - a. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 - b. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
 2. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
 - a. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
 - b. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.
- K. Miscellaneous Glazing Materials
1. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of security glazing and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
 2. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
 3. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
 4. Spacers: Elastomeric blocks or continuous extrusions of hardness required by security glazing manufacturer to maintain security glazing lites in place for installation indicated.
 5. Edge Blocks: Elastomeric material of hardness needed to limit security glazing lateral movement (side walking).
 6. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.
- L. Fabrication Of Security Glazing
1. Fabricate security glazing in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
- M. Laminated-Glass Security Glazing Types
1. Security Glazing: Clear laminated glass **OR** Tinted laminated glass **OR** Clear reflective-coated laminated glass **OR** Tinted reflective-coated laminated glass, **as directed**.



- a. Forced-Entry Resistance: Class I **OR** Class II **OR** Class III **OR** Class IV **OR** Class V, **as directed**, per ASTM F 1233.
OR
Forced-Entry Resistance: Level I **OR** Level II **OR** Level III **OR** Level IV **OR** Level V, **as directed**, per HPW-TP-0500.03.
 - b. Ballistic Resistance: Class/Level HG1 **OR** Class/Level HG2 **OR** Class/Level HG3 **OR** Class/Level HG4 **OR** Class/Level SMG **OR** Class/Level R1 **OR** Class/Level R2 **OR** Class/Level R3 **OR** Class/Level R4-AP **OR** Class/Level SH1 **OR** Class/Level SH2, **as directed**, per ASTM F 1233.
OR
Ballistic Resistance: Level 1 **OR** Level 2 **OR** Level 3 **OR** Level 4 **OR** Level 5 **OR** Level 6 **OR** Level 7 **OR** Level 8 **OR** Level 1-SG **OR** Level 2-SG **OR** Level 3-SG **OR** Level 4-SG **OR** Level 5-SG **OR** Level 6-SG **OR** Level 7-SG **OR** Level 8-SG, **as directed**, per UL 752.
 - c. Blast Resistance:
 - 1) Hazard Rating: No hazard **OR** Minimal hazard **OR** Very low hazard **OR** Low hazard **OR** High hazard, **as directed**, per ASTM F 1642.
OR
Performance Condition: 1 **OR** 2 **OR** 3a **OR** 3b **OR** 4 **OR** 5, **as directed**, per GSA-TS01.
 - 2) Peak Pressure: as directed by the Owner.
 - 3) Positive Phase Impulse: as directed by the Owner.
 - d. Number of Plies: Two **OR** Three, **as directed**.
 - e. Overall Unit Thickness: as directed by the Owner.
 - f. Outer Ply: 3-mm **OR** 5-mm **OR** 6-mm, **as directed**, float glass **OR** heat-strengthened float glass **OR** fully tempered float glass **OR** chemically strengthened float glass, **as directed**.
 - g. Core Ply: 3-mm **OR** 5-mm **OR** 6-mm, **as directed**, float glass **OR** heat-strengthened float glass **OR** fully tempered float glass **OR** chemically strengthened float glass, **as directed**.
 - h. Inner Ply: 3-mm **OR** 5-mm **OR** 6-mm, **as directed**, float glass **OR** heat-strengthened float glass **OR** fully tempered float glass **OR** chemically strengthened float glass, **as directed**.
 - i. Interlayer Thickness: 0.030 inch (0.76 mm) **OR** 0.060 inch (1.52 mm) **OR** 0.090 inch (2.3 mm), **as directed**.
 - j. Glass Tint Color: Blue **OR** Blue-green **OR** Bronze **OR** Green **OR** Gray **as directed**.
 - k. Tinted Glass Location: Outer ply.
 - l. Coating Color: Gold **OR** Pewter **OR** Silver, **as directed**.
 - m. Coating Location: Second **OR** Third **OR** Fifth, **as directed**, surface.
 - n. Overall Visible Light Transmittance: as directed by the Owner.
 - o. Outdoor Visible Reflectance: as directed by the Owner. Winter Nighttime U-Factor: as directed by the Owner.
 - p. Summer Daytime U-Factor: as directed by the Owner.
 - q. Solar Heat-Gain Coefficient: as directed by the Owner.
 - r. Provide safety glazing labeling.
2. Security Glazing: Tinted reflective-coated, **as directed**, laminated glass with clear glass and tinted interlayer.
 - a. Forced-Entry Resistance: Class I **OR** Class II **OR** Class III **OR** Class IV **OR** Class V, **as directed**, per ASTM F 1233.
OR
Forced-Entry Resistance: Level I **OR** Level II **OR** Level III **OR** Level IV **OR** Level V, **as directed**, per HPW-TP-0500.03.
 - b. Ballistic Resistance: Class/Level HG1 **OR** Class/Level HG2 **OR** Class/Level HG3 **OR** Class/Level HG4 **OR** Class/Level SMG **OR** Class/Level R1 **OR** Class/Level R2 **OR** Class/Level R3 **OR** Class/Level R4-AP **OR** Class/Level SH1 **OR** Class/Level SH2, **as directed**, per ASTM F 1233.
OR
Ballistic Resistance: Level 1 **OR** Level 2 **OR** Level 3 **OR** Level 4 **OR** Level 5 **OR** Level 6 **OR** Level 7 **OR** Level 8 **OR** Level 1-SG **OR** Level 2-SG **OR** Level 3-SG **OR** Level 4-SG **OR** Level 5-SG **OR** Level 6-SG **OR** Level 7-SG **OR** Level 8-SG, **as directed**, per UL 752.



- c. Blast Resistance:
 - 1) Hazard Rating: No hazard **OR** Minimal hazard **OR** Very low hazard **OR** Low hazard **OR** High hazard, **as directed**, per ASTM F 1642.
OR
Performance Condition: 1 **OR** 2 **OR** 3a **OR** 3b **OR** 4 **OR** 5, **as directed**, per GSA-TS01.
 - 2) Peak Pressure: as directed by the Owner.
 - 3) Positive Phase Impulse: as directed by the Owner.
 - d. Number of Plies: Two **OR** Three, **as directed**.
 - e. Overall Unit Thickness: as directed by the Owner.
 - f. Outer Ply: 3-mm **OR** 5-mm **OR** 6-mm, **as directed**, float glass **OR** heat-strengthened float glass **OR** fully tempered float glass **OR** chemically strengthened float glass, **as directed**.
 - g. Core Ply: 3-mm **OR** 5-mm **OR** 6-mm, **as directed**, float glass **OR** heat-strengthened float glass **OR** fully tempered float glass **OR** chemically strengthened float glass, **as directed**.
 - h. Inner Ply: 3-mm **OR** 5-mm **OR** 6-mm, **as directed**, float glass **OR** heat-strengthened float glass **OR** fully tempered float glass **OR** chemically strengthened float glass, **as directed**.
 - i. Interlayer Thickness: 0.030 inch (0.76 mm) **OR** 0.060 inch (1.52 mm) **OR** 0.090 inch (2.3 mm), **as directed**.
 - j. Interlayer Color: Clear **OR** Blue-green **OR** Bronze light **OR** Gray, **as directed**.
 - k. Coating Color: Gold **OR** Pewter **OR** Silver, **as directed**.
 - l. Coating Location: Second **OR** Third **OR** Fifth, **as directed**, surface.
 - m. Overall Visible Light Transmittance: as directed by the Owner.
 - n. Outdoor Visible Reflectance: as directed by the Owner. Winter Nighttime U-Factor: as directed by the Owner.
 - o. Summer Daytime U-Factor: as directed by the Owner.
 - p. Solar Heat-Gain Coefficient: as directed by the Owner. Provide safety glazing labeling.
- N. Monolithic Polycarbonate Security Glazing Types
- 1. Security Glazing: Monolithic polycarbonate with mar-resistant coating on both surfaces.
 - a. Detention Security Grade: Grade 4 per ASTM F 1915 cold-temperature impact test **OR** warm-temperature impact test **OR** torch and small blunt impactor test, **as directed**.
OR
Thickness: 3/8 inch (9.25 mm) **OR** 1/2 inch (12.7 mm), **as directed**.
- O. Laminated-Polycarbonate Security Glazing Types
- 1. Security Glazing: Laminated polycarbonate.
 - a. Detention Security Grade: Grade 1 **OR** Grade 2 **OR** Grade 3 **OR** Grade 4, **as directed**, per ASTM F 1915 cold-temperature impact test **OR** warm-temperature impact test **OR** torch and small blunt impactor test, **as directed**.
 - b. Forced-Entry Resistance: Class I **OR** Class II **OR** Class III **OR** Class IV **OR** Class V, **as directed**, per ASTM F 1233.
OR
Forced-Entry Resistance: Level I **OR** Level II **OR** Level III **OR** Level IV **OR** Level V, **as directed**, per HPW-TP-0500.03.
 - c. Blast Resistance:
 - 1) Hazard Rating: No hazard **OR** Minimal hazard **OR** Very low hazard **OR** Low hazard **OR** High hazard, **as directed**, per ASTM F 1642.
OR
Performance Condition: 1 **OR** 2 **OR** 3a **OR** 3b **OR** 4 **OR** 5, **as directed**, per GSA-TS01.
 - 2) Peak Pressure: as directed by the Owner.
 - 3) Positive Phase Impulse: as directed by the Owner.
 - d. Number of Plies: Two **OR** Three **OR** Four, **as directed**.
 - e. Overall Unit Thickness: as directed by the Owner.



- f. Outer and Inner Plies: 0.118-inch (4.57-mm) **OR** 0.177-inch (2.97-mm) **OR** 0.236-inch (5.99-mm), **as directed**, polycarbonate.
 - g. Core Ply **OR** Core Plies, **as directed**: 0.118-inch (4.57-mm) **OR** 0.177-inch (2.97-mm) **OR** 0.236-inch (5.99-mm), **as directed**, polycarbonate.
 - h. Interlayer Thicknesses: 0.025 inch (0.635 mm).
- P. Glass-Clad Polycarbonate Security Glazing Types
- 1. Security Glazing: Clear symmetrical glass-clad polycarbonate **OR** Tinted symmetrical glass-clad polycarbonate **OR** Clear reflective-coated symmetrical glass-clad polycarbonate **OR** Tinted reflective-coated symmetrical glass-clad polycarbonate, **as directed**.
 - a. Detention Security Grade: Grade 1 **OR** Grade 2 **OR** Grade 3 **OR** Grade 4, **as directed**, per ASTM F 1915 cold-temperature impact test **OR** warm-temperature impact test **OR** torch and small blunt impactor test, **as directed**.
 - b. Forced-Entry Resistance: Class I **OR** Class II **OR** Class III **OR** Class IV **OR** Class V, **as directed**, per ASTM F 1233.
OR
Forced-Entry Resistance: Level I **OR** Level II **OR** Level III **OR** Level IV **OR** Level V, **as directed**, per HPW-TP-0500.03.
 - c. Ballistic Resistance: Class/Level HG1 **OR** Class/Level HG2 **OR** Class/Level HG3 **OR** Class/Level HG4 **OR** Class/Level SMG **OR** Class/Level R1 **OR** Class/Level R2 **OR** Class/Level R3 **OR** Class/Level R4-AP **OR** Class/Level SH1 **OR** Class/Level SH2, **as directed**, per ASTM F 1233.
OR
Ballistic Resistance: Level 1 **OR** Level 2 **OR** Level 3 **OR** Level 4 **OR** Level 5 **OR** Level 6 **OR** Level 7 **OR** Level 8 **OR** Level 1-SG **OR** Level 2-SG **OR** Level 3-SG **OR** Level 4-SG **OR** Level 5-SG **OR** Level 6-SG **OR** Level 7-SG **OR** Level 8-SG, **as directed**, per UL 752.
 - d. Blast Resistance:
 - 1) Hazard Rating: No hazard **OR** Minimal hazard **OR** Very low hazard **OR** Low hazard **OR** High hazard, **as directed**, per ASTM F 1642.
OR
Performance Condition: 1 **OR** 2 **OR** 3a **OR** 3b **OR** 4 **OR** 5, **as directed**, per GSA-TS01.
 - 2) Peak Pressure: as directed by the Owner.
 - 3) Positive Phase Impulse: as directed by the Owner.
 - e. Overall Unit Thickness: as directed by the Owner. Outer Ply: 3-mm **OR** 5-mm **OR** 6-mm, **as directed**, heat-strengthened **OR** chemically strengthened, **as directed**, float glass.
 - f. Single Core: 0.118-inch (4.57-mm) **OR** 0.177-inch (2.97-mm) **OR** 0.236-inch (5.99-mm), **as directed**, polycarbonate.
OR
Multiple Core:
 - 1) Outer Core Ply: 0.118-inch (4.57-mm) **OR** 0.177-inch (2.97-mm) **OR** 0.236-inch (5.99-mm), **as directed**, polycarbonate.
 - 2) Single Inner Core Ply **OR** Double Inner Core Plies, **as directed**: 0.118-inch (4.57-mm) **OR** 0.177-inch (2.97-mm) **OR** 0.236-inch (5.99-mm), **as directed**, polycarbonate.
 - g. Inner Ply: 3-mm **OR** 5-mm **OR** 6-mm, **as directed**, heat-strengthened **OR** chemically strengthened, **as directed**, float glass.
 - h. Interlayer Thickness: 0.025 inch (0.635 mm) **OR** 0.050 inch (0.127 mm), **as directed**.
 - i. Glass Tint Color: Blue **OR** Blue-green **OR** Bronze **OR** Green **OR** Gray, **as directed**.
 - j. Tinted Glass Location: Outer ply.
 - k. Coating Color: Gold **OR** Pewter **OR** Silver, **as directed**.
 - l. Coating Location: Second **OR** Third **OR** Fifth, **as directed**, surface.
 - m. Overall Visible Light Transmittance: as directed by the Owner.
 - n. Outdoor Visible Reflectance: as directed by the Owner.
 - o. Winter Nighttime U-Factor: as directed by the Owner.
 - p. Summer Daytime U-Factor: as directed by the Owner.



- q. Solar Heat-Gain Coefficient: as directed by the Owner.
- r. Provide safety glazing labeling.

Q. Laminated-Glass-And-Polycarbonate Security Glazing Types

1. Security Glazing: Nonsymmetrical clear **OR** tinted **OR** reflective-coated, **as directed**, laminated glass and polycarbonate with glass plies on the attack or threat side and polycarbonate plies on the witness side.
 - a. Detention Security Grade: Grade 1 **OR** Grade 2 **OR** Grade 3 **OR** Grade 4, **as directed**, per ASTM F 1915 cold-temperature impact test **OR** warm-temperature impact test **OR** torch and small blunt impactor test, **as directed**.
 - b. Forced-Entry Resistance: Class I **OR** Class II **OR** Class III **OR** Class IV **OR** Class V, **as directed**, per ASTM F 1233.
OR
Forced-Entry Resistance: Level I **OR** Level II **OR** Level III **OR** Level IV **OR** Level V, **as directed**, per HPW-TP-0500.03.
 - c. Ballistic Resistance: Class/Level HG1 **OR** Class/Level HG2 **OR** Class/Level HG3 **OR** Class/Level HG4 **OR** Class/Level SMG **OR** Class/Level R1 **OR** Class/Level R2 **OR** Class/Level R3 **OR** Class/Level R4-AP **OR** Class/Level SH1 **OR** Class/Level SH2, **as directed**, per ASTM F 1233.
OR
Ballistic Resistance: Level 1 **OR** Level 2 **OR** Level 3 **OR** Level 4 **OR** Level 5 **OR** Level 6 **OR** Level 7 **OR** Level 8 **OR** Level 1-SG **OR** Level 2-SG **OR** Level 3-SG **OR** Level 4-SG **OR** Level 5-SG **OR** Level 6-SG **OR** Level 7-SG **OR** Level 8-SG, **a directed**, per UL 752.
 - d. Blast Resistance:
 - 1) Hazard Rating: No hazard **OR** Minimal hazard **OR** Very low hazard **OR** Low hazard **OR** High hazard, **as directed**, per ASTM F 1642.
OR
Performance Condition: 1 **OR** 2 **OR** 3a **OR** 3b **OR** 4 **OR** 5, **as directed**, per GSA-TS01.
 - 2) Peak Pressure: as directed by the Owner.
 - 3) Positive Phase Impulse: as directed by the Owner.
 - e. Overall Unit Thickness: as directed by the Owner.
 - f. Makeup:
 - 1) Outer Glass Ply: 3-mm heat-strengthened float glass.
 - 2) Interlayer Thickness: 0.025 inch (0.635 mm) **OR** 0.050 inch (0.127 mm), **as directed**.
 - 3) First Inner Glass Ply: 12-mm, **as directed**, float glass.
 - 4) Interlayer Thickness: 0.025 inch (0.635 mm) **OR** 0.050 inch (0.127 mm), **as directed**.
 - 5) Second Inner Glass Ply: 10-mm, **as directed**, float glass.
 - 6) Interlayer Thickness: 0.025 inch (0.635 mm) **OR** 0.050 inch (0.127 mm), **as directed**.
 - 7) Inner Polycarbonate Ply: 0.118-inch (4.57-mm) **OR** 0.177-inch (2.97-mm) **OR** 0.236-inch (5.99-mm), **as directed**, Type I (standard, UV-stabilized) polycarbonate.
 - 8) Interlayer Thickness: 0.025 inch (0.635 mm) **OR** 0.050 inch (0.127 mm), **as directed**.
 - 9) Outer Polycarbonate Ply: 0.118-inch (4.57-mm) **OR** 0.177-inch (2.97-mm) **OR** 0.236-inch (5.99-mm), **as directed**, Type II (coated, mar-resistant, UV-stabilized) polycarbonate.
 - g. Glass Tint Color: Blue **OR** Blue-green **OR** Bronze **OR** Green **OR** Gray, **as directed**.
 - h. Tinted Glass Location: Outer glass ply.
 - i. Coating Color: Gold **OR** Pewter **OR** Silver, **as directed**.
 - j. Coating Location: Second **OR** Third **OR** Fifth, **as directed**, surface.
 - k. Overall Visible Light Transmittance: as directed by the Owner.
 - l. Outdoor Visible Reflectance: as directed by the Owner.



- m. Winter Nighttime U-Factor: as directed by the Owner.
- n. Summer Daytime U-Factor: as directed by the Owner.
- o. Solar Heat-Gain Coefficient: as directed by the Owner.
- p. Provide safety glazing labeling.

R. Insulating Security Glazing Types

1. Security Glazing: Clear insulating security glazing **OR** Tinted insulating security glazing **OR** Reflective-coated, clear insulating security glazing **OR** Reflective-coated, tinted insulating security glazing, **as directed**. Outdoor lite is monolithic glass and indoor lite is glass-clad polycarbonate.
 - a. Detention Security Grade: Grade 1 **OR** Grade 2 **OR** Grade 3 **OR** Grade 4, **as directed**, per ASTM F 1915 cold-temperature impact test **OR** warm-temperature impact test **OR** torch and small blunt impactor test, **as directed**.
 - b. Overall Unit Thickness: as directed by the Owner.
 - c. Outdoor Lite: Float glass **OR** Heat-strengthened float glass **OR** Fully tempered float glass, **as directed**.
 - d. Indoor Lite: Glass-clad polycarbonate.
 - 1) Outer Ply: 3-mm **OR** 5-mm **OR** 6-mm, **as directed**, heat-strengthened **OR** chemically strengthened **OR** fully tempered, **as directed**, float glass.
 - 2) Single Core: 0.118-inch (4.57-mm) **OR** 0.177-inch (2.97-mm) **OR** 0.236-inch (5.99-mm), **as directed**, polycarbonate.
OR
Multiple Core:
 - a) Outer Core Ply: 0.118-inch (4.57-mm) **OR** 0.177-inch (2.97-mm) **OR** 0.236-inch (5.99-mm), **as directed**, polycarbonate.
 - b) Single Inner Core Ply **OR** Double Inner Core Plies, **as directed**: 0.118-inch (4.57-mm) **OR** 0.177-inch (2.97-mm) **OR** 0.236-inch (5.99-mm), **as directed**, polycarbonate.
 - 3) Inner Ply: 3-mm **OR** 5-mm **OR** 6-mm, **as directed**, heat-strengthened **OR** chemically strengthened **OR** fully tempered, **as directed**, float glass.
 - e. Interspace Content: Air **OR** Argon, **as directed**.
 - f. Interspace Dimension: as directed by the Owner.
 - g. Glass Tint Color: Blue **OR** Blue-green **OR** Bronze **OR** Green **OR** Gray, **as directed**.
 - h. Tinted Glass Location: Outdoor lite.
 - i. Coating Color: Gold **OR** Pewter **OR** Silver, **as directed**.
 - j. Coating Location: Second **OR** Third **OR** Fifth, **as directed**, surface.
 - k. Overall Visible Light Transmittance: as directed by the Owner.
 - l. Outdoor Visible Reflectance: as directed by the Owner.
 - m. Winter Nighttime U-Factor: as directed by the Owner.
 - n. Summer Daytime U-Factor: as directed by the Owner.
 - o. Solar Heat-Gain Coefficient: as directed by the Owner.
 - p. Provide safety glazing labeling.
2. Security Glazing: Low-e-coated, clear insulating security glazing **OR** Low-e-coated, tinted insulating security glazing, **as directed**. Outdoor lite is monolithic glass and indoor lite is glass-clad polycarbonate.
 - a. Detention Security Grade: Grade 1 **OR** Grade 2 **OR** Grade 3 **OR** Grade 4, **as directed**, per ASTM F 1915 cold-temperature impact test **OR** warm-temperature impact test **OR** torch and small blunt impactor test, **as directed**.
 - b. Overall Unit Thickness: as directed by the Owner.
 - c. Outdoor Lite: Float glass **OR** Heat-strengthened float glass **OR** Fully tempered float glass, **as directed**.
 - d. Indoor Lite: Glass-clad polycarbonate.
 - 1) Outer Ply: 3-mm **OR** 5-mm **OR** 6-mm, **as directed**, heat-strengthened **OR** chemically strengthened **OR** fully tempered, **as directed**, float glass.
 - 2) Single Core: 0.118-inch (4.57-mm) **OR** 0.177-inch (2.97-mm) **OR** 0.236-inch (5.99-mm), **as directed**, polycarbonate.
OR



- Multiple Core:
- a) Outer Core Ply: 0.118-inch (4.57-mm) **OR** 0.177-inch (2.97-mm) **OR** 0.236-inch (5.99-mm), **as directed**, polycarbonate.
 - b) Single Inner Core Ply **OR** Double Inner Core Plies, **as directed**: 0.118-inch (4.57-mm) **OR** 0.177-inch (2.97-mm) **OR** 0.236-inch (5.99-mm), **as directed**, polycarbonate.
- 3) Inner Ply: 3-mm **OR** 5-mm **OR** 6-mm, **as directed**, heat-strengthened **OR** chemically strengthened **OR** fully tempered, **as directed**, float glass.
- e. Interspace Content: Air **OR** Argon, **as directed**.
 - f. Interspace Dimension: as directed by the Owner.
 - g. Glass Tint Color: Blue **OR** Blue-green **OR** Bronze **OR** Green **OR** Gray, **as directed**.
 - h. Tinted Glass Location: Outer lite.
 - i. Low-E Coating: Pyrolytic on second surface **OR** Pyrolytic on third surface **OR** Sputtered on second surface **OR** Sputtered on third surface, **as directed**.
 - j. Overall Visible Light Transmittance: as directed by the Owner.
 - k. Winter Nighttime U-Factor: as directed by the Owner.
 - l. Summer Daytime U-Factor: as directed by the Owner.
 - m. Solar Heat-Gain Coefficient: as directed by the Owner..
 - n. Provide safety glazing labeling.
3. Security Glazing: Clear insulating security glazing **OR** Tinted insulating security glazing **OR** Reflective-coated, clear insulating security glazing **OR** Reflective-coated, tinted insulating security glazing, **as directed**. Outdoor lite is laminated glass and indoor lite is glass-clad polycarbonate with spall-resistant film on inside face.
- a. Detention Security Grade: Grade 1 **OR** Grade 2 **OR** Grade 3 **OR** Grade 4, **as directed**, per ASTM F 1915 cold-temperature impact test **OR** warm-temperature impact test **OR** torch and small blunt impactor test, **as directed**.
 - b. Forced-Entry Resistance: Class I **OR** Class II **OR** Class III **OR** Class IV **OR** Class V, **as directed**, per ASTM F 1233.
OR
Forced-Entry Resistance: Level I **OR** Level II **OR** Level III **OR** Level IV **OR** Level V, **as directed**, per HPW-TP-0500.03.
 - c. Ballistic Resistance: Class/Level HG1 **OR** Class/Level HG2 **OR** Class/Level HG3 **OR** Class/Level HG4 **OR** Class/Level SMG **OR** Class/Level R1 **OR** Class/Level R2 **OR** Class/Level R3 **OR** Class/Level R4-AP **OR** Class/Level SH1 **OR** Class/Level SH2, **as directed**, per ASTM F 1233.
OR
Ballistic Resistance: Level 1 **OR** Level 2 **OR** Level 3 **OR** Level 4 **OR** Level 5 **OR** Level 6 **OR** Level 7 **OR** Level 8 **OR** Level 1-SG **OR** Level 2-SG **OR** Level 3-SG **OR** Level 4-SG **OR** Level 5-SG **OR** Level 6-SG **OR** Level 7-SG **OR** Level 8-SG, **as directed**, per UL 752.
 - d. Blast Resistance:
 - 1) Hazard Rating: No hazard **OR** Minimal hazard **OR** Very low hazard **OR** Low hazard **OR** High hazard, **as directed**, per ASTM F 1642.
OR
Performance Condition: 1 **OR** 2 **OR** 3a **OR** 3b **OR** 4 **OR** 5, **as directed**, per GSA-TS01.
 - 2) Peak Pressure: as directed by the Owner.
 - 3) Positive Phase Impulse: as directed by the Owner.
 - e. Overall Unit Thickness: as directed by the Owner.
 - f. Outdoor Lite: Laminated glass with two plies of heat-strengthened float glass **OR** three plies of heat-strengthened float glass **OR** two outer plies of heat-strengthened float glass and two inner plies of annealed float glass, **as directed**.
 - 1) Outer Ply Thickness: 3 mm **OR** 5 mm **OR** 6 mm, **as directed**.
 - 2) Core Ply Thickness: 3 mm **OR** 5 mm **OR** 6 mm, **as directed**.
 - 3) Inner Ply Thickness: 3 mm **OR** 5 mm **OR** 6 mm, **as directed**.



- 4) Interlayer Thickness: 0.030 inch (0.76 mm) **OR** 0.060 inch (1.52 mm) **OR** 0.090 inch (2.3 mm), **as directed**.
- g. Indoor Lite: Glass-clad polycarbonate faced with a 0.037-inch- (0.94-mm-) thick, spall-resistant polyester film laminated to indoor face.
- 1) Outer Ply: 3-mm **OR** 5-mm **OR** 6-mm, **as directed**, heat-strengthened **OR** chemically strengthened, **as directed**, float glass.
- 2) Single Core: 0.118-inch (4.57-mm) **OR** 0.177-inch (2.97-mm) **OR** 0.236-inch (5.99-mm), **as directed**, polycarbonate.
OR
Multiple Core:
- a) Outer Core Ply: 0.118-inch (4.57-mm) **OR** 0.177-inch (2.97-mm) **OR** 0.236-inch (5.99-mm), **as directed**, polycarbonate.
- b) Single Inner Core Ply **OR** Double Inner Core Plies, **as directed**: 0.118-inch (4.57-mm) **OR** 0.177-inch (2.97-mm) **OR** 0.236-inch (5.99-mm), **as directed**, polycarbonate.
- 3) Inner Ply: 3-mm **OR** 5-mm **OR** 6-mm, **as directed**, heat-strengthened **OR** chemically strengthened, **as directed**, float glass.
- h. Interspace Content: Air **OR** Argon, **as directed**.
- i. Interspace Dimension: as directed by the Owner.
- j. Glass Tint Color: Blue **OR** Blue-green **OR** Bronze **OR** Green **OR** Gray, **as directed**.
- k. Tinted Glass Location: Outer **OR** Inner, **as directed**, ply of outdoor lite.
- l. Coating Color: Gold **OR** Pewter **OR** Silver, **as directed**.
- m. Coating Location: Second **OR** Third **OR** Fifth, **as directed**, surface.
- n. Overall Visible Light Transmittance: as directed by the Owner.
- o. Outdoor Visible Reflectance: as directed by the Owner.
- p. Winter Nighttime U-Factor: as directed by the Owner.
- q. Summer Daytime U-Factor: as directed by the Owner.
- r. Solar Heat-Gain Coefficient: as directed by the Owner.
- s. Provide safety glazing labeling.
4. Security Glazing: Low-e-coated, clear insulating security glazing **OR** Low-e-coated, tinted insulating security glazing, **as directed**. Outdoor lite is laminated glass and indoor lite is glass-clad polycarbonate with spall-resistant film on inside face.
- a. Detention Security Grade: Grade 1 **OR** Grade 2 **OR** Grade 3 **OR** Grade 4, **as directed**, per ASTM F 1915 cold-temperature impact test **OR** warm-temperature impact test **OR** torch and small blunt impactor test, **as directed**.
- b. Forced-Entry Resistance: Class I **OR** Class II **OR** Class III **OR** Class IV **OR** Class V, **as directed**, per ASTM F 1233.
OR
Forced-Entry Resistance: Level I **OR** Level II **OR** Level III **OR** Level IV **OR** Level V, **as directed**, per HPW-TP-0500.03.
- c. Ballistic Resistance: Class/Level HG1 **OR** Class/Level HG2 **OR** Class/Level HG3 **OR** Class/Level HG4 **OR** Class/Level SMG **OR** Class/Level R1 **OR** Class/Level R2 **OR** Class/Level R3 **OR** Class/Level R4-AP **OR** Class/Level SH1 **OR** Class/Level SH2, **as directed**, per ASTM F 1233.
OR
Ballistic Resistance: Level 1 **OR** Level 2 **OR** Level 3 **OR** Level 4 **OR** Level 5 **OR** Level 6 **OR** Level 7 **OR** Level 8 **OR** Level 1-SG **OR** Level 2-SG **OR** Level 3-SG **OR** Level 4-SG **OR** Level 5-SG **OR** Level 6-SG **OR** Level 7-SG **OR** Level 8-SG, **as directed**, per UL 752.
- d. Blast Resistance:
- 1) Hazard Rating: No hazard **OR** Minimal hazard **OR** Very low hazard **OR** Low hazard **OR** High hazard, **as directed**, per ASTM F 1642.
OR
Performance Condition: 1 **OR** 2 **OR** 3a **OR** 3b **OR** 4 **OR** 5, **as directed**, per GSA-TS01.
- 2) Peak Pressure: as directed by the Owner.
- 3) Positive Phase Impulse: as directed by the Owner.



- e. Overall Unit Thickness: as directed by the Owner.
- f. Outdoor Lite: Laminated glass with two plies of heat-strengthened float glass **OR** three plies of heat-strengthened float glass **OR** two outer plies of heat-strengthened float glass and two inner plies of annealed float glass, **as directed**.
- 1) Outer Ply Thickness: 3 mm **OR** 5 mm **OR** 6 mm, **as directed**.
 - 2) Core Ply Thickness: 3 mm **OR** 5 mm **OR** 6 mm, **as directed**.
 - 3) Inner Ply Thickness: 3 mm **OR** 5 mm **OR** 6 mm, **as directed**.
 - 4) Interlayer Thickness: 0.030 inch (0.76 mm) **OR** 0.060 inch (1.52 mm) **OR** 0.090 inch (2.3 mm), **as directed**.
- g. Indoor Lite: Glass-clad polycarbonate faced with a 0.037-inch- (0.94-mm-) thick, spall-resistant polyester film laminated to indoor face.
- 1) Outer Ply: 3-mm **OR** 5-mm **OR** 6-mm, **as directed**, heat-strengthened **OR** chemically strengthened, **as directed**, float glass.
 - 2) Inner Ply: 3-mm **OR** 5-mm **OR** 6-mm, **as directed**, heat-strengthened **OR** chemically strengthened, **as directed**, float glass.
 - 3) Single Core: 0.118-inch (4.57-mm) **OR** 0.177-inch (2.97-mm) **OR** 0.236-inch (5.99-mm), **as directed**, polycarbonate.
OR
Multiple Core:
 - a) Outer Core Ply: 0.118-inch (4.57-mm) **OR** 0.177-inch (2.97-mm) **OR** 0.236-inch (5.99-mm), **as directed**, polycarbonate.
 - b) Single Inner Core Ply **OR** Double Inner Core Plies, **as directed**: 0.118-inch (4.57-mm) **OR** 0.177-inch (2.97-mm) **OR** 0.236-inch (5.99-mm), **as directed**, polycarbonate.
 - 4) Inner Ply: 3-mm **OR** 5-mm **OR** 6-mm, **as directed**, heat-strengthened **OR** chemically strengthened, **as directed**, float glass.
- h. Interspace Content: Air **OR** Argon, **as directed**.
- i. Interspace Dimension: as directed by the Owner.
- j. Glass Tint Color: Blue **OR** Blue-green **OR** Bronze **OR** Green **OR** Gray, **as directed**.
- k. Tinted Glass Location: Outer lite.
- l. Low-E Coating: Pyrolytic on second surface **OR** Pyrolytic on third surface **OR** Sputtered on second surface **OR** Sputtered on third surface, **as directed**.
- m. Overall Visible Light Transmittance: as directed by the Owner.
- n. Winter Nighttime U-Factor: as directed by the Owner.
- o. Summer Daytime U-Factor: as directed by the Owner.
- p. Solar Heat-Gain Coefficient: as directed by the Owner. Provide safety glazing labeling.
- S. Air-Gap Security Glazing Types
1. Security Glazing: Clear air-gap security glazing **OR** Tinted air-gap security glazing **OR** Clear reflective-coated air-gap security glazing **OR** Tinted reflective-coated air-gap security glazing, **as directed**. Outdoor lite is laminated glass and indoor lite is laminated polycarbonate.
 - a. Forced-Entry Resistance: Class I **OR** Class II **OR** Class III **OR** Class IV **OR** Class V, **as directed**, per ASTM F 1233.
OR
Forced-Entry Resistance: Level I **OR** Level II **OR** Level III **OR** Level IV **OR** Level V, **as directed**, per HPW-TP-0500.03.
 - b. Ballistic Resistance: Class/Level HG1 **OR** Class/Level HG2 **OR** Class/Level HG3 **OR** Class/Level HG4 **OR** Class/Level SMG **OR** Class/Level R1 **OR** Class/Level R2 **OR** Class/Level R3 **OR** Class/Level R4-AP **OR** Class/Level SH1 **OR** Class/Level SH2, **as directed**, per ASTM F 1233.
OR
Ballistic Resistance: Level 1 **OR** Level 2 **OR** Level 3 **OR** Level 4 **OR** Level 5 **OR** Level 6 **OR** Level 7 **OR** Level 8 **OR** Level 1-SG **OR** Level 2-SG **OR** Level 3-SG **OR** Level 4-SG **OR** Level 5-SG **OR** Level 6-SG **OR** Level 7-SG **OR** Level 8-SG, **as directed**, per UL 752.
 - c. Blast Resistance:



- 1) Hazard Rating: No hazard **OR** Minimal hazard **OR** Very low hazard **OR** Low hazard **OR** High hazard, **as directed**, per ASTM F 1642.
OR
Performance Condition: 1 **OR** 2 **OR** 3a **OR** 3b **OR** 4 **OR** 5, **as directed**, per GSA-TS01.
- 2) Peak Pressure: as directed by the Owner.
- 3) Positive Phase Impulse: as directed by the Owner.
- d. Overall Unit Thickness: as directed by the Owner.
- e. Outdoor Lite: Laminated glass with two **OR** three, **as directed**, plies of float glass **OR** heat-strengthened float glass **OR** fully tempered float glass **OR** chemically strengthened float glass, **as directed**.
 - 1) Outer Ply Thickness: 3 mm **OR** 5 mm **OR** 6 mm, **as directed**.
 - 2) Core Ply Thickness: 3 mm **OR** 5 mm **OR** 6 mm, **as directed**.
 - 3) Inner Ply Thickness: 3 mm **OR** 5 mm **OR** 6 mm, **as directed**.
 - 4) Interlayer Thickness: 0.030 inch (0.76 mm) **OR** 0.060 inch (1.52 mm) **OR** 0.090 inch (2.3 mm), **as directed**.
- f. Indoor Lite: Laminated polycarbonate with two **OR** three **OR** four, **as directed**, polycarbonate plies.
 - 1) Overall Unit Thickness: as directed by the Owner.
 - 2) Outer and Inner Plies: 0.118-inch (4.57-mm) **OR** 0.177-inch (2.97-mm) **OR** 0.236-inch (5.99-mm), **as directed**, polycarbonate.
 - 3) Core Ply **OR** Core Plies, **as directed**: 0.118-inch (4.57-mm) **OR** 0.177-inch (2.97-mm) **OR** 0.236-inch (5.99-mm), **as directed**, polycarbonate.
 - 4) Interlayer Thicknesses: 0.025 inch (0.635 mm).
- g. Air-Gap Dimension: as directed by the Owner.
- h. Glass Tint Color: Blue **OR** Blue-green **OR** Bronze **OR** Green **OR** Gray, **as directed**.
- i. Tinted Glass Location: Outer **OR** Inner, **as directed**, ply of outdoor lite.
- j. Coating Color: Gold **OR** Pewter **OR** Silver, **as directed**.
- k. Coating Location: Second **OR** Third **OR** Fifth, **as directed**, surface.
- l. Overall Visible Light Transmittance: as directed by the Owner..
- m. Outdoor Visible Reflectance: as directed by the Owner.
- n. Winter Nighttime U-Factor: as directed by the Owner.
- o. Summer Daytime U-Factor: as directed by the Owner.
- p. Solar Heat-Gain Coefficient: as directed by the Owner.
- q. Provide safety glazing labeling.
2. Security Glazing: Low-e-coated, clear air-gap security glazing **OR** Low-e-coated, tinted air-gap security glazing, **as directed**. Outdoor lite is laminated glass and indoor lite is laminated polycarbonate.
 - a. Forced-Entry Resistance: Class I **OR** Class II **OR** Class III **OR** Class IV **OR** Class V, **as directed**, per ASTM F 1233.
OR
Forced-Entry Resistance: Level I **OR** Level II **OR** Level III **OR** Level IV **OR** Level V, **as directed**, per HPW-TP-0500.03.
 - b. Ballistic Resistance: Class/Level HG1 **OR** Class/Level HG2 **OR** Class/Level HG3 **OR** Class/Level HG4 **OR** Class/Level SMG **OR** Class/Level R1 **OR** Class/Level R2 **OR** Class/Level R3 **OR** Class/Level R4-AP **OR** Class/Level SH1 **OR** Class/Level SH2, **as directed**, per ASTM F 1233.
OR
Ballistic Resistance: Level 1 **OR** Level 2 **OR** Level 3 **OR** Level 4 **OR** Level 5 **OR** Level 6 **OR** Level 7 **OR** Level 8 **OR** Level 1-SG **OR** Level 2-SG **OR** Level 3-SG **OR** Level 4-SG **OR** Level 5-SG **OR** Level 6-SG **OR** Level 7-SG **OR** Level 8-SG, **as directed**, per UL 752.
 - c. Blast Resistance:
 - 1) Hazard Rating: No hazard **OR** Minimal hazard **OR** Very low hazard **OR** Low hazard **OR** High hazard, **as directed**, per ASTM F 1642.
OR



- Performance Condition: 1 **OR** 2 **OR** 3a **OR** 3b **OR** 4 **OR** 5, **as directed**, per GSA-TS01.
- 2) Peak Pressure: as directed by the Owner.
 - 3) Positive Phase Impulse: as directed by the Owner.
- d. Overall Unit Thickness: as directed by the Owner.
 - e. Outdoor Lite: Laminated glass with two **OR** three, **as directed**, plies of float glass **OR** heat-strengthened float glass **OR** fully tempered float glass **OR** chemically strengthened float glass, **as directed**.
 - 1) Outer Ply Thickness: 3 mm **OR** 5 mm **OR** 6 mm, **as directed**.
 - 2) Core Ply Thickness: 3 mm **OR** 5 mm **OR** 6 mm, **as directed**.
 - 3) Inner Ply Thickness: 3 mm **OR** 5 mm **OR** 6 mm, **as directed**.
 - 4) Interlayer Thickness: 0.030 inch (0.76 mm) **OR** 0.060 inch (1.52 mm) **OR** 0.090 inch (2.3 mm), **as directed**.
 - f. Indoor Lite: Laminated polycarbonate with two **OR** three **OR** four, **as directed**, polycarbonate plies.
 - 1) Overall Unit Thickness: as directed by the Owner.
 - 2) Outer and Inner Plies: 0.118-inch (4.57-mm) **OR** 0.177-inch (2.97-mm) **OR** 0.236-inch (5.99-mm), **as directed**, polycarbonate.
 - 3) Core Ply **OR** Core Plies, **as directed**: 0.118-inch (4.57-mm) **OR** 0.177-inch (2.97-mm) **OR** 0.236-inch (5.99-mm), **as directed**, polycarbonate.
 - 4) Interlayer Thicknesses: 0.025 inch (0.635 mm).
 - g. Air-Gap Dimension: as directed by the Owner.
 - h. Glass Tint Color: Blue **OR** Blue-green **OR** Bronze **OR** Green **OR** Gray, **as directed**.
 - i. Tinted Glass Location: Outer **OR** Inner, **as directed**, ply of outdoor lite.
 - j. Low-E Coating: Pyrolytic on second surface **OR** Pyrolytic on third surface **OR** Sputtered on second surface **OR** Sputtered on third surface, **as directed**.
 - k. Overall Visible Light Transmittance: as directed by the Owner.
 - l. Winter Nighttime U-Factor: as directed by the Owner.
 - m. Summer Daytime U-Factor: as directed by the Owner.
 - n. Solar Heat-Gain Coefficient: as directed by the Owner.
 - o. Provide safety glazing labeling.

1.3 EXECUTION

A. Examination

1. Examine framing for security glazing, with Installer present, for compliance with the following:
 - a. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - b. Presence and functioning of weep system.
 - c. Minimum required face or edge clearances.
 - d. Effective sealing between joints of framing members.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Preparation

1. Clean glazing channels and other framing members receiving security glazing immediately before glazing. Remove coatings not firmly bonded to substrates.

C. Glazing, General

1. Comply with combined written instructions of manufacturers of security glazing, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
2. Protect edges of security glazing from damage during handling and installation. Remove damaged security glazing from Project site and legally dispose of off Project site. Damaged



- security glazing includes units with edge or face damage or other imperfections that, when installed, could weaken security glazing, impair performance, or impair appearance.
3. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
 4. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications unless otherwise required by glazing unit manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
 5. Do not exceed edge pressures stipulated by security glazing manufacturers for installing lites.
 6. Provide spacers for security glazing lites where the length plus width is larger than 50 inches (1270 mm).
 - a. Locate spacers directly opposite each other on both inside and outside faces of security glazing. Install correct size and spacing to preserve required face clearances unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with performance requirements.
 - b. Provide 1/8-inch (3-mm) minimum bite of spacers on glazing lites and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
 7. Provide edge blocking where indicated or needed to prevent security glazing from moving sideways in glazing channel, as recommended in writing by security glazing manufacturer and according to requirements in referenced glazing publications.
 8. Set security glazing in each series with uniform pattern, draw, bow, and similar characteristics.
 9. Set coated security glazing with proper orientation so that coatings face exterior or interior as specified.
 10. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
 11. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.
- D. Tape Glazing
1. Position tapes on fixed stops so that, when compressed by security glazing, their exposed edges are flush with or protrude slightly above sightline of stops.
 2. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
 3. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
 4. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
 5. Do not remove release paper from tape until just before each glazing unit is installed.
 6. Apply heel bead of elastomeric sealant.
 7. Center security glazing in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
 8. Apply cap bead of elastomeric sealant over exposed edge of tape.
- E. Gasket Glazing (Dry)
1. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
 2. Insert soft compression gasket securely in place between glazing unit and frame or fixed stop, with joints miter cut and bonded together at corners.
 3. Installation with Drive-in Wedge Gaskets: Center security glazing in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal



without developing bending stresses in security glazing. Seal gasket joints with sealant recommended by gasket manufacturer.

4. Installation with Pressure-Glazing Stops: Center security glazing in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in security glazing. Seal gasket joints with sealant recommended by gasket manufacturer.
5. Install gaskets so they protrude past face of glazing stops.

F. Sealant Glazing (Wet)

1. Install continuous spacers, or spacers combined with cylindrical sealant backing, between security glazing and glazing stops to maintain face clearances and to prevent sealant from extruding into glazing channel and blocking weep systems. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
2. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to security glazing and channel surfaces.
3. Tool exposed surfaces of sealants to provide a substantial wash away from security glazing.

G. Protection And Cleaning

1. Protect exterior security glazing from damage immediately after installation by attaching crossed streamers to framing held away from glazing unit. Do not apply markers to security glazing surfaces. Remove nonpermanent labels, and clean surfaces.
2. Protect security glazing from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with security glazing, remove substances immediately as recommended in writing by security glazing manufacturer.
3. Examine security glazing surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by security glazing manufacturer.
4. Remove and replace security glazing that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, or vandalism during construction period.
5. Wash security glazing on exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Final Completion. Wash security glazing as recommended in writing by security glazing manufacturer.

END OF SECTION 08 88 53 00



Task	Specification	Specification Description
08 88 53 00	08 01 81 00	Glazing



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SECTION 08 90 00 00 - LOUVERS AND VENTS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for louvers and vents. Product shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Fixed, extruded-aluminum and formed-metal louvers.
 - b. Adjustable, extruded-aluminum and formed-metal louvers.
 - c. Adjustable, extruded-aluminum and formed-metal insulated louvers.
 - d. Fixed, formed-metal acoustical louvers.
 - e. Wall vents (brick vents).

C. Definitions

1. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
2. Horizontal Louver: Louver with horizontal blades; i.e., the axes of the blades are horizontal.
3. Vertical Louver: Louver with vertical blades; i.e., the axes of the blades are vertical.
4. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.
5. Storm-Resistant Louver: Louver that provides specified wind-driven rain performance, as determined by testing according to AMCA 500-L.

D. Performance Requirements

1. Delegated Design: Design louvers, including comprehensive engineering analysis by a qualified professional engineer, using structural and seismic performance requirements and design criteria indicated.
2. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors.
 - a. Wind Loads:
 - 1) Determine loads based on pressures as indicated on Drawings.
OR
Determine loads based on a uniform pressure of 20 lbf/sq. ft. (957 Pa) **OR** 30 lbf/sq. ft. (1436 Pa), **as directed**, acting inward or outward.
3. Seismic Performance: Louvers, including attachments to other construction, shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
 - a. Design earthquake spectral response acceleration, short period (Sds) for Project is **as directed**.
 - b. Component Importance Factor is 1.5 **OR** 1.0, **as directed**.
4. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes, without buckling, opening of joints, overstressing of components, failure of connections, or other detrimental effects.
 - a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
5. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.



6. Acoustic Performance: Provide acoustical louvers complying with ratings specified, as demonstrated by testing manufacturer's stock units identical to those specified, except for length and width for airborne sound-transmission loss according to ASTM E 90 **OR** outdoor-indoor sound-transmission loss according to ASTM E 966, **as directed**.

E. Submittals

1. Product Data: For each type of product indicated.
 - a. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
2. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
3. Samples: For each type of metal finish required.
4. Delegated-Design Submittal: For louvers indicated to comply with structural and seismic performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
5. Product Test Reports: Based on tests performed according to AMCA 500-L.

F. Quality Assurance

1. Welding: Qualify procedures and personnel according to the following:
 - a. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 - b. AWS D1.3, "Structural Welding Code - Sheet Steel."
 - c. AWS D1.6, "Structural Welding Code - Stainless Steel."
2. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.
3. UL and NEMA Compliance: Provide motors and related components for motor-operated louvers that are listed and labeled by UL and comply with applicable NEMA standards.

1.2 PRODUCTS

A. Materials

1. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T5, T-52, or T6.
2. Aluminum Sheet: ASTM B 209 (ASTM B 209M), Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.
3. Aluminum Castings: ASTM B 26/B 26M, Alloy 319.
4. Galvanized-Steel Sheet: ASTM A 653/A 653M, G60 (Z180) **OR** G90 (Z275), **as directed**, zinc coating, mill phosphatized.
5. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, No. 2B finish **OR** No. 2D finish **OR** No. 4 finish, with grain running parallel to length of blades and frame members **OR** No. 4 finish, with grain running perpendicular to length of blades and frame members **OR** No. 4 finish, with grain running perpendicular to length of blades and parallel to length of frame members **OR** No. 6 finish, **as directed**.
6. Fasteners: Use types and sizes to suit unit installation conditions.
 - a. Use Phillips flat-head **OR** hex-head or Phillips pan-head **OR** tamper-resistant, **as directed**, screws for exposed fasteners unless otherwise indicated.
 - b. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
 - c. For fastening galvanized steel, use hot-dip-galvanized steel or 300 series stainless-steel fasteners.
 - d. For fastening stainless steel, use 300 series stainless-steel fasteners.
 - e. For color-finished louvers, use fasteners with heads that match color of louvers.
7. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
8. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

**B. Fabrication, General**

1. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
2. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.
 - a. Continuous Vertical Assemblies: Fabricate units without interrupting blade-spacing pattern unless horizontal mullions are indicated **OR** where indicated, **as directed**.
 - b. Horizontal Mullions: Provide horizontal mullions at joints unless continuous vertical assemblies are indicated **OR** where indicated, **as directed**.
3. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, **as directed**, to produce uniform appearance.
4. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
 - a. Frame Type: Channel **OR** Exterior flange **OR** Interior flange, **as directed**, unless otherwise indicated.
5. Include supports, anchorages, and accessories required for complete assembly.
6. Provide vertical mullions of type and at spacings indicated, but not more than recommended by manufacturer, or 72 inches (1830 mm) o.c., whichever is less.
 - a. Fully Recessed Mullions: Where indicated, provide mullions fully recessed behind louver blades. Where length of louver exceeds fabrication and handling limitations, fabricate with close-fitting blade splices designed to permit expansion and contraction.
 - b. Semirecessed Mullions: Where indicated, provide mullions partly recessed behind louver blades so louver blades appear continuous. Where length of louver exceeds fabrication and handling limitations, fabricate with interlocking split mullions and close-fitting blade splices designed to permit expansion and contraction.
 - c. Exposed Mullions: Where indicated, provide units with exposed mullions of same width and depth as louver frame. Where length of louver exceeds fabrication and handling limitations, provide interlocking split mullions designed to permit expansion and contraction.
 - d. Exterior Corners: Prefabricated corner units with mitered and welded blades **OR** blades with concealed close-fitting splices, **as directed**, and with fully recessed **OR** semirecessed, **as directed**, mullions at corners.
7. Provide subsills made of same material as louvers **OR** extended sills, **as directed**, for recessed louvers.
8. Join frame members to each other and to fixed louver blades with fillet welds concealed from view **OR** welds, threaded fasteners, or both, as standard with louver manufacturer, **as directed**, unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

C. Fixed, Extruded-Aluminum Louvers

1. Horizontal Storm-Resistant Louver:
 - a. Louver Depth: 4 inches (100 mm) **OR** 5 inches (125 mm) **OR** 7 inches (175 mm) **OR** 8 inches (200 mm) **OR** 9 inches (225 mm), **as directed**.
 - b. Frame and Blade Nominal Thickness: Not less than 0.080 inch (2.03 mm) **OR** 0.060 inch (1.52 mm) for blades and 0.080 inch (2.03 mm) for frames, **as directed**.
 - c. Louver Performance Ratings:
 - 1) Free Area: Not less than 5.0 sq. ft. (0.46 sq. m) **OR** 6.0 sq. ft. (0.56 sq. m) **OR** 7.0 sq. ft. (0.65 sq. m), **as directed**, for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.
 - 2) Air Performance: Not more than 0.10-inch wg (25-Pa) static pressure drop at 600-fpm (3.0-m/s) **OR** 700-fpm (3.6-m/s) **OR** 800-fpm (4.1-m/s), **as directed**, free-area exhaust **OR** intake, **as directed**, velocity.



- 3) Wind-Driven Rain Performance: Not less than 99 **OR** 95 **OR** 80, **as directed**, percent effectiveness when subjected to a rainfall rate of 3 inches (75 mm) per hour and a wind speed of 29 mph (13 m/s) **OR** 8 inches (200 mm) per hour and a wind speed of 50 mph (22.4 m/s), **as directed**, at a core-area intake velocity of 300 fpm (1.5 m/s) **OR** 400 fpm (2.0 m/s) **OR** 500 fpm (2.5 m/s), **as directed**.
- d. AMCA Seal: Mark units with AMCA Certified Ratings Seal.
2. Vertical Storm-Resistant Louver:
 - a. Louver Depth: 4 inches (100 mm) **OR** 6 inches (150 mm) **OR** 8 inches (200 mm) **OR** 9 inches (225 mm) **OR** 12 inches (300 mm), **as directed**.
 - b. Frame and Blade Nominal Thickness: Not less than 0.080 inch (2.03 mm) **OR** 0.060 inch (1.52 mm) for blades and 0.080 inch (2.03 mm) for frames, **as directed**.
 - c. Louver Performance Ratings:
 - 1) Free Area: Not less than 5.0 sq. ft. (0.46 sq. m) **OR** 6.0 sq. ft. (0.56 sq. m) **OR** 7.0 sq. ft. (0.65 sq. m) **as directed**, for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.
 - 2) Air Performance: Not more than 0.10-inch wg (25-Pa) static pressure drop at 600-fpm (3.0-m/s) **OR** 700-fpm (3.6-m/s) **OR** 800-fpm (4.1-m/s), **as directed**, free-area exhaust **OR** intake, **as directed**, velocity.
 - 3) Wind-Driven Rain Performance: Not less than 99 percent effectiveness when subjected to a rainfall rate of 3 inches (75 mm) per hour and a wind speed of 29 mph (13 m/s) **OR** 8 inches (200 mm) per hour and a wind speed of 50 mph (22.4 m/s), **as directed**, at a core-area intake velocity of 300 fpm (1.5 m/s) **OR** 400 fpm (2.0 m/s) **OR** 500 fpm (2.5 m/s), **as directed**.
 - d. AMCA Seal: Mark units with AMCA Certified Ratings Seal.
3. Horizontal, Drainable-Blade Louver:
 - a. Louver Depth: 4 inches (100 mm) **OR** 6 inches (150 mm), **as directed**.
 - b. Frame and Blade Nominal Thickness: Not less than 0.080 inch (2.03 mm) **OR** 0.060 inch (1.52 mm) for blades and 0.080 inch (2.03 mm) for frames, **as directed**.
 - c. Mullion Type: Exposed.
 - d. Louver Performance Ratings:
 - 1) Free Area: Not less than 7.0 sq. ft. (0.65 sq. m) **OR** 7.5 sq. ft. (0.70 sq. m) **OR** 8.0 sq. ft. (0.74 sq. m) **OR** 8.5 sq. ft. (0.79 sq. m), **as directed**, for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.
 - 2) Point of Beginning Water Penetration: Not less than 900 fpm (4.6 m/s) **OR** 950 fpm (4.8 m/s) **OR** 1000 fpm (5.1 m/s) **OR** 1050 fpm (5.3 m/s) **OR** 1100 fpm (5.6 m/s), **as directed**.
 - 3) Air Performance: Not more than 0.10-inch wg (25-Pa) static pressure drop at 700-fpm (3.6-m/s) **OR** 750-fpm (3.8-m/s) **OR** 800-fpm (4.1-m/s) **OR** 850-fpm (4.3-m/s), **as directed**, free-area exhaust **OR** intake, **as directed**, velocity.
 - 4) Air Performance: Not more than 0.15-inch wg (37-Pa) static pressure drop at 900-fpm (4.6-m/s) **OR** 950-fpm (4.8-m/s) **OR** 1000-fpm (5.1-m/s), **as directed**, free-area exhaust **OR** intake, **as directed**, velocity.
 - e. AMCA Seal: Mark units with AMCA Certified Ratings Seal.
4. Horizontal, Continuous-Line, Drainable-Blade Louver: Drainable-blade louver with blade gutters (drains) in rear two-thirds of blades only and with semirecessed mullions capable of collecting and draining water from blades.
 - a. Louver Depth: 6 inches (150 mm).
 - b. Frame and Blade Nominal Thickness: Not less than 0.080 inch (2.03 mm).
 - c. Louver Performance Ratings:
 - 1) Free Area: Not less than 7.8 sq. ft. (0.72 sq. m) for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.
 - 2) Point of Beginning Water Penetration: Not less than 850 fpm (4.3 m/s).
 - 3) Air Performance: Not more than 0.10-inch wg (25-Pa) static pressure drop at 800-fpm (4.1-m/s) free-area exhaust **OR** intake, **as directed**, velocity.
5. Horizontal, Sightproof, Drainable-Blade Louver:



- a. Louver Depth: 5 inches (125 mm).
 - b. Frame and Blade Nominal Thickness: Not less than 0.080 inch (2.03 mm) **OR** 0.060 inch (1.52 mm) for blades and 0.080 inch (2.03 mm) for frames, **as directed**.
 - c. Mullion Type: Exposed.
 - d. Louver Performance Ratings:
 - 1) Free Area: Not less than 8.3 sq. ft. (0.77 sq. m) for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.
 - 2) Point of Beginning Water Penetration: Not less than 750 fpm (3.8 m/s) **OR** 950 fpm (4.8 m/s), **as directed**.
 - 3) Air Performance: Not more than 0.10-inch wg (25-Pa) static pressure drop at 550-fpm (2.8-m/s) free-area exhaust **OR** intake, **as directed**, velocity.
6. Horizontal, Nondrainable-Blade Louver:
- a. Louver Depth: 2 inches (50 mm) **OR** 4 inches (100 mm) **OR** 6 inches (150 mm), **as directed**.
 - b. Blade Profile: Plain blade without **OR** Blade with, **as directed**, center baffle.
 - c. Frame and Blade Nominal Thickness: Not less than 0.080 inch (2.03 mm) **OR** 0.060 inch (1.52 mm) for blades and 0.080 inch (2.03 mm) for frames, **as directed**.
 - d. Mullion Type: Exposed **OR** Semirecessed **OR** Fully recessed, **as directed**.
 - e. Louver Performance Ratings:
 - 1) Free Area: Not less than 7.5 sq. ft. (0.70 sq. m) **OR** 8.0 sq. ft. (0.74 sq. m) **OR** 8.5 sq. ft. (0.79 sq. m), **as directed**, for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.
 - 2) Point of Beginning Water Penetration: Not less than 700 fpm (3.6 m/s) **OR** 750 fpm (3.8 m/s) **OR** 800 fpm (4.1 m/s) **OR** 850 fpm (4.3 m/s) **OR** 900 fpm (4.6 m/s) **OR** 950 fpm (4.8 m/s), **as directed**.
 - 3) Air Performance: Not more than 0.10-inch wg (25-Pa) static pressure drop at 650-fpm (3.3-m/s) **OR** 700-fpm (3.6-m/s) **OR** 750-fpm (3.8-m/s), **as directed**, free-area exhaust **OR** intake, **as directed**, velocity.
7. Vertical, Sightproof, Louver:
- a. Louver Depth: 4 inches (100 mm).
 - b. Blade Profile: Chevron **OR** Y **OR** Labyrinth, **as directed**, -shaped blade.
 - c. Frame and Blade Nominal Thickness: Not less than 0.080 inch (2.03 mm) **OR** 0.060 inch (1.52 mm) for blades and 0.080 inch (2.03 mm) for frames, **as directed**.
 - d. Blade Spacing: 2 inches (50 mm) **OR** 4 inches (100 mm), **as directed**, o.c.
 - e. Mullion Type: Exposed **OR** Semirecessed **OR** Fully recessed, **as directed**.
- D. Fixed, Formed-Metal Louvers
1. Horizontal, Drainable-Blade Louver:
 - a. Louver Depth: 4 inches (100 mm) **OR** 6 inches (150 mm), **as directed**.
 - b. Frame and Blade Material and Nominal Thickness: Galvanized-steel sheet, not less than 0.052 inch (1.32 mm) for frames and 0.040 inch (1.02 mm) for blades **OR** 0.052 inch (1.32 mm) **OR** 0.064 inch (1.63 mm), **as directed**.
 - c. Frame and Blade Material and Nominal Thickness: Stainless-steel sheet, not less than 0.050 inch (1.27 mm) **OR** 0.062 inch (1.59 mm), **as directed**.
 - d. Mullion Type: Exposed.
 - e. Louver Performance Ratings:
 - 1) Free Area: Not less than 7.0 sq. ft. (0.65 sq. m) **OR** 7.5 sq. ft. (0.70 sq. m) **OR** 8.0 sq. ft. (0.74 sq. m) **OR** 8.5 sq. ft. (0.79 sq. m), **as directed**, for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.
 - 2) Point of Beginning Water Penetration: Not less than 800 fpm (4.1 m/s) **OR** 850 fpm (4.3 m/s) **OR** 900 fpm (4.6 m/s) **OR** 950 fpm (4.8 m/s) **OR** 1000 fpm (5.1 m/s), **as directed**.
 - 3) Air Performance: Not more than 0.10-inch wg (25-Pa) static pressure drop at 700-fpm (3.6-m/s) **OR** 750-fpm (3.8-m/s) **OR** 800-fpm (4.1-m/s) **OR** 850-fpm (4.3-m/s), **as directed**, free-area exhaust **OR** intake, **as directed**, velocity.



- 4) Air Performance: Not more than 0.15-inch wg (37-Pa) static pressure drop at 900-fpm (4.6-m/s) **OR** 950-fpm (4.8-m/s) **OR** 1000-fpm (5.1-m/s), **as directed**, free-area velocity.
- f. AMCA Seal: Mark units with AMCA Certified Ratings Seal.
2. Horizontal, Nondrainable-Blade Louver:
 - a. Louver Depth: 4 inches (100 mm) **OR** 6 inches (150 mm), **as directed**.
 - b. Blade Profile: Plain blade without **OR** Blade with, **as directed**, center baffle.
 - c. Frame and Blade Material and Nominal Thickness: Galvanized-steel sheet, not less than 0.052 inch (1.32 mm) for frames and 0.040 inch (1.02 mm) for blades **OR** 0.052 inch (1.32 mm) **OR** 0.064 inch (1.63 mm), **as directed**.
 - d. Frame and Blade Material and Nominal Thickness: Stainless-steel sheet, not less than 0.050 inch (1.27 mm) **OR** 0.062 inch (1.59 mm), **as directed**.
 - e. Mullion Type: Exposed **OR** Semirecessed **OR** Fully recessed, **as directed**.
 - f. Louver Performance Ratings:
 - 1) Free Area: Not less than 6.5 sq. ft. (0.60 sq. m) **OR** 7.0 sq. ft. (0.65 sq. m) **OR** 7.5 sq. ft. (0.70 sq. m) **OR** 8.0 sq. ft. (0.74 sq. m), **as directed**, for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.
 - 2) Point of Beginning Water Penetration: Not less than 550 fpm (2.8 m/s) **OR** 600 fpm (3.0 m/s) **OR** 650 fpm (3.3 m/s) **OR** 700 fpm (3.6 m/s), **as directed**.
 - 3) Air Performance: Not more than 0.10-inch wg (25-Pa) static pressure drop at 550-fpm (2.8-m/s) **OR** 600-fpm (3.0-m/s) **OR** 650-fpm (3.3-m/s) **OR** 700-fpm (3.6-m/s), **as directed**, free-area exhaust **OR** intake, **as directed**, velocity.
- E. Adjustable, Extruded-Aluminum Louvers
 1. Louver Construction and Operation: Provide adjustable louvers with extruded-aluminum frames and blades not less than 0.080-inch (2.03-mm) nominal thickness, and with operating mechanisms to suit louver sizes.
 - a. Hand operation with push bars.
 - b. Crank operation with removable-crank operator in sill or jamb.
 - c. Chain operation with tension spring, wall clip, pull chain, and 160 deg F (71 deg C) fusible link.
 - d. Motor operation with 2-position, spring-return application (with power on, motor opens louver; with power off, spring closes louver); 110-V, 60-Hz motor and limit switch **OR** 2-direction, 110-V, 60-Hz motor and limit switches, **as directed**; equipped with frame-mounted switch **OR** remote-mounted switch with indicator light **OR** terminals for controlling devices, **as directed**.
 - e. Pneumatic piston operation for use with 80- to 100-psi (550- to 690-kPa) compressed air for 2-position **OR** modulating, **as directed**, operation; power open, power close with spring-return fail-safe, **as directed**.
 2. Dual-Blade, Drainable-Blade, Adjustable Louver: Fixed drainable blades and adjustable plain blades combined in single frame.
 - a. Louver Depth: 4 inches (100 mm) **OR** 6 inches (150 mm), **as directed**, overall.
 - b. Louver Performance Ratings:
 - 1) Free Area: Not less than 6.0 sq. ft. (0.56 sq. m) **OR** 6.5 sq. ft. (0.60 sq. m) **OR** 7.0 sq. ft. (0.65 sq. m) **OR** 7.5 sq. ft. (0.70 sq. m) **OR** 8.0 sq. ft. (0.74 sq. m), **as directed**, for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.
 - 2) Point of Beginning Water Penetration: Not less than 750 fpm (3.8 m/s) **OR** 800 fpm (4.1 m/s) **OR** 850 fpm (4.3 m/s) **OR** 900 fpm (4.6 m/s) **OR** 950 fpm (4.8 m/s) **OR** 1000 fpm (5.1 m/s), **as directed**.
 - 3) Air Performance: Not more than 0.10-inch wg (25-Pa) static pressure drop at 750-fpm (3.8-m/s) **OR** 800-fpm (4.1-m/s) **OR** 850-fpm (4.3-m/s) **OR** 900-fpm (4.6-m/s), **as directed**, free-area exhaust **OR** intake, **as directed**, velocity.
 - 4) Air Leakage: Not more than 1.5 cfm/sq. ft. (7.6 L/s per sq. m) of louver gross area at a differential static pressure of 0.15-inch wg (37 Pa) with adjustable louver blades closed.



- c. AMCA Seal: Mark units with AMCA Certified Ratings Seal.
3. Single-Blade, Adjustable Louver:
 - a. Louver Depth: 4 inches (100 mm) **OR** 6 inches (150 mm), **as directed**.
 - b. Blade Type: Drainable **OR** Plain, **as directed**.
 - c. Accessories: Equip louvers as follows:
 - 1) Vinyl blade-edge gaskets for each louver blade.
 - 2) Stainless-steel jamb seals **OR** vinyl blade-end gaskets, **as directed**.
 - d. Louver Performance Ratings:
 - 1) Free Area: Not less than 6.5 sq. ft. (0.60 sq. m) **OR** 7.0 sq. ft. (0.65 sq. m) **OR** 7.5 sq. ft. (0.70 sq. m) **OR** 8.0 sq. ft. (0.74 sq. m), **as directed**, for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.
 - 2) Point of Beginning Water Penetration: Not less than 500 fpm (2.5 m/s) **OR** 600 fpm (3.0 m/s) **OR** 700 fpm (3.6 m/s) **OR** 800 fpm (4.1 m/s) **OR** 900 fpm (4.6 m/s) **OR** 1000 fpm (5.1 m/s), **as directed**.
 - 3) Air Performance: Not more than 0.10-inch wg (25-Pa) static pressure drop at 500-fpm (2.5-m/s) **OR** 600-fpm (3.0-m/s) **OR** 700-fpm (3.6-m/s) **OR** 800-fpm (4.1-m/s) **OR** 900-fpm (4.6-m/s), **as directed**, free-area exhaust **OR** intake, **as directed**, velocity.
 - 4) Air Leakage: Not more than 3.5 cfm/sq. ft. (17.8 L/s per sq. m) of louver gross area at a differential static pressure of 0.15-inch wg (37 Pa) with adjustable louver blades closed.
 - e. AMCA Seal: Mark units with AMCA Certified Ratings Seal.
- F. Adjustable, Formed-Metal Louvers
 1. Louver Operation: Provide adjustable louvers with operating mechanisms to suit louver sizes.
 - a. Hand operation with push bars.
 - b. Crank operation with removable-crank operator in sill or jamb.
 - c. Chain operation with tension spring, wall clip, pull chain, and 160 deg F (71 deg C) fusible link.
 - d. Motor operation with 2-position, spring-return application (with power on, motor opens louver; with power off, spring closes louver); 110-V, 60-Hz motor and limit switch **OR** 2-direction, 110-V, 60-Hz motor and limit switches, **as directed**; equipped with frame-mounted switch **OR** remote-mounted switch with indicator light **OR** terminals for controlling devices, **as directed**.
 - e. Pneumatic piston operation for use with 80- to 100-psi (550- to 690-kPa) compressed air for 2-position **OR** modulating, **as directed**, operation; power open, power close with spring-return fail-safe, **as directed**.
 2. Dual-Blade, Drainable-Blade, Adjustable Louver: Fixed drainable blades and adjustable plain blades combined in single frame.
 - a. Louver Depth: 4 inches (100 mm) **OR** 6 inches (150 mm), **as directed**, overall.
 - b. Frame and Blade Material and Nominal Thickness: Galvanized-steel sheet, not less than 0.052 inch (1.32 mm) for frames and 0.040 inch (1.02 mm) for blades **OR** 0.052 inch (1.32 mm) **OR** 0.064 inch (1.63 mm), **as directed**.
 - c. Frame and Blade Material and Nominal Thickness: Stainless-steel sheet, not less than 0.050 inch (1.27 mm) **OR** 0.062 inch (1.59 mm), **as directed**.
 - d. Louver Performance Ratings:
 - 1) Air Leakage: Not more than 1.5 cfm/sq. ft. (7.6 L/s per sq. m) of louver gross area at a differential static pressure of 0.15-inch wg (37 Pa) with adjustable louver blades closed.
 - e. AMCA Seal: Mark units with AMCA Certified Ratings Seal.
 3. Single-Blade, Adjustable Louver:
 - a. Louver Depth: 4 inches (100 mm) **OR** 6 inches (150 mm), **as directed**.
 - b. Blade Type: Drainable **OR** Plain, **as directed**.
 - c. Frame and Blade Material and Nominal Thickness: Galvanized-steel sheet, not less than 0.052 inch (1.32 mm) for frames and 0.040 inch (1.02 mm) for blades **OR** 0.052 inch (1.32 mm) **OR** 0.064 inch (1.63 mm), **as directed**.



- d. Frame and Blade Material and Nominal Thickness: Stainless-steel sheet, not less than 0.050 inch (1.27 mm) **OR** 0.062 inch (1.59 mm), **as directed**.
- e. Accessories: Equip louvers as follows:
 - 1) Vinyl blade-edge gaskets for each louver blade.
 - 2) Stainless-steel jamb seals **OR** vinyl blade-end gaskets, **as directed**.
- f. Louver Performance Ratings:
 - 1) Free Area: Not less than 6.5 sq. ft. (0.60 sq. m) **OR** 7.0 sq. ft. (0.65 sq. m) **OR** 7.5 sq. ft. (0.70 sq. m) **OR** 8.0 sq. ft. (0.74 sq. m), **as directed**, for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.
 - 2) Point of Beginning Water Penetration: Not less than 500 fpm (2.5 m/s) **OR** 600 fpm (3.0 m/s) **OR** 700 fpm (3.6 m/s) **OR** 800 fpm (4.1 m/s) **OR** 900 fpm (4.6 m/s) **OR** 1000 fpm (5.1 m/s), **as directed**.
 - 3) Air Performance: Not more than 0.10-inch wg (25-Pa) static pressure drop at 500-fpm (2.5-m/s) **OR** 600-fpm (3.0-m/s) **OR** 700-fpm (3.6-m/s) **OR** 800-fpm (4.1-m/s) **OR** 900-fpm (4.6-m/s), **as directed**, free-area exhaust **OR** intake, **as directed**, velocity.
 - 4) Air Leakage: Not more than 3.5 cfm/sq. ft. (17.8 L/s per sq. m) of louver gross area at a differential static pressure of 0.15-inch wg (37 Pa) with adjustable louver blades closed.
- g. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

G. Adjustable, Insulated Louvers

- 1. Louver Operation: Provide adjustable louvers with operating mechanisms to suit louver sizes.
 - a. Hand operation with push bars.
 - b. Crank operation with removable-crank operator in sill or jamb.
 - c. Chain operation with tension spring, wall clip, pull chain, and 160 deg F (71 deg C) fusible link.
 - d. Motor operation with 2-position, spring-return application (with power on, motor opens louver; with power off, spring closes louver); 110-V, 60-Hz motor and limit switch **OR** 2-direction, 110-V, 60-Hz motor and limit switches, **as directed**; equipped with frame-mounted switch **OR** remote-mounted switch with indicator light **OR** terminals for controlling devices, **as directed**.
 - e. Pneumatic piston operation for use with 80- to 100-psi (550- to 690-kPa) compressed air for 2-position **OR** modulating, **as directed**, operation; power open, power close with spring-return fail-safe, **as directed**.
- 2. Adjustable, Insulated, Extruded-Aluminum Louver: Single-blade, adjustable louver with gasketed, insulated blades. Frames and blade facings have urethane thermal break. Frames are extruded aluminum, not less than 0.080-inch (2.03-mm) nominal thickness. Blade facings are aluminum sheet, not less than 0.032-inch (0.81-mm) nominal thickness.
 - a. Louver Depth: 6 inches (150 mm) **OR** 9 inches (225 mm), **as directed**.
 - b. Insulation: Extruded-polystyrene foam, 2 inches (50 mm) thick **OR** Foamed-in-place polyurethane, **as directed**.
- 3. Adjustable, Insulated, Formed-Metal Louver: Single-blade, adjustable louver with gasketed, insulated blades.
 - a. Louver Depth: 6 inches (150 mm) **OR** 8 inches (200 mm), **as directed**.
 - b. Frame Material and Nominal Thickness: Galvanized-steel sheet, not less than 0.052 inch (1.32 mm) **OR** 0.064 inch (1.63 mm), **as directed**.
 - c. Frame Material and Nominal Thickness: Stainless-steel sheet, not less than 0.050 inch (1.27 mm) **OR** 0.062 inch (1.59 mm), **as directed**.
 - d. Blade Material and Nominal Thickness: Galvanized-steel sheet, not less than 0.028 inch (0.71 mm) **OR** 0.040 inch (1.02 mm) **OR** 0.052 inch (1.32 mm) **OR** 0.064 inch (1.63 mm), **as directed**.
 - e. Blade Material and Nominal Thickness: Stainless-steel sheet, not less than 0.025 inch (0.64 mm) **OR** 0.038 inch (0.95 mm) **OR** 0.050 inch (1.27 mm) **OR** 0.062 inch (1.59 mm), **as directed**.



- f. Insulation: Extruded-polystyrene foam, 1 inch (25 mm) thick **OR** Rigid, glass-fiber-board insulation, 1 inch (25 mm) thick **OR** Foamed-in-place polyurethane, 1/2 inch (13 mm) thick, **as directed**.

H. Fixed, Acoustical Louvers

1. Fixed, Formed-Metal Acoustical Louver: Louver with formed-metal blades filled on interior with mineral-fiber, rigid-board, acoustical insulation retained by perforated metal sheet of same material and finish as blade.
 - a. Louver Depth: 6 inches (150 mm) **OR** 8 inches (200 mm) **OR** 12 inches (300 mm), **as directed**.
 - b. Frame Material: Extruded-aluminum or aluminum sheet, not less than 0.080-inch (2.03-mm) nominal thickness.
 - c. Frame Material: Galvanized-steel sheet, not less than 0.052-inch (1.32-mm) **OR** 0.064-inch (1.63-mm), **as directed**, nominal thickness.
 - d. Blade Material: Aluminum sheet, not less than 0.063-inch (1.60-mm) **OR** 0.080-inch (2.03-mm), **as directed**, nominal thickness.
 - e. Blade Material: Galvanized-steel sheet, not less than 0.034-inch (0.86-mm) **OR** 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
 - f. Blade Shape: Straight **OR** Airfoil **OR** Chevron, **as directed**.
 - g. Blade Angle: 45 degrees unless otherwise indicated.
 - h. Blade Spacing: 6 inches (150 mm) o.c. for 6-inch- (150-mm-) deep louvers.
 - i. Blade Spacing: 6 inches (150 mm) **OR** 8 inches (200 mm), **as directed**, o.c. for 8-inch- (200-mm-) deep louvers.
 - j. Blade Spacing: 9 inches (225 mm) **OR** 12 inches (300 mm), **as directed**, o.c. for 12-inch- (300-mm-) deep louvers.
 - k. Free Area: Not less than 4 sq. ft. (0.37 sq. m) for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.
 - l. Airborne Sound-Transmission Loss: STC 10 per ASTM E 413, determined by testing per ASTM E 90.
 - m. Outdoor-Indoor Sound-Transmission Loss: OITC 10 per ASTM E 1332, determined by testing per ASTM E 966.

I. Louver Screens

1. General: Provide screen at each exterior louver **OR** louvers indicated, **as directed**.
 - a. Screen Location for Fixed Louvers: Interior face.
 - b. Screen Location for Adjustable Louvers: Interior **OR** Exterior, **as directed**, face unless otherwise indicated.
 - c. Screening Type: Bird screening **OR** Bird screening except where insect screening is indicated **OR** Insect screening, **as directed**.
2. Secure screen frames to louver frames with stainless-steel machine screws **OR** machine screws with heads finished to match louver, **as directed**, spaced a maximum of 6 inches (150 mm) from each corner and at 12 inches (300 mm) o.c.
3. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.
 - a. Metal: Same kind and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips, **as directed**.
 - b. Finish: Same finish as louver frames to which louver screens are attached **OR** Mill finish unless otherwise indicated, **as directed**.
 - c. Type: Rewirable frames with a driven spline or insert **OR** Non-rewirable, U-shaped frames, **as directed**.
4. Louver Screening for Aluminum Louvers:
 - a. Bird Screening: Aluminum, 1/2-inch- (13-mm-) square mesh, 0.063-inch (1.60-mm) wire.
 - b. Bird Screening: Stainless steel, 1/2-inch- (13-mm-) square mesh, 0.047-inch (1.19-mm) wire.
 - c. Bird Screening: Flattened, expanded aluminum, 3/4 by 0.050 inch (19 by 1.27 mm) thick.
 - d. Insect Screening: Aluminum, 18-by-16 (1.4-by-1.6-mm) mesh, 0.012-inch (0.30-mm) wire.



- e. Insect Screening: Stainless steel, 18-by-18 (1.4-by-1.4-mm) mesh, 0.009-inch (0.23-mm) wire.
 5. Louver Screening for Galvanized-Steel Louvers:
 - a. Bird Screening: Galvanized steel, 1/2-inch- (13-mm-) square mesh, 0.041-inch (1.04-mm) wire.
 - b. Bird Screening: Stainless steel, 1/2-inch- (13-mm-) square mesh, 0.047-inch (1.19-mm) wire.
 - c. Insect Screening: Galvanized steel, 18-by-14 (1.4-by-1.8-mm) mesh, 0.011-inch (0.28-mm) wire.
 - d. Insect Screening: Stainless steel, 18-by-18 (1.4-by-1.4-mm) mesh, 0.009-inch (0.23-mm) wire.
 6. Louver Screening for Stainless-Steel Louvers:
 - a. Bird Screening: Stainless steel, 1/2-inch- (13-mm-) square mesh, 0.047-inch (1.19-mm) wire.
 - b. Insect Screening: Stainless steel, 18-by-18 (1.4-by-1.4-mm) mesh, 0.009-inch (0.23-mm) wire.
- J. Blank-Off Panels
1. Uninsulated, Blank-Off Panels: Metal sheet attached to back of louver.
 - a. Aluminum sheet for aluminum louvers, not less than 0.050-inch (1.27-mm) nominal thickness.
 - b. Galvanized-steel sheet for galvanized-steel louvers, not less than 0.040-inch (1.02-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal thickness.
 - c. Stainless-steel sheet for stainless-steel louvers, not less than 0.038-inch (0.95-mm) **OR** 0.050-inch (1.27-mm), **as directed**, nominal thickness, with grain running in same direction as grain of louver blades.
 - d. Panel Finish: Same finish applied to louvers **OR** Same type of finish applied to louvers, but black color, **as directed**.
 - e. Attach blank-off panels with clips **OR** sheet metal screws, **as directed**.
 2. Insulated, Blank-Off Panels: Laminated panels consisting of insulating core surfaced on back and front with metal sheets and attached to back of louver.
 - a. Thickness: 1 inch (25 mm) **OR** 2 inches (50 mm), **as directed**.
 - b. Metal Facing Sheets: Aluminum sheet, not less than 0.032-inch (0.81-mm) nominal thickness.
 - c. Metal Facing Sheets: Galvanized-steel sheet, not less than 0.028-inch (0.71-mm) nominal thickness.
 - d. Metal Facing Sheets: Stainless-steel sheet, not less than 0.031-inch (0.79-mm) nominal thickness.
 - e. Insulating Core: Rigid, glass-fiber-board insulation **OR** extruded-polystyrene foam, **as directed**.
 - f. Edge Treatment: Trim perimeter edges of blank-off panels with louver manufacturer's standard extruded-aluminum-channel frames, not less than 0.080-inch (2.03-mm) nominal thickness **OR** channel frames, **as directed**, with corners mitered and with same finish as panels.
 - g. Seal perimeter joints between panel faces and louver frames with gaskets or sealant.
 - h. Panel Finish: Same finish applied to louvers **OR** Same type of finish applied to louvers, but black color, **as directed**.
 - i. Attach blank-off panels with clips **OR** sheet metal screws, **as directed**.
- K. Wall Vents (Brick Vents)
1. Extruded-Aluminum Wall Vents:
 - a. Extruded-aluminum louvers and frames, not less than 0.125-inch (3.18-mm) nominal thickness, assembled by welding; with 18-by-14- (1.4-by-1.8-mm-) mesh, aluminum insect screening on inside face; incorporating weep holes, continuous drip at sill, and integral waterstop on inside edge of sill; of load-bearing design and construction.



- b. Dampers: Aluminum blades and frames mounted on inside of wall vents; operated from exterior with Allen wrench in socket-head cap screw. Fabricate operating mechanism from Type 304 stainless-steel components.
 - c. Finish: Mill finish.
 2. Cast-Aluminum Wall Vents:
 - a. One-piece, cast-aluminum louvers and frames; with 18-by-14- (1.4-by-1.8-mm-) mesh, aluminum insect screening on inside face; incorporating integral waterstop on inside edge of sill; of load-bearing design and construction.
 - b. Dampers: Aluminum blades and frames mounted on inside of wall vents; operated from exterior with Allen wrench in socket-head cap screw. Fabricate operating mechanism from Type 304 stainless-steel components.
 - c. Finish: Mill finish.
- L. Finishes, General
 1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- M. Aluminum Finishes
 1. Finish louvers after assembly.
 2. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm **OR** AA-M12C22A31, Class II, 0.010 mm, **as directed**, or thicker.
 3. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm **OR** AA-M12C22A32/A34, Class II, 0.010 mm, **as directed**, or thicker.
 - a. Color: As selected from full range of industry colors and color densities.
 4. Conversion-Coated Finish: AA-C12C42 (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating).
 5. Conversion-Coated and Factory-Primed Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below).
 - a. Organic Coating: Air-dried primer of not less than 2-mil (0.05-mm) dry film thickness.
 6. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 7. High-Performance Organic Finish: 2-coat fluoropolymer finish complying with AAMA 2604 **OR** AAMA 2605, **as directed**, and containing not less than 50 **OR** 70, **as directed**, percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 8. High-Performance Organic Finish: 3 **OR** 4, **as directed**, -coat fluoropolymer finish complying with AAMA 2605 and containing not less than 50 **OR** 70, **as directed**, percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
- N. Galvanized-Steel Sheet Finishes
 1. Finish louvers after assembly.
 2. Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas and repair according to ASTM A 780.
 3. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard 2-coat, baked-on finish consisting of prime coat and thermosetting



topcoat, with a minimum dry film thickness of 1 mil (0.025 mm) for topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).

a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

O. Stainless-Steel Sheet Finishes

1. Repair sheet finish by grinding and polishing irregularities, weld spatter, scratches, and forming marks to match surrounding finish.

1.3 EXECUTION

A. Installation

1. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.
2. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
3. Form closely fitted joints with exposed connections accurately located and secured.
4. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
5. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.
6. Protect unpainted galvanized and nonferrous-metal surfaces that will be in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.
7. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Division 07 Section "Joint Sealants" for sealants applied during louver installation.

B. Adjusting And Cleaning

1. Test operation of adjustable louvers and adjust as needed to produce fully functioning units that comply with requirements.
2. Clean exposed surfaces of louvers and vents that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.
3. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
4. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by the Owner, remove damaged units and replace with new units.
 - a. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 08 90 00 00



Task	Specification	Specification Description
08 91 16 00	08 90 00 00	Louvers And Vents
08 95 13 00	01 22 16 00	No Specification Required
08 95 16 00	01 22 16 00	No Specification Required
08 95 16 00	05 50 00 00	Metal Fabrications
08 95 16 00	05 73 00 00	Miscellaneous Ornamental Metals



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Task	Specification	Specification Description
09 01 30 91	09 31 00 00	Ceramic Tile



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SECTION 09 01 60 00 - PORTLAND CEMENT TERRAZZO FLOORING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for portland cement terrazzo flooring. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Poured-in-place portland cement terrazzo flooring and base.
 - b. Poured-in-place rustic terrazzo flooring.
 - c. Precast terrazzo units.

C. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:
 - a. Product Data for Credit MR 4.1 and Credit MR 4.2, **as directed**: For marble chips, aggregates, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - 1) Include statement that indicates cost for each product having recycled content.
 - b. Product Data for Credit EQ 4.1: For adhesives, including printed statement of VOC content.
3. Shop Drawings: Include terrazzo installation requirements. Include plans, elevations, sections, component details, and attachments to other work.
4. Samples: For each type, material, color, and pattern of terrazzo and accessory required showing the full range of color, texture, and pattern variations expected
5. Qualification data.
6. Material certificates.
7. Maintenance data.

D. Quality Assurance

1. Installer Qualifications: An installer who is a contractor member of NTMA.
2. NTMA Standards: Comply with NTMA's "Terrazzo Specifications and Design Guide" and with written recommendations for terrazzo type indicated unless more stringent requirements are specified.
3. Preinstallation Conference: Conduct conference at Project site.

E. Delivery, Storage, And Handling

1. Deliver materials to Project site in supplier's original wrappings and containers, labeled with source's or manufacturer's name, material or product brand name, and lot number if any.
2. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

F. Project Conditions

1. Environmental Limitations: Maintain temperature above 50 deg F (10 deg C) for 48 hours before and during terrazzo installation.
2. Weather Limitations: Proceed with rustic terrazzo installation only when forecasted weather conditions permit work to be performed according to NTMA's written recommendations and temperatures remain above 45 deg F (7.2 deg C).
3. Field Measurements: Verify actual dimensions of construction contiguous with precast terrazzo by field measurements before fabrication.



4. Control and collect dust produced by grinding operations. Protect adjacent construction from detrimental effects of grinding operations.
 - a. Provide dustproof partitions and temporary enclosures to limit dust migration and to isolate areas from noise.

1.2 PRODUCTS

A. Portland Cement Terrazzo

1. Portland Cement Terrazzo Type: Sand cushion **OR** Structural **OR** Bonded **OR** Monolithic **OR** Installed over metal deck, **as directed**.
2. Materials:
 - a. Portland Cement: ASTM C 150, Type 1.
 - 1) Color for Exposed Matrix: As required by mix indicated **OR** White **OR** Gray, **as directed**.
 - b. Water: Potable.
 - c. Sand: ASTM C 33.
 - d. Marble Chips **OR** Aggregates, **as directed**: Complying with NTMA gradation standards for mix indicated and containing no deleterious or foreign matter.
 - 1) Abrasion and Impact Resistance: Less than 40 percent loss per ASTM C 131 and ASTM C 535, **as directed**.
 - 2) 24-Hour Absorption Rate: Less than 0.75 percent.
 - 3) Dust Content: Less than 1.0 percent by weight.
 - e. Matrix Pigments: Pure mineral or synthetic pigments, alkali resistant, durable under exposure to sunlight, and compatible with terrazzo matrix.
 - f. Bonding Agent: Neat portland cement or epoxy or acrylic bonding agents formulated for use with topping indicated.
 - g. Underbed Reinforcement: Galvanized welded-wire reinforcement, 2 by 2 inches (51 by 51 mm) by 0.062-inch- (1.57-mm-) diameter wire, complying with ASTM A 185 and ASTM A 82, except for minimum wire size.
 - h. Isolation Membrane: Polyethylene sheeting, ASTM D 2103, Type 13300, 4 mils (0.1 mm) thick; or unperforated asphalt felt, ASTM D 226, Type I (No. 15).
3. Mixes:
 - a. Underbed (for structural portland cement terrazzo or portland cement terrazzo installed over metal deck): Structural-concrete underbed as specified in Division 03 Section "Cast-in-place Concrete".
 - b. Underbed (for sand-cushion or bonded portland cement terrazzo): Comply with NTMA's "Terrazzo Specifications and Design Guide" for terrazzo type indicated for component proportions and mixing.
 - c. Portland Cement Terrazzo (below for NTMA-formulated design mixes): Comply with NTMA's "Terrazzo Specifications and Design Guide" for terrazzo type indicated for matrix and marble-chip proportions and mixing.
 - 1) Formulated Mix Color and Pattern: As selected from NTMA standard-terrazzo plates **OR** As selected from NTMA Venetian-terrazzo plates, **as directed**.
 - d. Portland Cement Terrazzo (for custom design mixes): Comply with NTMA's "Terrazzo Specifications and Design Guide" for terrazzo type indicated for matrix and marble-chip **OR** aggregate, **as directed**, proportions and mixing.
 - 1) Custom Mix Color and Pattern: Match sample **OR** Match existing, **as directed**.

B. Rustic Terrazzo

1. Rustic Terrazzo Type: Structural **OR** Bonded **OR** Monolithic **OR** Unbonded, **as directed**.
2. Materials:
 - a. Portland Cement: ASTM C 150, Type 1.
 - 1) Color for Exposed Matrix: As required by mix indicated.
 - b. Water: Potable.



- c. Sand: ASTM C 33.
 - d. Marble Chips **OR** Aggregates, **as directed**: As required for mix indicated, sizes complying with NTMA gradation standards, 0.25 percent maximum 24-hour absorption rate, and containing no deleterious or foreign matter.
 - e. Matrix Pigments: Pure mineral or synthetic pigments, alkali resistant, durable under exposure to sunlight and weather, and compatible with matrix binder.
 - f. Air-Entraining Agent (for underbed of structural, bonded, or unbonded rustic terrazzo): Complying with NTMA's written recommendations and recommended by supplier for intended use.
 - g. Underbed Bonding Agent (for bonded rustic terrazzo): Neat portland cement.
 - h. Topping Bonding Agent (for monolithic rustic terrazzo): Neat portland cement, or epoxy or acrylic bonding agents formulated for use with topping indicated.
 - i. Isolation Membrane (for unbonded rustic terrazzo): Polyethylene sheeting, ASTM D 2103, Type 13300, 4 mils (0.1 mm) thick.
3. Mixes:
- a. Underbed (for structural or unbonded rustic terrazzo): Structural-concrete underbed as specified in Division 03 Section "Cast-in-place Concrete".
 - b. Underbed (for bonded rustic terrazzo): Comply with NTMA's "Terrazzo Specifications and Design Guide" for component proportions and mixing.
 - 1) Exterior Applications: Provide air-entraining agent.
 - c. Rustic Terrazzo (for NTMA-formulated design mixes): Comply with NTMA's "Terrazzo Specifications and Design Guide" for terrazzo type indicated for matrix and marble-chip proportions and mixing.
 - 1) Formulated Mix Color and Pattern: As selected from NTMA rustic-terrazzo plates.
 - d. Rustic Terrazzo (for custom design mixes): Comply with NTMA's "Terrazzo Specifications and Design Guide" for terrazzo type indicated for matrix and marble-chip **OR** aggregate, **as directed**, proportions and mixing.
 - 1) Custom Mix Color and Pattern: Match sample **OR** Match existing, **as directed**.
- C. Strip Materials
1. Standard Divider Strips: One-piece, flat-type strips for grouting into sawed joints prepared in concrete slab or underbed.
 - a. Material: As indicated **OR** White-zinc alloy **OR** Brass, **as directed**.
 - b. Depth: As indicated **OR** 3/4 inch (19 mm) **OR** 1-1/4 inches (32 mm) **OR** 2 inches (51 mm), **as directed**.
 - c. Width: As indicated **OR** 0.05 inch (1.27 mm) **OR** 1/8 inch (3.2 mm) **OR** 1/4 inch (6.4 mm), **as directed**.
 2. Heavy-Top Divider Strips: One-piece, flat-type strips for grouting into sawed joints prepared in concrete slab or underbed.
 - a. Base-Section Material: As indicated **OR** White-zinc alloy **OR** Galvanized steel, **as directed**.
 - b. Top-Section Material: As indicated **OR** White-zinc alloy **OR** Brass **OR** Plastic, in color selected from manufacturer's full range, **as directed**.
 - c. Depth: As indicated **OR** 3/4 inch (19 mm) **OR** 1-1/4 inches (32 mm) **OR** 2 inches (51 mm), **as directed**.
 - d. Top-Section Width: As indicated **OR** 1/8 inch (3.2 mm) **OR** 1/4 inch (6.4 mm) **OR** 1/2 inch (12.7 mm), **as directed**.
 3. Heavy-Top Angle Divider Strips: One-piece, L-type angle strips with anchoring device and in depth required for topping thickness indicated.
 - a. Material: As indicated **OR** White-zinc alloy **OR** Brass **OR** Plastic, in color selected from manufacturer's full range, **as directed**.
 - b. Top-Section Width: As indicated **OR** 1/8 inch (3.2 mm) **OR** 1/4 inch (6.4 mm) **OR** 3/8 inch (9.5 mm) **OR** 1/2 inch (12.7 mm), **as directed**.
 4. Control-Joint Strips: Separate, double L-type angles, positioned back to back, that match material, thickness, and color of divider strips and in depth required for topping thickness indicated.



5. Expansion-Joint Strips (for structural portland cement terrazzo or for any type of rustic terrazzo): Brass **OR** Plastic strips in color selected from manufacturer's full range, **as directed**, with removable zip-strip top for installing sealant; in width indicated **OR** minimum 1/2 inch (12.7 mm) wide, **as directed**.
 6. Accessory Strips: Match divider strip width, material, and color unless otherwise indicated. Use the following types of accessory strips as required to provide a complete installation:
 - a. Base-bead strips for exposed top edge of terrazzo base.
 - b. Edge-bead strips for exposed edges of terrazzo.
 - c. Nosings for terrazzo stair treads and landings.
 7. Abrasive Strips (for terrazzo stair treads and landings): Silicon carbide or aluminum oxide, or combination of both, in epoxy-resin binder and set in channel.
 - a. Width: 1/2 inch (12.7 mm).
 - b. Depth: As required by terrazzo thickness.
 - c. Length: 4 inches (100 mm) less than stair width **OR** As indicated, **as directed**.
 - d. Color: As selected from manufacturer's full range.
- D. Miscellaneous Accessories
1. Strip Adhesive: Adhesive recommended by manufacturer for this use.
 - a. Use adhesives that have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Anchoring Devices:
 - a. Strips: Provide mechanical anchoring devices for strip materials as required for secure attachment to substrate.
 - b. Precast Terrazzo: Provide mechanical anchoring devices as recommended by fabricator for proper anchorage and support of units for conditions of installation and support.
 3. Isolation and Expansion-Joint Material: Closed-cell polyethylene foam, nonabsorbent to liquid water and gas, and nonoutgassing in unruptured state; butyl rubber; rubber; or cork; in width indicated **OR** minimum 1/2 inch (12.7 mm) wide, **as directed**.
 4. Portland Cement Terrazzo Cleaner: Chemically neutral cleaner with pH factor between 7 and 10 that is biodegradable, phosphate free, and recommended by cleaner manufacturer for use on terrazzo type indicated.
 5. Rustic Terrazzo Cleaner: Solution of muriatic acid and water for use on terrazzo type indicated.
 6. Sealer: Slip- and stain-resistant, penetrating-type sealer that is chemically neutral with pH factor between 7 and 10; does not affect color or physical properties of terrazzo; is recommended by sealer manufacturer; and complies with NTMA's "Terrazzo Specifications and Design Guide" for terrazzo type indicated.
 - a. Rustic Terrazzo: Use solvent acrylic-type sealer.
- E. Precast Terrazzo
1. Precast Terrazzo Base Units: Minimum 3/4-inch- (19-mm-) thick, reinforced portland cement terrazzo units cast in maximum lengths possible, but not less than 36 inches (900 mm).
 - a. Type: As indicated **OR** Coved with minimum 3/4-inch (19-mm) radius **OR** Straight **OR** Splayed, **as directed**.
 - b. Top Edge: Straight, unfinished if top edge is concealed **OR** Beveled with polished top surface **OR** Radius edge with polished top surface, **as directed**.
 - c. Metal Toe Strip (for coved-toe bases): Zinc **OR** Brass, **as directed**.
 - d. Outside Corner Units: With finished returned edges at outside corner.
 - e. Color, Pattern, and Finish: As selected from manufacturer's full range **OR** Match sample **OR** Match adjacent poured-in-place terrazzo flooring, **as directed**.
 2. Precast Terrazzo Units for Stair Treads, Thresholds, Sills, Benches and Planters: Comply with NTMA's written recommendations for fabricating precast terrazzo units in sizes and profiles indicated. Reinforce units as required by unit sizes, profiles, and thicknesses and as recommended by manufacturer.
 - a. Stair Treads: Three-line **OR** Two-line **OR** One-line **OR** Abrasive nosing strip and two-line, **as directed**, abrasive inserts at nosings.



- b. Color, Pattern, and Finish: As selected from manufacturer's full range **OR** Match sample **OR** Match adjacent poured-in-place terrazzo flooring, **as directed**.
3. Precast Terrazzo Finishing (for custom precast terrazzo components):
 - a. Finish exposed-to-view edges or reveals to match face finish.
 - b. Ease exposed edges to 1/8-inch (3-mm) radius.

1.3 EXECUTION

A. Preparation

1. Clean substrates to produce clean, dry, and neutral substrate for terrazzo application.
 - a. Remove substances, including oil, grease, and curing compounds, that might impair bond of terrazzo system.
 - b. Roughen concrete substrates before installing terrazzo system according to NTMA's written recommendations.
2. Protect other work from dust generated by grinding operations. Control dust to prevent air pollution and comply with environmental protection regulations.
 - a. Erect and maintain temporary enclosures and other suitable methods to limit dust migration and to ensure adequate ambient temperatures and ventilation conditions during installation.

B. Installation, General

1. Comply with NTMA's written recommendations for terrazzo and accessory installation.
2. Installation Tolerance: Limit variation in terrazzo surface from level to 1/4 inch in 10 feet (6 mm in 3 m); noncumulative.
3. Structural Portland Cement **OR** Structural Rustic **OR** Bonded Rustic **OR** Monolithic Rustic **OR** Unbonded Rustic, **as directed**, Terrazzo: Install isolation and expansion material where terrazzo and underbed abut **OR** terrazzo abuts, **as directed**, adjacent construction and directly above substrate expansion joints.
4. Underbed (for structural portland cement terrazzo or portland cement terrazzo installed over metal deck, or for structural or unbonded rustic terrazzo): Install structural-concrete underbed according to requirements specified in Division 03 Section "Cast-in-place Concrete".
5. Underbed (for sand-cushion or bonded portland cement terrazzo or for bonded rustic terrazzo):
 - a. Comply with NTMA's "Terrazzo Specifications and Design Guide" for underbed installation.
 - b. For sand-cushion portland cement terrazzo only:
 - 1) Cover entire surface to receive terrazzo with dusting of sand.
 - 2) Install isolation membrane over sand, overlapping ends and edges a minimum of 3 inches (75 mm).
 - 3) Install welded wire reinforcement, overlapping at edges and ends at least two squares. Stop mesh a minimum of 1 inch (25 mm) short of expansion joints.
 - c. Place underbed and screed to elevation indicated below finished floor elevation.
6. Strip Materials:
 - a. Divider and Control-Joint Strips:
 - 1) Locate divider strips over each edge of steel beams and girders **OR** centered over steel beams and joists **OR** directly over control joints, breaks, and saw cuts in concrete slabs **OR** in locations indicated, **as directed**.
 - 2) Install control-joint strips back to back and directly above concrete-slab control joints **OR** in locations indicated, **as directed**.
 - 3) Install control-joint strips with 1/4-inch (6.4-mm) gap between strips, and install sealant in gap.
 - 4) Install strips in adhesive setting bed without voids below strips, or mechanically anchor strips as required to attach strips to substrate, as recommended by strip manufacturer.
 - b. Expansion-Joint Strips (for structural portland cement terrazzo or for any type of rustic terrazzo): Form expansion joints using divider strips and install directly above concrete-slab expansion joints.



- c. Accessory Strips: Install accessory strips as required to provide a complete installation.
 - d. Abrasive Strips: Install with surface of abrasive strip positioned 1/16 inch (1.6 mm) **OR** 1/32 inch (0.8 mm), **as directed**, higher than terrazzo surface.
7. Repair: Cut out and replace terrazzo areas that evidence lack of bond with substrate or underbed, including areas that emit a "hollow" sound if tapped. Cut out terrazzo areas in panels defined by strips and replace to match adjacent terrazzo, or repair panels according to NTMA's written recommendations, as approved by the Owner.
- C. Portland Cement Terrazzo Installation
1. Pour in place, cure, and finish portland cement terrazzo according to NTMA's "Terrazzo Specifications and Design Guide" for terrazzo type indicated.
 2. Terrazzo Topping Thickness: As indicated.
 3. Finishing:
 - a. Seed additional marble chips **OR** aggregates, **as directed**, in matrix to uniformly distribute granular material on surface.
 - b. Delay fine grinding until heavy trade work is complete and construction traffic through area is restricted.
 - c. Fine Grinding: Grind with stones 120 grit or finer until all grout is removed from surface. Repeat rough grinding, grout coat, and fine grinding if large voids exist after initial fine grinding. Produce surface with a minimum of 70 percent aggregate exposure.
- D. Rustic Terrazzo Installation
1. Pour in place, cure, and finish rustic terrazzo according to NTMA's "Terrazzo Specifications and Design Guide" for terrazzo type indicated.
 2. Terrazzo Topping Thickness: As indicated.
 3. Finishing:
 - a. Seed additional marble chips **OR** aggregates, **as directed**, in matrix to uniformly distribute granular material on surface.
- E. Precast Terrazzo Installation
1. Install precast terrazzo units using method recommended by NTMA and manufacturer unless otherwise indicated.
 2. Installation Tolerance: Set units with alignment level and true to dimensions, varying 1/8 inch (3.2 mm) maximum in length, height, or width; noncumulative.
 3. Do not install units that are chipped, cracked, discolored, or improperly finished.
 4. Seal joints between units with cement grout matching precast terrazzo matrix **OR** joint sealant, **as directed**.
- F. Cleaning And Protection
1. Portland Cement Terrazzo and Precast Terrazzo Cleaning:
 - a. Remove grinding dust from installation and adjacent areas.
 - b. Wash surfaces with cleaner immediately after grouting precast terrazzo units and final cleaning of terrazzo flooring.
 - c. Wash surfaces with cleaner according to NTMA's written recommendations and manufacturer's written instructions; rinse surfaces with water and allow to dry thoroughly.
 2. Rustic Terrazzo Cleaning: Clean surfaces with 1:10 solution of muriatic acid in water. Legally contain and dispose of runoff from cleaning operations. Rinse surfaces with water and allow to dry thoroughly.
 3. Sealing:
 - a. Seal surfaces according to NTMA's written recommendations.
 - b. Apply sealer according to sealer manufacturer's written instructions.
 4. Protection: Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure that terrazzo is without damage or deterioration at time of Final Completion.



END OF SECTION 09 01 60 00



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SECTION 09 01 60 00a - CARPET

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for carpet. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Tufted carpet.
 - b. Woven carpet.
 - c. Carpet cushion.

C. Submittals

1. Product Data: For each product indicated.
2. Shop Drawings: Show the following:
 - a. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet.
 - b. Existing flooring materials to be removed.
 - c. Existing flooring materials to remain.
 - d. Carpet type, color, and dye lot.
 - e. Locations where dye lot changes occur.
 - f. Seam locations, types, and methods.
 - g. Type of subfloor.
 - h. Type of installation.
 - i. Pattern type, repeat size, location, direction, and starting point.
 - j. Pile direction.
 - k. Type, color, and location of insets and borders.
 - l. Type, color, and location of edge, transition, and other accessory strips.
 - m. Transition details to other flooring materials.
 - n. Type of carpet cushion.
3. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
 - a. Carpet: 12-inch- (300-mm-) square Sample.
 - b. Exposed Edge, Transition, and other Accessory Stripping: 12-inch- (300-mm-) long Samples.
 - c. Carpet Cushion: 6-inch- (150-mm-) square Sample.
 - d. Carpet Seam: 6-inch (150-mm) Sample.
 - e. Mitered Carpet Border Seam: 12-inch- (300-mm-) square Sample. Show carpet pattern alignment.
4. LEED Submittals:
 - a. Product Data for Credit EQ 4.3:
 - 1) For carpet, documentation indicating compliance with testing and product requirements of Carpet and Rug Institute's "Green Label Plus" program.
 - 2) For carpet cushion, documentation indicating compliance with testing and product requirements of Carpet and Rug Institute's "Green Label" program.
 - 3) For installation adhesive, including printed statement of VOC content.
5. Product Schedule: For carpet and carpet cushion. Use same designations indicated on Drawings.
6. Maintenance data.



- D. Quality Assurance
1. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.
 2. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated in Part 1.2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
 3. Preinstallation Conference: Conduct conference at Project site.
- E. Delivery, Storage, And Handling
1. Comply with CRI 104, Section 5, "Storage and Handling."
- F. Project Conditions
1. Comply with CRI 104, Section 7.2, "Site Conditions; Temperature and Humidity" and Section 7.12, "Ventilation."
 2. Environmental Limitations: Do not install carpet and carpet cushion until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
 3. Do not install carpet and carpet cushion over concrete slabs until slabs have cured, are sufficiently dry to bond with adhesive, and have pH range recommended by carpet manufacturer.
 4. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.
- G. Warranty
1. Special Warranty for Carpet: Manufacturer's standard form in which manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period.
 - a. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse.
 - b. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, loss of tuft bind strength, excess static discharge, and delamination.
 - c. Warranty Period: 10 years from date of Final Completion.
 2. Special Warranty for Carpet Cushion: Manufacturer's standard form in which manufacturer agrees to repair or replace components of carpet cushion installation that fail in materials or workmanship within specified warranty period.
 - a. Warranty includes consequent removal and replacement of carpet and accessories.
 - b. Warranty does not include deterioration or failure of carpet cushion due to unusual traffic, failure of substrate, vandalism, or abuse.
 - c. Failure includes, but is not limited to, permanent indentation or compression.
 - d. Warranty Period: 10 years from date of Final Completion.

1.2 PRODUCTS

- A. Tufted Carpet
1. Fiber Content: 100 percent nylon 6, 6 **OR** 100 percent nylon 6 **OR** 100 percent polypropylene, **as directed**.
 2. Pile Characteristic: Level-loop **OR** Cut **OR** Cut-and-loop **OR** Multilevel-loop **OR** Level tip shear **OR** Random shear **OR** Frieze **OR** Sculptured, **as directed**, pile.
 3. Yarn Twist: as directed by the Owner.
 4. Yarn Count: as directed by the Owner.
 5. Density: as directed by the Owner.
 6. Pile Thickness: finished carpet per ASTM D 6859.
 7. Stitches: as directed by the Owner.
 8. Gage: as directed by the Owner.
 9. Face Weight: as directed by the Owner.



10. Total Weight: for finished carpet.
 11. Primary Backing: Manufacturer's standard material **OR** Woven polypropylene **OR** Nonwoven, polypropylene or polyester, **as directed**.
 12. Secondary Backing: Manufacturer's standard material **OR** Woven polypropylene **OR** Nonwoven, polypropylene or polyester **OR** Woven jute **OR** Fiberglass, **as directed**.
 13. Backcoating: Manufacturer's standard material **OR** SBR latex **OR** PVC **OR** Thermoplastic copolymer, **as directed**.
 14. Width: 12 feet (3.7 m) **OR** 6 feet (1.8 m) **OR** 13.5 feet (4.1 m) **OR** 15 feet (4.6 m), **as directed**.
 15. Applied Soil-Resistance Treatment: Manufacturer's standard material.
 16. Antimicrobial Treatment: Manufacturer's standard material.
 17. Performance Characteristics: As follows:
 - a. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm **OR** 0.22 W/sq. cm, **as directed**.
 - b. Dry Breaking Strength: Not less than 100 lbf (445 N) per ASTM D 2646.
 - c. Tuft Bind: Not less than 3 lbf (13 N) **OR** 5 lbf (22 N) **OR** 6.2 lbf (28 N) **OR** 8 lbf (36 N) **OR** 10 lbf (45 N), **as directed**, per ASTM D 1335.
 - d. Delamination: Not less than 2.5 lbf/in. (12 N/mm) **OR** 3.5 lbf/in. (15 N/mm) **OR** 4 lbf/in. (18 N/mm), **as directed**, per ASTM D 3936.
 - e. Resistance to Insects: Comply with AATCC 24.
 - f. Noise Reduction Coefficient (NRC): per ASTM C 423.
 - g. Colorfastness to Crocking: Not less than 4, wet and dry, per AATCC 165.
 - h. Colorfastness to Light: Not less than 4 after 40 **OR** 60, **as directed**, AFU (AATCC fading units) per AATCC 16, Option E.
 - i. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria; not less than 1-mm halo of inhibition for gram-negative bacteria; no fungal growth; per AATCC 174.
 - j. Electrostatic Propensity: Less than 3.5 **OR** 2, **as directed**, kV per AATCC 134.
 - k. Environmental Requirements: Provide carpet that complies with testing and product requirements of Carpet and Rug Institute's "Green Label Plus" program.
- B. Woven Carpet
1. Fiber Content: 100 percent wool **OR** 80 percent wool; 20 percent nylon 6, 6 **OR** 80 percent wool; 20 percent nylon 6, **as directed**.
 2. Face Construction: Axminster **OR** Wilton **OR** Velvet, **as directed**.
 3. Pile Characteristic: Level-loop **OR** Cut **OR** Cut-and-loop, **as directed**, pile.
 4. Yarn Twist: as directed by the Owner.
 5. Yarn Count: as directed by the Owner.
 6. Density: as directed by the Owner.
 7. Pile Thickness: for finished carpet per ASTM D 6859.
 8. Rows: as directed by the Owner.
 9. Pitch: as directed by the Owner.
 10. Face Weight: as directed by the Owner.
 11. Total Weight: as directed by the Owner., for finished carpet.
 12. Backing: Manufacturers standard **OR** As follows, **as directed**:
 - a. Chain Warp: as directed by the Owner.
 - b. Stuffer Warp: as directed by the Owner.
 - c. Shot or Fill Weft: as directed by the Owner.
 - d. Backcoating: as directed by the Owner.
 13. Applied Soil-Resistance Treatment: Manufacturer's standard material.
 14. Performance Characteristics: As follows:
 - a. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm **OR** 0.22 W/sq. cm, **as directed**.
 - b. Dry Breaking Strength: Not less than 100 lbf (445 N) per ASTM D 2646.
 - c. Resistance to Insects: Comply with AATCC 24.
 - d. Noise Reduction Coefficient (NRC): per ASTM C 423.
 - e. Colorfastness to Crocking: Not less than 4, wet and dry, per AATCC 165.



- f. Colorfastness to Light: Not less than 4 after 40 **OR** 60, **as directed**, AFU (AATCC fading units) per AATCC 16, Option E.
- g. Electrostatic Propensity: Less than 3.5 **OR** 2, **as directed**, kV per AATCC 134.
- h. Environmental Requirements: Provide carpet that complies with testing and product requirements of Carpet and Rug Institute's "Green Label Plus" program.

C. Carpet Cushion

1. Traffic Classification: CCC Class I, moderate **OR** II, heavy **OR** III, extra-heavy, **as directed**, traffic.
2. Fiber Cushion: Rubberized hair, mothproofed and sterilized **OR** Rubberized jute, mothproofed and sterilized **OR** Synthetic **OR** Resinated, recycled textile, **as directed**.
 - a. Weight: as directed by the Owner.
 - b. Thickness: as directed by the Owner.plus 5 percent maximum.
 - c. Density: as directed by the Owner.
3. Rubber Cushion: Flat **OR** Rippled waffle **OR** Textured flat **OR** Reinforced, **as directed**.
 - a. Weight: as directed by the Owner.
 - b. Thickness: as directed by the Owner.plus 5 percent maximum.
 - c. Compression Resistance: at 25 **OR** 65, **as directed**, percent per ASTM D 3676.
 - d. Density: as directed by the Owner.
4. Polyurethane-Foam Cushion: Grafted prime **OR** Densified **OR** Bonded **OR** Mechanically frothed, **as directed**.
 - a. Compression Force Deflection at 65 Percent: per ASTM D 3574.
 - b. Thickness: as directed by the Owner.
 - c. Density: as directed by the Owner.
5. Performance Characteristics: As follows:
 - a. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm **OR** 0.22 W/sq. cm, **as directed**.
 - b. Noise Reduction Coefficient (NRC): per ASTM C 423.
 - c. Environmental Requirements: Provide carpet cushion that complies with testing and product requirements of Carpet and Rug Institute's "Green Label" program.

D. Installation Accessories

1. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet **OR** carpet cushion, **as directed**, manufacturer.
2. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and is recommended or provided by carpet manufacturer **OR** carpet and carpet cushion manufacturers, **as directed**.
 - a. VOC Limits: Provide adhesives with VOC content not more than 50g/L when calculated according to 40 CFR 59, Subpart D (EPA method 24).
3. Tackless Carpet Stripping: Water-resistant plywood, in strips as required to match cushion thickness and that comply with CRI 104, Section 12.2.
4. Seam Adhesive: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for sealing and taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.
5. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

1.3 EXECUTION

A. Preparation

1. General: Comply with CRI 104, Section 7.3, "Site Conditions; Floor Preparation," and with carpet manufacturer's written installation instructions for preparing substrates.



2. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider, and protrusions more than 1/32 inch (0.8 mm), unless more stringent requirements are required by manufacturer's written instructions.
3. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet **OR** carpet cushion, **as directed**, manufacturer.
4. Broom and vacuum clean substrates to be covered immediately before installing carpet.

B. Installation

1. Comply with CRI 104 and carpet manufacturer's **OR** carpet and carpet cushion manufacturers', **as directed**, written installation instructions for the following:
 - a. Direct-Glue-Down Installation: Comply with CRI 104, Section 9, "Direct Glue-Down Installation."
 - b. Double-Glue-Down Installation: Comply with CRI 104, Section 10, "Double Glue-Down Installation."
 - c. Carpet with Attached-Cushion Installation: Comply with CRI 104, Section 11, "Attached-Cushion Installations."
 - d. Preapplied Adhesive Installation: Comply with CRI 104, Section 11.4, "Pre-Applied Adhesive Systems (Peel and Stick)."
 - e. Hook-and-Loop Installation: Comply with CRI 104, Section 11.5, "Hook and Loop Technology."
 - f. Stretch-in Installation: Comply with CRI 104, Section 12, "Stretch-in Installation."
 - g. Stair Installation: Comply with CRI 104, Section 13, "Carpet on Stairs" for stretch-in **OR** glue-down, **as directed**, installation.
2. Comply with carpet manufacturer's written recommendations and Shop Drawings for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.
 - a. Bevel adjoining border edges at seams with hand shears **OR** Level adjoining border edges, **as directed**.
3. Do not bridge building expansion joints with carpet.
4. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.
5. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
6. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.
7. Install pattern parallel to walls and borders to comply with CRI 104, Section 15, "Patterned Carpet Installations" and with carpet manufacturer's written recommendations.
8. Comply with carpet cushion manufacturer's written recommendations. Install carpet cushion seams at 90-degree angle with carpet seams.

C. Cleaning And Protecting

1. Perform the following operations immediately after installing carpet:
 - a. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
 - b. Remove yarns that protrude from carpet surface.
 - c. Vacuum carpet using commercial machine with face-beater element.
2. Protect installed carpet to comply with CRI 104, Section 16, "Protection of Indoor Installations."
3. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer and carpet cushion manufacturer **OR** and carpet adhesive manufacturer **OR** and carpet cushion and adhesive manufacturers, **as directed**.



END OF SECTION 09 01 60 00a



Task	Specification	Specification Description
09 01 60 00	07 91 23 00	Joint Sealants
09 01 60 00	09 68 13 00	Carpet Tile
09 05 71 00	09 31 00 00	Ceramic Tile



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SECTION 09 22 13 00 - GYPSUM PLASTER

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for gypsum plaster. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Gypsum plasterwork on expanded-metal lath, unit masonry and monolithic concrete.
 - b. Solid-plaster partitions.

C. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:
 - a. Product Data for Credit MR 4.1 and Credit MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - 1) Include statement indicating costs for each product having recycled content.
 - b. Product Data for Credit EQ 4.1: For sealants, including printed statement of VOC content.
3. Shop Drawings: Show locations and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other work.

D. Quality Assurance

1. Fire-Resistance Ratings: Where indicated, provide gypsum plaster assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
2. Sound Transmission Characteristics: Where indicated, provide gypsum plaster assemblies identical to those of assemblies tested for STC ratings per ASTM E 90 and classified according to ASTM E 413 by a qualified testing agency.

E. Delivery, Storage, And Handling

1. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

F. Project Conditions

1. Comply with ASTM C 842 requirements or gypsum plaster manufacturer's written recommendations, whichever are more stringent.
2. Room Temperatures: Maintain temperatures at not less than 55 deg F (13 deg C) or greater than 80 deg F (27 deg C) for at least seven days before application of gypsum plaster, continuously during application, and for seven days after plaster has set or until plaster has dried.
3. Avoid conditions that result in gypsum plaster drying out too quickly.
 - a. Distribute heat evenly; prevent concentrated or uneven heat on plaster.
 - b. Maintain relative humidity levels for prevailing ambient temperature that produce normal drying conditions.
 - c. Ventilate building spaces in a manner that prevents drafts of air from contacting surfaces during plaster application and until plaster is dry.



1.2 PRODUCTS

A. Steel Framing For Solid-Plaster Partitions

1. Components, General: Comply with ASTM C 841. For steel sheet components not included in ASTM C 841, comply with ASTM C 645 requirements for metal unless otherwise indicated.
2. Channel Studs: Cold-rolled channels, 3/4 inch (19.1 mm) **OR** 1-1/2 inches (38.1 mm), **as directed**, deep.
3. Runners: L-runners with perforated or plain legs to suit lath attachment requirements, in 0.033-inch (0.84-mm) base-metal thickness where attached to overhead support and in 0.043-inch (1.1-mm) base-metal thickness where attached to floor.

B. Expanded-Metal Lath

1. Expanded-Metal Lath: ASTM C 847, cold-rolled carbon-steel sheet, ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coated.
 - a. Recycled Content: Provide steel products with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
 - b. Paper Backing: Kraft paper factory bonded to back of lath.
 - c. Diamond-Mesh Lath: Flat **OR** Self-furring, **as directed**, 2.5 lb/sq. yd. (1.4 kg/sq. m) **OR** 3.4 lb/sq. yd. (1.8 kg/sq. m), **as directed**.
 - d. Flat Rib Lath: Rib depth of not more than 1/8 inch (3.1 mm), 2.75 lb/sq. yd. (1.5 kg/sq. m) **OR** 3.4 lb/sq. yd. (1.8 kg/sq. m), **as directed**.
 - e. 3/8-Inch (9.5-mm) Rib Lath: 3.4 lb/sq. yd. (1.8 kg/sq. m) **OR** 4 lb/sq. yd. (2.2 kg/sq. m), **as directed**.

C. Accessories

1. General: Comply with ASTM C 841 and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.
2. Metal Accessories:
 - a. Cornerite: Fabricated from expanded-metal lath with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coating.
 - b. Striplath: Fabricated from expanded-metal lath with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coating.
 - c. Cornerbeads: Fabricated from zinc or zinc-coated (galvanized) steel.
 - 1) Small nose cornerbead with expanded flanges; use unless otherwise indicated.
 - 2) Small nose cornerbead with perforated flanges; use on curved corners.
 - 3) Small nose cornerbead with expanded flanges reinforced by perforated stiffening rib; use on columns and for finishing unit masonry corners.
 - 4) Bull nose cornerbead, radius 3/4 inch (19.1 mm) minimum, with expanded flanges; use at locations indicated on Drawings.
 - d. Casing Beads: Fabricated from zinc or zinc-coated (galvanized) steel; square-edged style; with expanded flanges.
 - e. Control Joints: Fabricated from zinc or zinc-coated (galvanized) steel; one-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
 - f. Expansion Joints: Fabricated from zinc or zinc-coated (galvanized) steel; folded pair of unperforated screeds in M-shaped configuration; with expanded flanges.
 - g. Two-Piece Expansion Joints: Fabricated from zinc or zinc-coated (galvanized) steel; formed to produce slip-joint and square-edged reveal that is adjustable from 1/4 to 5/8 inch (6 to 16 mm) wide; with perforated flanges.
3. Plastic Accessories: Fabricated from high-impact PVC.
 - a. Cornerbeads: With perforated flanges.
 - 1) Small nose cornerbead; use unless otherwise indicated.
 - 2) Bull nose cornerbead, radius 3/4 inch (19.1 mm) minimum; use at locations indicated on Drawings.



- b. Casing Beads: With perforated flanges in depth required to suit plaster bases indicated and flange length required to suit applications indicated.
 - 1) Square-edge style; use unless otherwise indicated.
 - 2) Bull-nose style, radius 3/4 inch (19.1 mm) minimum; use at locations indicated on Drawings.
 - c. Control Joints: One-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
 - d. Expansion Joints: Two-piece type, formed to produce slip-joint and square-edged 1/2-inch- (13-mm-) **OR** 1-inch- (25.4-mm-) **OR** 1-1/2-inch- (38.1-mm-), **as directed**, wide reveal; with perforated concealed flanges.
4. Aluminum Trim: Extruded accessories of profiles and dimensions indicated on Drawings.
- a. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221 (ASTM B 221M), Alloy 6063-T5.
 - b. Finish: Mill **OR** Chemical-conversion coating, ASTM D 1730, Type B, compatible with field-applied finish coatings specified, **as directed**.
- D. Miscellaneous Materials
1. Water for Mixing and Finishing Plaster: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.
 2. Bonding Compound: ASTM C 631.
 3. Steel Drill Screws: For metal-to-metal fastening, ASTM C 1002 or ASTM C 954, as required by thickness of metal being fastened; with pan head that is suitable for application; in lengths required to achieve penetration through joined materials of no fewer than three exposed threads.
 4. Fasteners for Attaching Metal Lath to Substrates: Complying with ASTM C 841.
 5. Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, not less than 0.0475-inch (1.21-mm) diameter, unless otherwise indicated.
 6. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - a. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of rated assembly.
 - b. Recycled Content: Provide blankets with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 25 percent by weight.
 7. Acoustical Sealant: As specified in Division 7 Section "Joint Sealants."
 - a. Provide sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. Base-Coat Plaster Materials
1. Base-Coat Plasters, General: ASTM C 28/C 28M.
 2. Lightweight Gypsum Ready-Mixed Plaster: With mill-mixed perlite aggregate.
 3. Gypsum Neat Plaster: For use with job-mixed aggregates.
 4. Gypsum Wood-Fibered Plaster:
 5. High-Strength Gypsum Neat Plaster: With a minimum, average, dry compressive strength of 2800 psi (19 MPa) per ASTM C 472 for a mix of 100 lb (45 kg) of plaster and 2 cu. ft. (0.06 cu. m) of sand.
 6. Aggregates for Base-Coat Plasters: ASTM C 35, sand and perlite.
- F. Finish-Coat Plaster Materials
1. Gypsum Gaging Plaster: ASTM C 28/C 28M.
 2. Gypsum Ready-Mixed Finish Plaster: Manufacturer's standard, mill-mixed, gaged, interior finish.
 3. High-Strength Gypsum Gaging Plaster: ASTM C 28/C 28M, with a minimum, average, dry compressive strength of 5000 psi (34 MPa) per ASTM C 472 for a neat mix.
 4. Gypsum Keene's Cement: ASTM C 61/C 61M.
 5. Lime: ASTM C 206, Type S, special finishing hydrated lime.



6. Lime: ASTM C 206, Type N, normal finishing hydrated lime.
7. Aggregates for Float Finishes: ASTM C 35, sand **OR** perlite, **as directed**; graded per ASTM C 842.

G. Plaster Mixes

1. Mixing: Comply with ASTM C 842 and manufacturer's written instructions for applications indicated.

1.3 EXECUTION

A. Examination

1. Examine nonstructural and structural metal framing, substrates, and hollow-metal frames, for compliance with requirements and other conditions affecting performance of the Work.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Preparation

1. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.

C. Installation, General

1. Fire-Resistance-Rated Assemblies: Install components according to requirements for design designations from listing organization and publication indicated on Drawings.
2. STC-Rated Assemblies: Install components according to requirements for design designations from listing organization and publication indicated on Drawings.
 - a. Seal construction at perimeters, behind control and expansion joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations.
 - b. Comply with ASTM C 919 and manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
3. Sound Attenuation Blankets: Where required, install blankets before installing lath unless blankets are readily installed after lath has been installed on one side.
4. Acoustical Sealant: Where required, seal joints between edges of plasterwork and abutting construction with acoustical sealant.

D. Installing Steel Framing For Solid-Plaster Partitions

1. Install according to ASTM C 841.
2. Framing for Solid-Plaster Partitions: Provide channel stud to support expanded-metal lath construction.
 - a. Space channel studs at 16 inches (406 mm) **OR** 24 inches (610 mm), **as directed**, o.c. unless otherwise indicated.
3. Framing for Studless Solid-Plaster Partition: Provide top and bottom L-track runners to support expanded-metal lath.

E. Installing Expanded-Metal Lath

1. Expanded-Metal Lath: Install according to ASTM C 841.
 - a. Partition Framing and Vertical Furring: Install flat diamond-mesh **OR** flat rib, **as directed**, lath.
 - b. Flat-Ceiling and Horizontal Framing: Install flat diamond-mesh **OR** flat rib, **as directed**, lath.
 - c. Curved-Ceiling Framing: Install flat diamond-mesh lath.
 - d. On Solid Surfaces, Not Otherwise Furred: Install self-furring, diamond-mesh lath.
 - e. Solid-Plaster Partitions: Where supported by channel studs, install flat rib **OR** flat diamond-mesh, **as directed**, lath.



- f. Studless Solid-Plaster Partitions: Install 3/8-inch (9.5-mm) rib lath.

F. Installing Accessories

1. General: Install according to ASTM C 841.
2. Cornerbeads: Install at external corners.
3. Casing Beads: Install at terminations of plasterwork, except where plaster passes behind and is concealed by other work and where metal screeds, bases, or frames act as casing beads.
4. Control Joints: Install control joints at locations indicated on Drawings **OR** with spacing between joints in either direction not exceeding the following and in specific locations approved by Architect for visual effect, **as directed**:
 - a. Partitions: 30 feet (9 m).
 - b. Ceilings: 50 feet (15 m) **OR** 30 feet (9 m), **as directed**.

G. Plaster Application

1. General: Comply with ASTM C 842.
 - a. Do not deviate more than plus or minus 1/8 inch in 10 feet (3.1 mm in 3 m) from a true plane in finished plaster surfaces, as measured by a 10-foot (3-m) straightedge placed on surface.
 - b. Grout hollow-metal frames, bases, and similar work occurring in plastered areas, with base-coat plaster material, before lathing where necessary. Except where full grouting is indicated or required for fire-resistance rating, grout at least 6 inches (152 mm) at each jamb anchor.
 - c. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.
 - d. Provide plaster surfaces that are ready to receive field-applied finishes indicated.
2. Bonding Compound: Apply on unit masonry and concrete plaster bases.
3. Base Coats:
 - a. Base Coats over Expanded-Metal Lath: High-strength gypsum **OR** Gypsum neat, **as directed**, plaster with job-mixed sand for scratch and brown coats.
 - b. Base Coats over Expanded-Metal Lath:
 - 1) Scratch Coat: Gypsum wood-fibered plaster; neat or with job-mixed sand.
 - 2) Brown Coat: Gypsum wood-fibered plaster with job-mixed sand **OR** neat plaster with job-mixed sand **OR** lightweight ready-mixed plaster **OR** neat plaster with job-mixed perlite, **as directed**.
 - c. Base Coats over Unit Masonry: Gypsum wood-fibered plaster with job-mixed sand **OR** neat plaster with job-mixed sand **OR** lightweight ready-mixed plaster, **as directed**.
 - d. Base-Coat Mix over Monolithic Concrete: Gypsum neat plaster with job-mixed sand.
4. Finish Coats:
 - a. Finish-Coat Mix for Smooth-Troweled Finishes: Gypsum gaging plaster **OR** Gypsum ready-mixed finish plaster **OR** High-strength gypsum gaging plaster **OR** Gypsum Keene's cement, **as directed**.
 - b. Finish-Coat Mix for Float Finishes: Gypsum gaging plaster **OR** Gypsum Keene's cement, **as directed**.
 - c. Finish-Coat Mix for Sprayed Finishes: Gypsum ready-mixed finish plaster.
 - d. Finish-Coat Mix for Textured Finishes: Gypsum ready-mixed finish plaster.
5. Plaster Finishes:
 - a. Provide troweled finish unless otherwise indicated **OR** where indicated, **as directed**.
 - b. Provide float finish unless otherwise indicated **OR** where indicated, **as directed**.
 - c. Provide sprayed finish unless otherwise indicated **OR** where indicated, **as directed**.
 - 1) Sprayed Finish: Match sample.
 - d. Provide textured finish where indicated.
 - 1) Textured Finish: Match sample.
6. Concealed Plaster:



-
- a. Where plaster application will be concealed behind built-in cabinets, similar furnishings, and equipment, apply finish coat.
 - b. Where plaster application will be concealed above suspended ceilings and in similar locations, finish coat may be omitted.
 - c. Where plaster application will be used as a base for adhesive application of tile and similar finishes, finish coat may be omitted.

H. Plaster Repairs

- 1. Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

I. Cleaning And Protection

- 1. Remove temporary protection and enclosure of other work. Promptly remove plaster from door frames, windows, and other surfaces not indicated to be plastered. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.

END OF SECTION 09 22 13 00



SECTION 09 22 13 00a - GYPSUM VENEER PLASTER

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for gypsum veneer plastering. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Gypsum veneer plaster and gypsum base for veneer plaster.
 - b. Gypsum veneer plaster over cementitious backer units.
 - c. Gypsum veneer plaster over masonry surfaces.
 - d. Gypsum veneer plaster over monolithic concrete surfaces.

C. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: Show locations, fabrication, and installation of control joints, and reveals and trim; include plans, elevations, sections, details of components, and attachments to other work.
3. Samples: For the following products:
 - a. Trim Accessories: Full-size Sample in 12-inch (300-mm) length for each trim accessory.
 - b. Textured Finishes: Manufacturer's standard size for each textured finish and on rigid backing.
4. LEED Submittals:
 - a. Product Data for Credit EQ 4.1: For adhesives, including printed statement of VOC content.
 - b. Product Data for Credit MR 4.1 and MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - 1) Include statement indicating costs for each product having recycled content.

D. Quality Assurance

1. Source Limitations: Obtain gypsum veneer plaster products, including gypsum base for veneer plaster, **OR** cementitious base units, **as directed**, joint reinforcing tape, and embedding material, from a single manufacturer.
2. Fire-Resistance-Rated Assemblies: Provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by a testing and inspecting agency.
3. STC-Rated Assemblies: Provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by a testing and inspecting agency.

E. Delivery, Storage, And Handling

1. Deliver materials in original packages, containers, and bundles bearing brand name and identification of manufacturer or supplier.
2. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.
3. Stack panels flat on leveled supports off floor or slab to prevent sagging.

F. Project Conditions

1. Environmental Limitations: Comply with ASTM C 843 requirements or gypsum veneer plaster manufacturer's written recommendations, whichever are more stringent.



2. Room Temperatures: Maintain not less than 55 deg F (13 deg C) or more than 80 deg F (27 deg C) for 7 days before application of gypsum base and gypsum veneer plaster, continuously during application, and after application until veneer plaster is dry.
3. Avoid conditions that result in gypsum veneer plaster drying too rapidly.
 - a. Distribute heat evenly; prevent concentrated or uneven heat on veneer plaster.
 - b. Maintain relative humidity levels, for prevailing ambient temperature, that produce normal drying conditions.
 - c. Ventilate building spaces in a manner that prevents drafts of air from contacting surfaces during veneer plaster application until it is dry.
4. Do not install panels that are wet, moisture damaged, or mold damaged.
 - a. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
 - b. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

1.2 PRODUCTS

A. Gypsum Veneer Plaster Materials

1. One-Component Gypsum Veneer Plaster: ASTM C 587, formulated for application directly over substrate without use of separate base-coat material.
2. High-Strength, One-Component Gypsum Veneer Plaster: ASTM C 587, ready-mixed, smooth, finish-coat veneer plaster containing mill-mixed, fine silica sand; with a compressive strength of 3000 psi (20 MPa) when tested according to ASTM C 472; and formulated for application directly over substrate without use of separate base-coat material.
3. Two-Component Gypsum Veneer Plaster: ASTM C 587, with separate formulations; one for base-coat and one for finish-coat application over substrates.
4. High-Strength, Two-Component Gypsum Veneer Plaster: ASTM C 587, ready-mixed, base-coat plaster and smooth finish-coat veneer plaster containing mill-mixed, fine silica sand; with a compressive strength of 3000 psi (20 MPa) when tested according to ASTM C 472.
5. Radiant-Heat, Two-Component Gypsum Veneer Plaster: ASTM C 587, and approved in writing by gypsum veneer plaster manufacturer for application with embedded electric heating cables.
 - a. Provide ready-mixed **OR** job-aggregated, **as directed**, components, as standard for manufacturer, to comply with manufacturer's written recommendations.
 - b. Aggregate: For job-aggregated base coat and texture finish coat, provide white silica sand passing a No. 30 (0.6-mm) sieve.

B. Panel Products

1. Recycled Content: Provide gypsum panel products with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 25 percent by weight.
2. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.
3. Gypsum Base for Veneer Plaster: ASTM C 588/C 588M.
 - a. Regular Type: In thickness indicated **OR** 1/2 inch (13 mm) thick, unless otherwise indicated, **as directed**.
 - b. Type X: In thickness indicated **OR** 5/8 inch (16 mm) thick, **as directed**.
 - c. Foil-Backed, Regular-Type Core: In thickness indicated **OR** 1/2 inch (13 mm) thick, unless otherwise indicated, **as directed**.
 - d. Type C: In thickness indicated **OR** 5/8 inch (16 mm) thick **OR** 1/2 inch (13 mm) thick, **as directed**.
 - e. Abuse-Resistant Base: With specially reinforced core for greater resistance to surface indentation, 5/8-inch (16-mm) thick, Type X core **OR** 1/2-inch (13-mm) thick, regular-type core, **as directed**.



- f. High-Impact Base: With Type X core, plastic film laminated to back side for greater resistance to through-penetration (impact resistance), and in thickness indicated **OR** 5/8 inch (16 mm) thick, **as directed**.
 - 1) Plastic-Film Thickness: 0.010 inch (0.254 mm) **OR** 0.020 inch (0.508 mm) **OR** 0.030 inch (0.762 mm) **OR** 0.081 inch (2.057 mm), **as directed**.
 - g. Moisture- and Mold-Resistant Base: With moisture- and mold-resistant core, glass-mat facing on both sides of panel, and in thickness indicated **OR** 5/8-inch (16-mm) thick, Type X core **OR** 1/2-inch (13-mm) thick, regular-type core, **as directed**.
 - 1) Mold Resistance: ASTM D 3273; no mold growth after four weeks' exposure.
 4. Backing Panels for Multilayer Applications: ASTM C 588/C 588M gypsum base or ASTM C 36/C 36M gypsum board, as recommended by gypsum veneer plaster manufacturer, for application method and thicknesses indicated.
 - a. Core: Matching face layer, unless otherwise indicated.
 - b. Thickness: Matching face layer, unless otherwise indicated.
 5. Cementitious Backer Units: ANSI A118.9, in thickness indicated **OR** 1/2 inch (13 mm) thick, **as directed**.
- C. Trim Accessories
1. Standard Trim: ASTM C 1047, provided or approved by manufacturer for use in gypsum veneer plaster applications indicated.
 - a. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet **OR** Galvanized or aluminum-coated steel sheet or rolled zinc **OR** Plastic **OR** Paper-faced galvanized steel sheet, **as directed**.
 - b. Shapes:
 - 1) Cornerbead.
 - 2) Bullnose bead.
 - 3) LC-Bead: J-shaped; exposed long flange receives joint compound.
 - 4) L-Bead: L-shaped; exposed long flange receives joint compound.
 - 5) U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - 6) Curved-Edge Cornerbead: With notched or flexible flanges.
 - 7) Control joints.
 2. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
 - a. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221 (ASTM B 221M), Alloy 6063-T5.
 - b. Finish: Manufacturer's standard Architectural Class II, Clear Anodic Finish AA-M12C22A31, complying with AAMA 611 **OR** chemical conversion coat finish **OR** prime paint finish, **as directed**.
- D. Joint Reinforcing Materials
1. General: Comply with joint strength requirements in ASTM C 587 and with gypsum veneer plaster manufacturer's written recommendations for each application indicated.
 2. Joint Tape:
 - a. Gypsum Base for Veneer Plaster: As recommended by gypsum veneer plaster manufacturer for applications indicated **OR** Paper **OR** Open-mesh, glass fiber, **as directed**.
 - b. Cementitious Backer Units: As recommended by cementitious backer unit manufacturer.
 3. Embedding Material for Joint Tape:
 - a. Gypsum Base for Veneer Plaster: As recommended by gypsum veneer plaster manufacturer for use with joint-tape material and gypsum veneer plaster applications indicated.
 - b. Cementitious Backer Units: As recommended by cementitious backer unit manufacturer for applications indicated.
- E. Auxiliary Materials
1. General: Provide auxiliary materials that comply with referenced product standards and manufacturer's written recommendations.



2. Bonding Agent: ASTM C 631, polyvinyl acetate.
3. Laminating Adhesive: Adhesive or joint compound recommended by manufacturer for directly adhering gypsum base face-layer panels to backing-layer panels in multilayer construction.
 - a. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
4. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 - a. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
5. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
6. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing), produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - a. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
 - b. Recycled Content: Provide blankets with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 25 percent by weight.
7. Acoustical Sealant: As specified in Division 07 Section "Thermal Insulation".
 - a. Provide sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
8. Patching Mortar: Dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.

F. Gypsum Veneer Plaster Mixes

1. Mechanically mix gypsum veneer plaster materials to comply with ASTM C 843 and with gypsum veneer plaster manufacturer's written recommendations.

1.3 EXECUTION

A. Preparation

1. Monolithic Concrete Substrates: Prepare according to gypsum veneer plaster manufacturer's written recommendations and as follows:
 - a. Clean surfaces to remove dust, loose particles, grease, oil, incompatible curing compounds, form-release agents, and other foreign matter and deposits that could impair bond with gypsum veneer plaster.
 - b. Remove ridges and protrusions greater than 1/8 inch (3 mm) and fill depressions greater than 1/4 inch (6 mm) with patching mortar. Allow to set and dry.
 - c. Apply bonding agent on dry and cured concrete substrates.
2. Masonry Substrates: Prepare according to gypsum veneer plaster manufacturer's written recommendations and as follows:
 - a. Clean surfaces to remove dirt, grease, oil, and other foreign matter and deposits that could impair bond with gypsum veneer plaster.
 - b. Apply bonding agent on dry masonry substrates.

B. Installing Panels, General

1. Gypsum Base for Veneer Plaster: Apply according to ASTM C 844 unless manufacturer's written recommendations are more stringent.
 - a. Do not allow gypsum base to degrade from exposure to sunlight as evidenced by fading of paper facing.
 - b. Erection Tolerance: No more than 1/16-inch (1.6-mm) offsets between planes of gypsum base panels, and 1/8 inch in 8 feet (3 mm in 2.4 m) noncumulative, for level, plumb, warp, and bow.



2. Install sound attenuation blankets before installing gypsum base for veneer plaster unless blankets are readily installed after panels have been installed on one side.
3. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
4. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.6 mm) of open space between panels. Do not force into place.
5. Locate edge and end joints over supports except in ceiling applications where intermediate supports or back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints, other than control joints, at corners of framed openings.
6. Attach panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
7. Attach panels to framing provided at openings and cutouts.
8. Form control joints with space between edges of adjoining panels.
9. Cover both sides of steel stud partition framing with panels in concealed spaces, including above ceilings, except in internally braced chases.
 - a. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.74 sq. m) in area.
 - b. Fit panels around ducts, pipes, and conduits.
 - c. Where partitions intersect open concrete coffers, concrete joists, and other structural members projecting below underside of floor/roof slabs and decks, cut panels to fit profile formed by coffers, joists, and other structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints; seal joints with acoustical sealant.
10. Wood Framing: Install panels over wood framing, with "floating" internal corner construction. Do not attach panels across the flat grain of wide-dimension lumber, including floor joists and headers. "Float" panels over these members or provide control joints to counteract wood shrinkage.
11. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
12. Fastener Spacing: Comply with ASTM C 844, manufacturer's written recommendations, and fire-resistance-rating requirements.
 - a. Space screws a maximum of 12 inches (305 mm) o.c. along framing members for wall or ceiling application.
 - b. Space fasteners in cementitious backer units a maximum of 8 inches (200 mm) o.c. along framing members for wall applications and 6 inches (150 mm) o.c. along framing members for ceiling applications.

C. Installing Panels

1. Install gypsum base panels for veneer plaster in the following locations:
 - a. Regular Type: As indicated on Drawings **OR** Vertical surfaces, unless otherwise indicated, **as directed**.
 - b. Ceiling Type: As indicated on Drawings **OR** Ceiling surfaces, **as directed**.
 - c. Type X: As indicated on Drawings **OR** Where required for fire-resistance-rated assembly **OR** Vertical surfaces, unless otherwise indicated, **as directed**.
 - d. Type C: As indicated on Drawings **OR** Where required for specific fire-resistance-rated assembly indicated, **as directed**.
 - e. Foil-Backed, Regular-Type Core: As indicated on Drawings **OR as directed**.
 - f. Abuse-Resistant Base: As indicated on Drawings **OR as directed**.
 - g. High-Impact Base: As indicated on Drawings **OR as directed**.
 - h. Moisture- and Mold-Resistant Base: As indicated on Drawings **OR as directed**.
2. Single-Layer Application:



- a. On ceilings, apply gypsum base panels before wall panels, to the greatest extent possible and at right angles to framing, unless otherwise indicated.
 - b. On walls, apply gypsum base panels vertically and parallel **OR** horizontally and perpendicular, **as directed**, to framing, unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - 1) Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - 2) At stairwells and other walls higher than 30 feet (9.0 m), install gypsum base panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
 - c. On Z-furring, apply gypsum base panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
3. Multilayer Application on Ceilings: Apply backing panels for ceilings before applying backing panels for partitions; apply gypsum-base face layers in same sequence. Apply backing panels at right angles to framing members and offset gypsum-base face-layer joints a minimum of 16 inches (400 mm) from parallel backing panel joints, unless otherwise required by fire-resistance-rated assembly.
 4. Multilayer Application on Partitions: Apply backing panels indicated and gypsum-base face layers vertically (parallel to framing) with joints of backing panels located over stud or furring members and gypsum-base face-layer joints offset at least one stud or furring member from backing-panel joints, unless otherwise required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
 - a. Z-Furring: Apply backing panels vertically (parallel to framing) and gypsum-base face layer either vertically or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of backing panels over furring members.
 5. Single-Layer Fastening Methods: Apply gypsum base panels to supports with steel drill screws.
 6. Multilayer Fastening Methods: Fasten backing panels and gypsum-base face layers separately to supports with screws **OR** with screws; fasten gypsum-base face layers with adhesive and supplementary fasteners, **as directed**.
 7. Curved Partitions: Comply with gypsum base manufacturer's written installation recommendations.
 8. Cementitious Backer Units: Install according to ANSI A108.11.
 - a. Where cementitious backer units abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.
- D. Installing Trim Accessories
1. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
 2. Control Joints: Install at locations indicated on Drawings **OR** according to ASTM C 844 and in specific locations approved by the Owner, **as directed**.
 3. Trim: Install in the following locations:
 - a. Cornerbead: Use at outside corners, unless otherwise indicated.
 - b. Bullnose Bead: Use at outside corners **OR** where indicated, **as directed**.
 - c. LC-Bead: Use at exposed panel edges.
 - d. L-Bead: Use where indicated.
 - e. U-Bead: Use at exposed panel edges **OR** where indicated, **as directed**.
 - f. Curved-Edge Cornerbead: Use at curved openings.
 4. Aluminum Trim:
 - a. Install aluminum trim according to manufacturer's written recommendations.
 - b. Apply and embed joint tape over flanges of aluminum trim accessories if recommended by trim manufacturer.
- E. Installing Joint Reinforcement



1. Gypsum Base for Veneer Plaster: Reinforce interior angles and flat joints with joint tape and embedding material to comply with ASTM C 843 and with gypsum veneer plaster manufacturer's written recommendations.
 2. Abuse-Resistant Base: Reinforce joints between abuse-resistant panels with joint tape and embedding material according to panel manufacturer's written recommendations.
 3. Impact-Resistant Base: Reinforce joints between impact-resistant panels with joint tape and embedding material according to panel manufacturer's written recommendations.
 4. Moisture- and Mold-Resistant Base: Reinforce joints between moisture- and mold-resistant panels with joint tape and embedding material according to panel manufacturer's written recommendations.
 5. Cementitious Backer Units: Reinforce joints between cementitious backer units with joint tape and embedding material according to unit manufacturer's written recommendations.
- F. Gypsum Veneer Plastering
1. Bonding Agent: Apply bonding agent on dry monolithic concrete **OR** masonry **OR** abuse-resistant base panels **OR** cementitious backer units, **as directed**, according to gypsum veneer plaster manufacturer's written recommendations.
 2. Gypsum Veneer Plaster Application: Comply with ASTM C 843 and with veneer plaster manufacturer's written recommendations.
 - a. One-Component Gypsum Veneer Plaster: Trowel apply base coat over substrate to uniform thickness of 1/16 to 3/32 inch (1.6 to 2.4 mm). Fill all voids and imperfections. Allow plaster to set, then scratch and immediately double back with gypsum veneer plaster to uniform total thickness of 3/16 inch (4.8 mm).
 - b. Two-Component Gypsum Veneer Plaster:
 - 1) Base Coat: Trowel apply base coat over substrate to uniform thickness of 1/16 to 3/32 inch (1.6 to 2.4 mm). Fill all voids and imperfections.
 - 2) Finish Coat: Trowel apply finish-coat plaster over base-coat plaster to uniform thickness of 1/16 to 3/32 inch (1.6 to 2.4 mm).
 - c. Where gypsum veneer plaster abuts only metal door frames, windows, and other units, groove finish coat to eliminate spalling.
 - d. Do not apply veneer plaster to gypsum base if paper facing has degraded from exposure to sunlight. Before applying veneer plaster, use remedial methods to restore bonding capability to degraded paper facing according to manufacturer's written recommendations and as approved by the Owner.
 3. Radiant-Heat, Two-Component Gypsum Veneer Plaster Ceilings: Comply with ASTM C 843 and with radiant-heat veneer plaster manufacturer's written recommendations.
 - a. Base Coat: Apply plaster base coat to sufficiently cover electric heating cables. Trowel plaster parallel in direction of cables to uniform thickness of 3/16 inch (4.8 mm). Completely cover cables.
 - b. Finish Coat: After base coat has developed sufficient bond, apply finish coat. Trowel plaster to uniform thickness of 1/16 to 3/32 inch (1.6 to 2.4 mm).
 4. Concealed Surfaces: Do not omit gypsum veneer plaster behind cabinets, furniture, furnishings, and similar removable items. Omit veneer plaster in the following areas where it will be concealed from view in the completed Work unless otherwise indicated or required to maintain fire-resistance and STC ratings:
 - a. Above suspended ceilings.
 - b. Behind wood paneling.
 5. Gypsum Veneer Plaster Finish: Smooth-troweled finish, unless otherwise indicated **OR** Textured finish matching the Owner's sample, **as directed**.
- G. Protection
1. Protect installed gypsum veneer plaster from damage from weather, condensation, construction, and other causes during remainder of the construction period.
 2. Remove and replace gypsum veneer plaster and gypsum base panels that are wet, moisture damaged, or mold damaged.



-
- a. Indications that gypsum base panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
 - b. Indications that gypsum base panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 22 13 00a



SECTION 09 22 13 00b - PORTLAND CEMENT PLASTER

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for portland cement plaster. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Interior portland cement plasterwork on metal lath, unit masonry and monolithic concrete.
 - b. Exterior portland cement plasterwork (stucco) on metal lath, unit masonry and monolithic concrete.

C. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:
 - a. Product Data for Credit MR 4.1 and Credit MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - 1) Include statement indicating costs for each product having recycled content.
 - b. Product Data for Credit EQ 4.1: For sealants, including printed statement of VOC content.
3. Shop Drawings: Show locations and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other work.
4. Samples: For each type of factory-prepared, colored or textured finish coat indicated; 12 by 12 inches (305 by 305 mm), and prepared on rigid backing.

D. Quality Assurance

1. Fire-Resistance Ratings: Where indicated, provide portland cement plaster assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
2. Sound-Transmission Characteristics: Where indicated, provide portland cement plaster assemblies identical to those of assemblies tested for STC ratings per ASTM E 90 and classified according to ASTM E 413 by a qualified testing agency.
3. Preinstallation Conference: Conduct conference at Project site.

E. Delivery, Storage, And Handling

1. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

F. Project Conditions

1. Comply with ASTM C 926 requirements.
2. Interior Plasterwork: Maintain room temperatures at greater than 40 deg F (4.4 deg C) for at least 48 hours before plaster application, and continuously during and after application.
 - a. Avoid conditions that result in plaster drying out during curing period. Distribute heat evenly; prevent concentrated or uneven heat on plaster.
 - b. Ventilate building spaces as required to remove water in excess of that required for hydrating plaster in a manner that prevents drafts of air from contacting surfaces during plaster application and until plaster is dry.
3. Exterior Plasterwork:



- a. Apply and cure plaster to prevent plaster drying out during curing period. Use procedures required by climatic conditions, including moist curing, providing coverings, and providing barriers to deflect sunlight and wind.
 - b. Apply plaster when ambient temperature is greater than 40 deg F (4.4 deg C).
 - c. Protect plaster coats from freezing for not less than 48 hours after set of plaster coat has occurred.
4. Factory-Prepared Finishes: Comply with manufacturer's written recommendations for environmental conditions for applying finishes.

1.2 PRODUCTS

A. Metal Lath

1. Expanded-Metal Lath: ASTM C 847 with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coating.
 - a. Recycled Content: Provide steel products with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
 - b. Diamond-Mesh Lath: Flat **OR** Self-furring, **as directed**, 2.5 lb/sq. yd. (1.4 kg/sq. m) **OR** 3.4 lb/sq. yd. (1.8 kg/sq. m), **as directed**.
 - c. Flat Rib Lath: Rib depth of not more than 1/8 inch (3.1 mm), 2.75 lb/sq. yd. (1.5 kg/sq. m) **OR** 3.4 lb/sq. yd. (1.8 kg/sq. m), **as directed**.
 - d. 3/8-Inch (9.5-mm) Rib Lath: 3.4 lb/sq. yd. (1.8 kg/sq. m) **OR** 4 lb/sq. yd. (2.2 kg/sq. m), **as directed**.
2. Wire-Fabric Lath:
 - a. Welded-Wire Lath: ASTM C 933; self-furring, 1.4 lb/sq. yd. (0.8 kg/sq. m) **OR** 1.95 lb/sq. yd. (1.1 kg/sq. m), **as directed**.
 - b. Woven-Wire Lath: ASTM C 1032; self-furring, with stiffener wire backing, 1.1 lb/sq. yd. (0.6 kg/sq. m) **OR** 1.4 lb/sq. yd. (0.8 kg/sq. m), **as directed**.
3. Paper Backing: FS UU-B-790, Type I, Grade D, Style 2 vapor-permeable paper **OR** Grade B, Style 1a vapor-retardant paper, **as directed**.
 - a. Provide paper-backed lath unless otherwise indicated **OR** at exterior locations **OR** in locations indicated on Drawings, **as directed**.

B. Accessories

1. General: Comply with ASTM C 1063 and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.
2. Metal Accessories:
 - a. Foundation Weep Screed: Fabricated from hot-dip galvanized-steel sheet, ASTM A 653/A 653M, G60 (Z180) zinc coating.
 - b. Cornerite: Fabricated from metal lath with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coating.
 - c. External-Corner Reinforcement: Fabricated from metal lath with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coating.
 - d. Cornerbeads: Fabricated from zinc or zinc-coated (galvanized) steel.
 - 1) Small nose cornerbead with expanded flanges; use unless otherwise indicated.
 - 2) Small nose cornerbead with perforated flanges; use on curved corners.
 - 3) Small nose cornerbead with expanded flanges reinforced by perforated stiffening rib; use on columns and for finishing masonry corners.
 - 4) Bull nose cornerbead, radius 3/4 inch (19.1 mm) minimum, with expanded flanges; use at locations indicated on Drawings.
 - e. Casing Beads: Fabricated from zinc or zinc-coated (galvanized) steel; square-edged style; with expanded flanges.



- f. Control Joints: Fabricated from zinc or zinc-coated (galvanized) steel; one-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
 - g. Expansion Joints: Fabricated from zinc or zinc-coated (galvanized) steel; folded pair of unperforated screeds in M-shaped configuration; with expanded flanges.
 - h. Two-Piece Expansion Joints: Fabricated from zinc or zinc-coated (galvanized) steel; formed to produce slip-joint and square-edged reveal that is adjustable from 1/4 to 5/8 inch (6.34 to 16 mm) wide; with perforated flanges.
3. Plastic Accessories: Fabricated from high-impact PVC.
- a. Cornerbeads: With perforated flanges.
 - 1) Small nose cornerbead; use unless otherwise indicated.
 - 2) Bull nose cornerbead, radius 3/4 inch (19.1 mm) minimum; use at locations indicated on Drawings.
 - b. Casing Beads: With perforated flanges in depth required to suit plaster bases indicated and flange length required to suit applications indicated.
 - 1) Square-edge style; use unless otherwise indicated.
 - 2) Bull-nose style, radius 3/4 inch (19.1 mm) minimum; use at locations indicated on Drawings.
 - c. Control Joints: One-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
 - d. Expansion Joints: Two-piece type, formed to produce slip-joint and square-edged 1/2-inch- (13-mm-) **OR** 1-inch- (25-mm-) **OR** 1-1/2-inch- (38-mm-), **as directed**, wide reveal; with perforated concealed flanges.
- C. Miscellaneous Materials
1. Water for Mixing: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.
 2. Fiber for Base Coat: Alkaline-resistant glass or polypropylene fibers, 1/2 inch (13 mm) long, free of contaminants, manufactured for use in portland cement plaster.
 3. Bonding Compound: ASTM C 932.
 4. Steel Drill Screws: For metal-to-metal fastening, ASTM C 1002 or ASTM C 954, as required by thickness of metal being fastened; with pan head that is suitable for application; in lengths required to achieve penetration through joined materials of no fewer than three exposed threads.
 5. Fasteners for Attaching Metal Lath to Substrates: Complying with ASTM C 1063.
 6. Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, not less than 0.0475-inch (1.21-mm) diameter, unless otherwise indicated.
 7. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - a. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
 - b. Recycled Content: Provide blankets with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 25 percent by weight.
 8. Acoustical Sealant: As specified in Division 7 Section "Joint Sealants".
 - a. Provide sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. Plaster Materials
1. Portland Cement: ASTM C 150, Type I **OR** Type II, **as directed**.
 - a. Color for Finish Coats: White **OR** Gray, **as directed**.
 2. Masonry Cement: ASTM C 91, Type N.
 - a. Color for Finish Coats: White **OR** Gray, **as directed**.
 3. Plastic Cement: ASTM C 1328.
 4. Colorants for Job-Mixed Finish Coats: Colorfast mineral pigments that produce finish plaster color to match sample.



5. Lime: ASTM C 206, Type S; or ASTM C 207, Type S.
6. Sand Aggregate: ASTM C 897.
 - a. Color for Job-Mixed Finish Coats: White **OR** In color matching sample, **as directed**.
7. Perlite Aggregate: ASTM C 35.
8. Exposed Aggregates for Finish Coats: For marblecrete finish, clean, sound, crushed marble matching color and size gradation of sample.
9. Ready-Mixed Finish-Coat Plaster: Mill-mixed portland cement, aggregates, coloring agents, and proprietary ingredients.
 - a. Color: As selected from manufacturer's full range.
10. Acrylic-Based Finish Coatings: Factory-mixed acrylic-emulsion coating systems, formulated with colorfast mineral pigments and fine aggregates; for use over portland cement plaster base coats. Include manufacturer's recommended primers and sealing topcoats for acrylic-based finishes.
 - a. Color: As selected from manufacturer's full range.

E. Plaster Mixes

1. General: Comply with ASTM C 926 for applications indicated.
 - a. Fiber Content: Add fiber to base-coat mixes after ingredients have mixed at least two minutes. Comply with fiber manufacturer's written instructions for fiber quantities in mixes, but do not exceed 1 lb of fiber/cu. yd. (0.6 kg of fiber/cu. m) of cementitious materials.
2. Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork as follows:
 - a. Portland Cement Mixes:
 - 1) Scratch Coat: For cementitious material, mix 1 part portland cement and 0 to 3/4 **OR** 3/4 to 1-1/2, **as directed**, parts lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
 - 2) Brown Coat: For cementitious material, mix 1 part portland cement and 0 to 3/4 **OR** 3/4 to 1-1/2, **as directed**, parts lime. Use 3 to 5 parts aggregate per part of cementitious material, but not less than volume of aggregate used in scratch coat.
 - b. Masonry Cement Mixes:
 - 1) Scratch Coat: 1 part masonry cement and 2-1/2 to 4 parts aggregate.
 - 2) Brown Coat: 1 part masonry cement and 3 to 5 parts aggregate, but not less than volume of aggregate used in scratch coat.
 - c. Portland and Masonry Cement Mixes:
 - 1) Scratch Coat: For cementitious material, mix 1 part portland cement and 1 part masonry cement. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
 - 2) Brown Coat: For cementitious material, mix 1 part portland cement and 1 part masonry cement. Use 3 to 5 parts aggregate per part of cementitious material, but not less than volume of aggregate used in scratch coat.
 - d. Plastic Cement Mixes:
 - 1) Scratch Coat: 1 part plastic cement and 2-1/2 to 4 parts aggregate.
 - 2) Brown Coat: 1 part plastic cement and 3 to 5 parts aggregate, but not less than volume of aggregate used in scratch coat.
 - e. Portland and Plastic Cement Mixes:
 - 1) Scratch Coat: For cementitious material, mix 1 part plastic cement and 1 part portland cement. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
 - 2) Brown Coat: For cementitious material, mix 1 part plastic cement and 1 part portland cement. Use 3 to 5 parts aggregate per part of cementitious material, but not less than volume of aggregate used in scratch coat.
3. Base-Coat Mixes: Single base coats for two-coat plasterwork as follows:
 - a. Portland Cement Mix: For cementitious material, mix 1 part portland cement and 0 to 3/4 part lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
 - b. Portland and Masonry Cement Mix: For cementitious material, mix 1 part portland cement and 1 part masonry cement. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
 - c. Plastic Cement Mix: Use 1 part plastic cement and 2-1/2 to 4 parts aggregate.



4. Base-Coat Mixes: Single base coats for two-coat plasterwork as follows:
 - a. Portland Cement Mix: For cementitious material, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
 - b. Masonry Cement Mix: Use 1 part masonry cement and 2-1/2 to 4 parts aggregate.
 - c. Plastic Cement Mix: Use 1 part plastic cement and 2-1/2 to 4 parts aggregate.
5. Job-Mixed Finish-Coat Mixes:
 - a. Portland Cement Mix: For cementitious materials, mix 1 part portland cement and 3/4 to 1-1/2 **OR** 1-1/2 to 2, **as directed**, parts lime. Use 1-1/2 to 3 parts aggregate per part of cementitious material.
 - b. Masonry Cement Mix: 1 part masonry cement and 1-1/2 to 3 parts aggregate.
 - c. Portland and Masonry Cement Mix: For cementitious materials, mix 1 part portland cement and 1 part masonry cement. Use 1-1/2 to 3 parts aggregate per part of cementitious material.
 - d. Plastic Cement Mix: 1 part plastic cement and 1-1/2 to 3 parts aggregate.
6. Factory-Prepared Finish-Coat Mixes: For ready-mixed finish-coat plasters or acrylic-based finish coatings, comply with manufacturer's written instructions.

1.3 EXECUTION

A. Examination

1. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Preparation

1. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.
2. Prepare solid substrates for plaster that are smooth or that do not have the suction capability required to bond with plaster according to ASTM C 926.

C. Installation, General

1. Fire-Resistance-Rated Assemblies: Install components according to requirements for design designations from listing organization and publication indicated on Drawings.
2. Sound Attenuation Blankets: Where required, install blankets before installing lath unless blankets are readily installed after lath has been installed on one side.
3. Acoustical Sealant: Where required, seal joints between edges of plasterwork and abutting construction with acoustical sealant.

D. Installing Metal Lath

1. Expanded-Metal Lath: Install according to ASTM C 1063.
 - a. Partition Framing and Vertical Furring: Install flat diamond-mesh **OR** flat rib **OR** welded-wire **OR** woven-wire, **as directed**, lath.
 - b. Flat-Ceiling and Horizontal Framing: Install flat diamond-mesh **OR** flat rib **OR** 3/8-inch (9.5-mm) rib lath **OR** welded-wire **OR** woven-wire, **as directed**, lath.
 - c. Curved-Ceiling Framing: Install flat diamond-mesh **OR** welded-wire **OR** flat woven-wire, **as directed**, lath.
 - d. On Solid Surfaces, Not Otherwise Furred: Install self-furring, diamond-mesh **OR** welded-wire **OR** woven-wire, **as directed**, lath.

E. Installing Accessories

1. Install according to ASTM C 1063 and at locations indicated on Drawings.
2. Reinforcement for External Corners:
 - a. Install lath-type, external-corner reinforcement at exterior locations.
 - b. Install cornerbead at interior and exterior, **as directed**, locations.



3. Control Joints: Install control joints at locations indicated on Drawings **OR** in specific locations approved for visual effect as follows, **as directed**:
 - a. As required to delineate plasterwork into areas (panels) of the following maximum sizes:
 - 1) Vertical Surfaces: 144 sq. ft. (13.4 sq. m).
 - 2) Horizontal and other Nonvertical Surfaces: 100 sq. ft. (9.3 sq. m).
 - b. At distances between control joints of not greater than 18 feet (5.5 m) o.c.
 - c. As required to delineate plasterwork into areas (panels) with length-to-width ratios of not greater than 2-1/2:1.
 - d. Where control joints occur in surface of construction directly behind plaster.
 - e. Where plasterwork areas change dimensions, to delineate rectangular-shaped areas (panels) and to relieve the stress that occurs at the corner formed by the dimension change.

F. Plaster Application

1. General: Comply with ASTM C 926.
 - a. Do not deviate more than plus or minus 1/4 inch in 10 feet (6.4 mm in 3 m) from a true plane in finished plaster surfaces, as measured by a 10-foot (3-m) straightedge placed on surface.
 - b. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.
 - c. Provide plaster surfaces that are ready to receive field-applied finishes indicated.
2. Bonding Compound: Apply on unit masonry and concrete plaster bases.
3. Walls; Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork, on masonry or on concrete; 3/4-inch (19-mm) thickness.
 - a. Portland cement mixes.
 - b. Masonry cement mixes.
 - c. Portland and masonry cement mixes.
 - d. Plastic cement mixes.
 - e. Portland and plastic cement mixes.
4. Ceilings; Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork; 1/2 inch (13 mm) thick **OR** 3/4 inch (19 mm) thick on concrete, **as directed**.
 - a. Portland cement mixes.
 - b. Masonry cement mixes.
 - c. Portland and masonry cement mixes.
 - d. Plastic cement mixes.
 - e. Portland and plastic cement mixes.
5. Walls; Base-Coat Mix: Scratch coat for two-coat plasterwork, 3/8 inch (10 mm) thick on concrete masonry **OR** 1/4 inch (6 mm) thick on concrete, **as directed**.
 - a. Portland cement mixes.
 - b. Masonry cement mixes.
 - c. Portland and masonry cement mixes.
 - d. Plastic cement mixes.
 - e. Portland and plastic cement mixes.
6. Ceilings; Base-Coat Mix: Scratch coat for two-coat plasterwork, 1/4 inch (6 mm) thick on concrete.
 - a. Portland cement mixes.
 - b. Masonry cement mixes.
 - c. Portland and masonry cement mixes.
 - d. Plastic cement mixes.
 - e. Portland and plastic cement mixes.
7. Plaster Finish Coats: Apply to provide float **OR** dash **OR** scraped trowel-textured **OR** skip trowel-textured **OR** brocade (knock-down dash) **OR** trowel sweep **OR** combed **OR** sacked (California mission) **OR** English **OR** marblecrete, **as directed**, finish to match sample.



8. Acrylic-Based Finish Coatings: Apply coating system, including primers, finish coats, and sealing topcoats, according to manufacturer's written instructions.
 9. Concealed Exterior Plasterwork: Where plaster application will be used as a base for adhered finishes, omit finish coat.
 10. Concealed Interior Plasterwork:
 - a. Where plaster application will be concealed behind built-in cabinets, similar furnishings, and equipment, apply finish coat.
 - b. Where plaster application will be concealed above suspended ceilings and in similar locations, finish coat may be omitted.
 - c. Where plaster application will be used as a base for adhesive application of tile and similar finishes, omit finish coat.
- G. Plaster Repairs
1. Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.
- H. Protection
1. Remove temporary protection and enclosure of other work. Promptly remove plaster from door frames, windows, and other surfaces not indicated to be plastered. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.

END OF SECTION 09 22 13 00b



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SECTION 09 22 16 13 - NON-LOAD-BEARING STEEL FRAMING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for non-load bearing steel framing. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes non-load-bearing steel framing members for the following applications:
 - a. Interior framing systems (e.g., supports for partition walls, framed soffits, furring, etc.).
 - b. Interior suspension systems (e.g., supports for ceilings, suspended soffits, etc.).

C. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittal:
 - a. Product Data for Credit MR 4.1 and Credit MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - 1) Include statement indicating costs for each product having recycled content.

D. Quality Assurance

1. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
2. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

1.2 PRODUCTS

A. Non-Load-Bearing Steel Framing, General

1. Recycled Content of Steel Products: Provide products with average recycled content of steel products such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
2. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
 - a. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
 - b. Protective Coating: ASTM A 653/A 653M, G40 (Z120) **OR** ASTM A 653/A 653M, G60 (Z180) **OR** Coating with equivalent corrosion resistance of ASTM A 653/A 653M, G40 (Z120), **as directed**, hot-dip galvanized, unless otherwise indicated.

B. Suspension System Components

1. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- (1.59-mm-) diameter wire, or double strand of 0.0475-inch- (1.21-mm-) diameter wire.
2. Hanger Attachments to Concrete:
 - a. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.



- 1) Type: Cast-in-place anchor, designed for attachment to concrete forms **OR** Postinstalled, chemical anchor **OR** Postinstalled, expansion anchor, **as directed**.
 - b. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.
 3. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch (4.12-mm) diameter.
 4. Flat Hangers: Steel sheet, in size indicated on Drawings **OR** 1 by 3/16 inch (25.4 by 4.76 mm) by length indicated, **as directed**.
 5. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch (1.37 mm) and minimum 1/2-inch- (12.7-mm-) wide flanges.
 - a. Depth: As indicated on Drawings **OR** 2-1/2 inches (64 mm) **OR** 2 inches (51 mm) **OR** 1-1/2 inches (38 mm), **as directed**.
 6. Furring Channels (Furring Members):
 - a. Cold-Rolled Channels: 0.0538-inch (1.37-mm) bare-steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flanges, 3/4 inch (19.1 mm) deep.
 - b. Steel Studs: ASTM C 645.
 - 1) Minimum Base-Metal Thickness: As indicated on Drawings **OR** 0.0179 inch (0.45 mm) **OR** 0.0312 inch (0.79 mm), **as directed**.
 - 2) Depth: As indicated on Drawings **OR** 1-5/8 inches (41.3 mm) **OR** 2-1/2 inches (63.5 mm) **OR** 3-5/8 inches (92.1 mm), **as directed**.
 - c. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch (22.2 mm) deep.
 - 1) Minimum Base Metal Thickness: As indicated on Drawings **OR** 0.0179 inch (0.45 mm) **OR** 0.0312 inch (0.79 mm), **as directed**.
 - d. Resilient Furring Channels: 1/2-inch- (12.7-mm-) deep members designed to reduce sound transmission.
 - 1) Configuration: Asymmetrical **OR** Hat shaped, **as directed**.
 7. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
- C. Steel Framing For Framed Assemblies
1. Steel Studs and Runners: ASTM C 645.
 - a. Minimum Base-Metal Thickness: As indicated on Drawings **OR** 0.0179 inch (0.45 mm) **OR** 0.027 inch (0.7 mm) **OR** 0.0312 inch (0.79 mm), **as directed**.
 - b. Depth: As indicated on Drawings **OR** 3-5/8 inches (92.1 mm) **OR** 6 inches (152.4 mm) **OR** 4 inches (101.6 mm) **OR** 2-1/2 inches (63.5 mm) **OR** 1-5/8 inches (41.3 mm), **as directed**.
 2. Slip-Type Head Joints: Where indicated, provide one of the following:
 - a. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch- (50.8-mm-) deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches (305 mm) of the top of studs to provide lateral bracing.
 - b. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch- (50.8-mm-) deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
 - c. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
 3. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
 4. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
 - a. Minimum Base-Metal Thickness: As indicated on Drawings **OR** 0.0179 inch (0.45 mm) **OR** 0.027 inch (0.7 mm) **OR** 0.0312 inch (0.79 mm), **as directed**.



5. Cold-Rolled Channel Bridging: 0.0538-inch (1.37-mm) bare-steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flanges.
 - a. Depth: As indicated on Drawings **OR** 1-1/2 inches (38.1 mm), **as directed**.
 - b. Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38.1 by 38.1 mm), 0.068-inch- (1.73-mm-) thick, galvanized steel.
6. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
 - a. Minimum Base Metal Thickness: As indicated on Drawings **OR** 0.0179 inch (0.45 mm) **OR** 0.0312 inch (0.79 mm), **as directed**.
 - b. Depth: As indicated on Drawings **OR** 7/8 inch (22.2 mm) **OR** 1-1/2 inches (38.1 mm), **as directed**.
7. Resilient Furring Channels: 1/2-inch- (12.7-mm-) deep, steel sheet members designed to reduce sound transmission.
 - a. Configuration: Asymmetrical **OR** Hat shaped, **as directed**.
8. Cold-Rolled Furring Channels: 0.0538-inch (1.37-mm) bare-steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flanges.
 - a. Depth: As indicated on Drawings **OR** 3/4 inch (19.1 mm), **as directed**.
 - b. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum bare-steel thickness of 0.0312 inch (0.79 mm).
 - c. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- (1.59-mm-) diameter wire, or double strand of 0.0475-inch- (1.21-mm-) diameter wire.
9. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (31.8 mm), wall attachment flange of 7/8 inch (22.2 mm), minimum bare-metal thickness of 0.0179 inch (0.45 mm), and depth required to fit insulation thickness indicated.

D. Auxiliary Materials

1. General: Provide auxiliary materials that comply with referenced installation standards.
 - a. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
2. Isolation Strip at Exterior Walls: Provide one of the following:
 - a. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
 - b. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

1.3 EXECUTION

A. Preparation

1. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
 - a. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.
2. Coordination with Sprayed Fire-Resistive Materials:
 - a. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches (600 mm) o.c.
 - b. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

B. Installation, General

1. Installation Standard: ASTM C 754, except comply with framing sizes and spacing indicated.



- a. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C 841 that apply to framing installation.
 - b. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.
 - c. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C 844 that apply to framing installation.
 - d. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
2. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
 3. Install bracing at terminations in assemblies.
 4. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.
- C. Installing Suspension Systems
1. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.
 2. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
 3. Suspend hangers from building structure as follows:
 - a. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - 1) Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - b. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - 1) Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
 - c. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 - d. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 - e. Do not attach hangers to steel roof deck.
 - f. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 - g. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
 - h. Do not connect or suspend steel framing from ducts, pipes, or conduit.
 4. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
 5. Seismic Bracing: Sway-brace suspension systems with hangers used for support.
 6. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
 7. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet (3 mm in 3.6 m) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.
- D. Installing Framed Assemblies
1. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.



2. Install studs so flanges within framing system point in same direction.
 - a. Space studs as follows:
 - 1) Single-Layer Application: 16 inches (406 mm) **OR** 24 inches (610 mm) **OR** 400 mm **OR** 600 mm, **as directed**, o.c., unless otherwise indicated.
 - 2) Multilayer Application: 16 inches (406 mm) **OR** 24 inches (610 mm) **OR** 400 mm **OR** 600 mm, **as directed**, o.c., unless otherwise indicated.
 - 3) Tile backing panels: 16 inches (406 mm) **OR** 400 mm, **as directed**, o.c., unless otherwise indicated.
 3. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
 - a. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 - b. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - 1) Install two studs at each jamb, unless otherwise indicated.
 - 2) Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (12.7-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
 - 3) Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 - c. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 - d. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - 1) Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
 - e. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
 - f. Curved Partitions:
 - 1) Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
 - 2) Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of not less than 2 studs at ends of arcs, place studs 6 inches (150 mm) o.c.
 4. Direct Furring:
 - a. Screw to wood framing.
 - b. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.
 5. Z-Furring Members:
 - a. Erect insulation (specified in Division 7 Section "Building Insulation") vertically and hold in place with Z-furring members spaced 24 inches (610 mm) **OR** 600 mm, **as directed**, o.c.
 - b. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (600 mm) o.c.
 - c. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches (300 mm) from corner and cut insulation to fit.
 6. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

END OF SECTION 09 22 16 13



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Task	Specification	Specification Description
09 22 36 13	09 22 13 00	Gypsum Plaster
09 22 36 13	09 22 13 00a	Gypsum Veneer Plaster
09 22 36 13	09 22 13 00b	Portland Cement Plaster



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SECTION 09 22 36 23 - LATH AND PLASTER RENOVATION

GENERAL

Description Of Work

1. This specification covers the furnishing and installation of materials for lath and plaster renovation. Products shall be as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

Quality Assurance

2. Regulatory Requirements:
 - a. Plaster Partitions: Listed and labeled for fire-protective ratings as indicated or scheduled.
 - b. Plaster Floor/Ceilings and Roof/Ceiling Assemblies: Listed and labeled for fire-protective ratings as indicated or scheduled.
 - c. Fire Rated Assemblies: Comply with UL 05, FM P8016, or GA 600 for required fire-rated assembly.

Submittals

3. Product Data: Submit in accordance with Detailed Scope of Work. Include each type of plaster material, metal lath, and lathing accessories to be installed.

Delivery, Storage, And Handling

4. General:
 - a. Plastering Materials: Deliver in original unopened containers and store off ground and under cover.
 - b. Metal Lath and Accessories: Protect from rusting during storage.
 - c. Rusted or Water Damaged Materials: Subject to rejection before or after installation.

Project Conditions

5. Environmental Requirements: Comply with Detailed Scope of Work.
 - a. Cold-Weather Protection: Do not apply plaster if ambient temperature is less than 4 degrees C (40 degrees F) or more than 26 degrees C (80 degrees F). Maintain this temperature range in all areas 7 days prior to application, during application, and for 7 days after plaster is set.
 - b. Hot-Weather Protection: Protect plaster against uneven or excessive evaporation during dry, hot weather and from strong blasts of dry air, either natural or artificial.
 - c. Ventilation: Ventilate building spaces as required to remove water in excess of that required for hydration of plaster. Begin ventilation immediately after plaster is applied and continue until it sets.
6. Existing Conditions: See Division 1 Section "Summary of Work". Do not interfere with use of occupied buildings or portions of buildings. Maintain free and safe passage to and from occupied areas.
7. Protection: Protect grounds, plantings, buildings, and any other facilities or property from damage caused by construction operations.

Scheduling And Sequencing

8. Scheduling and Completion: Comply with Detailed Scope of Work.
 - a. Sequence plaster application with installation and protection of other work so that neither will be damaged by installation of other.

PRODUCTS



Materials

9. Materials for Patching, Extending, and Matching:
 - a. Provide same products or types of construction as existing structure, as needed to patch, extend, or match existing work.
 - 1) Generally, Contract Documents will not define products or standards of workmanship present in existing construction. Determine products by inspection and any necessary testing, and workmanship by use of existing as sample of comparison.
 - 2) Patching, extending, and matching of existing work and systems shall result in complete, finished system.
 - b. Presence of product, finish, or type of construction, requires that patching, extending, or matching shall be performed as necessary to make work complete and consistent.
10. Partition Metals: ASTM C 645, galvanized steel:
 - a. Interior Steel Studs: Minimum 0.46 mm (25 gage), provide sizes and gages to match existing, or as indicated.
 - 1) Provide minimum of 0.84 mm (20 gage) studs both sides of hollow metal frames.
 - b. Steel Stud Runners: Match studs. Provide long leg runners for slip joint at structure above to allow for deflection.
 - c. Furring Channels: Hat-shaped furring channels, minimum 0.46 mm (25 gage).
 - d. Sheet Metal Reinforcement (Alternate to Wood Blocking): 1.52 mm (16 gage) minimum.
11. Suspended Ceiling Metals:
 - a. Main Runners (Primary Members): ASTM C 754 cold-rolled steel channels with rust-inhibitive finish.
 - 1) 50 mm (2 inches) deep, 88 kg per 100 m (590 pounds per 1,000 LF).
 - 2) 38 mm (1-1/2 inch) deep, 70 kg per 100 m (475 pounds per 1,000 LF).
 - 3) 19 mm (3/4 inch) deep, 45 kg per 100 m (300 pounds per 1,000 LF).
 - b. Cross Furring (Furring Channels): Hat-shaped galvanized steel furring channels, minimum 0.46 mm (25 gage).
 - c. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper.
 - 1) Hanger Wire: Minimum 4.1 mm (8 gage).
 - 2) Tie Wire: 6 mm (16 gage).
12. Lath:
 - a. Metal Lath: ASTM C 847, galvanized expanded metal.
 - 1) Weight: In compliance with ASTM C 841 for conditions and spacing of supports.
 - b. Gypsum Lath: ASTM C 37, plain. Provide Type X at fire-rated assemblies.
 - 1) Thickness: As indicated or specified and in compliance with ASTM C 841 for conditions and spacing of supports.
13. Fasteners:
 - a. Screws: ASTM C 1002, corrosion-resistant. Provide types as recommended by manufacturer for each application.
 - 1) To Metal Framing: Minimum 25 mm (1 inch), Type S.
 - 2) To Wood Framing: Minimum 32 mm (1-1/4 inch), Type W bugle head.
14. Accessories: ASTM C 841, galvanized steel.
 - a. Comer Beads: Small nose with expanded flanges, unless otherwise indicated.
 - b. Casing Beads: Square-edged style. with short or expanded flanges to suit kinds of plaster bases indicated.
 - c. Control Joints: Prefabricated folded pair of non-perforated screeds in M-shaped configuration, with expanded or perforated flanges.
 - 1) Provide removable protective tape on plaster face of control joints.
 - d. Cornerite: Galvanized expanded metal lath in accordance with ASTM C 841.
15. Gypsum Plaster Materials: ASTM C 28.
 - a. Base Coat Plasters: One of following:
 - 1) Gypsum ready-mixed plaster with mill-mixed perlite aggregate.
 - 2) Gypsum wood-fibered plaster, ASTM C 28, Type N.
 - b. Finish Coat Plasters: One of following:
 - 1) Gypsum ready-mixed finished plaster, manufacturers standard mill-mixed gauged interior finish.



- 2) Gypsum Gauging Plaster: ASTM C 28, Type G.
 - c. Quicklime: ASTM C 5.
 - d. Sand: ASTM C 35.
 - e. Finishing Hydrated Limes: ASTM C 206, Type S, special hydrated lime for finishing purposes.
 - f. Bonding Compound for Gypsum Plaster: ASTM C 631.
 - g. Water: Clean and free from injurious amounts of oils, acids, alkalis, salts, organic materials, or substances that may be deleterious to plaster or metals in contact with plaster.
16. Sound-Isolation Materials:
- a. Sound Insulation: ASTM C 665, Type I (unfaced) mineral-fiber blankets, 12 to 16 kg per cu m (0.75 to 1 PCF), thickness as indicated or scheduled, or required by fire-rated assembly.
 - b. Acoustical Sealant:
 - 1) Concealed: ASTM C 919 nondrying, non-hardening, non-skinning, non-bleeding, and non-staining.
 - 2) Exposed: ASTM C 919 non-oxidizing and skinning, permanently elastic, and paintable.
 - c. Ductwork Penetrations Packing: Low-density fiberglass.
17. Gypsum Plaster Mixes: As recommended by manufacturer:
- a. Scratch Coat:
 - 1) Over Metal Lath: Gypsum wood-fibered plaster, neat or with job-mixed sand.
 - 2) Over Gypsum Lath: Gypsum neat plaster with job-mixed sand.
 - 3) Over Unit Masonry: Gypsum wood-fibered plaster, neat or with job-mixed sand.
 - b. Brown Coat:
 - 1) Over Metal Lath: Gypsum wood-fibered plaster, with job-mixed sand.
 - 2) Over Gypsum Lath: Gypsum neat plaster with job-mixed sand.
 - 3) Over Unit Masonry: Gypsum wood-fibered plaster with job-mixed sand.
 - c. Finish Coat: Proportion materials for finish coats to comply with ASTM C 842 for each type of finish coat and texture indicated.
 - 1) Gypsum Gauging Plaster 1 part plaster and 2 parts lime.
 - a) Over lightweight aggregate base coats, add 15 L (1/2 cubic foot) of perlite fines or 23 kg (50 pounds) of No. 1 white silica sand per 45 kg (100 pounds) of plaster.
 - 2) Gypsum Ready-mixed Finish Plaster Neat.
 - d. Mechanically mix cementitious and aggregate materials for plasters to comply with applicable referenced application standard and with recommendations of plaster manufacturer.

EXECUTION

Examination

18. Units, Spaces, and Areas to be renovated: Comply with Detailed Scope of Work.
 - a. Verify that surfaces to receive rough carpentry are prepared to required grades and dimensions.

Preparation

19. Dust Protection: Comply with Detailed Scope of Work.
20. Building Occupation: Carry out demolition and renovation work to cause as little inconvenience to occupants as possible. See Detailed Scope of Work.
21. Protection: Comply with Detailed Scope of Work.
 - a. Protection: Provide drapes and drop cloths necessary to protect walls, floors, ductwork and piping, electrical work, etc. during plastering operations.
22. Selective Demolition: Comply with Detailed Scope of Work.
23. Surface Preparation: Clean projections, dust, loose particles, grease, bond breakers, and foreign matter from surfaces to receive plaster.



- a. Do not apply plaster directly to surfaces (1) of masonry or concrete that have been coated with bituminous compound or other waterproofing agents, or (2) that have been painted or previously plastered.
- b. Before plaster work is started, wet masonry and concrete surfaces thoroughly with fine fog spray of clean water to produce uniformly moist surface.
- c. Do not apply plaster to surfaces containing frost.

Laying-Out Work

24. Discrepancies: Verify dimensions and elevations indicated in layout of existing work.
 - a. Prior to commencing work, carefully compare and check Drawings (if any) for discrepancies in locations or elevations of work to be executed.
 - b. Refer discrepancies among Drawings (if any), Specifications, and existing conditions to the Owner for adjustment before work affected is performed.
 - 1) Failure to make such notification shall place responsibility on Contractor to carry out work in satisfactory, workmanlike manner.
25. Contractor: Responsible for location and elevation of construction contemplated by Construction Documents.

Performance

26. Patching: Patch and extend existing work using skilled mechanics who are capable of matching existing quality of workmanship.
 - a. Quality of Patched or Extended Work: Not less than specified for new work. If similar new work is not specified, equal to existing work.
27. Damaged Surfaces: Comply with Detailed Scope of Work.
28. Transitions from Existing to New Work: Comply with Detailed Scope of Work.
29. Isolation: Where lathing and metal support system abuts building structure horizontally and where partition/wall work abuts overhead structure, isolate work from structural movement sufficiently to prevent transfer of loads to work from building structure. Install slip or cushion-type joints to absorb deflections but maintain lateral support.
 - a. Frame both sides of control and expansion joints independently, and do not bridge joints with furring and lathing or accessories.

Installation Of Suspended Steel Framing

30. General: Construct ceilings of lath and plaster on suspended steel framing system in accordance with manufacturer's recommendations and Reference Standards.
31. Hanger Installation: Attach hangers to structure above ceiling to comply with NAAMM ML/SFA 920.
32. Ceiling Suspension System Components: Install In sizes and at spacings indicated but not in smaller sizes or greater spacings than those required by ASTM C 841 and NAAMM ML/SFA 920.
 - a. Wire Hangers: Space and install wire hangers in accordance with ASTM C 841 and within 150 mm (6 inches) of channel ends, unless closer spacing indicated or required for fire-resistance rated assembly.
 - b. Main Runners (Primary Members): Space and install channels in accordance with ASTM C 841, unless closer spacing indicated or required for fire-resistance rated assembly.
 - c. Cross Furring (Furring Channels): Space and install furring channels in accordance with ASTM C 841, unless closer spacing indicated or required for fire-resistance rated assembly.
33. Framing Around Openings: Frame channels and lath on suspended soffits and ceilings and at furring to receive electric lights, etc. as indicated or as necessary to complete work. Furnish and install in furring, plaster rings or access panels furnished under other sections.

Installation Of Steel Stud Partitions

34. General: Install steel stud partition support systems in accordance with manufacturer's recommendations and Reference Standards.
35. Steel Stud Systems: Comply with ASTM C 754.



- a. To Receive Metal Lath: Space studs in accordance with ASTM C 841 and NAAMM ML/SFA 920.
 - b. To Receive Gypsum Lath: Space studs in accordance with ASTM C 841.
36. Extend partition support systems to finish ceilings and attach to ceiling suspension members, unless otherwise indicated.

Metal Furring

37. General: Install in accordance with ASTM C 841 and NAAMM ML/SFA 920.
 - a. Install supplementary framing, blocking, and bracing at terminations in work and for support of fixtures, equipment services, heavy trim, grab bars, bath accessories, furnishings, and similar work to comply with manufacturer's recommendations.
38. Metal Furring to Receive Gypsum Lath: Space furring channels in accordance with ASTM C 841.
39. Metal Furring Systems:
 - a. To Receive Metal Lath: Space furring in accordance with ASTM C 841 and NAAMM ML/SFA 920.
 - b. To Receive Gypsum Lath: Space furring in accordance with ASTM C 841.
40. Isolation: Where lathing and metal support system abuts building structure horizontally and where partition/wall work abuts overhead structure, isolate work from structural movement sufficiently to prevent transfer of loads to work from building structure. Install slip or cushion-type joints to absorb deflections but maintain lateral support.
 - a. Frame both sides of control and expansion joints independently, and do not bridge joints with furring and lathing or accessories.

Installation Of Suspended Steel Framing

41. General: Construct ceilings of lath and plaster on suspended steel framing system in accordance with manufacturer's recommendations and Reference Standards.
42. Hanger Installation: Attach hangers to structure above ceiling to comply with NAAMM ML/SFA 920.
43. Ceiling Suspension System Components: Install in sizes and at spacings indicated but not in smaller sizes or greater spacings than those required by ASTM C 841 and NAAMM ML/SFA 920.
 - a. Wire Hangers: Space and install wire hangers in accordance with ASTM C 841 and within 150 mm (6 inches) of channel ends, unless closer spacing indicated or required for fire-resistance rated assembly.
 - b. Main Runners (Primary Members): Space and install channels in accordance with ASTM C 841, unless closer spacing indicated or required for fire-resistance rated assembly.
 - c. Cross Furring (Furring Channels): Space and install furring channels in accordance with ASTM C 841, unless closer spacing indicated or required for fire-resistance rated assembly.
44. Framing Around Openings: Frame channels and lath on suspended soffits and ceilings and at furring to receive electric lights, etc. as indicated or as necessary to complete work. Furnish and install in furring, plaster rings or access panels furnished under other sections.

Installation Of Steel Stud Partitions

45. General: Install steel stud partition support systems in accordance with manufacturer's recommendations and Reference Standards.
46. Steel Stud Systems: Comply with ASTM C 754.
 - a. To Receive Metal Lath: Space studs in accordance with ASTM C 841 and NAAMM ML/SFA 920.
 - b. To Receive Gypsum Lath: Space studs in accordance with ASTM C 841.
47. Extend partition support systems to finish ceilings and attach to ceiling suspension members, unless otherwise indicated.

Metal Furring

48. General: Install in accordance with ASTM C 841 and NAAMM ML/SFA 920.
 - a. Install supplementary framing, blocking, and bracing at terminations in work and for support of fixtures, equipment services, heavy trim, grab bars, bath accessories, furnishings, and similar work to comply with manufacturer's recommendations.



49. Metal Furring to Receive Gypsum Lath: Space furring channels in accordance with ASTM C 841.
50. Metal Furring Systems:
 - a. To Receive Metal Lath: Space furring in accordance with ASTM C 841 and NAAMM ML/SFA 920.
 - b. To Receive Gypsum Lath: Space furring in accordance with ASTM C 841.

Lathing

51. Metal Lathing: Install in accordance with ASTM C 841 and NAAMM ML/SFA 920.
 - a. At Metal Framing: Attach metal lath to furring channels with long dimension of sheet at right angles to furring channels with gage wire ties spaced not over 150 mm (6 inches) apart.
 - b. At Wood Framing: Nail metal lath to wood framing with long dimension of sheet at right angles to framing member.
 - c. Place ties where sides of sheets laps at supports and at side laps of sheets between supports. Lap metal lath not less than 13 mm (1/2 inch) at sides of sheets and 25 mm (1 inch) at ends of sheets.
 - d. Suspended and Furred Ceilings: Use 1.8 kg/sq m (3.4 pounds/SY) minimum weight diamond mesh lath.
 - e. Ceramic Tile Setting Beds: Use 1.8 kg/sq m (3.4 pounds/SY) minimum weight diamond mesh lath.
52. Gypsum Lath: Install in accordance with ASTM C 841.
 - a. Wood Framing and Furring: Install lath as follows:
 - 1) With screws to comply with lath manufacturer's directions.
 - 2) With nails.
 - 3) Provide floating angle construction.
 - b. Suspended and Furred Ceilings: Install lath to furring members with clips.
 - c. Vertical Metal Framing and Furring: Install lath as follows:
 - 1) With screws.
 - 2) With clips, supplemented by screws where required by lath manufacturer.
 - 3) Where sound-rated partitions are indicated, attach lath with resilient clips.

Installation Of Accessories

53. Accessories: Install as required to repair area of work to match existing. Install in accordance with ASTM C 841. Miter or cope accessories at comers; Install with tight joints and in alignment. Attach accessories securely to plaster bases to hold accessories in place and alignment during plastering.
54. Interior Corners: Apply cornerite.
55. Corner Beads: Install corner beads tightly secured to lath at exposed exterior corners.
56. Casing Beads: Install at terminations of plaster work, except where plaster passes behind and is concealed by other work and where metal screeds, bases, or metal frames act as casing beads.
57. Control Joints: Install at locations indicated or, if not indicated, at spacings and locations required by Reference Standards. Coordinate specific locations with the Owner.
58. Access Panels: Provide access panels as required for maintenance of concealed plumbing work in coordination with Division 15 Section "Plumbing." Tiled Areas: Coordinate with Division 9 Section "Ceramic Tile."
59. Sound-Rated Plaster Work: Where sound-rated plaster work is indicated by STC ratings or other notation:
 - a. Acoustical Sealant: Seal work at perimeters, control joints, openings, and penetrations with continuous bead of acoustical sealant. Comply with ASTM C 919 and plastering manufacturer's recommendations for location of sealant beads.
 - b. Sound Insulation: Install insulation blankets within stud cavities of sound-rated partition assemblies where indicated.

Plastering

60. Plastering: Comply with ASTM C 842 in thickness to match existing.



- a. Preparation: Remove loose, fractured, or separated plaster to face of substrate. repairing lath at substrate to ensure repair area bounded by solid and sound existing plaster construction.
 - 1) Prepare monolithic surfaces for bonded base coats and use bonding compound to comply with Reference Standards for conditioning of monolithic surfaces.
 - b. Grout hollow metal frames, bases, and similar work with base-mat plaster material, and prior to lathing where necessary. Except where full grouting is indicated or required for fire-resistance rating, grout at least 150 mm (6 inches) at each jamb anchor dip.
 - c. Plaster flush with metal frames and other built-in metal items or accessories that act as plaster ground, unless otherwise indicated. Where plaster is not terminated at metal by casing beads, cut base coat free from metal before plaster sets and groove finish coat at junctures with metal.
61. Preparation: Check metal grounds, corner beads, screeds, and other accessories carefully for alignment before starting plaster application. Check expansion and control joints and supporting metal structures to ensure that expansion and control joints can move unrestrained.
62. Plaster: Apply in accordance with ASTM C 842 in thickness to match existing:
- a. Use three-coat work over following plaster bases:
 - 1) Metal lath.
 - 2) Gypsum lath attached to ceiling supports by clips.
 - 3) Gypsum lath attached to ceiling supports spaced over 400 mm (16 inches) OC.
 - 4) Gypsum lath, 9.5 mm (3/8 inch) thick, with separate vapor retarder behind.
 - b. Use two-coat work over following bases.
 - 1) Gypsum lath except for installations requiring three-coat work.
 - 2) Unit masonry.
 - 3) Concrete, cast-in-place or precast when surface condition complies with ASTM C 842 for plaster bonded to solid base.
 - c. First Coat: Apply first coat of plaster with such force to secure good key.
 - d. Finish Coats: Apply troweled finish coats unless otherwise indicated.
63. Workmanship: Perform work true to line, straight, and plumb.
- a. Finished Surfaces: Free from waves, dents, bumps, cracks, pits, checks, streaks, catfaces, blisters, or other defects. Cutout and properly replace defective areas.
 - b. Execute work to avoid any irregularity occurring at point or place where one section is joined to another.
 - c. Arises and Angles: True and sharp.
64. Tolerances: Plaster surface plane within plus/minus 3 mm in 3 000 mm (1/8 inch in 10 feet).

Integrating Existing Work

65. Protection: Comply with Detailed Scope of Work.

Adjustments

66. Partition Removal: Comply with Detailed Scope of Work.

Dust Control

67. Dust: Comply with Detailed Scope of Work.

Patching And Cleaning

68. Cutting and Patching: Do necessary cutting, patching, and repairing and pointing up of plastering after other work is in place to restore defective areas. Repair or replace work to eliminate blisters, buckles, excessive crazing and check-cracking, dry outs, efflorescence, sweat-outs, and similar defects and where bond to substrate has failed.
- a. Sand smooth-troweled finishes lightly to remove trowel marks and arises.
69. Cleaning: As rapidly as plastering is completed in each space, clean up rubbish, utensils, and surplus material, sweep floor and leave in neat condition for work of others.
- a. When general plastering is concluded, remove plastering rubbish, equipment, and surplus materials from premises.
 - b. Clean surfaces splattered with plaster.



END OF SECTION 09 22 36 23



Task	Specification	Specification Description
09 22 36 23	09 22 13 00	Gypsum Plaster
09 22 36 23	09 22 13 00a	Gypsum Veneer Plaster
09 22 36 23	09 22 13 00b	Portland Cement Plaster
09 22 36 33	09 22 13 00	Gypsum Plaster
09 22 36 33	09 22 13 00a	Gypsum Veneer Plaster
09 22 36 33	09 22 13 00b	Portland Cement Plaster
09 22 36 33	09 22 36 23	Lath and Plaster Renovation



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SECTION 09 23 13 00 - GYPSUM BOARD RENOVATION

GENERAL

Description Of Work

1. This specification covers the furnishing and installation of materials for gypsum board renovation. Products shall be as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

Submittals

2. Quality Assurance/Control Submittals
 - a. Certificates: Manufacturer's written certification that gypsum products meet or exceed specified requirements.

Quality Assurance

3. Regulatory Requirements:
 - a. Gypsum Board Partitions: Listed and labeled for fire-protective ratings as indicated or scheduled.
 - b. Gypsum Board Floor/Ceilings and Roof/Ceiling Assemblies: Listed and labeled for fire protective ratings as indicated or scheduled.
 - c. Fire-Rated Assemblies: Comply with UL 05, FM P8016, or GA 600 for required fire-rated assembly.

Delivery, Storage, And Handling

4. Storage and Protection: Store wallboard off ground to protect it from weather and damage due to moisture damage.
 - a. Wallboard: Dry, free of warpage, and have bundling tape intact immediately prior to use.

Project Conditions

5. Environmental Requirements: Comply with Detailed Scope of Work.
 - a. During gypsum-panel application and finishing, maintain indoor temperatures within range of 13 degrees C (55 degrees F) to 21 degrees C (70 degrees F). Provide adequate ventilation to carry off excess moisture.
6. Existing Conditions: See Division 1 Section "Summary of Work". Do not interfere with use of occupied buildings or portions of buildings. Maintain free and safe passage to and from occupied areas.
7. Protection: Protect grounds, plantings, buildings and any other facilities or property from damage caused by construction operations.

Scheduling And Sequencing

8. Scheduling and Completion: Comply with Detailed Scope of Work.

PRODUCTS

Materials

9. Materials for Patching, Extending, and Matching:



- a. Provide same products or types of construction as in existing structure, as needed to patch, extend, or match existing work.
 - 1) Generally, Contract Documents will not define products present in existing construction. Determine products by Inspection and any necessary testing.
 - 2) Patching, extending, and matching of existing work and systems shall result in a complete, finished system.
- b. Presence of product, finish, or type of construction requires that patching, extending, or matching be performed as necessary to make work complete and consistent.

Metals

10. Partition Metals: ASTM C 645, galvanized steel:
 - a. Interior Steel Studs: Minimum 0.46 mm (25 gage), provide sizes and gages to match existing or as indicated.
 - 1) Provide minimum of 0.84 mm (20 gage) studs both sides of hollow metal frames.
 - b. Steel Stud Runners: Match studs. Provide long leg runners for slip joint at structure above to allow for deflection.
 - c. Furring Channels: Hat-shaped furring channels, minimum 0.46 mm (25 gage).
 - d. Resilient Furring Channels: Manufacturer's standard product designed to reduce sound transmission by resilient attachment of gypsum board, 13 mm (1/2 inch) deep.
 - e. Sheet-Metal Reinforcement (Alternate to Wood Blocking): 1.52 mm (16 gage) minimum.
11. Suspended Coiling Metals:
 - a. Runner Channels: ASTM C 754 cold-rolled steel channels with rust-inhibitive finish.
 - 1) 50 mm (2 Inches) deep, 88 kg per 100 m (590 pounds per 1,000 LF).
 - 2) 38 mm (1-1/2 inch) deep, 70 kg per 100 m (475 pounds per 1,000 LF).
 - 3) 19 mm (3/4 Inch) deep, 45 kg per 100 m (300 pounds per 1,000 LF).
 - b. Furring Channels: Hat-shaped galvanized-steel furring channels, minimum 0.46 mm (25 gage).
 - c. Steel Studs: Galvanized steel as specified above, minimum 0.46 mm (25 gage).
 - d. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper.
 - 1) Hanger Wire: Minimum 4.1 mm (8 gage).
 - 2) Tie Wire: 6 mm (16 gage).

Gypsum Board And Related Materials

12. Gypsum Board: GA216 and ASTM C 36
 - a. Size: 12.7 mm and 15.9 mm (1/2 inch and 5/8 inch) thick to match existing, as indicated or scheduled. Provide boards 1 200 mm (48 inches) wide by length required to minimize cross joints.
 - b. Regular Tapered-edge gypsum panels.
 - 1) Provide Type X gypsum panels at fire-rated assemblies.
 - c. Water-Resistant: ASTM C 630, paintable, tapered-edge gypsum panels.
 - 1) Provide Type X water-resistant gypsum panels at fire-rated assemblies.
13. Cementitious Backer Units (CBU): ANSI A118.9, nailable/screwable backer board composed of stable portland cement, aggregates, and reinforcements with ability to remain unaffected by prolonged exposure to moisture, 12.7 mm (1/2 inch) thick.
14. Fasteners:
 - a. Screws: ASTM C 1002, drywall screws, corrosion resistant. Provide types as recommended by manufacturer for each application.
 - 1) Wallboard to Metal Framing: Minimum 25 mm (1 inch), Type S.
 - 2) Wall board to Wood Framing: Minimum 32 mm (1-1/4 inch) Type W bugle head.



- 3) Wall board to Wallboard: Type G.
- b. Nails: ASTM C 514.
15. Accessories: GA 216 and ASTM C 1047, galvanized steel.
 - a. Comer Bead: GA 216 Type CB-114 x 114.
 - b. Metal Trim (Casing Beads): GA 216 Type L, in depth to match gypsum-board thickness.
 - c. Control Joint: V-shaped control joint.
 - d. Adhesive: ASTM C 557 multi-purpose adhesive.
16. Finishing Materials: ASTM C 475.
 - a. Joint Tape: Provide type as recommended by panel manufacturer.
 - b. Joint Treatment: Joint compound, adhesive, water, and fasteners.
17. Sound-Isolation Materials:
 - a. Sound Insulation: ASTM C 665, Type I (unfaced) mineral fiber blankets, 3.7 to 4.9 kg per sq m (3/4 to 1 PCF), thickness as indicated, scheduled, or required by fire-rated assembly.
 - b. Acoustical Sealant:
 - 1) Concealed: ASTM C 919 nondrying, non-hardening, and non-skinning; non-bleeding; and non-staining.
 - 2) Exposed: ASTM C 919 non-oxidizing and skinning; permanently elastic; and paintable.
 - c. Ductwork Penetrations Packing: Low-density fiberglass.

EXECUTION

Examination

18. Units, Spaces, and Areas to be Renovated: Comply with Detailed Scope of Work.
 - a. Existing Conditions: Before beginning installation, examine substrates and framing to receive gypsum board for defects or conditions adversely affecting quality and execution of installation.

Preparation

19. Dust Protection: Comply with Detailed Scope of Work.
20. Building Occupation: Carry out demolition and renovation work to cause as little inconvenience to occupants as possible. See Detailed Scope of Work.
21. Protection: Comply with Detailed Scope of Work.
 - a. Protection: Provide drapes and drop cloths necessary to protect walls, floors, ductwork and piping, electrical work, etc. during drywall finishing operations.
22. Selective Demolition: Comply with Detailed Scope of Work.

Laying Out Work

23. Discrepancies: Verify dimensions and elevations indicated in layout of existing work.
 - a. Prior to commencing work, carefully compare and check Drawings (if any) for discrepancies in locations or elevations of work to be executed.
 - b. Refer discrepancies among Drawings (if any), Specifications, and existing conditions to the Owner or adjustment before work affected is performed.
 - 1) Failure to make such notification shall place responsibility on Contractor to carry out work in satisfactory, workmanlike manner.
 - c. Contractor: Responsible for location and elevation of construction indicated by Construction Documents.

Performance



24. Patching: Patch and extend existing work using skilled mechanics capable of matching existing quality of workmanship.
 - a. Quality of Patched or Extended Work: Not less than specified for new work. If similar new work is not specified, equal to existing work.
25. Damaged Surfaces: Comply with Detailed Scope of Work.
26. Transitions from Existing to New Work: Comply with Detailed Scope of Work.

Erection Of Drywall Stud Partitions

27. Reference Standard: Erect steel framing in accordance with ASTM C 754.
28. Layouts: Align partition studs accurately according to partition layout.
29. Anchoring: Anchor runner channels to concrete slabs with concrete stub nails or power-driven anchors at 600 mm (24 inches) OC. Anchor runner channels to coiling grid, where applicable, with stove bolts. Where studs extend above ceiling system, install headers where required to receive runners.
30. Studs: Position studs vertically in runners. Where studs are located adjacent to openings or partition intersections and comers. anchor studs to runners with manufacturer's metal lock fastener or with 13 mm (1/2 inch) Type S pan-head screws.
 - a. Space studs at 400 mm (16 Inches) and 600 mm (24 inches) OC as indicated or scheduled.
 - 1) Cementitious Backer Units (CBU): Space studs at maximum of 400 mm (16 inches) OC.
 - 2) Limiting Heights: Comply with ASTM C 754 for transverse load of 240 Pa (5 lb-force/SF) without exceeding either allowable stress or deflection of L/240. Comers and Intersections: Locate studs no more than 50 mm (2 inches) from abutting partitions, comers, etc.
 - b. Openings: Locate studs not more than 50 mm (2 inches) from opening frames. Anchor studs to frame anchor clips by bolt or screw attachment. Install headers over openings as recommended by the manufacturer.
 - 1) Solid-Core Wood Doors and Hollow Metal Doors: Provide two full-height studs at jambs fastened together back to back.
 - 2) Fire-Rated Openings: Comply with GA 219.
31. Bracing: Provide diagonal bracing at head of studs that terminate above the ceiling level. Bracing shall consist of metal studs bent to V-shape and extending at 45 degrees from partition head to structure above. Locate bracing 1 200 mm (48 inches) maximum OC.
32. Wood Blocking or Metal Reinforcement:
 - a. Wood Blocking: See Division 6 Section "Rough Carpentry."
 - b. Install metal reinforcement of size required for support of toilet and bath accessories, hardware, cabinets, shelving, counters, and other wall-mounted items.
 - c. Set true to line, level, or plumb well-secured in stud wall and flush with back of drywall or other wall finish.
 - d. Coordinate exact locations with other sections.

Miscellaneous Framing And Furring

33. General: Provide necessary framing and furring for special framing at recesses, offsets, specialty items, and at wall-mounted casework, shelving, and equipment.
34. Furring Channels: Install furring channels over back-up material. Position channels vertically at 600 mm (24 inches) OC. Use power-activated fasteners or stub nails at 600 mm (24 Inches) OC along alternating flanges. Shim channels level as required.
 - a. Cementitious Backer Units (CBU): Space furring at maximum of 400 mm (16 inches) OC.



35. Resilient Furring Channels: Screw-attach In accordance with manufacturer's recommendations.
 - a. Spacing: 600 mm (24 inches) OC for framing at 16 inches OC and 400 mm (16 inches) OC for framing at 24 Inches OC.

Ceiling Grillage Erection

36. Reference Standard: Erect steel framing In accordance with ASTM C 754.
37. Hangers: Install wire hangers spaced not over 1 200 mm (48 inches) OC in direction of 38 mm (1-1/2 inch) main runner channels and within 150 mm (6 inches) of ends of main runners or interruptions of ceiling continuity. Hang from structure above.
38. Runners: Place main runners not over 1 200 mm (48 inches) OC. Provide, position, and level hangers with hangers saddle-tied along runners. Space furring channels at 600 mm (24 inches) OC at right angles to runner channels and secure with furring channel clips.
39. Reinforcement: At light troffers or other openings, reinforce grillage with 19 mm (3/4 inch) cold-rolled channels wired atop and parallel to main runner channels.
 - a. Provide lateral seismic bracing as required by code.
40. Special Shapes: Provide necessary framing and suspension for off sets, verticals, etc.

Insulation

41. Sound Insulation: Place sound Insulation blankets in partitions tight within spaces, around cut openings. behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
 - a. Ductwork Penetrations: Provide one-inch wide clearance around ductwork and pack with fiberglass ready for joint sealers.

Installation Of Gypsum Drywall

42. Reference Standards: Apply and finish gypsum board in accordance with GA 216 and ASTM C 840.
43. Partition Gypsum Board Layout: Apply gypsum wallboard panels vertically with abutting ends and edges occurring over stud flanges or furring.
 - a. Joints on Opposite Sides of Partitions: Stagger; joints shall not occur over same stud.
 - b. Two Layer Construction: Stagger Joints between layers.
44. Ceiling Gypsum Board: Apply gypsum board of maximum practical length with long dimensions at right angles to furring channels. End and edge joints shall occur over furring channels with end joints staggered. Properly support gypsum board around cutouts and openings.
45. Fasteners: Apply board to studs or furring with drywall screws spaced 300 mm (12 inches) OC in field of board and 200 mm (8 inches) OC staggered along abutting edges.
46. Water-Resistant: Apply gypsum wallboard manufacturer's recommended sealant to raw cut edges and screw heads.
47. Cementitious Backer Units (CBU): Install in accordance with ANSI A108.11 and manufacturer's recommendations.
48. Accessories:
 - a. Comer Bead: Apply as recommended by manufacturer at exposed outer corners.
 - b. Trim (Casing Beads): Apply as recommended by manufacturer, where gypsum board abuts other materials, and as indicated.
 - c. Control Joints: Comply with GA 216.
 - 1) Walls: Install at not more than 9 m (30 feet) OC.
 - 2) Ceilings: Install at not more than 15 m (50 feet) OC and where framing changes direction.
 - 3) Coordinate locations with the Owner.
49. Access Panels: Securely install access panels furnished under other sections. Set plumb and square to align with finish surface.



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50. Acoustical Sealant: Seal perimeter and penetrations on both sides of sound-rated partitions and partitions with sound-attenuation blankets with minimum of single 6 mm (1/4 inch) bead of sealant
 - a. Locations:
 - 1) Seal around gypsum-board perimeter in angle formed by gypsum-board panels and abutting dissimilar materials.
 - 2) Seal intersections of gypsum board with dissimilar materials.
 - 3) Seal pipe, conduit, ductwork, penetrations, etc.
 - 4) Seal around cutouts for lights, cabinets, pipes, ductwork, electrical boxes, etc.
 - 5) Seal gypsum board panel terminations in door and window frames.
 - 6) Seal control-joint locations before installing control Joints to panels.
 - b. Installation: Comply with ASTM C 919 and requirements of indicated sound-rated assembly. Provide number and positions of beads to comply with sound rating of assembly.
 51. Tolerances: Gypsum-board surface plane within plus or minus 3 mm in 3 000 mm (1/8 inch in 10 feet).
 52. Finishing: Finish in accordance with GA 214.
 - a. Concealed Locations (Not Exposed to View in Rooms): Level 1
 - b. Beneath Tile: Level 2.
 - c. Other Finished Areas: Level 4. Finish joints, trim, and fastener dimples. Sand smooth.
 - d. Cementitious Backer Units (CBU): Treat joints in accordance with ANSI A108.11 and manufacturer's recommendations.

END OF SECTION 09 23 13 00



Task	Specification	Specification Description
09 23 13 00	09 22 13 00	Gypsum Plaster
09 23 13 00	09 22 13 00a	Gypsum Veneer Plaster
09 23 13 00	09 22 13 00b	Portland Cement Plaster
09 23 13 00	09 22 36 23	Lath and Plaster Renovation
09 24 33 00	01 22 16 00	No Specification Required



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SECTION 09 28 13 00 - GYPSUM BOARD

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for gypsum board. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Interior gypsum board.
 - b. Exterior gypsum board for ceilings and soffits.
 - c. Tile backing panels.

C. Submittals

1. Product Data: For each type of product indicated.
2. Samples: For the following products:
 - a. Trim Accessories: Full-size Sample in 12-inch- (300-mm-) long length for each trim accessory indicated.
 - b. Textured Finishes: Manufacturer's standard size for each textured finish indicated and on same backing indicated for Work.
3. LEED Submittals:
 - a. Product Data for Credit MR 4.1 and MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - 1) Include statement indicating costs for each product having recycled content.
 - b. Product Data for Credit EQ 4.1: For adhesives used to laminate gypsum board panels to substrates, including printed statement of VOC content.

D. Quality Assurance

1. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
2. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

E. Storage And Handling

1. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

F. Project Conditions

1. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
2. Do not install interior products until installation areas are enclosed and conditioned.
3. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
 - a. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - b. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.



1.2 PRODUCTS

A. Panels, General

1. Recycled Content: Provide gypsum panel products with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 25 percent by weight.
2. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

B. Interior Gypsum Board

1. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.
2. Regular Type:
 - a. Thickness: 1/2 inch (12.7 mm).
 - b. Long Edges: Tapered **OR** Tapered and featured (rounded or beveled) for prefilling, **as directed**.
3. Type X:
 - a. Thickness: 5/8 inch (15.9 mm).
 - b. Long Edges: Tapered **OR** Tapered and featured (rounded or beveled) for prefilling, **as directed**.
4. Type C:
 - a. Thickness: As required by fire-resistance-rated assembly indicated on Drawings.
 - b. Long Edges: Tapered.
5. Flexible Type: Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.
 - a. Thickness: 1/4 inch (6.4 mm).
 - b. Long Edges: Tapered.
6. Ceiling Type: Manufactured to have more sag resistance than regular-type gypsum board.
 - a. Thickness: 1/2 inch (12.7 mm).
 - b. Long Edges: Tapered.
7. Foil-Backed Type:
 - a. Core: As indicated on Drawings **OR** 3/8 inch (9.5 mm), regular type **OR** 1/2 inch (12.7 mm), regular type **OR** 5/8 inch (15.9 mm), Type X **OR** Type C as required by fire-resistance-rated assembly indicated on Drawings, **as directed**.
 - b. Long Edges: Tapered **OR** Tapered and featured (rounded or beveled) for prefilling, **as directed**.
8. Abuse-Resistant Type: Manufactured to produce greater resistance to surface indentation, through-penetration (impact resistance), and abrasion than standard, regular-type and Type X gypsum board.
 - a. Core: As indicated on Drawings **OR** 1/2 inch (12.7 mm), regular type **OR** 5/8 inch (15.9 mm), Type X, **as directed**.
 - b. Long Edges: Tapered.
9. High-Impact Type: Manufactured with Type X core, plastic film laminated to back side for greater resistance to through-penetration (impact resistance).
 - a. Core: As indicated on Drawings **OR** 5/8 inch (15.9 mm) thick, **as directed**.
 - b. Plastic-Film Thickness: 0.010 inch (0.254 mm) **OR** 0.020 inch (0.508 mm) **OR** 0.030 inch (0.762 mm) **OR** 0.081 inch (2.057 mm), **as directed**.
10. Moisture- and Mold-Resistant Type: With moisture- and mold-resistant core and surfaces.
 - a. Core: 5/8 inch (15.9 mm), Type X.
 - b. Long Edges: Tapered.

C. Exterior Gypsum Board For Ceilings And Soffits

1. Exterior Gypsum Soffit Board: ASTM C 931/C 931M or ASTM C 1396/C 1396M, with manufacturer's standard edges.



- 1) Core: As indicated **OR** 1/2 inch (12.7 mm), regular type **OR** 5/8 inch (15.9 mm), Type X, **as directed**.
 2. Glass-Mat Gypsum Sheathing Board: ASTM C 1177/C 1177M.
 - a. Core: As indicated **OR** 1/2 inch (12.7 mm), regular type **OR** 5/8 inch (15.9 mm), Type X, **as directed**.
- D. Tile Backing Panels
1. Water-Resistant Gypsum Backing Board: ASTM C 630/C 630M or ASTM C 1396/C 1396M.
 - a. Core: As indicated on Drawings **OR** 1/2 inch (12.7 mm), regular type **OR** 5/8 inch (15.9 mm), Type X **OR** Type C as required by fire-resistance-rated assembly indicated on Drawings, **as directed**.
 2. Glass-Mat, Water-Resistant Backing Board:
 - a. Complying with ASTM C 1178/C 1178M.
 - b. Complying with ASTM C1177/C 1177M.
 - c. Core: As indicated on Drawings **OR** 1/2 inch (12.7 mm), regular type **OR** 5/8 inch (15.9 mm), Type X, **as directed**.
 3. Cementitious Backer Units: ANSI A118.9.
 - a. Thickness: As indicated on Drawings **OR** 1/2 inch (12.7 mm), **as directed**.
- E. Trim Accessories
1. Interior Trim: ASTM C 1047.
 - a. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet **OR** Galvanized or aluminum-coated steel sheet or rolled zinc **OR** Plastic **OR** Paper-faced galvanized steel sheet, **as directed**.
 - b. Shapes:
 - 1) Cornerbead.
 - 2) Bullnose bead.
 - 3) LC-Bead: J-shaped; exposed long flange receives joint compound.
 - 4) L-Bead: L-shaped; exposed long flange receives joint compound.
 - 5) U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - 6) Expansion (control) joint.
 - 7) Curved-Edge Cornerbead: With notched or flexible flanges.
 2. Exterior Trim: ASTM C 1047.
 - a. Material: Hot-dip galvanized steel sheet, plastic, or rolled zinc.
 - b. Shapes:
 - 1) Cornerbead.
 - 2) LC-Bead: J-shaped; exposed long flange receives joint compound.
 - 3) Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.
 3. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
 - a. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221 (ASTM B 221M), Alloy 6063-T5.
 - b. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.
- F. Joint Treatment Materials
1. General: Comply with ASTM C 475/C 475M.
 2. Joint Tape:
 - a. Interior Gypsum Wallboard: Paper.
 - b. Exterior Gypsum Soffit Board: Paper.
 - c. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
 - d. Tile Backing Panels: As recommended by panel manufacturer.
 3. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
 - a. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.



- b. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping **OR** drying-type, all-purpose, **as directed**, compound.
 - 1) Use setting-type compound for installing paper-faced metal trim accessories.
 - c. Fill Coat: For second coat, use setting-type, sandable topping **OR** drying-type, all-purpose, **as directed**, compound.
 - d. Finish Coat: For third coat, use setting-type, sandable topping **OR** drying-type, all-purpose, **as directed**, compound.
 - e. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound **OR** drying-type, all-purpose compound **OR** high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish, **as directed**.
4. Joint Compound for Exterior Applications:
 - a. Exterior Gypsum Soffit Board: Use setting-type taping compound and setting-type, sandable topping compound.
 - b. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.
 5. Joint Compound for Tile Backing Panels:
 - a. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.
 - b. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
 - c. Cementitious Backer Units: As recommended by backer unit manufacturer.

G. Auxiliary Materials

1. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
2. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
 - a. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 - a. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
 - b. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
4. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - a. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
 - b. Recycled Content: Provide blankets with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 25 percent by weight.
5. Acoustical Sealant: As specified in Division 07 Section "Joint Sealants".
 - a. Provide sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Thermal Insulation: As specified in Division 07 Section "Thermal Insulation".
7. Vapor Retarder: As specified in Division 07 Section "Thermal Insulation".

H. Texture Finishes

1. Primer: As recommended by textured finish manufacturer.
2. Polystyrene Aggregate Ceiling Finish: Water-based, job-mixed, polystyrene aggregate finish with flame-spread and smoke-developed indexes of not more than 25 when tested according to ASTM E 84.
 - a. Texture: Fine **OR** Medium **OR** Coarse, **as directed**.
3. Aggregate Finish: Water-based, job-mixed, aggregated, drying-type texture finish for spray application.



- a. Texture: Light spatter **OR** Spatter knock-down, **as directed**.
4. Acoustical Finish: Water-based, chemical-setting or drying-type, job-mixed texture finish for spray application.
 - a. Application Thickness: 1/2 inch (12.7 mm).
 - b. Fire-Test-Response Characteristics: Indices when tested according to ASTM E 84 as follows:
 - 1) Flame Spread: Less than 25.
 - 2) Smoke Developed: Less than 450.
 - c. NRC: 0.55 according to ASTM C 423.

1.3 EXECUTION

A. Examination

1. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.
2. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Applying And Finishing Panels, General

1. Comply with ASTM C 840.
2. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
3. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.
4. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
5. Form control and expansion joints with space between edges of adjoining gypsum panels.
6. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - a. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
 - b. Fit gypsum panels around ducts, pipes, and conduits.
 - c. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.
7. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
8. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
9. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members, or provide control joints to counteract wood shrinkage.
10. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.



11. Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.

C. Applying Interior Gypsum Board

1. Install interior gypsum board in the following locations:
 - a. Regular Type: As indicated on Drawings **OR** Vertical surfaces, unless otherwise indicated, **as directed**.
 - b. Type X: As indicated on Drawings **OR** Where required for fire-resistance-rated assembly **OR** Vertical surfaces, unless otherwise indicated, **as directed**.
 - c. Type C: As indicated on Drawings **OR** Where required for specific fire-resistance-rated assembly indicated, **as directed**.
 - d. Flexible Type: As indicated on Drawings **OR** Apply in double layer at curved assemblies, **as directed**.
 - e. Ceiling Type: As indicated on Drawings **OR** Ceiling surfaces, **as directed**.
 - f. Foil-Backed Type: As indicated on Drawings **OR as directed**.
 - g. Abuse-Resistant Type: As indicated on Drawings **OR as directed**.
 - h. High-Impact Type: As indicated on Drawings **OR as directed**.
 - i. Moisture- and Mold-Resistant Type: As indicated on Drawings **OR as directed**.
2. Single-Layer Application:
 - a. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
 - b. On partitions/walls, apply gypsum panels vertically (parallel to framing) **OR** horizontally (perpendicular to framing), **as directed**, unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - 1) Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - 2) At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
 - c. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
 - d. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
3. Multilayer Application:
 - a. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints 1 framing member, 16 inches (400 mm) minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
 - b. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
 - c. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
 - d. Fastening Methods: Fasten base layers and face layers separately to supports with screws **OR** Fasten base layers with screws; fasten face layers with adhesive and supplementary fasteners, **as directed**.
4. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.
5. Curved Surfaces:



- a. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch- (300-mm-) long straight sections at ends of curves and tangent to them.
 - b. For double-layer construction, fasten base layer to studs with screws 16 inches (400 mm) o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches (300 mm) o.c.
- D. Applying Exterior Gypsum Panels For Ceilings And Soffits
1. Apply panels perpendicular to supports, with end joints staggered and located over supports.
 - a. Install with 1/4-inch (6.4-mm) open space where panels abut other construction or structural penetrations.
 - b. Fasten with corrosion-resistant screws.
- E. Applying Tile Backing Panels
1. Water-Resistant Gypsum Backing Board: Install at showers, tubs, and where indicated. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.
 2. Glass-Mat, Water-Resistant Backing Panel: Comply with manufacturer's written installation instructions and install at showers, tubs, and where indicated **OR** locations indicated to receive tile, **as directed**. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.
 3. Cementitious Backer Units: ANSI A108.11, at showers, tubs, and where indicated **OR** locations indicated to receive tile, **as directed**.
 4. Areas Not Subject to Wetting: Install regular-type gypsum wallboard panels to produce a flat surface except at showers, tubs, and other locations indicated to receive water-resistant panels.
 5. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.
- F. Installing Trim Accessories
1. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
 2. Control Joints: Install control joints at locations indicated on Drawings **OR** according to ASTM C 840 and in specific locations approved by the Owner for visual effect, **as directed**.
 3. Interior Trim: Install in the following locations:
 - a. Cornerbead: Use at outside corners, unless otherwise indicated.
 - b. Bullnose Bead: Use at outside corners **OR** where indicated, **as directed**.
 - c. LC-Bead: Use at exposed panel edges.
 - d. L-Bead: Use where indicated.
 - e. U-Bead: Use at exposed panel edges **OR** where indicated, **as directed**.
 - f. Curved-Edge Cornerbead: Use at curved openings.
 4. Exterior Trim: Install in the following locations:
 - a. Cornerbead: Use at outside corners.
 - b. LC-Bead: Use at exposed panel edges.
 5. Aluminum Trim: Install in locations indicated on Drawings.
- G. Finishing Gypsum Board
1. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
 2. Prefill open joints, rounded or beveled edges, and damaged surface areas.
 3. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
 4. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 - a. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - b. Level 2: Panels that are substrate for tile **OR** Panels that are substrate for acoustical tile **OR** Where indicated on Drawings, **as directed**.



- c. Level 3: For surfaces receiving medium- or heavy-textured finishes before painting or heavy wallcoverings where lighting conditions are not critical **OR** Where indicated on Drawings, **as directed**.
- d. Level 4: For surfaces receiving light-textured finishes, wallcoverings, and flat paints **OR** At panel surfaces that will be exposed to view, unless otherwise indicated, **as directed**. This is generally the standard exposed finish. Gloss and semi-gloss enamel paints are not usually recommended over this level of finish. ASTM C 840 requires application of "drywall primer" on surfaces before final decoration
 - 1) Primer and its application to surfaces are specified in other Division 07.
- e. Level 5: For surfaces receiving gloss and semigloss enamels and other surfaces subject to severe lighting **OR** Where indicated on Drawings, **as directed**.
 - 1) Primer and its application to surfaces are specified in other Division 07.
- f. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.
- g. Glass-Mat, Water-Resistant Backing Panels: Finish according to manufacturer's written instructions.
- h. Cementitious Backer Units: Finish according to manufacturer's written instructions.

H. Applying Texture Finishes

- 1. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.
- 2. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture free of starved spots or other evidence of thin application or of application patterns.
- 3. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture-finish manufacturer's written recommendations.

I. Protection

- 1. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- 2. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - a. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - b. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 28 13 00



SECTION 09 28 13 00a - GYPSUM BOARD SHAFT-WALL ASSEMBLIES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for gypsum board shaft-wall assemblies. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes gypsum board shaft-wall assemblies for the following:
 - a. Shaft-wall enclosures.
 - b. Chase enclosures.
 - c. Stair enclosures.
 - d. Horizontal enclosures.

C. Submittals

1. Product Data: For each gypsum board shaft-wall assembly indicated.
2. LEED Submittals:
 - a. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.
 - b. Product Data for Credit MR 4.1 and Credit MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - 1) Include statement indicating costs for each product having recycled content.

D. Quality Assurance

1. Fire-Resistance Ratings: Provide materials and construction identical to those of assemblies with fire-resistance ratings determined according to ASTM E 119 by a testing and inspecting agency.
2. STC-Rated Assemblies: Provide materials and construction identical to those of assemblies tested according to ASTM E 90 and classified according to ASTM E 413 by a testing and inspecting agency.
3. Preinstallation Conference: Conduct conference at Project site.

E. Delivery, Storage, And Handling

1. Deliver materials in original packages, containers, and bundles bearing brand name and identification of manufacturer or supplier.
2. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.
3. Stack panels flat on leveled supports off floor or slab to prevent sagging.

F. Project Conditions

1. Environmental Limitations: Comply with ASTM C 840 requirements or with gypsum board manufacturer's written recommendations, whichever are more stringent.
2. Do not install interior products until installation areas are enclosed and conditioned.
3. Do not install panels that are wet, moisture damaged, or mold damaged.
 - a. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
 - b. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.



PART 2 - PRODUCTS

- A. Gypsum Board Shaft-Wall Assemblies, General
1. Provide materials and components complying with requirements of fire-resistance-rated assemblies indicated.
 - a. Provide panels in maximum lengths available to eliminate or minimize end-to-end butt joints.
 - b. Provide auxiliary materials complying with gypsum board shaft-wall assembly manufacturer's written recommendations.
- B. Panel Products
1. Recycled Content: Provide gypsum panel products with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 25 percent by weight.
 2. Gypsum Liner Panels: Comply with ASTM C 442/C 442M.
 - a. Type X: Manufacturer's proprietary liner panels with moisture-resistant paper faces.
 - 1) Core: 1 inch (25.4 mm) thick.
 - 2) Long Edges: Double bevel.
 - b. Moisture- and Mold-Resistant Type X: Manufacturer's proprietary liner panels with moisture- and mold-resistant core and surfaces; comply with ASTM D 3273.
 - 1) Core: 1 inch (25.4 mm) thick.
 - 2) Long Edges: Double bevel.
 3. Gypsum Base for Gypsum Veneer Plaster: As specified in Division 09 Section "Gypsum Veneer Plastering".
 4. Gypsum Board: As specified in Division 09 Section "Gypsum Board".
 5. Water-Resistant Gypsum Backing Board: As specified in Division 09 Section "Gypsum Board".
 6. Cementitious Backer Units: As specified in Division 09 Section "Tiling".
- C. Non-Load-Bearing Steel Framing
1. Framing Members: Comply with ASTM C 754 for conditions indicated.
 2. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
 - a. Recycled Content: Provide steel sheet with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
 - b. Protective Coating: ASTM A 653/A 653M, G40 (Z120) **OR** ASTM A 653/A 653M, G60 (Z180) **OR** Coating with equivalent corrosion resistance of ASTM A 653/A 653M, G40 (Z120), **as directed**, hot-dip galvanized, unless otherwise indicated.
- D. Auxiliary Materials
1. General: Provide auxiliary materials that comply with referenced product standards and manufacturer's written recommendations.
 2. Trim Accessories: Cornerbead, edge trim, and control joints of material and shapes specified in Division 09 Section(s) "Gypsum Veneer Plastering" OR "Gypsum Board", **as directed**, that comply with gypsum board shaft-wall assembly manufacturer's written recommendations for application indicated.
 3. Gypsum Base Joint-Reinforcing Materials: As specified in Division 09 Section "Gypsum Veneer Plastering".
 4. Gypsum Veneer Plaster: As specified in Division 09 Section "Gypsum Veneer Plastering".
 5. Gypsum Board Joint-Treatment Materials: As specified in Division 09 Section "Gypsum Board".
 6. Laminating Adhesive: Adhesive or joint compound recommended by manufacturer for directly adhering gypsum face-layer panels and gypsum-base face-layer panels to backing-layer panels in multilayer construction.
 - a. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).



7. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 - a. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
8. Track Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft-wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.
 - a. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified testing agency.
 - b. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.
9. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing), produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - a. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
 - b. Recycled Content: Provide blankets with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 25 percent by weight.
10. Acoustical Sealant: As specified in Division 07 Section "Thermal Insulation".
 - a. Provide sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Gypsum Board Shaft-Wall Assemblies

1. Basis-of-Design Product: As indicated on Drawings by design designation of a qualified testing agency.
2. Fire-Resistance Rating: As indicated **OR** 1 hour **OR** 2 hours **OR** 3 hours **OR** 4 hours, **as directed**.
3. STC Rating: As indicated **OR** 51, minimum, **as directed**.
4. Studs: Manufacturer's standard profile for repetitive members, corner and end members, and fire-resistance-rated assembly indicated.
 - a. Depth: As indicated **OR** 2-1/2 inches (64 mm) **OR** 4 inches (102 mm) **OR** 6 inches (152 mm), **as directed**.
 - b. Minimum Base-Metal Thickness: As indicated **OR** 0.0179 inch (0.45 mm) **OR** 0.0220 inch (0.55 mm) **OR** 0.0329 inch (0.84 mm), **as directed**.
5. Runner Tracks: Manufacturer's standard J-profile track with long-leg length as standard with manufacturer, but at least 2 inches (51 mm) long and in depth matching studs.
 - a. Minimum Base-Metal Thickness: As indicated **OR** Matching steel studs **OR** 0.0179 inch (0.45 mm) **OR** 0.0220 inch (0.55 mm) **OR** 0.0329 inch (0.84 mm), **as directed**.
6. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
7. Jamb Struts: Manufacturer's standard J-profile strut with long-leg length of 3 inches (76 mm), in depth matching studs, and not less than 0.0329 inch (0.84 mm) thick.
8. Room-Side Finish: As indicated **OR** Gypsum board **OR** Gypsum veneer plaster **OR** Cementitious backer units, **as directed**.
9. Shaft-Side Finish: As indicated **OR** As indicated by fire-resistance-rated assembly design designation, **as directed**.
10. Insulation: Sound attenuation blankets.

2.2 EXECUTION

A. Preparation



1. Sprayed Fire-Resistive Materials: Coordinate with gypsum board shaft-wall assemblies so both elements of Work remain complete and undamaged. Patch or replace sprayed fire-resistive materials removed or damaged during installation of shaft-wall assemblies to comply with requirements specified in Division 07 Section "Applied Fireproofing".
 - a. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runner tracks to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches (610 mm) o.c.
2. After sprayed fire-resistive materials are applied, remove only to extent necessary for installation of gypsum board shaft-wall assemblies and without reducing the fire-resistive material thickness below that which is required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

B. Installation

1. General: Install gypsum board shaft-wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated, manufacturer's written installation instructions, and the following:
 - a. ASTM C 754 for installing steel framing except comply with framing spacing indicated.
 - b. Division 09 Section(s) "Gypsum Veneer Plastering" OR "Gypsum Board", **as directed**, for applying and finishing panels.
 - c. Division 09 Section "Tiling" for cementitious backer units.
2. Do not bridge architectural or building expansion joints with shaft-wall assemblies; frame both sides of expansion joints with furring and other support.
3. Install supplementary framing in gypsum board shaft-wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, and similar items that cannot be supported directly by shaft-wall assembly framing.
 - a. At elevator hoistway entrance door frames, provide jamb struts on each side of door frame.
 - b. Where handrails directly attach to gypsum board shaft-wall assemblies, provide galvanized steel reinforcing strip with 0.0312-inch (0.79-mm) minimum thickness of base (uncoated) metal, accurately positioned and secured behind at least 1 gypsum base for veneer plaster **OR** gypsum board **OR** cementitious backer unit, **as directed**, face-layer panel.
4. Integrate stair hanger rods with gypsum board shaft-wall assemblies by locating cavity of assemblies where required to enclose rods.
5. At penetrations in shaft wall, maintain fire-resistance rating of shaft-wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons, elevator floor indicators, and similar items.
6. Isolate perimeter of gypsum panels from building structure to prevent cracking of panels, while maintaining continuity of fire-rated construction.
7. Firestop Tracks: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
8. Control Joints: Install control joints at locations indicated on Drawings **OR** according to ASTM C 840 and in specific locations approved by the Owner, **as directed**, while maintaining fire-resistance rating of gypsum board shaft-wall assemblies.
9. Seal gypsum board shaft walls with acoustical sealant at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly. Install acoustical sealant to withstand dislocation by air-pressure differential between shaft and external spaces; maintain an airtight and smoke-tight seal; and comply with ASTM C 919 requirements or with manufacturer's written instructions, whichever are more stringent.
10. In elevator shafts where gypsum board shaft-wall assemblies cannot be positioned within 4 inches (102 mm) of the shaft face of structural beams, floor edges, and similar projections into shaft, install 1/2- or 5/8-inch- (13- or 16-mm-) thick, gypsum board cants covering tops of projections. No recesses allowed (at steel beams especially).



- a. Slope cant panels at least 75 degrees from horizontal. Set base edge of panels in adhesive and secure top edges to shaft walls at 24 inches (610 mm) o.c. with screws fastened to shaft-wall framing.
 - b. Where steel framing is required to support gypsum board cants, install framing at 24 inches (610 mm) o.c. and extend studs from the projection to shaft-wall framing.
11. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3mm) from the plane formed by faces of adjacent framing.

C. Protection

1. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
2. Remove and replace panels that are wet, moisture damaged, or mold damaged.
 - a. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
 - b. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 28 13 00a



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Task	Specification	Specification Description
09 28 13 00	09 22 13 00a	Gypsum Veneer Plaster
09 28 13 00	09 31 00 00	Ceramic Tile
09 29 00 00	01 22 16 00	No Specification Required
09 29 00 00	09 28 13 00	Gypsum Board
09 29 00 00	09 23 13 00	Gypsum Board Renovation
09 29 00 00	09 28 13 00a	Gypsum Board Shaft-Wall Assemblies
09 30 13 00	09 31 00 00	Ceramic Tile
09 30 16 00	09 31 00 00	Ceramic Tile



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SECTION 09 31 00 00 - CERAMIC TILE

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for ceramic tile. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Ceramic tile.
 - b. Stone thresholds.
 - c. Waterproof membrane.
 - d. Crack isolation membrane.
 - e. Tile backing panels.
 - f. Metal edge strips.

C. Definitions

1. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
2. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in "American National Standard Specifications for Installation of Ceramic Tile."
3. Module Size: Actual tile size plus joint width indicated.
4. Face Size: Actual tile size, excluding spacer lugs.

D. Performance Requirements

1. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:
 - a. Level Surfaces: Minimum 0.6.
 - b. Step Treads: Minimum 0.6.
 - c. Ramp Surfaces: Minimum 0.8.

E. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittal:
 - a. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.
3. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
4. Samples:
 - a. Full-size units of each type and composition of tile and for each color and finish required. For ceramic mosaic tile in color blend patterns, provide full sheets of each color blend.
OR
Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 12 inches (300 mm) square, but not fewer than 4 tiles. Use grout of type and in color or colors approved for completed Work.



- b. Full-size units of each type of trim and accessory for each color and finish required.
- c. Stone thresholds in 6-inch (150-mm) lengths.
- d. Metal edge strips in 6-inch (150-mm) lengths.
- 5. Qualification Data: For qualified Installer.
- 6. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
- 7. Product Certificates: For each type of product, signed by product manufacturer.
- 8. Material Test Reports: For each tile-setting and -grouting product and special purpose tile.

F. Quality Assurance

- 1. Source Limitations for Tile: Obtain tile of each type and color or finish **OR** tile of each type **OR** tile of each color or finish **OR** tile, **as directed**, from one source or producer.
 - a. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- 2. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.
- 3. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:
 - a. Stone thresholds.
 - b. Waterproof membrane.
 - c. Crack isolation membrane.
 - d. Joint sealants.
 - e. Cementitious backer units.
 - f. Metal edge strips.
- 4. Preinstallation Conference: Conduct conference at Project site.

G. Delivery, Storage, And Handling

- 1. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- 2. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- 3. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- 4. Store liquid materials in unopened containers and protected from freezing.
- 5. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

H. Project Conditions

- 1. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.2 PRODUCTS

A. Products, General

- 1. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
 - a. Provide tile complying with Standard grade requirements unless otherwise indicated.
- 2. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 1.2 articles, ANSI standards referenced by TCA installation methods specified in tile installation schedules, and other requirements specified.



3. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
4. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.
 - a. Where tile is indicated for installation in swimming pools, on exteriors or in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.
5. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

B. Tile Products

1. Tile Type: Factory-mounted unglazed **OR** glazed, **as directed**, ceramic mosaic tile.
 - a. Composition: Porcelain **OR** Impervious natural clay or porcelain **OR** Vitreous or impervious natural clay or porcelain, **as directed**.
 - b. Module Size: 1 by 1 inch (25.4 by 25.4 mm) **OR** 1 by 2 inches (25.4 by 50.8 mm) **OR** 2 by 2 inches (50.8 by 50.8 mm), **as directed**.
 - c. Thickness: 1/4 inch (6.35 mm).
 - d. Face: Plain **OR** Pattern of design indicated, **as directed**, with cushion edges.
 - e. Surface (for unglazed tile): Smooth, without **OR** Slip-resistant, with, **as directed**, abrasive admixture.
 - f. Finish (for glazed tile): Bright, opaque **OR** Bright, clear **OR** Mat, opaque **OR** Mat, clear **OR** Semimat, opaque **OR** Semimat, clear **OR** Vellum, opaque **OR** Vellum, clear **OR** Crystalline, **as directed**, glaze.
 - g. Tile Color and Pattern: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - h. Grout Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - i. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile, **as directed**. Provide shapes as follows, selected from manufacturer's standard shapes:
 - 1) Base Cove: Cove, module size 1 by 1 inch (25.4 by 25.4 mm) **OR** 2 by 1 inch (50.8 by 25.4 mm), **as directed**.
 - 2) Base Cap for Portland Cement Mortar Installations: Bead (bullnose), module size 1 by 1 inch (25.4 by 25.4 mm) **OR** 2 by 1 inch (50.8 by 25.4 mm), **as directed**.
 - 3) Base Cap for Thin-Set Mortar Installations: Surface bullnose, module size 1 by 1 inch (25.4 by 25.4 mm) **OR** 2 by 1 inch (50.8 by 25.4 mm) **OR** 2 by 2 inches (50.8 by 50.8 mm), **as directed**.
 - 4) Wainscot Cap for Portland Cement Mortar Installations: Bead (bullnose), module size 1 by 1 inch (25.4 by 25.4 mm) **OR** 2 by 1 inch (50.8 by 25.4 mm), **as directed**.
 - 5) Wainscot Cap for Thin-Set Mortar Installations: Surface bullnose, module size 1 by 1 inch (25.4 by 25.4 mm) **OR** 2 by 1 inch (50.8 by 25.4 mm) **OR** 2 by 2 inches (50.8 by 50.8 mm), **as directed**.
 - 6) Wainscot Cap for Flush Conditions: Regular flat tile for conditions where tile wainscot is shown flush with wall surface above it, same size as adjoining flat tile.
 - 7) External Corners for Portland Cement Mortar Installations: Bead (bullnose), module size 1 by 1 inch (25.4 by 25.4 mm) **OR** 2 by 1 inch (50.8 by 25.4 mm), **as directed**.
 - 8) External Corners for Thin-Set Mortar Installations: Surface bullnose, module size 1 by 1 inch (25.4 by 25.4 mm) **OR** 2 by 1 inch (50.8 by 25.4 mm) **OR** 2 by 2 inches (50.8 by 50.8 mm), **as directed**.
 - 9) Internal Corners: Cove, module size 1 by 1 inch (25.4 by 25.4 mm) **OR** 2 by 1 inch (50.8 by 25.4 mm), **as directed**.

OR



Internal Corners: Field-butteted square corners. For coved base and cap, use angle pieces designed to fit with stretcher shapes.

- 10) Tapered Transition Tile: Shape designed to effect transition between thickness of tile floor and adjoining floor finishes of different thickness, tapered to provide reduction in thickness from 1/2 to 1/4 inch (12.7 to 6.35 mm) across nominal 4-inch (100-mm) dimension.
2. Tile Type: Unglazed **OR** Glazed, **as directed**, square-edged quarry tile.
 - a. Face Size: 3 by 3 inches (76 by 76 mm) **OR** 4 by 4 inches (102 by 102 mm) **OR** 6 by 3 inches (152 by 76 mm) **OR** 6 by 6 inches (152 by 152 mm) **OR** 8 by 3-7/8 inches (203 by 98 mm) **OR** 8 by 8 inches (203 by 203 mm), **as directed**.
 - b. Thickness: 3/8 inch (9.5 mm) **OR** 1/2 inch (12.7 mm) **OR** 3/4 inch (19 mm), **as directed**.
 - c. Wearing Surface (for unglazed tile): Nonabrasive, smooth **OR** Abrasive aggregate embedded in surface, **as directed**.
 - d. Finish (for glazed tile): Bright, opaque **OR** Bright, clear **OR** Mat, opaque **OR** Mat, clear **OR** Semimat, opaque **OR** Semimat, clear **OR** Vellum, opaque **OR** Vellum, clear **OR** Crystalline, **as directed**, glaze.
 - e. Tile Color and Pattern: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - f. Grout Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - g. For furan-grouted quarry tile, precoat with temporary protective coating.
 - h. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile, **as directed**. Provide shapes as follows, selected from manufacturer's standard shapes:
 - 1) Base: Coved with surface bullnose top edge, **as directed**, face size 6 by 6 inches (152 by 152 mm) **OR** 8 by 3-7/8 inches (203 by 98 mm), **as directed**.
 - 2) Wainscot Cap: Surface bullnose, face size 6 by 6 inches (152 by 152 mm) **OR** 8 by 3-7/8 inches (203 by 98 mm), **as directed**.
 - 3) Wainscot Cap for Flush Conditions: Regular flat tile for conditions where tile wainscot is shown flush with wall surface above it, same size as adjoining flat tile.
 3. Tile Type: Unglazed **OR** Glazed, **as directed**, paver tile.
 - a. Composition: Porcelain **OR** Impervious natural clay or porcelain **OR** Vitreous or impervious natural clay or porcelain **OR** Natural clay or porcelain, **as directed**.
 - b. Face Size: 3 by 3 inches (76 by 76 mm) **OR** 4 by 4 inches (102 by 102 mm) **OR** 6 by 6 inches (152 by 152 mm) **OR** 7-3/4 by 3-7/8 inches (197 by 98 mm) **OR** 7-7/8 by 7-7/8 inches (200 by 200 mm) **OR** 11-13/16 by 11-13/16 inches (300 by 300 mm) **OR** 165 by 333 mm **OR** 200 by 250 mm **OR** 250 by 250 mm **OR** 165 by 333 mm **OR** 333 by 333 mm **OR** 400 by 400 mm, **as directed**.
 - c. Thickness: 1/4 inch (6.35 mm) **OR** 3/8 inch (9.5 mm) **OR** 1/2 inch (12.7 mm), **as directed**.
 - d. Face: Plain with square or cushion edges **OR** Plain with square edges **OR** Plain with cushion edges **OR** Pattern of design indicated, with square or cushion edges **OR** As indicated, **as directed**.
 - e. Finish (for glazed tile): Bright, opaque **OR** Bright, clear **OR** Mat, opaque **OR** Mat, clear **OR** Semimat, opaque **OR** Semimat, clear **OR** Vellum, opaque **OR** Vellum, clear **OR** Crystalline, **as directed**, glaze.
 - f. Tile Color and Pattern: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - g. Grout Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 4. Tile Type: Glazed wall tile **OR** Decorative thin wall tile, **as directed**.
 - a. Module Size: 4-1/4 by 4-1/4 inches (108 by 108 mm) **OR** 6 by 4-1/4 inches (152 by 108 mm) **OR** 6 by 6 inches (152 by 152 mm) **OR** 200 by 200 mm **OR** 250 by 250 mm **OR** 200 by 300 mm, **as directed**.
 - b. Thickness: 5/16 inch (8 mm).



- c. Face: Plain with modified square edges or cushion edges **OR** Plain with modified square edges **OR** Plain with cushion edges **OR** Pattern of design indicated, with manufacturer's standard edges, **as directed**.
 - d. Finish: Bright, opaque **OR** Bright, clear **OR** Mat, opaque **OR** Mat, clear **OR** Semimat, opaque **OR** Semimat, clear **OR** Vellum, opaque **OR** Vellum, clear **OR** Crystalline, **as directed**, glaze.
 - e. Tile Color and Pattern: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - f. Grout Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - g. Mounting: Factory, back mounted.
 - h. Mounting: Pregouted sheets of tiles factory assembled and grouted with manufacturer's standard white silicone rubber.
 - i. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile, **as directed**. Provide shapes as follows, selected from manufacturer's standard shapes:
 - 1) Base for Portland Cement Mortar Installations: Coved, module size 4-1/4 by 4-1/4 inches (108 by 108 mm) **OR** 6 by 6 inches (152 by 152 mm) **OR** 6 by 3-3/4 inches (152 by 95 mm), **as directed**.
 - 2) Base for Thin-Set Mortar Installations: Straight, module size 4-1/4 by 4-1/4 inches (108 by 108 mm) **OR** 6 by 6 inches (152 by 152 mm) **OR** 6 by 2 inches (152 by 51 mm), **as directed**.
 - 3) Wainscot Cap for Portland Cement Mortar Installations: Bullnose cap, module size 4-1/4 by 4-1/4 inches (108 by 108 mm) **OR** 6 by 6 inches (152 by 152 mm) **OR** 6 by 2 inches (152 by 51 mm), **as directed**.
 - 4) Wainscot Cap for Thin-Set Mortar Installations: Surface bullnose, module size 4-1/4 by 4-1/4 inches (108 by 108 mm) **OR** 6 by 6 inches (152 by 152 mm) **OR** 6 by 2 inches (152 by 51 mm), **as directed**.
 - 5) Wainscot Cap for Flush Conditions: Regular flat tile for conditions where tile wainscot is shown flush with wall surface above it, same size as adjoining flat tile.
 - 6) External Corners for Portland Cement Mortar Installations: Bullnose shape with radius of at least 3/4 inch (19 mm) unless otherwise indicated.
 - 7) External Corners for Thin-Set Mortar Installations: Surface bullnose, same size as adjoining flat tile.
 - 8) Internal Corners: Field-buttet square corners. For coved base and cap use angle pieces designed to fit with stretcher shapes.
5. Accessories: Provide vitreous china accessories of type and size indicated, suitable for installing by same method as adjoining wall tile.
- a. One soap holder with grab handle, **as directed**, for each shower and tub indicated.
 - b. One paper holder at each water closet.
 - c. Color and Finish: Match adjoining glazed wall tile **OR** As indicated by manufacturer's designations **OR** As selected from manufacturer's full range **OR** White, bright glaze, **as directed**.
- C. Thresholds
- 1. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
 - a. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch (1.5 mm) above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch (12.7 mm) or less above adjacent floor surface.
 - 2. Granite Thresholds: ASTM C 615, with polished **OR** honed, **as directed**, finish.
 - a. Description: Uniform, fine **OR** medium, **as directed**,-grained, white **OR** gray **OR** black, **as directed**, stone without veining.
OR
Description: Match sample.



3. Marble Thresholds: ASTM C 503, with a minimum abrasion resistance of 10 **OR** 12, **as directed**, per ASTM C 1353 or ASTM C 241 and with honed finish.
 - a. Description: Uniform, fine- to medium-grained white stone with gray veining.
OR
Description: Match sample.
 4. Slate Thresholds: ASTM C 629, Classification I Exterior **OR** II Interior, **as directed**, with fine, even grain and honed finish.
 - a. Description: Uniform, black **OR** blue-black **OR** gray **OR** blue-gray **OR** green, **as directed**, stone and unfading.
OR
Description: Match sample.
- D. Tile Backing Panels
1. Cementitious Backer Units: ANSI A118.9 or ASTM C 1325, in maximum lengths available to minimize end-to-end butt joints.
 - a. Thickness: 1/4 inch (6.4 mm) **OR** 1/2 inch (12.7 mm) **OR** 5/8 inch (15.9 mm) **OR** As indicated, **as directed**.
 2. Fiber-Cement Underlayment: ASTM C 1288, in maximum lengths available to minimize end-to-end butt joints.
 - a. Thickness: 1/4 inch (6.4 mm) **OR** 1/2 inch (12.7 mm) **OR** As indicated, **as directed**.
- E. Waterproof Membrane
1. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
 2. Chlorinated Polyethylene Sheet: Nonplasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric; 0.030-inch (0.76-mm) nominal thickness.
 3. PVC Sheet: Two layers of PVC sheet heat-fused together and to facings of nonwoven polyester; 0.040-inch (1.01-mm) nominal thickness.
 4. Polyethylene Sheet: Polyethylene faced on both sides with fleece webbing; 0.008-inch (0.203-mm) nominal thickness.
 5. Fabric-Reinforced, Modified-Bituminous Sheet: Self-adhering, SBS-modified-bituminous sheet with woven reinforcement facing; 0.040-inch (1.01-mm) nominal thickness.
 6. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and continuous fabric reinforcement.
 7. Fluid-Applied Membrane: Liquid-latex rubber or elastomeric polymer.
 8. Latex-Portland Cement: Flexible mortar consisting of cement-based mix and latex additive.
 9. Urethane Waterproofing and Tile-Setting Adhesive: One-part, liquid-applied urethane, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), in a consistency suitable for trowel application and intended for use as both waterproofing and tile-setting adhesive in a two-step process.
- F. Crack Isolation Membrane
1. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.12 for standard **OR** high, **as directed**, performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
 2. Chlorinated Polyethylene Sheet: Nonplasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric; 0.030-inch (0.76-mm) nominal thickness.
 3. PVC Sheet: Two layers of PVC sheet heat-fused together and to facings of nonwoven polyester; 0.040-inch (1.01-mm) nominal thickness.
 4. Polyethylene Sheet: Polyethylene faced on both sides with fleece webbing; 0.008-inch (0.203-mm) nominal thickness.
 5. Corrugated Polyethylene: Corrugated polyethylene with dovetail-shaped corrugations and with anchoring webbing on the underside; 3/16-inch (4-mm) nominal thickness.



6. Fabric-Reinforced, Modified-Bituminous Sheet: Self-adhering, modified-bituminous sheet with fabric reinforcement facing; 0.040-inch (1.01-mm) nominal thickness.
7. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and fabric reinforcement.
8. Fluid-Applied Membrane: Liquid-latex rubber or elastomeric polymer.
9. Latex-Portland Cement: Flexible mortar consisting of cement-based mix and latex additive.
10. Urethane Crack Isolation Membrane and Tile-Setting Adhesive: One-part, liquid-applied urethane, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), in a consistency suitable for trowel application and intended for use as both waterproofing and tile-setting adhesive in a two-step process.

G. Setting Materials

1. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.
 - a. Cleavage Membrane: Asphalt felt, ASTM D 226, Type I (No. 15); or polyethylene sheeting, ASTM D 4397, 4.0 mils (0.1 mm) thick.
 - b. Reinforcing Wire Fabric: Galvanized, welded wire fabric, 2 by 2 inches (50.8 by 50.8 mm) by 0.062-inch (1.57-mm) diameter; comply with ASTM A 185 and ASTM A 82 except for minimum wire size.
 - c. Expanded Metal Lath: Diamond-mesh lath complying with ASTM C 847.
 - 1) Base Metal and Finish for Interior Applications: Uncoated or zinc-coated (galvanized) steel sheet, with uncoated steel sheet painted after fabrication into lath.
 - 2) Base Metal and Finish for Exterior Applications: Zinc-coated (galvanized) steel sheet.
 - 3) Configuration over Studs and Furring: Flat.
 - 4) Configuration over Solid Surfaces: Self furring.
 - 5) Weight: 2.5 lb/sq. yd. (1.4 kg/sq. m) **OR** 3.4 lb/sq. yd. (1.8 kg/sq. m), **as directed**.
 - d. Latex Additive: Manufacturer's standard, acrylic resin or styrene-butadiene-rubber water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed.
2. Dry-Set Portland Cement Mortar (Thin Set): ANSI A118.1.
 - a. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.1.
3. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.
 - a. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
OR
Provide prepackaged, dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive at Project site.
 - b. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.
4. Medium-Bed, Latex-Portland Cement Mortar: Comply with requirements in ANSI A118.4. Provide product that is approved by manufacturer for application thickness of 5/8 inch (16 mm).
 - a. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
OR
Provide prepackaged, dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive at Project site.
5. EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar (Thin Set): ANSI A118.11.
 - a. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
 - b. Provide prepackaged, dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive at Project site.
6. Water-Cleanable, Tile-Setting Epoxy: ANSI A118.3, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).



- a. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 deg F (60 deg C) and 212 deg F (100 deg C), respectively, and certified by manufacturer for intended use.
7. Chemical-Resistant Furan Mortar: ANSI A118.5, with carbon filler.
8. Organic Adhesive: ANSI A136.1, Type I, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

H. Grout Materials

1. Sand-Portland Cement Grout: ANSI A108.10, composed of white or gray cement and white or colored aggregate as required to produce color indicated.
 2. Standard Cement Grout: ANSI A118.6.
 3. Polymer-Modified Tile Grout: ANSI A118.7.
 - a. Polymer Type: Ethylene vinyl acetate or acrylic additive, in dry, redispersible form, prepackaged with other dry ingredients.

OR

Polymer Type: Acrylic resin or styrene-butadiene rubber in liquid-latex form for addition to prepackaged dry-grout mix.
4. Water-Cleanable Epoxy Grout: ANSI A118.3.
 - a. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 deg F (60 deg C) and 212 deg F (100 deg C), respectively, and certified by manufacturer for intended use.
 5. Chemical-Resistant Furan Grout: ANSI A118.5, with carbon filler.
 6. Grout for Pregrouted Tile Sheets: Same product used in factory to pregrout tile sheets.

I. Elastomeric Sealants

1. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Division 7 Section "Joint Sealants."
 - a. Use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Use primers, backer rods, and sealant accessories recommended by sealant manufacturer.
2. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.
3. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.
4. Multipart, Pourable Urethane Sealant for Use T: ASTM C 920; Type M; Grade P; Class 25; Uses T, M, A, and, as applicable to joint substrates indicated, O.
5. Chemical-Resistant Sealants: For chemical-resistant floors, provide chemical-resistant elastomeric sealant of type recommended and produced by chemical-resistant mortar and grout manufacturer for type of application indicated, with proven service record and compatibility with tile and other setting materials, and with chemical resistance equivalent to mortar/grout.

J. Miscellaneous Materials

1. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
2. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; half-hard brass **OR** white zinc alloy **OR** nickel silver **OR** stainless-steel, ASTM A 666, 300 Series, **as directed**, exposed-edge material.



3. Temporary Protective Coating: Either product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.
 - a. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 deg F (49 to 60 deg C) per ASTM D 87.
 - b. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.
 4. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
 5. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints and that does not change color or appearance of grout.
- K. Mixing Mortars And Grout
1. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
 2. Add materials, water, and additives in accurate proportions.
 3. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

1.3 EXECUTION

A. Examination

1. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
 - a. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
 - b. Verify that concrete substrates for tile floors installed with adhesives, bonded mortar bed or thin-set mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
 - 1) Verify that surfaces that received a steel trowel finish have been mechanically scarified.
 - 2) Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
 - c. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
 - d. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Preparation

1. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with adhesives or thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
2. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.
3. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.



4. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

C. Tile Installation

1. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
 - a. For the following installations, follow procedures in the ANSI A108 Series of tile installation standards for providing 95 percent mortar coverage:
 - 1) Exterior tile floors.
 - 2) Tile floors in wet areas.
 - 3) Tile swimming pool decks.
 - 4) Tile floors in laundries.
 - 5) Tile floors composed of tiles 8 by 8 inches (200 by 200 mm) or larger.
 - 6) Tile floors composed of rib-backed tiles.
2. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
3. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
4. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
 - a. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
 - b. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
 - c. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
5. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
 - a. Ceramic Mosaic Tile: 1/16 inch (1.6 mm).
 - b. Quarry Tile: 1/4 inch (6.35 mm) **OR** 3/8 inch (9.5 mm), **as directed**.
 - c. Paver Tile: 1/4 inch (6.35 mm) **OR** 3/8 inch (9.5 mm), **as directed**.
 - d. Glazed Wall Tile: 1/16 inch (1.6 mm).
 - e. Decorative Thin Wall Tile: 1/16 inch (1.6 mm).
6. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
7. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
 - a. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
 - b. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants".
8. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.
 - a. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in latex-portland cement mortar (thin set).
 - b. Do not extend cleavage membrane, waterproofing or crack isolation membrane under thresholds set in dry-set portland cement or latex-portland cement mortar. Fill joints between such thresholds and adjoining tile set on cleavage membrane, waterproofing or crack isolation membrane with elastomeric sealant.



9. Metal Edge Strips: Install at locations indicated **OR** where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile **OR** where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated, **as directed**.
 10. Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.
- D. Tile Backing Panel Installation
1. Install cementitious backer units and fiber-cement underlayment and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use latex-portland cement mortar for bonding material unless otherwise directed in manufacturer's written instructions.
- E. Waterproofing Installation
1. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness and bonded securely to substrate.
 2. Do not install tile or setting materials over waterproofing until waterproofing has cured and been tested to determine that it is watertight.
- F. Crack Isolation Membrane Installation
1. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.
 2. Do not install tile or setting materials over crack isolation membrane until membrane has cured.
- G. Cleaning And Protecting
1. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 - a. Remove epoxy and latex-portland cement grout residue from tile as soon as possible.
 - b. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
 - c. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.
 2. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
 3. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
 4. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.
- H. Exterior Tile Installation Schedule
1. Exterior Floor Installations:
 - a. Tile Installation F101: Cement mortar bed (thickset) bonded to concrete **OR** over waterproof membrane on concrete **OR** over waterproof membrane on concrete where indicated and bonded to concrete where membrane is not indicated, **as directed**; TCA F101 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.



- 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
- b. Tile Installation F102: Thin-set mortar on concrete **OR** over waterproof membrane on concrete **OR** over waterproof membrane on concrete where indicated and on concrete where membrane is not indicated, **as directed**; TCA F102.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
2. Exterior Wall Installations, Masonry or Concrete:
 - a. Tile Installation W201: Cement mortar bed (thickset) on metal lath over waterproof membrane; TCA W201 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
 - b. Tile Installation W202: Thin-set mortar; TCA W202.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
- I. Interior Tile Installation Schedule
 1. Interior Floor Installations, Concrete Subfloor:
 - a. Tile Installation F111: Cement mortar bed (thickset) with cleavage membrane; TCA F111 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
 - b. Tile Installation F112: Cement mortar bed (thickset) bonded to concrete; TCA F112 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
 - c. Tile Installation F113: Thin-set mortar; TCA F113.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.



- 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
 - d. Tile Installation F114: Cement mortar bed (thickset) with cleavage membrane; epoxy **OR** furan, **as directed**, grout; TCA F114 and ANSI A108.1B.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Water-cleanable epoxy **OR** Chemical-resistant furan, **as directed**, grout.
 - e. Tile Installation F115: Thin-set mortar; epoxy **OR** furan, **as directed**, grout; TCA F115.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Water-cleanable epoxy **OR** Chemical-resistant furan, **as directed**, grout.
 - f. Tile Installation F116: Organic adhesive **OR** Water-cleanable, tile-setting epoxy, **as directed**; TCA F116.
 - 1) Tile Type: as directed by the Owner.
 - 2) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
 - g. Tile Installation F121: Cement mortar bed (thickset) on waterproof membrane; TCA F121 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
 - h. Tile Installation F122: Thin-set mortar on waterproof membrane; TCA F122.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Polymer-modified sanded **OR** unsanded, **as directed**, grout.
 - i. Tile Installation F125A: Thin-set mortar on crack isolation membrane; TCA F125A.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
 - j. Tile Installation F131: Water-cleanable, tile-setting epoxy; epoxy grout; TCA F131.
 - 1) Tile Type: as directed by the Owner.
 - 2) Grout: Water-cleanable epoxy grout.
 - k. Tile Installation F132: Water-cleanable, tile-setting epoxy on cured cement mortar bed bonded to concrete subfloor **OR** installed over cleavage membrane, **as directed**; epoxy grout; TCA F132.
 - 1) Tile Type: as directed by the Owner.
 - 2) Grout: Water-cleanable epoxy grout.
 - l. Tile Installation F133: Chemical-resistant furan mortar **OR** Water-cleanable, tile-setting epoxy, **as directed**; furan grout. TCA F133 except use water-cleanable, tile-setting epoxy instead of chemical-resistant furan mortar for setting tile.
 - 1) Tile Type: as directed by the Owner.
 - 2) Grout: Chemical-resistant furan grout.
2. Interior Floor Installations, Wood Subfloor:
 - a. Tile Installation F121: Cement mortar bed (thickset) on waterproof membrane; TCA F121 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.



- 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
- b. Tile Installation F141: Cement mortar bed (thickset) with cleavage membrane; TCA F141 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
- 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
- c. Tile Installation F142: Organic adhesive; TCA F142.
- 1) Tile Type: as directed by the Owner.
 - 2) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
- d. Tile Installation F143: Water-cleanable, tile-setting epoxy; epoxy grout; TCA F143.
- 1) Tile Type: as directed by the Owner.
 - 2) Grout: Water-cleanable epoxy grout.
- e. Tile Installation F144: Thin-set mortar on cementitious backer units or fiber cement underlayment; TCA F144.
- 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
- f. Tile Installation F150/160: Thin-set mortar on exterior-gluе plywood; TCA F150 or TCA F160.
- 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: EGP latex-portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
3. Interior Radiant Heat Floor Installations, Concrete Subfloor:
- a. Tile Installation RH110: Thin-set mortar on crack isolation membrane; hydronic piping installed in concrete; TCA RH110.
- 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
- b. Tile Installation RH115: Thin-set mortar; electric radiant system encapsulated in thin-set mortar; TCA RH115.
- 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.



- c. Tile Installation RH116: Thin-set mortar on crack isolation membrane; electric radiant system encapsulated in cementitious self-leveling underlayment; TCA RH116.
 - 1) Tile Type: as directed by the Owner.
 - 2) Cementitious Self-Leveling Underlayment: Specified in Division 03 Section "Hydraulic Cement Underlayment".
 - 3) Thin-Set Mortar: Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
- 4. Interior Radiant Heat Floor Installations, Wood Subfloor:
 - a. Tile Installation RH130: Thin-set mortar on exterior-glue plywood; electric radiant system encapsulated in thin-set mortar; TCA RH130.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: EGP latex-portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
 - b. Tile Installation RH135: Thin-set mortar on cementitious backer units or fiber cement underlayment; electric radiant system encapsulated in thin-set mortar; TCA RH135.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
 - c. Tile Installation RH140: Thin-set mortar on crack isolation membrane; electric radiant system encapsulated in cementitious self-leveling underlayment; TCA RH140.
 - 1) Tile Type: as directed by the Owner.
 - 2) Cementitious Self-Leveling Underlayment: Specified in Division 03 Section "Hydraulic Cement Underlayment".
 - 3) Thin-Set Mortar: Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
- 5. Interior Wall Installations, Masonry or Concrete:
 - a. Tile Installation W202: Thin-set mortar; TCA W202.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
 - b. Tile Installation W211: Cement mortar bed (thickset) bonded to substrate; TCA W211 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.



- c. Tile Installation W221: Cement mortar bed (thickset) on metal lath over waterproof membrane, **as directed**; TCA W221 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
- 1) Tile Type: as directed by the Owner.
 - 2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
- d. Tile Installation W222: One-coat cement mortar bed (thickset) on metal lath over waterproof membrane, **as directed**; TCA W222 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
- 1) Tile Type: as directed by the Owner.
 - 2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
- e. Tile Installation W223: Organic adhesive; TCA W223.
- 1) Tile Type: as directed by the Owner.
 - 2) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
6. Interior Wall Installations, Wood Studs or Furring:
- a. Tile Installation W221: Cement mortar bed (thickset) over waterproof membrane, **as directed**, on solid backing; TCA W221 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
- 1) Tile Type: as directed by the Owner.
 - 2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
- b. Tile Installation W222: One-coat cement mortar bed (thickset) over waterproof membrane, **as directed**, on solid backing; TCA W222 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
- 1) Tile Type: as directed by the Owner.
 - 2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
- c. Tile Installation W223: Organic adhesive on solid backing; TCA W223.
- 1) Tile Type: as directed by the Owner.
 - 2) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.



- d. Tile Installation W231: Cement mortar bed (thickset); TCA W231 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
- e. Tile Installation W243: Thin-set mortar on gypsum board; TCA W243.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
- f. Tile Installation W244: Thin-set mortar on cementitious backer units or fiber cement underlayment over cleavage membrane, **as directed**; TCA W244.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
- g. Tile Installation W245: Thin-set mortar **OR** Organic adhesive, **as directed**, on coated glass-mat, water-resistant gypsum backer board; TCA W245.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
- 7. Interior Wall Installations, Metal Studs or Furring:
 - a. Tile Installation W221: Cement mortar bed (thickset) over waterproof membrane, **as directed**, on solid backing; TCA W221 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
 - b. Tile Installation W222: One-coat cement mortar bed (thickset) over waterproof membrane, **as directed**, on solid backing; TCA W222 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
 - c. Tile Installation W223: Organic adhesive on solid backing; TCA W223.
 - 1) Tile Type: as directed by the Owner.



- 2) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
- d. Tile Installation W241: Cement mortar bed (thickset); TCA W241 and ANSI A108.1B.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
- e. Tile Installation W242: Organic adhesive on gypsum board; TCA W242.
 - 1) Tile Type: as directed by the Owner.
 - 2) Grout: Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
- f. Tile Installation W243: Thin-set mortar on gypsum board; TCA W243.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
- g. Tile Installation W244: Thin-set mortar on cementitious backer units or fiber cement underlayment over cleavage membrane, **as directed**; TCA W244.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
- h. Tile Installation W245: Thin-set mortar **OR** Organic adhesive, **as directed**, on coated glass-mat, water-resistant gypsum backer board; TCA W245.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
8. Bathtub Wall Installations, Wood **OR** Metal, **as directed**, Studs or Furring:
 - a. Tile Installation B413: Thin-set mortar **OR** Organic adhesive, **as directed**, on water-resistant gypsum board; TCA B413.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
9. Bathtub/Shower Wall Installations, Wood **OR** Metal, **as directed**, Studs or Furring:
 - a. Tile Installation B411: Cement mortar bed (thickset); TCA B411 and ANSI A108.1A.
 - 1) Tile Type: as directed by the Owner.
 - 2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **s directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
 - b. Tile Installation B412: Thin-set mortar on cementitious backer units or fiber cement underlayment; TCA B412.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.



- 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
 - c. Tile Installation B419: Thin-set mortar **OR** Organic adhesive, **as directed**, on coated glass-mat, water-resistant backer board; TCA B419.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
10. Shower Receptor and Wall Installations, Concrete or Masonry:
- a. Tile Installation B414: Cement mortar bed (thickset); TCA B414 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
 - b. Tile Installation B421: Thin-set mortar on waterproof membrane; TCA B421.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Latex-portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
 - c. Tile Installation B422: Thin-set mortar on waterproof membrane with integrated bonding flange for bonded membranes; TCA B422.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
11. Shower Receptor and Wall Installations, Wood **OR** Metal, **as directed**, Studs or Furring:
- a. Tile Installation B414: Cement mortar bed (thickset); TCA B414 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
 - b. Tile Installation B415: Thin-set mortar on cementitious backer units or fiber cement underlayment; TCA B415.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
 - c. Tile Installation B420: Thin-set mortar on coated glass-mat, water-resistant backer board; TCA B420.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.



- 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
- d. Tile Installation B421: Thin-set mortar on waterproof membrane over cementitious backer units or fiber cement underlayment; TCA B421.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Latex-portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
- e. Tile Installation B422: Thin-set mortar on waterproof membrane over cementitious backer units or fiber cement underlayment with integrated bonding flange for bonded membranes; TCA B422.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Latex-portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.

END OF SECTION 09 31 00 00



Task	Specification	Specification Description
09 32 00 00	09 31 00 00	Ceramic Tile
09 34 00 00	09 31 00 00	Ceramic Tile
09 35 00 00	09 31 00 00	Ceramic Tile
09 39 00 00	09 31 00 00	Ceramic Tile



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SECTION 09 51 13 00 - ACOUSTICAL PANEL CEILINGS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for acoustical panel ceilings. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes acoustical panels and exposed suspension systems for ceilings.
2. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete at ceilings.

C. Definitions

1. AC: Articulation Class.
2. CAC: Ceiling Attenuation Class.
3. LR: Light Reflectance coefficient.
4. NRC: Noise Reduction Coefficient.

D. Submittals

1. Product Data: For each type of product indicated.
2. Coordination Drawings: Drawn to scale and coordinating acoustical panel ceiling installation with hanger attachment to building structure and ceiling mounted items:
3. Samples: For each exposed finish.
4. LEED Submittals:
 - a. Product Data for Credit MR 4.1 and MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - 1) Include statement indicating costs for each product having recycled content.
 - b. Product Data for Credit EQ 4.1: For sealants, including printed statement of VOC content.
5. Product test reports.
6. Research/evaluation reports.
7. Maintenance data.

E. Quality Assurance

1. Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.
2. Fire-Test-Response Characteristics
 - a. Fire-Resistance Characteristics: Where indicated, provide acoustical panel ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1) Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
 - 2) Identify materials with appropriate markings of applicable testing and inspecting agency.
 - b. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A **OR B OR C**, **as directed**, materials as determined by testing identical products per ASTM E 84:
 - 1) Smoke-Developed Index: 450 or less.



3. Seismic Standard: Provide acoustical panel ceilings designed and installed to withstand the effects of earthquake motions according to the following:
 - a. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E 580.
 - b. CISCA's Recommendations for Acoustical Ceilings: Comply with CISCA's "Recommendations for Direct-Hung Acoustical Tile and Lay-in Panel Ceilings--Seismic Zones 0-2."
 - c. CISCA's Guidelines for Systems Requiring Seismic Restraint: Comply with CISCA's "Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies--Seismic Zones 3 & 4."
 - d. IBC Standard for Metal Suspension Systems for Acoustical Tile and for Lay-in Panel Ceilings.
 - e. ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."
4. Preinstallation Conference: Conduct conference at Project site.

F. Delivery, Storage, And Handling

1. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
2. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
3. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.2 PRODUCTS

A. Acoustical Panels, General

1. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
 - a. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface per ASTM E 795.
2. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
 - a. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by the Owner from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.
3. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.
4. Antimicrobial Fungicide Treatment: Provide acoustical panels with face and back surfaces coated with antimicrobial treatment consisting of manufacturer's standard formulation with fungicide added to inhibit growth of mold and mildew and showing no mold or mildew growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

B. Acoustical Panels For Acoustical Panel Ceiling

1. Classification: Provide fire-resistance-rated, **as directed**, panels complying with ASTM E 1264 for type, form, and pattern as follows:



- a. Type and Form: Type III, mineral base with painted finish; Form 1, nodular **OR** 2, water felted **OR** 4, cast or molded, **as directed**.
 - b. Type and Form: Type IV, mineral base with membrane-faced overlay; Form 1, nodular; with glass-fiber cloth **OR** washable vinyl-film, **as directed**, overlay.
 - c. Type and Form: Type IV, mineral base with membrane-faced overlay; Form 2, water felted; with vinyl overlay on face **OR** vinyl overlay on face and back **OR** vinyl overlay on face, back, and sealed edges **OR** fiberglass-fabric overlay on face, **as directed**.
 - d. Type and Form: Type XII, glass-fiber base with membrane-faced overlay; Form 1, plastic **OR** 2, cloth **OR** 3, other, **as directed**.
 - e. Type and Form: Type XX, other types; described as high-density, ceramic- and mineral-base panels with scrubbable finish, resistant to heat, moisture, and corrosive fumes.
 - f. Pattern: C (perforated, small holes) **OR** CD (perforated, small holes and fissured) **OR** CE (perforated, small holes and lightly textured) **OR** D (fissured) **OR** E (lightly textured) **OR** F (heavily textured) **OR** G (smooth) **OR** GH (smooth and printed) **OR** I (embossed) **OR** J (embossed-in-register) **OR** K (surface scored) **OR** Z (other patterns as described) **OR** As indicated by manufacturer's designation, **as directed**.
2. Color: White **OR** As selected from manufacturer's full range **OR** Match sample **OR** As indicated by manufacturer's designation **OR** As indicated on Drawings **OR** As indicated in a schedule, **as directed**.
 3. LR: Not less than 0.65 **OR** 0.70 **OR** 0.75 **OR** 0.80 **OR** 0.85 **OR** 0.90, **as directed**.
 4. NRC: Not less than 0.10 **OR** 0.35 **OR** 0.40 **OR** 0.50 **OR** 0.55 **OR** 0.60 **OR** 0.65 **OR** 0.70 **OR** 0.75 **OR** 0.80 **OR** 0.85 **OR** 0.90 **OR** 0.95 **OR** 1.00, **as directed**.
 5. CAC: Not less than 20 **OR** 25 **OR** 30 **OR** 35 **OR** 40, **as directed**.
 6. AC: Not less than 170 **OR** 180 **OR** 190 **OR** 200 **OR** 210, **as directed**.
 7. Edge/Joint Detail: Square **OR** Reveal sized to fit flange of exposed suspension system members **OR** Flush reveal sized to fit flange of exposed suspension system members **OR** Beveled, kerfed and rabbeted long edges and square, butt-on short edges, **as directed**.
 8. Thickness: 5/8 inch (15 mm) **OR** 3/4 inch (19 mm) **OR** 7/8 inch (22 mm) **OR** As indicated on Drawings **OR** As indicated in a schedule, **as directed**.
 9. Thickness (For glass-fiber-based panels): 1/8 inch (3 mm) **OR** 9/16 inch (15 mm) **OR** 5/8 inch (15 mm) **OR** 7/16 inch (22 mm) **OR** 3/4 inch (19 mm) **OR** 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (51 mm) **OR** 3 inches (76 mm) **OR** As indicated on Drawings **OR** As indicated in a schedule, **as directed**.
 10. Modular Size: 24 by 24 inches (610 by 610 mm) **OR** 24 by 48 inches (610 by 1220 mm) **OR** 600 by 600 mm **OR** 600 by 1200 mm **OR** As indicated on Drawings **OR** As indicated in a schedule, **as directed**.
 11. Antimicrobial Treatment: Broad spectrum fungicide and bactericide **OR** Fungicide, **as directed**, based.
- C. Metal Suspension Systems, General
1. Recycled Content: Provide products made from steel sheet with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
 2. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.
 3. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.
 - a. High-Humidity Finish: Comply with ASTM C 635 requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.
 4. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
 - a. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per



ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.

- 1) Type: Cast-in-place **OR** Postinstalled expansion **OR** Postinstalled bonded, **as directed**, anchors.
 - 2) Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
 - 3) Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchor.
 - 4) Corrosion Protection: Components fabricated from nickel-copper-alloy rods complying with ASTM B 164 for UNS No. N04400 alloy.
- b. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.
5. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
- a. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
OR
Stainless-Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic.
OR
Nickel-Copper-Alloy Wire: ASTM B 164, nickel-copper-alloy UNS No. N04400.
 - b. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) **OR** 0.135-inch- (3.5-mm-), **as directed**, diameter wire.
6. Hanger Rods **OR** Flat Hangers, **as directed**: Mild steel, zinc coated or protected with rust-inhibitive paint.
7. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04-inch- (1-mm-) thick, galvanized steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch- (8-mm-) diameter bolts.
8. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.
9. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.
10. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in-place.
11. Hold-Down Clips: Where indicated, provide manufacturer's standard hold-down clips spaced 24 inches (610 mm) o.c. on all cross tees.
12. Impact Clips: Where indicated, provide manufacturer's standard impact-clip system designed to absorb impact forces against acoustical panels.
13. Clean-Room Gasket System: Where indicated, provide manufacturer's standard system, including manufacturer's standard **OR** closed-cell PVC **OR** neoprene **OR** antimicrobial, **as directed**, gasket and related adhesives, tapes, seals, and retention clips, designed to seal out foreign material from and maintain positive pressure in clean room.
- D. Metal Suspension System For Acoustical Panel Ceiling
1. Wide-Face, Capped, Double-Web, Fire-Rated, **as directed**, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 (Z90) coating designation, with prefinished 15/16-inch- (24-mm-) wide metal caps on flanges.
 - a. Structural Classification: Intermediate-duty **OR** Heavy-duty, **as directed**, system.
 - b. End Condition of Cross Runners: Override (stepped) **OR** Butt-edge, **as directed**, type.
 - c. Face Design: Flat, flush.
 - d. Cap Material: Steel **OR** Aluminum, **as directed**, cold-rolled sheet.
 - e. Cap Finish: Painted white **OR** Painted in color as selected from manufacturer's full range **OR** Painted to match color indicated by manufacturer's designation **OR** Painted to match



- color of acoustical unit **OR** Plated with metallic finish, as selected from manufacturer's full range **OR** Plated with metallic finish indicated by manufacturer's designation **OR** Natural finish for aluminum, **as directed**.
2. Narrow-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 (Z90) coating designation, with prefinished 9/16-inch- (15-mm-) wide metal caps on flanges.
 - a. Structural Classification: Intermediate-duty **OR** Heavy-duty, **as directed**, system.
 - b. End Condition of Cross Runners: Override (stepped) **OR** Butt-edge, **as directed**, type.
 - c. Face Design: Flat, flush **OR** Flanges formed with an integral center reveal, **as directed**.
 - d. Cap Material: Steel **OR** Aluminum, **as directed**, cold-rolled sheet.
 - e. Cap Finish: Painted white **OR** Painted in color as selected from manufacturer's full range **OR** Painted to match color indicated by manufacturer's designation **OR** Painted to match color of acoustical unit **OR** Plated with metallic finish, as selected from manufacturer's full range **OR** Plated with metallic finish indicated by manufacturer's designation **OR** Natural finish for aluminum, **as directed**.
 3. Narrow-Face, Steel-Capped, Double-Web, Fire-Rated Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 (Z90) coating designation, with prefinished, cold-rolled, 9/16-inch- (15-mm-) wide metal caps on flanges.
 - a. Structural Classification: Intermediate-duty system.
 - b. Face Design: Flat, flush.
 - c. Cap Finish: Painted white **OR** Painted in color as selected from manufacturer's full range **OR** Painted to match color indicated by manufacturer's designation **OR** Painted to match color of acoustical unit **OR** Plated with metallic finish, as selected from manufacturer's full range **OR** Plated with metallic finish indicated by manufacturer's designation **OR** Natural finish for aluminum, **as directed**.
 4. Narrow-Face, Uncapped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized, to produce structural members with 9/16-inch- (15-mm-) wide faces.
 - a. Structural Classification: Intermediate-duty **OR** Heavy-duty, **as directed**, system.
 - b. Face Design: With 1/8-inch- (3.2-mm-) wide, slotted, box-shaped flange **OR** With 1/4-inch- (6.35-mm-) wide, slotted, box-shaped flange **OR** Flanges formed in stepped design with a center protrusion projecting 19/64 inch (7.54 mm) below flange surfaces supporting panel faces and forming 3/16-inch- (4.76-mm-) wide reveals between edges of protrusion and those of panels, **as directed**.
 - c. Face Finish: Painted white **OR** in color as selected from manufacturer's full range **OR** to match color indicated by manufacturer's designation **OR** to match color of acoustical unit, **as directed**.
 - d. Reveal Finish: Painted to match flange color **OR** white **OR** black **OR** in color other than flange color as selected from manufacturer's full range of contrasting reveal colors, **as directed**.
 5. Wide-Face, Capped, Double-Web, Fire-Rated, **as directed**, Hot-Dip Galvanized, G60 (Z180), Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, hot-dip galvanized according to ASTM A 653/A 653M, G60 (Z180) coating designation, with prefinished, cold-rolled, 15/16-inch- (24-mm-) wide, aluminum caps on flanges.
 - a. Structural Classification: Intermediate-duty **OR** Heavy-duty, **as directed**, system.
 - b. Face Design: Flat, flush.
 - c. Face Finish: Painted white **OR** Painted to match color indicated by manufacturer's designation **OR** Painted to match color of acoustical unit **OR** Natural finish, **as directed**.
 6. Wide-Face, Single-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet electrolytically zinc coated, with prefinished flanges of width indicated.
 - a. Structural Classification: Heavy-duty system.
 - b. Face Finish: Painted white **OR** black, **as directed**.



7. Wide-Face, Capped, Double-Web, Stainless-Steel Suspension System: Main and cross runners roll formed from Type 304 or 316, stainless-steel sheet, with prefinished 15/16-inch- (24-mm-) wide, stainless-steel caps on flanges.
 - a. Structural Classification: Intermediate-duty system.
 - b. Face Design: Flat, flush.
8. Narrow-Face, Single-Web, Extruded-Aluminum Suspension System: Main and cross runners formed from extruded aluminum to produce structural members with 9/16-inch- (15-mm-) wide faces.
 - a. Structural Classification: Intermediate-duty **OR** Heavy-duty, **as directed**, system.
 - b. Face Design: Screw-slot profile.
 - c. Face Finish: Painted white **OR** Satin anodized per AA-M12C22A31 and AAMA 611, **as directed**.
 - d. Reveal Finish: Match face finish **OR** Painted white **OR** Painted black, **as directed**.
9. Extra-Wide-Face, Double-Web **OR** Single-Web, **as directed**, Metal Suspension System: Main and cross runners formed from extruded aluminum **OR** aluminum-capped steel **OR** steel-capped steel, **as directed**, to produce structural members with 1-1/2-inch- (50-mm-) **OR** 2-inch- (50-mm-), **as directed**, wide flanges.
 - a. Structural Classification: Intermediate-duty **OR** Heavy-duty, **as directed**, system.
 - b. Face Design: Flat, flush.
 - c. Face Finish: Painted white **OR** Satin anodized per AA-M12C22A31 and AAMA 611, **as directed**.
 - d. Gasket System: Clean-room type.

E. Metal Edge Moldings And Trim

1. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.
 - a. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners, unless otherwise indicated.
 - b. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
 - c. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
2. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements and the following:
 - a. Aluminum Alloy: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of aluminum extrusions complying with ASTM B 221 (ASTM B 221M) for Alloy and Temper 6063-T5.
 - b. Finish designations prefixed by AA comply with system established by the Aluminum Association for designating aluminum finishes.
 - c. Conversion-Coated Finish: AA-M12C42 (Chemical Finish: cleaned with inhibited chemicals; acid-chromate-fluoride-phosphate conversion coating).
 - d. Conversion-Coated and Factory-Primed Finish: AA-M12C42R1x (Chemical Finish: cleaned with inhibited chemicals; acid-chromate-fluoride-phosphate conversion coating; organic coating as follows):
 - 1) Manufacturer's standard, factory-applied prime-coat finish ready for field painting.
 - e. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.



f. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; organic coating: as specified below). Apply baked enamel complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.

1) Organic Coating: Thermosetting, primer/topcoat system with a minimum dry film thickness of 0.8 to 1.2 mils (0.02 to 0.03 mm).

F. Acoustical Sealant

1. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

2. Acoustical Sealant for Concealed Joints: Manufacturer's standard nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), recommended for sealing interior concealed joints to reduce airborne sound transmission.

1.3 EXECUTION

A. Preparation

1. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

B. Installation

1. General: Install acoustical panel ceilings to comply with ASTM C 636 **OR** IBC Standard, **as directed**, and seismic design requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

a. Fire-Rated Assembly: Install fire-rated ceiling systems according to tested fire-rated design.

2. Suspend ceiling hangers from building's structural members and as follows:

a. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.

b. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

c. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

d. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.

e. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.

f. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.

g. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.



- h. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 - i. Do not attach hangers to steel deck tabs.
 - j. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 - k. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
 - l. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
3. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
 4. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
 - a. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 - b. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
 - c. Do not use exposed fasteners, including pop rivets, on moldings and trim.
 5. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
 6. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
 - a. Arrange directionally patterned acoustical panels as follows:
 - 1) As indicated on reflected ceiling plans.
OR
Install panels with pattern running in one direction parallel to long **OR** short, **as directed**, axis of space.
OR
Install panels in a basket-weave pattern.
 - b. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
 - c. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
 - d. For reveal-edged panels on suspension system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension system surfaces and panel faces flush with bottom face of runners.
 - e. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
 - f. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions, unless otherwise indicated.
 - g. Install clean-room gasket system in areas indicated, sealing each panel and fixture as recommended by panel manufacturer's written instructions.
 - h. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

C. Field Quality Control

1. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.



2. Tests and Inspections: Testing and inspecting of completed installations of acoustical panel ceiling hangers and anchors and fasteners shall take place in successive stages, in areas of extent and using methods as follows. Do not proceed with installations of acoustical panel ceiling hangers for the next area until test results for previously completed installations of acoustical panel ceiling hangers show compliance with requirements.
 - a. Extent of Each Test Area: When installation of ceiling suspension systems on each floor has reached 20 percent completion but no panels have been installed.
 - 1) Within each test area, testing agency will select 1 of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf (890 N) of tension; it will also select one of every 2 postinstalled anchors used to attach bracing wires to concrete and will test them for 440 lbf (1957 N) of tension.
 - 2) When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.
3. Remove and replace acoustical panel ceiling hangers and anchors and fasteners that do not pass tests and inspections and retest as specified above.

D. Cleaning

1. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

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SECTION 09 51 23 00 - ACOUSTICAL TILE CEILINGS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for acoustical tile ceilings. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes acoustical tiles for ceilings and the following:
 - a. Concealed suspension systems.
 - b. Direct attachment of tiles to substrates with adhesive.
 - c. Direct attachment of tiles to substrates with staples.
2. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete at ceilings.

C. Definitions

1. AC: Articulation Class.
2. CAC: Ceiling Attenuation Class.
3. LR: Light-Reflectance coefficient.
4. NRC: Noise Reduction Coefficient.

D. Submittals

1. Product Data: For each type of product indicated.
2. Coordination Drawings: Drawn to scale and coordinating acoustical tile ceiling installation with hanger attachment to building structure and ceiling mounted items. Show size and location of initial access modules.
3. Samples: For each exposed finish.
4. LEED Submittals:
 - a. Product Data for Credit MR 4.1 and MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - 1) Include statement indicating costs for each product having recycled content.
 - b. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.
5. Field quality-control test reports.
6. Product test reports.
7. Research/evaluation reports.
8. Maintenance data.

E. Quality Assurance

1. Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.
2. Fire-Test-Response Characteristics: Provide acoustical tile ceilings that comply with the following requirements:
 - a. Fire-Resistance Characteristics: Where indicated, provide acoustical tile ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1) Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.



- 2) Identify materials with appropriate markings of applicable testing and inspecting agency.
- b. Surface-Burning Characteristics: Provide acoustical tiles with the following surface-burning characteristics complying with ASTM E 1264 for Class A **OR B OR C**, **as directed**, materials as determined by testing identical products per ASTM E 84:
 - 1) Smoke-Developed Index: 450 or less.
3. Seismic Standard: Provide acoustical tile ceilings designed and installed to withstand the effects of earthquake motions according to the following:
 - a. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E 580.
 - b. CISCA's Recommendations for Acoustical Ceilings: Comply with CISCA's "Recommendations for Direct-Hung Acoustical Tile and Lay-in Panel Ceilings--Seismic Zones 0-2."
 - c. CISCA's Guidelines for Systems Requiring Seismic Restraint: Comply with CISCA's "Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies--Seismic Zones 3 & 4."
 - d. IBC Standard for Metal Suspension Systems for Acoustical Tile and for Lay-in Panel Ceilings.
 - e. ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."
4. Preinstallation Conference: Conduct conference at Project site.

F. Delivery, Storage, And Handling

1. Deliver acoustical tiles, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
2. Before installing acoustical tiles, permit them to reach room temperature and a stabilized moisture content.
3. Handle acoustical tiles carefully to avoid chipping edges or damaging units in any way.

1.2 PRODUCTS

A. Acoustical Tiles, General

1. Acoustical Tile Standard: Provide manufacturer's standard tiles of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
 - a. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface per ASTM E 795.
2. Acoustical Tile Colors and Patterns: Match appearance characteristics indicated for each product type.
 - a. Where appearance characteristics of acoustical tiles are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by the Owner from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.
3. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical tiles treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.
4. Antimicrobial Fungicide Treatment: Provide acoustical tiles with face and back surfaces coated with antimicrobial treatment consisting of manufacturer's standard formulation with fungicide



added to inhibit growth of mold and mildew and showing no mold or mildew growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

- B. Acoustical Tiles For Acoustical Tile Ceiling
1. Classification: Provide fire-resistance-rated, **as directed**, tiles complying with ASTM E 1264 for type, form, and pattern as follows:
 - a. Type III, mineral base with painted finish; Form 1, nodular **OR** 2, water felted **OR** 4, cast or molded, **as directed**.
 - b. Pattern: C (perforated, small holes) **OR** CD (perforated, small holes and fissured) **OR** CE (perforated, small holes and lightly textured) **OR** D (fissured) **OR** E (lightly textured) **OR** F (heavily textured) **OR** G (smooth) **OR** I (embossed) **OR** J (embossed-in-register) **OR** As indicated by manufacturer's designation, **as directed**.
 2. Color: White **OR** As selected from manufacturer's full range **OR** Match sample **OR** As indicated by manufacturer's designation **OR** As indicated on Drawings **OR** As indicated in a schedule, **as directed**.
 3. LR: Not less than 0.65 **OR** 0.70 **OR** 0.75 **OR** 0.80, **as directed**.
 4. NRC: Not less than 0.50 **OR** 0.55 **OR** 0.60 **OR** 0.65 **OR** 0.70, **as directed**.
 5. CAC: Not less than 20 **OR** 25 **OR** 30 **OR** 35 **OR** 40, **as directed**.
 6. AC: Not less than 170 **OR** 180 **OR** 190 **OR** 200 **OR** 210, **as directed**.
 7. Edge/Joint Detail: Square, kerfed and rabbeted, or tongue and grooved, or butt **OR** Beveled, kerfed and rabbeted, or tongue and grooved, or butt **OR** Beveled, kerfed and rabbeted long edges and square, butt on short edges, **as directed**.
 8. Thickness: 5/8 inch (15 mm) **OR** 3/4 inch (19 mm) **OR** As indicated on Drawings **OR** As indicated in a schedule, **as directed**.
 9. Modular Size: 12 by 12 inches (305 by 305 mm) **OR** 300 by 300 mm **OR** As indicated on Drawings **OR** As indicated in a schedule, **as directed**.
 10. Antimicrobial Treatment: Broad spectrum fungicide and bactericide **OR** Fungicide, **as directed**, based.
- C. Metal Suspension Systems, General
1. Recycled Content: Provide products made from steel sheet with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
 2. Metal Suspension System Standard: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.
 3. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.
 4. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
 - a. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
 - 1) Type: Cast-in-place **OR** Postinstalled expansion **OR** Postinstalled bonded, **as directed**, anchors.
 - 2) Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
 - 3) Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchors.
 - b. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without



failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.

5. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
 - a. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 - b. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) **OR** 0.135-inch- (3.5-mm-), **as directed**, diameter wire.
 6. Hanger Rods **OR** Flat Hangers, **as directed**: Mild steel, zinc coated or protected with rust-inhibitive paint.
 7. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04-inch- (1-mm-) thick, galvanized steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch- (8-mm-) diameter bolts.
 8. Seismic Struts: Manufacturer's standard compression struts designed to accommodate lateral forces.
 9. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical tiles in-place.
- D. Metal Suspension System For Acoustical Tile Ceiling
1. Direct-Hung, Double-Web, Fire-Rated, **as directed**, Suspension System: Main and cross runners roll formed from and capped with cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, G30 (Z90) coating designation.
 - a. Structural Classification: Intermediate-duty **OR** Heavy-duty, **as directed**, system.
 - b. Access: Upward **OR** Downward, **as directed**, and end pivoted, **OR** side pivoted, **as directed**, with initial access openings of size indicated below and located throughout ceiling within each module formed by main and cross runners, with additional access available by progressively removing remaining acoustical tiles.
 2. Indirect-Hung, Fire-Rated, **as directed**, Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, G30 (Z90) coating designation.
 - a. Structural Classification: Intermediate-duty **OR** Heavy-duty, **as directed**, system.
 - b. Carrying Channels: Cold-rolled steel, 0.059850-inch- (1.52-mm-) minimum base (uncoated) metal thickness, not less than 3/16-inch- (4.7-mm-) wide flanges by 1-1/2-inch- (38-mm-) deep steel channels, 475 lb/1000 feet (0.707 kg/m), with rust-inhibitive paint finish **OR** hot-dip galvanized according to ASTM A 653/A 653M, G60 (Z180) coating designation, **as directed**.
 - c. Access: Where access is indicated, provide special cross runners or split splines to allow for removal of acoustical units in indicated access areas. Identify access tile with manufacturer's standard unobtrusive markers for each access unit.
- E. Metal Edge Moldings And Trim
1. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.
 - a. Provide manufacturer's standard edge moldings that fit acoustical tile edge details and suspension systems indicated and that match width and configuration of exposed runners, unless otherwise indicated.
 - b. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
 2. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements and the following:
 - a. Aluminum Alloy: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability



properties of aluminum extrusions complying with ASTM B 221 (ASTM B 221M) for Alloy and Temper 6063-T5.

- b. Finish designations prefixed by AA comply with system established by the Aluminum Association for designating aluminum finishes.
- c. Conversion-Coated Finish: AA-M12C42 (Chemical Finish: cleaned with inhibited chemicals; acid-chromate-fluoride-phosphate conversion coating).
- d. Conversion-Coated and Factory-Primed Finish: AA-M12C42R1x (Chemical Finish: cleaned with inhibited chemicals; acid-chromate-fluoride-phosphate conversion coating; organic coating as follows):
 - 1) Manufacturer's standard factory-applied prime-coat finish ready for field painting.
- e. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.
- f. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; organic coating: as specified below). Apply baked enamel complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.
 - 1) Organic Coating: Thermosetting, enamel primer/topcoat system with a minimum dry film thickness of 0.8 to 1.2 mils (0.02 to 0.03 mm).

F. Acoustical Sealant

1. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
2. Acoustical Sealant for Concealed Joints: Manufacturer's standard nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), recommended for sealing interior concealed joints to reduce airborne sound transmission.

G. Miscellaneous Materials

1. Tile Adhesive: Type recommended by tile manufacturer, bearing UL label for Class 0-25 flame spread.
 - a. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Staples: 5/16-inch- (8-mm-) long, divergent-point staples.

1.3 EXECUTION

A. Preparation

1. Testing Substrates: Before installing adhesively applied tiles on wet-placed substrates such as cast-in-place concrete or plaster, test and verify that moisture level is below tile manufacturer's recommended limits.
2. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders, and comply with layout shown on reflected ceiling plans.

B. Installation, Suspended Acoustical Tile Ceilings

1. General: Install acoustical tile ceilings to comply with ASTM C 636 **OR** IBC Standard, **as directed**, and seismic design requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
 - a. Fire-Rated Assembly: Install fire-rated ceiling systems according to tested fire-rated design.
2. Suspend ceiling hangers from building's structural members and as follows:



- a. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 - b. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
OR
Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - c. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 - d. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
OR
Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
 - e. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 - f. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 - g. Do not attach hangers to steel deck tabs.
 - h. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 - i. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
 - j. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
3. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
 4. Install edge moldings and trim of type indicated at perimeter of acoustical tile ceiling area and where necessary to conceal edges of acoustical tiles.
 - a. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 - b. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
 - c. Do not use exposed fasteners, including pop rivets, on moldings and trim.
 5. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
 6. Arrange directionally patterned acoustical tiles as follows:
 - a. As indicated on reflected ceiling plans.
OR
Install tiles with pattern running in one direction parallel to long **OR** short, **as directed**, axis of space.
OR



- Install tiles in a basket-weave pattern.
7. Install acoustical tiles in coordination with suspension system and exposed moldings and trim. Place splines or suspension system flanges into kerfed edges so tile-to-tile joints are closed by double lap of material.
 - a. Fit adjoining tile to form flush, tight joints. Scribe and cut tile for accurate fit at borders and around penetrations through tile.
 - b. Hold tile field in compression by inserting leaf-type, spring-steel spacers between tile and moldings, spaced 12 inches (305 mm) o.c.
 - c. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.
- C. Installation, Directly Attached Acoustical Tile Ceilings
1. Adhesive Installation: Install acoustical tile by bonding to substrate, using amount of adhesive and procedure recommended in writing by tile manufacturer and as follows:
 - a. Remove loose dust from backs of tiles by brushing and prime them with a thin coat of adhesive.
 - b. Install splines in joints between tiles; maintain level of bottom surface of tiles to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m) and not exceeding 1/4 inch (6.35 mm) cumulatively.
 - c. Maintain tight butt joints, aligned in both directions and coordinated with ceiling fixtures.
 2. Stapled Installation: Fasten acoustical tile to substrate using a minimum of two staples per tile that are installed in flanges of tile and as follows:
 - a. Form double-lapped joint between tiles by securely pressing tile tongues into corresponding tile grooves.
 - b. Maintain level of bottom surface of tiles to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m) and not exceeding 1/4 inch (6.35 mm) cumulatively. Shim tile or correct substrate as required to maintain tolerance.
 - c. Maintain tight butt joints, aligned in both directions and coordinated with ceiling fixtures.
 3. Install edge moldings and trim of type indicated at perimeter of acoustical tile ceiling area and where necessary to conceal edges of acoustical units.
 4. Arrange directionally patterned acoustical tiles as follows:
 - a. As indicated on reflected ceiling plans.
OR
Install tiles with pattern running in one direction parallel to long axis of space.
OR
Install tiles with pattern running in one direction parallel to short axis of space.
OR
Install tiles in a basket-weave pattern.
- D. Field Quality Control
1. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.
 2. Tests and Inspections: Testing and inspecting of completed installations of acoustical tile ceiling hangers and anchors and fasteners shall take place in successive stages, in areas of extent and using methods as follows. Do not proceed with installations of acoustical tile ceiling hangers for the next area until test results for previously completed installations of acoustical tile ceiling hangers show compliance with requirements.
 - a. Extent of Each Test Area: When installation of ceiling suspension systems on each floor has reached 20 percent completion but no tiles have been installed.
 - 1) Within each test area, testing agency will select 1 of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf (890 N) of tension; it will also select one of every 2 postinstalled anchors used to attach bracing wires to concrete and will test them for 440 lbf (1957 N) of tension.
 - 2) When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.



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3. Remove and replace acoustical tile ceiling hangers and anchors and fasteners that do not pass tests and inspections and retest as specified above.

E. Cleaning

1. Clean exposed surfaces of acoustical tile ceilings, including trim and edge moldings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace tiles and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 51 23 00



SECTION 09 51 33 13 - ACOUSTICAL METAL PAN CEILINGS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for acoustical metal pan ceilings. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes clip-in, lay-in, snap-in, and torsion-spring acoustical metal pans and the following suspension system for ceilings:
 - a. Direct hung, exposed tee and slot-bolt grid.
 - b. Direct-hung and Indirect-hung, concealed grid designed to support metal pans.
2. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete at ceilings.

C. Definitions

1. CAC: Ceiling Attenuation Class.
2. LR: Light Reflectance coefficient.
3. NRC: Noise Reduction Coefficient.

D. Performance Requirements

1. Structural Performance: Exterior snap-in metal pan ceilings shall withstand exterior exposure and the effects of gravity loads and the following loads and stresses without showing permanent deformation of ceiling system components including pans and suspension system; noise or metal fatigue caused by vibration, deflection, and displacement of ceiling units; or permanent damage to fasteners and anchors.
 - a. Wind Load: Uniform pressure of 20 lbf/sq. ft. (960 Pa) **OR** of 30 lbf/sq. ft. (1436 Pa) **OR** as indicated on Drawings, **as directed**, acting inward or outward.
2. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - a. Temperature Change (Range): 100 deg F (55 deg C).

E. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:
 - a. Product Data for Credit MR 4.1 and MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - 1) Include statement indicating costs for each product having recycled content.
 - b. Product Data for Credit EQ 4.1: For sealants, including printed statement of VOC content.
3. Samples: For each exposed finish.
4. Performance Data: For installed products indicated to comply with design loads and other criteria, include structural analysis and other analytical data signed and sealed by the qualified professional engineer responsible for their preparation.
5. Coordination Drawings: Drawn to scale and coordinating and showing the following:
 - a. Ceiling suspension members.
 - b. Method of attaching hangers to building structure.
 - c. Ceiling-mounted items.
 - d. Ceiling perimeter and penetrations through the ceiling; and trim and moldings.
6. Product test reports.



7. Evaluation reports.
8. Field quality-control reports.
9. Maintenance data.

F. Quality Assurance

1. Acoustical Testing Agency Qualifications: An independent testing laboratory or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.
2. Surface-Burning Characteristics: Complying with ASTM E 1264 for Class A materials as determined by testing identical products according to ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
3. Seismic Standard: Provide acoustical metal pan ceilings designed and installed to withstand the effects of earthquake motions according to the following:
 - a. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E 580.
 - b. CISCA's Recommendations for Acoustical Ceilings: Comply with CISCA's "Recommendations for Direct-Hung Acoustical Tile and Lay-in Panel Ceilings - Seismic Zones 0-2."
 - c. CISCA's Guidelines for Systems Requiring Seismic Restraint: Comply with CISCA's "Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies - Seismic Zones 3 & 4."
 - d. IBC Standard for Metal Suspension Systems for Acoustical Tile and for Lay-in Panel Ceilings.
 - e. SEI/ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."
4. Preinstallation Conference: Conduct conference at Project site.

G. Delivery, Storage, And Handling

1. Deliver acoustical metal pans, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
2. Handle acoustical metal pans, suspension system components, and accessories carefully to avoid damaging units and finishes in any way.

1.2 PRODUCTS

A. Acoustical Metal Ceiling Pans

1. Acoustical Metal Pan Standard: Provide manufacturer's standard acoustical metal pans of configuration indicated that comply with ASTM E 1264 classifications as designated by types, acoustical ratings, and light reflectances unless otherwise indicated.
 - a. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface per ASTM E 795.
2. Sheet Metal Characteristics: For metal components exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, roughness, stains, or discolorations.
 - a. Aluminum Sheet: Roll-formed aluminum sheet, complying with ASTM B 209 (ASTM B 209M); alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
 - b. Steel Sheet: Commercial-quality, cold-rolled, carbon-steel sheet; stretcher leveled; with protective coating complying with ASTM C 635.



- 1) Recycled Content: Provide products made from steel sheet with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
 - 2) Painted Finishes: Electrolytic zinc-coated steel complying with ASTM A 591/A 591M, 40Z (12G) coating, surface treatment as recommended by finish manufacturer for type of use and finish indicated.
 - 3) Chemical/Mechanical Finishes: Uncoated steel sheet complying with ASTM A 1008/A 1008M with luster or bright finish as required by finisher for applying electroplating or other metallic-finishing processes.
 - c. Stainless-Steel Sheet: Complying with ASTM A 240/A 240M, Type 304 **OR** Type 430, **as directed**.
3. Sound-Absorbent Fabric Layer: Provide fabric layer, sized to fit concealed surface of pan, and consisting of black, nonwoven, nonflammable, sound-absorbent material with surface-burning characteristics for flame-spread index of 25 or less and smoke-developed index of 50 or less, as determined by testing per ASTM E 84.
- a. Bond fabric layer to panels in the factory with manufacturer's standard nonflammable adhesive.
4. Sound-Absorbent Pads: Provide width and length to completely fill concealed surface of pan, with surface-burning characteristics for flame-spread index of 25 or less and smoke-developed index of 50 or less, as determined by testing per ASTM E 84, and to comply with the following requirements:
- a. Plastic Sheet-Wrapped Mineral-Fiber Insulation: Pads consisting of nonrigid, PVC plastic sheet encapsulating unfaced mineral-fiber insulation complying with ASTM C 553, Type I, II, or III, and as follows:
 - 1) Mineral-Fiber Type and Thickness: Glass fiber; 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 3 inches (76 mm), **as directed**.
 - 2) Mineral-Fiber Density: 3/4 lb/cu. ft. (12 kg/cu. m) **OR** 1 lb/cu. ft. (16 kg/cu. m) **OR** 1-1/2 lb/cu. ft. (24 kg/cu. m), **as directed**.
 - 3) Plastic Sheet Thickness and Color: Not less than 0.003 inch (0.076 mm); clear **OR** flat black **OR** white, **as directed**.
 - b. Unwrapped, Glass-Fiber Insulation: Black coated, unfaced, complying with ASTM C 553, Type I, II, or III; not less than 1-lb/cu. ft. (16-kg/cu. m) density; treated to be nondusting; and as follows:
 - 1) Thickness: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm), **as directed**.
 - c. Spacer Grids: Provide manufacturer's standard aluminum **OR** galvanized-steel, **as directed**, grid units that provide an air cushion between metal pans and insulation pads and that act to improve sound absorption.
 - d. Sound Attenuation Panels: Provide manufacturer's standard aluminum **OR** galvanized-steel, **as directed**, unperforated metal backing unit that acts as a sound-attenuating pan to reduce the travel of sound through ceiling plenum into adjoining rooms.
 - 1) Sound-Absorbent Pads: Provide secondary sound-absorbent pads, same as specified for primary pads, for placement over sound attenuation pan to reduce plenum sound.
- B. Aluminum Pans For Acoustical Metal Pan Ceiling
1. Classification: Units complying with ASTM E 1264 for Type VII, perforated aluminum facing (pan) with mineral- or glass-fiber-base backing **OR** Type XX, other types described as perforated aluminum facing (pan) units with sound-absorbent fabric backing **OR** Type XX, other types described as unperforated aluminum facing (pan) units, **as directed**.
 - a. Pattern: Pattern A (perforated, regularly spaced large holes), arranged in diagonal **OR** parallel, **as directed**, alignment to pan edge with uniform perforations of dimension, holes per square foot or inch, and percent open area as indicated by product designation **OR** selected from manufacturer's full range, **as directed**.
OR



Pattern: Pattern C (perforated, small holes) regularly spaced, with uniform perforations of dimension, holes per square foot or inch, and percent open area as specified by product designation **OR** selected from manufacturer's full range, **as directed**.

2. Pan Fabrication: Manufacturer's standard units of size, profile, and edge treatment indicated, formed from metal indicated and finished to comply with requirements indicated.
 - a. Lay-in Pans: Formed to set in exposed suspension grid.
 - b. Clip-in Pans: Designed to clip-in and be securely retained in exposed suspension grid by formed edges or accessory clips.
 - c. Snap-in Pans: Designed with dimples or continuous beads on flanges for snap-in, secure engagement with concealed suspension system.
 - d. Torsion-Spring-Hinged Pans: Designed to be securely retained in preslotted exposed suspension grid by torsion springs.
3. Pan Thickness: Not less than 0.020 inch (0.5 mm) **OR** 0.025 inch (0.6 mm) **OR** 0.032 inch (0.8 mm) **OR** 0.040 inch (1.0 mm), **as directed**.
4. Pan Edge Detail: Square **OR** Beveled **OR** Reveal **OR** Manufacturer's standard edge detail, **as directed**.
OR
Pan Joint Detail: Butt **OR** Wide reveal, not less than 15/16 inch (24 mm) wide **OR** Narrow reveal, not greater than 9/16 inch (15 mm) wide **OR** Flush narrow reveal, not greater than 9/16 inch (15 mm) wide, **as directed**.
5. Pan Size: 12 by 12 inches (305 by 305 mm) **OR** 12 by 24 inches (305 by 610 mm) **OR** 12 by 36 inches (305 by 915 mm) **OR** 24 by 24 inches (610 by 610 mm) **OR** 24 by 48 inches (610 by 1220 mm) **OR** 24 by 60 inches (610 by 1525 mm) **OR** 30 by 30 inches (760 by 760 mm) **OR** 30 by 60 inches (760 by 1525 mm) **OR** As indicated on Drawings, **as directed**.
6. Scoring: Score pans at intervals to appear as 12-by-12-inch (305-by-305-mm) ceiling units.
7. Pan Face Finish: Mill **OR** Lacquered mill **OR** Clear anodized **OR** Clear mirror-anodized **OR** Painted white **OR** Painted to match color indicated by product designation **OR** Painted to match sample **OR** Painted in color selected from manufacturer's full range **OR** Bright-reflective metallic finish selected from manufacturer's full range, **as directed**.
8. LR: Not less than 0.70 **OR** 0.75, **as directed**.
9. NRC: Not less than 0.60 **OR** 0.65 **OR** 0.70 **OR** 0.75 **OR** 0.80 **OR** 0.85 **OR** 0.90 **OR** 0.95, **as directed**.
10. CAC: Not less than 35 **OR** 40 **OR** 45, **as directed**.

C. Steel Pans For Acoustical Metal Pan Ceiling

1. Classification: Units complying with ASTM E 1264 for Type V, perforated steel facing (pan) with mineral- or glass-fiber-base backing **OR** Type XX, other types described as perforated steel facing (pan) units with sound-absorbent fabric backing **OR** Type XX, other types described as unperforated steel facing (pan) units, **as directed**.
 - a. Pattern: Pattern A (perforated, regularly spaced large holes), arranged in diagonal **OR** parallel, **as directed**, alignment to pan edge with uniform perforations of dimension, holes per square foot or inch, and percent open area as indicated by product designation **OR** selected from manufacturer's full range, **as directed**.
OR
Pattern: Pattern C (perforated, small holes) regularly spaced, with uniform perforations of dimension, holes per square foot or inch, and percent open area as specified by product designation **OR** selected from manufacturer's full range, **as directed**.
2. Pan Fabrication: Manufacturer's standard units of size, profile, and edge treatment indicated, formed from metal indicated and finished to comply with requirements indicated.
 - a. Lay-in Pans: Formed to set in exposed suspension grid.
 - b. Clip-in Pans: Designed to clip-in and be securely retained in exposed suspension grid by formed edges or accessory clips.
 - c. Snap-in Pans: Designed with dimples or continuous beads on flanges for snap-in, secure engagement with concealed suspension system.



- d. Torsion-Spring-Hinged Pans: Designed to be securely retained in preslotted exposed suspension grid by torsion springs.
3. Pan Thickness: Not less than 0.010-inch (0.25-mm) **OR** 0.020-inch (0.5-mm) **OR** 0.024-inch (0.6-mm) **OR** 0.030-inch (0.75-mm) **OR** 0.036-inch (0.9-mm), **as directed**, nominal thickness.
4. Pan Edge Detail: Square **OR** Beveled **OR** Reveal **OR** Manufacturer's standard edge detail, **as directed**.
OR
Pan Joint Detail: Butt **OR** Wide reveal, not less than 15/16 inch (24 mm) wide **OR** Narrow reveal, not greater than 9/16 inch (15 mm) wide **OR** Flush narrow reveal, not greater than 9/16 inch (15 mm) wide, **as directed**.
5. Pan Size: 12 by 12 inches (305 by 305 mm) **OR** 12 by 24 inches (305 by 610 mm) **OR** 12 by 36 inches (305 by 915 mm) **OR** 24 by 24 inches (610 by 610 mm) **OR** 24 by 48 inches (610 by 1220 mm) **OR** 24 by 60 inches (610 by 1525 mm) **OR** 30 by 30 inches (760 by 760 mm) **OR** 30 by 60 inches (760 by 1525 mm) **OR** As indicated on Drawings, **as directed**.
6. Scoring: Score pans at intervals to appear as 12-by-12-inch (305-by-305-mm) ceiling units.
7. Pan Face Finish: Painted white **OR** Painted to match color indicated by product designation **OR** Painted to match sample **OR** Painted in color selected from manufacturer's full range **OR** Plated with metallic finish, as selected from manufacturer's full range **OR** Bright-reflective metallic finish selected from manufacturer's full range, **as directed**.
8. LR: Not less than 0.70 **OR** 0.75, **as directed**.
9. NRC: Not less than 0.60 **OR** 0.65 **OR** 0.70 **OR** 0.75 **OR** 0.80 **OR** 0.85 **OR** 0.90 **OR** 0.95, **as directed**.
10. CAC: Not less than 35 **OR** 40 **OR** 45, **as directed**.

D. Stainless-Steel Pans For Acoustical Metal Pan Ceiling

1. Classification: Units complying with ASTM E 1264 for Type VI, perforated stainless-steel facing (pan) with mineral- or glass-fiber-base backing **OR** Type XX, other types described as perforated stainless-steel facing (pan) units with sound-absorbent fabric backing **OR** Type XX, other types described as unperforated stainless-steel facing (pan) units, **as directed**.
 - a. Pattern: Pattern A (perforated, regularly spaced large holes), arranged in parallel alignment to pan edge with uniform perforations of 0.109-inch (2.8-mm) diameter, 1800 holes/sq. ft. or inch, and 11.8 percent open area.
2. Pan Fabrication: Manufacturer's standard units of size, profile, and edge treatment indicated, formed from metal indicated and finished to comply with requirements indicated.
 - a. Lay-in Pans: Formed to set in exposed suspension grid.
 - b. Clip-in Pans: Designed to clip-in and be securely retained in exposed suspension grid by formed edges or accessory clips.
 - c. Snap-in Pans: Designed with dimples or continuous beads on flanges for snap-in, secure engagement with concealed suspension system.
 - d. Torsion-Spring-Hinged Pans: Designed to be securely retained in preslotted exposed suspension grid by torsion springs.
3. Pan Thickness: Not less than 0.019 inch (0.5 mm) **OR** 0.025 inch (0.65 mm) **OR** 0.030 inch (0.76 mm), **as directed**.
4. Pan Edge Detail: Square **OR** Beveled **OR** Reveal **OR** Manufacturer's standard edge detail, **as directed**.
OR
Pan Joint Detail: Butt **OR** Wide reveal, not less than 15/16 inch (24 mm) wide **OR** Narrow reveal, not greater than 9/16 inch (15 mm) wide **OR** Flush narrow reveal, not greater than 9/16 inch (15 mm) wide, **as directed**.
5. Pan Size: 12 by 12 inches (305 by 305 mm) **OR** 12 by 24 inches (305 by 610 mm) **OR** 12 by 36 inches (305 by 915 mm) **OR** 24 by 24 inches (610 by 610 mm) **OR** 24 by 48 inches (610 by 1220 mm) **OR** 30 by 30 inches (760 by 760 mm) **OR** As indicated on Drawings, **as directed**.
6. Scoring: Score pans at intervals to appear as 12-by-12-inch (305-by-305-mm) ceiling units.
7. Pan Face Finish: Brushed, directional polish **OR** Satin, directional polish **OR** Mirrorlike reflective, nondirectional polish, **as directed**.



8. NRC: Not less than 0.60 **OR** 0.65 **OR** 0.70 **OR** 0.75 **OR** 0.80 **OR** 0.85 **OR** 0.90 **OR** 0.95, **as directed**.
9. CAC: Not less than 35 **OR** 40 **OR** 45, **as directed**.

E. Metal Suspension Systems

1. Recycled Content: Provide products made from steel sheet with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
2. Metal Suspension System Standard: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable ASTM C 635 requirements.
3. Suspension Systems: Provide systems complete with carriers, runners, splice sections, connector clips, alignment clips, leveling clips, hangers, molding, trim, retention clips, load-resisting struts, and other suspension components required to support ceiling units and other ceiling-supported construction.
4. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
 - a. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
 - 1) Type: Cast-in-place **OR** Postinstalled expansion **OR** Postinstalled bonded, **as directed**, anchors.
 - 2) Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
 - 3) Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchor.
 - 4) Corrosion Protection: Components fabricated from nickel-copper-alloy rods complying with ASTM B 164 for UNS No. N04400 alloy.
 - b. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.
5. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
 - a. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 - b. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic.
 - c. Nickel-Copper-Alloy Wire: ASTM B 164, nickel-copper-alloy UNS No. N04400.
 - d. Size: Select wire diameter so its stress at 3 times the hanger design load indicated in ASTM C 635, Table 1, Direct Hung will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) **OR** 0.135-inch- (3.5-mm-), **as directed**, diameter wire.
6. Hanger Rods **OR** Flat Hangers, **as directed**: Mild steel, zinc coated or protected with rust-inhibitive paint.
7. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04-inch- (1.0-mm-) thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch- (8-mm-) diameter bolts.
8. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.
9. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.
10. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical metal pans in place.
11. Hold-Down Clips: Manufacturer's standard hold-down clips spaced to secure acoustical metal pans in place to molding and trim at perimeter **OR** at each pan, **as directed**.



12. Exposed Metal Edge Moldings and Trim: Provide exposed members as indicated or as required to comply with seismic requirements of authorities having jurisdiction, to conceal edges of and penetrations through ceiling, to conceal edges of pans and runners, for fixture trim and adapters, for fasciae at changes in ceiling height, and for other conditions; of metal and finish matching acoustical metal pan ceiling units, unless otherwise indicated.
 - a. For Circular Penetrations of Ceiling: Fabricate edge moldings to diameter required to fit penetration exactly.
- F. Direct-Hung, Standard-Grid, Metal Suspension System For Acoustical Metal Pan Ceiling
 1. Suspension System: For clip-in **OR** lay-in **OR** torsion-spring, **as directed**, pans.
 2. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytic zinc-coated or hot-dip galvanized according to ASTM A 653/A 653M, G30 (Z90) coating designation, with prefinished, cold-rolled, 15/16-inch- (24-mm-) wide sheet metal caps on flanges.
 - a. Structural Classification: Intermediate-duty **OR** Heavy-duty, **as directed**, system.
 - b. End Condition of Cross Runners: Override (stepped) **OR** Butt-edge, **as directed**, type.
 - c. Face Design: Flat, flush.
 - d. Cap Material: Steel **OR** Aluminum, **as directed**, cold-rolled sheet.
 - e. Cap Finish: Painted white **OR** Painted in color as selected from manufacturer's full range **OR** Painted to match color indicated by manufacturer's designation **OR** Painted to match color of metal pan **OR** Plated with metallic finish, as selected from manufacturer's full range **OR** Plated with metallic finish indicated by manufacturer's designation **OR** Natural finish for aluminum, **as directed**.
 3. Narrow-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytic zinc-coated or hot-dip galvanized according to ASTM A 653/653M, G30 (Z90) coating designation, with prefinished, cold-rolled, 9/16-inch- (15-mm-) wide sheet metal caps on flanges.
 - a. Structural Classification: Intermediate-duty **OR** Heavy-duty, **as directed**, system.
 - b. End Condition of Cross Runners: Override (stepped) **OR** Butt-edge, **as directed**, type.
 - c. Face Design: Flat, flush **OR** Flanges formed with an integral center reveal, **as directed**.
 - d. Cap Material: Steel **OR** Aluminum, **as directed**, cold-rolled sheet.
 - e. Cap Finish: Painted white **OR** Painted in color as selected from manufacturer's full range **OR** Painted to match color indicated by manufacturer's designation **OR** Painted to match color of metal pan **OR** Plated with metallic finish, as selected from manufacturer's full range **OR** Plated with metallic finish indicated by manufacturer's designation **OR** Natural finish for aluminum, **as directed**.
 4. Narrow-Face, Uncapped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytic zinc-coated or hot-dip galvanized, to produce structural members with 9/16-inch- (15-mm-) wide faces.
 - a. Structural Classification: Intermediate-duty **OR** Heavy-duty, **as directed**, system.
 - b. Face Design: With 1/8-inch- (3.2-mm-) wide, slotted, box-shaped flange **OR** With 1/4-inch- (6.35-mm-) wide, slotted, box-shaped flange, **as directed**.
 - c. Face Finish: Painted white **OR** in color as selected from manufacturer's full range **OR** to match color indicated by manufacturer's designation **OR** to match color of metal pan, **as directed**.
 5. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, hot-dip galvanized according to ASTM A 653/A 653M, G60 (Z180) coating designation, with prefinished, cold-rolled, 15/16-inch- (24-mm-) wide aluminum caps on flanges.
 - a. Structural Classification: Intermediate-duty **OR** Heavy-duty, **as directed**, system.
 - b. Face Design: Flat, flush.
 - c. Face Finish: Painted white **OR** Painted to match color indicated by manufacturer's designation **OR** Painted to match color of acoustical unit **OR** Natural finish, **as directed**.
 6. Wide-Face, Capped, Double-Web, Stainless-Steel Suspension System: Main and cross runners roll formed from and capped with Type 304 or 316 stainless-steel sheet, with prefinished, cold-rolled, 15/16-inch- (24-mm-) wide stainless-steel caps on flanges.



- a. Structural Classification: Intermediate-duty system.
 - b. Face Design: Flat, flush.
7. Suspension System for Torsion-Spring Metal Pans: Provide runners with factory-cut slots fabricated to accept torsion-spring attachment.
- G. Metal Suspension System For Acoustical Snap-In Metal Pan Ceiling
1. Indirect-Hung, Snap-Tee **OR** Bar, **as directed**, System: Designed to support metal pans that snap into main runners, consisting of main runners connected to carrying channels that are attached by hangers to building structure, and complying with the following requirements:
 - a. Main Runners: Formed from the following metal:
 - 1) Aluminum Sheet: Alloy and temper recommended by aluminum producer and finisher for type of use indicated and manufacturer's standard finish, complying with ASTM B 209 (ASTM B 209M).
 - 2) Electrolytic Zinc-Coated Steel Sheet: ASTM A 591/A 591M, with not less than 80Z (24G) zinc coating.
 - 3) Hot-Dip Galvanized Steel: ASTM A 653/A 653M, not less than G60 (Z180) zinc coating.
 - 4) Stainless-Steel Sheet: ASTM A 666, Type 302 or 304, stretcher leveled, with cold-rolled mill finish.
 - 5) Metal Sheet: Metal as standard with ceiling system manufacturer with factory-applied protective finish complying with ASTM C 635.
 - b. Carrying Channels: Same member and metal as indicated for main runners.
OR
Carrying Channels: Cold-rolled steel, not less than 0.060-inch (1.5-mm) nominal thickness of base (uncoated) metal and 7/16-inch- (11-mm-) wide flanges, protected with rust-inhibitive paint **OR** hot-dip galvanized according to ASTM A 653/A 653M, G60 (Z180) coating designation, **as directed**, and as follows:
 - 1) Depth and Weight: 1-1/2 inches and 475 lb/1000 feet (38 mm and 215 kg/305 m) **OR** 2 inches and 590 lb/1000 feet (51 mm and 268 kg/305 m), **as directed**.
 - c. Exterior Bracing Channels and Angles: Cold-rolled steel, hot-dip galvanized to comply with ASTM A 653/A 653M, G60 (Z180) coating designation; size and profile as required to withstand wind load.
 2. Direct-Hung, Snap-Tee **OR** Bar, **as directed**, System: Designed to support metal pans that snap into main runners, consisting of main runners supported by hangers attached directly to building structure, and complying with the following requirements:
 - a. Hangers: Angles or channels, as standard with ceiling system manufacturer, formed from same metal as main runners.
 - b. Main Runners: Rolled aluminum sheet; alloy and temper recommended by aluminum producer and finisher for type of use indicated and manufacturer's standard finish, complying with ASTM B 209 (ASTM B 209M).
 3. Access Panels: For access at locations indicated, provide acoustical snap-in metal pan ceiling units, accessible by key or tool **OR** two access knobs; place one access knob at each end of panel near corners, **as directed**.
 - a. Access Key or Tool: Provide manufacturer' standard key or tool for opening access panels; one **OR** two, **as directed**.
- H. Acoustical Sealant
1. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 2. Acoustical Sealant for Concealed Joints: Manufacturer's standard nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant, with a VOC content of 250 g/L or



less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), recommended for sealing interior concealed joints to reduce airborne sound transmission.

- I. General Finish Requirements
 1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - a. High-Humidity Finish: Comply with ASTM C 635 requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.
 2. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
 3. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- J. Aluminum Finishes
 1. Mill Finish: AA-M10C10 (Mechanical Finish: as fabricated, unspecified; Chemical Finish: chemically cleaned).
 2. Lacquered Mill Finish: AA-M10C10R1x (Mechanical Finish: as fabricated, unspecified; Chemical Finish: chemically cleaned; Organic Coating: as specified below).
 - a. Organic Coating: Manufacturer's standard clear organic coating.
 3. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.
 4. Clear Mirror Anodic Finish: AA-M21C12A212, 0.005 mm or thicker.
 5. Color-Coated Finish: Manufacturer's standard powder-coat, **as directed**, baked paint complying with coating manufacturer's written instructions for surface preparation, pretreatment, application, baking, and minimum dry film thickness.
 6. Bright-Reflective Finish: Manufacturer's standard chemical/mechanical bright-reflective metallic finish complying with finish manufacturer's written instructions for surface preparation, pretreatment, process, protective coating, and minimum thickness to produce a finish uniform in appearance and free of blisters, pits, roughness, nodules, burning, cracks, unfinished areas, and other visible defects.
- K. Galvanized-Steel Sheet Finishes
 1. Color-Coated Finish: Manufacturer's standard powder-coat, **as directed**, baked paint complying with coating manufacturer's written instructions for surface preparation, pretreatment, application, baking, and minimum dry film thickness.
- L. Steel Sheet Finishes
 1. Electroplated Finish: Electroplating process complying with finish manufacturer's written instructions for surface preparation, pretreatment, process, and minimum thickness to produce a coating uniform in appearance and free of blisters, pits, roughness, nodules, burning, cracks, unplated areas, and other visible defects.
 2. Bright-Reflective Finish: Manufacturer's standard chemical/mechanical bright-reflective metallic finish complying with finish manufacturer's written instructions for surface preparation, pretreatment, process, protective coating, and minimum thickness to produce a finish uniform in appearance and free of blisters, pits, roughness, nodules, burning, cracks, unfinished areas, and other visible defects.
- M. Stainless-Steel Finishes
 1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
 2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - a. Run grain of directional finishes with long dimension of each piece.
 - b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.



1.3 EXECUTION

A. Preparation

1. Measure each ceiling area and establish layout of acoustical metal pans to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width pans at borders, and comply with layout shown on reflected ceiling plans and Coordination Drawings.

B. Installation

1. Install acoustical metal pan ceilings to comply with ASTM C 636 **OR** IBC Standard, **as directed**, and seismic requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
2. Suspend ceiling hangers from building's structural members and as follows:
 - a. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 - b. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - c. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 - d. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
OR
Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved.
 - e. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 - f. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 - g. Do not attach hangers to steel deck tabs.
 - h. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 - i. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
 - j. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
3. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
4. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical metal pans.
 - a. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 - b. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
 - c. Do not use exposed fasteners, including pop rivets, on moldings and trim.
5. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.



6. Cut acoustical metal pan units for accurate fit at borders and at interruptions and penetrations by other work through ceilings. Stiffen edges of cut units as required to eliminate evidence of buckling or variations in flatness exceeding referenced standards for stretcher-leveled metal sheet.
 7. Install acoustical metal pans in coordination with suspension system and exposed moldings and trim.
 - a. For lay-in square-edge pans, install pans with edges fully hidden from view by flanges of suspension system runners and moldings.
 - b. For lay-in reveal-edge pans on suspension system runners, install pans with bottom of reveal in firm contact with top surface of runner flanges.
 - c. For lay-in reveal-edge pans on suspension system members with box-shaped flanges, install pans with reveal surfaces in firm contact with suspension system surfaces and panel faces flush with bottom face of runners.
 - d. For clip-in **OR** torsion-spring-hinged, **as directed**, pans, position pans according to manufacturer's written instructions.
 - e. For snap-in pans, fit adjoining units to form flush, tight joints.
 - f. Align joints in adjacent courses to form uniform, straight joints parallel to room axis in both directions unless otherwise indicated.
 - g. Fit adjoining units to form flush, tight joints.
 - h. Install directionally patterned or textured metal pans in directions indicated.
 - i. Install sound-absorbent fabric layers in perforated metal pans.
 - j. Install sound-absorbent pads in perforated metal pans over metal spacer grids, **as directed**.
 8. Install sound attenuation panels in areas indicated by reflected ceiling plans or room finish schedules. Lay panels directly on ceiling system and close major openings to form complete coverage in required areas. Lay second sound-absorbent pads on sound attenuation panels.
 9. Install hold-down clips where indicated.
- C. Field Quality Control
1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
 2. Tests and Inspections: Testing and inspecting of completed installations of acoustical panel ceiling hangers and anchors and fasteners shall take place in successive stages, in areas of extent and using methods as follows. Do not proceed with installations of acoustical panel ceiling hangers for the next area until test results for previously completed installations of acoustical panel ceiling hangers show compliance with requirements.
 - a. Extent of Each Test Area: When installation of ceiling suspension systems on each floor has reached 20 percent completion but no panels have been installed.
 - 1) Within each test area, testing agency will select 1 of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf (890 N) of tension; it will also select one of every 2 postinstalled anchors used to attach bracing wires to concrete and will test them for 440 lbf (1957 N) of tension.
 - 2) When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.
 3. Acoustical panel ceiling hangers and anchors and fasteners will be considered defective if they do not pass tests and inspections.
 4. Prepare test and inspection reports.
- D. Cleaning
1. Clean exposed surfaces of acoustical metal pan ceilings, including trim and edge moldings after removing strippable, temporary protective covering, if any. Comply with manufacturer's written instructions for stripping of temporary protective covering, cleaning, and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage, including dented and bent units.



END OF SECTION 09 51 33 13



Task	Specification	Specification Description
09 53 23 00	09 51 13 00	Acoustical Panel Ceilings



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SECTION 09 54 23 00 - LINEAR METAL CEILINGS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for linear metal ceilings. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes strip linear metal pans and suspension systems for ceilings.

C. Definitions

1. LR: Light Reflectance coefficient.
2. NRC: Noise Reduction Coefficient.

D. Performance Requirements

1. Structural Performance: Exterior linear metal ceilings shall withstand exterior exposure and the effects of gravity loads and the following loads and stresses without showing permanent deformation of ceiling system components including pans and suspension system; noise or metal fatigue caused by vibration, deflection, and displacement of ceiling units; or permanent damage to fasteners and anchors.
 - a. Wind Load: Uniform pressure of 20 lbf/sq. ft. (960 Pa) **OR** of 30 lbf/sq. ft. (1436 Pa) **OR** as indicated on Drawings, **as directed**, acting inward or outward.
2. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), **as directed**, material surfaces.

E. Submittals

1. Product Data: For each type of product indicated.
2. Performance Data: For installed products indicated to comply with design loads and other criteria, include structural analysis and other analytical data signed and sealed by the qualified professional engineer responsible for their preparation.
3. Samples: For each exposed finish.
4. Coordination Drawings: Drawn to scale and coordinating and showing the following:
 - a. Linear pattern.
 - b. Joint pattern.
 - c. Ceiling suspension members.
 - d. Method of attaching hangers to building structure.
 - e. Ceiling-mounted items.
 - f. Ceiling perimeter and penetrations through ceiling; trim and moldings.
5. Product test reports.
6. Evaluation reports.
7. Maintenance data.

F. Quality Assurance

1. Acoustical Testing Agency Qualifications: An independent testing laboratory or an NVLAP-accredited laboratory.
2. Surface-Burning Characteristics: Complying with ASTM E 1264 for Class A materials, as determined by testing identical products according to ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.



3. Seismic Standard: Comply with the following:
 - a. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E 580.
 - b. CISCA's Recommendations for Acoustical Ceilings: Comply with CISCA's "Recommendations for Direct-Hung Acoustical Tile and Lay-in Panel Ceilings - Seismic Zones 0-2."
 - c. CISCA's Guidelines for Systems Requiring Seismic Restraint: Comply with CISCA's "Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies - Seismic Zones 3 & 4."
 - d. IBC Standard for Metal Suspension Systems for Acoustical Tile and for Lay-in Panel Ceilings.
 - e. SEI/ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."

G. Delivery, Storage, And Handling

1. Deliver linear metal pans, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
2. Handle linear metal pans, suspension system components, and accessories carefully to avoid damaging units and finishes in any way.

1.2 PRODUCTS

A. Linear Metal Ceiling Pans

1. Acoustical Metal Pan Standard: Provide manufacturer's standard linear metal pans of configuration indicated that comply with ASTM E 1264.
 - a. Mounting Method for Measuring NRC: Type E-400.
2. Sheet Metal Characteristics: For metal components exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, roughness, stains, or discolorations.
 - a. Aluminum Sheet: Roll-formed aluminum sheet, complying with ASTM B 209 (ASTM B 209M); alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
 - b. Steel Sheet: Commercial-quality, cold-rolled, carbon-steel sheet; stretcher leveled; with protective coating complying with ASTM C 635.
 - c. Steel Sheet: Commercial-quality, cold-rolled, carbon-steel sheet; stretcher leveled and ASTM A 591/A 591M, 40Z (12G) coating for painted finish **OR** ASTM A 1008/A 1008M for electroplating, **as directed**; with protective coating complying with ASTM C 635 and recommended by finisher for finish indicated.
 - d. Stainless-Steel Sheet: Complying with ASTM A 240/A 240M, Type 304 **OR** Type 430, **as directed**.
3. Pan Fabrication: Manufacturer's standard units of size, profile, and edge treatment indicated, formed from metal indicated to snap on and be securely retained on carriers without separate fasteners, and finished to comply with requirements indicated.
4. Pan Splices: Construction same as pans, in lengths 8 to 12 inches (200 to 300 mm); with manufacturer's standard finish.
5. End Caps: Metal matching pans **OR** Plastic **OR** Manufacturer's standard material, **as directed**; fabricated to fit and conceal exposed ends of pans.
6. Filler Strips: Metal matching pans **OR** Plastic **OR** Manufacturer's standard material, **as directed**; fabricated to uninterruptedly close voids between pans.
7. Moldings and Trim: Provide manufacturer's standard moldings and trim for exposed members, and as indicated or required, for edges and penetrations of ceiling, around fixtures, at changes in ceiling height, and for other conditions; of same metal and finish as linear metal ceiling pans.



8. Sound-Absorbent Fabric Layer: Provide fabric layer, sized to fit concealed surface of pan, and consisting of black, nonwoven, nonflammable, sound-absorbent material with surface-burning characteristics for flame-spread index of 25 or less and smoke-developed index of 50 or less, as determined by testing per ASTM E 84.
 - a. Bond fabric layer to pan in the factory with manufacturer's standard nonflammable adhesive.
9. Sound-Absorbent Pads: Provide width and length to completely fill between carriers, joined at center of panel, with surface-burning characteristics for flame-spread index of 25 or less and smoke-developed index of 50 or less, as determined by testing per ASTM E 84, and to comply with the following requirements:
 - a. Plastic Sheet-Wrapped Mineral-Fiber Insulation: Pads consisting of nonrigid, PVC plastic sheet encapsulating unfaced mineral-fiber insulation complying with ASTM C 553, Type I, II, or III, and as follows:
 - 1) Mineral-Fiber Type and Thickness: Glass fiber; 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 3 inches (76 mm), **as directed**.
 - 2) Mineral-Fiber Density: 3/4 lb/cu. ft. (12 kg/cu. m) **OR** 1 lb/cu. ft. (16 kg/cu. m) **OR** 1-1/2 lb/cu. ft. (24 kg/cu. m), **as directed**.
 - 3) Plastic Sheet Thickness and Color: Not less than 0.003 inch (0.076 mm); clear **OR** flat black **OR** white, **as directed**.
 - b. Unwrapped, Glass-Fiber Insulation: Black-coated, unfaced, glass-fiber insulation complying with ASTM C 553, Type I, II, or III, not less than 1-lb/cu. ft. (16-kg/cu. m) density, treated to be nondusting, and as follows:
 - 1) Thickness: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm), **as directed**.

B. Metal Suspension Systems

1. Metal Suspension Systems Standard: Provide ceiling manufacturer's standard metal suspension systems of types and finishes indicated that comply with applicable ASTM C 635 requirements.
2. Suspension Systems: Provide systems complete with carriers, splice sections, connector clips, alignment clips, leveling clips, hangers, molding, trim, retention clips, load-resisting struts, fixture adapters, and other suspension components required to support ceiling units and other ceiling-supported construction.
3. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, Direct Hung, unless otherwise indicated.
 - a. Cast-in-Place and Postinstalled Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
 - 1) Type: Cast-in-place **OR** Postinstalled expansion **OR** Postinstalled bonded, **as directed**, anchors.
 - 2) Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC service condition (mild).
 - 3) Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchors.
 - 4) Corrosion Protection: Components fabricated from nickel-copper-alloy rods complying with ASTM B 164 for UNS No. N04400 alloy.
 - b. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.
4. Wire Hangers, Braces, and Ties: Provide wire complying with the following requirements:
 - a. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 - b. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic.
 - c. Nickel-Copper-Alloy Wire: ASTM B 164, nickel-copper-alloy UNS No. N04400.



- d. Size: Select wire diameter so its stress at 3 times the hanger design load indicated in ASTM C 635, Table 1, Direct Hung will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) **OR** 0.135-inch- (3.5-mm-), **as directed**, diameter wire.
 5. Hanger Rods **OR** Flat Hangers, **as directed**: Mild steel, zinc coated or protected with rust-inhibitive paint.
 6. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed from 0.04-inch- (1.0-mm-) thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch- (8-mm-) diameter bolts.
 7. Carriers: Factory finished with matte-black baked finish, **as directed**.
 - a. Main Carriers: Aluminum, not less than 0.240-inch (6.0-mm) rolled sheet, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, complying with ASTM B 209 (ASTM B 209M).
 - b. Main Carriers: Steel, not less than 0.0209-inch (0.53-mm) nominal thickness, cold-rolled sheet, with factory-applied protective coating, complying with ASTM C 635.
 - 1) Electrolytic Zinc-Coated Steel: ASTM A 591/A 591M, not less than 80Z (24G), **as directed**, zinc coating.
 - 2) Hot-Dip Galvanized Steel: ASTM A 653/A 653M, not less than G60 (Z180), **as directed**, zinc coating.
 - c. Adaptable Carriers: Manufacturer's standard carriers for direct attachment to existing suspended tees.
 - d. Flexible Radial Carriers: Manufacturer's standard radial carriers.
 - e. Expansion Carriers: Manufacturer's standard carriers allowing for irregularities or other unusual space conditions.
 8. Carrier Splices: Same metal, profile, and finish as indicated for carriers.
 9. Stabilizer Channels, Tees, and Bars: Manufacturer's standard components for stabilizing main carriers at regular intervals and at light fixtures, air-distribution equipment, access doors, and other equipment; spaced as standard with manufacturer for use indicated; and factory finished with matte-black baked finish.
 10. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.
 11. Exterior Bracing Channels and Angles: Cold-rolled steel, hot-dip galvanized to comply with ASTM A 653/A 653M, G60 (Z180) coating designation; size and profile as required to withstand wind load.
 12. Hold-Down Clips: Manufacturer's standard hold-down clips spaced as standard with manufacturer.
 13. Edge Moldings and Trim: Provide exposed members as indicated or required to comply with seismic requirements of authorities having jurisdiction, to conceal edges of penetrations through ceiling, to conceal ends of pans and carriers, for fixture trim and adapters, for fasciae at changes in ceiling height, and for other conditions; of metal and finish matching linear metal pans or extruded plastic unless otherwise indicated.
 - a. For Circular Penetrations of Ceiling: Fabricate edge moldings to diameter required to fit penetration exactly.
- C. Aluminum Pans And Suspension System For Linear Metal Ceiling
1. Aluminum Pans and Suspension System:
 2. Classification: Units complying with ASTM E 1264 for Type XIII, aluminum strips with mineral- or glass-fiber-base backing; Form 1, perforated **OR** Type XIII, aluminum strips with mineral- or glass-fiber-base backing; Form 2, unperforated **OR** Type XX, other types described as perforated aluminum strips with sound-absorbent fabric backing, **as directed**.
 3. Pan Thickness: Not less than 0.018 inch (0.46 mm) **OR** 0.022 inch (0.56 mm) **OR** 0.024 inch (0.6 mm) **OR** 0.025 inch (0.65 mm) **OR** 0.027 inch (0.7 mm) **OR** 0.032 inch (0.8 mm) **OR** 0.040 inch (1.0 mm), **as directed**.
 4. Pan Edge Detail: Beveled **OR** Square **OR** Round **OR** Manufacturer's standard edge detail, **as directed**.



5. Linear Module Width and Pan Face Width: 2-inch (51-mm) module width and 1-1/4-inch (32-mm) face width **OR** 4-inch (102-mm) module width and 3-1/4-inch (83-mm) face width **OR** 6-inch (152-mm) module width and 5-1/4-inch (133-mm) face width **OR** 8-inch (203-mm) module width and 7-1/4-inch (184-mm) face width **OR** 100-mm module width and 80-mm face width **OR** 200-mm module width and 180-mm face width **OR** 300-mm module width and 280-mm face width **OR** As indicated on Drawings, **as directed**.
 6. Pan Depth: 5/8 inch (16 mm) deep **OR** 3/4 inch (19 mm) deep **OR** Not less than 1 to 1-1/2 inches (25 to 38 mm) deep **OR** 15 mm deep **OR** As indicated, **as directed**.
 7. Pan Face Finish: Mill **OR** Lacquered mill **OR** Clear anodized **OR** Clear mirror-anodized **OR** Painted white **OR** Painted to match color indicated by product designation **OR** Painted to match sample **OR** Painted in color selected from manufacturer's full range **OR** High-performance organic coating in color selected from manufacturer's full range **OR** Bright-reflective finish selected from manufacturer's full range, **as directed**.
 8. End Cap, Finish of Exposed Portions: Matte black **OR** To match pan **OR** Manufacturer's standard finish, **as directed**.
 9. Filler Strip Design: Recessed **OR** Flush **OR** An integral extension of pan profile **OR** Expansion, for use with expansion carriers **OR** Slotted, for air diffusion, **as directed**.
 10. Filler Strip, Finish of Exposed Portions: Matte black **OR** To match pan, **as directed**.
 11. LR: Not less than 0.70 **OR** 0.75, **as directed**.
 12. NRC: Not less than 0.65 **OR** 0.75 **OR** 0.95, **as directed**.
 13. Suspension-System Main-Carrier Material: Aluminum **OR** Electrolytic zinc-coated steel **OR** Hot-dip galvanized steel **OR** Manufacturer's standard material and protective finish, **as directed**.
- D. Steel Pans And Suspension System For Linear Metal Ceiling
1. Steel Pans and Suspension System:
 2. Classification: Units complying with ASTM E 1264 for Type XIII, steel strips with mineral- or glass-fiber-base backing; Form 1, perforated **OR** Type XIII, steel strips with mineral- or glass-fiber-base backing; Form 2, unperforated **OR** Type XX, other types described as perforated steel strips with sound-absorbent fabric backing, **as directed**.
 3. Pan Thickness: Not less than 0.015 inch (0.4 mm) **OR** 0.020 inch (0.5 mm) **OR** 0.024 inch (0.6 mm) **OR** 0.030 inch (0.75 mm), **as directed**.
 4. Pan Edge Detail: Beveled **OR** Square **OR** Round **OR** Manufacturer's standard edge detail, **as directed**.
 5. Linear Module Width and Pan Face Width: 2-inch (51-mm) module width and 1-1/4-inch (32-mm) face width **OR** 4-inch (102-mm) module width and 3-1/4-inch (83-mm) face width **OR** 6-inch (152-mm) module width and 5-1/4-inch (133-mm) face width **OR** 8-inch (203-mm) module width and 7-1/4-inch (184-mm) face width **OR** As indicated on Drawings, **as directed**.
 6. Pan Depth: 5/8 inch (16 mm) deep **OR** 3/4 inch (19 mm) deep **OR** Not less than 1 to 1-1/2 inches (25 to 38 mm) deep **OR** 15 mm deep **OR** As indicated, **as directed**.
 7. Pan Face Finish: Painted white **OR** Painted to match color indicated by product designation **OR** Painted to match sample **OR** Painted in color selected from manufacturer's full range **OR** Electroplated finish selected from manufacturer's full range, **as directed**.
 8. End Cap, Finish of Exposed Portions: Matte black **OR** To match pan **OR** Manufacturer's standard finish, **as directed**.
 9. Filler Strip Design: Recessed **OR** Flush **OR** An integral extension of pan profile **OR** Expansion, for use with expansion carriers **OR** Slotted, for air diffusion, **as directed**.
 10. Filler Strip, Finish of Exposed Portions: Matte black **OR** To match pan, **as directed**.
 11. LR: Not less than 0.70 **OR** 0.75, **as directed**.
 12. NRC: Not less than 0.65 **OR** 0.75 **OR** 0.95, **as directed**.
 13. Suspension-System Main-Carrier Material: Aluminum **OR** Electrolytic zinc-coated steel **OR** Hot-dip galvanized steel **OR** Manufacturer's standard material and protective finish, **as directed**.
- E. Stainless-Steel Pans And Suspension System For Linear Metal Ceiling
1. Stainless-Steel Pans and Suspension System:
 2. Classification: Units complying with ASTM E 1264 for Type XIII, stainless-steel strips with mineral- or glass-fiber-base backing; Form 1, perforated **OR** Type XIII, stainless-steel strips with



mineral- or glass-fiber-base backing; Form 2, unperforated **OR** Type XX, other types described as perforated stainless-steel strips with sound-absorbent fabric backing, **as directed**.

3. Pan Thickness: Not less than 0.016 inch (0.396 mm) **OR** 0.019 inch (0.475 mm), **as directed**.
4. Pan Edge Detail: Manufacturer's standard edge detail, **as directed**.
5. Linear Module Width and Pan Face Width: 2-inch (51-mm) module width and 1-1/4-inch (32-mm) face width **OR** 4-inch (102-mm) module width and 3-1/4-inch (83-mm) face width **OR** 6-inch (152-mm) module width and 5-1/4-inch (133-mm) face width **OR** 8-inch (203-mm) module width and 7-1/4-inch (184-mm) face width **OR** As indicated on Drawings, **as directed**.
6. Pan Depth: 5/8 inch (16 mm) deep **OR** As indicated, **as directed**.
7. Pan Face Finish: Brushed, directional polish **OR** Satin, directional polish **OR** Mirrorlike reflective, nondirectional polish, **as directed**.
8. End Cap, Finish of Exposed Portions: Matte black **OR** To match pan **OR** Manufacturer's standard finish, **as directed**.
9. Filler Strip Design: Recessed **OR** Flush **OR** An integral extension of pan profile **OR** Expansion, for use with expansion carriers **OR** Slotted, for air diffusion, **as directed**.
10. Filler Strip, Finish of Exposed Portions: Matte black **OR** To match pan, **as directed**.
11. NRC: Not less than 0.65 **OR** 0.75 **OR** 0.95, **as directed**.
12. Suspension-System Main-Carrier Material: Aluminum **OR** Electrolytic zinc-coated steel **OR** Hot-dip galvanized steel **OR** Manufacturer's standard material and protective finish, **as directed**.

F. Accessories

1. Access Panels: For access at locations indicated, provide door hinge assembly, retainer clip, and retainer bar, assembled with ceiling panels and carrier sections into access doors of required size, permitting upward or downward opening.

G. General Finish Requirements

1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
3. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

H. Aluminum Finishes

1. Mill Finish: AA-M10C10.
2. Lacquered Mill Finish: AA-M10C10R1x with manufacturer's standard clear, organic coating.
3. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.
4. Clear Mirror Anodic Finish: AA-M21C12A212, 0.005 mm or thicker.
5. Color-Coated Finish: Manufacturer's standard powder-coat baked paint finish complying with coating manufacturer's written instructions for surface preparation, pretreatment, application, baking, and minimum dry film thickness.
6. High-Performance Organic Finish: 2-coat fluoropolymer finish complying with AAMA 2604 **OR** AAMA 2605, **as directed**, and containing not less than 50 **OR** 70, **as directed**, percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
7. Bright-Reflective Finish: Manufacturer's standard chemical/mechanical bright-reflective metallic finish complying with finish manufacturer's written instructions for surface preparation, pretreatment, process, protective coating, and minimum thickness to produce a finish uniform in appearance and free of blisters, pits, roughness, nodules, burning, cracks, unfinished areas, and other visible defects.

I. Galvanized-Steel Sheet Finishes



1. Color-Coated Finish: Manufacturer's standard powder-coat baked paint finish complying with coating manufacturer's written instructions for surface preparation, pretreatment, application, baking, and minimum dry film thickness.

J. Steel Sheet Finishes

1. Electroplated Finish: Electroplating process complying with finish manufacturer's written instructions for surface preparation, pretreatment, process, and minimum thickness to produce a coating uniform in appearance and free of blisters, pits, roughness, nodules, burning, cracks, unplated areas, and other visible defects.
2. Bright-Reflective Finish: Manufacturer's standard chemical/mechanical bright-reflective metallic finish complying with finish manufacturer's written instructions for surface preparation, pretreatment, process, protective coating, and minimum thickness to produce a finish uniform in appearance and free of blisters, pits, roughness, nodules, burning, cracks, unfinished areas, and other visible defects.

K. Stainless-Steel Finishes

1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - a. Run grain of directional finishes with long dimension of each piece.
 - b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

1.3 EXECUTION

A. Installation

1. Comply with ASTM C 636 **OR** IBC Standard, **as directed**, and seismic requirement indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
2. Suspend ceiling hangers from building's structural members and as follows:
 - a. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 - b. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - c. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 - d. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate to which hangers are attached and for type of hanger involved.
 - e. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
 - f. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 - g. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 - h. Do not attach hangers to steel deck tabs.
 - i. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 - j. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.



- k. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
 3. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers but without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
 4. Install edge moldings and trim of type indicated at perimeter of linear metal ceiling area and where necessary to conceal edges and ends of linear metal pans.
 - a. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
 - b. Do not use exposed fasteners, including pop rivets, on moldings and trim.
 5. Install suspension system carriers so they are aligned and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
 6. Cut linear metal pans for accurate fit at borders and at interruptions and penetrations by other work through ceilings. Stiffen edges of cut units as required to eliminate evidence of buckling or variations in flatness exceeding referenced standards for stretcher-leveled metal sheet.
 7. Install linear metal pans in coordination with suspension system and exposed moldings and trim.
 - a. Align joints in adjacent courses to form uniform, straight joints parallel to room axis in both directions unless otherwise indicated.
 - b. Fit adjoining units to form flush, tight joints. Scribe and cut units for accurate fit at borders and around construction penetrating ceiling.
 - c. Install pans with butt joints using internal pan splices.
 - 1) Joint Configuration: Aligned **OR** Aligned, every other panel length **OR** Staggered a minimum of 12 inches (300 mm) **OR** Random **OR** As indicated, **as directed**.
 - d. Install directionally textured metal pans in directions indicated.
 - e. Where metal pan ends are visible, install end caps unless trim is indicated.
 - f. Install filler strips where indicated.
 - g. Install sound-absorbent fabric layers in perforated metal pans.
 - h. Install sound-absorbent pads at right angle to perforated metal pans so pads do not hang unsupported.
 8. Install hold-down clips where indicated.
- B. Cleaning
1. Clean exposed surfaces of linear metal ceilings, including trim and edge moldings after removing strippable, temporary protective covering if any. Comply with manufacturer's written instructions for stripping of temporary protective covering, cleaning, and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage, including dented and bent units.

END OF SECTION 09 54 23 00



Task	Specification	Specification Description
09 54 23 00	09 51 33 13	Acoustical Metal Pan Ceilings



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SECTION 09 64 00 00 - WOOD FLOORING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for wood flooring. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes:
 - a. Factory-finished wood flooring.
 - b. Field-finished wood flooring.
 - c. Sound control underlayment

C. Action Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:
 - a. Product Data for Credit MR 4: For recycled-rubber underlayment, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
 - b. Certificates for Credit MR 6 OR Credit MR 7: Chain-of-custody certificates certifying that products specified to be made from certified wood comply with forest certification requirements. Include evidence that mill is certified for chain of custody by an FSC-accredited certification body. Include statement indicating cost for each certified wood product.
 - c. Product Data for Credit IEQ 4.1: For wood flooring installation adhesives, documentation including printed statement of VOC content.
 - d. Product Data for Credit IEQ 4.2: For field-applied finishes for wood flooring, documentation including printed statement of VOC content.
 - e. Product Data for Credit IEQ 4.3: For wood flooring installation adhesives and field-applied finishes for wood flooring, documentation including printed statement of VOC content.
 - f. Product Data for Credit IEQ 4.3: For wood flooring, documentation from an independent testing agency indicating compliance with the FloorScore Standard.
 - g. Product Data for Credit IEQ 4.4: For composite wood products, documentation indicating that the bonding agent contains no urea formaldehyde.
 - h. Laboratory Test Reports for Credit IEQ 4: For adhesives, field-applied finishes, flooring system elements, composite wood products and wood flooring systems.
3. Shop Drawings: For each type of floor assembly and accessory. Include plans, elevations, sections, details, and attachments to other work. Include expansion provisions and trim details.
4. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors and finishes available for wood flooring.
5. Samples for Verification: For each type of wood flooring and accessory, with stain color and finish required, approximately 12 inches (300 mm) long and of same thickness and material indicated for the Work and showing the full range of normal color and texture variations expected.

D. Maintenance Material Submittals

1. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - a. Wood Flooring: Equal to 1 percent of amount installed for each type of wood flooring indicated.



E. Quality Assurance

1. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
2. Hardwood Flooring: Comply with NOFMA's "Official Flooring Grading Rules" for species, grade, and cut.
 - a. Certification: Provide flooring that carries NOFMA grade stamp on each bundle or piece.
3. Maple Flooring: Comply with applicable MFMA grading rules for species, grade, and cut.
 - a. Certification: Provide flooring that carries MFMA mark on each bundle or piece.
4. Softwood Flooring: Comply with WCLIB No. 17 grading rules for species, grade, and cut.

F. Delivery, Storage, And Handling

1. Deliver wood flooring materials in unopened cartons or bundles.
2. Protect wood flooring from exposure to moisture. Do not deliver wood flooring until after concrete, masonry, plaster, ceramic tile, and similar wet work is complete and dry.
3. Store wood flooring materials in a dry, warm, ventilated, weathertight location.

G. Project Conditions

1. Conditioning period begins not less than seven days before wood flooring installation, is continuous through installation, and continues not less than seven days after wood flooring installation.
 - a. Environmental Conditioning: Maintain an ambient temperature between 65 and 75 deg F (18 and 24 deg C) and relative humidity planned for building occupants in spaces to receive wood flooring during the conditioning period.
 - b. Wood Flooring Conditioning: Move wood flooring into spaces where it will be installed, no later than the beginning of the conditioning period.
 - 1) Do not install flooring until it adjusts to relative humidity of, and is at same temperature as, space where it is to be installed.
 - 2) Open sealed packages to allow wood flooring to acclimatize immediately on moving flooring into spaces in which it will be installed.
2. After conditioning period, maintain relative humidity and ambient temperature planned for building occupants.
3. Install factory-finished wood flooring after other finishing operations, including painting, have been completed.

1.2 PRODUCTS

A. Field-Finished Wood Flooring

1. Certified Wood: Provide wood flooring produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
2. Solid-Wood Plank Flooring: Kiln dried to 6 to 9 percent maximum moisture content, tongue and groove and end matched, and with backs channeled (kerfed) for stress relief.
 - a. Species and Grade: Select red oak **OR** No. 1 Common red oak **OR** No. 2 Common red oak **OR** MFMA-RL First Grade hard maple **OR** MFMA-RL Second and Better Grade hard maple **OR** C & BTR - Flooring Douglas fir **OR** D - Flooring Douglas fir, **as directed**.
 - b. Cut: Plain sawn **OR** Quarter/rift sawn **OR** Edge grain **OR** Vertical grain, **as directed**.
 - c. Thickness: 3/4 inch (19 mm) **OR** 25/32 inch (20 mm), **as directed**.
 - d. Face Width: 2-1/4 inches (57 mm) **OR** 3-1/8 inches (79 mm) **OR** 5-1/8 inches (130 mm), **as directed**.
 - e. Lengths: Manufacturer's Standard **OR** Random-length strips complying with applicable grading rules **OR** Lengths required to form pattern indicated, **as directed**.
 - f. Preservative Treatment: Clear, penetrating, water-repellent wood preservative that protects against mold, mildew, staining, and decay fungi; complying with MFMA's written recommendations and applied by immersion.



- f. Edge Style: Square **OR** Beveled (eased), **as directed**.
- g. Finish: UV urethane **OR** Acrylic impregnated, **as directed**.
 - 1) Color: As selected in manufacturer's full range.
- 5. Engineered-Wood Parquet Flooring: HPVA EF, except bonding agent contains no urea formaldehyde.
 - a. Species: Red oak **OR** Ash **OR** Beech **OR** Maple **OR** Walnut, **as directed**.
 - b. Thickness: 3/8 inch (9.5 mm) **OR** 1/2 inch (13 mm), **as directed**.
 - c. Construction: Five **OR** Three, **as directed**, ply.
 - d. Finish: UV urethane.
 - 1) Color: As selected from manufacturer's full range.

C. Sound Control Underlayment

- 1. Sound Control Underlayment: Sound reducing underlayment consisting of impact-absorbing materials. Minimum Impact Insulation Class (IIC) of 50 **OR** 55, as directed when tested according to ASTM E 492.
- 2. Material: Recycled rubber **OR** Polyurethane foam **OR** Wood fiber **OR** Wood fiber made with binder containing no urea formaldehyde, as directed.
- 3. Thickness: 3/4 inch (19 mm) **OR** 1/2 inch (13 mm) **OR** 3/8 inch (9 mm) **OR** 1/4 inch (6 mm) **OR** 5/32 inch (4 mm), as directed.

D. Accessory Materials

- 1. Wood Underlayment: As specified in Division 06 Section "Rough Carpentry".
- 2. Vapor Retarder: ASTM D 4397, polyethylene sheet not less than 6.0 mils (0.15 mm) **OR** 8.0 mils (0.2 mm) thick, **as directed**.
- 3. Asphalt-Saturated Felt: ASTM D 4869, Type II.
- 4. Wood Flooring Adhesive: Mastic recommended by flooring and adhesive manufacturers for application indicated.
 - a. Use adhesives that have a VOC content of not more than 100 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- 5. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by wood flooring manufacturer.
- 6. Fasteners: As recommended by manufacturer, but not less than that recommended in NWWFA's "Installation Guidelines: Wood Flooring."
- 7. Thresholds and Saddles: To match wood flooring. Tapered on each side.
- 8. Reducer Strips: To match wood flooring. 2 inches (51 mm) wide, tapered, and in thickness required to match height of flooring.
- 9. Cork Expansion Strip: Composition cork strip.
- 10. Feature Strips: 2-inch- (51-mm-) wide, square-edged walnut strips furnished in lengths as long as practical and in thickness to match wood flooring.
- 11. Metal Feature Strips: 1/8-by-1/8-inch (3-by-3-mm) solid-brass strip, designed for inlaying into routed reveal in wood flooring surface.
- 12. Wood air vents and grilles of same species and grade as wood flooring and in sizes indicated on Drawings.

1.3 EXECUTION

A. Examination

- 1. Examine substrates, areas and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, and other conditions affecting performance of wood flooring.
- 2. Proceed with installation only after unsatisfactory conditions have been corrected.
- 3. Concrete Slabs: Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.



- a. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. (18.6 sq. m), and perform no fewer than two tests in each installation area and with test areas evenly spaced in installation areas.
 - 1) Perform anhydrous calcium chloride test per ASTM F 1869, as follows:
 - a) Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) **OR** 4.5 lb of water/1000 sq. ft. (2.04 kg of water/92.9 sq. m), as directed in 24 hours.
 - 2) Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

B. Preparation

1. Concrete Slabs: Grind high spots and fill low spots on concrete substrates to produce a maximum 1/8-inch (3-mm) deviation in any direction when checked with a 10-foot (3-m) straight edge.
 - a. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.
2. Remove coatings, including curing compounds, and other substances on substrates that are incompatible with installation adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Broom or vacuum clean substrates to be covered immediately before product installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Installation

1. Comply with flooring manufacturer's written installation instructions, but not less than applicable recommendations in NWFA's "Installation Guidelines: Wood Flooring."
2. Wood Sleepers and Subfloor: Install according to requirements in Division 06 Section "Rough Carpentry".
3. Wood Underlayment: Install according to requirements in Division 06 Section "Rough Carpentry".
4. Provide expansion space at walls and other obstructions and terminations of flooring as indicated on Drawings **OR** of not less than 3/4 inch (19 mm), **as directed**.
5. Vapor Retarder: Comply with NOFMA's "Installing Hardwood Flooring" for vapor retarder installation and the following:
 - a. Wood Flooring Nailed to Sleepers over Concrete: Install flooring over a layer of polyethylene sheet with edges overlapped over sleepers and turned up behind baseboards.
 - b. Wood Flooring Nailed to Sleepers over Concrete: Install flooring over a layer of polyethylene sheet with edges overlapped over sleepers and turned up behind baseboards.
 - c. Wood Flooring Installed Directly on Concrete: Install a layer of polyethylene sheet according to flooring manufacturer's written instructions.
6. Sound Control Underlayment: Install over vapor retarder in accordance with manufacturer's written instructions.
7. Solid-Wood Flooring: Blind nail or staple flooring to substrate.
 - a. For flooring of face width more than 3 inches (75 mm), do the following:
 - 1) Install countersunk screws at each end of each piece in addition to blind nailing. Cover screw heads with wood plugs glued flush with flooring.
 - 2) Install no fewer than 2 countersunk nails at each end of each piece, spaced not more than 16 inches (406 mm) along length of each piece, in addition to blind nailing. Fill holes with matching wood filler.
8. Solid-Wood Parquet Flooring: Set in adhesive.
9. Engineered-Wood Flooring: Set in adhesive **OR** Nail or staple **OR** Install floating floor, **as directed**.

D. Field Finishing



1. Machine-sand flooring to remove offsets, ridges, cups, and sanding-machine marks that would be noticeable after finishing. Vacuum and tack with a clean cloth immediately before applying finish.
 - a. Comply with applicable recommendations in NWFA's "Installation Guidelines: Wood Flooring."
2. Fill open-grained hardwood.
3. Fill and repair wood flooring seams and defects.
4. Apply floor-finish materials in number of coats recommended by finish manufacturer for application indicated, but not less than one coat of floor sealer and three finish coats.
 - a. Apply stains to achieve an even color distribution matching approved Samples.
 - b. For water-based finishes, use finishing methods recommended by finish manufacturer to minimize grain raise.
5. Cover wood flooring before finishing.
6. Do not cover wood flooring after finishing until finish reaches full cure, and not before seven days after applying last finish coat.

E. Protection

1. Protect installed wood flooring during remainder of construction period with covering of heavy kraft paper or other suitable material. Do not use plastic sheet or film that might cause condensation.
 - a. Do not move heavy and sharp objects directly over kraft-paper-covered wood flooring. Protect flooring with plywood or hardboard panels to prevent damage from storing or moving objects over flooring.

END OF SECTION 09 64 00 00



Task	Specification	Specification Description
09 64 13 00	09 64 00 00	Wood Flooring



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SECTION 09 64 23 00 - WOOD SPORTS-FLOOR ASSEMBLIES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for wood sports-floor assemblies. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes wood sports-floor assemblies.

C. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: Show installation details including location and layout of each type of floor assembly and accessory. Include the following:
 - a. Expansion provisions and trim details.
 - b. Layout, colors, widths, and dimensions of game lines and markers.
 - c. Locations of floor inserts for athletic equipment installed through flooring assembly.
3. Samples: For each exposed finish.
4. LEED Submittals:
 - a. Product Data for Credit EQ 4.1: For wood sports-floor assembly installation adhesives, including printed statement of VOC content.
 - b. Product Data for Credit EQ 4.2: For field-applied finishes and game-line and marker paints, including printed statement of VOC content.
 - c. Certificates for Credit MR 7: Chain-of-custody certificates certifying that wood flooring complies with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.
 - 1) Include statement indicating costs for each certified wood product.
5. Maintenance data.

D. Quality Assurance

1. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
2. Installer Responsibilities: Include installation and field finishing of sports-floor assembly components and accessories, and application of game lines and markers.
3. Forest Certification: Provide wood components produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
4. Maple Flooring: Comply with MFMA grading rules for species, grade, and cut.
 - a. Certification: Provide flooring that carries MFMA mark on each bundle or piece.

E. Delivery, Storage, And Handling

1. Deliver assembly materials in unopened cartons or bundles.
2. Protect wood from exposure to moisture. Do not deliver wood components until after concrete, masonry, plaster, ceramic tile, and similar wet work is complete and dry.
3. Store wood components in a dry, warm, well-ventilated, weathertight location and in a horizontal position.

F. Field Conditions

1. Conditioning period begins not less than seven days before sports-floor assembly installation, is continuous through installation, and continues not less than seven days after sports-floor installation.



- a. Environmental Conditioning: Maintain an ambient temperature between 65 and 75 deg F (18 and 24 deg C) and relative humidity planned for building occupants, but not less than 35 percent or more than 50 percent, in spaces to receive sports-floor assemblies during the conditioning period.
- b. Wood Conditioning: Move wood components into spaces where they will be installed, no later than beginning of the conditioning period.
 - 1) Do not install sports-floor assemblies until wood components adjust to relative humidity of, and are at same temperature as, spaces where they are to be installed.
 - 2) Open sealed packages to allow wood components to acclimatize immediately on moving wood components into spaces in which they will be installed.
- c. After conditioning period, maintain relative humidity and ambient temperature planned for building occupants.
- d. Install sports-floor assemblies after other finishing operations, including painting, have been completed.

1.2 PRODUCTS

A. Description

1. System Type: Floating **OR** Fixed **OR** Anchored resilient **OR** Portable, as directed.
2. Overall System Height: 2-1/8 inches (54 mm) **OR** 2-1/4 inches (57 mm) **OR** 2-1/2 inches (64 mm), **as directed**.

B. Performance

1. Provide wood athletic flooring systems tested by a qualified testing agency according to DIN V 18032-2 and shown to meet the following requirements:
 - a. Shock Absorption: Minimum 53 percent.
 - b. Vertical Deflection: Minimum 0.09 inch (2.3 mm).
 - c. Area of Deflection: Maximum 15 percent.
 - d. Ball Bounce: Minimum **90** percent.
 - e. Surface Friction: Not less than 0.5 or more than 0.7.
 - f. Rolling Loads: No damage when subjected to 337 lbf (1500 N) applied through a single wheel.

C. Flooring Material

1. Random-Length Strip Flooring: Northern hard maple (*Acer saccharum*), kiln dried, random length, tongue and groove, and end matched.
 - a. Grade: MFMA-RL First **OR** Second and Better **OR** Third and Better, **as directed**.
 - 1) Exception: For areas under stacked portion of telescoping bleachers that are normally concealed from view, provide Third and Better Grade.
 - b. Cut: Edge **OR** Flat, **as directed**.
 - c. Thickness: 25/32 inch (20 mm) **OR** 33/32 inch (26 mm), **as directed**.
 - d. Face Width: 2-1/4 inches (57 mm) **OR** 1-1/2 inches (38 mm), **as directed**.
2. Finger-Jointed Strip Flooring: Northern hard maple (*Acer saccharum*), kiln dried, random length, tongue and groove, and end matched.
 - a. Grade: MFMA-RL First **OR** Second and Better **OR** Third and Better, **as directed**.
 - 1) Exception: For areas under stacked portion of telescoping bleachers that are normally concealed from view, provide Third and Better Grade.
 - b. Cut: Edge **OR** Flat, **as directed**.
 - c. Thickness: 25/32 inch (20 mm) **OR** 33/32 inch (26 mm), **as directed**.
 - d. Face Width: 2-1/4 inches (57 mm) **OR** 1-1/2 inches (38 mm), **as directed**.
3. Parquet Flooring: Northern hard maple (*Acer saccharum*), kiln dried, edge grain, and square edge.
 - a. Grade: MFMA-PQ Second and Better **OR** Third and Better, **as directed**.



- b. Thickness: Not less than 5/16 inch (8 mm) **OR** 3/8 inch (10 mm) **OR** 7/16 inch (11 mm) **OR** 1/2 inch (13 mm) **OR** 11/16 inch (17 mm), **as directed**.
- c. Picket Dimensions:
 - 1) Width: 7/8 inch (22 mm) or 1-1/8 inches (29 mm) **OR** 7/8 inch (22 mm) **OR** 1-1/8 inches (29 mm), **as directed**.
 - 2) Length: 6 inches (152 mm) **OR** 9 inches (229 mm), **as directed**.

D. Subfloor Materials

- 1. Board Underlayment: Nominal 1-by-6-inch (25-by-150-mm) graded boards; of SPIB No. 2 Southern pine, WCLIB Construction grade (any species), or WWPA No. 3 (any species), dried to 15 percent moisture content.
- 2. Plywood Underlayment: APA rated, C-D Plugged, exterior glue, tongue and groove, 15/32 inch (12 mm) **OR** 23/32 inch (18 mm), **as directed**, thick.
- 3. Wood Sleepers: Standard grade; 48 inches (1200 mm) long; kiln-dried Eastern hemlock, fir, pine, or spruce.
 - a. Size: Nominal 2 by 3 inches (50 by 75 mm) **OR** 2 by 4 inches (50 by 100 mm), **as directed**.
 - b. Sleeper Anchors: Manufacturer's standard, but not less than steel drive pins recommended by anchor manufacturer to achieve minimum 900-lbf (4000-N) pullout strength.
 - c. Sleeper Shims: In size and type recommended in writing by flooring manufacturer for application indicated.
 - d. Asphalt Primer: ASTM D 41.
 - e. Asphalt Mastic: ASTM D 312, Type I, cold-applied dead-level asphalt or Type III, hot-applied steep asphalt, as recommended in writing by manufacturer.
- 4. Channels: Manufacturer's standard as indicated by product designation above.
 - a. Channel Anchors: Manufacturer's standard but not less than modified steel drive pins recommended by anchor manufacturer to achieve minimum 900-lbf (4000-N) pullout strength.
 - b. Clips: Manufacturer's standard as indicated by product designation above.
- 5. Resilient Pads: With air voids for resiliency and installed at manufacturer's standard spacing for product designation indicated above.
 - a. Material: PVC **OR** Rubber **OR** Neoprene, **as directed**.
 - b. Thickness: 3/8 inch (10 mm) **OR** 7/16 inch (11 mm) **OR** 5/8 inch (16 mm) **OR** 3/4 inch (19 mm), **as directed**.
- 6. Resilient Underlayment: Flexible, multicellular, closed-cell, expanded polyethylene-foam sheet; 1/2 inch (13 mm) thick; nominal 2-lb/cu. ft. (32-kg/cu. m) density, **as directed**.

E. Finishes

- 1. Floor-Finish System: System of compatible components recommended in writing by flooring manufacturer, and MFMA approved.
 - a. Floor-Sealer Formulation: Pliable, penetrating type. MFMA Group 1, Sealers.
 - b. Finish-Coat Formulation: Formulated for gloss finish indicated and multicoat application.
 - 1) Type: MFMA Group 3, Gymnasium-Type Surface Finishes **OR** MFMA Group 5, Water-Based Finishes, **as directed**.
 - c. Game-Line and Marker Paint: Industrial enamel compatible with finish coats and recommended in writing by manufacturers of finish coats, and paint for this use.
 - d. VOC Content: Provide products that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1) Floor Sealers and Finish Coats: VOC content of not more than 350 g/L.
 - 2) Game-Line and Marker Paint: VOC content of not more than 150 g/L.
 - e. VOC Emissions: Provide products that comply with the maximum allowable concentrations of VOCs when tested according to California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."



F. Accessories

1. Vapor Retarder: ASTM D 4397, polyethylene sheet not less than 6 mils (0.15 mm) thick.
2. Resilient Wall Base: Molded, vented, rubber or vinyl cove base; 4 by 3 by 48 inches (100 by 75 by 1200 mm); with premolded outside corners.
 - a. Color: Black **OR** Brown, **as directed**.
3. Wood Wall Base: Nominal 1-by-3-inch (25-by-75-mm) wood base **OR** Built-up wood base as indicated on Drawings, **as directed**, matching species, grade, and cut of wood flooring.
4. Thresholds: As specified in Division 08 Section "Door Hardware".
5. Fasteners: Type and size recommended by manufacturer, but not less than those recommended by MFMA for application indicated.
6. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by sports-floor manufacturer.
7. Adhesives: Manufacturer's standard for application indicated.
 - a. Concrete Primers: Manufacturer's standard for application indicated.
 - b. Use adhesive and primer, if any, that have a VOC content of 100 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
8. Floor-Finish System: System of compatible components recommended in writing by flooring manufacturer and MFMA approved.
 - a. Type: MFMA Group 3, Gymnasium Type (Surface) Finishes; urethane-oil type **OR** Group 5, Water Based Finishes; polyurethane, **as directed**.
 - b. Floor-Sealer Formulation: Pliable, penetrating type.
 - c. Finish-Coat Formulation: Formulated for gloss finish and multicoat application.
 - d. Game-Line and Marker Paint: Industrial enamel compatible with finish coats and recommended in writing by manufacturers of finish coats, and paint for this use.
 - e. VOC content: Provide products that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1) Floor Sealers and Finish Coats: VOC content of not more than 350 g/L.
 - 2) Game-Line and Marker Paint: VOC content of not more than 150 g/L.

1.3 EXECUTION

A. Preparation

1. Grind high spots and fill low spots on concrete substrates to produce a maximum 1/8-inch (3-mm) deviation in any direction when checked with a 10-foot (3-m) straight edge.
 - a. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.
2. Remove coatings including curing compounds and other substances on substrates that are incompatible with installation adhesives and that contain soap, wax, oil, or silicone; use mechanical methods recommended by manufacturer. Do not use solvents.
3. Broom and vacuum clean substrates to be covered immediately before product installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Installation

1. General: Comply with sports-floor assembly manufacturer's written instructions, but not less than written recommendations of MFMA applicable to flooring type indicated.
2. Pattern: Lay flooring parallel with long dimension of space to be floored, unless otherwise indicated.
3. Expansion Spaces: Provide as indicated, but not less than that required by manufacturer's written instructions and MFMA's written recommendations at walls and other obstructions, and at interruptions and terminations of flooring.
 - a. Cover expansion spaces with base molding, trim, and saddles, as indicated on Drawings.
4. Vapor Retarder: Install with joints lapped a minimum of 6 inches (150 mm) and sealed.



5. Underlayment: Install perpendicular to direction of flooring, staggering end joints in adjacent rows.
 6. Sleepers:
 - a. Install perpendicular to direction of flooring, staggering end joints a minimum of 24 inches (610 mm).
 - b. Space at spacing recommended by manufacturer for system components indicated **OR** 12 inches (305 mm) o.c. **OR** 9 inches (229 mm) o.c. **OR** 8 inches (203 mm) o.c., **as directed**.
 - c. Shim and level sleepers and install anchors at spacing recommended by manufacturer, but not less than 30 inches (760 mm) o.c.
 - d. Anchor predrilled sleepers through resilient pads.
 7. Channels: Anchor channels to substrate according to manufacturer's written instructions.
 - a. Install wood strip flooring across channels.
 - b. Insert steel clip at each intersection of a flooring strip with a channel.
 8. Strip Flooring: Mechanically fasten perpendicular to supports.
 9. Parquet Flooring: Adhere to substrates according to manufacturer's written instructions.
 10. Installation Tolerances: 1/8 inch in 10 feet (3 mm in 3 m) of variance from level.
- C. Sanding And Finishing
1. Follow applicable recommendations in MFMA's "Industry Recommendations for Sanding, Sealing, Court Lining, Finishing, and Resurfacing of Maple Gym Floors."
 2. Allow installed flooring to acclimate to ambient conditions for at least 10 days before sanding.
 3. Machine sand with coarse, medium, and fine grades of sandpaper to achieve a level, smooth, uniform surface without ridges or cups. Remove sanding dust by tack or vacuum.
 4. Finish: Apply seal and finish coats of finish system according to finish manufacturer's written instructions. Provide not less than four coats total and not less than two finish coats.
 - a. Water-Based Finishes: Use finishing methods recommended by finish manufacturer to reduce grain raise and sidebonding effect.
 - b. Game Lines and Markers: Apply game-line and marker paint between final seal coat and first finish coat according to paint manufacturer's written instructions.
 - 1) Mask flooring at game lines and markers, and apply paint to produce lines and markers with sharp edges.
 - 2) Where game lines cross, break minor game line at intersection; do not overlap lines.
 - 3) Apply game lines and markers in widths and colors according to requirements indicated on Drawings.
 - 4) Apply finish coats after game-line and marker paint is fully cured.
- D. Protection
1. Protect sports floors during remainder of construction period to allow finish to cure and to ensure that flooring and finish are without damage or deterioration at time of Final Completion.
 - a. Do not cover sports floors after finishing until finish reaches full cure, and not before seven days after applying last finish coat.
 - b. Do not move heavy and sharp objects directly over sports floors. Protect fully cured floor finishes and surfaces with plywood or hardboard panels to prevent damage from storing or moving objects over sports floors.

END OF SECTION 09 64 23 00



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Task	Specification	Specification Description
09 64 23 00	09 64 00 00	Wood Flooring
09 64 29 00	09 64 00 00	Wood Flooring
09 64 29 00	09 64 23 00	Wood Sports-Floor Assemblies
09 64 66 00	09 64 00 00	Wood Flooring
09 64 66 00	09 64 23 00	Wood Sports-Floor Assemblies



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SECTION 09 65 13 13 - RESILIENT WALL BASE AND ACCESSORIES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for resilient wall base and accessories. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Resilient base.
 - b. Resilient stair accessories.
 - c. Resilient molding accessories.

C. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:
 - a. Product Data for Credit EQ 4.1: For adhesives, including printed statement of VOC content.
3. Samples: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches (300 mm) long, of each resilient product color, texture, and pattern required.

D. Quality Assurance

1. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 - a. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

E. Delivery, Storage, And Handling

1. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).

F. Project Conditions

1. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive resilient products during the following time periods:
 - a. 48 hours before installation.
 - b. During installation.
 - c. 48 hours after installation.
2. Until Final Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).
3. Install resilient products after other finishing operations, including painting, have been completed.

1.2 PRODUCTS

A. Resilient Base

1. Resilient Base Standard: ASTM F 1861.
 - a. Material Requirement: Type TV (vinyl, thermoplastic) **OR** Type TS (rubber, vulcanized thermoset) **OR** Type TP (rubber, thermoplastic), **as directed**.
 - b. Manufacturing Method: Group I (solid, homogeneous) **OR** Group II (layered), **as directed**.



- c. Style: Cove (base with toe) **OR** Straight (flat or toeless) **OR** Butt to (fit-to-floor), **as directed**.
 2. Minimum Thickness: 0.125 inch (3.2 mm) **OR** 0.080 inch (2.0 mm), **as directed**.
 3. Height: 2-1/2 inches (64 mm) **OR** 4 inches (102 mm) **OR** 6 inches (152 mm) **OR** As indicated on Drawings, **as directed**.
 4. Lengths: Cut lengths, 48 inches (1219 mm) long **OR** Coils in manufacturer's standard length, **as directed**.
 5. Outside Corners: Job formed **OR** Preformed, **as directed**.
 6. Inside Corners: Job formed **OR** Preformed, **as directed**.
 7. Finish: Satin **OR** Matte **OR** Low luster **OR** As selected from manufacturer's full range, **as directed**.
 8. Colors and Patterns: As selected from full range of industry colors.
- B. Resilient Stair Accessories
1. Resilient Stair Treads Standard: ASTM F 2169.
 - a. Material Requirement: Type TV (vinyl, thermoplastic) **OR** Type TS (rubber, vulcanized thermoset) **OR** Type TP (rubber, thermoplastic), **as directed**.
 - b. Surface Design:
 - 1) Class 1, Smooth (flat).
 - 2) Class 2, Pattern: Raised-disc design **OR** Raised-square design **OR** Raised-chevron design **OR** Raised-diamond design **OR** Raised-rib design **OR** Raised-rib design with abrasive strips, **as directed**.
 - c. Manufacturing Method: Group 1, tread with embedded abrasive strips **OR** Group 2, tread with contrasting color for the visually impaired, **as directed**.
 2. Nosing Style: Square, adjustable to cover angles between 60 and 90 degrees **OR** Square **OR** Round, **as directed**.
 3. Nosing Height: 1-1/2 inches (38 mm) **OR** 2 inches (51 mm) **OR** 2-3/16 inches (56 mm), **as directed**.
 4. Thickness: 1/4 inch (6 mm) and tapered to back edge.
 5. Size: Lengths and depths to fit each stair tread in one piece **OR** one piece or, for treads exceeding maximum lengths manufactured, in equal-length units, **as directed**.
 6. Risers: Smooth, flat, coved-toe, 7 inches (178 mm) high by length matching treads **OR** toeless, height and length to cover risers, **as directed**; produced by same manufacturer as treads and recommended by manufacturer for installation with treads.
 - a. Thickness: 0.125 inch (3.2 mm) **OR** 0.080 inch (2.0 mm), **as directed**.
 7. Stringers: Of same thickness as risers, height and length after cutting to fit risers and treads and to cover stair stringers; produced by same manufacturer as treads and recommended by manufacturer for installation with treads.
 8. Colors and Patterns: As selected from full range of industry colors.
- C. Resilient Molding Accessory
1. Description: Cap for cove carpet **OR** Cap for cove resilient floor covering **OR** Carpet bar for tackless installations **OR** Carpet edge for glue-down applications **OR** Nosing for carpet **OR** Nosing for resilient floor covering **OR** Reducer strip for resilient floor covering **OR** Joiner for tile and carpet **OR** Transition strips, **as directed**.
 2. Material: Vinyl **OR** Rubber, **as directed**.
 3. Profile and Dimensions: As indicated.
 4. Colors and Patterns: As selected from full range of industry colors.
- D. Installation Materials
1. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
 2. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.



- a. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1) Cove Base Adhesives: Not more than 50 g/L.
 - 2) Rubber Floor Adhesives: Not more than 60 g/L.
3. Stair-Tread-Nose Filler: Two-part epoxy compound recommended by resilient tread manufacturer to fill nosing substrates that do not conform to tread contours.
4. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of tiles, and in maximum available lengths to minimize running joints.
5. Floor Polish: Provide protective liquid floor polish products as recommended by resilient stair tread manufacturer.

1.3 EXECUTION

A. Preparation

1. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
2. Concrete Substrates for Resilient Stair Treads and Accessories: Prepare according to ASTM F 710.
 - a. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - b. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
 - c. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer.
 - d. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
 - 1) Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
 - 2) Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level measurement.
3. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
4. Do not install resilient products until they are same temperature as the space where they are to be installed.
 - a. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
5. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

B. Resilient Base Installation

1. Comply with manufacturer's written instructions for installing resilient base.
2. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
3. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
4. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
5. Do not stretch resilient base during installation.
6. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
7. Preformed Corners: Install preformed corners before installing straight pieces.
8. Job-Formed Corners:
 - a. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends.



b. Inside Corners: Use straight pieces of maximum lengths possible.

C. Resilient Accessory Installation

1. Comply with manufacturer's written instructions for installing resilient accessories.
2. Resilient Stair Accessories:
 - a. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
 - b. Tightly adhere to substrates throughout length of each piece.
 - c. For treads installed as separate, equal-length units, install to produce a flush joint between units.
3. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of carpet **OR** resilient floor covering, **as directed**, that would otherwise be exposed.

D. Cleaning And Protection

1. Comply with manufacturer's written instructions for cleaning and protection of resilient products.
2. Perform the following operations immediately after completing resilient product installation:
 - a. Remove adhesive and other blemishes from exposed surfaces.
 - b. Sweep and vacuum surfaces thoroughly.
 - c. Damp-mop surfaces to remove marks and soil.
3. Protect resilient products from marks, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
4. Floor Polish: Remove soil, visible adhesive, and surface blemishes from resilient stair treads before applying liquid floor polish.
 - a. Apply one **OR** two **OR** three, **as directed**, coat(s).
5. Cover resilient products until Final Completion.

END OF SECTION 09 65 13 13



Task	Specification	Specification Description
09 65 13 13	01 95 09 00	Cork Flooring
09 65 13 23	01 95 09 00	Cork Flooring



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SECTION 09 65 13 33 - RESILIENT FLOOR TILE

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for resilient floor tile. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Solid vinyl floor tile.
 - b. Rubber floor tile.
 - c. Vinyl composition floor tile.
 - d. Resilient terrazzo floor tile.

C. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:
 - a. Product Data for Credit EQ 4.1: For adhesives, sealants and chemical-bonding compounds, including printed statement of VOC content.
3. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
 - a. Show details of special patterns.
4. Samples: Full-size units of each color and pattern of floor tile required.
5. Seam Samples: For seamless-installation technique indicated and for each flooring product, color, and pattern required; with seam running lengthwise and in center of 6-by-9-inch (150-by-230-mm) Sample applied to a rigid backing and prepared by Installer for this Project.
6. Maintenance data.

D. Quality Assurance

1. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 - a. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

E. Delivery, Storage, And Handling

1. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store floor tiles on flat surfaces.

F. Project Conditions

1. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive floor tile during the following time periods:
 - a. 48 hours before installation.
 - b. During installation.
 - c. 48 hours after installation.
2. Until Final Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).
3. Close spaces to traffic during floor tile installation.
4. Close spaces to traffic for 48 hours after floor tile installation.
5. Install floor tile after other finishing operations, including painting, have been completed.



1.2 PRODUCTS

- A. Solid Vinyl Floor Tile
1. Tile Standard: ASTM F 1700.
 - a. Class: As indicated by product designations **OR** Class I, monolithic vinyl tile **OR** Class II, surface-decorated vinyl tile **OR** Class III, printed film vinyl tile, **as directed**.
 - b. Type: Type A, smooth surface **OR** Type B, embossed surface, **as directed**.
 2. Thickness: 0.080 inch (2.0 mm) **OR** 0.100 inch (2.5 mm) **OR** 0.120 inch (3.0 mm) **OR** 0.125 inch (3.2 mm), **as directed**.
 3. Size: 12 by 12 inches (305 by 305 mm) **OR** 18 by 18 inches (457 by 457 mm) **OR** 24 by 24 inches (610 by 610 mm) **OR** 36 by 36 inches (914 by 914 mm) **OR** 3 by 36 inches (76 by 914 mm), **as directed**.
 4. Seaming Method: Heat welded **OR** Chemically bonded **OR** Standard, **as directed**.
 5. Colors and Patterns: As selected from full range of industry colors.
- B. Rubber Floor Tile
1. Tile Standard: ASTM F 1344, Class I-A, homogeneous rubber tile, solid color **OR** Class I-B, homogeneous rubber tile, through mottled **OR** Class II-A, laminated rubber tile, solid-color wear layer **OR** Class II-B, laminated rubber tile, mottled wear layer, **as directed**.
 2. Hardness: Not less than 85 as required by ASTM F 1344, measured using Shore, Type A durometer per ASTM D 2240 **OR** Manufacturer's standard hardness, **as directed**.
 3. Wearing Surface: Smooth **OR** Textured **OR** Molded pattern, **as directed**.
 - a. Molded-Pattern Figure: Raised discs **OR** Raised squares, **as directed**.
 4. Thickness: 0.125 inch (3.2 mm).
 5. Size: 12 by 12 inches (305 by 305 mm) **OR** 24 by 24 inches (610 by 610 mm), **as directed**.
 6. Seaming Method: Heat welded **OR** Chemically bonded **OR** Standard, **as directed**.
 7. Colors and Patterns: As selected from full range of industry colors.
- C. Vinyl Composition Floor Tile
1. Tile Standard: ASTM F 1066, Class 1, solid-color tile **OR** Class 2, through-pattern tile **OR** Class 3, surface-pattern tile, **as directed**.
 2. Wearing Surface: Smooth **OR** Embossed, **as directed**.
 3. Thickness: 0.125 inch (3.2 mm).
 4. Size: 12 by 12 inches (305 by 305 mm).
 5. Colors and Patterns: As selected from full range of industry colors.
- D. Resilient Terrazzo Floor Tile
1. Resilient Terrazzo Floor Tile: Marble or granite chips embedded in flexible, thermoset-polyester-resin matrix; electrically nonconductive and chemical, oil, and corrosion resistive, with smooth wearing surface and manufacturer's standard factory-applied, protective urethane coating.
 2. Thickness: 1/8 inch (3.0 mm) **OR** 3/16 inch (4.8 mm), **as directed**.
 3. Size: 12 by 12 inches (305 by 305 mm).
 4. Performance Characteristics:
 - a. Compressive Strength: 2900 to 5000 psi (20 to 34.5 MPa), ASTM C 109/C 109M or ASTM D 695.
 - b. Abrasion Resistance: Maximum 0.0196 cubic centimeters volume loss, ASTM F 510, Taber abrader, S-39 wheels, at 500 cycles with 1000-gram load.
 - c. Static Load Limit: 0.0007-inch (0.0177-mm) maximum indentation, ASTM F 970 at 125 lb (57 kg).
 - d. Resin Matrix Hardness: Not less than 78, as measured using Shore, Type D durometer per ASTM D 2240.
 5. Colors and Patterns: As selected from full range of industry colors.
- E. Installation Materials



1. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
2. Adhesives: Water-resistant type recommended by manufacturer to suit floor tile and substrate conditions indicated.
 - a. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1) VCT and Asphalt Tile Adhesives: Not more than 50 g/L.
 - 2) Rubber Floor Adhesives: Not more than 60 g/L.
3. Seamless-Installation Accessories:
 - a. Heat-Welding Bead: Manufacturer's solid-strand product for heat welding seams.
 - 1) Color: As selected from manufacturer's full range to contrast with floor tile **OR** Match floor tile, **as directed**.
 - b. Chemical-Bonding Compound: Manufacturer's product for chemically bonding seams.
 - 1) Use chemical-bonding compound that has a VOC content of 350 **OR** 510, **as directed**, g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
4. Floor Polish: Provide protective liquid floor polish products as recommended by manufacturer.
5. Joint Sealant for Resilient Terrazzo Floor Tile: Silicone sealant of type and grade as recommended in writing by manufacturer to suit resilient terrazzo floor tile.
 - a. Use sealant that has a VOC content of not more than 250 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Joint-Sealant Color: White **OR** As selected from manufacturer's full range to match floor tile **OR** Match floor tile, **as directed**.
6. Sealers and Finish Coats for Resilient Terrazzo Floor Tile: Premium-type products as recommended by manufacturer for resilient terrazzo floor tile.

1.3 EXECUTION

A. Preparation

1. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
2. Concrete Substrates: Prepare according to ASTM F 710.
 - a. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - b. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
 - c. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
 - d. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
 - 1) Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
 - 2) Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75% relative humidity level measurement.
3. Access Flooring Panels: Remove protective film of oil or other coating using method recommended by access flooring manufacturer.
4. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
5. Do not install floor tiles until they are same temperature as space where they are to be installed.
 - a. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.



6. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

B. Floor Tile Installation

1. Comply with manufacturer's written instructions for installing floor tile.
2. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
 - a. Lay tiles square with room axis **OR** at a 45-degree angle with room axis **OR** in pattern indicated, **as directed**.
3. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
 - a. Lay tiles with grain running in one direction **OR** with grain direction alternating in adjacent tiles (basket-weave pattern) **OR** in pattern of colors and sizes indicated, **as directed**.
4. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
5. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
6. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.
7. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
8. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
9. Seamless Installation:
 - a. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and heat weld with welding bead to permanently fuse sections into a seamless floor covering. Prepare, weld, and finish seams to produce surfaces flush with adjoining floor covering surfaces.
 - b. Chemically Bonded Seams: Bond seams with chemical-bonding compound to permanently fuse sections into a seamless floor covering. Prepare seams and apply compound to produce tightly fitted seams without gaps, overlays, or excess bonding compound on floor covering surfaces.

C. Cleaning And Protection

1. Comply with manufacturer's written instructions for cleaning and protection of floor tile.
2. Perform the following operations immediately after completing floor tile installation:
 - a. Remove adhesive and other blemishes from exposed surfaces.
 - b. Sweep and vacuum surfaces thoroughly.
 - c. Damp-mop surfaces to remove marks and soil.
3. Protect floor tile products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
4. Floor Polish: Remove soil, visible adhesive, and surface blemishes from floor tile surfaces before applying liquid floor polish.
 - a. Apply one **OR** two **OR** three, **as directed**, coat(s).
5. Joint Sealant: Apply sealant to resilient terrazzo floor tile perimeter and around columns, at door frames, and at other joints and penetrations.
6. Sealers and Finish Coats: Remove soil, visible adhesive, and surface blemishes from resilient terrazzo floor tile surfaces before applying liquid cleaners, sealers, and finish products.
 - a. Sealer: Apply two base coats of liquid sealer.
 - b. Finish: Apply two **OR** three, **as directed**, coats of liquid floor finish.



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7. Cover floor tile until Final Completion.

END OF SECTION 09 65 13 33



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SECTION 09 65 13 33a - LINOLEUM FLOOR COVERINGS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for linoleum floor coverings. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Linoleum floor tile **OR** sheet flooring, **as directed**.

C. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:
 - a. Product Data for Credit MR 6.0: For linoleum flooring, including printed statement of costs for each rapidly renewable material.
 - b. Product Data for Credit EQ 4.1: For adhesives, including printed statement of VOC content.
3. Shop Drawings: For each type of floor covering. Include floor covering layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
4. Samples for Verification: In manufacturer's standard size, but not less than 6-by-9-inch (152-by-230-mm) sections of each color and pattern of floor covering required.
 - a. Heat-Welding Bead: Include manufacturer's standard-size Samples, but not less than 9 inches (230 mm) long, of each color required.
5. Heat-Welded Seam Samples: For each floor covering product and welding bead color and pattern combination required; with seam running lengthwise and in center of 6-by-9-inch (152-by-230-mm) Sample applied to rigid backing and prepared by Installer for this Project.
6. Maintenance data.

D. Quality Assurance

1. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 - a. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

E. Delivery, Storage, And Handling

1. Store floor coverings and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 65 deg F (18 deg C) or more than 90 deg F (32 deg C).
 - a. Floor Tile: Store on flat surfaces.
 - b. Sheet Flooring: Store rolls upright.

F. Project Conditions

1. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive floor coverings during the following time periods:
 - a. 72 hours before installation.
 - b. During installation.
 - c. 72 hours after installation.
2. Until Final Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).
3. Close spaces to traffic during floor covering installation.



4. Close spaces to traffic for 72 hours after floor covering installation.
5. Install floor coverings after other finishing operations, including painting, have been completed.

1.2 PRODUCTS

A. Linoleum Floor Covering

1. Floor Tile: ASTM F 2195, Type I, linoleum floor tile with fibrous backing **OR** Type II, linoleum floor tile with special backing **OR** Type III, linoleum floor tile without backing, **as directed**.
 - a. Nominal Floor Tile Size: Manufacturer's standard **OR** 12 by 12 inches (300 by 300 mm) **OR** 18 by 18 inches (460 by 460 mm) **OR** 20 by 20 inches (500 by 500 mm) **OR** 24 by 24 inches (600 by 600 mm), **as directed**.
2. Sheet Flooring: ASTM F 2034, Type I, linoleum sheet with backing **OR** Type III, linoleum sheet with special backing, **as directed**.
 - a. Roll Size: In manufacturer's standard length by not less than 78 inches (1980 mm) wide.
3. Seaming Method: Standard **OR** Heat welded, **as directed**.
4. Thickness: 0.08 inch (2.0 mm) **OR** 0.10 inch (2.5 mm) **OR** 0.13 inch (3.2 mm) **OR** 0.16 inch (4.0 mm) **OR** 0.18 inch (4.5 mm), **as directed**.
5. Colors and Patterns: As selected from full range of industry colors.

B. Installation Materials

1. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
2. Adhesives: Water-resistant type recommended by manufacturer to suit products and substrate conditions indicated.
 - a. Use adhesives that have a VOC content of not more than 50 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Heat-Welding Bead: Solid-strand product of linoleum floor covering manufacturer.
 - a. As selected from manufacturer's full range to contrast with linoleum floor covering **OR** Match linoleum floor covering, **as directed**.
4. Integral-Flash-Cove-Base Accessories:
 - a. Cove Strip: 1-inch (25.4-mm) radius provided or approved by manufacturer.
 - b. Cove-Base Cap Strip: Square metal, vinyl, or rubber cap provided or approved by manufacturer.
5. Floor Polish: Provide protective liquid floor polish products as recommended by manufacturer.

1.3 EXECUTION

A. Preparation

1. Prepare substrates according to manufacturer's written instructions to ensure adhesion of floor coverings.
2. Concrete Substrates: Prepare according to ASTM F 710.
 - a. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - b. Remove substrate coatings and other substances that are incompatible with floor covering adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
 - c. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
 - d. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
 - 1) Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.



- 2) Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level measurement.
 3. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
 4. Do not install floor coverings until they are same temperature as space where they are to be installed.
 - a. Move floor coverings and installation materials into spaces where they will be installed at least 72 hours in advance of installation.
 5. Sweep and vacuum clean substrates to be covered by floor coverings immediately before installation.
- B. Installation, General
1. Comply with manufacturer's written instructions for installing floor coverings.
 2. Scribe and cut floor coverings to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings.
 3. Extend floor coverings into toe spaces, door reveals, closets, and similar openings.
 4. Maintain reference markers, holes, or openings that are in place or marked for future cutting by repeating on floor coverings as marked on subfloor. Use chalk or other nonpermanent marking device.
 5. Install floor coverings on covers for telephone and electrical ducts and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of floor covering installed on covers and adjoining floor covering. Tightly adhere floor covering edges to substrates that abut covers and to cover perimeters.
 6. Adhere floor coverings to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
 7. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and use welding bead to permanently fuse sections into a seamless floor covering. Prepare, weld, and finish seams to produce surfaces flush with adjoining floor covering surfaces.
- C. Linoleum Floor Tile Installation
1. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so floor tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
 - a. Lay floor tiles square with room axis **OR** at a 45-degree angle with room axis **OR** in pattern indicated, **as directed**.
 2. Match floor tiles for color and pattern by selecting tiles from cartons in same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed floor tiles.
 - a. Lay floor tiles with grain running in one direction **OR** with grain direction alternating in adjacent floor tiles (basket-weave pattern) **OR** in pattern of colors and sizes indicated, **as directed**.
- D. Linoleum Sheet Flooring Installation
1. Unroll sheet floorings and allow them to stabilize before cutting and fitting.
 2. Lay out sheet floorings as follows:
 - a. Maintain uniformity of floor covering direction.
 - b. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches (152 mm) away from parallel joints in floor covering substrates.
 - c. Match edges of floor coverings for color shading at seams.
 - d. Avoid cross seams.
 - e. Eliminate deformations that result from hanging method used during drying process (stove bar marks).



3. Integral-Flash-Cove Base: Cove linoleum floor covering 6 inches (152 mm) **OR** dimension indicated, **as directed**, up vertical surfaces. Support floor covering at horizontal and vertical junction with cove strip. Butt at top against cap strip.

E. Cleaning And Protection

1. Comply with manufacturer's written instructions for cleaning and protection of floor coverings.
2. Perform the following operations immediately after completing floor covering installation:
 - a. Remove adhesive and other blemishes from exposed surfaces.
 - b. Sweep and vacuum surfaces thoroughly.
 - c. Damp-mop surfaces to remove marks and soil.
3. Protect floor coverings from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
4. Floor Polish: Remove soil, visible adhesive, and surface blemishes from floor coverings before applying liquid floor polish.
 - a. Apply two **OR** three, **as directed**, coat(s).
5. After allowing drying room film (yellow film caused by linseed oil oxidation) to disappear, cover floor coverings until Final Completion.

END OF SECTION 09 65 13 33a



Task	Specification	Specification Description
09 65 13 33	01 22 16 00	No Specification Required
09 65 13 33	01 95 09 00	Cork Flooring
09 65 13 33	09 65 23 00	Resilient Sheet Flooring
09 65 13 33	09 65 13 13	Resilient Wall Base And Accessories
09 65 13 36	01 95 09 00	Cork Flooring
09 65 13 36	09 65 13 13	Resilient Wall Base And Accessories
09 65 16 23	01 95 09 00	Cork Flooring
09 65 16 23	09 65 23 00	Resilient Sheet Flooring
09 65 19 19	01 95 09 00	Cork Flooring
09 65 19 19	09 65 13 33	Resilient Floor Tile
09 65 19 23	01 95 09 00	Cork Flooring
09 65 19 23	09 65 13 33	Resilient Floor Tile
09 65 19 33	01 95 09 00	Cork Flooring
09 65 19 33	09 65 13 33	Resilient Floor Tile
09 65 19 43	01 95 09 00	Cork Flooring
09 65 19 43	09 65 13 33	Resilient Floor Tile



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SECTION 09 65 23 00 - RESILIENT SHEET FLOORING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for resilient sheet floor flooring. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Vinyl sheet floor covering, with and without backing.
 - b. Rubber sheet floor covering, with and without backing.

C. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:
 - a. Product Data for Credit EQ 4.1: For adhesives and chemical-bonding compounds, including printed statement of VOC content.
3. Shop Drawings: For each type of floor covering. Include floor covering layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
 - a. Show details of special patterns.
4. Samples: In manufacturer's standard size, but not less than 6-by-9-inch (150-by-230-mm) sections of each different color and pattern of floor covering required.
 - a. For heat-welding bead, manufacturer's standard-size Samples, but not less than 9 inches (230 mm) long, of each color required.
5. Seam Samples: For seamless-installation technique indicated and for each floor covering product, color, and pattern required; with seam running lengthwise and in center of 6-by-9-inch (150-by-230-mm) Sample applied to a rigid backing and prepared by Installer for this Project.
6. Maintenance data.

D. Quality Assurance

1. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 - a. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

E. Delivery, Storage, And Handling

1. Store floor coverings and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store rolls upright.

F. Project Conditions

1. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 85 deg F (29 deg C), in spaces to receive floor coverings during the following time periods:
 - a. 48 hours before installation.
 - b. During installation.
 - c. 48 hours after installation.
2. Until Final Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).
3. Close spaces to traffic during floor covering installation.
4. Close spaces to traffic for 48 hours after floor covering installation.
5. Install floor coverings after other finishing operations, including painting, have been completed.



1.2 PRODUCTS

A. Vinyl Sheet Floor Covering

1. Unbacked Vinyl Sheet Floor Covering: ASTM F 1913, 0.080 inch (2.0 mm) thick.
2. Vinyl Sheet Floor Covering with Backing: ASTM F 1303.
 - a. Type (Binder Content): Type I, minimum binder content of 90 percent **OR** Type II, minimum binder content of 34 percent, **as directed**.
 - b. Wear-Layer Thickness: Grade 1.
 - c. Overall Thickness: As standard with manufacturer.
 - d. Interlayer Material: Foamed plastic **OR** None, **as directed**.
 - e. Backing Class: Class A (fibrous) **OR** Class B (nonfoamed plastic) **OR** Class C (foamed plastic), **as directed**.
3. Wearing Surface: Smooth **OR** Embossed **OR** Smooth with embedded abrasives **OR** Embossed with embedded abrasives, **as directed**.
4. Sheet Width: As standard with manufacturer **OR** 4.9 feet (1.5 m) **OR** 6 feet (1.8 m) **OR** 6.5 feet (1.98 m) **OR** 6.6 feet (2.0 m) **OR** 9 feet (2.7 m) **OR** 12 feet (3.6 m), **as directed**.
5. Seaming Method: Heat welded **OR** Chemically bonded **OR** Standard, **as directed**.
6. Colors and Patterns: As selected from full range of industry colors.

B. Rubber Sheet Floor Covering

1. Unbacked Rubber Sheet Floor Covering: ASTM F 1859.
 - a. Type: Type I (homogeneous rubber sheet) **OR** Type II (layered rubber sheet), **as directed**.
 - b. Thickness: As standard with manufacturer.
2. Rubber Sheet Floor Covering with Backing: ASTM F 1860.
 - a. Type: Type I, homogeneous rubber sheet with backing **OR** Type II, layered rubber sheet with backing, **as directed**.
 - b. Wear-Layer Thickness: As standard with manufacturer.
 - c. Overall Thickness: As standard with manufacturer.
 - d. Interlayer Material: As standard with manufacturer **OR** None, **as directed**.
 - e. Backing Type: Fibrous) **OR** Foamed rubber, **as directed**.
3. Hardness: Not less than required by ASTM F 1859 **OR** Not less than required by ASTM F 1860 **OR** Manufacturer's standard hardness, measured using Shore, Type A durometer per ASTM D 2240, **as directed**.
4. Wearing Surface: Smooth **OR** Textured **OR** Molded pattern, **as directed**.
 - a. Molded-Pattern Figure: Raised discs **OR** Raised squares, **as directed**.
5. Sheet Width: As standard with manufacturer **OR** 4.9 feet (1.5 m) **OR** 6 feet (1.8 m) **OR** 6.5 feet (1.98 m) **OR** 6.6 feet (2.0 m) **OR** 9 feet (2.7 m) **OR** 12 feet (3.6 m), **as directed**.
6. Seaming Method: Heat welded **OR** Chemically bonded **OR** Standard, **as directed**.
7. Colors and Patterns: As selected from full range of industry colors.

C. Installation Materials

1. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
2. Adhesives: Water-resistant type recommended by manufacturer to suit floor covering and substrate conditions indicated.
 - a. Use adhesives that have a VOC content of not more than 50 g/L **OR** 60 g/L, **as directed**, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Seamless-Installation Accessories:
 - a. Heat-Welding Bead: Manufacturer's solid-strand product for heat welding seams.
 - 1) Color: As selected from manufacturer's full range to contrast with floor covering **OR** Match floor covering, **as directed**.
 - b. Chemical-Bonding Compound: Manufacturer's product for chemically bonding seams.



- 1) VOC Content: Not more than 510 g/L. when calculated according to 40 CFR 59, Subpart D (EPA method 24).
4. Integral-Flash-Cove-Base Accessories:
 - a. Cove Strip: 1-inch (25-mm) radius provided or approved by manufacturer.
 - b. Cap Strip: Square metal, vinyl, or rubber cap **OR** Tapered vinyl cap, **as directed**, provided or approved by manufacturer.
 - c. Corners: Metal inside and outside corners and end stops provided or approved by manufacturer.
5. Floor Polish: Provide protective liquid floor polish products as recommended by manufacturer.

1.3 EXECUTION

A. Preparation

1. Prepare substrates according to manufacturer's written instructions to ensure adhesion of floor coverings.
2. Concrete Substrates: Prepare according to ASTM F 710.
 - a. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - b. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
 - c. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
 - d. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
 - 1) Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
 - 2) Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
3. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
4. Do not install floor coverings until they are same temperature as space where they are to be installed.
 - a. Move floor coverings and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
5. Sweep and vacuum clean substrates to be covered by floor coverings immediately before installation.

B. Floor Covering Installation

1. Comply with manufacturer's written instructions for installing floor coverings.
2. Unroll floor coverings and allow them to stabilize before cutting and fitting.
3. Lay out floor coverings as follows:
 - a. Maintain uniformity of floor covering direction.
 - b. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches (152 mm) away from parallel joints in floor covering substrates.
 - c. Match edges of floor coverings for color shading at seams.
 - d. Avoid cross seams.
4. Scribe and cut floor coverings to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, and door frames.
5. Extend floor coverings into toe spaces, door reveals, closets, and similar openings.
6. Maintain reference markers, holes, or openings that are in place or marked for future cutting by repeating on floor coverings as marked on substrates. Use chalk or other nonpermanent marking device.



7. Install floor coverings on covers for telephone and electrical ducts and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of floor coverings installed on covers and adjoining floor covering. Tightly adhere floor covering edges to substrates that abut covers and to cover perimeters.
8. Adhere floor coverings to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
9. Seamless Installation:
 - a. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and use welding bead to permanently fuse sections into a seamless floor covering. Prepare, weld, and finish seams to produce surfaces flush with adjoining floor covering surfaces.
 - b. Chemically-Bonded Seams: Bond seams with chemical-bonding compound to permanently fuse sections into a seamless floor covering. Prepare seams and apply compound to produce tightly-fitted seams without gaps, overlays, or excess bonding compound on floor covering surfaces.
10. Integral-Flash-Cove Base: Cove floor coverings 6 inches (152 mm) **OR** dimension indicated, **as directed**, up vertical surfaces. Support floor coverings at horizontal and vertical junction by cove strip. Butt at top against cap strip.
 - a. Install metal corners at inside and outside corners.

C. Cleaning And Protection

1. Comply with manufacturer's written instructions for cleaning and protection of floor coverings.
2. Perform the following operations immediately after completing floor covering installation:
 - a. Remove adhesive and other blemishes from floor covering surfaces.
 - b. Sweep and vacuum floor coverings thoroughly.
 - c. Damp-mop floor coverings to remove marks and soil.
3. Protect floor coverings from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
4. Floor Polish: Remove soil, visible adhesive, and surface blemishes from floor covering before applying liquid floor polish.
 - a. Apply one **OR** two **OR** three, **as directed**, coat(s).
5. Cover floor coverings until Final Completion.

END OF SECTION 09 65 23 00



Task	Specification	Specification Description
09 65 23 00	01 95 09 00	Cork Flooring
09 65 43 00	01 95 09 00	Cork Flooring
09 65 43 00	09 65 23 00	Resilient Sheet Flooring
09 65 66 00	09 65 13 33	Resilient Floor Tile
09 66 13 00	09 01 60 00	Portland Cement Terrazzo Flooring
09 66 16 00	09 01 60 00	Portland Cement Terrazzo Flooring



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SECTION 09 66 33 13 - RESINOUS MATRIX TERRAZZO FLOORING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for resinous matrix terrazzo flooring. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Thin-set epoxy-resin terrazzo flooring and base.
 - b. Precast terrazzo units.

C. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:
 - a. Product Data for Credit MR 4.1 and Credit MR 4.2, **as directed**: For marble chips, aggregates, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - 1) Include statement that indicates cost for each product having recycled content.
 - b. Product Data for Credit EQ 4.1: For adhesives, including printed statement of VOC content.
3. Shop Drawings: Include terrazzo installation requirements. Include plans, elevations, sections, component details, and attachments to other work.
4. Samples: For each type, material, color, and pattern of terrazzo and accessory required showing the full range of color, texture, and pattern variations expected.
5. Installer certificates.
6. Qualification data.
7. Material certificates.
8. Maintenance data.

D. Quality Assurance

1. Installer Qualifications: A qualified installer who is acceptable to terrazzo manufacturer to install manufacturer's products.
 - a. Engage an installer who is certified in writing by terrazzo manufacturer as qualified to install manufacturer's products.
 - b. Engage an installer who is a contractor member of NTMA.
2. NTMA Standards: Comply with NTMA's "Terrazzo Specifications and Design Guide" and with written recommendations for terrazzo type indicated unless more stringent requirements are specified.
3. Preinstallation Conference: Conduct conference at Project site.

E. Delivery, Storage, And Handling

1. Deliver materials to Project site in supplier's original wrappings and containers, labeled with source's or manufacturer's name, material or product brand name, and lot number if any.
2. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

F. Project Conditions

1. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting terrazzo installation.



2. Field Measurements: Verify actual dimensions of construction contiguous with precast terrazzo by field measurements before fabrication.
3. Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during terrazzo installation.
4. Close spaces to traffic during terrazzo application and for not less than 24 hours after application unless manufacturer recommends a longer period.
5. Control and collect dust produced by grinding operations. Protect adjacent construction from detrimental effects of grinding operations.
 - a. Provide dustproof partitions and temporary enclosures to limit dust migration and to isolate areas from noise.

1.2 PRODUCTS

A. Epoxy-Resin Terrazzo

1. Materials:

- a. Flexible Reinforcing Membrane: Manufacturer's resinous membrane for substrate crack preparation and reflective crack reduction.
 - 1) Reinforcement: Fiberglass scrim.
- b. Primer: Manufacturer's product recommended for substrate and use indicated.
- c. Epoxy-Resin Matrix: Manufacturer's standard recommended for use indicated and in color required for mix indicated.
 - 1) Physical Properties without Marble Chips **OR** Aggregates, **as directed**:
 - a) Hardness: 60 to 85 per ASTM D 2240, Shore D.
 - b) Minimum Tensile Strength: 3000 psi (20.7 MPa) per ASTM D 638 for a 2-inch (51-mm) specimen made using a "C" die per ASTM D 412.
 - c) Minimum Compressive Strength: 10,000 psi (6.9 MPa) per ASTM D 695, Specimen B cylinder.
 - d) Chemical Resistance: No deleterious effects by contaminants listed below after seven-day immersion at room temperature per ASTM D 1308.
 - i. Distilled water.
 - ii. Mineral water.
 - iii. Isopropanol.
 - iv. Ethanol.
 - v. 0.025 percent detergent solution.
 - vi. 1.0 percent soap solution.
 - vii. 10 percent sodium hydroxide.
 - viii. 10 percent hydrochloric acid.
 - ix. 30 percent sulfuric acid.
 - x. 5 percent acetic acid.
 - 2) Physical Properties with Marble Chips **OR** Aggregates, **as directed**: For resin blended with Georgia white marble, ground, grouted, and cured per requirements in NTMA's "Terrazzo Specifications and Design Guide," comply with the following:
 - a) Flammability: Self-extinguishing, maximum extent of burning 0.25 inch (6.35 mm) per ASTM D 635.
 - b) Thermal Coefficient of Linear Expansion: 0.0025 inch/inch per deg F (0.0025 mm/mm per 0.5556 deg C) for temperature range of minus 12 to plus 140 deg F (minus 24 to plus 60 deg C) per ASTM D 696.
- d. Marble Chips **OR** Aggregates, **as directed**: Complying with NTMA gradation standards for mix indicated and containing no deleterious or foreign matter.
 - 1) Abrasion and Impact Resistance: Less than 40 percent loss per ASTM C 131.
 - 2) 24-Hour Absorption Rate: Less than 0.75 percent.
 - 3) Dust Content: Less than 1.0 percent by weight.
- e. Finishing Grout: Resin based.



2. Terrazzo (for NTMA-formulated design mixes): Comply with NTMA's "Terrazzo Specifications and Design Guide" and manufacturer's written instructions for matrix and marble-chip proportions and mixing.
 - a. Formulated Mix Color and Pattern: As selected by the Owner from manufacturer's full range **OR** As selected from NTMA standard-terrazzo plates **OR** As selected from NTMA thin-set terrazzo plates, **as directed**.
 3. Terrazzo (for custom design mixes): Comply with NTMA's "Terrazzo Specifications and Design Guide" and manufacturer's written instructions for matrix and marble-chip **OR** aggregate, **as directed**, proportions and mixing.
 - a. Custom Mix Color and Pattern: Match sample **OR** Match existing, **as directed**.
- B. Strip Materials
1. Thin-Set Divider Strips: L-type angle or T-type, 1/4 inch (6.4 mm) deep.
 - a. Material: White-zinc alloy **OR** Brass **OR** Aluminum **OR** Plastic, in color selected from manufacturer's full range, **as directed**.
 - b. Top Width: 1/8 inch (3.2 mm) **OR** 1/4 inch (6.4 mm), **as directed**.
 2. Heavy-Top Divider Strips: L-type angle in depth required for topping thickness indicated.
 - a. Bottom-Section Material: Galvanized steel **OR** Matching top-section material, **as directed**.
 - b. Top-Section Material: White-zinc alloy **OR** Brass **OR** Aluminum **OR** Plastic, in color selected from manufacturer's full range, **as directed**.
 - c. Top-Section Width: 1/8 inch (3.2 mm) **OR** 1/4 inch (6.4 mm) **OR** 3/8 inch (9.5 mm) **OR** 1/2 inch (12.7 mm), **as directed**.
 3. Control-Joint Strips: Separate, double L-type angles, positioned back to back, that match material, thickness, and color of divider strips and in depth required for topping thickness indicated.
 4. Accessory Strips: Match divider strip width, material, and color unless otherwise indicated. Use the following types of accessory strips as required to provide a complete installation:
 - a. Base-bead strips for exposed top edge of terrazzo base.
 - b. Edge-bead strips for exposed edges of terrazzo.
 - c. Nosings for terrazzo stair treads and landings.
 5. Abrasive Strips (for terrazzo stair treads and landings): Silicon carbide or aluminum oxide, or combination of both, in epoxy-resin binder and set in channel.
 - a. Width: 1/2 inch (12.7 mm).
 - b. Depth: As required by terrazzo thickness.
 - c. Length: 4 inches (100 mm) less than stair width **OR** As indicated, **as directed**.
 - d. Color: As selected from manufacturer's full range.
- C. Miscellaneous Accessories
1. Strip Adhesive: Epoxy-resin adhesive recommended by adhesive manufacturer for this use and acceptable to terrazzo manufacturer.
 - a. Use adhesives that have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Anchoring Devices:
 - a. Strips: Provide mechanical anchoring devices for strip materials as required for secure attachment to substrate.
 - b. Precast Terrazzo: Provide mechanical anchoring devices as recommended by fabricator for proper anchorage and support of units for conditions of installation and support.
 3. Patching and Fill Material: Terrazzo manufacturer's resinous product approved and recommended by manufacturer for application indicated.
 4. Joint Compound: Terrazzo manufacturer's resinous product approved and recommended by manufacturer for application indicated.
 5. Cleaner: Chemically neutral cleaner with pH factor between 7 and 10 that is biodegradable, phosphate free, and recommended by sealer manufacturer for use on terrazzo type indicated.
 6. Sealer: Slip- and stain-resistant penetrating-type sealer that is chemically neutral with pH factor between 7 and 10; does not affect color or physical properties of terrazzo; is recommended by



sealer manufacturer; and complies with NTMA's "Terrazzo Specifications and Design Guide" for terrazzo type indicated **OR Acrylic OR Urethane OR Chemical-resistant epoxy, as directed.**

- D. Precast Terrazzo
1. Precast Terrazzo Units: Precast epoxy-resin terrazzo base, stair tread, threshold, bench, and planter units.
 2. Precast Terrazzo Base Units: 1/4 inch (6.4 mm) thick; cast in maximum lengths possible, but not less than 36 inches (900 mm); with rounded, finished top edge.
 - a. Type: Coved with minimum 3/4-inch (19-mm) radius **OR Straight OR Splayed OR As indicated, as directed.**
 - b. Height: 6 inches (152 mm) **OR 4 inches (101 mm) OR As indicated, as directed.**
 - c. Outside Corner Units: With finished returned edges at outside corner.
 - d. Color, Pattern, and Finish: As selected from manufacturer's full range **OR Match sample OR Match adjacent poured-in-place terrazzo flooring, as directed.**
 3. Precast Terrazzo Stair Treads: 1/2 inch (12.7 mm) thick with rounded nosing edge.
 - a. Abrasive Strips: Three-line **OR Two-line OR One-line OR Abrasive nosing strip and two-line, as directed,** abrasive inserts at nosings.
 - b. Color, Pattern, and Finish: As selected from manufacturer's full range **OR Match sample OR Match adjacent poured-in-place terrazzo flooring, as directed.**
 4. Precast Terrazzo Finishing (for custom precast terrazzo components):
 - a. Finish exposed-to-view edges or reveals to match face finish.
 - b. Ease exposed edges to 1/8-inch (3-mm) radius.

1.3 EXECUTION

- A. Preparation
1. Clean substrates of substances, including oil, grease, and curing compounds, that might impair terrazzo bond. Provide clean, dry, and neutral substrate for terrazzo application.
 2. Concrete Slabs:
 - a. Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with terrazzo.
 - 1) Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
 - 2) Repair damaged and deteriorated concrete according to terrazzo manufacturer's written recommendations.
 - 3) Use patching and fill material to fill holes and depressions in substrates according to terrazzo manufacturer's written instructions.
 - b. Verify that concrete substrates are visibly dry and free of moisture.
 - c. Moisture Testing:
 - 1) Test for moisture by anhydrous calcium chloride method according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
 - 2) Test for moisture by relative humidity probe and digital meter method according to ASTM F 2170. Proceed with installation only after substrates have a maximum relative-humidity-measurement reading of 70 to 75 percent in 24 hours.
 - 3) Test for moisture content by method recommended in writing by terrazzo manufacturer. Proceed with installation only after substrates pass testing.
 3. Protect other work from dust generated by grinding operations. Control dust to prevent air pollution and comply with environmental protection regulations.
 - a. Erect and maintain temporary enclosures and other suitable methods to limit dust migration and to ensure adequate ambient temperatures and ventilation conditions during installation.



4. Installation of terrazzo indicates acceptance of surfaces and conditions.

B. Epoxy-Resin Terrazzo Installation

1. General:
 - a. Comply with NTMA's written recommendations for terrazzo and accessory installation.
 - b. Place, rough grind, grout, cure grout, fine grind, and finish terrazzo according to manufacturer's written instructions and NTMA's "Terrazzo Specifications and Design Guide."
 - c. Installation Tolerance: Limit variation in terrazzo surface from level to 1/4 inch in 10 feet (6 mm in 3 m); noncumulative.
 - d. Ensure that matrix components and fluids from grinding operations do not stain terrazzo by reacting with divider and control-joint strips.
 - e. Delay fine grinding until heavy trade work is complete and construction traffic through area is restricted.
2. Thickness: 1/4 inch (6.4 mm) **OR** 3/8 inch (9.5 mm) **OR** As indicated, **as directed**, nominal.
3. Flexible Reinforcing Membrane:
 - a. Prepare and prefill substrate cracks with membrane material.
 - b. Install membrane to produce full substrate coverage in areas to receive terrazzo.
 - c. Reinforce membrane with fiberglass scrim.
 - d. Prepare membrane according to manufacturer's written instructions before applying substrate primer.
4. Primer: Apply to terrazzo substrates according to manufacturer's written instructions.
5. Strip Materials:
 - a. Divider and Control-Joint Strips:
 - 1) Locate divider strips in locations indicated.
 - 2) Install control-joint strips back to back directly above concrete-slab control joints **OR** in locations indicated, **as directed**.
 - 3) Install control-joint strips with 1/4-inch (6.4-mm) gap between strips, and install sealant in gap.
 - 4) Install strips in adhesive setting bed without voids below strips, or mechanically anchor strips as required to attach strips to substrate, as recommended by strip manufacturer.
 - b. Accessory Strips: Install accessory strips as required to provide a complete installation **OR** in locations indicated, **as directed**.
 - c. Abrasive Strips: Install with surface of abrasive strip positioned 1/16 inch (1.6 mm) **OR** 1/32 inch (0.8 mm), **as directed**, higher than terrazzo surface.
6. Fine Grinding: Grind with stones 120 grit or finer until all grout is removed from surface. Repeat rough grinding, grout coat, and fine grinding if large voids exist after initial fine grinding. Produce surface with a minimum of 70 percent aggregate exposure.
7. Repair: Remove and replace terrazzo areas that evidence lack of bond with substrate. Cut out terrazzo areas in panels defined by strips and replace to match adjacent terrazzo, or repair panels according to NTMA's written recommendations, as approved by the Owner.

C. Precast Terrazzo Installation

1. Install precast terrazzo units using method recommended NTMA and manufacturer unless otherwise indicated.
2. Installation Tolerance: Set units with alignment level and true to dimensions, varying 1/8-inch (3.2-mm) maximum in length, height, or width; noncumulative.
3. Do not install units that are chipped, cracked, discolored, or not properly finished.
4. Seal joints between units with joint compound matching precast terrazzo matrix **OR** joint sealant, **as directed**.

D. Cleaning And Protection

1. Cleaning:
 - a. Remove grinding dust from installation and adjacent areas.



-
- b. Wash surfaces with cleaner according to NTMA's written recommendations and manufacturer's written instructions; rinse surfaces with water and allow to dry thoroughly.
2. Sealing:
 - a. Seal surfaces according to NTMA's written recommendations.
 - b. Apply sealer according to sealer manufacturer's written instructions.
 3. Protection: Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure that terrazzo is without damage or deterioration at time of Final Completion.

END OF SECTION 09 66 33 13



Task	Specification	Specification Description
09 66 33 16	09 66 33 13	Resinous Matrix Terrazzo Flooring
09 66 33 19	09 66 33 13	Resinous Matrix Terrazzo Flooring



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SECTION 09 68 13 00 - CARPET TILE

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for carpet tile. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes modular, fusion-bonded **OR** tufted, **as directed**, carpet tile.

C. Submittals

1. Product Data: For each product indicated.
2. Shop Drawings: Show the following:
 - a. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
 - b. Existing flooring materials to be removed.
 - c. Existing flooring materials to remain.
 - d. Carpet tile type, color, and dye lot.
 - e. Type of subfloor.
 - f. Type of installation.
 - g. Pattern of installation.
 - h. Pattern type, location, and direction.
 - i. Pile direction.
 - j. Type, color, and location of insets and borders.
 - k. Type, color, and location of edge, transition, and other accessory strips.
 - l. Transition details to other flooring materials.
3. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
 - a. Carpet Tile: Full-size Sample.
 - b. Exposed Edge, Transition, and other Accessory Stripping: 12-inch- (300-mm-) long Samples.
4. LEED Submittal:
 - a. Product Data for Credit EQ 4.3:
 - 1) For carpet tile, documentation indicating compliance with testing and product requirements of Carpet and Rug Institute's "Green Label Plus" program.
 - 2) For installation adhesive, including printed statement of VOC content.
5. Product Schedule: For carpet tile. Use same designations indicated on Drawings.
6. Maintenance data.

D. Quality Assurance

1. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.
2. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated in Part 2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
3. Preinstallation Conference: Conduct conference at Project site.

E. Delivery, Storage, And Handling

1. Comply with CRI 104, Section 5, "Storage and Handling."



F. Project Conditions

1. Comply with CRI 104, Section 7.2, "Site Conditions; Temperature and Humidity" and Section 7.12, "Ventilation."
2. Environmental Limitations: Do not install carpet tiles until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
3. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.
4. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

G. Warranty

1. Special Warranty for Carpet Tiles: Manufacturer's standard form in which manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
 - a. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
 - b. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, loss of tuft bind strength, dimensional stability, excess static discharge, and delamination.
 - c. Warranty Period: 10 years from date of Final Completion.

1.2 PRODUCTS

A. Carpet Tile

1. Fiber Content: 100 percent nylon 6, 6 **OR** 100 percent nylon 6 **OR** 100 percent polypropylene **OR** 100 percent wool **OR** 80 percent wool; 20 percent nylon 6, 6 **OR** 80 percent wool; 20 percent nylon 6, 6 **as directed**.
2. Fiber Type: **<Insert proprietary fiber type.>**
3. Pile Characteristic: Level-loop **OR** Cut **OR** Cut-and-loop, **as directed**, pile.
4. Yarn Twist: **<Insert twist in TPI (TPCM).>**
5. Yarn Count: **<Insert yarn count.>**
6. Density: **<Insert oz./cu. yd. (g/cu. cm).>**
7. Pile Thickness: **<Insert inches (mm)>** for finished carpet tile per ASTM D 6859.
8. Stitches: **<Insert stitches per inch (mm).>**
9. Gage: **<Insert gage in ends per inch (mm).>**
10. Surface Pile Weight: **<Insert oz./sq. yd. (g/sq. m).>**
11. Total Weight: **<Insert oz./sq. yd. (g/sq. m)>** for finished carpet tile.
12. Primary Backing/Backcoating: Manufacturer's standard composite materials **OR** PVC **OR** Fiberglass-reinforced PVC **OR** Fiberglass-reinforced amorphous resin **OR** Reinforced polyurethane composite cushion **OR** Reinforced polyurethane composite **OR** Reinforced thermoplastic copolymer, **as directed**.
13. Secondary Backing: Manufacturer's standard material.
14. Backing System: **<Insert proprietary name.>**
15. Size: 18 by 18 inches (457 by 457 mm) **OR** 24 by 24 inches (610 by 610 mm) **OR** 18 by 36 inches (457 by 914 mm) **OR** 36 by 36 inches (914 by 914 mm), **as directed**.
16. Applied Soil-Resistance Treatment: Manufacturer's standard material.
17. Antimicrobial Treatment: Manufacturer's standard material.
18. Performance Characteristics: As follows:
 - a. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm **OR** 0.22 W/sq. cm, **as directed**.
 - b. Dry Breaking Strength: Not less than 100 lbf (445 N) per ASTM D 2646.
 - c. Tuft Bind: Not less than 3 lbf (13 N) **OR** 5 lbf (22 N) **OR** 6.2 lbf (28 N) **OR** 8 lbf (36 N) **OR** 10 lbf (45 N), **as directed**, per ASTM D 1335.



- d. Delamination: Not less than 3.5 lbf/in. (15 N/mm) **OR** 4 lbf/in. (18 N/mm), **as directed**, per ASTM D 3936.
- e. Dimensional Tolerance: Within 1/32 inch (0.8 mm) of specified size dimensions, as determined by physical measurement.
- f. Dimensional Stability: 0.2 percent or less per ISO 2551 (Aachen Test).
- g. Resistance to Insects: Comply with AATCC 24.
- h. Noise Reduction Coefficient (NRC): **<Insert NRC>** per ASTM C 423.
- i. Colorfastness to Crocking: Not less than 4, wet and dry, per AATCC 165.
- j. Colorfastness to Light: Not less than 4 after 40 **OR** 60, **as directed**, AFU (AATCC fading units) per AATCC 16, Option E.
- k. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria; not less than 1-mm halo of inhibition for gram-negative bacteria; no fungal growth; per AATCC 174.
- l. Electrostatic Propensity: Less than 3.5 **OR** 2, **as directed**, kV per AATCC 134.
- m. Environmental Requirements: Provide carpet tile that complies with testing and product requirements of Carpet and Rug Institute's "Green Label Plus" program.

B. Installation Accessories

1. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.
2. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.
 - a. VOC Limits: Provide adhesives with VOC content not more than 50 g/L when calculated according to 40 CFR 59, Subpart D (EPA method 24).

1.3 EXECUTION

A. Preparation

1. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.
2. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider and protrusions more than 1/32 inch (0.8 mm), unless more stringent requirements are required by manufacturer's written instructions.
3. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.
4. Clean metal substrates of grease, oil, soil and rust, and prime if directed by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.
5. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

B. Installation

1. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.
2. Installation Method: As recommended in writing by carpet tile manufacturer **OR** Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive **OR** Partial glue down; install periodic tiles with releasable, pressure-sensitive adhesive **OR** Free lay; install carpet tiles without adhesive, **as directed**.
3. Maintain dye lot integrity. Do not mix dye lots in same area.
4. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.



5. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
6. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.
7. Install pattern parallel to walls and borders.
8. Stagger joints of carpet tiles so carpet tile grid is offset from access flooring panel grid. Do not fill seams of access flooring panels with carpet adhesive; keep seams free of adhesive.

C. Cleaning And Protection

1. Perform the following operations immediately after installing carpet tile:
 - a. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
 - b. Remove yarns that protrude from carpet tile surface.
 - c. Vacuum carpet tile using commercial machine with face-beater element.
2. Protect installed carpet tile to comply with CRI 104, Section 16, "Protection of Indoor Installations."
3. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 09 68 13 00



Task	Specification	Specification Description
09 68 16 00	09 01 60 00a	Carpet
09 68 16 00	09 68 13 00	Carpet Tile



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SECTION 09 69 13 00 - ACCESS FLOORING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for access flooring. Product shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Access flooring panels and understructure.
 - b. Floor panel coverings.

C. Definition

1. ESD: Electrostatic discharge. The transfer of electric charge between bodies at different potentials.

D. System Description

1. Access Flooring System: Assemblies composed of modular floor panels on pedestals with or without stringers.

E. Performance Requirements

1. Structural Performance: Provide access flooring systems capable of withstanding the following loads and stresses within limits and under conditions indicated, as determined by testing manufacturer's current standard products according to referenced procedures in CISCA A/F, "Recommended Test Procedures for Access Floors":
 - a. Concentrated Loads: Provide floor panels, including those with cutouts, capable of withstanding a concentrated design load of 1000 lbf (4448 N) **OR** 1250 lbf (5560 N) **OR** 1500 lbf (6672 N) **OR** 2000 lbf (8896 N), **as directed**, with a top-surface deflection under load and a permanent set not to exceed, respectively, 0.10 and 0.010 inch (2.54 and 0.25 mm) **OR** 0.080 inch and 0.010 inch (2.03 and 0.25 mm), **as directed**, according to CISCA A/F, Section I, "Concentrated Loads."
OR
Concentrated Loads: Provide floor panels, including those with cutouts, capable of withstanding a concentrated design load of 1000 lbf (4448 N) **OR** 1250 lbf (5560 N) **OR** 1500 lbf (6672 N) **OR** 2000 lbf (8896 N), **as directed**, with a bottom-surface deflection under load and a permanent set not to exceed, respectively, 0.10 and 0.010 inch (2.54 and 0.25 mm) **OR** 0.13 inch and 0.010 inch (3.30 and 0.25 mm), **as directed**, measured below each applied-load location at horizontal surface of nearest composite beam according to CISCA A/F, Section I, "Concentrated Loads."
 - b. Ultimate Loads: Provide access flooring systems capable of withstanding a minimum ultimate concentrated load of 2000 lbf (8896 N) **OR** 2500 lbf (11 121 N) **OR** 2600 lbf (11 565 N) **OR** 3000 lbf (13 345 N) **OR** 4000 lbf (17 793 N), **as directed**, without failing, according to CISCA A/F, Section II, "Ultimate Loading."
 - c. Rolling Loads: Provide access flooring systems capable of withstanding rolling loads of the following magnitude, with a combination of local and overall deformation not to exceed 0.040 inch (1.02 mm) after exposure to rolling load over CISCA A/F Path A or B, whichever path produces the greatest top-surface deformation, according to CISCA A/F, Section III, "Rolling Loads."
 - 1) CISCA A/F Wheel 1 Rolling Load: 600 lbf (2669 N) **OR** 800 lbf (3559 N) **OR** 1000 lbf (4448 N) **OR** 1200 lbf (5338 N), **as directed**.



- 2) CISCA A/F Wheel 2 Rolling Load: 500 lbf (2224 N) **OR** 600 lbf (2669 N) **OR** 800 lbf (3559 N) **OR** 1000 lbf (4448 N), **as directed**.
 - d. Stringer Load Testing: Provide stringers, without panels in place, capable of withstanding a concentrated load of 75 lbf (334 N) **OR** 225 lbf (1001 N) **OR** 450 lbf (2002 N) **OR** 850 lbf (3781 N), **as directed**, at center of span with a permanent set not to exceed 0.010 inch (0.25 mm), as determined per CISCA A/F, Section IV, "Stringer Load Testing."
 - e. Pedestal Axial Load Test: Provide pedestal assemblies, without panels or other supports in place, capable of withstanding a 5000 lbf (22 240 N) **OR** 6000 lbf (26 690 N), **as directed**, axial load per pedestal, according to CISCA A/F, Section V, "Pedestal Axial Load Test."
 - f. Pedestal Overturning Moment Test: Provide pedestal assemblies, without panels or other supports in place, capable of withstanding an overturning moment per pedestal of 1000 lbf x inches (113 N x meters), according to CISCA A/F, Section VI, "Pedestal Overturning Moment Test."
2. Floor Panel Impact-Load Performance: Provide access flooring system capable of withstanding an impact load of 75 lb (34.0 kg) **OR** 100 lb (45.5 kg) **OR** 125 lb (56.7 kg) **OR** 150 lb (68.0 kg) **OR** 175 lbs (79.4 kg), **as directed**, when dropped from 36 inches (914 mm) onto a 1-sq. in. (6.5-sq. cm) area located anywhere on panel, without failing. Failure is defined as collapse of access flooring system.
 3. Seismic Performance: Provide access flooring system capable of withstanding the effects of seismic motions determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."
 4. ESD-Control Properties: Provide floor coverings with ESD-control properties indicated as determined by testing identical products per test method indicated by an independent testing and inspecting agency.
 - a. Static-Dissipative Floor Covering Properties:
 - 1) Electrical Resistance: Test per ASTM F 150 with 100-V applied voltage **OR** ESD STM 7.1, **as directed**.
 - a) Average greater than 1 megohm and less than or equal to 1000 megohms when test specimens are tested surface to ground.
 - b) Average no less than 1 megohm and less than or equal to 1000 megohms when installed floor coverings are tested surface to ground.
 - 2) Static Generation: Less than 300 V when tested per AATCC-134 at 20 percent relative humidity with conductive footwear.
 - 3) Static Decay: 5000 to 0 V in less than 0.25 seconds when tested per FED-STD-101C/4046.1.
 - b. Static-Conductive Floor Covering Properties:
 - 1) Electrical Resistance: Test per ASTM F 150 with 500-V applied voltage **OR** ESD STM 7.1 **OR** NFPA 99, Annex 2 **OR** UL 779, **as directed**.
 - a) Average greater than 25,000 ohms and less than 1 megohm when test specimens and installed floor coverings are tested surface to surface (point to point).
 - b) Average no less than 25,000 ohms with no single measurement less than 10,000 ohms when installed floor coverings are tested surface to ground.
 - 2) Static Generation: Less than 100 V when tested per AATCC-134 at 20 percent relative humidity with conductive footwear.
 - 3) Static Decay: 5000 to 0 V in less than 0.03 **OR** 0.01, **as directed**, seconds when tested per FED-STD-101C/4046.1.
 - c. Antistatic Floor Covering Properties:
 - 1) Electrical Resistance: Test per ESD STM 7.1.
 - a) Average greater than 25,000 ohms and less than 1,000 megohm when test specimens and installed floor coverings are tested surface to surface (point to point).
 - 2) Static Generation: Less than 100 V when tested per AATCC-134 at 20 percent relative humidity with conductive footwear.



- d. Panel-to-Understructure Resistance: Not more than 10 ohms as measured without floor coverings.

F. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: Include layout of access flooring system and relationship to adjoining Work based on field-verified dimensions.
3. Shop Drawings: Include layout, details, sections, and relationship to adjoining Work.
4. LEED Submittals:
 - a. Product Data for Credit EQ 4.1: For pedestal installation adhesive, including printed statement of VOC content.
 - b. Product Data for Credit EQ 4.3: For carpet and installation adhesive, documentation indicating compliance with specified requirements.
 - c. Product Data for Credit EQ 4.4: For particleboard used in steel-encapsulated, wood core panels, documentation indicating that particleboard contains no urea formaldehyde.
5. Product test reports.

G. Quality Assurance

1. Regulatory Requirements: Fabricate and install access flooring to comply with NFPA 75 requirements for raised flooring.
2. Preinstallation Conference: Conduct conference at Project site.

1.2 PRODUCTS

A. Floor Panels And Understructure

1. Floor Panels, General: Provide modular panels complying with the following requirements that one person, using a portable lifting device, can interchange with other field panels without disturbing adjacent panels or understructure:
 - a. Nominal Panel Size: 24 by 24 inches (610 by 610 mm) **OR** 600 by 600 mm, **as directed**.
 - b. Fabrication Tolerances: Fabricate panels to the following tolerances with squareness tolerances expressed as the difference between diagonal measurements from corner to corner:
 - 1) Size and Squareness: Plus or minus 0.015 inch (0.38 mm) of required size, with a squareness tolerance of plus or minus 0.015 inch (0.38 mm), unless tolerances are otherwise indicated for a specific panel type.
 - 2) Flatness: Plus or minus 0.020 inch (0.50 mm), measured on a diagonal on top of panel.
 - c. Panel Attachment to Understructure: By gravity.
 - d. Panel Attachment to Understructure: By bolting to pedestal head. Provide panels with holes drilled in corners to align precisely with threaded holes in pedestal heads and to accept countersunk screws with heads flush with top of panel.
 - 1) Provide fasteners held captive to panels.
2. Steel-Encapsulated, Wood-Core Panels: Fabricated with 1-inch- (25-mm-) thick, particleboard core, made without urea formaldehyde laminated to top and bottom steel face sheets, with metal surfaces protected against corrosion by manufacturer's standard factory-applied finish, and with a flame-spread index of 25 or less per ASTM E 84. Provide core edges enclosed with upturned, die-formed edge of bottom sheet or with perimeter steel channel welded to top sheet and welded or bonded to bottom sheet.
3. Formed-Steel Panels: Fabricated with die-cut flat top sheet and die-formed and stiffened steel bottom pan formed from cold-rolled steel sheet and joined together by resistance welding, with metal surfaces protected against corrosion by manufacturer's standard factory-applied finish to produce units of the following type:
 - a. Solid Panels: Flat, solid top surface.



- b. Perforated Panels: Perforated top surface with holes **OR** slots, **as directed**, of number, spacing, and size standard with manufacturer to produce a nominal open area of 25 percent. Provide mechanical dampers with each panel unit, **as directed**.
 - 1) Quantity: As directed.
 - 2) Finish: Manufacturer's standard **OR** To match solid panels, **as directed**.
 - c. Grates: Grating ribs arranged in manufacturer's standard pattern to produce a nominal open area of 56 percent. Provide mechanical dampers with each panel unit, **as directed**.
 - 1) Quantity: As directed.
 - 2) Finish: Manufacturer's standard **OR** To match solid panels, **as directed**.
- 4. Cementitious-Filled, Formed-Steel Panels: Fabricated with die-cut flat top sheet and die-formed and stiffened bottom pan formed from cold-rolled steel sheet joined together by resistance welding to form an enclosed assembly, with metal surfaces protected against corrosion by manufacturer's standard factory-applied finish. Fully grout internal spaces of completed units with manufacturer's standard cementitious fill.
- 5. Die-Cast Aluminum Panels: Fabricated from manufacturer's standard aluminum alloy but not less than the strength and corrosion resistance of Alloy UNS No. A03830 or UNS No. A03840 per ASTM B 85, to produce units of the following type and with the following finish:
 - a. Solid Panels: Flat, solid surface on top and symmetrical crossing ribs on bottom; edge machined after casting to specified tolerances.
 - b. Perforated Panels: Perforated top surface with holes **OR** slots, **as directed**, of number, spacing, and size standard with manufacturer to produce a nominal open area of 25 percent. Provide mechanical dampers with each panel unit, **as directed**.
 - 1) Quantity: As directed.
 - 2) Finish: Manufacturer's standard **OR** To match solid panels, **as directed**.
 - c. Grates: Grating ribs arranged in manufacturer's standard pattern to produce a nominal open area of 56 percent. Provide mechanical dampers with each panel unit, **as directed**.
 - 1) Quantity: As directed.
 - 2) Finish: Manufacturer's standard **OR** To match solid panels, **as directed**.
 - d. Epoxy Finish: Epoxy **OR** Conductive epoxy, **as directed**, powder coating with a minimum average thickness of 2.5 mils (0.064 mm) and in color selected from manufacturer's full range.
 - e. Plated Finish: Nickel-chrome electrodeposited plating, 0.000005-inch (0.000127-mm) chrome over 0.0008-inch (0.02-mm) nickel, without copper or brass strike, to produce complete coverage over significant surfaces with a matte metallic appearance.
- 6. Concrete-Filled, Steel Pan Panels: Fabricated with bottom pan die-formed from electrolytic-zinc-coated steel sheet and filled with lightweight concrete that is reinforced and bonded to pan by shear ties.
- 7. Pedestals: Assembly consisting of base, column with provisions for height adjustment, and head (cap); made of steel **OR** aluminum, **as directed**.
 - a. Provide pedestals designed for use in seismic applications.
 - b. Base: Square or circular base with not less than 16 sq. in. (103 sq. cm) of bearing area.
 - c. Column: Of height required to bring finished floor to elevations indicated. Weld to base plate.
 - d. Provide vibration-proof leveling mechanism for making and holding fine adjustments in height over a range of not less than 2 inches (51 mm) and for locking at a selected height, so deliberate action is required to change height setting and vibratory displacement is prevented.
 - e. Head: Designed to support understructure system indicated.
 - 1) Provide sound-deadening pads or gaskets at contact points between heads and panels.
 - 2) Provide head with four holes aligned with holes in floor panels for bolting of panels to pedestals.
- 8. Stringer Systems: Modular steel **OR** aluminum, **as directed**, stringer systems made to interlock with pedestal heads and form a grid pattern placing stringers under each edge of each floor panel



and a pedestal under each corner of each floor panel. Protect steel components with manufacturer's standard galvanized or corrosion-resistant paint finish.

- a. Bolted Stringers: System of main and cross stringers connected to pedestals with threaded fasteners accessible from above.
- b. Snap-on Stringers: System of stringers attached to pedestals with nonbolted interlocking connections to provide a stable understructure and to prevent accidental disengagement.
- c. Provide continuous gasket at contact surfaces between panel and stringers to deaden sound, to seal off underfloor cavity from above, and to maintain panel alignment and position.
- d. Provide stringers that support each edge of each panel where required to meet design-load criteria.

B. Floor Panel Coverings

1. Provide bare panels without factory-applied floor coverings on traffic surfaces.
2. General: Provide factory-applied floor coverings of type indicated that are laminated by access flooring manufacturer to tops of floor panels including perforated panels, **as directed**.
3. Colors, Textures, and Patterns: As selected from manufacturer's full range.
4. Standard Plastic Laminate: NEMA LD 3, High-Wear type, Grade HWH **OR** HDS, **as directed**; fabricated in one piece to cover each panel face within perimeter plastic **OR** with integral trim serving as, **as directed**, edging.
5. Static-Conductive Plastic Laminate: NEMA LD 3, High-Wear type, Grade CHWH **OR** CHDS, **as directed**, fabricated in one piece to cover each panel face within perimeter plastic edging or with integral trim serving as edging.
6. Solid Vinyl Tile: Static-Conductive **OR** Static-Dissipative, **as directed**, ASTM F 1700, Class I (Monolithic Vinyl Tile), Type A (Smooth Surface), fabricated in one piece to cover panel face within plastic edging.
7. Low-Emissivity, Solid Vinyl Tile: Static-Conductive **OR** Static-Dissipative, **as directed**, ASTM F 1700, Class I (Monolithic Vinyl Tile), Type A (Smooth Surface), with minimum 50 percent reduction in outgassing **OR** total mass loss of 1 percent and minimum 98 percent reduction in collected volatile condensable materials, **as directed**, compared to products with dioctyl phthalate as determined by testing per ASTM E 595.
8. Standard Commercial Carpet: Die cut and adhesively bonded to top surface of panel.
 - a. Provide factory-applied carpet with the following characteristics:
 - 1) Style: Passport.
 - 2) Fiber Type: 100% BCF nylon.
 - 3) Pile Characteristics: Level loop.
 - 4) Pile Thickness: 0.130 inch (3.30 mm).
 - 5) Stitches: 10.0/inch (10.0/2.54 cm).
 - 6) Surface Pile Weight: 26 oz./sq. yd. (881 g/sq. m).
 - 7) Total Weight: 56 oz./sq. yd. (1899 g/sq. m).
 - 8) Backing: Woven polypropylene.
 - 9) Critical Radiant Flux Rating: Minimum of 0.45 W/sq. cm per ASTM E 648.
 - b. Environmental Requirements: Provide carpet that complies with testing and product requirements of Carpet and Rug Institute's "Green Label Plus" program. Bond carpet to panels with adhesives with VOC content not more than 50g/L when calculated according to 40 CFR 59, Subpart D (EPA method 24).
9. Antistatic Carpet: Antistatic modular carpet tile bonded with conductive adhesive to **OR** with buttons that engage into positioning holes in, **as directed**, top surface of panel.
 - a. Provide carpet with the following characteristics:
 - 1) Style: Classic **OR** Contempo, **as directed**.
 - 2) Fiber Type: Solutia LXI nylon **OR** Performa SD Type 6 nylon, **as directed**
 - 3) Pile Characteristics: Textured loop **OR** Textured graphic loop, **as directed**.
 - 4) Pile Thickness: 0.125 and 0.188 inch (3.18 and 4.78 mm).
 - 5) Stitches: 11.0/inch (11.0/2.54 cm) **OR** 10.0/inch (10.0/ 2.54 cm), **as directed**.
 - 6) Surface Pile Weight: 24 oz./sq. yd. (814 g/sq. m).
 - 7) Total Weight: 148 oz./sq. yd. (5018 g/sq. m).



- 8) Backing: Static-dissipative, unitary PVC backing with conductive additive.
- 9) Critical Radiant Flux Rating: Minimum of 0.45 W/sq. cm per ASTM E 648.
- b. Environmental Requirements: Provide carpet that complies with testing and product requirements of Carpet and Rug Institute's "Green Label Plus" program. Bond carpet to panels with adhesives with VOC content not more than 50g/L when calculated according to 40 CFR 59, Subpart D (EPA method 24), **as directed**.
10. Edging: Manufacturer's standard applied **OR** integral, **as directed**, edge trim. Provide size and profile of applied edge trim that fits floor coverings selected.
11. Resilient Wall Base: ASTM F 1861, Type TS (rubber, vulcanized thermoset) **OR** TV (vinyl, thermoplastic), **as directed**, Group 1 (solid), Style B (cove), 0.080 inch (2.03 mm) **OR** 0.125 inch (3.18 mm), **as directed**, thick and 2-1/2 inches (63.5 mm) **OR** 4 inches (102 mm) **OR** 6 inches (152 mm), **as directed**, high, with matching end stops and factory-made corner units, **as directed**.

C. Accessories

1. Adhesives: Manufacturer's standard adhesive for bonding pedestal bases to subfloor.
 - a. Provide adhesive with a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Post-Installed Anchors: For anchoring pedestal bases to subfloor, provide 2 **OR** 4, **as directed**, post-installed expansion anchors **OR** threaded concrete screws, **as directed**, made from carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (5 microns) for Class SC 1 service condition (mild), with the capability to sustain, without failure, a load equal to 1.5 times the loads imposed by pedestal overturning moment on fasteners, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
3. Cutouts: Provide cutouts in floor panels for cable penetrations and service outlets. Provide reinforcement or additional support, if needed, to make panels with cutouts comply with standard performance requirements.
 - a. Number, Size, Shape, and Location: As directed.
 - b. Trim edge of cutouts with manufacturer's standard plastic molding.
 - c. Fit cutouts with manufacturer's standard grommets in sizes indicated or, if size of cutouts exceeds maximum grommet size available, trim edge of cutouts with manufacturer's standard plastic molding having tapered top flange. Furnish removable covers for grommets, **as directed**.
 - d. Provide foam-rubber pads for sealing annular space formed in cutouts by cables.
4. Service Outlets: Standard UL-listed and -labeled assemblies, for recessed mounting flush with top of floor panels, for power, communication, and signal services, and complying with the following requirements:
 - a. Structural Performance: Cover capable of supporting a 1000-lbf (4448-N) concentrated load.
 - b. Cover and Box Type: Hinged polycarbonate cover with opening for passage of cables when cover is closed and including frame and steel box or formed-steel plate for mounting electrical receptacles.
OR
Cover and Box Type: Grommet with twist-close cover and including steel junction box for electrical receptacle with provision for telephone Amphenol connectors and signal cables.
 - c. Location: In center of panel quadrant, unless otherwise indicated.
 - d. Receptacles and Wiring: Electrical receptacles and wiring for service outlets are specified in Division 22.
OR
Receptacles and Wiring: Equip each service outlet with power receptacles to comply with the following requirements:
 - 1) Type of Receptacle: Heavy-duty duplex, 2-pole, 3-wire grounding, 20 A, 125 V, NEMA WD 6, Configuration 5-20R, unless otherwise indicated.
 - 2) Number of Receptacles for Outlet: One **OR** Two **OR** Four, **as directed**.



- 3) Wiring Method: Factory wired for hard wiring in field with armored cable, containing 3 insulated No. 12 AWG solid-copper conductors, terminated with a 6-inch- (152-mm-) long pigtail.
OR
Wiring Method: Power-in connectors, built into outlet housing, of type to fit power-in and power-out connectors of branch-circuit cables supplied with building electrical system.
5. Diffusers: Manufacturer's standard round diffusers, 4 inches (102 mm) **OR** 8 inches (203 mm), **as directed**, in diameter, formed from aluminum **OR** polycarbonate plastic, **as directed**, to produce a removable 1-piece unit complete with diffuser, manually adjustable flow regulator, dirt and dust receptacle, trim ring, and underfloor compression mounting ring; precisely fitted in factory-prepared openings of standard field panels, and complying with the following requirements:
 - a. Air-Distribution Characteristics: 100 cfm (47 L/s) at 0.096-inch (24-Pa) static pressure and a maximum noise criterion rating of 15, **as directed**.
 - b. Structural Performance: Capable of supporting a 600-lbf (2669-N) concentrated load, **as directed**.
 - c. Fire-Test-Response Characteristics: Classified 94V-0 per UL 94.
6. Floor Grilles: Standard load-bearing grilles formed from aluminum **OR** polycarbonate plastic, **as directed**, to produce removable one-piece unit precisely fitted in factory-prepared openings of standard field panels, with adjustable/removable **OR** without, **as directed**, dampers and complying with the following requirements:
 - a. Air-Distribution Characteristics: 468 cfm at 0.10-inch wg (221 L/s at 25-Pa) static pressure.
 - b. Structural Performance: Capable of supporting a 1000-lbf (4448-N) concentrated load.
 - c. Fire-Test-Response Characteristics: Classified 94V-0 per UL 94.
7. Cavity Dividers: Provide manufacturer's standard metal dividers located where indicated to divide underfloor cavities.
8. Vertical Closures (Fasciae): Where underfloor cavity is not enclosed by abutting walls or other construction, provide metal-closure plates with manufacturer's standard finish.
9. Ramps: Manufacturer's standard ramp construction of width and slope indicated but not steeper than 1:12, with raised-disc or textured rubber or vinyl floor coverings, and of same materials, performance, and construction requirements as access flooring.
10. Steps: Provide steps of size and arrangement indicated with floor coverings to match access flooring. Apply nonslip aluminum nosings to treads, unless otherwise indicated.
11. Railings: Standard extruded-aluminum railings, at ramps and open-sided perimeter of access flooring where indicated. Include handrail, intermediate rails, posts, brackets, end caps, wall returns, wall and floor flanges, plates, and anchorages where required.
 - a. Provide railings that comply with structural performance requirements specified in Division 05 Section(s) "Pipe And Tube Railings" **OR** "Decorative Metal", **as directed**.
12. Panel Lifting Device: Manufacturer's standard portable lifting device of type required for specified panels. Provide one lifting devices per room of each type required.
13. Perimeter Support: Where indicated, provide manufacturer's standard method for supporting panel edge and forming transition between access flooring and adjoining floor coverings at same level as access flooring.

1.3 EXECUTION

A. Preparation

1. Lay out floor panel installation to keep the number of cut panels at floor perimeter to a minimum. Avoid using panels cut to less than 6 inches (152 mm).
2. Locate each pedestal, complete any necessary subfloor preparation, and vacuum clean subfloor to remove dust, dirt, and construction debris before beginning installation.

B. Installation



1. Install access flooring system and accessories under supervision of access flooring manufacturer's authorized representative to produce a rigid, firm installation that complies with performance requirements and is free of instability, rocking, rattles, and squeaks.
 2. Set pedestals in adhesive as recommended in writing by access flooring manufacturer to provide full bearing of pedestal base on subfloor.
 3. Attach pedestals to subfloor by post-installed mechanical anchors.
 4. Adjust pedestals to permit top of installed panels to be set flat, level, and to proper height.
 5. Secure stringers to pedestal heads according to access flooring manufacturer's written instructions.
 6. Install flooring panels securely in place, properly seated with panel edges flush. Do not force panels into place.
 - a. Carpeted Panels: Install panels with carpet pile in same direction.
 7. Scribe perimeter panels to provide a close fit with adjoining construction with no voids greater than 1/8 inch (3 mm) where panels abut vertical surfaces.
 - a. To prevent dusting, seal cut edges of steel-encapsulated, wood-core panels with sealer recommended in writing by panel manufacturer.
 8. Cut and trim access flooring and perform other dirt-or-debris-producing activities at a remote location or as required to prevent contamination of subfloor under access flooring already installed.
 9. Ground flooring system as recommended by manufacturer and as needed to comply with performance requirements for electrical resistance of floor coverings.
 10. Scribe and install underfloor-cavity dividers to closely fit against subfloor surfaces, and seal with mastic.
 11. Scribe vertical closures to closely fit against subfloor and adjacent finished-floor surfaces. Set in mastic and seal to maintain plenum effect within underfloor cavity.
 12. Clean dust, dirt, and construction debris caused by floor installation, and vacuum subfloor area, as installation of floor panels proceeds.
 13. Seal underfloor air cavities at construction seams, penetrations, and perimeter to control air leakage as recommended in writing by manufacturer.
 14. Install access flooring without change in elevation between adjacent panels and within the following tolerances:
 - a. Plus or minus 1/16 inch (1.5 mm) **OR** 1/8 inch (3 mm), **as directed**, in any 10-foot (3-m) distance.
 - b. Plus or minus 1/8 inch (3 mm) **OR** 1/4 inch (6.5 mm), **as directed**, from a level plane over entire access flooring area.
- C. Adjusting, Cleaning, And Protection
1. Prohibit traffic on access flooring for 24 hours and removal of floor panels for 72 hours after installation to allow pedestal adhesive to set.
 2. After completing installation, vacuum clean access flooring and cover with continuous sheets of reinforced paper or plastic. Maintain protective covering until time of Final Completion.
 3. Replace access flooring panels that are stained, scratched, or otherwise damaged or that do not comply with specified requirements.

END OF SECTION 09 69 13 00



Task	Specification	Specification Description
09 69 53 00	09 69 13 00	Access Flooring



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SECTION 09 72 13 00 - WALL COVERINGS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for wall coverings. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Vinyl wall covering.
 - b. Woven glass-fiber wall covering.
 - c. Textile wall covering.
 - d. Heavy-duty synthetic textile wall covering.
 - e. Wood-veneer wall covering.
 - f. Wallpaper.

C. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:
 - a. Certificates for Credit MR 7: Chain-of-custody certificates certifying that wood-veneer wall coverings comply with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.
 - b. Product Data for Credit EQ 4.1: For adhesives, including printed statement of VOC content.
 - c. Product Data for Credit EQ 4.2: For paints and coatings, including printed statement of VOC content and chemical components.
3. Shop Drawings: Show location and extent of each wall-covering type. Indicate pattern placement, veneer matching, seams and termination points.
4. Samples: Full width by 36-inch- (914-mm-) long section of wall covering from same print run or dye lot to be used for the Work, with specified treatments, paint, applied. Show complete pattern repeat. Mark top and face of fabric.
5. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for wall covering.
6. Maintenance Data: For wall coverings to include in maintenance manuals.

D. Quality Assurance

1. Forest Certification: Fabricate products with wood veneer produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
2. Fire-Test-Response Characteristics: As determined by testing identical wall coverings applied with identical adhesives to substrates according to test method indicated below by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Surface-Burning Characteristics: As follows, per ASTM E 84:
 - 1) Flame-Spread Index: 25 or less.
 - 2) Smoke-Developed Index: 50 **OR** 450, **as directed**, or less.
 - b. Fire-Growth Contribution: Textile wall coverings complying with acceptance criteria of IBC Standard 803.
 - c. Fire-Growth Contribution: Textile wall coverings tested according to NFPA 265 **OR** NFPA 286, **as directed**, and complying with test protocol and criteria in the IBC Standard 803.



E. Project Conditions

1. Environmental Limitations: Do not deliver or install wall coverings until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
 - a. Wood-Veneer Wall Coverings: Condition spaces for not less than 48 hours before installation.
2. Lighting: Do not install wall covering until a permanent level of lighting is provided on the surfaces to receive wall covering.
3. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by wall-covering manufacturer for full drying or curing.

1.2 PRODUCTS

A. Wall Coverings

1. General: Provide rolls of each type of wall covering from same print run or dye lot.

B. Vinyl Wall Covering

1. Vinyl Wall-Covering Standards: Provide products **OR** mildew-resistant products, **as directed**, complying with the following:
 - a. FS CCC-W-408D and CFFA-W-101-D for Type I, Light-Duty **OR** Type II, Medium-Duty **OR** Type III, Heavy-Duty, **as directed**, products.
 - b. ASTM F 793 for peelable **OR** strippable, **as directed**, wall coverings that qualify as Category I, Decorative Only **OR** Category II, Decorative with Medium Serviceability **OR** Category III, Decorative with High Serviceability **OR** Category IV, Type I, Commercial Serviceability **OR** Category V, Type II, Commercial Serviceability **OR** Category VI, Type III, Commercial Serviceability, **as directed**, products.
2. Width: 27 inches (686 mm) **OR** 54 inches (1372 mm), **as directed**.
3. Backing: Scrim **OR** Osnaburg **OR** Drill **OR** Nonwoven, **as directed**, fabric.
 - a. Fiber Content: Cotton **OR** Polyester **OR** Polycotton **OR** Polyester cellulose, **as directed**.
4. Repeat: Random.
5. Colors, Textures, and Patterns: As selected from manufacturer's full range.

C. Woven Glass-Fiber Wall Covering

1. Width: 39 inches (991 m).
2. Colors, Textures, and Patterns: As selected from manufacturer's full range.

D. Textile Wall Covering

1. Wall-Covering Standard: Provide mildew-resistant **OR** peelable **OR** strippable, **as directed**, wall coverings that comply with ASTM F 793 for Category I, Decorative Only **OR** Category II, Decorative with Medium Serviceability **OR** Category III, Decorative with High Serviceability **OR** Category IV, Type I, Commercial Serviceability **OR** Category V, Type II, Commercial Serviceability **OR** Category VI, Type III, Commercial Serviceability, **as directed**, products.
2. Test Responses:
 - a. Colorfastness to Wet and Dry Crocking: Passes AATCC 8, Grade 3, minimum.
 - b. Colorfastness to Light: Passes AATCC 16, Option 1 or 3, Grade 4, minimum, at 40 hours.
3. Repeat: Random.
4. Applied Backing Material: Acrylic **OR** Paper, **as directed**.
5. Colors, Textures, and Patterns: As selected from manufacturer's full range.

E. Heavy-Duty Synthetic Textile Wall Covering

1. Wall-Covering Standard: Provide wall coverings **OR** mildew-resistant wall coverings, **as directed**, that comply with ASTM F 793 for Category IV, Type I, Commercial Serviceability **OR**



- Category V, Type II, Commercial Serviceability **OR** Category VI, Type III, Commercial Serviceability, **as directed**, products.
2. Test Responses:
 - a. Colorfastness to Wet and Dry Crocking: Passes AATCC 8, Class 3, minimum.
 - b. Colorfastness to Light: Passes AATCC 16A or AATCC 16E, Class 4, minimum, at 40 hours.
 3. Width: 54 inches (1372 mm) **OR** 60 inches (1524 mm), **as directed**.
 4. Colors, Textures, and Patterns: As selected from manufacturer's full range.
- F. Wood-Veneer Wall Covering
1. Sheet Size: 24 by 96 inches (610 by 2440 mm) **OR** 48 by 96 inches (1220 by 2440 mm) **OR** 48 by 120 inches (1220 by 3050 mm), **as directed**.
 2. Veneer Construction: Single ply veneer **OR** Two veneer plies assembled perpendicular to one another, **as directed**.
 3. Wood Species: Red oak **OR** Maple **OR** Cherry, **as directed**.
 4. Veneer Match: Book **OR** Slip, **as directed**.
 5. Sheet Match: Running **OR** Balance **OR** Center **OR** Sequence, as indicated **OR** Blueprint, as indicated, **as directed**.
 6. Applied Backing Material: Fabric.
 7. Finish: Factory **OR** Field, **as directed**, applied using wall-covering manufacturer's standard stain and polyurethane system.
 - a. Colors: As selected from manufacturer's full range.
- G. Wallpaper
1. Wall-Covering Standard: Provide mildew-resistant **OR** peelable **OR** strippable, **as directed**, wallpaper that complies with ASTM F 793 for Category I, Decorative Only **OR** Category II, Decorative with Medium Serviceability **OR** Category III, Decorative with High Serviceability, **as directed**, products.
 2. Width: 20-1/2 inches (520.7 mm) **OR** 28 inches (711.2 mm), **as directed**.
 3. Repeat: Random.
 4. Colors, Textures, and Patterns: As selected from manufacturer's full range.
- H. Accessories
1. Adhesive: Mildew-resistant, nonstaining, strippable, **as directed**, adhesive, for use with specific wall covering and substrate application; as recommended in writing by wall-covering manufacturer and with a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Primer/Sealer: Mildew resistant, complying with requirements in Division 09 Section "Interior Painting" and recommended in writing by wall-covering manufacturer for intended substrate.
 3. Wall Liner: Nonwoven, synthetic underlayment and adhesive as recommended by wall-covering manufacturer.
 4. Seam Tape: As recommended in writing by wall-covering manufacturer.
 5. Metal Primer: Interior ferrous metal primer complying with Division 09 Section "Interior Painting".
- 1.3 EXECUTION
- A. Preparation
1. Comply with manufacturer's written instructions for surface preparation.
 2. Clean substrates of substances that could impair bond of wall covering, including dirt, oil, grease, mold, mildew, and incompatible primers.
 3. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.
 - a. Moisture Content: Maximum of 5 percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.



- b. Plaster: Allow new plaster to cure. Neutralize areas of high alkalinity. Prime with primer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
- c. Metals: If not factory primed, clean and apply metal as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
- d. Gypsum Board: Prime with primer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
- e. Painted Surfaces: Treat areas susceptible to pigment bleeding.
4. Check painted surfaces for pigment bleeding. Sand gloss, semigloss, and eggshell finish with fine sandpaper.
5. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.
6. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.
7. Install wall liner, with no gaps or overlaps, where required by wall-covering manufacturer. Form smooth wrinkle-free surface for finished installation. Do not begin wall-covering installation until wall liner has dried.

B. Installation

1. General: Comply with wall-covering manufacturers' written installation instructions applicable to products and applications indicated except where more stringent requirements apply.
2. Cut wall-covering strips in roll number sequence. Change roll numbers at partition breaks and corners.
3. Install strips in same order as cut from roll.
4. Install reversing every other strip.
5. Install wall covering with no gaps or overlaps, no lifted or curling edges, and no visible shrinkage.
6. Match pattern 72 inches (1830 mm) above the finish floor.
7. Install seams vertical and plumb at least 6 inches (150 mm) from outside corners and 3 inches (75 mm) **OR** 6 inches (150 mm), **as directed**, from inside corners unless a change of pattern or color exists at corner. No horizontal seams are permitted.
8. Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.
9. Trim edges and seams for color uniformity, pattern match, and tight closure. Butt seams without any overlay or spacing between strips.

C. Field Finishing Of Wood-Veneer Wall Coverings

1. Apply wall-covering manufacturer's standard stain and polyurethane system according to coating manufacturer's written instructions to produce finish that is consistent in color and gloss and matches approved Samples.
2. Apply no fewer than two **OR** three, **as directed**, finish coats.

D. Cleaning

1. Remove excess adhesive at finished seams, perimeter edges, and adjacent surfaces.
2. Use cleaning methods recommended in writing by wall-covering manufacturer.
3. Replace strips that cannot be cleaned.
4. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION 09 72 13 00



Task	Specification	Specification Description
09 72 16 00	09 72 13 00	Wall Coverings
09 72 19 00	09 72 13 00	Wall Coverings
09 72 23 00	09 72 13 00	Wall Coverings
09 73 00 00	09 01 60 00a	Carpet
09 81 16 00	09 84 13 00	Acoustical Wall Panels



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SECTION 09 84 13 00 - ACOUSTICAL WALL PANELS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for acoustical wall panels. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes spline-mounted **OR** back-mounted, **as directed**, acoustical wall panels.

C. Definitions

1. NRC: Noise reduction coefficient.

D. Submittals

1. Product Data: For each type of panel edge, core material, and mounting indicated.
2. Shop Drawings: For acoustical wall panels. Include mounting devices and details.
3. Coordination Drawings: Show intersections with adjacent work.
4. Samples: For each fabric and sample panels.
5. LEED Submittal:
 - a. Product Data for Credit EQ 4.1: For installation adhesive, including printed statement of VOC content.
6. Product certificates **OR** test reports, **as directed**.
7. Maintenance data.
8. Warranty: Special warranty specified in this Section.

E. Quality Assurance

1. Fire-Test-Response Characteristics: Provide acoustical wall panels with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 **OR** IBC Chapter 8, **as directed**, by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
2. Fire Growth Contribution: Meeting acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265 **OR** NFPA 286, **as directed**.
3. Preinstallation Conference: Conduct conference at Project site.

F. Delivery, Storage, And Handling

1. Comply with fabric and acoustical wall panel manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.
2. Deliver materials and panels in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.
3. Protect panel edges from crushing and impact.

G. Project Conditions

1. Environmental Limitations: Do not install acoustical wall panels until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
2. Lighting: Do not install acoustical wall panels until a permanent level of lighting **OR** a lighting level of not less than 50 fc (538 lux), **as directed**, is provided on surfaces to receive acoustical wall panels.



3. Air-Quality Limitations: Protect acoustical wall panels from exposure to airborne odors, such as tobacco smoke, and install panels under conditions free from odor contamination of ambient air.
4. Field Measurements: Verify locations of acoustical wall panels by field measurements before fabrication and indicate measurements on Shop Drawings.

H. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of acoustical wall panels that fail in performance, materials, or workmanship within two years from date of Final Completion.
 - a. Failure in performance includes, but is not limited to, acoustical performance.
 - b. Failures in materials include, but are not limited to, fabric sagging, distorting, or releasing from panel edge; or warping of core.

1.2 PRODUCTS

A. Core Materials

1. Glass-Fiber Board: ASTM C 612, Type IA or Types IA and IB; density as specified, unfaced, dimensionally stable, molded rigid board, with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.
2. Mineral-Fiber Board: Maximum flame-spread and smoke-developed indexes of 15 and 5, respectively.
3. Cementitious-Fiber Board Core: Density of not less than 20 lb/cu. ft. (320 kg/cu. m).
4. Tackable, Impact-Resistant, High-Density Face Layer: 1/8-inch- (3.2-mm-) thick layer of compressed molded glass-fiber board with a minimum nominal density of 16 to 18 lb/cu. ft. (256 to 288 kg/cu. m) laminated to face of core.
5. Impact-Resistant, Acoustically Transparent, Copolymer Face-Sheet Layer for High-Abuse Applications: 1/16- to 1/8-inch- (1.6- to 3.2-mm-) thick layer of perforated, noncombustible, copolymer sheet laminated to face of core.
6. Wood: Clear, vertical grain, straight, kiln-dried hardwood of manufacturer's standard species, AWWA C20, Interior Type A, fire-retardant treated, low-hygroscopic-type formulation. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Kiln-dry material after treatment to 5 to 10 percent moisture content.

B. Spline-Mounted Acoustical Wall Panels With Perforated Mineral-Fiber Board Core Or Cementitious-Fiber Board Core

1. Panel Construction: Manufacturer's standard panel construction consisting of facing material laminated to front face of a perforated, water-felted, mineral-fiber board **OR** cementitious-fiber board, **as directed**, core; with long edges kerfed and rabbeted to receive splines.
 - a. Mineral-Fiber Board: Not less than 13-lb/cu. ft. (208-kg/cu. m) **OR** 20-lb/cu. ft. (320-kg/cu. m), **as directed**, nominal density; with perforated surface.
2. Facing Material: Fabric from same dye lot; color and pattern as indicated by manufacturer's designations **OR** matching samples **OR** as selected from manufacturer's full range **OR** as indicated on Drawings, **as directed**.
 - a. Fiber Content: 100 percent woven polyester **OR** nonwoven polyester **OR** polyolefin **OR** acoustically transparent vinyl, **as directed**.
 - b. Width: 54 inches (1371 mm) **OR** 66 inches (1676 mm), **as directed**.
 - c. Applied Treatments: Stain resistance.
3. Nominal Overall Panel Thickness: 3/4 inch (19 mm) **OR** 1 inch (25 mm), **as directed**.
4. NRC: For Type A mounting per ASTM E 795, NRC 0.50 to NRC 0.90 **OR** NRC 0.60 to NRC 0.70 **OR** NRC 0.65 to NRC 0.75, **as directed**.
5. Panel Width: 24 inches (610 mm) **OR** 30 inches (762 mm) **OR** 48 inches (1220 mm) **OR** 600 mm **OR** As indicated on Drawings, **as directed**.
6. Panel Height: Fabricated from units 96 inches (2438 mm) **OR** 108 inches (2743 mm) **OR** 120 inches (3048 mm), **as directed**, in height; mounting height **as directed**.



7. Panel Edge: Core self-edge.
 8. Panel Short Edge Detail: Square.
- C. Spline-Mounted Acoustical Wall Panels With Glass-Fiber Board Core
1. Panel Construction: Manufacturer's standard panel construction consisting of facing material laminated to front face of a dimensionally stable, rigid glass-fiber board core with a nominal density of 6 to 7 lb/cu. ft. (96 to 112 kg/cu. m); with long edges kerfed and rabbeted to receive splines.
 2. Core-Face Layer: Tackable, impact-resistant, high-density board **OR** Impact-resistant, acoustically transparent, copolymer face-sheet, **as directed**.
 3. Facing Material: Fabric from same dye lot; color and pattern as indicated by manufacturer's designations **OR** matching samples **OR** as selected from manufacturer's full range **OR** as indicated on Drawings, **as directed**.
 - a. Fiber Content: 100 percent woven polyester **OR** nonwoven polyester **OR** polyolefin **OR** acoustically transparent vinyl, **as directed**.
 - b. Width: 54 inches (1371 mm) **OR** 66 inches (1676 mm), **as directed**.
 - c. Applied Treatments: Stain resistance.
 4. Nominal Overall Panel Thickness: 3/4 inch (19 mm) **OR** 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (51 mm), **as directed**.
 5. NRC: For Type A mounting per ASTM E 795, not less than NRC 0.20 **OR** NRC 0.80 **OR** NRC 0.95, **as directed**.
 6. Panel Width: Manufacturer's standard **OR** 24 inches (610 mm) **OR** 30 inches (762 mm) **OR** 48 inches (1220 mm) **OR** 600 mm **OR** 1200 mm **OR** As indicated on Drawings, **as directed**.
 7. Panel Height: Fabricated from units 96 inches (2438 mm) **OR** 108 inches (2743 mm) **OR** 120 inches (3048 mm), **as directed**, in height; mounting height **as directed**.
 8. Panel Edge: Manufacturer's standard short edge.
 9. Panel Short Edge Detail: Square.
- D. Back-Mounted Acoustical Wall Panels With Perforated Mineral-Fiber Board Core
1. Panel Construction: Manufacturer's standard panel construction consisting of facing material laminated to front face of a perforated, water-felted, mineral-fiber board core of not less than 13-lb/cu. ft. (208-kg/cu. m) **OR** 20-lb/cu. ft. (320-kg/cu. m), **as directed**, nominal density; with perforated surface.
 2. Facing Material: Fabric from same dye lot; color and pattern as indicated by manufacturer's designations **OR** matching samples **OR** as selected from manufacturer's full range **OR** as indicated on Drawings, **as directed**.
 - a. Fiber Content: 100 percent woven polyester **OR** nonwoven polyester **OR** polyolefin **OR** acoustically transparent vinyl, **as directed**.
 - b. Width: 54 inches (1371 mm) **OR** 66 inches (1676 mm), **as directed**.
 - c. Applied Treatments: Stain resistance.
 3. Nominal Core Thickness and Overall System NRC: 1/2 inch (13 mm) and not less than NRC 0.35 **OR** 3/4 inch (19 mm) and not less than NRC 0.45, **as directed**, for Type A mounting.
 4. Panel Width: 24 inches (610 mm) **OR** 30 inches (762 mm) **OR** 48 inches (1220 mm) **OR** 600 mm **OR** As indicated on Drawings, **as directed**.
 5. Panel Height: Fabricated from units 96 inches (2438 mm) **OR** 108 inches (2743 mm) **OR** 120 inches (3048 mm), **as directed**, in height; mounting height **as directed**.
 6. Panel Edge: Core self-edge.
 7. Panel Short Edge Detail: Square.
- E. Back-Mounted, Edge-Reinforced Acoustical Wall Panels With Glass-Fiber Board Core
1. Panel Construction: Manufacturer's standard panel construction consisting of facing material laminated to front face, edges, and back border of dimensionally stable, rigid glass-fiber **OR** rock-fiber/slag-fiber, **as directed**, board core; with edges chemically hardened or impact resistant and resilient to reinforce panel perimeter against warpage and damage.
 2. Nominal Core Density: 4 to 7 lb/cu. ft. (64 to 112 kg/cu. m) **OR** 6 to 7 lb/cu. ft. (96 to 112 kg/cu. m), **as directed**.



3. Core-Face Layer: Tackable, impact-resistant, high-density board **OR** Impact-resistant, acoustically transparent, copolymer face-sheet, **as directed**.
 4. Facing Material: Fabric from same dye lot; color and pattern as indicated by manufacturer's designations **OR** matching samples **OR** as selected from manufacturer's full range **OR** as indicated on Drawings, **as directed**.
 - a. Fiber Content: 100 percent woven polyester **OR** nonwoven polyester **OR** polyolefin **OR** acoustically transparent vinyl, **as directed**.
 - b. Width: 54 inches (1371 mm) **OR** 66 inches (1676 mm), **as directed**.
 - c. Applied Treatments: Stain resistance.
 5. Nominal Core Thickness and Overall System NRC: 3/4 inch (19 mm) and not less than NRC 0.65 **OR** 1 inch (25 mm) and not less than NRC 0.80 **OR** 1-1/2 inches (38 mm) and not less than NRC 0.85 **OR** 2 inches (51 mm) and not less than NRC 0.90 **OR** 2 inches (51 mm) and not less than NRC 1.00, **as directed**, for Type A mounting per ASTM E 795.
 6. Panel Width: Manufacturer's standard **OR** 24 inches (610 mm) **OR** 30 inches (762 mm) **OR** 48 inches (1220 mm) **OR** 600 mm **OR** 1200 mm **OR** As indicated on Drawings, **as directed**.
 7. Panel Height: Fabricated height as indicated on Drawings **OR as directed**; mounting height as indicated on Drawings **OR as directed**.
 8. Panel Edge Detail: Square **OR** Bullnosed (radiused) **OR** Chamfered (beveled) **OR** Mitered **OR** Custom as indicated on Drawings, **as directed**.
 9. Corner Detail: Square **OR** Round, radius as indicated **OR** Off-square, dimensions as indicated, **as directed**, to form continuous profile to match edge detail.
- F. Back-Mounted, Edge-Framed Acoustical Wall Panels With Glass-Fiber Board Core
1. Panel Construction: Manufacturer's standard panel construction consisting of facing material stretched over front face of edge-framed, dimensionally stable, rigid glass-fiber board core and bonded or attached to edges and back of frame.
 2. Nominal Core Density: 4 to 7 lb/cu. ft. (64 to 112 kg/cu. m) **OR** 6 to 7 lb/cu. ft. (96 to 112 kg/cu. m), **as directed**.
 3. Core-Face Layer: Tackable, impact-resistant, high-density board **OR** Impact-resistant, acoustically transparent, copolymer face-sheet, **as directed**.
 4. Facing Material: Fabric from same dye lot; color and pattern as indicated by manufacturer's designations **OR** matching samples **OR** as selected from manufacturer's full range **OR** as indicated on Drawings, **as directed**.
 - a. Fiber Content: 100 percent woven polyester **OR** nonwoven polyester **OR** polyolefin **OR** acoustically transparent vinyl, **as directed**.
 - b. Width: 54 inches (1371 mm) **OR** 66 inches (1676 mm), **as directed**.
 - c. Applied Treatments: Stain resistance.
 5. Nominal Core Thickness and Overall System NRC: 1 inch (25 mm) and not less than NRC 0.80 **OR** 1-1/2 inches (38 mm) and not less than NRC 0.85 **OR** 2 inches (51 mm) and not less than NRC 0.90, **as directed**, for Type A mounting per ASTM E 795.
 6. Panel Width: Manufacturer's standard **OR** 24 inches (610 mm) **OR** 30 inches (762 mm) **OR** 48 inches (1220 mm) **OR** 600 mm **OR** 1200 mm **OR** As indicated on Drawings, **as directed**.
 7. Panel Height: Fabricated height as indicated on Drawings **OR as directed**; mounting height as indicated on Drawings **OR as directed**.
 8. Panel Edge and Frame: Extruded-aluminum or zinc-coated, rolled-steel shape **OR** Extruded PVC **OR** Hardwood, rabbeted, and splined with glued joints and machined corners, **as directed**.
 - a. Panel Edge Detail: Square.
- G. Fabrication
1. Sound-Absorption Performance: Provide acoustical wall panels with minimum NRCs indicated, as determined by testing per ASTM C 423 for mounting type specified.
 2. Acoustical Wall Panels: Panel construction consisting of facing material adhered to face, **as directed**, edges and back border of dimensionally stable core; with rigid edges to reinforce panel perimeter against warpage and damage.
 - a. Glass-Fiber Board: Resin harden areas of core for attachment of mounting devices.



3. Fabric Facing: Stretched straight, on the grain, tight, square, and free from puckers, ripples, wrinkles, sags, blisters, seams, adhesive, or other foreign matter. Applied with visible surfaces fully covered.
 - a. Where square corners are indicated, tailor corners. Heat seal vinyl fabric seams at corners.
 - b. Where radius or other nonsquare corners are indicated, attach facing material so there are no seams or gathering of material.
 - c. Where fabrics with directional or repeating patterns or directional weave are indicated, mark fabric top and attach fabric in same direction so pattern or weave matches in adjacent panels.
4. Core-Face Layer: Evenly stretched over core face and edges and securely attached to core; free from puckers, ripples, wrinkles, sags.
5. Dimensional Tolerances of Finished Units: Plus or minus 1/16 inch (1.6 mm) for the following:
 - a. Thickness.
 - b. Edge straightness.
 - c. Overall length and width.
 - d. Squareness from corner to corner.
 - e. Chords, radii, and diameters.
6. Spline-Mounting Accessories: Manufacturer's standard concealed, extruded-aluminum or plastic connecting splines designed and fabricated for screw attachment to walls, with other moldings and trim for interior and exterior corners, leveling and base support with factory-applied finish on exposed items.
 - a. Finish Color: White **OR** Black **OR** Match color of facing material **OR** Match sample, **as directed**.
7. Back-Mounting Devices: Concealed on backside of panel, recommended to support weight of panel, with base-support bracket system where recommended by manufacturer for additional support of panels, and as follows:
 - a. Adhesive. Use only adhesives that have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Hook-and-loop tape.
 - c. Impaling clips.
 - d. Magnetic strip or devices.
 - e. Metal "Z" Clips: Two-part panel clips, with one part of each clip mechanically attached to back of panel and the other part to wall substrate, designed to allow for panel removal.
 - f. As recommended by manufacturer.
8. Owner-Furnished Fabric: Provide fabric acceptable to acoustical wall panel manufacturer for application indicated. Notify the Owner of fabric unacceptability.

1.3 EXECUTION

A. Installation

1. Install acoustical wall panels in locations indicated with vertical surfaces and edges plumb, top edges level and in alignment with other panels, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.
 - a. Cut units to be at least 50 percent of unit width, with facing material extended over cut edge to match uncut edge. Scribe acoustical wall panels to fit adjacent work. Butt joints tightly.
2. Comply with acoustical wall panel manufacturer's written instructions for installation of panels using type of concealed mounting accessories indicated or, if not indicated, as recommended by manufacturer. Anchor panels securely to supporting substrate.
3. Match and level fabric pattern and grain among adjacent panels.
4. Installation Tolerances: As follows:
 - a. Variation from Level and Plumb: Plus or minus 1/16 inch (1.6 mm).
 - b. Variation of Panel Joints from Hairline: Not more than 1/16 inch (1.6 mm) **OR** 1/32 inch (0.79 mm), **as directed**, wide.



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- B. Cleaning
1. Clip loose threads; remove pills and extraneous materials.
 2. Clean panels with fabric facing, on completion of installation, to remove dust and other foreign materials according to manufacturer's written instructions.
- C. Protection
1. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, to ensure that acoustical wall panels are without damage or deterioration at time of Final Completion.
 2. Replace acoustical wall panels that cannot be cleaned and repaired, in a manner approved by the Owner, before time of Final Completion.

END OF SECTION 09 84 13 00



Task	Specification	Specification Description
09 85 00 00	09 28 13 00	Gypsum Board
09 85 00 00	09 23 13 00	Gypsum Board Renovation
09 85 00 00	09 28 13 00a	Gypsum Board Shaft-Wall Assemblies



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SECTION 09 91 13 00 - EXTERIOR PAINTING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for exterior painting. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes surface preparation and the application of paint systems on the following exterior substrates:
 - a. Concrete.
 - b. Clay masonry.
 - c. Concrete masonry units (CMU).
 - d. Steel.
 - e. Galvanized metal.
 - f. Aluminum (not anodized or otherwise coated).
 - g. Wood.
 - h. Plastic trim fabrications.
 - i. Exterior portland cement (stucco).
 - j. Exterior gypsum board.

C. Submittals

1. Product Data: For each type of product indicated.
2. Samples: For each finish and for each color and texture required.
3. Product List: Printout of current "MPI Approved Products List" for each product category specified in Part 1.2, with the proposed product highlighted.

D. Quality Assurance

1. MPI Standards:
 - a. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
 - b. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated. For renovation projects, comply with requirements of "MPI Maintenance Repainting Manual" for products and paint systems indicated.
2. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - a. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
 - 1) Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
 - 2) Other Items: Architect will designate items or areas required.
 - b. Final approval of color selections will be based on mockups.
 - 1) If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 - c. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - d. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.



- E. Delivery, Storage, And Handling
 - 1. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
 - a. Maintain containers in clean condition, free of foreign materials and residue.
 - b. Remove rags and waste from storage areas daily.
- F. Project Conditions
 - 1. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
 - 2. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1.2 PRODUCTS

- A. Paint, General
 - 1. Material Compatibility:
 - a. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - b. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
 - 2. Colors: As selected from manufacturer's full range.
- B. Block Fillers
 - 1. Interior/Exterior Latex Block Filler: MPI #4.
 - a. VOC Content: E Range of E2 **OR** E3, **as directed**.
- C. Primers/Sealers
 - 1. Alkali-Resistant Primer: MPI #3.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - 2. Bonding Primer (Water Based): MPI #17.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - 3. Bonding Primer (Solvent Based): MPI #69.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - 4. Wood-Knot Sealer: Sealer recommended in writing by topcoat manufacturer for use in paint system indicated.
- D. Metal Primers
 - 1. Alkyd Anticorrosive Metal Primer: MPI #79.
 - a. VOC Content: E Range of E1 **OR** E2, **as directed**.
 - 2. Quick-Drying Alkyd Metal Primer: MPI #76.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - 3. Cementitious Galvanized-Metal Primer: MPI #26.
 - a. VOC Content: E Range of E1.
 - 4. Waterborne Galvanized-Metal Primer: MPI #134.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 1 **OR** EPR 2 **OR** EPR 3, **as directed**.
 - 5. Quick-Drying Primer for Aluminum: MPI #95.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
- E. Wood Primers
 - 1. Exterior Latex Wood Primer: MPI #6.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - 2. Exterior Alkyd Wood Primer: MPI #5.



- a. VOC Content: E Range of E2 **OR** E3, **as directed**.
 3. Exterior Oil Wood Primer: MPI #7.
 - a. VOC Content: E Range of E2.
- F. Exterior Latex Paints
1. Exterior Latex (Flat): MPI #10 (Gloss Level 1).
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 2. Exterior Latex (Semigloss): MPI #11 (Gloss Level 5).
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 3. Exterior Latex (Gloss): MPI #119 (Gloss Level 6, except minimum gloss of 65 units at 60 deg).
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
- G. Exterior Alkyd Paints
1. Exterior Alkyd Enamel (Flat): MPI #8 (Gloss Level 1).
 - a. VOC Content: E Range of E1.
 2. Exterior Alkyd Enamel (Semigloss): MPI #94 (Gloss Level 5).
 - a. VOC Content: E Range of E1 **OR** E2, **as directed**.
 3. Exterior Alkyd Enamel (Gloss): MPI #9 (Gloss Level 6).
 - a. VOC Content: E Range of E1 **OR** E2, **as directed**.
- H. Quick-Drying Enamels
1. Quick-Drying Enamel (Semigloss): MPI #81 (Gloss Level 5).
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 2. Quick-Drying Enamel (High Gloss): MPI #96 (Gloss Level 7).
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
- I. Textured And High-Build Coatings
1. Latex Stucco and Masonry Textured Coating: MPI #42.
 - a. VOC Content: E Range of E2 **OR** E3, **as directed**.
 2. High-Build Latex (Exterior): MPI #40.
 - a. VOC Content: E Range of E1 **OR** E3, **as directed**.
- J. Aluminum Paint
1. Aluminum Paint: MPI #1.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
- K. Floor Coatings
1. Interior/Exterior Clear Concrete Floor Sealer (Water Based): MPI #99.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 2. Interior/Exterior Clear Concrete Floor Sealer (Solvent Based): MPI #104.
 - a. VOC Content: E Range of E1 **OR** E2, **as directed**.
 3. Interior/Exterior Latex Floor and Porch Paint (Low Gloss): MPI #60 (maximum Gloss Level 3).
 - a. VOC Content: E Range of E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 3.
 4. Exterior/Interior Alkyd Floor Enamel (Gloss): MPI #27 (Gloss Level 6).
 - a. VOC Content: E Range of E1 **OR** E2, **as directed**.
 - b. Additives: Manufacturer's standard additive to increase skid resistance of painted surface.
- 1.3 EXECUTION
- A. Examination
1. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.
 2. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:



- a. Concrete: 12 percent.
 - b. Masonry (Clay and CMU): 12 percent.
 - c. Wood: 15 percent.
 - d. Plaster: 12 percent.
 - e. Gypsum Board: 12 percent.
3. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
 4. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
 - a. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.
- B. Preparation And Application
1. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
 2. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
 - a. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.
 3. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
 4. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
 5. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.
- C. Exterior Painting Schedule
1. Paint systems herein are based on "MPI Architectural Painting Specification Manual" (hereafter, "MPI Manual"). For renovation projects, consult "MPI Maintenance Repainting Manual" and revise paint systems accordingly.
 2. For a Premium Grade system, "MPI Manual" requires intermediate coat; if Custom Grade system is required or if so directed, delete intermediate coat, **unless directed otherwise** or as otherwise required by manufacturer's recommendations.
 3. Concrete Substrates, Nontraffic Surfaces:
 - a. Latex System: MPI EXT 3.1A.
 - 1) Prime Coat: Exterior latex matching topcoat.
 - 2) Intermediate Coat: Exterior latex matching topcoat.
 - 3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - b. Latex Aggregate/Latex System: MPI EXT 3.1 B.
 - 1) Prime Coat: Latex stucco and masonry textured coating.
 - 2) Intermediate Coat: Exterior latex matching topcoat.
 - 3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - c. Latex Over Alkali-Resistant Primer System: MPI EXT 3.1K.
 - 1) Prime Coat: Alkali-resistant primer.
 - 2) Intermediate Coat: Exterior latex matching topcoat.
 - 3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - d. High-Build Latex System: MPI EXT 3.1L, applied to form dry film thickness of not less than 10 mils (0.25 mm).
 - 1) Prime Coat: As recommended in writing by topcoat manufacturer.
 - 2) Intermediate Coat: As recommended in writing by topcoat manufacturer.
 - 3) Topcoat: High-build latex (exterior).
 - e. Latex Aggregate System: MPI EXT 3.1N.
 - 1) Prime Coat: As recommended in writing by topcoat manufacturer.



- 2) Intermediate Coat: As recommended in writing by topcoat manufacturer.
 - 3) Topcoat: Latex stucco and masonry textured coating.
4. Concrete Substrates, Traffic Surfaces:
 - a. Latex Floor Paint System: MPI EXT 3.2A.
 - 1) Prime Coat: Interior/exterior latex floor and porch paint (low gloss).
 - 2) Intermediate Coat: Interior/exterior latex floor and porch paint (low gloss).
 - 3) Topcoat: Interior/exterior latex floor and porch paint (low gloss).
 - b. Alkyd Floor Enamel System: MPI EXT 3.2D.
 - 1) Prime Coat: Exterior/interior alkyd floor enamel (gloss).
 - 2) Intermediate Coat: Exterior/interior alkyd floor enamel (gloss).
 - 3) Topcoat: Exterior/interior alkyd floor enamel (gloss).
 - c. Clear Sealer System: MPI EXT 3.2G.
 - 1) Prime Coat: Interior/exterior clear concrete floor sealer (solvent based).
 - 2) Intermediate Coat: Interior/exterior clear concrete floor sealer (solvent based).
 - 3) Topcoat: Interior/exterior clear concrete floor sealer (solvent based).
 - d. Water-Based Clear Sealer System: MPI EXT 3.2H.
 - 1) Prime Coat: Interior/exterior clear concrete floor sealer (water based).
 - 2) Intermediate Coat: Interior/exterior clear concrete floor sealer (water based).
 - 3) Topcoat: Interior/exterior clear concrete floor sealer (water based).
 5. Clay-Masonry Substrates:
 - a. Latex System: MPI EXT 4.1A.
 - 1) Prime Coat: Exterior latex matching topcoat.
 - 2) Intermediate Coat: Exterior latex matching topcoat.
 - 3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - b. High-Build Latex System: MPI EXT 4.1H, applied to form dry film thickness of not less than 10 mils (0.25 mm).
 - 1) Prime Coat: As recommended in writing by topcoat manufacturer.
 - 2) Intermediate Coat: As recommended in writing by topcoat manufacturer.
 - 3) Topcoat: High-build latex (exterior).
 - c. Latex Aggregate System: MPI EXT 4.1B.
 - 1) Prime Coat: As recommended in writing by topcoat manufacturer.
 - 2) Intermediate Coat: As recommended in writing by topcoat manufacturer.
 - 3) Topcoat: Latex stucco and masonry textured coating.
 6. CMU Substrates:
 - a. Latex System: MPI EXT 4.2A.
 - 1) Prime Coat: Interior/exterior latex block filler.
 - 2) Intermediate Coat: Exterior latex matching topcoat.
 - 3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - b. Latex Over Alkali-Resistant Primer System: MPI EXT 4.2L.
 - 1) Prime Coat: Alkali-resistant primer.
 - 2) Intermediate Coat: Exterior latex matching topcoat.
 - 3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - c. High-Build Latex System: MPI EXT 4.2K, applied to form dry film thickness of not less than 10 mils (0.25 mm).
 - 1) Prime Coat: As recommended in writing by topcoat manufacturer.
 - 2) Intermediate Coat: As recommended in writing by topcoat manufacturer.
 - 3) Topcoat: High-build latex (exterior).
 - d. Latex Aggregate System: MPI EXT 4.2B.
 - 1) Prime Coat: As recommended in writing by topcoat manufacturer.
 - 2) Intermediate Coat: As recommended in writing by topcoat manufacturer.
 - 3) Topcoat: Latex stucco and masonry textured coating.
 7. Steel Substrates:
 - a. Quick-Drying Enamel System: MPI EXT 5.1A.
 - 1) Prime Coat: Quick-drying alkyd metal primer.
 - 2) Intermediate Coat: Quick-drying enamel matching topcoat.
 - 3) Topcoat: Quick-drying enamel (semigloss) **OR** (high gloss), **as directed**.



- b. Alkyd System: MPI EXT 5.1D.
 - 1) Prime Coat: Alkyd anticorrosive metal primer.
 - 2) Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - 3) Topcoat: Exterior alkyd enamel (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
- c. Aluminum Paint System: MPI EXT 5.1K.
 - 1) Prime Coat: Alkyd anticorrosive metal primer.
 - 2) Intermediate Coat: Aluminum paint.
 - 3) Topcoat: Aluminum paint.
- 8. Galvanized-Metal Substrates: Galvanized-metal substrates should not be chromate passivated (commercially known as "bonderized") if primer is field applied. If galvanized metal is chromate passivated, consult manufacturers for appropriate surface preparation and primers.
 - a. Latex System: MPI EXT 5.3A.
 - 1) Prime Coat: Cementitious galvanized-metal primer.
 - 2) Intermediate Coat: Exterior latex matching topcoat.
 - 3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - b. Latex Over Water-Based Primer System: MPI EXT 5.3H. "MPI Manual" recommends latex over water-based primer system for low-contact/traffic areas.
 - 1) Prime Coat: Waterborne galvanized-metal primer.
 - 2) Intermediate Coat: Exterior latex matching topcoat.
 - 3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - c. Alkyd System: MPI EXT 5.3B.
 - 1) Prime Coat: Cementitious galvanized-metal primer.
 - 2) Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - 3) Topcoat: Exterior alkyd enamel (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
- 9. Aluminum Substrates:
 - a. Latex System: MPI EXT 5.4H.
 - 1) Prime Coat: Quick-drying primer for aluminum.
 - 2) Intermediate Coat: Exterior latex matching topcoat.
 - 3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - b. Alkyd System: MPI EXT 5.4F.
 - 1) Prime Coat: Quick-drying primer for aluminum.
 - 2) Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - 3) Topcoat: Exterior alkyd enamel (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
- 10. Glue-Laminated Beam and Column Substrates:
 - a. Latex System: MPI EXT 6.1L.
 - 1) Prime Coat: Exterior latex wood primer.
 - 2) Intermediate Coat: Exterior latex matching topcoat.
 - 3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - b. Latex Over Alkyd Primer System: MPI EXT 6.1A.
 - 1) Prime Coat: Exterior alkyd **OR** oil, **as directed**, wood primer.
 - 2) Intermediate Coat: Exterior latex matching topcoat.
 - 3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - c. Alkyd System: MPI EXT 6.1B.
 - 1) Prime Coat: Exterior alkyd **OR** oil, **as directed**, wood primer.
 - 2) Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - 3) Topcoat: Exterior alkyd enamel (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
- 11. Dressed Lumber Substrates: Including architectural woodwork **OR** doors, **as directed**.
 - a. Latex System: MPI EXT 6.3L.
 - 1) Prime Coat: Exterior latex wood primer.
 - 2) Intermediate Coat: Exterior latex matching topcoat.
 - 3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**. Flat paint is not recommended for use on doors.
 - b. Latex Over Alkyd Primer System: MPI EXT 6.3A.
 - 1) Prime Coat: Exterior alkyd **OR** oil, **as directed**, wood primer.
 - 2) Intermediate Coat: Exterior latex matching topcoat.



- 3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**. Flat paint is not recommended for use on doors.
- c. Alkyd System: MPI EXT 6.3B.
 - 1) Prime Coat: Exterior alkyd **OR** oil, **as directed**, wood primer.
 - 2) Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - 3) Topcoat: Exterior alkyd enamel (flat) **OR** (semigloss) **OR** (gloss), **as directed**. Flat paint is not recommended for use on doors.
12. Wood Panel Substrates: Including plywood siding **OR** fascias **OR** soffits, **as directed**.
 - a. Latex System: MPI EXT 6.4K.
 - 1) Prime Coat: Exterior latex wood primer.
 - 2) Intermediate Coat: Exterior latex matching topcoat.
 - 3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - b. Latex Over Alkyd Primer System: MPI EXT 6.4G.
 - 1) Prime Coat: Exterior alkyd wood primer.
 - 2) Intermediate Coat: Exterior latex matching topcoat.
 - 3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - c. Alkyd System: MPI EXT 6.4B.
 - 1) Prime Coat: Exterior alkyd **OR** oil, **as directed**, wood primer.
 - 2) Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - 3) Topcoat: Exterior alkyd enamel (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
13. Wood Shingle and Shake Substrates (Excluding Roofs):
 - a. Latex System: MPI EXT 6.6E.
 - 1) Prime Coat: Exterior latex wood primer.
 - 2) Intermediate Coat: Exterior latex matching topcoat.
 - 3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - b. Latex Over Alkyd Primer System: MPI EXT 6.6A.
 - 1) Prime Coat: Exterior alkyd **OR** oil, **as directed**, wood primer.
 - 2) Intermediate Coat: Exterior latex matching topcoat.
 - 3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - c. Alkyd System: MPI EXT 6.6B.
 - 1) Prime Coat: Exterior alkyd **OR** oil, **as directed**, wood primer.
 - 2) Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - 3) Topcoat: Exterior alkyd enamel (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
14. Dimension Lumber Substrates, Nontraffic Surfaces: Including board siding **OR** fencing **OR** undersides of decking, **as directed**.
 - a. Latex System: MPI EXT 6.2M.
 - 1) Prime Coat: Exterior latex wood primer.
 - 2) Intermediate Coat: Exterior latex matching topcoat.
 - 3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - b. Latex Over Alkyd Primer System: MPI EXT 6.2A.
 - 1) Prime Coat: Exterior alkyd **OR** oil, **as directed**, wood primer.
 - 2) Intermediate Coat: Exterior latex matching topcoat.
 - 3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - c. Alkyd System: MPI EXT 6.2C.
 - 1) Prime Coat: Exterior alkyd **OR** oil, **as directed**, wood primer.
 - 2) Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - 3) Topcoat: Exterior alkyd enamel (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
15. Dimension Lumber Substrates, Traffic Surfaces: Including lumber decking **OR** stairs, **as directed**.
 - a. Latex System: MPI EXT 6.5E.
 - 1) Prime Coat: Exterior latex wood primer.
 - 2) Intermediate Coat: Interior/exterior latex floor and porch (low gloss).
 - 3) Topcoat: Interior/exterior latex floor and porch (low gloss).
 - a) With additive to increase skid resistance of painted surface.
 - b. Latex Over Alkyd Primer System: MPI EXT 6.5A.
 - 1) Prime Coat: Exterior alkyd wood primer.



- 2) Intermediate Coat: Interior/exterior latex floor and porch (low gloss).
- 3) Topcoat: Interior/exterior latex floor and porch (low gloss).
 - a) With additive to increase skid resistance of painted surface.
- c. Alkyd Floor Enamel System: MPI EXT 6.5B.
 - 1) Prime Coat: Exterior/interior alkyd floor enamel (gloss).
 - 2) Intermediate Coat: Exterior/interior alkyd floor enamel (gloss).
 - 3) Topcoat: Exterior/interior alkyd floor enamel (gloss).
 - a) With additive to increase skid resistance of painted surface.
16. Plastic Trim Fabrication Substrates:
 - a. Latex System: MPI EXT 6.8A.
 - 1) Prime Coat: Bonding primer (water based) **OR** (solvent based), **as directed**.
 - 2) Intermediate Coat: Exterior latex matching topcoat.
 - 3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - b. Alkyd System: MPI EXT 6.8B.
 - 1) Prime Coat: Bonding primer (water based) **OR** (solvent based), **as directed**.
 - 2) Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - 3) Topcoat: Exterior alkyd enamel (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
17. Stucco Substrates:
 - a. Latex System: MPI EXT 9.1A.
 - 1) Prime Coat: Exterior latex matching topcoat.
 - 2) Intermediate Coat: Exterior latex matching topcoat.
 - 3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - b. Latex Over Alkali-Resistant Primer System: MPI EXT 9.1J.
 - 1) Prime Coat: Alkali-resistant primer.
 - 2) Intermediate Coat: Exterior latex matching topcoat.
 - 3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - c. High-Build Latex System: MPI EXT 9.1H, applied to form dry film thickness of not less than 10 mils (0.25 mm).
 - 1) Prime Coat: As recommended in writing by topcoat manufacturer.
 - 2) Intermediate Coat: As recommended in writing by topcoat manufacturer.
 - 3) Topcoat: High-build latex (exterior).
18. Exterior Gypsum Board Substrates:
 - a. Latex System: MPI EXT 9.2A.
 - 1) Prime Coat: Exterior latex matching topcoat.
 - 2) Intermediate Coat: Exterior latex matching topcoat.
 - 3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.

END OF SECTION 09 91 13 00



SECTION 09 91 13 00a - WOOD STAINS AND TRANSPARENT FINISHES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for wood stains and transparent finishes. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes surface preparation and the application of wood finishes on the following substrates:
 - a. Exterior Substrates:
 - 1) Exposed glue-laminated beams and columns.
 - 2) Exposed dimension lumber (rough carpentry).
 - 3) Dressed lumber (finish carpentry).
 - 4) Exposed wood panel products.
 - 5) Wood decks and stairs.
 - 6) Wood shingles and shakes (excluding roofs).
 - b. Interior Substrates:
 - 1) Exposed glue-laminated beams and columns.
 - 2) Exposed dimension lumber (rough carpentry).
 - 3) Dressed lumber (finish carpentry).
 - 4) Exposed wood panel products.

C. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittal:
 - a. Product Data for Credit EQ 4.2: For interior primers, stains, and transparent finishes, including printed statement of VOC content.
3. Samples: For each finish and for each color and texture required.
4. Product List: Printout of MPI's current "MPI Approved Products List" for each product category specified in Part 1.2, with the product proposed for use highlighted.

D. Quality Assurance

1. MPI Standards:
 - a. Products: Complying with MPI standards indicated and listed in its "MPI Approved Products List."
 - b. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and finish systems indicated.

E. Delivery, Storage, And Handling

1. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
 - a. Maintain containers in clean condition, free of foreign materials and residue.
 - b. Remove rags and waste from storage areas daily.

F. Project Conditions

1. Apply finishes only when temperature of surfaces to be finished and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
2. Do not apply exterior finishes in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.



1.2 PRODUCTS

A. Materials, General

1. Material Compatibility:
 - a. Provide materials for use within each finish system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - b. For each coat in a finish system, provide products recommended in writing by manufacturers of topcoat for use in finish system and on substrate indicated.
2. VOC Content of Field-Applied Interior Primers, Stains, and Transparent Finishes: Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24); these requirements do not apply to primers, stains, and transparent finishes that are applied in a fabrication or finishing shop:
 - a. Flat Primers: VOC content of not more than 50 g/L.
 - b. Nonflat Primers: VOC content of not more than 150 g/L.
 - c. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
 - d. Clear Wood Finishes, Varnishes: VOC not more than 350 g/L.
 - e. Clear Wood Finishes, Lacquers: VOC not more than 550 g/L.
 - f. Floor Coatings: VOC not more than 100 g/L.
 - g. Shellacs, Clear: VOC not more than 730 g/L.
 - h. Stains: VOC not more than 250 g/L.
3. Stain Colors: As selected from manufacturer's full range **OR** Match samples **OR** As indicated in a color schedule, **as directed**.

B. Wood Fillers

1. Wood Filler Paste: MPI #91.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.

C. Primers And Sealers

1. Exterior Alkyd Wood Primer: MPI #5.
 - a. VOC Content: E Range of E2 **OR** E3, **as directed**.
2. Exterior Latex Wood Primer: MPI #6.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
3. Exterior Oil Wood Primer: MPI #7.
 - a. VOC Content: E Range of E2.
4. Wood Preservative: MPI #37.
 - a. VOC Content: E Range of E1 **OR** E3, **as directed**.
5. Alkyd Sanding Sealer: MPI #102.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
6. Lacquer Sanding Sealer: MPI #84.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
7. Shellac: MPI #88.
 - a. VOC Content: E Range of E2 **OR** E3, **as directed**.

D. Stains

1. Exterior Semitransparent Stain (Solvent Based): MPI #13.
 - a. VOC Content: E Range of E1 **OR** E2, **as directed**.
2. Exterior Solid-Color Stain (Solvent Based): MPI #14.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
3. Exterior, Solid-Color Latex Stain: MPI #16.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
4. Stain for Wood Decks: MPI #33.
 - a. VOC Content: E Range of E1 **OR** E3, **as directed**.
5. Interior Wood Stain (Semitransparent): MPI #90.



- a. VOC Content: E Range of E1 **OR** E2, **as directed**.

E. Varnishes

1. Exterior Marine Spar Varnish (Gloss): MPI #28, Gloss Level 7.
 - a. VOC Content: E Range of E1 **OR** E2, **as directed**.
2. Exterior Varnish (Gloss): MPI #29, Gloss Level 6.
 - a. VOC Content: E Range of E1.
3. Exterior Varnish (Semigloss): MPI #30, Gloss Level 5.
 - a. VOC Content: E Range of E1.
4. Interior Varnish (Flat): MPI #73, Gloss Level 1, alkyd type.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
5. Interior Varnish (Semigloss): MPI #74, Gloss Level 5, alkyd type.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
6. Interior Varnish (Gloss): MPI #75, Gloss Level 6, alkyd type.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.

F. Polyurethane Finishes

1. Two-Component Aliphatic Polyurethane (Clear): MPI #78.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
2. Interior, Oil-Modified, Clear Urethane (Satin): MPI #57, Gloss Level 4.
 - a. VOC Content: E Range of E1 **OR** E2, **as directed**.
3. Interior, Oil-Modified, Clear Urethane (Gloss): MPI #56, Gloss Level 6.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
4. Moisture-Cured Clear Polyurethane (Flat): MPI #71, Gloss Level 1.
 - a. VOC Content: E Range of E2.
5. Moisture-Cured Clear Polyurethane (Gloss): MPI #31.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.

G. Waterborne Acrylic Finishes

1. Waterborne Clear Acrylic (Satin): MPI #128, Gloss Level 4.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 1 **OR** EPR 2 **OR** EPR 3, **as directed**.
2. Waterborne Clear Acrylic (Semigloss): MPI #129, Gloss Level 5.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 1 **OR** EPR 2 **OR** EPR 3, **as directed**.
3. Waterborne Clear Acrylic (Gloss): MPI #130, Gloss Level 6.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 1 **OR** EPR 2 **OR** EPR 3, **as directed**.

H. Lacquers

1. Lacquer (Clear Flat): MPI #87, Gloss Level 1.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
2. Lacquer (Clear Satin): MPI #85, Gloss Level 4.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
3. Lacquer (Clear Gloss): MPI #86, Gloss Level 6.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.

I. Oil Finish

1. Danish Oil: MPI #92.
 - a. VOC Content: E Range of E3.

1.3 EXECUTION

A. Preparation



1. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
 2. Remove plates, machined surfaces, and similar items already in place that are not to be finished. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and finishing.
 - a. After completing finishing operations, reinstall items that were removed; use workers skilled in the trades involved. Remove surface-applied protection if any.
 3. Clean and prepare surfaces to be finished according to manufacturer's written instructions for each particular substrate condition and as specified.
 - a. Remove surface dirt, oil, or grease by washing with a detergent solution; rinse thoroughly with clean water and allow to dry. Remove grade stamps and pencil marks by sanding lightly. Remove loose wood fibers by brushing.
 - b. Remove mildew by scrubbing with a commercial wash formulated for mildew removal and as recommended by stain manufacturer.
 - c. Countersink steel nails, if used, and fill with putty tinted to final color to eliminate rust leach stains.
 4. Apply wood filler paste to open-grain woods, as defined in "MPI Architectural Painting Specification Manual," to produce smooth, glasslike finish.
- B. Application
1. Apply finishes according to manufacturer's written instructions.
 - a. Use applicators and techniques suited for finish and substrate indicated.
 - b. Finish surfaces behind movable equipment and furniture same as similar exposed surfaces.
 2. Apply finishes to produce surface films without cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other surface imperfections.
- C. Field Quality Control
1. the Owner reserves the right to invoke the following procedure at any time and as often as the Owner deems necessary during the period when finishes are being applied:
 - a. the Owner will engage the services of a qualified testing agency to sample finish materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
 - b. Testing agency will perform tests for compliance with product requirements.
 - c. the Owner may direct Contractor to stop applying finishes if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying materials from Project site, pay for testing, and refinish surfaces finished with rejected materials. Contractor will be required to remove rejected materials from previously finished surfaces if, on refinishing with complying materials, the two finishes are incompatible.
- D. Cleaning And Protection
1. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
 2. After completing finish application, clean spattered surfaces. Remove spattered materials by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
 3. Protect work of other trades against damage from finish application. Correct damage by cleaning, repairing, replacing, and refinishing, as approved by the Owner, and leave in an undamaged condition.
 4. At completion of construction activities of other trades, touch up and restore damaged or defaced finished wood surfaces.
- E. Exterior Wood-Finish-System Schedule
1. Exposed Glue-Laminated Beam and Column Substrates:
 - a. Solid-Color, Solvent-Based Stain System: MPI EXT 6.1C.



- 1) Prime Coat: Exterior alkyd **OR** oil, **as directed**, wood primer.
- 2) Two Stain Coats: Exterior solid-color stain (solvent based).
- b. Varnish Over Semitransparent Stain System: MPI EXT 6.1D.
 - 1) Stain Coat: Exterior semitransparent stain (solvent based).
 - 2) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Exterior marine spar varnish (gloss) **OR** varnish (gloss) **OR** varnish (semigloss), **as directed**.
- c. Varnish System: MPI EXT 6.1K.
 - 1) Four (for a Premium Grade system) **OR** Three, **as directed**, Finish Coats: Exterior marine spar varnish (gloss) **OR** varnish (gloss) **OR** varnish (semigloss), **as directed**.
- d. Clear, Two-Component Polyurethane Over Stain System: MPI EXT 6.1E.
 - 1) Stain Coat: Exterior semitransparent stain (solvent based).
 - 2) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Two-component aliphatic polyurethane (clear).
- e. Clear, Two-Component Polyurethane System: MPI EXT 6.1H.
 - 1) Three Finish Coats: Two-component aliphatic polyurethane (clear).
2. Exposed Rough Carpentry Substrates:
 - a. Solid-Color Latex Stain System: MPI EXT 6.2B.
 - 1) Prime Coat: Exterior alkyd **OR** oil, **as directed**, wood primer.
 - 2) Two Stain Coats (for a Premium Grade system) **OR** One Stain Coat, **as directed**: Exterior, solid-color latex stain.
 - b. Solid-Color, Solvent-Based Stain System: MPI EXT 6.2D.
 - 1) Prime Coat: Exterior alkyd **OR** oil, **as directed**, wood primer.
 - c. Two Stain Coats (for a Premium Grade system) One Stain Coat, **as directed**: Exterior solid-color stain (solvent based).
 - d. Semitransparent Stain System: MPI EXT 6.2L.
 - 1) Two Stain Coats: Exterior semitransparent stain (solvent based).
 - e. Varnish Over Semitransparent Stain System: MPI EXT 6.2E.
 - 1) Stain Coat: Exterior semitransparent stain (solvent based).
 - 2) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Exterior marine spar varnish (gloss) **OR** varnish (gloss) **OR** varnish (semigloss), **as directed**.
 - f. Varnish System: MPI EXT 6.2K.
 - 1) Four (for a Premium Grade system) **OR** Three, **as directed**, Finish Coats: Exterior varnish (marine spar, high gloss) **OR** (gloss) **OR** (semigloss), **as directed**.
 - g. Clear, Two-Component Polyurethane System: MPI EXT 6.2H.
 - 1) Three Finish Coats: Two-component aliphatic polyurethane (clear).
3. Finish Carpentry Substrates:
 - a. Solid-Color Latex Stain System: MPI EXT 6.3K.
 - 1) Prime Coat: Exterior alkyd **OR** oil, **as directed**, wood primer.
 - 2) Two Stain Coats (for a Premium Grade system) **OR** One Stain Coat, **as directed**: Exterior, solid-color latex stain.
 - b. Solid-Color, Solvent-Based Stain System: MPI EXT 6.3C.
 - 1) Prime Coat: Exterior alkyd **OR** oil, **as directed**, wood primer.
 - 2) Two Stain Coats (for a Premium Grade system) **OR** One Stain Coat, **as directed**: Exterior solid-color stain (solvent based).
 - c. Semitransparent Stain System: MPI EXT 6.3D.
 - 1) Two Stain Coats: Exterior semitransparent stain (solvent based).
 - d. Varnish Over Semitransparent Stain System: MPI EXT 6.3E.
 - 1) Stain Coat: Exterior semitransparent stain (solvent based).
 - 2) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Exterior varnish (marine spar, high gloss) **OR** (gloss) **OR** (semigloss), **as directed**.
 - e. Varnish System: MPI EXT 6.3F.
 - 1) Four (for a Premium Grade system) **OR** Three, **as directed**, Finish Coats: Exterior varnish (marine spar, high gloss) **OR** (gloss) **OR** (semigloss), **as directed**.
 - f. Clear, Two-Component Polyurethane System: MPI EXT 6.3G.
 - 1) Three Finish Coats: Two-component aliphatic polyurethane (clear).



- F. Exposed Wood Panel-Product Substrates:
- a. Solid-Color Latex Stain System: MPI EXT 6.4A.
 - 1) Prime Coat: Exterior alkyd **OR** latex **OR** oil, **as directed**, wood primer.
 - 2) Two Stain Coats (for a Premium Grade system) **OR** One Stain Coat, **as directed**: Exterior, solid-color latex stain.
 - b. Solid-Color, Solvent-Based Stain System: MPI EXT 6.4C.
 - 1) Prime Coat (for a Premium Grade system): Exterior alkyd **OR** oil, **as directed**, wood primer.
 - 2) Two Stain Coats: Exterior solid-color stain (solvent based).
 - c. Semitransparent Stain System: MPI EXT 6.4D.
 - 1) Two Stain Coats: Exterior semitransparent stain (solvent based).
 - d. Varnish Over Semitransparent Stain System: MPI EXT 6.4J.
 - 1) Stain Coat: Exterior semitransparent stain (solvent based).
 - 2) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Exterior varnish (marine spar, high gloss) **OR** (gloss) **OR** (semigloss), **as directed**.
 - e. Varnish System: MPI EXT 6.4H.
 - 1) Four (for a Premium Grade system) **OR** Three, **as directed**, Finish Coats: Exterior varnish (marine spar, high gloss) **OR** (gloss) **OR** (semigloss), **as directed**.
2. Wood Deck and Stair Substrates:
- a. MPI EXT 6.5D.
 - 1) Preservative Coat: Wood preservative.
 - 2) Two Stain Coats (for a Premium Grade system) **OR** One Stain Coat, **as directed**: Stain for wood decks.
 - b. MPI EXT 6.5F.
 - 1) Two Stain Coats: Stain for wood decks.
3. Wood Shingle and Shake Substrates (Excluding Roofs):
- a. Solid-Color Latex Stain System: MPI EXT 6.6D.
 - 1) Prime Coat: Exterior alkyd **OR** oil, **as directed**, wood primer.
 - 2) Two Stain Coats (for a Premium Grade system) **OR** One Stain Coat, **as directed**: Exterior, solid-color latex stain.
 - b. Solid-Color, Solvent-Based Stain System: MPI EXT 6.6C.
 - 1) Prime Coat: Exterior alkyd **OR** oil, **as directed**, wood primer.
 - 2) Two Stain Coats (for a Premium Grade system) **OR** One Stain Coat, **as directed**: Exterior solid-color stain (solvent based).
 - c. Semitransparent Stain System: MPI EXT 6.6F.
 - 1) Two Stain Coats: Exterior semitransparent stain (solvent based).
- G. Interior Wood-Finish-System Schedule
1. Exposed Glue-Laminated Beam and Column Substrates:
 - a. Alkyd Varnish Over Stain System: MPI INT 6.1K.
 - 1) Stain Coat: Interior wood stain (semitransparent).
 - 2) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Interior varnish (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - b. Alkyd Varnish Over Stain and Sealer System: MPI INT 6.1P.
 - 1) Stain Coat: Interior wood stain (semitransparent).
 - 2) Seal Coat: Alkyd sanding sealer.
 - 3) Two Finish Coats (for a Premium Grade system) **OR** One Finish Coat, **as directed**: Interior varnish (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - c. Alkyd Varnish Over Sealer System: MPI INT 6.1C.
 - 1) Seal Coat: Alkyd sanding sealer.
 - 2) Two Finish Coats: Interior varnish (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - d. Polyurethane Varnish Over Stain System: MPI INT 6.1J.
 - 1) Stain Coat: Interior wood stain (semitransparent).
 - 2) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Interior, oil-modified, clear urethane (satin) **OR** (gloss), **as directed**.



- e. Polyurethane Varnish System: MPI INT 6.1D.
 - 1) One Factory-Applied Finish Coat: Matching field-applied finish coats.
 - 2) Two Field-Applied Finish Coats: Interior, oil-modified, clear urethane (satin) **OR** (gloss), **as directed**.
- f. Moisture-Cured Clear Polyurethane Over Stain System: MPI INT 6.1S.
 - 1) Stain Coat: Interior wood stain (semitransparent).
 - 2) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Moisture-cured clear polyurethane (flat) **OR** (gloss), **as directed**.
- g. Waterborne Clear Acrylic Over Stain System: MPI INT 6.1R.
 - 1) Stain Coat: Interior wood stain (semitransparent).
 - 2) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Waterborne clear acrylic (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
- h. Waterborne Clear Acrylic System: MPI INT 6.F.
 - 1) Three Finish Coats: Waterborne clear acrylic (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
- i. Solid-Color Latex Stain System: MPI INT 6.1T.
 - 1) Prime Coat: Exterior alkyd **OR** oil, **as directed**, wood primer.
 - 2) Two Stain Coats (for a Premium Grade system) **OR** One Stain Coat, **as directed**: Exterior, solid-color latex stain.
- j. Solid-Color, Solvent-Based Stain System: MPI INT 6.1H.
 - 1) Two Stain Coats: Exterior solid-color stain (solvent based).
- k. Semitransparent Stain System: MPI INT 6.1G.
 - 1) Two Stain Coats: Exterior semitransparent stain (solvent based).
- 2. Exposed Rough Carpentry Substrates:
 - a. Alkyd Varnish Over Stain and Sealer System: MPI INT 6.2K.
 - 1) Stain Coat: Interior wood stain (semitransparent).
 - 2) Seal Coat: Alkyd sanding sealer.
 - 3) Two Finish Coats (for a Premium Grade system) **OR** One Finish Coat, **as directed**: Interior varnish (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - b. Alkyd Varnish Over Sealer System: MPI INT 6.2P.
 - 1) Seal Coat: Alkyd sanding sealer.
 - 2) Two Finish Coats (for a Premium Grade system) **OR** One Finish Coat, **as directed**: Interior varnish (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - c. Polyurethane Varnish Over Stain System: MPI INT 6.2J.
 - 1) Stain Coat: Interior wood stain (semitransparent).
 - 2) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Interior, oil-modified, clear urethane (satin) **OR** (gloss), **as directed**.
 - d. Polyurethane Varnish System: MPI INT 6.2H.
 - 1) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Interior, oil-modified, clear urethane (satin) **OR** (gloss), **as directed**.
 - e. Moisture-Cured Clear Polyurethane Over Stain System: MPI INT 6.2N.
 - 1) Stain Coat: Interior wood stain (semitransparent).
 - 2) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Moisture-cured clear polyurethane (flat) **OR** (gloss), **as directed**.
 - f. Waterborne Clear Acrylic Over Stain System: MPI INT 6.2M.
 - 1) Stain Coat: Interior wood stain (semitransparent).
 - 2) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Waterborne clear acrylic (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
- 3. Finish Carpentry Substrates:
 - a. Alkyd Varnish Over Stain and Sealer System: MPI INT 6.3D.
 - 1) Stain Coat: Interior wood stain (semitransparent).
 - 2) Seal Coat: Alkyd sanding sealer **OR** Shellac, **as directed**.
 - 3) Two Finish Coats (for a Premium Grade system) **OR** One Finish Coat, **as directed**: Interior varnish (semigloss) **OR** (gloss), **as directed**.
 - b. Alkyd Varnish Over Sealer System: MPI INT 6.3J.
 - 1) Seal Coat: Alkyd sanding sealer **OR** Shellac, **as directed**.



- 2) Two Finish Coats (for a Premium Grade system) **OR** One Finish Coat, **as directed**: Interior varnish (semigloss) **OR** (gloss), **as directed**.
- c. Polyurethane Varnish Over Stain System: MPI INT 6.3E.
 - 1) Stain Coat: Interior wood stain (semitransparent).
 - 2) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Interior, oil-modified, clear urethane (satin) **OR** (gloss), **as directed**.
- d. Polyurethane Varnish System: MPI INT 6.3K.
 - 1) One Factory-Applied Finish Coat: Matching field-applied finish coats.
 - 2) Two Field-Applied Finish Coats: Interior, oil-modified, clear urethane (satin) **OR** (gloss), **as directed**.
- e. Moisture-Cured Clear Polyurethane Over Stain System: MPI INT 6.3Y.
 - 1) Stain Coat: Interior wood stain (semitransparent).
 - 2) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Moisture-cured clear polyurethane (flat) **OR** (gloss), **as directed**.
- f. Moisture-Cured Clear Polyurethane System: MPI INT 6.3X.
 - 1) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Moisture-cured clear polyurethane (flat) **OR** (gloss), **as directed**.
- g. Clear, Two-Component Polyurethane System: MPI INT 6.3Z.
 - 1) Three (for a Premium Grade system) Two, **as directed**, Finish Coats: Two-component aliphatic polyurethane (clear).
- h. Waterborne Clear Acrylic Over Stain System: MPI INT 6.3W.
 - 1) Stain Coat: Interior wood stain (semitransparent).
 - 2) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Waterborne clear acrylic (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
- i. Waterborne Clear Acrylic System: MPI INT 6.3Q.
 - 1) Three Finish Coats: Waterborne clear acrylic (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
- j. Lacquer Over Stain and Sealer System: MPI INT 6.3F.
 - 1) Stain Coat: Interior wood stain (semitransparent).
 - 2) Seal Coat: Lacquer sanding sealer.
 - 3) Two Finish Coats (for a Premium Grade system) **OR** One Finish Coat, **as directed**: Lacquer (clear flat **OR** satin **OR** gloss, **as directed**).
- k. Lacquer Over Sealer System: MPI INT 6.3H.
 - 1) Seal Coat: Lacquer sanding sealer.
 - 2) Two Finish Coats (for a Premium Grade system) **OR** One Finish Coat, **as directed**: Lacquer (clear flat **OR** satin **OR** gloss, **as directed**).
- l. Semitransparent Stain System: MPI INT 6.3C.
 - 1) Two Stain Coats: Exterior semitransparent stain (solvent based).
- m. Danish Oil System: MPI INT 6.3M.
 - 1) Two Finish Coats: Danish oil.
4. Exposed Wood Panel-Product Substrates:
 - a. Alkyd Varnish Over Sealer and Stain System: MPI INT 6.4D.
 - 1) Stain Coat: Interior wood stain (semitransparent).
 - 2) Seal Coat: Alkyd sanding sealer **OR** Shellac, **as directed**.
 - 3) Two Finish Coats (for a Premium Grade system) **OR** One Finish Coat, **as directed**: Interior varnish (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - b. Alkyd Varnish Over Sealer System: MPI INT 6.4G.
 - 1) Seal Coat: Alkyd sanding sealer **OR** Shellac, **as directed**.
 - 2) Two Finish Coats (for a Premium Grade system) **OR** One Finish Coat, **as directed**: Interior varnish (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - c. Polyurethane Varnish Over Stain System: MPI INT 6.4E.
 - 1) Stain Coat: Interior wood stain (semitransparent).
 - 2) Three (for a Premium Grade system) **OR** Two, **as directed**, Finish Coats: Interior, oil-modified, clear urethane (satin) **OR** (gloss), **as directed**.
 - d. Polyurethane Varnish System: MPI INT 6.4.J.



- 1) One Factory-Applied Finish Coat: Matching field-applied finish coats.
- 2) Two Field-Applied Finish Coats: Interior, oil-modified, clear urethane (satin) **OR** (gloss), **as directed**.
- e. Moisture-Cured Clear Polyurethane Over Stain System: MPI INT 6.4V.
 - 1) Stain Coat: Interior wood stain (semitransparent).
 - 2) Three (for a Premium Grade system) Two, **as directed**, Finish Coats: Moisture-cured clear polyurethane (flat) **OR** (gloss), **as directed**.
- f. Waterborne Clear Acrylic Over Stain System: MPI INT 6.4U.
 - 1) Stain Coat: Interior wood stain (semitransparent).
 - 2) Three (for a Premium Grade system) Two, **as directed**, Finish Coats: Waterborne clear acrylic (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
- g. Lacquer Over Stain and Sealer System: MPI INT 6.4F.
 - 1) Stain Coat: Interior wood stain (semitransparent).
 - 2) Seal Coat: Lacquer sanding sealer.
 - 3) Two Finish Coats (for a Premium Grade system) **OR** One Finish Coat, **as directed**: Lacquer (clear flat **OR** satin **OR** gloss, **as directed**).
- h. Lacquer Over Sealer System: MPI INT 6.4Y.
 - 1) Seal Coat: Lacquer sanding sealer.
 - 2) Three (for a Premium Grade system) Two, **as directed**, Finish Coats: Lacquer (clear flat **OR** satin **OR** gloss, **as directed**).
- i. Semitransparent Stain System: MPI INT 6.4C.
 - 1) Two Stain Coats: Exterior semitransparent stain (solvent based).
- j. Danish Oil System: MPI INT 6.4K.
 - 1) Two Finish Coats: Danish oil.

END OF SECTION 09 91 13 00a



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SECTION 09 91 13 00b - HIGH-TEMPERATURE-RESISTANT COATINGS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for high-temperature-resistant coatings. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes surface preparation and application of high-temperature-resistant coating systems on steel substrates subject to high temperatures.

C. Submittals

1. Product Data: For each type of product indicated.
2. Samples: For each coating and for each color and texture required.
3. LEED Submittal:
 - a. Product Data for Credit EQ 4.2: For coatings, including printed statement of VOC content and chemical components.

D. Quality Assurance

1. Master Painters Institute (MPI) Standards:
 - a. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List" **OR** "MPI Maintenance Repainting Manual," **as directed**.
 - b. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" **OR** "MPI Maintenance Repainting Manual," **as directed**, for products and coating systems indicated.

E. Delivery, Storage, And Handling

1. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
 - a. Maintain containers in clean condition, free of foreign materials and residue.
 - b. Remove rags and waste from storage areas daily.

F. Project Conditions

1. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 50 and 104 deg F (10 and 40 deg C).
2. Do not apply coatings in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1.2 PRODUCTS

A. High-Temperature-Resistant Coatings

1. VOC Content of Interior Paints and Coatings: Provide products that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24) :
 - a. Flat Paints, Coatings, and Primers: VOC content of not more than 50 g/L.
 - b. Nonflat Paints, Coatings, and Primers: VOC content of not more than 150 g/L.
 - c. Anticorrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC content of not more than 250 g/L.
 - d. Flat Interior Topcoat Paints: VOC content of not more than 50 g/L.
 - e. Nonflat Interior Topcoat Paints: VOC content of not more than 150 g/L.



- f. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
 - g. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
 - h. Zinc-Rich Industrial Maintenance Primers: VOC content of not more than 340 g/L.
2. Chemical Components of Interior Paints and Coatings: Provide topcoat paints and anti-corrosive and anti-rust paints applied to ferrous metals that comply with the following chemical restrictions; these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:
- a. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing 1 or more benzene rings).
 - b. Restricted Components: Paints and coatings shall not contain any of the following:
 - 1) Acrolein.
 - 2) Acrylonitrile.
 - 3) Antimony.
 - 4) Benzene.
 - 5) Butyl benzyl phthalate.
 - 6) Cadmium.
 - 7) Di (2-ethylhexyl) phthalate.
 - 8) Di-n-butyl phthalate.
 - 9) Di-n-octyl phthalate.
 - 10) 1,2-dichlorobenzene.
 - 11) Diethyl phthalate.
 - 12) Dimethyl phthalate.
 - 13) Ethylbenzene.
 - 14) Formaldehyde.
 - 15) Hexavalent chromium.
 - 16) Isophorone.
 - 17) Lead.
 - 18) Mercury.
 - 19) Methyl ethyl ketone.
 - 20) Methyl isobutyl ketone.
 - 21) Methylene chloride.
 - 22) Naphthalene.
 - 23) Toluene (methylbenzene).
 - 24) 1,1,1-trichloroethane.
 - 25) Vinyl chloride.
3. Colors: As selected from manufacturer's full range **OR** Match samples, **as directed**.
4. Primer: Undercoating recommended in writing for use in coating system by manufacturer of high-temperature-resistant coating under conditions indicated.
5. Heat-Resistant Enamel (Gloss): MPI #21.
- a. VOC Content: Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.
6. Inorganic Zinc Primer: MPI #19.
- a. VOC Content: Minimum E Range of 0 **OR** E1 **OR** E2 **OR** E3, **as directed**.
7. Aluminum Heat-Resistant Enamel: MPI #2.
- a. VOC Content: Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.
8. High-Heat-Resistant Coating: MPI #22.
- a. VOC Content: Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.

1.3 EXECUTION

A. Preparation



1. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" **OR** "MPI Maintenance Repainting Manual," **as directed**, applicable to substrates indicated.
 2. Remove plates, machined surfaces, and similar items already in place that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.
 - a. After completing coating operations, reinstall items that were removed; use workers skilled in the trades involved.
 3. Clean steel substrates of substances that could impair bond of coatings, including dirt, oil, grease, and incompatible paints and encapsulants.
 - a. Remove incompatible primers as required to produce coating systems indicated.
- B. Application
1. Apply high-temperature-resistant coating systems according to manufacturer's written instructions.
 - a. Use applicators and techniques suited for coating and substrate indicated.
 - b. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
 - c. Coat back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
- C. Field Quality Control
1. Contractor shall invoke the following procedure at any time and as often as necessary during the period when coatings are being applied:
 - a. Engage the services of a qualified testing agency to sample coating material being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
 - b. Testing agency will perform tests for compliance with specified requirements.
 - c. the Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with specified requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, the two coatings are incompatible.
- D. Cleaning And Protection
1. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
 2. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
 3. Protect work of other trades against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by the Owner, and leave in an undamaged condition.
 4. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.
- E. High-Temperature-Resistant Coating Schedule
1. Heat-Resistant Enamel (Gloss) Coating System (System below corresponds with MPI EXT 5.2A and MPI INT 5.2A coating systems) {suitable for use on surfaces that reach a maximum temperature of 400 deg F (205 deg C)}:
 - a. Surface Preparation: Clean using methods recommended in writing by finish-coat manufacturer, but not less than blast cleaning according to SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning **OR** SSPC-SP 10/NACE No. 2, "Near-White Blast Cleaning **OR** SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning," **as directed**.
 - b. Prime Coat: Primer.



- c. Finish Coat(s): Heat-resistant enamel (gloss), MPI #21, in number of coats recommended in writing by manufacturer for conditions indicated.
 2. Inorganic Zinc Primer Coating System (System below corresponds with MPI EXT 5.2C and MPI INT 5.2C coating systems) {suitable for use on surfaces that reach a maximum temperature of 750 deg F (400 deg C)}:
 - a. Surface Preparation: Clean using methods recommended in writing by finish-coat manufacturer, but not less than blast cleaning according to SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning **OR** SSPC-SP 10/NACE No. 2, "Near-White Blast Cleaning **OR** SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning," **as directed**.
 - b. Prime Coat: Primer.
 - c. Finish Coat(s): Inorganic zinc primer, MPI #19, in number of coats recommended in writing by manufacturer for conditions indicated.
 3. Aluminum Heat-Resistant Enamel Coating System (System below corresponds with MPI EXT 5.2B and MPI INT 5.2B coating systems) {suitable for use on surfaces that reach a maximum temperature of 800 deg F (427 deg C)}:
 - a. Surface Preparation: Clean using methods recommended in writing by finish-coat manufacturer, but not less than blast cleaning according to SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning **OR** SSPC-SP 10/NACE No. 2, "Near-White Blast Cleaning **OR** SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning," **as directed**.
 - b. Prime Coat: Primer.
 - c. Finish Coat(s): Aluminum heat-resistant enamel, MPI #2, in number of coats recommended in writing by manufacturer for conditions indicated.
 4. High-Heat-Resistant Coating System (System below corresponds with MPI EXT 5.2D and MPI INT 5.2D coating systems) {suitable for use on surfaces that reach a maximum temperature of 1100 deg F (593 deg C)}:
 - a. Surface Preparation: Clean using methods recommended in writing by finish-coat manufacturer, but not less than blast cleaning according to SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning **OR** SSPC-SP 10/NACE No. 2, "Near-White Blast Cleaning **OR** SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning," **as directed**.
 - b. Prime Coat: Primer.
 - c. Finish Coat(s): High-heat-resistant coating, MPI #22, in number of coats recommended in writing by manufacturer for conditions indicated.

END OF SECTION 09 91 13 00b



Task	Specification	Specification Description
09 91 13 00	01 22 16 00	No Specification Required



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SECTION 09 91 23 00 - INTERIOR PAINTING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for interior painting. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes surface preparation and the application of paint systems on the following interior substrates:
 - a. Concrete.
 - b. Clay masonry.
 - c. Concrete masonry units (CMU).
 - d. Steel.
 - e. Galvanized metal.
 - f. Aluminum (not anodized or otherwise coated).
 - g. Wood.
 - h. Gypsum board.
 - i. Plaster.
 - j. Spray-textured ceilings.
 - k. Cotton or canvas insulation covering.

C. Submittals

1. Product Data: For each type of product indicated.
2. Samples: For each finish and for each color and texture required.
3. Product List: Printout of current "MPI Approved Products List" for each product category specified in Part 1.2, with the proposed product highlighted.
4. LEED Submittal:
 - a. Product Data for Credit EQ 4.2: For paints, including printed statement of VOC content and chemical components.

D. Quality Assurance

1. MPI Standards:
 - a. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
 - b. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.
2. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - a. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
 - 1) Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
 - 2) Other Items: Architect will designate items or areas required.
 - b. Final approval of color selections will be based on mockups.
 - 1) If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 - c. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.



- d. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. Delivery, Storage, And Handling

1. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
 - a. Maintain containers in clean condition, free of foreign materials and residue.
 - b. Remove rags and waste from storage areas daily.

F. Project Conditions

1. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
2. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1.2 PRODUCTS

A. Paint, General

1. Material Compatibility:
 - a. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - b. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
2. VOC Content of Field-Applied Interior Paints and Coatings: Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24); these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:
 - a. Flat Paints, Coatings, and Primers: VOC content of not more than 50 g/L.
 - b. Nonflat Paints, Coatings, and Primers: VOC content of not more than 150 g/L.
 - c. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
 - d. Floor Coatings: VOC not more than 100 g/L.
 - e. Shellacs, Clear: VOC not more than 730 g/L.
 - f. Shellacs, Pigmented: VOC not more than 550 g/L.
 - g. Flat Topcoat Paints: VOC content of not more than 50 g/L.
 - h. Nonflat Topcoat Paints: VOC content of not more than 150 g/L.
 - i. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
 - j. Floor Coatings: VOC not more than 100 g/L.
 - k. Shellacs, Clear: VOC not more than 730 g/L.
 - l. Shellacs, Pigmented: VOC not more than 550 g/L.
 - m. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
 - n. Dry-Fog Coatings: VOC content of not more than 400 g/L.
 - o. Zinc-Rich Industrial Maintenance Primers: VOC content of not more than 340 g/L.
 - p. Pre-Treatment Wash Primers: VOC content of not more than 420 g/L.
3. Chemical Components of Field-Applied Interior Paints and Coatings: Provide topcoat paints and anti-corrosive and anti-rust paints applied to ferrous metals that comply with the following chemical restrictions; these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:
 - a. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
 - b. Restricted Components: Paints and coatings shall not contain any of the following:



- 1) Acrolein.
 - 2) Acrylonitrile.
 - 3) Antimony.
 - 4) Benzene.
 - 5) Butyl benzyl phthalate.
 - 6) Cadmium.
 - 7) Di (2-ethylhexyl) phthalate.
 - 8) Di-n-butyl phthalate.
 - 9) Di-n-octyl phthalate.
 - 10) 1,2-dichlorobenzene.
 - 11) Diethyl phthalate.
 - 12) Dimethyl phthalate.
 - 13) Ethylbenzene.
 - 14) Formaldehyde.
 - 15) Hexavalent chromium.
 - 16) Isophorone.
 - 17) Lead.
 - 18) Mercury.
 - 19) Methyl ethyl ketone.
 - 20) Methyl isobutyl ketone.
 - 21) Methylene chloride.
 - 22) Naphthalene.
 - 23) Toluene (methylbenzene).
 - 24) 1,1,1-trichloroethane.
 - 25) Vinyl chloride.
4. Colors: As selected from manufacturer's full range **OR** Match samples **OR** As indicated in a color schedule, **as directed**.
- B. Block Fillers
1. Interior/Exterior Latex Block Filler: MPI #4.
 - a. VOC Content: E Range of E2 **OR** E3, **as directed**.
- C. Primers/Sealers
1. Interior Latex Primer/Sealer: MPI #50.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 1 **OR** EPR 2 **OR** EPR 3, **as directed**.
 2. Interior Alkyd Primer/Sealer: MPI #45.
 - a. VOC Content: E Range of E1 **OR** E2, **as directed**.
 3. Wood-Knot Sealer: Sealer recommended in writing by topcoat manufacturer for use in paint systems indicated.
- D. Metal Primers
1. Alkyd Anticorrosive Metal Primer: MPI #79.
 - a. VOC Content: E Range of E1 **OR** E2, **as directed**.
 2. Quick-Drying Alkyd Metal Primer: MPI #76.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 3. Rust-Inhibitive Primer (Water Based): MPI #107.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 1 **OR** EPR 2 **OR** EPR 3, **as directed**.
 4. Cementitious Galvanized-Metal Primer: MPI #26.
 - a. VOC Content: E Range of E1.
 5. Waterborne Galvanized-Metal Primer: MPI #134.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 1 **OR** EPR 2 **OR** EPR 3, **as directed**.
 6. Vinyl Wash Primer: MPI #80.
 - a. VOC Content: E Range of E2 **OR** E3, **as directed**.



7. Quick-Drying Primer for Aluminum: MPI #95.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.

E. Wood Primers

1. Interior Latex-Based Wood Primer: MPI #39.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 1 **OR** EPR 2 **OR** EPR 3, **as directed**.

F. Latex Paints

1. Interior Latex (Flat): MPI #53 (Gloss Level 1).
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 0.5 **OR** EPR 1.5 **OR** EPR 2.5, **as directed**.
2. Interior Latex (Low Sheen): MPI #44 (Gloss Level 2).
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 1 **OR** EPR 2 **OR** EPR 3, **as directed**.
3. Interior Latex (Eggshell): MPI #52 (Gloss Level 3).
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 1 **OR** EPR 2 **OR** EPR 3, **as directed**.
4. Interior Latex (Satin): MPI #43 (Gloss Level 4).
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 1.5 **OR** EPR 2 **OR** EPR 2.5 **OR** EPR 3.5, **as directed**.
5. Interior Latex (Semigloss): MPI #54 (Gloss Level 5).
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 2 **OR** EPR 3 **OR** EPR 4, **as directed**.
6. Interior Latex (Gloss): MPI #114 (Gloss Level 6, except minimum gloss of 65 units at 60 deg).
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 2 **OR** EPR 3 **OR** EPR 4, **as directed**.
7. Institutional Low-Odor/VOC Latex (Flat): MPI #143 (Gloss Level 1).
 - a. VOC Content: E Range of E3.
 - b. Environmental Performance Rating: EPR 4 **OR** EPR 5.5, **as directed**.
8. Institutional Low-Odor/VOC Latex (Low Sheen): MPI #144 (Gloss Level 2).
 - a. VOC Content: E Range of E3.
 - b. Environmental Performance Rating: EPR 4.5.
9. Institutional Low-Odor/VOC Latex (Eggshell): MPI #145 (Gloss Level 3).
 - a. VOC Content: E Range of E3.
 - b. Environmental Performance Rating: EPR 4.5.
10. Institutional Low-Odor/VOC Latex (Semigloss): MPI #147 (Gloss Level 5).
 - a. VOC Content: E Range of E3.
 - b. Environmental Performance Rating: EPR 3 **OR** EPR 5.5, **as directed**.
11. High-Performance Architectural Latex (Low Sheen): MPI #138 (Gloss Level 2).
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 4 **OR** EPR 5 **OR** EPR 6, **as directed**.
12. High-Performance Architectural Latex (Eggshell): MPI #139 (Gloss Level 3).
 - a. VOC Content: E Range of E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 5 **OR** EPR 6, **as directed**.
13. High-Performance Architectural Latex (Satin): MPI #140 (Gloss Level 4).
 - a. VOC Content: E Range of E1 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 4.5 **OR** EPR 6.5, **as directed**.
14. High-Performance Architectural Latex (Semigloss): MPI #141 (Gloss Level 5).
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 5 **OR** EPR 6 **OR** EPR 7, **as directed**.
15. Exterior Latex (Flat): MPI #10 (Gloss Level 1).
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
16. Exterior Latex (Semigloss): MPI #11 (Gloss Level 5).



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- a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 17. Exterior Latex (Gloss): MPI #119 (Gloss Level 6, except minimum gloss of 65 units at 60 deg).
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
- G. Alkyd Paints
1. Interior Alkyd (Flat): MPI #49 (Gloss Level 1).
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 2. Interior Alkyd (Eggshell): MPI #51 (Gloss Level 3).
 - a. VOC Content: E Range of E1 **OR** E2, **as directed**.
 3. Interior Alkyd (Semigloss): MPI #47 (Gloss Level 5).
 - a. VOC Content: E Range of E1 **OR** E2, **as directed**.
 - b. Environmental Performance Rating: EPR 1 **OR** EPR 2 **OR** EPR 3, **as directed**.
 4. Interior Alkyd (Gloss): MPI #48 (Gloss Level 6).
 - a. VOC Content: E Range of E1 **OR** E2, **as directed**.
- H. Quick-Drying Enamels
1. Quick-Drying Enamel (Semigloss): MPI #81 (Gloss Level 5).
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 2. Quick-Drying Enamel (High Gloss): MPI #96 (Gloss Level 7).
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
- I. Textured Coating
1. Latex Stucco and Masonry Textured Coating: MPI #42.
 - a. VOC Content: E Range of E2 **OR** E3, **as directed**.
- J. Dry Fog/Fall Coatings
1. Latex Dry Fog/Fall: MPI #118.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 1 **OR** EPR 2 **OR** EPR 3, **as directed**.
 2. Waterborne Dry Fall: MPI #133.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 1 **OR** EPR 2 **OR** EPR 3, **as directed**.
 3. Interior Alkyd Dry Fog/Fall: MPI #55.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
- K. Aluminum Paint
1. Aluminum Paint: MPI #1.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
- L. Floor Coatings
1. Interior Concrete Floor Stain: MPI #58.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 2.
 2. Interior/Exterior Clear Concrete Floor Sealer (Water Based): MPI #99.
 - a. VOC Content: E Range of E1 **OR** E2 **OR** E3, **as directed**.
 3. Interior/Exterior Clear Concrete Floor Sealer (Solvent Based): MPI #104.
 - a. VOC Content: E Range of E1 **OR** E2, **as directed**.
 4. Interior/Exterior Latex Floor and Porch Paint (Low Gloss): MPI #60 (maximum Gloss Level 3).
 - a. VOC Content: E Range of E2 **OR** E3, **as directed**.
 - b. Environmental Performance Rating: EPR 3.
 5. Exterior/Interior Alkyd Floor Enamel (Gloss): MPI #27 (Gloss Level 6).
 - a. VOC Content: E Range of E1 **OR** E2, **as directed**.
 - b. Additives: Manufacturer's standard additive to increase skid resistance of painted surface.



1.3 EXECUTION

A. Preparation

1. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
2. Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - a. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
 - b. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
3. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
 - a. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.
4. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
5. Clay Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content of surfaces or alkalinity of mortar joints to be painted exceed that permitted in manufacturer's written instructions.
6. Concrete Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
7. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.
8. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
9. Aluminum Substrates: Remove surface oxidation.
10. Wood Substrates:
 - a. Scrape and clean knots, and apply coat of knot sealer before applying primer.
 - b. Sand surfaces that will be exposed to view, and dust off.
 - c. Prime edges, ends, faces, undersides, and backsides of wood.
 - d. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
11. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.
12. Plaster Substrates: Do not begin paint application until plaster is fully cured and dry.
13. Spray-Textured Ceiling Substrates: Do not begin paint application until surfaces are dry.
14. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

B. Application

1. Apply paints according to manufacturer's written instructions.
 - a. Use applicators and techniques suited for paint and substrate indicated.
 - b. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - c. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
2. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.



3. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
 4. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
 5. Painting Mechanical and Electrical Work: Paint items exposed in equipment rooms and occupied spaces including, but not limited to, the following:
 - a. Mechanical Work:
 - 1) Uninsulated metal piping.
 - 2) Uninsulated plastic piping.
 - 3) Pipe hangers and supports.
 - 4) Tanks that do not have factory-applied final finishes.
 - 5) Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
 - 6) Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - 7) Mechanical equipment that is indicated to have a factory-primed finish for field painting.
 - b. Electrical Work:
 - 1) Switchgear.
 - 2) Panelboards.
 - 3) Electrical equipment that is indicated to have a factory-primed finish for field painting.
- C. Field Quality Control
1. Testing of Paint Materials: the Owner reserves the right to invoke the following procedure at any time and as often as the Owner deems necessary during the period when paints are being applied:
 - a. the Owner will engage the services of a qualified testing agency to sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
 - b. Testing agency will perform tests for compliance with product requirements.
 - c. the Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying-paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.
- D. Cleaning And Protection
1. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
 2. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
 3. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by the Owner, and leave in an undamaged condition.
 4. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.
- E. Interior Painting Schedule
1. Concrete Substrates, Nontraffic Surfaces:
 - a. Latex System: MPI INT 3.1E.
 - 1) Prime Coat: Interior latex matching topcoat.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.



- b. Latex Over Sealer System: MPI INT 3.1A.
 - 1) Prime Coat: Interior latex primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
- c. Latex Over Latex Aggregate System: MPI INT 3.1B.
 - 1) Prime Coat: Latex stucco and masonry textured coating.
 - 2) Intermediate Coat (for MPI Premium Grade system): Exterior latex matching topcoat.
 - 3) Topcoat: Exterior latex (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
- d. Alkyd System: MPI INT 3.1D.
 - 1) Prime Coat: Interior latex primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
 - 3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
- e. Institutional Low-Odor/VOC Latex System: MPI INT 3.1M.
 - 1) Prime Coat: Institutional low-odor/VOC interior latex matching topcoat.
 - 2) Intermediate Coat (for MPI Premium Grade system): Institutional low-odor/VOC interior latex matching topcoat.
 - 3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.
- f. High-Performance Architectural Latex System: MPI INT 3.1C.
 - 1) Prime Coat: Interior latex primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): High-performance architectural latex matching topcoat.
 - 3) Topcoat: High-performance architectural latex (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.
- 2. Concrete Substrates, Traffic Surfaces:
 - a. Latex Floor Enamel System: MPI INT 3.2A.
 - 1) Prime Coat: Interior/exterior latex floor and porch paint (low gloss).
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior/exterior latex floor and porch paint (low gloss).
 - 3) Topcoat: Interior/exterior latex floor and porch paint (low gloss).
 - b. Alkyd Floor Enamel System: MPI INT 3.2B.
 - 1) Prime Coat: Exterior/interior alkyd floor enamel (gloss).
 - 2) Intermediate Coat (for MPI Premium Grade system): Exterior/interior alkyd floor enamel (gloss).
 - 3) Topcoat: Exterior/interior alkyd floor enamel (gloss).
 - c. Concrete Stain System: MPI INT 3.2E.
 - 1) First Coat (for MPI Premium Grade system): Interior concrete floor stain.
 - 2) Topcoat: Interior concrete floor stain.
 - d. Clear Sealer System: MPI INT 3.2F.
 - 1) First Coat: Interior/exterior clear concrete floor sealer (solvent based).
 - 2) Topcoat: Interior/exterior clear concrete floor sealer (solvent based).
 - e. Water-Based Clear Sealer System: MPI INT 3.2G.
 - 1) First Coat: Interior/exterior clear concrete floor sealer (water based).
 - 2) Topcoat: Interior/exterior clear concrete floor sealer (water based).
- 3. Clay-Masonry Substrates:
 - a. Latex System: MPI INT 4.1A.
 - 1) Prime Coat: Interior latex matching topcoat.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
 - b. Alkyd System: MPI INT 4.1D.
 - 1) Prime Coat: Interior latex primer/sealer.



- 2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
- 3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
- c. Latex Aggregate System: MPI INT 4.1B.
 - 1) Prime Coat: As recommended in writing by topcoat manufacturer.
 - 2) Intermediate Coat: As recommended in writing by topcoat manufacturer.
 - 3) Topcoat: Latex stucco and masonry textured coating.
- d. Institutional Low-Odor/VOC Latex System: MPI INT 4.1M.
 - 1) Prime Coat: Institutional low-odor/VOC interior latex matching topcoat.
 - 2) Intermediate Coat (for MPI Premium Grade system): Institutional low-odor/VOC interior latex matching topcoat.
 - 3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.
- e. High-Performance Architectural Latex System: MPI INT 4.1L.
 - 1) Prime Coat: High-performance architectural latex matching topcoat.
 - 2) Intermediate Coat (for MPI Premium Grade system): High-performance architectural latex matching topcoat.
 - 3) Topcoat: High-performance architectural latex (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.
4. CMU Substrates:
 - a. Latex System: MPI INT 4.2A.
 - 1) Prime Coat: Interior/exterior latex block filler.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
 - b. Alkyd System: MPI INT 4.2C.
 - 1) Prime Coat: Interior/exterior latex block filler.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
 - 3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
 - c. Alkyd Over Latex Sealer System: MPI INT 4.2N.
 - 1) Prime Coat: Interior/exterior latex block filler.
 - 2) Sealer Coat: Interior latex primer/sealer.
 - 3) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
 - 4) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
 - d. Institutional Low-Odor/VOC Latex System: MPI INT 4.2E.
 - 1) Prime Coat: Interior/exterior latex block filler.
 - 2) Intermediate Coat (for MPI Premium Grade system): Institutional low-odor/VOC interior latex matching topcoat.
 - 3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.
 - e. High-Performance Architectural Latex System: MPI INT 4.2D.
 - 1) Prime Coat: Interior/exterior latex block filler.
 - 2) Intermediate Coat (for MPI Premium Grade system): High-performance architectural latex matching topcoat.
 - 3) Topcoat: High-performance architectural latex (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.
5. Steel Substrates:
 - a. Quick-Drying Enamel System: MPI INT 5.1A.
 - 1) Prime Coat: Quick-drying alkyd metal primer.
 - 2) Intermediate Coat: Quick-drying enamel matching topcoat.
 - 3) Topcoat: Quick-drying enamel (semigloss) **OR** (high gloss), **as directed**.
 - b. Water-Based Dry-Fall System: MPI INT 5.1C.
 - 1) Prime Coat: Alkyd anticorrosive **OR** Quick-drying alkyd, **as directed**, metal primer.
 - 2) Topcoat: Latex dry fog/fall **OR** Waterborne dry fall, **as directed**.



- c. Alkyd Dry-Fall System: MPI INT 5.1D.
 - 1) Prime Coat: Alkyd anticorrosive **OR** Quick-drying alkyd, **as directed**, metal primer.
 - 2) Topcoat: Interior alkyd dry fog/fall.
- d. Latex Over Alkyd Primer System: MPI INT 5.1Q.
 - 1) Prime Coat: Alkyd anticorrosive **OR** Quick-drying alkyd, **as directed**, metal primer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
- e. Alkyd System: MPI INT 5.1E.
 - 1) Prime Coat: Alkyd anticorrosive **OR** Quick-drying alkyd, **as directed**, metal primer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
 - 3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
- f. Aluminum Paint System: MPI INT 5.1M.
 - 1) Prime Coat: Alkyd anticorrosive **OR** Quick-drying alkyd, **as directed**, metal primer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Aluminum paint.
 - 3) Topcoat: Aluminum paint.
- g. Institutional Low-Odor/VOC Latex System: MPI INT 5.1S.
 - 1) Prime Coat: Rust-inhibitive primer (water based).
 - 2) Intermediate Coat (for MPI Premium Grade system): Institutional low-odor/VOC interior latex matching topcoat.
 - 3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.
- h. High-Performance Architectural Latex System: MPI INT 5.1R.
 - 1) Prime Coat: Alkyd anticorrosive **OR** Quick-drying alkyd, **as directed**, metal primer.
 - 2) Intermediate Coat (for MPI Premium Grade system): High-performance architectural latex matching topcoat.
 - 3) Topcoat: High-performance architectural latex (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.
- 6. Galvanized-Metal Substrates:
 - a. Water-Based Dry-Fall System: MPI INT 5.3H.
 - 1) Prime Coat: Waterborne dry fall.
 - 2) Topcoat: Waterborne dry fall.
 - b. Alkyd Dry-Fall System: MPI INT 5.3F.
 - 1) Prime Coat: Cementitious galvanized-metal primer.
 - 2) Topcoat: Interior alkyd dry fog/fall.
 - c. Latex System: MPI INT 5.3A.
 - 1) Prime Coat: Cementitious galvanized-metal primer.
 - 2) Intermediate Coat: Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
 - d. Latex Over Waterborne Primer System: MPI INT 5.3J.
 - 1) Prime Coat: Waterborne galvanized-metal primer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
 - e. Alkyd System: MPI INT 5.3C.
 - 1) Prime Coat: Cementitious galvanized-metal primer.
 - 2) Intermediate Coat: Interior alkyd matching topcoat.
 - 3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
 - f. Aluminum Paint System: MPI INT 5.3G.
 - 1) Prime Coat: Cementitious galvanized-metal primer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Aluminum paint.
 - 3) Topcoat: Aluminum paint.
 - g. Institutional Low-Odor/VOC Latex System: MPI INT 5.3N.



- 1) Prime Coat: Waterborne galvanized-metal primer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Institutional low-odor/VOC interior latex matching topcoat.
 - 3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.
- h. High-Performance Architectural Latex System: MPI INT 5.3M.
- 1) Prime Coat: Waterborne galvanized-metal primer.
 - 2) Intermediate Coat (for MPI Premium Grade system): High-performance architectural latex matching topcoat.
 - 3) Topcoat: High-performance architectural latex (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.
7. Aluminum (Not Anodized or Otherwise Coated) Substrates:
- a. Latex System: MPI INT 5.4H.
- 1) Prime Coat: Quick-drying primer for aluminum.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
- b. Alkyd Over Vinyl Wash Primer System: MPI INT 5.4A.
- 1) Prime Coat: Vinyl wash primer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
 - 3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
- c. Alkyd Over Quick-Drying Primer System: MPI INT 5.4J.
- 1) Prime Coat: Quick-drying primer for aluminum.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
 - 3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
- d. Aluminum Paint System: MPI INT 5.4D.
- 1) Prime Coat: Vinyl wash primer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Aluminum paint.
 - 3) Topcoat: Aluminum paint.
- e. Institutional Low-Odor/VOC Latex System: MPI INT 5.4G.
- 1) Prime Coat: Quick-drying primer for aluminum.
 - 2) Intermediate Coat (for MPI Premium Grade system): Institutional low-odor/VOC interior latex matching topcoat.
 - 3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.
- f. High-Performance Architectural Latex System: MPI INT 5.4F.
- 1) Prime Coat: Quick-drying primer for aluminum.
 - 2) Intermediate Coat (for MPI Premium Grade system): High-performance architectural latex matching topcoat.
 - 3) Topcoat: High-performance architectural latex (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.
8. Glue-Laminated Beam and Column Substrates:
- a. Latex System: MPI INT 6.1M.
- 1) Prime Coat: Interior latex-based wood primer.
 - 2) Intermediate Coat: Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
- b. Latex Over Alkyd Primer System: MPI INT 6.1A.
- 1) Prime Coat: Interior alkyd primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
- c. Alkyd System: MPI INT 6.1B.
- 1) Prime Coat: Interior alkyd primer/sealer.



- 2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
- 3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
- d. Institutional Low-Odor/VOC Latex System: MPI INT 6.1Q.
 - 1) Prime Coat: Interior latex-based wood primer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Institutional low-odor/VOC interior latex matching topcoat.
 - 3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.
- e. High-Performance Architectural Latex System: MPI INT 6.1N.
 - 1) Prime Coat: Interior latex-based wood primer.
 - 2) Intermediate Coat: High-performance architectural latex matching topcoat.
 - 3) Topcoat: High-performance architectural latex (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.
9. Dressed Lumber Substrates: Including architectural woodwork and doors.
 - a. Latex System: MPI INT 6.3T.
 - 1) Prime Coat: Interior latex-based wood primer.
 - 2) Intermediate Coat: Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (semigloss) **OR** (gloss), **as directed**.
 - b. Latex Over Alkyd Primer System: MPI INT 6.3U.
 - 1) Prime Coat: Interior alkyd primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (semigloss) **OR** (gloss), **as directed**.
 - c. Alkyd System: MPI INT 6.3B.
 - 1) Prime Coat: Interior alkyd primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
 - 3) Topcoat: Interior alkyd (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
 - d. Institutional Low-Odor/VOC Latex System: MPI INT 6.3V.
 - 1) Prime Coat: Interior latex-based wood primer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Institutional low-odor/VOC interior latex matching topcoat.
 - 3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.
 - e. High-Performance Architectural Latex System: MPI INT 6.3A.
 - 1) Prime Coat: Interior latex-based wood primer.
 - 2) Intermediate Coat: High-performance architectural latex matching topcoat.
 - 3) Topcoat: High-performance architectural latex (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.
10. Wood Panel Substrates: Including painted plywood, medium-density fiberboard, and hardboard.
 - a. Latex System: MPI INT 6.4R.
 - 1) Prime Coat: Interior latex-based wood primer.
 - 2) Intermediate Coat: Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (semigloss) **OR** (gloss), **as directed**.
 - b. Latex Over Alkyd Primer System: MPI INT 6.4A.
 - 1) Prime Coat: Interior alkyd primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
 - c. Alkyd System: MPI INT 6.4B.
 - 1) Prime Coat: Interior alkyd primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
 - 3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
 - d. Institutional Low-Odor/VOC Latex System: MPI INT 6.4T.



- 1) Prime Coat: Interior latex-based wood primer.
 - 2) Intermediate Coat : Institutional low-odor/VOC interior latex matching topcoat.
 - 3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.
 - e. High-Performance Architectural Latex System: MPI INT 6.4S.
 - 1) Prime Coat: Interior latex-based wood primer.
 - 2) Intermediate Coat: High-performance architectural latex matching topcoat.
 - 3) Topcoat: High-performance architectural latex (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.
11. Dimension Lumber Substrates, Nontraffic Surfaces: Including exposed joists and exposed beams.
 - a. Latex System: MPI INT 6.2D.
 - 1) Prime Coat: Interior latex-based wood primer.
 - 2) Intermediate Coat: Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
 - b. Latex Over Alkyd Primer System: MPI INT 6.2A.
 - 1) Prime Coat: Interior alkyd primer/sealer.
 - 2) Intermediate Coat : Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
 - c. Alkyd System: MPI INT 6.2C.
 - 1) Prime Coat: Interior alkyd primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
 - 3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
 - d. Institutional Low-Odor/VOC Latex System: MPI INT 6.2L.
 - 1) Prime Coat: Interior latex-based wood primer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Institutional low-odor/VOC interior latex matching topcoat.
 - 3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.
 - e. High-Performance Architectural Latex System: MPI INT 6.2B.
 - 1) Prime Coat: Interior alkyd primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): High-performance architectural latex matching topcoat.
 - 3) Topcoat: High-performance architectural latex (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.
12. Wood Substrates, Traffic Surfaces:
 - a. Latex Floor Paint System: MPI INT 6.5G.
 - 1) Prime Coat: Interior alkyd primer/sealer.
 - 2) Intermediate Coat: Interior/exterior latex floor and porch paint (low gloss).
 - 3) Topcoat: Interior/exterior latex floor and porch paint (low gloss).
 - b. Alkyd Floor Enamel System: MPI INT 6.5A.
 - 1) Prime Coat: Exterior/interior alkyd floor enamel (gloss).
 - 2) Intermediate Coat: Exterior/interior alkyd floor enamel (gloss).
 - 3) Topcoat: Exterior/interior alkyd floor enamel (gloss).
13. Gypsum Board Substrates:
 - a. Latex System: MPI INT 9.2A.
 - 1) Prime Coat: Interior latex primer/sealer (for MPI Premium Grade system) **OR** matching topcoat, **as directed**.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
 - b. Alkyd Over Latex Primer System: MPI INT 9.2C.
 - 1) Prime Coat: Interior latex primer/sealer.



- 2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
 - 3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
 - c. Institutional Low-Odor/VOC Latex System: MPI INT 9.2M.
 - 1) Prime Coat: Interior latex primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Institutional low-odor/VOC interior latex matching topcoat.
 - 3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.
 - d. High-Performance Architectural Latex System: MPI INT 9.2B.
 - 1) Prime Coat: Interior latex primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): High-performance architectural latex matching topcoat.
 - 3) Topcoat: High-performance architectural latex (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.
14. Plaster Substrates:
- a. Latex System: MPI INT 9.2A.
 - 1) Prime Coat: Interior latex primer/sealer (for MPI Premium Grade system) **OR** matching topcoat, **as directed**.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
 - b. Latex Over Alkyd Primer System: MPI INT 9.2K.
 - 1) Prime Coat: Interior alkyd primer/sealer.
 - 2) Intermediate Coat: Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
 - c. Alkyd Over Latex Primer System: MPI INT 9.2C.
 - 1) Prime Coat: Interior latex primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
 - 3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
 - d. Institutional Low-Odor/VOC Latex System: MPI INT 9.2M.
 - 1) Prime Coat: Interior latex primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Institutional low-odor/VOC interior latex matching topcoat.
 - 3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.
 - e. High-Performance Architectural Latex System: MPI INT 9.2B.
 - 1) Prime Coat: Interior latex primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): High-performance architectural latex matching topcoat.
 - 3) Topcoat: High-performance architectural latex (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.
15. Spray-Textured Ceiling Substrates:
- a. Latex (Flat) System: MPI INT 9.1A, spray applied.
 - 1) Prime Coat: Interior latex primer/sealer **OR** (flat), **as directed**.
 - 2) Topcoat: Interior latex (flat).
 - b. Latex System: MPI INT 9.1E, spray applied.
 - 1) Prime Coat: Interior latex matching topcoat.
 - 2) Intermediate Coat: Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss), **as directed**.
 - c. Latex Over Alkyd Primer System: MPI INT 9.1B.
 - 1) Prime Coat: Interior alkyd primer/sealer.



- 2) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
- d. Alkyd (Flat) System: MPI INT 9.1C.
 - 1) Prime Coat: Interior alkyd (flat).
 - 2) Topcoat: Interior alkyd (flat).
- e. Alkyd System: MPI INT 9.1D.
 - 1) Prime Coat: Interior alkyd primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
 - 3) Topcoat: Interior alkyd (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
16. Cotton or Canvas Insulation-Covering Substrates: Including pipe and duct coverings.
 - a. Latex System: MPI INT 10.1A.
 - 1) Prime Coat: Interior latex primer/sealer (for MPI Premium Grade system) **OR** matching topcoat, **as directed**.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
 - b. Alkyd Over Latex Primer System: MPI INT 10.1B.
 - 1) Prime Coat: Interior latex primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior alkyd matching topcoat.
 - 3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
 - c. Aluminum Paint System: MPI INT 10.1C.
 - 1) Prime Coat: Interior latex primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Aluminum paint.
 - 3) Topcoat: Aluminum paint.
 - d. Institutional Low-Odor/VOC Latex System: MPI INT 10.1D.
 - 1) Prime Coat: Interior latex primer/sealer.
 - 2) Intermediate Coat (for MPI Premium Grade system): Institutional low-odor/VOC interior latex matching topcoat.
 - 3) Topcoat: Institutional low-odor/VOC interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (semigloss), **as directed**.

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SECTION 09 91 23 00a - MULTICOLORED INTERIOR COATINGS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for multicolored interior coatings. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes surface preparation and field application of multicolor interior coating systems applied on the following substrates:
 - a. Vertical concrete.
 - b. Cementitious composition board.
 - c. Clay masonry units.
 - d. Concrete masonry units (CMU).
 - e. Wood.
 - f. Fiberglass moldings and trim.
 - g. Plastic moldings and trim.
 - h. Plaster, Gypsum veneer plaster, and Gypsum board.

C. Submittals

1. Product Data: For each type of product indicated.
2. Samples: For each finish-coat product and for each color and texture required.
3. LEED Submittal:
 - a. Product Data for Credit EQ 4.2: For coatings, including printed statement of VOC content and chemical components.

D. Quality Assurance

1. Fire-Test-Response Characteristics: Provide coatings with flame-spread and smoked-developed indexes of 25 or less and 450 or less, respectively, as determined by testing identical products per ASTM E 84 by testing and inspecting agency acceptable to authorities having jurisdiction.
2. Master Painters Institute (MPI) Standards: Comply with recommendations in "MPI Architectural Painting Specification Manual" **OR** "MPI Maintenance Repainting Manual," **as directed**, applicable to products and coating systems indicated.
3. Mockups: Apply mockup of each coating system indicated to verify preliminary selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - a. Architect will select one surface to represent surfaces and conditions for application of each coating system and type of substrate.
 - 1) Wall Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
 - 2) Other Items: Architect will designate items or areas required.
 - b. Apply mockup after permanent lighting and other environmental services have been activated.
 - c. Final approval of color and pattern selections will be based on mockup.
 - 1) If preliminary color and pattern selections are not approved, apply additional mockups of colors and patterns selected by Architect at no added cost to Owner.
 - d. Repair Mockup: After approval of color and pattern selections, apply representative repairs to 100 sq. in. (65 sq. cm) of mockup to establish quality standards for coating system repairs.
 - e. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.



- f. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. Delivery, Storage, And Handling

1. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
 - a. Maintain containers in clean condition, free of foreign materials and residue.
 - b. Remove rags and waste from storage areas daily.

1.2 PRODUCTS

A. Multicolor Coating Systems, General

1. Material Compatibility: Provide materials for use within each coating system that are compatible with one another and substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
2. VOC Content of Interior Paints and Coatings: Provide products that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Flat Paints, Coatings, and Primers: VOC content of not more than 50 g/L.
 - b. Nonflat Paints, Coatings, and Primers: VOC content of not more than 150 g/L.
 - c. Clear Wood Finishes, Varnishes: VOC not more than 350 g/L.
 - d. Shellacs, Clear: VOC not more than 730 g/L.
 - e. Shellacs, Pigmented: VOC not more than 550 g/L.
 - f. Flat Topcoat Paints: VOC content of not more than 50 g/L.
 - g. Nonflat Topcoat Paints: VOC content of not more than 150 g/L.
 - h. Clear Wood Finishes, Varnishes: VOC not more than 350 g/L.
 - i. Shellacs, Clear: VOC not more than 730 g/L.
 - j. Shellacs, Pigmented: VOC not more than 550 g/L.
 - k. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
3. Chemical Components of Interior Paints and Coatings: Provide topcoat paints that comply with the following chemical restrictions; these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:
 - a. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing 1 or more benzene rings).
 - b. Restricted Components: Paints and coatings shall not contain any of the following:
 - 1) Acrolein.
 - 2) Acrylonitrile.
 - 3) Antimony.
 - 4) Benzene.
 - 5) Butyl benzyl phthalate.
 - 6) Cadmium.
 - 7) Di (2-ethylhexyl) phthalate.
 - 8) Di-n-butyl phthalate.
 - 9) Di-n-octyl phthalate.
 - 10) 1,2-dichlorobenzene.
 - 11) Diethyl phthalate.
 - 12) Dimethyl phthalate.
 - 13) Ethylbenzene.
 - 14) Formaldehyde.
 - 15) Hexavalent chromium.
 - 16) Isophorone.
 - 17) Lead.
 - 18) Mercury.
 - 19) Methyl ethyl ketone.



- 20) Methyl isobutyl ketone.
 - 21) Methylene chloride.
 - 22) Naphthalene.
 - 23) Toluene (methylbenzene).
 - 24) 1,1,1-trichloroethane.
 - 25) Vinyl chloride.
4. Colors and Patterns: Match samples **OR** As selected from manufacturer's full range **OR** As indicated in color schedule, **as directed**.

B. Fillers And Primers

1. General: Undercoatings recommended in writing for use in coating systems by manufacturer of multicolor interior coating on substrates and under conditions indicated.
2. Latex Block Filler: Waterborne, high-solids, emulsion-type, pigmented coating product recommended in writing for use in coating system indicated by manufacturer of multicolor interior coating, with bridging and filling properties, and formulated for filling surfaces of CMU for subsequent applications of finish coatings.
 - a. VOC Content: Minimum E Range of E2 **OR** E3, **as directed**, according to requirements for MPI #4.
3. Wood Filler Paste: Solvent-based, high-solids, clear paste product recommended in writing for use in coating system indicated by manufacturer of multicolor interior coating, for use on open-grained or damaged woods and that fills hardwood pores with minimal surface residues and without showing cracking or shrinkage. When dry, sanding filler produces a smooth surface without clogging or gumming sandpaper.
 - a. VOC Content: Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**, according to requirements for MPI #91.
4. Wood-Knot Sealer: White shellac or other sealer recommended in writing for this purpose by manufacturer of multicolor interior coating.
5. Primer/Sealer for Multicolor Systems: Acrylic or acrylic/polyvinyl acetate (PVA) co-polymer emulsion-type, pigmented primer/sealer product recommended in writing for use in coating system indicated by manufacturer of multicolor interior coating.
 - a. VOC Content: Minimum E Range of E2 **OR** E3, **as directed**, according to requirements for MPI #125.
6. Interior Alkyd Primer/Sealer: Solvent-based, pigmented primer/sealer.
 - a. VOC Content: Minimum E Range of E1 **OR** E2, **as directed**, according to requirements for MPI #45.
7. Water-Based Bonding Primer: Water-based, emulsion-type, pigmented primer product recommended in writing for use in coating system indicated by manufacturer of multicolor interior coating, and formulated to promote adhesion of subsequent coatings.
 - a. VOC Content: Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**, according to requirements for MPI #17.
8. Solvent-Based Bonding Primer: Solvent-based, pigmented product recommended in writing for use in coating system indicated by manufacturer of multicolor interior coating, and formulated to promote adhesion of subsequent coatings to substrate.
 - a. VOC Content: Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**, according to requirements for MPI #69.

C. Multicolor Coatings

1. Multicolor Coatings: Complying with MPI #112 and listed in "MPI Approved Products List."
 - a. VOC Content: Minimum E Range of E1 **OR** E3, **as directed**.
2. Clear Topcoat: Product of multicolor coating manufacturer complying with MPI #121 and listed in "MPI Approved Products List."
 - a. VOC Content: Minimum E Range of E1 **OR** E2, **as directed**.



1.3 EXECUTION

A. Preparation

1. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
2. Remove plates, machined surfaces, and similar items already in place that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.
 - a. After completing coating operations, reinstall items that were removed; use workers skilled in the trades involved.
3. Clean substrates of substances that could impair bond of coatings, including dirt, oil, grease, and incompatible primers, paints, and encapsulants.
4. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
5. Clay Masonry Substrates: Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
6. Concrete Masonry Substrates: Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
7. Wood Substrates:
 - a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of knot sealer before applying primer.
 - b. Sand surfaces that will be exposed to view and dust off.
 - c. Prime edges, ends, faces, undersides, and back sides of wood.
 - d. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

B. Application

1. Apply coatings according to manufacturer's written instructions using applicators and techniques suited for coating and substrate indicated.
2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Coat back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Apply coating systems to produce uniformly textured, colored, and patterned finished-surface films without substrates, undercoats, marks, or stains showing through. Produce sharp, even glass lines and color breaks.

C. Cleaning And Protection

1. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
2. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
3. Protect work of other trades against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by the Owner, and leave in an undamaged condition.
4. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

D. Multicolor Interior Coating Schedule

1. Vertical Concrete Substrates: System below corresponds to MPI INT 3.1H
 - a. Prime Coat: Primer/sealer for multicolor systems.



- b. Multicolor Base Coat: Multicolor coating, MPI #112.
- c. Multicolor Pattern Coat: Multicolor coating, MPI #112.
- d. Topcoat (for a Premium Grade system): Clear topcoat, MPI #121.
2. Cementitious Composition Board Substrates: System below corresponds to MPI INT 3.3F
 - a. Prime Coat: Primer/sealer for multicolor systems.
 - b. Multicolor Base Coat: Multicolor coating, MPI #112.
 - c. Multicolor Pattern Coat: Multicolor coating, MPI #112.
 - d. Topcoat (for a Premium Grade system): Clear topcoat, MPI #121.
3. Clay Masonry Units Substrates: System below corresponds to MPI INT 4.1H
 - a. Prime Coat: Primer/sealer for multicolor systems tinted to match multicolor basecoat.
 - b. Multicolor Base Coat: Multicolor coating, MPI #112.
 - c. Multicolor Pattern Coat: Multicolor coating, MPI #112.
 - d. Topcoat (for a Premium Grade system): Clear topcoat, MPI #121.
4. CMU Substrates: System below corresponds to MPI INT 4.2H
 - a. Block Filler: Latex block filler.
 - b. Prime Coat: Primer/sealer for multicolor systems.
 - c. Multicolor Base Coat: Multicolor coating, MPI #112.
 - d. Multicolor Pattern Coat: Multicolor coating, MPI #112.
 - e. Topcoat (for a Premium Grade system): Clear topcoat, MPI #121.
5. Wood Substrates: System below corresponds to MPI INT 6.2E, MPI INT 6.3N, and MPI INT 6.4L
 - a. Fill Coat: Wood filler paste (Fill coat is optional component and is for use on open-grained woods where a smooth, glasslike finish is desired).
 - b. Prime Coat: Interior alkyd primer/sealer tinted to match multicolor base coat (for dressed lumber (finished carpentry)).
 - c. Multicolor Base Coat: Multicolor coating, MPI #112.
 - d. Multicolor Pattern Coat: Multicolor coating, MPI #112.
 - e. Topcoat (for a Premium Grade system): Clear topcoat, MPI #121.
6. Fiberglass Molding and Trim Substrates: System below corresponds to MPI INT 6.7G
 - a. Prime Coat: Water-based **OR** Solvent-based, **as directed**, bonding primer.
 - b. Multicolor Base Coat: Multicolor coating, MPI #112.
 - c. Multicolor Pattern Coat: Multicolor coating, MPI #112.
 - d. Topcoat (for a Premium Grade system): Clear topcoat, MPI #121.
7. Plastic Molding and Trim Substrates: System below corresponds to MPI INT 6.8D
 - a. Prime Coat: Solvent-based bonding primer.
 - b. Multicolor Base Coat: Multicolor coating, MPI #112.
 - c. Multicolor Pattern Coat: Multicolor coating, MPI #112.
 - d. Topcoat (for a Premium Grade system): Clear topcoat, MPI #121.
8. Plaster **OR** Gypsum Veneer Plaster **OR** Gypsum Board, **as directed**, Substrates: System below corresponds to MPI INT 9.2G
 - a. Prime Coat: Primer/sealer for multicolor systems.
 - b. Multicolor Base Coat: Multicolor coating, MPI #112.
 - c. Multicolor Pattern Coat: Multicolor coating, MPI #112.
 - d. Topcoat (for a Premium Grade system): Clear topcoat, MPI #121.

END OF SECTION 09 91 23 00a



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Task	Specification	Specification Description
09 91 23 00	09 91 13 00	Exterior Painting
09 91 33 00	09 91 13 00a	Wood Stains and Transparent Finishes
09 91 33 00	09 91 13 00b	High-Temperature-Resistant Coatings
09 91 43 00	03 01 30 71	Concrete Rehabilitation



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SECTION 09 93 23 53 - FLOOR TREATMENT REFINISHING WOOD FLOORS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for refinishing wood floors. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: For each type of product indicated.

C. Quality Assurance

1. Build mockup of typical flooring area as shown on Drawings including base and shoe moldings.
 - a. To set quality standards for sanding and application of field finishes, prepare finish mockup of floor area as shown on Drawings.
 - b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - c. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.2 PRODUCTS

- A. Cleaning Compound: A liquid chemical cleaner containing non-ionic and anionic type detergents, non-reactive to wood flooring. Compound shall have no free metal alkalies, no artificial coloring and no fatty acids. Compound shall be UL listed as "slip-resistant."
- B. Varnish Remover: Non-flammable paint and varnish remover.
- C. Stain: Penetrating type non-fading wood stain.
- D. Wood Filler: Paste type wood filler, pigmented if necessary to match sample, complying with Fed. Spec. TT-F-336.
- E. Floor Sealer: Penetrating type, pliable, wood-hardening finish/sealer.
- F. Floor Varnish: Alkyd resin varnish, specially compounded for floor finish, Fed. Spec. TT-V-109.
- G. Urethane Finish: Specially compounded for wood floor finish, moisture curing type, for multiple-coat application.
- H. Floor Wax: Liquid, solvent-type, slip-resistant, CID A-A-1550, Type II.

1.3 EXECUTION

A. Preparation:

1. Cleaning: Scrub thoroughly with cleaning compound and warm water. Rinse with clean water, mop dry, and buff with polishing machine.
2. Varnish Removal: Apply paint and varnish remover as required.



3. Sanding: Traverse floors two times with an electric-powered sanding machine. A rotary disc sander may be used for the final cut, but first cut shall be made with a drum-type machine. The first cut may be made crosswise of the grain or at a 45-degree angle. Make second cut in direction of grain. Use No. 1/2 sandpaper for first traverse and No. 0 for second traverse. Use an electric edger or hand sander for sanding areas near walls, in corners, and small closets.

B. Installation:

1. Apply Wood Paste Filler, followed by wiping cross-grain to work into pores and cracks.
2. Apply Stain if needed to match selected finish.
3. Apply Sealer (2 coats) complying with Fed. Spec. TT-S-176. Use Class I for white oak and red oak floors and Class II for beech, birch, and hard maple floors.
4. Apply Floor Varnish, (3 coats) buffing after each coat. First coat may be thinned as a sealer.
5. Apply Urethane Finish. Apply as many coats as needed to build a dry film thickness of 1.0 mil.
6. When Floors are Dry, apply two coats of wax complying with Fed. Spec. P-W-155; concentration 12 percent. Spread the wax at the rate of 1,500 square feet per gallon and polish the floors with a weighted floor brush or an electric polisher.
7. Protection: Upon completion of work, cover all traffic areas immediately with nonstaining kraft paper or polyethylene, taped along edges, and maintain floor protection until acceptance.

END OF SECTION 09 93 23 53



Task	Specification	Specification Description
09 93 23 53	09 91 13 00a	Wood Stains and Transparent Finishes



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SECTION 09 96 00 00 - HIGH-PERFORMANCE COATINGS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for high performance coatings. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes surface preparation and application of high-performance coating systems on the following substrates:
 - a. Exterior Substrates:
 - 1) Concrete, vertical and horizontal surfaces.
 - 2) Clay masonry.
 - 3) Concrete masonry units (CMU).
 - 4) Steel.
 - 5) Galvanized metal.
 - 6) Aluminum (not anodized or otherwise coated).
 - 7) Wood.
 - b. Interior Substrates:
 - 1) Concrete, vertical and horizontal surfaces.
 - 2) Clay masonry.
 - 3) Concrete masonry units (CMU).
 - 4) Steel.
 - 5) Galvanized metal.
 - 6) Aluminum (not anodized or otherwise coated).
 - 7) Wood.
 - 8) Gypsum board.

C. Submittals

1. Product Data: For each type of product indicated.
2. Samples: For each type of finish-coat product indicated.
3. Product List: For each product indicated. Cross-reference products to coating system and locations of application areas. Use same designations indicated on Drawings and in schedules.
4. LEED Submittals:
 - a. Product Data for Credit EQ 4.2: For coatings, including printed statement of VOC content and chemical components.

D. Quality Assurance

1. Master Painters Institute (MPI) Standards:
 - a. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
 - b. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" **OR** "MPI Maintenance Repainting Manual," **as directed**, for products and coating systems indicated.
2. Mockups: Apply mockups of each coating system indicated to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - a. Architect will select one surface to represent surfaces and conditions for application of each coating system specified in Part 3.
 - 1) Wall and Ceiling Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
 - 2) Other Items: Architect will designate items or areas required.



- b. Final approval of color selections will be based on mockups.
 - 1) If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
- c. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
- d. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. Delivery, Storage, And Handling

- 1. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
 - a. Maintain containers in clean condition, free of foreign materials and residue.
 - b. Remove rags and waste from storage areas daily.

F. Project Conditions

- 1. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 50 and 95 deg F (10 and 35 deg C).
- 2. Do not apply coatings in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1.2 PRODUCTS

A. High-Performance Coatings, General

- 1. Material Compatibility:
 - a. Provide materials for use within each coating system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - b. Provide products of same manufacturer for each coat in a coating system.
- 2. VOC Content of Field-Applied Interior Paints and Coatings: Provide products that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Flat Paints, Coatings, and Primers: VOC content of not more than 50 g/L.
 - b. Nonflat Paints, Coatings, and Primers: VOC content of not more than 150 g/L.
 - c. Anticorrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC content of not more than 250 g/L.
 - d. Clear Wood Finishes, Varnishes: VOC not more than 350 g/L.
 - e. Clear Wood Finishes, Lacquers: VOC not more than 550 g/L.
 - f. Floor Coatings: VOC not more than 100 g/L.
 - g. Shellacs, Clear: VOC not more than 730 g/L.
 - h. Shellacs, Pigmented: VOC not more than 550 g/L.
 - i. Stains: VOC content of not more than 250 g/L.
 - j. Flat Interior Topcoat Paints: VOC content of not more than 50 g/L.
 - k. Nonflat Interior Topcoat Paints: VOC content of not more than 150 g/L.
 - l. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
 - m. Clear Wood Finishes, Varnishes: VOC not more than 350 g/L.
 - n. Clear Wood Finishes, Lacquers: VOC not more than 550 g/L.
 - o. Floor Coatings: VOC not more than 100 g/L.
 - p. Shellacs, Clear: VOC not more than 730 g/L.
 - q. Shellacs, Pigmented: VOC not more than 550 g/L.
 - r. Stains: VOC not more than 250 g/L.
 - s. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
 - t. Zinc-Rich Industrial Maintenance Primers: VOC content of not more than 340 g/L.



- u. Pre-Treatment Wash Primers: VOC content of not more than 420 g/L.
 3. Chemical Components of Field-Applied Interior Paints and Coatings: Provide topcoat paints and anti-corrosive and anti-rust paints applied to ferrous metals that comply with the following chemical restrictions; these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:
 - a. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing 1 or more benzene rings).
 - b. Restricted Components: Paints and coatings shall not contain any of the following:
 - 1) Acrolein.
 - 2) Acrylonitrile.
 - 3) Antimony.
 - 4) Benzene.
 - 5) Butyl benzyl phthalate.
 - 6) Cadmium.
 - 7) Di (2-ethylhexyl) phthalate.
 - 8) Di-n-butyl phthalate.
 - 9) Di-n-octyl phthalate.
 - 10) 1,2-dichlorobenzene.
 - 11) Diethyl phthalate.
 - 12) Dimethyl phthalate.
 - 13) Ethylbenzene.
 - 14) Formaldehyde.
 - 15) Hexavalent chromium.
 - 16) Isophorone.
 - 17) Lead.
 - 18) Mercury.
 - 19) Methyl ethyl ketone.
 - 20) Methyl isobutyl ketone.
 - 21) Methylene chloride.
 - 22) Naphthalene.
 - 23) Toluene (methylbenzene).
 - 24) 1,1,1-trichloroethane.
 - 25) Vinyl chloride.
 4. Colors: As selected from manufacturer's full range **OR** Match samples **OR** As indicated in color schedule, **as directed**.
- B. Block Fillers
1. Interior/Exterior Latex Block Filler: MPI#4.
 - a. VOC Content: Minimum E Range of E2 **OR** E3, **as directed**.
 2. Epoxy Block Filler: MPI #116.
 - a. VOC Content: Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.
- C. Interior Primers/Sealers
1. Interior Latex Primer/Sealer: MPI #50.
 - a. Environmental Characteristics:
 - 1) VOC Content:
 - a) Minimum E Range of E2 **OR** E3, **as directed**.
 - b) Meets or exceeds LEED requirements for VOC content.
 - 2) Environmental Performance Rating (EPR): Minimum EPR 2 **OR** 3, **as directed**.
 2. Interior Alkyd Primer/Sealer: MPI #45.
 - a. VOC Content: Minimum E Range of E1 **OR** E2, **as directed**.
 3. Interior Latex-Based Wood Primer: MPI #39.
 - a. Environmental Characteristics:
 - 1) VOC Content:
 - a) Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.



- b) Meets or exceeds LEED requirements for VOC content.
 - 2) Environmental Performance Rating (EPR): Minimum EPR 1 **OR 2 OR 3, as directed.**
 - 4. Wood-Knot Sealer: White shellac or other sealer recommended in writing by manufacturer for this purpose.
- D. Metal Primers
 - 1. Inorganic Zinc Primer: MPI #19.
 - a. VOC Content: Minimum E Range of 0 **OR E1 OR E2 OR E3, as directed.**
 - 2. Epoxy Zinc Primer: MPI #20.
 - a. VOC Content: Minimum E Range of E1 **OR E2 OR E3, as directed.**
 - 3. Rust-Inhibitive Primer (Water Based): MPI #107.
 - a. Environmental Characteristics:
 - 1) VOC Content:
 - a) Minimum E Range of E1 **OR E2 OR E3, as directed.**
 - b) Meets or exceeds LEED requirements for VOC content.
 - 2) Environmental Performance Rating (EPR): Minimum EPR 1 **OR 2 OR 3, as directed.**
 - 4. Cold-Curing Epoxy Primer: MPI #101.
 - a. VOC Content: Minimum E Range of E1 **OR E3, as directed.**
 - 5. Alkyd Anticorrosive Metal Primer: MPI #79.
 - a. VOC Content: Minimum E Range of E1 **OR E2, as directed.**
 - 6. Quick-Dry Alkyd Metal Primer: MPI #76.
 - a. VOC Content: Minimum E Range of E1 **OR E2 OR E3, as directed.**
 - 7. Cementitious Galvanized-Metal Primer: MPI #26.
 - a. VOC Content: Minimum E Range of E1 **OR E2 OR E3, as directed.**
 - 8. Waterborne Galvanized-Metal Primer: MPI #134.
 - a. Environmental Characteristics:
 - 1) VOC Content:
 - a) Minimum E Range of E1 **OR E2 OR E3, as directed.**
 - b) Meets or exceeds LEED requirements for VOC content.
 - 2) Environmental Performance Rating (EPR): Minimum EPR 1 **OR 2 OR 3, as directed.**
 - 9. Quick-Drying Primer for Aluminum: MPI #95.
 - a. VOC Content: Minimum E Range of E1 **OR E2 OR E3, as directed.**
 - 10. Vinyl Wash Primer: MPI #80.
 - a. VOC Content: Minimum E Range of E2 **OR E3, as directed.**
- E. Water-Based, Light-Industrial Coatings
 - 1. Gloss, Water-Based, Light-Industrial Coating: MPI #110-G6.
 - a. Environmental Characteristics:
 - 1) VOC Content: Minimum E Range of E2.
 - 2) Environmental Performance Rating (EPR): Minimum EPR 2.
 - 2. Semigloss, Water-Based, Light-Industrial Coating: MPI #110-G5.
 - a. Environmental Characteristics:
 - 1) VOC Content:
 - a) Minimum E Range of E2 **OR E3, as directed.**
 - b) Meets or exceeds LEED requirements for VOC content.
 - 2) Environmental Performance Rating (EPR): Minimum EPR 2 **OR 3, as directed.**
 - 3. Eggshell, Water-Based, Light-Industrial Coating: MPI #110-G3.
 - a. Environmental Characteristics:
 - 1) VOC Content:
 - a) Minimum E Range of E2 **OR E3, as directed.**
 - b) Meets or exceeds LEED requirements for VOC content.
 - 2) Environmental Performance Rating (EPR): Minimum EPR 2 **OR 3, as directed.**

**F. Epoxy Coatings**

1. Epoxy, Cold-Cured, Gloss: MPI #77.
 - a. VOC Content: Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.
2. Water-Based Epoxy (Interior and Exterior): MPI #115.
 - a. VOC Content: Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.
3. High-Build Epoxy Marine Coating, Low Gloss: MPI #108.
 - a. VOC Content: Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.
4. Epoxy Deck Coating: MPI #82.
 - a. VOC Content: Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.
5. Water-Based Epoxy Floor Paint: MPI #93.
 - a. Environmental Characteristics:
 - 1) VOC Content:
 - a) Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b) Meets or exceeds LEED requirements for VOC content.
 - 2) Environmental Performance Rating (EPR): Minimum EPR 1 **OR** 2 **OR** 3, **as directed**.

G. Polyurethane Coatings

1. Polyurethane, Two-Component, Pigmented, Gloss: MPI #72.
 - a. VOC Content: Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.
2. Two-Component, Aliphatic Polyurethane, Clear: MPI #78.
 - a. VOC Content: Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.
3. Polyurethane, Moisture Cured, Clear, Gloss: MPI #31.
 - a. VOC Content: Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.
4. Polyurethane, Moisture Cured, Clear, Flat: MPI #71.
 - a. VOC Content: Minimum E Range of E2.

H. Interior High-Performance Architectural Latex Coatings

1. High-Performance Architectural Latex, Velvet Finish: MPI #138, Gloss Level 2.
 - a. Environmental Characteristics:
 - 1) VOC Content:
 - a) Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b) Meets or exceeds LEED requirements for VOC content.
 - 2) Environmental Performance Rating (EPR): Minimum EPR 4 **OR** 5 **OR** 6, **as directed**.
2. High-Performance Architectural Latex, Eggshell Finish: MPI #139, Gloss Level 3.
 - a. Environmental Characteristics:
 - 1) VOC Content:
 - a) Minimum E Range of E2 **OR** E3, **as directed**.
 - b) Meets or exceeds LEED requirements for VOC content.
 - 2) Environmental Performance Rating (EPR): Minimum EPR 5 **OR** 6, **as directed**.
3. High-Performance Architectural Latex, Satin Finish: MPI #140, Gloss Level 4.
 - a. Environmental Characteristics:
 - 1) VOC Content:
 - a) Minimum E Range of E1 **OR** E3, **as directed**.
 - b) Meets or exceeds LEED requirements for VOC content.
 - 2) Environmental Performance Rating (EPR): Minimum EPR 4.5 **OR** 6.5, **as directed**.
4. High-Performance Architectural Latex, Semigloss Finish: MPI #141, Gloss Level 5.
 - a. Environmental Characteristics:
 - 1) VOC Content:
 - a) Minimum E Range of E1 **OR** E2 **OR** E3, **as directed**.
 - b) Meets or exceeds LEED requirements for VOC content.
 - 2) Environmental Performance Rating (EPR): Minimum EPR 5 **OR** 6 **OR** 7, **as directed**.

I. Wood Stains



1. Exterior Semitransparent Stain (Solvent Based): MPI #13.
 - a. VOC Content: Minimum E Range of E1 **OR** E2, **as directed**.
2. Interior Wood Stain, Semitransparent (Solvent Based): MPI #90.
 - a. VOC Content: Minimum E Range of E1 **OR** E2, **as directed**.

1.3 EXECUTION

A. Preparation

1. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
2. Remove plates, machined surfaces, and similar items already in place that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.
 - a. After completing coating operations, reinstall items that were removed; use workers skilled in the trades involved.
3. Clean substrates of substances that could impair bond of coatings, including dirt, oil, grease, and incompatible paints and encapsulants.
 - a. Remove incompatible primers and reprime substrate with compatible primers as required to produce coating systems indicated.
4. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
 - a. Clean surfaces with pressurized water. Use pressure range of 1500 to 4000 psi (10 350 to 27 580 kPa) at 6 to 12 inches (150 to 300 mm) **OR** 4000 to 10,000 psi (27 580 to 68 950 kPa), **as directed**.
OR
Abrasive blast clean surfaces to comply with SSPC-SP 7/NACE No. 4, "Brush-Off Blast Cleaning."
5. Clay Masonry Substrates: Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
 - a. Clean surfaces with pressurized water. Use pressure range of 100 to 600 psi (690 to 4140 kPa) **OR** 1500 to 4000 psi (10 350 to 27 580 kPa), **as directed**, at 6 to 12 inches (150 to 300 mm).
6. CMU Substrates: Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
7. Steel Substrates (for field applied primers): Remove rust and loose mill scale.
 - a. Clean using methods recommended in writing by coating manufacturer.

Blast clean according to SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning **OR** SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning **OR** SSPC-SP 7/NACE No. 4, "Brush-Off Blast Cleaning **OR** SSPC-SP 10/NACE No. 2, "Near-White Blast Cleaning," **as directed**.
8. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.
9. Aluminum Substrates: Remove surface oxidation.
10. Wood Substrates:
 - a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of knot sealer before applying primer.
 - b. Sand surfaces that will be exposed to view and dust off.
 - c. Prime edges, ends, faces, undersides, and back sides of wood.
 - d. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.



B. Application

1. Apply high-performance coatings according to manufacturer's written instructions.
 - a. Use applicators and techniques suited for coating and substrate indicated.
 - b. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
 - c. Coat back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
2. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
3. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.
4. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

C. Field Quality Control

1. the Owner reserves the right to invoke the following procedure at any time and as often as the Owner deems necessary during the period when coatings are being applied:
 - a. the Owner will engage the services of a qualified testing agency to sample coating material being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
 - b. Testing agency will perform tests for compliance with specified requirements.
 - c. the Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with specified requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, the two coatings are incompatible.

D. Cleaning And Protection

1. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
2. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
3. Protect work of other trades against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by the Owner, and leave in an undamaged condition.
4. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

E. Exterior High-Performance Coating Schedule

1. Coating systems in this Article are based on "MPI Architectural Painting Specification Manual." For renovation projects, consult "MPI Maintenance Repainting Manual" and revise coating systems accordingly.
2. Concrete Substrates, Vertical Surfaces:
 - a. Water-Based, Light-Industrial Coating System (System below corresponds to MPI EXT 3.1C):
 - 1) Prime Coat: Water-based, light-industrial coating, MPI #110, gloss matching topcoat.
 - 2) Intermediate Coat: Not required **OR** Water-based, light-industrial coating, MPI #110, gloss matching topcoat, **as directed**.
 - 3) Topcoat: Water-based, light-industrial coating, MPI #110-G6, gloss **OR** 5, semigloss **OR** 3, eggshell, **as directed**.
 - b. Epoxy Coating System (System below corresponds to MPI EXT 3.1D):
 - 1) Prime Coat: Epoxy, cold-cured, gloss, MPI #77.



- 2) Intermediate Coat: Not required **OR** Epoxy, cold-cured, gloss, MPI #77, **as directed**.
- 3) Topcoat: Epoxy, cold-cured, gloss, MPI #77.
- c. Water-Based Epoxy Coating System (System below corresponds to MPI EXT 3.1E):
 - 1) Prime Coat: Water-based epoxy (interior and exterior), MPI #115.
 - 2) Intermediate Coat: Not required **OR** Water-based epoxy (interior and exterior), MPI #115, **as directed**.
 - 3) Topcoat: Water-based epoxy (interior and exterior), MPI #115.
3. Concrete Substrates, Horizontal Surfaces (System below corresponds to MPI EXT 3.2C):
 - a. Epoxy Slip-Resistant Deck Coating System:
 - 1) Topcoat: Epoxy deck coating, MPI #82.
4. Clay-Masonry Substrates (System below corresponds to MPI EXT 4.1C):
 - a. Water-Based, Light-Industrial Coating System:
 - 1) Prime Coat: Water-based, light-industrial coating, MPI #110, gloss matching topcoat.
 - 2) Intermediate Coat: Not required **OR** Water-based, light-industrial coating, MPI #110, gloss matching topcoat, **as directed**.
 - 3) Topcoat: Water-based, light-industrial coating, MPI #110-G6, gloss **OR** 5, semigloss **OR** 3, eggshell, **as directed**.
 - b. Epoxy Coating System (System below corresponds to MPI EXT 4.1D) (MPI recommends this system for smooth brick.):
 - 1) Prime Coat: Epoxy, cold-cured, gloss, MPI #77.
 - 2) Intermediate Coat : Not required **OR** Epoxy, cold-cured, gloss, MPI #77, **as directed**.
 - 3) Topcoat: Epoxy, cold-cured, gloss, MPI #77.
 - c. Water-Based Epoxy Coating System (System below corresponds to MPI EXT 4.1E) (MPI recommends this system for smooth brick.):
 - 1) Prime Coat: Water-based epoxy (interior and exterior), MPI #115.
 - 2) Intermediate Coat: Not required **OR** Water-based epoxy (interior and exterior), MPI #115, **as directed**.
 - 3) Topcoat: Water-based epoxy (interior and exterior), MPI #115.
 - d. Polyurethane, Pigmented, Over Epoxy Coating System (System below corresponds to MPI EXT 4.1J):
 - 1) Prime Coat: Epoxy, cold-cured, gloss, MPI #77.
 - 2) Intermediate Coat: Epoxy, cold-cured, gloss, MPI #77.
 - 3) Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
5. CMU Substrates:
 - a. Water-Based, Light-Industrial Coating System (System below corresponds to MPI EXT 4.2C):
 - 1) Prime Coat: Interior/exterior latex block filler, MPI #4.
 - 2) Intermediate Coat: Not required **OR** Water-based, light-industrial coating, MPI #110, gloss matching topcoat, **as directed**.
 - 3) Topcoat: Water-based, light-industrial coating, MPI #110-G6, gloss **OR** 5, semigloss **OR** 3, eggshell, **as directed**.
 - b. Epoxy Coating System (System below corresponds to MPI EXT 4.2E):
 - 1) Block Filler: Epoxy block filler, MPI #116.
 - 2) Intermediate Coat: Not required **OR** Epoxy, cold-cured, gloss, MPI #77, **as directed**.
 - 3) Topcoat: Epoxy, cold-cured, gloss, MPI #77.
 - c. Water-Based Epoxy Coating System (System below corresponds to MPI EXT 4.2F):
 - 1) Block Filler: Epoxy block filler, MPI #116.
 - 2) Intermediate Coat: Not required **OR** Water-based epoxy (interior and exterior), MPI #115, **as directed**.
 - 3) Topcoat: Water-based epoxy (interior and exterior), MPI #115.



- d. Polyurethane, Pigmented, Over High-Build Epoxy Coating System (System below corresponds to MPI EXT 4.2G):
 - 1) Block Filler: Epoxy block filler, MPI #116.
 - 2) Intermediate Coat: High-build epoxy marine coating, low gloss, MPI #108.
 - 3) Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
6. Steel Substrates:
 - a. Water-Based, Light-Industrial Coating System (System below corresponds to MPI EXT 5.1B, MPI EXT 5.1C, MPI EXT 5.1M and MPI EXT 5.1N, depending on primer selected):
 - 1) Prime Coat: Inorganic zinc primer, MPI #19 **OR** Alkyd anticorrosive metal primer, MPI #79 **OR** Rust-inhibitive primer, (water based), MPI #107 **OR** Cold-curing epoxy primer, MPI #101, **as directed**, primer.
 - 2) Intermediate Coat: Water-based, light-industrial coating, MPI #110, gloss matching topcoat (intermediate coat is required for coating systems except MPI Custom Grade system using inorganic zinc primer).
 - 3) Topcoat: Water-based, light-industrial coating, MPI #110-G6, gloss **OR** 5, semigloss **OR** 3, eggshell, **as directed**.
 - b. High-Build Epoxy Coating System (System below corresponds to MPI EXT 5.1F):
 - 1) Prime Coat: Cold-curing epoxy primer, MPI #101.
 - 2) Intermediate Coat: High-build epoxy marine coating, low gloss, MPI #108.
 - 3) Topcoat: Epoxy, cold-cured, gloss, MPI #77.
 - c. Water-Based Epoxy Coating System (System below corresponds to MPI EXT 5.1E):
 - 1) Prime Coat: Rust-inhibitive primer, (water based), MPI #107.
 - 2) Intermediate Coat: Water-based epoxy (interior and exterior), MPI #115.
 - 3) Topcoat: Water-based epoxy (interior and exterior), MPI #115.
 - d. Polyurethane, Pigmented, Over Epoxy Coating System (System below corresponds to MPI EXT 5.1H):
 - 1) Prime Coat: Cold-curing epoxy primer, MPI #101.
 - 2) Intermediate Coat: Epoxy, cold-cured, gloss, MPI #77.
 - 3) First Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
 - 4) Second Topcoat (for Premium Grade system): Polyurethane, two-component, pigmented, gloss, MPI #72.
 - e. Polyurethane, Pigmented, Over Epoxy Coating System (System below corresponds to MPI EXT 5.1P)
 - 1) Prime Coat: Epoxy zinc primer, MPI#20.
 - 2) Intermediate Coat: Epoxy, cold-cured, gloss, MPI #77.
 - 3) First Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
 - 4) Second Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
 - f. Polyurethane, Pigmented, Over High-Build Epoxy Coating System (System below corresponds to MPI EXT 5.1G):
 - 1) Prime Coat: Epoxy zinc primer, MPI#20.
 - 2) Intermediate Coat: High-build epoxy marine coating, low gloss, MPI #108.
 - 3) First Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
 - 4) Second Topcoat (for Premium Grade system): Polyurethane, two-component, pigmented, gloss, MPI #72.
 - g. Polyurethane, Pigmented, Over High-Build Epoxy Coating System (System below corresponds to MPI EXT 5.1J):
 - 1) Prime Coat: Cold-curing epoxy primer, MPI #101.
 - 2) Intermediate Coat: High-build epoxy marine coating, low gloss, MPI #108.
 - 3) First Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
 - 4) Second Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
 - h. Polyurethane, Pigmented, Over High-Build Epoxy Coating System (System below corresponds to MPI EXT 5.1L):
 - 1) Prime Coat: Inorganic zinc primer, MPI #19.
 - 2) Intermediate Coat: High-build epoxy marine coating, low gloss, MPI #108.
 - 3) First Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.



- 4) Second Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
7. Galvanized-Metal Substrates:
 - a. Water-Based, Light-Industrial Coating System (System below corresponds to MPI EXT 5.3G and MPI EXT 5.3J, depending on primer selected):
 - 1) Prime Coat: Cementitious galvanized-metal primer, MPI #26 **OR** Waterborne galvanized-metal primer, MPI #134, **as directed**.
 - 2) Intermediate Coat (for Premium Grade system): Not required **OR** Water-based, light-industrial coating, MPI #110, gloss matching topcoat, **as directed**.
 - 3) Topcoat: Water-based, light-industrial coating, MPI #110-G6, gloss **OR** 5, semigloss **OR** 3, eggshell, **as directed**.
 - b. Epoxy Coating System (System below corresponds to MPI EXT 5.3C) (MPI recommends this system for high-contact and -traffic areas.):
 - 1) Prime Coat: Cold-curing epoxy primer, MPI #101.
 - 2) Intermediate Coat (for Premium Grade system): Not required **OR** Epoxy, cold-cured, gloss, MPI #77, **as directed**.
 - 3) Topcoat: Epoxy, cold-cured, gloss, MPI #77.
 - c. Polyurethane, Pigmented Coating System (System below corresponds to MPI EXT 5.3D) (MPI recommends these systems for high-contact and -traffic areas.):
 - 1) Prime Coat: Vinyl wash primer, MPI #80.
 - 2) Intermediate Coat: Not required **OR** Cold-curing epoxy primer, MPI #101, **as directed**.
 - 3) First Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
 - 4) Second Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
 - d. Polyurethane, Pigmented Coating System (System below corresponds to MPI EXT 5.3L):
 - 1) Prime Coat: Cold-curing epoxy primer, MPI #101.
 - 2) Intermediate Coat: Not required **OR** Polyurethane, two-component, pigmented, gloss, MPI #72, **as directed**.
 - 3) First Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
 - 4) Second Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
8. Aluminum (Not Anodized or Otherwise Coated) Substrates:
 - a. Water-Based, Light-Industrial Coating System (System below corresponds to MPI EXT 5.4G):
 - 1) Prime Coat: Quick-drying primer for aluminum, MPI #95.
 - 2) Intermediate Coat: Not required **OR** Water-based, light-industrial coating, MPI #110, gloss matching topcoat, **as directed**.
 - 3) Topcoat: Water-based, light-industrial coating, MPI #110-G6, gloss **OR** 5, semigloss **OR** 3, eggshell, **as directed**.
 - b. Epoxy Coating System (System below corresponds to MPI EXT 5.4E):
 - 1) Prime Coat: Vinyl wash primer, MPI #80.
 - 2) Intermediate Coat (for Premium Grade system): Epoxy, cold-cured, gloss, MPI #77.
 - 3) Topcoat: Epoxy, cold-cured, gloss, MPI #77.
 - c. Polyurethane, Pigmented Coating System (System below corresponds to MPI EXT 5.4B) (MPI recommends these systems for high-contact and -traffic areas.):
 - 1) Prime Coat: Vinyl wash primer, MPI #80.
 - 2) Intermediate Coat: Cold-curing epoxy primer, MPI #101.
 - 3) First Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
 - 4) Second Topcoat (for Premium Grade system): Polyurethane, two-component, pigmented, gloss, MPI #72.
9. Wood Substrates:
 - a. Pigmented Polyurethane Coating System (System below corresponds to MPI EXT 6.1J, MPI EXT 6.2J, and MPI EXT 6.3H):
 - 1) Prime Coat: Polyurethane, two-component, pigmented, gloss, MPI #72.
 - 2) Intermediate Coat: Polyurethane, two-component, pigmented, gloss, MPI #72.
 - 3) Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.



- b. Polyurethane, Clear, Two-Component Coating System (System below corresponds to MPI EXT 6.1E for use on glue-laminated beams and columns):
 - 1) Stain Coat: Exterior semitransparent stain (solvent based), MPI #13.
 - 2) Intermediate Coat: Two-component, aliphatic polyurethane, clear, MPI #78.
 - 3) First Topcoat: Two-component, aliphatic polyurethane, clear, MPI #78.
 - 4) Second Topcoat (for Premium Grade systems): Two-component, aliphatic polyurethane, clear, MPI #78.
- F. Interior High-Performance Coating Schedule
1. Coating systems in this Article are based on "MPI Architectural Painting Specification Manual." For renovation projects, consult "MPI Maintenance Repainting Manual" and revise coating systems accordingly.
 2. Concrete Substrates, Vertical Surfaces (System below corresponds to MPI INT 3.1C):
 - a. High-Performance Architectural Latex Coating System:
 - 1) Prime Coat: Interior latex primer/sealer, MPI #50.
 - 2) Intermediate Coat: Not required **OR** High-performance architectural latex matching topcoat, **as directed**.
 - 3) Topcoat: High-performance architectural latex, velvet finish, MPI #138, Gloss Level 2 **OR** eggshell finish, MPI #139, Gloss Level 3 **OR** satin finish, MPI #140, Gloss Level 4 **OR** semigloss finish, MPI #141, Gloss Level 5, **as directed**.
 - b. Water-Based, Light-Industrial Coating System (System below corresponds to MPI INT 3.1L):
 - 1) Prime Coat: Water-based, light-industrial coating, MPI #110, gloss matching topcoat.
 - 2) Intermediate Coat: Not required **OR** Water-based, light-industrial coating, MPI #110, gloss matching topcoat, **as directed**.
 - 3) Topcoat: Water-based, light-industrial coating, MPI #110-G6, gloss **OR** 5, semigloss **OR** 3, eggshell, **as directed**.
 - c. Epoxy Coating System (System below corresponds to MPI INT 3.1F.) (MPI recommends this system for smooth concrete.):
 - 1) Prime Coat: Epoxy, cold-cured, gloss, MPI #77.
 - 2) Intermediate Coat: Not required **OR** Epoxy, cold-cured, gloss, MPI #77, **as directed**.
 - 3) Topcoat: Epoxy, cold-cured, gloss, MPI #77.
 - d. Water-Based Epoxy Coating System (System below corresponds to MPI INT 3.1G) (MPI recommends this system for smooth concrete.):
 - 1) Prime Coat: Water-based epoxy (interior and exterior), MPI #115.
 - 2) Intermediate Coat: Not required **OR** Water-based epoxy (interior and exterior), MPI #115, **as directed**.
 - 3) Topcoat: Water-based epoxy (interior and exterior), MPI #115.
 3. Concrete Substrates, Horizontal Surfaces.
 - a. Epoxy Coating System (System below corresponds to MPI INT 3.2C):
 - 1) Prime Coat: Epoxy, cold-cured, gloss, MPI #77.
 - 2) Intermediate Coat: Not required **OR** Epoxy, cold-cured, gloss, MPI #77, **as directed**.
 - 3) Topcoat: Epoxy, cold-cured, gloss, MPI #77.
 - b. Water-Based Epoxy Floor Paint Coating System (System below corresponds to MPI INT 3.2L).
 - 1) Prime Coat: Water-based epoxy floor paint, MPI #93.
 - 2) Intermediate Coat: Not required **OR** Water-based epoxy floor paint, MPI #93, **as directed**.
 - 3) Topcoat: Water-based epoxy floor paint, MPI #93.
 - c. Polyurethane, Pigmented Coating System (System below corresponds to MPI INT 3.2D):
 - 1) Prime Coat: Epoxy, cold-cured, gloss, MPI #77.
 - 2) Intermediate Coat: Not required **OR** Polyurethane, two-component, pigmented, gloss, MPI #72, **as directed**.



- 3) Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
- d. Polyurethane, Clear, Two-Component Coating System (System below corresponds to MPI INT 3.2K):
 - 1) Prime Coat: Two-component, aliphatic polyurethane, clear, MPI #78.
 - 2) Intermediate Coat: Not required **OR** Two-component, aliphatic polyurethane, clear, MPI #78, **as directed**.
 - 3) Topcoat: Two-component, aliphatic polyurethane, clear, MPI #78.
4. Clay-Masonry Substrates:
 - a. High-Performance Architectural Latex Coating System (System below corresponds to MPI INT 4.1L):
 - 1) Prime Coat: High-performance architectural latex matching topcoat.
 - 2) Intermediate Coat: Not required **OR** High-performance architectural latex matching topcoat, **as directed**.
 - 3) Topcoat: High-performance architectural latex, velvet finish, MPI #138, Gloss Level 2 **OR** eggshell finish, MPI #139, Gloss Level 3 **OR** satin finish, MPI #140, Gloss Level 4 **OR** semigloss finish, MPI #141, Gloss Level 5, **as directed**.
 - b. Water-Based, Light-Industrial Coating System (System below corresponds to MPI INT 4.1C):
 - 1) Prime Coat: Water-based, light-industrial coating, MPI #110, gloss matching topcoat.
 - 2) Intermediate Coat: Not required **OR** Water-based, light-industrial coating, MPI #110, gloss matching topcoat, **as directed**.
 - 3) Topcoat: Water-based, light-industrial coating, MPI #110-G6, gloss **OR** 5, semigloss **OR** 3, eggshell, **as directed**.
 - c. Epoxy Coating System (System below corresponds to MPI INT 4.1F) (MPI recommends this system for smooth brick.):
 - 1) Prime Coat: Epoxy, cold-cured, gloss, MPI #77.
 - 2) Intermediate Coat: Not required **OR** Epoxy, cold-cured, gloss, MPI #77, **as directed**.
 - 3) Topcoat: Epoxy, cold-cured, gloss, MPI #77.
 - d. Water-Based Epoxy Coating System (System below corresponds to MPI INT 4.1G) (MPI recommends this system for smooth brick.):
 - 1) Prime Coat: Water-based epoxy (interior and exterior), MPI #115.
 - 2) Intermediate Coat: Not required **OR** Water-based epoxy (interior and exterior), MPI #115, **as directed**.
 - 3) Topcoat: Water-based epoxy (interior and exterior), MPI #115.
 - e. Polyurethane, Clear, Two-Component Coating System (System below corresponds to MPI INT 4.1K):
 - 1) Prime Coat: Two-component, aliphatic polyurethane, clear, MPI #78.
 - 2) Intermediate Coat: Not required **OR** Two-component, aliphatic polyurethane, clear, MPI #78, **as directed**.
 - 3) Topcoat: Two-component, aliphatic polyurethane, clear, MPI #78.
5. CMU Substrates:
 - a. High-Performance Architectural Latex Coating System (System below corresponds to MPI INT 4.2D):
 - 1) Prime Coat: Interior/exterior latex block filler, MPI #4.
 - 2) Intermediate Coat: Not required **OR** High-performance architectural latex matching topcoat, **as directed**.
 - 3) Topcoat: High-performance architectural latex, velvet finish, MPI #138, Gloss Level 2 **OR** eggshell finish, MPI #139, Gloss Level 3 **OR** satin finish, MPI #140, Gloss Level 4 **OR** semigloss finish, MPI #141, Gloss Level 5, **as directed**.
 - b. Water-Based, Light-Industrial Coating System (System below corresponds to MPI INT 4.2K):
 - 1) Prime Coat: Interior/exterior latex block filler, MPI #4.



- 2) Intermediate Coat: Not required **OR** Water-based, light-industrial coating, MPI #110, gloss matching topcoat, **as directed**.
 - 3) Topcoat: Water-based, light-industrial coating, MPI #110-G6, gloss **OR** 5, semigloss **OR** 3, eggshell, **as directed**.
 - c. Epoxy Coating System (System below corresponds to MPI INT 4.2F and MPI INT 4.2G, depending on primer selected) (MPI recommends these systems for dry environments.):
 - 1) Prime Coat: Interior/exterior latex block filler, MPI #4 **OR** Epoxy block filler, MPI #116, **as directed**.
 - 2) Intermediate Coat: Not required **OR** Epoxy, cold-cured, gloss, MPI #77, **as directed**.
 - 3) Topcoat: Epoxy, cold-cured, gloss, MPI #77.
 - d. Water-Based Epoxy Coating System (System below corresponds to MPI INT 4.2J) (MPI recommends this system for wet environments.):
 - 1) Prime Coat: Interior/exterior latex block filler, MPI #4.
 - 2) Intermediate Coat: Not required **OR** Water-based epoxy (interior and exterior), MPI #115, **as directed**.
 - 3) Topcoat: Water-based epoxy (interior and exterior), MPI #115.
6. Steel Substrates:
- a. High-Performance Architectural Latex Coating System (System below corresponds to MPI INT 5.1R):
 - 1) Prime Coat: Alkyd anticorrosive metal primer, MPI #79 **OR** Quick-dry alkyd metal primer, MPI #76, **as directed**.
 - 2) Intermediate Coat: Not required **OR** High-performance architectural latex matching topcoat, **as directed**.
 - 3) Topcoat: High-performance architectural latex, velvet finish, MPI #138, Gloss Level 2 **OR** eggshell finish, MPI #139, Gloss Level 3 **OR** satin finish, MPI #140, Gloss Level 4 **OR** semigloss finish, MPI #141, Gloss Level 5, **as directed**.
 - b. Water-Based, Light-Industrial Coating System (System below corresponds to MPI INT 5.1B and MPI INT 5.1N, depending on primer selected.):
 - 1) Prime Coat: Rust-inhibitive primer (water based), MPI #107 **OR** Cold-curing epoxy primer, MPI #101, **as directed**.
 - 2) Intermediate Coat: Not required **OR** Water-based, light-industrial coating, MPI #110, gloss matching topcoat, **as directed**.
 - 3) Topcoat: Water-based, light-industrial coating, MPI #110-G6, gloss **OR** 5, semigloss **OR** 3, eggshell, **as directed**.
 - c. High-Build Epoxy Coating System - Premium Grade (System below corresponds to MPI INT 5.1P):
 - 1) Prime Coat: Epoxy zinc primer, MPI#20.
 - 2) Intermediate Coat: High-build epoxy marine coating, low gloss, MPI #108.
 - 3) Topcoat: Epoxy, cold-cured, gloss, MPI #77.
 - d. High-Build Epoxy Coating System – Custom Grade (System below corresponds to MPI INT 5.1P):
 - 1) Prime Coat: Epoxy zinc primer, MPI#20.
 - 2) Topcoat: High-build epoxy marine coating, low gloss, MPI #108.
 - e. Epoxy Coating System (System below corresponds to MPI INT 5.1L):
 - 1) Prime Coat: Cold-curing epoxy primer, MPI #101.
 - 2) Intermediate Coat: Not required **OR** Epoxy, cold-cured, gloss, MPI #77, **as directed**.
 - 3) Topcoat: Epoxy, cold-cured, gloss, MPI #77.
 - f. Water-Based Epoxy Coating System (System below corresponds to MPI INT 5.1K):
 - 1) Prime Coat: Rust-inhibitive primer (water based), MPI #107.
 - 2) Intermediate Coat: Water-based epoxy (interior and exterior), MPI #115.
 - 3) Topcoat: Water-based epoxy (interior and exterior), MPI #115.
 - g. Polyurethane, Pigmented Coating System (System below corresponds to MPI INT 5.1F):
 - 1) Prime Coat: Cold-curing epoxy primer, MPI #101.



- 2) Intermediate Coat: Not required **OR** Polyurethane, two-component, pigmented, gloss, MPI #72, **as directed**.
- 3) Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
- h. Polyurethane, Pigmented Coating System (System below corresponds to MPI INT 5.1H):
 - 1) Prime Coat: Inorganic zinc primer, MPI #19.
 - 2) Intermediate Coat: Epoxy, cold-cured, gloss, MPI #77.
 - 3) Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
- i. Polyurethane, Pigmented Coating System (System below corresponds to MPI INT 5.1J):
 - 1) Prime Coat: Epoxy zinc primer, MPI#20.
 - 2) Intermediate Coat: Epoxy, cold-cured, gloss, MPI #77.
 - 3) Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
- j. Polyurethane, Pigmented, Over High-Build Epoxy Coating System (System below corresponds to MPI INT 5.1G):
 - 1) Prime Coat: Cold-curing epoxy primer, MPI #101.
 - 2) Intermediate Coat: High-build epoxy marine coating, low gloss, MPI #108.
 - 3) Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
7. Galvanized-Metal Substrates:
 - a. High-Performance Architectural Latex Coating System (System below corresponds to MPI INT 5.3M):
 - 1) Prime Coat: Waterborne galvanized-metal primer, MPI #134.
 - 2) Intermediate Coat: Not required **OR** High-performance architectural latex matching topcoat, **as directed**.
 - 3) Topcoat: High-performance architectural latex, velvet finish, MPI #138, Gloss Level 2 **OR** eggshell finish, MPI #139, Gloss Level 3 **OR** satin finish, MPI #140, Gloss Level 4 **OR** semigloss finish, MPI #141, Gloss Level 5, **as directed**.
 - b. Water-Based, Light-Industrial Coating System (System below corresponds to MPI INT 5.3B and MPI INT 5.3K, depending on primer selected.):
 - 1) Prime Coat: Cementitious galvanized-metal primer, MPI #26 **OR** Waterborne galvanized-metal primer, MPI #134, **as directed**.
 - 2) Intermediate Coat: Not required **OR** Water-based, light-industrial coating, MPI #110, gloss matching topcoat, **as directed**.
 - 3) Topcoat: Water-based, light-industrial coating, MPI #110-G6, gloss **OR** 5, semigloss **OR** 3, eggshell, **as directed**.
 - c. Epoxy Coating System (System below corresponds to MPI INT 5.3D):
 - 1) Prime Coat: Cold-curing epoxy primer, MPI #101.
 - 2) Intermediate Coat: Not required **OR** Epoxy, cold-cured, gloss, MPI #77, **as directed**.
 - 3) Topcoat: Epoxy, cold-cured, gloss, MPI #77.
8. Aluminum (Not Anodized or Otherwise Coated) Substrates (System below corresponds to MPI INT 5.4F):
 - a. High-Performance Architectural Latex Coating System:
 - 1) Prime Coat: Quick-drying primer for aluminum, MPI #95.
 - 2) Intermediate Coat: Not required **OR** High-performance architectural latex, matching topcoat, **as directed**.
 - 3) Topcoat: High-performance architectural latex, velvet finish, MPI #138, Gloss Level 2 **OR** eggshell finish, MPI #139, Gloss Level 3 **OR** satin finish, MPI #140, Gloss Level 4 **OR** semigloss finish, MPI #141, Gloss Level 5, **as directed**.
 - b. Water-Based, Light-Industrial Coating System (System below corresponds to MPI INT 5.4E):
 - 1) Prime Coat: Quick-drying primer for aluminum, MPI #95.
 - 2) Intermediate Coat: Not required **OR** Water-based, light-industrial coating, MPI #110, gloss matching topcoat, **as directed**.
 - 3) Topcoat: Water-based, light-industrial coating, MPI #110-G6, gloss **OR** 5, semigloss **OR** 3, eggshell, **as directed**.
 - c. Epoxy Coating System (System below corresponds to MPI INT 5.4B):



- 1) Prime Coat: Vinyl wash primer, MPI #80.
 - 2) Intermediate Coat: Not required **OR** Epoxy, cold-cured, gloss, MPI #77, **as directed**.
 - 3) Topcoat: Epoxy, cold-cured, gloss, MPI #77.
- d. Polyurethane, Pigmented Coating System (System below corresponds to MPI INT 5.4C):
- 1) Prime Coat: Vinyl wash primer, MPI #80.
 - 2) Intermediate Coat: Epoxy, cold-cured, gloss, MPI #77.
 - 3) Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
9. Wood Substrates:
- a. High-Performance Architectural Latex Coating System (System below corresponds to MPI INT 6.1N, MPI INT 6.3A, and MPI INT 6.4S):
- 1) Prime Coat: Interior latex-based wood primer, MPI #39.
 - 2) Intermediate Coat: High-performance architectural latex matching topcoat.
 - 3) Topcoat: High-performance architectural latex, velvet finish, MPI #138, Gloss Level 2 **OR** eggshell finish, MPI #139, Gloss Level 3 **OR** satin finish, MPI #140, Gloss Level 4 **OR** semigloss finish, MPI #141, Gloss Level 5, **as directed**.
- b. Water-Based, Light-Industrial Coating System (System below corresponds to MPI INT 6.3P and MPI INT 6.4N):
- 1) Prime Coat: Interior alkyd primer/sealer, MPI #45.
 - 2) Intermediate Coat: Water-based, light-industrial coating, MPI #110, gloss matching topcoat.
 - 3) Topcoat: Water-based, light-industrial coating, MPI #110-G6, gloss **OR** 5, semigloss **OR** 3, eggshell, **as directed**.
- c. Epoxy Coating System (System below corresponds to MPI INT 6.1L and MPI INT 6.3L):
- 1) Prime Coat: Epoxy, cold-cured, gloss, MPI #77.
 - 2) Intermediate Coat: Not required **OR** Epoxy, cold-cured, gloss, MPI #77, **as directed**.
 - 3) Topcoat: Epoxy, cold-cured, gloss, MPI #77.
- d. Pigmented Polyurethane Coating System (System below corresponds to MPI INT 6.1E):
- 1) Prime Coat: Polyurethane, two-component, pigmented, gloss, MPI #72.
 - 2) Intermediate Coat: Polyurethane, two-component, pigmented, gloss, MPI #72.
 - 3) Topcoat: Polyurethane, two-component, pigmented, gloss, MPI #72.
- e. Polyurethane, Clear, Moisture-Cured Coating System (System below corresponds to MPI INT 6.1S, MPI INT 6.2N, MPI INT 6.3Y, and MPI INT 6.4V):
- 1) Stain Coat: Interior wood stain, semitransparent (solvent based), MPI #90.
 - 2) Intermediate Coat: Polyurethane, moisture cured, clear, flat, MPI #71 **OR** Polyurethane, moisture cured, clear, gloss, MPI #31, **as directed**.
 - 3) First Topcoat: Polyurethane, moisture cured, clear, flat, MPI #71 **OR** Polyurethane, moisture cured, clear, gloss, MPI #31, **as directed**.
 - 4) Second Topcoat: Not required **OR** Polyurethane, moisture cured, clear, flat, MPI #71 **OR** Polyurethane, moisture cured, clear, gloss, MPI #31, **as directed**.
- f. Polyurethane, Clear, Moisture-Cured Coating System (System below corresponds to MPI INT 6.3X):
- 1) Intermediate Coat: Polyurethane, moisture cured, clear, flat, MPI #71 **OR** Polyurethane, moisture cured, clear, gloss, MPI #31, **as directed**.
 - 2) First Topcoat: Polyurethane, moisture cured, clear, flat, MPI #71 **OR** Polyurethane, moisture cured, clear, gloss, MPI #31, **as directed**.
 - 3) Second Topcoat: Not required **OR** Polyurethane, moisture cured, clear, flat, MPI #71 **OR** Polyurethane, moisture cured, clear, gloss, MPI #31, **as directed**.
- g. Polyurethane, Clear, Two-Component Coating System (System below corresponds to MPI INT 6.3Z):
- 1) Stain Coat: Exterior semitransparent stain (solvent based), MPI #13.
 - 2) Intermediate Coat: Not required **OR** Two-component, aliphatic polyurethane, clear, MPI #78, **as directed**.
 - 3) Topcoat: Two-component, aliphatic polyurethane, clear, MPI #78.
10. Gypsum Board Substrates:



- a. High-Performance Architectural Latex Coating System (System below corresponds to MPI INT 9.2B):
 - 1) Prime Coat: Interior latex primer/sealer, MPI #50.
 - 2) Intermediate Coat: High-performance architectural latex matching topcoat.
 - 3) Topcoat: High-performance architectural latex, velvet finish, MPI #138, Gloss Level 2 **OR** eggshell finish, MPI #139, Gloss Level 3 **OR** satin finish, MPI #140, Gloss Level 4 **OR** semigloss finish, MPI #141, Gloss Level 5, **as directed**.
- b. Water-Based, Light-Industrial Coating System (System below corresponds to MPI INT 9.2L):
 - 1) Prime Coat: Interior latex primer/sealer, MPI #50.
 - 2) Intermediate Coat: Water-based, light-industrial coating, MPI #110, gloss matching topcoat.
 - 3) Topcoat: Water-based, light-industrial coating, MPI #110-G6, gloss **OR** 5, semigloss **OR** 3, eggshell, **as directed**.
- c. Epoxy Coating System (System below corresponds to MPI INT 9.2E):
 - 1) Prime Coat: Interior latex primer/sealer, MPI #50.
 - 2) Intermediate Coat: Not required **OR** Epoxy, cold-cured, gloss, MPI #77, **as directed**.
 - 3) Topcoat: Epoxy, cold-cured, gloss, MPI #77.
- d. Water-Based Epoxy Coating System (System below corresponds to MPI INT 9.2F):
 - 1) Prime Coat: Interior latex primer/sealer, MPI #50.
 - 2) Intermediate Coat: Not required **OR** Water-based epoxy (interior and exterior), MPI #115, **as directed**.
 - 3) Topcoat: Water-based epoxy (interior and exterior), MPI #115.

END OF SECTION 09 96 00 00



Task	Specification	Specification Description
09 96 53 00	09 91 13 00	Exterior Painting
09 97 35 00	09 91 23 00	Interior Painting



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SECTION 10 11 13 13 - VISUAL DISPLAY SURFACES

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for visual display surfaces. Product shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Chalkboards.
 - b. Markerboards.
 - c. Tackboards.
 - d. Visual display rails.
 - e. Visual display wall panels.
 - f. Support systems for visual display boards.
 - g. Sliding visual display units.
 - h. Visual display conference units.
 - i. Visual display wall coverings.
 - j. Electronic markerboards.

C. Definitions

1. Tackboard: Framed or unframed, tackable, visual display board assembly.
2. Visual Display Board Assembly: Visual display surface that is factory fabricated into composite panel form, either with or without a perimeter frame; includes chalkboards, markerboards, and tackboards.
3. Visual Display Surface: Surfaces that are used to convey information visually, including surfaces of chalkboards, markerboards, tackboards, and surfacing materials that are not fabricated into composite panel form but are applied directly to walls.

D. Submittals

1. Product Data: For each type of product indicated.
 - a. Include rated capacities, operating characteristics, electrical characteristics and individual panel weights for sliding visual display units.
 - b. Include computer system requirements for electronic markerboards.
2. LEED Submittals:
 - a. Product Data for Credit EQ 4.4: For composite wood products, documentation indicating that the product contains no urea formaldehyde.
 - b. Product Data for Credit EQ 4.1: For adhesives, including printed statement of VOC content and chemical components.
3. Shop Drawings: For visual display surfaces. Include plans, elevations, sections, details, and attachments to other work.
 - a. Show locations of panel joints.
 - b. Show locations of special-purpose graphics for visual display surfaces.
 - c. Include sections of typical trim members.
 - d. Wiring Diagrams: For power, signal, and control wiring.
4. Samples: For each exposed product and for each color and texture specified.
5. Qualification Data: For qualified Installer.
6. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for surface-burning characteristics of fabrics.
7. Operation and Maintenance Data: For visual display surfaces and power-operated units to include in maintenance manuals.



8. Warranties: Sample of special warranties.

E. Quality Assurance

1. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of motor-operated, sliding visual display units required for this Project.
2. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 50 **OR** 450, **as directed**, or less.
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
4. Preinstallation Conference: Conduct conference at Project site.

F. Delivery, Storage, And Handling

1. Deliver factory-built visual display surfaces, including factory-applied trim where indicated, completely assembled in one piece without joints, where possible. If dimensions exceed maximum manufactured panel size, provide two or more pieces of equal length as acceptable to the Owner. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site.
2. Store visual display surfaces vertically with packing materials between each unit.

G. Project Conditions

1. Environmental Limitations: Do not deliver or install visual display surfaces until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Field Measurements: Verify actual dimensions of construction contiguous with visual display surfaces by field measurements before fabrication.
 - a. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

H. Warranty

1. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer's standard form in which manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.
 - a. Failures include, but are not limited to, the following:
 - 1) Surfaces lose original writing and erasing qualities.
 - 2) Surfaces exhibit crazing, cracking, or flaking.
 - b. Warranty Period: 50 years from date of Final Completion **OR** Life of the building, **as directed**.
2. Special Warranty for Electronic Markerboards: Manufacturer's standard form in which manufacturer agrees to repair or replace electronic markerboards that fail in materials or workmanship within two years from date of Final Completion.

1.2 PRODUCTS

A. Materials, General

1. Porcelain-Enamel Face Sheet: ASTM A 424, enameling-grade steel, uncoated thickness indicated; with exposed face and edges coated with primer, 1.7-to-2.5-mil- (0.043-to-0.064-mm-) thick ground coat, and color cover coat; and with concealed face coated with primer and 1.7-to-2.5-mil- (0.043-to-0.064-mm-) thick ground coat.
 - a. Matte-Finish Cover Coat: Low reflective; chalk wipes clean with dry cloth or standard eraser. Minimum 2.0-to-2.5-mil- (0.051-to-0.064-mm-) thick cover coat. Cover and ground



- coats shall be fused to steel at manufacturer's standard firing temperatures but not less than 1250 deg F (677 deg C).
- b. Gloss-Finish Cover Coat: Gloss as indicated; dry-erase markers wipe clean with dry cloth or standard eraser. Minimum 3.0-to-4.0-mil- (0.076-to-0.102-mm-) thick cover coat. Cover and ground coats shall be fused to steel at manufacturer's standard firing temperatures but not less than 1475 deg F (802 deg C).
2. Porcelain-Enamel Face Sheet: Porcelain-enamel-clad, ASTM A 463/A 463M, Type 1, stretcher-leveled aluminized steel, with 0.024-inch (0.60-mm) uncoated thickness; with porcelain-enamel coating fused to steel at approximately 1000 deg F (538 deg C).
 - a. Matte Finish: Low reflective; chalk wipes clean with dry cloth or standard eraser.
 - b. Gloss Finish: Low gloss; dry-erase markers wipe clean with dry cloth or standard eraser. Suitable for use as projection screen.
 3. Porcelain-Enamel Face Sheet: Manufacturer's standard steel sheet with porcelain-enamel coating fused to steel; uncoated thickness indicated.
 - a. Matte Finish: Low reflective; chalk wipes clean with dry cloth or standard eraser.
 - b. Gloss Finish: Gloss as indicated; dry-erase markers wipe clean with dry cloth or standard eraser.
 4. Melamine: Thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.
 5. High-Pressure Plastic Laminate: NEMA LD 3.
 6. Natural Cork Sheet: Seamless, single-layer, compressed fine-grain cork sheet; bulletin board quality; face sanded for natural finish with surface-burning characteristics indicated.
 7. Plastic-Impregnated Cork Sheet: Seamless, homogeneous, self-sealing sheet consisting of granulated cork, linseed oil, resin binders, and dry pigments that are mixed and calendared onto fabric backing; with washable vinyl finish and integral color throughout with surface-burning characteristics indicated.
 8. Vinyl Fabric: Mildew resistant, washable, complying with FS CCC-W-408D, Type II, burlap weave; weighing not less than 13 oz./sq. yd. (440 g/sq. m); with surface-burning characteristics indicated.
 9. Polyester Fabric: Nondirectional weave, 100 percent polyester; weighing not less than 15 oz./sq. yd. (508 g/sq. m); with surface-burning characteristics indicated.
 10. Hardboard: ANSI A135.4, tempered.
 11. Particleboard: ANSI A208.1, Grade M-1, made with binder containing no urea formaldehyde.
 12. Fiberboard: ASTM C 208.
 13. Extruded Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6063.
- B. Chalkboard Assemblies
1. Porcelain-Enamel Chalkboards: Balanced, high-pressure, factory-laminated chalkboard assembly of three-ply construction consisting of backing sheet, core material, and 0.021-inch- (0.53-mm-) thick, **OR** 0.013-inch- (0.33-mm-) thick, **as directed**, porcelain-enamel face sheet with matte finish.
 - a. Hardboard Core: 1/4 inch (6 mm) thick; with 0.005-inch- (0.127-mm-) thick, aluminum foil **OR** 0.015-inch- (0.38-mm-) thick, aluminum sheet **OR** 0.0129-inch- (0.35-mm-) thick, galvanized-steel sheet, **as directed**, backing.
 - b. Particleboard Core: 3/8 inch (9.5 mm) thick; with 0.005-inch- (0.127-mm-) thick, aluminum foil **OR** 0.015-inch- (0.38-mm-) thick, aluminum sheet **OR** 0.0129-inch- (0.35-mm-) thick, galvanized-steel sheet, **as directed**, backing.
 - c. Fiberboard Core: 3/8 inch (9.5 mm) **OR** 1/2 inch (13 mm), **as directed**, thick; with 0.001-inch- (0.025-mm-) thick, aluminum foil **OR** 0.015-inch- (0.38-mm-) thick, aluminum sheet **OR** 0.0129-inch- (0.35-mm-) thick, galvanized-steel sheet, **as directed**, backing.
 - d. Manufacturer's Standard Core: Minimum 1/4 inch (6 mm) thick, with manufacturer's standard moisture-barrier backing.
 - e. Laminating Adhesive: Manufacturer's standard, moisture-resistant thermoplastic type.
 2. High-Pressure-Laminate Chalkboards: Balanced, high-pressure, factory-laminated chalkboard assembly of two-ply construction consisting of fiberboard core material and high-pressure-laminate writing surface.



3. Melamine Chalkboards: Fabricated from 1/4-inch- (6-mm-) thick, sealed and primed hardboard panels permanently bonded with melamine writing surface.
4. Painted-Finish Chalkboards: Fabricated from two plies of 1/4-inch- (6-mm-) thick, treated, tempered hardboard panels permanently surfaced with manufacturer's standard, heat-cured organic coating formulated for chalk-receptive matte finish.
5. Natural-Slate Chalkboards: Select grade, resurfaced, natural slate; free from ribbons and other natural marks that impair their functional use and durability as a writing surface.
 - a. Writing surface shall be free of tooling marks, pits, chipping, scratches, and surface spalls in excess of those that can be easily corrected; and shall be free of surface-applied stain, dye, or other artificial coloring.
 - b. Thickness: Not less than 1/4 inch (6 mm) or more than 3/8 inch (9.5 mm) thick with maximum deviation of 1/16 inch (1.6 mm) when an average thickness of at least 1/4 inch (6 mm) is maintained.

C. Markerboard Assemblies

1. Porcelain-Enamel Markerboards: Balanced, high-pressure, factory-laminated markerboard assembly of three-ply construction consisting of backing sheet, core material, and 0.021-inch- (0.53-mm-) thick, **OR** 0.013-inch- (0.33-mm-) thick, **as directed**, porcelain-enamel face sheet with high-gloss **OR** low-gloss, **as directed**, finish.
 - a. Hardboard Core: 1/4 inch (6 mm) thick; with 0.005-inch- (0.127-mm-) thick, aluminum foil **OR** 0.015-inch- (0.38-mm-) thick, aluminum sheet **OR** 0.013-inch- (0.35-mm-) thick, galvanized-steel sheet, **as directed**, backing.
 - b. Particleboard Core: 3/8 inch (9.5 mm) **OR** 1/2 inch (13 mm), **as directed**, thick; with 0.005-inch- (0.127-mm-) thick, aluminum foil **OR** 0.015-inch- (0.38-mm-) thick, aluminum sheet **OR** 0.013-inch- (0.35-mm-) thick, galvanized-steel sheet, **as directed**, backing.
 - c. Fiberboard Core: 3/8 inch (9.5 mm) **OR** 1/2 inch (13 mm), **as directed**, thick; with 0.001-inch- (0.025-mm-) thick, aluminum foil **OR** 0.015-inch- (0.38-mm-) thick, aluminum sheet **OR** 0.013-inch- (0.35-mm-) thick, galvanized-steel sheet, **as directed**, backing.
 - d. Manufacturer's Standard Core: Minimum 1/4 inch (6 mm) thick, with manufacturer's standard moisture-barrier backing.
 - e. Laminating Adhesive: Manufacturer's standard, moisture-resistant thermoplastic type.
2. Melamine Markerboards: Fabricated from 1/4-inch- (6-mm-) thick, sealed and primed hardboard panels permanently bonded with melamine or another high-pressure-laminate writing surface.
3. High-Pressure-Laminate Markerboard Assembly: Balanced, high-pressure, factory-laminated chalkboard assembly of three-ply construction consisting of backing sheet, fiberboard core material, and high-pressure-laminate writing surface.

D. Tackboard Assemblies

1. Natural-Cork Tackboard:
 - a. 1/16-inch- (1.6-mm-) thick, natural cork sheet factory laminated to 3/8-inch- (9.5-mm-) **OR** 7/16-inch- (11-mm-), **as directed**, thick fiberboard backing.
 - b. 1/8-inch- (3-mm-) thick, natural cork sheet factory laminated to 3/8-inch- (9.5-mm-) thick fiberboard backing.
 - c. 1/4-inch- (6-mm-) thick, natural cork sheet factory laminated to 1/4-inch- (6-mm-) thick hardboard **OR** particleboard, **as directed**, backing.
2. Plastic-Impregnated-Cork Tackboard:
 - a. 1/8-inch- (3-mm-) thick, plastic-impregnated cork sheet factory laminated to 3/8-inch- (9.5-mm-) thick fiberboard backing.
 - b. 1/4-inch- (6-mm-) thick, plastic-impregnated cork sheet factory laminated to 1/4-inch- (6-mm-) thick hardboard **OR** particleboard, **as directed**, backing.
3. Vinyl-Fabric-Faced Tackboard:
 - a. Vinyl fabric factory laminated to 3/8-inch- (9.5-mm-) **OR** 7/16-inch- (11-mm-) **OR** 1/2-inch- (13-mm-), **as directed**, thick fiberboard backing.
 - b. 1/16-inch- (1.6-mm-) thick, vinyl-fabric-faced cork sheet factory laminated to 3/8-inch- (9.5-mm-) thick fiberboard backing.



- c. 1/8-inch- (3-mm-) thick, vinyl-fabric-faced cork sheet factory laminated to 3/8-inch- (9.5-mm-) thick fiberboard backing.
 - d. 1/4-inch- (6-mm-) thick, vinyl-fabric-faced cork sheet factory laminated to 1/4-inch- (6-mm-) thick hardboard **OR** particleboard, **as directed**, backing.
4. Polyester-Fabric-Faced Tackboard:
- a. Polyester fabric factory laminated to 3/8-inch- (9.5-mm-) **OR** 1/2-inch- (13-mm-), **as directed**, thick fiberboard backing.
 - b. 1/16-inch- (1.6-mm-) thick, polyester-fabric-faced cork sheet factory laminated to 3/8-inch- (9.5-mm-) thick fiberboard backing.
 - c. 1/8-inch- (3-mm-) thick, polyester-fabric-faced cork sheet factory laminated to 3/8-inch- (9.5-mm-) thick fiberboard backing.
 - d. 1/4-inch- (6-mm-) thick, polyester-fabric-faced cork sheet factory laminated to 1/4-inch- (6-mm-) thick hardboard **OR** particleboard, **as directed**, backing.
- E. Visual Display Rails
1. General: Manufacturer's standard, aluminum-framed, tackable cork **OR** fabric, **as directed**, visual display surface fabricated into narrow rail shape and designed for displaying material.
- F. Visual Display Wall Panels
1. Marker Wall Sheets: Fabricated from 0.021-inch (0.53-mm) uncoated thickness, porcelain-enamel face sheets; for direct application to wall surface.
 2. Marker Wall Panels: Fabricated from markerboard assembly indicated.
 3. Tack Wall Panels: With tackable surface.
 - a. Fabricated from tackboard assembly indicated.
 - b. Natural Cork: 1/8-inch- (3-mm-) **OR** 1/4-inch- (6-mm-), **as directed**, thick, natural cork sheet for direct application to wall surface.
 - c. Plastic-Impregnated Cork: 1/8-inch- (3-mm-) **OR** 1/4-inch- (6-mm-), **as directed**, thick, plastic-impregnated cork sheet for direct application to wall surface.
 - d. Vinyl Fabric-Faced Cork: 1/4-inch- (6-mm-) thick, vinyl-fabric-faced cork sheet for direct application to wall surface.
 - e. Polyester-Fabric-Faced Cork: 1/4-inch- (6-mm-) thick, polyester-fabric-faced cork sheet for direct application to wall surface.
 4. Joint Accessories: Manufacturer's standard, exposed trim **OR** concealed aluminum or steel spline, **as directed**, at butt joints.
 5. Adhesive: Mildew-resistant, nonstaining adhesive, for use with specific tack wall panels and substrate application, as recommended in writing by visual display surface manufacturer, and with a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 6. Primer/Sealer: Mildew-resistant primer/sealer complying with requirements in Division 09 Section "Interior Painting" and recommended in writing by visual display surface manufacturer for intended substrate.
- G. Rail Support System For Visual Display Boards
1. Support Rails: Horizontal, wall-mounted, extruded-aluminum rails designed to receive hanger clip and to support visual display boards; capable of gripping and suspending paper directly from rail.
 - a. Finish: Clear anodic **OR** Color anodic **OR** Baked enamel **OR** Powder coat, **as directed**.
 - b. Color and Gloss: Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black **OR** As indicated by manufacturer's designations **OR** Match sample **OR** As selected from manufacturer's full range, **as directed**.
 2. Hanger Clips: Extruded aluminum with finish to match rails; designed to support independent visual display boards by engaging support rail and top trim of board.
 3. Visual Display Panels: Fabricated from not less than 3/8-inch- (9.5-mm-) thick, kraft-paper honeycomb core; designed to be rigid and to resist warpage, and with aluminum trim designed to engage hanger clips.
- H. Modular Support System For Visual Display Boards



1. Standards: 72-inch- (1829-mm-) long, extruded-aluminum slotted standards designed for supporting visual display boards on panel clips. Standards shall be punched at not less than 4 inches (100 mm) o.c.
 - a. Finish: Clear anodic **OR** Color anodic **OR** Baked enamel **OR** Powder coat, **as directed**.
 - b. Color and Gloss: Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black **OR** As indicated by manufacturer's designations **OR** Match sample **OR** As selected from manufacturer's full range, **as directed**.
 2. Panel Clips: Extruded aluminum or steel with finish to match standards.
- I. Sliding Visual Display Units
1. Horizontal-Sliding Visual Display Units: Factory-fabricated units consisting of extruded-aluminum tubular frame, fixed-rear visual display panel, aluminum-framed horizontal-sliding panels, and extruded-aluminum fascia that conceals overhead sliding track; designed for recessed mounting. Provide panels that operate smoothly without vibration or chatter.
 - a. Two-Track Units: Fabricate unit with fixed rear panel covering entire rear surface. Provide two sliding panels, each equal to not less than one-half of overall length of unit.
 - b. Three-Track Units: Fabricate unit with fixed rear panel covering entire rear surface. Provide three sliding panels, each equal to not less than one-third **OR** one-half, **as directed**, of overall length of unit.
 - c. Four-Track Units: Fabricate unit with fixed rear panel centered in and covering not less than one-half of rear surface, and fixed front panel on each side of unit equal to not less than one-quarter of overall length of unit. Provide four sliding panels, each equal to not less than one-quarter of overall length of unit.
 - 1) Swinging Doors: Fabricated from same construction as sliding panels and supported on full-height continuous hinges. Provide visual display surface on both sides of each door.
 - d. Sliding Panels: Fabricated from not less than 3/8-inch- (9.5-mm-) thick, kraft-paper honeycomb core; designed to be rigid and to resist warpage.
 - 1) Fabricate sliding panels with 0.021-inch (0.53-mm) uncoated thickness, porcelain-enamel face sheets.
 - e. Hardware: Manufacturer's standard, extruded-aluminum overhead track and channel-shaped bottom guides; with two nylon ball-bearing carriers and two nylon rollers for each sliding panel.
 2. Vertical-Sliding Visual Display Units: Factory-fabricated units consisting of extruded-aluminum tubular frame, fixed-rear visual display panel, and aluminum-framed vertical-sliding panels; designed for recessed mounting. Provide panels that operate smoothly without vibration or chatter.
 - a. Type: Tubular frame on four sides **OR** top and two sides, with sides extending to floor; with kick panel to conceal sliding panels, **as directed**. Unit shall be designed to support panels independent of wall.
 - b. Two-Track Units: Fabricate unit with fixed rear panel covering entire rear surface. Provide two sliding panels, each equal to not less than one-half of overall height of unit.
 - c. Three-Track Units: Fabricate unit with fixed rear panel covering entire rear surface. Provide three sliding panels, each equal to not less than one-half of overall height of unit.
 - d. Four-Track Units: Fabricate unit with fixed rear panel centered in and covering not less than one-half of rear surface. Provide four sliding panels, each equal to not less than one-half of overall height of unit.
 - e. Sliding Panels: Fabricated from not less than 3/8-inch- (9.5-mm-) thick, kraft-paper honeycomb core; designed to be rigid and to resist warpage.
 - 1) Fabricate sliding panels with 0.021-inch (0.53-mm) uncoated thickness, porcelain-enamel face sheets.
 - f. Hardware: Manufacturer's standard, neoprene ball-bearing end rollers, four on each side of each sliding panel. Counterbalance each sliding panel with lead counterweights supported by steel aircraft cable over ball-bearing sheaves; with removable cover plate for



- access to counterweights. Provide rubber bumpers at top and bottom for each sliding panel.
- g. Motorized Operation: Provide not less than one motor with gearhead reducers for each sliding panel, mounted above visual display unit and connected to sliding panels with steel aircraft cable. Provide removable cover plate for access to motor. Equip motors with limit switches to automatically stop motor at each end of travel.
- 1) Electric Motors: UL approved or recognized, totally enclosed, complying with NEMA MG 1, with thermal-overload protection; 1/15 hp, single phase, 110 **OR** 220, **as directed**, V, 60 Hz.
 - 2) Control Station: Three-position, maintained-contact **OR** momentary-contact, **as directed**, switch-operated control station with open, close, and off functions; with NEMA ICS 6, Type 1 enclosure. Provide one control station for each sliding panel unit, unless directed otherwise.
 - 3) Key Switch: Provide supplementary key switch for each control station. Furnish two keys for each control station, keyed alike.
- J. Visual Display Conference Units
1. Visual Display Conference Units: Factory-fabricated units consisting of hinged-door wood cabinet with perimeter face frame, sides, and back; not less than 3-inch (75-mm) interior depth and designed for surface wall mounting. Fabricate inside of cabinet and cabinet doors with fixed visual display surfaces.
 - a. Wood Cabinets: Fabricated from solid wood with integral, solid-wood markertray. Fabricate hinged door panels with solid wood frame and wood-veneer exterior surface.
 - b. Plastic-Laminate Cabinets: Cabinet and hinged door panels fabricated from manufacturer's standard, high-pressure, plastic-laminate-finished panels; with integral markertray.
 - c. Hardware: Manufacturer's standard, full-height continuous hinges, wire door pulls, and door bumpers.
 - d. Projection Screens: Manufacturer's standard, pull-down, matte, white projection screen, not less than 8 inches (200 mm) smaller in each direction than overall cabinet size, and mounted above rear visual display surface.
 - e. Fluorescent Light: Manufacturer's standard, not less than 24 inches (610 mm) long, and mounted above rear visual display surface.
- K. Visual Display Wall Coverings
1. Visual Display Wall Covering: Intended for use with dry-erase markers and as a projection surface, **as directed**, and consisting of low-gloss **OR** moderate-gloss **OR** high-gloss, **as directed**, plastic film bonded to fabric backing; not less than 0.012-mil (0.0003-mm) **OR** 0.020-mil (0.0005-mm), **as directed**, total thickness.
 2. Surface Graphics: 2-inch- (50-mm-) square grid.
 - a. Color: As indicated by manufacturer's designations **OR** Match sample **OR** As selected from manufacturer's full range, **as directed**.
 3. Magnetic Visual Display Wall Covering: Intended for use with dry-erase markers and magnetic aids and consisting of moderate-gloss plastic film bonded to ferrous-powdered fabric backing; not less than 0.025-mil (0.0006-mm) total thickness.
 - a. Color: As indicated by manufacturer's designations **OR** Match sample **OR** As selected from manufacturer's full range, **as directed**.
 4. Adhesive: Mildew-resistant, nonstaining, strippable, **as directed**, adhesive, for use with specific wall covering and substrate application, as recommended in writing by wall covering manufacturer, and with a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 5. Primer/Sealer: Mildew-resistant primer/sealer complying with requirements in Division 09 Section "Interior Painting" and recommended in writing by wall covering manufacturer for intended substrate.
- L. Electronic Markerboards



1. General: Provide manufacturer's standard electronic markerboard that consists of touch-sensitive writing surface connected to microcomputer via RS-232 serial cable and that electronically records writing with standard dry-erase markers. Equip unit with cables, software, pens, erasers, mounting hardware, and accessories required for a complete installation.
2. Software: Capable of real-time recording, saving, and printing of everything that is written and drawn on electronic markerboard; with Windows **OR** Macintosh, **as directed**, operating system.
 - a. File Export Formats: BMP, WMF, HTML, and vector-based formats.
 - b. Compatibility: Compatible with Microsoft NetMeeting or other T.120-compliant software.
 - c. Features: Capable of the following:
 - 1) Saving directly from screen.
 - 2) Erasing portions of screen.
 - 3) Printing directly from screen.
 - 4) Saving individual screens as separate pages.
 - 5) Showing onscreen toolbar **OR** keyboard, **as directed**.
 - 6) Recognizing not less than four pen colors.
 - 7) Recognizing finger touch control for presentations.
 - 8) Connecting multiple electronic markerboards to a single computer.
 - 9) Showing online help and tutorial.
3. Overall Size: Approximately 48 inches high by 60 inches wide (1219 mm high by 1524 mm wide).
4. Mounting: Wall mounted **OR** Supported by rail support system, **as directed**.

M. Chalkboard, Markerboard, And Tackboard Accessories

1. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch- (1.57-mm-) thick, extruded aluminum; standard size and shape **OR** slim size and standard shape **OR** of size and shape indicated on Drawings, **as directed**.
 - a. Field-Applied Trim: Manufacturer's standard, snap-on trim with no visible screws or exposed joints **OR** slip-on trim **OR** screw-on trim with Phillips flat-head screws, **as directed**.
 - b. Factory-Applied Trim: Manufacturer's standard.
2. Factory-Applied Wood Trim: Red oak **OR** Walnut **OR** Manufacturer's standard species, **as directed**, not less than 1/2 inch (13 mm) thick; standard size and shape **OR** of size and shape indicated on Drawings, **as directed**.
3. Field-Applied Wood Trim: Comply with requirements specified in Division 06 Section(s) "Finish Carpentry" **OR** "Interior Architectural Woodwork" **as directed**.
4. Chalktray: Manufacturer's standard, continuous.
 - a. Box Type: Extruded aluminum with slanted front, grooved tray, and cast-aluminum end closures.
 - b. Solid Type: Extruded aluminum with ribbed section and smoothly curved exposed ends.
5. Map Rail: Provide the following accessories:
 - a. Display Rail: Continuous and integral with map rail; fabricated from cork approximately 1 to 2 inches (25 to 50 mm) wide.
 - b. End Stops: Located at each end of map rail.
 - c. Map Hooks: Two map hooks for every 48 inches (1219 mm) **OR** 1200 mm, **as directed**, of map rail or fraction thereof.
 - d. Map Hooks and Clips: Two map hooks with flexible metal clips for every 48 inches (1219 mm) **OR** 1200 mm, **as directed**, of map rail or fraction thereof.
 - e. Flag Holder: One for each room.
 - f. Paper Holder: Extruded aluminum; designed to hold paper by clamping action.
6. Special-Purpose Graphics: Fuse or paint the following graphics into surface of porcelain-enamel visual display unit:
 - a. Semivisible writing guidelines.
 - b. Penmanship lines.
 - c. Music staff lines.
 - d. Grid, 1 inch (25 mm) square.
 - e. Graph coordinates, rectangular.



- f. Horizontal lines, 2 inches (50 mm) o.c.
- g. Polar coordinates.
- h. USA map.
- i. World map.
- j. Soccer field.
- k. Football field.
- l. Basketball court.

N. Fabrication

1. Porcelain-Enamel Visual Display Assemblies: Laminate porcelain-enamel face sheet and backing sheet to core material under heat and pressure with manufacturer's standard flexible, waterproof adhesive.
2. Natural-Slate Chalkboards: Surface slate panels to a natural plane. Grind and hone to smooth, uniform finish equivalent to that obtained by minimum 180 grit and maximum 220 grit.
 - a. Cut joints straight and true. Space joints symmetrically. Fit and match panels before shipment to provide continuous, uniform writing surface.
 - b. Length: Furnish panels approximately equal in length with permissible variation not more than 3 inches (75 mm) in either direction of equal spacing. Allow 1/4-inch (6-mm) clearance at trim in length and width for fitting. Provide lengths of panels in each space as follows:
 - 1) Up to 5 feet (1.5 m); one panel.
 - 2) More than 5 feet (1.5 m) but less than 9 feet (2.7 m); two panels.
 - 3) More than 9 feet (2.7 m) but less than 13.5 feet (4.1 m); three panels.
 - 4) More than 13.5 feet (4.1 m) but less than 18 feet (5.5 m); four panels.
 - 5) More than 18 feet (5.5 m) but less than 22.5 feet (6.9 m); five panels.
 - 6) More than 22.5 feet (6.9 m) but less than 27 feet (8.2 m); six panels.
3. Visual Display Boards: Factory **OR** Field, **as directed**, assemble visual display boards unless otherwise indicated.
 - a. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display boards at manufacturer's factory before shipment.
4. Factory-Assembled Visual Display Units: Coordinate factory-assembled units with trim and accessories indicated. Join parts with a neat, precision fit.
 - a. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to the Owner **OR** as indicated on approved Shop Drawings, **as directed**.
 - b. Provide manufacturer's standard vertical-joint spline **OR** H-trim, **as directed**, system between abutting sections of chalkboards **OR** markerboards, **as directed**.
 - c. Provide manufacturer's standard mullion trim at joints between chalkboards **OR** markerboards **OR** tackboards, **as directed**, of combination units.
 - d. Where size of visual display boards or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by the Owner from manufacturer's standard structural support accessories to suit conditions indicated.
5. Modular Visual Display Boards: Fabricated with integral panel clips attached to core material.
6. Aluminum Frames and Trim: Fabricate units straight and of single lengths, keeping joints to a minimum. Miter corners to a neat, hairline closure.
 - a. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display units at manufacturer's factory before shipment.

O. General Finish Requirements

1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.



3. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

P. Aluminum Finishes

1. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.
2. Color Anodic Finish: AAMA 611, AA-M12C22A32/A34, Class II, 0.010 mm or thicker.
3. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1.3 EXECUTION

A. Examination

1. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.
2. Examine roughing-in for electrical power systems to verify actual locations of connections before installation of motor-operated, sliding visual display units.
3. Examine walls and partitions for proper preparation and backing for visual display surfaces.
4. Examine walls and partitions for suitable framing depth where sliding visual display units will be installed.
5. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Preparation

1. Comply with manufacturer's written instructions for surface preparation.
2. Clean substrates of substances that could impair the performance of and affect the smooth, finished surfaces of visual display boards, including dirt, mold, and mildew.
3. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display surfaces and wall surfaces.
 - a. Prime wall surfaces indicated to receive direct-applied, visual display tack wall panels **OR** visual display wall coverings, **as directed**, and as recommended in writing by primer/sealer manufacturer and wall covering manufacturer.
 - b. Prepare surfaces to receive visual display wall coverings and test for moisture according to requirements specified in Division 09 Section "Wall Coverings".

OR

 Prepare substrates indicated to receive visual display wall covering as required by manufacturer's written instructions to achieve a smooth, dry, clean, structurally sound surface that is uniform in color.
 - 1) Moisture Content: Maximum of 4 percent when tested with an electronic moisture meter.
 - 2) Plaster: Allow new plaster to cure. Neutralize areas of high alkalinity. Prime with primer as recommended in writing by primer/sealer manufacturer and wall covering manufacturer.
 - 3) Metals: If not factory primed, clean and apply metal as recommended in writing by primer/sealer manufacturer and wall covering manufacturer.
 - 4) Gypsum Board: Prime with primer as recommended in writing by primer/sealer manufacturer and wall covering manufacturer.
 - 5) Painted Surfaces: Treat areas susceptible to pigment bleeding.
4. Prepare recesses for sliding visual display units as required by type and size of unit.

C. Installation, General



1. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.
 - a. Mounting Height for Grades K through 3: 24 inches (610 mm) above finished floor to top of chalktray.
 - b. Mounting Height for Grades 4 through 6: 28 inches (711 mm) above finished floor to top of chalktray.
 - c. Mounting Height for Grades 7 and Higher: 36 inches (914 mm) above finished floor to top of chalktray.

OR

 - a. Mounting heights of 24 inches (610 mm) above finished floor to top of chalktray for kindergarten.
 - b. Mounting heights of 26 inches (660 mm) above finished floor to top of chalktray for Grades 1 through 3.
 - c. Mounting heights of 30 inches (762 mm) above finished floor to top of chalktray for Grades 4 through 6.
 - d. Mounting heights of 34 inches (864 mm) above finished floor to top of chalktray for Grades 7 through 9.
 - e. Mounting heights of 37 inches (940 mm) above finished floor to top of chalktray for Grades 10 and higher,
as directed
- D. Installation Of Field-Fabricated Visual Display Boards And Assemblies
 1. Field-Assembled Visual Display Units: Coordinate field-assembled units with grounds, trim, and accessories indicated. Join parts with a neat, precision fit.
 - a. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to the Owner **OR** as indicated on approved Shop Drawings, **as directed**.
 - b. Provide manufacturer's standard vertical-joint spline **OR** H-trim, **as directed**, system between abutting sections of chalkboards **OR** markerboards, **as directed**.
 - c. Provide manufacturer's standard mullion trim at joints between chalkboards **OR** markerboards **OR** tackboards, **as directed**, of combination units.
 - d. Where size of visual display boards or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by the Owner from manufacturer's standard structural support accessories to suit conditions indicated.
 2. Natural-Slate Chalkboards: Align and level joints between adjoining panels and apply manufacturer's recommended joint-filler compound. Hone and finish joints to continuous even plane.
- E. Installation Of Factory-Fabricated Visual Display Boards And Assemblies
 1. Visual Display Boards:
 - a. Attach visual display boards to wall surfaces with egg-size adhesive gobs at 16 inches (400 mm) o.c., horizontally and vertically.
OR
Attach concealed clips, hangers, and grounds to wall surfaces and to visual display boards with fasteners at not more than 16 inches (400 mm) o.c. Secure both top and bottom of boards to walls.
 - b. Field-Applied Aluminum Trim: Attach trim over edges of visual display boards and conceal grounds and clips. Attach trim to boards with fasteners at not more than 24 inches (610 mm) o.c.
 - 1) Attach chalktrays to boards with fasteners at not more than 12 inches (300 mm) o.c.
 - c. Field-Applied Wood Trim: Install trim according to requirements in Division 06 Section(s) "Finish Carpentry" **OR** "Interior Architectural Woodwork", **as directed**.



- F. Installation Of Visual Display Rails
1. Display Rails: Install rails in locations and at mounting heights indicated on Drawings, or if not indicated, at height indicated below. Attach to wall surface with fasteners at not more than 16 inches (400 mm) o.c.
 - a. Mounting Height: 48 inches (1219 mm) **OR** 60 inches (1524 mm), **as directed**, above finished floor to top of rail.
- G. Installation Of Visual Display Wall Panels
1. Marker Wall Sheets: Attach wall sheets to wall surface with thin layer of adhesive over entire wall surface. Butt join adjacent panels and cover joint with matching joint strip installed with double-stick tape, **as directed**.
 2. Marker Wall Panels: Attach panels to wall surface with egg-size adhesive gobs at 16 inches (400 mm) o.c., horizontally and vertically.
 - a. Join adjacent wall panels with concealed steel splines for smooth alignment.
OR
Join adjacent wall panels with exposed, H-shaped aluminum trim painted to match wall panel.
 3. Tack Wall Panels: Attach panels to wall surface with egg-size adhesive gobs at 16 inches (400 mm) o.c. horizontally and vertically.
 - a. Install wrapped-edge wall panels with butt joints between adjacent wall panels.
 - b. Join adjacent wall panels with exposed, H-shaped aluminum trim covered with same fabric as wall panels.
- H. Installation Of Rail **OR** Modular, **as directed**, Support System
1. Rail Support System: Install horizontal support rail in locations and at mounting heights indicated on Drawings, or if not indicated, at height indicated below. Attach to wall surface with fasteners at 12 inches (300 mm) o.c.
 - a. Mounting Height: 72 inches (1829 mm) above finished floor to top of rail.
 - b. Hang visual display units on rail support system.
 2. Modular Support System: Install adjustable standards in locations and at mounting heights indicated on Drawings, or if not indicated, at height indicated below. Install standards at 48 inches (1219 mm) o.c., vertically aligned and plumb, and attached to wall surface with fasteners at 12 inches (300 mm) o.c.
 - a. Mounting Height: 12 inches (300 mm) above finished floor to bottom of standard.
 - b. Install single-slotted standard at each end of each run of standards and double-slotted standards at intermediate locations.
 - c. Provide locking screw at top corner of visual display board at each standard.
 - d. Hang visual display units on modular support system.
- I. Installation Of Factory-Fabricated Visual Display Units
1. Sliding Visual Display Units: Install units in recessed locations and at mounting heights indicated. Attach to wall framing with fasteners at not more than 16 inches (400 mm) o.c.
 - a. Adjust panels to operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.
 2. Visual Display Conference Units: Install units in locations and at mounting heights indicated on Drawings, or if not indicated, at height indicated below. Attach to wall surface with fasteners through back of cabinet **OR** concealed brackets screwed to wall **OR** concealed wood cleats screwed to wall, **as directed**.
 - a. Mounting Height: 72 inches (1829 mm) above finished floor to top of cabinet.
- J. Installation Of Visual Display Wall Covering
1. General: Comply with visual display wall covering manufacturers' written installation instructions.
 2. Install seams horizontal and level, with lowest seam 24 inches (610 mm) above finished floor. Railroad fabric (reverse roll direction) to ensure color matching.



3. Double cut seams, with no gaps or overlaps. Remove air bubbles, wrinkles, blisters, and other defects.
 4. After installation, clean visual display wall covering according to manufacturer's written instructions. Remove excess adhesive at finished seams, perimeter edges, and adjacent surfaces.
- K. Installation Of Visual Electronic Markerboards
1. Electronic Markerboards: Install units in locations and at mounting heights indicated on Drawings, or if not indicated, at height indicated below. Attach to wall **OR** cubicle, **as directed**, surface with manufacturer's standard mounting hardware.
 - a. Mounting Height: 72 inches (1829 mm) above finished floor to top of markerboard.
- L. Cleaning And Protection
1. Clean visual display surfaces according to manufacturer's written instructions. Attach one cleaning label to visual display surface in each room.
 2. Touch up factory-applied finishes to restore damaged or soiled areas.
 3. Cover and protect visual display surfaces after installation and cleaning.
- M. Demonstration
1. Train Owner's maintenance personnel to adjust, operate, and maintain motor-operated, sliding visual display units.

END OF SECTION 10 11 13 13



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Task	Specification	Specification Description
10 11 13 33	10 11 13 13	Visual Display Surfaces
10 11 16 13	10 11 13 13	Visual Display Surfaces
10 11 16 33	10 11 13 13	Visual Display Surfaces
10 11 23 13	10 11 13 13	Visual Display Surfaces
10 13 16 00	10 11 13 13	Visual Display Surfaces



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SECTION 10 14 00 00 - VITRIFIED BRICK PAVEMENT REPLACEMENT**1.1 GENERAL****A. General**

1. Limits of Brick Pavement Replacement shall be as per the detail entitled "Payment Limits for Surface Restoration" shown in the plans, plus one foot on each side. Alternate individual bricks may have to be removed in order to maintain staggered joint pattern along the edge of the undisturbed brick pavement.

1.2 PRODUCT**A. Preparation**

1. Base shall be provided and shaped to match level, kind and thickness (4" min.) of adjoining base. The base material shall be compacted to meet the density standards. 4" 2500 PSI concrete base may be used for irregular patches and where compaction is otherwise impractical. Concrete shall be properly placed, consolidated and cured. One inch of sand, or good grade dirt, free from clay, loam or other foreign matter shall be used for cushion to hold the bricks in place. The sand shall be shaped to a true surface parallel to required finished pavement surface.

B. Materials

1. Existing bricks shall be cleaned, stored, and secured by the Contractor.

1.3 EXECUTION**A. Reinstallation of Bricks**

1. The bricks shall be installed in rows, better face upward, sorted by size with joints staggered, then rolled daily with a static tandem wheel roller. Additional bricks, if required, will be supplied by the Owner. City Personnel shall inspect work daily. After inspection, the bricks shall be sprayed with a solution of lime and water, using 26 lbs. of lime to 55 gallons of water. Asphalt steep 7330 or equal shall be used for joint filler. The steep shall be heated until fluid and poured over bricks and removed when cool with square pointed shovels dipped in lime water. Removed asphalt may be reused. If adjoining bricks are grouted, new filler shall be grout (8:1, builders sand: cement).

B. Acceptance

1. Upon completion of the work, and before acceptance and final payment, the Contractor shall remove all false work, equipment, rubbish, surplus, and discarded materials. The Contractor shall restore in an acceptable manner all property, both public and private, damaged during the prosecution of the work. The Contractor shall leave the roadway in a neat and presentable condition each day.

END OF SECTION 10 14 00 00



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Task	Specification	Specification Description
10 14 19 00	01 22 16 00	No Specification Required
10 14 19 00	10 14 00 00	Vitrified Brick Pavement Replacement
10 14 19 00	01 58 13 00	Signage
10 14 23 00	10 14 00 00	Vitrified Brick Pavement Replacement
10 14 23 00	01 58 13 00	Signage



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SECTION 10 14 53 00 - TRAFFIC SIGNS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of traffic signs. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

1.2 PRODUCT

A. Sign Foundations:

1. Replacement Foundation Footing Concrete shall be a mixture of cement complying with ASTM C 150 and aggregate complying with ASTM C 33. Compressive strength shall be 2,800 psi at 28 days.
2. Sulfur Mortar shall comply with ASTM C 287.
3. Reinforcing Steel shall comply with ASTM A 615.

B. Sign Supports shall be of the "break-away" type. Supports shall be strong enough to resist applicable wind forces without damage, but shall be designed to experience a brittle rupture type failure or a "quick separation" type joint.

1. Sign Support, Aluminum:

- a. Replacement Castings shall be Alloy A356.0-T6 in compliance with ASTM B 108.
- b. Replacement Structural Members shall comply with ASTM B 308.
- c. Replacement Bars, Rods, Shapes, and Tubes shall comply with ASTM B 221, alloy 6061-T6.
- d. Replacement Bolts, Nuts, and Screws shall match items being replaced and shall be alloy 2024-T4 with anodic coating complying with ASTM B 580, or 6061-T6 in compliance with ASTM B 211. Bolt heads shall be hexagon. Bolt threads shall be Class 2, 2A, or 2B in compliance with ANSI B18.2.1. Nuts shall be hexagon shaped in compliance with ANSI B18.2.2.
- e. Replacement washers shall be furnished from sheet metal complying with ASTM B 209, alloy Alclad 2024-T3 or T4.

2. Sign Support, Steel:

- a. Replacement Structural Members shall comply with ASTM A 36.
- b. Replacement Bars shall comply with ASTM A 108.
- c. Replacement Pipe shall comply with ASTM A 53 standard weight.
- d. Replacement Fasteners shall comply with ASTM A 307 and ASTM A 325.
- e. Replacement Anchor Bolts for anchoring base plates to concrete bases and nuts and washers shall be galvanized in compliance with ASTM A 153.

3. Sign Support, Wood:

- a. Replacement Wood Sign Post shall be of the species listed in AASHTO M168, dressed four sides and having a pyramidal top cut before being treated.
- b. Replacement Sign Post shall be pressure treated with creosote or creosote-tar solution complying with AWPB LP-55.

C. Sign Face:

1. Replacement Plywood Sign Face shall be grade HDOAB G-1 EXTERIOR, in compliance with DOC PS 1. Material shall be cut to size in compliance with ANSI D6.1E.
2. Replacement Galvanizing Steel Sign Face shall comply with USDOT FHA MUTCD.

D. Reflective Sheeting shall be enclosed lens unless otherwise directed by the Owner.



1. Enclosed Lens Reflective Sheeting shall comply with Fed. Spec. L-S-300.
 2. Reflective Sheeting shall comply with FP-79 minimum reflective intensity. Measurements shall comply with Fed. Spec. L-S-300.
 3. Color shall be matched visually and within the limits shown on the Color Tolerance Charts issued by the Federal Highway Administration. The diffuse day color of the reflective sheeting shall be determined in compliance with ASTM E 97.
 4. Film:
 - a. General: Reflective sheeting shall be sufficiently flexible to be easily cut to shape and permit application over, and conformance to, moderate shallow embossing characteristic of certain sign borders and symbols.
 - b. Surface: Sheeting surface shall be smooth and flat, shall facilitate cleaning and wet performance, and shall exhibit 85 degrees glossmeter rating of not less than 40, as specified in ASTM D 523. The sheeting surface shall withstand cleaning with gasoline, VM&P Naphtha, mineral spirits, turpentine, methanol, and xylol.
- E. Demountable Sign Face Materials:
1. Acrylic Plastic Reflectors: Replacement demountable sign letters, digits, arrows, borders, and alphabet accessories shall be reflectorized and shall consist of acrylic plastic reflectors supported by embossed aluminum frames. They shall comply with the Standard Alphabet for Highway Signs, of the Federal Highway Administration, Series E.
 2. Design and Fabrication: The letters shall be modified as necessary to accommodate the required reflectors. All items except border strips shall be fabricated from 0.040-inch minimum sheet aluminum. Border strips shall be of 0.032-inch minimum sheet aluminum. Mounting holes shall be provided within the frames to permit the use of screws, rivets or other acceptable fasteners. The size and spacing of the reflector holes shall provide maximum night legibility and visibility of the finished cutout figure.
 3. General Requirements: The reflectors shall be of acrylic plastic meeting the requirements of Fed. Spec. L-P-380, Type I, Class 3. The reflectors shall be yellow or colorless. The lens shall consist of a smooth front surface, free from projections or indentations other than for identification, and a rear surface bearing a prismatic configuration that will effect total internal reflection of light.
 4. Reflective Sheeting:
 - a. Demountable Sign Letters, Digits, Arrows, Borders, and Alphabet Accessories, when so specified, shall be reflectorized with reflective sheeting supported by flat aluminum backing and shall comply with the Standard Alphabet Highway Signs of the Federal Highway Administration.
 - b. Design and Fabrication: Letter design shall be Series E, modified for legibility. All items except border strips shall be fabricated from 0.040-inch sheet aluminum, 6061-T6 alloy, with mounting holes to permit use of screws, rivets, or other acceptable fasteners.
- F. Highway Delineators, Enclosed Lens Type: Replacement reflectors shall be of acrylic plastic and a minimum of 3 inches in diameter. They shall be mounted in a heavy-duty housing with a back plate. The reflector shall consist of a clear and transparent plastic lens, which shall be colorless, and a plastic back of the same material, fused to the lens under heat and pressure around the entire perimeter to form a homogeneous unit, permanently sealed against dust, water, and water vapor. The acrylic plastic shall comply with Fed. Spec. L-P-380, Type I, Class 3.
- G. Highway Delineators, High Intensity Type:
1. Replacement Reflectorized Delineators shall consist of a reflective sheeting compound of glass spheres, embedded in a weatherproof, synthetic, noncellulose material. The overall size of the plastic reflectors shall be 4 inches by 5 inches, with a reflective area of at least 17.5 square inches.
 2. Delineators shall be silver-white when viewed with reflected light.
- H. Highway Delineators Including Posts and Attachments:



1. Reflective Sheeting: Replacement reflective sheeting for delineators shall match delineators being replaced.
 2. Delineator Posts and Accessories shall be of steel or aluminum. They shall have the necessary holes for attachment of the delineator housing. The assembly shall be furnished with the necessary bolts, nuts, and washers for attaching to the posts.
 3. Insulating Materials: Neoprene, for separation of aluminum and steel parts, shall contain at least 60 percent, by volume, of pure neoprene. Other material may be used, subject to the approval of the Owner as to pliability and ability to withstand wear caused by stretching or distortion.
 4. Reflector Units for guardrail installation shall match existing reflector being replaced in size and color.
 5. Highway Delineators shall be supplemented with directional guidance signs as directed by the Owner. Signs shall be the chevron alignment type and shall comply with ANSI D6.1E, Type W 1-8.
- I. Painting Panels for Nonreflectorized Background:
1. Replacement Metal Panels for sign categories not required to be reflectorized shall have a nonreflectorized background composed of one spray coat of primer and two finish coats of baked enamel.
 2. Finish Coats shall be baked alkyd resin enamels meeting Fed. Spec. TT-E-529, Class B, of a composition that affects the finished background surface. When thoroughly dry, the colors shall match those described in the current Highway Blue Color Tolerance Chart, PR Color No. 3, or in Highway Green Color Tolerance Chart, PR Color No. 4, of the Federal Highway Administration.
 3. Wood Signs shall have two coats of oil paint complying with Fed. Spec. TT-P-52. Message paint shall be a single coat of oil paint. All colors shall comply with ANSI D6.1E.
- J. Sign Wash Detergent shall comply with ASTM D 3399.
- K. Street, Wayside, Utility Location, And Parking Lot Signs; Decals
1. Blanks: aluminum of type, size, and shape indicated.
 2. Reflective sheeting: Type 1 sheeting having Level A reflective intensity.
 3. Silk screen lettering paint and transparent process colors: as directed by the Owner.
 4. Posts
 - a. Drive type: as directed by the Owner.
 - b. Pipe type: Two-inch inside diameter.
 5. Hardware: as directed by the Owner.
 6. Fabrication
 - a. Dimensions, colors, and reflectorizing: As indicated, and in accordance with MUTCD.
 - b. Size, style, and spacing of letters, numerals, symbols, and borders: As indicated, and the Owner; as supplemented by DOT/FHA's publication entitled Standard Highway Signs as specified in MUTCD 1978.
 - c. Workmanship: as directed by the Owner.
- 1.3 EXECUTION
- A. Footings for Signs, Posts, and Supports:
1. Backfill Material shall be at or near optimum moisture and neither dry nor saturated. It shall be tamped thoroughly in place.
 2. Concrete Footings may be cast in place or precast. Hand mixing of concrete will be permitted where the quantity does not exceed one-half cubic yard.
- B. Erection of Signs and Sign Supports: Sign posts shall be erected vertically. Posts erected in sleeves shall be anchored with sulphur mortar. Mortar shall comply with ASTM C 287. Sign faces shall be positioned to be generally perpendicular to the line-of-sight for the observer. Reflectorized signs shall



be inspected at night. If specular reflection is apparent on any sign, its position shall be adjusted by the Contractor to eliminate the condition.

- C. Delineators and Hazard Markers: Delineator posts shall be driven to a depth of 30 inches.
- D. Removal of Existing Signs and Posts:
 - 1. Damaged, Obsolete, or Change of Purpose Signs and Posts shall be removed and delivered to a storage area designated by the Owner. Post hole shall be backfilled, tamped, and made level with the adjacent surface. Disturbed paving, sidewalks, and grassed areas shall be replaced with matching material of same quality and quantity as existing.
 - 2. Signs and Posts to be Replaced shall be removed and replaced by new signs and posts in identical locations. Backfill around post shall be thoroughly compacted to hold posts securely in a vertical position.
- E. Installation: Install in accordance with manufacturer's recommendations and as directed by the Owner. Unless otherwise indicated, install not more than one sign on each post.

END OF SECTION 10 14 53 00



Task	Specification	Specification Description
10 14 53 00	10 14 00 00	Vitrified Brick Pavement Replacement



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SECTION 10 21 13 13 - TOILET COMPARTMENTS

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for toilet compartments. Product shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Steel toilet compartments configured as toilet enclosures, entrance screens, and urinal screens.
 - b. Stainless-steel toilet compartments configured as toilet enclosures, entrance screens, and urinal screens.
 - c. Plastic-laminate-faced toilet compartments configured as toilet enclosures, entrance screens, and urinal screens.
 - d. Phenolic-core toilet compartments configured as toilet enclosures, entrance screens, and urinal screens.
 - e. Solid-polymer toilet compartments configured as toilet enclosures, entrance screens, and urinal screens.

C. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:
 - a. Product Data for Credit MR 4.1 and Credit MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.
 - b. Product Data for Credit EQ 4.4: For particleboard, documentation indicating that product contains no urea formaldehyde.
3. Shop Drawings: For toilet compartments. Include plans, elevations, sections, details, and attachments to other work.
4. Samples for each exposed product and for each color and texture specified.
5. Product certificates.
6. Maintenance data.

D. Quality Assurance

1. Comply with requirements in GSA's CID-A-A-60003, "Partitions, Toilets, Complete", **as directed**.
2. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84, or another standard acceptable to authorities having jurisdiction, by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 **OR** 75 **OR** 200, **as directed**, or less.
 - b. Smoke-Developed Index: 450 or less.
3. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities" and ICC/ANSI A117.1 for toilet compartments designated as accessible.

1.2 PRODUCTS

A. Materials



1. Aluminum Castings: ASTM B 26/B 26M.
2. Aluminum Extrusions: ASTM B 221 (ASTM B 221M).
3. Brass Castings: ASTM B 584.
4. Brass Extrusions: ASTM B 455.
5. Steel Sheet: Commercial steel sheet for exposed applications; mill phosphatized and selected for smoothness.
 - a. Electrolytically Zinc Coated: ASTM A 879/A 879M, 01Z (03G).
 - b. Hot-Dip Galvanized: ASTM A 653/A 653M, either hot-dip galvanized or galvanized.
6. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness.
7. Stainless-Steel Castings: ASTM A 743/A 743M.
8. Zamac: ASTM B 86, commercial zinc-alloy die castings.
9. Particleboard: ANSI A208.1, Grade M-2 with 45-lb (20.4-kg) density, made with binder containing no urea formaldehyde.
10. Plastic Laminate: NEMA LD 3, general-purpose HGS grade, 0.048-inch (1.2-mm) nominal thickness.

B. Steel Units

1. Toilet-Enclosure Style: Overhead braced **OR** Floor anchored **OR** Ceiling hung **OR** Floor and ceiling anchored, **as directed**.
2. Entrance-Screen Style: Overhead braced **OR** Floor anchored **OR** Ceiling hung **OR** Floor and ceiling anchored, **as directed**.
3. Urinal-Screen Style: Wall hung, flat panel **OR** Wall hung with integral flanges **OR** Wall hung, wedge shaped **OR** Floor anchored **OR** Overhead braced **OR** Post to ceiling, **as directed**.
4. Door, Panel, and Pilaster Construction: Seamless, metal facing sheets pressure laminated to core material; with continuous, interlocking molding strip or lapped-and-formed edge closures; corners secured by welding or clips and exposed welds ground smooth. Provide with no-sightline system, **as directed**. Exposed surfaces shall be free of pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections.
 - a. Core Material: Manufacturer's standard sound-deadening honeycomb of resin-impregnated kraft paper in thickness required to provide finished thickness of 1 inch (25 mm) for doors and panels and 1-1/4 inches (32 mm) for pilasters.
 - b. Grab-Bar Reinforcement: Provide concealed internal reinforcement for grab bars mounted on units.
 - c. Tapping Reinforcement: Provide concealed reinforcement for tapping (threading) at locations where machine screws are used for attaching items to units.
5. Urinal-Screen Construction:
 - a. Flat-Panel Urinal Screen: Matching panel construction.
 - b. Integral-Flange, Wall-Hung Urinal Screen: Similar to panel construction, with integral full-height flanges for wall attachment, and maximum 1-1/4 inches (32 mm) thick.
 - c. Wedge-Shaped, Wall-Hung Urinal Screen: Similar to panels, V-shaped, fabricated for concealed wall attachment, and maximum 6 inches (152 mm) wide at wall and minimum 1 inch (25 mm) wide at protruding end.
6. Facing Sheets and Closures: Electrolytically coated steel **OR** Hot-dip galvanized-steel **OR** Electrolytically coated or hot-dip galvanized-steel, **as directed**, sheet with nominal base-metal (uncoated) thicknesses as follows:
 - a. Pilasters, Braced at Both Ends (for overhead-braced and floor-and-ceiling-anchored mounting styles): Manufacturer's standard thickness, but not less than 0.036 inch (0.91 mm).
 - b. Pilasters, Unbraced at One End (for floor-anchored and ceiling-hung mounting styles): Manufacturer's standard thickness, but not less than 0.048 inch (1.21 mm).
 - c. Panels: Manufacturer's standard thickness, but not less than 0.030 inch (0.76 mm) **OR** 0.036 inch (0.91 mm), **as directed**.
 - d. Doors: Manufacturer's standard thickness, but not less than 0.030 inch (0.76 mm).
 - e. Flat-Panel Urinal Screens: Thickness matching the panels.



- f. Integral-Flange, Wall-Hung Urinal Screens (for government-style metal screens): Manufacturer's standard thickness, but not less than 0.030 inch (0.76 mm).
 - g. Wedge-Shaped, Wall-Hung Urinal Screens: Manufacturer's standard thickness, but not less than 0.036 inch (0.91 mm).
 7. Pilaster Shoes and Sleeves (Caps): Stainless-steel sheet, not less than 0.031-inch (0.79-mm) nominal thickness and 3 inches (76 mm) high, finished to match hardware.
 8. Urinal-Screen Post (for floor-anchored, overhead-braced, and post-to-ceiling urinal screens): Manufacturer's standard post design of material matching the thickness and construction of pilasters **OR** 1-3/4-inch- (44-mm-) square, aluminum tube with satin finish, **as directed**; with shoe and sleeve (cap), **as directed**, matching that on the pilaster.
 9. Brackets (Fittings):
 - a. Stirrup Type: Ear or U-brackets; chrome-plated zamac **OR** clear-anodized aluminum **OR** stainless steel **OR** chrome-plated brass, **as directed**.
 - b. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel **OR** aluminum, **as directed**.
 10. Steel-Sheet Finish: Immediately after cleaning and pretreating, apply manufacturer's standard baked-on finish, including thermosetting, electrostatically applied, and powder coatings. Comply with coating manufacturer's written instructions for applying and baking. Apply one color **OR** two colors, **as directed**, in each room.
 - a. Color: As selected from manufacturer's full range.
- C. Stainless-Steel Units
1. Toilet-Enclosure Style: Overhead braced **OR** Floor anchored **OR** Ceiling hung **OR** Floor and ceiling anchored, **as directed**.
 2. Entrance-Screen Style: Overhead braced **OR** Floor anchored **OR** Ceiling hung **OR** Floor and ceiling anchored, **as directed**.
 3. Urinal-Screen Style: Wall hung flat panel **OR** Wall hung with integral flanges **OR** Wall hung, wedge shaped **OR** Floor anchored **OR** Overhead braced **OR** Post to ceiling, **as directed**.
 4. Door, Panel, and Pilaster Construction: Seamless, metal facing sheets pressure laminated to core material; with continuous, interlocking molding strip or lapped-and-formed edge closures; corners secured by welding or clips and exposed welds ground smooth. Provide with no-sightline system, **as directed**. Exposed surfaces shall be free of pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections.
 - a. Core Material: Manufacturer's standard sound-deadening honeycomb of resin-impregnated kraft paper in thickness required to provide finished thickness of 1 inch (25 mm) for doors and panels and 1-1/4 inches (32 mm) for pilasters.
 - b. Grab-Bar Reinforcement: Provide concealed internal reinforcement for grab bars mounted on units.
 - c. Tapping Reinforcement: Provide concealed reinforcement for tapping (threading) at locations where machine screws are used for attaching items to units.
 5. Urinal-Screen Construction:
 - a. Flat-Panel Urinal Screen: Matching panel construction.
 - b. Integral-Flange, Wall-Hung Urinal Screen (for government-style metal screens): Similar to panel construction, with integral full-height flanges for wall attachment, and maximum 1-1/4 inches (32 mm) thick.
 - c. Wedge-Shaped, Wall-Hung Urinal Screen: Similar to panels, V-shaped, fabricated for concealed wall attachment, and maximum 6 inches (152 mm) wide at wall and minimum 1 inch (25 mm) wide at protruding end.
 6. Facing Sheets and Closures: Stainless-steel sheet of nominal thicknesses as follows:
 - a. Pilasters, Braced at Both Ends (for overhead-braced and floor-and-ceiling-anchored mounting styles): Manufacturer's standard thickness, but not less than 0.038 inch (0.95 mm).
 - b. Pilasters, Unbraced at One End (for floor-anchored and ceiling-hung mounting styles): Manufacturer's standard thickness, but not less than 0.050 inch (1.27 mm).
 - c. Panels: Manufacturer's standard thickness, but not less than 0.031 inch (0.79 mm) **OR** 0.038 inch (0.95 mm), **as directed**.



- d. Doors: Manufacturer's standard thickness, but not less than 0.031 inch (0.79 mm).
 - e. Flat-Panel Urinal Screens: Thickness matching the panels.
 - f. Integral-Flange, Wall-Hung Urinal Screens (for government-style metal screens: Manufacturer's standard thickness, but not less than 0.031 inch (0.79 mm).
 - g. Wedge-Shaped, Wall-Hung Urinal Screens: Manufacturer's standard thickness, but not less than 0.038 inch (0.95 mm).
7. Pilaster Shoes and Sleeves (Caps): Stainless-steel sheet, not less than 0.031-inch (0.79-mm) nominal thickness and 3 inches (76 mm) high, finished to match hardware.
 8. Urinal-Screen Post (for floor-anchored, overhead-braced, and post-to-ceiling urinal screens): Manufacturer's standard post design of material matching the thickness and construction of pilasters **OR** 1-3/4-inch- (44-mm-) square, aluminum tube with satin finish, **as directed**; with shoe and sleeve (cap) matching that on the pilaster.
 9. Brackets (Fittings):
 - a. Stirrup Type: Ear or U-brackets; chrome-plated zamac **OR** clear-anodized aluminum **OR** stainless steel **OR** chrome-plated brass, **as directed**.
 - b. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel **OR** aluminum, **as directed**.
 10. Stainless-Steel Finish: No. 4 bright, directional polish **OR** Manufacturer's standard textured finish, **as directed**, on exposed faces. Protect exposed surfaces from damage by application of strippable, temporary protective covering before shipment.
- D. Plastic-Laminate-Faced Units
1. Toilet-Enclosure Style: Overhead braced **OR** Floor anchored **OR** Ceiling hung **OR** Floor and ceiling anchored, **as directed**.
 2. Entrance-Screen Style: Overhead braced **OR** Floor anchored **OR** Ceiling hung **OR** Floor and ceiling anchored, **as directed**.
 3. Urinal-Screen Style: Wall hung **OR** Floor anchored **OR** Overhead braced **OR** Post to ceiling, **as directed**.
 4. Door, Panel, Screen, and Pilaster Construction: One-piece, plastic-laminate facing sheets pressure laminated to core material without splices or joints in facings or cores; with laminate **OR** stainless-steel edge trim 0.050 inch (1.27 mm) thick, **as directed**, applied to edges before faces to seal edges and prevent laminate from being pried loose. Seal exposed core material at cutouts to protect core from moisture. Provide with no-sightline system, **as directed**.
 - a. Core Material: Particleboard.
 - b. Doors and Panels: Finished to not less than 7/8 inch (22 mm) **OR** 1 inch (25 mm), **as directed**, thick.
 - c. Pilasters: Provide construction to comply with one of the following, **as directed**:
 - 1) Finished to not less than 1-1/4 inches (32 mm) thick and with internal, nominal 0.134-inch- (3.42-mm-) thick, steel-sheet reinforcement, **as directed**.
 - 2) Finished to 1-1/4 inches (32 mm) thick and with manufacturer's standard steel-sheet core laminated to both sides of honeycomb of resin-impregnated kraft paper in lieu of particleboard core.
 - 3) Finished to not less than 1 inch (25 mm) thick and with internal, nominal 0.120-inch- (3.04-mm-) thick, steel-sheet reinforcement.
 5. Pilaster Shoes and Sleeves (Caps): Formed from stainless-steel sheet, not less than 0.031-inch (0.79-mm) nominal thickness and 3 inches (76 mm) high, finished to match hardware.
 6. Urinal-Screen Post (for floor-anchored, overhead-braced, and post-to-ceiling urinal screens): Manufacturer's standard post design of material matching the thickness and construction of pilasters **OR** 1-3/4-inch- (44-mm-) square, aluminum tube with satin finish **OR** 1-1/4-inch- (32-mm-) square, stainless-steel tube 0.050 inch (1.27 mm) thick with satin finish, **as directed**; with shoe and sleeve (cap) matching that on the pilaster.
 7. Brackets (Fittings):
 - a. Stirrup Type: Ear or U-brackets, chrome-plated zamac **OR** clear-anodized aluminum **OR** stainless steel **OR** chrome-plated brass, **as directed**.



- a. Polymer Color and Pattern: Matching pilaster **OR** Contrasting with pilaster, as indicated by manufacturer's designations **OR** Contrasting with pilaster, as selected from manufacturer's full range, **as directed**.
6. Urinal-Screen Post (for floor-anchored, overhead-braced, and post-to-ceiling urinal screens): Manufacturer's standard post design of material matching the thickness and construction of pilasters **OR** 1-3/4-inch- (44-mm-) square, aluminum tube with satin finish, **as directed**; with shoe and sleeve (cap) matching that on the pilaster.
7. Brackets (Fittings):
 - a. Stirrup Type: Ear or U-brackets, chrome-plated zamac **OR** clear-anodized aluminum **OR** stainless steel **OR** chrome-plated brass, **as directed**.
 - b. Full-Height (Continuous) Type: Manufacturer's standard design; polymer or extruded aluminum **OR** polymer **OR** extruded aluminum **OR** stainless steel, **as directed**.
 - 1) Polymer Color and Pattern: Matching panel **OR** Contrasting with panel, as indicated by manufacturer's designations **OR** Contrasting with panel, as selected from manufacturer's full range, **as directed**.
8. Overhead Cross Bracing for Ceiling-Hung Units: As recommended by manufacturer and fabricated from solid polymer.

G. Accessories

1. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.
 - a. Material: Chrome-plated zamac **OR** Clear-anodized aluminum **OR** Stainless steel **OR** Chrome-plated brass, **as directed**.
 - b. Hinges: Manufacturer's standard paired, self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees **OR** continuous, cam type that swings to a closed or partially open position **OR** continuous, spring-loaded type **OR** integral hinge for solid-polymer doors, **as directed**.
 - c. Latch and Keeper: Manufacturer's standard recessed **OR** surface-mounted, **as directed**, latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.
 - d. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories.
 - e. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors and entrance-screen doors, **as directed**.
 - f. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.
2. Overhead Bracing (for overhead-braced units): Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.
3. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel.

H. Fabrication

1. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.
2. Floor-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.
3. Ceiling-Hung Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for connection to structural support above finished



- ceiling. Provide assemblies that support pilasters from structure without transmitting load to finished ceiling. Provide sleeves (caps) at tops of pilasters to conceal anchorage.
4. Floor-and-Ceiling-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment at tops and bottoms of pilasters. Provide shoes and sleeves (caps) at pilasters to conceal anchorage.
 5. Urinal-Screen Posts: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment at tops and bottoms, **as directed**, of posts. Provide shoes and sleeves (caps) at posts to conceal anchorage.
 6. Door Size and Swings: Unless otherwise indicated, provide 24-inch- (610-mm-) wide, in-swinging doors for standard toilet compartments and 36-inch- (914-mm-) wide, out-swinging doors with a minimum 32-inch- (813-mm-) wide, clear opening for compartments designated as accessible.

1.3 EXECUTION

A. Installation

1. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
 - a. Maximum Clearances:
 - 1) Pilasters and Panels: 1/2 inch (13 mm).
 - 2) Panels and Walls: 1 inch (25 mm).
 - b. Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than two brackets attached **OR** three brackets attached at midpoint and, **as directed**, near top and bottom of panel.
 - 1) Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
 - 2) Align brackets at pilasters with brackets at walls.
2. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches (44 mm) into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.
3. Floor-Anchored Units: Set pilasters with anchors penetrating not less than 2 inches (51 mm) into structural floor unless otherwise indicated in manufacturer's written instructions. Level, plumb, and tighten pilasters. Hang doors and adjust so tops of doors are level with tops of pilasters when doors are in closed position.
4. Ceiling-Hung Units: Secure pilasters to supporting structure and level, plumb, and tighten. Hang doors and adjust so bottoms of doors are level with bottoms of pilasters when doors are in closed position.
5. Floor-and-Ceiling-Anchored Units: Secure pilasters to supporting construction and level, plumb, and tighten. Hang doors and adjust so doors are level and aligned with panels when doors are in closed position.
6. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

B. Adjusting

1. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors and doors in entrance screens to return doors to fully closed position.

END OF SECTION 10 21 13 13



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Task	Specification	Specification Description
10 21 13 13	01 22 16 00	No Specification Required
10 21 13 16	01 22 16 00	No Specification Required
10 21 13 16	10 21 13 13	Toilet Compartments



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SECTION 10 21 13 19 - SOLID SURFACE MATERIAL TOILET COMPARTMENTS

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for solid surface material toilet compartments. Product shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
2. Samples:
 - a. Panel: 1'-0" by 1'-0" panel showing construction with two sides and two edges, including one finished corner condition.
 - b. Hardware: Actual hardware item
3. Manufacturer's installation and maintenance instructions.

C. Warranty

1. Special Warranty: Solid surface material compartment manufacturer's three year warranty against defects in fabricated products. Provide for product replacement only; labor not included. Damage caused by physical or chemical abuse is not warranted.

1.2 PRODUCTS

A. Manufactured Units

1. Product standard of quality: E.I. DuPont de Nemours and Company, Inc.; Privacy Partitions.

B. Types:

1. Floor supported, overhead braced compartments.
2. Wall hung urinal screens.

C. Materials:

1. Partitions, panels, headrails, and doors:
 - a. Material: E.I. DuPont de Nemours and Company, Inc.; Corian, or approved equivalent.
 - b. Characteristics:
 - 1) Material type: Homogeneous filled methyl methacrylate sheet, not coated.
 - 2) Meet ANSI Z124.3 and 6, Type Six.
 - 3) Thickness: 1/2".
 - a) Partition panels and doors: 1/2".
 - b) Urinal screen panels: 1/2".
 - c. Colors: Selected from manufacturer's color selection.
 - d. Finish: Matte.
2. Pilasters, hardware, and fittings: Note requirements in FABRICATION Article for hardware concealment.
 - a. Pilaster material: Same material as panels; 1" thickness.
 - b. Acceptable hardware manufacturer: Jack Knob Hardware, or approved equivalent.
 - c. Hinges:
 - 1) ANSI Type 304 stainless steel; surface mounted; self closing pivot hinge type, two per door; matt finish.
 - 2) Type: Adjustable to return door by gravity to preset position when not latched.
 - d. Wall brackets:



- 1) Material: ASTM B209-90, extruded aluminum alloy 6463-T5, mill finish, full length continuous wall brackets; extrusion weighing not less than 1.685 lbs. per LF.
- 2) Predrill by manufacturer; holes spaced 6" along full bracket length; tamper resistant bolt attachment.
- e. Pilaster hanger:
 - 1) Manufacturer's standard galvanized anchorage device for attachment of pilaster to structural support and for leveling compartment.
 - 2) Hanger consists of threaded rods, saddle, lock washers, and leveling nuts.
 - 3) Design pilaster hangers to transmit loads to above-ceiling support system, not finished ceiling.
- f. Pilaster base:
 - 1) Type: Manufacturer's standard galvanized anchorage devices for attachment of pilaster to supporting floor and for leveling of compartment. Base consists of threaded rods, saddle, lock washers, leveling nuts, and minimum of two brass or lead expansion shields per base.
 - 2) Anchor penetration: Penetrate floor at least 1" for overhead braced compartments.
- g. Latch and keeper: AISI Type 304 Type stainless steel; 360 deg. pivot on latch; ADA compatible; surface mounted.
- h. Door stop/bumper: AISI Type 304 Type stainless steel; surface mounted.
- i. Door pull: Same material as panels; meet ADA requirements on handicap stalls.
- j. Coat hook; one per unit: Same material as panels; surface mounted.
- k. Grab bar mounting plate: Same material as panels; recessed back; complete with "T" nuts and screws; one per each mounting location to divider panel.
- l. Headrail for overhead braced units: ASTM B209-90, 6063-T6 extruded aluminum, satin anodized finish.

D. Accessories:

1. Exposed fasteners: Stainless steel or chrome plated brass with theft resistant one-way heads,
2. Unexposed fasteners: Galvanized steel, hot-dip coated following fabrication.
3. Inserts for door hardware, hinges, latches, and coat hooks: Threaded steel.
4. Adhesives: Type recommended by panel material manufacturer for joints.
5. Silicone sealant: Specified in Joints Sealants Section.

E. Fabrication

1. Shop assembly:
 - a. Fabricate components in accord with manufacturers standards, without face or edge seams in solid plastic material; bevel exposed edges.
 - b. Factory install metal inserts into components for screw fastened hardware; fasteners secured directly into core are prohibited.
 - c. Pre-notch and predrill panels for hardware at factory. Exposed hardware in completed installation includes only the following items or portion of items:
 - 1) Door hinge barrel.
 - 2) Door latch and keeper.
 - 3) Door striker.
 - d. Cover hardware with 1/2" solid surfacing material strips, except as indicated above.
 - e. Secure templates and factory cut panels for installation of accessories furnished under other Sections.
 - f. Doors: Inswing and outswing type indicated.
 - g. Exposed surfaces free from marks and blemishes; completely hide through material joints.
2. Tolerances; variation in size: $\pm 1/8$ "

1.3 EXECUTION

A. Installation



1. General:
 - a. Erect solid surface material compartment system plumb; attach to supporting structure indicated on reviewed shop drawings.
 - b. Attach solid surface material compartment system to back-up construction; use fasteners indicated on reviewed shop drawings.
 - c. Secure solid surface material panels to walls with continuous mounting flanges.
 - d. Locate wall brackets aligning holes for fasteners with masonry or tile joints.
 - e. Floor supported, overhead braced compartments:
 - 1) Attach pilasters to supporting floor with pilaster base indicated on reviewed shop drawings.
 - 2) Level and plumb compartments. Tighten pilaster base fasteners.
 - 3) Secure pilaster shoes in position against finished floor.
 - 4) Secure headrail to panels with minimum of two fasteners per face. Provide cover plates for exposed ends.
 - 5) Set door tops parallel with headrail when doors are in closed position.
 - f. Wall hung screens:
 - 1) Attach screens to wall construction with brackets and fasteners, indicated on reviewed shop drawings.
 - 2) Position and level units. Tighten fasteners in place.
- B. Application
 1. Tolerances:
 - a. Between panel and pilaster: 1/2", except where concealed fasteners are used.
 - b. Between door edge and pilaster: 1/4"
 - c. Between panel and wall: 1".
 2. Conceal evidence of drilling, cutting, and fitting to room finishes.
- C. Adjustment And Cleaning
 1. Adjustment:
 - a. Lubricate and adjust hardware. Tighten fasteners.
 - b. Set hinges on in-swing doors to hold doors open approximately 15 deg. from closed position when unlatched.
 - c. Set hinges on out-swing doors to return to closed position.
 2. Cleaning:
 - a. Remove protective coverings from compartments and hardware.
 - b. Clean exposed surfaces of compartments and hardware using materials and methods recommended by solid surface material compartment system manufacturer.

END OF SECTION 10 21 13 19



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Task	Specification	Specification Description
10 21 13 19	10 21 13 13	Toilet Compartments
10 21 13 43	01 22 16 00	No Specification Required
10 21 13 43	10 21 13 13	Toilet Compartments



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SECTION 10 21 16 00 - SHOWER AND DRESSING COMPARTMENTS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for shower and dressing compartments. Product shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Shower compartments fabricated from steel, stainless steel, solid phenolic, or solid polymer.
 - b. Dressing compartments fabricated from steel, stainless steel, solid phenolic, solid polymer, or plastic laminate.
 - c. Shower receptors.

C. Submittals

1. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. LEED Submittals:
 - a. Product Data for Credit MR 4.1 and Credit MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.
 - b. Product Data for Credit EQ 4.4: For particleboard, documentation indicating that product contains no urea formaldehyde.
3. Shop Drawings: For shower and dressing compartments. Include plans, elevations, sections, details, and attachments to other work.
 - a. Show locations of cutouts for compartment-mounted accessories.
 - b. Show locations of reinforcements for compartment-mounted grab bars.
 - c. Show locations of centerlines of drains.
 - d. Show ceiling grid and overhead support or bracing locations.
4. Samples: For the following products, in manufacturer's standard sizes unless otherwise indicated:
 - a. Each type of material, color, and finish required for compartments, prepared on 6-inch- (152-mm-) square Samples of same thickness and material indicated for the Work.
 - b. Each type of hardware and accessory.
 - c. Curtain Fabric: 12-inch- (305-mm-) square swatch or larger as required to show complete pattern repeat, from dye lot used for the Work, with specified treatments applied. Mark top and face of material.
5. Product Certificates: For each type of shower and dressing compartment, from manufacturer.
6. Maintenance Data: For shower and dressing compartments to include in maintenance manuals.

D. Quality Assurance

1. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84, or another standard acceptable to authorities having jurisdiction, by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 **OR** 75 **OR** 200, **as directed**, or less.
 - b. Smoke-Developed Index: 450 or less.
2. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1 for shower and dressing compartments designated as accessible.



E. Project Conditions

1. Field Measurements: Verify actual locations of walls, columns, ceilings, and other construction contiguous with shower and dressing compartments by field measurements before fabrication.

1.2 PRODUCTS

A. Materials

1. Aluminum Castings: ASTM B 26/B 26M.
2. Aluminum Extrusions: ASTM B 221 (ASTM B 221M).
3. Brass Castings: ASTM B 584.
4. Brass Extrusions: ASTM B 455.
5. Steel Sheet: ASTM A 653/A 653M, either hot-dip galvanized or galvanized; mill phosphatized and selected for smoothness.
6. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness.
7. Stainless-Steel Castings: ASTM A 743/A 743M.
8. Particleboard: ANSI A208.1, Grade M-2 with 45-lb (20.4-kg) density, made with binder containing no urea formaldehyde.
9. Plastic Laminate: NEMA LD 3, general-purpose HGS grade, 0.048-inch (1.2-mm) nominal thickness.

B. Steel Compartments

1. Configuration: Shower compartment **OR** Shower and dressing compartments **OR** Shower compartment with two dressing compartments **OR** As shown on Drawings, **as directed**.
2. Enclosure Style: Overhead braced **OR** Floor and ceiling anchored, **as directed**.
3. Panel and Pilaster Construction: Seamless metal facing sheets, pressure laminated to core material; with continuous, interlocking molding strip or lapped-and-formed edge closures and with corners secured by welding or clips and exposed welds ground smooth. Exposed surfaces shall be free of pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections.
 - a. Core Material: Manufacturer's standard, sound-deadening honeycomb of resin-impregnated kraft paper in thickness required to provide finished thickness of 1 inch (25 mm) for panels and 1-1/4 inches (32 mm) for pilasters.
 - b. Grab-Bar Reinforcement: Provide concealed internal reinforcement for grab bars mounted on compartments.
 - c. Tapping Reinforcement: Provide concealed reinforcement for tapping (threading) at locations where machine screws are used for attaching items to compartments.
4. Door Construction: Match panels; 1-inch (25-mm) finished thickness.
5. Facing Sheets and Closures: Hot-dip galvanized-steel sheet with nominal base-metal (uncoated) thicknesses as follows:
 - a. Pilasters, Braced at Both Ends: Manufacturer's standard thickness, but not less than 0.036 inch (0.91 mm).
 - b. Panels: Manufacturer's standard thickness, but not less than 0.030 inch (0.76 mm) **OR** 0.036 inch (0.91 mm), **as directed**.
 - c. Doors: Manufacturer's standard thickness, but not less than 0.030 inch (0.76 mm).
6. Pilaster Shoes and Sleeves (Caps): Formed from stainless-steel sheet, not less than 0.031-inch (0.79-mm) nominal thickness and 3 inches (76 mm) high, finished to match hardware.
7. Brackets (Fittings):
 - a. Full-Height (Continuous) Type: Manufacturer's standard design; clear-anodized aluminum.
 - b. Stirrup Type: Ear or U-brackets; clear-anodized aluminum **OR** stainless steel **OR** chrome-plated brass, **as directed**.
 - c. Dressing-Compartment Brackets: Match toilet-compartment brackets specified in Division 10 Section "Toilet Compartments".
8. Steel-Sheet Finish: Immediately after cleaning and pretreating, apply manufacturer's standard baked-on finish, including thermosetting, electrostatically applied, and powder coatings. Comply



with coating manufacturer's written instructions for applying and baking. Apply one color **OR** two colors, **as directed**, in each room.

- a. Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range **OR** Match steel toilet compartments specified in Division 10 Section "Toilet Compartments", **as directed**.

C. Stainless-Steel Compartments

1. Configuration: Shower compartment **OR** Shower and dressing compartments **OR** Shower compartment with two dressing compartments **OR** As shown on Drawings, **as directed**.
2. Enclosure Style: Overhead braced **OR** Floor and ceiling anchored, **as directed**.
3. Panel and Pilaster Construction: Seamless metal facing sheets, pressure laminated to core material; with continuous, interlocking molding strip or lapped-and-formed edge closures and with corners secured by welding or clips and exposed welds ground smooth. Exposed surfaces shall be free of pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections.
 - a. Core Material: Manufacturer's standard, sound-deadening honeycomb of resin-impregnated kraft paper in thickness required to provide finished thickness of 1 inch (25 mm) for panels and 1-1/4 inches (32 mm) for pilasters.
 - b. Grab-Bar Reinforcement: Provide concealed internal reinforcement for grab bars mounted on compartments.
 - c. Tapping Reinforcement: Provide concealed reinforcement for tapping (threading) at locations where machine screws are used for attaching items to compartments.
4. Door Construction: Match panels; 1-inch (25-mm) finished thickness.
5. Facing Sheets and Closures: Stainless-steel sheet of nominal thicknesses as follows:
 - a. Pilasters, Braced at Both Ends: Manufacturer's standard thickness, but not less than 0.038 inch (0.95 mm).
 - b. Panels: Manufacturer's standard thickness, but not less than 0.031 inch (0.79 mm) **OR** 0.038 inch (0.95 mm), **as directed**.
6. Doors: Manufacturer's standard thickness, but not less than 0.031 inch (0.79 mm).
7. Pilaster Shoes and Sleeves (Caps): Formed from stainless-steel sheet, not less than 0.031-inch (0.79-mm) nominal thickness and 3 inches (76 mm) high, finished to match hardware.
8. Brackets (Fittings):
 - a. Full-Height (Continuous) Type: Manufacturer's standard design; clear-anodized aluminum.
 - b. Stirrup Type: Ear or U-brackets; clear-anodized aluminum **OR** stainless steel **OR** chrome-plated brass, **as directed**.
 - c. Dressing-Compartment Brackets: Match toilet-compartment brackets specified in Division 10 Section "Toilet Compartments".
9. Stainless-Steel Finish: No. 4, bright, directional polish **OR** Manufacturer's standard textured finish **OR** Match stainless-steel toilet-compartment finish, specified in Division 10 Section "Toilet Compartments", **as directed**, on exposed faces. Protect exposed surfaces from damage by applying strippable, temporary protective covering before shipment.

D. Phenolic-Core Compartments

1. Configuration: Shower compartment **OR** Shower and dressing compartments **OR** Shower compartment with two dressing compartments **OR** As shown on Drawings, **as directed**.
2. Enclosure Style: Overhead braced **OR** Floor and ceiling anchored, **as directed**.
3. Panel and Pilaster Construction: Solid phenolic material consisting of solid phenolic-core panel with melamine facing on both sides fused to substrate during panel manufacture (not separately laminated) and with eased and polished edges. Provide minimum 3/4-inch- (19-mm-) thick pilasters and minimum 1/2-inch- (13-mm-) thick panels.
4. Door Construction: Match panels; 3/4-inch (19-mm) minimum thickness.
5. Pilaster Shoes and Sleeves (Caps): Formed from stainless-steel sheet, not less than 0.031-inch (0.79-mm) nominal thickness and 3 inches (76 mm) high, finished to match hardware.
6. Brackets (Fittings):
 - a. Full-Height (Continuous) Type: Manufacturer's standard design; clear-anodized aluminum.



- b. Stirrup Type: Ear or U-brackets; clear-anodized aluminum **OR** stainless steel **OR** chrome-plated brass, **as directed**.
 - c. Dressing-Compartment Brackets: Match toilet-compartment brackets specified in Division 10 Section "Toilet Compartments".
 - 7. Phenolic-Core-Panel Finish:
 - a. Facing Sheet Finish: One color and pattern **OR** Two colors and patterns, **as directed**, in each room.
 - b. Color and Pattern: As indicated by manufacturer's designations, **OR** As selected from manufacturer's full range, **OR** Match phenolic-core toilet compartments specified in Division 10 Section "Toilet Compartments", **as directed**, with manufacturer's standard dark-color core **OR** through-color core matching face sheet, **as directed**.
- E. Solid-Polymer Compartments
1. Configuration: Shower compartment **OR** Shower and dressing compartments **OR** Shower compartment with two dressing compartments **OR** As shown on Drawings, **as directed**.
 2. Enclosure Style: Overhead braced **OR** Floor and ceiling anchored, **as directed**.
 3. Panel and Pilaster Construction: Solid HDPE panel material, not less than 1 inch (25 mm) thick, seamless, with eased edges and with homogenous color and pattern throughout thickness of material.
 - a. Integral Hinges: Configure doors and pilasters to receive integral hinges.
 - b. Heat-Sink Strip: Manufacturer's standard, continuous, clear-anodized extruded-aluminum or stainless-steel strip fastened to exposed bottom edges of solid-polymer components to prevent burning.
 - c. Color and Pattern: One color and pattern **OR** Two colors and patterns, **as directed**, in each room; as indicated by manufacturer's designations **OR** as selected from manufacturer's full range **OR** match solid-polymer toilet compartments specified in Division 10 Section "Toilet Compartments", **as directed**.
 4. Door Construction: Match panels.
 5. Pilaster Shoes and Sleeves (Caps): Manufacturer's standard design; polymer or stainless steel.
 - a. Polymer Color and Pattern: Match pilaster **OR** Contrast with pilaster, as indicated by manufacturer's designations **OR** Contrast with pilaster, as selected from manufacturer's full range **OR** Match solid-polymer toilet compartments specified in Division 10 Section "Toilet Compartments", **as directed**.
 6. Brackets (Fittings):
 - a. Full-Height (Continuous) Type: Manufacturer's standard design; polymer or clear-anodized extruded aluminum **OR** polymer **OR** clear-anodized extruded aluminum, **as directed**.
 - 1) Polymer Color and Pattern: Match panel **OR** Contrast with panel, as indicated by manufacturer's designations **OR** Contrast with panel, as selected from manufacturer's full range **OR** Match solid-polymer toilet compartments specified in Division 10 Section "Toilet Compartments", **as directed**.
 - b. Stirrup Type: Ear or U-brackets; clear-anodized aluminum **OR** stainless steel **OR** chrome-plated brass, **as directed**.
 - c. Dressing-Compartment Brackets: Match toilet-compartment brackets specified in Division 10 Section "Toilet Compartments".
- F. Plastic-Laminate-Faced Dressing Compartments
1. Configuration: Dressing compartment attached to steel **OR** stainless-steel **OR** phenolic-core **OR** solid-polymer, **as directed**, shower compartment as shown on Drawings.
 2. Enclosure Style: Overhead braced **OR** Floor and ceiling anchored, **as directed**.
 3. Panel and Pilaster Construction: One-piece, plastic-laminate facing sheets pressure laminated to core material without splices or joints in facings or cores; with laminate **OR** stainless-steel edge trim 0.050 inch (1.27 mm) thick, **as directed**, applied to edges before faces to seal edges and prevent laminate from being pried loose. Seal exposed core material at cutouts to protect core from moisture.
 - a. Core Material: Particleboard.



- b. Panels: Finished to not less than 1 inch (25 mm) thick.
 - c. Pilasters: Comply with one of the following:
 - 1) Finished to not less than 1-1/4 inches (32 mm) thick and with internal, nominal 0.134-inch- (3.42-mm-) thick, steel-sheet reinforcement.
OR
Finished to not less than 1 inch (25 mm) thick and with internal, nominal 0.120-inch- (3.04-mm-) thick, steel-sheet reinforcement.
 4. Door Construction: Match panels.
 5. Pilaster Shoes and Sleeves (Caps): Formed from stainless-steel sheet, not less than 0.031-inch (0.79-mm) nominal thickness and 3 inches (76 mm) high, finished to match hardware.
 6. Brackets (Fittings):
 - a. Full-Height (Continuous) Type: Manufacturer's standard design; clear-anodized aluminum.
 - b. Stirrup Type: Ear or U-brackets; clear-anodized aluminum **OR** stainless steel **OR** chrome-plated brass, **as directed**.
 7. Plastic-Laminate Finish: One color and pattern **OR** Two colors and patterns, **as directed**, in each room.
 - a. Color and Pattern: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range **OR** Match toilet compartments specified in Division 10 Section "Toilet Compartments", **as directed**.
- G. Shower Receptors
1. General: Manufacturer's standard, prefabricated, terrazzo receptor complete with integral drain.
 - a. Curb: Not less than 2 inches (51 mm) and not more than 9 inches (229 mm) deep when measured from the top of the curb to the top of the drain; with curb threshold not less than 1 inch (25 mm) below the sides and back of the receptor; and with a ramped entrance surface for accessible compartments, **as directed**.
 - b. Floor: Finished, sloping uniformly toward the drain and not less than 1/4 unit vertical in 12 units horizontal and not more than 1/2 inch (13 mm).
 - c. Drain Strainer: Manufacturer's standard, removable brass strainer **OR** chrome strainer **OR** stainless-steel strainer **OR** plastic strainer, matching the receptor, **as directed**.
 - d. Drain Gasket: Manufacturer's standard gasket sized to fit waste pipe.
 - e. Waterstop: Manufacturer's standard, continuous galvanized-steel flange or rabbeted groove to receive panels and create a waterstop when panels are in place.
 2. Finish: Manufacturer's standard finish on exposed surfaces, matching the enclosure panels **OR** contrasting with the enclosure panels, as indicated by manufacturer's designations **OR** contrasting with the enclosure panels, as selected from manufacturer's full range, **as directed**, and with slip-resistant floor surface texture.
- H. Accessories
1. Door Hardware and Accessories: Manufacturer's standard design, heavy-duty, operating hardware and accessories.
 - a. Material: Clear-anodized aluminum **OR** Stainless steel **OR** Chrome-plated brass, **as directed**.
 - b. Hinges: Manufacturer's standard, paired, self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees **OR** continuous, cam type that swings to a closed or partially open position **OR** continuous, spring-loaded type **OR** integral hinge for solid-polymer doors, **as directed**.
 - c. Latch and Keeper: Manufacturer's standard, recessed **OR** surface-mounted, **as directed**, latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at each compartment, accessible or not **OR** at compartments designated as accessible, **as directed**.
 - d. Clothing Hooks: Manufacturer's standard clothing hooks in each dressing compartment; include one combination hook and rubber-tipped bumper at in-swinging doors, sized to prevent door from hitting wall panel or compartment-mounted accessories, **as directed**.



- e. Door Bumper: Manufacturer's standard, rubber-tipped bumper at out-swinging doors.
- f. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.
- 2. Overhead Bracing: Manufacturer's standard, continuous, extruded-aluminum head rail or cap with antigrip profile; in manufacturer's standard finish.
- 3. Head Rail with Hooks: Manufacturer's standard, continuous, extruded-aluminum head rail or cap with curtain hooks running in concealed track; with antigrip profile; in manufacturer's standard finish.
- OR**
- Curtain Rod with Hooks: Manufacturer's standard, 1-inch- (25-mm-) diameter, stainless-steel curtain rod with matching hooks.
- 4. Curtain: Flame-resistant, polyester-reinforced vinyl fabric **OR** manufacturer's standard fabric, **as directed**, that is stain resistant, self-sanitizing, antistatic, and antimicrobial; launderable to a temperature of not less than 90 deg F (32 deg C).
 - a. Flame Resistance: Passes NFPA 701 tests when tested by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - b. Labeling: Identify fabrics with appropriate markings of applicable testing and inspecting agency.
 - c. Curtain Grommets: Two-piece, rolled-edge, rustproof, nickel-plated brass; spaced not more than 6 inches (152 mm) o.c.; machined into top hem.
 - d. Length: Where curtain extends to a floor surface, size so that bottom hem clears finished floor by not more than 1 inch (25 mm) and not less than 1/2 inch (13 mm) above floor surface. Where curtains extend to a shower-receptor curb, size so that bottom hem hangs above curb line and clears curb line by not more than 1/2 inch (13 mm).
 - e. Color and Pattern: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
- 5. Soap Holder: Surface-mounted **OR** Recessed, **as directed**, seamless stainless-steel soap dish.
- 6. Seats: Manufacturer's standard, panel-mounted, wall-mounted or floor-mounted benches.
 - a. Material: Wood **OR** Solid phenolic **OR** Molded plastic **OR** Stainless steel, **as directed**.
 - b. Operation: Fixed **OR** Folding, **as directed**.
 - c. Finish: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range **OR** Match enclosure panels, **as directed**.
- 7. Anchorages and Fasteners: Manufacturer's standard, exposed fasteners of stainless steel, chrome-plated steel, or solid brass, finished to match the items they are securing; with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel.

I. Fabrication

- 1. Overhead-Braced Compartments: Provide manufacturer's standard, corrosion-resistant supports, leveling method, and anchors at pilasters and walls to suit floor and wall conditions. Provide shoes at pilasters to conceal supports and leveling method.
- 2. Floor-and-Ceiling-Anchored Compartments: Provide manufacturer's standard, corrosion-resistant anchoring assemblies at pilasters and walls with leveling adjustment at tops and bottoms of pilasters. Provide shoes and sleeves (caps) at pilasters to conceal anchorage.
- 3. Door Sizes and Swings: Unless otherwise indicated, provide 24-inch- (610-mm-) wide, in-swinging doors for standard shower and dressing compartments, and 36-inch- (914-mm-) wide, out-swinging doors with a minimum 32-inch- (813-mm-) wide, clear opening for compartments designated as accessible.

1.3 EXECUTION

A. Installation



1. General: Comply with manufacturer's written installation instructions. Install compartments rigid, straight, level, and plumb. Secure compartments in position with manufacturer's recommended anchoring devices.
 - a. Maximum Clearances for Dressing Compartment:
 - 1) Pilasters and Panels: 1/2 inch (13 mm).
 - 2) Panels and Walls: 1 inch (25 mm).
 - b. Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than two brackets attached **OR** three brackets attached at midpoint and, **as directed**, near top and bottom of panel.
 - 1) Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
 - 2) Align brackets at pilasters with brackets at walls.
2. Overhead-Braced Compartments: Secure pilasters to floor, and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches (44 mm) into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position, **as directed**.
3. Floor-and-Ceiling-Anchored Compartments: Secure pilasters to supporting construction, and level, plumb, and tighten. Hang doors and adjust so doors are level and aligned with panels when doors are in closed position, **as directed**.
4. Curtains: Install curtains to specified length and verify that they hang vertically without stress points or diagonal folds.
5. Shower Receptors: Install prefabricated shower receptors with drain gasket compression fit to outside diameter of waste pipe.

B. Adjusting

1. Curtain Adjustment: After hanging curtains, test and adjust each track or rod to produce unencumbered, smooth operation. Steam and dress down curtains as required to produce crease- and wrinkle-free installation. Remove and replace curtains that are stained or soiled or that have stress points or diagonal folds.
2. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 10 21 16 00



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SECTION 10 21 16 00a - CUBICLE CURTAINS AND TRACKS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for cubicle curtains and tracks. Product shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Curtain tracks and curtain carriers.
 - b. IV tracks and hangers.
 - c. Cubicle, dressing area, tub, and shower curtains.

C. Definition

1. IV: Intravenous.

D. Performance Requirements

1. Curtains: Provide curtain fabrics with the following characteristics:
 - a. Fabrics are launderable to a temperature of not less than 160 deg F (71 deg C) **OR** 90 deg F (32 deg C), **as directed**.
 - b. Fabrics are flame resistant and are identical to those that have passed NFPA 701 when tested by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1) Identify fabrics with appropriate markings of applicable testing and inspecting agency.

E. Submittals

1. Product Data: Include durability, laundry temperature limits, fade resistance, and fire-test-response characteristics for each type of curtain fabric indicated.
 - a. Include data on each type of applied curtain treatment.
2. Shop Drawings: Show layout and types of cubicles, sizes of curtains, number of carriers, anchorage details, and conditions requiring accessories. Indicate dimensions taken from field measurements.
 - a. Include details on blocking above ceiling and in walls.
3. Samples: For each type of product required.
4. Curtain and Track Schedule: Use same designations indicated on Drawings.
5. Operation and Maintenance Data.

1.2 PRODUCTS

A. Curtain Tracks

1. Extruded-Aluminum Track: Not less than 1-1/4 inches wide by 3/4 inch high (32 mm wide by 19 mm high) **OR** 5/8 inch wide by 1/2 inch high (16 mm wide by 13 mm high), **as directed**; with minimum wall thickness of 0.050 inch (1.27 mm) **OR** 0.058 inch (1.47 mm) **OR** 0.062 inch (1.57 mm), **as directed**.
 - a. Curved Track: Factory-fabricated, 12-inch- (305-mm-) **OR** 14-inch- (356-mm-) **OR** 18-inch- (457-mm-), **as directed**, radius bends.
 - b. Finish: Clear anodized **OR** Satin anodized **OR** Baked enamel, acrylic, or epoxy, **as directed**.
2. PVC Track: Not less than 1-1/4 inches wide by 15/16 inch high (32 mm wide by 24 mm high).
 - a. Curved Track: Factory-fabricated, 12-inch- (305-mm-) radius bends.



3. Track Accessories: Fabricate splices, end caps, connectors, end stops, coupling and joining sleeves, wall flanges, brackets, ceiling clips, and other accessories from same material and with same finish as track.
 - a. Suspended Track Support: Not less than 5/8-inch- (16-mm-) square **OR** 7/8-inch- (22.2-mm-) OD, **as directed**, tube.
 - b. End Stop: Nonremovable **OR** Removable with carrier hook, **as directed**.
 - c. Switch Unit: Shuttle and coupling device for rerouting and securing cubicle curtain, with pull chain for switching track.
 - d. Hinged Loading Unit: Detachable hinge and lock unit factory assembled on 60-inch (1524-mm) section of manufacturer's extruded-aluminum track. Provide 1 operating wand for every 10 cubicles.
 4. Curtain Carriers: Two nylon rollers and nylon axle with chrome-plated steel **OR** nylon **OR** aluminum, **as directed**, hook.
 5. Curtain Carriers: One-piece nylon glide with chrome-plated steel **OR** nylon, **as directed**, hook.
 6. Breakaway Curtain Carriers: One-piece nylon **OR** Velcro, **as directed**, breakaway curtain carriers designed to allow curtains to detach from tracks with a pulling force of no more than 5 lbf (22.2 N).
 7. Exposed Fasteners: Stainless steel.
 8. Concealed Fasteners: Hot-dip galvanized **OR** Stainless steel, **as directed**.
- B. IV Support Systems
1. Extruded-Aluminum IV Track: Not less than 1-1/4 inches wide by 3/4 inch high (32 mm wide by 19 mm high); with minimum wall thickness of 0.058 inch (1.47 mm) **OR** 0.062 inch (1.57 mm), **as directed**.
 - a. Curved Track: Factory fabricated 12-inch- (305-mm-) **OR** 14-inch- (356-mm-) **OR** 18-inch- (457-mm-), **as directed**, radius bends.
 - b. Finish: Clear anodized **OR** Satin anodized **OR** Baked enamel, acrylic, or epoxy, **as directed**.
 2. IV Carriers: Four nylon rollers and nylon **OR** steel or stainless-steel, **as directed**, axles, with ball bearings, **as directed**, with hanger loop fabricated from 1/4-inch- (6-mm-) diameter stainless steel.
 3. Stationary IV Hangers: 24-inch (610-mm) **OR** 30-inch (762-mm) **OR** 36-inch (914-mm) **OR** 42-inch (1067-mm) **OR** 48-inch (1219-mm), **as directed**, overall height with stainless-steel shaft; with 4 **OR** 8, **as directed**, folding **OR** nonfolding, **as directed**, 1/4-inch (6-mm) stainless-steel arms with loops, a stainless-steel bottom loop, and a stainless-steel top loop to attach to carrier.
 - a. Top Loop: Coated for nonconductivity **OR** Uncoated, **as directed**.
 4. Telescoping IV Hangers: 28-inch (711-mm) **OR** 39-inch (991-mm) **OR** 45-inch (1143-mm) **OR** 51-inch (1295-mm) **OR** 57-inch (1448-mm), **as directed**, overall height with a 3/4-inch (19-mm) stainless-steel main shaft and a 3/8-inch (9.5-mm) stainless-steel inner shaft, minimum vertical adjustment of 16 inches (406 mm); with 4 **OR** 8, **as directed**, folding **OR** nonfolding, **as directed**, 1/4-inch (6-mm) stainless-steel arms with loops and a stainless-steel top loop to attach to carrier.
 - a. Top Loop: Coated for nonconductivity **OR** Uncoated, **as directed**.
 - b. Adjustment Control: Push button **OR** Release ring, **as directed**.
- C. Curtains
1. Cubicle Curtain and Dressing Area Fabric: Curtain manufacturer's standard, 100 percent polyester, inherently and permanently flame resistant, stain resistant, and antimicrobial.
 - a. Pattern: <Insert manufacturer's style name.>
 - b. Color: As selected from manufacturer's full range.
 2. Shower and Tub Curtain Fabric: Curtain manufacturer's standard. Polyester-reinforced vinyl fabric; flame resistant, stain resistant, and antimicrobial.
 - a. Pattern: <Insert manufacturer's style name.>
 - b. Color: As selected from manufacturer's full range.
 3. Curtain Grommets: Two-piece, rolled-edge, rustproof, nickel-plated brass; spaced not more than 6 inches (152 mm) o.c.; machined into top hem.



4. Mesh Top: No. 50 **OR** 40 **OR** 42, **as directed**, nylon mesh.
5. Beaded-Chain Curtain Drop: 6 inches (152 mm) **OR** 9 inches (229 mm) **OR** 12 inches (305 mm) **OR** 15 inches (381 mm) **OR** 18 inches (457 mm), **as directed**, long; nickel-plated steel, with aluminum hook.
6. PVC-Strip Curtain Drop: 16 inches (406 mm) **OR** 18 inches (457 mm), **as directed**, long, with chrome-plated steel hook.
 - a. Curtain Movers: In-line hinged nylon spacers that connect to the top of PVC-strip curtain drops to provide tangle-free operation.
7. Curtain Tieback: Nickel-plated brass chain; one at each curtain termination.

D. Curtain Fabrication

1. Fabricate curtains to comply with the following requirements:
 - a. Width: Equal to track length from which curtain is hung plus 10 percent added fullness, but not less than 12 inches (305 mm) added fullness.
 - b. Length: Equal to floor-to-ceiling height minus depth of track and carrier at top, and minus distance above the finished floor at bottom as follows:
OR
Length: Equal to floor-to-ceiling height, with 20-inch (508-mm) mesh top, and minus distance above the finished floor at bottom as follows:
OR
Length: Equal to floor-to-ceiling height minus 18 inches (457 mm) from finished ceiling at top, and minus distance above the finished floor at bottom as follows:
 - 1) Cubicle Curtains: 12 inches (305 mm) **OR** 15 inches (381 mm), **as directed**.
 - 2) Dressing Area Curtains: 4 inches (102 mm) **OR** 6 inches (152 mm), **as directed**.
 - 3) Tub Curtains: 6 inches (152 mm).
 - 4) Shower Curtains: 1/2 inch (13 mm).
 - c. Top Hem: Not less than 1 inch (25.4 mm) and not more than 1-1/2 inches (38 mm) wide, triple thickness, reinforced with integral web, and double lock stitched.
 - d. Mesh Top: Top hem not less than 1 inch (25.4 mm) and not more than 1-1/2 inches (38 mm) wide, triple thickness, reinforced with integral web, and double lock stitched. Double lock stitch bottom of mesh directly to 1/2-inch (13-mm) triple thickness, top hem of curtain fabric.
 - e. Bottom Hem: Not less than 1 inch (25.4 mm) and not more than 1-1/2 inches (38 mm) wide, double thickness and single **OR** double thickness and double **OR** triple thickness, reinforced, and double, **as directed**, lock stitched.
 - f. Side Hems: Not less than 1/2 inch (13 mm) and not more than 1-1/4 inches (32 mm) wide, with double **OR** triple, **as directed**, turned edges, and single lock stitched.
2. Vertical Seams: Not less than 1/2 inch (13 mm) wide, double turned and double stitched.

1.3 EXECUTION

A. Installation

1. General: Install tracks level and plumb, according to manufacturer's written instructions.
2. Up to 16 feet (4.9 m) **OR** 20 feet (6.0 m), **as directed**, in length, provide track fabricated from 1 continuous length.
 - a. Curtain Track Mounting: Surface **OR** Suspended **OR** Recessed **OR** As indicated on Drawings, **as directed**.
 - b. IV Track Mounting: Surface.
3. Surface Track Mounting: Fasten surface-mounted tracks at intervals of not less than 24 inches (610 mm). Fasten support at each splice and tangent point of each corner. Center fasteners in track to ensure unencumbered carrier operation. Attach track to ceiling as follows:
 - a. Mechanically fasten directly to bottom of concrete deck with post-installed anchors.
 - b. Mechanically fasten directly to finished ceiling with toggle bolts.
 - c. Mechanically fasten to furring through suspended ceiling with screw and tube spacer.
 - d. Mechanically fasten to suspended ceiling grid with screws.



-
- e. Attach track to suspended ceiling grid with manufacturer's proprietary clip.
 4. Suspended Track Mounting: Install track with suspended supports at intervals of not more than 48 inches (1219 mm). Fasten support at each splice and tangent point of each corner. Secure ends of track to wall with flanged fittings or brackets.
 5. Track Accessories: Install splices, end caps, connectors, end stops, coupling and joining sleeves, and other accessories as required for a secure and operational installation.
 - a. Provide one locking switch unit for each pair of beds.
 - b. Provide one hinged loading unit for each bed **OR** pair of beds with locking switch unit, **as directed**.
 6. IV Hangers: Unless otherwise indicated, install one IV hook on each IV track and hang one IV hanger.
 7. Curtain Carriers: Provide curtain carriers adequate for 6-inch (152-mm) spacing along full length of curtain plus an additional carrier.
 8. Curtains: Hang curtains on each curtain track. Secure with curtain tieback, **as directed**.
- B. Protection
1. Protect installed recessed track openings with nonresidue adhesive tape to prevent construction debris from impeding carrier operation. Remove tape prior to Final Completion.

END OF SECTION 10 21 16 00a



Task	Specification	Specification Description
10 21 16 00	10 21 13 13	Toilet Compartments



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SECTION 10 26 13 00 - IMPACT-RESISTANT WALL PROTECTION

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for impact-resistant wall protection. Product shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Wall guards.
 - b. Impact-resistant handrails.
 - c. Bed locators.
 - d. Corner guards.
 - e. Impact-resistant wall coverings.
 - f. Door protection systems.

C. Performance Requirements

1. Structural Performance: Provide handrails capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - a. Uniform load of 50 lbf/ft. (0.73 kN/m) applied in any direction.
 - b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.

D. Submittals

1. Product Data: Include construction details, material descriptions, impact strength, fire-test-response characteristics, dimensions of individual components and profiles, and finishes for each impact-resistant wall protection unit.
2. LEED Submittals:
 - a. Certificates for Credit MR 7: Chain-of-custody certificates certifying that wood rails comply with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.
 - 1) Include statement indicating costs for each certified wood product.
 - b. Product Data for Credit EQ 4.1: For adhesives, including printed statement of VOC content.
 - c. Product Data for Credit EQ 4.4: For particleboard, documentation indicating that products contain no urea formaldehyde.
3. Shop Drawings: For each impact-resistant wall protection unit showing locations and extent. Include sections, details, and attachments to other work.
 - a. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
4. Samples: For each type of exposed finish required, prepared on Samples of size indicated below. Include Samples of accent strips to verify color selected.
 - a. Wall and Corner Guards: 12 inches (300 mm) long. Include examples of joinery, corners, end caps, top caps, and field splices.
 - b. Handrails: 12 inches (300 mm) long. Include examples of joinery, corners, and field splices.
 - c. Impact-Resistant Wall Covering: 6 by 6 inches (150 by 150 mm) square.
 - d. Door-Surface Protection: 6 by 6 inches (150 by 150 mm) square.
 - e. Door-Edge and -Frame Protectors: 12 inches (300 mm) long.
 - f. Door-Knob and -Lever Protectors: Full-size unit of each type.



5. Qualification Data: For qualified Installer and testing agency.
 6. Material Certificates: For each impact-resistant plastic material, from manufacturer.
 7. Material Test Reports: For each impact-resistant plastic material.
 8. Maintenance Data: For each impact-resistant wall protection unit to include in maintenance manuals.
 - a. Include recommended methods and frequency of maintenance for maintaining optimum condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to plastic finishes and performance.
 9. Warranty: Sample of special warranty.
- E. Quality Assurance
1. Installer Qualifications: An employer of workers trained and approved by manufacturer.
 2. Source Limitations: Obtain impact-resistant wall protection units from single source from single manufacturer.
 3. Product Options: Drawings indicate size, profiles, and dimensional requirements of impact-resistant wall protection units and are based on the specific system indicated.
 - a. Do not modify intended aesthetic effects, as judged solely by the Owner, except with the Owner's approval. If modifications are proposed, submit comprehensive explanatory data to the Owner for review.
 4. Forest Certification: Fabricate wood rails from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
 5. Surface-Burning Characteristics: Provide impact-resistant, plastic wall protection units with surface-burning characteristics as determined by testing identical products per ASTM E 84, NFPA 255, or UL 723 by UL or another qualified testing agency.
 6. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.
 7. Preinstallation Conference: Conduct conference at Project site.
- F. Delivery, Storage, And Handling
1. Store impact-resistant wall protection units in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
 - a. Maintain room temperature within storage area at not less than 70 deg F (21 deg C) during the period plastic materials are stored.
 - b. Keep plastic sheet material out of direct sunlight.
 - c. Store plastic wall protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F (21 deg C).
 - 1) Store corner-guard covers in a vertical position.
 - 2) Store wall-guard, bed-locator and handrail covers in a horizontal position.
- G. Project Conditions
1. Environmental Limitations: Do not deliver or install impact-resistant wall protection units until building is enclosed and weatherproof, wet work is complete and dry, and HVAC system is operating and maintaining temperature at 70 deg F (21 deg C) for not less than 72 hours before beginning installation and for the remainder of the construction period.
- H. Warranty
1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of impact-resistant wall protection units that fail in materials or workmanship within specified warranty period.
 - a. Failures include, but are not limited to, the following:
 - 1) Structural failures.



- 2) Deterioration of plastic and other materials beyond normal use.
- b. Warranty Period: Five years from date of Final Completion.

1.2 PRODUCTS

A. Materials

1. PVC Plastic: ASTM D 1784, Class 1, textured, chemical- and stain-resistant, high-impact-resistant PVC or acrylic-modified vinyl plastic with integral color throughout; extruded and sheet material, thickness as indicated.
 - a. Impact Resistance: Minimum 25.4 ft-lbf/in. (1356 J/m) of notch when tested according to ASTM D 256, Test Method A.
 - b. Chemical and Stain Resistance: Tested according to ASTM D 543 **OR** ASTM D 1308.
 - c. Self-extinguishing when tested according to ASTM D 635.
 - d. Flame-Spread Index: 25 or less.
 - e. Smoke-Developed Index: 450 or less.
2. Polycarbonate Plastic Sheet: ASTM D 6098, S-PC01, Class 1 or 2, abrasion resistant; with a minimum impact-resistance rating of 15 ft-lbf/in. (800 J/m) of notch when tested according to ASTM D 256, Test Method A.
3. Aluminum Extrusions: Alloy and temper recommended by manufacturer for type of use and finish indicated, but with not less than strength and durability properties specified in ASTM B 221 (ASTM B 221M) for Alloy 6063-T5.
4. Stainless-Steel Sheet: ASTM A 240/A 240M.
5. Brass: ASTM B 249/B 249M for extruded shapes and ASTM B 36/B 36 M for sheet.
6. Solid Wood: Clear hardwood lumber of species indicated, free of appearance defects, and selected for compatible grain and color.
7. Particleboard: ANSI A208.1, Grade M-2; made with binder containing no urea formaldehyde.
8. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.
9. Adhesive: As recommended by impact-resistant plastic wall protection manufacturer and with a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Wall Guards

1. Crash Rail: Heavy-duty assembly consisting of continuous snap-on plastic cover installed over concealed retainer system; designed to withstand impacts.
 - a. Cover: Extruded rigid plastic, minimum 0.100-inch (2.5-mm) wall thickness; as follows: **OR** in dimensions and profiles indicated on Drawings, **as directed**.
 - 1) Profile: Flat **OR** Convex, **as directed**.
 - a) Dimensions: Nominal 6 inches high by 1 inch deep (150 mm high by 25 mm deep) **OR** 8 inches high by 1 inch deep (200 mm high by 25 mm deep), **as directed**.
 - b) Surface: Uniform **OR** Uniform with coextruded accent inlay strip in contrasting color **OR** Grooved, **as directed**.
 - i. Accent Inlay Strip: Nominal 2 inches (50 mm) high by length of rail.
 - 2) Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - b. Continuous Retainer: Minimum 0.080-inch- (2.0-mm-) thick, one-piece, extruded aluminum.
OR
Retainer Clips: Manufacturer's standard impact-absorbing clips designed for heavy-duty performance.
 - c. Bumper: Continuous rubber or vinyl bumper cushion(s).



- d. End Caps and Corners: Prefabricated, injection-molded plastic; matching color **OR** contrasting with color, **as directed**, cover; field adjustable for close alignment with snap-on cover.
 - e. Accessories: Concealed splices and mounting hardware.
 - f. Mounting: Surface mounted directly to wall **OR** Reveal mounted on bumper cushion(s) **OR** Extended mounting on injection-molded plastic mounting brackets, **as directed**.
2. Bumper Rail: Assembly consisting of continuous snap-on plastic cover installed over concealed, continuous retainer; designed to withstand impacts.
- a. Cover: Extruded rigid plastic, minimum 0.078-inch (2.0-mm) wall thickness; as follows: **OR** in dimensions and profiles indicated on Drawings, **as directed**.
 - 1) Profile: Half round profile, nominal 1 inch high by 1 inch deep (25 mm high by 25 mm deep) **OR** Rounded bullnose profile, nominal 4 inches high by 2 inches deep (100 mm high by 50 mm deep) **OR** Angled profile with rounded-bullnose front edge, nominal 4 inches high by 2 inches deep (100 mm high by 50 mm deep) **OR** Flat profile, nominal 4 inches high by 1 inch deep (100 mm high by 25 mm deep), **as directed**.
 - 2) Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - b. Continuous Retainer: Minimum 0.080-inch- (2.0-mm-) thick, one-piece, extruded aluminum.

OR

 Retainer Clips: Manufacturer's standard impact-absorbing clips.
 - c. Bumper: Continuous rubber or vinyl bumper cushion(s).
 - d. End Caps and Corners: Prefabricated, injection-molded plastic; matching color **OR** contrasting with color, **as directed**, cover; field adjustable for close alignment with snap-on cover.
 - e. Accessories: Concealed splices and mounting hardware.
 - f. Mounting: Surface mounted directly to wall **OR** Reveal mounted on bumper cushions **OR** Extended mounting on injection-molded plastic mounting brackets, **as directed**.
3. Rub Rail: Assembly consisting of continuous snap-on cover installed over concealed, continuous retainer.
- a. Cover: Extruded rigid plastic **OR** flexible PVC, **as directed**, minimum 0.078-inch (2.0-mm) wall thickness; as follows: **OR** in dimensions and profiles indicated on Drawings, **as directed**.
 - 1) Profile: Half-round profile, nominal 1-1/8 inches high by 1-1/8 inches deep (30 mm high by 30 mm deep) **OR** Rounded bullnose profile, nominal 2 inches high by 1 inch deep (50 mm high by 25 mm deep), **as directed**.
 - 2) Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - b. Retainer: Minimum 0.0625-inch- (1.6-mm-) thick, one-piece, extruded aluminum.
 - c. End Caps and Corners: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.
 - d. Accessories: Concealed splices and mounting hardware.
 - e. Mounting: Surface mounted directly to wall **OR** Reveal mounted on bumper cushions, **as directed**.
4. Wood Chair Rail with Bumper: Assembly consisting of continuous sculpted, solid-wood rail, with continuous bumper insert installed in continuous recessed retainer.
- a. Wood Rail: 3-1/2 inches high by 7/8 inch deep (89 mm high by 22 mm deep) **OR** 5-1/2 inches high by 1-1/2 inches deep (140 mm high by 38 mm deep) **OR** Size and profile indicated on Drawings, **as directed**.
 - 1) Wood Species: Red oak **OR** Maple **OR** Ash **OR** Beech, **as directed**.
 - 2) Finish: Clear **OR** Stained, **as directed**.
 - 3) Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.



- b. Bumper: Extruded rigid plastic **OR** flexible vinyl, **as directed**, minimum 0.078-inch (2.0-mm) wall thickness; as follows: **OR** in dimensions and profiles indicated on Drawings, **as directed**.
 - 1) Profile: Half-round profile, nominal 2 inches high by 1 inch deep (50 mm high by 25 mm deep) **OR** Small rounded profile, nominal 1-1/8 inches high by 1-1/8 inches deep (30 mm high by 30 mm deep), **as directed**.
 - 2) Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - 3) End Caps and Corners: Prefabricated, injection-molded plastic; color matching bumper; field adjustable for close alignment with snap-on bumper.
- c. Retainer: Minimum 0.0625-inch- (1.6-mm-) thick, one-piece, extruded aluminum.
 - 1) Finish: Mill **OR** Brass colored, **as directed**.
- d. Accessories: Concealed splices and mounting hardware.
- e. Mounting: Surface mounted directly to wall.
- 5. Wood Chair Rail: Assembly consisting of continuous sculpted, solid-wood rail.
 - a. Rail: 3-1/2 inches high by 7/8 inch deep (89 mm high by 22 mm deep) **OR** 5-1/2 inches high by 1-1/2 inches deep (140 mm high by 38 mm deep) **OR** As indicated on Drawings, **as directed**.
 - 1) Wood Species: Red oak **OR** Maple **OR** Ash **OR** Bamboo, **as directed**.
 - 2) Finish: Clear **OR** Stained, **as directed**.
 - 3) Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - b. Accessories: Concealed splices and mounting hardware.
 - c. Mounting: Surface mounted directly to wall.
- 6. Opaque-Plastic Chair Rail: Assembly consisting of continuous snap-on cover installed over continuous retainer.
 - a. Cover: Extruded rigid plastic, minimum 0.070-inch (1.8-mm) wall thickness; as follows: **OR** in dimensions and profiles indicated on Drawings, **as directed**.
 - 1) Profile: Rounded bullnose profile, nominal 2 inches high by 1 inch deep (50 mm high by 25 mm deep) **OR** Half-round profile, nominal 1-1/8 inches high by 1-1/8 inches deep (30 mm high by 30 mm deep), **as directed**.
 - 2) Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - b. Retainer: Minimum 0.060-inch- (1.5-mm-) thick, one-piece, extruded aluminum.
 - c. Bumper: Continuous rubber or vinyl bumper cushion(s).
 - d. End Caps and Corners: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.
 - e. Accessories: Concealed splices and mounting hardware.
 - f. Mounting: Surface mounted directly to wall **OR** Reveal mounted on bumper cushions, **as directed**.
- 7. Transparent-Plastic Chair Rail: Consisting of clear polycarbonate plastic sheet.
 - a. Height: 3 inches (75 mm) nominal **OR** 4 inches (100 mm) nominal **OR** As indicated on Drawings, **as directed**.
 - b. Mounting: Surface mounted using flat-head countersunk screws through factory-drilled mounting holes.
- 8. Rub Strip: Consisting of minimum 0.040-inch- (1.0-mm-) **OR** 0.060-inch- (1.5-mm-), **as directed**, thick, plastic sheet wall-covering material.
 - a. Height: 8 inches (200 mm) nominal.
 - b. Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - c. Mounting: Surface mounted with adhesive or double-faced adhesive tape.

C. Handrails

- 1. Impact-Resistant Plastic Handrails: Assembly consisting of snap-on plastic cover installed over continuous retainer.



- a. Cover: Minimum 0.078-inch- (2.0-mm-) **OR** 0.100-inch- (2.5-mm-), **as directed**, thick, extruded rigid plastic; as follows: **OR** in dimensions and profiles indicated on Drawings, **as directed**.
- 1) Single Handrail: Cylindrical tube profile cover with continuous retainer; with mounting brackets supporting bottom of rail.
 - a) Tube Diameter: as directed by the Owner.
 - 2) Bumper Rail: Cover with flat **OR** sculpted with contoured thumb recess on, **as directed**, front side; with 1-1/2-inch- (38-mm-) diameter gripping surface and finger recess on back side; supported by concealed, continuous retainer and extended mounting brackets.
 - a) Bumper-Rail Dimensions: Nominal 5-1/2 inches high by 1-1/2 inches deep (140 mm high by 38 mm deep) **OR** 5-1/2 inches high by 2 inches deep (140 mm high by 50 mm deep), **as directed**.
 - b) Bumper Surface: Smooth **OR** Smooth with coextruded accent inlay strip in contrasting color **OR** Grooved, **as directed**.
 - c) Accent Inlay Strip: Nominal 2 inches (50 mm) high by length of rail.
 - 3) Double Handrail with Bumper-Rail Profile: Two tubes mounted above and below nominal, flat-faced bumper rail; each tube with 1-1/2-inch- (38-mm-) diameter gripping surface and finger recess on back side; supported by concealed, continuous retainer and extended mounting brackets.
 - a) Bumper-Rail Dimensions: Nominal 4 inches high by 1-1/2 inches deep (100 mm high by 38 mm deep).
 - b) Bumper Surface: Smooth **OR** Smooth with coextruded accent inlay strip in contrasting color **OR** Grooved, **as directed**.
 - c) Accent Inlay Strip: Nominal 2 inches (50 mm) high by length of rail.
 - 4) Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
- b. Retainer: Minimum 0.080-inch- (2.0-mm-) thick, one-piece, extruded aluminum.
- c. Mounting Bracket: Extended mounting on injection-molded plastic **OR** anodized-aluminum, **as directed**, mounting brackets.
- d. End Caps and Corners: Prefabricated, injection-molded plastic; matching color **OR** contrasting with color, **as directed**, cover; field adjustable for close alignment with snap-on cover.
- e. Accessories: Concealed splices, cushions, and mounting hardware.
2. Combination Wood-Plastic Bumper Handrail: Assembly consisting of solid-wood handrail mounted above plastic bumper rail, both mounted on continuous retainer; with reveal between handrail and bumper serving as thumb recess on front side; with 1-1/2-inch- (38-mm-) diameter gripping surface and finger recess on back side.
- a. Wood Handrail: 1-1/2 inches (38 mm) in diameter; with matching end caps and corners.
 - 1) Wood Species: Red oak **OR** Maple **OR** Ash **OR** Beech, **as directed**.
 - 2) Finish: Clear **OR** Stained, **as directed**.
 - 3) Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - b. Bumper: Extruded rigid plastic, minimum 0.078-inch- (2.0-mm-) **OR** 0.100-inch- (2.5-mm-), **as directed**, wall thickness; as follows: **OR** in dimensions and profiles indicated on Drawings, **as directed**.
 - 1) Profile: Flat **OR** Convex, **as directed**, profile, nominal 4 inches high by 1 inch deep (100 mm high by 25 mm deep).
 - 2) Accent Inlay Strip: Nominal 2 inches (50 mm) high by length of rail.
 - 3) Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - 4) End Caps and Corners: Prefabricated, injection-molded plastic; color matching bumper; field adjustable for close alignment with snap-on bumper.
 - c. Retainer: Minimum 0.0625-inch- (1.6-mm-) thick, one-piece, extruded aluminum.
 - d. Reveal: Extruded rigid plastic or vinyl over aluminum retainer.



- 1) Color: Brass **OR** Chrome **OR** As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - e. Accessories: Concealed splices, cushion(s), and mounting hardware.
 3. Wood Handrail with Bumper: Assembly consisting of continuous sculpted, solid-wood handrail, with bumper insert installed in continuous retainer recessed into the face of the wood.
 - a. Wood Handrail: As indicated on Drawings with 1-1/2-inch- (38-mm-) diameter gripping surface.
 - 1) End Caps, Returns, Corners, and Mounting Brackets: Solid wood that matches rail.
 - 2) Wood Species: Red oak **OR** Maple **OR** Ash **OR** Beech **OR** Bamboo, **as directed**.
 - 3) Finish: Clear **OR** Stained, **as directed**.
 - 4) Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - b. Bumper: Extruded rigid plastic **OR** flexible vinyl, **as directed**, minimum 0.078-inch (2.0-mm) wall thickness; as follows: **OR** in dimensions and profiles indicated on Drawings, **as directed**.
 - 1) Profile: Half-round profile, nominal 2 inches high by 1 inch deep (50 mm high by 25 mm deep) **OR** Small rounded profile, nominal 1-1/8 inches high by 1-1/8 inches deep (30 mm high by 30 mm deep), **as directed**.
 - 2) Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - 3) End Caps and Corners: Prefabricated, injection-molded plastic; color matching bumper; field adjustable for close alignment with snap-on bumper.
 - c. Retainer: Minimum 0.0625-inch- (1.6-mm-) thick, one-piece, extruded aluminum.
 - 1) Finish: Mill **OR** Brass colored, **as directed**.
 - d. Accessories: Concealed splices and mounting hardware.
 4. Solid-Wood Handrail: Assembly consisting of continuous sculpted, solid-wood handrail.
 - a. Handrail: 5-1/2 inches high by 1-1/2 inches deep (140 mm high by 38 mm deep) **OR** As indicated on Drawings, **as directed**, with 1-1/2-inch- (38-mm-) diameter gripping surface.
 - 1) End Caps, Returns, Corners, and Mounting Brackets: Solid wood that matches rail.
 - 2) Wood Species: Red oak **OR** Maple **OR** Ash **OR** Beech, **as directed**.
 - 3) Finish: Clear **OR** Stained, **as directed**.
 - 4) Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
- D. Bed Locators
1. Bed Locators: Assembly consisting of continuous snap-on plastic cover installed over continuous retainer; with two bed-locator end caps and mounting hardware; cover designed to spring back when hit.
 - a. Cover: Extruded rigid plastic, minimum 0.078-inch (2.0-mm) wall thickness.
 - 1) Profile: Large rounded angled **OR** bullnose, **as directed**, profile, nominal 4 inches high by 2 inches deep (100 mm high by 50 mm deep).
 - 2) Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - b. Retainer: Minimum 0.080-inch- (2.0-mm-) thick, one-piece, extruded aluminum.
 - c. Bed-Locator End Caps: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.
 - d. Mounting Type: Surface mounted on 1/2-inch- (13-mm-) thick cushion spacers **OR** Extended mounting on injection-molded plastic mounting brackets **OR** Extended mounting on aluminum mounting brackets, **as directed**.
- E. Corner Guards
1. Surface-Mounted, Resilient, Plastic Corner Guards: Assembly consisting of snap-on plastic cover installed over continuous retainer; including mounting hardware; fabricated with 90- or 135-degree turn to match wall condition.



- a. Cover: Extruded rigid plastic, minimum 0.078-inch (2.0-mm) **OR** 0.100-inch (2.5-mm), **as directed**, wall thickness; as follows: **OR** in dimensions and profiles indicated on Drawings, **as directed**.
 - 1) Profile: Nominal 2-inch- (50-mm-) long leg and 1/4-inch (6-mm) corner radius **OR** 3-inch- (75-mm-) long leg and 1/4-inch (6-mm) corner radius **OR** 3-inch- (75-mm-) long leg and 1-1/4-inch (32-mm) corner radius, **as directed**.
 - 2) Height: 4 feet (1.2 m) **OR** 8 feet (2.4 m), **as directed**.
 - 3) Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - b. Retainer: Minimum 0.060-inch- (1.5-mm-) thick, one-piece, extruded aluminum **OR** One-piece extruded plastic, **as directed**.
OR
Retainer Clips: Manufacturer's standard impact-absorbing clips.
 - c. Top and Bottom Caps: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.
2. Flush-Mounted, Resilient, Plastic Corner Guards: Assembly consisting of snap-on plastic cover that is flush with adjacent wall surface, installed over continuous retainer; including mounting hardware; fabricated with 90- or 135-degree turn to match wall condition; full wall height.
 - a. Cover: Extruded rigid plastic, minimum 0.078-inch (2.0-mm) **OR** 0.100-inch (2.5-mm), **as directed**, wall thickness; as follows: **OR** in dimensions and profiles indicated on Drawings, **as directed**.
 - 1) Profile: Nominal 2-inch- (50-mm-) long leg and 1/4-inch (6-mm) corner radius **OR** 3-inch- (75-mm-) long leg and 1/4-inch (6-mm) corner radius **OR** 3-inch- (75-mm-) long leg and 1-1/4-inch (32-mm) corner radius, **as directed**.
 - 2) Height: 4 feet (1.2 m) **OR** 8 feet (2.4 m), **as directed**.
 - 3) Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - b. Retainer: Minimum 0.060-inch- (1.5-mm-) thick, one-piece, extruded aluminum.
OR
Retainer Clips: Manufacturer's standard impact-absorbing clips.
 - c. Aluminum Cove Base: Nominal 4 inches (100 mm) **OR** 6 inches (150 mm), **as directed**, high.
 3. Fire-Rated, Resilient, Plastic Corner Guards: Assembly consisting of snap-on plastic cover that is flush with adjacent wall surface, installed over continuous retainer and intumescent fire barrier; including mounting hardware; fabricated with 90- or 135-degree turn to match wall condition; full wall height.
 - a. Fire Rating: 1 hour **OR** 2 hours **OR** Same rating as wall in which corner guard is installed, **as directed**; UL listed and labeled according to UL 2079.
 - b. Cover: Extruded rigid plastic, minimum 0.078-inch (2.0-mm) **OR** 0.100-inch (2.5-mm), **as directed**, wall thickness; as follows: **OR** in dimensions and profiles indicated on Drawings, **as directed**.
 - 1) Leg: Nominal 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**.
 - 2) Corner Radius: 1/4 inch (6 mm) **OR** 1-1/4 inches (32 mm), **as directed**.
 - 3) Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - c. Retainer: Minimum 0.070-inch- (1.8-mm-) thick, one-piece, extruded aluminum.
 - d. Aluminum Cove Base: Nominal 4 inches (100 mm) **OR** 6 inches (150 mm), **as directed**, high.
 4. Surface-Mounted, Opaque-Plastic Corner Guards: Fabricated from PVC plastic, acrylic-modified vinyl sheet or opaque polycarbonate sheet; with formed edges; fabricated with 90- or 135-degree turn to match wall condition.
 - a. Wing Size: Nominal 3/4 by 3/4 inch (20 by 20 mm) **OR** 1-1/8 by 1-1/8 inches (30 by 30 mm) **OR** 2-1/2 by 2-1/2 inches (65 by 65 mm), **as directed**.
 - b. Mounting: Countersunk screws through factory-drilled mounting holes **OR** Adhesive **OR** Double-faced adhesive foam tape, **as directed**.



- c. Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
5. Surface-Mounted, Transparent-Plastic Corner Guards: Fabricated from clear polycarbonate plastic sheet; with formed edges; fabricated with 90- or 135-degree turn to match wall condition.
- a. Wing Size: Nominal 3/4 by 3/4 inch (20 by 20 mm) **OR** 1-1/8 by 1-1/8 inches (30 by 30 mm) **OR** 2-1/2 by 2-1/2 inches (65 by 65 mm), **as directed**.
- b. Thickness: Minimum 0.050 inch (1.3 mm) **OR** 0.075 inch (1.9 mm) **OR** 0.100 inch (2.5 mm), **as directed**.
- c. Mounting: Countersunk screws through factory-drilled mounting holes **OR** Corner clips, **as directed**.
6. Surface-Mounted, Metal Corner Guards: Fabricated from one-piece, formed or extruded metal with formed edges; with 90- or 135-degree turn to match wall condition.
- a. Material: Stainless steel, Type 304 **OR** Type 430, **as directed**.
- 1) Thickness: Minimum 0.0500 inch (1.3 mm) **OR** 0.0625 inch (1.6 mm) **OR** 0.0781 inch (2.0 mm), **as directed**.
- 2) Finish: Directional satin, No. 4 **OR** Bright annealed, **as directed**.
- OR**
- Material: Extruded aluminum, minimum 0.0625 inch (1.6 mm) thick, with clear anodic finish.
- OR**
- Material: Brass sheet, minimum 0.0500 inch (1.3 mm) thick, with buffed, smooth specular **OR** fine satin, **as directed**, finish.
- b. Wing Size: Nominal 1-1/2 by 1-1/2 inches (38 by 38 mm) **OR** 2-1/2 by 2-1/2 inches (65 by 65 mm) **OR** 3-1/2 by 3-1/2 inches (90 by 90 mm), **as directed**.
- c. Corner Radius: 1/8 inch (3 mm) **OR** 3/4 inch (19 mm), **as directed**.
- d. Mounting: Flat-head, countersunk screws through factory-drilled mounting holes **OR** Oval head, countersunk screws through factory-drilled mounting holes **OR** Double-faced, adhesive foam tape **OR** Adhesive, **as directed**.
- F. End-Wall Guards
1. Surface-Mounted, Resilient, Plastic End-Wall Guard: Assembly consisting of snap-on plastic cover installed over continuous retainer **OR** continuous retainer at each corner, with end of wall covered by semirigid, impact-resistant sheet wall covering, **as directed**; including mounting hardware.
- a. Cover: Extruded rigid plastic, minimum 0.078-inch (2.0-mm) **OR** 0.100-inch (2.5-mm), **as directed**, wall thickness; as follows: **OR** in dimensions and profiles indicated on Drawings, **as directed**.
- 1) Profile: Nominal 2-inch- (50-mm-) long leg and 1/4-inch (6-mm) corner radius **OR** 3-inch- (75-mm-) long leg and 1/4-inch (6-mm) corner radius **OR** 3-inch- (75-mm-) long leg and 1-1/4-inch (32-mm) corner radius, **as directed**.
- 2) Height: 4 feet (1.2 m) **OR** 8 feet (2.4 m), **as directed**.
- 3) Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **a directed**.
- b. Retainer: Minimum 0.060-inch- (1.5-mm-) thick, one-piece, extruded aluminum.
- c. Top and Bottom Caps: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.
2. Flush-Mounted, Resilient, Plastic End-Wall Guard: Assembly consisting of snap-on plastic cover that is flush with adjacent wall surface and that covers entire end of wall, installed over continuous retainer **OR** continuous retainer at each corner, with end of wall covered by semirigid, impact-resistant sheet wall covering, **as directed**; including mounting hardware.
- a. Cover: Extruded rigid plastic, minimum 0.078-inch (2.0-mm) **OR** 0.100-inch (2.5-mm), **as directed**, wall thickness; as follows: **OR** in dimensions and profiles indicated on Drawings, **as directed**.
- 1) Profile: Nominal 2-inch- (50-mm-) long leg and 1/4-inch (6-mm) corner radius **OR** 3-inch- (75-mm-) long leg and 1/4-inch (6-mm) corner radius **OR** 3-inch- (75-mm-) long leg and 1-1/4-inch (32-mm) corner radius, **as directed**.



- 2) Height: 4 feet (1.2 m) **OR** 8 feet (2.4 m), **as directed**.
 - 3) Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - b. Retainer: Minimum 0.060-inch- (1.5-mm-) thick, one-piece, extruded aluminum.
 - c. Aluminum Cove Base: Nominal 4 inches (100 mm) **OR** 6 inches (150 mm), **as directed**, high.
 3. Fire-Rated, Resilient, Plastic End-Wall Guard: Assembly consisting of snap-on plastic cover that is flush with adjacent wall surface and that covers entire end of wall, installed over continuous retainer and intumescent fire barrier; including mounting hardware; full wall height.
 - a. Fire Rating: 1 hour **OR** 2 hours **OR** Same rating as wall in which end guard is installed, **as directed**; UL listed and labeled according to UL 2079.
 - b. Cover: Extruded rigid plastic, minimum 0.078-inch (2.0-mm) **OR** 0.100-inch (2.5-mm), **as directed**, wall thickness; as follows: **OR** in dimensions and profiles indicated on Drawings, **as directed**.
 - 1) Leg: Nominal 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**.
 - 2) Corner Radius: 1/4 inch (6 mm) **OR** 1-1/4 inches (32 mm), **as directed**.
 - 3) Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - c. Retainer: Minimum 0.070-inch- (1.8-mm-) thick, one-piece, extruded aluminum.
 - d. Aluminum Cove Base: Nominal 4 inches (100 mm) **OR** 6 inches (150 mm), **as directed**, high.
 4. Surface-Mounted, Metal, End-Wall Guards: Fabricated from one-piece, formed or extruded metal that covers entire end of wall; with formed edges.
 - a. Material: Stainless steel, Type 304 **OR** Type 430 **as directed**.
 - 1) Thickness: Minimum 0.0500 inch (1.3 mm) **OR** 0.0625 inch (1.6 mm) **OR** 0.0781 inch (2.0 mm), **as directed**.
 - 2) Finish: Directional satin, No. 4 **OR** Bright annealed, **as directed**.

OR

Material: Extruded aluminum, minimum 0.0625 inch (1.6 mm) thick, with clear anodic finish.

OR

Material: Brass sheet, minimum 0.0500 inch (1.3 mm) thick, with buffed, smooth specular **OR** fine satin, **as directed**, finish.
 - b. Wing Size: Nominal 1-1/2 by 1-1/2 inches (38 by 38 mm) **OR** 2-1/2 by 2-1/2 inches (65 by 65 mm) **OR** 3-1/2 by 3-1/2 inches (90 by 90 mm), **as directed**.
 - c. Corner Radius: 1/8 inch (3 mm) **OR** 3/4 inch (19 mm), **as directed**.
 - d. Mounting: Flat-head, countersunk screws through factory-drilled mounting holes **OR** Oval head, countersunk screws through factory-drilled mounting holes **OR** Double-faced, adhesive foam tape **OR** Adhesive, **as directed**.
- G. Impact-Resistant Wall Coverings
1. Impact-Resistant Sheet Wall Covering: Fabricated from plastic sheet wall-covering material.
 - a. Size: 48 by 96 inches (1219 by 2438 mm) for sheet **OR** 48 by 120 inches (1219 by 3048 mm) for roll **OR** As indicated, **as directed**.
 - b. Sheet Thickness: 0.022 inch (0.56 mm) **OR** 0.028 inch (0.7 mm) **OR** 0.040 inch (1.0 mm) **OR** 0.060 inch (1.5 mm) **OR** 0.080 inch (2.0 mm) **OR** 0.093 inch (2.4 mm) **OR** 0.125 inch (3.0 mm), **as directed**.
 - c. Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - d. Height: Full wall **OR** Wainscot **OR** As indicated, **as directed**.
 - e. Trim and Joint Moldings: Extruded rigid plastic that matches sheet wall covering color.
 - f. Mounting: Adhesive.
 2. Prelaminated, Impact-Resistant Wall Panels: Rigid wall panels consisting of impact-resistant plastic sheet wall covering material factory laminated to high-impact-resistant core, with moisture-resistant vapor barrier factory laminated to reverse side of panel for stability.



- a. Composition: 0.028-inch- (0.70-mm-) thick plastic sheet laminated to 3/8-inch- (9.5-mm-) thick, particleboard core **OR** 0.04-inch- (1.02-mm-) thick plastic sheet laminated to 3/8-inch- (9.5-mm-) thick, particleboard core, **as directed**.
 - b. Sheet Size: 48 by 96 inches (1219 by 2438 mm) **OR** 48 by 108 inches (1219 by 2743 mm) **OR** 48 by 120 inches (1219 by 3048 mm) **OR** As indicated, **as directed**.
 - c. Height: Full wall **OR** Wainscot **OR** As indicated, **as directed**.
 - d. Sheet Edge: Square **OR** Beveled, **as directed**.
 - e. Trim and Joint Moldings: Extruded rigid plastic that matches sheet wall covering color.
 - f. Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - g. Mounting: Adhesive.
- H. Door Protection Systems
1. General: Comply with BHMA A156.6.
 - a. For fire-rated doors, provide door protection systems that are UL listed and labeled.
 2. Protection Plates: Fabricated from extruded rigid plastic, of thickness indicated.
 3. Full-Height Door-Surface Protection: Minimum 0.040-inch (1.0-mm) **OR** 0.060-inch (1.5-mm) **OR** 0.080-inch (2.0-mm), **as directed**, wall thickness; with 90-degree bend for door-edge protection.
 - a. Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - b. Mounting: Adhesive **OR** Countersunk screws through factory-drilled mounting holes **OR** Double-faced adhesive foam tape, **as directed**.
 4. Armor Plates: Minimum 0.040-inch (1.0-mm) **OR** 0.060-inch (1.5-mm) **OR** 0.080-inch (2.0-mm), **as directed**, wall thickness; beveled four sides.
 - a. Size: 32 inches (813 mm) **OR** 36 inches (914 mm) **OR** 40 inches (1016 mm) **OR** 42 inches (1067 mm), **as directed**, high by door width, with allowance for frame stops.
 - b. Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - c. Mounting: Adhesive **OR** Countersunk screws through factory-drilled mounting holes **OR** Double-faced adhesive foam tape, **as directed**.
 5. Kick Plates: Minimum 0.040-inch (1.0-mm) **OR** 0.060-inch (1.5-mm) **OR** 0.080-inch (2.0-mm), **as directed** wall thickness; beveled four sides.
 - a. Size: 8 inches (203 mm) **OR** 10 inches (254 mm) **OR** 12 inches (305 mm), **as directed**, high by door width, with allowance for frame stops.
 - b. Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - c. Mounting: Adhesive **OR** Countersunk screws through factory-drilled mounting holes **OR** Double-faced adhesive foam tape, **as directed**.
 6. Mop Plates: Minimum 0.040-inch (1.0-mm) **OR** 0.060-inch (1.5-mm) **OR** 0.080-inch (2.0-mm), **as directed**, wall thickness; beveled four sides.
 - a. Size: 4 inches (102 mm) **OR** 6 inches (152 mm), **as directed**, high by 1 inch (25 mm) less than door width.
 - b. Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - c. Mounting: Adhesive **OR** Countersunk screws through factory-drilled mounting holes **OR** Double-faced adhesive foam tape, **as directed**.
 7. Stretcher Plates: Minimum 0.040-inch (1.0-mm) **OR** 0.060-inch (1.5-mm) **OR** 0.080-inch (2.0-mm), **as directed**, wall thickness; beveled four sides.
 - a. Size: 6 inches (152 mm) **OR** 8 inches (203 mm), **as directed**, high by door width, with allowance for frame stops.
 - b. Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - c. Mounting: Adhesive **OR** Countersunk screws through factory-drilled mounting holes **OR** Double-faced adhesive foam tape, **as directed**.
 8. Push Plates: Minimum 0.040-inch (1.0-mm) **OR** 0.060-inch (1.5-mm) **OR** 0.080-inch (2.0-mm), **as directed**, wall thickness; beveled four sides.



- a. Size: 12 inches high by 4 inches wide (305 mm high by 102 mm wide) **OR** 16 inches high by 4 inches wide (406 mm high by 102 mm wide), **as directed**.
 - b. Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - c. Mounting: Adhesive **OR** Countersunk screws through factory-drilled mounting holes **OR** Double-faced adhesive foam tape, **as directed**.
9. Door-Edge Protection: Fabricated from extruded rigid plastic, minimum 0.040-inch (1.0-mm) **OR** 0.060-inch (1.5-mm), **as directed**, wall thickness; formed to fit over door edge without mortising.
- a. Shape: L **OR** U, **as directed**.
 - b. Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - c. Mounting: Adhesive **OR** Countersunk screws through factory-drilled mounting holes **OR** Double-faced adhesive foam tape, **as directed**.
10. Door-Frame Protector: Fabricated from extruded rigid plastic, minimum 0.040-inch (1.0-mm) **OR** 0.050-inch (1.3-mm) **OR** 0.060-inch (1.5-mm), **as directed**, wall thickness; formed to fit entire door-frame profile.
- a. Height: 36 inches (914 mm) **OR** 48 inches (1219 mm), **as directed**.
 - b. Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - c. Mounting: Adhesive **OR** Countersunk screws through factory-drilled mounting holes **OR** Double-faced adhesive foam tape, **as directed**.
11. Door-Frame Protector: Assembly consisting of snap-on plastic cover installed over continuous retainer; formed to fit door frame on opposite side of door swing.
- a. Cover: Extruded rigid plastic, minimum 0.080-inch (2.0-mm) wall thickness; in dimensions and profiles indicated.
 - 1) Height: 36 inches (914 mm) **OR** 48 inches (1219 mm), **as directed**.
 - 2) Corner Radius: 1/4 inch (6 mm) **OR** 1-1/4 inches (32 mm), **as directed**.
 - 3) Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - b. Retainer: Minimum 0.080-inch- (2.0-mm-) thick, one-piece, extruded aluminum.
12. Door-Knob **OR** Door-Lever, **as directed**, Protector: Fabricated from injection-molded plastic, minimum 0.060-inch (1.5-mm) wall thickness.
- a. Color and Texture: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - b. Mounting: Countersunk screws through factory-drilled mounting holes.
- I. Fabrication
1. Fabricate impact-resistant wall protection units to comply with requirements indicated for design, dimensions, and member sizes, including thicknesses of components.
 2. Preform curved semirigid, impact-resistant sheet wall covering in factory for radius and sheet thickness as follows:
 - a. Sheet Thickness of 0.040 Inch (1.0 mm): 24-inch (610-mm) radius.
 - b. Sheet Thickness of 0.060 Inch (1.5 mm): 36-inch (914-mm) radius.
 3. Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.
 4. Fabricate components with tight seams and joints with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.
 5. Miter corners and ends of wood handrails for returns.
- J. Metal Finishes
1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - a. Remove tool and die marks and stretch lines, or blend into finish.
 - b. Grind and polish surfaces to produce uniform finish, free of cross scratches.



- c. Run grain of directional finishes with long dimension of each piece.
 - d. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
2. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

1.3 EXECUTION

A. Examination

1. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances, fire rating, and other conditions affecting performance of work.
2. Examine walls to which impact-resistant wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.
 - a. For impact-resistant wall protection units attached with adhesive or foam tape, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Preparation

1. Complete finishing operations, including painting, before installing impact-resistant wall protection system components.
2. Before installation, clean substrate to remove dust, debris, and loose particles.

C. Installation

1. General: Install impact-resistant wall protection units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
 - a. Install impact-resistant wall protection units in locations and at mounting heights indicated on Drawings or, if not indicated, at heights indicated on Drawings **OR** as directed.
 - b. Provide splices, mounting hardware, anchors, and other accessories required for a complete installation.
 - 1) Provide anchoring devices to withstand imposed loads.
 - 2) Where splices occur in horizontal runs of more than 20 feet (6.1 m), splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches (305 mm).
 - 3) Adjust end and top caps as required to ensure tight seams.
2. Impact-Resistant Wall Covering: Install top and edge moldings, corners, and divider bars as required for a complete installation.

D. Cleaning

1. Immediately after completion of installation, clean plastic covers and accessories using a standard, ammonia-based, household cleaning agent.
2. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 10 26 13 00



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Task	Specification	Specification Description
10 26 13 00	05 50 00 00	Metal Fabrications
10 26 23 00	10 26 13 00	Impact-Resistant Wall Protection



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SECTION 10 28 13 13 - TOILET AND BATH ACCESSORIES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for toilet and bath accessories. Product shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Public-use washroom accessories.
 - b. Public-use shower room accessories.
 - c. Private-use bathroom accessories.
 - d. Healthcare accessories.
 - e. Warm-air dryers.
 - f. Childcare accessories.
 - g. Underlavatory guards.
 - h. Custodial accessories.

C. Submittals

1. Product Data: For each type of product indicated.
2. Product Schedule:
 - a. Identify locations using room designations indicated on Drawings.
 - b. Identify products using designations indicated on Drawings.

D. Warranty

1. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within 15 years from date of Final Completion.

1.2 PRODUCTS

A. Materials

1. Stainless Steel: ASTM A 666, Type 304, 0.0312-inch (0.8-mm) minimum nominal thickness, unless otherwise indicated.
2. Brass: ASTM B 19 flat products; ASTM B 16 (ASTM B 16M), rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.
3. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.0359-inch (0.9-mm) minimum nominal thickness.
4. Galvanized Steel Sheet: ASTM A 653/A 653M, with G60 (Z180) hot-dip zinc coating.
5. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
6. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
7. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
8. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.
9. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

B. Public-Use Washroom Accessories

1. Toilet Tissue (Roll) Dispenser:



- a. Description: Roll-in-reserve dispenser with hinged front secured with tumbler lockset **OR** Single-roll dispenser **OR** Double-roll dispenser **OR** Double-roll dispenser with shelf, **as directed**.
 - b. Mounting: Recessed **OR** Partition mounted serving two adjacent toilet compartments **OR** Surface mounted, **as directed**.
 - c. Operation: Noncontrol delivery with standard spindle **OR** Noncontrol delivery with theft-resistant spindle **OR** Spindleless with tension-spring controlled delivery **OR** Spindleless with tension-spring controlled delivery and self-locking device extending through core that prevents core removal until roll is empty **OR** Eccentric-shaped, molded-plastic spindle revolves one-half revolution per dispensing operation for controlled delivery; core cannot be removed until roll is empty, **as directed**.
 - d. Capacity: Designed for 4-1/2- or 5-inch- (114- or 127-mm-) **OR** 5-inch- (127-mm-), **as directed**, diameter tissue rolls.
 - e. Material and Finish: Stainless steel, No. 4 finish (satin) **OR** Chrome-plated zinc alloy (zamac) or steel **OR** Satin-finish aluminum bracket with plastic spindle **OR** ABS plastic, gray, **as directed**.
2. Combination Toilet Tissue Dispenser:
 - a. Description: Combination unit with double-roll toilet tissue dispenser and the following:
 - 1) Removable sanitary-napkin waste receptacle with self-closing disposal-opening cover.
 - 2) Seat-cover dispenser with minimum capacity of 500 **OR** 1000, **as directed**, single or half-fold seat covers.
 - b. Mounting: Recessed **OR** Surface mounted **OR** Partition mounted, dual access with two tissue rolls per compartment **OR** Partition mounted, dual access with two tissue rolls per compartment and with one side that mounts flush with partition of accessible compartment, **as directed**.
 - c. Toilet Tissue Dispenser Capacity: 4-1/2- or 5-inch- (114- or 127-mm-) diameter tissue rolls.
 - d. Toilet Tissue Dispenser Operation: Noncontrol delivery with theft-resistant spindles.
 - e. Material and Finish: Stainless steel, No. 4 finish (satin).
 - f. Lockset: Tumbler type.
 3. Toilet Tissue (Folded) Dispenser:
 - a. Description: Folded-tissue dispenser with cover hinged at bottom.
 - b. Mounting: Surface mounted.
 - c. Minimum Capacity: 1250 single-fold tissues.
 - d. Material and Finish: Stainless steel, No. 4 finish (satin).
 - e. Lockset: Tumbler type.
 - f. Refill Indicators: Pierced slots at front.
 4. Toilet Tissue (Jumbo-Roll) Dispenser:
 - a. Description: One-roll unit **OR** Two-roll unit with sliding panel to expose other roll, **as directed**.
 - b. Mounting: Surface mounted.
 - c. Capacity: 9- or 10-inch- (228- or 254-mm-) diameter rolls.
 - d. Material and Finish: Stainless steel, No. 4 finish (satin) **OR** ABS plastic, gray, **as directed**.
 - e. Lockset: Tumbler type.
 - f. Refill Indicator: Pierced slots at front.
 5. Paper Towel (Folded) Dispenser:
 - a. Mounting: Recessed **OR** Semirecessed **OR** Deck mounted, recessed **OR** Surface mounted, **as directed**.
 - b. Minimum Capacity: 400 C-fold or 525 multifold towels **OR** 600 C-fold or 800 multifold towels **OR** 400 single-fold towels, **as directed**.
 - c. Material and Finish: Stainless steel, No. 4 finish (satin) **OR** ABS plastic, gray, **as directed**.
 - d. Lockset: Tumbler type.
 - e. Refill Indicators: Pierced slots at sides or front.
 6. Paper Towel (Roll) Dispenser:



- a. Description: Lever-actuated mechanism permits controlled delivery of paper rolls in preset lengths per stroke.
 - b. Mounting: Recessed **OR** Semirecessed **OR** Surface mounted, **as directed**.
 - c. Minimum Capacity: 8-inch (203-mm) wide, 800-foot (244-m) long roll.
 - d. Material and Finish: Stainless steel, No. 4 finish (satin) **OR** ABS plastic, gray, **as directed**.
 - e. Lockset: Tumbler type.
7. Waste Receptacle:
- a. Mounting: Open top, recessed **OR** Self-closing disposal-opening cover, recessed **OR** Semirecessed **OR** Surface mounted **OR** Wall mounted for corner installation **OR** Freestanding **OR** Undercounter, **as directed**.
 - b. Minimum Capacity: Capacity in gal. (L) **as directed**.
 - c. Material and Finish: Stainless steel, No. 4 finish (satin).
 - d. Liner: Reusable vinyl liner.
 - e. Lockset: Tumbler type for waste-receptacle.
8. Combination Towel (Folded) Dispenser/Waste Receptacle:
- a. Description: Combination unit for dispensing C-fold or multifold towels, with removable waste receptacle.
 - b. Mounting: Surface mounted **OR** Surface mounted with stainless-steel collar **OR** Recessed **OR** Recessed with projecting receptacle **OR** Semirecessed, **as directed**.
 - 1) Designed for nominal 4-inch (100-mm) **OR** 6-inch (150-mm), **as directed**, wall depth.
 - c. Minimum Towel-Dispenser Capacity: 600 C-fold or 800 multifold paper towels.
 - d. Minimum Waste-Receptacle Capacity: 4 gal. (15 L) **OR** 12 gal. (45.4 L), **as directed**.
 - e. Material and Finish: Stainless steel, No. 4 finish (satin).
 - f. Liner: Reusable, vinyl waste-receptacle liner.
 - g. Lockset: Tumbler type for towel-dispenser compartment and waste receptacle.
9. Combination Towel (Roll) Dispenser/Waste Receptacle:
- a. Description: Combination unit for dispensing preset length of roll paper towels, with removable waste receptacle.
 - b. Mounting: Recessed **OR** Semirecessed **OR** Surface mounted, **as directed**.
 - c. Minimum Towel-Dispenser Capacity: 8-inch (203-mm) wide, 800-foot (244-m) long roll.
 - d. Minimum Waste Receptacle Capacity: 8 gal. (30 L) **OR** 12 gal. (45.4 L) **OR** 15 gal. (56.8 L), **as directed**.
 - e. Material and Finish: Stainless steel, No. 4 finish (satin).
 - f. Liner: Reusable, vinyl waste-receptacle liner.
 - g. Lockset: Tumbler type for towel dispenser compartment and waste receptacle.
10. Multipurpose Soap/Towel Dispenser Unit:
- a. Description: Combination unit for dispensing soap in liquid or lotion **OR** lather, **as directed**, form and folded towels.
 - b. Mounting: Recessed, designed for nominal 4-inch (100-mm) wall depth **OR** Surface mounted with stainless-steel collar, **as directed**.
 - c. Minimum Soap-Dispenser Capacity: 80 oz. (2.36 L).
 - d. Minimum Towel-Dispenser Capacity: 600 C-fold or 800 multifold **OR** 1000 single-fold, **as directed**, towels.
 - e. Material and Finish: Stainless steel, No. 4 finish (satin) for unit body and soap valve.
 - f. Lockset: Tumbler type.
11. Liquid-Soap Dispenser:
- a. Description: Designed for dispensing soap in liquid or lotion **OR** lather, **as directed**, form.
 - b. Mounting: Deck mounted on vanity **OR** Deck mounted on lavatory **OR** Horizontally oriented, recessed **OR** Horizontally oriented, surface mounted **OR** Vertically oriented, surface mounted, **as directed**.
 - c. Capacity: Capacity in **oz. (mL)**, **as directed**.
 - d. Materials: Valve and reservoir materials and finishes, **as directed**.
 - e. Lockset: Tumbler type.
 - f. Refill Indicator: Window type.
12. Grab Bar:



- a. Mounting: Flanges with concealed **OR** exposed, **as directed**, fasteners.
 - b. Material: Stainless steel, 0.05 inch (1.3 mm) thick.
 - 1) Finish: Smooth, No. 4, satin finish **OR** Smooth, No. 4, satin finish on ends and slip-resistant texture in grip area, **as directed**.
 - c. Outside Diameter: 1-1/4 inches (32 mm) **OR** [1-1/2 inches (38 mm)], **as directed**.
 - d. Configuration and Length: As indicated on Drawings **OR** Straight, 36 inches (914 mm) long, **as directed**.
13. Vendor:
- a. Type: Sanitary napkin **OR** Sanitary napkin and tampon **OR** Condom, **as directed**.
 - b. Mounting: Fully recessed, designed for 4-inch (100-mm) wall depth, **OR** Semirecessed, **OR** Surface mounted, **as directed**.
 - c. Capacity: **As directed**.
 - d. Operation: No coin (free) **OR** Single coin (25 cents) **OR** Two coin (50 cents), **as directed**.
 - e. Exposed Material and Finish: Stainless steel, No. 4 finish (satin).
 - f. Lockset: Tumbler type with separate lock and key for coin box.
14. Sanitary-Napkin Disposal Unit:
- a. Mounting: Recessed **OR** Partition mounted, dual access **OR** Surface mounted, **as directed**.
 - b. Door or Cover: Self-closing disposal-opening cover and hinged face panel with tumbler lockset.
 - c. Receptacle: Removable.
 - d. Material and Finish: Stainless steel, No. 4 finish (satin) **OR** ABS plastic, gray, **as directed**.
15. Seat-Cover Dispenser:
- a. Mounting: Surface mounted **OR** Recessed **OR** Partition mounted, dual access, **as directed**.
 - b. Minimum Capacity: 250 **OR** 500, **as directed**, seat covers.
 - c. Exposed Material and Finish: Stainless steel, No. 4 finish (satin) **OR** ABS plastic, gray, **as directed**.
 - d. Lockset: Tumbler type.
16. Fold-Down Purse Shelf:
- a. Description: Hinged unit with spring-loaded shelf that automatically returns to vertical position.
 - b. Nominal Size: 15 inches (381 mm) long by 5-1/2 inches (140 mm) wide.
 - c. Material and Finish: Chrome-plated cast-zinc alloy (zamac) with stippled finish on tray or stainless steel, No. 4 finish (satin) **OR** Chrome-plated cast-zinc alloy (zamac) with stippled finish on tray and bright chrome finish on edges **OR** Stainless steel, No. 4 finish (satin), **as directed**.
17. Mirror Unit:
- a. Frame: Stainless-steel angle, 0.05 inch (1.3 mm) thick **OR** Stainless-steel channel **OR** Stainless steel, fixed tilt **OR** Stainless steel, adjustable tilt, **as directed**.
 - 1) Corners: Manufacturer's standard **OR** Mitered and mechanically interlocked **OR** Welded and ground smooth, **as directed**.
 - b. Integral Shelf: 5 inches (127 mm) deep.
 - c. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
 - 1) One-piece, galvanized steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
 - 2) Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.
 - d. Size: As indicated on Drawings **OR** **as directed**.
18. Facial Tissue Dispenser:
- a. Mounting: Wall mounted, recessed **OR** Surface mounted, **as directed**.
 - b. Nominal Depth: 2-1/4 inches (57 mm) **OR** 4 inches (102 mm), **as directed**.
 - c. Capacity: 150 double-ply tissues.
 - d. Material and Finish:



- 1) Dispenser Face: Stainless steel, No. 4 finish (satin) **OR** Stainless steel, No. 7 finish (polished), **as directed**.
- 2) Cabinet: Steel with corrosion-resistant finish.

C. Public-Use Shower Room Accessories

1. Shower Curtain Rod:
 - a. Description: 1-inch (25.4-mm) OD; fabricated from nominal 0.0375-inch- (0.95-mm-) thick stainless steel **OR** 1-1/4-inch (32-mm) OD; fabricated from nominal **0.05-inch- (1.3-mm-) thick stainless steel, as directed**.
 - b. Mounting Flanges: Stainless-steel flanges designed for exposed fasteners.
 - c. Finish: No. 4 (satin).
2. Shower Curtain:
 - a. Size: Minimum 6 inches (152 mm) **OR** 12 inches (305 mm), **as directed**, wider than opening by 72 inches (1828 mm) high.
 - b. Material: Vinyl, minimum 0.006-inch- (0.15-mm-) thick, opaque, matte, **OR** Duck, minimum 8 oz. (227 g), white, 100 percent cotton, **OR** Nylon-reinforced vinyl, minimum 10-oz. (284-g) or 0.008-inch- (0.2-mm-) thick vinyl, with integral antibacterial agent, **as directed**.
 - c. Color: White **OR** Green **OR** As selected from manufacturer's full range, **as directed**.
 - d. Grommets: Corrosion resistant at minimum 6 inches (152 mm) o.c. through top hem.
 - e. Shower Curtain Hooks: Chrome-plated or stainless-steel, spring wire curtain hooks with snap fasteners, sized to accommodate specified curtain rod. Provide one hook per curtain grommet.
3. Folding Shower Seat:
 - a. Configuration: L-shaped seat, designed for wheelchair access **OR** Rectangular seat **OR** Triangular, corner-type seat **OR** Stainless-steel seat designed to fold into recessed-mounted, stainless-steel wall box, **as directed**.
 - b. Seat: Phenolic or polymeric composite of slat-type or one-piece construction in color as selected **OR** White vinyl padded seat **OR** Stainless steel, No. 4 finish (satin); 0.05-inch (1.3-mm) minimum nominal thickness; with single-piece, pan-type construction and edge seams welded and ground smooth, **as directed**.
 - c. Mounting Mechanism: Stainless steel, No. 4 finish (satin).
 - d. Dimensions: **As directed**.
4. Soap Dish:
 - a. Description: With **OR** Without, **as directed**, washcloth bar.
 - b. Mounting: Recessed **OR** Surface mounted, **as directed**.
 - c. Material and Finish: Stainless steel, No. 4 finish (satin) **OR** Ceramic at Cermaic Tile Bathtub surround (See Ceramic Tile Section) **OR** Metal at Porcelain Steel Bathtub Surround (Fastenings: Plated expansion toggle or molly bolts, lead anchors or as required by existing wall conditions), **as directed**.

D. Private-Use Bathroom Accessories

1. Toilet Tissue Dispenser:
 - a. Description: Single-roll dispenser **OR** Double-roll dispenser **OR** Single-roll dispenser with hood **OR** Double-roll dispenser with hood, **as directed**.
 - b. Mounting: Recessed **OR** Surface mounted, **as directed**.
 - c. Capacity: Designed for 4-1/2- or 5-inch- (114- or 127-mm-) diameter tissue rolls.
 - d. Material and Finish: Solid brass, polished **OR** Polished brass-plated zinc alloy (zamac) **OR** Polished chrome-plated brass **OR** Polished chrome-plated zinc alloy (zamac) **OR** Stainless steel, No. 4 finish (satin) **OR** Stainless steel, No. 7 finish (polished), **as directed**.
2. Shower Curtain Rod:
 - a. Outside Diameter: 1 inch (25.4 mm) **OR** 1-1/4 inch (32 mm), **as directed**.
 - b. Mounting: Flanges with exposed **OR** concealed, **as directed**, fasteners.
 - c. Rod Material and Finish: Solid brass, polished **OR** Polished chrome-plated brass **OR** Stainless steel, No. 4 finish (satin) **OR** Stainless steel, No. 7 finish (polished), **as directed**.



- d. Flange Material and Finish: Polished brass-plated zinc alloy (zamac) **OR** Polished chrome-plated brass **OR** Polished chrome-plated zinc alloy (zamac) **OR** Stainless steel, No. 4 finish (satin) **OR** Stainless steel, No. 7 finish (polished), **as directed**.
- e. Accessories: Integral chrome-plated brass glide hooks.
3. Soap Dish:
 - a. Description: **As directed**.
 - b. Mounting: Recessed **OR** Surface mounted, **as directed**.
 - c. Material and Finish: Solid brass, polished **OR** Polished brass-plated zinc alloy (zamac) **OR** Polished chrome-plated brass **OR** Polished chrome-plated zinc alloy (zamac) **OR** Stainless steel, No. 4 finish (satin) **OR** Stainless steel, No. 7 finish (polished) **OR** Ceramic at Cermaic Tile Bathtub surround (See Ceramic Tile Section) **OR** Metal at Porcelain Steel Bathtub Surround (Fastenings: Plated expansion toggle or molly bolts, lead anchors or as required by existing wall conditions), **as directed**.
4. Medicine Cabinet:
 - a. Mounting: Recessed, for nominal 4-inch (100-mm) wall depth **OR** Surface mounted, **as directed**.
 - b. Size: 18 by 24 inches (460 by 610 mm).
 - c. Door: Framed mirror door concealing storage cabinet equipped with continuous hinge and spring-buffered, rod-type stop and magnetic door catch.
 - d. Shelves: Three, adjustable.
 - e. Material and Finish:
 - 1) Cabinet: Stainless steel, No. 4 finish (satin) **OR** Steel with corrosion resistant finish, **as directed**.
 - 2) Mirror Frame: **As directed**.
 - 3) Door: **As directed**.
 - 4) Hinge: **As directed**.
 - 5) Shelves: **As directed**.
5. Facial Tissue Dispenser:
 - a. Mounting: Wall mounted, recessed **OR** Surface mounted, **as directed**.
 - b. Depth: 2-5/8 inches (67 mm) **OR** 4 inches (102 mm), **as directed**.
 - c. Material and Finish:
 - 1) Dispenser Face: Polished chrome-plated brass **OR** Polished brass-plated zinc alloy (zamac) **OR** Polished chrome-plated steel **OR** Stainless steel, No. 4 finish (satin) **OR** Stainless steel, No. 7 finish (polished), **as directed**.
 - 2) Cabinet: Steel with corrosion-resistant finish.
6. Robe Hook:
 - a. Description: Double-prong **OR** Single-prong, **as directed**, unit.
 - b. Material and Finish: Solid brass, polished **OR** Polished brass-plated zinc alloy (zamac) **OR** Polished chrome-plated brass **OR** Polished chrome-plated zinc alloy (zamac) **OR** Stainless steel, No. 4 finish (satin) **OR** Stainless steel, No. 7 finish (polished), **as directed**.
7. Toothbrush and Tumbler Holder:
 - a. Description: **As directed**.
 - b. Material and Finish: Solid brass, polished **OR** Polished brass-plated zinc alloy (zamac) **OR** Polished chrome-plated brass **OR** Polished chrome-plated zinc alloy (zamac) **OR** Stainless steel, No. 4 finish (satin) **OR** Stainless steel, No. 7 finish (polished), **as directed**.
8. Towel Bar:
 - a. Description: 3/4-inch- (19-mm-) square tube with rectangular end brackets **OR** 3/4-inch- (19-mm-) round tube with circular end brackets, **as directed**.
 - b. Mounting: Flanges with concealed **OR** exposed, **as directed**, fasteners.
 - c. Length: 18 inches (457 mm), **OR** 24 inches (610 mm), **OR** 30 inches (762 mm), **as directed**.
 - d. Material and Finish: Stainless steel, No. 4 finish (satin) **OR** Stainless steel, No. 7 finish (polished) **OR** Polished aluminum, **as directed**.
9. Towel Pin:



- a. Description: Projecting minimum of 3 inches (75 mm) **OR** 5 inches (127 mm), **as directed**, from wall surface.
 - b. Material and Finish: Polished brass-plated zinc alloy (zamac) **OR** Polished chrome-plated brass **OR** Stainless steel, No. 4 finish (satin) **OR** Stainless steel, No. 7 finish (polished), **as directed**.
10. Towel Ring:
- a. Description: Pin projecting approximately 2-1/2 inches (63 mm) from wall with square **OR** circular **OR** oval **OR** trapezoidal, **as directed**, ring.
 - b. Pin Material and Finish: Solid brass, polished **OR** Polished brass-plated zinc alloy (zamac) **OR** Polished chrome-plated brass **OR** Polished chrome-plated zinc alloy (zamac) **OR** Stainless steel, No. 4 finish (satin) **OR** Stainless steel, No. 7 finish (polished), **as directed**.
 - c. Ring Material and Finish: Matching pin **OR** Clear plastic, **as directed**.
11. Towel Shelf:
- a. Description: Surface-mounted, guest-towel shelf with four 3/8-inch- (9-mm-) diameter **OR** 5/16-inch- (8-mm-) square, **as directed**, stainless steel tubes mounted in support arms.
 - 1) Towel Bar: 1/4-inch (6-mm-) diameter **OR** 5/16-inch- (8-mm-) square, **as directed**, stainless-steel towel bar below shelf.
 - b. Length: 18 inches (457 mm) **OR** 24 inches (610 mm), **as directed**.
 - c. Material and Finish: Polished brass-plated stainless steel tubes mounted in zinc alloy (zamac) support arms **OR** Polished chrome-plated stainless steel tubes mounted in zinc alloy (zamac) support arms **OR** Stainless steel, No. 7 finish (polished), **as directed**.
12. Towel Rack:
- a. Description: Surface-mounted, guest-towel unit with approximately 1/4-inch- (6-mm-) diameter wire rings welded to upright wire bracket.
 - b. Capacity: 2 **OR** 3 **OR** 4, **as directed**, sets of bath towels, hand towels, and washcloths.
 - c. Nominal Height: 11 inches (279 mm) **OR** 17 inches (432 mm) **OR** 21 inches (533 mm), **as directed**.
 - d. Material and Finish: Polished brass-plated zinc alloy (zamac) **OR** Polished chrome-plated zinc alloy (zamac), **as directed**.
13. Retractable Clothesline:
- a. Description: Surface-mounted rectangular **OR** circular, **as directed**, housing with minimum 72-inch- (1829-mm-) long, retractable, spring-actuated, synthetic clothesline and remote retention bracket.
 - b. Material and Finish Chrome-plated brass **OR** Stainless steel, No. 7 finish (polished), **as directed**.
14. Bottle Opener:
- a. Description: Surface-mounted unit with standard **OR** vandal-resistant, **as directed**, fasteners.
 - b. Material and Finish: Stainless steel, No. 4 finish (satin) **OR** Stainless steel, No. 7 finish (polished) **OR** Chrome-plated steel, **as directed**.
- E. Healthcare Accessories
1. Specimen Pass-Through Cabinet:
 - a. Description: With self-closing doors on both sides, lock that prevents doors from both being opened at the same time, and removable stainless-steel tray.
 - b. Nominal Wall Opening: 12 by 11-1/4 inches (305 by 285 mm), width times height.
 - c. Material and Finish: Stainless steel, No. 4 finish (satin).
 2. Specimen Pass-Through Box:
 - a. Description: With minimum 12-inch (305-mm) diameter turntable removable cylinder that revolves on stainless-steel self-lubricating ball bearing plates, and with mechanism to prevent over rotation of cylinder.
 - b. Nominal Wall Opening: 13-1/4 by 14 inches (335 by 355 mm), width times height.
 - c. Material and Finish: Stainless steel, No. 4 finish (satin).
 - d. Lockset: Tumbler type.
 3. Bedpan and Urinal Cabinet:



- a. Description: For storing one conventional size bedpan and one urinal bottle; with door that produces 1/2-inch (13-mm) opening at top and bottom of cabinet to allow air circulation.
 - b. Mounting: Recessed.
 - c. Nominal Wall Opening: 13-1/2 by 26-1/2 by 5 inches (340 by 670 by 130 mm), width times height times depth.
 - d. Material and Finish: Stainless steel, No. 4 finish (satin).
4. Bedpan and Urinal Rack:
- a. Description: For storing one conventional size bedpan and one urinal bottle.
 - b. Mounting: Surface mounted.
 - c. Size: 12 by 27 inches (300 by 685 mm), width times height.
 - d. Material and Finish: Stainless steel, No. 4 finish (satin).
- F. Warm-Air Dryers
1. Warm-Air Dryer:
- a. Mounting: Recessed **OR** Semirecessed **OR** Surface mounted, **as directed**.
 - b. Operation: Touch-button **OR** Electronic-sensor, **as directed**, activated with timed power cut-off switch.
 - 1) Operation Time: 30 to 40, **OR** 80, **as directed**, seconds.
 - c. Cover Material and Finish: Steel, with white enamel finish **OR** Cast iron, with enamel finish in color selected **OR** Chrome-plated steel **OR** Stainless steel, No. 4 finish (satin) **OR** Molded plastic, gray **OR** Molded plastic, white, **as directed**.
 - d. Electrical Requirements: 115 V, 13 A, 1500 W **OR** 115 V, 15 A, 1725 W **OR** 115 V, 20 A, 2300 W **OR** 208-240 V, 9-10 A, 1900-2300 W, **as directed**.
- G. Childcare Accessories
1. Diaper-Changing Station:
- a. Description: Horizontal **OR** Vertical, **as directed**, unit that opens by folding down from stored position and with child-protection strap.
 - 1) Engineered to support a minimum of 250-lb (113-kg) static load when opened.
 - b. Mounting: Surface mounted, with unit projecting not more than 4 inches (100 mm) from wall when closed **OR** Semirecessed, with unit projecting not more than 1 inch (25 mm) from wall when closed, **as directed**.
 - c. Operation: By pneumatic shock-absorbing mechanism.
 - d. Material and Finish: High-density polyethylene in manufacturer's standard color **OR** High-density polyethylene with plastic laminate insert in color selected **OR** Stainless steel, No. 4 finish (satin), with replaceable insulated polystyrene tray liner and rounded plastic corners **OR** Stainless steel, No. 4 finish (satin), exterior shell with rounded plastic corners; high-density polyethylene interior in manufacturer's standard color, **as directed**.
 - e. Liner Dispenser: Built in.
2. Diaper-Pack Vendor:
- a. Mounting: Surface mounted **OR** Recessed, **as directed**.
 - b. Minimum Capacity: 100 diaper packs.
 - c. Coin Operation: Coin slot preset for 1 U.S. dollar, adjustable up in 25-cent increments.
 - d. Material and Finish: Stainless steel, No. 4 finish (satin).
3. Child-Protection Seat:
- a. Description: Unit that opens by folding down from stored position and with child-protection strap.
 - 1) Engineered to support a minimum of 80-lb (36-kg), **OR** 150-lb (68-kg), **as directed**, static load when opened.
 - b. Mounting: Surface mounted, with unit projecting not more than 4-1/2 inches (114 mm), **OR** 6 inches (152 mm), **as directed**, from wall when closed.
 - c. Material and Finish: High-density polyethylene in manufacturer's standard color.
- H. Underlavatory Guards
1. Material and Finish: Antimicrobial, molded-plastic, white.



- I. Custodial Accessories
1. Utility Shelf:
 - a. Description: With exposed edges turned down not less than 1/2 inch (12.7 mm) and supported by two triangular brackets welded to shelf underside.
 - b. Size: 16 inches (406 mm) long by 6 inches (152 mm) deep.
 - c. Material and Finish: Not less than nominal 0.05-inch- (1.3-mm-) thick stainless steel, No. 4 finish (satin).
 2. Mop and Broom Holder:
 - a. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
 - b. Length: 36 inches (914 mm).
 - c. Hooks: Three.
 - d. Mop/Broom Holders: Four, spring-loaded, rubber hat, cam type.
 - e. Material and Finish: Stainless steel, No. 4 finish (satin).
 - 1) Shelf: Not less than nominal 0.05-inch- (1.3-mm-) thick stainless steel.
 - 2) Rod: Approximately 1/4-inch- (6-mm-) diameter stainless steel.
 3. Paper Towel (Folded) Dispenser:
 - a. Mounting: Recessed **OR** Semirecessed **OR** Surface mounted, **as directed**.
 - b. Minimum Capacity: 400 C-fold or 525 multifold towels **OR** 600 C-fold or 800 multifold towels **OR** 400 single-fold towels, **as directed**.
 - c. Material and Finish: Stainless steel, No. 4 finish (satin) **OR** ABS plastic, gray, **as directed**.
 - d. Lockset: Tumbler type.
 - e. Refill Indicators: Pierced slots at sides or front.
 4. Paper Towel (Roll) Dispenser:
 - a. Description: Lever-actuated mechanism permits controlled delivery of paper rolls in preset lengths per stroke.
 - b. Mounting: Recessed **OR** Semirecessed **OR** Surface mounted, **as directed**.
 - c. Minimum Capacity: 8-inch (203-mm) wide, 800-foot (244-m) long roll.
 - d. Material and Finish: Stainless steel, No. 4 finish (satin), **OR** ABS plastic, gray, **as directed**.
 - e. Lockset: Tumbler type.
 5. Liquid-Soap Dispenser:
 - a. Description: Designed for dispensing soap in liquid or lotion **OR** lather, **as directed**, form.
 - b. Mounting: Deck mounted on vanity **OR** Deck mounted on lavatory **OR** Horizontally oriented, recessed **OR** Horizontally oriented, surface mounted **OR** Vertically oriented, surface mounted, **as directed**.
 - c. Capacity: Capacity in oz. (mL), **as directed**.
 - d. Materials: Valve and reservoir materials and finishes, **as directed**.
 - e. Lockset: Tumbler type.
 - f. Refill Indicator: Window type.
- J. Fabrication
1. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

1.3 EXECUTION

A. Installation

- a. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- b. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to method in ASTM F 446.

END OF SECTION 10 28 13 13



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SECTION 10 28 13 13a - DETENTION TOILET ACCESSORIES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for detention toilet accessories. Product shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Safety hooks.
 - b. Shelves.
 - c. Combination shelves with safety hooks.
 - d. Miscellaneous toilet accessories.
 - e. Stainless-steel mirrors.
 - f. Grab bars.
 - g. Shower seats.

C. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:
 - a. Product Data for Credit EQ 4.1: For security sealants, including printed statement of VOC content.
3. Samples: For each type of detention toilet accessory indicated.
4. Product Schedule: Indicate types, quantities, sizes, and installation locations by room.
5. Coordination Drawings: Drawings showing location of each built-in anchor supporting detention toilet accessories, including anchors to be installed as work of other Sections, drawn to scale and coordinating anchorage with detention toilet accessories.
6. Welding certificates.
7. Maintenance data.
8. Warranties: Sample of special warranties.
9. Other Informational Submittals:
 - a. Examination reports documenting inspection of substrates, areas, and conditions.
 - b. Anchor inspection reports documenting inspections of built-in and cast-in anchors.
 - c. Field quality-control certification signed by Contractor and Detention Specialist.

D. Quality Assurance

1. Welding Qualifications: Qualify procedures and personnel according to the following:
 - a. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - b. AWS D1.3, "Structural Welding Code - Sheet Steel."
 - c. AWS D1.6, "Structural Welding Code - Stainless Steel."
2. Preinstallation Conference: Conduct conference at Project site.
3. Coordination Meetings: Conduct coordination meetings at Project site to comply with requirements in Division 01 Section "Special Project Procedures For Detention Facilities".

E. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace detention toilet accessories that fail in materials or workmanship within two years from date of Final Completion.



1.2 PRODUCTS

A. Materials

1. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, CS (Commercial Steel), Type B.
2. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, CS (Commercial Steel), Type B; with G60 (Z180) zinc (galvanized) coating designation.
3. Stainless-Steel Sheet: ASTM A 666 or ASTM A 240/A 240M, austenitic stainless steel, Type 304; Type 430 for mirrors.
4. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
5. Concealed Bolts: ASTM A 307, Grade A unless otherwise indicated.
6. Cast-in-Place Anchors in Concrete: Anchors of type indicated below, fabricated from corrosion-resistant materials capable of sustaining, without failure, a load equal to 4 times the load imposed, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
 - a. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.
7. Embedded Plate Anchors: Fabricated from steel shapes and plates, minimum 3/16 inch (4.8 mm) thick; with minimum 1/2-inch- (12.7-mm-) diameter headed studs welded to back of plate.
8. Proprietary Built-in Masonry Anchors: Fabricated from 0.134-inch (3.41-mm) nominal-thickness steel sheet **OR** 1/4-inch (6.3-mm) nominal-thickness steel plate **OR** 1/2-inch (12.7-mm) nominal-thickness steel plate, **as directed**, into 6-inch- (152-mm-) **OR** 8-inch- (203-mm-), **as directed**, deep blocks matching size of concrete masonry units; with weld nuts attached on inside to receive field-bolted attachments, **as directed**.
 - a. Finish: Factory primed for field painting for anchors with field-welded attachments **OR** Polyester powder coat for anchors with bolted attachments **OR** Epoxy paint for anchors with bolted attachments, **as directed**.
9. Welding Rods and Bare Electrodes: Select according to AWS specifications.

B. Security Sealants

1. Manufacturer's standard, high-modulus, nonsag, two-part, pick-proof, epoxy sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), recommended for sealing nonmoving interior joints in security applications.

C. Security Fasteners

1. Fasteners that are operable only by tools produced by fastener manufacturer or other licensed fabricator for use on specific type of fastener.
2. Provide drive-system type, head style, material, and protective coating as required for assembly, installation, and strength, and as follows:
 - a. Drive-System Types: Pinned Torx-Plus **OR** Pinned Torx, **as directed**.
 - b. Fastener Strength: 120,000 psi (827 MPa).
 - c. Socket Button Head Fasteners:
 - 1) Heat-treated alloy steel, ASTM F 835 (ASTM F 835M).
 - 2) Stainless steel, ASTM F 879 (ASTM F 879M), Group 1 CW.
 - d. Socket Flat Countersunk Head Fasteners:
 - 1) Heat-treated alloy steel, ASTM F 835 (ASTM F 835M).
 - 2) Stainless steel, ASTM F 879 (ASTM F 879M), Group 1 CW.
 - e. Socket Head Cap Fasteners:
 - 1) Heat-treated alloy steel, ASTM A 574 (ASTM A 574M).
 - 2) Stainless steel, ASTM F 837 (ASTM F 837M), Group 1 CW.
 - f. Protective Coatings for Heat-Treated Alloy Steel:
 - 1) Zinc and clear trivalent chromium, where indicated.
 - 2) Zinc phosphate with oil, ASTM F 1137, Grade I, or black oxide unless otherwise indicated.



D. Detention Safety Hooks

1. Individual, Curved, Detention Safety Hook: 0.188-inch (4.77-mm) nominal-thickness, stainless-steel curved hook held by 0.141-inch- (3.58-mm-) **OR** 0.109-inch- (2.77-mm-), **as directed**, thick, stainless-steel bracket punched with not less than 2 holes for fastening with security fastener. Provide friction washer assembly, adjustable with a nonremovable security screw that maintains pressure on hook and allows hook to pivot when load exceeds preset limit. Provide No. 4 finish.
2. Individual, Straight, Detention Safety Hook: 3/8-inch- (9.5-mm-) **OR** 1/4-inch- (6.3-mm-), **as directed**, diameter, stainless-steel straight hook held by 0.109-inch- (2.77-mm-) **OR** 0.078-inch- (1.98-mm-), **as directed**, thick, stainless-steel mounting plate approximately 4 inches (102 mm) square. Provide pivoting assembly that maintains pressure on hook and snaps down when load exceeds 8 lbf (35.6 N). Provide No. 4 finish.
 - a. Mounting: Front mounting with security fasteners **OR** Chase mounting with welded anchor nuts on backplate, **as directed**.
3. Multiple, Curved, Safety Hook Strip: Minimum 5-1/2-inch- (140-mm-) high backplate by length indicated, formed from 0.125-inch- (3.18-mm-) **OR** 0.109-inch- (2.77-mm-) **OR** 0.078-inch- (1.98-mm-), **as directed**, thick, stainless-steel sheet. Provide 0.188-inch- (4.77-mm-) thick, stainless-steel hooks attached to backplate; with each hook having a friction washer assembly, adjustable with a nonremovable security screw that maintains pressure on hook and allows hook to pivot when load exceeds preset limit. Provide No. 4 finish.
 - a. Configuration: 16 inches (406 mm) long with 2 hooks **OR** 18 inches (457 mm) long with 4 hooks **OR** 21 inches (533 mm) long with 4 hooks **OR** 24 inches (610 mm) long with 3 hooks **OR** 32 inches (813 mm) long with 4 hooks, **as directed**.
 - b. Mounting: Front mounting with security fasteners **OR** Chase mounting with welded anchor nuts on backplate, **as directed**.
4. Multiple, Straight, Safety Hook Strip: Minimum 5-1/2-inch- (140-mm-) high backplate by length indicated, formed from 0.141-inch- (3.58-mm-) **OR** 0.109-inch- (2.77-mm-) **OR** 0.078-inch- (1.98-mm-), **as directed**, thick, stainless-steel sheet. Provide 3/8-inch- (9.5-mm-) **OR** 1/4-inch- (6.3-mm-), **as directed**, diameter, stainless-steel straight hooks attached to backplate. Provide pivoting assembly that maintains pressure on hook and snaps down when load exceeds 8 lbf (35.6 N). Provide No. 4 finish.
 - a. Configuration: 16 inches (406 mm) long with 2 hooks **OR** 18 inches (457 mm) long with 4 hooks **OR** 24 inches (610 mm) long with 3 hooks **OR** 32 inches (813 mm) long with 4 hooks, **as directed**.
 - b. Mounting: Front mounting with security fasteners **OR** Chase mounting with welded anchor nuts on backplate, **as directed**.

E. Detention Shelves

1. Surface-Mounted, Steel Detention Shelf: Minimum 6 inches high by 8 inches (152 mm high by 203 mm) deep by 16 inches (406 mm) **OR** 24 inches (610 mm) **OR** 32 inches (813 mm), **as directed**, long; formed from 0.138-inch (3.50-mm) **OR** 0.108-inch (2.74-mm), **as directed**, nominal-thickness, metallic-coated steel sheet; with welded side gussets and minimum 1-inch (25.4-mm) flanged front edge; with back punched for fastening to wall with security fasteners. Provide factory priming for field-painted **OR** baked-enamel, **as directed**, finish.
2. Surface-Mounted, Stainless-Steel Detention Shelf: Minimum 5-1/2 inches high by 8 inches (140 mm high by 203 mm) deep by 18 inches (457 mm) **OR** 24 inches (610 mm), **as directed**, long; formed from 0.078-inch- (1.98-mm-) thick, stainless-steel sheet; with welded side gussets and hemmed front edge. Provide No. 4 finish.
 - a. Mounting: Front mounting with security fasteners **OR** Chase mounting with welded anchor nuts on backplate, **as directed**.
3. Recessed Detention Shelf: Minimum inside dimensions of 16 inches (406 mm) wide by 5 inches high by 4 inches (127 mm high by 102 mm) deep; formed from 0.062-inch- (1.57-mm-) thick, stainless-steel sheet; with 1-inch- (25.4-mm-) wide flanged front edge. Secure to wall with rear-mounting steel strap and adjustment bolts. Provide No. 4 finish.

F. Combination Detention Shelves With Safety Hooks



1. Steel Detention Shelf with Multiple, Curved Safety Hooks: Minimum 6 inches high by 8 inches (152 mm high by 203 mm) deep by length indicated, formed from 0.138-inch (3.50-mm) **OR** 0.108-inch (2.74-mm), **as directed**, nominal-thickness, metallic-coated steel sheet, with welded side gussets and hemmed or flanged front edge. Provide 0.138-inch (3.50-mm) nominal-thickness, zinc-plated-steel curved hooks held by 0.1265-inch- (3.21-mm-) thick steel brackets welded to backplate, with each hook having a friction washer assembly, adjustable with a nonremovable security screw that maintains pressure on hook and allows hook to pivot when load exceeds preset limit. Provide factory priming for field-painted **OR** baked-enamel, **as directed**, finish.
 - a. Configuration: 16 inches (406 mm) long with 2 hooks **OR** 24 inches (610 mm) long with 3 hooks **OR** 32 inches (813 mm) long with 4 hooks, **as directed**.
 - b. Mounting: Front mounting with security fasteners **OR** Chase mounting with welded anchor nuts on backplate, **as directed**.
 2. Stainless-Steel Detention Shelf with Multiple, Curved Safety Hooks: Minimum 5-1/2 inches high by 8 inches (140 mm high by 203 mm) deep by length indicated; formed from 0.078-inch- (1.98-mm-) thick, stainless-steel sheet; with welded side gussets and hemmed or flanged front edge. Provide 0.141-inch (3.58-mm) stainless-steel curved hooks held by 0.141-inch- (3.58-mm-) thick stainless-steel brackets welded to backplate, with each hook having a friction washer assembly, adjustable with a nonremovable security screw that maintains pressure on hook and allows hook to pivot when load exceeds preset limit. Provide No. 4 finish.
 - a. Configuration: 16 inches (406 mm) long with 2 hooks **OR** 18 inches (457 mm) long with 4 hooks **OR** 24 inches (610 mm) long with 3 hooks **OR** 32 inches (813 mm) long with 4 hooks, **as directed**.
 - b. Mounting: Front mounting with security fasteners **OR** Chase mounting with welded anchor nuts on backplate, **as directed**.
 3. Stainless-Steel Detention Shelf with Multiple, Straight Safety Hooks: Minimum 5-1/2 inches high by 8 inches (140 mm high by 203 mm) deep by length indicated; formed from 0.078-inch- (1.98-mm-) thick, stainless-steel sheet; with welded side gussets and hemmed or flanged front edge. Provide 3/8-inch- (9.5-mm-) **OR** 1/4-inch- (6.3-mm-), **as directed**, diameter, stainless-steel straight hooks held by 0.109-inch- (2.77-mm-) **OR** 0.078-inch- (1.98-mm-), **as directed**, thick, stainless-steel mounting plate. Provide pivoting assembly that maintains pressure on hook and snaps down when load exceeds 8 lbf (35.6 N). Provide No. 4 finish.
 - a. Configuration: 16 inches (406 mm) long with 2 hooks **OR** 18 inches (457 mm) long with 4 hooks **OR** 24 inches (610 mm) long with 3 hooks **OR** 32 inches (813 mm) long with 4 hooks, **as directed**.
 - b. Mounting: Front mounting with security fasteners **OR** Chase mounting with welded anchor nuts on backplate, **as directed**.
- G. Miscellaneous Detention Toilet Accessories
1. Recessed, Detention Toilet Tissue Dispenser: Minimum 5-inch diameter by 4-1/2 inches (127-mm diameter by 114 mm) deep; formed from 0.062-inch- (1.57-mm-) thick, stainless-steel sheet. Secure to wall with rear-mounting steel strap and adjustment bolts. Provide No. 4 finish.
 - a. Face: 1-inch (25.4-mm) lip around entire face **OR** 7-inch- (178-mm-) square face flange, **as directed**.
 2. Recessed, Detention Soap Dish: Minimum inside dimensions of 5-3/4 inches wide by 4-1/2 inches high by 2-1/2 inches (146 mm wide by 114 mm high by 64 mm) deep with 3/4-inch (19-mm) lip around entire face; formed from 0.062-inch- (1.57-mm-) **OR** 0.050-inch- (1.27-mm-), **as directed**, thick, stainless-steel sheet. Secure to wall with rear-mounting steel strap and adjustment bolts. Provide No. 4 finish.
- H. Detention Mirrors
1. Small, Framed Detention Mirror: Approximately 9-1/2 inches wide by 11 inches (241 mm wide by 279 mm) high; formed from 0.038-inch- (0.95-mm-) thick, stainless-steel sheet with fiberboard backing; enclosed in a frame formed from 0.064-inch (1.63-mm) nominal-thickness, zinc-plated



- steel sheet; with round corners. Fabricate frame with welded and ground corners or from one piece of metal. Provide No. 8 **OR** 4, **as directed**, finish for mirror, chrome plating for frame.
- a. Mounting: Front mounting with security fasteners to 0.168-inch (4.27-mm) nominal-thickness, metallic-coated steel mounting plate **OR** Chase mounting with welded anchor nuts on backplate, **as directed**.
2. Small, Integrally Framed Detention Mirror: Approximately 9-1/2 inches wide by 11 inches (241 mm wide by 279 mm) high; with mirror and integral frame formed from a single sheet of 0.038-inch- (0.95-mm-) **OR** 0.062-inch- (1.57-mm-), **as directed**, thick stainless steel; with round corners. Provide No. 8 **OR** 4, **as directed**, finish for mirror, chrome plating for frame.
 - a. Mounting: Front mounting with security fasteners to 0.168-inch (4.27-mm) nominal-thickness, metallic-coated steel mounting plate **OR** Chase mounting with welded anchor nuts on backplate, **as directed**.
 3. Large, Framed Detention Mirror with Square Corners: Minimum 11 inches wide by 16 inches (279 mm wide by 406 mm) high; formed from 0.038-inch- (0.95-mm-) **OR** 0.078-inch- (1.98-mm-), **as directed**, thick, stainless-steel sheet with fiberboard backing and No. 8 **OR** No. 4, **as directed**, finish; enclosed in a metal frame.
 - a. Frame: Formed from 0.064-inch (1.63-mm) nominal-thickness, chrome-plated steel **OR** 0.062-inch- (1.57-mm-) thick, stainless-steel **OR** 0.078-inch- (1.98-mm-) thick, stainless-steel, **as directed**, sheet. Fabricate frame with welded and ground corners or from one piece of metal.
 - b. Mounting: Front mounting with security fasteners to 0.168-inch (4.27-mm) nominal-thickness, metallic-coated steel mounting plate **OR** Chase mounting with welded anchor nuts on backplate, **as directed**.
 4. Large, Framed Detention Mirror with Round Corners: Minimum 11 inches wide by 16 inches (279 mm wide by 406 mm) high, formed from a single sheet of 0.038-inch- (0.95-mm-) **OR** 0.078-inch- (1.98-mm-), **as directed**, thick stainless steel with No. 8 **OR** No. 4, **as directed**, finish; enclosed in a metal frame.
 - a. Frame: Formed from 0.064-inch (1.63-mm) nominal-thickness, chrome-plated steel **OR** 0.078-inch- (1.98-mm-) thick, stainless-steel, **as directed**, sheet. Fabricate frame with welded and ground corners or from one piece of metal.
 - b. Mounting: Front mounting with security fasteners to 0.168-inch (4.27-mm) nominal-thickness, metallic-coated steel mounting plate **OR** Chase mounting with welded anchor nuts on backplate, **as directed**.
 5. Large, Integrally Framed Detention Mirror with Round Corners: Minimum 11 inches wide by 16 inches (279 mm wide by 406 mm) high; with mirror and integral frame formed from 0.038-inch- (0.95-mm-) **OR** 0.062-inch- (1.57-mm-) **OR** 0.078-inch- (1.98-mm-), **as directed**, thick, stainless-steel sheet; with round corners. Provide No. 8 **OR** 4, **as directed**, finish for mirror, chrome plating for frame.
 - a. Mounting: Front mounting with security fasteners to 0.168-inch (4.27-mm) nominal-thickness, metallic-coated steel mounting plate **OR** Chase mounting with welded anchor nuts on backplate, **as directed**.
- I. Detention Grab Bars
 1. Grab Bars: 1-1/2 inches (38.1 mm) in diameter; formed from 0.038-inch- (0.95-mm-) thick, stainless-steel tubing, with 3-inch- (76.2-mm-) diameter flanges formed from 0.125-inch- (3.18-mm-) thick, stainless steel. Closure plates formed from 0.125-inch- (3.18-mm-) thick, stainless steel. All-welded construction. Provide No. 4 finish.
 - a. Length: As indicated on Drawings **OR** 36 inches (914 mm) long, **as directed**.
 - b. Mounting: Front mounting with security fasteners **OR** Chase mounting with welded anchor nuts on backplate, **as directed**.
 - J. Detention Shower Seats
 1. Shower Seats: Double-pan retractable, recessed shower seat with recessed handle. Approximately 16-inch by 16-inch (406-mm by 406-mm) overall size formed from 0.062-inch- (1.57-mm-) **OR** 0.078-inch- (1.98-mm-), **as directed**, thick, stainless-steel sheet. Seat pivots on



solid 0.375-inch- (9.5-mm-) diameter stainless-steel rod and self-latches when closed. Minimum 750 lb. (340 kg) loading capacity. Provide No. 4 finish.

K. Fabrication

1. Coordinate dimensions and attachment methods of detention toilet accessories with those of adjoining construction to produce integrated assemblies with closely fitting joints and with edges and surfaces aligned unless otherwise indicated.
2. Shear and punch metals cleanly and accurately. Remove burrs.
3. Form edges and corners to be free of sharp edges and rough areas. Fold back exposed edges of unsupported sheet metal to form a 1/2-inch- (12.7-mm-) wide hem on the concealed side, or ease edges to a radius of approximately 1/32 inch (0.8 mm) and support with concealed stiffeners.
4. Form metal in maximum lengths to minimize joints. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
5. Weld corners and seams continuously to comply with referenced AWS standard and the following:
 - a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - b. Obtain fusion without undercut or overlap.
 - c. Remove welding flux immediately.
 - d. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
 - e. Weld before finishing components to greatest extent possible. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
6. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure detention toilet accessories rigidly in place and to support expected loads. Build in straps, plates, and brackets as needed to support and anchor fabricated items to adjoining construction. Reinforce formed-metal units as needed to attach and support other construction.
7. Cut, reinforce, drill, and tap detention toilet accessories to receive hardware, security fasteners, and similar items.
8. Form exposed work true to line and level with accurate angles and surfaces. Grind off and ease edges unless otherwise indicated.
9. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Use exposed security fasteners of type indicated or, if not indicated, flat-head (countersunk) security fasteners. Locate joints where least conspicuous.

L. Finishes

1. Finish detention toilet accessories after assembly.
2. Steel Finishes:
 - a. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
 - b. Factory Priming for Field-Painted Finish: Apply manufacturer's standard prime coat immediately after surface preparation and pretreatment.
 - c. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 1.2 mils (0.03 mm).
 - 1) Color and Gloss: As indicated by manufacturer's designations **OR** Match sample **OR** As selected from manufacturer's full range, **as directed**.
 - d. Chromium Plating: ASTM B 456, Service Condition Number SC 2 (moderate service), nickel plus chromium electrodeposited on base metal.
3. Stainless-Steel Finishes: Remove tool and die marks and stretch lines or blend into finish.



- a. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
- b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

1.3 EXECUTION

A. Installation

1. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing detention toilet accessories to in-place construction. Include threaded fasteners for concrete and masonry inserts, security fasteners, and other connectors.
2. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or masonry or similar construction.
3. Apply security sealant around perimeter in a continuous ribbon on back of detention toilet accessories before installation.
4. Security Fasteners: Install detention toilet accessories using security fasteners with head style appropriate for installation requirements, strength, and finish of adjacent materials. Provide stainless-steel security fasteners in stainless-steel materials, **as directed**.

B. Field Quality Control

1. Inspect installed products to verify compliance with requirements. Prepare inspection reports and indicate compliance with and deviations from the Contract Documents.
2. Remove and replace detention work where inspections indicate that work does not comply with specified requirements.
3. Perform additional inspections to determine compliance of replaced or additional work. Prepare inspection reports.
4. Prepare field quality-control certification that states installed products and their installation comply with requirements in the Contract Documents.

C. Adjusting And Cleaning

1. Remove temporary labels and protective coatings.
2. Adjust safety hooks to release with application of 8-lbf (35.6-N) load.
3. Painting: Immediately after erection, clean bolted connections and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
4. Touchup Painting: Cleaning and touchup painting of bolted connections and abraded areas of shop paint are specified in Division 07..

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Task	Specification	Specification Description
10 28 13 13	01 22 16 00	No Specification Required
10 28 13 63	10 28 13 13	Toilet And Bath Accessories
10 28 13 63	10 28 13 13a	Detention Toilet Accessories



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SECTION 10 28 16 13 - BATH ACCESSORIES

DESCRIPTION OF WORK

This specification covers the furnishing and installation of materials for bath accessories. Products shall be as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

GENERAL

Definitions

1. Supply and Delivery Only: Include supply and delivery to site(s) FOB destination freight prepaid. Unless otherwise specified or scheduled, unloading and handling at site is by the Owner.

Submittals

2. Product Data.
3. Shop Drawings.
4. Quality Assurance/Control Submittals:
 - a. Certificates: Submit manufacturer's written self certification that bath accessories meet or exceed specified requirements.

Quality Assurance

5. Regulatory Requirements: Comply with following:
 - a. Accessibility:
 - 1) Architectural Barriers Act of 1968 as amended (42 USC 4152-4157) and HUD implementing regulations (24 CFR Part 40).
 - a) Uniform Federal Accessibility Standards (UFAS).
 - 2) Section 504 of the Rehabilitation Act of 1973 as amended (29 USC 794) and HUD implementing regulations 24 CFR Part 8.
 - 3) Fair Housing Accessibility Guidelines (24 CFR Chapter 1).
 - 4) Americans with Disabilities Act of 1990 (ADA) (28 CFR Part 35).
6. Mock-ups: Install one complete mock-up of bath accessories in each typical bathroom installation. Comply with Detailed Scope of Work for bathroom renovation mock-up requirements.
 - a. Locations: As directed.
 - b. Approved Mock-ups: Standard for rest of work.
 - c. Approved Mock-ups: May remain part of completed project.

Scheduling

7. Scheduling and Completion: Comply with requirements of Detailed Scope of Work.

PRODUCTS

Bath Accessories

8. Ceramic Soap Dishes at Ceramic Tile Bathtub Surround: See Division 9 Section "Ceramic Tile."
9. Metal Soap Dishes at Porcelain Steel Bathtub Surround:
 - a. Recessed: FS WW-P-541/8B, Type VI, Class 2, heavy duty satin stainless steel.
 - b. Fastenings: Plated expansion toggle or molly bolts, lead anchors or as required by existing wall conditions.



10. Safety Grab Bars: Type 304 stainless steel, minimum 32 mm (1-1/4 inch) OD, maximum 38 mm (1-1/2 inch) OD, 1.2 mm (18 gage) wall thickness in accordance with Uniform Federal Accessibility Standards (UFAS).
 - a. Grab Bar Posts: Stainless steel.
 - b. Post Flanges: Diameter of not less than 68 mm (2-11/16 inches) with center line of screw holes located minimum 13 mm (1/2 inch) from edges of flange.
11. Shower Curtains and Rods: By Bobrick Washroom Equipment, McKinney/Parker, or Leigh Products, or approved equal:
 - a. Rods: Type 304 stainless steel, satin finish, adjustable length type to fit bathtub length, minimum 25 mm (1 inch) OD, minimum 1.0 mm (20 gage) wall thickness, similar to Bobrick No. B-6107 or McKinney/Parker No. 267.
 - b. Flanges: Chrome plated cast brass or stainless steel.
 - c. Shower Curtains: FS L-C-780a, Style I, opaque, matte white vinyl 0.2 mm (0.008 inch) thick, 1 829 mm (72 inches) by 1 829 mm (72 inches) high.
 - 1) Curtains: Germ proof, bacteria proof, and mildew resistant.
 - 2) Curtains: Similar to Bobrick No. 204-2 or McKinney/Parker No. 268SC.
 - d. Curtain Hooks: Stainless steel, Type 304 or nickel plated brass wire, similar to Bobrick No. 204-1 or McKinney/Parker No. 269SH. Provide 12 hooks per curtain.
12. Other Bathroom Accessories: FS WW-P-541/8B, Type 304 stainless steel, satin finish, by Bobrick Washroom Equipment, McKinney/Parker, or Leigh Products, or approved equal:
 - a. Surface Mounted:
 - 1) Medicine Cabinets: Type III, Class 2, Style S, swinging door, minimum 381 mm (15 inches) wide by 610 mm (24 inches) high. Provide complete with magnetic catch, three adjustable shelves, and full length mirror.
 - 2) Towel Bars: Type IV, Class 1, square bar, 610 mm (24 inches) long.
 - 3) Toilet Paper Holders: Type I, Class 1, Mounting S, Style A.
 - 4) Tumbler and Toothbrush Holders: Type VI, Class 4.
 - 5) Lavatory Soap Dishes: Type VI, Class 1.
 - 6) Robe hooks.
 - b. Recessed:
 - 1) Medicine Cabinets: Type III, Class 2, Style R, enamel painted steel, swinging door, minimum 381 mm (15 inches) wide by 610 mm (24 inches) high. Provide complete with magnetic catch, three adjustable shelves, and full length mirror.
 - 2) Toilet Paper Holders: Type I, Class 1, Style K.
 - 3) Lavatory Soap Dishes: Type VI, Class 2.
13. Window Curtains and Rods: Provide over bathroom window openings.
 - a. Rods: Solid steel with brass finish, minimum 10 mm (3/8 inch) diameter.
 - b. Rod Brackets: Two brass-finished brackets with open tops and brass finish.
 - c. Window Curtains: FS L-C-780a, Style II, opaque, matte white vinyl 0.2 mm (0.008 inch) thick.
 - 1) Curtains : Germ proof, bacteria proof, and mildew resistant.
 - 2) Size: To fit bathroom windows.
14. Joint Sealant: Mildew resistant one-component silicone; FS TT-S-001543A, Class A; ASTM C 920, Type S, Grade NS, Class 25, Uses NT, G, and A.
 - a. Color: As selected from manufacturer's standard line.

EXECUTION

Examination

15. Site Verification of Conditions:
 - 1) Field Measurements: Verify field measurements.
 - 2) Existing Conditions: Ensure proper openings and blocking have been installed.

Installation



16. General: Install accessories rigidly and securely to blocking in walls using methods and materials recommended by manufacturer.
 - a. Locations and Mounting Heights: As indicated or directed.
 - b. Comply with Regulatory Requirements.
17. Bath Accessories: Securely install flanges for bath accessories and window curtain rods in accordance with manufacturer s recommendations and approved Shop Drawing.
 - a. Safety Grab Bars: Install 100 mm (4 inch) by 100 mm (4 inch) perforated 1.2 mm (18 gage) galvanized steel plates at each post, flush to wall, by using toggle bolts, molly bolts, or anchors as required by conditions.
 - 1) After installation of wall finish, secure each grab bar flange to perforated plates through wall finish with three - 6 mm (1/4 inch) chrome plated machine screws, screwed into threaded sleeves or tee nuts welded to plates.
 - b. Shower Curtains and Rods: Mount flanges to existing wall with approved expansion type inserts and chrome plated or stainless steel wood screws.
18. Bath Accessories at Bathroom with Porcelain Steel Surround:
 - a. Metal Soap Dishes: Mount to new porcelain enamel panels and anchored securely to existing walls using approved mechanical fastenings.
 - 1) Waterproof with joint sealant between surround panel and dishes.
 - b. China Soap Dishes: Anchor securely, using approved mechanical fastening.
 - c. Safety Grab Bars: After installation of wall panels, secure each grab bar flange to perforated plates through panels with three - 6 mm (1/4 inch) chrome plated machine screws, screwed into threaded sleeves or tee nuts welded to plates.

Cleaning

19. Cleaning: Comply with requirements of Detailed Scope of Work.

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Task	Specification	Specification Description
10 28 16 13	10 28 13 13	Toilet And Bath Accessories
10 28 16 13	10 28 13 13a	Detention Toilet Accessories



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SECTION 10 28 19 16 - PLUMBING FIXTURES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for plumbing fixtures. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following conventional plumbing fixtures and related components:
 - a. Faucets for lavatories, bathtubs, bathtub/showers, showers, and sinks.
 - b. Laminar-flow faucet-spout outlets.
 - c. Flushometers.
 - d. Toilet seats.
 - e. Protective shielding guards.
 - f. Fixture supports.
 - g. Interceptors.
 - h. Shower receptors.
 - i. Dishwasher air-gap fittings.
 - j. Disposers.
 - k. Hot-water dispensers.
 - l. Water closets.
 - m. Urinals.
 - n. Bidets.
 - o. Lavatories.
 - p. Commercial sinks.
 - q. Shampoo bowls.
 - r. Wash fountains.
 - s. Bathtubs.
 - t. Individual showers.
 - u. Group showers.
 - v. Whirlpool bathtubs.
 - w. Kitchen sinks.
 - x. Service sinks.
 - y. Service basins.
 - z. Laundry trays.
 - aa. Sacristy sinks.

C. Definitions

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
3. Cast Polymer: Cast-filled-polymer-plastic material. This material includes cultured-marble and solid-surface materials.
4. Cultured Marble: Cast-filled-polymer-plastic material with surface coating.
5. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.
6. FRP: Fiberglass-reinforced plastic.
7. PMMA: Polymethyl methacrylate (acrylic) plastic.
8. PVC: Polyvinyl chloride plastic.



9. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

D. Submittals

1. Product Data: For each type of plumbing fixture indicated.
2. LEED Submittal:
 - a. Product Data for Credit WE 2, 3.1, and 3.2: Documentation indicating flow and water consumption requirements.
3. Shop Drawings: Diagram power, signal, and control wiring.
4. Operation and maintenance data
5. Warranty: Special warranty specified in this Section.

E. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities" **OR** Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act", **as directed**; for plumbing fixtures for people with disabilities.
3. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
4. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
5. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
6. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
 - a. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
 - b. Plastic Bathtubs: ANSI Z124.1.
 - c. Plastic Lavatories: ANSI Z124.3.
 - d. Plastic Laundry Trays: ANSI Z124.6.
 - e. Plastic Mop-Service Basins: ANSI Z124.6.
 - f. Plastic Shower Enclosures: ANSI Z124.2.
 - g. Plastic Sinks: ANSI Z124.6.
 - h. Plastic Urinal Fixtures: ANSI Z124.9.
 - i. Plastic Whirlpool Bathtubs: ANSI Z124.1 and ASME A112.19.7M.
 - j. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
 - k. Slip-Resistant Bathing Surfaces: ASTM F 462.
 - l. Solid-Surface-Material Lavatories and Sinks: ANSI/ICPA SS-1.
 - m. Stainless-Steel Commercial, Handwash Sinks: NSF 2 construction.
 - n. Stainless-Steel Residential Sinks: ASME A112.19.3.
 - o. Vitreous-China Fixtures: ASME A112.19.2M.
 - p. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.
 - q. Water-Closet, Flushometer Tank Trim: ASSE 1037.
 - r. Whirlpool Bathtub Fittings: ASME A112.19.8M.
7. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:
 - a. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
 - b. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
 - c. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
 - d. Faucets: ASME A112.18.1.
 - e. Hose-Connection Vacuum Breakers: ASSE 1011.
 - f. Hose-Coupling Threads: ASME B1.20.7.
 - g. Integral, Atmospheric Vacuum Breakers: ASSE 1001.



- h. NSF Potable-Water Materials: NSF 61.
 - i. Pipe Threads: ASME B1.20.1.
 - j. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
 - k. Supply Fittings: ASME A112.18.1.
 - l. Brass Waste Fittings: ASME A112.18.2.
8. Comply with the following applicable standards and other requirements specified for bathtub, bathtub/shower, and shower faucets:
- a. Backflow Protection Devices for Hand-Held Showers: ASME A112.18.3M.
 - b. Combination, Pressure-Equalizing and Thermostatic-Control Antiscald Faucets: ASSE 1016.
 - c. Deck-Mounted Bath/Shower Transfer Valves: ASME 18.7.
 - d. Faucets: ASME A112.18.1.
 - e. Hand-Held Showers: ASSE 1014.
 - f. High-Temperature-Limit Controls for Thermal-Shock-Preventing Devices: ASTM F 445.
 - g. Hose-Coupling Threads: ASME B1.20.7.
 - h. Manual-Control Antiscald Faucets: ASTM F 444.
 - i. Pipe Threads: ASME B1.20.1.
 - j. Pressure-Equalizing-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
 - k. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
 - l. Thermostatic-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
9. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:
- a. Atmospheric Vacuum Breakers: ASSE 1001.
 - b. Brass and Copper Supplies: ASME A112.18.1.
 - c. Dishwasher Air-Gap Fittings: ASSE 1021.
 - d. Manual-Operation Flushometers: ASSE 1037.
 - e. Plastic Tubular Fittings: ASTM F 409.
 - f. Brass Waste Fittings: ASME A112.18.2.
 - g. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.
10. Comply with the following applicable standards and other requirements specified for miscellaneous components:
- a. Disposers: ASSE 1008 and UL 430.
 - b. Dishwasher Air-Gap Fittings: ASSE 1021.
 - c. Flexible Water Connectors: ASME A112.18.6.
 - d. Floor Drains: ASME A112.6.3.
 - e. Grab Bars: ASTM F 446.
 - f. Hose-Coupling Threads: ASME B1.20.7.
 - g. Hot-Water Dispensers: ASSE 1023 and UL 499.
 - h. Off-Floor Fixture Supports: ASME A112.6.1M.
 - i. Pipe Threads: ASME B1.20.1.
 - j. Plastic Shower Receptors: ANSI Z124.2.
 - k. Plastic Toilet Seats: ANSI Z124.5.
 - l. Supply and Drain Protective Shielding Guards: ICC A117.1.
 - m. Whirlpool Bathtub Equipment: UL 1795.

F. Warranty

1. Special Warranties: Manufacturer's standard form in which manufacturer agrees to repair or replace components of whirlpools that fail in materials or workmanship within specified warranty period.
 - a. Warranty Period for Commercial Applications: One **OR** Three, **as directed**, year(s) from date of Final Completion.
 - b. Warranty Period for Residential Applications of Shells: Five **OR** 20 **OR** 30, **as directed**, years from date of Final Completion.
 - c. Warranty Period for Residential Applications of Pumps and Blowers: Five **OR** 20, **as directed**, years from date of Final Completion.



- d. Warranty Period for Residential Applications of Electronic Controls: Five years from date of Final Completion.

1.2 PRODUCTS

A. Lavatory Faucets

1. Description: Single-control mixing **OR** Single-control nonmixing **OR** Two-handle mixing, **as directed**, valve. Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
 - a. Body Material: Commercial, solid brass **OR** General-duty, solid brass **OR** General-duty, solid brass or copper or brass underbody with brass cover plate **OR** General-duty, copper or brass underbody with brass cover plate **OR** Residential, nonmetallic underbody with brass cover plate **OR** Residential, nonmetallic underbody with nonmetallic cover plate, **as directed**.
 - b. Finish: Polished chrome plate **OR** Polished brass **OR** Nonmetallic, **as directed**.
 - c. Maximum Flow Rate: 0.5 gpm (1.5 L/min.) **OR** 2.2 gpm (8.3 L/min.) **OR** 2.5 gpm (9.5 L/min.), **as directed**.
OR
Maximum Flow: 0.25 gal. (0.95 L).
 - d. Centers: 3-3/8 inches (86 mm) **OR** 4 inches (102 mm) **OR** 6 inches (152 mm) **OR** 8 inches (203 mm) **OR** Single hole **OR** Adjustable, **as directed**.
 - e. Mounting: Deck, exposed **OR** Deck, concealed **OR** Back/wall, exposed **OR** Back/wall, concealed, **as directed**.
 - f. Valve Handle(s): Lever **OR** Knob **OR** Knob, nonmetallic **OR** Cross, four arm **OR** Wrist blade, 4 inches (102 mm) **OR** Elbow, 6 inches (152 mm) **OR** Push button **OR** Not applicable, **as directed**.
 - g. Inlet(s): NPS 3/8 (DN 10) tubing, plain end **OR** NPS 3/8 (DN 10) tubing, with NPS 1/2 (DN 15) male adaptor **OR** NPS 1/2 (DN 15) male shank **OR** NPS 1/2 (DN 15) female shank, **as directed**.
 - h. Spout: Rigid **OR** Swing **OR** Rigid, gooseneck **OR** Swivel, gooseneck, **as directed**, type.
 - i. Spout Outlet: Aerator **OR** Spray **OR** Laminar flow **OR** Plain end **OR** Spray, 0.5 gpm (1.5 L/min.), **as directed**.
 - j. Operation: Compression, manual **OR** Noncompression, manual **OR** Sensor **OR** Self-closing, metering, **as directed**.
 - k. Drain: Not required **OR** Pop up **OR** Stopper with chain **OR** Grid **OR** Lift and turn, **as directed**.
 - l. Tempering Device: Mechanical **OR** Thermostatic **OR** Pressure balance **OR** Not required, **as directed**.

B. Bathtub Faucets

1. Description: Single-control mixing **OR** Two-handle mixing **OR** Three-handle mixing **OR** Push-button, metering, nonmixing, **as directed**, valve. Include hot- and cold-water indicators and tub spout. Coordinate faucet inlets with supplies.
 - a. Body Material: Solid brass.
 - b. Finish: Polished chrome plate **OR** Polished brass, **as directed**.
 - c. Mounting: Deck **OR** Exposed, over rim **OR** Wall, **as directed**.
 - d. Valve Handle(s): Lever **OR** Knob **OR** Knob, nonmetallic **OR** Cross, four arm **OR** Not applicable, **as directed**.
 - e. Bathtub Spout: Chrome-plated brass with diverter, **as directed**.
 - f. Operation: Compression, manual **OR** Noncompression, manual **OR** Sensor, **as directed**.
 - g. Supply Connections: NPS 1/2 (DN 15) **OR** NPS 1/2 (DN 15), union **OR** Sweat, **as directed**.

C. Bathtub/Shower Faucets



1. Description: Single-handle pressure-balance **OR** thermostatic **OR** thermostatic/pressure-balance, **as directed**, valve for bathtub and for shower. Include hot- and cold-water indicators; check stops; tub spout; and shower head, arm, and flange. Coordinate faucet inlets with supplies; coordinate outlet with diverter valve.
 - a. Body Material: Solid brass with nonmetallic trim, **as directed**.
 - b. Finish: Polished chrome plate **OR** Polished brass, **as directed**.
 - c. Maximum Flow Rate: 2.5 gpm (9.5 L/min.), unless otherwise indicated.
 - d. Diverter Valve: Integral **OR** Not integral, **as directed**, with mixing valve.
 - e. Mounting: Wall.
 - f. Bathtub Spout: Chrome-plated brass with diverter, **as directed**.
 - g. Operation: Compression, manual **OR** Noncompression, manual **OR** Sensor, **as directed**.
 - h. Antiscald Device: Integral with mixing valve **OR** Separate unit, **as directed**.
 - i. Check Stops: Check-valve type, integral with or attached to body; on hot- and cold-water supply connections.
 - j. Supply Connections: NPS 1/2 (DN 15) **OR** NPS 1/2 (DN 15), union **OR** Sweat, **as directed**.
 - k. Backflow Protection Device for Hand-Held Shower: Required **OR** Not required, **as directed**.
 - l. Shower Head Type: Ball joint **OR** Without ball joint **OR** Ball joint and head integral with mounting flange **OR** Integral with mounting flange **OR** Hand held, slide-bar mounted **OR** Hand held, hook mounted, **as directed**.
 - m. Shower Head Material: Metallic **OR** Nonmetallic **OR** Combined, metallic and nonmetallic, **as directed**, with chrome-plated finish.
 - n. Spray Pattern: Fixed **OR** Adjustable, **as directed**.
 - o. Integral Volume Control: Required **OR** Not required, **as directed**.
 - p. Shower-Arm Flow-Control Fitting: Not required **OR** 1.5 gpm (5.7 L/min.) **OR** 2.0 gpm (7.6 L/min.), **as directed**.
- D. Shower Faucets
 1. Description: Single-handle pressure-balance **OR** thermostatic **OR** thermostatic and pressure-balance, **as directed**, valve. Include hot- and cold-water indicators; check stops; and shower head, arm, and flange. Coordinate faucet inlets with supplies and outlet with diverter valve.
 - a. Body Material: Solid brass with nonmetallic trim, **as directed**.
 - b. Finish: Polished chrome plate **OR** Polished brass, **as directed**.
 - c. Maximum Flow Rate: 2.5 gpm (9.5 L/min.), unless otherwise indicated.
 - d. Diverter Valve: Not required **OR** Integral with mixing valve **OR** Not integral with mixing valve, **as directed**.
 - e. Mounting: Exposed **OR** Concealed, **as directed**.
 - f. Backflow Protection Device for Hand-Held Shower: Required **OR** Not required, **as directed**.
 - g. Operation: Compression, manual **OR** Noncompression, manual **OR** Sensor, **as directed**.
 - h. Antiscald Device: Integral with mixing valve **OR** Separate unit **OR** Not required, **as directed**.
 - i. Check Stops: Check-valve type, integral with or attached to body; on hot- and cold-water supply connections.
 - j. Supply Connections: NPS 1/2 (DN 15) **OR** NPS 1/2 (DN 15), union **OR** Sweat, **as directed**.
 - k. Shower Head Type: Ball joint **OR** Without ball joint **OR** Ball joint and head integral with mounting flange **OR** Integral with mounting flange **OR** Hand held, slide-bar mounted **OR** Hand held, hook mounted, **as directed**.
 - l. Shower Head Material: Metallic **OR** Nonmetallic **OR** Combined, metallic and nonmetallic, **as directed**, with chrome-plated finish.
 - m. Spray Pattern: Fixed **OR** Adjustable, **as directed**.
 - n. Integral Volume Control: Required **OR** Not required, **as directed**.
 - o. Shower-Arm Flow-Control Fitting: Not required **OR** 1.5 gpm (5.7 L/min.) **OR** 2.0 gpm (7.6 L/min.), **as directed**.



- p. Temperature Indicator: Not required **OR** Integral with faucet, **as directed**.

E. Sink Faucets

1. Description: Kitchen faucet with spray, three-hole fixture **OR** Kitchen faucet with spray, four-hole fixture **OR** Kitchen faucet without spray **OR** Laundry tray faucet **OR** Service sink faucet with stops in shanks, vacuum breaker, hose-thread outlet, and pail hook **OR** Bar sink faucet, **as directed**. Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
 - a. Body Material: Commercial, solid brass **OR** General-duty, solid brass **OR** General-duty, solid brass or copper or brass underbody with brass cover plate **OR** General-duty, copper or brass underbody with brass cover plate **OR** Residential, nonmetallic underbody with brass cover plate **OR** Residential, nonmetallic underbody with nonmetallic cover plate, **as directed**.
 - b. Finish: Polished chrome plate **OR** Polished brass **OR** Nonmetallic **OR** Polished or rough brass **OR** Rough brass, **as directed**.
 - c. Maximum Flow Rate: 2.5 gpm (9.5 L/min.), unless otherwise indicated.
 - d. Mixing Valve: Single control **OR** Two-lever handle, **as directed**.
 - e. Backflow Protection Device for Hose Outlet: Required **OR** Not required, **as directed**.
 - f. Backflow Protection Device for Side Spray: Required **OR** Not required, **as directed**.
 - g. Centers: 3-3/8 inches (86 mm) **OR** 4 inches (102 mm) **OR** 6 inches (152 mm) **OR** 8 inches (203 mm) **OR** Single hole **OR** Adjustable, **as directed**.
 - h. Mounting: Deck **OR** Back/wall, **as directed**, exposed **OR** concealed, **as directed**.
 - i. Handle(s): Lever **OR** Knob **OR** Knob, nonmetallic **OR** Cross, four arm **OR** Wrist blade, 4 inches (102 mm) **OR** Elbow, 6 inches (152 mm) **OR** Not applicable, **as directed**.
 - j. Inlet(s): NPS 3/8 (DN 10) plain-end tubing **OR** NPS 3/8 (DN 10) tubing with NPS 1/2 (DN 15) male adapter **OR** NPS 1/2 (DN 15) male shank **OR** NPS 1/2 (DN 15) female shank, **as directed**.
 - k. Spout Type: Rigid, solid brass **OR** Rigid, solid brass with wall brace **OR** Swing, round tubular **OR** Swing, shaped tube **OR** Swing, solid brass **OR** Rigid gooseneck **OR** Swivel gooseneck, **as directed**.
 - l. Spout Outlet: Aerator **OR** Swivel aerator/spray **OR** Spray **OR** Laminar flow **OR** Hose thread **OR** Plain end, **as directed**.
 - m. Vacuum Breaker: Required **OR** Not required, **as directed**.
 - n. Operation: Compression, manual **OR** Noncompression, manual **OR** Sensor, **as directed**.
 - o. Drain: Not required **OR** Pop up **OR** Stopper with chain **OR** Grid **OR** Lift and turn, **as directed**.

F. Laminar-Flow Faucet-Spout Outlets

1. Description: Chrome-plated-brass faucet-spout outlet that produces non-aerating, laminar stream. Include male or female thread that mates with faucet outlet for attachment to faucets where indicated and flow-rate range that includes flow of faucet.

G. Flushometers

1. Description: Flushometer for urinal-type **OR** water-closet-type, **as directed**, fixture. Include brass body with corrosion-resistant internal components, non-hold-open feature, **as directed**, control stop with check valve, vacuum breaker, copper or brass tubing, and polished chrome-plated finish on exposed parts.
 - a. Internal Design: Diaphragm **OR** Piston, **as directed**, operation.
 - b. Style: Exposed **OR** Concealed, **as directed**.
 - c. Inlet Size: NPS 3/4 (DN 20) **OR** NPS 1 (DN 25), **as directed**.
 - d. Trip Mechanism: Oscillating, lever-handle actuator **OR** Mechanical, push-button actuator with stainless-steel access plate **OR** Hydraulic, push-button actuator **OR** Foot-pedal actuator **OR** Hard-wired, electric-sensor actuator **OR** Battery-operated sensor actuator, **as directed**.



- e. Consumption: 0.5 gal./flush (1.9 L/flush) **OR** 1.0 gal./flush (3.8 L/flush) **OR** 1.5 gal./flush (5.7 L/flush) **OR** 1.6 gal./flush (6.0 L/flush) **OR** 3.5 gal./flush (13.3 L/flush), **as directed**.
 - f. Tailpiece Size: NPS 3/4 (DN 20) **OR** NPS 1-1/4 (DN 32) **OR** NPS 1-1/2 (DN 40), **as directed**, and standard, **as directed**, length to top of bowl.
- H. Toilet Seats
- 1. Description: Toilet seat for water-closet-type fixture.
 - a. Material: Molded, solid plastic with antimicrobial agent, **as directed**.
 - b. Configuration: Closed **OR** Open, **as directed**, front with **OR** without, **as directed**, cover.
 - c. Size: Elongated **OR** Regular, **as directed**.
 - d. Hinge Type: CK, check **OR** SS, self-sustaining **OR** SC, self-sustaining, check **OR** SR, self-raising, **as directed**.
 - e. Class: Residential **OR** Standard commercial **OR** Heavy-duty commercial, **as directed**.
 - f. Color: White **OR** Black, **as directed**.
- I. Protective Shielding Guards
- 1. Protective Shielding Pipe Covers:
 - a. Description: Manufactured plastic wraps for covering plumbing fixture hot-water supply **OR** hot- and cold-water supplies, **as directed**, and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.
 - 2. Protective Shielding Piping Enclosures:
 - a. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.
- J. Fixture Supports
- 1. Water-Closet Supports:
 - a. Description: Combination carrier designed for accessible **OR** standard, **as directed**, mounting height of wall-mounting, water-closet-type fixture. Include single or double, vertical or horizontal, hub-and-spigot or hubless waste fitting as required for piping arrangement; faceplates; couplings with gaskets; feet; and fixture bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.
 - 2. Urinal Supports:
 - a. Description: Type I, urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture **OR** Type II, urinal carrier with hanger and bearing plates, **as directed**, for wall-mounting, urinal-type fixture. Include steel uprights with feet.
 - b. Accessible-Fixture Support: Include rectangular steel uprights.
 - 3. Lavatory Supports:
 - a. Description: Type I, lavatory carrier with exposed arms and tie rods **OR** Type II, lavatory carrier with concealed arms and tie rod **OR** Type III, lavatory carrier with hanger plate and tie rod, **as directed**, for wall-mounting, lavatory-type fixture. Include steel uprights with feet.
 - b. Accessible-Fixture Support: Include rectangular steel uprights.
 - 4. Sink Supports:
 - a. Description: Type I, sink carrier with exposed arms and tie rods **OR** Type II, sink carrier with hanger plate, bearing studs, and tie rod **OR** Type III, sink carrier with hanger plate and exposed arms, **as directed**, for sink-type fixture. Include steel uprights with feet.
- K. Interceptors
- 1. Hair Interceptors:
 - a. Description: Manufactured unit with removable screen or strainer and removable cover; designed to trap and retain hair.
 - 1) Material: Brass **OR** Stainless-steel, **as directed**, body.
 - 2) Pipe Connections: NPS 1-1/4 (DN 32) **OR** NPS 1-1/2 (DN 40), **as directed**.
 - 2. Sediment Interceptors:



- a. Description: Manufactured unit with removable screens or strainer and removable cover; designed to trap and retain waste material.
- 1) Material: Cast-iron or steel body with acid-resistant lining and coating **OR** Carbon-steel body with acid-resistant lining and coating **OR** Stainless-steel, **as directed**.
 - 2) Pipe Connections: NPS 1-1/2 (DN 40) **OR** NPS 2 (DN 50), **as directed**.
- L. Shower Receptors
1. Description: Cast-polymer **OR** FRP **OR** PMMA **OR** Precast-terrazzo **OR** Solid-surface, **as directed**, base for built-up-type shower fixture.
 - 1) Type: Standard, residential **OR** Handicapped/wheelchair, **as directed**.
 - 2) Size: 32 by 32 inches (813 by 813 mm) **OR** 36 by 36 inches (914 by 914 mm) **OR** 32 by 42 inches (813 by 1067 mm) **OR** 48 by 60 inches (1219 by 1524 mm), **as directed**.
 - 3) Color: White.
 - 4) Outlet: Cast-in-floor drain **OR** Drain, **as directed**, with NPS 1-1/2 (DN 40) **OR** NPS 2 (DN 50) **OR** NPS 3 (DN 80), **as directed**, outlet.
- M. Dishwasher Air-Gap Fittings
1. Description: Fitting suitable for use with domestic dishwashers and for deck mounting; with plastic body, chrome-plated brass cover, **as directed**; and capacity of at least 5 gpm (0.32 L/s); and inlet pressure of at least 5 psig (35 kPa) at a temperature of at least 140 deg F (60 deg C). Include 5/8-inch- (16-mm-) ID inlet and 7/8-inch- (22-mm-) ID outlet hose connections.
 2. Hoses: Rubber and suitable for temperature of at least 140 deg F (60 deg C).
 - a. Inlet Hose: 5/8-inch (16-mm) ID and 48 inches (1219 mm) long.
 - b. Outlet Hose: 7/8-inch (22-mm) ID and 48 inches (1219 mm) long.
- N. Disposers
1. Description: Batch-feed **OR** Continuous-feed, **as directed**, household, food-waste disposer. Include reset button; wall switch; corrosion-resistant chamber with jam-resistant, cutlery- or stainless-steel grinder or shredder; NPS 1-1/2 (DN 40) outlet; quick-mounting, stainless-steel sink flange; antisplash guard; and combination cover/stopper.
 - a. Type: Batch-feed **OR** Continuous-feed, **as directed**, household.
 - b. Model: Not applicable **OR** Sound-insulated chamber **OR** Sound-insulated chamber and stainless-steel outer shell, **as directed**.
 - c. Motor: 115-V ac, 1725 rpm, 1/3 **OR** 1/2 **OR** 3/4 **OR** 1, **as directed**, hp with overload protection.
- O. Hot-Water Dispensers
1. Description: Gooseneck spout with lever-handle **OR** Spout with twist-knob or push-button, **as directed**, flow control, household-type dispenser with instant on-off control; insulated, corrosion-resistant-metal storage tank that is open to atmosphere; electric heating element; chrome-plated faucet or spout; removable strainer; thermostat control for water temperature up to 190 deg F (88 deg C); and thermal-overload protection.
 - a. Storage Tank Capacity: 0.5 gal. (1.5 L).
 - b. Heating Element: 750 W minimum, 115-V ac.
- P. Water Closets
1. Water Closets, Wall-Mounting, Back-Outlet Type:
 - a. Description Accessible, wall-mounting **OR** Wall-mounting, **as directed**, back-outlet, vitreous-china fixture designed for flushometer-tank **OR** gravity-type tank **OR** flushometer valve, **as directed**, operation.
 - 1) Style: Close coupled **OR** One piece, **as directed**.
 - a) Bowl Type: Elongated **OR** Round front, **as directed**, with siphon-jet design.
 - b) Design Consumption: 1.6 gal./flush (6 L/flush) **OR** 3.5 gal./flush (13.3 L/flush), **as directed**.



- c) Tank: Gravity type with trim **OR** Flushometer-tank type with trim and pressurized tank, **as directed**. Include cover.
 - d) Trip Mechanism: Lever-handle **OR** Push-button, **as directed**, actuator.
 - e) Color: White.
 - 2) Supply: NPS 1/2 (DN 15) chrome-plated brass or copper with wheel-handle **OR** screwdriver **OR** loose-key, **as directed**, stop.
 - 3) Style: Flushometer valve.
 - a) Bowl Type: Elongated **OR** Round front, **as directed**, with siphon-jet **OR** blowout, **as directed**, design.
 - b) Design Consumption: 1.6 gal./flush (6 L/flush) **OR** 3.5 gal./flush (13.3 L/flush), **as directed**.
 - c) Color: White.
 - 4) Fixture Support: Water-closet support <Insert designation> combination carrier.
2. Water Closets, Floor-Mounting, Floor-Outlet Type:
- a. Description: Accessible, floor-mounting **OR** Floor-mounting, **as directed**, floor-outlet, vitreous-china fixture designed for gravity-type tank **OR** flushometer tank **OR** flushometer valve, **as directed**, operation.
 - 1) Style: Close coupled **OR** One piece, **as directed**.
 - a) Bowl Type: Elongated **OR** Round front, **as directed**, with siphon-jet design. Include bolt caps matching fixture.
 - b) Height: Standard **OR** Accessible **OR** Juvenile **OR** Child, **as directed**.
 - c) Design Consumption: 1 gal./flush (3.8 L/flush) **OR** 1.6 gal./flush (6 L/flush) **OR** 3.5 gal./flush (13.3 L/flush), **as directed**.
 - d) Tank: Gravity type with trim **OR** Flushometer-tank type with trim and pressurized tank, **as directed**. Include cover.
 - e) Trip Mechanism: Lever-handle **OR** Push-button, **as directed**, actuator.
 - f) Color: White.
 - 2) Supply: NPS 3/8 (DN 10) **OR** NPS 1/2 (DN 15), **as directed**, chrome-plated brass or copper with wheel-handle **OR** screwdriver **OR** loose-key, **as directed**, stop.
 - 3) Style: Flushometer valve.
 - a) Bowl Type: Elongated **OR** Round front, **as directed**, with siphon-jet **OR** reverse-trap **OR** blowout **OR** siphon-vortex **OR** siphon-wash **OR** washdown, **as directed**, design. Include bolt caps matching fixture.
 - b) Height: Standard **OR** Accessible **OR** Juvenile **OR** Child, **as directed**.
 - c) Design Consumption: 1.6 gal./flush (6 L/flush) **OR** 3.5 gal./flush (13.3 L/flush), **as directed**.
 - d) Color: White.
3. Water Closets, Floor-Mounting, Back-Outlet Type:
- a. Description Accessible, floor-mounting **OR** Floor-mounting, **as directed**, back-outlet, vitreous-china fixture designed for gravity-tank **OR** flushometer-tank **OR** flushometer-valve, **as directed**, operation.
 - 1) Style: Close coupled.
 - a) Bowl Type: Elongated with siphon-jet design. Include bolt caps matching fixture.
 - b) Height: Standard **OR** Accessible, **as directed**.
 - c) Design Consumption: 1.6 gal./flush (6 L/flush).
 - d) Tank: Gravity type with trim. Include cover.
 - e) Trip Mechanism: Lever-handle actuator.
 - f) Color: White.
 - 2) Supply: NPS 1/2 (DN 15) chrome-plated brass or copper with wheel-handle **OR** screwdriver **OR** loose-key, **as directed**, stop.
 - 3) Style: Flushometer valve.
 - a) Bowl Type: Elongated with siphon-jet design. Include bolt caps matching fixture.
 - b) Height: Standard **OR** Accessible, **as directed**.



- c) Design Consumption: 1.6 gal./flush (6 L/flush) **OR** 3.5 gal./flush (13.3 L/flush), **as directed**.
- d) Color: White.
- 4) Wall Support: Manufactured waste fitting with seal and fixture bolts.

Q. Urinals

1. Urinals, Wall-Mounting, Back-Outlet Type:
 - a. Description: Accessible, wall-mounting **OR** Wall-mounting, **as directed**, back-outlet, vitreous-china fixture designed for flushometer valve operation.
 - 1) Type: Blowout **OR** Siphon jet **OR** Blowout with extended shields **OR** Siphon jet with extended shields **OR** Washout with extended shields, **as directed**.
 - 2) Strainer or Trapway: Integral cast strainer **OR** Separate removable strainer **OR** Open trapway, **as directed**, with integral trap.
 - 3) Design Consumption: 0.5 gal./flush (1.9 L/flush) **OR** 1 gal./flush (3.8 L/flush) **OR** 1.5 gal./flush (5.7 L/flush), **as directed**.
 - 4) Color: White.
 - 5) Supply Spud Size: NPS 3/4 (DN 20) **OR** NPS 1-1/4 (DN 32) **OR** NPS 1-1/2 (DN 40), **as directed**.
 - 6) Outlet Size: NPS 1-1/2 (DN 40) **OR** NPS 2 (DN 50) **OR** NPS 3 (DN 80), **as directed**.
 - 7) Fixture Support: Urinal chair carrier.
2. Urinals, Wall-Mounting, Bottom-Outlet Type:
 - a. Description: Accessible, wall-mounting **OR** Wall-mounting, **as directed**, bottom-outlet, vitreous-china fixture designed for flushometer valve operation.
 - 1) Type: Washout **OR** Washdown, **as directed**.
 - 2) Strainer or Trapway: Integral cast strainer **OR** Separate removable strainer **OR** Open trapway, **as directed**.
 - 3) Design Consumption: 0.5 gal./flush (1.9 L/flush) **OR** 1 gal./flush (3.8 L/flush), **as directed**.
 - 4) Color: White.
 - 5) Supply Spud Size: NPS 3/4 (DN 20).
 - 6) Outlet Size: NPS 1-1/2 (DN 40).
 - 7) Drain Piping: NPS 1-1/2 (DN 40) chrome-plated, cast-brass P-trap; 0.045-inch- (1.1-mm-) thick tubular brass waste to wall; and wall escutcheon.
 - 8) Flushing Device: Fixture manufacturer's standard matching fixture.
 - 9) Flushometer: **As directed**.
 - 10) Fixture Support: Urinal chair carrier.
3. Urinals, Stall-Type, Bottom-Outlet:
 - a. Description Stall-type, bottom-outlet, vitreous-china fixture designed for flushometer valve operation.
4. Urinals, Wall-Mounting, Bottom-Outlet, Trough-Type:
 - a. Description: Wall-mounting, bottom-outlet, trough-type, enameled, cast-iron fixture modified for flushometer valve operation.
 - 1) Style: Similar to wash sink with back and without pedestal.
 - 2) Size: 36 inches (915 mm) **OR** 48 inches (1219 mm) **OR** 60 inches (1525 mm) **OR** 72 inches (1830 mm), **as directed**.
 - 3) Color: White.
 - 4) Drain: Separate removable dome strainer.
 - 5) Design Consumption: Not applicable.
 - 6) Supply: NPS 1/2 (DN 15).
 - 7) Outlet Size: NPS 1-1/2 (DN 40).
 - 8) Drain Piping: NPS 1-1/2 (DN 40) chrome-plated, cast-brass P-trap; 0.045-inch- (1.1-mm-) thick tubular brass waste to wall; and wall escutcheon.
 - 9) Flushing Device: Fixture manufacturer's standard, with washdown pipe, matching fixture.



- 10) Fixture Support: Sink chair carrier.
5. Urinals, Wall-Mounting, Back-Outlet Dry Type:
 - a. Description Accessible, wall-mounting **OR** Wall-mounting, **as directed**, back-outlet dry, plastic **OR** vitreous-china, **as directed**, fixture designed for liquid-trap-seal operation.
 - 1) Type: Without water supply.
 - 2) Trap-Seal Method: Proprietary cartridge or trap system.
 - 3) Color: White.
 - 4) Outlet Size: NPS 1-1/2 (DN 40) **OR** NPS 2 (DN 50), **as directed**. Include transition coupling, if required.
 - 5) Trap-Sealing Liquid: Proprietary.
 - 6) Fixture Support: Urinal chair carrier.
- R. Bidets
 1. Description: Floor-mounting, vitreous-china fixture with fittings.
 - a. Type: With spray **OR** flushing rim **OR** spray and flushing rim, **as directed**, and overflow. Include bolt caps matching fixture.
 - b. Faucet Hole Punching: One **OR** Two **OR** Three **OR** Four **OR** No, **as directed**, hole(s).
 - c. Color: White.
 - d. Faucet: Fixture manufacturer's standard, or two-valve supply, provided by fixture supplier, with vacuum breaker, diverter, submerged spray, **OR** over-rim filling, **as directed**, pop-up waste, and chrome-plated finish.
 - e. Supplies: NPS 3/8 (DN 10) **OR** NPS 1/2 (DN 15), **as directed**, chrome-plated copper with stops.
 - f. Drain Piping: NPS 1-1/4 (DN 32) chrome-plated, cast-brass P-trap; 0.032-inch- (0.8-mm-) **OR** 0.045-inch- (1.1-mm-), **as directed**, thick tubular brass waste to wall; and wall escutcheon.
- S. Lavatories
 1. Lavatories, Wall-Mounting Type:
 - a. Description: Accessible, wall-mounting **OR** Wall-mounting **OR** Wall-and-pedestal-mounting, **as directed**, enameled, cast-iron **OR** vitreous-china, **as directed**, fixture.
 - 1) Type: With back **OR** Ledge back **OR** Shelf back **OR** Slab **OR** Pedestal, **as directed**.
 - 2) Size: 18 by 15 inches (457 by 381 mm) **OR** 19 by 16 inches (483 by 406 mm) **OR** 20 by 18 inches (508 by 457 mm) **OR** 24 by 20 inches (610 by 508 mm), **as directed**, rectangular.
 - 3) Faucet Hole Punching: One hole **OR** Three holes, 2-inch (51-mm) centers **OR** Three holes, 4-inch (102-mm) centers, **as directed**.
 - 4) Faucet Hole Location: Top **OR** Front wall **OR** Inclined panel, **as directed**.
 - 5) Pedestal: Not required **OR** Required, **as directed**.
 - 6) Color: White.
 - 7) Faucet: Lavatory with pop-up waste **OR** for separate drain, **as directed**.
 - 8) Supplies: NPS 3/8 (DN 10) chrome-plated copper with stops.
 - 9) Drain: See faucet **OR** Grid **OR** Grid with offset waste, **as directed**.
 - a) Location: Not applicable **OR** Near back of bowl, **as directed**.
 - 10) Drain Piping: NPS 1-1/4 (DN 32) **OR** NPS 1-1/4 by NPS 1-1/2 (DN 32 by DN 40), **as directed**, chrome-plated, cast-brass P-trap; NPS 1-1/4 (DN 32) **OR** NPS 1-1/2 (DN 40), **as directed**, 0.032-inch- (0.8-mm-) **OR** 0.045-inch- (1.1-mm-), **as directed**, thick tubular brass waste to wall; and wall escutcheon.
OR
Drain Piping: Schedule 40 ABS **OR** PVC, **as directed**, NPS 1-1/4 (DN 32) **OR** NPS 1-1/4 by NPS 1-1/2 (DN 32 by DN 40), **as directed**, P-trap; NPS 1-1/4 (DN 32) **OR** NPS 1-1/2 (DN 40), **as directed**, tubular waste to wall; and wall escutcheon.
 - a) Exception: Omit P-trap if hair interceptor is required.
 - 11) Hair Interceptor: Not required.
 - 12) Protective Shielding Guard(s): **As directed**.



- 13) Fixture Support: Lavatory.
2. Lavatories, Counter-Mounting Type:
- a. Description: Accessible **OR** Counter-mounting **OR** Undercounter-mounting, **as directed**, enameled, cast-iron **OR** FRP **OR** PMMA **OR** porcelain-enameled, formed-steel **OR** solid-surface **OR** stainless-steel **OR** vitreous-china, **as directed** fixture.
- 1) Type: Flat rim with ledge **OR** Self-rimming, **as directed**.
 - 2) Rectangular Lavatory Size: 18 by 15 inches (457 by 381 mm) **OR** 19 by 16 inches (483 by 406 mm) **OR** 20 by 18 inches (508 by 457 mm) **OR** 24 by 20 inches (610 by 508 mm), **as directed**.
 - 3) Oval Lavatory Size: 19 by 16 inches (483 by 406 mm) **OR** 20 by 17 inches (508 by 432 mm), **as directed**.
 - 4) Round Lavatory Size: 18 inches (457 mm) **OR** 19 inches (483 mm), **as directed**, in diameter.
 - 5) Faucet Hole Punching: One hole **OR** Three holes, 2-inch (51-mm) centers **OR** Three holes, 4-inch (102-mm) centers, **as directed**.
 - 6) Faucet Hole Location: Top **OR** Front wall **OR** Inclined panel, **as directed**.
 - 7) Color: White.
 - 8) Faucet: Lavatory with pop-up waste **OR** for separate drain, **as directed**.
 - 9) Supplies: NPS 3/8 (DN 10) chrome-plated copper with stops.
 - 10) Drain: See faucet **OR** Grid **OR** Grid with offset waste, **as directed**.
 - a) Location: Not applicable **OR** Near back of bowl, **as directed**.
 - 11) Drain Piping: NPS 1-1/4 (DN 32) **OR** NPS 1-1/4 by NPS 1-1/2 (DN 32 by DN 40), **as directed**, chrome-plated, cast-brass P-trap; NPS 1-1/4 (DN 32) **OR** NPS 1-1/2 (DN 40), **as directed**, 0.032-inch- (0.8-mm-) **OR** 0.045-inch- (1.1-mm-), **as directed**, thick tubular brass waste to wall; and wall escutcheon.

OR

 Drain Piping: Schedule 40 ABS **OR** PVC, **as directed**, NPS 1-1/4 (DN 32) **OR** NPS 1-1/4 by NPS 1-1/2 (DN 32 by DN 40), **as directed**, P-trap; NPS 1-1/4 (DN 32) **OR** NPS 1-1/2 (DN 40), **as directed**, tubular waste to wall; and wall escutcheon.
 - a) Exception: Omit P-trap if hair interceptor is required.
 - 12) Hair Interceptor: Not required.
 - 13) Protective Shielding Guard(s): **As directed**.
3. Lavatories, Countertop With Integral Bowl Type:
- a. Description: Countertop **OR** Accessible countertop, **as directed**, with integral bowl fixtures for mounting on base unit.
- 1) Backsplash: Integral with countertop **OR** Separate, same material as countertop **OR** Not required, **as directed**.
 - 2) Overall Rectangular Top Size: 25 by 17 inches (635 by 432 mm) **OR** 31 by 19 inches (787 by 483 mm) **OR** 49 by 22 inches (1245 by 559 mm) **OR** 73 by 22 inches (1854 by 559 mm), **as directed**, with 1 **OR** 2 **OR** 3 **OR** 4, **as directed**, bowl(s).
 - a) Bowl Size: Oval 19 by 16 inches (483 by 406 mm) **OR** 20 by 17 inches (508 by 432 mm), **as directed**.
 - 3) Faucet Hole Punching: One hole **OR** Three holes, 2-inch (51-mm) centers **OR** Three holes, 4-inch (102-mm) centers, **as directed**.
 - 4) Faucet Hole Location: Countertop.
 - 5) Color: White.
 - 6) Faucet(s): Lavatory with pop-up waste **OR** with separate drain, **as directed**, for each bowl.
 - 7) Supplies: NPS 3/8 (DN 10) chrome-plated copper with stops.
 - 8) Drain(s): See faucets **OR** Grid **OR** Grid with offset waste, **as directed**.
 - a) Location: Not applicable **OR** Near back of bowl, **as directed**.
 - 9) Drain Piping: NPS 1-1/4 (DN 32) **OR** NPS 1-1/4 by NPS 1-1/2 (DN 32 by DN 40), **as directed**, chrome-plated, cast-brass P-trap; NPS 1-1/4 (DN 32) **OR** NPS 1-1/2 (DN 40), **as directed**, 0.032-inch- (0.8-mm-) **OR** 0.045-inch- (1.1-mm-), **as directed**, thick tubular brass waste to wall; and wall escutcheon.



- OR**
Drain Piping: Schedule 40 ABS **OR** PVC, **as directed**, NPS 1-1/4 (DN 32) **OR** NPS 1-1/4 by NPS 1-1/2 (DN 32 by DN 40), **as directed**, P-trap; NPS 1-1/4 (DN 32) **OR** NPS 1-1/2 (DN 40), **as directed**, tubular waste to wall; and wall escutcheon.
- 10) Hair Interceptor(s): **As directed** for bowls as indicated.
 - 11) Protective Shielding Guard(s): **As directed** for bowls as indicated.
4. Lavatories, For Wheelchair-Bound Persons:
- a. Description: Accessible, wall-mounting, vitreous-china fixture designed for people in wheelchairs.
 - 1) Type: Ledge back **OR** Shelf back **OR** Slab, **as directed**.
 - 2) Size: 20 by 26 inches (508 by 660 mm) minimum; rectangular.
 - 3) Faucet Hole Punching: One hole **OR** Three holes, 2-inch (51-mm) centers **OR** Three holes, 4-inch (102-mm) centers **OR** Three holes, 8-inch (203-mm) centers **OR** Three holes, 12-inch (305-mm) centers, **as directed**.
 - 4) Color: White.
 - 5) Faucet: Lavatory for separate drain.
 - 6) Supplies: NPS 3/8 (DN 10) chrome-plated copper with stops.
 - 7) Drain: Grid **OR** Grid with offset waste, **as directed**.
 - 8) Drain Piping: NPS 1-1/4 (DN 32) **OR** NPS 1-1/4 by NPS 1-1/2 (DN 32 by DN 40), **as directed**, chrome-plated, cast-brass P-trap; NPS 1-1/4 (DN 32) **OR** NPS 1-1/2 (DN 40), **as directed**, 0.045-inch- (1.1-mm-) thick tubular brass waste to wall; and wall escutcheon.

OR
Drain Piping: Schedule 40 ABS **OR** PVC, **as directed**, NPS 1-1/4 (DN 32) **OR** NPS 1-1/4 by NPS 1-1/2 (DN 32 by DN 40), **as directed**, P-trap; NPS 1-1/4 (DN 32) **OR** NPS 1-1/2 (DN 40), **as directed**, tubular waste to wall; and wall escutcheon.
 - 9) Fixture Support: Lavatory.
- T. Commercial Sinks
1. Commercial Sinks, Counter-Mounting Type:
 - a. Description: One-compartment **OR** Two-compartment **OR** Three-compartment, **as directed**, counter-mounting, stainless-steel commercial sink with backsplash.
 - 1) Metal Thickness: 0.050 inch (1.3 mm).
 - 2) Compartment (for single-compartment sink):
 - a) Drain: Grid with NPS 1-1/2 (DN 40) tailpiece and twist drain **OR** Grid with NPS 2 (DN 50) tailpiece and twist drain **OR** NPS 1-1/2 (DN 40) tailpiece with stopper **OR** NPS 1-1/2 (DN 40) tailpiece with pop-up waste, **as directed**.
 - i. Location: Centered in compartment **OR** Near back of compartment **OR** Near left side of compartment **OR** Near right side of compartment, **as directed**.
 - 3) Each Compartment (for multiple-compartment sink):
 - a) Drains: Grid with NPS 1-1/2 (DN 40) tailpiece and twist drain **OR** Grid with NPS 2 (DN 50) tailpiece and twist drain **OR** NPS 1-1/2 (DN 40) tailpiece with stopper **OR** NPS 1-1/2 (DN 40) tailpiece with pop-up waste, **as directed**.
 - i. Location: Centered in compartment **OR** Near back of compartment, **as directed**.
 - 4) Faucet(s): Sink.
 - a) Number Required: One **OR** Two, **as directed**.
 - b) Mounting: Deck.
 - 5) Supplies: NPS 1/2 (DN 15) **OR** NPS 3/4 (DN 20), **as directed**, chrome-plated copper with stops or shutoff valves.
 - 6) Drain Piping: NPS 1-1/2 (DN 40) **OR** NPS 2 (DN 50), **as directed**, chrome-plated, cast-brass P-trap; 0.045-inch- (1.1-mm-) thick tubular brass **OR** copper pipe, **as directed**, waste to wall; continuous waste, **as directed**; and wall escutcheon(s).
 2. Commercial Sinks, Freestanding Type:



- a. Description: One-compartment **OR** Two-compartment **OR** Three-compartment, **as directed**, freestanding, stainless-steel commercial sink with backsplash.
- 1) Metal Thickness: 0.050 inch (1.3 mm) **OR** 0.063 inch (1.6 mm), **as directed**.
 - 2) Compartment (for single-compartment sink):
 - a) Drain: Grid with NPS 1-1/2 (DN 40) tailpiece and twist drain **OR** Grid with NPS 2 (DN 50) tailpiece and twist drain **OR** NPS 1-1/2 (DN 40) tailpiece with stopper **OR** NPS 1-1/2 (DN 40) tailpiece with pop-up waste, **as directed**.
 - i. Location: Centered in compartment **OR** Near back of compartment **OR** Near left side of compartment **OR** Near right side of compartment, **as directed**.
 - 3) Each Compartment (for multiple-compartment sink):
 - a) Drains: Grid with NPS 1-1/2 (DN 40) tailpiece and twist drain **OR** Grid with NPS 2 (DN 50) tailpiece and twist drain **OR** NPS 1-1/2 (DN 40) tailpiece with stopper **OR** NPS 1-1/2 (DN 40) tailpiece with pop-up waste, **as directed**.
 - i. Location: Centered in compartment **OR** Near back of compartment, **as directed**.
 - 4) Drainboard(s): Not required **OR** Both **OR** Left **OR** Right, **as directed**, side(s).
 - a) Dimensions Each: Not applicable.
 - 5) Supports: Adjustable-length, steel legs.
 - 6) Faucet(s): Sink.
 - a) Number Required: One **OR** Two, **as directed**.
 - b) Mounting: In backsplash.
 - 7) Supplies: NPS 1/2 (DN 15) **OR** NPS 3/4 (DN 20), **as directed**, chrome-plated copper with stops or shutoff valves.
 - 8) Drain Piping: NPS 1-1/2 (DN 40) **OR** NPS 2 (DN 50), **as directed**, chrome-plated, cast-brass P-trap; 0.045-inch- (1.1-mm-) thick tubular brass **OR** copper pipe, **as directed**, waste to wall; continuous waste, **as directed**; and wall escutcheon(s).
3. Commercial Sinks, Handwash Type:
- a. Description: Wall-mounting, stainless-steel, commercial, handwash-sink fixture.
- 1) Type: Basin with radius corners, back for faucet, and support brackets.
 - 2) Size; Approximately 17 by 16 by 5 inches (432 by 406 by 127 mm).
 - 3) Faucet: Back-mounting, chrome-plated, solid-brass, gooseneck type with individual valves.
 - 4) Supplies: NPS 1/2 (DN 15) chrome-plated copper with stops.
 - 5) Drain: Grid.
 - 6) Drain Piping: NPS 1-1/2 (DN 40) chrome-plated, cast-brass P-trap; 0.045-inch- (1.1-mm-) thick tubular brass waste to wall; and wall escutcheon.
 - 7) Fixture Support: Sink for wall-mounting installation.

U. Shampoo Bowls

1. Description: Enameled, cast-iron **OR** PMMA, **as directed**, fixture shaped for head rest. Include vacuum breaker, faucet, hose and spray, drain, and mounting brackets.
 - a. Color: White.
 - b. Supplies: NPS 3/8 (DN 10) **OR** NPS 1/2 (DN 15), **as directed**, chrome-plated copper with stops.
 - c. Drain Piping: NPS 1-1/2 (DN 40) chrome-plated, cast-brass P-trap; 0.045-inch- (1.1-mm-) thick tubular brass waste to wall; and wall escutcheon.

OR

 Drain Piping: Schedule 40 ABS **OR** PVC, **as directed**, NPS 1-1/2 (DN 40) P-trap; tubular waste to wall; and wall escutcheon.
 - d. Hair Interceptor: **As directed**
 - e. Fixture Support for Counter Mounting: Brackets or forms.

OR

 Fixture Support for Wall Mounting: Sink.



V. Wash Fountains

1. Wash Fountains, Freestanding Type:
 - a. Description: Accessible, Circular, freestanding-design, wash-up fixture.
 - 1) Arrangement: Wash-up stations facing central spray head.
 - 2) Receptor Material: Precast terrazzo **OR** Stainless steel **OR** Solid surface, **as directed**, on base.
 - 3) Receptor Color or Finish: Not applicable.
 - 4) Size: 36- to 39-inch (914- to 990-mm) **OR** 54-inch (1370-mm), **as directed**, diameter.
 - 5) Number of Stations: Two **OR** Three **OR** Four **OR** Five **OR** Six **OR** Eight, **as directed**.
 - 6) Control: Collective **OR** Individual, **as directed**, push-button **OR** foot-pedal **OR** sensor, **as directed**, actuation with thermostatic valve and check stops or field-installed check valves.
 - 7) Liquid Soap Dispensers: Manual **OR** Sensor, **as directed**, for each station.
 - 8) Mounting: Floor.
 - 9) Supplies: NPS 3/4 (DN 20) **OR** NPS 1 (DN 25), **as directed**, copper tubing with ball, gate, or globe valves from bottom **OR** top, **as directed**.
 - 10) Shroud: Not required **OR** Stainless steel of size to cover supplies and vent piping, **as directed**.
 - 11) Drain: Grid with NPS 2 (DN 50) tailpiece.
 - 12) Trap Fitting: Not required **OR** NPS 2 (DN 50) trap with waste and vent connections, **as directed**.
 - 13) Drain Piping: NPS 1-1/2 (DN 40), **OR** NPS 2 (DN 50), **as directed**, waste to floor.
 - 14) Vent Piping: Not required **OR** NPS 1-1/2 (DN 40) to ceiling, **as directed**.
2. Wash Fountains, Semicircular Or Corner Type:
 - a. Description: Accessible, Semicircular **OR** Corner, **as directed**, design, wash-up fixture.
 - 1) Arrangement: Wash-up stations facing central spray head.
 - 2) Receptor Material: Precast terrazzo **OR** Stainless steel **OR** Solid surface, **as directed**, on base.
 - 3) Receptor Color or Finish: Not applicable.
 - 4) Size: 36- to 39-inch (914- to 990-mm) **OR** 54-inch (1370-mm), **as directed**, diameter.
 - 5) Number of Stations: Two **OR** Three **OR** Four, **as directed**.
 - 6) Control: Collective **OR** Individual, **as directed**, push-button **OR** foot-pedal **OR** sensor, **as directed**, actuation with thermostatic valve and check stops or field-installed check valves.
 - 7) Liquid Soap Dispensers: Manual **OR** Sensor, **as directed**, for each station.
 - 8) Mounting: Floor and flush-to-wall with wall bracket.
 - 9) Supplies: NPS 1/2 (DN 15) **OR** NPS 3/4 (DN 20), **as directed**, copper tubing with ball, gate, or globe valves.
 - 10) Drain: Grid with NPS 1-1/2 (DN 40) **OR** NPS 2 (DN 50), **as directed**, tailpiece.
 - 11) Drain Piping: NPS 1-1/2 (DN 40) **OR** NPS 2 (DN 50), **as directed**, P-trap, waste to wall, and wall flange.
3. Wash Fountains, Wall-Mounting Type:
 - a. Description: Accessible, **as directed**, Flush-to-wall, **as directed**, linear design, wash-up fixture.
 - 1) Arrangement: Wash-up stations facing spray heads.
 - 2) Receptor Material: Precast terrazzo **OR** Stainless steel **OR** Solid surface, **as directed**, on base.
 - 3) Receptor Color or Finish: Not applicable.
 - 4) Number of Stations: One **OR** Two **OR** Three **OR** Four, **as directed**.
 - 5) Control: Collective **OR** Individual, **as directed**, push-button **OR** sensor, **as directed**, actuation with thermostatic valve and check stops or field-installed check valves.
 - 6) Liquid Soap Dispensers: Manual **OR** Sensor, **as directed**, for each station.



- 7) Mounting: Floor mounting with bracket for attaching to wall.
- 8) Faucet(s): Push-button **OR** Sensor-actuated, **as directed**, mixing valve with check stops.
- 9) Supplies: NPS 1/2 (DN 15) copper tubing with ball, gate, or globe valves.
- 10) Drain: Grid with NPS 1-1/2 (DN 40) tailpiece.
- 11) Drain Piping: NPS 1-1/2 (DN 40) P-trap, waste to wall, and wall flange.

W. Bathtubs

1. Description: Enameled, cast-iron **OR** FRP **OR** PMMA **OR** Porcelain-enameled, formed-steel, **as directed**, fixture.
 - a. Bathing Surface: Slip resistant.
 - b. Size: 48 by 30 inches (1220 by 765 mm) **OR** 60 by 30 inches (1525 by 765 mm) **OR** 66 by 30 inches (1680 by 765 mm), **as directed**, with front apron **OR** drop-in type, **as directed**.
 - c. Color: White.
 - d. Drain Location: Left **OR** Right, **as directed**, end.
 - e. Accessibility Options: Include grab bar and bench.
 - f. Faucet: Bathtub **OR** Bathtub/shower, **as directed**.
 - g. Supplies: NPS 1/2 (DN 15) copper tubing with ball, gate, or globe valves.
 - h. Drain: NPS 1-1/2 (DN 40); chrome-plated exposed parts; brass pop-up waste and overflow.
 - i. Drain Piping: NPS 1-1/2 (DN 40) cast-brass P-trap and waste.
OR
Drain Piping: Schedule 40 ABS **OR** PVC, **as directed**, NPS 1-1/2 (DN 40) P-trap and waste.

X. Individual Showers

1. Individual Showers, Enclosure Type:
 - a. Description: Accessible, **as directed**, FRP **OR** PMMA, **as directed**, shower enclosure with slip-resistant bathing surface and shower rod with curtain.
 - 1) Size: 36 by 34 inches (915 by 865 mm) **OR** 42 by 36 inches (1065 by 915 mm) **OR** 43 by 39 inches (1090 by 990 mm) **OR** 48 by 34 inches (1220 by 865 mm) **OR** 52 by 36 inches (1320 by 915 mm) **OR** 60 by 36 inches (1525 by 915 mm) **OR** 72 by 36 inches (1830 by 915 mm), **as directed**.
 - 2) Surround: One piece or sealed, multiple piece, **as directed**.
OR
Surround: One piece.
 - 3) Color: White.
 - 4) Drain Location: Left side **OR** Center **OR** Right side, **as directed**.
 - 5) Accessibility Options: Include grab bar and bench.
 - 6) Faucet: Shower.
 - 7) Drain: Grid, NPS 2 (DN 50).
2. Individual Showers, Built-Up Type:
 - a. Description: Components for built-up shower.
 - 1) Receptor: Not required.
3. Individual Showers, Cabinet Type:
 - a. Description: Factory-fabricated, accessible, **as directed**, cabinet type with faucet and receptor.
 - 1) Size: 30 by 30 inches (760 by 760 mm) **OR** 32 by 32 inches (815 by 815 mm) **OR** 36 by 36 inches (915 by 915 mm) **OR** 36 by 39 inches (915 by 990 mm) **OR** 45 by 39 inches (1145 by 990 mm), **as directed**.
 - 2) Material: Steel **OR** Composite **OR** Plastic, **as directed**, front **OR** corner **OR** front and rear, **as directed**, access.
 - 3) Color: Not applicable.
 - 4) Accessibility Options: Grab bar and bench.
 - 5) Faucet: Shower.



- 6) Supplies: NPS 1/2 (DN 15) copper tubing with ball, gate, or globe valves, **as directed**.
- 7) Drain: Grid, NPS 2 (DN 50).

Y. Group Showers

1. Group Showers, Column Type:

- a. Description: Stainless-steel column fixture with two **OR** three **OR** four **OR** five **OR** six, **as directed**, individual showers.
 - 1) Height to Shower Heads: 66 inches (1675 mm) **OR** 72 inches (1830 mm), **as directed**.
 - 2) Control: Thermostatic **OR** Pressure-balance, **as directed**, valve with individual hot-and cold-water mixing valve operation.
OR
Control: Thermostatic valve with individual tempered-water supply and push-button **OR** sensor, **as directed**, operation.
 - 3) Flow Control: 2 gpm (7.6 L/min.) **OR** 2.5 gpm (9.5 L/min.), **as directed**, for each shower head.
 - 4) Liquid Soap Dispenser: For each shower.
 - 5) Mounting: Floor flange.
 - 6) Supplies: NPS 3/4 (DN 20) **OR** NPS 1 (DN 25), **as directed**, copper tubing with ball, gate, or globe valves from bottom **OR** top, **as directed**.
 - 7) Shroud: Not required **OR** Stainless steel of size to cover supplies and vent piping, **as directed**.
 - 8) Drain Fitting: NPS 3 (DN 80) **OR** NPS 4 (DN 100), **as directed**, outlet with NPS 2 (DN 50) vent, integral with base of column.
 - 9) Vent Piping: Not required **OR** NPS 2 (DN 50) to ceiling, **as directed**.

2. Group Showers, Wall-Mounting Type:

- a. Description: Wall-mounting fixture with stainless-steel surface enclosure with two **OR** three, **as directed**, individual showers.
 - 1) Control: Thermostatic **OR** Pressure-balance, **as directed**, valve with individual hot-and cold-water mixing valve operation.
OR
Control: Thermostatic valve with individual tempered-water supply and push-button **OR** sensor, **as directed**, operation.
 - 2) Flow Control: 2 gpm (7.6 L/min.) **OR** 2.5 gpm (9.5 L/min.), **as directed**, for each shower head.
 - 3) Liquid Soap Dispenser: For each shower.
 - 4) Mounting: Wall bracket.
 - 5) Supplies: NPS 3/4 (DN 20) copper tubing with ball, gate, or globe valves.

3. Group Showers, Freestanding, Plastic Type:

- a. Description: Freestanding, plastic group-shower fixture.
 - 1) Number of Shower Stations: One **OR** Two **OR** Three **OR** Four, **as directed**, with individual self-closing control valve(s).
 - 2) Number of Foot Wash Stations: One **OR** Two, **as directed**, with individual self-closing control valve(s).
 - 3) Hose Bibb: Not **OR** One, **as directed**, required.
 - 4) Control-Valve Mounting Height: 50 inches (1270 mm) **OR** 48 inches (1219 mm), **as directed**.
 - 5) Material: Cast-filled-polymer plastic.
 - 6) Color: Gray.
 - 7) Internal Piping: Factory installed.
 - 8) Mounting: Base flange with bolt holes.

4. Group Showers, Freestanding, Steel Type:

- a. Description: Freestanding, steel group-shower fixture.
 - 1) Number of Shower Stations: One **OR** Two, **as directed**, with individual self-closing control valve(s).



- 2) Number of Foot Wash Stations: One **OR** Two, **as directed**, with individual self-closing control valve(s).
- 3) Material: Painted steel pipe.
- 4) Color: Blue.
- 5) Internal Piping: Factory installed.
- 6) Mounting: Base flange with bolt holes.

Z. Whirlpool Bathtubs

1. Whirlpool Bathtubs, Water-Circulation Hydromassage Type:

- a. Description: Packaged, enameled, cast-iron **OR** FRP **OR** PMMA **OR** porcelain-enameled, formed-steel, **as directed**, hydromassage bathtub with air-entrained-water jet nozzles and water circulation.
 - 1) Seating Capacity: One **OR** Two, **as directed**, person(s).
 - 2) Bathing Surface: Slip resistant.
 - 3) Size: 60 by 30 inches (1525 by 765 mm) **OR** 66 by 30 inches (1680 by 765 mm) **OR** 60 by 42 inches (1525 by 1065 mm), **as directed**.
 - 4) Base for Drop-in Unit: **<Insert description>** with access panel.
OR
Apron: Matching unit, covering exposed front and sides, and with access panel.
 - 5) Color: White.
 - 6) Drain Location: Left **OR** Right, **as directed**, end.
 - 7) Controls: For pump, timer, **as directed**, and water heater, **as directed**.
 - 8) Faucet: Fixture manufacturer's individual valves **OR** mixing valve, **as directed**, with over-rim tub filler.
 - 9) Supplies: NPS 1/2 (DN 15) copper tubing with ball, gate, or globe valves.
 - 10) Drain: NPS 1-1/2 (DN 40); chrome-plated exposed parts; brass pop-up waste and overflow.
 - 11) Drain Piping: NPS 1-1/2 (DN 40) cast-brass P-trap and waste.
OR
Drain Piping: Schedule 40 ABS **OR** PVC, **as directed**, NPS 1-1/2 (DN 40) P-trap and waste.
 - 12) Water-Circulating System: Electric circulating pump and plastic piping.
 - 13) Water Heater: Electric, inline, **as directed**.

2. Whirlpool Bathtubs, Airmassage Type:

- a. Description: Packaged, PMMA airmassage bathtub with air-injection nozzles.
 - 1) Seating Capacity: One **OR** Two, **as directed**, person(s).
 - 2) Bathing Surface: Slip resistant.
 - 3) Size: 60 by 30 inches (1525 by 765 mm) **OR** 66 by 30 inches (1680 by 765 mm) **OR** 60 by 42 inches (1525 by 1065 mm), **as directed**.
 - 4) Base for Drop-in Unit: **<Insert description>** with access panel.
OR
Apron: Matching unit, covering exposed front and sides, and with access panel.
 - 5) Color: White.
 - 6) Drain Location: Left **OR** Right, **as directed**, end.
 - 7) Controls: For blower, timer, **as directed**, and water heater, **as directed**.
 - 8) Faucet: Fixture manufacturer's individual valves **OR** mixing valve, **as directed**, with over-rim tub filler.
 - 9) Supplies: NPS 1/2 (DN 15) copper tubing with ball, gate, or globe valves.
 - 10) Drain: NPS 1-1/2 (DN 40); chrome-plated exposed parts; brass pop-up waste and overflow.
 - 11) Drain Piping: NPS 1-1/2 (DN 40) cast-brass P-trap and waste.
OR
Drain Piping: Schedule 40 ABS **OR** PVC, **as directed**, NPS 1-1/2 (DN 40) P-trap and waste.



- 12) Air-Injection System: Electric, blower **OR** combination blower/heater, **as directed**, and plastic piping.

AA. Kitchen Sinks

1. Kitchen Sinks:

- a. Description: One-bowl **OR** Two-bowl **OR** Three-bowl, **as directed**, residential, counter-mounting, enameled, cast-iron **OR** PMMA **OR** porcelain-enameled, formed-steel **OR** solid-surface **OR** stainless-steel, **as directed**, kitchen sink.
 - 1) Metal Thickness: 0.038 inch (1.0 mm) **OR** 0.050 inch (1.3 mm), **as directed**.
 - 2) Bowl (single bowl):
 - a) Drain: 3-1/2-inch (89-mm) crumb cup **OR** grid **OR** grid with offset waste **OR** outlet for disposer, **as directed**.
 - i. Location: Centered in bowl **OR** Near back of bowl, **as directed**.
 - 3) Left Bowl:
 - a) Drain: 3-1/2-inch (89-mm) crumb cup **OR** grid **OR** grid with offset waste **OR** outlet for disposer, **as directed**.
 - i. Location: Centered in bowl **OR** Near back of bowl, **as directed**.
 - 4) Right Bowl:
 - a) Drain: 3-1/2-inch (89-mm) crumb cup **OR** grid **OR** grid with offset waste **OR** outlet for disposer, **as directed**.
 - i. Location: Centered in bowl **OR** Near back of bowl, **as directed**.
 - 5) Center Bowl:
 - a) Drain: 1-1/2-inch (38-mm) **OR** 3-1/2-inch (89-mm), **as directed**, crumb cup **OR** grid **OR** grid with offset waste, **as directed**.
 - i. Location: Centered in bowl.
 - 6) Supplies: NPS 1/2 (DN 15) chrome-plated copper with stops.
 - 7) Drain Piping: NPS 1-1/2 (DN 40) chrome-plated, cast-brass P-trap; 0.045-inch- (1.1-mm-) thick tubular brass waste to wall; continuous waste, **as directed**; and wall escutcheon(s).
OR
Drain Piping: Schedule 40 ABS **OR** PVC, **as directed**, NPS 1-1/2 (DN 40) P-trap; tubular waste to wall; continuous waste, **as directed**; and wall escutcheon(s).
 - 8) Disposer: Not required.
 - 9) Dishwasher Air-Gap Fitting: Required **OR** Not required, **as directed**.
 - 10) Hot-Water Dispenser: Not required.

2. Bar Sinks:

- a. Description: Single-bowl, residential, counter-mounting, enameled, cast-iron **OR** PMMA **OR** stainless-steel **OR** porcelain-enameled, cast-iron **OR** solid-surface, **as directed**, bar sink.
 - 1) Supplies: NPS 3/8 (DN 10) **OR** NPS 1/2 (DN 15), **as directed**, chrome-plated copper with stops.
 - 2) Drain: 1-1/2-inch (38-mm) **OR** 3-1/2-inch (89-mm), **as directed**, crumb cup **OR** grid **OR** grid with offset waste, **as directed**.
 - 3) Drain Piping: NPS 1-1/2 (DN 40) chrome-plated, cast-brass P-trap; 0.045-inch- (1.1-mm-) thick tubular brass waste to wall; and wall escutcheon.
OR
Drain Piping: Schedule 40 ABS **OR** PVC, **as directed**, NPS 1-1/2 (DN 40) P-trap; tubular waste to wall; and wall escutcheon.
 - 4) Protective Shielding Guard(s): **As directed**.

BB. Service Sinks

1. Service Sinks, Standard Type:

- a. Description: Trap-standard- and wall-mounting, enameled, cast-iron fixture with roll-rim **OR** vitreous-china fixture, **as directed**, with plain **OR** two faucet holes in, **as directed**, back and rim guard on front and sides.



- 1) Size (cast-iron fixture): 22 by 18 inches (560 by 460 mm) **OR** 24 by 20 inches (610 by 510 mm), **as directed**.
 - 2) Size (vitreous-china fixture): 19 by 16 inches (480 by 405 mm) **OR** 22 by 20 inches (560 by 510 mm), **as directed**.
 - 3) Color: White.
 - 4) Faucet: Sink type. Polished **OR** rough, as directed, chrome-plated, solid-brass faucet. Include integral stops in shanks, vacuum breaker, hose-thread outlet, and pail hook. Provide type with wall brace if faucet will be mounted above back.
 - 5) Drain: Grid with NPS 2 (DN 50) **OR** NPS 3 (DN 80), **as directed**, outlet.
 - 6) Trap Standard: NPS 2 (DN 50) **OR** NPS 3 (DN 80), **as directed**, enameled, cast iron with cleanout and floor flange.
 - 7) Fixture Support: Sink.
2. Service Sinks, Floor-Mounting Type:
- a. Description: Floor-mounting, enameled, cast-iron fixture with front apron, raised back, and coated, wire rim guard. (This type of service sink requires a drainage piping trap under the fixture. This trap is not part of fixture fittings)
 - 1) Size: 28 by 28 inches (710 by 710 mm).
 - 2) Color: White.
 - 3) Faucet: Sink type. Polished **OR** rough, as directed, chrome-plated, solid-brass faucet with wall brace. Include integral stops in shanks, vacuum breaker, hose-thread outlet, and pail hook..
 - 4) Drain: Grid with NPS 2 (DN 50) **OR** NPS 3 (DN 80), **as directed**, outlet.

CC. Service Basins

1. Description: Flush-to-wall, floor-mounting, precast terrazzo **OR** cast-polymer, **as directed**, fixture with rim guard. (This type of fixture requires a drainage piping trap under the fixture. This trap is not part of fixture fittings.)
 - a. Shape: Square **OR** Rectangular **OR** Five sided **OR** Radial front, **as directed**.
 - b. Size: 24 by 24 inches (610 by 610 mm) **OR** 28 by 28 inches (710 by 710 mm) **OR** 24 by 36 inches (610 by 915 mm) **OR** 32 by 32 inches (815 by 815 mm) **OR** 36 by 36 inches (915 by 915 mm), **as directed**.
 - c. Height: 6 inches (150 mm) **OR** 10 inches (255 mm) **OR** 12 inches (305 mm) **OR** 12 inches (305 mm) with dropped front, **as directed**.
 - d. Tiling Flange: Not required **OR** On one side **OR** On two sides **OR** On three sides, **as directed**.
 - e. Rim Guard: On front **OR** all, **as directed**, top surfaces.
 - f. Color: Not applicable.
 - g. Faucet: Sink type. Polished **OR** rough, as directed, chrome-plated, solid-brass faucet with wall brace. Include integral stops in shanks, vacuum breaker, hose-thread outlet, and pail hook.
 - h. Drain: Grid with NPS 2 (DN 50) **OR** NPS 3 (DN 80), **as directed**, outlet.

DD. Laundry Trays

1. Description: Stand-mounting **OR** Counter-mounting, **as directed**, enameled, cast-iron **OR** plastic, **as directed**, laundry trays.
 - a. Size: 24 by 21 inches (610 by 535 mm) **OR** 25 by 22 inches (635 by 560 mm), **as directed**.
 - b. Color: Not applicable.
 - c. Faucet: Sink type, polished, chrome-plated, solid brass, for fixture-ledge **OR** wall **OR** counter, **as directed**, mounting.
 - d. Supplies: NPS 1/2 (DN 15) chrome-plated copper with stops **OR** copper tubing with ball, gate, or globe valves, **as directed**.
 - e. Drain: Grid with NPS 1-1/2 (DN 40) outlet.
 - f. Drain Piping: NPS 1-1/2 (DN 40) chrome-plated, cast-brass P-trap; 0.045-inch- (1.1-mm-) thick tubular brass waste to wall; and wall escutcheon.

**OR**

Drain Piping: Schedule 40 ABS **OR** PVC, **as directed**, NPS 1-1/2 (DN 40) P-trap; tubular waste to wall; and wall escutcheon.

- g. Stand: Not required **OR** Painted steel, **as directed**.

EE. Sacristy Sinks

1. Description: Two-bowl, counter-mounting, stainless-steel fixture.
 - a. Size: Approximately 22 by 42 inches (560 by 1070 mm).
 - b. Cover: Hinged with lock on left **OR** right, **as directed**, bowl.
 - c. Supplies: NPS 1/2 (DN 15) chrome-plated copper with stops.
 - d. Drains: One with stopper and one with grid.
 - e. Drain Piping: NPS 1-1/2 (DN 40) chrome-plated, tubular-brass waste. Include one trap, one direct waste without trap, separate waste piping, and wall flanges.

1.3 EXECUTION

A. Installation

1. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.
2. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.
 - a. Use carrier supports with waste fitting and seal for back-outlet fixtures.
 - b. Use carrier supports without waste fitting for fixtures with tubular waste piping.
 - c. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
3. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.
4. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
5. Install wall-mounting fixtures with tubular waste piping attached to supports.
6. Install floor-mounting, back-outlet water closets attached to building floor substrate and wall bracket and onto waste fitting seals.
7. Install counter-mounting fixtures in and attached to casework.
8. Install fixtures level and plumb according to roughing-in drawings.
9. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
 - a. Exception: Use ball, gate, or globe valves if supply stops are not specified with fixture. Valves are specified in Division 22 Section "General-duty Valves For Plumbing Piping".
10. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
11. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
12. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.
13. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.
14. Install toilet seats on water closets.
15. Install trap-seal liquid in dry urinals.
16. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
17. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.
18. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
19. Install shower flow-control fittings with specified maximum flow rates in shower arms.
20. Install traps on fixture outlets.
 - a. Exception: Omit trap on fixtures with integral traps.



b. Exception: Omit trap on indirect wastes, unless otherwise indicated.

21. Install disposer in outlet of each sink indicated to have disposer. Install switch where indicated or in wall adjacent to sink if location is not indicated.
22. Install dishwasher air-gap fitting at each sink indicated to have air-gap fitting. Install in sink deck **OR** on countertop at sink, **as directed**. Connect inlet hose to dishwasher and outlet hose to disposer.
23. Install hot-water dispensers in back top surface of sink or in countertop with spout over sink.
24. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Common Work Results For Plumbing".
25. Set bathtubs, shower receptors, and service basins in leveling bed of cement grout. Grout is specified in Division 22 Section "Common Work Results For Plumbing".
26. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants".

B. Connections

1. Piping installation requirements are specified in other Division 14. Drawings indicate general arrangement of piping, fittings, and specialties.
2. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
3. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
4. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

C. Field Quality Control

1. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
2. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
3. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.
4. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.
5. Install fresh batteries in sensor-operated mechanisms.

D. Adjusting

1. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
2. Operate and adjust disposers, hot-water dispensers, and controls. Replace damaged and malfunctioning units and controls.
3. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.
4. Replace washers and seals of leaking and dripping faucets and stops.
5. Install fresh batteries in sensor-operated mechanisms.

E. Cleaning

1. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:
 - a. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
 - b. Remove sediment and debris from drains.
2. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.



F. Protection

1. Provide protective covering for installed fixtures and fittings.
2. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by the Owner.

END OF SECTION 10 28 19 16



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Task	Specification	Specification Description
10 28 19 19	10 28 19 16	Plumbing Fixtures



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SECTION 10 44 13 00 - FIRE PROTECTION CABINETS

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for fire extinguisher cabinets. Product shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Fire protection cabinets for the following:
 - 1) Portable fire extinguishers.
 - 2) Fire hose valves.
 - 3) Fire hoses and racks.

C. Submittals

1. Product Data: For each type of product indicated.
2. Show location of knockouts for hose valves.
3. Shop Drawings: For fire protection cabinets. Include plans, elevations, sections, details, and attachments to other work.
4. Samples: For each type of fire protection cabinet indicated.
5. Maintenance Data.

D. Quality Assurance

1. Fire-Rated, Fire Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.
2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Coordination

1. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
2. Coordinate size of fire protection cabinets to ensure that type and capacity of fire hoses, hose valves, and hose racks indicated are accommodated.
3. Coordinate sizes and locations of fire protection cabinets with wall depths.

F. Sequencing

1. Apply decals **OR** vinyl lettering, **as directed**, on field-painted, fire protection cabinets after painting is complete.

1.2 PRODUCTS

A. Materials

1. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
2. Aluminum: Alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated, and as follows:
 - a. Sheet: ASTM B 209 (ASTM B 209M).
 - b. Extruded Shapes: ASTM B 221 (ASTM B 221M).
3. Stainless-Steel Sheet: ASTM A 666, Type 304.
4. Copper-Alloy Brass Sheet: ASTM B 36/B 36M, alloy UNS No. C26000 (cartridge brass, 70 percent copper).



5. Copper-Alloy Bronze Sheet: ASTM B 36/B 36M, alloy UNS No. C28000 (muntz metal, 60 percent copper).
6. Clear Float Glass: ASTM C 1036, Type I, Class 1, Quality q3, 3 **OR** 6, **as directed**, mm thick.
7. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear) **OR** Class 2 (tinted, heat absorbing, and light reducing), bronze tint, **as directed**.
8. Break Glass: Clear annealed float glass, ASTM C 1036, Type I, Class 1, Quality q3, 1.5 mm thick, single strength.
9. Tempered Break Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 1.5 mm thick.
10. Wire Glass: ASTM C 1036, Type II, Class 1, Form 1, Quality q8, Mesh m1 (diamond), 6 mm thick.
11. Transparent Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), 1.5 **OR** 3 **OR** 6, **as directed**, mm thick, with Finish 1 (smooth or polished) **OR** Finish 2 (patterned, textured), **as directed**.
12. Acrylic Bubble: One piece.

B. Fire Protection Cabinet

1. Cabinet Type: Suitable for fire extinguisher **OR** extinguisher and hose valve **OR** hose, rack, valve, and extinguisher **OR** hose, rack, and valve **OR** hose valve, **as directed**.
2. Cabinet Construction: Nonrated **OR** 1-hour fire rated **OR** 2-hour fire rated, **as directed**.
 - a. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.0428-inch- (1.1-mm-) thick, cold-rolled steel sheet lined with minimum 5/8-inch- (16-mm-) thick, fire-barrier material. Provide factory-drilled mounting holes.
3. Cabinet Material: Steel **OR** Aluminum **OR** Stainless-steel, **as directed**, sheet.
 - a. Shelf: Same metal and finish as cabinet.
4. Recessed Cabinet: Cabinet box recessed in walls of sufficient depth to suit style of trim indicated.
 - a. Trimless with Concealed Flange: Surface of surrounding wall finishes flush with exterior finished surface of cabinet frame and door, without overlapping trim attached to cabinet. Provide recessed flange, of same material as box, attached to box to act as plaster stop **OR** drywall bead, **as directed**.
 - b. Trimless with Hidden Flange: Flange of same metal and finish as box overlaps surrounding wall finish and is concealed from view by an overlapping door.
 - c. Exposed Flat Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
5. Semirecessed Cabinet: Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semirecessed cabinet installation.
 - a. Square-Edge Trim: 1-1/4- to 1-1/2-inch (32- to 38-mm) backbend depth.
 - b. Rolled-Edge Trim: 2-1/2-inch (64-mm) **OR** 4-inch (102-mm) **OR** 4-1/2-inch (114-mm), **as directed**, backbend depth.
6. Surface-Mounted Cabinet: Cabinet box fully exposed and mounted directly on wall with no trim. Provide where walls are of insufficient depth for semirecessed cabinet installation.
7. Cabinet Trim Material: Steel sheet **OR** Aluminum sheet **OR** Extruded-aluminum shapes **OR** Stainless-steel sheet **OR** Copper-alloy brass sheet **OR** Copper-alloy bronze sheet **OR** Same material and finish as door, **as directed**.
8. Door Material: Steel sheet **OR** Aluminum sheet **OR** Extruded-aluminum shapes **OR** Stainless-steel sheet **OR** Copper-alloy brass sheet **OR** Copper-alloy bronze sheet, **as directed**.
9. Door Style: Fully glazed, frameless, backless, acrylic panel **OR** Fully glazed panel with frame **OR** Full bubble, frameless **OR** Full bubble with frame **OR** Full bubble with frameless, rotating turntable **OR** Horizontal duo panel with frame **OR** Vertical duo panel with frame **OR** Center glass panel with frame **OR** Solid opaque panel with frame **OR** Flush opaque panel, frameless, with no exposed hinges, **as directed**.



10. Door Glazing: Clear float glass **OR** Tempered float glass (clear) **OR** Tempered float glass (bronze tint) **OR** Break glass **OR** Tempered break glass **OR** Wire glass **OR** Mirror glass **OR** Acrylic sheet **OR** Break acrylic bubble **OR** Molded acrylic bubble, **as directed**.
 - a. Acrylic Sheet Color: Clear **OR** Bronze, **as directed**, transparent acrylic sheet.
 - b. Acrylic Sheet Color: Clear transparent acrylic sheet painted white **OR** red **OR** black, **as directed**, on unexposed side.
 - c. Acrylic Bubble Color: Clear **OR** Bronze **OR** Red, **as directed**, transparent.
 11. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - a. Provide projecting lever handle with cam-action latch **OR** projecting door pull and friction latch **OR** recessed door pull and friction latch **OR** manufacturer's standard, **as directed**.
 - b. Provide continuous hinge, of same material and finish as trim, **OR** concealed hinge **OR** pivot hinge **OR** manufacturer's standard hinge, **as directed**, permitting door to open 180 degrees.
 12. Accessories:
 - a. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
 - b. Break-Glass Strike: Manufacturer's standard metal strike, complete with chain and mounting clip, secured to cabinet.
 - c. Lettered Door Handle: One-piece, cast-iron door handle with the word "FIRE" embossed into face.
 - d. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle **OR** Cylinder lock, keyed alike to other cabinets, **as directed**.
 - e. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed.
 - 1) Identify fire extinguisher in fire protection cabinet with the words "FIRE EXTINGUISHER."
 - a) Location: Applied to cabinet door **OR** cabinet glazing **OR** location indicated on Drawings, **as directed**.
 - b) Application Process: Silk-screened **OR** Engraved **OR** Etched **OR** Decals **OR** Pressure-sensitive vinyl letters, **as directed**.
 - c) Lettering Color: Red **OR** Black **OR** White, **as directed**.
 - d) Orientation: Vertical **OR** Horizontal **OR** As indicated on Drawings, **as directed**.
 - f. Alarm: Manufacturer's standard alarm that actuates when fire protection cabinet door is opened and that is powered by batteries **OR** low voltage, complete with transformer, **as directed**.
 13. Finishes:
 - a. Manufacturer's standard baked-enamel paint for the following:
 - 1) Exterior of cabinet door **OR** trim, **OR** door, and trim, **as directed**, except for those surfaces indicated to receive another finish.
 - 2) Interior of cabinet and door, **as directed**.
 - b. Aluminum: Clear anodic **OR** Color anodic **OR** Baked enamel or powder coat, **as directed**.
 - c. Steel: Factory primed for field painting **OR** Baked enamel or powder coat, **as directed**.
 - d. Stainless Steel: No. 2B **OR** No. 4 **OR** No. 6 **OR** No. 7 **OR** No. 8, **as directed**.
 - e. Copper Alloy, Brass: Buffed **OR** Hand rubbed **OR** Hand rubbed, lacquered **OR** Medium satin **OR** Fine matte **OR** Statuary conversion **OR** Patina conversion, **as directed**.
 - f. Copper Alloy, Bronze: Buffed **OR** Hand rubbed **OR** Hand rubbed, lacquered **OR** Medium satin **OR** Fine matte **OR** Statuary conversion **OR** Patina conversion, **as directed**.
- C. Security Fire Protection Cabinet
1. Cabinet Type: Suitable for fire extinguisher **OR** extinguisher and hose valve **OR** hose, rack, valve, and extinguisher **OR** hose, rack, and valve **OR** hose valve, **as directed**.
 2. Cabinet Construction: Nonrated **OR** 1-hour fire rated **OR** 2-hour fire rated, **as directed**.



- a. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls lined with minimum 5/8-inch- (16-mm-) thick, fire-barrier material.
3. Cabinet Material: 0.0677-inch- (1.7-mm-) thick steel **OR** 0.0966-inch- (2.5-mm-) thick steel **OR** 0.0781-inch- (2.0-mm-) thick, stainless-steel, **as directed**, sheet.
 - a. Shelf: Same metal and finish as cabinet.
4. Recessed Cabinet: Cabinet box recessed in walls of sufficient depth to suit style of trim indicated.
 - a. Exposed Flat Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
5. Semirecessed Cabinet: Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semirecessed cabinet installation.
 - a. Square-Edge Trim: 1-1/4- to 1-1/2-inch (32- to 38-mm) backbend depth.
 - b. Rolled-Edge Trim: 2-1/2-inch (64-mm) backbend depth.
6. Surface-Mounted Cabinet: Cabinet box fully exposed and mounted directly on wall; with no trim. Provide where walls are of insufficient depth for semirecessed cabinet installation.
7. Cabinet Trim Material: Steel sheet **OR** Stainless-steel sheet **OR** Same material and finish as door, **as directed**.
8. Door Material: 0.0966-inch- (2.5-mm-) thick steel **OR** 0.0781-inch- (2.0-mm-) thick, stainless-steel **OR** 0.1094-inch- (2.8-mm-) thick, stainless-steel, **as directed**, sheet.
9. Door Style: Solid opaque panel with frame.
10. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated, and as follows:
 - a. Recessed door pull.
 - b. Continuous Hinge: Same material and finish as trim, permitting door to open 180 degrees.
 - c. Mechanical Deadlock: Lockbolt retracted and extended by five-tumbler paracentric **OR** mogul, **as directed**, cylinder; keyed one side.
 - 1) Lockbolt: 1-1/2 inches high by 3/4 inch (38 mm high by 19 mm) thick; 5/8-inch (16-mm) throw.
 - d. Mechanical Deadlock: As specified in Division 08 Section "Detention Door Hardware".
 - e. Mechanical Snaplatch: Automatic snaplatch when closed; latchbolt retracted by five-tumbler paracentric **OR** mogul, **as directed**, cylinder; keyed one side.
 - 1) Lockbolt: 1 inch high by 7/16 inch (25 mm high by 11 mm) thick; 5/16-inch (8-mm) throw.
 - f. Mechanical Snaplatch: As specified in Division 08 Section "Detention Door Hardware".
11. Accessories:
 - a. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to security fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
 - b. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed.
 - 1) Identify fire extinguisher in security fire protection cabinet with the words "FIRE EXTINGUISHER."
 - a) Location: Applied to cabinet door **OR** location indicated on Drawings, **as directed**.
 - b) Application Process: Silk-screened **OR** Engraved **OR** Etched **OR** Decals **OR** Pressure-sensitive vinyl letters, **as directed**.
 - c) Lettering Color: Red **OR** Black **OR** White, **as directed**.
 - d) Orientation: Vertical **OR** Horizontal **OR** As indicated on Drawings, **as directed**.
 - c. Keys to Door Locks: Three per lock.
12. Finishes:
 - a. Manufacturer's standard baked-enamel paint for the following:



- 1) Exterior of cabinet door **OR** trim, **OR** door, and trim, **as directed**, except for those surfaces indicated to receive another finish.
- 2) Interior of cabinet and door, **as directed**.
- b. Steel: Factory primed for field painting **OR** Baked enamel or powder coat, **as directed**.
- c. Stainless Steel: No. 4 finish.

D. Fabrication

1. Fire Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
 - a. Weld joints and grind smooth.
 - b. Provide factory-drilled mounting holes.
 - c. Prepare doors and frames to receive locks.
 - d. Install door locks at factory.
2. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
 - a. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch (13 mm) thick.
 - b. Fabricate door frames of one-piece construction with edges flanged.
 - c. Miter and weld perimeter door frames.
3. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

E. General Finish Requirements

1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Protect mechanical finishes on exposed surfaces of fire protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
3. Finish fire protection cabinets after assembly.
4. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

F. Aluminum Finishes

1. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm **OR** AA-M12C22A31, Class II, 0.010 mm, **as directed**, or thicker.
2. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm **OR** AA-M12C22A32/A34, Class II, 0.010 mm, **as directed**, or thicker.
 - a. Color: Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black, **as directed**.
 - b. Color: As selected from full range of industry colors and color densities, **as directed**.
3. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

G. Steel Finishes

1. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning" **OR** SSPC-SP 8, "Pickling", **as directed**. After cleaning, apply a conversion coating suited to the organic coating to be applied over it, **as directed**.
2. Factory Prime Finish: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.
3. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).



- a. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

H. Stainless-Steel Finishes

1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - a. Run grain of directional finishes with long dimension of each piece.
 - b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - c. Directional Satin Finish: No. 4.
 - d. Dull Satin Finish: No. 6.
 - e. Reflective, Directional Polish: No. 7.
 - f. Mirrorlike Reflective, Nondirectional Polish: No. 8.
3. Bright, Cold-Rolled, Unpolished Finish: No. 2B.

I. Copper-Alloy Finishes

1. Buffed Finish, Lacquered: M21-O6x (Mechanical Finish: buffed, smooth specular; Coating: clear organic, air drying, as specified below).
 - a. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in 2 coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).
2. Hand-Rubbed Finish, Lacquered: M31-M34-O6x (Mechanical Finish: directionally textured, fine satin; Mechanical Finish: directionally textured, hand rubbed; Coating: clear organic, air drying, as specified below).
 - a. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in 2 coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).
3. Statuary Conversion Coating over Satin Finish: M31-C55 (Mechanical Finish: directionally textured, fine satin; Chemical Finish: conversion coating, sulfide).
 - a. Color: Match sample.
4. Patina Conversion Coating: CDA-M36-C12-C52 (Mechanical Finish: directionally textured, uniform; Chemical Finish: nonetched cleaned, degreased; Chemical Finish: conversion coating, ammonium sulfate).
 - a. Color: Match sample.

1.3 EXECUTION

A. Preparation

1. Prepare recesses for recessed and semirecessed fire protection cabinets as required by type and size of cabinet and trim style.

B. Installation

1. General: Install fire protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights indicated below: or, if not indicated, at heights acceptable to authorities having jurisdiction.
 - a. Fire Protection Cabinets: 54 inches (1372 mm) above finished floor to top of cabinet.
2. Fire Protection Cabinets: Fasten cabinets to structure, square and plumb.
 - a. Unless otherwise indicated, provide recessed fire protection cabinets. If wall thickness is not adequate for recessed cabinets, provide semirecessed fire protection cabinets.
 - b. Provide inside latch and lock for break-glass panels.
 - c. Fasten mounting brackets to inside surface of fire protection cabinets, square and plumb.
 - d. Fire-Rated, Hose and Valve **OR** Hose-Valve, **as directed**, Cabinets:
 - 1) Install cabinet with not more than 1/16-inch (1.6-mm) tolerance between pipe OD and knockout OD. Center pipe within knockout.



- 2) Seal through penetrations with firestopping sealant as specified in Division 07 Section "Penetration Firestopping".
 3. Identification: Apply decals **OR** vinyl lettering, **as directed**, at locations indicated.
- C. Adjusting And Cleaning
1. Remove temporary protective coverings and strippable films, if any, as fire protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
 2. Adjust fire protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
 3. On completion of fire protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
 4. Touch up marred finishes, or replace fire protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire protection cabinet and mounting bracket manufacturers.
 5. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 10 44 13 00



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SECTION 10 44 16 13 - FIRE EXTINGUISHERS

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for fire extinguishers. Product shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes portable, hand-carried and wheeled fire extinguishers and mounting brackets for fire extinguishers.
2. Owner-Furnished Material: Hand-carried **OR** Wheeled, **as directed**, fire extinguishers.

C. Submittals

1. Product Data: For each type of product indicated.
2. Operation and maintenance data.
3. Warranty: Sample of special warranty.

D. Quality Assurance

1. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
2. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
3. Preinstallation Conference: Conduct conference at Project site.
4. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

E. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within six years from date of Final Completion.
 - a. Failures include, but are not limited to, the following:
 - 1) Failure of hydrostatic test according to NFPA 10.
 - 2) Faulty operation of valves or release levers.

1.2 PRODUCTS

A. Portable, Hand-Carried Fire Extinguishers

1. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet **OR** mounting bracket **OR** fire protection cabinet and mounting bracket, **as directed**, indicated.
 - a. Valves: Manufacturer's standard **OR** Nickel-plated, polished brass body, **as directed**.
 - b. Handles and Levers: Manufacturer's standard **OR** Stainless steel, **as directed**.
 - c. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.
2. Stored-Pressure Water Type: UL-rated 2-A, 2.5-gal. (9.5-L) nominal capacity, with water in stainless-steel container; with pressure-indicating gage.
3. Stored-Pressure Antifreeze Water Type: UL-rated 2-A, 2.5-gal. (9.5-L) nominal capacity, with water and approved antifreeze solution mixed for temperatures as low as minus 40 deg F (minus 40 deg C) in stainless-steel container; with pressure-indicating gage.



4. Stored-Pressure Water-Mist Type: UL-rated 2-A:C, 2.5-gal. (9.5-L) nominal capacity, with water in enameled-steel container; with pressure-indicating gage.
5. Pressurized, AFFF-Foam Type: UL-rated 2-A:10-B, 1.6-gal. (6-L) **OR** 3-A:20-B, 2.5-gal. (9.5-L), **as directed**, nominal capacity, with AFFF foam in stainless-steel container; with pressure-indicating gage.
6. Pressurized, FFFP-Foam Type: UL-rated 3-A:20-B, 2.5-gal. (9.5-L) nominal capacity, with FFFP foam in stainless-steel container; with pressure-indicating gage.
7. Wet-Chemical Type: UL-rated 2-A:1-B:C:K, 1.6-gal. (6-L) **OR** 2.5-gal. (9.5-L), **as directed**, nominal capacity, with potassium acetate-based **OR** citrate-based **OR** carbonate-based, **as directed**, chemical in stainless-steel container; with pressure-indicating gage.
8. Regular Dry-Chemical Type: UL-rated <Insert capacity> nominal capacity, with sodium bicarbonate-based dry chemical in manufacturer's standard enameled container.
9. Regular Dry-Chemical Type in Steel Container: UL-rated 2-B:C, 1-lb (0.4-kg) **OR** 10-B:C, 2.5-lb (1.1-kg) **OR** 10-B:C, 5-lb (2.3-kg) **OR** 40-B:C, 5.5-lb (2.5-kg) **OR** 40-B:C, 6-lb (2.7-kg) **OR** 60-B:C, 10-lb (4.5-kg) **OR** 120-B:C, 20-lb (9.1-kg), **as directed**, nominal capacity, with sodium bicarbonate-based dry chemical in enameled-steel container.
10. Regular Dry-Chemical Type in Aluminum Container: UL-rated 2-B:C, 1-lb (0.4-kg) **OR** 10-B:C, 2.5-lb (1.1-kg) **OR** 10-B:C, 5-lb (2.3-kg) **OR** 40-B:C, 5.5-lb (2.5-kg) **OR** 60-B:C, 10-lb (4.5-kg) **OR** 120-B:C, 20-lb (9.1-kg), **as directed**, nominal capacity, with sodium bicarbonate-based dry chemical in enameled-aluminum container.
11. Regular Dry-Chemical Type in Brass Container: UL-rated 40-B:C, 6-lb (2.7-kg) **OR** 60-B:C, 10-lb (4.5-kg) **OR** 120-B:C, 20-lb (9.1-kg), **as directed**, nominal capacity, with sodium bicarbonate-based dry chemical in chrome-plated brass container.
12. Multipurpose Dry-Chemical Type: UL-rated <Insert capacity> nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.
13. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 1-A:10-B:C, 2.5-lb (1.1-kg) **OR** 2-A:10-B:C, 5-lb (2.3-kg) **OR** 3-A:40-B:C, 5-lb (2.3-kg) **OR** 3-A:40-B:C, 6-lb (2.7-kg) **OR** 4-A:60-B:C, 10-lb (4.5-kg) **OR** 20-A:120-B:C, 20-lb (9.1-kg), **as directed**, nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.
14. Multipurpose Dry-Chemical Type in Aluminum Container: UL-rated 1-A:10-B:C, 2.5-lb (1.1-kg) **OR** 2-A:10-B:C, 5-lb (2.3-kg) **OR** 3-A:40-B:C, 5-lb (2.3-kg) **OR** 3-A:40-B:C, 6-lb (2.7-kg) **OR** 4-A:60-B:C, 10-lb (4.5-kg) **OR** 20-A:120-B:C, 20-lb (9.1-kg), **as directed**, nominal capacity, with monoammonium phosphate-based dry chemical in enameled-aluminum container.
15. Multipurpose Dry-Chemical Type in Brass Container: UL-rated 2-A:10-B:C, 5-lb (2.3-kg) **OR** 3-A:40-B:C, 6-lb (2.7-kg) **OR** 4-A:60-B:C, 10-lb (4.5-kg) **OR** 4-A:80-B:C, 10-lb (4.5-kg) **OR** 20-A:120-B:C, 20-lb (9.1-kg), **as directed**, nominal capacity, with monoammonium phosphate-based dry chemical in chrome-plated brass container.
16. Purple-K Dry-Chemical Type in Aluminum Container: UL-rated 10-B:C, 2.5-lb (1.1-kg) **OR** 30-B:C, 5-lb (2.3-kg) **OR** 120-B:C, 20-lb (9.1-kg), **as directed**, nominal capacity, with potassium bicarbonate-based dry chemical in enameled-aluminum container.
17. Purple-K Dry-Chemical Type in Brass Container: UL-rated 80-B:C, 10-lb (4.5-kg) **OR** 120-B:C, 20-lb (9.1-kg), **as directed**, nominal capacity, with potassium bicarbonate-based dry chemical in chrome-plated brass container.
18. Carbon Dioxide Type: UL-rated 5-B:C, 5-lb (2.3-kg) **OR** 10-B:C, 10-lb (4.5-kg) **OR** 10-B:C, 15-lb (6.8-kg) **OR** 10-B:C, 20-lb (9.1-kg), **as directed**, nominal capacity, with carbon dioxide in manufacturer's standard enameled-metal **OR** enameled-steel **OR** enameled-aluminum, **as directed** container.
19. Dry-Powder Type: FMG-approved, **as directed**, UL-rated Class D, 30-lb (13.6-kg) nominal capacity, with sodium chloride-based **OR** copper-based, **as directed**, powder in enameled-steel container; with pressure-indicating gage.
20. Halon Type: UL-rated 5-B:C, 2.5-lb (1.1-kg) **OR** 10-B:C, 5-lb (2.3-kg), **as directed**, nominal capacity, in enameled-steel container; with pressure-indicating gage.
21. Clean-Agent Type in Aluminum Container: UL-rated 1-B:C, 1.4-lb (0.6-kg) **OR** 2-B:C, 2.5-lb (1.1-kg) **OR** 5-B:C, 5-lb (2.3-kg), **as directed**, nominal capacity, with HCFC Blend B agent and inert material in enameled-aluminum container; with pressure-indicating gage.



22. Clean-Agent Type in Brass Container: UL-rated 1-A:10-B:C, 11-lb (5-kg) **OR** 2-A:10-B:C, 15.5-lb (7-kg), **as directed**, nominal capacity, with HCFC Blend B agent and inert material in chrome-plated brass container; with pressure-indicating gage.
 23. Clean-Agent Type in Steel Container: UL-rated 5-B:C, 4.75-lb (2.2-kg) **OR** 1-A:10-B:C, 10-lb (4.5-kg) **OR** 2-A:10-B:C, 14-lb (6.4-kg), **as directed**, nominal capacity, with HFC blend agent and inert material in enameled-steel container; with pressure-indicating gage.
- B. Mounting Brackets
1. Mounting Brackets: Manufacturer's standard galvanized, **as directed**, steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red **OR** black, **as directed**, baked-enamel finish.
 2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.
 - a. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
 - 1) Orientation: Vertical **OR** Horizontal, **as directed**.
- C. Wheeled Fire Extinguishers
1. Wheeled Fire Extinguishers: Type, size, and capacity for locations indicated, complete with carriage.
 - a. Carriage: Fabricated from enameled-steel pipe, complete with hanger assembly, long-range nozzle, hose, and semipneumatic solid-rubber tires **OR** wide-rim wheels, **as directed**.
 - 1) Hose: 15 feet (4.6 m) **OR** 50 feet (15.2 m) **OR** 100 feet (30.5 m), **as directed**.
 2. Pressurized, FFFP-Foam Type: UL-rated 20-A:160-B, 33-gal. (125-L) nominal capacity, with FFFP foam in stainless-steel container.
 3. Regular Dry-Chemical Type: UL-rated 160-B:C, 50-lb (23-kg) **OR** 240-B:C, 150-lb (68-kg) **OR** 160-B:C, 250-lb (113-kg), **as directed**, nominal capacity, with sodium bicarbonate-based dry chemical in regulated-pressure **OR** stored-pressure **OR** direct-pressure, **as directed**, enameled-steel container.
 4. Multipurpose Dry-Chemical Type: UL-rated 20-A:160-B:C, 30-lb (13.6-kg) **OR** 30-A:160-B:C, 50-lb (23-kg) **OR** 40-A:240-B:C, 125-lb (57-kg) **OR** 40-A:160-B:C, 250-lb (113-kg), **as directed**, nominal capacity, with monoammonium phosphate-based dry chemical in regulated-pressure **OR** stored-pressure **OR** direct-pressure, **as directed**, enameled-steel **OR** enameled-aluminum, **as directed**, container.
 5. Purple-K Dry-Chemical Type: UL-rated 160-B:C, 50-lb (23-kg) **OR** 320-B:C, 125-lb (57-kg) **OR** 160-B:C, 250-lb (113-kg), **as directed**, nominal capacity, with potassium bicarbonate-based dry chemical in regulated-pressure **OR** stored-pressure **OR** direct-pressure, **as directed**, enameled-steel container.
 6. Carbon Dioxide Type: UL-rated 20-B:C, 50-lb (23-kg) **OR** 20-B:C, 100-lb (45-kg), **as directed**, nominal capacity, with carbon dioxide in manufacturer's standard enameled-metal **OR** enameled-steel **OR** enameled-aluminum, **as directed**, container.
 7. Dry-Powder Type: FMG-approved, **as directed**, UL-rated Class D, sodium chloride-based powder, 150-lb (68-kg) **OR** copper-based powder, 250-lb (113-kg), **as directed**, nominal capacity, in regulated-pressure, enameled-steel container; with pressure-indicating gage.
 8. Clean-Agent Type: UL-rated 4-A:40-B:C, 65-lb (29-kg) **OR** 10-A:80-B:C, 150-lb (68-kg), **as directed**, nominal capacity, with HCFC Blend B agent and inert material in stored-pressure, enameled-steel container; with pressure-indicating gage.

1.3 EXECUTION

A. Installation

1. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.



-
- a. Mounting Brackets: 54 inches (1372 mm) above finished floor to top of fire extinguisher. If NFPA 10 is the governing code, maximum mounting height for fire extinguishers weighing 40 lb (18 kg) or less shall be 60 inches (1524 mm); for those weighing more, maximum mounting height shall be 42 inches (1067 mm).
 2. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 10 44 16 13



Task	Specification	Specification Description
10 44 16 13	01 22 16 00	No Specification Required
10 44 16 13	10 44 13 00	Fire Protection Cabinets



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SECTION 10 51 13 00 - METAL LOCKERS

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for metal lockers. Product shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Standard metal lockers.
 - b. Heavy-duty metal lockers.
 - c. Athletic metal lockers.
 - d. Open-front athletic metal lockers.
 - e. Coin-operated metal lockers.
 - f. Locker benches.

C. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: For metal lockers. Include plans, elevations, sections, details, and attachments to other work.
3. Samples: For units with factory-applied color finishes.
4. Maintenance data.
5. Warranty: Sample of special warranty.

D. Quality Assurance

1. Regulatory Requirements: Where metal lockers and benches are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities" and ICC/ANSI A117.1.

E. Preinstallation Conference: Conduct conference at Project site.

1. Delivery, Storage, And Handling
2. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for their installation.
3. Deliver master and control keys **OR** combination control charts, **as directed**, to the Owner by registered mail or overnight package service.

F. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.
 - a. Warranty Period for Knocked-Down Metal Lockers: Two years from date of Final Completion.
 - b. Warranty Period for All-Welded Metal Lockers: Lifetime **OR** 10 years, **as directed**, from date of Final Completion.

1.2 PRODUCTS

A. Materials



1. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
2. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with A60 (ZF180) zinc-iron, alloy (galvannealed) coating designation.
3. Expanded Metal: ASTM F 1267, Type II (flattened), Class I, 3/4-inch (19-mm) steel mesh, with at least 70 percent open area.
4. Stainless-Steel Sheet: ASTM A 666, Type 304.
5. Plastic Laminate: NEMA LD 3, Grade HGP.
6. Extruded Aluminum: ASTM B 221 (ASTM B 221M), alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated.
7. Steel Tube: ASTM A 500, cold rolled.
8. Particleboard: ANSI A208.1, Grade M-2.
9. Fasteners: Zinc- or nickel-plated steel, slotless-type, exposed bolt heads; with self-locking nuts or lock washers for nuts on moving parts.
10. Anchors: Material, type, and size required for secure anchorage to each substrate.
 - a. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls, and elsewhere as indicated, for corrosion resistance.
 - b. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

B. Standard Metal Lockers

1. Locker Arrangement: Single tier **OR** Double tier **OR** Triple tier **OR** Box **OR** Two person **OR** Duplex **OR** 16 person **OR** As indicated on Drawings, **as directed**.
2. Material: Cold-rolled **OR** Metallic-coated, **as directed**, steel sheet.
3. Body: Assembled by riveting or bolting body components together. Fabricate from unperforated steel sheet as follows:
 - a. Tops, Bottoms, and Intermediate Dividers: 0.024-inch (0.61-mm) nominal thickness, with single bend at sides.
 - b. Backs and Sides: 0.024-inch (0.61-mm) nominal thickness, with full-height, double-flanged connections.
 - c. Shelves: 0.024-inch (0.61-mm) nominal thickness, with double bend at front and single bend at sides and back.
4. Frames: Channel formed; fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral door strike full height on vertical main frames.
 - a. Cross Frames between Tiers: Channel formed and fabricated from same material as main frames; welded to vertical main frames.
 - b. Frame Vents: Fabricate face frames with vents.
5. Doors: One piece; fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet; formed into channel shape with double bend at vertical edges and with right-angle single bend at horizontal edges.
 - a. Doors less than 12 inches (305 mm) wide may be fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet.
 - b. Doors for box lockers less than 15 inches (381 mm) wide may be fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet.
 - c. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches (381 mm) wide; welded to inner face of doors.
 - d. Stiffeners: Manufacturer's standard full-height stiffener fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet; welded to inner face of doors.
 - e. Sound-Dampening Panels: Manufacturer's standard, designed to stiffen doors and reduce sound levels when doors are closed, of die-formed metal with full perimeter flange and sound-dampening material; welded to inner face of doors.
 - f. Door Style: Unperforated panel. **OR** Vented panel as follows:, **as directed**,
 - 1) Louvered Vents: No fewer than six louver openings at top and bottom for single-tier **OR** three louver openings at top and bottom for double-tier **OR** two louver openings



- at top and bottom, or three louver openings at top or bottom, for triple-tier, **as directed**, lockers.
- 2) Security Vents: Manufacturer's standard, stamped horizontal or vertical.
 - 3) Perforated Vents: Manufacturer's standard shape and configuration.
 - 4) Concealed Vents: Slotted perforations in top and bottom horizontal return flanges of doors.
6. Hinges: Welded to door and attached to door frame with no fewer than two factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees; self-closing, **as directed**.
- a. Knuckle Hinges: Steel, full loop, five or seven knuckles, tight pin; minimum 2 inches (51 mm) high. Provide no fewer than three hinges for each door more than 42 inches (1067 mm) high.
 - b. Continuous Hinges: Manufacturer's standard, steel, full height.
7. Projecting Door Handle and Latch: Finger-lift latch control designed for use with either built-in combination locks or padlocks; positive automatic latching, chromium plated; pry and vandal resistant.
- a. Latch Hooks: Equip doors 48 inches (1219 mm) and higher with three latch hooks and doors less than 48 inches (1219 mm) high with two latch hooks; fabricated from 0.105-inch (2.66-mm) nominal-thickness steel sheet; welded or riveted to full-height door strikes; with resilient silencer on each latch hook.
 - b. Latching Mechanism: Manufacturer's standard, rattle-free latching mechanism and moving components isolated to prevent metal-to-metal contact, and incorporating a prelocking device that allows locker door to be locked while door is open and then closed without unlocking or damaging lock or latching mechanism.
8. Recessed Door Handle and Latch: Stainless-steel cup with integral door pull, recessed so locking device does not protrude beyond face of door; pry and vandal resistant.
- a. Multipoint Latching: Finger-lift latch control designed for use with built-in combination locks, built-in key locks, or padlocks; positive automatic latching and prelocking.
 - 1) Latch Hooks: Equip doors 48 inches (1219 mm) and higher with three latch hooks and doors less than 48 inches (1219 mm) high with two latch hooks; fabricated from 0.105-inch (2.66-mm) nominal-thickness steel sheet; welded or riveted to full-height door strikes; with resilient silencer on each latch hook.
 - 2) Latching Mechanism: Manufacturer's standard, rattle-free latching mechanism and moving components isolated with vinyl or nylon to prevent metal-to-metal contact, and incorporating a prelocking device that allows locker door to be locked while door is open and then closed without unlocking or damaging lock or latching mechanism.
 - b. Single-Point Latching: Nonmoving latch hook designed to engage bolt of built-in combination or cylinder lock **OR** with steel padlock loop that projects through recessed cup and is finished to match metal locker body, **as directed**.
 - 1) Latch Hook: Equip each door with one latch hook, fabricated from 0.105-inch (2.66-mm) nominal-thickness steel sheet; welded midway up full-height door strike; with resilient silencer.
9. Door Handle and Latch for Box **OR** 16-Person, **as directed**, Lockers: Stainless-steel strike plate with integral pull; with steel padlock loop that projects through metal locker door.
10. Combination Padlocks: Key-controlled, three-number dialing combination locks; capable of five combination changes **OR** Provided by the Owner, **as directed**.
11. Built-in Combination Locks: Key-controlled, three-number dialing combination locks; capable of at least five combination changes made automatically with a control key.
- a. Bolt Operation: Manually locking deadbolt **OR** automatically locking spring bolt, **as directed**.
12. Cylinder Locks: Built-in, flush, cam locks with five-pin tumbler keyway, keyed separately and master keyed. Furnish two change keys for each lock and two, **as directed**, master keys.
- a. Key Type: Flat **OR** Grooved, **as directed**, with minimum 2- by 2.68-inch (51- by 68.3-mm) key head for accessible lockers, **as directed**.
 - b. Bolt Operation: Manually locking deadbolt **OR** automatically locking spring bolt, **as directed**.



13. Equipment: Equip each metal locker with identification plate and the following unless otherwise indicated:
 - a. Single-Tier Units: Shelf, one double-prong ceiling hook, and two single-prong wall hooks.
 - b. Double-Tier Units: One double-prong ceiling hook and two single-prong wall hooks.
 - c. Triple-Tier **OR** Box, **as directed**, Units: One double-prong ceiling hook.
 - d. Coat Rods: As indicated on Drawings **OR** For each compartment of single-tier, double-tier, and triple-tier metal lockers **OR** In lieu of ceiling hook for metal lockers 24 inches (610 mm) high or more **OR** In lieu of ceiling hook for metal lockers 18 inches (457 mm) deep or more, **as directed**.
14. Accessories:
 - a. Legs: 6 inches (152 mm) high; formed by extending vertical frame members, or fabricated from 0.075-inch (1.90-mm) nominal-thickness steel sheet; welded to bottom of locker.
 - 1) Closed Front and End Bases: Fabricated from 0.036-inch (0.91-mm) nominal-thickness steel sheet.
 - b. Continuous Zee Base: Fabricated from 0.060-inch (1.52-mm) **OR** 0.075-inch (1.90-mm) **OR** manufacturer's standard thickness, but not less than 0.060-inch (1.52-mm), **as directed**, nominal-thickness steel sheet.
 - 1) Height: 4 inches (102 mm).
 - c. Continuous Sloping Tops: Fabricated from 0.036-inch (0.91-mm) **OR** 0.048-inch (1.21-mm) **OR** manufacturer's standard thickness, but not less than 0.036-inch (0.91-mm), **as directed**, nominal-thickness steel sheet.
 - 1) Closures: Vertical-end **OR** Hipped-end, **as directed**, type.
 - 2) Sloping-top corner fillers, mitered.
 - d. Individual Sloping Tops: Fabricated from 0.024-inch (0.61-mm) nominal-thickness steel sheet.
 - e. Recess Trim: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet.
 - f. Filler Panels: Fabricated from 0.036-inch (0.91-mm) **OR** 0.048-inch (1.21-mm) **OR** manufacturer's standard thickness, but not less than 0.036-inch (0.91-mm), **as directed**, nominal-thickness steel sheet.
 - g. Boxed End Panels: Fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet.
 - h. Finished End Panels: Fabricated from 0.024-inch (0.61-mm) nominal-thickness steel sheet.
 - i. Center Dividers: Fabricated from 0.024-inch (0.61-mm) nominal-thickness steel sheet.
15. Finish: Baked enamel **OR** Powder coat, **as directed**.
 - a. Color(s): As selected from manufacturer's full range **OR** Two colors, with door one color and frame and body another color; as selected from manufacturer's full range, **as directed**.

C. Heavy-Duty Metal Lockers

1. Locker Arrangement: Single tier **OR** Double tier **OR** Triple tier **OR** As indicated on Drawings, **as directed**.
2. Material: Cold-rolled steel sheet.
3. Body: Assembled by welding body components together. Fabricate from unperforated steel sheet with thicknesses as follows:
 - a. Tops, Bottoms, and Sides: 0.060-inch (1.52-mm) nominal thickness.
 - b. Backs: 0.048-inch (1.21-mm) nominal thickness.
 - c. Shelves: 0.060-inch (1.52-mm) nominal thickness, with double bend at front and single bend at sides and back.
4. Frames: Channel formed; fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral door strike full height on vertical main frames.
 - a. Cross Frames between Tiers: Channel formed and fabricated from same material as main frames; welded to vertical main frames.
5. Doors: One piece; fabricated from 0.075-inch (1.90-mm) nominal-thickness steel sheet; formed into channel shape with double bend at vertical edges and with right-angle single bend at horizontal edges.



- a. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches (381 mm) wide; welded to inner face of doors.
- b. Door Style:
 - 1) Louvered Vents: No fewer than six louver openings at top and bottom for single-tier **OR** three louver openings at top and bottom for double-tier **OR** two louver openings at top and bottom, or three louver openings at top or bottom, for triple-tier, **as directed**, lockers.
 - 2) Security Vents: Manufacturer's standard, stamped horizontal or vertical.
 - 3) Perforated Vents: Manufacturer's standard shape and configuration.
6. Hinges: Welded to door and attached to door frame with no fewer than two factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees; self-closing, **as directed**.
 - a. Knuckle Hinges: Steel, full loop, five or seven knuckles, tight pin; minimum 2 inches (51 mm) high. Provide no fewer than three hinges for each door more than 42 inches (1067 mm) high.
 - b. Continuous Hinges: Manufacturer's standard, steel, full height.
7. Recessed Door Handle and Latch: Stainless-steel cup with integral door pull, recessed so locking device does not protrude beyond face of door; pry and vandal resistant.
 - a. Multipoint Latching: Finger-lift latch control designed for use with built-in combination locks or padlocks; positive automatic latching and prelocking.
 - 1) Latch Hooks: Equip doors 48 inches (1219 mm) and higher with three latch hooks and doors less than 48 inches (1219 mm) high with two latch hooks; fabricated from 0.120-inch (3.04-mm) nominal-thickness steel sheet; welded to full-height door strikes; with resilient silencer on each latch hook.
 - 2) Latching Mechanism: Manufacturer's standard, rattle-free latching mechanism and moving components isolated to prevent metal-to-metal contact, and incorporating a prelocking device that allows locker door to be locked while door is open and then closed without unlocking or damaging lock or latching mechanism.
 - b. Single-Point Latching: Nonmoving latch hook designed to engage bolt of built-in combination or cylinder lock **OR** with steel padlock loop that projects through recessed cup and is finished to match metal locker body, **as directed**.
 - 1) Latch Hook: Equip each door with one latch hook, fabricated from 0.120-inch (3.04-mm) nominal-thickness steel sheet; welded midway up full-height door strike; with resilient silencer.
8. Combination Padlocks: Key-controlled, three-number dialing combination locks; capable of five combination changes **OR** Provided by the Owner, **as directed**.
9. Built-in Combination Locks: Key-controlled, three-number dialing combination locks; capable of at least five combination changes made automatically with a control key.
 - a. Bolt Operation: Manually locking deadbolt **OR** automatically locking spring bolt, **as directed**.
10. Equipment: Equip each metal locker with identification plate and the following unless otherwise indicated:
 - a. Single-Tier Units: Shelf, one double-prong ceiling hook, and two single-prong wall hooks.
 - b. Double-Tier Units: One double-prong ceiling hook and two single-prong wall hooks.
 - c. Triple-Tier Units: One double-prong ceiling hook.
 - d. Coat Rods: As indicated on Drawings **OR** For each compartment of single-tier, double-tier and triple-tier metal lockers **OR** In lieu of ceiling hook for metal lockers 24 inches (610 mm) high or more **OR** In lieu of ceiling hook for metal lockers 18 inches (457 mm) deep or more.
11. Accessories:
 - a. Legs: 6 inches (152 mm) high; formed by extending vertical frame members, or fabricated from 0.075-inch (1.90-mm) nominal-thickness steel sheet; welded to bottom of locker.
 - 1) Closed Front and End Bases: Fabricated from 0.036-inch (0.91-mm) nominal-thickness steel sheet.
 - b. Continuous Zee Base: Fabricated from, 0.060-inch (1.52-mm) **OR** 0.075-inch (1.90-mm) **OR** manufacturer's standard thickness, but not less than 0.060-inch (1.52-mm), **as directed**, nominal-thickness steel sheet.



- 1) Height: 4 inches (102 mm).
- c. Continuous Sloping Tops: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet, with a pitch of approximately 20 degrees.
 - 1) Closures: Vertical-end **OR** Hipped-end, **as directed**, type.
- d. Recess Trim: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet.
- e. Filler Panels: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet.
- f. Boxed End Panels: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet.
12. Finish: Baked enamel **OR** Powder coat, **as directed**.
 - a. Color(s): As selected from manufacturer's full range **OR** Two colors, with door one color and frame and body another color; as selected from manufacturer's full range, **as directed**.

D. Athletic Metal Lockers

1. Locker Arrangement: Single tier **OR** Double tier **OR** Triple tier **OR** Box **OR** As indicated on Drawings, **as directed**.
2. Material: Cold-rolled **OR** Metallic-coated, **as directed**, steel sheet.
3. Body: Assembled by welding **OR** riveting or bolting, **as directed**, body components together. Fabricate from unperforated steel sheet with thicknesses as follows:
 - a. Tops and Bottoms: 0.060-inch (1.52-mm) nominal thickness, with single bend at edges.
 - b. Backs: 0.048-inch (1.21-mm) nominal thickness.
 - c. Shelves: 0.060-inch (1.52-mm) nominal thickness, with double bend at front and single bend at sides and back.
4. Unperforated Sides: Fabricated from 0.048-inch (1.21-mm) **OR** 0.060-inch (1.52-mm), **as directed**, nominal-thickness steel sheet.
5. Perforated Sides: Fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet with manufacturer's standard diamond perforations.
6. Expanded-Metal Sides: Fabricated from 0.090-inch (2.28-mm) nominal-thickness expanded metal; welded to 0.105-inch (2.66-mm) nominal-thickness steel angles or 0.060-inch (1.52-mm) nominal-thickness steel channel frames.
7. Frames: Channel formed; fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet or 0.097-inch (2.45-mm) nominal-thickness steel angles; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral door strike full height on vertical main frames.
 - a. Cross Frames for Double-Tier **OR** Triple-Tier, **as directed**, Lockers: Channel formed and fabricated from same material as main frames; welded to vertical main frames.
8. Reinforced Bottoms: Structural channels, formed from 0.060-inch (1.52-mm) **OR** 0.075-inch (1.90-mm), **as directed**, nominal-thickness steel sheet; welded to front and rear of side-panel frames.
9. Perforated Doors: One piece; fabricated from 0.075-inch (1.90-mm) nominal-thickness steel sheet with manufacturer's standard diamond perforations; formed into channel shape with double bend at vertical edges and with right-angle single bend at horizontal edges and latch point (bottom) and right-angle single bend at remaining edges for box lockers.
 - a. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches (381 mm) wide; welded to inner face of doors.
10. Expanded-Metal Doors: Fabricated from 0.090-inch (2.28-mm) nominal-thickness expanded metal; welded to 0.105-inch (2.66-mm) nominal-thickness steel angle frame; with 0.090-inch (2.28-mm) nominal-thickness, steel sheet lock panel backed by 0.060-inch (1.52-mm) nominal-thickness steel sheet retainer welded to door frame.
11. Hinges: Welded to door and attached to door frame with no fewer than two factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees; self-closing, **as directed**.
 - a. Knuckle Hinges: Steel, full loop, five or seven knuckles, tight pin; minimum 2 inches (51 mm) high. Provide no fewer than three hinges for each door more than 42 inches (1067 mm) high.
 - b. Continuous Hinges: Manufacturer's standard, steel; side or top mounted as required by locker configuration.



- c. Hinges: Manufacturer's standard, steel continuous or knuckle type.
12. Recessed Door Handle and Latch: Stainless-steel cup with integral door pull, recessed so locking device does not protrude beyond face of door; pry and vandal resistant.
- a. Multipoint Latching: Finger-lift latch control designed for use with built-in combination locks, built-in cylinder locks, or padlocks; positive automatic latching and prelocking.
- 1) Latch Hooks: Equip doors 48 inches (1219 mm) and higher with three latch hooks and doors less than 48 inches (1219 mm) high with two latch hooks; fabricated from 0.120-inch (3.04-mm) nominal-thickness steel sheet; welded to full-height door strikes; with resilient silencer on each latch hook.
- 2) Latching Mechanism: Manufacturer's standard, rattle-free latching mechanism and moving components isolated to prevent metal-to-metal contact, and incorporating a prelocking device that allows locker door to be locked while door is open and then closed without unlocking or damaging lock or latching mechanism.
- b. Single-Point Latching: Nonmoving latch hook designed to engage bolt of built-in combination or cylinder lock **OR** with steel padlock loop that projects through recessed cup and is finished to match metal locker body, **as directed**.
- 1) Latch Hook: Equip each door with one latch hook, fabricated from 0.120-inch (3.04-mm) nominal-thickness steel sheet; welded midway up full-height door strike; with resilient silencer.
13. Projecting Turn-Handle and Latch: Steel handle welded to manufacturer's standard, three-point, cremone-type latching mechanism consisting of steel rods or bars that engage main locker frame at top and bottom of door, and center latch that engages strike jamb; with steel padlock loop.
14. Door Handle and Latch for Box Lockers: Stainless-steel strike plate with integral pull; with steel padlock loop that projects through metal locker door.
15. Combination Padlocks: Key-controlled, three-number dialing combination locks; capable of five combination changes **OR** Provided by the Owner, **as directed**.
16. Built-in Combination Locks: Key-controlled, three-number dialing combination locks; capable of at least five combination changes made automatically with a control key.
- a. Bolt Operation: Manually locking deadbolt **OR** automatically locking spring bolt, **as directed**.
17. Cylinder Locks: Built-in, flush, cam locks with five-pin tumbler keyway, keyed separately and master keyed. Furnish two change keys for each lock and two, **as directed**, master keys.
- a. Key Type: Flat **OR** Grooved, **as directed**, with minimum 2- by 2.68-inch (51- by 68.3-mm) key head for accessible lockers, **as directed**.
- b. Bolt Operation: Manually locking deadbolt **OR** automatically locking spring bolt, **as directed**.
18. Equipment: Equip each metal locker with identification plate and the following unless otherwise indicated:
- a. Single-Tier Units: Shelf, one double-prong ceiling hook, and two single-prong wall hooks.
- b. Double-Tier Units: One double-prong ceiling hook and two single-prong wall hooks.
- c. Triple-Tier Units: One double-prong ceiling hook.
- d. Coat Rods: As indicated on Drawings **OR** For each compartment of single-tier, double-tier and triple-tier metal lockers **OR** In lieu of ceiling hook for metal lockers 24 inches (610 mm) high or more **OR** In lieu of ceiling hook for metal lockers 18 inches (457 mm) deep or more, **as directed**.
19. Accessories:
- a. Legs: 6 inches (152 mm) high; formed by extending vertical frame members, or fabricated from 0.075-inch (1.90-mm) nominal-thickness steel sheet; welded to bottom of locker.
- 1) Closed Front and End Bases: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet.
- b. Continuous Zee Base: 4 inches (102 mm) high; fabricated from 0.075-inch (1.90-mm) nominal-thickness steel sheet.
- c. Continuous Sloping Tops: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet, with a pitch of approximately 20 degrees.
- 1) Closures: Vertical-end **OR** Hipped-end, **as directed**, type.
- d. Recess Trim: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet.



- e. Filler Panels: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet.
 - f. Boxed End Panels: Fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet.
20. Finish: Baked enamel **OR** Powder coat, **as directed**.
- a. Color(s): As selected from manufacturer's full range **OR** Two colors, with door one color and frame and body another color; as selected from manufacturer's full range, **as directed**.

E. Open-Front Athletic Metal Lockers

1. Locker Arrangement: Open front, with seat/shelf **OR** seat/footlocker, upper shelf **OR** upper shelf with security box **OR** full-width security compartment **OR** configuration as indicated on Drawings, **as directed**.
2. Material: Cold-rolled **OR** Metallic-coated, **as directed**, steel sheet.
3. Body: Assembled by welding **OR** riveting or bolting, **as directed**, body components together. Fabricate from unperforated steel sheet with thicknesses as follows:
 - a. Tops and Bottoms: 0.060-inch (1.52-mm) nominal thickness, with single bend at edges.
 - b. Backs: 0.048-inch (1.21-mm) nominal thickness.
 - c. Shelves: 0.060-inch (1.52-mm) nominal thickness, with double bend at front and single bend at sides and back.
4. Unperforated Sides: Fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet.
5. Perforated Sides: Fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet with manufacturer's standard diamond perforations. Perforations shall not occur above upper shelf **OR** at security compartment **OR** at seat/footlocker, **as directed**.
6. Expanded-Metal Sides: Fabricated from 0.090-inch (2.28-mm) nominal-thickness expanded metal; welded to 0.105-inch (2.66-mm) nominal-thickness steel angles or 0.060-inch (1.52-mm) nominal-thickness steel channel frames.
7. Frames: Channel formed; fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet or 0.105-inch (2.66-mm) nominal-thickness steel angles; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames.
8. Reinforced Bottoms: Structural channels, formed from 0.075-inch (1.90-mm) nominal-thickness steel sheet; welded to front and rear of side-panel frames.
9. Seats/Shelves: Full width of metal locker; channel formed; fabricated from 0.075-inch (1.90-mm) nominal-thickness steel sheet; with stiffeners for reinforcement.
10. Seats/Footlockers: Enclosure full width of bottom of metal locker; fabricated from cold-rolled steel sheet.
 - a. Seat/Lid: 0.075-inch (1.90-mm) nominal-thickness steel sheet; channel formed and reinforced with stiffeners; with manufacturer's standard, steel continuous hinge that is completely concealed and tamper resistant when seat/lid is closed; with padlock hasp.
 - b. Front Panel: 0.075-inch (1.90-mm) nominal-thickness steel sheet; channel formed at top edge; with minilouvers for ventilation; recessed for padlock loop.
 - c. Sides: Integral part of unperforated **OR** Unperforated bottom portions of perforated **OR** 0.060-inch (1.52-mm) nominal-thickness steel sheet inside expanded-metal, **as directed**, sides.
11. Security Boxes: Consisting of partition extending from upper shelf to top of metal locker, fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet; with channel-formed, 0.060-inch (1.52-mm) nominal-thickness, steel sheet door frame, and door fabricated from 0.075-inch (1.90-mm) nominal-thickness steel sheet with right-angle single bend at edges; with manufacturer's standard, steel continuous hinge that is completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees.
 - a. Single-Point Latching: Stainless-steel strike plate with integral pull; with steel, nonmoving latch hook designed to engage bolt of built-in combination or cylinder lock **OR** with steel padlock loop that projects through door and is finished to match metal locker body, **as directed**.
12. Security Compartments: Full width of metal locker, with door fabricated from 0.075-inch (1.90-mm) nominal-thickness steel sheet.
13. Combination Padlocks: Key-controlled, three-number dialing combination locks; capable of five combination changes **OR** Provided by the Owner, **as directed**.



14. Built-in Combination Locks: Key-controlled, three-number dialing combination locks; capable of at least five combination changes made automatically with a control key.
 - a. Bolt Operation: Manually locking deadbolt **OR** automatically locking spring bolt, **as directed**.
15. Cylinder Locks: Built-in, flush, cam locks with five-pin tumbler keyway, keyed separately and master keyed. Furnish two change keys for each lock and two, **as directed**, master keys.
 - a. Key Type: Flat **OR** Grooved, **as directed**, with minimum 2- by 2.68-inch (51- by 68.3-mm) key head for accessible lockers, **as directed**.
 - b. Bolt Operation: Manually locking deadbolt **OR** automatically locking spring bolt, **as directed**.
16. Equipment: Equip each metal locker with identification plate and the following unless otherwise indicated:
 - a. Two single-prong wall hooks bolted to locker back.
 - b. Coat rod and two rod holders.
17. Accessories:
 - a. Continuous Sloping Tops: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet, with a pitch of approximately 20 degrees.
 - 1) Closures: Vertical-end **OR** Hipped-end, **as directed**, type.
 - b. Recess Trim: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet.
 - c. Filler Panels: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet.
 - d. Boxed End Panels: Fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet.
18. Finish: Baked enamel **OR** Powder coat, **as directed**.
 - a. Color(s): As selected from manufacturer's full range **OR** Two colors; as selected from manufacturer's full range, **as directed**.

F. Coin-Operated Metal Lockers

1. Steel Lockers: Fabricated from cold-rolled steel sheet with thicknesses as follows:
 - a. Tops, Bottoms, Sides, and Shelves: 0.024-inch (0.61-mm) nominal thickness.
 - b. Backs: 0.036-inch (0.91-mm) nominal thickness.
 - c. Frames: 0.060-inch (1.52-mm) nominal thickness.
 - d. Doors: 0.060-inch (1.52-mm) nominal thickness.
 - e. Exposed Ends of Nonrecessed Lockers: 0.060-inch (1.52-mm) nominal thickness.
2. Stainless-Steel Lockers: Fabricated from stainless-steel sheet with thicknesses and finishes as follows:
 - a. Tops, Bottoms, Sides, Backs, and Shelves: 0.025 inch (0.64 mm) thick, with No. 2B finish.
 - b. Frames: 0.062 inch (1.59 mm) thick, with No. 3 or No. 4 finish.
 - c. Doors: 0.062 inch (1.59 mm) thick, with manufacturer's standard patterned finish.
 - d. Exposed Ends of Nonrecessed Lockers: 0.062 inch (1.59 mm) thick, with No. 3 or No. 4 finish.
3. Body: Assembled by welding or riveting body components to frames using manufacturer's standard aluminum or stainless-steel rivets; flanged for double thickness at back vertical corners; back ventilated.
4. Frames: Channel formed; lapped and welded at corners; with top, bottom, and cross frames welded into vertical main frames. Form continuous, integral door strike full height on vertical main frames, and equip frames with resilient bumpers to cushion door closing.
 - a. Cross Frames between Tiers: Channel formed and fabricated from same material as main frames; welded to vertical main frame.
5. Doors: One piece; formed into channel shape at vertical edges and flanged at right angles at horizontal edges; fabricated to swing 180 degrees. Brace or reinforce inner face of doors with manufacturer's standard reinforcing angles, channels, or stiffener panels.
6. Hinges: Manufacturer's standard, full-loop, five- or seven-knuckle type; tight pin; minimum 2-1/2 inches (64 mm) high or continuous type, of same material as door; self-closing, **as directed**. Weld hinge to inside of door frame and attach hinge to door with factory-installed fasteners that are completely concealed and tamper resistant when door is closed.
 - a. Provide at least three hinges for each door more than 42 inches (1067 mm) high.
7. Projecting Door Handle: Manufacturer's standard; stainless steel; pry and vandal resistant.



8. Built-in, Coin-Operated Locks: Self-contained units mounted on interior of door with replaceable lock cylinders keyed separately and master keyed. Mount instruction decals on both faces of door. Furnish one change key for each lock and one master key.
 - a. Bolt Operation: Manually locking deadbolt **OR** automatically locking spring bolt, **as directed**.
 - b. Lock Type: Fee return/deposit **OR** collect/pay, **as directed**.
 - c. Fee Type: Token **OR** Coin, one quarter **OR** Coin, two quarters, **as directed**.
 - d. Coin Box: Manufacturer's standard housing or stainless-steel cash box with stainless-steel flanged cover set into base of lock channel frame. Furnish with removable cylinder and key, and master code changer key.
9. Finish: Baked enamel **OR** Powder coat, **as directed**.
 - a. Color(s): As selected from manufacturer's full range **OR** Two colors, with door one color and frame and body another color; as selected from manufacturer's full range, **as directed**.

G. Keyless Locks

1. Built-in, Card-Operated Locks: Self-contained units mounted on interior of door with replaceable lock cylinders keyed separately and master keyed. Mount instruction decals on both faces of door. Furnish one change card key for each lock and one master card key.
 - a. Bolt Operation: Manually locking deadbolt **OR** automatically locking spring bolt, **as directed**.
2. Digital Keypad Locks: Battery-powered electronic keypad with reprogrammable manager and the Owner codes that override access. Three consecutive incorrect code entries shall disable lock for three minutes.
 - a. Designed for permanently assigned access via entry of user's four-digit code.
 - b. Designed for shared or temporary access by multiple users, with user-defined code to lock and unlock. Provide LED indicator to show when lock is in use.

H. Locker Benches

1. Provide bench units with overall assembly height of 17-1/2 inches (445 mm).
2. Bench Tops: Manufacturer's standard one-piece units, with rounded corners and edges.
 - a. Size: Minimum 9-1/2 inches wide by 1-1/4 inches thick (241 mm wide by 32 mm thick) except provide minimum 20-inch- (508-mm-) wide tops where accessible benches are indicated.
 - b. Laminated clear hardwood with one coat of clear sealer on all surfaces and one coat of clear lacquer on top and sides.
 - c. Plastic laminate over particleboard core, with two steel tubes running full length of top and positioned to receive pedestal fasteners.
 - 1) Color: As selected from manufacturer's full range.
 - d. Extruded aluminum with clear anodic finish.
3. Fixed Pedestals: Manufacturer's standard supports, with predrilled fastener holes for attaching bench top and anchoring to floor, complete with fasteners and anchors, and as follows:
 - a. Tubular Steel: 1-1/2-inch- (38-mm-) diameter steel tubing threaded on both ends, with standard pipe flange at top and bell-shaped cast-iron base; with baked-enamel or powder-coat finish; anchored with exposed fasteners.
 - 1) Color: As selected from manufacturer's full range.
 - b. Tubular Steel: 1-1/4-inch- (32-mm-) diameter steel tubing, with 0.1265-inch- (3.2-mm-) thick steel flanges welded at top and base; with baked-enamel **OR** zinc-plated, **as directed**, finish; anchored with exposed fasteners.
 - 1) Color: As selected from manufacturer's full range.
4. Freestanding Pedestals: Manufacturer's standard supports, with predrilled fastener holes for attaching bench top, complete with fasteners, and as follows:
 - a. Aluminum: 1/8-inch-thick by 3-inch-wide (3-mm-thick by 76-mm-wide) channel or 1/4-inch-thick by 3-inch-wide (6-mm-thick by 76-mm-wide) bar stock, shaped into trapezoidal **OR** inverted-T, **as directed**, form; with nonskid pads at bottom.
 - 1) Finish: Clear **OR** Black **OR** Gold, **as directed**, anodic finish.



- b. Stainless Steel: 1/8-inch-thick by 3-inch-wide (3-mm-thick by 76-mm-wide) channel or 1/4-inch-thick by 3-inch-wide (6-mm-thick by 76-mm-wide) bar stock, shaped into trapezoidal form; with nonskid pads at bottom. Add finish.

I. Fabrication

1. Fabricate metal lockers square, rigid, and without warp and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.
 - a. Form body panels, doors, shelves, and accessories from one-piece steel sheet unless otherwise indicated.
 - b. Provide fasteners, filler plates, supports, clips, and closures as required for complete installation.
2. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments. Factory weld frame members of each metal locker together to form a rigid, one-piece assembly.
3. Knocked-Down Construction: Fabricate metal lockers using nuts, bolts, screws, or rivets for nominal assembly at Project site **OR** preassembly at plant prior to shipping, **as directed**.
4. All-Welded Construction: Factory preassemble metal lockers by welding all joints, seams, and connections; with no bolts, nuts, screws, or rivets used in assembly of main locker groups. Factory weld main locker groups into one-piece structures. Grind exposed welds flush.
5. Accessible Lockers: Fabricate as follows:
 - a. Locate bottom shelf no lower than 15 inches (381 mm) above the floor.
 - b. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches (1219 mm) above the floor.
6. Hooks: Manufacturer's standard ball-pointed type, aluminum or steel; zinc plated.
7. Coat Rods: Fabricated from 1-inch- (25-mm-) **OR** 3/4-inch- (19-mm-), **as directed**, diameter steel, chrome finished **OR** nickel plated, **as directed**.
8. Identification Plates: Manufacturer's standard, etched, embossed, or stamped aluminum **OR** plastic, **as directed**, plates, with numbers and letters at least 3/8 inch (9 mm) high.
9. Continuous Base: Formed into channel or zee profile for stiffness, and fabricated in lengths as long as practical to enclose base and base ends of metal lockers; finished to match lockers.
10. Continuous Sloping Tops: Fabricated in lengths as long as practical, without visible fasteners at splice locations; finished to match lockers.
 - a. Sloping-top corner fillers, mitered.
11. Individual Sloping Tops: Fabricated in width to fit one locker frame in lieu of flat locker tops; with integral back; finished to match lockers. Provide wedge-shaped divider panels between lockers.
12. Recess Trim: Fabricated with minimum 2-1/2-inch (64-mm) face width and in lengths as long as practical; finished to match lockers.
13. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip-joint filler angle formed to receive filler panel.
14. Boxed End Panels: Fabricated with 1-inch- (25-mm-) wide edge dimension, and designed for concealing fasteners and holes at exposed ends of nonrecessed metal lockers; finished to match lockers.
 - a. Provide one-piece panels for double-row (back-to-back) locker ends.
15. Finished End Panels: Designed for concealing unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.
 - a. Provide one-piece panels for double-row (back-to-back) locker ends.
16. Center Dividers: Full-depth, vertical partitions between bottom and shelf; finished to match lockers.

J. Steel Sheet Finishes

1. Factory finish steel surfaces and accessories except stainless-steel and chrome-plated surfaces.
2. Baked-Enamel Finish: Immediately after cleaning, pretreating, and phosphatizing, apply manufacturer's standard thermosetting baked-enamel finish. Comply with paint manufacturer's written instructions for application, baking, and minimum dry film thickness.



3. Powder-Coat Finish: Immediately after cleaning and pretreating, electrostatically apply manufacturer's standard, baked-polymer, thermosetting powder finish. Comply with resin manufacturer's written instructions for application, baking, and minimum dry film thickness.

K. Stainless-Steel Finishes

1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - a. Run grain of directional finishes with long dimension of each piece.
 - b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

1.3 EXECUTION

A. Installation

1. General: Install level, plumb, and true; shim as required, using concealed shims.
 - a. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches (910 mm) o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
 - b. Anchor single rows of metal lockers to walls near top and bottom of lockers **OR** of lockers and to floor, **as directed**.
 - c. Anchor back-to-back metal lockers to floor.
2. Knocked-Down Metal Lockers: Assemble with standard fasteners, with no exposed fasteners on door faces or face frames.
3. All-Welded Metal Lockers: Connect groups together with standard fasteners, with no exposed fasteners on face frames.
4. Equipment and Accessories: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.
 - a. Attach hooks with at least two fasteners.
 - b. Attach door locks on doors using security-type fasteners.
 - c. Identification Plates: Identify metal lockers with identification indicated on Drawings.
 - 1) Attach plates to each locker door, near top, centered, with at least two aluminum rivets.
 - 2) Attach plates to upper shelf of each open-front metal locker, centered, with a least two aluminum rivets.
 - d. Attach recess trim to recessed metal lockers with concealed clips.
 - e. Attach filler panels with concealed fasteners. Locate filler panels where indicated on Drawings.
 - f. Attach sloping-top units to metal lockers, with closures at exposed ends.
 - g. Attach boxed end panels with concealed fasteners to conceal exposed ends of nonrecessed metal lockers.
 - h. Attach finished end panels with fasteners only at perimeter to conceal exposed ends of nonrecessed metal lockers.
5. Fixed Locker Benches: Provide no fewer than two pedestals for each bench, uniformly spaced not more than 72 inches (1830 mm) apart. Securely fasten tops of pedestals to undersides of bench tops, and anchor bases to floor.
6. Freestanding Locker Benches: Place benches in locations indicated on Drawings.

B. Adjusting, Cleaning, And Protection

1. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding. Verify that integral locking devices operate properly.
2. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.



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3. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION 10 51 13 00



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SECTION 10 51 13 00a - WIRE BASKET LOCKERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for wire basket lockers. Product shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Shop Drawings: Submitted shop drawings showing individual locker construction and overall dimensions, including complete installation instructions.

C. Product Handling

1. Store locker components flat until assembly. Protect all finishes from soiling and damage during handling.

D. Warranty

1. Manufacturer shall warranty lockers for a period of 10 years against rust and other types of corrosion, or breakage of any of the baskets and shelves under normal use.

1.2 PRODUCTS

A. Materials

1. Wire Basket Racks:
 - a. Shelving: Shelving units shall consist of minimum 13 ga. steel angle posts punched for bolting shelves.
 - b. Sway Braces: Minimum 12 ga. steel for back and sides of unit.
 - c. Shelves: Minimum 20 ga. formed steel, with down turned flanges at the back to act as backstop and to prevent removal from rear.
 - d. Dividers: Minimum 20 ga., 3-inches in height, with an attaching flange formed at right angles. Dividers shall be bolted to shelves.
 - e. Padlock Attachment: Provide minimum 14 ga. padlock staple attachment at the front edge of each shelf located to match the locking loop formed in the basket rim.
 - f. Casters (Option): 3-inch dia., swivel-type mobility casters bolted to each corner post.
 - g. Number Plates: Aluminum number plates with 3/8" high black letters. Rivet plates to shelf face at each basket opening.
2. Baskets:
 - a. Baskets shall be 12" x 13" x 8" **OR** 9" x 13" x 8", **as directed**, all wire or wire mesh or perforated steel front type. Provide number plates specified above on the front of each basket.
 - b. Pilfer Guards (Option): Provide sheet steel pilfer guard designed for field attachment to the top of the basket to cover the first 3" of depth.
3. Finish:
 - a. Baskets and pilfer guards: electroplating with bright zinc chromate.
 - b. Basket rack posts, shelves, and braces: In color selected from manufacturer's standard colors.

B. Fabrication

1. Locker components shall be fabricated square and rigid with a finish free of scratches and chips. All sides, tops, bottoms, and shelves shall be coated on both sides with a protective masking.



1.3 EXECUTION

A. Installation

1. Install lockers at the location shown in accordance with the manufacturer's instructions for plumb, level, rigid, and flush installations.
2. Anchor the units to wall studs through the locker back and to the floor using #8 pan head wood screws. Furring must be installed between lockers and wall of installations.

END OF SECTION 10 51 13 00a



Task	Specification	Specification Description
10 51 13 00	01 22 16 00	No Specification Required



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SECTION 10 51 26 00 - SOLID PLASTIC LOCKERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for solid plastic lockers. Product shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Shop Drawings: Submitted shop drawings showing individual locker construction and overall dimensions, including complete installation instructions.

C. Product Handling

1. Store locker components flat until assembly. Protect all finishes from soiling and damage during handling.

D. Warranty

1. Manufacturer shall warranty lockers for a period of 10 years against rust and other types of corrosion, delamination, or breakage of any of the plastic panels, doors, and shelves under normal use.

1.2 PRODUCTS

- #### A. Materials: Sides, tops, bottoms, rears, doors, and shelves shall be made from high impact, high density polyethylene (HDPE) formed under high pressure into solid plastic components 3/8" thick with homogeneous color throughout. All panels, doors, and shelves will match in color.

1. Material testing: All solid plastic components shall resist deterioration and discoloration when subjected to any of the following:
 - Acetic Acid 80%
 - Acetone
 - Ammonia Liquid
 - Ammonium Phosphate
 - Bleach 12%
 - Borax
 - Brine
 - Caustic Soda
 - Chlorine Water
 - Citric Acid
 - Copper Chloride
 - Core Oils
 - Hydrochloric Acid 40%
 - Hydrogen Peroxide 30%
 - Isopropyl Alcohol
 - Lactic Acid 25%
 - Lime Sulfur
 - Nicotine
 - Potassium Bromide
 - Soaps
 - Sodium Bicarbonate
 - Trisodium Phosphate
 - Urea and Urine



Vinegar

(Testing in accordance with corrosion testing procedure established by the United States Plastic Corporation)

2. Continuous latch, capable of accepting various locking mechanisms, shall be securely fastened to the entire length of the door, providing a continuous security latch.
3. Door hinge shall be made from plastic with no steel or metal parts. Door hinge shall be continuous and integrated into the full length of the door and main locker body.
4. Coat hooks shall be made from chrome plated steel and attached with tempered screws.
5. All components shall have a smooth "orange peel" finish. All components shall be of the same color and selected from the manufacturer's full color line.

B. Fabrication

1. Locker components shall be fabricated square and rigid with a finish free of scratches and chips. All sides, tops, bottoms, backs, doors, and shelves shall be coated on both sides with a protective masking.
2. Solid plastic locker components shall snap together for easy assembly and shall provide a solid and secure construction. Adjacent lockers shall share a common side panel. Locker units shall be manufactured for assembly in a group of no more than five adjacent lockers.

1.3 EXECUTION

A. Installation

1. Install lockers at the location shown in accordance with the manufacturer's instructions for plumb, level, rigid, and flush installations.
2. Anchor the units to wall studs through the locker back and to the floor using #8 pan head wood screws. Furring must be installed between lockers and wall of installations.
3. Lockers can be either floor-mounted or installed on a 4" high base. Hardware and instructions for either method shall be provided by the manufacturer.
4. Number plates shall be available for field or factory mounting.

END OF SECTION 10 51 26 00



Task	Specification	Specification Description
10 51 53 00	01 22 16 00	No Specification Required



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SECTION 10 55 23 26 - POSTAL SPECIALTIES**1.1 GENERAL****A. Description Of Work:**

1. This specification covers the furnishing and installation of materials for postal specialties. Product shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. USPS-approved horizontal mail receptacles.
 - b. Private-delivery horizontal mail receptacles.
 - c. Private postal-facility horizontal mail receptacles.
 - d. Vertical mail receptacles.
 - e. USPS-approved cluster box units (CBUs).
 - f. Neighborhood delivery and collection box units (NDCBUs).
 - g. USPS-approved parcel lockers.
 - h. USPS-approved collection boxes.
 - i. Private collection boxes.
 - j. Data distribution boxes.
 - k. Mail chutes.
 - l. Accessories:
 - 1) Directory for mail receptacles.
 - 2) Key keeper.
 - 3) Key cabinet.
 - 4) Mail-sorting collection unit.
 - 5) Letter drops.
 - 6) Package depository.

C. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: For postal specialties. Include plans, elevations, sections, details, identification sequence for compartments, and attachments to other work.
3. Samples: For each exposed product and for each color and texture specified.
4. Product certificates, including written approval by Postmaster General, as applicable.
5. Maintenance data.
6. Other Informational Submittals: Final USPS local postmaster approval for installed postal specialties to be served by USPS.

D. Quality Assurance

1. Source Limitations for Each Type of Postal Specialty: For USPS-approved products, use only those included on current lists of USPS manufacturers and models.
2. Preinstallation Conference: Conduct conference at Project site.

E. Delivery, Storage, And Handling

1. Deliver lock keys to the Owner by registered mail or overnight package service with a record of each corresponding lock and key number.
2. Deliver combination-lock combinations to the Owner by registered mail or overnight package service with a record of each corresponding lock and combination.

F. Warranty



1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of postal specialties that fail in materials or workmanship within five years from date of Final Completion.

1.2 PRODUCTS

A. Materials

1. Aluminum: Manufacturer's standard alloy and temper for type of use and finish indicated, and as follows:
 - a. Sheet and Plate: ASTM B 209 (ASTM B 209M).
 - b. Extruded Shapes: ASTM B 221 (ASTM B 221M).
2. Steel Sheet: Cold rolled, ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, exposed matte finish where exposed.
3. Metallic-Coated Steel Sheet: Galvanized-steel sheet, ASTM A 653/A 653M, G60 (Z180) coating designation, extra smooth where exposed; or electrolytic zinc-coated steel sheet, ASTM A 879/A 879M, Coating Designation 08Z (24G).
4. Stainless-Steel Sheet: ASTM A 666, Type 304.
5. Brass Sheet: ASTM B 36/B 36M, manufacturer's standard copper alloy.
6. Zinc Sheet or Plate: ASTM B 69, manufacturer's standard sheet or plate and zinc alloy.
7. Die-Cast Aluminum: ASTM B 85, manufacturer's standard aluminum alloy.
8. Die-Cast Brass: ASTM B 176, manufacturer's standard copper alloy.
9. Die-Cast Zinc: ASTM B 86, manufacturer's standard zinc alloy.
10. Steel Anchor Bolts, Nuts, and Washers: ASTM F 1554, Grade 36 or 55, hot-dip galvanized.
11. Stainless-Steel Anchor Bolts, Nuts, and Washers: ASTM A 193/A 193M, Grade B8M, Type 316.
12. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

B. USPS-Approved Horizontal Mail Receptacles

1. Front-Loading, USPS-Approved Horizontal Mail Receptacles: Consisting of multiple compartments with fixed, solid compartment backs, enclosed within recessed wall box. Provide access to compartments for distributing incoming mail from front of unit by unlocking master lock and swinging side-hinged master door to provide accessibility to entire group of compartments. Provide access to each compartment for removing mail by swinging compartment door. Comply with USPS-STD-4C **OR** USPS-STD-4B+, **as directed**.
 - a. Mail Delivery: USPS **OR** Private, **as directed**.
 - b. Compartments: Number and size as follows: **OR** As indicated on Drawings, of the following sizes: **OR** As indicated on Drawings, **as directed**.
 - 1) Type I: A group of mail receptacles in single-column configuration with single master door, three – eight mail compartments not less than 3 inches high by 12 inches wide by 15 inches deep (76 mm high by 305 mm wide by 381 mm deep), one outgoing mail collection compartment prepared for master-door lock, and one parcel compartment 15 inches high by 12 inches wide by 15 inches deep (381 mm high by 305 mm wide by 381 mm deep).
 - 2) Type II: A group of mail receptacles in double-column configuration with double master door, three - sixteen mail compartments not less than 3 inches high by 12 inches wide by 15 inches deep (76 mm high by 305 mm wide by 381 mm deep), one outgoing mail collection compartment prepared for master-door lock, and one **OR** two, **as directed**, parcel compartment(s): 15 inches high by 12 inches wide by 15 inches deep (381 mm high by 305 mm wide by 381 mm deep) and 18 inches high by 12 inches wide by 15 inches deep (457 mm high by 305 mm wide by 381 mm deep).
 - 3) Type III: A group of mail receptacles in double-column configuration with single master door, three - sixteen mail compartments not less than 3 inches high by 12 inches wide by 15 inches deep (76 mm high by 305 mm wide by 381 mm deep), one outgoing mail collection compartment prepared for master-door lock, and one **OR** two, **as directed**, parcel compartment(s): 15 inches high by 12 inches wide by 15



- inches deep (381 mm high by 305 mm wide by 381 mm deep) and 18 inches high by 12 inches wide by 15 inches deep (457 mm high by 305 mm wide by 381 mm deep).
- 4) Type VI (No Parcel Compartment): A group of mail receptacles in single-column configuration with single master door, three – ninemail compartments not less than 3 inches high by 12 inches wide by 15 inches deep (76 mm high by 305 mm wide by 381 mm deep), and one outgoing mail collection compartment prepared for master-door lock.
 - 5) Type VIII (No Parcel Compartment): A group of mail receptacles in double-column configuration with double master door, three – nineteen mail compartments not less than 3 inches high by 12 inches wide by 15 inches deep (76 mm high by 305 mm wide by 381 mm deep), and one outgoing mail collection compartment prepared for master-door lock.
- c. Compartments: Number and size as follows: **OR** Number as indicated on Drawings, of the following sizes: **OR** Number and size as indicated on Drawings, **as directed**.
- 1) Type A: Provide compartments with inside dimensions not less than 5 inches high by 6 inches wide by 15 inches deep (127 mm high by 152 mm wide by 381 mm deep).
 - 2) Type B: Provide compartments with inside dimensions not less than 5 inches high by 12-1/2 inches wide by 15 inches deep (127 mm high by 318 mm wide by 381 mm deep).
 - 3) Type C: Provide compartments with inside dimensions not less than 10-1/2 inches high by 6 inches wide by 15 inches deep (267 mm high by 152 mm wide by 381 mm deep).
 - 4) Type D: Provide compartments with inside dimensions not less than 10-1/2 inches high by 12-1/2 inches wide by 15 inches deep (267 mm high by 318 mm wide by 381 mm deep).
 - 5) Type E: Provide compartments with inside dimensions not less than 16 inches high by 12-1/2 inches wide by 15 inches deep (406 mm high by 318 mm wide by 381 mm deep).
- d. Front-Loading Master Door: Fabricated from extruded aluminum and braced and framed to hold compartment doors; prepared to receive master-door lock.
- 1) Master-Door Lock: Door prepared to receive lock provided by local postmaster, for units served by USPS.
OR
Master-Door Lock: Cylinder lock keyed to building keying system; with two **OR** three, **as directed**, keys. Provide cylinders specified in Division 08 Section "Door Hardware".
- e. Compartment Doors: Fabricated from extruded aluminum. Equip each with lock and tenant identification as required by cited standard. Provide mail slot in the compartment with master-door lock, **as directed**.
- 1) Compartment-Door Locks (for units served by USPS): Comply with USPS-L-1172C, PSIN O910, for locks and keys, or equivalent as approved by USPS; with three keys for each compartment door. Key each compartment differently.
 - 2) Compartment-Door Locks: Five-pin tumbler, cylinder cam **OR** spring-latch-type, **as directed**, locks capable of at least 1000 key changes; with two **OR** three, **as directed**, keys for each compartment door. Key each compartment differently.
 - 3) Compartment-Door Locks: Removable core locks, furnished by the Owner and installed as Work of this Section.
 - 4) Compartment-Door Locks: Spring-latch-type lock designed to accommodate cylinders keyed to building keying system; with two **OR** three, **as directed**, keys for each compartment door. Provide cylinders specified in Division 08 Section "Door Hardware".
 - 5) Compartment-Door Locks: Three-digit, single-dial, combination locks with spring latch and automatic throw off. Set each compartment with different combination.
- f. Frames: Fabricated from extruded aluminum or aluminum sheet; ganged and nested units, with cardholder and blank cards for tenant's identification within each compartment.



- g. Snap-on Trim: Fabricated from same material and finish as compartment doors.
 - h. Concealed Components and Mounting Frames: Aluminum or steel sheet with manufacturer's standard finish.
 - i. Exposed Aluminum Finish: Finish surfaces exposed to view as follows:
 - 1) Anodic Finish: Clear **OR** Brass **OR** Dark bronze **OR** As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - 2) Baked-Enamel or Powder-Coated Finish: Silver **OR** Black **OR** Medium bronze **OR** Dark bronze **OR** Gold **OR** Color as indicated by manufacturer's designations **OR** Color as selected from manufacturer's full range, **as directed**.
2. Rear-Loading, USPS-Approved Horizontal Mail Receptacles: Consisting of multiple compartments enclosed within recessed wall box. Provide access to compartments for distributing incoming mail from rear of unit with accessibility to entire group of compartments. Provide access to each compartment for removing mail by swinging compartment door. Comply with USPS-STD-4C **OR** USPS-STD-4B+, **as directed**.
- a. Mail Delivery: USPS **OR** Private, **as directed**.
 - b. Compartments: Number and size as follows: **OR** As indicated on Drawings, of the following sizes: **OR** As indicated on Drawings, **as directed**.
 - 1) Type IV: A group of mail receptacles in single-column configuration with a rear-access cover, three - eight mail compartments not less than 3 inches high by 12 inches wide by 15 inches deep (76 mm high by 305 mm wide by 381 mm deep), one outgoing mail collection compartment, and one parcel compartment 15 inches high by 12 inches wide by 15 inches deep (381 mm high by 305 mm wide by 381 mm deep).
 - 2) Type V: A group of mail receptacles in double-column configuration with a rear-access cover, three - sixteen mail compartments not less than 3 inches high by 12 inches wide by 15 inches deep (76 mm high by **OR** 305 mm wide by 381 mm deep), one outgoing mail collection compartment, and one **OR** two, **as directed**, parcel compartment(s) 15 inches high by 12 inches wide by 15 inches deep (381 mm high by 305 mm wide by 381 mm deep) and 18 inches high by 12 inches wide by 15 inches deep (457 mm high by 305 mm wide by 381 mm deep).
 - 3) Type VII (No Parcel Compartment): A group of mail receptacles in single-column configuration with a rear-access cover, three - nine mail compartments not less than 3 inches high by 12 inches wide by 15 inches deep (76 mm high by 305 mm wide by 381 mm deep), and one outgoing mail collection compartment.
 - 4) Type IX (No Parcel Compartment): A group of mail receptacles in double-column configuration with a rear-access cover, three - nineteen mail compartments not less than 3 inches high by 12 inches wide by 15 inches deep (76 mm high by 305 mm wide by 381 mm deep), and one outgoing mail collection compartment.
 - c. Compartments: Number and size as follows: **OR** Number as indicated on Drawings, of the following sizes: **OR** Number and size as indicated on Drawings, **as directed**.
 - 1) Type A: Provide compartments with inside dimensions not less than 5 inches high by 6 inches wide by 15 inches deep (127 mm high by 152 mm wide by 381 mm deep).
 - 2) Type B: Provide compartments with inside dimensions not less than 5 inches high by 12-1/2 inches wide by 15 inches deep (127 mm high by 318 mm wide by 381 mm deep).
 - 3) Type C: Provide compartments with inside dimensions not less than 10-1/2 inches high by 6 inches wide by 15 inches deep (267 mm high by 152 mm wide by 381 mm deep).
 - 4) Type D: Provide compartments with inside dimensions not less than 10-1/2 inches high by 12-1/2 inches wide by 15 inches deep (267 mm high by 318 mm wide by 381 mm deep).
 - 5) Type E: Provide compartments with inside dimensions not less than 16 inches high by 12-1/2 inches wide by 15 inches deep (406 mm high by 318 mm wide by 381 mm deep).



- d. Rear-Loading Cover: Not required **OR** Lift-off rear cover fabricated from extruded aluminum or aluminum sheet, finished to match front of unit, **as directed**.
OR
Rear-Loading Door: Side hinged, fabricated from extruded aluminum or aluminum sheet, finished to match front of unit; with full-length, stainless-steel piano hinge on one side and positive-latching **OR** locking, **as directed**, mechanism on the other.
 - 1) Rear-Door Lock (for units served by USPS if lock is required): Door prepared to receive lock provided by local postmaster.
OR
Rear-Door Lock: Cylinder lock keyed to building keying system; with two **OR** three, **as directed**, keys. Provide cylinders specified in Division 08 Section "Door Hardware".
- e. Compartment Doors: Fabricated from extruded aluminum. Equip each with lock and tenant identification as required by cited standard. Provide one compartment with outgoing mail slot, **as directed**.
 - 1) Compartment-Door Locks (for units served by USPS): Comply with USPS-L-1172C, PSIN O910, for locks and keys, or equivalent as approved by USPS; with three keys for each compartment door. Key each compartment differently.
 - 2) Compartment-Door Locks: Five-pin tumbler, cylinder cam **OR** spring-latch-type, **as directed**, locks capable of at least 1000 key changes; with two **OR** three, **as directed**, keys for each compartment door. Key each compartment differently.
 - 3) Compartment-Door Locks: Removable core locks, furnished by the Owner and installed as Work of this Section.
 - 4) Compartment-Door Locks: Spring-latch-type lock designed to accommodate cylinders keyed to building keying system; with two **OR** three, **as directed**, keys for each compartment door. Provide cylinders specified in Division 08 Section "Door Hardware".
 - 5) Compartment-Door Locks: Three-digit, single-dial, combination locks with spring latch and automatic throw off. Set each compartment with different combination.
- f. Frames: Fabricated from extruded aluminum or aluminum sheet; ganged and nested units, with cardholder and blank cards for tenant's identification behind each compartment.
- g. Snap-on Trim: Fabricated from same material and finish as compartment doors.
- h. Concealed Components and Mounting Frames: Aluminum or steel sheet with manufacturer's standard finish.
- i. Exposed Aluminum Finish: Finish surfaces exposed to view as follows:
 - 1) Anodic Finish: Clear **OR** Brass **OR** Dark bronze **OR** As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - 2) Baked-Enamel or Powder-Coated Finish: Silver **OR** Black **OR** Medium bronze **OR** Dark bronze **OR** Gold **OR** Color as indicated by manufacturer's designations **OR** Color as selected from manufacturer's full range, **as directed**.

C. Private-Delivery Horizontal Mail Receptacles

- 1. Front-Loading, Private-Delivery Horizontal Mail Receptacles: Consisting of multiple compartments with fixed, solid compartment backs, enclosed within recessed wall box. Provide access to compartments for distributing incoming mail from front of unit by unlocking master lock and swinging side-hinged master door to provide accessibility to entire group of compartments. Provide access to each compartment for removing mail by swinging compartment door.
 - a. Front-Loading Master Door: Fabricated from extruded aluminum and braced and framed to hold compartment doors; with master-door lock and concealed, full-length, stainless-steel piano hinge on one side. Fabricate master door to remain open while mail is deposited.
 - 1) Master-Door Lock: Manufacturer's standard five-pin tumbler, cylinder lock; with two **OR** three, **as directed**, keys.
OR



- Master-Door Lock: Cylinder lock keyed to building keying system; with two **OR** three, **as directed**, keys. Provide cylinders specified in Division 08 Section "Door Hardware".
- b. Compartments and Doors: Manufacturer's standard compartments with extruded aluminum doors. Equip each with lock, tenant identification, and concealed, full-length, flush hinge on one side. Provide one compartment prepared for master-door lock and with outgoing mail slot, **as directed**.
- 1) Compartments: Number and size as follows: **OR** As indicated on Drawings, of the following sizes: **OR** As indicated on Drawings, **as directed**.
 - a) Size 1: Provide compartments with inside dimensions not less than 3 inches high by 6 inches wide by 15 inches deep (76 mm high by 152 mm wide by 381 mm deep).
 - b) Size 2: Provide compartments with inside dimensions not less than 5 inches high by 3-1/2 inches wide by 15 inches deep (127 mm high by 89 mm wide by 381 mm deep).
 - c) Size 3: Provide compartments with inside dimensions not less than 5 inches high by 7-1/2 inches wide by 15 inches deep (127 mm high by 191 mm wide by 381 mm deep).
 - d) Size 4: Provide compartments with inside dimensions not less than 10-1/2 inches high by 3-1/2 inches wide by 15 inches deep (267 mm high by 89 mm wide by 381 mm deep).
 - e) Size 5: Provide compartments with inside dimensions not less than 10-1/2 inches high by 7-1/2 inches wide by 15 inches deep (267 mm high by 191 mm wide by 381 mm deep).
 - 2) Tenant Identification: 2-inch-wide by 5/8-inch- (51-mm-wide by 16-mm-) high, clear-plastic cardholder set in recessed slot in face of compartment door. Provide cardboard strip and self-adhesive numbers.

OR

Tenant Identification: Laminated, black plastic tabs, engraved with identification and adhesively applied to face of compartment door.

OR

Tenant Identification: Identification engraved into face of compartment door.
- c. Compartments and Doors: Manufacturer's standard compartments with ornamental doors fabricated from solid, die-cast brass **OR** zinc, **as directed**. Equip each with glass window, **as directed**, lock, nameplate, and two hinges.
- 1) Compartments: Number and size as follows: **OR** As indicated on Drawings, of the following sizes: **OR** As indicated on Drawings, **as directed**.
 - a) Size 1: Provide compartments 15 inches (381 mm) deep with doors 5 inches high by 3-1/2 inches wide (127 mm high by 89 mm wide).
 - b) Size 2: Provide compartments 15 inches (381 mm) deep with doors 6 inches high by 5-1/2 inches wide (152 mm high by 140 mm wide).
 - c) Size 3: Provide compartments 15 inches (381 mm) deep with doors 6 inches high by 11 inches wide (152 mm high by 279 mm wide).
 - 2) Compartment-Door Locks: Five-pin tumbler, cylinder cam **OR** spring-latch-type, **as directed**, locks capable of at least 1000 key changes; with two **OR** three, **as directed**, keys for each compartment door. Key each compartment differently.
 - 3) Compartment-Door Locks: Removable core locks, furnished by the Owner and installed as Work of this Section.
 - 4) Compartment-Door Locks: Spring-latch-type lock designed to accommodate cylinders keyed to building keying system; with two **OR** three, **as directed**, keys for each compartment door. Provide cylinders specified in Division 08 Section "Door Hardware".
 - 5) Compartment-Door Locks: Three-digit, single-dial, combination locks with spring latch and automatic throw off. Set each compartment with different combination.



- d. Frames: Fabricated from extruded aluminum or aluminum sheet **OR** brass sheet **OR** zinc sheet or plate, **as directed**; ganged and nested units, with cardholder and blank cards for tenant's identification behind each compartment.
 - e. Snap-on Trim: Fabricated from same material and finish as compartment doors.
 - f. Concealed Components and Mounting Frames: Aluminum or steel sheet with manufacturer's standard finish.
 - g. Exposed Aluminum Finish: Finish surfaces exposed to view as follows:
 - 1) Anodic Finish: Clear, **as directed**.
 - 2) Baked-Enamel or Powder-Coated Finish: Black **OR** Dark bronze **OR** Gold **OR** Medium bronze **OR** Silver **OR** Color as indicated by manufacturer's designations **OR** Color as selected from manufacturer's full range, **as directed**.
 - h. Brass Finish: Buffed finish, lacquered **OR** Hand-rubbed finish, lacquered **OR** Brushed satin, lacquered, **as directed**.
 - i. Zinc Finish: Manufacturer's standard powder-coated finish, tan, **as directed**.
2. Rear-Loading, Private-Delivery Horizontal Mail Receptacles: Consisting of multiple compartments enclosed within recessed wall box. Provide access to compartments for distributing incoming mail from rear of unit with accessibility to entire group of compartments. Provide access to each compartment for removing mail by swinging compartment door.
- a. Rear-Loading Cover: Not required **OR** Lift-off rear cover fabricated from extruded aluminum or aluminum sheet, finished to match front of unit, **as directed**.
OR
Rear-Loading Door: Side hinged, fabricated from extruded aluminum or aluminum sheet, finished to match front of unit; with full-length, stainless-steel piano hinge on one side and positive-latching **OR** locking, **as directed**, mechanism on the other. Fabricate rear-loading door to open not less than 90 degrees and to remain open while mail is deposited.
 - 1) Rear-Door Lock: Manufacturer's standard five-pin tumbler, cylinder lock; with two **OR** three, **as directed**, keys.
OR
Rear-Door Lock: Cylinder lock keyed to building keying system; with two **OR** three, **as directed**, keys. Provide cylinders specified in Division 08 Section "Door Hardware".
 - b. Compartments and Doors: Manufacturer's standard compartments with doors fabricated from extruded aluminum. Equip each with lock, tenant identification, and concealed, full-length, flush hinge on one side. Provide one compartment prepared for master-door lock and with outgoing mail slot, **as directed**.
 - 1) Compartments: Number and size as follows: **OR** As indicated on Drawings, of the following sizes: **OR** As indicated on Drawings, **as directed**.
 - a) Size 1: Provide with inside dimensions not less than 3 inches high by 6 inches wide by 15 inches deep (76 mm high by 152 mm wide by 381 mm deep).
 - b) Size 2: Provide compartments with inside dimensions not less than 5 inches high by 3-1/2 inches wide by 15 inches deep (127 mm high by 89 mm wide by 381 mm deep).
 - c) Size 3: Provide compartments with inside dimensions not less than 5 inches high by 7-1/2 inches wide by 15 inches deep (127 mm high by 191 mm wide by 381 mm deep).
 - d) Size 4: Provide compartments with inside dimensions not less than 10-1/2 inches high by 3-1/2 inches wide by 15 inches deep (267 mm high by 89 mm wide by 381 mm deep).
 - e) Size 5: Provide compartments with inside dimensions not less than 10-1/2 inches high by 7-1/2 inches wide by 15 inches deep (267 mm high by 191 mm wide by 381 mm deep).
 - 2) Tenant Identification: 2-inch-wide by 5/8-inch- (51-mm-wide by 16-mm-) high, clear-plastic cardholder set in recessed slot in face of compartment door. Provide cardboard strip and self-adhesive numbers.
OR



Tenant Identification: Laminated, black plastic tabs, engraved with identification and adhesively applied to face of compartment door.

OR

Tenant Identification: Identification engraved into face of compartment door.

- c. Compartments and Doors: Manufacturer's standard compartments with ornamental doors fabricated from solid, die-cast brass **OR** zinc, **as directed**. Equip each with glass window, **as directed**, lock, nameplate, and two hinges.
- 1) Compartments: Number and size as follows: **OR** As indicated on Drawings, of the following sizes: **OR** As indicated on Drawings, **as directed**.
 - a) Size 1: Provide compartments 15 inches (381 mm) deep with doors 5 inches high by 3-1/2 inches wide (127 mm high by 89 mm wide).
 - b) Size 2: Provide compartments 15 inches (381 mm) deep with doors 6 inches high by 5-1/2 inches wide (152 mm high by 140 mm wide).
 - c) Size 3: Provide compartments 15 inches (381 mm) deep with doors 6 inches high by 11 inches wide (152 mm high by 279 mm wide).
- d. Compartment-Door Locks: Five-pin tumbler, cylinder cam **OR** spring-latch-type, **as directed**, locks capable of at least 1000 key changes; with two **OR** three, **as directed**, keys for each compartment door. Key each compartment differently.
- e. Compartment-Door Locks: Removable core locks, furnished by the Owner and installed as Work of this Section.
- f. Compartment-Door Locks: Spring-latch-type lock designed to accommodate cylinders keyed to building keying system; with two **OR** three, **as directed**, keys for each compartment door. Provide cylinders specified in Division 08 Section "Door Hardware".
- g. Compartment-Door Locks: Three-digit, single-dial, combination locks with spring latch and automatic throw off. Set each compartment with different combination.
- h. Frames: Fabricated from extruded aluminum or aluminum sheet **OR** brass sheet **OR** zinc sheet or plate, **as directed**; ganged and nested units, with cardholder and blank cards for tenant's identification behind each compartment.
- i. Snap-on Trim: Fabricated from same material and finish as compartment doors.
- j. Concealed Components and Mounting Frames: Aluminum or steel sheet with manufacturer's standard finish.
- k. Exposed Aluminum Finish: Finish surfaces exposed to view as follows:
 - 1) Anodic Finish: Clear, **as directed**.
 - 2) Baked-Enamel or Powder-Coated Finish: Black **OR** Dark bronze **OR** Gold **OR** Medium bronze **OR** Silver **OR** Color as indicated by manufacturer's designations **OR** Color as selected from manufacturer's full range, **as directed**.
- l. Brass Finish: Buffed finish, lacquered **OR** Hand-rubbed finish, lacquered **OR** Brushed satin, lacquered, **as directed**.
- m. Zinc Finish: Manufacturer's standard powder-coated finish, tan, **as directed**.
- D. Private Postal-Facility Horizontal Mail Receptacles
1. Standard, Rear-Loading Horizontal Mail Receptacles: Consisting of multiple compartments with open backs, enclosed within recessed, modular wall box, with approximate overall module dimensions of 30 inches high by 23-1/2 inches wide by 15-1/2 inches deep (762 mm high by 596 mm wide by 394 mm deep); for installation between studs spaced 24 inches (610 mm) o.c. Provide access to compartments for distributing incoming mail from rear of unit with accessibility to entire group of compartments. Provide access to each compartment for removing mail by swinging compartment door.
 - a. Compartments: Provide 10 **OR** 20 **OR** 30, **as directed**, equal-sized compartments within each module.

OR

 Compartments: Provide number and size, and number of modules as indicated on Drawings.
 - b. Compartment Doors: Fabricated from extruded or die-cast aluminum. Equip each with lock, tenant identification, and concealed, full-length, flush hinge on one side.



- 1) Tenant Identification: Identification engraved into face of compartment door **OR** self-adhesive placards, **as directed**.
 - 2) Compartment-Door Locks: Five-pin tumbler, cylinder cam **OR** spring-latch-type, **as directed**, locks capable of at least 1000 key changes; with two **OR** three, **as directed**, keys for each compartment door. Key each compartment differently.
 - c. Frames: Fabricated from aluminum or cold-rolled steel sheet; ganged and nested units, with cardholder and blank cards for tenant's identification behind each compartment.
 - d. Trim: Fabricated from same material as compartment doors.
 - e. Concealed Components and Mounting Frames: Aluminum or steel sheet with manufacturer's standard finish.
 - f. Exposed Aluminum Finish: Finish surfaces exposed to view with silver powder coat on doors, black on trim **OR** gold powder coat on doors and trim **OR** silver powder coat on doors and trim, **as directed**.
2. Rack-Ladder, Rear-Loading Horizontal Mail Receptacles: Consisting of multiple compartments with open backs, enclosed within recessed, modular wall box, with approximate overall module dimensions of 12 inches high by 23-1/2 inches wide by 15-1/2 inches deep (305 mm high by 596 mm wide by 394 mm deep); for installation between rack ladders. Provide access to compartments for distributing incoming mail from rear of unit with accessibility to entire group of compartments. Provide access to each compartment for removing mail by swinging compartment door.
- a. Compartments: Provide one within each module and number of modules as indicated on Drawings.
OR
Compartments: Provide two **OR** four **OR** eight **OR** 12, **as directed**, equal-sized compartments within each module and number of modules as indicated on Drawings.
OR
Compartments: Provide number and size, and number of modules as indicated on Drawings.
 - b. Compartment Doors: Fabricated from extruded aluminum. Equip each with lock, tenant identification, and concealed, full-length, flush hinge on one side.
 - 1) Tenant Identification: Identification engraved into face of compartment door **OR** self-adhesive placards, **as directed**.
 - 2) Compartment-Door Locks: Five-pin tumbler, cylinder cam **OR** spring-latch-type, **as directed**, locks capable of at least 1000 key changes; with two **OR** three, **as directed**, keys for each compartment door. Key each compartment differently.
 - c. Frames: Fabricated from aluminum or cold-rolled steel sheet; ganged and nested units, with cardholder and blank cards for tenant's identification behind each compartment.
 - d. Trim: Fabricated from same material as compartment doors.
 - e. Concealed Components and Mounting Frames: Aluminum or steel sheet with manufacturer's standard finish.
 - f. Rack Ladders: Aluminum or steel with manufacturer's standard finish.
 - 1) Height of Rack Ladders: Two **OR** Three **OR** Four **OR** Five **OR** Six, **as directed**, modules high.
 - 2) Provide two rack ladders for first column of modules and one ladder for each additional, adjacent column of modules.
 - g. Exposed Aluminum Finish: Finish surfaces exposed to view with silver powder coat on doors, black on trim.
- E. Vertical Mail Receptacles
1. USPS-Approved Vertical Mail Receptacles: Consisting of three to seven compartments enclosed within wall box; with inside dimensions of each compartment not less than 15 inches high by 5 inches wide by 6 inches deep (381 mm high by 127 mm wide by 152 mm deep). Provide access to compartments for distributing incoming mail from front of unit by unlocking master lock and tilting inner compartments forward as a group. Provide access to each compartment for removing mail by swinging compartment door. Comply with USPS-STD-4B+.



- a. Mounting: Recessed **OR** Semirecessed with mounting frame **OR** Surface mounted with mounting frame **OR** As indicated on Drawings, **as directed**.
 - b. Mail Delivery: USPS **OR** Private, **as directed**.
 - c. Compartments: Provide three - seven.
OR
Compartments: Provide number as indicated on Drawings.
 - d. Compartment Doors and Frames: Fabricated from striated, extruded aluminum. Equip each compartment door with lock, slot in face of door to receive tenant identification, and concealed, full-length, flush hinge on one side. Provide one double-wide compartment with outgoing mail slot, **as directed**.
 - 1) Tenant Identification: Cardboard name and number tab **OR** Laminated, black plastic tabs, engraved with identification, **as directed**.
 - 2) Compartment-Door Locks (for units served by USPS): Five-pin tumbler, cylinder cam **OR** spring-latch-type, **as directed**, locks capable of at least 1000 key changes; with two **OR** three, **as directed**, keys for each compartment door. Key each compartment differently.
OR
Compartment-Door Locks: Removable core locks, furnished by the Owner and installed as Work of this Section.
OR
Compartment-Door Locks: Spring-latch-type lock designed to accommodate cylinders keyed to building keying system; with two **OR** three, **as directed**, keys for each compartment door. Provide cylinders specified in Division 08 Section "Door Hardware".
 - e. Frames: Fabricated from aluminum or cold-rolled steel sheet; ganged and nested units, with cardholder and blank cards for tenant's identification within each compartment.
 - f. Concealed Components and Mounting Frames: Aluminum or steel sheet with manufacturer's standard finish.
 - g. Exposed Aluminum Finish: Finish surfaces exposed to view as follows:
 - 1) Anodic Finish: Clear **OR** Gold **OR** As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - 2) Baked-Enamel or Powder-Coated Finish: Aluminum **OR** Black **OR** Brass **OR** Dark bronze **OR** Gold **OR** Green **OR** Ivory **OR** Medium bronze **OR** Silver **OR** Color as indicated by manufacturer's designations **OR** Color as selected from manufacturer's full range, **as directed**.
- F. USPS-Approved Cluster Box Units (CBUs)
1. General: Consisting of multiple compartments enclosed within freestanding, pedestal-mounted enclosure. Provide access to compartments for distributing incoming mail from front of unit by unlocking master lock and swinging pair of side-hinged master doors to provide accessibility to entire group of compartments. Provide access to each compartment for removing mail by swinging compartment door. Comply with USPS-B-1118F.
 2. Compartment Enclosure: Fabricated from aluminum sheet with aluminum mounting pedestal and weather-protection hood, with the following number and size of compartments:
 - a. Type I: Provide eight compartments 12 inches wide by 3 inches high by 15 inches deep (305 mm wide by 76 mm high by 381 mm deep), one outgoing mail compartment 12 inches wide by 3 inches high by 15 inches deep (305 mm wide by 76 mm high by 381 mm deep), one parcel compartment 12 inches wide by 10 inches high by 15 inches deep (305 mm wide by 254 mm high by 381 mm deep), and another parcel compartment 12 inches wide by 13-1/2 inches high by 15 inches deep (305 mm wide by 343 mm high by 381 mm deep).
 - b. Type II: Provide 12 compartments 12 inches wide by 3 inches high by 15 inches deep (305 mm wide by 76 mm high by 381 mm deep), one outgoing mail compartment 12 inches wide by 3 inches high by 15 inches deep (305 mm wide by 76 mm high by 381 mm deep), and one parcel compartment 12 inches wide by 10 inches high by 15 inches deep (305 mm wide by 254 mm high by 381 mm deep).



- c. Type III: Provide 16 compartments 12 inches wide by 3 inches high by 15 inches deep (305 mm wide by 76 mm high by 381 mm deep), one outgoing mail compartment 12 inches wide by 3 inches high by 15 inches deep (305 mm wide by 76 mm high by 381 mm deep), one parcel compartment 12 inches wide by 10 inches high by 15 inches deep (305 mm wide by 254 mm high by 381 mm deep), and another parcel compartment 12 inches wide by 13-1/2 inches high by 15 inches deep (305 mm wide by 343 mm high by 381 mm deep).
 - d. Type IV: Provide 13 compartments 12 inches wide by 4-3/4 inches high by 15 inches deep (305 mm wide by 121 mm high by 381 mm deep), one outgoing mail compartment 12 inches wide by 4-3/4 inches high by 15 inches deep (305 mm wide by 121 mm high by 381 mm deep), and one parcel compartment 12 inches wide by 10 inches high by 15 inches deep (305 mm wide by 254 mm high by 381 mm deep).
 3. Compartment Doors and Frames: Fabricated from one-piece extruded aluminum or aluminum sheet. Equip each compartment door with lock, tenant identification, and concealed, full-length, flush hinge on one side. Provide outgoing mail slot with weather protection flap.
 - a. Tenant Identification: Number engraved into face **OR** applied into recess, **as directed**, of compartment door.
 - b. Compartment-Door Locks: Comply with USPS-L-1172C, PSIN O910, for locks and keys, or equivalent as approved by USPS; with three keys for each compartment door. Key each compartment differently.
 - c. Parcel-Locker-Door Locks: Two-key security system in which control key provides access to parcel-locker key, which opens compartment and is retained once opened.
 4. Pedestal: Aluminum, with same finish as compartment enclosure and attached with theft-resistant fasteners.
 5. Exposed Aluminum Finish: Finish surfaces exposed to view with powder-coated finish in postal gray (light gray) **OR** color as selected from manufacturer's full range of colors, **as directed**.
- G. Neighborhood Delivery And Collection Box Units (NDCBUs)
 1. General: Consisting of multiple compartments, with inside dimensions of each compartment not less than 5 inches high by 6 inches wide by 15 inches deep (127 mm high by 152 mm wide by 381 mm deep), enclosed within freestanding, pedestal-mounted enclosure. Provide access to compartments for distributing incoming mail from rear of unit by side-hinged rear door with accessibility to entire group of compartments. Provide access to each compartment for removing mail by swinging compartment door.
 2. Compartment Enclosure: Fabricated from aluminum sheet with integral weather protection hood, with eight equal-sized compartments (Type I) **OR** 12 equal-sized compartments (Type II) **OR** 16 equal-sized compartments (Type III) **OR** compartments of number and size as indicated on Drawings, **as directed**.
 3. Compartment Doors and Frames: Fabricated from one-piece extruded aluminum or aluminum sheet. Equip each compartment door with lock, tenant identification, and concealed, full-length, flush hinge on one side. Provide top left compartment with outgoing mail slot, **as directed**.
 - a. Tenant Identification: Number engraved into face of compartment door.
 - b. Compartment-Door Locks: Dustproof, five-pin tumbler, cylinder cam locks capable of at least 1000 key changes; with three, **as directed**, keys for each compartment door. Key each compartment differently.
 4. Rear-Loading Door: Fabricated from aluminum sheet, with full-length, stainless-steel piano hinge on one side and three-point latching mechanism on the other. Fabricate rear-loading door to open not less than 90 degrees and to remain open while mail is deposited.
 - a. Rear-Door Lock: Door prepared to receive lock furnished by local postmaster.
OR
Rear-Door Lock: Cylinder lock with two **OR** three, **as directed**, keys. Provide cylinders specified in Division 08 Section "Door Hardware".
 5. Pedestal: Same material and finish as compartment enclosure and attached with theft-resistant fasteners **OR** As indicated on Drawings, **as directed**.
 6. Exposed Aluminum Finish: Finish surfaces exposed to view as follows:
 - a. Anodic Finish: Clear, **as directed**.



- b. Baked-Enamel or Powder-Coated Finish: Black **OR** Dark bronze **OR** Gold **OR** Medium bronze **OR** Color as selected from manufacturer's full range, **as directed**.

H. USPS-Approved Parcel Lockers

1. Front-Loading, USPS-Approved Indoor Parcel Lockers: Consisting of single or multiple compartments enclosed within a larger enclosure of type indicated below. Provide access to compartments for distributing incoming parcels from front of unit. Provide access to each compartment for removing parcels by swinging compartment door. Comply with USPS-STD-4C **OR** USPS-STD-4B+ or USPS-B-1116A construction, adapted for larger-sized, interior, parcel compartments, **as directed**.
 - a. Enclosure Type: Recessed **OR** Freestanding, **as directed**.
 - b. Mail Delivery: USPS **OR** Private, **as directed**.
 - c. Compartments: Number and size as follows: **OR** As indicated on Drawings, of the following sizes: **OR** As indicated on Drawings, **as directed**.
 - 1) Type X, Parcel Only (No Master Door): Single parcel receptacle 15 inches high by 12 inches wide by 15 inches deep (381 mm high by 305 mm wide by 381 mm deep) **OR** 18 inches high by 12 inches wide by 15 inches deep (457 mm high by 305 mm wide by 381 mm deep), **as directed**.
 - 2) Type X, Parcel Only (No Master Door): A group of parcel receptacles in single-column configuration without a master door; one **OR** two, **as directed**, compartment(s) 18 inches high by 12 inches wide by 15 inches deep (457 mm high by 305 mm wide by 381 mm deep) and one compartment 15 inches high by 12 inches wide by 15 inches deep (381 mm high by 305 mm wide by 381 mm deep).
 - 3) Type XI, Parcel Only: A group of parcel receptacles in single-column configuration with single master door prepared for master-door lock; one **OR** two, **as directed**, compartment(s) 15 inches high by 12 inches wide by 15 inches deep (381 mm high by 305 mm wide by 381 mm deep) and one **OR** two, **as directed**, compartment(s) 18 inches high by 12 inches wide by 15 inches deep (457 mm high by 305 mm wide by 381 mm deep).
 - d. Compartments: Fabricated from aluminum sheet with number and size as follows: **OR** as indicated on Drawings, **as directed**.
 - 1) Type I: Provide one box with two compartments, one on top of the other, each compartment with inside dimensions of 12 inches wide by 14 inches high by 15 inches deep (305 mm wide by 356 mm high by 381 mm deep).
 - 2) Type II: Provide one box with four compartments, side by side, two on top and two on bottom, each compartment with inside dimensions of 12 inches wide by 14 inches high by 15 inches deep (305 mm wide by 356 mm high by 381 mm deep).
 - e. Front-Loading Master Door: Fabricated to hold compartment doors; prepared to receive master-door lock provided by local postmaster.
 - f. Compartment Doors and Frames: Fabricated from same material and finish as adjacent mail receptacles **OR** extruded aluminum **OR** aluminum sheet **OR** metallic-coated steel sheet **OR** aluminum or metallic-coated steel sheet, **as directed**. Equip each compartment door with lock, identification, and concealed, full-length, spring-loaded, flush hinge on right side.
 - 1) Compartment Identification: Black, sequential numbers engraved into **OR** stamped onto, **as directed**, recess in face of compartment door.
 - 2) Compartment-Door Locks (for USPS delivery): Dual lock security system in which master lock provides access to customer lock (USPS-L-1172C, PSIN O910) and parcel-locker key opens compartment and is retained once opened.
 - 3) Compartment-Door Locks (for private delivery): Two-key security system in which control key provides access to parcel-locker key, which opens compartment and is retained once opened.
 - g. Exposed Aluminum Finish: Finish surfaces exposed to view as follows:
 - 1) Anodic Finish: Clear **OR** Brass **OR** Dark bronze **OR** As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.



- 2) Baked-Enamel or Powder-Coated Finish: Silver **OR** Black **OR** Medium bronze **OR** Dark bronze **OR** Gold **OR** Color as indicated by manufacturer's designations **OR** Color as selected from manufacturer's full range, **as directed**.
- h. Metallic-Coated Steel Finish: Finish surfaces exposed to view with baked-enamel or powder-coated finish; color as indicated by manufacturer's designations **OR** color as selected from manufacturer's full range, **as directed**.
2. Rear-Loading, USPS-Approved Indoor Parcel Lockers: Consisting of single or multiple compartments enclosed within recessed wall box. Provide access to compartments for distributing incoming parcels from rear of unit with accessibility to entire group of compartments. Provide access to each compartment for removing parcels by swinging compartment door. Comply with USPS-STD-4C **OR** USPS-STD-4B+ or USPS-B-1116A construction, adapted for larger-sized, interior, parcel compartments, **as directed**.
 - a. Mail Delivery: USPS **OR** Private, **as directed**.
 - b. Compartments: Number and size as follows: **OR** As indicated on Drawings, of the following sizes: **OR** As indicated on Drawings, **as directed**.
 - 1) Type XII, Parcel Only: A group of parcel receptacles in single-column configuration with a rear-access cover; one **OR** two, **as directed** compartment(s) 15 inches high by 12 inches wide by 15 inches deep (381 mm high by 305 mm wide by 381 mm deep) and one **OR** two, **as directed**, compartment(s) 18 inches high by 12 inches wide by 15 inches deep (457 mm high by 305 mm wide by 381 mm deep).
 - c. Compartments: Fabricated enclosure with number and size as follows: **OR** as indicated on Drawings, **as directed**.
 - 1) Type I: Provide one box with two compartments, one on top of the other, each compartment with inside dimensions of 12 inches wide by 14 inches high by 15 inches deep (305 mm wide by 356 mm high by 381 mm deep).
 - 2) Type II: Provide one box with four compartments, side by side, two on top and two on bottom, each compartment with inside dimensions of 12 inches wide by 14 inches high by 15 inches deep (305 mm wide by 356 mm high by 381 mm deep).
 - d. Rear-Loading Cover: Not required **OR** Lift-off rear cover fabricated from extruded aluminum or aluminum sheet, finished to match front of unit, **as directed**.

OR

Rear-Loading Door: Side hinged, fabricated from extruded aluminum or aluminum sheet, finished to match front of unit; with full-length, stainless-steel piano hinge on one side and positive-latching **OR** locking, **as directed**, mechanism on the other.
 - 1) Rear-Door Lock: Door prepared to receive lock provided by local postmaster.

OR

Rear-Door Lock: Cylinder lock keyed to building keying system; with two **OR** three, **as directed**, keys. Provide cylinders specified in Division 08 Section "Door Hardware".
 - e. Compartment Doors and Frames: Fabricated from same material and finish as adjacent mail receptacles **OR** extruded aluminum **OR** aluminum sheet **OR** metallic-coated steel sheet **OR** aluminum or metallic-coated steel sheet, **as directed**. Equip each compartment door with lock, identification, and concealed, full-length, spring-loaded, flush hinge on one side.
 - 1) Compartment Identification: Black, sequential numbers engraved into **OR** stamped onto, **as directed**, recess in face of compartment door.
 - 2) Compartment-Door Locks (for USPS delivery): Dual-lock security system in which master lock provides access to customer lock (USPS-L-1172C, PSIN O910) and parcel-locker key opens compartment and is retained once opened.
 - 3) Compartment-Door Locks (for private delivery): Two-key security system in which control key provides access to parcel-locker key, which opens compartment and is retained once opened.
 - f. Exposed Aluminum Finish: Finish surfaces exposed to view as follows:
 - 1) Anodic Finish: Clear **OR** Brass **OR** Dark bronze **OR** As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.



- 2) Baked-Enamel or Powder-Coated Finish: Silver **OR** Black **OR** Medium bronze **OR** Dark bronze **OR** Gold **OR** Color as indicated by manufacturer's designations **OR** Color as selected from manufacturer's full range, **as directed**.
- g. Metallic-Coated Steel Finish: Finish surfaces exposed to view with baked-enamel or powder-coated finish; color as indicated by manufacturer's designations **OR** color as selected from manufacturer's full range, **as directed**.
3. USPS-Approved Outdoor Parcel Lockers (OPLs), Pedestal Mounted: Consisting of multiple compartments enclosed within freestanding, pedestal-mounted enclosure. Provide access to compartments for distributing incoming mail from front of unit by unlocking master lock and swinging pair of side-hinged master doors to provide accessibility to entire group of compartments. Provide access to each compartment for removing mail by swinging compartment door. Comply with USPS-B-1116A.
 - a. Compartment Enclosure: Fabricated from aluminum sheet with aluminum mounting pedestal and weather-protection hood, with the following number and size of compartments:
 - 1) Type I: Provide one box with two compartments, one on top of the other, each compartment with inside dimensions of 12 inches wide by 14 inches high by 15 inches deep (305 mm wide by 356 mm high by 381 mm deep).
 - 2) Type II: Provide one box with four compartments, side by side, two on top and two on bottom, each compartment with inside dimensions of 12 inches wide by 14 inches high by 15 inches deep (305 mm wide by 356 mm high by 381 mm deep).
 - b. Compartment Doors and Frames: Fabricated from one-piece extruded aluminum or aluminum sheet. Equip each compartment door with lock, tenant identification, and concealed, full-length, flush hinge on one side. Provide outgoing mail slot with weather protection flap.
 - 1) Locker Identification: Number engraved into face **OR** applied into recess, **as directed**, of compartment door.
 - 2) Door Locks: Two-key security system in which control key provides access to parcel-locker key, which opens compartment and is retained once opened.
 - c. Pedestal: Aluminum, with same finish as compartment enclosure and attached with theft-resistant fasteners.
 - d. Exposed Aluminum Finish: Finish surfaces exposed to view with powder-coated finish in postal gray (light gray) **OR** color as selected from manufacturer's full range of colors, **as directed**.
- I. USPS-Approved Collection Boxes
 1. USPS-Approved, Front-Loading Collection **OR** Receiving, **as directed**, Boxes: Consisting of single compartment with fire-resistant cushion bottom, enclosed within wall box, with mail slot **OR** hopper door, **as directed**, to receive mail. Provide access to compartment for collecting mail from front of unit. Comply with USPS Publication 16.
 - a. Mail Collection: USPS **OR** Private, **as directed**.
 - b. Mounting: Recessed **OR** Semirecessed **OR** Surface mounted, **as directed**.
 - c. Type: Collection box **OR** Receiving box for mail chutes, **as directed**.
 - d. Height: Sized to match height of four **OR** five **OR** six **OR** seven, **as directed**, horizontal mail receptacles.
OR
Height: As indicated on Drawings, **as directed**.
 - e. Compartment Door and Frame: Fabricated from 1/4-inch- (6-mm-) **OR** minimum 1/8-inch- (3-mm-), **as directed**, thick aluminum, with opening not less than 12 by 20 inches (305 by 508 mm) and not more than 18 by 30 inches (457 by 762 mm). Equip door with lock and concealed, full-length, flush hinge on one side.
 - 1) Door Lock (for units served by USPS): Door prepared to receive lock provided by local postmaster.
OR



- Door Lock: Cylinder lock keyed to building keying system; with two **OR** three, **as directed**, keys. Provide cylinders specified in Division 08 Section "Door Hardware".
- 2) Identification: Engrave face of compartment door with 1-inch- (25-mm-) high letters as follows: "U.S. MAIL LETTER BOX" on two lines at top or bottom of unit.
 - 3) Door Style: Set door within face frame **OR** Extend door full width and height of unit, with no exposed frame, **as directed**.
- f. Mail Slot: Fabricated from 1/4-inch- (6-mm-) thick aluminum, with 11-inch-wide by 1-1/4-inch- (279-mm-wide by 32-mm-) high opening, protected by inside hood and hinge flap, and with inside baffle to prevent removal of mail from box.
- OR**
- Hopper Door: Fabricated from 1/4-inch- (6-mm-) thick aluminum, with opening that allows a bundle measuring 6-1/2 inches wide by 11-1/2 inches long by 4 inches high (165 mm wide by 292 mm long by 102 mm high) to be deposited, and with inside baffle to prevent removal of mail from box. Equip door with door pull and concealed, full-length bottom hinge.
- 1) Identification: Engrave face of hopper door with 1-inch- (25-mm-) high letters as follows: "LETTERS AND LETTER MAIL TIED IN BUNDLES."
 - 2) Door Style: Set door within face frame **OR** Extend door full width and height of unit, with no exposed frame, **as directed**.
- g. Exposed Materials: Fabricated from stainless-steel-clad **OR** brass-clad, **as directed**, extruded or sheet aluminum.
- h. Concealed Components and Mounting Frames: Aluminum or steel sheet with manufacturer's standard finish.
- i. Schedule-Card Holder: Provide recessed or surface-mounted holder for pick-up schedule card in center of bottom front portion of unit. Fabricate of same material and finish as front of unit.
- j. Mailbag Hooks: Provide two aluminum or stainless-steel hooks at exterior front edge of bottom of surface-mounted units, spaced 15 to 17-1/2 inches (381 to 445 mm) apart, for supporting mailbags.
- k. Mailbag Rack: Provide internal rack system for supporting mailbags within unit.
2. USPS-Approved, Rear-Loading Collection Boxes: Consisting of single compartment with fire-resistant cushion bottom, enclosed within recessed wall box, with mail slot **OR** hopper door, **as directed**, to receive mail. Provide access to compartment for collecting mail from rear of unit. Comply with USPS Publication 16.
- a. Mail Collection: USPS **OR** Private, **as directed**.
 - b. Height: Sized to match height of four **OR** five **OR** six **OR** seven, **as directed**, horizontal mail receptacles.
- OR**
- Height: As indicated on Drawings, **as directed**.
- c. Compartment Frame and Front Panel: Fabricated from 1/4-inch- (6-mm-) **OR** minimum 1/8-inch- (3-mm-), **as directed**, thick aluminum.
- 1) Identification: Engrave face of front panel with 1-inch- (25-mm-) high letters as follows: "U.S. MAIL LETTER BOX" on two lines at top or bottom of unit.
- d. Mail Slot: Fabricated from 1/4-inch- (6-mm-) thick metal plate, with 11-inch-wide by 1-1/4-inch- (279-mm-wide by 32-mm-) high opening, protected by inside hood and hinge flap, and with inside baffle to prevent removal of mail from box.
- OR**
- Hopper Door: Fabricated from 1/4-inch- (6-mm-) thick metal plate, with opening that allows a bundle measuring 6-1/2 inches wide by 11-1/2 inches long by 4 inches high (165 mm wide by 292 mm long by 102 mm high) to be deposited, and with inside baffle to prevent removal of mail from box. Equip door with door pull and concealed, full-length bottom hinge.
- 1) Identification: Engrave face of hopper door with 1-inch- (25-mm-) high letters as follows: "LETTERS AND LETTER MAIL TIED IN BUNDLES."
 - 2) Door Style: Set door within face frame **OR** Extend door full width and height of unit, with no exposed frame, **as directed**.



- e. Rear-Loading Enclosure: Lift-off rear cover fabricated from same material and finish as front of unit.
OR
 Rear-Loading Door: Side hinged, with opening not less than 12 by 20 inches (305 by 508 mm) and not more than 18 by 30 inches (457 by 762 mm), fabricated from same material and finish as front of unit; with full-length, stainless-steel piano hinge on one side and positive-latching mechanism on the other. Fabricate rear-loading door to remain open while mail is collected.
- 1) Rear-Door Lock (for units served by USPS): Door prepared to receive lock provided by local postmaster.
OR
 Rear-Door Lock: Cylinder lock keyed to building keying system; with two **OR** three, **as directed**, keys. Provide cylinders specified in Division 08 Section "Door Hardware".
- f. Exposed Materials: Fabricated from extruded or sheet aluminum.
- g. Concealed Components and Mounting Frames: Aluminum or steel sheet with manufacturer's standard finish.
- h. Schedule-Card Holder: Provide recessed or surface-mounted holder for pick-up schedule card in center of bottom front portion of unit. Fabricate of same material and finish as front of unit.
- i. Mailbag Hooks: Provide two aluminum or stainless-steel hooks at exterior front edge of bottom of surface-mounted units, spaced 15 to 17-1/2 inches (381 to 445 mm) apart, for supporting mailbags.
- j. Mailbag Rack: Provide internal rack system for supporting mailbags within unit.
3. Finish surfaces exposed to view as follows:
- a. Aluminum Finish: Finish surfaces exposed to view as follows:
 - 1) Anodic Finish: Clear **OR** Black **OR** Gold **OR** Dark bronze **OR** Light bronze **OR** Medium bronze **OR** As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - 2) Baked-Enamel or Powder-Coated Finish: Black **OR** Gold **OR** Dark bronze **OR** Medium bronze **OR** Silver **OR** Color as indicated by manufacturer's designations **OR** Color as selected from manufacturer's full range, **as directed**.
 - b. Brass Finish: Buffed finish, lacquered **OR** Hand-rubbed finish, lacquered **OR** Brushed satin, lacquered, **as directed**.
 - c. Stainless-Steel Finish: No. 4.
- J. Private Collection Boxes
1. Private, Horizontal, Front-Loading Collection Boxes: Consisting of single compartment of same depth as horizontal mail receptacles, enclosed within wall box, with slot in top of front to receive mail. Provide access to compartment for collecting mail from front of unit.
 - a. Height: Sized to match height of four **OR** five **OR** six **OR** seven, **as directed**, horizontal mail receptacles.
 - b. Mounting: Recessed **OR** Semirecessed **OR** Surface mounted, **as directed**.
 - c. Compartment Door and Frame: Fabricated from extruded aluminum or aluminum sheet that is full height of unit including **OR** in portion of unit below, **as directed**, mail slot, and equipped with lock and concealed, continuous side hinge.
 - 1) Door Lock (for units served by USPS): Door prepared to receive lock provided by local postmaster.
OR
 Door Lock: Cylinder lock keyed to building keying system; with two **OR** three, **as directed**, keys. Provide cylinders specified in Division 08 Section "Door Hardware".
 - 2) Identification: Engrave face of compartment door with 1-inch- (25-mm-) high letters as follows: "LETTERS" **OR** "OUTGOING MAIL" **OR** "OFFICE," **as directed**.
 - d. Aluminum Finish: Finish surfaces exposed to view as follows:
 - 1) Anodic Finish: Clear, **as directed**.



- 2) Baked-Enamel or Powder-Coated Finish: Black **OR** Dark bronze **OR** Gold **OR** Medium bronze **OR** Color as indicated by manufacturer's designations **OR** Color as selected from manufacturer's full range, **as directed**.
2. Private, Horizontal, Rear-Loading Collection Boxes: Consisting of single compartment of same depth as horizontal mail receptacles, enclosed within recessed wall box, with slot in top of front to receive mail. Provide access to compartment for collecting mail from rear of unit.
 - a. Height: Sized to match height of four **OR** five **OR** six **OR** seven, **as directed**, horizontal mail receptacles.
 - b. Rear-Loading Cover: Not required **OR** Lift-off rear cover fabricated from extruded aluminum or aluminum sheet, finished to match front of unit, **as directed**.
OR
Rear-Loading Door: Side hinged, fabricated from extruded aluminum or aluminum sheet, finished to match front of unit; with continuous hinge on one side and positive-latching **OR** locking, **as directed**, mechanism on the other.
 - 1) Rear-Door Lock (for units served by USPS if lock is required): Door prepared to receive lock provided by local postmaster.
OR
Rear-Door Lock: Cylinder lock keyed to building keying system; with two **OR** three, **as directed**, keys. Provide cylinders specified in Division 08 Section "Door Hardware".
 - c. Exposed Materials: Fabricated from extruded or sheet aluminum.
 - d. Concealed Components and Mounting Frames: Aluminum or steel sheet with manufacturer's standard finish.
 - e. Identification: Engrave front of unit below mail slot with 1-inch- (25-mm-) high letters as follows: "LETTERS" **OR** "OUTGOING MAIL" **OR** "OFFICE," **as directed**.
 - f. Aluminum Finish: Finish surfaces exposed to view as follows:
 - 1) Anodic Finish: Clear, **as directed**.
 - 2) Baked-Enamel or Powder-Coated Finish: Black **OR** Dark bronze **OR** Gold **OR** Medium bronze **OR** Color as indicated by manufacturer's designations **OR** Color as selected from manufacturer's full range, **as directed**.
3. Vertical Collection Boxes: Consisting of single compartment enclosed within wall box, with slot in top of front to receive mail. Provide access to compartment for collecting incoming mail from front of unit.
 - a. Mounting: Recessed **OR** Semirecessed **OR** Surface mounted, **as directed**.
 - b. Size: Same height as adjacent vertical mail receptacles **OR** 8-3/4 inches wide by 19 inches high by 6-1/2 inches deep (222 mm wide by 483 mm high by 165 mm deep) **OR** 15 inches wide by 19 inches high by 6-1/2 inches deep (381 mm wide by 483 mm high by 165 mm deep), **as directed**.
 - c. Compartment Door and Frame: Fabricated from aluminum, with opening for mail. Equip door with lock and concealed, full-length, flush hinge on one side. Set door within face frame.
 - 1) Door Lock (for units served by USPS): Door prepared to receive lock provided by local postmaster.
OR
Door Lock: Cylinder lock keyed to building keying system; with two **OR** three, **as directed**, keys. Provide cylinders specified in Division 08 Section "Door Hardware".
 - 2) Identification: Engrave face of compartment door with 1-inch- (25-mm-) high letters as follows: "LETTERS" **OR** "OUTGOING MAIL" **OR** "OFFICE," **as directed**.
 - d. Exposed Materials: Fabricated from extruded or sheet aluminum.
 - e. Concealed Components and Mounting Frames: Aluminum or steel sheet with manufacturer's standard finish.
 - f. Aluminum Finish: Finish surfaces exposed to view as follows:
 - 1) Anodic Finish: Clear, **as directed**.
 - 2) Baked-Enamel or Powder-Coated Finish: Aluminum **OR** Black **OR** Brass **OR** Dark bronze **OR** Gold **OR** Green **OR** Ivory **OR** Medium bronze **OR** Silver **OR** Color as



indicated by manufacturer's designations **OR** Color as selected from manufacturer's full range, **as directed**.

4. Private, Pedestal-Mounted Collection Boxes: Consisting of single compartment enclosed within freestanding, pedestal-mounted enclosure, with slot in top of front of unit to receive mail. Provide access to compartment for collecting mail from front or rear of unit through door equipped with concealed, continuous side hinge and lock.
 - a. Compartment Enclosure: Fabricated from extruded aluminum or aluminum sheet with integral weather-protection hood.
 - b. Pedestal: Same material and finish as parcel locker and attached with theft-resistant fasteners **OR** As indicated on Drawings, **as directed**.
 - c. Aluminum Finish: Finish surfaces exposed to view as follows:
 - 1) Anodic Finish: Clear, **as directed**.
 - 2) Baked-Enamel or Powder-Coated Finish: Blue **OR** Gray **OR** White **OR** Color as indicated by manufacturer's designations **OR** Color as selected from manufacturer's full range, **as directed**.
5. Private, Curbside Collection Boxes: Consisting of single compartment enclosed within curved-top, freestanding enclosure with four legs and casters, **as directed**. Fabricate enclosure from welded and riveted steel. Provide hopper door with door pull in top of unit to receive packages, with opening size not less than 4-1/2 inches high by 15-1/2 inches wide (114 mm high by 394 mm wide). Provide access to compartment for collecting packages from bottom of front of unit through door equipped with concealed, continuous bottom hinge and lock.
 - a. Door Lock: Five-pin tumbler cylinder **OR** Hasp for padlock, **as directed**.
 - b. Snorkel: Provide rear-mounted, drive-by attachment with opening not less than 12 inches wide by 3 inches high (305 mm wide by 76 mm high).
 - c. Steel Finish: Baked-enamel or powder-coated finish; gray **OR** white **OR** color as indicated by manufacturer's designations **OR** color as selected from manufacturer's full range, **as directed**.

K. Data Distribution Boxes

1. Data Distribution Boxes: Consisting of multiple compartments enclosed within enclosure.
 - a. Enclosure Configuration: Freestanding **OR** Recessed in wall **OR** Recessed in wall and installed between rack ladders, **as directed**.
 - b. Compartment Access: Provide access to compartments as follows:
 - 1) For Distributing Incoming Mail from Front of Unit: Mail slot in each compartment door.
 - 2) For Distributing Incoming Mail from Rear of Unit: Open backs with aluminum cover finished to match front of unit, **as directed**.
 - 3) For Removing Mail: Unlocking and swinging compartment door.
 - c. Compartments: Number and size as follows: **OR** As indicated on Drawings, of the following sizes: **OR** As indicated on Drawings, **as directed**.
 - 1) Size 1: Provide compartments with inside dimensions not less than 5 inches high by 12-1/2 inches wide by 15 inches deep (127 mm high by 318 mm wide by 381 mm deep).
 - d. Compartment Doors: Equip each with lock and concealed, continuous hinge.
 - 1) Door Locks: Five-pin tumbler, cylinder cam **OR** spring-latch-type, **as directed**, locks capable of at least 1000 key changes; with two **OR** three, **as directed**, keys for each compartment door. Key each compartment differently.
OR
Door Locks: Three-digit, single-dial, combination locks with spring latch and automatic throw off. Set each compartment with different combination.
 - e. Concealed Components and Mounting Frames: Aluminum or steel sheet with manufacturer's standard finish.
 - f. Exposed Materials: Fabricated from steel sheet or aluminum with powder-coat finish.
 - g. Rack Ladders: Aluminum or steel with manufacturer's standard finish.



- h. Powder-Coated Finish: Silver **OR** Silver with black trim **OR** Silver with slate trim **OR** Sandalwood with sand trim **OR** Color as indicated by manufacturer's designations **OR** Color as selected from manufacturer's full range, **as directed**.

L. Mail Chutes

1. General: Factory assembled and fabricated with tight joints, overlaps in direction of mail flow, and free of ledges. Provide transition sections so all sections of chutes are connected and overlap at least 2 inches (51 mm). Fabricate mail chutes so joint sections comply with same dimensions with no reduction in chute size. Provide removable panels for access to concealed portions of chutes that exceed 5 feet (1.5 m) in length. Comply with USPS Publication 16, **as directed**.
 - a. Mail Collection: USPS **OR** Private, **as directed**.
 - b. Inside Dimensions: 8 inches wide by 2 inches deep (203 mm wide by 51 mm deep) (for chutes served by USPS) **OR** 14 inches wide by 3 inches deep (356 mm wide by 76 mm deep) **OR** 14 inches wide by 7 inches deep (356 mm wide by 178 mm deep), **as directed**.
 - c. Mounting: Recessed **OR** Semirecessed **OR** Surface mounted **OR** As detailed, **as directed**.
2. Exposed Front Panels: Continuous, one-piece frames and covers fabricated from 0.125-inch- (3.2-mm-) thick, stainless-steel-clad **OR** brass-clad, **as directed**, extruded aluminum, and retaining removable transparent material as follows, for not less than 3/4 of length of front of chute on each floor:
 - a. Transparent Material: Manufacturer's standard glazing, complying with USPS Publication 16.
3. Concealed Front Panels: Consisting of continuous, one-piece frames retaining 0.0269-inch- (0.7-mm-) thick, metallic-coated steel sheet panels. Extend concealed front panels from top of ceiling fasciae to bottom of floor collar above.
4. Sides and Backs: Continuous, one-piece, 0.125-inch- (3.2-mm-) thick aluminum sheet extending from floor to ceiling on each floor and extending 54 inches (1372 mm) above finish flooring at top story.
5. Floor and Ceiling Fasciae and Lock Band: Manufacturer's standard, matching material and finish of front frames and covers. Provide lock band with locking device and keyed lock that prevents key removal if locking device is not secured.
6. Mail Slots: Same material and finish as chute; not less than 4-3/4 inches wide by 1/2 inch high (121 mm wide by 13 mm high) with device designed to guide mail into inside opening of same size located 2-1/2 inches (64 mm) below mail slot. Provide mail slots on each floor.
 - a. For chutes served by USPS, inscribe the words "U.S. MAIL" on face of mail slots.
7. Finish surfaces exposed to view as follows:
 - a. Aluminum Finish: Finish surfaces exposed to view as follows:
 - 1) Anodic Finish: Clear **OR** Black **OR** Dark bronze **OR** Medium bronze **OR** As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - 2) Baked-Enamel or Powder-Coated Finish: Color as indicated by manufacturer's designations **OR** Color as selected from manufacturer's full range, **as directed**.
 - b. Brass Finish: Buffed finish, lacquered **OR** Hand-rubbed finish, lacquered **OR** Brushed satin, lacquered, **as directed**.
 - c. Stainless-Steel Finish: No. 4.

M. Accessories

1. Directory for Mail Receptacles: Surface-mounted, front-opening unit, with clear glass or plastic window.
 - a. Framed, Top-Mount Unit for Horizontal Mail Receptacles: Fabricate directory as framed, horizontal unit with modular sections having a 24-name capacity (3 modules) **OR** 32-name capacity (4 modules) **OR** 40-name capacity (5 modules), **as directed**; of same material, size, **as directed**, and finish as adjacent mail receptacles; mounted above mail receptacles as indicated on Drawings, **as directed**.



- b. Framed, Side-Mount Unit for Horizontal Mail Receptacles: Fabricate directory as framed, horizontal unit with 50-name capacity, 28 inches (711 mm) **OR** 60-name capacity, 33-3/8 inches (848 mm) **OR** 70-name capacity, 38-3/4 inches (984 mm), **as directed** high; of same material and finish as adjacent mail receptacles; mounted along side of mail receptacles as indicated on Drawings, **as directed**.
- c. Framed, Side-Mount Unit for Vertical Mail Receptacles: Fabricate directory as framed, vertical unit with modular sections having a 40-name capacity (1 module) **OR** 80-name capacity (2 modules) **OR** 120-name capacity (3 modules) **OR** 160-name capacity (4 modules) **OR** 200-name capacity (5 modules), **as directed**; of same size, material, and finish as adjacent vertical mail compartment doors unless otherwise indicated.
- d. Insert Units for Vertical Mail Receptacles: Fabricate directory as modular inserts having a 40-name capacity (1 module) **OR** 80-name capacity (2 modules) **OR** 120-name capacity (3 modules) **OR** 160-name capacity (4 modules) **OR** 200-name capacity (5 modules), **as directed**; of same size, material, and finish as adjacent vertical mail compartment doors unless otherwise indicated.
- e. Provide name strips made of 1/4-inch- (6-mm-) high label tape.
2. Key Keeper: Consisting of single compartment with door; interior compartment size not less than 4-3/4 inches wide by 2-1/4 inches high by 1-1/2 inches deep (121 mm wide by 57 mm high by 38 mm deep), **as directed**. USPS approved, **as directed**.
 - a. Mounting: Recessed **OR** Surface mounted, **as directed**.
 - b. Style: Compartment door set within face frame **OR** extending full width and height of unit, with no exposed frame, **as directed**.
 - c. Type of Operation: Loose key in box **OR** Retractor reel with minimum 20-inch- (508-mm-) long chain **OR** Push button, 24-V switch in box, **as directed**.
 - d. Mail Delivery: USPS **OR** Private, **as directed**.
 - e. Door Lock (for units served by USPS): Door prepared to receive lock furnished by local postmaster.
OR
 Door Lock: Five-pin tumbler, cylinder cam lock capable of at least 1000 key changes; with two **OR** three, **as directed**, keys.
OR
 Door Lock: Cylinder lock keyed to building keying system; with two **OR** three, **as directed**, keys. Provide cylinders specified in Division 08 Section "Door Hardware".
 - f. Exposed Material and Finish: Exposed surfaces fabricated from same material and finish as adjacent mail receptacles.
 - g. Exposed Material and Finish: Steel, aluminum **OR** brass, **as directed**, powder-coated finish.
 - h. Exposed Material and Finish: Stainless steel, brushed finish.
 - i. Exposed Material and Finish: Aluminum, as follows:
 - 1) Anodic Finish: Clear **OR** Brass **OR** Dark bronze **OR** As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - 2) Baked-Enamel or Powder-Coated Finish: Black **OR** Dark bronze **OR** Medium bronze **OR** Gold **OR** Color as indicated by manufacturer's designations **OR** Color as selected from manufacturer's full range, **as directed**.
3. Key Cabinet: Wall-mounted, metallic-coated, **as directed**, steel cabinet with pivoting, key-holding panels and side-hinged door equipped with five-pin tumbler, cylinder door lock and concealed, full-length flush hinge. Finish cabinet, panels, and door with baked-enamel or powder-coated finish. Provide key control system consisting of key-holding hooks, labels, two sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers.
 - a. Capacity: Keys for 150 percent of the number of, **as directed**, mail-receptacle locks.
 - b. Cross-Index System: Consisting of index cards for recording key information. Include three receipt forms for each key-holding hook.
 - c. Baked-Enamel or Powder-Coated Finish: Color as indicated by manufacturer's designations **OR** Color as selected from manufacturer's full range, **as directed**.



4. Mail-Sorting Collection Unit: Consisting of 1/4-inch- (6-mm-) thick, metal face plate and through-the-wall hopper door(s) allowing receipt and separation of mail.
 - a. Hopper Doors: One **OR** Two **OR** Three, **as directed**, door(s), with door pull for each and with opening size not less than dimensions approved by the Owner.
 - 1) Engrave doors with 1-inch- (25-mm-) high letters as follows: "STAMPED MAIL" **OR** "METERED MAIL," **as directed**.
 - 2) Identification: Engrave unit at top with 2-inch- (51-mm-) high letters as follows: "U.S. MAIL" **OR** "UNITED STATES MAIL," **as directed**.
 - b. Exposed Material and Finish: Exposed surfaces fabricated from same material and finish as adjacent mail receptacles.
 - c. Aluminum Finish: Finish surfaces exposed to view as follows:
 - 1) Anodic Finish: Clear **OR** Black **OR** Dark bronze **OR** Light bronze **OR** Medium bronze **OR** As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - 2) Baked-Enamel or Powder-Coated Finish: Black **OR** Dark bronze **OR** Gold **OR** Medium bronze **OR** Color as indicated by manufacturer's designations **OR** Color as selected from manufacturer's full range, **as directed**.
 - d. Brass Finish: Buffed finish, lacquered **OR** Hand-rubbed finish, lacquered **OR** Brushed satin, lacquered, **as directed**.
 - e. Stainless-Steel Finish: No. 4.
5. Letter Drops (Through Wall): Consisting of 11-inch-wide by 3-1/2-inch- (279-mm-wide by 89-mm-) high, top-hinged, spring-loaded flap that pivots inward, held in place by 1-inch- (25-mm-) wide face frame. Fabricated from 1/4-inch- (6-mm-) thick aluminum or steel, with exposed surfaces finished to match adjacent mail receptacles.
 - a. Sleeve: Provide metallic-coated, **as directed**, steel wall sleeve for full depth of wall.
 - b. Finished Frame: Provide finished face frame on back side of wall opening.
 - c. Identification: Engrave face of swinging flap with 1-inch- (25-mm-) high letters as follows: "U.S. MAIL" **OR** "LETTERS" **OR** "OUTGOING MAIL," **as directed**
 - d. Exposed Material and Finish: Exposed surfaces fabricated from same material and finish as adjacent mail receptacles, **as directed**.
6. Package Depository (Through Wall): Consisting of 1/4-inch- (6-mm-) thick, aluminum or steel face plate and through-the-wall hopper door with hinged baffle, **as directed**, allowing receipt of packages; fabricated from 1/4-inch- (6-mm-) thick aluminum or steel.
 - a. Hopper Door: Equipped with door pull and concealed, full-length bottom hinge; with opening size not less than 15 inches wide by 6-1/2 inches high (381 mm wide by 165 mm high) **OR** as indicated on Drawings, **as directed**.
 - b. Sleeve: Provide metallic-coated, **as directed**, steel wall sleeve for full depth of wall.
 - c. Slowdown: Provide steel slowdown ramp on back side of wall opening.
 - d. Identification: Engrave face of hopper door with 1-inch- (25-mm-) high letters as follows: "BOOK DEPOSITORY," **as directed**
 - e. Finish: Exposed surfaces finished same as mail receptacles.
 - f. Aluminum Finish: Finish surfaces exposed to view as follows:
 - 1) Anodic Finish: Clear **OR** As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - 2) Baked-Enamel or Powder-Coated Finish: Dark bronze **OR** Gold **OR** Color as indicated by manufacturer's designations **OR** Color as selected from manufacturer's full range, **as directed**.
 - g. Steel Finish: Finish surfaces exposed to view with baked-enamel or powder-coated finish; color as indicated by manufacturer's designations **OR** color as selected from manufacturer's full range, **as directed**.

N. Fabrication

1. Form postal specialties to required shapes and sizes, with true lines and angles, square, rigid, and without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges and corners free of sharp edges and burrs and safe to touch. Fabricate doors of postal specialties to preclude binding, warping, or misalignment.



2. Preassemble postal specialties in shop to greatest extent possible to minimize field assembly.
3. Mill joints to a tight, hairline fit. Cope or miter corner joints. Form joints exposed to weather to exclude water penetration.
4. Drill or punch holes required for fasteners and remove burrs. Use security fasteners where fasteners are exposed. If used, seal external rivets before finishing.
5. Weld in concealed locations to greatest extent possible without distorting or discoloring exposed surfaces. Remove weld spatter and welding oxides from exposed surfaces.
6. Fabricate tubular and channel frame assemblies with manufacturer's standard welded or mechanical joints. Provide subframes and reinforcement as required for a complete system to support loads.
7. Fabricate rack ladders to support indicated number of units to form a column of units.
8. Where dissimilar metals will contact each other, protect against galvanic action by painting contact surfaces with bituminous coating or by applying other permanent separation as recommended by manufacturers of dissimilar metals.

O. General Finish Requirements

1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
3. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

P. Copper-Alloy Finishes

1. Buffed Finish, Lacquered: M21-O6x (Mechanical Finish: buffed, smooth specular; Coating: clear organic coating as specified below).
2. Hand-Rubbed Finish, Lacquered: M31-M34-O6x (Mechanical Finish: directionally textured, fine satin; Mechanical Finish: directionally textured, hand rubbed; Coating: clear organic coating as specified below).
3. Brushed Satin Finish, Lacquered: M32-O6x (Mechanical Finish: directionally textured, medium satin; Coating: clear organic coating as specified below).
4. Clear Organic Coating: Clear, waterborne, air-drying, acrylic lacquer specially developed for coating copper-alloy products, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm). It consists of a solution of methyl methacrylate copolymer with benzotriazole to prevent breakdown of the film in UV light, and is called "Incralac."

1.3 EXECUTION

A. Installation

1. General: Install postal specialties level and plumb, according to manufacturer's written instructions and roughing-in drawings.
 - a. Where dissimilar metals will be in permanent contact with each other, protect against galvanic action by painting contact surfaces with bituminous coating or by applying other permanent separation as recommended by manufacturer for this purpose.
 - b. Where aluminum will contact grout, concrete, masonry, or wood, protect against corrosion by painting contact surfaces with bituminous coating.
 - c. Final acceptance of postal specialties served by USPS depends on compliance with USPS requirements.
2. Horizontal Mail Receptacles: Install horizontal mail receptacles with center of tenant-door lock cylinders and bottom of compartments at the maximum and minimum heights above finished floor established by USPS and manufacturer's written instructions.



- a. Install removable-core and keyed-in door lock cylinders as required for each type of cylinder lock.
 - b. Install and align two rack ladders for the first column of mail receptacles and one rack ladder for each additional adjacent column of mail receptacles.
 3. Vertical Mail Receptacles: Install vertical mail receptacles with center of master lock cylinder not more than 48 inches (1219 mm) and not less than 30 inches (762 mm) above finished floor.
 4. Pedestal-Mounted Postal Specialties: Anchor units with 1/2-inch- (13-mm-) diameter, galvanized **OR** stainless, **as directed**, -steel anchor bolts with hooked ends, for CBUs, NDCBUs, and some models of parcel lockers and collection boxes.
 5. Collection Boxes: Install collection boxes with centerline of mail slots **OR** handle of hopper doors, **as directed**, not more than 48 inches (1219 mm) above finished floor.
 6. Receiving Boxes: Install receiving boxes with bottom of unloading door not less than 30 inches (762 mm) above finished floor.
 - a. Install receiving boxes with exterior of box bottom not more than 20 inches (508 mm) above finished floor.
 7. Freestanding Data Distribution Boxes: Locate freestanding data distribution boxes at locations indicated or, if not indicated, as directed.
 8. Rack-Ladder Data Distribution Boxes: Install and align two rack ladders for the first column of data distribution boxes and one rack ladder for each additional adjacent column of data distribution boxes.
 9. Mail Chutes: Mount chutes with bottom ends extending 1 inch (25 mm) into receiving boxes. Attach chutes with straps, collars, and sleeves. Do not penetrate chute with fasteners.
 - a. Comply with USPS Publication 16 for installation.
 - b. Install chutes with centerline of mail slots not more than 48 inches (1219 mm) above finished floor.
 10. Key Keeper: Install horizontally **OR** vertically **OR** as indicated on Drawings, **as directed**.
- B. Field Quality Control
1. Arrange for USPS personnel to examine and test postal specialties served by USPS after they have been installed according to USPS regulations.
 2. Obtain written final approval of postal specialties to be served by USPS. Obtain this approval from USPS postmaster that authorizes mail collection for the served installation.
- C. Adjusting, Cleaning, And Protection
1. Remove temporary protective coverings and strippable films, if any, as postal specialties are installed unless otherwise indicated in manufacturer's written installation instructions.
 2. Adjust doors, hardware, and moving parts to function smoothly, and lubricate as recommended by manufacturer. Verify that integral locking devices operate properly.
 3. Touch up marred finishes or replace postal specialties that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by postal specialty manufacturer.
 4. Replace postal specialties that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.
 5. On completion of postal specialty installation, clean interior and exterior surfaces as recommended by manufacturer.

END OF SECTION 10 55 23 26



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Task	Specification	Specification Description
10 55 26 00	10 55 23 26	Postal Specialties
10 56 16 00	01 95 06 00	Miscellaneous Carpentry



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SECTION 10 73 13 00 - AWNINGS

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for awnings. Product shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Fixed awnings.
 - b. Retractable awnings, manually operated and motorized.

C. Definitions

1. Awning: An architectural projection that provides weather protection, identity, or decoration and is wholly supported by the building to which it is attached. An awning is comprised of a lightweight, rigid skeleton structure over which a rigid covering is attached.
2. Retractable Awning: A cover with a frame that retracts against a building or other structure to which it is entirely supported.

D. Performance Requirements

1. General: Design, fabricate, and install awnings to withstand loads from gravity, wind, snow, ponding, drift, seismic, and structural movement, including thermally induced movement; and to resist, without failure, other conditions of in-service use, including exposure to weather.
2. Structural Performance: Provide awnings capable of withstanding the effects of gravity loads and loads and stresses within limits and under conditions required for the location of the Work.
3. Seismic Performance: Provide awnings capable of withstanding the effects of earthquake motions determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures."
4. Thermal Movements: Provide awnings that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, tearing of fabric, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

E. Submittals

1. Product Data: Include styles, material descriptions, construction details, fabrication details, dimensions of individual components and profiles, hardware, fittings, mounting accessories, features, finishes, and operating instructions for awnings.
 - a. Motorized Awning Operators: Include operating instructions.
 - b. Motors: Show nameplate data, ratings, characteristics, and mounting arrangements.
2. Shop Drawings: Show location and extent of awnings. Include elevations, sections, and details not shown in Product Data. Show materials, fabrication, dimensions, mounting heights, connections, anchorages, installation details, attachments to other work, operational clearances, and relationship to adjoining work. Show colors and graphic layout and content.
3. Samples: For each of the following products and for the full range of color, texture, and pattern variations required, prepared on Samples of size indicated below. If finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.
 - a. Awning Fabric: 12-inch- (300-mm-) square section of fabric from dye lot to be used for the Work, with specified treatments applied. Mark face of fabric.



- b. Graphics: Not less than 12-inch- (300-mm-) square section showing graphics application method.
 - c. Seam, Edge, and Corner Condition: Not less than 12-inch- (300-mm-) long section showing seam, edge, and corner treatment.
 - d. Valance: Full-size unit, not less than 12 inches (300 mm) long.
 - e. Frame Finish: Not less than 6-inch (150-mm) lengths.
 - f. Frame Corner and Three **OR** Four, **as directed**, -Way Truss Intersection: Not less than 12-inch (300-mm) sections showing finished joint construction and fabric and valance attachment to awning frame.
 - g. Exposed Hardware Finishes: Manufacturer's standard-size unit, not less than 3 inches (76 mm) square.
 - h. Accessories: Manufacturer's full-size unit.
4. Welding certificates.
 5. Maintenance Data: For awnings to include in maintenance manuals.

F. Quality Assurance

1. Welding: Qualify procedures and personnel according to the following:
 - a. AWS D1.1/D1.1M, "Structural Welding Code--Steel."
 - b. AWS D1.2, "Structural Welding Code--Aluminum."
2. Regulatory Requirements: Provide awnings complying with or exceeding requirements of authorities having jurisdiction>.
3. Fire-Test-Response Characteristics: Provide awning fabrics with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - a. Flame-Resistance Ratings: Passes NFPA 701 **OR** California Code of Regulations, Title 19, **as directed**.
 - b. Permanently attach label to each awning fabric indicating whether fabric is inherently and permanently flame resistant, or treated with flame-retardant chemicals, and whether it will require retreatment after designated time period or cleaning.
4. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

G. Warranty: Manufacturer's standard form in which manufacturer and fabricator agree to repair or replace components of awnings that fail in materials or workmanship within specified warranty period.

1. Awning Warranty Period: Five years from date of Final Completion.
2. Fabric Warranty Period: Three **OR** Five **OR** Eight **OR** 12, **as directed**, years from date of Final Completion.
3. Thread Warranty Period: Five **OR** Eight, **as directed**, years from date of Final Completion.
4. Graphics Warranty Period: Outdoor durability not less than five **OR** three, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Source Limitations: Obtain awnings from single source from single manufacturer.

B. Awning Fabrics

1. Fabric Fiber Content: Vinyl-laminated or -coated polyester mesh **OR** Vinyl-laminated or -coated polyester **OR** Acrylic-coated polyester **OR** Resin-coated polyester **OR** Vinyl-coated polyester/cotton blend **OR** Acrylic-coated polyester/cotton blend **OR** Resin-coated polyester/cotton blend **OR** Solution-dyed acrylic **OR** Solution-dyed modacrylic, **as directed**.
2. Style:



- a. Bottom Hem: Straight **OR** Scalloped, evenly spaced pattern **OR** As indicated by manufacturer's designation **OR** As indicated in an awning schedule, **as directed**.
 - b. Trim: As indicated by manufacturer's designation for style and color **OR** As indicated in a window treatment schedule, **as directed**.
 - c. Fringe: As indicated by manufacturer's designation for style and color **OR** As indicated in an awning schedule, **as directed**.
 - d. Color: Match samples **OR** As selected from manufacturer's full range **OR** As indicated in an awning schedule, **as directed**.
 - e. Applied Treatment: Stain resistant **OR** Mildew resistant **OR** Polymer, flame resistant **OR** Water repellent **OR** Lamination, **as directed**.
 - f. Performance Characteristics: As follows:
 - 1) Mildew Resistance: Showing no growth when tested per ASTM G 21.
 - 2) Shrinkage: Not greater than 0.1 **OR** 0.5 **OR** 1, **as directed**, percent per ASTM D 1204.
 - 3) Stretch Factor: Not less than 0.4 **OR** 1 **OR** 4, **as directed**, percent per ASTM D 4851.
3. Graphic Application: Hand painting **OR** Silk-screen printing **OR** Heat color transfer **OR** Vinyl film with pressure-sensitive adhesive backing **OR** PVDF film with pressure-sensitive adhesive backing **OR** PVF film with pressure-sensitive adhesive backing **OR** Radio-frequency, heat-sealed vinyl film **OR** Eradication **OR** Cut-out lettering, **as directed**.
- a. Text Message: As indicated on Drawings **OR** As indicated in an awning schedule, **as directed**.
 - 1) Text Font: Arial, **unless directed otherwise**.
 - 2) Character Size: Minimum 1-inch- (25.4-mm-) **OR** 1-foot- (0.3048-m-), **as directed**, high characters.
 - b. Vinyl Film: Calendered-vinyl film, not less than 3 mils (0.076 mm) thick, with pressure-sensitive adhesive backing **OR** Cast-vinyl film, not less than 2 mils (0.051 mm) thick, with pressure-sensitive adhesive backing **OR** Cast-vinyl reflective film, not less than 2 mils (0.051 mm) thick, with pressure-sensitive adhesive backing, **as directed**.
4. Inset Fabric: Heat-sealed **OR** Sewn-in, **as directed**, process, and as follows:
- a. Colors: Match samples **OR** As selected from manufacturer's full range **OR** As indicated in an awning schedule, **as directed**.
 - b. Applied Treatment: Stain resistant **OR** Mildew resistant **OR** Polymer, flame resistant **OR** Water repellent, **as directed**.
- C. Thread: 100 percent expanded PTFE **OR** 100 percent bonded polyester, **as directed**, UV-light, mildew, and rot resistant.
- D. Awning Frames
1. Steel Frames:
 - a. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
 - b. Cold-Formed Steel Tubing: ASTM A 500, grade as required by structural loads.
 - c. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless another weight is indicated or required by structural loads.
 - d. Steel Mechanical Tubing: Cold-rolled, electric-resistance-welded carbon or alloy steel tubing complying with ASTM A 513 or steel tubing fabricated from steel complying with ASTM A 1011/A 1011M and complying with dimensional tolerances in ASTM A 500.
 - e. Steel Finish: Manufacturer's standard galvanized and corrosion-resistant mill **OR** Manufacturer's standard decorative **OR** Baked-enamel **OR** Powder-coat, **as directed**, finish complying with finish manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.
 2. Aluminum Frames: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated and with not less than the strength and durability properties of alloy and temper required by structural loads.
 - a. Aluminum Plate and Sheet: ASTM B 209 (ASTM B 209M).
 - b. Aluminum Extrusions: ASTM B 221 (ASTM B 221M).



- c. Extruded Structural Pipe and Round Tubing: ASTM B 429, standard weight (Schedule 40) unless another weight is indicated or required by structural loads.
 - d. Drawn Seamless Tubing: ASTM B 210 (ASTM B 210M).
 - e. Aluminum Finish: Mill **OR** Manufacturer's standard decorative **OR** Baked-enamel **OR** Powder-coat, **as directed**, finish complying with finish manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.
3. Anchors, Fasteners, Fittings, Hardware, and Installation Accessories: Complying with performance requirements indicated and suitable for exposure conditions, supporting structure, anchoring substrates, and installation methods indicated. Corrosion-resistant or noncorrodible units; weather-resistant, tamperproof, vandal- and theft-resistant, compatible, nonstaining materials. Provide as required for awning assembly, mounting, and secure attachment. Number as needed to comply with performance requirements and to maximize appearance; evenly spaced. Where exposed to view, with finish and color as selected by Architect from manufacturer's full range.
- a. Wood Screws: ASME B18.6.1.
 - b. Lag Bolts: ASME B18.2.1. (ASME B18.2.3.8M).
 - c. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.
 - d. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
 - 1) Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).
 - e. Adhesive-Bonded Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 1512 conducted by a qualified independent testing and inspecting agency.
 - 1) Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).
 - f. Grommets: Zinc-coated brass, No. 2 **OR** Stainless steel, No. 2, **as directed**.
 - 1) Grommet Spacing: 6-inch (150-mm) o.c.
 - g. Lacing: 100 percent polyester, braided No. 4.
4. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
5. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- E. Awning Fabrication
1. Fabrics: Reinforce wear points and hardware attachment points with nonwoven **OR** mesh **OR** polypropylene mesh, **as directed**, webbing.
 - a. Fabric Edges and Seams:
 - 1) Fold and stitch selvedge, and cut fabric edges.
 - 2) Hot cut and sealed.
 - 3) Radio-frequency welded.
 - 4) Adhesively bonded.
 - 5) Manufacturer's standard hemming and seaming methods.
 2. Decorative Trims: Borders **OR** Braid and bindings **OR** Cords **OR** Fringe **OR** Patterned edge; scalloped **OR** Patterned edge; V-shaped **OR** Streamers **OR** Tassels **OR** Welting, **as directed**.



- a. Colors: As indicated by manufacturer's designations **OR** Match samples **OR** Matching or coordinating with awning fabric color **OR** As selected from manufacturer's full range **OR** As indicated in an awning schedule, **as directed**.
3. Frames: Preassemble awning frames in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
 - a. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
 - b. Form exposed work true to line and level with accurate angles and surfaces and straight edges.
 - c. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Fabricate slip-fit connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
 - d. Weld corners and connections continuously. Obtain fusion without undercut or overlap. Remove welding flux immediately. At exposed corners and connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
 - e. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications in place and to properly transfer loads.
4. Colors of Metal and Plastic Components Exposed to View: As indicated by manufacturer's designations **OR** Match samples **OR** Matching or coordinating with awning fabric color **OR** As selected from manufacturer's full range **OR** As indicated in an awning schedule, **as directed**.

F. Retractable Awning Operators

1. Manual Operation: With gear and crank operator.
 - a. Manual Operation Assist Mechanism: Manufacturer's standard spring assist for operating heavy awnings.
 - b. Crank Handle: One **OR** Two, **as directed**, detachable.
 - c. Awning Coupler System: Designed for simultaneously operating two **OR** three, **as directed**, awnings with a single crank. Provide system for each group of awnings **OR** where indicated on Drawings **OR** where indicated in an awning schedule, **as directed**.
 - d. Operating Function: Stop and hold awning at any position in ascending or descending travel **OR** Stop and hold awning at either fully open or fully closed positions only, **as directed**.
2. Motorized Operation: Provide factory-assembled motorized retractable awning operation systems designed for retracing awnings of type, size, weight, construction, use, and operation frequency indicated. Provide operation systems of size and capacity and with features, characteristics, and accessories suitable for Project conditions and recommended by awning manufacturer, complete with electric motors and factory-prewired motor controls, remote-control stations, remote-control devices, power disconnect switches, enclosures protecting controls and all operating parts, and accessories required for reliable operation without malfunction. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with building electrical system.
3. Comply with NFPA 70.
4. Control Equipment: Comply with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6 with NFPA 70, Class 2 control circuit, maximum 24-V ac or dc.
5. Electric Motors: UL-approved or -recognized, totally enclosed, insulated motor, complying with NEMA MG 1, with thermal-overload protection and internal limit switches; sized by awning manufacturer to start and operate size and weight of awning considering service factor or considering Project's service conditions without exceeding nameplate ratings.
 - a. Service Factor: According to NEMA MG 1, unless otherwise indicated.
 - b. Motor Characteristics: Single phase, 24 **OR** 110 **OR** 220, **as directed**, V, 60 Hz.
 - c. Coordinate wiring requirements and electrical characteristics of motors with building electrical system.
 - d. Motor Mounting: Within manufacturer's standard roller enclosure.



6. Remote Controls: Electric controls with NEMA ICS 6, Type 1 **OR** 4, **as directed**, enclosure for surface **OR** recessed or flush, **as directed**, mounting. Provide the following devices for remote-control activation of awnings:
 - a. Control Stations:
 - 1) Keyed, maintained **OR** momentary, **as directed**, -contact, three-position, switch-operated control station with open, close, and off functions. Provide two keys per station.
OR
Maintained **OR** Momentary, **as directed**, -contact, three-position, toggle **OR** rocker, **as directed**, -style, wall switch-operated control station with open, close, and center off functions.
 - 2) Color: Ivory **OR** White **OR** As indicated in an awning schedule, **as directed**.
 - b. Group Control Stations: Maintained **OR** Momentary, **as directed**, -contact, three-position, rocker-style, wall switch-operated control station with open, close, and center-off functions for single-switch group control.
 - 1) Color: Ivory **OR** White **OR** As indicated in an awning schedule, **as directed**.
 - c. Individual/Group Control Stations: Maintained **OR** Momentary, **as directed**, -contact, three-position, rocker-style, wall switch-operated control station with open, close, and center-off functions for individual and group control.
 - 1) Color: Ivory **OR** White **OR** As indicated in an awning schedule, **as directed**.
 - d. Sun Sensor Controls: Programmable system activated by LEDs detecting daylight intensity and responding by automatically adjusting awnings.
 - e. Radio Controls: Digital system consisting of code-compatible universal coaxial receiver, one per awning **OR** where indicated on Drawings, **as directed**, and two portable single-channel transmitters for operating a single motor with a single button to open and close awning.
 - f. Radio Controls: Digital system consisting of code-compatible universal coaxial receiver, one per awning **OR** where indicated on Drawings **OR** where indicated in an awning schedule, **as directed**, and two portable multiple-channel transmitters for operating two **OR** four **OR** up to 12, **as directed**, awnings individually, each with a single button to open and close awnings.
 - g. Timer Controls: Clock timer, 24-hour **OR** seven-day, **as directed**, programmable for regular events.
 - h. Microprocessor Controls: Electronic programmable means for setting, changing, and adjusting control features. Provide unit isolated from voltage spikes and surges.
7. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop awning at fully raised and fully lowered positions.
8. Operating Function: Stop and hold awning at any position **OR** Stop and hold awning at three predetermined positions including open, closed, and one user-programmed position, **as directed**.
9. Operating Features: Include the following:
 - a. Group switching with integrated switch control; single face plate for multiple switch cut-outs.
 - b. Capable of accepting input from building automation control system.
 - c. Override switch.
 - d. Backup gear and crank operator for manual operation during power failures with detachable handle, 6 feet (1.8 m) long **OR** manufacturer's standard length **OR** length required to make operation convenient from ground level **OR** length as indicated on Drawings, **as directed**.
10. Awning Hood: Sheet metal enclosure sized to fit awning roller and operating hardware inside and designed for UV-light, dust, weather, and vandal protection. Finish and color to match awning framing **OR** as indicated on Drawings **OR** as indicated in an awning schedule, **as directed**.



1.3 EXECUTION

A. Installation, General

1. General: Install awnings and motor controls at locations and in position indicated, securely connected to supports, free of rack, and in proper relation to adjacent construction. Use mounting methods of types described and in compliance with Shop Drawings and fabricator's written instructions.
2. Install awnings after other finishing operations, including joint sealing and painting, have been completed.
3. Attach fabric to frames as recommended by fabricator, by stapling into slotted track in frame **OR** using lacing method as required to conceal ends of lacing **OR** using fabric hem pockets, **as directed**, to ensure tight, wrinkle-free fit of fabric to frame.
4. Slip fit frame connections accurately together to form hairline joints and tighten to secure.
5. Weld frame connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
 - a. Field Welding: Comply with the following requirements:
 - 1) Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2) Obtain fusion without undercut or overlap.
 - 3) Remove welding flux immediately.
 - 4) At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
6. Anchoring to In-Place Construction: Use anchors, fasteners, fittings, hardware, and installation accessories where necessary for securing awnings to structural support and for properly transferring load to in-place construction.
7. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.
8. Coordinate awning installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed exterior wall and roof assemblies.
9. Connections: Connect motorized operators to building electrical system.

B. Adjusting

1. Adjust awnings to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

C. Cleaning And Protection

1. Clean awning surfaces after installation, according to manufacturer's written instructions.
2. Touchup Painting: Immediately after erection, clean field welds, connections, and abraded areas. Paint uncoated and abraded areas with same or compatible material as used for shop-applied finish painting.
 - a. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.
3. Galvanized Surfaces: Clean field welds, connections, and abraded areas and repair galvanizing to comply with ASTM A 780.
4. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that awnings are without damage or deterioration at time of Final Completion.
5. Replace damaged awnings that cannot be repaired, in a manner approved, before time of Final Completion.

END OF SECTION 10 73 13 00



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SECTION 10 73 26 00 - EXTRUDED ALUMINUM WALKWAY COVER

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of mesh or netting for extruded aluminum walkway cover. Products shall be as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: Submit manufacturer's product information, specifications and installation instructions for building components and accessories.
2. Shop Drawings: Submit complete shop drawings including all necessary plan dimensions, elevations and details. Contractor shall verify all dimensions and provide elevations at each column, finish floor, and related soffit prior to manufacturer for fabrication.
3. Certification: Submit design calculations signed by a Registered Professional Engineer, licensed in the project state. Design calculations shall state that the walkway cover system design complies with the wind requirements of ASCE 7-95, the stability criteria of applicable building code, and all other governing criteria.

C. Quality Assurance

1. Walkway cover shall be wholly produced by a recognized manufacturer with at least 5 years experience in the design and fabrication of extruded aluminum walkway cover systems. Components shall be assembled in shop to the greatest extent possible to minimize field assembly. Walkway system shall be installed by manufacturer. Walkway system, including material and workmanship, shall be warranted from defects for a period of one year from Final Completion of installation.

1.2 PRODUCTS

A. Design

1. Walkway cover shall be all welded extruded aluminum system complete with internal drainage. Non-welded systems are not acceptable. Roll formed deck is not acceptable. Expansion joints shall be included to accommodate temperature changes of 120 degrees F. Expansion joints shall have no metal to metal contact.

B. Materials

1. Aluminum Members: Extruded aluminum 6063 alloy, heat treated to T-6 temper.
2. Fasteners: Aluminum, 18-8 stainless steel or 300 series stainless steel.
3. Protective coating: Aluminum columns embedded in concrete shall be protected with clear acrylic coating.
4. Grout: 2000 psi compressive strength, 1 part Portland cement to 3 parts masonry sand. Add water to grout mixture to produce pouring consistency.
5. Gaskets: Dry seal santoprene or neoprene, pressure type.

C. Components

1. Columns: Radius-cornered tubular extrusion of size indicated with cutout and internal diverter for drainage where indicated. Circular downspout openings in columns are not acceptable.
2. Beams: Open-top tubular extrusion of size and shape indicated, top edges thickened for strength and designed to receive deck members in self-flashing manner. Structural ties shall be installed in tops of beams.



3. Deck: Extruded self-flashing sections interlocking into a composite unit. Closures at deck ends shall be welded plates.
4. Fascia: Manufacturer's standard shape. Size as directed.
5. Flashing: Minimum 0.040-inch thick aluminum.

D. Fabrication

1. Internal Drainage: Water flow shall be directed from deck to beams to columns, as indicated by the shop drawings, for discharge out "weepholes" at ground level. Should underground drainage be required, proper coordination of trades shall be by Contractor.
2. Bent Construction: Beams and columns shall be factory welded with neatly mitered corners into rigid, one-piece units. All welds shall be smooth and uniform using an inert gas shielded arc. Suitable edge preparation shall be provided to assure 100 percent penetration. Grind welds only where interfering with adjoining structure to allow for flush connection. Field welding is not permitted. When size of bent does not permit shipment as a welded unit, rigid mechanical joints may be utilized.
3. Deck Construction: Extruded self-flashing deck sections shall interlock into a composite unit, spanning double-bays. Interlocking joints shall be positively fastened at 8-inches on centers, creating a monolithic structural unit capable of developing the full strength of the sections. The fastenings shall have minimum shear strength of 350 pounds each. Deck shall be assembled with sufficient camber to offset dead load deflection.

E. Finish

1. Clear anodized 204-R1, per AA-M10C22A21 (AAMA 607.1) **OR** bronze, amber or black anodizing per AA-M10C22A42 (AAMA 606.1), **as directed**, color to be selected,
OR
Painted finish shall be baked acrylic enamel (AAMA 603.8) over chromate conversion pretreatment or wash-etch primer **OR** polyester powder coating **OR** high-performance fluoropolymer coating (AAMA 605.2), **as directed**, on deck and fascia.

F. Light Fixture

1. Surface mounted to roof deck as shown on the drawings. Construction shall be of a welded weatherproof, extruded housing, high impact FR grade white acrylic diffuser tethered to housing by wire cables, including 1/2-inch conduit coupling and "Weldnuts" for attachment to roof deck. Finish shall match the extruded roof deck. Ballast shall be class P of voltage required, 0 degree F start. Sockets shall receive dual lamps. Fixtures shall occur at each bay of deck. All penetrations will be covered with a bed of silicone caulking. Caulking shall be applied to a clean and dry surface.

G. Accessories

1. Provide all accessories, fasteners, flashings and other items as necessary for a complete installation.

1.3 EXECUTION

A. Erection

1. Concrete Footings: Provide manufacturer's standard column sleeves (styrofoam block-outs).
2. Surface Mount: Bents shall be anchored to top of existing walks. In canopy runs where lengths exceed 100 ft., the next proceeding bent shall be set into a concrete footing.

B. Installation

1. Walkway cover shall be erected true to line, level, and plumb. Aluminum columns embedded in concrete shall be protected with clear acrylic. Downspout columns shall be filled with grout to the discharge level to prevent standing water. Non-draining columns shall have weep holes installed at top of concrete to remove condensation.



C. Cleaning

1. All walkway cover components shall be cleaned promptly after installation.

D. Protection

1. Extreme care shall be taken to protect materials during and after installation.

END OF SECTION 10 73 26 00



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Task	Specification	Specification Description
10 73 26 00	01 22 16 00	No Specification Required



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SECTION 10 75 16 00 - FLAGPOLES

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for flagpoles. Product shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes ground-mounted, wall-mounted, and roof-mounted flagpoles made from aluminum, copper alloy (bronze), fiberglass, stainless steel, and steel.

C. Performance Requirements

1. Structural Performance: Flagpole assemblies, including anchorages and supports, shall withstand the effects of gravity loads, and the following loads and stresses within limits and under conditions indicated according to the following design criteria:
 - a. Seismic Loads: **<Insert seismic criteria>** according to SEI/ASCE 7.
 - b. Wind Loads: **<Insert wind speed and exposure factor>** according to NAAMM FP 1001, "Guide Specifications for Design of Metal Flagpoles" **OR** SEI/ASCE 7, **as directed**.
 - c. Base flagpole design on polyester **OR** nylon or cotton, **as directed**, flags of maximum standard size suitable for use with flagpole or flag size indicated, whichever is more stringent.

D. Submittals

1. Product Data: For each type of product indicated.
2. Delegated-Design Submittal: For flagpole assemblies indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - a. Include loads, point reactions, and locations for attachment of flagpoles to building's structure.
3. Operation and Maintenance Data: For flagpoles to include in operation and maintenance manuals.

E. Delivery, Storage, And Handling

1. General: Spiral wrap flagpoles with heavy paper and enclose in a hard fiber tube or other protective container.

1.2 PRODUCTS

A. Flagpoles

1. Flagpole Construction, General: Construct flagpoles in one piece if possible. If more than one piece is necessary, comply with the following:
 - a. Fabricate shop and field joints without using fasteners, screw collars, or lead caulking.
 - b. Provide flush hairline joints using self-aligning, snug-fitting, internal sleeves.
OR
Provide self-aligning, snug-fitting joints.
2. Exposed Height: 20 feet (6 m) **OR** 25 feet (7.5 m) **OR** 30 feet (9 m) **OR** 35 feet (11 m) **OR** 40 feet (12 m) **OR** 45 feet (13.5 m) **OR** 50 feet (15 m) **OR** 60 feet (18 m) **OR** 70 feet (21 m) **OR** 80 feet (24 m), **as directed**.



3. Aluminum Flagpoles: Provide cone **OR** entasis, **as directed**, tapered flagpoles fabricated from seamless extruded tubing complying with ASTM B 241/B 241M, Alloy 6063, with a minimum wall thickness of 3/16 inch (4.8 mm).
4. Copper-Alloy (Bronze) Flagpoles: Provide cone **OR** entasis, **as directed**, tapered flagpoles fabricated from seamless pipe or tube complying with ASTM B 43 or ASTM B 135 (ASTM B 135M), Alloy UNS C23000 (red brass, 85 percent copper).
5. Fiberglass Flagpoles: Provide cone **OR** entasis, **as directed**, tapered flagpoles fabricated from polyester resin reinforced with woven glass-fiber roving with 75 percent of glass fibers parallel to length of flagpole.
6. Stainless-Steel Flagpoles: Provide cone **OR** entasis, **as directed**, tapered flagpoles fabricated from pipe, tube, or plate complying with ASTM A 312/A 312M, ASTM A 269, or ASTM A 666, Alloy UNS S30400 **OR** Alloy UNS S31603, **as directed**.
7. Steel Flagpoles: Provide cone-tapered **OR** stepped-sectional, **as directed**, flagpoles fabricated from standard-weight, seamless steel pipe complying with ASTM A 53/A 53M, Type S, Grade B or steel tube complying with ASTM A 513.
8. Metal Foundation Tube: Manufacturer's standard corrugated-steel foundation tube, not less than 0.064-inch- (1.6-mm-) nominal wall thickness. Provide with 3/16-inch (4.8-mm) steel bottom plate and support plate; 3/4-inch- (19-mm-) diameter, steel ground spike; and steel centering wedges welded together. Galvanize steel after assembly. Provide loose hardwood wedges at top of foundation tube for plumbing pole.
 - a. Provide flashing collar of same material and finish as flagpole.
 - b. Provide steel ground protectors extending 12 inches (300 mm) aboveground and 6 inches (150 mm) belowground for steel flagpoles where flashing collars are not provided.
9. Sleeve for Fiberglass **OR** Aluminum, **as directed**, Flagpole: Fiberglass or PVC pipe foundation sleeve, made to fit flagpole, for casting into concrete foundation.
 - a. Provide flashing collar of same material and finish as flagpole.
10. Cast-Metal Shoe Base: For anchor-bolt mounting; provide with anchor bolts.
 - a. Provide units made from aluminum **OR** steel, **as directed**, with same finish and color as flagpoles.
 - b. Provide ground spike at grade-mounted flagpoles for metal flagpoles or fiberglass flagpoles with metal halyards.
 - c. Provide connector to building's lightning protection system conductor at roof-mounted flagpoles for metal flagpoles or fiberglass flagpoles with metal halyards.
11. Hinged Baseplate: Cast-metal tilting hinged base and anchored plate joined by permanently secured pivot rod for aluminum and fiberglass flagpoles 30 to 40 feet (9 to 12 m) or less in height. Provide with stainless-steel screws for securing tilting base to anchored plate when not tilted; provide with anchor bolts.
 - a. Finish base to match flagpole.
 - b. Provide aluminum base or aluminum flashing collar finished to match flagpole.
 - c. Provide ground spike at grade-mounted flagpoles for metal flagpoles or fiberglass flagpoles with metal halyards.
 - d. Provide connector to building's lightning protection system conductor at roof-mounted metal flagpoles for metal flagpoles or fiberglass flagpoles with metal halyards.
12. Pivoting Tilt Base: Steel baseplate with channel or rectangular tube uprights, pivot bolt, and locking device for tilting flagpole. Provide tilting flagpole with steel counterweight box and weights, or provide with internal counterweight. Provide base with anchor bolts.
 - a. Finish base to match flagpole.
 - b. Provide ground spike at grade-mounted flagpoles.

OR

Provide connector to building's lightning protection system conductor at roof-mounted metal flagpoles.
13. Vertical Wall Mount: Cast-aluminum **OR** Cast-copper-alloy (bronze), **as directed**, mounting bracket complete with escutcheon, **as directed**, mounting plate and through-wall anchorage.
 - a. Provide units with same finish as flagpole for copper-alloy (bronze) or aluminum units.



- 1) Provide with neoprene or vinyl covers.
- e. Plastic Halyard Flag Clips: Made from injection-molded, UV-stabilized, acetal resin (Delrin). Clips attach to flag and have two eyes for inserting both runs of halyards. Provide two flag clips per halyard.

C. Miscellaneous Materials

1. Nonshrink, Nonmetallic Grout (for baseplate-mounted flagpoles): Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.
2. Drainage Material (for ground-set flagpoles with foundations): Crushed stone, or crushed or uncrushed gravel; coarse aggregate.
3. Sand (for ground-set, foundation-tube-mounted flagpoles): ASTM C 33, fine aggregate.
4. Elastomeric Joint Sealant (for ground-set, foundation-tube-mounted flagpoles): Multicomponent nonsag urethane **OR** Single-component nonsag urethane **OR** Single-component neutral- and basic-curing silicone **OR** Single-component neutral-curing silicone, **as directed**, joint sealant complying with requirements in Division 07 Section "Joint Sealants" for Use NT (nontraffic) and for Use M, G, A, and, as applicable to joint substrates indicated, for Use O.
5. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

D. General Finish Requirements

1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

E. Aluminum Finishes

1. Natural Satin Finish: AA-M32, fine, directional, medium satin polish; buff complying with AA-M20; seal aluminum surfaces with clear, hard-coat wax.
2. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm **OR** AA-M12C22A31, Class II, 0.010 mm, **as directed**, or thicker.
3. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm **OR** AA-M12C22A32/A34, Class II, 0.010 mm, **as directed**, or thicker.
 - a. Color: Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black, **as directed**.
 - b. Color: Match sample **OR** As selected from full range of industry colors and color densities, **as directed**.
4. Gold Anodic Finish: AAMA 611, AA-M32C22A43 Class I, 0.018 mm or thicker; gold color.
5. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - a. Color and Gloss: As indicated by manufacturer's designations **OR** Match sample **OR** As selected from manufacturer's full range, **as directed**.
6. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2604 **OR** AAMA 2605, **as directed**, and containing not less than 50 **OR** 70, **as directed**, percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Color and Gloss: As indicated by manufacturer's designations **OR** Match sample **OR** As selected from manufacturer's full range, **as directed**.

F. Steel Finishes

1. Flagpole Interior Finish: Apply one coat of bituminous paint on interior of flagpole or otherwise treat to prevent corrosion.
2. Galvanized Finish: Hot-dip galvanize after fabrication to comply with ASTM A 123/A 123M.
3. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning" **OR** SSPC-SP 8, "Pickling," **as**



- directed.** After cleaning, apply a conversion coating suited to the organic coating to be applied over it, **as directed.**
4. Polyurethane Enamel Finish: Immediately after cleaning, apply manufacturer's standard primer and two-coat, high-gloss, high-build polyurethane-enamel finish.
 - a. Color: As indicated by manufacturer's designations **OR** Match sample **OR** As selected from manufacturer's full range, **as directed.**
 5. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).
 - a. Color and Gloss: As indicated by manufacturer's designations **OR** Match sample **OR** As selected from manufacturer's full range, **as directed.**
- G. Stainless-Steel Finishes
1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
 2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - a. Run grain of directional finishes with long dimension of each piece.
 - b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - c. Directional Satin Finish: No. 4.
- H. Copper-Alloy Finishes
1. Buffed Finish, Lacquered: M21-O6x (Mechanical Finish: buffed, smooth specular; Coating: clear organic, air drying, as specified below).
 - a. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).
 2. Medium Satin Finish, Lacquered: M32-O6x (Mechanical Finish: medium satin; Coating: clear organic, air drying, as specified below).
 - a. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).
 3. Statuary Conversion Coating over Satin Finish: M31-C55 (Mechanical Finish: directionally textured, fine satin; Chemical Finish: conversion coating, sulfide).
 - a. Color: Match sample.
- I. Fiberglass Finishes
1. Fiberglass: UV-light stable, hard, high-gloss gel coat or high-gloss, high-build polyurethane or polyester coating.
 - a. Color: As indicated by manufacturer's designations **OR** Match sample **OR** As selected from manufacturer's full range, **as directed.**
- 1.3 EXECUTION
- A. Preparation
1. Prepare uncoated metal flagpoles that are set in foundation tubes by painting below-grade portions with a heavy coat of bituminous paint.
 2. Foundation Excavation: Excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete. Place and compact drainage material at excavation bottom.
 3. Provide forms where required due to unstable soil conditions and for perimeter of flagpole base at grade. Secure and brace forms to prevent displacement during concreting.
 4. Place concrete, as specified in Division 03 Section "Cast-in-place Concrete". Compact concrete in place by using vibrators. Moist-cure exposed concrete for not less than seven days or use nonstaining curing compound.



5. Trowel exposed concrete surfaces to a smooth, dense finish, free of trowel marks, and uniform in texture and appearance. Provide positive slope for water runoff to perimeter of concrete base.

B. Flagpole Installation

1. General: Install flagpoles where shown and according to Shop Drawings and manufacturer's written instructions.
2. Ground Set: Place foundation tube, sleeve, center, and brace to prevent displacement during concreting. Place concrete. Plumb and level foundation tube **OR** sleeve, **as directed**, and allow concrete to cure. Install flagpole, plumb, in foundation tube **OR** sleeve, **as directed**.
 - a. Foundation Tube: Place tube seated on bottom plate between steel centering wedges and install hardwood wedges to secure flagpole in place. Place and compact sand in foundation tube and remove hardwood wedges. Seal top of foundation tube with a 2-inch (50-mm) layer of elastomeric joint sealant and cover with flashing collar.
3. Baseplate: Cast anchor bolts in concrete foundation. Install baseplate on washers placed over leveling nuts on anchor bolts and adjust until flagpole is plumb. After flagpole is plumb, tighten retaining nuts and fill space under baseplate solidly with nonshrink, nonmetallic grout. Finish exposed grout surfaces smooth and slope 45 degrees away from edges of baseplate.
4. Mounting Brackets and Bases: Anchor brackets and bases securely through to structural support with fasteners as indicated on Shop Drawings.

END OF SECTION 10 75 16 00



Task	Specification	Specification Description
10 75 23 00	10 75 16 00	Flagpoles



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SECTION 10 81 13 00 - ORIENTED FLEXIBLE NETTING BIRD BARRIER

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of oriented flexible netting bird barrier. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

1.2 PRODUCTS

A. Material

1. Polyethylene twine netting attached to pre-installed cable system and steel installation hardware.
2. Netting shall be high density polyethylene knitted into sheets with mesh sizes of 3/4" **OR** 1-1/8" **OR** 2", **as directed**. Polyethylene shall be UV treated, color stable, and flame-retardant.
3. Color shall be selected from manufacturer's standard colors.
4. Installation hardware shall include corner and intermediate attachments, perimeter cable, turnbuckles, ferrules or clamps and net rings.

1.3 EXECUTION

A. Installation

1. Comply with manufacturer's printed instructions.

END OF SECTION 10 81 13 00



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SECTION 11 12 16 00 - PARKING CONTROL EQUIPMENT

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for parking control equipment. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Automatic barrier gates.
 - b. Vehicle detectors.
 - c. Traffic controllers.
 - d. Entry terminal ticket dispensers.
 - e. Exit terminals.
 - f. Pay stations.
 - g. Fee computers.
 - h. Parking facility management software.
 - i. Access control units.

C. System Description

1. Parking Control System: Intended to be used for the following types of parking management:
 - a. Transient Parking: Hourly rated parking, with fee paid while entering **OR** exiting, **as directed**.
 - b. Monthly Parking: Monthly rated parking, with fee paid by the month and access gained by access control card.
 - c. Flat-Rate Parking: Unlimited-duration parking, with free gate entry and fixed-fee amount paid while exiting.
 - d. Special-Event Parking: Duration-of-event parking, with fee paid while entering with gates up or down.
 - e. Limited Date(s) and Time(s) Parking: Limited-duration parking, with predetermined fee access control card.
 - f. Merchant Validated Parking: Fee set, reduced, or waived by merchant validation, with free gate entry and fee paid while exiting.
 - g. Valet Parking: Assisted parking, with fee paid while entering or exiting.
 - h. Hotel Guest Parking: Unlimited access for duration of stay, with access gained by access control card.

D. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: For parking control equipment. Include plans, elevations, sections, details, and attachments to other work.
 - a. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - b. Wiring Diagrams: For power, signal, and control wiring.
3. Field quality-control reports.
4. Operation and Maintenance Data: For parking control equipment to include in emergency, operation, and maintenance manuals.
5. Software and Firmware Operational Documentation:
 - a. Software operating and upgrade manuals.
 - b. Program Software Backup: On magnetic media or compact disk, complete with data files.
 - c. Device address list.



d. Printout of software application and graphic screens.

E. Quality Assurance

1. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. Preinstallation Conference: Conduct conference at Project site.

F. Software Service Agreement

1. Technical Support: Beginning with Final Completion, provide software support for two, **as directed**, years.
2. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two, **as directed**, years from date of Final Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
 - a. Provide 30, **as directed**, days' notice to the Owner to allow scheduling and access to system and to allow the Owner to upgrade computer equipment if necessary.

1.2 PRODUCTS

A. Materials

1. Aluminum: Alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated, and as follows:
 - a. Sheet: ASTM B 209 (ASTM B 209M).
 - b. Extruded Shapes: ASTM B 221 (ASTM B 221M).
2. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
3. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, commercial quality, with G60 (Z180) coating designation; mill phosphatized.
4. Stainless-Steel Sheet: ASTM A 666, Type 304.
5. Anchorages: Anchor bolts, hot-dip galvanized according to ASTM A 153/A 153M and ASTM F 2329.

B. Automatic Barrier Gates

1. General: Provide UL-approved parking control device consisting of operator and controller housed in a weathertight, tamper-resistant cabinet enclosure with gate arm. Device shall be activated by a signal from access or revenue control device. Fabricate unit with gate-arm height in down position of not more than 35 inches (889 mm) above pavement to prevent even small vehicles from passing under gate arm.
2. Standard: Provide barrier gates and gate operators that are listed and labeled according to UL 325 by a qualified testing agency. Provide barrier gates that comply with ASTM F 2200, **as directed**.
3. Controller: Factory-sealed, solid-state, plug-in type, with galvanized-steel box for wiring connections.
 - a. Type: Noncommunicating.
 - 1) Capable of logic for one- and two-way lanes.
 - 2) Separate momentary contacts for transient patrons, monthly patrons, vehicle entries, and vehicle exits.
 - b. Type: Communicating.
 - 1) Real-time communication of lane counts, status messages, and execute commands.
 - 2) Monitor illegal entries and exits, tailgates, tickets, monthlies, and backouts.
 - 3) Status messages for gate up too long, backouts, ticket in chute, and gate-arm rebound.



- 4) Communication commands for resetting loops, turning "Full" signs on/off, raising and lowering gate arm, and disabling ticket dispensers **OR** card readers, **as directed**.
- c. Features: Equip unit with the following:
 - 1) Able to store successive inputs and sequentially processing each one.
 - 2) Automatic instant-reversing obstacle detector mechanism that stops downward motion of gate arm if arm contacts or nears an object and that immediately returns arm to upward position. Include a 0- to 60-second, variable-time reset device.
 - 3) On-off power supply switch.
 - 4) Automatic-manual switch.
 - 5) Differential counter.
 - 6) Directional arming logic.
 - 7) RS-422 communication port.
 - 8) Broken gate-arm monitoring.
 - 9) Programmable automatic, **as directed**, timer.
 - 10) Internal resettable **OR** non-resettable, **as directed**, counters.
 - 11) Thermal-overload protection with manual reset.
 - 12) Plug-in connectors for two **OR** three, **as directed**, vehicle loop detectors.
 - 13) Thermostatically controlled heater with on/off/auto switch.
 - 14) Diagnostic mode for on-site testing, with LEDs for inputs and outputs, **as directed**.
 - 15) Automatic and continuous testing of inputs and outputs.
 - 16) Switch to test motor and limit switches.
 - 17) Emergency manual disconnect.
 - 18) Battery backup.
 - 19) Single, 115-V ac grounded power receptacle.
 - 20) Reversible arm capability for right- or left-handed operation.
4. Cabinets: Fabricated from metal sheet with seams welded and ground smooth; approximately 15 inches square by 40 inches tall (381 mm square by 1016 mm tall). Provide single, gasketed access door for each cabinet with flush-mounted locks. Furnish two keys for each lock, all locks keyed alike, **as directed**. Fabricate cabinet with internal reinforcing and four mounting holes accessible only from inside cabinet.
 - a. Material: Not less than 0.097-inch- (2.5-mm-) thick, galvanized-, **as directed**, steel sheet or 0.125-inch- (3.2-mm-) thick aluminum sheet.
 - 1) Finish cabinet, interior and exterior, with manufacturer's standard white **OR** yellow, **as directed**, baked-enamel finish over primer.
 - b. Material: Not less than 0.109-inch- (2.8-mm-) thick, stainless-steel sheet.
 - 1) Finish cabinet exterior with No. 4 finish.
OR
Finish cabinet, interior and exterior, with manufacturer's standard white **OR** yellow, **as directed**, baked-enamel finish over primer.
5. Straight Gate Arm: 1-by-4-inch nominal- (19-by-89-mm actual-) size pine or redwood **OR** 0.097-inch- (2.5-mm-) thick steel **OR** Fiberglass, PVC, or polycarbonate **OR** Aluminum, **as directed**, with painted finish and black diagonal stripes on traffic-side face. Provide mounting flange with breakaway feature to ensure clean break if arm is struck by vehicle.
 - a. Length: 10 feet (3.0 m) **OR** 12 feet (3.7 m) **OR** As indicated on Drawings, **as directed**.
6. Folding Gate Arm: Two pieces of 1-by-4-inch nominal- (19-by-89-mm actual-) size pine or redwood joined together with metal side brackets; with painted finish and black diagonal stripes on traffic-side face. Provide mounting flange with breakaway feature to ensure clean break if arm is struck by vehicle.
 - a. Length: 10 feet (3.0 m) **OR** 12 feet (3.7 m) **OR** As indicated on Drawings, **as directed**.
7. Straight Gate Arm with Counterbalance: 1-by-6-inch nominal- (19-by-140-mm actual-) size pine or redwood with steel counterweights; with painted finish and black diagonal stripes on traffic-side face. Provide mounting flange with breakaway feature to ensure clean break if arm is struck by vehicle.
 - a. Length: 16 feet (4.9 m) **OR** As indicated on Drawings, **as directed**.
8. Wishbone-Style Gate Arm: 1-by-4-inch nominal- (19-by-89-mm actual-) size pine or redwood **OR** 0.097-inch- (2.5-mm-) thick steel, **as directed**, formed into wishbone configuration, with steel



counterweights; with painted finish and black diagonal stripes on traffic-side face. Provide mounting flange with breakaway feature to ensure clean break if arm is struck by vehicle.

- a. Length: 14 feet (4.3 m) **OR** As indicated on Drawings, **as directed**.
9. Operator: 1/3 **OR** 1/2, **as directed**, hp; 60-Hz, single-phase, instant-reversing, continuous-duty motor for operating gate arm. Transmit power to gate-arm drive shaft through speed reducer to harmonic-acting crank and connecting rod. Fabricate crank, rod, and drive shaft of galvanized solid bar steel. Provide an operable cam for adjusting arm travel.
 - a. Opening Time: Three **OR** Six, **as directed**, seconds.
 - b. Inherently adjustable torque limiting clutch for safety.
10. Accessories:
 - a. Audible alarm that activates as part of a safety device system.
 - b. Additional obstruction detector; noncontact infrared **OR** photoelectric **OR** radio-frequency barrier, **as directed**.
 - c. Barrier-arm warning safety signs on both sides of unit limiting traffic to vehicular traffic.
 - d. Low-voltage yellow **OR** red, **as directed**, warning lights that illuminate when gate is in down position.
 - e. Low-voltage light on cabinet top that flashes or changes from red to green when barrier gate is operating.
 - f. Manually operated crank for emergency operation.
 - g. Local authorities' emergency access as directed by the Owner.
 - h. Gate-arm tip support with electromagnetic lock, **as directed**.

C. Vehicle Detectors

1. Vehicle Loop Detector System: Provide self-tuning electronic presence detector with adjustable detection patterns, adjustable sensitivity and frequency settings, and panel indicator light designed to detect presence or transit of a vehicle over an embedded loop of wire and to emit signal activating gate-arm operator. Include automatic closing timer with adjustable time delay before closing, timer cut-off switch, **as directed**, and vehicle loop detector designed to open and close gate arm **OR** hold gate arm open until traffic clears, **as directed**. Provide number of loops consisting of multiple strands of wire, number of turns, loop size, and method of placement at location shown on Drawings, as recommended in writing by detection system manufacturer for function indicated.
 - a. Field-Assembled Loop: Wire, in size indicated for field assembly, and sealant; style for pave-over **OR** saw-cut, **as directed**, installation.
 - b. Factory-Formed Loop: Wire, preformed in size indicated; style for pave-over **OR** saw-cut, **as directed**, installation.
 - c. System Performance: Capable of the following:
 - 1) Recognize two vehicles within 6 inches (152 mm) of each other on standard-sized loop.
 - 2) Recognize vehicle direction by detecting vehicle moving from one loop to another.
 - 3) Generate reverse count if vehicle backs up after generating directional count in forward direction.
 - 4) Continuous diagnostic monitoring for intermittently operating and failed loops.
 - 5) Crosstalk test between adjacent loops.
2. Active Infrared Vehicle Detector: Provide retroreflective **OR** emitter/receiver, **as directed**,-type presence detector with adjustable detection zone pattern and sensitivity, designed to detect the presence or transit of vehicle in gate-arm pathway by interrupting infrared beam in zone pattern and to emit signal activating gate-arm operator. Include automatic closing timer with adjustable time delay before closing, timer cut-off switch, **as directed**, and vehicle presence detector designed to open and close gate arm **OR** hold gate arm open until traffic clears, **as directed**.

D. Traffic Controllers

1. Penetrating Type: Provide directional enforcement system consisting of multiple raised teeth that allow vehicular traffic in one direction and that puncture tires of vehicular traffic in the other direction. Fabricate system from steel plate contained in welded steel frame.



- a. Mounting: Surface **OR** Recessed, **as directed**.
 - b. Operation: Manual, with each tooth controlled by torsion spring **OR** Electromechanical **OR** Hydraulic, **as directed**.
 - c. Latch Down: Allow disarming for two-way traffic flow. Provide one, **as directed**, tool(s) for latch-down operation.
 - d. Illuminated Warning Signs: Single **OR** Double, **as directed**, -faced warning signs consisting of fluorescent lamps with cold-start ballasts contained in welded steel bodies with baked-enamel finish and fiberglass sign faces. Provide base sleeves and posts for post mounting, **as directed**.
 - 1) Sign Copy: "Wrong Way, Stop, Severe Tire Damage" **OR** "Warning, Do Not Back Up, Tire Damage," **as directed**.
2. Nonpenetrating Type: Provide directional enforcement system consisting of spring-activated steel curb that allows traffic in only one direction. Fabricate system from steel plate contained in welded steel frame.
 - a. Mounting: Surface **OR** Recessed, **as directed**.
 - b. Operation: Manual **OR** Electromechanical **OR** Hydraulic, **as directed**.
- E. Entry Terminal Ticket Dispensers
1. General: Provide entry terminal ticket dispensers, consisting of ticket-printing and issuing mechanisms, ticket magazines, thermal printers, and controllers housed in cabinet enclosures.
 - a. Features: Include the following:
 - 1) Time and date display.
 - 2) Time Indicator: 24-hour cycle with A.M. and P.M. **OR** military-time, **as directed**, clock mechanism.
 - 3) Voice annunciation.
 - 4) Tickets: Standard paper **OR** Magnetic-stripe **OR** Barcode, **as directed**, type.
 - 5) Removable ticket tray with capacity of 5000, **as directed**, fan-folded tickets.
 - 6) Operation: Standalone **OR** Online communication to remote computer, **as directed**.
 - 7) Battery backup for clock and RAM memory.
 - 8) RS-422 communication port.
 - 9) Thermostatically controlled heater with on/off/auto switch.
 - 10) Access **OR** Credit, **as directed**, card acceptance with activation slot and "Insert Ticket/Card" message.
 - 11) License plate recognition.
 - 12) Multiple ticket option for valet parking.
 - 13) Intercom.
 2. System Performance: Activation by button with "Push for Ticket" message **OR** vehicle detector **OR** card reader, **as directed**. On activation, unit automatically records entry time and date on ticket, sounds buzzer, **as directed**, and dispenses ticket.
 - a. Automatic ticket validation.
 - b. Program ticket numbering.
 - c. Low-ticket alarm.
 - d. Out-of-ticket alarm.
 - e. Ticket jam detection.
 - f. Print test ticket.
 3. Cabinets: Fabricated from metal sheet with seams welded and ground smooth, approximately 15 inches square by 40 inches tall (381 mm square by 1016 mm tall); consisting of base and top components. Provide single, gasketed access door for each base component with flush-mounted locks. Furnish two keys for each lock, all locks keyed alike, **as directed**. Fabricate cabinet with internal reinforcing and four mounting holes accessible only from inside cabinet. Fabricate top component so it can be unlocked and opened for ticket loading and maintenance. Include flush-mounted lock in rear of top, keyed the same as base component lock.
 - a. Material: Not less than 0.097-inch- (2.5-mm-) thick, galvanized-, **as directed**, steel sheet or 0.125-inch- (3.2-mm-) thick aluminum sheet.
 - 1) Finish cabinet, interior and exterior, with manufacturer's standard white **OR** yellow, **as directed**, baked-enamel finish over primer.



b. Material: Not less than 0.109-inch- (2.8-mm-) thick, stainless-steel sheet.

1) Finish cabinet exterior with No. 4 finish.

OR

Finish cabinet, interior and exterior, with manufacturer's standard white **OR** yellow, **as directed**, baked-enamel finish over primer.

4. Ticket-Dispensing Mechanisms: Removable assembly, with self-sharpening ticket cutter or ticket burster and plug-in controller.

F. Exit Terminals

1. General: Provide exit terminals consisting of ticket collectors, magnetic-stripe ticket readers, LCD, **as directed**, displays, thermal printers, and controllers housed in cabinet enclosures. Provide "Please Insert Ticket" sign on side of cabinet visible to driver.

a. Features: Include the following:

1) Operation: Standalone **OR** Online communication to remote computer, **as directed**.

2) Battery backup for clock and RAM memory.

3) Thermostatically controlled heater with on/off/auto switch.

4) RS-422 communication port.

5) Access **OR** Credit, **as directed**, card acceptance with activation slot and "Insert Ticket/Card" message.

6) Intercom.

2. System Performance: Capable of the following:

a. Activated by vehicle detector **OR** card reader, **as directed**.

b. Print receipts on demand.

c. Voice annunciation.

d. Program facility code.

e. Program grace period.

f. Program display.

g. Program timer for closing barrier gate.

h. Reports for events and exception events.

i. Built-in service diagnostics.

3. Operation: Inserting exit ticket into exit ticket reader results in the following actions:

a. Valid Exit Ticket: Exit ticket reader captures ticket and automatically sends signal to raise barrier gate.

b. Invalid Exit Ticket: Exit ticket reader rejects ticket and displays "Pay Cashier First" message.

c. Exit Ticket with Elapsed Grace Time: Exit ticket reader rejects ticket and displays "Return to Cashier" message.

4. Cabinets: Fabricated from metal sheet with seams welded and ground smooth; approximately 15 inches square by 40 inches tall (381 mm square by 1016 mm tall). Provide single, gasketed access door for each cabinet with flush-mounted locks. Furnish two keys for each lock, all locks keyed alike, **as directed**. Fabricate cabinet with internal reinforcing and four mounting holes accessible only from inside cabinet.

a. Material: Not less than 0.097-inch- (2.5-mm-) thick, galvanized-, **as directed**, steel sheet or 0.125-inch- (3.2-mm-) thick aluminum sheet.

1) Finish cabinet, interior and exterior, with manufacturer's standard white **OR** yellow, **as directed**, baked-enamel finish over primer.

b. Material: Not less than 0.109-inch- (2.8-mm-) thick, stainless-steel sheet.

1) Finish cabinet exterior with No. 4 finish.

OR

Finish cabinet, interior and exterior, with manufacturer's standard white **OR** yellow, **as directed**, baked-enamel finish over primer.

G. Pay Stations

1. General: Provide self-contained cashiering central **OR** entry **OR** exit, **as directed**, pay stations designed for self-service operation; consisting of magnetic-stripe ticket dispensers and, **as**



directed, readers/validators, LCD, **as directed**, displays, fee computers, controllers, **as directed**, and thermal printers housed in a combined enclosure.

- a. Features: Include the following:
 - 1) Operation: Standalone **OR** Online communication to remote computer, **as directed**.
 - 2) Battery backup for clock and RAM memory.
 - 3) Thermostatically controlled heater with on/off/auto switch.
 - 4) Access card acceptance.
 - 5) Intercom.
2. System Performance: Capable of the following:
 - a. Compute multiple parking fees based on entry times on ticket from ticket dispenser.
 - b. Compute multiple taxes by percent and fixed amount.
 - c. Program lost ticket function.
 - d. Display fee.
 - e. Accept payment by cash credit card **OR** debit card **OR** merchant ticket, **as directed**.
 - f. Compute change.
 - g. Print receipts on demand.
 - h. Print validation on ticket.
 - i. Voice annunciation.
 - j. Print audit trail.
 - k. Program six, **as directed**, fee structures.
 - l. Program time.
 - m. Program merchant validations.
 - n. Test mode to verify accuracy of fee structure program.
 - o. Built-in service diagnostics.
 - p. Print cash audit, revenue, operational, and statistical reports on demand.
 - q. Duress alarm output for emergencies.
 - r. Battery backup.
3. Cabinets: Fabricated from cold-rolled steel sheet with seams welded and ground smooth, approximately 36 inches wide by 18 inches deep by 60 inches tall (914 mm wide by 457 mm deep by 1524 mm tall). Provide single, gasketed access door with flush-mounted locks. Furnish two keys for each lock, all locks keyed alike, **as directed**. Fabricate cabinet with internal reinforcing and four mounting holes accessible only from inside cabinet.
 - a. Finish cabinet, interior and exterior, with manufacturer's standard white **OR** yellow, **as directed**, baked-enamel finish over primer.

H. Fee Computers

1. Fee Computer System: Provide modular PC-based, **as directed**, system consisting of fee computer terminal, cash drawer, **OR** two cash drawers, **as directed**, standard ticket reader, **OR** magnetic-stripe ticket reader, **OR** barcode ticket reader, **as directed**, and detachable printer. Register permanent record of each transaction in computer's memory.
 - a. Features: Provide the following:
 - 1) Battery backup for clock and RAM memory.
 - 2) RS-422 communication port.
 - 3) Keyed **OR** Keyless-membrane, **as directed**, keypad.
2. System Performance: Capable of the following:
 - a. Compute multiple parking fees based on entry times on ticket from ticket dispenser.
 - b. Compute multiple taxes by percent and fixed amount.
 - c. Program lost ticket function.
 - d. Display fee on remote fee display device.
 - e. Accept payment by cash check **OR** credit card **OR** debit card **OR** merchant ticket, **as directed**.
 - f. Control independent cash drawer.
 - g. Compute change.
 - h. Print receipts.
 - i. Print validation on ticket.
 - j. Print audit trail.



- k. Interface to automatic barrier gate.
 - l. Program six, **as directed**, fee structures.
 - m. Program time.
 - n. Program keys.
 - o. Program special events validations.
 - p. Program automatic activation for limited date(s) and time(s) validations.
 - q. Program merchant validations.
 - r. Program valet parking.
 - s. Program hotel guest parking.
 - t. Three levels of security, including cashier, supervisor, and master.
 - u. Recall last transaction.
 - v. Test mode to verify accuracy of fee structure program.
 - w. Built-in service diagnostics.
 - x. View cash audit, revenue, operational, and statistical reports on screen or print on demand.
 - y. Duress alarm output for emergencies.
 - z. Battery backup.
3. Cash Drawer: Fabricated with a removable tray and drawer, with five compartments for paper currency and five compartments for coins.
 4. Remote Fee Display: Single-faced signs designed for use with fee computer, consisting of 1-inch- (25-mm-) tall, LCD or LED displays contained in welded steel bodies with baked-enamel finish.
 - a. Messages: Amount due, "Thank You," "Closed," and time in A.M./P.M. format.
 - b. Mounting: Front of cashier's booth **OR** 42-inch- (1067-mm-) high pedestal, **as directed**.
- I. Miscellaneous Parking Control Equipment
1. Lot "Full" Signs: Single-faced signs consisting of illumination source contained in welded steel bodies with extended hood and baked-enamel finish. Sign copy shall be 4 inches (102 mm), **as directed**, tall.
 - a. Type: Flashing **OR** Nonflashing, **as directed**.
 - b. Operation: Manual by push button **OR** Automatic by barrier gate controller, **as directed**.
 - c. Illumination: Traffic signal lamps and colored **OR** Neon tube and clear, **as directed**, fiberglass sign face.
 - d. Mounting: Top of barrier gate cabinet **OR** 42-inch- (1067-mm-) high pedestal, **as directed**.
- J. Parking Facility Management Software
1. General: Manufacturer's standard software that is compatible with security access control system and that provides automatic facility monitoring, supervision, and remote control of parking control equipment from one or more locations.
 - a. System Performance: Capable of the following:
 - 1) Collect data for revenue and activity reporting.
 - 2) Collect data for access and space control.
 - 3) Track tickets.
 - 4) Program parking control equipment.
- K. Access Control Units
1. General: Provide access control unit that activates barrier gates.
 - a. Unit Housing: Fabricate from welded cold-rolled steel or aluminum sheet **OR** plastic, **as directed**, with weatherproof front access panel equipped with flush-mounted lock and two keys. Provide face-lighted unit fully visible at night.
 - 1) Steel Finish: Manufacturer's standard baked-enamel coating system.
 2. Card Reader Controlled Unit: Functions only when authorized card is presented.
 - a. System: Magnetically coded, single-code system activated by coded card **OR** Programmable, multiple-code capability permitting validating or voiding of individual cards, **as directed**.
 - 1) Permit four different access time periods.



- b. Reader: Swipe type for magnetic-stripe **OR** barcode **OR** Wiegand, **as directed**, cards.
OR
Reader: Insertion type for magnetic-stripe **OR** barcode **OR** Wiegand, **as directed**, cards.
OR
Reader: Proximity type for proximity cards.
 - c. Operation: Standalone **OR** Online communication to remote parking control system computer **OR** Online communication to remote security access control system computer, **as directed**.
 - d. Features: Timed antipassback **OR** Limited-time usage **OR** Capable of monitoring and auditing barrier gate activity **OR** LCD display **OR** Programmable by PDA (personal digital assistant) by infrared interface, **as directed**.
 - e. Mounting: With pedestal **OR** Wall **OR** In enclosed cabinet **OR** As indicated on Drawings, **as directed**.
 - f. Cards: Provide number as directed by the Owner..
 - 1) Imprint cards: as directed by the Owner.
3. Digital Keypad Controlled Unit: Functions only when authorized code is entered on keyed **OR** keyless-membrane, **as directed**, keypad.
- a. System: Multiple-code capability of not less than five **OR** 100 **OR** 500, **as directed**, possible individual codes.
OR
System: Programmable, multiple-code capability permitting validating or voiding of not less than 100 **OR** 2500 **OR** 10,000, **as directed**, possible individual codes, consisting of one to six, **as directed**, digits, and permitting four different access time periods, **as directed**.
 - b. Operation: Standalone **OR** Online communication to remote parking control system computer **OR** Online communication to remote security access control system computer, **as directed**.
 - c. Features: Timed antipassback **OR** Limited-time usage **OR** Capable of monitoring and auditing barrier gate activity, **as directed**.
 - d. Mounting: With pedestal **OR** Wall **OR** As indicated on Drawings, **as directed**.
4. Radio-Controlled System: Digital access control system consisting of code-compatible universal coaxial receiver, one per barrier gate, **OR**, where indicated on Drawings, **as directed**, remote antenna with coaxial cable and mounting brackets, and one permanently mounted **OR** four portable, **as directed**, transmitter(s) per receiver designed to operate barrier gates. Provide programmable transmitter with multiple-code capability permitting validating or voiding of not less than 1000 **OR** 10,000, **as directed**, codes per channel configured for the following functions:
- a. Transmitters: Single-button operated, with open **OR** open and close, **as directed**, functions.
OR
Transmitters: Triple-button operated, with open, close, and stop functions.
 - 1) Provide transmitters featuring two **OR** three **OR** four, **as directed**, independent channel settings controlling separate receivers for operating more than one barrier gate from each transmitter.
- L. Aluminum Finishes
- 1. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - a. Color and Gloss: As indicated by manufacturer's designations **OR** Match sample **OR** As selected from manufacturer's full range, **as directed**.
- M. Steel Finishes
- 1. Galvanizing: Hot-dip galvanize items as indicated to comply with the following:
 - a. ASTM A 123/A 123M for iron and steel parking control equipment.
 - b. ASTM A 153/A 153M and ASTM F 2329 for iron and steel hardware for parking control equipment.



2. Galvanized-Steel and Steel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
 - a. Color and Gloss: As indicated by manufacturer's designations **OR** Match sample **OR** As selected from manufacturer's full range, **as directed**.

N. Stainless-Steel Finishes

1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - a. Run grain of directional finishes with long dimension of each piece.
 - b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

1.3 EXECUTION

A. Preparation

1. Excavation for Traffic Controllers: Saw cut existing pavement for recessed traffic controllers and hand-excavate recesses to dimensions and depths and at locations as required by traffic controller manufacturer's written instructions and as indicated on Drawings.

B. Installation

1. General: Install parking control equipment as required for a complete and integrated installation.
 - a. Rough-in electrical connections according to requirements specified in Division 22..
2. Automatic Barrier Gates: Anchor cabinets to concrete bases with anchor bolts or expansion anchors and mount barrier gate arms.
 - a. Install barrier gates according to UL 325.
3. Vehicle Loop Detectors: Cut grooves in pavement and bury **OR** Bury, **as directed**, and seal wire loop at locations indicated on Drawings according to manufacturer's written instructions. Connect to parking control equipment operated by detector.
4. Traffic Controllers: Anchor controllers to recessed concrete bases **OR** driveway surfaces, **as directed**, with anchor bolts or expansion anchors.
5. Entry Terminal Ticket Dispensers, Pay Stations and Exit Terminals: Attach cabinets to concrete bases with anchor bolts or expansion anchors.
 - a. Connect equipment to remote computer.
 - b. Load ticket dispenser with supply of tickets.
6. Fee Computers: Install computers at locations indicated, including connecting to peripheral equipment and remote computers, **as directed**.
7. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".
8. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".

C. Field Quality Control

1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
2. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
3. Perform tests and inspections.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
4. Tests and Inspections:
 - a. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.



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- b. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - c. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 5. Parking control equipment will be considered defective if it does not pass tests and inspections.
 6. Prepare test and inspection reports.
- D. Adjusting
1. Adjust parking control equipment to function smoothly and lubricate as recommended by manufacturer.
 2. Confirm that locks engage accurately and securely without forcing or binding.
 3. After completing installation of exposed, factory-finished parking control equipment, inspect exposed finishes and repair damaged finishes.
- E. Protection
1. Remove barrier gate arms during the construction period to prevent damage, and install them immediately before Final Completion.

END OF SECTION 11 12 16 00



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SECTION 11 12 16 00a - PREFABRICATED CONTROL BOOTHS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for prefabricated control booths. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes prefabricated steel and aluminum control booths.

C. Definition

1. ADA-ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines."

D. Performance Requirements

1. Structural Performance: Control booths shall withstand the effects of gravity loads and the loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

E. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
3. Samples: For control booths with factory-applied color finishes.
4. Delegated-Design Submittal: For control booths indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
5. Welding certificates.
6. Maintenance data.
7. Warranty: Sample of special warranty.

F. Quality Assurance

1. Welding Qualifications: Qualify procedures and personnel according to the following:
 - a. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - b. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 - c. AWS D1.3, "Structural Welding Code - Sheet Steel."
2. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
4. Safety Glazing Products: Category II materials complying with testing requirements in 16 CFR 1201.
5. Preinstallation Conference: Conduct conference at Project site.

G. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair finish or replace wall panels that fail in materials or workmanship within five years from date of Final Completion.



1.2 PRODUCTS

A. Materials

1. Aluminum: Alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated, and as follows:
 - a. Sheet: ASTM B 209 (ASTM B 209M).
 - b. Extruded Shapes: ASTM B 221 (ASTM B 221M).
 - c. Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T4 or Alloy 6061-T6.
2. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, commercial quality, G90 (Z275) coating designation; mill phosphatized.
3. Galvanized, Rolled Steel Tread Plate: ASTM A 786/A 786M, rolled from steel plate complying with ASTM A 572/A 572M, Grade 55 (380); hot-dip galvanized according to ASTM A 123/A 123M.
4. Steel Structural Tubing: ASTM A 500, Grade B.
5. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
6. Steel Mechanical Tubing: ASTM A 513, welded steel mechanical tubing.
7. Zinc-Coated (Galvanized) Steel: Hot-dip galvanized according to ASTM A 123/A 123M.
8. Stainless-Steel Sheet: ASTM A 666, Type 304.
9. Plastic Laminate: NEMA LD 3, HGS or HGL grade.
10. Plywood: DOC PS 1, Exterior grade.
11. Particleboard: ANSI A208.1, Grade M-2.
12. Clear Float Glass: ASTM C 1036, Type I, Class 1, Quality q3.
13. Clear Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Class 1, and Quality q3.
14. Insulating Glass: Units complying with ASTM E 774 for Class CBA and consisting of two lites of 2.5-mm-thick clear float glass and dehydrated air space, with a total overall unit thickness of 7/16 inch (11 mm) and with manufacturer's standard dual seal.
15. Ballistics-Resistant Glazing: Comply with requirements specified in Division 08 Section "Security Glazing".
16. Anchorages: Anchor bolts; hot-dip galvanized according to ASTM A 153/A 153M or ASTM F 2329 **OR** stainless steel, **as directed**.

B. Prefabricated Control Booths, General

1. General: Provide a complete, integrated set of mutually dependent components that form a completely assembled, prefabricated control booth, ready for installation on Project site.
 - a. Building Style: Standard square corners **OR** Radius corners **OR** Round corners **OR** Butt-glazed corners **OR** Wraparound type, with single rounded building end **OR** Wraparound type, with both building ends rounded **OR** As indicated on Drawings, **as directed**.
 - b. Doors: Sliding door on one side **OR** Sliding doors on both sides **OR** Swinging door on back **OR** As indicated on Drawings, **as directed**.
2. Windows: Extruded-aluminum sash frames glazed with 6-mm-thick, clear tempered glass **OR** clear insulating glass **OR** ballistics-resistant glazing, UL 752 Level **as directed**.
 - a. Frame Finish: Mill **OR** Clear anodic, **as directed**.
 - b. Provide insect screens for each operable window.
 - c. Provide galvanized-steel security screens for each window.
 - d. Corner Shape: Square **OR** Round, **as directed**.
3. Horizontal Sliding Windows: Extruded-aluminum sash frames glazed with 3-mm-thick, clear tempered float glass. Equip windows with cam locks, weather stripping, and stainless-steel **OR** nylon, **as directed**, ball-bearing rollers.
 - a. Frame Finish: Mill **OR** Clear anodic, **as directed**.
 - b. Provide insect screens for each operable window.
 - c. Corner Shape: Square **OR** Round, **as directed**.
4. Work Counters: Full width of control booth, reinforced; with 16-inch- (406-mm-) wide storage **OR** cash, **as directed**, drawer below each counter, and an access opening for electrical cords at each rear corner of counter.



- a. Material: 0.078-inch- (1.98-mm-) thick, stainless-steel sheet **OR** 0.079-inch (2.01-mm) nominal-thickness, galvanized-steel sheet **OR** 1/2-inch- (13-mm-) thick particleboard with plastic-laminate finish, **as directed**.
 - b. Depth: 22 inches (559 mm) **OR** 20 inches (508 mm) **OR** 18 inches (457 mm), **as directed**.
 5. Electrical Power Service: 125-A, 120/240-V ac, single-phase, three-wire load center, with no fewer than four open circuits **OR** service with 8-16 circuit-breaker panel, **as directed**; located under one end of work counter. Run copper wiring in 1/2-inch (13-mm) EMT conduit.
 - a. Provide one 120-V ground-fault circuit interrupter (GFCI) power receptacle(s).
 6. Lighting Fixtures: One **OR** Two, **as directed**, ceiling-mounted fluorescent lighting fixture(s), 48 inches (1219 mm) long, with acrylic lens and two 40-W lamps in each fixture. Provide single-pole switch mounted adjacent to door to control lighting fixture.
 7. Heating Unit: Wall-mounted **OR** Roof-mounted, **as directed**, thermostatically controlled, 110-V, 1500-W electric heater with fan-forced operation and with capacity of not less than 5000 Btu/h (1465 W). Enclose in enameled-steel cabinet and mount under work counter.
 8. Cooling Unit: Wall-mounted **OR** Roof-mounted, **as directed**, thermostatically controlled air conditioner with cooling capacity of not less than 13,500 Btu/h (3956 W). Enclose in enameled-steel cabinet.
 9. Accessories: Provide the following for each control booth:
 - a. Through-wall transaction drawers and speaking apertures complying with requirements specified in Division 08 Section "Security Windows".
 - b. Antifatigue mats.
 - c. Exterior stainless-steel counter.
 - d. Floor-mounted **OR** Wall-mounted, **as directed**, safe.
 - e. Signage: **<Insert requirements>**.
 - f. Ventilation fan.
 - g. Intercom.
 - h. Traffic control lights.
- C. Prefabricated Steel Control Booths
1. Structural Framework: Fabricated from 2-by-2-by-0.075-inch (50-by-50-by-1.90-mm) steel structural or mechanical tubing. Connect framework by welding.
 2. Base/Floor Assembly: 4-inch- (102-mm-) **OR** 3-inch- (76-mm-), **as directed**, high assembly consisting of perimeter frame welded to structural framework of booth. Fabricate frame from 2-by-4-inch (51-by-102-mm) galvanized-steel structural tubing; 0.108-inch (2.74-mm) nominal-thickness, C-shaped, galvanized-steel sheet channels; or galvanized structural-steel angles. Include anchor clips fabricated from 1/4-inch- (6-mm-) thick galvanized-steel plate, predrilled and welded to exterior of integral floor frame.
 - a. Finished Floor: 0.108-inch (2.74-mm) nominal-thickness, galvanized, rolled steel tread plate.
 - b. Subfloor and Finished Floor: Assembly consisting of 0.079-inch (2.01-mm) nominal-thickness, galvanized-steel sheet underside with rigid insulation core; covered by 0.125-inch- (3.18-mm-) thick, aluminum rolled tread plate; with overall assembly thickness of 2 inches (51 mm).

OR

Subfloor and Finished Floor: Assembly consisting of one **OR** two, **as directed**, layer(s) of 3/4-inch- (19-mm-) thick plywood or oriented strand board with 0.125-inch- (3.18-mm-) thick, aluminum rolled tread plate **OR** vinyl composition flooring **OR** carpeting, **as directed**.

OR

Base/Floor Assembly: No perimeter frame, with finished floor fabricated from 0.108-inch (2.74-mm) nominal-thickness, galvanized, rolled steel tread plate.

OR

Base/Floor Assembly: No perimeter frame, with surface of supporting concrete base as finished floor.
 3. Wall Panel Assembly: Assembly consisting of exterior face panel fabricated from 0.079-inch (2.01-mm) nominal-thickness, galvanized-steel sheet; and interior face panel fabricated from 0.064-inch (1.63-mm) **OR** 0.052-inch (1.32-mm), **as directed**, nominal-thickness, galvanized-



steel sheet; with 2-inch- (51-mm-) **OR** 3-inch- (76-mm-), **as directed**, thick, rigid fiberglass or polystyrene board insulation in cavity between exterior and interior face panels.

- a. Thermal Resistance Value (R-Value): R-7.
4. Flat Roof/Ceiling Assembly: Consisting of exterior roof panels, interior ceiling panels, and insulation between exterior and interior panels; sloped to drain at booth perimeter.
 - a. Exterior Roof Panel: Fabricated from 0.079-inch (2.01-mm) **OR** 0.064-inch (1.63-mm), **as directed**, nominal-thickness, galvanized-steel sheet; with painted finish **OR** EPDM membrane, **as directed**, continuously welded seams, and full-perimeter gutter.
 - b. Interior Ceiling Panel: Fabricated from 0.079-inch (2.01-mm) nominal-thickness, galvanized-steel sheet; with fiberglass insulation in cavity between ceiling and roof.
 - 1) Thermal Resistance Value (R-Value): R-17.
 - c. Insulated Exterior/Interior Panel: Fabricated from 0.028-inch (0.71-mm) nominal-thickness, galvanized-steel **OR** 0.032-inch- (0.81-mm-) thick, aluminum, **as directed**, sheet faces and expanded-foam insulation core.
 - 1) Thermal Resistance Value (R-Value): R-17.
 - d. Canopy Fascia: Fabricated from 0.079-inch (2.01-mm) nominal-thickness, galvanized-steel sheet, of manufacturer's standard design **OR** custom design indicated on Drawings, **as directed**.
 - 1) Height: 6 inches (152 mm) **OR** 8 inches (203 mm), **as directed**.
 - 2) Overhang: 3 inches (76 mm) beyond **OR** Flush with, **as directed**, face of walls below.
 - e. Downspouts: Integral, extending 3 inches (76 mm) beyond booth walls.
 - f. Roof scuppers.
 - g. Rooftop finial.
5. Sliding Door: Top suspended from aluminum track with ball-bearing rollers; 1-3/4 inches (44 mm) thick; tubular-frame design fabricated from clear-anodized aluminum **OR** galvanized steel, **as directed**; with top half of door glazed. Equip door with deadlock, lock support, guide hardware, and full weather stripping.
 - a. Glazing: Fixed **OR** Horizontal sliding, **as directed**, unit with 6-mm-thick, clear tempered float glass.
 - b. Deadlock: Mortised, laminated-hook bolt type with removable cylinder capable of being master keyed.
6. Swinging Door: 1-3/4 inches (44 mm) thick; tubular-frame design fabricated from clear-anodized aluminum **OR** galvanized steel, **as directed**; with top half of door glazed. Equip door with deadlock, three butt hinges, closer, and full weather stripping.
 - a. Glazing: Fixed **OR** Horizontal sliding, **as directed**, unit with 6-mm-thick, clear tempered float glass.
 - b. Deadlock: Mortised, with lever handle and removable cylinder capable of being master keyed.
7. Finish: Finish exposed metal surfaces, including structural framework, walls, canopy, and ceiling with rust-inhibitive primer and one finish coat of industrial air-dry acrylic **OR** polyurethane, **as directed**, enamel.
 - a. Color: As selected from manufacturer's full range.

D. Prefabricated Aluminum Control Booths

1. Structural Framework: Fabricated from 2-by-2-by-0.125-inch (51-by-51-by-3.18-mm) aluminum tubing, channel, angle, or tee extrusions; with clear **OR** color, **as directed**, anodic finish. Connect framework with exposed, **as directed**, mechanical fasteners.
2. Base/Floor Assembly: 4-inch- (102-mm-) high assembly consisting of perimeter frame welded to structural framework of booth. Fabricate frame from 2-by-4-by-0.125-inch (51-by-102-by-3.18-mm) aluminum tubing or aluminum angles. Include anchor clips fabricated from 1/4-inch- (6-mm-) thick aluminum, predrilled and welded to exterior of integral floor frame.
 - a. Subfloor and Finished Floor: Assembly consisting of 0.032-inch- (0.81-mm-) thick, aluminum sheet underside, plywood and rigid insulation core; covered by 0.125-inch-



(3.18-mm-) thick, aluminum rolled tread plate; with overall assembly thickness of 2 inches (51 mm).

OR

Subfloor and Finished Floor: Assembly consisting of one **OR** two, **as directed**, layer(s) of 3/4-inch- (19-mm-) thick plywood or oriented strand board with 0.125-inch- (3.18-mm-) thick, aluminum rolled tread plate **OR** vinyl composition flooring **OR** carpeting, **as directed**.

OR

Base/Floor Assembly: No perimeter frame, with surface of supporting concrete base as finished floor.

3. Wall Panel Assembly: Assembly consisting of exterior face panel fabricated from 0.032-inch- (0.81-mm-) **OR** 0.063-inch- (1.60-mm-), **as directed**, thick aluminum sheet, and interior face panel fabricated from 0.032-inch- (0.81-mm-) **OR** 0.050-inch- (1.27-mm-), **as directed**, thick aluminum sheet; with 2-inch- (51-mm-) thick, polystyrene or polyisocyanurate board insulation in cavity between exterior and interior face panels.
 - a. Thermal Resistance Value (R-Value): R-7.
4. Flat Roof/Ceiling Assembly: Consisting of exterior roof panels, interior ceiling panels, and insulation between exterior and interior panels; sloped to drain at booth perimeter.
 - a. Exterior Roof Panel: Fabricated from 0.032-inch- (0.81-mm-) thick aluminum sheet with protective plastic sheet finish and full-perimeter gutter.
 - b. Interior Ceiling Panel: Fabricated from 0.125-inch- (3.18-mm-) thick hardboard; with polyisocyanurate board insulation in cavity between ceiling and roof.
 - 1) Thermal Resistance Value (R-Value): R-19.
 - c. Insulated Exterior/Interior Panel: Fabricated from 0.032-inch- (0.81-mm-) thick, aluminum **OR** 0.021-inch (0.53-mm) nominal-thickness, galvanized-steel, **as directed**, sheet faces and expanded-foam insulation core.
 - 1) Thermal Resistance Value (R-Value): R-19.
 - d. Canopy Fascia: Fabricated from 0.063-inch- (1.60-mm-) thick aluminum sheet, of manufacturer's standard design **OR** custom design indicated on Drawings, **as directed**.
 - 1) Height: 6 inches (152 mm) **OR** 8 inches (203 mm), **as directed**.
 - 2) Overhang: 3 inches (76 mm) beyond **OR** Flush with, **as directed**, face of walls below.
 - e. Downspouts: Integral, extending 3 inches (76 mm) beyond booth walls.
 - f. Roof scuppers.
 - g. Rooftop finial.
5. Sliding Door: Top suspended from aluminum track with ball-bearing rollers; 1-3/4 inches (44 mm) thick; tubular-frame design fabricated from aluminum matching exterior and interior wall panels; with top half of door glazed and with extruded-aluminum door frame. Equip door with deadlock, lock support, guide hardware, and full weather stripping.
 - a. Glazing: Fixed **OR** Horizontal sliding, **as directed**, unit with 6-mm-thick, clear tempered float glass.
 - b. Deadlock: Mortised, laminated-hook bolt type with removable cylinder capable of being master keyed.
6. Swinging Door: 1-3/4 inches (44 mm) thick; tubular-frame design fabricated from aluminum matching exterior and interior wall panels; with top half of door glazed and with extruded-aluminum door frame. Equip door with deadlock, three butt hinges, closer, and full weather stripping.
 - a. Glazing: Fixed **OR** Horizontal sliding, **as directed**, unit with 6-mm-thick, clear tempered float glass.
 - b. Deadlock: Mortised, with lever handle and removable cylinder capable of being master keyed.
7. Finish: Finish exposed metal surfaces, including structural framework, walls, canopy, and ceiling with clear anodizing **OR** color anodizing **OR** baked enamel or powder coat, **as directed**.
 - a. Color: As selected from manufacturer's full range.

E. Fabrication

1. Fabricate control booths completely in factory.



2. Preglaze windows and doors at factory.
3. Prewire control booths at factory, ready for connection to service at Project site.
4. Fabricate control booths with forklift pockets in base of booth **OR** removable lifting eye centered in roof, **as directed**.
5. Accessible Control Booths: Where indicated to be accessible, fabricate control booths as follows:
 - a. Provide service windows located no higher than 34 inches (865 mm) above exterior grade.
 - b. Provide door opening with minimum 32-inch (813-mm) clear width.
 - c. Provide minimum 60-inch (1525-mm) clear turning spacing within the booth.
 - d. Provide minimum 27-inch (685-mm) clearance beneath interior work surfaces. Locate work surfaces 28 inches (710 mm) minimum and 34 inches (865 mm) maximum above the floor.
 - e. Locate controls and operable parts no lower than 15 inches (381 mm) and no higher than 48 inches (1219 mm) above the floor where reach is unobstructed. Where side reach is obstructed, locate controls and operable parts no lower than 15 inches (381 mm) and no higher than 46 inches (1219 mm) above the floor.

F. General Finish Requirements

1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

G. Finishes

1. Steel and Galvanized-Steel Factory Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
 - a. Color and Gloss: As selected from manufacturer's full range.

H. Aluminum Finishes

1. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm **OR** AA-M12C22A31, Class II, 0.010 mm, **as directed**, or thicker.
2. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm **OR** AA-M12C22A32/A34, Class II, 0.010 mm, **as directed**, or thicker.
 - a. Color: Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black **OR** As selected from full range of industry colors and color densities, **as directed**.
3. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - a. Color and Gloss: As selected from manufacturer's full range.

1.3 EXECUTION

A. Installation

1. Install control booths according to manufacturer's written instructions.
2. Accessible Control Booths: Install with interior floor surface at same elevation as adjacent paved surfaces.
3. Set control booths plumb and aligned. Level baseplates true to plane with full bearing on concrete bases.
4. Fasten control booths securely to cast-in anchor bolts **OR** concrete bases with expansion anchors, **as directed**.
5. Connect electrical power service to power distribution system according to requirements specified in Division 22.



B. Adjusting

1. Adjust doors, operable windows, and hardware to operate smoothly, easily, properly, and without binding. Confirm that locks engage accurately and securely without forcing or binding.
2. Lubricate hardware and other moving parts.
3. After completing installation, inspect exposed finishes and repair damaged finishes.

END OF SECTION 11 12 16 00a



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Task	Specification	Specification Description
11 12 23 00	11 12 16 00	Parking Control Equipment
11 12 23 00	11 12 16 00a	Prefabricated Control Booths
11 12 26 00	11 12 16 00	Parking Control Equipment
11 12 26 00	11 12 16 00a	Prefabricated Control Booths



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SECTION 11 13 13 00 - LOADING DOCK EQUIPMENT

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for loading dock equipment. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Dock levelers.
 - b. Truck levelers.
 - c. Truck restraints.
 - d. Light-communication systems.
 - e. Dock bumpers.
 - f. Dock lifts (scissors lifts).
 - g. Dock seals.
 - h. Dock shelters.
 - i. Transparent-strip door curtains.

C. Definitions

1. Operating Range: Maximum amount of travel above and below the loading dock level.
2. Working Range: Recommended amount of travel above and below the loading dock level for which loading and unloading operations can take place.

D. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: For loading dock equipment. Include plans, elevations, sections, details, and attachments to other work.
 - a. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - b. Wiring Diagrams: For power, signal, and control wiring.
3. Samples: For each type of dock-seal and -shelter fabric indicated.
4. Qualification Data: For qualified Installer.
5. Welding certificates.
6. Product Test Reports.
7. Operation and Maintenance Data.
8. Warranty: Sample of special warranty.

E. Quality Assurance

1. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
2. Welding Qualifications: Qualify procedures and personnel according to the following:
 - a. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - b. AWS D1.3, "Structural Welding Code - Sheet Steel."
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
4. Preinstallation Conference: Conduct conference at Project site.

F. Delivery, Storage, And Handling

1. Store and handle dock seals and shelters in a manner to avoid significant or permanent damage to fabric or frame.



- a. Comply with manufacturer's written instructions for minimum and maximum temperature requirements for storage.

G. Project Conditions

1. Field Measurements: Verify actual dimensions of construction contiguous with loading dock equipment, including recessed pit dimensions, slopes of driveways, and heights of loading docks, by field measurements before fabrication.

H. Warranty

1. Special Warranty for Dock Levelers: Manufacturer's standard form in which manufacturer agrees to repair or replace dock-leveler components that fail in materials or workmanship within specified warranty period.
 - a. Failures include, but are not limited to, the following:
 - 1) Structural failures including cracked or broken structural support members, load-bearing welds, and front and rear hinges.
 - 2) Faulty operation of operators, control system, or hardware.
 - 3) Deck plate failures including cracked plate or permanent deformation in excess of 1/4 inch (6 mm) between deck supports.
 - 4) Hydraulic system failures including failure of hydraulic seals and cylinders.
 - b. Warranty Period for Structural Assembly: 10 years from date of Final Completion.
 - c. Warranty Period for Hydraulic System: Five years from date of Final Completion.
 - d. Warranty shall be for unlimited usage of leveler for the specified rated capacity over the term of the warranty.

1.2 PRODUCTS

A. Materials

1. Steel Plates, Shapes, and Bars: ASTM 36/A 36M.
2. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from steel plate complying with ASTM A 572/A 572M, Grade 55 (380).
3. Steel Tubing: ASTM A 500, cold formed.
4. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
5. Wood: DOC PS 20 dimension lumber, select structural grade, kiln dried.
6. Pressure-Treated Wood: DOC PS 20 dimension lumber, select structural grade, kiln dried, and pressure treated with waterborne preservatives to comply with AWPA C2.

B. Recessed Dock Levelers

1. General: Recessed, hinged-lip-type dock levelers designed for permanent installation in concrete pits preformed in the edge of loading platform; of type, function, operation, capacity, size, and construction indicated; and complete with controls, safety devices, and accessories required.
2. Standard: Comply with MH 30.1, except for structural testing to establish rated capacity, **as directed**.
3. Rated Capacity: Capable of supporting total gross load without permanent deflection or distortion.
4. Platform: Not less than 3/16-inch- (5-mm-) **OR** 1/4-inch- (6-mm-) **OR** 3/8-inch- (9.5-mm-), **as directed**, thick, nonskid steel plate.
 - a. Platform Size: As indicated on Drawings, **as directed**.
 - b. Frame: Manufacturer's standard **OR** Clean-pit type, designed to support leveler at sides of pit, with no side-to-side supports at front of pit floor, **as directed**.
 - c. Toe Guards: Equip open sides of dock leveler over range indicated with metal toe guards.
 - 1) Toe-Guard Range: Entire upper operating **OR** working, **as directed**, range.
5. Hinged Lip: Not less than 1/2-inch- (13-mm-) **OR** 5/8-inch- (16-mm-) **OR** 3/4-inch- (19-mm-) **OR** 1-inch- (25-mm-), **as directed**, thick, nonskid steel plate.



- a. Hinge: Full width, piano-type hinge with heavy-wall hinge tube and greased fittings, **as directed**, with gussets on lip and ramp for support.
- b. Safety Barrier Lip: Designed to protect material-handling equipment from an accidental fall from loading platform edge of the dock leveler when the leveler is not in use.
6. Function: Dock levelers shall compensate for differences in height between truck bed and loading platform.
 - a. Vertical Travel: Operating range above platform level of sufficient height to enable lip to extend and clear truck bed before contact with the following minimum working range:
 - 1) Above Adjoining Platform: 12 inches (305 mm) **OR** 18 inches (457 mm) **OR** As indicated on Drawings, **as directed**.
 - 2) Below Adjoining Platform: 12 inches (305 mm) **OR** 14 inches (356 mm) **OR** As indicated on Drawings, **as directed**.
 - b. Automatic Vertical Compensation: Floating travel of ramp with lip extended and resting on truck bed shall compensate automatically for upward or downward movement of truck bed during loading and unloading.
 - c. Automatic Lateral Compensation: Tilting of ramp with lip extended and resting on truck bed shall compensate automatically for canted truck beds of up to 4 inches (102 mm) over width of ramp.
 - d. Lip Operation: Manufacturer's standard mechanism that automatically extends and supports hinged lip on ramp edge with lip resting on truck bed over dock leveler's working range, allows lip to yield under impact of incoming truck, and automatically retracts lip when truck departs.
 - 1) Length of Lip Extension: 16 inches (406 mm) **OR** 18 inches (457 mm) **OR** 20 inches (508 mm) **OR** As indicated on Drawings, **as directed**.
 - e. Automatic Ramp Return: Automatic return of unloaded ramp, from raised or lowered positions to stored position, level with platform, as truck departs.
 - f. Interlock: Leveler will not operate while overhead door is in closed position **OR** leveler night lock is engaged **OR** truck restraint is not engaged **OR** inflatable dock seal is not inflated **OR** inflatable dock shelter is not inflated, **as directed**.
7. Mechanical Operating System: Manual control; counterbalance and spring operation. Spring-operated raising and walk-down lowering of unloaded ramp. Equip leveler with an upward-biased-spring counterbalancing mechanism controlled by a hold-down device. Ramp raises to top limit of operating range by operating recessed control handle in ramp to disengage hold-down device. Ramp lowers below platform level with lip retracted by operating auxiliary, recessed control handle to release support legs.
 - a. Free-Fall Protection: Manufacturer's standard protection system to limit free fall of loaded ramps with front edge supported by truck bed.
8. Hydraulic Operating System: Electric control from a remote-control station; fully hydraulic operation. Electric-powered hydraulic raising and hydraulic lowering of ramp. Equip leveler with a packaged unit including a unitized, totally enclosed, nonventilated electric motor, pump, manifold reservoir, and valve assembly of proper size, type, and operation for capacity of leveler indicated. Include means for lowering ramp below platform level with lip retracted behind dock bumpers. Provide a hydraulic velocity fuse connected to main hydraulic cylinder to limit loaded ramp's free fall to not more than 3 inches (76 mm).
 - a. Remote-Control Station: Weatherproof single **OR** Single, **as directed**, -button station of the constant-pressure type, enclosed in NEMA ICS 6, Type 4 **OR** Type 12, **as directed**, box. Ramp raises by depressing and holding button; ramp lowers at a controlled rate by releasing button.
 - b. Remote-Control Station with Emergency Stop: Weatherproof multibutton **OR** Multibutton, **as directed**, control station with an UP button of the constant-pressure type and an emergency STOP button of the momentary-contact type, enclosed in NEMA ICS 6, Type 4 **OR** Type 12, **as directed**, box. Ramp raises by depressing and holding UP button; ramp lowers at a controlled rate by releasing UP button. All ramp movement stops, regardless of position of ramp or lip, by depressing STOP button. Normal operation resumes by engaging a manual reset button or by pulling out STOP button.



- 1) Dual-Panel Control Station: Remote-control station for operating side-by-side dock levelers.
- 2) Master Panel: Control panel with integral fused disconnecting means for operating dock leveler, dock door, and truck restraints.
- c. Independent Lip Operation: Electric-powered hydraulic raising and hydraulic lowering of lip, controlled independent of raising and lowering of ramp.
9. Electric Operating System: Electric control from a remote-control station; motorized operation. Electric activation for raising of ramp and automatic extending of lip. Equip leveler with a packaged unit including a unitized electric motor and shaft assembly of proper size, type, and operation for capacity of leveler indicated. Include means for lowering ramp below platform level with lip retracted behind dock bumpers.
 - a. Remote-Control Station: Weatherproof single **OR** Single, **as directed**, -button station of the constant-pressure type, enclosed in NEMA ICS 6, Type 4 **OR** Type 12, **as directed**, box. Ramp raises by depressing and holding button; ramp lowers at a controlled rate by releasing button.
 - b. Remote-Control Station with Emergency Stop: Weatherproof multibutton **OR** Multibutton, **as directed**, control station with an UP button of the constant-pressure type and an emergency STOP button of the momentary-contact type, enclosed in NEMA ICS 6, Type 4 **OR** Type 12, **as directed**, box. Ramp raises by depressing and holding UP button; ramp lowers at a controlled rate by releasing UP button. All ramp movement stops, regardless of position of ramp or lip, by depressing STOP button. Normal operation resumes by engaging a manual reset button or by pulling out STOP button.
10. Air-Bag Operating System: Electric control from a remote-control station; pneumatic operation. High-volume, low-pressure lifting of ramp. Equip leveler with a packaged unit including a PVC-coated, reinforced polyester lifting bag and two-stage, single-speed electric fan of proper size, type, and operation for capacity of leveler indicated. Include dock-leveler supports controlled by release chain for lowering ramp below platform level without extending lip.
 - a. Remote-Control Station: Weatherproof single **OR** Single, **as directed**, -button station of the constant-pressure type, enclosed in NEMA ICS 6, Type 4, **as directed**, box. Ramp raises by depressing and holding button; ramp lowers at a controlled rate by releasing button.
11. Construction: Fabricate dock-leveler frame, platform supports, and lip supports from structural- or formed-steel shapes. Weld platform and hinged lip to supports. Fabricate entire assembly to withstand deformation during both operating and stored phases of service. Chamfer lip edge to minimize obstructing wheels of material-handling vehicles.
 - a. Cross-Traffic Support: Manufacturer's standard method of supporting ramp at platform level in stored position with lip retracted. Provide a means to release supports to allow ramp to descend below platform level.
 - b. Maintenance Strut: Integral strut to positively support ramp in up position during maintenance of dock leveler.
12. Integral Molded-Rubber Dock Bumpers: Fabricated from 4-inch- (102-mm-) **OR** 6-inch- (152-mm-), **as directed**, thick, heavy molded-rubber compound reinforced with nylon, rayon, or polyester cord; with Type A Shore durometer hardness of 80, plus or minus 5, when tested according to ASTM D 2240. Provide two dock bumpers for each recessed dock leveler, attached to face of loading dock with expansion bolts.
13. Integral Laminated-Tread Dock Bumper: Fabricated from 4-1/2-inch- (114-mm-) **OR** 6-inch- (152-mm-), **as directed**, thick, multiple, uniformly thick plies cut from fabric-reinforced rubber tires. Laminate plies under pressure on not less than two 3/4-inch- (19-mm-) diameter, steel supporting rods that are welded at one end to 1/4-inch- (6-mm-) thick, structural-steel end angle and secured with a nut and angle at the other end. Fabricate angles with predrilled anchor holes and sized to provide not less than 1 inch (25 mm) of tread plies extending beyond the face of closure angles.
14. Accessories:
 - a. Curb Angles: 3-by-3-by-1/4-inch (76-by-76-by-6-mm) galvanized-steel curb angles for edge of recessed leveler pit, with 1/2-inch- (13-mm-) diameter by 6-inch- (152-mm-) long concrete anchors welded to angle at 6 inches (152 mm) o.c.



- b. Self-Forming Pan: Manufacturer's standard prefabricated, self-forming steel form system for poured-in-place construction of concrete pit.
 - c. Night Locks: Manufacturer's standard means to prevent extending lip and lowering ramp when overhead doors are locked.
 - d. Side and rear weatherseals.
 - e. Foam insulation under dock-leveler platform.
 - f. Abrasive skid-resistant **OR** Smooth, **as directed**, surface.
15. Finish: Paint **OR** Hot-dip galvanize, **as directed**, dock levelers after assembly and testing, **as directed**.
- a. Toe Guards: Paint yellow **OR** orange, **as directed**, to comply with ANSI Z535.1.

C. Edge-Of-Dock Levelers

- 1. General: Surface-mounted, hinged-lip-type, edge-of-dock levelers designed for permanent installation on face of loading dock platform; of type, function, operation, capacity, size, and construction indicated; and complete with controls, safety devices, and accessories required.
- 2. Standard: Comply with MH 30.1, except for structural testing to establish rated capacity, **as directed**.
- 3. Rated Capacity: Capable of supporting total gross load without permanent deflection or distortion.
- 4. Platform Ramp Width: 66 inches (1676 mm) **OR** 72 inches (1829 mm) **OR** 78 inches (1981 mm) **OR** 84 inches (2134 mm) **OR** As indicated on Drawings, **as directed**.
- 5. Hinged Lip: Not less than 3/8-inch- (9.5-mm-) **OR** 7/16-inch- (11-mm-) **OR** 1/2-inch- (13-mm-), **as directed**, thick, nonskid steel tread plate.
 - a. Hinge: Full width, piano-type hinge with heavy-wall hinge tube and greased fittings, **as directed**, with gussets on lip and ramp for support.
- 6. Function: Dock levelers shall compensate for differences in height between truck bed and loading platform.
 - a. Vertical Travel: Operating range above platform level of sufficient height to enable lip to extend and clear truck bed before contact with the following minimum working range:
 - 1) Above Adjoining Platform: 5 inches (127 mm) **OR** 6 inches (152 mm) **OR** As indicated on Drawings, **as directed**.
 - 2) Below Adjoining Platform: 5 inches (127 mm) **OR** As indicated on Drawings, **as directed**.
 - b. Automatic Vertical Compensation: Floating travel of ramp with lip extended and resting on truck bed shall compensate automatically for upward or downward movement of truck bed during loading and unloading.
 - c. Automatic Lateral Compensation: Tilting of ramp with lip extended and resting on truck bed shall compensate automatically for canted truck beds of up to 3 inches (76 mm) over width of ramp.
 - d. Lip Operation: Manufacturer's standard mechanism that automatically extends and supports hinged lip on ramp edge with lip resting on truck bed over dock leveler's working range, allows lip to yield under impact of incoming truck, and automatically retracts lip when truck departs.
 - 1) Length of Lip Extension: 15 inches (381 mm) **OR** 17 inches (432 mm) **OR** As indicated on Drawings, **as directed**.
 - e. Automatic Ramp Return: Automatic return of unloaded ramp, from raised or lowered positions to stored position, level with platform, as truck departs. Leveler shall be capable of retracting to stored position while truck is at loading dock.
- 7. Mechanical Operating System: Manual control; counterbalance and spring operation. Spring-operated raising and walk-down lowering of unloaded ramp. Equip leveler with a torsion-spring counterbalancing mechanism controlled by a hold-down device.
 - a. Lever Handle: Self-storing lever handle for raising unloaded ramp with minimal lifting force by pulling lever back to extend lip and pushing lever forward to lower ramp and lip.
 - b. Removable Lifting Handle: For raising unloaded ramp by lifting action.
- 8. Hydraulic Operating System: Electric control from a remote-control station; fully hydraulic operation. Electric-powered hydraulic raising and hydraulic lowering of ramp. Equip leveler with



a packaged unit including a unitized, totally enclosed, nonventilated electric motor, pump, manifold reservoir, and valve assembly of proper size, type, and operation for capacity of leveler indicated. Provide a hydraulic velocity fuse connected to main hydraulic cylinder to limit loaded ramp's free fall to not more than 3 inches (76 mm).

- a. Remote-Control Station: Weatherproof single **OR** Single, **as directed**, button station of the constant-pressure type, enclosed in NEMA ICS 6, Type 12, **as directed**, box. Ramp and lip raise to vertical position and extend to truck bed by depressing and holding button.
9. Construction: Fabricate dock-leveler frame, platform supports, and lip supports from structural- and formed-steel shapes. Weld platform and hinged lip to supports. Fabricate entire assembly to withstand deformation during both operating and stored phases of service. Chamfer lip edge to minimize obstructing wheels of material-handling vehicles.
 - a. Cross-Traffic Support: Manufacturer's standard method of supporting ramp at platform level in stored position with lip retracted. Provide a means to release supports to allow ramp to descend below platform level.
 - b. Maintenance Strut: Integral strut to positively support ramp in up position during maintenance of dock leveler.
10. Integral Molded-Rubber Dock Bumpers: Fabricated from 4-inch- (102-mm-) **OR** 6-inch- (152-mm-), **as directed**, thick, heavy molded-rubber compound reinforced with nylon, rayon, or polyester cord; with Type A Shore durometer hardness of 80, plus or minus 5, when tested according to ASTM D 2240. Provide two dock bumpers for each recessed dock leveler, attached to face of loading dock with expansion bolts.
11. Integral Laminated-Tread Dock Bumper: Fabricated from 4-1/2-inch- (114-mm-) **OR** 6-inch- (152-mm-), **as directed**, thick, multiple, uniformly thick plies cut from fabric-reinforced rubber tires. Laminate plies under pressure on not less than two 3/4-inch- (19-mm-) diameter, steel supporting rods that are welded at one end to 1/4-inch- (6-mm-) thick, structural-steel end angle and secured with a nut and angle at the other end. Fabricate angles with predrilled anchor holes and sized to provide not less than 1 inch (25 mm) of tread plies extending beyond the face of closure angles.
12. Accessories:
 - a. Self-forming pan.
 - b. Cast-in-place design.
 - c. Run-off guards.
 - d. Ramp approach plate.
13. Dock-Leveler Finish: Painted in manufacturer's standard color.

D. Top-Of-Dock Levelers

1. General: Surface-mounted, hinged-lip-type, top-of-dock levelers designed for permanent installation on top edge of loading dock platform without concrete pit; of type, function, operation, capacity, size, and construction indicated; and complete with controls, safety devices, and accessories required.
2. Standard: Comply with MH 30.1, except for structural testing to establish rated capacity, **as directed**.
3. Rated Capacity: Capable of supporting total gross load without permanent deflection or distortion.
4. Platform Width: 72 inches (1829 mm) **OR** As indicated on Drawings, **as directed**.
5. Hinged Lip: Not less than 3/8-inch- (9.5-mm-) **OR** 7/16-inch- (11-mm-), **as directed**, thick, nonskid steel plate.
 - a. Hinge: Full width, piano-type hinge with heavy-wall hinge tube and greased fittings, **as directed**, with gussets on lip and ramp for support.
6. Function: Dock levelers shall compensate for differences in height between truck bed and loading platform.
 - a. Vertical Travel: Operating range above platform level of sufficient height to enable lip to extend and clear truck bed before contact with a minimum working range of 10 inches (250 mm), **as directed**, above and 4 inches (102 mm), **as directed**, below adjoining platform level.



- b. Automatic Vertical Compensation: Floating travel of ramp with lip extended and resting on truck bed shall compensate automatically for upward or downward movement of truck bed during loading and unloading.
 - c. Lip Operation: Manufacturer's standard mechanism that automatically extends and supports hinged lip on ramp edge with lip resting on truck bed over dock leveler's working range, allows lip to yield under impact of incoming truck, and automatically retracts lip when truck departs.
 - 1) Length of Lip Extension: 15 inches (381 mm) **OR** As indicated on Drawings, **as directed**.
 - d. Automatic Ramp Return: Automatic return of unloaded ramp, from raised or lowered positions to stored position, level with platform, as truck departs. Leveler shall be capable of retracting to stored position while truck is at loading dock.
7. Mechanical Operating System: Manual control; counterbalance and spring operation. Spring-operated raising and walk-down lowering of unloaded ramp. Equip leveler with a torsion-spring counterbalancing mechanism controlled by a hold-down device.
 - a. Removable Lifting Hook: For raising unloaded ramp by lifting action and pushing forward to lower ramp and lip.
 8. Hydraulic Operating System: Electric control from a remote-control station, fully hydraulic operation. Electric-powered hydraulic raising and hydraulic lowering of ramp. Equip leveler with a packaged unit including a unitized, totally enclosed, nonventilated electric motor, pump, manifold reservoir, and valve assembly of proper size, type, and operation for capacity of leveler indicated.
 - a. Remote-Control Station: Weatherproof single **OR** Single, **as directed**, -button station of the constant-pressure type, enclosed in NEMA ICS 6, Type 12, **as directed**, box. Ramp and lip raise to vertical position and extend to truck bed by depressing and holding button.
 9. Construction: Fabricate dock-leveler frame, platform supports, and lip supports from structural- or formed-steel shapes. Weld platform and hinged lip to supports. Fabricate entire assembly to withstand deformation during both operating and stored phases of service. Chamfer lip edge to minimize obstructing wheels of material-handling vehicles.
 10. Integral Molded-Rubber Dock Bumpers: Fabricated from 4-inch- (102-mm-) **OR** 6-inch- (152-mm-), **as directed**, thick, heavy molded-rubber compound reinforced with nylon, rayon, or polyester cord; with Type A Shore durometer hardness of 80, plus or minus 5, when tested according to ASTM D 2240. Provide two dock bumpers for each recessed dock leveler, attached to face of loading dock with expansion bolts.
 11. Integral Laminated-Tread Dock Bumper: Fabricated from 4-1/2-inch- (114-mm-) **OR** 6-inch- (152-mm-), **as directed**, thick, multiple, uniformly thick plies cut from fabric-reinforced rubber tires. Laminate plies under pressure on not less than two 3/4-inch- (19-mm-) diameter, steel supporting rods that are welded at one end to 1/4-inch- (6-mm-) thick, structural-steel end angle and secured with a nut and angle at the other end. Fabricate angles with predrilled anchor holes and sized to provide not less than 1 inch (25 mm) of tread plies extending beyond the face of closure angles.
 12. Dock-Leveler Finish: Painted in manufacturer's standard color.
- E. Vertical-Storing Dock Levelers
1. General: Recessed, hinged-lip-type, vertical-storing dock levelers designed for permanent installation in shallow concrete pits preformed in the edge of loading platform; of type, function, operation, capacity, size, and construction indicated; and complete with controls, safety devices, and accessories required.
 2. Standard: Comply with MH 30.1, except for structural testing to establish rated capacity, **as directed**.
 3. Rated Capacity: Capable of supporting total gross load without permanent deflection or distortion.
 4. Platform: Not less than 3/16-inch- (5-mm-) **OR** 1/4-inch- (6-mm-), **as directed**, thick, nonskid steel plate.
 - a. Platform Size: As indicated on Drawings, **as directed**.
 5. Hinged Lip: Not less than 1/2-inch- (13-mm-) **OR** 5/8-inch- (16-mm-), **as directed**, thick, nonskid steel plate.



- a. Hinge: Full width, piano-type hinge with heavy-wall hinge tube and greased fittings, **as directed**, with gussets on lip and ramp for support.
6. Function: Dock levelers shall compensate for differences in height between truck bed and loading platform.
 - a. Vertical Travel: Operating range above platform level of sufficient height to enable lip to extend and clear truck bed before contact with the following minimum working range:
 - 1) Above Adjoining Platform: 6 inches (152 mm) **OR** 10 inches (250 mm) **OR** 12 inches (305 mm) **OR** As indicated on Drawings, **as directed**.
 - 2) Below Adjoining Platform: 6 inches (152 mm) **OR** As indicated on Drawings, **as directed**.
 - b. Automatic Vertical Compensation: Floating travel of ramp with lip extended and resting on truck bed shall compensate automatically for upward or downward movement of truck bed during loading and unloading.
 - c. Automatic Lateral Compensation: Tilting of ramp with lip extended and resting on truck bed shall compensate automatically for canted truck beds of up to 4 inches (102 mm) over width of ramp.
 - d. Lip Operation: Manufacturer's standard mechanism that automatically extends and supports hinged lip on ramp edge with lip resting on truck bed over dock leveler's working range, allows lip to yield under impact of incoming truck, and automatically retracts lip when truck departs.
 - 1) Length of Lip Extension: 16 inches (406 mm) **OR** 18 inches (457 mm) **OR** 20 inches (508 mm) **OR** As indicated on Drawings, **as directed**.
7. Hydraulic Operating System: Electric control from a remote-control station; fully hydraulic operation. Electric-powered hydraulic raising and hydraulic lowering of ramp. Equip leveler with a packaged unit including a unitized, totally enclosed, nonventilated electric motor, pump, manifold reservoir, and valve assembly of proper size, type, and operation for capacity of leveler indicated. Provide a hydraulic velocity fuse connected to main hydraulic cylinder to limit loaded ramp's free fall to not more than 3 inches (76 mm). Provide mechanical lock that prevents leveler from lowering without hydraulic pressure.
 - a. Remote-Control Station: Weatherproof single **OR** Single, **as directed**, -button station of the constant-pressure type, enclosed in NEMA ICS 6, Type 12, **as directed**, box. Ramp lowers at a controlled rate.
 - b. Remote-Control Station with Emergency Stop: Weatherproof multibutton **OR** Multibutton, **as directed**, control station with an UP button of the constant-pressure type and an emergency STOP button of the momentary-contact type, enclosed in NEMA ICS 6, Type 12, **as directed**, box. Ramp raises by depressing and holding UP button; ramp lowers at a controlled rate by releasing UP button. All ramp movement stops, regardless of position of ramp or lip, by depressing STOP button. Normal operation resumes by engaging a manual reset button or by pulling out STOP button.
 - 1) Master Panel: Control panel with integral fused disconnecting means for operating dock leveler, dock door, and truck restraints.
 - c. Independent Lip Operation: Electric-powered hydraulic raising and lowering of lip, controlled independent of raising and lowering of ramp.
8. Construction: Fabricate dock-leveler frame, platform supports, run-off guards, **as directed**, and lip supports from structural- or formed-steel shapes. Weld platform and hinged lip to supports. Fabricate entire assembly to withstand deformation during both operating and stored phases of service. Chamfer lip edge to minimize obstructing wheels of material-handling vehicles.
9. Integral Molded-Rubber Dock Bumpers: Fabricated from 4-inch- (102-mm-) **OR** 6-inch- (152-mm-), **as directed**, thick, heavy molded-rubber compound reinforced with nylon, rayon, or polyester cord; with Type A Shore durometer hardness of 80, plus or minus 5, when tested according to ASTM D 2240. Provide two dock bumpers for each recessed dock leveler, attached to face of loading dock with expansion bolts.
10. Integral Laminated-Tread Dock Bumper: Fabricated from 4-1/2-inch- (114-mm-) **OR** 6-inch- (152-mm-), **as directed**, thick, multiple, uniformly thick plies cut from fabric-reinforced rubber tires. Laminate plies under pressure on not less than two 3/4-inch- (19-mm-) diameter, steel supporting



rods that are welded at one end to 1/4-inch- (6-mm-) thick, structural-steel end angle and secured with a nut and angle at the other end. Fabricate angles with predrilled anchor holes and sized to provide not less than 1 inch (25 mm) of tread plies extending beyond the face of closure angles.

11. Accessories:
 - a. Interlock: Leveler will not operate while overhead door is in closed position **OR** truck restraint is not engaged, **as directed**.
 - b. Curb Angles: 3-by-3-by-1/4-inch (76-by-76-by-6-mm) galvanized-steel curb angles for edge of recessed leveler pit, with 1/2-inch- (13-mm-) diameter by 6-inch- (152-mm-) long concrete anchors welded to angle at 6 inches (152 mm) o.c.
12. Finish: Paint **OR** Hot-dip galvanize, **as directed**, dock levelers after assembly and testing, **as directed**.

F. Truck Levelers

1. General: Two-cylinder, hydraulic ramp designed to raise and lower end of truck at loading dock. Equip leveler with a packaged unit including a unitized electric motor, pump, manifold reservoir, and valve assembly of proper size, type, and operation for capacity indicated. Provide manufacturer's standard means for limiting loaded ramp's free fall.
2. Rated Capacity: Capable of supporting total gross load without permanent deflection or distortion.
3. Travel Speed: Leveler raises and lowers at 3 fpm (0.015 m/s), measured at traveling end.
4. Surface-Mounted Units: Designed for mounting on surface of concrete driveway.
5. Shallow-Pit-Mounted Units: Designed for mounting in sloping shallow pit; capable of 18 inches (457 mm) of vertical travel above and below level of driveway.
6. Full-Pit-Mounted Units: Designed for installation in a fully recessed pit, with top of platform in stored position flush with driveway.
 - a. Provide removable plate for access to pit for service.
7. Hydraulic Operating System: Electric control from a remote-control station; fully hydraulic operation. Self-contained, electric-powered hydraulic raising and hydraulic lowering of lift.
 - a. Remote-Control Station: Weatherproof, multibutton control station of the constant-pressure type with UP and DOWN push buttons. Controller shall consist of magnetic motor starter with three-pole adjustable overloads and 24-V control transformer with 4-A, fused secondary prewired to terminal strips and enclosed in NEMA ICS 6, Type 12, **as directed**, box.
 - 1) Upper-Travel-Limit Switch: Equip unit with manufacturer's standard, adjustable, upper-travel-limit switch.
8. Construction: Fabricate truck leveler from structural- and formed-steel shapes; fabricate platform from nonskid steel plate. Construct platform with notch at loading-dock end to provide clearance for truck restraint.
 - a. Cylinders: Equip truck leveler with not less than two heavy-duty, high-pressure, hydraulic, ram-type cylinders. Rams shall be manufacturer's standard, either direct-displacement plunger or rod-and-piston type with positive internal stops. Cylinder rods shall be chrome plated and polished.
9. Truck-Leveler Finish: Manufacturer's standard finish.

G. Truck Restraints

1. General: Manufacturer's standard device designed to engage truck's rear-impact guard and hold truck at loading dock. Restraint shall consist of an iron or steel restraining arm that raises until contacting rear-impact guard. Arm shall move vertically, automatically adjusting to varying height of truck due to loading and unloading operations.
2. Standard: Comply with MH 30.3.
3. Rated Capacity: Capable of supporting total gross load of **<Insert capacity>** without permanent deflection or distortion.
4. Operating Range: Capable of restraining rear-impact guards within a range from:
 - a. Vertical: 12 inches (305 mm) **OR** 30 inches (762 mm) **OR** As indicated on Drawings, **as directed**, above driveway.



- b. Horizontal: 12 inches (305 mm) **OR** As indicated on Drawings, **as directed**, in front of dock bumpers.
 5. Power Operating System: Manufacturer's standard electromechanical or hydraulic unit.
 - a. Remote-Control Station: Single-button station of the constant-pressure type, enclosed in NEMA ICS 6, Type 12, **as directed**, box. Restraint is engaged by depressing and holding button; restraint is released by releasing button.
 - b. Interlock: Leveler will not operate while truck restraint is not engaged.
 6. Mechanical Operating System: Restraint operates by use of a lifting rod or hook to raise engagement device.
 7. Rear-Impact-Guard Sensor: Detects presence of rear-impact guard and automatically returns to stored position if rear-impact guard is not engaged, **as directed**.
 8. Caution Signs: Exterior, surface mounted; designed to inform both dock attendant and truck driver; with sign copy as follows. Provide one sign at each truck-restraint location.
 - a. Sign Copy in Forward and Reverse Text: Manufacturer's standard text permitting truck movement with green light, **as directed**.
 - b. Interior Sign Copy: Manufacturer's standard text permitting truck movement with green light, **as directed**.
 9. Light-Communication System: Red and green illuminated signal-light sets, with lens approximately 4 inches (102 mm) in diameter, designed to indicate status to both dock attendant and truck driver. Equip system with steel control panel located at interior of dock that includes illuminated lights indicating **OR** indicates, **as directed**, status of exterior signal lights. Provide signal-light set and control panel at each location indicated for light-communication system. Enclose exterior signal-light sets in steel or plastic housing with sunshade.
 - a. Manual Operation: System is activated by push button or switch located on interior **OR** truck-restraint, **as directed**, control panel.
 - b. Automatic Operation: System is activated automatically by limit switch **OR** photoelectric sensor **OR** magnetic switch, **as directed**, mounted on overhead door track. Provide on-off switch located on light-communication system **OR** truck-restraint, **as directed**, control panel.
 - c. Automatic Operation: System is activated automatically when device engages rear-impact guard. Provide on-off switch located on truck-restraint control panel.
 - d. Mounting: Wall **OR** Driveway **OR** Pit, **as directed**.
 10. Alarm: Audible **OR** Visual **OR** Audible and visual, **as directed**, system indicating that rear-impact guard is not engaged, with manual reset.
 11. Accessories: Interlock to dock leveler **OR** Key switch, **as directed**.
 12. Truck-Restraint Finish: Painted **OR** Hot-dip galvanized, **as directed**.
- H. Light-Communication Systems
1. General: Provide communication system consisting of signal-light sets, caution signs, alarms, and controls for each location indicated.
 2. Caution Signs: Surface mounted; designed to inform both dock attendant and truck driver; with sign copy as follows:
 - a. Exterior Sign Copy in Forward and Reverse Text: Manufacturer's standard text permitting truck movement with green light, **as directed**.
 - b. Interior Sign Copy: Manufacturer's standard text permitting truck movement with green light, **as directed**.
 3. Signal-Light Sets: Red and green illuminated signal-light sets, with lens approximately 4 inches (102 mm) in diameter, designed to indicate status to both dock attendant and truck driver. Equip system with steel control panel that includes illuminated lights indicating **OR** indicates, **as directed**, status of exterior signal lights; located at interior of dock. Provide signal-light set and control panel at each location indicated for light-communication system. Enclose signal lights in steel or plastic housing, with exterior signal-light sets equipped with sunshade.
 - a. Manual Operation: Lights are activated by push button or switch located on interior signal-light enclosure **OR** control panel, **as directed**.



- b. Automatic Operation: Lights are activated automatically by limit switch **OR** photoelectric sensor **OR** magnetic switch, **as directed**, mounted on overhead door track. Provide on-off switch located on control panel.
- I. Dock Bumpers
1. Laminated-Tread Dock Bumper: Fabricated from multiple, uniformly thick plies cut from fabric-reinforced rubber tires. Laminate plies under pressure on not less than two 3/4-inch- (19-mm-) diameter, steel supporting rods that are welded at one end to 1/4-inch- (6-mm-) thick, structural-steel end angle and secured with a nut and angle at the other end. Fabricate angles with predrilled anchor holes and sized to provide not less than 1 inch (25 mm) of tread plies extending beyond the face of closure angles.
 - a. Thickness: 4-1/2 inches (114 mm) **OR** 6 inches (152 mm) **OR** As indicated on Drawings, **as directed**.
 - b. Horizontal Style: 6 inches (152 mm) **OR** 10 inches (250 mm) **OR** 12 inches (305 mm), **as directed**, high by length indicated on Drawings, **as directed**.
 - c. Vertical Style: 8 inches (203 mm) wide by 20 inches (508 mm) high **OR** 24 inches (610 mm) high **OR** 36 inches (914 mm) high **OR** height indicated on Drawings, as directed.
 2. Molded-Rubber Bumpers: Fabricated from molded-rubber compound reinforced with nylon, rayon, or polyester cord; with Type A Shore durometer hardness of 80, plus or minus 5, when tested according to ASTM D 2240; of size and configuration indicated. Fabricate units with not less than two predrilled anchor holes.
 - a. Configuration: T shape **OR** Inverted-L shape **OR** Square **OR** Rectangular **OR** As indicated on Drawings, **as directed**.
 - b. Thickness: 2 inches (50 mm) **OR** 3 inches (76 mm) **OR** 4 inches (102 mm) **OR** 6 inches (152 mm) **OR** As indicated on Drawings, **as directed**.
 3. Extruded-Rubber Bumpers: Fabricated from ASTM D 2000, extruded synthetic rubber with Type A Shore durometer hardness of 75, plus or minus 5, when tested according to ASTM D 2240; of size and configuration indicated. Furnish units with predrilled anchor holes and concealed, flat, steel mounting bar.
 - a. Configuration: Flat or ribbed, with 2-inch (50-mm) nominal thickness and 9-inch (229-mm) height **OR** 4-1/2-inch- (114-mm-) wide base and 4-inch (102-mm) depth with half-oval shape that compresses and returns to original shape **OR** As indicated on Drawings, **as directed**.
 4. Steel-Face, Laminated-Tread Bumpers: Fabricated from multiple, uniformly thick plies cut from fabric-reinforced rubber tires and with 3/8-inch (9.5-mm) steel face plate of same size as rubber surface. Laminate plies under pressure on not less than two 3/4-inch- (19-mm-) diameter, steel supporting rods that are welded at one end to 1/4-inch- (6-mm-) thick, structural-steel end angle and secured with a nut and angle at the other end. Fabricate angles with predrilled anchor holes and sized to provide not less than 1 inch (25 mm) of tread plies extending beyond the face of closure angles. Weld face plate to two steel support brackets, which shall extend back to and engage 3/4-inch- (19-mm-) diameter support rods in elongated holes, allowing steel face to float on impact.
 - a. Thickness: 4-1/2 inches (114 mm) **OR** 6 inches (152 mm) **OR** As indicated on Drawings, **as directed**.
 - b. Horizontal Style: 6 inches (152 mm) **OR** 10 inches (250 mm) **OR** 12 inches (305 mm), **as directed**, high by length indicated, **as directed**.
 - c. Vertical Style: 8 inches (203 mm) wide by 20 inches (508 mm) high **OR** 24 inches (610 mm) high **OR** 36 inches (914 mm) high **OR** height indicated, **as directed**.
 5. Anchorage Devices: Hot-dip galvanized-steel anchor bolts, nuts, washers, bolts, sleeves, cast-in-place plates, and other anchorage devices as required to fasten bumpers securely in place and to suit installation type indicated.
- J. Dock Lifts
1. General: Built-in, scissors-type, single-leg, hydraulic dock lift of capacity, size, and construction indicated; complete with controls, safety devices, and accessories required.
 2. Standard: MH 29.1.



3. Rated Capacity: Lifting capacity of not less than 8000 lb (3629 kg) with 6500-lb (2948-kg) **OR** indicated on Drawings, **as directed**, axle load at ends and 5000-lb (2268-kg) **OR** indicated on Drawings, **as directed**, axle load at sides.
4. Platform: Nonskid, safety-tread **OR** Smooth-surface, **as directed**, heavy steel deck plate.
 - a. Platform Size: As indicated on Drawings, **as directed**.
 - b. Platform Guarding: Bevel toe guards **OR** Toe sensor **OR** Indicator bar **OR** Skirts **OR** Enclosure, **as directed**, to comply with requirements in MH 29.1.
 - c. Removable **OR** Fixed, **as directed**, Handrails: Equip lift with handrails on two sides of platform with a single, removable chain across each end. Provide handrails not less than 39 inches (991 mm) high with midrail and 4-inch- (102-mm-) high kick plate at bottom. Mount rail sockets flush with platform surface, **as directed**.
5. Bridge: Nonskid, safety-tread steel **OR** High-tensile aluminum, **as directed**, plate.
 - a. Hinged Bridge: Hinged, throw-over bridge bolted to full-length, heavy-duty, piano-type hinge welded to toe guard at end of platform. Provide bridge complete with heavy-duty lifting chains. Chamfer edge of bridge to minimize obstructing wheels of material-handling vehicles.
 - b. Size: 18 inches (457 mm) long by 60 inches (1524 mm) wide **OR** 18 inches (457 mm) long by 72 inches (1829 mm) wide **OR** As indicated on Drawings, **as directed**.
 - c. Locations: Ends **OR** Sides **OR** As indicated on Drawings, **as directed**.
6. Function: Dock lifts shall compensate for differences in height between truck bed and loading platform.
 - a. Vertical Travel: Maximum of 60 inches (1524 mm), **as directed**, from a lowered height of 12 inches (305 mm), **as directed**, for a total raised height of 72 inches (1829 mm), **as directed**.
 - b. Travel Speed: Nominal raising speed of 8 fpm (0.04 m/s) **OR** 10 fpm (0.05 m/s) **OR** 12 fpm (0.06 m/s), **as directed**.
 - c. Vertical Travel and Travel Speed: As indicated on Drawings, **as directed**.
 - d. Hinged Throw-Over Bridges Operation: Manual **OR** Manual-assist bridge winch **OR** Automatic powered, **as directed**.
7. Hydraulic Operating System: Self-contained, electric, hydraulic power unit for raising and lowering lift; of size, type, and operation needed for capacity of lift indicated; controlled from a remotely located push-button station.
 - a. Power Unit: Consisting of continuous-duty motor, high-pressure gear pump, valve manifold, oil-line filters, and oil reservoir.
 - 1) Equip manifold with relief valve, check valve, pressure-compensated flow-control valve, and solenoid valve and with provisions for lowering lift manually if power fails.
 - 2) Equip reservoir, valve manifold, and pressure line with oil-line filters.
 - b. Cylinders: Equip lift with not less than two heavy-duty, high-pressure, hydraulic, ram-type cylinders. Rams shall be manufacturer's standard, either direct-displacement plunger or rod-and-piston type with positive internal stops. Cylinder rods shall be chrome plated and polished.
 - 1) Rate of Descent Protection: Pressure-compensated flow control or hydraulic velocity fuse to limit down speed for each cylinder.
 - c. Remote-Control Station: Multibutton control station of the constant-pressure type with UP and DOWN push buttons. Controller shall consist of magnetic motor starter with three-pole adjustable overloads and 24-V control transformer with 4-A, fused secondary prewired to terminal strips and enclosed in NEMA ICS 6, Type 12, **as directed**, box.
 - 1) Upper-Travel-Limit Switch: Equip unit with manufacturer's standard, adjustable, upper-travel-limit switch.
8. Construction: Fabricate lift from structural-steel shapes rigidly welded and reinforced for maximum strength, safety, and stability. Design assembly to withstand deformation during both operating and stored phases of service. Provide mounting brackets and removable lifting eyes for ease of installation.
 - a. Scissors Mechanism: Fabricate leg members from heavy, steel-formed tube or plate members to provide maximum strength and rigidity.



- b. Scissors Configuration: Single leg **OR** Multiple width **OR** Multiple length, **as directed**.
 - c. Bearings: Pivot points with permanently lubricated antifriction bushings or sealed ball-bearings for minimum maintenance.
 - d. Maintenance Leg: Removable, safety maintenance leg or hinged, safety maintenance bars.
 - e. Mounting: Surface **OR** Pit, **as directed**.
9. Dock Lift Finish: Painted **OR** Hot-dip galvanized, **as directed**.
- a. Toe Guards: Paint yellow **OR** orange, **as directed**, to comply with ANSI Z535.1.

K. Foam-Pad Dock Seals

- 1. General: Dock seals consisting of fabric-covered foam pads designed to compress 4 to 5 inches (102 to 127 mm) under pressure of truck body to form an airtight seal at jambs and head of loading dock openings; of type, size, and construction indicated.
- 2. Door Opening Size: As indicated on Drawings, **as directed**.
- 3. Stationary Head Pad: 8 inches (203 mm) **OR** 12 inches (305 mm) **OR** 18 inches (457 mm) **OR** 24 inches (610 mm), **as directed**, high and same depth as jamb pads; beveled, **as directed**; sized for opening width.
- 4. Adjustable Head Pad: 18 inches (457 mm) **OR** 24 inches (610 mm) **OR** 30 inches (762 mm), **as directed**, high and same depth as jamb pads; sized for opening width; with manufacturer's standard hardware and tension spring or counterweight mechanism for adjusting height of pad.
- 5. Jamb Pads: Square **OR** Beveled; tapered to reduce opening width, **as directed**.
 - a. Nominal Size: 12 inches (305 mm) **OR** As indicated on Drawings, **as directed**, wide and sized for opening height.
- 6. Construction: Consisting of single- or double-ply, coated, fabric-covered, urethane-foam core with supporting frame. Fabricate jamb and head pads of same depth and sized for opening width.
 - a. Pressure-Treated, **as directed**, Wood Support Frame: Factory painted; with steel mounting hardware.
 - b. Steel Support Frame: Steel channel frame of manufacturer's standard weight, shape, and finish; with steel mounting hardware.
 - c. Tapered Side Panels: Taper side panels to angle required to accommodate sloped loading dock approach grades and make sealing edge of dock shelter parallel to back edge of truck. Taper for declined **OR** inclined, **as directed**, approach.
 - d. Cover Fabric: Vinyl-coated nylon or polyester with minimum total weight of 22 oz./sq. yd. (746 g/sq. m) **OR** 40 oz./sq. yd. (1356 g/sq. m), **as directed**.
 - 1) Color: Black **OR** Green **OR** Blue **OR** Brown **OR** Tan **OR** As indicated by manufacturer's designations **OR** Match sample **OR** As selected from manufacturer's full range, **as directed**.
 - e. Cover Fabric: Neoprene-coated nylon with minimum total weight of 16 oz./sq. yd. (543 g/sq. m) **OR** 40 oz./sq. yd. (1356 g/sq. m) **OR** 45 oz./sq. yd. (1526 g/sq. m), **as directed**.
 - 1) Color: Black **OR** Green **OR** Blue **OR** Brown **OR** Tan **OR** As indicated by manufacturer's designations **OR** Match sample **OR** As selected from manufacturer's full range, **as directed**.
 - f. Cover Fabric: Hypalon-coated nylon with minimum total weight of 16 oz./sq. yd. (543 g/sq. m) **OR** 40 oz./sq. yd. (1356 g/sq. m), **as directed**.
 - 1) Color: Black **OR** Green **OR** Blue **OR** Brown **OR** Tan **OR** As indicated by manufacturer's designations **OR** Match sample **OR** As selected from manufacturer's full range, **as directed**.
 - g. Cover Fabric: Manufacturer's proprietary cover fabric complying with the following minimum requirements:
 - 1) Tearing strength of not less than 300 by 300 lbf (1334 by 1334 N) when tested according to ASTM D 2261.
 - 2) Abrasion resistance of not less than 6000 cycles when tested according to FED-STD-191A-5306.
 - 3) Tensile strength of not less than 1200 by 1200 lbf (5338 by 5338 N) when tested according to FED-STD-191A-5100.1.



- 4) Cold resistance to minus 40 deg F (minus 40 deg C) when tested according to FED-STD-191A-5874.
 - 5) Color: Black **OR** Green **OR** Blue **OR** Brown **OR** Tan **OR** As indicated by manufacturer's designations **OR** Match sample **OR** As selected from manufacturer's full range, **as directed**.
- h. Guide Strips: 4-inch- (102-mm-) wide, coated, nylon guide strips on jamb pads.
- i. Pleated Protectors: On face of jamb pads of overlapping layers of coated fabric attached to base fabric; 4-inch (102-mm) **OR** 8-inch (203-mm) **OR** 16-inch (406-mm), **as directed**, wear exposure.
- L. Inflatable Dock Seals
1. General: Inflatable dock seals consisting of one-piece jamb, sill, **as directed**, and header seals designed to inflate by motor/blower and compress against truck bodies to form airtight seals at loading dock openings; of type, size, and construction indicated.
 2. Door Opening Size: As indicated on Drawings, **as directed**.
 3. Head Members: One **OR** Two, **as directed**.
 4. Jamb Members: One **OR** Two, **as directed**.
 5. Construction: Fabricate header seal full width over jamb seals. Mount seals on pressure-treated wood frame with hot-dip galvanized-steel mounting hardware. Inflate seals by use of 1/2-hp motor/blower with on-off switch, mounted above header seal in galvanized-steel hood. Provide bottom of header and jamb seals with grommets to allow for release of moisture and excess air.
 - a. Fabric: Neoprene-coated nylon with minimum total weight of 14 oz./sq. yd. (475 g/sq. m).
 - 1) Color: Black **OR** Gray **OR** Blue **OR** Brown **OR** As indicated by manufacturer's designations **OR** Match sample **OR** As selected from manufacturer's full range, **as directed**.
 - b. Fabric: Manufacturer's proprietary fabric complying with the following minimum requirements:
 - 1) Tearing strength of not less than 110 by 85 lbf (489 by 378 N) when tested according to ASTM D 2261.
 - 2) Abrasion resistance of not less than 490 cycles when tested according to FED-STD-191A-5306.
 - 3) Tensile strength of not less than 500 by 440 lbf (2224 by 1957 N) when tested according to FED-STD-191A-5100.1.
 - 4) Cold resistance to minus 40 deg F (minus 40 deg C) when tested according to FED-STD-191A-5874.
 - 5) Color: Black **OR** Gray **OR** Blue **OR** Brown **OR** As indicated by manufacturer's designations **OR** Match sample **OR** As selected from manufacturer's full range, **as directed**.
- M. Frame-Type Dock Shelters
1. General: Dock shelters designed to form a seal with sides and top of truck body while leaving entire width and height of truck's rear opening unobstructed; of type, size, and construction indicated.
 2. Door Opening Size: As indicated on Drawings, **as directed**.
 3. Rigid-Frame Type: Fabricated from translucent, fabric-covered **OR** fiberglass, **as directed**, side and top panels attached to fixed supporting framework. Provide head and side curtains with built-in flexible stays, wind straps between head curtain and side frame, pleated protectors on head curtain, and a yellow aim patch on side curtains. Slope head frame from center for drainage. Provide replaceable, fabric-covered, tapered, foam-bottom pads and protective steel bumpers of size and type required for application shown.
 4. Flexible-Frame Type: Fabricated from fabric-covered side and top panels attached to retractable supporting framework with independent spring-tension extension arms. Provide head and side curtains with built-in flexible stays, pleated protectors on head curtain, and a yellow aim patch on side curtains. Provide replaceable, fabric-covered, tapered, foam-bottom pads of size and type required for application shown.



5. Head-Pad Height: 12 inches (305 mm) **OR** 18 inches (457 mm) **OR** 24 inches (610 mm) **OR** 30 inches (762 mm), **as directed**.
6. Construction: Fabricate framework, pads, bumpers, fabric for curtains and panels, and other components to sizes and shapes indicated or required to fit door opening sizes shown and allow for not less than 18 inches (457 mm) of truck-body penetration when truck is docked.
 - a. Wood Framework: Factory painted, mechanically fastened together using nails and lag bolts or metal connectors to form a rigid assembly.
 - b. Steel Framework: Zinc-plated steel tubing of size and thickness standard with manufacturer, with joints welded.
 - c. Top and Side Panels: White, translucent fiberglass, 0.045 inch (1.1 mm) thick, weighing 6 oz./sq. ft. (1831 g/sq. m).
 - d. Top and Side Panels: White, translucent vinyl, weighing 14 oz./sq. ft. (4272 g/sq. m).
 - e. Tapered Side Panels: Taper side panels to angle required to accommodate sloped loading dock approach grades and make sealing edge of dock shelter parallel to back edge of truck. Taper for declined **OR** inclined, **as directed**, approach.
 - f. Cover Fabric: Vinyl-coated nylon with minimum total weight of 22 oz./sq. yd. (746 g/sq. m) **OR** 40 oz./sq. yd. (1356 g/sq. m), **as directed**.
 - 1) Color: Black **OR** Green **OR** Blue **OR** Brown **OR** Tan **OR** As indicated by manufacturer's designations **OR** Match sample **OR** As selected from manufacturer's full range, **as directed**.
 - g. Cover Fabric: Polyurethane-coated nylon with minimum total weight of 25 oz./sq. yd. (848 g/sq. m).
 - 1) Color: Black **OR** Green **OR** Blue **OR** Brown **OR** Tan **OR** As indicated by manufacturer's designations **OR** Match sample **OR** As selected from manufacturer's full range, **as directed**.
 - h. Cover Fabric: Neoprene-coated nylon with minimum total weight of 16 oz./sq. yd. (543 g/sq. m) **OR** 40 oz./sq. yd. (1356 g/sq. m) **OR** 45 oz./sq. yd. (1526 g/sq. m), **as directed**.
 - 1) Color: Black **OR** Green **OR** Blue **OR** Brown **OR** Tan **OR** As indicated by manufacturer's designations **OR** Match sample **OR** As selected from manufacturer's full range, **as directed**.
 - i. Cover Fabric: Hypalon-coated nylon with minimum total weight of 16 oz./sq. yd. (543 g/sq. m) **OR** 40 oz./sq. yd. (1356 g/sq. m), **as directed**.
 - 1) Color: Black **OR** Green **OR** Blue **OR** Brown **OR** Tan **OR** As indicated by manufacturer's designations **OR** Match sample **OR** As selected from manufacturer's full range, **as directed**.
 - j. Cover Fabric: Manufacturer's proprietary cover fabric complying with the following minimum requirements:
 - 1) Tearing strength of not less than 300 by 300 lbf (1334 by 1334 N) when tested according to ASTM D 2261.
 - 2) Abrasion resistance of not less than 6000 cycles when tested according to FED-STD-191A-5306.
 - 3) Tensile strength of not less than 1200 by 1200 lbf (5338 by 5338 N) when tested according to FED-STD-191A-5100.1.
 - 4) Cold resistance to minus 40 deg F (minus 40 deg C) when tested according to FED-STD-191A-5874.
 - 5) Color: Black **OR** Green **OR** Blue **OR** Brown **OR** Tan **OR** As indicated by manufacturer's designations **OR** Match sample **OR** As selected from manufacturer's full range, **as directed**.
 - k. Pleated Protectors: Overlapping layers of same fabric as cover.
7. Accessories:
 - a. Buffer flaps.
 - b. Bottom filler curtain.
 - c. Bottom seal pads.

N. Inflatable Dock Shelters



1. General: Inflatable dock shelters designed to inflate by motor/blower and compress against truck bodies to form airtight seals at loading dock openings; of type, size, and construction indicated.
 2. Door Opening Size: As indicated on Drawings, **as directed**.
 3. Rigid Canopy: Consisting of rigid canopy, fabric-covered header curtain, and one-piece inflatable header and jamb seals. Fabricate canopy from white, translucent plastic attached to rigid support framework.
 4. Rigid Canopy and Sides: Consisting of rigid canopy and sides, fabric-covered header curtain, and one-piece, inflatable header and jamb seals. Fabricate canopy and sides from white, translucent plastic attached to rigid support framework.
 5. Construction: Fabricate header seal full width over jamb seals. Mount seals on pressure-treated wood frame with hot-dip galvanized-steel mounting hardware. Provide header curtain with built-in flexible stays and two yellow aim patches. Slope canopy frame from center for drainage. Provide two protective steel bumpers of size and type required for application shown. Inflate seals by use of a 1/2-hp motor/blower with on-off switch, mounted under canopy frame. Provide bottom of header and jamb seals with grommets to allow for release of moisture and excess air.
 - a. Shape and Size: Fabricate framework, fabric for curtains, and other components to sizes and shapes indicated or required to fit door opening sizes shown and allow for not less than 12 inches (305 mm) of truck-body penetration when truck is docked.
 - b. Wood Framework: Fasten members together mechanically using nails and lag bolts or metal connectors to form a rigid assembly.
 - c. Steel Framework: Zinc-plated steel tubing of size and thickness standard with manufacturer, with joints welded.
 - d. Fabric: Polyurethane **OR** Vinyl, **as directed**, -coated nylon with minimum total weight of 14 oz./sq. yd. (475 g/sq. m).
 - 1) Color: Black **OR** Green **OR** Blue **OR** Brown **OR** As indicated by manufacturer's designations **OR** Match sample **OR** As selected from manufacturer's full range, **as directed**.
 - e. Fabric: Manufacturer's proprietary fabric complying with the following minimum requirements:
 - 1) Tearing strength of not less than 110 by 85 lbf (489 by 378 N) when tested according to ASTM D 2261.
 - 2) Abrasion resistance of not less than 490 cycles when tested according to FED-STD-191A-5306.
 - 3) Tensile strength of not less than 500 by 440 lbf (2224 by 1957 N) when tested according to FED-STD-191A-5100.1.
 - 4) Cold resistance to minus 40 deg F (minus 40 deg C) when tested according to FED-STD-191A-5874.
 - 5) Color: Black **OR** Green **OR** Blue **OR** Brown **OR** As indicated by manufacturer's designations **OR** Match sample **OR** As selected from manufacturer's full range, **as directed**.
- O. Transparent-Strip Door Curtains
1. General: Door curtains consisting of overlapping strips suspended from top of opening to form a sealed door curtain. Provide strips of length required to suit opening height and with sufficient number in unit to close opening width with overlap indicated.
 2. Strip Material: Curved, clear, transparent, extruded PVC. Fabricate strips for manufacturer's standard method of attachment to overhead mounting system indicated.
 - a. Standard Grade: Designed to withstand temperature range of 0 to plus 150 deg F (minus 18 to plus 66 deg C).
 - b. Low-Temperature Grade: USDA accepted, designed to withstand temperature range of minus 30 to plus 150 deg F (minus 34 to plus 66 deg C).
 - c. Strip Width and Thickness:
 - 1) 6 inches (152 mm) wide and 0.060 inch (1.5 mm) thick.
OR
8 inches (203 mm) wide and 0.080 inch (2 mm) thick.



OR

12 inches (305 mm) wide and 0.120 inch (3 mm) thick.

OR

16 inches (406 mm) wide and 0.160 inch (4 mm) thick.

- d. Overlap: None **OR** One-third **OR** One-half **OR** Two-thirds **OR** Three-quarters **OR** Full, **as directed**.
3. Header Mounting: Consisting of an angle bolted or welded to opening lintel; equip angle with permanently attached mounting pins and a steel-angle or -plate retaining strip attached to angle with wing nuts.
4. Wall Surface Mounting:
- a. Consisting of a steel plate bolted to side of lintel; equip plate with permanently attached, threaded, mounting pins and steel-angle or -plate retaining strip attached to plate with wing nuts.
- OR**
Consisting of steel pipe attached to side of lintel by manufacturer's standard, winged-U-type suspension brackets.
- OR**
Consisting of a rigid, vinyl wall-mounting unit bolted to side of lintel above opening; equip unit with a similarly formed, rigid, vinyl retainer attached to unit with wing nuts.
- P. General Finish Requirements
1. Finish loading dock equipment after assembly and testing.
- Q. Steel Finishes
1. Galvanizing: Hot-dip galvanize components as indicated to comply with the following:
- a. ASTM A 123/A 123M for iron and steel loading dock equipment.
- b. ASTM A 153/A 153M or ASTM F 2329 for iron and steel hardware for loading dock equipment.
2. Galvanized-Steel and Steel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat in manufacturer's standard color.

1.3 EXECUTION

A. Preparation

1. Coordinate size and location of loading dock equipment indicated to be attached to or recessed into concrete or masonry, and furnish anchoring devices with templates, diagrams, and instructions for their installation.
2. Set curb angles in concrete edges of dock-leveler recessed pits with tops flush with loading platform. Fit exposed connections together to form hairline joints.
3. Set curb angles in concrete edges of truck-leveler recessed pits with tops flush with driveway. Fit exposed connections together to form hairline joints.
4. Place self-forming pan system for recessed dock **OR** edge-of-dock, **as directed**, levelers in proper relation to loading platform before pouring concrete.
5. Clean recessed pits of debris.

B. Installation

1. General: Install loading dock equipment, including motors, pumps, control stations, wiring, safety devices, light-communication systems, and accessories as required for a complete installation.
 - a. Rough-in electrical connections according to requirements specified in Division 22..
2. Recessed Dock Levelers: Attach dock levelers securely to loading dock platform, flush with adjacent loading dock surfaces and square to recessed pit.
3. Edge **OR** Top, **as directed**,-of-Dock Levelers: Attach dock levelers to loading dock platform in a manner that complies with requirements indicated for arrangement and position relative to top of platform.



- a. Weld anchor holes in contact with continuous embedded loading dock edge channel. Weld or bolt bumper blocks to face of loading dock.
4. Truck Levelers: Attach truck levelers securely to driveway construction with expansion anchors and bolts.
5. Truck Restraints: Attach truck restraints in a manner that complies with requirements for arrangement and height required for device to engage vehicle rear-impact guard. Interconnect control panel and signals with dock leveler, **as directed**.
 - a. Wall-Mounted Units: Weld truck restraints to steel curb angle **OR** edge channel **OR** mounting plate, **as directed**, embedded in loading dock edge.
 - b. Wall-Mounted Units: Anchor truck restraints to face of loading dock with expansion anchors and bolts.
 - c. Driveway-Mounted Units: Anchor truck restraints to driveway with expansion anchors and bolts.
 - d. Pit-Mounted Units: Anchor truck restraints to concrete pit with expansion anchors and bolts.
6. Dock Bumpers: Attach dock bumpers to face of loading dock in a manner that complies with requirements indicated for spacing, arrangement, and position relative to top of platform and anchorage.
 - a. Welded Attachment: Plug-weld anchor holes in contact with steel inserts and fillet weld at other locations.
 - b. Bolted Attachment: Attach dock bumpers to preset anchor bolts embedded in concrete or to cast-in-place inserts or threaded studs welded to embedded-steel plates or angles. If preset anchor bolts, cast-in-place inserts, or threaded studs welded to embedded-steel plates or angles are not provided, attach dock bumpers by drilling and anchoring with expansion anchors and bolts.
 - c. Screw Attachment: Attach dock bumpers to wood construction with lag bolts as indicated.
7. Dock Lifts: Attach dock lifts securely to loading platform **OR** floor of recessed pit **OR** surface of driveway, **as directed**.
8. Dock Seals: Attach dock-seal support frames securely to building structure in proper relation to openings, dock bumpers, and dock levelers to ensure compression of dock seals when trucks are positioned against dock bumpers.
9. Dock Shelters: Attach dock shelters securely to building structure in proper relation to openings, dock bumpers, and dock levelers to ensure an effective seal of dock-shelter curtains with sides and top of truck body when trucks are positioned against dock bumpers.
10. Transparent-Strip Door Curtains: Attach door-curtain mounting system to lintel with screw anchors or toggle bolts. Mount curtain strips to achieve overlap indicated.

C. Adjusting

1. Adjust loading dock equipment to function smoothly and safely, and lubricate as recommended by manufacturer.
2. Test dock levelers and lifts for vertical travel within operating range indicated.
3. After completing installation of exposed, factory-finished loading dock equipment, inspect exposed finishes and repair damaged finishes.

END OF SECTION 11 13 13 00



Task	Specification	Specification Description
11 13 16 13	11 13 13 00	Loading Dock Equipment
11 13 16 23	11 13 13 00	Loading Dock Equipment
11 13 19 13	11 13 13 00	Loading Dock Equipment
11 13 19 26	11 13 13 00	Loading Dock Equipment
11 13 19 33	11 13 13 00	Loading Dock Equipment
11 13 23 23	11 13 13 00	Loading Dock Equipment
11 13 26 00	11 13 13 00	Loading Dock Equipment



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SECTION 11 14 13 16 - TURNSTILES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of turnstiles. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Shop Drawings: Drawings showing individual turnstile construction, overall dimensions for installation, and installation details including trim and accessories.
2. Materials List showing major components, materials and material thicknesses.
3. Product Sample: Manufacturer shall demonstrate field up-gradability of the rotary gates from mechanical control to electronic control.

- #### C. Product Handling: Store turnstiles in a dry well ventilated place in the original crating and protective wrappings and protect all finished from damage during handling.

1.2 PRODUCTS

A. Security Turnstiles

1. Type B Rotary Gate

- a. Mechanism: All steel and machined cast iron with two ratchets each 1-1/4" thick hardened steel. Two locking pawls 1-1/4" thick hardened steel. Automatic control with free turning one direction **OR** free turning both directions, **as directed**.
- b. Arms: Hot dip galvanized steel tubing, wall thickness of 0.105" and 1.31" o.d.. Arm ends spun closed under heat and pressure, for a smooth safe finish. Heel guards on bottom arms of rotor "U" shaped sheet steel channels surrounding the lower arms and extending to the flooring.
- c. Rotor and Barrier Vertical Members: 1/4" thick steel angles, hot dip galvanized. Arms pinned into rotor with malleable iron clamps. Non-welded construction.
- d. Vertical Passage Members: Tubing with 1/8" wall thickness and 1" o.d., hot dip galvanized.
- e. Bottom Bearing: Machined grey iron casting 1-1/2" thick, 12" diameter.
- f. Height: As required to meet project requirements.

2. Type AA Rotary Gate

- a. Mechanism: All steel and machined cast iron. Two control ratchets each 1-1/4" thick hardened steel. Two locking pawls each 1-1/4" thick hardened steel. Automatic control with free turning one direction **OR** free turning both directions, **as directed**.
- b. Arms: Square steel tubing, walls 0.097" thick, ends spun closed, bottom arms with heel guards.
- c. Rotor and Barrier Columns: Five angles of 1/4" thick steel, sixty-three malleable cast iron clamps, non-welded construction.
- d. Vertical Cage Members: 3 "U" channels 0.097" wall thickness, passage sheet 4' high by 5'2" length of 0.048" thick steel, 7 reinforcing bands of 0.38" thick steel.
- e. Bottom Bearing: Machined grey iron casting 1-1/2" thick, 12" diameter.
- f. Ceiling: Full round steel sheet 0.052" thick with 1" x 1" circular reinforcing angle at edge.
- g. Height: As required to meet project requirements.

3. Type SA Rotary Gate

- a. Mechanism: All steel and machine cast iron. Two control ratchets each 1-1/4" thick hardened steel. Two locking pawls each 1-1/4" thick hardened steel. Time delay and power



- relays with 10 amp contact ratings and ten million operation life. One-way operation **OR** two-way, **as directed**, agent operated.
- b. Arms: ANSI 304 stainless steel (brushed finish); 4" reinforcing plugs at rotor end, spun closed ends, walls 0.065" thick.
 - c. Rotor: One piece solid aluminum extrusion weighing 140 lbs., three wing cross section, anodized.
 - d. Vertical Columns: One barrier support column of 3" by 3" solid aluminum, three passageway support columns of 2" by 2" aluminum tubing with 1/8" wall thickness.
 - e. Passageway Sheeting: ANSI 304 stainless steel (brushed finish) 0.065" thick **OR** 1/4" thick curved polycarbonate sheet, **as directed**, rising from 4" above floor level to 4" below mechanism housing.
 - f. Ceiling: Full ceiling 6 ft. diameter, 5" deep.
 - g. Height: As required to meet project requirements.
4. Type Dual Rotary Gate
- a. Mechanism: All steel and machine cast iron. Two control ratchets each 1.25" thick hardened steel. Two locking pawls each 1-1/4" thick hardened steel. Time delay and power relays with 10 amp contact ratings and ten million operation life. One-way operation **OR** two-way, **as directed**, agent operated.
 - b. Arms: ANSI 304 stainless steel (brushed finish); 4" reinforcing plugs at rotor end, spun closed ends, walls 0.065" thick. Press fit 3.5" into rotor sockets.
 - c. Rotors: One piece solid aluminum extrusions weighing 140 lbs. each, three wing cross section, clear anodized.
 - d. Barriers: Two columns of 2" by 2" solid aluminum, 21 arms 54" in length bent 1" o.d. ANSI 302 Tubing with 0.080" wall thickness, force fit and pin secured.
 - e. Passageway Columns: Four columns of 2" by 2" clear anodized aluminum tubing with 1/8" wall thickness.
 - f. Passageway Sheeting: ANSI 304 stainless steel (brushed finish) 0.065" thick **OR** 1/4" thick curved polycarbonate sheet, **as directed**, rising from 4" above floor level to 4" below mechanism housing.
 - g. Ceiling: Full ceiling 8' by 4'6", 5" deep.
 - h. Height: As required to meet project requirements.
5. 24" Diameter Manual Turnstiles
- a. Cover: Deep drawn ANSI #304 stainless steel (brushed finish), 0.078" thick, corners with 1-3/8" radii.
 - b. Frame: ANSI #304 stainless steel (brushed finish) **OR** painted mild steel, **as directed**. Welded double wall (cavity) construction. Each wall 0.078" thick. 2" blending outer wall radii, 1/4" thick stainless steel base plate.
 - c. Mechanical Mechanism: Ratchet of 1" x 6-1/2" machined cast iron. Use aided by springs of 0.175" diameter spring steel. Motion stabilized by large rotary shock absorber and cast iron two-lobe cam. Self centered by 1/2" steel compression shoe.
 - 1) Unlocking Controls: One continuous-duty rated 24VDC solenoid with 620% of required strength. Solenoid shall operate for 45 milliseconds per passage. All unlocking elements shall be mechanical. No time relays or transformers.
 - 2) Mechanism shall be field upgradable from mechanical counting to electronic counting both local and remote, without cutting, filing or other structural modifications. Mechanism shall be field upgradable from mechanical unlocking control to electronic unlocking control, both single passage and escrow control, without cutting, filing or other structural modifications.
 - d. Arms: ANSI #304 stainless steel tubing (brushed finish), 0.049" thick walls, spun closed ends. Arms shall be press fit into grey cast iron hub and held to main shaft with drill rod taper pin.
 - e. Hub: Grey cast iron, taper pin mounting.
 - f. Portable: 0.063" thick machined cast iron floor tread, force fit ANSI #304 stainless steel railing (brushed finish), with 0.0112" wall thickness hand-grip loops, 3-1/2" diameter solid rubber wheels recessed into cabinet.



1.3 EXECUTION:

- A. Installation: Install turnstiles in accordance with manufacturer's instructions.

END OF SECTION 11 14 13 16



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Task	Specification	Specification Description
11 14 13 19	11 14 13 16	Turnstiles



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SECTION 11 21 63 00 - FOOD SERVICE EQUIPMENT**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for food service equipment. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Fabricated equipment.
 - b. Food waste machines.
 - c. Cooking equipment.
 - d. Self-contained refrigeration equipment.
 - e. Walk-in refrigeration equipment.
 - f. Powered food-preparation equipment.
 - g. Warewashing equipment.
 - h. Serving equipment.
 - i. Utility distribution systems.
2. Owner-Furnished Equipment: Where indicated, the Owner will furnish equipment for installation by Contractor.

C. Submittals

1. Product Data: For each type of product indicated. Include the following:
 - a. Manufacturer's model number.
 - b. Accessories and components that will be included for Project.
 - c. Clearance requirements for access and maintenance.
 - d. Utility service connections for water, drainage, power, and fuel; include roughing-in dimensions.
2. Shop Drawings: For fabricated equipment. Include plans, elevations, sections, roughing-in dimensions, fabrication details, utility service requirements, and attachments to other work.
3. Samples: For each factory-applied color finish required, in manufacturer's standard sizes.
4. Coordination Drawings: For foodservice facilities.
 - a. Indicate locations of foodservice equipment and connections to utilities.
 - b. Key equipment using same designations as indicated on Drawings.
 - c. Include plans and elevations; clearance requirements for equipment access and maintenance; details of equipment supports; and utility service characteristics.
 - d. Include details of seismic bracing for equipment.
5. Operation and Maintenance Data: For foodservice equipment to include in emergency, operation, and maintenance manuals. Include the following:
 - a. Product Schedule: For each foodservice equipment item, include the following:
 - 1) Designation indicated on Drawings.
 - 2) Manufacturer's name and model number.
 - 3) List of factory-authorized service agencies including addresses and telephone numbers.
6. Warranty: Samples of special warranty.

D. Quality Assurance

1. NSF Standards: Provide equipment that bears NSF Certification Mark or UL Classification Mark certifying compliance with applicable NSF standards.
2. BISSC Standards: Provide bakery equipment that complies with BISSC/Z50.2.



- a. Provide BISSC-certified equipment, with certification verified by a third-party agency, **as directed**.
 3. UL Certification: Provide electric and fuel-burning equipment and components that are evaluated by UL for fire, electric shock, and casualty hazards according to applicable safety standards, and that are UL certified for compliance and labeled for intended use.
 4. Steam Equipment: Provide steam-generating and direct-steam heating equipment that is fabricated and labeled to comply with ASME Boiler and Pressure Vessel Code.
 5. Regulatory Requirements: Install equipment to comply with the following:
 - a. ASHRAE 15, "Safety Code for Mechanical Refrigeration."
 - b. NFPA 54, "National Fuel Gas Code."
 - c. NFPA 70, "National Electrical Code."
 - d. NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operations."
 6. Seismic Restraints: Comply with SMACNA's "Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines," Appendix A, "Seismic Restraint Details," unless otherwise indicated.
 7. Preinstallation Conference: Conduct conference at Project site.
- E. Project Conditions
1. Field Measurements: Verify actual dimensions of construction contiguous with foodservice equipment by field measurements before fabrication. Indicate measurements on Coordination Drawings.
- F. Coordination
1. Coordinate foodservice equipment layout and installation with other work, including layout and installation of lighting fixtures, HVAC equipment, and fire-suppression system components.
 2. Coordinate locations and requirements of utility service connections.
 3. Coordinate sizes, locations, and requirements of the following:
 - a. Overhead equipment supports.
 - b. Equipment bases.
 - c. Floor depressions.
 - d. Insulated floors.
 - e. Floor areas with positive slopes to drains.
 - f. Floor sinks and drains serving foodservice equipment.
 - g. Roof curbs, equipment supports, and penetrations.
- G. Warranty
1. Refrigeration Compressor Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace compressors that fail in materials or workmanship within specified warranty period.
 - a. Failure includes, but is not limited to, inability to maintain set temperature.
 - b. Warranty Period: Five years from date of Final Completion.
- 1.2 PRODUCTS
- A. Fabricated Equipment
1. Stainless-Steel Sinks:
 - a. Description: One **OR** Two **OR** Three **OR** Four, **as directed**,-compartment sink(s). Fabricate units of welded stainless steel, sound deadened.
 - 1) Bowls: Stainless steel, Type 304, 0.078 inch (1.98 mm) **OR** 0.062 inch (1.59 mm), **as directed**, thick.
 - 2) Integral Drainboards: Stainless steel, Type 304, 0.078 inch (1.98 mm) **OR** 0.062 inch (1.59 mm), **as directed**, thick.
 - 3) Body: Stainless steel, Type 304, 0.078 inch (1.98 mm) **OR** Type 304, 0.062 inch (1.59 mm) **OR** Type 430, 0.062 inch (1.59 mm), **as directed**, thick.



- a) Back Splash: Manufacturer's standard height **OR** 13 inches (330 mm) **OR** 18 inches (457 mm), **as directed**.
 - b) Side Splash: Manufacturer's standard height **OR** 13 inches (330 mm) **OR** 18 inches (457 mm), **as directed**.
 - 4) Legs and Feet: Stainless-steel tubing legs with adjustable bullet feet.
 - 5) Accessories:
 - a) Faucets and Spouts: as directed by the Owner.
 - b) Prerinse Faucet: as directed by the Owner.
 - c) Vacuum breaker.
 - d) Lever waste with **OR** without, **as directed**, overflow.
 - e) Basket strainer.
 - f) Continuous waste.
 - g) Scrap trough.
 - h) Control bracket for food waste disposer controls.
 - i) Scrap block and hole.
 - j) Stainless-steel pot rack.
 - b. Stainless-Steel Sheet: ASTM A 240/A 240M, austenitic stainless steel, type as indicated.
 - c. Fabrication: Prepare sink for installation of the following equipment items:
 - 1) Water heater.
 - 2) Food waste disposer; weld disposer cone or collar into sink.
 - 3) Undercounter dishwasher.
 - d. Stainless-Steel Finish: Directional satin finish, No. 4.
2. Stainless-Steel Tables:
- a. Description: Flat-countertop **OR** Prep **OR** Equipment-stand **OR** Mixer-stand **OR** Dish, **as directed**, table.
 - 1) Tops: Stainless steel, Type 304, 0.078 inch (1.98 mm) **OR** Type 304, 0.062 inch (1.59 mm) **OR** Type 430, 0.062 inch (1.59 mm), **as directed**, thick, reinforced and sound deadened.
 - a) Back Splash: Manufacturer's standard height **OR** 1-1/2 inches (38 mm) **OR** 5 inches (127 mm), **as directed**.
 - b) Edge: Bullnose on four sides **OR** Bullnose on front edge, straight on sides and back **OR** Marine edge, **as directed**.
 - 2) Welded **OR** Adjustable, **as directed**, Undershelf: Stainless steel, Type 304, 0.050 inch (1.27 mm) thick **OR** Metallic-coated steel, 0.052-inch (1.32-mm) nominal thickness, **as directed**.
 - 3) Crossbracing: Stainless-steel **OR** Metallic-coated steel, **as directed**, tubing, bolted **OR** welded, **as directed**, to legs.
 - 4) Cabinet:
 - a) Body: Stainless steel, Type 430, 0.050 inch (1.27 mm) thick.
 - b) Doors: Sliding **OR** Hinged, **as directed**, stainless steel, Type 304, 0.038 inch (0.95 mm) thick.
 - c) Drawers: Stainless-steel drawer and faceplate **OR** Galvanized-steel drawer and stainless-steel faceplate **OR** Stainless-steel front and liner **OR** Stainless-steel front and galvanized-steel liner, **as directed**.
 - 5) Sink: Stainless steel, Type 304, 0.078 inch (1.98 mm) thick, welded into tabletop and including the following:
 - a) Faucet and Spout: as directed by the Owner.
 - b) Vacuum breaker.
 - c) Leverwaste with **OR** without, **as directed**, overflow.
 - d) Basket strainer.
 - e) Tail piece.
 - 6) Legs: Stainless-steel **OR** Metallic-coated steel, **as directed**, tubing.
 - 7) Feet: Stainless-steel adjustable bullets **OR** Plastic adjustable bullets **OR** Stainless-steel, flanged, adjustable bullets **OR** Casters, **as directed**.
 - 8) Accessories:
 - a) Control panel.



- b) Control bracket for food waste disposer controls.
 - c) Aluminum pan rack slides, six **OR** three, **as directed**, slides each.
 - d) Urn trough.
 - e) Spice bins.
 - b. Materials:
 - 1) Stainless-Steel Sheet: ASTM A 240/A 240M, austenitic stainless steel, type as indicated.
 - 2) Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G90 (Z275) coating.
 - c. Fabrication: Prepare table for installation of the following equipment items:
 - 1) Food waste disposer; weld disposer cone or collar into sink.
 - 2) Heat lamp.
 - d. Stainless-Steel Finish: Directional satin finish, No. 4.
- 3. Stainless-Steel Shelf Units:
 - a. Description: Table mounted, single deck **OR** Table mounted, double deck **OR** Wall mounted, **as directed**. Fabricate units of stainless steel, Type 304, 0.062 inch (1.59 mm) **OR** Type 304, 0.050 inch (1.27 mm) **OR** Type 430, 0.050 inch (1.27 mm), **as directed**, thick.
 - b. Stainless-Steel Sheet: ASTM A 240/A 240M, austenitic stainless steel, type as indicated.
 - c. Stainless-Steel Finish: Directional satin finish, No. 4.
- 4. Pot Racks:
 - a. Description: Wall mounted **OR** Ceiling hung **OR** Corner, **as directed**. Fabricate units of stainless steel **OR** painted, cold-rolled steel, **as directed**.
 - 1) Bars: Double **OR** Single, **as directed**.
 - 2) Hooks: 18 per unit.
 - b. Materials:
 - 1) Stainless-Steel Sheet: ASTM A 240/A 240M, austenitic stainless steel, Type 304.
 - 2) Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
 - c. Finishes:
 - 1) Stainless Steel: Directional satin finish, No. 4.
 - 2) Cold-Rolled Steel: Powder-coat painted finish.
- 5. Stainless-Steel Hand Sinks:
 - a. Description: Lavatory sink. Fabricate units of stainless steel, Type 304, 0.050 inch (1.27 mm) **OR** 0.038 inch (0.95 mm), **as directed**, thick.
 - 1) Operation: Electronic **OR** Knee valve **OR** Foot pedal **OR** Wrist handle **OR** Handle, **as directed**.
 - 2) Faucet and Spout: as directed by the Owner.
 - 3) Accessories:
 - a) Chrome-plated tail piece and P trap, NPS 1-1/2 (DN 40), with 0.045-inch (1.1-mm) minimum wall thickness.
 - b) Strainer basket with metal post.
 - c) Liquid soap dispenser, splash **OR** deck, **as directed**, mounted.
 - d) Liquid soap and towel dispenser.
 - e) Towel dispenser.
 - f) Tubular wall supports.
 - g) Skirt assembly for support.
 - h) Side splashes.
 - b. Stainless-Steel Sheet: ASTM A 240/A 240M, austenitic stainless steel, type as indicated.
 - c. Stainless-Steel Finish: Directional satin finish, No. 4.
- 6. Floor Troughs **OR** Water Receptacles, **as directed**:
 - a. Description: 4-inch (102-mm) **OR** 2-inch (50-mm), **as directed**, nominal depth excluding tailpiece.
 - 1) Body: Stainless steel, Type 304, 0.078 inch (1.98 mm) thick.
 - 2) Grate: Stainless-steel bar, Type 304 **OR** Fiberglass, **as directed**.



- 3) Waste Connection: NPS 3 (DN 80).
 - b. Materials:
 - 1) Stainless-Steel Sheet: ASTM A 240/A 240M, austenitic stainless steel, type as indicated.
 - 2) Stainless-Steel Bars: ASTM A 276, austenitic stainless steel, type as indicated.
 - c. Stainless-Steel Finish: Directional satin finish, No. 4.
- B. Food Waste Machines
1. Food Waste Disposer Units:
 - a. Description: 3 **OR** 5 **OR** 7, **as directed**, hp, with dual-direction shredding elements, and the following:
 - 1) Stainless-steel **OR** Corrosion-resistant, **as directed**, housing.
 - 2) Flow control.
 - 3) Solenoid valve.
 - 4) Vacuum breaker.
 - 5) Fixed nozzle.
 - 6) Control Panel:
 - a) Autoreversing and internal timed water flush.
 - b) Stainless-steel mounting bracket.
 - 7) Prerinse: Backsplash mounted with hot- and cold-water mixing valve and with stainless-steel **OR** corrosion-resistant, **as directed**, exposed metal parts and the following:
 - a) Wall support bracket.
 - b) Flexible, 3/8-inch (10-mm) metal-encased hose with a minimum length of 29 inches (737 mm) and supported by spiral spring.
 - c) Spray-head assembly with lockable lever handle.
 - 8) Accessories:
 - a) Collar adaptor for sink **OR** trough, **as directed**.
 - b) Cone with adaptor ring.
 - i. Size: 12 inches (305 mm) **OR** 15 inches (381 mm) **OR** 18 inches (457 mm), **as directed**.
 - c) Cone cover in size that matches cone.
 - d) Silver accumulator.
 - 9) Electrical Service: Equip unit for connection to service indicated on Drawings.
 2. Food Waste Pulper and Water Extractor Systems:
 - a. Description: Stainless-steel pulper unit, extractor unit, and control panel with water-level control and push-button start.
 - 1) Capacity: Not less than 600 lb (272 kg) **OR** 700 lb (318 kg) **OR** 900 lb (408 kg), **as directed**, of waste per hour.
 - 2) Accessories:
 - a) Feed trough connection.
 - b) Feed tray.
 - c) Feed hood assembly.
 - d) Under-dish-table lid.
 - e) Remote Water Extractor:
 - i. Dam, to prevent siphoning of water from pulper tank.
 - ii. Remote piping system, overhead **OR** below floor, **as directed**.
 - 3) Electrical Service: Equip unit for connection to service indicated on Drawings.
 3. Food Waste Grinder and Water Extractor Systems:
 - a. Description: Stainless-steel construction; with off and on controls on unit, food waste hopper, silver saver, internal disposer, removable water extraction auger with internal water sprays, and discharge chute.
 - 1) Capacity: Not less than 600 lb (272 kg) **OR** 700 lb (318 kg), **as directed**, of waste per hour.
 - 2) Accessories:
 - a) Reel rinse unit with spray valve.



- b) Recirculation water pump.
 - c) Trough mount.
 - 3) Electrical Service: Equip unit for connection to service indicated on Drawings.
 - 4. Undercounter Food Waste Grinder and Water Extractors:
 - a. Description: Stainless-steel, undercounter, cleanable assembly including the following:
 - 1) Capacity: Not less than 600 lb (272 kg) **OR** 700 lb (318 kg), **as directed**, of waste per hour.
 - 2) Separate water-extractor and disposer units.
 - a) Disposer: Corrosion-resistant housing, dual-direction shredding elements.
 - 3) Piping between disposer and water extractor.
 - 4) Vacuum breaker.
 - 5) Solenoid valve.
 - 6) Flow control.
 - 7) Time-delayed relay.
 - 8) Control Panel:
 - a) Autoreversing and internal timed water flush.
 - b) Stainless-steel mounting bracket.
 - 9) Prerinse: Backsplash mounted with hot- and cold-water mixing valve and with stainless-steel **OR** corrosion-resistant, **as directed**, exposed metal parts and the following:
 - a) Wall support bracket.
 - b) Flexible, 3/8-inch (10-mm) metal-encased hose with a minimum length of 29 inches (737 mm) and supported by spiral spring.
 - c) Spray-head assembly with lockable lever handle.
 - 10) Accessories:
 - a) Cone with adaptor ring.
 - i. Size: 12 inches (305 mm) **OR** 15 inches (381 mm) **OR** 18 inches (457 mm), **as directed**.
 - b) Cone cover in size that matches cone.
 - c) Silver sorter.
 - d) Trough collar connection.
 - 11) Electrical Service: Equip unit for connection to service indicated on Drawings.
- C. Cooking Equipment
 - 1. Ranges:
 - a. Description:
 - 1) Top Configuration:
 - a) Open-Burner Unit:
 - i. Standard Burners: Four **OR** Six **OR** Eight **OR** Four, step-up type, **as directed**.
 - ii. Wok **OR** Saute, **as directed**, Head: as directed by the Owner.
 - b) Griddle: Flat **OR** Raised, **as directed**.
 - c) Radiant Broiler: as directed by the Owner.
 - 2) Base Configuration:
 - a) Standard Oven(s): One **OR** Two, **as directed**.
 - b) Convection Oven(s): One **OR** Two, **as directed**.
 - c) Storage Base: One.
 - 3) Accessories:
 - a) High **OR** Double-deck, **as directed**, back shelf.
 - b) Stainless-steel sides.
 - c) Stainless-steel back.
 - d) Legs for curb base.
 - e) Toe Base: 4 inches (102 mm) high.
 - f) Casters: as directed by the Owner.
 - g) Oven Rack(s): One for each oven.



- 4) Electrical Service: Equip unit for connection to service indicated on Drawings.
 - 5) Gas Service: Natural **OR** Liquefied propane, **as directed**, gas.
2. Deep Fat Fryers:
- a. Description: Electric fryer, solid-state controls **OR** Electric, programmable computer controls **OR** Gas fryer, **as directed**.
 - 1) Oil Capacity: 40 lb (18 kg) **OR** 85 lb (39 kg), **as directed**.
 - 2) Accessories:
 - a) Stainless-steel sides.
 - b) Stainless-steel fry tank.
 - c) Stainless-steel fry tank cover.
 - d) Casters: as directed by the Owner.
 - e) Automatic basket lifts.
 - f) Single Fry Baskets: as directed by the Owner.
 - g) Twin Fry Baskets: as directed by the Owner.
 - h) Triple Fry Baskets: as directed by the Owner.
 - i) Quick gas-service disconnect and flexible hose.
 - 3) Electrical Service: Equip unit for connection to service indicated on Drawings.
 - 4) Gas Service: Natural **OR** Liquefied propane, **as directed**, gas.
3. Steam Jacketed Kettles:
- a. Description: Stainless steel, Type 304.
 - 1) Type: Stationary **OR** Tilting, **as directed**.
 - 2) Steam Source: Electrically heated, self-contained **OR** Direct, **as directed**.
 - a) Maximum **OR** Operating, **as directed**, Steam Pressure: 50 psig (345 kPa) **OR** 25 psig (172 kPa), **as directed**.
 - 3) Capacity: 10 quarts (9.5 L) **OR** 20 gal. (76 L), **as directed**.
 - 4) Accessories:
 - a) Basket insert.
 - b) Lift-off cover.
 - c) Single **OR** Double, **as directed**, -pantry water filler.
 - d) Tangent Drawoff: 2 inches (50 mm) **OR** 3 inches (76 mm), **as directed**.
 - e) Disc Strainer: 1/8 inch (3 mm), perforated **OR** solid, **as directed**.
 - f) Interior Finish: Manufacturer's standard **OR** Stainless steel, Type 316, **as directed**.
 - g) Cold-water jacket cooling.
 - h) Steam trap assemblies.
 - i) Kettle brush kit.
 - 5) Electrical Service: Equip unit for connection to service indicated on Drawings.
 - b. Stainless-Steel Sheet: ASTM A 240/A 240M, austenitic stainless steel, type as indicated.
 - c. Stainless-Steel Finish: Directional satin finish, No. 4.
4. Ovens:
- a. Description: Electric convection **OR** Gas convection **OR** Rotisserie, **as directed**.
 - 1) Single deck **OR** Double deck **OR** Single deck with open stand, **as directed**.
 - 2) Accessories:
 - a) Oven Rack(s): One per oven chamber.
 - b) Stainless-steel drip pan.
 - c) Down-draft flue diverter.
 - d) Stacking kit.
 - 3) Electrical Service: Equip unit for connection to service indicated on Drawings.
 - 4) Gas Service: Natural **OR** Liquefied propane, **as directed**, gas.
5. Microwave Ovens:
- a. Description: 1200-W cooking power.
 - 1) Electrical Service: Equip unit with plug and cord for 120-V service.
6. Coffee Urns:
- a. Description: Single **OR** Twin **OR** Triple, **as directed**, urn.
 - 1) Capacity: 3 gal. (11 L) **OR** 6 gal. (23 L) **OR** 10 gal. (38 L), **as directed**, per liner.
 - 2) Type: Electric **OR** Gas **OR** Steam, **as directed**, heated.



- 3) Agitator: Automatic **OR** Push button, **as directed**.
- 4) Spray Arm: With **OR** Without, **as directed**, bypass.
- 5) Timer: Digital **OR** Electromechanical, **as directed**.
- 6) Accessories:
 - a) Fill/Dispense: as directed by the Owner.
 - b) Multiple Faucet: as directed by the Owner.
 - c) Filtering: Permanent, stainless-steel, woven-wire cloth **OR** Disposable filter paper, **as directed**.
 - d) Finish: Manufacturer's standard **OR** Brass body and trim **OR** Copper body and brass trim, **as directed**.
- b. Electrical Service: Equip unit for connection to service indicated on Drawings.
- c. Gas Service: Natural **OR** Liquefied propane, **as directed**, gas.
- d. Operating Steam Pressure: As indicated on Drawings **OR** As directed.

D. Self-Contained Refrigeration Equipment

1. Refrigerators **OR** Freezers, **as directed**:

- a. Description: Reach-in **OR** Roll-in **OR** Pass-through, **as directed**, type.
 - 1) Exterior Finish: Stainless steel.
 - 2) Interior Finish: Stainless steel **OR** Manufacturer's standard, **as directed**.
 - 3) Doors: Full length **OR** Half length **OR** In configuration shown on Drawings, **as directed**.
 - 4) Accessories:
 - a) Casters.
 - b) Stainless-steel back with rear louvers.
 - c) Re-hinging feature for doors.
 - d) Hinged glass doors and fluorescent fixtures.
 - e) Tray Slides: For sheet pans.
 - f) Chrome-Plated **OR** Stainless-Steel, **as directed**, Shelves: Quantity, as directed by the Owner.
 - g) Loading Rack: as directed by the Owner.
 - h) Transfer Carriage: as directed by the Owner.
 - 5) Electrical Service: Equip unit with plug and cord for service indicated on Drawings.

2. Undercounter Refrigerators **OR** Freezers, **as directed**:

- a. Description: Compact unit with rear-mounted, self-contained refrigeration system.
 - 1) Accessories:
 - a) Stainless-steel top with backsplash.
 - b) Stainless-steel back panel.
 - c) Casters: 6 inches (152 mm) **OR** 4 inches (102 mm) **OR** 3-1/2 inches (89 mm), **as directed**, high.
 - d) Utility Base: 6 inches (152 mm) high.
 - e) Shelves: Description and quantity, as directed by the Owner.
 - f) Stacking kit.
 - 2) Electrical Service: Equip unit with plug and cord for service indicated on Drawings.

3. Merchandiser Refrigeration Units:

- a. Description: Curved-glass, self-contained refrigerator **OR** Sliding-glass, self-contained refrigerator **OR** Sliding-glass, self-contained freezer, **as directed**.
 - 1) Exterior Finish: Manufacturer's standard **OR** Stainless steel, **as directed**.
 - 2) Interior Finish: Manufacturer's standard **OR** Stainless steel **OR** White, **as directed**.
 - 3) Accessories:
 - a) Door locks.
 - b) Fluorescent Light Fixtures: Quantity, as directed by the Owner.
 - c) Base: as directed by the Owner.
 - d) Casters: as directed by the Owner.
 - e) Legs: as directed by the Owner.
 - f) Chrome-Plated Shelves: Quantity, as directed by the Owner.



- 4) Electrical Service: Equip unit with plug and cord for service indicated on Drawings.
4. Ice-Making Machine:
 - a. Description: Undercounter **OR** Freestanding, **as directed**, units.
 - 1) Production: Ice cubes **OR** cubes, dice **OR** cubes, half dice **OR** flakes **OR** chiplets (compacted flake ice), **as directed**.
 - 2) Capacity: as directed by The Owner per 24-hour period.
 - 3) Accessories:
 - a) Storage Bin: as directed by the Owner..
 - i. Stainless-steel stand and legs.
 - b) Water filter.
 - 4) Electrical Service: Equip unit for connection to service indicated on Drawings.
- E. Walk-In Refrigeration Equipment
 1. Walk-in Refrigeration Units:
 - a. Description: Cooler **OR** Freezer **OR** Two-compartment unit, with cooler and freezer compartments, **as directed**.
 - 1) Wall and Ceiling Panels: Interlocking insulating panels.
 - 2) Floors: Insulated floor panels **OR** Field installed; provide manufacturer's standard insulated floor screed, **as directed**.
 - 3) Doors:
 - a) Hinges: Two per door **OR** Self-closing and spring loaded; three per door, **As directed**.
 - b) Latch: Edge-mounted, positive-type latch with cylinder lock.
 - c) Include safety-release handle that opens door from inside when door is locked.
 - 4) Door Accessories:
 - a) Vision port.
 - b) Pressure relief port.
 - c) Threshold: Stainless steel, factory installed.
 - d) Antic condensate heater at freezer doors.
 - 5) Vaporproof Lighting Fixtures: Incandescent fixture with 100-W lamp.
 - a) Control: Neon pilot light and toggle switch located on exterior of door panel.
 - b) Quantity: One per compartment, located on door panel.
 - 6) Refrigeration System: Self-contained, mounted on unit **OR** Remote system with preassembled condensing unit and evaporator assemblies.
 - a) Exterior Condensing Units: Include winter control, crankcase heater, and enclosed weatherproof housing.
 - b) Operating Temperature: as directed by the Owner.
 - 7) Temperature Monitoring System: Electronic monitoring and remote audible alarm system that warns when temperatures register 10 deg F (6 deg C) above or below set temperature.
 - 8) Closure Panels and Trim: Include closure panels and trim.
 - 9) Electrical Service: Equip unit for connection to service indicated on Drawings.
 - b. Finishes:
 - 1) Exposed Exterior Finish: Stucco-patterned aluminum **OR** Smooth, mill-finished aluminum **OR** White-painted aluminum, **as directed**.
 - 2) Unexposed Exterior Finish: Stucco-patterned, metallic-coated steel.
 - 3) Interior Finish: Stucco-patterned aluminum **OR** Smooth, mill-finished aluminum **OR** White-painted aluminum, **as directed**.
 - 4) Closure Panels and Trim: Matched to exposed exterior finish of panels.
- F. Powered Food-Preparation Equipment
 1. Mixers **OR** Slicers **OR** Meat Saws **OR** Peelers, **as directed**:
 - a. Description: as directed by the Owner.
 - b. Accessories: as directed by the Owner.
 - c. Electrical Service: Equip unit with plug and cord for service indicated on Drawings.



G. Warewashing Equipment

1. Warewashing Machines:

- a. Description: Dishwashing, single tank **OR** Dishwashing, double tank **OR** Dishwashing, rackless conveyor **OR** Dishwashing, with circular conveyor table **OR** Pot and pan washing, two racks **OR OR** Pot and pan washing, one rack, **as directed**.
 - 1) Capacity: as directed by the Owner.
 - 2) Accessories: as directed by the Owner.
 - 3) Electrical Service: Equip unit for connection to service indicated on Drawings.

H. Serving Equipment

1. Modular Counters:

- a. Description: Hot food **OR** Refrigerated salad **OR** Ice-cooled salad **OR** Sliding-glass door refrigerated **OR** Frost-top **OR** Sandwich **OR** Pizza **OR** Refrigerated-chest **OR** Dual-temperature **OR** Tray-starter **OR** Storage **OR** Cashier, **as directed**, module.
 - 1) Cabinet Face Panels: Manufacturer's standard.
 - 2) Accessories:
 - a) Tray slide.
 - b) Work shelf.
 - c) Casters.
 - d) Electrical receptacle.
 - e) Cam-action latch locks with trigger release to mate with adjoining modular counters.
 - f) Tempered-glass, food-protector shield.
 - 3) Electrical Service: Equip unit for connection to service indicated on Drawings.
 - 4) Color: As selected from manufacturer's full range.

I. Utility Distribution Systems

1. Utility Distribution Systems:

- a. Description: Overhead **OR** Counter **OR** Island **OR** Tray-slide **OR** Steam **OR** Wall-mounted, **as directed**, system.
- b. Accessories: as directed by the Owner.

J. Miscellaneous Materials

1. Installation Accessories, General: NSF certified for end-use application indicated.
2. Elastomeric Joint Sealant: ASTM C 920; silicone **OR** urethane, **as directed**. Type S (single component), Grade NS (nonsag), Class 25, Use NT (nontraffic) related to exposure, and Use M, G, A, or O as applicable to joint substrates indicated.
 - a. Public Health and Safety Requirements:
 - 1) Sealant is certified for compliance with NSF standards for end-use application indicated.
 - 2) Washed and cured sealant complies with the FDA's regulations for use in areas that come in contact with food.
 - b. Cylindrical Sealant Backing: ASTM C 1330, Type C, closed-cell polyethylene, in diameter greater than joint width.

K. Finishes

1. Stainless-Steel Finishes:

- a. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- b. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1) Run grain of directional finishes with long dimension of each piece.
 - 2) When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.



2. Powder-Coat Finishes: Immediately after cleaning and pretreating, electrostatically apply manufacturer's standard, baked-polymer, thermosetting powder finish. Comply with resin manufacturer's written instructions for application, baking, and minimum dry film thickness.

1.3 EXECUTION

A. Installation

1. Install foodservice equipment level and plumb, according to manufacturer's written instructions.
 - a. Connect equipment to utilities.
 - b. Provide cutouts in equipment, neatly formed, where required to run service lines through equipment to make final connections.
2. Complete equipment assembly where field assembly is required.
 - a. Provide closed butt and contact joints that do not require a filler.
 - b. Grind field welds on stainless-steel equipment until smooth and polish to match adjacent finish.
3. Install equipment with access and maintenance clearances that comply with manufacturer's written installation instructions and with requirements of authorities having jurisdiction.
4. Install cabinets and similar equipment on bases in a bed of sealant.
5. Install closure-trim strips and similar items requiring fasteners in a bed of sealant.
6. Install joint sealant in joints between equipment and abutting surfaces with continuous joint backing unless otherwise indicated. Produce airtight, watertight, vermin-proof, sanitary joints.

B. Cleaning And Protecting

1. After completing installation of equipment, repair damaged finishes.
2. Clean and adjust equipment as required to produce ready-for-use condition.
3. Protect equipment from damage during remainder of the construction period.

C. Demonstration

1. Train the Owner's maintenance personnel to adjust, operate, and maintain foodservice equipment.

END OF SECTION 11 21 63 00



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SECTION 11 26 13 00 - UNIT KITCHENS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for unit kitchens. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes factory-fabricated and -assembled unit kitchens with metal, laminate-clad and wood cabinets, countertops, fixtures, appliances, and accessories.

C. Submittals

1. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, finishes, furnished specialties, and accessories. Include rated capacities, operating characteristics, and utility requirements of appliances.
2. LEED Submittals:
 - a. Product Data for Credit EQ 4.4: For composite wood products, documentation indicating that product contains no urea formaldehyde.
 - b. Certificates for Credit MR 7: Chain-of-custody certificates certifying that cabinets and countertops comply with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body. Include statement indicating costs for each certified wood product.
 - c. Product Data for Credit EA 1.4: For appliances, documentation indicating that products are ENERGY STAR rated.
3. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - a. Wiring Diagrams: For power, signal, and control wiring.
4. Samples: For each type of exposed finish required, prepared on Samples of size indicated below:
 - a. Metal finish for cabinets and countertops, 8 by 10 inches (200 by 250 mm).
 - b. Wood finish for cabinets, 8 by 10 inches (200 by 250 mm).
 - c. Plastic laminate for cabinets and countertops, 8 by 10 inches (200 by 250 mm).
 - d. Solid surfacing for countertops, 6 inches (150 mm) square.
 - e. One full-size unit of each type of exposed hardware.
5. Product Certificates: For each type of unit kitchen, from manufacturer.
6. Manufacturer Certificate: Signed by manufacturer certifying that units comply with requirements.
7. Maintenance Data: For unit kitchen appliances to include in maintenance manuals.
8. Warranty: Sample of special warranty.

D. Quality Assurance

1. Manufacturer Qualifications: A qualified manufacturer that fabricates unit kitchens and their components.
2. Source Limitations: Obtain unit kitchens from single source from single manufacturer.
3. Regulatory Requirements: Where unit kitchens are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines, ICC/ANSI A117.1 and HUD's "Fair Housing Accessibility Guidelines".
4. Forest Certification: Provide cabinets and countertops made from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
5. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.



- a. Built-in Refrigerators: Listed and labeled for recessed installation. Mount label to be visible after installation of unit; include electrical rating, type of refrigerant, and minimum installation clearances.
- b. Refrigerated Unit Kitchens and Wet Bars: Listed and labeled for entire unit as a single integrated system. Mount label to be visible after installation of unit; include electrical rating, type of refrigerant, and minimum installation clearances.
6. Wood and Laminate-Clad Cabinet Fabrication Standard:
 - a. KCMA A161.1. Provide cabinets with KCMA's "Certified Cabinet" seal affixed to a semiexposed location of each unit and showing compliance with standard.
 - b. AWI 400B, Custom grade.
 - c. Either fabrication standard above.
7. Appliance Standards:
 - a. Refrigerators and Freezers: UL 250 or AHAM ER-1.
 - b. Electric Ranges: UL 858 or AHAM HRF-1.
 - c. Microwave Ovens: UL 923.
 - d. Gas-Burning Appliances: ANSI Z21 Series, and certified by CSA International, UL, or another testing and inspecting agency acceptable to authorities having jurisdiction.
8. ENERGY STAR Rating: Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.

E. Delivery, Storage, And Handling

1. Deliver factory-assembled units, individually factory packaged and protected. Label with manufacturer's name, product name, and model number.

F. Project Conditions

1. Environmental Limitations: Do not deliver or install unit kitchens until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Field Measurements: Verify actual dimensions of construction contiguous with unit kitchens by field measurements before fabrication.

G. Coordination

1. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that unit kitchens can be supported and installed as indicated.
2. Coordinate wiring requirements and current characteristics of unit kitchens with building electrical system. See Division 22.
3. Coordinate layout and installation of plumbing, mechanical, and electrical services for unit kitchens.

H. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace hermetically sealed refrigerator compressor system of unit kitchens that fail within specified warranty period.
 - a. Warranty Period: Five years from date of Final Completion.

1.2 PRODUCTS

A. Materials

1. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.



2. Porcelain-Enamel-Finished Steel Sheet: ASTM A 424, enameling-grade steel, uncoated thickness indicated; with exposed face and edges coated with primer, ground coat, and color cover coat; and concealed face coated with primer and ground coat; acid resistant.
3. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.
4. Medium-Density Fiberboard: ANSI A208.2, Grade 130, made with binder containing no urea-formaldehyde resin.
5. Particleboard: ANSI A208.1, Grade M-2 **OR** Grade M-2-Exterior Glue **OR** Grade M-2, made with binder containing no urea-formaldehyde resin, **as directed**.
6. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, Type I, made with adhesive containing no urea formaldehyde.
7. Solid Wood: Clear hardwood lumber of species indicated, free of defects, selected for compatible grain and color, and kiln dried to 7 percent moisture content.
8. High-Pressure Decorative Laminate: NEMA LD 3.
9. Solid-Surfacing Material: Homogenous solid sheets fabricated from reacted monomers and resins, mineral fillers, and pigments; in thickness indicated; complying with ISSFA-2.
10. Adhesives: Do not use adhesives that contain urea formaldehyde.

B. Metal Cabinets

1. Steel Base Cabinets: Fabricate frames and sides from 0.036-inch (0.91-mm) **OR** 0.030-inch (0.76-mm), **as directed**, nominal-thickness, cold-rolled steel sheet; welded and reinforced with internal gussets and bracing; with baked-enamel finish.
 - a. Door and Drawer Fronts: 0.036-inch (0.91-mm) **OR** 0.030-inch (0.76-mm), **as directed**, nominal-thickness, cold-rolled steel sheet, textured or smooth; welded, reinforced, and sound-deadened; with baked-enamel finish.
OR
Door and Drawer Fronts: 0.038-inch- (0.95-mm-) thick, stainless-steel sheet; welded, reinforced, and sound deadened.
2. Stainless-Steel Base Cabinets: Fabricate frames and sides from 0.038-inch- (0.95-mm-) thick, stainless-steel sheet; welded and reinforced with internal gussets and bracing.
 - a. Door and Drawer Fronts: 0.038-inch- (0.95-mm-) thick, stainless-steel sheet; welded, reinforced, and sound deadened.
3. Undercounter Storage Cabinet: Same material and finish as base cabinets, with adjustable shelf and drawer or with two drawers.
4. Wall Cabinets: Same material and finish as base cabinets, with flush double bottoms and adjustable shelves.
 - a. Wall Shields: Fabricated from textured, cold-rolled steel sheet with baked-enamel finish, color to match cabinets **OR** textured, cold-rolled steel sheet with baked-enamel finish, color to match countertop **OR** stainless-steel sheet, **as directed**. Provide wall shields for back wall and side walls, **as directed**, between countertop splash and wall cabinets.
5. Shelves: Manufacturer's standard rolled-front shelves, fixed **OR** adjustable, **as directed**, of same material and finish as cabinets.
6. Wire Pulls: Brushed-chrome **OR** Polished-chrome **OR** Brushed-brass **OR** Polished-brass, **as directed**, finish.

C. Laminate-Clad Cabinets

1. Framed-Style Base Cabinets:
 - a. Face Frames: 3/4-inch- (19-mm-) thick plywood or solid wood.
 - b. Back Panels: 3/8-inch- (10-mm-) thick particleboard with melamine bonded to inside surface.
 - c. Top, Bottom, and End Panels: 3/8-inch- (10-mm-) thick particleboard with melamine bonded to both sides.
 - d. Door and Drawer Fronts: 3/4-inch- (19-mm-) thick, medium-density fiberboard with 16-mil- (0.4-mm-) thick vinyl film (Thermofoil) bonded to exposed surfaces and melamine bonded to inside surfaces.
OR



- Door and Drawer Fronts: 5/8-inch- (16-mm-) thick particleboard with melamine bonded to both sides.
- e. Drawers: Four sided, with 1/2-inch- (13-mm-) thick particleboard fronts, backs, and sides, and 1/4-inch- (6-mm-) thick particleboard bottom.
 - f. Shelves: 5/8-inch- (16-mm-) thick particleboard with melamine bonded to both sides and PVC edges.
2. Frameless-Style Base Cabinets:
- a. Back Panels: 1/4-inch- (6-mm-) thick plywood or particleboard with melamine bonded to inside surface.
 - b. Top and Bottom Panels: 3/4-inch- (19-mm-) thick particleboard with melamine bonded to both sides.
 - c. End Panels: 5/8-inch- (16-mm-) thick particleboard with melamine bonded to both sides.
 - d. Door and Drawer Fronts: 3/4-inch- (19-mm-) thick plywood with Grade HGS high-pressure decorative laminate bonded to front and edges, and Grade CLS high-pressure decorative laminate bonded to inside surface.
- OR**
- Door and Drawer Fronts: 5/8-inch- (16-mm-) thick particleboard with melamine bonded to both sides.
- OR**
- Door and Drawer Fronts: 5/8-inch- (16-mm-) thick particleboard with melamine bonded to both sides. Provide continuous bevel edge at tops and bottoms of doors and bottom of drawer fronts in wood-grain laminate **OR** solid wood, **as directed**.
- e. Drawers: Four sided, with 1/2-inch- (13-mm-) thick particleboard fronts, backs, and sides, and 1/4-inch- (6-mm-) thick particleboard bottom.
 - f. Shelves: 3/4-inch- (19-mm-) thick particleboard with melamine bonded to both sides and PVC edges.
3. Wall Cabinets: Same material and finish as base cabinets, with adjustable shelves.
- a. Wall Shields: Fabricated from high-pressure decorative laminate of grade and color to match cabinets **OR** high-pressure decorative laminate of grade and color to match countertop **OR** stainless-steel sheet, **as directed**. Provide wall shields for back wall and side walls, **as directed**, between countertop splash and wall cabinets.
4. Scribe Strips for Recessed Cabinets: Same material, finish, and color as cabinet.
5. Wire Pulls: Brushed-chrome **OR** Polished-chrome **OR** Brushed-brass **OR** Polished-brass, **as directed**, finish.
- D. Wood Cabinets
1. Base Cabinets: Birch **OR** Maple **OR** Oak **OR** Cherry **OR** Ash, **as directed**.
 - a. Face Frames: 3/4-inch- (19-mm-) thick, hardwood-veneer plywood or solid wood.
 - b. Back Panels: 3/8-inch- (10-mm-) thick particleboard with melamine bonded to inside surface.
 - c. Top, Bottom, and End Panels: 3/8-inch- (10-mm-) thick particleboard with melamine bonded to both sides.
 - d. Shelves: 5/8-inch- (16-mm-) thick particleboard with melamine bonded to both sides and PVC edges.
 - e. Door and Drawer Fronts: 5/8-inch- (16-mm-) thick, hardwood-veneer plywood with matching hardwood edges.

OR

Door and Drawer Fronts: 3/4-inch- (19-mm-) thick, solid wood stiles and rails, with solid wood center panels.
2. Wall Cabinets: Same material and finish as base cabinets, with adjustable shelves.
 - a. Wall Shields: Fabricated from high-pressure decorative laminate of grade and color to match countertop **OR** stainless-steel sheet, **as directed**. Provide wall shields for back wall and side walls, **as directed**, between countertop splash and wall cabinets.
3. Scribe Strips for Recessed Cabinets: Same material, finish, and color as cabinet.



4. Wire Pulls: Brushed-chrome **OR** Polished-chrome **OR** Brushed-brass **OR** Polished-brass, **as directed**, finish.
- E. Countertops
1. Countertop and Integral Sink: Seamless, one-piece countertop and sink with integral embossed drainboard and backsplash and side splashes, **as directed**.
 - a. Stainless Steel: 0.038-inch- (0.95-mm-) thick sheet bonded to 3/4-inch (19-mm) plywood.
 - b. Porcelain-Enamel-Finished Steel: 0.0677 inch (1.7 mm) thick.
 - c. Solid-Surfacing Material: Minimum 1/2 inch (13 mm) thick.
 2. Countertop **OR** Countertop for Drop-in Sink, **as directed**: Seamless, one-piece countertop with integral backsplash and side splashes, **as directed**.
 - a. Stainless Steel: 0.038-inch- (0.95-mm-) thick sheet bonded to 3/4-inch (19-mm) plywood.
 - b. High-Pressure Decorative Laminate: Grade HGS, bonded to 3/4-inch (19-mm) plywood.
OR
High-Pressure Decorative Laminate: Grade HGP, post formed, bonded to 3/4-inch (19-mm) particleboard with Grade BKL unfinished backing sheet bonded to reverse side.
 3. Countertop **OR** Countertop for Undercounter-Mounted Sink, **as directed**: Seamless, one-piece countertop with integral backsplash and side splashes, **as directed**; fabricated from 1/2-inch- (13-mm-) thick, solid-surfacing material.
- F. Fixtures
1. Stainless-Steel Drop-in Sinks: 0.050 inch (1.27 mm) **OR** 0.038 inch (0.95 mm), **as directed**, thick; seamless; single compartment.
 2. Porcelain-Enamel-Finished Steel Drop-in Sinks: 0.043 inch (1.09 mm) thick; seamless; single compartment.
 3. Undercounter-Mounted Sinks: Solid-surfacing material; seamless; single compartment.
 4. Supplies: NPS 3/8 (DN 12) **OR** NPS 1/2 (DN 15), **as directed**, chrome-plated copper with stops.
 5. Sink Faucet: Single-lever control; polished chrome-plated mixing **OR** European-style, pull-out spray, **as directed**, faucet with limited-swing spout and aerator.
OR
Sink Faucet: Separate hot and cold controls with wrist-blade handles, **as directed**; polished chrome-plated mixing faucet with limited-swing spout **OR** gooseneck spout, **as directed**, and aerator.
 6. Sink Outlet with Disposer: 3-1/2-inch- (89-mm-) diameter outlet.
 7. Sink Outlet without Disposer: 3-1/2-inch- (89-mm-) diameter outlet with stainless-steel cup strainer and 1-1/2-inch- (38-mm-) diameter tailpiece.
 8. Drain Piping: NPS 1-1/2 (DN 40) chrome-plated cast-brass trap, tubular brass waste to wall, and wall escutcheon.
 9. Bar Sink Outlet: 2-inch- (51-mm-) diameter outlet with stainless-steel grid strainer.
 10. Disposers: Continuous-feed, household, food-waste disposers. Include 115-V ac, 1725-rpm, 1/2-hp motor with overload protection and reset button; three-conductor, grounded power cord; wall switch; corrosion-resistant chamber with jam-resistant, cutlery- or stainless-steel grinder or shredder; NPS 1-1/2 (DN 40) outlet; quick-mounting, stainless-steel sink flange; antisplash guard; and combination cover/stopper.
 11. Hot-Water Dispensers: Household type with instant on-off control; insulated, corrosion-resistant-metal storage tank that is open to atmosphere; electric, 115-V ac, heating element; three-conductor, grounded power cord; chrome-plated faucet or spout; removable strainer; thermostat control for water temperature up to 190 deg F (88 deg C); thermal-overload protection; and minimum 1/2-gal. (1.9-L) tank capacity dispensing approximately 60 cups (240 mL) of water per hour.
- G. Appliances
1. Built-in Refrigerators: Fabricated with one-piece seamless steel or ABS plastic inner liner; refrigerator compartment with slide-out or removable shelves and meat tray; adjustable automatic temperature control; door with magnetic gaskets and storage shelves; interior light; closed



- compartment for 25-lb (11-kg) minimum storage of prefrozen food and two ice cube trays; 115-V ac.
- a. Minimum Capacity: 3.2 cu. ft. (0.091 cu. m) **OR** 5.5 cu. ft. (0.156 cu. m) **OR** 6.0 cu. ft. (0.169 cu. m), **as directed**.
 - b. Defrost System: Automatic defrost timer **OR** Push button or manual, **as directed**.
 - c. Compressor: Cushion-mounted, self-oiling, and hermetically sealed compressor; fan or gravity cooled.
 - d. Finish Panel: Manufacturer's standard door trim kit with filler panel or integral finish panel; match material and finish of base cabinets.
2. Freestanding, Upright Refrigerator-Freezers: Two-door combination unit with one-piece seamless steel or ABS plastic inner liner; automatic defrost; closed freezer compartment with two adjustable shelves and two ice cube trays, **as directed**; full-width vegetable crisper; dairy compartment; interior light; adjustable automatic temperature control; door with magnetic gaskets and storage shelves; 115-V ac, with three-conductor, grounded power cord.
 - a. Minimum Capacity: 12-cu. ft. (0.340-cu. m) refrigerator capacity with 100-lb (45-kg) freezer capacity **OR** 14-cu. ft. (0.396-cu. m) refrigerator capacity with 125-lb (57-kg) freezer capacity, **as directed**.
 - b. Icemaker: Built-in automatic unit, **as directed**.
 - c. Finish Panel: Manufacturer's standard door trim kit with filler panel or integral finish panel; match material and finish of base cabinets.
 3. Automatic Icemakers: Built-in undercounter unit; capable of producing 22 lb (10 kg) of ice per day; with 12-lb (5.4-kg) **OR** 35 lb (15.9 kg) of ice per day; with 26-lb (11.8-kg) **OR** 50 lb (22.6 kg) of ice per day; with 35-lb (15.9-kg), **as directed**, storage bin; 115-V ac, with three-conductor, grounded power cord; with plumbed water supply.
 4. Electric Cooktops: Porcelain-enamel-finished steel; coil-element burners with removable rings and reflector bowls, infinitely adjustable heating controls, and individual signal lights; with wiring terminated at factory-installed junction box.
 - a. Cooktop Burner: One element rated at 900 W; 115 **OR** 1250 W; 208/240, **as directed**, -V ac.
OR
Cooktop Burners: One element rated at 550 W and one element rated at 950 W; 115-V ac.
OR
Cooktop Burners: Two elements, each rated at 1250 W; 115 **OR** 208/240, **as directed**, -V ac.
OR
Cooktop Burners: Two elements rated at 1250 W and one element rated at 2100 W; 208/240-V ac.
 5. Built-in Electric Ovens: Porcelain-enamel-finished steel exterior surfaces; coil-element burners with removable rings and reflector bowls, infinitely adjustable heating controls, and individual signal lights. Oven interior fabricated from one-piece porcelain-enamel-finished steel with rounded corners, with "Bake" and "Broil" oven elements, automatic heat control, signal light, and removable wire oven rack; textured baked-enamel- or porcelain-enamel-finished steel oven door; 208/240-V ac, with wiring terminated at factory-installed junction box.
 - a. Cooktop Burners: Three elements, each rated at 1250 W.
 - b. Oven Elements: 1500 W bake; 2000 W broil **OR** Manufacturer's standard, **as directed**.
 6. Freestanding Electric Ranges: Porcelain-enamel-finished steel exterior surfaces; coil-element burners with removable rings and reflector bowls, infinitely adjustable heating controls, and individual signal lights; anti-tip anchors. Oven interior fabricated from one-piece porcelain-enamel-finished steel with rounded corners, with "Bake" and "Broil" oven elements, automatic heat control, signal light, two removable wire oven racks, and porcelain-on-steel broiler pan; textured baked-enamel- or porcelain-enamel-finished steel oven door; 208/240-V ac, with wiring terminated at factory-installed junction box.
 - a. Cooktop Burners: Three elements, each rated at 1250 W, and one element rated at 2100 W.
 - b. Oven Elements: Manufacturer's standard.



7. Gas Cooktops: Porcelain-enamel-finished steel; surface burners with removable cast-iron grates, lift-out burner bowls, and 115-V ac electronic ignition; with wiring terminated at factory-installed junction box, and burner control panel mounted at front of unit.
 - a. Cooktop Burners: Two elements, each rated at 8000 Btu/h (8440 kJ) **OR** 10,000 Btu/h (10 550 kJ), **as directed**, for natural gas.
8. Built-in Gas Ovens: Stainless-steel **OR** Porcelain-enamel-finished steel, **as directed**, exterior surfaces; surface burners with removable cast-iron grates, lift-out burner bowls, and 115-V ac electronic ignition; with wiring terminated at factory-installed junction box. Oven interior fabricated from porcelain-enamel-finished steel with rounded corners; removable wire oven rack, automatic heat control, and combination surface burner and oven control panel mounted above oven door at front of unit.
 - a. Cooktop Burners: Three elements, each rated at 5000 Btu/h (5275 kJ) for natural gas.
OR
Cooktop Burners: Four elements, each rated at 9000 Btu/h (9495 kJ) for natural gas.
 - b. Oven Burner: Rated at 9000 Btu/h (9495 kJ) **OR** 18,000 Btu/h (18 990 kJ), **as directed**, for natural gas.
9. Freestanding Gas Ranges: Porcelain-enamel-finished steel exterior surfaces; surface burners with removable grates, lift-out burner bowls, and 115-V ac electronic ignition; with three-conductor, grounded power cord; anti-tip anchors. Oven interior fabricated from porcelain-enamel-finished steel with rounded corners; two removable wire oven racks, porcelain-on-steel broiler pan, automatic heat control, and combination surface burner and oven control panel mounted above oven door at front of unit.
 - a. Cooktop Burners: Four elements, each rated at 9000 Btu/h (9495 kJ) for natural gas.
 - b. Oven Burner: Rated at 18,000 Btu/h (18 990 kJ) for natural gas.
10. Freestanding Microwave Ovens: 0.7-cu. ft. (0.020-cu. m) capacity with 600 W **OR** 0.8-cu. ft. (0.023-cu. m) capacity with 700 W, **as directed**, cooking power; electronic touch controls, variable power control, digital clock timer, interior light, turntable, and tempered glass door; 115-V ac, with three-conductor, grounded power cord.
11. Built-in Microwave Ovens with Exhaust Hood: Undercabinet mounted, minimum 1.0-cu. ft. (0.028-cu. m) capacity with 800-W cooking power; electronic touch controls, variable power control, digital clock timer, interior light, turntable, tempered glass door, and exhaust hood with integral light and two-speed fan control; 115-V ac, with three-conductor, grounded power cord.
 - a. Exhaust Hood: Recirculating, nonventing type, with replaceable charcoal filter.
OR
Exhaust Hood: Ventilating type, with permanent washable filter. Provide exhaust duct and wall **OR** roof, **as directed**, cap and shutter. See Division 23 Section "Metal Ducts".
12. Built-in Microwave/Convection Ovens with Exhaust Hood: Undercabinet mounted, minimum 1.0-cu. ft. (0.028-cu. m) capacity with 800-W cooking power; electronic touch controls, variable power control, digital clock timer, interior light, turntable, convection rack, tempered glass door, and exhaust hood with integral light and two-speed fan control; 115-V ac, with three-conductor, grounded power cord.
 - a. Exhaust Hood: Recirculating, nonventing type, with replaceable charcoal filter.
 - b. Exhaust Hood: Ventilating type, with permanent washable filter. Provide exhaust duct and wall **OR** roof, **as directed**, cap and shutter. See Division 23 Section "Metal Ducts".
13. Ventilating Exhaust Hoods: Undercabinet mounted, 24 inches (610 mm) wide, stainless **OR** baked-enamel, **as directed**, steel; two-speed fan control, permanent washable filter, and built-in lighting; 115-V ac, with wiring terminated at factory-installed junction box.
 - a. Provide exhaust duct and wall **OR** roof, **as directed**, cap and shutter. See Division 23 Section "Metal Ducts".
14. Recirculating, Nonventing Exhaust Hoods: Undercabinet mounted, 24 inches (610 mm) wide, stainless **OR** baked-enamel, **as directed**, steel; two-speed fan control, replaceable charcoal filter, and built-in lighting; 115-V ac, with wiring terminated at factory-installed junction box.
15. Dishwashers: Built-in undercounter unit, 18 inches (457 mm) wide **OR** 24 inches (610 mm) wide **OR** width as indicated, **as directed**; multiple wash cycles, coated roll-out racks, detergent dispenser, and insulated cavity walls and door; 115-V ac, with wiring terminated at factory-installed junction box.



16. Automatic Coffeemakers: Stainless steel, with capacity for three pots of coffee; automatic brewing, nonstick warmer plates, and lighted on-off switch; 115-V ac, with three-conductor, grounded power cord; designed for permanent installation in countertop, with plumbed water supply. Provide glass coffee decanters in number to match capacity.

H. Accessories

1. Locks: Brass-cylinder type; furnish two keys per lock. Provide where indicated **OR** on base cabinet doors **OR** on refrigerator, **as directed**.
2. Fluorescent Light Fixtures: Surface mounted to underside of overhead cabinet; with 15-W lamp, on-off switch, grounded convenience receptacle, and translucent plastic lens.
3. Cutlery Drawers: Concealed drawer in undercounter storage compartment with pull-out divided tray.
4. Cutting Boards: Pull-out hardwood board.
5. Heat Shields: Minimum 12 inches high by 24 inches (305 mm high by 610 mm) wide, 0.025-inch- (0.64-mm-) thick stainless steel over 1/4-inch- (6-mm-) thick board insulation.

I. Fabrication

1. General: Factory fabricate and assemble unit kitchens, with base cabinets, sink **OR** refrigerator, **as directed**, and countertop shipping as a one-piece assembly. Securely fasten components, fixtures, and appliances together.
 - a. Provide manufacturer's standard hardware including concealed, adjustable plated-steel hinges; steel drawer slides with nylon rollers; and catches and rubber bumpers on doors and drawers. Unless otherwise indicated, provide chromium-plated metal or satin-finished stainless steel for exposed hardware.
2. Accessible Units: Fabricate unit kitchens to comply with accessibility regulations as follows:
 - a. Standard, Accessible Countertops: Fabricate unit kitchens with one-piece countertop located at height of 34 inches (864 mm) above floor.

OR

 Adjustable, Accessible Countertops: Fabricate unit kitchens with two-piece countertop that allows countertop over sink, including backsplash, side splashes, and sink assembly, to be adjusted between 29 and 36 inches (735 and 915 mm) above finished floor.
 - b. Removable, Accessible Cabinets: Fabricate cabinet under sink to allow removal for future accessibility conversion. Fabricate cabinet to allow access to plumbing and electrical connections after conversion.
 - c. Knee and Toe Clearance: Provide minimum 30-inch- (760-mm-) wide open space beneath countertop with a minimum clear height of 27 inches (685 mm) above floor for first 8 inches (205 mm) of depth, then reduce clearance at a rate of 1 inch (25 mm) in depth for each 6 inches (150 mm) in height, to a minimum clear height of 9 inches (230 mm) above floor at a depth of 11 inches (280 mm).
 - d. Pipe Enclosure Panels: Provide manufacturer's standard panels to enclose plumbing under countertop, of same material and finish as cabinets. Install panel to prevent exposure of sharp or abrasive surfaces under countertop.
 - e. Operable Parts: Locate operable parts no higher than 48 inches (1219 mm) and no lower than 15 inches (380 mm) above floor. Provide operable parts that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22.2 N).
 - f. Range or Cooktop: Provide top surface 34 inches (865 mm) above floor, with controls that do not require reaching across burners. Provide knee and toe clearance beneath range or cooktop; insulate underside of cooktop to prevent burns, shocks, or abrasions.
 - g. Refrigerator/Freezer: Provide 50 percent of freezer space no higher than 54 inches (1370 mm) off floor.
 - h. Oven: Provide work surface adjacent to one side of bottom-hinged doors. Locate controls on front panel.

J. General Finish Requirements



1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

K. Finishes

1. Stainless-Steel Finishes: Remove tool and die marks and stretch lines, or blend into finish. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
 - a. Bright, Directional Polish: No. 4 finish.
2. Wood Finishes: Factory finished with manufacturer's standard stain, sealer, and clear finish coat. Defer only final touchup until after installation.

1.3 EXECUTION

A. Examination

1. Examine walls and floors, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
2. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
3. Examine walls and partitions for proper backing for unit kitchens.
4. Examine roughing-in for electrical power plumbing and mechanical system(s) to verify actual locations of connections before installation of unit kitchens.
5. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Installation

1. General: Install level, plumb, and true; shim as required, using concealed shims. Provide fasteners, clips, backing materials, brackets, anchors, fillers, scribes, trim, and accessories necessary for complete installation.
 - a. Anchor unit kitchens at ends and at intervals recommended by manufacturer, but not more than 36 inches (910 mm) o.c. Install anchors through backup reinforcing plates, channels, or blocking as required to prevent material distortion; use concealed fasteners.
 - b. Freestanding Ranges: Install anti-tip anchors at locations recommended by manufacturer.
2. Comply with requirements specified in Division 14 AND Division 21 for connecting unit kitchens to plumbing and mechanical system(s).
3. Comply with requirements specified in Division 22 for connecting unit kitchens to electrical power system.

C. Adjusting And Cleaning

1. Test, adjust, and verify operation of each appliance, plumbing fixture, and component of unit kitchens. Repair or replace items found to be defective or operating below rated capacity.
2. Verify that operating parts work freely and fit neatly and that clearances are adequate to properly and freely operate appliances.
3. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding. Verify that locking devices operate properly.
4. After completing unit kitchen installation, remove protective coverings if any.
5. Repair or replace damaged parts, dents, buckles, abrasions, and other defects affecting appearance or serviceability. Touch up factory-applied finishes to restore damaged or soiled areas.

END OF SECTION 11 26 13 00



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SECTION 11 30 13 13 - RESIDENTIAL APPLIANCES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for residential appliances. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes:
 - a. Cooking appliances.
 - b. Kitchen exhaust ventilation.
 - c. Refrigeration appliances.
 - d. Cleaning appliances
 - e. Trash compactors.

C. Submittals

1. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, dimensions, furnished accessories, and finishes for each appliance.
2. LEED Submittal:
 - a. Product Data for Credit EA 1.4 or LEED for Homes Credit EA9: For appliances, documentation indicating that products are ENERGY STAR rated.
3. Samples: For each exposed finish.
4. Product Schedule: For appliances; use same designations indicated on Drawings.
5. Qualification Data: For qualified Installer or manufacturer.
6. Product Certificates: For each type of appliance, from manufacturer.
7. Field quality-control reports.
8. Operation and Maintenance Data: For each residential appliance to include in operation and maintenance manuals.
9. Warranties: Special warranties specified in this Section.

D. Quality Assurance

1. Manufacturer Qualifications: Maintains a service center capable of providing training, parts, and emergency maintenance repairs.
2. Installer Qualifications: An employer of workers trained and approved by manufacturer for installation and maintenance of units required for this Project.
3. Source Limitations: Obtain residential appliances from single source and each type of residential appliance from single manufacturer.
4. High-Altitude and Propane Conversion: Provide gas-operated appliances with manufacturer's conversion kit installed by a qualified service agency according to manufacturer's written instructions for Project location and type of fuel.
5. Regulatory Requirements: Comply with the following:
 - a. NFPA: Provide electrical appliances listed and labeled as defined in NFPA 70, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
 - b. ANSI: Provide gas-burning appliances that comply with ANSI Z21 Series standards.
6. Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1, " **as directed**."
7. Preinstallation Conference: Conduct conference at Project site.

E. Warranty



1. Special Warranties: Manufacturer's standard form in which manufacturer agrees to repair or replace residential appliances or components that fail in materials or workmanship within specified warranty period.
 - a. Warranty Period: Two **OR** Five years, **as directed**, from date of Final Completion.
2. Electric Cooktop **OR** Range: Full warranty including parts and labor **OR** Limited warranty including parts and labor for first year and parts thereafter for on-site service on surface-burner elements, **as directed**.
 - a. Warranty Period: Two **OR** Five years, **as directed**, from date of Final Completion.
3. Microwave Oven: Full warranty including parts and labor **OR** Limited warranty including parts and labor for first year and parts thereafter for on-site service on the magnetron tube, **as directed**.
 - a. Warranty Period: Two **OR** Five years, **as directed**, from date of Final Completion.
4. Refrigerator/Freezer **OR** Freezer **OR** Icemaker, Sealed System: Full warranty including parts and labor **OR** Limited warranty including parts and labor for first year and parts thereafter for on-site service on the product, **as directed**.
 - a. Warranty Period for Sealed Refrigeration System: Two **OR** Five years, **as directed**, from date of Final Completion.
 - b. Warranty Period for Other Components: Two years from date of Final Completion.
5. Dishwasher: Full warranty including parts and labor **OR** Limited warranty including parts and labor for first year and parts thereafter for on-site service on the product, **as directed**.
 - a. Warranty Period for Deterioration of Tub and Metal Door Liner: Three **OR** Five **OR** 10 years, **as directed**, from date of Final Completion.
 - b. Warranty Period for Other Components: Two years from date of Final Completion.
6. Clothes Washer: Full warranty including parts and labor **OR** Limited warranty including parts and labor for first year and parts thereafter for on-site service on the product, **as directed**.
 - a. Warranty Period: Two **OR** Three years, **as directed**, from date of Final Completion.

1.2 PRODUCTS

A. Cooktops:

1. Electric Cooktop:
 - a. Width: 12 inches (305 mm) **OR** 30 inches (762 mm) **OR** 36 inches (914 mm), **as directed**.
 - b. Electric Burner Elements: Two **OR** Four **OR** Six, **as directed**.
 - c. Coil Type: Manufacturer's standard **OR** Two 1200 W and two 2200 W **OR** One 1200 W, one 2200-W dual element, and two 2200 W, **as directed**.
 - d. Radiant Type: Two 1500 W and two 2000 W **OR** One 1200-W element, dual 1500-W/1500-W bridge element, and one 1200-W/2500-W expandable element **as directed**.
 - e. Induction Type: Manufacturer's standard **OR** Two 1200 W and two 1800 W **OR** One 1200 W, one 1800 W, one 2700 W, and one 3300 W, **as directed**.
 - f. Controls: Digital panel controls, located on front **OR** on left side **OR** on right side **OR** remotely, where indicated, **as directed**.
 - g. Downdraft Ventilation: Manufacturer's standard **OR** 550 cfm (260 L/s) **as directed**, built-in downdraft ventilation, with remote blower and exterior weatherproof wall cap.
 - h. Other Features: Grill **OR** deep fryer **OR** wok burner and wok ring, **as directed**.
 - i. Electric Power Supply: 240 V, 60 Hz, 1 phase, 30 A, **as directed**.
 - j. Top Material: Manufacturer's standard **OR** Ceramic glass **OR** Porcelain-enamel steel **OR** Stainless steel, **as directed**.
 - 1) Color/Finish: White **OR** Black, **as directed**.
2. Gas Cooktop
 - a. Width: 12 inches (300 mm) **OR** 30 inches (760 mm) **OR** 36 inches (915 mm), **as directed**.
 - b. Gas Burners: Two **OR** Four **OR** Six, **as directed**.
 - 1) Power Ratings: Manufacturer's standard **OR** One 5000 Btu/h (1500 W), two 9100 Btu/h (2700 W), and one 12,000 Btu/h (3500 W), **as directed**.
 - 2) Grates: Individual **OR** Continuous, **as directed**.



- c. Controls: Digital panel **OR** Manual-dial controls, located on front **OR** left side **OR** right side, **as directed**.
 - d. Downdraft Ventilation: Manufacturer's standard **OR** 550 cfm (260 L/s), **as directed**, with remote, **as directed**, blower and exterior weatherproof wall cap.
 - e. Other Features: Sealed burners **OR** Auto-reigniting **OR** Grill **OR** deep fryer **OR** wok burner and wok ring, **as directed**.
 - f. Electric Power Supply: 120 V, 60 Hz, 1 phase, 30 A, **as directed**.
 - g. Top Materials: Porcelain-enamel steel **OR** Ceramic glass **OR** glass **OR** Stainless steel **OR** Manufacturer's standard, **as directed**.
 - 1) Color/Finish: White **OR** Black, **as directed**.
- B. Range:
- 1. Electric Range: Freestanding **OR** Slide-in **OR** Drop-in range, **as directed**, with one **OR** two oven(s), **as directed** and complying with AHAM ER-1.
 - a. Width: 30 inch (762 mm) **OR** 36 inch (914 mm), **as directed**.
 - b. Electric Burner Elements: Four **OR** Six, **as directed**.
 - 1) Coil Type: Manufacturer's standard **OR** Two 1200 W and two 2200 W **OR** One 1200 W, one 2200-W dual element, and two 2200 W, **as directed**.
 - 2) Radiant Type: Two 1500 W and two 2000 W **OR** One 1200-W element, dual 1500-W/1500-W bridge element, and one 1200-W/2500-W expandable element, **as directed**.
 - 3) Induction Type: Manufacturer's standard **OR** Two 1200 W and two 1800 W **OR** One 1200 W, one 1800 W, one 2700 W, and one 3300 W, **as directed**.
 - 4) Controls: Digital panel controls, located on front **OR** left side **OR** right side **OR** splash panel at rear of rangetop, **as directed**.
 - c. Oven Features:
 - 1) Capacity: 3.3 cu. ft. (0.09 cu. m).
 - 2) Operation: Baking **OR** convection **as directed**, and self-cleaning.
 - 3) Broiler: Located in top of oven **OR** separate roll-out drawer on bottom **as directed**.
 - 4) Oven Door(s): Counterbalanced, removable, with observation window and full-width handle.
 - 5) Electric Power Rating:
 - a) Oven(s): Manufacturer's standard **OR** 2400 W **as directed**.
 - b) Broiler: Manufacturer's standard **OR** 3500 W **as directed**.
 - 6) Controls: Digital panel controls and timer display, located on front **OR** left side **OR** right side **OR** splash panel at rear of rangetop, **as directed**.
 - d. Anti-Tip Device: Manufacturer's standard.
 - e. Electric Power Supply: 240 V, 60 Hz, 1 phase, 30 A.
 - f. Material Porcelain-enamel **OR** Stainless, **as directed**, with manufacturer's standard, **as directed**, cooktop.
 - a) Color/Finish: White **OR** Black, **as directed**.
 - 2. Gas Range: Freestanding **OR** Slide-in range with one **OR** two ovens, **as directed**.
 - a. Width: 30 inch (762 mm) **OR** 36 inch (914 mm), **as directed**.
 - b. Gas Burners: Four **OR** Six, **as directed**.
 - 1) Power Ratings: Manufacturer's standard **OR** One 5000 Btu/h (1500 W), **as directed**, two 9100 Btu/h (2700 W), and one 12,000 Btu/h (3500 W).
 - 2) Controls: Digital panel **OR** Manual-dial controls, **as directed** located on front **OR** left side **OR** right side **OR** splash panel at rear of rangetop, **as directed**.
 - 3) Grates: Individual **OR** Continuous, **as directed**.
 - 4) Other Feature(s): Sealed burners **OR** auto-re-igniting burners, **as directed**, and grill.
 - c. Oven Features:
 - 1) Capacity: 3.3 cu. ft. (0.09 cu. m).
 - 2) Operation: Baking **OR** convection **as directed**, and self-cleaning.
 - 3) Broiler: Located in top of oven **OR** separate roll-out drawer on bottom **as directed**.



- 4) Oven Door(s): Counterbalanced, removable, with observation window and full-width handle.
 - 5) Electric Power Rating:
 - a) Oven(s): Manufacturer's standard **OR** 9100 Btu/h (2700 W) **as directed**.
 - b) Broiler: Manufacturer's standard **OR** 14,500 Btu/h (4200 W) **as directed**.
 - 6) Controls: Digital panel controls and timer display, located on front **OR** left side **OR** right side **OR** splash panel at rear of rangetop, **as directed**.
 - d. Anti-Tip Device: Manufacturer's standard.
 - e. Electric Power Supply: 240 V, 60 Hz, 1 phase, 15 A.
 - f. Material Porcelain-enamel **OR** Stainless, **as directed**, with manufacturer's standard, **as directed**, cooktop.
 - a) Color/Finish: White **OR** Black, **as directed**.
3. Dual Fuel Range Freestanding **OR** Slide-in range, **as directed**, with gas burners and one **OR** two electric ovens, **as directed**.
- a. Width: 30 inch (762 mm) **OR** 36 inch (914 mm), **as directed**.
 - b. Gas Burners: Four **OR** Six, **as directed**.
 - 1) Power Ratings: Manufacturer's standard **OR** One 5000 Btu/h (1500 W), **as directed**, two 9100 Btu/h (2700 W), and one 12,000 Btu/h (3500 W)
 - 2) Controls: Digital panel **OR** Manual-dial controls, **as directed** located on front **OR** left side **OR** right side **OR** splash panel at rear of rangetop, **as directed**.
 - 3) Grates: Individual **OR** Continuous, **as directed**.
 - 4) Other Feature(s): Sealed burners **OR** auto-re-igniting burners, **as directed**, and grill.
 - c. Oven Features:
 - 1) Capacity: 3.3 cu. ft. (0.09 cu. m).
 - 2) Operation: Baking **OR** convection **as directed**, and self-cleaning.
 - 3) Broiler: Located in top of oven **OR** separate roll-out drawer on bottom **as directed**.
 - 4) Oven Door(s): Counterbalanced, removable, with observation window and full-width handle.
 - 5) Electric Power Rating:
 - a) Oven(s): Manufacturer's standard **OR** 2400 W **as directed**.
 - b) Broiler: Manufacturer's standard **OR** 3500 W **as directed**.
 - 6) Controls: Digital panel controls and timer display, located on front **OR** left side **OR** right side **OR** splash panel at rear of rangetop, **as directed**.
 - d. Anti-Tip Device: Manufacturer's standard.
 - e. Electric Power Supply: 240 V, 60 Hz, 1 phase, 30 A.
 - f. Material Porcelain-enamel **OR** Stainless, **as directed**, with manufacturer's standard, **as directed**, cooktop.
 - 1) Color/Finish: White **OR** Black, **as directed**.
- C. Wall Oven:
1. Electric Wall Oven(s): One **OR** Two-oven unit, **as directed**.
 - a. Mounting: Built-in wall **OR** undercounter .
 - b. Capacity: 3.3 cu. ft. (0.09 cu. m).
 - c. Operation: Baking **OR** convection and self-cleaning, **as directed**.
 - d. Broiler: Located in top of oven **OR** separate roll-out drawer on bottom, **as directed**.
 - e. Oven Door(s): Counterbalanced, removable, with observation window and full-width handle.
 - f. Electric Power Rating:
 - 1) Oven(s): Manufacturer's standard **OR** 2400 W, **as directed**.
 - 2) Broiler: Manufacturer's standard **OR** 3500 W, **as directed**.
 - g. Electric Power Supply: 240 V, 60 Hz, 1 phase, 30 A
 - h. Controls: Digital panel **OR** Manual-dial controls and timer display, **as directed**.



- i. Material: Porcelain-enameled steel **OR** Stainless steel **OR** Manufacturer's standard, **as directed**.
 - 1) Color/Finish: White **OR** Black, **as directed**.
- 2. Gas Wall Oven(s): One **OR** Two-oven unit, **as directed**.
 - a. Mounting: Built-in wall **OR** undercounter .
 - b. Capacity: 3.3 cu. ft. (0.09 cu. m).
 - c. Operation: Baking **OR** convection and self-cleaning, **as directed**.
 - d. Broiler: Located in top of oven **OR** separate roll-out drawer on bottom, **as directed**.
 - e. Oven Door(s): Counterbalanced, removable, with observation window and full-width handle.
 - f. Electric Power Rating:
 - 1) Oven(s): Manufacturer's standard **OR** 9100 Btu/h (2700 W), **as directed**.
 - 2) Broiler: Manufacturer's standard **OR** 14,500 Btu/h (4200 W), **as directed**.
 - g. Electric Power Supply: 240 V, 60 Hz, 1 phase, 30 A
 - h. Controls: Digital panel **OR** Manual-dial controls and timer display, **as directed**.
 - i. Material: Porcelain-enameled steel **OR** Stainless steel **OR** Manufacturer's standard, **as directed**.
 - 1) Color/Finish: White **OR** Black, **as directed**.
- D. Microwave Oven:
 - 1. Microwave Oven(s):
 - a. Mounting: Undercabinet **OR** Wall cabinet, **as directed**.
 - b. Type: Conventional **OR** Convection, **as directed**.
 - c. Dimensions:
 - 1) Width: 24 inches (610 mm) **OR** 30 inches (762 mm), **as directed**.
 - 2) Depth: 19-1/2 inches (495 mm), **as directed**.
 - 3) Height: 14 inches (356 mm) **OR** 18 inches (457 mm), **as directed**.
 - d. Capacity: 1.5 cu. ft. (0.04 cu. m) **OR** 2.0 cu. ft. (0.06 cu. m), **as directed**.
 - e. Oven Door: Door with observation window and pull handle **OR** and push-button latch release, **as directed**.
 - f. Exhaust Fan: Variable **OR** Two **OR** Four-speed fan, , **as directed**, vented to outside **OR** nonvented, **as directed**, recirculating type with charcoal filter and with manufacturer's standard **OR** 300-cfm (140-L/s) capacity, **as directed**.
 - g. Microwave Power Rating: Manufacturer's standard **OR** 1000 W, **as directed**.
 - 1) Convection Element Power Rating: Manufacturer's standard **OR** 1450 W, **as directed**.
 - h. Electric Power Supply: 120 V, 60 Hz, 1 phase, 15 A.
 - i. Controls: Digital panel controls and timer display.
 - j. Other Features: Turntable **OR** temperature probe, **as directed**, and lock-out feature.
 - k. Material: Porcelain-enameled steel **OR** Stainless steel **OR** Manufacturer's standard, **as directed**.
 - 1) Color/Finish: White **OR** Black, **as directed**.
- E. Kitchen Exhaust Ventilation:
 - 1. Overhead Exhaust Hood
 - a. Type: Wall-mounted, **OR** Suspended-island-canopy, exhaust-hood system, **as directed**.
 - b. Dimensions:
 - 1) Width: 30 inches (762 mm) **OR** 36 inches (914 mm) **OR** 48 inches (1219 mm), **as directed**.
 - 2) Depth: 30 inches (762 mm) **OR** 36 inches (914 mm) **OR** 48 inches (1219 mm), **as directed**.
 - c. Exhaust Fan: Variable **OR** Two **OR** Three-speed fan, **as directed**, built into hood **OR** remotely located, , **as directed**, with separate housing and with manufacturer's standard **OR** 500-cfm (236-L/s) **OR** 900-cfm (425-L/s) capacity, **as directed**.
 - 1) Venting: Vented to outside through roof with weatherproof roof cap, backdraft damper, and rodent-proof screening **OR** Vented to outside through wall with



- weatherproof wall cap, backdraft damper, and rodent-proof screening **OR** Nonvented, recirculating type with charcoal filter, **as directed**.
- 2) Fan Control: Hood **OR** Wall-mounted touch-pad to control fan switch, with separate hood-light control switch, **as directed**.
- d. Duct Type: Manufacturer's standard **OR** 7-inch- (175-mm-) diameter round **OR** 3-1/4 by 10 inches (82 by 250 mm) rectangular, **as directed**.
 - e. Finish: Baked enamel **OR** Stainless steel, **as directed**.
 - 1) Color: White **OR as directed**.
 - f. Features:
 - 1) Permanent, washable aluminum mesh **OR** stainless-steel mesh **OR** baffle-type filter(s), **as directed**.
 - 2) Built-in halogen **OR** incandescent **OR** fluorescent lighting, **as directed**.
 - 3) Warming lamp socket(s).
2. Downdraft Exhaust:
 - a. Type: Retractable-downdraft exhaust system.
 - b. Width: 30 inches (762 mm) **OR** 36 inches (914 mm), **as directed**.
 - c. Exhaust Fan: Variable **OR** Two **OR** Three-speed fan built into cabinet below countertop **OR** remotely located, **as directed**, with separate housing and with manufacturer's standard **OR** 500-cfm (236-L/s) **OR** 900-cfm (425-L/s) capacity, **as directed**.
 - 1) Venting: Vented to outside through roof with weatherproof roof cap, backdraft damper, and rodent-proof screening **OR** Vented to outside through wall with weatherproof wall cap, backdraft damper, and rodent-proof screening **OR** Nonvented, recirculating type with charcoal filter, **as directed**.
 - 2) Fan Control: Countertop-mounted touch-pad to control fan switch.
 - d. Duct Type: Manufacturer's standard **OR** 7-inch- (175-mm-) diameter round **OR** 3-1/4 by 10 inches (82 by 250 mm) rectangular, **as directed**.
 - e. Finish: Baked enamel **OR** Stainless steel, **as directed**.
 - 1) Color: White **OR as directed**.
 - f. Features:
 - 1) Permanent, washable aluminum mesh **OR** stainless-steel mesh **OR** baffle-type filter(s), **as directed**.
- F. Refrigerator/Freezers
1. Refrigerator/Freezer One-door refrigerator with inside freezer compartment **OR** Two-door, side-by-side refrigerator/freezer **OR** Two-door refrigerator/freezer with freezer on top **OR** Two-door refrigerator/freezer with freezer on bottom, **as directed** and complying with AHAM HRF-1.
 - a. Type: Freestanding **OR** Built in **OR** Undercounter.
 - b. Dimensions:
 - 1) Width: 16 inches (406 mm) **OR** 24 inches (610 mm) **OR** 27 inches (686 mm) **OR** 30 inches (762 mm) **OR** 36 inches (914 mm) **OR** 42 inches (1067 mm) **OR** 48 inches (1220 mm), **as directed**.
 - 2) Depth: 24 inches (610 mm) **OR** 27 inches (686 mm) **OR** 33-1/4 inches (845 mm), **as directed**.
 - 3) Height: 34-1/2 inches (876 mm) **OR** 70 inches (1778 mm) **OR** 73 inches (1854 mm) **OR** 84 inches (2134 mm), **as directed**.
 - c. Storage Capacity:
 - 1) Refrigeration Compartment Volume: 15.6 cu. ft. (0.44 cu. m).
 - 2) Freezer Volume: 5.13 cu. ft. (0.15 cu. m).
 - 3) Shelf Area: Three adjustable wire **OR** glass shelves, **as directed**, 26 sq. ft. (2.42 sq. m).
 - d. General Features:
 - 1) Door Configuration: Framed **OR** Overlay.
 - 2) Revise first option in first subparagraph below if either crushed or cubed ice is required.
 - 3) Dispenser in door for ice and cold water dispenser lock.



- 4) Built-in water filtration system.
- 5) Dual refrigeration systems.
- 6) Separate touch-pad temperature controls for each compartment.
- e. Refrigerator Features:
 - 1) Interior light in refrigeration compartment.
 - 2) Compartment Storage: Wine racks **OR** vegetable crisper **OR** meat compartment, **as directed**.
 - 3) Door Storage: Glazed door without storage **OR** Modular compartments **OR** Gallon (3.8 L-) milk-container storage, **as directed**.
 - 4) Temperature-controlled meat/deli bin.
- f. Freezer Features: One **OR** Two freezer compartment(s) with door(s) **OR** configured as pull-out drawer(s), **as directed**.
 - 1) Automatic **OR** Manual defrost, **as directed**.
 - 2) Interior light in freezer compartment.
 - 3) Automatic icemaker and storage bin.
- g. Energy Performance, ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.
- h. Front Panel(s): Manufacturer's standard **OR** Wood panel(s) to match kitchen cabinets **OR** Porcelain enamel **OR** Stainless steel **OR** Wood-panel insert(s) specified in Division 06 Section "Interior Architectural Woodwork" to match kitchen cabinets **OR** Wood-panel insert(s) specified in Division 12 Section "Residential Casework" to match kitchen cabinets **OR** Reversible panel(s) with choice of colors, **as directed**.
 - 1) Panel Color: White **OR** Black, **as directed**.
- i. Appliance Color/Finish: White **OR** Black **OR** Stainless steel, **as directed**.

G. Freezers

1. Freezer One **OR** Two freezer compartment(s) with door(s) **OR** configured as pull-out drawer(s), **as directed** and complying with AHAM HRF-1.
 - a. Type: Freestanding **OR** Built in **OR** Undercounter.
 - b. Dimensions:
 - 1) Width: 27 inches (686 mm) **OR** 30 inches (762 mm) **OR** 36 inches (914 mm), **as directed**.
 - 2) Depth: 24 inches (610 mm) **OR** 27 inches (686 mm), **as directed**.
 - 3) Height: 34-1/2 inches (876 mm) **OR** 70 inches (1778 mm) **OR** 73 inches (1854 mm) **OR** 84 inches (2134 mm), **as directed**.
 - c. Storage Capacity:
 - 1) Volume: 5.13 cu. ft. (0.15 cu. m) **OR** 15.0 cu. ft. (0.42 cu. m), **as directed**.
 - 2) Shelf Area: Three adjustable wire **OR** glass shelves, **as directed**, 26 sq. ft. (2.42 sq. m).
 - d. Features:
 - 1) Door Configuration: Framed **OR** Overlay, **as directed**.
 - 2) Automatic **OR** Manual defrost, **as directed**.
 - 3) Interior light in compartment.
 - 4) Automatic icemaker and storage bin.
 - 5) Temperature touch-pad controls for each compartment.
 - 6) Defrost drain.
 - 7) Lock with key.
 - e. Energy Performance, ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.
 - f. Front Panel(s): Manufacturer's standard **OR** Wood panel(s) to match kitchen cabinets **OR** Porcelain enamel **OR** Stainless steel **OR** Wood-panel insert(s) specified in Division 06 Section "Interior Architectural Woodwork" to match kitchen cabinets **OR** Wood-panel insert(s) specified in Division 12 Section "Residential Casework" to match kitchen cabinets, **as directed**.
 - 1) Panel Color: White **OR** Black, **as directed**.
 - g. Appliance Color/Finish: White **OR** Black **OR** Stainless steel, **as directed**.



H. Icemakers

1. Icemaker:
 - a. Type: Undercounter.
 - b. Dimensions:
 - 1) Width: 14-3/4 inches (375 mm) **OR** 15-1/4 inches (387 mm), **as directed**.
 - 2) Depth: 24 inches (610 mm) **OR** 25-1/4 inches (641 mm), **as directed**.
 - 3) Height: 33-5/8 inches (386 mm) **OR** 34-1/2 inches (876 mm), **as directed**.
 - c. Ice Capacity:
 - 1) Production: 30 lb (13.6 kg) **OR** 50 lb (22.7 kg) per day, **as directed**.
 - 2) Storage: 25 lb (11.3 kg) **OR** 35 lb (15.9 kg), **as directed**.
 - d. Features:
 - 1) Door Configuration: Framed **OR** Overlay, **as directed**.
 - 2) Automatic defrost.
 - 3) Automatic shutoff.
 - 4) Defrost drain with pump.
 - e. Front Panel: Manufacturer's standard **OR** Wood panel to match kitchen cabinets **OR** Porcelain enamel **OR** Stainless steel **OR** Wood-panel insert specified in Division 06 Section "Interior Architectural Woodwork" to match kitchen cabinets **OR** Wood-panel insert specified in Division 12 Section "Residential Casework" to match kitchen cabinets, **as directed**.
 - a) Panel Color: White **OR** Black, **as directed**.
 - f. Appliance Color/Finish: White **OR** Black **OR** Stainless steel, **as directed**.

I. Dishwashers

1. Dishwasher Complying with AHAM DW-1 and ASSE 1006.
 - a. Type: Built-in undercounter **OR** Built-in under sink **OR** Portable, **as directed**.
 - b. Dimensions:
 - 1) Width: 18 inches (457 mm) **OR** 24 inches (610 mm), **as directed**.
 - 2) Depth: 23 inches (584 mm) **OR** 25-3/4 inches (654 mm), **as directed**.
 - 3) Height: 34-1/2 inches (876 mm), **as directed**.
 - c. Capacity:
 - 1) International Place Settings of China: Eight **OR** 12 **OR** 14, **as directed**.
 - 2) Water Consumption for Full Load: 3.2 gal. (12 L) per cycle.
 - d. Sound Level: Maximum 42 **OR** 48 dB, **as directed**.
 - e. Tub and Door Liner: Manufacturer's standard **OR** Porcelain-enameled steel **OR** Stainless steel **OR** Porcelain-enameled steel tub and molded-plastic door liner, **as directed** with sealed detergent and automatic rinsing-aid dispensers.
 - f. Rack System: Nylon **OR** PVC-coated sliding dish racks, **as directed**, with removable cutlery basket **OR** top cutlery tray **as directed**.
 - g. Controls: Touch-pad **OR** Rotary-dial controls, **as directed**, with four wash cycles and hot-air and heat-off drying cycle options.
 - h. Features:
 - 1) Features in first three subparagraphs below are standard with most models.
 - 2) Waste food disposer.
 - 3) Self-cleaning food-filter system.
 - 4) Hot-water booster heater for 140 deg F (60 deg C) **OR** 160 deg F (71 deg C) wash water with incoming water at 100 deg F (38 deg C).
 - 5) Lock-out feature.
 - 6) Half-load option.
 - 7) Delay-wash option.
 - 8) Digital display panel.
 - 9) Water softener.
 - 10) Soil-sensing water use control system.



- i. Energy Performance, ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.
 - j. Front Panel: Manufacturer's standard **OR** Wood panel to match kitchen cabinets **OR** Porcelain enamel **OR** Stainless steel **OR** Wood-panel insert specified in Division 06 Section "Interior Architectural Woodwork" to match kitchen cabinets **OR** Wood-panel insert specified in Division 12 Section "Residential Casework" to match kitchen cabinets **OR** Reversible panel with choice of colors, **as directed**.
 - 1) Panel Color: White **OR** Black, **as directed**.
 - k. Appliance Color/Finish: White **OR** Black **OR** Stainless steel, **as directed** .
- J. Clothes Washers And Dryers
- 1. Clothes Washer Complying with ASSE 1007:
 - a. Type: Freestanding **OR** Stacking **OR** Undercounter, top **OR** front-loading unit.
 - b. Dimensions:
 - 1) Width: 23-1/2 inches (597 mm) **OR** 27 inches (686 mm) **OR** 30 inches (762 mm), **as directed**.
 - 2) Depth: 24 inches (610 mm) **OR** 29 inches (737 mm) **OR** 31 inches (787 mm), **as directed**.
 - 3) Height: 34-1/2 inches (876 mm) **OR** 38 inches (965 mm) **OR** 45 inches (1143 mm), **as directed**.
 - c. Drum: Manufacturer's standard **OR** Perforated porcelain-enameled steel **OR** Perforated stainless steel, **as directed**.
 - 1) Capacity: 2.7 cu. ft. (0.08 cu. m) **OR** 3.2 cu. ft. (0.09 cu. m) **OR** 3.8 cu. ft. (0.11 cu. m).
 - d. Controls: Touch-pad **OR** Rotary-dial controls, **as directed**, for water-fill levels, wash/rinse water temperatures, and variable-speed and fabric selectors.
 - 1) Wash Cycles: Four **OR** Six **OR** 10 wash cycles, **as directed**, including regular, delicate, and permanent press.
 - 2) Wash Temperatures: Three settings.
 - 3) Speed Combinations: Two **OR** Four **OR** Five, **as directed**.
 - e. Electrical Power: 120 V, 60 Hz, 1 phase.
 - f. Motor: Manufacturer's standard with built-in overload protector.
 - g. Features:
 - 1) Agitator: Center spindle **OR** Impeller (without spindle), **as directed**.
 - 2) Self-cleaning lint filter.
 - 3) Unbalanced-load compensator.
 - 4) Inlet Hoses: Minimum length 60 inches (1525 mm).
 - 5) Drain Hoses: Minimum length 48 inches (1220 mm).
 - 6) Self-leveling legs.
 - 7) Automatic dispenser for bleach **OR** fabric softener **OR** and **OR** detergent, **as directed**.
 - 8) Spin-cycle safety switch.
 - 9) End-of-cycle signal.
 - 10) Extra-rinse option.
 - 11) Delay-wash option.
 - 12) Electronic temperature control.
 - 13) Water levels automatically set.
 - 14) Pedestal: 8-inch- (203-mm-) high **OR** 15-inch- (381-mm-) high **OR** Manufacturer's standard height laundry pedestal , **as directed**, with storage drawer, matching appliance finish.
 - h. Energy Performance, ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.
 - i. Water-Efficient Clothes Washer: Provide clothes washer with modified energy factor greater than or equal to 2.0 and water factor less than 5.5.
 - j. Appliance Finish: Porcelain enamel on top and lid; baked enamel on front and sides **OR** Stainless steel, **as directed**.



- 1) Color: White **OR** Almond, **as directed**.
- k. Front-Panel Finish: Manufacturer's standard **OR** Wood panel to match kitchen cabinets **OR** Porcelain enamel **OR** Stainless steel **OR** Wood-panel insert specified in Division 06 Section "Interior Architectural Woodwork" to match kitchen cabinets **OR** Wood-panel insert specified in Division 12 Section "Residential Casework" to match kitchen cabinets, **as directed**.
 - 1) Panel Color: White **OR** Black, **as directed**.
2. Clothes Dryer Complying with AHAM HLD-1:
 - a. Type: Freestanding **OR** Stacking **OR** Undercounter, **as directed**, frontloading, gas **OR** electric **OR** electric, ventless unit, **as directed**..
 - b. Dimensions:
 - 1) Width: 23-1/2 inches (597 mm) **OR** 27 inches (686 mm), **as directed**.
 - 2) Depth: 24 inches (610 mm) **OR** 31 inches (787 mm), **as directed**.
 - 3) Height: 34-1/2 inches (876 mm) **OR** 36 inches (914 mm), **as directed**.
 - c. Drum: Manufacturer's standard **OR** Perforated porcelain-enameled steel **OR** Perforated stainless steel, **as directed**.
 - 1) Capacity: 5.7 cu. ft. (0.16 cu. m) **OR** 7.0 cu. ft. (0.20 cu. m), **as directed**.
 - d. Controls: Touch-pad **OR** Rotary-dial controls for drying cycle, **as directed**, temperatures, and fabric selectors.
 - e. Electric-Dryer Power: 240 V, 60 Hz, 1 phase, 30 A.
 - f. Gas-Dryer Power: 120 V, 60 Hz, 1 phase, 15 A electric; 22,000-Btu/h (6400-W) gas.
 - g. Features:
 - 1) Features in first five subparagraphs below are standard with most manufacturers.
 - 2) Removable lint filter.
 - 3) Electronic temperature and moisture level sensor control.
 - 4) End-of-cycle signal.
 - 5) Interior drum light.
 - 6) Self-leveling legs.
 - 7) Antibacterial cycle.
 - 8) Auxiliary drying rack.
 - 9) Built-in electrical power fuse.
 - 10) Stacking kit to stack dryer over washer.
 - 11) Pedestal: 8-inch- (203-mm-) high **OR** 15-inch- (381-mm-) high **OR** Manufacturer's standard height laundry pedestal, **as directed**, with storage drawer, matching appliance finish.
 - h. Appliance Finish: Porcelain enamel on top and lid; baked enamel on front and sides **OR** Stainless steel, **as directed**.
 - 1) Color: White **OR** Almond, **as directed**.
 - i. Front-Panel Finish: Manufacturer's standard **OR** Wood panel to match kitchen cabinets **OR** Porcelain enamel **OR** Stainless steel **OR** Wood-panel insert specified in Division 06 Section "Interior Architectural Woodwork" to match kitchen cabinets **OR** Wood-panel insert specified in Division 12 Section "Residential Casework" to match kitchen cabinets.
 - 1) Panel Color: White **OR** Black, **as directed**.
- K. Clothes Washer/Dryer Combinations
 1. Clothes Washer/Dryer Combination Complying with ASSE 1007.
 - a. Type: Freestanding washer/dryer unit with dual-drum design and electric dryer **OR** dual-drum design and gas dryer **OR** all-in-one, single-drum design, **as directed**; washer is top **OR** front loading, **as directed**.
 - b. Dimensions:
 - 1) Width: 23-1/2 inches (597 mm) **OR** 27 inches (686 mm), **as directed**.
 - 2) Depth: 25 inches (635 mm) **OR** 32 inches (813 mm), **as directed**.
 - 3) Height: 34-1/2 inches (876 mm) **OR** 71-1/2 inches (1816 mm), **as directed**.
 - c. Washer and Dryer Drums: Manufacturer's standard **OR** Perforated porcelain-enameled steel **OR** Perforated stainless steel, **as directed**.



- 1) Washer-Drum Capacity: 1.5 cu. ft. (0.04 cu. m) **OR** 2.0 cu. ft. (0.06 cu. m) **OR** 2.6 cu. ft. (0.07 cu. m), **as directed**.
- 2) Dryer-Drum Capacity: 2.0 cu. ft. (0.06 cu. m) **OR** 3.4 cu. ft. (0.10 cu. m) **OR** 5.9 cu. ft. (0.17 cu. m), **as directed**.
- d. Washer/Dryer Drum: Manufacturer's standard **OR** Perforated stainless steel, **as directed**.
 - 1) Drum Capacity: 2.3 cu. ft. (0.07 cu. m).
2. Washer Controls: Touch-pad **OR** Rotary-dial controls for water-fill levels, **as directed**, wash/rinse water temperatures and variable-speed and fabric selectors.
3. Dryer Controls: Touch-pad **OR** Rotary-dial controls for drying cycle, **as directed**, temperatures and fabric selectors.
 - a. Wash Cycles: Three wash cycles including regular, delicate, and permanent press.
 - b. Wash Temperatures: Three settings.
 - c. Speed Combinations: Two.
4. Electric Washer/Dryer Power: 240 V, 60 Hz, 1 phase, 30 A **OR** 120 V, 60 Hz, 1 phase, 15 A, **as directed**.
5. Gas Washer/Dryer Power: 120 V, 60 Hz, 1 phase, 15 A electric; 22,000-Btu/h (6400-W) gas.
6. Motor: Manufacturer's standard with built-in overload protector.
7. Washing Features:
 - a. Self-cleaning lint filter.
 - b. Unbalanced-load compensator.
 - c. Inlet Hoses: Minimum length 60 inches (1525 mm).
 - d. Drain Hoses: Minimum length 48 inches (1220 mm).
 - e. Self-leveling legs.
 - f. Automatic dispenser for bleach, fabric softener and **OR** detergent.
 - g. Spin-cycle safety switch.
8. Drying Features:
 - a. Removable lint filter.
 - b. Electronic temperature and moisture level sensor control.
 - c. End-of-cycle signal.
 - d. Interior drum light.
9. Energy Performance, ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.
10. Water-Efficient Clothes Washer: Provide clothes washer with modified energy factor greater than or equal to 2.0 and water factor less than 5.5.
11. Appliance Finish: Porcelain enamel on top and lid; baked enamel on front and sides **OR** Stainless steel, **as directed**.
 - 1) Color: White **OR** Almond, **as directed**.

L. Trash Compactors

- a. Type: Built in **OR** Convertible, **as directed**.
- b. Width: 15 inches (381 mm) **OR** 18 inches (457 mm), **as directed**.
- c. Capacity: 1.4 cu. ft. (0.04 cu. m) **OR** 1.7 cu. ft. (0.05 cu. m), **as directed**.
- d. Features:
 - 1) Key-operated starting switch.
 - 2) Rear wheels.
 - 3) Removable bag carrier.
 - 4) Retainer for disposable bags.
 - 5) Odor-control mechanism.
 - 6) Foot-operated drawer operator.
- e. Front Panel: Manufacturer's standard **OR** Wood panel to match kitchen cabinets **OR** Enameled steel **OR** Stainless steel **OR** Wood-panel insert specified in Division 06 Section "Interior Architectural Woodwork" to match kitchen cabinets **OR** Wood-panel insert specified in Division 12 Section "Residential Casework" to match kitchen cabinets, **as directed**.
 - a) Panel Color: White **OR** Black, **as directed**.



M. General Finish Requirements

1. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
2. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

1.3 EXECUTION

A. Examine

1. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, power connections, and other conditions affecting installation and performance of residential appliances.
2. Examine roughing-in for piping systems to verify actual locations of piping connections before appliance installation.
3. Examine walls, ceilings, and roofs for suitable conditions where overhead exhaust hoods **OR** downdraft exhaust and microwave ovens with vented exhaust fans will be installed.
4. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
5. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Installation, General

1. General: Comply with manufacturer's written instructions.
2. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and rough openings are completely concealed.
3. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.
4. Range Anti-Tip Device: Install at each range according to manufacturer's written instructions
5. Utilities: Refer to Division 21 AND Division 26 for plumbing and electrical requirements.

C. Field Quality Control

1. Perform tests and inspections.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Tests and Inspections:
 - a. Perform visual, mechanical, and electrical inspection and testing for each appliance according to manufacturers' written recommendations. Certify compliance with each manufacturer's appliance-performance parameters.
 - b. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
 - c. Operational Test: After installation, start units to confirm proper operation.
 - d. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and components.
3. An appliance will be considered defective if it does not pass tests and inspections.
4. Prepare test and inspection reports.

END OF SECTION 11 30 13 13



SECTION 11 30 13 13a - REFRIGERATORS

1.1 GENERAL

A. Summary

1. Section Includes:
 - a. Remove existing refrigerators.
 - b. Refrigerators supply and deliver only or supply and install as scheduled.
2. Related Requirements: Comply with requirements of following sections:
 - a. Contractor Use of Premises and Work Sequence
 - b. Section "Alteration Project Procedures."
3. Related Sections:
 - a. Kitchen Renovation Requirements; "Summary of Work"
 - b. Reference Standards: Section "References."

B. References

1. Reference Standards: See Section "References." Comply with following:
 - a. Association of Home Appliance Manufacturers (AHAM) HRF-1 - Standard for Household Refrigerators and Household Freezers, 1988.
 - 1) ASTM B 117 - Salt Spray (Fog) Testing.
 - b. ANSI/UL 250 - Household Refrigerators and Freezers, 1991.
 - c. Certification:
 - 1) ANSI Z34.2 - Certification, Self-Certification by Producer or Supplier, 1987.

C. Definitions

1. Configurations:
 - a. SD: Single Door.
 - b. TF: Top Freezer.
 - c. BF: Bottom Freezer.
 - d. SS: Side-by-Side.
2. Defrost System:
 - a. M: Manual Defrost: Defrost system in which defrosting action for refrigerated surfaces is initiated manually.
 - b. P: Partial Automatic: Defrost system in which defrosting action for refrigerated surfaces in refrigerator compartment is initiated and terminated automatically and defrosting action for refrigerated surfaces in freezer is initiated manually.
 - c. A: Automatic Defrost: Defrost system in which defrosting action for all refrigerated surfaces is initiated and terminated automatically.
3. Efficiency Standards:
 - a. Refrigerator: Cabinet designed for refrigerated storage of food at temperatures above 0 degrees C (32 degrees F) and may include compartment for freezing and storage of food at temperatures below 0 degrees C (32 degrees F), but does not provide separate low temperature compartment designed for freezing and storage of food at temperatures below minus 13 degrees C (8 degrees F).
 - b. Refrigerator-freezer: Cabinet with two or more compartments with at least one compartment designed for refrigerated storage of food at temperatures above 0 degrees C (32 degrees F) and with at least one compartment designed for freezing and storage of food at temperatures below minus 13 degrees C (8 degrees F).
 - c. AV: Adjusted Volume:
 - 1) Refrigerator: [1.44 x freezer volume (cubic feet)] + refrigerator volume (cubic feet).
 - 2) Refrigerator-freezer: [1.63 x freezer volume (cubic feet)] + refrigerator volume (cubic feet).
4. Supply and Delivery Only: Include supply and delivery to site(s) FOB destination freight prepaid. Unless otherwise specified or scheduled, unloading and handling at site is by PHA/IHA.



D. System Description

1. Performance Requirements: Comply with following:
 - a. Refrigerators: Capable of producing average cabinet air temperature in general food storage compartment of 2.2 degrees C (36 degrees F) in ambient of 21.1 degrees C (70 degrees F), and 3.3 degrees C (38 degrees F) in ambient of 43.3 degrees C (110 degrees F).
 - 1) Performance Test Procedures: As specified in AHAM HRF-1.
 - b. Plastic Compartment and Door Liners: Not show any cracks or crazing when tested under Environment Cracking Resistance Test specified in AHAM HRF-1.
 - 1) Single-Piece Liners Testing: As specified in AHAM HRF-1, paragraph 10.6.
2. Efficiency Standards: Provide refrigerators which do not exceed following annual energy consumption in kWh:
 - a. Refrigerators and Refrigerator-freezers with Manual Defrost: 13.5 AV plus 299.
 - b. Refrigerator-freezers with Partial Automatic Defrost: 10.4 AV plus 398.
 - c. Refrigerator-freezers with Automatic Defrost with Top Mounted Freezer without Through-the-door Ice Service: 16.0 AV plus 355.
 - d. Refrigerator-freezers with Automatic Defrost with Side Mounted Freezer without Through-the-door Ice Service: 11.8 AV plus 501.
 - e. Refrigerator-freezers with Automatic Defrost with Bottom Mounted Freezer without Through-the-door Ice Service: 16.5 AV plus 367.

E. Submittal

1. Product Data: Submit to Contracting Officer.
2. Samples:
 - a. Production Sample: When requested, provide sample refrigerator to Contracting Officer for examination as to compliance with specifications.
 - b. Color Samples: Submit samples of manufacturer s standard colors to Contracting Officer for selection.
3. Quality Assurance/Control Submittals: Submit following to Contracting Officer:
 - a. Certificates: Manufacturer's written self certification that refrigerators meet or exceed specified requirements.
 - b. Manufacturer's installation instructions.
4. Closeout Submittals: Submit following to Contracting Officer:
 - a. Operation and Maintenance: Provide use and care information with each refrigerator. Include parts manual with diagrams and part numbers.
 - b. Special warranty.

F. Quality Assurance

1. Qualifications: Manufacturer: Stock and sell parts for refrigerators supplied for five years from time of delivery.
2. Regulatory Requirements: Comply with following:
 - a. EPA regulations regarding refrigerant.
 - b. Accessibility:
 - 1) Architectural Barriers Act of 1968 as amended (42 USC 4152-4157) and HUD implementing regulations (24 CFR Part 40).
 - a) Uniform Federal Accessibility Standards (UFAS).
 - 2) Section 504 of the Rehabilitation Act of 1973 as amended (29 USC 794) and HUD implementing regulations 24 CFR Part 8.
 - 3) Fair Housing Accessibility Guidelines (24 CFR Chapter 1).
 - 4) Americans with Disabilities Act of 1990 (ADA) (28 CFR Part 35).
3. Appliances shall meet or exceed requirements established by the Energy Star program and bear the Energy Star logo. Visit www.energystar.gov for a listing of products that qualify. Energy Star® is a voluntary partnership that includes the U.S. Department of Energy, the U.S. Environmental Protection Agency, product manufacturers, local utilities, and retailers, helps



promote efficient products by labeling them with the Energy Star logo and educating consumers about the benefits of energy efficiency.

- G. Delivery, Storage, And Handling
 - 1. Packing, Shipping, Handling, and Unloading: In accordance with standard commercial practices.
 - 2. Acceptance at Site: Inspect refrigerators upon delivery. Replace damaged or defective appliances before installation.
- H. Scheduling
 - 1. Scheduling and Completion: Comply with requirements of Division 1.
- I. Warranty
 - 1. Special Warranties: Provide following written special warranties:
 - a. Plastic parts of cabinet for period of two years.
 - b. Sealed refrigerator cooling system for five years.
 - 1) Provide new or reconditioned cooling system units or components, replacing units and/or parts which become defective (excluding damage due to visible abuse) during five year period.
 - c. Entire refrigerator for one year.
 - 2. Special Warranty Periods: If refrigerator becomes inoperative, as defined in following paragraph, repair or replace and install any part (except enamel, porcelain or lacquer) necessary to make refrigerator operative within five working days of notification.
 - a. Inoperative Refrigerator: When interior cabinet temperature rises above 10.0 degrees C (50 degrees F) and remains at such temperature for six or more consecutive hours after usual normal adjustments have been made or other mechanical and electrical trouble affecting normal operations has been corrected.
 - 3. Special Warranties: Include labor, material and equipment to provide replacements and make repairs to refrigerators at no additional cost to PHA/IHA.
 - a. Defective Units and/or Parts: Become property of Contractor.
 - b. Submit name and address of local agent who will furnish service and replacement parts in connection with warranties to PHA/IHA.
 - 1) Charges by local service agent to PHA/IHA for services covered under special warranties not allowed.

1.2 PRODUCT

- A. Refrigerators - General Requirements
 - 1. Refrigerators: Household type, self-contained with electric-motor-driven condensing units and comply with Performance Requirements and Energy Standard Requirements.
 - 2. Types, Sizes and Grades: As specified and scheduled.
 - 3. Total Storage Volumes, Shelf Areas and Dimensions: In accordance with descriptions and computed in accordance with AHAM HRF-1.
- B. Refrigerators Cabinets
 - 1. Outer Shells (including Doors): Carbon-steel sheet finished in baked synthetic enamel.
 - a. Colors: As scheduled from manufacturer s standard colors.
 - 2. Exterior Doors: Provide with reversible hinges for right or left hand swing except on side-by-side (SS) configuration.
 - a. Construction of Freezer or Evaporator Door and Hinging: Door may be operated without breaking, cracking, or distorting when freezer or evaporator is free from or has maximum thickness of 6 mm (1/4 inch) of frost on outer surface of evaporator adjacent to door.
 - b. Exterior Doors: Equipped with magnetic gasket.
 - c. Doors: Contain shelves.
 - 3. Interior Liners of (including General and Low-Temperature) Storage Compartments and Doors: Porcelain enamel on carbon-steel or molded plastic.



- a. Carbon-Steel Sheet Inner Liners: Porcelain enamel or baked synthetic enamel finish.
 - b. Color of Plastic Inner Liners: White or pastel.
 - c. Plastic Liners in Conjunction with Foamed-In-Place Polyurethane Employing Fluorinated Hydrocarbons: Isolate liner material from polyurethane foam or fabricate of acrylonitrile butadiene styrene (ABS) or High Impact Polystyrene (HIPS).
 - d. Breaker Strips: ABS plastic, polypropylene, or HIPS when insulation is foamed-in-place polyurethane with fluorinated hydrocarbons.
4. Drawers and Trays:
 - a. Vegetable Drawers or Crisper Trays: Provide one or more trays occupying full width of food compartment and readily removable.
 - b. Drawers or Trays: Constructed of steel finished with porcelain enamel, anodized aluminum, or durable plastic; durable glass; or non-corrosive metal.
 - c. Ice Cube Trays: Provide minimum of two standard size ice cube trays.
 - d. Defrosting or Chiller Tray: Made of material suitable for intended service and of adequate size to receive drip from cooling unit during defrosting.
 5. Hardware Components: Sturdy construction and made of material that are durable and structurally correct for application.
 - a. Hardware Attachment Devices (screws, bolts and nuts): Of material and finish consistent with material of components and parts which they are used.
 - b. Hardware Finish: Remain intact after being subjected to salt spray test for period of 25 hours in accordance with ASTM B 117.
 - 1) Center Section of Door Handle: Vinyl covered steel is acceptable.
 - c. Food Compartment Door Hinges: May be same finish as specified for outer panel of food compartment door.
 - d. Hardware: Securely attached in substantial manner and to extent that removal may not be accomplished without use of tools.
 6. Manual Defrost and Partial Defrost Refrigerators: Provide clear and legible caution similar to following: Do not use implements to defrost or to remove ice trays or other material from freezer section.
 - a. Location: Print or impress on freezer door or on name plate securely fastened in another prominent position easily read by user.
- C. Refrigerators Components
1. Electrical Components and Parts: Locate and mount controls, lamp socket, relay, switches, thermostat, wiring harness, cables and leads and their accessories in manner that their replacement may be readily accomplished.
 - a. Electrical Assemblies and Harness: Design and manufacture so that replacement of complete assembly or harness is not necessary when any component part of assembly becomes defective or inoperative.
 - b. Individual Components and Parts of Assemblies and Harness: Obtainable for relatively simple replacement purposes.
 2. Temperature Control: Equip refrigerators with off position and contact points or setting positions for wide range of degrees of temperature, which may be selected by readily accessible knob, properly marked with settings available, mounted on temperature control shaft.
 - a. Relay: Quality and rating which under normal operating conditions shall function properly for at least one year period and which is consistent with requirements specified and its companion components and parts in electrical circuit.
 3. Motor: For 115 volt, plus or minus 10 percent, 60 HZ, single phase, alternating current operation and capable of starting in ambient temperature of 37.8 degrees C (100 degrees F) on voltages between 90 percent and 100 percent of rated voltage.
 - a. Thermal Overload Protection: Automatic re-set type to prevent excess temperature rise of motor windings.
 - b. Three-Wire Cord with Three-Prong Attachment Plug: Provide grounding of refrigerator and extend five feet to nine feet beyond point at which it is attached to back of cabinet.



- c. Motor: Type, speed, load and horsepower ratings consistent with other requirements specified.
- 4. Refrigeration Unit: Compressor, motor and housing of hermetically sealed type with reciprocating or rotary-type compressor.
 - a. Compressor: Equipped with means of unloading, such as automatic unloader or capillary tube.
 - b. Sealed Refrigerating System: Serviceable by complete unit replacement or replacement of component parts such as motor compressor assembly, evaporator, condenser and heat exchanger.
 - c. Hermetic Compressor Unit: Quiet in operation, free from excessive vibration and entirely automatic in operation.

D. Workmanship

- 1. Welding and Brazing: Complete; uniform and properly fused; with no holes, slag inclusions, scale, or flux deposits; and not cracked, fractured or undercut.
- 2. Soldering: Complete, clean, adherent and without pin-holes.
- 3. Fasteners: Not be broken, fractured, stripped, or loose.
 - a. Structural Parts Subject to Vibration: Provide lock washers or self-locking washers.

1.3 EXECUTION

A. Examination

- 1. Site Verification of Conditions:
 - a. Utilities: Verify that required utilities are available, in proper locations, and ready for use.

B. Preparation

- 1. Existing Refrigerators: Remove existing refrigerators and debris from site.

C. Installation

- 1. General: Install refrigerators in accordance with manufacturer's recommendations.
 - a. Make adjustments to feet of refrigerators for a level installation.
 - b. Install in manner to ensure proper ventilation space is present.

D. Cleaning

- 1. Cleaning: Comply with requirements of Section 01120.

E. Schedules

- 1. Provide refrigerators as selected in following schedule:

- _____ Remove existing refrigerators.
- _____ Supply and Deliver Only to _____.
- _____ Unloading and handling included.
- _____ Supply and Install.

SELECTION SIZE

COLOR TYPE

_____ 0.28 cu m (10.0 CU FT) Minimum	_____ SD/M/S: Small, Single Door, Manual Defrost.
_____ 0.37 cu m (13.0 CU FT) Minimum	_____ SD/M/L: Large, Single Door, Manual Defrost.
_____ 0.28 - 0.34 cu m (10.0 - 11.9) CU FT	_____ TF/P/S: Small, Top Freezer, Partial Automatic Defrost.
_____ 0.34 - 0.39 cu m (12.0 - 13.9 CU FT)	_____ TF/P/M: Medium, Top Freezer, Partial Automatic Defrost.

11 - Equipment



_____ 0.40 cu m (14.0 CU FT) Minimum	_____ TF/P/L: Large, Top Freezer, Partial Automatic Defrost.
_____ 0.28 - 0.34 cu m (10.0 - 11.9 CU FT)	_____ TF/A/S: Small, Top Freezer, Automatic Defrost.
_____ 0.34 - 0.39 cu m (12.0 - 13.9 CU FT)	_____ TF/A/M: Medium, Top Freezer, Automatic Defrost.
_____ 0.40 - 0.45 cu m (14.0 - 15.9 CU FT)	_____ TF/A/ML: Medium/Large, Top Freezer, Automatic Defrost.
_____ 0.45 - 0.51 cu m (16.0 - 17.9 CU FT)	_____ TF/A/L: Large, Top Freezer, Automatic Defrost.
_____ 0.51 cu m (18.0 CU FT) Minimum	_____ TF/A/EL: Extra Large, Top Freezer, Automatic Defrost.
_____ 0.45 cu m (16.0 CU FT) Minimum	_____ BF/A for Accessible Units: Bottom Freezer, Automatic Defrost in accordance with UFAS requirements.
_____ 0.45 cu m (16.0 CU FT) Minimum	_____ SS/A for Accessible Units: Side-by-Side, Automatic Defrost in accordance with UFAS requirements.

END OF SECTION 11 30 13 13a



SECTION 11 30 13 13b - GAS RANGES

GENERAL

Summary

1. Section Includes:
 - a. Remove existing ranges.
 - b. Gas ranges, supply and deliver only or supply and install as scheduled.
2. Related Requirements: Comply with requirements of following sections:
 - a. Contractor Use of Premises and Work Sequence; "Summary of Work"
 - b. Section "Alteration Project Procedures."
3. Related Sections:
 - a. Kitchen Renovation Requirements: Section "Summary of Work"
 - b. Reference Standards: Section "References."
 - c. Electric Ranges: Section "Electric Ranges."
 - d. Gas Line Relocation: Section "Plumbing."

References

4. Reference Standards: See Section "References." Comply with following:
 - a. American National Standard Institute (ANSI) Z21.1 - Household Cooking Gas Appliances, 1990, including addenda Z21.1a, 1991.
 - 1) ANSI Z21.20 - Automatic Gas Ignition Systems and Components, 1989, including addenda Z21.20a, 1991, and Z21.20b, 1992.
 - b. Certification:
 - 1) ANSI Z34.1 - Certification, Third-Party Certification Program, 1987.
 - 2) ANSI Z34.2 - Certification, Self-Certification by Producer or Supplier, 1987.

Definitions

5. Types:
 - a. Type A: Economy or Builder's Model
 - b. Type C: Quality Model with hinged top.
6. Supply and Delivery Only: Include supply and delivery to site(s) FOB destination freight prepaid. Unless otherwise specified or scheduled, unloading and handling at site is by PHA/IHA.

Submittals

7. Product Data: Submit to the Owner.
8. Samples:
 - a. Production Sample: When requested, provide sample gas range to the Owner for examination as to compliance with specifications.
 - b. Color Samples: Submit samples of manufacturer's standard colors to the Owner for selection.
9. Quality Assurance/Control Submittals: Submit following to the Owner:
 - a. Certificates: Manufacturer's written certification that ranges have been tested and comply with ANSI Z21.1 for operation with natural or LP gas.
 - 1) Certification by American Gas Association (AGA) Laboratories, or Third Party Certifier in accordance with ANSI Z34.1.
 - 2) Acceptable Evidence of Meeting Applicable Requirements of Standard: Photostatic copy of American Gas Association (AGA) Laboratories Appliance Certificate or listing including igniter device in American Gas Association (AGA) Laboratories Directory of Certified Appliances and Accessories.
 - b. Manufacturer's installation instructions.
10. Closeout Submittals: Submit following to the Owner:



- a. Operation and Maintenance: Provide use and care information with each gas range. Include parts manual with diagrams and part numbers.
- b. Special warranty.

Quality Assurance

11. Qualifications: Manufacturer: Stock and sell parts for ranges supplied for five years from time of delivery.
12. Regulatory Requirements: Comply with and following:
 - a. Gas Connections: Comply with applicable codes and regulations.
 - b. Accessibility:
 - 1) Architectural Barriers Act of 1968 as amended (42 USC 4152-4157) and HUD implementing regulations (24 CFR Part 40).
 - a) Uniform Federal Accessibility Standards (UFAS).
 - 2) Section 504 of the Rehabilitation Act of 1973 as amended (29 USC 794) and HUD implementing regulations 24 CFR Part 8.
 - 3) Fair Housing Accessibility Guidelines (24 CFR Chapter 1).
 - 4) Americans with Disabilities Act of 1990 (ADA) (28 CFR Part 35).
13. Appliances shall meet or exceed requirements established by the Energy Star program and bear the Energy Star logo. Visit www.energystar.gov for a listing of products that qualify. Energy Star® is a voluntary partnership that includes the U.S. Department of Energy, the U.S. Environmental Protection Agency, product manufacturers, local utilities, and retailers, helps promote efficient products by labeling them with the Energy Star logo and educating consumers about the benefits of energy efficiency.

Delivery, Storage, And Handling

14. Packing, Shipping, Handling, and Unloading: In accordance with standard commercial practices.
15. Acceptance at Site: Inspect gas ranges upon delivery. Replace damaged or defective appliances before installation.

Scheduling

16. Scheduling and Completion: Comply with requirements of Division 1.

Warranty

17. Special Warranties: Provide following written special warranties:
 - a. Entire gas range for one year.
18. Special Warranties: Include labor, material and equipment to provide replacements and make repairs to gas ranges at no additional cost to PHA/IHA.
 - a. Defective Units and/or Parts: Become property of Contractor.
 - b. Submit name and address of local agent who will furnish service and replacement parts in connection with warranties to PHA/IHA.
 - 1) Charges by local service agent to PHA/IHA for services covered under special warranties not allowed.

PRODUCTS

Gas Ranges - General Requirements

19. Ranges: ANSI Z21.1, current standard models of manufacturer except for additional requirements specified.
 - a. Ranges: Floor mounted, free standing flush-to-wall, domestic gas ranges with open cooking top, oven and broiler below.
 - b. Ranges of Same Size: Identical, including parts and assemblies.
20. Gas Valves: Provide with either:
 - a. Convertible orifice set for gas specified on purchase order .
 - b. Fixed orifice hood for use with gas specified on order.



21. Convertible Gas Pressure Regulators: Provide with each range.

Type A Ranges (Economy Or Builder S Model)

22. Burners: Provide cooking top with four burners.
- Each Burner: Rated at no less than 2 650 W (9000 BTU/H) for natural gas and 2 350 W (8000 BTU/H) for LP.
23. Manual Gas Valves: Limited displacement type complying with ANSI Z21.1.
24. Grates: Provide each top burner with porcelain enameled cast iron or steel grate.
25. Ignition: One of following:
- Automatic Ignition: Equip burners with means for automatic ignition of gas. Failure of oven burner pilot shall activate means for shutting off gas to oven burner.
 - Intermittent Ignition: Equip burners with means for automatic electric ignition of gas complying with applicable requirements of ANSI Z21.20. Electric Ignition System: May be either spark, coil, glow bar, or combination of these.
26. Oven Thermostat Control: Provide oven thermostat control for controlling oven temperatures down to "hold warm temperature", approximately 77 degrees C (170 degrees F).
27. F. Insulation: Glass fiber blanket type, installed in manner to prevent sagging, and of sufficient thermal efficiency to meet surface and handle temperature tests specified in ANSI Z21.1.
28. Oven and Broiler Sections: Porcelain enamel-coated steel.
- Broiling Section: Either drop door type, pull-out-type, or swing-door type with 3-position smokeless broiler pan and grill sliding on stationary runners.
 - Provide stops so that oven racks cannot be completely pulled out by accident.
29. Oven Vents: Provide ovens with vent designed to deflect moisture and fumes away from wall behind range.
30. Oven Doors: Drop-shelf type, counter-balanced and provided with device to hold door fully closed.
- Hinges: Permit ready removal and replacement of hinge brackets and parts subject to wear.
 - Provide oven doors with means for adjusting misaligned door.
31. Burner Bowls (Aeration Bowls): Corrosion-resisting steel, plated steel, or steel coated with porcelain enamel.
- Bowls: May be separate bowls or integral part of top.
32. Exterior Surfaces: Porcelain enamel, except body sides and front panels (including oven door) may be finished in synthetic baked-on enamel capable of withstanding 121 degrees C (250 degrees F).
- Trim: In accordance with manufacturer's standard practice.
 - Backguard, Manifold Shield, Aeration Bowls, and Burners: May be porcelain enamel.
 - Range Body Back Panel, Legs, and/or Base: Porcelain enamel, baked-on enamel, galvanized, or aluminized steel.
 - Colors: As scheduled from manufacturer s standard colors.
33. Backguards: Equip each range with back guards not less than 100 mm (4 inches) higher than top cooking surface and extending full width of range top.
34. Equipment and Accessories: Provide accessories such as oven and broiler racks normally supplied with manufacturer's standard production for type range scheduled.
35. Name Plate: Permanent record of manufacturer's name and address, range model and serial number, and manufacturer's normal hourly W (BTU/H) input rating for oven, broiler and top burners.
- Securely fasten nameplate to main part of each range in accessible place.

Type C Ranges (Quality Model)

36. General Requirements: Comply with requirements for Type A Ranges except as modified by following requirements.
37. B. Range Top: Hinged at back or lift off for easy cleaning and access to burners, valves, and pilots.
- Hinge Top: May have supporting rod to hold top in raised position or be removable. Design supporting rod, when in raised position, to prevent accidental closing of range top. Counterbalanced top is also acceptable.



- 38. Cooking Top Burners/Low Setting: Equip each range with burners with low settings not in excess of 400 W (1400 BTU/H).
- 39. Leg levelers: Equip each range with at least two leg levelers.
- 40. Manifold Shield: Provide recessed or slanted manifold shield to minimize burning of burner knobs from heat from open oven doors.
- 41. Oven Door: Provide 610 mm (24 inch), 760 mm (30 inch) and 910 mm (36 inch) ranges with removable oven door.

EXECUTION

Examination

- 42. Site Verification of Conditions:
 - a. Utilities: Verify that required utilities are available, in proper locations, and ready for use.

Preparation

- 43. Existing Ranges: Remove existing ranges and debris from site.

Installation

- 44. General: Install gas ranges in accordance with manufacturer's recommendations.
 - a. Make connection to gas line in accordance with applicable codes.
 - b. Make adjustments to feet of ranges for a level installation.

Cleaning

- 45. Cleaning: Comply with requirements of Division 1.

Schedules

- 46. Provide gas ranges as selected in following schedule:
 - _____ Remove existing ranges.
 - _____ Supply and Deliver Only to _____.
 - _____ Unloading and handling included.
 - _____ Supply and Install.

<u>SELECTION</u>	<u>NUMBER OF</u>	<u>SIZE</u>	<u>COLOR</u>	<u>TYPE BURNERS</u>
_____	4 Burner	510 mm (20 Inch)	_____	Type A Economy or Builders Model.
_____	4 Burner	610 mm (24 Inch)	_____	Type A Economy or Builders Model.
_____	4 Burner	760 mm (30 Inch)	_____	Type A Economy or Builders Model.
_____	4 Burner	910 mm (36 Inch)	_____	Type A Economy or Builders Model.
_____	4 Burner	510 mm (20 Inch)	_____	Type C Quality Model.
_____	4 Burner	610 mm (24 Inch)	_____	Type C Quality Model.
_____	4 Burner	760 mm (30 Inch)	_____	Type C Quality Model.
_____	4 Burner	910 mm (36 Inch)	_____	Type C Quality Model.

END OF SECTION 11 30 13 13b

**SECTION 11 30 13 13c - ELECTRIC RANGES****GENERAL**

Summary

1. Section Includes:
 - a. Remove existing ranges.
 - b. Electric ranges, supply and deliver only or supply and install as scheduled.
2. Related Requirements: Comply with requirements of following sections:
 - a. Contractor Use of Premises and Work Sequence: Section "Summary of Work."
 - b. Section "Alteration Project Procedures."
3. Related Sections:
 - a. Kitchen Renovation Requirements: Section "Summary of Work."
 - b. Reference Standards: Section "References."
 - c. Gas Ranges: Section "Gas Ranges."
 - d. Electrical Renovation: Section "Electrical Renovation."

References

4. Reference Standards: See Section "References." Comply with following:
 - a. Association of Home Appliance Manufacturers (AHAM) ER-1 - American National Standard Household Electric Ranges, 1992.
 - b. Federal Specification (FS): WR-101F dated March 13, 1970, and Interim Amendment 2 dated December 31, 1970.
 - c. Underwriter's Laboratories (UL): ANSI/UL 858 - Household Electric Ranges, 1986.
 - d. Certification:
 - 1) ANSI Z34.1 - Certification, Third-Party Certification Program, 1987.
 - 2) ANSI Z34.2 - Certification, Self-Certification by Producer or Supplier, 1987.

Definitions

5. Standard Ranges: Four Surface Cooking Units: Three - 150 mm (6 inch) and one - 200 mm (8 inch) with oven and broiler below.
 - a. Type, Style, and Sizes as defined in FS W-R-101F:
 - 1) Type I: Freestanding range.
 - 2) Type II: Build-in (slide-in) range.
 - 3) Style 1: Single oven.
 - 4) Style 2: Double oven 1 020 mm (40 inches) wide.
 - 5) Size 1: 1 020 mm (40 inches) wide.
 - 6) Size 2: 910 mm (36 inches) wide.
 - 7) Size 3: 760 mm (30 inches) wide.
 - 8) Size 4: 610 mm (24 inches) wide.
 - 9) Size 5: 510 mm (20 inches) wide.
6. Supply and Delivery Only: Include supply and delivery to site(s) FOB destination freight prepaid. Unless otherwise specified or scheduled, unloading and handling at site is by PHA/IHA.

Submittals

7. Product Data: Submit to the Owner.
8. Samples:
 - a. Production Sample: When requested, provide sample electric range to the Owner for examination as to compliance with specifications.
 - b. Color Samples: Submit samples of manufacturer's standard colors to the Owner for selection.
9. Quality Assurance/Control Submittals: Submit following to the Owner:
 - a. Certificates: Manufacturer's written certification that electric ranges meet or exceed specified requirements including UL requirements and requirements of FS WR-101F.



- b. Manufacturer's installation instructions.
- 10. Closeout Submittals: Submit following to the Owner:
 - a. Operation and Maintenance Instructions: Provide use and care information with each range. Include parts manual with diagrams and part numbers.
 - b. Special warranty.

Quality Assurance

- 11. Qualifications: Manufacturer: Stock and sell parts for ranges supplied for five years from time of delivery.
- 12. Regulatory Requirements: Comply with following:
 - a. Accessibility:
 - 1) Architectural Barriers Act of 1968 as amended (42 USC 4152-4157) and HUD implementing regulations (24 CFR Part 40).
 - a) Uniform Federal Accessibility Standards (UFAS).
 - 2) Section 504 of the Rehabilitation Act of 1973 as amended (29 USC 794) and HUD implementing regulations 24 CFR Part 8.
 - 3) Fair Housing Accessibility Guidelines (24 CFR Chapter 1).
 - 4) Americans with Disabilities Act of 1990 (ADA) (28 CFR Part 35).
- 13. Appliances shall meet or exceed requirements established by the Energy Star program and bear the Energy Star logo. Visit www.energystar.gov for a listing of products that qualify. Energy Star® is a voluntary partnership that includes the U.S. Department of Energy, the U.S. Environmental Protection Agency, product manufacturers, local utilities, and retailers, helps promote efficient products by labeling them with the Energy Star logo and educating consumers about the benefits of energy efficiency.

Delivery, Storage, And Handling

- 14. Packing, Shipping, Handling, and Unloading: In accordance with standard commercial practices.
- 15. Acceptance at Site: Inspect electric ranges upon delivery. Replace damaged or defective appliances before installation.

Scheduling

- 16. Scheduling and Completion: Comply with requirements of Division 1.

Warranty

- 17. Special Warranties: Provide following written special warranties:
 - a. Entire electric range for one year.
- 18. Special Warranties: Include labor, material and equipment to provide replacements and make repairs to electric ranges at no additional cost to PHA/IHA.
 - a. Defective Units and/or Parts: Become property of Contractor.
 - b. Submit name and address of local agent who will furnish service and replacement parts in connection with warranties to PHA/IHA.
 - 1) Charges by local service agent to PHA/IHA for services covered under special warranties not allowed.

PRODUCTS

Electric Ranges

- 19. Ranges: AHAM ER-1, ANSI/UL 858, and FS WR-101F, current standard models of manufacturer except for additional requirements specified.
 - a. Ranges: Floor mounted, free standing flush-to-wall, domestic electric ranges with open cooking top, oven and broiler below.
 - b. Ranges of Same Classification: Identical, including parts and assemblies.
 - c. Ranges: UL listed and bear UL label.



- 20. Operating Service: 115/230 volts or 120/208 volts, 3-wire, single-phase, 60-HZ.
 - a. Type of Service: As scheduled.
- 21. Ranges:
 - a. Each Range: Equipped with at least two leg levelers.
 - b. Oven Door: Equip 610 mm (24 inch), 760 mm (30 inch), and 910 mm (36 inch) ranges with removable oven door.
 - c. Ranges without Storage Drawer: May be equipped with only one oven rack.

Ranges For Elderly Housing

- 22. Ranges for Elderly Housing: Same as above, Type I or II, Style 1, Sizes 4 and 5, standard electric ranges but, as minimum, include following additional items:
 - a. Location of Controls for Ranges and Cook-Tops: Not require reaching across burners.
 - b. Burner Indicator Lights: Provide light for each top burner and oven unit that will clearly indicate when burner is on.
 - 1) Indicator Light: Integral part of, or adjacent to, each control switch or adjacent to each top burner unit.
 - c. Oven Interior Light: Provide light in each oven that will clearly illuminate interior when oven door is open.

EXECUTION

Examination

- 23. Site Verification of Conditions:
 - a. Utilities: Verify that required utilities are available, in proper locations, and ready for use.

Preparation

- 24. Existing Ranges: Remove existing ranges and debris from site.

Installation

- 25. General: Install electric ranges in accordance with manufacturer's recommendations.
 - a. Make adjustments to feet of ranges for a level installation.
 - b. Electrical Renovation: See Section 16095.

Cleaning

- 26. Cleaning: Comply with requirements of Division 1.

Schedules

- 27. Provide electric ranges as selected in following schedule:

- _____ Remove existing ranges.
- _____ Supply and Deliver Only to _____.
- _____ Unloading and handling included.
- _____ Supply and Install.

<u>SELECTION</u>	<u>NUMBER</u>	<u>ELECTRIC</u>	<u>COLOR</u>	<u>TYPE AND SIZE</u>
	<u>BURNERS</u>	<u>SERVICE</u>		
_____	4 Burner	_____	_____	Type I, Style I, Size 1, 1 020 mm (40 inches wide).
_____	4 Burner	_____	_____	Type I, Style I, Size 2, 910 mm (36 inches) wide.
_____	4 Burner	_____	_____	Type I, Style I, Size 3, 760 mm (30 inches) wide.
_____	4 Burner	_____	_____	Type I, Style I, Size 4, 610 mm (24 inches) wide.
_____	4 Burner	_____	_____	Type I, Style I, Size 5, 510 mm (20 inches) wide.
_____	4 Burner	_____	_____	Type I or II, Style I, Size 5, 510 mm (20 inches) wide with specified elderly housing requirements.

11 - Equipment



_____ 4 Burner _____ _____ Type I or II, Style I, Size 4, 610 mm (24 inches) wide with specified elderly housing requirements.

END OF SECTION 11 30 13 13c

**SECTION 11 30 13 13d - RANGE HOODS****GENERAL**

Summary

1. Section Includes:
 - a. Remove existing range hoods.
 - b. Range hoods, supply and deliver only or supply and install as scheduled.
2. Related Requirements: Comply with requirements of following sections:
 - a. Contractor Use of Premises and Work Sequence: Section "Summary of Work."
 - b. Section "Alteration Project Procedures."
3. Related Sections:
 - a. Kitchen Renovation Requirements: Section "Summary of Work."
 - b. Reference Standards: Section "References."
 - c. Gas Ranges: Section "Gas Ranges."
 - d. Electric Ranges: Section "Electric Ranges."
 - e. Residential Cabinets: Section "Residential Cabinets."
 - f. Electrical Hook-up: Section "Electrical Renovation."

References

4. Reference Standards: See Section "References." Comply with following:
 - a. National Fire Protection Association (NFPA): NFPA 70 - National Electrical Code (NEC).
 - b. Certification:
 - 1) ANSI Z34.1 - Certification, Third-Party Certification Program, 1987.
 - 2) ANSI Z34.2 - Certification, Self-Certification by Producer or Supplier, 1987.

Definitions

5. Supply and Delivery Only: Include supply and delivery to site(s) FOB destination freight prepaid. Unless otherwise specified or scheduled, unloading and handling at site is by PHA/IHA.

Submittals

6. Product Data: Submit to the Owner.
7. Samples: Submit to the Owner.
Production Sample: When requested, provide sample range hood to the Owner for examination as to compliance with specifications.
 - a. Color Samples: Samples of manufacturer's standard colors for selection.
8. Quality Assurance/Control Submittals: Submit following to the Owner:
 - a. Certificates: Manufacturer's written certification that range hoods meet or exceed specified requirements including UL requirements.
 - b. Manufacturer's installation instructions.
 - c. Appliances shall meet or exceed requirements established by the Energy Star program and bear the Energy Star logo. Visit www.energystar.gov for a listing of products that qualify. Energy Star® is a voluntary partnership that includes the U.S. Department of Energy, the U.S. Environmental Protection Agency, product manufacturers, local utilities, and retailers, helps promote efficient products by labeling them with the Energy Star logo and educating consumers about the benefits of energy efficiency.
 - d. Closeout Submittals: Submit following to the Owner:
 - 1) Operation and Maintenance Instructions: Provide use and care information with each range hood. Include parts manual with diagrams and part numbers.
 - e. Special warranty.

Quality Assurance

9. Qualifications: Manufacturer: Stock and sell parts for range hoods supplied for five years from time of delivery.



10. Regulatory Requirements: Comply with following:
 - a. Accessibility:
 - 1) Architectural Barriers Act of 1968 as amended (42 USC 4152-4157) and HUD implementing regulations (24 CFR Part 40).
 - a) Uniform Federal Accessibility Standards (UFAS).
 - 2) Section 504 of the Rehabilitation Act of 1973 as amended (29 USC 794) and HUD implementing regulations 24 CFR Part 8.
 - 3) Fair Housing Accessibility Guidelines (24 CFR Chapter 1).
 - 4) Americans with Disabilities Act of 1990 (ADA) (28 CFR Part 35).

Delivery, Storage, And Handling

11. Packing, Shipping, Handling, and Unloading: In accordance with standard commercial practices.
12. Acceptance at Site: Inspect range hoods upon delivery. Replace damaged or defective appliances before installation.

Scheduling

13. Scheduling and Completion: Comply with requirements of Division 1.

Warranty

14. Special Warranties: Provide following written special warranties:
 - a. Entire range hood for one year.
15. Special Warranties: Include labor, material and equipment to provide replacements and make repairs to range hoods at no additional cost to PHA/IHA.

PRODUCTS

Range Hoods

16. Range Hoods: Ductless type with fan.
 - a. Size: 610 mm (24 inches) or 760 mm (30 inches) wide as scheduled, by 150 mm (6 inches) high by 445 mm (17.5 inches) deep.
 - b. Hoods: UL listed and bear UL label.
 - c. Fan: 120 V, 60 HZ, two speed, 2.0 A fan.
 - d. Light: Enclosed 75 watt.
 - e. Filter: Washable filter.
 - f. Color: As selected from manufacturer s standard colors.
17. Range Hood Shell: Same as range hoods above without fan and without light.
 - a. Size: 610 mm (24 inches) or 760 mm (30 inches) wide as scheduled, by 150 mm (6 inches) high by 445 mm (17.5 inches) deep.
 - b. Color: As selected from manufacturer standard colors.

EXECUTION

Examination

18. Site Verification of Conditions:
 - a. Utilities: Verify that required utilities are available, in proper locations, and ready for use.
 - b. Cabinets: Verify that adjacent residential cabinets and range hood are coordinated.

Preparation

19. Existing Range Hoods: Remove existing range hoods and debris from site.

Installation

20. General: Install range hoods in accordance with manufacturer's recommendations.
 - a. Electrical Hook-up: See electrical specifications.



Cleaning

21. Cleaning: Comply with requirements of Division 1.

Schedules

22. Provide range hoods as selected in following schedule:

- _____ Remove existing range hoods.
- _____ Supply and Deliver Only to _____.
- _____ Unloading and handling included.
- _____ Supply and Install.
- _____ Range Hood (with fan, filter, and light).
- _____ 760 mm (30 inches) wide.
- _____ 610 mm (24 inches) wide.
- _____ Range Hood Shell.
- _____ 760 mm (30 inches) wide.
- _____ 610 mm (24 inches) wide.

END OF SECTION 11 30 13 13d



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Task	Specification	Specification Description
11 30 13 23	11 30 13 13	Residential Appliances
11 30 33 00	01 22 16 00	No Specification Required
11 41 13 00	11 21 63 00	Food Service Equipment
11 41 31 00	11 21 63 00	Food Service Equipment



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SECTION 11 41 33 00 - RESIDENTIAL CASEWORK

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for residential casework. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Kitchen cabinets.
 - b. Vanity cabinets.
 - c. Plastic-laminate countertops and backsplashes.
 - d. Solid-surfacing-material countertops and backsplashes.

C. Definitions

1. Exposed Surfaces of Cabinets: Surfaces visible when doors and drawers are closed, including visible surfaces in open cabinets or behind glass doors.
2. Semiexposed Surfaces of Cabinets: Surfaces behind opaque doors or drawer fronts, including interior faces of doors and interiors and sides of drawers. Bottoms of wall cabinets are defined as "semiexposed."
3. Concealed Surfaces of Cabinets: Surfaces not usually visible after installation, including sleepers, web frames, dust panels, bottoms of drawers, and ends of cabinets installed directly against and completely concealed by walls or other cabinets. Tops of wall cabinets and utility cabinets are defined as "concealed."

D. Submittals

1. Product Data: For cabinets, countertop material, and cabinet hardware.
2. Shop Drawings: For cabinets and countertops. Include plans, elevations, details, and attachments to other work. Show materials, finishes, filler panels, hardware, edge and backsplash profiles, methods of joining countertops, and cutouts for plumbing fixtures.
3. Samples: For each type of material exposed to view.
4. LEED Submittals:
 - a. Product Data for Credit EQ 4.4: For adhesives and composite wood products, documentation indicating that product contains no urea formaldehyde.
 - b. Product Data for Credit MR 4.1 and MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - 1) Include statement indicating costs for each product having recycled content.
 - c. Certificates for Credit MR 7: Chain-of-custody certificates certifying that wood used to produce cabinets and countertops complies with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.
 - 1) Include statement indicating costs for each certified wood product.

E. Quality Assurance

1. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
2. Quality Standards: Unless otherwise indicated, comply with the following standards:
 - a. Cabinets: KCMA A161.1.



- 1) KCMA Certification: Provide cabinets with KCMA's "Certified Cabinet" seal affixed in a semiexposed location of each unit and showing compliance with the above standard.
- b. Plastic-Laminate Countertops: KCMA A161.2.

1.2 PRODUCTS

A. Cabinet Materials

1. General:

- a. Certified Wood Materials: Fabricate cabinets with wood and wood-based products produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
- b. Adhesives: Do not use adhesives that contain urea formaldehyde.
- c. Hardwood Lumber: Kiln dried to 7 percent moisture content.
- d. Softwood Lumber: Kiln dried to 10 percent moisture content.
- e. Hardwood Plywood: HPVA HP-1, made with adhesive containing no urea formaldehyde.
- f. Particleboard: ANSI A208.1, Grade M-2, made with binder containing no urea formaldehyde.

OR

Particleboard: Straw-based particleboard complying with requirements of ANSI A208.1, Grade M-2, except for density.

- g. Medium-Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.
 - h. Hardboard: AHA A135.4, Class 1 Tempered.
- #### 2. Exposed Materials:
- a. Exposed Wood Species: Oak **OR** Maple **OR** Alder **OR** Birch **OR** Hickory **OR** Cherry **OR** Manufacturer's standard domestic hardwood species, **as directed**.
 - 1) Select materials for compatible color and grain. Do not use two adjacent exposed surfaces that are noticeably dissimilar in color, grain, figure, or natural character markings.
 - 2) Staining and Finish: As selected from manufacturer's full range.
 - b. Solid Wood: Clear hardwood lumber of species indicated, free of defects.
 - c. Plywood: Hardwood plywood with face veneer of species indicated, with Grade A faces and Grade C backs of same species as faces.
 - 1) Edge band exposed edges with minimum 1/8-inch- (3-mm-) thick, solid-wood edging of same species as face veneer.
 - d. Plastic Laminate: Particleboard faced with high-pressure decorative laminate complying with NEMA LD 3, Grade VGS **OR** HGL, **as directed**.
 - 1) Where edges of solid-color plastic-laminate sheets will be visible after fabrication, provide through-color plastic laminate.
 - 2) For doors and drawer fronts faced with plastic laminate, provide plastic-laminate edges of same grade, pattern, color, and texture of plastic laminate as for faces.
 - 3) Colors, Textures, and Patterns: As selected from cabinet manufacturer's full range.
 - e. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.
 - 1) Provide material finished on both sides for doors and drawer fronts.
 - 2) Provide PVC or polyester edge banding complying with LMA EDG-1 on components with exposed or semiexposed edges.
 - 3) Colors: As selected from cabinet manufacturer's full range.
 - f. Thermoformed Vinyl-Faced Panels: Medium-density fiberboard, milled to required shapes, with a thermoformed vinyl overlay applied in a vacuum or membrane press.
 - 1) Color: As selected from cabinet manufacturer's full range.
 - g. PVC Edge Molding: Rigid PVC extrusions, through color with satin finish, 3 mm thick at doors and drawer fronts, and 1 mm thick elsewhere.



- 1) Color: As selected from cabinet manufacturer's full range.
 3. Semiexposed Materials: Unless otherwise indicated, provide the following:
 - a. Solid Wood: Sound hardwood lumber, selected to eliminate appearance defects. Same species as exposed surfaces or stained to be compatible with exposed surfaces.
 - b. Plywood: Hardwood plywood with Grade C faces and not less than Grade 3 backs of same species as faces. Face veneers of same species as exposed surfaces or stained to be compatible with exposed surfaces.
 - c. Plastic Laminate: Particleboard faced with high-pressure decorative laminate complying with NEMA LD 3, Grade VGS **OR** CLS, **as directed**.
 - 1) For backs of doors and drawer fronts faced with plastic laminate, provide same grade, pattern, color, and texture of plastic laminate as for faces.
 - 2) For face frames faced with plastic laminate, provide plastic-laminate edges of same grade, pattern, color, and texture of plastic laminate as for faces.
 - 3) Colors, Textures, and Patterns: As selected from cabinet manufacturer's full range.
 - d. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.
 - 1) Provide material finished on both sides for shelves, dividers, drawer bodies, and other components with two semiexposed surfaces.
 - 2) Provide PVC or polyester edge banding complying with LMA EDG-1 on components with semiexposed edges.
 - 3) Colors: As selected from cabinet manufacturer's full range.
 - e. Vinyl-Faced Particleboard: Medium-density particleboard with embossed, wood-grain-patterned, **as directed**, vinyl film adhesively bonded to particleboard.
 - 1) Provide vinyl film on both sides of shelves, dividers, drawer bodies, and other components with two semiexposed surfaces and on semiexposed edges.
 - 2) Colors, Textures, and Patterns: As selected from cabinet manufacturer's full range.
 4. Concealed Materials: Solid wood or plywood, of any hardwood or softwood species, with no defects affecting strength or utility; particleboard; medium-density fiberboard; or hardboard.
- B. Cabinet Hardware
1. General: Manufacturer's standard units complying with BHMA A156.9, of type, size, style, material, and finish as selected from manufacturer's full range.
 2. Pulls: Surface-mounted decorative pulls **OR** Back-mounted decorative pulls **OR** Back-mounted decorative pulls with backing plates **OR** Wire pulls **OR** Back-mounted Knobs **OR** Surface-mounted porcelain knobs, **as directed**.
 3. Hinges: Decorative full-surface hinges **OR** Concealed butt hinges **OR** Semiconcealed (wraparound) butt hinges for overlay doors **OR** Pivot (knife) hinges **OR** Concealed European-style self-closing hinges, **as directed**.
 4. Drawer Guides: Epoxy-coated-metal, self-closing drawer guides; designed to prevent rebound when drawers are closed; with nylon-tired, ball-bearing rollers; and complying with BHMA A156.9, Type B05011 or B05091.
- C. Countertop Materials
1. Plastic Laminate: High-pressure decorative laminate complying with NEMA LD 3.
 - a. Grade: HGS **OR** HGL **OR** HGP, **as directed**.
 - b. Provide through-color plastic laminate.
 - c. Grade for Backer Sheet: BKL.
 - d. Colors, Textures, and Patterns: As selected from countertop manufacturer's full range.
 2. Certified Wood Materials: Fabricate countertops with wood and wood-based products produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
 3. Particleboard: ANSI A208.1, Grade M-2 **OR** M-2-Exterior Glue, **as directed**.
OR
Particleboard: Straw-based particleboard complying with requirements of ANSI A208.1, Grade M-2, except for density.



4. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.
5. Adhesives: Do not use adhesives that contain urea formaldehyde.
6. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.
 - a. Type: Provide Standard Type or Veneer Type made from material complying with requirements for Standard Type, as indicated, unless Special Purpose Type is indicated.
 - b. Integral Sink Bowls: Comply with ISSFA-2 and ANSI Z124.3, Type 5 or Type 6, without a precoated finish.
 - c. Colors and Patterns: As selected from manufacturer's full range.
7. Solid Wood Edges and Trim: Clear red oak **OR** white oak **OR** hard maple **OR** cherry, **as directed**, lumber, free of defects, selected for compatible grain and color, and kiln dried to 7 percent moisture content.

D. Cabinets

1. Face Style: Flush overlay; door and drawer faces cover cabinet fronts with only enough space between faces for operating clearance.
OR
Face Style: Reveal overlay; door and drawer faces partially cover cabinet fronts.
OR
Face Style: Lipped overlay; door and drawer faces are rabbeted and partially inset within cabinet fronts with the lip of the rabbet overlapping cabinet body members or face frames.
OR
Face Style: Flush inset; door and drawer faces are set within cabinet fronts, flush with face.
2. Cabinet Style: Face Frame **OR** Frameless, **as directed**.
3. Door and Drawer Fronts: Solid-wood stiles and rails, 5/8 inch (16 mm) thick, with 3/4-inch- (19-mm-) thick, solid-wood center panels.
OR
Door and Drawer Fronts: Solid-wood stiles and rails, 3/4 inch (19 mm) thick, with 1/4-inch- (6.4-mm-) thick, veneer-faced plywood center panels.
OR
Door and Drawer Fronts: 1/2-inch- (12.7-mm-) thick, veneer-faced plywood.

OR Door and Drawer Fronts: 1/2-inch- (12.7-mm-) thick plastic-laminate-faced particleboard, with continuous solid-wood pulls on one edge, **as directed**, with PVC edge banding, **as directed**.
OR
Door and Drawer Fronts: 1/2-inch- (12.7-mm-) thick thermoset decorative panels, with continuous solid-wood pulls on one edge, **as directed**.
OR
Door and Drawer Fronts: 1/2-inch- (12.7-mm-) thick, thermoformed-vinyl-faced panels with vinyl overlay on faces and edges and with thermoset decorative panel backs **OR** faces, backs, and edges, **as directed**.
4. Face Frames: 3/4-by-1-5/8-inch (19-by-41-mm) solid wood with glued mortise and tenon or doweled joints, **as directed**.
OR
Face Frames: 5/8-inch- (16-mm-) thick particleboard with plastic laminate on exposed and semiexposed surfaces.
OR
Face Frames: 5/8-inch- (16-mm-) thick thermoset-decorative-panel material.
OR
Face Frames: 1/2-inch- (12.7-mm-) thick, thermoformed-vinyl-faced panels with vinyl overlay on exposed and semiexposed surfaces.
5. Exposed Cabinet End Finish: Wood veneer **OR** Plastic laminate **OR** Thermoset decorative panels **OR** Thermoformed vinyl-faced panels, **as directed**.



6. Cabinet End Construction: 5/8-inch- (16-mm-) **OR** 1/2-inch- (12.7-mm-), **as directed**, thick particleboard or 1/2-inch- (12.7-mm-) **OR** 3/8-inch- (9.5-mm-), **as directed**, thick plywood.
 7. Cabinet Tops and Bottoms: 5/8-inch- (16-mm-) thick particleboard or 1/2-inch- (12.7-mm-) thick plywood, fully supported by and secured in rabbets in end panels, front frame (if any), and back rail.
OR
Cabinet Tops and Bottoms: 1/2-inch- (12.7-mm-) thick particleboard or 3/8-inch- (9.5-mm-) thick plywood, fully supported by and secured in rabbets in end panels, front frame, and back rail.
 8. Back, Top, and Bottom Rails: 3/4-by-2-1/2-inch (19-by-63-mm) solid wood, interlocking with end panels and rabbeted to receive top and bottom panels. Back rails secured under pressure with glue and with mechanical fasteners.
 9. Wall-Hung-Unit Back Panels: 3/16-inch- (4.8-mm-) thick plywood fastened to rear edge of end panels and to top and bottom rails.
 10. Base-Unit Back Panels: 3/16-inch- (4.8-mm-) thick plywood fastened to rear edge of end panels and to top and bottom rails.
 11. Base-Unit Back Panels: 1/8-inch- (3.2-mm-) thick hardboard fastened to rear edge of end panels and to top and bottom rails.
 12. Front Frame Drawer Rails: 3/4-by-1-1/4-inch (19-by-32-mm) solid wood mortised and fastened into face frame.
 13. Drawers: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
 - a. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners **OR** glued dovetail joints, **as directed**.
 - b. Subfronts, Backs, and Sides: 3/4-inch- (19-mm-) **OR** 1/2-inch- (12.7-mm-), **as directed**, thick solid wood.
OR
Subfronts, Backs, and Sides: 1/2-inch- (12.7-mm-) thick solid wood or 3/8-inch- (9.5-mm-) thick plywood.
OR
Subfronts, Backs, and Sides: 3/8-inch- (9.5-mm-) thick particleboard.
 - c. Bottoms: 1/4-inch- (6.4-mm-) **OR** 3/16-inch- (4.8-mm-), **as directed**, thick plywood.
OR
Bottoms: 1/4-inch- (6.4-mm-) thick hardboard **OR** particleboard, **as directed**.
 14. Shelves: 3/4-inch- (19-mm-) thick particleboard or 5/8-inch- (16-mm-) thick plywood.
OR
Shelves: 5/8-inch- (16-mm-) thick particleboard or 1/2-inch- (12.7-mm-) thick plywood.
 15. Joinery: Rabbet backs flush into end panels and secure with concealed mechanical fasteners. Connect tops and bottoms of wall cabinets and bottoms and stretchers of base cabinets to ends and dividers with mechanical fasteners. Rabbet tops, bottoms, and backs into end panels.
 16. Factory Finishing: Finish cabinets at factory. Defer only final touchup until after installation.
- E. Plastic-Laminate Countertops
1. Configuration: Provide countertops with the following front, cove (intersection of top with backsplash), backsplash, and endsplash style:
 - a. Front: No drip (raised marine edge with rolled front) **OR** Rolled **OR** Bevel **OR** Self-edge **OR** Wood-trimmed edge as indicated, **as directed**.
 - b. Cove: Cove molding (one-piece postformed laminate supported at junction of top and backsplash by wood cove molding) **OR** Applied (backsplash rests on top forming seam at inside corner), **as directed**.
 - c. Backsplash: Curved or waterfall shape with scribe **OR** Square edge without scribe **OR** Sloped top edge without scribe **OR** Square edge with scribe, **as directed**.
 - d. Endsplash: None **OR** Square edge without scribe **OR** Sloped top edge without scribe **OR** Square edge with scribe, **as directed**.
 2. Plastic-Laminate Substrate: Particleboard not less than 3/4 inch (19 mm) thick.
 - a. For countertops at sinks and lavatories, use Grade M-2-Exterior-Glue particleboard or exterior-grade plywood.



- b. Build up countertop thickness to 1-1/2 inches (38 mm) at front, back, and ends with additional layers of particleboard laminated to top.
3. Backer Sheet: Provide plastic-laminate backer sheet on underside of countertop substrate.
4. Paper Backing: Provide paper backing on underside of countertop substrate.

F. Solid-Surfacing-Material Countertops

1. Configuration: Provide countertops with the following front and backsplash style:
 - a. Front: Straight, slightly eased at top **OR** Bevel **OR** 3/4-inch (19-mm) bullnose **OR** Radius edge with apron, 2 inches (50 mm) high with 3/8-inch (9.5-mm) radius **OR** 1-1/2-inch (38-mm) laminated bullnose **OR** 1-inch (25-mm) laminated bullnose **OR** Wood-trimmed edge as indicated, **as directed**.
 - b. Backsplash: Straight, slightly eased at corner **OR** Bevel **OR** Radius edge with 3/8-inch (9.5-mm) radius, **as directed**.
 - c. Endsplash: Matching backsplash **OR** None, **as directed**.
2. Countertops: 1/2-inch- (12.7-mm-) **OR** 3/4-inch- (19-mm-), **as directed**, thick, solid-surfacing material with wood-trimmed edges, **as directed**.
OR
 Countertops: 1/2-inch- (12.7-mm-) **OR** 3/4-inch- (19-mm-), **as directed**, thick, solid-surfacing material with front edge built up with same material.
OR
 Countertops: 1/4-inch- (6.4-mm-) thick, solid-surfacing material laminated to 3/4-inch- (19-mm-) thick particleboard with wood-trimmed edges.
OR
 Countertops: 1/4-inch- (6.4-mm-) thick, solid-surfacing material laminated to 3/4-inch- (19-mm-) thick particleboard with front edge built up with 3/4-inch- (19-mm-) thick, solid-surfacing material.
3. Backsplashes: 1/2-inch- (12.7-mm-) **OR** 3/4-inch- (19-mm-), **as directed**, thick, solid-surfacing material with wood-trimmed edges, **as directed**.
4. Fabrication: Fabricate tops in one piece with shop-applied edges and backsplashes, **as directed**, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
 - a. Fabricate with loose backsplashes for field assembly.
 - b. Install integral sink bowls in countertops in the shop.

1.3 EXECUTION

A. Installation

1. Install cabinets with no variations in flushness of adjoining surfaces; use concealed shims. Where cabinets abut other finished work, scribe and cut for accurate fit. Provide filler strips, scribe strips, and moldings in finish to match cabinet face.
2. Install cabinets without distortion so doors and drawers fit openings and are aligned. Complete installation of hardware and accessories as indicated.
3. Install cabinets and countertop level and plumb to a tolerance of 1/8 inch in 8 feet (3 mm in 2.4 m).
4. Fasten cabinets to adjacent units and to backing.
 - a. Fasten wall cabinets through back, near top and bottom, at ends and not less than 24 inches (600 mm) o.c. with No. 10 wafer-head screws sized for 1-inch (25-mm) penetration into wood framing, blocking, or hanging strips.
 - b. Fasten wall cabinets through back, near top and bottom, at ends and not less than 24 inches (600 mm) o.c., with toggle bolts through metal backing behind gypsum board.
5. Fasten plastic-laminate countertops by screwing through corner blocks of base units into underside of countertop. Form seams using splines to align adjacent surfaces, and secure with glue and concealed clamping devices designed for this purpose.
 - a. Provide cutouts for sinks and lavatories, including holes for faucets and accessories.
 - b. Seal edges of cutouts by saturating with varnish.



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6. Fasten solid-surfacing-material countertops by screwing through corner blocks of base units into underside of countertop. Align adjacent surfaces, and form seams to comply with manufacturer's written instructions using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
 - a. Install backsplashes and endsplashes to comply with solid-surfacing-material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
 - b. Seal edges of cutouts by saturating with varnish.

 - B. Adjusting And Cleaning
 1. Adjust cabinets and hardware so doors and drawers are centered in openings and operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.
 2. Clean casework on exposed and semiexposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

END OF SECTION 11 41 33 00



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Task	Specification	Specification Description
11 41 33 00	11 21 63 00	Food Service Equipment
11 42 13 00	11 21 63 00	Food Service Equipment
11 42 16 00	11 21 63 00	Food Service Equipment
11 44 13 00	11 21 63 00	Food Service Equipment
11 44 16 00	11 21 63 00	Food Service Equipment
11 44 19 00	11 21 63 00	Food Service Equipment
11 44 19 00	11 30 13 13	Residential Appliances
11 46 13 00	11 21 63 00	Food Service Equipment
11 46 16 00	11 21 63 00	Food Service Equipment
11 46 19 00	11 21 63 00	Food Service Equipment
11 46 83 00	11 21 63 00	Food Service Equipment
11 48 13 00	11 21 63 00	Food Service Equipment
11 48 16 00	11 21 63 00	Food Service Equipment



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SECTION 11 52 13 13 - PROJECTION SCREENS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for projection screens. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Manually operated projection screens.
 - b. Electrically operated projection screens and controls.
 - c. Rigid rear-projection screens.

C. Definitions

1. Gain of Front-Projection Screens: Ratio of light reflected from screen material to that reflected perpendicularly from a magnesium carbonate surface as determined per SMPTE RP 94.
2. Gain of Rear-Projection Screens: Ratio of light refracted by screen material to that reflected perpendicularly from a magnesium carbonate surface as determined per SMPTE RP 94, except that for measuring luminance of test screen, projection lamp shall be placed behind screen same distance as it was placed in front of magnesium carbonate surface for measuring luminance of reference standard.
3. Half-Gain Angle: The angle, measured from the axis of the screen surface to the most central position on a perpendicular plane through the horizontal centerline of the screen where the gain is half of the peak gain.

D. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: For projection screens. Show layouts and types of projection screens. Include the following:
 - a. For manually operated projection screens:
 - 1) Drop lengths.
 - 2) Anchorage details.
 - 3) Accessories.
 - b. For electrically operated projection screens and controls:
 - 1) Location of screen centerline relative to ends of screen case.
 - 2) Location of wiring connections for electrically operated units.
 - 3) Location of seams in viewing surfaces.
 - 4) Drop lengths.
 - 5) Anchorage details, including connection to supporting structure for suspended units.
 - 6) Details of juncture of exposed surfaces with adjacent finishes.
 - 7) Accessories.
 - 8) Wiring diagrams.
 - c. For rigid rear-projection screens:
 - 1) Frame details.
 - 2) Anchorage details.
 - 3) Details of juncture of exposed surfaces with adjacent finishes.
 - 4) Accessories.
3. Maintenance Data: For projection screens to include in maintenance manuals.

E. Quality Assurance



1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Delivery, Storage, And Handling

1. Environmental Limitations: Do not deliver or install projection screens until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Store rear-projection screens in manufacturer's protective packaging and according to manufacturer's written instructions.

1.2 PRODUCTS

A. Manually Operated Projection Screens

1. General: Manufacturer's standard spring-roller-operated units, consisting of case, screen, mounting accessories, and other components necessary for a complete installation.
 - a. Screen Mounting: Top edge securely anchored to a 3-inch- (75-mm-) diameter, rigid steel roller; bottom edge formed into a pocket holding a tubular metal slat, with ends of slat protected by plastic caps, and with a saddle and pull attached to slat by screws.
 - b. Tab Tensioning: Provide units that have a durable low-stretch cord, such as braided polyester, on each side of screen connected to edge of screen by tabs to pull screen flat horizontally. In lieu of tab tensioning, screens may be constructed from vinyl-coated screen cloth that contains horizontal stiffening monofilaments to resist edge curling, **as directed**.
2. Bracket-Mounted or Ceiling-Suspended, Metal-Encased, Manually Operated Screens: Units designed and fabricated for suspending from wall brackets or ceiling, fabricated from formed-steel sheet not less than 0.027 inch (0.7 mm) thick or from aluminum extrusions; with vinyl covering or baked-enamel finish and matching end caps. Provide mounting brackets unless otherwise indicated.
3. Surface-Mounted, Metal-Encased, Manually Operated Screens: Units designed and fabricated for surface mounting on wall or ceiling, fabricated from formed-steel sheet not less than 0.027 inch (0.7 mm) thick or from aluminum extrusions; with flat back design and vinyl covering or baked-enamel finish. Provide units with matching end caps and concealed mounting.
4. Surface-Mounted, Wood-Finished, Manually Operated Screens: Units designed and fabricated for surface mounting on wall or ceiling; with flat back design, hardwood finish, and concealed mounting brackets.
 - a. Hardwood: Oak **OR** Walnut **OR** Mahogany **OR** Cherry **OR** As selected from manufacturer's full range of species, **as directed**.
 - b. Finish: As selected from manufacturer's full range.

B. Electrically Operated Projection Screens

1. General: Manufacturer's standard units consisting of case, screen, motor, controls, mounting accessories, and other components necessary for a complete installation. Provide units that are listed and labeled as an assembly by UL or another testing and inspecting agency acceptable to authorities having jurisdiction, **as directed**.
 - a. Controls: Remote, key-operated, **as directed**, three-position control switch installed in recessed device box with flush cover plate matching other electrical device cover plates in room where switch is installed.
 - 1) Provide two **OR** three, **as directed**, control switches for each screen.
 - 2) Provide number of control switches indicated for each screen.
 - 3) Provide power supply for low-voltage systems if required.
 - 4) Provide locking cover plates for switches.
 - 5) Provide key-operated, power-supply switch.



- 6) Provide infrared **OR** radio-frequency, **as directed**, remote control consisting of battery-powered transmitter and receiver.
 - 7) Provide video interface control for connecting to projector. Projector provides signal to raise or lower screen.
 - b. Motor in Roller: Instant-reversing motor of size and capacity recommended by screen manufacturer; with permanently lubricated ball bearings, automatic thermal-overload protection, preset limit switches to automatically stop screen in up and down positions, and positive-stop action to prevent coasting. Mount motor inside roller with vibration isolators to reduce noise transmission.
 - c. End-Mounted Motor: Instant-reversing, gear-drive motor of size and capacity recommended by screen manufacturer; with permanently lubricated ball bearings, automatic thermal-overload protection, preset limit switches to automatically stop screen in up and down positions, and positive-stop action to prevent coasting. Locate motor in its own compartment on right end of screen unless otherwise indicated **OR** on left end of screen unless otherwise indicated **OR** on end of screen indicated, **as directed**.
 - d. Screen Mounting: Top edge securely anchored to rigid metal roller and bottom edge formed into a pocket holding a 3/8-inch- (9.5-mm-) diameter metal rod with ends of rod protected by plastic caps.
 - 1) Roller for end-mounted motor supported by self-aligning bearings in brackets.
 - 2) Roller for motor in roller supported by vibration- and noise-absorbing supports.
 - e. Tab Tensioning: Provide units that have a durable low-stretch cord, such as braided polyester, on each side of screen connected to edge of screen by tabs to pull screen flat horizontally. In lieu of tab tensioning, screens may be constructed from vinyl-coated screen cloth that contains horizontal stiffening monofilaments to resist edge curling.
2. Surface-Mounted, Metal-Encased, Electrically Operated Screens: Motor-in-roller **OR** End-mounted motor, **as directed**, units designed and fabricated for surface mounting on wall or ceiling, fabricated from formed-steel sheet not less than 0.027 inch (0.7 mm) thick or from aluminum extrusions; with flat back design and vinyl covering or baked-enamel finish. Provide with matching end caps and concealed mounting.
 3. Surface-Mounted, Wood-Finished, Electrically Operated Screens: Motor in roller units designed and fabricated for surface mounting on wall or ceiling; with flat back design, hardwood finish, and concealed mounting brackets.
 - a. Hardwood: Oak **OR** Walnut **OR** Mahogany **OR** Cherry **OR** As selected from manufacturer's full range of species, **as directed**.
 - b. Finish: As selected from manufacturer's full range.
 4. Suspended, Electrically Operated Screens without Ceiling Closure: Motor-in-roller **OR** End-mounted motor, **as directed**, units designed and fabricated for suspended mounting, with bottom of case entirely or partially open under screen compartment.
 - a. Provide metal or metal-lined motor enclosure on units with end-mounted motor.
 - b. Provide metal or metal-lined wiring compartment on units with motor in roller.
 - c. Screen Case: Made from metal **OR** metal and fire-retardant materials **OR** metal, wood, wood products, and fire-retardant materials, **as directed**.
 - d. Provide screen case with trim flange to receive ceiling finish **OR** constructed to be installed with underside flush with ceiling **OR** constructed to be installed with ceiling finish applied to underside, **as directed**.
 - e. Finish on Exposed Surfaces: Prime painted **OR** Vinyl covering or baked enamel, **as directed**.
 5. Suspended, Electrically Operated Screens with Automatic Ceiling Closure: Motor-in-roller **OR** End-mounted motor, **as directed**, units designed and fabricated for suspended mounting; with bottom of case composed of two panels, fully enclosing screen, motor, and wiring; one panel hinged and designed to open and close automatically when screen is lowered and fully raised, the other removable or openable for access to interior of case.
 - a. Provide metal or metal-lined motor enclosure on units with end-mounted motor.
 - b. Provide metal or metal-lined wiring compartment on units with motor in roller.
 - c. Screen Case: Made from metal **OR** metal and fire-retardant materials **OR** metal, wood, wood products, and fire-retardant materials, **as directed**.



- d. Provide screen case with trim flange to receive ceiling finish **OR** constructed to be installed with underside flush with ceiling **OR** constructed to be installed with ceiling finish applied to underside, **as directed**.
- e. Finish on Exposed Surfaces: Prime painted **OR** Vinyl covering or baked enamel, **as directed**.

C. Front-Projection Screen Material

1. Matte-White Viewing Surface: Peak gain not less than 0.9, and gain not less than 0.8 at an angle of 50 degrees from the axis of the screen surface.
2. Matte-Gray Viewing Surface: Peak gain not less than 0.8, and half-gain angle of not less than 50 degrees from the axis of the screen surface.
3. Glass-Beaded Viewing Surface: Peak gain not less than 2.0, and half-gain angle of at least 15 degrees from the axis of the screen surface.
4. Matte Reflective Viewing Surface: Peak gain not less than 1.3, and half-gain angle of at least 40 degrees from the axis of the screen surface.
5. Wide-Angle Reflective Viewing Surface: Peak gain not less than 1.5, and half-gain angle of at least 35 degrees from the axis of the screen surface.
6. Multipurpose Reflective Viewing Surface: Peak gain not less than 1.8, and half-gain angle of at least 25 degrees from the axis of the screen surface.
7. High-Gain Reflective Viewing Surface: Peak gain not less than 2.5, and half-gain angle of at least 20 degrees from the axis of the screen surface.
8. Material: Vinyl-coated, glass-fiber fabric or vinyl sheet.
9. Mildew-Resistance Rating: 0 or 1 when tested according to ASTM G 21.
10. Flame Resistance: Passes NFPA 701.
11. Flame-Spread Index: Not greater than 75 when tested according to ASTM E 84.
12. Seams: Where length of screen indicated exceeds maximum length produced without seams in material specified, provide screen with horizontal seam placed as follows:
 - a. At top **OR** bottom, **as directed**, of screen at juncture between extra drop length and viewing surface.
 - b. In location indicated.
13. Seamless Construction: Provide screens, in sizes indicated, without seams.
14. Edge Treatment: Black **OR** Without black, **as directed**, masking borders.
15. Size of Viewing Surface: 50 by 50 inches (1270 by 1270 mm) **OR** 60 by 60 inches (1524 by 1524 mm) **OR** 70 by 70 inches (1778 by 1778 mm) **OR** 84 by 84 inches (2133 by 2133 mm) **OR** 48 by 65 inches (1219 by 1651 mm) **OR** 54 by 72 inches (1371 by 1828 mm) **OR** 58 by 79 inches (1473 by 2006 mm) **OR** 72 by 96 inches (1828 by 2438 mm), **as directed**.
16. Provide extra drop length of dimensions and at locations indicated.
 - a. Color: Same as viewing surface **OR** Black, **as directed**.

D. Flexible Rear-Projection Screen Material

1. Wide-Angle Screens: Peak gain not less than 1.0, and half-gain angle of at least 35 degrees from the axis of the screen surface.
2. Moderate-Gain Screens: Peak gain not less than 1.3, and half-gain angle of at least 30 degrees from the axis of the screen surface.
3. High-Gain Screens: Peak gain not less than 1.8, and half-gain angle of at least 15 degrees from the axis of the screen surface.
4. Material: Coated vinyl sheet.
5. Mildew-Resistance Rating: 0 or 1 when tested according to ASTM G 21.
6. Flame Resistance: Passes NFPA 701.
7. Flame-Spread Index: Not greater than 75 when tested according to ASTM E 84.
8. Seamless Construction: Provide screens, in sizes indicated, without seams.
9. Size of Viewing Surface: 50 by 50 inches (1270 by 1270 mm) **OR** 60 by 60 inches (1524 by 1524 mm) **OR** 70 by 70 inches (1778 by 1778 mm) **OR** 84 by 84 inches (2133 by 2133 mm) **OR** 48 by 65 inches (1219 by 1651 mm) **OR** 54 by 72 inches (1371 by 1828 mm) **OR** 58 by 79 inches (1473 by 2006 mm) **OR** 72 by 96 inches (1828 by 2438 mm), **as directed**.



10. Provide extra drop length of dimensions and at locations indicated.
 - a. Color: Same as viewing surface **OR** Black, **as directed**.
- E. Optically Coated Rigid Rear-Projection Screens
 1. Screen Substrate: Optically clear substrate complying with the following requirements:
 - a. Clear float glass complying with ASTM C 1036 for Type I (transparent glass, flat), Class 1 (clear), and Quality q3 (glazing select), 6.0 mm thick **OR** 10.0 mm thick **OR** 12.0 mm thick **OR** thickness as indicated, **as directed**.
 - b. Colorless, transparent, cast-acrylic sheet with a luminous transmittance of 92 percent per ASTM D 1003 and complying with ASTM D 4802, Category A-1 (cell cast), Finish 1 (smooth or polished), 1/4 inch (6.4 mm) thick **OR** 3/8 inch (9.5 mm) thick **OR** 1/2 inch (12.7 mm) thick **OR** thickness as indicated, **as directed**.
 - c. Fresnel lens cast from colorless, transparent, acrylic with a luminous transmittance of 92 percent per ASTM D 1003 and complying with ASTM D 4802, Category A-1 (cell cast), Finish 1 (smooth or polished) on one side and Finish 2 (patterned) on other side, 1/4 inch (6.4 mm) thick **OR** 3/8 inch (9.5 mm) thick **OR** 1/2 inch (12.7 mm) thick **OR** thickness as indicated, **as directed**.
 2. Optical Coating: Durable, washable coating bonded to one side of substrate.
 3. Wide-Angle Screens: Peak gain not less than 1.0, and half-gain angle of at least 35 degrees from the axis of the screen surface.
 4. Moderate-Gain Screens: Peak gain not less than 1.3, and half-gain angle of at least 30 degrees from the axis of the screen surface.
 5. General-Purpose Screens: Peak gain of not less than 1.8, and half-gain angle of at least 28 degrees from the axis of the screen surface.
 6. High-Gain Screens: Peak gain not less than 2.0, and half-gain angle of at least 20 degrees from the axis of the screen surface.
 7. Optical Tint: High-contrast dark gray **OR** Medium neutral gray **OR** Neutral white **OR** Manufacturer's standard, **as directed**.
 8. Protective Coating: Provide formulation designed by screen manufacturer as a permanent topcoat over optical coatings to protect against normal abrasion before, during, and after installation.
 9. Writing-Surface Coating: Provide screen manufacturer's protective coating, designed as a writing surface for dry-erase markers, on front of screen.
 10. Size of Viewing Surface: 40 by 54 inches (1016 by 1371 mm) **OR** 43 by 57 inches (1092 by 1447 mm) **OR** 50 by 67 inches (1270 by 1701 mm) **OR** 54 by 72 inches (1371 by 1828 mm) **OR** 60 by 80 inches (1524 by 2032 mm) **OR** 72 by 96 inches (1828 by 2438 mm), **as directed**.
- F. High-Performance Rigid Rear-Projection Screens
 1. High-Performance Screens, General: Acrylic screen with Fresnel lens on rear surface and linear lenses on front surface.
 - a. Screen Substrate: Optically clear acrylic with a luminous transmittance of 92 percent per ASTM D 1003 and complying with ASTM D 4802, Category A-1 (cell cast), Finish 2 (patterned), 1/4 inch (6.4 mm) thick **OR** 3/8 inch (9.5 mm) thick **OR** 1/2 inch (12.7 mm) thick **OR** thickness as indicated, **as directed**.
 2. Performance:
 - a. Peak gain not less than 3.0 **OR** 4.0, **as directed**, and horizontal half-gain angle of at least 50 degrees from the axis of the screen surface.
 - b. Peak gain of 3.5 **OR** 4.0, **as directed**, and horizontal half-gain angle of at least 30 degrees from the axis of the screen surface.
 - c. Performance: Peak gain of 5.0, and horizontal half-gain angle of at least 25 degrees from the axis of the screen surface.
 - d. Performance: Peak gain not less than 1.5 **OR** 3.0, **as directed**, and horizontal half-gain angle of at least 20 degrees from the axis of the screen surface.
 3. Size of Viewing Surface: 40 by 54 inches (1016 by 1371 mm) **OR** 43 by 57 inches (1092 by 1447 mm) **OR** 50 by 67 inches (1270 by 1701 mm) **OR** 54 by 72 inches (1371 by 1828 mm) **OR** 60 by 80 inches (1524 by 2032 mm) **OR** 72 by 96 inches (1828 by 2438 mm), **as directed**.



G. Rigid Rear-Projection Screen Accessories

1. Factory Frames: Screen manufacturer's standard frames of profile indicated, fabricated to sizes required to fit screens from aluminum extrusions complying with ASTM B 221 (ASTM B 221M) for 6063-T5 alloy and temper.
 - a. Class II, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.
 - b. Class II, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, integrally colored or electrolytically deposited color coating 0.010 mm or thicker) complying with AAMA 611.
 - 1) Color: Black **OR** Dark bronze **OR** Either black or dark bronze, as standard with manufacturer, **as directed**.
2. Glazing Accessories for Factory Frames: Provide gaskets and setting blocks with proven record of compatibility with screen and frame surfaces, of sizes and shapes to accommodate thickness of screen indicated and to fit glazing channel provided.
3. Glazing Accessories for Field-Framed Screens: Provide materials compatible with screen and frame surfaces while complying with applicable requirements in Division 08 Section "Glazing".

1.3 EXECUTION

A. Front-Projection Screen Installation

1. Install front-projection screens at locations indicated to comply with screen manufacturer's written instructions.
2. Install front-projection screens with screen cases in position and in relation to adjoining construction indicated. Securely anchor to supporting substrate in a manner that produces a smoothly operating screen with vertical edges plumb and viewing surface flat when screen is lowered.
 - a. Install low-voltage controls according to NFPA 70 and complying with manufacturer's written instructions.
 - 1) Wiring Method: Install wiring in raceway except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Use UL-listed plenum cable in environmental air spaces, including plenum ceilings. Conceal raceway and cables except in unfinished spaces.
 - b. Test electrically operated units to verify that screen controls, limit switches, closures, and other operating components are in optimum functioning condition.
 - c. Test manually operated units to verify that screen-operating components are in optimum functioning condition.

B. Rigid Rear-Projection Screen Installation

1. Install rear-projection screens at locations indicated to comply with screen manufacturer's written instructions. Handle screens carefully during installation using procedures and tools recommended by screen manufacturer; do not abrade screen surfaces.
2. Install optically coated rear-projection screens with optical coating toward projector **OR** audience, **as directed**.
3. Install high-performance, rear-projection screens with orientation as indicated in manufacturer's written instructions.
4. Install factory-framed, rear-projection screens in prepared wall openings. Securely anchor frames to surrounding construction so frames are plumb and level and screen surfaces are flat.
5. Install rear-projection screens with glass substrates, in frames specified in other Sections, to comply with applicable requirements in Division 08 Section "Glazing" and with screen manufacturer's written instructions. Set projection screen with surfaces flat and edges plumb and level.



6. Install rear-projection screens with plastic substrates, in frames specified in other Sections, to comply with screen manufacturer's written instructions. Clamp units only at top edge and allow for expansion and contraction of plastic glazing material by providing frame with adequate bite and edge clearances.
- C. Protecting And Cleaning Rigid Rear-Projection Screens
1. Provide temporary covering of rear-projection screens until time of Final Completion. Use type of covering approved by screen manufacturer that will effectively protect screen from abrasion, breakage, or other damage.
 2. Clean rear-projection screens on both faces immediately before date scheduled for inspection intended to establish date of Final Completion. Use methods and cleaning materials recommended by screen manufacturer, taking care not to scratch or damage optical coatings or screen substrates.
- D. Projection Screen Schedule
1. Manually Operated, Front-Projection Screen Type: Surface mounted, metal encased **OR** Surface mounted, wood finished, **as directed**.
 - a. Screen Surface: Matte white **OR** Matte gray **OR** Glass beaded **OR** Matte reflective **OR** Wide-angle reflective **OR** Multipurpose reflective **OR** High-gain reflective, **as directed**.
 - b. Viewing Surface Size: 50 by 50 inches (1270 by 1270 mm) **OR** 60 by 60 inches (1524 by 1524 mm) **OR** 70 by 70 inches (1778 by 1778 mm) **OR** 84 by 84 inches (2133 by 2133 mm) **OR** 48 by 65 inches (1219 by 1651 mm) **OR** 54 by 72 inches (1371 by 1828 mm) **OR** 58 by 79 inches (1473 by 2006 mm) **OR** 72 by 96 inches (1828 by 2438 mm), **as directed**.
 - c. Extra Drop Length: As needed at top of screen for bottom of screen to be 36 inches (900 mm) above floor and 36 inches (900 mm) at bottom of screen, **as directed**.
 2. Electrically Operated, Front-Projection Screen Type: Surface mounted, metal encased **OR** Surface mounted, wood finished **OR** Suspended, without ceiling closure **OR** Suspended, with automatic ceiling closure, **as directed**.
 - a. Motor Configuration: Motor in roller **OR** End-mounted motor on right end of screen **OR** End-mounted motor on left end of screen **OR** End-mounted motor on end of screen indicated, **as directed**.
 - b. Screen Surface: Matte white **OR** Matte gray **OR** Glass beaded **OR** Matte reflective **OR** Wide-angle reflective **OR** Multipurpose reflective **OR** High-gain reflective, **as directed**.
 - c. Viewing Surface Size: 50 by 50 inches (1270 by 1270 mm) **OR** 60 by 60 inches (1524 by 1524 mm) **OR** 70 by 70 inches (1778 by 1778 mm) **OR** 84 by 84 inches (2133 by 2133 mm) **OR** 48 by 65 inches (1219 by 1651 mm) **OR** 54 by 72 inches (1371 by 1828 mm) **OR** 58 by 79 inches (1473 by 2006 mm) **OR** 72 by 96 inches (1828 by 2438 mm), **as directed**.
 - d. Extra Drop Length: As needed at top of screen for bottom of screen to be 36 inches (900 mm) above floor and 36 inches (900 mm) at bottom of screen, **as directed**.
 3. Manually Operated, Rear-Projection Screen Type: Surface mounted, metal encased **OR** Surface mounted, wood finished, **as directed**.
 - a. Screen Type: Wide angle **OR** Moderate gain **OR** High gain, **as directed**.
 - b. Viewing Surface Size: 50 by 50 inches (1270 by 1270 mm) **OR** 60 by 60 inches (1524 by 1524 mm) **OR** 70 by 70 inches (1778 by 1778 mm) **OR** 84 by 84 inches (2133 by 2133 mm) **OR** 48 by 65 inches (1219 by 1651 mm) **OR** 54 by 72 inches (1371 by 1828 mm) **OR** 58 by 79 inches (1473 by 2006 mm) **OR** 72 by 96 inches (1828 by 2438 mm), **as directed**.
 - c. Extra Drop Length: As needed at top of screen for bottom of screen to be 36 inches (900 mm) above floor and 36 inches (900 mm) at bottom of screen, **as directed**.
 4. Electrically Operated, Rear-Projection Screen Type: Surface mounted, metal encased **OR** Surface mounted, wood finished **OR** Suspended, without ceiling closure **OR** Suspended, with automatic ceiling closure, **as directed**.
 - a. Motor Configuration: Motor in roller **OR** End-mounted motor on right end of screen **OR** End-mounted motor on left end of screen **OR** End-mounted motor on end of screen indicated, **as directed**.
 - b. Screen Type: Wide angle **OR** Moderate gain **OR** High gain, **as directed**.



- c. Viewing Surface Size: 50 by 50 inches (1270 by 1270 mm) **OR** 60 by 60 inches (1524 by 1524 mm) **OR** 70 by 70 inches (1778 by 1778 mm) **OR** 84 by 84 inches (2133 by 2133 mm) **OR** 48 by 65 inches (1219 by 1651 mm) **OR** 54 by 72 inches (1371 by 1828 mm) **OR** 58 by 79 inches (1473 by 2006 mm) **OR** 72 by 96 inches (1828 by 2438 mm), **as directed**.
- d. Extra Drop Length: As needed at top of screen for bottom of screen to be 36 inches (900 mm) above floor and 36 inches (900 mm) at bottom of screen, **as directed**.
- 5. Rigid Rear-Projection Screen Type: Optically coated screen.
 - a. Screen Substrate: Glass **OR** Acrylic, **as directed**.
 - b. Screen Type: Wide angle **OR** Moderate gain **OR** General purpose **OR** High gain, **as directed**.
 - c. Optical Tint: High-contrast dark gray **OR** Medium neutral gray **OR** Neutral white, **as directed**.
 - d. Size of Viewing Surface: 40 by 54 inches (1016 by 1371 mm) **OR** 43 by 57 inches (1092 by 1447 mm) **OR** 50 by 67 inches (1270 by 1701 mm) **OR** 54 by 72 inches (1371 by 1828 mm) **OR** 60 by 80 inches (1524 by 2032 mm) **OR** 72 by 96 inches (1828 by 2438 mm), **as directed**.
 - e. Additional Features: Protective coating **OR** Writing surface coating **OR** Factory frame, **as directed**.
- 6. Rigid Rear-Projection Screen Type: High-performance screen.
 - a. Gain: Not less than 1.5 **OR** 3 **OR** 3.5 **OR** 4 **OR** 5, **as directed**.
 - b. Horizontal Half-Gain Angle: At least 20 **OR** 25 **OR** 30 **OR** 50, **as directed**, degrees from screen axis.
 - c. Size of Viewing Surface: 40 by 54 inches (1016 by 1371 mm) **OR** 43 by 57 inches (1092 by 1447 mm) **OR** 50 by 67 inches (1270 by 1701 mm) **OR** 54 by 72 inches (1371 by 1828 mm) **OR** 60 by 80 inches (1524 by 2032 mm) **OR** 72 by 96 inches (1828 by 2438 mm), **as directed**.
 - d. Additional Features: Factory frame.

END OF SECTION 11 52 13 13



Task	Specification	Specification Description
11 52 13 13	01 22 16 00	No Specification Required
11 52 16 26	01 22 16 00	No Specification Required
11 52 19 00	11 52 13 13	Projection Screens



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SECTION 11 68 23 13 - PLAYING FIELDS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for repair and maintenance of playing fields. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: For each type of product/material indicated.
2. Shop drawings shall be submitted for approval.

1.2 PRODUCTS

- #### A. Fills required to bring the subgrade of playing surfaces up to required elevation shall be placed in horizontal layers of not more than 8 in. (200 mm) in loose thickness. The top layer of all fills and excavated areas under the playing surfaces shall be compacted to 95 percent maximum density in accordance with ASTM D 698.

- #### B. Sand-Clay Playing Surfaces shall consist of a stone foundation course, a clay foundation course, a wearing course and, where equipped, a drainage filter course, constructed on the prepared subgrade.

1. Stone Foundation Course: A layer at least 3 in. (75 mm) thick of 3/4- to 1-1/2 in. (19 to 38 mm) crushed stone shall be spread over the subgrade or over the drainage filter course constructed thereon and shall be given preliminary compaction by rolling, followed by a filler consisting of 1/4- to 1/2-in. (6 to 13 mm) crushed stone to fill voids in the underlying stone. The stone foundation course shall be compacted to a minimum of 95 percent maximum density in accordance with ASTM D 698.
2. Clay Foundation Course: Selected inorganic fat clay (CH) shall be evenly spread on the stone foundation course to produce a compacted layer not less than 3 in. (75 mm) thick. The clay layer shall be compacted to a minimum of 90 percent of CE 55 maximum density in accordance with ASTM D 698.
3. Wearing Course: The approved inorganic clay-silt mixture of approximately 50 percent each of clay and silt shall be screened through a 1/4-in. (6 mm) mesh screen. The wearing course shall be mixed in proportions of 1 part sand to 2 parts clay-silt by volume. The wearing course shall be compacted to at least 95 percent maximum density in accordance with ASTM D 698 and shall range from 1 to 1-1/2 in. (25 to 38 mm) in thickness.
4. Drainage Filter Course: The drainage filter course shall consist of a well-graded aggregate course encased in a geotextile material and laid in such a manner to allow water to freely drain from the playing surfaces. The geotextile material shall be a woven or non-woven filter material with a minimum permeability of 0.008 in./sec (0.02 cm/sec). The material shall be resistant to mildew, ridding, insects, rodents, and chemicals normally encountered in a subsurface drainage system.

- #### C. Bituminous Concrete Playing Surfaces shall consist of a base course, prime coat, bituminous leveling course, tack coat, surface course, color coating and, where required, a drainage filter course, all constructed on a prepared subgrade. The stabilized-aggregate base course shall be compacted at optimum moisture to at least 95 percent maximum density in accordance with ASTM D 698. Marshall stability shall not be less than 500 pounds (190 kg) and the flow shall not be greater than 20/100 in. (12.7 mm). The bituminous mixture shall be compacted until the voids in the total mix are reduced to less than 4.0 percent by volume.



1. Thickness of Courses: Base course shall be 4 in. (400 mm) thick after compaction. Leveling course shall be 1-1/2 in. (38 mm) thick after compaction unless directed otherwise. Surface course shall be 1 in. (100 mm) thick after Compaction.
2. Color Coating and Marking Paint: After curing of the bituminous surface course, the entire playing surface shall be covered with a color coat as required.

D. Portland Cement Concrete Playing Surfaces:

1. Aggregate: The nominal aggregate size shall be 1-1/2 in. (38 mm) to No. 4 sieve size and shall conform to ASTM C 33.
2. Portland Cement: The cement shall conform to ASTM C 150, Type IA or IIA; or ASTM C 595, Type IP-A.
3. Thickness: Horizontal Portland cement concrete playing surfaces shall consist of concrete slabs 4 inches thick.

E. Maintenance of Sand-Clay Surfaces: Prior to final acceptance, the Contractor shall make one application of 3/4 lb/sq yd (0.4 kg/sq m) of calcium chloride to the sand-clay surface of the entire playing area.

F. Portable Outdoor Bleachers:

1. Bleachers shall be designed to support a uniformly distributed live load of 100 lb/sq ft (490 kg/sq m) of gross horizontal projection and a horizontal wind load of 30 lbs/sq ft (150 kg/sq ft) of gross vertical projection. All seat and foot plank members shall be designed to support not less than 120 lb/lin ft (150 kg/m).
2. Wood Seating and Walk Boards shall be preservative-treated and painted.

G. Steel Basketball Poles: Minimum diameter 3-1/2 in. (88 mm); galvanized pipe.

H. Running Track: Gravel and cinders over stone base; compaction to 95 percent of maximum density in accordance with ASTM D 698. One hundred percent by weight of the gravel and cinders shall pass the 3/4-in. (19 mm) screen, and 90 percent of the gravel and cinders shall be retained on the No. 4 screen.

1.3 EXECUTION (Not Used)

END OF SECTION 11 68 23 13



Task	Specification	Specification Description
11 82 26 00	11 21 63 00	Food Service Equipment
11 98 16 00	08 34 63 13a	Detention Furniture



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SECTION 12 01 60 00 - FIXED AUDIENCE SEATING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for fixed audience seating. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes fixed audience seating with the following:
 - a. Standard, Beam, and Pedestal mounting.
 - b. Upholstered chairs, Molded-plastic chairs and Molded-plastic chairs with upholstered inserts.
 - c. Self-rising seat mechanism.
 - d. Power and data service to individual seats.

C. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:
 - a. Certificates for Credit MR 7: Chain-of-custody certificates certifying that wood and wood-based materials comply with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.
 - 1) Include statement indicating costs for each certified wood product.
 - b. Product Data for Credit EQ 4.4: For each composite wood product, documentation indicating that product contains no urea formaldehyde.
3. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - a. Seating Layout: Show seating layout, aisle widths, row-lettering and chair-numbering scheme, chair widths, and chair spacing in each row.
 - b. Accessories: Show accessories, including locations of left- and right-hand tablet arms, electrical devices, accessibility provisions, and attachments to other work.
 - c. Wiring Diagrams: For power, signal, and control wiring.
4. Samples: For each seating component and for each color and texture required.
5. Product Certificates: For each type of flame-retardant treatment of fabric, from manufacturer.
6. Maintenance Data.
7. Warranty: Sample of special warranty.

D. Quality Assurance

1. Source Limitations: Obtain fabric of a single dye lot for each color and pattern of fabric required.
2. Forest Certification: Fabricate products with wood components produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
3. Fire-Test-Response Characteristics of Upholstered Chairs:
 - a. Fabric: Class 1 according to DOC CS 191 and 16 CFR 1610.61, tested according to California Technical Bulletin 117.
 - b. Padding: Comply with California Technical Bulletin 117.
 - c. Full-Scale Fire Test: Comply with California Technical Bulletin 133.
4. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
5. Preinstallation Conference: Conduct conference at Project site.

E. Warranty



1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fixed audience seating that fail in materials or workmanship within specified warranty period.
 - a. Failures include, but are not limited to, the following:
 - 1) Structural failures including standards, beams, and pedestals.
 - 2) Faulty operation of self-rising seat mechanism.
 - 3) Faulty operation of electrical components.
 - 4) Wear and deterioration of fabric and stitching beyond normal use.
 - 5) Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
 - b. Warranty Periods: As follows, from date of Final Completion.
 - 1) Structural: Five years **OR** 10 years **OR** Lifetime, **as directed**.
 - 2) Operating Mechanisms: Three years **OR** Five years **OR** Lifetime, **as directed**.
 - 3) Electrical Components: Three **OR** Five, **as directed**, years.
 - 4) Plastic, Wood, and Paint Components: Two **OR** Three **OR** Five, **as directed**, years.

1.2 PRODUCTS

A. Materials And Finishes

1. Steel: ASTM A 36/A 36M plates, shapes, and bars; ASTM A 513 mechanical tubing; ASTM A 1008/A 1008M cold-rolled sheet; and ASTM A 1011 hot-rolled sheet and strip.
2. Cast Iron: ASTM A 48/A 48M, Class 25 (Class 175), gray iron castings free of blow holes and hot checks with parting lines ground smooth.
3. Cast Aluminum: ASTM B 85 aluminum-alloy die castings.
4. Metal Finish: Finish exposed metal parts with manufacturer's standard polyurethane **OR** baked-on **OR** minimum 1.5-mil- (0.04-mm-) thick, polyester baked-on powder **OR** minimum 1.5-mil- (0.04-mm-) thick, epoxy baked-on powder, **as directed**, coating.
 - a. Color: As selected from manufacturer's full range.
5. Medium-Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.
6. Concealed Plywood: HPVA HP-1 hardwood plywood, made with adhesive containing no urea formaldehyde, or DOC PS 1 softwood plywood, as standard with manufacturer.
7. Exposed Plywood: HPVA HP-1, Face Grade A, hardwood veneer core with color-matched hardwood-veneer faces, made with adhesive containing no urea formaldehyde.
8. Hardwood Lumber and Veneer Faces: American black walnut **OR** Red oak **OR** Teak **OR** Birch **OR** Cherry **OR** Maple, **as directed**, selected to be free of visible defects.
 - a. Stain and Finish: As selected from manufacturer's full range.
9. Plastic Laminate: NEMA LD 3, Grade VGS for vertical surfaces and Grade HGS for horizontal surfaces.
 - a. Color and Pattern: As selected from manufacturer's full range.
10. Fabric: Manufacturer's standard 100 percent nylon **OR** 100 percent polyolefin, **as directed**, with flame-retardant treatment.
 - a. Weight: 12 oz./linear yd. (0.37 kg/linear m) **OR** 16 oz./linear yd. (0.50 kg/linear m) **OR** 18 oz./linear yd. (0.56 kg/linear m) **OR** 20 oz./linear yd. (0.62 kg/linear m), **as directed**.
 - b. Color and Pattern: As selected from manufacturer's full range.
11. Upholstery Padding: Flexible, cellular, molded or slab polyurethane foam.
12. Molded Plastic: High-density polyethylene or polypropylene, blow or injection molded, with smooth or textured surface that is mar and dent resistant.
 - a. Provide with UV inhibitors to retard fading where exposed to sunlight.
 - b. Color and Texture: As selected from manufacturer's full range.

B. Fixed Audience Seating

1. Chair Mounting Standards: Floor **OR** Riser, **as directed**, attached of the following material:



- a. Steel: One-piece heavy-tube or reinforced sheet with welded mounting plate and welded connections for seat pivots, backs, armrests, and end panels.
- b. Cast Iron **OR** Aluminum, **as directed**: One-piece castings with integral mounting points and attachment anchoring points for seat pivots, backs, and armrests.
- c. Molded Plastic: One-piece, solid injection-molded plastic with integral reinforcing ribs and attachment anchoring points for seat pivots, backs, and armrests.
2. Chair Mounting Beam: Steel horizontal beam mounted on floor-attached **OR** riser-attached, **as directed**, steel support pedestals spaced at intervals of 2 to 2-1/2 chair widths.
3. Chair Mounting Pedestal: Floor-attached pedestal, manufacturer's standard jury base with swivel **OR** diffuser pedestal, **as directed**.
4. End Panels:
 - a. Material: Steel **OR** Cast iron with design **OR** Cast aluminum with design **OR** Plastic laminate **OR** Hardwood-veneer plywood **OR** Solid hardwood **OR** Fabric upholstered **OR** Molded plastic, **as directed**.
 - 1) Cast-Metal Design: As selected from manufacturer's full range.
 - b. Decorative Insert: Plastic laminate **OR** Hardwood-veneer plywood **OR** Solid hardwood **OR** Fabric upholstered **OR** Molded plastic **OR** Customized medallion, **as directed**.
 - c. Style: Rectangular **OR** Oval **OR** Teardrop **OR** Tapered **OR** Panel to floor (pew), **as directed**, with square **OR** rounded, **as directed**, corners.
5. Fabric Upholstered Chairs:
 - a. Backs:
 - 1) Padding Thickness: 1-1/4 inches (32 mm) **OR** 2 inches (51 mm) **OR** 3 inches (76 mm), **as directed**.
 - 2) Rear Panel: Steel **OR** Molded plastic **OR** Fabric upholstered with 1/4-inch (6-mm) padding **OR** Plastic laminate **OR** Hardwood-veneer plywood, **as directed**.
 - 3) Top Corners: Square **OR** Rounded, **as directed**.
 - 4) Upholstery Options: Tufting **OR** Decorative stitching, **as directed**.
 - b. Seats: Two part **OR** One part with slip-on upholstered padding **OR** One part, fully upholstered, **as directed**, and as follows:
 - 1) Padding Thickness: Minimum 1-1/2 inches (38 mm) **OR** 3 inches (76 mm) **OR** 4 inches (102 mm), **as directed**, at front and rear edge.
 - 2) Seat Underside: Steel sheet seat pan **OR** Perforated steel sheet seat pan with acoustical insulation **OR** Hardwood-veneer-faced, formed plywood shell **OR** Molded-plastic shell **OR** Fabric upholstered with padding, **as directed**.
6. Plastic Chairs: One-piece **OR** Two-piece, **as directed**, molded plastic and as follows:
 - a. Back: Smooth surface **OR** Textured surface **OR** Formed slats **OR** Smooth surface with upholstered inserts, **as directed**, with square **OR** rounded, **as directed**, top corners.
 - b. Seat: Smooth surface **OR** Textured surface **OR** With simulated slats **OR** Smooth surface with upholstered inserts, **as directed**.
 - c. Upholstered Inserts: Padding and fabric covering over 1/8-inch (3-mm) plywood or fiberboard backing board, recessed 3/16 inch (5 mm) into seat and back, centered, and attached with hidden, vandal-resistant fasteners.
7. Chair Width: Vary chair widths to accommodate sightlines and row lengths **OR** Single width chair in each row, **as directed**, with minimum chair width of 18 inches (457 mm) **OR** 19 inches (483 mm) **OR** 20 inches (508 mm) **OR** 22 inches (559 mm) **OR** 23 inches (584 mm) **OR** 24 inches (610 mm), **as directed**, from center to center of armrests.
8. Back Height: Standard-style **OR** High-style **OR** Planetarium-style, **as directed**, backs, 31 inches (787 mm) **OR** 32-1/2 inches (826 mm) **OR** 35 inches (889 mm) **OR** 38 inches (965 mm) **OR** 40 inches (1016 mm) **OR** 44 inches (1117 mm), **as directed**, high.
9. Back Pitch: Fixed **OR** Variable, hinged (rocker), **as directed**.
10. Chair Seat Hinges: Self-lubricating, compensating type with noiseless self-rising seat mechanism passing ASTM F 851 and with positive internal stops cushioned with rubber or neoprene.
11. Chair Back Hinges: Self-lubricating type with noiseless mechanism that raises back to vertical position when chair is unoccupied.
12. Self-Rising Seat Mechanism: Spring-actuated, three-quarter fold **OR** Spring-actuated, full fold **OR** Gravity-actuated, full fold, **as directed**.



13. Armrests: Plastic **OR** Hardwood **OR** Upholstered **OR** Plastic laminate on medium-density fiberboard **OR** Integral scrolled cast iron, **as directed**, with rounded edges, concealed mounting, and integral cup holder, **as directed**.
14. Aisle Lighting Fixtures: Manufacturer's standard round **OR** rectangular louvered **OR** concealed in armrest, **as directed**, fixtures.
 - a. Bulb: LED **OR** Incandescent, **as directed**.
 - b. Power: 24 **OR** 120, **as directed**, V.
 - c. For low-voltage lighting, provide manufacturer's voltage-reduction device housed in safety enclosure equipped with fuses, terminal blocks, and safety disconnect.
15. Power and Data Service Package: Manufacturer's standard service **OR** Service, **as directed**, to individual seats including terminal devices and wiring with 18 inches (457 mm) of extra length and as follows.
 - a. Power Receptacles: 120 V with wiring and receptacle as specified in Division 22.
 - b. Data Ports: Data port terminal with wiring and receptacle jack as specified in Division 23.
 - c. Location: Manufacturer's standard location **OR** On raceway beneath the seating **OR** In the armrest **OR** Beneath the armrest on front or side of the standard **OR** In back panel of seat in front, **as directed**.
16. Row-Letter and Chair-Number and Donor Plates: Manufacturer's standard.
 - a. Material: Aluminum **OR** Bronze **OR** Stainless steel, **as directed**, with black embossed characters.
 - b. Attachment: Manufacturer's standard method **OR** Adhesive **OR** Minimum of two mechanical fasteners, **as directed**.
17. Tablet Arms: Manufacturer's standard-size **OR** Manufacturer's oversize, **as directed**, fixed **OR** foldaway, **as directed**, tablet arm with plastic-laminate writing surface over medium-density fiberboard or plywood core and with rounded, matching PVC edges.
 - a. Mounting: Right-hand mounted unless otherwise indicated.
 - b. Fold-Away Mechanism: Cast-iron or steel hinge and swivel mechanism that gives positive support in open position and semiautomatic return to stored position below arm block and parallel to chair.
18. Accessible Seating:
 - a. Provide removable **OR** rollaway **OR** swing-away, **as directed**, chairs where wheelchair spaces are indicated.
 - b. Provide chairs without **OR** with retractable **OR** with foldup, **as directed**, arm on aisle side in locations indicated, but not less than 5 percent of aisle seats. Identify these seats with a sign or marker.

C. Fabrication

1. Floor Attachments: Fabricate to conform to floor slope, if any, so that standards and pedestals are plumb and chairs are maintained at same angular relationship to vertical throughout Project.
 2. For beam-mounted chairs in curved patterns, curve the beam to the various radii required for the rows.
 3. Upholstery: Fabricate fabric-covered cushions with molded padding beneath fabric and with fabric covering free of welts, creases, stretch lines, and wrinkles. For each upholstered component, install pile and pattern run in a consistent direction.
 4. Upholstered Chairs: Fabricate as follows:
 - a. Two-Part Upholstered Back: In length required to protect seat in raised position, with padded cushion glued to a curved steel, plywood, or molded-plastic support panel covered with easily replaceable fabric, and with curved rear shell that fully encloses upholstery edges.
 - b. Two-Part Seats: Upper part, an upholstered cushion with molded padding over no fewer than five serpentine springs attached to reinforced steel frame, with weight-distributing and abrasion-resistant sheeting separating padding from springs, and removable for reupholstering without removing seat from chair. Lower part, steel pan reinforced at stress points and completely enclosing hinges and self-rising mechanism.
- OR**



- Two-Part Seats: Upper part, an upholstered cushion with formed padding over a five-ply plywood panel with fabric cover conforming to shape of cushion to conceal inner seat structure and hinge mechanism. Lower part, molded-plastic shell.
- c. One-Part Seats: Double-wall plastic shells fitted with a padded upholstered cushion and covered with easily replaceable fabric **OR** padded and fully upholstered, **as directed**.
 5. Two-Piece, Molded-Plastic Chairs: Fabricate contoured seat and back separately with double-wall, blow-molded plastic. Fabricate back in length required to protect seat in raised position. Reinforce plastic with steel plates at attachment points.
 6. One-Piece, Molded-Plastic Chairs: Provide contoured plastic shell with smoothly rolled edges and reinforcing ribs on underside of shell. Fabricate for attachment of chair to support with self-threading, corrosion-resistant screws.

1.3 EXECUTION

A. Installation

1. Install seating in locations indicated and fastened securely to substrates according to manufacturer's written installation instructions.
 - a. Use installation methods and fasteners that produce fixed audience seating assemblies with individual chairs capable of supporting an evenly distributed 600-lb (272-kg) static load without failure or other conditions that might impair the chair's usefulness.
 - b. Install standards and pedestals plumb.
2. Install seating with chair end standards aligned from first to last row and with backs and seats varied in width **OR** spacing **OR** width and spacing, **as directed**, to optimize sightlines.
3. Install riser-mounted attachments to maintain uniform chair heights above floor.
4. Install chairs in curved rows at a smooth radius.
5. Install seating so moving components operate smoothly and quietly.
6. Install wiring conductors and cables concealed in components of seating and accessible for servicing.

B. Field Quality Control

1. Perform tests and inspections.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
 - b. Tests for Power Receptacles: As specified in Division 22.
 - c. Tests for Data Ports: As specified in Division 23.
2. Prepare test and inspection reports.

C. Adjusting

1. Adjust chair backs so that they are aligned with each other in straight **OR** uniformly curved, **as directed**, rows.
2. Adjust self-rising seat mechanisms so seats in each row are aligned when in upright position.
3. Verify that all components and devices are operating properly.
4. Verify that seating returns to correct at-rest position.
5. Repair minor abrasions and imperfections in finishes with coating that matches factory-applied finish.
6. Replace upholstery fabric damaged during installation.

END OF SECTION 12 01 60 00



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Task	Specification	Specification Description
12 01 60 00	01 22 16 00	No Specification Required



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SECTION 12 21 13 13 - HORIZONTAL LOUVER BLINDS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for horizontal louver blinds. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Horizontal louver blinds with aluminum, wood and polymer slats.
 - b. Motorized blind operators.

C. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: Show fabrication and installation details for horizontal louver blinds and motorized blind operators.
 - a. Wiring Diagrams: Power, system, and control wiring.
3. Samples: For each exposed finish.
4. Product certificates **OR** test reports, **as directed**.
5. Maintenance data.

D. Quality Assurance

1. Fire-Test-Response Characteristics: Provide horizontal louver blinds with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
 - a. Flame-Resistance Ratings: Passes NFPA 701.
2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
3. Product Standard: Provide horizontal louver blinds complying with WCSC A 100.1.

E. Delivery, Storage, And Handling

1. Deliver horizontal louver blinds in factory packages, marked with manufacturer and product name, fire-test-response characteristics, lead-free designation, and location of installation using same designations indicated on Drawings and in a window treatment schedule.

1.2 PRODUCTS

A. Horizontal Louver Blinds, Aluminum Slats

1. Slats: Aluminum; alloy and temper recommended by producer for type of use and finish indicated; with crowned profile and radiused corners.
 - a. Width: 2 inches (51 mm) **OR** 1 inch (25 mm) **OR** 1/2 to 5/8 inch (13 to 16 mm), **as directed**.
 - b. Finish: One color **OR** One color each side **OR** As indicated, **as directed**.
 - 1) Ionized Coating: Antistatic, dust-repellent, baked polyester finish.
 - 2) Reflective Coating: Manufacturer's special coating enhancing the reflection of solar energy on the outside-facing slat surface.
 - c. Perforated Slats: Openness factor of 6 to 7 percent.



2. Headrail: Formed steel or extruded aluminum; long edges returned or rolled; fully enclosing operating mechanisms on three sides and end plugs.
 3. Bottom Rail: Formed-steel or extruded-aluminum tube, with plastic or metal capped ends.
 4. Maximum Light-Blocking Blinds: Designed for eliminating all visible light gaps if slats are tilted closed and with minimal-sized rout holes for ladders hidden and placed near back edge for maximum slat overlap; with headrail and bottom rail extended and formed for light-tight joints between rail and adjacent slats or construction.
 - a. Finish: Match color, texture, pattern, and gloss of slats **OR** Color, texture, pattern, and gloss differing from slats as indicated by manufacturer's designations **OR** Color, texture, pattern, and gloss differing from slats, matching samples **OR** Color texture, pattern, and gloss differing from slats as selected from manufacturer's full range, **as directed**.
 5. Ladders: Evenly spaced to prevent long-term slat sag.
 - a. For Blinds with Nominal Slat Width 1 Inch (25 mm) or Less: Braided string.
 - b. For Blinds with Nominal Slat Width 1 Inch (25 mm) **OR** 2 Inches (51 mm)\, **as directed**, or More: Braided string **OR** Manufacturer's standard-width reinforced vinyl tapes **OR** Manufacturer's standard-width cloth tapes, **as directed**.
 - 1) Tape Color, Texture, and Pattern: Color, texture, and pattern as indicated by manufacturer's designations **OR** Color, texture, and pattern matching samples **OR** Color, texture, and pattern as selected from manufacturer's full range, **as directed**.
 6. Lift-and-Tilt Control: Motorized operator.
 7. Lift Cords: Manufacturer's standard.
 8. Tilt Control: Enclosed worm-gear mechanism, slip clutch or detachable wand preventing overrotation, and linkage rod.
 9. Lift Operation: Manual.
 10. Valance: Two slats **OR** PVC strip **OR** Manufacturer's standard, **as directed**.
 11. Mounting: Wall mounting **OR** Ceiling mounting **OR** End mounting **OR** Wall extension brackets **OR** As indicated, **as directed**.
 12. Hold-Down Brackets and Hooks or Pins: Manufacturer's standard.
 13. Side Channels and Perimeter Light Gap Seals: Manufacturer's standard.
 14. Colors, Textures, Patterns, and Gloss: As selected from manufacturer's full range.
- B. Horizontal Louver Blinds, Wood Slats
1. Slats: Hardwood, North American **OR** basswood **OR** poplar **OR** ramin, **as directed**, species, flame-retardant treated; with flat profile and radiused corners and beaded edges **OR** and double beaded edges, **as directed**.
 - a. Width: 1 inch (25 mm) **OR** 1-3/8 inch (35 mm) **OR** 2 inches (51 mm) **OR** 2-3/8-inch (60-mm), **as directed**.
 - b. Finish: Manufacturer's standard colors as indicated, for striped blind with pattern as indicated on Drawings.
 2. Headrail: Formed steel or extruded aluminum; long edges returned or rolled; fully enclosing operating mechanisms on three sides and ends.
 3. Bottom Rail: Hardwood matching slats.
 - a. Finish Color Characteristics: Match color, texture, pattern, and gloss of slats **OR** Match color, texture, pattern, and gloss of valance **OR** Color, texture, pattern, and gloss differing from slats as indicated by manufacturer's designations **OR** Color, texture, pattern, and gloss differing from slats, matching samples **OR** Color texture, pattern, and gloss differing from slats as selected from manufacturer's full range, **as directed**.
 4. Maximum Light-Blocking Blinds: Designed for eliminating all visible light gaps if slats are tilted closed and with minimal-sized rout holes for ladders hidden and placed near back edge for maximum slat overlap; with headrail and bottom rail extended and formed for light-tight joints between rail and adjacent slats or construction.
 5. Ladders: Braided string **OR** Manufacturer's standard-width cloth tapes, **as directed**. Evenly spaced to prevent long-term louver sag.



- a. Tape Color, Texture, and Pattern: Color, texture, and pattern as indicated by manufacturer's designations **OR** Color, texture, and pattern matching samples **OR** Color, texture, and pattern as selected from manufacturer's full range, **as directed**.
 6. Tilt Control: Enclosed worm gear mechanism, slip clutch or detachable wand preventing overrotation, and linkage rod.
 7. Lift Operation: Manual.
 8. Lift Operation: Motorized operator.
 9. Valance: Manufacturer's standard.
 10. Cornice: as directed by the Owner.
 11. Mounting: Wall mounting **OR** Ceiling mounting **OR** End mounting **OR** Wall extension brackets **OR** As indicated, **as directed**.
 12. Hold-Down Brackets and Hooks or Pins: Manufacturer's standard, as indicated.
 13. Colors, Textures, Patterns, and Gloss: As selected from manufacturer's full range.
- C. Horizontal Louver Blinds, Polymer Slats
1. Slats: Lead-free, UV-stabilized, integrally colored, opaque, permanently flexible, extruded PVC **OR** polymer/wood alloy, **as directed**, that will not crack or yellow; antistatic, dust-repellent treated; with crowned **OR** manufacturer's standard, **as directed**, profile.
 - a. Width: 2 inches (51 mm) **OR** 2-1/2 inches (64 mm), **as directed**.
 - 1) Spacing: Manufacturer's standard.
 - b. Finish: Wood-tone **OR** Painted, **as directed**, color as indicated.
 - c. Finish: Two colors **OR** textures **OR** patterns, **as directed**, as indicated, one per side of slat.
 2. Headrail: Formed steel or extruded aluminum; long edges returned or rolled; fully enclosing operating mechanisms on three sides and ends.
 3. Bottom Rail: Manufacturer's standard **OR** Formed-steel or extruded-aluminum tube, with plastic or metal capped ends **OR** Hardwood matching slats and trapezoid-shaped bottom angled for minimizing light gaps, **as directed**.
 4. Ladders: Braided string **OR** Manufacturer's standard-width cloth tapes, **as directed**. Evenly spaced to prevent long-term slat sag.
 - a. Tape Color, Texture, and Pattern: Color, texture, and pattern as selected from manufacturer's full range.
 5. Tilt Control: Enclosed worm-gear mechanism and linkage rod.
 6. Lift Operation: Manual.
 7. Lift Operation: Motorized operator.
 8. Valance: Manufacturer's standard.
 9. Mounting: Wall mounting **OR** Ceiling mounting **OR** End mounting **OR** Wall extension brackets **OR** As indicated, **as directed**.
 10. Hold-Down Brackets and Hooks or Pins: Manufacturer's standard, as indicated.
 11. Colors, Textures, Patterns, and Gloss: As selected from manufacturer's full range.
- D. Horizontal Louver Blind Fabrication
1. Concealed Components: Noncorrodible or corrosion-resistant-coated materials.
 - a. Lift-and-Tilt Mechanisms: With permanently lubricated moving parts.
 2. Unit Sizes: Obtain units fabricated in sizes to fill window and other openings as follows:
 - a. Blind Units Installed between (inside) Jamb: Width equal to 1/4 inch (6 mm) per side or 1/2 inch (13 mm) total, plus or minus 1/8 inch (3.1 mm), less than jamb-to-jamb dimension of opening in which each blind is installed. Length equal to 1/4 inch (6 mm), plus or minus 1/8 inch (3.1 mm), less than head-to-sill dimension of opening in which each blind is installed.
 - b. Blind Units Installed outside Jamb: Width and length as indicated, with terminations between blinds of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.
 3. Installation Brackets: Designed for easy removal and reinstallation of blind, for supporting headrail, valance, and operating hardware, and for hardware position and blind mounting method indicated.



4. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal noncorrosive to blind hardware and adjoining construction; type designed for securing to supporting substrate; and supporting blinds and accessories under conditions of normal use.
5. Color-Coated Finish:
 - a. Metal: For components exposed to view, apply manufacturer's standard baked finish.
 - b. Wood: Apply manufacturer's standard opaque **OR** transparent, **as directed**, factory-applied finish.
6. Component Color: Provide rails, cords, ladders, and exposed-to-view metal, wood, and plastic matching or coordinating with slat color, unless otherwise indicated.

E. Motorized Horizontal Louver Blind Operators

1. General: Provide factory-assembled blind operation systems designed for blind type, size, weight, construction, use, and operation frequency indicated, with lift **OR** tilt **OR** lift-and-tilt, **as directed**, functions. Provide operation systems of size and capacity and with features, characteristics, and accessories suitable for Project conditions and recommended by blind manufacturer, complete with electric motors and factory-prewired motor controls, remote-control stations, remote-control devices, power disconnect switches, enclosures protecting controls and all operating parts, headrail, and accessories required for reliable operation without malfunction. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with building electrical system.
2. Comply with NFPA 70.
3. Control Equipment: Comply with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6 with NFPA 70, Class 2 control circuit, maximum 24-V ac or dc.
4. Electric Motors: UL-approved or -recognized, totally enclosed, insulated motor, complying with NEMA MG 1, with thermal-overload protection and internal limit switches; sized by blind manufacturer to start and operate size and weight of blind considering service factor or Project's service conditions without exceeding nameplate ratings.
 - a. Service Factor: According to NEMA MG 1, unless otherwise indicated.
 - b. Motor Characteristics: Single phase, 24 **OR** 110 **OR** 220, **as directed**, V, 60 Hz.
 - c. Motor Mounting: Within manufacturer's standard headrail enclosure.
5. Remote Controls: Electric controls with NEMA ICS 6, Type 1 enclosure for surface **OR** recessed or flush **OR** within headrail, **as directed**, mounting. Provide the following devices for remote-control activation of blinds:
 - a. Control Stations: Keyed, maintained **OR** momentary, **as directed**,-contact, three-position, switch-operated control station with open, close, and off functions. Provide two keys per station.
 - b. Control Stations: Maintained **OR** Momentary, **as directed**,-contact, three-position, toggle **OR** rocker, **as directed**,-style, wall-switch-operated control station with open, close, and center off functions.
 - 1) Color: Ivory **OR** White **OR** As indicated, **as directed**.
6. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop blind at fully raised and fully lowered positions.
7. Operating Features: as directed by the Owner.
8. Accessories:
 - a. Solar Power Unit: For use with control system indicated.

1.3 EXECUTION

A. Installation

1. Install horizontal louver blinds level and plumb and aligned with adjacent units according to manufacturer's written instructions, and located so exterior slat edges in any position are not closer than 1 inch (25 mm) **OR** 2 inches (51 mm), **as directed**, to interior face of glass. Install intermediate support as required to prevent deflection in headrail. Allow clearances between adjacent blinds and for operating glazed opening's operation hardware if any.



2. Flush Mounted: Install horizontal louver blinds with slat edges flush with finish face of opening if slats are tilted open.
3. Jamb Mounted: Install headrail flush with face of opening jamb and head.
4. Head Mounted: Install headrail on face of opening head.
5. Recessed: Install headrail concealed within blind pocket.
6. Connections: Connect motorized operators to building electrical system.
7. Adjust horizontal louver blinds to operate smoothly, easily, safely, and free of binding or malfunction throughout entire operational range.
8. Clean horizontal louver blind surfaces after installation, according to manufacturer's written instructions.

END OF SECTION 12 21 13 13



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SECTION 12 21 13 13a - VERTICAL LOUVER BLINDS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for vertical louver blinds. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Vertical louver blinds, aluminum vanes, PVC vanes, PVC vanes with fabric vane insert and fabric vanes.
 - b. Motorized blind operators.

C. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: Show fabrication and installation details for vertical louver blinds and motorized operators.
 - a. Wiring Diagrams: Power, system, and control wiring.
3. Samples: For each exposed finish.
4. Product certificates **OR** test reports, **as directed**.
5. Maintenance data.

D. Quality Assurance

1. Fire-Test-Response Characteristics: Provide vertical louver blinds with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
 - a. Flame-Resistance Ratings: Passes NFPA 701.
2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
3. Product Standard: Provide vertical louver blinds complying with WCSC A 100.1.

E. Delivery, Storage, And Handling

1. Deliver vertical louver blinds in factory packages, marked with manufacturer and product name, fire-test-response characteristics, lead-free designation, and location of installation using same designations indicated on Drawings and in a window treatment schedule.

1.2 PRODUCTS

A. Vertical Louver Blinds, Aluminum Vanes

1. Rail System: Headrail **OR** Dual system with headrail and bottom rail, **as directed**.
 - a. Rails: Extruded aluminum **OR** Formed steel **OR** Manufacturer's standard, **as directed**; long edges returned or rolled; channel-shaped, enclosing operating mechanisms.
 - 1) Color: Custom color **OR** As selected from manufacturer's standard color range, **as directed**.
 - 2) Anodized aluminum, clear **OR** color, **as directed**, anodized.



2. Vanes: Aluminum, alloy, and temper recommended by producer for type of use and finish indicated; with crowned profile and not less than 3/8-inch (9.5-mm) overlap when vanes are rotated fully closed.
 - a. Nominal Vane Width: 3-1/2 inches (89 mm) wide.
 - b. Vane Finish: One color as indicated, **OR** Two colors as indicated, one per side of slat, **as directed**.
3. Vane Directional Control: Manual **OR** Motorized operator, **as directed**.
4. Traversing Control: Manual **OR** Motorized operator, **as directed**.
5. Draw and Stack Position: One way, controls and stack left **OR** One way, controls and stack right **OR** One way, controls left and stack opposite **OR** One way, controls right and stack opposite **OR** Center split, controls left **OR** Center split, controls right **OR** Center stack, controls left **OR** Center stack, controls right **OR** Off center, controls left **OR** Off center, controls right **OR** As indicated on Drawings **OR** As indicated in a window treatment schedule, **as directed**.
6. Cord-Tensioner Mounting: Wall **OR** Floor **OR** Sill **OR** Baseboard **OR** As indicated, **as directed**.
7. Valance: One **OR** Two-tiered, **as directed**, vane insert; with dust cover.
 - a. Finish Color Characteristics: Match color, texture, pattern, and gloss of vanes **OR** Color, texture, pattern, and gloss differing from vanes as indicated by manufacturer's designations **OR** Color, texture, pattern, and gloss differing from vanes matching samples **OR** Color texture, pattern, and gloss differing from vanes as selected from manufacturer's full range, **as directed**.
8. Louver Bottom: Connecting or spacing chains.
9. Mounting: Wall mounting **OR** Ceiling mounting **OR** End mounting **OR** Wall extension brackets **OR** As indicated, **as directed**.
10. Stack Release: Permitting stacked vanes to be moved away from stacking position for total access to glazed opening.
11. Colors, Textures, Patterns, and Gloss: As selected from manufacturer's full range.

B. Vertical Louver Blinds, PVC Vanes

1. Rail System: Headrail **OR** Dual system with headrail and bottom rail, **as directed**.
 - a. Rails: Extruded aluminum **OR** Formed steel **OR** Manufacturer's standard, **as directed**; long edges returned or rolled; channel-shaped, enclosing operating mechanisms.
 - 1) Color: Custom color **OR** As selected from manufacturer's standard color range, **as directed**.
 - 2) Anodized aluminum, clear **OR** color, **as directed**, anodized.
2. Vanes: Lead-free, UV-stabilized, integrally colored, opaque, permanently flexible, extruded PVC that will not crack or yellow; with flat **OR** crowned **OR** ribbed, **as directed**, profile and not less than 3/8-inch (9.5-mm) overlap when vanes are rotated fully closed.
 - a. Nominal Vane Width: 2 inches (51 mm) **OR** 3-1/2 inches (89 mm) **OR** 4 inches (100 mm) **OR** 5 inches (125 mm), **as directed**.
 - b. Perforated Vanes: Openness factor of 3 **OR** 6 **OR** 8 **OR** 10 **OR** 12, **as directed**, percent.
3. Vane Directional Control: Manual, **OR** Motorized operator, **as directed**.
4. Traversing Control: Manual **OR** Motorized operator, **as directed**.
5. Draw and Stack Position: One way, controls and stack left **OR** One way, controls and stack right **OR** One way, controls left and stack opposite **OR** One way, controls right and stack opposite **OR** Center split, controls left **OR** Center split, controls right **OR** Center stack, controls left **OR** Center stack, controls right **OR** Off center, controls left **OR** Off center, controls right **OR** As indicated on Drawings **OR** As indicated, **as directed**.
6. Cord-Tensioner Mounting: Wall **OR** Floor **OR** Sill **OR** Baseboard **OR** As indicated, **as directed**.
7. Valance: One **OR** Two-tiered, **as directed**, vane insert; with dust cover.
 - a. Finish Color Characteristics: Match color, texture, pattern, and gloss of vanes **OR** Color, texture, pattern, and gloss differing from vanes as indicated by manufacturer's designations **OR** Color, texture, pattern, and gloss differing from vanes matching samples **OR** Color texture, pattern, and gloss differing from vanes as selected from manufacturer's full range, **as directed**.
8. Louver Bottom: Connecting or spacing chains.



9. Mounting: Wall mounting **OR** Ceiling mounting **OR** End mounting **OR** Wall extension brackets **OR** As indicated, **as directed**.
 10. Stack Release: Permitting stacked vanes to be moved away from stacking position for total access to glazed opening.
 11. Colors, Textures, Patterns, and Gloss: As selected from manufacturer's full range.
- C. Vertical Louver Blinds, PVC Vanes With Fabric Vane Inserts
1. Rail System: Headrail **OR** Dual system with headrail and bottom rail, **as directed**.
 - a. Rails: Extruded aluminum **OR** Formed steel **OR** Manufacturer's standard, **as directed**; long edges returned or rolled; channel-shaped, enclosing operating mechanisms.
 - 1) Color: Custom color **OR** As selected from manufacturer's standard color range, **as directed**.
 - 2) Anodized aluminum, clear **OR** color, **as directed**, anodized.
 2. Vanes: Lead-free, UV-stabilized, permanently flexible, extruded PVC that will not crack or yellow; with not less than 3/8-inch (9.5-mm) overlap when vanes are rotated fully closed. Provide integrally colored, opaque vane with clear grooves for holding fabric insert.
 - a. Nominal Vane Width: 3-1/2 inches (89 mm).
 - b. Fabric Insert: Manufacturer's standard; stain and fade resistant.
 3. Vane Directional Control: Manual **OR** Motorized operator, **as directed**.
 4. Traversing Control: Manual **OR** Motorized operator, **as directed**.
 5. Draw and Stack Position: One way, controls and stack left **OR** One way, controls and stack right **OR** One way, controls left and stack opposite **OR** One way, controls right and stack opposite **OR** Center split, controls left **OR** Center split, controls right **OR** Center stack, controls left **OR** Center stack, controls right **OR** Off center, controls left **OR** Off center, controls right **OR** As indicated, **as directed**.
 6. Cord-Tensioner Mounting: Wall **OR** Floor **OR** Sill **OR** Baseboard **OR** As indicated on Drawings, **as directed**.
 7. Valance: One **OR** Two-tiered, **as directed**, vane insert; with dust cover. Fabric vane insert matching vanes.
 8. Louver Bottom: Connecting or spacing chains.
 9. Mounting: Wall mounting **OR** Ceiling mounting **OR** End mounting **OR** Wall extension brackets **OR** As indicated, **as directed**.
 10. Stack Release: Permitting stacked vanes to be moved away from stacking position for total access to glazed opening.
 11. Fabric Colors, Textures, and Patterns: As selected from manufacturer's full range.
- D. Vertical Louver Blinds, Fabric Vanes
1. Rail System: Headrail **OR** Dual system with headrail and bottom rail, **as directed**.
 - a. Rails: Extruded aluminum **OR** Formed steel **OR** Manufacturer's standard, **as directed**; long edges returned or rolled; channel-shaped, enclosing operating mechanisms.
 - 1) Color: Custom color **OR** As selected from manufacturer's standard color range, **as directed**.
 - 2) Anodized aluminum, clear **OR** color, **as directed** anodized.
 2. Vanes: Manufacturer's standard **OR** PVC-coated fiberglass mesh **OR** PVC-coated polyester mesh, **as directed**, freehanging fabric with hemmed, nonraveling edges; stain and fade resistant; with not less than 3/8-inch (9.5-mm) overlap when vanes are rotated fully closed.
 - a. Nominal Vane Width: 2 inches (51 mm) **OR** 3-1/2 inches (89 mm) **OR** 5 inches (125 mm), **as directed**.
 3. Vane Directional Control: Manual.
 4. Vane Directional Control: Motorized operator.
 5. Traversing Control: Manual.
 6. Traversing Control: Motorized operator.
 7. Draw and Stack Position: One way, controls and stack left **OR** One way, controls and stack right **OR** One way, controls left and stack opposite **OR** One way, controls right and stack opposite **OR** Center split, controls left **OR** Center split, controls right **OR** Center stack, controls left **OR** Center



stack, controls right **OR** Off center, controls left **OR** Off center, controls right **OR** As indicated, **as directed**.

8. Cord-Tensioner Mounting: Wall **OR** Floor **OR** Sill **OR** Baseboard **OR** As indicated, **as directed**.
9. Valance: One **OR** Two-tiered, **as directed**, vane insert; with dust cover. Fabric vane insert matching vanes.
10. Louver Bottom: Connecting or spacing chains **OR** Weights, **as directed**.
11. Mounting: Wall mounting **OR** Ceiling mounting **OR** End mounting **OR** Wall extension brackets **OR** As indicated, **as directed**.
12. Stack Release: Permitting stacked vanes to be moved away from stacking position for total access to glazed opening.
13. Fabric Colors, Textures, and Patterns: As selected from manufacturer's full range.

E. Vertical Louver Blind Fabrication

1. Product Description: Vertical louver blind consisting of equally spaced, synchronized vanes and rail system with self-aligning carrier mechanisms, carriers, traverse and vane directional mechanisms and controls, and installation hardware.
2. Concealed Components: Noncorrodible or corrosion-resistant-coated materials.
 - a. Louver Directional and Traversing Control Mechanisms: With permanently lubricated moving parts.
3. Unit Sizes: Obtain units fabricated in sizes to fill window and other openings as follows:
 - a. Blind Units Installed between (inside) Jamb: Width equal to 1/4 inch (6 mm) per side or 1/2 inch (13 mm) total less than jamb-to-jamb dimension of opening in which each blind is installed. Length equal to 1/4 inch (6 mm), plus or minus 1/8 inch (3.1 mm), less than head-to-sill dimension of opening in which each blind is installed.
 - b. Blind Units Installed outside Jamb: Width and length as indicated, with terminations between blinds of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.
4. Installation Brackets: Designed for easy removal and reinstallation of blind, for supporting headrail, valance, and operating hardware, and for hardware position and blind mounting method indicated.
5. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal noncorrosive to blind hardware and adjoining construction; type designed for securing to supporting substrate; and supporting blinds and accessories under conditions of normal use.
6. Color-Coated Finish: For metal components exposed to view, unless anodized or plated finish is indicated. Apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.
7. Component Color: Provide cords and exposed-to-view metal and plastic matching or coordinating with vane color, unless otherwise indicated.

F. Motorized Vertical Louver Blind Operators

1. General: Provide factory-assembled blind operation systems designed for blind type, size, weight, construction, use, and operation frequency indicated, with traverse **OR** rotation **OR** traverse and rotation, **as directed** functions. Provide operation systems of size and capacity and with features, characteristics, and accessories suitable for Project conditions and recommended by blind manufacturer, complete with electric motors and factory-prewired motor controls, remote-control stations, remote-control devices, power disconnect switches, enclosures protecting controls and all operating parts, headrail, and accessories required for reliable operation without malfunction. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with the building electrical system.
2. Comply with NFPA 70.
3. Control Equipment: Comply with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6 with NFPA 70, Class 2 control circuit, maximum 24-V ac or dc.
4. Electric Motors: UL-approved or -recognized, totally enclosed, insulated motor, complying with NEMA MG 1, with thermal-overload protection and internal limit switches; sized by blind



- manufacturer to start and operate size and weight of blind considering service factor or Project's service conditions without exceeding nameplate ratings.
- a. Service Factor: According to NEMA MG 1, unless otherwise indicated.
 - b. Motor Characteristics: Single phase, 24 **OR** 110 **OR** 220, **as directed**, V, 60 Hz.
 - c. Motor Mounting: On top of **OR** Behind, **as directed**, track, left **OR** right, **as directed**, side of headrail.
 - d. Motor Mounting: As indicated.
5. Remote Controls: Electric controls with NEMA ICS 6, Type 1 enclosure for surface **OR** recessed or flush **OR** within headrail, **as directed**, mounting. Provide the following devices for remote-control activation of blinds:
- a. Control Stations: Keyed, maintained **OR** momentary, **as directed**,-contact, three-position, switch-operated control station with open, close, and off functions. Provide two keys per station.
 - b. Control Stations: Maintained **OR** Momentary, **as directed**,-contact, three-position, toggle **OR** rocker, **as directed**,-style, wall-switch-operated control station with open, close, and center off functions.
 - 1) Color: Ivory **OR** White **OR** As indicated, **as directed**.
6. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop blind at fully traversed, rotated closed and fully retracted, rotated open positions.
7. Operating Features: **<Insert feature.>**
8. Accessories:
- a. Solar Power Unit: For use with control system indicated.

1.3 EXECUTION

A. Installation

1. Install vertical louver blinds level and plumb and aligned with adjacent units according to manufacturer's written instructions, and located so exterior vane edges in any position are not closer than 2 inches (51 mm) to interior face of glass. Install intermediate support as required to prevent deflection in headrail. Allow clearances between adjacent blinds and for operating glazed opening's operation hardware, if any.
2. Flush Mounted: Install vertical louver blinds with vane edges flush with finish face of opening when vanes are tilted open.
3. Jamb Mounted: Install headrail flush with face of opening jamb and head.
4. Head Mounted: Install headrail on face of opening head.
5. Recessed: Install headrail concealed within blind pocket.
6. Connections: Connect motorized operators to building electrical system.
7. Adjust vertical louver blinds to operate smoothly, easily, safely and free of binding or malfunction throughout entire operational range.
8. Clean vertical louver blind surfaces after installation, according to manufacturer's written instructions.

END OF SECTION 12 21 13 13a



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Task	Specification	Specification Description
12 21 13 33	12 21 13 13	Horizontal Louver Blinds
12 21 13 33	12 21 13 13a	Vertical Louver Blinds
12 21 16 13	12 21 13 13	Horizontal Louver Blinds
12 21 16 13	12 21 13 13a	Vertical Louver Blinds
12 21 16 33	12 21 13 13	Horizontal Louver Blinds
12 21 16 33	12 21 13 13a	Vertical Louver Blinds



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SECTION 12 22 13 00 - DRAPERIES AND TRACKS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for draperies and tracks. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes draperies and drapery tracks.

C. Submittals

1. Product Data: For the following:
 - a. Tracks: Include maximum weights of draperies that can be supported.
 - 1) Motorized Tracks: Indicate motor weights, motor-mounting requirements, and electrical requirements.
 - b. Fabrics and textile treatments.
2. Shop Drawings: For tracks. Show installation and anchorage details, locations of components and controls, and field measurements.
 - a. Draperies: Show sizes, locations, and details of installation.
3. Coordination Drawings: For track installation; reflected ceiling plans drawn to scale and coordinating track installation with openings and ceiling-mounted items.
4. Samples: For each drapery and for each fabric color and texture required.
5. Product Schedule: Use same designations indicated on Drawings.
6. Product Certificates: For each fabric treated with flame retardant, signed by fabric supplier.
7. Maintenance data.

D. Quality Assurance

1. Installer Qualifications: For draperies and tracks, fabricator of draperies.
2. Source Limitations: For draperies, obtain each color and pattern of fabric and trim from one dye lot.
3. Fire-Test-Response Characteristics: For fabrics treated with fire retardants, provide products that pass NFPA 701 as determined by testing of fabrics that were treated using treatment-application method intended for use for this Project by a testing and inspecting agency acceptable to authorities having jurisdiction.
4. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
5. Corded Window Covering Product Standard: Provide drapery tracks operated by pull cords complying with ANSI A100.1.

1.2 PRODUCTS

A. Drapery Tracks

1. Manually Operated Track:
 - a. Construction: Extruded aluminum, slotted for mounting at interval of not more than 24 inches (610 mm) o.c., and bendable to radii indicated.
 - 1) Lengths and Configurations: As directed.
 - 2) Support Capability: Weight of drapery indicated **OR** 30 lb (14 kg) **OR** 45 lb (20 kg) **OR** 60 lb (27 kg) **OR** 80 lb (36 kg) **OR** 140 lb (64 kg) **OR** 210 lb (95 kg), **as directed**, mounted on track length indicated.



- 3) Finish: Manufacturer's standard **OR** White baked enamel **OR** Clear anodic coating, **as directed**.
 - b. Mounting Brackets: Aluminum, of type suitable for fastening track to surface indicated and designed to support weight of track assembly and drapery plus force applied to operate track.
 - 1) Mounting Surface: As indicated on Drawings **OR** Wall **OR** Ceiling **OR** Drapery pocket, **as directed**.
 - c. Installation Fasteners: Sized to support track assembly and drapery, and fabricated from metal compatible with track, brackets, and supporting construction. Provide two fasteners to fasten each bracket to supporting construction.
 - d. Operation: Baton **OR** Cord **OR** Cord tension pulley, **as directed**.
 - 1) Pulley Mounting Location: Wall **OR** Baseboard **OR** Floor, **as directed**.
 - 2) Draw: One way, stack as indicated on Drawings **OR** One way, stack left **OR** One way, stack right **OR** Two way, center opening, **as directed**.
 - 3) Operating Hardware Location: On stack side **OR** Left **OR** Right **OR** As indicated on Drawings, **as directed**.
 - e. Carriers: Rollers **OR** Rollers with hooks **OR** Rollers with snaps **OR** Coordinate with drapery headings indicated, **as directed**.
 - 1) Master Carriers: Butt **OR** Overlap, **as directed**.
 - f. Accessories: <Insert accessories.>
2. Motorized Track:
- a. Construction: Extruded aluminum, slotted for mounting at interval of not more than 24 inches (610 mm) o.c., and bendable to radii indicated.
 - 1) Lengths and Configurations: As directed.
 - 2) Support Capability: Weight of drapery indicated **OR** 30 lb (14 kg) **OR** 45 lb (20 kg) **OR** 60 lb (27 kg) **OR** 80 lb (36 kg) **OR** 140 lb (64 kg) **OR** 210 lb (95 kg), **as directed**, mounted on track length indicated.
 - 3) Finish: Manufacturer's standard **OR** White baked enamel **OR** Clear anodic coating, **as directed**.
 - b. Mounting Brackets: Suitable for fastening track to surface indicated and designed to support weight of track assembly and drapery plus force applied to operate track.
 - 1) Mounting Surface: As indicated on Drawings **OR** Wall **OR** Ceiling **OR** Drapery pocket, **as directed**.
 - c. Installation Fasteners: Sized to support track assembly and drapery, and fabricated from metal compatible with track, brackets, and supporting construction. Provide two fasteners to fasten each bracket to supporting construction.
 - d. Motor Operation: Low-voltage motor with built-in low-voltage interface for direct access to control systems, with thermal-overload switch; sized for weight of drapery and track length indicated; and equipped with stops to prevent overdrawing.
 - 1) Control: Wall switch **OR** Remote, infrared **OR** Remote, radio controlled **OR** Digital timer, **as directed**.
 - 2) Draw: One way, stack as indicated on Drawings **OR** One way, stack left **OR** One way, stack right **OR** Two way, center opening, **as directed**.
 - 3) Electrical Requirements: 115 V/60 Hz/120 W/1.10 A **OR** 115 V/60 Hz/140 W/1.20 A **OR** 110 V/60 Hz/150 W/1.0 A **OR** 110 V/60 Hz/550 W/5.0 A, **as directed**.
 - 4) Travel Speed: 6 inches (152 mm) **OR** 8 inches (203 mm) **OR** 12 inches (305 mm), **as directed**, per second.
 - e. Carriers: Rollers **OR** Rollers with hooks **OR** Rollers with snaps **OR** Coordinate with drapery headings indicated, **as directed**.
 - 1) Master Carriers: Butt **OR** Overlap, **as directed**.
 - f. Accessories: <Insert accessories.>

B. Draperies

1. Drapery:
 - a. Heading:



- 1) Pinch (French) Pleats: 100 **OR** 150 **OR** 200, **as directed**, percent fullness.
- 2) Stack Pleats: 60 **OR** 80 **OR** 100 **OR** 120, **as directed**, percent fullness.
- 3) Roll Pleats: 60 **OR** 80 **OR** 100 **OR** 120, **as directed**, percent fullness.
- 4) Accordion Pleats: 40 **OR** 80 **OR** 100 **OR** 120, **as directed**, percent fullness.
- 5) Pleat Spacing: **<Insert dimension.>**
- 6) Heading Accessories:
 - a) Nonwoven buckram.
 - b) Woven snap tape, 7/8 inch (22 mm) wide, with nickel-plated snaps at 4 inches (102 mm) o.c.
 - c) Hooks.
- b. Drapery Fabric:
 - 1) Manufacturer, Designation, Pattern, Color, and Fiber Content: **As directed**.
 - 2) Orientation: Run right (up the bolt).
 - 3) Width and Pattern Repeat Distance: **As directed**.
 - 4) Textile Treatments: Stain repellent **OR** Flame retardant, polymer type **OR** Stain repellent; and flame retardant, polymer type, **as directed**.
- c. Lining Fabric:
 - 1) Lining Type: Blackout; light tight **OR** Water resistant, **as directed**.
 - 2) Manufacturer, Manufacturer's Designation, Color, Fiber Content, and Width: **As directed**.
 - 3) Textile Treatments: Stain repellent **OR** Flame retardant, polymer type **OR** Stain repellent; and flame retardant, polymer type, **as directed**.
- d. Interlining: Acoustical.
 - 1) Manufacturer: **As directed**.
- e. Textile Trim and Tiebacks: **As directed**.
- f. Hem Weights: 1-inch- (25-mm-) square lead weights **OR** Tape type (string weights), **as directed**.

C. Drapery Fabrication

1. Fabricate draperies in heading styles and fullnesses indicated. Fabricate headings to stand erect. If less than a full width of fabric is required to produce panel of specified fullness, use equal widths of not less than one-half width of fabric located at ends of panel.
 - a. One-Way-Stacking Draperies: Add 5 inches (127 mm) to overall width for returns.
 - b. Center-Opening Draperies: Add 10 inches (254 mm) to overall width for overlap.
2. Seams: Sew vertical seams with twin-needle sewing machine with selvage trimmed and overlocked. Join widths so that patterns match and vertical seams lay flat and straight without puckering. Horizontal seams are not acceptable.
3. Side Hems: Double-turned, 1-1/2-inch- (38-mm-) wide hems consisting of three layers of fabric, and blindstitched so that stitches are not visible on face of drapery.
4. Bottom Hems: Double-turned, 4-inch- (102-mm-) wide hems consisting of three layers of fabric, and weighted and blindstitched so that weights and stitches are not visible on face of drapery.
 - a. Sew in square lead weights at each seam and at panel corners.
5. Interlinings: Extend from top of drapery to within 1/2 inch (13 mm) of lining's bottom hem and to leading edge of side hems to produce full-shadowed appearance.
6. Linings: Equal to widths of drapery fabric and joined to drapery fabric at top by inside invisible seam, and hand stitched at side hems and shadowed with 1-1/2-inch (38-mm) return of face fabric.
 - a. Bottom Hem: Hem separately from **OR** Blind stitch to, **as directed**, drapery fabric.

1.3 EXECUTION

A. Drapery Track Installation

1. Install track systems according to manufacturer's written instructions, level and plumb, and at height and location in relation to adjoining openings as indicated on Drawings.



2. Isolate metal parts of tracks and brackets from concrete, masonry, and mortar to prevent galvanic action. Use tape or another method recommended in writing by track manufacturer.

B. Drapery Installation

1. Where draperies abut overhead construction, hang draperies so that clearance between headings and overhead construction is 1/4 inch (6.4 mm).
2. Where draperies extend to floor, install so that bottom hems clear finished floor by not more than 1 inch (25 mm) and not less than 1/2 inch (13 mm).
3. Where draperies extend to windowsill, install so that bottom hems hang above sill line and clear sill line by not more than 1/2 inch (13 mm).

C. Adjusting

1. After hanging draperies, test and adjust each track to produce unencumbered, smooth operation.
2. Steam and dress down draperies as required to produce crease- and wrinkle-free installation.
3. Remove and replace draperies that are stained or soiled.

END OF SECTION 12 22 13 00



Task	Specification	Specification Description
12 22 16 00	12 22 13 00	Draperies and Tracks



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SECTION 12 24 13 00 - ROLLER SHADES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for roller shades. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes roller shades and motorized shade operators.

C. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: Include plans, elevations, sections, details, details of installation, operational clearances, wiring diagrams, and relationship to adjoining Work.
 - a. Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings.
3. Samples: For each exposed finish and for each color and texture required.
4. Window Treatment Schedule: Use same designations indicated on Drawings.
5. Maintenance data.

D. Quality Assurance

1. Fire-Test-Response Characteristics: Provide products passing flame-resistance testing according to NFPA 701 by a testing agency acceptable to authorities having jurisdiction.
2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
3. Comply with WCMA A 100.1.

E. Delivery, Storage, And Handling

1. Deliver shades in factory packages, marked with manufacturer and product name, fire-test-response characteristics, lead-free designation, and location of installation using same designations indicated on Drawings and in a window treatment schedule.

1.2 PRODUCTS

A. Roller Shades

1. Shade Band Material: PVC-coated fiberglass **OR** PVC-coated polyester **OR** PVC-coated fiberglass and polyester blends **OR** Fiberglass and acrylic blend **OR** Metallized film **OR** Mirror film **OR** Tinted film **OR** Owner-furnished material, **as directed**.
 - a. Colors: Match samples **OR** As selected from manufacturer's full range **OR** As indicated in a window treatment schedule, **as directed**.
 - b. Material Solar-Optical Properties: **As directed**.
 - c. Material Openness Factor: **As directed** percent.
 - d. Material UV Blockage: **As directed** percent.
2. Rollers: Electrogalvanized or epoxy primed steel or extruded-aluminum tube of diameter and wall thickness required to support and fit internal components of operating system and the weight and width of shade band material without sagging; designed to be easily removable from support brackets. Provide capacity for one **OR** two, **as directed**, roller shade band(s) per roller.



3. Direction of Roll: Regular, from back of roller **OR** Reverse, from front of roller **OR** Regular, from back of roller, and reverse, from front of roller, as indicated on Drawings for double-roller shades, **as directed**.
4. Mounting Brackets: Galvanized or zinc-plated steel **OR** Fascia end caps, fabricated from steel finished to match fascia or headbox, **as directed**.
5. Fascia: L-shaped, formed-steel sheet or extruded aluminum; long edges returned or rolled; continuous panel concealing front and bottom of shade roller, brackets, and operating hardware and operators; removable design for access.
6. Top/Back Cover: L-shaped; material and finish to match fascia; combining with fascia and end caps to form a six-sided headbox enclosure sized to fit shade roller and operating hardware inside.
7. Pocket-Style Headbox: U-shaped, formed-steel sheet or extruded aluminum; long edges returned or rolled; with a bottom cover consisting of slot opening of minimum dimension to allow lowering and raising of shade and a removable or an openable, continuous metal access panel concealing shade roller, brackets, and operating hardware and operators within.
8. Pocket with Ceiling Slot Opening: Six-sided box units for recessed installation; fabricated from formed-steel sheet, extruded aluminum, or wood; with a bottom consisting of slot opening of minimum dimension to allow lowering and raising of shade and a removable or an openable, continuous metal access panel concealing rollers, brackets, and operating hardware and operators within.
 - a. Corner Section: Factory formed and welded.
9. Bottom Bar: Steel or extruded aluminum, with plastic or metal capped ends. Provide exposed-to-view, external **OR** concealed, by pocket of shade material, internal, **as directed**, -type.
10. Audiovisual Light-Blocking Shades: Designed for eliminating all visible light gaps when shades are fully closed; fabricated from blackout shade band material with fascia **OR** headbox **OR** pocket, **as directed**, and bottom bar extended and formed for light-tight joints among shade components and between shade components and adjacent construction.
11. Skylight Shades: Manufacturer's complete system for operable skylight shades, including operator, operating hardware, and accessories for smooth operation, designed for installation in horizontal position **OR** inclined position, slope as indicated on Drawings, **as directed**.
12. Valance: As indicated by manufacturer's designation for style and color **OR** Style matching hem; as indicated by manufacturer's designation color **OR** As indicated in a window treatment schedule, **as directed**.
13. Mounting: Inside **OR** Outside **OR** Ceiling **OR** Recessed in ceiling pocket **OR** Wall extension brackets **OR** Bottom-up brackets **OR** As indicated on Drawings, **as directed**.
14. Shade Operation: Manual; with spring roller **OR** continuous-loop bead-chain, clutch, and cord tensioner and bracket **OR** gear and crank **OR** cordless system, **as directed**, lift operator.
15. Hold-Down Brackets and Hooks or Pins and Side Channels: Manufacturer's standard for fixing shade in place, keeping shade band material taut, and reducing light gaps when shades are closed.
16. Shade Operation: Manual; with spring roller **OR** continuous-loop bead-chain, clutch, and cord tensioner and bracket **OR** gear and crank **OR** cordless system, **as directed**, lift operator.

B. Roller Shade Fabrication

1. Unit Sizes: Obtain units fabricated in sizes to fill window and other openings as follows, measured at 74 deg F (23 deg C):
 - a. Shade Units Installed between (Inside) Jambs: Edge of shade not more than 1/4 inch (6 mm) from face of jamb. Length equal to head to sill dimension of opening in which each shade is installed.
 - b. Shade Units Installed Outside Jambs: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.
2. Installation Brackets: Designed for easy removal and reinstallation of shade, for supporting fascia, headbox, roller, and operating hardware and for hardware position and shade mounting method indicated.



3. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal noncorrosive to shade hardware and adjoining construction; type designed for securing to supporting substrate; and supporting shades and accessories under conditions of normal use.
- C. Motorized Roller Shade Operators
1. General: Provide factory-assembled motorized shade operation systems designed for lifting shades of type, size, weight, construction, use, and operation frequency indicated. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with the building electrical system.
 2. Comply with NFPA 70.
 3. Control Equipment: Comply with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6 with NFPA 70, Class 2 control circuit, maximum 24-V ac or dc.
 4. Electric Motors: UL-approved or -recognized, totally enclosed, insulated motor, complying with NEMA MG 1, with thermal-overload protection, brake, permanently lubricated bearings, and limit switches; sized by shade manufacturer to start and operate size and weight of shade considering service factor or considering Project's service conditions without exceeding nameplate ratings.
 - a. Service Factor: According to NEMA MG 1, unless otherwise indicated.
 - b. Motor Characteristics: Single phase, 24 **OR** 110 **OR** 220, **as directed**, V, 60 Hz.
 - c. Motor Mounting: Within manufacturer's standard roller enclosure.
 5. Remote Controls: Electric controls with NEMA ICS 6, Type 1 enclosure surface **OR** recessed or flush, **as directed**, mounting. Keyed switch **OR** Toggle-style, wall switch Rocker-style, wall switch **OR** Rocker-style, group-control wall switch **OR** Rocker-style, individual/group-control wall switch **OR** Sun sensor **OR** Radio **OR** Infrared **OR** Timer **OR** Microprocessor, **as directed**.
 6. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop shade at fully raised and fully lowered positions.

1.3 EXECUTION

- A. Roller Shade Installation
1. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions, and located so shade band is not closer than 2 inches (50 mm) to interior face of glass. Allow clearances for window operation hardware.
 2. Connections: Connect motorized operators to building electrical system.
 3. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.
 4. Clean roller shade surfaces after installation, according to manufacturer's written instructions.

END OF SECTION 12 24 13 00



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SECTION 12 24 13 00a - PLEATED SHADES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for pleated shades. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following types of horizontal-fold shades and accessories:
 - a. Z-pleated shades.
 - b. Cellular shades.
 - c. Motorized shade operators.

C. Definitions

1. Cellular Shades: Pleated shades with more than one horizontally folded fabric layer forming accordion-folded fabric with enclosed air spaces or cells. Cellular shades may consist of two fabric layers forming a continuous accordion fold of enclosed air spaces or cells for a linear row of cells, one cell wide; three fabric layers forming two interconnected accordion folds of enclosed air spaces or cells for two honeycombed rows of cells, nominally two cells wide; or four fabric layers forming three interconnected accordion folds of enclosed air spaces or cells for three honeycombed rows of cells, nominally three cells wide.
2. Pleated Shades: Permanently creased, horizontally folded shades. Alternatively, pleated shades are synonymous with Z-pleated shades according to the industry. Z-pleated shades consist of one fabric layer forming Z-folded pleats.

D. Submittals

1. Product Data: For each type of product indicated.
 - a. Motorized Shade Operators: Include operating instructions.
 - b. Motors: Show nameplate data, ratings, characteristics, and mounting arrangements.
2. Shop Drawings: Show location and extent of pleated shades. Include elevations, sections, details, and dimensions not shown in Product Data. Show installation details, mountings, attachments to other work, operational clearances, and relationship to adjoining work.
 - a. Motorized Shade Operators: Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
 - b. Wiring Diagrams: Power, system, and control wiring.
3. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - a. Suspended ceiling components.
 - b. Structural members to which equipment **OR** suspension systems, **as directed**, will be attached.
 - c. Sizes and locations of initial access modules for acoustical tile.
 - d. Items penetrating finished ceiling, including the following:
 - 1) Lighting fixtures.
 - 2) Air outlets and inlets.
 - 3) Speakers.
 - 4) Sprinklers.
 - 5) Access panels.
 - e. Perimeter moldings.
4. Samples: For the following products:



- a. Shade Fabrics: Not less than 3 inches (76 mm) square, with specified treatments applied. Mark face of material.
 - b. Valance: Full-size unit, not less than 12 inches (300 mm) long.
5. Maintenance Data.

E. Quality Assurance

1. Fire-Test-Response Characteristics: Provide pleated shades with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency:
 - a. Flame-Resistance Ratings: Passes NFPA 701.
2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
3. Product Standard: Provide pleated shades complying with WCMA A 100.1.

F. Delivery, Storage, And Handling

1. Deliver shades in factory packages, marked with manufacturer and product name, fire-test-response characteristics, **OR** lead-free designation, **as directed**, and location of installation using same designations indicated on Drawings and in a window treatment schedule.

1.2 PRODUCTS

A. Z-Pleated Shades

1. Z-Pleated Shade Construction: One-fabric thickness, with uniform pleat spacing maintained at all positions.
 - a. Nominal Pleat Width: 1 inch (25 mm) **OR** 2 inches (50 mm) **OR** 3 inches (76 mm) **OR** 4 inches (100 mm), **as directed**.
2. Shade Fabric: Manufacturer's standard **OR** 100 percent nonwoven polyester with antistatic treatment **OR** PVC-coated polyester mesh **OR** 100 percent spun-woven polyester, **as directed**; stain and fade resistant, width as wide as required for seamless shade.
 - a. Fabric Width: 36 inches (910 mm) **OR** 48 inches (1220 mm) **OR** 60 inches (1520 mm) **OR** 72 inches (1830 mm) **OR** 84 inches (2130 mm) **OR** 96 inches (2440 mm) **OR** As indicated on Drawings **OR** As indicated in a window treatment schedule, **as directed**.
 - b. Pattern: as directed by the Owner.
 - c. Style: as directed by the Owner.
 - d. Colors: Match samples **OR** As selected from manufacturer's full range **OR** As indicated in a window treatment schedule, **as directed**.
 - e. **Material Solar-Optical Properties: as directed by the Owner.**
 - f. Material Openness Factor: percent as directed by the Owner..
 - g. Material UV Blockage: percent as directed by the Owner..
3. Headrail: Formed steel or extruded aluminum; long edges returned or rolled; fully enclosing operating mechanisms on three sides and ends; capacity for one **OR** two, **as directed**, shade(s) per headrail, unless otherwise indicated on Drawings **OR** in a window treatment schedule, **as directed**.
4. Bottom Rail: Formed-steel or extruded-aluminum tube, sealed with plastic or metal capped ends.
5. Valance: Clear plastic with fabric insert matching fabric shade.
6. R-Value: Not less than 2.22 deg F x h x sq. ft./Btu (0.39 K x sq. m/W) **OR** 4.8 deg F x h x sq. ft./Btu (0.85 K x sq. m/W), **as directed**.
7. Mounting: Wall **OR** Ceiling **OR** End **OR** Wall extension brackets **OR** As indicated on Drawings, **as directed**, mounting permitting easy removal and replacement without damaging shade or adjacent surfaces and finishes; with spacers and shims required for shade placement and alignment indicated.



8. Hold-Down Brackets and Hooks or Pins: Manufacturer's standard, as indicated.
 9. Side Channels and Perimeter Seals: Manufacturer's standard for eliminating light gaps when shades are closed.
 10. Shade Operation: Manual.
 - a. Lift Control: System including lift cord, crash-proof cord lock, and cord joiner ball **OR** System including continuous-cord loop, clutch, and cord tensioner and bracket **OR** Cordless system, **as directed**, designed to hold shade in place unless force is applied to move shade.
 - b. Length of Lift Cord **OR** Cord Loop, **as directed**: Manufacturer's standard length **OR** Full length of shade **OR** Length required to make operation convenient from floor level **OR** As indicated on Drawings, **as directed**.
 - c. Position of Lift Cord **OR** Cord Loop, **as directed**: As indicated on Drawings **OR** in a window treatment schedule, **as directed**.
 - d. Position of Lift Cord **OR** Cord Loop, **as directed**: Left side **OR** Right side **OR** Left end **OR** Right end, **as directed**, of headrail, unless otherwise indicated on Drawings **OR** in a window treatment schedule, **as directed**.
 - e. Cord Tensioner Mounting: Wall **OR** Floor **OR** Sill **OR** Baseboard **OR** As indicated on Drawings, **as directed**.
 11. Shade Operation: Motorized operator.
- B. Cellular Shades
1. Cellular Shade Construction: Two-fabric thicknesses and one row of cells, one cell wide.
 - a. Nominal Cell Width: 3/8 to 7/16 inch (10 to 11 mm) **OR** 1/2 inch (13 mm) **OR** 9/16 inch (14.2 mm) **OR** 3/4 inch (19 mm), **as directed**.
 2. Cellular Shade Construction: Three-fabric thicknesses and two honeycombed cells, nominally two cells wide.
 - a. Nominal Cell Width: 3/8 inch (10 mm).
 3. Cellular Shade Construction: Four-fabric thicknesses and three honeycombed cells, nominally three cells wide.
 - a. Nominal Cell Width: 3/8 inch (10 mm).
 4. Shade Fabric: Manufacturer's standard **OR** 100 percent nonwoven polyester with antistatic treatment **OR** 100 percent spun-woven polyester, **as directed**; stain and fade resistant, width as wide as required for seamless shade.
 - a. Fabric Width: 36 inches (910 mm) **OR** 48 inches (1220 mm) **OR** 60 inches (1520 mm) **OR** 72 inches (1830 mm) **OR** 84 inches (2130 mm) **OR** 96 inches (2440 mm) **OR** As indicated on Drawings **OR** As indicated in a window treatment schedule, **as directed**.
 - b. Pattern: as directed by the Owner.
 - c. Style: as directed by the Owner.
 - d. Colors: Match samples **OR** As selected from manufacturer's full range **OR** As indicated in a window treatment schedule, **as directed**.
 5. Headrail: Formed steel or extruded aluminum; long edges returned or rolled; fully enclosing operating mechanisms on three sides and ends; capacity for one **OR** two, **as directed**, shade(s) per headrail, unless otherwise indicated on Drawings **OR** in a window treatment schedule, **as directed**.
 6. Bottom Rail: Formed-steel or extruded-aluminum tube, sealed with plastic or metal capped ends.
 7. Valance: Clear plastic with fabric insert matching fabric shade.
 8. R-Value: Not less than 2.22 deg F x h x sq. ft./Btu (0.39 K x sq. m/W) **OR** 4.8 deg F x h x sq. ft./Btu (0.85 K x sq. m/W), **as directed**.
 9. Mounting: Wall **OR** Ceiling **OR** End **OR** Wall extension brackets **OR** As indicated on Drawings, **as directed**, mounting permitting easy removal and replacement without damaging shade or adjacent surfaces and finishes; with spacers and shims required for shade placement and alignment indicated.
 10. Hold-Down Brackets and Hooks or Pins: Manufacturer's standard, as indicated.
 11. Side Channels and Perimeter Seals: Manufacturer's standard for eliminating light gaps when shades are closed.
 12. Shade Operation: Manual.



- a. Lift Control: System including lift cord, crash-proof cord lock, and cord joiner ball **OR** System including continuous-cord loop, clutch, and cord tensioner and bracket **OR** Cordless system, **as directed**, designed to hold shade in place unless force is applied to move shade.
 - b. Length of Lift Cord **OR** Cord Loop, **as directed**: Manufacturer's standard length **OR** Full length of shade **OR** Length required to make operation convenient from floor level **OR** As indicated on Drawings, **as directed**.
 - c. Position of Lift Cord **OR** Cord Loop, **as directed**: As indicated on Drawings **OR** in a window treatment schedule, **as directed**.
 - d. Position of Lift Cord **OR** Cord Loop, **as directed**: Left side **OR** Right side **OR** Left end **OR** Right end, **as directed**, of headrail, unless otherwise indicated on Drawings **OR** in a window treatment schedule, **as directed**.
 - e. Cord Tensioner Mounting: Wall **OR** Floor **OR** Sill **OR** Baseboard **OR** As indicated on Drawings, **as directed**.
13. Shade Operation: Motorized operator.

C. Pleated Shade Fabrication

1. Product Description: Pleated shades each consisting of fabric, rails, ladders, lifting mechanism, self-leveling device, and installation hardware.
2. Concealed Components: Noncorrodible or corrosion-resistant-coated materials.
 - a. Lifting Mechanism: With permanently lubricated moving parts.
3. Unit Sizes: Obtain units fabricated in sizes to fill window and other openings as follows, measured at 74 deg F (23 deg C):
 - a. Shade Units Installed between (Inside) Jambs: Edge of shade not more than 1/4 inch (6 mm) from face of jamb. Length equal to head-to-sill dimension of opening in which each shade is installed.
 - b. Shade Units Installed Outside Jambs: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.
4. Installation Brackets: Designed for easy removal and reinstallation of shade, for supporting headrail, valance, **as directed**, and operating hardware and for hardware position and shade mounting method indicated.
5. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal noncorrosive to shade hardware and adjoining construction; type designed for securing to supporting substrate; and supporting shades and accessories under conditions of normal use.
6. Color-Coated Finish: For metal components exposed to view, apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.
7. Component Color: Provide rails and cords, **as directed**, and exposed-to-view ladders, **as directed**, metal and plastic matching or coordinating with fabric color, unless otherwise indicated.

D. Motorized Pleated Shade Operators

1. General: Provide factory-assembled shade operation systems designed for lifting shades of type, size, weight, construction, use, and operation frequency indicated. Provide operation systems of size and capacity and with features, characteristics, and accessories suitable for Project conditions and recommended by shade manufacturer, complete with electric motors and factory-prewired motor controls, remote-control stations, remote-control devices, power disconnect switches, enclosures protecting controls and all operating parts, headrail, and accessories required for reliable operation without malfunction. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with the building electrical system.
2. Comply with NFPA 70.
3. Control Equipment: Comply with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6 with NFPA 70, Class 2 control circuit, maximum 24-V ac or dc, **as directed**.



4. Electric Motors: UL-approved or -recognized, totally enclosed, insulated motor, complying with NEMA MG 1, with thermal-overload protection, brake, permanently lubricated bearings, and internal limit switches; sized by shade manufacturer to start and operate size and weight of shade considering service factor or considering Project's service conditions without exceeding nameplate ratings.
 - a. Service Factor: According to NEMA MG 1, unless otherwise indicated.
 - b. Motor Characteristics: Single phase, 24 **OR** 110 **OR** 220, **as directed**, V, 60 Hz.
 - c. Motor Mounting: Within manufacturer's standard headrail enclosure.
5. Remote Controls: Electric controls with NEMA ICS 6, Type 1 enclosure for surface **OR** recessed or flush **OR** within headrail, **as directed**, mounting. Provide the following devices for remote-control activation of shades:
 - a. Control Stations: Keyed, maintained **OR** momentary, **as directed**, -contact, three-position, switch-operated control station with open, close, and off functions. Provide two keys per station.
 - b. Control Stations: Maintained **OR** Momentary, **as directed**, -contact, three-position, toggle **OR** rocker, **as directed**, -style, wall switch-operated control station with open, close, and center off functions.
 - 1) Color: Ivory **OR** White **OR** As indicated in a window treatment schedule, **as directed**.
 - c. Group Control Stations: Maintained **OR** Momentary, **as directed**, -contact, three-position, rocker-style, wall switch-operated control station with open, close, and center off functions for single-switch group control.
 - 1) Color: Ivory **OR** White **OR** As indicated in a window treatment schedule, **as directed**.
 - d. Individual/Group Control Stations: Maintained **OR** Momentary, **as directed**, -contact, three-position, rocker-style, wall switch-operated control station with open, close, and center-off functions for individual and group control.
 - 1) Color: Ivory **OR** White **OR** As indicated in a window treatment schedule, **as directed**.
 - e. Sun Sensor Controls: Programmable system activated by LEDs detecting daylight intensity and responding by automatically adjusting shades.
 - f. Radio Controls: Digital system consisting of code-compatible universal coaxial receiver, one per shade **OR** one per headrail **OR** where indicated on Drawings, **as directed**, and two, **as directed**, portable, multiple-channel transmitters for operating two **OR** four **OR** up to 12, **as directed**, shades individually, each with a single button to open and close shades.
 - g. Infrared Controls: System consisting of concealed receiver complete with external eye and connecting modular cable, and two, **as directed**, portable, multiple-channel transmitters with separate buttons to open and close up to 12, **as directed**, individual shades or groups of shades, to open and close all shades simultaneously, and to stop.
 - h. Timer Controls: Clock timer, 24-hour **OR** seven-day, **as directed**, programmable for regular events.
 - i. Microprocessor Controls: Electronic programmable means for setting, changing, and adjusting control features. Provide unit isolated from voltage spikes and surges.
6. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop shade at fully raised and fully lowered positions.
7. Operating Features: Include the following:
 - a. Group switching with integrated switch control; one face plate for multiple switch cut-outs.
 - b. Capable of interface with audiovisual **OR** multiroom, **as directed**, control system.
 - c. Capable of accepting input from building automation control system.
 - d. Override switch.
8. Accessories: Include the following:
 - a. Solar Power Unit: For use with control system indicated.
9. Headrail: Manufacturer's standard formed steel or extruded aluminum; long edges returned or rolled; fully enclosing operating mechanisms on three sides and ends; capacity for one **OR** two,



as directed, shade(s) per headrail, unless otherwise indicated on Drawings **OR** in a window treatment schedule, **as directed**.

- a. Color: Match shade **OR** As indicated by manufacturer's designations **OR** As selected from manufacturer's full range **OR** As indicated in a window treatment schedule, **as directed**.

1.3 EXECUTION

A. Pleated Shade Installation

1. Install shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions, and located so pleat edges are not closer than 2 inches (50 mm) to interior face of glass. Install intermediate support as required to prevent deflection in headrail. Allow clearances for window operation hardware.
2. Flush Mounted: Install shades with pleat edges flush with finish face of opening if shade is in fully lowered position.
3. Jamb Mounted: Install headrail flush with face of opening jamb and head.
4. Head Mounted: Install headrail on face of opening head.
5. Recessed: Install headrail concealed within shade pocket.
6. Connections: Connect motorized operators to building electrical system.

B. Adjusting

1. Adjust and balance pleated shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

C. Cleaning And Protection

1. Clean pleated shade surfaces after installation, according to manufacturer's written instructions.
2. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that pleated shades are without damage or deterioration at time of Final Completion.
3. Replace damaged pleated shades that cannot be repaired, in a manner approved, before time of Final Completion.

END OF SECTION 12 24 13 00a



Task	Specification	Specification Description
12 24 13 00	12 21 13 13	Horizontal Louver Blinds
12 24 13 00	12 21 13 13a	Vertical Louver Blinds



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SECTION 12 31 13 00 - KITCHEN CASEWORK, STAINLESS STEEL CABINETS**1.1 GENERAL****A. Description of Work**

1. This specification covers the furnishing and installation of materials for kitchen casework, stainless steel cabinets. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Quality Assurance

1. Comply with all provisions of specifications for the design, quality testing. Manufacturing and installation of metal kitchen cabinets and specified equipment.
2. All kitchen cabinetry and equipment herein specified and shown on the drawings shall meet the standards, quality of materials, construction, workmanship and finish of Innovative Laboratory Systems Co., 1336 Industrial Rd., Omaha Nebraska, (402) 333-0679. Equal manufacturers acceptable.
3. All metal cabinetry and equipment herein shall be the product of one manufacturer and be the one on which this specification is based or approved of substitutes must be obtained in writing from the Owner ten days prior to the bid due date. All manufacturers other than the specified product shall provide evidence of having a minimum of five years experience in the manufacturing and installation of stainless steel kitchen cabinetry.
4. The manufacturer shall, from one year to date of installation, warrant parts or products manufactured and finished against manufacturing defects in material and any such parts which under normal use prove defective within one year form date of installation, shall be repaired or replaced without charge to the Owner.
5. Wood shall not be used in any portion of the casework construction whether exposed or hidden from view.

C. Submittals

1. Shop Drawings
 - a. Identify location of metal cabinetry and related items.
 - b. Detail cabinets, shelving, countertops, etc, in related and dimensional position, with sections. Locations for roughing-in of plumbing, including sinks, faucets, strainers, cocks, etc. shall be included
2. Certificates: All bidders shall provide to the Owner independent test results from a nationally recognized testing laboratory on the finishes required for this project with the bid.

1.2 PRODUCTS**A. Material**

1. All metal cabinetry shall be fabricated to Type 304 stainless steel free of scales buckles or other defects.
2. Minimum metal gauge: All minimum thickness of metal referred to herein shall be U.S. standard gauge.
 - a. 20 Gauge: Inner door panels, inner and outer drawer panels, drawer body, and shelves.
 - b. 18 Gauge: Outer door panels, sides, backs, bottoms, and tops.
 - c. 16 Gauge: Top rails, cross rails, drawer slides.
 - d. 14 Gauge: Leveling and corner gussets.

B. Fabrications

1. Cabinet Grade: Premium and complying with the following.
 - a. Align sides, top rails, bottoms and vertical stiles, at intersections, without overlap.



- b. Rounded edges.
 - c. Full welded seams.
 - d. Grind exposed welds flush and smooth.
2. Cases: The sides of cabinets shall be formed to make a rabbeted stile 1-1/8" wide. Top of case stiles shall be closed by a mitered 45-degree bend from tip of case side. Stiles shall be closed by welded channel, which contains front shelf adjustment louvers. All case members including intermediate cross rails shall be welded for maximum strength. Use of sheet metal screws to hold intermediate cross rails in place is not acceptable. Sides of all cabinets shall be free from any holes to prevent dust and bacteria from entering the cabinet. Pre-punched holes in the side of any cabinet will not be allowed. All drawer cabinets and cupboard cabinets shall have full backs and bottoms welded into place. Any cabinet without any backs or bottoms will be rejected. All interior bottoms of base and tall cabinets shall be turned down to provide a clean, flush interior free from dust catching ledges and preventing bacterial accumulation. Bottoms of all wall units shall be flushed; recessed bottoms are not acceptable.
3. Doors
 - a. Doors shall be double panel reinforced construction 5/8" thick and sound deadened with vertical steel battens. Door fronts and liners shall be welded together for added strength. Door fronts and cases shall be slotted to receive hinges. Hinge wings must be concealed when doors open. Wrap around type hinges are not acceptable. All doors shall have soft rubber bumpers for quiet closing. Rubber bumpers must be securely locked in place. Rubber Bumpers attached by adhesives are not acceptable. All corners of doors shall be welded and ground smooth.
 - b. Sliding doors shall be double panel reinforced construction 5/8" thick and operate on nylon rollers suspended from stainless steel track at top of unit and center guide at bottom. Sliding doors shall have recessed door pulls.
4. Drawers
 - a. Drawers front shall be double panel reinforced construction with 5/8" thick fronts and sound deadened with vertical steel battens. Drawers shall be all welded construction. All drawers shall have soft rubber bumpers for quiet closing. Rubber bumpers must be securely locked in place. Rubber bumpers attached by adhesives are not acceptable. All edges of drawer fronts shall be closed.
 - b. Drawer bodies shall be formed from a single sheet of steel including the bottom, two sides, back and inner front. Interior bottoms of drawers shall be fully covered on four sides for ease in cleaning. The top front of the inner drawer shall be offset to interlock with the outer drawer front.
 - c. Flanges on the top of drawer body shall be fully formed channel and bent at a 6-degree angle for maximum strength. Flanges shall be formed to leave the inside of the drawer free form sharp edges. Drawer slide shall be welded to drawer body and be part of a "Z" shaped member in a wrap around design to support drawer body. Drawer slides shall have a 15/16" nylon tired ball bearing roller. Drawer slide shall be roller type, positive in action permitting drawer to be fully opened; yet preventing drawer from accidental removal. Case slides shall be a formed piece of galvanized steel with 15/16" nylon tired ball bearing roller at front of slide. All ball bearing rollers for drawer slide and case slide shall be pre-lubricated to guarantee a smooth, quiet operation. All drawers shall rise upward when opened to prevent engaging of drawers and doors below. Drawers shall have self-closing design during the last 5" of travel.
5. Shelves: Shelves shall be formed from a single sheet of stainless steel with 7/8" face turned back and up at a 30-degree angle and edge of flange shall make firm contact with underside of shelf for sound deadening. All shelves in cabinets shall be adjustable on 1-1/2" center and supported by stainless steel clips placed in embossed louvers. All shelves shall be solid.
6. Hardware: Door catch shall be positive type latch located at upper inside edge of door. Stainless steel strike bracket shall be installed inside of door with accessible removable screws. Bolt shall be nylon self-closing type tested for 300,000 opening and closing cycles. Complete bolt housing shall be recessed behind cross rail. Roller catches and/or friction catches are not acceptable.



7. Hinges: Hinges shall be institutional type, 2-1/2" long, with a metal thickness of least 0.090", containing 5-knuckles, and centered 3" above bottom and below top of door. Doors 45" high and over shall have an additional hinge in center. Hinges shall be stainless steel with smooth rounded joints for easy cleaning. When door is closed, only the joint shall be exposed. Both hinge wings shall be encased, one within the door, the other within the case. Hinges shall be attached to the door and the case by screws. Hinges welded to door and/or case are not acceptable.
8. Door and Drawer Pull: Door and drawer pull shall be stainless steel with a brushed satin finish. Shoulder screws shall be used so that when handles are mounted they do not cause the door to buckle or cave. Sliding doors shall have recessed door pulls.
9. Base Cabinet Legs: All base cabinets and sink units shall be furnished with integral stainless steel legs with adjustable levelers. Bottom of base cabinets shall be approximately 6" above the floor.
10. Locking Mechanism: All cabinet doors shall be provided with stainless steel angle hasps, with half-inch diameter holes for pad locking, as shown on the drawings. The left door of each door pair shall have a sliding flush bolt on the inside face, as shown on the drawings, to prevent the pair of doors from swinging open when pad locked.

C. Steel Cabinet Finish

1. Test Procedure: Chemical spot tests shall be made by applying 10 to 15 drops (approximately 0.5 cubic cm) of each reagent listed in Table 1 to the surface to be tested. Each reagent spot shall be open to the atmosphere. Ambient temperature is 68-72 degrees F (20-22 degrees C). After one hour, chemicals shall be flushed away with cold water and the surface, washed with detergent and warm water at 150 degrees F (65 degrees C). Surface shall be examined under 100-foot candles of illumination.

D. Kitchen Cabinets Performance Requirements

1. Base Cabinets.
 - a. Cabinets Load Test: A 48" wide standing height combination cupboard and drawer cabinet shall be freestanding with installed counter top. Cabinet shall sit 1" off the floor on all four leveling screws and be capable of supporting a uniform distributed load of 2,000 lbs. Door and drawer operation shall not be affected by the load.
 - b. Leveling device for floor mounted cabinets shall be capable of supporting a load of 500 lbs. Without failure and capable of adjustment after load is removed.
 - c. Cabinet Door Test: An open door shall withstand a load of 200 lbs. applied directly at the outer edge. Door shall be moved through a 180 degree arc and weight removed. Operation of the door after test shall be normal without distortion that will adversely affect operation for the door catch.
 - d. Life Cycle Test.
 - 1) Door hinge shall operate for 300,000 opening and closing cycles without a failure.
 - 2) Positive door catch shall operate for 300,000 opening and closing cycles without failure.
 - 3) Drawer shall be tested and operated with a load of 100 lbs. for a minimum of 150,000 opening and closing cycles. After test, drawers shall operate freely without evidence of dragging or scraping.
2. Wall Cabinets
 - a. A 48" wide, 30" high, 12 3/4" deep hinged wall case shall support a load of 1lbs. on cabinet bottom and 100 lbs. on each adjustable shelf for a total of 300 lbs. Cabinet shall not show any significant permanent deflection of cabinet, cabinet bottom or shelves. Doors shall operate smoothly when cabinet is fully loaded.
 - b. An adjustable shelf shall support a uniformly distributed load of 100 lbs. When load is removed, shelf should show no significant permanent distortion.
 - c. Performance of hinge and catch shall be the same as used on base cabinets.

E. Working Surfaces

1. Stainless Steel: Sink and counter tops shall be fabricated of 16 gauge, Type 304, 18-8 solid stainless steel formed down and back making a 1 1/2" high face on all exposed edges.



Drainboards and cabinet tops shall be rigidly reinforced the full length of the top. Drainboards shall be two-way pitched to the bowl to provide drainage without channeling or grooving. Drainboards, flanges and splashes shall be integral, being formed from one sheet of metal. Raised edge surrounding unit shall be seamless die formed at front and ends of unit. Sink bowls shall be fabricated of 16 gauge, Type 304, 18-8 solid stainless steel seamless electrically welded to drainboard. All joints shall be electrically welded, ground and polished to a satin finish. Entire units shall be thoroughly sound deadened on under surface with sprayed or trowelled undercoating. Wood shall not be used. All tops shall have stainless steel runners to facilitate fastening to cabinets.

1.3 EXECUTION

A. Insulations

1. Install cabinets, shelves, counter tops and other equipment level and square. Install sink units to provide positive drainage of bottom surface of the sinks.
2. Wall cabinets shall be hung from the metal stud framing system wherever possible. If the wall cabinets must be hung from the wall surfacing at any location, proper anchors shall be used. Install wall cabinets level and aligned.
3. Install base cabinets firmly on ground. Level all the surfaces by adjusting the leg levelers. Attached countertops to inslatted base cabinets with stainless steel screws as required. Caulk with silicone all around counter tops where it interfaces with the existing walls. Install the flat back panels to the wall surfaces by the most appropriate method and caulk as required.
4. All work, including installation of new casework, flooring, ceiling, ductwork, etc., as well as the demolition of the existing casework, flooring, etc. shall be completed within three (3) consecutive days of work start. Hours of work shall be between 7:30 a.m. 9:00 p.m. All work, including work noted on Punch List, shall be completed by 9:00 p.m. of the third work day after work starts.

B. Temporary Work Station

1. During the period of demolition and new casework installation (3 days maximum) the contractor shall provide a temporary cabinet assembly for use by the Owner. The temporary assembly shall have a 6-foot section of cabinets with countertop, sink and faucet. The faucet shall be temporary connected to an apparatus hose bib for providing cold water to the sink. The sink shall be temporarily connected to a sewer line or floor drain if possible for the discharge or to another approved system of temporary discharge by means of a suitable container. For the latter method, the Contractor shall be responsible for periodically disposing of the waste container's contents. The temporary cabinet assembly shall be located reasonably close to the existing kitchens and/or dining areas being remodeled. the Owner shall approve the location of the temporary cabinets.

C. Inspection

1. Inspect installed work of other trades and installation conditions for acceptability. Inform the Owner of discrepancies that will jeopardize a complete and proper installation
2. Cleaning: Touching up marred and/or abraded finished surfaces, clean components to post construction accepted levels, remove crating and packing material, broom sweep premises.

END OF SECTION 12 31 13 00



Task	Specification	Specification Description
12 31 13 00	01 22 16 00	No Specification Required



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SECTION 12 36 23 13 - STONE COUNTERTOPS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for stone countertops. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes stone countertops.

C. Submittals

1. Product Data: For each variety of stone and manufactured products.
2. Shop Drawings: Include plans, sections, details, and attachments to other work.
3. Samples: For each stone type indicated.
4. LEED Submittal:
 - a. Product Data for Credit EQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content.
5. Sealant Compatibility Test Report: From sealant manufacturer, complying with requirements in Division 07 Section "Joint Sealants" and indicating that sealants will not stain or damage stone.
6. Maintenance Data: For stone countertops to include in maintenance manuals. Include Product Data for stone-care products used or recommended by Installer, and names, addresses, and telephone numbers of local sources for products.

D. Quality Assurance

1. Installer Qualifications: Fabricator of products.
2. Source Limitations for Stone: Obtain each variety of stone from a single quarry with resources to provide materials of consistent quality in appearance and physical properties.
 - a. Make stone slabs available for the Owner to examine for appearance characteristics. the Owner will select aesthetically acceptable slabs.

E. Delivery, Storage, And Handling

1. Lift stone with wide-belt slings; do not use wire rope or ropes that might cause staining. Move stone, if required, using dollies with cushioned wood supports.
2. Store stone on wood A-frames or pallets with nonstaining separators and nonstaining, waterproof covers. Ventilate under covers to prevent condensation.

F. Project Conditions

1. Field Measurements: Verify dimensions of construction to receive stone countertops by field measurements before fabrication.

1.2 PRODUCTS

A. Granite

1. Granite: Comply with ASTM C 615.
2. Cut stone from contiguous, matched slabs in which natural markings occur, **as directed**.
3. Finish: Polished **OR** Honed **OR** Thermal **OR** As indicated **OR** Match the Owner's sample, **as directed**.

B. Marble

1. Marble: Comply with ASTM C 503.



- a. Stone Abrasion Resistance: Minimum value of 10, based on testing according to ASTM C 241 or ASTM C 1353.
 2. Cut stone from contiguous, matched slabs in which natural markings occur, **as directed**.
 3. Finish: Polished **OR** Honed **OR** As indicated **OR** Match the Owner's sample, **as directed**.
- C. Serpentine
1. Serpentine: Comply with ASTM C 1526, Classification I Exterior **OR** II Interior, **as directed**.
 - a. Stone Abrasion Resistance: Minimum value of 10, based on testing according to ASTM C 241 or ASTM C 1353.
 2. Cut stone from contiguous, matched slabs in which natural markings occur, **as directed**.
 3. Finish: Polished **OR** Honed **OR** As indicated **OR** Match the Owner's sample, **as directed**.
- D. Slate
1. Slate: Comply with ASTM C 629, Classification I Exterior **OR** II Interior, **as directed**, with a fine, even grain and unfading color, from clear, sound stock.
 - a. Stone Abrasion Resistance: Minimum value of 8, based on testing according to ASTM C 241 or ASTM C 1353.
 2. Finish: Honed **OR** Sand rubbed **OR** Natural cleft **OR** As indicated **OR** Match the Owner's sample, **as directed**.
- E. Adhesives, Grout, Sealants, And Stone Accessories
1. General: Use only adhesives formulated for stone and ceramic tile and recommended by their manufacturer for the application indicated.
 2. Water-Cleanable Epoxy Adhesive: ANSI A118.3, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Water-Cleanable Epoxy Grout: ANSI A118.3, chemical-resistant, water-cleanable, tile-setting and -grouting epoxy.
 4. Stone Adhesive: 2-part epoxy or polyester adhesive, formulated specifically for bonding stone to stone, with an initial set time of not more than 2 hours at 70 deg F (21 deg C), and with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - a. Color: Clear **OR** Match stone, **as directed**.
 5. Sealant for Countertops: Manufacturer's standard sealant of characteristics indicated below that comply with applicable requirements in Division 07 Section "Joint Sealants" and will not stain the stone it is applied to.
 - a. Single-component, neutral-curing **OR** acid-curing, **as directed**, silicone sealant.
 - b. Color: Clear **OR** As selected by the Owner from manufacturer's full range, **as directed**.
 - c. Use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 6. Stone Joint Splines: Stainless-steel or brass washers approximately 1 inch (25 mm) in diameter and of thickness to fit snugly in saw-cut kerf in edge of stone units.
 7. Stone Cleaner: Cleaner specifically formulated for stone types, finishes, and applications indicated, as recommended by stone producer and, if a sealer is specified, by sealer manufacturer. Do not use cleaning compounds containing acids, caustics, harsh fillers, or abrasives.
 8. Stone Sealer: Colorless, stain-resistant sealer that does not affect color or physical properties of stone surfaces, as recommended by stone producer for application indicated.
- F. Stone Fabrication, General
1. Select stone for intended use to prevent fabricated units from containing cracks, seams, and starts that could impair structural integrity or function.
 - a. Repairs that are characteristic of the varieties specified are acceptable provided they do not impair structural integrity or function and are not aesthetically unpleasing, as judged by the Owner.
 2. Grade and mark stone for final locations to produce assembled countertop units with an overall uniform appearance.



3. Fabricate stone countertops in sizes and shapes required to comply with requirements indicated, including details on Drawings and Shop Drawings.
 - a. For granite, comply with recommendations in NBGQA's "Specifications for Architectural Granite."
 - b. For marble and serpentine, comply with recommendations in MIA's "Dimension Stone-- Design Manual."
 - c. Clean sawed backs of stones to remove rust stains and iron particles.
 - d. Dress joints straight and at right angle to face, unless otherwise indicated.
 - e. Cut and drill sinkages and holes in stone for anchors, supports, and attachments.
 - f. Provide openings, reveals, and similar features as needed to accommodate adjacent work.
 - g. Fabricate molded edges with machines having abrasive shaping wheels made to reverse contour of edge profile to produce uniform shape throughout entire length of edge and with precisely formed arris slightly eased to prevent snipping, and matched at joints between units. Form corners of molded edges as indicated with outside corners slightly eased, unless otherwise indicated.
 - h. Finish exposed faces of stone to comply with requirements indicated for finish of each type of stone required and to match approved Samples and mockups. Provide matching finish on exposed edges of countertops, splashes, and cutouts.
4. Carefully inspect finished stone units at fabrication plant for compliance with requirements for appearance, material, and fabrication. Replace defective units.

G. Stone Countertops

1. General: Comply with recommendations in MIA's "Dimension Stone - Design Manual."
2. Nominal Thickness: Provide thickness indicated, but not less than 3/4 inch (20 mm) **OR** 7/8 inch (22 mm) **OR** 1-1/4 inches (32 mm), **as directed**. Gage backs to provide units of identical thickness.
3. Edge Detail: Straight, slightly eased at top **OR** 3/8-inch (10-mm) bevel **OR** 3/4-inch (20-mm) full bullnose **OR** 1-1/4-inch (20-mm) full bullnose **OR** 3/8-inch (10-mm) radius with 2-inch (50-mm) apron **OR** 1-1/2-inch (40-mm) laminated bullnose **OR** As indicated, **as directed**.
4. Splashes: Provide 3/4-inch- (20-mm-) thick backsplashes **OR** end splashes **OR** backsplashes and end splashes, **as directed**, unless otherwise indicated.
5. Joints: Fabricate countertops without joints.
OR
Fabricate countertops in sections for joining in field, with joints at locations indicated and as follows:
 - a. Bonded Joints: 1/32 inch (0.8 mm) or less in width.
 - b. Grouted Joints: 1/16 inch (1.5 mm) in width.
 - c. Sealant-Filled Joints: 1/16 inch (1.5 mm) in width.
 - d. Splined Joints: Accurately cut kerfs in edges at joints for insertion of metal splines to maintain alignment of surfaces at joints where indicated. Make width of cuts slightly more than thickness of splines to provide snug fit. Provide at least three splines in each joint.
6. Cutouts and Holes:
 - a. Undercounter Fixtures: Make cutouts for undercounter fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
 - 1) Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch (5 mm) into fixture opening.
 - 2) Provide vertical edges, rounded to 3/8-inch (10-mm) radius at juncture of cutout edges with top surface of countertop, slightly eased at bottom, and projecting 3/16 inch (5 mm) into fixture opening.
 - 3) Provide 3/4-inch (20-mm) full bullnose edges projecting 3/8 inch (10 mm) into fixture opening.
 - b. Counter-Mounted Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
 - c. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.



1.3 EXECUTION

A. Preparation

1. Advise installers of other work about specific requirements for placement of inserts and similar items to be used by stone countertop Installer for anchoring stone countertops. Furnish installers of other work with Drawings or templates showing locations of these items.
2. Clean dirty or stained stone surfaces by removing soil, stains, and foreign materials before setting. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives. Allow stone to dry before installing.

B. Construction Tolerances

1. Variation from Plumb: For vertical lines and surfaces, do not exceed 1/16 inch in 48 inches (1.5 mm in 1200 mm).
2. Variation from Level: Do not exceed 1/8 inch in 96 inches (3 mm in 2400 mm), 1/4 inch (6 mm) maximum.
3. Variation in Joint Width: Do not vary joint thickness more than 1/4 of nominal joint width.
4. Variation in Plane at Joints (Lipping): Do not exceed 1/64-inch (0.4-mm) difference between planes of adjacent units.
5. Variation in Line of Edge at Joints (Lipping): Do not exceed 1/64-inch (0.4-mm) difference between edges of adjacent units, where edge line continues across joint.

C. Installation Of Countertops

1. General: Install countertops over plywood subtops with full spread of water-cleanable epoxy adhesive.
OR
Install countertops by adhering to supports with water-cleanable epoxy adhesive.
2. Do not cut stone in field, unless otherwise indicated. If stone countertops or splashes require additional fabrication not specified to be performed at Project site, return to fabrication shop for adjustment.
OR
Do necessary field cutting as stone is set. Use power saws with diamond blades to cut stone. Cut lines straight, true, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
3. Set stone to comply with requirements indicated on Drawings and Shop Drawings. Shim and adjust stone to locations indicated, with uniform joints of widths indicated and with edges and faces aligned according to established relationships and indicated tolerances. Install anchors and other attachments indicated or necessary to secure stone countertops in place.
4. Bond joints with stone adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
5. If joints are allowed, space joints with 1/16-inch (1.5-mm) gap for filling with grout **OR** sealant, **as directed**. Use temporary shims to ensure uniform spacing.
 - a. Install metal splines in kerfs in stone edges at joints where indicated. Fill kerfs with stone adhesive **OR** setting adhesive **OR** sealant, **as directed**, before inserting splines and remove excess immediately after adjoining units are drawn into position.
 - b. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.
6. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Use power saws with diamond blades to cut stone. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
7. Install backsplash and end splash by adhering to wall with water-cleanable epoxy adhesive and to countertops with stone adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.
OR



Install backsplash and end splash by adhering to countertops with stone adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Leave 1/16-inch (1.5-mm) gap between splash and wall for filling with sealant. Use temporary shims to ensure uniform spacing.

OR

Install backsplash and end splash by adhering to wall with water-cleanable epoxy adhesive. Leave 1/16-inch (1.5-mm) gap between countertop and splash for filling with sealant. Use temporary shims to ensure uniform spacing.

8. If grouted joints are acceptable, grout joints to comply with ANSI A108.10. Remove temporary shims before grouting. Tool grout uniformly and smoothly with plastic tool.
9. Apply sealant to joints and gaps specified for filling with sealant; comply with Division 07 Section "Joint Sealants". Remove temporary shims before applying sealant.

D. Adjusting And Cleaning

1. In-Progress Cleaning: Clean countertops as work progresses. Remove adhesive, grout, mortar, and sealant smears immediately.
2. Remove and replace stone countertops of the following description:
 - a. Broken, chipped, stained, or otherwise damaged stone. Stone may be repaired if methods and results are approved by the Owner.
 - b. Defective countertops.
 - c. Defective joints, including misaligned joints.
 - d. Interior stone countertops and joints not matching approved Samples and mockups.
 - e. Interior stone countertops not complying with other requirements indicated.
3. Replace in a manner that results in stone countertops matching approved Samples and mockups, complying with other requirements, and showing no evidence of replacement.
4. Clean stone countertops not less than six days after completion of sealant installation **OR** installation, **as directed**, using clean water and soft rags. Do not use wire brushes, acid-type cleaning agents, cleaning compounds with caustic or harsh fillers, or other materials or methods that could damage stone.
5. Sealer Application: Apply stone sealer to comply with stone producer's and sealer manufacturer's written instructions.

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SECTION 12 36 61 16 - SOLID POLYMER FABRICATIONS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for cast, mineral filled, nonporous, solid polymer material used for countertops, vanity tops, sinks, bowls, window sills, tub and shower walls, and other applications where a hard, durable, stain resistant surface is desired. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Shop Drawings: Fabrications; indicate joints, shapes, dimensions, accessories and installation details.
2. Product Data: Solid polymer fabrications; panel adhesive; joint adhesive; sealant; heat reflective tape.
3. Samples: Solid polymer fabrications; where colors and patterns are not indicated, submit at least 3 different samples of manufacturer's standard colors and patterns for selection.
4. Test Reports: Tensile strength; hardness; flammability; thermal expansion; boiling water resistance; high temperature resistance; liquid absorption; mold and mildew growth; bacteria growth; impact resistance; sanitation.
5. Operation and Maintenance Data: Solid polymer fabrications; provide manuals indicating manufacturer's care and maintenance data, including repair and cleaning instructions. Provide maintenance kit(s) for selected finish(es).

- #### C. Quality Assurance:
- Do not change source of supply for materials after work has started if the appearance of finished work would be affected. Variation in component size and location of openings to be plus or minus 1/8 inch (3 mm).

- #### D. Delivery:
- Do not deliver until areas are ready for installation. Deliver components and materials to the site undamaged in containers, clearly marked and labeled with manufacturer's name. Store in dry, weathertight enclosure. Protect materials to prevent damage to finished surfaces. Provide protective coverings to prevent physical damage or staining after installation until completion of the project.

- #### E. Warranty:
- Provide the solid surface material manufacturer's 10 year warranty, from date of acceptance of the work.

1.2 PRODUCTS

- #### A. Solid Polymer Fabrications:
- Provide fabrication of cast, solid polymer material composed of acrylic polymer, mineral fillers and pigments. Material shall not be coated or laminated to substrates. Polymer thickness to be as indicated but not less than 1/4 inch (6 mm). Superficial damage to a depth of 0.010 inch (0.25 mm) shall be repairable by sanding or polishing.

1. Performance Requirements

- a. Tensile strength, ASTM D 638: 5800 psi (40 Mpa) minimum
- b. Hardness, ASTM D 2583: Barcol Impressor 55 minimum
- c. Flammability, ASTM E 84: Class I/A, flame spread 25 maximum; smoke developed 30 maximum
- d. Thermal Expansion, ASTM D 696: 0.00002 in/in/F (0.000036 mm/mm/K) maximum
- e. Boiling water resistance, NEMA LD 3: No effect
- f. High temperature resistance, NEMA LD 3: No effect
- g. Liquid absorption, ASTM D 570 (24 hours): 0.10 percent maximum



- h. Mold and mildew growth, ASTM G 21: No growth, no effect
 - i. Bacteria growth, ASTM G 22: No growth, no effect
 - j. Sanitation, NSF 51: "Food Contact" approval for food area applications
 - k. Impact resistance, NEMA LD 3 (1/2 lb. (0.227 kg) ball drop): 1/4 inch (6 mm) material, 36 inch (914 mm) drop, no failure **OR** 1/2 inch (13 mm) material, 120 inch (3048 mm) drop, no failure, **as directed**.
2. Joint Adhesive: Two part acrylic joint adhesive as recommended by the solid polymer manufacturer to form inconspicuous, non-porous joints by chemical bond.
 3. Panel Adhesive: Neoprene based panel adhesive as recommended by the solid polymer manufacturer, UL listed.
 4. Sealant: Mildew resistant, FDA compliant and UL listed, silicone sealant as recommended by the solid polymer manufacturer.
 5. Heat Reflective Tape: Heat reflective tape as recommended by the solid polymer manufacturer for use with cutouts for heat sources.
 6. Mounting Hardware: Provide mounting hardware including sink/bowl clips, inserts and fasteners for attachment of undermount sinks and lavatories.

B. Fabrications: Fabrication requirements.

1. Factory fabricate components to the greatest extent possible to the sizes and shapes indicated, in accordance with approved shop drawings. Where indicated, factory fabricate side and back splashes with 1/2 inch (13 mm) cove at intersections.
2. Form joints between components using manufacturer's standard acrylic joint adhesive. Joints shall be inconspicuous, non-porous, and reinforced with strips of solid polymer material in accordance with the manufacturer's printed instructions.
3. Provide factory cutouts for plumbing and accessories as indicated. Reinforce heated or cooled cutouts in accordance with approved shop drawings and the manufacturer's printed instructions. Support all cutouts in accordance with approved shop drawings and the manufacturer's printed instructions.
4. Cut and finish component edges with clean returns. Round edges of cutouts to 1/8 inch (3 mm) radius. Round corners of cutouts with 1/2 inch (13 mm) minimum radius. Use router to form all cutouts. Provide thick edges where indicated using strips of solid polymer material and manufacturer's acrylic joint adhesive. All joints to be inconspicuous and non-porous. All exposed surfaces to have uniform finish and gloss.

1.3 EXECUTION

A. Installation: Deliver fabrications to the locations indicated. Assemble and install complete with accessories and hardware.

1. Assembly Requirements
 - a. Install components plumb and level and scribed to adjacent finishes in accordance with approved shop drawings and data.
 - b. Fasten and support fabrications to walls, brackets, and partitions as indicated. Fasteners shall be appropriate for use with adjoining construction.
 - c. Form field joints using manufacturer's recommended acrylic adhesive. Joints shall be inconspicuous and non-porous. Keep components and hands clean when forming joints. Seal flexible joints using manufacturer's recommended sealant.
 - d. Provide integral backsplashes and sidesplashes as indicated. Attach splashes with silicone or joint adhesive as indicated.
 - e. Keep components and hands clean during installation. Remove excessive adhesive and sealants. Clean finished surfaces of all dirt and stains.
2. Protection: Provide protective coverings to prevent physical damage or staining following installation.



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SECTION 12 48 13 13 - FLOOR MATS AND FRAMES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for floor mats and frames. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Roll-up mats in recessed and surface-mounted frames.
 - b. Entrance mats in recessed and surface-mounted frames.
 - c. Entrance tiles in recessed and surface-mounted frames.

C. Submittals

1. Product Data: For each type of floor mat and frame.
2. Shop Drawings: Show the following:
 - a. Items penetrating floor mats and frames, including the following:
 - 1) Door control devices.
 - b. Divisions between mat sections.
 - c. Perimeter floor moldings.
 - d. Custom Graphics: Scale drawing indicating colors.
3. Samples: For each floor mat, tread rail, and frame member.
4. Maintenance Data.

D. Quality Assurance

1. Accessibility Requirements: Provide installed floor mats that comply with Section 4.5 in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)" **OR** Sections 302 and 303 in ICC A117.1, **as directed**.

1.2 PRODUCTS

A. Roll-Up Mats

1. Roll-up, Vinyl-Rail Hinged Mats: Vinyl-acrylic tread rails 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, wide by 3/8 inch (9.5 mm) thick, with slotted or perforated vinyl **OR** aluminum, **as directed**, hinges.
 - a. Tread Inserts: Textured-surface, resilient vinyl **OR** Ribbed-design-surface, resilient vinyl **OR** Mineral abrasive particles bonded to or embedded in vinyl **OR** Aluminum-oxide or silicon-carbide grit in epoxy matrix **OR** 1/4-inch- (6-mm-) high, 28-oz./sq. yd. (950-g/sq. m) weight, level-cut, nylon-pile, fusion-bonded carpet, **as directed**.
 - b. Colors, Textures, and Patterns of Inserts: As selected from manufacturer's full range.
 - c. Rail Color: Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black **OR** As selected from manufacturer's full range, **as directed**.
 - d. Mat Size: As indicated **OR as directed**.
2. Roll-up, Aluminum-Rail Hinged Mats: Extruded-aluminum tread rails 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, wide by 3/8 inch (9.5 mm) thick, sitting on continuous vinyl cushions.
 - a. Tread Inserts: Plain serrated aluminum treads **OR** Textured-surface, resilient vinyl **OR** Ribbed-design-surface, resilient vinyl **OR** Mineral abrasive particles bonded to or embedded in vinyl **OR** Aluminum-oxide or silicon-carbide grit in epoxy matrix **OR** 1/4-inch-



- (6-mm-) high, 28-oz./sq. yd. (950-g/sq. m) weight, level-cut, nylon-pile, fusion-bonded carpet, **as directed**.
- b. Colors, Textures, and Patterns of Inserts: As selected from manufacturer's full range.
 - c. Rail Color: Mill-finish **OR** Clear **OR** Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black **OR** As selected from manufacturer's full range, **as directed**.
 - d. Hinges: Plastic **OR** Aluminum, **as directed**.
 - e. Mat Size: As indicated **OR as directed**.
3. Surface-Mounted Frames:
 - a. Tapered Frames: Tapered flexible vinyl edge-frame **OR** aluminum frame, **as directed**, members, not less than 1-1/2 inches (38 mm) wide, attached to mat at all 4 edges, with welded mitered corners.
 - b. Color: Mill finish **OR** Clear **OR** Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black **OR** As selected from manufacturer's full range, **as directed**.
 4. Recessed Frames:
 - a. Extruded Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6061-T6 or Alloy 6063-T5, T6, or T52.
 - b. Color: Mill finish **OR** Clear **OR** Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black **OR** As selected from manufacturer's full range, **as directed**.
 - c. Architectural Bronze: ASTM B 455, Alloy UNS No. C38500.
 5. Structural Performance (if floor mats must withstand heavy wheeled-cart loads): Provide roll-up mats and frames capable of withstanding the following loads and stresses within limits and under conditions indicated:
 - a. Uniform floor load of 300 lbf/sq. ft. (14.36 kN/sq. m) **OR as directed**.
 - b. Wheel load of 350 lb (159 kg) per wheel **OR as directed**.

B. Entrance Mats

1. Resilient Link Mats: 3/8-inch- (9.5-mm-) **OR** 7/16-inch- (11-mm-), **as directed**, thick, reversible vinyl **OR** rubber **OR** rubber-tire, **as directed**, link mats with galvanized spring-steel **OR** stainless-steel, **as directed**, wire link rods, vulcanized edge-nosing trim, steel-reinforced end trim, and links consisting of rectangular units or continuous strips in a heel-proof, solid-weave pattern with no openings between links **OR** heel-proof, close-weave pattern with openings between links not exceeding 1/8 inch (3 mm) wide by 1 inch (25.4 mm) long **OR** open-weave pattern with openings between links about 1/2 inch (13 mm) wide by 1 inch (25.4 mm) long, **as directed**.
 - a. Color: As selected from manufacturer's full range.
 - b. Mat Size: As indicated **OR as directed**.
2. Rubber **OR** Vinyl, **as directed**, Mats: 1/4-inch- (6-mm-) **OR** 3/8-inch- (9.5-mm-) **OR** 7/16-inch- (11-mm-) **OR** 1/2-inch- (13-mm-), **as directed**, thick mats; with square edges for recessed installations **OR** beveled edges for surface applications, **as directed**, and with solid sheet (no perforations) style **OR** perforated style, 1/4-inch (6-mm) diameter on standard spacing **OR** perforated style, 3/16 by 3/4 inch (5 by 19 mm) on standard spacing, **as directed**, standard pyramid design **OR** standard wide-wale corrugated **OR** hi-rib, narrow-wale corrugated, **as directed**, top profile, and low-rib, narrow-wale corrugated **OR** standard knob-base **OR** flat-base, **as directed**, bottom surface.
 - a. Color: As selected from manufacturer's full range.
 - b. Mat Size: As indicated, **OR as directed**.
3. Cocoa Mats: Constructed from cocoa fiber yarn permanently bonded to PVC backing for dimensional stability and resistance to shedding; 5/8- to 3/4-inch (16- to 19-mm) overall thickness; 1.5-lb/sq. ft (7.3-kg/sq. m) **OR** 1-inch (25.4-mm) overall thickness; 2.0-lb/sq. ft (10-kg/sq. m) **OR** 1-1/4-inch (32-mm) overall thickness; 2.5-lb/sq. ft (12-kg/sq. m), **as directed**, weight.
 - a. Color: As selected from manufacturer's full range.
 - b. Mat Size: As indicated, **as directed**.
4. Rubber-Tire Mats: Units of edge-grain-laminated and chenille-buffed, rubber-tire wall cuts; bonded to sheet rubber or other durable flexible backing sheet to form 3/8- to 7/16-inch- (9.5- to



- 11-mm-) thick, 12-inch- (300-mm-) square tile **OR** wide, continuous linear strip up to 25 feet (7.6 m) long, **as directed**.
- a. Mat Size: As indicated **OR as directed**.
5. Carpet-Type Mats: Nylon **OR** Polypropylene **OR** Olefin **OR** Polyester, **as directed**, carpet bonded to 1/8- to 1/4-inch- (3- to 6-mm-) thick, flexible vinyl backing to form mats 3/8 or 7/16 inch (9.5 or 11 mm) thick with nonraveling edges.
 - a. Colors, Textures, and Patterns: As selected from manufacturer's full range.
 - b. Mat Size: As indicated **OR as directed**.
 6. Loop Filament Mats: 3M's "Nomad" loop filament vinyl material 3/8 inch (9.5 mm) **OR** 1/2 inch (13 mm), **as directed**, thick, with solid vinyl sheet **OR** foam sheet, **as directed**, backing and with built-in chemical agents to reduce fungus and mildew.
 - a. Color: As selected from manufacturer's full range.
 - b. Mat Size: As indicated **OR as directed**.
 7. Nuway Mats: Nylon-reinforced, 1/2-inch- (13-mm-) wide by 7/16-inch- (11-mm-) **OR** 11/16-inch- (17.4-mm-), **as directed**, thick, vulcanized laminated rubber strips alternating with 9/16-inch- (14-mm-) wide, profile shapes assembled on 0.1055-inch- (2.7-mm-) diameter, galvanized steel wire, 1-1/2 inches (38 mm) o.c. Fibered surface buffed on rubber strips for interior **OR** unbuffed on rubber strips for exterior, **as directed**, installations.
 - a. Semiopen construction incorporating a 1/8-inch- (3-mm-) thick, PVC spacer on each wire between each profile shape and rubber strip to allow dirt, grit, and water to drop through.
 - b. Profile Shape Finish: Extruded-aluminum, mill finish **OR** Solid architectural-quality brass **OR** High-impact, solid PVC in color selected, **as directed**.
 - c. Color: As selected from manufacturer's full range.
 - d. Mat Size: As indicated **OR as directed**.
 8. Surface-Mounted Frames:
 - a. Tapered Frames: Tapered flexible vinyl edge-frame **OR** aluminum frame, **as directed**, members, not less than 2 inches (50 mm) **OR** 1-1/2 inches (38 mm), **as directed**, wide, attached to mat at all 4 edges, **as directed**, with welded mitered corners.
 - b. Color: Mill finish **OR** Clear **OR** Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black **OR** As selected from manufacturer's full range, **as directed**.
 9. Recessed Frames:
 - a. Extruded Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6061-T6 or Alloy 6063-T5, T6, or T52.
 - b. Color: Mill-finish **OR** Clear **OR** Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black **OR** As selected from manufacturer's full range, **as directed**.
 - c. Architectural Bronze: ASTM B 455, Alloy UNS No. C38500.
 10. Graphics: Custom inlaid or woven-in graphic design **OR** logo **OR** emblem **OR** characters, **as directed**, as indicated.
- C. Entrance Tiles
1. Rubber-Tire Tiles: Units of edge-grain-laminated and chenille-buffed, rubber-tire wall cuts; bonded to sheet rubber or other durable flexible backing sheet to form 3/8- to 7/16-inch- (9.5- to 11-mm-) thick, square tile **OR** continuous linear strip, **as directed**.
 - a. Colors, Textures, and Patterns: As selected from manufacturer's full range.
 - b. Tile Size: 12 inches (300 mm) **OR** As indicated, **as directed**.
 2. Rubber **OR** Vinyl, **as directed**, Tiles: 5/8-inch- (16-mm-) **OR** 7/16-inch- (11-mm-), **as directed**, thick, solid **OR** open-grid, **as directed**, rubber **OR** vinyl, **as directed**, compound molded tiles with concealed interlocking joint tabs **OR** 1/4-inch- (6-mm-) deep, serpentine-grooved top face and knob-base back face on solid tile, **as directed**.
 - a. Colors, Textures, and Patterns: As selected from manufacturer's full range.
 - b. Tile Size: As indicated **OR as directed**.
 3. Carpet-Type Tiles: Nylon **OR** Polypropylene **OR** Olefin **OR** Polyester, **as directed**, carpet bonded to 1/8- to 1/4-inch- (3- to 6-mm-) thick, flexible vinyl backing to form mats 3/8 or 7/16 inch (9.5 or 11 mm) thick with nonraveling edges.
 - a. Colors, Textures, and Patterns: As selected from manufacturer's full range.
 - b. Tile Size: As indicated **OR as directed**.



4. Surface-Mounted Frames:
 - a. Tapered Frames: Tapered flexible vinyl edge-frame **OR** aluminum frame, **as directed**, members, not less than 2 inches (50 mm) **OR** 1-1/2 inches (38 mm), **as directed**, wide, attached to mat at all 4 edges, **as directed**, with welded mitered corners.
 - b. Color: Mill finish **OR** Clear **OR** Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black **OR** As selected from manufacturer's full range, **as directed**.
 5. Recessed Frames: Manufacturer's standard extrusion.
 - a. Extruded Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6061-T6 or Alloy 6063-T5, T6, or T52.
 - b. Color: Mill-finish **OR** Clear **OR** Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black **OR** As selected from manufacturer's full range, **as directed**.
- D. Concrete Fill And Grout Materials
1. Provide concrete grout and fill equivalent in strength to cast-in-place concrete slabs for recessed mats and frames. Use aggregate no larger than one-third fill thickness.
- E. Fabrication
1. Floor Mats: Shop fabricate units to greatest extent possible in sizes indicated. Unless otherwise indicated, provide single unit for each mat installation; do not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in mats are necessary, space symmetrically and away from normal traffic lanes. Miter corner joints in framing elements with hairline joints or provide prefabricated corner units without joints.
 2. Surface-Mounted Frames: As indicated for permanent surface-mounted installation, complete with corner connectors, splice plates or connecting pins, and postinstalled expansion anchors.
 3. Recessed Frames: As indicated, for permanent recessed installation, complete with corner pins or reinforcement and anchorage devices.
 - a. Fabricate edge-frame members in single lengths or, where frame dimensions exceed maximum available lengths, provide minimum number of pieces possible, with hairline joints equally spaced and pieces spliced together by straight connecting pins.
 4. Coat surfaces of aluminum frames that will contact cementitious material with manufacturer's standard protective coating.
- F. Aluminum Finishes
1. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 2. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
 3. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.
 4. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
 5. Class II, Color Anodic Finish: AA-M12C22A32/A34 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, integrally colored or electrolytically deposited color coating 0.010 mm or thicker) complying with AAMA 611.
 6. Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
- G. Copper-Alloy (Bronze) Finishes



1. Finish designations prefixed by CDA comply with the system established by the Copper Development Association for designating copper-alloy finishes, as defined in NAAMM's "Metal Finishes Manual for Architectural and Metal Products."
 - a. Remove tool and die marks and stretch lines or blend into finish.
 - b. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
2. CDA Mechanical Finish Designation: M11, specular, as fabricated **OR** M32, directionally textured, medium satin, **as directed**.

1.3 EXECUTION

A. Installation

1. Install recessed mat frames to comply with manufacturer's written instructions. Set mat tops at height recommended by manufacturer for most effective cleaning action; coordinate top of mat surfaces with bottom of doors that swing across mats to provide clearance between door and mat.
 - a. For installation in terrazzo flooring areas, provide allowance for grinding and polishing of terrazzo without grinding surface of recessed frames. Coordinate with other trades as required.
 - b. Install necessary shims, spacers, and anchorages for proper location and secure attachment of frames.
 - c. Install grout and fill around frames and, if required to set mat tops at proper elevations, in recesses under mats. Finish grout and fill smooth and level.
2. Install surface-type units to comply with manufacturer's written instructions at locations indicated; coordinate with entrance locations and traffic patterns.
 - a. Anchor fixed surface-type frame members to floor with devices spaced as recommended by manufacturer.

B. Protection

1. After completing frame installation and concrete work, provide temporary filler of plywood or fiberboard in recesses and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and Project is near Final Completion.

END OF SECTION 12 48 13 13



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SECTION 12 48 13 13a - FOOT GRILLES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for foot grilles. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the Work.

B. Summary

1. This Section includes recessed foot grilles and frames.

C. Performance Requirements

1. Structural Performance: Provide foot grilles and frames capable of withstanding the following loads and stresses:
 - a. Uniform floor load of 300 lbf/sq. ft. (14.36 kN/sq. m) **OR as directed**.
 - b. Wheel load of 350 lb (159 kg) **OR as directed**, per wheel.

D. Submittals

1. Product Data: For each type of foot grille and frame.
2. Shop Drawings: Show the following:
 - a. Items penetrating foot grilles and frames, including the following:
 - 1) Door control devices.
 - b. Divisions between grille sections.
 - c. Perimeter floor moldings.
3. Samples: For each type of product involving color selection.
 - a. Foot Grille: 12-inch- (300-mm-) square assembled sections.
 - b. Frame Members: 12-inch- (300-mm-) long Sample of each type and color.
4. Maintenance data.

E. Quality Assurance

1. Accessibility Requirements: Provide installed foot grilles that comply with Section 4.5 in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)" **OR** Sections 302 and 303 in ICC A117.1., **as directed**

1.2 PRODUCTS

A. Materials

1. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B, with A60 (ZF180) zinc-iron-alloy (galvannealed) coating or with G60 (Z180) mill-phosphatized zinc coating; stretcher-leveled standard of flatness; with minimum thickness indicated representing specified thickness according to ASTM A 924/A 924M.
2. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304.
3. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than strength and durability properties of Alloy 5005-H15.
4. Extruded Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6061-T6 or Alloy 6063-T5, T6, or T52 as standard with manufacturer. Coat surface of frame in contact with cementitious materials with manufacturer's standard protective coating.
5. Extruded Architectural Bronze: ASTM B 455, Alloy No. C38500.
6. Stainless-Steel Angles: ASTM A 276 or ASTM A 479/A 479M, corrosion resistant, Type 304.



B. Foot Grilles

1. General: Provide manufacturer's standard foot-grille assemblies consisting of treads of type and profile indicated, interlocked or joined together by cross members, and with support legs (if any) and other components needed to produce a complete installation.
2. Aluminum **OR** Bronze, **as directed**, Foot Grilles: Provide manufacturer's standard foot grilles with extruded members, top-surfaced tread rails, and as follows:
 - a. Tread Rails: Extruded-aluminum **OR** Extruded-bronze, **as directed**, tread rails with extruded-aluminum frame, **as directed**.
 - b. Tread Rail Spacing: 1-1/2 inches (38 mm) o.c. with 1/8- to 3/16-inch- (3- to 4.8-mm-) **OR** 2 inches (50 mm) o.c. with 1/4-inch- (6-mm-), **as directed**, wide openings between treads.
 - c. Aluminum Finish: Mill **OR** Anodized, **as directed**.
 - 1) Colors: Clear natural aluminum **OR** Light bronze **OR** Medium bronze **OR** Dark bronze **OR** Black **OR** As selected from manufacturer's full range, **as directed**.
 - d. Top Surface: Serrated aluminum **OR** Serrated bronze **OR** Serrated vinyl cap with UV stabilizer and antifungal additive **OR** Textured-surface, resilient vinyl insert **OR** Aluminum-oxide or silicon-carbide grit in epoxy matrix **OR** Abrasive particles bonded to or imbedded in vinyl insert **OR** Fusion-bonded, level-cut-pile nylon carpet insert; 1/4 inch (6 mm) high, 28 oz./sq. yd. (950 g/sq. m), **as directed**.
 - 1) Colors: As selected from manufacturer's full range, **as directed**.
 - e. Grille Size: As indicated **OR as directed**.
3. Stainless-Steel Foot Grille: Type 304.
 - a. Surface Treads: 0.071-by-0.177-inch (1.8-by-4.49-mm) wire with 0.125-inch- (3.17-mm-) **OR** 0.090-by-0.172-inch (2.2-by-4.37-mm) wire with 0.145-inch- (3.68-mm-) **OR** 0.093-by-0.156-inch (2.36-by-3.96-mm) wire with 0.125-inch- (3.17-mm-), **as directed**, wide openings between wires.
 - b. Support Rods: Spaced 1 inch (25 mm) o.c., welded to each wire.
 - c. Mat Grating: 5/8 inch (16 mm) deep.
 - d. Pit Grating: 1-1/8 inches (28.5 mm) deep.
 - e. Stainless-Steel Finish: Mill **OR** No. 4, **as directed**, finish.
 - f. Grille Size: As indicated **OR as directed**.
4. PVC Foot Grille: 1/8-by-1-1/2-by-1-inch (3-by-38-by-25-mm) ribbed top, PVC tread bars joined with 3/8-inch (10-mm) stainless-steel rods with 1-1/16-inch- (27-mm-) long nylon spacers at 12 inches (300 mm) o.c. Provide PVC frame with nylon anchors.
 - a. Colors: As selected from manufacturer's full range.
 - b. Grille Size: As indicated **OR as directed**.
5. Lockdown: Manufacturer's standard **OR** Hidden **OR** In view, **as directed**.

C. Frames

1. Provide manufacturer's standard frames of size and style for grille type, for permanent recessed installation in subfloor, complete with installation anchorages and accessories. Unless otherwise indicated, fabricate frame of same material and finish as grilles.

D. Support System

1. Level Bed Applications: Provide manufacturer's standard, vinyl cushion support system.
2. Drainage Pit Applications: Provide manufacturer's special deep-pit frame and support extrusion system with intermediate support beams, sized and spaced as recommended by manufacturer for indicated spans and equipped with vinyl support cushions.

E. Drain Pans

1. Provide manufacturer's standard, 0.060-inch- (1.52-mm-) thick, **as directed**, metallic-coated steel **OR** aluminum **OR** stainless-steel, **as directed**, sheet drain pan with NPS 2 (DN 50) drain outlet for each floor grille unit. Coat bottom of pan with protective coating recommended by manufacturer.

F. Fabrication



1. Shop fabricate foot grilles to greatest extent possible in sizes as indicated. Unless otherwise indicated, provide each grille as a single unit; do not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in grilles are necessary, space symmetrically and away from normal traffic lanes.
2. Fabricate frame members in single lengths or, where frame dimensions exceed maximum available lengths, provide minimum number of pieces possible, with hairline joints equally spaced and pieces spliced together by straight connecting pins.

G. Finishes, General

1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

H. Aluminum Finishes

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
2. Mill Finish: AA-M10 (Mechanical Finish: as fabricated); grind and buff as required to remove scratches, welding, or abrasions produced in fabrication process.
3. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.
4. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
5. Class II, Color Anodic Finish: AA-M12C22A32/A34 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, integrally colored or electrolytically deposited color coating 0.010 mm or thicker).
6. Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.

I. Stainless-Steel Finishes

1. Mill finish.
2. Directional Satin Finish: No. 4.
 - a. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

J. Copper-Alloy (Bronze) Finishes

1. Finish designations for copper alloys comply with the system established for designating copper-alloy finish systems defined in NAAMM's "Metal Finishes Manual for Architectural and Metal Products."
 - a. Remove tool and die marks and stretch lines or blend into finish.
 - b. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
2. Mechanical Finish Designation: M11, specular, as fabricated **OR** M32, directionally textured, medium satin, **as directed**.

1.3 EXECUTION

A. Installation

1. Install recessed foot grilles and frames and drain pans to comply with manufacturer's written instructions at locations indicated and with top of foot grilles and frames in relationship to one another and to adjoining finished flooring as recommended by manufacturer. Set foot-grille tops



at height for most effective cleaning action. Coordinate top of foot-grille surfaces with doors that swing across grilles to provide clearance under door.

B. Protection

1. After completing frame installations, provide temporary filler of plywood or fiberboard in foot-grille recesses and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and Project is near Final Completion.

END OF SECTION 12 48 13 13a



Task	Specification	Specification Description
12 48 13 16	12 48 13 13	Floor Mats And Frames
12 48 13 16	12 48 13 13a	Foot Grilles
12 61 13 00	12 01 60 00	Fixed Audience Seating
12 61 16 00	12 01 60 00	Fixed Audience Seating
12 61 19 00	12 01 60 00	Fixed Audience Seating



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SECTION 12 62 23 00 - PORTABLE BLEACHERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of portable bleachers. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: For each type of product indicated.

C. Warranty

1. Contractor shall warranty any and all materials or workmanship covered by these specifications for a period of one (1) year. Defects shall be corrected by the Contractor at once without charge to the Owner.

1.2 PRODUCTS

A. Design:

1. The design shall be in accordance with the generally accepted standards as published by The American Institute of Steel Construction and The Aluminum Association.
2. Design Loads:
 - a. A uniformly distributed live load of not less than 100 psf of gross horizontal projection of the bleachers.
 - b. Bleachers shall be designed to withstand, with or without live loads, the horizontal and uplift pressures due to the wind. Wind pressures shall be derived from ANSI/ASCE 7-93, Minimum Design Loads in Buildings and Other Structures.
 - c. A horizontal swaying force applied to the seats, in a direction parallel to the length of the seats, of 24 lbs./ft.
 - d. A horizontal swaying force applied to the seats, in a direction perpendicular to the length of the seats, of 10 lb./ft.
 - e. All seat and footboard members shall be designed for live loads of not less than 120 lb. per lineal foot.
 - f. Guardrails shall be capable of sustaining a vertical load of 100 plf and a horizontal thrust of 50 plf. Acting outwardly at the top of the rail.
 - g. Under these loads, stresses shall not exceed those allowed in the "Specifications for Structural Steel Buildings, June 1, 1989" as adopted by the American Institute of Steel Construction.
3. Shop Connections: Welded and capable of carrying stress put upon them as per AWS standards.
4. Supporting Members (Framework):
 - a. Main supporting members are to be of a welded angle frame design.
 - b. Spaced at 6'-0" centers (maximum).
 - c. Constructed of a minimum 2 x 2 x 3/16" angle.
 - d. Every frame shall be laterally supported with cross-bracing to the adjacent frame.
5. Dimensions:
 - a. Length of Unit: 15" **OR** 21" **OR** 27," **as directed**.
 - b. Number of rows: 2 **OR** 3 **OR** 4 **OR** 5 **OR** 10, **as directed**.
 - c. Seat Height: 17 inches.
 - d. Typical Stands: 8" Rise with a 24" row depth.
6. Deck Arrangements:



- a. Seats: Nominal 2 x 10, anodized aluminum.
 - b. Footboards: Nominal 2 x 10 mill finish aluminum. (Optional 2 @ 2 x 10 mill finish aluminum on 2, 3, 4, 5 row units; Standard on 10 row units).
 - c. Riser: Optional on 2,3,4 & 5 row units, Standard on 10 row units
 - d. Vertical aisles with handrails as required by code.
7. Guardrails:
- a. Furnished on sides of any bleacher that is 5 rows high or higher per code. (Optional on 2, 3, & 4 row units).
 - b. All pipes shall be 1 5/8" O.D. anodized aluminum pipe with end plugs and elbows at corners. Secured to angle rail posts with galvanized fasteners.
 - c. Rails not less than 42" vertically above the center of the seatboard surface shall be provided at the back and sides of the bleacher.
 - d. Included on all sides of the bleacher shall be 2" x 9 gauge galvanized chain link fencing fastened in place with aluminum ties and galvanized tension bars and aluminum rail clamps.
8. Mudsills: 2 x 4 pressure treated wood shall be provided on all frames.
9. Transporting Options:
- a. Galvanized steel angle tow bar
 - b. Pneumatic wheels with axles
10. Tip-N-Roll Package: Optional on 2, 3, & 4 row units up to 21'-0" long.
- a. Non-marking rubber grommets shall be provided on all frames.
 - b. Caster wheels shall be 4" diameter, swivel mounted, non-marking soft rubber.

B. Materials

1. Steel: ASTM A572 (Hot-Dipped Galvanized), ASTM A586 (Weathering Steel).
2. Aluminum: Extruded alloy 6063-T6.
3. Accessories:
 - a. High Strength Bolts and Nuts - ASTM A325 steel.
 - b. Ordinary Bolts and Nuts - ASTM A307.
 - c. Hold-Down Clip Assemblies - Aluminum alloy 6063-T6.
 - d. End Caps - Channel aluminum alloy 6063-T6.

C. Finishes

1. Steel: Galvanized Steel and Weathering Steel.
2. Aluminum:
 - a. Anodized: Seat planks, backrest, stanchions and also risers if requested clear anodized 204R1, AA-M10C22A31, Class II.
 - b. Mill Finish: Footboards and riser boards (6063-T6).
 - c. Paint: Electrostatically applied, baked-on siliconized acrylic or siliconized polyester enamel.

1.3 EXECUTION

A. Installation

1. Install bleacher unit in accordance with manufacturer's installation procedures.

END OF SECTION 12 62 23 00



Task	Specification	Specification Description
12 62 23 00	01 22 16 00	No Specification Required



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**SECTION 13 34 16 13 - FIXED WOOD BLEACHERS (EXTERIOR)**

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of fixed wood bleachers (exterior). Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: For each type of product indicated.

1.2 PRODUCTS

A. Hardware, Brackets, Fasteners, and Connectors

1. Zinc-coated or hot-dipped galvanized steel or aluminum. Nails, brads, staples, and spikes shall comply with ASTM F 547.

B. Lumber and Timber Members

1. Repair or replacement bleacher components shall be of the species and grades complying with National Design Specification for Wood Construction and its Fastenings (National Forest Products Association). Sizes shall comply with American Lumber Standards Committee PS20. Lumber materials shall bear a mark of recognized inspection agency identifying the species, grade, and compliance with the applicable standard. Wood preservatives shall be pressure-applied and shall comply with ASTM D 1760. Creosote or arsenate treatments shall not be used.
 - a. Seatboard Lumber shall be kiln-dried Dense No. 1 Douglas fir or Dense No. 1 Southern yellow pine boards.
 - b. Footboard Lumber shall be kiln-dried Dense No. 1 Douglas fir or Dense No. 1 Southern yellow pine boards.
 - c. Support Member and Timber shall be Dense No. 1 Douglas fir or Dense No. 1 Southern yellow pine timbers or boards.

C. Ready-Mixed Concrete

1. Comply with ASTM C 94 with compressive strength of 3,000 pounds per square inch (210.9 kgs per square cm) at 28 days and shall be protected from freezing for seven days after placement.

D. Reinforcement for Concrete

1. Comply with ASTM A 184, A 185, or A 615 as indicated.

1.3 EXECUTION

- A. Repair or replace bleacher components using methods complying with the approved practices as referenced in American Institute of Timber Construction Timber Construction Manual.

END OF SECTION 13 34 16 13



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**SECTION 13 34 16 13a - DEMOUNTABLE BLEACHERS (EXTERIOR)**

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of demountable bleachers (exterior). Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: For each type of product indicated.

1.2 PRODUCTS

A. Hardware and Accessories

1. Zinc-coated or hot-dipped galvanized steel or aluminum.

B. Lumber

1. Seat-board and foot-board repair or replacement lumber shall be species and grades complying with National Forest Products Association National Design Specification for Wood Construction and Its Fastenings. Sizes shall comply with American Lumber Standards Committee PS20. Lumber materials shall bear the mark of a recognized inspection agency identifying the species, grade, and compliance with the applicable standard. Wood preservatives shall be pressure-applied and shall comply with ASTM D 1760. Creosote or arsenate treatments shall not be used.
 - a. Seat-board Lumber shall be kiln-dried Dense No. 1 Douglas fir or Dense No. 1 Southern yellow pine boards.
 - b. Foot-board Lumber shall be kiln-dried Dense No. 1 Douglas fir or Dense No. 1 Southern yellow pine boards.

C. Steel Structural Members

1. Comply with ASTM A36.

D. Aluminum Structural Members

1. Comply with ASTM B308.

1.3 EXECUTION

- A. Repair or replace bleacher components using methods complying with the approved practices as referenced in American Institute of Timber Construction Timber Construction Manual.

END OF SECTION 13 34 16 13a



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SECTION 13 34 16 13b - GRANDSTANDS AND BLEACHERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of grandstands and bleachers. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: Shop Drawings submitted shall be Designed and Detailed under the direct supervision of a licensed, in house, Professional Engineer. The Professional Engineer shall be present during the time the design and detailing is completed unless all details are included on the approval drawings bearing his/her seal.

C. Warranty

1. Contractor shall warranty any and all materials or workmanship covered by these specifications for a period of one (1) year. Defects shall be corrected by the Contractor at once without charge to the Owner.

1.2 PRODUCTS

A. Design:

1. The design shall be in accordance with the generally accepted standards as published by The American Institute of Steel Construction and The Aluminum Association.
2. Design Loads:
 - a. A uniformly distributed live load of not less than 100 psf of gross horizontal projection of the grandstand.
 - b. Grandstands and bleachers shall be designed to withstand, with or without live loads, the horizontal and uplift pressures due to the wind. Wind pressures shall be derived from ANSI/ASCE 7-93, Minimum Design Loads in Buildings and Other Structures.
 - c. A horizontal swaying force applied to the seats, in a direction parallel to the length of the seats, of 24 lbs./ft.
 - d. A horizontal swaying force applied to the seats, in a direction perpendicular to the length of the seats, of 10 lb./ft.
 - e. All seat and footboard members shall be designed for live loads of not less than 120 lb. per lineal foot.
 - f. Guardrails shall be capable of sustaining a vertical load of 100 plf and a horizontal thrust of 50 plf. Acting outwardly at the top of the rail.
 - g. Under these loads, stresses shall not exceed those allowed in the "Specifications for Structural Steel Buildings, June 1, 1989" as adopted by the American Institute of Steel Construction.
3. Shop Connections: Welded and capable of carrying stress put upon them as per AWS standards.
4. Steel Members for Grandstands:
 - a. Stringers: Wide flange beams spaced at 6'-0" on center.
 - b. Columns: Wide flange beams spaced at 18'-0" on center longitudinally and transversely they will be spaced according to the size of the stand with a maximum of 24'-0" on center.
 - c. Cross Beams: Horizontal cross beams shall be wide flange beams and run "continuously" for the length of the stand.



- d. Cross-Bracing: Front to back bracing shall be structural steel angle, bolted at ends and centers. Rod bracing shall be used for side to side bracing. On columns requiring 2 or more sets of cross-bracing, the connecting strut shall run continuously for the entire length of the stand.
5. Supporting Members (Framework) for Bleachers:
 - a. Main supporting members are to be of a welded angle frame design.
 - b. Spaced at 6'-0" centers (maximum).
 - c. Constructed of a minimum 2 x 2 x 3/16" angle.
 - d. Every frame shall be laterally supported with cross-bracing to the adjacent frame.
6. Dimensions:
 - a. Length of Unit: As required to meet Project requirements.
 - b. Number of rows: As required to meet Project requirements.
 - c. Net seating capacity: As required to meet Project requirements.
 - d. Bleacher seats: As required to meet Project requirements.
 - e. Wheelchair spaces: As required to meet Project requirements, A.D.A. or Local Codes
 - f. Front Walkways: 66 inches clear width
 - g. Seat Height:
 - 1) Grandstands: 17 to 18 inches.
 - 2) Bleachers: 17 inches.
 - h. Walkway Elevation:
 - 1) Grandstands: 42 to 49 inches.
 - 2) Bleachers: 30 to 42 inches.
 - i. Aisle Width: 48" minimum clear width, unless directed otherwise.
7. Typical Stands:
 - a. Grandstands:
 - 1) 8" Rise or 10" Rise with a 24" **OR** 28", **as directed**, row spacing.
 - 2) 12" Rise with 30" row spacing (Min. required for backrest).
 - b. Bleachers: Standard 8: Rise with a 24" row depth
8. Deck Arrangements:
 - a. Walkways: Six 2 x 12 planks.
 - b. Seats: Standard 2 x 10, unless directed otherwise.
 - c. Aisle Steps: Standard 2 x 12 plank **OR** 2 x 12 plank with 1" contrasting nosing to delineate the leading edge, **as directed**.
 - d. Footboard and Riser plank arrangement: Semi-closed (SC), Fully Closed Deck Plank Arrangement (CD), and Interlocked Deck (IL).
9. Guardrails:
 - a. Furnished on sides of the bleacher including stairs, ramps, portals and landings.
 - b. All pipes shall be 1 5/8" O.D. anodized aluminum pipe with end plugs and elbows at corners. Secured to angle rail posts with galvanized fasteners.
 - c. Rails not less than 42" vertically above the center of the seatboard surface shall be provided at the back and sides of the bleacher.
 - d. Rails are not to be less than 42" above the elevated front footrests.
 - e. Included on all sides of the bleacher shall be 2" x 9 gauge galvanized chain link fencing fastened in place with aluminum ties and galvanized tension bars and aluminum rail clamps.
10. Stairs: Per applicable codes and/or drawings.
 - a. 2 x 12 aluminum plank with a maximum rise of 7".
 - b. Stairs shall have a multi-pipe rail system that conforms to the 4" ball rule. Top rail shall be 42" above the leading edge of the treads.
11. Mudills: 2 x 4 pressure treated wood shall be provided on all frames.
12. Handicap Provisions:
 - a. Wheelchair pockets inset into the front rows of seating shall be provided to comply with local codes and ADA for wheelchair accessibility.
 - b. Handicapped seating will be enclosed on all three sides with no exposed vertical rise allowed.



- c. Front platform shall be accessible from a ramp with a maximum gradient of 1:12.
 - d. Ramp width shall be minimum 5'-0" for two-way traffic.
 - e. Ramp shall have a 3-pipe rail system consisting of 1 5/8" O.D. anodized aluminum pipe with 2 x 9 gauge galvanized fence. Top rail will be 42" above the ramp surface.
 - f. A handrail 36" above the ramp surface shall be provided.
13. Pressbox
- a. Grandstands: Pressbox Support Structure will be independently supported but connected to the rear of the grandstand.
 - b. Bleachers: Pressbox Support Structure will be independently supported on its own poured concrete piers and connected to bleacher by means of stairs off bleacher aisle.
 - c. Support Structure to be 8'-0" wide and in increments of 6'-0" in length.
 - d. Pressbox specifications as required to meet Project requirements.

B. Materials

1. Steel: ASTM A572 (Hot-Dipped Galvanized), ASTM A586 (Weathering Steel).
2. Aluminum: Extruded alloy 6063-T6.
3. Ready-Mixed Concrete shall comply with ASTM C94 with compressive strength of 3,000 pounds per square inch (210.9 kgs per square cm) at 28 days and shall be protected from freezing for seven days after placement.
4. Reinforcement for Concrete shall comply with ASTM A184, A185, or A615 as indicated.
5. Accessories:
 - a. High Strength Bolts and Nuts - ASTM A325 steel.
 - b. Ordinary Bolts and Nuts - ASTM A307.
 - c. Hold-Down Clip Assemblies - Aluminum alloy 6063-T6.
 - d. End Caps - Channel aluminum alloy 6063-T6.

C. Finishes

1. Steel: Galvanized Steel and Weathering Steel.
2. Aluminum:
 - a. Anodized: Seat planks, backrest, stanchions and also risers if requested clear anodized 204R1, AA-M10C22A31, Class II.
 - b. Mill Finish: Footboards and riser boards (6063-T6).
 - c. Paint: Electrostatically applied, baked-on siliconized acrylic or siliconized polyester enamel.

1.3 EXECUTION

A. Installation

1. All work will be performed by factory-trained technicians experienced in bleacher seating installation.
2. Complete installation as per approved shop drawings and manufacturers instructions.
3. Bleachers shall be sufficiently anchored to the ground to withstand the wind loads for their particular areas.
4. After installation, unit shall be inspected for proper alignment and function.

B. Foundations/Piers

1. Piers for the pressbox shall be designed to provide sufficient bearing area to support the total live and dead loads of the pressbox without exceeding the allowable soil bearing pressure.
2. Footings for the grandstand shall be designed to provide sufficient bearing area to support the total live and dead loads of the grandstand without exceeding the allowable soil bearing pressure.
3. Design and depth of footings shall be determined from the Owner supplied geotechnical report indicating local soil conditions.
4. Hot-Dipped galvanized anchor bolts shall be used, secured in the concrete footings.
5. Concrete shall attain a working strength of 3,000 psi.



END OF SECTION 13 34 16 13b



SECTION 13 34 23 13 - METAL BUILDING SYSTEMS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for metal building systems. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Structural-steel framing.
 - b. Metal roof panels.
 - c. Metal wall panels.
 - d. Foam-insulation-core metal wall panels.
 - e. Translucent panels.
 - f. Metal soffit panels.
 - g. Thermal insulation.
 - h. Doors and frames.
 - i. Windows.
 - j. Accessories.

C. Definitions

1. Terminology Standard: See MBMA's "Metal Building Systems Manual" for definitions of terms for metal building system construction not otherwise defined in this Section or in referenced standards.

D. Submittals

1. Product Data: For each type of metal building system component. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
 - a. Structural-steel-framing system.
 - b. Metal roof panels.
 - c. Metal wall panels.
 - d. Metal liner panels.
 - e. Translucent panels.
 - f. Insulation and vapor retarder facings.
 - g. Flashing and trim.
 - h. Doors.
 - i. Windows.
 - j. Accessories.
2. LEED Submittals:
 - a. Product Test Reports for Credit SS 7.2: For roof panels, documentation indicating that panels comply with Solar Reflectance Index requirement.
 - b. Product Data for Credit MR 4.1 and Credit MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.
3. Shop Drawings: For the following metal building system components. Include plans, elevations, sections, details, and attachments to other work.
 - a. Anchor-Bolt Plans: Submit anchor-bolt plans and templates before foundation work begins. Include location, diameter, and projection of anchor bolts required to attach metal building to foundation. Indicate column reactions at each location.



- b. Structural-Framing Drawings: Show complete fabrication of primary and secondary framing; include provisions for openings. Indicate welds and bolted connections, distinguishing between shop and field applications. Include transverse cross-sections.
 - 1) Show provisions for attaching roof curbs, service walkways, platforms and pipe racks.
- c. Metal Roof and Wall Panel Layout Drawings: Show layouts of metal panels including methods of support. Include details of edge conditions, joints, panel profiles, corners, anchorages, trim, flashings, closures, and special details. Distinguish between factory- and field-assembled work; show locations of exposed fasteners.
 - 1) Show roof-mounted items including roof hatches, equipment supports, pipe supports and penetrations, lighting fixtures, and items mounted on roof curbs.
 - 2) Show wall-mounted items including doors, windows, louvers, and lighting fixtures.
 - 3) Show translucent panels.
4. Samples: For each type of exposed finish required, prepared on Samples of sizes indicated below:
 - a. Metal Panels: Nominal 12 inches (300 mm) long by actual panel width. Include fasteners, closures, and other exposed panel accessories.
 - b. Translucent Panels: Nominal 12 inches (300 mm) long by actual panel width.
 - c. Flashing and Trim: Nominal 12 inches (300 mm) long. Include fasteners and other exposed accessories.
 - d. Vapor-Retarder Facings: Nominal 6-inch- (150-mm-) square Samples.
 - e. Windows: Full-size, nominal 12-inch- (300-mm-) long frame Samples showing typical profile.
 - f. Accessories: Nominal 12-inch- (300-mm-) long Samples for each type of accessory.
5. Door Schedule: For doors and frames. Use same designations indicated on Drawings. Include details of reinforcement.
 - a. Door Hardware Schedule: Include details of fabrication and assembly of door hardware. Organize schedule into door hardware sets indicating complete designations of every item required for each door or opening.
 - b. Keying Schedule: Detail the Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.
6. Delegated-Design Submittal: For metal building systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
7. Qualification Data: For qualified erector, manufacturer, professional engineer, land surveyor and testing agency.
8. Welding certificates.
9. Metal Building System Certificates: For each type of metal building system, from manufacturer.
 - a. Letter of Design Certification: Signed and sealed by a qualified professional engineer. Include the following:
 - 1) Name and location of Project.
 - 2) Order number.
 - 3) Name of manufacturer.
 - 4) Name of Contractor.
 - 5) Building dimensions including width, length, height, and roof slope.
 - 6) Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
 - 7) Governing building code and year of edition.
 - 8) Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category or effective peak velocity-related acceleration/peak acceleration, and auxiliary loads (cranes).
 - 9) Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.
 - 10) Building-Use Category: Indicate category of building use and its effect on load importance factors.



- 11) AISC Certification for Category MB: Include statement that metal building system and components were designed and produced in an AISC-Certified Facility by an AISC-Certified Manufacturer.
10. Erector Certificates: For each product, from manufacturer.
11. Manufacturer Certificates: For each product, from manufacturer.
12. Material Test Reports: For each of the following products:
 - a. Structural steel including chemical and physical properties.
 - b. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 - c. Tension-control, high-strength, bolt-nut-washer assemblies.
 - d. Shop primers.
 - e. Nonshrink grout.
13. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for insulation and vapor-retarder facings. Include reports for thermal resistance, fire-test-response characteristics, water-vapor transmission, and water absorption.
14. Source quality-control reports.
15. Field quality-control reports.
16. Surveys: Show final elevations and locations of major members. Indicate discrepancies between actual installation and the Contract Documents. Have surveyor who performed surveys certify their accuracy.
17. Maintenance Data: For metal panel finishes and door hardware to include in maintenance manuals.
18. Warranties: Sample of special warranties.

E. Quality Assurance

1. Manufacturer Qualifications: A qualified manufacturer and member of MBMA.
 - a. AISC Certification for Category MB: An AISC-Certified Manufacturer that designs and produces metal building systems and components in an AISC-Certified Facility.
 - b. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
2. Land Surveyor Qualifications: A professional land surveyor who practices in jurisdiction where Project is located and who is experienced in providing surveying services of the kind indicated.
3. Erector Qualifications: An experienced erector who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.
4. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
5. Source Limitations: Obtain metal building system components, including primary and secondary framing and metal panel assemblies, from single source from single manufacturer.
6. Welding Qualifications: Qualify procedures and personnel according to the following:
 - a. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - b. AWS D1.3, "Structural Welding Code - Sheet Steel."
7. Structural Steel: Comply with AISC 360, "Specification for Structural Steel Buildings," for design requirements and allowable stresses.
8. Cold-Formed Steel: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" for design requirements and allowable stresses.
9. Fire-Resistance Ratings: Where indicated, provide metal panel assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
 - b. Combustion Characteristics: ASTM E 136.
10. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.



- a. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
11. Preinstallation Conference: Conduct conference at Project site.
- F. Delivery, Storage, And Handling
1. Deliver components, sheets, panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
 2. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
 3. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
 4. Protect foam-plastic insulation as follows:
 - a. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
 - b. Protect against ignition at all times. Do not deliver foam-plastic insulation materials to Project site before installation time.
 - c. Complete installation and concealment of foam-plastic materials as rapidly as possible in each area of construction.
- G. Project Conditions
1. Weather Limitations: Proceed with installation only when weather conditions permit metal panels to be installed according to manufacturers' written instructions and warranty requirements.
 2. Field Measurements:
 - a. Established Dimensions for Foundations: Comply with established dimensions on approved anchor-bolt plans, establishing foundation dimensions and proceeding with fabricating structural framing without field measurements. Coordinate anchor-bolt installation to ensure that actual anchorage dimensions correspond to established dimensions.
 - b. Established Dimensions for Metal Panels: Where field measurements cannot be made without delaying the Work, either establish framing and opening dimensions and proceed with fabricating metal panels without field measurements, or allow for field trimming metal panels. Coordinate construction to ensure that actual building dimensions, locations of structural members, and openings correspond to established dimensions.
- H. Coordination
1. Coordinate sizes and locations of concrete foundations and casting of anchor-bolt inserts into foundation walls and footings. Concrete, reinforcement, and formwork requirements are specified in Division 03 Section "Cast-in-place Concrete".
 2. Coordinate installation of roof curbs, equipment supports and roof penetrations, which are specified in Division 07 Section "Roof Accessories".
 3. Coordinate metal panel assemblies with rain drainage work, flashing, trim, and construction of supports and other adjoining work to provide a leakproof, secure, and noncorrosive installation.
- I. Warranty
1. Special Warranty on Metal Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - a. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - 1) Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - 2) Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - 3) Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - b. Finish Warranty Period: **20 OR 10, as directed**, years from date of Final Completion.



2. Special Weathertightness Warranty for Standing-Seam Metal Roof Panels: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that leak or otherwise fail to remain weathertight within specified warranty period.
 - a. Warranty Period: 20 years from date of Final Completion.

1.2 PRODUCTS

A. Metal Building Systems

1. Description: Provide a complete, integrated set of metal building system manufacturer's standard mutually dependent components and assemblies that form a metal building system capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water into building interior.
 - a. Provide metal building system of size and with bay spacings, roof slopes, and spans indicated.
2. Primary-Frame Type:
 - a. Rigid Clear Span: Solid-member, structural-framing system without interior columns.
 - b. Rigid Modular: Solid-member, structural-framing system with interior columns.
 - c. Truss-Frame Clear Span: Truss-member, structural-framing system without interior columns.
 - d. Truss-Frame Modular: Truss-member, structural-framing system with interior columns.
 - e. Lean to: Solid- or truss-member, structural-framing system without interior columns, designed to be partially supported by another structure.
3. End-Wall Framing: Manufacturer's standard, for buildings not required to be expandable, consisting of primary frame, capable of supporting one-half of a bay design load, and end-wall columns **OR** load-bearing end-wall and corner columns and rafters, **as directed**.
OR
End-Wall Framing: Engineer end walls to be expandable. Provide primary frame, capable of supporting full-bay design loads, and end-wall columns.
4. Secondary-Frame Type: Manufacturer's standard purlins and joists and flush-framed **OR** partially inset-framed **OR** exterior-framed (bypass), **as directed**, girts.
5. Eave Height: 16 feet (4.9 m) **OR** 20 feet (6.1 m) **OR** 24 feet (7.3 m) **OR** 28 feet (8.5 m) **OR** Manufacturer's standard height, as indicated by nominal height on Drawings, **as directed**.
6. Bay Spacing: 20 feet (6.1 m) **OR** 25 feet (7.6 m) **OR** 30 feet (9.1 m) **OR** As determined by manufacturer, **as directed**.
7. Roof Slope: 1/4 inch per 12 inches (1:48) **OR** 1/2 inch per 12 inches (1:24) **OR** 1 inch per 12 inches (1:12) **OR** 4 inches per 12 inches (1:3) **OR** Manufacturer's standard for frame type required, **as directed**.
8. Roof System: Manufacturer's standard vertical-rib, standing-seam **OR** trapezoidal-rib, standing-seam **OR** lap-seam, **as directed**, metal roof panels with field-installed insulation, **as directed**.
9. Exterior Wall System: Manufacturer's standard tapered-rib, exposed-fastener **OR** reverse-rib, exposed-fastener **OR** concealed-fastener, **as directed**, metal wall panels with field-installed insulation, **as directed**.
OR
Exterior Wall System: Manufacturer's standard foam-insulation-core metal wall panels.

B. Metal Building System Performance

1. Delegated Design: Design metal building system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2. Structural Performance: Metal building systems shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to procedures in MBMA's "Metal Building Systems Manual."
 - a. Design Loads: As indicated on Drawings.**OR**



- Design Loads: As required by MBMA's "Metal Building Systems Manual" **OR** ASCE/SEI 7, **as directed**.
- b. Deflection Limits: Design metal building system assemblies to withstand design loads with deflections no greater than the following:
 - 1) Purlins and Rafters: Vertical deflection of 1/180 **OR** 1/240, **as directed**, of the span.
 - 2) Girts: Horizontal deflection of 1/180 **OR** 1/240, **as directed**, of the span.
 - 3) Metal Roof Panels: Vertical deflection of 1/180 **OR** 1/240, **as directed**, of the span.
 - 4) Metal Wall Panels: Horizontal deflection of 1/180 **OR** 1/240, **as directed**, of the span.
 - 5) Design secondary-framing system to accommodate deflection of primary framing and construction tolerances, and to maintain clearances at openings.
 - c. Drift Limits: Engineer building structure to withstand design loads with drift limits no greater than the following:
 - 1) Lateral Drift: Maximum of 1/200 **OR** 1/400, **as directed**, of the building height.
 - d. Metal panel assemblies shall withstand the effects of gravity loads and loads and stresses within limits and under conditions indicated according to ASTM E 1592.
3. Seismic Performance: Metal building systems shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 4. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
 5. Air Infiltration for Metal Roof Panels: Air leakage through assembly of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) of roof area when tested according to ASTM E 1680 at negative test-pressure difference of 1.57 lbf/sq. ft. (75 Pa).
 6. Air Infiltration for Metal Wall Panels: Air leakage through assembly of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) of wall area when tested according to ASTM E 283 at static-air-pressure difference of 1.57 lbf/sq. ft. (75 Pa).
 7. Water Penetration for Metal Roof Panels: No water penetration when tested according to ASTM E 1646 at test-pressure difference of 2.86 lbf/sq. ft. (137 Pa).
 8. Water Penetration for Metal Wall Panels: No water penetration when tested according to ASTM E 331 at a wind-load design pressure of not less than 2.86 lbf/sq. ft. (137 Pa).
 9. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for Class 30 **OR** Class 60 **OR** Class 90, **as directed**.
 10. Thermal Performance: Provide insulated metal panel assemblies with the following maximum U-factors and minimum R-values for opaque elements when tested according to ASTM C 1363 or ASTM C 518:
 - a. Metal Roof Panel Assemblies:
 - 1) U-Factor: as directed by the Owner.
 - 2) R-Value: as directed by the Owner.
 - b. Metal Wall Panel Assemblies:
 - 1) U-Factor: as directed by the Owner.
 - 2) R-Value: as directed by the Owner.
 11. Energy Performance (for LEED-NC Credit SS 7.2): Provide roof panels with Solar Reflectance Index not less than 78 **OR** 29, **as directed**, when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency.
 12. Energy Performance (for ENERGY STAR requirements): Provide roof panels that are listed on the DOE's ENERGY STAR Roof Products Qualified Product List for low **OR** steep, **as directed**, -slope roof products.
 13. Energy Performance (for roofs that must comply with CEC-Title 24): Provide roof panels with initial solar reflectance not less than 0.70 and emissivity not less than 0.75 when tested according to CRRC.



C. Structural-Steel Framing

1. Primary Framing: Manufacturer's standard primary-framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse and lean-to frames; rafter, rake, and canopy beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing.
 - a. General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly. Provide frame span and spacing indicated.
 - 1) Slight variations in span and spacing may be acceptable if necessary to comply with manufacturer's standard, as approved by the Owner.
 - b. Rigid Clear-Span Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Interior columns are not permitted.
 - c. Rigid Modular Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Provide interior columns fabricated from round steel pipes or tubes, or shop-welded, built-up steel plates.
 - d. Truss-Frame, Clear-Span Frames: Rafter frames fabricated from joist girders, and I-shaped column sections fabricated from shop-welded, built-up steel plates or structural-steel shapes.
 - e. Truss-Frame Modular Frames: Rafter frames fabricated from joist girders, and I-shaped column sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Provide interior columns fabricated from round steel pipes or tubes, or shop-welded, built-up steel plates.
 - f. Long-Bay Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Provide interior columns fabricated from round steel pipes or tubes, or shop-welded, built-up steel plates.
 - g. Frame Configuration: Single gable **OR** One-directional sloped **OR** Lean to, with high side connected to and supported by another structure **OR** Multiple gable **OR** Load-bearing-wall type **OR** Multistory, **as directed**.
 - h. Exterior Column Type: Uniform depth **OR** Tapered, **as directed**.
 - i. Rafter Type: Uniform depth **OR** Tapered, **as directed**.
2. End-Wall Framing: Manufacturer's standard primary end-wall framing fabricated for field-bolted assembly to comply with the following:
 - a. End-Wall and Corner Columns: I-shaped sections fabricated from structural-steel shapes; shop-welded, built-up steel plates; or C-shaped, cold-formed, structural-steel sheet.
 - b. End-Wall Rafters: C-shaped, cold-formed, structural-steel sheet; or I-shaped sections fabricated from shop-welded, built-up steel plates or structural-steel shapes.
3. Secondary Framing: Manufacturer's standard secondary framing, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Unless otherwise indicated, fabricate framing from either cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet, prepainted with coil coating, to comply with the following:
 - a. Purlins: C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; minimum 2-1/2-inch- (64-mm-) wide flanges.
 - 1) Depth: As indicated **OR** As needed to comply with system performance requirements, **as directed**.

OR

Purlins: Steel joists of depths indicated.
 - b. Girts: C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes. Form ends of Z-sections with stiffening lips angled 40 to 50 degrees from flange, with minimum 2-1/2-inch- (64-mm-) wide flanges.
 - 1) Depth: As indicated **OR** As required to comply with system performance requirements, **as directed**.
 - c. Eave Struts: Unequal-flange, C-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; to provide adequate backup for metal panels.
 - d. Flange Bracing: Minimum 2-by-2-by-1/8-inch (51-by-51-by-3-mm) structural-steel angles or 1-inch (- (25-mm-) diameter, cold-formed structural tubing to stiffen primary-frame flanges.



- e. Sag Bracing: Minimum 1-by-1-by-1/8-inch (25-by-25-by-3-mm) structural-steel angles.
 - f. Base or Sill Angles: Minimum 3-by-2-inch (76-by-51-mm) zinc-coated (galvanized) steel sheet.
 - g. Purlin and Girt Clips: Manufacturer's standard clips fabricated from steel sheet. Provide galvanized clips where clips are connected to galvanized framing members.
 - h. Secondary End-Wall Framing: Manufacturer's standard sections fabricated from zinc-coated (galvanized) steel sheet **OR** structural-steel sheet, **as directed**.
 - i. Framing for Openings: Channel shapes; fabricated from cold-formed, structural-steel sheet or structural-steel shapes. Frame head and jamb of door openings and head, jamb, and sill of other openings.
 - j. Miscellaneous Structural Members: Manufacturer's standard sections fabricated from cold-formed, structural-steel sheet; built-up steel plates; or zinc-coated (galvanized) steel sheet; designed to withstand required loads.
4. Canopy Framing: Manufacturer's standard structural-framing system, designed to withstand required loads; fabricated from shop-welded, built-up steel plates or structural-steel shapes. Provide frames with attachment plates and splice members, factory drilled for field-bolted assembly.
 - a. Type: Straight-beam, eave type **OR** Purlin-extension type **OR** Tapered-beam, below-eave type **OR** As indicated, **as directed**.
 5. Bracing: Provide adjustable wind bracing as follows:
 - a. Rods: ASTM A 36/A 36M; ASTM A 572/A 572M, Grade 50 (345); or ASTM A 529/A 529M, Grade 50 (345); minimum 1/2-inch- (13-mm-) diameter steel; threaded full length or threaded a minimum of 6 inches (152 mm) at each end.
 - b. Cable: ASTM A 475, 1/4-inch- (6-mm-) diameter, extra-high-strength grade, Class B, zinc-coated, seven-strand steel; with threaded end anchors.
 - c. Angles: Fabricated from structural-steel shapes to match primary framing, of size required to withstand design loads.
 - d. Rigid Portal Frames: Fabricated from shop-welded, built-up steel plates or structural-steel shapes to match primary framing; of size required to withstand design loads.
 - e. Fixed-Base Columns: Fabricated from shop-welded, built-up steel plates or structural-steel shapes to match primary framing; of size required to withstand design loads.
 - f. Diaphragm Action of Metal Panels: Design metal building to resist wind forces through diaphragm action of metal panels.
 - g. Bracing: Provide wind bracing using any method specified above, at manufacturer's option.
 6. Bolts: Provide plain-finish bolts for structural-framing components that are primed or finish painted. Provide zinc-plated or hot-dip galvanized bolts for structural-framing components that are galvanized.
 7. Materials:
 - a. W-Shapes: ASTM A 992/A 992M; ASTM A 572/A 572M, Grade 50 or 55 (345 or 380); or ASTM A 529/A 529M, Grade 50 or 55 (345 or 380).
 - b. Channels, Angles, M-Shapes, and S-Shapes: ASTM A 36/A 36M; ASTM A 572/A 572M, Grade 50 or 55 (345 or 380); or ASTM A 529/A 529M, Grade 50 or 55 (345 or 380).
 - c. Plate and Bar: ASTM A 36/A 36M; ASTM A 572/A 572M, Grade 50 or 55 (345 or 380); or ASTM A 529/A 529M, Grade 50 or 55 (345 or 380).
 - d. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.
 - e. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B or C, structural tubing.
 - f. Structural-Steel Sheet: Hot-rolled, ASTM A 1011/A 1011M, Structural Steel (SS), Grades 30 through 55 (205 through 380), or High-Strength Low-Alloy Steel (HSLAS), Grades 45 through 70 (310 through 480); or cold-rolled, ASTM A 1008/A 1008M, Structural Steel (SS), Grades 25 through 80 (170 through 550), or High-Strength Low-Alloy Steel (HSLAS), Grades 45 through 70 (310 through 480).
 - g. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grades 33 through 80 (230 through 550), or High-Strength Low-Alloy Steel (HSLAS), Grades 50 through 80 (340 through 550); with G60 (Z180) coating designation; mill phosphatized.



- h. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
- 1) Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grades 33 through 80 (230 through 550), or High-Strength Low-Alloy Steel (HSLAS), Grades 50 through 80 (340 through 550); with G90 (Z275) coating designation.
 - 2) Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Structural Steel (SS), Grade 50 or 80 (340 or 550); with Class AZ50 (AZM150) coating.
- i. Joist Girders: Manufactured according to "Standard Specifications for Joist Girders," in SJI's "Standard Specifications and Load Tables for Steel Joists and Joist Girders"; with steel-angle, top- and bottom-chord members, and end- and top-chord arrangements as indicated and required for primary framing.
- j. Steel Joists: Manufactured according to "Standard Specifications for Open Web Steel Joists, K-Series," in SJI's "Standard Specifications and Load Tables for Steel Joists and Joist Girders"; with steel-angle, top- and bottom-chord members, and end- and top-chord arrangements as indicated and required for secondary framing.
- k. Non-High-Strength Bolts, Nuts, and Washers: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6), carbon-steel, hex-head bolts; ASTM A 563 (ASTM A 563M) carbon-steel hex nuts; and ASTM F 844 plain (flat) steel washers.
- 1) Finish: Plain **OR** Hot-dip zinc coating, ASTM A 153/A 153M, Class C **OR** Mechanically deposited zinc coating, ASTM B 695, Class 50, **as directed**.
- l. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563 (ASTM A 563M) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M) hardened carbon-steel washers.
- 1) Finish: Plain **OR** Hot-dip zinc coating, ASTM A 153/A 153M, Class C **OR** Mechanically deposited zinc coating, ASTM B 695, Class 50, **as directed**.
- m. High-Strength Bolts, Nuts, and Washers: ASTM A 490 (ASTM A 490M), Type 1, heavy-hex steel structural bolts or tension-control, bolt-nut-washer assemblies with spline ends; ASTM A 563 (ASTM A 563M) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M) hardened carbon-steel washers, plain.
- n. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex-head steel structural bolts with spline ends.
- 1) Finish: Plain **OR** Mechanically deposited zinc coating, ASTM B 695, Class 50 **OR** Mechanically deposited zinc coating, ASTM B 695, Class 50, baked-epoxy coated, **as directed**.
- o. Unheaded Anchor Rods: ASTM F 1554, Grade 36 **OR** ASTM A 572/A 572M, Grade 50 (345) **OR** ASTM A 36/A 36M **OR** ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6), **as directed**.
- 1) Configuration: Straight.
 - 2) Nuts: ASTM A 563 (ASTM A 563M) hex **OR** heavy-hex, **as directed**, carbon steel.
 - 3) Plate Washers: ASTM A 36/A 36M carbon steel.
 - 4) Washers: ASTM F 436 (ASTM F 436M) hardened carbon steel.
 - 5) Finish: Plain **OR** Hot-dip zinc coating, ASTM A 153/A 153M, Class C **OR** Mechanically deposited zinc coating, ASTM B 695, Class 50, **as directed**.
- p. Headed Anchor Rods: ASTM F 1554, Grade 36 **OR** ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6), **as directed**.
- 1) Configuration: Straight.
 - 2) Nuts: ASTM A 563 (ASTM A 563M) hex **OR** heavy-hex, **as directed**, carbon steel.
 - 3) Plate Washers: ASTM A 36/A 36M carbon steel.
 - 4) Washers: ASTM F 436 (ASTM F 436M) hardened carbon steel.
 - 5) Finish: Plain **OR** Hot-dip zinc coating, ASTM A 153/A 153M, Class C **OR** Mechanically deposited zinc coating, ASTM B 695, Class 50, **as directed**.
- q. Threaded Rods: ASTM A 193/A 193M **OR** ASTM A 572/A 572M, Grade 50 (345) **OR** ASTM A 36/A 36M **OR** ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6), **as directed**.



- 1) Nuts: ASTM A 563 (ASTM A 563M) hex **OR** heavy-hex, **as directed**, carbon steel.
 - 2) Washers: ASTM F 436 (ASTM F 436M) hardened **OR** ASTM A 36/A 36M, **as directed**, carbon steel.
 - 3) Finish: Plain **OR** Hot-dip zinc coating, ASTM A 153/A 153M, Class C **OR** Mechanically deposited zinc coating, ASTM B 695, Class 50, **as directed**.
- r. Recycled Content of Steel Products: Provide steel products with an average recycled content so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
8. Finish: Factory primed. Apply specified primer immediately after cleaning and pretreating.
- a. Apply primer to primary and secondary framing to a minimum dry film thickness of 1 mil (0.025 mm).
 - 1) Prime secondary framing formed from uncoated steel sheet to a minimum dry film thickness of 0.5 mil (0.013 mm) on each side.
 - b. Prime galvanized members with specified primer after phosphoric acid pretreatment.
 - c. Primer: SSPC-Paint 15, Type I, red oxide.
- D. Metal Roof Panels
1. Vertical-Rib, Standing-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels.
 - a. Material: Zinc-coated (galvanized) **OR** Aluminum-zinc alloy-coated, **as directed**, steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: Fluoropolymer **OR** Siliconized polyester, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - b. Clips: Manufacturer's standard, fixed type **OR** floating type to accommodate thermal movement, **as directed**; fabricated from zinc-coated (galvanized) steel **OR** aluminum-zinc alloy-coated steel **OR** stainless-steel, **as directed**, sheet.
 - c. Joint Type: Panels snapped together.
OR
Joint Type: Mechanically seamed, single folded **OR** double folded **OR** folded according to manufacturer's standard, **as directed**.
 - d. Panel Coverage: 16 inches (406 mm).
 - e. Panel Height: 2 inches (51 mm).
 - f. Uplift Rating: UL 30 **OR** UL 60 **OR** UL 90, **as directed**.
 2. Trapezoidal-Rib, Standing-Seam Metal Roof Panels: Formed with raised trapezoidal ribs at panel edges and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels.
 - a. Material: Zinc-coated (galvanized) **OR** Aluminum-zinc alloy-coated, **as directed**, steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: Fluoropolymer **OR** Siliconized polyester, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - b. Clips: Manufacturer's standard, fixed type **OR** floating type to accommodate thermal movement, **as directed**; fabricated from zinc-coated (galvanized) steel **OR** aluminum-zinc alloy-coated steel **OR** stainless-steel, **as directed**, sheet.
 - c. Joint Type: Panels snapped together.
OR
Joint Type: Mechanically seamed, single folded **OR** double folded **OR** folded according to manufacturer's standard, **as directed**.
 - d. Panel Coverage: 24 inches (610 mm).



- e. Panel Height: 3 inches (76 mm).
- f. Uplift Rating: UL 30 **OR** UL 60 **OR** UL 90, **as directed**.
- 3. Tapered-Rib-Profile, Lap-Seam Metal Roof Panels: Formed with raised, trapezoidal major ribs and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between major ribs; designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.
 - a. Material: Zinc-coated (galvanized) **OR** Aluminum-zinc alloy-coated, **as directed**, steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: Fluoropolymer **OR** Siliconized polyester, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - b. Major-Rib Spacing: 6 inches (152 mm) **OR** 12 inches (305 mm), **as directed**, o.c.
 - c. Panel Coverage: 36 inches (914 mm).
 - d. Panel Height: 0.75 inch (19 mm) **OR** 1.125 inches (29 mm) **OR** 1.188 inches (30 mm) **OR** 1.25 inches (32 mm) **OR** 1.5 inches (38 mm), **as directed**.
- 4. Tapered-Rib-Profile, Metal Liner Panels: Formed with raised, trapezoidal major ribs and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between major ribs; designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.
 - a. Material: Zinc-coated (galvanized) **OR** Aluminum-zinc alloy-coated, **as directed**, steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: Fluoropolymer **OR** Siliconized polyester, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - b. Major-Rib Spacing: 6 inches (152 mm) **OR** 12 inches (305 mm), **as directed**, o.c.
 - c. Panel Coverage: 36 inches (914 mm).
 - d. Panel Height: 1.25 inches (32 mm) **OR** 1.5 inches (38 mm), **as directed**.
- 5. Materials:
 - a. Metallic-Coated Steel Sheet: Restricted-flatness steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - 1) Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.
 - 2) Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40 (Class AZM150 coating designation, Grade 275); structural quality.
 - 3) Surface: Smooth, flat **OR** Embossed, **as directed**, finish.
- 6. Finishes:
 - a. Exposed Coil-Coated Finish:
 - 1) Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2) Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 3) Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
 - b. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

E. Metal Wall Panels



1. Tapered-Rib-Profile, Exposed-Fastener Metal Wall Panels: Formed with raised, trapezoidal major ribs and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between major ribs; designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.
 - a. Material: Zinc-coated (galvanized) **OR** Aluminum-zinc alloy-coated, **as directed**, steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: Fluoropolymer **OR** Siliconized polyester, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - b. Major-Rib Spacing: 6 inches (152 mm) **OR** 12 inches (305 mm), **as directed**, o.c.
 - c. Panel Coverage: 36 inches (914 mm).
 - d. Panel Height: 0.75 inch (19 mm) **OR** 1.125 inches (29 mm) **OR** 1.188 inches (30 mm) **OR** 1.25 inches (32 mm) **OR** 1.5 inches (38 mm), **as directed**.
2. Reverse-Rib-Profile, Exposed-Fastener Metal Wall Panels: Formed with recessed, trapezoidal major valleys and intermediate stiffening valleys symmetrically spaced **OR** flat pan, **as directed**, between major valleys; designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.
 - a. Material: Zinc-coated (galvanized) **OR** Aluminum-zinc alloy-coated, **as directed**, steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: Fluoropolymer **OR** Siliconized polyester, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - b. Major-Rib Spacing: 12 inches (305 mm) o.c.
 - c. Panel Coverage: 36 inches (914 mm).
 - d. Panel Height: 1.125 inches (29 mm) **OR** 1.188 inches (30 mm) **OR** 1.25 inches (32 mm) **OR** 1.5 inches (38 mm), **as directed**.
3. Concealed-Fastener Metal Wall Panels: Formed with vertical panel edges and a single wide recess, centered between panel edges **OR** flush surface, **as directed**; with flush joint between panels; with 1-inch- (25-mm-) wide flange for attaching interior finish; designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant, **as directed**, in side laps.
 - a. Material: Zinc-coated (galvanized) **OR** Aluminum-zinc alloy-coated, **as directed**, steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: Fluoropolymer **OR** Siliconized polyester, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - b. Panel Coverage: 16 inches (406 mm).
 - c. Panel Height: 3 inches (76 mm).
4. Tapered-Rib-Profile, Metal Liner Panels: Formed with raised, trapezoidal major ribs and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between major ribs; designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.
 - a. Material: Zinc-coated (galvanized) **OR** Aluminum-zinc alloy-coated, **as directed**, steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: Siliconized polyester **OR** Acrylic enamel, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - b. Major-Rib Spacing: 6 inches (152 mm) **OR** 12 inches (305 mm), **as directed** o.c.
 - c. Panel Coverage: 36 inches (914 mm).
 - d. Panel Height: 1.25 inches (32 mm) **OR** 1.5 inches (38 mm), **as directed**.



5. Flush-Profile, Metal Liner Panels: Solid **OR** Perforated, **as directed**, panels formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between panel edges; with flush joint between panels; designed for interior side of metal wall panel assemblies and installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant, **as directed**, in side laps.
 - a. Material: Zinc-coated (galvanized) **OR** Aluminum-zinc alloy-coated, **as directed**, steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: Siliconized polyester **OR** Polyester **OR** Acrylic enamel, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - b. Sound Absorption: NRC not less than 0.65 **OR** 0.85 **OR** 1.00, **as directed** when tested according to ASTM C 423.
 - c. Panel Coverage: 12 inches (305 mm).
 - d. Panel Height: 1.5 inches (38 mm).
 6. Materials:
 - a. Metallic-Coated Steel Sheet: Restricted-flatness steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - 1) Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.
 - 2) Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40 (Class AZM150 coating designation, Grade 275); structural quality.
 - 3) Surface: Smooth, flat **OR** Embossed, **as directed**, finish.
 7. Finishes:
 - a. Exposed Coil-Coated Finish:
 - 1) Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2) Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 3) Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
 - b. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).
- F. Foam-Insulation-Core Metal Wall Panels
1. Description: Provide factory-formed and -assembled, metal wall panels fabricated from two metal facing sheets and an insulation core foamed in place during fabrication, with joints between panels designed to form weathertight seals. Include accessories required for weathertight installation.
 - a. Concealed-Fastener, Foam-Insulation-Core Metal Wall Panels: Formed with tongue-and-groove panel edges; designed for sequential installation by interlocking panel edges and mechanically attaching panels to supports using concealed clips or fasteners.
 - 1) Facings: Fabricate panel with exterior and interior facings of same material and thickness.
 - 2) Exterior Surface: Smooth, flat **OR** Striated **OR** Shallow ribs **OR** Shallow V grooves, **as directed**.
 - 3) Panel Coverage: 36 inches (914 mm) **OR** 42 inches (1067 mm), **as directed**, nominal.



- 4) Panel Thickness: 2 inches (51 mm) **OR** 2.5 inches (64 mm) **OR** 3 inches (76 mm) **OR** 4 inches (102 mm) **OR** 5 inches (127 mm) **OR** 6 inches (152 mm), **as directed**.
 - 5) Thermal-Resistance Value (R-Value): as directed by the Owner.
2. Panel Performance:
 - a. Flatwise Tensile Strength: 30 psi (200 kPa) when tested according to ASTM C 297/C 297M.
 - b. Humid Aging: Volume increase not greater than 6.0 percent and no delamination or metal corrosion when tested for seven days at 140 deg F (60 deg C) and 100 percent relative humidity according to ASTM D 2126.
 - c. Heat Aging: Volume increase not greater than 2.0 percent and no delamination, surface blistering, or permanent bowing when tested for seven days at 200 deg F (93 deg C) according to ASTM D 2126.
 - d. Cold Aging: Volume decrease not more than 1.0 percent and no delamination, surface blistering, or permanent bowing when tested for seven days at minus 20 deg F (29 deg C) according to ASTM D 2126.
 - e. Fatigue: No evidence of delamination, core cracking, or permanent bowing when tested to a 20-lbf/sq. ft. (958-kPa) positive and negative wind load and with deflection of L/180 for two million cycles.
 - f. Autoclave: No delamination when exposed to 2-psi (13.8-kPa) pressure at a temperature of 212 deg F (100 deg C) for 2-1/2 hours.
 - g. Fire-Test-Response Characteristics: Class A according to ASTM E 108.
 3. Polyisocyanurate Insulation-Core Performance:
 - a. Density: 2.0 to 2.6 lb/cu. ft. (32 to 42 kg/cu. m) when tested according to ASTM D 1622.
 - b. Compressive Strength: Minimum 20 psi (140 kPa) when tested according to ASTM D 1621.
 - c. Shear Strength: 26 psi (179 kPa) when tested according to ASTM C 273/C 273M.
 4. Materials:
 - a. Polyisocyanurate Insulation: Modified polyisocyanurate foam using a non-CFC blowing agent, foamed-in-place or board type as indicated, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively.
 - 1) Closed-Cell Content: 90 percent when tested according to ASTM D 6226.
 - b. Metallic-Coated Steel Sheet: Restricted-flatness steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - 1) Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.
 - 2) Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40 (Class AZM150 coating designation, Grade 275); structural quality.
 - 3) Surface: Smooth, flat **OR** Embossed, **as directed**, finish.
 5. Finishes:
 - a. Exposed Coil-Coated Finish:
 - 1) Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2) Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 3) Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
 - b. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).



G. Translucent Panels

1. Uninsulated Translucent Panels: Glass-fiber-reinforced polyester, translucent plastic; complying with ASTM D 3841, Type CC2 (general purpose) **OR** Type CC1 (limited flammability), **as directed**, Grade 1 (weather resistant); smooth finish on both sides. Match profile of adjacent metal panels.
 - a. Roof Panel Weight: Not less than 8 oz./sq. ft. (2441 g/sq. m).
 - b. Wall Panel Weight: Not less than 6 oz./sq. ft. (1831 g/sq. m).
 - c. Light Transmittance: Not less than 55 percent according to ASTM D 1494.
 - d. Metal Edge: Fabricate full length of each side of panel with metal edge for seaming into standing-seam roof panel joint.
 - e. Color: White.
2. Insulated Translucent Panels: Fabricate insulating units of two sheets of glass-fiber-reinforced polyester, translucent plastic separated by an air space; complying with ASTM D 3841, Type CC1 (limited flammability), Grade 1 (weather resistant); smooth finish on both sides. Match profile of adjacent metal panels.
 - a. Exterior Panel Weight: Not less than 8 oz./sq. ft. (2441 g/sq. m) **OR** 6 oz./sq. ft. (1831 g/sq. m), **as directed**.
 - b. Interior Panel Weight: Not less than 8 oz./sq. ft. (2441 g/sq. m) **OR** 6 oz./sq. ft. (1831 g/sq. m) **OR** 4 oz./sq. ft. (1221 g/sq. m), **as directed**.
 - c. Light Transmittance: Not less than 42 percent according to ASTM D 1494.
 - d. Metal Edge: Fabricate full length of each side of panel with metal edge for seaming into standing-seam roof panel joint.
 - e. Color: White.
3. Mastic for Translucent Panels: Nonstaining, saturated vinyl polymer as recommended by translucent panel manufacturer for sealing laps.
4. Performance:
 - a. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1) Flame-Spread Index: 25 or less.
 - 2) Smoke-Developed Index: 450 or less.

H. Metal Soffit Panels

1. General: Provide factory-formed metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant, **as directed**, in side laps. Include accessories required for weathertight installation.
2. Metal Soffit Panels: Match profile and material of metal roof **OR** wall, **as directed**, panels.
 - a. Finish: Match finish and color of metal roof panels **OR** Match finish and color of metal wall panels **OR** As indicated on Drawings, **as directed**.
3. Tapered-Rib-Profile, Exposed-Fastener Metal Soffit Panels: Formed with raised, trapezoidal major ribs and intermediate stiffening ribs symmetrically spaced **OR** flat pan, **as directed**, between major ribs; designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.
 - a. Material: Zinc-coated (galvanized) **OR** Aluminum-zinc alloy-coated, **as directed**, steel sheet, 0.022-inch (0.56-mm) **OR** 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: Fluoropolymer **OR** Siliconized polyester, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
 - b. Major-Rib Spacing: 6 inches (152 mm) **OR** 12 inches (305 mm), **as directed**, o.c.
 - c. Panel Coverage: 36 inches (914 mm).
 - d. Panel Height: 0.75 inch (19 mm) **OR** 1.125 inches (29 mm) **OR** 1.188 inches (30 mm) **OR** 1.25 inches (32 mm) **OR** 1.5 inches (38 mm), **as directed**.
4. Concealed-Fastener Metal Soffit Panels: Formed with vertical panel edges and a single wide recess, centered between panel edges **OR** flush surface, **as directed**; with flush joint between



panels; with 1-inch- (25-mm-) wide flange for attaching interior finish; designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant, **as directed**, in side laps.

- a. Material: Zinc-coated (galvanized) **OR** Aluminum-zinc alloy-coated, **as directed**, steel sheet, 0.028-inch (0.71-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal thickness.
 - 1) Exterior Finish: Fluoropolymer **OR** Siliconized polyester, **as directed**.
 - 2) Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
- b. Panel Coverage: 12 inches (305 mm) **OR** 16 inches (406 mm), **as directed**.
- c. Panel Height: 1 inch (25 mm) **OR** 1.5 inches (38 mm), **as directed**.

I. Thermal Insulation

1. Faced Metal Building Insulation: ASTM C 991, Type II, glass-fiber-blanket insulation; 0.5-lb/cu. ft. (8-kg/cu. m) density; 2-inch- (51-mm-) wide, continuous, vapor-tight edge tabs; with a flame-spread index of 25 or less.
2. Unfaced Metal Building Insulation: ASTM C 991, Type I, or NAIMA 202, glass-fiber-blanket insulation; 0.5-lb/cu. ft. (8-kg/cu. m) density; 2-inch- (51-mm-) wide, continuous, vapor-tight edge tabs; with a flame-spread index of 25 or less.
 - a. Vapor-Retarder Facing: ASTM C 1136, with permeance not greater than 0.02 perm (1.15 ng/Pa x s x sq. m) when tested according to ASTM E 96/E 96M, Desiccant Method.
 - 1) Composition: White metallized-polypropylene film facing, fiberglass scrim reinforcement, and kraft-paper backing.
OR
Composition: Aluminum foil facing, elastomeric barrier coating, fiberglass scrim reinforcement, and kraft-paper backing.
OR
Composition: White polypropylene **OR** vinyl, **as directed**, film facing, fiberglass scrim reinforcement, and metallized-polyester film backing.
OR
Composition: White polypropylene film facing and fiberglass-polyester-blend fabric backing.
3. Mineral-Fiber-Blanket Insulation: ASTM C 665, type indicated below; consisting of fibers manufactured from glass, slag wool, or rock wool.
 - a. Nonreflective Faced: Type II (blankets with nonreflective membrane covering), Category 1 (membrane is a vapor retarder), Class A (membrane-faced surface with a flame-spread index of 25 or less).
 - b. Reflective Faced: Type III (blankets with reflective membrane covering), Category 1 (membrane is a vapor retarder), Class A (membrane-faced surface with a flame-spread index of 25 or less).
 - c. Unfaced: Type I (blankets without membrane covering), passing ASTM E 136 for combustion characteristics.
 - d. Vapor-Retarder Facing: ASTM C 1136, with permeance not greater than 0.02 perm (1.15 ng/Pa x s x sq. m) when tested according to ASTM E 96/E 96M, Desiccant Method.
 - 1) Composition: White metallized-polypropylene film facing, fiberglass scrim reinforcement, and kraft-paper backing.
 - 2) Composition: Aluminum foil facing, elastomeric barrier coating, fiberglass scrim reinforcement, and kraft-paper backing.
 - 3) Composition: White polypropylene **OR** vinyl, **as directed**, film facing, fiberglass scrim reinforcement, and metallized-polyester film backing.
 - 4) Composition: White polypropylene film facing and fiberglass-polyester blend fabric backing.
4. Faced, Polyisocyanurate Board Insulation: ASTM C 1289, Type I (foil facing), Class 2, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, based on



- tests performed on unfaced core. Provide units tested for interior exposure without an approved thermal barrier.
5. Retainer Strips: 0.025-inch (0.64-mm) nominal-thickness, formed, metallic-coated steel or PVC retainer clips colored to match insulation facing.
 6. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
- J. Doors And Frames
1. Swinging Personnel Doors and Frames: As specified in Division 08 Section "Hollow Metal Doors And Frames".
OR
Swinging Personnel Doors and Frames: Metal building system manufacturer's standard doors and frames; prepared and reinforced at strike and at hinges to receive factory- and field-applied hardware according to BHMA A156 Series.
 - a. Steel Doors: 1-3/4 inches (44 mm) thick; fabricated from 0.040-inch (1.02-mm) nominal-thickness, metallic-coated steel face sheets; of seamed **OR** seamless, **as directed**, hollow-metal construction; with 0.064-inch (1.63-mm) nominal-thickness, inverted metallic-coated steel channels welded to face sheets at top and bottom of door.
 - 1) Design: Flush panel **OR** As indicated, **as directed**.
 - 2) Core: Kraft honeycomb with U-factor rating of at least 0.47 Btu/sq. ft. x h x deg F (2.67 W/sq. m x K).
OR
Core: Polystyrene foam with U-factor rating of at least 0.16 Btu/sq. ft. x h x deg F (0.91 W/sq. m x K).
OR
Core: Polyurethane foam with U-factor rating of at least 0.07 Btu/sq. ft. x h x deg F (0.40 W/sq. m x K).
 - 3) Glazing Frames: Steel frames to receive field-installed glass.
 - 4) Glazing: As specified in Division 08 Section "Glazing".
 - b. Steel Frames: Fabricate 2-inch- (51-mm-) wide face frames from 0.064-inch (1.63-mm) nominal-thickness, metallic-coated steel sheet.
 - 1) Type: Knocked down for field assembly **OR** Factory welded, **as directed**.
 - c. Fabricate concealed stiffeners, reinforcement, edge channels, and moldings from either cold- or hot-rolled steel sheet.
 - d. Hardware:
 - 1) Provide hardware for each door leaf, as follows:
 - a) Hinges: BHMA A156.1. Three plain **OR** antifriction, **as directed**, -bearing, standard-weight, full-mortise, stainless-steel or bronze, template-type hinges; 4-1/2 by 4-1/2 inches (114 by 114 mm), with nonremovable pin.
 - b) Lockset: BHMA A156.2. Key-in-lever cylindrical **OR** Mortise, with lever handle, **as directed**, type.
 - c) Exit Device: BHMA A156.3. Touch- or push-bar type.
 - d) Threshold: BHMA A156.21. Extruded aluminum.
 - e) Silencers: Pneumatic rubber; three silencers on strike jambs of single door frames and two silencers on heads of double door frames.
 - f) Closer: BHMA A156.4. Surface-applied, standard-duty hydraulic type.
 - g) Weather Stripping: Vinyl applied to head and jambs, with vinyl sweep at sill.
 - 2) Provide each pair of double doors with the following hardware in addition to that specified for each leaf:
 - a) Astragal: Removable type.
 - b) Surface Bolts: Top and bottom of inactive door.
 - e. Anchors and Accessories: Manufacturer's standard units, galvanized according to ASTM A 123/A 123M.
 - f. Fabrication: Fabricate doors and frames to be rigid; neat in appearance; and free from defects, warp, or buckle. Provide continuous welds on exposed joints; grind, dress, and make welds smooth, flush, and invisible.



2. Horizontal-Sliding Doors: Manufacturer's standard horizontal-sliding door assembly including structural frame, door panels, brackets, guides, tracks, hardware, and installation accessories.
 - a. Door Frames: Channels and zeeks; fabricated from minimum 0.064-inch (1.63-mm) nominal-thickness, metallic-coated steel sheet or structural-steel shapes.
 - b. Door Panels: Same material and finish as metal wall panels.
 - c. Hardware: Manufacturer's standard metallic-coated steel track, bottom guides, lock angles for side closure, and brackets. Support each door leaf by two four-wheel trolleys. Provide metallic-coated steel handle for each leaf, and slide bolt or padlock hasp. Flash top of track with metallic-coated steel sheet hood.
3. Materials:
 - a. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
 - b. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
 - c. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with G60 (Z180) zinc (galvanized) or A60 (ZF180) zinc-iron-alloy (galvannealed) coating designation.
4. Finishes for Personnel Doors and Frames:
 - a. Prime Finish: Factory-apply manufacturer's standard primer immediately after cleaning and pretreating.
 - 1) Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.
 - b. Factory-Applied Paint Finish: Manufacturer's standard, complying with SDI A250.3 for performance and acceptance criteria.
 - 1) Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

K. Windows

1. Aluminum Windows: As specified in Division 08 Section "Aluminum Windows".
OR
Aluminum Windows: Metal building system manufacturer's standard, with self-flashing mounting fins, and as follows:
 - a. Type, Performance Class, and Performance Grade: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 and as follows:
 - 1) Horizontal-Sliding Units: HS-LC25 **OR** HS-C30, **as directed**.
 - 2) Single-Hung Units: H-LC25 **OR** H-C30, **as directed**.
 - 3) Fixed Units: F-LC25 **OR** F-C30, **as directed**.
 - b. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish, but not less than 0.064-inch (1.63-mm) thickness at any location for main frame and sash members.
 - 1) Thermally Improved Construction: Fabricate window units with an integral, concealed, low-conductance thermal barrier; located between exterior materials and window members exposed on interior side; in a manner that eliminates direct metal-to-metal contact.
 - c. Mullions: Between adjacent windows, fabricated of extruded aluminum matching finish of window units.
 - d. Fasteners, Anchors, and Clips: Nonmagnetic stainless steel, aluminum, or other noncorrosive material, compatible with aluminum window members, trim, hardware, anchors, and other components of window units. Fasteners shall not be exposed, except for attaching hardware.
 - 1) Reinforcement: Where fasteners screw-anchor into aluminum less than 0.128 inch (3.26 mm) thick, reinforce interior with aluminum or nonmagnetic stainless steel to



- receive screw threads, or provide standard, noncorrosive, pressed-in, spline grommet nuts.
- e. Hardware: Manufacturer's standard; of aluminum, stainless steel, die-cast steel, malleable iron, or bronze; including the following:
 - 1) Cam-action sweep sash lock and keeper at meeting rails.
 - 2) Spring-loaded, snap-type lock at jambs.
 - 3) Pole-operated, cam-action locking device on meeting rail where rail is more than 72 inches (1830 mm) above floor.
 - 4) Lift handles for single-hung units.
 - 5) Nylon sash rollers for horizontal-sliding units.
 - 6) Steel or bronze operating arms.
 - f. Sliding-Type Weather Stripping: Woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric; complying with AAMA 701/702.
 - g. Insect Screens: Provide removable insect screen on each operable exterior sash, with screen frame finished to match window unit, and as follows:
 - 1) Aluminum Wire Fabric: 18-by-18 (1.1-by-1.1-mm), 18-by-16 (1.1-by-1.3-mm), or 18-by-14 (1.1-by-1.5-mm) mesh of 0.013-inch- (0.3-mm-) diameter, coated aluminum wire; complying with FS RR-W-365, Type VII.
OR
Glass-Fiber Mesh Fabric: 18-by-16 (1.1-by-1.3-mm) or 18-by-14 (1.1-by-1.5-mm) mesh of PVC-coated, glass-fiber threads, woven and fused to form a fabric mesh; complying with ASTM D 3656.
OR
Fabric: Manufacturer's standard aluminum wire fabric or glass-fiber mesh fabric.
2. Glazing: Comply with requirements specified in Division 08 Section "Glazing".
- OR**
- Glazing:
- a. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear), 3 mm thick.
 - b. Heat-Treated Float Glass: ASTM C 1048, Type I, Quality-Q3, Class I (clear), Condition A, 3 mm thick.
 - c. Tinted Float Glass: ASTM C 1036, Type I, Quality-Q3, Class 2, 3 mm thick.
 - 1) Tint Color: Blue **OR** Blue-green **OR** Bronze **OR** Green **OR** Gray **OR** Manufacturer's standard color, **as directed**.
 - d. Patterned Glass: ASTM C 1036, Type II, Quality-Q6, Class 1 (clear), Form 3, Pattern P3 (random), 3 mm thick.
 - e. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of 2.5-mm-thick clear float glass separated by a dehydrated interspace, qualified according to ASTM E 2190.
 - f. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201.
 - 1) Provide safety glazing labeling.
 - g. Glazing Stops: Screw-applied or snap-on glazing stops coordinated with Division 08 Section "Glazing" and with glazing system indicated. Match material and finish of window frames.
 - h. Factory-Glazed Fabrication: Glaze window units in the factory to greatest extent possible and practical for applications indicated. Comply with requirements in Division 08 Section "Glazing".
3. Finish:
- a. Mill finish.
 - b. Baked-Enamel Finish: Organic Coating: Thermosetting, modified-acrylic enamel primer/topcoat system complying with AAMA 2603 except with a minimum dry film thickness of 0.7 mil (0.02 mm), medium gloss.
 - 1) Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.

L. Accessories



1. General: Provide accessories as standard with metal building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.
 - a. Form exposed sheet metal accessories that are without excessive oil-canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including copings, fasciae, corner units, ridge closures, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.
 - a. Closures: Provide closures at eaves and ridges, fabricated of same material as metal roof panels.
 - b. Clips: Manufacturer's standard, formed from steel **OR** stainless-steel, **as directed**, sheet, designed to withstand negative-load requirements.
 - c. Cleats: Manufacturer's standard, mechanically seamed cleats formed from steel **OR** stainless-steel sheet or nylon-coated aluminum, **as directed**, sheet.
 - d. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 - e. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
 - f. Thermal Spacer Blocks: Where metal panels attach directly to purlins, provide thermal spacer blocks of thickness required to provide 1-inch (25-mm) standoff; fabricated from extruded polystyrene.
3. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including copings, fasciae, mullions, sills, corner units, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels unless otherwise indicated.
 - a. Closures: Provide closures at eaves and rakes, fabricated of same material as metal wall panels.
 - b. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 - c. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
4. Flashing and Trim: Formed from 0.022-inch (0.56-mm) nominal-thickness, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match adjacent metal panels.
 - a. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers.
 - b. Opening Trim: Formed from 0.022-inch (0.56-mm) **OR** 0.034-inch (0.86-mm), **as directed**, nominal-thickness, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Trim head and jamb of door openings, and head, jamb, and sill of other openings.
5. Gutters: Formed from 0.022-inch (0.56-mm) nominal-thickness, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match roof fascia and rake trim. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch- (2438-mm-) long sections, sized according to SMACNA's "Architectural Sheet Metal Manual."
 - a. Gutter Supports: Fabricated from same material and finish as gutters.
 - b. Strainers: Bronze, copper, or aluminum wire ball type at outlets.



6. Downspouts: Formed from 0.022-inch (0.56-mm) nominal-thickness, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match metal wall panels. Fabricate in minimum 10-foot- (3-m-) long sections, complete with formed elbows and offsets.
 - a. Mounting Straps: Fabricated from same material and finish as gutters.
7. Roof Ventilators: Gravity type, complete with hardware, flashing, closures, and fittings.
 - a. Circular-Revolving Type: Minimum 20-inch- (508-mm-) diameter throat opening; fabricated from 0.028-inch (0.71-mm) nominal-thickness, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match metal roof panels; with matching base and rain cap.
 - 1) Type: Directional **OR** Stationary, **as directed**, revolving.
 - 2) Bird Screening: Galvanized steel, 1/2-inch- (13-mm-) square mesh, 0.041-inch (1.04-mm) wire; or aluminum, 1/2-inch- (13-mm-) square mesh, 0.063-inch (1.6-mm) wire.
 - 3) Dampers: Spring-loaded, butterfly type; pull-chain operation; with pull chain of length required to reach within 36 inches (914 mm) of floor.
 - 4) Reinforce and brace units, with joints properly formed and edges beaded to be watertight under normal positive-pressure conditions.
 - 5) Mount ventilators on square-to-round bases for ridge or on-slope mounting, designed to match roof pitch and roll formed to match metal roof panel profile.
 - b. Continuous or Sectional-Ridge Type: Factory-engineered and -fabricated, continuous unit; fabricated from 0.022-inch (0.56-mm) nominal-thickness, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match metal roof panels. Fabricated in minimum 10-foot- (3-m-) long sections. Provide throat size and total length indicated, complete with side baffles, ventilator assembly, end caps, splice plates, and reinforcing diaphragms.
 - 1) Bird Screening: Galvanized steel, 1/2-inch- (13-mm-) square mesh, 0.041-inch (1.04-mm) wire; or aluminum, 1/2-inch- (13-mm-) square mesh, 0.063-inch (1.6-mm) wire.
 - 2) Dampers: Manually operated, spring-loaded, vertically rising type; chain and worm gear operator; with pull chain of length required to reach within 36 inches (914 mm) of floor.
 - 3) Throat Size: 9 inches (229 mm) **OR** 12 inches (305 mm), **as directed**.
8. Louvers: Size and design indicated; self-framing and self-flashing. Fabricate welded frames from minimum 0.052-inch (1.32-mm) nominal-thickness, metallic-coated steel sheet; finished to match metal wall panels. Form blades from 0.040-inch (1.02-mm) nominal-thickness, metallic-coated steel sheet; folded or beaded at edges, set at an angle that excludes driving rains, and secured to frames by riveting or welding. Fabricate louvers with equal blade spacing to produce uniform appearance.
 - a. Blades: Fixed.
OR
Blades: Adjustable type, with weather-stripped edges, and manually operated by hand crank or pull chain.
 - b. Free Area: Not less than 7.0 sq. ft. (0.65 sq. m) for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.
 - c. Bird Screening: Galvanized steel, 1/2-inch- (13-mm-) square mesh, 0.041-inch (1.04-mm) wire; with rewirable frames, removable and secured with clips; fabricated of same kind and form of metal and with same finish as louvers.
 - 1) Mounting: Interior **OR** Exterior, **as directed**, face of louvers.
 - d. Vertical Mullions: Provide mullions at spacings recommended by manufacturer, or 72 inches (1830 mm) o.c., whichever is less.
9. Roof Curbs: Fabricated from minimum 0.052-inch (1.32-mm) nominal-thickness, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match metal roof panels; with welded top box and bottom skirt, and integral full-length cricket; capable of withstanding loads of size and height indicated.



- a. Curb Subframing: Fabricated from 0.064-inch (1.63-mm) nominal-thickness, angle-, C-, or Z-shaped metallic-coated steel sheet.
- b. Insulation: 1-inch- (25-mm-) thick, rigid type.
- 10. Service Walkways: Fabricated from 0.052-inch (1.32-mm) nominal-thickness, metallic-coated steel plank grating; with slip-resistant pattern; 18-inch (457-mm) **OR** 24-inch (610-mm) **OR** 36-inch (914-mm), **as directed**, overall width. Support walkways on framing system anchored to metal roof panels without penetrating panels; with predrilled holes and clamps or hooks for anchoring.
- 11. Pipe Flashing: Premolded, EPDM pipe collar with flexible aluminum ring bonded to base.
- 12. Materials:
 - a. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide fasteners with heads matching color of materials being fastened by means of plastic caps or factory-applied coating.
 - 1) Fasteners for Metal Roof Panels: Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws, with a stainless-steel cap or zinc-aluminum-alloy head and EPDM sealing washer.
OR
Fasteners for Metal Roof Panels: Self-drilling, Type 410 stainless-steel or self-tapping, Type 304 stainless-steel or zinc-alloy-steel hex washer head, with EPDM washer under heads of fasteners bearing on weather side of metal panels.
 - 2) Fasteners for Metal Wall Panels: Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws, with EPDM sealing washers bearing on weather side of metal panels, **as directed**.
OR
Fasteners for Metal Wall Panels: Self-drilling, Type 410 stainless-steel or self-tapping, Type 304 stainless-steel or zinc-alloy-steel hex washer head, with EPDM sealing washers bearing on weather side of metal panels, **as directed**.
 - 3) Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
 - 4) Blind Fasteners: High-strength aluminum or stainless-steel rivets.
 - b. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
 - c. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.
 - d. Metal Panel Sealants:
 - 1) Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene-compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape of manufacturer's standard size.
 - 2) Joint Sealant: ASTM C 920; one-part elastomeric polyurethane or polysulfide; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended by metal building system manufacturer.

M. Source Quality Control

- 1. Testing Agency (if required): Engage a qualified testing agency to evaluate product.
- 2. Special Inspector (if required by local code): the Owner will engage a qualified special inspector to perform the following tests and inspections and to submit reports. Special inspector will verify that manufacturer maintains detailed fabrication and quality-control procedures and will review the completeness and adequacy of those procedures to perform the Work.
 - a. Special inspections will not be required if fabrication is performed by manufacturer registered and approved by authorities having jurisdiction to perform such Work without special inspection.



- 1) After fabrication, submit copy of certificate of compliance to authorities having jurisdiction, certifying that Work was performed according to Contract requirements.
3. Testing: Test and inspect shop connections for metal buildings according to the following:
 - a. Bolted Connections: Shop-bolted connections shall be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
 - b. Welded Connections: In addition to visual inspection, shop-welded connections shall be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at inspector's option:
 - 1) Liquid Penetrant Inspection: ASTM E 165.
 - 2) Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - 3) Ultrasonic Inspection: ASTM E 164.
 - 4) Radiographic Inspection: ASTM E 94.
4. Product will be considered defective if it does not pass tests and inspections.
5. Prepare test and inspection reports.

N. Fabrication

1. General: Design components and field connections required for erection to permit easy assembly.
 - a. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
 - b. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members shall be free of cracks, tears, and ruptures.
2. Tolerances: Comply with MBMA's "Metal Building Systems Manual" for fabrication and erection tolerances.
3. Primary Framing: Shop fabricate framing components to indicated size and section, with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.
 - a. Make shop connections by welding or by using high-strength bolts.
 - b. Join flanges to webs of built-up members by a continuous, submerged arc-welding process.
 - c. Brace compression flange of primary framing with steel angles or cold-formed structural tubing between frame web and purlin web or girt web, so flange compressive strength is within allowable limits for any combination of loadings.
 - d. Weld clips to frames for attaching secondary framing.
 - e. Shop Priming: Prepare surfaces for shop priming according to SSPC-SP 2. Shop prime primary framing with specified primer after fabrication.
4. Secondary Framing: Shop fabricate framing components to indicated size and section by roll-forming or break-forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.
 - a. Make shop connections by welding or by using non-high-strength bolts.
 - b. Shop Priming: Prepare uncoated surfaces for shop priming according to SSPC-SP 2. Shop prime uncoated secondary framing with specified primer after fabrication.
5. Metal Panels: Fabricate and finish metal panels at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.
 - a. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of metal panel.

1.3 EXECUTION

A. Examination

1. Examine substrates, areas, and conditions, with erector present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.



2. Before erection proceeds, survey elevations and locations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments to receive structural framing, with erector present, for compliance with requirements and metal building system manufacturer's tolerances.
 - a. Engage land surveyor to perform surveying.
 3. Proceed with erection only after unsatisfactory conditions have been corrected.
- B. Preparation
1. Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition.
 2. Provide temporary shores, guys, braces, and other supports during erection to keep structural framing secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural framing, connections, and bracing are in place unless otherwise indicated.
- C. Erection Of Structural Framing
1. Erect metal building system according to manufacturer's written erection instructions and erection drawings.
 2. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.
 3. Set structural framing accurately in locations and to elevations indicated, according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.
 4. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - a. Set plates for structural members on wedges, shims, or setting nuts as required.
 - b. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - c. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
 5. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - a. Level and plumb individual members of structure.
 - b. Make allowances for difference between temperature at time of erection and mean temperature when structure will be completed and in service.
 6. Primary Framing and End Walls: Erect framing level, plumb, rigid, secure, and true to line. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist-cure grout for not less than seven days after placement.
 - a. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for bolt type and joint type specified.
 - 1) Joint Type: Snug tightened or pretensioned.
 7. Secondary Framing: Erect framing level, plumb, rigid, secure, and true to line. Field bolt secondary framing to clips attached to primary framing.
 - a. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
 - b. Locate and space wall girts to suit openings such as doors and windows.
 - c. Locate canopy framing as indicated.
 - d. Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.
 8. Steel Joists and Joist Girders: Install joists, girders, and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Standard Specifications and



Load Tables for Steel Joists and Joist Girders," joist manufacturer's written instructions, and requirements in this Section.

- a. Before installation, splice joists delivered to Project site in more than one piece.
- b. Space, adjust, and align joists accurately in location before permanently fastening.
- c. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
- d. Bolt joists to supporting steel framework using carbon-steel bolts unless otherwise indicated.

OR

Bolt joists to supporting steel framework using high-strength structural bolts unless otherwise indicated. Comply with RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for high-strength structural bolt installation and tightening requirements.

- e. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.
9. Bracing: Install bracing in roof and sidewalls where indicated on erection drawings.
 - a. Tighten rod and cable bracing to avoid sag.
 - b. Locate interior end-bay bracing only where indicated.
 10. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to structural framing.
 11. Erection Tolerances: Maintain erection tolerances of structural framing within AISC 303.

D. Metal Panel Installation, General

1. Examination: Examine primary and secondary framing to verify that structural-panel support members and anchorages have been installed within alignment tolerances required by manufacturer.
 - a. Examine roughing-in for components and systems penetrating metal panels, to verify actual locations of penetrations relative to seams before metal panel installation.
2. General: Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - a. Field cut metal panels as required for doors, windows, and other openings. Cut openings as small as possible, neatly to size required, and without damage to adjacent metal panel finishes.
 - 1) Field cutting of metal panels by torch is not permitted unless approved in writing by manufacturer.
 - b. Install metal panels perpendicular to structural supports unless otherwise indicated.
 - c. Flash and seal metal panels with weather closures at perimeter of openings and similar elements. Fasten with self-tapping screws.
 - d. Locate and space fastenings in uniform vertical and horizontal alignment.
 - e. Locate metal panel splices over, but not attached to, structural supports with end laps in alignment.
 - f. Lap metal flashing over metal panels to allow moisture to run over and off the material.
3. Lap-Seam Metal Panels: Install screw fasteners using power tools with controlled torque adjusted to compress EPDM washers tightly without damage to washers, screw threads, or metal panels. Install screws in predrilled holes.
 - a. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply metal panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
4. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.



5. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal panel assemblies. Provide types of gaskets, fillers, and sealants indicated; or, if not indicated, provide types recommended by metal panel manufacturer.
 - a. Seal metal panel end laps with double beads of tape or sealant the full width of panel. Seal side joints where recommended by metal panel manufacturer.
 - b. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants".

E. Metal Roof Panel Installation

1. General: Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.
 - a. Install ridge and hip caps as metal roof panel work proceeds.
 - b. Flash and seal metal roof panels with weather closures at eaves and rakes. Fasten with self-tapping screws.
2. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint, at location and spacing and with fasteners recommended by manufacturer.
 - a. Install clips to supports with self-drilling or self-tapping fasteners.
 - b. Install pressure plates at locations indicated in manufacturer's written installation instructions.
 - c. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
OR
Seamed Joint: Crimp standing seams with manufacturer-approved motorized seamer tool so that clip, metal roof panel, and factory-applied sealant are completely engaged.
 - d. Rigidly fasten eave end of metal roof panels and allow ridge end free movement due to thermal expansion and contraction. Pre-drill panels for fasteners.
 - e. Provide metal closures at peaks, rake edges, rake walls and each side of ridge and hip caps.
3. Lap-Seam Metal Roof Panels: Fasten metal roof panels to supports with exposed fasteners at each lapped joint, at location and spacing recommended by manufacturer.
 - a. Provide metal-backed sealing washers under heads of exposed fasteners bearing on weather side of metal roof panels.
 - b. Provide sealant tape at lapped joints of metal roof panels and between panels and protruding equipment, vents, and accessories.
 - c. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps and on side laps of nesting-type metal panels, on side laps of ribbed or fluted metal panels, and elsewhere as needed to make metal panels weatherproof to driving rains.
 - d. At metal panel splices, nest panels with minimum 6-inch (152-mm) end lap, sealed with butyl-rubber sealant and fastened together by interlocking clamping plates.
4. Metal Fascia Panels: Align bottom of metal panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws. Flash and seal metal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.
5. Metal Roof Panel Installation Tolerances: Shim and align metal roof panels within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

F. Metal Wall Panel Installation

1. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts, extending full height of building, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - a. Unless otherwise indicated, begin metal panel installation at corners with center of rib lined up with line of framing.
 - b. Shim or otherwise plumb substrates receiving metal wall panels.



- c. When two rows of metal panels are required, lap panels 4 inches (102 mm) minimum.
 - d. When building height requires two rows of metal panels at gable ends, align lap of gable panels over metal wall panels at eave height.
 - e. Rigidly fasten base end of metal wall panels and allow eave end free movement due to thermal expansion and contraction. Pre-drill panels.
 - f. Flash and seal metal wall panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.
 - g. Install screw fasteners in pre-drilled holes.
 - h. Install flashing and trim as metal wall panel work proceeds.
 - i. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated; or, if not indicated, as necessary for waterproofing.
 - j. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws.
 - k. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.
2. Metal Wall Panels: Install metal wall panels on exterior side of girts. Attach metal wall panels to supports with fasteners as recommended by manufacturer.
 3. Insulated Metal Wall Panels: Install insulated metal wall panels on exterior side of girts. Attach panels to supports at each panel joint using concealed clip and fasteners at maximum 42 inches (1067 mm) o.c., spaced not more than manufacturer's recommendation. Fully engage tongue and groove of adjacent insulated metal wall panels.
 - a. Install clips to supports with self-tapping fasteners.
 - b. Apply continuous ribbon of sealant to panel joint on concealed side of insulated metal wall panels as vapor seal; apply sealant to panel joint on exposed side of panels as weather seal.
 4. Installation Tolerances (for highly finished metal wall panel assemblies): Shim and align metal wall panels within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m), nonaccumulative, on level, plumb, and on location lines as indicated, and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.
- G. Translucent Panel Installation
1. Translucent Panels: Attach translucent panels to structural framing with fasteners according to manufacturer's written instructions. Install panels perpendicular to supports unless otherwise indicated. Anchor translucent panels securely in place, with provisions for thermal and structural movement.
 - a. Provide end laps of not less than 6 inches (152 mm) and side laps of not less than 1-1/2-inch (38-mm) corrugations for metal roof panels.
 - b. Provide end laps of not less than 4 inches (102 mm) and side laps of not less than 1-1/2-inch (38-mm) corrugations for metal wall panels.
 - c. Align horizontal laps with adjacent metal panels.
 - d. Seal intermediate end laps and side laps of translucent panels with translucent mastic.
- H. Metal Soffit Panel Installation
1. Provide metal soffit panels the full width of soffits. Install panels perpendicular to support framing.
 2. Flash and seal metal soffit panels with weather closures where panels meet walls and at perimeter of all openings.
- I. Thermal Insulation Installation
1. General: Install insulation concurrently with metal panel installation, in thickness indicated to cover entire surface, according to manufacturer's written instructions.
 - a. Set vapor-retarder-faced units with vapor retarder toward warm side of construction unless otherwise indicated. Do not obstruct ventilation spaces except for firestopping.
 - b. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to the surrounding construction to ensure airtight installation.
 - c. Install factory-laminated, vapor-retarder-faced blankets straight and true in one-piece lengths, with both sets of facing tabs sealed, to provide a complete vapor retarder.
- OR**



Install blankets straight and true in one-piece lengths. Install vapor retarder over insulation, with both sets of facing tabs sealed, to provide a complete vapor retarder.

2. Blanket Roof Insulation: Comply with the following installation method:
 - a. Over-Framing Installation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Hold in place by metal roof panels fastened to secondary framing.
 - b. Between-Purlin Installation: Extend insulation and vapor retarder between purlins. Carry vapor-retarder-facing tabs up and over purlin, overlapping adjoining facing of next insulation course and maintaining continuity of retarder. Hold in place with bands and crossbands below insulation.
 - c. Over-Purlin-with-Spacer-Block Installation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Install layer of filler insulation over first layer to fill space formed by metal roof panel standoffs. Hold in place by panels fastened to standoffs.
 - 1) Thermal Spacer Blocks: Where metal roof panels attach directly to purlins, install thermal spacer blocks.
 - d. Two-Layers-between-Purlin-with-Spacer-Block Installation: Extend insulation and vapor retarder between purlins. Carry vapor-retarder-facing tabs up and over purlin, overlapping adjoining facing of next insulation course and maintaining continuity of retarder. Install layer of filler insulation over first layer to fill space between purlins formed by thermal spacer blocks. Hold in place with bands and crossbands below insulation.
 - 1) Thermal Spacer Blocks: Where metal roof panels attach directly to purlins, install thermal spacer blocks.
 - e. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.
3. Blanket Wall Insulation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Hold in place by metal wall panels fastened to secondary framing.
 - a. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.
 - b. Sound-Absorption Insulation: Where sound-absorption requirement is indicated for metal liner panels, cover insulation with polyethylene film and provide inserts of wire mesh to form acoustical spacer grid.
4. Board Wall Insulation: Extend board insulation in thickness indicated to cover entire wall. Hold in place by metal wall panels fastened to secondary framing. Comply with manufacturers' written instructions.
 - a. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.

J. Door And Frame Installation

1. General: Install doors and frames plumb, rigid, properly aligned, and securely fastened in place according to manufacturers' written instructions. Coordinate installation with wall flashings and other components. Seal perimeter of each door frame with elastomeric sealant used for metal wall panels.
2. Personnel Doors and Frames: Install doors and frames according to SDI A250.8. Fit non-fire-rated doors accurately in their respective frames, with the following clearances:
 - a. Between Doors and Frames at Jambs and Head: 1/8 inch (3 mm).
 - b. Between Edges of Pairs of Doors: 1/8 inch (3 mm).
 - c. At Door Sills with Threshold: 3/8 inch (9.5 mm).
 - d. At Door Sills without Threshold: 3/4 inch (19.1 mm).
 - e. At fire-rated openings, install frames according to, and doors with clearances specified in, NFPA 80.
3. Sliding Service Doors: Bolt support angles to opening head members through factory-punched holes. Bolt door tracks to support angles at maximum 24 inches (610 mm) o.c. Set doors and operating equipment with necessary hardware, jamb and head mold stops, continuous hood flashing, anchors, inserts, hangers, and equipment supports.



4. Field Glazing: Comply with installation requirements in Division 8 Section "Glazing."
 5. Door Hardware: Mount units at heights indicated in DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - a. Install surface-mounted items after finishes have been completed on substrates involved.
 - b. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 - c. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
 - d. Set thresholds for exterior doors in full bed of butyl-rubber sealant complying with requirements specified in Division 07 Section "Joint Sealants".
- K. Window Installation
1. General: Install windows plumb, rigid, properly aligned, without warp or rack of frames or sash, and securely fasten in place according to manufacturer's written instructions. Coordinate installation with wall flashings and other components. Seal perimeter of each window frame with elastomeric sealant used for metal wall panels.
 - a. Separate dissimilar materials from sources of corrosion or electrolytic action at points of contact with other materials by complying with requirements specified in AAMA/WDMA/CSA 101/I.S.2/A440.
 2. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.
 3. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.
 4. Mount screens directly to frames with tapped screw clips.
 5. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing".
- L. Accessory Installation
1. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
 - a. Install components required for a complete metal roof panel assembly, including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
 - b. Install components for a complete metal wall panel assembly, including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
 - c. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturer.
 2. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
 - a. Install exposed flashing and trim that is without excessive oil-canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
 - b. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).
 3. Gutters: Join sections with riveted-and-soldered or lapped-and-sealed joints. Attach gutters to eave with gutter hangers spaced as required for gutter size, but not more than 36 inches (914 mm) o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.



4. Downspouts: Join sections with 1-1/2-inch (38-mm) telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1524 mm) o.c. in between.
 - a. Provide elbows at base of downspouts to direct water away from building.

OR

Tie downspouts to underground drainage system indicated.
5. Circular Roof Ventilators: Set ventilators complete with necessary hardware, anchors, dampers, weather guards, rain caps, and equipment supports. Mount ventilators on flat level base. Install preformed filler strips at base to seal ventilator to metal roof panels.
6. Continuous Roof Ventilators: Set ventilators complete with necessary hardware, anchors, dampers, weather guards, rain caps, and equipment supports. Join sections with splice plates and end-cap skirt assemblies where required to achieve indicated length. Install preformed filler strips at base to seal ventilator to metal roof panels.
7. Louvers: Locate and place louver units level, plumb, and at indicated alignment with adjacent work.
 - a. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
 - b. Provide perimeter reveals and openings of uniform width for sealants and joint fillers.
 - c. Protect galvanized- and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of corrosion-resistant paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.
 - d. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Division 07 Section "Joint Sealants" for sealants applied during louver installation.
8. Roof Curbs: Install curbs at locations indicated on Drawings. Install flashing around bases where they meet metal roof panels.
9. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to panel as recommended by manufacturer.

M. Field Quality Control

1. Special Inspections: Engage, **as directed**, a qualified special inspector to perform the following special inspections:
 - a. Inspection of fabricators.
 - b. Steel construction.
2. Testing Agency: Engage, **as directed**, a qualified testing agency to perform tests and inspections.
3. Tests and Inspections:
 - a. High-Strength, Field-Bolted Connections: Connections shall be tested and inspected during installation according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
 - b. Welded Connections: In addition to visual inspection, field-welded connections shall be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at inspector's option:
 - 1) Liquid Penetrant Inspection: ASTM E 165.
 - 2) Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - 3) Ultrasonic Inspection: ASTM E 164.
 - 4) Radiographic Inspection: ASTM E 94.
4. Product will be considered defective if it does not pass tests and inspections.
5. Prepare test and inspection reports.

N. Adjusting

1. Doors: After completing installation, test and adjust doors to operate easily, free of warp, twist, or distortion.



2. Door Hardware: Adjust and check each operating item of door hardware and each door to ensure proper operation and function of every unit. Replace units that cannot be adjusted to operate as intended.
 3. Windows: Adjust operating sashes and ventilators, screens, hardware, and accessories for a tight fit at contact points and at weather stripping to ensure smooth operation and weathertight closure. Lubricate hardware and moving parts.
 4. Roof Ventilators and Adjustable Louvers: After completing installation, including work by other trades, lubricate, test, and adjust units to operate easily and be free of warp, twist, or distortion as needed to provide fully functioning units.
 - a. Adjust louver blades to be weathertight when in closed position.
- O. Cleaning And Protection
1. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
 2. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
 3. Touchup Painting: After erection, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted structural framing, bearing plates, and accessories.
 - a. Clean and prepare surfaces by SSPC-SP 2, "Hand Tool Cleaning," or by SSPC-SP 3, "Power Tool Cleaning."
 - b. Apply a compatible primer of same type as shop primer used on adjacent surfaces.
- OR**
- Touchup Painting: Cleaning and touchup painting are specified in Division 9 painting Sections.
4. Metal Panels: Remove temporary protective coverings and strippable films, if any, as metal panels are installed. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
 - a. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.
 5. Doors and Frames: Immediately after installation, sand rusted or damaged areas of prime coat until smooth and apply touchup of compatible air-drying primer.
 - a. Immediately before final inspection, remove protective wrappings from doors and frames.
 6. Windows: Clean metal surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances. Clean factory-glazed glass immediately after installing windows.
 7. Louvers: Clean exposed surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.
 - a. Restore louvers damaged during installation and construction period so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by the Owner, remove damaged units and replace with new units.
 - 1) Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

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Task	Specification	Specification Description
13 34 23 16	11 12 16 00	Parking Control Equipment
13 34 23 16	11 12 16 00a	Prefabricated Control Booths



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SECTION 14 01 20 00 - ELECTRIC TRACTION ELEVATORS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for electric traction elevators. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes electric traction passenger and service elevators.

C. Definitions

1. Definitions in ASME A17.1 apply to work of this Section.
2. Defective Elevator Work: Operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.
3. Service Elevator: A passenger elevator that is also used to carry freight.

D. Submittals

1. Product Data: Include capacities, sizes, performances, operations, safety features, finishes, and similar information. Include product data for the following:
 - a. Car enclosures and hoistway entrances.
 - b. Operation, control, and signal systems.
2. Shop Drawings: Show plans, elevations, sections, and large-scale details indicating service at each landing, machine room layout, coordination with building structure, relationships with other construction, and locations of equipment and signals. Include large-scale layout of car control station and standby power operation control panel, **as directed**. Indicate variations from specified requirements, maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands.
3. Samples: For exposed finishes of cars, hoistway doors and frames, and signal equipment; 3-inch- (75-mm-) square Samples of sheet materials; and 4-inch (100-mm) lengths of running trim members.
4. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway, pit, and machine room layout and dimensions, as shown on Drawings, and electrical service, as shown and specified, are adequate for elevator system being provided.
5. Qualification Data: For Installer.
6. Operation and Maintenance Data: For elevators to include in emergency, operation, and maintenance manuals.
7. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.
8. Warranty: Special warranty specified in this Section.

E. Quality Assurance

1. Installer Qualifications: Elevator manufacturer or manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
2. Source Limitations: Obtain elevators, including hydraulic passenger elevators specified in another Division 14 Section, through one source from a single manufacturer.
 - a. Provide major elevator components, including driving machines, controllers, signal fixtures, door operators, car frames, cabs, and entrances, manufactured by a single manufacturer.
3. Regulatory Requirements: Comply with ASME A17.1 and elevator design requirements for earthquake loads in ASCE 7.



- a. Effective peak velocity acceleration (A_v) for Project's location is less than 0.10 (seismic risk zones 0 and 1) **OR** greater than or equal to 0.10, but less than 0.20 (seismic risk zone 2) **OR** greater than or equal to 0.20 (seismic risk zones 3 and 4), **as directed**.
 - b. Provide earthquake equipment required by ASME A17.1.
 - c. Design earthquake spectral response acceleration, short period (Sds) for Project is determined by Project's location and site classification.
 - d. Project's seismic design category is A **OR** B **OR** C **OR** D, **as directed**.
 - e. Elevator importance factor is 1.5 **OR** 1.0, **as directed**.
4. Accessibility Requirements: Comply with Section 4.10 in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)" **OR** 407 in ICC A117.1, **as directed**.
 5. Fire-Rated Hoistway Entrance Assemblies: Door and frame assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252 **OR** IBC Standard 3002.4 **OR** UL 10B, **as directed**.

F. Delivery, Storage, And Handling

1. Deliver, store, and handle materials, components, and equipment in manufacturer's protective packaging.
2. Store materials, components, and equipment off of ground, under cover, and in a dry location. Handle according to manufacturer's written recommendations to prevent damage, deterioration, or soiling.

G. Coordination

1. Coordinate installation of sleeves, block outs, elevator equipment with integral anchors, and other items that are embedded in concrete or masonry for elevator equipment. Furnish templates, sleeves, elevator equipment with integral anchors, and installation instructions and deliver to Project site in time for installation.
2. Coordinate sequence of elevator installation with other work to avoid delaying the Work.
3. Coordinate locations and dimensions of other work relating to electric traction elevators including pit ladders, sumps, and floor drains in pits; entrance subsills; machine beams, **as directed**; and electrical service, electrical outlets, lights, and switches in pits and machine rooms **OR** hoistways, **as directed**.

H. Warranty

1. Special Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to repair, restore, or replace defective elevator work within specified warranty period.
 - a. Warranty Period: One year from date of Final Completion.

1.2 PRODUCTS

A. Systems And Components

1. General: Provide manufacturer's standard elevator systems. Where components are not otherwise indicated, provide standard components published by manufacturer as included in standard preengineered elevator systems and as required for complete system.
2. Elevator Machines: Provide variable-voltage, variable-frequency, ac-type hoisting machines **OR** At manufacturer's option, provide either variable-voltage, variable-frequency, ac-type or variable-voltage, dc-type hoisting machines, **as directed**. Provide solid-state power converters.
 - a. Provide regenerative **OR** nonregenerative, **as directed**, system.
 - b. Limit total harmonic distortion of regenerated power to 5 percent per IEEE 519.
 - c. Provide means for absorbing regenerated power when elevator system is operating on standby power.
 - d. Provide line filters or chokes to prevent electrical peaks or spikes from feeding back into building power system.



3. Fluid for Oil Buffers: If oil buffers are used, use only fire-resistant hydraulic fluid containing antioxidant, anticorrosive, antifoaming, and metal-passivating additives.
4. Inserts: Furnish required concrete and masonry inserts and similar anchorage devices for installing guide rails, machinery, and other components of elevator work where installation of devices is specified in another Section.
5. Machine Beams: Provide framing to support elevator hoisting machine and deflector sheaves from the building structure. Comply with Division 5 Section "Metal Fabrications" for materials and fabrication.
6. Car Frame and Platform: Welded steel units.
7. Guides: Provide roller guides **OR** polymer-coated, nonlubricated sliding guides, **as directed**, at top and bottom of car and counterweight frames.

B. Operation Systems

1. General: Provide manufacturer's standard microprocessor operation system for each elevator **OR** for each group of elevators, **as directed**, as required to provide type of operation system indicated.
2. Group Automatic Operation with Demand-Based Dispatching: Provide reprogrammable, **as directed**, group automatic system that assigns cars to hall calls based on a dispatching program designed to minimize passenger waiting time. System automatically adjusts to changes in demand for different traffic conditions including heavy incoming, heavy two-way, heavy outgoing, and light off-hours as variations of normal two-way traffic.
3. Destination-Based Group Automatic Operation: Provide reprogrammable group automatic system that assigns elevators leaving the main lobby in the up direction to a selected group of floors and directs passengers to an elevator serving their destination floor. System dispatches cars in a regulated sequence for optimum system efficiency; dispatch is based on origin and destination of calls. System automatically adjusts to changes in demand for different traffic conditions including heavy incoming, heavy two-way, heavy outgoing, and light off-hours as variations of normal two-way traffic.
4. Auxiliary **OR** Single-Car Auxiliary, **as directed**, Operations: In addition to primary operation system features, provide the following operational features for elevators where indicated:
 - a. Standby Power Operation: On activation of standby power, car is returned to a designated floor and parked with doors open. Car can be manually put in service on standby power, either for return operation or for regular operation, by switches in control panel located at main lobby **OR** fire command station, **as directed**. Manual operation causes automatic operation to cease.
 - b. Standby Powered Lowering: On activation of standby power, if car is at a floor, it remains at that floor, opens its doors, and shuts down. If car is between floors, it is lowered to the next floor below, opens its doors, and shuts down.
 - c. Battery-Powered Lowering: If power fails and car is at a floor, it remains at that floor, opens its doors, and shuts down. If car is between floors, it is lowered to the next floor below, opens its doors, and shuts down. System includes rechargeable battery and automatic recharging system.
 - d. Automatic Dispatching of Loaded Car: When car load exceeds 80 percent of rated capacity, doors will begin closing.
 - e. Nuisance Call Cancel: When car calls exceed a preset number while car load is less than a predetermined weight, all car calls are canceled. Preset number of calls and predetermined weight, **as directed**, can be adjusted.
5. Group Auxiliary Operations: In addition to primary operation system features, provide the following operational features for elevators and elevator groups where indicated:
 - a. Standby Power Operation: On activation of standby power, cars are returned to a designated floor and parked with doors open. One car is returned at a time, with priority given to loaded cars. If a car cannot be returned after two attempts, it is removed from the system. When all cars have been returned or removed from the system, one car is automatically placed in service. If car selected for service cannot operate within 60 seconds, the system removes car from service and places another car in service. Cars can be manually put in service on standby power, either for return operation or for regular



- operation, by switches in control panel located at main lobby **OR** fire command station, **as directed**. Manual operation causes automatic operation to cease.
- b. Standby Power Operation: On activation of standby power, cars are returned, one at a time, to a designated floor and parked with doors open. If a car cannot be returned, it is removed from the system. When all cars have been returned or removed from the system, one car can be put in service on standby power by a selector switch in control panel located at main lobby **OR** fire command station, **as directed**.
 - c. Battery-Powered Lowering: If power fails, cars that are at a floor remain at that floor, open their doors, and shut down. Cars that are between floors are lowered one at a time to the next floor below, open their doors, and shut down. System includes rechargeable battery and automatic recharging system.
 - d. Automatic Dispatching of Loaded Car: When car load exceeds 80 percent of rated capacity, doors will begin closing.
 - e. Nuisance Call Cancel: When car calls exceed a preset number while the car load is less than a predetermined weight, all car calls are canceled. Preset number of calls and predetermined weight, **as directed**, can be adjusted.
 - f. Emergency Hospital **OR** Priority, **as directed**, Service: Service is initiated by a keyswitch **OR** card reader **OR** remote switch, **as directed**, at designated floors. One elevator is removed from group operation and directed to the floor where service was initiated. On arriving at the floor, elevator opens its doors and parks and a lighted sign directs passengers to exit elevator, **as directed**. Car is placed in operation by selecting a floor and pressing door close button or by operating keyswitch to put car in independent service. After responding to floor selected or being removed from independent service, car is returned to group operation. If car is not placed in operation within a preset time after being called, it is returned to group operation.
 - g. Independent Service: Keyswitch in car control station removes car from group operation and allows it to respond only to car calls. Key cannot be removed from keyswitch when car is in independent service. When in independent service, doors close only in response to door close button.
 - h. Loaded-Car Bypass: When car load exceeds 80 percent of rated capacity, car will respond only to car calls, not to hall calls.
 - i. Distributed Parking: When cars are not required for response to calls, they are parked with doors closed, distributed in predetermined zones throughout the building. One zone shall include the main floor and adjacent floors; remaining floors shall be divided into approximately equal zones.
6. Security Features: Provide the following security features, where indicated. Security features shall not affect emergency firefighters' service.
- a. Card-Reader Operation: System uses card readers at car control stations **OR** hall push-button stations, **as directed**, to authorize calls. Security system determines which landings and at what times calls require authorization by card reader. Provide required conductors in traveling cable and panel in machine room for interconnecting card readers, other security access system equipment, and elevator controllers. Allow space as indicated for card reader in car **OR** Provide stripe-swipe card reader integral with each car control station, **as directed**.
 - 1) Security access system equipment is specified in Division 28 Section "Access Control".
OR
Security access system equipment is not in the Contract.
 - b. Keyswitch Operation: Push buttons are activated and deactivated by security keyswitches at car control stations **OR** hall push-button stations, **as directed**. Key is removable only in deactivated position **OR** in either position, **as directed**.
 - c. Keypad Operation: Allows each landing to be restricted or unrestricted. When a restricted landing button is pressed, a "Restricted Floor" lamp lights and remains lit until landing access code has been entered into a keypad or predetermined time period has elapsed.



Car calls for restricted landings do not register until landing access code is entered into keypad within predetermined time period after landing button is pressed.

- 1) Access codes are programmed at each car operating panel using a security keyswitch. Keypad operation can be activated and deactivated by security keyswitch at main landing.
 - d. Car-to-Lobby Feature: Feature, activated by keyswitch at main lobby, that causes car **OR** all cars in a group, **as directed**, to return immediately to lobby and open doors for inspection. On deactivation by keyswitch, calls registered before keyswitch activation are completed and normal operation is resumed.
- C. Door Reopening Devices
1. Infrared Array: Provide door reopening devices with uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of one or more of the light beams shall cause doors to stop and reopen.
 2. Nudging Feature: After car doors are prevented from closing for predetermined adjustable time, through activating door reopening device, a loud buzzer shall sound and doors shall begin to close at reduced kinetic energy.
- D. Finish Materials
1. General: Provide the following materials for exposed parts of elevator car enclosures, car doors, hoistway entrance doors and frames, and signal equipment as indicated.
 2. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, commercial steel, Type B, exposed, matte finish.
 3. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, commercial steel, Type B, pickled.
 4. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.
 - a. Textured Stainless-Steel Sheet: Product with coined **OR** embossed, **as directed**, texture rolled into exposed surface.
 - 1) Metal surface is satin polished **OR** satin relieved **OR** titanium nitride colored **OR** oxide colored **OR** satin polished and titanium nitride colored **OR** satin relieved and titanium nitride colored **OR** satin polished and oxide colored **OR** satin relieved and oxide colored **OR** color coated and satin relieved **OR** color coated and bright relieved, **as directed**, after rolling.
 5. Stainless-Steel Bars: ASTM A 276, Type 304.
 6. Stainless-Steel Tubing: ASTM A 554, Grade MT 304.
 7. Bronze Plate and Sheet: ASTM B 36/B 36M, Alloy UNS No. C28000 (muntz metal).
 8. Bronze Extrusions: ASTM B 455, Alloy UNS No. C38500 (architectural bronze).
 9. Bronze Tubing: ASTM B 135 (ASTM B 135M), Alloy UNS No. C23000 (red brass, 85 percent copper).
 10. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063.
 11. Nickel Silver Extrusions: ASTM B 151/B 151M, Alloy UNS No. C74500 or No. C77600.
 12. Plastic Laminate: High-pressure type complying with NEMA LD 3, Type HGS for flat applications **OR** Type HGL for flat applications, **as directed**, Type HGP for postformed applications and Type BKV for panel backing.
- E. Car Enclosures
1. General: Provide enameled-steel car enclosures to receive removable **OR** steel-framed car enclosures with nonremovable, **as directed**, wall panels, with car **OR** removable car, **as directed**, roof, access doors, power door operators, and ventilation.
 - a. Provide standard railings complying with ASME A17.1 on car tops where required by ASME A17.1.
 - b. Provide finished car including materials and finishes specified below.
 2. Materials and Finishes: Provide manufacturer's standards, but not less than the following:
 - a. Subfloor: Underlayment grade, exterior plywood, 5/8-inch (16-mm) nominal thickness.
 - b. Floor Finish: Specified in a Division 9 Section **OR** Elevator manufacturer's standard level-loop nylon carpet; color as selected from manufacturer's full range, **as directed**.



- c. Enameled-Steel Wall Panels: Flush, hollow-metal construction; fabricated from cold-rolled steel sheet. Provide with factory-applied enamel finish; colors as selected from manufacturer's full range.
 - d. Stainless-Steel Wall Panels: Flush, hollow-metal construction; fabricated from stainless-steel sheet.
 - e. Bronze Wall Panels: Flush, hollow-metal construction; fabricated from bronze sheet.
 - f. Plastic-Laminate Wall Panels: Plastic laminate adhesively applied to 1/2-inch (13-mm) fire-retardant-treated particleboard **OR** manufacturer's standard honeycomb core, **as directed**, with plastic-laminate panel backing and, **as directed**, manufacturer's standard protective edge trim. Panels have a flame-spread index of 25 **OR** 75, **as directed**, or less, when tested according to ASTM E 84. Plastic-laminate color, texture, and pattern as selected from plastic-laminate **OR** elevator, **as directed**, manufacturer's full range.
 - g. Fabricate car with recesses and cutouts for signal equipment.
 - h. Fabricate car door frame integrally with front wall of car.
 - i. Enameled-Steel Doors: Flush, hollow-metal construction; fabricated from cold-rolled steel sheet. Provide with factory-applied enamel finish; colors as selected from manufacturer's full range.
 - j. Stainless-Steel Doors: Flush, hollow-metal construction; fabricated from stainless-steel sheet **OR** by laminating stainless-steel sheet to exposed faces and edges of enameled cold-rolled steel doors using adhesive that fully bonds metal to metal without telegraphing or oil-canning, **as directed**.
 - k. Bronze Doors: Flush, hollow-metal construction; fabricated by laminating bronze sheet to exposed faces and edges of enameled cold-rolled steel doors using adhesive that fully bonds metal to metal without telegraphing or oil-canning.
 - l. Plastic-Laminate Doors: Flush, hollow-metal construction; fabricated by laminating plastic laminate to exposed faces of enameled cold-rolled steel doors and covering edges with protective edge trim matching return panels, **as directed**. Plastic-laminate color, texture, and pattern as selected from plastic-laminate **OR** elevator, **as directed**, manufacturer's full range.
 - m. Sight Guards: Provide sight guards on car doors.
 - n. Sills: Extruded metal, with grooved surface, 1/4 inch (6.4 mm) thick.
 - o. Luminous Ceiling: Fluorescent light fixtures and ceiling panels of translucent acrylic or other permanent rigid plastic.
 - p. Metal **OR** Metallic-Finish, Plastic-Laminate, **as directed**, Ceiling: Flush panels, with incandescent downlights in the center of **OR** four low-voltage downlights in, **as directed**, each panel. Align ceiling panel joints with joints between wall panels, **as directed**.
 - q. Handrails: Manufacturer's standard handrails, of shape, metal, and finish indicated.
- F. Hoistway Entrances
- 1. General: Provide manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sills, and accessories. Provide frame size and profile to coordinate with hoistway wall construction.
 - a. Where gypsum board wall construction is indicated, provide self-supporting frames with reinforced head sections.
 - 2. Materials and Fabrication: Provide manufacturer's standards, but not less than the following:
 - a. Enameled-Steel Frames: Formed from cold-rolled or hot-rolled steel sheet. Provide with factory-applied enamel finish; colors as selected from manufacturer's full range.
 - b. Steel Subframes: Formed from cold-rolled or hot-rolled steel sheet with factory-applied enamel finish or corrosion-inhibiting primer. Fabricate to receive applied finish as indicated.
 - c. Stainless-Steel Frames: Formed from stainless-steel sheet.
 - d. Bronze Frames: Formed from cold-rolled or hot-rolled steel sheet, with enamel finish, and with formed-bronze sheet laminated to steel frames using adhesive that fully bonds metal to metal without telegraphing or oil-canning.



- e. Enameled-Steel Doors and Transoms: Flush, hollow-metal construction; fabricated from cold-rolled steel sheet. Provide with factory-applied enamel finish; colors as selected from manufacturer's full range.
- f. Stainless-Steel Doors and Transoms: Flush, hollow-metal construction; fabricated from stainless-steel sheet **OR** by laminating stainless-steel sheet to exposed faces and edges of enameled cold-rolled steel doors using adhesive that fully bonds metal to metal without telegraphing or oil-canning, **as directed**.
- g. Bronze Doors and Transoms: Flush, hollow-metal construction; fabricated by laminating bronze sheet to exposed faces and edges of enameled cold-rolled steel doors using adhesive that fully bonds metal to metal without telegraphing or oil-canning.
- h. Plastic-Laminate Doors and Transoms: Flush, hollow-metal construction; fabricated by laminating plastic laminate to exposed faces of enameled cold-rolled steel doors and covering edges with protective edge trim matching door frames, **as directed**. Plastic-laminate color, texture, and pattern as selected from plastic-laminate **OR** elevator, **as directed**, manufacturer's full range.
- i. Sight Guards: Provide sight guards on doors matching door edges.
- j. Sills: Extruded metal, with grooved surface, 1/4 inch (6.4 mm) thick.
- k. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.

G. Signal Equipment

1. General: Provide hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Fabricate lighted elements with long-life incandescent lamps and acrylic or other permanent, nonyellowing translucent plastic diffusers **OR** LEDs, **as directed**.
OR
General: Provide signal equipment designed for destination-based system. Fabricate lighted elements with long-life incandescent lamps and acrylic or other permanent, nonyellowing translucent plastic diffusers **OR** LEDs, **as directed**.
2. Car Control Stations: Provide manufacturer's standard recessed **OR** semirecessed, **as directed**, car control stations. Mount in return panel adjacent to car door, unless otherwise indicated.
OR
Swing-Return Car Control Stations: Provide car control stations mounted on rear of hinged return panel adjacent to car door and with buttons, switches, controls, and indicator lights projecting through return panel but substantially flush with face of return panel.
 - a. Mark buttons and switches with standard identification for required use or function that complies with ASME A17.1. Use both tactile symbols and Braille.
 - b. Provide "No Smoking" sign matching car control station, either integral with car control station or mounted adjacent to it, with text and graphics as required by authorities having jurisdiction.
3. Emergency Communication System: Provide system that complies with ASME A17.1 and the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." On activation, system dials preprogrammed number of monitoring station and identifies elevator location to monitoring station. System provides two-way voice communication without using a handset and provides visible signals that indicate when system has been activated and when monitoring station has responded. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.
4. Firefighters' Two-Way Telephone Communication Service: Provide flush-mounted cabinet **OR** telephone jack, **as directed**, in each car and required conductors in traveling cable for firefighters' two-way telephone communication service specified in Division 28 Section(s) "Digital, Addressable Fire-alarm System" **OR** "Zoned (dc Loop) Fire-alarm System".
5. Car Position Indicator: Provide illuminated, **as directed**, digital-type car position indicator, located above car door or above car control station. Also provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served.
 - a. Include travel direction arrows if not provided in car control station.



6. Hall Push-Button Stations: Provide one hall push-button station at each landing for each single elevator or group of elevators, but not less than one station for each four elevators in a group, **as directed**.
OR
Hall Push-Button Stations: Provide hall push-button stations at each landing as indicated.
- a. Provide manufacturer's standard wall-mounted units.
OR
Provide units with flat faceplate for mounting with body of unit recessed in wall.
 - b. Equip units with buttons for calling elevator and for indicating desired direction of travel.
OR
Equip units with buttons **OR** touch screen, **as directed**, for calling elevator and for indicating direction of travel or destination as required by system. Provide a signaling system to verify floor selection, where destination registration is required, and to direct passengers to appropriate car.
 - 1) Provide a means for passengers to indicate that they have disabilities so control system can allow extra room in assigned car.
 - 2) Provide for connecting units that require destination registration to building security access system so a card reader can be used to register calls.
 - c. Provide telephone jack in each unit for firefighters' two-way telephone communication service specified in Division 28 Section(s) "Digital, Addressable Fire-alarm System" OR "Zoned (dc Loop) Fire-alarm System".
7. Hall Lanterns: Units with illuminated arrows; but provide single arrow at terminal landings. Provide one of the following:
- a. Manufacturer's standard wall-mounted units, for mounting above entrance frames.
 - b. Units with flat faceplate for mounting with body of unit recessed in wall and with illuminated elements projecting from faceplate for ease of angular viewing.
 - c. Units mounted in both jambs of entrance frame for each elevator, **as directed**.
 - d. Units mounted in both car door jambs; may be used only for single elevators or for two-car groups, **as directed**.
8. Hall Annunciator: With each hall lantern, provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down.
- a. At manufacturer's option, audible signals may be placed on car **OR** each car, **as directed**.
9. Hall Position Indicators: Provide illuminated, **as directed**, digital-display-type position indicators, located above each, **as directed**, hoistway entrance at ground floor. Provide units with flat faceplate for mounting with body of unit recessed in wall.
- a. Integrate ground-floor hall lanterns with hall position indicators.
10. Standby Power Elevator Selector Switches: Provide switches, as required by ASME A17.1, where indicated. Adjacent to switches, provide illuminated signal that indicates when normal power supply has failed. For each elevator, provide illuminated signals that indicate when they are operational and when they are at the designated emergency return level with doors open.
OR
Fire Command Center Annunciator Panel: Provide panel containing illuminated position indicators for each elevator, clearly labeled with elevator designation; include illuminated signal that indicates when elevator is operational and when it is at the designated emergency return level with doors open. Provide standby power elevator selector switch(es), as required by ASME A17.1, adjacent to position indicators. Provide illuminated signal that indicates when normal power supply has failed.
11. Corridor Call Station Pictograph Signs: Provide signs matching hall push-button stations, with text and graphics as required by authorities having jurisdiction, indicating that in case of fire elevators are out of service and exits should be used instead. Provide one sign at each hall push-button station, unless otherwise indicated.

H. Elevators

1. Elevator Description:



- a. Group Number: **<Insert a different number for each group of elevators that share a group operation system.>**
- b. Elevator Number(s): **<Insert elevator number(s) as shown on Drawings.>**
- c. Service Elevator Number(s): **<Insert elevator number(s) as shown on Drawings.>**
- d. Type: Geared **OR** Gearless, **as directed**, traction.
- e. Machine Location: Machine room above hoistway **OR** Hoistway; no machine room is provided, **as directed**.
- f. Rated Load: 2000 lb (908 kg) **OR** 2100 lb (953 kg) **OR** 2500 lb (1135 kg) **OR** 3000 lb (1362 kg) **OR** 3500 lb (1589 kg) **OR** 4000 lb (1816 kg) **OR** 4500 lb (2043 kg) **OR** 5000 lb (2270 kg), **as directed**.
- g. Freight Loading Class for Service Elevator(s): Class A.
- h. Rated Speed: 200 fpm (1.0 m/s) **OR** 350 fpm (1.8 m/s) **OR** 400 fpm (2.0 m/s) **OR** 450 fpm (2.3 m/s) **OR** 500 fpm (2.5 m/s) **OR** 700 fpm (3.6 m/s) **OR** 800 fpm (4.1 m/s) **OR** 1000 fpm (5.1 m/s) **OR** 1200 fpm (6.1 m/s) **OR** 1400 fpm (7.1 m/s), **as directed**.
- i. Operation System: Selective collective automatic operation **OR** Group automatic operation **OR** Group automatic operation with demand-based dispatching **OR** Destination-based group automatic operation, **as directed**.
- j. Auxiliary Operations:
 - 1) Standby power operation.
 - 2) Standby powered lowering.
 - 3) Battery-powered lowering.
 - 4) Earthquake Emergency Operation: Comply with requirements in ASME A17.1.
 - 5) Automatic dispatching of loaded car.
 - 6) Nuisance call cancel.
 - 7) Emergency hospital **OR** Priority, **as directed**, service at designated floors **OR** all floors, **as directed**.
 - 8) Independent service for service elevator **OR** all cars in group, **as directed**.
 - 9) Loaded-car bypass.
 - 10) Distributed parking.
- k. Security Features: Card-reader operation **OR** Keyswitch operation **OR** Keypad operation **OR** Car-to-lobby feature, **as directed**.
- l. Dual Car Control Stations: Provide two car control stations in each elevator, **as directed**; equip only one with required keyswitches if any.
- m. Car Enclosures:
 - 1) Inside Width: 64 inches (1626 mm) **OR** 68 inches (1727 mm) **OR** 80 inches (2032 mm) **OR** 92 inches (2337 mm), **as directed**, from side wall to side wall.
 - 2) Inside Depth: 51 inches (1295 mm) **OR** 53 inches (1346 mm) **OR** 57 inches (1448 mm) **OR** 65 inches (1651 mm) **OR** 87-1/2 inches (2222 mm) **OR** 90 inches (2286 mm) **OR** 93 inches (2362 mm) **OR** 93-1/2 inches (2375 mm) **OR** 96 inches (2438 mm) **OR** 101 inches (2565 mm) **OR** 102 inches (2591 mm), **as directed**, from back wall to front wall (return panels).
 - 3) Inside Height: 88 inches (2235 mm) **OR** 92 inches (2337 mm) **OR** 94 inches (2388 mm) **OR** 100 inches (2540 mm) **OR** 104 inches (2642 mm) **OR** 108 inches (2743 mm) **OR** 112 inches (2845 mm), **as directed**, to underside of ceiling.
 - 4) Front Walls (Return Panels): Polished stainless steel, No. 8 finish **OR** Satin stainless steel, No. 4 finish **OR** Polished bronze, lacquered **OR** Satin bronze, lacquered, **as directed**.
 - 5) Car Fixtures: Polished stainless steel, No. 8 finish **OR** Satin stainless steel, No. 4 finish **OR** Polished bronze, lacquered **OR** Satin bronze, lacquered, **as directed**.
 - 6) Side and Rear Wall Panels: Enameled steel **OR** Plastic laminate **OR** Satin stainless steel, No. 4 finish **OR** Textured stainless steel, **as directed**.
 - 7) Reveals: Enameled steel **OR** Polished stainless steel, No. 8 finish **OR** Satin stainless steel, No. 4 finish **OR** Polished bronze, lacquered **OR** Satin bronze, lacquered, **as directed**.



- 8) Door Faces (Interior): Enameled steel **OR** Polished stainless steel, No. 8 finish **OR** Satin stainless steel, No. 4 finish **OR** Textured stainless steel **OR** Polished bronze, lacquered **OR** Satin bronze, lacquered **OR** Plastic laminate, **as directed**.
 - 9) Door Sills: Aluminum, mill finish **OR** Bronze, polished **OR** Nickel silver, polished, **as directed**.
 - 10) Ceiling: Luminous ceiling **OR** Polished stainless steel, No. 8 finish **OR** Satin stainless steel, No. 4 finish **OR** Polished bronze, lacquered **OR** Reflective metallic-finish, plastic-laminate, stainless steel **OR** Reflective metallic-finish, plastic-laminate, bronze, **as directed**.
 - 11) Handrails: 1-1/2 inches (38 mm) round **OR** 1/2 by 2 inches (13 by 50 mm) rectangular, **as directed**, mirror-polished stainless steel, No. 8 finish **OR** satin stainless steel, No. 4 finish **OR** mirror-polished bronze, lacquered **OR** satin bronze, lacquered, **as directed**, at sides **OR** rear **OR** sides and rear, **as directed**, of car.
 - 12) Floor: Manufacturer's standard carpet.
OR
 Floor prepared to receive carpet (specified in Division 09 Section "Sheet Carpeting").
OR
 Floor prepared to receive resilient tile (specified in Division 09 Section "Resilient Tile Flooring").
OR
 Floor prepared to receive sheet vinyl (specified in Division 09 Section "Resilient Sheet Flooring").
OR
 Floor recessed and prepared to receive dimension stone tile (specified in Division 09 Section "Stone Tiling") **OR** ceramic tile (specified in Division 09 Section "Tiling"), **as directed**.
 - 13) Floor Thickness, Including Setting Materials: **<Insert thickness>** above plywood subfloor.
- n. Hoistway Entrances: As follows:
- 1) Width: 36 inches (914 mm) **OR** 42 inches (1067 mm) **OR** 48 inches (1219 mm) **OR** 54 inches (1372 mm), **as directed**.
 - 2) Height: 84 inches (2134 mm) **OR** 96 inches (2438 mm), **as directed**.
 - 3) Type: Single-speed side sliding **OR** Two-speed side sliding **OR** Single-speed center opening **OR** Two-speed center opening, **as directed**.
 - 4) Fire-Protection Rating: 1 hour **OR** 1-1/2 hours, **as directed**, with 30-minute temperature rise of 450 deg F (250 deg C), **as directed**.
 - 5) Frames at First Floor **OR** at Basement Floors, **as directed**: Enameled steel **OR** Polished stainless steel, No. 8 finish **OR** Satin stainless steel, No. 4 finish **OR** Polished bronze, lacquered **OR** Satin bronze, lacquered, **as directed**.
 - 6) Frames at Other Floors: Enameled steel **OR** Polished stainless steel, No. 8 finish **OR** Satin stainless steel, No. 4 finish **OR** Polished bronze, lacquered **OR** Satin bronze, lacquered, **as directed**.
 - 7) Doors and Transoms at First Floor **OR** at Basement Floors, **as directed**: Enameled steel **OR** Polished stainless steel, No. 8 finish **OR** Satin stainless steel, No. 4 finish **OR** Textured stainless steel **OR** Polished bronze, lacquered **OR** Satin bronze, lacquered **OR** Plastic laminate, **as directed**.
 - 8) Doors and Transoms at Other Floors: Enameled steel **OR** Polished stainless steel, No. 8 finish **OR** Satin stainless steel, No. 4 finish **OR** Textured stainless steel **OR** Polished bronze, lacquered **OR** Satin bronze, lacquered **OR** Plastic laminate, **as directed**.
 - 9) Sills at First Floor **OR** at Basement Floors, **as directed**: Aluminum, mill finish **OR** Bronze, polished **OR** Nickel silver, polished, **as directed**.
 - 10) Sills at Other Floors: Aluminum, mill finish **OR** Bronze, polished **OR** Nickel silver, polished, **as directed**.



- o. Hall Fixtures at First Floor **OR** at Basement Floors, **as directed**: Polished stainless steel, No. 8 finish **OR** Satin stainless steel, No. 4 finish **OR** Polished bronze, lacquered **OR** Satin bronze, lacquered **OR** Recessed type with no exposed-metal surfaces, **as directed**.
- p. Hall Fixtures at Other Floors: Polished stainless steel, No. 8 finish **OR** Satin stainless steel, No. 4 finish **OR** Polished bronze, lacquered **OR** Satin bronze, lacquered **OR** Recessed type with no exposed-metal surfaces, **as directed**.
- q. Additional Requirements:
 - 1) Provide inspection certificate in each car, mounted under acrylic cover with frame made from polished stainless steel, No. 8 finish **OR** satin stainless steel, No. 4 finish **OR** polished bronze, lacquered **OR** satin bronze, lacquered, **as directed**.
 - 2) Provide blanket hooks in all cars, **as directed**, and one **OR** two, **as directed**, complete set(s) of full-height protective blankets.

1.3 EXECUTION

A. Examination

- 1. Examine elevator areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance. Examine hoistways, hoistway openings, pits, and machine rooms as constructed; verify critical dimensions; and examine supporting structure and other conditions under which elevator work is to be installed.
 - a. For the record, prepare a written report, endorsed by Installer, listing dimensional discrepancies and conditions detrimental to performance or indicating that dimensions and conditions were found to be satisfactory.
 - b. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Installation

- 1. Comply with manufacturer's written instructions.
- 2. Welded Construction: Provide welded connections for installing elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS standards for workmanship and for qualifications of welding operators.
- 3. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts designed to minimize transmission of vibrations to structure and thereby minimize structure-borne noise from elevator system.
- 4. Lubricate operating parts of systems, including ropes, as recommended by manufacturers.
- 5. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with car. Where possible, delay final adjustment of sills and doors until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.
- 6. Leveling Tolerance: 1/8 inch (3 mm), up or down, regardless of load and direction of travel.
- 7. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.
- 8. Locate hall signal equipment for elevators as follows, unless otherwise indicated:
 - a. For groups of elevators, locate hall push-button stations between two elevators at center of group or at location most convenient for approaching passengers.
 - b. Place hall lanterns either above or beside each hoistway entrance.
 - c. Mount hall lanterns at a minimum of 72 inches (1829 mm) above finished floor.

C. Field Quality Control

- 1. Acceptance Testing: On completion of elevator installation and before permitting use (either temporary or permanent) of elevators, perform acceptance tests as required and recommended by ASME A17.1 and by governing regulations and agencies.
- 2. Operating Test: Load elevator **OR** each elevator **OR** one elevator of each type, capacity, speed, and travel distance, **as directed**, to rated capacity and operate continuously for 30 minutes over full travel distance, stopping at each level and proceeding immediately to the next. Record



temperature rise of elevator machine during 30-minute test period. Record failure to perform as required.

3. Advise Owner and authorities having jurisdiction in advance of dates and times tests are to be performed on elevators.

D. Protection

1. Temporary Use: Limit temporary use for construction purposes to one elevator **as directed**. Comply with the following requirements for each, **as directed**, elevator used for construction purposes:
 - a. Provide car with temporary enclosure, either within finished car or in place of finished car, to protect finishes from damage.
 - b. Provide strippable protective film on entrance and car doors and frames.
 - c. Provide padded wood bumpers on entrance door frames covering jambs and frame faces.
 - d. Provide other protective coverings, barriers, devices, signs, and procedures as needed to protect elevator and elevator equipment.
 - e. Do not load elevators beyond their rated weight capacity.
 - f. Engage elevator Installer to provide full maintenance service. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as necessary for proper elevator operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.
 - g. Engage elevator Installer to restore damaged work, if any, so no evidence remains of correction. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.

E. Demonstration

1. Train Owner's maintenance personnel to operate, adjust, and maintain elevator(s).
2. Check operation of each elevator with Owner's personnel present and before date of Final Completion. Determine that operation systems and devices are functioning properly.
3. Check operation of each elevator with Owner's personnel present not more than one month before end of warranty period. Determine that operation systems and devices are functioning properly.

END OF SECTION 14 01 20 00



SECTION 14 01 20 00a - HYDRAULIC ELEVATORS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for hydraulic elevators. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes hydraulic passenger and service elevators.

C. Definitions

1. Definitions in ASME A17.1 apply to work of this Section.
2. Defective Elevator Work: Operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.
3. Service Elevator: A passenger elevator that is also used to carry freight.

D. Submittals

1. Product Data: Include capacities, sizes, performances, operations, safety features, finishes, and similar information. Include product data for the following:
 - a. Car enclosures and hoistway entrances.
 - b. Operation, control, and signal systems.
2. Shop Drawings: Show plans, elevations, sections, and large-scale details indicating service at each landing, machine room layout, coordination with building structure, relationships with other construction, and locations of equipment and signals. Include large-scale layout of car control station and standby power operation control panel, **as directed**. Indicate variations from specified requirements, maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands.
3. Samples: For exposed finishes of cars, hoistway doors and frames, and signal equipment; 3-inch- (75-mm-) square Samples of sheet materials; and 4-inch (100-mm) lengths of running trim members.
4. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway, pit, and machine room layout and dimensions, as shown on Drawings, and electrical service, as shown and specified, are adequate for elevator system being provided.
5. Qualification Data: For Installer.
6. Operation and Maintenance Data: For elevators to include in emergency, operation, and maintenance manuals.
7. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.
8. Warranty: Special warranty specified in this Section.

E. Quality Assurance

1. Installer Qualifications: Elevator manufacturer or manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
2. Source Limitations: Obtain elevators, including electric traction passenger elevators specified in another Division 14 Section, through one source from a single manufacturer.
 - a. Provide major elevator components, including pump-and-tank units, plunger-cylinder assemblies, controllers, signal fixtures, door operators, car frames, cabs, and entrances, manufactured by a single manufacturer.



3. Regulatory Requirements: Comply with ASME A17.1 and elevator design requirements for earthquake loads in ASCE 7.
 - a. Effective peak velocity acceleration (A_v) for Project's location is less than 0.10 (seismic risk zones 0 and 1) **OR** greater than or equal to 0.10, but less than 0.20 (seismic risk zone 2) **OR** greater than or equal to 0.20 (seismic risk zones 3 and 4), **as directed**.
 - b. Design earthquake spectral response acceleration, short period (S_d s) for Project is determined by Project's location and site classification.
 - c. Project's seismic design category is A **OR** B **OR** C **OR** D, **as directed**.
 - d. Elevator importance factor is 1.5 **OR** 1.0, **as directed**.
4. Accessibility Requirements: Comply with Section 4.10 in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)" **OR** 407 in ICC A117.1, **as directed**.
5. Fire-Rated Hoistway Entrance Assemblies: Door and frame assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252 **OR** IBC Standard 3002 **OR** UL 10B, **as directed**.

F. Delivery, Storage, And Handling

1. Deliver, store, and handle materials, components and equipment in manufacturer's protective packaging.
2. Store materials, components, and equipment off of ground, under cover, and in a dry location. Handle according to manufacturer's written recommendations to prevent damage, deterioration, or soiling.

G. Coordination

1. Coordinate installation of sleeves, block outs, and items that are embedded in concrete or masonry for elevator equipment. Furnish templates and installation instructions and deliver to Project site in time for installation.
2. Furnish well casing and coordinate delivery with related excavation work.
3. Coordinate sequence of elevator installation with other work to avoid delaying the Work.
4. Coordinate locations and dimensions of other work relating to hydraulic elevators including pit ladders, sumps, and floor drains in pits; entrance subsills; and electrical service, electrical outlets, lights, and switches in pits and machine rooms.

H. Warranty

1. Special Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to repair, restore, or replace defective elevator work within specified warranty period.
 - a. Warranty Period: One year from date of Final Completion.

1.2 PRODUCTS

A. Systems And Components

1. General: Provide manufacturer's standard elevator systems. Where components are not otherwise indicated, provide standard components published by manufacturer as included in standard preengineered elevator systems and as required for complete system.
2. Pump Units: Positive-displacement type with a maximum of 10 percent variation between no load and full load and with minimum pulsations. Provide the following, **as directed**:
 - a. Pump, with fan-cooled squirrel-cage induction motor, mounted on oil tank with vibration isolation mounts. Enclose pump in prime-painted steel enclosure lined with 1-inch- (25-mm-) thick, glass-fiber insulation board.
 - b. Submersible pump, with submersible squirrel-cage induction motor, suspended inside oil tank from vibration isolation mounts.
 - c. Provide motor with wye-delta **OR** solid-state, **as directed**, starting.
 - d. Provide variable-voltage variable-frequency motor control.



3. Hydraulic Silencers: Provide hydraulic silencer containing pulsation-absorbing material in a blowout-proof housing at pump unit.
4. Piping: Provide size, type, and weight piping recommended by manufacturer, and provide flexible connectors to minimize sound and vibration transmissions from power unit.
 - a. Provide dielectric couplings at cylinder units.
 - b. Casing for Underground Piping: PVC pipe complying with ASTM D 1785, joined with PVC fittings complying with ASTM D 2466 and solvent cement complying with ASTM D 2564.
5. Hydraulic Fluid: Elevator manufacturer's standard fire-resistant, **as directed**, fluid with additives as needed to prevent oxidation of fluid, corrosion of cylinder and other components, and other adverse effects.

OR

Hydraulic Fluid: Nontoxic, readily biodegradable, fire-resistant, **as directed**, fluid made from vegetable oil with antioxidant, anticorrosive, antifoaming, and metal-passivating additives. Hydraulic fluid is approved by elevator manufacturer for use with elevator equipment.
6. Inserts: Furnish required concrete and masonry inserts and similar anchorage devices for installing guide rails, machinery, and other components of elevator work where installation of devices is specified in another Section.
7. Protective Cylinder Casing: PVC or HDPE pipe casing complying with ASME A17.1, of sufficient size to provide not less than 1-inch (25-mm) clearance from cylinder and extending above pit floor. Provide means to monitor casing effectiveness to comply with ASME A17.1.
8. Corrosion Protective Filler: A nontoxic, petroleum-based gel formulated for filling the space between hydraulic cylinder and protective casing. Filler is electrically nonconductive, displaces or absorbs water, and gels or solidifies at temperatures below 60 deg F (16 deg C).
9. Car Frame and Platform: Welded steel units.
10. Guides: Provide either roller guides or sliding guides at top and bottom of car and counterweight frames. If sliding guides are used, provide guide-rail lubricators or polymer-coated, nonlubricated guides.

B. Operation Systems

1. General: Provide manufacturer's standard microprocessor operation system for each elevator **OR** for each group of elevators, **as directed**, as required to provide type of operation system indicated.
2. Auxiliary **OR** Single-Car Auxiliary, **as directed**, Operations: In addition to primary operation system features, provide the following operational features for elevators where indicated:
 - a. Standby Power Operation: On activation of standby power, car is returned to a designated floor and parked with doors open. Car can be manually put in service on standby power, either for return operation or for regular operation, by switches in control panel located at main lobby **OR** fire command station, **as directed**. Manual operation causes automatic operation to cease.

OR

Standby-Powered Lowering: On activation of standby power, if car is at a floor it remains at that floor, opens its doors, and shuts down. If car is between floors, it is lowered to a preselected floor, opens its doors, and shuts down. If car is below the preselected floor, it is lowered to the next lower floor, opens its doors, and shuts down.

OR

Standby-Powered Lowering: On activation of standby power, car is lowered to the lowest floor, opens its doors, and shuts down.

OR

Battery-Powered Lowering: If power fails and car is at a floor, it remains at that floor, opens its doors, and shuts down. If car is between floors, it is lowered to a preselected floor, opens its doors, and shuts down. If car is below the preselected floor, it is lowered to the next lower floor, opens its doors, and shuts down. System includes rechargeable battery and automatic recharging system.

OR



- Battery-Powered Lowering: When power fails, car is lowered to the lowest floor, opens its doors, and shuts down. System includes rechargeable battery and automatic recharging system.
- b. Automatic Dispatching of Loaded Car: When car load exceeds 80 percent of rated capacity, doors will begin closing.
 - c. Nuisance Call Cancel: When car calls exceed a preset number while car load is less than a predetermined weight, all car calls are canceled. Preset number of calls and predetermined weight, **as directed**, can be adjusted.
3. Group Auxiliary Operations: In addition to primary operation system features, provide the following operational features for elevators and elevator groups where indicated:
- a. Standby Power Operation: On activation of standby power, cars are returned to a designated floor and parked with doors open. Only one car is moved upward at a time, with priority given to loaded cars. If a car cannot be returned after two attempts, it is removed from the system. When all cars have been returned or removed from the system, one car is automatically placed in service. If car selected for service cannot operate within 60 seconds, the system removes car from service and places another car in service. Cars can be manually put in service on standby power, either for return operation or for regular operation, by switches in control panel located at main lobby **OR** fire command station, **as directed**. Manual operation causes automatic operation to cease.
OR
Standby Power Operation: On activation of standby power, cars are returned to lowest floor and parked with doors open. If a car cannot be returned, it is removed from the system. One car is selected for service on standby power by a switch located at main lobby **OR** fire command station, **as directed**.
OR
Standby-Powered Lowering: On activation of standby power, cars that are at a floor remain at that floor, open their doors, and shut down. Cars that are between floors are lowered to a preselected floor, open their doors, and shut down. Cars that are below the preselected floor are lowered to the next lower floor, open their doors, and shut down.
OR
Standby-Powered Lowering: On activation of standby power, cars are lowered to the lowest floor, open their doors, and shut down.
OR
Battery-Powered Lowering: If power fails, cars that are at a floor remain at that floor, open their doors, and shut down. Cars that are between floors are lowered to a preselected floor, open their doors, and shut down. Cars that are below the preselected floor are lowered to the next lower floor, open their doors, and shut down. System includes rechargeable battery and automatic recharging system.
OR
Battery-Powered Lowering: When power fails, cars are lowered to the lowest floor, open their doors, and shut down. System includes rechargeable battery and automatic recharging system.
 - b. Automatic Dispatching of Loaded Car: When car load exceeds 80 percent of rated capacity, doors will begin closing.
 - c. Nuisance Call Cancel: When car calls exceed a preset number while car load is less than a predetermined weight, all car calls are canceled. Preset number of calls and predetermined weight, **as directed**, can be adjusted.
 - d. Emergency Hospital **OR** Priority, **as directed**, Service: Service is initiated by a keyswitch **OR** card reader **OR** remote switch, **as directed**, at designated floors. One elevator is removed from group operation and directed to the floor where service was initiated. On arriving at the floor, elevator opens its doors and parks and a lighted sign directs passengers to exit elevator, **as directed**. Car is placed in operation by selecting a floor and pressing door close button or by operating keyswitch to put car in independent service. After responding to floor selected or being removed from independent service, car is



- returned to group operation. If car is not placed in operation within a preset time after being called, it is returned to group operation.
- e. Independent Service: Keyswitch in car control station removes car from group operation and allows it to respond only to car calls. Key cannot be removed from keyswitch when car is in independent service. When in independent service, doors close only in response to door close button.
 - f. Loaded-Car Bypass: When car load exceeds 80 percent of rated capacity, car will respond only to car calls, not to hall calls.
4. Security Features: Provide the following security features, where indicated. Security features shall not affect emergency firefighters' service.
- a. Card-Reader Operation: System uses card readers at car control stations **OR** hall push-button stations, **as directed**, to authorize calls. Security system determines which landings and at what times calls require authorization by card reader. Provide required conductors in traveling cable and panel in machine room for interconnecting card readers, other security access system equipment, and elevator controllers. Allow space as indicated for card reader in car **OR** Provide stripe-swipe card reader integral with each car control station, **as directed**.
 - 1) Security access system equipment is specified in Division 28 Section "Access Control".
OR
Security access system equipment is not in the Contract.
 - b. Keyswitch Operation: Push buttons are activated and deactivated by security keyswitches at car control stations **OR** hall push-button stations, **as directed**. Key is removable only in deactivated position **OR** in either position, **as directed**.
 - c. Keypad Operation: Allows each landing to be restricted or unrestricted. When a restricted landing button is pressed, a "Restricted Floor" lamp lights and remains lit until landing access code has been entered into a keypad or predetermined time period has elapsed. Car calls for restricted landings do not register until landing access code is entered into keypad within predetermined time period after landing button is pressed.
 - 1) Access codes are programmed at each car operating panel using a security keyswitch. Keypad operation can be activated and deactivated by security keyswitch at main landing.
 - d. Car-to-Lobby Feature: Feature, activated by keyswitch at main lobby, that causes car **OR** all cars in a group, **as directed**, to return immediately to lobby and open doors for inspection. On deactivation by keyswitch, calls registered before keyswitch activation are completed and normal operation is resumed.
- C. Door Reopening Devices
1. Infrared Array: Provide door reopening devices with uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of one or more of the light beams shall cause doors to stop and reopen.
 2. Nudging Feature: After car doors are prevented from closing for predetermined adjustable time, through activating door reopening device, a loud buzzer shall sound and doors shall begin to close at reduced kinetic energy.
- D. Finish Materials
1. General: Provide the following materials for exposed parts of elevator car enclosures, car doors, hoistway entrance doors and frames, and signal equipment as indicated.
 2. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, commercial steel, Type B, exposed, matte finish.
 3. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, commercial steel, Type B, pickled.
 4. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.
 - a. Textured Stainless-Steel Sheet: Product with coined **OR** embossed, **as directed**, texture rolled into exposed surface.
 - 1) Metal surface is satin polished **OR** satin relieved **OR** titanium nitride colored **OR** oxide colored **OR** satin polished and titanium nitride colored **OR** satin relieved and



titanium nitride colored **OR** satin polished and oxide colored **OR** satin relieved and oxide colored **OR** color coated and satin relieved **OR** color coated and bright relieved, **as directed**, after rolling.

5. Stainless-Steel Bars: ASTM A 276, Type 304.
6. Stainless-Steel Tubing: ASTM A 554, Grade MT 304.
7. Bronze Plate and Sheet: ASTM B 36/B 36M, Alloy UNS No. C28000 (muntz metal).
8. Bronze Extrusions: ASTM B 455, Alloy UNS No. C38500 (architectural bronze).
9. Bronze Tubing: ASTM B 135 (ASTM B 135M), Alloy UNS No. C23000 (red brass, 85 percent copper).
10. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063.
11. Nickel Silver Extrusions: ASTM B 151/B 151M, Alloy UNS No. C74500 or No. C77600.
12. Plastic Laminate: High-pressure type complying with NEMA LD 3, Type HGS for flat applications **OR** Type HGL for flat applications, **as directed**, Type HGP for postformed applications and Type BKV for panel backing.

E. Car Enclosures

1. General: Provide enameled-steel car enclosures to receive removable **OR** steel-framed car enclosures with nonremovable, **as directed**, wall panels, with car **OR** removable car, **as directed**, roof, access doors, power door operators, and ventilation.
 - a. Provide standard railings complying with ASME A17.1 on car tops where required by ASME A17.1.
 - b. Provide finished car including materials and finishes specified below.
2. Materials and Finishes: Provide manufacturer's standards, but not less than the following:
 - a. Subfloor: Underlayment grade, exterior plywood, 5/8-inch (16-mm) nominal thickness.
 - b. Floor Finish: Specified in a Division 07 **OR** Elevator manufacturer's standard level-loop nylon carpet; color as selected from manufacturer's full range, **as directed**.
 - c. Enameled-Steel Wall Panels: Flush, hollow-metal construction; fabricated from cold-rolled steel sheet. Provide with factory-applied enamel finish; colors as selected from manufacturer's full range.
 - d. Stainless-Steel Wall Panels: Flush, hollow-metal construction; fabricated from stainless-steel sheet.
 - e. Bronze Wall Panels: Flush, hollow-metal construction; fabricated from bronze sheet.
 - f. Plastic-Laminate Wall Panels: Plastic laminate adhesively applied to 1/2-inch (13-mm) fire-retardant-treated particleboard **OR** manufacturer's standard honeycomb core, **as directed**, with plastic-laminate panel backing and, **as directed**, manufacturer's standard protective edge trim. Panels have a flame-spread index of 25 **OR** 75, **as directed**, or less, when tested according to ASTM E 84. Plastic-laminate color, texture, and pattern as selected from plastic-laminate **OR** elevator, **as directed**, manufacturer's full range.
 - g. Fabricate car with recesses and cutouts for signal equipment.
 - h. Fabricate car door frame integrally with front wall of car.
 - i. Enameled-Steel Doors: Flush, hollow-metal construction; fabricated from cold-rolled steel sheet. Provide with factory-applied enamel finish; colors as selected from manufacturer's full range.
 - j. Stainless-Steel Doors: Flush, hollow-metal construction; fabricated from stainless-steel sheet **OR** by laminating stainless-steel sheet to exposed faces and edges of enameled cold-rolled steel doors using adhesive that fully bonds metal to metal without telegraphing or oil-canning, **as directed**.
 - k. Bronze Doors: Flush, hollow-metal construction; fabricated by laminating bronze sheet to exposed faces and edges of enameled cold-rolled steel doors using adhesive that fully bonds metal to metal without telegraphing or oil-canning.
 - l. Plastic-Laminate Doors: Flush, hollow-metal construction; fabricated by laminating plastic laminate to exposed faces of enameled cold-rolled steel doors and covering edges with protective edge trim matching return panels, **as directed**. Plastic-laminate color, texture, and pattern as selected from plastic-laminate **OR** elevator, **as directed**, manufacturer's full range.



- m. Sight Guards: Provide sight guards on car doors.
 - n. Sills: Extruded metal, with grooved surface, 1/4 inch (6.4 mm) thick.
 - o. Luminous Ceiling: Fluorescent light fixtures and ceiling panels of translucent acrylic or other permanent rigid plastic.
 - p. Metal **OR** Metallic-Finish, Plastic-Laminate, **as directed**, Ceiling: Flush panels, with incandescent downlights in the center of **OR** four low-voltage downlights in, **as directed**, each panel. Align ceiling panel joints with joints between wall panels, **as directed**.
 - q. Handrails: Manufacturer's standard handrails, of shape, metal, and finish indicated.
- F. Hoistway Entrances
- 1. General: Provide manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sills, and accessories. Provide frame size and profile to coordinate with hoistway wall construction.
 - a. Where gypsum board wall construction is indicated, provide self-supporting frames with reinforced head sections.
 - 2. Materials and Fabrication: Provide manufacturer's standards, but not less than the following:
 - a. Enameled-Steel Frames: Formed from cold-rolled or hot-rolled steel sheet. Provide with factory-applied enamel finish; colors as selected from manufacturer's full range.
 - b. Steel Subframes: Formed from cold-rolled or hot-rolled steel sheet with factory-applied enamel finish or corrosion-inhibiting primer. Fabricate to receive applied finish as indicated.
 - c. Stainless-Steel Frames: Formed from stainless-steel sheet.
 - d. Bronze Frames: Formed from cold-rolled or hot-rolled steel sheet, with enamel finish, and with formed-bronze sheet laminated to steel frames using adhesive that fully bonds metal to metal without telegraphing or oil-canning.
 - e. Enameled-Steel Doors and Transoms: Flush, hollow-metal construction; fabricated from cold-rolled steel sheet. Provide with factory-applied enamel finish; colors as selected from manufacturer's full range.
 - f. Stainless-Steel Doors and Transoms: Flush, hollow-metal construction; fabricated from stainless-steel sheet **OR** by laminating stainless-steel sheet to exposed faces and edges of enameled cold-rolled steel doors using adhesive that fully bonds metal to metal without telegraphing or oil-canning, **as directed**.
 - g. Bronze Doors and Transoms: Flush, hollow-metal construction; fabricated by laminating bronze sheet to exposed faces and edges of enameled cold-rolled steel doors using adhesive that fully bonds metal to metal without telegraphing or oil-canning.
 - h. Plastic-Laminate Doors and Transoms: Flush, hollow-metal construction; fabricated by laminating plastic laminate to exposed faces of enameled cold-rolled steel doors and covering edges with protective edge trim matching door frames, **as directed**. Plastic-laminate color, texture, and pattern as selected from plastic-laminate **OR** elevator, **as directed**, manufacturer's full range.
 - i. Sight Guards: Provide sight guards on doors matching door edges.
 - j. Sills: Extruded metal, with grooved surface, 1/4 inch (6.4 mm) thick.
 - k. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.
- G. Signal Equipment
- 1. General: Provide hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Fabricate lighted elements with long-life incandescent lamps and acrylic or other permanent, nonyellowing translucent plastic diffusers **OR** LEDs, **as directed**.
 - 2. Car Control Stations: Provide manufacturer's standard recessed **OR** semirecessed, **as directed**, car control stations. Mount in return panel adjacent to car door, unless otherwise indicated.
OR
Swing-Return Car Control Stations: Provide car control stations mounted on rear of hinged return panel adjacent to car door and with buttons, switches, controls, and indicator lights projecting through return panel but substantially flush with face of return panel.



- a. Mark buttons and switches with standard identification for required use or function that complies with ASME A17.1. Use both tactile symbols and Braille.
 - b. Provide "No Smoking" sign matching car control station, either integral with car control station or mounted adjacent to it, with text and graphics as required by authorities having jurisdiction.
3. Emergency Communication System: Provide system that complies with ASME A17.1 and the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." On activation, system dials preprogrammed number of monitoring station and identifies elevator location to monitoring station. System provides two-way voice communication without using a handset and provides visible signals that indicate when system has been activated and when monitoring station has responded. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.
 4. Firefighters' Two-Way Telephone Communication Service: Provide flush-mounted cabinet **OR** telephone jack, **as directed**, in each car and required conductors in traveling cable for firefighters' two-way telephone communication service specified in Division 28 Section(s) "Digital, Addressable Fire-alarm System" **OR** "Zoned (dc Loop) Fire-alarm System"
 5. Car Position Indicator: Provide illuminated, **as directed**, digital-type car position indicator, located above car door or above car control station. Also provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served.
 - a. Include travel direction arrows if not provided in car control station.
 6. Hall Push-Button Stations: Provide one hall push-button station at each landing for each single elevator or group of elevators, but not less than one station for each four elevators in a group, **as directed**.
OR
Hall Push-Button Stations: Provide hall push-button stations at each landing as indicated.
 - a. Provide manufacturer's standard wall-mounted units.
 - b. Provide units with flat faceplate for mounting with body of unit recessed in wall.
 - c. Equip units with buttons for calling elevator and for indicating desired direction of travel.
 - d. Provide telephone jack in each unit for firefighters' two-way telephone communication service specified in Division 28 Section(s) "Digital, Addressable Fire-alarm System" **OR** "Zoned (dc Loop) Fire-alarm System".
 7. Hall Lanterns: Units with illuminated arrows; but provide single arrow at terminal landings. Provide one of the following, **as directed**:
 - a. Manufacturer's standard wall-mounted units, for mounting above entrance frames.
 - b. Units with flat faceplate for mounting with body of unit recessed in wall and with illuminated elements projecting from faceplate for ease of angular viewing.
 - c. Units mounted in both jambs of entrance frame for each elevator, **as directed**.
 - d. Units mounted in both car door jambs; may be used only for single elevators or for two-car groups, **as directed**.
 8. Hall Annunciator: With each hall lantern, provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down.
 - a. At manufacturer's option, audible signals may be placed on car **OR** each car, **as directed**.
 9. Hall Position Indicators: Provide illuminated, **as directed**, digital-display-type position indicators, located above each, **as directed**, hoistway entrance at ground floor. Provide units with flat faceplate for mounting and with body of unit recessed in wall.
 - a. Integrate ground-floor hall lanterns with hall position indicators.
 10. Standby Power Elevator Selector Switches: Provide switches, as required by ASME A17.1, where indicated. Adjacent to switches, provide illuminated signal that indicates when normal power supply has failed. For each elevator, provide illuminated signals that indicate when they are operational and when they are at the designated emergency return level with doors open, **as directed**.
OR
Fire Command Center Annunciator Panel: Provide panel containing illuminated position indicators for each elevator, clearly labeled with elevator designation; include illuminated signal



that indicates when elevator is operational and when it is at the designated emergency return level with doors open. Provide standby power elevator selector switch(es), as required by ASME A17.1, adjacent to position indicators. Provide illuminated signal that indicates when normal power supply has failed.

11. Corridor Call Station Pictograph Signs: Provide signs matching hall push-button stations, with text and graphics as required by authorities having jurisdiction, indicating that in case of fire elevators are out of service and exits should be used instead. Provide one sign at each hall push-button station, unless otherwise indicated.

H. Elevators

1. Elevator Description:

- a. Group Number: Insert a different number for each group of elevators that share a group operation system, as directed by the Owner.
- b. Elevator Number(s): Insert elevator number(s) as shown on Drawings, as directed by the Owner.
- c. Service Elevator Number(s): Insert elevator number(s) as shown on Drawings, as directed by the Owner.
- d. Type: Under-the-car single cylinder.
OR
Type: Holeless, beside-the-car, single-acting, single **OR** dual, **as directed**, cylinder.
OR
Type: Holeless, beside-the-car, telescoping, single **OR** dual, **as directed**, cylinder.
OR
Type: Holeless, beside-the-car, roped hydraulic, single **OR** dual, **as directed**, cylinder.
- e. Rated Load: 2000 lb (908 kg) **OR** 2100 lb (953 kg) **OR** 2500 lb (1135 kg) **OR** 3000 lb (1362 kg) **OR** 3500 lb (1589 kg) **OR** 4000 lb (1816 kg) **OR** 4500 lb (2043 kg) **OR** 5000 lb (2270 kg), **as directed**.
- f. Freight Loading Class for Service Elevators: Class A.
- g. Rated Speed: 75 or 80 fpm (0.38 or 0.41 m/s) **OR** 100 fpm (0.51 m/s) **OR** 125 fpm (0.64 m/s) **OR** 150 fpm (0.76 m/s) **OR** 175 fpm (0.89 m/s) **OR** 200 fpm (1.0 m/s), **as directed**.
- h. Operation System: Single automatic **OR** Selective collective automatic **OR** Group automatic, **as directed**, operation.
- i. Auxiliary Operations:
 - 1) Standby power operation.
 - 2) Standby-powered lowering.
 - 3) Battery-powered lowering.
 - 4) Automatic dispatching of loaded car.
 - 5) Nuisance call cancel.
 - 6) Emergency hospital **OR** Priority, **as directed**, service at designated floors **OR** all floors, **as directed**.
 - 7) Independent service for service elevator **OR** all cars in group, **as directed**.
 - 8) Loaded-car bypass.
- j. Security Features: Card-reader operation **OR** Keyswitch operation **OR** Keypad operation **OR** Car-to-lobby feature, **as directed**.
- k. Dual Car Control Stations: Provide two car control stations in each elevator, **as directed**; equip only one with required keyswitches, if any.
- l. Car Enclosures:
 - 1) Inside Width: 64 inches (1626 mm) **OR** 68 inches (1727 mm) **OR** 80 inches (2032 mm) **OR** 92 inches (2337 mm), **as directed**, from side wall to side wall.
 - 2) Inside Depth: 51 inches (1295 mm) **OR** 53 inches (1346 mm) **OR** 57 inches (1448 mm) **OR** 65 inches (1651 mm) **OR** 87-1/2 inches (2222 mm) **OR** 90 inches (2286 mm) **OR** 93 inches (2362 mm) **OR** 93-1/2 inches (2375 mm) **OR** 96 inches (2438 mm) **OR** 101 inches (2565 mm) **OR** 102 inches (2591 mm), **as directed**, from back wall to front wall (return panels).



- 3) Inside Height: 88 inches (2235 mm) **OR** 92 inches (2337 mm) **OR** 94 inches (2388 mm) **OR** 100 inches (2540 mm) **OR** 104 inches (2642 mm) **OR** 108 inches (2743 mm) **OR** 112 inches (2845 mm), **as directed**, to underside of ceiling.
 - 4) Front Walls (Return Panels): Polished stainless steel, No. 8 finish **OR** Satin stainless steel, No. 4 finish **OR** Polished bronze, lacquered **OR** Satin bronze, lacquered, **as directed**, with integral car door frames.
 - 5) Car Fixtures: Polished stainless steel, No. 8 finish **OR** Satin stainless steel, No. 4 finish **OR** Polished bronze, lacquered **OR** Satin bronze, lacquered, **as directed**.
 - 6) Side and Rear Wall Panels: Enameled steel **OR** Plastic laminate **OR** Satin stainless steel, No. 4 finish **OR** Textured stainless steel, **as directed**.
 - 7) Reveals: Enameled steel **OR** Polished stainless steel, No. 8 finish **OR** Satin stainless steel, No. 4 finish **OR** Polished bronze, lacquered **OR** Satin bronze, lacquered, **as directed**.
 - 8) Door Faces (Interior): Enameled steel **OR** Polished stainless steel, No. 8 finish **OR** Satin stainless steel, No. 4 finish **OR** Textured stainless steel **OR** Polished bronze, lacquered **OR** Satin bronze, lacquered **OR** Plastic laminate, **as directed**.
 - 9) Door Sills: Aluminum, mill finish **OR** Bronze, polished **OR** Nickel silver, polished, **as directed**.
 - 10) Ceiling: Luminous ceiling **OR** Polished stainless steel, No. 8 finish **OR** Satin stainless steel, No. 4 finish **OR** Polished bronze, lacquered **OR** Reflective metallic-finish, plastic-laminate, stainless steel **OR** Reflective metallic-finish, plastic-laminate, bronze, **as directed**.
 - 11) Handrails: 1-1/2 inches (38 mm) round **OR** 1/2 by 2 inches (13 by 50 mm) rectangular, **as directed**, mirror-polished stainless steel, No. 8 finish **OR** satin stainless steel, No. 4 finish **OR** mirror-polished bronze, lacquered **OR** satin bronze, lacquered, **as directed**, at sides **OR** sides and rear, **as directed**, of car.
 - 12) Floor: Manufacturer's standard carpet.
OR
Floor prepared to receive carpet (specified in Division 09 Section "Sheet Carpeting").
OR
Floor prepared to receive resilient tile (specified in Division 09 Section "Resilient Tile Flooring").
OR
Floor prepared to receive sheet vinyl (specified in Division 09 Section "Resilient Sheet Flooring").
OR
Floor recessed and prepared to receive dimension stone tile (specified in Division 09 Section "Stone Tiling") **OR** ceramic tile (specified in Division 09 Section "Tiling"), **as directed**.
OR
Floor Thickness, Including Setting Materials: Thickness above plywood subfloor, shall be as directed by the Owner.
- m. Hoistway Entrances:
- 1) Width: 36 inches (914 mm) **OR** 42 inches (1067 mm) **OR** 48 inches (1219 mm) **OR** 54 inches (1372 mm), **as directed**.
 - 2) Height: 84 inches (2134 mm) **OR** 96 inches (2438 mm), **as directed**.
 - 3) Type: Single-speed side sliding **OR** Two-speed side sliding **OR** Single-speed center opening **OR** Two-speed center opening, **as directed**.
 - 4) Fire-Protection Rating: 1 hour **OR** 1-1/2 hours, **as directed**, with 30-minute temperature rise of 450 deg F (250 deg C), **as directed**.
 - 5) Frames at First Floor **OR** at Basement Floors, **as directed**: Enameled steel **OR** Polished stainless steel, No. 8 finish **OR** Satin stainless steel, No. 4 finish **OR** Polished bronze, lacquered **OR** Satin bronze, lacquered, **as directed**.



- 6) Frames at Other Floors: Enameled steel **OR** Polished stainless steel, No. 8 finish **OR** Satin stainless steel, No. 4 finish **OR** Polished bronze, lacquered **OR** Satin bronze, lacquered, **as directed**.
- 7) Doors and Transoms at First Floor **OR** at Basement Floors, **as directed**: Enameled steel **OR** Polished stainless steel, No. 8 finish **OR** Satin stainless steel, No. 4 finish **OR** Textured stainless steel **OR** Polished bronze, lacquered **OR** Satin bronze, lacquered **OR** Plastic laminate, **as directed**.
- 8) Doors and Transoms at Other Floors: Enameled steel **OR** Polished stainless steel, No. 8 finish **OR** Satin stainless steel, No. 4 finish **OR** Textured stainless steel **OR** Polished bronze, lacquered **OR** Satin bronze, lacquered **OR** Plastic laminate, **as directed**.
- 9) Sills at First Floor **OR** at Basement Floors, **as directed**: Aluminum, mill finish **OR** Bronze, polished **OR** Nickel silver, polished, **as directed**.
- 10) Sills at Other Floors: Aluminum, mill finish **OR** Bronze, polished **OR** Nickel silver, polished, **as directed**.
- n. Hall Fixtures at First Floor **OR** at Basement Floors, **as directed**: Polished stainless steel, No. 8 finish **OR** Satin stainless steel, No. 4 finish **OR** Polished bronze, lacquered **OR** Satin bronze, lacquered **OR** Recessed type with no exposed-metal surfaces, **as directed**.
- o. Hall Fixtures at Other Floors: Polished stainless steel, No. 8 finish **OR** Satin stainless steel, No. 4 finish **OR** Polished bronze, lacquered **OR** Satin bronze, lacquered **OR** Recessed type with no exposed-metal surfaces, **as directed**.
- p. Additional Requirements:
 - 1) Provide inspection certificate in each car, mounted under acrylic cover with frame made from polished stainless steel, No. 8 finish **OR** satin stainless steel, No. 4 finish **OR** polished bronze, lacquered **OR** satin bronze, lacquered, **as directed**.
 - 2) Provide blanket hooks in all cars, **as directed**, and one **OR** two, **as directed**, complete set(s) of full-height protective blankets.

1.3 EXECUTION

A. Examination

1. Examine elevator areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance. Verify critical dimensions and examine supporting structure and other conditions under which elevator work is to be installed.
 - a. For the record, prepare a written report, endorsed by Installer, listing dimensional discrepancies and conditions detrimental to performance or indicating that dimensions and conditions were found to be satisfactory.
 - b. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Installation

1. Excavation for Cylinder: Drill well hole in each, **as directed**, elevator pit to accommodate installation of cylinder; comply with applicable requirements in Division 31 Section "Earth Moving".
2. Provide waterproof well casing as necessary to retain walls of well hole.
3. Install cylinder in protective casing within well hole. Before installing protective casing, remove water and debris from well hole and provide permanent waterproof seal at bottom of well casing, **as directed**.
 - a. Fill void space between protective casing and cylinder with corrosion protective filler.
 - b. Align cylinders and fill space around protective casing with fine sand.
4. Install cylinder plumb and accurately centered for elevator car position and travel. Anchor securely in place, supported at pit floor. Seal between well **OR** protective, **as directed**, casing and pit floor with 4 inches (100 mm) of nonshrink, nonmetallic grout.
5. Install cylinder plumb and accurately centered for elevator car position and travel. Anchor securely in place, supported at pit floor and braced at intervals as needed to maintain alignment. Anchor cylinder guides at spacing needed to maintain alignment and avoid overstressing guides.



6. Welded Construction: Provide welded connections for installing elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS standards for workmanship and for qualifications of welding operators.
7. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts designed to effectively prevent transmission of vibrations to structure and thereby eliminate sources of structure-borne noise from elevator system.
8. Install piping above the floor, where possible. Where not possible, install underground piping in Schedule 40 PVC pipe casing assembled with solvent-cemented fittings.
OR
Install piping above the floor, where possible. Where not possible, cover underground piping with permanent protective wrapping before backfilling.
9. Lubricate operating parts of systems as recommended by manufacturers.
10. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with car. Where possible, delay installation of sills and frames until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.
11. Leveling Tolerance: 1/4 inch (6 mm), up or down, regardless of load and direction of travel.
12. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.
13. Locate hall signal equipment for elevators as follows, unless otherwise indicated:
 - a. For groups of elevators, locate hall push-button stations between two elevators at center of group or at location most convenient for approaching passengers.
 - b. Place hall lanterns either above or beside each hoistway entrance.
 - c. Mount hall lanterns at a minimum of 72 inches (1829 mm) above finished floor.

C. Field Quality Control

1. Acceptance Testing: On completion of elevator installation and before permitting use (either temporary or permanent) of elevators, perform acceptance tests as required and recommended by ASME A17.1 and by governing regulations and agencies.
2. Advise Owner and authorities having jurisdiction in advance of dates and times tests are to be performed on elevators.

D. Protection

1. Temporary Use: Limit temporary use for construction purposes to one elevator, **as directed**. Comply with the following requirements for each, **as directed**, elevator used for construction purposes:
 - a. Provide car with temporary enclosure, either within finished car or in place of finished car, to protect finishes from damage.
 - b. Provide strippable protective film on entrance and car doors and frames.
 - c. Provide padded wood bumpers on entrance door frames covering jambs and frame faces.
 - d. Provide other protective coverings, barriers, devices, signs, and procedures as needed to protect elevator and elevator equipment.
 - e. Do not load elevators beyond their rated weight capacity.
 - f. Engage elevator Installer to provide full maintenance service. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as necessary for proper elevator operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.
 - g. Engage elevator Installer to restore damaged work, if any, so no evidence remains of correction. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.

E. Demonstration

1. Train Owner's maintenance personnel to operate, adjust, and maintain elevator(s).



2. Check operation of each, **as directed**, elevator with Owner's personnel present and before date of Final Completion. Determine that operation systems and devices are functioning properly.
3. Check operation of each, **as directed**, elevator with Owner's personnel present not more than one month before end of warranty period. Determine that operation systems and devices are functioning properly.

END OF SECTION 14 01 20 00a



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Task	Specification	Specification Description
14 01 20 00	01 22 16 00	No Specification Required
14 01 30 00	14 01 20 00	Electric Traction Elevators
14 01 30 00	14 01 20 00a	Hydraulic Elevators
14 01 30 00	14 31 00 00	Escalators



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SECTION 14 24 13 00 - HYDRAULIC FREIGHT ELEVATORS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for hydraulic freight elevators. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes hydraulic freight elevators.

C. Definitions

1. Definitions in ASME A17.1 apply to work of this Section.
2. Defective Elevator Work: Operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.

D. Submittals

1. Product Data: Include capacities, sizes, performances, operations, safety features, finishes, and similar information.
2. Shop Drawings: Show plans, elevations, sections, and large-scale details indicating service at each landing, machine room layout, coordination with building structure, relationships with other construction, and locations of equipment and signals. Indicate variations from specified requirements, maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands.
3. Samples for Initial Selection: For finishes involving color selection.
4. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway, pit, and machine room layout and dimensions, as shown on Drawings, and electrical service, as shown and specified, are adequate for elevator system being provided.
5. Qualification Data: For Installer.
6. Operation and Maintenance Data: For elevators to include in emergency, operation, and maintenance manuals.
7. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.
8. Warranty: Special warranty specified in this Section.

E. Quality Assurance

1. Installer Qualifications: Elevator manufacturer or manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
2. Source Limitations: Obtain freight elevators, including electric traction freight elevators specified in another Division 14 Section, through one source from a single manufacturer.
 - a. Provide major elevator components, including pump-and-tank units, plunger-cylinder assemblies, controllers, signal fixtures, door operators, car frames, cabs, and entrances, manufactured by a single manufacturer.
3. Regulatory Requirements: Comply with ASME A17.1 and elevator design requirements for earthquake loads in ASCE 7.
 - a. Effective peak velocity acceleration (A_v) for Project's location is less than 0.10 (seismic risk zones 0 and 1) **OR** greater than or equal to 0.10, but less than 0.20 (seismic risk zone 2) **OR** greater than or equal to 0.20 (seismic risk zones 3 and 4), **as directed**.
 - b. Design earthquake spectral response acceleration, short period (S_d s) for Project is determined by Project's location and site classification.



- c. Project's seismic design category is A **OR** B **OR** C **OR** D, **as directed**.
- d. Elevator importance factor is 1.5 **OR** 1.0, **as directed**.
- 4. Accessibility Requirements: Comply with Section 4.10 in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)" **OR** 407 in ICC A117.1, **as directed**.
- 5. Fire-Rated Hoistway Entrance Assemblies: Door and frame assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252 **OR** IBC Standard 3002 **OR** UL 10B, **as directed**.

F. Delivery, Storage, And Handling

- 1. Deliver, store, and handle materials, components and equipment in manufacturer's protective packaging.
- 2. Store materials, components, and equipment off of ground, under cover, and in a dry location. Handle according to manufacturer's written recommendations to prevent damage, deterioration, or soiling.

G. Coordination

- 1. Coordinate installation of sleeves, block outs, and items that are embedded in concrete or masonry for elevator equipment. Furnish templates and installation instructions and deliver to Project site in time for installation.
- 2. Furnish well casing and coordinate delivery with related excavation work.
- 3. Coordinate sequence of freight elevator installation with other work to avoid delaying the Work.
- 4. Coordinate locations and dimensions of other work relating to hydraulic freight elevators including pit ladders, sumps, and floor drains in pits; entrance subsills; and electrical service, electrical outlets, lights, and switches in pits and machine rooms.

H. Warranty

- 1. Special Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to repair, restore, or replace defective elevator work within specified warranty period.
 - a. Warranty Period: One year from date of Final Completion.

1.2 PRODUCTS

A. Systems And Components

- 1. General: Provide manufacturer's standard freight elevator systems. Where components are not otherwise indicated, provide standard components published by manufacturer as included in standard preengineered freight elevator systems and as required for complete system.
- 2. Pump Units: Positive-displacement type with a maximum of 10 percent variation between no load and full load and with minimum pulsations. Provide either of the following:
 - a. Pump, with fan-cooled squirrel-cage induction motor, mounted on oil tank with vibration isolation mounts. Enclose pump in prime-painted steel enclosure lined with 1-inch- (25-mm-) thick, glass-fiber insulation board.
 - b. Submersible pump, with submersible squirrel-cage induction motor, suspended inside oil tank from vibration isolation mounts.
 - c. Provide motor with wye-delta or solid-state starting.
- 3. Hydraulic Silencers: Provide hydraulic silencer containing pulsation-absorbing material in a blowout-proof housing at pump unit.
- 4. Piping: Provide size, type, and weight piping recommended by manufacturer, and provide flexible connectors to minimize sound and vibration transmissions from power unit.
 - a. Provide dielectric couplings at cylinder units.
 - b. Casing for Underground Piping: PVC pipe complying with ASTM D 1785, joined with PVC fittings complying with ASTM D 2466 and solvent cement complying with ASTM D 2564.



5. Hydraulic Fluid: Elevator manufacturer's standard fluid **OR** fire-resistant fluid, **as directed**, with additives as needed to prevent oxidation of fluid, corrosion of cylinder and other components, and other adverse effects.
OR
Hydraulic Fluid: Nontoxic, readily biodegradable, fluid **OR** fire-resistant fluid, **as directed**, made from vegetable oil with antioxidant, anticorrosive, antifoaming, and metal-passivating additives. Hydraulic fluid is approved by elevator manufacturer for use with elevator equipment.
 6. Inserts: Furnish required concrete and masonry inserts and similar anchorage devices for installing guide rails, machinery, and other components of elevator work where installation of devices is specified in another Section.
 7. Protective Cylinder Casing: PVC or HDPE pipe casing complying with ASME A17.1, of sufficient size to provide not less than 1-inch (25-mm) clearance from cylinder and extending above pit floor. Provide means to monitor casing effectiveness to comply with ASME A17.1.
 8. Corrosion Protective Filler: A nontoxic, petroleum-based gel formulated for filling the space between hydraulic cylinder and protective casing. Filler is electrically nonconductive, displaces or absorbs water, and gels or solidifies at temperatures below 60 deg F (16 deg C).
 9. Car Frame and Platform: Welded steel units.
 - a. Provide special heavy-duty units where indicated for power truck loading, designed to withstand impacts and wheel loadings indicated.
 10. Guides: Provide either roller guides or sliding guides at top and bottom of car and counterweight frames. If sliding guides are used, provide guide-rail lubricators or polymer-coated, nonlubricated guides.
- B. Operation Systems
1. General: Provide manufacturer's standard microprocessor operation system for each elevator **OR** for each group of elevators, **as directed**, as required to provide type of operation system indicated.
 2. Battery-Powered Lowering: When power fails, car is lowered to the lowest floor, opens its doors, and shuts down. System includes rechargeable battery and automatic recharging system.
 3. Load-Weighing Device: When car load exceeds 80 percent of rated capacity, a signal light is lit in the car control station; when car load exceeds rated capacity, car will not respond to car or hall calls.
 4. Security Features: Provide the following security features, where indicated. Security features shall not affect emergency firefighters' service.
 - a. Card-Reader Operation: System uses card readers at car control stations **OR** hall push-button stations, **as directed**, to authorize calls. Security system determines which landings and at what times calls require authorization by card reader. Provide required conductors in traveling cable and panel in machine room for interconnecting card readers, other security access system equipment, and elevator controllers. Allow space as indicated for card reader in car **OR** Provide stripe-swipe card reader integral with each car control station, **as directed**.
 - 1) Security access system equipment is specified in Division 28 Section "Access Control".
OR
Security access system equipment is not in the Contract.**OR**
Keyswitch Operation: Push buttons are activated and deactivated by security keyswitches at car control stations **OR** hall push-button stations, **as directed**. Key is removable only in deactivated position **OR** in either position, **as directed**.
- C. Door Reopening Devices
1. Infrared Array: Provide door reopening devices with uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of one or more of the light beams shall cause doors to stop and reopen.
- D. Finish Materials



1. General: Provide the following materials for exposed parts of elevator car enclosures, car doors, hoistway entrance doors and frames, and signal equipment as indicated.
2. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, commercial steel, Type B, exposed, matte finish.
3. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, commercial steel, Type B, pickled.
4. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, commercial steel, with G60 (Z180) zinc coating (galvanized) or A60 (ZF180) zinc-iron-alloy coating (galvannealed).
5. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.
 - a. Textured Stainless-Steel Sheet: Product with coined **OR** embossed, **as directed**, texture rolled into exposed surface.
6. Stainless-Steel Bars: ASTM A 276, Type 304.
7. Stainless-Steel Tubing: ASTM A 554, Grade MT 304.
8. Rolled Steel Floor Plate: ASTM A 786/A 786M.
9. Rolled Stainless-Steel Floor Plate: ASTM A 793.
10. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Pattern 1, Alloy 6061-T6.

E. Car Enclosures

1. General: Provide car enclosures as indicated, including ventilation, lighting, finishes, access doors, thresholds, trim, and accessories. Fabricate with recesses and cutouts for signal equipment.
 - a. Provide power door operators with linkages for hoistway door operation.
 - b. Provide standard railings complying with ASME A17.1 on car tops where required by ASME A17.1.
2. Materials and Fabrication: Provide manufacturer's standard, flush panel, welded construction made from metal sheet, of metal indicated, not less than 0.067 inch (1.7 mm) and reinforced at 16-inch (406-mm) maximum spacing.
 - a. Provide perforated panels for ceiling and for walls above 72 inches (1829 mm) from car floor unless required to be solid by ASME A17.1.

F. Hoistway Entrances

1. General: Structural-steel frames and sills for hoistway entrances are specified in Division 05 Section(s) "Structural Steel Framing" OR "Metal Fabrications", **as directed**. Unless otherwise indicated, provide hoistway entrance doors of type indicated below, with truckable sill bars and resilient safety meeting-rail gaskets.
 - a. Equip for power operation by means of coordinated linkage with power-operated car door.
 - b. Where gypsum board wall construction is indicated, provide fire-resistance-rated, hollow-metal, door-and-frame hoistway entrances. Provide self-supporting frames with reinforced head sections.
2. Materials and Fabrication: Provide manufacturer's standards, but not less than the following:
 - a. Metal Door Panels: Constructed of metal sheets, flush on room side, welded and reinforced in steel framing with vertical reinforcing spaced not more than 24 inches (610 mm) o.c. Fabricate panel faces from metal sheet, of metal indicated, not less than 0.097 inch (2.5 mm) thick.

G. Signal Equipment

1. General: Provide hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Fabricate lighted elements of acrylic or other permanent, nonyellowing translucent plastic.
2. Car Control Stations: Provide manufacturer's standard car control station. Mount adjacent to car door, unless otherwise indicated.
 - a. Mark buttons and switches with manufacturer's standard identification for required use or function that complies with ASME A17.1. Use both tactile symbols and Braille.
 - b. Mount controls at heights complying with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)" **OR** ICC A117.1, **as directed**.



3. Emergency Communication System: Provide system that complies with ASME A17.1 and the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Building and Facilities (ADAAG)." On activation, system dials preprogrammed number of monitoring station and identifies elevator location to monitoring station. System provides two-way voice communication without using a handset and provides visible signals that indicate when system has been activated and when monitoring station has responded. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.
4. Firefighters' Two-Way Telephone Communication Service: Provide flush-mounted cabinet **OR** telephone jack, **as directed**, in each car and required conductors in traveling cable for firefighters' two-way telephone communication service specified in Division 28 Section(s) "Digital, Addressable Fire-alarm System" **OR** "Zoned (dc Loop) Fire-alarm System".
5. Car Position Indicator: Provide illuminated digital-type car position indicator, located above car door or above car control station.
6. Hall Push-Button Stations: Provide hall push-button stations at each landing as indicated.
 - a. Provide single-button stations with position **OR** "In-Use", **as directed**, indicator.

H. Elevators

1. Elevator No(s): **<Insert elevator number(s) as shown on Drawings.>**
 - a. Type: Under-the-car single or dual cylinder.
OR
Type: Holeless, beside-the-car, single-acting, single **OR** dual, **as directed**, cylinder.
OR
Type: Holeless, beside-the-car, telescoping, single **OR** dual, **as directed**, cylinder.
OR
Type: Holeless, beside-the-car, roped hydraulic, single **OR** dual, **as directed**, cylinder.
 - b. Rated Load: 2000 lb (908 kg) **OR** 2500 lb (1135 kg) **OR** 3000 lb (1362 kg) **OR** 4000 lb (1816 kg) **OR** 5000 lb (2270 kg) **OR** 6000 lb (2720 kg) **OR** 8000 lb (3632 kg) **OR** 10 000 lb (4540 kg), **as directed**.
 - c. Freight Loading Class: Class A **OR** B **OR** C1 **OR** C2 **OR** C3, **as directed**.
 - d. Rated Speed (Up): 50 fpm (0.25 m/s) **OR** 75 or 80 fpm (0.38 or 0.41 m/s) **OR** 100 fpm (0.51 m/s), **as directed**.
 - e. Operational Speed (Down): Approximately 30 percent more than **OR** Same as, **as directed**, rated speed (up).
 - f. Operation System: Single automatic **OR** Car-switch automatic floor-stop **OR** Selective collective automatic, **as directed**, operation.
 - g. Auxiliary Operations: Battery-powered lowering **OR** Card-reader operation **OR** Keyswitch operation **OR** Load-weighing device, **as directed**.
 - h. Auxiliary Car Control Station: Provide additional car control station mounted on side of car at height to facilitate operation by forklift-truck operator without leaving truck.
 - i. Car Enclosures:
 - 1) Platform Width: 60 inches (1524 mm) **OR** 64 inches (1626 mm) **OR** 66 inches (1676 mm) **OR** 76 inches (1930 mm) **OR** 78 inches (1981 mm) **OR** 88 inches (2235 mm) **OR** 100 inches (2540 mm) **OR** 102 inches (2591 mm) **OR** 124 inches (3150 mm) **OR** 126 inches (3200 mm), **as directed**.
 - 2) Platform Depth: 72 inches (1829 mm) **OR** 84 inches (2134 mm) **OR** 96 inches (2438 mm) **OR** 120 inches (3048 mm) **OR** 144 inches (3658 mm) **OR** 168 inches (4267 mm), **as directed**.
 - 3) Ceiling Height: 84 inches (2134 mm) **OR** 96 inches (2438 mm) **OR** 108 inches (2743 mm), **as directed**.
 - 4) Walls and Ceiling: Prime-painted steel **OR** Prime-painted, metallic-coated steel **OR** Satin stainless steel, No. 4 finish **OR** Textured stainless steel, **as directed**.
 - 5) Car Fixtures: Satin stainless steel, No. 4 finish.
 - 6) Floor: Rolled steel floor plate **OR** Aluminum-alloy rolled tread plate **OR** Rolled stainless-steel floor plate, **as directed**.



- 7) Car Gate Type: Vertical biparting **OR** Single-speed vertical lift **OR** Two-speed vertical lift, **as directed**.
 - 8) Car Gate Operation: Manual **OR** Power operated, **as directed**.
 - 9) Car Gate Material: Prime-painted steel **OR** Satin stainless steel, No. 4 finish, **as directed**.
 - 10) Car Sill: Steel angle.
 - 11) Lighting: One **OR** Two **OR** Three, **as directed**, 48-inch (1219-mm), suspended, **OR** surface-mounted, **as directed**, 2-tube fluorescent light fixture(s) with white reflectors **OR** wire lamp guards, **as directed**.
OR
Lighting: One **OR** Two, **as directed**, 48-inch (1219-mm), recessed, 2 **OR** 3, **as directed**, -tube fluorescent light fixture(s) with UV stabilized acrylic diffusers not less than 0.125 inch (3.2 mm) thick.
- j. Hoistway Entrances:
- 1) Width: 56 inches (1422 mm) **OR** 60 inches (1524 mm) **OR** 62 inches (1575 mm) **OR** 72 inches (1829 mm) **OR** 96 inches (2438 mm) **OR** 98 inches (2489 mm) **OR** 120 inches (3048 mm) **OR** 122 inches (3099 mm), **as directed**.
 - 2) Height: 84 inches (2134 mm) **OR** 96 inches (2438 mm), **as directed**.
 - 3) Door Type: Vertical biparting **OR** Single-speed vertical lift **OR** Two-speed vertical lift, **as directed**.
 - 4) Fire-Protection Rating: 1 hour **OR** 1-1/2 hours, **as directed**, with 30-minute temperature rise of 450 deg F (250 deg C), **as directed**.
 - 5) Door Operation: Manual **OR** Power operated, **as directed**.
 - 6) Door Material: Prime-painted steel **OR** Satin stainless steel, No. 4 finish, **as directed**.
 - 7) Door Frame Material: Prime-painted steel **OR** Satin stainless steel, No. 4 finish, **as directed**.
 - 8) Door frames and sills are specified in Division 05 Section(s) "Structural Steel Framing" **OR** "Metal Fabrications", **as directed**.
- k. Hall Fixtures: Satin stainless steel, No. 4 finish.
- l. Auxiliary Hall Stations: Provide additional pendant-mounted, hall push-button stations where indicated mounted at height to facilitate operation by forklift-truck operator without leaving truck.
- m. Additional Requirements:
- 1) Provide door reopening device.

1.3 EXECUTION

A. Examination

1. Examine elevator areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance. Verify critical dimensions and examine supporting structure and other conditions under which elevator work is to be installed.
 - a. For the record, prepare a written report, endorsed by Installer, listing dimensional discrepancies and conditions detrimental to performance or indicating that dimensions and conditions were found to be satisfactory.
 - b. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Installation

1. Excavation for Cylinder: Drill well hole in each elevator pit to accommodate installation of cylinder; comply with applicable requirements in Division 31 Section "Earth Moving".
2. Provide waterproof well casing as necessary to retain walls of well hole.
3. Install cylinder in protective casing within well hole. Before installing protective casing, remove water and debris from well hole and provide permanent waterproof seal at bottom of well casing.
 - a. Fill void space between protective casing and cylinder with corrosion-protective filler.



- b. Align cylinders and fill space around protective casing with fine sand.
 4. Install cylinder plumb and accurately centered for elevator car position and travel. Anchor securely in place, supported at pit floor. Seal between well **OR** protective, **as directed**, casing and pit floor with 4 inches (100 mm) of nonshrink, nonmetallic grout.
 5. Install cylinder plumb and accurately centered for elevator car position and travel. Anchor securely in place, supported at pit floor and braced at intervals as needed to maintain alignment. Anchor cylinder guides at spacing needed to maintain alignment and avoid overstressing guides.
 6. Welded Construction: Provide welded connections for installing elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS standards for workmanship and for qualifications of welding operators.
 7. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts designed to effectively prevent transmission of vibrations to structure and thereby eliminate sources of structure-borne noise from elevator system.
 8. Install piping above the floor, where possible. Where not possible, install underground piping in Schedule 40 PVC pipe casing assembled with solvent-cemented fittings.
OR
Install piping above the floor, where possible. Where not possible, cover underground piping with permanent protective wrapping before backfilling.
 9. Lubricate operating parts of systems as recommended by manufacturers.
 10. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with car. Where possible, delay installation of sills and frames until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.
- C. Field Quality Control
1. Acceptance Testing: On completion of elevator installation and before permitting use (either temporary or permanent) of elevators, perform acceptance tests as required and recommended by ASME A17.1 and by governing regulations and agencies.
 2. Advise the Owner and authorities having jurisdiction in advance of dates and times tests are to be performed on elevators.
- D. Protection
1. Temporary Use: Limit temporary use for construction purposes to one elevator, **as directed**. Comply with the following requirements for each, **as directed**, elevator used for construction purposes:
 - a. Provide protective coverings, barriers, devices, signs, and procedures as needed to protect elevator and elevator equipment.
 - b. Do not load elevators beyond their rated weight capacity.
 - c. Engage elevator Installer to provide full maintenance service. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as necessary for proper elevator operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.
 - d. Engage elevator Installer to restore damaged work, if any, so no evidence remains of correction. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.
- E. Demonstration
1. Train the Owner's maintenance personnel to operate, adjust, and maintain elevator(s).
 2. Check operation of each elevator with the Owner's personnel present and before date of Final Completion. Determine that operation systems and devices are functioning properly.
 3. Check operation of each elevator with the Owner's personnel present not more than one month before end of warranty period. Determine that operation systems and devices are functioning properly.

14 - Conveying Equipment



END OF SECTION 14 24 13 00



Task	Specification	Specification Description
14 24 13 00	14 01 20 00a	Hydraulic Elevators
14 24 23 00	14 01 20 00a	Hydraulic Elevators



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SECTION 14 31 00 00 - ESCALATORS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for escalators. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes high-traffic, interior and exterior escalators.

C. Definitions

1. High-Traffic Escalators: Escalators designed specifically for use where high-traffic volumes produce dense occupancy resulting in structural, machinery, and brake loads much higher than normal.
2. Defective Escalator Work: Operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; the need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.

D. Performance Requirements

1. Rated Speed: 90 fpm (0.46 m/s) or 100 fpm (0.5 m/s).
2. Braking Performance: Provide brakes that stop escalator in up-running mode at a rate no greater than 3 ft./s² (0.91 m/s²).
OR
Braking Performance: Provide brakes that produce a stopping force on escalator in up-running mode that is one-third that used in down-running mode.
3. Step/Skirt Performance Index: Not more than 0.15.
4. Structural and Mechanical Performance for High-Traffic Escalators: For the purpose of structural design, driving machine and power transmission calculations, and brake calculations, design high-traffic escalators for loads not less than 2 times the design loads required by ASME A17.1.
5. Structural Performance of Balustrades, Deck Barricades, and Handrails: Provide components and assemblies capable of withstanding the effects of loads indicated in ASCE 7 for handrail assemblies and guardrail systems.

E. Submittals

1. Product Data: Include capacities, sizes, performances, safety features, finishes, and similar information.
2. Shop Drawings: Show plans, elevations, sections, and details indicating coordination with building structure and relationships with other construction. Indicate variations from specified requirements, maximum loads imposed on building structure at points of support, and power requirements. Indicate access and ventilation for escalator machine space.
3. Samples: For exposed finishes, 3-inch- (75-mm-) square Samples of sheet materials, and 4-inch (100-mm) lengths of running trim members.
4. Manufacturer Certificates: Signed by manufacturer certifying that escalator layout and dimensions, as shown on Drawings, and electrical service, as shown and specified, are adequate for escalator system being provided.
5. Qualification Data: For Installer.
6. Operation and Maintenance Data: For escalators to include in emergency, operation, and maintenance manuals.
7. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted escalator use.



8. Warranty: Special warranty specified in this Section.

F. Quality Assurance

1. Installer Qualifications: Escalator manufacturer or manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
2. Source Limitations: Obtain escalators and moving walks, specified in another Division 14 Section, through one source from a single manufacturer.
3. Regulatory Requirements: Comply with ASME A17.1.

G. Delivery, Storage, And Handling

1. Deliver, store, and handle materials, components, and equipment in manufacturer's protective packaging.
2. Store materials, components, and equipment off of ground, under cover, and in a dry location. Handle according to manufacturer's recommendations to prevent damage, deterioration, or soiling.

H. Coordination

1. Coordinate installation of sleeves, block outs, escalator equipment with integral anchors, and other items that are embedded in concrete or masonry for escalator equipment. Furnish templates, sleeves, escalator equipment with integral anchors, and installation instructions and deliver to Project site in time for installation.
2. Coordinate sequence of escalator installation with other work to avoid delaying the Work.
3. Coordinate locations and dimensions of other work relating to escalators including sumps and floor drains in pits, electrical service, and electrical outlets, lights, and switches in pits.

I. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair, restore, or replace defective escalator work within specified warranty period.
 - a. Warranty Period: One year from date of Final Completion.

1.2 PRODUCTS

A. Materials

1. Stainless Steel: ASTM A 240/A 240M, Type 304 **OR** 316 **OR** 304, except use Type 316 for exterior escalators, **as directed**.
 - a. Satin Finish: No. 4 directional satin.
 - b. Polished Finish: No. 8 mirror polish.
 - c. Gold-Colored Satin Finish: No. 4 directional satin with gold-colored oxide or titanium nitride finish.
 - d. Gold-Colored Mirror Finish: No. 8 mirror polish with gold-colored oxide or titanium nitride finish.
2. Satin Bronze Sheet: ASTM B 36/B 36M, Alloy UNS No. C28000 (muntz metal), fine satin finish, lacquered.
3. Satin Bronze Extrusions: ASTM B 455, Alloy UNS No. C38500 (architectural bronze), fine satin finish, lacquered.
4. Steel Sheet: Cold-rolled steel sheet, ASTM A 1008/A 1008M, commercial steel, Type B, exposed, matte finish.
5. Clear Tempered Glass: ASTM C 1048, Condition A (uncoated surfaces), Type 1 (transparent glass, flat), Class 1 (clear), Quality q3 (glazing, select), Kind FT (fully tempered), **[10.0] [12.0]** mm thick.
6. Tinted Tempered Glass: ASTM C 1048, Condition A (uncoated surfaces), Type 1 (transparent glass, flat), Class 2 (tinted), Quality q3 (glazing, select), Kind FT (fully tempered), **[10.0] [12.0]** mm thick.
 - a. Color: Bronze **OR** Gray **OR** Green, **as directed**.



B. Components

1. General: Provide preengineered escalators complying with requirements. Unless otherwise indicated, provide standard components as indicated in manufacturers' publications and as required for a complete escalator.
2. General: Provide high-traffic escalators complying with requirements. Unless otherwise indicated, provide heavy-duty components as indicated in manufacturers' publications and as required for a complete escalator.
 - a. Provide escalators with two **OR** three **OR** four, **as directed**, flat steps at top and bottom landings.
 - b. Fabricate exposed metalwork, including deck covers, balustrade panels, and trim to provide surface flatness equivalent to stretcher-leveled standard of flatness and sufficient strength for indicated use; increase metal thickness or reinforce with concealed stiffeners, backing materials, or both, as necessary. Support joints with concealed stiffeners as needed to hold exposed faces of adjoining sheets in flush alignment.
3. Opaque Balustrades: Manufacturer's standard profile or arrangement of moving handrails on fully paneled guide rail with interior balustrade panels, deck covers, skirts, trim, and accessories. Prepare for exterior finish below the deck covers, specified in another Section.
4. Transparent Balustrades: Manufacturer's standard profile or arrangement of moving handrails on guide rail that is supported by tempered glass panels, with deck covers, skirts, trim, and accessories. Prepare for exterior finish below the deck covers, specified in another Section.
5. Guards at Ceiling Intersection: Clear plastic.
6. Handrails: Smooth, jointless, reinforced neoprene.
 - a. Color: Black **OR** As selected from manufacturer's full range, **as directed**.
7. Deck Covers and Trim: Satin stainless steel **OR** Polished stainless steel **OR** Gold-colored satin stainless steel **OR** Gold-colored polished stainless steel **OR** Satin bronze, **as directed**.
8. Antislip Devices: Satin stainless steel **OR** Polished stainless steel **OR** Gold-colored satin stainless steel **OR** Gold-colored polished stainless steel **OR** Satin bronze, **as directed**.
9. Balustrade Interior Panels: Satin stainless steel **OR** Polished stainless steel **OR** Gold-colored satin stainless steel **OR** Gold-colored polished stainless steel **OR** Satin bronze, **as directed**.
10. Balustrade Exterior Panels and Escalator Soffits: Satin stainless steel **OR** Polished stainless steel **OR** Gold-colored satin stainless steel **OR** Gold-colored polished stainless steel **OR** Satin bronze, **as directed**.
11. Skirt Panels, if Applicable: Satin stainless steel **OR** Polished stainless steel **OR** Satin stainless steel with exposed surface coated with clear PTFE **OR** Steel panels with exposed surface coated with PTFE **OR** Manufacturer's standard low-friction material, **as directed**.
12. Steps: One-piece, die-cast aluminum with demarcation grooves at front and rear of tread surface.
 - a. Finish: Powder-coated, gray **OR** black, **as directed**.
 - b. Step Demarcation: Yellow inserts at sides and back of step treads.
 - c. Nosing Demarcation: 2-inch- (50-mm-) wide yellow stripe at nosings of step treads.
13. Combs: Integrally colored structural plastic **OR** Cast aluminum **OR** Cast aluminum with powder-coated finish, **as directed**.
 - a. Comb Color: Yellow.
14. Floor Plates: Cast or extruded aluminum with grooved or patterned surface and mill finish.
15. Abrasive-Surface Floor Plates: Cast or extruded aluminum **OR** Stainless steel, **as directed**, with grooved or patterned surface and with abrasive material embedded in or metallurgically bonded to floor-plate surface and having a coefficient of friction of 0.6 or higher when tested according to ASTM C 1028.
16. Operational Control: Provide escalators designed and equipped to run equally in either direction. Provide key-operated switches for directional control and key-operated starter switches located on exterior deck above newel base at both upper and lower landings of escalators.

C. Features

1. Fault Indicator: Provide escalators with a microprocessor unit that monitors safety devices, motor temperature, and escalator speed and records in nonvolatile memory date, time, and device identification if a safety device is activated or escalator malfunctions.



- a. Provide built-in or plug-in unit to display recorded information.
2. Reduced-Current Starting: Provide escalator motors with wye-delta or solid-state starting.
3. Energy-Saving Feature: Provide escalator motors and controls designed for motors to run on partial windings (at reduced power) when not under full load.
4. Provide motors complying with NEMA MG 1, Insulation Class B.
5. Brake-Saving Feature: Provide stopping mechanism that allows escalator to coast to a stop before applying brakes, unless stopping is initiated by a safety device.
6. Equip step drive mechanism with automatic step-chain lubricators.
7. Oil Drip Pan: Provide metal pan under full width and length of escalator to collect and hold oil and grease drippings from lubricated components. Design and fabricate drip pan to sustain a load of 250 lbf (1.1 kN) on a 1.0-sq. ft. (0.9-sq. m) area at any location without permanent deflection.
8. Direction Indicator Lights: Provide red and green indicator lights at least 2 inches (50 mm) in diameter in right-hand **OR** both, **as directed**, balustrade newels at both upper and lower landings. Green light indicates entrance end, and red light indicates exit end. When escalator is stopped, red lights are illuminated at both ends.
9. Combplate Lights: Provide recessed light fixtures with flush lenses mounted in skirt panels at each side of combplates designed to illuminate steps at combplate.
10. Overspeed Governor: Provide units with overspeed governor that is activated if speed of steps exceeds rated speed by more than 20 percent.
11. Upper-Landing, Step Upthrust Device: Activated if a step is displaced against upthrust track at upper curve in passenger-carrying line of track system.
12. Comb-Step Impact Device: Activated if a horizontal force in direction of travel is applied exceeding 112 lbf (500 N) at either side or exceeding 225 lbf (1000 N) at center of front edge of combplate, or a resultant force in upward direction is applied exceeding 150 lbf (688 N) at center of front edge of combplate.

D. Exterior Escalators

1. Fabricate exposed components from stainless steel **OR** bronze, **as directed**, unless otherwise indicated.
2. Hot-dip galvanize escalator trusses and other structural components to comply with ASTM A 123/A 123M. Use only stainless-steel or zinc-plated fasteners for assembly of escalator components.
3. Fabricate oil drip pan from galvanized steel sheet. Provide drain and oil/water separator in oil drip pan.
4. Provide drains, weeps, and drips to prevent water accumulation on horizontal surfaces and to direct water away from electrical equipment and moving parts.
5. Provide enclosures complying with NEMA 250, Type 4 for electrical connections, switches, and equipment.
6. Provide totally enclosed motors complying with NEMA MG 1, Insulation Class B.
7. Equip step drive mechanism with automatic step-chain lubricators.
8. Provide electric heaters with integral thermostats in escalator truss space to maintain temperature above 40 deg F (4.4 deg C).
9. Equip combplates with 400-W electric heaters to prevent ice and snow accumulation.

1.3 EXECUTION

A. Examination

1. Examine escalator areas, with Installer present, for compliance with requirements, installation tolerances, and other conditions affecting performance. Examine supporting structure, machine spaces, and pits; verify critical dimensions; and examine conditions under which escalators are to be installed.
 - a. Proceed with installation only after unsatisfactory conditions have been corrected.



- b. For the record, prepare written report, endorsed by Installer, listing dimensional discrepancies and conditions detrimental to performance or indicating that dimensions and conditions were found to be satisfactory.

B. Installation

1. Comply with manufacturer's written instructions.
2. Set escalators true to line and level, properly supported, and anchored to building structure. Use established benchmarks, lines, and levels to ensure dimensional coordination of the Work.
3. Adjust installed components for smooth, efficient operation, complying with required tolerances and free of hazardous conditions. Lubricate operating parts, including bearings, tracks, chains, guides, and hardware. Test operating devices, equipment, signals, controls, and safety devices. Install oil drip pans and verify that no oil drips outside of pans.
4. Repair damaged finishes so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.

C. Field Quality Control

1. Acceptance Testing: On completion of escalator installation and before permitting use of escalators, perform acceptance tests as required and recommended by ASME A17.1 and by authorities having jurisdiction.
 - a. For escalators specified to comply with requirements more stringent than those of ASME A17.1, perform tests for compliance with specified requirements. Test optional safety devices.
2. Advise the Owner and authorities having jurisdiction in advance of dates and times tests are to be performed.

D. Demonstration

1. Train the Owner's maintenance personnel to operate, adjust, and maintain escalators.
2. Check operation of escalators with the Owner's personnel present and before date of Final Completion. Determine that operation systems and devices are functioning properly.
3. Check operation of escalators with the Owner's personnel present not more than one month before end of warranty period. Determine that operation systems and devices are functioning properly.

END OF SECTION 14 31 00 00



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SECTION 14 32 00 00 - MOVING WALKS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for moving walks. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes interior and exterior moving walks.

C. Definition

1. Defective Moving Walk Work: Operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; the need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.

D. Performance Requirements

1. Rated Speed: 90 fpm (0.45 m/s) **OR** 100 fpm (0.5 m/s) **OR** 120 fpm (0.6 m/s) **OR** 130 fpm (0.66 m/s) **OR** 150 fpm (0.76 m/s), **as directed**.
2. Structural Performance of Balustrades, Deck Barricades, and Handrails: Provide components and assemblies capable of withstanding the effects of loads indicated in ASCE 7 for handrail assemblies and guardrail systems.

E. Submittals

1. Product Data: Include capacities, sizes, performances, safety features, finishes, and similar information.
2. Shop Drawings: Show plans, elevations, sections, and details indicating coordination with building structure and relationships with other construction. Indicate variations from specified requirements, maximum loads imposed on building structure at points of support, and power requirements. Indicate access and ventilation for moving walk machine space.
3. Samples: For exposed finishes, 3-inch- (75-mm-) square Samples of sheet materials, and 4-inch (100-mm) lengths of running trim members.
4. Manufacturer Certificates: Signed by manufacturer certifying that moving walk layout and dimensions, as shown on Drawings, and electrical service, as shown and specified, are adequate for moving walks being provided.
5. Operation and Maintenance Data: For moving walks to include in emergency, operation, and maintenance manuals.
6. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted use of moving walks.

F. Quality Assurance

1. Regulatory Requirements: Comply with ASME A17.1.

G. Delivery, Storage, And Handling

1. Deliver, store, and handle materials, components, and equipment in manufacturer's protective packaging.
2. Store materials, components, and equipment off of ground, under cover, and in a dry location. Handle according to manufacturer's recommendations to prevent damage, deterioration, or soiling.

H. Warranty



1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair, restore, or replace defective moving walk work within one year from date of Final Completion.

I. Maintenance Service

1. Initial Maintenance Service: Beginning at Final Completion, provide one years' full maintenance service by skilled employees of moving walk Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper moving walk operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

1.2 PRODUCTS

A. General

1. Provide preengineered pallet- or belt-type moving walks complying with requirements.

B. Materials

1. Stainless Steel: ASTM A 240/A 240M, Type 304 **OR** 316 **OR** 304, except use Type 316 for exterior moving walks, **as directed**.
 - a. Satin Finish: No. 4 directional satin.
 - b. Polished Finish: No. 8 mirror polish.
 - c. Gold-Colored Satin Finish: No. 4 directional satin with gold-colored oxide or titanium nitride finish.
 - d. Gold-Colored Mirror Finish: No. 8 mirror polish with gold-colored oxide or titanium nitride finish.
2. Satin Bronze Sheet: ASTM B 36/B 36M, Alloy UNS No. C28000 (muntz metal), fine satin finish, lacquered.
3. Satin Bronze Extrusions: ASTM B 455, Alloy UNS No. C38500 (architectural bronze), fine satin finish, lacquered.
4. Steel Sheet: Cold-rolled steel sheet, ASTM A 1008/A 1008M, commercial steel, Type B, exposed, matte finish.
5. Clear Tempered Glass: ASTM C 1048, Condition A (uncoated surfaces), Type 1 (transparent glass, flat), Class 1 (clear), Quality q3 (glazing, select), Kind FT (fully tempered), 10.0 **OR** 12.0, **as directed**, mm thick.
6. Tinted Tempered Glass: ASTM C 1048, Condition A (uncoated surfaces), Type 1 (transparent glass, flat), Class 2 (tinted), Quality q3 (glazing, select), Kind FT (fully tempered), 10.0 **OR** 12.0, **as directed**, mm thick.
 - a. Color: Bronze **OR** Gray **OR** Green, **as directed**.

C. Components

1. General: Unless otherwise indicated, provide standard components as indicated in manufacturers' publications and as required for a complete moving walk.
 - a. Fabricate exposed metalwork, including deck covers, balustrade panels, and trim to provide surface flatness equivalent to stretcher-leveled standard of flatness and sufficient strength for indicated use; increase metal thickness or reinforce with concealed stiffeners, backing materials, or both, as necessary. Support joints with concealed stiffeners as needed to hold exposed faces of adjoining sheets in flush alignment.
2. Opaque Balustrades: Manufacturer's standard profile or arrangement of moving handrails on fully paneled guide rail with interior balustrade panels, deck covers, skirts, trim, and accessories. Prepare for exterior finish below the deck covers, specified in another Section.
3. Transparent Balustrades: Manufacturer's standard profile or arrangement of moving handrails on guide rail that is supported by clear **OR** tinted, **as directed**, tempered glass panels, with deck covers, skirts, trim, and accessories. Prepare for exterior finish below the deck covers, specified in another Section.
4. Handrails: Smooth, jointless, reinforced neoprene.



- a. Color: Black **OR** As selected from manufacturer's full range, **as directed**.
5. Deck Covers and Trim: Satin stainless steel **OR** Polished stainless steel **OR** Gold-colored satin stainless steel **OR** Gold-colored polished stainless steel **OR** Satin bronze, **as directed**.
6. Balustrade Interior Panels: Satin stainless steel **OR** Polished stainless steel **OR** Gold-colored satin stainless steel **OR** Gold-colored polished stainless steel **OR** Satin bronze, **as directed**.
7. Balustrade Exterior Panels: Satin stainless steel **OR** Polished stainless steel **OR** Gold-colored satin stainless steel **OR** Gold-colored polished stainless steel **OR** Satin bronze, **as directed**.
8. Skirt Panels, if Applicable: Polished stainless steel **OR** Satin stainless steel with exposed surface coated with clear PTFE **OR** Steel panels with exposed surface coated with PTFE, **as directed**.
 - a. Clearance between skirt panels or overhanging balustrade panels and treadway shall not exceed 1/16 inch (1.6 mm).
9. Combs: Integrally colored structural plastic **OR** Cast aluminum **OR** Cast aluminum with powder-coated finish, **as directed**.
 - a. Comb Color: Yellow **OR** Black **OR** Gray **OR** Red, **as directed**.
10. Floor Plates: Cast or extruded aluminum **OR** Stainless steel, **as directed**, with grooved or patterned surface and mill finish.
11. Abrasive-Surface Floor Plates: Cast or extruded aluminum **OR** Stainless steel, **as directed**, with grooved or patterned surface and with abrasive material embedded in or metallurgically bonded to floor-plate surface and having a coefficient of friction of 0.6 or higher when tested according to ASTM C 1028.
12. Operational Control: Provide moving walks designed and equipped to run equally in either direction. Provide key-operated switches for directional control and key-operated starter switches located on exterior deck above newel base at both ends of moving walks.

D. Features

1. Fault Indicator: Provide moving walks with a microprocessor unit that monitors safety devices, motor temperature, and moving walk speed and records in nonvolatile memory date, time, and device identification if a safety device is activated or moving walk malfunctions.
 - a. Provide built-in or plug-in unit to display recorded information.
2. Reduced-Current Starting: Provide moving walk motors with wye-delta or solid-state starting.
3. Energy-Saving Feature: Provide moving walk motors and controls designed for motors to run on partial windings (at reduced power) when not under full load.
4. Brake-Saving Feature: Provide stopping mechanism that allows moving walks to coast to a stop before applying brakes, unless stopping is initiated by a safety device.
5. Equip pallet drive mechanism with automatic pallet drive-chain lubricators.
6. Oil Drip Pan: Provide metal pan under full width and length of moving walks to collect and hold oil and grease drippings from lubricated components. Design and fabricate drip pan to sustain a load of 250 lbf (1.1 kN) on a 1.0-sq. ft. (0.09-sq. m) area at any location without permanent deflection.
7. Direction Indicator Lights: Provide red and green indicator lights at least 2 inches (50 mm) in diameter in right-hand **OR** both, **as directed**, balustrade newels at both landings. Green light indicates entrance end, and red light indicates exit end. When moving walk is stopped, red lights are illuminated at both ends.
8. Combplate Lights: Provide recessed light fixtures with flush lenses mounted in interior balustrade panels at each side of combplates designed to illuminate treadway at combplate.
9. Comb-Step Impact Device: Activated if a horizontal force in direction of travel is applied exceeding 112 lbf (500 N) at either side or exceeding 225 lbf (1000 N) at center of front edge of combplate, or a resultant force in upward direction is applied exceeding 150 lbf (688 N) at center of front edge of combplate.

E. Exterior Moving Walks

1. Fabricate exposed components from stainless steel **OR** bronze, **as directed**, unless otherwise indicated.
2. Hot-dip galvanize moving walk trusses and other structural components to comply with ASTM A 123/A 123M. Use only stainless-steel or zinc-plated fasteners for assembly of moving walk components.



3. Fabricate oil drip pan from galvanized steel sheet. Provide drain and oil/water separator in oil drip pan.
4. Provide drains, weeps, and drips to prevent water accumulation on horizontal surfaces and to direct water away from electrical equipment and moving parts.
5. Provide enclosures complying with NEMA 250, Type 4 for electrical connections, switches, and equipment.
6. Provide totally enclosed fan-cooled motors complying with NEMA MG 1, Insulation Class B.
7. Equip pallet drive mechanism with automatic pallet drive-chain lubricators.
8. Provide electric heaters with integral thermostats in moving walk truss space to maintain temperature above 40 deg F (4.4 deg C).
9. Equip combplates with 400-W electric heaters to prevent ice and snow accumulation.

1.3 EXECUTION

A. Installation

1. Comply with manufacturer's written instructions.
2. Set moving walks true to line and level, or to indicated slope, properly supported, and anchored to building structure. Use established benchmarks, lines, and levels to ensure dimensional coordination of the Work.
3. Adjust installed components for smooth, efficient operation, complying with required tolerances and free of hazardous conditions. Lubricate operating parts, including bearings, tracks, chains, guides, and hardware. Test operating devices, equipment, signals, controls, and safety devices. Install oil drip pans and verify that no oil drips outside of pans.
4. Repair damaged finishes so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.

B. Field Quality Control

1. Acceptance Testing: On completion of moving walk installation and before permitting use of moving walks, perform acceptance tests as required and recommended by ASME A17.1 and by authorities having jurisdiction.
2. Advise the Owner, Architect, and authorities having jurisdiction in advance of dates and times tests are to be performed.

C. Demonstration

1. Engage a factory-authorized service representative to train the Owner's maintenance personnel to operate, adjust, and maintain moving walks.

END OF SECTION 14 32 00 00



SECTION 14 42 13 00 - WHEELCHAIR LIFTS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for wheelchair lifts. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Vertical and Private-residence, vertical platform lifts.
 - b. Inclined and Private-residence, inclined platform lifts.
 - c. Inclined and Private-residence, inclined stairway chairlifts.

C. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: For each lift. Include plans, elevations, sections, details, and attachments to other work.
 - a. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - b. Wiring Diagrams: For power, signal, and control wiring.
3. Samples: For each type of exposed finish required.
4. Manufacturer Certificates: Signed by lift manufacturer certifying that runway, ramp or pit, and dimensions as shown on Drawings and that electrical service as shown and specified are adequate for lift being provided.
5. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted use of lifts.
6. Operation and Maintenance Data: For each type of lift to include in operation and maintenance manuals.
7. Warranty: Sample of special warranty.
8. Continuing maintenance proposal.

D. Quality Assurance

1. Regulatory Requirements: In addition to requirements of authorities having jurisdiction, comply with ASME A18.1, "Safety Standard for Platform Lifts and Stairway Chairlifts."
2. Fire-Rated, Runway-Enclosure Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252 **OR** IBC Standard **OR** UL 10B, **as directed**.
 - a. Temperature-Rise Limit: Provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.

E. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of lifts that fail in materials or workmanship within two **OR** Four **OR** Five, **as directed**, years from date of Final Completion.

F. Maintenance Service

1. Initial Maintenance Service: Beginning at Final Completion, provide 12 months' full maintenance by skilled employees of lift Installer. Include quarterly preventive maintenance and repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for



proper lift operation at rated speed and capacity. Provide parts and supplies the same as those used in the manufacture and installation of original equipment.

2. Continuing Maintenance Proposal: From Installer to the Owner, in the form of a standard yearly **OR** two-year **OR** five-year, **as directed**, maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

1.2 PRODUCTS

A. Materials

1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
2. Steel Tubing: ASTM A 500.
3. Steel Pipe: ASTM A 53/A 53M; standard weight (Schedule 40) unless otherwise indicated or required by structural loads.
4. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, commercial steel (CS), Type B, exposed, matte finish.
5. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, commercial steel (CS), Type B, pickled.
6. Galvanized-Steel Sheet: ASTM A 653/A 653M, G90 (Z275) zinc coating,
7. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
 - a. ASTM A 123/A 123M, for galvanizing steel and iron products.
 - b. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
8. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required:
 - a. Extruded Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6063-T6.
 - b. Aluminum Sheet: ASTM B 209 (ASTM B 209M), Alloy 5005-H15.
9. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.
10. Stainless-Steel Tubing: ASTM A 554, Grade MT-304.
11. Stainless-Steel Sheet, Strip, and Plate: ASTM A 240/A 240M or ASTM A 666, Type 304.
12. Stainless-Steel Floor Plate: ASTM A 793.
13. Wood and Wood Panel Products: Comply with requirements in Division 06 Section "Interior Architectural Woodwork".
14. Wood and Wood Panel Products:
 - a. Wood: Clear, vertical-grain, straight, kiln-dried wood, AWPA C20-02, Interior Type A, fire-retardant treated, **as directed**; of manufacturer's standard species.
 - b. Wood Panels: Provide wood panels consisting of wood veneer and wood panel as follows:
 - 1) Wood Veneer: Laminated to core with moisture-resistant adhesive.
 - 2) Plywood: DOC PS 1.
 - 3) Particleboard: ANSI A208.1, made with binder containing no urea formaldehyde, **as directed**.
 - 4) Medium-Density Fiberboard: ANSI A208.2, made with binder containing no urea formaldehyde, **as directed**.
 - c. Fire-Retardant-Treated Wood Panels: Provide wood panels consisting of wood veneer and AWPA C27-02 fire-retardant-treated wood panels. Panels shall have flame-spread index of 75 **OR** 25, **as directed**, or less and smoke-developed index of 450 or less per ASTM E 84.
 - 1) Wood Veneer: Laminated to core with moisture-resistant adhesive.
 - 2) Plywood: DOC PS 1.
 - 3) Particleboard: ANSI A208.1, made with binder containing no urea formaldehyde, **as directed**.
 - 4) Medium-Density Fiberboard: ANSI A208.2, made with binder containing no urea formaldehyde, **as directed**.



15. Fiberglass: Multiple laminations of glass-fiber-reinforced polyester resin with UV-light-stable, colorfast, nonfading, weather- and stain-resistant, colored polyester gel coat, and manufacturer's standard finish.
 16. Glass:
 - a. Comply with requirements in Division 08 Section "Glazing".
OR
As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**, and complying with ASME A18.1.
 - 1) Safety Glazing Products: Comply with testing requirements in 16 CFR 1201, Category II.
 - 2) Safety Glass Marking: Glass permanently marked with certification label of SGCC or another certification agency or manufacturer acceptable to authorities having jurisdiction.
 17. Acrylic Glazing: ASTM D 4802, Category A-1 (cell-cast) or Category A-2 (continuous cast), Finish 1 (smooth or polished), clear or tinted as indicated.
 18. Inserts: Furnish required concrete and masonry inserts and similar anchorage devices for installing structural members, guide rails, machines, and other lift components where installation of devices is specified in another Section.
 19. Expansion Anchors: Anchor-bolt-and-sleeve assembly of material indicated below with capability to sustain a load equal to 10 times the load imposed as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
 - a. Material:
 - 1) Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
OR
Group 1, Alloy 304 or Alloy 316, stainless-steel bolts and nuts complying with ASTM F 593 (ASTM F 738M) and ASTM F 594 (ASTM F 836M).
 20. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.
- B. Vertical Platform Lifts
1. Private-Residence, **as directed**, Vertical Platform Lifts: Manufacturer's standard preengineered lift systems as indicated.
 2. Platform Size: 34 by 54 inches (864 by 1372 mm) **OR** 35 by 48 inches (889 by 1220 mm) **OR** 35 by 51 inches (889 by 1295 mm) **OR** 36 by 56 inches (914 by 1422 mm) **OR** 36 by 60 inches (914 by 1524 mm), **as directed**.
 3. Door Operation and Clear Opening Width: Low-energy, power-operated doors that remain open for 20 seconds minimum; end door with minimum 32-inch (815-mm) and side door with minimum 42-inch (1065-mm) clear opening width.
 4. Rated Speed: 8 fpm (0.04 m/s) **OR** 10 fpm (0.05 m/s) **OR** 12 fpm (0.06 m/s) **OR** 15 fpm (0.08 m/s) **OR** 20 fpm (0.10 m/s) **OR** 22 fpm (0.11 m/s) **OR** 30 fpm (0.15 m/s), **as directed**.
 5. Power Supply: 208 V, 60 Hz, 3 phase **OR** 240 V, 60 Hz, 1 phase **OR** 120 V, 60 Hz, 1 phase, **as directed**.
 6. Emergency Operation: Provide emergency manual operation and emergency battery power system **OR** connection to indicated standby (emergency) power, **as directed**, to raise or lower units in case of malfunction or power loss.
 7. Attendant Operation: Provide attendant operation at location shown.
 8. Self-Supporting Units: Support vertical loads of units only at base, with lateral support only at landing levels.
 9. Partial, **as directed**, Runway Enclosure: Manufacturer's standard weather-resistant, **as directed**, enclosure assembly.
 - a. Runway Enclosure: One of the following, **as directed**.
 - 1) Rectangular steel-tube frame with flush steel-sheet panels.
 - 2) Rectangular hot-dip-galvanized steel-tube frame with flush galvanized-steel-sheet panels.
 - 3) Extruded-aluminum frame with flush galvanized-steel-sheet panels.



- 4) Extruded-aluminum frame with flush aluminum-sheet panels; with hot-dip-galvanized steel-tube frame for structural framing that cannot be aluminum.
 - 5) Rectangular steel-tube frame with wood panels and trim.
 - 6) Rectangular wood frame with wood panels and trim.
 - 7) Rectangular steel-tube frame with fiberglass panels.
 - b. Glazed Runway Enclosure: Rectangular structure of glazed extruded-aluminum framing with a tinted, acrylic dome roof.
 - 1) Glazing:
 - a) Bronze-tinted acrylic glazing, 6.0 mm thick.
OR
Bronze-tinted, float glass **OR** tempered safety **OR** laminated safety, **as directed**, glass, 6.0 mm thick, where indicated.
 - c. Runway-Enclosure Doors: One of the following, **as directed**:
 - 1) Rectangular steel-tube frames with flush steel-sheet panels.
 - 2) Rectangular steel-tube frames glazed with 6.0-mm-thick, clear acrylic glazing and with 12-inch- (300-mm-) high, steel kick panels.
 - 3) Wide-stile aluminum entrance doors glazed with bronze-tinted tempered safety glass, 6.0 mm thick.
 - 4) Enclosure doors matching appearance of adjacent glass-supported railings, complying with Division 05 Section "Decorative Metal Railings".
 - d. Fire-Rated Runway-Enclosure Door: Provide fire-rated runway-enclosure door where shown **OR** at upper landing **OR** at lower landing, **as directed**.
 - 1) Fire-Protection Rating: 1-1/2 hours.
 - 2) Equip door with wired glass vision panel, delay-action door closer, dead latch, dummy trim door handle, and electric strike.
10. Platform: One of the following, **as directed**:
- a. Galvanized-steel sheet with black rubber flooring.
 - b. Stainless-steel floor plate with checkered texture.
 - c. Aluminum floor plate with nonskid surface texture.
11. Platform Low-Profile Carriage: Fabricate platform floor assembly to total thickness not exceeding 1-1/2 inches (38 mm).
12. Platform Enclosure and Door: One of the following, **as directed**:
- a. Rectangular steel-tube frame with flush steel-sheet panels.
 - b. Rectangular hot-dip-galvanized steel-tube frame with flush galvanized-steel-sheet panels.
 - c. Extruded-aluminum frame with flush galvanized-steel-sheet panels.
 - d. Extruded-aluminum frame with flush aluminum-sheet panels; with hot-dip-galvanized steel-tube frame for structural framing that cannot be aluminum.
 - e. Rectangular steel-tube frame with wood panels and trim.
 - f. Rectangular steel-tube frame with fiberglass panels.
 - g. Enclosure walls and doors matching appearance of adjacent glass-supported railings, complying with Division 05 Section "Decorative Metal Railings".
13. Platform Top: Provide a non-load-bearing top, matching construction of enclosure walls. Permanently mark top to indicate that it cannot sustain a load.
14. Fixed Ramp: Provide fixed ramp matching platform to provide transition from floor to lift platform at bottom landing.
15. Retractable Ramp: Provide ramp matching platform to provide transition from lower floor to lift platform. Ramp lowers to floor automatically when lifts reach lower landing and door opens. Ramp rises automatically when lift control is activated for lift to leave lower landing.
- a. Ramp Size: End ramps a minimum of 32 inches (815 mm) and side ramps a minimum of 42 inches (1065 mm) wide; length as required for slope.
 - b. Ramp Slope: As indicated **OR** Maximum 1:12, **as directed**.
 - c. Ramp Finish: Finish ramps to match lift platform **OR** Ramp finish is specified elsewhere as indicated, **as directed**.
16. Accessories: Provide units with the following accessories:
- a. Fold-down seat with armrests and safety belt.



- b. Forced Ventilation System: Minimum 1 air change per minute, continuously operating **OR** thermostatically controlled to activate at 90 deg F (32.22 deg C) , **as directed**, and with auxiliary power source to operate ventilation for 1 hour in case of power failure.
- c. Lighting system within lift enclosures as indicated on Drawings **OR** selected from manufacturer's available products, **as directed**.

C. Inclined Platform Lifts

1. Private-Residence, **as directed**, Inclined Platform Lifts: Manufacturer's standard preengineered lift systems as indicated.
2. Platform Size: 29 by 33 inches (737 by 838 mm) **OR** 28 by 35 inches (711 by 889 mm) **OR** 30 by 35 inches (760 by 889 mm) **OR** 30 by 36 inches (760 by 914 mm) **OR** 31 by 39 inches (787 by 991 mm) **OR** 30 by 41 inches (760 by 1041 mm) **OR** 30 by 42 inches (760 by 1067 mm) **OR** 31 by 43 inches (787 by 1092 mm) **OR** 30 by 48 inches (760 by 1220 mm), **as directed**.
3. Door Operation and Clear Opening Width: Low-energy, power-operated doors that remain open for 20 seconds minimum; end door with minimum 32-inch (815-mm) and side door with minimum 42-inch (1065-mm) clear opening width.
4. Rated Speed: 20 fpm (0.10 m/s) **OR** 22 fpm (0.11 m/s) **OR** 25 fpm (0.13 m/s) **OR** 30 fpm (0.15 m/s), **as directed**.
5. Minimum Headroom Clearance during Travel: Minimum of 80 inches (2032 mm) above any point on platform floor.
6. Power Supply: 208 V, 60 Hz, 3 phase **OR** 240 V, 60 Hz, 1 phase **OR** 120 V, 60 Hz, 1 phase, **as directed**.
7. Emergency Operation: Provide emergency manual operation and emergency battery power system **OR** connection to indicated standby (emergency) power, **as directed**, to raise or lower units in case of malfunction or power loss.
8. Attendant Operation: Provide attendant operation at location shown.
9. Platform: One of the following, **as directed**:
 - a. Galvanized-steel sheet with black rubber flooring.
 - b. Stainless-steel floor plate with checkered texture.
 - c. Aluminum floor plate with nonskid surface texture.
10. Automatic Folding Platforms: When not in use, platforms automatically fold up against wall to minimize projection into stairway.
11. Manual Folding Platforms: When not in use, platforms can be folded up against wall to minimize projection into stairway.
12. Platform Guarding: Guard platform with passenger restraining arms **OR** enclosure, **as directed**.
 - a. Passenger Restraining Arms: Steel **OR** Galvanized-steel **OR** Stainless-steel, **as directed**, tubing, manually **OR** power, **as directed**, operated.
 - b. Platform Enclosure (Side Walls and Self-Closing Door): One of the following, **as directed**:
 - 1) Rectangular steel-tube frame with flush steel-sheet panels.
 - 2) Enclosure walls and doors matching appearance of adjacent glass-supported railings, complying with Division 05 Section "Decorative Metal Railings".
13. Platform Guarding: Guard platform with automatically **OR** manually, **as directed**, actuated, retractable metal guard on lower access end of platform.
14. Fixed Ramp: Provide fixed ramp matching platform to provide transition from floor to lift platform at bottom landing.
15. Retractable Ramp: Provide ramp matching platform to provide transition from floor to lift platform. Ramp lowers to floor automatically when lifts reach landing and enclosure door opens. Ramp rises automatically when lift control is activated for lift to leave landing.
 - a. Ramp Size: End ramps a minimum of 32 inches (815 mm) and side ramps a minimum of 42 inches (1065 mm) wide; length as required for slope.
 - b. Ramp Slope: As indicated **OR** Maximum 1:12, **as directed**.
 - c. Ramp Finish: Finish ramps to match lift platform **OR** Ramp finish is specified elsewhere as indicated, **as directed**.
16. Supporting Structure: Provide framing to support vertical loads from floor or stair treads and only lateral loads from walls. Fabricate framing from steel **OR** stainless-steel, **as directed**, rectangular tubing, plates, shapes, and bars.



17. Guide Rails: Fabricate from steel **OR** stainless-steel, **as directed**, tubing.
18. Accessories: Provide units with the following accessories:
 - a. Fold-down seat with armrests and safety belt.
 - b. Caution sign as required by ASME A18.1.

D. Inclined Stairway Chairlifts

1. Private-Residence, **as directed**, Inclined Stairway Chairlifts: Manufacturer's standard preengineered lift systems as indicated.
2. Systems and Machinery: Manufacturer's standard preengineered lift systems as indicated in published product literature and as follows:
 - a. Rated Capacity: Minimum 250 lb (113 kg) **OR** 400 lb (181 kg), **as directed**.
 - b. Rated Speed: 18 fpm (0.09 m/s) **OR** 20 fpm (0.10 m/s) **OR** 22 fpm (0.11 m/s) **OR** 25 fpm (0.13 m/s), **as directed**.
3. Power Supply: 120 V, 60 Hz, 1 phase.
4. Battery Operation: Provide battery-operated drive with automatic charging system.
5. Manual Lowering: Provide means to manually lower units in case of malfunction or power loss.
6. Folding Units: Provide units that can be folded up against wall when not in use, to minimize projection into stairway.
7. Supporting Structure: Provide brackets to support vertical loads from floor or stair treads and to support lateral loads from walls. Fabricate brackets from steel plates, shapes, or bars.
8. Accessories: Provide units with the following accessories:
 - a. Tubular-steel, manually operated safety arms designed to restrain and provide grab bar for occupant.
 - b. Retractable seat belt.
 - c. Seat with back and two handgrips or arms.

E. General Finish Requirements

1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
3. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

F. Finishes

1. Steel and Galvanized-Steel Factory Finish:
 - a. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard 2-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil (0.025 mm) for topcoat.
 - b. Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard, thermosetting polyester or acrylic urethane powder coating with a cured film thickness not less than 1.5 mils (0.04 mm).
 - c. Color and Gloss: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range, **as directed**.
2. Stainless-Steel Finishes:
 - a. Floor Plate Finish: Mill **OR** Abrasive blasted, **as directed**.
 - b. Grab Rail Finish: As selected from manufacturer's full range **OR** Directional satin finish No. 4, **as directed**.
3. Aluminum Finishes:
 - a. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm **OR** AA-M12C22A31, Class II, 0.010 mm, **as directed**, or thicker.
 - b. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm **OR** AA-M12C22A32/A34, Class II, 0.010 mm, **as directed**, or thicker.
 - 1) Color: As selected from full range of industry colors and color densities.



- c. Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard, thermosetting polyester or acrylic urethane powder coating with a cured film thickness not less than 1.5 mils (0.04 mm).
 - 1) Color and Gloss: As selected from manufacturer's full range.
4. Wood Finish:
 - a. As specified in Division 09 Section "Staining And Transparent Finishing".
OR
As selected from manufacturer's full range, as follows:
 - 1) Type: Transparent finish **OR** Transparent finish over stain, **as directed**, over wood variety indicated.
5. Fiberglass Color and Gloss: As selected from manufacturer's full range.

1.3 EXECUTION

A. Installation

1. Wiring Method: Conceal conductors and cables within housings of units or building construction. Do not install conduit exposed to view in finished spaces. Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.
2. Coordinate runway doors with platform travel and positioning, for accurate alignment and minimum clearance between platforms, runway doors, sills, and door frames.
3. Position sills accurately and fill space under sills solidly with nonshrink, nonmetallic grout.
4. Coordinate platform doors with platform travel and positioning.
5. Adjust stops for accurate stopping and leveling at each landing, within required tolerances.
 - a. Leveling Tolerance: 1/4 inch (6 mm) up or down, regardless of load and direction of travel.
6. Adjust retractable ramps to meet maximum allowable slope and change-in-elevation requirements, and to lie fully against landing surfaces.
7. Lubricate operating parts of lift, including drive mechanism, guide rails, hinges, safety devices, and hardware.
8. Test safety devices and verify smoothness of required protective enclosures and fascias

B. Field Quality Control

1. Acceptance Testing: On completion of lift installation and before permitting use of lifts, perform acceptance tests as required and recommended by ASME A18.1 and authorities having jurisdiction.
2. Operating Test: In addition to above testing, load lifts to rated capacity and operate continuously for 30 minutes between lowest and highest landings served. Readjust stops, signal equipment, and other devices for accurate stopping and operation of system.
3. Advise the Owner, Architect, and authorities having jurisdiction in advance of dates and times tests are to be performed on lifts.

C. Demonstration

1. Engage a factory-authorized service representative to train the Owner's maintenance personnel to adjust, operate, and maintain lifts. Include a review of emergency systems and emergency procedures to be followed at time of operational failure and other building emergencies.

END OF SECTION 14 42 13 00



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Task	Specification	Specification Description
14 42 16 00	14 42 13 00	Wheelchair Lifts



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SECTION 21 05 13 00 - COMMON MOTOR REQUIREMENTS FOR FIRE SUPPRESSION EQUIPMENT

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for common motor requirements for fire suppression equipment. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

C. Coordination

1. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - a. Motor controllers.
 - b. Torque, speed, and horsepower requirements of the load.
 - c. Ratings and characteristics of supply circuit and required control sequence.
 - d. Ambient and environmental conditions of installation location.

1.2 PRODUCTS

A. General Motor Requirements

1. Comply with requirements in this Section except when stricter requirements are specified in fire suppression equipment schedules or Sections.
2. Comply with NEMA MG 1 unless otherwise indicated.
3. Comply with IEEE 841 for severe-duty motors.

B. Motor Characteristics

1. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet (1000 m) above sea level.
2. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

C. Polyphase Motors

1. Description: NEMA MG 1, Design B, medium induction motor.
2. Efficiency: Energy efficient, as defined in NEMA MG 1.
3. Service Factor: 1.15.
4. Multispeed Motors: Variable torque.
 - a. For motors with 2:1 speed ratio, consequent pole, single winding.
 - b. For motors with other than 2:1 speed ratio, separate winding for each speed.
5. Multispeed Motors: Separate winding for each speed.
6. Rotor: Random-wound, squirrel cage.
7. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
8. Temperature Rise: Match insulation rating.
9. Insulation: Class F.
10. Code Letter Designation:

Common Motor Requirements for Fire Suppression Equip-
ment



- a. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 - b. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
11. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

D. Polyphase Motors With Additional Requirements

1. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
2. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 - a. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
 - b. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - c. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - d. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
3. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

E. Single-Phase Motors

1. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - a. Permanent-split capacitor.
 - b. Split phase.
 - c. Capacitor start, inductor run.
 - d. Capacitor start, capacitor run.
2. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
3. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
4. Motors 1/20 HP and Smaller: Shaded-pole type.
5. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

1.3 EXECUTION (Not Applicable)

END OF SECTION 21 05 13 00



SECTION 21 05 19 00 - WATER DISTRIBUTION

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for water distribution. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes water-distribution piping and related components outside the building for water service **OR** fire-service mains **OR** combined water service and fire-service mains, **as directed**.
2. Utility-furnished products include water meters that will be furnished to the site, ready for installation.

C. Definitions

1. EPDM: Ethylene propylene diene terpolymer rubber.
2. LLDPE: Linear, low-density polyethylene plastic.
3. PA: Polyamide (nylon) plastic.
4. PE: Polyethylene plastic.
5. PP: Polypropylene plastic.
6. PVC: Polyvinyl chloride plastic.
7. RTRF: Reinforced thermosetting resin (fiberglass) fittings.
8. RTRP: Reinforced thermosetting resin (fiberglass) pipe.

D. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.
 - a. Wiring Diagrams: Power, signal, and control wiring for alarms.
3. Field quality-control test reports.
4. Operation and Maintenance Data.

E. Quality Assurance

1. Regulatory Requirements:
 - a. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
 - b. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
 - c. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.
2. Piping materials shall bear label, stamp, or other markings of specified testing agency.
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
4. Comply with ASTM F 645 for selection, design, and installation of thermoplastic water piping.
5. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.
6. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.
7. NSF Compliance:



- a. Comply with NSF 14 for plastic potable-water-service piping. Include marking "NSF-pw" on piping.
- b. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

F. Delivery, Storage, And Handling

1. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:
 - a. Ensure that valves are dry and internally protected against rust and corrosion.
 - b. Protect valves against damage to threaded ends and flange faces.
 - c. Set valves in best position for handling. Set valves closed to prevent rattling.
2. During Storage: Use precautions for valves, including fire hydrants, according to the following:
 - a. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
 - b. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.
3. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.
4. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
5. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.
6. Protect flanges, fittings, and specialties from moisture and dirt.
7. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

G. Project Conditions

1. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by the Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:
 - a. Notify the Owner no fewer than two days in advance of proposed interruption of service.
 - b. Do not proceed with interruption of water-distribution service without the Owner's written permission.

H. Coordination

1. Coordinate connection to water main with utility company.

1.2 PRODUCTS

A. Copper Tube And Fittings

1. Soft Copper Tube: ASTM B 88, Type K (ASTM B 88M, Type A) **OR** ASTM B 88, Type L (ASTM B 88M, Type B), **as directed**, water tube, annealed temper.
 - a. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.
 - b. Copper, Pressure-Seal Fittings:
 - 1) NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.
 - 2) NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Bronze fitting with stainless-steel grip ring and EPDM O-ring seal in each end.
2. Hard Copper Tube: ASTM B 88, Type K (ASTM B 88M, Type A) **OR** ASTM B 88, Type L (ASTM B 88M, Type B), **as directed**, water tube, drawn temper.
 - a. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.
 - b. Copper, Pressure-Seal Fittings:



- 1) NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.
 - 2) NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Bronze fitting with stainless-steel grip ring and EPDM O-ring seal in each end.
 3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.
 4. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
- B. Ductile-Iron Pipe And Fittings
1. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
 - a. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - b. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
 2. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.
 - a. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - b. Gaskets: AWWA C111, rubber.
 3. Grooved-Joint, Ductile-Iron Pipe: AWWA C151, with cut, rounded-grooved ends.
 - a. Grooved-End, Ductile-Iron Pipe Appurtenances:
 - 1) Grooved-End, Ductile-Iron Fittings: ASTM A 47/A 47M, malleable-iron castings or ASTM A 536, ductile-iron castings with dimensions matching pipe.
 - 2) Grooved-End, Ductile-Iron-Piping Couplings: AWWA C606, for ductile-iron-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.
 4. Flanges: ASME 16.1, Class 125, cast iron.
- C. PE Pipe And Fittings
1. PE, ASTM Pipe: ASTM D 2239, SIDR No. 5.3, 7, or 9; with PE compound number required to give pressure rating not less than 160 psig (1100 kPa) **OE** 200 psig (1380 kPa), **as directed**.
 - a. Insert Fittings for PE Pipe: ASTM D 2609, made of PA, PP, or PVC with serrated male insert ends matching inside of pipe. Include bands or crimp rings.
 - b. Molded PE Fittings: ASTM D 3350, PE resin, socket- or butt-fusion type, made to match PE pipe dimensions and class.
 2. PE, AWWA Pipe: AWWA C906, DR No. 7.3, 9, or 9.3; with PE compound number required to give pressure rating not less than 160 psig (1100 kPa) **OR** 200 psig (1380 kPa), **as directed**.
 - a. PE, AWWA Fittings: AWWA C906, socket- or butt-fusion type, with DR number matching pipe and PE compound number required to give pressure rating not less than 160 psig (1100 kPa) **OR** 200 psig (1380 kPa), **as directed**.
 3. PE, Fire-Service Pipe: ASTM F 714, AWWA C906, or equivalent for PE water pipe; FMG approved, with minimum thickness equivalent to FMG Class 150 and Class 200.
 - a. Molded PE Fittings: ASTM D 3350, PE resin, socket- or butt-fusion type, made to match PE pipe dimensions and class.
- D. PVC Pipe And Fittings
1. PVC, Schedule 40 Pipe: ASTM D 1785.
 - a. PVC, Schedule 40 Socket Fittings: ASTM D 2466.
 2. PVC, Schedule 80 Pipe: ASTM D 1785.
 - a. PVC, Schedule 80 Socket Fittings: ASTM D 2467.
 - b. PVC, Schedule 80 Threaded Fittings: ASTM D 2464.
 3. PVC, AWWA Pipe: AWWA C900, Class 150 **OR** Class 200, **as directed**, with bell end with gasket, and with spigot end.
 - a. Comply with UL 1285 for fire-service mains if indicated.



- b. PVC Fabricated Fittings: AWWA C900, Class 150 **OR** Class 200, **as directed**, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
 - c. PVC Molded Fittings: AWWA C907, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
 - d. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - 1) Gaskets: AWWA C111, rubber.
 - e. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - 1) Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- E. Fiberglass Pipe And Fittings
- 1. AWWA RTRP: AWWA C950, Class 150 **OR** Class 200 **OR** Class 250, **as directed**, Type I **OR** II, **as directed**, Grade 1, epoxy **OR** Grade 2, polyester, **as directed**, with bell-and-spigot ends for bonded **OR** with gasket or seal for gasketed, **as directed**, joints. Liner is optional, unless otherwise indicated. Include FMG approval if used for fire-service mains.
 - a. RTRF: AWWA C950, similar to pipe in material, pressure class, and joining method.
 - 2. UL RTRP: UL 1713, Class 150 **OR** Class 200 **OR** Class 250, **as directed**, with bell-and-spigot ends with gasket or seal for gasketed joints. Liner is optional, unless otherwise indicated.
 - a. RTRF: Similar to pipe in material, pressure class, and joining method.
- F. Special Pipe Fittings
- 1. Ductile-Iron Rigid Expansion Joints:
 - a. Description: Three-piece, ductile-iron assembly consisting of telescoping sleeve with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Select and assemble components for expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
 - 1) Pressure Rating: 250 psig (1725 kPa) minimum.
 - 2) Expansion Required: As directed by the manufacturer or as directed by the Owner.
 - 2. Ductile-Iron Flexible Expansion Joints:
 - a. Description: Compound, ductile-iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include two gasketed ball-joint sections and one or more gasketed sleeve sections. Assemble components for offset and expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
 - 1) Pressure Rating: 250 psig (1725 kPa) minimum.
 - 2) Offset: As directed by the manufacturer or as directed by the Owner.
 - 3) Expansion Required: As directed by the manufacturer or as directed by the Owner.
 - 3. Ductile-Iron Deflection Fittings:
 - a. Description: Compound, ductile-iron coupling fitting with sleeve and 1 or 2 flexing sections for up to 15-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
 - 1) Pressure Rating: 250 psig (1725 kPa) minimum.
- G. Joining Materials
- 1. Refer to Division 33 Section "Common Work Results For Utilities" for commonly used joining materials.
 - 2. Brazing Filler Metals: AWS A5.8, BCuP Series.
 - 3. Bonding Adhesive for Fiberglass Piping: As recommended by fiberglass piping manufacturer.
 - 4. Plastic Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- H. Piping Specialties



1. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.
 2. Tubular-Sleeve Pipe Couplings:
 - a. Description: Metal, bolted, sleeve-type, reducing or transition coupling, with center sleeve, gaskets, end rings, and bolt fasteners and with ends of same sizes as piping to be joined.
 - 1) Standard: AWWA C219.
 - 2) Center-Sleeve Material: Manufacturer's standard **OR** Carbon steel **OR** Stainless steel **OR** Ductile iron **OR** Malleable iron, **as directed**.
 - 3) Gasket Material: Natural or synthetic rubber.
 - 4) Pressure Rating: 150 psig (1035 kPa) **OR** 200 psig (1380 kPa), **as directed**, minimum.
 - 5) Metal Component Finish: Corrosion-resistant coating or material.
 3. Split-Sleeve Pipe Couplings:
 - a. Description: Metal, bolted, split-sleeve-type, reducing or transition coupling with sealing pad and closure plates, O-ring gaskets, and bolt fasteners.
 - 1) Standard: AWWA C219.
 - 2) Sleeve Material: Manufacturer's standard **OR** Carbon steel **OR** Stainless steel, **as directed**.
 - 3) Sleeve Dimensions: Of thickness and width required to provide pressure rating.
 - 4) Gasket Material: O-rings made of EPDM rubber, unless otherwise indicated.
 - 5) Pressure Rating: 150 psig (1035 kPa) **OR** 200 psig (1380 kPa), **as directed**, minimum.
 - 6) Metal Component Finish: Corrosion-resistant coating or material.
 4. Flexible Connectors:
 - a. Nonferrous-Metal Piping: Bronze hose covered with bronze wire braid; with copper-tube, pressure-type, solder-joint ends or bronze flanged ends brazed to hose.
 - b. Ferrous-Metal Piping: Stainless-steel hose covered with stainless-steel wire braid; with ASME B1.20.1, threaded steel pipe nipples or ASME B16.5, steel pipe flanges welded to hose.
 5. Dielectric Fittings: Combination of copper alloy and ferrous; threaded, solder, or plain end types; and matching piping system materials.
 - a. Dielectric Unions: Factory-fabricated union assembly, designed for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C). Include insulating material that isolates dissimilar metals and ends with inside threads according to ASME B1.20.1.
 - b. Dielectric Flanges: Factory-fabricated companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure to suit system pressures.
 - c. Dielectric-Flange Insulation Kits: Field-assembled companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
 - 1) Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure to suit system pressures.
 - d. Dielectric Couplings: Galvanized-steel couplings with inert and noncorrosive thermoplastic lining, with threaded ends and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).
 - e. Dielectric Nipples: Electroplated steel nipples with inert and noncorrosive thermoplastic lining, with combination of plain, threaded, or grooved end types, and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).
- I. Corrosion-Protection Piping Encasement
1. Encasement for Underground Metal Piping:
 - a. Standards: ASTM A 674 or AWWA C105.
 - b. Form: Sheet **OR** Tube, **as directed**.
 - c. Material: LLDPE film of 0.008-inch (0.20-mm) minimum thickness.
 - d. Material: LLDPE film of 0.008-inch (0.20-mm) minimum thickness, or high-density, crosslaminated PE film of 0.004-inch (0.10-mm) minimum thickness.



- e. Material: High-density, crosslaminated PE film of 0.004-inch (0.10-mm) minimum thickness.
- f. Color: Black **OR** Natural, **as directed**.

J. Gate Valves

1. AWWA, Cast-Iron Gate Valves:
 - a. Nonrising-Stem, Metal-Seated Gate Valves:
 - 1) Description: Gray- or ductile-iron body and bonnet; with cast-iron or bronze double-disc gate, bronze gate rings, bronze stem, and stem nut.
 - a) Standard: AWWA C500.
 - b) Minimum Pressure Rating: 200 psig (1380 kPa).
 - c) End Connections: Mechanical joint.
 - d) Interior Coating: Complying with AWWA C550.
 - b. Nonrising-Stem, Resilient-Seated Gate Valves:
 - 1) Description: Gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.
 - a) Standard: AWWA C509.
 - b) Minimum Pressure Rating: 200 psig (1380 kPa).
 - c) End Connections: Mechanical joint.
 - d) Interior Coating: Complying with AWWA C550.
 - c. Nonrising-Stem, High-Pressure, Resilient-Seated Gate Valves:
 - 1) Description: Ductile-iron body and bonnet; with bronze or ductile-iron gate, resilient seats, bronze stem, and stem nut.
 - a) Standard: AWWA C509.
 - b) Minimum Pressure Rating: 250 psig (1725 kPa).
 - c) End Connections: Push on or mechanical joint.
 - d) Interior Coating: Complying with AWWA C550.
 - d. OS&Y, Rising-Stem, Metal-Seated Gate Valves:
 - 1) Description: Cast- or ductile-iron body and bonnet, with cast-iron double disc, bronze disc and seat rings, and bronze stem.
 - a) Standard: AWWA C500.
 - b) Minimum Pressure Rating: 200 psig (1380 kPa).
 - c) End Connections: Flanged.
 - e. OS&Y, Rising-Stem, Resilient-Seated Gate Valves:
 - 1) Description: Cast- or ductile-iron body and bonnet, with bronze or gray- or ductile-iron gate, resilient seats, and bronze stem.
 - a) Standard: AWWA C509.
 - b) Minimum Pressure Rating: 200 psig (1380 kPa).
 - c) End Connections: Flanged.
2. UL/FMG, Cast-Iron Gate Valves:
 - a. UL/FMG, Nonrising-Stem Gate Valves:
 - 1) Description: Iron body and bonnet with flange for indicator post, bronze seating material, and inside screw.
 - a) Standards: UL 262 and FMG approved.
 - b) Minimum Pressure Rating: 175 psig (1207 kPa).
 - c) End Connections: Flanged.
 - b. OS&Y, Rising-Stem Gate Valves:
 - 1) Description: Iron body and bonnet and bronze seating material.
 - a) Standards: UL 262 and FMG approved.
 - b) Minimum Pressure Rating: 175 psig (1207 kPa).
 - c) End Connections: Flanged.
3. Bronze Gate Valves:
 - a. OS&Y, Rising-Stem Gate Valves:
 - 1) Description: Bronze body and bonnet and bronze stem.
 - a) Standards: UL 262 and FMG approved.



- b) Minimum Pressure Rating: 175 psig (1207 kPa).
 - c) End Connections: Threaded.
 - b. Nonrising-Stem Gate Valves:
 - 1) Description: Class 125, Type 1, bronze with solid wedge, threaded ends, and malleable-iron handwheel.
 - a) Standard: MSS SP-80.
- K. Gate Valve Accessories And Specialties
 - 1. Tapping-Sleeve Assemblies:
 - a. Description: Sleeve and valve compatible with drilling machine.
 - 1) Standard: MSS SP-60.
 - 2) Tapping Sleeve: Cast- or ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.
 - 3) Valve: AWWA, cast-iron, nonrising-stem, metal **OR** resilient, **as directed**, -seated gate valve with one raised face flange mating tapping-sleeve flange.
 - 2. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches (125 mm) in diameter.
 - a. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.
 - 3. Indicator Posts: UL 789, FMG-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.
- L. Check Valves
 - 1. AWWA Check Valves:
 - a. Description: Swing-check type with resilient seat. Include interior coating according to AWWA C550 and ends to match piping.
 - 1) Standard: AWWA C508.
 - 2) Pressure Rating: 175 psig (1207 kPa).
 - 2. UL/FMG, Check Valves:
 - a. Description: Swing-check type with pressure rating; rubber-face checks, unless otherwise indicated; and ends matching piping.
 - 1) Standards: UL 312 and FMG approved.
 - 2) Pressure Rating: 175 psig (1207 kPa) **OR** 250 psig (1725 kPa), **as directed**.
- M. Detector Check Valves
 - 1. Detector Check Valves:
 - a. Description (with water meter): Galvanized cast-iron body, bolted cover with air-bleed device for access to internal parts, and flanged ends. Include one-piece bronze disc with bronze bushings, pivot, and replaceable seat. Include threaded bypass taps in inlet and outlet for bypass meter connection. Set valve to allow minimal water flow through bypass meter when major water flow is required.
 - 1) Standards: UL 312 and FMG approved.
 - 2) Pressure Rating: 175 psig (1207 kPa).
 - 3) Water Meter: AWWA C700, disc type, at least one-fourth size of detector check valve. Include meter, bypass piping, gate valves, check valve, and connections to detector check valve.
 - b. Description (without water meter): Iron body, corrosion-resistant clapper ring and seat ring material, flanged ends, with connections for bypass and installation of water meter.
 - 1) Standards: UL 312 and FMG approved.
 - 2) Pressure Rating: 175 psig (1207 kPa).
- N. Butterfly Valves
 - 1. AWWA Butterfly Valves:



- a. Description: Rubber seated.
 - 1) Standard: AWWA C504.
 - 2) Body: Cast or ductile iron.
 - 3) Body Type: Wafer **OR** Flanged, **as directed**.
 - 4) Pressure Rating: 150 psig (1035 kPa).
 - 2. UL Butterfly Valves:
 - a. Description: Metal on resilient material seating.
 - 1) Standards: UL 1091 and FMG approved.
 - 2) Body: Cast or ductile iron.
 - 3) Body Type: Wafer **OR** Flanged, **as directed**.
 - 4) Pressure Rating: 175 psig (1207 kPa).
- O. Plug Valves
 - 1. Plug Valves:
 - a. Description: Resilient-seated eccentric.
 - 1) Standard: MSS SP-108.
 - 2) Body: Cast iron.
 - 3) Pressure Rating: 175-psig (1207-kPa) minimum CWP.
 - 4) Seat Material: Suitable for potable-water service.
- P. Corporation Valves And Curb Valves
 - 1. Service-Saddle Assemblies: Comply with AWWA C800. Include saddle and valve compatible with tapping machine.
 - a. Service Saddle: Copper alloy with seal and AWWA C800, threaded outlet for corporation valve.
 - b. Corporation Valve: Bronze body and ground-key plug, with AWWA C800, threaded inlet and outlet matching service piping material.
 - c. Manifold (if utility company requires multiple connections): Copper fitting with two to four inlets as required, with ends matching corporation valves and outlet matching service piping material.
 - 2. Curb Valves: Comply with AWWA C800. Include bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material.
 - 3. Service Boxes for Curb Valves: Similar to AWWA M44 requirements for cast-iron valve boxes. Include cast-iron telescoping top section of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over curb valve and with a barrel approximately 3 inches (75 mm) in diameter.
 - a. Shutoff Rods: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve.
- Q. Water Meters
 - 1. Water meters will be furnished by utility company.
NOTE: If water meters are specified in this Section, delete paragraph above and retain and edit paragraphs and subparagraphs below.
 - 2. Displacement-Type Water Meters:
 - a. Description: With bronze main case.
 - 1) Standard: AWWA C700.
 - 2) Registration: Flow in gallons (liters) **OR** cubic feet (cubic meters), **as directed**.
 - 3. Turbine-Type Water Meters:
 - a. Description:
 - 1) Standard: AWWA C701.
 - 2) Registration: Flow in gallons (liters) **OR** cubic feet (cubic meters), **as directed**.
 - 4. Compound-Type Water Meters:
 - a. Description:
 - 1) Standard: AWWA C702.
 - 2) Registration: Flow in gallons (liters) **OR** cubic feet (cubic meters), **as directed**.



5. Remote Registration System:
 - a. Description: Utility company standard; direct-reading type. Include meter modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly.
 - 1) Standard: AWWA C706.
 - 2) Registration: Flow in gallons (liters) **OR** cubic feet (cubic meters), **as directed**.
 6. Remote Registration System:
 - a. Description: Utility company standard; encoder type. Include meter modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly.
 - 1) Standard: AWWA C707.
 - 2) Registration: Flow in gallons (liters) **OR** cubic feet (cubic meters), **as directed**.
 - 3) Data-Acquisition Units: Comply with utility company requirements for type and quantity.
OR
Visible Display Units: Comply with utility company requirements for type and quantity.
- R. Detector-Type Water Meters
1. Detector-Type Water Meters
 2. Description: Main line, proportional meter with second meter on bypass. Register flow in gallons (liters) **OR** cubic feet (cubic meters), **as directed**.
 - a. Standards: AWWA C703, UL listed, and FMG approved.
 - b. Pressure Rating: 150 psig (1035 kPa).
 - c. Bypass Meter: AWWA C701, turbine **OR** AWWA C702, compound, **as directed**, -type, bronze case.
 - 1) Size: At least one-half nominal size of main-line meter.
 3. Description: Main-line turbine meter with strainer and second meter on bypass. Register flow in gallons (liters) **OR** cubic feet (cubic meters), **as directed**.
 - a. Standards: AWWA C703, UL listed, and FMG approved.
 - b. Pressure Rating: 175 psig (1207 kPa).
 - c. Bypass Meter: AWWA C701, turbine-type, bronze case.
 - 1) Size: At least NPS 2 (DN 50).
 4. Remote Registration System:
 - a. Description: Utility company standard; direct-reading type. Include meter modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly.
 - 1) Standard: AWWA C706.
 - 2) Registration: Flow in gallons (liters) **OR** cubic feet (cubic meters), **as directed**.
 5. Remote Registration System:
 - a. Description: Utility company standard; encoder type. Include meter modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly.
 - 1) Standard: AWWA C707.
 - 2) Registration: Flow in gallons (liters) **OR** cubic feet (cubic meters), **as directed**.
 - 3) Data-Acquisition Units: Comply with utility company requirements for type and quantity.
OR
Visible Display Units: Comply with utility company requirements for type and quantity.
- S. Pressure-Reducing Valves
1. Water Regulators:
 - a. Standard: ASSE 1003.
 - b. Pressure Rating: Initial pressure of 150 psig (1035 kPa).
 - c. Size: As directed by the manufacturer or as directed by the Owner.
 - d. Design Flow Rate: As directed by the manufacturer or as directed by the Owner.
 - e. Design Inlet Pressure: As directed by the manufacturer or as directed by the Owner.
 - f. Design Outlet Pressure Setting: As directed by the manufacturer or as directed by the Owner.



- g. Body: Bronze with chrome-plated finish, **as directed**, for NPS 2 (DN 50) and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved, **as directed**, for NPS 2-1/2 and NPS 3 (DN 65 and DN 80).
 - h. Valves for Booster Heater Water Supply: Include integral bypass.
 - i. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 and NPS 3 (DN 65 and DN 80).
2. Water Control Valves:
- a. Description: Pilot-operation, diaphragm-type, single-seated main water control valve with AWWA C550 or FDA-approved, interior epoxy coating. Include small pilot control valve, restrictor device, specialty fittings, and sensor piping.
 - 1) Pressure Rating: Initial pressure of 150 psig (1035 kPa) minimum.
 - 2) Main Valve Body: Cast- or ductile-iron body with AWWA C550 or FDA-approved, interior epoxy coating; or stainless-steel body.
 - a) Size: As directed by the manufacturer or as directed by the Owner.
 - b) Pattern: Angle **OR** Globe, **as directed**, -valve design.
 - c) Trim: Stainless steel.
 - 3) Design Flow Rate: As directed by the manufacturer or as directed by the Owner.
 - 4) Design Inlet Pressure: As directed by the manufacturer or as directed by the Owner.
 - 5) Design Outlet Pressure Setting: As directed by the manufacturer or as directed by the Owner.
 - 6) End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged, **as directed**, for NPS 2-1/2 (DN 65) and larger.

T. Relief Valves

- 1. Air-Release Valves:
 - a. Description: Hydromechanical device to automatically release accumulated air.
 - 1) Standard: AWWA C512.
 - 2) Pressure Rating: 300 psig (2070 kPa), **as directed**.
 - 3) Body Material: Cast iron, **as directed**.
 - 4) Trim Material: Stainless steel, brass, or bronze, **as directed**.
 - 5) Water Inlet Size: As directed by the manufacturer or as directed by the Owner.
 - 6) Air Outlet Size: As directed by the manufacturer or as directed by the Owner.
 - 7) Orifice Size: As directed by the manufacturer or as directed by the Owner.
 - 8) Design Air-Release Capacity: As directed by the manufacturer or as directed by the Owner.
- 2. Air/Vacuum Valves:
 - a. Description: Direct-acting, float-operated, hydromechanical device with large orifice to automatically release accumulated air or to admit air during filling of piping.
 - 1) Standard: AWWA C512.
 - 2) Pressure Rating: 300 psig (2070 kPa), **as directed**.
 - 3) Body Material: Cast iron, **as directed**.
 - 4) Trim Material: Stainless steel, brass, or bronze, **as directed**.
 - 5) Inlet and Outlet Size: As directed by the manufacturer or as directed by the Owner.
 - 6) Orifice Size: As directed by the manufacturer or as directed by the Owner.
 - 7) Design Air Capacity: As directed by the manufacturer or as directed by the Owner.
- 3. Combination Air Valves:
 - a. Description: Float-operated, hydromechanical device to automatically release accumulated air or to admit air.
 - 1) Standard: AWWA C512.
 - 2) Pressure Rating: 300 psig (2070 kPa), **as directed**.
 - 3) Body Material: Cast iron, **as directed**.
 - 4) Trim Material: Stainless steel, brass, or bronze, **as directed**.
 - 5) Inlet and Outlet Size: As directed by the manufacturer or as directed by the Owner.
 - 6) Orifice Size: As directed by the manufacturer or as directed by the Owner.
 - 7) Design Air Capacity: As directed by the manufacturer or as directed by the Owner.



U. Vacuum Breakers

1. Pressure Vacuum Breaker Assembly:
 - a. Standard: ASSE 1020.
 - b. Operation: Continuous-pressure applications.
 - c. Pressure Loss: 5 psig (35 kPa), **as directed**, maximum, through middle 1/3 of flow range.
 - d. Size: As directed by the manufacturer or as directed by the Owner.
 - e. Design Flow Rate: As directed by the manufacturer or as directed by the Owner.
 - f. Selected Unit Flow Range Limits: As directed by the manufacturer or as directed by the Owner.
 - g. Pressure Loss at Design Flow Rate: As directed by the manufacturer or as directed by the Owner.
 - h. Accessories: Ball valves on inlet and outlet.

V. Backflow Preventers

1. Reduced-Pressure-Principle Backflow Preventers:
 - a. Standard: ASSE 1013 **OR** AWWA C511, **as directed**.
 - b. Operation: Continuous-pressure applications.
 - c. Pressure Loss: 12 psig (83 kPa), **as directed**, maximum, through middle 1/3 of flow range.
 - d. Size: As directed by the manufacturer or as directed by the Owner.
 - e. Design Flow Rate: As directed by the manufacturer or as directed by the Owner.
 - f. Selected Unit Flow Range Limits: As directed by the manufacturer or as directed by the Owner.
 - g. Pressure Loss at Design Flow Rate: As directed by the manufacturer or as directed by the Owner.for NPS 2 (DN 50) and smaller; As directed by the manufacturer or as directed by the Owner.for NPS 2-1/2 (DN 65) and larger.
 - h. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved **OR** steel with interior lining complying with AWWA C550 or that is FDA approved **OR** stainless steel, **as directed**, for NPS 2-1/2 (DN 65) and larger.
 - i. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged, **as directed**, for NPS 2-1/2 (DN 65) and larger.
 - j. Configuration: Designed for horizontal, straight through **OR** vertical inlet, horizontal center section, and vertical outlet **OR** vertical, **as directed**, flow.
 - k. Accessories:
 - 1) Valves: Ball type with threaded ends on inlet and outlet of NPS 2 (DN 50) and smaller; OS&Y gate type with flanged ends on inlet and outlet of NPS 2-1/2 (DN 65) and larger.
 - 2) Air-Gap Fitting: ASME A112.1.2, matching backflow preventer connection.
2. Double-Check, Backflow-Prevention Assemblies:
 - a. Standard: ASSE 1015 **OR** AWWA C510, **as directed**.
 - b. Operation: Continuous-pressure applications, unless otherwise indicated.
 - c. Pressure Loss: 5 psig (35 kPa), **as directed**, maximum, through middle 1/3 of flow range.
 - d. Size: As directed by the manufacturer or as directed by the Owner.
 - e. Design Flow Rate: As directed by the manufacturer or as directed by the Owner.
 - f. Selected Unit Flow Range Limits: As directed by the manufacturer or as directed by the Owner.
 - g. Pressure Loss at Design Flow Rate: As directed by the manufacturer or as directed by the Owner.for NPS 2 (DN 50) and smaller; As directed by the manufacturer or as directed by the Owner.for NPS 2-1/2 (DN 65) and larger.
 - h. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved **OR** steel with interior lining complying with AWWA C550 or that is FDA approved **OR** stainless steel, **as directed**, for NPS 2-1/2 (DN 65) and larger.
 - i. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged, **as directed**, for NPS 2-1/2 (DN 65) and larger.



- j. Configuration: Designed for horizontal, straight through, **as directed**, flow.
 - k. Accessories: Ball valves with threaded ends on inlet and outlet of NPS 2 (DN 50) and smaller; OS&Y gate valves with flanged ends on inlet and outlet of NPS 2-1/2 (DN 65) and larger.
3. Reduced-Pressure-Detector, Fire-Protection Backflow Preventer Assemblies:
- a. Standards: ASSE 1047 and UL listed or FMG approved.
 - b. Operation: Continuous-pressure applications.
 - c. Pressure Loss: 12 psig (83 kPa), **as directed**, maximum, through middle 1/3 of flow range.
 - d. Size: As directed by the manufacturer or as directed by the Owner. Design Flow Rate: As directed by the manufacturer or as directed by the Owner.
 - e. Selected Unit Flow Range Limits: As directed by the manufacturer or as directed by the Owner.
 - f. Pressure Loss at Design Flow Rate: As directed by the manufacturer or as directed by the Owner.
 - g. Body: Cast iron with interior lining complying with AWWA C550 or that is FDA approved **OR** Steel with interior lining complying with AWWA C550 or that is FDA approved **OR** Stainless steel, **as directed**.
 - h. End Connections: Flanged.
 - i. Configuration: Designed for horizontal, straight through **OR** vertical inlet, horizontal center section, and vertical outlet **OR** vertical, **as directed**, flow.
 - j. Accessories:
 - 1) Valves: UL 262, FMG-approved, OS&Y gate type with flanged ends on inlet and outlet.
 - 2) Air-Gap Fitting: ASME A112.1.2, matching backflow preventer connection.
 - 3) Bypass: With displacement-type water meter, shutoff valves, and reduced-pressure backflow preventer.
4. Double-Check, Detector-Assembly Backflow Preventers:
- a. Standards: ASSE 1048 and UL listed or FMG approved.
 - b. Operation: Continuous-pressure applications.
 - c. Pressure Loss: 5 psig (35 kPa), **as directed**, maximum, through middle 1/3 of flow range.
 - d. Size: As directed by the manufacturer or as directed by the Owner.
 - e. Design Flow Rate: As directed by the manufacturer or as directed by the Owner.
 - f. Selected Unit Flow Range Limits: As directed by the manufacturer or as directed by the Owner.
 - g. Pressure Loss at Design Flow Rate: As directed by the manufacturer or as directed by the Owner.
 - h. Body: Cast iron with interior lining complying with AWWA C550 or that is FDA approved **OR** Steel with interior lining complying with AWWA C550 or that is FDA approved **OR** Stainless steel, **as directed**.
 - i. End Connections: Flanged.
 - j. Configuration: Designed for horizontal, straight through **OR** vertical inlet, horizontal center section, and vertical outlet **OR** vertical, **as directed**, flow.
 - k. Accessories:
 - 1) Valves: UL 262, FMG-approved, OS&Y gate type with flanged ends on inlet and outlet.
 - 2) Bypass: With displacement-type water meter, shutoff valves, and reduced-pressure backflow preventer.
5. Backflow Preventer Test Kits:
- a. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.
- W. Water Meter Boxes
- 1. Description: Cast-iron body and cover for disc-type water meter, with lettering "WATER METER" in cover; and with slotted, open-bottom base section of length to fit over service piping.



- a. Option: Base section may be cast-iron, PVC, clay, or other pipe.
2. Description: Cast-iron body and double cover for disc-type water meter, with lettering "WATER METER" in top cover; and with separate inner cover; air space between covers; and slotted, open-bottom base section of length to fit over service piping.
3. Description: Polymer-concrete body and cover for disc-type water meter, with lettering "WATER" in cover; and with slotted, open-bottom base section of length to fit over service piping. Include vertical and lateral design loadings of 15,000 lb minimum over 10 by 10 inches (6800 kg minimum over 254 by 254 mm) square.
 - a. Use of this meter box is permitted in walks or unpaved areas away from traffic; do not use in roadways.

X. Concrete Vaults

1. Description: Precast, reinforced-concrete vault, designed for A-16 load designation according to ASTM C 857 and made according to ASTM C 858.
 - a. Ladder: ASTM A 36/A 36M, steel or polyethylene-encased steel steps.
 - b. Manhole: ASTM A 48/A 48M Class No. 35A minimum tensile strength, gray-iron traffic frame and cover.
 - 1) Dimension: 24-inch (610-mm) minimum diameter, unless otherwise indicated.
 - c. Manhole: ASTM A 536, Grade 60-40-18, ductile-iron traffic frame and cover.
 - 1) Dimension: 24-inch- (610-mm-) minimum diameter, unless otherwise indicated.
 - d. Drain: ASME A112.6.3, cast-iron floor drain with outlet of size indicated. Include body anchor flange, light-duty cast-iron grate, bottom outlet, and integral or field-installed bronze ball or clapper-type backwater valve.

Y. Protective Enclosures

1. Freeze-Protection Enclosures:
 - a. Description: Insulated enclosure designed to protect aboveground water piping, equipment, or specialties from freezing and damage, with heat source to maintain minimum internal temperature of 40 deg F (4 deg C) when external temperatures reach as low as minus 34 deg F (minus 36 deg C).
 - 1) Standard: ASSE 1060.
 - 2) Class I: For equipment or devices other than pressure or atmospheric vacuum breakers.
 - 3) Class I-V: For pressure or atmospheric vacuum breaker equipment or devices. Include drain opening in housing.
 - a) Housing: Reinforced-aluminum **OR** -fiberglass, **as directed**, construction.
 - i. Size: Of dimensions indicated, but not less than those required for access and service of protected unit.
 - ii. Drain opening for units with drain connection.
 - iii. Access doors with locking devices.
 - iv. Insulation inside housing.
 - v. Anchoring devices for attaching housing to concrete base.
 - b) Electric heating cable or heater with self-limiting temperature control.
2. Weather-Resistant Enclosures:
 - a. Description: Uninsulated enclosure designed to protect aboveground water piping, equipment, or specialties from weather and damage.
 - 1) Standard: ASSE 1060.
 - 2) Class III: For equipment or devices other than pressure or atmospheric vacuum breakers.
 - 3) Class III-V: For pressure or atmospheric vacuum breaker equipment or devices. Include drain opening in housing.
 - i. Housing: Reinforced-aluminum **OR** -fiberglass, **as directed**, construction.
 - ii. Size: Of dimensions indicated, but not less than those required for access and service of protected unit.
 - iii. Drain opening for units with drain connection.



- iv. Access doors with locking devices.
 - v. Anchoring devices for attaching housing to concrete base.
3. Expanded-Metal Enclosures:
- a. Description: Enclosure designed to protect aboveground water piping, equipment, or specialties from damage.
 - 1) Material: ASTM F 1267, expanded metal side and top panels, of weight and with reinforcement of same metal at edges as required for rigidity.
 - 2) Type: Type I, expanded **OR** II, expanded and flattened, **as directed**.
 - 3) Class: Class 1, uncoated carbon steel **OR** 2, hot-dip, zinc-coated carbon steel **OR** 3, corrosion-resisting steel, **as directed**.
 - 4) Finish: Manufacturer's enamel paint.
 - 5) Size: Of dimensions indicated, but not less than those required for access and service of protected unit.
 - 6) Locking device.
 - 7) Lugs or devices for securing enclosure to base.
4. Enclosure Bases:
- a. Description: 4-inch- (100-mm-) **OR** 6-inch- (150-mm-), **as directed**, minimum thickness precast concrete, of dimensions required to extend at least 6 inches (150 mm) beyond edges of enclosure housings. Include openings for piping.

Z. Fire Hydrants

1. Dry-Barrel Fire Hydrants:
- a. Description (for AWWA dry-barrel fire hydrants): Freestanding, with one NPS 4-1/2 (DN 115) and two NPS 2-1/2 (DN 65) outlets, 5-1/4-inch (133-mm) main valve, drain valve, and NPS 6 (DN 150) mechanical-joint inlet. Include interior coating according to AWWA C550. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure.
 - 1) Standard: AWWA C502.
 - 2) Pressure Rating: 150 psig (1035 kPa) minimum **OR** 250 psig (1725 kPa), **as directed**.
 - 3) Outlet Threads: NFPA 1963, with external hose thread used by local fire department. Include cast-iron caps with steel chains.
 - 4) Operating and Cap Nuts: Pentagon, 1-1/2 inches (38 mm) point to flat.
 - 5) Direction of Opening: Open hydrant valve by turning operating nut to left or counterclockwise.
 - 6) Exterior Finish: Red alkyd-gloss enamel paint, unless otherwise indicated.
 - b. Description (for UL/FMG, dry-barrel fire hydrants): Freestanding, with one NPS 4-1/2 (DN 115) and two NPS 2-1/2 (DN 65) outlets, 5-1/4-inch (133-mm) main valve, drain valve, and NPS 6 (DN 150) mechanical-joint inlet. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure.
 - 1) Standards: UL 246, FMG approved.
 - 2) Pressure Rating: 150 psig (1035 kPa) minimum **OR** 250 psig (1725 kPa), **as directed**.
 - 3) Outlet Threads: NFPA 1963, with external hose thread used by local fire department. Include cast-iron caps with steel chains.
 - 4) Operating and Cap Nuts: Pentagon, 1-1/2 inches (38 mm) point to flat.
 - 5) Direction of Opening: Open hydrant valve by turning operating nut to left or counterclockwise.
 - 6) Exterior Finish: Red alkyd-gloss enamel paint, unless otherwise indicated.
2. Wet-Barrel Fire Hydrants:
- a. Description (for AWWA wet-barrel fire hydrants): Freestanding, with one NPS 4-1/2 (DN 115) and two NPS 2-1/2 (DN 65) outlets, NPS 6 (DN 150) threaded or flanged inlet, and base section with NPS 6 (DN 150) mechanical-joint inlet. Include interior coating according to AWWA C550.
 - 1) Standard: AWWA C503.



- 2) Pressure Rating: 150 psig (1035 kPa) minimum.
 - 3) Outlet Threads: NFPA 1963, with external hose thread used by local fire department. Include cast-iron caps with steel chains.
 - 4) Operating and Cap Nuts: Pentagon, 1-1/2 inches (38 mm) point to flat.
 - 5) Direction of Opening: Open hydrant valves by turning operating nut to left or counterclockwise.
 - 6) Exterior Finish: Red alkyd-gloss enamel paint, unless otherwise indicated.
- b. Description (for UL/FMG, wet-barrel fire hydrants): Freestanding, with one NPS 4-1/2 (DN 115) and two NPS 2-1/2 (DN 65) outlets, NPS 6 (DN 150) threaded or flanged inlet, and base section with NPS 6 (DN 150) mechanical-joint inlet.
- 1) Standards: UL 246 and FMG approved.
 - 2) Pressure Rating: 150 psig (1035 kPa) minimum.
 - 3) Outlet Threads: NFPA 1963, with external hose thread used by local fire department. Include cast-iron caps with steel chains.
 - 4) Operating and Cap Nuts: Pentagon, 1-1/2 inches (38 mm) point to flat.
 - 5) Direction of Opening: Open hydrant valves by turning operating nut to left or counterclockwise.
 - 6) Exterior Finish: Red alkyd-gloss enamel paint, unless otherwise indicated.

AA. Flushing Hydrants

1. Post-Type Flushing Hydrants:
 - a. Description: Nonfreeze and drainable, of length required for shutoff valve installation below frost line.
 - 1) Pressure Rating: 150 psig (1035 kPa) minimum.
 - 2) Outlet: One, with horizontal discharge.
 - 3) Hose Thread: NPS 2-1/2 (DN 65), with NFPA 1963 external hose thread for use by local fire department, and with cast-iron cap with brass chain.
 - 4) Barrel: Cast-iron or steel pipe with breakaway feature.
 - 5) Valve: Bronze body with bronze-ball or plunger closure, and automatic draining.
 - 6) Security: Locking device for padlock.
 - 7) Exterior Finish: Red alkyd-gloss enamel paint, unless otherwise indicated.
 - 8) Inlet: NPS 2 (DN 50) minimum.
 - 9) Operating Wrench: One for each unit.
2. Ground-Type Flushing Hydrants:
 - a. Description: Nonfreeze and drainable, of length required for shutoff valve installation below frost line.
 - 1) Pressure Rating: 150 psig (1035 kPa) minimum.
 - 2) Outlet: One, with vertical **OR** angle, **as directed**, discharge.
 - 3) Hose Thread: NPS 2-1/2 (DN 65), with NFPA 1963 external hose thread for use by local fire department, and with cast-iron cap with brass chain.
 - 4) Barrel: Cast-iron or steel pipe.
 - 5) Valve: Bronze body with bronze-ball or plunger closure, and automatic draining.
 - 6) Inlet: NPS 2 (DN 50) minimum.
 - 7) Hydrant Box: Cast iron with cover, for ground mounting.
 - 8) Operating Wrench: One for each unit.
3. Post-Type Sampling Station:
 - a. Description: Nonfreeze and drainable, of length required for shutoff valve installation below frost line.
 - 1) Pressure Rating: 100 psig (690 kPa) minimum.
 - 2) Sampling Outlet: One unthreaded nozzle with handle.
 - 3) Valve: Bronze body with bronze-ball or plunger closure. Include operating handle.
 - 4) Drain: Tubing with separate manual vacuum pump.
 - 5) Inlet: NPS 3/4 (DN 20) minimum.
 - 6) Housing: Weatherproof material with locking device. Include anchor device.
 - 7) Operating Wrench: One for each unit.



BB. Fire Department Connections

1. Fire Department Connections:

- a. Description: Freestanding, with cast-bronze body, thread inlets according to NFPA 1963 and matching local fire department hose threads, and threaded bottom outlet. Include lugged caps, gaskets, and chains; lugged swivel connection and drop clapper for each hose-connection inlet; 18-inch- (460-mm-) high brass sleeve; and round escutcheon plate.
 - 1) Standard: UL 405.
 - 2) Connections: Two NPS 2-1/2 (DN 65) inlets and one NPS 4 (DN 100) **OR** NPS 6 (DN 150), **as directed**, outlet.
 - 3) Connections: Three **OR** Four, **as directed**, NPS 2-1/2 (DN 65) inlets and one NPS 6 (DN 150) outlet.
 - 4) Connections: Six NPS 2-1/2 (DN 65) inlets and one NPS 6 (DN 150) **OR** NPS 8 (DN 200), **as directed**, outlet.
 - 5) Inlet Alignment: Inline, horizontal **OR** Square, **as directed**.
 - 6) Finish Including Sleeve: Polished chrome-plated **OR** Rough chrome-plated **OR** Polished bronze, **as directed**.
 - 7) Escutcheon Plate Marking: "AUTO SPKR" **OR** "STANDPIPE" **OR** "AUTO SPKR & STANDPIPE."

CC. Alarm Devices

1. Alarm Devices, General: UL 753 and FMG approved, of types and sizes to mate and match piping and equipment.
2. Water-Flow Indicators (can be used with wet-barrel fire hydrants): Vane-type water-flow detector, rated for 250-psig (1725-kPa) working pressure; designed for horizontal or vertical installation; with 2 single-pole, double-throw circuit switches to provide isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal when cover is removed.
3. Supervisory Switches: Single pole, double throw; designed to signal valve in other than fully open position. Mount on stem of OS&Y gate valves and on indicator posts.
4. Pressure Switches: Single pole, double throw; designed to signal increase in pressure. Mount on barrel of dry-barrel fire hydrants.

1.3 EXECUTION

A. Earthwork

1. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

B. Piping Applications

1. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.
2. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.
3. Do not use flanges or unions for underground piping.
4. Flanges, unions, grooved-end-pipe couplings, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.
5. Underground water-service piping NPS 3/4 to NPS 3 (DN 20 to DN 80), **as directed**, shall be selected from the following, **as directed**:
 - a. Soft copper tube, ASTM B 88, Type K (ASTM B 88M, Type A) **OR** ASTM B 88, Type L (ASTM B 88M, Type B), **as directed**; wrought-copper, solder-joint fittings; and brazed **OR** copper, pressure-seal fittings; and pressure-sealed, **as directed**, joints.
 - b. PE, ASTM pipe; insert fittings for PE pipe; and clamped **OR** molded PE fittings; and heat-fusion, **as directed**, joints.
 - c. PVC, Schedule 40 pipe; PVC, Schedule 40 **OR** Schedule 80 pipe; PVC, Schedule 80, **as directed**, socket fittings; and solvent-cemented joints.



- d. NPS 1 to NPS 3 (DN 25 to DN 80) fiberglass, AWWA RTRP, Class 150 **OR** 200 **OR** 250, **as directed**; RTRF; and bonded joints.
- e. Fiberglass, AWWA RTRP, Class 150 **OR** 200 **OR** 250, **as directed**; RTRF; and bonded joints.
6. Underground water-service piping NPS 4 to NPS 8 (DN 100 to DN 200), **as directed**, shall be selected from the following, **as directed**:
 - a. Soft copper tube, ASTM B 88, Type K (ASTM B 88M, Type A) **OR** ASTM B 88, Type L (ASTM B 88M, Type B), **as directed**; wrought-copper, solder-joint fittings; and brazed joints.
 - b. Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed **OR** mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical **OR** grooved-end pipe; ductile-iron-pipe appurtenances; and grooved, **as directed**, joints.
 - c. PE, AWWA pipe; PE, AWWA fittings; and heat-fusion joints.
 - d. PVC, Schedule 40 pipe; PVC, Schedule 40 **OR** Schedule 80 pipe; PVC, Schedule 80, **as directed**, socket fittings; and solvent-cemented joints.
 - e. NPS 4 and NPS 6 (DN 100 and DN 150): NPS 6 (DN 150) PVC, AWWA Class 150 pipe; PVC, AWWA Class 150 fabricated **OR** molded, **as directed**, fittings; and gasketed joints.
 - f. NPS 8 (DN 200): PVC, AWWA Class 200 pipe; PVC, AWWA Class 200 fabricated **OR** push-on-joint, ductile-iron **OR** mechanical-joint, ductile-iron, **as directed**, fittings; and gasketed joints.
 - g. Fiberglass, AWWA RTRP, Class 150 **OR** 200 **OR** 250, **as directed**; RTRF; and bonded joints.
7. Water Meter Box Water-Service Piping NPS 3/4 to NPS 2 (DN 20 to DN 50), **as directed**, shall be same as underground water-service piping.
8. Aboveground and Vault, **as directed**, Water-Service Piping NPS 3/4 to NPS 3 (DN 20 to DN 80), **as directed**, shall be selected from the following:

NOTE: Water-service piping materials listed in subparagraphs below are for potable-water service. They may not be suitable for fire-service mains.

- a. Hard copper tube, ASTM B 88, Type K (ASTM B 88M, Type A) **OR** ASTM B 88, Type L (ASTM B 88M, Type B), **as directed**; wrought-copper, solder-joint fittings; and brazed **OR** copper, pressure-seal fittings; and pressure-sealed, **as directed**, joints.
- b. PVC, Schedule 80 pipe; PVC, Schedule 80 socket fittings; and solvent-cemented **OR** threaded fittings; and threaded, **as directed**, joints.
- c. NPS 1 to NPS 2 (DN 25 to DN 50) fiberglass, AWWA RTRP, Class 150 **OR** 200 **OR** 250, **as directed**; RTRF; and bonded joints.
9. Aboveground and vault, **as directed**, water-service piping NPS 4 to NPS 8 (DN 100 to DN 200), **as directed**, shall be selected from the following:
 - a. Hard copper tube, ASTM B 88, Type K (ASTM B 88M, Type A) **OR** ASTM B 88, Type L (ASTM B 88M, Type B), **as directed**; wrought-copper, solder-joint fittings; and brazed joints.
 - b. Ductile-iron, grooved-end pipe; ductile-iron, grooved-end appurtenances; and grooved joints.
 - c. PVC, Schedule 80 pipe; PVC, Schedule 80 socket fittings; and solvent-cemented **OR** threaded fittings; and threaded, **as directed**, joints.
 - d. Fiberglass, AWWA RTRP, Class 150 **OR** 200 **OR** 250, **as directed**; RTRF; and bonded joints.
10. Underground Fire-Service-Main Piping NPS 4 to NPS 12 (DN 100 to DN 300), **as directed**, shall be selected from the following:

NOTE: Fire-service-main piping materials listed in subparagraphs below are for fire-protection water service. They may not be suitable for potable-water service.

- a. Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed **OR** mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical **OR** grooved-end pipe; ductile-iron-pipe appurtenances; and grooved, **as directed**, joints.
- b. PE, Class 150 **OR** 200, **as directed**, fire-service pipe; molded PE fittings; and heat-fusion joints.



- c. PVC, AWWA Class 150 pipe listed for fire-protection service; PVC Class 150 fabricated or molded fittings; and gasketed joints.
 - d. PVC, AWWA Class 200 pipe listed for fire-protection service; PVC Class 200 fabricated fittings; and gasketed joints.
 - e. Fiberglass, AWWA, FMG-approved RTRP, Class 150 **OR** 200, **as directed**; RTRF; and gasketed joints.
 - f. Fiberglass, UL RTRP, Class 150 **OR** 200 **OR** 250, **as directed**; RTRF; and gasketed joints.
11. Aboveground and Vault, **as directed**, Fire-Service-Main Piping NPS 4 to NPS 12 (DN 100 to DN 300), **as directed**, shall be ductile-iron, grooved-end pipe; ductile-iron-pipe appurtenances; and grooved joints.
12. Underground Combined Water-Service and Fire-Service-Main Piping NPS 6 to NPS 12 (DN 150 to DN 300), **as directed**, shall be selected from the following:
- a. Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed **OR** mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical **OR** grooved-end pipe; ductile-iron-pipe appurtenances; and grooved, **as directed**, joints.
 - b. PVC, AWWA Class 150 **OR** 200, **as directed**, pipe listed for fire-protection service; PVC fabricated or molded fittings of same class as pipe; and gasketed joints.
 - c. Fiberglass, AWWA, FMG-approved RTRP, Class 150 **OR** 200, **as directed**; RTRF; and gasketed joints.
13. Aboveground and Vault, **as directed**, Combined Water Service and Fire-Service-Main Piping NPS 6 to NPS 12 (DN 150 to DN 300), **as directed**, shall be ductile-iron, grooved-end pipe; ductile-iron-pipe appurtenances; and grooved joints.

C. Valve Applications

1. General Application: Use mechanical-joint-end valves for NPS 3 (DN 80) and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FMG, nonrising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 (DN 50) and smaller installation.
2. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - a. Underground Valves, NPS 3 (DN 80) and Larger: AWWA, cast-iron, nonrising-stem, metal **OR** resilient **OR** high-pressure, resilient, **as directed**, -seated gate valves with valve box.
 - b. Underground Valves, NPS 4 (DN 100) and Larger, for Indicator Posts: UL/FMG, cast-iron, nonrising-stem gate valves with indicator post.
 - c. Use the following for valves in vaults and aboveground:
 - 1) Gate Valves, NPS 2 (DN 50) and Smaller: Bronze, nonrising **OR** rising, **as directed**, stem.
 - 2) Gate Valves, NPS 3 (DN 80) and Larger: AWWA, cast iron, OS&Y rising stem, metal seated **OR** AWWA, cast iron, OS&Y rising stem, resilient seated **OR** UL/FMG, cast iron, OS&Y rising stem, **as directed**.
 - 3) Check Valves: AWWA C508 **OR** UL/FMG, **as directed**, swing type.
 - d. Pressure-Reducing Valves: Use for water-service piping in vaults and aboveground to control water pressure.
 - e. Relief Valves: Use for water-service piping in vaults and aboveground.
 - 1) Air-Release Valves: To release accumulated air.
 - 2) Air/Vacuum Valves: To release or admit large volume of air during filling of piping.
 - 3) Combination Air Valves: To release or admit air.
 - f. Detector Check Valves: Use for water-service piping in vaults and aboveground to detect unauthorized use of water.

D. Piping Systems - Common Requirements

1. See Division 22 Section "Common Work Results For Plumbing" for piping-system common requirements.



E. Piping Installation

1. Water-Main Connection (if tap is made by utility company): Arrange with utility company for tap of size and in location indicated in water main.
2. Water-Main Connection (if tap is made by Contractor): Tap water main according to requirements of water utility company and of size and in location indicated.
3. Make connections larger than NPS 2 (DN 50) with tapping machine according to the following:
 - a. Install tapping sleeve and tapping valve according to MSS SP-60.
 - b. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
 - c. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
 - d. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.
4. Make connections NPS 2 (DN 50) and smaller with drilling machine according to the following:
 - a. Install service-saddle assemblies and corporation valves in size, quantity, and arrangement required by utility company standards.
 - b. Install service-saddle assemblies on water-service pipe to be tapped. Position outlets for corporation valves.
 - c. Use drilling machine compatible with service-saddle assemblies and corporation valves. Drill hole in main. Remove drilling machine and connect water-service piping.
 - d. Install corporation valves into service-saddle assemblies.
 - e. Install manifold for multiple taps in water main.
 - f. Install curb valve in water-service piping with head pointing up and with service box.
5. Comply with NFPA 24 for fire-service-main piping materials and installation.
 - a. Install PE corrosion-protection encasement according to ASTM A 674 or AWWA C105.
 - b. Install copper tube and fittings according to CDA's "Copper Tube Handbook."
6. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.
 - a. If required, install PE corrosion-protection encasement according to ASTM A 674 or AWWA C105.
7. Install PE pipe according to ASTM D 2774 and ASTM F 645.
8. Install PVC, AWWA pipe according to ASTM F 645 and AWWA M23.
9. Install fiberglass AWWA pipe according to AWWA M45.
10. Bury piping with depth of cover over top at least 30 inches (750 mm), **as directed**, with top at least 12 inches (300 mm), **as directed**, below level of maximum frost penetration, and according to the following:
 - a. Under Driveways: With at least 36 inches (910 mm), **as directed**, cover over top.
 - b. Under Railroad Tracks: With at least 48 inches (1220 mm), **as directed**, cover over top.
 - c. In Loose Gravelly Soil and Rock: With at least 12 inches (300 mm), **as directed**, additional cover.
11. Install piping by tunneling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed.
12. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.
 - a. Terminate water-service piping at building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.
13. Sleeves are specified in Division 22 Section "Common Work Results For Plumbing".
14. Mechanical sleeve seals are specified in Division 22 Section "Common Work Results For Plumbing".
15. For piping with gasketed joints: Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.
16. See Division 21 Section "Common Work Results For Fire Suppression" for fire-suppression-water piping inside the building.
17. See Division 22 Section "Common Work Results For Plumbing" for potable-water piping inside the building.



F. Joint Construction

1. See Division 22 Section "Common Work Results For Plumbing" for basic piping joint construction.
2. Make pipe joints according to the following:
 - a. Copper-Tubing, Pressure-Sealed Joints: Use proprietary crimping tool and procedure recommended by copper, pressure-seal-fitting manufacturer.
 - b. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.
 - c. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.
 - d. Ductile-Iron Piping, Grooved Joints: Cut-groove pipe. Assemble joints with grooved-end, ductile-iron-piping couplings, gaskets, lubricant, and bolts according to coupling manufacturer's written instructions.
 - e. PE Piping Insert-Fitting Joints: Use plastic insert fittings and fasteners according to fitting manufacturer's written instructions.
 - f. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D 2774 or ASTM D 3139 and pipe manufacturer's written instructions.
 - g. Fiberglass Piping Bonded Joints: Use adhesive and procedure recommended by piping manufacturer.
 - h. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure. Refer to Division 22 Section "Common Work Results For Plumbing" for joining piping of dissimilar metals.

G. Anchorage Installation

1. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:
 - a. Concrete thrust blocks.
 - b. Locking mechanical joints.
 - c. Set-screw mechanical retainer glands.
 - d. Bolted flanged joints.
 - e. Heat-fused joints.
 - f. Pipe clamps and tie rods.
2. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:
 - a. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
 - b. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
 - c. Bonded-Joint Fiberglass, Water-Service Piping: According to AWWA M45.
 - d. Fire-Service-Main Piping: According to NFPA 24.
3. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

H. Valve Installation

1. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.
2. AWWA Valves Other Than Gate Valves: Comply with AWWA C600 and AWWA M44.
3. UL/FMG, Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.
4. UL/FMG, Valves Other Than Gate Valves: Comply with NFPA 24.
5. MSS Valves: Install as component of connected piping system.
6. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.
7. Pressure-Reducing Valves: Install in vault or aboveground between shutoff valves. Install full-size valved bypass, **as directed**.
8. Relief Valves: Comply with AWWA C512. Install aboveground with shutoff valve on inlet.

I. Detector-Check Valve Installation



1. Install in vault or aboveground.
 2. Install for proper direction of flow. Install bypass with water meter, gate valves on each side of meter, and check valve downstream from meter.
 3. Support detector check valves, meters, shutoff valves, and piping on brick or concrete piers.
- J. Water Meter Installation
1. If water meters are provided by the Contractor: Install water meters, piping, and specialties according to utility company's written instructions.
 2. Water Meters: Install displacement **OR** turbine, **as directed**,-type water meters, NPS 2 (DN 50) and smaller, in meter boxes with shutoff valves on water meter inlets. Include valves on water meter outlets and valved bypass around meters unless prohibited by authorities having jurisdiction.
 3. Water Meters: Install compound **OR** turbine, **as directed**,-type water meters, NPS 3 (DN 80) and larger, in meter vaults. Include shutoff valves on water meter inlets and outlets and valved bypass around meters. Support meters, valves, and piping on brick or concrete piers.
 4. Water Meters: Install detector-type water meters in meter vault according to AWWA M6. Include shutoff valves on water meter inlets and outlets and full-size valved bypass around meters. Support meters, valves, and piping on brick or concrete piers.
- K. Roughing-In For Water Meters
1. If Contractor is to rough-in for water meters to be installed by utility company: Rough-in piping and specialties for water meter installation according to utility company's written instructions.
- L. Vacuum Breaker Assembly Installation
1. Install pressure vacuum breaker assemblies of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.
 2. Do not install pressure vacuum breaker assemblies in vault or other space subject to flooding.
- M. Backflow Preventer Installation
1. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.
 2. Do not install backflow preventers that have relief drain in vault or in other spaces subject to flooding.
 3. Do not install bypass piping around backflow preventers.
 4. Support NPS 2-1/2 (DN 65) and larger backflow preventers, valves, and piping near floor and on brick or concrete piers.
- N. Water Meter Box Installation
1. Install water meter boxes in paved areas flush with surface.
 2. Install water meter boxes in grass or earth areas with top 2 inches (50 mm), **as directed**, above surface.
- O. Concrete Vault Installation
1. Install precast concrete vaults according to ASTM C 891.
- P. Protective Enclosure Installation
1. Install concrete base level and with top approximately 2 inches (50 mm), **as directed**, above grade.
 2. Install protective enclosure over valves and equipment.
 3. Anchor protective enclosure to concrete base.
- Q. Fire Hydrant Installation
1. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.



2. Wet-Barrel Fire Hydrants: Install with valve below frost line. Provide for drainage.
3. AWWA Fire Hydrants: Comply with AWWA M17.
4. UL/FMG Fire Hydrants: Comply with NFPA 24.

R. Flushing Hydrant Installation

1. Install post-type flushing hydrants with valve below frost line and provide for drainage. Support in upright position. Include separate gate valve or curb valve and restrained joints in supply piping.
2. Install ground-type flushing hydrants with valve below frost line and provide for drainage. Install hydrant box flush with grade. Include separate gate valve or curb valve and restrained joints in supply piping.
3. Install sampling stations with valve below frost line and provide for drainage. Attach weather-resistant housing and support in upright position. Include separate curb valve in supply piping.

S. Fire Department Connection Installation

1. Install ball drip valves at each check valve for fire department connection to mains.
2. Install protective pipe bollards on two sides of **OR** on three sides of, **as directed**, each fire department connection. Pipe bollards are specified in Division 05 Section "Metal Fabrications".

T. Alarm Device Installation

1. General: Comply with NFPA 24 for devices and methods of valve supervision. Underground valves with valve box do not require supervision.
2. Supervisory Switches: Supervise valves in open position.
 - a. Valves: Grind away portion of exposed valve stem. Bolt switch, with plunger in stem depression, to OS&Y gate-valve yoke.
 - b. Indicator Posts: Drill and thread hole in upper-barrel section at target plate. Install switch, with toggle against target plate, on barrel of indicator post.
3. Locking and Sealing: Secure unsupervised valves as follows:
 - a. Valves: Install chain and padlock on open OS&Y gate valve.
 - b. Post Indicators: Install padlock on wrench on indicator post.
4. Pressure Switches: Drill and thread hole in exposed barrel of fire hydrant. Install switch.
5. Water-Flow Indicators: Install in water-service piping in vault. Select indicator with saddle and vane matching pipe size. Drill hole in pipe, insert vane, and bolt saddle to pipe.
6. Connect alarm devices to building fire alarm system. Wiring and fire-alarm devices are specified in Division 28.

U. Connections

1. Piping installation requirements are specified in other Division 22. Drawings indicate general arrangement of piping, fittings, and specialties.
2. See Division 22 Section "Common Work Results For Plumbing" for piping connections to valves and equipment.
3. Connect water-distribution piping to utility water main **OR** existing water main, **as directed**. Use tapping sleeve and tapping valve **OR** service clamp and corporation valve, **as directed**.
4. Connect water-distribution piping to interior domestic water **OR** fire-suppression, **as directed**, piping.
5. Connect waste piping from concrete vault drains to sanitary sewerage system. See Division 22 for connection to sanitary-sewer **OR** storm-drainage system. See Division 23 for connection to storm-sewer, **as directed**, piping.
6. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
7. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

V. Field Quality Control



1. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.
2. Hydrostatic Tests: Test at not less than one-and-one-half times working pressure for two hours.
 - a. Increase pressure in 50-psig (350-kPa) increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig (0 kPa). Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts (1.89 L) per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.
3. Prepare reports of testing activities.

W. Identification

1. Install continuous underground detectable, **as directed**, warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Division 31 Section "Earth Moving".
2. Permanently attach equipment nameplate or marker indicating plastic water-service piping, on main electrical meter panel. See Division 22 Section "Common Work Results For Plumbing" for identifying devices.

NOTE: Delete paragraph above if metallic water-service piping without electrically insulated fittings will be used.

X. Cleaning

1. Clean and disinfect water-distribution piping as follows:
 - a. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
 - b. If fire-protection-water piping is not connected to potable-water supply, use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
 - c. If fire-protection-water piping is connected to potable-water supply, use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:
 - 1) Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours **OR** Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours, **as directed**.
 - 2) After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
 - 3) Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.
2. Prepare reports of purging and disinfecting activities.

END OF SECTION 21 05 19 00



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SECTION 21 05 19 00a - METERS AND GAGES FOR PLUMBING PIPING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for meters and gages for plumbing piping. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Bimetallic-actuated thermometers.
 - b. Filled-system thermometers.
 - c. Liquid-in-glass thermometers.
 - d. Light-activated thermometers.
 - e. Thermowells.
 - f. Dial-type pressure gages.
 - g. Gage attachments.
 - h. Test plugs.
 - i. Test-plug kits.
 - j. Sight flow indicators.

C. Submittals

1. Product Data: For each type of product indicated.
2. Product Certificates: For each type of meter and gage, from manufacturer.
3. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

1.2 PRODUCTS

A. Bimetallic-Actuated Thermometers

1. Standard: ASME B40.200.
2. Case: Liquid-filled and sealed type(s); stainless steel with 3-inch (76-mm) **OR** 5-inch (127-mm), **as directed**, nominal diameter.
3. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F (deg C) **OR** deg F and deg C, **as directed**.
4. Connector Type(s): Union joint, adjustable angle **OR** rigid, back **OR** rigid, bottom, **as directed**, with unified-inch screw threads.
5. Connector Size: 1/2 inch (13 mm), with ASME B1.1 screw threads.
6. Stem: 0.25 or 0.375 inch (6.4 or 9.4 mm) in diameter; stainless steel.
7. Window: Plain glass or plastic.
8. Ring: Stainless steel.
9. Element: Bimetal coil.
10. Pointer: Dark-colored metal.
11. Accuracy: Plus or minus 1 **OR** 1.5, **as directed**, percent of scale range.

B. Filled-System Thermometers

1. Direct-Mounted, Metal-Case, Vapor-Actuated Thermometers:
 - a. Standard: ASME B40.200.
 - b. Case: Sealed type, cast aluminum or drawn steel; 4-1/2-inch (114-mm) **OR** 5-inch (127-mm) **OR** 6-inch (152-mm), **as directed**, nominal diameter.
 - c. Element: Bourdon tube or other type of pressure element.



- d. Movement: Mechanical, dampening type, **as directed**, with link to pressure element and connection to pointer.
- e. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F (deg C) **OR** deg F and deg C, **as directed**.
- f. Pointer: Dark-colored metal.
- g. Window: Glass or plastic.
- h. Ring: Metal **OR** Stainless steel, **as directed**.
- i. Connector Type(s): Union joint, adjustable, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device **OR** rigid, back **OR** rigid, bottom, **as directed**; with ASME B1.1 screw threads.
- j. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.
 - 1) Design for Thermowell Installation: Bare stem.
- k. Accuracy: Plus or minus 1 percent of scale range.
- 2. Direct-Mounted, Plastic-Case, Vapor-Actuated Thermometers:
 - a. Standard: ASME B40.200.
 - b. Case: Sealed type, plastic; 4-1/2-inch (114-mm) **OR** 5-inch (127-mm) **OR** 6-inch (152-mm), **as directed**, nominal diameter.
 - c. Element: Bourdon tube or other type of pressure element.
 - d. Movement: Mechanical, with link to pressure element and connection to pointer.
 - e. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F (deg C) **OR** deg F and deg C, **as directed**.
 - f. Pointer: Dark-colored metal.
 - g. Window: Glass or plastic.
 - h. Ring: Metal or plastic.
 - i. Connector Type(s): Union joint, adjustable, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device **OR** rigid, back **OR** rigid, bottom, **as directed**; with ASME B1.1 screw threads.
 - j. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.
 - 1) Design for Thermowell Installation: Bare stem.
 - k. Accuracy: Plus or minus 1 percent of scale range.
- 3. Remote-Mounted, Metal-Case, Vapor-Actuated Thermometers:
 - a. Standard: ASME B40.200.
 - b. Case: Sealed type, cast aluminum or drawn steel; 4-1/2-inch (114-mm) **OR** 6-inch (152-mm), **as directed**, nominal diameter with back **OR** front, **as directed**, flange and holes for panel mounting.
 - c. Element: Bourdon tube or other type of pressure element.
 - d. Movement: Mechanical, with link to pressure element and connection to pointer.
 - e. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F (deg C) **OR** deg F and deg C, **as directed**.
 - f. Pointer: Dark-colored metal.
 - g. Window: Glass or plastic.
 - h. Ring: Metal **OR** Stainless steel, **as directed**.
 - i. Connector Type(s): Union joint, back **OR** bottom, **as directed**; with ASME B1.1 screw threads.
 - j. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.
 - 1) Design for Thermowell Installation: Bare stem.
 - k. Accuracy: Plus or minus 1 percent of scale range.
- 4. Remote-Mounted, Plastic-Case, Vapor-Actuated Thermometers:
 - a. Standard: ASME B40.200.
 - b. Case: Sealed type, plastic; 4-1/2-inch (114-mm) **OR** 6-inch (152-mm), **as directed**, nominal diameter with back **OR** front, **as directed**, flange and holes for panel mounting.
 - c. Element: Bourdon tube or other type of pressure element.



- d. Movement: Mechanical, with link to pressure element and connection to pointer.
- e. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F (deg C) **OR** deg F and deg C, **as directed**.
- f. Pointer: Dark-colored metal.
- g. Window: Glass or plastic.
- h. Ring: Metal or plastic.
- i. Connector Type(s): Union joint, threaded, back **OR** bottom, **as directed**; with ASME B1.1 screw threads.
- j. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.
 - 1) Design for Thermowell Installation: Bare stem.
- k. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

C. Liquid-In-Glass Thermometers

- 1. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:
 - a. Standard: ASME B40.200.
 - b. Case: Cast aluminum; 6-inch (152-mm) nominal size.
 - c. Case Form: Back angle **OR** Straight, **as directed**, unless otherwise indicated.
 - d. Tube: Glass with magnifying lens and blue or red organic liquid.
 - e. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F (deg C) **OR** deg F and deg C, **as directed**.
 - f. Window: Glass or plastic.
 - g. Stem: Aluminum or brass and of length to suit installation.
 - 1) Design for Thermowell Installation: Bare stem.
 - h. Connector: 3/4 inch (19 mm), with ASME B1.1 screw threads.
 - i. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.
- 2. Plastic-Case, Compact-Style, Liquid-in-Glass Thermometers:
 - a. Standard: ASME B40.200.
 - b. Case: Plastic; 6-inch (152-mm) nominal size.
 - c. Case Form: Back angle **OR** Straight, **as directed**, unless otherwise indicated.
 - d. Tube: Glass with magnifying lens and blue or red organic liquid.
 - e. Tube Background: Nonreflective with permanently etched scale markings graduated in deg F (deg C) **OR** deg F and deg C, **as directed**.
 - f. Window: Glass or plastic.
 - g. Stem: Aluminum or brass and of length to suit installation.
 - 1) Design for Thermowell Installation: Bare stem.
 - h. Connector: 3/4 inch (19 mm), with ASME B1.1 screw threads.
 - i. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.
- 3. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:
 - a. Standard: ASME B40.200.
 - b. Case: Cast aluminum; 7-inch (178-mm) **OR** 9-inch (229-mm), **as directed**, nominal size unless otherwise indicated.
 - c. Case Form: Adjustable angle **OR** Back angle **OR** Straight, **as directed**, unless otherwise indicated.
 - d. Tube: Glass with magnifying lens and blue or red organic liquid.
 - e. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F (deg C) **OR** deg F and deg C, **as directed**.
 - f. Window: Glass or plastic.
 - g. Stem: Aluminum and of length to suit installation.
 - 1) Design for Thermowell Installation: Bare stem.
 - h. Connector: 1-1/4 inches (32 mm), with ASME B1.1 screw threads.
 - i. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.



4. Plastic-Case, Industrial-Style, Liquid-in-Glass Thermometers:
 - a. Standard: ASME B40.200.
 - b. Case: Plastic; 7-inch (178-mm) **OR** 9-inch (229-mm), **as directed**, nominal size unless otherwise indicated.
 - c. Case Form: Adjustable angle **OR** Back angle **OR** Straight, **as directed**, unless otherwise indicated.
 - d. Tube: Glass with magnifying lens and blue or red organic liquid.
 - e. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F (deg C) **OR** deg F and deg C, **as directed**.
 - f. Window: Glass or plastic.
 - g. Stem: Aluminum **OR** Brass **OR** Stainless steel **OR** Aluminum, brass, or stainless steel, **as directed**, and of length to suit installation.
 - 1) Design for Thermowell Installation: Bare stem.
 - h. Connector: 1-1/4 inches (32 mm), with ASME B1.1 screw threads.
 - i. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

- D. Light-Activated Thermometers
 1. Direct-Mounted, Light-Activated Thermometers:
 - a. Case: Plastic **OR** Metal, **as directed**; 7-inch (178-mm) **OR** 9-inch (229-mm), **as directed**, nominal size unless otherwise indicated.
 - b. Scale(s): Deg F (Deg C) **OR** Deg F and deg C, **as directed**.
 - c. Case Form: Adjustable angle.
 - d. Connector: 1-1/4 inches (32 mm), with ASME B1.1 screw threads.
 - e. Stem: Aluminum and of length to suit installation.
 - 1) Design for Thermowell Installation: Bare stem.
 - f. Display: Digital.
 - g. Accuracy: Plus or minus 2 deg F (1 deg C).
 2. Remote-Mounted, Light-Activated Thermometers:
 - a. Case: Plastic, for wall mounting.
 - b. Scale(s): Deg F (Deg C) **OR** Deg F and deg C, **as directed**.
 - c. Sensor: Bulb and thermister wire.
 - 1) Design for Thermowell Installation: Bare stem.
 - d. Display: Digital.
 - e. Accuracy: Plus or minus 2 deg F (1 deg C).

- E. Thermowells
 1. Thermowells:
 - a. Standard: ASME B40.200.
 - b. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
 - c. Material for Use with Copper Tubing: CNR or CUNI.
 - d. Material for Use with Steel Piping: CRES **OR** CSA, **as directed**.
 - e. Type: Stepped shank unless straight or tapered shank is indicated.
 - f. External Threads: NPS 1/2, NPS 3/4, or NPS 1, (DN 15, DN 20, or NPS 25,) ASME B1.20.1 pipe threads.
 - g. Internal Threads: 1/2, 3/4, and 1 inch (13, 19, and 25 mm), with ASME B1.1 screw threads.
 - h. Bore: Diameter required to match thermometer bulb or stem.
 - i. Insertion Length: Length required to match thermometer bulb or stem.
 - j. Lagging Extension: Include on thermowells for insulated piping and tubing.
 - k. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.
 2. Heat-Transfer Medium: Mixture of graphite and glycerin.

- F. Pressure Gages



1. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:
 - a. Standard: ASME B40.100.
 - b. Case: Liquid-filled **OR** Sealed **OR** Open-front, pressure relief **OR** Solid-front, pressure relief, **as directed**, type(s); cast aluminum or drawn steel; 4-1/2-inch (114-mm) **OR** 6-inch (152-mm), **as directed**, nominal diameter.
 - c. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
 - d. Pressure Connection: Brass, with NPS 1/4 (DN 8) **OR** NPS 1/4 or NPS 1/2 (DN 8 or DN 15) **OR** NPS 1/2 (DN 15), **as directed**, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
 - e. Movement: Mechanical, with link to pressure element and connection to pointer.
 - f. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi (kPa) **OR** psi and kPa, **as directed**.
 - g. Pointer: Dark-colored metal.
 - h. Window: Glass or plastic.
 - i. Ring: Metal **OR** Brass **OR** Stainless steel, **as directed**.
 - j. Accuracy: Grade A, plus or minus 1 percent of middle half of **OR** Grade B, plus or minus 2 percent of middle half of **OR** Grade C, plus or minus 3 percent of middle half of **OR** Grade D, plus or minus 5 percent of whole, **as directed**, scale range.
2. Direct-Mounted, Plastic-Case, Dial-Type Pressure Gages:
 - a. Standard: ASME B40.100.
 - b. Case: Sealed type; plastic; 4-1/2-inch (114-mm) **OR** 6-inch (152-mm), **as directed**, nominal diameter.
 - c. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
 - d. Pressure Connection: Brass, with NPS 1/4 (DN 8) **OR** NPS 1/4 or NPS 1/2 (DN 8 or DN 15) **OR** NPS 1/2 (DN 15), **as directed**, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
 - e. Movement: Mechanical, with link to pressure element and connection to pointer.
 - f. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi (kPa) **OR** psi and kPa, **as directed**.
 - g. Pointer: Dark-colored metal.
 - h. Window: Glass or plastic.
 - i. Accuracy: Grade A, plus or minus 1 percent of middle half of **OR** Grade B, plus or minus 2 percent of middle half of **OR** Grade C, plus or minus 3 percent of middle half of **OR** Grade D, plus or minus 5 percent of whole, **as directed**, scale range.
3. Remote-Mounted, Metal-Case, Dial-Type Pressure Gages:
 - a. Standard: ASME B40.100.
 - b. Case: Liquid-filled **OR** Sealed, **as directed**, type; cast aluminum or drawn steel **OR** metal, **as directed**; 4-1/2-inch (114-mm) **OR** 6-inch (152-mm), **as directed**, nominal diameter with back **OR** front, **as directed**, flange and holes for panel mounting.
 - c. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
 - d. Pressure Connection: Brass, with NPS 1/4 (DN 8) **OR** NPS 1/4 or NPS 1/2 (DN 8 or DN 15) **OR** NPS 1/2 (DN 15), **as directed**, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
 - e. Movement: Mechanical, with link to pressure element and connection to pointer.
 - f. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi (kPa) **OR** psi and kPa, **as directed**.
 - g. Pointer: Dark-colored metal.
 - h. Window: Glass or plastic.
 - i. Ring: Metal **OR** Stainless steel, **as directed**.
 - j. Accuracy: Grade A, plus or minus 1 percent of middle half of **OR** Grade B, plus or minus 2 percent of middle half of **OR** Grade C, plus or minus 3 percent of middle half of **OR** Grade D, plus or minus 5 percent of whole, **as directed**, scale range.
4. Remote-Mounted, Plastic-Case, Dial-Type Pressure Gages:
 - a. Standard: ASME B40.100.
 - b. Case: Sealed type; plastic; 4-1/2-inch (114-mm) **OR** 6-inch (152-mm), **as directed**, nominal diameter with back **OR** front, **as directed**, flange and holes for panel mounting.



- c. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
 - d. Pressure Connection: Brass, with NPS 1/4 (DN 8) **OR** NPS 1/4 or NPS 1/2 (DN 8 or DN 15) **OR** NPS 1/2 (DN 15), **as directed**, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
 - e. Movement: Mechanical, with link to pressure element and connection to pointer.
 - f. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi (kPa) **OR** psi and kPa, **as directed**.
 - g. Pointer: Dark-colored metal.
 - h. Window: Glass or plastic.
 - i. Accuracy: Grade A, plus or minus 1 percent of middle half of **OR** Grade B, plus or minus 2 percent of middle half of **OR** Grade C, plus or minus 3 percent of middle half of **OR** Grade D, plus or minus 5 percent of whole, **as directed**, scale range.
- G. Gage Attachments
- 1. Snubbers: ASME B40.100, brass; with NPS 1/4 (DN 8) **OR** NPS 1/4 or NPS 1/2 (DN 8 or DN 15) **OR** NPS 1/2 (DN 15), **as directed**, ASME B1.20.1 pipe threads and piston **OR** porous-metal, **as directed**, -type surge-dampening device. Include extension for use on insulated piping.
 - 2. Valves: Brass ball **OR** Brass or stainless-steel needle, **as directed**, with NPS 1/4 (DN 8) **OR** NPS 1/4 or NPS 1/2 (DN 8 or DN 15) **OR** NPS 1/2 (DN 15), **as directed**, ASME B1.20.1 pipe threads.
- H. Test Plugs
- 1. Description: Test-station fitting made for insertion into piping tee fitting.
 - 2. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.
 - 3. Thread Size: NPS 1/4 (DN 8) or NPS 1/2 (DN 15), ASME B1.20.1 pipe thread.
 - 4. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F (3450 kPa at 93 deg C).
 - 5. Core Inserts: Chlorosulfonated polyethylene synthetic and EPDM self-sealing rubber.
- I. Test-Plug Kits
- 1. Furnish one test-plug kit(s) containing one **OR** two, **as directed**, thermometer(s), one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.
 - 2. Low-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- (25- to 51-mm-) diameter dial and tapered-end sensing element. Dial range shall be at least 25 to 125 deg F (minus 4 to plus 52 deg C).
 - 3. High-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- (25- to 51-mm-) diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220 deg F (minus 18 to plus 104 deg C).
 - 4. Pressure Gage: Small, Bourdon-tube insertion type with 2- to 3-inch- (51- to 76-mm-) diameter dial and probe. Dial range shall be at least 0 to 200 psig (0 to 1380 kPa).
 - 5. Carrying Case: Metal or plastic, with formed instrument padding.
- J. Sight Flow Indicators
- 1. Description: Piping inline-installation device for visual verification of flow.
 - 2. Construction: Bronze or stainless-steel body, with sight glass and ball, flapper, or paddle wheel indicator, and threaded or flanged ends.
 - 3. Minimum Pressure Rating: 125 psig (860 kPa) **OR** 150 psig (1034 kPa), **as directed**.
 - 4. Minimum Temperature Rating: 200 deg F (93 deg C).
 - 5. End Connections for NPS 2 (DN 50) and Smaller: Threaded.
 - 6. End Connections for NPS 2-1/2 (DN 65) and Larger: Flanged.



1.3 EXECUTION

A. Installation

1. Install thermowells with socket extending a minimum of 2 inches (51 mm) into fluid **OR** one-third of pipe diameter **OR** to center of pipe, **as directed**, and in vertical position in piping tees.
2. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
3. Install thermowells with extension on insulated piping.
4. Fill thermowells with heat-transfer medium.
5. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
6. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.
7. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
8. Install remote-mounted pressure gages on panel.
9. Install valve and snubber in piping for each pressure gage for fluids.
10. Install test plugs in piping tees.
11. Install thermometers in the following locations:
 - a. Inlet and outlet of each water heater.
 - b. Inlets and outlets of each domestic water heat exchanger.
 - c. Inlet and outlet of each domestic hot-water storage tank.
 - d. Inlet and outlet of each remote domestic water chiller.
12. Install pressure gages in the following locations:
 - a. Building water service entrance into building.
 - b. Inlet and outlet of each pressure-reducing valve.
 - c. Suction and discharge of each domestic water pump.

B. Connections

1. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

C. Adjusting

1. Adjust faces of meters and gages to proper angle for best visibility.

D. Thermometer Schedule

1. Thermometers at inlet and outlet of each domestic water heater shall be one of the following:
 - a. Liquid-filled **OR** Sealed, **as directed**, bimetallic-actuated type.
 - b. Direct **OR** Remote, **as directed**, -mounted, metal **OR** plastic, **as directed**, -case, vapor-actuated type.
 - c. Compact **OR** Industrial, **as directed**, -style, liquid-in-glass type.
 - d. Direct **OR** Remote, **as directed**, -mounted, light-activated type.
 - e. Test plug with chlorosulfonated polyethylene synthetic **OR** EPDM, **as directed**, self-sealing rubber inserts.
2. Thermometers at inlets and outlets of each domestic water heat exchanger shall be one of the following:
 - a. Liquid-filled **OR** Sealed, **as directed**, bimetallic-actuated type.
 - b. Direct **OR** Remote, **as directed**, -mounted, metal **OR** plastic, **as directed**, -case, vapor-actuated type.
 - c. Compact **OR** Industrial, **as directed**, -style, liquid-in-glass type.
 - d. Direct **OR** Remote, **as directed**, -mounted, light-activated type.
 - e. Test plug with chlorosulfonated polyethylene synthetic **OR** EPDM, **as directed**, self-sealing rubber inserts.
3. Thermometers at inlet and outlet of each domestic hot-water storage tank shall be one of the following:
 - a. Liquid-filled **OR** Sealed, **as directed**, bimetallic-actuated type.



- b. Direct **OR** Remote, **as directed**, -mounted, metal **OR** plastic, **as directed**, -case, vapor-actuated type.
 - c. Compact **OR** Industrial, **as directed**, -style, liquid-in-glass type.
 - d. Direct **OR** Remote, **as directed**, -mounted, light-activated type.
 - e. Test plug with chlorosulfonated polyethylene synthetic **OR** EPDM, **as directed**, self-sealing rubber inserts.
4. Thermometers at inlet and outlet of each remote domestic water chiller shall be one of the following:
 - a. Liquid-filled **OR** Sealed, **as directed**, bimetallic-actuated type.
 - b. Direct **OR** Remote, **as directed**, -mounted, metal **OR** plastic, **as directed**, -case, vapor-actuated type.
 - c. Compact **OR** Industrial, **as directed**, -style, liquid-in-glass type.
 - d. Direct **OR** Remote, **as directed**, -mounted, light-activated type.
 - e. Test plug with chlorosulfonated polyethylene synthetic **OR** EPDM, **as directed**, self-sealing rubber inserts.
 5. Thermometer stems shall be of length to match thermowell insertion length.
- E. Thermometer Scale-Range Schedule
1. Scale Range for Domestic Cold-Water Piping: 0 to 100 deg F (Minus 20 to plus 50 deg C) **OR** 0 to 100 deg F and minus 20 to plus 50 deg C, **as directed**.
 2. Scale Range for Domestic Cold-Water Piping: 0 to 150 deg F (Minus 20 to plus 70 deg C) **OR** 0 to 150 deg F and minus 20 to plus 70 deg C, **as directed**.
 3. Scale Range for Domestic Cold-Water Piping: 30 to 240 deg F (0 to plus 115 deg C) **OR** 30 to 240 deg F and 0 to plus 115 deg C, **as directed**.
 4. Scale Range for Domestic Hot-Water Piping: 0 to 250 deg F (0 to 150 deg C) **OR** 0 to 250 deg F and 0 to 150 deg C, **as directed**.
 5. Scale Range for Domestic Hot-Water Piping: 20 to 240 deg F (0 to 150 deg C) **OR** 20 to 240 deg F and 0 to 150 deg C, **as directed**.
 6. Scale Range for Domestic Hot-Water Piping: 30 to 240 deg F (0 to plus 115 deg C) **OR** 30 to 240 deg F and 0 to plus 115 deg C, **as directed**.
 7. Scale Range for Domestic Cooled-Water Piping: 0 to 100 deg F (Minus 20 to plus 50 deg C) **OR** 0 to 100 deg F and minus 20 to plus 50 deg C, **as directed**.
 8. Scale Range for Domestic Cooled-Water Piping: 0 to 150 deg F (Minus 20 to plus 70 deg C) **OR** 0 to 150 deg F and minus 20 to plus 70 deg C, **as directed**.
- F. Pressure-Gage Schedule
1. Pressure gages at discharge of each water service into building shall be one of the following:
 - a. Liquid-filled **OR** Sealed **OR** Open-front, pressure-relief **OR** Solid-front, pressure-relief, **as directed**, direct **OR** remote, **as directed**, -mounted, metal case.
 - b. Sealed, direct **OR** remote, **as directed**, -mounted, plastic case.
 - c. Test plug with chlorosulfonated polyethylene synthetic **OR** EPDM, **as directed**, self-sealing rubber inserts.
 2. Pressure gages at inlet and outlet of each water pressure-reducing valve shall be one of the following:
 - a. Liquid-filled **OR** Sealed **OR** Open-front, pressure-relief **OR** Solid-front, pressure-relief, **as directed**, direct **OR** remote, **as directed**, -mounted, metal case.
 - b. Sealed, direct **OR** remote, **as directed**, -mounted, plastic case.
 - c. Test plug with chlorosulfonated polyethylene synthetic **OR** EPDM, **as directed**, self-sealing rubber inserts.
 3. Pressure gages at suction and discharge of each domestic water pump shall be one of the following:
 - a. Liquid-filled **OR** Sealed **OR** Open-front, pressure-relief **OR** Solid-front, pressure-relief, **as directed**, direct **OR** remote, **as directed**, -mounted, metal case.
 - b. Sealed, direct **OR** remote, **as directed**, -mounted, plastic case.



- c. Test plug with chlorosulfonated polyethylene synthetic **OR** EPDM, **as directed**, self-sealing rubber inserts.

G. Pressure-Gage Scale-Range Schedule

1. Scale Range for Water Service Piping: 0 to 100 psi (0 to 600 kPa) **OR** 0 to 100 psi and 0 to 600 kPa, **as directed**.
2. Scale Range for Water Service Piping: 0 to 160 psi (0 to 1100 kPa) **OR** 0 to 160 psi and 0 to 1100 kPa, **as directed**.
3. Scale Range for Water Service Piping: 0 to 200 psi (0 to 1400 kPa) **OR** 0 to 200 psi and 0 to 1400 kPa, **as directed**.
4. Scale Range for Domestic Water Piping: 0 to 100 psi (0 to 600 kPa) **OR** 0 to 100 psi and 0 to 600 kPa, **as directed**.
5. Scale Range for Domestic Water Piping: 0 to 160 psi (0 to 1100 kPa) **OR** 0 to 160 psi and 0 to 1100 kPa, **as directed**.
6. Scale Range for Domestic Water Piping: 0 to 200 psi (0 to 1400 kPa) **OR** 0 to 200 psi and 0 to 1400 kPa, **as directed**.
7. Scale Range for Domestic Water Piping: 0 to 300 psi (0 to 2500 kPa) **OR** 0 to 300 psi and 0 to 2500 kPa, **as directed**.

END OF SECTION 21 05 19 00a



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SECTION 21 05 19 00b - METERS AND GAGES FOR HVAC PIPING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for meters and gages for HVAC piping. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Bimetallic-actuated thermometers.
 - b. Filled-system thermometers.
 - c. Liquid-in-glass thermometers.
 - d. Light-activated thermometers.
 - e. Thermowells.
 - f. Dial-type pressure gages.
 - g. Gage attachments.
 - h. Test plugs.
 - i. Test-plug kits.
 - j. Sight flow indicators.
 - k. Orifice flowmeters.
 - l. Pitot-tube flowmeters.
 - m. Turbine flowmeters.
 - n. Venturi flowmeters.
 - o. Vortex-shedding flowmeters.
 - p. Impeller-turbine, thermal-energy meters.
 - q. Ultrasonic, thermal-energy meters.

C. Submittals

1. Product Data: For each type of product indicated.
2. Wiring Diagrams: For power, signal, and control wiring.
3. Product Certificates: For each type of meter and gage, from manufacturer.
4. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

1.2 PRODUCTS

A. Bimetallic-Actuated Thermometers

1. Standard: ASME B40.200.
2. Case: Liquid-filled and sealed type(s); stainless steel with 3-inch (76-mm) **OR** 5-inch (127-mm), **as directed**, nominal diameter.
3. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F (deg C) **OR** deg F and deg C, **as directed**.
4. Connector Type(s): Union joint, adjustable angle **OR** rigid, back **OR** rigid, bottom, **as directed**, with unified-inch screw threads.
5. Connector Size: 1/2 inch (13 mm), with ASME B1.1 screw threads.
6. Stem: 0.25 or 0.375 inch (6.4 or 9.4 mm) in diameter; stainless steel.
7. Window: Plain glass or plastic.
8. Ring: Stainless steel.
9. Element: Bimetal coil.
10. Pointer: Dark-colored metal.



11. Accuracy: Plus or minus 1 **OR** 1.5, **as directed**, percent of scale range.

B. Filled-System Thermometers

1. Direct-Mounted, Metal-Case, Vapor-Actuated Thermometers:
 - a. Standard: ASME B40.200.
 - b. Case: Sealed type, cast aluminum or drawn steel; 4-1/2-inch (114-mm) **OR** 5-inch (127-mm) **OR** 6-inch (152-mm), **as directed**, nominal diameter.
 - c. Element: Bourdon tube or other type of pressure element.
 - d. Movement: Mechanical, dampening type, **as directed**, with link to pressure element and connection to pointer.
 - e. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F (deg C) **OR** deg F and deg C, **as directed**.
 - f. Pointer: Dark-colored metal.
 - g. Window: Glass or plastic.
 - h. Ring: Metal **OR** Stainless steel.
 - i. Connector Type(s): Union joint, adjustable, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device **OR** rigid, back **OR** rigid, bottom, **as directed**; with ASME B1.1 screw threads.
 - j. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.
 - 1) Design for Air-Duct Installation: With ventilated shroud.
 - 2) Design for Thermowell Installation: Bare stem.
 - k. Accuracy: Plus or minus 1 percent of scale range.
2. Direct-Mounted, Plastic-Case, Vapor-Actuated Thermometers:
 - a. Standard: ASME B40.200.
 - b. Case: Sealed type, plastic; 4-1/2-inch (114-mm) **OR** 5-inch (127-mm) **OR** 6-inch (152-mm), **as directed**, nominal diameter.
 - c. Element: Bourdon tube or other type of pressure element.
 - d. Movement: Mechanical, with link to pressure element and connection to pointer.
 - e. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F (deg C) **OR** deg F and deg C, **as directed**.
 - f. Pointer: Dark-colored metal.
 - g. Window: Glass or plastic.
 - h. Ring: Metal or plastic.
 - i. Connector Type(s): Union joint, adjustable, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device **OR** rigid, back **OR** rigid, bottom, **as directed**; with ASME B1.1 screw threads.
 - j. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.
 - 1) Design for Air-Duct Installation: With ventilated shroud.
 - 2) Design for Thermowell Installation: Bare stem.
 - k. Accuracy: Plus or minus 1 percent of scale range.
3. Remote-Mounted, Metal-Case, Vapor-Actuated Thermometers:
 - a. Standard: ASME B40.200.
 - b. Case: Sealed type, cast aluminum or drawn steel; 4-1/2-inch (114-mm) **OR** 6-inch (152-mm), **as directed**, nominal diameter with back **OR** front, **as directed**, flange and holes for panel mounting.
 - c. Element: Bourdon tube or other type of pressure element.
 - d. Movement: Mechanical, with link to pressure element and connection to pointer.
 - e. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F (deg C) **OR** deg F and deg C, **as directed**.
 - f. Pointer: Dark-colored metal.
 - g. Window: Glass or plastic.
 - h. Ring: Metal **OR** Stainless steel, **as directed**.



- i. Connector Type(s): Union joint, back **OR** bottom, **as directed**; with ASME B1.1 screw threads.
 - j. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.
 - 1) Design for Air-Duct Installation: With ventilated shroud.
 - 2) Design for Thermowell Installation: Bare stem.
 - k. Accuracy: Plus or minus 1 percent of scale range.
4. Remote-Mounted, Plastic-Case, Vapor-Actuated Thermometers:
- a. Standard: ASME B40.200.
 - b. Case: Sealed type, plastic; 4-1/2-inch (114-mm) **OR** 6-inch (152-mm), **as directed**, nominal diameter with back **OR** front, **as directed**, flange and holes for panel mounting.
 - c. Element: Bourdon tube or other type of pressure element.
 - d. Movement: Mechanical, with link to pressure element and connection to pointer.
 - e. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F (deg C) **OR** deg F and deg C, **as directed**.
 - f. Pointer: Dark-colored metal.
 - g. Window: Glass or plastic.
 - h. Ring: Metal or plastic.
 - i. Connector Type(s): Union joint, threaded, back **OR** bottom, **as directed**; with ASME B1.1 screw threads.
 - j. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.
 - 1) Design for Air-Duct Installation: With ventilated shroud.
 - 2) Design for Thermowell Installation: Bare stem.
 - k. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.
- C. Liquid-In-Glass Thermometers
- 1. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:
 - a. Standard: ASME B40.200.
 - b. Case: Cast aluminum; 6-inch (152-mm) nominal size.
 - c. Case Form: Back angle **OR** Straight, **as directed**, unless otherwise indicated.
 - d. Tube: Glass with magnifying lens and blue or red, **as directed**, organic liquid.
 - e. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F (deg C) **OR** deg F and deg C, **as directed**.
 - f. Window: Glass or plastic.
 - g. Stem: Aluminum or brass and of length to suit installation.
 - 1) Design for Air-Duct Installation: With ventilated shroud.
 - 2) Design for Thermowell Installation: Bare stem.
 - h. Connector: 3/4 inch (19 mm), with ASME B1.1 screw threads.
 - i. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.
 - 2. Plastic-Case, Compact-Style, Liquid-in-Glass Thermometers:
 - a. Standard: ASME B40.200.
 - b. Case: Plastic; 6-inch (152-mm) nominal size.
 - c. Case Form: Back angle **OR** Straight, **as directed**, unless otherwise indicated.
 - d. Tube: Glass with magnifying lens and blue or red, **as directed**, organic liquid.
 - e. Tube Background: Nonreflective with permanently etched scale markings graduated in deg F (deg C) **OR** deg F and deg C, **as directed**.
 - f. Window: Glass or plastic.
 - g. Stem: Aluminum or brass and of length to suit installation.
 - 1) Design for Air-Duct Installation: With ventilated shroud.
 - 2) Design for Thermowell Installation: Bare stem.
 - h. Connector: 3/4 inch (19 mm), with ASME B1.1 screw threads.
 - i. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.



3. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:
 - a. Standard: ASME B40.200.
 - b. Case: Cast aluminum; 7-inch (178-mm) **OR** 9-inch (229-mm), **as directed**, nominal size unless otherwise indicated.
 - c. Case Form: Adjustable angle **OR** Back angle **OR** Straight, **as directed**, unless otherwise indicated.
 - d. Tube: Glass with magnifying lens and blue or red, **as directed**, organic liquid.
 - e. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F (deg C) **OR** deg F and deg C, **as directed**.
 - f. Window: Glass or plastic.
 - g. Stem: Aluminum and of length to suit installation.
 - 1) Design for Air-Duct Installation: With ventilated shroud.
 - 2) Design for Thermowell Installation: Bare stem.
 - h. Connector: 1-1/4 inches (32 mm), with ASME B1.1 screw threads.
 - i. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.
 4. Plastic-Case, Industrial-Style, Liquid-in-Glass Thermometers:
 - a. Standard: ASME B40.200.
 - b. Case: Plastic; 7-inch (178-mm) **OR** 9-inch (229-mm), **as directed**, nominal size unless otherwise indicated.
 - c. Case Form: Adjustable angle **OR** Back angle **OR** Straight, **as directed**, unless otherwise indicated.
 - d. Tube: Glass with magnifying lens and blue or red, **as directed**, organic liquid.
 - e. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F (deg C) **OR** deg F and deg C, **as directed**.
 - f. Window: Glass or plastic.
 - g. Stem: Aluminum **OR** Brass **OR** Stainless steel, **as directed**, and of length to suit installation.
 - 1) Design for Air-Duct Installation: With ventilated shroud.
 - 2) Design for Thermowell Installation: Bare stem.
 - h. Connector: 1-1/4 inches (32 mm), with ASME B1.1 screw threads.
 - i. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.
- D. Light-Activated Thermometers
1. Direct-Mounted, Light-Activated Thermometers:
 - a. Case: Plastic **OR** Metal, **as directed**; 7-inch (178-mm) **OR** 9-inch (229-mm), **as directed**, nominal size unless otherwise indicated.
 - b. Scale(s): Deg F (Deg C) **OR** Deg F and deg C, **as directed**.
 - c. Case Form: Adjustable angle.
 - d. Connector: 1-1/4 inches (32 mm), with ASME B1.1 screw threads.
 - e. Stem: Aluminum and of length to suit installation.
 - 1) Design for Air-Duct Installation: With ventilated shroud.
 - 2) Design for Thermowell Installation: Bare stem.
 - f. Display: Digital.
 - g. Accuracy: Plus or minus 2 deg F (1 deg C).
 2. Remote-Mounted, Light-Activated Thermometers:
 - a. Case: Plastic, for wall mounting.
 - b. Scale(s): Deg F (Deg C) **OR** Deg F and deg C, **as directed**.
 - c. Sensor: Bulb and thermister wire.
 - 1) Design for Air-Duct Installation: With ventilated shroud.
 - 2) Design for Thermowell Installation: Bare stem.
 - d. Display: Digital.
 - e. Accuracy: Plus or minus 2 deg F (1 deg C).



- E. Duct-Thermometer Mounting Brackets
1. Description: Flanged bracket with screw holes, for attachment to air duct and made to hold thermometer stem.
- F. Thermowells
1. Thermowells:
 - a. Standard: ASME B40.200.
 - b. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
 - c. Material for Use with Copper Tubing: CNR **OR** CUNI, **as directed**.
 - d. Material for Use with Steel Piping: CRES **OR** CSA, **as directed**.
 - e. Type: Stepped shank unless straight or tapered shank is indicated.
 - f. External Threads: NPS 1/2, NPS 3/4, or NPS 1, (DN 15, DN 20, or NPS 25,) ASME B1.20.1 pipe threads.
 - g. Internal Threads: 1/2, 3/4, and 1 inch (13, 19, and 25 mm), with ASME B1.1 screw threads.
 - h. Bore: Diameter required to match thermometer bulb or stem.
 - i. Insertion Length: Length required to match thermometer bulb or stem.
 - j. Lagging Extension: Include on thermowells for insulated piping and tubing.
 - k. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.
 2. Heat-Transfer Medium: Mixture of graphite and glycerin.
- G. Pressure Gages
1. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:
 - 1) Standard: ASME B40.100.
 - 2) Case: Liquid-filled **OR** Sealed **OR** Open-front, pressure relief **OR** Solid-front, pressure relief, **as directed**, type(s); cast aluminum or drawn steel; 4-1/2-inch (114-mm) **OR** 6-inch (152-mm), **as directed**, nominal diameter.
 - 3) Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
 - 4) Pressure Connection: Brass, with NPS 1/4 (DN 8) **OR** NPS 1/2 (DN 15), **as directed**, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
 - 5) Movement: Mechanical, with link to pressure element and connection to pointer.
 - 6) Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi (kPa) **OR** psi and kPa, **as directed**.
 - 7) Pointer: Dark-colored metal.
 - 8) Window: Glass or plastic.
 - 9) Ring: Metal **OR** Brass **OR** Stainless steel, **as directed**.
 - 10) Accuracy: Grade A, plus or minus 1 percent of middle half of **OR** Grade B, plus or minus 2 percent of middle half of **OR** Grade C, plus or minus 3 percent of middle half of **OR** Grade D, plus or minus 5 percent of whole, **as directed**, scale range.
 2. Direct-Mounted, Plastic-Case, Dial-Type Pressure Gages:
 - a. Standard: ASME B40.100.
 - b. Case: Sealed type; plastic; 4-1/2-inch (114-mm) **OR** 6-inch (152-mm), **as directed**, nominal diameter.
 - c. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
 - d. Pressure Connection: Brass, with NPS 1/4 (DN 8) **OR** NPS 1/2 (DN 15), **as directed**, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
 - e. Movement: Mechanical, with link to pressure element and connection to pointer.
 - f. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi (kPa) **OR** psi and kPa, **as directed**.
 - g. Pointer: Dark-colored metal.
 - h. Window: Glass or plastic.
 - i. Accuracy: Grade A, plus or minus 1 percent of middle half of **OR** Grade B, plus or minus 2 percent of middle half of **OR** Grade C, plus or minus 3 percent of middle half of **OR** Grade D, plus or minus 5 percent of whole, **as directed**, scale range.



3. Remote-Mounted, Metal-Case, Dial-Type Pressure Gages:
 - a. Standard: ASME B40.100.
 - b. Case: Liquid-filled **OR** Sealed, **as directed**, type; cast aluminum or drawn steel **OR** metal, **as directed**; 4-1/2-inch (114-mm) **OR** 6-inch (152-mm), **as directed**, nominal diameter with back **OR** front, **as directed**, flange and holes for panel mounting.
 - c. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
 - d. Pressure Connection: Brass, with NPS 1/4 (DN 8) **OR** NPS 1/2 (DN 15), **as directed**, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
 - e. Movement: Mechanical, with link to pressure element and connection to pointer.
 - f. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi (kPa) **OR** psi and kPa, **as directed**.
 - g. Pointer: Dark-colored metal.
 - h. Window: Glass or plastic.
 - i. Ring: Metal **OR** Stainless steel, **as directed**.
 - j. Accuracy: Grade A, plus or minus 1 percent of middle half of **OR** Grade B, plus or minus 2 percent of middle half of **OR** Grade C, plus or minus 3 percent of middle half of **OR** Grade D, plus or minus 5 percent of whole, **as directed**, scale range.
 4. Remote-Mounted, Plastic-Case, Dial-Type Pressure Gages:
 - a. Standard: ASME B40.100.
 - b. Case: Sealed type; plastic; 4-1/2-inch (114-mm) **OR** 6-inch (152-mm), **as directed**, nominal diameter with back **OR** front, **as directed**, flange and holes for panel mounting.
 - c. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
 - d. Pressure Connection: Brass, with NPS 1/4 (DN 8) **OR** NPS 1/2 (DN 15), **as directed**, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
 - e. Movement: Mechanical, with link to pressure element and connection to pointer.
 - f. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi (kPa) **OR** psi and kPa, **as directed**.
 - g. Pointer: Dark-colored metal.
 - h. Window: Glass or plastic.
 - i. Accuracy: Grade A, plus or minus 1 percent of middle half of **OR** Grade B, plus or minus 2 percent of middle half of **OR** Grade C, plus or minus 3 percent of middle half of **OR** Grade D, plus or minus 5 percent of whole, **as directed**, scale range.
- H. Gage Attachments
1. Snubbers: ASME B40.100, brass; with NPS 1/4 (DN 8) **OR** NPS 1/2 (DN 15), **as directed**, ASME B1.20.1 pipe threads and piston-type **OR** porous-metal-type, **as directed**, surge-dampening device. Include extension for use on insulated piping.
 2. Siphons: Loop-shaped section of brass **OR** stainless-steel **OR** steel, **as directed**, pipe with NPS 1/4 (DN 8) **OR** NPS 1/2 (DN 15), **as directed**, pipe threads.
 3. Valves: Brass ball **OR** Brass or stainless-steel needle, **as directed**, with NPS 1/4 (DN 8) **OR** NPS 1/2 (DN 15), **as directed**, ASME B1.20.1 pipe threads.
- I. Test Plugs
1. Description: Test-station fitting made for insertion into piping tee fitting.
 2. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.
 3. Thread Size: NPS 1/4 (DN 8) **OR** NPS 1/2 (DN 15), **as directed**, ASME B1.20.1 pipe thread.
 4. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F (3450 kPa at 93 deg C).
 5. Core Inserts: Chlorosulfonated polyethylene synthetic **OR** EPDM, **as directed**, self-sealing rubber.
- J. Test-Plug Kits
1. Furnish one test-plug kit(s) containing one **OR** two, **as directed**, thermometer(s), one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.



2. Low-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- (25- to 51-mm-) diameter dial and tapered-end sensing element. Dial range shall be at least 25 to 125 deg F (minus 4 to plus 52 deg C).
 3. High-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- (25- to 51-mm-) diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220 deg F (minus 18 to plus 104 deg C).
 4. Pressure Gage: Small, Bourdon-tube insertion type with 2- to 3-inch- (51- to 76-mm-) diameter dial and probe. Dial range shall be at least 0 to 200 psig (0 to 1380 kPa).
 5. Carrying Case: Metal or plastic, with formed instrument padding.
- K. Sight Flow Indicators
1. Description: Piping inline-installation device for visual verification of flow.
 2. Construction: Bronze or stainless-steel body, with sight glass and ball, flapper, or paddle wheel indicator, and threaded or flanged ends.
 3. Minimum Pressure Rating: 125 psig (860 kPa) **OR** 150 psig (1034 kPa), **as directed**.
 4. Minimum Temperature Rating: 200 deg F (93 deg C).
 5. End Connections for NPS 2 (DN 50) and Smaller: Threaded.
 6. End Connections for NPS 2-1/2 (DN 65) and Larger: Flanged.
- L. Flowmeters
1. Orifice Flowmeters:
 - a. Description: Flowmeter with sensor, hoses or tubing, fittings, valves, indicator, and conversion chart.
 - b. Flow Range: Sensor and indicator shall cover operating range of equipment or system served.
 - c. Sensor: Wafer-orifice-type, calibrated, flow-measuring element; for installation between pipe flanges.
 - 1) Design: Differential-pressure-type measurement for gas **OR** oil **OR** steam **OR** water, **as directed**.
 - 2) Construction: Cast-iron body, brass valves with integral check valves and caps, and calibrated nameplate.
 - 3) Minimum Pressure Rating: 300 psig (2070 kPa).
 - 4) Minimum Temperature Rating: 250 deg F (121 deg C).
 - d. Permanent Indicators: Meter suitable for wall or bracket mounting, calibrated for connected sensor and having 6-inch- (152-mm-) diameter, or equivalent, dial with fittings and copper tubing for connecting to sensor.
 - 1) Scale: Gallons per minute (Liters per second).
 - 2) Accuracy: Plus or minus 1 percent between 20 and 80 percent of scale range.
 - e. Portable Indicators: Hand-held, differential-pressure type, calibrated for connected sensor and having two 12-foot (3.7-m) hoses, with carrying case.
 - 1) Scale: Gallons per minute (Liters per second).
 - 2) Accuracy: Plus or minus 2 percent between 20 and 80 percent of scale range.
 - f. Display: Shows rate of flow, with register to indicate total volume in gallons (liters).
 - g. Conversion Chart: Flow rate data compatible with sensor and indicator.
 - h. Operating Instructions: Include complete instructions with each flowmeter.
 2. Pitot-Tube Flowmeters:
 - a. Description: Flowmeter with sensor and indicator.
 - b. Flow Range: Sensor and indicator shall cover operating range of equipment or system served.
 - c. Sensor: Insertion type; for inserting probe into piping and measuring flow directly in gallons per minute (liters per second).
 - 1) Design: Differential-pressure-type measurement for oil **OR** water, **as directed**.
 - 2) Construction: Stainless-steel probe of length to span inside of pipe, with integral transmitter and direct-reading scale.
 - 3) Minimum Pressure Rating: 150 psig (1035 kPa).
 - 4) Minimum Temperature Rating: 250 deg F (121 deg C).



- d. Indicator: Hand-held meter; either an integral part of sensor or a separate meter.
 - e. Integral Transformer: For low-voltage power connection.
 - f. Accuracy: Plus or minus 3 percent.
 - g. Display: Shows rate of flow, with register to indicate total volume in gallons (liters).
 - h. Operating Instructions: Include complete instructions with each flowmeter.
3. Turbine Flowmeters:
- a. Description: Flowmeter with sensor and indicator.
 - b. Flow Range: Sensor and indicator shall cover operating range of equipment or system served.
 - c. Sensor: Impeller turbine; for inserting into pipe fitting or for installing in piping and measuring flow directly in gallons per minute (liters per second).
 - 1) Design: Device or pipe fitting with inline turbine and integral direct-reading scale for gas **OR** oil **OR** steam **OR** water, **as directed**.
 - 2) Construction: Bronze or stainless-steel body, with plastic turbine or impeller.
 - 3) Minimum Pressure Rating: 150 psig (1035 kPa).
 - 4) Minimum Temperature Rating: 180 deg F (82 deg C).
 - d. Indicator: Hand-held meter; either an integral part of sensor or a separate meter.
 - e. Accuracy: Plus or minus 1-1/2 percent.
 - f. Display: Shows rate of flow, with register to indicate total volume in gallons (liters).
 - g. Operating Instructions: Include complete instructions with each flowmeter.
4. Venturi Flowmeters:
- a. Description: Flowmeter with calibrated flow-measuring element, hoses or tubing, fittings, valves, indicator, and conversion chart.
 - b. Flow Range: Sensor and indicator shall cover operating range of equipment or system served.
 - c. Sensor: Venturi-type, calibrated, flow-measuring element; for installation in piping.
 - 1) Design: Differential-pressure-type measurement for gas **OR** oil **OR** steam **OR** water, **as directed**.
 - 2) Construction: Bronze, brass, or factory-primed steel, with brass fittings and attached tag with flow conversion data.
 - 3) Minimum Pressure Rating: 250 psig (1725 kPa).
 - 4) Minimum Temperature Rating: 250 deg F (121 deg C).
 - 5) End Connections for NPS 2 (DN 50) and Smaller: Threaded.
 - 6) End Connections for NPS 2-1/2 (DN 65) and Larger: Flanged or welded.
 - 7) Flow Range: Flow-measuring element and flowmeter shall cover operating range of equipment or system served.
 - d. Permanent Indicators: Meter suitable for wall or bracket mounting, calibrated for connected flowmeter element, and having 6-inch- (152-mm-) diameter, or equivalent, dial with fittings and copper tubing for connecting to flowmeter element.
 - 1) Scale: Gallons per minute (Liters per second).
 - 2) Accuracy: Plus or minus 1 percent between 20 and 80 percent of scale range.
 - e. Portable Indicators: Hand-held, differential-pressure type, calibrated for connected flowmeter element and having two 12-foot (3.7-m) hoses, with carrying case.
 - 1) Scale: Gallons per minute (Liters per second).
 - 2) Accuracy: Plus or minus 2 percent between 20 and 80 percent of scale range.
 - f. Display: Shows rate of flow, with register to indicate total volume in gallons (liters).
 - g. Conversion Chart: Flow rate data compatible with sensor.
 - h. Operating Instructions: Include complete instructions with each flowmeter.
5. Vortex-Shedding Flowmeters:
- a. Description: Flowmeter with sensor and indicator.
 - b. Flow Range: Sensor and indicator shall cover operating range of equipment or system served.
 - c. Sensor: Inline type; for installing between pipe flanges and measuring flow directly in gallons per minute (liters per second).



- 1) Design: Flow obstruction device, vortex-measurement type for gas **OR** steam **OR** liquids, **as directed**.
- 2) Construction: Stainless-steel body, with integral transmitter and direct-reading scale.
- 3) Minimum Pressure Rating: 1000 psig (6900 kPa).
- 4) Minimum Temperature Rating: 500 deg F (260 deg C).
- 5) Integral Transformer: For low-voltage power operation.
- d. Indicator: Hand-held meter; either an integral part of sensor or a separate meter.
- e. Accuracy: Plus or minus 0.25 percent for liquids and 0.75 percent for gases.
- f. Display: Shows rate of flow, with register to indicate total volume in gallons (liters).
- g. Operating Instructions: Include complete instructions with each flowmeter.

M. Thermal-Energy Meters

1. Impeller-Turbine, Thermal-Energy Meters:

- a. Description: System with strainer, **as directed**, flow sensor, temperature sensors, transmitter, indicator, and connecting wiring.
- b. Flow Sensor: Impeller turbine with corrosion-resistant-metal body and transmitter; for installing in piping.
 - 1) Design: Total thermal-energy measurement.
 - 2) Minimum Pressure Rating: 150 psig (1035 kPa).
 - 3) Minimum Temperature Range: 40 to 250 deg F (5 to 121 deg C).
- c. Temperature Sensors: Insertion-type transducer.
- d. Indicator: Solid-state, integrating-type meter with integral battery pack, **as directed**; for wall mounting.
 - 1) Data Output: Six-digit electromechanical counter with readout in kilowatts per hour or British thermal units (joules).
 - 2) Battery Pack: Five-year lithium battery.
- e. Accuracy: Plus or minus 1 percent.
- f. Display: Visually indicates total fluid volume in gallons (liters) and thermal-energy flow in kilowatts per hour or British thermal units (joules).
- g. Strainer: Full size of main line piping.
- h. Operating Instructions: Include complete instructions with each thermal-energy meter system.

2. Ultrasonic, Thermal-Energy Meters:

- a. Description: Meter with flow sensor, temperature sensors, transmitter, indicator, and connecting wiring.
- b. Flow Sensor: Transit-time ultrasonic type with transmitter.
- c. Temperature Sensors: Insertion-type or strap-on transducer.
- d. Indicator: Solid-state, integrating-type meter with integral battery pack, **as directed**.
 - 1) Data Output: Six-digit electromechanical counter with readout in kilowatts per hour or British thermal units (joules).
 - 2) Battery Pack: Five-year lithium battery.
- e. Accuracy: Plus or minus 1 percent.
- f. Display: Visually indicates total fluid volume in gallons (liters) and thermal-energy flow in kilowatts per hour or British thermal units (joules).
- g. Operating Instructions: Include complete instructions with each thermal-energy meter system.

1.3 EXECUTION

A. Installation

1. Install thermowells with socket extending a minimum of 2 inches (51 mm) into fluid **OR** one-third of pipe diameter **OR** to center of pipe, **as directed**, and in vertical position in piping tees.
2. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.



3. Install thermowells with extension on insulated piping.
 4. Fill thermowells with heat-transfer medium.
 5. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
 6. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.
 7. Install duct-thermometer mounting brackets in walls of ducts. Attach to duct with screws.
 8. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
 9. Install remote-mounted pressure gages on panel.
 10. Install valve and snubber in piping for each pressure gage for fluids (except steam).
 11. Install valve and syphon fitting in piping for each pressure gage for steam.
 12. Install test plugs in piping tees.
 13. Install flow indicators in piping systems in accessible positions for easy viewing.
 14. Assemble and install connections, tubing, and accessories between flow-measuring elements and flowmeters according to manufacturer's written instructions.
 15. Install flowmeter elements in accessible positions in piping systems.
 16. Install wafer-orifice flowmeter elements between pipe flanges.
 17. Install differential-pressure-type flowmeter elements, with at least minimum straight lengths of pipe, upstream and downstream from element according to manufacturer's written instructions.
 18. Install permanent indicators on walls or brackets in accessible and readable positions.
 19. Install connection fittings in accessible locations for attachment to portable indicators.
 20. Mount thermal-energy meters on wall if accessible; if not, provide brackets to support meters.
 21. Install thermometers in the following locations:
 - a. Inlet and outlet of each hydronic zone.
 - b. Inlet and outlet of each hydronic boiler.
 - c. Two inlets and two outlets of each chiller.
 - d. Inlet and outlet of each hydronic coil in air-handling units.
 - e. Two inlets and two outlets of each hydronic heat exchanger.
 - f. Inlet and outlet of each thermal-storage tank.
 - g. Outside-, return-, supply-, and mixed-air ducts.
 22. Install pressure gages in the following locations:
 - a. Discharge of each pressure-reducing valve.
 - b. Inlet and outlet of each chiller chilled-water and condenser-water connection.
 - c. Suction and discharge of each pump.
- B. Connections
1. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.
 2. Connect flowmeter-system elements to meters.
 3. Connect flowmeter transmitters to meters.
 4. Connect thermal-energy meter transmitters to meters.
- C. Adjusting
1. After installation, calibrate meters according to manufacturer's written instructions.
 2. Adjust faces of meters and gages to proper angle for best visibility.
- D. Thermometer Schedule
1. Thermometers at inlet and outlet of each hydronic zone shall be one of the following:
 - a. Liquid-filled **OR** Sealed, **as directed**, bimetallic-actuated type.
 - b. Direct-mounted **OR** Remote-mounted, **as directed**, metal-case **OR** plastic-case, **as directed**, vapor-actuated type.
 - c. Compact-style **OR** Industrial-style, **as directed**, liquid-in-glass type.
 - d. Direct-mounted **OR** Remote-mounted, **as directed**, light-activated type.
 - e. Test plug with chlorosulfonated polyethylene synthetic **OR** EPDM, **as directed**, self-sealing rubber inserts.



2. Thermometers at inlet and outlet of each hydronic boiler shall be one of the following:
 - a. Liquid-filled **OR** Sealed, **as directed**, bimetallic-actuated type.
 - b. Direct-mounted **OR** Remote-mounted, **as directed**, metal-case **OR** plastic-case, **as directed**, vapor-actuated type.
 - c. Compact-style **OR** Industrial-style, **as directed**, liquid-in-glass type.
 - d. Direct-mounted **OR** Remote-mounted, **as directed**, light-activated type.
 - e. Test plug with chlorosulfonated polyethylene synthetic **OR** EPDM, **as directed**, self-sealing rubber inserts.
3. Thermometers at inlets and outlets of each chiller shall be one of the following:
 - a. Liquid-filled **OR** Sealed, **as directed**, bimetallic-actuated type.
 - b. Direct-mounted **OR** Remote-mounted, **as directed**, metal-case **OR** plastic-case, **as directed**, vapor-actuated type.
 - c. Compact-style **OR** Industrial-style, **as directed**, liquid-in-glass type.
 - d. Direct-mounted **OR** Remote-mounted, **as directed**, light-activated type.
 - e. Test plug with chlorosulfonated polyethylene synthetic **OR** EPDM, **as directed**, self-sealing rubber inserts.
4. Thermometers at inlet and outlet of each hydronic coil in air-handling units and built-up central systems shall be one of the following:
 - a. Liquid-filled **OR** Sealed, **as directed**, bimetallic-actuated type.
 - b. Direct-mounted **OR** Remote-mounted, **as directed**, metal-case **OR** plastic-case, **as directed**, vapor-actuated type.
 - c. Compact-style **OR** Industrial-style, **as directed**, liquid-in-glass type.
 - d. Direct-mounted **OR** Remote-mounted, **as directed**, light-activated type.
 - e. Test plug with chlorosulfonated polyethylene synthetic **OR** EPDM, **as directed**, self-sealing rubber inserts.
5. Thermometers at inlets and outlets of each hydronic heat exchanger shall be one of the following:
 - a. Liquid-filled **OR** Sealed, **as directed**, bimetallic-actuated type.
 - b. Direct-mounted **OR** Remote-mounted, **as directed**, metal-case **OR** plastic-case, **as directed**, vapor-actuated type.
 - c. Compact-style **OR** Industrial-style, **as directed**, liquid-in-glass type.
 - d. Direct-mounted **OR** Remote-mounted, **as directed**, light-activated type.
 - e. Test plug with chlorosulfonated polyethylene synthetic **OR** EPDM, **as directed**, self-sealing rubber inserts.
6. Thermometers at inlet and outlet of each hydronic heat-recovery unit shall be one of the following:
 - a. Liquid-filled **OR** Sealed, **as directed**, bimetallic-actuated type.
 - b. Direct-mounted **OR** Remote-mounted, **as directed**, metal-case **OR** plastic-case, **as directed**, vapor-actuated type.
 - c. Compact-style **OR** Industrial-style, **as directed**, liquid-in-glass type.
 - d. Direct-mounted **OR** Remote-mounted, **as directed**, light-activated type.
 - e. Test plug with chlorosulfonated polyethylene synthetic **OR** EPDM, **as directed**, self-sealing rubber inserts.
7. Thermometers at inlet and outlet of each thermal-storage tank shall be one of the following:
 - a. Liquid-filled **OR** Sealed, **as directed**, bimetallic-actuated type.
 - b. Direct-mounted **OR** Remote-mounted, **as directed**, metal-case **OR** plastic-case, **as directed**, vapor-actuated type.
 - c. Compact-style **OR** Industrial-style, **as directed**, liquid-in-glass type.
 - d. Direct-mounted **OR** Remote-mounted, **as directed**, light-activated type.
 - e. Test plug with chlorosulfonated polyethylene synthetic **OR** EPDM, **as directed**, self-sealing rubber inserts.
8. Thermometers at outside-, return-, supply-, and mixed-air ducts shall be one of the following:
 - a. Liquid-filled **OR** Sealed, **as directed**, bimetallic-actuated type.
 - b. Direct-mounted **OR** Remote-mounted, **as directed**, metal-case **OR** plastic-case, **as directed**, vapor-actuated type.
 - c. Compact-style **OR** Industrial-style, **as directed**, liquid-in-glass type.
 - d. Direct-mounted **OR** Remote-mounted, **as directed**, light-activated type.
9. Thermometer stems shall be of length to match thermowell insertion length.



E. Thermometer Scale-Range Schedule

1. Scale Range for Chilled-Water Piping: Minus 40 to plus 160 deg F (Minus 40 to plus 100 deg C) **OR** Minus 40 to plus 160 deg F and minus 40 to plus 100 deg C, **as directed**.
2. Scale Range for Chilled-Water Piping: 0 to 100 deg F (Minus 20 to plus 50 deg C) **OR** 0 to 100 deg F and minus 20 to plus 50 deg C, **as directed**.
3. Scale Range for Chilled-Water Piping: 0 to 150 deg F (Minus 20 to plus 70 deg C) **OR** 0 to 150 deg F and minus 20 to plus 70 deg C, **as directed**.
4. Scale Range for Chilled-Water Piping: 0 to 250 deg F (0 to 150 deg C) **OR** 0 to 250 deg F and 0 to 150 deg C, **as directed**.
5. Scale Range for Condenser-Water Piping: 0 to 100 deg F (Minus 20 to plus 50 deg C) **OR** 0 to 100 deg F and minus 20 to plus 50 deg C, **as directed**.
6. Scale Range for Condenser-Water Piping: 0 to 150 deg F (Minus 20 to plus 70 deg C) **OR** 0 to 150 deg F and minus 20 to plus 70 deg C, **as directed**.
7. Scale Range for Condenser-Water Piping: 0 to 250 deg F (0 to 150 deg C) **OR** 0 to 250 deg F and 0 to 150 deg C, **as directed**.
8. Scale Range for Condenser-Water Piping: 20 to 240 deg F (0 to 150 deg C) **OR** 20 to 240 deg F and 0 to 150 deg C, **as directed**.
9. Scale Range for Condenser-Water Piping: 30 to 240 deg F (0 to plus 115 deg C) **OR** 30 to 240 deg F and 0 to plus 115 deg C, **as directed**.
10. Scale Range for Heating, Hot-Water Piping: 0 to 250 deg F (0 to 150 deg C) **OR** 0 to 250 deg F and 0 to 150 deg C, **as directed**.
11. Scale Range for Heating, Hot-Water Piping: 20 to 240 deg F (0 to 150 deg C) **OR** 20 to 240 deg F and 0 to 150 deg C, **as directed**.
12. Scale Range for Heating, Hot-Water Piping: 30 to 240 deg F (0 to plus 115 deg C) **OR** 30 to 240 deg F and 0 to plus 115 deg C, **as directed**.
13. Scale Range for Heating, Hot-Water Piping: 50 to 400 deg F (0 to 200 deg C) **OR** 50 to 400 deg F and 0 to 200 deg C, **as directed**.
14. Scale Range for Heating, Hot-Water Piping: 50 to 550 deg F (10 to 300 deg C) **OR** 50 to 550 deg F and 10 to 300 deg C, **as directed**.
15. Scale Range for Steam and Steam-Condensate Piping: 0 to 250 deg F (0 to 150 deg C) **OR** 0 to 250 deg F and 0 to 150 deg C, **as directed**.
16. Scale Range for Steam and Steam-Condensate Piping: 20 to 240 deg F (0 to 150 deg C) **OR** 20 to 240 deg F and 0 to 150 deg C, **as directed**.
17. Scale Range for Steam and Steam-Condensate Piping: 30 to 240 deg F (0 to plus 115 deg C) **OR** 30 to 240 deg F and 0 to plus 115 deg C, **as directed**.
18. Scale Range for Steam and Steam-Condensate Piping: 50 to 400 deg F (0 to 200 deg C) **OR** 50 to 400 deg F and 0 to 200 deg C, **as directed**.
19. Scale Range for Air Ducts: Minus 40 to plus 110 deg F (Minus 40 to plus 45 deg C) **OR** Minus 40 to plus 110 deg F and minus 40 to plus 45 deg C, **as directed**.
20. Scale Range for Air Ducts: Minus 40 to plus 160 deg F (Minus 40 to plus 100 deg C) **OR** Minus 40 to plus 160 deg F and minus 40 to plus 100 deg C, **as directed**.
21. Scale Range for Air Ducts: 0 to 100 deg F (Minus 20 to plus 50 deg C) **OR** 0 to 100 deg F and minus 20 to plus 50 deg C, **as directed**.
22. Scale Range for Air Ducts: 0 to 150 deg F (Minus 20 to plus 70 deg C) **OR** 0 to 150 deg F and minus 20 to plus 70 deg C, **as directed**.
23. Scale Range for Air Ducts: 0 to 250 deg F (0 to 150 deg C) **OR** 0 to 250 deg F and 0 to 150 deg C, **as directed**.
24. Scale Range for Air Ducts: 20 to 240 deg F (0 to 150 deg C) **OR** 20 to 240 deg F and 0 to 150 deg C, **as directed**.
25. Scale Range for Air Ducts: 30 to 240 deg F (0 to plus 115 deg C) **OR** 30 to 240 deg F and 0 to plus 115 deg C, **as directed**.
26. Scale Range for Air Ducts: 50 to 400 deg F (0 to 200 deg C) **OR** 50 to 400 deg F and 0 to 200 deg C, **as directed**.

F. Pressure-Gage Schedule



1. Pressure gages at discharge of each pressure-reducing valve shall be one of the following:
 - a. Liquid-filled **OR** Sealed **OR** Open-front, pressure-relief **OR** Solid-front, pressure-relief, **as directed**, direct-mounted **OR** remote-mounted, **as directed**, metal case.
 - b. Sealed, direct-mounted **OR** remote-mounted, **as directed**, plastic case.
 - c. Test plug with chlorosulfonated polyethylene synthetic **OR** EPDM, **as directed**, self-sealing rubber inserts.
 2. Pressure gages at inlet and outlet of each chiller chilled-water and condenser-water connection shall be one of the following:
 - a. Liquid-filled **OR** Sealed **OR** Open-front, pressure-relief **OR** Solid-front, pressure-relief, **as directed**, direct-mounted **OR** remote-mounted, **as directed**, metal case.
 - b. Sealed, direct-mounted **OR** remote-mounted, **as directed**, plastic case.
 - c. Test plug with chlorosulfonated polyethylene synthetic **OR** EPDM, **as directed**, self-sealing rubber inserts.
 3. Pressure gages at suction and discharge of each pump shall be one of the following:
 - a. Liquid-filled **OR** Sealed **OR** Open-front, pressure-relief **OR** Solid-front, pressure-relief, **as directed**, direct-mounted **OR** remote-mounted, **as directed**, metal case.
 - b. Sealed, direct-mounted **OR** remote-mounted, **as directed**, plastic case.
 - c. Test plug with chlorosulfonated polyethylene synthetic **OR** EPDM, **as directed**, self-sealing rubber inserts.
- G. Pressure-Gage Scale-Range Schedule
1. Scale Range for Chilled-Water Piping: 30 in. Hg to 15 psi (minus 100 to 0 kPa) **OR** 30 in. Hg to 15 psi and minus 100 to 0 kPa, **as directed**.
 2. Scale Range for Chilled-Water Piping: 0 to 30 psi (0 to 240 kPa) **OR** 0 to 30 psi and 0 to 240 kPa, **as directed**.
 3. Scale Range for Chilled-Water Piping: 0 to 100 psi (0 to 600 kPa) **OR** 0 to 100 psi and 0 to 600 kPa, **as directed**.
 4. Scale Range for Chilled-Water Piping: 0 to 160 psi (0 to 1100 kPa) **OR** 0 to 160 psi and 0 to 1100 kPa, **as directed**.
 5. Scale Range for Chilled-Water Piping: 0 to 200 psi (0 to 1400 kPa) **OR** 0 to 200 psi and 0 to 1400 kPa, **as directed**.
 6. Scale Range for Chilled-Water Piping: 0 to 300 psi (0 to 2500 kPa) **OR** 0 to 300 psi and 0 to 2500 kPa, **as directed**.
 7. Scale Range for Chilled-Water Piping: 0 to 600 psi (0 to 4000 kPa) **OR** 0 to 600 psi and 0 to 4000 kPa, **as directed**.
 8. Scale Range for Condenser-Water Piping: 30 in. Hg to 15 psi (minus 100 to 0 kPa) **OR** 30 in. Hg to 15 psi and minus 100 to 0 kPa, **as directed**.
 9. Scale Range for Condenser-Water Piping: 0 to 30 psi (0 to 240 kPa) **OR** 0 to 30 psi and 0 to 240 kPa, **as directed**.
 10. Scale Range for Condenser-Water Piping: 0 to 100 psi (0 to 600 kPa) **OR** 0 to 100 psi and 0 to 600 kPa, **as directed**.
 11. Scale Range for Condenser-Water Piping: 0 to 160 psi (0 to 1100 kPa) **OR** 0 to 160 psi and 0 to 1100 kPa, **as directed**.
 12. Scale Range for Condenser-Water Piping: 0 to 200 psi (0 to 1400 kPa) **OR** 0 to 200 psi and 0 to 1400 kPa, **as directed**.
 13. Scale Range for Condenser-Water Piping: 0 to 300 psi (0 to 2500 kPa) **OR** 0 to 300 psi and 0 to 2500 kPa, **as directed**.
 14. Scale Range for Condenser-Water Piping: 0 to 600 psi (0 to 4000 kPa) **OR** 0 to 600 psi and 0 to 4000 kPa, **as directed**.
 15. Scale Range for Heating, Hot-Water Piping: 30 in. Hg to 15 psi (minus 100 to 0 kPa) **OR** 30 in. Hg to 15 psi and minus 100 to 0 kPa, **as directed**.
 16. Scale Range for Heating, Hot-Water Piping: 0 to 30 psi (0 to 240 kPa) **OR** 0 to 30 psi and 0 to 240 kPa, **as directed**.
 17. Scale Range for Heating, Hot-Water Piping: 0 to 100 psi (0 to 600 kPa) **OR** 0 to 100 psi and 0 to 600 kPa, **as directed**.



18. Scale Range for Heating, Hot-Water Piping: 0 to 160 psi (0 to 1100 kPa) **OR** 0 to 160 psi and 0 to 1100 kPa, **as directed**.
19. Scale Range for Heating, Hot-Water Piping: 0 to 200 psi (0 to 1400 kPa) **OR** 0 to 200 psi and 0 to 1400 kPa, **as directed**.
20. Scale Range for Heating, Hot-Water Piping: 0 to 300 psi (0 to 2500 kPa) **OR** 0 to 300 psi and 0 to 2500 kPa, **as directed**.
21. Scale Range for Heating, Hot-Water Piping: 0 to 600 psi (0 to 4000 kPa) **OR** 0 to 600 psi and 0 to 4000 kPa, **as directed**.
22. Scale Range for Steam Piping: 30 in. Hg to 15 psi (minus 100 to 0 kPa) **OR** 30 in. Hg to 15 psi and minus 100 to 0 kPa, **as directed**.
23. Scale Range for Steam Piping: 0 to 30 psi (0 to 240 kPa) **OR** 0 to 30 psi and 0 to 240 kPa, **as directed**.
24. Scale Range for Steam Piping: 0 to 100 psi (0 to 600 kPa) **OR** 0 to 100 psi and 0 to 600 kPa, **as directed**.
25. Scale Range for Steam Piping: 0 to 160 psi (0 to 1100 kPa) **OR** 0 to 160 psi and 0 to 1100 kPa, **as directed**.
26. Scale Range for Steam Piping: 0 to 200 psi (0 to 1400 kPa) **OR** 0 to 200 psi and 0 to 1400 kPa, **as directed**.
27. Scale Range for Steam Piping: 0 to 300 psi (0 to 2500 kPa) **OR** 0 to 300 psi and 0 to 2500 kPa, **as directed**.
28. Scale Range for Steam Piping: 0 to 600 psi (0 to 4000 kPa) **OR** 0 to 600 psi and 0 to 4000 kPa, **as directed**.

H. Flowmeter Schedule

1. Flowmeters for Chilled-Water Piping: Orifice **OR** Pitot-tube **OR** Turbine **OR** Venturi **OR** Vortex-shedding, **as directed**, type.
2. Flowmeters for Condenser-Water Piping: Orifice **OR** Pitot-tube **OR** Turbine **OR** Venturi **OR** Vortex-shedding, **as directed**, type.
3. Flowmeters for Heating, Hot-Water Piping: Orifice **OR** Pitot-tube **OR** Turbine **OR** Venturi **OR** Vortex-shedding, **as directed**, type.
4. Flowmeters for Steam and Steam-Condensate Piping: Orifice **OR** Turbine **OR** Venturi **OR** Vortex-shedding, **as directed**, type.

I. Thermal-Energy Meter Schedule

1. Thermal-Energy Meters for Chilled-Water Piping: Impeller-turbine **OR** Ultrasonic, **as directed**, type.
2. Thermal-Energy Meters for Condenser-Water Piping: Impeller-turbine **OR** Ultrasonic, **as directed**, type.
3. Thermal-Energy Meters for Heating, Hot-Water Piping: Impeller-turbine **OR** Ultrasonic, **as directed**, type.
4. Thermal-Energy Meters for Steam and Steam-Condensate Piping: Impeller-turbine **OR** Ultrasonic, **as directed**, type.

END OF SECTION 21 05 19 00b



Task	Specification	Specification Description
21 05 19 00	01 22 16 00	No Specification Required



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SECTION 21 05 48 00 - VIBRATION AND SEISMIC CONTROLS FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of vibration and seismic controls for fire-suppression piping and equipment. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Isolation pads.
 - b. Isolation mounts.
 - c. Restrained elastomeric isolation mounts.
 - d. Restraining braces.

C. Definitions

1. IBC: International Building Code.
2. ICC-ES: ICC-Evaluation Service.
3. OSHPD: Office of Statewide Health Planning and Development for the State of California.

D. Performance Requirements

1. Seismic-Restraint Loading:
 - a. Site Class as Defined in the IBC: **A OR B OR C OR D OR E OR F, as directed.**
 - b. Assigned Seismic Use Group or Building Category as Defined in the IBC: **I OR II OR III, as directed.**
 - 1) Component Importance Factor: **1.0 OR 1.5, as directed.**
 - 2) Component Response Modification Factor: **1.5 OR 2.5 OR 3.5 OR 5.0, as directed.**
 - 3) Component Amplification Factor: **1.0 OR 2.5, as directed.**
 - c. Design Spectral Response Acceleration at Short Periods (0.2 Second): As required to meet Project requirements.
 - d. Design Spectral Response Acceleration at 1-Second Period: As required to meet Project requirements.

E. Submittals

1. Product Data: For each product indicated.
2. Delegated-Design Submittal: For vibration isolation and seismic-restraint calculations and details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
3. Welding certificates.
4. Qualification Data: For professional engineer.

F. Quality Assurance

1. Comply with seismic-restraint requirements in the IBC and NFPA 13 unless requirements in this Section are more stringent.
2. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
3. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on

Vibration And Seismic Controls For Fire-Suppression Piping And Equipment



calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

1.2 PRODUCTS

A. Vibration Isolators

1. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.
 - a. Resilient Material: Oil- and water-resistant neoprene **OR** rubber **OR** hermetically sealed compressed fiberglass, **as directed**.
2. Mounts: Double-deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.
 - a. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
 - b. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.
3. Restrained Mounts: All-directional mountings with seismic restraint.
 - a. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
 - b. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

B. Seismic-Restraint Devices

1. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of ICC-ES **OR** OSHPD **OR** an agency acceptable to authorities having jurisdiction, **as directed**.
 - a. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
2. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.
3. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections **OR** Reinforcing steel angle clamped, **as directed**, to hanger rod.
4. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.
5. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings and matched to type and size of attachment devices used.
6. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.
7. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.



8. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

C. Factory Finishes

1. Finish

- a. Manufacturer's standard prime-coat finish ready for field painting.

OR

Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

- 1) Powder coating on springs and housings.
- 2) All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
- 3) Baked enamel or powder coat for metal components on isolators for interior use.
- 4) Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

1.3 EXECUTION

A. Applications

1. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an evaluation service member of ICC-ES **OR** OSHPD **OR** an agency acceptable to authorities having jurisdiction, **as directed**.
2. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
3. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

B. Vibration-Control And Seismic-Restraint Device Installation

1. Equipment Restraints:

- a. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
- b. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES **OR** OSHPD **OR** an agency acceptable to authorities having jurisdiction, **as directed**, providing required submittals for component.

2. Piping Restraints:

- a. Comply with requirements in MSS SP-127 and NFPA 13.
- b. Space lateral supports a maximum of 40 feet (12 m) o.c., and longitudinal supports a maximum of 80 feet (24 m) o.c.
- c. Brace a change of direction longer than 12 feet (3.7 m).

3. Install cables so they do not bend across edges of adjacent equipment or building structure.
4. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES **OR** OSHPD **OR** an agency acceptable to authorities having jurisdiction, **as directed**, providing required submittals for component.
5. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
6. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
7. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
8. Drilled-in Anchors:



- a. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
- b. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
- c. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
- d. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
- e. Set anchors to manufacturer's recommended torque, using a torque wrench.
- f. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

C. Accommodation Of Differential Seismic Motion

1. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Division 21 Section "Wet-pipe Sprinkler Systems" for piping flexible connections.

END OF SECTION 21 05 48 00

**SECTION 21 07 00 00 - FIRE-SUPPRESSION SYSTEMS INSULATION**

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for fire-suppression systems insulation. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Insulation Materials:
 - 1) Calcium silicate.
 - 2) Cellular glass.
 - 3) Flexible elastomeric.
 - 4) Mineral fiber.
 - 5) Phenolic.
 - 6) Polyisocyanurate.
 - 7) Polyolefin.
 - 8) Polystyrene.
 - b. Insulating cements.
 - c. Adhesives.
 - d. Mastics.
 - e. Lagging adhesives.
 - f. Sealants.
 - g. Factory-applied jackets.
 - h. Field-applied fabric-reinforcing mesh.
 - i. Field-applied cloths.
 - j. Field-applied jackets.
 - k. Tapes.
 - l. Securements.
 - m. Corner angles.

C. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittal:
 - a. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.
3. Shop Drawings:
 - a. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - b. Detail attachment and covering of heat tracing inside insulation.
 - c. Detail insulation application at pipe expansion joints for each type of insulation.
 - d. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - e. Detail removable insulation at piping specialties and equipment connections.
 - f. Detail application of field-applied jackets.
 - g. Detail application at linkages of control devices.
 - h. Detail field application for fire-suppression water storage tanks.
4. Field quality-control reports.

D. Quality Assurance



1. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
 - a. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - b. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

E. Delivery, Storage, And Handling

1. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.2 PRODUCTS

A. Insulation Materials

1. Comply with requirements in Part 1.3 schedule articles for where insulating materials shall be applied.
2. Products shall not contain asbestos, lead, mercury, or mercury compounds.
3. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
4. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
5. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
6. Calcium Silicate:
 - a. Preformed Pipe Sections: Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.
 - b. Prefabricated Fitting Covers: Comply with ASTM C 450 and ASTM C 585 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.
7. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - a. Block Insulation: ASTM C 552, Type I.
 - b. Special-Shaped Insulation: ASTM C 552, Type III.
 - c. Board Insulation: ASTM C 552, Type IV.
 - d. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
 - e. Preformed Pipe Insulation with Factory-Applied ASJ **OR** ASJ-SSL, **as directed**: Comply with ASTM C 552, Type II, Class 2.
 - f. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
8. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
9. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
10. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For equipment applications, provide insulation without factory-applied jacket **OR** with factory-applied ASJ **OR** with factory-applied FSK jacket, **as directed**. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
11. Mineral-Fiber, Preformed Pipe Insulation:
 - a. Type I, 850 deg F (454 deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, without factory-applied



- jacket **OR** with factory-applied ASJ **OR** with factory-applied ASJ-SSL, **as directed**.
Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- b. Type II, 1200 deg F (649 deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type II, Grade A, without factory-applied jacket **OR** with factory-applied ASJ **OR** with factory-applied ASJ-SSL, **as directed**.
Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
12. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ **OR** FSK jacket, **as directed**, complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. (40 kg/cu. m) or more. Thermal conductivity (k-value) at 100 deg F (55 deg C) is 0.29 Btu x in./h x sq. ft. x deg F (0.042 W/m x K) or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
13. Phenolic:
- a. Preformed pipe insulation of rigid, expanded, closed-cell structure. Comply with ASTM C 1126, Type III, Grade 1.
- b. Block insulation of rigid, expanded, closed-cell structure. Comply with ASTM C 1126, Type II, Grade 1.
- c. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
- d. Factory-Applied Jacket: Requirements are specified in "Factory-Applied Jackets" Article.
- 1) Preformed Pipe Insulation: None **OR** ASJ, **as directed**.
- 2) Board for Equipment Applications: None **OR** ASJ, **as directed**.
14. Polyisocyanurate: Unfaced, preformed, rigid cellular polyisocyanurate material intended for use as thermal insulation.
- a. Comply with ASTM C 591, Type I or Type IV, except thermal conductivity (k-value) shall not exceed 0.19 Btu x in./h x sq. ft. x deg F (0.027 W/m x K) at 75 deg F (24 deg C) after 180 days of aging.
- b. Flame-spread index shall be 25 or less and smoke-developed index shall be 50 or less for thickness up to 1-1/2 inches (38 mm) as tested by ASTM E 84.
- c. Fabricate shapes according to ASTM C 450 and ASTM C 585.
- d. Factory-Applied Jacket: Requirements are specified in "Factory-Applied Jackets" Article.
- 1) Pipe Applications: None **OR** ASJ **OR** ASJ-SSL **OR** PVDC **OR** PVDC-SSL, **as directed**.
- 2) Equipment Applications: None **OR** ASJ **OR** ASJ-SSL **OR** PVDC **OR** PVDC-SSL, **as directed**.
15. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials and Type II, Grade 1 for sheet materials.
16. Polystyrene: Rigid, extruded cellular polystyrene intended for use as thermal insulation. Comply with ASTM C 578, Type IV or Type XIII, except thermal conductivity (k-value) shall not exceed 0.26 Btu x in./h x sq. ft. x deg F (0.038 W/m x K) after 180 days of aging. Fabricate shapes according to ASTM C 450 and ASTM C 585.
- B. Insulating Cements
1. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
2. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.
3. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.
- C. Adhesives
1. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
2. Calcium Silicate Adhesive: Fibrous, sodium-silicate-based adhesive with a service temperature range of 50 to 800 deg F (10 to 427 deg C).
- a. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).



3. Cellular-Glass, Phenolic, Polyisocyanurate, and Polystyrene Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F (minus 59 to plus 149 deg C).
 - a. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
4. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 - a. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
5. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - a. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Polystyrene Adhesive: Solvent- or water-based, synthetic resin adhesive with a service temperature range of minus 20 to plus 140 deg F (29 to plus 60 deg C).
7. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A, for bonding insulation jacket lap seams and joints.
 - a. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
8. PVC Jacket Adhesive: Compatible with PVC jacket.
 - a. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Mastics

1. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
 - a. For indoor applications, use mastics that have a VOC content of <Insert value> g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
 - a. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
 - b. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
 - c. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
 - d. Color: White.
3. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.
 - a. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.033 metric perm) at 30-mil (0.8-mm) dry film thickness.
 - b. Service Temperature Range: Minus 50 to plus 220 deg F (Minus 46 to plus 104 deg C).
 - c. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
 - d. Color: White.
4. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
 - a. Water-Vapor Permeance: ASTM F 1249, 3 perms (2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
 - b. Service Temperature Range: Minus 20 to plus 200 deg F (Minus 29 to plus 93 deg C).
 - c. Solids Content: 63 percent by volume and 73 percent by weight.
 - d. Color: White.

E. Lagging Adhesives

1. Description: Comply with MIL-A-3316C, Class I, Grade A, and shall be compatible with insulation materials, jackets, and substrates.
 - a. For indoor applications, use lagging adhesives that have a VOC content of <Insert value> g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over equipment and pipe insulation.
 - c. Service Temperature Range: Minus 50 to plus 180 deg F (Minus 46 to plus 82 deg C).
 - d. Color: White.



F. Sealants

1. Joint Sealants:
 - a. Materials shall be compatible with insulation materials, jackets, and substrates.
 - b. Permanently flexible, elastomeric sealant.
 - c. Service Temperature Range: Minus 100 to plus 300 deg F (Minus 73 to plus 149 deg C).
 - d. Color: White or gray.
 - e. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. FSK and Metal Jacket Flashing Sealants:
 - a. Materials shall be compatible with insulation materials, jackets, and substrates.
 - b. Fire- and water-resistant, flexible, elastomeric sealant.
 - c. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
 - d. Color: Aluminum.
 - e. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
 - a. Materials shall be compatible with insulation materials, jackets, and substrates.
 - b. Fire- and water-resistant, flexible, elastomeric sealant.
 - c. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
 - d. Color: White.
 - e. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

G. Factory-Applied Jackets

1. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 - a. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
 - b. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
 - c. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
 - d. PVDC Jacket for Indoor Applications: 4-mil- (0.10-mm-) thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms (0.013 metric perms) when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.
 - e. PVDC Jacket for Outdoor Applications: 6-mil- (0.15-mm-) thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perms (0.007 metric perms) when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.
 - f. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.

H. Field-Applied Fabric-Reinforcing Mesh

1. Woven Glass-Fiber Fabric for Pipe Insulation: Approximately 2 oz./sq. yd. (68 g/sq. m) with a thread count of 10 strands by 10 strands/sq. inch (4 strands by 4 strands/sq. mm) for covering pipe and pipe fittings.
2. Woven Glass-Fiber Fabric for Equipment Insulation: Approximately 6 oz./sq. yd. (203 g/sq. m) with a thread count of 5 strands by 5 strands/sq. inch (2 strands by 2 strands/sq. mm) for covering equipment.
3. Woven Polyester Fabric: Approximately 1 oz./sq. yd. (34 g/sq. m) with a thread count of 10 strands by 10 strands/sq. inch (4 strands by 4 strands/sq. mm), in a Leno weave.

I. Field-Applied Cloths

1. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd. (271 g/sq. m).



J. Field-Applied Jackets

1. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
2. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
 - a. Adhesive: As recommended by jacket material manufacturer.
 - b. Color: White **OR** Color-code jackets based on system. Color as selected by the Owner, **as directed**.
 - c. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - 1) Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
 - d. Factory-fabricated tank heads and tank side panels.
3. Metal Jacket:
 - a. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105 or 5005, Temper H-14.
 - 1) Sheet and roll stock ready for shop or field sizing **OR** Factory cut and rolled to size, **as directed**.
 - 2) Finish and thickness are indicated in field-applied jacket schedules.
 - 3) Moisture Barrier for Indoor Applications: 1-mil- (0.025-mm-) thick, heat-bonded polyethylene and kraft paper **OR** 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper **OR** 2.5-mil- (0.063-mm-) thick Polysurlyn, **as directed**.
 - 4) Moisture Barrier for Outdoor Applications: 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper **OR** 2.5-mil- (0.063-mm-) thick Polysurlyn, **as directed**.
 - 5) Factory-Fabricated Fitting Covers:
 - a) Same material, finish, and thickness as jacket.
 - b) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - c) Tee covers.
 - d) Flange and union covers.
 - e) End caps.
 - f) Beveled collars.
 - g) Valve covers.
 - h) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.
 - b. Stainless-Steel Jacket: ASTM A 167 or ASTM A 240/A 240M.
 - 1) Sheet and roll stock ready for shop or field sizing **OR** Factory cut and rolled to size, **as directed**.
 - 2) Material, finish, and thickness are indicated in field-applied jacket schedules.
 - 3) Moisture Barrier for Indoor Applications: 1-mil- (0.025-mm-) thick, heat-bonded polyethylene and kraft paper **OR** 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper **OR** 2.5-mil- (0.063-mm-) thick Polysurlyn, **as directed**.
 - 4) Moisture Barrier for Outdoor Applications: 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper **OR** 2.5-mil- (0.063-mm-) thick Polysurlyn, **as directed**.
 - 5) Factory-Fabricated Fitting Covers:
 - a) Same material, finish, and thickness as jacket.
 - b) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - c) Tee covers.
 - d) Flange and union covers.
 - e) End caps.
 - f) Beveled collars.
 - g) Valve covers.
 - h) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

K. Tapes



1. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
 - a. Width: 3 inches (75 mm).
 - b. Thickness: 11.5 mils (0.29 mm).
 - c. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
 - d. Elongation: 2 percent.
 - e. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
 - f. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
2. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
 - a. Width: 3 inches (75 mm).
 - b. Thickness: 6.5 mils (0.16 mm).
 - c. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
 - d. Elongation: 2 percent.
 - e. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
 - f. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
3. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.
 - a. Width: 2 inches (50 mm).
 - b. Thickness: 6 mils (0.15 mm).
 - c. Adhesion: 64 ounces force/inch (0.7 N/mm) in width.
 - d. Elongation: 500 percent.
 - e. Tensile Strength: 18 lbf/inch (3.3 N/mm) in width.
4. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
 - a. Width: 2 inches (50 mm).
 - b. Thickness: 3.7 mils (0.093 mm).
 - c. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
 - d. Elongation: 5 percent.
 - e. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.
5. PVDC Tape for Indoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.
 - a. Width: 3 inches (75 mm).
 - b. Film Thickness: 4 mils (0.10 mm).
 - c. Adhesive Thickness: 1.5 mils (0.04 mm).
 - d. Elongation at Break: 145 percent.
 - e. Tensile Strength: 55 lbf/inch (10.1 N/mm) in width.
6. PVDC Tape for Outdoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.
 - a. Width: 3 inches (75 mm).
 - b. Film Thickness: 6 mils (0.15 mm).
 - c. Adhesive Thickness: 1.5 mils (0.04 mm).
 - d. Elongation at Break: 145 percent.
 - e. Tensile Strength: 55 lbf/inch (10.1 N/mm) in width.

L. Securements

1. Bands:
 - a. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 **OR** Type 316, **as directed**; 0.015 inch (0.38 mm) thick, 1/2 inch (13 mm) **OR** 3/4 inch (19 mm), **as directed**, wide with wing seal **OR** closed seal, **as directed**.
 - b. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 1/2 inch (13 mm) **OR** 3/4 inch (19 mm), **as directed**, wide with wing seal **OR** closed seal, **as directed**.
 - c. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.
2. Insulation Pins and Hangers:
 - a. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in



position indicated when self-locking washer is in place. Comply with the following requirements:

- 1) Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.
 - 2) Spindle: Copper- or zinc-coated, low carbon steel **OR** Aluminum **OR** Stainless steel, **as directed**, fully annealed, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.
 - 3) Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
- b. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
- 1) Baseplate: Galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.
 - 2) Spindle: Copper- or zinc-coated, low carbon steel **OR** Aluminum **OR** Stainless steel, **as directed**, fully annealed, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.
 - 3) Adhesive-backed base with a peel-off protective cover.
- c. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick, galvanized-steel **OR** aluminum **OR** stainless-steel, **as directed**, sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.
- 1) Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
3. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.
 4. Wire: 0.080-inch (2.0-mm) nickel-copper alloy **OR** 0.062-inch (1.6-mm) soft-annealed, stainless steel **OR** 0.062-inch (1.6-mm) soft-annealed, galvanized steel, **as directed**.

1.3 EXECUTION

A. Preparation

1. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
OR
Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
 - a. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils (0.127 mm) thick and an epoxy finish 5 mils (0.127 mm) thick if operating in a temperature range between 140 and 300 deg F (60 and 149 deg C). Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
 - b. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F (0 and 149 deg C) with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
3. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

B. General Installation Requirements

1. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.



2. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified in insulation system schedules.
3. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
4. Install insulation with longitudinal seams at top and bottom of horizontal runs.
5. Install multiple layers of insulation with longitudinal and end seams staggered.
6. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
7. Keep insulation materials dry during application and finishing.
8. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
9. Install insulation with least number of joints practical.
10. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - a. Install insulation continuously through hangers and around anchor attachments.
 - b. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - c. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - d. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
11. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
12. Install insulation with factory-applied jackets as follows:
 - a. Draw jacket tight and smooth.
 - b. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
 - c. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) **OR** 4 inches (100 mm), **as directed**, o.c.
 - 1) For below ambient services, apply vapor-barrier mastic over staples.
 - d. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
 - e. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
13. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
14. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
15. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
16. For above ambient services, do not install insulation to the following:
 - a. Vibration-control devices.
 - b. Testing agency labels and stamps.
 - c. Nameplates and data plates.
 - d. Manholes.
 - e. Handholes.
 - f. Cleanouts.

C. Penetrations



1. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 - a. Seal penetrations with flashing sealant.
 - b. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - c. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
 - d. Seal jacket to roof flashing with flashing sealant.
 2. Insulation Installation at Below-Grade Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
 3. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - a. Seal penetrations with flashing sealant.
 - b. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - c. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
 - d. Seal jacket to wall flashing with flashing sealant.
 4. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
 5. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
 - a. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
 6. Insulation Installation at Floor Penetrations:
 - a. Pipe: Install insulation continuously through floor penetrations.
 - b. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping".
- D. Equipment, Tank, And Vessel Insulation Installation
1. Secure insulation with adhesive and anchor pins and speed washers.
 - a. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 **OR** 50, **as directed**, percent coverage of tank and vessel surfaces.
 - b. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
 - c. Protect exposed corners with secured corner angles.
 - d. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:
 - 1) Do not weld anchor pins to ASME-labeled pressure vessels.
 - 2) Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
 - 3) On tanks and vessels, maximum anchor-pin spacing is 3 inches (75 mm) from insulation end joints, and 16 inches (400 mm) o.c. in both directions.
 - 4) Do not overcompress insulation during installation.
 - 5) Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
 - 6) Impale insulation over anchor pins and attach speed washers.
 - 7) Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.



- e. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
 - f. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches (150 mm) from each end. Install wire or cable between two circumferential girdles 12 inches (300 mm) o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches (1200 mm) o.c. Use this network for securing insulation with tie wire or bands.
 - g. Stagger joints between insulation layers at least 3 inches (75 mm).
 - h. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
 - i. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
 - j. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.
2. Flexible Elastomeric Thermal Insulation Installation for Tanks and Vessels: Install insulation over entire surface of tanks and vessels.
 - a. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive.
 - b. Seal longitudinal seams and end joints.

E. General Pipe Insulation Installation

1. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
2. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 - a. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
 - b. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 - c. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 - d. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 - e. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
 - f. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 - g. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for



- above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
- h. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 - i. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.
3. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
 4. Install removable insulation covers at locations indicated. Installation shall conform to the following:
 - a. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 - b. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 - c. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
 - d. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
 - e. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.
- F. Calcium Silicate Insulation Installation
1. Insulation Installation on Straight Pipes and Tubes:
 - a. Secure single-layer insulation with stainless-steel bands at 12-inch (300-mm) intervals and tighten bands without deforming insulation materials.
 - b. Install 2-layer insulation with joints tightly butted and staggered at least 3 inches (75 mm). Secure inner layer with wire spaced at 12-inch (300-mm) intervals. Secure outer layer with stainless-steel bands at 12-inch (300-mm) intervals.
 - c. Apply a skim coat of mineral-fiber, hydraulic-setting cement to insulation surface. When cement is dry, apply flood coat of lagging adhesive and press on one layer of glass cloth or tape. Overlap edges at least 1 inch (25 mm). Apply finish coat of lagging adhesive over glass cloth or tape. Thin finish coat to achieve smooth, uniform finish.
 2. Insulation Installation on Pipe Flanges:
 - a. Install preformed pipe insulation to outer diameter of pipe flange.
 - b. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - c. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of same material and thickness as pipe insulation.
 - d. Finish flange insulation same as pipe insulation.
 3. Insulation Installation on Pipe Fittings and Elbows:
 - a. Install preformed sections of same material as straight segments of pipe insulation when available.



- b. When preformed insulation sections of insulation are not available, install mitered sections of calcium silicate insulation. Secure insulation materials with wire or bands.
 - c. Finish fittings insulation same as pipe insulation.
4. Insulation Installation on Valves and Pipe Specialties:
- a. Install mitered segments of calcium silicate insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - b. Install insulation to flanges as specified for flange insulation application.
 - c. Finish valve and specialty insulation same as pipe insulation.
- G. Cellular-Glass Insulation Installation
1. Insulation Installation on Straight Pipes and Tubes:
- a. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
 - b. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and applicable insulation joint sealant.
 - c. For insulation with factory-applied jackets on above ambient services, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
 - d. For insulation with factory-applied jackets on below ambient services, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
2. Insulation Installation on Pipe Flanges:
- a. Install preformed pipe insulation to outer diameter of pipe flange.
 - b. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - c. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
 - d. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.
3. Insulation Installation on Pipe Fittings and Elbows:
- a. Install preformed sections of same material as straight segments of pipe insulation when available.
 - b. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.
4. Insulation Installation on Valves and Pipe Specialties:
- a. Install preformed sections of cellular-glass insulation to valve body.
 - b. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - c. Install insulation to flanges as specified for flange insulation application.
- H. Flexible Elastomeric Insulation Installation
1. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
2. Insulation Installation on Pipe Flanges:
- a. Install pipe insulation to outer diameter of pipe flange.
 - b. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - c. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
 - d. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
3. Insulation Installation on Pipe Fittings and Elbows:
- a. Install mitered sections of pipe insulation.
 - b. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.



4. Insulation Installation on Valves and Pipe Specialties:
 - a. Install preformed valve covers manufactured of same material as pipe insulation when available.
 - b. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - c. Install insulation to flanges as specified for flange insulation application.
 - d. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

- I. Mineral-Fiber Insulation Installation
 1. Insulation Installation on Straight Pipes and Tubes:
 - a. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
 - b. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and applicable insulation joint sealant.
 - c. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
 - d. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
 2. Insulation Installation on Pipe Flanges:
 - a. Install preformed pipe insulation to outer diameter of pipe flange.
 - b. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - c. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
 - d. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.
 3. Insulation Installation on Pipe Fittings and Elbows:
 - a. Install preformed sections of same material as straight segments of pipe insulation when available.
 - b. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
 4. Insulation Installation on Valves and Pipe Specialties:
 - a. Install preformed sections of same material as straight segments of pipe insulation when available.
 - b. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
 - c. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - d. Install insulation to flanges as specified for flange insulation application.

- J. Phenolic Insulation Installation
 1. General Installation Requirements:
 - a. Secure single-layer insulation with stainless-steel bands at 12-inch (300-mm) intervals and tighten bands without deforming insulation materials.
 - b. Install 2-layer insulation with joints tightly butted and staggered at least 3 inches (75 mm). Secure inner layer with 0.062-inch (1.6-mm) wire spaced at 12-inch (300-mm) intervals. Secure outer layer with stainless-steel bands at 12-inch (300-mm) intervals.
 2. Insulation Installation on Straight Pipes and Tubes:
 - a. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.



- b. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and applicable insulation joint sealant.
 - c. For insulation with factory-applied jackets on above ambient services, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
 - d. For insulation with factory-applied jackets with vapor retarders on below ambient services, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
 3. Insulation Installation on Pipe Flanges:
 - a. Install preformed pipe insulation to outer diameter of pipe flange.
 - b. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - c. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of same material and thickness as pipe insulation.
 4. Insulation Installation on Pipe Fittings and Elbows:
 - a. Install preformed insulation sections of same material as straight segments of pipe insulation.
 5. Insulation Installation on Valves and Pipe Specialties:
 - a. Install preformed insulation sections of same material as straight segments of pipe insulation.
 - b. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - c. Install insulation to flanges as specified for flange insulation application.
- K. Polyisocyanurate Insulation Installation
 1. Insulation Installation on Straight Pipes and Tubes:
 - a. Secure each layer of insulation to pipe with tape or bands and tighten without deforming insulation materials. Orient longitudinal joints between half sections in 3 and 9 o'clock positions on the pipe.
 - b. For insulation with factory-applied jackets with vapor barriers, do not staple longitudinal tabs but secure tabs with additional adhesive or tape as recommended by insulation material manufacturer and seal with vapor-barrier mastic.
 - c. All insulation shall be tightly butted and free of voids and gaps at all joints. Vapor barrier must be continuous. Before installing jacket material, install vapor-barrier system.
 2. Insulation Installation on Pipe Flanges:
 - a. Install preformed pipe insulation to outer diameter of pipe flange.
 - b. Make width of insulation section same as overall width of flange and bolts, same thickness of adjacent pipe insulation, not to exceed 1-1/2-inch (38-mm) thickness.
 - c. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyisocyanurate block insulation of same thickness as pipe insulation.
 3. Insulation Installation on Fittings and Elbows:
 - a. Install preformed sections of same material as straight segments of pipe insulation.
 4. Insulation Installation on Valves and Pipe Specialties:
 - a. Install preformed sections of polyisocyanurate insulation to valve body.
 - b. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - c. Install insulation to flanges as specified for flange insulation application.
- L. Polyolefin Insulation Installation
 1. Insulation Installation on Straight Pipes and Tubes:
 - a. Seal split-tube longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
 2. Insulation Installation on Pipe Flanges:
 - a. Install pipe insulation to outer diameter of pipe flange.



- b. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
- c. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyolefin sheet insulation of same thickness as pipe insulation.
- d. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
3. Insulation Installation on Pipe Fittings and Elbows:
 - a. Install mitered sections of polyolefin pipe insulation.
 - b. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
4. Insulation Installation on Valves and Pipe Specialties:
 - a. Install cut sections of polyolefin pipe and sheet insulation to valve body.
 - b. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - c. Install insulation to flanges as specified for flange insulation application.
 - d. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

M. Polystyrene Insulation Installation

1. Insulation Installation on Straight Pipes and Tubes:
 - a. Secure each layer of insulation with tape or bands and tighten bands without deforming insulation materials. Orient longitudinal joints between half sections in 3 and 9 o'clock positions on the pipe.
 - b. For insulation with factory-applied jackets with vapor barriers, do not staple longitudinal tabs but secure tabs with additional adhesive or tape as recommended by insulation material manufacturer and seal with vapor-barrier mastic.
 - c. All insulation shall be tightly butted and free of voids and gaps at all joints. Vapor barrier must be continuous. Before installing jacket material, install vapor-barrier system.
2. Insulation Installation on Pipe Flanges:
 - a. Install preformed pipe insulation to outer diameter of pipe flange.
 - b. Make width of insulation section same as overall width of flange and bolts, same thickness of adjacent pipe insulation, not to exceed 1-1/2-inch (38-mm) thickness.
 - c. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polystyrene block insulation of same thickness as pipe insulation.
3. Insulation Installation on Pipe Fittings and Elbows:
 - a. Install preformed insulation sections of same material as straight segments of pipe insulation.
4. Insulation Installation on Valves and Pipe Specialties:
 - a. Install preformed section of polystyrene insulation to valve body.
 - b. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - c. Install insulation to flanges as specified for flange insulation application.

N. Field-Applied Jacket Installation

1. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
 - a. Draw jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.
 - b. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of lagging adhesive.
 - c. Completely encapsulate insulation with coating, leaving no exposed insulation.
2. Where FSK jackets are indicated, install as follows:
 - a. Draw jacket material smooth and tight.
 - b. Install lap or joint strips with same material as jacket.



- c. Secure jacket to insulation with manufacturer's recommended adhesive.
 - d. Install jacket with 1-1/2-inch (38-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
 - e. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
3. Where PVC jackets are indicated, install with 1-inch (25-mm) overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.
 - a. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
 4. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints.
 5. Where PVDC jackets are indicated, install as follows:
 - a. Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.
 - b. Wrap factory-presizes jackets around individual pipe insulation sections with one end overlapping the previously installed sheet. Install presized jacket with an approximate overlap at butt joint of 2 inches (50 mm) over the previous section. Adhere lap seal using adhesive or SSL, and then apply 1-1/4 circumferences of appropriate PVDC tape around overlapped butt joint.
 - c. Continuous jacket can be spiral wrapped around a length of pipe insulation. Apply adhesive or PVDC tape at overlapped spiral edge. When electing to use adhesives, refer to manufacturer's written instructions for application of adhesives along this spiral edge to maintain a permanent bond.
 - d. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches (850 mm) or less. The 33-1/2-inch- (850-mm-) circumference limit allows for 2-inch- (50-mm-) overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.
 - e. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.
- O. Finishes
1. Equipment and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 07.
 - a. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - 1) Finish Coat Material: Interior, flat, latex-emulsion size.
 2. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
 3. Color: Final color as selected by the Owner. Vary first and second coats to allow visual inspection of the completed Work.
 4. Do not field paint aluminum or stainless-steel jackets.
- P. Field Quality Control
1. Perform tests and inspections.
 2. Tests and Inspections:
 - a. Inspect field-insulated equipment, randomly selected by the Owner, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.
 - b. Inspect pipe, fittings, strainers, and valves, randomly selected by the Owner, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of



inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

3. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

Q. Equipment Insulation Schedule

1. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.
2. Insulate indoor and outdoor equipment in paragraphs below that is not factory insulated.
3. Fire-suppression water storage tank insulation shall be one of the following:
 - a. Cellular Glass: 2 inches (50 mm) thick.
 - b. Flexible Elastomeric: 1 inch (25 mm) thick.
 - c. Mineral-Fiber Board: 1 inch (25 mm) thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - d. Mineral-Fiber Pipe and Tank: 1 inch (25 mm) thick.
 - e. Phenolic: 1 inch (25 mm) thick.
 - f. Polyisocyanurate: 1 inch (25 mm) thick.
 - g. Polyolefin: 1 inch (25 mm) thick.

R. Piping Insulation Schedule, General

1. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
2. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 - a. Indoor fire-suppression piping.
 - b. Underground piping.

S. Indoor Piping Insulation Schedule

1. Indoor Engine Coolant Piping for Remote Radiator of Engine-Driven Fire Pump:
 - a. All Pipe Sizes: Insulation shall be one of the following:
 - 1) Calcium Silicate: 2 inches (50 mm) thick.
 - 2) Cellular Glass: 2 inches (50 mm) thick.
 - 3) Mineral-Fiber, Preformed Pipe, Type I or II: 2 inches (50 mm) thick.
2. Indoor Engine Exhaust Piping and Silencer, All Pipe Sizes: Calcium silicate, 4 inches (100 mm) thick.

T. Outdoor, Aboveground Piping Insulation Schedule

1. Outdoor Engine Coolant Piping for Remote Radiator of Engine-Driven Fire Pump:
 - a. All Pipe Sizes: Insulation shall be one of the following:
 - 1) Calcium Silicate: 2 inches (50 mm) thick.
 - 2) Cellular Glass: 2 inches (50 mm) thick.
 - 3) Mineral-Fiber, Preformed Pipe, Type I or II: 2 inches (50 mm) thick.
2. Outdoor Engine Exhaust Piping and Silencer, All Pipe Sizes: Calcium silicate, 4 inches (100 mm) thick.
3. Outdoor Fire-Suppression Piping Filled with Water:
 - a. All Pipe Sizes: Insulation shall be one of the following:
 - 1) Cellular Glass: 2 inches (50 mm) thick.
 - 2) Flexible Elastomeric: 2 inches (50 mm) thick.
 - 3) Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches (50 mm) thick.
 - 4) Phenolic: 2 inches (50 mm) thick.
 - 5) Polyisocyanurate: 2 inches (50 mm) thick.
 - 6) Polyolefin: 2 inches (50 mm) thick.
 - 7) Polystyrene: 2 inches (50 mm) thick.

**U. Indoor, Field-Applied Jacket Schedule**

1. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
2. If more than one material is listed, selection from materials listed is Contractor's option.
3. Piping, Concealed:
 - a. None.
 - b. Aluminum, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm) **OR** 0.040 inch (1.0 mm), **as directed**, thick.
 - c. Painted Aluminum, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm), **as directed**, thick.
 - d. Stainless Steel, Type 304 **OR** Type 316, **as directed**, Smooth 2B Finish **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.010 inch (0.25 mm) **OR** 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm), **as directed**, thick.
4. Piping, Exposed:
 - a. None.
 - b. PVC **OR** PVC, Color-Coded by System, **as directed**: 20 mils (0.5 mm) **OR** 30 mils (0.8 mm), **as directed**, thick.
 - c. Aluminum, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm) **OR** 0.040 inch (1.0 mm), **as directed**, thick.
 - d. Painted Aluminum, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm), **as directed**, thick.
 - e. Stainless Steel, Type 304 **OR** Type 316, **as directed**, Smooth 2B Finish **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.010 inch (0.25 mm) **OR** 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm), **as directed**, thick.

V. Outdoor, Field-Applied Jacket Schedule

1. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
2. If more than one material is listed, selection from materials listed is Contractor's option.
3. Equipment, Concealed:
 - a. None.
 - b. PVC **OR** PVC, Color-Coded by System, **as directed**: 20 mils (0.5 mm) **OR** 30 mils (0.8 mm), **as directed**, thick.
 - c. Aluminum, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm) **OR** 0.040 inch (1.0 mm), **as directed**, thick.
 - d. Painted Aluminum, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm), **as directed**, thick.
 - e. Stainless Steel, Type 304 **OR** Type 316, **as directed**, Smooth 2B Finish **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.010 inch (0.25 mm) **OR** 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm), **as directed**, thick.
4. Equipment, Exposed, up to 48 Inches (1200 mm) in Diameter or with Flat Surfaces up to 72 Inches (1800 mm):
 - a. Aluminum **OR** Painted Aluminum, **as directed**, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**, with Z-Shaped Locking Seam, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm) **OR** 0.040 inch (1.0 mm), **as directed**, thick.
 - b. Stainless Steel, Type 304 **OR** Type 316, **as directed**, Smooth 2B Finish **OR** Corrugated **OR** Stucco Embossed, **as directed**, with Z-Shaped Locking Seam, **as directed**: 0.010 inch (0.25 mm) **OR** 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm), **as directed**, thick.



5. Equipment, Exposed, Larger Than 48 Inches (1200 mm) in Diameter or with Flat Surfaces Larger Than 72 Inches (1800 mm):
 - a. Aluminum **OR** Painted Aluminum, **as directed**, Smooth **OR** Stucco Embossed, **as directed**, with 1-1/4-Inch- (32-mm-) Deep Corrugations **OR** 2-1/2-Inch- (65-mm-) Deep Corrugations **OR** 4-by-1-Inch (100-by-25-mm) Box Ribs, **as directed**: 0.032 inch (0.81 mm) **OR** 0.040 inch (1.0 mm), **as directed**, thick.
 - b. Stainless Steel, Type 304 **OR** Type 316, **as directed**, Smooth **OR** Stucco Embossed, **as directed**, with 1-1/4-Inch- (32-mm-) Deep Corrugations **OR** 2-1/2-Inch- (65-mm-) Deep Corrugations **OR** 4-by-1-Inch (100-by-25-mm) Box Ribs, **as directed**: 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm), **as directed**, thick.
6. Outdoor Exposed Piping:
 - a. PVC: 20 mils (0.5 mm) **OR** 30 mils (0.8 mm) **OR** 40 mils (1.0 mm), **as directed**, thick.
 - b. Aluminum **OR** Painted Aluminum, **as directed**, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**, with Z-Shaped Locking Seam, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm) **OR** 0.040 inch (1.0 mm), **as directed**, thick.
 - c. Stainless Steel, Type 304 **OR** Type 316, **as directed**, Smooth 2B Finish **OR** Corrugated **OR** Stucco Embossed, **as directed** with Z-Shaped Locking Seam, **as directed**: 0.010 inch (0.25 mm) **OR** 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm), **as directed**, thick.

END OF SECTION 21 07 00 00



SECTION 21 11 19 00 - FIRE-SUPPRESSION STANDPIPES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for fire-suppression standpipes. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Pipes, fittings, and specialties.
 - b. Fire-protection valves.
 - c. Hose connections.
 - d. Hose stations.
 - e. Monitors.
 - f. Fire-department connections.
 - g. Alarm devices.
 - h. Manual control stations.
 - i. Control panels.
 - j. Pressure gages.

C. Definitions

1. High-Pressure Standpipe Piping: Fire-suppression standpipe piping designed to operate at working pressure higher than standard 175 psig (1200 kPa), but not higher than 250 psig (1725 kPa) **OR** 300 psig (2070 kPa), **as directed**.
2. Standard-Pressure Standpipe Piping: Fire-suppression standpipe piping designed to operate at working pressure 175 psig (1200 kPa) maximum.

D. System Descriptions

1. Automatic Wet-Type, Class I Standpipe System: Includes NPS 2-1/2 (DN 65) hose connections. Has open water-supply valve with pressure maintained and is capable of supplying water demand.
2. Automatic Wet-Type, Class II Standpipe System: Includes NPS 1-1/2 (DN 40) hose stations. Has open water-supply valve with pressure maintained and is capable of supplying water demand.
3. Automatic Wet-Type, Class III Standpipe System: Includes NPS 1-1/2 (DN 40) hose stations and NPS 2-1/2 (DN 65) hose connections. Has open water-supply valve with pressure maintained and is capable of supplying water demand.
4. Automatic Dry-Type, Class I Standpipe System: Includes NPS 2-1/2 (DN 65) hose connections. Has open water-supply valve and dry-pipe valve with standpipes containing compressed air. Opening fire-hose valve releases compressed air and permits water pressure to open dry-pipe valve. Water then flows into standpipes.
5. Automatic Dry-Type, Class II Standpipe System: Includes NPS 1-1/2 (DN 40) hose stations. Has open water-supply valve and dry-pipe valve with standpipes containing compressed air. Opening fire-hose valve releases compressed air and permits water pressure to open dry-pipe valve. Water then flows into standpipes.
6. Automatic Dry-Type, Class III Standpipe System: Includes NPS 1-1/2 (DN 40) hose stations and NPS 2-1/2 (DN 65) hose connections. Has open water-supply valve and dry-pipe valve with standpipes containing compressed air. Opening fire-hose valve releases compressed air and permits water pressure to open dry-pipe valve. Water then flows into standpipes.
7. Semiautomatic Dry-Type, Class I Standpipe System: Includes NPS 2-1/2 (DN 65) hose connections. Has open water-supply valve and deluge valve with standpipes containing air.



Actuation of detection device permits water pressure to open deluge valve. Water then flows into standpipes.

8. Semiautomatic Dry-Type, Class II Standpipe System: Includes NPS 1-1/2 (DN 40) hose stations. Has open water-supply valve and deluge valve with standpipes containing air. Actuation of detection device permits water pressure to open deluge valve. Water then flows into standpipes.
9. Semiautomatic Dry-Type, Class III Standpipe System: Includes NPS 1-1/2 (DN 40) hose stations and NPS 2-1/2 (DN 65) hose connections. Has open water-supply valve and deluge valve with standpipes containing air. Actuation of detection device permits water pressure to open deluge valve. Water then flows into standpipes.
10. Manual Wet-Type, Class I Standpipe System: Includes NPS 2-1/2 (DN 65) hose connections. Has small water supply to maintain water in standpipes. Piping is wet, but water must be pumped into standpipes to satisfy demand.
11. Manual Dry-Type, Class I Standpipe System: Includes NPS 2-1/2 (DN 65) hose connections. Does not have permanent water supply. Piping is dry. Water must be pumped into standpipes to satisfy demand.

E. Performance Requirements

1. Standard-Pressure, Fire-Suppression Standpipe System Component: Listed for 175-psig (1200-kPa) minimum working pressure.
2. High-Pressure, Fire-Suppression Standpipe System Component: Listed for 250-psig (1725-kPa) minimum **OR** 300-psig (2070-kPa), **as directed**, working pressure.
3. Delegated Design: Design fire-suppression standpipes, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
4. Fire-suppression standpipe design shall be approved by authorities having jurisdiction.
 - a. Minimum residual pressure at each hose-connection outlet is as follows:
 - 1) NPS 1-1/2 (DN 40) Hose Connections: 65 psig (450 kPa).
 - 2) NPS 2-1/2 (DN 65) Hose Connections: 100 psig (690 kPa).
 - b. Maximum residual pressure at required flow at each hose-connection outlet is as follows unless otherwise indicated:
 - 1) NPS 1-1/2 (DN 40) Hose Connections: 100 psig (690 kPa).
 - 2) NPS 2-1/2 (DN 65) Hose Connections: 175 psig (1200 kPa).
5. Seismic Performance: Fire-suppression standpipes shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.

F. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: For fire-suppression standpipes. Include plans, elevations, sections, details, and attachments to other work.
 - a. Wiring Diagrams: For power, signal, and control wiring.
3. Delegated-Design Submittal: For standpipe systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
4. Qualification Data: For qualified Installer and professional engineer.
5. Approved Standpipe Drawings: Working plans, prepared according to NFPA 14, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.
6. Welding certificates.
7. Fire-hydrant flow test report.
8. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 14. Include "Contractor's Material and Test Certificate for Aboveground Piping" and "Contractor's Material and Test Certificate for Underground Piping."
9. Field quality-control reports.
10. Operation and Maintenance Data: For fire-suppression standpipes specialties to include in emergency, operation, and maintenance manuals.



G. Quality Assurance

1. Installer Qualifications:
 - a. Installer's responsibilities include designing, fabricating, and installing fire-suppression standpipes and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
 - 1) Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.
2. Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
4. NFPA Standards: Fire-suppression standpipe equipment, specialties, accessories, installation, and testing shall comply with NFPA 14, "Installation of Standpipe and Hose Systems."

H. Project Conditions

1. Interruption of Existing Fire-Suppression Standpipe Service: Do not interrupt fire-suppression standpipe service to facilities occupied by the Owner or others unless permitted under the following conditions and then only after arranging to provide temporary fire-suppression standpipe service according to requirements indicated:
 - a. Notify the Owner no fewer than two days in advance of proposed interruption of fire-suppression standpipe service.
 - b. Do not proceed with interruption of fire-suppression standpipe service without the Owner's written permission.

1.2 PRODUCTS

A. Piping Materials

1. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

B. Steel Pipe And Fittings

1. Standard Weight, Galvanized- and Black-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.
2. Schedule 30, Galvanized- and Black-Steel Pipe: ASTM A 135; ASTM A 795/A 795M, Type E; or ASME B36.10M, wrought steel; with wall thickness not less than Schedule 30 and not more than Schedule 40. Pipe ends may be factory or field formed to match joining method.
3. Thinwall Galvanized- and Black-Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, threadable, with wall thickness less than Schedule 30 and equal to or greater than Schedule 10. Pipe ends may be factory or field formed to match joining method.
4. Schedule 10, Black-Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, Schedule 10 in NPS 5 (DN 125) and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10 (DN 150 to DN 250), plain end.
5. Nonstandard OD, Thinwall Black-Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, thinwall, with plain ends and wall thickness less than Schedule 10.
6. Hybrid Black-Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, lightwall, with wall thickness less than Schedule 10 and greater than Schedule 5.
7. Standard-Weight, Galvanized- and Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, seamless steel pipe with threaded ends.
8. Galvanized and Uncoated, Steel Couplings: ASTM A 865, threaded.
9. Galvanized and Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
10. Malleable- or Ductile-Iron Unions: UL 860.
11. Cast-Iron Flanges: ASME B16.1, Class 125.
12. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.
13. Steel Welding Fittings: ASTM A 234/A 234M and ASME B16.9.



14. Grooved-Joint, Steel-Pipe Appurtenances:
 - a. Pressure Rating: 175 psig (1200 kPa) **OR** 250 psig (1725 kPa) **OR** 300 psig (2070 kPa), **as directed**, minimum.
 - b. Galvanized and Uncoated, Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
 - c. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213, rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

- C. Copper Tube And Fittings
 1. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B) and ASTM B 88, Type M (ASTM B 88M, Type C) water tube, drawn temper.
 2. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
 3. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, pressure fittings.
 4. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
 5. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
 6. Grooved-Joint, Copper-Tube Appurtenances:
 - a. Grooved-End, Copper Fittings: ASTM B 75 (ASTM B 75M), copper tube or ASTM B 584, bronze castings.
 - b. Grooved-End-Tube Couplings: To fit copper tube dimensions, with design similar to AWWA C606. Include ferrous housing sections, EPDM-rubber gasket suitable for hot and cold water, and bolts and nuts.

- D. Piping Joining Materials
 1. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick or ASME B16.21, nonmetallic and asbestos free.
 - a. Class 125, Cast-Iron Flanges and Class 150, Bronze Flat-Face Flanges: Full-face gaskets.
 - b. Class 250, Cast-Iron Flanges and Class 300, Steel Raised-Face Flanges: Ring-type gaskets.
 2. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
 3. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.
 4. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

- E. Listed Fire-Protection Valves
 1. General Requirements:
 - a. Valves shall be UL listed or FM approved.
 - b. Minimum Pressure Rating for Standard-Pressure Piping: 175 psig (1200 kPa).
 - c. Minimum Pressure Rating for High-Pressure Piping: 250 psig (1725 kPa) **OR** 300 psig (2070 kPa), **as directed**.
 2. Ball Valves:
 - a. Standard: UL 1091 except with ball instead of disc.
 - b. Valves NPS 1-1/2 (DN 40) and Smaller: Bronze body with threaded ends.
 - c. Valves NPS 2 and NPS 2-1/2 (DN 50 and DN 65): Bronze body with threaded ends or ductile-iron body with grooved ends.
 - d. Valves NPS 3 (DN 80): Ductile-iron body with grooved ends.
 3. Bronze Butterfly Valves:
 - a. Standard: UL 1091.
 - b. Pressure Rating: 175 psig (1200 kPa).
 - c. Body Material: Bronze.
 - d. End Connections: Threaded.



4. Iron Butterfly Valves:
 - a. Standard: UL 1091.
 - b. Pressure Rating: 175 psig (1200 kPa).
 - c. Body Material: Cast or ductile iron.
 - d. Style: Lug or wafer.
OR
End Connections: Grooved.
5. Check Valves:
 - a. Standard: UL 312.
 - b. Pressure Rating: 250 psig (1725 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - c. Type: Swing check.
 - d. Body Material: Cast iron.
 - e. End Connections: Flanged or grooved.
6. Bronze OS&Y Gate Valves:
 - a. Standard: UL 262.
 - b. Pressure Rating: 175 psig (1200 kPa).
 - c. Body Material: Bronze.
 - d. End Connections: Threaded.
7. Iron OS&Y Gate Valves:
 - a. Standard: UL 262.
 - b. Pressure Rating: 250 psig (1725 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - c. Body Material: Cast or ductile iron.
 - d. End Connections: Flanged or grooved.
8. Indicating-Type Butterfly Valves:
 - a. Standard: UL 1091.
 - b. Pressure Rating: 175 psig (1200 kPa) minimum.
 - c. Valves NPS 2 (DN 50) and Smaller:
 - 1) Valve Type: Ball or butterfly.
 - 2) Body Material: Bronze.
 - 3) End Connections: Threaded.
 - d. Valves NPS 2-1/2 (DN 65) and Larger:
 - 1) Valve Type: Butterfly.
 - 2) Body Material: Cast or ductile iron.
 - 3) End Connections: Flanged, grooved, or wafer.
 - e. Valve Operation: Integral electrical, 115-V ac, prewired, single-circuit, supervisory switch **OR** electrical, 115-V ac, prewired, two-circuit, supervisory switch **OR** visual, **as directed**, indicating device.
9. NRS Gate Valves:
 - a. Standard: UL 262.
 - b. Pressure Rating: 250 psig (1725 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - c. Body Material: Cast iron with indicator post flange.
 - d. Stem: Nonrising.
 - e. End Connections: Flanged or grooved.
10. Indicator Posts:
 - a. Standard: UL 789.
 - b. Type: Horizontal for wall mounting.
 - c. Body Material: Cast iron with extension rod and locking device.
 - d. Operation: Wrench **OR** Hand wheel, **as directed**.

F. Trim And Drain Valves

1. General Requirements:
 - a. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 - b. Pressure Rating: 175 psig (1200 kPa) minimum.
2. Angle Valves.
3. Ball Valves.



4. Globe Valves.
5. Plug Valves.

G. Specialty Valves

1. General Requirements:
 - a. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 - b. Pressure Rating:
 - 1) Standard-Pressure Piping Specialty Valves: 175 psig (1200 kPa) minimum.
 - 2) High-Pressure Piping Specialty Valves: 250 psig (1725 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - c. Body Material: Cast or ductile iron.
 - d. Size: Same as connected piping.
 - e. End Connections: Flanged or grooved.
2. Alarm Valves:
 - a. Standard: UL 193.
 - b. Design: For horizontal or vertical installation.
 - c. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber, **as directed**, and fill-line attachment with strainer.
 - d. Drip Cup Assembly (if retarding chamber is required): Pipe drain without valves and separate from main drain piping.
 - e. Drip Cup Assembly (if retarding chamber is not required): Pipe drain with check valve to main drain piping.
3. Dry-Pipe Valves:
 - a. Standard: UL 260.
 - b. Design: Differential-pressure type.
 - c. Include UL 1486, quick-opening devices, trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
 - d. Air-Pressure Maintenance Device:
 - 1) Standard: UL 260.
 - 2) Type: Automatic device to maintain minimum air pressure in piping.
 - 3) Include shutoff valves to permit servicing without shutting down sprinkler piping, bypass valve for quick filling, pressure regulator or switch to maintain pressure, strainer, pressure ratings with 14- to 60-psig (95- to 410-kPa) adjustable range, and 175-psig (1200-kPa) **OR** 300-psig (2070-kPa), **as directed**, outlet pressure.
 - e. Air Compressor:
 - 1) Standard: UL's "Fire Protection Equipment Directory" listing.
 - 2) Motor Horsepower: Fractional.
 - 3) Power: 120-V ac, 60 Hz, single phase.
4. Deluge Valves:
 - a. Standard: UL 260.
 - b. Design: Hydraulically operated, differential-pressure type.
 - c. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, drip cup assembly piped without valves and separate from main drain line, fill-line attachment with strainer, and push-rod chamber supply connection.
 - d. Wet, Pilot-Line Trim Set: Include gage to read push-rod chamber pressure, globe valve for manual operation of deluge valve, and connection for actuation device.
 - e. Dry, Pilot-Line Trim Set: Include dry, pilot-line actuator; air- and water-pressure gages; low-air-pressure warning switch; air relief valve; and actuation device. Dry, pilot-line actuator includes cast-iron, operated, diaphragm-type valve with resilient facing plate, resilient diaphragm, and replaceable bronze seat. Valve includes threaded water and air inlets and water outlet. Loss of air pressure on dry, pilot-line side allows pilot-line actuator to open and causes deluge valve to open immediately.
 - f. Air-Pressure Maintenance Device:



- 1) Standard: UL 260.
- 2) Type: Automatic device to maintain minimum air pressure in piping.
- 3) Include shutoff valves to permit servicing without shutting down sprinkler piping, bypass valve for quick filling, pressure regulator, or switch to maintain pressure, strainer, pressure ratings with 14- to 60-psig (95- to 410-kPa) adjustable range, and 175-psig (1200-kPa) **OR** 300-psig (2070-kPa), **as directed**, outlet pressure.
- g. Air Compressor:
 - 1) Standard: UL's "Fire Protection Equipment Directory" listing.
 - 2) Motor Horsepower: Fractional.
 - 3) Power: 120-V ac, 60 Hz, single phase.
5. Pressure-Reducing Valves:
 - a. UL 668 hose valve, with integral UL 1468 reducing device.
 - b. Pressure Rating: 300 psig (2070 kPa) minimum.
 - c. Material: Brass or bronze.
 - d. Inlet: Female pipe threads.
 - e. Outlet: Threaded with or without adapter having male hose threads.
 - f. Pattern: Angle or gate.
 - g. Finish: Polished chrome plated **OR** Rough brass or bronze **OR** Rough chrome plated, **as directed**.
6. Automatic (Ball Drip) Drain Valves:
 - a. Standard: UL 1726.
 - b. Pressure Rating: 175 psig (1200 kPa) minimum.
 - c. Type: Automatic draining, ball check.
 - d. Size: NPS 3/4 (DN 20).
 - e. End Connections: Threaded.
- H. Hose Connections
 1. Adjustable-Valve Hose Connections:
 - a. Standard: UL 668 hose valve, with integral UL 1468 reducing or restricting pressure-control device, for connecting fire hose.
 - b. Pressure Rating: 300 psig (2070 kPa) minimum.
 - c. Material: Brass or bronze.
 - d. Size: NPS 1-1/2 or NPS 2-1/2 (DN 40 or DN 65), as indicated.
 - e. Inlet: Female pipe threads.
 - f. Outlet: Male hose threads with lugged cap, gasket, and chain. Include hose valve threads according to NFPA 1963 and matching local fire-department threads.
 - g. Pattern: Angle or gate.
 - h. Pressure-Control Device Type: Pressure reducing **OR** restricting, **as directed**.
 - i. Design Outlet Pressure Setting: as directed by the Owner.
 - j. Finish: Polished chrome plated **OR** Rough brass or bronze **OR** Rough chrome plated, **as directed**.
 2. Nonadjustable-Valve Hose Connections:
 - a. Standard: UL 668 hose valve for connecting fire hose.
 - b. Pressure Rating: 300 psig (2070 kPa) minimum.
 - c. Material: Brass or bronze.
 - d. Size: NPS 1-1/2 or NPS 2-1/2 (DN 40 or DN 65), as indicated.
 - e. Inlet: Female pipe threads.
 - f. Outlet: Male hose threads with lugged cap, gasket, and chain. Include hose valve threads according to NFPA 1963 and matching local fire-department threads.
 - g. Pattern: Angle or gate.
 - h. Finish: Polished chrome plated **OR** Rough brass or bronze **OR** Rough chrome plated, **as directed**.
- I. NPS 1-1/2 (DN 40) Rack-Type Hose Stations
 1. Hose Rack:
 - a. Standard: UL 47.



- b. Material: Brass or bronze with polished chrome-plated **OR** Steel with red-enamel, **as directed**, finish.
 - c. Type: Hose-rack assembly. Include hose valve, hose rack, water-retention device, hose pins, and hose.
 - d. Operation: Semiautomatic.
 - e. Sized to hold fire hose.
2. Hose Valve:
- a. Standard: UL 668 NPS 1-1/2 (DN 40), for connecting fire hose.
 - b. Type: Adjustable **OR** Nonadjustable, **as directed**.
 - c. Pressure-Control Device: Not required **OR** Pressure reducing **OR** Pressure restricting, **as directed**.
 - d. Design Outlet Pressure Setting: Not applicable **OR as directed**.
 - e. Hose Valve and Trim Finish: Polished chrome plated **OR** Rough brass or bronze **OR** Rough chrome plated, **as directed**.
 - f. Pressure Rating: 300 psig (2070 kPa) minimum.
 - g. Pattern: Angle.
 - h. Material: Brass or bronze.
 - i. Pressure-Control Device: UL 1468 integral or for field installation if indicated.
 - j. Size: NPS 1-1/2 (DN 40).
 - k. Inlet: Female pipe threads.
 - l. Outlet: Male hose threads according to NFPA 1963 and matching local fire-department threads.
3. Hose:
- a. Standards: NFPA 1961 and UL 219 lined fire hose with swivel inlet, coupling, gaskets, and nozzle.
 - b. Size: NPS 1-1/2 (DN 40).
 - c. Length: 50 feet (15 m) **OR** 75 feet (23 m) **OR** 100 feet (30 m), **as directed**.
 - d. Jacket: Combination of natural and synthetic threads **OR** Natural thread **OR** Synthetic thread, **as directed**.
 - e. Lining: Combination of rubber and plastic compounds **OR** Rubber compound **OR** Plastic compound, **as directed**.
 - f. Cover: Rubber, plastic, or combination of rubber and plastic compounds.
 - g. Nozzle: UL 401.
 - 1) Material: Brass **OR** Polished brass **OR** Rough chrome-plated brass **OR** Polished chrome-plated brass **OR** Polycarbonate plastic, **as directed**.
 - 2) Type: Plain, for nonadjustable water stream **OR** Spray, adjustable from shutoff to fog spray or straight stream **OR** Spray, adjustable from shutoff to full fog; for use on electrical fires, **as directed**.
- J. NPS 1-1/2 BY NPS 2-1/2 (DN 40 BY DN 65) Rack-Type Hose Stations
1. Hose Rack:
- a. Standard: UL 47.
 - b. Material: Brass or bronze with polished chrome-plated **OR** Steel with red-enamel, **as directed**, finish.
 - c. Type: Hose-rack assembly. Include hose valve, reducer adapter, hose rack, water-retention device, hose pins, and hose.
 - d. Operation: Semiautomatic.
 - e. Sized to hold fire hose.
2. Hose Valve:
- a. Standard: UL 668, NPS 2-1/2 (DN 65), for connecting fire hose.
 - b. Type: Adjustable **OR** Nonadjustable, **as directed**.
 - c. Pressure-Control Device: Not required **OR** Pressure reducing **OR** Pressure restricting, **as directed**.
 - d. Design Outlet Pressure Setting: Not applicable **OR as directed**.



- e. Hose Valve and Trim Finish: Polished chrome plated **OR** Rough brass or bronze **OR** Rough chrome plated, **as directed**.
 - f. Pressure Rating: 300 psig (2070 kPa) minimum.
 - g. Pattern: Angle.
 - h. Material: Brass or bronze.
 - i. Pressure-Control Device: UL 1468, integral or for field installation if indicated.
 - j. Size: NPS 2-1/2 (DN 65).
 - k. Inlet: Female pipe threads.
 - l. Outlet: Male hose threads according to NFPA 1963 and matching local fire-department threads.
 - m. Reducer Adapter: NPS 2-1/2 by NPS 1-1/2 (DN 65 by DN 40).
3. Hose:
- a. Standards: NFPA 1961 and UL 219, lined fire hose with swivel inlet, coupling, gaskets, and nozzle.
 - b. Size: NPS 1-1/2 (DN 40).
 - c. Length: 50 feet (15 m) **OR** 75 feet (23 m) **OR** 100 feet (30 m), **as directed**.
 - d. Jacket: Combination of natural and synthetic threads **OR** Natural thread **OR** Synthetic thread, **as directed**.
 - e. Lining: Combination of rubber and plastic compounds **OR** Rubber compound **OR** Plastic compound, **as directed**.
 - f. Cover: Rubber, plastic, or combination of rubber and plastic compounds.
 - g. Nozzle: UL 401 spray nozzle unless plain nozzle is indicated.
 - 1) Material: Brass **OR** Polished brass **OR** Rough chrome-plated brass **OR** Polished chrome-plated brass **OR** Polycarbonate plastic, **as directed**.
 - 2) Type: Plain, for nonadjustable water stream **OR** Spray, adjustable from shutoff to fog spray or straight stream **OR** Spray, adjustable from shutoff to full fog; for use on electrical fires, **as directed**.
- K. NPS 1-1/2 (DN 40) Reel-Type Hose Stations
- 1. Hose Reel:
 - a. Standard: UL 47.
 - b. Hose Reel and Bracket Material: Steel.
 - c. Type: Hose-reel assembly. Include hose valve, wall bracket, hose reel, water-retention device, hose pins, and hose.
 - d. Operation: Semiautomatic.
 - e. Sized to hold fire hose.
 - f. Finish: Red enamel.
 - 2. Hose Valve:
 - a. Standard: UL 668, NPS 1-1/2 (DN 40), for connecting fire hose.
 - b. Type: Adjustable **OR** Nonadjustable, **as directed**.
 - c. Pressure-Control Device: Not required **OR** Pressure reducing **OR** Pressure restricting, **as directed**.
 - d. Design Outlet Pressure Setting: Not applicable **OR as directed**.
 - e. Hose Valve and Trim Finish: Polished chrome plated **OR** Rough brass or bronze **OR** Rough chrome plated, **as directed**.
 - f. Pressure Rating: 300 psig (2070 kPa) minimum.
 - g. Pattern: Angle.
 - h. Material: Brass or bronze.
 - i. Pressure-Control Device: UL 1468, integral or for field installation if indicated.
 - j. Size: NPS 1-1/2 (DN 40).
 - k. Inlet: Female pipe threads.
 - l. Outlet: Male hose threads according to NFPA 1963 and matching local fire-department threads.
 - 3. Hose:
 - a. Standards: NFPA 1961 and UL 219 lined fire hose with swivel inlet, coupling, gaskets, and nozzle.



- b. Size: NPS 1-1/2 (DN 40).
- c. Length: 50 feet (15 m) **OR** 75 feet (23 m) **OR** 100 feet (30 m), **as directed**.
- d. Jacket: Combination of natural and synthetic threads **OR** Natural thread **OR** Synthetic thread, **as directed**.
- e. Lining: Combination of rubber and plastic compounds **OR** Rubber compound **OR** Plastic compound, **as directed**.
- f. Cover: Rubber, plastic, or combination of rubber and plastic compounds.
- g. Nozzle: UL 401.
 - 1) Material: Brass **OR** Polished brass **OR** Rough chrome-plated brass **OR** Polished chrome-plated brass **OR** Polycarbonate plastic, **as directed**.
 - 2) Type: Spray, adjustable from shutoff to fog spray or straight stream **OR** full fog; for use on electrical fires, **as directed**.

L. Monitors

- 1. Type: Stationary.
- 2. Nozzle: UL 401, NPS 2-1/2 (DN 65), brass, adjustable from fog spray to straight stream to shutoff.
- 3. Horizontal Rotation: 360 degrees with locking device.
- 4. Vertical Rotation: 80-degree elevation and 60-degree depression with locking device.
- 5. Waterway: Double **OR** Single, **as directed**, brass or stainless-steel tube.
- 6. Waterway Size: NPS 2-1/2 (DN 65) minimum.
- 7. Water Stream Flow: 500 gpm (31.5 L/s) **OR** 750 gpm (47.3 L/s) **OR** 1000 gpm (63 L/s), **as directed**.
- 8. Operation: Lever **OR** Wheel, **as directed**.
- 9. Base Inlet Size: NPS 2-1/2 (DN 65) **OR** NPS 3 (DN 80) **OR** NPS 4 (DN 100), **as directed**.
- 10. Finish: Red-painted body with brass trim.

M. Fire-Department Connections

- 1. Exposed-Type, Fire-Department Connection:
 - a. Standard: UL 405.
 - b. Type: Exposed, projecting, for wall mounting.
 - c. Pressure Rating: 175 psig (1200 kPa) minimum.
 - d. Body Material: Corrosion-resistant metal.
 - e. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
 - f. Caps: Brass, lugged type, with gasket and chain.
 - g. Escutcheon Plate: Round, brass, wall type.
 - h. Outlet: Back, with pipe threads.
 - i. Number of Inlets: Two **OR** Three, **as directed**.
 - j. Escutcheon Plate Marking: Similar to "AUTO SPKR & STANDPIPE" **OR** "STANDPIPE", **as directed**.
 - k. Finish: Polished chrome plated **OR** Rough brass or bronze **OR** Rough chrome plated, **as directed**.
 - l. Outlet Size: NPS 4 (DN 100) **OR** NPS 5 (DN 125) **OR** NPS 6 (DN 150), **as directed**.
- 2. Flush-Type, Fire-Department Connection:
 - a. Standard: UL 405.
 - b. Type: Flush, for wall mounting.
 - c. Pressure Rating: 175 psig (1200 kPa) minimum.
 - d. Body Material: Corrosion-resistant metal.
 - e. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
 - f. Caps: Brass, lugged type, with gasket and chain.
 - g. Escutcheon Plate: Rectangular, brass, wall type.



- h. Outlet: With pipe threads.
 - i. Body Style: Horizontal **OR** Square **OR** Vertical, **as directed**.
 - j. Number of Inlets: Two **OR** Three **OR** Four **OR** Six, **as directed**.
 - k. Outlet Location: Back **OR** Bottom **OR** Left side **OR** Right side **OR** Top, **as directed**.
 - l. Escutcheon Plate Marking: Similar to "AUTO SPKR & STANDPIPE" **OR** "STANDPIPE", **as directed**.
 - m. Finish: Polished chrome plated **OR** Rough brass or bronze **OR** Rough chrome plated, **as directed**.
 - n. Outlet Size: NPS 4 (DN 100) **OR** NPS 5 (DN 125) **OR** NPS 6 (DN 150) **OR** NPS 8 (DN 200), **as directed**.
3. Yard-Type, Fire-Department Connection:
- a. Standard: UL 405.
 - b. Type: Exposed, freestanding.
 - c. Pressure Rating: 175 psig (1200 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - d. Body Material: Corrosion-resistant metal.
 - e. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
 - f. Caps: Brass, lugged type, with gasket and chain.
 - g. Escutcheon Plate: Round, brass, floor type.
 - h. Outlet: Bottom, with pipe threads.
 - i. Number of Inlets: Two **OR** Three **OR** Four, **as directed**.
 - j. Sleeve: Brass **OR** Not required, **as directed**.
 - k. Sleeve Height: 18 inches (460 mm).
 - l. Escutcheon Plate Marking: Similar to "AUTO SPKR & STANDPIPE" **OR** "STANDPIPE", **as directed**.
 - m. Finish, Including Sleeve: Polished chrome plated **OR** Rough brass or bronze **OR** Rough chrome plated, **as directed**.
 - n. Outlet Size: NPS 4 (DN 100) **OR** NPS 5 (DN 125) **OR** NPS 6 (DN 150), **as directed**.
- N. Alarm Devices
- 1. Alarm-device types shall match piping and equipment connections.
 - 2. Water-Motor-Operated Alarm:
 - a. Standard: UL 753.
 - b. Type: Mechanically operated, with Pelton wheel.
 - c. Alarm Gong: Cast aluminum with red-enamel factory finish.
 - d. Size: 10-inch (250-mm) diameter.
 - e. Components: Shaft length, bearings, and sleeve to suit wall construction.
 - f. Inlet: NPS 3/4 (DN 20).
 - g. Outlet: NPS 1 (DN 25) drain connection.
 - 3. Electrically Operated Alarm Bell:
 - a. Standard: UL 464.
 - b. Type: Vibrating, metal alarm bell.
 - c. Size: 6-inch (150-mm) minimum **OR** 8-inch (200-mm) minimum **OR** 10-inch (250-mm), **as directed**, diameter.
 - d. Finish: Red-enamel factory finish, suitable for outdoor use.
 - 4. Water-Flow Indicators:
 - a. Standard: UL 346.
 - b. Water-Flow Detector: Electrically supervised.
 - c. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
 - d. Type: Paddle operated.
 - e. Pressure Rating: 250 psig (1725 kPa).
 - f. Design Installation: Horizontal or vertical.



5. Pressure Switches:
 - a. Standard: UL 346.
 - b. Type: Electrically supervised water-flow switch with retard feature.
 - c. Components: Single-pole, double-throw switch with normally closed contacts.
 - d. Design Operation: Rising pressure signals water flow.
 6. Valve Supervisory Switches:
 - a. Standard: UL 346.
 - b. Type: Electrically supervised.
 - c. Components: Single-pole, double-throw switch with normally closed contacts.
 - d. Design: Signals that controlled valve is in other than fully open position.
 7. Indicator-Post Supervisory Switches:
 - a. Standard: UL 346.
 - b. Type: Electrically supervised.
 - c. Components: Single-pole, double-throw switch with normally closed contacts.
 - d. Design: Signals that controlled indicator-post valve is in other than fully open position.
- O. Manual Control Stations
1. Description: UL listed or FM approved, hydraulic operation, with union, NPS 1/2 (DN 15) pipe nipple, and bronze ball valve. Include metal enclosure labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut to prevent accidental opening.
- P. Control Panels
1. Description: Single-area, two-area, or single-area cross-zoned control panel as indicated, including NEMA ICS 6, Type 1 enclosure, detector, alarm, and solenoid-valve circuitry for operation of deluge valves. Panels contain power supply; battery charger; standby batteries; field-wiring terminal strip; electrically supervised solenoid valves and polarized fire-alarm bell; lamp test facility; single-pole, double-throw auxiliary alarm contacts; and rectifier.
 - a. Panels: UL listed and FM approved when used with thermal detectors and Class A detector circuit wiring. Electrical characteristics are 120-V ac, 60 Hz, with 24-V dc rechargeable batteries.
 - b. Manual Control Stations: Electric operation, metal enclosure, labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut to prevent accidental opening.
OR
 Manual Control Stations: Hydraulic operation, with union, NPS 1/2 (DN 15) pipe nipple, and bronze ball valve. Include metal enclosure labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut to prevent accidental opening.
- Q. Pressure Gages
1. Standard: UL 393.
 2. Dial Size: 3-1/2- to 4-1/2-inch (90- to 115-mm) diameter.
 3. Pressure Gage Range: 0 to 250 psig (0 to 1725 kPa) minimum **OR** 0 to 300 psig (0 to 2070 kPa), **as directed**.
 4. Water System Piping Gage: Include "WATER" or "AIR/WATER" label on dial face.
 5. Air System Piping Gage: Include retard feature, **as directed**, and "AIR" or "AIR/WATER" label on dial face.
- R. Escutcheons
1. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.
 2. One-Piece, Cast-Brass Escutcheons: Polished chrome-plated or rough-brass finish with set-screws.
 3. One-Piece, Deep-Pattern Escutcheons: Deep-drawn, box-shaped brass with chrome-plated finish.



4. One-Piece, Stamped-Steel Escutcheons: Chrome-plated finish with set-screw or spring clips.
5. Split-Casting, Cast-Brass Escutcheons: Polished chrome-plated or rough-brass finish with concealed hinge and set-screw.
6. Split-Plate, Stamped-Steel Escutcheons: Chrome-plated finish with concealed **OR** exposed-rivet, **as directed**, hinge, set-screw or spring clips.
7. One-Piece Floor Plates: Cast-iron flange with holes for fasteners, **as directed**.
8. Split-Casting Floor Plates: Cast brass with concealed hinge.

S. Sleeves

1. Cast-Iron Wall-Pipe Sleeves: Cast or fabricated of cast iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
2. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
3. Molded-PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
4. Molded-PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.
5. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
6. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, standard weight, zinc coated, plain ends.
7. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - a. Underdeck Clamp: Clamping ring with set-screws.

T. Sleeve Seals

1. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - a. Sealing Elements: EPDM-rubber or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - b. Pressure Plates: Carbon steel **OR** Plastic **OR** Stainless steel, **as directed**.
 - c. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating **OR** Stainless steel, **as directed**, of length required to secure pressure plates to sealing elements.

U. Grout

1. Standard: ASTM C 1107, Grade B, posthardening and volume adjusting, dry, hydraulic-cement grout.
2. Characteristics: Nonshrink, and recommended for interior and exterior applications.
3. Design Mix: 5000-psi (34-MPa), 28-day compressive strength.
4. Packaging: Premixed and factory packaged.

1.3 EXECUTION

A. Preparation

1. Perform fire-hydrant flow test according to NFPA 14 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.
2. Report test results promptly and in writing.

B. Service-Entrance Piping

1. Connect fire-suppression standpipe piping to water-service piping at service entrance into building. Comply with requirements for exterior piping in Division 21 Section "Facility Fire-suppression Water-service Piping".
2. Install shutoff valve, backflow preventer, **as directed**, pressure gage, drain, and other accessories at connection to fire-suppression water-service piping. Comply with requirements for backflow preventers in Division 21 Section "Facility Fire-suppression Water-service Piping", **as directed**.
3. Install shutoff valve, check valve, pressure gage, and drain at connection to water service.



C. Water-Supply Connections

1. Connect fire-suppression standpipe piping to building's interior water-distribution piping. Comply with requirements for interior piping in Division 22 Section "Domestic Water Piping".
2. Install shutoff valve, backflow preventer, **as directed**, pressure gage, drain, and other accessories at connection to water-distribution piping. Comply with requirements for backflow preventers in Division 22 Section "Domestic Water Piping Specialties", **as directed**.
OR
Install shutoff valve, check valve, pressure gage, and drain at connection to water supply.

D. Piping Installation

1. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
 - a. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with the Owner before deviating from approved working plans.
2. Piping Standard: Comply with requirements in NFPA 14 for installation of fire-suppression standpipe piping.
3. Install seismic restraints on piping. Comply with requirements in NFPA 13 for seismic-restraint device materials and installation.
4. Install listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
5. Install drain valves on standpipes. Extend drain piping to outside of building.
6. Install automatic (ball drip) drain valves to drain piping between fire-department connections and check valves. Drain to floor drain or outside building.
7. Install alarm devices in piping systems.
8. Install hangers and supports for standpipe system piping according to NFPA 14. Comply with requirements in NFPA 13 for hanger materials.
9. Install pressure gages on riser or feed main and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 (DN 8) and with soft-metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.
10. Drain dry-type standpipe system piping.
11. Pressurize and check dry-type standpipe system piping and air-pressure maintenance devices **OR** air compressors, **as directed**.
12. Fill wet-type standpipe system piping with water.
13. Install electric heating cables and pipe insulation on wet-type, fire-suppression standpipe piping in areas subject to freezing. Comply with requirements for heating cables in Division 21 Section "Heat Tracing For Fire-suppression Piping" and for piping insulation in Division 21 Section "Fire-suppression Systems Insulation".
14. Connect compressed-air supply to dry-pipe sprinkler piping.
OR
Connect air compressor to the following piping and wiring:
 - a. Pressure gages and controls.
 - b. Electrical power system.
 - c. Fire-alarm devices, including low-pressure alarm.

E. Joint Construction

1. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
2. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller.
3. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.
4. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.



5. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
 6. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
 7. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - a. Apply appropriate tape or thread compound to external pipe threads.
 - b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
 8. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.
 9. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
 10. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
 - a. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.
 11. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.
 12. Copper-Tubing Grooved Joints: Roll rounded-edge groove in end of tube according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join copper tube and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
 13. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.
- F. Valve And Specialties Installation
1. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 14 and authorities having jurisdiction.
 2. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
 3. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.
 4. Specialty Valves:
 - a. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.
 - b. Alarm Valves: Install bypass check valve and retarding chamber drain-line connection.
 - c. Dry-Pipe and Deluge Valves: Install trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
 - 1) Install air compressor and compressed-air supply piping.
OR
Air-Pressure Maintenance Device: Install shutoff valves to permit servicing without shutting down sprinkler system; bypass valve for quick system filling; pressure regulator or switch to maintain system pressure; strainer; pressure ratings with 14- to 60-psig (95- to 410-kPa) adjustable range; and 175-psig (1200-kPa) maximum inlet pressure.
 - 2) Install compressed-air supply piping from building's compressed-air piping system.
- G. Hose-Connection Installation
1. Install hose connections adjacent to standpipes.
 2. Install freestanding hose connections for access and minimum passage restriction.
 3. Install NPS 1-1/2 (DN 40) hose-connection valves with flow-restricting device.



4. Install NPS 2-1/2 (DN 65) hose connections with quick-disconnect NPS 2-1/2 by NPS 1-1/2 (DN 65 by DN 40) reducer adapter and flow-restricting device.
 5. Install wall-mounted-type hose connections in cabinets. Include pipe escutcheons, with finish matching valves, inside cabinet where water-supply piping penetrates cabinet. Install valves at angle required for connection of fire hose. Comply with requirements for cabinets in Division 10 Section "Fire Extinguisher Cabinets".
- H. Hose-Station Installation
1. Install freestanding hose stations for access and minimum passage restriction.
 2. Install NPS 1-1/2 (DN 40) hose-station valves with flow-restricting device unless otherwise indicated.
 3. Install NPS 2-1/2 (DN 65) hose connections with quick-disconnect NPS 2-1/2 by NPS 1-1/2 (DN 65 by DN 40) reducer adapter and flow-restricting device unless otherwise indicated.
 4. Install freestanding hose stations with support or bracket attached to standpipe.
 5. Install wall-mounted, rack hose stations in cabinets. Include pipe escutcheons, with finish matching valves, inside cabinet where water-supply piping penetrates cabinet. Install valves at angle required for connection of fire hose. Comply with requirements for cabinets in Division 10 Section "Fire Extinguisher Cabinets".
 6. Install hose-reel hose stations on wall with bracket.
- I. Monitor Installation
1. Install monitors on standpipe piping.
- J. Fire-Department Connection Installation
1. Install wall-type, fire-department connections.
 2. Install yard-type, fire-department connections in concrete slab support. Comply with requirements for concrete in Division 03 Section "Cast-in-place Concrete".
 - a. Install two **OR** three, **as directed**, protective pipe bollards around **OR** on sides of, **as directed**, each fire-department connection. Comply with requirements for bollards in Division 05 Section "Metal Fabrications".
 3. Install automatic (ball drip) drain valve at each check valve for fire-department connection.
- K. Escutcheon Installation
1. Install escutcheons for penetrations of walls, ceilings, and floors.
 2. Escutcheons for New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
 - b. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish **OR** stamped steel with set-screw **OR** stamped steel with set-screw or spring clips **OR** stamped steel with spring clips, **as directed**.
 - c. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish **OR** One piece or split casting, cast brass with polished chrome-plated finish **OR** Split casting, cast brass with polished chrome-plated finish **OR** One piece, stamped steel with set-screw **OR** One piece or split plate, stamped steel with set-screw **OR** Split plate, stamped steel with set-screw, **as directed**.
 - d. Bare Piping in Unfinished Service Spaces: One piece, cast brass with polished chrome-plated finish **OR** cast brass with rough-brass finish **OR** stamped steel with set-screw **OR** stamped steel with spring clips **OR** stamped steel with set-screw or spring clips, **as directed**.
 - e. Bare Piping in Equipment Rooms: One piece, cast brass **OR** stamped steel with set-screw **OR** stamped steel with spring clips **OR** stamped steel with set-screw or spring clips, **as directed**.
 - f. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece floor plate.
 3. Escutcheons for Existing Piping:
 - a. Chrome-Plated Piping: Split casting, cast brass with chrome-plated finish.



- b. Insulated Piping: Split plate, stamped steel with concealed or exposed-rivet hinge and spring clips.
 - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split casting, cast brass with chrome-plated finish **OR** plate, stamped steel with concealed hinge and spring clips, **as directed**.
 - d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split casting, cast brass with chrome-plated finish **OR** plate, stamped steel with concealed hinge and set-screw, **as directed**.
 - e. Bare Piping in Unfinished Service Spaces: Split casting, cast brass with polished chrome-plated finish **OR** casting, cast brass with rough-brass finish **OR** plate, stamped steel with concealed hinge and set-screw or spring clips **OR** plate, stamped steel with concealed or exposed-rivet hinge and set-screw or spring clips **OR** plate, stamped steel with exposed-rivet hinge and set-screw or spring clips, **as directed**.
 - f. Bare Piping in Equipment Rooms: Split casting, cast brass **OR** plate, stamped steel with set-screw or spring clips, **as directed**.
 - g. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting floor plate.
- L. Sleeve Installation
- 1. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, roofs, and walls.
 - 2. Sleeves are not required for core-drilled holes.
 - 3. Permanent sleeves are not required for holes formed by removable PE sleeves.
 - 4. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.
 - 5. Install sleeves in new partitions, slabs, and walls as they are built.
 - 6. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 07 Section "Joint Sealants".
 - 7. For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 07 Section "Joint Sealants".
 - 8. For exterior wall penetrations below grade, seal annular space between sleeve and pipe using sleeve seals.
 - 9. Seal space outside of sleeves in concrete slabs and walls with grout.
 - 10. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation unless otherwise indicated.
 - 11. Install sleeve materials according to the following applications:
 - a. Sleeves for Piping Passing through Concrete Floor Slabs: Molded PE **OR** Molded PVC **OR** Galvanized-steel pipe, **as directed**.
 - b. Sleeves for Piping Passing through Concrete Floor Slabs of Mechanical Equipment Areas or Other Wet Areas: Galvanized-steel pipe **OR** Stack sleeve fittings, **as directed**.
 - 1) Extend sleeves 2 inches (50 mm) above finished floor level.
 - 2) For pipes penetrating floors with membrane waterproofing, extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Comply with requirements for flashing in Division 07 Section "Sheet Metal Flashing And Trim".
 - c. Sleeves for Piping Passing through Gypsum-Board Partitions:
 - 1) PVC-pipe **OR** Galvanized-steel-pipe, **as directed**, sleeves for pipes smaller than NPS 6 (DN 150).
 - 2) Galvanized-steel-sheet sleeves for pipes NPS 6 (DN 150) and larger.
 - 3) Exception: Sleeves are not required for water-supply tubes and waste pipes for individual plumbing fixtures if escutcheons will cover openings.
 - d. Sleeves for Piping Passing through Concrete Roof Slabs: Molded PE **OR** Molded PVC **OR** Galvanized-steel pipe, **as directed**.
 - e. Sleeves for Piping Passing through Exterior Concrete Walls:
 - 1) Galvanized-steel-pipe sleeves for pipes smaller than NPS 6 (DN 150).



- 2) Cast-iron wall pipe sleeves for pipes NPS 6 (DN 150) and larger.
 - 3) Install sleeves that are large enough to provide 1-inch (25-mm) annular clear space between sleeve and pipe or pipe insulation when sleeve seals are used.
 - f. Sleeves for Piping Passing through Interior Concrete Walls:
 - 1) PVC-pipe **OR** Galvanized-steel-pipe, **as directed**, sleeves for pipes smaller than NPS 6 (DN 150).
 - 2) Galvanized-steel-sheet sleeves for pipes NPS 6 (DN 150) and larger.
 12. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestop materials and installations in Division 07 Section "Penetration Firestopping".
- M. Sleeve Seal Installation
1. Install sleeve seals in sleeves in exterior concrete walls at water-service piping entries into building.
 2. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- N. Identification
1. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 14.
 2. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification For Electrical Systems".
- O. Field Quality Control
1. Perform tests and inspections.
 2. Tests and Inspections:
 - a. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
 - b. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - c. Flush, test, and inspect standpipe systems according to NFPA 14, "System Acceptance" Chapter.
 - d. Energize circuits to electrical equipment and devices.
 - e. Start and run air compressors.
 - f. Coordinate with fire-alarm tests. Operate as required.
 - g. Coordinate with fire-pump tests. Operate as required.
 - h. Verify that equipment hose threads are same as local fire-department equipment.
 3. Fire-suppression standpipe system will be considered defective if it does not pass tests and inspections.
 4. Prepare test and inspection reports.
- P. Demonstration
1. Train the Owner's maintenance personnel to adjust, operate, and maintain specialty valves.
- Q. Piping Schedule
1. Piping between Fire-Department Connections and Check Valves: Galvanized, standard-weight steel pipe with threaded ends; cast-iron threaded fittings; and threaded **OR** grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved, **as directed**, joints.
 2. Standard-pressure, wet-type, fire-suppression standpipe piping, NPS 4 (DN 100) and smaller, shall be one of the following:
 - a. Standard-weight or Schedule 30, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
 - b. Standard-weight **OR** Schedule 30 or thinwall, **as directed**, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.



- c. Standard-weight or Schedule 30, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - d. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - e. Standard-weight or Schedule 30, black-steel pipe with plain ends; steel welding fittings; and welded joints.
 - f. Thinwall **OR** Schedule 10, **as directed**, **OR** nonstandard OD, thinwall or hybrid, **as directed**, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - g. Thinwall **OR** Schedule 10, **as directed**, **OR** nonstandard OD, thinwall or hybrid, **as directed**, black-steel pipe with plain ends; welding fittings; and welded joints.
 - h. Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube with plain ends; cast- or wrought-copper solder-joint fittings; and brazed joints.
 - i. Type L (Type B) **OR** Type M (Type B), **as directed**, hard copper tube with roll-grooved ends; copper, grooved-end fittings; grooved-end-tube couplings; and grooved joints.
3. Standard-pressure, wet-type, fire-suppression standpipe piping, NPS 5 to NPS 8 (DN 125 to DN 200), shall be one of the following:
- a. Standard-weight **OR** Schedule 30, **as directed**, or thinwall, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
 - b. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
 - c. Standard-weight or Schedule 30, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - d. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - e. Standard-weight or Schedule 30, black-steel pipe with plain ends; steel welding fittings; and welded joints.
 - f. Thinwall **OR** Schedule 10, **as directed**, or hybrid black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - g. Thinwall **OR** Schedule 10, **as directed**, or hybrid black-steel pipe with plain ends; welding fittings; and welded joints.
 - h. Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube with plain ends; cast- or wrought-copper solder-joint fittings; and brazed joints.
 - i. Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube with roll-grooved ends; copper, grooved-end fittings; grooved-end-tube couplings; and grooved joints.
4. Standard-pressure, wet-type, fire-suppression standpipe piping, NPS 10 and NPS 12 (DN 250 and DN 300), shall be one of the following:
- a. Standard-weight or Schedule 30, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
 - b. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
 - c. Standard-weight or Schedule 30, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - d. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - e. Standard-weight or Schedule 30, black-steel pipe with plain ends; steel welding fittings; and welded joints.
 - f. Thinwall **OR** Schedule 10, **as directed**, **OR** nonstandard OD, thinwall or hybrid, **as directed**, black-steel pipe with plain ends; welding fittings; and welded joints.



5. High-pressure, wet-type, fire-suppression standpipe piping, NPS 4 (DN 100) and smaller, shall be one of the following:
 - a. Standard-weight or Schedule 30, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
 - b. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
 - c. Standard-weight or Schedule 30, black-steel pipe with cut-grooved **OR** roll-grooved, **as directed**, ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - d. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - e. Standard-weight or Schedule 30, black-steel pipe with plain ends; steel welding fittings; and welded joints.
 - f. Thinwall **OR** Schedule 10, **as directed**, **OR** nonstandard OD, thinwall or hybrid, **as directed**, black-steel pipe with plain ends; welding fittings; and welded joints.
6. High-pressure, wet-type, fire-suppression standpipe piping, NPS 5 (DN 125) and larger, shall be one of the following:
 - a. Standard-weight or Schedule 30, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
 - b. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
 - c. Standard-weight or Schedule 30, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - d. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - e. Standard-weight or Schedule 30, black-steel pipe with plain ends; steel welding fittings; and welded joints.
 - f. Thinwall **OR** Schedule 10, **as directed**, **OR** nonstandard OD, thinwall or hybrid, **as directed**, black-steel pipe with plain ends; welding fittings; and welded joints.
7. Standard-pressure, dry-type, fire-suppression standpipe piping, NPS 4 (DN 100) and smaller, shall be one of the following:
 - a. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
 - b. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - c. Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube with plain ends; cast- or wrought-copper solder-joint fittings; and brazed joints.
 - d. Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube with roll-grooved ends; copper, grooved-end fittings; grooved-end-tube couplings; and grooved joints.
8. Standard-pressure, dry-type, fire-suppression standpipe piping, NPS 5 and NPS 6 (DN 125 and DN 150), shall be one of the following:
 - a. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
 - b. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - c. Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube with plain ends; cast- or wrought-copper solder-joint fittings; and brazed joints.
 - d. Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube with roll-grooved ends; copper, grooved-end fittings; grooved-end-tube couplings; and grooved joints.



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Task	Specification	Specification Description
21 12 13 00	21 11 19 00	Fire-Suppression Standpipes
21 12 23 00	21 11 19 00	Fire-Suppression Standpipes
21 12 29 00	01 22 16 00	No Specification Required
21 12 29 00	21 11 19 00	Fire-Suppression Standpipes



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SECTION 21 13 13 00 - WET-PIPE FIRE-SUPPRESSION SPRINKLERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for wet-pipe fire-suppression sprinklers. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Pipes, fittings, and specialties.
 - b. Fire-protection valves.
 - c. Fire-department connections.
 - d. Sprinklers.
 - e. Excess-pressure pumps.
 - f. Alarm devices.
 - g. Manual control stations.
 - h. Control panels.
 - i. Pressure gages.

C. Definitions

1. High-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure higher than standard 175 psig (1200 kPa), but not higher than 250 psig (1725 kPa) **OR** 300 psig (2070 kPa), **as directed**.
2. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175 psig (1200 kPa) maximum.

D. System Descriptions

1. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply through alarm valve. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.
2. Deluge Sprinkler System: Open sprinklers are attached to piping connected to water supply through deluge valve. Fire-detection system, in same area as sprinklers, opens valve. Water flows into piping system and discharges from attached sprinklers when valve opens.

E. Performance Requirements

1. Standard-Pressure Piping System Component: Listed for 175-psig (1200-kPa) minimum working pressure.
2. High-Pressure Piping System Component: Listed for 250-psig (1725-kPa) minimum **OR** 300-psig (2070-kPa), **as directed**, working pressure.
3. Delegated Design: Design sprinkler system(s), including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
4. Sprinkler system design shall be approved by authorities having jurisdiction.
 - a. Margin of Safety for Available Water Flow and Pressure: 10 **OR** 20, **as directed**, percent, including losses through water-service piping, valves, and backflow preventers.
 - b. Sprinkler Occupancy Hazard Classifications:
 - 1) Automobile Parking Areas: Ordinary Hazard, Group 1.
 - 2) Building Service Areas: Ordinary Hazard, Group 1.
 - 3) Churches: Light Hazard.
 - 4) Electrical Equipment Rooms: Ordinary Hazard, Group 1.
 - 5) Dry Cleaners: Ordinary Hazard, Group 2.



- 6) General Storage Areas: Ordinary Hazard, Group 1.
- 7) Laundries: Ordinary Hazard, Group 1.
- 8) Libraries except Stack Areas: Light Hazard.
- 9) Library Stack Areas: Ordinary Hazard, Group 2.
- 10) Machine Shops: Ordinary Hazard, Group 2.
- 11) Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
- 12) Office and Public Areas: Light Hazard.
- 13) Plastics Processing Areas: Extra Hazard, Group 2.
- 14) Printing Plants: Extra Hazard, Group 1.
- 15) Repair Garages: Ordinary Hazard, Group 2.
- 16) Residential Living Areas: Light Hazard.
- 17) Restaurant Service Areas: Ordinary Hazard, Group 1.
- 18) Solvent Cleaning Areas: Extra Hazard, Group 2.
- 19) Upholstering Plants: Extra Hazard, Group 1.
- c. Minimum Density for Automatic-Sprinkler Piping Design:
 - 1) Residential (Dwelling) Occupancy: 0.05 gpm over 400-sq. ft. (2.04 mm/min. over 37.2-sq. m) area.
 - 2) Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. (4.1 mm/min. over 139-sq. m) area.
 - 3) Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. (6.1 mm/min. over 139-sq. m) area.
 - 4) Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over 1500-sq. ft. (8.1 mm/min. over 139-sq. m) area.
 - 5) Extra-Hazard, Group 1 Occupancy: 0.30 gpm over 2500-sq. ft. (12.2 mm/min. over 232-sq. m) area.
 - 6) Extra-Hazard, Group 2 Occupancy: 0.40 gpm over 2500-sq. ft. (16.3 mm/min. over 232-sq. m) area.
 - 7) Special Occupancy Hazard: As determined by authorities having jurisdiction.
- d. Minimum Density for Deluge-Sprinkler Piping Design:
 - 1) Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm (6.1 mm/min.) over entire area.
 - 2) Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm (8.1 mm/min.) over entire area.
 - 3) Extra-Hazard, Group 1 Occupancy: 0.30 gpm (12.2 mm/min.) over entire area.
 - 4) Extra-Hazard, Group 2 Occupancy: 0.40 gpm (16.3 mm/min.) over entire area.
 - 5) Special Occupancy Hazard: As determined by authorities having jurisdiction.
- e. Maximum Protection Area per Sprinkler: Per UL listing.
OR
 Maximum Protection Area per Sprinkler:
 - 1) Residential Areas: 400 sq. ft. (37 sq. m).
 - 2) Office Spaces: 120 sq. ft. (11.1 sq. m) **OR** 225 sq. ft. (20.9 sq. m), **as directed**.
 - 3) Storage Areas: 130 sq. ft. (12.1 sq. m).
 - 4) Mechanical Equipment Rooms: 130 sq. ft. (12.1 sq. m).
 - 5) Electrical Equipment Rooms: 130 sq. ft. (12.1 sq. m).
 - 6) Other Areas: According to NFPA 13 recommendations unless otherwise indicated.
- f. Total Combined Hose-Stream Demand Requirement: According to NFPA 13 unless otherwise indicated:
 - 1) Light-Hazard Occupancies: 100 gpm (6.3 L/s) for 30 minutes.
 - 2) Ordinary-Hazard Occupancies: 250 gpm (15.75 L/s) for 60 to 90 minutes.
 - 3) Extra-Hazard Occupancies: 500 gpm (31.5 L/s) for 90 to 120 minutes.
5. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.

F. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittal:



- a. Product Data for Credit EQ 4.1: For solvent cements and adhesive primers, including printed statement of VOC content and chemical components.
 3. Shop Drawings: For wet-pipe sprinkler systems. Include plans, elevations, sections, details, and attachments to other work.
 - a. Wiring Diagrams: For power, signal, and control wiring.
 4. Delegated-Design Submittal: For sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 5. Qualification Data: For qualified Installer and professional engineer, **as directed**.
 6. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.
 7. Welding certificates.
 8. Fire-hydrant flow test report.
 9. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
 10. Field quality-control reports.
 11. Operation and maintenance data.
- G. Quality Assurance
1. Installer Qualifications:
 - a. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
 - 1) Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.
 2. Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
 3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 4. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:
 - a. NFPA 13, "Installation of Sprinkler Systems."
 - b. NFPA 13R, "Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height."
 - c. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."
- H. Project Conditions
1. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by the Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:
 - a. Notify the Owner no fewer than two days in advance of proposed interruption of sprinkler service.
 - b. Do not proceed with interruption of sprinkler service without the Owner's written permission.
- 1.2 PRODUCTS
- A. Piping Materials
1. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.
- B. Steel Pipe And Fittings
1. Standard Weight, Galvanized- and Black-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.



2. Schedule 30, Galvanized- and Black-Steel Pipe: ASTM A 135; ASTM A 795/A 795M, Type E; or ASME B36.10M, wrought steel; with wall thickness not less than Schedule 30 and not more than Schedule 40. Pipe ends may be factory or field formed to match joining method.
3. Thinwall Galvanized- and Black-Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, threadable, with wall thickness less than Schedule 30 and equal to or greater than Schedule 10. Pipe ends may be factory or field formed to match joining method.
4. Schedule 10, Black-Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, Schedule 10 in NPS 5 (DN 125) and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10 (DN 150 to DN 250), plain end.
5. Nonstandard OD, Thinwall Black-Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, thinwall, with plain ends and wall thickness less than Schedule 10.
6. Hybrid Black-Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, lightwall, with wall thickness less than Schedule 10 and greater than Schedule 5.
7. Schedule 5 Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, lightwall, with plain ends.
8. Galvanized- and Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.
9. Galvanized and Uncoated, Steel Couplings: ASTM A 865, threaded.
10. Galvanized and Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
11. Malleable- or Ductile-Iron Unions: UL 860.
12. Cast-Iron Flanges: ASME 16.1, Class 125.
13. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.
14. Steel Welding Fittings: ASTM A 234/A 234M and ASME B16.9.
15. Grooved-Joint, Steel-Pipe Appurtenances:
 - a. Pressure Rating: 175 psig (1200 kPa) **OR** 250 psig (1725 kPa) **OR** 300 psig (2070 kPa), **as directed**, minimum.
 - b. Galvanized and Uncoated, Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
 - c. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213, rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.
16. Steel Pressure-Seal Fittings: UL 213, FM-approved, 175-psig (1200-kPa) pressure rating with steel housing, rubber O-rings, and pipe stop; for use with fitting manufacturers' pressure-seal tools.

C. Copper Tube And Fittings

1. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B) and ASTM B 88, Type M (ASTM B 88M, Type C) water tube, drawn temper.
2. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
3. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, pressure fittings.
4. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
5. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
6. Copper Pressure-Seal Fittings:
 - a. Standard: UL 213.
 - b. NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.
 - c. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Cast-bronze fitting with EPDM-rubber O-ring seal in each end.
7. Grooved-Joint, Copper-Tube Appurtenances:
 - a. Grooved-End, Copper Fittings: ASTM B 75 (ASTM B 75M), copper tube or ASTM B 584, bronze castings.



- a. Standard: UL 1091 except with ball instead of disc.
 - b. Valves NPS 1-1/2 (DN 40) and Smaller: Bronze body with threaded ends.
 - c. Valves NPS 2 and NPS 2-1/2 (DN 50 and DN 65): Bronze body with threaded ends or ductile-iron body with grooved ends.
 - d. Valves NPS 3 (DN 80): Ductile-iron body with grooved ends.
3. Bronze Butterfly Valves:
- a. Standard: UL 1091.
 - b. Pressure Rating: 175 psig (1200 kPa).
 - c. Body Material: Bronze.
 - d. End Connections: Threaded.
4. Iron Butterfly Valves:
- a. Standard: UL 1091.
 - b. Pressure Rating: 175 psig (1200 kPa).
 - c. Body Material: Cast or ductile iron.
 - d. Style: Lug or wafer.
- OR**
End Connections: Grooved.
5. Check Valves:
- a. Standard: UL 312.
 - b. Pressure Rating: 250 psig (1725 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - c. Type: Swing check.
 - d. Body Material: Cast iron.
 - e. End Connections: Flanged or grooved.
6. Bronze OS&Y Gate Valves:
- a. Standard: UL 262.
 - b. Pressure Rating: 175 psig (1200 kPa).
 - c. Body Material: Bronze.
 - d. End Connections: Threaded.
7. Iron OS&Y Gate Valves:
- a. Standard: UL 262.
 - b. Pressure Rating: 250 psig (1725 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - c. Body Material: Cast or ductile iron.
 - d. End Connections: Flanged or grooved.
8. Indicating-Type Butterfly Valves:
- a. Standard: UL 1091.
 - b. Pressure Rating: 175 psig (1200 kPa) minimum.
 - c. Valves NPS 2 (DN 50) and Smaller:
 - 1) Valve Type: Ball or butterfly.
 - 2) Body Material: Bronze.
 - 3) End Connections: Threaded.
 - d. Valves NPS 2-1/2 (DN 65) and Larger:
 - 1) Valve Type: Butterfly.
 - 2) Body Material: Cast or ductile iron.
 - 3) End Connections: Flanged, grooved, or wafer.
 - e. Valve Operation: Integral electrical, 115-V ac, prewired, single-circuit, supervisory switch **OR** electrical, 115-V ac, prewired, two-circuit, supervisory switch **OR** visual, **as directed**, indicating device.
9. NRS Gate Valves:
- a. Standard: UL 262.
 - b. Pressure Rating: 250 psig (1725 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - c. Body Material: Cast iron with indicator post flange.
 - d. Stem: Nonrising.
 - e. End Connections: Flanged or grooved.
10. Indicator Posts:
- a. Standard: UL 789.



- b. Type: Horizontal for wall mounting.
- c. Body Material: Cast iron with extension rod and locking device.
- d. Operation: Wrench **OR** Hand wheel, **as directed**.

H. Trim And Drain Valves

- 1. General Requirements:
 - a. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 - b. Pressure Rating: 175 psig (1200 kPa) minimum.
- 2. Angle Valves.
- 3. Ball Valves.
- 4. Globe Valves.
- 5. Plug Valves.

I. Specialty Valves

- 1. General Requirements:
 - a. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 - b. Pressure Rating:
 - 1) Standard-Pressure Piping Specialty Valves: 175 psig (1200 kPa) minimum.
 - 2) High-Pressure Piping Specialty Valves: 250 psig (1725 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - c. Body Material: Cast or ductile iron.
 - d. Size: Same as connected piping.
 - e. End Connections: Flanged or grooved.
- 2. Alarm Valves:
 - a. Standard: UL 193.
 - b. Design: For horizontal or vertical installation.
 - c. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber, **as directed**, and fill-line attachment with strainer.
 - d. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.
OR
Drip Cup Assembly: Pipe drain with check valve to main drain piping.
- 3. Deluge Valves:
 - a. Standard: UL 260.
 - b. Design: Hydraulically operated, differential-pressure type.
 - c. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, drip cup assembly piped without valves and separate from main drain line, fill-line attachment with strainer, and push-rod chamber supply connection.
 - d. Wet, Pilot-Line Trim Set: Include gage to read push-rod chamber pressure, globe valve for manual operation of deluge valve, and connection for actuation device.
- 4. Automatic (Ball Drip) Drain Valves:
 - a. Standard: UL 1726.
 - b. Pressure Rating: 175 psig (1200 kPa) minimum.
 - c. Type: Automatic draining, ball check.
 - d. Size: NPS 3/4 (DN 20).
 - e. End Connections: Threaded.

J. Fire-Department Connections

- 1. Exposed-Type, Fire-Department Connection:
 - a. Standard: UL 405.
 - b. Type: Exposed, projecting, for wall mounting.
 - c. Pressure Rating: 175 psig (1200 kPa) minimum.
 - d. Body Material: Corrosion-resistant metal.



- e. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
 - f. Caps: Brass, lugged type, with gasket and chain.
 - g. Escutcheon Plate: Round, brass, wall type.
 - h. Outlet: Back, with pipe threads.
 - i. Number of Inlets: Two **OR** Three, **as directed**.
 - j. Escutcheon Plate Marking: Similar to "AUTO SPKR & STANDPIPE" **OR** "AUTO SPKR", **as directed**.
 - k. Finish: Polished chrome plated **OR** Rough brass or bronze **OR** Rough chrome plated, **as directed**.
 - l. Outlet Size: NPS 4 (DN 100) **OR** NPS 5 (DN 125) **OR** NPS 6 (DN 150), **as directed**.
2. Flush-Type, Fire-Department Connection:
- a. Standard: UL 405.
 - b. Type: Flush, for wall mounting.
 - c. Pressure Rating: 175 psig (1200 kPa) minimum.
 - d. Body Material: Corrosion-resistant metal.
 - e. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
 - f. Caps: Brass, lugged type, with gasket and chain.
 - g. Escutcheon Plate: Rectangular, brass, wall type.
 - h. Outlet: With pipe threads.
 - i. Body Style: Horizontal **OR** Square **OR** Vertical, **as directed**.
 - j. Number of Inlets: Two **OR** Three **OR** Four **OR** Six, **as directed**.
 - k. Outlet Location: Back **OR** Bottom **OR** Left side **OR** Right side **OR** Top, **as directed**.
 - l. Escutcheon Plate Marking: Similar to "AUTO SPKR & STANDPIPE" **OR** "AUTO SPKR", **as directed**.
 - m. Finish: Polished chrome plated **OR** Rough brass or bronze **OR** Rough chrome plated, **as directed**.
 - n. Outlet Size: NPS 4 (DN 100) **OR** NPS 5 (DN 125) **OR** NPS 6 (DN 150) **OR** NPS 8 (DN 200), **as directed**.
3. Yard-Type, Fire-Department Connection:
- a. Standard: UL 405.
 - b. Type: Exposed, freestanding.
 - c. Pressure Rating: 175 psig (1200 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - d. Body Material: Corrosion-resistant metal.
 - e. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
 - f. Caps: Brass, lugged type, with gasket and chain.
 - g. Escutcheon Plate: Round, brass, floor type.
 - h. Outlet: Bottom, with pipe threads.
 - i. Number of Inlets: Two **OR** Three **OR** Four, **as directed**.
 - j. Sleeve: Brass **OR** Not required, **as directed**.
 - k. Sleeve Height: 18 inches (460 mm).
 - l. Escutcheon Plate Marking: Similar to "AUTO SPKR & STANDPIPE" **OR** "AUTO SPKR", **as directed**.
 - m. Finish, Including Sleeve: Polished chrome plated **OR** Rough brass or bronze **OR** Rough chrome plated, **as directed**.
 - n. Outlet Size: NPS 4 (DN 100) **OR** NPS 5 (DN 125) **OR** NPS 6 (DN 150), **as directed**.
- K. Sprinkler Specialty Pipe Fittings
- 1. Branch Outlet Fittings:
 - a. Standard: UL 213.



- b. Pressure Rating: 175 psig (1200 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - c. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
 - d. Type: Mechanical-T and -cross fittings.
 - e. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
 - f. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
 - g. Branch Outlets: Grooved, plain-end pipe, or threaded.
 2. Flow Detection and Test Assemblies:
 - a. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 - b. Pressure Rating: 175 psig (1200 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - c. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
 - d. Size: Same as connected piping.
 - e. Inlet and Outlet: Threaded.
 3. Branch Line Testers:
 - a. Standard: UL 199.
 - b. Pressure Rating: 175 psig (1200 kPa).
 - c. Body Material: Brass.
 - d. Size: Same as connected piping.
 - e. Inlet: Threaded.
 - f. Drain Outlet: Threaded and capped.
 - g. Branch Outlet: Threaded, for sprinkler.
 4. Sprinkler Inspector's Test Fittings:
 - a. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 - b. Pressure Rating: 175 psig (1200 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - c. Body Material: Cast- or ductile-iron housing with sight glass.
 - d. Size: Same as connected piping.
 - e. Inlet and Outlet: Threaded.
 5. Adjustable Drop Nipples:
 - a. Standard: UL 1474.
 - b. Pressure Rating: 250 psig (1725 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - c. Body Material: Steel pipe with EPDM-rubber O-ring seals.
 - d. Size: Same as connected piping.
 - e. Length: Adjustable.
 - f. Inlet and Outlet: Threaded.
 6. Flexible, Sprinkler Hose Fittings:
 - a. Standard: UL 1474.
 - b. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
 - c. Pressure Rating: 175 psig (1200 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - d. Size: Same as connected piping, for sprinkler.
- L. Sprinklers
1. General Requirements:
 - a. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 - b. Pressure Rating for Residential Sprinklers: 175 psig (1200 kPa) maximum.
 - c. Pressure Rating for Automatic Sprinklers: 175 psig (1200 kPa) minimum.
 - d. Pressure Rating for High-Pressure Automatic Sprinklers: 250 psig (1725 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 2. Automatic Sprinklers with Heat-Responsive Element:
 - a. Early-Suppression, Fast-Response Applications: UL 1767.
 - b. Nonresidential Applications: UL 199.
 - c. Residential Applications: UL 1626.



- d. Characteristics: Nominal 1/2-inch (12.7-mm) orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.
 3. Open Sprinklers with Heat-Responsive Element Removed: UL 199.
 - a. Characteristics:
 - 1) Nominal 1/2-inch (12.7-mm) Orifice: With Discharge Coefficient K between 5.3 and 5.8.
 - 2) Nominal 17/32-inch (13.5-mm) Orifice: With Discharge Coefficient K between 7.4 and 8.2.
 4. Sprinkler Finishes:
 - a. Chrome plated.
 - b. Bronze.
 - c. Painted.
 5. Special Coatings:
 - a. Wax.
 - b. Lead.
 - c. Corrosion-resistant paint.
 6. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
 - a. Ceiling Mounting: Chrome-plated steel, one piece, flat **OR** Chrome-plated steel, two piece, with 1-inch (25-mm) vertical adjustment **OR** Plastic, white finish, one piece, flat, **as directed**.
 - b. Sidewall Mounting: Chrome-plated steel **OR** Plastic, white finish, **as directed**, one piece, flat.
 7. Sprinkler Guards:
 - a. Standard: UL 199.
 - b. Type: Wire cage with fastening device for attaching to sprinkler.
- M. Excess-Pressure Pumps
1. Pump: Factory-fabricated, positive-displacement, gear type.
 - a. Pump and Motor: Directly connected.
 - b. Motor: Comply with requirements in Division 21 Section "Common Work Results For Fire Suppression".
 2. Miscellaneous Components: Wet-pipe kit of switches, fittings, valves, mounting brackets, and connections for power, hydraulic piping, and wiring from alarm devices.
 3. Motor Control: Differential-pressure switch.
 4. Lights: To indicate sprinkler system's operating condition.
 - a. White Light: Pressure is normal.
 - b. Red Light: Pressure is low.
 5. Capacity: 2.0 gpm at 75-psig (0.13 L/s at 520-kPa) differential pressure and 1/3 hp **OR** 1.85 gpm at 100-psig (0.12 L/s at 690-kPa) differential pressure and 1/2 hp **OR** 3.5 gpm at 100-psig (0.22 L/s at 690-kPa) differential pressure and 1/2 hp, **as directed**.
- N. Alarm Devices
1. Alarm-device types shall match piping and equipment connections.
 2. Water-Motor-Operated Alarm:
 - a. Standard: UL 753.
 - b. Type: Mechanically operated, with Pelton wheel.
 - c. Alarm Gong: Cast aluminum with red-enamel factory finish.
 - d. Size: 10-inch (250-mm) diameter.
 - e. Components: Shaft length, bearings, and sleeve to suit wall construction.
 - f. Inlet: NPS 3/4 (DN 20).
 - g. Outlet: NPS 1 (DN 25) drain connection.
 3. Electrically Operated Alarm Bell:



- a. Standard: UL 464.
 - b. Type: Vibrating, metal alarm bell.
 - c. Size: 6-inch (150-mm) minimum-diameter **OR** 8-inch (200-mm) minimum-diameter **OR** 10-inch (250-mm) diameter, **as directed**.
 - d. Finish: Red-enamel factory finish, suitable for outdoor use.
4. Water-Flow Indicators:
- a. Standard: UL 346.
 - b. Water-Flow Detector: Electrically supervised.
 - c. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
 - d. Type: Paddle operated.
 - e. Pressure Rating: 250 psig (1725 kPa).
 - f. Design Installation: Horizontal or vertical.
5. Pressure Switches:
- a. Standard: UL 346.
 - b. Type: Electrically supervised water-flow switch with retard feature.
 - c. Components: Single-pole, double-throw switch with normally closed contacts.
 - d. Design Operation: Rising pressure signals water flow.
6. Valve Supervisory Switches:
- a. Standard: UL 346.
 - b. Type: Electrically supervised.
 - c. Components: Single-pole, double-throw switch with normally closed contacts.
 - d. Design: Signals that controlled valve is in other than fully open position.
7. Indicator-Post Supervisory Switches:
- a. Standard: UL 346.
 - b. Type: Electrically supervised.
 - c. Components: Single-pole, double-throw switch with normally closed contacts.
 - d. Design: Signals that controlled indicator-post valve is in other than fully open position.
- O. Manual Control Stations
1. Description: UL listed or FM approved, hydraulic operation, with union, NPS 1/2 (DN 15) pipe nipple, and bronze ball valve. Include metal enclosure labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut to prevent accidental opening.
- P. Control Panels
1. Description: Single-area, two-area, or single-area cross-zoned control panel as indicated, including NEMA ICS 6, Type 1 enclosure, detector, alarm, and solenoid-valve circuitry for operation of deluge valves. Panels contain power supply; battery charger; standby batteries; field-wiring terminal strip; electrically supervised solenoid valves and polarized fire-alarm bell; lamp test facility; single-pole, double-throw auxiliary alarm contacts; and rectifier.
 - a. Panels: UL listed and FM approved when used with thermal detectors and Class A detector circuit wiring. Electrical characteristics are 120-V ac, 60 Hz, with 24-V dc rechargeable batteries.
 - b. Manual Control Stations: Electric operation, metal enclosure, labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut to prevent accidental opening.

OR

Manual Control Stations: Hydraulic operation, with union, NPS 1/2 (DN 15) pipe nipple, and bronze ball valve. Include metal enclosure labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut to prevent accidental opening.
- Q. Pressure Gages



1. Standard: UL 393.
2. Dial Size: 3-1/2- to 4-1/2-inch (90- to 115-mm) diameter.
3. Pressure Gage Range: 0 to 250 psig (0 to 1725 kPa) minimum **OR** 0 to 300 psig (0 to 2070 kPa), **as directed**.
4. Water System Piping Gage: Include "WATER" or "AIR/WATER" label on dial face.
5. Air System Piping Gage: Include retard feature, **directed**, and "AIR" or "AIR/WATER" label on dial face.

R. Escutcheons

1. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.
2. One-Piece, Cast-Brass Escutcheons: Polished chrome-plated **OR** rough-brass, **as directed**, finish with set-screws.
3. One-Piece, Deep-Pattern Escutcheons: Deep-drawn, box-shaped brass with chrome-plated finish.
4. One-Piece, Stamped-Steel Escutcheons: Chrome-plated finish with set-screw **OR** spring clips, **as directed**.
5. Split-Casting, Cast-Brass Escutcheons: Polished chrome-plated **OR** rough-brass, **as directed**, finish with concealed hinge and set-screw.
6. Split-Plate, Stamped-Steel Escutcheons: Chrome-plated finish with concealed **OR** exposed-rivet, **as directed**, hinge, set-screw **OR** spring clips, **as directed**.
7. One-Piece Floor Plates: Cast-iron flange with holes for fasteners, **as directed**.
8. Split-Casting Floor Plates: Cast brass with concealed hinge.

S. Sleeves

1. Cast-Iron Wall Pipe Sleeves: Cast or fabricated of cast iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
2. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
3. Molded-PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
4. Molded-PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.
5. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
6. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, standard weight, zinc coated, plain ends.
7. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - a. Underdeck Clamp: Clamping ring with set-screws.

T. Sleeve Seals

1. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - a. Sealing Elements: EPDM-rubber or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - b. Pressure Plates: Carbon steel **OR** Plastic **OR** Stainless steel, **as directed**.
 - c. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating **OR** Stainless steel, **as directed**, of length required to secure pressure plates to sealing elements.

U. Grout

1. Standard: ASTM C 1107, Grade B, posthardening and volume adjusting, dry, hydraulic-cement grout.
2. Characteristics: Nonshrink, and recommended for interior and exterior applications.
3. Design Mix: 5000-psi (34-MPa), 28-day compressive strength.
4. Packaging: Premixed and factory packaged.



1.3 EXECUTION

A. Preparation

1. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.
2. Report test results promptly and in writing.

B. Service-Entrance Piping

1. Connect sprinkler piping to water-service piping for service entrance to building. Comply with requirements for exterior piping in Division 21 Section "Facility Fire-suppression Water-service Piping".
2. Install shutoff valve, backflow preventer, **as directed**, pressure gage, drain, and other accessories indicated at connection to water-service piping. Comply with requirements for backflow preventers in Division 21 Section "Facility Fire-suppression Water-service Piping", **as directed**.
OR
Install shutoff valve, check valve, pressure gage, and drain at connection to water service.

C. Water-Supply Connections

1. Connect sprinkler piping to building's interior water-distribution piping. Comply with requirements for interior piping in Division 22 Section "Domestic Water Piping".
2. Install shutoff valve, backflow preventer, **as directed**, pressure gage, drain, and other accessories indicated at connection to water-distribution piping. Comply with requirements for backflow preventers in Division 22 Section "Domestic Water Piping Specialties", **as directed**.
OR
Install shutoff valve, check valve, pressure gage, and drain at connection to water supply.

D. Piping Installation

1. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
 - a. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with the Owner before deviating from approved working plans.
2. Piping Standard: Comply with requirements for installation of sprinkler piping in NFPA 13.
3. Install seismic restraints on piping. Comply with requirements for seismic-restraint device materials and installation in NFPA 13.
4. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
5. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller.
6. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.
7. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.
8. Install sprinkler piping with drains for complete system drainage.
9. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
10. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.
11. Install alarm devices in piping systems.
12. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.
13. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 (DN 8) and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.



14. Pressurize and check preaction sprinkler system piping and air-pressure maintenance devices **OR** air compressors, **as directed**.
15. Fill sprinkler system piping with water.
16. Install electric heating cables and pipe insulation on sprinkler piping in areas subject to freezing. Comply with requirements for heating cables in Division 21 Section "Heat Tracing For Fire-suppression Piping" and for piping insulation in Division 21 Section "Fire-suppression Systems Insulation".

E. Joint Construction

1. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
2. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller.
3. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.
4. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
5. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
6. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
7. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - a. Apply appropriate tape or thread compound to external pipe threads.
 - b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
8. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.
9. Steel-Piping, Pressure-Sealed Joints: Join lightwall steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.
10. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
 - a. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.
11. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.
12. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
13. Steel-Piping, Pressure-Sealed Joints: Join Schedule 5 steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.
14. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.
15. Copper-Tubing Grooved Joints: Roll rounded-edge groove in end of tube according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join copper tube and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
16. Copper-Tubing, Pressure-Sealed Joints: Join copper tube and copper pressure-seal fittings with tools recommended by fitting manufacturer.
17. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.
18. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.



19. Plastic-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
 - b. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
- F. Installation Of Cover System For Sprinkler Piping
 1. Install cover system, brackets, and cover components for sprinkler piping according to manufacturer's "Installation Manual" and with NFPA 13 or NFPA 13R for supports.
- G. Valve And Specialties Installation
 1. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
 2. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
 3. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.
 4. Specialty Valves:
 - a. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.
 - b. Alarm Valves: Include bypass check valve and retarding chamber drain-line connection.
 - c. Deluge Valves: Install in vertical position, in proper direction of flow, and in main supply to deluge system. Install trim sets for drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
- H. Excess-Pressure Pump Installation
 1. Assemble components and mount on wood backing. Comply with requirements in Division 06 Section "Rough Carpentry" for wood backing material and installation.
 2. Install excess-pressure pumps, controls, devices, and supports for sprinkler piping application.
 - a. Mounting: Install on wall, where indicated **OR** attached to water-supply pipe, **as directed**.
- I. Sprinkler Installation
 1. Install sprinklers in suspended ceilings in center of narrow dimension of, **as directed**, acoustical ceiling panels.
 2. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.
 3. Install sprinklers into flexible, sprinkler hose fittings and install hose into bracket on ceiling grid.
- J. Fire-Department Connection Installation
 1. Install wall-type, fire-department connections.
 2. Install yard-type, fire-department connections in concrete slab support. Comply with requirements for concrete in Division 03 Section "Cast-in-place Concrete".
 - a. Install two **OR** three, **as directed**, protective pipe bollards around **OR** on sides of, **as directed**, each fire-department connection. Comply with requirements for bollards in Division 05 Section "Metal Fabrications".
 3. Install automatic (ball drip) drain valve at each check valve for fire-department connection.
- K. Escutcheon Installation
 1. Install escutcheons for penetrations of walls, ceilings, and floors.
 2. Escutcheons for New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
 - b. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish **OR** stamped steel with set-screw **OR** stamped steel with set-screw or spring clips **OR** stamped steel with spring clips, **as directed**.



- c. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish **OR** One piece or split casting, cast brass with polished chrome-plated finish **OR** Split casting, cast brass with polished chrome-plated finish **OR** One piece, stamped steel with set-screw **OR** One piece or split plate, stamped steel with set-screw **OR** Split plate, stamped steel with set-screw, **as directed**.
 - d. Bare Piping in Unfinished Service Spaces: One piece, cast brass with polished chrome-plated finish **OR** cast brass with rough-brass finish **OR** stamped steel with set-screw **OR** stamped steel with spring clips **OR** stamped steel with set-screw or spring clips, **as directed**.
 - e. Bare Piping in Equipment Rooms: One piece, cast brass **OR** stamped steel with set-screw **OR** stamped steel with spring clips **OR** stamped steel with set-screw or spring clips, **as directed**.
 - f. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece floor plate.
3. Escutcheons for Existing Piping:
- a. Chrome-Plated Piping: Split casting, cast brass with chrome-plated finish.
 - b. Insulated Piping: Split plate, stamped steel with concealed or exposed-rivet hinge and spring clips.
 - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split casting, cast brass with chrome-plated finish **OR** plate, stamped steel with concealed hinge and spring clips, **as directed**.
 - d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split casting, cast brass with chrome-plated finish **OR** plate, stamped steel with concealed hinge and set-screw, **as directed**.
 - e. Bare Piping in Unfinished Service Spaces: Split casting, cast brass with polished chrome-plated finish **OR** casting, cast brass with rough-brass finish **OR** plate, stamped steel with concealed hinge and set-screw or spring clips **OR** plate, stamped steel with concealed or exposed-rivet hinge and set-screw or spring clips **OR** plate, stamped steel with exposed-rivet hinge and set-screw or spring clips, **as directed**.
 - f. Bare Piping in Equipment Rooms: Split casting, cast brass **OR** plate, stamped steel with set-screw or spring clips, **as directed**.
 - g. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting floor plate.
- L. Sleeve Installation
- 1. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, roofs, and walls.
 - 2. Sleeves are not required for core-drilled holes.
 - 3. Permanent sleeves are not required for holes formed by removable PE sleeves.
 - 4. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.
 - 5. Install sleeves in new partitions, slabs, and walls as they are built.
 - 6. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 07 Section "Joint Sealants".
 - 7. For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 07 Section "Joint Sealants".
 - 8. For exterior wall penetrations below grade, seal annular space between sleeve and pipe using sleeve seals.
 - 9. Seal space outside of sleeves in concrete slabs and walls with grout.
 - 10. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation unless otherwise indicated.
 - 11. Install sleeve materials according to the following applications:
 - a. Sleeves for Piping Passing through Concrete Floor Slabs: Molded PE **OR** Molded PVC **OR** Galvanized-steel pipe, **as directed**.
 - b. Sleeves for Piping Passing through Concrete Floor Slabs of Mechanical Equipment Areas or Other Wet Areas: Galvanized-steel pipe **OR** Stack sleeve fittings, **as directed**.



- 1) Extend sleeves 2 inches (50 mm) above finished floor level.
 - 2) For pipes penetrating floors with membrane waterproofing, extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Comply with requirements for flashing in Division 07 Section "Sheet Metal Flashing And Trim".
 - c. Sleeves for Piping Passing through Gypsum-Board Partitions:
 - 1) PVC-pipe **OR** Galvanized-steel-pipe, **as directed**, sleeves for pipes smaller than NPS 6 (DN 150).
 - 2) Galvanized-steel-sheet sleeves for pipes NPS 6 (DN 150) and larger.
 - 3) Exception: Sleeves are not required for water-supply tubes and waste pipes for individual plumbing fixtures if escutcheons will cover openings.
 - d. Sleeves for Piping Passing through Concrete Roof Slabs: Molded PE **OR** Molded PVC **OR** Galvanized-steel pipe, **as directed**.
 - e. Sleeves for Piping Passing through Exterior Concrete Walls:
 - 1) Galvanized-steel-pipe sleeves for pipes smaller than NPS 6 (DN 150).
 - 2) Cast-iron wall-pipe sleeves for pipes NPS 6 (DN 150) and larger.
 - 3) Install sleeves that are large enough to provide 1-inch (25-mm) annular clear space between sleeve and pipe or pipe insulation when sleeve seals are used.
 - f. Sleeves for Piping Passing through Interior Concrete Walls:
 - 1) PVC-pipe **OR** Galvanized-steel-pipe, **as directed**, sleeves for pipes smaller than NPS 6 (DN 150).
 - 2) Galvanized-steel-sheet sleeves for pipes NPS 6 (DN 150) and larger.
12. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestop materials and installations in Division 07 Section "Penetration Firestopping".
- M. Sleeve Seal Installation
1. Install sleeve seals in sleeves in exterior concrete walls at water-service piping entries into building.
 2. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- N. Identification
1. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.
 2. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification For Electrical Systems".
- O. Field Quality Control
1. Perform tests and inspections.
 2. Tests and Inspections:
 - a. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
 - b. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - c. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
 - d. Energize circuits to electrical equipment and devices.
 - e. Start and run excess-pressure pumps.
 - f. Coordinate with fire-alarm tests. Operate as required.
 - g. Coordinate with fire-pump tests. Operate as required.
 - h. Verify that equipment hose threads are same as local fire-department equipment.
 3. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
 4. Prepare test and inspection reports.



- P. Cleaning
1. Clean dirt and debris from sprinklers.
 2. Remove and replace sprinklers with paint other than factory finish.
- Q. Piping Schedule
1. Piping between Fire-Department Connections and Check Valves: Galvanized, standard-weight steel pipe with threaded ends; cast-iron threaded fittings; and threaded **OR** grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved, **as directed**, joints.
 2. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.
 3. Copper-tube, extruded-tee connections may be used for tee branches in copper tubing instead of specified copper fittings. Branch-connection joints must be brazed.
 4. CPVC pipe; Schedule 40 **OR** Schedule 80, **as directed**, CPVC fittings; and solvent-cemented joints may be used for light-hazard and residential occupancies.
 5. Standard-pressure, wet-pipe sprinkler system, NPS 2 (DN 50) and smaller, shall be one of the following:
 - a. Standard-weight or Schedule 30, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
 - b. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
 - c. Standard-weight or Schedule 30, black-steel pipe with plain ends; uncoated, plain-end-pipe fittings; and twist-locked joints.
 - d. Standard-weight or Schedule 30, galvanized-steel pipe with plain ends; galvanized, plain-end-pipe fittings; and twist-locked joints.
 - e. Standard-weight or Schedule 30, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - f. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - g. Standard-weight or Schedule 30, black-steel pipe with plain ends; steel welding fittings; and welded joints.
 - h. Thinwall **OR** Schedule 10, **as directed**, nonstandard OD, thinwall or hybrid black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - i. Thinwall **OR** Schedule 10, **as directed**, or hybrid black-steel pipe with plain ends; uncoated, plain-end-pipe fittings; and twist-locked joints.
 - j. Thinwall **OR** Schedule 10, **as directed**, nonstandard OD, thinwall or hybrid black-steel pipe with plain ends; welding fittings; and welded joints.
 - k. Schedule 5 steel pipe; steel pressure-seal fittings; and pressure-sealed joints.
 - l. Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube with plain ends; cast- or wrought-copper solder-joint fittings; and brazed joints.
 - m. Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube with plain ends; copper pressure-seal fittings; and pressure-sealed joints.
 - n. NPS 2 (DN 50), Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube with roll-grooved ends; copper, grooved-end fittings; grooved-end-tube couplings; and grooved joints.
 6. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 to NPS 4 (DN 65 to DN 100), shall be one of the following:
 - a. Standard-weight or Schedule 30, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
 - b. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
 - c. Standard-weight or Schedule 30, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.



- d. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - e. Standard-weight or Schedule 30, black-steel pipe with plain ends; steel welding fittings; and welded joints.
 - f. Thinwall **OR** Schedule 10, **as directed**, nonstandard OD, thinwall or hybrid black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - g. Thinwall **OR** Schedule 10, **as directed**, nonstandard OD, thinwall or hybrid black-steel pipe with plain ends; welding fittings; and welded joints.
 - h. Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube with plain ends; cast-or wrought-copper solder-joint fittings; and brazed joints.
 - i. Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube with plain ends; copper pressure-seal fittings; and pressure-sealed joints.
 - j. Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube with roll-grooved ends; copper, grooved-end fittings; grooved-end-tube couplings; and grooved joints.
7. Standard-pressure, wet-pipe sprinkler system, NPS 5 (DN 125) and larger, shall be one of the following:
- a. Standard-weight or Schedule 30, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
 - b. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
 - c. Standard-weight or Schedule 30, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - d. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - e. Standard-weight or Schedule 30, black-steel pipe with plain ends; steel welding fittings; and welded joints.
 - f. Thinwall **OR** Schedule 10, **as directed**, or hybrid black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - g. Thinwall **OR** Schedule 10, **as directed**, or hybrid black-steel pipe with plain ends; welding fittings; and welded joints.
 - h. Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube with plain ends; cast-or wrought-copper solder-joint fittings; and brazed joints.
 - i. Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube with roll-grooved ends; copper, grooved-end fittings; grooved-end-tube couplings; and grooved joints.
8. High-pressure, wet-pipe sprinkler system, NPS 4 (DN 100) and smaller, shall be one of the following:
- a. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
 - b. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - c. Standard-weight or Schedule 30, black-steel pipe with plain ends; steel welding fittings; and welded joints.
 - d. Thinwall **OR** Schedule 10, **as directed**, or hybrid black-steel pipe with plain ends; welding fittings; and welded joints.
9. High-pressure, wet-pipe sprinkler system, NPS 5 (DN 125) and larger, shall be one of the following:
- a. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.



- b. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
- c. Standard-weight or Schedule 30, black-steel pipe with plain ends; steel welding fittings; and welded joints.
- d. Thinwall **OR** Schedule 10, **as directed**, or hybrid black-steel pipe with plain ends; welding fittings; and welded joints.

R. Sprinkler Schedule

- 1. Use sprinkler types in subparagraphs below for the following applications:
 - a. Rooms without Ceilings: Upright sprinklers.
 - b. Rooms with Suspended Ceilings: Pendent sprinklers **OR** Recessed sprinklers **OR** Flush sprinklers **OR** Concealed sprinklers, **as directed**.
 - c. Wall Mounting: Sidewall sprinklers.
 - d. Spaces Subject to Freezing: Upright sprinklers **OR** Pendent, dry sprinklers **OR** Sidewall, dry sprinklers, **as directed**.
 - e. Deluge-Sprinkler Systems: Upright and pendent, open sprinklers.
 - f. Special Applications: Extended-coverage, flow-control, and quick-response sprinklers where indicated.
- 2. Provide sprinkler types in subparagraphs below with finishes indicated.
 - a. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
 - b. Flush Sprinklers: Bright chrome, with painted white escutcheon.
 - c. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
 - d. Residential Sprinklers: Dull chrome.
 - e. Upright, Pendent, and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

END OF SECTION 21 13 13 00



SECTION 21 13 16 00 - DRY-PIPE FIRE-SUPPRESSION SPRINKLERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for dry-pipe fire-suppression sprinklers. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Pipes, fittings, and specialties.
 - b. Fire-protection valves.
 - c. Fire-department connections.
 - d. Sprinkler specialty pipe fittings.
 - e. Sprinklers.
 - f. Alarm devices.
 - g. Manual control stations.
 - h. Control panels.
 - i. Pressure gages.

C. Definitions

1. Standard-Pressure Sprinkler Piping: Dry-pipe sprinkler system piping designed to operate at working pressure 175 psig (1200 kPa) maximum.

D. System Descriptions

1. Dry-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing compressed air. Opening of sprinklers releases compressed air and permits water pressure to open dry-pipe valve. Water then flows into piping and discharges from sprinklers that are open.
2. Combined Dry-Pipe and Preaction Sprinkler System: Automatic sprinklers are attached to piping containing compressed air. Fire-detection system in same area as sprinklers actuates tripping devices that open dry-pipe valve without loss of air pressure and actuates fire alarm. Water discharges from sprinklers that have opened.
3. Single-Interlock Preaction Sprinkler System: Automatic sprinklers are attached to piping containing low-pressure air. Actuation of fire-detection system in same area as sprinklers opens deluge valve, permitting water to flow into piping and to discharge from sprinklers that have opened.
4. Double-Interlock Preaction Sprinkler System: Automatic sprinklers are attached to piping containing low-pressure air. Actuation of a fire-detection system in the same area as sprinklers opens the deluge valve permitting water to flow into the sprinkler piping; a closed solenoid valve in the sprinkler piping is opened by another fire-detection device; then water will discharge from sprinklers that have opened.

E. Performance Requirements

1. Standard-Pressure Piping System Component: Listed for 175-psig (1200-kPa) minimum working pressure.
2. Delegated Design: Design sprinkler system(s), including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
3. Sprinkler system design shall be approved by authorities having jurisdiction.
 - a. Margin of Safety for Available Water Flow and Pressure: 10 **OR** 20, **as directed**, percent, including losses through water-service piping, valves, and backflow preventers.
 - b. Sprinkler Occupancy Hazard Classifications:
 - 1) Automobile Parking Areas: Ordinary Hazard, Group 1.



- 2) Building Service Areas: Ordinary Hazard, Group 1.
- 3) Churches: Light Hazard.
- 4) Electrical Equipment Rooms: Ordinary Hazard, Group 1.
- 5) Dry Cleaners: Ordinary Hazard, Group 2.
- 6) General Storage Areas: Ordinary Hazard, Group 1.
- 7) Laundries: Ordinary Hazard, Group 1.
- 8) Libraries Except Stack Areas: Light Hazard.
- 9) Library Stack Areas: Ordinary Hazard, Group 2.
- 10) Machine Shops: Ordinary Hazard, Group 2.
- 11) Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
- 12) Office and Public Areas: Light Hazard.
- 13) Plastics Processing Areas: Extra Hazard, Group 2.
- 14) Printing Plants: Extra Hazard, Group 1.
- 15) Repair Garages: Ordinary Hazard, Group 2.
- 16) Restaurant Service Areas: Ordinary Hazard, Group 1.
- 17) Solvent Cleaning Areas: Extra Hazard, Group 2.
- 18) Upholstering Plants: Extra Hazard, Group 1.
- c. Minimum Density for Automatic-Sprinkler Piping Design:
 - 1) Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. (4.1 mm/min. over 139-sq. m) area.
 - 2) Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. (6.1 mm/min. over 139-sq. m) area.
 - 3) Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over 1500-sq. ft. (8.1 mm/min. over 139-sq. m) area.
 - 4) Extra-Hazard, Group 1 Occupancy: 0.30 gpm over 2500-sq. ft. (12.2 mm/min. over 232-sq. m) area.
 - 5) Extra-Hazard, Group 2 Occupancy: 0.40 gpm over 2500-sq. ft. (16.3 mm/min. over 232-sq. m) area.
 - 6) Special Occupancy Hazard: As determined by authorities having jurisdiction.
- d. Maximum Protection Area per Sprinkler: Per UL listing.
OR
Maximum Protection Area per Sprinkler:
 - 1) Office Spaces: 120 sq. ft. (11.1 sq. m) **OR** 225 sq. ft. (20.9 sq. m), **as directed**.
 - 2) Storage Areas: 130 sq. ft. (12.1 sq. m).
 - 3) Mechanical Equipment Rooms: 130 sq. ft. (12.1 sq. m).
 - 4) Electrical Equipment Rooms: 130 sq. ft. (12.1 sq. m).
 - 5) Other Areas: According to NFPA 13 recommendations unless otherwise indicated.
- e. Total Combined Hose-Stream Demand Requirement: According to NFPA 13 unless otherwise indicated:
 - 1) Light-Hazard Occupancies: 100 gpm (6.3 L/s) for 30 minutes.
 - 2) Ordinary-Hazard Occupancies: 250 gpm (15.75 L/s) for 60 to 90 minutes.
 - 3) Extra-Hazard Occupancies: 500 gpm (31.5 L/s) for 90 to 120 minutes.
4. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.

F. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: For dry-pipe sprinkler systems. Include plans, elevations, sections, details, and attachments to other work.
 - a. Wiring Diagrams: For power, signal, and control wiring.
3. Delegated-Design Submittal: For sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
4. Qualification Data: For qualified Installer and professional engineer, **as directed**.



5. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.
6. Fire-hydrant flow test report.
7. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
8. Field quality-control reports.
9. Operation and maintenance data.

G. Quality Assurance

1. Installer Qualifications:
 - a. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
 - 1) Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.
2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:
 - a. NFPA 13, "Installation of Sprinkler Systems."
 - b. NFPA 13R, "Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height."
 - c. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."

H. Project Conditions

1. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by the Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:
 - a. Notify the Owner no fewer than two days in advance of proposed interruption of sprinkler service.
 - b. Do not proceed with interruption of sprinkler service without the Owner's written permission.

1.2 PRODUCTS

A. Piping Materials

1. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Steel Pipe And Fittings

1. Standard Weight, Galvanized-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.
2. Schedule 30, Galvanized-Steel Pipe: ASTM A 135; ASTM A 795/A 795M, Type E; or ASME B36.10M, wrought steel; with wall thickness not less than Schedule 30 and not more than Schedule 40. Pipe ends may be factory or field formed to match joining method.
3. Thinwall Galvanized-Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, threadable, with wall thickness less than Schedule 30 and equal to or greater than Schedule 10. Pipe ends may be factory or field formed to match joining method.
4. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.
5. Galvanized, Steel Couplings: ASTM A 865, threaded.
6. Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
7. Malleable- or Ductile-Iron Unions: UL 860.
8. Cast-Iron Flanges: ASME B16.1, Class 125.



9. Plain-End-Pipe Fittings: UL 213, ductile-iron body with retainer lugs that require one-quarter turn or screwed retainer pin to secure pipe in fitting.
 10. Grooved-Joint, Steel-Pipe Appurtenances:
 - a. Pressure Rating: 175 psig (1200 kPa) **OR** 250 psig (1725 kPa) **OR** 300 psig (2070 kPa), **as directed**, minimum.
 - b. Galvanized, Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
 - c. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213, rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.
- C. Copper Tube And Fittings
1. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B) and ASTM B 88, Type M (ASTM B 88M, Type C) water tube, drawn temper.
 2. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
 3. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, pressure fittings.
 4. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
 5. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
 6. Copper Pressure-Seal Fittings:
 - a. Standard: UL 213.
 - b. NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.
 - c. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Cast-bronze fitting with EPDM-rubber O-ring seal in each end.
 7. Grooved-Joint, Copper-Tube Appurtenances:
 - a. Grooved-End, Copper Fittings: ASTM B 75 (ASTM B 75M), copper tube or ASTM B 584, bronze castings.
 - b. Grooved-End-Tube Couplings: To fit copper tube, with dimensions and design similar to AWWA C606. Include ferrous housing sections, EPDM-rubber gasket suitable for hot and cold water, and bolts and nuts.
 8. Copper-Tube, Extruded-Tee Connections:
 - a. Description: Tee formed in copper tube according to ASTM F 2014.
- D. Piping Joining Materials
1. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick or ASME B16.21, nonmetallic and asbestos free.
 - a. Class 125, Cast-Iron and Class 150, Bronze Flat-Face Flanges: Full-face gaskets.
 - b. Class 250, Cast-Iron and Class 300, Raised-Face Flanges: Ring-type gaskets.
 2. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
 3. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.
- E. Listed Fire-Protection Valves
1. General Requirements:
 - a. Valves shall be UL listed or FM approved.
 - b. Minimum Pressure Rating for Standard-Pressure Piping: 175 psig (1200 kPa).
 2. Ball Valves:
 - a. Standard: UL 1091 except with ball instead of disc.
 - b. Valves NPS 1-1/2 (DN 40) and Smaller: Bronze body with threaded ends.
 - c. Valves NPS 2 and NPS 2-1/2 (DN 50 and DN 65): Bronze body with threaded ends or ductile-iron body with grooved ends.
 - d. Valves NPS 3 (DN 80): Ductile-iron body with grooved ends.
- F. Bronze Butterfly Valves:



- a. Standard: UL 1091.
 - b. Pressure Rating: 175 psig (1200 kPa).
 - c. Body Material: Bronze.
 - d. End Connections: Threaded.
- G. Iron Butterfly Valves:
- a. Standard: UL 1091.
 - b. Pressure Rating: 175 psig (1200 kPa).
 - c. Body Material: Cast or ductile iron.
 - d. Style: Lug or wafer.
- OR**
End Connections: Grooved.
- H. Check Valves:
- a. Standard: UL 312
 - b. Pressure Rating: 250 psig (1725 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - c. Type: Swing check.
 - d. Body Material: Cast iron.
 - e. End Connections: Flanged or grooved.
2. Bronze OS&Y Gate Valves:
- a. Standard: UL 262.
 - b. Pressure Rating: 175 psig (1200 kPa).
 - c. Body Material: Bronze.
 - d. End Connections: Threaded.
3. Iron OS&Y Gate Valves:
- a. Standard: UL 262.
 - b. Pressure Rating: 250 psig (1725 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - c. Body Material: Cast or ductile iron.
 - d. End Connections: Flanged or grooved.
4. Indicating-Type Butterfly Valves:
- a. Standard: UL 1091.
 - b. Pressure Rating: 175 psig (1200 kPa) minimum.
 - c. Valves NPS 2 (DN 50) and Smaller:
 - 1) Valve Type: Ball or butterfly.
 - 2) Body Material: Bronze.
 - 3) End Connections: Threaded.
 - d. Valves NPS 2-1/2 (DN 65) and Larger:
 - 1) Valve Type: Butterfly.
 - 2) Body Material: Cast or ductile iron.
 - 3) End Connections: Flanged, grooved, or wafer.
 - e. Valve Operation: Integral electrical, 115-V ac, prewired, single-circuit, supervisory switch **OR** electrical, 115-V ac, prewired, two-circuit, supervisory switch **OR** visual, **as directed**, indicating device.
5. NRS Gate Valves:
- a. Standard: UL 262.
 - b. Pressure Rating: 250 psig (1725 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - c. Body Material: Cast iron with indicator post flange.
 - d. Stem: Nonrising.
 - e. End Connections: Flanged or grooved.
6. Indicator Posts:
- a. Standard: UL 789.
 - b. Type: Horizontal for wall mounting.
 - c. Body Material: Cast iron with extension rod and locking device.
 - d. Operation: Wrench **OR** Hand wheel, **as directed**.
- I. Trim And Drain Valves



1. General Requirements:
 - a. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 - b. Pressure Rating: 175 psig (1200 kPa) minimum.
2. Angle Valves.
3. Ball Valves.
4. Globe Valves.
5. Plug Valves.

J. Specialty Valves

1. General Requirements:
 - a. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 - b. Pressure Rating:
 - 1) Standard-Pressure Piping Specialty Valves: 175 psig (1200 kPa) minimum.
 - 2) High-Pressure Piping Specialty Valves: 250 psig (1725 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - c. Body Material: Cast or ductile iron.
 - d. Size: Same as connected piping.
 - e. End Connections: Flanged or grooved.
2. Dry-Pipe Valves:
 - a. Standard: UL 260
 - b. Design: Differential-pressure type.
 - c. Include UL 1486, quick-opening devices, trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
 - d. Air-Pressure Maintenance Device:
 - 1) Standard: UL 260.
 - 2) Type: Automatic device to maintain minimum air pressure in piping.
 - 3) Include shutoff valves to permit servicing without shutting down sprinkler piping, bypass valve for quick filling, pressure regulator or switch to maintain pressure, strainer, pressure ratings with 14- to 60-psig (95- to 410-kPa) adjustable range, and 175-psig (1200-kPa) **OR** 300-psig (2070-kPa), **as directed**, outlet pressure.
 - e. Air Compressor:
 - 1) Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 - 2) Motor Horsepower: Fractional.
 - 3) Power: 120-V ac, 60 Hz, single phase.
3. Deluge Valves:
 - a. Standard: UL 260.
 - b. Design: Hydraulically operated, differential-pressure type.
 - c. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, drip cup assembly piped without valves and separate from main drain line, fill-line attachment with strainer, and push-rod chamber supply connection.
 - d. Dry, Pilot-Line Trim Set: Include dry, pilot-line actuator; air- and water-pressure gages; low-air-pressure warning switch; air relief valve; and actuation device. Dry, pilot-line actuator includes cast-iron, operated, diaphragm-type valve with resilient facing plate, resilient diaphragm, and replaceable bronze seat. Valve includes threaded water and air inlets and water outlet. Loss of air pressure on dry, pilot-line side allows pilot-line actuator to open and causes deluge valve to open immediately.
 - e. Air-Pressure Maintenance Device:
 - 1) Standard: UL 260.
 - 2) Type: Automatic device to maintain minimum air pressure in piping.
 - 3) Include shutoff valves to permit servicing without shutting down sprinkler piping, bypass valve for quick filling, pressure regulator or switch to maintain pressure,



- strainer, pressure ratings with 14- to 60-psig (95- to 410-kPa) adjustable range, and 175-psig (1200-kPa) **OR** 300-psig (2070-kPa), **as directed**, outlet pressure.
- f. Air Compressor:
 - 1) Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 - 2) Motor Horsepower: Fractional.
 - 3) Power: 120-V ac, 60 Hz, single phase.
 4. Automatic (Ball Drip) Drain Valves:
 - a. Standard: UL 1726.
 - b. Pressure Rating: 175 psig (1200 kPa) minimum.
 - c. Type: Automatic draining, ball check.
 - d. Size: NPS 3/4 (DN 20).
 - e. End Connections: Threaded.
- K. Fire-Department Connections
1. Exposed-Type, Fire-Department Connection:
 - a. Standard: UL 405.
 - b. Type: Exposed, projecting, for wall mounting.
 - c. Pressure Rating: 175 psig (1200 kPa) minimum.
 - d. Body Material: Corrosion-resistant metal.
 - e. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
 - f. Caps: Brass, lugged type, with gasket and chain.
 - g. Escutcheon Plate: Round, brass, wall type.
 - h. Outlet: Back, with pipe threads.
 - i. Number of Inlets: Two **OR** Three, **as directed**.
 - j. Escutcheon Plate Marking: Similar to "AUTO SPKR & STANDPIPE" **OR** "AUTO SPKR", **as directed**.
 - k. Finish: Polished chrome plated **OR** Rough brass or bronze **OR** Rough chrome plated, **as directed**.
 - l. Outlet Size: NPS 4 (DN 100) **OR** NPS 5 (DN 125) **OR** NPS 6 (DN 150), **as directed**.
 2. Flush-Type, Fire-Department Connection:
 - a. Standard: UL 405.
 - b. Type: Flush, for wall mounting.
 - c. Pressure Rating: 175 psig (1200 kPa) minimum.
 - d. Body Material: Corrosion-resistant metal.
 - e. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
 - f. Caps: Brass, lugged type, with gasket and chain.
 - g. Escutcheon Plate: Rectangular, brass, wall type.
 - h. Outlet: With pipe threads.
 - i. Body Style: Horizontal **OR** Square **OR** Vertical, **as directed**.
 - j. Number of Inlets: Two **OR** Three **OR** Four **OR** Six, **as directed**.
 - k. Outlet Location: Back **OR** Bottom **OR** Left side **OR** Right side **OR** Top, **as directed**.
 - l. Escutcheon Plate Marking: Similar to "AUTO SPKR & STANDPIPE" **OR** "AUTO SPKR", **as directed**.
 - m. Finish: Polished chrome plated **OR** Rough brass or bronze **OR** Rough chrome plated, **as directed**.
 - n. Outlet Size: NPS 4 (DN 100) **OR** NPS 5 (DN 125) **OR** NPS 6 (DN 150) **OR** NPS 8 (DN 200), **as directed**.
 3. Yard-Type, Fire-Department Connection:
 - a. Standard: UL 405.
 - b. Type: Exposed, freestanding.
 - c. Pressure Rating: 175 psig (1200 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.



- d. Body Material: Corrosion-resistant metal.
 - e. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
 - f. Caps: Brass, lugged type, with gasket and chain.
 - g. Escutcheon Plate: Round, brass, floor type.
 - h. Outlet: Bottom, with pipe threads.
 - i. Number of Inlets: Two **OR** Three **OR** Four, **as directed**.
 - j. Sleeve: Brass **OR** Not required, **as directed**.
 - k. Sleeve Height: 18 inches (460 mm).
 - l. Escutcheon Plate Marking: Similar to "AUTO SPKR & STANDPIPE" **OR** "AUTO SPKR", **as directed**.
 - m. Finish, Including Sleeve: Polished chrome plated **OR** Rough brass or bronze **OR** Rough chrome plated, **as directed**.
 - n. Outlet Size: NPS 4 (DN 100) **OR** NPS 5 (DN 125) **OR** NPS 6 (DN 150), **as directed**.
- L. Sprinkler Specialty Pipe Fittings
1. General Requirements for Dry-Pipe-System Fittings: UL listed for dry-pipe service.
 2. Branch Outlet Fittings:
 - a. Standard: UL 213.
 - b. Pressure Rating: 175 psig (1200 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - c. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
 - d. Type: Mechanical-T and -cross fittings.
 - e. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
 - f. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
 - g. Branch Outlets: Grooved, plain-end pipe, or threaded.
 3. Flow Detection and Test Assemblies:
 - a. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 - b. Pressure Rating: 175 psig (1200 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - c. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
 - d. Size: Same as connected piping.
 - e. Inlet and Outlet: Threaded.
 4. Branch Line Testers:
 - a. Standard: UL 199.
 - b. Pressure Rating: 175 psig (1200 kPa) minimum.
 - c. Body Material: Brass.
 - d. Size: Same as connected piping.
 - e. Inlet: Threaded.
 - f. Drain Outlet: Threaded and capped.
 - g. Branch Outlet: Threaded, for sprinkler.
 5. Sprinkler Inspector's Test Fittings:
 - a. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 - b. Pressure Rating: 175 psig (1200 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - c. Body Material: Cast- or ductile-iron housing with sight glass.
 - d. Size: Same as connected piping.
 - e. Inlet and Outlet: Threaded.
 6. Adjustable Drop Nipples:
 - a. Standard: UL 1474.
 - b. Pressure Rating: 250 psig (1725 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - c. Body Material: Steel pipe with EPDM O-ring seals.
 - d. Size: Same as connected piping.
 - e. Length: Adjustable.



- f. Inlet and Outlet: Threaded.
7. Flexible, Sprinkler Hose Fittings:
 - a. Standard: UL 1474.
 - b. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
 - c. Pressure Rating: 175 psig (1200 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - d. Size: Same as connected piping, for sprinkler.

M. Sprinklers

1. General Requirements:
 - a. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 - b. Pressure Rating for Residential Sprinklers: 175 psig (1200 kPa) maximum.
 - c. Pressure Rating for Automatic Sprinklers: 175 psig (1200 kPa) minimum.
 - d. Pressure Rating for High-Pressure Automatic Sprinklers: 250 psig (1725 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
2. Automatic Sprinklers with Heat-Responsive Element:
 - a. Nonresidential Applications: UL 199.
 - b. Residential Applications: UL 1626.
 - c. Characteristics: Nominal 1/2-inch (12.7-mm) orifice with discharge coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.
3. Sprinkler Finishes:
 - a. Chrome plated.
 - b. Bronze.
 - c. Painted.
4. Special Coatings:
 - a. Wax.
 - b. Lead.
 - c. Corrosion-resistant paint.
5. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
 - a. Ceiling Mounting: Chrome-plated steel, one piece, flat **OR** Chrome-plated steel, two piece, with 1-inch (25-mm) vertical adjustment **OR** Plastic, white finish, one piece, flat, **as directed**.
 - b. Sidewall Mounting: Chrome-plated steel **OR** Plastic, white finish, **as directed**, one piece, flat.
6. Sprinkler Guards:
 - a. Standard: UL 199.
 - b. Type: Wire cage with fastening device for attaching to sprinkler.

N. Alarm Devices

1. Alarm-device types shall match piping and equipment connections.
2. Water-Motor-Operated Alarm:
 - a. Standard: UL 753.
 - b. Type: Mechanically operated, with Pelton wheel.
 - c. Alarm Gong: Cast aluminum with red-enamel factory finish.
 - d. Size: 10-inch (250-mm) diameter.
 - e. Components: Shaft length, bearings, and sleeve to suit wall construction.
 - f. Inlet: NPS 3/4 (DN 20).
 - g. Outlet: NPS 1 (DN 25) drain connection.
3. Electrically Operated Alarm Bell:
 - a. Standard: UL 464.
 - b. Type: Vibrating, metal alarm bell.



- c. Size: 6-inch (150-mm) minimum **OR** 8-inch (200-mm) minimum **OR** 10-inch (250-mm), **as directed**, diameter.
 - d. Finish: Red-enamel factory finish, suitable for outdoor use.
 - 4. Pressure Switches:
 - a. Standard: UL 346.
 - b. Type: Electrically supervised water-flow switch with retard feature.
 - c. Components: Single-pole, double-throw switch with normally closed contacts.
 - d. Design Operation: Rising pressure signals water flow.
 - 5. Valve Supervisory Switches:
 - a. Standard: UL 346.
 - b. Type: Electrically supervised.
 - c. Components: Single-pole, double-throw switch with normally closed contacts.
 - d. Design: Signals that controlled valve is in other than fully open position.
 - 6. Indicator-Post Supervisory Switches:
 - a. Standard: UL 346.
 - b. Type: Electrically supervised.
 - c. Components: Single-pole, double-throw switch with normally closed contacts.
 - d. Design: Signals that controlled indicator-post valve is in other than fully open position.
- O. Manual Control Stations
 - 1. Description: UL listed or FM Global approved, hydraulic operation, with union, NPS 1/2 (DN 15) pipe nipple, and bronze ball valve. Include metal enclosure labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut to prevent accidental opening.
- P. Control Panels
 - 1. Description: Single-area, two-area, or single-area cross-zoned type control panel as indicated, including NEMA ICS 6, Type 1 enclosure, detector, alarm, and solenoid-valve circuitry for operation of deluge valves. Panels contain power supply; battery charger; standby batteries; field-wiring terminal strip; electrically supervised solenoid valves and polarized fire-alarm bell; lamp test facility; single-pole, double-throw auxiliary alarm contacts; and rectifier.
 - 2. Panels: UL listed and FM Global approved when used with thermal detectors and Class A detector circuit wiring. Electrical characteristics are 120-V ac, 60 Hz, with 24-V dc rechargeable batteries.
 - a. Manual Control Stations: Electric operation, metal enclosure, labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut to prevent accidental opening.
OR
Manual Control Stations: Hydraulic operation, with union, NPS 1/2 (DN 15) pipe nipple, and bronze ball valve. Include metal enclosure labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut to prevent accidental opening.
- Q. Pressure Gages
 - 1. Standard: UL 393.
 - 2. Dial Size: 3-1/2- to 4-1/2-inch (90- to 115-mm) diameter.
 - 3. Pressure Gage Range: 0 to 250 psig (0 to 1725 kPa) minimum **OR** 0 to 300 psig (0 to 2070 kPa), **as directed**.
 - 4. Water System Piping Gage: Include "WATER" or "AIR/WATER" label on dial face.
 - 5. Air System Piping Gage: Include retard feature, **as directed**, and "AIR" or "AIR/WATER" label on dial face.
- R. Escutcheons
 - 1. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.



2. One-Piece, Cast-Brass Escutcheons: Polished chrome-plated or rough-brass finish with set-screws.
3. One-Piece, Deep-Pattern Escutcheons: Deep-drawn, box-shaped brass with chrome-plated finish.
4. One-Piece, Stamped-Steel Escutcheons: Chrome-plated finish with set-screw or spring clips.
5. Split-Casting, Cast-Brass Escutcheons: Polished chrome-plated or rough-brass finish with concealed hinge and set-screw.
6. Split-Plate, Stamped-Steel Escutcheons: Chrome-plated finish with concealed **OR** exposed-rivet, **as directed**, hinge, set-screw or spring clips.
7. One-Piece Floor Plates: Cast-iron flange with holes for fasteners, **as directed**.
8. Split-Casting Floor Plates: Cast brass with concealed hinge.

S. Sleeves

1. Cast-Iron Wall Pipe Sleeves: Cast or fabricated of cast iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
2. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
3. Molded-PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
4. Molded-PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.
5. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
6. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, standard weight, zinc coated, plain ends.
7. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - a. Underdeck Clamp: Clamping ring with set-screws.

T. Sleeve Seals

1. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - a. Sealing Elements: EPDM-rubber or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - b. Pressure Plates: Carbon steel **OR** Plastic **OR** Stainless steel, **as directed**.
 - c. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating **OR** Stainless steel, **as directed**, of length required to secure pressure plates to sealing elements.

U. Grout

1. Standard: ASTM C 1107, Grade B, posthardening and volume adjusting, dry, hydraulic-cement grout.
2. Characteristics: Nonshrink, and recommended for interior and exterior applications.
3. Design Mix: 5000-psi (34-MPa), 28-day compressive strength.
4. Packaging: Premixed and factory packaged.

1.3 EXECUTION

A. Preparation

1. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.
2. Report test results promptly and in writing.

B. Service-Entrance Piping

1. Connect sprinkler piping to water-service piping for service entrance to building. Comply with requirements in Division 21 Section "Facility Fire-suppression Water-service Piping" for exterior piping.



2. Install shutoff valve, backflow preventer, **as directed**, pressure gage, drain, and other accessories indicated at connection to water-service piping. Comply with requirements in Division 21 Section "Facility Fire-suppression Water-service Piping" for backflow preventers, **as directed**.
3. Install shutoff valve, check valve, pressure gage, and drain at connection to water service.

C. Water-Supply Connections

1. Connect sprinkler piping to building's interior water-distribution piping. Comply with requirements in Division 22 Section "Domestic Water Piping" for interior piping.
2. Install shutoff valve, backflow preventer, **as directed**, pressure gage, drain, and other accessories indicated at connection to water-distribution piping. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for backflow preventers, **as directed**.
3. Install shutoff valve, check valve, pressure gage, and drain at connection to water supply.

D. Piping Installation

1. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
 - a. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with the Owner before deviating from approved working plans.
2. Piping Standard: Comply with requirements in NFPA 13 for installation of sprinkler piping.
3. Install seismic restraints on piping. Comply with requirements in NFPA 13 for seismic-restraint device materials and installation.
4. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
5. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller.
6. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.
7. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.
8. Install sprinkler piping with drains for complete system drainage.
9. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
10. Install automatic (ball drip) drain valves to drain piping between fire-department connections and check valves. Drain to floor drain or to outside building.
11. Connect compressed-air supply to dry-pipe sprinkler piping.

OR

Connect air compressor to the following piping and wiring:

 - a. Pressure gages and controls.
 - b. Electrical power system.
 - c. Fire-alarm devices, including low-pressure alarm.
12. Install alarm devices in piping systems.
13. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements in NFPA 13 for hanger materials.
14. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 (DN 8) and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.
15. Drain dry-pipe sprinkler piping.
16. Pressurize and check dry-pipe sprinkler system piping and air-pressure maintenance devices **OR** air compressors, **as directed**.

E. Joint Construction



1. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
 2. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller.
 3. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.
 4. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
 5. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
 6. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
 7. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - a. Apply appropriate tape or thread compound to external pipe threads.
 - b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
 8. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.
 9. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.
 10. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.
 11. Copper-Tubing Grooved Joints: Roll rounded-edge groove in end of tube according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join copper tube and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
 12. Copper-Tubing, Pressure-Sealed Joints: Join copper tube and copper pressure-seal fittings with tools recommended by fitting manufacturer.
 13. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.
 14. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.
- F. Valve And Specialties Installation
1. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
 2. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
 3. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.
 4. Specialty Valves:
 - a. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.
 - b. Dry-Pipe and Deluge Valves: Install trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
 - 1) Install air compressor and compressed-air supply piping.
 - 2) Air-Pressure Maintenance Device: Install shutoff valves to permit servicing without shutting down sprinkler system; bypass valve for quick system filling; pressure regulator or switch to maintain system pressure; strainer; pressure ratings with 14- to 60-psig (95- to 410-kPa) adjustable range; and 175-psig (1200-kPa) maximum inlet pressure.
 - 3) Install compressed-air supply piping from building's compressed-air piping system.



- G. Sprinkler Installation
1. Install sprinklers in suspended ceilings in center of narrow dimension of, **as directed**, acoustical ceiling panels.
 2. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.
 3. Install sprinklers into flexible, sprinkler hose fittings and install hose into bracket on ceiling grid.
- H. Fire-Department Connection Installation
1. Install wall-type, fire-department connections.
 2. Install yard-type, fire-department connections in concrete slab support. Comply with requirements for concrete in Division 03 Section "Cast-in-place Concrete".
 - a. Install two **OR** three, **as directed**, protective pipe bollards around **OR** on sides of, **as directed**, each fire-department connection. Comply with requirements for bollards in Division 05 Section "Metal Fabrications".
 3. Install automatic (ball drip) drain valve at each check valve for fire-department connection.
- I. Escutcheon Installation
1. Install escutcheons for penetrations of walls, ceilings, and floors.
 2. Escutcheons for New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
 - b. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish **OR** stamped steel with set-screw **OR** stamped steel with set-screw or spring clips **OR** stamped steel with spring clips, **as directed**.
 - c. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish **OR** One piece or split casting, cast brass with polished chrome-plated finish **OR** Split casting, cast brass with polished chrome-plated finish **OR** One piece, stamped steel with set-screw **OR** One piece or split plate, stamped steel with set-screw **OR** Split plate, stamped steel with set-screw, **as directed**.
 - d. Bare Piping in Unfinished Service Spaces: One piece, cast brass with polished chrome-plated finish **OR** cast brass with rough-brass finish **OR** stamped steel with set-screw **OR** stamped steel with spring clips **OR** stamped steel with set-screw or spring clips, **as directed**.
 - e. Bare Piping in Equipment Rooms: One piece, cast brass **OR** stamped steel with set-screw **OR** stamped steel with spring clips **OR** stamped steel with set-screw or spring clips, **as directed**.
 - f. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece floor plate.
 3. Escutcheons for Existing Piping:
 - a. Chrome-Plated Piping: Split casting, cast brass with chrome-plated finish.
 - b. Insulated Piping: Split plate, stamped steel with concealed or exposed-rivet hinge and spring clips.
 - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split casting, cast brass with chrome-plated finish **OR** plate, stamped steel with concealed hinge and spring clips, **as directed**.
 - d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split casting, cast brass with chrome-plated finish **OR** plate, stamped steel with concealed hinge and set-screw, **as directed**.
 - e. Bare Piping in Unfinished Service Spaces: Split casting, cast brass with polished chrome-plated finish **OR** casting, cast brass with rough-brass finish **OR** plate, stamped steel with concealed hinge and set-screw or spring clips **OR** plate, stamped steel with concealed or exposed-rivet hinge and set-screw or spring clips **OR** plate, stamped steel with exposed-rivet hinge and set-screw or spring clips, **as directed**.
 - f. Bare Piping in Equipment Rooms: Split casting, cast brass **OR** plate, stamped steel with set-screw or spring clips, **as directed**.
 - g. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting floor plate.



J. Sleeve Installation

1. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, roofs, and walls.
2. Sleeves are not required for core-drilled holes.
3. Permanent sleeves are not required for holes formed by removable PE sleeves.
4. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.
5. Install sleeves in new partitions, slabs, and walls as they are built.
6. For interior wall penetrations, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 07 Section "Joint Sealants".
7. For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 07 Section "Joint Sealants".
8. For exterior wall penetrations below grade, seal annular space between sleeve and pipe using sleeve seals.
9. Seal space outside of sleeves in concrete slabs and walls with grout.
10. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe unless otherwise indicated.
11. Install sleeve materials according to the following applications:
 - a. Sleeves for Piping Passing through Concrete Floor Slabs: Molded PE **OR** Molded PVC **OR** Galvanized-steel pipe, **as directed**.
 - b. Sleeves for Piping Passing through Concrete Floor Slabs of Mechanical Equipment Areas or Other Wet Areas: Galvanized-steel pipe **OR** Stack sleeve fittings, **as directed**.
 - 1) Extend sleeves 2 inches (50 mm) above finished floor level.
 - 2) For pipes penetrating floors with membrane waterproofing, extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Comply with requirements for flashing in Division 07 Section "Sheet Metal Flashing And Trim".
 - c. Sleeves for Piping Passing through Gypsum-Board Partitions:
 - 1) PVC-pipe **OR** Galvanized-steel-pipe, **as directed**, sleeves for pipes smaller than NPS 6 (DN 150).
 - 2) Galvanized-steel-sheet sleeves for pipes NPS 6 (DN 150) and larger.
 - 3) Exception: Sleeves are not required for water-supply tubes and waste pipes for individual plumbing fixtures if escutcheons will cover openings.
 - d. Sleeves for Piping Passing through Concrete Roof Slabs: Molded PE **OR** Molded PVC **OR** Galvanized-steel pipe, **as directed**.
 - e. Sleeves for Piping Passing through Exterior Concrete Walls:
 - 1) Galvanized-steel-pipe sleeves for pipes smaller than NPS 6 (DN 150).
 - 2) Cast-iron wall pipe sleeves for pipes NPS 6 (DN 150) and larger.
 - 3) Install sleeves that are large enough to provide 1-inch (25-mm) annular clear space between sleeve and pipe when sleeve seals are used.
 - f. Sleeves for Piping Passing through Interior Concrete Walls:
 - 1) PVC-pipe **OR** Galvanized-steel pipe, **as directed**, sleeves for pipes smaller than NPS 6 (DN 150).
 - 2) Galvanized-steel-sheet sleeves for pipes NPS 6 (DN 150) and larger.
12. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestop materials and installations.

K. Sleeve Seal Installation

1. Install sleeve seals in sleeves in exterior concrete walls at water-service piping entries into building.
2. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe



and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

- L. Identification
1. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.
 2. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification For Electrical Systems".
- M. Field Quality Control
1. Perform tests and inspections.
 2. Tests and Inspections:
 - a. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
 - b. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - c. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
 - d. Energize circuits to electrical equipment and devices.
 - e. Start and run air compressors.
 - f. Coordinate with fire-alarm tests. Operate as required.
 - g. Coordinate with fire-pump tests. Operate as required.
 - h. Verify that equipment hose threads are same as local fire-department equipment.
 3. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
 4. Prepare test and inspection reports.
- N. Cleaning
1. Clean dirt and debris from sprinklers.
 2. Remove and replace sprinklers with paint other than factory finish.
- O. Demonstration
1. Train the Owner's maintenance personnel to adjust, operate, and maintain specialty valves.
- P. Piping Schedule
1. Piping between Fire-Department Connections and Check Valves: Galvanized, standard-weight steel pipe with threaded ends; cast-iron threaded fittings; and threaded **OR** grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved, **as directed**, joints.
 2. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.
 3. Copper-tube, extruded-tee connections may be used for tee branches in copper tubing instead of specified copper fittings. Branch-connection joints must be brazed.
 4. Standard-pressure, dry-pipe sprinkler system, NPS 2 (DN 50) and smaller, shall be one of the following:
 - a. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
 - b. Standard-weight **OR** Schedule 30 **OR** thinwall, **as directed**, galvanized-steel pipe with plain ends; plain-end-pipe fittings; and twist-locked joints.
 - c. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - d. Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube with plain ends; cast-or wrought-copper solder-joint fittings; and brazed joints.
 - e. Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube with plain ends; copper pressure-seal fittings; and pressure-sealed joints.
 - f. NPS 2 (DN 50), Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube with roll-grooved ends; copper, grooved-end fittings; grooved-end-tube couplings; and grooved joints.



5. Standard-pressure, dry-pipe sprinkler system, NPS 2-1/2 to NPS 4 (DN 65 to DN 100), shall be one of the following:
 - a. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
 - b. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - c. Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube with plain ends; cast-or wrought-copper solder-joint fittings; and brazed joints.
 - d. Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube with plain ends; copper pressure-seal fittings; and pressure-sealed joints.
 - e. Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube with roll-grooved ends; copper, grooved-end fittings; grooved-end-tube couplings; and grooved joints.
6. Standard-pressure, dry-pipe sprinkler system, NPS 5 and NPS 6 (DN 125 and DN 150), shall be one of the following:
 - a. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
 - b. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - c. Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube with plain ends; cast-or wrought-copper solder-joint fittings; and brazed joints.
 - d. Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube with roll-grooved ends; copper, grooved-end fittings; grooved-end-tube couplings; and grooved joints.

Q. Sprinkler Schedule

1. Use sprinkler types in subparagraphs below for the following applications:
 - a. Rooms without Ceilings: Upright sprinklers.
 - b. Rooms with Suspended Ceilings: Dry pendent sprinklers **OR** Dry recessed sprinklers **OR** Dry flush sprinklers **OR** Dry concealed sprinklers, **as directed**.
 - c. Wall Mounting: Dry sidewall sprinklers.
 - d. Spaces Subject to Freezing: Upright sprinklers **OR** Dry pendent sprinklers **OR** Dry sidewall sprinklers, **as directed**.
 - e. Special Applications: Extended-coverage and quick-response sprinklers where indicated.
2. Provide sprinkler types in subparagraphs below with finishes indicated.
 - a. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
 - b. Flush Sprinklers: Bright chrome, with painted white escutcheon.
 - c. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
 - d. Upright, Pendent, and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

END OF SECTION 21 13 16 00



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SECTION 21 13 39 00 - FOAM FIRE EXTINGUISHING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for foam fire extinguishing. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes fixed, low-expansion, AFFF fire-extinguishing systems and the following:
 - a. Concentrate piping and piping specialties.
 - b. Proportioning tanks and proportioning devices.
 - c. Foam concentrate.
 - d. Discharge devices.
 - e. Monitoring and alarm devices.

C. Definitions

1. AFFF: Aqueous film-forming foam.
2. AR-AFFF: Alcohol-resistant aqueous film-forming foam.
3. ATS: Acceptance Testing Specifications.

D. System Description

1. Description: Engineered, fixed, wet-pipe **OR** dry-pipe, **OR** preaction, **OR** deluge, **as directed**, automatically actuated, low-expansion, AFFF **OR** AR-AFFF, **as directed**, fire-extinguishing system for flammable-liquid fires. System includes diaphragm proportioning tanks and devices as described in NFPA 16.

E. Performance Requirements

1. Standard Piping System Component Working Pressure: Listed for at least 175 psig (1200 kPa).
2. Minimum design parameters to be used with the approval of authorities having jurisdiction are as follows:
 - a. Solution: 3 percent foam-water solution.
 - b. Sprinkler Spacing: Maximum of 100 sq. ft. (9.5 sq. m) per sprinkler, and maximum 12-foot (3.7-m) spacing.
 - c. Design Density: Minimum 0.16 gpm/sq. ft. (0.108 L/s per sq. m).
 - d. Foam Supply: Minimum 10-minute discharge time.
 - e. Water Supply: Minimum 60 minutes.
 - f. Remote Area: Minimum 5000-sq. ft. (476-sq. m) design area for closed-sprinkler systems. Open-sprinkler systems shall discharge over the entire system area.
 - g. Sprinkler Temperature Rating: Maximum 250 to 300 deg F (121 to 149 deg C) at a roof or ceiling, and 135 to 170 deg F (57 to 77 deg C) for intermediate sprinklers.
3. Seismic Performance: Fire-suppression piping shall be capable of withstanding the effects of earthquake motions determined according to NFPA 13.

F. Submittals

1. Product Data: For the following:
 - a. Piping and equipment seismic restraints.
 - b. Valves.
 - c. Proportioning tanks and proportioning devices.
 - d. Foam concentrate.
 - e. Discharge devices. Include flow characteristics.
 - f. Monitoring and alarm devices. Include electrical data.



2. Shop Drawings: Signed and sealed by a qualified professional engineer. Include the following for each hazard area, drawn to scale:
 - a. Include plans, elevations, sections, details, and attachments to other work. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - b. Wiring Diagrams: Power, signal, and control wiring.
 - c. Design Calculations: For amount of foam concentrate required for each hazard area.
 - d. Plans: Show the following:
 - 1) Foam-solution proportioning tanks and devices, piping, discharge devices, monitoring and alarm devices, and accessories.
 - 2) Method of attaching hangers to building structure.
 - 3) Fire alarm panel.
 - 4) Equipment and furnishings.
3. Permit-Approved Drawings: Working plans, prepared according to NFPA 16, that have been approved by authorities having jurisdiction. Include design calculations.
4. Welding certificates.
5. Field quality-control test reports.
6. Operation and Maintenance Data: For foam fire extinguishing to include in emergency, operation, and maintenance manuals.

G. Quality Assurance

1. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
3. FMG Compliance: Provide components that are FMG approved and that are listed in FMG's "Fire Protection Approval Guide."
4. UL Compliance: Provide equipment listed in UL's "Fire Protection Equipment Directory."

1.2 PRODUCTS

A. Pipe And Fittings

1. Steel Pipe: ASTM A 53/A 53M, ASTM A 135, ASTM A 106, or ASTM A 795, Type E or S, Grade A or B, Schedule 40, with factory- or field-formed threaded ends.
 - a. Cast-Iron Threaded Flanges: ASME B16.1.
 - b. Malleable-Iron Threaded Fittings: ASME B16.3.
 - c. Gray-Iron Threaded Fittings: ASME B16.4.
 - d. Butt-Weld Fittings: ASTM A 234/A 234M, Grade WPB, Schedule 40, carbon-steel butt-weld fittings.
 - e. Steel Threaded Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, seamless steel pipe. Include ends matching joining method.
 - f. Steel Threaded Couplings: ASTM A 865.
2. Stainless Steel: ASTM A 312/A 312M, Schedule 40, with factory-formed threaded or beveled ends; ASTM A 376/A 376M for seamless pipe; or ASTM A 213/A 213M, ASTM A 249/A 249M, and ASTM A 269 for seamless and welded tubing.
 - a. Class 150 Threaded Fittings: ASME B16.3 and MSS SP 114.
 - b. Butt-Weld Fittings: ASTM A 403/A 403M.
 - c. Flanges, Forged Fittings and Flanges, and Socket-Weld Fittings: ASTM A 182/A 182M.
 - d. Bar Stock and Compression Fittings: ASTM A 276 and ASTM A 479/A 479M.
3. Red Brass Pipe: ASTM B 43, Schedule 40, with factory- or field-formed threaded ends.
 - a. Threaded Flanges and Fittings: ASTM B 584.
4. Refer to Division 21 Section "Common Work Results For Fire Suppression" for basic joining materials.



- B. Valves
1. Ball Valves: Bronze body with threaded or flanged ends. Comply with UL 1091, except with stainless-steel ball instead of disc.
- C. Specialties
1. Concentrate Storage Tank: Buna-N, bladder-type proportioning tank complying with UL 162 and ASME Boiler and Pressure Vessel Code: Section VIII. Include bladder, internal piping, fill and drain, pipe assembly, glass sight gage, piping, and valves. Concentrate to be contained in the bladder.
 - a. Orientation: Horizontal design with saddle **OR** Vertical design with skirt, **as directed**, support.
 2. Proportioning Controller: Venturi type complying with UL 162 and of capacity to match design at minimum and maximum flow.
 3. Concentrate Control Valve: Water-operated ball or deluge valve designed to open with flow through the proportioning controller.
 4. Concentrate Strainers: Bronze body and stainless-steel mesh strainer with minimum 0.125-inch (3.2-mm) perforations to remove solids that would block system components.
 5. Provide devices that comply with NFPA 16, are compatible with the foam concentrate, and are designed to be drained and cleaned.
- D. Foam Concentrate
1. Description: AFFF **OR** AR-AFFF, **as directed**, liquid concentrate, complying with NFPA 11 and UL 162, for making foam-water fire-extinguishing foam solution.
- E. Pressure Gages
1. Description: Comply with UL 393, with 3-1/2-inch- (90-mm-) minimum diameter dial, 0- to 300-psig (0- to 2070-kPa) dial range, and caption "WATER" or "CONCENTRATE" on dial face.
- F. Discharge Devices
1. General: Discharge devices shall be listed and approved by UL and FMG.
 2. Sprinklers: Closed **OR** Open, **as directed**, air-aspirating **OR** non-air-aspirating, **as directed**, type complying with UL 162 and suitable for discharging foam.
 3. Spray Nozzles: Foam-water spray nozzles including foam generator and distributing deflector complying with UL 162 and designed to distribute foam or water in the absence of foam solution in a special pattern peculiar to a particular head.
- G. Monitoring Devices
1. Valve Supervisory Switches: UL 753, electrical, single pole, double throw, with normally closed contacts. Include design that signals controlled valve is in other than fully open position.
- H. Alarm Devices
1. Description: UL listed or FMG approved, low voltage, and surface mounting. Alarm and monitoring devices are specified in Division 28 Section(s) "Digital, Addressable Fire-alarm System" OR "Zoned (dc Loop) Fire-alarm System".

1.3 EXECUTION

- A. Concentrate Storage Tank Installation
1. Install proportioning tanks on concrete bases. Concrete bases are specified in Division 21 Section "Common Work Results For Fire Suppression".
 2. Install tanks level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
 3. Install seismic restraints for tanks. Anchor tanks to substrate.



- B. Piping Applications
1. Flanged pipe and fittings and flanged joints may be used to connect to specialties and accessories and where required for maintenance.
 2. AFFF-Concentrate Piping: Steel pipe, malleable- or cast-iron threaded fittings, and threaded joints.
 3. AFFF-Concentrate Piping: Steel pipe with welded fittings and joints.
 4. AR-AFFF-Concentrate Piping: Brass **OR** Stainless-steel, **as directed**, pipe, threaded fittings, and joints.
 5. AR-AFFF-Concentrate Piping: Stainless-steel pipe with welded fittings and joints.
 6. Foam-solution piping is specified in Division 21 Section "Wet-pipe Sprinkler Systems".
- C. Piping Installation
1. Install piping and other components level and plumb.
 2. Refer to Division 21 Section "Common Work Results For Fire Suppression" for basic pipe installation and joint construction.
 3. Install proportioning tanks anchored to substrate.
 4. Install pipe and fittings, valves, and discharge devices according to requirements listed in NFPA 16, "Installation of Deluge Foam-Water Sprinkler and Foam-Water Spray Systems."
 - a. Support piping using supports and methods according to NFPA 13.
 - b. Install seismic restraints for proportioning tanks and piping systems.
 - c. Install monitoring and alarm devices according to NFPA 16 and NFPA 72.
- D. Connections
1. Piping installation requirements are specified in Division 21 Section "Wet-pipe Sprinkler Systems". Drawings indicate general arrangement of piping, fittings, and specialties.
 2. Provide concentrate control, maintenance service, and drain valves with piping to permit maintenance of the foam concentrate with continuous sprinkler system service.
 3. Install proportioning controller in fire-suppression piping to provide coverage to area indicated on Drawings.
 4. Install piping adjacent to equipment to allow service and maintenance.
 5. Connect electrical devices to building's fire alarm system. Electrical power, wiring, and devices are specified in Division 28 Section(s) "Digital, Addressable Fire-alarm System" OR "Zoned (dc Loop) Fire-alarm System".
- E. Labeling
1. Install labeling on piping, equipment, and panels according to Division 22 Section "Identification For Plumbing Piping And Equipment".
- F. Charging System
1. Fill proportioning tanks with foam concentrate after field quality-control testing is complete and satisfactory results have been achieved.
- G. Field Quality Control
1. Inspection: Engage the services of a qualified professional engineer to inspect installed fire-extinguishing systems, prepare installation report, and certify that installation complies with the Contract Documents, calculations, and requirements of authorities having jurisdiction.
 2. Comply with operating instructions and procedures in NFPA 16, "Acceptance Tests" Chapter. Include the following tests and inspections to demonstrate compliance with requirements:
 - a. Check mechanical items.
 - b. Inspect equipment and fire-extinguishing foam concentrate, and check mountings for adequate anchoring to substrate.
 - c. Check electrical systems.
 - d. Flush piping.
 - e. Perform acceptance test.
 - f. Perform pressure test.



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SECTION 21 16 00 00 - PRESSURE-MAINTENANCE PUMPS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for pressure-maintenance pumps. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Multistage, pressure-maintenance pumps.
 - b. Regenerative-turbine, pressure-maintenance pumps.
 - c. Submersible, pressure-maintenance pumps.
 - d. Vertical-turbine, pressure-maintenance pumps.

C. Performance Requirements

1. Pump Equipment, Accessory, and Specialty Pressure Rating: 175 psig (1200 kPa) minimum unless higher pressure rating is indicated.

D. Submittals

1. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, performance curves, electrical characteristics, and furnished specialties and accessories.
2. Shop Drawings: For pumps, accessories, and specialties. Include plans, elevations, sections, details, and attachments to other work.
 - a. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - b. Wiring Diagrams: For power, signal, and control wiring.
3. Field quality-control reports.
4. Operation and maintenance data.

E. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.2 PRODUCTS

A. Multistage, Pressure-Maintenance Pumps

1. Description: Factory-assembled and -tested, multistage, barrel-type vertical pump as defined in HI 2.1-2.2 and HI 2.3; designed for surface installation with pump and motor direct coupled and mounted vertically.
2. Pump Construction:
 - a. Barrel: Stainless steel.
 - b. Suction and Discharge Chamber: Cast iron with flanged inlet and outlet.
 - c. Pump Head/Motor Mount: Cast iron.
 - d. Impellers: Stainless steel, balanced, and keyed to shaft.
 - e. Pump Shaft: Stainless steel.
 - f. Seal: Mechanical type with carbon rotating face and silicon-carbide stationary seat.
 - g. Intermediate Chamber Bearings: Aluminum-oxide ceramic or bronze.
 - h. Chamber-Base Bearing: Tungsten carbide.
 - i. O-Rings: EPDM or NBR.



3. Motor: Single speed with permanently lubricated ball bearings and rigidly mounted to pump head. Comply with requirements in Division 15 Section "Common Motor Requirements for Fire Suppression Equipment."
 - a. Power Cord: Factory-connected to motor for field connection to controller and at least 10 feet (3 m) long.
 4. Nameplate: Permanently attached to pump and indicating capacity and characteristics.
- B. Regenerative-Turbine, Pressure-Maintenance Pumps
1. Description: Factory-assembled and -tested, close-coupled, single-stage, regenerative-turbine centrifugal pump as defined in HI 1.1-1.2 and HI 1.3; with pump and motor mounted horizontally.
 2. Pump Construction:
 - a. Casing: Radially split, cast iron, with threaded inlet and outlet.
 - b. Impeller: Bronze, balanced, and keyed to shaft.
 - c. Pump Shaft: Stainless steel **OR** steel, **as directed**, with deflector.
 - d. Shaft Sleeve: Bronze.
 - e. Seal: Mechanical type with spring-loaded rotating head.
 3. Motor: Single speed with permanently lubricated ball bearings. Comply with requirements in Division 15 Section "Common Motor Requirements for Fire Suppression Equipment."
 - a. Power Cord: Factory-connected to motor for field connection to controller and at least 10 feet (3 m) long.
 4. Nameplate: Permanently attached to pump and indicating capacity and characteristics.
- C. Submersible, Pressure-Maintenance Pumps
1. Description: Factory-assembled and -tested, vertical, multistage, submersible pump as defined in HI 2.1-2.2 and HI 2.3; with pump motor mounted below pump.
 2. Pump Construction:
 - a. Pump Head or Elbow: Cast iron, for surface discharge, with flanged or threaded connections.
 - b. Pump Shaft: Stainless steel.
 - c. Bearings: Bronze.
 - d. Bowl Section: Multiple cast-iron bowls with closed-type bronze or stainless-steel impellers.
 - e. Column Pipe: ASTM A 53/A 53M, Schedule 40, galvanized-steel pipe with threaded ends and cast-iron or steel fittings, in sections 10 feet (3 m) or less, with strainer of cast or fabricated bronze or stainless steel between pump and bowl section.
 3. Motor: Single speed with permanently lubricated ball bearings and capable of continuous operation under water. Comply with requirements in Division 15 Section "Common Motor Requirements for Fire Suppression Equipment."
 - a. Power Cord: Capable of continuous under-water operation, factory-connected to motor for field connection to controller, and at least 10 feet (3 m) long.
 4. Base: Cast iron or steel with hole for electrical cable.
 5. Nameplate: Permanently attached to pump and indicating capacity and characteristics.
- D. Vertical-Turbine, Pressure-Maintenance Pumps
1. Description: Factory-assembled and -tested, vertical, multistage, open-line-shaft turbine pump as defined in HI 2.1-2.2 and HI 2.3; with pump motor mounted above pump head.
 2. Pump Construction:
 - a. Pump Head: Cast iron, for surface discharge, with flange except connections may be threaded in sizes in which flanges are not available.
 - b. Pump Head Seal: Stuffing box and stuffing.
 - c. For static water levels of 50 feet (15 m) or less and for water-lubricated bearings.
 - 1) Line Shaft: Stainless steel or steel, with corrosion-resistant shaft sleeves.
 - 2) Line Shaft Bearings: Rubber sleeve, water lubricated.
 - d. For static water levels between 50 and 200 feet (15 and 61 m) and for oil-lubricated bearings.
 - 1) Line Shaft: Steel.



- 2) Line Shaft Bearings: Corrosion resistant, oil lubricated.
 - e. Impeller Shaft: Monel metal or stainless steel.
 - f. Bowl Section: Multiple cast-iron bowls with closed-type bronze or stainless-steel impellers.
 - g. Column Pipe: ASTM A 53/A 53M, Schedule 40, galvanized-steel pipe with threaded ends and cast-iron or steel fittings, in sections 10 feet (3 m) or less, with strainer of cast or fabricated bronze or stainless steel at bottom.
 3. Motor: Single speed with permanently lubricated ball bearings. Comply with requirements in Division 15 Section "Common Motor Requirements for Fire Suppression Equipment."
 - a. Power Cord: Factory-connected to motor for field connection to controller and at least 10 feet (3 m) long.
 4. Base: Cast iron or steel with hole for electrical cable.
 5. Nameplate: Permanently attached to pump and indicating capacity and characteristics.
- E. Motors
1. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 15 Section "Common Motor Requirements for Fire Suppression Equipment."
 - a. Motor Sizes: Minimum size as indicated; if not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - b. Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 16 Sections.

1.3 EXECUTION

- A. Equipment Installation
1. NFPA Standard: Comply with NFPA 20 for installation of pressure-maintenance pumps.
 2. Base-Mounted Pump Mounting: Install pumps on concrete bases. Comply with requirements for concrete bases specified in Division 3 Section "Cast-in-Place Concrete."
 - a. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - b. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - d. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - e. Attach pumps to equipment base using anchor bolts.
 3. Install multistage and regenerative-turbine, pressure-maintenance pumps according to HI 1.4.
 4. Install submersible and vertical-turbine, pressure-maintenance pumps according to HI 2.4.
- B. Field Quality Control
1. Perform tests and inspections.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
 2. Tests and Inspections:
 - a. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - b. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 3. Pressure-maintenance pumps will be considered defective if they do not pass tests and inspections.
 4. Prepare test and inspection reports.
- C. Adjusting
1. Lubricate pumps as recommended by manufacturer.

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2. Set field-adjustable pressure-switch ranges as indicated.

END OF SECTION 21 16 00 00



SECTION 21 16 00 00a - CONTROLLERS FOR FIRE-PUMP DRIVERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for controllers for fire-pump drivers. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Full-service, full-voltage **OR** reduced-voltage, **as directed**, controllers rated 600 V and less.
 - b. Limited-service controllers rated 600 V and less.
 - c. Controllers for diesel-drive fire pumps.
 - d. Remote alarm panels.
 - e. Low-suction-shutdown panels.

C. Definitions

1. ATS: Automatic transfer switch(es).
2. ECM: Electronic control module.
3. MCCB: Molded-case circuit breaker.
4. N.O.: Normally open.

D. Performance Requirements

1. Seismic Performance: Fire-pump controllers and alarm panels shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

E. Submittals

1. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Shop Drawings: For each type of product indicated. Include dimensioned plans, elevations, sections, details, and attachments to other work, including required clearances and service spaces around controller enclosures.
 - a. Show tabulations of the following:
 - 1) Each installed unit's type and details.
 - 2) Enclosure types and details for types other than NEMA 250, Type 2.
 - 3) Factory-installed devices.
 - 4) Nameplate legends.
 - 5) Short-circuit current (withstand) rating of integrated unit.
 - 6) Features, characteristics, ratings, and factory settings of individual overcurrent protective devices.
 - 7) Specified modifications.
 - b. Detail equipment assemblies and indicate dimensions, weights, loads, method of field assembly, components, and location and size of each field connection.
 - c. Schematic and Connection Diagrams: For power, signal, alarm, and control wiring and for pressure-sensing tubing.
3. Qualification Data: For qualified testing agency.
4. Seismic Qualification Certificates: For each type of product indicated, from manufacturer.



- a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
5. Product Certificates: For each type of product indicated, from manufacturer.
 6. Manufacturer's factory test reports of fully assembled and tested equipment.
 7. Source quality-control reports.
 8. Field quality-control reports.
 9. Operation and Maintenance Data: For each type of product indicated to include in emergency, operation, and maintenance manuals. Include the following:
 - a. Manufacturer's written instructions for setting field-adjustable timers, controls, and status and alarm points.
 - b. Manufacturer's written instructions for testing, adjusting, and reprogramming microprocessor-based logic controls.
- F. Quality Assurance
1. Testing Agency Qualifications: Member company of an NRTL.
 2. Source Limitations: Obtain fire-pump controllers and all associated equipment from single source or producer.
 3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 4. Comply with standards of authorities having jurisdiction pertaining to materials and installation.
 5. Comply with NFPA 20 and NFPA 70.
 6. IEEE Compliance: Fabricate and test enclosed controllers according to IEEE 344 to withstand seismic forces defined in Division 16 Section "Vibration and Seismic Controls for Electrical Systems."
- G. Delivery, Storage, And Handling
1. Store controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect enclosed controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.
 2. If stored in areas subject to weather, protect controllers from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside controllers; install temporary electric heating, with at least 250 W per controller **OR** connect factory-installed space heaters to temporary electrical service, **as directed**.
- H. Project Conditions
1. Environmental Limitations:
 - a. Ambient Temperature Rating: Not less than 40 deg F (5 deg C) and not exceeding 122 deg F (50 deg C) unless otherwise indicated.
 - b. Altitude Rating: Not exceeding 6600 feet (2010 m) unless otherwise indicated.
 2. Interruption of Existing Electric Service: Notify the Owner no fewer than seven days in advance of proposed interruption of electric service, and comply with NFPA 70E.
- I. Coordination
1. Coordinate layout and installation of controllers with other construction including conduit, piping, fire-pump equipment, and adjacent surfaces. Maintain required clearances for workspace and equipment access doors and panels. Ensure that controllers are within sight of fire-pump drivers.
 2. Coordinate sizes and locations of concrete bases with actual equipment provided.



1.2 PRODUCTS

A. Full-Service Controllers

1. General Requirements for Full-Service Controllers:
 - a. Comply with NFPA 20 and UL 218.
 - b. Listed by an NRTL for electric-motor driver for fire-pump service.
 - c. Combined automatic and nonautomatic **OR** Nonautomatic, **as directed**, operation.
 - d. Factory assembled, wired, and tested; continuous-duty rated.
 - e. Service Equipment Label: NRTL labeled for use as service equipment.
2. Method of Starting:
 - a. Pressure **OR** Nonpressure, **as directed**, -switch actuated.
 - 1) Water-pressure-actuated switch and pressure transducer with independent high- and low-calibrated adjustments responsive to water pressure in fire-suppression piping.
 - 2) System pressure recorder, electric ac driven, with spring backup.
 - 3) Programmable minimum-run-time relay to prevent short cycling.
 - 4) Programmable timer for weekly tests.
 - b. Magnetic Controller: Across-the-line **OR** Autotransformer **OR** Part-winding **OR** Primary-resistor **OR** Wye-delta (open transition) **OR** Wye-delta (closed transition), **as directed**, type.
OR
Solid-State Controller: Reduced-voltage type.
 - c. Emergency Start: Mechanically operated start handle that closes and retains the motor RUN contactor independent of all electric or pressure actuators.
3. Method of Stopping: Automatic and nonautomatic shutdown after automatic starting **OR** Nonautomatic, **as directed**.
4. Capacity: Rated for fire-pump-driver horsepower and short-circuit-current (withstand) rating equal to or greater than short-circuit current available at controller location.
5. Method of Isolation and Overcurrent Protection: Interlocked isolating switch and nonthermal MCCB; with a common, externally mounted operating handle, and providing locked-rotor protection.
6. Door-Mounted Operator Interface and Controls:
 - a. Monitor, display, and control the devices, alarms, functions, and operations listed in NFPA 20 as required for drivers and controller types used.
 - b. Method of Control and Indication:
 - 1) Microprocessor-based logic controller, with multiline digital readout.
 - 2) Membrane keypad.
 - 3) LED alarm and status indicating lights.
 - c. Local and Remote, **as directed**, Alarm and Status Indications:
 - 1) Controller power on.
 - 2) Motor running condition.
 - 3) Loss-of-line power.
 - 4) Line-power phase reversal.
 - 5) Line-power single-phase condition.
 - d. Audible alarm, with silence push button.
 - e. Nonautomatic START and STOP push buttons or switches.
7. Optional Features:
 - a. Extra Output Contacts:
 - 1) One N.O. contact(s) for motor running condition.
 - 2) One set(s) of contacts for loss-of-line power.
 - 3) One each, Form C contacts for high and low reservoir level.
 - b. Local alarm bell.
 - c. Door-mounted thermal or impact printer for alarm and status logs.
 - d. Operator Interface Communications Ports: USB, Ethernet, and RS485.
8. ATS:
 - a. Complies with NFPA 20, UL 218, and UL 1008.



- b. Integral with controller as a listed combination fire-pump controller and power transfer switch.
- c. Automatically transfers fire-pump controller from normal power supply to alternate power supply in event of power failure.
- d. Allows manual transfer from one source to the other.
- e. Alternate-Source Isolating and Disconnecting Means: Integral molded-case switch, with an externally mounted operating handle.
OR
Alternate-Source Isolating and Disconnecting Means: Mechanically interlocked isolation switch and circuit breaker rated at a minimum of 115 percent of rated motor full-load current, with an externally mounted operating handle; circuit breaker shall be provided with nonthermal sensing, instantaneous-only short-circuit overcurrent protection to comply with available fault currents.
- f. Local and Remote, **as directed**, Alarm and Status Indications:
 - 1) Normal source available.
 - 2) Alternate source available.
 - 3) In normal position.
 - 4) In alternate position.
 - 5) Isolating means open.
- g. Audible alarm, with silence push button.
- h. Nonautomatic (manual, nonelectric) means of transfer.
- i. Engine test push button.
- j. Start generator output contacts.
- k. Timer for weekly generator tests.

B. Limited-Service Controllers

1. General Requirements for Limited-Service Controllers:
 - a. Comply with NFPA 20 and UL 218.
 - b. Listed by an NRTL for electric-motor driver for fire-pump service.
 - c. Combined automatic and nonautomatic **OR** Nonautomatic, **as directed**, operation.
 - d. Factory assembled, wired, and tested; continuous-duty rated.
 - e. Service Equipment Label: NRTL labeled for use as service equipment.
2. Method of Starting:
 - a. Pressure **OR** Nonpressure, **as directed**, -switch actuated.
 - 1) Water-pressure-actuated switch and pressure transducer with independent high- and low-calibrated adjustments responsive to water pressure in fire-suppression piping.
 - 2) System pressure recorder, electric ac driven, with spring backup.
 - 3) Programmable minimum-run-time relay to prevent short cycling.
 - 4) Programmable timer for weekly tests.
 - b. Across-the-line magnetic controller.
 - c. Emergency Start: Mechanically operated start handle that closes and retains the motor RUN contactor independent of all electric or pressure actuators.
3. Method of Stopping: Automatic and nonautomatic shutdown after automatic starting **OR** Nonautomatic, **as directed**.
4. Capacity: Rated for fire-pump-driver horsepower and short-circuit-current (withstand) rating equal to or greater than short-circuit current available at controller location.
5. Method of Isolation and Overcurrent Protection: Inverse-time, nonadjustable MCCB, with an externally mounted operating handle.
6. Door-Mounted Operator Interface and Controls:
 - a. Monitor, display, and control the devices, alarms, functions, and operations listed in NFPA 20 as required for drivers and controller types used.
 - b. Method of Control and Indication:
 - 1) Microprocessor-based logic controller, with multiline LCD digital readout.
 - 2) Membrane keypad.



- 3) LED alarm and status indicating lights.
 - c. Local and Remote, **as directed** Alarm and Status Indications:
 - 1) Controller power on.
 - 2) Motor running condition.
 - 3) Loss-of-line power.
 - 4) Line-power phase reversal.
 - 5) Line-power single-phase condition.
 - d. Audible alarm, with silence push button.
 - e. Nonautomatic START and STOP push buttons.
7. Optional Features:
- a. Extra Output Contacts:
 - 1) One N.O. contact(s) for motor running condition.
 - 2) One set(s) of contacts for loss-of-line power.
 - 3) One each, Form C contacts for high and low reservoir level.
 - b. Local alarm bell.
 - c. Door-mounted thermal or impact printer for alarm and status logs.
 - d. Operator Interface Communications Ports: USB, Ethernet, and RS485.
8. ATS:
- a. Complies with NFPA 20, UL 218, and UL 1008.
 - b. Integral with controller as a listed combination fire-pump controller and power transfer switch.
 - c. Automatically transfers fire-pump controller from normal power supply to alternate power supply in event of power failure.
 - d. Allows manual transfer from one source to the other.
 - e. Alternate-Source Isolating and Disconnecting Means: Integral molded-case switch, with an externally mounted operating handle.
OR
Alternate-Source Isolating and Disconnecting Means: Mechanically interlocked isolation switch and circuit breaker rated at a minimum of 115 percent of rated motor full-load current, with an externally mounted operating handle; circuit breaker shall be provided with nonthermal sensing, instantaneous-only short-circuit overcurrent protection to comply with available fault currents.
 - f. Local and Remote, **as directed**, Alarm and Status Indications:
 - 1) Normal source available.
 - 2) Alternate source available.
 - 3) In normal position.
 - 4) In alternate position.
 - 5) Isolating means open.
 - g. Audible alarm, with silence push button.
 - h. Nonautomatic (manual, nonelectric) means of transfer.
 - i. Engine test push button.
 - j. Start generator output contacts.
 - k. Timer for weekly generator tests.
- C. Standalone ATS
- 1. General Requirements for Standalone ATS:
 - a. Complies with NFPA 20, UL 218, and UL 1008.
 - b. Listed by an NRTL for fire-pump service.
 - c. Automatic and nonautomatic operation.
 - d. Separate from controller and individually listed as a fire-pump-controller power transfer switch.
 - e. Automatically transfers fire-pump controller from normal power supply to alternate power supply in event of power failure.
 - f. Allows manual transfer from one source to the other; factory assembled, wired, and tested.
 - 2. Capacity: Rated for fire-pump-driver horsepower and short-circuit-current (withstand) rating equal to or greater than short-circuit current available at ATS location.



3. Alternate-Source Isolating and Disconnecting Means: Integral molded-case switch, with an externally mounted operating handle.
 4. Alternate-Source Isolating and Disconnecting Means:
 - a. Mechanically interlocked isolation switch and circuit breaker rated at a minimum of 115 percent of rated motor full-load current.
 - b. Externally mounted operating handle.
 - c. Circuit breaker provided with nonthermal sensing, instantaneous-only, short-circuit overcurrent protection.
 - d. Equipped with a voltage surge arrester.
 5. Door-Mounted Operator Interface and Controls:
 - a. Monitor, display, and control devices, alarms, functions, and operations listed in NFPA 20 as required for drivers and controller types used.
 - b. Method of Control and Indication:
 - 1) Microprocessor-based logic controller, with multiline LCD readout.
 - 2) Membrane keypad.
 - 3) LED alarm and status indicating lights.
 - c. Local and Remote, **as directed**, Alarm and Status Indications:
 - 1) Normal source available.
 - 2) Alternate source available.
 - 3) In normal position.
 - 4) In alternate position.
 - 5) Isolating means open.
 - d. Audible alarm, with silence push button.
 - e. Nonautomatic (manual, nonelectric) means of transfer.
 - f. Engine test push button.
 - g. Start generator output contacts.
 - h. Timer for weekly generator tests
 6. Optional Features:
 - a. Extra Output Contacts:
 - 1) One each, Form A; isolating means open.
 - 2) One each, Form C; in normal or alternate position
 - b. Door-mounted thermal or impact printer for alarm and status logs.
 - c. Operator Interface Communications Ports: USB, Ethernet, and RS485.
- D. Controllers For Diesel-Drive Fire Pumps
1. General Requirements for Controllers:
 - a. Comply with NFPA 20 and UL 218.
 - b. Listed by an NRTL for diesel-engine driver for fire-pump service.
 - c. Combined automatic and nonautomatic **OR** Nonautomatic, **as directed** operation.
 - d. Factory assembled, wired, and tested.
 2. Method of Starting:
 - a. Pressure **OR** Nonpressure, **as directed**, -switch actuated.
 - 1) Water-pressure-actuated switch and pressure transducer with independent high- and low-calibrated adjustments responsive to water pressure in fire-suppression piping.
 - 2) System pressure recorder, electric ac driven, with spring backup.
 - 3) Programmable minimum-run-time relay to prevent short cycling.
 - 4) Programmable timer for weekly tests.
 - b. Dual, redundant dc-voltage battery units, with automatic changeover.
 - c. Emergency Control: Bypasses all automatic control circuits during manual starting and running.
 - d. Automatic engine start on loss of ac power to the controller.
 3. Method of Stopping: Automatic and nonautomatic shutdown after automatic starting **OR** Nonautomatic, **as directed**.
 4. Door-Mounted Operator Interface and Controls:



- a. Monitor, display, and control devices, alarms, functions, and operations listed in NFPA 20 as required for drivers and controller types used.
 - b. Method of Control and Indication:
 - 1) Microprocessor-based logic controller, with multiline LCD readout.
 - 2) Membrane keypad.
 - 3) LED alarm and status indicating lights.
 - c. Local and Remote, **as directed**, Alarm and Status Indications:
 - 1) Controller power on.
 - 2) Engine-lubrication-system critically low oil pressure.
 - 3) Engine-jacket coolant high temperature.
 - 4) Engine fail-to-start.
 - 5) Engine overspeed shutdown.
 - 6) Low fuel level.
 - 7) Missing or failed battery.
 - 8) Battery charger failure.
 - 9) System overpressure.
 - 10) ECM selector switch in alternate ECM position.
 - 11) Fuel injector malfunction.
 - d. Audible alarm.
 - e. Nonautomatic START and STOP push buttons or switches.
 5. Optional Features:
 - a. Extra Output Contacts:
 - 1) One Form C contacts for low pump-room temperature.
 - 2) One each, Form C contacts for high and low fuel levels.
 - 3) One each, Form C contacts for high and low reservoir levels.
 - b. Door-mounted thermal or impact printer for alarm and status logs.
 - c. Operator Interface Communications Ports: USB, Ethernet, and RS485.
 - d. Powered louver contacts.
 - e. Powered engine-oil heater contacts.
 6. Battery Charger System:
 - a. Built-in, independent, dual battery chargers with automatic changeover; 12-V dc **OR** 24-V dc, **as directed**, for lead-acid **OR** nickel-cadmium, **as directed**, batteries.
 - b. Standard: UL 1236.
- E. Remote Alarm Panels
1. General Requirements for Remote Alarm Panels: Comply with NFPA 20 and UL 218; listed by an NRTL for fire-pump service.
 2. General Requirements for Remote Alarm Panels: Factory assembled, wired, and tested.
 3. Supervisory and Normal Control Voltage: 120-V ac **OR** 240-V ac, **as directed**; single **OR** dual, **as directed**, source.
 4. Audible and Visual Alarm and Status Indications:
 - a. Driver running.
 - b. Loss of phase.
 - c. Phase reversal.
 - d. Supervised power on.
 - e. Common **OR** Separate, **as directed**, trouble on the controller.
 - f. Controller connected to alternate power source.
 5. Audible and Visual Alarm and Status Indications: Manufacturer's standard indicating lights; push-to-test **OR** non-push-to-test, with separate test push button, **as directed**.
 - a. Engine running.
 - b. Controller main switch turned to the off or manual position.
 - c. Supervised power on.
 - d. Common **OR** Separate, **as directed**, trouble on the controller or engine.
 - e. Common pump room trouble.
 - f. Controller connected to alternate power source.
 6. Audible alarm, with silence push button.



7. Pump REMOTE START push button.

F. Low-Suction-Shutdown Panels

1. General Requirements for Low-Suction-Shutdown Panels:
 - a. Listed by an NRTL for fire-pump service.
 - b. Factory assembled, wired, and tested.
 - c. Prevents automatic start of fire pump, and shuts down automatically started fire pump, on low-suction pressure.
 - d. Automatic **OR** Manual, **as directed**, reset.
2. Operation: External contact input **OR** Integral pressure switch, **as directed**.
3. Supervisory and Normal Control Voltage: 120-V ac **OR** 240-V ac, **as directed**; single **OR** dual, **as directed**, source.
4. Include audible and visual alarms and status indications, with silence push button, for the following conditions:
 - a. Control power available.
 - b. Low-suction pressure.
 - c. Normal-suction pressure.

G. Enclosures

1. Fire-Pump Controllers, ATS, Remote Alarm Panels, and Low-Suction-Shutdown Panels: NEMA 250, to comply with environmental conditions at installed locations and NFPA 20.
 - a. Indoor, Dry and Clean Locations: Type 1 (IEC IP10).
 - b. Indoor Locations Subject to Dripping Noncorrosive Liquids: Type 2 (IEC IP11).
 - c. Outdoor Locations: Type 3R (IEC IP14) **OR** Type 4 (IEC IP56) **OR** Type 4X (IEC IP56), **as directed**.
 - d. Other Wet or Damp, Indoor Locations: Type 4 (IEC IP56) **OR** Type 4X (IEC IP56), **as directed**.
 - e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: Type 12 (IEC IP12).
2. Enclosure Color: Manufacturer's standard "fire-pump-controller red".
3. Nameplates: Comply with NFPA 20; complete with capacity, characteristics, approvals, listings, and other pertinent data.
4. Optional Features:
 - a. Floor stands, 12 inches (305 mm) high, for floor-mounted controllers.
 - b. Space heater, 120-V ac **OR** 240-V ac, **as directed**, with humidistat, **as directed**, with thermostat, **as directed**.
 - c. Tropicalization.

H. Source Quality Control

1. Testing: Test and inspect fire-pump controllers according to requirements in NFPA 20 and UL 218.
 - a. Verification of Performance: Rate controllers according to operation of functions and features specified.
2. Fire-pump controllers will be considered defective if they do not pass tests and inspections.
3. Prepare test and inspection reports.

1.3 EXECUTION

A. Examination

1. Examine areas and surfaces to receive equipment, with Installer present, for compliance with requirements and other conditions affecting performance.
2. Examine equipment before installation. Reject equipment that is wet or damaged by moisture or mold.
3. Proceed with installation only after unsatisfactory conditions have been corrected.



B. Controller Installation

1. Install controllers within sight of their respective drivers.
2. Connect controllers to their dedicated pressure-sensing lines.
3. Wall-Mounting Controllers: Install controllers on walls with disconnect operating handles not higher than 79 inches (2006 mm) above finished floor, and bottom of enclosure not less than 12 inches (305 mm) above finished floor unless otherwise indicated. Bolt units to wall or mount on lightweight structural-steel channels bolted to wall. For controllers not on walls, provide freestanding racks complying with Division 16 Section "Hangers and Supports for Electrical Systems."
4. Floor-Mounting Controllers: Install controllers on 4-inch (100-mm) nominal-thickness concrete bases, using floor stands high enough so that the bottom of enclosure cabinet is not less than 12 inches (305 mm) above finished floor. Comply with requirements for concrete bases specified in Division 3 Section "Cast-in-Place Concrete."
 - a. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - b. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base, and anchor into structural concrete floor.
 - c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - d. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Seismic Bracing: Comply with requirements specified in Division 16 Section "Vibration and Seismic Controls for Electrical Systems."
6. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
7. Comply with NEMA ICS 15.

C. Standalone ATS Installation

1. Wall-Mounting ATS: Install ATS on walls with disconnect operating handles not higher than 79 inches (2006 mm) above finished floor, and bottom of enclosure not less than 12 inches (305 mm) above finished floor unless otherwise indicated. Bolt units to wall or mount on lightweight structural-steel channels bolted to wall. For ATS not on walls, provide freestanding racks complying with Division 16 Section "Hangers and Supports for Electrical Systems."
2. Floor-Mounting ATS: Install ATS on 4-inch (100-mm) nominal-thickness concrete bases, using floor stands high enough so that the bottom of enclosure cabinet is not less than 12 inches (305 mm) above finished floor. Comply with requirements for concrete bases specified in Division 3 Section "Cast-in-Place Concrete."
 - a. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - b. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base, and anchor into structural concrete floor.
 - c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - d. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Seismic Bracing: Comply with requirements specified in Division 16 Section "Vibration and Seismic Controls for Electrical Systems."
4. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Remote Alarm And Low-Suction-Shutdown, **as directed**, Panel Installation

1. Install panels on walls with tops not higher than 72 inches (1829 mm) above finished floor unless otherwise indicated. Bolt units to wall or mount on lightweight structural-steel channels bolted to wall. For ATS not on walls, provide freestanding racks complying with Division 16 Section "Hangers and Supports for Electrical Systems."

E. Power Wiring Installation



1. Install power wiring between controllers and their services or sources, and between controllers and their drivers. Comply with requirements in NFPA 20, NFPA 70, and Division 16 Section "Conductors and Cables."
 2. Comply with NECA 1.
- F. Control And Alarm Wiring Installation
1. Install wiring between controllers and remote devices and facility's central monitoring system, **as directed**. Comply with requirements in NFPA 20, NFPA 70, and Division 16 Section "Control-Voltage Electrical Power Cables."
 2. Install wiring between remote alarm and low-suction-shutdown, **as directed**, panels and controllers. Comply with requirements in NFPA 20, NFPA 70, and Division 16 Section "Control-Voltage Electrical Power Cables."
 3. Install wiring between controllers and the building's fire-alarm system. Comply with requirements specified in Division 13 Section "Digital, Addressable Fire-Alarm System."
 4. Bundle, train, and support wiring in enclosures.
 5. Connect remote manual and automatic activation devices where applicable.
- G. Identification
1. Comply with requirements in NFPA 20 for marking fire-pump controllers.
 2. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification in NFPA 20 and as specified in Division 16 Section "Electrical Identification."
- H. Field Quality Control
1. Perform tests and inspections.
 2. Acceptance Testing Preparation:
 - a. Inspect and Test Each Component:
 - 1) Inspect wiring, components, connections, and equipment installations. Test and adjust components and equipment.
 - 2) Test insulation resistance for each element, component, connecting supply, feeder, and control circuits.
 - 3) Test continuity of each circuit.
 - b. Verify and Test Each Electric-Driver Controller:
 - 1) Verify that voltages at controller locations are within plus 10 or minus 1 percent of motor nameplate rated voltages, with motors off. If outside this range for any motor, notify the Owner before starting the motor(s).
 - 2) Test each motor for proper phase rotation.
 - c. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation.
 - d. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 3. Field Acceptance Tests:
 - a. Do not begin field acceptance testing until suction piping has been flushed and hydrostatically tested and the certificate for flushing and testing has been submitted to the Owner and authorities having jurisdiction.
 - b. Prior to starting, notify authorities having jurisdiction of the time and place of the acceptance testing.
 - c. Engage manufacturer's factory-authorized service representative to be present during the testing.
 - d. Perform field acceptance tests as outlined in NFPA 20.
 4. Controllers will be considered defective if they do not pass tests and inspections.
 5. Prepare test and inspection reports.
- I. Startup Service
1. Perform startup service.
 - a. Complete installation and startup checks according to manufacturer's written instructions.



J. Adjusting

1. Adjust controllers and battery charger systems, **as directed**, to function smoothly and as recommended by manufacturer.
2. Set field-adjustable switches, auxiliary relays, time-delay relays, and timers.
3. Program microprocessors for required operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing and prior to Final Completion.
4. Set field-adjustable pressure switches.

K. Protection

1. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until enclosed controllers are ready to be energized and placed into service.
2. Replace controllers whose interiors have been exposed to water or other liquids prior to Final Completion.

L. Demonstration

1. Train the Owner's maintenance personnel to adjust, operate, and maintain controllers, remote alarm panels, **as directed**, low-suction-shutdown panels, **as directed**, and to use and reprogram microprocessor-based controls within this equipment, **as directed**.

END OF SECTION 21 16 00 00a



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SECTION 21 22 16 00 - CLEAN-AGENT EXTINGUISHING SYSTEMS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for clean-agent extinguishing systems. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes clean-agent extinguishing systems and the following:
 - a. Piping and piping specialties.
 - b. Extinguishing-agent containers.
 - c. Extinguishing agent.
 - d. Detection and alarm devices.
 - e. Control and alarm panels.
 - f. Accessories.
 - g. Connection devices for and wiring between system components.
 - h. Connection devices for power and integration into building's fire alarm system.

C. Definitions

1. ATS: Acceptance Testing Specifications.
2. EPO: Emergency Power Off.

D. System Description

1. Clean-agent fire-extinguishing system shall be an engineered system for total flooding of the hazard area including the room cavity below the ceiling and below the raised floor. Provide separate zones above and below the raised floor. If smoke is detected below the raised floor, agent shall be discharged in the underfloor zone only. If smoke is detected above the raised floor, agent shall be discharged in zones above and below the floor.

E. Performance Requirements

1. Design clean-agent extinguishing system and obtain approval from authorities having jurisdiction. Design system for Class A, B, or C fires as appropriate for areas being protected and include safety factor. Use clean agent indicated and in concentration suitable for normally occupied areas.
2. Performance Requirements: Discharge HFC 227ea within 10 seconds and maintain 7.1 percent concentration by volume at 70 deg F (21 deg C) for 10-minute holding time in hazard areas.
 - a. HFC 227ea concentration in hazard areas greater than 9.0 percent immediately after discharge or less than 5.8 percent throughout holding time will not be accepted without written authorization from the Owner and authorities having jurisdiction.
 - b. System Capabilities: Minimum 620-psig (4278-kPa) calculated working pressure and 360-psig (2484-kPa) initial charging pressure.
3. Performance Requirements: Discharge IG-541 within 60 seconds and maintain 38 percent concentration by volume at 70 deg F (21 deg C) for 10-minute holding time in hazard areas.
 - a. IG-541 concentration in hazard areas greater than 40 percent immediately after discharge or less than 32 percent throughout holding time will not be accepted without written authorization from the Owner and authorities having jurisdiction.
 - b. System Capabilities: Minimum 2175-psig (15-MPa) calculated working pressure upstream from orifice union, minimum 1000-psig (6895-kPa) calculated working pressure downstream from orifice union, and 2175-psig (15-MPa) initial charging pressure.



4. Cross-Zoned Detection: Devices located in two separate zones. Sound alarm on activating single-detection device, and discharge extinguishing agent on actuating single-detection device in other zone.
OR
Verified Detection: Devices located in single zone. Sound alarm on activating single-detection device, and discharge extinguishing agent on actuating second-detection device.
5. System Operating Sequence: As follows:
 - a. Actuating First Detector: Visual indication on annunciator panel, energize audible alarm and visual alarms (slow pulse), shut down air-conditioning and ventilating systems serving protected area, close doors in protected area, and send signal to fire alarm system.
 - b. Actuating Second Detector: Visual indication on annunciator panel, energize audible and visual alarms (fast pulse), shut down power to protected equipment, start time delay for extinguishing-agent discharge for 30 seconds, and discharge extinguishing agent. On agent discharge, release preaction valve to allow water to fill sprinkler system.
 - c. Extinguishing-agent discharge will operate audible alarms and strobe lights inside and outside the protected area.
6. System Operating Sequence: System shall be cross-zoned, air-sampling detectors and photoelectric detectors reporting to a fully programmable microprocessor-based control panel programmed to operate as follows:
 - a. If one photoelectric detector and air-sampling detector reaches the third detection level (Fire 1), agent discharge will be initiated as described for the third detection level (Fire 1) below.
 - b. Air-Sampling System:
 - 1) First Detection Level (Alert): Mild audible and visual indication on annunciator panel. Strobe lights flash slowly in the protected area.
 - 2) Second Detection Level (Action): Strong audible and visual indication on annunciator panel. Strobe lights flash rapidly in the protected area.
 - 3) Third Detection Level (Fire 1): Strong audible and visual indication on annunciator panel. Energize horn(s), bell(s), and strobe light(s) in the protected area and outside entry doors. Shut down air-conditioning and ventilating systems serving the protected area, and close doors in the protected area. Send signal to fire alarm system, initiate 30-second time delay for extinguishing-agent discharge, and discharge extinguishing agent. At agent discharge, terminate power to equipment in the protected area, and release preaction valve to allow water flow to sprinkler system.
 - 4) Fourth Detection Level (Fire 2): Same as Fire 1.
7. Manual stations shall immediately discharge extinguishing agent when activated.
8. Operating abort switches will delay extinguishing-agent discharge while being activated, and switches must be reset to prevent agent discharge. Release of hand pressure on the switch will cause agent discharge if the time delay has expired.
9. EPO: Will terminate power to protected equipment immediately on actuation.
10. Low-Agent Pressure Switch: Initiate trouble alarm if sensing less than set pressure.
11. Power Transfer Switch: Transfer from normal to stand-by power source.
12. Seismic Performance: Fire-suppression piping and containers shall be capable of withstanding the effects of earthquake motions determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."

F. Submittals

1. Product Data: For each product indicated.
2. LEED Submittal:
 - a. Product Data for Credit EA 4: Documentation required by Credit EA 4 indicating that clean agents comply.
3. Shop Drawings: Signed and sealed by a qualified professional engineer. Include design calculations.



4. Permit Approved Drawings: Working plans, prepared according to NFPA 2001, that have been approved by authorities having jurisdiction. Include design calculations.
5. Field quality-control test reports.
6. Maintenance Data: For components to include in maintenance manuals.

G. Quality Assurance

1. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of clean-agent extinguishing systems that are similar to those indicated for this Project in material, design, and extent.
2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.2 PRODUCTS

A. Piping Materials

1. Refer to Part 1.3 piping applications Article retained for applications of pipe, tube, fitting, and joining materials.
2. Piping, Valves, and Discharge Nozzles: Comply with types and standards listed in NFPA 2001, Section "Distribution," for charging pressure of system.

B. Pipe And Fittings

1. Steel Pipe: ASTM A 53/A 53M, Type S, Grade B or ASTM A 106, Grade B; Schedule 40, or Schedule 80, seamless steel pipe.
 - a. Threaded Fittings:
 - 1) Malleable-Iron Fittings: ASME B16.3, Class 300.
 - 2) Flanges and Flanged Fittings: ASME B16.5, Class 300, unless Class 600 is indicated.
 - b. Forged-Steel Welding Fittings: ASME B16.11, Class 3000, socket pattern.
 - c. Grooved-End Fittings: FMG approved and NRTL listed, ASTM A 47/A 47M malleable iron or ASTM A 536 ductile iron, with dimensions matching steel pipe and ends factory grooved according to AWWA C606.
Plain-End, Hard Copper Tube: ASTM B 88, Type K **OR** L, **as directed**, (ASTM B 88M, Type A **OR** B, **as directed**), water tube, drawn temper.
 - d. Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper alloy, pressure.
 - e. Bronze Flanges and Flanged Fittings: ASME B16.24, Class 300.
2. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - a. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness, unless thickness or specific material is indicated.
3. Flange Bolts and Nuts: ASME B18.2.1, carbon steel.
4. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing.
5. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
6. Steel, Keyed Couplings: UL 213, AWWA C606, approved or listed for clean-agent service, and matching steel-pipe dimensions. Include ASTM A 536, ductile-iron housing, rubber gasket, and steel bolts and nuts.

C. Valves

1. General: Brass; suitable for intended operation.
2. Container Valves: With rupture disc or solenoid and manual-release lever, capable of immediate and total agent discharge and suitable for intended flow capacity.



3. Valves in Sections of Closed Piping and Manifolds: Fabricate to prevent entrapment of liquid, or install valve and separate pressure relief device.
 4. Valves in Manifolds: Check valve; installed to prevent loss of extinguishing agent when container is removed from manifold.
- D. Extinguishing-Agent Containers
1. Description: Steel tanks complying with ASME Boiler and Pressure Vessel Code: Section VIII, for unfired pressure vessels. Include minimum working-pressure rating that matches system charging pressure, valve, pressure switch, and pressure gage.
 - a. Finish: Red **OR** Manufacturer's standard color, **as directed**, enamel or epoxy paint.
 - b. Manifold: Fabricate with valves, pressure switches, and connections for multiple storage containers, as indicated.
OR
Manifold: Fabricate with valves, pressure switches, selector switch, and connections for main- and reserve-supply banks of multiple storage containers.
 - c. Storage-Tank Brackets: Factory- or field-fabricated retaining brackets consisting of steel straps and channels; suitable for container support, maintenance, and tank refilling or replacement.
- E. Fire-Extinguishing Clean Agent
1. Clean Agent: HFC 227ea, heptafluoropropane.
OR
Clean Agent: IG-541, mixture of nitrogen, argon, and carbon dioxide inert gases.
- F. Discharge Nozzles
1. Equipment manufacturer's standard one-piece brass or aluminum alloy of type, discharge pattern, and capacity required for application.
- G. Manifold And Orifice Unions
1. Description: NRTL-listed device with minimum 2175-psig (15-MPa) pressure rating, to control flow and reduce pressure of IG-541 gas in piping.
 - a. NPS 2 (DN 50) and Smaller: Piping assembly with orifice, sized for system design requirements.
 - b. NPS 2-1/2 (DN 65) and Larger: Piping assembly with nipple, sized for system design requirements.
- H. Control Panels
1. Description: FMG approved or NRTL listed, including equipment and features required for testing, supervising, and operating fire-extinguishing system.
 2. Power Requirements: 120/240-V ac; with electrical contacts for connection to system components and fire alarm system, and transformer or rectifier as needed to produce power at voltage required for accessories and alarm devices.
 3. Enclosure: NEMA ICS 6, Type 1, enameled-steel cabinet.
 - a. Mounting: Recessed flush with surface **OR** Surface, **as directed**.
 4. Supervised Circuits: Separate circuits for each independent hazard area.
 - a. Detection circuits equal to the required number of zones, or addressable devices assigned to the required number of zones.
 - b. Manual pull-station circuit.
 - c. Alarm circuit.
 - d. Release circuit.
 - e. Abort circuit.
 - f. EPO circuit.
 5. Provide the following control-panel features:
 - a. Electrical contacts for shutting down fans, activating dampers, and operating system electrical devices.



- b. Automatic switchover to standby power at loss of primary power.
 - c. Storage container, low-pressure indicator.
 - d. Service disconnect to interrupt system operation for maintenance with visual status indication on the annunciator panel.
6. Annunciator Panel: Graphic type showing protected, hazard-area plans and locations of detectors, abort, EPO, and manual stations. Include lamps to indicate device-initiating alarm, electrical contacts for connection to control panel, and stainless-steel or aluminum enclosure.
 7. Standby Power: Lead-acid or nickel-cadmium batteries with capacity to operate system for 72 hours and alarm for minimum of 15 minutes. Include automatic battery charger, with varying charging rate between trickle and high depending on battery voltage, that is capable of maintaining batteries fully charged. Include manual voltage control, dc voltmeter, dc ammeter, electrical contacts for connection to control panel, and suitable enclosure.
- I. Detection Devices
1. Description: Comply with NFPA 2001 and NFPA 72, and include the following types:
 - a. Ionization Detectors: Comply with UL 268, dual-chamber type, having sampling and referencing chambers, with smoke-sensing element.
 - b. Photoelectric Detectors: Comply with UL 268, consisting of LED light source and silicon photodiode receiving element.
 - c. Remote Air-Sampling Detector System: Includes air-sampling pipe network, a laser-based photoelectric detector, a sample transport fan, and a control unit.
 - 1) Comply with UL 268 and NRTL listed, operating at 24-V dc, nominal.
 - 2) Pipe Network: CPVC tubing connects control unit with calibrated sampling holes.
 - 3) Smoke Detector: Particle-counting type with continuous laser beam. Sensitivity adjustable to a minimum of four preset values.
 - 4) Sample Transport Fan: Centrifugal type, creating a minimum static pressure of 0.05-inch wg (12.5 Pa) at all sampling ports.
 - 5) Control Unit: Multizone unit as indicated on Drawings. Provides same system power supply, supervision, and alarm features as specified for the control panel plus separate trouble indication for airflow and detector problems.
 - 6) Signals to the Central Fire Alarm Control Panel: Any type of local system trouble is reported to the central fire alarm control panel as a composite "trouble" signal. Alarms on each system zone are individually reported to the central fire alarm control panel as separately identified zones.
- J. Manual Stations
1. General Description: Surface **OR** Semirecessed, **as directed**, FMG approved or NRTL listed, with clear plastic hinged cover, 120-V ac or low voltage compatible with controls. Include contacts for connection to control panel.
 2. Manual Release: "MANUAL RELEASE" caption, and red finish. Unit can manually discharge extinguishing agent with operating device that remains engaged until unlocked.
 3. Abort Switch: "ABORT" caption, momentary contact, with green finish.
 4. EPO Switch: "EPO" caption, with yellow finish.
- K. Switches
1. Description: FMG approved or NRTL listed, where available, 120-V ac or low voltage compatible with controls. Include contacts for connection to control panel.
 - a. Low-Agent Pressure Switches: Pneumatic operation.
 - b. Power Transfer Switches: Key-operation selector, for transfer of release circuit signal from main supply to reserve supply.
 - c. Door Closers: Magnetic retaining and release device or electrical interlock to cause the door operator to drive the door closed.
- L. Alarm Devices
1. Description: FMG approved or NRTL listed, low voltage, and surface mounting, unless otherwise indicated.



2. Bells: Minimum 6-inch (150-mm) diameter.
3. Horns: 90 to 94 dBA.
4. Strobe Lights: Translucent lens, with "FIRE" or similar caption.

M. Electrical Power And Wiring

1. Electrical power, wiring, and devices are specified in Division 22.

1.3 EXECUTION

A. Piping Applications

1. Flanged pipe and fittings and flanged joints may be used to connect to specialties and accessories and where required for maintenance.
2. Fittings Working Pressure: 620 psig (4278 kPa) minimum.
3. Flanged Joints: Class 300 minimum.
4. NPS 2 (DN 50) and Smaller: ASTM B 88, Type K **OR** L, **as directed**, (ASTM B 88M, Type A **OR** B, **as directed**,) copper tube; copper, solder-joint fittings; and brazed joints.
OR
NPS 2 (DN 50) and Smaller: Schedule 40, steel pipe; malleable-iron threaded fittings; and threaded joints.
5. NPS 2-1/2 and NPS 3 (DN 65 and DN 80): ASTM B 88, Type K **OR** L, **as directed**, (ASTM B 88M, Type A **OR** B, **as directed**,) copper tube; copper, solder-joint fittings; and brazed joints.
OR
NPS 2-1/2 and NPS 3 (DN 65 and DN 80): Schedule 40, steel pipe; forged-steel welding fittings; and welded joints.
OR
NPS 2-1/2 and NPS 3 (DN 65 and DN 80): Schedule 40, steel pipe; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
6. NPS 4 (DN 100) and Larger: Schedule 40, steel pipe; steel, grooved-end fittings; steel, keyed couplings; and grooved joints.
OR
NPS 4 (DN 100) and Larger: Schedule 40, steel pipe; forged-steel welding fittings; and welded joints.

B. Piping Applications

1. Piping between Storage Containers and Orifice Union:
 - a. Flanged pipe and fittings and flanged joints may be used to connect to specialties and accessories and where required for maintenance.
 - b. Fittings Working Pressure: 2175 psig (15 MPa) minimum.
 - c. Flanged Joints: Class 600 minimum.
 - d. All Sizes: Schedule 80, steel pipe; forged-steel welding fittings; and welded joints.
2. Piping Downstream from Orifice Union:
 - a. Flanged pipe and fittings and flanged joints may be used to connect to specialties and accessories and where required for maintenance.
 - b. Fittings Working Pressure: 1000 psig (6900 kPa) minimum.
 - c. Flanged Joints: Class 300 minimum.
 - d. All Sizes: Schedule 40 **OR** 80, **as directed**, steel pipe; forged-steel welding fittings; and welded joints.

C. Clean-Agent Extinguishing Piping Installation

1. Install clean-agent extinguishing piping and other components level and plumb and according to manufacturers' written instructions.
2. Refer to Division 21 Section "Common Work Results For Fire Suppression" for basic pipe installation and joint construction.



3. Grooved Piping Joints: Groove pipe ends according to AWWA C606 dimensions. Assemble grooved-end steel pipe and steel, grooved-end fittings with steel, keyed couplings and lubricant according to manufacturer's written instructions.
 4. Install extinguishing-agent containers anchored to substrate.
 5. Install pipe and fittings, valves, and discharge nozzles according to requirements listed in NFPA 2001, Section "Distribution," and in ASME B31.1.
 - a. Install valves designed to prevent entrapment of liquid or install pressure relief devices in valved sections of piping systems.
 - b. Support piping using supports and methods according to NFPA 13.
 - c. Install seismic restraints for extinguishing-agent containers and piping systems.
 - d. Install control panels, detection system components, alarms, and accessories, complying with requirements of NFPA 2001, Section "Detection, Actuation, and Control Systems," as required for supervised system application.
- D. Connections
1. Drawings indicate general arrangement of piping, fittings, and specialties.
 2. Install piping adjacent to extinguishing-agent containers to allow service and maintenance.
 3. Connect electrical devices to control panel and to building's fire alarm system. Electrical power, wiring, and devices are specified in Division 28 Section(s) "Digital, Addressable Fire-alarm System" OR "Zoned (dc Loop) Fire-alarm System".
- E. Labeling
1. Install labeling on piping, extinguishing-agent containers, other equipment, and panels according to NFPA 2001.
 2. Install signs at entry doors for protected areas to warn occupants that they are entering a room protected with a clean-agent fire extinguishing system.
 3. Install signs at entry doors to advise persons outside the room the meaning of the horn(s), bell(s), and strobe light(s) outside the protected space.
- F. Field Quality Control
1. Comply with operating instructions and procedures of NFPA 2001, Section "Approval of Installations." Include the following tests and inspections to demonstrate compliance with requirements:
 - a. Check mechanical items.
 - b. Inspect extinguishing-agent containers and extinguishing agent, and check mountings for adequate anchoring to substrate.
 - c. Check electrical systems.
 - d. Check enclosure integrity. Comply with NFPA 2001, Section "Enclosure Inspection," and Appendix C, "Enclosure Integrity Procedure."
 - e. Perform functional pre-discharge test.
 - f. Perform system functional operational test including, EPO, abort, and manual release.
 - g. Check remote monitoring operations.
 - h. Check control-panel primary power source.
 - i. Perform "puff" test on piping system, using nitrogen.
 2. Perform field-acceptance tests of each clean-agent extinguishing system when installation is complete. Perform system testing only after hazard-area enclosure construction has been completed and openings sealed. Comply with operating instructions and procedures of NFPA 2001, Section "Approval of Installations." Include the following to demonstrate compliance with requirements:
 - a. Perform functional pre-discharge test.
 - b. Perform system functional operational test.
 - c. Check remote monitoring operations.
 - d. Check control-panel primary power source.
 - e. Perform "puff" test on piping system, using nitrogen.



3. Correct malfunctioning equipment, then retest to demonstrate compliance. Replace equipment that cannot be corrected or does not perform as specified and indicated, then retest to demonstrate compliance. Repeat procedure until satisfactory results are obtained.
 - a. Report test results promptly and in writing to the Owner and authorities having jurisdiction.
 4. Perform the following field tests and inspections and prepare test reports:
 - a. After installing clean-agent extinguishing piping system and after electrical circuitry has been energized, test for compliance with requirements.
 - b. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Sections "Inspection and Test Procedures" and "System Function Tests." Certify compliance with test parameters.
 - c. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - d. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.
 - e. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 5. Remove and replace malfunctioning units and retest as specified above.
- G. Cleaning
1. Each pipe section shall be cleaned internally after preparation and before assembly by means of swabbing, using a suitable nonflammable cleaner. Pipe network shall be free of particulate matter and oil residue before installing nozzles or discharge devices.
- H. System Filling
1. Preparation:
 - a. Verify that piping system installation is completed and cleaned.
 - b. Check for complete enclosure integrity.
 - c. Check operation of ventilation and exhaust systems.
 2. Filling Procedures:
 - a. Fill extinguishing-agent containers with extinguishing agent and pressurize to indicated charging pressure.
 - b. Install filled extinguishing-agent containers.
 - c. Energize circuits.
 - d. Adjust operating controls.
- I. Demonstration
1. Train the Owner's maintenance personnel to adjust, operate, and maintain clean-agent extinguishing systems.

END OF SECTION 21 22 16 00



Task	Specification	Specification Description
21 22 16 00	01 22 16 00	No Specification Required



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SECTION 21 24 00 00 - FIBERGLASS REINFORCED POLYESTER (FRP) FLUSH DOORS**1.1 GENERAL****A. Description of Work**

1. This specification covers the furnishing and installation of materials for fiberglass reinforced polyester (FRP) flush doors and aluminum frames. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Performance Requirements

1. General: Provide door assemblies that have been designed and fabricated to comply with specified performance requirements, as demonstrated by testing manufacturer's corresponding standard systems.
2. Air Infiltration: For a single door 3'-0" x 7'-0", test specimen shall be tested in accordance with ASTM E 283 at pressure differential of 6.24 psf. Door shall not exceed 0.90 cfm per linear foot of perimeter crack.
3. Water Resistance: For a single door 3'-0" x 7'-0", test specimen shall be tested in accordance with ASTM E 331 at pressure differential of 7.50 psf. Door shall not have water leakage.
4. Hurricane Test Standards, Single Door with Single-Point Latching:
 - a. Uniform Static Load, ASTM E 330: Plus or minus 75 pounds per square foot.
 - b. Forced Entry Test, 300 Pound Load Applied, SFBC 3603.2 (b)(5): Passed.
 - c. Cyclic Load Test, SFBC PA 203: Plus or minus 53 pounds per square foot.
 - d. Large Missile Impact Test, SFBC PA 201: Passed.
5. Swinging Door Cycle Test, Doors and Frames, ANSI A250.4: Minimum of 20,000,000 cycles.
6. Swinging Security Door Assembly, Doors and Frames, ASTM F 476: Grade 40.
7. Salt Spray, Exterior Doors and Frames, ASTM B 117: Minimum of 500 hours.
8. Sound Transmission, Exterior Doors, STC, ASTM E 90: Minimum of 25.
9. Thermal Transmission, Exterior Doors, U-Value, AAMA 1503-98: Maximum of 0.29 BTU/hr x sf x degrees F. Minimum of 55 CRF value.
10. Surface Burning Characteristics, FRP Doors and Panels, ASTM E 84:
 - a. Flame Spread: Maximum of 200, Class C.
 - b. Smoke Developed: Maximum of 450, Class C.
11. Surface Burning Characteristics, Class A Option On Interior Faces of FRP Exterior Panels and Both Faces of FRP Interior Panels, ASTM E 84:
 - a. Flame Spread: Maximum of 25.
 - b. Smoke Developed: Maximum of 450.
12. Impact Strength, FRP Doors and Panels, Nominal Value, ASTM D 256: 15.0 foot-pounds per inch of notch.
13. Tensile Strength, FRP Doors and Panels, Nominal Value, ASTM D 638: 14,000 psi.
14. Flexural Strength, FRP Doors and Panels, Nominal Value, ASTM D 790: 21,000 psi.
15. Water Absorption, FRP Doors and Panels, Nominal Value, ASTM D 570: 0.20 percent after 24 hours.
16. Indentation Hardness, FRP Doors and Panels, Nominal Value, ASTM D 2583: 55.
17. Abrasion Resistance, Face Sheet, Taber Abrasion Test, 25 Cycles at 1,000 Gram Weight with CS-17 Wheel: Maximum of 0.029 average weight loss percentage.
18. Stain Resistance, ASTM D 1308: Face sheet unaffected after exposure to red cabbage, tea, and tomato acid. Stain removed easily with mild abrasive or FRP cleaner when exposed to Sharpie ink pen and white spray paint.
19. Chemical Resistance, ASTM D 543. Excellent rating.
 - a. Acetic acid, 5 percent solution.
 - b. Chlorine bleach, 10 percent solution.
 - c. Sodium hypochlorite, 4 to 6 percent solution.
 - d. Citric acid, 10 percent solution.
 - e. Sodium carbonate, 20 percent solution.



- f. Turpentine.
- 20. Compressive Strength, Foam Core, Nominal Value, ASTM D 1621: 84.2 psi.
- 21. Compressive Modulus, Foam Core, Nominal Value, ASTM D 1621: 448 psi.
- 22. Tensile Adhesion, Foam Core, Nominal Value, ASTM D 1623: 48 psi.
- 23. Thermal and Humid Aging, Nominal Value, 158 Degrees F and 100 Percent Humidity for 14 Days, ASTM D 2126: Minus 4.89 percent volume change.

C. Submittals

1. Product Data: Submit manufacturer's product data, including description of materials, components, fabrication, finishes, and installation.
2. Shop Drawings: Submit manufacturer's shop drawings, including elevations, sections, and details, indicating dimensions, tolerances, materials, fabrication, doors, panels, framing, hardware schedule, and finish.
3. Samples:
 - a. Door: Submit manufacturer's sample of door showing face sheets, core, framing, and finish.
 - b. Color: Submit manufacturer's samples of standard colors of doors and frames.
4. Test Reports: Submit certified test reports from qualified independent testing agency indicating doors comply with specified performance requirements.
5. Manufacturer's Project References: Submit list of successfully completed projects including project name and location, name of architect, and type and quantity of doors manufactured.
6. Maintenance Manual: Submit manufacturer's maintenance and cleaning instructions for doors, including maintenance and operating instructions for hardware.
7. Warranty: Submit manufacturer's standard warranty.

D. Quality Assurance

1. Manufacturer's Qualifications:
 - a. Continuously engaged in manufacturing of doors of similar type to that specified, with a minimum of 25 years successful experience.
 - b. Door and frame components from same manufacturer.
 - c. Evidence of a compliant documented quality management system.

E. Delivery, Storage, And Handling

1. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying opening door mark and manufacturer.
2. Storage: Store materials in clean, dry area indoors in accordance with manufacturer's instructions.
3. Handling: Protect materials and finish from damage during handling and installation.

F. Warranty

1. Warrant doors, frames, and factory hardware against failure in materials and workmanship, including excessive deflection, faulty operation, defects in hardware installation, and deterioration of finish or construction in excess of normal weathering.
2. Warranty Period: Ten years starting on date of shipment.

1.2 PRODUCTS

A. Manufacturer: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Special-Lite, Inc., PO Box 6, Decatur, Michigan 49045. Toll Free (800) 821-6531. Phone (269) 423-7068. Fax (800) 423-7610. Web Site www.special-lite.com. E-Mail info@special-lite.com.

B. FRP Flush Doors

1. Model: SL-17 Flush Doors with SpecLite3 fiberglass reinforced polyester (FRP) face sheets.
2. Door Opening Size: As indicated on the Drawings **OR as directed**.



3. Construction:
 - a. Door Thickness: 1-3/4 inches.
 - b. Stiles and Rails: Aluminum Alloy 6063-T5, minimum of 2-5/16-inch depth.
 - c. Corners: Mitered.
 - d. Provide joinery of 3/8-inch diameter full-width tie rods through extruded splines top and bottom as standard tubular shaped stiles and rails reinforced to accept hardware as specified.
 - e. Securing Internal Door Extrusions: 3/16-inch angle blocks and locking hex nuts for joinery. Welds, glue, or other methods are not acceptable.
 - f. Furnish extruded stiles and rails with integral reglets to accept face sheets. Lock face sheets into place to permit flush appearance.
 - g. Rail caps or other face sheet capture methods are not acceptable.
 - h. Extrude top and bottom rail legs for interlocking continuous weather bar.
 - i. Meeting Stiles: Pile brush weatherseals. Extrude meeting stile to include integral pocket to accept pile brush weatherseals.
 - j. Bottom of Door: Install bottom weather bar with nylon brush weatherstripping into extruded interlocking edge of bottom rail.
 4. Face Sheet:
 - a. Material: SpecLite3 FRP, 0.120-inch thickness, finish color throughout. Abuse-resistant engineered surface.
 - b. Texture: Pebble.
 - c. Color: **As directed.**
 5. Core:
 - a. Material: Poured-in-place polyurethane foam.
 - b. Density: Minimum of 5 pounds per cubic foot.
 - c. R-Value: Minimum of 9.
 6. Cutouts:
 - a. Manufacture doors with cutouts for required vision lites, louvers, and panels.
 - b. Factory install vision lites, louvers, and panels.
 7. Hardware:
 - a. Premachine doors in accordance with templates from specified hardware manufacturers and hardware schedule.
 - b. Factory install hardware.
- C. Materials
1. Aluminum Members:
 - a. Extrusions: ASTM B 221.
 - b. Sheet and Plate: ASTM B 209.
 - c. Alloy and Temper: As required by manufacturer for strength, corrosion resistance, application of required finish, and control of color.
 2. Components: Door and frame components from same manufacturer.
 3. Fasteners:
 - a. Material: Aluminum, 18-8 stainless steel, or other noncorrosive metal.
 - b. Compatibility: Compatible with items to be fastened.
 - c. Exposed Fasteners: Screws with finish matching items to be fastened.
- D. Fabrication
1. Sizes and Profiles: Required sizes for door and frame units, and profile requirements shall be as indicated on the Drawings.
 2. Coordination of Fabrication: Field measure before fabrication and show recorded measurements on shop drawings.
 3. Assembly:
 - a. Complete cutting, fitting, forming, drilling, and grinding of metal before assembly.
 - b. Remove burrs from cut edges.
 4. Welding: Welding of doors or frames is not acceptable.
 5. Fit:



- a. Maintain continuity of line and accurate relation of planes and angles.
- b. Secure attachments and support at mechanical joints with hairline fit at contacting members.

E. Architectural Panels

1. FRP Panels:
 - a. Model: SL-37 Architectural Panels with SpecLite3 FRP face sheets.
 - b. Size: As indicated on the Drawings **OR as directed**.
 - c. Thickness: 1/4 inch **OR** 1 inch **OR** As indicated on the Drawings **OR as directed**.
2. Face Sheets:
 - a. Material: SpecLite3 FRP, 0.120-inch thickness, finish color throughout. Abuse-resistant engineered surface.
 - b. Texture: Pebble.
 - c. Color: **As directed**.
3. Insulated SpecLite3 FRP Panels:
 - a. Insulated Panels: Two 0.120-inch minimum thickness sheets.
 - b. Core: Foamed polyurethane core of a minimum of 5 pounds per cubic foot density.
 - c. Form components to function as single unit.
 - d. U-Value: Minimum of 0.23 for 1-inch panels.
4. Class A Flame Spread and Smoke Developed Rating, **as directed**:
 - a. Class A flame spread and smoke developed rating on interior faces of exterior panels and both faces of interior panels.
 - b. Flame Spread, ASTM E 84: Maximum of 25.
 - c. Smoke Developed, ASTM E 84: Maximum of 450.

F. Aluminum Door Framing Systems

1. Tubular Framing:
 - a. Size and Type: As indicated on the Drawings.
 - b. Materials: Aluminum Alloy 6063-T5, 1/8-inch minimum wall thickness.
 - c. Applied Door Stops: 0.625-inch high, with screws and weatherstripping. Door stop shall incorporate pressure gasketing for weathering seal. Counterpunch fastener holes in door stop to preserve full metal thickness under fastener head.
 - d. Frame Members: Box type with 4 enclosed sides. Open-back framing is not acceptable.
 - e. Caulking: Caulk joints before assembling frame members.
 - f. Joints:
 - 1) Secure joints with fasteners.
 - 2) Provide hairline butt joint appearance.
 - g. Field Fabrication: Field fabrication of framing using stick material is not acceptable.
 - h. Applied Stops: For side, transom, and borrowed lites and panels. Applied stops shall incorporate pressure gasketing for weathering seal. Reinforce with solid bar stock fill for frame hardware attachments.
 - i. Hardware:
 - 1) Premachine and reinforce frame members for hardware in accordance with manufacturer's standards and hardware schedule.
 - 2) Factory install hardware.
 - j. Anchors:
 - 1) Anchors appropriate for wall conditions to anchor framing to wall materials.
 - 2) Door Jamb and Header Mounting Holes: Maximum of 24-inch centers.
 - 3) Secure head and sill members of transom, side lites, and similar conditions.
 - k. Side Lites:
 - 1) Factory preassemble side lites to greatest extent possible.
 - 2) Mark frame assemblies according to location.
2. Insert Framing System:
 - a. Model: SL-1030 Series, SL-1031 **OR** SL-1032 **OR** SL-1034, **as directed**.
 - b. Insert frame as indicated on the Drawings, using integral stop fitted with weatherstripping.



- c. Corner joints of miter design, secure with furnished aluminum clips, and screw into place.
 - d. Hardware:
 - 1) Premachine and reinforce insert frame members for hardware in accordance with manufacturer's standards and hardware schedule.
 - 2) Factory install hardware.
 - e. Anchors:
 - 1) Anchors of suitable type to fasten insert framing to existing frame materials.
 - 2) Minimum of 5 anchors on jambs up to 7'-4" height, 3 anchors on headers, and 1 additional anchor for each additional foot of frame.
3. Frame Capping:
- a. Model: SL-70.
 - b. Capping: With insert frame as indicated on the Drawings, **OR as directed**.
 - c. Finish: Match framing.
- G. Hardware
1. Premachine doors in accordance with templates from specified hardware manufacturers and hardware schedule.
 2. Factory install hardware.
 3. Hardware Schedule: As specified in Division 08 Section "Door Hardware" **OR** As indicated on the Drawings, **OR as directed**.
 - a. Hinges shall be continuous type.
 4. Finish: As specified in Division 08 Section "Door Hardware" **OR** As indicated on the Drawings, **OR as directed**.
- H. Vision Lites
1. Factory Glazing: 1/4-inch glass **OR** 1-inch glass insulating units, **as directed**.
 2. Lites in Exterior Doors: Allow for thermal expansion.
 3. Rectangular Lites:
 - a. Size: 12 inches by 12 inches **OR** Half lite **OR** Full lite **OR** Narrow lite **OR** Double lite **OR** As indicated on the Drawings **OR as directed**.
 - b. Factory glazed with screw-applied aluminum stops anodized to match perimeter door rails.
 4. Security Grate: SL-SG349.
 - a. Frame Perimeter: 1-inch by 1-inch by 1/8-inch steel angle.
 - b. Expanded Metal: 1/4-inch diameter, round hole perforated, 14-gauge steel sheet.
 - c. Finish: Factory painted to match door finish.
 5. Vandal Screen: SL-SG350.
 - a. Frame Perimeter: Aluminum. Finish to match vision lite.
 - b. Expanded Metal: 1/4-inch diameter, round hole perforated, 16-gauge stainless steel sheet. Powder coat black finish.
- I. Louvers
1. Type: Aluminum, inverted Y-type, fixed blade, 12 inches minimum from bottom of door.
 2. Size: As indicated on the Drawings **OR** as directed.
 3. Installation: Factory installed into standard vision lite kit. Exterior side of louver shall be free of fasteners.
 4. Insect screen.
- J. Aluminum Finishes
1. Anodized Finish: Class I finish, 0.7 mils thick.
 - a. Clear 215 R1, AA-M10C12C22A41, Class I, 0.7 mils thick.
 - b. Champagne, AA-M10C12C22A44, Class I, 0.7 mils thick.
 - c. Light Bronze, AA-M10C12C22A44, Class I, 0.7 mils thick.
 - d. Medium Bronze, AA-M10C12C22A44, Class I, 0.7 mils thick.
 - e. Dark Bronze, AA-M10C12C22A44, Class I, 0.7 mils thick.
 - f. Black, AA-M10C12C22A44, Class I, 0.7 mils thick.
 2. Painted: as directed by the Owner.



1.3 EXECUTION

A. Preparation

1. Ensure openings to receive frames are plumb, level, square, and in tolerance.

B. Installation

1. Install doors in accordance with manufacturer's instructions.
2. Install doors plumb, level, square, true to line, and without warp or rack.
3. Anchor frames securely in place.
4. Separate aluminum from other metal surfaces with bituminous coatings or other means approved by the Owner.
5. Set thresholds in bed of mastic and backseal.
6. Install exterior doors to be weathertight in closed position.
7. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by the Owner.
8. Remove and replace damaged components that cannot be successfully repaired as determined by the Owner.

C. Field Quality Control

1. Manufacturer's Field Services: Manufacturer's representative shall provide technical assistance and guidance for installation of doors.

D. Adjusting

1. Adjust doors, hinges, and locksets for smooth operation without binding.

E. Cleaning

1. Clean doors promptly after installation in accordance with manufacturer's instructions.
2. Do not use harsh cleaning materials or methods that would damage finish.

F. Protection

1. Protect installed doors to ensure that, except for normal weathering, doors will be without damage or deterioration at time of Final Completion.

END OF SECTION 21 24 00 00



Task	Specification	Specification Description
21 24 16 00	21 24 00 00	Fiberglass Reinforced Polyester (FRP) Flush Doors



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SECTION 21 31 13 00 - ELECTRIC-DRIVE, CENTRIFUGAL FIRE PUMPS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for electric-drive, centrifugal fire pumps. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. End-suction, In-line, and Split-case fire pumps.
 - b. Fire-pump accessories and specialties.
 - c. Flowmeter systems.

C. Performance Requirements

1. Seismic Performance: Fire pumps shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
2. Pump Equipment, Accessory, and Specialty Pressure Rating: 175 psig (1200 kPa) minimum unless higher pressure rating is indicated.

D. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: For fire pumps, motor drivers, and fire-pump accessories and specialties. Include plans, elevations, sections, details, and attachments to other work.
 - a. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - b. Wiring Diagrams: For power, signal, and control wiring.
3. Seismic Qualification Certificates: For fire pumps, accessories, and components, from manufacturer.
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
4. Product Certificates: For each fire pump, from manufacturer.
5. Source quality-control reports.
6. Field quality-control reports.
7. Operation and maintenance data.

E. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. NFPA Compliance: Comply with NFPA 20, "Installation of Stationary Pumps for Fire Protection."

1.2 PRODUCTS

A. General Requirements For Centrifugal Fire Pumps



1. Description: Factory-assembled and -tested fire-pump and driver unit.
2. Base: Fabricated and attached to fire-pump and driver unit with reinforcement to resist movement of pump during seismic events when base is anchored to building substrate.
3. Finish: Red paint applied to factory-assembled and -tested unit before shipping.

B. End-Suction Fire Pumps

1. Pump:
 - a. Standard: UL 448, for end-suction pumps for fire service.
 - b. Casing: Radially split case, cast iron with ASME B16.1 pipe-flange connections.
 - c. Impeller: Cast bronze, statically and dynamically balanced, and keyed to shaft.
 - d. Wear Rings: Replaceable bronze.
 - e. Shaft and Sleeve: Steel shaft with bronze sleeve.
 - 1) Shaft Bearings: Grease-lubricated ball bearings in cast-iron housing.
 - 2) Seals: Stuffing box with minimum of four rings of graphite-impregnated braided yarn and bronze packing gland.
 - f. Mounting: Pump and driver shafts are horizontal, with pump and driver on same base.
2. Coupling: Flexible and capable of absorbing torsional vibration and shaft misalignment. Include metal coupling guard.
3. Driver:
 - a. Standard: UL 1004A.
 - b. Type: Electric motor; NEMA MG 1, polyphase Design B.

C. In-Line Fire Pumps

1. Pump:
 - a. Standard: UL 448, for in-line pumps for fire service.
 - b. Casing: Radially split case, cast iron with ASME B16.1 pipe-flange connections.
 - c. Impeller: Cast bronze, statically and dynamically balanced, and keyed to shaft.
 - d. Wear Rings: Replaceable bronze.
 - e. Shaft and Sleeve: Steel shaft with bronze sleeve.
 - 1) Shaft Bearings: Grease-lubricated ball bearings in cast-iron housing.
 - 2) Seals: Stuffing box with minimum of four rings of graphite-impregnated braided yarn and bronze packing gland.
 - f. Mounting: Pump and driver shaft is vertical, with motor above pump and pump on base.
2. Coupling: None or rigid.
3. Driver:
 - a. Standard: UL 1004A.
 - b. Type: Electric motor; NEMA MG 1, polyphase Design B.

D. Horizontally Mounted, Single-Stage, Split-Case Fire Pumps

1. Pump:
 - a. Standard: UL 448, for split-case pumps for fire service.
 - b. Casing: Axially split case, cast iron with ASME B16.1 pipe-flange connections.
 - c. Impeller: Cast bronze, statically and dynamically balanced, and keyed to shaft.
 - d. Wear Rings: Replaceable bronze.
 - e. Shaft and Sleeve: Steel shaft with bronze sleeve.
 - 1) Shaft Bearings: Grease-lubricated ball bearings in cast-iron housing.
 - 2) Seals: Stuffing box with minimum of four rings of graphite-impregnated braided yarn and bronze packing gland.
 - f. Mounting: Pump and driver shafts are horizontal, with pump and driver on same base.
2. Coupling: Flexible and capable of absorbing torsional vibration and shaft misalignment. Include metal coupling guard.
3. Driver:
 - a. Standard: UL 1004A.
 - b. Type: Electric motor; NEMA MG 1, polyphase Design B.



- E. Horizontally Mounted, Multistage, Split-Case Fire Pumps
1. Pump:
 - a. Standard: UL 448, for split-case pumps for fire service.
 - b. Number of Stages: Two.
 - c. Casing: Axially split case, cast iron with ASME B16.1 pipe-flange connections.
 - d. Impeller: Cast bronze, statically and dynamically balanced, and keyed to shaft.
 - e. Wear Rings: Replaceable bronze.
 - f. Shaft and Sleeve: Steel shaft with bronze sleeve.
 - 1) Shaft Bearings: Grease-lubricated ball bearings in cast-iron housing.
 - 2) Seals: Stuffing box with minimum of four rings of graphite-impregnated braided yarn and bronze packing gland.
 - g. Mounting: Pump and driver shafts are horizontal, with pump and driver on same base.
 2. Coupling: Flexible and capable of absorbing torsional vibration and shaft misalignment. Include metal coupling guard.
 3. Driver:
 - a. Standard: UL 1004A.
 - b. Type: Electric motor; NEMA MG 1, polyphase Design B.
- F. Vertically Mounted, Single-Stage, Split-Case Fire Pumps
1. Pump:
 - a. Standard: UL 448, for split-case pumps for fire service.
 - b. Casing: Axially split case, cast iron with ASME B16.1 pipe-flange connections.
 - c. Impeller: Cast bronze, statically and dynamically balanced, and keyed to shaft.
 - d. Wear Rings: Replaceable bronze.
 - e. Shaft and Sleeve: Steel shaft with bronze sleeve.
 - 1) Shaft Bearings: Grease-lubricated ball bearings in cast-iron housing.
 - 2) Seals: Stuffing box with minimum of four rings of graphite-impregnated braided yarn and bronze packing gland.
 - f. Mounting: Pump and driver shafts are vertical, with motor above pump and pump on base.
 2. Coupling: Flexible and capable of absorbing torsional vibration and shaft misalignment. Include metal coupling guard.
 3. Driver:
 - a. Standard: UL 1004A.
 - b. Type: Electric motor; NEMA MG 1, polyphase Design B.
- G. Fire-Pump Accessories And Specialties
1. Automatic Air-Release Valves: Comply with NFPA 20 for installation in fire-pump casing.
 2. Circulation Relief Valves: UL 1478, brass, spring loaded; for installation in pump discharge piping.
 3. Relief Valves:
 - a. Description: UL 1478, bronze or cast iron, spring loaded; for installation in fire-suppression water-supply piping.
 4. Inlet Fitting: Eccentric tapered reducer at pump suction inlet.
 5. Outlet Fitting: Concentric tapered reducer at pump discharge outlet.
 6. Discharge Cone: Closed **OR** Open, **as directed**, type.
 7. Hose Valve Manifold Assembly:
 - a. Standard: Comply with requirements in NFPA 20.
 - b. Header Pipe: ASTM A 53/A 53M, Schedule 40, galvanized steel with ends threaded according to ASME B1.20.1.
 - c. Header Pipe Fittings: ASME B16.4, galvanized cast-iron threaded fittings.
 - d. Automatic Drain Valve: UL 1726.
 - e. Manifold:
 - 1) Test Connections: Comply with UL 405 except provide outlets without clappers instead of inlets.
 - 2) Body: Flush type, brass or ductile iron, with number of outlets required by NFPA 20.



- 3) Nipples: ASTM A 53/A 53M, Schedule 40, galvanized-steel pipe with ends threaded according to ASME B1.20.1.
 - 4) Adapters and Caps with Chain: Brass or bronze, with outlet threaded according to NFPA 1963 and matching local fire-department threads.
 - 5) Escutcheon Plate: Brass or bronze; rectangular.
 - 6) Hose Valves: UL 668, bronze, with outlet threaded according to NFPA 1963 and matching local fire-department threads.
 - 7) Exposed Parts Finish: Polished **OR** Rough, **as directed**, brass, chrome plated, **as directed**.
 - 8) Escutcheon Plate Marking: Equivalent to "FIRE PUMP TEST."
- OR**
Manifold:
- 1) Test Connections: Comply with UL 405 except provide outlets without clappers instead of inlets.
 - 2) Body: Exposed type, brass, with number of outlets required by NFPA 20.
 - 3) Escutcheon Plate: Brass or bronze; round.
 - 4) Hose Valves: UL 668, bronze, with outlet threaded according to NFPA 1963 and matching local fire-department threads. Include caps and chains.
 - 5) Exposed Parts Finish: Polished **OR** Rough, **as directed**, brass, chrome plated, **as directed**.
 - 6) Escutcheon Plate Marking: Equivalent to "FIRE PUMP TEST."

H. Flowmeter Systems

1. Description: UL-listed or FM-Approved, fire-pump flowmeter system with capability to indicate flow to not less than 175 percent of fire-pump rated capacity.
2. Pressure Rating: 175 psig (1200 kPa) minimum **OR** 250 psig (1725 kPa), **as directed**.
3. Sensor: Annubar probe, orifice plate, or venturi unless otherwise indicated. Sensor size shall match pipe, tubing, flowmeter, and fittings.
4. Permanently Mounted Flowmeter: Compatible with flow sensor; with dial not less than 4-1/2 inches (115 mm) in diameter. Include bracket or device for wall mounting.
 - a. Tubing Package: NPS 1/8 or NPS 1/4 (DN 6 or DN 10) soft copper **OR** plastic, **as directed**, tubing with copper or brass fittings and valves.

OR
Portable Flowmeter: Compatible with flow sensor; with dial not less than 4-1/2 inches (115 mm) in diameter and with two 12-foot- (3.7-m-) long hoses in carrying case.

I. Grout

1. Standard: ASTM C 1107, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
2. Characteristics: Nonshrink and recommended for interior and exterior applications.
3. Design Mix: 5000-psi (34-MPa), 28-day compressive strength.
4. Packaging: Premixed and factory packaged.

J. Source Quality Control

1. Testing: Test and inspect fire pumps according to UL 448 requirements for "Operation Test" and "Manufacturing and Production Tests."
 - a. Verification of Performance: Rate fire pumps according to UL 448.
2. Fire pumps will be considered defective if they do not pass tests and inspections.
3. Prepare test and inspection reports.

1.3 EXECUTION

A. Installation



1. Fire-Pump Installation Standard: Comply with NFPA 20 for installation of fire pumps, relief valves, and related components.
 2. Equipment Mounting: Install fire pumps on concrete bases. Comply with requirements for concrete bases specified in Division 03 Section "Cast-in-place Concrete".
 - a. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - b. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - d. Install anchor bolts to elevations required for proper attachment to supported equipment.
 3. Install fire-pump suction and discharge piping equal to or larger than sizes required by NFPA 20.
 4. Support piping and pumps separately so weight of piping does not rest on pumps.
 5. Install valves that are same size as connecting piping. Comply with requirements for fire-protection valves specified in Division 21 Section(s) "Fire-suppression Standpipes" OR "Wet-pipe Sprinkler Systems", **as directed**.
 6. Install pressure gages on fire-pump suction and discharge flange pressure-gage tappings. Comply with requirements for pressure gages specified in Division 21 Section(s) "Fire-suppression Standpipes" OR "Wet-pipe Sprinkler Systems", **as directed**.
 7. Install piping hangers and supports, anchors, valves, gages, and equipment supports according to NFPA 20.
 8. Install flowmeters and sensors. Install flowmeter-system components and make connections according to NFPA 20 and manufacturer's written instructions.
 9. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not factory mounted. Furnish copies of manufacturers' wiring diagram submittals to electrical Installer.
 10. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- B. Alignment
1. Align end-suction and split-case pump and driver shafts after complete unit has been leveled on concrete base, grout has set, and anchor bolts have been tightened.
 2. After alignment is correct, tighten anchor bolts evenly. Fill baseplate completely with grout, with metal blocks and shims or wedges in place. Tighten anchor bolts after grout has hardened. Check alignment and make required corrections.
 3. Align piping connections.
 4. Align pump and driver shafts for angular and parallel alignment according to HI 1.4 and to tolerances specified by manufacturer.
- C. Connections
1. Comply with requirements for piping and valves specified in Division 21 Section(s) "Fire-suppression Standpipes" OR "Wet-pipe Sprinkler Systems", **as directed**. Drawings indicate general arrangement of piping, fittings, and specialties.
 2. Install piping adjacent to pumps and equipment to allow service and maintenance.
 3. Connect relief-valve discharge to drainage piping or point of discharge.
 4. Connect flowmeter-system meters, sensors, and valves to tubing.
 5. Connect fire pumps to their controllers.
- D. Identification
1. Identify system components. Comply with requirements for fire-pump marking according to NFPA 20.
- E. Field Quality Control
1. Test each fire pump with its controller as a unit. Comply with requirements for electric-motor-driver fire-pump controllers specified in Division 21 Section(s) "Electric-drive, Centrifugal Fire Pumps" OR "Diesel-drive, Centrifugal Fire Pumps" OR "Electric-drive, Vertical-turbine Fire Pumps" OR "Diesel-drive, Vertical-turbine Fire Pumps".



2. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
 3. Perform tests and inspections.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
 4. Tests and Inspections:
 - a. After installing components, assemblies, and equipment including controller, test for compliance with requirements.
 - b. Test according to NFPA 20 for acceptance and performance testing.
 - c. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - d. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - e. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 5. Components, assemblies, and equipment will be considered defective if they do not pass tests and inspections.
 6. Prepare test and inspection reports.
 7. Furnish fire hoses in number, size, and length required to reach storm drain or other acceptable location to dispose of fire-pump test water. Hoses are for tests only and do not convey to the Owner.
- F. Demonstration
1. Train the Owner's maintenance personnel to adjust, operate, and maintain fire pumps.

END OF SECTION 21 31 13 00



Task	Specification	Specification Description
21 31 13 00	21 16 00 00	Pressure-Maintenance Pumps
21 31 13 00	21 16 00 00a	Controllers for Fire-Pump Drivers



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SECTION 21 31 16 00 - DIESEL-DRIVE, CENTRIFUGAL FIRE PUMPS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for diesel-drive, centrifugal fire pumps. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. End-suction and Split-case fire pumps.
 - b. Fire-pump accessories and specialties.
 - c. Flowmeter systems.

C. Performance Requirements

1. Seismic Performance: Fire pumps shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
2. Pump Equipment, Accessory, and Specialty Pressure Rating: 175 psig (1200 kPa) minimum unless higher pressure rating is indicated.

D. Submittals

1. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, performance curves, electrical characteristics, and furnished specialties and accessories.
2. Shop Drawings: For fire pumps, engine drivers, and fire-pump accessories and specialties. Include plans, elevations, sections, details, and attachments to other work.
 - a. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - b. Wiring Diagrams: For power, signal, and control wiring.
3. Seismic Qualification Certificates: For fire pumps, accessories, and components, from manufacturer.
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
4. Product Certificates: For each fire pump, from manufacturer.
5. Source quality-control reports.
6. Field quality-control reports.
7. Operation and maintenance data.

E. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. NFPA Compliance: Comply with NFPA 20, "Installation of Stationary Pumps for Fire Protection."

1.2 PRODUCTS



- A. General Requirements For Centrifugal Fire Pumps
1. Description: Factory-assembled and -tested fire-pump and driver unit.
 2. Base: Fabricated and attached to fire-pump and driver unit with reinforcement to resist movement of pump during seismic events when base is anchored to building substrate.
 3. Finish: Red paint applied to factory-assembled and -tested unit before shipping.
- B. End-Suction Fire Pumps
1. Pump:
 - a. Standard: UL 448, for end-suction pumps for fire service.
 - b. Casing: Radially split case, cast iron with ASME B16.1 pipe-flange connections.
 - c. Impeller: Cast bronze, statically and dynamically balanced, and keyed to shaft.
 - d. Wear Rings: Replaceable bronze.
 - e. Shaft and Sleeve: Steel shaft with bronze sleeve.
 - 1) Shaft Bearings: Grease-lubricated ball bearings in cast-iron housing.
 - 2) Seals: Stuffing box with minimum of four rings of graphite-impregnated braided yarn and bronze packing gland.
 - f. Mounting: Pump and driver shafts are horizontal, with pump and driver on same base.
 2. Coupling: Flexible and capable of absorbing torsional vibration and shaft misalignment. Include metal coupling guard.
 3. Driver:
 - a. Standard: UL 1247.
 - b. Type: Diesel engine.
 - c. Emergency Manual Operator: Factory wired for starting and operating standby engine in case of malfunction in main controller or wiring.
 - d. Engine Cooling System: Factory-installed radiator.
 - 1) Coolant: Type recommended by driver manufacturer.

OR

Engine Cooling System: Factory-installed water piping, valves, strainer, pressure regulator, heat exchanger, coolant pump, bypass piping, and fittings.
 - 1) Piping: ASTM B 88, Type L (ASTM B 88M, Type B), copper water tube; ASME B16.22, wrought-copper, solder-joint pressure fittings; AWS A5.8/A5.8M, BCuP Series brazing filler metal; and brazed joints.
 - e. Engine-Jacket Water Heater: Factory-installed electric elements.
 - f. Dual Batteries: Lead-acid-storage type with 100 percent standby reserve capacity.
 - g. Fuel System: Comply with NFPA 20.
 - 1) Fuel Storage Tank: Size indicated but not less than required by NFPA 20. Include floor legs, direct-reading level gage, and secondary containment tank with capacity at least equal to fuel storage tank.
 - h. Exhaust System: ASTM A 53/A 53M, Type E or S, Schedule 40, black steel pipe; ASME B16.9, weld-type pipe fittings; ASME B16.5, steel flanges; and ASME B16.21, nonmetallic gaskets. Fabricate double-wall, ventilated thimble from steel pipe.
 - 1) Exhaust Connector: Flexible type.
 - 2) Exhaust Silencer: Industrial **OR** Residential, **as directed**, type.
- C. Single-Stage, Split-Case Fire Pumps
1. Pump:
 - a. Standard: UL 448, for split-case pumps for fire service.
 - b. Casing: Axially split case, cast iron with ASME B16.1 pipe-flange connections.
 - c. Impeller: Cast bronze, statically and dynamically balanced, and keyed to shaft.
 - d. Wear Rings: Replaceable bronze.
 - e. Shaft and Sleeve: Steel shaft with bronze sleeve.
 - 1) Shaft Bearings: Grease-lubricated ball bearings in cast-iron housing.
 - 2) Seals: Stuffing box with minimum of four rings of graphite-impregnated braided yarn and bronze packing gland.
 - f. Mounting: Pump and driver shafts are horizontal, with pump and driver on same base.



2. Coupling: Flexible and capable of absorbing torsional vibration and shaft misalignment. Include metal coupling guard.
 3. Driver:
 - a. Standard: UL 1247.
 - b. Type: Diesel engine.
 - c. Emergency Manual Operator: Factory wired for starting and operating standby engine in case of malfunction in main controller or wiring.
 - d. Engine Cooling System: Factory-installed radiator.
 - 1) Coolant: Type recommended by driver manufacturer.

OR

Engine Cooling System: Factory-installed water piping, valves, strainer, pressure regulator, heat exchanger, coolant pump, bypass piping, and fittings.
 - 1) Piping: ASTM B 88, Type L (ASTM B 88M, Type B), copper water tube; ASME B16.22, wrought-copper, solder-joint pressure fittings; AWS A5.8/A5.8M, BCuP Series brazing filler metal; and brazed joints.
 - e. Engine-Jacket Water Heater: Factory-installed electric elements.
 - f. Dual Batteries: Lead-acid-storage type with 100 percent standby reserve capacity.
 - g. Fuel System: Comply with NFPA 20.
 - 1) Fuel Storage Tank: Size indicated but not less than required by NFPA 20. Include floor legs, direct-reading level gage, and secondary containment tank with capacity at least equal to fuel storage tank.
 - h. Exhaust System: ASTM A 53/A 53M, Type E or S, Schedule 40, black steel pipe; ASME B16.9, weld-type pipe fittings; ASME B16.5, steel flanges; and ASME B16.21, nonmetallic gaskets. Fabricate double-wall, ventilated thimble from steel pipe.
 - 1) Exhaust Connector: Flexible type.
 - 2) Exhaust Silencer: Industrial **OR** Residential, **as directed**, type.
- D. Multistage, Split-Case Fire Pumps
1. Pump:
 - a. Standard: UL 448, for split-case pumps for fire service.
 - b. Number Stages: Two.
 - c. Casing: Axially split case, cast iron with ASME B16.1 pipe-flange connections.
 - d. Impeller: Cast bronze, statically and dynamically balanced, and keyed to shaft.
 - e. Wear Rings: Replaceable bronze.
 - f. Shaft and Sleeve: Steel shaft with bronze sleeve.
 - 1) Shaft Bearings: Grease-lubricated ball bearings in cast-iron housing.
 - 2) Seals: Stuffing box with minimum of four rings of graphite-impregnated braided yarn and bronze packing gland.
 - g. Mounting: Pump and driver shafts are horizontal, with pump and driver on same base.
 2. Coupling: Flexible and capable of absorbing torsional vibration and shaft misalignment. Include metal coupling guard.
 3. Driver:
 - a. Standard: UL 1247.
 - b. Type: Diesel engine.
 - c. Emergency Manual Operator: Factory wired for starting and operating standby engine in case of malfunction in main controller or wiring.
 - d. Engine Cooling System: Factory-installed radiator.
 - 1) Coolant: Type recommended by driver manufacturer.

OR

Engine Cooling System: Factory-installed water piping, valves, strainer, pressure regulator, heat exchanger, coolant pump, bypass piping, and fittings.
 - 1) Piping: ASTM B 88, Type L (ASTM B 88M, Type B), copper water tube; ASME B16.22, wrought-copper, solder-joint pressure fittings; AWS A5.8/A5.8M, BCuP Series brazing filler metal; and brazed joints.
 - e. Engine-Jacket Water Heater: Factory-installed electric elements.
 - f. Dual Batteries: Lead-acid-storage type with 100 percent standby reserve capacity.



- g. Fuel System: Comply with NFPA 20.
 - 1) Fuel Storage Tank: Size indicated but not less than required by NFPA 20. Include floor legs, direct-reading level gage, and secondary containment tank with capacity at least equal to fuel storage tank.
 - h. Exhaust System: ASTM A 53/A 53M, Type E or S, Schedule 40, black steel pipe; ASME B16.9, weld-type pipe fittings; ASME B16.5, steel flanges; and ASME B16.21, nonmetallic gaskets. Fabricate double-wall, ventilated thimble from steel pipe.
 - 1) Exhaust Connector: Flexible type.
 - 2) Exhaust Silencer: Industrial **OR** Residential, **as directed**, type.
- E. Fire-Pump Accessories And Specialties
- 1. Automatic Air-Release Valves: Comply with NFPA 20 for installation in fire-pump casing.
 - 2. Circulation Relief Valves: UL 1478, brass, spring loaded; for installation in pump discharge piping.
 - 3. Relief Valves:
 - a. Description: UL 1478, bronze or cast iron, spring loaded; for installation in fire-suppression water-supply piping.
 - 4. Inlet Fitting: Eccentric tapered reducer at pump suction inlet.
 - 5. Outlet Fitting: Concentric tapered reducer at pump discharge outlet.
 - 6. Discharge Cone: Closed **OR** Open, **as directed**, type.
 - 7. Hose Valve Manifold Assembly:
 - a. Standard: Comply with requirements in NFPA 20.
 - b. Header Pipe: ASTM A 53/A 53M, Schedule 40, galvanized steel with ends threaded according to ASME B1.20.1.
 - c. Header Pipe Fittings: ASME B16.4, galvanized cast-iron threaded fittings.
 - d. Automatic Drain Valve: UL 1726.
 - e. Manifold:
 - 1) Test Connections: Comply with UL 405 except provide outlets without clappers instead of inlets.
 - 2) Body: Flush type, brass or ductile iron, with number of outlets required by NFPA 20.
 - 3) Nipples: ASTM A 53/A 53M, Schedule 40, galvanized-steel pipe with ends threaded according to ASME B1.20.1.
 - 4) Adapters and Caps with Chain: Brass or bronze, with outlet threaded according to NFPA 1963 and matching local fire-department threads.
 - 5) Escutcheon Plate: Brass or bronze; rectangular.
 - 6) Hose Valves: UL 668, bronze, with outlet threaded according to NFPA 1963 and matching local fire-department threads.
 - 7) Exposed Parts Finish: Polished **OR** Rough, **as directed**, brass, **as directed**, chrome plated, **as directed**.
 - 8) Escutcheon Plate Marking: Equivalent to "FIRE PUMP TEST."
- OR**
- Manifold:
- 1) Test Connections: Comply with UL 405 except provide outlets without clappers instead of inlets.
 - 2) Body: Exposed type, brass, with number of outlets required by NFPA 20.
 - 3) Escutcheon Plate: Brass or bronze; round.
 - 4) Hose Valves: UL 668, bronze, with outlet threaded according to NFPA 1963 and matching local fire-department threads. Include caps and chains.
 - 5) Exposed Parts Finish: Polished **OR** Rough, **as directed**, brass, **as directed**, chrome plated, **as directed**.
 - 6) Escutcheon Plate Marking: Equivalent to "FIRE PUMP TEST."
- F. Flowmeter Systems
- 1. Description: UL-listed or FM-Approved, fire-pump flowmeter system with capability to indicate flow to not less than 175 percent of fire-pump rated capacity.



2. Pressure Rating: 175 psig (1200 kPa) minimum **OR** 250 psig (1725 kPa), **as directed**.
3. Sensor: Annubar probe, orifice plate, or venturi unless otherwise indicated. Sensor size shall match pipe, tubing, flowmeter, and fittings.
4. Permanently Mounted Flowmeter: Compatible with flow sensor; with dial not less than 4-1/2 inches (115 mm) in diameter. Include bracket or device for wall mounting.
 - a. Tubing Package: NPS 1/8 or NPS 1/4 (DN 6 or DN 10) soft copper **OR** plastic, **as directed**, tubing with copper or brass fittings and valves.**OR**
Portable Flowmeter: Compatible with flow sensor; with dial not less than 4-1/2 inches (115 mm) in diameter and with two 12-foot- (3.7-m-) long hoses in carrying case.

G. Grout

1. Standard: ASTM C 1107, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
2. Characteristics: Nonshrink and recommended for interior and exterior applications.
3. Design Mix: 5000-psi (34-MPa), 28-day compressive strength.
4. Packaging: Premixed and factory packaged.

H. Source Quality Control

1. Testing: Test and inspect fire pumps according to UL 448 requirements for "Operation Test" and "Manufacturing and Production Tests."
 - a. Verification of Performance: Rate fire pumps according to UL 448.
2. Fire pumps will be considered defective if they do not pass tests and inspections.
3. Prepare test and inspection reports.

1.3 EXECUTION

A. Installation

1. Fire-Pump Installation Standard: Comply with NFPA 20 for installation of fire pumps, relief valves, and related components.
2. Equipment Mounting: Install fire pumps on concrete bases. Comply with requirements for concrete bases specified in Division 03 Section "Cast-in-place Concrete".
 - a. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - b. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - d. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install fire-pump suction and discharge piping equal to or larger than sizes required by NFPA 20.
4. Support piping and pumps separately so weight of piping does not rest on pumps.
5. Install valves that are same size as connecting piping. Comply with requirements for fire-protection valves specified in Division 21 Section(s) "Fire-suppression Standpipes" OR "Wet-pipe Sprinkler Systems", **as directed**.
6. Install pressure gages on fire-pump suction and discharge flange pressure-gage tappings. Comply with requirements for pressure gages specified in Division 21 Section(s) "Fire-suppression Standpipes" OR "Wet-pipe Sprinkler Systems", **as directed**.
7. Install piping hangers and supports, anchors, valves, gages, and equipment supports according to NFPA 20.
8. Install fuel system according to NFPA 20.
9. Install water supply and drain piping for diesel-engine heat exchangers. Extend drain piping from heat exchangers to point of disposal.
10. Install exhaust-system piping for diesel engines. Extend to point of termination outside structure. Install pipe and fittings with welded joints; install components having flanged connections with gasketed joints.



11. Install condensate-drain piping for diesel-engine exhaust system. Extend drain piping from low points of exhaust system to condensate traps and to point of disposal.
 12. Install flowmeters and sensors. Install flowmeter-system components and make connections according to NFPA 20 and manufacturer's written instructions.
 13. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not factory mounted. Furnish copies of manufacturers' wiring diagram submittals to electrical Installer.
 14. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- B. Alignment
1. Align end-suction and split-case pump and driver shafts after complete unit has been leveled on concrete base, grout has set, and anchor bolts have been tightened.
 2. After alignment is correct, tighten anchor bolts evenly. Fill baseplate completely with grout, with metal blocks and shims or wedges in place. Tighten anchor bolts after grout has hardened. Check alignment and make required corrections.
 3. Align piping connections.
 4. Align pump and driver shafts for angular and parallel alignment according to HI 1.4 and to tolerances specified by manufacturer.
- C. Connections
1. Comply with requirements for piping and valves specified in Division 21 Section(s) "Fire-suppression Standpipes" OR "Wet-pipe Sprinkler Systems", **as directed**. Drawings indicate general arrangement of piping, fittings, and specialties.
 2. Install piping adjacent to pumps and equipment to allow service and maintenance.
 3. Connect relief-valve discharge to drainage piping or point of discharge.
 4. Connect flowmeter-system meters, sensors, and valves to tubing.
 5. Connect fire pumps to their controllers.
- D. Identification
1. Identify system components. Comply with requirements for fire-pump marking according to NFPA 20.
- E. Field Quality Control
1. Test each fire pump with its controller as a unit. Comply with requirements for diesel-engine-driver fire-pump controllers specified in Division 21 Section(s) "Electric-drive, Centrifugal Fire Pumps" OR "Diesel-drive, Centrifugal Fire Pumps" OR "Electric-drive, Vertical-turbine Fire Pumps" OR "Diesel-drive, Vertical-turbine Fire Pumps".
 2. Perform tests and inspections.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
 3. Tests and Inspections:
 - a. After installing components, assemblies, and equipment including controller, test for compliance with requirements.
 - b. Test according to NFPA 20 for acceptance and performance testing.
 - c. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - d. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - e. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 4. Components, assemblies, and equipment will be considered defective if they do not pass tests and inspections.
 5. Prepare test and inspection reports.



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6. Furnish fire hoses in number, size, and length required to reach storm drain or other acceptable location to dispose of fire-pump test water. Hoses are for tests only and do not convey to the Owner.

 - F. Startup Service
 1. Perform startup service.
 - a. Complete installation and startup checks according to manufacturer's written instructions.

 - G. Demonstration
 1. Train the Owner's maintenance personnel to adjust, operate, and maintain fire pumps.

END OF SECTION 21 31 16 00



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Task	Specification	Specification Description
21 31 16 00	21 16 00 00	Pressure-Maintenance Pumps
21 31 16 00	21 16 00 00a	Controllers for Fire-Pump Drivers



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Task	Specification	Specification Description
22 01 40 00	10 28 19 16	Plumbing Fixtures
22 01 40 00	01 95 22 00	Emergency Plumbing Fixtures



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SECTION 22 05 13 00 - COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for common motor requirements for plumbing equipment. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

C. Coordination

1. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - a. Motor controllers.
 - b. Torque, speed, and horsepower requirements of the load.
 - c. Ratings and characteristics of supply circuit and required control sequence.
 - d. Ambient and environmental conditions of installation location.

1.2 PRODUCTS

A. General Motor Requirements

1. Comply with requirements in this Section except when stricter requirements are specified in plumbing equipment schedules or Sections.
2. Comply with NEMA MG 1 unless otherwise indicated.
3. Comply with IEEE 841 for severe-duty motors.

B. Motor Characteristics

1. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet (1000 m) above sea level.
2. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

C. Polyphase Motors

1. Description: NEMA MG 1, Design B, medium induction motor.
2. Efficiency: Energy efficient, as defined in NEMA MG 1.
3. Service Factor: 1.15.
4. Multispeed Motors: Variable torque.
 - a. For motors with 2:1 speed ratio, consequent pole, single winding.
 - b. For motors with other than 2:1 speed ratio, separate winding for each speed.
5. Multispeed Motors: Separate winding for each speed.
6. Rotor: Random-wound, squirrel cage.
7. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
8. Temperature Rise: Match insulation rating.
9. Insulation: Class F.
10. Code Letter Designation:
 - a. Motors 15 HP and Larger: NEMA starting Code F or Code G.



- b. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- 11. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

D. Polyphase Motors With Additional Requirements

- 1. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- 2. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 - a. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
 - b. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - c. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - d. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
- 3. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

E. Single-Phase Motors

- 1. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - a. Permanent-split capacitor.
 - b. Split phase.
 - c. Capacitor start, inductor run.
 - d. Capacitor start, capacitor run.
- 2. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- 3. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- 4. Motors 1/20 HP and Smaller: Shaded-pole type.
- 5. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

1.3 EXECUTION (Not Applicable)

END OF SECTION 22 05 13 00



SECTION 22 05 23 00 - PIPED UTILITIES BASIC MATERIALS AND METHODS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for piped utilities - basic materials and methods. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Piping joining materials.
 - b. Transition fittings.
 - c. Dielectric fittings.
 - d. Sleeves.
 - e. Identification devices.
 - f. Grout.
 - g. Flowable fill.
 - h. Piped utility demolition.
 - i. Piping system common requirements.
 - j. Equipment installation common requirements.
 - k. Painting.
 - l. Concrete bases.
 - m. Metal supports and anchorages.

C. Definitions

1. Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.
2. Concealed Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
3. ABS: Acrylonitrile-butadiene-styrene plastic.
4. CPVC: Chlorinated polyvinyl chloride plastic.
5. PE: Polyethylene plastic.
6. PVC: Polyvinyl chloride plastic.

D. Submittals

1. Product Data: For the following:
 - a. Dielectric fittings.
 - b. Identification devices.
2. Welding certificates.

E. Quality Assurance

1. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. Steel Piping Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - a. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - b. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
3. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.



F. Delivery, Storage, And Handling

1. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
2. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.2 PRODUCTS

A. Piping Joining Materials

1. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - a. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch (3.2-mm) maximum thickness, unless otherwise indicated.
 - 1) Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - 2) Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 - b. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
3. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
4. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
5. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BA91, silver alloy for refrigerant piping, unless otherwise indicated.
6. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
7. Solvent Cements for Joining Plastic Piping:
 - a. ABS Piping: ASTM D 2235.
 - b. CPVC Piping: ASTM F 493.
 - c. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 - d. PVC to ABS Piping Transition: ASTM D 3138.
8. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

B. Transition Fittings

1. Transition Fittings, General: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
2. Transition Couplings NPS 1-1/2 (DN 40) and Smaller:
 - a. Underground Piping: Manufactured piping coupling or specified piping system fitting.
 - b. Aboveground Piping: Specified piping system fitting.
3. AWWA Transition Couplings NPS 2 (DN 50) and Larger:
 - a. Description: AWWA C219, metal sleeve-type coupling for underground pressure piping.
4. Plastic-to-Metal Transition Fittings:
 - a. Description: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint or threaded end.
5. Plastic-to-Metal Transition Unions:
 - a. Description: MSS SP-107, CPVC and PVC four-part union. Include brass or stainless-steel threaded end, solvent-cement-joint or threaded plastic end, rubber O-ring, and union nut.
6. Flexible Transition Couplings for Underground Nonpressure Drainage Piping:
 - a. Description: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.



C. Dielectric Fittings

1. Dielectric Fittings, General: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.
2. Dielectric Unions:
 - a. Description: Factory fabricated, union, NPS 2 (DN 50) and smaller.
 - 1) Pressure Rating: 150 psig (1035 kPa) minimum **OR** 250 psig (1725 kPa), **as directed**, at 180 deg F (82 deg C).
 - 2) End Connections: Solder-joint copper alloy and threaded ferrous; threaded ferrous.
3. Dielectric Flanges:
 - a. Description: Factory-fabricated, bolted, companion-flange assembly, NPS 2-1/2 to NPS 4 (DN 65 to DN 100) and larger.
 - 1) Pressure Rating: 150 psig (1035 kPa) minimum **OR** 175 psig (1200 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - 2) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
4. Dielectric-Flange Kits:
 - a. Description: Nonconducting materials for field assembly of companion flanges, NPS 2-1/2 (DN 65) and larger.
 - 1) Pressure Rating: 150 psig (1035 kPa) minimum.
 - 2) Gasket: Neoprene or phenolic.
 - 3) Bolt Sleeves: Phenolic or polyethylene.
 - 4) Washers: Phenolic with steel backing washers.
5. Dielectric Couplings:
 - a. Description: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining, NPS 3 (DN 80) and smaller.
 - 1) Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C).
 - 2) End Connections: Threaded.
6. Dielectric Nipples:
 - a. Description: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining.
 - 1) Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C).
 - 2) End Connections: Threaded or grooved.

D. Sleeves

1. Mechanical sleeve seals for pipe penetrations are specified in Division 22 Section "Common Work Results For Plumbing".
2. Galvanized-Steel Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
3. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized, plain ends.
4. Cast-Iron Sleeves: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
5. Molded PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.
6. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.
7. Molded PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

E. Identification Devices

1. Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.
 - a. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.
 - b. Location: Accessible and visible.
2. Stencils: Standard stencils prepared with letter sizes complying with recommendations in ASME A13.1. Minimum letter height is 1-1/4 inches (30 mm) for ducts, and 3/4 inch (20 mm) for access door signs and similar operational instructions.
 - a. Material: Fiberboard **OR** Brass, **as directed**.



- b. Stencil Paint: Exterior, oil-based, alkyd-gloss black enamel, unless otherwise indicated. Paint may be in pressurized spray-can form.
 - c. Identification Paint: Exterior, oil-based, alkyd enamel in colors according to ASME A13.1, unless otherwise indicated.
3. Snap-on Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap-on type. Include color-coding according to ASME A13.1, unless otherwise indicated.
4. Pressure-Sensitive Pipe Markers: Manufacturer's standard preprinted, color-coded, pressure-sensitive-vinyl type with permanent adhesive.
5. Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): Full-band pipe markers, extending 360 degrees around pipe at each location.
6. Pipes with OD, Including Insulation, 6 Inches (150 mm) and Larger: Either full-band or strip-type pipe markers, at least three times letter height and of length required for label.
7. Lettering: Manufacturer's standard preprinted captions as selected by the Owner.
8. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
 - a. Arrows: Either integrally with piping system service lettering to accommodate both directions of flow, or as separate unit on each pipe marker to indicate direction of flow.
9. Plastic Tape: Manufacturer's standard color-coded, pressure-sensitive, self-adhesive vinyl tape, at least 3 mils (0.08 mm) thick.
 - a. Width: 1-1/2 inches (40 mm) on pipes with OD, including insulation, less than 6 inches (150 mm); 2-1/2 inches (65 mm) for larger pipes.
 - b. Color: Comply with ASME A13.1, unless otherwise indicated.
10. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) sequenced numbers. Include 5/32-inch (4-mm) hole for fastener.
 - a. Material: 0.032-inch- (0.8-mm-) thick, polished brass **OR** aluminum, **as directed**.
 - b. Material: 0.0375-inch- (1-mm-) thick stainless steel.
 - c. Material: 3/32-inch- (2.4-mm-) thick plastic laminate with 2 black surfaces and a white inner layer.
 - d. Material: Valve manufacturer's standard solid plastic.
 - e. Size: 1-1/2 inches (40 mm) in diameter, unless otherwise indicated.
 - f. Shape: As indicated for each piping system.
11. Valve Tag Fasteners: Brass, wire-link or beaded chain; or brass S-hooks.
12. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.
 - a. Engraving: Engraver's standard letter style, of sizes and with terms to match equipment identification.
 - b. Thickness: 1/16 inch (1.6 mm), for units up to 20 sq. in. (130 sq. cm) or 8 inches (200 mm) in length, and 1/8 inch (3 mm) for larger units.
 - c. Fasteners: Self-tapping, stainless-steel screws or contact-type permanent adhesive.
13. Plastic Equipment Markers: Manufacturer's standard laminated plastic, in the following color codes:
 - a. Green: Cooling equipment and components.
 - b. Yellow: Heating equipment and components.
 - c. Brown: Energy reclamation equipment and components.
 - d. Blue: Equipment and components that do not meet criteria above.
 - e. Hazardous Equipment: Use colors and designs recommended by ASME A13.1.
 - f. Terminology: Match schedules as closely as possible. Include the following:
 - 1) Name and plan number.
 - 2) Equipment service.
 - 3) Design capacity.
 - 4) Other design parameters such as pressure drop, entering and leaving conditions, and speed.



- g. Size: 2-1/2 by 4 inches (65 by 100 mm) for control devices, dampers, and valves; 4-1/2 by 6 inches (115 by 150 mm) for equipment.
14. Plasticized Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with mat finish suitable for writing.
 - a. Size: 3-1/4 by 5-5/8 inches (83 by 143 mm).
 - b. Fasteners: Brass grommets and wire.
 - c. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.
15. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in piped utility identification with corresponding designations indicated. Use numbers, letters, and terms indicated for proper identification, operation, and maintenance of piped utility systems and equipment.
 - a. Multiple Systems: Identify individual system number and service if multiple systems of same name are indicated.

F. Grout

1. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - a. Characteristics: Post hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - b. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
 - c. Packaging: Premixed and factory packaged.

G. Flowable Fill

1. Description: Low-strength-concrete, flowable-slurry mix.
 - a. Cement: ASTM C 150, Type I, portland.
 - b. Density: 115- to 145-lb/cu. ft. (1840- to 2325-kg/cu. m).
 - c. Aggregates: ASTM C 33, natural sand, fine and crushed gravel or stone, coarse
OR
Aggregates: ASTM C 33, natural sand, fine with admixture, ASTM C 618, fly-ash mineral.
 - d. Water: Comply with ASTM C 94/C 94M.
 - e. Strength: 100 to 200 psig (690 to 1380 kPa) at 28 days.

1.3 EXECUTION

A. Piped Utility Demolition

1. Refer to Division 01 Section(s) "Cutting And Patching" AND Division 02 Section(s) "Selective Structure Demolition" for general demolition requirements and procedures.
2. Disconnect, demolish, and remove piped utility systems, equipment, and components indicated to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - b. Piping to Be Abandoned in Place: Drain piping. Fill abandoned piping with flowable fill, and cap or plug piping with same or compatible piping material.
 - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make operational.
 - e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to the Owner.
3. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

B. Dielectric Fitting Applications

1. Dry Piping Systems: Connect piping of dissimilar metals with the following:
 - a. NPS 2 (DN 50) and Smaller: Dielectric unions.
 - b. NPS 2-1/2 to NPS 12 (DN 65 to DN 300): Dielectric flanges or dielectric flange kits.



2. Wet Piping Systems: Connect piping of dissimilar metals with the following:
 - a. NPS 2 (DN 50) and Smaller: Dielectric couplings **OR** dielectric nipples, **as directed**.
 - b. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Dielectric nipples.
 - c. NPS 2-1/2 to NPS 8 (DN 65 to DN 200): Dielectric nipples or dielectric flange kits.
 - d. NPS 10 and NPS 12 (DN 250 and DN 300): Dielectric flange kits.

C. Piping Installation

1. Install piping according to the following requirements and Division 33 specifying piping systems.
2. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on the Coordination Drawings.
3. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
4. Install piping to permit valve servicing.
5. Install piping at indicated slopes.
6. Install piping free of sags and bends.
7. Install fittings for changes in direction and branch connections.
8. Select system components with pressure rating equal to or greater than system operating pressure.
9. Sleeves are not required for core-drilled holes, unless directed otherwise.
10. Permanent sleeves are not required for holes formed by removable PE sleeves, unless directed otherwise.
11. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
 - a. Cut sleeves to length for mounting flush with both surfaces.
 - 1) Exception: Extend sleeves installed in floors of equipment areas or other wet areas 2 inches (50 mm) above finished floor level.
 - b. Install sleeves in new walls and slabs as new walls and slabs are constructed.
 - 1) PVC **OR** Steel, **as directed**, Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
 - 2) Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.
12. Verify final equipment locations for roughing-in.
13. Refer to equipment specifications in other Sections for roughing-in requirements.

D. Piping Joint Construction

1. Join pipe and fittings according to the following requirements and Division 33 specifying piping systems.
2. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
3. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
4. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
5. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1.1 "Quality Assurance" Article.
6. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
7. Grooved Joints: Assemble joints with grooved-end pipe coupling with coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.



8. Soldered Joints: Apply ASTM B 813 water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy (0.20 percent maximum lead content) complying with ASTM B 32.
 9. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
 10. Pressure-Sealed Joints: Assemble joints for plain-end copper tube and mechanical pressure seal fitting with proprietary crimping tool to according to fitting manufacturer's written instructions.
 11. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - b. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 appendixes.
 - c. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - d. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 - e. PVC Nonpressure Piping: Join according to ASTM D 2855.
 - f. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.
 12. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
 13. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
 14. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 - a. Plain-End PE Pipe and Fittings: Use butt fusion.
 - b. Plain-End PE Pipe and Socket Fittings: Use socket fusion.
 15. Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.
- E. Piping Connections
1. Make connections according to the following, unless otherwise indicated:
 - a. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - b. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
 - c. Install dielectric fittings at connections of dissimilar metal pipes.
- F. Equipment Installation
1. Install equipment level and plumb, unless otherwise indicated.
 2. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference with other installations. Extend grease fittings to an accessible location.
 3. Install equipment to allow right of way to piping systems installed at required slope.
- G. Painting
1. Painting of piped utility systems, equipment, and components is specified in Division 09.
 2. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.
- H. Identification
1. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.
 - a. Stenciled Markers: According to ASME A13.1.
 - b. Plastic markers, with application systems. Install on insulation segment if required for hot noninsulated piping.
 - c. Locate pipe markers on exposed piping according to the following:
 - 1) Near each valve and control device.



- 2) Near each branch, excluding short takeoffs for equipment and terminal units. Mark each pipe at branch if flow pattern is not obvious.
 - 3) Near locations where pipes pass through walls or floors or enter inaccessible enclosures.
 - 4) At manholes and similar access points that permit view of concealed piping.
 - 5) Near major equipment items and other points of origination and termination.
2. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of equipment.
 - a. Lettering Size: Minimum 1/4 inch (6.4 mm) high for name of unit if viewing distance is less than 24 inches (610 mm), 1/2 inch (13 mm) high for distances up to 72 inches (1800 mm), and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.
 - b. Text of Signs: Provide name of identified unit. Include text to distinguish among multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.
 3. Adjusting: Relocate identifying devices that become visually blocked by work of this or other Divisions.

I. Concrete Bases

1. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 - a. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
 - b. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of base.
 - c. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - d. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - e. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - f. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 - g. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-place Concrete".

J. Erection Of Metal Supports And Anchorages

1. Refer to Division 05 Section "Metal Fabrications" for structural steel.
2. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor piped utility materials and equipment.
3. Field Welding: Comply with AWS D1.1/D1.1M.

K. Grouting

1. Mix and install grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors.
2. Clean surfaces that will come into contact with grout.
3. Provide forms as required for placement of grout.
4. Avoid air entrapment during placement of grout.
5. Place grout, completely filling equipment bases.
6. Place grout on concrete bases and provide smooth bearing surface for equipment.
7. Place grout around anchors.
8. Cure placed grout.

END OF SECTION 22 05 23 00



SECTION 22 05 23 00a - GENERAL-DUTY VALVES FOR PLUMBING PIPING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of general-duty valves for plumbing piping. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Bronze angle valves.
 - b. Brass ball valves.
 - c. Bronze ball valves.
 - d. Iron ball valves.
 - e. Iron, single-flange butterfly valves.
 - f. Iron, grooved-end butterfly valves.
 - g. Bronze lift check valves.
 - h. Bronze swing check valves.
 - i. Iron swing check valves.
 - j. Iron swing check valves with closure control.
 - k. Iron, grooved-end swing check valves.
 - l. Iron, center-guided check valves.
 - m. Iron, plate-type check valves.
 - n. Bronze gate valves.
 - o. Iron gate valves.
 - p. Bronze globe valves.
 - q. Iron globe valves.
 - r. Lubricated plug valves.
 - s. Chainwheels.

C. Definitions

1. CWP: Cold working pressure.
2. EPDM: Ethylene propylene copolymer rubber.
3. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
4. NRS: Nonrising stem.
5. OS&Y: Outside screw and yoke.
6. RS: Rising stem.
7. SWP: Steam working pressure.

D. Submittals

1. Product Data: For each type of valve indicated.

E. Quality Assurance

1. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
2. ASME Compliance:
 - a. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - b. ASME B31.1 for power piping valves.
 - c. ASME B31.9 for building services piping valves.
3. NSF Compliance: NSF 61 for valve materials for potable-water service.

F. Delivery, Storage, And Handling



1. Prepare valves for shipping as follows:
 - a. Protect internal parts against rust and corrosion.
 - b. Protect threads, flange faces, grooves, and weld ends.
 - c. Set angle, gate, and globe valves closed to prevent rattling.
 - d. Set ball and plug valves open to minimize exposure of functional surfaces.
 - e. Set butterfly valves closed or slightly open.
 - f. Block check valves in either closed or open position.
2. Use the following precautions during storage:
 - a. Maintain valve end protection.
 - b. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
3. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

1.2 PRODUCTS

A. General Requirements For Valves

1. Refer to valve schedule articles for applications of valves.
2. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
3. Valve Sizes: Same as upstream piping unless otherwise indicated.
4. Valve Actuator Types:
 - a. Gear Actuator: For quarter-turn valves NPS 8 (DN 200) and larger.
 - b. Handwheel: For valves other than quarter-turn types.
 - c. Handlever: For quarter-turn valves NPS 6 (DN 150) and smaller except plug valves, **as directed**.
 - d. Wrench: For plug valves with square heads. Furnish the Owner with 1 wrench for every 5 **OR 10, as directed**, plug valves, for each size square plug-valve head.
 - e. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.
5. Valves in Insulated Piping: With 2-inch (50-mm) stem extensions and the following features:
 - a. Gate Valves: With rising stem.
 - b. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
 - c. Butterfly Valves: With extended neck.
6. Valve-End Connections:
 - a. Flanged: With flanges according to ASME B16.1 for iron valves.
 - b. Grooved: With grooves according to AWWA C606.
 - c. Solder Joint: With sockets according to ASME B16.18.
 - d. Threaded: With threads according to ASME B1.20.1.
7. Valve Bypass and Drain Connections: MSS SP-45.

B. Bronze Angle Valves

1. Class 125, Bronze Angle Valves with Bronze Disc:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 1.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - 4) Ends: Threaded.
 - 5) Stem and Disc: Bronze.
 - 6) Packing: Asbestos free.
 - 7) Handwheel: Malleable iron, bronze, or aluminum, **as directed**.
2. Class 125, Bronze Angle Valves with Nonmetallic Disc:



- a. Description:
 - 1) Standard: MSS SP-80, Type 2.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - 4) Ends: Threaded.
 - 5) Stem: Bronze.
 - 6) Disc: PTFE or TFE.
 - 7) Packing: Asbestos free.
 - 8) Handwheel: Malleable iron, bronze, or aluminum, **as directed**.
 3. Class 150, Bronze Angle Valves with Bronze Disc:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 1.
 - 2) CWP Rating: 300 psig (2070 kPa).
 - 3) Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
 - 4) Ends: Threaded.
 - 5) Stem and Disc: Bronze.
 - 6) Packing: Asbestos free.
 - 7) Handwheel: Malleable iron, bronze, or aluminum, **as directed**.
 4. Class 150, Bronze Angle Valves with Nonmetallic Disc:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 2.
 - 2) CWP Rating: 300 psig (2070 kPa).
 - 3) Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
 - 4) Ends: Threaded.
 - 5) Stem: Bronze.
 - 6) Disc: PTFE or TFE.
 - 7) Packing: Asbestos free.
 - 8) Handwheel: Malleable iron, bronze, or aluminum, **as directed**.
- C. Brass Ball Valves
1. One-Piece, Reduced-Port, Brass Ball Valves with Brass Trim:
 - a. Description:
 - 1) Standard: MSS SP-110.
 - 2) CWP Rating: 400 psig (2760 kPa).
 - 3) Body Design: One piece.
 - 4) Body Material: Forged brass.
 - 5) Ends: Threaded.
 - 6) Seats: PTFE or TFE.
 - 7) Stem: Brass.
 - 8) Ball: Chrome-plated brass.
 - 9) Port: Reduced.
 2. Two-Piece, Full-Port, Brass Ball Valves with Brass Trim:
 - a. Description:
 - 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Two piece.
 - 5) Body Material: Forged brass.
 - 6) Ends: Threaded.
 - 7) Seats: PTFE or TFE.
 - 8) Stem: Brass.
 - 9) Ball: Chrome-plated brass.
 - 10) Port: Full.
 3. Two-Piece, Full-Port, Brass Ball Valves with Stainless-Steel Trim:
 - a. Description:
 - 1) Standard: MSS SP-110.



- 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Two piece.
 - 5) Body Material: Forged brass.
 - 6) Ends: Threaded.
 - 7) Seats: PTFE or TFE.
 - 8) Stem: Stainless steel.
 - 9) Ball: Stainless steel, vented.
 - 10) Port: Full.
4. Two-Piece, Regular-Port, Brass Ball Valves with Brass Trim:
 - a. Description:
 - 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Two piece.
 - 5) Body Material: Forged brass.
 - 6) Ends: Threaded.
 - 7) Seats: PTFE or TFE.
 - 8) Stem: Brass.
 - 9) Ball: Chrome-plated brass.
 - 10) Port: Regular.
 5. Two-Piece, Regular-Port, Brass Ball Valves with Stainless-Steel Trim:
 - a. Description:
 - 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Two piece.
 - 5) Body Material: Brass or bronze.
 - 6) Ends: Threaded.
 - 7) Seats: PTFE or TFE.
 - 8) Stem: Stainless steel.
 - 9) Ball: Stainless steel, vented.
 - 10) Port: Regular.
 6. Three-Piece, Full-Port, Brass Ball Valves with Brass Trim:
 - a. Description:
 - 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Three piece.
 - 5) Body Material: Forged brass.
 - 6) Ends: Threaded.
 - 7) Seats: PTFE or TFE.
 - 8) Stem: Brass.
 - 9) Ball: Chrome-plated brass.
 - 10) Port: Full.
 7. Three-Piece, Full-Port, Brass Ball Valves with Stainless-Steel Trim:
 - a. Description:
 - 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Three piece.
 - 5) Body Material: Forged brass.
 - 6) Ends: Threaded.
 - 7) Seats: PTFE or TFE.
 - 8) Stem: Stainless steel.



- 9) Ball: Stainless steel, vented.
- 10) Port: Full.

D. Bronze Ball Valves

1. One-Piece, Reduced-Port, Bronze Ball Valves with Bronze Trim:
 - a. Description:
 - 1) Standard: MSS SP-110.
 - 2) CWP Rating: 400 psig (2760 kPa).
 - 3) Body Design: One piece.
 - 4) Body Material: Bronze.
 - 5) Ends: Threaded.
 - 6) Seats: PTFE or TFE.
 - 7) Stem: Bronze.
 - 8) Ball: Chrome-plated brass.
 - 9) Port: Reduced.
2. One-Piece, Reduced-Port, Bronze Ball Valves with Stainless-Steel Trim:
 - a. Description:
 - 1) Standard: MSS SP-110.
 - 2) CWP Rating: 600 psig (4140 kPa).
 - 3) Body Design: One piece.
 - 4) Body Material: Bronze.
 - 5) Ends: Threaded.
 - 6) Seats: PTFE or TFE.
 - 7) Stem: Stainless steel.
 - 8) Ball: Stainless steel, vented.
 - 9) Port: Reduced.
3. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:
 - a. Description:
 - 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Two piece.
 - 5) Body Material: Bronze.
 - 6) Ends: Threaded.
 - 7) Seats: PTFE or TFE.
 - 8) Stem: Bronze.
 - 9) Ball: Chrome-plated brass.
 - 10) Port: Full.
4. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:
 - a. Description:
 - 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Two piece.
 - 5) Body Material: Bronze.
 - 6) Ends: Threaded.
 - 7) Seats: PTFE or TFE.
 - 8) Stem: Stainless steel.
 - 9) Ball: Stainless steel, vented.
 - 10) Port: Full.
5. Two-Piece, Regular-Port, Bronze Ball Valves with Bronze Trim:
 - a. Description:
 - 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Two piece.



- 5) Body Material: Bronze.
 - 6) Ends: Threaded.
 - 7) Seats: PTFE or TFE.
 - 8) Stem: Bronze.
 - 9) Ball: Chrome-plated brass.
 - 10) Port: Regular.
6. Two-Piece, Regular-Port, Bronze Ball Valves with Stainless-Steel Trim:
 - a. Description:
 - 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Two piece.
 - 5) Body Material: Bronze.
 - 6) Ends: Threaded.
 - 7) Seats: PTFE or TFE.
 - 8) Stem: Stainless steel.
 - 9) Ball: Stainless steel, vented.
 - 10) Port: Regular.
 7. Three-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:
 - a. Description:
 - 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Three piece.
 - 5) Body Material: Bronze.
 - 6) Ends: Threaded.
 - 7) Seats: PTFE or TFE.
 - 8) Stem: Bronze.
 - 9) Ball: Chrome-plated brass.
 - 10) Port: Full.
 8. Three-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:
 - a. Description:
 - 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Three piece.
 - 5) Body Material: Bronze.
 - 6) Ends: Threaded.
 - 7) Seats: PTFE or TFE.
 - 8) Stem: Stainless steel.
 - 9) Ball: Stainless steel, vented.
 - 10) Port: Full.

E. Iron Ball Valves

1. Class 125, Iron Ball Valves:
 - a. Description:
 - 1) Standard: MSS SP-72.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Split body.
 - 4) Body Material: ASTM A 126, gray iron.
 - 5) Ends: Flanged.
 - 6) Seats: PTFE or TFE.
 - 7) Stem: Stainless steel.
 - 8) Ball: Stainless steel.
 - 9) Port: Full.



F. Iron, Single-Flange Butterfly Valves

1. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Aluminum-Bronze Disc:
 - a. Description:
 - 1) Standard: MSS SP-67, Type I.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - 4) Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - 5) Seat: EPDM.
 - 6) Stem: One- or two-piece stainless steel.
 - 7) Disc: Aluminum bronze.
2. 200 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Aluminum-Bronze Disc:
 - a. Description:
 - 1) Standard: MSS SP-67, Type I.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - 4) Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - 5) Seat: NBR.
 - 6) Stem: One- or two-piece stainless steel.
 - 7) Disc: Aluminum bronze.
3. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Ductile-Iron Disc:
 - a. Description:
 - 1) Standard: MSS SP-67, Type I.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - 4) Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - 5) Seat: EPDM.
 - 6) Stem: One- or two-piece stainless steel.
 - 7) Disc: Nickel-plated or -coated, **as directed**, ductile iron.
4. 200 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Ductile-Iron Disc:
 - a. Description:
 - 1) Standard: MSS SP-67, Type I.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - 4) Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - 5) Seat: NBR.
 - 6) Stem: One- or two-piece stainless steel.
 - 7) Disc: Nickel-plated or -coated, **as directed**, ductile iron.
5. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Stainless-Steel Disc:
 - a. Description:
 - 1) Standard: MSS SP-67, Type I.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - 4) Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - 5) Seat: EPDM.
 - 6) Stem: One- or two-piece stainless steel.
 - 7) Disc: Stainless steel.
6. 200 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Stainless-Steel Disc:
 - a. Description:
 - 1) Standard: MSS SP-67, Type I.
 - 2) CWP Rating: 200 psig (1380 kPa).



- 3) Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
- 4) Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
- 5) Seat: NBR.
- 6) Stem: One- or two-piece stainless steel.
- 7) Disc: Stainless steel.

G. Iron, Grooved-End Butterfly Valves

1. 175 CWP, Iron, Grooved-End Butterfly Valves:
 - a. Description:
 - 1) Standard: MSS SP-67, Type I.
 - 2) CWP Rating: 175 psig (1200 kPa).
 - 3) Body Material: Coated, ductile iron.
 - 4) Stem: Two-piece stainless steel.
 - 5) Disc: Coated, ductile iron.
 - 6) Seal: EPDM.
2. 300 CWP, Iron, Grooved-End Butterfly Valves:
 - a. Description:
 - 1) Standard: MSS SP-67, Type I.
 - 2) NPS 8 (DN 200) and Smaller CWP Rating: 300 psig (2070 kPa).
 - 3) NPS 10 (DN 250) and Larger CWP Rating: 200 psig (1380 kPa).
 - 4) Body Material: Coated, ductile iron.
 - 5) Stem: Two-piece stainless steel.
 - 6) Disc: Coated, ductile iron.
 - 7) Seal: EPDM.

H. Bronze Lift Check Valves

1. Class 125, Lift Check Valves with Bronze Disc:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 1.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Vertical flow.
 - 4) Body Material: ASTM B 61 or ASTM B 62, bronze.
 - 5) Ends: Threaded.
 - 6) Disc: Bronze.
2. Class 125, Lift Check Valves with Nonmetallic Disc:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 2.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Vertical flow.
 - 4) Body Material: ASTM B 61 or ASTM B 62, bronze.
 - 5) Ends: Threaded.
 - 6) Disc: NBR, PTFE, or TFE.

I. Bronze Swing Check Valves

1. Class 125, Bronze Swing Check Valves with Bronze Disc:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 3.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Horizontal flow.
 - 4) Body Material: ASTM B 62, bronze.
 - 5) Ends: Threaded.
 - 6) Disc: Bronze.
2. Class 125, Bronze Swing Check Valves with Nonmetallic Disc:
 - a. Description:



- 1) Standard: MSS SP-80, Type 4.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Horizontal flow.
 - 4) Body Material: ASTM B 62, bronze.
 - 5) Ends: Threaded.
 - 6) Disc: PTFE or TFE.
3. Class 150, Bronze Swing Check Valves with Bronze Disc:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 3.
 - 2) CWP Rating: 300 psig (2070 kPa).
 - 3) Body Design: Horizontal flow.
 - 4) Body Material: ASTM B 62, bronze.
 - 5) Ends: Threaded.
 - 6) Disc: Bronze.
 4. Class 150, Bronze Swing Check Valves with Nonmetallic Disc:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 4.
 - 2) CWP Rating: 300 psig (2070 kPa).
 - 3) Body Design: Horizontal flow.
 - 4) Body Material: ASTM B 62, bronze.
 - 5) Ends: Threaded.
 - 6) Disc: PTFE or TFE.
- J. Iron Swing Check Valves
1. Class 125, Iron Swing Check Valves with Metal Seats:
 - a. Description:
 - 1) Standard: MSS SP-71, Type I.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Clear or full waterway.
 - 4) Body Material: ASTM A 126, gray iron with bolted bonnet.
 - 5) Ends: Flanged.
 - 6) Trim: Bronze.
 - 7) Gasket: Asbestos free.
 2. Class 125, Iron Swing Check Valves with Nonmetallic-to-Metal Seats:
 - a. Description:
 - 1) Standard: MSS SP-71, Type I.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Clear or full waterway.
 - 4) Body Material: ASTM A 126, gray iron with bolted bonnet.
 - 5) Ends: Flanged.
 - 6) Trim: Composition.
 - 7) Seat Ring: Bronze.
 - 8) Disc Holder: Bronze.
 - 9) Disc: PTFE or TFE.
 - 10) Gasket: Asbestos free.
 3. Class 250, Iron Swing Check Valves with Metal Seats:
 - a. Description:
 - 1) Standard: MSS SP-71, Type I.
 - 2) CWP Rating: 500 psig (3450 kPa).
 - 3) Body Design: Clear or full waterway.
 - 4) Body Material: ASTM A 126, gray iron with bolted bonnet.
 - 5) Ends: Flanged.
 - 6) Trim: Bronze.
 - 7) Gasket: Asbestos free.

K. Iron Swing Check Valves With Closure Control



1. Class 125, Iron Swing Check Valves with Lever- and Spring-Closure Control:
 - a. Description:
 - 1) Standard: MSS SP-71, Type I.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Clear or full waterway.
 - 4) Body Material: ASTM A 126, gray iron with bolted bonnet.
 - 5) Ends: Flanged.
 - 6) Trim: Bronze.
 - 7) Gasket: Asbestos free.
 - 8) Closure Control: Factory-installed, exterior lever and spring.
 2. Class 125, Iron Swing Check Valves with Lever- and Weight-Closure Control:
 - a. Description:
 - 1) Standard: MSS SP-71, Type I.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Clear or full waterway.
 - 4) Body Material: ASTM A 126, gray iron with bolted bonnet.
 - 5) Ends: Flanged.
 - 6) Trim: Bronze.
 - 7) Gasket: Asbestos free.
 - 8) Closure Control: Factory-installed, exterior lever and weight.
- L. Iron, Grooved-End Swing Check Valves
1. 300 CWP, Iron, Grooved-End Swing Check Valves:
 - a. Description:
 - 1) CWP Rating: 300 psig (2070 kPa).
 - 2) Body Material: ASTM A 536, ductile iron.
 - 3) Seal: EPDM.
 - 4) Disc: Spring-operated, ductile iron or stainless steel.
- M. Iron, Center-Guided Check Valves
1. Class 125, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat:
 - a. Description:
 - 1) Standard: MSS SP-125.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM A 126, gray iron.
 - 4) Style: Compact wafer.
 - 5) Seat: Bronze.
 2. Class 125, Iron, Globe, Center-Guided Check Valves with Metal Seat:
 - a. Description:
 - 1) Standard: MSS SP-125.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM A 126, gray iron.
 - 4) Style: Globe, spring loaded.
 - 5) Ends: Flanged.
 - 6) Seat: Bronze.
 3. Class 150, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat:
 - a. Description:
 - 1) Standard: MSS SP-125.
 - 2) CWP Rating: 300 psig (2070 kPa).
 - 3) Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - 4) Style: Compact wafer.
 - 5) Seat: Bronze.
 4. Class 150, Iron, Globe, Center-Guided Check Valves with Metal Seat:
 - a. Description:
 - 1) Standard: MSS SP-125.



- 2) CWP Rating: 300 psig (2070 kPa).
 - 3) Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - 4) Style: Globe, spring loaded.
 - 5) Ends: Flanged.
 - 6) Seat: Bronze.
5. Class 250, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat:
- a. Description:
 - 1) Standard: MSS SP-125.
 - 2) CWP Rating: 400 psig (2760 kPa).
 - 3) Body Material: ASTM A 126, gray iron.
 - 4) Style: Compact wafer, spring loaded.
 - 5) Seat: Bronze.
6. Class 250, Iron, Globe, Center-Guided Check Valves with Metal Seat:
- a. Description:
 - 1) Standard: MSS SP-125.
 - 2) CWP Rating: 400 psig (2760 kPa).
 - 3) Body Material: ASTM A 126, gray iron.
 - 4) Style: Globe, spring loaded.
 - 5) Ends: Flanged.
 - 6) Seat: Bronze.
7. Class 300, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat:
- a. Description:
 - 1) Standard: MSS SP-125.
 - 2) CWP Rating: 500 psig (3450 kPa).
 - 3) Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - 4) Style: Compact wafer, spring loaded.
 - 5) Seat: Bronze.
8. Class 300, Iron, Globe, Center-Guided Check Valves with Metal Seat:
- a. Description:
 - 1) Standard: MSS SP-125.
 - 2) CWP Rating: 500 psig (3450 kPa).
 - 3) Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - 4) Style: Globe, spring loaded.
 - 5) Ends: Flanged.
 - 6) Seat: Bronze.
9. Class 125, Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat:
- a. Description:
 - 1) Standard: MSS SP-125.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM A 126, gray iron.
 - 4) Style: Compact wafer.
 - 5) Seat: EPDM **OR** NBR, **as directed**.
10. Class 125, Iron, Globe, Center-Guided Check Valves with Resilient Seat:
- a. Description:
 - 1) Standard: MSS SP-125.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM A 126, gray iron.
 - 4) Style: Globe, spring loaded.
 - 5) Ends: Flanged.
 - 6) Seat: EPDM **OR** NBR, **as directed**.
11. Class 150, Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat:
- a. Description:
 - 1) Standard: MSS SP-125.
 - 2) CWP Rating: 300 psig (2070 kPa).
 - 3) Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - 4) Style: Compact wafer.



- 5) Seat: EPDM **OR** NBR, **as directed**.
 12. Class 150, Iron, Globe, Center-Guided Check Valves with Resilient Seat:
 - a. Description:
 - 1) Standard: MSS SP-125.
 - 2) CWP Rating: 300 psig (2070 kPa).
 - 3) Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - 4) Style: Globe, spring loaded.
 - 5) Ends: Flanged.
 - 6) Seat: EPDM **OR** NBR, **as directed**.
 13. Class 250, Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat:
 - a. Description:
 - 1) Standard: MSS SP-125.
 - 2) CWP Rating: 400 psig (2760 kPa).
 - 3) Body Material: ASTM A 126, gray iron.
 - 4) Style: Compact wafer, spring loaded.
 - 5) Seat: EPDM **OR** NBR, **as directed**.
 14. Class 250, Iron, Globe, Center-Guided Check Valves with Resilient Seat:
 - a. Description:
 - 1) Standard: MSS SP-125.
 - 2) CWP Rating: 400 psig (2760 kPa).
 - 3) Body Material: ASTM A 126, gray iron.
 - 4) Style: Globe, spring loaded.
 - 5) Ends: Flanged.
 - 6) Seat: EPDM **OR** NBR, **as directed**.
 15. Class 300, Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat:
 - a. Description:
 - 1) Standard: MSS SP-125.
 - 2) CWP Rating: 500 psig (3450 kPa).
 - 3) Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - 4) Style: Compact wafer, spring loaded.
 - 5) Seat: EPDM **OR** NBR, **as directed**.
 16. Class 300, Iron, Globe, Center-Guided Check Valves with Resilient Seat:
 - a. Description:
 - 1) Standard: MSS SP-125.
 - 2) CWP Rating: 500 psig (3450 kPa).
 - 3) Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - 4) Style: Globe, spring loaded.
 - 5) Ends: Flanged.
 - 6) Seat: EPDM **OR** NBR, **as directed**.
- N. Iron, Plate-Type Check Valves
1. Class 125, Iron, Dual-Plate Check Valves with Metal Seat:
 - a. Description:
 - 1) Standard: API 594.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Wafer, spring-loaded plates.
 - 4) Body Material: ASTM A 126, gray iron.
 - 5) Seat: Bronze.
 2. Class 150, Iron, Dual-Plate Check Valves with Metal Seat:
 - a. Description:
 - 1) Standard: API 594.
 - 2) CWP Rating: 300 psig (2070 kPa).
 - 3) Body Design: Wafer, spring-loaded plates.
 - 4) Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - 5) Seat: Bronze.



3. Class 250, Iron, Dual-Plate Check Valves with Metal Seat:
 - a. Description:
 - 1) Standard: API 594.
 - 2) CWP Rating: 400 psig (2760 kPa).
 - 3) Body Design: Wafer, spring-loaded plates.
 - 4) Body Material: ASTM A 126, gray iron.
 - 5) Seat: Bronze.
4. Class 300, Iron, Dual-Plate Check Valves with Metal Seat:
 - a. Description:
 - 1) Standard: API 594.
 - 2) CWP Rating: 500 psig (3450 kPa).
 - 3) Body Design: Wafer, spring-loaded plates.
 - 4) Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - 5) Seat: Bronze.
5. Class 125, Iron, Single-Plate Check Valves with Resilient Seat:
 - a. Description:
 - 1) Standard: API 594.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Wafer, spring-loaded plate.
 - 4) Body Material: ASTM A 126, gray iron.
 - 5) Seat: EPDM **OR** NBR, **as directed**.
6. Class 125, Iron, Dual-Plate Check Valves with Resilient Seat:
 - a. Description:
 - 1) Standard: API 594.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Wafer, spring-loaded plates.
 - 4) Body Material: ASTM A 126, gray iron.
 - 5) Seat: EPDM **OR** NBR, **as directed**.
7. Class 150, Iron, Dual-Plate Check Valves with Resilient Seat:
 - a. Description:
 - 1) Standard: API 594.
 - 2) CWP Rating: 300 psig (2070 kPa).
 - 3) Body Design: Wafer, spring-loaded plates.
 - 4) Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - 5) Seat: EPDM **OR** NBR, **as directed**.
8. Class 250, Iron, Wafer, Single-Plate Check Valves with Resilient Seat:
 - a. Description:
 - 1) Standard: API 594.
 - 2) CWP Rating: 400 psig (2760 kPa).
 - 3) Body Design: Wafer, spring-loaded plate.
 - 4) Body Material: ASTM A 126, gray iron.
 - 5) Seat: EPDM **OR** NBR, **as directed**.
9. Class 250, Iron, Dual-Plate Check Valves with Resilient Seat:
 - a. Description:
 - 1) Standard: API 594.
 - 2) CWP Rating: 400 psig (2760 kPa).
 - 3) Body Design: Wafer, spring-loaded plates.
 - 4) Body Material: ASTM A 126, gray iron.
 - 5) Seat: EPDM **OR** NBR, **as directed**.
10. Class 300, Iron, Dual-Plate Check Valves with Resilient Seat:
 - a. Description:
 - 1) Standard: API 594.
 - 2) CWP Rating: 500 psig (3450 kPa).
 - 3) Body Design: Wafer, spring-loaded plates.
 - 4) Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - 5) Seat: EPDM **OR** NBR, **as directed**.



O. Bronze Gate Valves

1. Class 125, NRS Bronze Gate Valves:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 1.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - 4) Ends: Threaded or solder joint, **as directed**.
 - 5) Stem: Bronze.
 - 6) Disc: Solid wedge; bronze.
 - 7) Packing: Asbestos free.
 - 8) Handwheel: Malleable iron, bronze, or aluminum, **as directed**.
2. Class 125, RS Bronze Gate Valves:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 2.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - 4) Ends: Threaded or solder joint, **as directed**.
 - 5) Stem: Bronze.
 - 6) Disc: Solid wedge; bronze.
 - 7) Packing: Asbestos free.
 - 8) Handwheel: Malleable iron, bronze, or aluminum, **as directed**.
3. Class 150, NRS Bronze Gate Valves:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 1.
 - 2) CWP Rating: 300 psig (2070 kPa).
 - 3) Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
 - 4) Ends: Threaded.
 - 5) Stem: Bronze.
 - 6) Disc: Solid wedge; bronze.
 - 7) Packing: Asbestos free.
 - 8) Handwheel: Malleable iron, bronze, or aluminum, **as directed**.
4. Class 150, RS Bronze Gate Valves:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 2.
 - 2) CWP Rating: 300 psig (2070 kPa).
 - 3) Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
 - 4) Ends: Threaded.
 - 5) Stem: Bronze.
 - 6) Disc: Solid wedge; bronze.
 - 7) Packing: Asbestos free.
 - 8) Handwheel: Malleable iron, bronze, or aluminum, **as directed**.

P. Iron Gate Valves

1. Class 125, NRS, Iron Gate Valves:
 - a. Description:
 - 1) Standard: MSS SP-70, Type I.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM A 126, gray iron with bolted bonnet.
 - 4) Ends: Flanged.
 - 5) Trim: Bronze.
 - 6) Disc: Solid wedge.
 - 7) Packing and Gasket: Asbestos free.
2. Class 125, OS&Y, Iron Gate Valves:
 - a. Description:
 - 1) Standard: MSS SP-70, Type I.



- 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM A 126, gray iron with bolted bonnet.
 - 4) Ends: Flanged.
 - 5) Trim: Bronze.
 - 6) Disc: Solid wedge.
 - 7) Packing and Gasket: Asbestos free.
3. Class 250, NRS, Iron Gate Valves:
 - a. Description:
 - 1) Standard: MSS SP-70, Type I.
 - 2) CWP Rating: 500 psig (3450 kPa).
 - 3) Body Material: ASTM A 126, gray iron with bolted bonnet.
 - 4) Ends: Flanged.
 - 5) Trim: Bronze.
 - 6) Disc: Solid wedge.
 - 7) Packing and Gasket: Asbestos free.
 4. Class 250, OS&Y, Iron Gate Valves:
 - a. Description:
 - 1) Standard: MSS SP-70, Type I.
 - 2) CWP Rating: 500 psig (3450 kPa).
 - 3) Body Material: ASTM A 126, gray iron with bolted bonnet.
 - 4) Ends: Flanged.
 - 5) Trim: Bronze.
 - 6) Disc: Solid wedge.
 - 7) Packing and Gasket: Asbestos free.

Q. Bronze Globe Valves

1. Class 125, Bronze Globe Valves with Bronze Disc:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 1.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - 4) Ends: Threaded or solder joint, **as directed**.
 - 5) Stem and Disc: Bronze.
 - 6) Packing: Asbestos free.
 - 7) Handwheel: Malleable iron, bronze, or aluminum, **as directed**.
2. Class 125, Bronze Globe Valves with Nonmetallic Disc:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 2.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - 4) Ends: Threaded or solder joint, **as directed**.
 - 5) Stem: Bronze.
 - 6) Disc: PTFE or TFE.
 - 7) Packing: Asbestos free.
 - 8) Handwheel: Malleable iron, bronze, or aluminum, **as directed**.
3. Class 150, Bronze Globe Valves with Nonmetallic Disc:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 2.
 - 2) CWP Rating: 300 psig (2070 kPa).
 - 3) Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
 - 4) Ends: Threaded.
 - 5) Stem: Bronze.
 - 6) Disc: PTFE or TFE.
 - 7) Packing: Asbestos free.
 - 8) Handwheel: Malleable iron, bronze, or aluminum, **as directed**.



R. Iron Globe Valves

1. Class 125, Iron Globe Valves:
 - a. Description:
 - 1) Standard: MSS SP-85, Type I.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM A 126, gray iron with bolted bonnet.
 - 4) Ends: Flanged.
 - 5) Trim: Bronze.
 - 6) Packing and Gasket: Asbestos free.
2. Class 250, Iron Globe Valves:
 - a. Description:
 - 1) Standard: MSS SP-85, Type I.
 - 2) CWP Rating: 500 psig (3450 kPa).
 - 3) Body Material: ASTM A 126, gray iron with bolted bonnet.
 - 4) Ends: Flanged.
 - 5) Trim: Bronze.
 - 6) Packing and Gasket: Asbestos free.

S. Lubricated Plug Valves

1. Class 125, Regular-Gland, Lubricated Plug Valves with Threaded Ends:
 - a. Description:
 - 1) Standard: MSS SP-78, Type II.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - 4) Pattern: Regular or short **OR** Venturi, **as directed**.
 - 5) Plug: Cast iron or bronze with sealant groove.
2. Class 125, Regular-Gland, Lubricated Plug Valves with Flanged Ends:
 - a. Description:
 - 1) Standard: MSS SP-78, Type II.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - 4) Pattern: Regular or short **OR** Venturi, **as directed**.
 - 5) Plug: Cast iron or bronze with sealant groove.
3. Class 125, Cylindrical, Lubricated Plug Valves with Threaded Ends:
 - a. Description:
 - 1) Standard: MSS SP-78, Type IV.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - 4) Pattern: Regular or short **OR** Venturi, **as directed**.
 - 5) Plug: Cast iron or bronze with sealant groove.
4. Class 125, Cylindrical, Lubricated Plug Valves with Flanged Ends:
 - a. Description:
 - 1) Standard: MSS SP-78, Type IV.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - 4) Pattern: Regular or short **OR** Venturi, **as directed**.
 - 5) Plug: Cast iron or bronze with sealant groove.
5. Class 250, Regular-Gland, Lubricated Plug Valves with Threaded Ends:
 - a. Description:
 - 1) Standard: MSS SP-78, Type II.
 - 2) CWP Rating: 400 psig (2760 kPa).



- 3) Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - 4) Pattern: Regular or short **OR** Venturi, **as directed**.
 - 5) Plug: Cast iron or bronze with sealant groove.
6. Class 250, Regular-Gland, Lubricated Plug Valves with Flanged Ends:
- a. Description:
 - 1) Standard: MSS SP-78, Type II.
 - 2) CWP Rating: 400 psig (2760 kPa).
 - 3) Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - 4) Pattern: Regular or short **OR** Venturi, **as directed**.
 - 5) Plug: Cast iron or bronze with sealant groove.
7. Class 250, Cylindrical, Lubricated Plug Valves with Threaded Ends:
- a. Description:
 - 1) Standard: MSS SP-78, Type IV.
 - 2) CWP Rating: 400 psig (2760 kPa).
 - 3) Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - 4) Pattern: Regular or short **OR** Venturi, **as directed**.
 - 5) Plug: Cast iron or bronze with sealant groove.
8. Class 250, Cylindrical, Lubricated Plug Valves with Flanged Ends:
- a. Description:
 - 1) Standard: MSS SP-78, Type IV.
 - 2) CWP Rating: 400 psig (2760 kPa).
 - 3) Body Material: ASTM A 48/A 48M or ASTM A 126, Grade 40 cast iron with lubrication-sealing system.
 - 4) Pattern: Regular or short **OR** Venturi, **as directed**.
 - 5) Plug: Cast iron or bronze with sealant groove.

T. Chainwheels

1. Description: Valve actuation assembly with sprocket rim, brackets, and chain.
 - a. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
 - b. Attachment: For connection to ball **OR** butterfly **OR** plug, **as directed**, valve stems.
 - c. Sprocket Rim with Chain Guides: Ductile iron **OR** Cast iron **OR** Aluminum **OR** Bronze, **as directed**, of type and size required for valve. Include zinc coating, **as directed**.
 - d. Chain: Hot-dip, galvanized steel **OR** Brass **OR** Stainless steel, **as directed**, of size required to fit sprocket rim.

1.3 EXECUTION

A. Valve Installation

1. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
2. Locate valves for easy access and provide separate support where necessary.
3. Install valves in horizontal piping with stem at or above center of pipe.
4. Install valves in position to allow full stem movement.
5. Install chainwheels on operators for ball **OR** butterfly **OR** gate **OR** globe **OR** plug, **as directed**, valves NPS 4 (DN 100) and larger and more than 96 inches (2400 mm) above floor. Extend chains to 60 inches (1520 mm) above finished floor.
6. Install check valves for proper direction of flow and as follows:
 - a. Swing Check Valves: In horizontal position with hinge pin level.
 - b. Center-Guided and Plate-Type Check Valves: In horizontal or vertical position, between flanges.
 - c. Lift Check Valves: With stem upright and plumb.



- B. Adjusting
1. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.
- C. General Requirements For Valve Applications
1. If valve applications are not indicated, use the following:
 - a. Shutoff Service: Ball **OR** butterfly **OR** gate **OR** plug, **as directed**, valves.
 - b. Butterfly Valve Dead-End Service: Single-flange (lug) type.
 - c. Throttling Service: Globe **OR** angle **OR** ball **OR** butterfly, **as directed**, valves.
 - d. Pump-Discharge Check Valves:
 - 1) NPS 2 (DN 50) and Smaller: Bronze swing check valves with bronze **OR** nonmetallic, **as directed**, disc.
 - 2) NPS 2-1/2 (DN 65) and Larger for Domestic Water: Iron swing check valves with lever and weight or with spring or iron, center-guided, metal **OR** resilient, **as directed**, -seat check valves.
 - 3) NPS 2-1/2 (DN 65) and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.
 2. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
 3. Select valves, except wafer types, with the following end connections:
 - a. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
 - b. For Copper Tubing, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - c. For Copper Tubing, NPS 5 (DN 125) and Larger: Flanged ends.
 - d. For Steel Piping, NPS 2 (DN 50) and Smaller: Threaded ends.
 - e. For Steel Piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - f. For Steel Piping, NPS 5 (DN 125) and Larger: Flanged ends.
 - g. For Grooved-End Copper Tubing and Steel Piping: Valve ends may be grooved.
- D. Low-Pressure, Compressed-Air Valve Schedule (150 psig (1035 kPa) Or Less)
1. Pipe NPS 2 (DN 50) and Smaller:
 - a. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
 - b. Ball Valves: One **OR** Two **OR** Three, **as directed**, piece, full **OR** regular **OR** reduced, **as directed**, port, brass **OR** bronze, **as directed**, with brass **OR** bronze **OR** stainless-steel, **as directed**, trim.
 - c. Bronze Lift Check Valves: Class 125, bronze **OR** nonmetallic, **as directed**, disc.
 - d. Bronze Swing Check Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic, **as directed**, disc.
 - e. Bronze Gate Valves: Class 125 **OR** Class 150, **as directed**, NRS **OR** RS, **as directed**.
 2. Pipe NPS 2-1/2 (DN 65) and Larger:
 - a. Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): May be provided with threaded ends instead of flanged ends.
 - b. Iron, Single-Flange Butterfly Valves: 200 CWP, NBR seat, aluminum-bronze **OR** ductile-iron **OR** stainless-steel, **as directed**, disc.
 - c. Iron, Grooved-End Butterfly Valves: 175 **OR** 300, **as directed**, CWP.
 - d. Iron Swing Check Valves: Class 125 **OR** Class 250, **as directed**, metal **OR** nonmetallic-to-metal, **as directed**, seats.
 - e. Iron, Grooved-End Swing Check Valves: 300 CWP.
 - f. Iron, Center-Guided Check Valves: Class 125 **OR** Class 150 **OR** Class 250 **OR** Class 300, **as directed**, compact-wafer **OR** globe, **as directed**, metal **OR** resilient, **as directed**, seat.
 - g. Iron, Plate-Type Check Valves: Class 125 **OR** Class 150 **OR** Class 250 **OR** Class 300, **as directed**; single **OR** dual, **as directed**, plate; metal **OR** resilient, **as directed**, seat.



- h. Iron Gate Valves: Class 125 **OR** Class 250, **as directed**, NRS **OR** OS&Y, **as directed**.
- E. High-Pressure, Compressed-Air Valve Schedule (150 to 200 psig (1035 to 1380 kPa))
- 1. Pipe NPS 2 (DN 50) and Smaller:
 - a. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
 - b. Ball Valves: One **OR** Two **OR** Three, **as directed**, piece, full **OR** regular **OR** reduced, **as directed**, port, brass **OR** bronze, **as directed**, with brass **OR** bronze **OR** stainless-steel, **as directed**, trim.
 - c. Bronze Lift Check Valves: Class 125, bronze **OR** nonmetallic, **as directed**, disc.
 - d. Bronze Swing Check Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic, **as directed**, disc.
 - e. Bronze Gate Valves: Class 125 **OR** Class 150, **as directed**, NRS **OR** RS, **as directed**.
 - 2. Pipe NPS 2-1/2 (DN 65) and Larger:
 - a. Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): May be provided with threaded ends instead of flanged ends.
 - b. Iron, Single-Flange Butterfly Valves: 200 CWP, NBR seat, aluminum-bronze **OR** ductile-iron **OR** stainless-steel, **as directed**, disc.
 - c. Iron, Grooved-End Butterfly Valves: 175 **OR** 300, **as directed**, CWP.
 - d. Iron Swing Check Valves: Class 125 **OR** Class 250, **as directed**, metal **OR** nonmetallic-to-metal, **as directed**, seats.
 - e. Iron, Grooved-End Swing Check Valves: 300 CWP.
 - f. Iron, Center-Guided Check Valves: Class 125 **OR** Class 150 **OR** Class 250 **OR** Class 300, **as directed**, compact-wafer **OR** globe, **as directed**, metal **OR** resilient, **as directed**, seat.
 - g. Iron, Plate-Type Check Valves: Class 125 **OR** Class 150 **OR** Class 250 **OR** Class 300, **as directed**; single **OR** dual, **as directed**, plate; metal **OR** resilient, **as directed**, seat.
 - h. Iron Gate Valves: Class 125 **OR** Class 250, **as directed**, NRS **OR** OS&Y, **as directed**.
- F. Domestic, Hot- And Cold-Water Valve Schedule
- 1. Pipe NPS 2 (DN 50) and Smaller:
 - a. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
 - b. Bronze Angle Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic, **as directed**, disc.
 - c. Ball Valves: One **OR** Two **OR** Three, **as directed**, piece, full **OR** regular **OR** reduced, **as directed**, port, brass **OR** bronze, **as directed**, with brass **OR** bronze **OR** stainless-steel, **as directed**, trim.
 - d. Bronze Swing Check Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic, **as directed**, disc.
 - e. Bronze Gate Valves: Class 125 **OR** Class 150, **as directed**, NRS **OR** RS, **as directed**.
 - f. Bronze Globe Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic, **as directed**, disc.
 - 2. Pipe NPS 2-1/2 (DN 65) and Larger:
 - a. Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): May be provided with threaded ends instead of flanged ends.
 - b. Iron Ball Valves: Class 150.
 - c. Iron, Single-Flange Butterfly Valves: 200 CWP, EPDM **OR** NBR, **as directed**, seat, aluminum-bronze **OR** ductile-iron **OR** stainless-steel, **as directed**, disc.
 - d. Iron, Grooved-End Butterfly Valves: 175 **OR** 300, **as directed**, CWP.
 - e. Iron Swing Check Valves: Class 125 **OR** Class 250, **as directed**, metal **OR** nonmetallic-to-metal, **as directed**, seats.
 - f. Iron Swing Check Valves with Closure Control: Class 125, lever and spring **OR** weight, **as directed**.
 - g. Iron, Grooved-End Swing Check Valves: 300 CWP.
 - h. Iron, Center-Guided Check Valves: Class 125 **OR** Class 150 **OR** Class 250 **OR** Class 300, **as directed**, compact-wafer **OR** globe, **as directed**, metal **OR** resilient, **as directed**, seat.



- i. Iron, Plate-Type Check Valves: Class 125 **OR** Class 150 **OR** Class 250 **OR** Class 300, **as directed**; single **OR** dual, **as directed**, plate; metal **OR** resilient, **as directed**, seat.
- j. Iron Gate Valves: Class 125 **OR** Class 250, **as directed**, NRS **OR** OS&Y, **as directed**.
- k. Iron Globe Valves: Class 125 **OR** Class 250, **as directed**.

G. Sanitary-Waste And Storm-Drainage Valve Schedule

1. Pipe NPS 2 (DN 50) and Smaller:
 - a. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
 - b. Bronze Angle Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic **OR** stainless-steel, **as directed**, disc.
 - c. Ball Valves: One **OR** Two **OR** Three, **as directed**, piece, full **OR** regular **OR** reduced, **as directed**, port, brass **OR** bronze, **as directed**, with brass **OR** bronze **OR** stainless-steel, **as directed**, trim.
 - d. Bronze Swing Check Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic, **as directed**, disc.
 - e. Bronze Gate Valves: Class 125 **OR** Class 150, **as directed**, NRS **OR** RS, **as directed**.
 - f. Bronze Globe Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic, **as directed**, disc.
2. Pipe NPS 2-1/2 (DN 65) and Larger:
 - a. Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): May be provided with threaded ends instead of flanged ends.
 - b. Iron Ball Valves: Class 150.
 - c. Iron Swing Check Valves: Class 125 **OR** Class 250, **as directed**, metal **OR** nonmetallic-to-metal, **as directed**, seats.
 - d. Iron Swing Check Valves with Closure Control: Class 125, lever and spring **OR** weight, **as directed**.
 - e. Iron, Grooved-End Swing Check Valves: 300 CWP.
 - f. Iron Gate Valves: Class 125 **OR** Class 250, **as directed**, NRS **OR** OS&Y, **as directed**.
 - g. Iron Globe Valves: Class 125 **OR** Class 250, **as directed**.
 - h. Lubricated Plug Valves: Class 125 **OR** Class 250, **as directed**, regular gland **OR** cylindrical, **as directed**, threaded **OR** flanged, **as directed**.

END OF SECTION 22 05 23 00a



SECTION 22 05 23 00b - GENERAL-DUTY VALVES FOR HVAC PIPING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of general-duty valves for HVAC piping. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Bronze angle valves.
 - b. Brass ball valves.
 - c. Bronze ball valves.
 - d. Iron ball valves.
 - e. Iron, single-flange butterfly valves.
 - f. Iron, grooved-end butterfly valves.
 - g. High-performance butterfly valves.
 - h. Bronze lift check valves.
 - i. Bronze swing check valves.
 - j. Iron swing check valves.
 - k. Iron swing check valves with closure control.
 - l. Iron, grooved-end swing-check valves.
 - m. Iron, center-guided check valves.
 - n. Iron, plate-type check valves.
 - o. Bronze gate valves.
 - p. Iron gate valves.
 - q. Bronze globe valves.
 - r. Iron globe valves.
 - s. Lubricated plug valves.
 - t. Eccentric plug valves.
 - u. Chainwheels.

C. Definitions

1. CWP: Cold working pressure.
2. EPDM: Ethylene propylene copolymer rubber.
3. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
4. NRS: Nonrising stem.
5. OS&Y: Outside screw and yoke.
6. RS: Rising stem.
7. SWP: Steam working pressure.

D. Submittals

1. Product Data: For each type of valve indicated.

E. Quality Assurance

1. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
2. ASME Compliance:
 - a. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - b. ASME B31.1 for power piping valves.
 - c. ASME B31.9 for building services piping valves.



F. Delivery, Storage, And Handling

1. Prepare valves for shipping as follows:
 - a. Protect internal parts against rust and corrosion.
 - b. Protect threads, flange faces, grooves, and weld ends.
 - c. Set angle, gate, and globe valves closed to prevent rattling.
 - d. Set ball and plug valves open to minimize exposure of functional surfaces.
 - e. Set butterfly valves closed or slightly open.
 - f. Block check valves in either closed or open position.
2. Use the following precautions during storage:
 - a. Maintain valve end protection.
 - b. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
3. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

1.2 PRODUCTS

A. General Requirements For Valves

1. Refer to HVAC valve schedule articles for applications of valves.
2. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
3. Valve Sizes: Same as upstream piping unless otherwise indicated.
4. Valve Actuator Types:
 - a. Gear Actuator: For quarter-turn valves NPS 8 (DN 200) and larger.
 - b. Handwheel: For valves other than quarter-turn types.
 - c. Handlever: For quarter-turn valves NPS 6 (DN 150) and smaller except plug valves, **as directed**.
 - d. Wrench: For plug valves with square heads. Furnish the Owner with 1 wrench for every 5 **OR 10, as directed**, plug valves, for each size square plug-valve head.
 - e. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.
5. Valves in Insulated Piping: With 2-inch (50-mm) stem extensions and the following features:
 - a. Gate Valves: With rising stem.
 - b. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
 - c. Butterfly Valves: With extended neck.
6. Valve-End Connections:
 - a. Flanged: With flanges according to ASME B16.1 for iron valves.
 - b. Grooved: With grooves according to AWWA C606.
 - c. Solder Joint: With sockets according to ASME B16.18.
 - d. Threaded: With threads according to ASME B1.20.1.
7. Valve Bypass and Drain Connections: MSS SP-45.

B. Bronze Angle Valves

1. Class 125, Bronze Angle Valves with Bronze Disc:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 1.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - 4) Ends: Threaded.
 - 5) Stem and Disc: Bronze.
 - 6) Packing: Asbestos free.
 - 7) Handwheel: Malleable iron, bronze, or aluminum, **as directed**.



2. Class 125, Bronze Angle Valves with Nonmetallic Disc:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 2.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - 4) Ends: Threaded.
 - 5) Stem: Bronze.
 - 6) Disc: PTFE or TFE.
 - 7) Packing: Asbestos free.
 - 8) Handwheel: Malleable iron, bronze, or aluminum, **as directed**.
3. Class 150, Bronze Angle Valves with Bronze Disc:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 1.
 - 2) CWP Rating: 300 psig (2070 kPa).
 - 3) Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
 - 4) Ends: Threaded.
 - 5) Stem and Disc: Bronze.
 - 6) Packing: Asbestos free.
 - 7) Handwheel: Malleable iron, bronze, or aluminum, **as directed**.
4. Class 150, Bronze Angle Valves with Nonmetallic Disc:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 2.
 - 2) CWP Rating: 300 psig (2070 kPa).
 - 3) Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
 - 4) Ends: Threaded.
 - 5) Stem: Bronze.
 - 6) Disc: PTFE or TFE.
 - 7) Packing: Asbestos free.
 - 8) Handwheel: Malleable iron, bronze, or aluminum, **as directed**.

C. Brass Ball Valves

1. One-Piece, Reduced-Port, Brass Ball Valves with Brass Trim:
 - a. Description:
 - 1) Standard: MSS SP-110.
 - 2) CWP Rating: 400 psig (2760 kPa).
 - 3) Body Design: One piece.
 - 4) Body Material: Forged brass.
 - 5) Ends: Threaded.
 - 6) Seats: PTFE or TFE.
 - 7) Stem: Brass.
 - 8) Ball: Chrome-plated brass.
 - 9) Port: Reduced.
2. Two-Piece, Full-Port, Brass Ball Valves with Brass Trim:
 - a. Description:
 - 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Two piece.
 - 5) Body Material: Forged brass.
 - 6) Ends: Threaded.
 - 7) Seats: PTFE or TFE.
 - 8) Stem: Brass.
 - 9) Ball: Chrome-plated brass.
 - 10) Port: Full.
3. Two-Piece, Full-Port, Brass Ball Valves with Stainless-Steel Trim:
 - a. Description:



- 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Two piece.
 - 5) Body Material: Forged brass.
 - 6) Ends: Threaded.
 - 7) Seats: PTFE or TFE.
 - 8) Stem: Stainless steel.
 - 9) Ball: Stainless steel, vented.
 - 10) Port: Full.
4. Two-Piece, Regular-Port, Brass Ball Valves with Brass Trim:
- a. Description:
 - 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Two piece.
 - 5) Body Material: Forged brass.
 - 6) Ends: Threaded.
 - 7) Seats: PTFE or TFE.
 - 8) Stem: Brass.
 - 9) Ball: Chrome-plated brass.
 - 10) Port: Regular.
5. Two-Piece, Regular-Port, Brass Ball Valves with Stainless-Steel Trim:
- a. Description:
 - 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Two piece.
 - 5) Body Material: Brass or bronze.
 - 6) Ends: Threaded.
 - 7) Seats: PTFE or TFE.
 - 8) Stem: Stainless steel.
 - 9) Ball: Stainless steel, vented.
 - 10) Port: Regular.
6. Three-Piece, Full-Port, Brass Ball Valves with Brass Trim:
- a. Description:
 - 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Three piece.
 - 5) Body Material: Forged brass.
 - 6) Ends: Threaded.
 - 7) Seats: PTFE or TFE.
 - 8) Stem: Brass.
 - 9) Ball: Chrome-plated brass.
 - 10) Port: Full.
7. Three-Piece, Full-Port, Brass Ball Valves with Stainless-Steel Trim:
- a. Description:
 - 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Three piece.
 - 5) Body Material: Forged brass.
 - 6) Ends: Threaded.
 - 7) Seats: PTFE or TFE.



- 8) Stem: Stainless steel.
- 9) Ball: Stainless steel, vented.
- 10) Port: Full.

D. Bronze Ball Valves

1. One-Piece, Reduced-Port, Bronze Ball Valves with Bronze Trim:
 - a. Description:
 - 1) Standard: MSS SP-110.
 - 2) CWP Rating: 400 psig (2760 kPa).
 - 3) Body Design: One piece.
 - 4) Body Material: Bronze.
 - 5) Ends: Threaded.
 - 6) Seats: PTFE or TFE.
 - 7) Stem: Bronze.
 - 8) Ball: Chrome-plated brass.
 - 9) Port: Reduced.
2. One-Piece, Reduced-Port, Bronze Ball Valves with Stainless-Steel Trim:
 - a. Description:
 - 1) Standard: MSS SP-110.
 - 2) CWP Rating: 600 psig (4140 kPa).
 - 3) Body Design: One piece.
 - 4) Body Material: Bronze.
 - 5) Ends: Threaded.
 - 6) Seats: PTFE or TFE.
 - 7) Stem: Stainless steel.
 - 8) Ball: Stainless steel, vented.
 - 9) Port: Reduced.
3. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:
 - a. Description:
 - 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Two piece.
 - 5) Body Material: Bronze.
 - 6) Ends: Threaded.
 - 7) Seats: PTFE or TFE.
 - 8) Stem: Bronze.
 - 9) Ball: Chrome-plated brass.
 - 10) Port: Full.
4. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:
 - a. Description:
 - 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Two piece.
 - 5) Body Material: Bronze.
 - 6) Ends: Threaded.
 - 7) Seats: PTFE or TFE.
 - 8) Stem: Stainless steel.
 - 9) Ball: Stainless steel, vented.
 - 10) Port: Full.
5. Two-Piece, Regular-Port, Bronze Ball Valves with Bronze Trim:
 - a. Description:
 - 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).



- 4) Body Design: Two piece.
 - 5) Body Material: Bronze.
 - 6) Ends: Threaded.
 - 7) Seats: PTFE or TFE.
 - 8) Stem: Bronze.
 - 9) Ball: Chrome-plated brass.
 - 10) Port: Regular.
6. Two-Piece, Regular-Port, Bronze Ball Valves with Stainless-Steel Trim:
 - a. Description:
 - 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Two piece.
 - 5) Body Material: Bronze.
 - 6) Ends: Threaded.
 - 7) Seats: PTFE or TFE.
 - 8) Stem: Stainless steel.
 - 9) Ball: Stainless steel, vented.
 - 10) Port: Regular.
 7. Three-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:
 - a. Description:
 - 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Three piece.
 - 5) Body Material: Bronze.
 - 6) Ends: Threaded.
 - 7) Seats: PTFE or TFE.
 - 8) Stem: Bronze.
 - 9) Ball: Chrome-plated brass.
 - 10) Port: Full.
 8. Three-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:
 - a. Description:
 - 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Three piece.
 - 5) Body Material: Bronze.
 - 6) Ends: Threaded.
 - 7) Seats: PTFE or TFE.
 - 8) Stem: Stainless steel.
 - 9) Ball: Stainless steel, vented.
 - 10) Port: Full.

E. Iron Ball Valves

1. Class 125, Iron Ball Valves:
 - a. Description:
 - 1) Standard: MSS SP-72.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Split body.
 - 4) Body Material: ASTM A 126, gray iron.
 - 5) Ends: Flanged.
 - 6) Seats: PTFE or TFE.
 - 7) Stem: Stainless steel.
 - 8) Ball: Stainless steel.



9) Port: Full.

F. Iron, Single-Flange Butterfly Valves

1. 150 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Aluminum-Bronze Disc:
 - a. Description:
 - 1) Standard: MSS SP-67, Type I.
 - 2) CWP Rating: 150 psig (1035 kPa).
 - 3) Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - 4) Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - 5) Seat: EPDM.
 - 6) Stem: One- or two-piece stainless steel.
 - 7) Disc: Aluminum bronze.
2. 150 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Aluminum-Bronze Disc:
 - a. Description:
 - 1) Standard: MSS SP-67, Type I.
 - 2) CWP Rating: 150 psig (1035 kPa).
 - 3) Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - 4) Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - 5) Seat: NBR.
 - 6) Stem: One- or two-piece stainless steel.
 - 7) Disc: Aluminum bronze.
3. 150 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Ductile-Iron Disc:
 - a. Description:
 - 1) Standard: MSS SP-67, Type I.
 - 2) CWP Rating: 150 psig (1035 kPa).
 - 3) Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - 4) Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - 5) Seat: EPDM.
 - 6) Stem: One- or two-piece stainless steel.
 - 7) Disc: Nickel-plated or -coated, **as directed**, ductile iron.
4. 150 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Ductile-Iron Disc:
 - a. Description:
 - 1) Standard: MSS SP-67, Type I.
 - 2) CWP Rating: 150 psig (1035 kPa).
 - 3) Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - 4) Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - 5) Seat: NBR.
 - 6) Stem: One- or two-piece stainless steel.
 - 7) Disc: Nickel-plated or -coated, **as directed**, ductile iron.
5. 150 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Stainless-Steel Disc:
 - a. Description:
 - 1) Standard: MSS SP-67, Type I.
 - 2) CWP Rating: 150 psig (1035 kPa).
 - 3) Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - 4) Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - 5) Seat: EPDM.
 - 6) Stem: One- or two-piece stainless steel.
 - 7) Disc: Stainless steel.
6. 150 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Stainless-Steel Disc:
 - a. Description:
 - 1) Standard: MSS SP-67, Type I.



- 2) CWP Rating: 150 psig (1035 kPa).
 - 3) Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - 4) Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - 5) Seat: NBR.
 - 6) Stem: One- or two-piece stainless steel.
 - 7) Disc: Stainless steel.
7. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Aluminum-Bronze Disc:
- a. Description:
 - 1) Standard: MSS SP-67, Type I.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - 4) Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - 5) Seat: EPDM.
 - 6) Stem: One- or two-piece stainless steel.
 - 7) Disc: Aluminum bronze.
8. 200 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Aluminum-Bronze Disc:
- a. Description:
 - 1) Standard: MSS SP-67, Type I.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - 4) Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - 5) Seat: NBR.
 - 6) Stem: One- or two-piece stainless steel.
 - 7) Disc: Aluminum bronze.
9. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Ductile-Iron Disc:
- a. Description:
 - 1) Standard: MSS SP-67, Type I.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - 4) Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - 5) Seat: EPDM.
 - 6) Stem: One- or two-piece stainless steel.
 - 7) Disc: Nickel-plated or -coated, **as directed**, ductile iron.
10. 200 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Ductile-Iron Disc:
- a. Description:
 - 1) Standard: MSS SP-67, Type I.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - 4) Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - 5) Seat: NBR.
 - 6) Stem: One- or two-piece stainless steel.
 - 7) Disc: Nickel-plated or -coated, **as directed**, ductile iron.
11. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Stainless-Steel Disc:
- a. Description:
 - 1) Standard: MSS SP-67, Type I.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - 4) Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - 5) Seat: EPDM.



- 6) Stem: One- or two-piece stainless steel.
 - 7) Disc: Stainless steel.
12. 200 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Stainless-Steel Disc:
- a. Description:
 - 1) Standard: MSS SP-67, Type I.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - 4) Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - 5) Seat: NBR.
 - 6) Stem: One- or two-piece stainless steel.
 - 7) Disc: Stainless steel.
- G. Iron, Grooved-End Butterfly Valves
1. 175 CWP, Iron, Grooved-End Butterfly Valves:
 - a. Description:
 - 1) Standard: MSS SP-67, Type I.
 - 2) CWP Rating: 175 psig (1200 kPa).
 - 3) Body Material: Coated, ductile iron.
 - 4) Stem: Two-piece stainless steel.
 - 5) Disc: Coated, ductile iron.
 - 6) Seal: EPDM.
 2. 300 CWP, Iron, Grooved-End Butterfly Valves:
 - a. Description:
 - 1) Standard: MSS SP-67, Type I.
 - 2) NPS 8 (DN 50) and Smaller CWP Rating: 300 psig (2070 kPa).
 - 3) NPS 10 (DN 250) and Larger CWP Rating: 200 psig (1380 kPa).
 - 4) Body Material: Coated, ductile iron.
 - 5) Stem: Two-piece stainless steel.
 - 6) Disc: Coated, ductile iron.
 - 7) Seal: EPDM.
- H. High-Performance Butterfly Valves
1. Class 150, Single-Flange, High-Performance Butterfly Valves:
 - a. Description:
 - 1) Standard: MSS SP-68.
 - 2) CWP Rating: 285 psig (1965 kPa) at 100 deg F (38 deg C).
 - 3) Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - 4) Body Material: Carbon steel, cast iron, ductile iron, or stainless steel.
 - 5) Seat: Reinforced PTFE or metal.
 - 6) Stem: Stainless steel; offset from seat plane.
 - 7) Disc: Carbon steel.
 - 8) Service: Bidirectional.
 2. Class 300, Single-Flange, High-Performance Butterfly Valves:
 - a. Description:
 - 1) Standard: MSS SP-68.
 - 2) CWP Rating: 720 psig (4965 kPa) at 100 deg F (38 deg C).
 - 3) Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - 4) Body Material: Carbon steel, cast iron, or ductile iron.
 - 5) Seat: Reinforced PTFE or metal.
 - 6) Stem: Stainless steel; offset from seat plane.
 - 7) Disc: Carbon steel.
 - 8) Service: Bidirectional.

**I. Bronze Lift Check Valves**

1. Class 125, Lift Check Valves with Bronze Disc:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 1.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Vertical flow.
 - 4) Body Material: ASTM B 61 or ASTM B 62, bronze.
 - 5) Ends: Threaded.
 - 6) Disc: Bronze.
2. Class 125, Lift Check Valves with Nonmetallic Disc:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 2.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Vertical flow.
 - 4) Body Material: ASTM B 61 or ASTM B 62, bronze.
 - 5) Ends: Threaded.
 - 6) Disc: NBR, PTFE, or TFE.

J. Bronze Swing Check Valves

1. Class 125, Bronze Swing Check Valves with Bronze Disc:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 3.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Horizontal flow.
 - 4) Body Material: ASTM B 62, bronze.
 - 5) Ends: Threaded.
 - 6) Disc: Bronze.
2. Class 125, Bronze Swing Check Valves with Nonmetallic Disc:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 4.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Design: Horizontal flow.
 - 4) Body Material: ASTM B 62, bronze.
 - 5) Ends: Threaded.
 - 6) Disc: PTFE or TFE.
3. Class 150, Bronze Swing Check Valves with Bronze Disc:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 3.
 - 2) CWP Rating: 300 psig (2070 kPa).
 - 3) Body Design: Horizontal flow.
 - 4) Body Material: ASTM B 62, bronze.
 - 5) Ends: Threaded.
 - 6) Disc: Bronze.
4. Class 150, Bronze Swing Check Valves with Nonmetallic Disc:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 4.
 - 2) CWP Rating: 300 psig (2070 kPa).
 - 3) Body Design: Horizontal flow.
 - 4) Body Material: ASTM B 62, bronze.
 - 5) Ends: Threaded.
 - 6) Disc: PTFE or TFE.

K. Iron Swing Check Valves

1. Class 125, Iron Swing Check Valves with Metal Seats:
 - a. Description:



- 1) Standard: MSS SP-71, Type I.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 200 psig (1380 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 150 psig (1035 kPa).
 - 4) Body Design: Clear or full waterway.
 - 5) Body Material: ASTM A 126, gray iron with bolted bonnet.
 - 6) Ends: Flanged.
 - 7) Trim: Bronze.
 - 8) Gasket: Asbestos free.
2. Class 125, Iron Swing Check Valves with Nonmetallic-to-Metal Seats:
 - a. Description:
 - 1) Standard: MSS SP-71, Type I.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 200 psig (1380 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 150 psig (1035 kPa).
 - 4) Body Design: Clear or full waterway.
 - 5) Body Material: ASTM A 126, gray iron with bolted bonnet.
 - 6) Ends: Flanged.
 - 7) Trim: Composition.
 - 8) Seat Ring: Bronze.
 - 9) Disc Holder: Bronze.
 - 10) Disc: PTFE or TFE.
 - 11) Gasket: Asbestos free.
 3. Class 250, Iron Swing Check Valves with Metal Seats:
 - a. Description:
 - 1) Standard: MSS SP-71, Type I.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 500 psig (3450 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 300 psig (2070 kPa).
 - 4) Body Design: Clear or full waterway.
 - 5) Body Material: ASTM A 126, gray iron with bolted bonnet.
 - 6) Ends: Flanged.
 - 7) Trim: Bronze.
 - 8) Gasket: Asbestos free.
- L. Iron Swing Check Valves With Closure Control
1. Class 125, Iron Swing Check Valves with Lever- and Spring-Closure Control:
 - a. Description:
 - 1) Standard: MSS SP-71, Type I.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 200 psig (1380 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 150 psig (1035 kPa).
 - 4) Body Design: Clear or full waterway.
 - 5) Body Material: ASTM A 126, gray iron with bolted bonnet.
 - 6) Ends: Flanged.
 - 7) Trim: Bronze.
 - 8) Gasket: Asbestos free.
 - 9) Closure Control: Factory-installed, exterior lever and spring.
 2. Class 125, Iron Swing Check Valves with Lever and Weight-Closure Control:
 - a. Description:
 - 1) Standard: MSS SP-71, Type I.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 200 psig (1380 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 150 psig (1035 kPa).
 - 4) Body Design: Clear or full waterway.
 - 5) Body Material: ASTM A 126, gray iron with bolted bonnet.
 - 6) Ends: Flanged.
 - 7) Trim: Bronze.
 - 8) Gasket: Asbestos free.
 - 9) Closure Control: Factory-installed, exterior lever and weight.



- M. Iron, Grooved-End Swing Check Valves
1. 300 CWP, Iron, Grooved-End Swing Check Valves:
 - a. Description:
 - 1) CWP Rating: 300 psig (2070 kPa).
 - 2) Body Material: ASTM A 536, ductile iron.
 - 3) Seal: EPDM.
 - 4) Disc: Spring operated, ductile iron or stainless steel.
- N. Iron, Center-Guided Check Valves
1. Class 125, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat:
 - a. Description:
 - 1) Standard: MSS SP-125.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 200 psig (1380 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 150 psig (1035 kPa).
 - 4) Body Material: ASTM A 126, gray iron.
 - 5) Style: Compact wafer.
 - 6) Seat: Bronze.
 2. Class 125, Iron, Globe, Center-Guided Check Valves with Metal Seat:
 - a. Description:
 - 1) Standard: MSS SP-125.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 200 psig (1380 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 150 psig (1035 kPa).
 - 4) Body Material: ASTM A 126, gray iron.
 - 5) Style: Globe, spring loaded.
 - 6) Ends: Flanged.
 - 7) Seat: Bronze.
 3. Class 150, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat:
 - a. Description:
 - 1) Standard: MSS SP-125.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 300 psig (2070 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 250 psig (1725 kPa).
 - 4) Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - 5) Style: Compact wafer.
 - 6) Seat: Bronze.
 4. Class 150, Iron, Globe, Center-Guided Check Valves with Metal Seat:
 - a. Description:
 - 1) Standard: MSS SP-125.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 300 psig (2070 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 250 psig (1725 kPa).
 - 4) Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - 5) Style: Globe, spring loaded.
 - 6) Ends: Flanged.
 - 7) Seat: Bronze.
 5. Class 250, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat:
 - a. Description:
 - 1) Standard: MSS SP-125.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 400 psig (2760 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 300 psig (2070 kPa).
 - 4) Body Material: ASTM A 126, gray iron.
 - 5) Style: Compact wafer, spring loaded.
 - 6) Seat: Bronze.
 6. Class 250, Iron, Globe, Center-Guided Check Valves with Metal Seat:
 - a. Description:
 - 1) Standard: MSS SP-125.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 400 psig (2760 kPa).



- 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 300 psig (2070 kPa).
 - 4) Body Material: ASTM A 126, gray iron.
 - 5) Style: Globe, spring loaded.
 - 6) Ends: Flanged.
 - 7) Seat: Bronze.
7. Class 300, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat:
- a. Description:
 - 1) Standard: MSS SP-125.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 500 psig (3450 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 400 psig (2760 kPa).
 - 4) Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - 5) Style: Compact wafer, spring loaded.
 - 6) Seat: Bronze.
8. Class 300, Iron, Globe, Center-Guided Check Valves with Metal Seat:
- a. Description:
 - 1) Standard: MSS SP-125.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 500 psig (3450 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 400 psig (2760 kPa).
 - 4) Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - 5) Style: Globe, spring loaded.
 - 6) Ends: Flanged.
 - 7) Seat: Bronze.
9. Class 125, Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat:
- a. Description:
 - 1) Standard: MSS SP-125.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 200 psig (1380 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 150 psig (1035 kPa).
 - 4) Body Material: ASTM A 126, gray iron.
 - 5) Style: Compact wafer.
 - 6) Seat: EPDM **OR** BR, **as directed**.
10. Class 125, Iron, Globe, Center-Guided Check Valves with Resilient Seat:
- a. Description:
 - 1) Standard: MSS SP-125.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 200 psig (1380 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 150 psig (1035 kPa).
 - 4) Body Material: ASTM A 126, gray iron.
 - 5) Style: Globe, spring loaded.
 - 6) Ends: Flanged.
 - 7) Seat: EPDM **OR** NBR, **as directed**.
11. Class 150, Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat:
- a. Description:
 - 1) Standard: MSS SP-125.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 300 psig (2070 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 250 psig (1725 kPa).
 - 4) Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - 5) Style: Compact wafer.
 - 6) Seat: EPDM **OR** NBR, **as directed**.
12. Class 150, Iron, Globe, Center-Guided Check Valves with Resilient Seat:
- a. Description:
 - 1) Standard: MSS SP-125.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 300 psig (2070 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 250 psig (1725 kPa).
 - 4) Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - 5) Style: Globe, spring loaded.
 - 6) Ends: Flanged.
 - 7) Seat: EPDM **OR** NBR, **as directed**.



13. Class 250, Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat:
 - a. Description:
 - 1) Standard: MSS SP-125.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 400 psig (2760 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 300 psig (2070 kPa).
 - 4) Body Material: ASTM A 126, gray iron.
 - 5) Style: Compact wafer, spring loaded.
 - 6) Seat: EPDM **OR** NBR, **as directed**.
 14. Class 250, Iron, Globe, Center-Guided Check Valves with Resilient Seat:
 - a. Description:
 - 1) Standard: MSS SP-125.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 400 psig (2760 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 300 psig (2070 kPa).
 - 4) Body Material: ASTM A 126, gray iron.
 - 5) Style: Globe, spring loaded.
 - 6) Ends: Flanged.
 - 7) Seat: EPDM **OR** NBR, **as directed**.
 15. Class 300, Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat:
 - a. Description:
 - 1) Standard: MSS SP-125.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 500 psig (3450 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 400 psig (2760 kPa).
 - 4) Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - 5) Style: Compact wafer, spring loaded.
 - 6) Seat: EPDM **OR** NBR, **as directed**.
 16. Class 300, Iron, Globe, Center-Guided Check Valves with Resilient Seat:
 - a. Description:
 - 1) Standard: MSS SP-125.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 500 psig (3450 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 400 psig (2760 kPa).
 - 4) Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - 5) Style: Globe, spring loaded.
 - 6) Ends: Flanged.
 - 7) Seat: EPDM **OR** NBR, **as directed**.
- O. Iron, Plate-Type Check Valves
1. Class 125, Iron, Dual-Plate Check Valves with Metal Seat:
 - a. Description:
 - 1) Standard: API 594.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 200 psig (1380 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 150 psig (1035 kPa).
 - 4) Body Design: Wafer, spring-loaded plates.
 - 5) Body Material: ASTM A 126, gray iron.
 - 6) Seat: Bronze.
 2. Class 150, Iron, Dual-Plate Check Valves with Metal Seat:
 - a. Description:
 - 1) Standard: API 594.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 300 psig (2070 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 250 psig (1725 kPa).
 - 4) Body Design: Wafer, spring-loaded plates.
 - 5) Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - 6) Seat: Bronze.
 3. Class 250, Iron, Dual-Plate Check Valves with Metal Seat:
 - a. Description:
 - 1) Standard: API 594.



- 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 400 psig (2760 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 300 psig (2070 kPa).
 - 4) Body Design: Wafer, spring-loaded plates.
 - 5) Body Material: ASTM A 126, gray iron.
 - 6) Seat: Bronze.
4. Class 300, Iron, Dual-Plate Check Valves with Metal Seat:
- a. Description:
 - 1) Standard: API 594.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 500 psig (3450 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 400 psig (2760 kPa).
 - 4) Body Design: Wafer, spring-loaded plates.
 - 5) Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - 6) Seat: Bronze.
5. Class 125, Iron, Single-Plate Check Valves with Resilient Seat:
- a. Description:
 - 1) Standard: API 594.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 200 psig (1380 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 150 psig (1035 kPa).
 - 4) Body Design: Wafer, spring-loaded plate.
 - 5) Body Material: ASTM A 126, gray iron.
 - 6) Seat: EPDM **OR** NBR, **as directed**.
6. Class 125, Iron, Dual-Plate Check Valves with Resilient Seat:
- a. Description:
 - 1) Standard: API 594.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 200 psig (1380 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 150 psig (1035 kPa).
 - 4) Body Design: Wafer, spring-loaded plates.
 - 5) Body Material: ASTM A 126, gray iron.
 - 6) Seat: EPDM **OR** NBR, **as directed**.
7. Class 150, Iron, Dual-Plate Check Valves with Resilient Seat:
- a. Description:
 - 1) Standard: API 594.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 300 psig (2070 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 250 psig (1725 kPa).
 - 4) Body Design: Wafer, spring-loaded plates.
 - 5) Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - 6) Seat: EPDM **OR** NBR, **as directed**.
8. Class 250, Iron, Wafer, Single-Plate Check Valves with Resilient Seat:
- a. Description:
 - 1) Standard: API 594.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 400 psig (2760 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 300 psig (2070 kPa).
 - 4) Body Design: Wafer, spring-loaded plate.
 - 5) Body Material: ASTM A 126, gray iron.
 - 6) Seat: EPDM **OR** NBR, **as directed**.
9. Class 250, Iron, Dual-Plate Check Valves with Resilient Seat:
- a. Description:
 - 1) Standard: API 594.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 400 psig (2760 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 300 psig (2070 kPa).
 - 4) Body Design: Wafer, spring-loaded plates.
 - 5) Body Material: ASTM A 126, gray iron.
 - 6) Seat: EPDM **OR** NBR, **as directed**.
10. Class 300, Iron, Dual-Plate Check Valves with Resilient Seat:
- a. Description:
 - 1) Standard: API 594.



- 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 500 psig (3450 kPa).
- 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 400 psig (2760 kPa).
- 4) Body Design: Wafer, spring-loaded plates.
- 5) Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
- 6) Seat: EPDM **OR** NBR, **as directed**.

P. Bronze Gate Valves

1. Class 125, NRS Bronze Gate Valves:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 1.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - 4) Ends: Threaded or solder joint, **as directed**.
 - 5) Stem: Bronze.
 - 6) Disc: Solid wedge; bronze.
 - 7) Packing: Asbestos free.
 - 8) Handwheel: Malleable iron, bronze, or aluminum, **as directed**.
2. Class 125, RS Bronze Gate Valves:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 2.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - 4) Ends: Threaded or solder joint, **as directed**.
 - 5) Stem: Bronze.
 - 6) Disc: Solid wedge; bronze.
 - 7) Packing: Asbestos free.
 - 8) Handwheel: Malleable iron, bronze, or aluminum, **as directed**.
3. Class 150, NRS Bronze Gate Valves:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 1.
 - 2) CWP Rating: 300 psig (2070 kPa).
 - 3) Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
 - 4) Ends: Threaded.
 - 5) Stem: Bronze.
 - 6) Disc: Solid wedge; bronze.
 - 7) Packing: Asbestos free.
 - 8) Handwheel: Malleable iron, bronze, or aluminum, **as directed**.
4. Class 150, RS Bronze Gate Valves:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 2.
 - 2) CWP Rating: 300 psig (2070 kPa).
 - 3) Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
 - 4) Ends: Threaded.
 - 5) Stem: Bronze.
 - 6) Disc: Solid wedge; bronze.
 - 7) Packing: Asbestos free.
 - 8) Handwheel: Malleable iron, bronze, or aluminum, **as directed**.

Q. Iron Gate Valves

1. Class 125, NRS, Iron Gate Valves:
 - a. Description:
 - 1) Standard: MSS SP-70, Type I.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 200 psig (1380 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 150 psig (1035 kPa).
 - 4) Body Material: ASTM A 126, gray iron with bolted bonnet.



- 5) Ends: Flanged.
 - 6) Trim: Bronze.
 - 7) Disc: Solid wedge.
 - 8) Packing and Gasket: Asbestos free.
2. Class 125, OS&Y, Iron Gate Valves:
 - a. Description:
 - 1) Standard: MSS SP-70, Type I.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 200 psig (1380 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 150 psig (1035 kPa).
 - 4) Body Material: ASTM A 126, gray iron with bolted bonnet.
 - 5) Ends: Flanged.
 - 6) Trim: Bronze.
 - 7) Disc: Solid wedge.
 - 8) Packing and Gasket: Asbestos free.
 3. Class 250, NRS, Iron Gate Valves:
 - a. Description:
 - 1) Standard: MSS SP-70, Type I.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 500 psig (3450 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 300 psig (2070 kPa).
 - 4) Body Material: ASTM A 126, gray iron with bolted bonnet.
 - 5) Ends: Flanged.
 - 6) Trim: Bronze.
 - 7) Disc: Solid wedge.
 - 8) Packing and Gasket: Asbestos free.
 4. Class 250, OS&Y, Iron Gate Valves:
 - a. Description:
 - 1) Standard: MSS SP-70, Type I.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 500 psig (3450 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 300 psig (2070 kPa).
 - 4) Body Material: ASTM A 126, gray iron with bolted bonnet.
 - 5) Ends: Flanged.
 - 6) Trim: Bronze.
 - 7) Disc: Solid wedge.
 - 8) Packing and Gasket: Asbestos free.

R. Bronze Globe Valves

1. Class 125, Bronze Globe Valves with Bronze Disc:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 1.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - 4) Ends: Threaded or solder joint, **as directed**.
 - 5) Stem and Disc: Bronze.
 - 6) Packing: Asbestos free.
 - 7) Handwheel: Malleable iron, bronze, or aluminum, **as directed**.
2. Class 125, Bronze Globe Valves with Nonmetallic Disc:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 2.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - 4) Ends: Threaded or solder joint, **as directed**.
 - 5) Stem: Bronze.
 - 6) Disc: PTFE or TFE.
 - 7) Packing: Asbestos free.
 - 8) Handwheel: Malleable iron, bronze, or aluminum, **as directed**.
3. Class 150, Bronze Globe Valves with Nonmetallic Disc:



- a. Description:
 - 1) Standard: MSS SP-80, Type 2.
 - 2) CWP Rating: 300 psig (2070 kPa).
 - 3) Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
 - 4) Ends: Threaded.
 - 5) Stem: Bronze.
 - 6) Disc: PTFE or TFE.
 - 7) Packing: Asbestos free.
 - 8) Handwheel: Malleable iron, bronze, or aluminum, **as directed**.

S. Iron Globe Valves

1. Class 125, Iron Globe Valves:
 - a. Description:
 - 1) Standard: MSS SP-85, Type I.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM A 126, gray iron with bolted bonnet.
 - 4) Ends: Flanged.
 - 5) Trim: Bronze.
 - 6) Packing and Gasket: Asbestos free.
2. Class 250, Iron Globe Valves:
 - a. Description:
 - 1) Standard: MSS SP-85, Type I.
 - 2) CWP Rating: 500 psig (3450 kPa).
 - 3) Body Material: ASTM A 126, gray iron with bolted bonnet.
 - 4) Ends: Flanged.
 - 5) Trim: Bronze.
 - 6) Packing and Gasket: Asbestos free.

T. Lubricated Plug Valves

1. Class 125, Regular-Gland, Lubricated Plug Valves with Threaded Ends:
 - a. Description:
 - 1) Standard: MSS SP-78, Type II.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 200 psig (1380 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 150 psig (1035 kPa).
 - 4) Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - 5) Pattern: Regular or short **OR Venturi, as directed**.
 - 6) Plug: Cast iron or bronze with sealant groove.
2. Class 125, Regular-Gland, Lubricated Plug Valves with Flanged Ends:
 - a. Description:
 - 1) Standard: MSS SP-78, Type II.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 200 psig (1380 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 150 psig (1035 kPa).
 - 4) Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - 5) Pattern: Regular or short **OR Venturi, as directed**.
 - 6) Plug: Cast iron or bronze with sealant groove.
3. Class 125, Cylindrical, Lubricated Plug Valves with Threaded Ends:
 - a. Description:
 - 1) Standard: MSS SP-78, Type IV.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 200 psig (1380 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 150 psig (1035 kPa).
 - 4) Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - 5) Pattern: Regular or short **OR Venturi, as directed**.



- 6) Plug: Cast iron or bronze with sealant groove.
4. Class 125, Cylindrical, Lubricated Plug Valves with Flanged Ends:
 - a. Description:
 - 1) Standard: MSS SP-78, Type IV.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 200 psig (1380 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 150 psig (1035 kPa).
 - 4) Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - 5) Pattern: Regular or short **OR** Venturi, **as directed**.
 - 6) Plug: Cast iron or bronze with sealant groove.
5. Class 250, Regular-Gland, Lubricated Plug Valves with Threaded Ends:
 - a. Description:
 - 1) Standard: MSS SP-78, Type II.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 400 psig (2760 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 300 psig (2070 kPa).
 - 4) Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - 5) Pattern: Regular or short **OR** Venturi, **as directed**.
 - 6) Plug: Cast iron or bronze with sealant groove.
6. Class 250, Regular-Gland, Lubricated Plug Valves with Flanged Ends:
 - a. Description:
 - 1) Standard: MSS SP-78, Type II.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 400 psig (2760 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 300 psig (2070 kPa).
 - 4) Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - 5) Pattern: Regular or short **OR** Venturi, **as directed**.
 - 6) Plug: Cast iron or bronze with sealant groove.
7. Class 250, Cylindrical, Lubricated Plug Valves with Threaded Ends:
 - a. Description:
 - 1) Standard: MSS SP-78, Type IV.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 400 psig (2760 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 300 psig (2070 kPa).
 - 4) Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - 5) Pattern: Regular or short **OR** Venturi, **as directed**.
 - 6) Plug: Cast iron or bronze with sealant groove.
8. Class 250, Cylindrical, Lubricated Plug Valves with Flanged Ends:
 - a. Description:
 - 1) Standard: MSS SP-78, Type IV.
 - 2) NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 400 psig (2760 kPa).
 - 3) NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 300 psig (2070 kPa).
 - 4) Body Material: ASTM A 48/A 48M or ASTM A 126, Grade 40 cast iron with lubrication-sealing system.
 - 5) Pattern: Regular or short **OR** Venturi, **as directed**.
 - 6) Plug: Cast iron or bronze with sealant groove.

U. Eccentric Plug Valves

1. 175 CWP, Eccentric Plug Valves with Resilient Seating.
 - a. Description:
 - 1) Standard: MSS SP-108.
 - 2) CWP Rating: 175 psig (1200 kPa) minimum.
 - 3) Body and Plug: ASTM A 48/A 48M, gray iron; ASTM A 126, gray iron; or ASTM A 536, ductile iron.
 - 4) Bearings: Oil-impregnated bronze or stainless steel.
 - 5) Ends: Flanged.



- 6) Stem-Seal Packing: Asbestos free.
- 7) Plug, Resilient-Seating Material: Suitable for potable-water service unless otherwise indicated.

V. Chainwheels

1. Description: Valve actuation assembly with sprocket rim, brackets, and chain.
 - a. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
 - b. Attachment: For connection to ball **OR** butterfly **OR** plug, **as directed**, valve stems.
 - c. Sprocket Rim with Chain Guides: Ductile iron **OR** Cast iron **OR** Aluminum **OR** Bronze, **as directed**, of type and size required for valve. Include zinc coating, **as directed**.
 - d. Chain: Hot-dip, galvanized steel **OR** Brass **OR** Stainless steel, **as directed**, of size required to fit sprocket rim.

1.3 EXECUTION

A. Valve Installation

1. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
2. Locate valves for easy access and provide separate support where necessary.
3. Install valves in horizontal piping with stem at or above center of pipe.
4. Install valves in position to allow full stem movement.
5. Install chainwheels on operators for ball **OR** butterfly **OR** gate **OR** globe **OR** plug, **as directed**, valves NPS 4 (DN 100) and larger and more than 96 inches (2400 mm) above floor. Extend chains to 60 inches (1520 mm) above finished floor.
6. Install check valves for proper direction of flow and as follows:
 - a. Swing Check Valves: In horizontal position with hinge pin level.
 - b. Center-Guided and Plate-Type Check Valves: In horizontal or vertical position, between flanges.
 - c. Lift Check Valves: With stem upright and plumb.

B. Adjusting

1. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

C. General Requirements For Valve Applications

1. If valve applications are not indicated, use the following:
 - a. Shutoff Service: Ball, butterfly **OR** gate **OR** plug, **as directed**, valves.
 - b. Butterfly Valve Dead-End Service: Single-flange (lug) type.
 - c. Throttling Service except Steam: Globe **OR** angle **OR** ball **OR** butterfly, **as directed**, valves.
 - d. Throttling Service, Steam: Globe **OR** angle **OR** butterfly, **as directed**, valves.
 - e. Pump-Discharge Check Valves:
 - 1) NPS 2 (DN 50) and Smaller: Bronze swing check valves with bronze **OR** nonmetallic, **as directed**, disc.
 - 2) NPS 2-1/2 (DN 65) and Larger: Iron swing check valves with lever and weight or with spring or iron, center-guided, metal **OR** resilient, **as directed**,-seat check valves.
2. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
3. Select valves, except wafer types, with the following end connections:
 - a. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
 - b. For Copper Tubing, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.



- c. For Copper Tubing, NPS 5 (DN 125) and Larger: Flanged ends.
- d. For Steel Piping, NPS 2 (DN 50) and Smaller: Threaded ends.
- e. For Steel Piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.
- f. For Steel Piping, NPS 5 (DN 125) and Larger: Flanged ends.
- g. For Grooved-End Copper Tubing and Steel Piping except Steam and Steam Condensate Piping: Valve ends may be grooved.

D. Chilled-Water Valve Schedule

- 1. Pipe NPS 2 (DN 50) and Smaller:
 - a. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
 - b. Bronze Angle Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic, **as directed**, disc.
 - c. Ball Valves: One **OR** Two **OR** Three, **as directed**, piece, full **OR** regular **OR** reduced, **as directed**, port, brass **OR** bronze, **as directed**, with brass **OR** bronze **OR** stainless-steel, **as directed**, trim.
 - d. Bronze Swing Check Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic, **as directed**, disc.
 - e. Bronze Gate Valves: Class 125 **OR** Class 150, **as directed**, NRS **OR** RS, **as directed**, bronze.
 - f. Bronze Globe Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic, **as directed**, disc.
- 2. Pipe NPS 2-1/2 (DN 65) and Larger:
 - a. Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): May be provided with threaded ends instead of flanged ends.
 - b. Iron Ball Valves, NPS 2-1/2 to NPS 10 (DN 65 to DN 250): Class 150.
 - c. Iron, Single-Flange Butterfly Valves, NPS 2-1/2 to NPS 12 (DN 65 to DN 300): 200 CWP, EPDM **OR** NBR, **as directed**, seat, aluminum-bronze **OR** ductile-iron **OR** stainless-steel, **as directed**, disc.
 - d. Iron, Single-Flange Butterfly Valves, NPS 14 to NPS 24 (DN 350 to DN 600): 150 CWP, EPDM **OR** NBR, **as directed**, seat, aluminum-bronze **OR** ductile-iron **OR** stainless-steel, **as directed**, disc.
 - e. Iron, Grooved-End Butterfly Valves, NPS 2-1/2 to NPS 12 (DN 65 to DN 300): 175 **OR** 300, **as directed**, CWP.
 - f. High-Performance Butterfly Valves: Class 150 **OR** Class 300, **as directed**, single flange.
 - g. Iron Swing Check Valves: Class 125 **OR** Class 250, **as directed**, metal **OR** nonmetallic-to-metal, **as directed**, seats.
 - h. Iron Swing Check Valves with Closure Control, NPS 2-1/2 to NPS 12 (DN 65 to DN 300): Class 125, lever and spring **OR** weight, **as directed**.
 - i. Iron, Grooved-End Check Valves, NPS 3 to NPS 12 (DN 80 to DN 300): 300 CWP.
 - j. Iron, Center-Guided Check Valves: Class 125 **OR** Class 150 **OR** Class 250 **OR** Class 300, **as directed**, compact-wafer **OR** globe, **as directed**, metal **OR** resilient, **as directed**, seat.
 - k. Iron, Plate-Type Check Valves: Class 125 **OR** Class 150 **OR** Class 250 **OR** Class 300, **as directed**; single **OR** dual, **as directed**, plate; metal **OR** resilient, **as directed**, seat.
 - l. Iron Gate Valves: Class 125 **OR** Class 250, **as directed**, NRS **OR** OS&Y, **as directed**.
 - m. Iron Globe Valves: Class 125 **OR** Class 250, **as directed**.
 - n. Lubricated Plug Valves: Class 125 **OR** Class 250, **as directed**, regular gland **OR** cylindrical, **as directed**, threaded **OR** flanged, **as directed**.
 - o. Eccentric Plug Valves: 175 CWP, resilient seating.

E. Condenser-Water Valve Schedule

- 1. Pipe NPS 2 (DN 50) and Smaller:
 - a. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.



- b. Bronze Angle Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic, **as directed**, disc.
 - c. Ball Valves: One **OR** Two **OR** Three, **as directed**, piece, full **OR** regular **OR** reduced, **as directed**, port, brass **OR** bronze, **as directed**, with brass **OR** bronze **OR** stainless-steel, **as directed**, trim.
 - d. Bronze Swing Check Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic, **as directed**, disc.
 - e. Bronze Gate Valves: Class 125 **OR** Class 150, **as directed**, NRS **OR** RS, **as directed**.
 - f. Bronze Globe Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic, **as directed**, disc.
2. Pipe NPS 2-1/2 (DN 65) and Larger:
- a. Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): May be provided with threaded ends instead of flanged ends.
 - b. Iron Ball Valves, NPS 2-1/2 to NPS 10 (DN 65 to DN 250): Class 150.
 - c. Iron, Single-Flange Butterfly Valves, NPS 2-1/2 to NPS 12 (DN 65 to DN 300): 200 CWP, EPDM **OR** NBR, **as directed**, seat, aluminum-bronze **OR** ductile-iron **OR** stainless-steel, **as directed**, disc.
 - d. Iron, Single-Flange Butterfly Valves, NPS 14 to NPS 24 (DN 350 to DN 600): 150 CWP, EPDM **OR** NBR, **as directed**, seat, aluminum-bronze **OR** ductile-iron **OR** stainless-steel, **as directed**, disc.
 - e. Iron, Grooved-End Butterfly Valves, NPS 2-1/2 to NPS 12 (DN 65 to DN 300): 175 **OR** 300, **as directed**, CWP.
 - f. High-Performance Butterfly Valves: Class 150 **OR** Class 300, **as directed**, single flange.
 - g. Iron Swing Check Valves: Class 125 **OR** Class 250, **as directed**, metal **OR** nonmetallic-to-metal, **as directed**, seats.
 - h. Iron Swing Check Valves with Closure Control, NPS 2-1/2 to NPS 12 (DN 65 to DN 300): Class 125, lever and spring **OR** weight, **as directed**.
 - i. Iron, Grooved-End Check Valves, NPS 3 to NPS 12 (DN 80 to DN 300): 300 CWP.
 - j. Iron, Center-Guided Check Valves, NPS 2-1/2 to NPS 24 (DN 65 to DN 600): Class 125 **OR** Class 150 **OR** Class 250 **OR** Class 300, **as directed**, metal **OR** resilient, **as directed**, seat.
 - k. Iron, Plate-Type Check Valves: Class 125 **OR** Class 150 **OR** Class 250 **OR** Class 300, **as directed**; single **OR** dual, **as directed**, plate; metal **OR** resilient, **as directed**, seat.
 - l. Iron Gate Valves: Class 125 **OR** Class 250, **as directed**, NRS **OR** OS&Y, **as directed**.
 - m. Iron Globe Valves, NPS 2-1/2 to NPS 12 (DN 65 to DN 300): Class 125 **OR** Class 250, **as directed**.
 - n. Lubricated Plug Valves: Class 125 **OR** Class 250, **as directed**, regular gland **OR** cylindrical, **as directed**, threaded **OR** flanged, **as directed**.
- F. Heating-Water Valve Schedule
1. Pipe NPS 2 (DN 50) and Smaller:
 - a. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
 - b. Bronze Angle Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic, **as directed**, disc.
 - c. Ball Valves: One **OR** Two **OR** Three, **as directed**, piece, full **OR** regular **OR** reduced, **as directed**, port, brass **OR** bronze, **as directed**, with brass **OR** bronze **OR** stainless-steel, **as directed**, trim.
 - d. Bronze Swing Check Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic, **as directed**, disc.
 - e. Bronze Gate Valves: Class 125 **OR** Class 150, **as directed**, NRS **OR** RS, **as directed**.
 - f. Bronze Globe Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic, **as directed**, disc.
 2. Pipe NPS 2-1/2 (DN 65) and Larger:



- a. Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): May be provided with threaded ends instead of flanged ends.
 - b. Iron Ball Valves, NPS 2-1/2 to NPS 10 (DN 65 to DN 250): Class 150.
 - c. Iron, Single-Flange Butterfly Valves, NPS 2-1/2 to NPS 12 (DN 65 to DN 300): 200 CWP, EPDM **OR** NBR, **as directed**, seat, aluminum-bronze **OR** ductile-iron **OR** stainless-steel, **as directed**, disc.
 - d. Iron, Single-Flange Butterfly Valves, NPS 14 to NPS 24 (DN 350 to DN 600): 150 CWP, EPDM **OR** NBR, **as directed**, seat, aluminum-bronze **OR** ductile-iron **OR** stainless-steel, **as directed**, disc.
 - e. Iron, Grooved-End Butterfly Valves, NPS 2-1/2 to NPS 12 (DN 65 to DN 300): 175 **OR** 300, **as directed**, CWP.
 - f. High-Performance Butterfly Valves: Class 150 **OR** Class 300, **as directed**, single flange.
 - g. Iron Swing Check Valves: Class 125 **OR** Class 250, **as directed**, metal **OR** nonmetallic-to-metal, **as directed**, seats.
 - h. Iron Swing Check Valves with Closure Control, NPS 2-1/2 to NPS 12 (DN 65 to DN 300): Class 125, lever and spring **OR** weight, **as directed**.
 - i. Iron, Grooved-End Check Valves, NPS 3 to NPS 12 (DN 80 to DN 300): 300 CWP.
 - j. Iron, Center-Guided Check Valves: Class 125 **OR** Class 150 **OR** Class 250 **OR** Class 300, **as directed**, compact-wafer **OR** globe, **as directed**, metal **OR** resilient, **as directed**, seat.
 - k. Iron, Plate-Type Check Valves: Class 125 **OR** Class 150 **OR** Class 250 **OR** Class 300, **as directed**; single **OR** dual, **as directed**, plate; metal **OR** resilient, **as directed**, seat.
 - l. Iron Gate Valves: Class 125 **OR** Class 250, **as directed**, NRS **OR** OS&Y, **as directed**.
 - m. Iron Globe Valves, NPS 2-1/2 to NPS 12 (DN 65 to DN 300): Class 125 **OR** Class 250, **as directed**.
- G. Low-Pressure Steam Valve Schedule (15 psig (104 kPa) Or Less)
1. Pipe NPS 2 (DN 50) and Smaller:
 - a. Bronze Angle Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic, **as directed**, disc.
 - b. Ball Valves: One **OR** Two **OR** Three, **as directed**, piece, full **OR** regular **OR** reduced, **as directed**, port, brass **OR** bronze, **as directed**, with brass **OR** bronze **OR** stainless-steel, **as directed**, trim.
 - c. Bronze Swing Check Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic, **as directed**, disc.
 - d. Bronze Gate Valves: Class 125 **OR** Class 150, **as directed**, NRS **OR** RS, **as directed**.
 - e. Bronze Globe Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic, **as directed**, disc.
 2. Pipe NPS 2-1/2 (DN 65) and Larger:
 - a. Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): May be provided with threaded ends instead of flanged ends.
 - b. Iron Ball Valves, NPS 2-1/2 to NPS 10 (DN 65 to DN 250): Class 150.
 - c. High-Performance Butterfly Valves: Class 150 **OR** Class 300, **as directed**, single flange.
 - d. Iron Swing Check Valves: Class 125 **OR** Class 250, **as directed**, metal **OR** nonmetallic-to-metal, **as directed**, seats.
 - e. Iron Swing Check Valves with Closure Control, NPS 2-1/2 to NPS 12 (DN 65 to DN 300): Class 125, lever and spring **OR** weight, **as directed**.
 - f. Iron Gate Valves: Class 125 **OR** Class 250, **as directed**, NRS **OR** OS&Y, **as directed**.
 - g. Iron Globe Valves, NPS 2-1/2 to NPS 12 (DN 65 to DN 300): Class 125 **OR** Class 250, **as directed**.
- H. High-Pressure Steam Valve Schedule (More Than 15 psig (104 kPa))
1. Pipe NPS 2 (DN 50) and Smaller:
 - a. Bronze Angle Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic, **as directed**, disc.



- b. Ball Valves: One **OR** Two **OR** Three, **as directed**, piece, full **OR** regular **OR** reduced, **as directed**, port, brass **OR** bronze, **as directed**, with brass **OR** bronze **OR** stainless-steel, **as directed**, trim.
 - c. Bronze Swing Check Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic, **as directed**, disc.
 - d. Bronze Gate Valves: Class 125 **OR** Class 150, **as directed**, NRS **OR** RS, **as directed**, bronze.
 - e. Globe Valves: Class 125 **OR** 150, **as directed**, bronze, bronze **OR** nonmetallic, **as directed**, disc.
2. Pipe Sizes NPS 2-1/2 (DN 65) and Larger:
- a. Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): May be provided with threaded ends instead of flanged ends.
 - b. Ball Valves, NPS 2-1/2 to NPS 10 (DN 65 to DN 250): Class 150, iron.
 - c. High-Performance Butterfly Valves: Class 150 **OR** Class 300, **as directed**, single flange.
 - d. Iron Swing Check Valves: Class 125 **OR** Class 250, **as directed**, metal **OR** nonmetallic-to-metal, **as directed**, seats.
 - e. Iron Swing Check Valves with Closure Control, NPS 2-1/2 to NPS 12 (DN 65 to DN 300): Class 125, lever and spring **OR** weight, **as directed**.
 - f. Iron Gate Valves: Class 125 **OR** Class 250, **as directed**, NRS **OR** OS&Y, **as directed**.
 - g. Iron Globe Valves, NPS 2-1/2 to NPS 12 (DN 65 to DN 300): Class 125 **OR** Class 250, **as directed**.
- I. Steam-Condensate Valve Schedule
1. Pipe NPS 2 (DN 50) and Smaller:
- a. Bronze Angle Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic, **as directed**, disc.
 - b. Ball Valves: One **OR** Two **OR** Three, **as directed**, piece, full **OR** regular **OR** reduced, **as directed**, port, brass **OR** bronze, **as directed**, with brass **OR** bronze **OR** stainless-steel, **as directed**, trim.
 - c. Bronze Swing Check Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic, **as directed**, disc.
 - d. Bronze Gate Valves: Class 125 **OR** Class 150, **as directed**, NRS **OR** RS, **as directed**.
 - e. Bronze Globe Valves: Class 125 **OR** Class 150, **as directed**, bronze **OR** nonmetallic, **as directed**, disc.
2. Pipe NPS 2-1/2 (DN 65) and Larger:
- a. Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): May be provided with threaded ends instead of flanged ends.
 - b. Iron Ball Valves, NPS 2-1/2 to NPS 10 (DN 65 to DN 250): Class 150.
 - c. High-Performance Butterfly Valves: Class 150 **OR** Class 300, **as directed**, single flange.
 - d. Iron Swing Check Valves: Class 125 **OR** Class 250, **as directed**, metal **OR** nonmetallic-to-metal, **as directed**, seats.
 - e. Iron Swing Check Valves with Closure Control: Class 125, lever and spring **OR** weight, **as directed**.
 - f. Iron Gate Valves: Class 125 **OR** Class 250, **as directed**, NRS **OR** OS&Y, **as directed**.
 - g. Iron Globe Valves, NPS 2-1/2 to NPS 12 (DN 65 to DN 300): Class 125 **OR** Class 250, **as directed**.
 - h. Lubricated Plug Valves: Class 125 **OR** Class 250, **as directed**, regular gland **OR** cylindrical, **as directed**, threaded **OR** flanged, **as directed**.

END OF SECTION 22 05 23 00b

**SECTION 22 05 48 00 - VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT**

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of vibration and seismic controls for plumbing piping and equipment. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Isolation pads.
 - b. Isolation mounts.
 - c. Restrained elastomeric isolation mounts.
 - d. Freestanding and Restrained spring isolators.
 - e. Housed spring mounts.
 - f. Elastomeric hangers.
 - g. Spring hangers.
 - h. Spring hangers with vertical-limit stops.
 - i. Pipe riser resilient supports.
 - j. Resilient pipe guides.
 - k. Seismic snubbers.
 - l. Restraining braces and cables.
 - m. Steel and Inertia, vibration isolation equipment bases.

C. Definitions

1. IBC: International Building Code.
2. ICC-ES: ICC-Evaluation Service.
3. OSHPD: Office of Statewide Health Planning and Development for the State of California.

D. Performance Requirements

1. Seismic-Restraint Loading:
 - a. Site Class as Defined in the IBC: **A OR B OR C OR D OR E OR F, as directed.**
 - b. Assigned Seismic Use Group or Building Category as Defined in the IBC: **I OR II OR III, as directed.**
 - 1) Component Importance Factor: **1.0 OR 1.5, as directed.**
 - 2) Component Response Modification Factor: **1.5 OR 2.5 OR 3.5 OR 5.0, as directed.**
 - 3) Component Amplification Factor: **1.0 OR 2.5, as directed.**
 - c. Design Spectral Response Acceleration at Short Periods (0.2 Second): Percentage as directed.
 - d. Design Spectral Response Acceleration at 1-Second Period: Percentage as directed.

E. Submittals

1. Product Data: For each product indicated.
2. Delegated-Design Submittal: For vibration isolation and seismic-restraint calculations and details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
3. Welding certificates.
4. Qualification Data: For professional engineer.
5. Field quality-control test reports.

F. Quality Assurance

Vibration And Seismic Controls For Plumbing Piping And
Equipment



1. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
2. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
3. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproved by ICC-ES, or preapproved by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

1.2 PRODUCTS

A. Vibration Isolators

1. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.
 - a. Resilient Material: Oil- and water-resistant neoprene **OR** rubber **OR** hermetically sealed compressed fiberglass, **as directed**.
2. Mounts: Double-deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.
 - a. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
 - b. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.
3. Restrained Mounts: All-directional mountings with seismic restraint.
 - a. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
 - b. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.
4. Spring Isolators: Freestanding, laterally stable, open-spring isolators.
 - a. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - b. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - c. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - d. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - e. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- (6-mm-) thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig (3447 kPa).
 - f. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.
5. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.
 - a. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.



- b. Restraint: Seismic or limit-stop as required for equipment and authorities having jurisdiction.
 - c. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - d. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - e. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - f. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Housed Spring Mounts: Housed spring isolator with integral seismic snubbers.
 - a. Housing: Ductile-iron or steel housing to provide all-directional seismic restraint.
 - b. Base: Factory drilled for bolting to structure.
 - c. Snubbers: Vertically adjustable to allow a maximum of 1/4-inch (6-mm) travel up or down before contacting a resilient collar.
 7. Elastomeric Hangers: Single or double-deflection type, fitted with molded, oil-resistant elastomeric isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.
 8. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.
 - a. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
 - b. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - c. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - d. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - e. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - f. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
 - g. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.
 9. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.
 - a. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
 - b. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - c. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - d. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - e. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - f. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
 - g. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
 - h. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.
 10. Pipe Riser Resilient Support: All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch- (13-mm-) thick neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on the isolation material of 500 psig (3.45 MPa) and for equal resistance in all directions.
 11. Resilient Pipe Guides: Telescopic arrangement of 2 steel tubes or post and sleeve arrangement separated by a minimum of 1/2-inch- (13-mm-) thick neoprene. Where clearances are not readily visible, a factory-set guide height with a shear pin to allow vertical motion due to pipe expansion



and contraction shall be fitted. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

B. Vibration Isolation Equipment Bases

1. Steel Base: Factory-fabricated, welded, structural-steel bases and rails.
 - a. Design Requirements: Lowest possible mounting height with not less than 1-inch (25-mm) clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.
 - 1) Include supports for suction and discharge elbows for pumps.
 - b. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
 - c. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
2. Inertia Base: Factory-fabricated, welded, structural-steel bases and rails ready for placement of cast-in-place concrete.
 - a. Design Requirements: Lowest possible mounting height with not less than 1-inch (25-mm) clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.
 - 1) Include supports for suction and discharge elbows for pumps.
 - b. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
 - c. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
 - d. Fabrication: Fabricate steel templates to hold equipment anchor-bolt sleeves and anchors in place during placement of concrete. Obtain anchor-bolt templates from supported equipment manufacturer.

C. Seismic-Restraint Devices

1. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of ICC-ES **OR** OSHPD **OR** an agency acceptable to authorities having jurisdiction, **as directed**.
 - a. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
2. Snubbers: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.
 - a. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
 - b. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
 - c. Maximum 1/4-inch (6-mm) air gap, and minimum 1/4-inch- (6-mm-) thick resilient cushion.
3. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.
4. Restraint Cables: ASTM A 603 galvanized-steel **OR** ASTM A 492 stainless-steel, **as directed**, cables with end connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.
5. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections **OR** Reinforcing steel angle clamped, **as directed**, to hanger rod.
6. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.



7. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.
8. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.
9. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.
10. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

D. Factory Finishes

1. Finish:

- a. Manufacturer's standard prime-coat finish ready for field painting.

OR

Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

- 1) Powder coating on springs and housings.
- 2) All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
- 3) Baked enamel or powder coat for metal components on isolators for interior use.
- 4) Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

1.3 EXECUTION

A. Applications

1. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an evaluation service member of ICC-ES **OR** OSHPD **OR** an agency acceptable to authorities having jurisdiction, **as directed**.
2. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
3. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

B. Vibration-Control And Seismic-Restraint Device Installation

1. Equipment Restraints:

- a. Install seismic snubbers on plumbing equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
- b. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inches (3.2 mm).
- c. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES **OR** OSHPD **OR** an agency acceptable to authorities having jurisdiction, **as directed**, providing required submittals for component.

2. Piping Restraints:

- a. Comply with requirements in MSS SP-127.
- b. Space lateral supports a maximum of 40 feet (12 m) o.c., and longitudinal supports a maximum of 80 feet (24 m) o.c.

Vibration And Seismic Controls For Plumbing Piping And



- c. Brace a change of direction longer than 12 feet (3.7 m).
 3. Install cables so they do not bend across edges of adjacent equipment or building structure.
 4. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES **OR** OSHPD **OR** an agency acceptable to authorities having jurisdiction, **as directed**, providing required submittals for component.
 5. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
 6. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
 7. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
 8. Drilled-in Anchors:
 - a. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - b. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - c. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 - d. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
 - e. Set anchors to manufacturer's recommended torque, using a torque wrench.
 - f. Install zinc-coated steel anchors for interior and stainless steel anchors for exterior applications.
- C. Accommodation Of Differential Seismic Motion
1. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Division 22 Section "Domestic Water Piping" for piping flexible connections.
- D. Field Quality Control
1. Perform tests and inspections.
 2. Tests and Inspections:
 - a. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 - b. Schedule test with the Owner before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
 - c. Obtain approval before transmitting test loads to structure. Provide temporary load-spreading members.
 - d. Test at least four of each type and size of installed anchors and fasteners selected.
 - e. Test to 90 percent of rated proof load of device.
 - f. Measure isolator restraint clearance.
 - g. Measure isolator deflection.
 - h. Verify snubber minimum clearances.
 - i. Air-Mounting System Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.



-
- j. Air-Mounting System Operational Test: Test the compressed-air leveling system.
 - k. Test and adjust air-mounting system controls and safeties.
 - l. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.
3. Remove and replace malfunctioning units and retest as specified above.
 4. Prepare test and inspection reports.
- E. Adjusting
1. Adjust isolators after piping system is at operating weight.
 2. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
 3. Adjust active height of sprint isolators.
 4. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 22 05 48 00



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SECTION 22 05 53 00 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for identification for plumbing piping and equipment. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Equipment labels.
 - b. Warning signs and labels.
 - c. Pipe labels.
 - d. Stencils.
 - e. Valve tags.
 - f. Warning tags.

C. Submittals

1. Product Data: For each type of product indicated.

1.2 PRODUCTS

A. Equipment Labels

1. Metal Labels for Equipment:
 - a. Material and Thickness: Brass, 0.032-inch (0.8-mm) **OR** Stainless steel, 0.025-inch (0.64-mm) **OR** Aluminum, 0.032-inch (0.8-mm) **OR** anodized aluminum, 0.032-inch (0.8-mm), **as directed**, minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - b. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
 - c. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - d. Fasteners: Stainless-steel rivets **OR** self-tapping screws, **as directed**.
 - e. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
2. Plastic Labels for Equipment:
 - a. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) **OR** 1/8 inch (3.2 mm), **as directed**, thick, and having predrilled holes for attachment hardware.
 - b. Letter Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 - c. Background Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 - d. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
 - e. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
 - f. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - g. Fasteners: Stainless-steel rivets **OR** self-tapping screws, **as directed**.
 - h. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.



3. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.
 4. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.
- B. Warning Signs And Labels
1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) **OR** 1/8 inch (3.2 mm), **as directed**, thick, and having predrilled holes for attachment hardware.
 2. Letter Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 3. Background Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
 6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 7. Fasteners: Stainless-steel rivets **OR** self-tapping screws, **as directed**.
 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
 9. Label Content: Include caution and warning information, plus emergency notification instructions.
- C. Pipe Labels
1. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
 2. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover **OR** cover full, **as directed**, circumference of pipe and to attach to pipe without fasteners or adhesive.
 3. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
 4. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
 - a. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
 - b. Lettering Size: At least 1-1/2 inches (38 mm) high.
- D. Stencils
1. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; and minimum letter height of 3/4 inch (19 mm) for access panel and door labels, equipment labels, and similar operational instructions.
 - a. Stencil Material: Aluminum **OR** Brass **OR** Fiberboard, **as directed**.
 - b. Stencil Paint: Exterior, gloss, alkyd enamel **OR** acrylic enamel, **as directed**, black unless otherwise indicated. Paint may be in pressurized spray-can form.
 - c. Identification Paint: Exterior, alkyd enamel **OR** acrylic enamel, **as directed**, in colors according to ASME A13.1 unless otherwise indicated.
- E. Valve Tags
1. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers.
 - a. Tag Material: Brass, 0.032-inch (0.8-mm) **OR** Stainless steel, 0.025-inch (0.64-mm) **OR** Aluminum, 0.032-inch (0.8-mm) **OR** anodized aluminum, 0.032-inch (0.8-mm), **as directed**, minimum thickness, and having predrilled or stamped holes for attachment hardware.



- b. Fasteners: Brass wire-link chain **OR** beaded chain **OR** S-hook, **as directed**.
2. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 - a. Valve-tag schedule shall be included in operation and maintenance data.

F. Warning Tags

1. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
 - a. Size: 3 by 5-1/4 inches (75 by 133 mm) minimum **OR** Approximately 4 by 7 inches (100 by 178 mm), **as directed**.
 - b. Fasteners: Brass grommet and wire **OR** Reinforced grommet and wire or string, **as directed**.
 - c. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
 - d. Color: Yellow background with black lettering.

1.3 EXECUTION

A. Preparation

1. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

B. Equipment Label Installation

1. Install or permanently fasten labels on each major item of mechanical equipment.
2. Locate equipment labels where accessible and visible.

C. Pipe Label Installation

1. Piping Color-Coding: Painting of piping is specified in Division 09 Section(s) "Interior Painting" **OR** "High-performance Coatings", **as directed**.
2. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels with painted, color-coded bands or rectangles **OR** complying with ASME A13.1, **as directed**, on each piping system.
 - a. Identification Paint: Use for contrasting background.
 - b. Stencil Paint: Use for pipe marking.
3. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - a. Near each valve and control device.
 - b. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - c. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - d. At access doors, manholes, and similar access points that permit view of concealed piping.
 - e. Near major equipment items and other points of origination and termination.
 - f. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
 - g. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
4. Pipe Label Color Schedule:
 - a. Low-Pressure, Compressed-Air Piping:
 - 1) Background Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 - 2) Letter Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 - b. Medium-Pressure, Compressed-Air Piping:
 - 1) Background Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.



- 2) Letter Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 - c. Domestic Water Piping:
 - 1) Background Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 - 2) Letter Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 - d. Sanitary Waste and Storm Drainage Piping:
 - 1) Background Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 - 2) Letter Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
- D. Valve-Tag Installation
1. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
 2. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
 - a. Valve-Tag Size and Shape:
 - 1) Cold Water: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, round **OR** square, **as directed**.
 - 2) Hot Water: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, round **OR** square, **as directed**.
 - 3) Low-Pressure Compressed Air: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, round **OR** square, **as directed**.
 - 4) High-Pressure Compressed Air: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, round **OR** square, **as directed**.
 - b. Valve-Tag Color:
 - 1) Cold Water: Natural **OR** Green, **as directed**.
 - 2) Hot Water: Natural **OR** Green, **as directed**.
 - 3) Low-Pressure Compressed Air: Natural **OR** Green, **as directed**.
 - 4) High-Pressure Compressed Air: Natural **OR** Green, **as directed**.
 - c. Letter Color:
 - 1) Cold Water: Black **OR** White, **as directed**.
 - 2) Hot Water: Black **OR** White, **as directed**.
 - 3) Low-Pressure Compressed Air: Black **OR** White, **as directed**.
 - 4) High-Pressure Compressed Air: Black **OR** White, **as directed**.
- E. Warning-Tag Installation
1. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 22 05 53 00



SECTION 22 05 76 00 - SANITARY SEWERAGE**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for sanitary sewerage. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Pipe and fittings.
 - b. Nonpressure and pressure couplings.
 - c. Expansion joints and deflection fittings.
 - d. Backwater valves.
 - e. Cleanouts.
 - f. Encasement for piping.
 - g. Manholes.

C. Definitions

1. FRP: Fiberglass-reinforced plastic.

D. Submittals

1. Product Data: For the following:
 - a. Expansion joints and deflection fittings.
 - b. Backwater valves.
2. Shop Drawings: For manholes. Include plans, elevations, sections, details, and frames and covers.
3. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from sewer system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.
4. Profile Drawings: Show system piping in elevation. Draw profiles to horizontal scale of not less than 1 inch equals 50 feet (1:500) and to vertical scale of not less than 1 inch equals 5 feet (1:50). Indicate manholes and piping. Show types, sizes, materials, and elevations of other utilities crossing system piping.
5. Product Certificates: For each type of cast-iron soil pipe and fitting, from manufacturer.
6. Field quality-control reports.

E. Delivery, Storage, And Handling

1. Do not store plastic manholes, pipe, and fittings in direct sunlight.
2. Protect pipe, pipe fittings, and seals from dirt and damage.
3. Handle manholes according to manufacturer's written rigging instructions.

F. Project Conditions

1. Interruption of Existing Sanitary Sewerage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - a. Notify the Owner no fewer than two days in advance of proposed interruption of service.
 - b. Do not proceed with interruption of service without the Owner written permission.



1.2 PRODUCTS

- A. Hub-And-Spigot, Cast-Iron Soil Pipe And Fittings
1. Pipe and Fittings: ASTM A 74, Service class **OR** Service and Extra-Heavy classes **OR** Extra-Heavy class, **as directed**.
 2. Gaskets: ASTM C 564, rubber.
 3. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.
- B. Hubless Cast-Iron Soil Pipe And Fittings
1. Pipe and Fittings: ASTM A 888 or CISPI 301.
 2. CISPI-Trademark, Shielded Couplings:
 - a. Description: ASTM C 1277 and CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
 3. Heavy-Duty, Shielded Couplings:
 - a. Description: ASTM C 1277 and ASTM C 1540, with stainless-steel shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
 4. Cast-Iron, Shielded Couplings:
 - a. Description: ASTM C 1277 with ASTM A 48/A 48M, two-piece, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve with integral, center pipe stop.
 5. Unshielded Couplings:
 - a. Description: ASTM C 1277 and ASTM C 1461, rigid, sleeve-type, reducing- or transition-type mechanical coupling, with integral, center pipe stop, molded from ASTM C 1440, TPE material; with corrosion-resistant-metal tension band and tightening mechanism on each end.
- C. Ductile-Iron, Gravity Sewer Pipe And Fittings
1. Pipe: ASTM A 746, for push-on joints.
 2. Standard Fittings: AWWA C110, ductile or gray iron, for push-on joints.
 3. Compact Fittings: AWWA C153, ductile iron, for push-on joints.
 4. Gaskets: AWWA C111, rubber.
- D. Ductile-Iron, Pressure Pipe And Fittings
1. Push-on-Joint Piping:
 - a. Pipe: AWWA C151.
 - b. Standard Fittings: AWWA C110, ductile or gray iron.
 - c. Compact Fittings: AWWA C153.
 - d. Gaskets: AWWA C111, rubber, of shape matching pipe and fittings.
 2. Mechanical-Joint Piping:
 - a. Pipe: AWWA C151, with bolt holes in bell.
 - b. Standard Fittings: AWWA C110, ductile or gray iron, with bolt holes in bell.
 - c. Compact Fittings: AWWA C153, with bolt holes in bells.
 - d. Glands: Cast or ductile iron; with bolt holes and high-strength, cast-iron or high-strength, low-alloy steel bolts and nuts.
 - e. Gaskets: AWWA C111, rubber, of shape matching pipe, fittings, and glands.
- E. ABS Pipe And Fittings
1. ABS Sewer Pipe and Fittings: ASTM D 2751, with bell-and-spigot ends for gasketed joints.
 - a. NPS 3 to NPS 6 (DN 80 to DN 150): SDR 35.
 - b. NPS 8 to NPS 12 (DN 200 to DN 300): SDR 42.
 2. Gaskets: ASTM F 477, elastomeric seals.
- F. PVC Pipe And Fittings



1. PVC Cellular-Core Sewer Piping:
 - a. Pipe: ASTM F 891, Sewer and Drain Series, PS 50 minimum stiffness, PVC cellular-core pipe with plain ends for solvent-cemented joints.
 - b. Fittings: ASTM D 3034, SDR 35, PVC socket-type fittings.
 2. PVC Corrugated Sewer Piping:
 - a. Pipe: ASTM F 949, PVC corrugated pipe with bell-and-spigot ends for gasketed joints.
 - b. Fittings: ASTM F 949, PVC molded or fabricated, socket type.
 - c. Gaskets: ASTM F 477, elastomeric seals.
 3. PVC Profile Sewer Piping:
 - a. Pipe: ASTM F 794, PVC profile, gravity sewer pipe with bell-and-spigot ends for gasketed joints.
 - b. Fittings: ASTM D 3034, PVC with bell ends.
 - c. Gaskets: ASTM F 477, elastomeric seals.
 4. PVC Type PSM Sewer Piping:
 - a. Pipe: ASTM D 3034, SDR 35, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
 - b. Fittings: ASTM D 3034, PVC with bell ends.
 - c. Gaskets: ASTM F 477, elastomeric seals.
 5. PVC Gravity Sewer Piping:
 - a. Pipe and Fittings: ASTM F 679, T-1 **OR** T-2, **as directed**, wall thickness, PVC gravity sewer pipe with bell-and-spigot ends and with integral ASTM F 477, elastomeric seals for gasketed joints.
 6. PVC Pressure Piping:
 - a. Pipe: AWWA C900, Class 100 **OR** Class 150 **OR** Class 200, **as directed**, PVC pipe with bell-and-spigot ends for gasketed joints.
 - b. Fittings: AWWA C900, Class 100 **OR** Class 150 **OR** Class 200, **as directed**, PVC pipe with bell ends.
 - c. Gaskets: ASTM F 477, elastomeric seals.
 7. PVC Water-Service Piping:
 - a. Pipe: ASTM D 1785, Schedule 40 **OR** Schedule 80, **as directed**, PVC, with plain ends for solvent-cemented joints.
 - b. Fittings: ASTM D 2466, Schedule 40 **OR** ASTM D 2467, Schedule 80, **as directed**, PVC, socket type.
- G. Fiberglass Pipe And Fittings
1. Fiberglass Sewer Pipe: ASTM D 3262, RTRP, for gasketed joints fabricated with Type 2, polyester **OR** Type 4, epoxy, **as directed**, resin.
 - a. Liner: Reinforced thermoset **OR** Nonreinforced thermoset **OR** Thermoplastic **OR** No liner, **as directed**.
 - b. Grade: Reinforced, surface layer matching pipe resin **OR** Nonreinforced, surface layer matching pipe resin **OR** No surface layer, **as directed**.
 - c. Stiffness: 9 psig (62 kPa) **OR** 18 psig (124 kPa) **OR** 36 psig (248 kPa) **OR** 72 psig (496 kPa), **as directed**.
 2. Fiberglass Nonpressure Fittings: ASTM D 3840, RTRF, for gasketed joints.
 - a. Laminating Resin: Type 1, polyester **OR** Type 2, epoxy, **as directed**, resin.
 - b. Reinforcement: Grade with finish compatible with resin.
 3. Gaskets: ASTM F 477, elastomeric seals.
- H. Concrete Pipe And Fittings
1. Nonreinforced-Concrete Sewer Pipe and Fittings: ASTM C 14 (ASTM C 14M), Class 1 **OR** Class 2 **OR** Class 3, **as directed**, with bell-and-spigot **OR** tongue-and-groove, **as directed**, ends for gasketed joints with ASTM C 443 (ASTM C 443M), rubber gaskets.
 2. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76 (ASTM C 76M).
 - a. Bell-and-spigot **OR** tongue-and-groove, **as directed**, ends for gasketed joints, with ASTM C 443 (ASTM C 443M), rubber gaskets.
 - b. Class II, Wall A **OR** Wall B **OR** Wall C, **as directed**.



- c. Class III, Wall A **OR** Wall B **OR** Wall C, **as directed**.
 - d. Class IV, Wall A **OR** Wall B **OR** Wall C, **as directed**.
 - e. Class V, Wall A **OR** Wall B, **as directed**.
- I. Nonpressure-Type Transition Couplings
1. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant-metal tension band and tightening mechanism on each end.
 2. Sleeve Materials:
 - a. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
 - b. For Concrete Pipes: ASTM C 443 (ASTM C 443M), rubber.
 - c. For Fiberglass Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - d. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - e. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
 3. Unshielded, Flexible Couplings:
 - a. Description: Elastomeric sleeve, with stainless-steel shear ring, **as directed**, and corrosion-resistant-metal tension band and tightening mechanism on each end.
 4. Shielded, Flexible Couplings:
 - a. Description: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
 5. Ring-Type, Flexible Couplings:
 - a. Description: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.
 6. Nonpressure-Type, Rigid Couplings:
 - a. Description: ASTM C 1461, sleeve-type, reducing- or transition-type mechanical coupling, molded from ASTM C 1440, TPE material; with corrosion-resistant-metal tension band and tightening mechanism on each end.
- J. Pressure-Type Pipe Couplings
1. Tubular-Sleeve Couplings: AWWA C219, with center sleeve, gaskets, end rings, and bolt fasteners.
 2. Metal, bolted, sleeve-type, reducing or transition coupling, for joining underground pressure piping. Include 150-psig (1035-kPa) **OR** 200-psig (1380-kPa), **as directed**, minimum pressure rating and ends of same sizes as piping to be joined.
 3. Center-Sleeve Material: Manufacturer's standard **OR** Carbon steel **OR** Stainless steel **OR** Ductile iron **OR** Malleable iron, **as directed**.
 4. Gasket Material: Natural or synthetic rubber.
 5. Metal Component Finish: Corrosion-resistant coating or material.
- K. Expansion Joints And Deflection Fittings
1. Ductile-Iron, Flexible Expansion Joints:
 - a. Description: Compound fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include two gasketed ball-joint sections and one or more gasketed sleeve sections, rated for 250-psig (1725-kPa) minimum working pressure and for offset and expansion indicated.
 2. Ductile-Iron Expansion Joints:
 - a. Description: Three-piece assembly of telescoping sleeve with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Include rating for 250-psig (1725-kPa) minimum working pressure and for expansion indicated.
 3. Ductile-Iron Deflection Fittings:



- a. Description: Compound coupling fitting with ball joint, flexing section, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include rating for 250-psig (1725-kPa) minimum working pressure and for up to 15 degrees of deflection.
- L. Backwater Valves
1. Cast-Iron Backwater Valves:
 - a. Description: ASME A112.14.1, gray-iron body and bolted cover, with bronze seat.
 - b. Horizontal type; with swing check valve and hub-and-spigot ends.
 - c. Combination horizontal and manual gate-valve type; with swing check valve, integral gate valve, and hub-and-spigot ends.
 - d. Terminal type; with bronze seat, swing check valve, and hub inlet.
 2. PVC Backwater Valves:
 - a. Description: Horizontal type; with PVC body, PVC removable cover, and PVC swing check valve.
- M. Cleanouts
1. Cast-Iron Cleanouts:
 - a. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
 - b. Top-Loading Classification(s): Light Duty **OR** Medium Duty **OR** Heavy Duty **OR** Extra-Heavy Duty, **as directed**.
 - c. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.
 2. PVC Cleanouts:
 - a. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.
- N. Encasement For Piping
1. Standard: ASTM A 674 or AWWA C105.
 2. Material: Linear low-density polyethylene film of 0.008-inch (0.20-mm) **OR** high-density, cross-laminated polyethylene film of 0.004-inch (0.10-mm), **as directed**, minimum thickness.
 3. Form: Sheet **OR** Tube, **as directed**.
 4. Color: Black **OR** Natural, **as directed**.
- O. Manholes
1. Standard Precast Concrete Manholes:
 - a. Description: ASTM C 478 (ASTM C 478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints.
 - b. Diameter: 48 inches (1200 mm) minimum unless otherwise indicated.
 - c. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
 - d. Base Section: 6-inch (150-mm) minimum thickness for floor slab and 4-inch (100-mm) minimum thickness for walls and base riser section; with separate base slab or base section with integral floor.
 - e. Riser Sections: 4-inch (100-mm) minimum thickness, of length to provide depth indicated.
 - f. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated; with top of cone of size that matches grade rings.
 - g. Joint Sealant: ASTM C 990 (ASTM C 990M), bitumen or butyl rubber.
 - h. Resilient Pipe Connectors: ASTM C 923 (ASTM C 923M), cast or fitted into manhole walls, for each pipe connection.
 - i. Steps: Individual FRP steps or FRP ladder **OR** Individual FRP steps, FRP ladder, or ASTM A 615/A 615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D 4101, PP **OR** ASTM A 615/A 615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D 4101, PP, **as directed**; wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor



- steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches (1500 mm).
- j. Adjusting Rings: Interlocking HDPE rings, with level or sloped edge in thickness and diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
OR
Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, with diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope.
2. Designed Precast Concrete Manholes:
 - a. Description: ASTM C 913; designed according to ASTM C 890 for A-16 (ASSHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for sealant joints.
 - b. Ballast: Increase thickness of one or more precast concrete sections or add concrete to manhole as required to prevent flotation.
 - c. Joint Sealant: ASTM C 990 (ASTM 990M), bitumen or butyl rubber.
 - d. Resilient Pipe Connectors: ASTM C 923 (ASTM C 923M), cast or fitted into manhole walls, for each pipe connection.
 - e. Steps: Individual FRP steps or FRP ladder **OR** Individual FRP steps, FRP ladder, or ASTM A 615/A 615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D 4101, PP **OR** ASTM A 615/A 615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D 4101, PP, **as directed**; wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches (1500 mm).
 - f. Adjusting Rings: Interlocking HDPE rings, with level or sloped edge in thickness and diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
OR
Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, with diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope.
 3. Fiberglass Manholes:
 - a. Description: ASTM D 3753.
 - b. Diameter: 48 inches (1200 mm) minimum unless otherwise indicated.
 - c. Ballast: Increase thickness of concrete base as required to prevent flotation.
 - d. Base Section: Concrete, 6-inch (150-mm) minimum thickness.
 - e. Resilient Pipe Connectors (if required): ASTM C 923 (ASTM C 923M), cast or fitted into manhole walls, for each pipe connection.
 - f. Steps: Individual FRP steps or FRP ladder, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches (1500 mm).
 - g. Adjusting Rings: Interlocking HDPE rings, with level or sloped edge in thickness and diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
OR
Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, with diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope.
 4. Manhole Frames and Covers:



- a. Description: Ferrous; 24-inch (610-mm) ID by 7- to 9-inch (175- to 225-mm) riser, with 4-inch- (100-mm-) minimum-width flange and 26-inch- (660-mm-) diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "SANITARY SEWER."
 - b. Material: ASTM A 536, Grade 60-40-18 ductile **OR** ASTM A 48/A 48M, Class 35 gray, **as directed**, iron unless otherwise indicated.
5. Manhole-Cover Inserts:
- a. Description: Manufactured, plastic form, of size to fit between manhole frame and cover and designed to prevent stormwater inflow. Include handle for removal and gasket for gastight sealing.
 - b. Type: Solid **OR** Drainage with vent holes **OR** Valve, **as directed**.

P. Concrete

1. General: Cast-in-place concrete complying with ACI 318, ACI 350/350R (ACI 350M/350RM), and the following:
 - a. Cement: ASTM C 150, Type II.
 - b. Fine Aggregate: ASTM C 33, sand.
 - c. Coarse Aggregate: ASTM C 33, crushed gravel.
 - d. Water: Potable.
2. Portland Cement Design Mix: 4000 psi (27.6 MPa) minimum, with 0.45 maximum water/cementitious materials ratio.
 - a. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
 - b. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.
3. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi (27.6 MPa) minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.
 - a. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
 - 1) Invert Slope: **1 OR 2, as directed**, percent through manhole.
 - b. Benches: Concrete, sloped to drain into channel.
 - 1) Slope: **4 OR 8, as directed**, percent.
4. Ballast and Pipe Supports: Portland cement design mix, 3000 psi (20.7 MPa) minimum, with 0.58 maximum water/cementitious materials ratio.
 - a. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
 - b. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

1.3 EXECUTION

A. Earthwork

1. Excavating, trenching, and backfilling are specified in Division 31 Section "Earth Moving".

B. Piping Installation

1. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
2. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.
3. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
4. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.



5. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.
6. Install gravity-flow, nonpressure, drainage piping according to the following:
 - a. Install piping pitched down in direction of flow, at minimum slope of 1 **OR** 2, **as directed**, percent unless otherwise indicated.
 - b. Install piping NPS 6 (DN 150) and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.
 - c. Install piping with 36-inch (915-mm) **OR** 48-inch (1220-mm) **OR** 60-inch (1520-mm) **OR** 72-inch (1830-mm), **as directed**, minimum cover.
 - d. Install hub-and-spigot, cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
 - e. Install hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
 - f. Install ductile-iron, gravity sewer piping according to ASTM A 746.
 - g. Install ABS sewer piping according to ASTM D 2321 and ASTM F 1668.
 - h. Install PVC cellular-core sewer piping according to ASTM D 2321 and ASTM F 1668.
 - i. Install PVC corrugated sewer piping according to ASTM D 2321 and ASTM F 1668.
 - j. Install PVC profile sewer piping according to ASTM D 2321 and ASTM F 1668.
 - k. Install PVC Type PSM sewer piping according to ASTM D 2321 and ASTM F 1668.
 - l. Install PVC gravity sewer piping according to ASTM D 2321 and ASTM F 1668.
 - m. Install fiberglass sewer piping according to ASTM D 3839 and ASTM F 1668.
 - n. Install nonreinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."
 - o. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."
7. Install force-main, pressure piping according to the following:
 - a. Install piping with restrained joints at tee fittings and at horizontal and vertical changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.
 - b. Install piping with 36-inch (915-mm) **OR** 48-inch (1220-mm) **OR** 60-inch (1520-mm) **OR** 72-inch (1830-mm), **as directed**, minimum cover.
 - c. Install ductile-iron pressure piping according to AWWA C600 or AWWA M41.
 - d. Install ductile-iron special fittings according to AWWA C600.
 - e. Install PVC pressure piping according to AWWA M23 or to ASTM D 2774 and ASTM F 1668.
 - f. Install PVC water-service piping according to ASTM D 2774 and ASTM F 1668.
8. If required to provide protection for metal piping, install corrosion-protection piping encasement over the following underground metal piping according to ASTM A 674 or AWWA C105:
 - a. Hub-and-spigot, cast-iron soil pipe.
 - b. Hubless cast-iron soil pipe and fittings.
 - c. Ductile-iron pipe and fittings.
 - d. Expansion joints and deflection fittings.
9. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

C. Pipe Joint Construction

1. Join gravity-flow, nonpressure, drainage piping according to the following:
 - a. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
 - b. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
 - c. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.



- d. Join ductile-iron, gravity sewer piping according to AWWA C600 for push-on joints.
 - e. Join ABS sewer piping according to ASTM D 2321 and ASTM D 2751 for elastomeric-seal joints.
 - f. Join PVC cellular-core sewer piping according to ASTM D 2321 and ASTM F 891 for solvent-cemented joints.
 - g. Join PVC corrugated sewer piping according to ASTM D 2321.
 - h. Join PVC profile sewer piping according to ASTM D 2321 for elastomeric-seal joints or ASTM F 794 for gasketed joints.
 - i. Join PVC Type PSM sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasket joints.
 - j. Join PVC gravity sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasket joints.
 - k. Join fiberglass sewer piping according to ASTM D 4161 for elastomeric-seal joints.
 - l. Join nonreinforced-concrete sewer piping according to ASTM C 14 (ASTM C 14M) and ACPA's "Concrete Pipe Installation Manual" for rubber-gasket joints.
 - m. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasket joints.
 - n. Join dissimilar pipe materials with nonpressure-type, flexible **OR** rigid, **as directed**, couplings.
2. Join force-main, pressure piping according to the following:
 - a. Join ductile-iron pressure piping according to AWWA C600 or AWWA M41 for push-on joints.
 - b. Join ductile-iron special fittings according to AWWA C600 or AWWA M41 for push-on joints.
 - c. Join PVC pressure piping according to AWWA M23 for gasketed joints.
 - d. Join PVC water-service piping according to ASTM D 2855.
 - e. Join dissimilar pipe materials with pressure-type couplings.
 3. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
 - a. Use nonpressure flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.
 - 1) Unshielded **OR** Shielded, **as directed**, flexible **OR** rigid, **as directed**, couplings for pipes of same or slightly different OD.
 - 2) Unshielded, increaser/reducer-pattern, flexible **OR** rigid, **as directed**, couplings for pipes with different OD.
 - 3) Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.
 - b. Use pressure pipe couplings for force-main joints.
- D. Manhole Installation
1. General: Install manholes complete with appurtenances and accessories indicated.
 2. Install precast concrete manhole sections with sealants according to ASTM C 891.
 3. Install FRP manholes according to manufacturer's written instructions.
 4. Form continuous concrete channels and benches between inlets and outlet.
 5. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches (76 mm) above finished surface elsewhere unless otherwise indicated.
 6. Install manhole-cover inserts in frame and immediately below cover.
- E. Concrete Placement
1. Place cast-in-place concrete according to ACI 318.
- F. Backwater Valve Installation
1. Install horizontal-type backwater valves in piping manholes or pits.
 2. Install combination horizontal and manual gate valves in piping and in manholes.
 3. Install terminal-type backwater valves on end of piping and in manholes. Secure units to sidewalls.



G. Cleanout Installation

1. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts, and use cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
 - a. Use Light-Duty, top-loading classification cleanouts in earth **OR** unpaved foot-traffic, **as directed**, areas.
 - b. Use Medium-Duty, top-loading classification cleanouts in paved foot-traffic areas.
 - c. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
 - d. Use Extra-Heavy-Duty, top-loading classification cleanouts in roads.
2. Set cleanout frames and covers in earth in cast-in-place-concrete block, 18 by 18 by 12 inches (450 by 450 by 300 mm) deep. Set with tops 1 inch (25 mm) above surrounding grade.
3. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

H. Connections

1. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drains specified in Division 22 Section "Sanitary Waste And Vent Piping".
2. Connect force-main piping to building's sanitary force mains specified in Division 22 Section "Sanitary Waste And Vent Piping". Terminate piping where indicated.
3. Make connections to existing piping and underground manholes.
 - a. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye fitting plus 6-inch (150-mm) overlap with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).
 - b. Make branch connections from side into existing piping, NPS 4 to NPS 20 (DN 100 to DN 500). Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).
 - c. Make branch connections from side into existing piping, NPS 21 (DN 525) or larger, or to underground manholes by cutting opening into existing unit large enough to allow 3 inches (76 mm) of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe or manhole wall, encase entering connection in 6 inches (150 mm) of concrete for minimum length of 12 inches (300 mm) to provide additional support of collar from connection to undisturbed ground.
 - 1) Use concrete that will attain a minimum 28-day compressive strength of 3000 psi (20.7 MPa) unless otherwise indicated.
 - 2) Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
 - d. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.
4. Connect to grease **OR** oil **OR** sand, **as directed**, interceptors specified in Division 22 Section "Sanitary Waste Interceptors".

I. Closing Abandoned Sanitary Sewer Systems

1. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:
 - a. Close open ends of piping with at least 8-inch- (203-mm-) thick, brick masonry bulkheads.
 - b. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.
2. Abandoned Manholes: Excavate around manhole as required and use either procedure below:
 - a. Remove manhole and close open ends of remaining piping.



- b. Remove top of manhole down to at least 36 inches (915 mm) below final grade. Fill to within 12 inches (300 mm) of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.
3. Backfill to grade according to Division 31 Section "Earth Moving".

J. Identification

1. Materials and their installation are specified in Division 31 Section "Earth Moving". Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.
 - a. Use warning tape **OR** detectable warning tape, **as directed**, over ferrous piping.
 - b. Use detectable warning tape over nonferrous piping and over edges of underground manholes.

K. Field Quality Control

1. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (600 mm) of backfill is in place, and again at completion of Project.
 - a. Submit separate report for each system inspection.
 - b. Defects requiring correction include the following:
 - 1) Alignment: Less than full diameter of inside of pipe is visible between structures.
 - 2) Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - 3) Damage: Crushed, broken, cracked, or otherwise damaged piping.
 - 4) Infiltration: Water leakage into piping.
 - 5) Exfiltration: Water leakage from or around piping.
 - c. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
 - d. Reinspect and repeat procedure until results are satisfactory.
2. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
 - a. Do not enclose, cover, or put into service before inspection and approval.
 - b. Test completed piping systems according to requirements of authorities having jurisdiction.
 - c. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
 - d. Submit separate report for each test.
 - e. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:
 - 1) Fill sewer piping with water. Test with pressure of at least 10-foot (3-m) head of water, and maintain such pressure without leakage for at least 15 minutes.
 - 2) Close openings in system and fill with water.
 - 3) Purge air and refill with water.
 - 4) Disconnect water supply.
 - 5) Test and inspect joints for leaks.

OR

Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:

 - 6) Option: Test plastic gravity sewer piping according to ASTM F 1417.
 - 7) Option: Test concrete gravity sewer piping according to ASTM C 924 (ASTM C 924M).
 - f. Force Main: Perform hydrostatic test after thrust blocks, supports, and anchors have hardened. Test at pressure not less than 1-1/2 times the maximum system operating pressure, but not less than 150 psig (1035 kPa).
 - 1) Ductile-Iron Piping: Test according to AWWA C600, "Hydraulic Testing" Section.
 - 2) PVC Piping: Test according to AWWA M23, "Testing and Maintenance" Chapter.
 - g. Manholes: Perform hydraulic test according to ASTM C 969 (ASTM C 969M).
3. Leaks and loss in test pressure constitute defects that must be repaired.



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4. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

L. Cleaning

1. Clean dirt and superfluous material from interior of piping. Flush with potable water.

END OF SECTION 22 05 76 00



SECTION 22 05 76 00a - STORM DRAINAGE PIPING SPECIALTIES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for storm drainage piping specialties. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Roof drains.
 - b. Miscellaneous storm drainage piping specialties.
 - c. Cleanouts.
 - d. Backwater valves.
 - e. Trench drains.
 - f. Channel drainage systems.
 - g. Through-penetration firestop assemblies.
 - h. Flashing materials.

C. Submittals

1. Product Data: For each type of product indicated.

D. Quality Assurance

1. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

1.2 PRODUCTS

A. Metal Roof Drains

1. Cast-Iron, Large-Sump, General-Purpose Roof Drains:
 - a. Standard: ASME A112.6.4, for general-purpose roof drains.
 - b. Body Material: Cast iron.
 - c. Dimension of Body: Nominal 14-inch (357-mm) diameter.
 - d. Combination Flashing Ring and Gravel Stop: Not required **OR** Required, **as directed**.
 - e. Flow-Control Weirs: Not required **OR** Required, **as directed**.
 - f. Outlet: Bottom **OR** Side, **as directed**.
 - g. Extension Collars: Not required **OR** Required, **as directed**.
 - h. Underdeck Clamp: Not required **OR** Required, **as directed**.
 - i. Expansion Joint: Not required **OR** Required, **as directed**.
 - j. Sump Receiver Plate: Not required **OR** Required, **as directed**.
 - k. Dome Material: Aluminum **OR** Cast iron **OR** PE **OR** Stainless steel, **as directed**.
 - l. Perforated Gravel Guard: Stainless steel **OR** Not required, **as directed**.
 - m. Vandal-Proof Dome: Not required **OR** Required, **as directed**.
 - n. Water Dam: Not required **OR** 2 inches (51 mm) high, **as directed**.
2. Cast-Iron, Medium-Sump, General-Purpose Roof Drains:
 - a. Standard: ASME A112.6.4, for general-purpose roof drains.
 - b. Body Material: Cast iron.
 - c. Dimension of Body: 8- to 12-inch (203- to 305-mm) diameter.
 - d. Combination Flashing Ring and Gravel Stop: Not required **OR** Required, **as directed**.
 - e. Flow-Control Weirs: Not required **OR** Required, **as directed**.
 - f. Outlet: Bottom **OR** Side, **as directed**.
 - g. Extension Collars: Not required **OR** Required, **as directed**.



- h. Underdeck Clamp: Not required **OR** Required, **as directed**.
 - i. Expansion Joint: Not required **OR** Required, **as directed**.
 - j. Sump Receiver Plate: Not required **OR** Required, **as directed**.
 - k. Dome Material: Aluminum **OR** Cast iron **OR** Copper **OR** PE **OR** Stainless steel, **as directed**.
 - l. Wire Mesh: Stainless steel or brass over dome **OR** Not required, **as directed**.
 - m. Perforated Gravel Guard: Stainless steel **OR** Not required, **as directed**.
 - n. Vandal-Proof Dome: Not required **OR** Required, **as directed**.
 - o. Water Dam: Not required **OR** 2 inches (51 mm) high, **as directed**.
3. Copper, Medium-Sump, General-Purpose Roof Drains:
- a. Standard: ASME A112.6.4, for general-purpose roof drains.
 - b. Body Material: Copper.
 - c. Dimension of Body: 8- to 12-inch (203- to 305-mm) diameter.
 - d. Combination Flashing Ring and Gravel Stop: Not required **OR** Required, **as directed**.
 - e. Flow-Control Weirs: Not required **OR** Required, **as directed**.
 - f. Outlet: Bottom **OR** Side, **as directed**.
 - g. Extension Collars: Not required **OR** Required, **as directed**.
 - h. Underdeck Clamp: Not required **OR** Required, **as directed**.
 - i. Expansion Joint: Not required **OR** Required, **as directed**.
 - j. Sump Receiver Plate: Not required **OR** Required, **as directed**.
 - k. Dome Material: Aluminum **OR** Cast iron **OR** Copper **OR** PE **OR** Stainless steel, **as directed**.
 - l. Wire Mesh: Stainless steel or brass over dome **OR** Not required, **as directed**.
 - m. Perforated Gravel Guard: Stainless steel **OR** Not required, **as directed**.
 - n. Vandal-Proof Dome: Not required **OR** Required, **as directed**.
 - o. Water Dam: Not required **OR** 2 inches (51 mm) high, **as directed**.
4. Cast-Iron, Small-Sump, General-Purpose Roof Drains:
- a. Standard: ASME A112.6.4, for general-purpose roof drains.
 - b. Body Material: Cast iron.
 - c. Dimension of Body: Nominal 8-inch (203-mm) diameter.
 - d. Combination Flashing Ring and Gravel Stop: Not required **OR** Required, **as directed**.
 - e. Outlet: Bottom **OR** Side, **as directed**.
 - f. Extension Collars: Not required **OR** Required, **as directed**.
 - g. Underdeck Clamp: Not required **OR** Required, **as directed**.
 - h. Expansion Joint: Not required **OR** Required, **as directed**.
 - i. Sump Receiver Plate: Not required **OR** Required, **as directed**.
 - j. Dome Material: Cast iron.
 - k. Wire Mesh: Stainless steel or brass over dome **OR** Not required, **as directed**.
 - l. Vandal-Proof Dome: Not required **OR** Required, **as directed**.
5. Copper, Small-Sump, General-Purpose Roof Drains:
- a. Standard: ASME A112.6.4, for general-purpose roof drains.
 - b. Body Material: Copper.
 - c. Dimension of Body: Nominal 8-inch (203-mm) diameter.
 - d. Combination Flashing Ring and Gravel Stop: Not required **OR** Required, **as directed**.
 - e. Outlet: Bottom **OR** Side, **as directed**.
 - f. Extension Collars: Not required **OR** Required, **as directed**.
 - g. Underdeck Clamp: Not required **OR** Required, **as directed**.
 - h. Expansion Joint: Not required **OR** Required, **as directed**.
 - i. Sump Receiver Plate: Not required **OR** Required, **as directed**.
 - j. Dome Material: Cast iron.
 - k. Wire Mesh: Stainless steel or brass over dome **OR** Not required, **as directed**.
 - l. Vandal-Proof Dome: Not required **OR** Required, **as directed**.
6. Metal, Cornice and Gutter Roof Drains:
- a. Standard: ASME A112.6.4, for cornice and gutter roof drains.
 - b. Body Material: Metal.



- c. Dimension of Body: Nominal 6-inch (152-mm) diameter.
 - d. Outlet: Bottom **OR** Side **OR** 45-degree angle, **as directed**.
 - e. Dome Material: Bronze.
 - f. Vandal-Proof Dome: Not required **OR** Required, **as directed**.
7. Metal, Parapet Roof Drains:
- a. Standard: ASME A112.6.4, for parapet roof drains.
 - b. Body Material: Cast iron.
 - c. Outlet: Back **OR** Angle, **as directed**.
 - d. Grate Material: Bronze **OR** Cast iron **OR** Nickel-bronze alloy, **as directed**.
 - e. Vandal-Proof Grate: Not required **OR** Required, **as directed**.
8. Metal, Large-Sump, Promenade Roof Drains:
- a. Standard: ASME A112.6.4, for promenade roof drains.
 - b. Body Material: Cast iron.
 - c. Dimension of Body: Nominal 14-inch (357-mm) diameter.
 - d. Dimension of Frame and Grate: Nominal 14 inches (357 mm) square.
 - e. Outlet: Bottom.
 - f. Grate Material: Bronze **OR** Cast iron **OR** Nickel-bronze alloy, **as directed**.
 - g. Vandal-Proof Grate: Not required **OR** Required, **as directed**.
 - h. Extension Collars: Not required **OR** Required, **as directed**.
 - i. Underdeck Clamp: Not required **OR** Required, **as directed**.
 - j. Expansion Joint: Not required **OR** Required, **as directed**.
 - k. Sump Receiver Plate: Not required **OR** Required, **as directed**.
9. Metal, Medium-Sump, Promenade Roof Drains:
- a. Standard: ASME A112.6.4, for promenade roof drains.
 - b. Body Material: Cast iron.
 - c. Dimension of Body: 11- to 12-inch (280- to 305-mm) diameter.
 - d. Dimension of Frame and Grate: Nominal 12 inches (305 mm) square.
 - e. Outlet: Bottom.
 - f. Grate Material: Bronze **OR** Cast iron **OR** Nickel-bronze alloy, **as directed**.
 - g. Vandal-Proof Grate: Not required **OR** Required, **as directed**.
 - h. Extension Collars: Not required **OR** Required, **as directed**.
 - i. Underdeck Clamp: Not required **OR** Required, **as directed**.
 - j. Expansion Joint: Not required **OR** Required, **as directed**.
 - k. Sump Receiver Plate: Not required **OR** Required, **as directed**.
10. Metal, Small-Sump, Promenade Roof Drains:
- a. Standard: ASME A112.6.4, for promenade roof drains.
 - b. Body Material: Cast iron.
 - c. Dimension of Body: Nominal 8-inch (203-mm) diameter.
 - d. Dimension of Frame and Grate: Nominal 8 inches (203 mm) square.
 - e. Outlet: Bottom.
 - f. Grate Material: Bronze **OR** Cast iron **OR** Nickel-bronze alloy, **as directed**.
 - g. Vandal-Proof Grate: Not required **OR** Required, **as directed**.
 - h. Extension Collars: Not required **OR** Required, **as directed**.
 - i. Underdeck Clamp: Not required **OR** Required, **as directed**.
 - j. Expansion Joint: Not required **OR** Required, **as directed**.
 - k. Sump Receiver Plate: Not required **OR** Required, **as directed**.
11. Metal, Medium-Sump, Deck Roof Drains:
- a. Standard: ASME A112.6.4, for deck roof drains; ASME A112.6.3, for floor drains.
 - b. Body Material: Metal.
 - c. Flange: Anchor **OR** Anchor with weep holes **OR** Not required, **as directed**.
 - d. Clamping Device: Not required **OR** Required, **as directed**.
 - e. Integral Backwater Valve: Not required **OR** Required, **as directed**.
 - f. Outlet: Bottom **OR** End **OR** Side, **as directed**.
 - g. Grate Material: Cast iron.
 - h. Grate Finish: Painted **OR** Not required, **as directed**.



- i. Overall Dimension of Frame and Grate: Nominal 14 inches (357 mm) round **OR** square, **as directed**.
 - j. Top-Loading Classification: Extra-Heavy Duty **OR** Heavy Duty, **as directed**.
 - k. Vandal-Proof Frame and Grate: Not required **OR** Required, **as directed**.
12. Metal, Small-Sump, Deck Roof Drains:
- a. Standard: ASME A112.6.4, for deck roof drains; ASME A112.6.3, for floor drains.
 - b. Body Material: Metal.
 - c. Flange: Anchor **OR** Anchor with weep holes **OR** Not required, **as directed**.
 - d. Clamping Device: Not required **OR** Required, **as directed**.
 - e. Integral Backwater Valve: Not required **OR** Required, **as directed**.
 - f. Outlet: Bottom **OR** End **OR** Side, **as directed**.
 - g. Grate Material: Cast iron.
 - h. Grate Finish: Painted **OR** Not required, **as directed**.
 - i. Overall Dimension of Frame and Grate: Nominal 8 inches (203 mm) round **OR** square, **as directed**.
 - j. Top-Loading Classification: Extra-Heavy Duty **OR** Heavy Duty **OR** Light Duty **OR** Medium Duty, **as directed**.
 - k. Vandal-Proof Frame and Grate: Not required **OR** Required, **as directed**.
- B. Plastic Roof Drains
- 1. Plastic Roof Drains:
 - a. Standard: ASME A112.6.4, for plastic roof drains.
 - b. Body Material: ABS or PVC.
 - c. Sump Diameter: <Insert nominal dimension>.
 - d. Combination Flashing Ring and Gravel Stop: Not required **OR** Required, **as directed**.
 - e. Outlet: Bottom.
 - f. Extension Collars: Not required **OR** Required, **as directed**.
 - g. Underdeck Clamp: Not required **OR** Required, **as directed**.
 - h. Expansion Joint: Not required **OR** Required, **as directed**.
 - i. Sump Receiver Plate: Not required **OR** Required, **as directed**.
 - j. Dome Material: Aluminum **OR** Cast iron **OR** PE **OR** Stainless steel, **as directed**.
 - k. Vandal-Proof Dome: Not required **OR** Required, **as directed**.
- C. Miscellaneous Storm Drainage Piping Specialties
- 1. Downspout Adaptors:
 - a. Description: Manufactured, gray-iron casting, for attaching to horizontal-outlet, parapet roof drain and to exterior, sheet metal downspout.
 - b. Size: Inlet size to match parapet drain outlet.
 - 2. Downspout Boots:
 - a. Description: Manufactured, ASTM A 48/A 48M, gray-iron casting, with strap or ears for attaching to building; NPS 4 (DN 100) outlet; and shop-applied bituminous coating.
 - b. Size: Inlet size to match downspout and NPS 4 (DN 100) outlet.
 - 3. Conductor Nozzles:
 - a. Description: Bronze body with threaded inlet and bronze wall flange with mounting holes.
 - b. Size: Same as connected conductor.
- D. Cleanouts
- 1. Floor Cleanouts:
 - a. Standard: ASME A112.36.2M, for adjustable housing **OR** cast-iron soil pipe with cast-iron ferrule **OR** heavy-duty, adjustable housing **OR** threaded, adjustable housing, **as directed**, cleanouts.
 - b. Size: Same as connected branch.
 - c. Type: Adjustable housing **OR** Cast-iron soil pipe with cast-iron ferrule **OR** Heavy-duty, adjustable housing **OR** Threaded, adjustable housing, **as directed**.
 - d. Body or Ferrule Material: Cast iron **OR** Stainless steel, **as directed**.



- e. Clamping Device: Not required **OR** Required, **as directed**.
 - f. Outlet Connection: Inside callk **OR** Spigot **OR** Threaded, **as directed**.
 - g. Closure: Brass plug with straight threads and gasket **OR** Brass plug with tapered threads **OR** Cast-iron plug **OR** Plastic plug, **as directed**.
 - h. Adjustable Housing Material: Cast iron **OR** Plastic, **as directed**, with threads **OR** set-screws or other device, **as directed**.
 - i. Frame and Cover Material and Finish: Nickel-bronze, copper alloy **OR** Painted cast iron **OR** Polished bronze **OR** Rough bronze **OR** Stainless steel, **as directed**.
 - j. Frame and Cover Shape: Round **OR** Square, **as directed**.
 - k. Top-Loading Classification: Extra-Heavy Duty **OR** Heavy Duty **OR** Light Duty **OR** Medium Duty, **as directed**.
 - l. Riser: ASTM A 74, Extra-Heavy **OR** Service, **as directed**, class, cast-iron drainage pipe fitting and riser to cleanout.
2. Test Tees:
 - a. Standard: ASME A112.36.2M and ASTM A 74, ASTM A 888, or CISPI 301, for cleanout test tees.
 - b. Size: Same as connected drainage piping.
 - c. Body Material: Hub-and-spigot, cast-iron soil-pipe T-branch or hubless, cast-iron soil-pipe test tee as required to match connected piping.
 - d. Closure Plug: Countersunk or raised head, brass.
 - e. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
 3. Wall Cleanouts:
 - a. Standard: ASME A112.36.2M, for cleanouts. Include wall access.
 - b. Size: Same as connected drainage piping.
 - c. Body Material: Hub-and-spigot, cast-iron soil-pipe T-branch **OR** Hubless, cast-iron soil-pipe test tee, **as directed**, as required to match connected piping.
 - d. Closure: Countersunk **OR** Countersunk or raised-head **OR** Raised-head, **as directed**, drilled-and-threaded **OR** brass **OR** cast-iron, **as directed**, plug.
 - e. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
 - f. Wall Access: Round, deep, chrome-plated bronze **OR** flat, chrome-plated brass or stainless-steel, **as directed**, cover plate with screw.
 - g. Wall Access: Round **OR** Square, **as directed**, nickel-bronze, copper-alloy, or stainless-steel wall-installation frame and cover.
 4. Plastic Floor Cleanouts:
 - a. Size: Same as connected branch.
 - b. Body Material: PVC.
 - c. Closure Plug: PVC.
 - d. Riser: Drainage pipe fitting and riser to cleanout of same material as drainage piping.
- E. Backwater Valves
1. Cast-Iron, Horizontal Backwater Valves:
 - a. Standard: ASME A112.14.1, for backwater valves.
 - b. Size: Same as connected piping.
 - c. Body Material: Cast iron.
 - d. Cover: Cast iron with bolted or threaded access check valve.
 - e. End Connections: Hub and spigot or hubless.
 - f. Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang closed **OR** open for airflow unless subject to backflow condition, **as directed**.
 - g. Extension: ASTM A 74, Service class; full-size, cast-iron soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.
 2. Cast-Iron, Drain-Outlet Backwater Valves:
 - a. Size: Same as floor drain outlet.
 - b. Body Material: Cast iron or bronze made for vertical installation in bottom outlet of floor drain.
 - c. Check Valve: Removable ball float.
 - d. Inlet: Threaded.



- e. Outlet: Threaded or spigot.
- 3. Plastic, Horizontal Backwater Valves:
 - a. Standard: ASME A112.14.1, for backwater valves.
 - b. Size: Same as connected piping.
 - c. Body Material: ABS **OR** PVC, **as directed**.
 - d. Cover: Same material as body with threaded access to check valve.
 - e. Check Valve: Removable swing check.
 - f. End Connections: Socket type.

- F. Trench Drains
 - 1. Trench Drains:
 - a. Standard: ASME A112.6.3, for trench drains.
 - b. Body Material: Cast iron.
 - c. Flange: Anchor **OR** Anchor with weep holes **OR** Not required, **as directed**.
 - d. Clamping Device: Not required **OR** Required, **as directed**.
 - e. Outlet: Bottom **OR** End **OR** Side, **as directed**.
 - f. Grate Material: Ductile iron or gray iron **OR** stainless steel, **as directed**.
 - g. Grate Finish: Painted **OR** Not required, **as directed**.
 - h. Dimensions of Frame and Grate: **<Insert dimensions>**.
 - i. Top-Loading Classification: Extra-Heavy Duty **OR** Heavy Duty **OR** Light Duty **OR** Medium Duty, **as directed**.

- G. Channel Drainage Systems
 - 1. Narrow, Sloped-Invert, Polymer-Concrete, Channel Drainage Systems:
 - a. Type: Modular system of channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling.
 - 1) Channel Sections: Narrow, interlocking-joint, sloped-invert, polymer-concrete modular units with end caps. Include rounded bottom, with built-in invert slope of 0.6 percent and with outlets in number, sizes, and locations indicated. Include extension sections necessary for required depth.
 - a) Dimensions: 4-inch (102-mm) inside width. Include number of units required to form total lengths indicated.
 - b) Frame: Galvanized steel or gray iron for grates **OR** Not required, **as directed**.
 - 2) Grates: Manufacturer's designation "heavy duty" **OR** "medium duty", **as directed**, with slots or perforations, and of width and thickness that fit recesses in channel sections.
 - a) Material: Ductile iron **OR** Fiberglass **OR** Galvanized steel **OR** Gray iron **OR** Stainless steel, **as directed**.
 - b) Locking Mechanism: Manufacturer's standard device for securing grates to channel sections **OR** Not required, **as directed**.
 - 3) Covers: Solid ductile or gray iron, of width and thickness that fit recesses in channel sections, and of lengths indicated.
 - 4) Supports, Anchors, and Setting Devices: Manufacturer's standard unless otherwise indicated.
 - 5) Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.
 - 2. Narrow, Level-Invert, Polymer-Concrete, Channel Drainage Systems:
 - a. Type: Modular system of channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling.
 - 1) Channel Sections: Narrow, interlocking-joint, precast, polymer-concrete modular units with end caps. Include rounded bottom, with level invert and with NPS 4 (DN 100) outlets in number and locations indicated.
 - a) Dimensions: 5-inch (127-mm) inside width and 9-3/4-inch (248-mm) depth. Include number of units required to form total lengths indicated.



2. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch (1.01-mm) minimum thickness unless otherwise indicated. Include G90 (Z275) hot-dip galvanized, mill-phosphatized finish for painting if indicated.
3. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil (1.01-mm) minimum thickness.
4. Fasteners: Metal compatible with material and substrate being fastened.
5. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
6. Solder: ASTM B 32, lead-free alloy.

1.3 EXECUTION

A. Installation

1. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions. Roofing materials are specified in Division 7 Sections.
 - a. Install flashing collar or flange of roof drain to prevent leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
 - b. Install expansion joints, if indicated, in roof drain outlets.
 - c. Position roof drains for easy access and maintenance.
2. Install downspout adapters on outlet of back-outlet parapet roof drains and connect to sheet metal downspouts.
3. Install downspout boots at grade with top 6 inches (152 mm) **OR** 12 inches (305 mm) **OR** 18 inches (457 mm), **as directed**, above grade. Secure to building wall.
4. Install conductor nozzles at exposed bottom of conductors where they spill onto grade.
5. Install cleanouts in aboveground piping and building drain piping according to the following instructions unless otherwise indicated:
 - a. Use cleanouts the same size as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.
 - b. Locate cleanouts at each change in direction of piping greater than 45 degrees.
 - c. Locate cleanouts at minimum intervals of 50 feet (15 m) for piping NPS 4 (DN 100) and smaller and 100 feet (30 m) for larger piping.
 - d. Locate cleanouts at base of each vertical soil and waste stack.
6. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
7. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
8. Install horizontal backwater valves in floor with cover flush with floor.
9. Install drain-outlet backwater valves in outlet of drains.
10. Install test tees in vertical conductors and near floor.
11. Install wall cleanouts in vertical conductors. Install access door in wall if indicated.
12. Install trench drains at low points of surface areas to be drained. Set grates of drains flush with finished surface unless otherwise indicated.
13. Assemble channel drainage system components according to manufacturer's written instructions. Install on support devices so that top will be flush with adjacent surface.
14. Install through-penetration firestop assemblies in plastic conductors at concrete floor penetrations.
15. Install sleeve flashing device with each conductor passing through floors with waterproof membrane.

B. Connections

1. Comply with requirements for piping specified in Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

C. Flashing Installation



1. Fabricate flashing from single piece of metal unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
 - a. Lead Sheets: Burn joints of 6.0-lb/sq. ft. (30-kg/sq. m) lead sheets, 0.0938-inch (2.4-mm) thickness or thicker. Solder joints of 4.0-lb/sq. ft. (20-kg/sq. m) lead sheets, 0.0625-inch (1.6-mm) thickness or thinner.
 - b. Copper Sheets: Solder joints of copper sheets.
 2. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
 - a. Pipe Flashing: Sleeve type, matching the pipe size, with a minimum length of 10 inches (250 mm) and with skirt or flange extending at least 8 inches (200 mm) around pipe.
 - b. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around sleeve.
 - c. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around specialty.
 3. Set flashing on floors and roofs in solid coating of bituminous cement.
 4. Secure flashing into sleeve and specialty clamping ring or device.
 5. Fabricate and install flashing and pans, sumps, and other drainage shapes.
- D. Protection
1. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
 2. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 05 76 00a



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SECTION 22 07 19 00 - PLUMBING INSULATION

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for plumbing insulation. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Insulation Materials:
 - 1) Calcium silicate.
 - 2) Cellular glass.
 - 3) Flexible elastomeric.
 - 4) Mineral fiber.
 - 5) Phenolic.
 - 6) Polyisocyanurate.
 - 7) Polyolefin.
 - 8) Polystyrene.
 - b. Insulating cements.
 - c. Adhesives.
 - d. Mastics.
 - e. Lagging adhesives.
 - f. Sealants.
 - g. Factory-applied jackets.
 - h. Field-applied fabric-reinforcing mesh.
 - i. Field-applied cloths.
 - j. Field-applied jackets.
 - k. Tapes.
 - l. Securements.
 - m. Corner angles.

C. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittal:
 - a. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.
3. Shop Drawings:
 - a. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - b. Detail attachment and covering of heat tracing inside insulation.
 - c. Detail insulation application at pipe expansion joints for each type of insulation.
 - d. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - e. Detail removable insulation at piping specialties, equipment connections, and access panels.
 - f. Detail application of field-applied jackets.
 - g. Detail application at linkages of control devices.
 - h. Detail field application for each equipment type.
4. Field quality-control reports.

D. Quality Assurance



1. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
 - a. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - b. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

E. Delivery, Storage, And Handling

1. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.2 PRODUCTS

A. Insulation Materials

1. Comply with requirements in Part 1.3 schedule articles for where insulating materials shall be applied.
2. Products shall not contain asbestos, lead, mercury, or mercury compounds.
3. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
4. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
5. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
6. Calcium Silicate:
 - a. Preformed Pipe Sections: Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.
 - b. Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.
 - c. Prefabricated Fitting Covers: Comply with ASTM C 450 and ASTM C 585 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.
7. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - a. Block Insulation: ASTM C 552, Type I.
 - b. Special-Shaped Insulation: ASTM C 552, Type III.
 - c. Board Insulation: ASTM C 552, Type IV.
 - d. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
 - e. Preformed Pipe Insulation with Factory-Applied ASJ **OR** ASJ-SSL, **as directed**: Comply with ASTM C 552, Type II, Class 2.
 - f. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
8. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
9. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
10. High-Temperature, Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type V, without factory-applied jacket.
11. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For equipment applications, provide insulation



- without factory-applied jacket **OR** with factory-applied ASJ **OR** with factory-applied FSK jacket, **as directed**. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
12. High-Temperature, Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type III, without factory-applied jacket.
 13. Mineral-Fiber, Preformed Pipe Insulation:
 - a. Type I, 850 deg F (454 deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, without factory-applied jacket **OR** with factory-applied ASJ **OR** with factory-applied ASJ-SSL, **as directed**. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 14. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ **OR** FSK jacket, **as directed**, complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. (40 kg/cu. m) or more. Thermal conductivity (k-value) at 100 deg F (55 deg C) is 0.29 Btu x in./h x sq. ft. x deg F (0.042 W/m x K) or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 15. Phenolic:
 - a. Preformed pipe insulation of rigid, expanded, closed-cell structure. Comply with ASTM C 1126, Type III, Grade 1.
 - b. Block insulation of rigid, expanded, closed-cell structure. Comply with ASTM C 1126, Type II, Grade 1.
 - c. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
 - d. Factory-Applied Jacket: Requirements are specified in "Factory-Applied Jackets" Article.
 - 1) Preformed Pipe Insulation: None **OR** ASJ, **as directed**.
 - 2) Board for Equipment Applications: None **OR** ASJ, **as directed**.
 16. Polyisocyanurate: Unfaced, preformed, rigid cellular polyisocyanurate material intended for use as thermal insulation.
 - a. Comply with ASTM C 591, Type I or Type IV, except thermal conductivity (k-value) shall not exceed 0.19 Btu x in./h x sq. ft. x deg F (0.027 W/m x K) at 75 deg F (24 deg C) after 180 days of aging.
 - b. Flame-spread index shall be 25 or less and smoke-developed index shall be 50 or less for thickness up to 1-1/2 inches (38 mm) as tested by ASTM E 84.
 - c. Fabricate shapes according to ASTM C 450 and ASTM C 585.
 - d. Factory-Applied Jacket: Requirements are specified in "Factory-Applied Jackets" Article.
 - 1) Pipe Applications: None **OR** ASJ **OR** ASJ-SSL **OR** PVDC **OR** PVDC-SSL, **as directed**.
 - 2) Equipment Applications: None **OR** ASJ **OR** ASJ-SSL **OR** PVDC **OR** PVDC-SSL, **as directed**.
 17. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials and Type II, Grade 1 for sheet materials.
 18. Polystyrene: Rigid, extruded cellular polystyrene intended for use as thermal insulation. Comply with ASTM C 578, Type IV or Type XIII, except thermal conductivity (k-value) shall not exceed 0.26 Btu x in./h x sq. ft. x deg F (0.038 W/m x K) after 180 days of aging. Fabricate shapes according to ASTM C 450 and ASTM C 585.
- B. Insulating Cements
1. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
 2. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.
 3. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.
- C. Adhesives
1. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
 2. Calcium Silicate Adhesive: Fibrous, sodium-silicate-based adhesive with a service temperature range of 50 to 800 deg F (10 to 427 deg C).



- a. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Cellular-Glass, Phenolic, Polyisocyanurate, and Polystyrene Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F (minus 59 to plus 149 deg C).
 - a. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
4. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 - a. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
5. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - a. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Polystyrene Adhesive: Solvent- or water-based, synthetic resin adhesive with a service temperature range of minus 20 to plus 140 deg F (29 to plus 60 deg C).
7. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - a. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
8. PVC Jacket Adhesive: Compatible with PVC jacket.
 - a. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Mastics

1. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
 - a. For indoor applications, use mastics that have a VOC content of <Insert value> g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
 - a. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
 - b. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
 - c. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
 - d. Color: White.
3. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.
 - a. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.03 metric perm) at 35-mil (0.9-mm) dry film thickness.
 - b. Service Temperature Range: 0 to 180 deg F (Minus 18 to plus 82 deg C).
 - c. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
 - d. Color: White.
4. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.
 - a. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.033 metric perm) at 30-mil (0.8-mm) dry film thickness.
 - b. Service Temperature Range: Minus 50 to plus 220 deg F (Minus 46 to plus 104 deg C).
 - c. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
 - d. Color: White.
5. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
 - a. Water-Vapor Permeance: ASTM F 1249, 3 perms (2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
 - b. Service Temperature Range: Minus 20 to plus 200 deg F (Minus 29 to plus 93 deg C).
 - c. Solids Content: 63 percent by volume and 73 percent by weight.
 - d. Color: White.

E. Lagging Adhesives



1. Description: Comply with MIL-A-3316C, Class I, Grade A, and shall be compatible with insulation materials, jackets, and substrates.
 - a. For indoor applications, use lagging adhesives that have a VOC content of <Insert value> g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over equipment and pipe insulation.
 - c. Service Temperature Range: Minus 50 to plus 180 deg F (Minus 46 to plus 82 deg C).
 - d. Color: White.

- F. Sealants
 1. Joint Sealants:
 - a. Materials shall be compatible with insulation materials, jackets, and substrates.
 - b. Permanently flexible, elastomeric sealant.
 - c. Service Temperature Range: Minus 100 to plus 300 deg F (Minus 73 to plus 149 deg C).
 - d. Color: White or gray.
 - e. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. FSK and Metal Jacket Flashing Sealants:
 - a. Materials shall be compatible with insulation materials, jackets, and substrates.
 - b. Fire- and water-resistant, flexible, elastomeric sealant.
 - c. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
 - d. Color: Aluminum.
 - e. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
 - a. Materials shall be compatible with insulation materials, jackets, and substrates.
 - b. Fire- and water-resistant, flexible, elastomeric sealant.
 - c. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
 - d. Color: White.
 - e. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

- G. Factory-Applied Jackets
 1. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 - a. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
 - b. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
 - c. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
 - d. PVDC Jacket for Indoor Applications: 4-mil- (0.10-mm-) thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms (0.013 metric perms) when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.
 - e. PVDC Jacket for Outdoor Applications: 6-mil- (0.15-mm-) thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perms (0.007 metric perms) when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.
 - f. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.

- H. Field-Applied Fabric-Reinforcing Mesh
 1. Woven Glass-Fiber Fabric for Pipe Insulation: Approximately 2 oz./sq. yd. (68 g/sq. m) with a thread count of 10 strands by 10 strands/sq. inch (4 strands by 4 strands/sq. mm) for covering pipe and pipe fittings.



2. Woven Glass-Fiber Fabric for Equipment Insulation: Approximately 6 oz./sq. yd. (203 g/sq. m) with a thread count of 5 strands by 5 strands/sq. inch (2 strands by 2 strands/sq. mm) for covering equipment.
 3. Woven Polyester Fabric: Approximately 1 oz./sq. yd. (34 g/sq. m) with a thread count of 10 strands by 10 strands/sq. inch (4 strands by 4 strands/sq. mm), in a Leno weave, for equipment and pipe.
- I. Field-Applied Cloths
1. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd. (271 g/sq. m).
- J. Field-Applied Jackets
1. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
 2. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
 - a. Adhesive: As recommended by jacket material manufacturer.
 - b. Color: White **OR** Color-code jackets based on system. Color as selected by the Owner, **as directed**.
 - c. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - 1) Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
 - d. Factory-fabricated tank heads and tank side panels.
 3. Metal Jacket:
 - a. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105 or 5005, Temper H-14.
 - 1) Sheet and roll stock ready for shop or field sizing **OR** Factory cut and rolled to size, **as directed**.
 - 2) Finish and thickness are indicated in field-applied jacket schedules.
 - 3) Moisture Barrier for Indoor Applications: 1-mil- (0.025-mm-) thick, heat-bonded polyethylene and kraft paper **OR** 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper **OR** 2.5-mil- (0.063-mm-) thick Polysurlyn, **as directed**.
 - 4) Moisture Barrier for Outdoor Applications: 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper **OR** 2.5-mil- (0.063-mm-) thick Polysurlyn, **as directed**.
 - 5) Factory-Fabricated Fitting Covers:
 - a) Same material, finish, and thickness as jacket.
 - b) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - c) Tee covers.
 - d) Flange and union covers.
 - e) End caps.
 - f) Beveled collars.
 - g) Valve covers.
 - h) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.
 - b. Stainless-Steel Jacket: ASTM A 167 or ASTM A 240/A 240M.
 - 1) Sheet and roll stock ready for shop or field sizing **OR** Factory cut and rolled to size, **as directed**.
 - 2) Material, finish, and thickness are indicated in field-applied jacket schedules.
 - 3) Moisture Barrier for Indoor Applications: 1-mil- (0.025-mm-) thick, heat-bonded polyethylene and kraft paper **OR** 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper **OR** 2.5-mil- (0.063-mm-) thick Polysurlyn, **as directed**.
 - 4) Moisture Barrier for Outdoor Applications: 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper **OR** 2.5-mil- (0.063-mm-) thick Polysurlyn, **as directed**.
 - 5) Factory-Fabricated Fitting Covers:



- a) Same material, finish, and thickness as jacket.
 - b) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - c) Tee covers.
 - d) Flange and union covers.
 - e) End caps.
 - f) Beveled collars.
 - g) Valve covers.
 - h) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.
4. Underground Direct-Buried Jacket: 125-mil- (3.2-mm-) thick vapor barrier and waterproofing membrane consisting of a rubberized bituminous resin reinforced with a woven-glass fiber or polyester scrim and laminated aluminum foil.

K. Tapes

1. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
 - a. Width: 3 inches (75 mm).
 - b. Thickness: 11.5 mils (0.29 mm).
 - c. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
 - d. Elongation: 2 percent.
 - e. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
 - f. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
2. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
 - a. Width: 3 inches (75 mm).
 - b. Thickness: 6.5 mils (0.16 mm).
 - c. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
 - d. Elongation: 2 percent.
 - e. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
 - f. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
3. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.
 - a. Width: 2 inches (50 mm).
 - b. Thickness: 6 mils (0.15 mm).
 - c. Adhesion: 64 ounces force/inch (0.7 N/mm) in width.
 - d. Elongation: 500 percent.
 - e. Tensile Strength: 18 lbf/inch (3.3 N/mm) in width.
4. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
 - a. Width: 2 inches (50 mm).
 - b. Thickness: 3.7 mils (0.093 mm).
 - c. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
 - d. Elongation: 5 percent.
 - e. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.
5. PVDC Tape: White vapor-retarder PVDC tape with acrylic adhesive.
 - a. Width: 3 inches (75 mm).
 - b. Film Thickness: 4 mils (0.10 mm) **OR** 6 mils (0.15 mm), **as directed**.
 - c. Adhesive Thickness: 1.5 mils (0.04 mm).
 - d. Elongation at Break: 145 percent.
 - e. Tensile Strength: 55 lbf/inch (10.1 N/mm) in width.

L. Securements

1. Bands:
 - a. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 **OR** Type 316, **as directed**; 0.015 inch (0.38 mm) thick, 1/2 inch (13 mm) **OR** 3/4 inch (19 mm), **as directed**, wide with wing seal **OR** closed seal, **as directed**.



- b. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 1/2 inch (13 mm) **OR** 3/4 inch (19 mm), **as directed**, wide with wing seal **OR** closed seal, **as directed**.
 - c. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.
2. Insulation Pins and Hangers:
- a. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- (2.6-mm-) **OR** 0.135-inch- (3.5-mm-), **as directed**, diameter shank, length to suit depth of insulation indicated.
 - b. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- (2.6-mm-) **OR** 0.135-inch- (3.5-mm-), **as directed**, diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch (38-mm) galvanized carbon-steel washer.
 - c. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - 1) Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.
 - 2) Spindle: Copper- or zinc-coated, low carbon steel **OR** Aluminum **OR** Stainless steel, **as directed**, fully annealed, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.
 - 3) Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
 - d. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - 1) Baseplate: Perforated, nylon sheet, 0.030 inch (0.76 mm) thick by 1-1/2 inches (38 mm) in diameter.
 - 2) Spindle: Nylon, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches (63 mm).
 - 3) Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
 - e. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - 1) Baseplate: Galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.
 - 2) Spindle: Copper- or zinc-coated, low carbon steel **OR** Aluminum **OR** Stainless steel, **as directed**, fully annealed, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.
 - 3) Adhesive-backed base with a peel-off protective cover.
 - f. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick, galvanized-steel **OR** aluminum **OR** stainless-steel, **as directed**, sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.
 - 1) Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
 - g. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.



3. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.
4. Wire: 0.080-inch (2.0-mm) nickel-copper alloy **OR** 0.062-inch (1.6-mm) soft-annealed, stainless steel **OR** 0.062-inch (1.6-mm) soft-annealed, galvanized steel, **as directed**.

M. Corner Angles

1. PVC Corner Angles: 30 mils (0.8 mm) thick, minimum 1 by 1 inch (25 by 25 mm), PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.
2. Aluminum Corner Angles: 0.040 inch (1.0 mm) thick, minimum 1 by 1 inch (25 by 25 mm), aluminum according to ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105 or 5005; Temper H-14.
3. Stainless-Steel Corner Angles: 0.024 inch (0.61 mm) thick, minimum 1 by 1 inch (25 by 25 mm), stainless steel according to ASTM A 167 or ASTM A 240/A 240M, Type 304 **OR** Type 316, **as directed**.

1.3 EXECUTION

A. Preparation

1. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
OR
Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
 - a. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils (0.127 mm) thick and an epoxy finish 5 mils (0.127 mm) thick if operating in a temperature range between 140 and 300 deg F (60 and 149 deg C). Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
 - b. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F (0 and 149 deg C) with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
3. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

B. General Installation Requirements

1. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.
2. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified in insulation system schedules.
3. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
4. Install insulation with longitudinal seams at top and bottom of horizontal runs.
5. Install multiple layers of insulation with longitudinal and end seams staggered.
6. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
7. Keep insulation materials dry during application and finishing.
8. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
9. Install insulation with least number of joints practical.
10. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - a. Install insulation continuously through hangers and around anchor attachments.



- b. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
- c. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
- d. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
11. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
12. Install insulation with factory-applied jackets as follows:
 - a. Draw jacket tight and smooth.
 - b. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
 - c. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) **OR** 4 inches (100 mm), **as directed**, o.c.
 - 1) For below ambient services, apply vapor-barrier mastic over staples.
 - d. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
 - e. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
13. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
14. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
15. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
16. For above ambient services, do not install insulation to the following:
 - a. Vibration-control devices.
 - b. Testing agency labels and stamps.
 - c. Nameplates and data plates.
 - d. Manholes.
 - e. Handholes.
 - f. Cleanouts.

C. Penetrations

1. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 - a. Seal penetrations with flashing sealant.
 - b. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - c. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
 - d. Seal jacket to roof flashing with flashing sealant.
2. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
3. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - a. Seal penetrations with flashing sealant.



- b. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - c. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
 - d. Seal jacket to wall flashing with flashing sealant.
 4. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
 5. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
 - a. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
 6. Insulation Installation at Floor Penetrations:
 - a. Pipe: Install insulation continuously through floor penetrations.
 - b. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping".
- D. Equipment, Tank, And Vessel Insulation Installation
1. Mineral Fiber, Pipe and Tank Insulation Installation for Tanks and Vessels: Secure insulation with adhesive and anchor pins and speed washers.
 - a. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 **OR** 50, **as directed**, percent coverage of tank and vessel surfaces.
 - b. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
 - c. Protect exposed corners with secured corner angles.
 - d. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:
 - 1) Do not weld anchor pins to ASME-labeled pressure vessels.
 - 2) Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
 - 3) On tanks and vessels, maximum anchor-pin spacing is 3 inches (75 mm) from insulation end joints, and 16 inches (400 mm) o.c. in both directions.
 - 4) Do not overcompress insulation during installation.
 - 5) Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
 - 6) Impale insulation over anchor pins and attach speed washers.
 - 7) Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 - e. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
 - f. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches (150 mm) from each end. Install wire or cable between two circumferential girdles 12 inches (300 mm) o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches (1200 mm) o.c. Use this network for securing insulation with tie wire or bands.
 - g. Stagger joints between insulation layers at least 3 inches (75 mm).
 - h. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.



- i. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
- j. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.
- 2. Flexible Elastomeric Thermal Insulation Installation for Tanks and Vessels: Install insulation over entire surface of tanks and vessels.
 - a. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive.
 - b. Seal longitudinal seams and end joints.
- 3. Insulation Installation on Pumps:
 - a. Fabricate metal boxes lined with insulation. Fit boxes around pumps and coincide box joints with splits in pump casings. Fabricate joints with outward bolted flanges. Bolt flanges on 6-inch (150-mm) centers, starting at corners. Install 3/8-inch- (10-mm-) diameter fasteners with wing nuts. Alternatively, secure the box sections together using a latching mechanism.
 - b. Fabricate boxes from galvanized steel **OR** aluminum **OR** stainless steel, **as directed**, at least 0.040 inch (1.0 mm) **OR** 0.050 inch (1.3 mm) **OR** 0.060 inch (1.6 mm), **as directed**, thick.
 - c. For below ambient services, install a vapor barrier at seams, joints, and penetrations. Seal between flanges with replaceable gasket material to form a vapor barrier.

E. General Pipe Insulation Installation

- 1. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- 2. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 - a. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
 - b. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 - c. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 - d. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 - e. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
 - f. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 - g. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.



- c. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of same material and thickness as pipe insulation.
 - d. Finish flange insulation same as pipe insulation.
 4. Insulation Installation on Pipe Fittings and Elbows:
 - a. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
 - b. When preformed insulation sections of insulation are not available, install mitered sections of calcium silicate insulation. Secure insulation materials with wire or bands.
 - c. Finish fittings insulation same as pipe insulation.
 5. Insulation Installation on Valves and Pipe Specialties:
 - a. Install mitered segments of calcium silicate insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - b. Install insulation to flanges as specified for flange insulation application.
 - c. Finish valve and specialty insulation same as pipe insulation.
- G. Cellular-Glass Insulation Installation
1. Insulation Installation on Straight Pipes and Tubes:
 - a. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
 - b. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 - c. For insulation with factory-applied jackets on above ambient services, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
 - d. For insulation with factory-applied jackets on below ambient services, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
 2. Insulation Installation on Pipe Flanges:
 - a. Install preformed pipe insulation to outer diameter of pipe flange.
 - b. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - c. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
 - d. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.
 3. Insulation Installation on Pipe Fittings and Elbows:
 - a. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
 - b. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.
 4. Insulation Installation on Valves and Pipe Specialties:
 - a. Install preformed sections of cellular-glass insulation to valve body.
 - b. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - c. Install insulation to flanges as specified for flange insulation application.
- H. Flexible Elastomeric Insulation Installation
1. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
 2. Insulation Installation on Pipe Flanges:
 - a. Install pipe insulation to outer diameter of pipe flange.
 - b. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.



- c. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
 - d. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
 3. Insulation Installation on Pipe Fittings and Elbows:
 - a. Install mitered sections of pipe insulation.
 - b. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
 4. Insulation Installation on Valves and Pipe Specialties:
 - a. Install preformed valve covers manufactured of same material as pipe insulation when available.
 - b. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - c. Install insulation to flanges as specified for flange insulation application.
 - d. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- I. Mineral-Fiber Insulation Installation
 1. Insulation Installation on Straight Pipes and Tubes:
 - a. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
 - b. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 - c. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
 - d. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
 2. Insulation Installation on Pipe Flanges:
 - a. Install preformed pipe insulation to outer diameter of pipe flange.
 - b. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - c. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
 - d. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.
 3. Insulation Installation on Pipe Fittings and Elbows:
 - a. Install preformed sections of same material as straight segments of pipe insulation when available.
 - b. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
 4. Insulation Installation on Valves and Pipe Specialties:
 - a. Install preformed sections of same material as straight segments of pipe insulation when available.
 - b. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
 - c. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - d. Install insulation to flanges as specified for flange insulation application.
- J. Phenolic Insulation Installation
 1. General Installation Requirements:



- a. Secure single-layer insulation with stainless-steel bands at 12-inch (300-mm) intervals and tighten bands without deforming insulation materials.
 - b. Install 2-layer insulation with joints tightly butted and staggered at least 3 inches (75 mm). Secure inner layer with 0.062-inch (1.6-mm) wire spaced at 12-inch (300-mm) intervals. Secure outer layer with stainless-steel bands at 12-inch (300-mm) intervals.
2. Insulation Installation on Straight Pipes and Tubes:
 - a. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
 - b. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 - c. For insulation with factory-applied jackets on above ambient services, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
 - d. For insulation with factory-applied jackets with vapor retarders on below ambient services, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
 3. Insulation Installation on Pipe Flanges:
 - a. Install preformed pipe insulation to outer diameter of pipe flange.
 - b. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - c. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of same material and thickness as pipe insulation.
 4. Insulation Installation on Pipe Fittings and Elbows:
 - a. Install preformed insulation sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.
 5. Insulation Installation on Valves and Pipe Specialties:
 - a. Install preformed insulation sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.
 - b. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - c. Install insulation to flanges as specified for flange insulation application.
- K. Polyisocyanurate Insulation Installation
1. Insulation Installation on Straight Pipes and Tubes:
 - a. Secure each layer of insulation to pipe with tape or bands and tighten without deforming insulation materials. Orient longitudinal joints between half sections in 3 and 9 o'clock positions on the pipe.
 - b. For insulation with factory-applied jackets with vapor barriers, do not staple longitudinal tabs but secure tabs with additional adhesive or tape as recommended by insulation material manufacturer and seal with vapor-barrier mastic.
 - c. All insulation shall be tightly butted and free of voids and gaps at all joints. Vapor barrier must be continuous. Before installing jacket material, install vapor-barrier system.
 2. Insulation Installation on Pipe Flanges:
 - a. Install preformed pipe insulation to outer diameter of pipe flange.
 - b. Make width of insulation section same as overall width of flange and bolts, same thickness of adjacent pipe insulation, not to exceed 1-1/2-inch (38-mm) thickness.
 - c. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyisocyanurate block insulation of same thickness as pipe insulation.
 3. Insulation Installation on Fittings and Elbows:
 - a. Install preformed sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.
 4. Insulation Installation on Valves and Pipe Specialties:
 - a. Install preformed sections of polyisocyanurate insulation to valve body.



- b. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
- c. Install insulation to flanges as specified for flange insulation application.

L. Polyolefin Insulation Installation

1. Insulation Installation on Straight Pipes and Tubes:
 - a. Seal split-tube longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
2. Insulation Installation on Pipe Flanges:
 - a. Install pipe insulation to outer diameter of pipe flange.
 - b. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - c. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyolefin sheet insulation of same thickness as pipe insulation.
 - d. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
3. Insulation Installation on Pipe Fittings and Elbows:
 - a. Install mitered sections of polyolefin pipe insulation.
 - b. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
4. Insulation Installation on Valves and Pipe Specialties:
 - a. Install cut sections of polyolefin pipe and sheet insulation to valve body.
 - b. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - c. Install insulation to flanges as specified for flange insulation application.
 - d. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

M. Polystyrene Insulation Installation

1. Insulation Installation on Straight Pipes and Tubes:
 - a. Secure each layer of insulation with tape or bands and tighten bands without deforming insulation materials. Orient longitudinal joints between half sections in 3 and 9 o'clock positions on the pipe.
 - b. For insulation with factory-applied jackets with vapor barriers, do not staple longitudinal tabs but secure tabs with additional adhesive or tape as recommended by insulation material manufacturer and seal with vapor-barrier mastic.
 - c. All insulation shall be tightly butted and free of voids and gaps at all joints. Vapor barrier must be continuous. Before installing jacket material, install vapor-barrier system.
2. Insulation Installation on Pipe Flanges:
 - a. Install preformed pipe insulation to outer diameter of pipe flange.
 - b. Make width of insulation section same as overall width of flange and bolts, same thickness of adjacent pipe insulation, not to exceed 1-1/2-inch (38-mm) thickness.
 - c. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polystyrene block insulation of same thickness as pipe insulation.
3. Insulation Installation on Pipe Fittings and Elbows:
 - a. Install preformed insulation sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.
4. Insulation Installation on Valves and Pipe Specialties:
 - a. Install preformed section of polystyrene insulation to valve body.
 - b. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - c. Install insulation to flanges as specified for flange insulation application.



N. Field-Applied Jacket Installation

1. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
 - a. Draw jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.
 - b. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of lagging adhesive.
 - c. Completely encapsulate insulation with coating, leaving no exposed insulation.
2. Where FSK jackets are indicated, install as follows:
 - a. Draw jacket material smooth and tight.
 - b. Install lap or joint strips with same material as jacket.
 - c. Secure jacket to insulation with manufacturer's recommended adhesive.
 - d. Install jacket with 1-1/2-inch (38-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
 - e. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
3. Where PVC jackets are indicated, install with 1-inch (25-mm) overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.
 - a. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
4. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints.
5. Where PVDC jackets are indicated, install as follows:
 - a. Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.
 - b. Wrap factory-presize jackets around individual pipe insulation sections with one end overlapping the previously installed sheet. Install presize jacket with an approximate overlap at butt joint of 2 inches (50 mm) over the previous section. Adhere lap seal using adhesive or SSL, and then apply 1-1/4 circumferences of appropriate PVDC tape around overlapped butt joint.
 - c. Continuous jacket can be spiral wrapped around a length of pipe insulation. Apply adhesive or PVDC tape at overlapped spiral edge. When electing to use adhesives, refer to manufacturer's written instructions for application of adhesives along this spiral edge to maintain a permanent bond.
 - d. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches (850 mm) or less. The 33-1/2-inch- (850-mm-) circumference limit allows for 2-inch- (50-mm-) overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.
 - e. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

O. Finishes

1. Equipment and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 07.
 - a. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - 1) Finish Coat Material: Interior, flat, latex-emulsion size.
2. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
3. Color: Final color as selected by the Owner. Vary first and second coats to allow visual inspection of the completed Work.
4. Do not field paint aluminum or stainless-steel jackets.



P. Field Quality Control

1. Perform tests and inspections.
2. Tests and Inspections:
 - a. Inspect field-insulated equipment, randomly selected by the Owner, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.
 - b. Inspect pipe, fittings, strainers, and valves, randomly selected by the Owner, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
3. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

Q. Domestic Water Boiler Breeching Insulation Schedule

1. Round, exposed breeching and connector insulation shall be one of the following:
 - a. Calcium Silicate: 4 inches (100 mm) thick.
 - b. High-Temperature Mineral-Fiber Blanket: 3 inches (75 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.
 - c. High-Temperature Mineral-Fiber Board: 3 inches (75 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
2. Round, concealed breeching and connector insulation shall be one of the following:
 - a. Calcium Silicate: 4 inches (100 mm) thick.
 - b. High-Temperature Mineral-Fiber Blanket: 3 inches (75 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.
 - c. High-Temperature Mineral-Fiber Board: 3 inches (75 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
3. Rectangular, exposed breeching and connector insulation shall be one of the following:
 - a. Calcium Silicate: 4 inches (100 mm) thick.
 - b. High-Temperature Mineral-Fiber Blanket: 3 inches (75 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.
 - c. High-Temperature Mineral-Fiber Board: 3 inches (75 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
4. Rectangular, concealed breeching and connector insulation shall be one of the following:
 - a. Calcium Silicate: 4 inches (100 mm) thick.
 - b. High-Temperature Mineral-Fiber Blanket: 3 inches (75 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.
 - c. High-Temperature Mineral-Fiber Board: 3 inches (75 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.

R. Equipment Insulation Schedule

1. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.
2. Insulate indoor and outdoor equipment in paragraphs below that is not factory insulated.
3. Heat-exchanger (water-to-water for domestic water heating service) insulation shall be one of the following:
 - a. Calcium Silicate: 3 inches (75 mm) thick.
 - b. Cellular Glass: 3 inches (75 mm) thick.
 - c. Mineral-Fiber Board: 2 inches (50 mm) thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - d. Mineral-Fiber Pipe and Tank: 2 inches (50 mm) thick.
4. Steam-to-hot-water converter insulation shall be one of the following:
 - a. Calcium Silicate: 3 inches (75 mm) thick.



- b. Cellular Glass: 3 inches (75 mm) thick.
 - c. Mineral-Fiber Board: 2 inches (50 mm) thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - d. Mineral-Fiber Pipe and Tank: 2 inches (50 mm) thick.
5. Domestic water pump insulation shall be one of the following:
- a. Cellular Glass: 2 inches (50 mm) thick.
 - b. Mineral-Fiber Board: 1 inch (25 mm) thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - c. Phenolic: 1 inch (25 mm) thick.
 - d. Polyisocyanurate: 1 inch (25 mm) thick.
6. Domestic chilled-water (potable) pump insulation shall be one of the following:
- a. Cellular Glass: 3 inches (75 mm) thick.
 - b. Mineral-Fiber Board: 2 inches (50 mm) thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - c. Phenolic: 1 inch (25 mm) thick.
 - d. Polyisocyanurate: 1-1/2 inches (38 mm) thick.
7. Domestic hot-water pump insulation shall be one of the following:
- a. Cellular Glass: 2 inches (50 mm) thick.
 - b. Mineral-Fiber Board: 1 inch (25 mm) thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - c. Phenolic: 1 inch (25 mm) thick.
 - d. Polyisocyanurate: 1 inch (25 mm) thick.
8. Domestic water, domestic chilled-water (potable), and domestic hot-water hydropneumatic tank insulation shall be one of the following:
- a. Cellular Glass: 1-1/2 inches (38 mm) thick.
 - b. Flexible Elastomeric: 1 inch (25 mm) thick.
 - c. Mineral-Fiber Board: 1 inch (25 mm) thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - d. Mineral-Fiber Pipe and Tank: 1 inch (25 mm) thick.
 - e. Phenolic: 1 inch (25 mm) thick.
 - f. Polyisocyanurate: 1 inch (25 mm) thick.
 - g. Polyolefin: 1 inch (25 mm) thick.
9. Domestic hot-water storage tank insulation shall be one of the following, of thickness to provide an R-value of 12.5:
- a. Cellular glass.
 - b. Mineral-Fiber Board: 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - c. Mineral-fiber pipe and tank.
 - d. Phenolic.
10. Domestic water storage tank insulation shall be one of the following:
- a. Cellular Glass: 2 inches (50 mm) thick.
 - b. Flexible Elastomeric: 1 inch (25 mm) thick.
 - c. Mineral-Fiber Board: 1 inch (25 mm) thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - d. Mineral-Fiber Pipe and Tank: 1 inch (25 mm) thick.
 - e. Phenolic: 1 inch (25 mm) thick.
 - f. Polyisocyanurate: 1 inch (25 mm) thick.
 - g. Polyolefin: 1 inch (25 mm) thick.
11. Domestic chilled-water (potable) storage tank insulation shall be one of the following:
- a. Cellular Glass: 2 inches (50 mm) thick.
 - b. Flexible Elastomeric: 1 inch (25 mm) thick.
 - c. Mineral-Fiber Board: 1 inch (25 mm) thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - d. Mineral-Fiber Pipe and Tank: 1 inch (25 mm) thick.
 - e. Phenolic: 1 inch (25 mm) thick.



- f. Polyisocyanurate: 1 inch (25 mm) thick.
- g. Polyolefin: 1 inch (25 mm) thick.
- 12. Piping system filter-housing insulation shall be one of the following:
 - a. Cellular Glass: 3 inches (75 mm) thick.
 - b. Mineral-Fiber Board: 2 inches (50 mm) thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - c. Mineral-Fiber Pipe and Tank: 2 inches (50 mm) thick.
- S. Piping Insulation Schedule, General
 - 1. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
 - 2. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 - a. Drainage piping located in crawl spaces.
 - b. Underground piping.
 - c. Chrome-plated pipes and fittings unless there is a potential for personnel injury.
- T. Indoor Piping Insulation Schedule
 - 1. Domestic Cold Water:
 - a. NPS 1 (DN 25) and Smaller: Insulation shall be one of the following:
 - 1) Cellular Glass: 1-1/2 inches (38 mm) thick.
 - 2) Flexible Elastomeric: 1/2 inch (13 mm) **OR** 3/4 inch (19 mm) **OR** 1 inch (25 mm), **as directed**, thick.
 - 3) Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch (13 mm) **OR** 1 inch (25 mm), **as directed**, thick.
 - 4) Phenolic: 1 inch (25 mm) thick.
 - 5) Polyisocyanurate: 1 inch (25 mm) thick.
 - 6) Polyolefin: 1/2 inch (13 mm) **OR** 3/4 inch (19 mm) **OR** 1 inch (25 mm), **as directed**, thick.
 - b. NPS 1-1/4 (DN 32) and Larger: Insulation shall be one of the following:
 - 1) Cellular Glass: 1-1/2 inches (38 mm) thick.
 - 2) Flexible Elastomeric: 1 inch (25 mm) thick.
 - 3) Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
 - 4) Phenolic: 1 inch (25 mm) thick.
 - 5) Polyisocyanurate: 1 inch (25 mm) thick.
 - 6) Polyolefin: 1 inch (25 mm) thick.
 - 2. Domestic Hot and Recirculated Hot Water:
 - a. NPS 1-1/4 (DN 32) and Smaller: Insulation shall be one of the following:
 - 1) Cellular Glass: 1-1/2 inches (38 mm) thick.
 - 2) Flexible Elastomeric: 3/4 inch (19 mm) **OR** 1 inch (25 mm), **as directed**, thick.
 - 3) Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch (13 mm) **OR** 1 inch (25 mm), **as directed**, thick.
 - 4) Phenolic: 1 inch (25 mm) thick.
 - 5) Polyisocyanurate: 1 inch (25 mm) thick.
 - 6) Polyolefin: 3/4 inch (19 mm) **OR** 1 inch (25 mm), **as directed**, thick.
 - b. NPS 1-1/2 (DN 40) and Larger: Insulation shall be one of the following:
 - 1) Cellular Glass: 1-1/2 inches (38 mm) thick.
 - 2) Flexible Elastomeric: 1 inch (25 mm) thick.
 - 3) Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
 - 4) Phenolic: 1 inch (25 mm) thick.
 - 5) Polyisocyanurate: 1 inch (25 mm) thick.
 - 6) Polyolefin: 1 inch (25 mm) thick.
 - 3. Domestic Chilled Water (Potable):
 - a. All Pipe Sizes: Insulation shall be one of the following:
 - 1) Cellular Glass: 1-1/2 inches (38 mm) thick.
 - 2) Flexible Elastomeric: 1 inch (25 mm) thick.



- 3) Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
 - 4) Phenolic: 1 inch (25 mm) thick.
 - 5) Polyisocyanurate: 1 inch (25 mm) thick.
 - 6) Polyolefin: 1 inch (25 mm) thick.
4. Stormwater and Overflow:
 - a. All Pipe Sizes: Insulation shall be one of the following:
 - 1) Cellular Glass: 1-1/2 inches (38 mm) thick.
 - 2) Flexible Elastomeric: 1 inch (25 mm) thick.
 - 3) Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
 - 4) Phenolic: 1 inch (25 mm) thick.
 - 5) Polyisocyanurate: 1 inch (25 mm) thick.
 - 6) Polyolefin: 1 inch (25 mm) thick.
 5. Roof Drain and Overflow Drain Bodies:
 - a. All Pipe Sizes: Insulation shall be one of the following:
 - 1) Cellular Glass: 1-1/2 inches (38 mm) thick.
 - 2) Flexible Elastomeric: 1 inch (25 mm) thick.
 - 3) Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
 - 4) Phenolic: 1 inch (25 mm) thick.
 - 5) Polyisocyanurate: 1 inch (25 mm) thick.
 - 6) Polyolefin: 1 inch (25 mm) thick.
 6. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:
 - a. All Pipe Sizes: Insulation shall be one of the following:
 - 1) Flexible Elastomeric: 1/2 inch (13 mm) **OR** 3/4 inch (19 mm) **OR** 1 inch (25 mm), **as directed**, thick.
 - 2) Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch (13 mm) **OR** 1 inch (25 mm) thick.
 - 3) Polyolefin: 1/2 inch (13 mm) **OR** 3/4 inch (19 mm) **OR** 1 inch (25 mm) thick.
 7. Sanitary Waste Piping Where Heat Tracing Is Installed:
 - a. All Pipe Sizes: Insulation shall be one of the following:
 - 1) Cellular Glass: 2 inches (50 mm) thick.
 - 2) Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inches (38 mm) thick.
 - 3) Phenolic: 1-1/2 inches (38 mm) thick.
 - 4) Polyisocyanurate: 1-1/2 inches (38 mm) thick.
 8. Condensate and Equipment Drain Water below 60 Deg F (16 Deg C):
 - a. All Pipe Sizes: Insulation shall be one of the following:
 - 1) Cellular Glass: 1-1/2 inches (38 mm) thick.
 - 2) Flexible Elastomeric: 3/4 inch (19 mm) **OR** 1 inch (25 mm), **as directed**, thick.
 - 3) Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch (13 mm) **OR** 1 inch (25 mm), **as directed**, thick.
 - 4) Phenolic: 1 inch (25 mm) thick.
 - 5) Polyisocyanurate: 1 inch (25 mm) thick.
 - 6) Polyolefin: 3/4 inch (19 mm) **OR** 1 inch (25 mm), **as directed**, thick.
 9. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet (3 m) of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F (16 Deg C):
 - a. All Pipe Sizes: Insulation shall be one of the following:
 - 1) Cellular Glass: 1-1/2 inches (38 mm) thick.
 - 2) Flexible Elastomeric: 3/4 inch (19 mm) **OR** 1 inch (25 mm), **as directed**, thick.
 - 3) Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch (13 mm) **OR** 1 inch (25 mm), **as directed**, thick.
 - 4) Phenolic: 1 inch (25 mm) thick.
 - 5) Polyisocyanurate: 1 inch (25 mm) thick.
 - 6) Polyolefin: 3/4 inch (19 mm) **OR** 1 inch (25 mm), **as directed**, thick.
 10. Hot Service Drains:
 - a. All Pipe Sizes: Insulation shall be one of the following:



- 1) Calcium Silicate: 1-1/2 inches (38 mm) thick.
 - 2) Cellular Glass: 1-1/2 inches (38 mm) thick.
 - 3) Mineral-Fiber, Preformed Pipe, Type I or II: 1 inch (25 mm) thick.
11. Hot Service Vents:
- a. All Pipe Sizes: Insulation shall be one of the following:
 - 1) Calcium Silicate: 1-1/2 inches (38 mm) thick.
 - 2) Cellular Glass: 1-1/2 inches (38 mm) thick.
 - 3) Mineral-Fiber, Preformed Pipe, Type I or II: 1 inch (25 mm) thick.
- U. Outdoor, Aboveground Piping Insulation Schedule
1. Domestic Water Piping:
 - a. All Pipe Sizes: Insulation shall be one of the following:
 - 1) Cellular Glass: 2 inches (50 mm) thick.
 - 2) Flexible Elastomeric: 2 inches (50 mm) thick.
 - 3) Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches (50 mm) thick.
 - 4) Phenolic: 2 inches (50 mm) thick.
 - 5) Polyisocyanurate: 2 inches (50 mm) thick.
 - 6) Polyolefin: 2 inches (50 mm) thick.
 - 7) Polystyrene: 2 inches (50 mm) thick.
 2. Domestic Hot and Recirculated Hot Water:
 - a. All Pipe Sizes: Insulation shall be one of the following:
 - 1) Cellular Glass: 2 inches (50 mm) thick.
 - 2) Flexible Elastomeric: 2 inches (50 mm) thick.
 - 3) Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches (50 mm) thick.
 - 4) Phenolic: 2 inches (50 mm) thick.
 - 5) Polyisocyanurate: 2 inches (50 mm) thick.
 - 6) Polyolefin: 2 inches (50 mm) thick.
 3. Sanitary Waste Piping Where Heat Tracing Is Installed:
 - a. All Pipe Sizes: Insulation shall be one of the following:
 - 1) Cellular Glass: 2 inches (50 mm) thick.
 - 2) Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches (50 mm) thick.
 - 3) Phenolic: 2 inches (50 mm) thick.
 - 4) Polyisocyanurate: 2 inches (50 mm) thick.
 4. Hot Service Drains:
 - a. All Pipe Sizes: Insulation shall be one of the following:
 - 1) Calcium Silicate: 1-1/2 inches (38 mm) thick.
 - 2) Cellular Glass: 1-1/2 inches (38 mm) thick.
 - 3) Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
 5. Hot Service Vents:
 - a. All Pipe Sizes: Insulation shall be one of the following:
 - 1) Calcium Silicate: 1-1/2 inches (38 mm) thick.
 - 2) Cellular Glass: 1-1/2 inches (38 mm) thick.
 - 3) Mineral-Fiber, Preformed Pipe Insulation, Type II: 1 inch (25 mm) thick.
- V. Outdoor, Underground Piping Insulation Schedule
1. Loose-fill insulation, for belowground piping, is specified in Division 28.
 2. Sanitary Waste Piping, All Sizes, Where Heat Tracing Is Installed: Cellular glass, 2 inches (50 mm) thick.
 3. Chilled Water, All Sizes: Cellular glass, 2 inches (50 mm) thick.
- W. Indoor, Field-Applied Jacket Schedule
1. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
 2. If more than one material is listed, selection from materials listed is Contractor's option.
 3. Equipment, Concealed:
 - a. None.



- b. PVC **OR** PVC, Color-Coded by System, **as directed**: 20 mils (0.5 mm) **OR** 30 mils (0.8 mm), **as directed**, thick.
 - c. Aluminum, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm) **OR** 0.040 inch (1.0 mm), **as directed**, thick.
 - d. Painted Aluminum, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm), **as directed**, thick.
 - e. Stainless Steel, Type 304 **OR** Type 316, **as directed**, Smooth 2B Finish **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.010 inch (0.25 mm) **OR** 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm), **as directed**, thick.
4. Equipment, Exposed, up to 48 Inches (1200 mm) in Diameter or with Flat Surfaces up to 72 Inches (1800 mm):
- a. None.
 - b. PVC **OR** PVC, Color-Coded by System, **as directed**: 20 mils (0.5 mm) **OR** 30 mils (0.8 mm), **as directed**, thick.
 - c. Aluminum, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm) **OR** 0.040 inch (1.0 mm), **as directed**, thick.
 - d. Painted Aluminum, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm), **as directed**, thick.
 - e. Stainless Steel, Type 304 **OR** Type 316, **as directed**, Smooth 2B Finish **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.010 inch (0.25 mm) **OR** 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm), **as directed**, thick.
5. Equipment, Exposed, Larger Than 48 Inches (1200 mm) in Diameter or with Flat Surfaces Larger Than 72 Inches (1800 mm):
- a. None.
 - b. Aluminum **OR** Painted Aluminum, **as directed**, Smooth **OR** Stucco Embossed, **as directed**, with 1-1/4-Inch- (32-mm-) Deep Corrugations **OR** 2-1/2-Inch- (65-mm-) Deep Corrugations **OR** 4-by-1-Inch (100-by-25-mm) Box Ribs, **as directed**: 0.032 inch (0.81 mm) **OR** 0.040 inch (1.0 mm), **as directed**, thick.
 - c. Stainless Steel, Type 304 **OR** Type 316, **as directed**, Smooth **OR** Stucco Embossed, **as directed**, with 1-1/4-Inch- (32-mm-) Deep Corrugations **OR** 2-1/2-Inch- (65-mm-) Deep Corrugations **OR** 4-by-1-Inch (100-by-25-mm) Box Ribs, **as directed**: 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm), **as directed**, thick.
6. Piping, Concealed:
- a. None.
 - b. PVC **OR** PVC, Color-Coded by System, **as directed**: 20 mils (0.5 mm) **OR** 30 mils (0.8 mm), **as directed**, thick.
 - c. Aluminum, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm) **OR** 0.040 inch (1.0 mm), **as directed**, thick.
 - d. Painted Aluminum, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm), **as directed**, thick.
 - e. Stainless Steel, Type 304 **OR** Type 316, **as directed**, Smooth 2B Finish **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.010 inch (0.25 mm) **OR** 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm), **as directed**, thick.
7. Piping, Exposed:
- a. None.
 - b. PVC **OR** PVC, Color-Coded by System, **as directed**: 20 mils (0.5 mm) **OR** 30 mils (0.8 mm), **as directed**, thick.



- c. Aluminum, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm) **OR** 0.040 inch (1.0 mm), **as directed**, thick.
 - d. Aluminum **OR** Painted Aluminum, **as directed**, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm), **as directed**, thick.
 - e. Stainless Steel, Type 304 **OR** Type 316, **as directed**, Smooth 2B Finish **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.010 inch (0.25 mm) **OR** 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm), **as directed**, thick.
- X. Outdoor, Field-Applied Jacket Schedule
1. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
 2. If more than one material is listed, selection from materials listed is Contractor's option.
 3. Equipment, Concealed:
 - a. None.
 - b. PVC **OR** PVC, Color-Coded by System, **as directed**: 20 mils (0.5 mm) **OR** 30 mils (0.8 mm), **as directed**, thick.
 - c. Aluminum, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm) **OR** 0.040 inch (1.0 mm), **as directed**, thick.
 - d. Aluminum **OR** Painted Aluminum, **as directed**, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm), **as directed**, thick.
 - e. Stainless Steel, Type 304 **OR** Type 316, **as directed**, Smooth 2B Finish **OR** Corrugated **OR** Stucco Embossed, **as directed**, 0.010 inch (0.25 mm) **OR** 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm), **as directed**, thick.
 4. Equipment, Exposed, up to 48 Inches (1200 mm) in Diameter or with Flat Surfaces up to 72 Inches (1800 mm):
 - a. Aluminum **OR** Painted Aluminum, **as directed**, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**, with Z-Shaped Locking Seam, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm) **OR** 0.040 inch (1.0 mm), **as directed**, thick.
 - b. Stainless Steel, Type 304 **OR** Type 316, **as directed**, Smooth 2B Finish **OR** Corrugated **OR** Stucco Embossed, **as directed**, with Z-Shaped Locking Seam, **as directed**: 0.010 inch (0.25 mm) **OR** 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm), **as directed**, thick.
 5. Equipment, Exposed, Larger Than 48 Inches (1200 mm) in Diameter or with Flat Surfaces Larger Than 72 Inches (1800 mm):
 - a. Aluminum **OR** Painted Aluminum, **as directed**, Smooth **OR** Stucco Embossed, **as directed** with 1-1/4-Inch- (32-mm-) Deep Corrugations **OR** 2-1/2-Inch- (65-mm-) Deep Corrugations **OR** 4-by-1-Inch (100-by-25-mm) Box Ribs, **as directed**: 0.032 inch (0.81 mm) **OR** 0.040 inch (1.0 mm), **as directed**, thick.
 - b. Stainless Steel, Type 304 **OR** Type 316, **as directed**, Smooth **OR** Stucco Embossed, **as directed**, with 1-1/4-Inch- (32-mm-) Deep Corrugations **OR** 2-1/2-Inch- (65-mm-) Deep Corrugations **OR** 4-by-1-Inch (100-by-25-mm) Box Ribs, **as directed**: 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm), **as directed**, thick.
 6. Piping, Concealed:
 - a. None.
 - b. PVC **OR** PVC, Color-Coded by System, **as directed**: 20 mils (0.5 mm) **OR** 30 mils (0.8 mm), **as directed**, thick.
 - c. Aluminum, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm) **OR** 0.040 inch (1.0 mm), **as directed**, thick.



- d. Aluminum **OR** Painted Aluminum, **as directed**, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm), **as directed**, thick.
 - e. Stainless Steel, Type 304 **OR** Type 316, **as directed**, Smooth 2B Finish **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.010 inch (0.25 mm) **OR** 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm), **as directed**, thick.
7. Piping, Exposed:
- a. PVC: 20 mils (0.5 mm) **OR** 30 mils (0.8 mm) **OR** 40 mils (1.0 mm), **as directed**, thick.
 - b. Aluminum **OR** Painted Aluminum, **as directed**, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**, with Z-Shaped Locking Seam, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm) **OR** 0.040 inch (1.0 mm), **as directed**, thick.
 - c. Stainless Steel, Type 304 **OR** Type 316, **as directed**, Smooth 2B Finish **OR** Corrugated **OR** Stucco Embossed, **as directed**, with Z-Shaped Locking Seam, **as directed**: 0.010 inch (0.25 mm) **OR** 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm), **as directed**, thick.
- Y. Underground, Field-Installed Insulation Jacket
- 1. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION 22 07 19 00



Task	Specification	Specification Description
22 07 19 00	21 07 00 00	Fire-Suppression Systems Insulation



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SECTION 22 11 16 00 - DOMESTIC WATER PIPING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for domestic water piping. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
 - b. Encasement for piping.
 - c. Specialty valves.
 - d. Flexible connectors.
 - e. Water meters furnished by utility company for installation by Contractor.
OR
Water meters.
 - f. Escutcheons.
 - g. Sleeves and sleeve seals.
 - h. Wall penetration systems.

C. Performance Requirements

1. Seismic Performance: Domestic water piping and support and installation shall withstand effects of earthquake motions determined according to ASCE/SEI 7.

D. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittal:
 - a. Product Data for Credit EQ 4.1: For solvent cements and adhesive primers, including printed statement of VOC content.
3. Field quality-control reports.

E. Quality Assurance

1. Piping materials shall bear label, stamp, or other markings of specified testing agency.
2. Comply with NSF 14 for plastic, potable domestic water piping and components. Include marking "NSF-pw" on piping, **as directed**.
3. Comply with NSF 61 for potable domestic water piping and components.

F. Project Conditions

1. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by the Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
 - a. Notify the Owner no fewer than two days in advance of proposed interruption of water service.
 - b. Do not proceed with interruption of water service without the Owner's written permission.

1.2 PRODUCTS

A. Piping Materials



1. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Copper Tube And Fittings

1. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B) water tube, drawn temper.
 - a. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
 - b. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
 - c. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
 - d. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
 - e. Copper Pressure-Seal-Joint Fittings:
 - 1) NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.
 - 2) NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Cast-bronze or wrought-copper fitting with EPDM-rubber O-ring seal in each end.
 - f. Copper Push-on-Joint Fittings:
 - 1) Description: Cast-copper fitting complying with ASME B16.18 or wrought-copper fitting complying with ASME B 16.22; with stainless-steel teeth and EPDM-rubber O-ring seal in each end instead of solder-joint ends.
 - g. Copper-Tube Extruded-Tee Connections:
 - 1) Description: Tee formed in copper tube according to ASTM F 2014.
 - h. Grooved-Joint Copper-Tube Appurtenances:
 - 1) Copper Grooved-End Fittings: ASTM B 75 (ASTM B 75M) copper tube or ASTM B 584 bronze castings.
 - 2) Grooved-End-Tube Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections, EPDM-rubber gaskets suitable for hot and cold water, and bolts and nuts.
2. Soft Copper Tube: ASTM B 88, Type K (ASTM B 88M, Type A) and ASTM B 88, Type L (ASTM B 88M, Type B) water tube, annealed temper.
 - a. Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
 - b. Copper Pressure-Seal-Joint Fittings:
 - 1) NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.
 - 2) NPS 3 and NPS 4 (DN 80 and DN 100): Cast-bronze or wrought-copper fitting with EPDM-rubber O-ring seal in each end.

C. Ductile-Iron Pipe And Fittings

1. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
 - a. Standard-Pattern, Mechanical-Joint Fittings: AWWA C110, ductile or gray iron.
 - b. Compact-Pattern, Mechanical-Joint Fittings: AWWA C153, ductile iron.
 - 1) Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
2. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.
 - a. Standard-Pattern, Push-on-Joint Fittings: AWWA C110, ductile or gray iron.
 - 1) Gaskets: AWWA C111, rubber.
 - b. Compact-Pattern, Push-on-Joint Fittings: AWWA C153, ductile iron.
 - 1) Gaskets: AWWA C111, rubber.
3. Plain-End, Ductile-Iron Pipe: AWWA C151.
 - a. Grooved-Joint, Ductile-Iron-Pipe Appurtenances:
 - 1) Grooved-End, Ductile-Iron Fittings: ASTM A 47/A 47M, malleable-iron castings or ASTM A 536, ductile-iron castings with dimensions matching pipe.



- 2) Grooved-End, Ductile-Iron-Pipe Couplings: AWWA C606 for ductile-iron-pipe dimensions. Include ferrous housing sections, EPDM-rubber gaskets suitable for hot and cold water, and bolts and nuts.
- D. Galvanized-Steel Pipe And Fittings
1. Galvanized-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B, Standard Weight. Include ends matching joining method.
 - a. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106/A 106M, Standard Weight, seamless steel pipe with threaded ends.
 - b. Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
 - c. Malleable-Iron Unions: ASME B16.39, Class 150, hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface, and female threaded ends.
 - d. Flanges: ASME B16.1, Class 125, cast iron.
 - e. Grooved-Joint, Galvanized-Steel-Pipe Appurtenances:
 - 1) Galvanized, Grooved-End Fittings for Galvanized-Steel Piping: ASTM A 47/A 47M, malleable-iron casting; ASTM A 106/A 106M, steel pipe; or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
 - 2) Grooved-End-Pipe Couplings for Galvanized-Steel Piping: AWWA C606 for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gaskets suitable for hot and cold water, and bolts and nuts.
- E. CPVC Piping
1. CPVC Pipe: ASTM F 441/F 441M, Schedule 40 and Schedule 80.
 - a. CPVC Socket Fittings: ASTM F 438 for Schedule 40 and ASTM F 439 for Schedule 80.
 - b. CPVC Threaded Fittings: ASTM F 437, Schedule 80.
 2. CPVC Piping System: ASTM D 2846/D 2846M, SDR 11, pipe and socket fittings.
 3. CPVC Tubing System: ASTM D 2846/D 2846M, SDR 11, tube and socket fittings.
- F. PEX Tube And Fittings
1. PEX Distribution System: ASTM F 877, SDR 9 tubing.
 - a. Fittings for PEX Tube: ASTM F 1807, metal-insert type with copper or stainless-steel crimp rings and matching PEX tube dimensions.
 - b. Manifold: Multiple-outlet, plastic or corrosion-resistant-metal assembly complying with ASTM F 877; with plastic or corrosion-resistant-metal valve for each outlet.
- G. PVC Pipe And Fittings
1. PVC Pipe: ASTM D 1785, Schedule 40 and Schedule 80.
 - a. PVC Socket Fittings: ASTM D 2466 for Schedule 40 and ASTM D 2467 for Schedule 80.
 - b. PVC Schedule 80 Threaded Fittings: ASTM D 2464.
- H. Piping Joining Materials
1. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick or ASME B16.21, nonmetallic and asbestos free, unless otherwise indicated; full-face or ring type unless otherwise indicated.
 2. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
 3. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
 4. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.
 5. Solvent Cements for Joining CPVC Piping and Tubing: ASTM F 493.
 - a. Use CPVC solvent cement that has a VOC content of 490 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 6. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.



- a. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.
- I. Encasement For Piping
1. Standard: ASTM A 674 or AWWA C105.
 2. Form: Sheet **OR** Tube, **as directed**.
 3. Material: LLDPE film of 0.008-inch (0.20-mm) **OR** LLDPE film of 0.008-inch (0.20-mm) minimum thickness or high-density, cross-laminated PE film of 0.004-inch (0.10-mm) **OR** High-density, cross-laminated PE film of 0.004-inch (0.10-mm), **as directed**, minimum thickness.
 4. Color: Black **OR** Natural, **as directed**.
- J. Specialty Valves
1. Comply with requirements in Division 22 Section "General-duty Valves For Plumbing Piping" for general-duty metal valves.
 2. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.
 3. CPVC Union Ball Valves:
 - a. Description:
 - 1) Standard: MSS SP-122.
 - 2) Pressure Rating: 125 psig (860 kPa) **OR** 150 psig (1035 kPa), **as directed**, at 73 deg F (23 deg C).
 - 3) Body Material: CPVC.
 - 4) Body Design: Union type.
 - 5) End Connections for Valves NPS 2 (DN 50) and Smaller: Detachable, socket **OR** threaded, **as directed**.
 - 6) End Connections for Valves NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Detachable, socket **OR** threaded **OR** flanged, **as directed**.
 - 7) Ball: CPVC; full port.
 - 8) Seals: PTFE or EPDM-rubber O-rings.
 - 9) Handle: Tee shaped.
 4. PVC Union Ball Valves:
 - a. Description:
 - 1) Standard: MSS SP-122.
 - 2) Pressure Rating: 125 psig (860 kPa) **OR** 150 psig (1035 kPa), **as directed**, at 73 deg F (23 deg C).
 - 3) Body Material: PVC.
 - 4) Body Design: Union type.
 - 5) End Connections for Valves NPS 2 (DN 50) and Smaller: Detachable, socket **OR** threaded, **as directed**.
 - 6) End Connections for Valves NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Detachable, socket **OR** threaded **OR** flanged, **as directed**.
 - 7) Ball: PVC; full port.
 - 8) Seals: PTFE or EPDM-rubber O-rings.
 - 9) Handle: Tee shaped.
 5. CPVC Non-Union Ball Valves:
 - a. Description:
 - 1) Standard: MSS SP-122.
 - 2) Pressure Rating: 125 psig (860 kPa) **OR** 150 psig (1035 kPa), **as directed**, at 73 deg F (23 deg C).
 - 3) Body Material: CPVC.
 - 4) Body Design: Non-union type.



- 5) End Connections: Socket or threaded.
 - 6) Ball: CPVC; full or reduced port.
 - 7) Seals: PTFE or EPDM-rubber O-rings.
 - 8) Handle: Tee shaped.
6. PVC Non-Union Ball Valves:
- a. Description:
 - 1) Standard: MSS SP-122.
 - 2) Pressure Rating: 125 psig (860 kPa) **OR** 150 psig (1035 kPa), **as directed**, at 73 deg F (23 deg C).
 - 3) Body Material: PVC.
 - 4) Body Design: Non-union type.
 - 5) End Connections: Socket or threaded.
 - 6) Ball: PVC; full or reduced port.
 - 7) Seals: PTFE or EPDM-rubber O-rings.
 - 8) Handle: Tee shaped.
7. CPVC Butterfly Valves:
- a. Description:
 - 1) Pressure Rating: 125 psig (860 kPa) **OR** 150 psig (1035 kPa), **as directed**, at 73 deg F (23 deg C).
 - 2) Body Material: CPVC.
 - 3) Body Design: Lug or wafer type.
 - 4) Seat: EPDM rubber.
 - 5) Seals: PTFE or EPDM-rubber O-rings.
 - 6) Disc: CPVC.
 - 7) Stem: Stainless steel.
 - 8) Handle: Lever.
8. PVC Butterfly Valves:
- a. Description:
 - 1) Pressure Rating: 125 psig (860 kPa) **OR** 150 psig (1035 kPa), **as directed**, at 73 deg F (23 deg C).
 - 2) Body Material: PVC.
 - 3) Body Design: Lug or wafer type.
 - 4) Seat: EPDM rubber.
 - 5) Seals: PTFE or EPDM-rubber O-rings.
 - 6) Disc: PVC.
 - 7) Stem: Stainless steel.
 - 8) Handle: Lever.
9. CPVC Ball Check Valves:
- a. Description:
 - 1) Pressure Rating: 125 psig (860 kPa) **OR** 150 psig (1035 kPa), **as directed**, at 73 deg F (23 deg C).
 - 2) Body Material: CPVC.
 - 3) Body Design: Union-type ball check.
 - 4) End Connections for Valves NPS 2 (DN 50) and Smaller: Detachable, socket **OR** threaded, **as directed**.
 - 5) End Connections for Valves NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Detachable, socket **OR** threaded **OR** flanged, **as directed**.
 - 6) Ball: CPVC.
 - 7) Seals: EPDM- or FKM-rubber O-rings.
10. PVC Ball Check Valves:
- a. Description:
 - 1) Pressure Rating: 125 psig (860 kPa) **OR** 150 psig (1035 kPa), **as directed**, at 73 deg F (23 deg C).
 - 2) Body Material: PVC.
 - 3) Body Design: Union-type ball check.



- 4) End Connections for Valves NPS 2 (DN 50) and Smaller: Detachable, socket **OR** threaded, **as directed**.
 - 5) End Connections for Valves NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Detachable, socket **OR** threaded **OR** flanged, **as directed**.
 - 6) Ball: PVC.
 - 7) Seals: EPDM- or FKM-rubber O-rings.
11. CPVC Gate Valves:
- a. Description:
 - 1) Pressure Rating: 125 psig (860 kPa) **OR** 150 psig (1035 kPa), **as directed**, at 73 deg F (23 deg C).
 - 2) Body Material: CPVC.
 - 3) Body Design: Nonrising stem.
 - 4) End Connections for Valves NPS 2 (DN 50) and Smaller: Socket **OR** Threaded, **as directed**.
 - 5) End Connections for Valves NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Socket **OR** Threaded **OR** Flanged, **as directed**.
 - 6) Gate and Stem: Plastic.
 - 7) Seals: EPDM rubber.
 - 8) Handle: Wheel.
12. PVC Gate Valves:
- a. Description:
 - 1) Pressure Rating: 125 psig (860 kPa) **OR** 150 psig (1035 kPa), **as directed**, at 73 deg F (23 deg C).
 - 2) Body Material: PVC.
 - 3) Body Design: Nonrising stem.
 - 4) End Connections for Valves NPS 2 (DN 50) and Smaller: Socket **OR** Threaded, **as directed**.
 - 5) End Connections for Valves NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Socket **OR** Threaded **OR** Flanged, **as directed**.
 - 6) Gate and Stem: Plastic.
 - 7) Seals: EPDM rubber.
 - 8) Handle: Wheel.
- K. Transition Fittings
1. General Requirements:
 - a. Same size as pipes to be joined.
 - b. Pressure rating at least equal to pipes to be joined.
 - c. End connections compatible with pipes to be joined.
 2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
 3. Sleeve-Type Transition Coupling: AWWA C219.
 4. Plastic-to-Metal Transition Fittings:
 - a. Description: CPVC **OR** PVC, **as directed**, one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert and one solvent-cement-socket threaded, **as directed**, end.
 5. Plastic-to-Metal Transition Unions:
 - a. Description: CPVC **OR** PVC, **as directed**, four-part union. Include brass or stainless-steel, **as directed**, threaded end, solvent-cement-joint or threaded, **as directed**, plastic end, rubber O-ring, and union nut.
- L. Dielectric Fittings
1. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.
 2. Dielectric Unions:



- a. Description:
 - 1) Pressure Rating: 150 psig (1035 kPa) **OR** 250 psig (1725 kPa), **as directed**, at 180 deg F (82 deg C).
 - 2) End Connections: Solder-joint copper alloy and threaded ferrous.
 3. Dielectric Flanges:
 - a. Description:
 - 1) Factory-fabricated, bolted, companion-flange assembly.
 - 2) Pressure Rating: 150 psig (1035 kPa) **OR** 175 psig (1200 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - 3) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
 4. Dielectric-Flange Kits:
 - a. Description:
 - 1) Nonconducting materials for field assembly of companion flanges.
 - 2) Pressure Rating: 150 psig (1035 kPa).
 - 3) Gasket: Neoprene or phenolic.
 - 4) Bolt Sleeves: Phenolic or polyethylene.
 - 5) Washers: Phenolic with steel backing washers.
 5. Dielectric Couplings:
 - a. Description:
 - 1) Galvanized-steel coupling.
 - 2) Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C).
 - 3) End Connections: Female threaded.
 - 4) Lining: Inert and noncorrosive, thermoplastic.
 6. Dielectric Nipples:
 - a. Description:
 - 1) Electroplated steel nipple complying with ASTM F 1545.
 - 2) Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C).
 - 3) End Connections: Male threaded or grooved.
 - 4) Lining: Inert and noncorrosive, propylene.
- M. Flexible Connectors
1. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
 - a. Working-Pressure Rating: Minimum 200 psig (1380 kPa) **OR** 250 psig (1725 kPa), **as directed**.
 - b. End Connections NPS 2 (DN 50) and Smaller: Threaded copper pipe or plain-end copper tube.
 - c. End Connections NPS 2-1/2 (DN 65) and Larger: Flanged copper alloy.
 2. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.
 - a. Working-Pressure Rating: Minimum 200 psig (1380 kPa) **OR** 250 psig (1725 kPa), **as directed**.
 - b. End Connections NPS 2 (DN 50) and Smaller: Threaded steel-pipe nipple.
 - c. End Connections NPS 2-1/2 (DN 65) and Larger: Flanged steel nipple.
- N. Water Meters
1. Displacement-Type Water Meters:
 - a. Description:
 - 1) Standard: AWWA C700.
 - 2) Pressure Rating: 150-psig (1035-kPa) working pressure.
 - 3) Body Design: Nutating disc; totalization meter.
 - 4) Registration: In gallons (liters) or cubic feet (cubic meters) as required by utility.
 - 5) Case: Bronze.
 - 6) End Connections: Threaded.
 2. Turbine-Type Water Meters:



- a. Description:
 - 1) Standard: AWWA C701.
 - 2) Pressure Rating: 150-psig (1035-kPa) working pressure.
 - 3) Body Design: Turbine; totalization meter.
 - 4) Registration: In gallons (liters) or cubic feet (cubic meters) as required by utility company.
 - 5) Case: Bronze.
 - 6) End Connections for Meters NPS 2 (DN 50) and Smaller: Threaded.
 - 7) End Connections for Meters NPS 2-1/2 (DN 65) and Larger: Flanged.
3. Compound-Type Water Meters:
 - a. Description:
 - 1) Standard: AWWA C702.
 - 2) Pressure Rating: 150-psig (1035-kPa) working pressure.
 - 3) Body Design: With integral mainline and bypass meters; totalization meter.
 - 4) Registration: In gallons (liters) or cubic feet (cubic meters) as required by utility company.
 - 5) Case: Bronze.
 - 6) Pipe Connections: Flanged.
4. Fire-Service-Type Water Meters:
 - a. Description:
 - 1) Standard: AWWA C703 and UL listing.
 - 2) Pressure Rating: 175-psig (1200-kPa) working pressure.
 - 3) Body Design:
 - a) Proportional, Detector-Type Water Meters: With meter on bypass.
 - i. Bypass Meter: AWWA C701, turbine **OR** AWWA C702, compound, **as directed**, type with bronze case; size not less than one-half nominal size of main-line meter.
 - b) Turbine-Type Water Meters: With strainer, and with meter on bypass.
 - i. Strainer: Full size, matching water meter.
 - ii. Bypass Meter: AWWA C701, turbine type with bronze case; not less than NPS 2 (DN 50).
 - 4) Registration: In gallons (liters) or cubic feet (cubic meters) as required by utility company.
 - 5) Case: Bronze.
 - 6) Pipe Connections for Meters NPS 2 (DN 50) and Smaller: Threaded.
 - 7) Pipe Connections for Meters NPS 2-1/2 (DN 65) and Larger: Flanged.
5. Remote Registration System: Direct-reading type complying with AWWA C706; modified with signal transmitting assembly, low-voltage connecting wiring, and remote register assembly as required by utility company.
OR
 Remote Registration System: Encoder type complying with AWWA C707; modified with signal transmitting assembly, low-voltage connecting wiring, and remote register assembly as required by utility company.

O. Escutcheons

1. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.
2. One Piece, Cast Brass: Polished, chrome-plated **OR** rough-brass, **as directed**, finish with setscrews.
3. One Piece, Deep Pattern: Deep-drawn, box-shaped brass with chrome-plated finish.
4. One Piece, Stamped Steel: Chrome-plated finish with setscrew **OR** spring clips, **as directed**.
5. Split Casting, Cast Brass: Polished, chrome-plated **OR** rough-brass, **as directed**, finish with concealed hinge and setscrew.
6. Split Plate, Stamped Steel: Chrome-plated finish with concealed **OR** exposed-rivet, **as directed**, hinge, setscrew **OR** spring clips, **as directed**.
7. One-Piece Floor Plates: Cast-iron flange with holes for fasteners, **as directed**.



8. Split-Casting Floor Plates: Cast brass with concealed hinge.

P. Sleeves

1. Cast-Iron Wall Pipes: Fabricated of cast iron, and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
2. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
3. Molded-PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
4. Molded-PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.
5. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
6. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc-coated, with plain ends.
7. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - a. Underdeck Clamp: Clamping ring with setscrews.

Q. Sleeve Seals

1. Description: Modular sealing element unit, designed for field assembly, used to fill annular space between pipe and sleeve.
 - a. Sealing Elements: EPDM-rubber **OR** NBR, **as directed**, interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - b. Pressure Plates: Carbon steel **OR** Plastic **OR** Stainless steel, **as directed**.
 - c. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, **OR** Stainless steel, **as directed**, of length required to secure pressure plates to sealing elements.

R. Wall Penetration Systems

1. Description: Wall-sleeve assembly, consisting of housing and gland, gaskets, and pipe sleeve.
 - a. Carrier-Pipe Deflection: Up to 5 percent without leakage.
 - b. Housing: Ductile-iron casting with hub, waterstop, anchor ring, and locking devices. Include gland, bolts, and nuts.
 - c. Housing-to-Sleeve Gasket: EPDM rubber **OR** NBR, **as directed**.
 - d. Housing-to-Carrier-Pipe Gasket: AWWA C111, EPDM rubber **OR** NBR, **as directed**.
 - e. Pipe Sleeve: AWWA C151, ductile-iron pipe **OR** ASTM A 53/A 53M, Schedule 40, zinc-coated steel pipe, **as directed**.

S. Grout

1. Standard: ASTM C 1107, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
2. Characteristics: Nonshrink; recommended for interior and exterior applications.
3. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
4. Packaging: Premixed and factory packaged.

1.3 EXECUTION

A. Earthwork

1. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

B. Piping Installation

1. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
2. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."



3. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
4. Install underground copper tube and ductile-iron pipe in PE encasement according to ASTM A 674 or AWWA C105.
5. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Comply with requirements in Division 22 Section "Meters And Gages For Plumbing Piping" for pressure gages and Division 22 Section "Domestic Water Piping Specialties" for drain valves and strainers.
6. Install shutoff valve immediately upstream of each dielectric fitting.
7. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for pressure-reducing valves.
8. Install domestic water piping level with 0.25 percent slope downward toward drain **OR** without pitch, **as directed**, and plumb.
9. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
10. Install seismic restraints on piping. Comply with requirements in Division 22 Section "Vibration And Seismic Controls For Plumbing Piping And Equipment" for seismic-restraint devices.
11. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
12. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
13. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
14. Install piping adjacent to equipment and specialties to allow service and maintenance.
15. Install piping to permit valve servicing.
16. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.
17. Install piping free of sags and bends.
18. Install fittings for changes in direction and branch connections.
19. Install PEX piping with loop at each change of direction of more than 90 degrees.
20. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
21. Install pressure gages on suction and discharge piping from each plumbing pump and packaged booster pump. Comply with requirements in Division 22 Section "Meters And Gages For Plumbing Piping" for pressure gages.
22. Install thermostats in hot-water circulation piping. Comply with requirements in Division 22 Section "Domestic Water Pumps" for thermostats.
23. Install thermometers on inlet **OR** inlet and outlet, **as directed**, piping from each water heater. Comply with requirements in Division 22 Section "Meters And Gages For Plumbing Piping" for thermometers.

C. Joint Construction

1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
2. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
3. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - a. Apply appropriate tape or thread compound to external pipe threads.
 - b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
4. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Braze Joints" Chapter.



5. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
 6. Pressure-Sealed Joints: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.
 7. Copper-Tubing, Push-on Joints: Clean end of tube. Measure insertion depth with manufacturer's depth gage. Join copper tube and push-on-joint fittings by inserting tube to measured depth.
 8. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.
 9. Copper-Tubing Grooved Joints: Roll groove end of tube. Assemble coupling with housing, gasket, lubricant, and bolts. Join copper tube and grooved-end fittings according to AWWA C606 for roll-grooved joints.
 10. Ductile-Iron-Piping Grooved Joints: Cut groove end of pipe. Assemble coupling with housing, gasket, lubricant, and bolts. Join ductile-iron pipe and grooved-end fittings according to AWWA C606 for ductile-iron-pipe, cut-grooved joints.
 11. Steel-Piping Grooved Joints: Cut **OR** Roll, **as directed**, groove end of pipe. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
 12. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
 13. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
 - b. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - c. PVC Piping: Join according to ASTM D 2855.
 14. PEX Piping Joints: Join according to ASTM F 1807.
 15. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.
- D. Valve Installation
1. General-Duty Valves: Comply with requirements in Division 22 Section "General-duty Valves For Plumbing Piping" for valve installations.
 2. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 2 (DN 50) and smaller. Use butterfly or gate valves for piping NPS 2-1/2 (DN 65) and larger.
 3. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties".
 - a. Hose-End Drain Valves: At low points in water mains, risers, and branches.
 - b. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.
 4. Install balancing valve in each hot-water circulation return branch and discharge side of each pump and circulator. Set balancing valves partly open to restrict but not stop flow. Use ball valves for piping NPS 2 (DN 50) and smaller and butterfly valves for piping NPS 2-1/2 (DN 65) and larger. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves.
 5. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for calibrated balancing valves.
- E. Transition Fitting Installation
1. Install transition couplings at joints of dissimilar piping.
 2. Transition Fittings in Underground Domestic Water Piping:



- a. NPS 1-1/2 (DN 40) and Smaller: Fitting-type coupling.
 - b. NPS 2 (DN 50) and Larger: Sleeve-type coupling.
3. Transition Fittings in Aboveground Domestic Water Piping NPS 2 (DN 50) and Smaller: Plastic-to-metal transition fittings **OR** unions, **as directed**.
- F. Dielectric Fitting Installation
1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
 2. Dielectric Fittings for NPS 2 (DN 50) and Smaller: Use dielectric couplings **OR** nipples **OR** unions, **as directed**.
 3. Dielectric Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Use dielectric flanges **OR** flange kits **OR** nipples, **as directed**.
 4. Dielectric Fittings for NPS 5 (DN 125) and Larger: Use dielectric flange kits.
- G. Flexible Connector Installation
1. Install flexible connectors in suction and discharge piping connections to each domestic water pump and in suction and discharge manifold connections to each domestic water booster pump, **as directed**.
 2. Install bronze-hose flexible connectors in copper domestic water tubing.
 3. Install stainless-steel-hose flexible connectors in steel domestic water piping.
- H. Water Meter Installation
1. Rough-in domestic water piping for water meter installation, and install water meters, **as directed**, according to utility company's requirements.
 2. Water meters will be furnished and installed by utility company.
OR
Install water meters according to AWWA M6 and utility company's requirements.
 3. Install displacement-type water meters with shutoff valve on water-meter inlet. Install valve on water-meter outlet and valved bypass around meter unless prohibited by authorities having jurisdiction.
OR
Install turbine-type water meters with shutoff valve on water-meter inlet. Install valve on water-meter outlet and valved bypass around meter unless prohibited by authorities having jurisdiction.
OR
Install compound-type water meters with shutoff valves on water-meter inlet and outlet and on valved bypass around meter. Support meters, valves, and piping on brick or concrete piers.
OR
Install fire-service water meters with shutoff valves on water-meter inlet and outlet and on full-size valved bypass around meter. Support meter, valves, and piping on brick or concrete piers.
 4. Install remote registration system according to standards of utility company and of authorities having jurisdiction.
- I. Hanger And Support Installation
1. Comply with requirements in Division 22 Section "Vibration And Seismic Controls For Plumbing Piping And Equipment" for seismic-restraint devices.
 2. Comply with requirements in Division 22 Section "Hangers And Supports For Plumbing Piping And Equipment" for pipe hanger and support products and installation.
 - a. Vertical Piping: MSS Type 8 or 42, clamps.
 - b. Individual, Straight, Horizontal Piping Runs:
 - 1) 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
 - 2) Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
 - 3) Longer Than 100 Feet (30 m) If Indicated: MSS Type 49, spring cushion rolls.
 - c. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - d. Base of Vertical Piping: MSS Type 52, spring hangers.
 3. Support vertical piping and tubing at base and at each floor.



4. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch (10 mm).
5. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - a. NPS 3/4 (DN 20) and Smaller: 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
 - b. NPS 1 and NPS 1-1/4 (DN 25 and DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
 - c. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
 - d. NPS 2-1/2 (DN 65): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.
 - e. NPS 3 to NPS 5 (DN 80 to DN 125): 10 feet (3 m) with 1/2-inch (13-mm) rod.
 - f. NPS 6 (DN 150): 10 feet (3 m) with 5/8-inch (16-mm) rod.
 - g. NPS 8 (DN 200): 10 feet (3 m) with 3/4-inch (19-mm) rod.
6. Install supports for vertical copper tubing every 10 feet (3 m).
7. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
 - a. NPS 1-1/4 (DN 32) and Smaller: 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
 - b. NPS 1-1/2 (DN 40): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.
 - c. NPS 2 (DN 50): 10 feet (3 m) with 3/8-inch (10-mm) rod.
 - d. NPS 2-1/2 (DN 65): 11 feet (3.4 m) with 1/2-inch (13-mm) rod.
 - e. NPS 3 and NPS 3-1/2 (DN 80 and DN 90): 12 feet (3.7 m) with 1/2-inch (13-mm) rod.
 - f. NPS 4 and NPS 5 (DN 100 and DN 125): 12 feet (3.7 m) with 5/8-inch (16-mm) rod.
 - g. NPS 6 (DN 150): 12 feet (3.7 m) with 3/4-inch (19-mm) rod.
 - h. NPS 8 to NPS 12 (DN 200 to DN 300): 12 feet (3.7 m) with 7/8-inch (22-mm) rod.
8. Install supports for vertical steel piping every 15 feet (4.5 m).
9. Install vinyl-coated hangers for CPVC piping with the following maximum horizontal spacing and minimum rod diameters:
 - a. NPS 1 (DN 25) and Smaller: 36 inches (900 mm) with 3/8-inch (10-mm) rod.
 - b. NPS 1-1/4 to NPS 2 (DN 32 to DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
 - c. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
 - d. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.
 - e. NPS 6 (DN 150): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.
 - f. NPS 8 (DN 200): 48 inches (1200 mm) with 7/8-inch (22-mm) rod.
10. Install supports for vertical CPVC piping every 60 inches (1500 mm) for NPS 1 (DN 25) and smaller, and every 72 inches (1800 mm) for NPS 1-1/4 (DN 32) and larger.
11. Install vinyl-coated hangers for PEX piping with the following maximum horizontal spacing and minimum rod diameters:
 - a. NPS 1 (DN 25) and Smaller: 32 inches (815 mm) with 3/8-inch (10-mm) rod.
12. Install hangers for vertical PEX piping every 48 inches (1200 mm).
13. Install vinyl-coated hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
 - a. NPS 2 (DN 50) and Smaller: 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
 - b. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
 - c. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.
 - d. NPS 6 (DN 150): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.
 - e. NPS 8 (DN 200): 48 inches (1200 mm) with 7/8-inch (22-mm) rod.
14. Install supports for vertical PVC piping every 48 inches (1200 mm).
15. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

J. Connections

1. Drawings indicate general arrangement of piping, fittings, and specialties.
2. Install piping adjacent to equipment and machines to allow service and maintenance.



3. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
4. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
 - a. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
 - b. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
 - c. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 Section(s) "Plumbing Fixtures" OR "Healthcare Plumbing Fixtures" OR "Emergency Plumbing Fixtures" OR "Security Plumbing Fixtures", **as directed**, for connection sizes.
 - d. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 (DN 65) and larger.

K. Escutcheon Installation

1. Install escutcheons for penetrations of walls, ceilings, and floors.
2. Escutcheons for New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
 - b. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish **OR** stamped steel with set screw **OR** stamped steel with set screw or spring clips **OR** stamped steel with spring clips, **as directed**.
 - c. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish **OR** One piece or split casting, cast brass with polished chrome-plated finish **OR** Split casting, cast brass with polished chrome-plated finish **OR** One piece, stamped steel with set screw **OR** One piece or split plate, stamped steel with set screw **OR** Split plate, stamped steel with set screw, **as directed**.
 - d. Bare Piping in Unfinished Service Spaces: One piece, cast brass with polished chrome-plated finish **OR** cast brass with rough-brass finish **OR** stamped steel with set screw **OR** stamped steel with spring clips **OR** stamped steel with set screw or spring clips, **as directed**.
 - e. Bare Piping in Equipment Rooms: One piece, cast brass **OR** stamped steel with set screw **OR** stamped steel with spring clips **OR** stamped steel with set screw or spring clips, **as directed**.
 - f. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece floor plate.
3. Escutcheons for Existing Piping:
 - a. Chrome-Plated Piping: Split casting, cast brass with chrome-plated finish.
 - b. Insulated Piping: Split plate, stamped steel with concealed **OR** exposed-rivet, **as directed**, hinge and spring clips.
 - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split casting, cast brass with chrome-plated finish **OR** plate, stamped steel with concealed hinge and spring clips, **as directed**.
 - d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split casting, cast brass with chrome-plated finish **OR** plate, stamped steel with concealed hinge and set screw, **as directed**.
 - e. Bare Piping in Unfinished Service Spaces: Split casting, cast brass with polished chrome-plated finish **OR** casting, cast brass with rough-brass finish **OR** plate, stamped steel with concealed hinge and set screw or spring clips **OR** plate, stamped steel with concealed or exposed-rivet hinge and set screw or spring clips **OR** plate, stamped steel with exposed-rivet hinge and set screw or spring clips, **as directed**.
 - f. Bare Piping in Equipment Rooms: Split casting, cast brass **OR** plate, stamped steel with set screw or spring clips, **as directed**.
 - g. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting floor plate.

L. Sleeve Installation



1. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, roofs, and walls.
2. Sleeves are not required for core-drilled holes.
3. Permanent sleeves are not required for holes formed by removable PE sleeves.
4. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.
5. Install sleeves in new partitions, slabs, and walls as they are built.
6. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants" for joint sealants.
7. For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants" for joint sealants.
8. For exterior wall penetrations below grade, seal annular space between sleeve and pipe using sleeve seals **OR** wall penetration systems, **as directed**, specified in this Section.
9. Seal space outside of sleeves in concrete slabs and walls with grout.
10. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation unless otherwise indicated.
11. Install sleeve materials according to the following applications:
 - a. Sleeves for Piping Passing through Concrete Floor Slabs: Molded PE **OR** Molded PVC **OR** Steel pipe, **as directed**.
 - b. Sleeves for Piping Passing through Concrete Floor Slabs of Mechanical Equipment Areas or Other Wet Areas: Steel pipe **OR** Stack sleeve fittings, **as directed**.
 - 1) Extend sleeves 2 inches (50 mm) above finished floor level.
 - 2) For pipes penetrating floors with membrane waterproofing, extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Comply with requirements in Division 07 Section "Sheet Metal Flashing And Trim" for flashing.
 - c. Sleeves for Piping Passing through Gypsum-Board Partitions:
 - 1) PVC pipe **OR** Steel pipe, **as directed**, sleeves for pipes smaller than NPS 6 (DN 150).
 - 2) Galvanized-steel sheet sleeves for pipes NPS 6 (DN 150) and larger.
 - 3) Exception: Sleeves are not required for water supply tubes and waste pipes for individual plumbing fixtures if escutcheons will cover openings.
 - d. Sleeves for Piping Passing through Concrete Roof Slabs: Molded PE **OR** Molded PVC **OR** Steel pipe, **as directed**.
 - e. Sleeves for Piping Passing through Exterior Concrete Walls:
 - 1) Steel pipe sleeves for pipes smaller than NPS 6 (DN 150).
 - 2) Cast-iron wall pipe sleeves for pipes NPS 6 (DN 150) and larger.
 - 3) Install sleeves that are large enough to provide 1-inch (25-mm) annular clear space between sleeve and pipe or pipe insulation when sleeve seals are used.
 - 4) Do not use sleeves when wall penetration systems are used.
 - f. Sleeves for Piping Passing through Interior Concrete Walls:
 - 1) PVC pipe **OR** Steel pipe, **as directed**, sleeves for pipes smaller than NPS 6 (DN 150).
 - 2) Galvanized-steel sheet sleeves for pipes NPS 6 (DN 150) and larger.
12. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestop materials and installations.

M. Sleeve Seal Installation

1. Install sleeve seals in sleeves in exterior concrete walls at water-service piping entries into building.
2. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe



and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

N. Wall Penetration System Installation

1. Install wall penetration systems in new, exterior concrete walls.
2. Assemble wall penetration system components with sleeve pipe. Install so that end of sleeve pipe and face of housing are flush with wall. Adjust locking devices to secure sleeve pipe in housing.

O. Identification

1. Identify system components. Comply with requirements in Division 22 Section "Identification For Plumbing Piping And Equipment" for identification materials and installation.
2. Label pressure piping with system operating pressure.

P. Field Quality Control

1. Perform tests and inspections.
2. Piping Inspections:
 - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - 2) Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
 - c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
 - d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
3. Piping Tests:
 - a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
 - b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
 - c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - d. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 - e. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
 - f. Prepare reports for tests and for corrective action required.
4. Domestic water piping will be considered defective if it does not pass tests and inspections.
5. Prepare test and inspection reports.

Q. Adjusting

1. Perform the following adjustments before operation:
 - a. Close drain valves, hydrants, and hose bibbs.
 - b. Open shutoff valves to fully open position.
 - c. Open throttling valves to proper setting.
 - d. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.



- 1) Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
- 2) Adjust calibrated balancing valves to flows indicated.
- e. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
- f. Remove and clean strainer screens. Close drain valves and replace drain plugs.
- g. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
- h. Check plumbing specialties and verify proper settings, adjustments, and operation.

R. Cleaning

1. Clean and disinfect potable and non-potable, **as directed**, domestic water piping as follows:
 - a. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 - b. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - 1) Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - 2) Fill and isolate system according to either of the following:
 - a) Fill system or part thereof with water/chlorine solution with at least 50 ppm (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours.
 - b) Fill system or part thereof with water/chlorine solution with at least 200 ppm (200 mg/L) of chlorine. Isolate and allow to stand for three hours.
 - 3) Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - 4) Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
2. Clean non-potable domestic water piping as follows:
 - a. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 - b. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:
 - 1) Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - 2) Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
3. Prepare and submit reports of purging and disinfecting activities.
4. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

S. Piping Schedule

1. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
2. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
3. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
4. Under-building-slab, domestic water, building service piping, NPS 3 (DN 80) and smaller, shall be one of the following:
 - a. Soft copper tube, ASTM B 88, Type K (ASTM B 88M, Type A) **OR** ASTM B 88, Type L (ASTM B 88M, Type B), **as directed**; wrought-copper solder-joint fittings; and brazed **OR** copper pressure-seal fittings; and pressure-sealed, **as directed**, joints.
 - b. PVC, Schedule 40 pipe; PVC, Schedule 40 **OR** Schedule 80 pipe; PVC, Schedule 80, **as directed**, socket fittings; and solvent-cemented joints.
5. Under-building-slab, domestic water, building-service piping, NPS 4 to NPS 8 (DN 100 to DN 200) and larger, shall be one of the following:



- a. Soft copper tube, ASTM B 88, Type K (ASTM B 88M, Type A) **OR** ASTM B 88, Type L (ASTM B 88M, Type B), **as directed**; wrought-copper solder-joint fittings; and brazed joints.
 - b. Mechanical-joint, ductile-iron pipe; standard-pattern **OR** compact-pattern, **as directed**, mechanical-joint fittings; and mechanical joints.
 - c. Push-on-joint, ductile-iron pipe; standard-pattern **OR** compact-pattern, **as directed**, push-on-joint fittings; and gasketed joints.
 - d. Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.
 - e. PVC, Schedule 40 pipe; PVC, Schedule 40 **OR** Schedule 80 pipe; PVC, Schedule 80, **as directed**, socket fittings; and solvent-cemented joints.
6. Under-building slab, combined domestic water, building-service, and fire-service-main piping, NPS 6 to NPS 12 (DN 150 to DN 300), shall be one of the following:
- a. Mechanical-joint, ductile-iron pipe; standard-pattern **OR** compact-pattern, **as directed**, mechanical-joint fittings; and mechanical joints.
 - b. Push-on-joint, ductile-iron pipe; standard-pattern **OR** compact-pattern, **as directed**, push-on-joint fittings; and gasketed joints.
 - c. Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.
7. Under-building-slab, domestic water piping, NPS 2 (DN 50) and smaller, shall be one of the following:
- a. Hard **OR** Soft, **as directed**, copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); wrought-copper solder-joint fittings; and brazed **OR** copper pressure-seal-joint fittings; and pressure-sealed, **as directed**, joints.
 - b. PVC, Schedule 40 pipe; PVC, Schedule 40 **OR** Schedule 80 pipe; PVC, Schedule 80, **as directed**, socket fittings; and solvent-cemented joints.
8. Aboveground domestic water piping, NPS 2 (DN 50) and smaller, shall be one of the following:
- a. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.
 - b. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B), **as directed**; cast-copper **OR** wrought-copper, **as directed**, solder-joint fittings; and brazed **OR** soldered, **as directed**, joints.
 - c. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B), **as directed**; copper pressure-seal-joint fittings; and pressure-sealed joints.
 - d. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B) **OR**, **as directed**; copper push-on-joint fittings; and push-on joints.
 - e. CPVC, Schedule 40 pipe; CPVC, Schedule 40 **OR** Schedule 80 pipe; CPVC, Schedule 80, **as directed**, socket fittings; and solvent-cemented joints.
 - f. CPVC, Schedule 80 pipe; CPVC, Schedule 80 threaded fittings; and threaded joints.
 - g. CPVC Tubing System: CPVC tube; CPVC socket fittings; and solvent-cemented joints. NPS 1-1/2 (DN 40) and NPS 2 (DN 50) CPVC pipe with CPVC socket fittings may be used instead of tubing.
 - h. PEX Tube, NPS 1 (DN 25) and smaller; fittings for PEX tube; and crimped joints.
 - i. PVC, Schedule 40 pipe; PVC, Schedule 40 **OR** Schedule 80 pipe; PVC, Schedule 80, **as directed**, socket fittings; and solvent-cemented joints.
9. Aboveground domestic water piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100), shall be one of the following:
- a. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B), **as directed**; cast-copper **OR** wrought-copper, **as directed**, solder-joint fittings; and brazed **OR** soldered, **as directed**, joints.
 - b. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B), **as directed**; copper pressure-seal-joint fittings; and pressure-sealed joints.
 - c. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B), **as directed**; grooved-joint copper-tube appurtenances; and grooved joints.



- d. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.
 - e. Galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.
 - f. CPVC, Schedule 40 pipe; CPVC, Schedule 40 **OR** Schedule 80 pipe; CPVC, Schedule 80, **as directed**, socket fittings; and solvent-cemented joints.
 - g. CPVC, Schedule 80 pipe; CPVC, Schedule 80 threaded fittings; and threaded joints.
 - h. PVC, Schedule 40 pipe; PVC, Schedule 40 **OR** Schedule 80 pipe; PVC, Schedule 80, **as directed**, socket fittings; and solvent-cemented joints.
10. Aboveground domestic water piping, NPS 5 to NPS 8 (DN 125 to DN 200), shall be one of the following:
- a. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B), **as directed**; cast-copper **OR** wrought-copper, **as directed**, solder-joint fittings; and brazed **OR** soldered, **as directed**, joints.
 - b. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B), **as directed**; grooved-joint copper-tube appurtenances; and grooved joints.
 - c. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.
 - d. Galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.
 - e. CPVC, Schedule 40 pipe; CPVC, Schedule 40 **OR** Schedule 80 pipe; CPVC, Schedule 80, **as directed**, socket fittings; and solvent-cemented joints.
 - f. CPVC, Schedule 80 pipe; CPVC, Schedule 80 threaded fittings; and threaded joints.
 - g. PVC, Schedule 40 pipe; PVC, Schedule 40 **OR** Schedule 80 pipe; PVC, Schedule 80, **as directed**, socket fittings; and solvent-cemented joints.
11. Aboveground, combined domestic-water-service and fire-service-main piping, NPS 6 to NPS 12 (DN 150 to DN300), shall be one of the following:
- a. Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.
 - b. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.
 - c. Galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.
- T. Valve Schedule
1. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - a. Shutoff Duty: Use ball or gate valves for piping NPS 2 (DN 50) and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
 - b. Throttling Duty: Use ball or globe valves for piping NPS 2 (DN 50) and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
 - c. Hot-Water Circulation Piping, Balancing Duty: Calibrated **OR** Memory-stop, **as directed**, balancing valves.
 - d. Drain Duty: Hose-end drain valves.
 2. Use check valves to maintain correct direction of domestic water flow to and from equipment.
 3. Iron grooved-end valves may be used with grooved-end piping.
 4. CPVC and PVC valves matching piping materials may be used.

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SECTION 22 11 16 00a - SANITARY WASTE AND VENT PIPING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for sanitary waste and vent piping. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes:
 - a. Pipe, tube, and fittings.
 - b. Special pipe fittings.
 - c. Encasement for underground metal piping.

C. Performance Requirements

1. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:
 - a. Soil, Waste, and Vent Piping: 10-foot head of water (30 kPa).
 - b. Sanitary Sewer, Force-Main Piping: 50 psig (345 kPa) **OR** 100 psig (690 kPa) **OR** 150 psig (1035 kPa), **as directed**.
2. Seismic Performance: Soil, waste, and vent piping and support and installation shall be capable of withstanding the effects of earthquake motions determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures."

D. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittal:
 - a. Product Data for Credit EQ 4.1: For solvent cements and adhesive primers, including printed statement of VOC content.
3. Shop Drawings: For solvent Drainage System: Include plans, elevations, sections, and details.
4. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.
5. Field quality-control inspection and test reports.

E. Quality Assurance

1. Piping materials shall bear label, stamp, or other markings of specified testing agency.
2. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

F. Project Conditions

1. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - a. Notify the Owner no fewer than two days in advance of proposed interruption of sanitary waste service.



- b. Do not proceed with interruption of sanitary waste service without the Owner written permission.

1.2 PRODUCTS

A. Piping Materials

1. Comply with requirements in "Piping Applications" Article for applications of pipe, tube, fitting, and joining methods for specific services, service locations, and pipe sizes.

B. Hub-And-Spigot, Cast-Iron Soil Pipe And Fittings

1. Pipe and Fittings: ASTM A 74, Service and Extra-Heavy class(es).
2. Gaskets: ASTM C 564, rubber.
3. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

C. Hubless, Cast-Iron Soil Pipe And Fittings

1. Pipe and Fittings: ASTM A 888 or CISPI 301.
2. Sovent Stack Fittings: ASME B16.45 or ASSE 1043, hubless, cast-iron aerator and deaerator drainage fittings.
3. CISPI, Hubless-Piping Couplings:
 - a. Standards: ASTM C 1277 and CISPI 310
 - b. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
4. Heavy-Duty, Hubless-Piping Couplings:
 - a. Standards: ASTM C 1277 and ASTM C 1540.
 - b. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
5. Cast-Iron, Hubless-Piping Couplings:
 - a. Standard: ASTM C 1277.
 - b. Description: Two-piece ASTM A 48/A 48M, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve with integral, center pipe stop.

D. Galvanized-Steel Pipe And Fittings

1. Galvanized Steel Pipe: ASTM A 53/A 53M, Type E, Standard Weight. Include ends matching joining method.
2. Galvanized-Cast-Iron Drainage Fittings: ASME B16.12, galvanized.
3. Steel Pipe Pressure Fittings:
 - a. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized, seamless steel pipe. Include ends matching joining method.
 - b. Malleable-Iron Unions: ASME B16.39; Class 150; hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface; and female threaded ends.
 - c. Galvanized-Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, galvanized, **as directed**, standard pattern.
4. Cast-Iron Flanges: ASME B16.1, Class 125.
 - a. Flange Gasket Materials: ASME ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
 - b. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
5. Grooved-Joint Systems:
 - a. Galvanized, Grooved-End Fittings for Galvanized-Steel Piping: ASTM A 536 ductile-iron castings, ASTM A 47/A 47M malleable-iron castings, ASTM A 234/A 234M forged steel fittings, or ASTM A 106/A 106M steel pipes with dimensions matching ASTM A 53/A 53M steel pipe, and complying with AWWA C606 for grooved ends.
 - b. Grooved Mechanical Couplings for Galvanized-Steel Piping: ASTM F 1476, Type I. Include ferrous housing sections with continuous curved keys; EPDM-rubber gasket suitable for hot and cold water; and bolts and nuts.



- E. Stainless-Steel Pipe And Fittings
1. Pipe and Fittings: ASME A112.3.1, drainage pattern with socket and spigot ends.
 2. Internal Sealing Rings: Elastomeric gasket shaped to fit socket groove.
 - a. Material: EPDM, unless NBR is indicated.
- F. Ductile-Iron Pipe And Fittings
1. Ductile-Iron, Mechanical-Joint Piping:
 - a. Ductile-Iron Pipe: AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
 - b. Ductile-Iron Fittings: AWWA C110/A21.10, mechanical-joint, ductile- or gray-iron standard pattern or AWWA C153/A21.53, ductile-iron compact pattern.
 - c. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
 2. Ductile-Iron, Push-on-Joint Piping:
 - a. Ductile-Iron Pipe: AWWA C151/A21.51, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.
 - b. Ductile-Iron Fittings: AWWA C110/A21.10, push-on-joint ductile- or gray-iron standard pattern or AWWA C153/A21.53, ductile-iron compact pattern.
 - c. Gaskets: AWWA C111/A21.11, rubber.
 3. Ductile-Iron, Grooved-Joint Piping:
 - a. Ductile-Iron Pipe: AWWA C151/A21.51 with round-cut-grooved ends according to AWWA C606.
 - b. Ductile-Iron-Pipe Appurtenances:
 - 1) Grooved-End, Ductile-Iron Fittings: ASTM A 536 ductile-iron castings with dimensions matching AWWA C110/A 21.10 ductile-iron pipe or AWWA C153/A 21.53 ductile-iron fittings and complying with AWWA C606 for grooved ends.
 - 2) Grooved Mechanical Couplings for Ductile-Iron Pipe: ASTM F 1476, Type I. Include ferrous housing sections with continuous curved keys; EPDM-rubber center-leg gasket suitable for hot and cold water; and bolts and nuts.
- G. Copper Tube And Fittings
1. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
 2. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.
 3. Hard Copper Tube: ASTM B 88, Types L and M (ASTM B 88M, Types B and C), water tube, drawn temper.
 4. Soft Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B), water tube, annealed temper.
 5. Copper Pressure Fittings:
 - a. ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 - b. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to metal seating surfaces, and solder-joint or threaded ends
 6. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
 - a. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
 - b. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
 7. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux
- H. ABS Pipe And Fittings
1. Solid-Wall ABS Pipe: ASTM D 2661, Schedule 40.
 2. Cellular-Core ABS Pipe: ASTM F 628, Schedule 40.
 3. ABS Socket Fittings: ASTM D 2661, made to ASTM D 3311, drain, waste, and vent patterns.
 4. Solvent Cement ASTM D 2235:
 - a. Use ABS solvent cement that has a VOC content of 325 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).



- I. PVC Pipe And Fittings
1. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
 2. Cellular-Core PVC Pipe: ASTM F 891, Schedule 40.
 3. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
 4. Adhesive Primer: ASTM F 656.
 - a. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 5. Solvent Cement: ASTM D 2564.
 - a. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- J. Specialty Pipe Fittings
1. Transition Couplings:
 - a. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
 - b. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
 - c. Unshielded, Nonpressure Transition Couplings:
 - 1) Standard: ASTM C 1173.
 - 2) Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - 3) Sleeve Materials:
 - a) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
 - b) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - c) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
 - d. Shielded Nonpressure Transition Couplings:
 - 1) ASTM C 1460.
 - 2) Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - e. Pressure Transition Pipe Couplings:
 - 1) AWWA C219.
 - 2) Description: Metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
 - 3) Center-Sleeve Material: Manufacturer's standard **OR** Carbon steel **OR** Stainless steel **OR** Ductile iron **OR** Malleable iron, **as directed**.
 - 4) Gasket Material: Natural or synthetic rubber.
 - 5) Metal Component Finish: Corrosion-resistant coating or material.
 2. Dielectric Fittings:
 - a. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
 - b. Dielectric Unions:
 - 1) Description:
 - a) Standard: ASSE 1079.
 - b) Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C) **OR** 150 psig (1035 kPa) **OR** 250 psig (1725 kPa), **as directed**.
 - c) End Connections: Solder-joint copper alloy and threaded ferrous.
 - c. Dielectric Flanges:
 - 1) Description:
 - a) Standard: ASSE 1079.



- b) Factory-fabricated, bolted, companion-flange assembly.
- c) Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C) **OR** 150 psig (1035 kPa) **OR** 175 psig (1200 kPa) **OR** 300 psig (2070 kPa), **as directed**.
- d) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- d. Dielectric-Flange Insulating Kits:
 - 1) Description:
 - a) Nonconducting materials for field assembly of companion flanges.
 - b) Pressure Rating: 150 psig (1035 kPa).
 - c) Gasket: Neoprene or phenolic.
 - d) Bolt Sleeves: Phenolic or polyethylene.
 - e) Washers: Phenolic with steel backing washers.
- e. Dielectric Nipples
 - 1) Description:
 - a) Electroplated steel nipple complying with ASTM F 1545.
 - b) Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C).
 - c) End Connections: Male threaded or grooved.
 - d) Lining: Inert and noncorrosive, propylene.

K. Encasement For Underground Metal Piping

- 1. Standard: ASTM A 674 or AWWA C105/A 21.5
- 2. Material: Linear low-density polyethylene film of 0.008-inch (0.20-mm) **OR** high density, cross-laminated polyethylene film of 0.004-inch (0.10-mm), **as directed**, minimum thickness.
- 3. Form: Sheet **OR** Tube, **as directed**.
- 4. Color: Black **OR** Natural, **as directed**.

1.3 EXECUTION

A. Earth Moving

- 1. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

B. Piping Installation

- 1. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- 2. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- 3. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- 4. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- 5. Install piping to permit valve servicing.
- 6. Install piping at indicated slopes.
- 7. Install piping free of sags and bends.
- 8. Install fittings for changes in direction and branch connections.
- 9. Install piping to allow application of insulation.
- 10. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Division 22 Section "Vibration And Seismic Controls For Plumbing Piping And Equipment".
- 11. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with



- common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
12. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
 13. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:
 - a. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 (DN 80) and smaller; 1 percent **OR** 2 percent, as directed downward in direction of flow for piping NPS 4 (DN 100) and larger.
 - b. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
 - c. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
 14. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 - a. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.
 15. Install steel piping according to applicable plumbing code.
 16. Install stainless-steel piping according to ASME A112.3.1 and applicable plumbing code.
 17. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."
 18. Install aboveground ABS piping according to ASTM D 2661.
 19. Install aboveground PVC piping according to ASTM D 2665.
 20. Install underground ABS and PVC piping according to ASTM D 2321.
 21. Install engineered soil and waste drainage and vent piping systems as follows:
 - a. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
 - b. Solvent Drainage System: Comply with ASSE 1043 and solvent fitting manufacturer's written installation instructions.
 - c. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.
 22. Install underground, ductile-iron, force-main piping according to AWWA C600. Install buried piping inside building between wall and floor penetrations and connection to sanitary sewer piping outside building with restrained joints. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.
 - a. Install encasement on piping according to ASTM A 674 or AWWA C105/A 21.5.
 23. Install underground, copper, force-main tubing according to CDA's "Copper Tube Handbook."
 - a. Install encasement on piping according to ASTM A 674 or AWWA C105/A 21.5.
 24. Install force mains at elevations indicated.
 25. Plumbing Specialties:
 - a. Install backwater valves in sanitary waste gravity-flow piping. Comply with requirements for backwater valves specified in Division 22 Section "Sanitary Waste Piping Specialties".
 - b. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping. Comply with requirements for cleanouts specified in Division 22 Section "Sanitary Waste Piping Specialties".
 - c. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Division 22 Section "Sanitary Waste Piping Specialties".
 26. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
 27. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Common Work Results For Plumbing".
 28. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Common Work Results For Plumbing".



29. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Common Work Results For Plumbing".

C. Joint Construction

1. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
2. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum calked joints.
3. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
4. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
5. Join stainless-steel pipe and fittings with gaskets according to ASME A112.3.1.
6. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.
7. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.
8. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.
9. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - b. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
 - c. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

D. Specialty Pipe Fitting Installation

1. Transition Couplings:
 - a. Install transition couplings at joints of piping with small differences in OD's.
 - b. In Drainage Piping: Unshielded **OR** Shielded, **as directed**, nonpressure transition couplings.
 - c. In Aboveground Force Main Piping: Fitting-type transition couplings.
 - d. In Underground Force Main Piping:
 - 1) NPS 1-1/2 (DN 40) and Smaller: Fitting-type transition couplings.
 - 2) NPS 2 (DN 50) and Larger: Pressure transition couplings.
2. Dielectric Fittings:
 - a. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
 - b. Dielectric Fittings for NPS 2 (DN 50) and Smaller: Use dielectric nipples **OR** unions, **as directed**.
 - c. Dielectric Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Use dielectric flanges **OR** flange kits **OR** nipples, **as directed**.
 - d. Dielectric Fittings for NPS 5 (DN 125) and Larger: Use dielectric flange kits.

E. Valve Installation

1. General valve installation requirements are specified in Division 22 Section "General-duty Valves For Plumbing Piping".
2. Shutoff Valves:
 - a. Install shutoff valve on each sewage pump discharge.



- b. Install gate or full-port ball valve for piping NPS 2 (DN 50) and smaller.
- c. Install gate valve for piping NPS 2-1/2 (DN 65) and larger.
- 3. Check Valves: Install swing check valve, between pump and shutoff valve, on each sewage pump discharge.
- 4. Backwater Valves: Install backwater valves in piping subject to sewage backflow.
 - a. Horizontal Piping: Horizontal backwater valves. Use normally closed type, unless otherwise indicated.
 - b. Floor Drains: Drain outlet backwater valves, unless drain has integral backwater valve.
 - c. Install backwater valves in accessible locations.
 - d. Backwater valve are specified in Division 22 Section "Sanitary Waste Piping Specialties".

F. Hanger And Support Installation

- 1. Comply with requirements for seismic-restraint devices specified in Division 22 Section "Vibration And Seismic Controls For Plumbing Piping And Equipment".
- 2. Comply with requirements for pipe hanger and support devices and installation specified in Division 22 Section "Hangers And Supports For Plumbing Piping And Equipment".
 - a. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
 - b. Install stainless-steel **OR** fiberglass pipe hangers, **as directed** for horizontal piping in corrosive environments.
 - c. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
 - d. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
 - e. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - f. Install individual, straight, horizontal piping runs according to the following:
 - 1) 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
 - 2) Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
 - 3) Longer Than 100 Feet (30 m), if Indicated: MSS Type 49, spring cushion rolls.
 - g. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - h. Base of Vertical Piping: MSS Type 52, spring hangers.
- 3. Support horizontal piping and tubing within 12 inches (300 mm) of each fitting[, **valve,**] and coupling.
- 4. Support vertical piping and tubing at base and at each floor.
- 5. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.
- 6. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
 - a. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
 - b. NPS 3 (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.
 - c. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1500 mm) with 5/8-inch (16-mm) rod.
 - d. NPS 6 (DN 150): 60 inches (1500 mm) with 3/4-inch (19-mm) rod.
 - e. NPS 8 to NPS 12 (DN 200 to DN 300): 60 inches (1500 mm) with 7/8-inch (22-mm) rod.
 - f. Spacing for 10-foot (3-m) lengths may be increased to 10 feet (3 m). Spacing for fittings is limited to 60 inches (1500 mm).
- 7. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).
- 8. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
 - a. NPS 1-1/4 (DN 32): 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
 - b. NPS 1-1/2 (DN 40): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.
 - c. NPS 2 (DN 50): 10 feet (3 m) with 3/8-inch (10-mm) rod.
 - d. NPS 2-1/2 (DN 65): 11 feet (3.4 m) with 1/2-inch (13-mm) rod.
 - e. NPS 3 (DN 80): 12 feet (3.7 m) with 1/2-inch (13-mm) rod.
 - f. NPS 4 and NPS 5 (DN 100 and DN 125): 12 feet (3.7 m) with 5/8-inch (16-mm) rod.
 - g. NPS 6 and NPS 8 (DN 150 and DN 200): 12 feet (3.7 m) with 3/4-inch (19-mm) rod.
 - h. NPS 10 to NPS 12 (DN 250 to DN 300): 12 feet (3.7 m) with 7/8-inch (22-mm) rod.



9. Install supports for vertical steel piping every 15 feet (4.5 m).
10. Install hangers for stainless-steel piping with the following maximum horizontal spacing and minimum rod diameters:
 - a. NPS 2 (DN 50): 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
 - b. NPS 3 (DN 80): 96 inches (2400 mm) with 1/2-inch (13-mm) rod.
 - c. NPS 4 (DN 100): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.
 - d. NPS 6 (DN 150): 10 feet (3 m) with 5/8-inch (16-mm) rod.
11. Install supports for vertical stainless-steel piping every 10 feet (3 m).
12. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - a. NPS 1-1/4 (DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
 - b. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
 - c. NPS 2-1/2 (DN 65): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.
 - d. NPS 3 to NPS 5 (DN 80 to DN 125): 10 feet (3 m) with 1/2-inch (13-mm) rod.
 - e. NPS 6 (DN 150): 10 feet (3 m) with 5/8-inch (16-mm) rod.
 - f. NPS 8 (DN 200): 10 feet (3 m) with 3/4-inch (19-mm) rod.
13. Install supports for vertical copper tubing every 10 feet (3 m).
14. Install hangers for ABS and PVC piping with the following maximum horizontal spacing and minimum rod diameters:
 - a. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
 - b. NPS 3 (DN 80): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
 - c. NPS 4 and 5 (DN 100 and 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.
 - d. NPS 6 and NPS 8 (DN 150 and DN 200): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.
 - e. NPS 10 to NPS 12 (DN 250 to DN 300): 48 inches (1200 mm) with 7/8-inch (22-mm) rod.
15. Install supports for vertical ABS and PVC piping every 48 inches (1200 mm).
16. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

G. Connections

1. Drawings indicate general arrangement of piping, fittings, and specialties.
2. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
3. Connect drainage and vent piping to the following:
 - a. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
 - b. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 - c. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
 - d. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
 - e. Install horizontal backwater valves with cleanout cover flush with floor **OR** in pit with pit cover flush with floor, **as directed**.
 - f. Comply with requirements for backwater valves, cleanouts and drains specified in Division 22 Section "Facility Storm Drainage Piping".
 - g. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 (DN 65) and larger.
4. Connect force-main piping to the following:
 - a. Sanitary Sewer: To exterior force main or sanitary manhole.
 - b. Sewage Pumps: To sewage pump discharge.
5. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
6. Make connections according to the following unless otherwise indicated:



- a. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
- b. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.

H. Identification

1. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Division 22 Section "Identification For Plumbing Piping And Equipment".

I. Field Quality Control

1. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - b. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
2. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
3. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
4. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - a. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 - b. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - c. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa). From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
 - d. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg (250 Pa). Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
 - e. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 - f. Prepare reports for tests and required corrective action.
5. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - a. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - b. Cap and subject piping to static-water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 - c. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 - d. Prepare reports for tests and required corrective action.



J. Cleaning and Protection

1. Clean interior of piping. Remove dirt and debris as work progresses.
2. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
3. Place plugs in ends of uncompleted piping at end of day and when work stops.
4. Exposed ABS and PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

END OF SECTION 22 11 16 00a



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SECTION 22 11 16 00b - STORM DRAINAGE PIPING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for storm drainage piping. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes:
 - a. Pipe, tube, and fittings.
 - b. Special pipe fittings.
 - c. Encasement for underground metal piping.

C. Performance Requirements

1. Components and installation shall be capable of withstanding the following minimum working-pressure, unless otherwise indicated:
 - a. Storm Drainage Piping: 10-foot head of water (30 kPa).
 - b. Storm Drainage, Force-Main Piping: 50 psig (345 kPa) **OR** 100 psig (690 kPa) **OR** 150 psig (1035 kPa), **as directed**.
2. Seismic Performance: Soil, waste, and vent piping and support and installation shall be capable of withstanding the effects of seismic events determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures."

D. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittal:
 - a. Product Data for Credit EQ 4.1: For solvent cements and adhesive primers, including printed statement of VOC content.
3. Shop Drawings: For controlled-flow **OR** siphonic roof drainage system, as directed by the Owner. Include calculations, plans, and details. Controlled-Flow Storm Drainage System: Include calculations, plans, and details.
4. Seismic Qualification Certificates: For storm drainage piping, accessories, and components, from manufacturer.
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
5. Field quality-control inspection and test reports.

E. Quality Assurance

1. Piping materials shall bear label, stamp, or other markings of specified testing agency.
2. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic drain piping and "NSF-sewer" for plastic sewer piping.

F. Project Conditions

1. Interruption of Existing Storm-Drainage Service: Do not interrupt service to facilities occupied by the Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - a. Notify the Owner no fewer than two days in advance of proposed interruption of storm-drainage service.



- b. Do not proceed with interruption of storm-drainage service without the Owner's written permission.

1.2 PRODUCTS

A. Piping Materials

1. Refer to Part 1.3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining methods for specific services, service locations, and pipe sizes.

B. Hub-And-Spigot, Cast-Iron Soil Pipe And Fittings

1. Pipe and Fittings: ASTM A 74, Service and Extra-Heavy class(es).
2. Gaskets: ASTM C 564, rubber.
3. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

C. Hubless Cast-Iron Soil Pipe And Fittings

1. Pipe and Fittings: ASTM A 888 or CISPI 301.
2. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
 - a. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.
 - b. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.
 - c. Heavy-Duty, Shielded, Cast-Iron Couplings: ASTM A 48/A 48M, two-piece, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve.
3. Rigid, Unshielded Couplings: ASTM C 1461, sleeve-type, reducing- or transition-type mechanical coupling molded from ASTM C 1440, TPE material with corrosion-resistant-metal tension band and tightening mechanism on each end.

D. Galvanized-Steel Pipe And Fittings

1. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade A or B, Standard Weight or Schedule 40, galvanized. Include ends matching joining method.
2. Drainage Fittings: ASME B16.12, galvanized, **as directed**, threaded, cast-iron drainage pattern.
3. Pressure Fittings:
 - a. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized, seamless steel pipe. Include ends matching joining method.
 - b. Malleable-Iron Unions: ASME B16.39; Class 150; hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface; and female threaded ends.
 - c. Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, galvanized, **as directed**, standard pattern.
 - d. Cast-Iron Flanges: ASME B16.1, Class 125.
 - e. Cast-Iron Flanged Fittings: ASME B16.1, Class 125, galvanized, **as directed**.
4. Grooved-Joint Systems:
 - a. Grooved-End, Steel-Piping Fittings: ASTM A 47/A 47M, galvanized, **as directed**, malleable-iron casting; ASTM A 106, galvanized-steel pipe; or ASTM A 536, galvanized, **as directed**, ductile-iron casting; with dimensions matching steel pipe.
 - b. Grooved-End, Steel-Piping Couplings: AWWA C606, for steel-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.

E. Ductile-Iron, Pipe and Fittings

1. Ductile-Iron, Mechanical-Joint Piping
 - a. Ductile-Iron Pipe: AWWA C151/A21.51, with mechanical-joint bell and plain spigot end, unless grooved or flanged ends are indicated.
 - b. Ductile-Iron Fittings: AWWA C110/A21.10, mechanical-joint ductile- or gray-iron standard pattern or AWWA C153/A21.53, ductile-iron compact pattern.



- c. Glands, Gaskets, and Bolts: AWWA C111/A121.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
 2. Ductile-Iron, Push-on-Joint,
 - a. Ductile-Iron Pipe: AWWA C151/A21.51, with push-on-joint bell and plain spigot end, unless grooved or flanged ends are indicated.
 - b. Ductile-Iron Fittings: AWWA C110/A21.10, ductile- or gray-iron standard pattern or AWWA C153/A21.53, ductile-iron compact pattern.
 - c. Gaskets: AWWA C111/A21.11, rubber.
 3. Ductile Iron, Grooved-Joint Piping:
 - a. Ductile-Iron Pipe: AWWA C151/A21.51 with round-cut-grooved ends according to AWWA C606.
 - b. Ductile-Iron-Pipe Appurtenances:
 - 1) Grooved-End, Ductile-Iron Fittings: ASTM A 536, ductile-iron castings with dimensions matching pipe. AWWA C110/A21.10 ductile-iron pipe or AWWA C153/A21.53 ductile-iron fittings and complying with AWWA C606 for grooved ends.
 - 2) Grooved Mechanical Couplings for Ductile-Iron Pipe: ASTM F 1476, Type I. Include ferrous housing sections with continuous curved keys, EPDM-rubber center-leg gasket suitable for hot and cold water, and bolts and nuts.
- F. Copper Tube And Fittings
 1. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
 2. Copper Drainage Fittings: ASME B16.23, cast-copper or ASME B16.29, wrought-copper, solder-joint fittings.
 3. Hard Copper Tube: ASTM B 88, Types L and M (ASTM B 88M, Types B and C), water tube, drawn temper.
 4. Soft Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B), water tube, annealed temper.
 5. Copper Pressure Fittings:
 - a. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 - b. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
 6. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
 - a. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
 - b. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
 7. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.
- G. ABS Pipe And Fittings
 1. Solid-Wall ABS Pipe: ASTM D 2661, Schedule 40.
 2. Cellular-Core ABS Pipe: ASTM F 628, Schedule 40.
 3. ABS Socket Fittings: ASTM D 2661, made to ASTM D 3311, drain, waste, and vent patterns.
 4. Solvent Cement: ASTM D 2235
 - a. Use ABS solvent cement that has a VOC content of 325 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- H. PVC Pipe And Fittings
 1. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
 2. Cellular-Core PVC Pipe: ASTM F 891, Schedule 40.
 3. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
 4. Adhesive Primer: ASTM F 656.
 - a. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 5. Solvent Cement: ASTM D 2564.



- a. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

I. Specialty Pipe Fittings

1. Transition Couplings:

- a. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
- b. Fitting-Type Transition Couplings: Manufactured piping coupling or specified-piping-system fitting.
- c. Unshielded, Nonpressure Transition Couplings:
 - 1) Standard: ASTM C 1173.
 - 2) Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - 3) Sleeve Materials:
 - a) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
 - b) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - c) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
- d. Shielded, Nonpressure Transition Couplings:
 - 1) Standard: ASTM C 1460.
 - 2) Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
- e. Pressure Transition Couplings:
 - f. Standard: AWWA C219.
 - g. Description: Metal, sleeve-type couplings same size as, with pressure rating at least equal to and ends compatible with, pipes to be joined.
 - h. Center-Sleeve Material: Manufacturer's standard **OR** Carbon steel **OR** Stainless steel **OR** Ductile iron **OR** Malleable iron, **as directed**.
 - i. Gasket Material: Natural or synthetic rubber.
 - j. Metal Component Finish: Corrosion-resistant coating or material.

2. Dielectric Fittings:

- a. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- b. Dielectric Unions:
 - 1) Description:
 - a) Standard: ASSE 1079.
 - b) Pressure Rating: **150 psig (1035 kPa) OR 250 psig (1725 kPa)** at 180 deg F (82 deg C), **as directed**.
 - c) End Connections: Solder-joint copper alloy and threaded ferrous.
- c. Dielectric Flanges:
 - 1) Description:
 - a) Standard: ASSE 1079.
 - b) Factory-fabricated, bolted, companion-flange assembly.
 - c) Pressure Rating: **150 psig (1035 kPa) OR 175 psig (1200 kPa)** minimum **OR 300 psig (2070 kPa), as directed**.
 - d) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- d. Dielectric-Flange Insulating Kits:
 - 1) Description:
 - a) Nonconducting materials for field assembly of companion flanges.



- b) Pressure Rating: **150 psig (1035 kPa)**
- c) Gasket: Neoprene or phenolic.
- d) Bolt Sleeves: Phenolic or polyethylene.
- e) Washers: Phenolic with steel-backing washers.
- e. Dielectric Nipples:
 - 1) Description:
 - a) Electroplated steel nipple complying with ASTM F 1545.
 - b) Pressure Rating: **300 psig (2070 kPa) at 225 deg F (107 deg C)**.
 - c) End Connections: Male threaded or grooved.
 - d) Lining: Inert and noncorrosive, propylene.
- J. Encasement For Underground Metal Piping
 - 1. Description: ASTM A 674 or AWWA C105
 - 2. Material: High-density, crosslaminated PE film of 0.004-inch (0.10-mm) **OR** LLDPE film of 0.008-inch (0.20-mm), **as directed**, minimum thickness.
 - 3. Form: Sheet **OR** Tube, **as directed**.
 - 4. Color: Black **OR** Natural, **as directed**.

1.3 EXECUTION

A. Earth Moving

- 1. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

B. Piping Installation

- 1. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations from layout are approved on coordination drawings.
- 2. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- 3. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- 4. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- 5. Install piping to permit valve servicing.
- 6. Install piping at indicated slopes.
- 7. Install piping free of sags and bends.
- 8. Install fittings for changes in direction and branch connections.
- 9. Install piping to allow application of insulation.
- 10. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Division 22 Section "Vibration And Seismic Controls For Plumbing Piping And Equipment".
- 11. Make changes in direction for storm drainage piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- 12. Lay buried building storm drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- 13. Install storm drainage piping at the following minimum slopes unless otherwise indicated:
 - a. Building Storm Drain: 1 percent **OR** 2 percent, **as directed**, downward in direction of flow for piping NPS 3 (DN 80) and smaller; 1 percent **OR** 2 percent, **as directed**, downward in direction of flow for piping NPS 4 (DN 100) and larger.



- b. Horizontal Storm-Drainage Piping: **2 percent** downward in direction of flow.
- 14. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 - a. Install encasement on underground piping according to ASTM A 674 or AWWA C105.
- 15. Install steel piping according to applicable plumbing code.
- 16. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."
- 17. Install aboveground ABS piping according to ASTM D 2661.
- 18. Install aboveground PVC piping according to ASTM D 2665.
- 19. Install underground ABS and PVC piping according to ASTM D 2321.
- 20. Install engineered controlled-flow **OR** siphonic, **as directed**, drain specialties and storm drainage piping in locations indicated.
- 21. Install underground, ductile-iron, force-main piping according to AWWA C600. Install buried piping inside building with wall and floor penetrations and connection to storm sewer piping outside building with restrained joints. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.
 - a. Install encasement on piping according to ASTM A 674 or AWWA C105.
- 22. Install underground, copper, force-main tubing according to CDA's "Copper Tube Handbook."
 - a. Install encasement on piping according to ASTM A 674 or AWWA C105.
- 23. Install force mains at elevations indicated.
- 24. Plumbing Specialties:
 - a. Install backwater valves in storm drainage gravity-flow piping. Comply with requirements for backwater valves specified in Division 33 Section "Storm Utility Drainage Piping".
 - b. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers in storm drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in storm drainage force-main piping. Comply with requirements for cleanouts specified in Division 33 Section "Storm Utility Drainage Piping".
 - c. Install drains in storm drainage gravity-flow piping. Comply with requirements for drains specified in Division 33 Section "Storm Utility Drainage Piping".
- 25. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- 26. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Common Work Results For Plumbing".
- 27. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Common Work Results For Plumbing".
- 28. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Common Work Results For Plumbing".

C. Joint Construction

- 1. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results For Plumbing".
- 2. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- 3. Hub-and-Spigot, Cast-Iron Soil Piping Calked Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
- 4. Hubless Cast-Iron Soil Piping Coupled Joints: Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
- 5. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.



6. Join copper tube and fittings with soldered joints according to ASTM B 828 procedure. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.
 7. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fittings. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.
 8. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.
 9. Plastic, Nonpressure-Piping, Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - b. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
 - c. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.
- D. Specialty Pipe Fitting Installation
1. Transition Couplings:
 - a. Install transition couplings at joints of piping with small differences in OD's.
 - b. In Drainage Piping: Unshielded **OR** Shielded, **as directed** nonpressure transition couplings.
 - c. In Aboveground Force-Main Piping: Fitting-type transition couplings.
 - d. In Underground Force-Main Piping:
 - 1) NPS 1-1/2 (DN 40) and Smaller: Fitting-type transition couplings.
 - 2) NPS 2 (DN 50) and Larger: Pressure transition couplings.
 2. Dielectric Fittings:
 - a. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
 - b. Dielectric Fittings for **NPS 2 (DN 50)** and Smaller: Use dielectric nipples **OR** unions, **as directed**.
 - c. Dielectric Fittings for **NPS 2-1/2 to NPS 4 (DN 65 to DN 100)**: Use dielectric flanges **OR** flange kits **OR** nipples, **as directed**.
 - d. Dielectric Fittings for **NPS 5 (DN 125)** and Larger: Use dielectric flange kits.
- E. Valve Installation
1. General valve installation requirements are specified in Division 22 Section "General-duty Valves For Plumbing Piping".
 2. Shutoff Valves: Install shutoff valve on each sump pump discharge.
 - a. Install gate or full-port ball valve for piping NPS 2 (DN 50) and smaller.
 - b. Install gate valve for piping NPS 2-1/2 (DN 65) and larger.
 3. Check Valves: Install swing check valve, between pump and shutoff valve, on each sump pump discharge.
 4. Backwater Valves: Install backwater valves in piping subject to backflow.
 - a. Horizontal Piping: Horizontal backwater valves. Use normally closed type, unless otherwise indicated.
 - b. Install backwater valves in accessible locations.
 - c. Comply with requirements for backwater valve specified in Division 22 Section "Storm Drainage Piping Specialties".
- F. Hanger And Support Installation
1. Comply with requirements for seismic-restraint devices specified in Division 22 Section "Vibration And Seismic Controls For Plumbing Piping And Equipment".
 2. Comply with requirements for pipe hangers and supports and installation specified in Division 22 Section "Hangers And Supports For Plumbing Piping And Equipment".
 - a. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
 - b. Install stainless-steel **OR** fiberglass pipe hangers, **as directed**, for horizontal piping in corrosive environments.
 - c. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.



- d. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
- e. Vertical Piping: MSS Type 8 or Type 42, clamps.
- f. Individual, Straight, Horizontal Piping Runs:
 - 1) 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
 - 2) Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
 - 3) Longer Than 100 Feet (30 m), if Indicated: MSS Type 49, spring cushion rolls.
- g. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
- h. Base of Vertical Piping: MSS Type 52, spring hangers.
3. Support horizontal piping and tubing within 12 inches (300 mm) of each fitting, valve, and coupling.
4. Support vertical piping and tubing at base and at each floor.
5. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.
6. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
 - a. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
 - b. NPS 3 (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.
 - c. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1500 mm) with 5/8-inch (16-mm) rod.
 - d. NPS 6 (DN 150): 60 inches (1500 mm) with 3/4-inch (19-mm) rod.
 - e. NPS 8 to NPS 12 (DN 200 to DN 300): 60 inches (1500 mm) with 7/8-inch (22-mm) rod.
 - f. Spacing for 10-foot (3-m) lengths may be increased to 10 feet (3 m). Spacing for fittings is limited to 60 inches (1500 mm).
7. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).
8. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
 - a. NPS 1-1/4 (DN 32): 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
 - b. NPS 1-1/2 (DN 40): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.
 - c. NPS 2 (DN 50): 10 feet (3 m) with 3/8-inch (10-mm) rod.
 - d. NPS 2-1/2 (DN 65): 11 feet (3.4 m) with 1/2-inch (13-mm) rod.
 - e. NPS 3 (DN 80): 12 feet (3.7 m) with 1/2-inch (13-mm) rod.
 - f. NPS 4 and NPS 5 (DN 100 and DN 125): 12 feet (3.7 m) with 5/8-inch (16-mm) rod.
 - g. NPS 6 (DN 150): 12 feet (3.7 m) with 3/4-inch (19-mm) rod.
 - h. NPS 8 to NPS 12 (DN 200 to DN 300): 12 feet (3.7 m) with 7/8-inch (22-mm) rod.
9. Install supports for vertical steel piping every 15 feet (4.5 m).
10. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - a. NPS 1-1/4 (DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
 - b. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
 - c. NPS 2-1/2 (DN 65): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.
 - d. NPS 3 to NPS 5 (DN 80 to DN 125): 10 feet (3 m) with 1/2-inch (13-mm) rod.
 - e. NPS 6 (DN 150): 10 feet (3 m) with 5/8-inch (16-mm) rod.
 - f. NPS 8 (DN 200): 10 feet (3 m) with 3/4-inch (19-mm) rod.
11. Install supports for vertical copper tubing every 10 feet (3 m).
12. Install hangers for ABS and PVC piping with the following maximum horizontal spacing and minimum rod diameters:
 - a. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
 - b. NPS 3 (DN 80): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
 - c. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.
 - d. NPS 6 (DN 150): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.
 - e. NPS 8 to NPS 12 (DN 200 to DN 300): 48 inches (1200 mm) with 7/8-inch (22-mm) rod.
13. Install supports for vertical ABS and PVC piping every 48 inches (1200 mm).



14. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

G. Connections

1. Drawings indicate general arrangement of piping, fittings, and specialties.
2. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.
3. Connect storm drainage piping to roof drains and storm drainage specialties.
 - a. Install test tees (wall cleanouts) in conductors near floor, and floor cleanouts with cover flush with floor.
 - b. Install horizontal backwater valves with cleanout cover flush with floor **OR** in pit with pit cover flush with floor, **as directed**.
 - c. Comply with requirements for backwater valves, cleanouts and drains specified in Division 22 Section "Storm Drainage Piping Specialties".
4. Connect force-main piping to the following:
 - a. Storm Sewer: To exterior force main or storm manhole.
 - b. Sump Pumps: To sump pump discharge.
5. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
6. Make connections according to the following unless otherwise indicated:
 - a. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - b. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.

H. Identification

1. Identify exposed storm drainage piping. Comply with requirements for identification specified in Division 22 Section "Identification For Plumbing Piping And Equipment".

I. Field Quality Control

1. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
 - b. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
2. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
3. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
4. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - a. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 - b. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - c. Test Procedure: Test storm drainage piping, except outside leaders, **as directed**, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa). From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
 - d. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 - e. Prepare reports for tests and required corrective action.



5. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - a. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - b. Cap and subject piping to static-water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 - c. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 - d. Prepare reports for tests and required corrective action.

J. Cleaning

1. Clean interior of piping. Remove dirt and debris as work progresses.
2. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
3. Place plugs in ends of uncompleted piping at end of day and when work stops.

K. Piping Schedule

1. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
2. Aboveground storm drainage piping NPS 6 (DN 150) and smaller shall be any of the following:
 - a. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - b. Hubless, cast-iron soil pipe and fittings; **CISPI, heavy-duty**, hubless-piping couplings; and coupled joints.
 - c. Galvanized-steel pipe, drainage fittings, and threaded joints.
 - d. Copper tube and fittings in first subparagraph below are only available in NPS 1-1/4 to NPS 8 (DN 32 to DN 200).
 - e. Copper DWV tube, copper drainage fittings, and soldered joints.
 - f. Solid-wall **OR** Cellular-core ABS pipe, **as directed**, ABS socket fittings, and solvent-cemented joints.
 - g. Solid-wall **OR** Cellular-core PVC pipe, **as directed**, PVC socket fittings, and solvent-cemented joints.
 - h. Dissimilar Pipe-Material Couplings: Unshielded **OR** Shielded, **as directed**, nonpressure transition couplings.
3. Aboveground, storm drainage piping NPS 8 (DN 200) and larger shall be any of the following:
 - a. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - b. Hubless, cast-iron soil pipe and fittings; **CISPI, heavy-duty**, hubless-piping couplings; and coupled joints.
 - c. Galvanized-steel pipe, drainage fittings, and threaded joints.
 - d. Copper DWV tube, copper drainage fittings, and soldered joints.
 - e. Solid-wall **OR** Cellular-core PVC pipe, **as directed**, PVC socket fittings, and solvent-cemented joints.
 - f. Dissimilar Pipe-Material Couplings: Unshielded **OR** Shielded, **as directed**, nonpressure transition couplings.
4. Underground storm drainage piping **NPS 6 (DN 150) and smaller** shall be **any of** the following:
 - a. Extra Heavy **OR** Service class, **as directed**, cast-iron soil pipe and fittings; gaskets; and gasketed **OR** calking materials; and calked joints, **as directed**.
 - b. Hubless, cast-iron soil pipe and fittings; **CISPI, heavy-duty, cast-iron**, hubless-piping couplings; and coupled joints.
 - c. Solid-wall **OR** Cellular-core ABS pipe, **as directed**, ABS socket fittings, and solvent-cemented joints.
 - d. **Solid-wall OR Cellular-core** PVC pipe, **as directed**, PVC socket fittings, and solvent-cemented joints.



- e. Dissimilar Pipe-Material Couplings: Unshielded **OR** Shielded, **as directed**, nonpressure transition couplings.
5. Underground, storm drainage piping **NPS 8 (DN 200) and larger** shall be **any of** the following:
 - a. Extra Heavy **OR** Service class, **as directed**, cast-iron soil pipe and fittings; gaskets; and gasketed **OR** calking materials; and calked joints **as directed**.
 - b. Hubless, cast-iron soil pipe and fittings; **CISPI, heavy-duty, cast-iron**, hubless-piping couplings; and coupled joints.
 - c. **Solid-wall OR Cellular-core** PVC pipe, **as directed**, PVC socket fittings, and solvent-cemented joints.
 - d. Cellular-core, sewer and drain series, PVC pipe; PVC socket fittings; and solvent-cemented joints.
 - e. Dissimilar Pipe-Material Couplings: **Unshielded OR Shielded, as directed**, nonpressure transition couplings.
6. Aboveground storm drainage force mains **NPS 1-1/2 and NPS 2 (DN 40 and DN 50)** shall be **any of** the following:
 - a. Hard copper tube, copper pressure fittings, and soldered joints.
 - b. Galvanized-steel pipe, pressure fittings, and threaded joints.
7. Aboveground storm drainage force mains **NPS 2-1/2 to NPS 6 (DN 65 to DN 150)** shall be any of the following:
 - a. Hard copper tube, copper pressure fittings, and soldered joints.
 - b. Galvanized-steel pipe, pressure fittings, and threaded joints.
 - c. Grooved-end, galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.
 - d. Fitting-type transition couplings if dissimilar pipe materials.
8. Underground storm drainage force mains NPS 4 (DN 100) and smaller shall be any of the following:
 - a. Hard **OR** Soft, **as directed** copper tube; **wrought-copper** pressure fittings; and soldered joints.
 - b. Ductile-iron, mechanical-joint piping and mechanical joints.
 - c. Ductile-iron, push-on-joint piping and push-on joints.
 - d. Ductile-iron, grooved-joint piping and grooved joints.
 - e. Fitting-type transition coupling for piping smaller than NPS 1-1/2 (DN 40) and pressure transition coupling for NPS 1-1/2 (DN 40) and larger if dissimilar pipe materials.
9. Underground storm drainage force mains NPS 5 (DN 125) and larger shall be any of the following:
 - a. Hard copper tube; **wrought-copper** pressure fittings; and soldered joints.
 - b. Ductile-iron, mechanical-joint piping and mechanical joints.
 - c. Ductile-iron, push-on-joint piping and push-on joints.
 - d. Ductile-iron, grooved-joint piping and grooved joints.
 - e. Pressure transition couplings if dissimilar pipe materials.

END OF SECTION 22 11 16 00b



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SECTION 22 11 16 00c - HYDRONIC PIPING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for hydronic piping. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes pipe and fitting materials, joining methods, special-duty valves, and specialties for the following:
 - a. Hot-water heating piping.
 - b. Chilled-water piping.
 - c. Dual-temperature heating and cooling water piping.
 - d. Condenser-water piping.
 - e. Glycol cooling-water piping.
 - f. Makeup-water piping.
 - g. Condensate-drain piping.
 - h. Blowdown-drain piping.
 - i. Air-vent piping.
 - j. Safety-valve-inlet and -outlet piping.

C. Definitions

1. PTFE: Polytetrafluoroethylene.
2. RTRF: Reinforced thermosetting resin (fiberglass) fittings.
3. RTRP: Reinforced thermosetting resin (fiberglass) pipe.

D. Performance Requirements

1. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature:
 - a. Hot-Water Heating Piping: **psig (kPa)**, as directed by the Owner at 200 deg F (93 deg C).
 - b. Chilled-Water Piping: **psig (kPa)**, as directed by the Owner at 200 deg F (93 deg C).
 - c. Dual-Temperature Heating and Cooling Water Piping: **psig (kPa)**, ethylene at 200 deg F (93 deg C).
 - d. Condenser-Water Piping: **psig (kPa)**, as directed by the Owner at 150 deg F (66 deg C).
 - e. Glycol Cooling-Water Piping: **psig (kPa)**, as directed by the Owner at 150 deg F (66 deg C).
 - f. Makeup-Water Piping: 80 psig (552 kPa) at 150 deg F (66 deg C).
 - g. Condensate-Drain Piping: 150 deg F (66 deg C).
 - h. Blowdown-Drain Piping: 200 deg F (93 deg C).
 - i. Air-Vent Piping: 200 deg F (93 deg C).
 - j. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

E. Submittals

1. Product Data: For each type of the following:
 - a. Plastic pipe and fittings with solvent cement.
 - b. RTRP and RTRF with adhesive.
 - c. Pressure-seal fittings.
 - d. Valves. Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
 - e. Air control devices.



- f. Chemical treatment.
- g. Hydronic specialties.
2. LEED Submittal:
 - a. Product Data for Credit EQ 4.1: For solvent cements and adhesive primers, including printed statement of VOC content.
3. Shop Drawings: Detail, at 1/4 (1:50) scale, the piping layout, fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to the building structure. Detail location of anchors, alignment guides, and expansion joints and loops.
4. Welding certificates.
5. Qualification Data: For Installer.
6. Field quality-control test reports.
7. Operation and Maintenance Data: For air control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.
8. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.

F. Quality Assurance

1. Installer Qualifications:
 - a. Installers of Pressure-Sealed Joints: Installers shall be certified by the pressure-seal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings.
 - b. Fiberglass Pipe and Fitting Installers: Installers of RTRF and RTRP shall be certified by the manufacturer of pipes and fittings as having been trained and qualified to join fiberglass piping with manufacturer-recommended adhesive.
2. Steel Support Welding: Qualify processes and operators according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
3. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
 - a. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - b. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
4. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

1.2 PRODUCTS

A. Copper Tube And Fittings

1. Drawn-Temper Copper Tubing: ASTM B 88, Type L (ASTM B 88M, Type B) **OR** ASTM B 88, Type M (ASTM B 88M, Type C), **as directed**.
2. Annealed-Temper Copper Tubing: ASTM B 88, Type K (ASTM B 88M, Type A).
3. DWV Copper Tubing: ASTM B 306, Type DWV.
4. Wrought-Copper Fittings: ASME B16.22.
 - a. Grooved-End Copper Fittings: ASTM B 75 (ASTM B 75M), copper tube or ASTM B 584, bronze casting.
 - b. Grooved-End-Tube Couplings: Rigid pattern, unless otherwise indicated; gasketed fitting. Ductile-iron housing with keys matching pipe and fitting grooves, prelubricated, **as directed**, EPDM gasket rated for minimum 230 deg F (110 deg C) for use with housing, and steel bolts and nuts.
5. Copper or Bronze Pressure-Seal Fittings:
 - a. Housing: Copper.
 - b. O-Rings and Pipe Stops: EPDM.



- c. Tools: Manufacturer's special tools.
 - d. Minimum 200-psig (1379-kPa) working-pressure rating at 250 deg F (121 deg C).
 6. Copper, Mechanically Formed Tee Option: For forming T-branch on copper water tube.
 7. Wrought-Copper Unions: ASME B16.22.
- B. Steel Pipe And Fittings**
1. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; type, grade, and wall thickness as indicated in Part 1.3 "Piping Applications" Article.
 2. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250 as indicated in Part 1.3 "Piping Applications" Article.
 3. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300 as indicated in Part 1.3 "Piping Applications" Article.
 4. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in Part 1.3 "Piping Applications" Article.
 5. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced as indicated in Part 1.3 "Piping Applications" Article.
 6. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.
 7. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
 - a. Material Group: 1.1.
 - b. End Connections: Butt welding.
 - c. Facings: Raised face.
 8. Grooved Mechanical-Joint Fittings and Couplings:
 - a. Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 47/A 47M, Grade 32510 malleable iron; ASTM A 53/A 53M, Type F, E, or S, Grade B fabricated steel; or ASTM A 106, Grade B steel fittings with grooves or shoulders constructed to accept grooved-end couplings; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
 - b. Couplings: Ductile- or malleable-iron housing and synthetic rubber gasket of central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
 9. Steel Pressure-Seal Fittings:
 - a. Housing: Steel.
 - b. O-Rings and Pipe Stop: EPDM.
 - c. Tools: Manufacturer's special tool.
 - d. Minimum 300-psig (2070-kPa) working-pressure rating at 230 deg F (110 deg C).
 10. Steel Pipe Nipples: ASTM A 733, made of same materials and wall thicknesses as pipe in which they are installed.
- C. Plastic Pipe And Fittings**
1. CPVC Plastic Pipe: ASTM F 441/F 441M, Schedules 40 and 80, plain ends as indicated in Part 1.3 "Piping Applications" Article.
 2. CPVC Plastic Pipe Fittings: Socket-type pipe fittings, ASTM F 438 for Schedule 40 pipe; ASTM F 439 for Schedule 80 pipe.
 3. PVC Plastic Pipe: ASTM D 1785, Schedules 40 and 80, plain ends as indicated in Part 1.3 "Piping Applications" Article.
 4. PVC Plastic Pipe Fittings: Socket-type pipe fittings, ASTM D 2466 for Schedule 40 pipe; ASTM D 2467 for Schedule 80 pipe.
- D. Fiberglass Pipe And Fittings**
1. RTRP: ASTM D 2996, filament-wound pipe with tapered bell and spigot ends for adhesive joints.
 2. RTRF: Compression or spray-up/contact molded of same material, pressure class, and joining method as pipe.
 3. Flanges: ASTM D 4024. Full-face gaskets suitable for the service, minimum 1/8-inch (3.2-mm) thick, 60-70 durometer. ASTM A 307, Grade B, hex head bolts with washers.



E. Joining Materials

1. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - a. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
 - 1) Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - 2) Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
3. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
4. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
5. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.
6. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
7. Solvent Cements for Joining Plastic Piping:
 - a. CPVC Piping: ASTM F 493.
 - 1) Use CPVC solvent cement that has a VOC content of 490 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2) Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 - 1) Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2) Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
8. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.
 - a. Use fiberglass adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
9. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

F. Transition Fittings

1. Plastic-to-Metal Transition Fittings:
 - a. CPVC **OR** PVC, **as directed**, one-piece fitting with one threaded brass or copper insert and one Schedule 80 solvent-cement-joint end.
2. Plastic-to-Metal Transition Unions:
 - a. MSS SP-107, CPVC **OR** PVC, **as directed**, union. Include brass or copper end, Schedule 80 solvent-cement-joint end, rubber gasket, and threaded union.

G. Dielectric Fittings

1. Description: Combination fitting of copper-alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
2. Insulating Material: Suitable for system fluid, pressure, and temperature.
3. Dielectric Unions:
 - a. Factory-fabricated union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).
4. Dielectric Flanges:
 - a. Factory-fabricated companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.
5. Dielectric-Flange Kits:
 - a. Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.



- b. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig (1035- or 2070-kPa) minimum working pressure where required to suit system pressures.
- 6. Dielectric Couplings:
 - a. Galvanized-steel coupling with inert and noncorrosive thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).
- 7. Dielectric Nipples:
 - a. Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

H. Valves

- 1. Gate, Globe, Check, Ball, and Butterfly Valves: Comply with requirements specified in Division 22 Section(s) "General-duty Valves For Plumbing Piping" OR Division 23 Section(s) "General-duty Valves For Hvac Piping".
- 2. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Division 23 Section "Instrumentation And Control For Hvac".
- 3. Plastic Ball Valves:
 - a. Body: One-, two-, or three-piece CPVC or PVC to match piping.
 - b. Ball: Full-port CPVC or PVC to match piping.
 - c. Seats: PTFE.
 - d. Seals: EPDM.
 - e. End Connections: Socket, union, or flanged.
 - f. Handle Style: Tee shape.
 - g. CWP Rating: Equal to piping service.
 - h. Maximum Operating Temperature: Equal to piping service.
 - i. Comply with MSS SP-122.
- 4. Plastic Butterfly Valves:
 - a. Body: PVC or CPVC to match piping wafer type for installation between flanges.
 - b. Disc: EPDM-coated steel.
 - c. Seats: PTFE.
 - d. Handle Style: Locking lever.
 - e. CWP Rating: Equal to piping service.
 - f. Maximum Operating Temperature: Equal to piping service.
- 5. Plastic Check Valves:
 - a. Body: One-, two-, or three-piece PVC or CPVC to match piping.
 - b. Ends: Socket or flanged.
 - c. Seats: PTFE.
 - d. Check Style: Swing or ball type.
 - e. CWP Rating: Equal to piping service.
 - f. Maximum Operating Temperature: Equal to piping service.
- 6. Bronze, Calibrated-Orifice, Balancing Valves:
 - a. Body: Bronze, ball or plug type with calibrated orifice or venturi.
 - b. Ball: Brass or stainless steel.
 - c. Plug: Resin.
 - d. Seat: PTFE.
 - e. End Connections: Threaded or socket.
 - f. Pressure Gage Connections: Integral seals for portable differential pressure meter.
 - g. Handle Style: Lever, with memory stop to retain set position.
 - h. CWP Rating: Minimum 125 psig (860 kPa).
 - i. Maximum Operating Temperature: 250 deg F (121 deg C).
- 7. Cast-Iron or Steel, Calibrated-Orifice, Balancing Valves:
 - a. Body: Cast-iron or steel body, ball, plug, or globe pattern with calibrated orifice or venturi.
 - b. Ball: Brass or stainless steel.
 - c. Stem Seals: EPDM O-rings.
 - d. Disc: Glass and carbon-filled PTFE.
 - e. Seat: PTFE.



- f. End Connections: Flanged or grooved.
 - g. Pressure Gage Connections: Integral seals for portable differential pressure meter.
 - h. Handle Style: Lever, with memory stop to retain set position.
 - i. CWP Rating: Minimum 125 psig (860 kPa).
 - j. Maximum Operating Temperature: 250 deg F (121 deg C).
8. Diaphragm-Operated, Pressure-Reducing Valves:
- a. Body: Bronze or brass.
 - b. Disc: Glass and carbon-filled PTFE.
 - c. Seat: Brass.
 - d. Stem Seals: EPDM O-rings.
 - e. Diaphragm: EPT.
 - f. Low inlet-pressure check valve.
 - g. Inlet Strainer: removable without system shutdown.
 - h. Valve Seat and Stem: Noncorrosive.
 - i. Valve Size, Capacity, and Operating Pressure: Selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.
9. Diaphragm-Operated Safety Valves:
- a. Body: Bronze or brass.
 - b. Disc: Glass and carbon-filled PTFE.
 - c. Seat: Brass.
 - d. Stem Seals: EPDM O-rings.
 - e. Diaphragm: EPT.
 - f. Wetted, Internal Work Parts: Brass and rubber.
 - g. Inlet Strainer: removable without system shutdown.
 - h. Valve Seat and Stem: Noncorrosive.
 - i. Valve Size, Capacity, and Operating Pressure: Comply with ASME Boiler and Pressure Vessel Code: Section IV, and selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.
10. Automatic Flow-Control Valves:
- a. Body: Brass or ferrous metal.
 - b. Piston and Spring Assembly: Stainless steel **OR** Corrosion resistant, **as directed**, tamper proof, self cleaning, and removable.
 - c. Combination Assemblies: Include bronze or brass-alloy ball valve.
 - d. Identification Tag: Marked with zone identification, valve number, and flow rate.
 - e. Size: Same as pipe in which installed.
 - f. Performance: Maintain constant flow, plus or minus 5 percent over system pressure fluctuations.
 - g. Minimum CWP Rating: 175 psig (1207 kPa) **OR** 300 psig (2070 kPa), **as directed**.
 - h. Maximum Operating Temperature: 200 deg F (93 deg C) **OR** 250 deg F (121 deg C), **as directed**.
- I. Air Control Devices
1. Manual Air Vents:
- a. Body: Bronze.
 - b. Internal Parts: Nonferrous.
 - c. Operator: Screwdriver or thumbscrew.
 - d. Inlet Connection: NPS 1/2 (DN 15).
 - e. Discharge Connection: NPS 1/8 (DN 6).
 - f. CWP Rating: 150 psig (1035 kPa).
 - g. Maximum Operating Temperature: 225 deg F (107 deg C).
2. Automatic Air Vents:
- a. Body: Bronze or cast iron.
 - b. Internal Parts: Nonferrous.
 - c. Operator: Noncorrosive metal float.
 - d. Inlet Connection: NPS 1/2 (DN 15).



- e. Discharge Connection: NPS 1/4 (DN 8).
- f. CWP Rating: 150 psig (1035 kPa).
- g. Maximum Operating Temperature: 240 deg F (116 deg C).
3. Expansion Tanks:
 - a. Tank: Welded steel, rated for 125-psig (860-kPa) working pressure and 375 deg F (191 deg C) maximum operating temperature, with taps in bottom of tank for tank fitting and taps in end of tank for gage glass. Tanks shall be factory tested with taps fabricated and labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 - b. Air-Control Tank Fitting: Cast-iron body, copper-plated tube, brass vent tube plug, and stainless-steel ball check, 100-gal. (379-L) unit only; sized for compression-tank diameter. Provide tank fittings for 125-psig (860-kPa) working pressure and 250 deg F (121 deg C) maximum operating temperature.
 - c. Tank Drain Fitting: Brass body, nonferrous internal parts; 125-psig (860-kPa) working pressure and 240 deg F (116 deg C) maximum operating temperature; constructed to admit air to compression tank, drain water, and close off system.
 - d. Gage Glass: Full height with dual manual shutoff valves, 3/4-inch- (20-mm-) diameter gage glass, and slotted-metal glass guard.
4. Diaphragm-Type **OR** Bladder-Type, **as directed**, Expansion Tanks:
 - a. Tank: Welded steel, rated for 125-psig (860-kPa) working pressure and 375 deg F (191 deg C) maximum operating temperature. Factory test with taps fabricated and supports installed and labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 - b. Diaphragm **OR** Bladder, **as directed**: Securely sealed into tank to separate air charge from system water to maintain required expansion capacity.
 - c. Air-Charge Fittings: Schrader valve, stainless steel with EPDM seats.
5. Tangential-Type Air Separators:
 - a. Tank: Welded steel; ASME constructed and labeled for 125-psig (860-kPa) minimum working pressure and 375 deg F (191 deg C) maximum operating temperature.
 - b. Air Collector Tube: Perforated stainless steel, constructed to direct released air into expansion tank.
 - c. Tangential Inlet and Outlet Connections: Threaded for NPS 2 (DN 50) and smaller; flanged connections for NPS 2-1/2 (DN 65) and larger.
 - d. Blowdown Connection: Threaded.
 - e. Size: Match system flow capacity.
6. In-Line Air Separators:
 - a. Tank: One-piece cast iron with an integral weir constructed to decelerate system flow to maximize air separation.
 - b. Maximum Working Pressure: Up to 175 psig (1207 kPa).
 - c. Maximum Operating Temperature: Up to 300 deg F (149 deg C).
7. Air Purgers:
 - a. Body: Cast iron with internal baffles that slow the water velocity to separate the air from solution and divert it to the vent for quick removal.
 - b. Maximum Working Pressure: 150 psig (1035 kPa).
 - c. Maximum Operating Temperature: 250 deg F (121 deg C).
- J. Chemical Treatment
 1. Bypass Chemical Feeder: Welded steel construction; 125-psig (860-kPa) working pressure; 5-gal. (19-L) capacity; with fill funnel and inlet, outlet, and drain valves.
 - a. Chemicals: Specially formulated, based on analysis of makeup water, to prevent accumulation of scale and corrosion in piping and connected equipment.
 2. Ethylene and Propylene Glycol: Industrial grade with corrosion inhibitors and environmental-stabilizer additives for mixing with water in systems indicated to contain antifreeze or glycol solutions.
- K. Hydronic Piping Specialties
 1. Y-Pattern Strainers:



- a. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
 - b. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.
 - c. Strainer Screen: 40 **OR** 60, **as directed**, -mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
 - d. CWP Rating: 125 psig (860 kPa).
2. Basket Strainers:
- a. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
 - b. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.
 - c. Strainer Screen: 40 **OR** 60, **as directed**, -mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
 - d. CWP Rating: 125 psig (860 kPa).
3. T-Pattern Strainers:
- a. Body: Ductile or malleable iron with removable access coupling and end cap for strainer maintenance.
 - b. End Connections: Grooved ends.
 - c. Strainer Screen: 40 **OR** 60, **as directed**, -mesh startup strainer, and perforated stainless-steel basket with 57 percent free area.
 - d. CWP Rating: 750 psig (5170 kPa).
4. Stainless-Steel Bellow, Flexible Connectors:
- a. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
 - b. End Connections: Threaded or flanged to match equipment connected.
 - c. Performance: Capable of 3/4-inch (20-mm) misalignment.
 - d. CWP Rating: 150 psig (1035 kPa).
 - e. Maximum Operating Temperature: 250 deg F (121 deg C).
5. Spherical, Rubber, Flexible Connectors:
- a. Body: Fiber-reinforced rubber body.
 - b. End Connections: Steel flanges drilled to align with Classes 150 and 300 steel flanges.
 - c. Performance: Capable of misalignment.
 - d. CWP Rating: 150 psig (1035 kPa).
 - e. Maximum Operating Temperature: 250 deg F (121 deg C).
6. Expansion fittings are specified in Division 22 Section(s) "Expansion Fittings And Loops For Plumbing Piping" OR Division 23 Section(s) "Expansion Fittings And Loops For Hvac Piping".

1.3 EXECUTION

1. Hot-water heating piping, aboveground, NPS 2 (DN 50) and smaller, shall be any of the following:
 - a. Type L (B) **OR** M (C), **as directed**, drawn-temper copper tubing, wrought-copper fittings, and soldered **OR** brazed **OR** pressure-seal, **as directed**, joints.
 - b. Schedule 40 **OR** 30 **OR** 20, **as directed**, steel pipe; Class 125, cast-iron **OR** 150, malleable-iron **OR** 250, cast-iron **OR** 300, malleable-iron, **as directed**, fittings; cast-iron flanges and flange fittings; and threaded joints.
 - c. Schedule 5 steel pipe; steel, pressure-seal couplings and fittings; and pressure-seal joints.
 - d. Schedule 40 **OR** 80, **as directed**, CPVC plastic pipe and fittings and solvent-welded joints.
2. Hot-water heating piping, aboveground, NPS 2-1/2 (DN 65) and larger, shall be any of the following:
 - a. Type L (B) **OR** M (C), **as directed**, drawn-temper copper tubing, wrought-copper fittings, and soldered **OR** brazed, **as directed**, joints.
 - b. Schedule 40 **OR** 30 **OR** 20, **as directed**, steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
 - c. Schedule 40 **OR** 30 **OR** 20, **as directed**, steel pipe; grooved, mechanical joint coupling and fittings; and grooved, mechanical joints.



- d. Schedule 40 **OR** 80, **as directed**, CPVC plastic pipe and fittings and solvent-welded joints.
- e. RTRP and RTRF with adhesive or flanged joints.
3. Hot-water heating piping installed belowground and within slabs shall be either of the following:
 - a. Type K (A), annealed-temper copper tubing, wrought-copper fittings, and soldered **OR** brazed, **as directed**, joints. Use the fewest possible joints.
 - b. RTRP and RTRF with adhesive or flanged joints.
4. Chilled-water piping, aboveground, NPS 2 (DN 50) and smaller, shall be any of the following:
 - a. Type L (B) **OR** M (C), **as directed**, drawn-temper copper tubing, wrought-copper fittings, and soldered **OR** brazed **OR** pressure-seal, **as directed**, joints.
 - b. Schedule 40 **OR** 30 **OR** 20, **as directed**, steel pipe; Class 125, cast-iron **OR** 150, malleable-iron **OR** 250, cast-iron **OR** 300, malleable-iron, **as directed**, fittings; cast-iron flanges and flange fittings; and threaded joints.
 - c. Schedule 5 steel pipe; steel, pressure-seal couplings and fittings; and pressure-seal joints.
 - d. Schedule 40 **OR** 80, **as directed**, CPVC plastic pipe and fittings and solvent-welded joints.
5. Chilled-water piping, aboveground, NPS 2-1/2 (DN 65) and larger, shall be any of the following:
 - a. Type L (B) **OR** M (C), **as directed**, drawn-temper copper tubing, wrought-copper fittings, and soldered **OR** brazed, **as directed**, joints.
 - b. Schedule 40 **OR** 30 **OR** 20, **as directed**, steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
 - c. Schedule 40 **OR** 30 **OR** 20, **as directed**, steel pipe; grooved, mechanical joint coupling and fittings; and grooved, mechanical joints.
 - d. Schedule 40 **OR** 80, **as directed**, CPVC plastic pipe and fittings and solvent-welded joints.
 - e. RTRP and RTRF with adhesive or flanged joints.
6. Chilled-water piping installed belowground and within slabs shall be either of the following:
 - a. Type K (A), annealed-temper copper tubing, wrought-copper fittings, and soldered **OR** brazed, **as directed**, joints. Use the fewest possible joints.
 - b. RTRP and RTRF with adhesive or flanged joints.
7. Dual-temperature heating and cooling water piping, aboveground, NPS 2 (DN 50) and smaller, shall be any of the following:
 - a. Type L (B) **OR** M (C), **as directed**, drawn-temper copper tubing, wrought-copper fittings, and soldered **OR** brazed **OR** pressure-seal, **as directed**, joints.
 - b. Schedule 40 **OR** 30 **OR** 20, **as directed**, steel pipe; Class 125, cast-iron **OR** 150, malleable-iron **OR** 250, cast-iron **OR** 300, malleable-iron, **as directed**, fittings; cast-iron flanges and flange fittings; and threaded joints.
 - c. Schedule 5 steel pipe; steel, pressure-seal couplings and fittings; and pressure-seal joints.
 - d. Schedule 40 **OR** 80, **as directed**, CPVC plastic pipe and fittings and solvent-welded joints.
8. Dual-temperature heating and cooling water piping, aboveground, NPS 2-1/2 (DN 65) and larger, shall be any of the following:
 - a. Type L (B) **OR** M (C), **as directed**, drawn-temper copper tubing, wrought-copper fittings, and soldered **OR** brazed, **as directed**, joints.
 - b. Schedule 40 **OR** 30 **OR** 20, **as directed**, steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
 - c. Schedule 40 **OR** 30 **OR** 20, **as directed**, steel pipe; grooved, mechanical joint coupling and fittings; and grooved, mechanical joints.
 - d. Schedule 40 **OR** 80, **as directed**, CPVC plastic pipe and fittings and solvent-welded joints.
 - e. RTRP and RTRF with adhesive or flanged joints.
9. Dual-temperature heating and cooling water piping installed belowground and within slabs shall be either of the following:
 - a. Type K (A), annealed-temper copper tubing, wrought-copper fittings, and soldered **OR** brazed, **as directed**, joints. Use the fewest possible joints.
 - b. RTRP and RTRF with adhesive or flanged joints.
10. Condenser-water piping, aboveground, NPS 2 (DN 50) and smaller, shall be any of the following:
 - a. Type L (B) **OR** M (C), **as directed**, drawn-temper copper tubing, wrought-copper fittings, and soldered **OR** brazed **OR** pressure-seal, **as directed**, joints.



- b. Schedule 80 **OR** 40 **OR** 30 **OR** 20, **as directed**, steel pipe; Class 125, cast-iron **OR** 150, malleable-iron **OR** 250, cast-iron **OR** 300, malleable-iron, **as directed**, fittings; cast-iron flanges and flange fittings; and threaded joints.
 - c. Schedule 5 steel pipe; steel, pressure-seal couplings and fittings; and pressure-seal joints.
 - d. Schedule 40 **OR** 80, **as directed**, CPVC plastic pipe and fittings and solvent-welded joints.
11. Condenser-water piping, aboveground, NPS 2-1/2 (DN 65) and larger, shall be any of the following:
 - a. Type L (B) **OR** M (C), **as directed**, drawn-temper copper tubing, wrought-copper fittings, and soldered **OR** brazed, **as directed**, joints.
 - b. Schedule 80 **OR** 40 **OR** 30 **OR** 20, **as directed**, steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
 - c. Schedule 80 **OR** 40 **OR** 30 **OR** 20, **as directed**, steel pipe; grooved, mechanical joint coupling and fittings; and grooved, mechanical joints.
 - d. Schedule 40 **OR** 80, **as directed**, CPVC plastic pipe and fittings and solvent-welded joints.
 - e. RTRP and RTRF with adhesive or flanged joints.
12. Condenser-water piping installed belowground and within slabs shall be either of the following:
 - a. Type K (A), annealed-temper copper tubing, wrought-copper fittings, and soldered **OR** brazed, **as directed**, joints. Use the fewest possible joints.
 - b. RTRP and RTRF with adhesive or flanged joints.
13. Glycol cooling-water piping, aboveground, NPS 2 (DN 50) and smaller, shall be any of the following:
 - a. Type L (B) **OR** M (C), **as directed**, drawn-temper copper tubing, wrought-copper fittings, and soldered **OR** brazed **OR** pressure-seal, **as directed**, joints.
 - b. Schedule 40 **OR** 30 **OR** 20, **as directed**, steel pipe; Class 125, cast-iron **OR** 150, malleable-iron **OR** 250, cast-iron **OR** 300, malleable-iron, **as directed**, fittings; cast-iron flanges and flange fittings; and threaded joints.
 - c. Schedule 5 steel pipe; steel, pressure-seal couplings and fittings; and pressure-seal joints.
 - d. Schedule 40 **OR** 80, **as directed**, CPVC plastic pipe and fittings and solvent-welded joints.
14. Glycol cooling-water piping, aboveground, NPS 2-1/2 (DN 65) and larger, shall be any of the following:
 - a. Type L (B) **OR** M (C), **as directed**, drawn-temper copper tubing, wrought-copper fittings, and soldered **OR** brazed, **as directed**, joints.
 - b. Schedule 40 **OR** 30 **OR** 20, **as directed**, steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
 - c. Schedule 40 **OR** 30 **OR** 20, **as directed**, steel pipe; grooved, mechanical joint coupling and fittings; and grooved, mechanical joints.
 - d. Schedule 40 **OR** 80, **as directed**, CPVC plastic pipe and fittings and solvent-welded joints.
 - e. RTRP and RTRF with adhesive or flanged joints.
15. Glycol cooling-water piping installed belowground and within slabs shall be either of the following:
 - a. Type K (A), annealed-temper copper tubing, wrought-copper fittings, and soldered **OR** brazed, **as directed**, joints. Use the fewest possible joints.
 - b. RTRP and RTRF with adhesive or flanged joints.
16. Makeup-water piping installed aboveground shall be either of the following:
 - a. Type L (B) **OR** M (C), **as directed**, drawn-temper copper tubing, wrought-copper fittings, and soldered **OR** brazed, **as directed**, joints.
 - b. Schedule 40 **OR** 80, **as directed**, CPVC plastic pipe and fittings, and solvent-welded joints.
17. Makeup-Water Piping Installed Belowground and within Slabs: Type K (A), annealed-temper copper tubing, wrought-copper fittings, and soldered joints. Use the fewest possible joints.
18. Condensate-Drain Piping: Type M (C) **OR** DWV, **as directed**, drawn-temper copper tubing, wrought-copper fittings, and soldered joints or Schedule 40 PVC plastic pipe and fittings and solvent-welded joints, **as directed**.
OR
 Condensate-Drain Piping: Schedule 40 PVC plastic pipe and fittings and solvent-welded joints.



19. Blowdown-Drain Piping: Same materials and joining methods as for piping specified for the service in which blowdown drain is installed.
 20. Air-Vent Piping:
 - a. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to the piping manufacturer's written instructions.
 - b. Outlet: Type K (A), annealed-temper copper tubing with soldered or flared joints.
 21. Safety-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed with metal-to-plastic transition fittings for plastic piping systems according to the piping manufacturer's written instructions.
- B. Valve Applications
1. Install shutoff-duty valves at each branch connection to supply mains, and at supply connection to each piece of equipment.
 2. Install throttling-duty **OR** calibrated-orifice, balancing, **as directed**, valves at each branch connection to return main.
 3. Install calibrated-orifice, balancing valves in the return pipe of each heating or cooling terminal.
 4. Install check valves at each pump discharge and elsewhere as required to control flow direction.
 5. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; and pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.
 6. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.
- C. Piping Installations
1. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
 2. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
 3. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
 4. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
 5. Install piping to permit valve servicing.
 6. Install piping at indicated slopes.
 7. Install piping free of sags and bends.
 8. Install fittings for changes in direction and branch connections.
 9. Install piping to allow application of insulation.
 10. Select system components with pressure rating equal to or greater than system operating pressure.
 11. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
 12. Install drains, consisting of a tee fitting, NPS 3/4 (DN 20) ball valve, and short NPS 3/4 (DN 20) threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
 13. Install piping at a uniform grade of 0.2 percent upward in direction of flow.
 14. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
 15. Install branch connections to mains using mechanically formed, **as directed**, tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.
 16. Install valves according to Division 22 Section(s) "General-duty Valves For Plumbing Piping" OR Division 23 Section(s) "General-duty Valves For Hvac Piping".
 17. Install unions in piping, NPS 2 (DN 50) and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.



18. Install flanges in piping, NPS 2-1/2 (DN 65) and larger, at final connections of equipment and elsewhere as indicated.
19. Install strainers on inlet side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS 3/4 (DN 20) nipple and ball valve in blowdown connection of strainers NPS 2 (DN 50) and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2 (DN 50).
20. Install expansion loops, expansion joints, anchors, and pipe alignment guides as specified in Division 22 Section(s) "Expansion Fittings And Loops For Plumbing Piping" OR Division 23 Section(s) "Expansion Fittings And Loops For Hvac Piping".
21. Identify piping as specified in Division 22 Section(s) "Identification For Plumbing Piping And Equipment" OR Division 23 Section(s) "Identification For Hvac Piping And Equipment".

D. Hangers And Supports

1. Hanger, support, and anchor devices are specified in Division 22 Section(s) "Hangers And Supports For Plumbing Piping And Equipment" OR Division 23 Section(s) "Hangers And Supports For Hvac Piping And Equipment". Comply with the following requirements for maximum spacing of supports.
2. Seismic restraints are specified in Division 21 Section(s) "Vibration And Seismic Controls For Fire-suppression Piping And Equipment" OR Division 22 Section(s) "Vibration And Seismic Controls For Plumbing Piping And Equipment" OR Division 23 Section(s) "Vibration And Seismic Controls For Hvac Piping And Equipment".
3. Install the following pipe attachments:
 - a. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet (6 m) long.
 - b. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet (6 m) or longer.
 - c. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet (6 m) or longer, supported on a trapeze.
 - d. Spring hangers to support vertical runs.
 - e. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
 - f. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.
4. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
 - a. NPS 3/4 (DN 20): Maximum span, 7 feet (2.1 m); minimum rod size, 3/8 inch (10 mm).
 - b. NPS 1 (DN 25): Maximum span, 7 feet (2.1 m); minimum rod size, 3/8 inch (10 mm).
 - c. NPS 1-1/4 (DN 32): Maximum span, 7 feet (2.1 m); minimum rod size, 3/8 inch (10 mm).
 - d. NPS 1-1/2 (DN 40): Maximum span, 9 feet (2.7 m); minimum rod size, 3/8 inch (10 mm).
 - e. NPS 2 (DN 50): Maximum span, 10 feet (3 m); minimum rod size, 3/8 inch (10 mm).
 - f. NPS 2-1/2 (DN 65): Maximum span, 11 feet (3.4 m); minimum rod size, 1/2 inch (12 mm).
 - g. NPS 3 (DN 80): Maximum span, 12 feet (3.7 m); minimum rod size, 1/2 inch (12 mm).
 - h. NPS 3-1/2 (DN 90): Maximum span, 13 feet (4 m); minimum rod size, 1/2 inch (12 mm).
 - i. NPS 4 (DN 100): Maximum span, 14 feet (4.3 m); minimum rod size, 5/8 inch (16 mm).
 - j. NPS 5 (DN 125): Maximum span, 16 feet (4.9 m); minimum rod size, 5/8 inch (16 mm).
 - k. NPS 6 (DN 150): Maximum span, 17 feet (5.2 m); minimum rod size, 3/4 inch (20 mm).
 - l. NPS 8 (DN 200): Maximum span, 19 feet (5.8 m); minimum rod size, 3/4 inch (20 mm).
 - m. NPS 10 (DN 250): Maximum span, 22 feet (6.7 m); minimum rod size, 7/8 inch (20 mm).
 - n. NPS 12 (DN 300): Maximum span, 23 feet (7 m); minimum rod size, 7/8 inch (20 mm).
 - o. NPS 14 (DN 350): Maximum span, 25 feet (7.6 m); minimum rod size, 1 inch (24 mm).
 - p. NPS 16 (DN 400): Maximum span, 27 feet (8.2 m); minimum rod size, 1 inch (24 mm).
 - q. NPS 18 (DN 450): Maximum span, 28 feet (8.5 m); minimum rod size, 1 inch (24 mm).
 - r. NPS 20 (DN 500): Maximum span, 30 feet (9.1 m); minimum rod size, 1-1/4 inches (30 mm).
5. Install hangers for drawn-temper copper tubing with the following maximum spacing and minimum rod sizes:
 - a. NPS 3/4 (DN 20): Maximum span, 5 feet (1.5 m); minimum rod size, 3/8 inch (10 mm).



- b. NPS 1 (DN 25): Maximum span, 6 feet (1.8 m); minimum rod size, 3/8 inch (10 mm).
 - c. NPS 1-1/4 (DN 32): Maximum span, 7 feet (2.1 m); minimum rod size, 3/8 inch (10 mm).
 - d. NPS 1-1/2 (DN 40): Maximum span, 8 feet (2.4 m); minimum rod size, 3/8 inch (10 mm).
 - e. NPS 2 (DN 50): Maximum span, 8 feet (2.4 m); minimum rod size, 3/8 inch (10 mm).
 - f. NPS 2-1/2 (DN 65): Maximum span, 9 feet (2.7 m); minimum rod size, 1/2 inch (12 mm).
 - g. NPS 3 (DN 80): Maximum span, 10 feet (3 m); minimum rod size, 1/2 inch (12 mm).
6. Plastic Piping Hanger Spacing: Space hangers according to pipe manufacturer's written instructions for service conditions. Avoid point loading. Space and install hangers with the fewest practical rigid anchor points.
 7. Fiberglass Piping Hanger Spacing: Space hangers according to pipe manufacturer's written instructions for service conditions. Avoid point loading. Space and install hangers with the fewest practical rigid anchor points.
 8. Support vertical runs at roof, at each floor, and at 10-foot (3-m) intervals between floors.
- E. Pipe Joint Construction
1. Join pipe and fittings according to the following requirements and Division 21 specifying piping systems.
 2. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
 3. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
 4. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
 5. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
 6. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
 7. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1.1 "Quality Assurance" Article.
 8. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
 9. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - b. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - c. PVC Pressure Piping: Join ASTM D 1785 schedule number, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule number PVC pipe and socket fittings according to ASTM D 2855.
 - d. PVC Nonpressure Piping: Join according to ASTM D 2855.
 10. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.
 11. Grooved Joints: Assemble joints with coupling and gasket, lubricant, and bolts. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. Use grooved-end fittings and rigid, grooved-end-pipe couplings.
 12. Mechanically Formed, Copper-Tube-Outlet Joints: Use manufacturer-recommended tool and procedure, and brazed joints.
 13. Pressure-Sealed Joints: Use manufacturer-recommended tool and procedure. Leave insertion marks on pipe after assembly.
- F. Hydronic Specialties Installation



1. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.
OR
Install automatic air vents at high points of system piping in mechanical equipment rooms only. Manual vents at heat-transfer coils and elsewhere as required for air venting.
2. Install piping from boiler air outlet, air separator, or air purger to expansion tank with a 2 percent upward slope toward tank.
3. Install in-line air separators in pump suction. Install drain valve on air separators NPS 2 (DN 50) and larger.
OR
Install tangential air separator in pump suction. Install blowdown piping with gate or full-port ball valve; extend full size to nearest floor drain.
4. Install bypass chemical feeders in each hydronic system where indicated, in upright position with top of funnel not more than 48 inches (1200 mm) above the floor. Install feeder in minimum NPS 3/4 (DN 20) bypass line, from main with full-size, full-port, ball valve in the main between bypass connections. Install NPS 3/4 (DN 20) pipe from chemical feeder drain, to nearest equipment drain and include a full-size, full-port, ball valve.
5. Install expansion tanks above the air separator. Install tank fitting in tank bottom and charge tank. Use manual vent for initial fill to establish proper water level in tank.
 - a. Install tank fittings that are shipped loose.
 - b. Support tank from floor or structure above with sufficient strength to carry weight of tank, piping connections, fittings, plus tank full of water. Do not overload building components and structural members.
OR
 Install expansion tanks on the floor. Vent and purge air from hydronic system, and ensure tank is properly charged with air to suit system Project requirements.

G. Terminal Equipment Connections

1. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.
2. Install control valves in accessible locations close to connected equipment.
3. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.
4. Install ports for pressure gages and thermometers at coil inlet and outlet connections according to Division 22 Section(s) "Meters And Gages For Plumbing Piping" OR Division 23 Section(s) "Meters And Gages For Hvac Piping".

H. Chemical Treatment

1. Perform an analysis of makeup water to determine type and quantities of chemical treatment needed to keep system free of scale, corrosion, and fouling, and to sustain the following water characteristics:
 - a. pH: 9.0 to 10.5.
 - b. "P" Alkalinity: 100 to 500 ppm.
 - c. Boron: 100 to 200 ppm.
 - d. Chemical Oxygen Demand: Maximum 100 ppm. Modify this value if closed system contains glycol.
 - e. Corrosion Inhibitor:
 - 1) Sodium Nitrate: 1000 to 1500 ppm.
 - 2) Molybdate: 200 to 300 ppm.
 - 3) Chromate: 200 to 300 ppm.
 - 4) Sodium Nitrate Plus Molybdate: 100 to 200 ppm each.
 - 5) Chromate Plus Molybdate: 50 to 100 ppm each.
 - f. Soluble Copper: Maximum 0.20 ppm.
 - g. Tolyriazole Copper and Yellow Metal Corrosion Inhibitor: Minimum 10 ppm.
 - h. Total Suspended Solids: Maximum 10 ppm.



- i. Ammonia: Maximum 20 ppm.
 - j. Free Caustic Alkalinity: Maximum 20 ppm.
 - k. Microbiological Limits:
 - 1) Total Aerobic Plate Count: Maximum 1000 organisms/ml.
 - 2) Total Anaerobic Plate Count: Maximum 100 organisms/ml.
 - 3) Nitrate Reducers: 100 organisms/ml.
 - 4) Sulfate Reducers: Maximum 0 organisms/ml.
 - 5) Iron Bacteria: Maximum 0 organisms/ml.
 2. Fill system with fresh water and add liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products from piping. Circulate solution for a minimum of 24 hours, drain, clean strainer screens, and refill with fresh water.
 3. Add initial chemical treatment and maintain water quality in ranges noted above for the first year of operation.
 4. Fill systems indicated to have antifreeze or glycol solutions with the following concentrations:
 - a. Hot-Water Heating Piping: Minimum percent ethylene, as directed by the Owner **OR** propylene, **as directed**, glycol.
 - b. Chilled-Water Piping: Minimum percent ethylene, as directed by the Owner **OR** propylene, **as directed**, glycol.
 - c. Dual-Temperature Heating and Cooling Water Piping: Minimum percent, as directed by the Owner ethylene **OR** propylene, **as directed**, glycol.
 - d. Glycol Cooling-Water Piping: Minimum percent ethylene, as directed by the Owner. **OR** propylene, **as directed**, glycol.
- I. Field Quality Control
1. Prepare hydronic piping according to ASME B31.9 and as follows:
 - a. Leave joints, including welds, uninsulated and exposed for examination during test.
 - b. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
 - c. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
 - d. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
 - e. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.
 2. Perform the following tests on hydronic piping:
 - a. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
 - b. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
 - c. Isolate expansion tanks and determine that hydronic system is full of water.
 - d. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
 - e. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
 - f. Prepare written report of testing.
 3. Perform the following before operating the system:
 - a. Open manual valves fully.
 - b. Inspect pumps for proper rotation.
 - c. Set makeup pressure-reducing valves for required system pressure.
 - d. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).



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- e. Set temperature controls so all coils are calling for full flow.
 - f. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
 - g. Verify lubrication of motors and bearings.

END OF SECTION 22 11 16 00c



SECTION 22 11 16 00d - STEAM AND CONDENSATE PIPING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for steam and condensate piping. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following for LP and HP steam and condensate piping:
 - a. Pipe and fittings.
 - b. Strainers.
 - c. Flash tanks.
 - d. Safety valves.
 - e. Pressure-reducing valves.
 - f. Steam traps.
 - g. Thermostatic air vents and vacuum breakers.
 - h. Steam and condensate meters.

C. Definitions

1. HP Systems: High-pressure piping operating at more than 15 psig (104 kPa) as required by ASME B31.1.
2. LP Systems: Low-pressure piping operating at 15 psig (104 kPa) or less as required by ASME B31.9.
3. RTRF: Reinforced thermosetting resin (fiberglass) fittings.
4. RTRP: Reinforced thermosetting resin (fiberglass) pipe.

D. Performance Requirements

1. Components and installation shall be capable of withstanding the following minimum working pressures and temperatures:
 - a. HP Steam Piping: <Insert psig (kPa).>
 - b. LP Steam Piping: <Insert psig (kPa).>
 - c. Condensate Piping: <Insert psig (kPa)> at 250 deg F (121 deg C).
 - d. Makeup-Water Piping: 80 psig (552 kPa) at 150 deg F (66 deg C).
 - e. Blowdown-Drain Piping: Equal to pressure of the piping system to which it is attached.
 - f. Air-Vent and Vacuum-Breaker Piping: Equal to pressure of the piping system to which it is attached.
 - g. Safety-Valve-Inlet and -Outlet Piping: Equal to pressure of the piping system to which it is attached.

E. Submittals

1. Product Data: For each type of the following:
 - a. RTRP and RTRF with adhesive.
 - b. Pressure-reducing and safety valve.
 - c. Steam trap.
 - d. Air vent and vacuum breaker.
 - e. Flash tank.
 - f. Meter.
2. Shop Drawings: Detail, 1/4 inch equals 1 foot (1:50) scale, flash tank assemblies and fabrication of pipe anchors, hangers, pipe, multiple pipes, alignment guides, and expansion joints and loops and their attachment to the building structure. Detail locations of anchors, alignment guides, and expansion joints and loops.



3. Welding certificates.
4. Field quality-control test reports.
5. Operation and Maintenance Data: For valves, safety valves, pressure-reducing valves, steam traps, air vents, vacuum breakers, and meters to include in emergency, operation, and maintenance manuals.

F. Quality Assurance

1. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code - Steel."
2. Pipe Welding: Qualify processes and operators according to the following:
 - a. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - b. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
3. ASME Compliance: Comply with ASME B31.1, "Power Piping" **AND/OR** ASME B31.9, "Building Services Piping", **as directed**, for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp flash tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

1.2 PRODUCTS

A. Copper Tube And Fittings

1. Drawn-Temper Copper Tubing: ASTM B 88, Type L (ASTM B 88M, Type B) **OR** ASTM B 88, Type M (ASTM B 88M, Type C), **as directed**.
2. Annealed-Temper Copper Tubing: ASTM B 88, Type K (ASTM B 88M, Type A).
3. Wrought-Copper Fittings and Unions: ASME B16.22.

B. Steel Pipe And Fittings

1. Steel Pipe: ASTM A 53/A 53M, black steel, plain ends, Type, Grade, and Schedule as indicated in Part 3 piping applications articles.
2. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125, 150, and 300 as indicated in Part 3 piping applications articles.
3. Malleable-Iron Threaded Fittings: ASME B16.3; Classes 150 and 300 as indicated in Part 3 piping applications articles.
4. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in Part 3 piping applications articles.
5. Cast-Iron Threaded Flanges and Flanged Fittings: ASME B16.1, Classes 125 and 250 as indicated in Part 3 piping applications articles; raised ground face, and bolt holes spot faced.
6. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.
7. Wrought-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
 - a. Material Group: 1.1.
 - b. End Connections: Butt welding.
 - c. Facings: Raised face.
8. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, black steel of same Type, Grade, and Schedule as pipe in which installed.
9. Stainless-Steel Bellows, Flexible Connectors:
 - a. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforced, protective jacket.
 - b. End Connections: Threaded or flanged to match equipment connected.
 - c. Performance: Capable of 3/4-inch (20-mm) misalignment.
 - d. CWP Rating: 150-psig (1035-kPa).
 - e. Maximum Operating Temperature: 250 deg F (121 deg C).

C. Fiberglass Pipe And Fittings



1. RTRP: ASTM D 2996 filament-wound pipe with tapered bell and spigot ends for adhesive joints.
2. RTRF: Compression or spray-up/contact molded fittings of same material, pressure class, and joining method as pipe.
3. Flanges: ASTM D 4024 full-face gaskets suitable for the service, minimum 1/8 inch (3.2 mm) thick, 60-70 durometer. ASTM A 307, Grade B, hex head bolts with washers.
4. Bonding Adhesive for Fiberglass Piping: As recommended by fiberglass piping manufacturer.

D. Joining Materials

1. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - a. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
 - 1) Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - 2) Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
3. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
4. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BA9-1, silver alloy for joining copper with bronze or steel.
5. Welding Filler Metals: Comply with AWS D10.12 (AWS D10.12M) for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
6. Welding Materials: Comply with Section II, Part C, of ASME Boiler and Pressure Vessel Code for welding materials appropriate for wall thickness and for chemical analysis of pipe being welded.

E. Dielectric Fittings

1. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
2. Insulating Material: Suitable for system fluid, pressure, and temperature.
3. Dielectric Unions:
 - a. Factory-fabricated union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).
4. Dielectric Flanges:
 - a. Factory-fabricated companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.
5. Dielectric-Flange Kits:
 - a. Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
 - b. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.

F. Valves

1. Gate, Globe, Check, Ball, and Butterfly Valves: Comply with requirements specified in Division 23 Section "General-duty Valves For Hvac Piping".
2. Stop-Check Valves:
 - a. Body and Bonnet: Malleable iron.
 - b. End Connections: Flanged.
 - c. Disc: Cylindrical with removable liner and machined seat.
 - d. Stem: Brass alloy.
 - e. Operator: Outside screw and yoke with cast-iron handwheel.
 - f. Packing: Polytetrafluoroethylene-impregnated packing with two-piece packing gland assembly.
 - g. Pressure Class: 250.

G. Strainers

1. Y-Pattern Strainers:



- a. Body: ASTM A 126, Class B cast iron, with bolted cover and bottom drain connection.
 - b. End Connections: Threaded ends for strainers NPS 2 (DN 50) and smaller; flanged ends for strainers NPS 2-1/2 (DN 65) and larger.
 - c. Strainer Screen: Stainless-steel, 20 mesh strainer, and perforated stainless-steel basket with 50 percent free area.
 - d. Tapped blowoff plug.
 - e. CWP Rating: 250-psig (1725-kPa) working steam pressure.
2. Basket Strainers:
- a. Body: ASTM A 126, Class B cast iron, with bolted cover and bottom drain connection.
 - b. End Connections: Threaded ends for strainers NPS 2 (DN 50) and smaller; flanged ends for strainers NPS 2-1/2 (DN 65) and larger.
 - c. Strainer Screen: Stainless-steel, 20 mesh strainer, and perforated stainless-steel basket with 50 percent free area.
 - d. CWP Rating: 250-psig (1725-kPa) working steam pressure.
- H. Flash Tanks
1. Shop or factory fabricated of welded steel according to ASME Boiler and Pressure Vessel Code, for 150-psig (1035-kPa) rating; and bearing ASME label. Fabricate with tappings for low-pressure steam and condensate outlets, high-pressure condensate inlet, air vent, safety valve, and legs.
- I. Safety Valves
1. Bronze **OR** Brass, **as directed**, Safety Valves:
 - a. Disc Material: Forged copper alloy.
 - b. End Connections: Threaded inlet and outlet.
 - c. Spring: Fully enclosed steel spring with adjustable pressure range and positive shutoff, factory set and sealed.
 - d. Pressure Class: 250.
 - e. Drip-Pan Elbow: Cast iron and having threaded inlet and outlet with threads complying with ASME B1.20.1.
 - f. Size and Capacity: As required for equipment according to ASME Boiler and Pressure Vessel Code.
 2. Cast-Iron Safety Valves:
 - a. Disc Material: Forged copper alloy with bronze nozzle.
 - b. End Connections: Raised-face flanged inlet and threaded or flanged outlet connections.
 - c. Spring: Fully enclosed cadmium-plated steel spring with adjustable pressure range and positive shutoff, factory set and sealed.
 - d. Pressure Class: 250.
 - e. Drip-Pan Elbow: Cast iron and having threaded inlet, outlet, and drain, with threads complying with ASME B1.20.1.
 - f. Exhaust Head: Cast iron and having threaded inlet and drain, with threads complying with ASME B1.20.1.
 - g. Size and Capacity: As required for equipment according to ASME Boiler and Pressure Vessel Code.
- J. Pressure-Reducing Valves
1. Size, Capacity, and Pressure Rating: Factory set for inlet and outlet pressures indicated.
 2. Description: Pilot-actuated, diaphragm type, with adjustable pressure range and positive shutoff.
 3. Body: Cast iron.
 4. End Connections: Threaded connections for valves NPS 2 (DN 50) and smaller and flanged connections for valves NPS 2-1/2 (DN 65) and larger.
 5. Trim: Hardened stainless steel.
 6. Head and Seat: Replaceable, main head stem guide fitted with flushing and pressure-arresting device cover over pilot diaphragm.
 7. Gaskets: Non-asbestos materials.



K. Steam Traps

1. Thermostatic Traps:
 - a. Body: Bronze angle-pattern body with integral union tailpiece and screw-in cap.
 - b. Trap Type: Balanced-pressure.
 - c. Bellows: Stainless steel or monel.
 - d. Head and Seat: Replaceable, hardened stainless steel.
 - e. Pressure Class: 125.
2. Thermodynamic Traps:
 - a. Body: Stainless steel with screw-in cap.
 - b. End Connections: Threaded.
 - c. Disc and Seat: Stainless steel.
 - d. Maximum Operating Pressure: 600 psig (4140 kPa).
3. Float and Thermostatic Traps:
 - a. Body and Bolted Cap: ASTM A 126, cast iron.
 - b. End Connections: Threaded.
 - c. Float Mechanism: Replaceable, stainless steel.
 - d. Head and Seat: Hardened stainless steel.
 - e. Trap Type: Balanced pressure.
 - f. Thermostatic Bellows: Stainless steel or monel.
 - g. Thermostatic air vent capable of withstanding 45 deg F (25 deg C) of superheat and resisting water hammer without sustaining damage.
 - h. Vacuum Breaker: Thermostatic with phosphor bronze bellows, and stainless steel cage, valve, and seat.
 - i. Maximum Operating Pressure: 125 psig (860 kPa).
4. Inverted Bucket Traps:
 - a. Body and Cap: Cast iron.
 - b. End Connections: Threaded.
 - c. Head and Seat: Stainless steel.
 - d. Valve Retainer, Lever, and Guide Pin Assembly: Stainless steel.
 - e. Bucket: Brass or stainless steel.
 - f. Strainer: Integral stainless-steel inlet strainer within the trap body.
 - g. Air Vent: Stainless-steel thermostatic vent.
 - h. Pressure Rating: 250 psig (1725 kPa).

L. Thermostatic Air Vents And Vacuum Breakers

1. Thermostatic Air Vents:
 - a. Body: Cast iron, bronze or stainless steel.
 - b. End Connections: Threaded.
 - c. Float, Valve, and Seat: Stainless steel.
 - d. Thermostatic Element: Phosphor bronze bellows in a stainless-steel cage.
 - e. Pressure Rating: 125 psig (861 kPa) **OR** 300 psig (2068 kPa), **as directed**.
 - f. Maximum Temperature Rating: 350 deg F (177 deg C).
2. Vacuum Breakers:
 - a. Body: Cast iron, bronze, or stainless steel.
 - b. End Connections: Threaded.
 - c. Sealing Ball, Retainer, Spring, and Screen: Stainless steel.
 - d. O-ring Seal: EPR.
 - e. Pressure Rating: 125 psig (861 kPa) **OR** 300 psig (2068 kPa), **as directed**.
 - f. Maximum Temperature Rating: 350 deg F (177 deg C).

M. Steam Meters

1. Meters shall have a microprocessor to display totalizer flow, flow rate, temperature, pressure, time, and date; alarms for high and low flow rate and temperature.
 - a. Computer shall have 4 to 20-mA or 2 to 10 volt output for temperature, pressure, and contact closure for flow increments.
 - b. Independent timers to store four peak flow rates and total flow.



- c. Interface compatible with central workstation described in Division 23 Section "Instrumentation And Control For Hvac".
 - d. Microprocessor Enclosure: NEMA 250, Type 4.
2. Sensor:
- a. Venturi, of stainless-steel **OR** carbon-steel, **as directed**, construction, for insertion in pipeline between flanges. At least 10:1 turndown with plus or minus 1 percent accuracy over full-flow range.
 - b. Vortex type with stainless-steel wetted parts and wafer **OR** flange, **as directed**, connections; and with a piezoelectric sensor removable and serviceable without shutting down the process. At least 10:1 turndown with plus or minus 1 percent accuracy over full-flow range.
 - c. Spring-loaded, variable-area flowmeter type; density compensated with stainless-steel wetted parts and wafer **OR** flange, **as directed**, connections. At least 10:1 turndown with plus or minus 2 percent accuracy over full-flow range.

N. Condensate Meters

- 1. Body: Cast iron, bronze, or brass.
- 2. Turbine: Copper, brass, or stainless steel.
- 3. Connections: Threaded for NPS 2 (DN 50) and smaller and flanged for NPS 2-1/2 (DN 65).
- 4. Totalizer: Meters shall have a microprocessor to display flow, flow rate, time, and date; alarms for high and low flow rate, pressure, and temperature.
 - a. Computer shall have 4- to 20-mA or 2- to 10-volt output for temperature, pressure, and contact closure for flow increments.
 - b. Independent timers to store four peak flow rates and total flow.
 - c. Interface compatible with central workstation specified in Division 23 Section "Instrumentation And Control For Hvac".
 - d. Microprocessor Enclosure: NEMA 250, Type 4.
- 5. Pressure Rating: Atmospheric.
- 6. Maximum Temperature Rating: 250 deg F (121 deg C).

1.3 EXECUTION

A. LP Steam Piping Applications

- 1. LP Steam Piping, NPS 2 (DN 50) and Smaller: Schedule 40 **OR** 80, **as directed**, Type S, Grade B, steel pipe; Class 125 cast-iron fittings; and threaded joints.
- 2. LP Steam Piping, NPS 2-1/2 through NPS 12 (DN 65 through DN 300): Schedule 40 **OR** 80, **as directed**, Type E, Grade B, steel pipe; Class 150 wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.
- 3. LP Steam Piping, NPS 14 through NPS 18 (DN 350 through DN 450): Schedule 30, Type E, Grade B, steel pipe; Class 150 wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.
- 4. LP Steam Piping, NPS 20 (DN 500) and Larger: Schedule 20, Type E, Grade B, steel pipe; Class 150 wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.
- 5. Condensate piping above grade, NPS 2 (DN 50) and smaller, shall be either of the following, **as directed**:
 - a. Schedule 80, Type S, Grade B, steel pipe; Class 125 cast-iron fittings; and threaded joints.
 - b. RTRP and RTRF with adhesive or flanged joints.
- 6. Condensate piping above grade, NPS 2-1/2 (DN 65) and larger, shall be either of the following, **as directed**:
 - a. Schedule 80, Type E, Grade B, steel pipe; Class 150 wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.
 - b. RTRP and RTRF with adhesive or flanged joints.
- 7. Condensate piping below grade, NPS 2 (DN 50) and smaller, shall be either of the following, **as directed**:



- a. Schedule 80, Type S, Grade B, steel pipe; Class 125 cast-iron fittings; and threaded joints.
 - b. RTRP and RTRF with adhesive or flanged joints.
 8. Condensate piping below grade, NPS 2-1/2 (DN 65) and larger, shall be either of the following, **as directed**:
 - a. Schedule 80, Type E, Grade B, steel pipe; Class 150 wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.
 - b. RTRP and RTRF with adhesive or flanged joints.
- B. HP Steam Piping Applications
 1. HP Steam Piping, NPS 2 (DN 50) and Smaller: Schedule 40 **OR** 80, **as directed**, Type S, Grade B, steel pipe; Class 125 cast-iron fittings; and threaded joints.
 2. HP Steam Piping, NPS 2-1/2 through NPS 12 (DN 65 through DN 300): Schedule 40 **OR** 80, **as directed**, Type E, Grade B, steel pipe; Class 150 wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.
 3. HP Steam Piping, NPS 14 through NPS 18 (DN 350 through DN 450): Schedule 30, Type E, Grade B, steel pipe; Class 150 wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.
 4. HP Steam Piping, NPS 20 (DN 500) and Larger: Schedule 20, Type E, Grade B, steel pipe; Class 150 wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.
 5. Condensate piping above grade, NPS 2 (DN 50) and smaller, shall be either of the following, **as directed**:
 - a. Schedule 80, Type S, Grade B, steel pipe; Class 125 cast-iron fittings; and threaded joints.
 - b. RTRP and RTRF with adhesive or flanged joints.
 6. Condensate piping above grade, NPS 2-1/2 (DN 65) and larger, shall be either of the following, **as directed**:
 - a. Schedule 80, Type E, Grade B, steel pipe; Class 150 wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.
 - b. RTRP and RTRF with adhesive or flanged joints.
 7. Condensate piping below grade, NPS 2 (DN 50) and smaller, shall be either of the following, **as directed**:
 - a. Schedule 80, Type S, Grade B, steel pipe; Class 125 cast-iron fittings; and threaded joints.
 - b. RTRP and RTRF with adhesive or flanged joints.
 8. Condensate piping below grade, NPS 2-1/2 (DN 65) and larger, shall be either of the following, **as directed**:
 - a. Schedule 80, Type E, Grade B, steel pipe; Class 150 wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.
 - b. RTRP and RTRF with adhesive or flanged joints.
- C. Ancillary Piping Applications
 1. Makeup-water piping installed above grade shall be either of the following, **as directed**:
 - a. Drawn-temper copper tubing, wrought-copper fittings, and soldered **OR** brazed, **as directed**, joints.
 - b. Schedule 40 **OR** 80, **as directed**, CPVC plastic pipe and fittings, and solvent welded joints.
 2. Makeup-Water Piping Installed below Grade and within Slabs: Annealed-temper copper tubing, wrought-copper fittings, and soldered joints. Use the fewest possible joints.
 3. Blowdown-Drain Piping: Same materials and joining methods as for piping specified for the service in which blowdown drain is installed.
 4. Air-Vent Piping:
 - a. Inlet: Same as service where installed.
 - b. Outlet: Type K (A) annealed-temper copper tubing with soldered or flared joints.
 5. Vacuum-Breaker Piping: Outlet, same as service where installed.
 6. Safety-Valve-Inlet and -Outlet Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed.
- D. Valve Applications



1. Install shutoff duty valves at branch connections to steam supply mains, at steam supply connections to equipment, and at the outlet of steam traps.
2. Install safety valves on pressure-reducing stations and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install safety-valve discharge piping, without valves, to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

E. Piping Installation

1. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Use indicated piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
2. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
3. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
4. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
5. Install piping to permit valve servicing.
6. Install piping free of sags and bends.
7. Install fittings for changes in direction and branch connections.
8. Install piping to allow application of insulation.
9. Select system components with pressure rating equal to or greater than system operating pressure.
10. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
11. Install drains, consisting of a tee fitting, NPS 3/4 (DN 20) full port-ball valve, and short NPS 3/4 (DN 20) threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
12. Install steam supply piping at a minimum uniform grade of 0.2 percent downward in direction of steam flow.
13. Install condensate return piping at a minimum uniform grade of 0.4 percent downward in direction of condensate flow.
14. Reduce pipe sizes using eccentric reducer fitting installed with level side down.
15. Install branch connections to mains using mechanically formed, **as directed**, tee fittings in main pipe, with the branch connected to top of main pipe.
16. Install valves according to Division 23 Section "General-duty Valves For Hvac Piping".
17. Install unions in piping, NPS 2 (DN 50) and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
18. Install flanges in piping, NPS 2-1/2 (DN 65) and larger, at final connections of equipment and elsewhere as indicated.
19. Install strainers on supply side of control valves, pressure-reducing valves, traps, and elsewhere as indicated. Install NPS 3/4 (DN 20) nipple and full port ball valve in blowdown connection of strainers NPS 2 (DN 50) and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2 (DN 50).
20. Install expansion loops, expansion joints, anchors, and pipe alignment guides as specified in Division 23 Section "Expansion Fittings And Loops For Hvac Piping".
21. Identify piping as specified in Division 23 Section "Identification For Hvac Piping And Equipment".
22. Install drip legs at low points and natural drainage points such as ends of mains, bottoms of risers, and ahead of pressure regulators, and control valves.
 - a. On straight runs with no natural drainage points, install drip legs at intervals not exceeding 300 feet (90 m).
 - b. Size drip legs same size as main. In steam mains NPS 6 (DN 150) and larger, drip leg size can be reduced, but to no less than NPS 4 (DN 100).
23. Flash Tank:



- a. Pitch condensate piping down toward flash tank.
 - b. If more than one condensate pipe discharges into flash tank, install a check valve in each line.
 - c. Install thermostatic air vent at tank top.
 - d. Install safety valve at tank top.
 - e. Install full-port ball valve, and swing check valve on condensate outlet.
 - f. Install inverted bucket or float and thermostatic trap at low-pressure condensate outlet, sized for three times the calculated heat load.
 - g. Install pressure gage on low-pressure steam outlet according to Division 23 Section "Meters And Gages For Hvac Piping".
- F. Steam-Trap Installation
1. Install steam traps in accessible locations as close as possible to connected equipment.
 2. Install full-port ball valve, strainer, and union upstream from trap; install union, check valve, and full-port ball valve downstream from trap unless otherwise indicated.
- G. Pressure-Reducing Valve Installation
1. Install pressure-reducing valves in accessible location for maintenance and inspection.
 2. Install bypass piping around pressure-reducing valves, with globe valve equal in size to area of pressure-reducing valve seat ring, unless otherwise indicated.
 3. Install gate valves on both sides of pressure-reducing valves.
 4. Install unions or flanges on both sides of pressure-reducing valves having threaded- or flanged-end connections respectively.
 5. Install pressure gages on low-pressure side of pressure-reducing valves after the bypass connection according to Division 23 Section "Meters And Gages For Hvac Piping".
 6. Install strainers upstream for pressure-reducing valve.
 7. Install safety valve downstream from pressure-reducing valve station.
- H. Steam Or Condensate Meter Installation
1. Install meters with lengths of straight pipe upstream and downstream according to steam meter manufacturer's instructions.
 2. Provide data acquisition wiring. Refer to Division 23 Section "Instrumentation And Control For Hvac".
- I. Safety Valve Installation
1. Install safety valves according to ASME B31.1, "Power Piping" **OR** ASME B31.9, "Building Services Piping," **as directed**
 2. Pipe safety-valve discharge without valves to atmosphere outside the building.
 3. Install drip-pan elbow fitting adjacent to safety valve and pipe drain connection to nearest floor drain.
 4. Install exhaust head with drain to waste, on vents equal to or larger than NPS 2-1/2 (DN 65).
- J. Hangers And Supports
1. Install hangers and supports according to Division 23 Section "Hangers And Supports For Hvac Piping And Equipment". Comply with requirements below for maximum spacing.
 2. Seismic restraints are specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 3. Install the following pipe attachments:
 - a. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet (6 m) long.
 - b. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet (6 m) or longer.
 - c. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet (6 m) or longer, supported on a trapeze.
 - d. Spring hangers to support vertical runs.
 4. Install hangers with the following maximum spacing and minimum rod sizes:
 - a. NPS 3/4 (DN 20): Maximum span, 9 feet (2.7 m); minimum rod size, 1/4 inch (6.4 mm).



- b. NPS 1 (DN 25): Maximum span, 9 feet (2.7 m); minimum rod size, 1/4 inch (6.4 mm).
 - c. NPS 1-1/2 (DN 40): Maximum span, 12 feet (3.7 m); minimum rod size, 3/8 inch (10 mm).
 - d. NPS 2 (DN 50): Maximum span, 13 feet (4 m); minimum rod size, 3/8 inch (10 mm).
 - e. NPS 2-1/2 (DN 65): Maximum span, 14 feet (4.3 m); minimum rod size, 3/8 inch (10 mm).
 - f. NPS 3 (DN 80): Maximum span, 15 feet (4.6 m); minimum rod size, 3/8 inch (10 mm).
 - g. NPS 4 (DN 100): Maximum span, 17 feet (5.2 m); minimum rod size, 1/2 inch (13 mm).
 - h. NPS 6 (DN 150): Maximum span, 21 feet (6.4 m); minimum rod size, 1/2 inch (13 mm).
 - i. NPS 8 (DN 200): Maximum span, 24 feet (7.3 m); minimum rod size, 5/8 inch (16 mm).
 - j. NPS 10 (DN 250): Maximum span, 26 feet (8 m); minimum rod size, 3/4 inch (19 mm).
 - k. NPS 12 (DN 300): Maximum span, 30 feet (9.1 m); minimum rod size, 7/8 inch (22 mm).
 - l. NPS 14 (DN 350): Maximum span, 32 feet (9.8 m); minimum rod size, 1 inch (25 mm).
 - m. NPS 16 (DN 400): Maximum span, 35 feet (10.7 m); minimum rod size, 1 inch (25 mm).
 - n. NPS 18 (DN 450): Maximum span, 37 feet (11.3 m); minimum rod size, 1-1/4 inches (32 mm).
 - o. NPS 20 (DN 500): Maximum span, 39 feet (11.9 m); minimum rod size, 1-1/4 inches (32 mm).
5. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:
 - a. NPS 1/2 (DN 15): Maximum span, 4 feet (1.2 m); minimum rod size, 1/4 inch (6.4 mm).
 - b. NPS 3/4 (DN 20): Maximum span, 5 feet (1.5 m); minimum rod size, 1/4 inch (6.4 mm).
 - c. NPS 1 (DN 25): Maximum span, 6 feet (1.8 m); minimum rod size, 1/4 inch (6.4 mm).
 - d. NPS 1-1/2 (DN 40): Maximum span, 8 feet (2.4 m); minimum rod size, 3/8 inch (10 mm).
 - e. NPS 2 (DN 50): Maximum span, 8 feet (2.4 m); minimum rod size, 3/8 inch (10 mm).
 - f. NPS 2-1/2 (DN 65): Maximum span, 9 feet (2.7 m); minimum rod size, 3/8 inch (10 mm).
 - g. NPS 3 (DN 80): Maximum span, 10 feet (3 m); minimum rod size, 3/8 inch (10 mm).
 6. Support vertical runs at roof, at each floor, and at 10-foot (3-m) intervals between floors.
 7. Fiberglass Piping Hanger Spacing: Space hangers according to pipe manufacturer's written instructions for service conditions. Avoid point loading. Space and install hangers with the fewest practical rigid anchor points.
- K. Pipe Joint Construction
1. Join pipe and fittings according to the following requirements and Division 21 specifying piping systems.
 2. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
 3. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
 4. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube ends. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
 5. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
 6. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
 7. Welded Joints: Construct joints according to AWS D10.12 (AWS D10.12M), using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
 8. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
 9. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.
- L. Terminal Equipment Connections



1. Size for supply and return piping connections shall be the same as or larger than equipment connections.
2. Install traps and control valves in accessible locations close to connected equipment.
3. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.
4. Install vacuum breakers downstream from control valve, close to coil inlet connection.
5. Install a drip leg at coil outlet.

M. Field Quality Control

1. Prepare steam and condensate piping according to ASME B31.1, "Power Piping" **AND/OR** ASME B31.9, "Building Services Piping," **as directed**, and as follows:
 - a. Leave joints, including welds, uninsulated and exposed for examination during test.
 - b. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
 - c. Flush system with clean water. Clean strainers.
 - d. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
2. Perform the following tests on steam and condensate piping:
 - a. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
 - b. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength.
 - c. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
3. Prepare written report of testing.

END OF SECTION 22 11 16 00d



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SECTION 22 11 16 00e - REFRIGERANT PIPING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for refrigerant piping. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes refrigerant piping used for air-conditioning applications.

C. Performance Requirements

1. Line Test Pressure for Refrigerant R-134a:
 - a. Suction Lines for Air-Conditioning Applications: 115 psig (793 kPa).
 - b. Suction Lines for Heat-Pump Applications: 225 psig (1551 kPa).
 - c. Hot-Gas and Liquid Lines: 225 psig (1551 kPa).
2. Line Test Pressure for Refrigerant R-407C:
 - a. Suction Lines for Air-Conditioning Applications: 230 psig (1586 kPa).
 - b. Suction Lines for Heat-Pump Applications: 380 psig (2620 kPa).
 - c. Hot-Gas and Liquid Lines: 380 psig (2620 kPa).
3. Line Test Pressure for Refrigerant R-410A:
 - a. Suction Lines for Air-Conditioning Applications: 300 psig (2068 kPa).
 - b. Suction Lines for Heat-Pump Applications: 535 psig (3689 kPa).
 - c. Hot-Gas and Liquid Lines: 535 psig (3689 kPa).

D. Submittals

1. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop, based on manufacturer's test data, for the following:
 - a. Thermostatic expansion valves.
 - b. Solenoid valves.
 - c. Hot-gas bypass valves.
 - d. Filter dryers.
 - e. Strainers.
 - f. Pressure-regulating valves.
2. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.
 - a. Shop Drawing Scale: 1/4 inch equals 1 foot (1:50).
 - b. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.
3. Welding certificates.
4. Field quality-control test reports.
5. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

E. Quality Assurance

1. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."



2. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
3. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

F. Product Storage And Handling

1. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

1.2 PRODUCTS

A. Copper Tube And Fittings

1. Copper Tube: ASTM B 88, Type K or L (ASTM B 88M, Type A or B) **OR** ASTM B 280, Type ACR, **as directed**.
2. Wrought-Copper Fittings: ASME B16.22.
3. Wrought-Copper Unions: ASME B16.22.
4. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.
5. Brazing Filler Metals: AWS A5.8.
6. Flexible Connectors:
 - a. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
 - b. End Connections: Socket ends.
 - c. Offset Performance: Capable of minimum 3/4-inch (20-mm) misalignment in minimum 7-inch- (180-mm-) long assembly.
 - d. Pressure Rating: Factory test at minimum 500 psig (3450 kPa).
 - e. Maximum Operating Temperature: 250 deg F (121 deg C).

B. Steel Pipe And Fittings

1. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; Type, Grade, and wall thickness as selected in Part 3 piping applications articles.
2. Wrought-Steel Fittings: ASTM A 234/A 234M, for welded joints.
3. Steel Flanges and Flanged Fittings: ASME B16.5, steel, including bolts, nuts, and gaskets, bevel-welded end connection, and raised face.
4. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
5. Flanged Unions:
 - a. Body: Forged-steel flanges for NPS 1 to NPS 1-1/2 (DN 25 to DN 40) and ductile iron for NPS 2 to NPS 3 (DN 50 to DN 80). Apply rust-resistant finish at factory.
 - b. Gasket: Fiber asbestos free.
 - c. Fasteners: Four plated-steel bolts, with silicon bronze nuts. Apply rust-resistant finish at factory.
 - d. End Connections: Brass tailpiece adapters for solder-end connections to copper tubing.
 - e. Offset Performance: Capable of minimum 3/4-inch (20-mm) misalignment in minimum 7-inch- (180-mm-) long assembly.
 - f. Pressure Rating: Factory test at minimum 400 psig (2760 kPa).
 - g. Maximum Operating Temperature: 330 deg F (165 deg C).
6. Flexible Connectors:
 - a. Body: Stainless-steel bellows with woven, flexible, stainless-steel-wire-reinforced protective jacket
 - b. End Connections:
 - 1) NPS 2 (DN 50) and Smaller: With threaded-end connections.
 - 2) NPS 2-1/2 (DN 65) and Larger: With flanged-end connections.
 - c. Offset Performance: Capable of minimum 3/4-inch (20-mm) misalignment in minimum 7-inch- (180-mm-) long assembly.
 - d. Pressure Rating: Factory test at minimum 500 psig (3450 kPa).



- e. Maximum Operating Temperature: 250 deg F (121 deg C).

C. Valves And Specialties

1. Diaphragm Packless Valves:
 - a. Body and Bonnet: Forged brass or cast bronze; globe design with straight-through or angle pattern.
 - b. Diaphragm: Phosphor bronze and stainless steel with stainless-steel spring.
 - c. Operator: Rising stem and hand wheel.
 - d. Seat: Nylon.
 - e. End Connections: Socket, union, or flanged.
 - f. Working Pressure Rating: 500 psig (3450 kPa).
 - g. Maximum Operating Temperature: 275 deg F (135 deg C).
2. Packed-Angle Valves:
 - a. Body and Bonnet: Forged brass or cast bronze.
 - b. Packing: Molded stem, back seating, and replaceable under pressure.
 - c. Operator: Rising stem.
 - d. Seat: Nonrotating, self-aligning polytetrafluoroethylene.
 - e. Seal Cap: Forged-brass or valox hex cap.
 - f. End Connections: Socket, union, threaded, or flanged.
 - g. Working Pressure Rating: 500 psig (3450 kPa).
 - h. Maximum Operating Temperature: 275 deg F (135 deg C).
3. Check Valves:
 - a. Body: Ductile iron, forged brass, or cast bronze; globe pattern.
 - b. Bonnet: Bolted ductile iron, forged brass, or cast bronze; or brass hex plug.
 - c. Piston: Removable polytetrafluoroethylene seat.
 - d. Closing Spring: Stainless steel.
 - e. Manual Opening Stem: Seal cap, plated-steel stem, and graphite seal.
 - f. End Connections: Socket, union, threaded, or flanged.
 - g. Maximum Opening Pressure: 0.50 psig (3.4 kPa).
 - h. Working Pressure Rating: 500 psig (3450 kPa).
 - i. Maximum Operating Temperature: 275 deg F (135 deg C).
4. Service Valves:
 - a. Body: Forged brass with brass cap including key end to remove core.
 - b. Core: Removable ball-type check valve with stainless-steel spring.
 - c. Seat: Polytetrafluoroethylene.
 - d. End Connections: Copper spring.
 - e. Working Pressure Rating: 500 psig (3450 kPa).
5. Solenoid Valves: Comply with ARI 760 and UL 429; listed and labeled by an NRTL.
 - a. Body and Bonnet: Plated steel.
 - b. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
 - c. Seat: Polytetrafluoroethylene.
 - d. End Connections: Threaded.
 - e. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch (16-GRC) conduit adapter, and 24 **OR** 115 **OR** 208, **as directed**, -V ac coil.
 - f. Working Pressure Rating: 400 psig (2760 kPa).
 - g. Maximum Operating Temperature: 240 deg F (116 deg C).
 - h. Manual operator.
6. Safety Relief Valves: Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
 - a. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.
 - b. Piston, Closing Spring, and Seat Insert: Stainless steel.
 - c. Seat Disc: Polytetrafluoroethylene.
 - d. End Connections: Threaded.
 - e. Working Pressure Rating: 400 psig (2760 kPa).
 - f. Maximum Operating Temperature: 240 deg F (116 deg C).
7. Thermostatic Expansion Valves: Comply with ARI 750.



- a. Body, Bonnet, and Seal Cap: Forged brass or steel.
 - b. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
 - c. Packing and Gaskets: Non-asbestos.
 - d. Capillary and Bulb: Copper tubing filled with refrigerant charge.
 - e. Suction Temperature: 40 deg F (4.4 deg C).
 - f. Superheat: Adjustable **OR** Nonadjustable, **as directed**.
 - g. Reverse-flow option (for heat-pump applications).
 - h. End Connections: Socket, flare, or threaded union.
 - i. Working Pressure Rating: 700 psig (4820 kPa) **OR** 450 psig (3100 kPa), **as directed**.
8. Hot-Gas Bypass Valves: Comply with UL 429; listed and labeled by an NRTL.
- a. Body, Bonnet, and Seal Cap: Ductile iron or steel.
 - b. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
 - c. Packing and Gaskets: Non-asbestos.
 - d. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
 - e. Seat: Polytetrafluoroethylene.
 - f. Equalizer: Internal **OR** External, **as directed**.
 - g. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch (16-GRC) conduit adapter, and 24 **OR** 115 **OR** 208, **as directed**, -V ac coil.
 - h. End Connections: Socket.
 - i. Set Pressure: as directed by the Owner.
 - j. Throttling Range: Maximum 5 psig (34 kPa).
 - k. Working Pressure Rating: 500 psig (3450 kPa).
 - l. Maximum Operating Temperature: 240 deg F (116 deg C).
9. Straight-Type Strainers:
- a. Body: Welded steel with corrosion-resistant coating.
 - b. Screen: 100-mesh stainless steel.
 - c. End Connections: Socket or flare.
 - d. Working Pressure Rating: 500 psig (3450 kPa).
 - e. Maximum Operating Temperature: 275 deg F (135 deg C).
10. Angle-Type Strainers:
- a. Body: Forged brass or cast bronze.
 - b. Drain Plug: Brass hex plug.
 - c. Screen: 100-mesh monel.
 - d. End Connections: Socket or flare.
 - e. Working Pressure Rating: 500 psig (3450 kPa).
 - f. Maximum Operating Temperature: 275 deg F (135 deg C).
11. Moisture/Liquid Indicators:
- a. Body: Forged brass.
 - b. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
 - c. Indicator: Color coded to show moisture content in ppm.
 - d. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
 - e. End Connections: Socket or flare.
 - f. Working Pressure Rating: 500 psig (3450 kPa).
 - g. Maximum Operating Temperature: 240 deg F (116 deg C).
12. Replaceable-Core Filter Dryers: Comply with ARI 730.
- a. Body and Cover: Painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets.
 - b. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
 - c. Desiccant Media: Activated alumina **OR** charcoal, **as directed**.
 - d. Designed for reverse flow (for heat-pump applications).
 - e. End Connections: Socket.
 - f. Access Ports: NPS 1/4 (DN 8) connections at entering and leaving sides for pressure differential measurement.
 - g. Maximum Pressure Loss: 2 psig (14 kPa).



- h. Rated Flow: as directed by the Owner.
 - i. Working Pressure Rating: 500 psig (3450 kPa).
 - j. Maximum Operating Temperature: 240 deg F (116 deg C).
13. Permanent Filter Dryers: Comply with ARI 730.
- a. Body and Cover: Painted-steel shell.
 - b. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
 - c. Desiccant Media: Activated alumina **OR** charcoal, **as directed**.
 - d. Designed for reverse flow (for heat-pump applications).
 - e. End Connections: Socket.
 - f. Access Ports: NPS 1/4 (DN 8) connections at entering and leaving sides for pressure differential measurement.
 - g. Maximum Pressure Loss: 2 psig (14 kPa).
 - h. Rated Flow: as directed by the Owner.
 - i. Working Pressure Rating: 500 psig (3450 kPa).
 - j. Maximum Operating Temperature: 240 deg F (116 deg C).
14. Mufflers:
- a. Body: Welded steel with corrosion-resistant coating.
 - b. End Connections: Socket or flare.
 - c. Working Pressure Rating: 500 psig (3450 kPa).
 - d. Maximum Operating Temperature: 275 deg F (135 deg C).
15. Receivers: Comply with ARI 495.
- a. Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
 - b. Comply with UL 207; listed and labeled by an NRTL.
 - c. Body: Welded steel with corrosion-resistant coating.
 - d. Tappings: Inlet, outlet, liquid level indicator, and safety relief valve.
 - e. End Connections: Socket or threaded.
 - f. Working Pressure Rating: 500 psig (3450 kPa).
 - g. Maximum Operating Temperature: 275 deg F (135 deg C).
16. Liquid Accumulators: Comply with ARI 495.
- a. Body: Welded steel with corrosion-resistant coating.
 - b. End Connections: Socket or threaded.
 - c. Working Pressure Rating: 500 psig (3450 kPa).
 - d. Maximum Operating Temperature: 275 deg F (135 deg C).
- D. Refrigerants
- 1. ASHRAE 34, R-134a: Tetrafluoroethane.
 - 2. ASHRAE 34, R-407C: Difluoromethane/Pentafluoroethane/1,1,1,2-Tetrafluoroethane.
 - 3. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

1.3 EXECUTION

A. Piping Applications For Refrigerant R-134a

- 1. Suction Lines NPS 1-1/2 (DN 40) and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed **OR** soldered, **as directed**, joints.
OR
Suction Lines NPS 4 (DN 100) and Smaller **OR** NPS 2 to NPS 4 (DN 50 to DN 100), **as directed**, for Conventional Air-Conditioning Applications: Copper, Type ACR **OR** L (B), **as directed**, drawn-temper tubing and wrought-copper fittings with brazed **OR** soldered, **as directed**, joints.
- 2. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications, **as directed**: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed **OR** soldered, **as directed**, joints.
OR



Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications, **as directed**: Copper, Type ACR **OR** K (A) **OR** L (B), **as directed**, drawn-temper tubing and wrought-copper fittings with soldered joints.

OR

Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications, **as directed**:

a. NPS 1-1/2 (DN 40) and Smaller: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed **OR** soldered, **as directed**, joints.

OR

NPS 1-1/2 (DN 40) and Smaller: Copper, Type ACR **OR** K (A) **OR** L (B), **as directed**, drawn-temper tubing and wrought-copper fittings with brazed **OR** soldered, **as directed**, joints.

b. NPS 4 (DN 100): Copper, Type ACR **OR** K (A) **OR** L (B), **as directed**, drawn-temper tubing and wrought-copper fittings with brazed **OR** soldered, **as directed**, joints.

3. Safety-Relief-Valve Discharge Piping: Schedule 40, black-steel and wrought-steel fittings with welded joints.

OR

Safety-Relief-Valve Discharge Piping: Copper, Type ACR **OR** K (A) **OR** L (B), **as directed**, drawn-temper tubing and wrought-copper fittings with soldered joints.

OR

Safety-Relief-Valve Discharge Piping:

a. NPS 1-1/2 (DN 40) and Smaller: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed **OR** soldered, **as directed**, joints.

OR

NPS 1-1/2 (DN 40) and Smaller: Copper, Type ACR **OR** L (B), **as directed**, drawn-temper tubing and wrought-copper fittings with brazed **OR** soldered, **as directed**, joints.

b. NPS 4 (DN 100): Copper, Type ACR **OR** K (A) **OR** L (B), **as directed**, drawn-temper tubing and wrought-copper fittings with brazed **OR** soldered, **as directed**, joints.

B. Piping Applications For Refrigerant R-407c

1. Suction Lines NPS 1-1/2 (DN 40) and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings

OR

Suction Lines NPS 4 (DN 100) and Smaller **OR** NPS 2 to NPS 4 (DN 50 to DN 100), **as directed**, for Conventional Air-Conditioning Applications: Copper, Type ACR **OR** L (B), **as directed**, drawn-temper tubing and wrought-copper fittings with brazed **OR** soldered, **as directed**, joints.

2. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications, **as directed**: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed **OR** soldered, **as directed**, joints.

OR

Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications, **as directed**: Copper, Type ACR **OR** K (A) **OR** L (B), **as directed**, drawn-temper tubing and wrought-copper fittings with soldered joints.

OR

Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications, **as directed**:

a. NPS 1 (DN 25) and Smaller: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed **OR** soldered, **as directed**, joints.

OR

NPS 1 (DN 25) and Smaller: Copper, Type ACR **OR** L (B), **as directed**, drawn-temper tubing and wrought-copper fittings with brazed **OR** soldered, **as directed**, joints.

b. NPS 1-1/4 to NPS 2 (DN 32 to DN 50): Copper, Type K (A), annealed- or drawn-temper tubing and wrought-copper fittings with brazed **OR** soldered, **as directed**, joints.

c. NPS 4 (DN 100): Copper, Type ACR **OR** K (A) **OR** L (B), **as directed**, drawn-temper tubing and wrought-copper fittings with soldered joints.

3. Safety-Relief-Valve Discharge Piping: Schedule 40, black-steel and wrought-steel fittings with welded joints.

**OR**

Safety-Relief-Valve Discharge Piping: Copper, Type ACR **OR** K (A) **OR** L (B), **as directed**, drawn-temper tubing and wrought-copper fittings with soldered joints.

OR

Safety-Relief-Valve Discharge Piping:

- a. NPS 1 (DN 25) and Smaller: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed **OR** soldered joints.

OR

NPS 1 (DN 25) and Smaller: Copper, Type ACR **OR** L (B), **as directed**, drawn-temper tubing and wrought-copper fittings with brazed **OR** soldered, **as directed**, joints.

- b. NPS 1-1/4 to NPS 2 (DN 32 to DN 50): Copper, Type K (A), annealed- or drawn-temper tubing and wrought-copper fittings with brazed **OR** soldered, **as directed**, joints.
- c. NPS 4 (DN 100): Copper, Type ACR **OR** K (A) **OR** L (B), **as directed**, drawn-temper tubing and wrought-copper fittings with soldered joints.

C. Piping Applications For Refrigerant R-410a

1. Suction Lines NPS 1-1/2 (DN 40) and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed **OR** soldered, **as directed**, joints.

OR

Suction Lines NPS 3-1/2 (DN 90) and Smaller **OR** NPS 2 to NPS 3-1/2 (DN 50 to DN 90), **as directed**, for Conventional Air-Conditioning Applications: Copper, Type ACR **OR** L (B), **as directed**, drawn-temper tubing and wrought-copper fittings with brazed **OR** soldered, **as directed**, joints.

OR

Suction Lines NPS 4 (DN 100) and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR **OR** K (A) **OR** L (B), **as directed**, drawn-temper tubing and wrought-copper fittings with soldered joints.

2. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications, **as directed**: Copper, Type ACR **OR** L (B), **as directed**, annealed- or drawn-temper tubing and wrought-copper fittings with brazed **OR** soldered, **as directed**, joints.

OR

Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications, **as directed** Copper, Type K (A), annealed- or drawn-temper tubing and wrought-copper fittings with brazed **OR** soldered, **as directed**, joints.

OR

Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications, **as directed**: Copper, Type ACR **OR** K (A) **OR** L (B), **as directed**, drawn-temper tubing and wrought-copper fittings with 95-5 tin-antimony soldered joints.

OR

Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications, **as directed**: Copper, Type ACR **OR** K (A) **OR** L (B), **as directed**, drawn-temper tubing and wrought-copper fittings with Alloy HB soldered joints.

OR

Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications, **as directed**:

- a. NPS 5/8 (DN 18) and Smaller: Copper, Type ACR **OR** L (B), **as directed**, annealed- or drawn-temper tubing and wrought-copper fittings with brazed **OR** soldered, **as directed**, joints.
- b. NPS 3/4 to NPS 1 (DN 20 to DN 25) and Smaller: Copper, Type K (A), annealed- or drawn-temper tubing and wrought-copper fittings with brazed **OR** soldered, **as directed**, joints.
- c. NPS 1-1/4 (DN 32) and Smaller: Copper, Type ACR **OR** K (A) **OR** L (B), **as directed**, drawn-temper tubing and wrought-copper fittings with 95-5 tin-antimony soldered joints.
- d. NPS 1-1/2 to NPS 2 (DN 40 to DN 50): Copper, Type ACR **OR** K (A) **OR** L (B), **as directed**, drawn-temper tubing and wrought-copper fittings with Alloy HB soldered joints.

OR



- Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications, **as directed**, NPS 2 to NPS 4 (DN 50 to DN 100): Schedule 40, black-steel and wrought-steel fittings with welded joints.
3. Safety-Relief-Valve Discharge Piping: Copper, Type ACR **OR** L (B), **as directed**, annealed- or drawn-temper tubing and wrought-copper fittings with brazed **OR** soldered, **as directed**, joints.
OR
 Safety-Relief-Valve Discharge Piping: Copper, Type K (A), annealed- or drawn-temper tubing and wrought-copper fittings with brazed **OR** soldered, **as directed**, joints.
OR
 Safety-Relief-Valve Discharge Piping: Copper, Type ACR **OR** K (A) **OR** L (B), **as directed**, drawn-temper tubing and wrought-copper fittings with 95-5 tin-antimony soldered joints.
OR
 Safety-Relief-Valve Discharge Piping: Copper, Type ACR **OR** K (A) **OR** L (B), **as directed**, drawn-temper tubing and wrought-copper fittings with Alloy HB soldered joints.
OR
 Safety-Relief-Valve Discharge Piping:
 - a. NPS 5/8 (DN 18) and Smaller: Copper, Type ACR **OR** L (B), **as directed**, annealed- or drawn-temper tubing and wrought-copper fittings with brazed **OR** soldered, **as directed**, joints.
 - b. NPS 3/4 to NPS 1 (DN 20 to DN 25) and Smaller: Copper, Type K (A), annealed- or drawn-temper tubing and wrought-copper fittings with brazed **OR** soldered, **as directed**, joints.
 - c. NPS 1-1/4 (DN 32) and Smaller: Copper, Type ACR **OR** K (A) **OR** L (B), **as directed**, drawn-temper tubing and wrought-copper fittings with 95-5 tin-antimony soldered joints.
 - d. NPS 1-1/2 to NPS 2 (DN 40 to DN 50): Copper, Type ACR **OR** K (A) **OR** L (B), **as directed**, drawn-temper tubing and wrought-copper fittings with Alloy HB soldered joints.**OR**
 Safety-Relief-Valve Discharge Piping NPS 2 to NPS 4 (DN 50 to DN 100): Schedule 40, black-steel and wrought-steel fittings with welded joints.
- D. Valve And Specialty Applications
1. Install diaphragm packless **OR** packed-angle, **as directed**, valves in suction and discharge lines of compressor.
 2. Install service valves for gage taps at inlet and outlet of hot-gas bypass valves and strainers if they are not an integral part of valves and strainers.
 3. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.
 4. Except as otherwise indicated, install diaphragm packless **OR** packed-angle, **as directed**, valves on inlet and outlet side of filter dryers.
 5. Install a full-sized, three-valve bypass around filter dryers.
 6. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at top.
 7. Install thermostatic expansion valves as close as possible to distributors on evaporators.
 - a. Install valve so diaphragm case is warmer than bulb.
 - b. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
 - c. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.
 8. Install safety relief valves where required by ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.
 9. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.
 10. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for device being protected:
 - a. Solenoid valves.
 - b. Thermostatic expansion valves.



- c. Hot-gas bypass valves.
 - d. Compressor.
 11. Install filter dryers in liquid line between compressor and thermostatic expansion valve, and in the suction line at the compressor, **as directed**.
 12. Install receivers sized to accommodate pump-down charge.
 13. Install flexible connectors at compressors.
- E. Piping Installation
1. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.
 2. Install refrigerant piping according to ASHRAE 15.
 3. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
 4. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
 5. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
 6. Install piping adjacent to machines to allow service and maintenance.
 7. Install piping free of sags and bends.
 8. Install fittings for changes in direction and branch connections.
 9. Select system components with pressure rating equal to or greater than system operating pressure.
 10. Refer to Division 23 Section(s) "Instrumentation And Control For Hvac" AND "Sequence Of Operations For Hvac Controls" for solenoid valve controllers, control wiring, and sequence of operation.
 11. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
 12. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Division 08 Section "Access Doors And Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.
 13. Install refrigerant piping in protective conduit where installed belowground.
 14. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.
 15. Slope refrigerant piping as follows:
 - a. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
 - b. Install horizontal suction lines with a uniform slope downward to compressor.
 - c. Install traps and double risers to entrain oil in vertical runs.
 - d. Liquid lines may be installed level.
 16. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.
 17. Before installation of steel refrigerant piping, clean pipe and fittings using the following procedures:
 - a. Shot blast the interior of piping.
 - b. Remove coarse particles of dirt and dust by drawing a clean, lintless cloth through tubing by means of a wire or electrician's tape.
 - c. Draw a clean, lintless cloth saturated with trichloroethylene through the tube or pipe. Continue this procedure until cloth is not discolored by dirt.
 - d. Draw a clean, lintless cloth, saturated with compressor oil, squeezed dry, through the tube or pipe to remove remaining lint. Inspect tube or pipe visually for remaining dirt and lint.
 - e. Finally, draw a clean, dry, lintless cloth through the tube or pipe.



- f. Safety-relief-valve discharge piping is not required to be cleaned but is required to be open to allow unrestricted flow.
18. Install pipe sleeves at penetrations in exterior walls and floor assemblies.
19. Seal penetrations through fire and smoke barriers according to Division 07 Section "Penetration Firestopping".
20. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
21. Install sleeves through floors, walls, or ceilings, sized to permit installation of full-thickness insulation.
22. Seal pipe penetrations through exterior walls according to Division 07 Section "Joint Sealants" for materials and methods.
23. Identify refrigerant piping and valves according to Division 23 Section "Identification For Hvac Piping And Equipment".

F. Pipe Joint Construction

1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
3. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.
4. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."
5. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
 - a. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
 - b. Use Type BA9, cadmium-free silver alloy for joining copper with bronze or steel.
6. Threaded Joints: Thread steel pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - a. Apply appropriate tape or thread compound to external pipe threads unless dry-seal threading is specified.
 - b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
7. Steel pipe can be threaded, but threaded joints must be seal brazed or seal welded.
8. Welded Joints: Construct joints according to AWS D10.12/D10.12M.
9. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

G. Hangers And Supports

1. Hanger, support, and anchor products are specified in Division 23 Section "Hangers And Supports For Hvac Piping And Equipment".
2. Install the following pipe attachments:
 - a. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet (6 m) long.
 - b. Roller hangers and spring hangers for individual horizontal runs 20 feet (6 m) or longer.
 - c. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet (6 m) or longer, supported on a trapeze.
 - d. Spring hangers to support vertical runs.
 - e. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
3. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:
 - a. NPS 1/2 (DN 15): Maximum span, 60 inches (1500 mm); minimum rod size, 1/4 inch (6.4 mm).
 - b. NPS 5/8 (DN 18): Maximum span, 60 inches (1500 mm); minimum rod size, 1/4 inch (6.4 mm).
 - c. NPS 1 (DN 25): Maximum span, 72 inches (1800 mm); minimum rod size, 1/4 inch (6.4 mm).



- d. NPS 1-1/4 (DN 32): Maximum span, 96 inches (2400 mm); minimum rod size, 3/8 inch (9.5 mm).
 - e. NPS 1-1/2 (DN 40): Maximum span, 96 inches (2400 mm); minimum rod size, 3/8 inch (9.5 mm).
 - f. NPS 2 (DN 50): Maximum span, 96 inches (2400 mm); minimum rod size, 3/8 inch (9.5 mm).
 - g. NPS 2-1/2 (DN 65): Maximum span, 108 inches (2700 mm); minimum rod size, 3/8 inch (9.5 mm).
 - h. NPS 3 (DN 80): Maximum span, 10 feet (3 m); minimum rod size, 3/8 inch (9.5 mm).
 - i. NPS 4 (DN 100): Maximum span, 12 feet (3.7 m); minimum rod size, 1/2 inch (13 mm).
4. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
 - a. NPS 2 (DN 50): Maximum span, 10 feet (3 m); minimum rod size, 3/8 inch (9.5 mm).
 - b. NPS 2-1/2 (DN 65): Maximum span, 11 feet (3.4 m); minimum rod size, 3/8 inch (9.5 mm).
 - c. NPS 3 (DN 80): Maximum span, 12 feet (3.7 m); minimum rod size, 3/8 inch (9.5 mm).
 - d. NPS 4 (DN 100): Maximum span, 14 feet (4.3 m); minimum rod size, 1/2 inch (13 mm).
 5. Support multifloor vertical runs at least at each floor.
- H. Field Quality Control
1. Perform tests and inspections and prepare test reports.
 2. Tests and Inspections:
 - a. Comply with ASME B31.5, Chapter VI.
 - b. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
 - c. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.
 - 1) Fill system with nitrogen to the required test pressure.
 - 2) System shall maintain test pressure at the manifold gage throughout duration of test.
 - 3) Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
 - 4) Remake leaking joints using new materials, and retest until satisfactory results are achieved.
- I. System Charging
1. Charge system using the following procedures:
 - a. Install core in filter dryers after leak test but before evacuation.
 - b. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers (67 Pa). If vacuum holds for 12 hours, system is ready for charging.
 - c. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig (14 kPa).
 - d. Charge system with a new filter-dryer core in charging line.
- J. Adjusting
1. Adjust thermostatic expansion valve to obtain proper evaporator superheat.
 2. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.
 3. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.
 4. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
 - a. Open shutoff valves in condenser water circuit.
 - b. Verify that compressor oil level is correct.
 - c. Open compressor suction and discharge valves.
 - d. Open refrigerant valves except bypass valves that are used for other purposes.
 - e. Check open compressor-motor alignment and verify lubrication for motors and bearings.
 5. Replace core or replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.



END OF SECTION 22 11 16 00e



SECTION 22 11 16 00f - GENERAL-SERVICE COMPRESSED-AIR PIPING

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for general-service compressed-air piping. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes piping and related specialties for general-service compressed-air systems operating at 200 psig (1380 kPa) or less.

C. Definitions

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. CR: Chlorosulfonated polyethylene synthetic rubber.
3. EPDM: Ethylene-propylene-diene terpolymer rubber.
4. HDPE: High-density polyethylene plastic.
5. NBR: Acrylonitrile-butadiene rubber.
6. PE: Polyethylene plastic.
7. PVC: Polyvinyl chloride plastic.
8. High-Pressure Compressed-Air Piping: System of compressed-air piping and specialties operating at pressures between 150 and 200 psig (1035 and 1380 kPa).
9. Low-Pressure Compressed-Air Piping: System of compressed-air piping and specialties operating at pressures of 150 psig (1035 kPa) or less.

D. Performance Requirements

1. Seismic Performance: Compressed-air piping and support and installation shall withstand effects of seismic events determined according to SEI/ASCE 7, "Minimum Design Loads for Buildings and Other Structures."

E. Submittals

1. Product Data: For the following:
 - a. Plastic pipes, fittings, and valves.
 - b. Dielectric fittings.
 - c. Flexible pipe connectors.
 - d. Safety valves.
 - e. Pressure regulators. Include rated capacities and operating characteristics.
 - f. Automatic drain valves.
 - g. Filters. Include rated capacities and operating characteristics.
 - h. Lubricators. Include rated capacities and operating characteristics.
 - i. Quick couplings.
 - j. Hose assemblies.
2. Brazing **OR** Welding, **as directed**, certificates.
3. Field quality-control test reports.
4. Operation and maintenance data.

F. Quality Assurance

1. Brazing: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications," or to AWS B2.2, "Standard for Brazing Procedure and Performance Qualification."
2. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.



3. ASME Compliance:
 - a. Comply with ASME B31.1, "Power Piping," for high-pressure compressed-air piping.
 - b. Comply with ASME B31.9, "Building Services Piping," for low-pressure compressed-air piping.

G. Project Conditions

1. Interruption of Existing Compressed-Air Service: Do not interrupt compressed-air service to facilities occupied by the Owner or others unless permitted under the following conditions and then only after arranging to provide temporary compressed-air service according to requirements indicated:
 - a. Notify the Owner no fewer than two days in advance of proposed interruption of compressed-air service.
 - b. Do not proceed with interruption of compressed-air service without the Owner's written permission.

1.2 PRODUCTS

A. Pipes, Tubes, And Fittings

1. Schedule 40, Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B, black or hot-dip zinc coated with ends threaded according to ASME B1.20.1.
 - a. Steel Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized seamless steel pipe. Include ends matching joining method.
 - b. Malleable-Iron Fittings: ASME B16.3, Class 150 or 300, threaded.
 - c. Malleable-Iron Unions: ASME B16.39, Class 150 or 300, threaded.
 - d. Steel Flanges: ASME B16.5, Class 150 or 300, carbon steel, threaded.
 - e. Wrought-Steel Butt-Welding Fittings: ASME B16.9, Schedule 40.
 - f. Steel Flanges: ASME B16.5, Class 150 or 300, carbon steel.
 - g. Grooved-End Fittings and Couplings:
 - 1) Grooved-End Fittings: ASTM A 47/A 47M, malleable-iron castings or ASTM A 536, ductile-iron casting; with grooves according to AWWA C606 and dimensions matching steel pipe.
 - 2) Couplings: AWWA C606 or UL 213, for steel-pipe dimensions and rated for 300-psig (2070-kPa) minimum working pressure. Include ferrous housing sections, gasket suitable for compressed air, and bolts and nuts. Provide EDPM gaskets for oil-free compressed air. Provide NBR gaskets if compressed air contains oil or oil vapor.
2. Schedule 5, Steel Pipe: ASTM A 135, carbon steel with plain ends and zinc-plated finish.
 - a. Pressure-Seal Fittings: Listed and labeled by a qualified testing agency and FMG-approved, carbon-steel, pressure-seal housing with O-ring end seals suitable for compressed-air piping and rated for 300-psig (2070-kPa) minimum working pressure. Provide EDPM seals for oil-free compressed air. Provide NBR seals if compressed air contains oil or oil vapor.
3. Copper Tube: ASTM B 88, Type K or L (ASTM B 88M, Type A or B) and ASTM B 88, Type M (ASTM B 88M, Type C) seamless, drawn-temper, water tube.
 - a. Wrought-Copper Fittings: ASME B16.22, solder-joint pressure type or MSS SP-73, wrought copper with dimensions for brazed joints.
 - b. Cast-Copper-Alloy Flanges: ASME B16.24, Class 150 or 300.
 - c. Copper Unions: ASME B16.22 or MSS SP-123.
 - d. Press-Type Fittings, NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.
 - e. Press-Type Fittings, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Bronze fitting with stainless-steel grip ring and EPDM O-ring seal in each end.
 - f. Extruded-Tee Outlets: Procedure for making branch outlets in copper tube according to ASTM F 2014.



- a. ABS Piping: ASTM D 2235.
 - b. PVC Piping: ASTM D 2564. Include primer complying with ASTM F 656.
- C. Valves
1. Metal Ball, Butterfly, Check, Gate, and Globe Valves: Comply with requirements in Division 22 Section "General-duty Valves For Plumbing Piping".
- D. Dielectric Fittings
1. General Requirements for Dielectric Fittings: Combination fitting of copper alloy and ferrous materials with insulating material; suitable for system fluid, pressure, and temperature. Include threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
 2. Dielectric Unions: Factory-fabricated union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).
 3. Dielectric Flanges: Factory-fabricated companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.
 4. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
 - a. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig (1035- or 2070-kPa) minimum working pressure where required to suit system pressures.
- E. Flexible Pipe Connectors
1. Bronze-Hose Flexible Pipe Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
 - a. Working-Pressure Rating: 200 psig (1380 kPa) **OR** 250 psig (1725 kPa), **as directed**, minimum.
 - b. End Connections, NPS 2 (DN 50) and Smaller: Threaded copper pipe or plain-end copper tube.
 - c. End Connections, NPS 2-1/2 (DN 65) and Larger: Flanged copper alloy.
 2. Stainless-Steel-Hose Flexible Pipe Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.
 - a. Working-Pressure Rating: 200 psig (1380 kPa) **OR** 250 psig (1725 kPa), **as directed**, minimum.
 - b. End Connections, NPS 2 (DN 50) and Smaller: Threaded steel pipe nipple.
 - c. End Connections, NPS 2-1/2 (DN 65) and Larger: Flanged steel nipple.
- F. Sleeves
1. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
 2. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - a. Underdeck Clamp: Clamping ring with set screws.
- G. Escutcheons
1. General Requirements: Manufactured wall and ceiling escutcheons and floor plates, with ID to closely fit around pipe and tube and OD that completely covers opening.
 2. One-Piece, Deep-Pattern Escutcheons: Deep-drawn, box-shaped brass with polished chrome-plated finish.
 3. One-Piece, Cast-Brass Escutcheons: With set screw.
 - a. Finish: Polished chrome-plated **OR** Rough brass, **as directed**.
 4. Split-Casting, Cast-Brass Escutcheons: With concealed hinge and set screw.
 - a. Finish: Polished chrome-plated **OR** Rough brass, **as directed**.
 5. One-Piece, Stamped-Steel Escutcheons: With set screw **OR** spring clips, **as directed**, and chrome-plated finish.



6. Split-Plate, Stamped-Steel Escutcheons: With concealed **OR** exposed-rivet, **as directed**, hinge, set screw **OR** spring clips, **as directed**, and chrome-plated finish.
7. One-Piece, Floor-Plate Escutcheons: Cast iron.
8. Split-Casting, Floor-Plate Escutcheons: Cast brass with concealed hinge and set screw.

H. Specialties

1. Safety Valves: ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," construction; National Board certified, labeled, and factory sealed; constructed of bronze body with poppet-type safety valve for compressed-air service.
 - a. Pressure Settings: Higher than discharge pressure and same or lower than receiver pressure rating.
2. Air-Main Pressure Regulators: Bronze body, direct acting, spring-loaded manual pressure-setting adjustment, and rated for 250-psig (1725-kPa) inlet pressure, unless otherwise indicated.
 - a. Type: Pilot operated.
3. Air-Line Pressure Regulators: Diaphragm **OR** Pilot, **as directed**, operated, bronze body, direct acting, spring-loaded manual pressure-setting adjustment, and rated for 200-psig (1380-kPa) minimum inlet pressure, unless otherwise indicated.

OR

Air-Line Pressure Regulators: Diaphragm operated, aluminum alloy or plastic body, direct acting, spring-loaded manual pressure-setting adjustment, and rated for 200-psig (1380-kPa) minimum inlet pressure, unless otherwise indicated.
4. Automatic Drain Valves: Stainless-steel body and internal parts, rated for 200-psig (1380-kPa) minimum working pressure, capable of automatic discharge of collected condensate. Include mounting bracket if wall mounting is indicated, **as directed**.
5. Coalescing Filters: Coalescing type with activated carbon capable of removing water and oil aerosols; with color-change dye to indicate when carbon is saturated and warning light to indicate when selected maximum pressure drop has been exceeded. Include mounting bracket if wall mounting is indicated, **as directed**.
6. Mechanical Filters: Two-stage, mechanical-separation-type, air-line filters. Equip with deflector plates, resin-impregnated-ribbon-type filters with edge filtration, and drain cock. Include mounting bracket if wall mounting is indicated, **as directed**.
7. Air-Line Lubricators: With drip chamber and sight dome for observing oil drop entering air stream; with oil-feed adjustment screw and quick-release collar for easy bowl removal. Include mounting bracket if wall mounting is indicated, **as directed**.
 - a. Provide with automatic feed device for supplying oil to lubricator.

I. Quick Couplings

1. General Requirements for Quick Couplings: Assembly with locking-mechanism feature for quick connection and disconnection of compressed-air hose.
2. Automatic-Shutoff Quick Couplings: Straight-through brass body with O-ring or gasket seal and stainless-steel or nickel-plated-steel operating parts.
 - a. Socket End: With one-way valve and threaded inlet for connection to piping or threaded hose fitting.
 - b. Plug End: Flow-sensor-bleeder, check-valve **OR** Straight-through, **as directed**, type with barbed outlet for attaching hose.
3. Valveless Quick Couplings: Straight-through brass body with stainless-steel or nickel-plated-steel operating parts.
 - a. Socket End: With O-ring or gasket seal, without valve, and with barbed inlet for attaching hose.
 - b. Plug End: With barbed outlet for attaching hose.

J. Hose Assemblies

1. Description: Compatible hose, clamps, couplings, and splicers suitable for compressed-air service, of nominal diameter indicated, and rated for 300-psig (2070-kPa) minimum working pressure, unless otherwise indicated.



- a. Hose: Reinforced single **OR** double, **as directed**,-wire-braid, CR-covered hose for compressed-air service.
- b. Hose Clamps: Stainless-steel clamps or bands.
- c. Hose Couplings: Two-piece, straight-through, threaded brass or stainless-steel O-ring or gasket-seal swivel coupling with barbed ends for connecting two sections of hose.
- d. Hose Splicers: One-piece, straight-through brass or stainless-steel fitting with barbed ends for connecting two sections of hose.

K. Grout

1. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - a. Characteristics: Post-hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - b. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
 - c. Packaging: Premixed and factory packaged.

1.3 EXECUTION

A. Piping Applications

1. Compressed-Air Piping between Air Compressors and Receivers: Use one of the following piping materials for each size range:
 - a. NPS 2 (DN 50) and Smaller: Schedule 40, black **OR** galvanized, **as directed**,-steel pipe; threaded, malleable-iron fittings; and threaded joints.
 - b. NPS 2 (DN 50) and Smaller: Schedule 5, galvanized-steel pipe; pressure-seal fittings; and pressure-sealed joints.
 - c. NPS 2 (DN 50) and Smaller: Schedule 40, black-steel pipe; wrought-steel fittings; and welded joints.
 - d. NPS 2 (DN 50) and Smaller: Type K or L (Type A or B), copper tube; wrought-copper fittings; and brazed joints.
 - e. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Schedule 40, black **OR** galvanized, **as directed**,-steel pipe; threaded, malleable-iron fittings; and threaded joints.
 - f. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Schedule 40, black **OR** galvanized, **as directed**,-steel pipe; grooved-end fittings; couplings; and grooved joints.
 - g. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Schedule 40, black-steel pipe; wrought-steel fittings; and welded joints.
 - h. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Type K or L (Type A or B), copper tube; wrought-copper fittings; and brazed joints.
 - i. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Type K or L (Type A or B), copper tube; grooved-end copper fittings; couplings; and grooved joints.
 - j. NPS 5 (DN 125) and Larger: Schedule 40, black **OR** galvanized, **as directed**,-steel pipe; threaded, malleable-iron fittings; and threaded joints.
 - k. NPS 5 (DN 125) and Larger: Schedule 40, black **OR** galvanized, **as directed**,-steel pipe; grooved-end fittings; couplings; and grooved joints.
 - l. NPS 5 (DN 125) and Larger: Schedule 40, black-steel pipe; wrought-steel fittings; and welded joints.
 - m. NPS 5 (DN 125) and Larger: Grooved-end, Type K or L (ASTM B 88M Type A or B), copper tube; grooved-end copper fittings; couplings; and grooved joints.
2. Low-Pressure Compressed-Air Distribution Piping: Use one of the following piping materials for each size range:
 - a. NPS 2 (DN 50) and Smaller: Schedule 40, black **OR** galvanized, **as directed**,-steel pipe; threaded, malleable-iron fittings; and threaded joints.
 - b. NPS 2 (DN 50) and Smaller: Schedule 5, galvanized-steel pipe; pressure-seal fittings; and pressure-sealed joints.
 - c. NPS 2 (DN 50) and Smaller: Type K or L (Type A or B), copper tube; wrought-copper fittings; and brazed **OR** soldered, **as directed**, joints.



- d. NPS 2 (DN 50) and Smaller: Type K or L (Type A or B), copper tube; press-type fittings; and pressure-sealed joints.
 - e. NPS 2 (DN 50) and Smaller: 63-mm and smaller, blue ABS pipe and fittings; transition fittings; valves; and solvent-cemented joints.
 - f. NPS 2 (DN 50) and Smaller: Green ABS pipe and fittings, transition fittings, and valves; and solvent-cemented joints.
 - g. NPS 2 (DN 50) and Smaller: HDPE pipe, fittings, and valves; and heat-fusion joints.
 - h. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Schedule 40, black **OR** galvanized, **as directed**, -steel pipe; threaded, malleable-iron fittings; and threaded joints.
 - i. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Schedule 40, black **OR** galvanized, **as directed**, -steel pipe; grooved-end fittings; couplings; and grooved joints.
 - j. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Type K or L (Type A or B), copper tube; wrought-copper fittings; and brazed **OR** soldered, **as directed**, joints.
 - k. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Type K or L (Type A or B), copper tube; grooved-end copper fittings; couplings; and grooved joints.
 - l. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Type K or L (Type A or B), copper tube; press-type fittings; and pressure-sealed joints.
 - m. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): 90- and 110-mm, blue ABS pipe and fittings; transition fittings; and solvent-cemented joints. Include butterfly valves and flanged joints.
 - n. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): NPS 3 and NPS 4 (DN 80 and DN 100), green ABS pipe and fittings; transition fittings; and solvent-cemented joints. Include ball valves and flanged joints.
 - o. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): NPS 3 and NPS 4 (DN 80 and DN 100), HDPE pipe and fittings; valves; and heat-fusion joints.
 - p. NPS 5 and NPS 6 (DN 125 and DN 150): Schedule 40, black **OR** galvanized, **as directed**, -steel pipe; threaded, malleable-iron fittings; and threaded joints.
 - q. NPS 5 (DN 125) and Larger: Schedule 40, black **OR** galvanized, **as directed**, -steel pipe; grooved-end fittings; couplings; and grooved joints.
 - r. NPS 5 to NPS 8 (DN 125 to DN 200): Type K or L (Type A or B), copper tube; grooved-end copper fittings; couplings; and grooved joints.
3. High-Pressure Compressed-Air Distribution Piping: Use one of the following piping materials for each size range:
- a. NPS 2 (DN 50) and Smaller: Schedule 40, black **OR** galvanized, **as directed**, -steel pipe; threaded, malleable-iron fittings; and threaded joints.
 - b. NPS 2 (DN 50) and Smaller: Schedule 5, galvanized-steel pipe; pressure-seal fittings; and pressure-sealed joints.
 - c. NPS 2 (DN 50) and Smaller: Schedule 40, black-steel pipe; wrought-steel fittings; and welded joints.
 - d. NPS 2 (DN 50) and Smaller: Type K or L (Type A or B), copper tube; wrought-copper fittings; and brazed **OR** soldered, **as directed**, joints.
 - e. NPS 2-1/2 to NPS 6 (DN 65 to DN 150): Schedule 40, black **OR** galvanized, **as directed**, -steel pipe; threaded, malleable-iron fittings; and threaded joints.
 - f. NPS 2-1/2 to NPS 6 (DN 65 to DN 150): Schedule 40, black **OR** galvanized, **as directed**, -steel pipe; grooved-end fittings; couplings; and grooved joints.
 - g. NPS 2-1/2 to NPS 6 (DN 65 to DN 150): Schedule 40, black-steel pipe; wrought-steel fittings; and welded joints.
 - h. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Type K or L (Type A or B), copper tube; wrought-copper fittings; and brazed **OR** soldered, **as directed**, joints.
 - i. NPS 2-1/2 to NPS 6 (DN 65 to DN 150): Type K or L (Type A or B), copper tube; wrought-copper fittings; and brazed joints.
 - j. NPS 2-1/2 to NPS 6 (DN 65 to DN 150): Type K or L (Type A or B), copper tube; grooved-end copper fittings; couplings; and grooved joints.
 - k. NPS 8 (DN 200) and Larger: Schedule 40, black **OR** galvanized, **as directed**, -steel pipe; grooved-end fittings; couplings; and grooved joints.
 - l. NPS 8 (DN 200) and Larger: Schedule 40, black-steel pipe; wrought-steel fittings; and welded joints.



- m. NPS 8 (DN 200): Type K or L (Type A or B), copper tube; grooved-end copper fittings; couplings; and grooved joints.
- 4. Drain Piping: Use one of the following piping materials:
 - a. NPS 2 (DN 50) and Smaller: Type M (Type C) copper tube; wrought-copper fittings; and brazed or soldered joints.
 - b. NPS 2 (DN 50) and Smaller: PVC pipe and fittings; and solvent-cemented joints.

B. Valve Applications

- 1. General-Duty Valves: Comply with requirements in Division 22 Section "General-duty Valves For Plumbing Piping" for metal general-duty valves. Use metal valves, unless otherwise indicated.
 - a. Metal General-Duty Valves: Use valve types specified in "Valve Applications" Article in Division 22 Section "General-duty Valves For Plumbing Piping" according to the following:
 - 1) Low-Pressure Compressed Air: Valve types specified for low-pressure compressed air.
 - 2) High-Pressure Compressed Air: Valve types specified for medium-pressure compressed air.
 - 3) Equipment Isolation NPS 2 (DN 50) and Smaller: Safety-exhaust, copper-alloy ball valve with exhaust vent and pressure rating at least as great as piping system operating pressure.
 - 4) Grooved-end valves may be used with grooved-end piping and grooved joints.
 - b. Plastic General-Duty Valves: Provide valves, made by piping manufacturer, that are compatible with piping. Do not use plastic valves between air compressors and receivers.
 - 1) Blue ABS Piping System: Ball and butterfly valves.
 - 2) Green ABS Piping System: Ball valves.
 - 3) HDPE Piping System: Ball valves.

C. Piping Installation

- 1. Drawing plans, schematics, and diagrams indicate general location and arrangement of compressed-air piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, air-compressor sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- 2. Install piping concealed from view and protected from physical contact by building occupants, unless otherwise indicated and except in equipment rooms and service areas.
- 3. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.
- 4. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal and to coordinate with other services occupying that space.
- 5. Install piping adjacent to equipment and machines to allow service and maintenance.
- 6. Install air and drain piping with 1 percent slope downward in direction of flow.
- 7. Install nipples, flanges, unions, transition and special fittings, and valves with pressure ratings same as or higher than system pressure rating, unless otherwise indicated.
- 8. Equipment and Specialty Flanged Connections:
 - a. Use steel companion flange with gasket for connection to steel pipe.
 - b. Use cast-copper-alloy companion flange with gasket and brazed **OR** soldered, **as directed**, joint for connection to copper tube. Do not use soldered joints for connection to air compressors or to equipment or machines producing shock or vibration.
- 9. Flanged joints may be used instead of specified joint for any piping or tubing system.
- 10. Extended-tee outlets with brazed branch connection may be used for copper tubing, within extruded-tee connection diameter to run tube diameter ratio for tube type, according to Extruded Tee Connections Sizes and Wall Thickness for Copper Tube (Inches) Table in ASTM F 2014.
- 11. Install eccentric reducers where compressed-air piping is reduced in direction of flow, with bottoms of both pipes and reducer fitting flush.
- 12. Install branch connections to compressed-air mains from top of main. Provide drain leg and drain trap at end of each main and branch and at low points.



13. Install thermometer and pressure gage on discharge piping from each air compressor and on each receiver. Comply with requirements in Division 22 Section "Meters And Gages For Plumbing Piping".
14. Install piping to permit valve servicing.
15. Install piping free of sags and bends.
16. Install fittings for changes in direction and branch connections.
17. Install seismic restraints on piping. Seismic-restraint devices are specified in Division 22 Section "Vibration And Seismic Controls For Plumbing Piping And Equipment".

D. Joint Construction

1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
3. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
4. Welded Joints for Steel Piping: Join according to AWS D10.12/D10.12M.
5. Brazed Joints for Copper Tubing: Join according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.
6. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Join according to ASTM B 828 or CDA's "Copper Tube Handbook."
7. Extruded-Tee Outlets for Copper Tubing: Form branches according to ASTM F 2014, with tools recommended by procedure manufacturer, and using operators qualified according to Part 1 "Quality Assurance" Article.
8. Flanged Joints: Use asbestos-free, nonmetallic gasket suitable for compressed air. Join flanges with gasket and bolts according to ASME B31.9 for bolting procedure.
9. Grooved Joints: Assemble couplings with housing, gasket, lubricant, and bolts. Join according to AWWA C606 for grooved joints. Do not apply lubricant to prelubricated gaskets.
10. Heat-Fusion Joints for PE Piping: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657 for socket-fusion joints.
11. Pressure-Sealed Joints: Join with tools recommended by fitting manufacturer, using operators qualified according to Part 1 "Quality Assurance" Article.
12. Solvent-Cemented Joints for ABS Piping: Clean and dry joining surfaces. Join according to the following:
 - a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - b. Join according to ASME B31.9 for solvent-cemented joints and to ASTM D 2235 Appendix.
13. Solvent-Cemented Joints for PVC Piping: Clean and dry joining surfaces. Join according to the following:
 - a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - b. Apply primer and join according to ASME B31.9 for solvent-cemented joints and to ASTM D 2672.
14. Dissimilar Metal Piping Material Joints: Use dielectric fittings.

E. Valve Installation

1. General-Duty Valves: Comply with requirements in Division 22 Section "General-duty Valves For Plumbing Piping".
2. Install shutoff valves and unions or flanged joints at compressed-air piping to air compressors.
3. Install shutoff valve at inlet to each automatic drain valve, filter, lubricator, and pressure regulator.
4. Install check valves to maintain correct direction of compressed-air flow to and from compressed-air piping specialties and equipment.



- F. Dielectric Fitting Installation
1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
 2. NPS 2 (DN 50) and Smaller: Use dielectric unions.
 3. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Use dielectric flanges.
 4. NPS 5 (DN 125) and Larger: Use dielectric flange kits.
- G. Flexible Pipe Connector Installation
1. Install flexible pipe connectors in discharge piping and in inlet air piping from remote air-inlet filter, **as directed**, of each air compressor.
 2. Install bronze-hose flexible pipe connectors in copper compressed-air tubing.
 3. Install stainless-steel-hose flexible pipe connectors in steel compressed-air piping.
- H. Specialty Installation
1. Install safety valves on receivers in quantity and size to relieve at least the capacity of connected air compressors.
 2. Install air-main pressure regulators in compressed-air piping at or near air compressors.
 3. Install air-line pressure regulators in branch piping to equipment and tools, **as directed**.
 4. Install automatic drain valves on aftercoolers, receivers, and dryers. Discharge condensate onto nearest floor drain.
 5. Install coalescing filters in compressed-air piping at or near air compressors and upstream from mechanical filters. Mount on wall at locations indicated, **as directed**.
 6. Install mechanical filters in compressed-air piping at or near air compressors and downstream from coalescing filters. Mount on wall at locations indicated, **as directed**.
 7. Install air-line lubricators in branch piping to machine tools. Mount on wall at locations indicated, **as directed**.
 8. Install quick couplings at piping terminals for hose connections.
 9. Install hose assemblies at hose connections.
- I. Connections
1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment and machine.
 2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment and machine.
- J. Sleeve Installation
1. Sleeves are not required for core-drilled holes.
 2. Permanent sleeves are not required for holes formed by removable PE sleeves.
 3. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs using galvanized-steel pipe **OR** galvanized-steel sheet **OR** stack sleeve fittings **OR** PVC pipe, **as directed**.
OR
Install sleeves for pipes passing through concrete and masonry walls, gypsum board partitions, and concrete floor and roof slabs.
 - a. Wall Penetrations: Cut sleeves to length for mounting flush with both surfaces.
 - b. Floor Penetrations: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 4. Install sleeves in new walls and slabs as new walls and slabs are constructed.
 5. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a. PVC **OR** Steel, **as directed**, Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
 - b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum board partitions.
 - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to



2 inches (50 mm) above finished floor level. Comply with requirements in Division 07 Section "Sheet Metal Flashing And Trim" for flashing.

- 1) Seal space outside of sleeve fittings with grout.
6. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping".

K. Escutcheon Installation

1. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - a. New Piping:
 - 1) Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
 - 2) Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish **OR** stamped steel with set screw **OR** stamped steel with set screw or spring clips **OR** stamped steel with spring clips, **as directed**.
 - 3) Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish **OR** One piece or split-casting, cast brass with polished chrome-plated finish **OR** Split casting, cast brass with polished chrome-plated finish **OR** One piece, stamped steel with set screw **OR** One piece or split plate, stamped steel with set screw **OR** Split plate, stamped steel with set screw, **as directed**.
 - 4) Bare Piping in Unfinished Service Spaces: One piece, cast brass with polished chrome-plated finish **OR** cast brass with rough-brass finish **OR** stamped steel with set screw **OR** stamped steel with spring clips **OR** stamped steel with set screw or spring clips, **as directed**.
 - 5) Bare Piping in Equipment Rooms: One piece, cast brass **OR** stamped steel with set screw **OR** stamped steel with spring clips **OR** stamped steel with set screw or spring clips, **as directed**.
 - 6) Bare Piping at Floor Penetrations in Equipment Rooms: One-piece floor plate.
 - b. Existing Piping:
 - 1) Chrome-Plated Piping: Split-casting, cast brass with chrome-plated finish.
 - 2) Insulated Piping: Split-plate, stamped steel with concealed **OR** exposed-rivet, **as directed**, hinge and spring clips.
 - 3) Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split casting, cast brass with chrome-plated finish **OR** plate, stamped steel with concealed hinge and spring clips, **as directed**.
 - 4) Bare Piping at Ceiling Penetrations in Finished Spaces: Split casting, cast brass with chrome-plated finish **OR** plate, stamped steel with concealed hinge and set screw, **as directed**.
 - 5) Bare Piping in Unfinished Service Spaces: Split casting, cast brass with polished chrome-plated finish **OR** casting, cast brass with rough-brass finish **OR** plate, stamped steel with concealed hinge and set screw or spring clips **OR** plate, stamped steel with concealed or exposed-rivet hinge and set screw or spring clips **OR** plate, stamped steel with exposed-rivet hinge and set screw or spring clips, **as directed**.
 - 6) Bare Piping in Equipment Rooms: Split casting, cast brass **OR** plate, stamped steel with set screw or spring clips, **as directed**.
 - 7) Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting floor plate.

L. Hanger And Support Installation

1. Comply with requirements in Division 22 Section "Vibration And Seismic Controls For Plumbing Piping And Equipment" for seismic-restraint devices.
2. Comply with requirements in Division 22 Section "Hangers And Supports For Plumbing Piping And Equipment" for pipe hanger and support devices.
3. Vertical Piping: MSS Type 8 or 42, clamps.
4. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet (30 m) or Less: MSS Type 1, adjustable, steel clevis hangers.



- b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
5. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
6. Base of Vertical Piping: MSS Type 52, spring hangers.
7. Support horizontal piping within 12 inches (300 mm) of each fitting and coupling.
8. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.
9. Install hangers for Schedule 40, steel piping with the following maximum horizontal spacing and minimum rod diameters:
 - a. NPS 1/4 to NPS 1/2 (DN 8 to DN 15): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
 - b. NPS 3/4 to NPS 1-1/4 (DN 20 to DN 32): 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
 - c. NPS 1-1/2 (DN 40): 12 feet (3.7 m) with 3/8-inch (10-mm) rod.
 - d. NPS 2 (DN 50): 13 feet (4 m) with 3/8-inch (10-mm) rod.
 - e. NPS 2-1/2 (DN 65): 14 feet (4.3 m) with 1/2-inch (13-mm) rod.
 - f. NPS 3 (DN 80): 15 feet (4.6 m) with 1/2-inch (13-mm) rod.
 - g. NPS 3-1/2 (DN 90): 16 feet (4.9 m) with 1/2-inch (13-mm) rod.
 - h. NPS 4 (DN 100): 17 feet (5.2 m) with 5/8-inch (16-mm) rod.
 - i. NPS 5 (DN 125): 19 feet (5.8 m) with 5/8-inch (16-mm) rod.
 - j. NPS 6 (DN 150): 21 feet (6.4 m) with 3/4-inch (19-mm) rod.
 - k. NPS 8 (DN 200): 24 feet (7.3 m) with 3/4-inch (19-mm) rod.
 - l. NPS 10 (DN 250): 26 feet (7.9 m) with 7/8-inch (22-mm) rod.
 - m. NPS 12 (DN 300): 30 feet (9.1 m) with 7/8-inch (22-mm) rod.
10. Install supports for vertical, Schedule 40, steel piping every 15 feet (4.6 m).
11. Install hangers for Schedule 5, steel piping with the following maximum horizontal spacing and minimum rod diameters:
 - a. NPS 1/2 (DN 15): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
 - b. NPS 3/4 (DN 20): 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
 - c. NPS 1 (DN 25): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
 - d. NPS 1-1/4 (DN 32): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.
 - e. NPS 1-1/2 (DN 40): 10 feet (3 m) with 3/8-inch (10-mm) rod.
 - f. NPS 2 (DN 50): 11 feet (3.4 m) with 3/8-inch (10-mm) rod.
12. Install supports for vertical, Schedule 5, steel piping every 10 feet (3 m).
13. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - a. NPS 1/4 (DN 8): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
 - b. NPS 3/8 and NPS 1/2 (DN 10 and DN 15): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
 - c. NPS 3/4 (DN 20): 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
 - d. NPS 1 (DN 25): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
 - e. NPS 1-1/4 (DN 32): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.
 - f. NPS 1-1/2 (DN 40): 10 feet (3 m) with 3/8-inch (10-mm) rod.
 - g. NPS 2 (DN 50): 11 feet (3.4 m) with 3/8-inch (10-mm) rod.
 - h. NPS 2-1/2 (DN 65): 13 feet (4 m) with 1/2-inch (13-mm) rod.
 - i. NPS 3 (DN 80): 14 feet (4.3 m) with 1/2-inch (13-mm) rod.
 - j. NPS 3-1/2 (DN 90): 15 feet (4.6 m) with 1/2-inch (13-mm) rod.
 - k. NPS 4 (DN 100): 16 feet (4.9 m) with 1/2-inch (13-mm) rod.
 - l. NPS 5 (DN 125): 18 feet (5.5 m) with 1/2-inch (13-mm) rod.
 - m. NPS 6 (DN 150): 20 feet (6 m) with 5/8-inch (16-mm) rod.
 - n. NPS 8 (DN 200): 23 feet (7 m) with 3/4-inch (19-mm) rod.
14. Install supports for vertical copper tubing every 10 feet (3 m).
15. Install vinyl-coated hangers for ABS piping with the following maximum horizontal spacing and minimum rod diameters:
 - a. All Sizes: Install continuous support for piping with compressed air at normal operating temperature above 100 deg F (38 deg C).
 - b. NPS 3/8 and NPS 1/2 (DN 10 and DN 15): 30 inches (760 mm) with 3/8-inch (10-mm) rod.



- c. NPS 3/4 (DN 20): 38 inches (975 mm) with 3/8-inch (10-mm) rod.
 - d. NPS 1 (DN 25): 40 inches (1015 mm) with 3/8-inch (10-mm) rod.
 - e. NPS 1-1/4 (DN 32): 45 inches (1140 mm) with 3/8-inch (10-mm) rod.
 - f. NPS 1-1/2 (DN 40): 52 inches (1330 mm) with 3/8-inch (10-mm) rod.
 - g. NPS 2 (DN 50): 58 inches (1470 mm) with 3/8-inch (10-mm) rod.
 - h. NPS 3 (DN 80): 68 inches (1730 mm) with 1/2-inch (13-mm) rod.
 - i. NPS 4 (DN 100): 76 inches (1900 mm) with 1/2-inch (13-mm) rod.
16. Install supports for vertical ABS piping every 48 inches (1220 mm).
 17. Install vinyl-coated hangers for HDPE piping with the following maximum horizontal spacing and minimum rod diameters:
 - a. All Sizes: Install continuous support for piping with compressed air at normal operating temperature above 100 deg F (38 deg C).
 - b. NPS 1/2 (DN 15): 30 inches (760 mm) with 3/8-inch (10-mm) rod.
 - c. NPS 3/4 (DN 20): 35 inches (890 mm) with 3/8-inch (10-mm) rod.
 - d. NPS 1 (DN 25): 40 inches (1015 mm) with 3/8-inch (10-mm) rod.
 - e. NPS 1-1/4 (DN 32): 43 inches (1090 mm) with 3/8-inch (10-mm) rod.
 - f. NPS 1-1/2 (DN 40): 49 inches (1245 mm) with 3/8-inch (10-mm) rod.
 - g. NPS 2 (DN 50): 55 inches (1400 mm) with 3/8-inch (10-mm) rod.
 - h. NPS 3 and NPS 4 (DN 80 and DN 100): 96 inches (2440 mm) with 1/2-inch (13-mm) rod.
 18. Install supports for vertical HDPE piping every 48 inches (1220 mm).

M. Labeling And Identification

1. Install identifying labels and devices for general-service compressed-air piping, valves, and specialties. Comply with requirements in Division 22 Section "Identification For Plumbing Piping And Equipment".

N. Field Quality Control

1. Perform field tests and inspections.
2. Tests and Inspections:
 - a. Piping Leak Tests for Metal Compressed-Air Piping: Test new and modified parts of existing piping. Cap and fill general-service compressed-air piping with oil-free dry air or gaseous nitrogen to pressure of 50 psig (345 kPa) above system operating pressure, but not less than 150 psig (1035 kPa). Isolate test source and let stand for four hours to equalize temperature. Refill system, if required, to test pressure; hold for two hours with no drop in pressure.
 - b. Piping Leak Tests for ABS Compressed-Air Piping: Test new and modified parts of existing piping. Cap and fill general-service compressed-air piping with oil-free dry air or gaseous nitrogen, at temperature of 110 deg F (43 deg C) or less, to pressure of 40 psig (275 kPa) above system operating pressure, but not less than 80 psig (550 kPa) **OR** 100 psig (690 kPa), **as directed**, or more than 120 psig (825 kPa). Isolate test source and let stand for four hours to equalize temperature. Refill system, if required, to test pressure; hold for two hours with no drop in pressure.
 - c. Piping Leak Tests for HDPE Compressed-Air Piping: Test new and modified parts of existing piping. Cap and fill general-service compressed-air piping with oil-free dry air or gaseous nitrogen, at temperature of 100 deg F (38 deg C) or less, to pressure of 40 psig (275 kPa) above system operating pressure, but not less than 100 psig (690 kPa) **OR** 125 psig (860 kPa) **OR** 150 psig (1035 kPa), **as directed**, or more than 180 psig (1240 kPa). Isolate test source and let stand for four hours to equalize temperature. Refill system, if required, to test pressure; hold for two hours with no drop in pressure.
 - d. Repair leaks and retest until no leaks exist.
 - e. Inspect filters, lubricators, and pressure regulators for proper operation.
3. Prepare test reports.

END OF SECTION 22 11 16 00f



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SECTION 22 11 16 00g - COMPRESSED-AIR PIPING FOR LABORATORY AND HEALTHCARE FACILITIES**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for compressed-air piping for laboratory and healthcare facilities. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Compressed-air piping and specialties for nonmedical laboratory facilities, designated "laboratory air," operating at 50 psig (345 kPa) **OR** 100 psig (690 kPa) **OR** 125 psig (860 kPa), **as directed**.
 - b. Medical air piping and specialties, designated "medical air," operating at 50 to 55 psig (345 to 380 kPa).
 - c. Dental air piping and specialties, designated "dental air," operating at 80 to 100 psig (550 to 690 kPa).
 - d. Gas-powered-tool air piping and specialties, designated "instrument air," operating at 175 psig (1200 kPa).
 - e. Healthcare laboratory air piping and specialties, designated "medical laboratory air," operating at 100 psig (690 kPa).

C. Definitions

1. D.I.S.S.: Diameter-index safety system.
2. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.
3. Medical Compressed-Air Piping Systems: Include medical air, dental air, instrument air, and medical laboratory air piping systems.

D. Submittals

1. Product Data: For the following:
 - a. Compressed-air tubes and fittings.
 - b. Compressed-air valves and valve boxes.
 - c. Medical compressed-air service connections.
 - d. Medical compressed-air pressure control panels.
 - e. Medical compressed-air manifolds.
 - f. Medical compressed-air alarm system components.
2. Shop Drawings: Diagram power, signal, and control wiring.
3. Piping Material Certification: Signed by Installer certifying that medical compressed-air piping materials comply with NFPA 99 requirements.
4. Brazing certificates.
5. Field quality-control test reports.
6. Operation and maintenance data.

E. Quality Assurance

1. Installer Qualifications:
 - a. Medical Compressed-Air Piping Systems for Healthcare Facilities: Qualify installers according to ASSE Standard #6010.
 - b. Pressure-Seal Joining Procedure for Copper Tubing: Qualify operators according to training provided by Viega; Plumbing and Heating Systems.



2. Testing Agency Qualifications: An independent testing agency, with the experience and capability to conduct the vacuum piping testing indicated, that is a member of the Medical Gas Professional Healthcare Organization **OR** is an NRTL, **as directed**, and that is acceptable to authorities having jurisdiction.
 - a. Qualify testing personnel according to ASSE Standard #6020 for inspectors and ASSE Standard #6030 for verifiers.
3. Source Limitations: Obtain compressed-air service connections of same type and from same manufacturer as service connections provided for in Division 22 Section "Gas Piping For Laboratory And Healthcare Facilities".
4. Brazing: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications," or AWS B2.2, "Standard for Brazing Procedure and Performance Qualification."
5. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
6. ASME Compliance:
 - a. Comply with ASME B31.1, "Power Piping," for laboratory compressed-air piping operating at more than 150 psig (1035 kPa).
 - b. Comply with ASME B31.9, "Building Services Piping," for laboratory compressed-air piping operating at 150 psig (1035 kPa) or less.
7. Comply with NFPA 99, "Health Care Facilities," for medical compressed-air system materials and installation in healthcare facilities.

F. Project Conditions

1. Interruption of Existing Laboratory and Medical Compressed-Air Service(s): Do not interrupt laboratory or medical compressed-air service to facilities occupied by the Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - a. Notify the Owner no fewer than two days in advance of proposed interruption of laboratory and medical compressed-air service(s).
 - b. Do not proceed with interruption of laboratory and medical compressed-air service(s) without the Owner's written permission.

1.2 PRODUCTS

A. Pipes, Tubes, And Fittings

1. Copper Medical Gas Tube: ASTM B 819, Type K **OR** Type L, **as directed**, seamless, drawn temper, that has been manufacturer cleaned, purged, and sealed for medical gas service or according to CGA G-4.1 for oxygen service. Include standard color marking "OXY," "MED," "OXY/MED," "OXY/ACR," or "ACR/MED" in green for Type K tube and in blue for Type L tube.
 - a. General Requirements for Copper Fittings: Manufacturer cleaned, purged, and bagged for oxygen service according to CGA G-4.1.
 - b. Wrought-Copper Fittings: ASME B16.22, solder-joint pressure type or MSS SP-73, with dimensions for brazed joints.
 - c. Copper Unions: ASME B16.22 or MSS SP-123, wrought copper or cast-copper alloy.
 - d. Press-Type Fittings:
 - 1) NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.
 - 2) NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Bronze fitting with stainless-steel grip ring and EPDM O-ring seal in each end.
2. Memory-Metal Couplings: Cryogenic compression fitting made of ASTM F 2063, nickel-titanium, shape-memory alloy, and that has been manufacturer cleaned, purged, and sealed for oxygen service according to CGA G-4.1.



3. Copper Water Tube: ASTM B 88, Type M (ASTM B 88M, Type C), seamless, drawn temper.
 - a. Copper Fittings: ASME B16.18, cast-copper or ASME B16.22, wrought-copper, solder-joint pressure type.
 - b. Press-Type Fittings:
 - 1) NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.
 - 2) NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Bronze fitting with stainless-steel grip ring and EPDM O-ring seal in each end.
 4. PVC Pipe: ASTM D 1785, Schedule 40.
 - a. PVC Fittings: ASTM D 2466, Schedule 40, socket type.
- B. Joining Materials
1. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
 2. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.
 3. Threaded-Joint Tape: PTFE.
 4. Solvent Cement for Joining PVC Piping: ASTM D 2564. Include primer complying with ASTM F 656.
- C. Valves
1. General Requirements for Valves: Manufacturer cleaned, purged, and bagged according to CGA G-4.1 for oxygen service.
 2. Ball Valves: MSS SP-110, 3-piece body, brass or bronze.
 - a. Pressure Rating: 300 psig (2070 kPa) minimum.
 - b. Ball: Full-port, chrome-plated brass.
 - c. Seats: PTFE or TFE.
 - d. Handle: Lever type with locking device, **as directed**.
 - e. Stem: Blowout proof with PTFE or TFE seal.
 - f. Ends: Manufacturer-installed ASTM B 819, copper-tube extensions.
 3. Check Valves: In-line pattern, bronze.
 - a. Pressure Rating: 300 psig (2070 kPa) minimum.
 - b. Operation: Spring loaded.
 - c. Ends: Manufacturer-installed ASTM B 819, copper-tube extensions.
 4. Zone Valves: MSS SP-110, 3-piece-body, brass or bronze ball valve with gage.
 - a. Pressure Rating: 300 psig (2070 kPa) minimum.
 - b. Ball: Full-port, chrome-plated brass.
 - c. Seats: PTFE or TFE.
 - d. Handle: Lever type with locking device, **as directed**.
 - e. Stem: Blowout proof with PTFE or TFE seal.
 - f. Ends: Manufacturer-installed ASTM B 819, copper-tube extensions.
 - g. Pressure Gage: Manufacturer installed on one copper-tube extension.
 5. Zone Valve Boxes: Formed steel with anchors for recessed mounting, holes with grommets in box sides for tubing extension protection, and of size for single or multiple valves with pressure gages and in sizes required to permit manual operation of valves.
 - a. Interior Finish: Factory-applied white enamel.
 - b. Cover Plate: Aluminum or extruded-anodized aluminum **OR** Satin-chrome finish steel **OR** Stainless steel with NAAMM AMP 503, No. 4 finish, **as directed**, with frangible or removable windows.
 - c. Valve-Box Windows: Clear or tinted transparent plastic with labeling that includes rooms served, according to NFPA 99.
- OR**
- Zone Valve Boxes: Formed or extruded aluminum with anchors for recessed mounting, holes with grommets in box sides for tubing extension protection, and of size for single or multiple valves with pressure gages and in sizes required to permit manual operation of valves.



- a. Interior Finish: Factory-applied white enamel.
 - b. Cover Plate: Aluminum or extruded-anodized aluminum **OR** Stainless steel with NAAMM AMP 503, No. 4 finish, **as directed**, with frangible or removable windows.
 - c. Valve-Box Windows: Clear or tinted transparent plastic with labeling that includes rooms served, according to NFPA 99.
6. Safety Valves: Bronze-body, ASME-construction, poppet, pressure-relief type with settings to match system requirements.
 7. Pressure Regulators: Bronze body and trim; spring-loaded, diaphragm-operated relieving type; manual pressure-setting adjustment; rated for 250-psig (1725-kPa) minimum inlet pressure; and capable of controlling delivered air pressure within 0.5 psig for each 10-psig (5.0 kPa for each 100-kPa) inlet pressure.
 8. Automatic Drain Valves: Stainless-steel body and internal parts, rated for 200-psig (1380-kPa) minimum working pressure, capable of automatic discharge of collected condensate. Include mounting bracket where wall mounting is indicated, **as directed**.
- D. Medical Compressed-Air Service Connections
1. Connection Devices: For specific medical compressed-air pressure and service listed. Include roughing-in assemblies, finishing assemblies, and cover plates. Individual cover plates are not required if service connection is in multiple unit or assembly with cover plate. Furnish recessed-type units made for concealed piping unless otherwise indicated.
 - a. Roughing-in Assembly:
 - 1) Steel outlet box for recessed mounting and concealed piping.
 - 2) Brass-body outlet block with secondary check valve that will prevent gas flow when primary valve is removed.
 - 3) Double seals that will prevent air leakage.
 - 4) ASTM B 819, NPS 3/8 (DN 10) copper outlet tube brazed to valve with service marking and tube-end dust cap.
 - b. Finishing Assembly:
 - 1) Brass housing with primary check valve.
 - 2) Double seals that will prevent air leakage.
 - 3) Cover plate with gas-service label.
 - c. Quick-Coupler Service Connections: Pressure outlet with noninterchangeable keyed indexing to prevent interchange between services, constructed to permit one-handed connection and removal of equipment, and with positive-locking ring that retains equipment stem in valve during use.
 - d. D.I.S.S. Service Connections: Pressure outlets, complying with CGA V-5, with threaded indexing to prevent interchange between services, constructed to permit one-handed connection and removal of equipment.
 - 1) Medical Air Service Connections: CGA V-5, D.I.S.S. No. 1160.
 - 2) Instrument Air Service Connections: CGA V-5, D.I.S.S. No. 1160.
 - e. Cover Plates: One piece, stainless steel, with NAAMM AMP 503, No. 4 finish **OR** metal, with chrome-plated finish **OR** anodized aluminum, **as directed**, and permanent, color-coded, identifying label matching corresponding service.
- E. Medical Compressed-Air Pressure Control Panels
1. Description: Steel box and support brackets for recessed roughing in with stainless-steel or anodized-aluminum cover plate with printed operating instructions. Include manifold assembly consisting of inlet supply valve, inlet supply pressure gage, line-pressure control regulator, outlet supply pressure gage, D.I.S.S. service connection, and piping outlet for remote service connection.
 - a. Minimum Working Pressure: 200 psig (1380 kPa).
 - b. Line-Pressure Control Regulator: Self-relieving diaphragm type with precision manual adjustment.
 - c. Pressure Gages: 0- to 300-psig (0- to 2070-kPa) range.



- d. Service Connection: CGA V-5, D.I.S.S. No. 1160, instrument air outlet.
- e. Before final assembly, provide temporary dust shield and U-tube for testing.
- f. Label cover plate "Air Pressure Control."

F. Medical Compressed-Air Manifolds

1. General Requirements for Medical Compressed-Air Manifolds: Comply with NFPA 99, Ch. 5, "Manifolds for Gas Cylinders without Reserve Supply."
2. Central Control Panel Unit: Weatherproof cabinet, supply and delivery pressure gages, electrical alarm system connections and transformer, indicator lights or devices, manifold connection, pressure changeover switch, line-pressure regulator, shutoff valves, and safety valve.
3. Manifold and Headers: Duplex, nonferrous-metal header for number of cylinders indicated, divided into two equal banks. Units include design for 2000-psig (13.8-MPa) minimum inlet pressure. Include cylinder bank headers with inlet (pigtail) connections complying with CGA V-1, individual inlet check valves, shutoff valve, pressure regulator, check valve, and pressure gage.
4. Compressed-Air Cylinders: Will be furnished by the Owner **OR** Number and type of compressed-air cylinders required for complete manifold systems, **as directed**.
5. Operation: Automatic, pressure-switch-activated changeover from one cylinder bank to the other when first bank becomes exhausted, without line-pressure fluctuation or resetting of regulators and without supply interruption by shutoff of either cylinder bank header.
6. Mounting: Wall with mounting brackets for manifold control cabinet and headers **OR** Floor with support legs for manifold control cabinet, **as directed**.
7. Label manifold control unit with permanent label identifying compressed air and system operating pressure.
8. Medical Air Manifolds: For 4 cylinders and 1250-cu. ft./h (9.85-L/s) **OR** 8 cylinders and 2500-cu. ft./h (19.7-L/s), **as directed**, capacity at 55-psig (380-kPa) line pressure.
9. Instrument Air Manifolds: For 8 cylinders and 2000-cu. ft./h (15.7-L/s) **OR** 12 cylinders and 3000-cu. ft./h (23.6-L/s), **as directed**, capacity at 200-psig (1380-kPa) minimum line pressure.

G. Medical Compressed-Air-Piping Alarm Systems

1. Panels for medical compressed-air piping systems may be combined in single panels with medical vacuum and medical gas piping systems.
2. Components: Designed for continuous service and to operate on power supplied from 120 **OR** 240 **OR** 277, **as directed**,-V ac power source to alarm panels and with connections for low-voltage wiring to remote sensing devices. Include step-down transformers if required.
3. Dew Point Monitors: Continuous line monitoring, having panel with gage or digital display, pipeline sensing element, electrical connections for alarm system, factory- or field-installed valved bypass, and visual and cancelable audio signal for dryer site and master alarm panels. Alarm signals when pressure dew point rises above 39 deg F (4 deg C) at 55 psig (380 kPa).
 - a. Operation: Chilled-mirror method **OR** Chilled-mirror method or hygrometer moisture analyzer with sensor probe **OR** Hygrometer moisture analyzer with sensor probe, **as directed**.
4. Pressure Switches or Transducer Sensors: Continuous line monitoring with electrical connections for alarm system.
 - a. Low-Pressure Operating Range: 0- to 100-psig (0- to 690-kPa).
 - b. High-Pressure Operating Range: Up to 250-psig (1725-kPa).
5. Carbon Monoxide Monitors: Panel with gage or digital display, pipeline sensing element, electrical connections for alarm system, and factory- or field-installed valved bypass. Alarm signals when carbon monoxide level rises above 10 ppm.
6. General Requirements for Medical Compressed-Air Alarm Panels: Factory wired with audible and color-coded visible signals to indicate specified functions.
 - a. Mounting: Exposed, surface **OR** Recessed, **as directed**, installation.
 - b. Enclosures: Fabricated from minimum 0.047-inch- (1.2-mm-) thick steel or minimum 0.05-inch- (1.27-mm-) thick aluminum, with knockouts for electrical and piping connections.
7. Master Alarm Panels: Separate trouble alarm signals, pressure gages, and indicators for medical compressed-air piping systems.



- a. Include alarm signals when the following conditions exist:
 - 1) Medical Air: Pressure drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa), backup air compressor is in operation, pressure drop across filter assembly increases more than 2 psig (13.8 kPa), dew point rises above 39 deg F (4 deg C) at 55 psig (380 kPa), carbon monoxide level rises above 10 ppm, and high water level is reached in receiver for liquid-ring, medical air compressor systems.
 - 2) Dental Air: Pressure drops below 65 psig (450 kPa) or rises above 110 psig (760 kPa), backup air compressor is in operation, pressure drop across filter assembly increases more than 2 psig (13.8 kPa), dew point rises above 50 deg F (10 deg C) at 125 psig (860 kPa), and carbon monoxide level rises above 10 ppm.
 - 3) Instrument Air: Pressure drops below 165 psig (1140 kPa) or rises above 185 psig (1275 kPa).
 - 4) Medical Laboratory Air: Pressure drops below 90 psig (630 kPa) or rises above 110 psig (760 kPa).
 8. Anesthetizing-Area Alarm Panels: Separate trouble alarm signals, pressure gages, and indicators for medical compressed-air piping systems.
 - a. Include alarm signals when the following conditions exist:
 - 1) Medical Air: Pressure drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa).
 - 2) Instrument Air: Pressure drops below 165 psig (1140 kPa) or rises above 185 psig (1275 kPa).
 9. Area Alarm Panels: Separate trouble alarm signals, pressure gages, and indicators for medical compressed-air piping systems.
 - a. Include alarm signals when the following condition exists:
 - 1) Medical Air: Pressure drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa).
 10. Dental-Area Alarm Panels: Separate trouble alarm signals, pressure gages, and indicators for medical compressed-air piping systems.
 - a. Include alarm signals when the following conditions exist:
 - 1) Dental Air: Pressure drops below 65 psig (450 kPa) or rises above 110 psig (760 kPa), backup air compressor is in operation, pressure drop across filter assembly increases more than 2 psig (13.8 kPa), dew point rises above 50 deg F (10 deg C) at 125 psig (860 kPa), and carbon monoxide level rises above 10 ppm.
 - 2) Instrument Air: Pressure drops below 165 psig (1140 kPa) or rises above 185 psig (1275 kPa).
 11. Medical Laboratory Area Alarm Panels: Separate trouble alarm signals, pressure gages,; and indicators for medical compressed-air piping systems.
 - a. Include alarm signals when the following condition exists:
 - 1) Medical Laboratory Air: Pressure drops below 90 psig (630 kPa) or rises above 110 psig (760 kPa).
- H. Computer Interface Cabinet
1. Description: Wall-mounting, welded-steel control cabinet with gasketed door, mounting brackets, grounding device, and white-enamel finish for connection of medical compressed-air- piping-system alarms to facility computer. Include factory-installed signal circuit boards, power transformer, circuit breaker, wiring terminal board, and internal wiring capable of interfacing 20, **as directed**, alarm signals.
- I. Compressed-Air-Cylinder Storage Racks
1. Wall Storage Racks: Fabricate racks with chain restraints for upright cylinders as indicated or provide equivalent manufactured wall racks.
 2. Freestanding Storage Racks: Fabricate racks as indicated or provide equivalent manufactured storage racks.



- J. Flexible Pipe Connectors
1. Description: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
 - a. Working-Pressure Rating: 200 psig (1380 kPa) **OR** 250 psig (1725 kPa), **as directed**, minimum.
 - b. End Connections: Threaded copper pipe or plain-end copper tube.
- K. Sleeves
1. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
 2. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - a. Underdeck Clamp: Clamping ring with set screws.
- L. Escutcheons
1. General Requirements for Escutcheons: Manufactured wall and ceiling escutcheons and floor plates, with ID to closely fit around pipe and tube and OD that completely covers opening.
 2. One-Piece, Deep-Pattern Escutcheons: Deep-drawn, box-shaped brass with polished chrome-plated finish.
 3. One-Piece, Cast-Brass Escutcheons: With set screw.
 - a. Finish: Polished chrome-plated **OR** Rough brass, **as directed**.
 4. Split-Casting, Cast-Brass Escutcheons: With concealed hinge and set screw.
 - a. Finish: Polished chrome-plated **OR** Rough brass, **as directed**.
 5. One-Piece, Stamped-Steel Escutcheons: With set screw **OR** spring clips, **as directed**, and chrome-plated finish.
 6. Split-Plate, Stamped-Steel Escutcheons: With concealed **OR** exposed-rivet, **as directed**, hinge, set screw **OR** spring clips, **as directed**, and chrome-plated finish.
 7. One-Piece, Floor-Plate Escutcheons: Cast iron.
 8. Split-Casting, Floor-Plate Escutcheons: Cast brass with concealed hinge and set screw.
- M. Grout
1. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - a. Characteristics: Post-hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - b. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
 - c. Packaging: Premixed and factory packaged.
- N. Nitrogen
1. Description: Comply with USP 28 - NF 23 for oil-free dry nitrogen.

1.3 EXECUTION

- A. Piping Applications
1. Connect new tubing to existing tubing with memory-metal couplings.
 2. Laboratory Air Piping: Use one of the following piping materials for each size range:
 - a. NPS 4 (DN 100) and Smaller: Type L, copper medical gas tube; wrought-copper fittings; and brazed joints.
 - b. NPS 4 (DN 100) and Smaller: Type L, copper medical gas tube; press-type fittings; and pressure-sealed joints.
 - c. NPS 5 to NPS 8 (DN 125 to DN 200): Type L, copper medical gas tube; wrought-copper fittings; and brazed joints.
 3. Medical Air Piping: Use Type L, copper medical gas tube; wrought-copper fittings; and brazed joints.



4. Dental Air Piping: Use Type L, copper medical gas tube; wrought-copper fittings; and brazed joints.
5. Instrument Air Piping:
 - a. NPS 3 (DN 80) and Smaller: Use Type K **OR** Type L, **as directed**, copper medical gas tube; wrought-copper fittings; and brazed joints.
 - b. NPS 3-1/2 (DN 90) and Larger: Use Type K, copper medical gas tube; wrought-copper fittings; and brazed joints.
6. Medical Laboratory Air Piping: Use Type L, copper medical gas tube; wrought-copper fittings; and brazed joints.
7. Drain Piping: Use one of the following piping materials:
 - a. Copper water tube, cast- or wrought-copper fittings, and soldered **OR** press-type fittings, and pressure-sealed, **as directed**, joints.
 - b. PVC pipe, PVC fittings, and solvent-cemented joints.

B. Piping Installation

1. Drawing plans, schematics, and diagrams indicate general location and arrangement of compressed-air piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, air-compressor sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
2. Comply with ASSE Standard #6010 for installation of compressed-air piping.
3. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
4. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
5. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal and coordinate with other services occupying that space.
6. Install piping adjacent to equipment and specialties to allow service and maintenance.
7. Install air and drain piping with 1 percent slope downward in direction of flow.
8. Install nipples, unions, special fittings, and valves with pressure ratings same as or higher than system pressure rating used in applications below unless otherwise indicated.
9. Install eccentric reducers, if available, where compressed-air piping is reduced in direction of flow, with bottoms of both pipes and reducer fitting flush.
10. Install branch connections to compressed-air mains from top of main. Provide drain leg and drain trap at end of each main and branch and at low points.
11. Install thermometer and pressure gage on discharge piping from each air compressor and on each receiver. Comply with requirements in Division 22 Section "Meters And Gages For Plumbing Piping".
12. Install piping to permit valve servicing.
13. Install piping free of sags and bends.
14. Install fittings for changes in direction and branch connections.
15. Install medical compressed-air piping to medical compressed-air service connections specified in this Section, to medical compressed-air service connections in equipment specified in Division 22 Section "Gas Piping For Laboratory And Healthcare Facilities", and to equipment specified in other Sections requiring medical compressed-air service.
16. Install seismic restraints on compressed-air piping. Seismic-restraint devices are specified in Division 22 Section "Vibration And Seismic Controls For Plumbing Piping And Equipment".
17. Install compressed-air service connections recessed in walls. Attach roughing-in assembly to substrate; attach finishing assembly to roughing-in assembly.
18. Connect compressed-air piping to air compressors and to compressed-air outlets and equipment requiring compressed-air service.
19. Install unions in copper compressed-air tubing adjacent to each valve and at final connection to each piece of equipment, machine, and specialty.



- C. Valve Installation
1. Install shutoff valve at each connection to and from compressed-air equipment and specialties.
 2. Install check valves to maintain correct direction of compressed-air flow from compressed-air equipment.
 3. Install valve boxes recessed in wall and anchored to substrate. Single boxes may be used for multiple valves that serve same area or function.
 4. Install zone valves and gages in valve boxes. Rotate valves to angle that prevents closure of cover when valve is in closed position.
 5. Install safety valves on compressed-air receivers where required by NFPA 99 and where recommended by specialty manufacturers.
 6. Install pressure regulators on compressed-air piping where reduced pressure is required.
 7. Install automatic drain valves on equipment, specialties, and piping with drain connection. Run drain piping to floor drain so contents spill over or into it.
 8. Install flexible pipe connectors in discharge piping and in inlet air piping from remote air-inlet filter, **as directed**, of each air compressor.
- D. Joint Construction
1. Ream ends of PVC pipes and remove burrs.
 2. Remove scale, slag, dirt, and debris from outside of cleaned tubing and fittings before assembly.
 3. Threaded Joints: Apply appropriate tape to external pipe threads.
 4. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter. Continuously purge joint with oil-free dry nitrogen during brazing.
 5. Soldered Joints: Apply ASTM B 813, water-flushable flux to tube end. Join copper tube and fittings according to ASTM B 828.
 6. Pressure-Sealed Joints: Join copper tube and press-type fittings with tools recommended by fitting manufacturer.
 7. Memory-Metal Coupling Joints: Join new copper tube to existing tube according to procedures developed by fitting manufacturer for installation of memory-metal coupling joints.
 8. Solvent-Cemented Joints: Clean and dry joining surfaces. Join PVC pipe and fittings according to the following:
 - a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - b. Apply primer and join according to ASME B31.9 for solvent-cemented joints, and ASTM D 2672.
- E. Compressed-Air Service Component Installation
1. Install compressed-air pressure control panel in walls. Attach to substrate.
 2. Install compressed-air manifolds on concrete base, **as directed**, anchored to substrate.
 3. Install compressed-air cylinders and connect to manifold piping.
 4. Install compressed-air manifolds with seismic restraints as indicated.
 5. Install compressed-air-cylinder wall storage racks attached to substrate.
- F. Medical Compressed-Air-Piping Alarm System Installation
1. Alarm panels for medical compressed-air piping systems may be combined in single panels with medical vacuum piping systems and medical gas piping systems.
 2. Install alarm system components for medical compressed-air-piping according to and in locations required by NFPA 99.
 3. Install area and master alarm panels for medical compressed-air piping system where indicated.
 4. Install computer interface cabinet with connection to medical compressed-air-piping alarm system and to facility computer.
- G. Sleeve Installation
1. Sleeves are not required for core-drilled holes.
 2. Permanent sleeves are not required for holes formed by removable PE sleeves.



3. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs using galvanized-steel pipe **OR** galvanized-steel sheet **OR** stack sleeve fittings **OR** PVC pipe, **as directed**.
 - a. Wall Penetrations: Cut sleeves to length for mounting flush with both surfaces.
 - b. Floor Penetrations: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

OR

Install sleeves in new walls and slabs as new walls and slabs are constructed.
4. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a. PVC **OR** Steel, **as directed**, Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
 - b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger penetrating gypsum board partitions.
 - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Comply with requirements in Division 07 Section "Sheet Metal Flashing And Trim" for flashing.
 - 1) Seal space outside of sleeve fittings with grout.
5. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping".

H. Escutcheon Installation

1. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - a. New Piping:
 - 1) Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
 - 2) Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish **OR** stamped steel with set screw **OR** stamped steel with set screw or spring clips **OR** stamped steel with spring clips, **as directed**.
 - 3) Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish **OR** One piece or split casting, cast brass with polished chrome-plated finish **OR** Split casting, cast brass with polished chrome-plated finish **OR** One piece, stamped steel with set screw **OR** One piece or split plate, stamped steel with set screw **OR** Split plate, stamped steel with set screw, **as directed**.
 - 4) Bare Piping in Unfinished Service Spaces: One piece, cast brass with polished chrome-plated finish **OR** cast brass with rough-brass finish **OR** stamped steel with set screw **OR** stamped steel with spring clips **OR** stamped steel with set screw or spring clips, **as directed**.
 - 5) Bare Piping in Equipment Rooms: One piece, cast brass **OR** stamped steel with set screw **OR** stamped steel with spring clips **OR** stamped steel with set screw or spring clips, **as directed**.
 - 6) Bare Piping at Floor Penetrations in Equipment Rooms: One-piece floor plate.
 - b. Existing Piping:
 - 1) Chrome-Plated Piping: Split casting, cast brass with chrome-plated finish.
 - 2) Insulated Piping: Split plate, stamped steel with concealed **OR** exposed-rivet, **as directed**, hinge and spring clips.
 - 3) Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split casting, cast brass with chrome-plated finish **OR** plate, stamped steel with concealed hinge and spring clips, **as directed**.



- 4) Bare Piping at Ceiling Penetrations in Finished Spaces: Split casting, cast brass with chrome-plated finish **OR** plate, stamped steel with concealed hinge and set screw, **as directed**.
- 5) Bare Piping in Unfinished Service Spaces: Split casting, cast brass with polished chrome-plated finish **OR** casting, cast brass with rough-brass finish **OR** plate, stamped steel with concealed hinge and set screw or spring clips **OR** plate, stamped steel with concealed or exposed-rivet hinge and set screw or spring clips **OR** plate, stamped steel with exposed-rivet hinge and set screw or spring clips, **as directed**.
- 6) Bare Piping in Equipment Rooms: Split casting, cast brass **OR** plate, stamped steel with set screw or spring clips, **as directed**.
- 7) Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting floor plate.

I. Hanger And Support Installation

1. Comply with requirements in Division 22 Section "Vibration And Seismic Controls For Plumbing Piping And Equipment" for seismic-restraint devices.
2. Comply with requirements in Division 22 Section "Hangers And Supports For Plumbing Piping And Equipment" for pipe hanger and support devices.
3. Vertical Piping: MSS Type 8 or 42, clamps.
4. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel, clevis hangers.
 - b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable, roller hangers.
5. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze. Comply with requirements in Division 22 Section "Hangers And Supports For Plumbing Piping And Equipment" for trapeze hangers.
6. Base of Vertical Piping: MSS Type 52, spring hangers.
7. Support horizontal piping within 12 inches (300 mm) of each fitting and coupling.
8. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.
9. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - a. NPS 1/4 (DN 8): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
 - b. NPS 3/8 and NPS 1/2 (DN 10 and DN 15): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
 - c. NPS 3/4 (DN 20): 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
 - d. NPS 1 (DN 25): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
 - e. NPS 1-1/4 (DN 32): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.
 - f. NPS 1-1/2 (DN 40): 10 feet (3 m) with 3/8-inch (10-mm) rod.
 - g. NPS 2 (DN 50): 11 feet (3.4 m) with 3/8-inch (10-mm) rod.
 - h. NPS 2-1/2 (DN 65): 13 feet (4 m) with 1/2-inch (13-mm) rod.
 - i. NPS 3 (DN 80): 14 feet (4.3 m) with 1/2-inch (13-mm) rod.
 - j. NPS 3-1/2 (DN 90): 15 feet (4.6 m) with 1/2-inch (13-mm) rod.
 - k. NPS 4 (DN 100): 16 feet (4.9 m) with 1/2-inch (13-mm) rod.
 - l. NPS 5 (DN 125): 18 feet (5.5 m) with 1/2-inch (13-mm) rod.
 - m. NPS 6 (DN 150): 20 feet (6 m) with 5/8-inch (16-mm) rod.
 - n. NPS 8 (DN 200): 23 feet (7 m) with 3/4-inch (19-mm) rod.
10. Install supports for vertical copper tubing every 10 feet (3 m).

J. Labeling And Identification

1. Install identifying labels and devices for nonmedical laboratory compressed-air piping, valves, and specialties. Comply with requirements in Division 22 Section "Identification For Plumbing Piping And Equipment".
2. Install identifying labels and devices for medical compressed-air piping systems according to NFPA 99. Use the following or similar captions and color-coding for piping products where required by NFPA 99:
 - a. Medical Air: Black letters on yellow background.



- b. Dental Air: Black letters on yellow-and-white diagonal stripe background.
 - c. Instrument Air: White letters on red background.
 - d. Medical Laboratory Air: Black letters on yellow-and-white checkerboard background.
- K. Field Quality Control For Compressed-Air Piping In Nonmedical Laboratory Facilities
- 1. Perform tests and inspections of compressed-air piping in nonmedical laboratory facilities and prepare test reports.
 - 2. Tests and Inspections:
 - a. Piping Leak Tests for Compressed-Air Piping: Test new and modified parts of existing piping. Cap and fill general-service compressed-air piping with oil-free dry nitrogen to pressure of 50 psig (345 kPa) above system operating pressure, but not less than 150 psig (1035 kPa). Isolate test source and let stand for four hours to equalize temperature. Refill system, if required, to test pressure; hold for two hours with no drop in pressure.
 - b. Repair leaks and retest until no leaks exist.
 - c. Inspect filters and pressure regulators for proper operation.
- L. Field Quality Control For Medical Compressed-Air Piping In Healthcare Facilities
- 1. Perform tests and inspections of medical compressed-air piping systems in healthcare facilities and prepare test reports.
 - 2. Tests and Inspections:
 - a. Medical Compressed-Air Testing Coordination: Perform tests, inspections, verifications, and certification of medical compressed-air piping systems concurrently with tests, inspections, and certification of medical vacuum piping and medical gas piping systems.
 - b. Preparation: Perform the following Installer tests according to requirements in NFPA 99 and ASSE Standard #6010:
 - 1) Initial blowdown.
 - 2) Initial pressure test.
 - 3) Cross-connection test.
 - 4) Piping purge test.
 - 5) Standing pressure test for positive-pressure medical compressed-air piping.
 - 6) Repair leaks and retest until no leaks exist.
 - c. System Verification: Comply with requirements in NFPA 99, ASSE Standard #6020, and ASSE Standard #6030 for verification of medical compressed-air piping systems and perform the following tests and inspections:
 - 1) Standing pressure test.
 - 2) Individual-pressurization **OR** Individual-pressurization or pressure-differential **OR** Pressure-differential, **as directed**, cross-connection test.
 - 3) Valve test.
 - 4) Master and area alarm tests.
 - 5) Piping purge test.
 - 6) Piping particulate test.
 - 7) Piping purity test.
 - 8) Final tie-in test.
 - 9) Operational pressure test.
 - 10) Medical air purity test.
 - 11) Verify correct labeling of equipment and components.
 - d. Testing Certification: Certify that specified tests, inspections, and procedures have been performed and certify report results. Include the following:
 - 1) Inspections performed.
 - 2) Procedures, materials, and gases used.
 - 3) Test methods used.
 - 4) Results of tests.
 - 3. Remove and replace components that do not pass tests and inspections and retest as specified above.



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SECTION 22 11 16 00h - VACUUM PIPING FOR LABORATORY AND HEALTHCARE FACILITIES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for vacuum piping for laboratory and healthcare facilities. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Laboratory low-vacuum piping and specialties, designated "laboratory low vacuum" operating at 12 inches mercury (40.6 kPa vacuum) **OR** 20 inches mercury (67.7 kPa vacuum), **as directed**.
 - b. Laboratory high-vacuum piping and specialties, designated "laboratory high vacuum" operating at 24 inches mercury (81.3 kPa vacuum) **OR** 29 inches mercury (98.2 kPa vacuum), **as directed**.
 - c. Medical surgical vacuum piping and specialties, designated "medical vacuum" operating at 15 inches mercury (380 mm mercury or 50.7 kPa vacuum) **OR** 20 inches mercury (510 mm mercury or 67.7 kPa vacuum) **OR** 30 inches mercury (760 mm mercury or 101.4 kPa vacuum), **as directed**.
 - d. Waste anesthetic gas disposal piping and specialties, designated "WAGD evacuation" operating at 14 inches mercury (355 mm mercury or 47.2 kPa vacuum) **OR** 15 inches mercury (380 mm mercury or 50.7 kPa vacuum), **as directed**.
 - e. Dental vacuum piping and specialties, designated "dental vacuum" operating at 10 inches mercury (255 mm mercury or 33.8 kPa vacuum) **OR** 12 inches mercury (305 mm mercury or 40.6 kPa vacuum), **as directed**.
 - f. Oral-evacuation piping and specialties, designated "HVE" operating at 5 inches mercury (127 mm mercury or 16.9 kPa vacuum) **OR** 8 inches mercury (203 mm mercury or 27.0 kPa vacuum), **as directed**.
 - g. Healthcare laboratory vacuum piping and specialties, designated "medical laboratory vacuum" operating at 12 inches mercury (40.6 kPa vacuum) **OR** 20 inches mercury (67.7 kPa vacuum) **OR** 24 inches mercury (81.3 kPa vacuum), **as directed**.

C. Definitions

1. D.I.S.S.: Diameter-index safety system.
2. HVE: High-volume (oral) evacuation.
3. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.
4. WAGD: Waste anesthetic gas disposal.
5. Medical vacuum piping systems include medical vacuum, WAGD evacuation, dental vacuum, HVE, and medical laboratory vacuum piping systems.

D. Submittals

1. Product Data: For the following:
 - a. Vacuum pipes **OR** tubes, **as directed**, and fittings.
 - b. Vacuum valves and valve boxes.
 - c. Medical vacuum service connections and vacuum-bottle brackets.
2. LEED Submittal:
 - a. Product Data for Credit EQ 4.1: For solvent cements and adhesive primers, including printed statement of VOC content.
3. Shop Drawings: Diagram power, signal, and control wiring.



4. Piping Material Certification: Signed by Installer certifying that medical vacuum piping materials comply with NFPA 99 requirements.
5. Qualification Data: For Installer and testing agency.
6. Brazing certificates.
7. Field quality-control test reports.
8. Operation and maintenance data.

E. Quality Assurance

1. Installer Qualifications:
 - a. Medical Vacuum Piping Systems for Healthcare Facilities: Qualify installers according to ASSE Standard #6010.
 - b. Extruded-Tee Outlet Procedure: Qualify operators according to training provided by T-DRILL Industries Inc., for making branch outlets.
 - c. Pressure-Seal Joining Procedure for Copper Tubing: Qualify operators according to training provided by Viega; Plumbing and Heating Systems.
2. Testing Agency Qualifications: An independent testing agency, with the experience and capability to conduct the vacuum piping testing indicated, that is a member of the Medical Gas Professional Healthcare Organization or is an NRTL, and that is acceptable to authorities having jurisdiction.
 - a. Qualify testing personnel according to ASSE Standard #6020 for inspectors and ASSE Standard #6030 for verifiers.
3. Source Limitations: Obtain vacuum service connections of same type and from same manufacture as service connections provided for in Division 22 Section "Gas Piping For Laboratory And Healthcare Facilities".
4. Brazing: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications," or AWS B2.2, "Standard for Brazing Procedure and Performance Qualification."
5. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
6. Comply with ASME B31.9, "Building Services Piping," for vacuum piping in laboratory facilities.
7. NFPA Compliance: Comply with NFPA 99, "Health Care Facilities," for medical vacuum system materials and installation in healthcare facilities.

F. Project Conditions

1. Interruption of Existing Laboratory or Medical Vacuum Service(s): Do not interrupt laboratory or medical vacuum service to facilities occupied by the Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - a. Notify the Owner no fewer than two days in advance of proposed interruption of laboratory or medical vacuum service(s).
 - b. Do not proceed with interruption of laboratory or medical vacuum service(s) without the Owner's written permission.

1.2 PRODUCTS

A. Pipes, Tubes, And Fittings

1. Copper Medical Gas Tube: ASTM B 819, Type L, seamless, drawn temper that has been manufacturer cleaned, purged, and sealed for medical gas service or according to CGA G-4.1 for oxygen service. Include standard color marking "OXY," "MED," "OXY/MED," "OXY/ACR," or "ACR/MED" in blue.
 - a. General Requirements for Copper Fittings: Manufacturer cleaned, purged, and bagged for oxygen service according to CGA G-4.1.



- b. Wrought-Copper Fittings: ASME B16.22, solder-joint pressure type or MSS SP-73, with dimensions for brazed joints.
 - c. Copper Unions: ASME B16.22 or MSS SP-123, wrought copper or cast-copper alloy.
 - d. Press-Type Fittings:
 - 1) NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.
 - 2) NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Bronze fitting with stainless-steel grip ring and EPDM O-ring seal in each end.
2. Copper Water Tube: ASTM B 88, Type M (ASTM B 88M, Type C), seamless, drawn temper.
 - a. Cast-Copper Fittings: ASME B16.18, solder-joint pressure type.
 - b. Wrought-Copper Fittings: ASME B16.22, solder-joint pressure type.
 - c. Cast-Copper-Alloy Flanges: ASME B16.24, Class 150.
 - d. Copper Unions: ASME B16.22 or MSS SP-123, wrought copper or cast-copper alloy.
 - e. Press-Type Fittings:
 - 1) NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.
 - 2) NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Bronze fitting with stainless-steel grip ring and EPDM O-ring seal in each end.
 3. Extruded-Tee Outlets: ASTM F 2014 procedure for making branch outlets in copper tube.
 4. Memory-Metal Couplings: Cryogenic compression fitting made of ASTM F 2063, nickel-titanium, shape-memory alloy, and that has been manufacturer cleaned, purged, and sealed for oxygen service according to CGA G-4.1.
 5. PVC Pipe: ASTM D 1785, Schedule 40 and Schedule 80.
 - a. PVC Pressure Fittings: ASTM D 2466, Schedule 40 and ASTM D 2467, Schedule 80; socket type.
- B. Joining Materials
1. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
 2. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.
 3. Threaded-Joint Tape: PTFE.
 4. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness, full-face type.
 5. Flange Bolts and Nuts: ASME B18.2.1, carbon steel.
 6. Solvent Cement for Joining PVC Piping: ASTM D 2564. Include primer complying with ASTM F 656.
 - a. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Valves
1. General Requirements for Valves: Manufacturer cleaned, purged, and bagged according to CGA G-4.1 for oxygen service.
 - a. Exception: Factory cleaning and bagging are not required for valves for WAGD service.
 2. Copper-Alloy Ball Valves: MSS SP-110, 3-piece body, brass or bronze.
 - a. Pressure Rating: 300 psig (2070 kPa) minimum.
 - b. Ball: Full-port, chrome-plated brass.
 - c. Seats: PTFE or TFE.
 - d. Handle: Lever type with locking device, **as directed**.
 - e. Stem: Blowout proof with PTFE or TFE seal.
 - f. Ends: Manufacturer-installed ASTM B 819, copper-tube extensions.
 3. Bronze Check Valves: In-line pattern.
 - a. Pressure Rating: 300 psig (2070 kPa) minimum.
 - b. Operation: Spring loaded.



- c. Ends: Manufacturer-installed ASTM B 819, copper-tube extensions.
 4. Zone Valves: MSS SP-110, 3-piece-body, brass or bronze ball valve with gage.
 - a. Pressure Rating: 300 psig (2070 kPa) minimum.
 - b. Ball: Full-port, chrome-plated brass.
 - c. Seats: PTFE or TFE.
 - d. Handle: Lever type with locking device, **as directed**.
 - e. Stem: Blowout proof with PTFE or TFE seal.
 - f. Ends: Manufacturer-installed ASTM B 819, copper-tube extensions.
 - g. Vacuum Gage: Manufacturer installed on one copper-tube extension.
 5. Zone Valve Boxes: Formed steel with anchors for recessed mounting, holes with grommets in box sides for tubing extension protection, and of size for single or multiple valves with vacuum gages and in sizes required to permit manual operation of valves.
 - a. Interior Finish: Factory-applied white enamel.
 - b. Cover Plate: Aluminum or extruded-anodized aluminum **OR** Satin-chrome finish steel **OR** Stainless steel with NAAMM AMP 503, No. 4 finish, **as directed**, with frangible or removable windows.
 - c. Valve-Box Windows: Clear or tinted transparent plastic with labeling that includes rooms served, according to NFPA 99.
 6. Zone Valve Boxes: Formed or extruded aluminum with anchors for recessed mounting, holes with grommets in box sides for tubing extension protection, and of size for single or multiple valves with vacuum gages and in sizes required to permit manual operation of valves.
 - a. Interior Finish: Factory-applied white enamel.
 - b. Cover Plate: Aluminum or extruded-anodized aluminum **OR** Stainless steel with NAAMM AMP 503, No. 4 finish, **as directed**, with frangible or removable windows.
 - c. Valve-Box Windows: Clear or tinted transparent plastic with labeling that includes rooms served, according to NFPA 99.
 7. PVC Ball Valves: MSS SP-122, with union ends and 150-psig (1035-kPa) minimum working-pressure rating and suitable for vacuum service.
 8. PVC Butterfly Valves: Lug type with lever handle and 150-psig (1035-kPa) minimum working-pressure rating and suitable for vacuum service.
 9. PVC Check Valves: Ball-, in-line-, piston-, or swing-check design with flanged or union ends and 70-psig (480-kPa) **OR** 100-psig (690-kPa), **as directed**, minimum working-pressure rating and suitable for vacuum service.
 10. Safety Valves: Bronze-body, ASME-construction, pressure-relief type with settings to match system requirements.
 11. Automatic Drain Valves: Stainless-steel body and internal parts, rated for 200-psig (1380-kPa) minimum working pressure, capable of automatic discharge of collected condensate. Include mounting bracket where wall mounting is indicated.
- D. Medical Vacuum Service Connections
1. Connection Devices: For specific medical vacuum service listed. Include roughing-in assemblies, finishing assemblies, and cover plates. Individual cover plates are not required if service connection is in multiple unit or assembly with cover plate. Furnish recessed-type units made for concealed piping unless otherwise indicated.
 - a. Roughing-in Assembly:
 - 1) Steel outlet box for recessed mounting and concealed piping.
 - 2) Brass-body inlet block.
 - 3) Seals that will prevent vacuum leakage.
 - 4) ASTM B 819, NPS 3/8 (DN 10) copper outlet tube brazed to valve with service marking and tube-end dust cap.
 - b. Finishing Assembly:
 - 1) Brass housing with primary check valve.
 - 2) Seals that will prevent vacuum leakage.
 - 3) Cover plate with gas-service label.



- c. Quick-Coupler Service Connections: Suction inlets for medical vacuum **OR** medical vacuum and WAGD evacuation **OR** WAGD evacuation, **as directed**, service outlets with noninterchangeable keyed indexing to prevent interchange between services, constructed to permit one-handed connection and removal of equipment, and with positive-locking ring that retains equipment stem in valve during use.
 - d. D.I.S.S. Service Connections: Suction inlets, complying with CGA V-5, with threaded indexing to prevent interchange between services, constructed to permit one-handed connection and removal of equipment.
 - 1) Medical Vacuum Service Connections: CGA V-5, D.I.S.S. No. 1220.
 - 2) WAGD Evacuation Service Connections: CGA V-5, D.I.S.S. No. 2220.
 - e. Vacuum Bottle Brackets: One piece, with pattern and finish matching corresponding service cover plate.
 - f. Cover Plates: One piece, stainless steel, with NAAMM AMP 503, No. 4 finish **OR** metal, with chrome-plated finish **OR** anodized aluminum, **as directed**, and permanent, color-coded, identifying label matching corresponding service.
- E. Medical Vacuum Piping Alarm Systems
1. Panels for medical vacuum piping systems may be combined in single panels with medical compressed-air and medical gas piping systems.
 2. Components: Designed for continuous service and to operate on power supplied from 120-V **OR** 240-V **OR** 277-V, **as directed**, ac power source to alarm panels and with connections for low-voltage wiring to remote sensing devices. Include step-down transformers if required.
 3. Vacuum Switches or Transducer Sensors: Continuous line monitoring with electrical connections for alarm system.
 - a. Vacuum Operating Range: 0- to 30-in. Hg (0- to 101-kPa vacuum).
 4. General Requirements for Medical Vacuum Alarm Panels: Factory wired with audible and color-coded visible signals to indicate specified functions.
 - a. Mounting: Exposed, surface **OR** Recessed, **as directed**, installation.
 - b. Enclosures: Fabricated from minimum 0.047-inch- (1.2-mm-) thick steel or minimum 0.05-inch- (1.27-mm-) thick aluminum, with knockouts for electrical and piping connections.
 5. Master Alarm Panels: With separate trouble alarm signals, vacuum gages, and indicators for medical vacuum piping systems.
 - a. Include alarm signals when the following conditions exist:
 - 1) Medical Vacuum: Vacuum drops below 12-in. Hg (40 kPa vacuum) and backup vacuum pump is in operation.
 - 2) WAGD Evacuation: Vacuum drops below 12-in. Hg (40 kPa vacuum).
 - 3) Dental Vacuum: Vacuum drops below 6-in. Hg (20 kPa vacuum) and backup vacuum producer is in operation.
 - 4) HVE: 4-in. Hg (13 kPa vacuum) and backup vacuum producer is in operation.
 - 5) Medical Laboratory Vacuum: Vacuum drops below 10-in. Hg (34 kPa vacuum).
 6. Anesthetizing-Area Alarm Panels: Separate trouble alarm signals; vacuum gages; and indicators for medical vacuum piping systems.
 - a. Include alarm signals when the following conditions exist:
 - 1) Medical Vacuum: Vacuum drops below 12-in. Hg (40 kPa vacuum).
 - 2) WAGD Evacuation: Vacuum drops below 12-in. Hg (40 kPa vacuum).
 7. Area Alarm Panels: Separate trouble alarm signals; vacuum gages; and indicators for medical vacuum piping systems.
 - a. Include alarm signals when the following condition exists:
 - 1) Medical Vacuum: Vacuum drops below 12-in. Hg (40 kPa vacuum).
 8. Dental Area Alarm Panels: Separate trouble alarm signals; vacuum gages; and indicators for medical vacuum piping systems.
 - a. Include alarm signals when the following conditions exist:
 - 1) Dental Vacuum: Vacuum drops below 6-in. Hg (20 kPa vacuum) and backup vacuum producer is in operation.
 - 2) HVE: 4-in. Hg (13 kPa vacuum) and backup vacuum producer is in operation.



9. Medical Laboratory Area Alarm Panels: Separate trouble alarm signals; vacuum gages; and indicators for medical vacuum piping systems.
 - a. Include alarm signals when the following condition exists:
 - 1) Medical Vacuum: Vacuum drops below 12-in. Hg (40 kPa vacuum).
- F. Computer Interface Cabinet
1. Description: Wall-mounting, welded-steel, control cabinet with gasketed door, mounting brackets, grounding device, and white-enamel finish for connection of medical vacuum piping system alarms to facility computer. Include factory-installed signal circuit boards, power transformer, circuit breaker, wiring terminal board, and internal wiring capable of interfacing 20 alarm signals.
- G. Flexible Pipe Connectors
1. Description: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
 - a. Working-Pressure Rating: 200 psig (1380 kPa) **OR** 250 psig (1725 kPa), **as directed**, minimum.
 - b. End Connections: Threaded copper pipe or plain-end copper tube.
- H. Sleeves
1. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
 2. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - a. Underdeck Clamp: Clamping ring with set screws.
- I. Escutcheons
1. General Requirements for Escutcheons: Manufactured wall and ceiling escutcheons and floor plates, with ID to closely fit around pipe and tube and OD that completely covers opening.
 2. One-Piece, Deep-Pattern Escutcheons: Deep-drawn, box-shaped brass with polished chrome-plated finish.
 3. One-Piece, Cast-Brass Escutcheons: With set screw.
 - a. Finish: Polished chrome-plated **OR** Rough brass **OR** Polished chrome-plated and rough brass, **as directed**.
 4. Split-Casting, Cast-Brass Escutcheons: With concealed hinge and set screw.
 - a. Finish: Polished chrome-plated **OR** Rough brass **OR** Polished chrome-plated and rough brass, **as directed**.
 5. One-Piece, Stamped-Steel Escutcheons: With set screw **OR** spring clips, **as directed**, and chrome-plated finish.
 6. Split-Plate, Stamped-Steel Escutcheons: With concealed **OR** exposed-rivet, **as directed**, hinge, set screw **OR** spring clips, **as directed**, and chrome-plated finish.
 7. One-Piece, Floor-Plate Escutcheons: Cast iron.
 8. Split-Casting, Floor-Plate Escutcheons: Cast brass with concealed hinge and set screw.
- J. Grout
1. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - a. Characteristics: Post-hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - b. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
 - c. Packaging: Premixed and factory packaged.
- K. Nitrogen
1. Description: Comply with USP 28 - NF 23 for oil-free dry nitrogen.



1.3 EXECUTION

A. Preparation

1. Cleaning of Medical Gas Tubing: If manufacturer-cleaned and -capped fittings or tubing are not available or if precleaned fittings or tubing must be recleaned because of exposure, have supplier or separate agency acceptable to authorities having jurisdiction perform the following procedures:
 - a. Clean medical gas tube and fittings, valves, gages, and other components of oil, grease, and other readily oxidizable materials as required for oxygen service according to CGA G-4.1, "Cleaning Equipment for Oxygen Service."
 - b. Wash medical gas tubing and components in hot, alkaline-cleaner-water solution of sodium carbonate or trisodium phosphate in proportion of 1 lb (0.453 kg) of chemical to 3 gal. (11.3 L) of water.
 - 1) Scrub to ensure complete cleaning.
 - 2) Rinse with clean, hot water to remove cleaning solution.

B. Piping Applications

1. Connect new copper tubing to existing tubing with memory-metal couplings.
2. Nonhealthcare Laboratory Low Vacuum Piping: Use one of the following piping materials for each size range:
 - a. NPS 4 (DN 100) and Smaller: Type L, copper medical gas **OR** M (C) copper water, **as directed**, tube; wrought-copper fittings; and brazed **OR** soldered, **as directed**, joints.
 - b. NPS 4 (DN 100) and Smaller: Type L, copper medical gas **OR** M (C) copper water, **as directed**, tube; press-type fittings; and pressure-sealed joints.
 - c. NPS 5 to NPS 8 (DN 125 to DN 200): Type L, copper medical gas **OR** M (C) copper water, **as directed**, tube; wrought-copper fittings; and brazed **OR** soldered, **as directed**, joints.
3. Nonhealthcare Laboratory High Vacuum Piping: Use one of the following piping materials for each size range:
 - a. NPS 4 (DN 100) and Smaller: Type L, copper medical gas **OR** M (C) copper water, **as directed**, tube; wrought-copper fittings; and brazed **OR** soldered, **as directed**, joints.
 - b. NPS 4 (DN 100) and Smaller: Type L, copper medical gas **OR** M (C) copper water, **as directed**, tube; press-type fittings; and pressure-sealed joints.
 - c. NPS 5 to NPS 8 (DN 125 to DN 200): Type L, copper medical gas **OR** M (C) copper water, **as directed**, tube; wrought-copper fittings; and brazed **OR** soldered, **as directed**, joints.
4. Medical Vacuum Piping: Use one of the following piping materials for each size range:
 - a. NPS 4 (DN 100) and Smaller: Type L, copper medical gas **OR** M (C) copper water, **as directed**, tube; wrought-copper fittings; and brazed joints.
 - b. NPS 4 (DN 100) and Smaller: Type L, copper medical gas **OR** M (C) copper water, **as directed**, tube; press-type fittings; and pressure-sealed joints.
 - c. NPS 5 to NPS 8 (DN 125 to DN 200): Type L, copper medical gas **OR** M (C) copper water, **as directed**, tube; wrought-copper fittings; and brazed joints.
5. WAGD Evacuation Piping: Use one of the following piping materials for each size range:
 - a. NPS 4 (DN 100) and Smaller: Type L, copper medical gas **OR** M (C) copper water, **as directed**, tube; wrought-copper fittings; and brazed joints.
 - b. NPS 4 (DN 100) and Smaller: Type L, copper medical gas **OR** M (C) copper water, **as directed**, tube; press-type fittings; and pressure-sealed joints.
 - c. NPS 5 to NPS 8 (DN 125 to DN 200): Type L, copper medical gas **OR** M (C) copper water, **as directed**, tube; wrought-copper fittings; and brazed joints.
6. Dental Vacuum Piping: Use one of the following piping materials for each size range:
 - a. NPS 4 (DN 100) and Smaller: Type L, copper medical gas **OR** M (C) copper water, **as directed**, tube; wrought-copper fittings; and brazed **OR** soldered, **as directed**, joints.
 - b. NPS 4 (DN 100) and Smaller: Type L, copper medical gas **OR** M (C) copper water, **as directed**, tube; press-type fittings; and pressure-sealed joints.
 - c. NPS 5 to NPS 8 (DN 125 to DN 200): Type L, copper medical gas **OR** M (C) copper water, **as directed**, tube; wrought-copper fittings; and brazed **OR** soldered, **as directed**, joints.
7. HVE Piping: Use one of the following piping materials for each size range:



- a. NPS 4 (DN 100) and Smaller: Type L, copper medical gas **OR** M (C) copper water, **as directed**, tube; wrought-copper fittings; and brazed **OR** soldered, **as directed**, joints.
 - b. NPS 4 (DN 100) and Smaller: Type L, copper medical gas **OR** M (C) copper water, **as directed**, tube; press-type fittings; and pressure-sealed joints.
 - c. NPS 4 (DN 100) and Smaller: Schedule 40 PVC pipe, Schedule 40 PVC fittings **OR** Schedule 80 PVC pipe, Schedule 80 PVC fittings, **as directed**, and solvent-cemented joints.
 - d. NPS 5 to NPS 8 (DN 125 to DN 200): Type L, copper medical gas **OR** M (C) copper water, **as directed**, tube; wrought-copper fittings; and brazed **OR** soldered, **as directed**, joints.
 - e. NPS 5 to NPS 8 (DN 125 to DN 200): Schedule 40 PVC pipe, Schedule 40 PVC fittings **OR** Schedule 80 PVC pipe, Schedule 80 PVC fittings, **as directed**, and solvent-cemented joints.
8. Medical Laboratory Vacuum Piping: Use one of the following piping materials for each size range:
- a. NPS 4 (DN 100) and Smaller: Type L, copper medical gas **OR** M (C) copper water, **as directed**, tube; wrought-copper fittings; and brazed joints.
 - b. NPS 4 (DN 100) and Smaller: Type L, copper medical gas **OR** M (C) copper water, **as directed**, tube; press-type fittings; and pressure-sealed joints.
 - c. NPS 5 to NPS 8 (DN 125 to DN 200): Type L, copper medical gas **OR** M (C) copper water, **as directed**, tube; wrought-copper fittings; and brazed joints.
9. Drain Piping: Use one of the following piping materials:
- a. Copper water tube, cast- or wrought-copper fittings, and soldered **OR** press-type fittings, and pressure-sealed, **as directed**, joints.
 - b. PVC pipe, PVC fittings, and solvent-cemented joints.

C. Piping Installation

1. Drawing plans, schematics, and diagrams indicate general location and arrangement of vacuum piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, air-compressor sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
2. Comply with ASSE Standard #6010 for installation of vacuum piping.
3. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
4. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
5. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal and coordinate with other services occupying that space.
6. Install piping adjacent to equipment and specialties to allow service and maintenance.
7. Install vacuum and drain piping with 1 percent slope downward in direction of flow.
8. Install nipples, unions, and special fittings, and valves with pressure ratings same as or higher than piping pressure rating used in applications below unless otherwise indicated.
9. Install eccentric reducers, if available, where vacuum piping is reduced in direction of flow, with bottoms of both pipes and reducer fitting flush.
10. Provide drain leg and drain trap at end of each main and branch and at low points.
11. Install thermometer and vacuum gage on inlet piping to each vacuum producer and on each receiver and separator, **as directed**. Comply with requirements in Division 22 Section "Meters And Gages For Plumbing Piping".
12. Install piping to permit valve servicing.
13. Install piping free of sags and bends.
14. Install fittings for changes in direction and for branch connections. Extruded-tee branch outlets in copper tubing may be made where specified.
15. Install medical vacuum piping to medical vacuum service connections specified in this Section and to equipment specified in other Sections requiring medical vacuum service.



16. Install seismic restraints on vacuum piping. Seismic-restraint devices are specified in Division 22 Section "Vibration And Seismic Controls For Plumbing Piping And Equipment".
 17. Install medical vacuum service connections recessed in walls. Attach roughing-in assembly to substrate; attach finishing assembly to roughing-in assembly.
 18. Install medical vacuum bottle bracket adjacent to each wall-mounted medical vacuum service connection suction inlet.
 19. Connect vacuum piping to vacuum producers and to equipment requiring vacuum service.
 20. Install unions, in copper vacuum tubing adjacent to each valve and at final connection to each piece of equipment, machine, and specialty.
 21. Install unions, in PVC vacuum piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment, machine, and specialty.
 22. Install flanges, in PVC vacuum piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment, machine, and specialty.
- D. Valve Applications
1. Valves for Copper Vacuum Tubing: Use copper alloy ball and bronze check types.
 2. Valves for PVC Vacuum Piping:
 - a. NPS 4 (DN 100) and Smaller: Use copper alloy ball and bronze **OR** PVC ball, butterfly, and, **as directed**, check types.
 - b. NPS 5 (DN 125) and Larger: Use PVC butterfly and check types.
- E. Valve Installation
1. Install shutoff valve at each connection to and from vacuum equipment and specialties.
 2. Install check valves to maintain correct direction of vacuum flow to vacuum-producing equipment.
 3. Install valve boxes recessed in wall and anchored to substrate. Single boxes may be used for multiple valves that serve same area or function.
 4. Install zone valves and gages in valve boxes. Rotate valves to angle that prevents closure of cover when valve is in closed position.
 5. Install safety valves on vacuum receivers, where required by NFPA 99, and where recommended by specialty manufacturers.
 6. Install automatic drain valves on equipment, specialties, and piping with drain connection. Run drain piping to floor drain, so contents spill over or into it.
 7. Install flexible pipe connectors in suction inlet piping to each vacuum producer.
- F. Joint Construction
1. Ream ends of pipes and tubes and remove burrs.
 2. Remove scale, slag, dirt, and debris from outside of cleaned tubing and fittings before assembly.
 3. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
 4. Threaded Joints: Apply appropriate tape to external pipe threads.
 5. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Braze Joints" Chapter. Continuously purge joint with oil-free dry nitrogen during brazing.
 6. Soldered Joints: Apply ASTM B 813, water-flushable flux to tube end. Join copper tube and fittings according to ASTM B 828.
 7. Extruded-Tee Outlets: Form branches in copper tube according to ASTM F 2014, with tools recommended by procedure manufacture.
 8. Flanged Joints:
 - a. Copper Tubing: Install flange on copper tubes. Use pipe-flange gasket between flanges. Join flanges with gasket and bolts according to ASME B31.9 for bolting procedure.
 - b. PVC Piping: Install PVC flange on PVC pipes. Use pipe-flange gasket between flanges. Join flanges with gasket and bolts according to ASME B31.9 for bolting procedure.
 9. Pressure-Sealed Joints: Join copper tube and copper and copper-alloy fittings with tools recommended by fitting manufacturer.
 10. Memory-Metal Coupling Joints: Join new copper tube to existing tube according to procedures developed by fitting manufacturer for installation of memory-metal coupling joints.
 11. Solvent-Cemented Joints: Clean and dry joining surfaces. Join PVC pipe and fittings according to the following:



- a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
- b. Apply primer and join according to ASME B31.9 for solvent-cemented joints and to ASTM D 2672.

G. Medical Vacuum Piping Alarm System Installation

1. Panels for medical vacuum piping systems may be combined in single panels with medical compressed-air piping systems and medical gas piping systems.
2. Install medical vacuum piping system alarm system components in locations required by and according to NFPA 99.
3. Install medical vacuum piping system area and master alarm panels where indicated.
4. Install computer interface cabinet with connection to medical vacuum piping alarm system and to facility computer.

H. Sleeve Installation

1. Sleeves are not required for core-drilled holes.
2. Permanent sleeves are not required for holes formed by removable PE sleeves.
3. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs using galvanized-steel pipe **OR** galvanized-steel sheet **OR** stack sleeve fittings **OR** PVC pipe, **as directed**.
 - a. Wall Penetrations: Cut sleeves to length for mounting flush with both surfaces.
 - b. Floor Penetrations: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

OR

Install sleeves in new walls and slabs as new walls and slabs are constructed.

4. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a. PVC **OR** Steel, **as directed**, Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
 - b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum board partitions.
 - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Comply with requirements in Division 07 Section "Sheet Metal Flashing And Trim" for flashing.
 - 1) Seal space outside of sleeve fittings with grout.
5. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping".

I. Escutcheon Installation

1. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - a. New Piping:
 - 1) Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
 - 2) Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish **OR** stamped steel with set screw **OR** stamped steel with set screw or spring clips **OR** stamped steel with spring clips, **as directed**.
 - 3) Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish **OR** One piece or split casting, cast brass with polished chrome-plated finish **OR** Split casting, cast brass with polished chrome-plated finish **OR** One-piece, stamped steel with set screw **OR** One piece or split plate, stamped steel with set screw **OR** Split plate, stamped steel with set screw, **as directed**.



- 4) Bare Piping in Unfinished Service Spaces: One piece, cast brass with polished chrome-plated finish **OR** cast brass with rough-brass finish **OR** stamped steel with set screw **OR** stamped steel with spring clips **OR** stamped steel with set screw or spring clips, **as directed**.
 - 5) Bare Piping in Equipment Rooms: One piece, cast brass **OR** stamped steel with set screw **OR** stamped steel with spring clips **OR** stamped steel with set screw or spring clips, **as directed**.
 - 6) Bare Piping at Floor Penetrations in Equipment Rooms: One-piece floor plate.
- b. Existing Piping:
- 1) Chrome-Plated Piping: Split casting, cast brass with chrome-plated finish.
 - 2) Insulated Piping: Split plate, stamped steel with concealed **OR** exposed-rivet, **as directed**, hinge and spring clips.
 - 3) Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split casting, cast brass with chrome-plated finish **OR** plate, stamped steel with concealed hinge and spring clips, **as directed**.
 - 4) Bare Piping at Ceiling Penetrations in Finished Spaces: Split casting, cast brass with chrome-plated finish **OR** plate, stamped steel with concealed hinge and set screw, **as directed**.
 - 5) Bare Piping in Unfinished Service Spaces: Split casting, cast brass with polished chrome-plated finish **OR** casting, cast brass with rough-brass finish **OR** plate, stamped steel with concealed hinge and set screw or spring clips **OR** plate, stamped steel with concealed or exposed-rivet hinge and set screw or spring clips **OR** plate, stamped steel with exposed-rivet hinge and set screw or spring clips, **as directed**.
 - 6) Bare Piping in Equipment Rooms: Split casting, cast brass **OR** plate, stamped steel with set screw or spring clips, **as directed**.
 - 7) Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting floor plate.

J. Hanger And Support Installation

1. Comply with requirements in Division 22 Section "Hangers And Supports For Plumbing Piping And Equipment" for pipe hanger and support devices.
2. Vertical Piping: MSS Type 8 or 42, clamps.
3. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel, clevis hangers.
 - b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable, roller hangers.
4. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze. Comply with requirements in Division 22 Section "Hangers And Supports For Plumbing Piping And Equipment" for trapeze hangers.
5. Base of Vertical Piping: MSS Type 52, spring hangers.
6. Support horizontal piping within 12 inches (300 mm) of each fitting and coupling.
7. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.
8. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - a. NPS 1/4 (DN 8): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
 - b. NPS 3/8 and NPS 1/2 (DN 10 and DN 15): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
 - c. NPS 3/4 (DN 20): 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
 - d. NPS 1 (DN 25): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
 - e. NPS 1-1/4 (DN 32): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.
 - f. NPS 1-1/2 (DN 40): 10 feet (3 m) with 3/8-inch (10-mm) rod.
 - g. NPS 2 (DN 50): 11 feet (3.4 m) with 3/8-inch (10-mm) rod.
 - h. NPS 2-1/2 (DN 65): 13 feet (4 m) with 1/2-inch (13-mm) rod.
 - i. NPS 3 (DN 80): 14 feet (4.3 m) with 1/2-inch (13-mm) rod.
 - j. NPS 3-1/2 (DN 90): 15 feet (4.6 m) with 1/2-inch (13-mm) rod.
 - k. NPS 4 (DN 100): 16 feet (4.9 m) with 1/2-inch (13-mm) rod.
 - l. NPS 5 (DN 125): 18 feet (5.5 m) with 1/2-inch (13-mm) rod.



- m. NPS 6 (DN 150): 20 feet (6 m) with 5/8-inch (16-mm) rod.
 - n. NPS 8 (DN 200): 23 feet (7 m) with 3/4-inch (19-mm) rod.
 - 9. Install supports for vertical copper tubing every 10 feet (3 m).
 - 10. Install hangers **OR** vinyl-coated hangers, **as directed**, for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
 - a. NPS 1 (DN 25) and Smaller: 30 inches (760 mm) with 3/8-inch (10-mm) rod.
 - b. NPS 1-1/2 to NPS 2 (DN 40 to DN 50): 36 inches (900 mm) with 3/8-inch (10-mm) rod.
 - c. NPS 2-1/2 and NPS 3 (DN 65 and DN 80): 42 inches (1150 mm) with 1/2-inch (13-mm) rod.
 - d. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1220 mm) with 1/2-inch (13-mm) rod.
 - e. NPS 6 and NPS 8 (DN 150 and DN 200): 54 inches (1350 mm) with 5/8-inch (16-mm) rod.
 - 11. Install supports for vertical PVC piping every 48 inches (1220 mm).
- K. Labeling And Identification
- 1. Install identifying labels and devices for laboratory vacuum piping, valves, and specialties. Comply with requirements in Division 22 Section "Identification For Plumbing Piping And Equipment".
 - 2. Install identifying labels and devices for medical vacuum piping systems according to NFPA 99. Use the following or similar captions and color-coding for piping products where required by NFPA 99:
 - a. Medical Vacuum: Black letters on white background.
 - b. WAGD: White letters on violet background.
 - c. Dental Vacuum: Black boxed letters on white-and-black diagonal stripe background.
 - d. HVE: Black boxed letters on white-and-black diagonal stripe background.
 - e. Medical Laboratory Vacuum: Black boxed letters on white-and-black checkerboard background.
- L. Field Quality Control For Laboratory Facility Nonmedical Vacuum Piping
- 1. Perform tests and inspections of vacuum piping in nonmedical laboratory facilities.
 - 2. Tests and Inspections:
 - a. Piping Leak Tests for Vacuum Piping: Test new and modified parts of existing piping. Cap and fill vacuum piping with oil-free, dry nitrogen. Isolate test source and let stand for four hours to equalize temperature. Refill system, if required, to test pressure; hold for two hours with no drop in pressure.
 - 1) Test Pressure for Copper Tubing: 100 psig (690 kPa) **OR** 150 psig (1035 kPa), **as directed**.
 - 2) Test Pressure for PVC Piping: 50 psig (345 kPa) **OR** 100 psig (690 kPa), **as directed**.
 - b. Repair leaks and retest until no leaks exist.
 - c. Inspect filters for proper operation.
 - 3. Prepare test reports.
- M. Field Quality Control For Healthcare Facility Medical Vacuum Piping
- 1. Perform tests and inspections of medical vacuum piping systems in healthcare facilities and prepare test reports.
 - 2. Tests and Inspections:
 - a. Medical Vacuum Testing Coordination: Perform tests, inspections, verifications, and certification of medical vacuum piping systems concurrently with tests, inspections, and certification of medical compressed-air piping and medical gas piping systems.
 - b. Perform the following Installer tests according to requirements in NFPA 99 and ASSE Standard #6010:
 - 1) Initial blow down.
 - 2) Initial pressure test.
 - 3) Cross-connection test.
 - 4) Piping purge test.



- 5) Standing pressure test for vacuum systems.
 - 6) Repair leaks and retest until no leaks exist.
 - c. System Verification: Comply with requirements in NFPA 99, ASSE Standard #6020, and ASSE Standard #6030 for verification of medical vacuum piping systems and perform the following tests and inspections:
 - 1) Standing pressure test.
 - 2) Individual-pressurization **OR** Pressure-differential, **as directed**, cross-connection test.
 - 3) Valve test.
 - 4) Master and area alarm tests.
 - 5) Piping purge test.
 - 6) Final tie-in test.
 - 7) Operational vacuum test.
 - 8) Verify correct labeling of equipment and components.
 - d. Testing Certification: Certify that specified tests, inspections, and procedures have been performed and certify report results. Include the following:
 - 1) Inspections performed.
 - 2) Procedures, materials, and gases used.
 - 3) Test methods used.
 - 4) Results of tests.
 3. Remove and replace components that do not pass tests and inspections and retest as specified above.
- N. Demonstration
1. Train the Owner's maintenance personnel to adjust, operate, and maintain medical vacuum alarm systems.

END OF SECTION 22 11 16 00h



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SECTION 22 11 16 00i - GAS PIPING FOR LABORATORY AND HEALTHCARE FACILITIES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for gas piping for laboratory and healthcare facilities. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Carbon dioxide piping and specialties designated "medical carbon dioxide" operating at 50 to 55 psig (345 to 380 kPa).
 - b. Helium piping, designated "medical helium" operating at 50 to 55 psig (345 to 380 kPa).
 - c. Nitrogen piping and specialties designated "medical nitrogen" operating at 160 to 185 psig (1100 to 1275 kPa) **OR** higher than 200 psig (1380 kPa), **as directed**.
 - d. Nitrous oxide piping and specialties designated "medical nitrous oxide" operating at 50 to 55 psig (345 to 380 kPa).
 - e. Oxygen piping and specialties designated "medical oxygen" operating at 50 to 55 psig (345 to 380 kPa).

C. Definitions

1. CR: Chlorosulfonated polyethylene synthetic rubber.
2. D.I.S.S.: Diameter-index safety system.
3. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.
4. Medical gas piping systems include medical carbon dioxide, medical helium, medical nitrogen, medical nitrous oxide, and medical oxygen nonflammable gas for healthcare facility patient care or for healthcare laboratory applications.
5. Specialty Gas: Gas, other than medical gas, for nonmedical laboratory facility applications.

D. Performance Requirements

1. Seismic Performance: Gas manifolds, Bulk gas storage tanks, Gas manifolds and bulk gas storage tanks, and piping shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

E. Submittals

1. Product Data: For the following:
 - a. Tubes and fittings.
 - b. Valves and valve boxes.
 - c. Medical gas service connections.
 - d. Electrical service connections.
 - e. Patient service consoles.
 - f. Medical nitrogen pressure control panels.
 - g. Ceiling columns. Include integral service connections.
 - h. Ceiling hose assemblies. Include integral service connections.
 - i. Gas manifolds.
 - j. Bulk gas storage tanks. Include rated capacities and operating weights.
 - k. Medical gas alarm system components.
 - l. Gas cylinder storage racks.
2. Shop Drawings: Diagram power, signal, and control wiring.



3. Piping Material Certification: Signed by Installer certifying that medical gas piping materials comply with NFPA 99 requirements.
4. Brazing certificates.
5. Manufacturer Seismic Qualification Certification: Submit certification that gas manifolds and bulk gas storage tanks, accessories, and components will withstand seismic forces defined in Division 22 Section "Vibration And Seismic Controls For Plumbing Piping And Equipment". Include the following:
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
6. Certificates of Shop Inspection and Data Report for Bulk Gas Storage Tanks: As required by ASME Boiler and Pressure Vessel Code.
7. Field quality-control test reports.
8. Operation and maintenance data.

F. Quality Assurance

1. Installer Qualifications:
 - a. Medical Gas Piping Systems for Healthcare Facilities: Qualify installers according to ASSE Standard #6010 for installers.
2. Testing Agency Qualifications: An independent testing agency, with the experience and capability to conduct the medical gas piping testing indicated, that is a member of the Medical Gas Professional Healthcare Organization or is an NRTL as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
 - a. Qualify testing personnel according to ASSE Standard #6020 for inspectors and ASSE Standard #6030 for verifiers.
3. Brazing: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications"; or AWS B2.2, "Standard for Brazing Procedure and Performance Qualification."
4. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
5. ASME Compliance: Fabricate and label bulk medical gas storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
6. NFPA Compliance:
 - a. Comply with NFPA 50, "Bulk Oxygen Systems at Consumer Sites," for bulk oxygen storage tanks.
 - b. Comply with NFPA 99, "Health Care Facilities," for medical gas piping system materials and installation.
7. CGA Compliance: Comply with CGA G-8.1, "Nitrous Oxide Systems at Consumer Sites," for bulk nitrous oxide storage tanks.
8. UL Compliance:
 - a. Comply with UL 498, "Attachment Plugs and Receptacles," for electrical service connections.
 - b. Comply with UL 544, "Medical and Dental Equipment," for medical gas specialties.

G. Project Conditions

1. Interruption of Existing Specialty and Medical Gas Service(s): Do not interrupt specialty or medical gas service to facilities occupied by the Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - a. Notify the Owner no fewer than two days in advance of proposed interruption of specialty and medical gas service(s).
 - b. Do not proceed with interruption of specialty and medical gas service(s) without the Owner's written permission.



1.2 PRODUCTS

A. Pipes, Tubes, And Fittings

1. Copper Medical Gas Tube: ASTM B 819, Type K **OR** Type L, **as directed**, seamless, drawn temper that has been manufacturer cleaned, purged, and sealed for medical gas service or according to CGA G-4.1 for oxygen service. Include standard color marking "OXY," "MED," "OXY/MED," "OXY/ACR," or "ACR/MED" in green for Type K tube and blue for Type L tube.
 - a. General Requirements for Copper Fittings: Manufacturer cleaned, purged, and bagged for oxygen service according to CGA G-4.1.
 - b. Wrought-Copper Fittings: ASME B16.22, solder-joint pressure type or MSS SP-73, with dimensions for brazed joints.
 - c. Copper Unions: ASME B16.22 or MSS SP-123, wrought copper or cast-copper alloy.
 - d. Press-Type Fittings:
 - 1) NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.
 - 2) NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Bronze fitting with stainless-steel grip ring and EPDM O-ring seal in each end.
 - e. Memory-Metal Couplings: Cryogenic compression fitting made of ASTM F 2063, nickel-titanium, shape-memory-alloy, and that has been manufacturer cleaned, purged, and sealed for oxygen service according to CGA G-4.1.
2. PVC Pipe: ASTM D 1785, Schedule 40 and Schedule 80.
 - a. PVC Fittings: ASTM D 2466, Schedule 40 **OR** ASTM D 2467, Schedule 80, **as directed**; socket type.

B. Joining Materials

1. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys.
2. Threaded-Joint Tape: PTFE.
3. Solvent Cement for Joining PVC Piping: ASTM D 2564. Include primer complying with ASTM F 656.

C. Valves

1. General Requirements for Valves: Manufacturer cleaned, purged, and bagged according to CGA G-4.1 for oxygen service.
2. Ball Valves: MSS SP-110, 3-piece body, brass or bronze.
 - a. Pressure Rating: 300 psig (2070 kPa) minimum.
 - b. Ball: Full-port, chrome-plated brass.
 - c. Seats: PTFE or TFE.
 - d. Handle: Lever type with locking device, **as directed**.
 - e. Stem: Blowout proof with PTFE or TFE seal.
 - f. Ends: Manufacturer-installed ASTM B 819, copper-tube extensions.
3. Check Valves: In-line pattern, bronze.
 - a. Pressure Rating: 300 psig (2070 kPa) minimum.
 - b. Operation: Spring loaded.
 - c. Ends: Manufacturer-installed ASTM B 819, copper-tube extensions.
4. Zone Valves: MSS SP-110, 3-piece-body, brass or bronze ball valve with gage.
 - a. Pressure Rating: 300 psig (2070 kPa) minimum.
 - b. Ball: Full-port, chrome-plated brass.
 - c. Seats: PTFE or TFE.
 - d. Handle: Lever type with locking device, **as directed**.
 - e. Stem: Blowout proof with PTFE or TFE seal.
 - f. Ends: Manufacturer-installed ASTM B 819, copper-tube extensions.
 - g. Pressure Gage: Manufacturer-installed on one copper-tube extension.
5. Zone Valve Boxes: Formed steel with anchors for recessed mounting, holes with grommets in box sides for tubing extension protection, and of size for single or multiple valves with pressure gages and in sizes required to permit manual operation of valves.
 - a. Interior Finish: Factory-applied white enamel.



- b. Cover Plate: Aluminum or extruded-anodized aluminum **OR** Satin-chrome finish steel **OR** Stainless steel with NAAMM AMP 503, No. 4 finish, **as directed**, with frangible or removable windows.
- c. Valve-Box Windows: Clear or tinted transparent plastic with labeling that includes rooms served, according to NFPA 99.

OR

Zone Valve Boxes: Formed or extruded aluminum with anchors for recessed mounting, holes with grommets in box sides for tubing extension protection, and of size for single or multiple valves with pressure gages and in sizes required to permit manual operation of valves.

- a. Interior Finish: Factory-applied white enamel.
 - b. Cover Plate: Aluminum or extruded-anodized aluminum **OR** Stainless steel with NAAMM AMP 503, No. 4 finish, **as directed**, with frangible or removable windows.
 - c. Valve-Box Windows: Clear or tinted transparent plastic with labeling that includes rooms served, according to NFPA 99.
6. Emergency Oxygen Connections: Low-pressure oxygen inlet assembly for connection to building oxygen piping systems.
 - a. Enclosure: Weatherproof hinged locking cover with caption similar to "Emergency Low-Pressure Gaseous Oxygen Inlet."
 - b. Inlet: Manufacturer-installed, NPS 1 or NPS 1-1/4 (DN 25 or DN 32), ASTM B 819, copper tubing with NPS 1 (DN 25) minimum ball valve and plugged inlet.
 - c. Safety Valve: Bronze-body, pressure relief valve set at 75 or 80 psig (520 or 550 kPa).
 - d. Instrumentation: Pressure gage.
 7. Safety Valves: Bronze-body, ASME-construction, poppet, pressure-relief type with settings to match system requirements.
 8. Pressure Regulators: Bronze **OR** Stainless-steel, **as directed**, body and trim; spring-loaded, diaphragm-operated, relieving type; manual pressure-setting adjustment; rated for 250-psig (1725-kPa) minimum inlet pressure; and capable of controlling delivered gas pressure within 0.5 psig for each 10-psig (5.0 kPa for each 100-kPa) inlet pressure.

D. Medical Gas Service Connections

1. General Requirements for Medical Gas Service Connections: For specific medical gas pressure and suction service listed. Include roughing-in assemblies, finishing assemblies, and cover plates. Individual cover plates are not required if service connection is in multiple unit or assembly with cover plate. Furnish recessed-type units made for concealed piping unless otherwise indicated.
 - a. Roughing-in Assembly:
 - 1) Steel outlet box for recessed mounting and concealed piping.
 - 2) Brass-body outlet block with secondary check valve that will prevent gas flow when primary valve is removed. Suction inlets to be without secondary valve.
 - 3) Double seals that will prevent gas leakage.
 - 4) ASTM B 819, NPS 3/8 (DN 10) copper outlet tube brazed to valve with service marking and tube-end dust cap.
 - b. Finishing Assembly:
 - 1) Brass housing with primary check valve.
 - 2) Double seals that will prevent gas leakage.
 - 3) Cover plate with gas-service label.
 - c. Quick-Coupler Service Connections: Pressure outlets for carbon dioxide, nitrous oxide, oxygen, and **<Insert medical gas>** service connections with noninterchangeable keyed indexing to prevent interchange between services, constructed to permit one-handed connection and removal of equipment, and with positive-locking ring that retains equipment stem in valve during use.
 - d. D.I.S.S. Service Connections: Pressure outlets, complying with CGA V-5, with threaded indexing to prevent interchange between services, constructed to permit one-handed connection and removal of equipment.
 - 1) Medical Carbon Dioxide Service Connections: D.I.S.S. No. 1080.



- 2) Medical Helium Service Connections: D.I.S.S. No. 1060.
 - 3) Medical Nitrogen Service Connections: D.I.S.S. No. 1120.
 - 4) Medical Nitrous Oxide Service Connections: D.I.S.S. No. 1040.
 - 5) Medical Oxygen Service Connections: D.I.S.S. No. 1240.
 - e. Cover Plates: One piece, stainless steel, with NAAMM AMP 503, No. 4 finish **OR** metal, with chrome-plated finish **OR** anodized aluminum, **as directed**, and permanent, color-coded, identifying label matching corresponding service.
- E. Electrical Service Connections
1. Power Outlets: UL 498, Hospital Grade, 125-V receptacles; color selected. Include the following configurations complying with NEMA WD 1:
 - a. L5-20R, locking type, 20 A, single or duplex.
 - b. L5-20R, isolated ground, locking type, 20 A, single or duplex.
 - c. Explosion proof, 20 A, 2 pole, 3 wire, single; suitable for Class I, Group C hazardous location and interchangeable with receptacles used in nonhazardous areas; flush mounted.
 - d. 5-20R, straight blade, 20 A, duplex.
 - e. 5-20R, isolated ground, straight blade, 20 A, duplex.
 2. Electrical Accessory Outlets: Provide the following configured receptacles in color selected:
 - a. Patient Equipment Ground Jack: Single pole, 30 A.
 - b. Patient Monitoring: Single, 5 and 37 pin.
 3. Wall Outlet Cover Plates: One piece, stainless steel, with NAAMM AMP 503, No. 4 finish **OR** metal, with chrome-plated finish **OR** anodized aluminum, **as directed**, and permanent identifying label.
- F. Patient Service Consoles
1. General Requirements for Patient Service Consoles: Recessed- or semirecessed-mounting wall units with medical gas service connections as specified in "Medical Gas Service Connections" Article and electrical service connections as specified in "Electrical Service Connections" Article, **as directed**. Include labels indicating services, and the following:
 - a. Recessed- or semirecessed-mounting steel console box or mounting bracket.
 - b. Concealed supplies.
 - c. Cover Plate: One piece, anodized aluminum **OR** stainless steel, **as directed**, and permanent identifying label with service connections for the following:
 - 1) Medical Air: Quick-coupler pressure outlet.
 - 2) Medical Oxygen: Quick-coupler pressure outlet.
 - 3) Medical Vacuum: Quick-coupler suction inlet.
 - 4) Medical vacuum bottle bracket.
 - 5) L5-20R, locking type, 20 A, single **OR** duplex, **as directed**.
- G. Medical Nitrogen Pressure Control Panels
1. Description: Steel box and support brackets for recessed roughing-in with stainless-steel or anodized-aluminum cover plate with printed operating instructions. Include manifold assembly consisting of inlet supply valve, inlet supply pressure gage, line-pressure control regulator, outlet supply pressure gage, D.I.S.S. service connection, and piping outlet for remote service connection.
 - a. Minimum Working Pressure: 200 psig (1380 kPa).
 - b. Line-Pressure Control Regulator: Self-relieving diaphragm type with precision manual adjustment.
 - c. Pressure Gages: 0- to 300-psig (0- to 2070-kPa) range.
 - d. Service Connection: CGA V-5, D.I.S.S. No. 1120, nitrogen outlet.
 - e. Before final assembly, provide temporary dust shield and U-tube for testing.
 - f. Label cover plate "Nitrogen Pressure Control."
- H. Ceiling Columns
1. General Requirements for Ceiling Columns: Ceiling-mounting units with medical gas service connections as specified in "Medical Gas Service Connections" Article and electrical service



connections as specified in "Electrical Service Connections" Article, **as directed**. Include labels indicating services, and the following:

- a. Ceiling-Mounting Plate: Manufacturer's standard plate or roughing-in assembly.
 - b. Exposed Surfaces: Minimum 0.0375-inch- (0.95-mm-) thick stainless steel with NAAMM AMP 503, No. 4 directional polish.
 - c. Servicing: Include access panels or means of removing shroud.
 - d. Blank cover plates for cutouts not having service connections.
 - e. ASTM B 819, NPS 3/8 (DN 10) copper-tube extensions for connection to medical gas systems.
 - f. Service Connections: Type and number indicated.
 - g. Dust Covers: For medical gas service connection.
2. Rigid Ceiling Columns: 44-inch- (1120-mm-) long, rectangular fixed column section with 2 **OR** 4, **as directed**, double intravenous medication hooks. Include 0.078-inch- (2.0-mm-) thick, stainless-steel bottom plate with the following service connections:
- a. Instrument Air: One D.I.S.S. No. 1160 pressure outlet(s).
 - b. Medical Air: One quick-coupler **OR** D.I.S.S. No. 1160, **as directed**, pressure outlet(s).
 - c. Medical Carbon Dioxide: One quick-coupler **OR** D.I.S.S. No. 1080, **as directed**, pressure outlet(s).
 - d. Medical Helium: One D.I.S.S. No. 1060, pressure outlet(s).
 - e. Medical Nitrogen: One D.I.S.S. No. 1120 pressure outlet(s).
 - f. Medical Nitrous Oxide: One quick-coupler **OR** D.I.S.S. No. 1040, **as directed**, pressure outlet(s).
 - g. Medical Oxygen: Two quick-coupler **OR** D.I.S.S. No. 1240, **as directed**, pressure outlets.
 - h. Medical Vacuum: Two quick-coupler **OR** D.I.S.S. No. 1220, **as directed**, suction inlets.
 - i. Vacuum Bottle Brackets: Two.
 - j. WAGD Evacuation: One quick-coupler **OR** D.I.S.S. No. 2220, **as directed**, suction inlet(s).
 - k. Power: 2 **OR** 4, **as directed**, L5-20R, locking-type, 20-A, single receptacles.
 - l. Patient Equipment: 2 **OR** 4, **as directed**, ground-jack, single-pole, 30-A receptacles.
3. Retractable Ceiling Columns: Manually adjustable using release and lock handles capable of locking column in all positions from fully retracted to fully extended; 15-inch- (380-mm-) long, rectangular counterbalanced telescoping section with 2 **OR** 4, **as directed**, double intravenous medication hooks; and 36-inch- (915-mm-) long, fixed column section. Include 0.078-inch- (2.0-mm-) thick, stainless-steel bottom plate with the following service connections:
- a. Instrument Air: One D.I.S.S. No. 1160 pressure outlet(s).
 - b. Medical Air: One quick-coupler **OR** D.I.S.S. No. 1160, **as directed**, pressure outlet(s).
 - c. Medical Carbon Dioxide: One quick-coupler **OR** D.I.S.S. No. 1080, **as directed**, pressure outlet(s).
 - d. Medical Helium: One D.I.S.S. No. 1060, pressure outlet(s).
 - e. Medical Nitrogen: One D.I.S.S. No. 1120 pressure outlet(s).
 - f. Medical Nitrous Oxide: One quick-coupler **OR** D.I.S.S. No. 1040, **as directed**, pressure outlet(s).
 - g. Medical Oxygen: Two quick-coupler **OR** D.I.S.S. No. 1240, **as directed**, pressure outlets.
 - h. Medical Vacuum: Two quick-coupler **OR** D.I.S.S. No. 1220, **as directed**, suction inlets.
 - i. Vacuum Bottle Brackets: Two.
 - j. WAGD Evacuation: One quick-coupler **OR** D.I.S.S. No. 2220, **as directed**, suction inlet(s).
 - k. Power: 2 **OR** 4, **as directed**, L5-20R, locking-type, 20-A, single receptacles.
 - l. Patient Equipment: 2 **OR** 4, **as directed**, ground-jack, single-pole, 30-A receptacles.
- I. Ceiling Hose Assemblies
1. Ceiling Hose Assemblies, General: Ceiling-mounting units with medical gas service connections as specified in "Medical Gas Service Connections" Article and electrical service connections as specified in "Electrical Service Connections" Article, **as directed**. Include labels indicating services, and the following:
 - a. Ceiling-Mounting Plate: Manufacturer's standard plate or roughing-in assembly.



- b. Exposed Surfaces: Minimum 0.0375-inch- (0.95-mm-) thick stainless steel with NAAMM AMP 503, No. 4 directional polish.
 - c. Servicing: Include access panels or means of removing shroud.
 - d. Blank cover plates for cutouts not having service connections.
 - e. ASTM B 819, NPS 3/8 (DN 10) copper-tube extensions for connection to medical gas systems.
 - f. Service Connections: Type and number indicated.
 - g. Dust Covers: For medical gas service connection.
2. Hose-Reel Service Assemblies: Individual, concealed, retractable hose-reel units with stainless-steel face plates, steel mounting boxes, factory- or field-fabricated mounting brackets, and color-coded service hoses with adjustable stops and service connections matching hoses. Include 15 feet (4.5 m) minimum of conductive, CR, 1/4- or 5/16-inch- (6.4- or 7.9-mm-) ID, medical gas hoses rated for 200-psig (1380-kPa) minimum working pressure, and the following service connections:
- a. Instrument Air Hose: D.I.S.S. No. 1160 pressure outlet.
 - b. Medical Air Hose: Quick-coupler **OR** D.I.S.S. No. 1160, **as directed**, pressure outlet.
 - c. Medical Carbon Dioxide Hose: Quick-coupler **OR** D.I.S.S. No. 1080, **as directed**, pressure outlet.
 - d. Medical Nitrogen Hose: D.I.S.S. No. 1120 pressure outlet.
 - e. Medical Nitrous Oxide Hose: Quick-coupler **OR** D.I.S.S. No. 1040, **as directed**, pressure outlet.
 - f. Medical Oxygen Hose: Quick-coupler **OR** D.I.S.S. No. 1240, **as directed**, pressure outlet.
 - g. Medical Vacuum Hose: Quick-coupler **OR** D.I.S.S. No. 1220, **as directed**, suction inlet.
 - h. WAGD Evacuation Hose: Quick-coupler **OR** D.I.S.S. No. 2220, **as directed**, suction inlet.
 - i. Power: L5-20R, locking-type, 20-A, single, power receptacle.
3. Fixed Hose Service Assemblies: Individual, concealed hose connection with stainless-steel face plates, steel mounting boxes, factory- or field-fabricated mounting brackets, and color-coded service hoses with retractor device and service connections matching hoses. Include 72 inches (1830 mm) of conductive, CR, 1/4- or 5/16-inch- (6.4- or 7.9-mm-), ID, medical gas hoses rated for 200-psig (1380-kPa) minimum working pressure, and the following service hose connections:
- a. Instrument Air Hose: D.I.S.S. No. 1160 pressure outlet.
 - b. Medical Air Hose: Quick-coupler **OR** D.I.S.S. No. 1160, **as directed**, pressure outlet.
 - c. Medical Carbon Dioxide Hose: Quick-coupler **OR** D.I.S.S. No. 1080, **as directed**, pressure outlet.
 - d. Medical Nitrogen Hose: D.I.S.S. No. 1120 pressure outlet.
 - e. Medical Nitrous Oxide Hose: Quick-coupler **OR** D.I.S.S. No. 1040, **as directed**, pressure outlet.
 - f. Medical Oxygen Hose: Quick-coupler **OR** D.I.S.S. No. 1240, **as directed**, pressure outlet.
 - g. Medical Vacuum Hose: Quick-coupler **OR** D.I.S.S. No. 1220, **as directed**, suction inlet.
 - h. WAGD Evacuation Hose: Quick-coupler **OR** D.I.S.S. No. 2220, **as directed**, suction inlet.
 - i. Power: L5-20R, locking-type, 20-A, single, power receptacle.

J. Gas Manifolds

1. Simplex Specialty Gas Manifolds:
 - a. Control Panel Unit: Weatherproof cabinet, supply and delivery pressure gages, electrical alarm system connections and transformer, indicator lights or devices, manifold connection, line-pressure regulator, shutoff valves, and safety valve.
 - b. Manifold and Header: Nonferrous-metal header for number of cylinders indicated. Units include design for 2000-psig (13.8-MPa) minimum inlet pressure. Include cylinder bank header with inlet (pigtail) connections complying with CGA V-1, individual inlet check valves, shutoff valve, pressure regulator, check valve, and pressure gage.
 - c. **<Insert specialty gas>** Manifold: For **<Insert number cylinders>** capacity at 55-psig (380-kPa) line pressure, with electric heater or orifice design that will prevent freezing during high demand.
 - d. Specialty Gas Cylinders: Will be furnished by the Owner **OR** Number and type of medical gas cylinders required for complete manifold systems, **as directed**.



- e. Label manifold control unit with permanent label identifying specialty gas type and system operating pressure.
 - f. Mounting: Wall with mounting brackets for manifold control cabinet and header **OR** Floor with support legs for manifold control cabinet, **as directed**.
2. Duplex Specialty Gas Manifolds:
- a. Central Control Panel Unit: Weatherproof cabinet, supply and delivery pressure gages, electrical alarm system connections and transformer, indicator lights or devices, manifold connection, line-pressure regulator, shutoff valves, and safety valve.
 - b. Manifold and Headers: Duplex, nonferrous-metal header for number of cylinders indicated, divided into two equal banks. Units include design for 2000-psig (13.8-MPa) minimum inlet pressure. Include cylinder bank headers with inlet (pigtail) connections complying with CGA V-1, individual inlet check valves, shutoff valve, pressure regulator, check valve, and pressure gage.
 - c. Operation: Automatic, pressure-switch-activated changeover from one cylinder bank to the other when first bank becomes exhausted, without line-pressure fluctuation or resetting of regulators and without supply interruption by shutoff of either cylinder bank header.
 - d. **<Insert specialty gas>** Manifold: For **<Insert number cylinders>** capacity at 55-psig (380-kPa) line pressure, with electric heater or orifice design that will prevent freezing during high demand.
 - e. Specialty Gas Cylinders: Will be furnished by the Owner **OR** Number and type of medical gas cylinders required for complete manifold systems, **as directed**.
 - f. Label manifold control unit with permanent label identifying specialty gas type and system operating pressure.
 - g. Mounting: Wall with mounting brackets for manifold control cabinet and headers **OR** Floor with support legs for manifold control cabinet, **as directed**.
3. Medical Gas Manifolds: Comply with NFPA 99, Ch. 5, for high-pressure medical gas cylinders.
- a. Central Control Panel Unit: Weatherproof cabinet, supply and delivery pressure gages, electrical alarm system connections and transformer, indicator lights or devices, manifold connection, pressure changeover switch, line-pressure regulator, shutoff valves, and safety valve.
 - b. Manifold and Headers: Duplex, nonferrous-metal header for number of cylinders indicated, divided into two equal banks. Units include design for 2000-psig (13.8-MPa) minimum inlet pressure, except nitrous oxide manifolds may be designed for 800 psig (5520 kPa) and carbon dioxide manifolds may be designed for 1500 psig (10.35 MPa). Include cylinder bank headers with inlet (pigtail) connections complying with CGA V-1, individual inlet check valves, shutoff valve, pressure regulator, check valve, and pressure gage.
 - c. Operation: Automatic, pressure-switch-activated changeover from one cylinder bank to the other when first bank becomes exhausted, without line-pressure fluctuation or resetting of regulators and without supply interruption by shutoff of either cylinder bank header.
 - d. Medical Carbon Dioxide Manifolds: For 2 cylinders and 250-cfh (1.97-L/s) **OR** 4 cylinders and 500-cfh (3.94-L/s), **as directed**, capacity at 55-psig (380-kPa) line pressure.
 - e. Medical Helium Manifolds: For 2 cylinders and 250-cfh (1.97-L/s) **OR** 4 cylinders and 500-cfh (3.94-L/s), **as directed**, capacity at 55-psig (380-kPa) line pressure.
 - f. Medical Nitrous Oxide Manifolds: For 8 cylinders and 1333-cfh (10.5-L/s) **OR** 12 cylinders and 2000-cfh (15.7-L/s), **as directed**, capacity at 55-psig (380-kPa) line pressure, with electric heater or orifice design that will prevent freezing during high demand.
 - g. Medical Nitrogen Manifolds: For 8 cylinders and 2000-cfh (15.7-L/s) **OR** 12 cylinders and 3000-cfh (23.6-L/s), **as directed**, capacity at 180-psig (1240-kPa) **OR** higher than 200-psig (1380-kPa), **as directed**, line pressure.
 - h. Medical Oxygen Manifolds: For 12 cylinders and 1500-cfh (11.8-L/s) **OR** 20 cylinders 2500-cfh (19.7-L/s), **as directed**, capacity at 55-psig (380-kPa), **as directed**, line pressure.
 - i. Medical Gas Cylinders: Will be furnished by the Owner **OR** Number and type of medical gas cylinders required for complete manifold systems, **as directed**.
 - j. Label manifold control unit with permanent label identifying medical gas type and system operating pressure.



- k. Mounting: Wall with mounting brackets for manifold control cabinet and headers **OR** Floor with support legs for manifold control cabinet, **as directed**.

K. Bulk Gas Storage Tanks

1. Bulk Specialty Gas Storage Tanks:
2. Bulk Medical Gas Storage Tanks:
 - a. Bulk Medical Gas Storage Tank Systems: Bulk storage tank with connections for alarm system, continuous supply, and reserve supply that will operate only during emergencies, complying with NFPA 99, "Health Care Facilities."
 - b. Controls: Include actuating switch for alarm system connection and means for automatic actuating of reserve supply.
 - c. Bulk Medical Gas Storage Tanks: Vertical mounting, double-wall construction with inner vessel fabricated according to ASME Boiler and Pressure Vessel Code for unfired pressure vessels and suitable for medical gas service. Include insulation and vacuum seal between walls. Fabricate outer shell from carbon steel with factory-applied manufacturer's standard protective paint finish suitable for exterior installation. Include the following features, specialties, and components:
 - 1) Safety Valves: ASME construction with pressure setting to correspond to tank working pressure and as required for component or system being protected.
 - 2) Pressure Gages: For tank pressure and facility service line pressure.
 - 3) Contents Gage: High- and low-level indicator with electric signal circuit connection.
 - 4) Drain Valves: For piping, inner vessel, and outer shell.
 - 5) Fill Assembly: Fill connection, piping, valves, relief devices, and controls.
 - 6) Facility Service Assembly: Piping, valves, relief devices, vaporizer, shutoff valve, pressure regulator, line shutoff valve or check valve, and reserve supply connection for connection to building service piping.
 - 7) Include permanent label showing medical gas type, storage tank capacity, tank pressure rating, vaporizer capacity, and operating instructions.
 - 8) Liquid Oxygen Storage Tank: Nickel-steel or stainless-steel inner vessel with 250-psig (1725-kPa) minimum working pressure. Include electric **OR** steam **OR** ambient vaporizer, **as directed**.
 - 9) Liquid Nitrous Oxide Storage Tank: Steel-alloy inner vessel with 300-psig (2070-kPa) minimum working pressure. Include electric **OR** steam, **as directed**, vaporizer.
 - d. Oxygen Reserve Supply: Manifold header for high-pressure cylinders, fabricated from copper-tube or brass pipe and fittings and suitable for pressures up to 4000 psig (27.6 MPa). Include header inlet connections complying with CGA V-1, with individual inlet check valves, header shutoff valve, header pressure regulator, line shutoff valve or check valve, pressure gage, and inlet connections for number of cylinders indicated.
 - e. Nitrous Oxide Reserve Supply: Manifold header for high-pressure cylinders, fabricated from copper-tube or brass pipe and fittings and suitable for pressures up to 4000 psig (27.6 MPa). Include header inlet connections complying with CGA V-1, with individual inlet check valves, header shutoff valve, header pressure regulator, line shutoff valve or check valve, pressure gage, inlet connections for number of cylinders indicated, and electric heater.

L. Medical Gas Piping Alarm Systems

1. Panels for medical gas piping systems may be combined in single panels with medical compressed-air and medical vacuum piping systems.
2. Components: Designed for continuous service and to operate on power supplied from 120 **OR** 240 **OR** 277, **as directed**, -V ac power source to alarm panels and with connections for low-voltage wiring to remote sensing devices. Include step-down transformers if required.
3. Pressure Switches or Pressure Transducer Sensors: Continuous line monitoring with electrical connections for alarm system.
 - a. Low-Pressure Operating Range: 0- to 100-psig (0- to 690-kPa).
 - b. High-Pressure Operating Range: Up to 250-psig (1725-kPa).



4. General Requirements for Medical Gas Alarm Panels: Factory wired with audible and color-coded visible signals to indicate specified functions.
 - a. Mounting: Exposed, surface **OR** Recessed, **as directed**, installation.
 - b. Enclosures: Fabricated from minimum 0.047-inch- (1.2-mm-) thick steel or minimum 0.05-inch- (1.27-mm-) thick aluminum, with knockouts for electrical and piping connections.
5. Master Alarm Panels: With separate trouble alarm signals, pressure gages, and indicators for medical gas piping systems.
 - a. Include alarm signals when the following conditions exist:
 - 1) Medical Carbon Dioxide: Pressure drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa) and changeover is made to alternate bank.
 - 2) Medical Helium: Pressure drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa) and changeover is made to alternate bank.
 - 3) Medical Nitrogen: Pressure drops below 145 psig (1000 kPa) or rises above 200 psig (1380 kPa) and changeover is made to alternate bank.
 - 4) Medical Nitrous Oxide (for bulk oxygen storage tank system with cylinder reserve): Liquid level is low, pressure downstream from main shutoff valve drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa), changeover is made to reserve, reserve is in use, and reserve level is low.
 - 5) Medical Nitrous Oxide (for nitrous oxide manifold system): Pressure drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa) and changeover is made to alternate bank.
 - 6) Medical Oxygen (for bulk oxygen storage tank system with cylinder reserve): Liquid level is low, pressure downstream from main shutoff valve drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa), changeover is made to reserve, reserve is in use, reserve level is low, and reserve pressure is low.
 - 7) Medical Oxygen (for oxygen manifold system): Pressure downstream from main shutoff valve drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa) and changeover is made to alternate bank.
6. Anesthetizing-Area Alarm Panels: Separate trouble alarm signals; pressure gages; and indicators for medical gas piping systems.
 - a. Include alarm signals when the following conditions exist:
 - 1) Medical Carbon Dioxide: Pressure drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa).
 - 2) Medical Helium: Pressure drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa).
 - 3) Medical Nitrous Oxide: Pressure drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa).
 - 4) Medical Nitrogen: Pressure drops below 145 psig (1000 kPa) or rises above 200 psig (1380 kPa).
 - 5) Medical Oxygen: Pressure drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa).
7. Area Alarm Panels: Separate trouble alarm signals; pressure and vacuum gages; and indicators for medical gas piping systems.
 - a. Include alarm signals when the following conditions exist:
 - 1) Oxygen: Pressure drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa).
8. Dental Area Alarm Panels: Separate trouble alarm signals; pressure and vacuum gages; and indicators for medical gas piping systems.
 - a. Include alarm signals when the following conditions exist:
 - 1) Medical Nitrogen: Pressure drops below 145 psig (1000 kPa) or rises above 200 psig (1380 kPa) and changeover is made to alternate bank.
 - 2) Medical Nitrous Oxide (for bulk nitrous oxide storage tank system with cylinder reserve): Liquid level is low, pressure downstream from main shutoff valve drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa), changeover is made to reserve, reserve is in use, and reserve level is low.



- 3) Medical Nitrous Oxide (for nitrous oxide manifold system): Pressure drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa) and changeover is made to alternate bank.
 - 4) Medical Oxygen (for bulk oxygen storage tank system with cylinder reserve): Liquid level is low, pressure downstream from main shutoff valve drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa), changeover is made to reserve, reserve is in use, reserve level is low, and reserve pressure is low.
 - 5) Medical Oxygen (for nitrous oxide manifold system): Pressure downstream from main shutoff valve drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa) and changeover is made to alternate bank.
9. Medical Laboratory Area Alarm Panels: Separate trouble alarm signals; pressure and vacuum gages; and indicators for medical gas piping systems.
- a. Include alarm signals when the following conditions exist:
 - 1) Medical Carbon Dioxide: Pressure drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa).
 - 2) Medical Helium: Pressure drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa).
 - 3) Medical Oxygen: Pressure drops below 40 psig (275 kPa) or rises above 60 psig (415 kPa).
- M. Computer Interface Cabinet
1. Description: Wall-mounting, welded-steel, control cabinet with gasketed door, mounting brackets, grounding device, and white-enamel finish for connection of medical gas system alarms to facility computer. Include factory-installed signal circuit boards, power transformer, circuit breaker, wiring terminal board, and internal wiring capable of interfacing 20, **as directed**, alarm signals.
- N. Gas Cylinder Storage Racks
1. Wall Storage Racks: Fabricate racks with chain restraints for upright cylinders as indicated or provide equivalent manufactured wall racks.
 2. Freestanding Storage Racks: Fabricate racks as indicated or provide equivalent manufactured storage racks.
- O. Sleeves
1. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
 2. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - a. Underdeck Clamp: Clamping ring with set screws.
- P. Escutcheons
1. General Requirements for Escutcheons: Manufactured wall and ceiling escutcheons and floor plates, with ID to closely fit around pipe and tube and OD that completely covers opening.
 2. One-Piece, Deep-Pattern Escutcheons: Deep-drawn, box-shaped brass with polished chrome-plated finish.
 3. One-Piece, Cast-Brass Escutcheons: With set screw.
 - a. Finish: Polished chrome-plated **OR** Rough brass, **as directed**.
 4. Split-Casting, Cast-Brass Escutcheons: With concealed hinge and set screw.
 - a. Finish: Polished chrome-plated **OR** Rough brass, **as directed**.
 5. One-Piece, Stamped-Steel Escutcheons: With set screw **OR** spring clips, **as directed**, and chrome-plated finish.
 6. Split-Plate, Stamped-Steel Escutcheons: With concealed **OR** exposed-rivet, **as directed**, hinge, set screw **OR** spring clips, **as directed**, and chrome-plated finish.
 7. One-Piece, Floor-Plate Escutcheons: Cast iron.
 8. Split-Casting, Floor-Plate Escutcheons: Cast brass with concealed hinge and set screw.
- Q. Grout



1. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - a. Characteristics: Post-hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - b. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
 - c. Packaging: Premixed and factory packaged.

R. Nitrogen

1. Description: Comply with USP 28 - NF 23 for oil-free dry nitrogen.

1.3 EXECUTION

A. Earthwork

1. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling and for underground warning tapes.

B. Piping Applications

1. Nonhealthcare, Specialty Gas Piping: Type L, copper medical gas tube; wrought-copper fittings; and brazed **OR** press-type fittings and pressure-sealed, **as directed**, joints.
2. Nonhealthcare, Specialty Gas Piping NPS 2-1/2 (DN 65) and Smaller: Type K **OR** Type L, **as directed**, copper medical gas tube; wrought-copper fittings; and brazed **OR** press-type fittings and pressure-sealed, **as directed**, joints.
3. Nonhealthcare, Specialty Gas Piping NPS 3 (DN 80) and Larger: Type K, copper tube; wrought-copper fittings; and brazed **OR** press-type fittings and pressure-sealed, **as directed**, joints.
4. Medical Gas Piping: Use Type L, copper medical gas tube; wrought-copper fittings; and brazed joints.
5. Medical Gas Piping Except Nitrogen: Use Type L, copper medical gas tube; wrought-copper fittings; and brazed joints.
6. Medical Nitrogen Piping: Type L, copper medical gas tube; wrought-copper fittings; and brazed joints.
7. Medical Nitrogen Piping NPS 2-1/2 (DN 65) and Smaller: Type K **OR** Type L, **as directed**, copper medical gas tube; wrought-copper fittings; and brazed joints.
8. Medical Nitrogen Piping NPS 3 (DN 80) and Larger: Type K, copper tube; wrought-copper fittings; and brazed joints.
9. Protective Conduit: Use PVC pipe, PVC fittings, and solvent-cemented joints.

C. Piping Installation

1. Drawing plans, schematics, and diagrams indicate general location and arrangement of gas piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, air-compressor sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
2. Comply with ASSE Standard #6010 for installation of medical gas piping.
3. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
4. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
5. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal and coordinate with other services occupying that space.
6. Install piping adjacent to equipment and specialties to allow service and maintenance.
7. Install nipples, unions, and special fittings, and valves with pressure ratings same as or higher than system pressure rating used in applications below unless otherwise indicated.
8. Install piping to permit valve servicing.
9. Install piping free of sags and bends.
10. Install fittings for changes in direction and branch connections.



11. Install medical gas piping to medical gas service connections specified in this Section, to medical gas service connections in equipment specified in this Section, and to equipment specified in other Sections requiring medical gas service.
12. Install exterior, buried medical gas piping in protective conduit fabricated with PVC pipe and fittings. Do not extend conduit through foundation wall.
13. Install seismic restraints on gas piping. Seismic-restraint devices are specified in Division 22 Section "Vibration And Seismic Controls For Plumbing Piping And Equipment".
14. Install medical gas service connections recessed in walls. Attach roughing-in assembly to substrate; attach finishing assembly to roughing-in assembly.
15. Connect gas piping to gas sources and to gas outlets and equipment requiring gas service.
16. Install unions, in copper tubing adjacent to each valve and at final connection to each piece of equipment and specialty.

D. Valve Installation

1. Install shutoff valve at each connection to gas laboratory and healthcare equipment and specialties.
2. Install check valves to maintain correct direction of gas flow from laboratory and healthcare gas supplies.
3. Install valve boxes recessed in wall and anchored to substrate. Single boxes may be used for multiple valves that serve same area or function.
4. Install zone valves and gages in valve boxes. Rotate valves to angle that prevents closure of cover when valve is in closed position.
5. Install pressure regulators on gas piping where reduced pressure is required.
6. Install emergency oxygen connection with pressure relief valve and full-size discharge piping to outside, with check valve downstream from pressure relief valve and with ball valve and check valve in supply main from bulk oxygen storage tank.

E. Joint Construction

1. Ream ends of PVC pipes and remove burrs.
2. Remove scale, slag, dirt, and debris from outside of cleaned tubing and fittings before assembly.
3. Threaded Joints: Apply appropriate tape to external pipe threads.
4. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter. Continuously purge joint with oil-free, dry nitrogen during brazing.
5. Pressure-Sealed Joints: Join copper tube and press-type fittings with tools recommended by fitting manufacturer.
6. Memory-Metal Coupling Joints: Join new copper tube to existing tube according to procedures developed by fitting manufacturer for installation of memory-metal coupling joints.
7. Solvent-Cemented Joints: Clean and dry joining surfaces. Join PVC pipe and fittings according to the following:
 - a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - b. Apply primer and join according to ASME B31.9 for solvent-cemented joints and to ASTM D 2672.

F. Gas Service Component Installation

1. Assemble patient service console with service connections. Install with supplies concealed, in walls. Attach console box or mounting bracket to substrate.
2. Install nitrogen pressure-control panels in walls. Attach to substrate.
3. Assemble ceiling columns and install anchored to substrate. Provide structural steel, hanger rods, anchors, and fasteners in addition to components furnished with specialties necessary to fabricate supports.
4. Assemble ceiling assemblies and install anchored to substrate. Provide structural steel, hanger rods, anchors, and fasteners in addition to components furnished with specialties necessary to fabricate supports.
5. Install gas manifolds on concrete base, **as directed**, anchored to substrate.
6. Install gas cylinders and connect to manifold piping.



7. Install gas manifolds with seismic restraints as indicated.
 8. Install bulk gas storage tanks and reserve supply tanks level on concrete bases. Set tanks and connect gas piping to tanks according to applicable requirements in NFPA 50 for bulk oxygen storage systems, **as directed**. Install tanks level and plumb, firmly anchored to concrete bases; maintain NFPA 50 and tank manufacturer's recommended clearances. Orient tanks so controls and devices are accessible for servicing.
 9. Install bulk gas storage tanks and reserve supply tanks with seismic restraints.
- G. Medical Gas Piping Alarm System Installation
1. Install medical gas alarm system components in locations required by and according to NFPA 99.
 2. Install medical gas area and master alarm panels where indicated.
 3. Install computer interface cabinet with connection to medical gas piping alarm system and facility computer.
- H. Sleeve Installation
1. Sleeves are not required for core-drilled holes.
 2. Permanent sleeves are not required for holes formed by removable PE sleeves.
 3. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs using galvanized-steel pipe **OR** galvanized-steel sheet **OR** stack sleeve fittings **OR** PVC pipe, **as directed**.
 - a. Wall Penetrations: Cut sleeves to length for mounting flush with both surfaces.
 - b. Floor Penetrations: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

OR

Install sleeves in new walls and slabs as new walls and slabs are constructed.
 4. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a. PVC **OR** Steel, **as directed**, Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
 - b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum board partitions.
 - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Comply with requirements in Division 07 Section "Sheet Metal Flashing And Trim" for flashing.
 - 1) Seal space outside of sleeve fittings with grout.
 5. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping".
- I. Escutcheon Installation
1. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - a. New Piping:
 - 1) Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
 - 2) Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish **OR** stamped steel with set screw **OR** stamped steel with set screw or spring clips **OR** stamped steel with spring clips, **as directed**.
 - 3) Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish **OR** One piece or split casting, cast brass with polished chrome-plated finish **OR** Split casting, cast brass with polished chrome-plated finish **OR** One piece, stamped steel with set screw **OR** One piece or split plate, stamped steel with set screw **OR** Split plate, stamped steel with set screw, **as directed**.



- 4) Bare Piping in Unfinished Service Spaces: One piece, cast brass with polished chrome-plated finish **OR** cast brass with rough-brass finish **OR** stamped steel with set screw **OR** stamped steel with spring clips **OR** stamped steel with set screw or spring clips, **as directed**.
- 5) Bare Piping in Equipment Rooms: One piece, cast brass **OR** stamped steel with set screw **OR** stamped steel with spring clips **OR** stamped steel with set screw or spring clips, **as directed**.
- 6) Bare Piping at Floor Penetrations in Equipment Rooms: One-piece floor plate.
- b. Existing Piping:
 - 1) Chrome-Plated Piping: Split casting, cast brass with chrome-plated finish.
 - 2) Insulated Piping: Split plate, stamped steel with concealed **OR** exposed-rivet, **as directed**, hinge and spring clips.
 - 3) Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split casting, cast brass with chrome-plated finish **OR** plate, stamped steel with concealed hinge and spring clips, **as directed**.
 - 4) Bare Piping at Ceiling Penetrations in Finished Spaces: Split casting, cast brass with chrome-plated finish **OR** plate, stamped steel with concealed hinge and set screw, **as directed**.
 - 5) Bare Piping in Unfinished Service Spaces: Split casting, cast brass with polished chrome-plated finish **OR** casting, cast brass with rough-brass finish **OR** plate, stamped steel with concealed hinge and set screw or spring clips **OR** plate, stamped steel with concealed or exposed-rivet hinge and set screw or spring clips **OR** plate, stamped steel with exposed-rivet hinge and set screw or spring clips, **as directed**.
 - 6) Bare Piping in Equipment Rooms: Split casting, cast brass **OR** plate, stamped steel with set screw or spring clips, **as directed**.
 - 7) Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting floor plate.

J. Hanger And Support Installation

1. Comply with requirements in Division 22 Section "Vibration And Seismic Controls For Plumbing Piping And Equipment" for seismic-restraint devices.
2. Comply with requirements in Division 22 Section "Hangers And Supports For Plumbing Piping And Equipment" for pipe hanger and support devices.
3. Vertical Piping: MSS Type 8 or 42, clamps.
4. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel, clevis hangers.
 - b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable, roller hangers.
5. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze. Comply with requirements in Division 22 Section "Hangers And Supports For Plumbing Piping And Equipment" for trapeze hangers.
6. Base of Vertical Piping: MSS Type 52, spring hangers.
7. Support horizontal piping within 12 inches (300 mm) of each fitting and coupling.
8. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.
9. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - a. NPS 1/4 (DN 8): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
 - b. NPS 3/8 and NPS 1/2 (DN 10 and DN 15): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
 - c. NPS 3/4 (DN 20): 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
 - d. NPS 1 (DN 25): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
 - e. NPS 1-1/4 (DN 32): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.
 - f. NPS 1-1/2 (DN 40): 10 feet (3 m) with 3/8-inch (10-mm) rod.
 - g. NPS 2 (DN 50): 11 feet (3.4 m) with 3/8-inch (10-mm) rod.
 - h. NPS 2-1/2 (DN 65): 13 feet (4 m) with 1/2-inch (13-mm) rod.
 - i. NPS 3 (DN 80): 14 feet (4.3 m) with 1/2-inch (13-mm) rod.
 - j. NPS 3-1/2 (DN 90): 15 feet (4.6 m) with 1/2-inch (13-mm) rod.



- k. NPS 4 (DN 100): 16 feet (4.9 m) with 1/2-inch (13-mm) rod.
 - l. NPS 5 (DN 125): 18 feet (5.5 m) with 1/2-inch (13-mm) rod.
 - m. NPS 6 (DN 150): 20 feet (6 m) with 5/8-inch (16-mm) rod.
 - n. NPS 8 (DN 200): 23 feet (7 m) with 3/4-inch (19-mm) rod.
10. Install supports for vertical copper tubing every 10 feet (3 m).
- K. Labeling And Identification
- 1. Install identifying labels and devices for specialty gas piping, valves, and specialties. Comply with requirements in Division 22 Section "Identification For Plumbing Piping And Equipment".
 - 2. Install identifying labels and devices for healthcare medical gas piping systems according to NFPA 99. Use the following or similar captions and color-coding for piping products where required by NFPA 99:
 - a. Carbon Dioxide: Black or white letters on gray background.
 - b. Helium: White letters on brown background.
 - c. Nitrogen: White letters on black background.
 - d. Nitrous Oxide: White letters on blue background.
 - e. Oxygen: White letters on green background or green letters on white background.
- L. Field Quality Control For Laboratory Facility Specialty Gas
- 1. Perform field tests and inspections of specialty gas piping for nonhealthcare laboratory facilities and prepare test reports.
 - 2. Tests and Inspections:
 - a. Piping Leak Tests for Specialty Gas Piping: Test new and modified parts of existing piping. Cap and fill specialty gas piping with oil-free, dry nitrogen to pressure of 50 psig (345 kPa) above system operating pressure, but not less than 150 psig (1035 kPa). Isolate test source and let stand for four hours to equalize temperature. Refill system, if required, to test pressure; hold for two hours with no drop in pressure.
 - b. Repair leaks and retest until no leaks exist.
 - c. Inspect specialty gas regulators for proper operation.
- M. Field Quality Control For Healthcare Facility Medical Gas
- 1. Perform tests and inspections of medical gas piping systems in healthcare facilities and prepare test reports.
 - 2. Tests and Inspections:
 - a. Medical Gas Piping Testing Coordination: Perform tests, inspections, verifications, and certification of medical gas piping systems concurrently with tests, inspections, and certification of medical compressed-air piping and medical vacuum piping systems.
 - b. Preparation: Perform the following Installer tests according to requirements in NFPA 99 and ASSE Standard #6010:
 - 1) Initial blow down.
 - 2) Initial pressure test.
 - 3) Cross-connection test.
 - 4) Piping purge test.
 - 5) Standing pressure test for positive pressure medical gas piping.
 - 6) Standing pressure test for vacuum systems.
 - 7) Repair leaks and retest until no leaks exist.
 - c. System Verification: Comply with requirements in NFPA 99, ASSE Standard #6020, and ASSE Standard #6030 for verification of medical gas piping systems and perform the following tests and inspections:
 - 1) Standing pressure test.
 - 2) Individual-pressurization **OR** Pressure-differential, **as directed**, cross-connection test.
 - 3) Valve test.
 - 4) Master and area alarm tests.
 - 5) Piping purge test.



- 6) Piping particulate test.
 - 7) Piping purity test.
 - 8) Final tie-in test.
 - 9) Operational pressure test.
 - 10) Medical gas concentration test.
 - 11) Medical air purity test.
 - 12) Verify correct labeling of equipment and components.
 - 13) Verify the following source equipment:
 - a) Medical gas supply sources.
- d. Testing Certification: Certify that specified tests, inspections, and procedures have been performed and certify report results. Include the following:
- 1) Inspections performed.
 - 2) Procedures, materials, and gases used.
 - 3) Test methods used.
 - 4) Results of tests.
3. Remove and replace components that do not pass tests and inspections and retest as specified above.

END OF SECTION 22 11 16 00i



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Task	Specification	Specification Description
22 11 16 00	07 63 00 00	Common Work Results for Fire Suppression
22 11 16 00	07 63 00 00a	Common Work Results for Plumbing
22 11 16 00	07 63 00 00b	Common Work Results for HVAC
22 11 19 00	01 22 16 00	No Specification Required
22 11 19 00	22 05 23 00	Piped Utilities Basic Materials And Methods
22 11 19 00	21 05 19 00	Water Distribution
22 11 19 00	07 63 00 00	Common Work Results for Fire Suppression
22 11 19 00	07 63 00 00a	Common Work Results for Plumbing
22 11 19 00	07 63 00 00b	Common Work Results for HVAC
22 11 19 00	22 11 16 00d	Steam And Condensate Piping



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SECTION 22 11 23 13 - WATER DISTRIBUTION PUMPS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for domestic water pumps. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. In-line, sealless centrifugal pumps.
 - b. Horizontally mounted, in-line, separately coupled centrifugal pumps.
 - c. Horizontally mounted, in-line, close-coupled centrifugal pumps.
 - d. Vertically mounted, in-line, close-coupled centrifugal pumps.

C. Definitions

1. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

D. Submittals

1. Product Data: For each type of product indicated. Include materials of construction, rated capacities, certified performance curves with operating points plotted on curves, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Operation and Maintenance Data: For domestic water pumps to include in operation and maintenance manuals.

E. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. UL Compliance: Comply with UL 778 for motor-operated water pumps.

F. Delivery, Storage, And Handling

1. Retain shipping flange protective covers and protective coatings during storage.
2. Protect bearings and couplings against damage.
3. Comply with pump manufacturer's written rigging instructions for handling.

G. Coordination

1. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.2 PRODUCTS

A. In-Line, Sealless Centrifugal Pumps

1. Description: Factory-assembled and -tested, in-line, close-coupled, canned-motor, sealless, overhung-impeller centrifugal pumps.
2. Pump Construction:
 - a. Pump and Motor Assembly: Hermetically sealed, replaceable-cartridge type with motor and impeller on common shaft and designed for installation with pump and motor shaft horizontal.
 - b. Casing: Bronze, with threaded or companion-flange connections.
 - c. Impeller: Plastic.
 - d. Motor: Single speed, unless otherwise indicated.



- B. Horizontally Mounted, In-Line, Separately Coupled Centrifugal Pumps
1. Description: Factory-assembled and -tested, in-line, single-stage, separately coupled, overhung-impeller centrifugal pumps designed for installation with pump and motor shafts mounted horizontal.
 2. Pump Construction:
 - a. Casing: Radially split with threaded companion-flange connections for pumps with NPS 2 (DN 50) pipe connections and flanged connections for pumps with NPS 2-1/2 (DN 65) pipe connections.
 - b. Impeller: Statically and dynamically balanced, closed, and keyed to shaft.
 - c. Shaft and Shaft Sleeve: Steel shaft, with copper-alloy shaft sleeve.
 - d. Coupling: Flexible.
 - e. Seal: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and rubber bellows and gasket.
 - f. Bearings: Oil-lubricated; bronze-journal or ball type.
 - g. Shaft Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.
 3. Motor: Single speed, with grease-lubricated ball bearings; and resiliently **OR** rigidly, **as directed**, mounted to pump casing.
- C. Horizontally Mounted, In-Line, Close-Coupled Centrifugal Pumps
1. Description: Factory-assembled and -tested, in-line, single-stage, close-coupled, overhung-impeller centrifugal pumps designed for installation with pump and motor shaft mounted horizontal.
 2. Pump Construction:
 - a. Casing: Radially split with threaded companion-flange connections for pumps with NPS 2 (DN 50) pipe connections and flanged connections for pumps with NPS 2-1/2 (DN 65) pipe connections.
 - b. Impeller: Statically and dynamically balanced, closed, and keyed to shaft.
 - c. Shaft and Shaft Sleeve: Steel shaft with deflector, with copper-alloy shaft sleeve. Include water slinger on shaft between motor and seal.
 - d. Seal: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and rubber bellows and gasket.
 - e. Bearings: Oil-lubricated; bronze-journal or ball type.
 - f. Shaft Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.
 3. Motor: Single speed, with grease-lubricated ball bearings; and resiliently or rigidly mounted to pump casing.
- D. Vertically Mounted, In-Line, Close-Coupled Centrifugal Pumps
1. Description: Factory-assembled and -tested, in-line, single-stage, close-coupled, overhung-impeller centrifugal pumps designed for installation with pump and motor shaft mounted vertical.
 2. Pump Construction:
 - a. Casing: Radially split, cast iron, with wear rings and threaded companion-flange connections for pumps with NPS 2 (DN 50) pipe connections and flanged connections for pumps with NPS 2-1/2 (DN 65) pipe connections. Include pump manufacturer's base attachment for mounting pump on concrete base, **as directed**.
 - b. Impeller: Statically and dynamically balanced, closed, and keyed to shaft.
 - c. Shaft and Shaft Sleeve: Stainless-steel or steel **OR** Stainless-steel, **as directed**, shaft, with copper-alloy shaft sleeve.
 - d. Seal: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and rubber bellows and gasket. Include water slinger on shaft between motor and seal.
 - e. Bearings: Oil-lubricated; bronze-journal or ball type.
 - f. Shaft Coupling: Flexible or rigid type if pump is provided with coupling.
 3. Motor: Single speed, with grease-lubricated ball bearings; and rigidly mounted to pump casing.
- E. Motors



1. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 22 Section "Common Motor Requirements For Plumbing Equipment".
 - a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - b. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 22.

F. Controls

1. Pressure Switches: Electric, adjustable for control of water-supply pump.
 - a. Type: Water-immersion pressure sensor, for installation in piping.
 - b. Enclosure: NEMA 250, Type 4X.
 - c. Operation of Pump: On or off.
 - d. Transformer: Provide if required.
 - e. Power Requirement: 24 V, ac **OR** 120 V, ac, **as directed**.
 - f. Settings: Start pump at **<Insert pressure>** and stop pump at **<Insert pressure>**.
2. Thermostats: Electric; adjustable for control of hot-water circulation pump.
 - a. Type: Water-immersion temperature sensor, for installation in piping.
 - b. Range: 50 to 125 deg F (10 to 52 deg C) **OR** 65 to 200 deg F (18 to 93 deg C) **OR** 100 to 240 deg F (38 to 116 deg C), **as directed**.
 - c. Enclosure: NEMA 250, Type 4X.
 - d. Operation of Pump: On or off.
 - e. Transformer: Provide if required.
 - f. Power Requirement: 24 V, ac **OR** 120 V, ac, **as directed**.
 - g. Settings: Start pump at 105 deg F (41 deg C) **OR** 110 deg F (43 deg C) **OR** 115 deg F (46 deg C), **as directed**, and stop pump at 120 deg F (49 deg C) **OR** 125 deg F (52 deg C), **as directed**.
3. Timers: Electric, for control of hot-water circulation pump.
 - a. Type: Programmable, seven-day clock with manual override on-off switch.
 - b. Enclosure: NEMA 250, Type 1, suitable for wall mounting.
 - c. Operation of Pump: On or off.
 - d. Transformer: Provide if required.
 - e. Power Requirement: 24 V, ac **OR** 120 V, ac, **as directed**.
 - f. Programmable Sequence of Operation: Up to two on-off cycles each day for seven days.
4. Time-Delay Relays: Electric, for control of hot-water circulation pump between water heater and connected hot-water storage tank.
 - a. Type: Adjustable time-delay relay.
 - b. Range: Up to five minutes.
 - c. Setting: Five minutes.
 - d. Enclosure: NEMA 250, Type 4X.
 - e. Operation of Pump: On or off.
 - f. Transformer: Provide if required.
 - g. Power Requirement: 24 V, ac **OR** 120 V, ac, **as directed**.
 - h. Programmable Sequence of Operation: Limit pump operation to periods of burner operation plus maximum five minutes after the burner stops.

1.3 EXECUTION

A. Examination

1. Examine roughing-in of domestic-water-piping system to verify actual locations of connections before pump installation.

B. Pump Installation

1. Comply with HI 1.4.
2. Install in-line, sealless centrifugal pumps with shaft horizontal unless otherwise indicated.



3. Install horizontally mounted, in-line, separately coupled and close-coupled centrifugal pumps with shaft(s) horizontal.
4. Install vertically mounted, in-line, close-coupled centrifugal pumps with shaft vertical.
5. Pump Mounting: Install vertically mounted, in-line, close-coupled centrifugal pumps with cast-iron base mounted on concrete base using elastomeric pads **OR** elastomeric mounts **OR** restrained spring isolators, **as directed**. Comply with requirements for concrete base specified in Division 03 Section "Cast-in-place Concrete".
 - a. Minimum Deflection: 1/4 inch (6 mm) **OR** 1 inch (25 mm), **as directed**.
 - b. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - c. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - d. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - e. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install continuous-thread hanger rods and spring hangers **OR** spring hangers with vertical-limit stop, **as directed**, of size required to support pump weight.
 - a. Comply with requirements for vibration isolation devices specified in Division 22 Section "Vibration And Seismic Controls For Plumbing Piping And Equipment". Fabricate brackets or supports as required.
 - b. Comply with requirements for hangers and supports specified in Division 22 Section "Hangers And Supports For Plumbing Piping And Equipment".
7. Install pressure switches in water supply piping.
8. Install thermostats in hot-water return piping.
9. Install timers on wall in engineer's office, **as directed**.
10. Install time-delay relays in piping between water heaters and hot-water storage tanks.

C. Connections

1. Comply with requirements for piping specified in Division 22 Section "Domestic Water Piping". Drawings indicate general arrangement of piping, fittings, and specialties.
2. Install piping adjacent to pumps to allow service and maintenance.
3. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles.
 - a. Install flexible connectors adjacent to pumps in suction and discharge piping of the following pumps:
 - 1) Horizontally mounted, in-line, separately coupled centrifugal pumps.
 - 2) Horizontally mounted, in-line, close-coupled centrifugal pumps.
 - 3) Vertically mounted, in-line, close-coupled centrifugal pumps.
 - 4) Comply with requirements for flexible connectors specified in Division 22 Section "Domestic Water Piping".
 - b. Install shutoff valve and strainer on suction side of each pump, and check, shutoff, and throttling valves on discharge side of each pump. Install valves same size as connected piping. Comply with requirements for valves specified in Division 22 Section "General-duty Valves For Plumbing Piping" and comply with requirements for strainers specified in Division 22 Section "Domestic Water Piping Specialties".
 - c. Install pressure gage and snubber, **as directed**, at suction of each pump and pressure gage and snubber, **as directed**, at discharge of each pump. Install at integral pressure-gage tappings where provided or install pressure-gage connectors in suction and discharge piping around pumps. Comply with requirements for pressure gages and snubbers specified in Division 22 Section "Meters And Gages For Plumbing Piping".
4. Comply with Division 22 for electrical connections, and wiring methods.
5. Connect pressure switches, thermostats, time-delay relays, and timers to pumps that they control.
6. Interlock pump between water heater and hot-water storage tank with water heater burner and time-delay relay.



-
- D. Identification
1. Comply with requirements for identification specified in Division 22 Section "Identification For Plumbing Piping And Equipment" for identification of pumps.
- E. Startup Service
1. Engage a factory-authorized service representative to perform **OR** Perform, **as directed**, startup service.
 - a. Complete installation and startup checks according to manufacturer's written instructions.
 - b. Check piping connections for tightness.
 - c. Clean strainers on suction piping.
 - d. Set pressure switches, thermostats, timers, and time-delay relays for automatic starting and stopping operation of pumps.
 - e. Perform the following startup checks for each pump before starting:
 - 1) Verify bearing lubrication.
 - 2) Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
 - 3) Verify that pump is rotating in the correct direction.
 - f. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
 - g. Start motor.
 - h. Open discharge valve slowly.
 - i. Adjust temperature settings on thermostats.
 - j. Adjust timer settings.
- F. Adjusting
1. Adjust domestic water pumps to function smoothly, and lubricate as recommended by manufacturer.
 2. Adjust initial temperature set points.
 3. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

END OF SECTION 22 11 23 13



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SECTION 22 11 23 13a - PACKAGED BOOSTER PUMPS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for packaged booster pumps. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Simplex, constant-speed booster pumps.
 - b. Multiplex, constant-speed booster pumps.
 - c. Simplex, variable-speed booster pumps.
 - d. Multiplex, variable-speed booster pumps.

C. Definitions

1. VFC: Variable-frequency controller(s).

D. Performance Requirements

1. Seismic Performance: Booster pumps shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - a. The term "withstand" means "the booster pump will remain in place without separation of any parts from the booster pump when subjected to the seismic forces specified and the booster pump will be fully operational after the seismic event."

E. Submittals

1. Product Data: For each type of product indicated. Include construction details, material descriptions, and dimensions of individual components and profiles **OR** Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories, **as directed**.
2. Shop Drawings: For booster pumps. Include plans, elevations, sections, details, and attachments to other work.
 - a. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - b. Wiring Diagrams: For power, signal, and control wiring.
3. Seismic Qualification Certificates: For booster pumps, accessories, and components, from manufacturer.
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
4. Operation and Maintenance Data: For booster pumps to include in emergency, operation, and maintenance manuals.

F. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. ASME Compliance: Comply with ASME B31.9 for piping.
3. UL Compliance for Packaged Pumping Systems:
 - a. UL 508, "Industrial Control Equipment."



- b. UL 508A, "Industrial Control Panels."
 - c. UL 778, "Motor-Operated Water Pumps."
 - d. UL 1995, "Heating and Cooling Equipment."
 - 4. Booster pumps shall be listed and labeled as packaged pumping systems by testing agency acceptable to authorities having jurisdiction.
- G. Delivery, Storage, And Handling
- 1. Retain protective coatings and flange's protective covers during storage.
- H. Coordination
- 1. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.2 PRODUCTS

A. Simplex, Constant-Speed Booster Pumps

- 1. Description: Factory-assembled and -tested, fluid-handling system for domestic water, with pump, piping, valves, specialties, and controls, and mounted on base.
- 2. Pump:
 - a. Type: End suction as defined in HI 1.1-1.2 and HI 1.3 for end-suction, close-coupled, single-stage, overhung-impeller, centrifugal pump.
 - b. Casing: Radially split; bronze **OR** cast iron **OR** stainless steel, **as directed**.
 - c. Impeller: Closed, ASTM B 584 cast bronze **OR** stainless steel, **s directed**; statically and dynamically balanced and keyed to shaft.
 - d. Shaft and Shaft Sleeve: Steel shaft, with copper-alloy shaft sleeve and deflector.
 - e. Seal: Mechanical.
 - f. Orientation: Mounted horizontally or vertically.
- 3. Motor: Single speed, with grease-lubricated or pre-greased, permanently shielded, ball-type bearings, and directly mounted to pump casing. Select motor that will not overload through full range of pump performance curve.
- 4. Piping: Copper tube and copper fittings **OR** Stainless-steel pipe and fittings **OR** Stainless-steel pipe and fitting headers and copper tube and copper fittings between headers and pump **OR** Galvanized-steel pipe and cast-iron fittings, **as directed**.
- 5. Valves:
 - a. Shutoff Valves NPS 2 (DN 50) and smaller: Gate valve or two-piece, full-port ball valve, in pump suction and discharge piping.
 - b. Shutoff Valves NPS 2-1/2 (DN 65) and Larger: Gate valve or lug-type butterfly valve, in pump suction and discharge piping.
 - c. Check Valve NPS 2 (DN 50) and smaller: Silent or swing type in pump discharge piping.
 - d. Check Valve NPS 2-1/2 (DN 65) and Larger: Silent type in pump discharge piping.
 - e. Control Valve: Adjustable, automatic, pilot-operated or direct-acting, pressure-reducing type in pump discharge piping.
 - f. Control Valve: Combination adjustable, automatic, pilot-operated or direct-acting pressure-reducing-and-check type in pump discharge piping.
 - g. Thermal-Relief Valve: Temperature-and-pressure relief type in pump discharge piping.
- 6. Dielectric Fittings: With insulating material isolating joined dissimilar metals.
- 7. Hydropneumatic Tank: Precharged, ASME-construction, **as directed**, diaphragm or bladder tank made of materials complying with NSF 61.
- 8. Control Panel: Factory installed and connected as an integral part of booster pump; automatic for single-pump, constant-speed operation, with load control and protection functions.
 - a. Control Logic: Electromechanical system with switches, relays **OR** Solid-state system with transducers, programmable microprocessor, **as directed**, and other devices in the controller.



- b. Motor Controller: NEMA ICS 2, general-purpose, Class A, full-voltage, combination-magnetic type with undervoltage release feature, motor-circuit-protector-type disconnect, and short-circuit protective device.
 - 1) Control Voltage: 24 **OR** 120, **as directed**, -V ac, with integral control-power transformer.
 - c. Motor Controller: NEMA ICS 2, solid-state, reduced-voltage type.
 - 1) Control Voltage: 24 **OR** 120, **as directed**, -V ac, with integral control-power transformer.
 - d. Enclosure: NEMA 250, Type 1 **OR** Type 3R **OR** Type 4 **OR** Type 12, **as directed**.
 - e. Motor Overload Protection: Overload relay in each phase.
 - f. Starting Devices: Hand-off-automatic selector switch in cover of control panel, plus pilot device for automatic control.
 - g. Pump Operation: Current- or pressure- sensing method.
 - 1) Time Delay: Controls pump on-off operation; adjustable from 1 to 300 seconds.
 - h. Instrumentation: Suction and discharge pressure gages.
 - i. Light: Running light for pump.
 - j. Thermal-bleed cutoff.
 - k. Low-suction-pressure **OR** Water-storage-tank, low-level, **as directed**, cutout.
 - l. High-suction-pressure cutout.
 - m. Low-discharge-pressure cutout.
 - n. High-discharge-pressure cutout.
 - o. Building Automation System Interface: Provide auxiliary contacts for interface to BACnet **OR** LonWorks, **as directed**, building automation system. Building automation systems are specified in Division 23 Section "Instrumentation And Control For Hvac". Include the following:
 - 1) On-off status of pump.
 - 2) Alarm status.
9. Base: Structural steel.

B. Multiplex, Constant-Speed Booster Pumps

- 1. Description: Factory-assembled and -tested, fluid-handling system for domestic water, with pumps, piping, valves, specialties, and controls, and mounted on base.
- 2. Pumps:
 - a. Type: End suction as defined in HI 1.1-1.2 and HI 1.3 for end-suction, close-coupled, single-stage, overhung-impeller, centrifugal pump.
 - b. Casing: Radially split; bronze **OR** cast iron **OR** stainless steel, **as directed**.
 - c. Impeller: Closed, ASTM B 584 cast bronze **OR** stainless steel, **as directed**; statically and dynamically balanced and keyed to shaft.
 - d. Shaft and Shaft Sleeve: Steel shaft, with copper-alloy shaft sleeve and deflector.
 - e. Seal: Mechanical.
 - f. Orientation: Mounted horizontally or vertically.

OR

Pumps:

 - a. Type: End suction as defined in HI 1.1-1.2 and HI 1.3 for end-suction, frame-mounted, separately coupled, single-stage, overhung-impeller, centrifugal pump. Include back-pullout design, **as directed**.
 - b. Casing: Radially split; bronze **OR** cast iron **OR** stainless steel, **as directed**.
 - c. Impeller: Closed, ASTM B 584 cast bronze **OR** stainless steel, **as directed**; statically and dynamically balanced and keyed to shaft.
 - d. Shaft and Shaft Sleeve: Stainless-steel or steel, **as directed**, shaft, with copper-alloy shaft sleeve and deflector.
 - e. Seal: Mechanical.
 - f. Bearing: Grease-lubricated or pre-greased, permanently shielded ball type.
 - g. Coupling: Flexible, with metal guard.

OR

Pumps:



- a. Type: In line, single stage as defined in HI 1.1-1.2 and HI 1.3 for in-line, single-stage, close-coupled, overhung-impeller, centrifugal pump.
 - b. Casing: Radially split; bronze **OR** cast iron **OR** stainless steel, **as directed**.
 - c. Impeller: Closed, ASTM B 584 cast bronze **OR** stainless steel, **as directed**; statically and dynamically balanced and keyed to shaft.
 - d. Shaft and Shaft Sleeve: Stainless-steel or steel, **as directed**, shaft, with copper-alloy shaft sleeve.
 - e. Seal: Mechanical.
 - f. Bearing: Grease-lubricated or pre-greased, permanently shielded ball type.
- OR**
- Pumps:
- a. Type: Vertical, multistage as defined in HI 1.1-1.2 and HI 1.3 for in-line, multistage, separately coupled, overhung-impeller, centrifugal pump.
 - b. Casing: Cast-iron or steel base and stainless-steel chamber.
 - c. Impeller: Closed, stainless steel; statically and dynamically balanced and keyed to shaft.
 - d. Shaft: Stainless steel.
 - e. Seal: Mechanical.
 - f. Bearing: Water-lubricated sleeve type.
- OR**
- Pumps:
- a. Type: Vertical, can, as defined in HI 2.1-2.2 and HI 2.3 for in-line, barrel or can, lineshaft, vertical pump.
 - b. Impeller: Closed, stainless steel; statically and dynamically balanced and keyed to shaft.
 - c. Bowls: Epoxy-coated cast iron **OR** Cast iron, **as directed**.
 - d. Shaft: Stainless steel.
 - e. Seals: Mechanical and stuffing-box types.
 - f. Bearings: Water-lubricated bushing type.
3. Motors: Single speed, with grease-lubricated or pre-greased, permanently shielded, ball-type bearings. Select motors that will not overload through full range of pump performance curve.
 4. Piping: Copper tube and copper fittings **OR** Stainless-steel pipe and fittings **OR** Stainless-steel pipe and fitting headers and copper tube and copper fittings between headers and pump **OR** Galvanized-steel pipe and cast-iron fittings, **as directed**.
 5. Valves:
 - a. Shutoff Valves NPS 2 (DN 50) and smaller: Gate valve or two-piece, full-port ball valve, in each pump's suction and discharge piping.
 - b. Shutoff Valves NPS 2-1/2 (DN 65) and Larger: Gate valve or lug-type butterfly valve, in each pump's suction and discharge piping and in inlet and outlet headers, **as directed**.
 - c. Check Valves NPS 2 (DN 50) and smaller: Silent or swing type in each pump's discharge piping.
 - d. Check Valves NPS 2-1/2 (DN 65) and Larger: Silent type in each pump's discharge piping.
 - e. Control Valves: Adjustable, automatic, pilot-operated or direct-acting, pressure-reducing type in each pump's discharge piping.
 - f. Control Valves: Combination adjustable, automatic, pilot-operated or direct-acting pressure-reducing-and-check type in each pump's discharge piping.
 - g. Thermal-Relief Valve: Temperature-and-pressure relief type in pump's discharge header piping.
 6. Dielectric Fittings: With insulating material isolating joined dissimilar metals.
 7. Control Panel: Factory installed and connected as an integral part of booster pump; automatic for multiple-pump, constant-speed operation, with load control and protection functions.
 - a. Control Logic: Electromechanical system with switches, relays **OR** Solid-state system with transducers, programmable microprocessor, **as directed**, and other devices in the controller.
 - b. Motor Controller: NEMA ICS 2, general-purpose, Class A, full-voltage, combination-magnetic type with undervoltage release feature, motor-circuit-protector-type disconnect, and short-circuit protective device.



- 1) Control Voltage: 24 **OR** 120, **as directed**, -V ac, with integral control-power transformer.
 - c. Motor Controller: NEMA ICS 2, solid-state, reduced-voltage type.
 - 1) Control Voltage: 24 **OR** 120, **as directed**, -V ac, with integral control-power transformer.
 - d. Enclosure: NEMA 250, Type 1 **OR** Type 3R **OR** Type 4 **OR** Type 12, **as directed**.
 - e. Motor Overload Protection: Overload relay in each phase.
 - f. Starting Devices: Hand-off-automatic selector switch for each pump in cover of control panel, plus pilot device for automatic control.
 - 1) Duplex, Automatic, Alternating Starter: Switches lead pump to lag main pump and to two-pump operation.
 - 2) Triplex, Sequence (Lead-Lag-Lag) Starter: Switches lead pump to one lag main pump and to three-pump operation.
 - g. Pump Operation and Sequencing: Current- or pressure- sensing method.
 - 1) Time Delay: Controls pump on-off operation; adjustable from 1 to 300 seconds.
 - h. Instrumentation: Suction and discharge pressure gages.
 - i. Lights: Running light for each pump.
 - j. Alarm Signal Device: Sounds alarm when backup pumps are operating.
 - 1) Time Delay: Controls alarm operation; adjustable from 1 to 300 seconds, with automatic **OR** manual, **as directed**, reset.
 - k. Thermal-bleed cutoff.
 - l. Low-suction-pressure **OR** Water-storage-tank, low-level, **as directed**, cutout.
 - m. High-suction-pressure cutout.
 - n. Low-discharge-pressure cutout.
 - o. High-discharge-pressure cutout.
 - p. Building Automation System Interface: Provide auxiliary contacts for interface to BACnet **OR** LonWorks, **as directed**, building automation system. Building automation systems are specified in Division 23 Section "Instrumentation And Control For Hvac". Include the following:
 - 1) On-off status of each pump.
 - 2) Alarm status.
8. Base: Structural steel.
- C. Simplex, Variable-Speed Booster Pumps
1. Description: Factory-assembled and -tested, fluid-handling system for domestic water, with pump, piping, valves, specialties, and controls, and mounted on base.
 2. Pump:
 - a. Type: End suction as defined in HI 1.1-1.2 and HI 1.3 for end-suction, close-coupled, single-stage, overhung-impeller, centrifugal pump.
 - b. Casing: Radially split; bronze **OR** cast iron **OR** stainless steel, **as directed**.
 - c. Impeller: Closed, ASTM B 584 cast bronze **OR** stainless steel, **as directed**; statically and dynamically balanced and keyed to shaft.
 - d. Shaft and Shaft Sleeve: Steel shaft, with copper-alloy shaft sleeve and deflector.
 - e. Seal: Mechanical.
 - f. Orientation: Mounted horizontally or vertically.
 3. Motor: Single speed, with grease-lubricated or pre-greased, permanently shielded, ball-type bearings, and directly mounted to pump casing. Select motor that will not overload through full range of pump performance curve.
 4. Piping: Copper tube and copper fittings **OR** Stainless-steel pipe and fittings **OR** Stainless-steel pipe and fitting headers and copper tube and copper fittings between headers and pump **OR** Galvanized-steel pipe and cast-iron fittings, **as directed**.
 5. Valves:
 - a. Shutoff Valves NPS 2 (DN 50) and Smaller: Gate valve or two-piece, full-port ball valve, in pump suction and discharge piping.
 - b. Shutoff Valves NPS 2-1/2 (DN 65) and Larger: Gate valve or lug-type butterfly valve, in pump suction and discharge piping.



- c. Check Valve NPS 2 (DN 50) and Smaller: Silent or swing type in pump discharge piping.
 - d. Check Valve NPS 2-1/2 (DN 65) and Larger: Silent type in pump discharge piping.
 - e. Thermal-Relief Valve: Temperature-and-pressure relief type in pump discharge piping.
 - 6. Dielectric Fittings: With insulating material isolating joined dissimilar metals.
 - 7. Hydropneumatic Tank: Precharged, ASME-construction, **as directed**, diaphragm or bladder tank made of materials complying with NSF 61.
 - 8. Control Panel: Factory installed and connected as an integral part of booster pump; automatic for single-pump, variable-speed operation, with load control and protection functions.
 - a. Control Logic: Solid-state system with transducers, programmable microprocessor, VFC, and other devices in the controller.
 - b. Motor Controller: NEMA ICS 2, variable-frequency, solid-state type.
 - 1) Control Voltage: 24 **OR** 120, **as directed**, -V ac, with integral control-power transformer.
 - c. Enclosure: NEMA 250, Type 1 **OR** Type 3R **OR** Type 4 **OR** Type 12, **as directed**.
 - d. Motor Overload Protection: Overload relay in each phase.
 - e. Starting Devices: Hand-off-automatic selector switch in cover of control panel, plus pilot device for automatic control.
 - f. Pump Operation: Pressure-sensing method.
 - 1) Time Delay: Controls pump on-off operation; adjustable from 1 to 300 seconds.
 - g. VFC: Voltage-source, pulse-width, modulating-frequency converter; installed in control panel.
 - h. Manual Bypass: Magnetic contactor arranged to transfer to constant-speed operation upon VFC failure.
 - i. Instrumentation: Suction and discharge pressure gages.
 - j. Light: Running light for pump.
 - k. Thermal-bleed cutoff.
 - l. Low-suction-pressure **OR** Water-storage-tank, low-level, **as directed**, cutout.
 - m. High-suction-pressure cutout.
 - n. Low-discharge-pressure cutout.
 - o. High-discharge-pressure cutout.
 - p. Building Automation System Interface: Provide auxiliary contacts for interface to BACnet **OR** LonWorks, **as directed**, building automation system. Building automation systems are specified in Division 23 Section "Instrumentation And Control For Hvac". Include the following:
 - 1) On-off status of each pump.
 - 2) Alarm status.
 - 9. Base: Structural steel.
- D. Multiplex, Variable-Speed Booster Pumps
- 1. Description: Factory-assembled and -tested, fluid-handling system for domestic water, with pumps, piping, valves, specialties, and controls, and mounted on base.
 - 2. Pumps:
 - a. Type: End suction as defined in HI 1.1-1.2 and HI 1.3 for end-suction, close-coupled, single-stage, overhung-impeller, centrifugal pump.
 - b. Casing: Radially split; bronze **OR** cast iron **OR** stainless steel, **as directed**.
 - c. Impeller: Closed, ASTM B 584 cast bronze **OR** stainless steel, **as directed**; statically and dynamically balanced and keyed to shaft.
 - d. Shaft and Shaft Sleeve: Steel shaft, with copper-alloy shaft sleeve and deflector.
 - e. Seal: Mechanical.
 - f. Orientation: Mounted horizontally or vertically.
 - 3. Pumps:
 - a. Type: End suction as defined in HI 1.1-1.2 and HI 1.3 for end-suction, frame-mounted, separately coupled, single-stage, overhung-impeller, centrifugal pump. Include back-pullout design, **as directed**.
 - b. Casing: Radially split; bronze **OR** cast iron **OR** stainless steel, **as directed**.



- c. Impeller: Closed, ASTM B 584 cast bronze **OR** stainless steel, **as directed**; statically and dynamically balanced and keyed to shaft.
- d. Shaft and Shaft Sleeve: Stainless-steel or steel, **as directed**, shaft, with copper-alloy shaft sleeve and deflector.
- e. Seal: Mechanical.
- f. Bearing: Grease-lubricated or pre-greased, permanently shielded ball type.
- g. Coupling: Flexible, with metal guard.
4. Pumps:
 - a. Type: In line, single stage as defined in HI 1.1-1.2 and HI 1.3 for in-line, single-stage, close-coupled, overhung-impeller, centrifugal pump.
 - b. Casing: Radially split; bronze **OR** cast iron **OR** stainless steel, **as directed**.
 - c. Impeller: Closed, ASTM B 584 cast bronze **OR** stainless steel, **as directed**; statically and dynamically balanced and keyed to shaft.
 - d. Shaft and Shaft Sleeve: Stainless-steel or steel, **as directed**, shaft, with copper-alloy shaft sleeve.
 - e. Seal: Mechanical.
 - f. Bearing: Grease-lubricated or pre-greased, permanently shielded ball type.
5. Pumps:
 - a. Type: Vertical, multistage as defined in HI 1.1-1.2 and HI 1.3 for in-line, multistage, separately coupled, overhung-impeller, centrifugal pump.
 - b. Casing: Cast-iron or steel base and stainless-steel chamber.
 - c. Impeller: Closed, stainless steel; statically and dynamically balanced and keyed to shaft.
 - d. Shaft: Stainless steel.
 - e. Seal: Mechanical.
 - f. Bearing: Water-lubricated sleeve type.
6. Pumps:
 - a. Type: Vertical, can, as defined in HI 2.1-2.2 and HI 2.3 for in-line, barrel or can, lineshaft, vertical pump.
 - b. Impeller: Closed, stainless steel; statically and dynamically balanced and keyed to shaft.
 - c. Bowls: Epoxy-coated cast iron **OR** Cast iron, **as directed**.
 - d. Shaft: Stainless steel.
 - e. Seals: Mechanical and stuffing-box types.
 - f. Bearings: Water-lubricated bushing type.
7. Motors: Single speed, with grease-lubricated or pre-greased, permanently shielded, ball-type bearings. Select motors that will not overload through full range of pump performance curve.
8. Piping: Copper tube and copper fittings **OR** Stainless-steel pipe and fittings **OR** Stainless-steel pipe and fitting headers and copper tube and copper fittings between headers and pump **OR** Galvanized-steel pipe and cast-iron fittings, **as directed**.
9. Valves:
 - a. Shutoff Valves NPS 2 (DN 50) and Smaller: Gate valve or two-piece, full-port ball valve, in each pump's suction and discharge piping.
 - b. Shutoff Valves NPS 2-1/2 (DN 65) and Larger: Gate valve or lug-type butterfly valve, in each pump's suction and discharge piping and in inlet and outlet headers, **as directed**.
 - c. Check Valves NPS 2 (DN 50) and Smaller: Silent or swing type in each pump's discharge piping.
 - d. Check Valves NPS 2-1/2 (DN 65) and Larger: Silent type in each pump's discharge piping.
 - e. Thermal-Relief Valve: Temperature-and-pressure relief type in pump's discharge header piping.
10. Dielectric Fittings: With insulating material isolating joined dissimilar metals.
11. Control Panel: Factory installed and connected as an integral part of booster pump; automatic for multiple-pump, variable-speed operation, with load control and protection functions.
 - a. Control Logic: Solid-state system with transducers, programmable microprocessor, VFC, and other devices in controller. Install VFC for pump motors larger than 25 hp in separate panel; same type as motor control panel enclosure.
 - b. Motor Controller: NEMA ICS 2, variable-frequency, solid-state type.



- 1) Control Voltage: 24 **OR** 120, **as directed**, -V ac, with integral control-power transformer.
 - c. Enclosure: NEMA 250, Type 1 **OR** Type 3R **OR** Type 4 **OR** Type 12, **as directed**.
 - d. Motor Overload Protection: Overload relay in each phase.
 - e. Starting Devices: Hand-off-automatic selector switch for each pump in cover of control panel, plus pilot device for automatic control.
 - 1) Duplex, Automatic, Alternating Starter: Switches lead pump to lag main pump and to two-pump operation.
 - 2) Triplex, Sequence (Lead-Lag-Lag) Starter: Switches lead pump to one lag main pump and to three-pump operation.
 - f. Pump Operation and Sequencing: Pressure-sensing method or flow-sensing method **OR** Pressure-sensing method for lead pump and flow-sensing method for lag pumps, **as directed**.
 - 1) Time Delay: Controls pump on-off operation; adjustable from 1 to 300 seconds.
 - g. VFC: Voltage-source, pulse-width, modulating-frequency converter for each **OR** lead, **as directed**, pump.
 - h. Manual Bypass: Magnetic contactor arranged to transfer to constant-speed operation upon VFC failure.
 - i. Instrumentation: Suction and discharge pressure gages.
 - j. Lights: Running light for each pump.
 - k. Alarm Signal Device: Sounds alarm when backup pumps are operating.
 - 1) Time Delay: Controls alarm operation; adjustable from 1 to 300 seconds, with automatic **OR** manual, **as directed**, reset.
 - l. Thermal-bleed cutoff.
 - m. Low-suction-pressure **OR** Water-storage-tank, low-level, **as directed**, cutout.
 - n. High-suction-pressure cutout.
 - o. Low-discharge-pressure cutout.
 - p. High-discharge-pressure cutout.
 - q. Building Automation System Interface: Provide auxiliary contacts for interface to BACnet **OR** LonWorks, **as directed**, building automation system. Building automation systems are specified in Division 23 Section "Instrumentation And Control For Hvac". Include the following:
 - 1) On-off status of each pump.
 - 2) Alarm status.
12. Base: Structural steel.

E. Motors

1. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors.
 - a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - b. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in NFPA 70.

1.3 EXECUTION

A. Examination

1. Examine roughing-in for booster pumps to verify actual locations of piping connections before booster-pump installation.

B. Installation

1. Equipment Mounting: Install booster pumps on concrete base using elastomeric pads **OR** elastomeric mounts **OR** restrained spring isolators, **as directed**. Comply with requirements for concrete base specified in Division 03 Section "Cast-in-place Concrete", **as directed**.



- a. Minimum Deflection: 1/4 inch (6 mm) **OR** 1 inch (25 mm), **as directed**.
 - b. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - c. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - d. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - e. Install anchor bolts to elevations required for proper attachment to supported equipment.
 2. Equipment Mounting: Install booster pumps using elastomeric pads **OR** elastomeric mounts **OR** restrained spring isolators, **as directed**. Comply with requirements for vibration isolation devices specified in Division 22 Section "Vibration And Seismic Controls For Plumbing Piping And Equipment".
 - a. Minimum Deflection: 1/4 inch (6 mm) **OR** 1 inch (25 mm), **as directed**.
 3. Support connected domestic-water piping so weight of piping is not supported by booster pumps.
- C. Connections
1. Comply with requirements for piping specified in Division 22 Section "Domestic Water Piping". Drawings indicate general arrangement of piping, fittings, and specialties.
 2. Connect domestic-water piping to booster pumps. Install suction and discharge pipe equal to or greater than size of system suction and discharge headers **OR** piping, **as directed**.
 - a. Install shutoff valves on piping connections to booster-pump suction and discharge headers **OR** piping, **as directed**. Install ball, butterfly, or gate valves same size as suction and discharge headers **OR** piping, **as directed**. Comply with requirements for general-duty valves specified in Division 22 Section "General-duty Valves For Plumbing Piping".
 - b. Install union, flanged, or grooved-joint connections on suction and discharge headers **OR** piping, **as directed**, at connection to domestic-water piping. Comply with requirements for unions and flanges specified in Division 22 Section "Domestic Water Piping".
 - c. Install valved bypass, same size as and between piping, at connections to booster-pump suction and discharge headers **OR** piping, **as directed**. Comply with requirements for domestic-water piping specified in Division 22 Section "Domestic Water Piping".
 - d. Install flexible connectors, same size as piping, on piping connections to booster-pump suction and discharge headers **OR** piping, **as directed**. Comply with requirements for flexible connectors specified in Division 22 Section "Domestic Water Piping".
 - e. Install piping adjacent to booster pumps to allow service and maintenance.
- D. Identification
1. Identify system components. Comply with requirements for identification specified in Division 22 Section "Identification For Plumbing Piping And Equipment".
- E. Field Quality Control
1. Perform tests and inspections.
 2. Tests and Inspections:
 - a. Perform visual and mechanical inspection.
 - b. Leak Test: After installation, charge booster pump and test for leaks. Repair leaks and retest until no leaks exist.
 - c. Operational Test: After electrical circuitry has been energized, start booster pumps to confirm proper motor rotation and booster-pump operation.
 - d. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 3. Pumps and controls will be considered defective if they do not pass tests and inspections.
 4. Prepare test and inspection reports.
- F. Startup Service
1. Perform startup service.
 - a. Complete installation and startup checks according to manufacturer's written instructions.



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- G. Adjusting
1. Adjust booster pumps to function smoothly, and lubricate as recommended by manufacturer.
 2. Adjust pressure set points.
 3. Occupancy Adjustments: When requested within 12 months of date of Final Completion, provide on-site assistance in adjusting booster pump to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.
- H. Demonstration
1. Train Owner's maintenance personnel to adjust, operate, and maintain booster pumps.

END OF SECTION 22 11 23 13a



SECTION 22 11 23 39 - WATER SUPPLY WELLS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for water supply wells. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Cable-tool, Rotary drilled, Reverse-rotary drilled, and Driven water supply wells.
 - b. Jet, Line-shaft, and Submersible well pumps.

C. Definitions

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. PA: Polyamide (nylon) plastic.
3. PE: Polyethylene plastic.
4. PP: Polypropylene plastic.
5. PVC: Polyvinyl chloride plastic.

D. Submittals

1. Product Data: Submit certified performance curves and rated capacities of selected well pumps and furnished specialties for each type and size of well pump indicated.
2. Shop Drawings: Show layout and connections for well pumps.
 - a. Wiring Diagrams: Power, signal, and control wiring.
3. Field quality-control reports.
4. Operation and maintenance data.

E. Quality Assurance

1. Well Driller Qualifications: An experienced water supply well driller licensed in the jurisdiction where Project is located.
2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
3. Comply with AWWA A100 for water supply wells.

F. Project Conditions

1. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by the Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
 - a. Notify the Owner no fewer than seven days in advance of proposed interruption of water service.
 - b. Do not proceed with interruption of water service without the Owner's written permission.
2. Well Drilling Water: Provide temporary water and piping for drilling purposes. Provide necessary piping for water supply.

1.2 PRODUCTS

A. Well Casings

1. Steel Casing: AWWA C200, single ply, steel pipe with threaded ends and threaded couplings for threaded joints.



2. ABS Casing: ASTM F 480, ABS, Schedule 40 **OR** 80, **as directed**, bell-and-spigot pipe and couplings for solvent-cemented joints.
 3. PVC Casing: ASTM F 480 and NSF 14, **as directed**, PVC, Schedule 40 **OR** 80, **as directed**, bell-and-spigot pipe and couplings for solvent-cemented joints. Include NSF listing mark "NSF wc," **as directed**.
 4. Pitless Adapter: Fitting, of shape required to fit onto casing, with waterproof seals.
 5. Pitless Unit: Factory-assembled equipment that includes pitless adapter.
 6. Well Seals: Casing cap, with holes for piping and cables, that fits into top of casing and is removable, waterproof, and vermin proof.
- B. Grout
1. Cement: ASTM C 150, Type II.
 2. Aggregates: ASTM C 33, fine and coarse grades.
 3. Water: Potable.
- C. Water Well Screens
1. Screen Material: Fabricated of ASTM A 666, Type 304 stainless steel, welded; with continuous-slot, V-shaped openings that widen inwardly **OR** tube; with slotted or perforated surface and designed for well-screen applications, **as directed**.
 - a. Screen Couplings: Butt-type, stainless-steel coupling rings.
 - b. Screen Fittings: Screen, with necessary fittings, closes bottom and makes tight seal between top of screen and well casing.
 - c. Maximum Entering Velocity: 0.1 fps (0.03 m/s).
- D. Pack Materials
1. Coarse, uniformly graded filter sand, maximum 1/8 inch (3 mm) in diameter.
 2. Fine gravel, maximum 1/4 inch (6 mm) in diameter.
- E. Jet-Type Well Pumps
1. Description: Shallow **OR** Deep, **as directed**, -well-design, jet well pump; self-priming; centrifugal pump capable of continuous operation; with the following features:
 - a. Housing: Cast iron.
 - b. Impeller: Single stage **OR** Multistage, **as directed**, centrifugal; fabricated of corrosion-resistant materials.
 - c. Seals: Mechanical.
 - d. Shaft: Stainless steel.
 - e. Motor: Manufacturer's standard, NEMA MG 1 motor, panel, and accessories.
 - f. Motor Controls: Electronic; variable speed.
 - g. Check valve, ejector, and pressure-control valve.
 2. Pump Accessories:
 - a. Compression Tanks: Comply with requirements in Division 22 Section "Facility Indoor Potable-water Storage Tanks" **OR** Precharged butyl rubber diaphragm, steel shell, fused polymeric lining, and 100-psig (690-kPa) working pressure, **as directed**.
 - b. Pressure Switches: For pump control; for installation in piping.
 - c. Water Piping: ASTM A 53/A 53M, Schedule 40, galvanized-steel pipe with threaded ends.
 - 1) Cast-Iron Fittings: ASME B16.4, threaded, galvanized.
 - d. Water Piping: ASTM D 2239, SDR Numbers 5.3, 7, or 9 PE pipe; made with PE compound number required to give pressure rating not less than 160 psig (1100 kPa) **OR** 200 psig (1380 kPa), **as directed**. Include NSF listing mark "NSF pw."
 - 1) Fittings for PE Pipe: ASTM D 2609, made of PA, PP, or PVC with serrated, male insert ends matching inside of pipe. Include bands or crimp rings.
- F. Line-Shaft Well Pumps
1. Description: Line-shaft, water **OR** oil, **as directed**, -lubricated, vertical-turbine well pump complying with HI 2.1-2.2 and HI 2.3; with the following features:



- a. Impeller Material: Stainless steel **OR** Carbon steel **OR** Bronze, **as directed**.
- b. Motor: Full-voltage starting, vertical hollow- or solid-shaft, squirrel-cage induction type complying with ANSI C50.10.
- c. Pump Base: Cast iron or fabricated steel.
- d. Column Pipe: ASTM A 53/A 53M, Schedule 40, galvanized-steel pipe with threaded ends and cast-iron or steel threaded couplings.

G. Submersible Well Pumps

1. Description: Submersible, vertical-turbine well pump complying with HI 2.1-2.2 and HI 2.3; with the following features:
 - a. Impeller Material: Stainless steel **OR** Silicon bronze, **as directed**.
 - b. Motor: Capable of continuous operation under water, with protected submersible power cable.
 - c. Column Pipe: ASTM A 53/A 53M, Schedule 40, galvanized-steel pipe with threaded ends and cast-iron or steel threaded couplings.
 - d. Discharge Piping: ASTM D 2239, SIDR Numbers 5.3, 7, or 9 PE pipe; made with PE compound number required to give pressure rating not less than 160 psig (1100 kPa) **OR** 200 psig (1380 kPa), **as directed**. Include NSF listing mark "NSF pw."
 - 1) Insert Fittings for PE Pipe: ASTM D 2609, made of PA, PP, or PVC with serrated, male insert ends matching inside of pipe. Include bands or crimp rings.

H. Motors

1. General requirements for motors are specified in Division 22 Section "Common Motor Requirements For Plumbing Equipment".
 - a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - b. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 22.

1.3 EXECUTION

A. Preparation

1. Pilot-Hole Data: Review pilot-hole test analysis furnished by the Owner.
2. Neighborhood Well Data: Review operating and test analyses.

B. Installation

1. Construct well using cable-tool **OR** rotary drilling **OR** reverse-rotary drilling **OR** driven, **as directed**, method.
2. Take samples of substrata formation at 10-foot (3-m) intervals and at changes in formation throughout entire depth of each water supply well. Carefully preserve samples on-site in glass jars properly labeled for identification.
3. If selecting rotary drilled or reverse-rotary drilled method, excavate for mud pit or provide aboveground structure, acceptable to authorities having jurisdiction, to allow settlement of cuttings and circulation of drill fluids back to well without discharging to on-site waterways.
4. Enlarge pilot hole and install permanent casing, screen, and grout. Install first section of casing with hardened steel driving shoe of an OD slightly larger than casing couplings if threaded couplings are used.
5. Set casing and liners round, plumb, and true to line.
6. Join casing pipe as follows:
 - a. Ream ends of pipe and remove burrs.
 - b. Remove scale, slag, dirt, and debris from inside and outside casing before installation.
 - c. Cut bevel in ends of steel casing pipe and make threaded joints.
 - d. Clean and make solvent-cemented joints for ABS and PVC casings.
7. If rotary drilled or reverse-rotary drilled well, mix grout in proportions of 1 cu. ft. (0.03 cu. m) or a 94-lb (42.6-kg) sack of cement with 5 to 6 gal. (19 to 23 L) of water. Bentonite clay may be added



in amounts of 3 to 5 lb/cu. ft. (1.4 to 2.3 kg/0.03 cu. m) for a 94-lb (42.6-kg) sack of cement. If bentonite clay is added, water may be increased to 6.5 gal./cu. ft. (25 L/0.03 cu. m) of cement.

8. If rotary drilled or reverse-rotary drilled well, place grout continuously, from bottom to top surface, to ensure filling of annular space in one operation. Do not perform other operations in well within 72 hours after grouting of casing. When quick-setting cement is used, this period may be reduced to 24 hours.
9. Provide permanent casing with temporary well cap. Install with top of casing 36 inches (910 mm) above finished grade, **as directed**.
10. Develop wells to maximum yield per foot (meter) of drawdown.
 - a. Extract maximum practical quantity of sand, drill fluid, and other fine materials from water-bearing formation.
 - b. Avoid settlement and disturbance of strata above water-bearing formation.
 - c. Do not disturb sealing around well casings.
 - d. Continue developing wells until water contains no more than 2 ppm of sand by weight when pumped at maximum testing rate.
11. Install jet well pumps with ejector in or attached to pump housing. Place check valve on suction line to prevent drainage of compression tank.
12. Install jet well pumps and pressure and suction lines. Install ejector where pressure and suction lines connect above well screen. Install check valve in suction line, or install foot valve below ejector, to prevent drainage of compression tank.
13. Install line-shaft **OR** submersible, **as directed**, well pumps according to HI 2.1-2.4 and provide access for periodic maintenance.
 - a. Before lowering permanent pump into well, lower a dummy pump that is slightly longer and wider than permanent pump to determine that permanent pump can be installed. Correct alignment problems.
 - b. Before lowering permanent pump into well, start pump to verify correct rotation.
 - c. Securely tighten discharge piping joints.
 - d. Locate line-shaft well pump near well bottom; locate motor above grade. Install driver plate to correctly align motor and pump.
 - e. Connect motor to submersible pump and locate near well bottom.
 - 1) Connect power cable while connection points are dry and undamaged.
 - 2) Do not damage power cable during installation; use cable clamps that do not have sharp edges.
 - 3) Install water-sealed surface plate that will support pump and piping.

C. Connections

1. Piping installation requirements are specified in Division 22 Section "Facility Water Distribution Piping". Drawings indicate general arrangement of piping, fittings, and specialties.
 - a. Connect piping between well pump and water piping.
 - b. Connect water distribution system in trench to well pipe at pitless adapter **OR** unit, **as directed**.
 - c. Connect building water distribution to well pipe inside well house.
2. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
3. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

D. Well Abandonment

1. Comply with AWWA A100 when abandoning water supply wells. Fill and seal holes and casings and restore ground surface to finished grade.
OR
Follow well-abandonment procedures of authorities having jurisdiction. Restore ground surface to finished grade.

E. Field Quality Control



1. Plumbness and Alignment Testing: Comply with AWWA A100.
 2. Furnish samples of water-bearing formation to testing laboratory and well-screen manufacturer for mechanical sieve analysis.
 3. Prepare reports on static level of ground water, level of water for various pumping rates, and depth to water-bearing strata.
 4. Performance Testing: Conduct final pumping tests after wells have been constructed, cleaned, and tested for plumbness and alignment.
 - a. Provide discharge piping to conduct water to locations where disposal will not create a nuisance or endanger adjacent property. Comply with requirements of authorities having jurisdiction.
 - b. Measure elevation to water level in wells.
 - c. Perform two bailer or air-ejection tests to determine expected yield. Test at depths with sufficient quantity of water to satisfy desired yields.
 - d. Test Pump: Variable capacity test pump with capacity equal to maximum expected yields at pressure equal to drawdown in wells, plus losses in pump columns and discharge pipes.
 - e. Start and adjust test pumps and equipment to required pumping rates.
 - f. Record readings of water levels in wells and pumping rates at 30-minute maximum intervals throughout 24-hour minimum period.
 - g. Record maximum yields when drawdown is 60 inches (1500 mm) above top of suction screens after designated times.
 - h. Operate pumping units continuously for eight hours after maximum drawdown is reached.
 - i. Record returning water levels in wells and plot curves of well recovery rates.
 - j. Remove sand, stones, and other foreign materials that may become deposited in wells after completing final tests.
 5. Water Analysis Testing:
 - a. Engage] a qualified testing agency to make bacteriological, physical, and chemical analyses of water from each finished well and report the results. Make analyses according to requirements of authorities having jurisdiction.
OR
Analyze water sample from each finished well for bacteriological, physical, and chemical quality and report the results. Make analyses according to requirements of authorities having jurisdiction.
- F. Cleaning
1. Disinfect water supply wells according to AWWA A100 and AWWA C654 before testing well pumps.
OR
Follow water supply well disinfection procedures required by authorities having jurisdiction before testing well pumps.
- G. Protection
1. Water Quality Protection: Prevent well contamination, including undesirable physical and chemical characteristics.
 2. Ensure that mud pit will not leak or overflow into streams or wetlands. When well is accepted, remove mud and solids in mud pit from Project site and restore site to finished grade.
 3. Provide casings, seals, sterilizing agents, and other materials to eliminate contamination; shut off contaminated water.
 4. Exercise care to prevent breakdown or collapse of strata overlaying that from which water is to be drawn.
 5. Protect water supply wells to prevent tampering and introducing foreign matter. Retain temporary well cap until installation is complete.

END OF SECTION 22 11 23 39



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SECTION 22 11 23 39a - HYDRONIC PUMPS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for hydronic pumps. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Close-coupled, in-line centrifugal pumps.
 - b. Close-coupled, end-suction centrifugal pumps.
 - c. Separately coupled, horizontal, in-line centrifugal pumps.
 - d. Separately coupled, vertical, in-line centrifugal pumps.
 - e. Separately coupled, base-mounted, end-suction centrifugal pumps.
 - f. Separately coupled, base-mounted, double-suction centrifugal pumps.
 - g. Separately coupled, vertical-mounted, double-suction centrifugal pumps.
 - h. Separately coupled, vertical-mounted, turbine centrifugal pumps.
 - i. Automatic condensate pump units.

C. Definitions

1. Buna-N: Nitrile rubber.
2. EPT: Ethylene propylene terpolymer.

D. Submittals

1. Product Data: Include certified performance curves and rated capacities, operating characteristics, furnished specialties, final impeller dimensions, and accessories for each type of product indicated. Indicate pump's operating point on curves.
2. Shop Drawings: Show pump layout and connections. Include setting drawings with templates for installing foundation and anchor bolts and other anchorages.
 - a. Wiring Diagrams: Power, signal, and control wiring.
3. Operation and Maintenance Data: For pumps to include in emergency, operation, and maintenance manuals.

E. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. UL Compliance: Comply with UL 778 for motor-operated water pumps.

F. Delivery, Storage, And Handling

1. Manufacturer's Preparation for Shipping: Clean flanges and exposed machined metal surfaces and treat with anticorrosion compound after assembly and testing. Protect flanges, pipe openings, and nozzles with wooden flange covers or with screwed-in plugs.
2. Store pumps in dry location.
3. Retain protective covers for flanges and protective coatings during storage.
4. Protect bearings and couplings against damage from sand, grit, and other foreign matter.
5. Comply with pump manufacturer's written rigging instructions.



1.2 PRODUCTS

A. Close-Coupled, In-Line Centrifugal Pumps

1. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, close-coupled, in-line pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted horizontally or vertically. Rate pump for 125-psig (860-kPa) **OR** 175-psig (1204-kPa) **OR** 250-psig (1720-kPa), **as directed**, minimum working pressure and a continuous water temperature of 200 deg F (93 deg C) **OR** 225 deg F (107 deg C) **OR** 250 deg F (121 deg C), **as directed**.
2. Pump Construction:
 - a. Casing: Radially split, cast iron, with replaceable bronze wear rings, **as directed**, threaded gage tappings at inlet and outlet, and threaded companion-flange **OR** union end, **as directed**, connections.
 - b. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. Trim impeller to match specified performance.
 - c. Pump Shaft: Steel, with copper-alloy shaft sleeve **OR** Stainless steel, **as directed**.
 - d. Mechanical Seal: Carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N **OR** EPT, **as directed**, bellows and gasket. Include water slinger on shaft between motor and seal.
 - e. Packing Seal: Stuffing box, with a minimum of four rings of graphite-impregnated braided yarn with bronze lantern ring between center two graphite rings, and bronze packing gland.
 - f. Pump Bearings: Permanently lubricated ball bearings **OR** Oil lubricated; bronze-journal or thrust type, **as directed**.
3. Motor: Single speed, with permanently lubricated **OR** grease-lubricated, **as directed**, ball bearings, unless otherwise indicated; and rigidly mounted to pump casing. Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".

B. Close-Coupled, End-Suction Centrifugal Pumps

1. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, close-coupled, end-suction pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted horizontally. Rate pump for 125-psig (860-kPa) **OR** 175-psig (1204-kPa), **as directed**, minimum working pressure and a continuous water temperature of 225 deg F (107 deg C) **OR** 250 deg F (121 deg C), **as directed**.
2. Pump Construction:
 - a. Casing: Radially split, cast iron, with replaceable bronze wear rings, **as directed**, drain plug at bottom and air vent at top of volute, threaded gage tappings at inlet and outlet, and threaded companion-flange **OR** flanged, **as directed**, connections.
 - b. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. Trim impeller to match specified performance.
 - c. Pump Shaft: Steel, with copper-alloy shaft sleeve **OR** Stainless steel, **as directed**.
 - d. Mechanical Seal: Carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N **OR** EPT, **as directed**, bellows and gasket. Include water slinger on shaft between motor and seal.
 - e. Pump Bearings: Permanently lubricated ball bearings **OR** Oil lubricated; bronze-journal or thrust type, **as directed**.
 - f. Motor: Single speed, with permanently lubricated **OR** grease-lubricated, **as directed**, ball bearings, unless otherwise indicated; rigidly mounted to pump casing with integral pump support. Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".

C. Separately Coupled, Horizontal, In-Line Centrifugal Pumps

1. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, separately coupled, in-line pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted horizontally. Rate pump for 125-psig (860-kPa) **OR** 175-psig (1204-kPa), **as**



- directed**, minimum working pressure and a continuous water temperature of 225 deg F (107 deg C) **OR** 250 deg F (121 deg C), **as directed**.
2. Pump Construction:
 - a. Casing: Radially split, cast iron, with threaded gage tappings at inlet and outlet, and threaded companion-flange **OR** union end, **as directed**, connections.
 - b. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, and keyed to shaft. Trim impeller to match specified performance.
 - c. Pump Shaft: Steel, with copper-alloy shaft sleeve **OR** Stainless steel, **as directed**.
 - d. Mechanical Seal: Carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N **OR** EPT, **as directed**, bellows and gasket. Include water slinger on shaft between motor and seal.
 - e. Pump Bearings: Permanently lubricated ball bearings **OR** Oil lubricated; bronze-journal or thrust type, **as directed**.
 3. Shaft Coupling: Molded rubber insert with interlocking spider **OR** Interlocking frame with interconnecting springs, **as directed**, capable of absorbing vibration.
 4. Motor: Single speed, with permanently lubricated ball **OR** oil-lubricated sleeve, **as directed**, bearings, unless otherwise indicated; and resiliently **OR** rigidly, **as directed**, mounted to pump casing. Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".
- D. Separately Coupled, Vertical, In-Line Centrifugal Pumps
1. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, separately coupled, in-line pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted vertically. Rate pump for 125-psig (860-kPa) **OR** 175-psig (1204-kPa) **OR** 250-psig (1720-kPa), **as directed**, minimum working pressure and a continuous water temperature of 200 deg F (93 deg C) **OR** 225 deg F (107 deg C) **OR** 250 deg F (121 deg C), **as directed**.
 2. Pump Construction:
 - a. Casing: Radially split, cast iron, with replaceable bronze wear rings, **as directed**, threaded gage tappings at inlet and outlet, and threaded companion-flange **OR** union end, **as directed**, connections.
 - b. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. Trim impeller to match specified performance.
 - c. Pump Shaft: Steel, with copper-alloy shaft sleeve **OR** Stainless steel, **as directed**.
 - d. Mechanical Seal: Carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N **OR** EPT, **as directed**, bellows and gasket. Include water slinger on shaft between motor and seal.
 - e. Packing Seal: Stuffing box, with a minimum of four rings of graphite-impregnated braided yarn with bronze lantern ring between center two graphite rings, and bronze packing gland.
 - f. Pump Bearings: Permanently lubricated ball bearings **OR** Oil lubricated; bronze-journal or thrust type, **as directed**.
 3. Shaft Coupling: Axially split spacer coupling.
 4. Motor: Single speed, with permanently lubricated **OR** grease-lubricated, **as directed**, ball bearings, unless otherwise indicated; rigidly mounted to pump casing with lifting eye and supporting lugs in motor enclosure. Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".
- E. Separately Coupled, Base-Mounted, End-Suction Centrifugal Pumps
1. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, separately coupled, end-suction pump as defined in HI 1.1-1.2 and HI 1.3; designed for base mounting, with pump and motor shafts horizontal. Rate pump for 125-psig (860-kPa) **OR** 175-psig (1204-kPa) **OR** 250-psig (1720-kPa), **as directed**, minimum working pressure and a continuous water temperature of 200 deg F (93 deg C) **OR** 225 deg F (107 deg C) **OR** 250 deg F (121 deg C), **as directed**.
 2. Pump Construction:
 - a. Casing: Radially split, cast iron, with replaceable bronze wear rings, **as directed**, threaded gage tappings at inlet and outlet, drain plug at bottom and air vent at top of volute, and threaded companion-flange **OR** flanged, **as directed**, connections. Provide integral mount



on volute to support the casing, and attached piping to allow removal and replacement of impeller without disconnecting piping or requiring the realignment of pump and motor shaft, **as directed**.

- b. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. Trim impeller to match specified performance.
 - c. Pump Shaft: Steel, with copper-alloy shaft sleeve **OR** Stainless steel, **as directed**.
 - d. Mechanical Seal: Carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N **OR** EPT, **as directed**, bellows and gasket.
 - e. Packing Seal: Stuffing box, with a minimum of four rings of graphite-impregnated braided yarn with bronze lantern ring between center two graphite rings, and bronze packing gland.
 - f. Pump Bearings: Grease-lubricated ball bearings contained in cast-iron housing with grease fittings.
3. Shaft Coupling: Molded rubber insert and interlocking spider capable of absorbing vibration. Couplings shall be drop-out type to allow disassembly and removal without removing pump shaft or motor **OR** EPDM coupling sleeve for variable-speed applications, **as directed**.
 4. Coupling Guard: Dual rated; ANSI B15.1, Section 8; OSHA 1910.219 approved; steel; removable; attached to mounting frame.
 5. Mounting Frame: Welded-steel frame and cross members, factory fabricated from ASTM A 36/A 36M channels and angles. Fabricate to mount pump casing, coupling guard, and motor.
 6. Motor: Single speed, with permanently lubricated **OR** grease-lubricated, **as directed**, ball bearings, unless otherwise indicated; secured to mounting frame, with adjustable alignment. Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".

F. Separately Coupled, Base-Mounted, Double-Suction Centrifugal Pumps

1. Description: Factory-assembled and -tested, centrifugal, impeller-between-bearings, separately coupled, double-suction pump as defined in HI 1.1-1.2 and HI 1.3; designed for base mounting, with pump and motor shafts horizontal. Rate pump for 125-psig (860-kPa) **OR** 175-psig (1204-kPa) **OR** 250-psig (1720-kPa), **as directed**, minimum working pressure and a continuous water temperature of 200 deg F (93 deg C) **OR** 225 deg F (107 deg C) **OR** 250 deg F (121 deg C), **as directed**.
2. Pump Construction:
 - a. Casing: Radially **OR** Horizontally, **as directed**, split, cast iron, with replaceable bronze wear rings, **as directed**, threaded gage tappings at inlet and outlet, drain plug at bottom and air vent at top of volute, and ASME B16.1, Class 125 **OR** 250, **as directed**, flanges. Casing supports shall allow removal and replacement of impeller without disconnecting piping, **as directed**.
 - b. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, and keyed to shaft. Trim impeller to match specified performance.
 - c. Pump Shaft: Stainless steel.
 - d. Mechanical Seal: Carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N **OR** EPT, **as directed**, bellows and gasket.
 - e. Packing Seal: Stuffing box, with a minimum of four rings of graphite-impregnated braided yarn with bronze lantern ring between center two graphite rings, and bronze packing gland.
 - f. Pump Bearings: Grease-lubricated ball bearings contained in cast-iron housing with grease fittings.
3. Shaft Coupling: Molded rubber insert and interlocking spider capable of absorbing vibration. Couplings shall be drop-out type to allow disassembly and removal without removing pump shaft or motor **OR** EPDM coupling sleeve for variable-speed applications, **as directed**.
4. Coupling Guard: Dual rated; ANSI B15.1, Section 8; OSHA 1910.219 approved; steel; removable; attached to mounting frame.
5. Mounting Frame: Welded-steel frame and cross members, factory fabricated from ASTM A 36/A 36M channels and angles. Fabricate to mount pump casing, coupling guard, and motor.



6. Motor: Single speed, with grease-lubricated ball bearings, unless otherwise indicated; secured to mounting frame, with adjustable alignment. Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".
- G. Separately Coupled, Vertical-Mounted, Double-Suction Centrifugal Pumps
1. Description: Factory-assembled and -tested, centrifugal, impeller-between-bearings, separately coupled, double-suction pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted vertically. Rate pump for 125-psig (860-kPa) **OR** 175-psig (1204-kPa) **OR** 250-psig (1720-kPa), **as directed**, minimum working pressure and a continuous water temperature of 200 deg F (93 deg C) **OR** 225 deg F (107 deg C) **OR** 250 deg F (121 deg C), **as directed**.
 2. Pump Construction:
 - a. Casing: Radially split, cast iron, with replaceable bronze wear rings, **as directed**, threaded gage tappings at inlet and outlet, drain plug at bottom of volute, mounting support, and ASME B16.1, Class 125 **OR** 250, **as directed**, flanges.
 - b. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, and keyed to shaft. Trim impeller to match specified performance.
 - c. Pump Shaft: Stainless steel.
 - d. Mechanical Seal: Carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N **OR** EPT, **as directed**, bellows and gasket.
 - e. Packing Seal: Stuffing box, with a minimum of four rings of graphite-impregnated braided yarn with bronze lantern ring between center two graphite rings, and bronze packing gland.
 - f. Pump Bearings: Grease-lubricated ball bearings contained in cast-iron housing with grease fittings.
 3. Shaft Coupling: Molded rubber insert and interlocking spider capable of absorbing vibration.
 4. Motor: Single speed, with grease-lubricated ball bearings, unless otherwise indicated; secured to casing. Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".
- H. Separately Coupled, Vertical-Mounted, Turbine Centrifugal Pumps
1. Description: Factory-assembled and -tested, single-stage **OR** multistage, **as directed**, centrifugal, impeller-between-bearings, end-suction pump as defined in HI 2.1-2.2 and HI 2.3; designed for installation with pump and motor shafts mounted vertically and projecting into a sump. Rate pump for 125-psig (860-kPa) **OR** 175-psig (1204-kPa), **as directed**, minimum working pressure and a continuous water temperature of 200 deg F (93 deg C).
 2. Pump Construction:
 - a. Pump Bowl: Cast iron, with replaceable bronze wear ring, **as directed**, cone **OR** basket, **as directed**, strainer, and suction bell. Water passages of intermediate bowls shall be coated with porcelain enamel, **as directed**.
 - b. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, and keyed to shaft. Trim impeller to match specified performance.
 - c. Pump Shaft: Carbon **OR** Stainless, **as directed**, steel sized per AWWA E-101.
 - d. Pump Bearings: Water-lubricated bronze and rubber sleeve bearings contained in cast-iron housing.
 - e. Pump Column: ASTM A 53/A 53M, Grade B steel pipe.
 - f. Mechanical Seal: Carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N bellows and gasket. Seal shall be replaceable without removing the motor or disturbing the piping.
 - g. Packing Seal: Stuffing box, with a minimum of four rings of graphite-impregnated braided yarn with bronze lantern ring between center two graphite rings, and bronze packing gland.
 3. Shaft Coupling: Keyed with locking collets.
 4. Discharge Head: ASME B16.1, Class 125 **OR** 250, **as directed**, discharge flange with threaded gage tapping. Top of discharge head shall have a registered fit to accurately locate the driver.
 5. Drive Ratchet: Nonreversing ratchet.



6. Hollow Shaft Motor: Single speed, with grease-lubricated ball bearings, unless otherwise indicated; secured to discharge head. Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".

I. Automatic Condensate Pump Units

1. Description: Packaged units with corrosion-resistant pump, plastic tank with cover, and automatic controls. Include factory- or field-installed check valve and a 72-inch- (1800-mm-) minimum, electrical power cord with plug.

J. Pump Specialty Fittings

1. Suction Diffuser: Angle pattern, 175-psig (1204-kPa) **OR** 300-psig (2060-kPa), **as directed**, pressure rating, cast **OR** ductile, **as directed**,-iron body and end cap, pump-inlet fitting; with bronze startup and bronze or stainless-steel permanent strainers; bronze or stainless-steel straightening vanes; drain plug; and factory-fabricated support.
2. Triple-Duty Valve: Angle or straight pattern, 175-psig (1204-kPa) **OR** 300-psig (2060-kPa), **as directed**, pressure rating, cast **OR** ductile, **as directed**,-iron body, pump-discharge fitting; with drain plug and bronze-fitted shutoff, balancing, and check valve features. Brass gage ports with integral check valve, and orifice for flow measurement.

1.3 EXECUTION

A. Concrete Bases

1. Install concrete bases of dimensions indicated for pumps and controllers. Refer to Division 23 Section "Common Work Results For Hvac"
 - a. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of base.
 - b. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - d. Install anchor bolts to elevations required for proper attachment to supported equipment.
2. Cast-in-place concrete materials and placement requirements are specified in Division 31.

B. Pump Installation

1. Comply with HI 1.4 **OR** HI 2.4, **as directed**.
2. Install pumps with access for periodic maintenance including removal of motors, impellers, couplings, and accessories.
3. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.
4. Install continuous-thread hanger rods and elastomeric hangers **OR** spring hangers **OR** spring hangers with vertical-limit stop, **as directed**, of sufficient size to support pump weight. Vibration isolation devices are specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment". Fabricate brackets or supports as required. Hanger and support materials are specified in Division 23 Section "Hangers And Supports For Hvac Piping And Equipment".
5. Suspend vertically mounted, in-line centrifugal pumps independent of piping. Install pumps with motor and pump shafts vertical. Use continuous-thread hanger rods and elastomeric hangers **OR** spring hangers **OR** spring hangers with vertical-limit stop, **as directed**, of sufficient size to support pump weight. Vibration isolation devices are specified in Division 21 Section(s) "Vibration And Seismic Controls For Fire-suppression Piping And Equipment" AND Division 23 Section(s) "Vibration And Seismic Controls For Hvac Piping And Equipment". Hanger and support materials are specified in Division 22 Section(s) "Hangers And Supports For Plumbing Piping And Equipment" AND Division 23 Section(s) "Hangers And Supports For Hvac Piping And Equipment".



6. Set base-mounted pumps on concrete foundation. Disconnect coupling before setting. Do not reconnect couplings until alignment procedure is complete.
 - a. Support pump baseplate on rectangular metal blocks and shims, or on metal wedges with small taper, at points near foundation bolts to provide a gap of 3/4 to 1-1/2 inches (19 to 38 mm) between pump base and foundation for grouting.
 - b. Adjust metal supports or wedges until pump and driver shafts are level. Check coupling faces and suction and discharge flanges of pump to verify that they are level and plumb.
7. Automatic Condensate Pump Units: Install units for collecting condensate and extend to open drain.

C. Alignment

1. Align pump and motor shafts and piping connections after setting on foundation, grout has been set and foundation bolts have been tightened, and piping connections have been made.
2. Comply with pump and coupling manufacturers' written instructions.
3. Adjust pump and motor shafts for angular and offset alignment by methods specified in HI 1.1-1.5, "Centrifugal Pumps for Nomenclature, Definitions, Application and Operation" **OR** HI 2.1-2.5, "Vertical Pumps for Nomenclature, Definitions, Application and Operation", **as directed**.
4. After alignment is correct, tighten foundation bolts evenly but not too firmly. Completely fill baseplate with nonshrink, nonmetallic grout while metal blocks and shims or wedges are in place. After grout has cured, fully tighten foundation bolts.

D. Connections

1. Piping installation requirements are specified in other Division 21. Drawings indicate general arrangement of piping, fittings, and specialties.
2. Install piping adjacent to machine to allow service and maintenance.
3. Connect piping to pumps. Install valves that are same size as piping connected to pumps.
4. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.
5. Install check valve and throttling **OR** triple-duty, **as directed**, valve on discharge side of pumps.
6. Install Y-type strainer **OR** suction diffuser, **as directed**, and shutoff valve on suction side of pumps.
7. Install flexible connectors on suction and discharge sides of base-mounted pumps between pump casing and valves.
8. Install pressure gages on pump suction and discharge, at integral pressure-gage tapping, or install single gage with multiple input selector valve.
9. Install check valve and gate or ball valve on each condensate pump unit discharge.
10. Install electrical connections for power, controls, and devices.
11. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
12. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

END OF SECTION 22 11 23 39a



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Task	Specification	Specification Description
22 11 23 39	22 05 23 00	Piped Utilities Basic Materials And Methods



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SECTION 22 12 23 13 - ELECTRIC, DOMESTIC WATER HEATERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for electric, water heaters. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following electric water heaters:
 - a. Household, small-capacity electric water heaters.
 - b. Household, storage electric water heaters.
 - c. Household, collector-to-tank, solar-electric water heaters.
 - d. Household, collector-to-tank, heat-exchanger-coil, solar-electric water heaters.
 - e. Flow-control, instantaneous electric water heaters.
 - f. Thermostat-control, instantaneous electric water heaters.
 - g. Light-commercial electric water heaters.
 - h. Commercial electric booster heaters.
 - i. Commercial, storage electric water heaters.
 - j. Compression tanks.
 - k. Water heater accessories.

C. Submittals

1. Product Data: For each type and size of water heater indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.
2. LEED Submittal:
 - a. Product Data for Prerequisite EA 2: Documentation indicating that units comply with ASHRAE/IESNA 90.1, Section 7 - "Service Water Heating."
3. Shop Drawings: Diagram power, signal, and control wiring.
4. Manufacturer Seismic Qualification Certification: Submit certification that commercial water heaters, accessories, and components will withstand seismic forces defined in Division 22 Section "Vibration And Seismic Controls For Plumbing Piping And Equipment".
5. Field quality-control test reports.
6. Operation and maintenance data.
7. Warranty: Special warranty specified in this Section.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1.
3. ASME Compliance: Where indicated, fabricate and label commercial water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
4. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for all components that will be in contact with potable water.

E. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric water heaters that fail in materials or workmanship within specified warranty period.
 - a. Failures include, but are not limited to, the following:
 - 1) Structural failures including storage tank and supports.



- 2) Faulty operation of controls.
- 3) Deterioration of metals, metal finishes, and other materials beyond normal use.
- b. Warranty Period(s): From date of Final Completion:
 - 1) Household Electric Water Heaters:
 - a) Storage Tank: Five **OR** Six **OR** 10, **as directed**, years.
 - b) Controls and Other Components: Two **OR** Three, **as directed**, years.
 - 2) Instantaneous Electric Water Heaters: One **OR** Two **OR** Five, **as directed**, year(s).
 - 3) Light-Commercial Electric Water Heaters:
 - a) Storage Tank: Three **OR** Five, **as directed**, years.
 - b) Controls and Other Components: Two **OR** Three, **as directed**, years.
 - 4) Commercial Electric Water Heaters:
 - a) Storage Tank: Three **OR** Five, **as directed**, years.
 - b) Controls and Other Components: Three **OR** Five, **as directed**, years.
 - 5) Compression Tanks: One year.

1.2 PRODUCTS

A. Household Electric Water Heaters

1. Household, Small-Capacity Electric Water Heaters: Comply with UL 174.
 - a. Storage-Tank Construction: Corrosion-resistant metal or steel with corrosion-resistant coating, **as directed**.
 - 1) Tappings: ASME B1.20.1 pipe thread.
 - 2) Pressure Rating: 150 psig (1035 kPa).
 - 3) Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.
 - b. Factory-Installed Storage-Tank Appurtenances:
 - 1) Drain Valve: ASSE 1005, if tank has drain outlet. Provide hose-end drain valve in piping for water heaters without drain outlet. Hose-end drain valves are specified in Division 22 Section "Domestic Water Piping Specialties".
 - 2) Insulation: Comply with ASHRAE/IESNA 90.1 or ASHRAE 90.2, **as directed**.
 - 3) Jacket: Steel with enameled finish.
 - 4) Heating Element: Electric, screw-in immersion type.
 - 5) Temperature Control: Adjustable thermostat.
 - 6) Safety Control: High-temperature-limit cutoff device or system.
 - 7) Power Supply Cord: 24 to 72 inches (610 to 1830 mm) with plug.
 - 8) Relief Valve: ASME rated and stamped and complying with ASME PTC 25.3 for combination temperature and pressure relief valves. Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select relief valve with sensing element that extends into storage tank.
2. Household, Standard **OR** Tabletop, **as directed**, Storage Electric Water Heaters: Comply with UL 174.
 - a. Storage-Tank Construction: Steel.
 - 1) Tappings: ASME B1.20.1 pipe thread.
 - 2) Pressure Rating: 150 psig (1035 kPa).
 - 3) Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.
 - b. Factory-Installed Storage-Tank Appurtenances:
 - 1) Anode Rod: Replaceable magnesium.
 - 2) Dip Tube: Provide unless cold-water inlet is near bottom of tank.
 - 3) Drain Valve: ASSE 1005.
 - 4) Insulation: Comply with ASHRAE/IESNA 90.1 or ASHRAE 90.2, **as directed**.
 - 5) Jacket: Steel with enameled finish.
 - a) Standard: Cylindrical shape.



- b) Tabletop: Rectangular shape, with flat-top work surface and raised back.
 - 6) Heat Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
 - 7) Heating Elements: Two; electric, screw-in immersion type with 12 kW or less total, and wired for nonsimultaneous operation, unless otherwise indicated.
 - 8) Temperature Control: Adjustable thermostat for each element.
 - 9) Safety Control: High-temperature-limit cutoff device or system.
 - 10) Relief Valve: ASME rated and stamped and complying with ASME PTC 25.3 for combination temperature and pressure relief valves. Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select relief valve with sensing element that extends into storage tank.
3. Household, Collector-to-Tank, Solar-Electric Water Heaters: Comply with UL 174 with piping and electrical connections for UL 1279 solar collector system.
- a. Storage-Tank Construction: Steel.
 - 1) Tappings: ASME B1.20.1 pipe thread.
 - 2) Pressure Rating: 150 psig (1035 kPa).
 - 3) Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.
 - b. Factory-Installed Storage-Tank Appurtenances:
 - 1) Sensor electrical connections and tank stud for sensor.
 - 2) Anode Rod: Replaceable magnesium.
 - 3) Dip Tube: Provide unless cold-water inlet is near bottom of tank.
 - 4) Drain Valve: ASSE 1005.
 - 5) Insulation: Comply with ASHRAE/IESNA 90.1 or ASHRAE 90.2, **as directed**.
 - 6) Jacket: Steel with enameled finish.
 - 7) Heat Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
 - 8) Heating Element: One; electric, screw-in immersion type with 6 kW or less.
 - 9) Temperature Control: Adjustable thermostat for each element.
 - 10) Safety Control: High-temperature-limit cutoff device or system.
 - 11) Relief Valve: ASME rated and stamped and complying with ASME PTC 25.3 for combination temperature and pressure relief valves. Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select relief valve with sensing element that extends into storage tank.
4. Household, Collector-to-Tank, Heat-Exchanger-Coil, Solar-Electric Water Heaters: Comply with UL 174 with integral coil-type heat exchanger.
- a. Storage-Tank Construction: Steel.
 - 1) Tappings: ASME B1.20.1 pipe thread.
 - 2) Pressure Rating: 150 psig (1035 kPa).
 - 3) Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.
 - b. Factory-Installed Storage-Tank Appurtenances:
 - 1) Anode Rod: Replaceable magnesium.
 - 2) Dip Tube: Provide unless cold-water inlet is near bottom of tank.
 - 3) Drain Valve: ASSE 1005.
 - 4) Insulation: Comply with ASHRAE/IESNA 90.1 or ASHRAE 90.2, **as directed**.
 - 5) Jacket: Steel with enameled finish.
 - 6) Heat Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
 - 7) Heat Exchanger: Corrosion-resistant-metal immersion coil.
 - 8) Heating Element: One; electric, screw-in immersion type with 6 kW or less.
 - 9) Temperature Control: Adjustable thermostat for each element.
 - 10) Safety Control: High-temperature-limit cutoff device or system.
 - 11) Relief Valve: ASME rated and stamped and complying with ASME PTC 25.3 for combination temperature and pressure relief valves. Include relieving capacity at least as great as heat input, and include pressure setting less than water heater



working-pressure rating. Select relief valve with sensing element that extends into storage tank.

B. Instantaneous Electric Water Heaters

1. Flow-Control, Instantaneous Electric Water Heaters: Comply with UL 499 for tankless electric (water heater) heating appliance.
 - a. Construction: Copper piping or tubing complying with NSF 61 barrier materials for potable water, without storage capacity.
 - 1) Connections: ASME B1.20.1 pipe thread.
 - 2) Pressure Rating: 150 psig (1035 kPa).
 - 3) Heating Element: Resistance heating system.
 - 4) Temperature Control: Flow-control fitting.
 - 5) Safety Control: High-temperature-limit cutoff device or system.
 - 6) Jacket: Aluminum or steel with enameled finish or plastic.
 - b. Support: Bracket for wall mounting.
2. Thermostat-Control, Instantaneous Electric Water Heaters: Comply with UL 499 for tankless electric (water heater) heating appliance.
 - a. Construction: Copper piping or tubing complying with NSF 61 barrier materials for potable water, without storage capacity.
 - 1) Connections: ASME B1.20.1 pipe thread.
 - 2) Pressure Rating: 150 psig (1035 kPa).
 - 3) Heating Element: Resistance heating system.
 - 4) Temperature Control: Thermostat.
 - 5) Safety Control: High-temperature-limit cutoff device or system.
 - 6) Jacket: Aluminum or steel with enameled finish or plastic.
 - b. Support: Bracket for wall mounting.

C. Light-Commercial Electric Water Heaters

1. Description: Comply with UL 174 for household, storage electric water heaters.
 - a. Storage-Tank Construction: Steel, vertical arrangement.
 - 1) Tappings: ASME B1.20.1 pipe thread.
 - 2) Pressure Rating: 150 psig (1035 kPa).
 - 3) Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.
 - b. Factory-Installed Storage-Tank Appurtenances:
 - 1) Anode Rod: Replaceable magnesium.
 - 2) Dip Tube: Provide unless cold-water inlet is near bottom of tank.
 - 3) Drain Valve: ASSE 1005.
 - 4) Insulation: Comply with ASHRAE/IESNA 90.1 or ASHRAE 90.2, **as directed**.
 - 5) Jacket: Steel with enameled finish.
 - 6) Heat Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
 - 7) Heating Elements: Two; electric, screw-in immersion type; wired for simultaneous operation, unless otherwise indicated.
 - 8) Temperature Control: Adjustable thermostat for each element.
 - 9) Safety Control: High-temperature-limit cutoff device or system.
 - 10) Relief Valve: ASME rated and stamped and complying with ASME PTC 25.3 for combination temperature and pressure relief valves. Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select relief valve with sensing element that extends into storage tank.
 - c. Special Requirements: NSF 5 construction with legs for off-floor installation.

D. Commercial Electric Water Heaters

1. Commercial Electric Booster Heaters: Comply with UL 1453 requirements for booster-type water heaters.



- a. Storage-Tank Construction: Corrosion-resistant metal **OR** Steel, **as directed**.
 - 1) Tappings: ASME B1.20.1 pipe thread.
 - 2) Pressure Rating: 150 psig (1035 kPa).
 - 3) Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.
 - b. Factory-Installed Storage-Tank Appurtenances:
 - 1) Anode Rod: Replaceable magnesium.
 - 2) Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
 - 3) Insulation: Comply with ASHRAE/IESNA 90.1.
 - 4) Jacket: Rectangular shaped, with stainless-steel front panel, unless otherwise indicated.
 - 5) Heating Elements: Electric, screw-in or bolt-on immersion type arranged in multiples of three.
 - a) Option: Booster heaters with 9 kW or less total may have 2 or 3 elements.
 - b) Staging: Input not exceeding 18 kW per step.
 - 6) Temperature Control: Adjustable thermostat, to setting of at least 180 deg F (82 deg C).
 - 7) Safety Controls: High-temperature-limit and low-water cutoff devices or systems.
 - 8) Relief Valve: ASME rated and stamped and complying with ASME PTC 25.3, combination temperature and pressure relief valve. Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select relief valve with sensing element that extends into storage tank.
 - 9) Gages: Combination temperature and pressure type or separate thermometer and pressure gage.
 - c. Special Requirements: NSF 5 construction with brackets for undercounter **OR** legs for floor, **as directed**, installation.
2. Commercial, Storage Electric Water Heaters: Comply with UL 1453 requirements for storage-tank-type water heaters.
 - a. Storage-Tank Construction: ASME-code **OR** Non-ASME-code, **as directed**, steel horizontal **OR** vertical, **as directed**, arrangement.
 - 1) Tappings: Factory fabricated of materials compatible with tank and piping connections. Attach tappings to tank before testing.
 - a) NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1.
 - b) NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
 - 2) Pressure Rating: 150 psig (1035 kPa).
 - 3) Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.
 - b. Factory-Installed Storage-Tank Appurtenances:
 - 1) Anode Rod: Replaceable magnesium.
 - 2) Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
 - 3) Insulation: Comply with ASHRAE/IESNA 90.1.
 - 4) Jacket: Steel with enameled finish.
 - 5) Heating Elements: Electric, screw-in or bolt-on immersion type arranged in multiples of three.
 - a) Staging: Input not exceeding 18 kW per step.
 - 6) Temperature Control: Adjustable thermostat.
 - 7) Safety Controls: High-temperature-limit and low-water cutoff devices or systems.
 - 8) Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3, for combination temperature and pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
 - c. Special Requirements: NSF 5 construction.



- d. Building Automation System Interface: Normally closed dry contacts for enabling and disabling water heater.

E. Compression Tanks

1. Description: Steel pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
 - a. Construction:
 - 1) Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1, pipe thread.
 - 2) Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - 3) Air-Charging Valve: Factory installed.

F. Water Heater Accessories

1. Combination Temperature and Pressure Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3. Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.
2. Pressure Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3. Include pressure setting less than water heater working-pressure rating.
3. Water Heater Stand and Drain-Pan Units: High-density-polyethylene-plastic, 18-inch- (457-mm-) high, enclosed-base stand complying with IAPMO PS 103 and IAS No. 2. Include integral or separate drain pan with raised edge and NPS 1 (DN 25) drain outlet with ASME B1.20.1 pipe thread.
4. Water Heater Stands: Water heater manufacturer's factory-fabricated steel stand for floor mounting and capable of supporting water heater and water. Include dimension that will support bottom of water heater a minimum of 18 inches (457 mm) above the floor.
5. Water Heater Mounting Brackets: Water heater manufacturer's factory-fabricated steel bracket for wall mounting and capable of supporting water heater and water.
6. Drain Pans: Corrosion-resistant metal with raised edge. Include dimensions not less than base of water heater and include drain outlet not less than NPS 3/4 (DN 20).
7. Piping Manifold Kits: Water heater manufacturer's factory-fabricated inlet and outlet piping arrangement for multiple-unit installation. Include piping and valves for field assembly that are capable of isolating each water heater and of providing balanced flow through each water heater.
8. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2, **as directed**.
9. Water Regulators: ASSE 1003, water-pressure reducing valve. Set at 25-psig- (172.5-kPa-) maximum outlet pressure, unless otherwise indicated.
10. Shock Absorbers: ASSE 1010 or PDI WH 201, Size A water hammer arrester.

G. Source Quality Control

1. Test and inspect water heater storage tanks, specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.
2. Hydrostatically test commercial, **as directed**, water heater storage tanks before shipment to minimum of one and one-half times pressure rating.
3. Prepare test reports.

1.3 EXECUTION

A. Water Heater Installation

1. Install commercial water heaters on concrete bases.
 - a. Exception: Omit concrete bases for commercial water heaters if installation on stand, bracket, suspended platform, or direct on floor is indicated.



- b. Concrete base construction requirements are specified in Division 22 Section "Common Work Results For Plumbing".
 2. Install water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
 3. Install seismic restraints for light-commercial and commercial water heaters. Anchor to substrate.
 4. Install combination temperature and pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
 5. Install combination temperature and pressure relief valves in water piping for water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
 6. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for water heaters that do not have tank drains. Refer to Division 22 Section "Domestic Water Piping Specialties" for hose-end drain valves.
 7. Install thermometer on outlet piping of water heaters. Refer to Division 22 Section "Meters And Gages For Plumbing Piping" for thermometers.
 8. Install thermometers on inlet and outlet piping of household, collector-to-tank, solar-electric water heaters. Refer to Division 22 Section "Meters And Gages For Plumbing Piping" for thermometers.
 9. Install pressure gage(s) on inlet and outlet of commercial electric water- heater piping. Refer to Division 22 Section "Meters And Gages For Plumbing Piping" for pressure gages.
 10. Assemble and install inlet and outlet piping manifold kits for multiple water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each water heater. Include shutoff valve, thermometer in each water heater inlet and outlet, and throttling valve in each water heater outlet. Refer to Division 22 Section "General-duty Valves For Plumbing Piping" for general-duty valves and to Division 22 Section "Meters And Gages For Plumbing Piping" for thermometers.
 11. Install water regulator, with integral bypass relief valve, in booster-heater inlet piping and water hammer arrester in booster-heater outlet piping.
 12. Install piping-type heat traps on inlet and outlet piping of water heater storage tanks without integral or fitting-type heat traps.
 13. Fill water heaters with water.
 14. Charge compression tanks with air.
- B. Connections
1. Piping installation requirements are specified in other Division 14. Drawings indicate general arrangement of piping, fittings, and specialties.
 2. Install piping adjacent to water heaters to allow service and maintenance. Arrange piping for easy removal of water heaters.
 3. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
 4. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".
- C. Field Quality Control
1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
 2. Perform the following field tests and inspections and prepare test reports:
 - a. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
 - b. Operational Test: After electrical circuitry has been energized, confirm proper operation.
 - c. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.



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3. Remove and replace water heaters that do not pass tests and inspections and retest as specified above.

D. Demonstration

1. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial and instantaneous electric water heaters.

END OF SECTION 22 12 23 13



SECTION 22 12 23 13a - FUEL-FIRED, DOMESTIC WATER HEATERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for fuel-fired water heaters. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following fuel-fired water heaters:
 - a. Household, atmospheric, storage, gas water heaters.
 - b. Household, direct-vent, storage, gas water heaters.
 - c. Household, power-vent, storage, gas water heaters.
 - d. Instantaneous, tankless, gas water heaters.
 - e. Commercial, atmospheric, storage, gas water heaters.
 - f. Commercial, power-burner, storage, gas water heaters.
 - g. Commercial, power-vent, storage, gas water heaters.
 - h. Commercial, high-efficiency, gas water heaters.
 - i. Commercial, coil-type, finned-tube, gas water heaters.
 - j. Commercial, grid-type, finned-tube, gas water heaters.
 - k. Household, oil-fired water heaters.
 - l. Commercial, oil-fired water heaters.
 - m. Large-capacity, oil-fired water heaters.
 - n. Dual-fuel, gas and oil-fired water heaters.
 - o. Compression tanks.
 - p. Water heater accessories.

C. Definitions

1. LP Gas: Liquefied-petroleum fuel gas.

D. Submittals

1. Product Data: For each type and size of water heater indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.
2. LEED Submittal:
 - a. Product Data for Prerequisite EA 2: Documentation indicating that units comply with ASHRAE/IESNA 90.1, Section 7 - "Service Water Heating."
3. Shop Drawings: Diagram power, signal, and control wiring.
4. Manufacturer Seismic Qualification Certification: Submit certification that commercial water heaters, accessories, and components will withstand seismic forces defined in Division 22 Section "Vibration And Seismic Controls For Plumbing Piping And Equipment". Include the following:
5. Field quality-control test reports.
6. Operation and maintenance data.
7. Warranty: Special warranty specified in this Section.

E. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1.
3. ASME Compliance:



- a. Where ASME-code construction is indicated, fabricate and label commercial water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 - b. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.
4. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9" for all components that will be in contact with potable water.

F. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired water heaters that fail in materials or workmanship within specified warranty period.
 - a. Failures include, but are not limited to, the following:
 - 1) Structural failures including storage tank and supports.
 - 2) Faulty operation of controls.
 - 3) Deterioration of metals, metal finishes, and other materials beyond normal use.
 - b. Warranty Period(s): From date of Final Completion:
 - 1) Household, Gas Water Heaters:
 - a) Storage Tank: Five **OR** Six **OR** 10, **as directed**, years.
 - b) Controls and Other Components: Two **OR** Three, **as directed**, years.
 - 2) Instantaneous, Gas Water Heaters:
 - a) Heat Exchanger: Five years.
 - b) Controls and Other Components: Three years.
 - 3) Commercial, Gas Water Heaters:
 - a) Storage Tank: Three **OR** Five, **as directed**, years.
 - b) Controls and Other Components: Three **OR** Five, **as directed**, years.
 - 4) Oil-Fired Water Heaters:
 - a) Storage Tank: Three **OR** Five, **as directed**, years.
 - b) Burner and Controls: One **OR** Two **OR** Three, **as directed**, year(s).
 - c) Other Components: Three **OR** Five, **as directed**, years.
 - 5) Dual-Fuel Water Heaters:
 - a) Storage Tank: Three **OR** Five, **as directed**, years.
 - b) Burner and Controls: One **OR** Two **OR** Three, **as directed**, year(s).
 - c) Other Components: Three **OR** Five, **as directed**, years.
 - 6) Compression Tanks: One year.

1.2 PRODUCTS

A. Household, Gas Water Heaters

1. Household, Atmospheric, Storage, Gas Water Heaters: Comply with ANSI Z21.10.1/CSA 4.1.
 - a. Storage-Tank Construction: Steel.
 - 1) Tappings: ASME B1.20.1 pipe thread.
 - 2) Pressure Rating: 150 psig (1035 kPa).
 - 3) Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.
 - b. Factory-Installed, Storage-Tank Appurtenances:
 - 1) Anode Rod: Replaceable magnesium.
 - 2) Dip Tube: Provide unless cold-water inlet is near bottom of tank.
 - 3) Drain Valve: ASSE 1005.
 - 4) Insulation: Comply with ASHRAE/IESNA 90.1 or ASHRAE 90.2, **as directed**.
 - 5) Jacket: Steel with enameled finish.
 - 6) Burner: For use with atmospheric water heaters and for natural-gas **OR** LP-gas, **as directed**, fuel.
 - 7) Automatic Ignition: ANSI Z21.20, electric, automatic, gas-ignition system.



- 8) Temperature Control: Adjustable thermostat.
 - 9) Heat Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
 - 10) Combination Temperature and Pressure Relief Valve: ANSI Z21.22/CSA 4.4. Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select relief valve with sensing element that extends into storage tank.
 - c. Draft Hood: Low-profile-type, draft diverter; complying with ANSI Z21.12.
 - d. Automatic Damper: ANSI Z21.66, electrically operated **OR** mechanically activated **OR** thermally activated, **as directed**, automatic-vent-damper device with size matching draft hood.
2. Household, Direct-Vent, Storage, Gas Water Heaters: Comply with ANSI Z21.10.1/CSA 4.1.
- a. Storage-Tank Construction: Steel.
 - 1) Tappings: ASME B1.20.1 pipe thread.
 - 2) Pressure Rating: 150 psig (1035 kPa).
 - 3) Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.
 - b. Factory-Installed, Storage-Tank Appurtenances:
 - 1) Anode Rod: Replaceable magnesium.
 - 2) Dip Tube: Provide unless cold-water inlet is near bottom of tank.
 - 3) Drain Valve: ASSE 1005.
 - 4) Insulation: Comply with ASHRAE/IESNA 90.1 or ASHRAE 90.2, **as directed**.
 - 5) Jacket: Steel with enameled finish.
 - 6) Burner: For use with direct-vent water heaters and for natural-gas **OR** LP-gas, **as directed**, fuel.
 - 7) Automatic Ignition: ANSI Z21.20, electric, automatic, gas-ignition system.
 - 8) Temperature Control: Adjustable thermostat.
 - 9) Heat Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
 - 10) Combination Temperature and Pressure Relief Valve: ANSI Z21.22/CSA 4.4. Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select relief valve with sensing element that extends into storage tank.
 - c. Direct-Vent System: Through-wall **OR** Through-roof, **as directed**, coaxial- or double-channel, vent assembly with water heater manufacturers' outside intake/exhaust screen.
3. Household, Power-Vent, Storage, Gas Water Heaters: Comply with ANSI Z21.10.1/CSA 4.1.
- a. Storage-Tank Construction: Steel.
 - 1) Tappings: ASME B1.20.1 pipe thread.
 - 2) Pressure Rating: 150 psig (1035 kPa).
 - 3) Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.
 - b. Factory-Installed, Storage-Tank Appurtenances:
 - 1) Anode Rod: Replaceable magnesium.
 - 2) Dip Tube: Provide unless cold-water inlet is near bottom of tank.
 - 3) Drain Valve: ASSE 1005.
 - 4) Insulation: Comply with ASHRAE/IESNA 90.1 or ASHRAE 90.2, **as directed**.
 - 5) Jacket: Steel with enameled finish.
 - 6) Burner: For use with power-vent water heaters and for natural-gas **OR** LP-gas, **as directed**, fuel.
 - 7) Automatic Ignition: ANSI Z21.20, electric, automatic, gas-ignition system.
 - 8) Temperature Control: Adjustable thermostat.
 - 9) Heat Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
 - 10) Combination Temperature and Pressure Relief Valve: ANSI Z21.22/CSA 4.4. Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select relief valve with sensing element that extends into storage tank.
 - c. Power-Vent System: Exhaust fan, interlocked with burner.



B. Instantaneous, Gas Water Heaters

1. Description: Comply with ANSI Z21.10.3/CSA 4.3, except storage is not required.
 - a. Construction: Copper piping or tubing complying with NSF 61 barrier materials for potable water, without storage capacity.
 - 1) Tappings: ASME B1.20.1 pipe thread.
 - 2) Pressure Rating: 150 psig (1035 kPa).
 - 3) Heat Exchanger: Copper tubing.
 - 4) Insulation: Comply with ASHRAE/IESNA 90.1 or ASHRAE 90.2, **as directed**.
 - 5) Burner: For use with tankless water heaters and for natural-gas **OR** LP-gas, **as directed**, fuel.
 - 6) Automatic Ignition: Manufacturer's proprietary system for automatic, gas ignition.
 - 7) Temperature Control: Adjustable thermostat.
 - 8) Jacket: Metal with enameled finish or plastic.
 - b. Support: Bracket for wall mounting.

C. Commercial, Gas Water Heaters

1. Commercial, Atmospheric, Storage, Gas Water Heaters: Comply with ANSI Z21.10.3/CSA 4.3.
 - a. Storage-Tank Construction: ASME-code **OR** Non-ASME-code, **as directed**, steel with 150-psig (1035-kPa) working-pressure rating.
 - 1) Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
 - a) NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1.
 - b) NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
 - 2) Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - 3) Lining: Cement **OR** Glass **OR** Nickel plate **OR** Phenolic coating **OR** Sheet copper, **as directed**, complying with NSF 61 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.
 - b. Factory-Installed, Storage-Tank Appurtenances:
 - 1) Anode Rod: Replaceable magnesium.
 - 2) Dip Tube: Provide unless cold-water inlet is near bottom of tank.
 - 3) Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
 - 4) Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
 - 5) Jacket: Steel with enameled finish.
 - 6) Burner: For use with atmospheric water heaters and for natural-gas **OR** LP-gas, **as directed**, fuel.
 - 7) Automatic Ignition: ANSI Z21.20, electric, automatic, gas-ignition system.
 - 8) Temperature Control: Adjustable thermostat.
 - 9) Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
 - 10) Combination Temperature and Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
 - c. Special Requirements: NSF 5 construction.
 - d. Draft Hood: Draft diverter; complying with ANSI Z21.12.
 - e. Automatic Damper: ANSI Z21.66, electrically operated **OR** mechanically activated **OR** thermally activated, **as directed**, automatic-vent-damper device with size matching draft hood.
 - f. Building Automation System Interface: Normally closed dry contacts for enabling and disabling water heater.
2. Commercial, Power-Burner, Storage, Gas Water Heaters: Comply with ANSI Z21.10.3/CSA 4.3.



- a. Storage-Tank Construction: ASME-code **OR** Non-ASME-code, **as directed**, steel with 150-psig (1035-kPa) working-pressure rating.
 - 1) Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
 - a) NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1.
 - b) NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
 - 2) Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - 3) Lining: Cement **OR** Glass **OR** Nickel plate **OR** Phenolic coating **OR** Sheet copper, **as directed**, complying with NSF 61 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.
 - b. Factory-Installed, Storage-Tank Appurtenances:
 - 1) Anode Rod: Replaceable magnesium.
 - 2) Dip Tube: Provide unless cold-water inlet is near bottom of tank.
 - 3) Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
 - 4) Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
 - 5) Jacket: Steel with enameled finish.
 - 6) Combination Temperature and Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
 - c. Burner: Comply with UL 795 for power-burner water heaters and for natural-gas **OR** LP-gas, **as directed**, fuel.
 - 1) Automatic Ignition: ANSI Z21.20, electric, automatic, gas-ignition system.
 - d. Temperature Control: Adjustable thermostat.
 - e. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
 - f. Special Requirements: NSF 5 construction.
 - g. Draft Hood: Draft diverter; complying with ANSI Z21.12.
 - h. Building Automation System Interface: Normally closed dry contacts for enabling and disabling water heater.
3. Commercial, Power-Vent, Storage, Gas Water Heaters: Comply with ANSI Z21.10.3/CSA 4.3.
 - a. Storage-Tank Construction: ASME-code **OR** Non-ASME-code, **as directed**, steel with 150-psig (1035-kPa) working-pressure rating.
 - 1) Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
 - a) NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1.
 - b) NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
 - 2) Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - 3) Lining: Cement **OR** Glass **OR** Nickel plate **OR** Phenolic coating **OR** Sheet copper, **as directed**, complying with NSF 61 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.
 - b. Factory-Installed, Storage-Tank Appurtenances:
 - 1) Anode Rod: Replaceable magnesium.
 - 2) Dip Tube: Provide unless cold-water inlet is near bottom of tank.
 - 3) Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
 - 4) Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
 - 5) Jacket: Steel with enameled finish.



- 6) Burner: For use with power-vent water heaters and for natural-gas **OR** LP-gas, **as directed**, fuel.
 - 7) Automatic Ignition: ANSI Z21.20, electric, automatic, gas-ignition system.
 - 8) Temperature Control: Adjustable thermostat.
 - 9) Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
 - 10) Combination Temperature and Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valve with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
 - c. Special Requirements: NSF 5 construction.
 - d. Power-Vent System: Exhaust fan, interlocked with burner.
 - e. Building Automation System Interface: Normally closed dry contacts for enabling and disabling water heater.
4. Commercial, High-Efficiency, Gas Water Heaters: Comply with ANSI Z21.10.3/CSA 4.3.
- a. Description: Manufacturer's proprietary design to provide at least 84 **OR** 85 **OR** 88 **OR** 95, **as directed**, percent combustion efficiency at optimum operating conditions. Following features and attributes may be modified or omitted if water heater otherwise complies with requirements for performance.
 - b. Storage-Tank Construction: ASME-code steel with 150-psig (1035-kPa) minimum working-pressure rating.
 - 1) Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
 - a) NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1.
 - b) NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
 - 2) Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - 3) Lining: Cement **OR** Glass **OR** Nickel plate **OR** Phenolic coating **OR** Sheet copper, **as directed**, complying with NSF 61 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.
 - c. Factory-Installed, Storage-Tank Appurtenances:
 - 1) Anode Rod: Replaceable magnesium.
 - 2) Dip Tube: Provide unless cold-water inlet is near bottom of tank.
 - 3) Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
 - 4) Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
 - 5) Jacket: Steel with enameled finish.
 - 6) Combination Temperature and Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
 - d. Burner or Heat Exchanger: Comply with UL 795 or approved testing agency requirements for high-efficiency water heaters and for natural-gas **OR** LP-gas, **as directed**, fuel.
 - e. Temperature Control: Adjustable thermostat.
 - f. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
 - g. Building Automation System Interface: Normally closed dry contacts for enabling and disabling water heater.
 - h. Draft Hood: Draft diverter; complying with ANSI Z21.12.
5. Commercial, Coil-Type, Finned-Tube, Gas Water Heaters: Comply with ANSI Z21.13 for hot-water boilers.
- a. Description: Packaged unit with boiler, storage tank, pump, piping, and controls.



- b. Boiler Construction: ASME code with 160-psig (1100-kPa) working-pressure rating for hot-water-boiler-type water heater.
 - 1) Heat Exchanger: Helix or spiral, finned-copper-tube coils with bronze headers.
 - 2) Connections: Factory fabricated of materials compatible with boiler. Attach to boiler before testing.
 - a) NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1.
 - b) NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
 - c. Boiler Appurtenances:
 - 1) Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire boiler except connections and controls.
 - 2) Jacket: Steel with enameled finish.
 - 3) Burner: For use with coil-type, finned-tube water heaters and for natural-gas **OR** LP-gas, **as directed**, fuel.
 - 4) Temperature Control: Adjustable, storage tank temperature-control fitting and flow switch, interlocked with circulator and burner.
 - 5) Safety Control: Automatic, high-temperature-limit cutoff device or system.
 - 6) Automatic Ignition: Intermittent electronic ignition complying with ANSI Z21.20.
 - d. Building Automation System Interface: Normally closed dry contacts for enabling and disabling water heater.
 - e. Support: Steel base or skids.
 - f. Draft Hood: Draft diverter; complying with ANSI Z21.12.
 - g. Automatic Damper: ANSI Z21.66, electrically operated **OR** mechanically activated **OR** thermally activated, **as directed**, automatic-vent-damper device with size matching draft hood.
 - h. Hot-Water Storage Tank: Connected with piping to circulating pump and water heater.
 - 1) Construction: According to ASME Boiler and Pressure Vessel Code: Section VIII, steel with 150-psig (1035-kPa) **OR** 125-psig (860-kPa), **as directed**, working-pressure rating.
 - 2) Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
 - a) NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1.
 - b) NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
 - 3) Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - 4) Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
 - 5) Jacket: Steel with enameled finish.
 - 6) Anode Rods: Factory installed, magnesium.
 - 7) Drain Valve: Corrosion-resistant metal complying with ASSE 1005, factory installed.
 - 8) Combination Temperature and Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
 - i. Circulating Pump: UL 778, all-bronze, centrifugal, overhung-impeller, separately coupled, in-line pump as defined in HI 1.1-1.2 and HI 1.3. Include mechanical seals, 125-psig (860-kPa) minimum working-pressure rating, and 225 deg F (107 deg C) continuous-water-temperature rating.
 - j. Piping: Copper tubing; copper, solder-joint fittings; and brazed or flanged joints.
 - k. Mounting: Water heater, tank, and accessories factory mounted on skids.
6. Commercial, Grid-Type, Finned-Tube, Gas Water Heaters: Comply with ANSI Z21.13 for hot-water boilers.
- a. Description: Packaged unit with boiler, storage tank, pump, piping, and controls.



- b. Boiler Construction: ASME code with 160-psig (1100-kPa) working-pressure rating for hot-water-boiler-type water heater.
 - 1) Heat Exchanger: Horizontal, straight, finned-copper tubes with bronze headers.
 - 2) Connections: Factory fabricated of materials compatible with boiler. Attach to boiler before testing.
 - a) NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1.
 - b) NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
- c. Boiler Appurtenances:
 - 1) Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire boiler except connections and controls.
 - 2) Jacket: Steel with enameled finish.
 - 3) Burner: For use with grid-type, finned-tube water heaters and for natural-gas **OR** LP-gas, **as directed**, fuel.
 - 4) Temperature Control: Adjustable, storage tank temperature-control fitting and flow switch, interlocked with circulator and burner.
 - 5) Safety Control: Automatic, high-temperature-limit cutoff device or system.
 - 6) Automatic Ignition: Intermittent electronic ignition complying with ANSI Z21.20.
- d. Building Automation System Interface: Normally closed dry contacts for enabling and disabling water heater.
- e. Support: Steel base or skids.
- f. Draft Hood: Draft diverter; complying with ANSI Z21.12.
- g. Automatic Damper: ANSI Z21.66, electrically operated **OR** mechanically activated **OR** thermally activated, **as directed**, automatic-vent-damper device with size matching draft hood.
- h. Hot-Water Storage Tank: Connected with piping to circulating pump and water heater.
 - 1) Construction: According to ASME Boiler and Pressure Vessel Code: Section VIII, steel with 150-psig (1035-kPa) **OR** 125-psig (860-kPa), **as directed**, working-pressure rating.
 - 2) Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
 - a) NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1.
 - b) NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
 - 3) Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - 4) Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
 - 5) Jacket: Steel with enameled finish.
 - 6) Anode Rods: Factory installed, magnesium.
 - 7) Drain Valve: Corrosion-resistant metal complying with ASSE 1005, factory installed.
 - 8) Combination Temperature and Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
- i. Circulating Pump: UL 778, all-bronze, centrifugal, overhung-impeller, separately-coupled, in-line pump as defined in HI 1.1-1.2 and HI 1.3. Include mechanical seals, 125-psig (860-kPa) minimum working-pressure rating, and 225 deg F (107 deg C) continuous-water-temperature rating.
- j. Piping: Copper tubing; copper, solder-joint fittings; and brazed or flanged joints.
- k. Mounting: Water heater, tank, and accessories factory mounted on skids.

D. Oil-Fired Water Heaters



1. Household, Oil-Fired Water Heaters: Comply with UL 732 for storage water heaters.
 - a. Storage-Tank Construction: Steel.
 - 1) Tappings: ASME B1.20.1 pipe thread.
 - 2) Pressure Rating: 150 psig (1035 kPa).
 - 3) Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.
 - b. Factory-Installed, Storage-Tank Appurtenances:
 - 1) Anode Rod: Replaceable magnesium.
 - 2) Dip Tube: Provide unless cold-water inlet is near bottom of tank.
 - 3) Drain Valve: ASSE 1005.
 - 4) Insulation: Comply with ASHRAE/IESNA 90.1 or ASHRAE 90.2, **as directed**.
 - 5) Jacket: Steel with enameled finish.
 - 6) Temperature Control: Adjustable thermostat.
 - 7) Heat Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
 - 8) Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3, for combination temperature and pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
 - c. Oil Burner: Comply with UL 296 for use with No. 2 fuel oil.
 - d. Draft Regulator: Barometric type or adjustable-damper device.
2. Commercial, Oil-Fired Water Heaters: Comply with UL 732 for storage water heaters.
 - a. Storage-Tank Construction: ASME-code **OR** Non-ASME-code, **as directed**, steel with 150-psig (1035-kPa) minimum working-pressure rating.
 - 1) Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
 - a) NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1.
 - b) NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
 - 2) Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - 3) Lining: Cement **OR** Glass **OR** Nickel plate **OR** Phenolic coating **OR** Sheet copper, **as directed**, complying with NSF 61 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.
 - b. Factory-Installed, Storage-Tank Appurtenances:
 - 1) Anode Rod: Replaceable magnesium.
 - 2) Dip Tube: Provide unless cold-water inlet is near bottom of tank.
 - 3) Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
 - 4) Insulation: Comply with ASHRAE/IESNA 90.1 or ASHRAE 90.2, **as directed**.
 - 5) Jacket: Steel with enameled finish.
 - 6) Temperature Control: Adjustable thermostat.
 - 7) Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3, for combination temperature and pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
 - c. Oil Burners: Comply with UL 296 for use with No. 2 fuel oil.
 - d. Safety Control: Automatic, high-temperature-limit cutoff device or system.
 - e. Draft Regulator: Barometric type or adjustable-damper device.
 - f. Building Automation System Interface: Normally closed dry contacts for enabling and disabling water heater.
3. Large-Capacity, Oil-Fired Water Heaters: Comply with UL 732 for storage water heaters except when capacity is greater than 120 gal. (454 L).
 - a. Storage-Tank Construction: ASME-code steel with 150-psig (1035-kPa) minimum working-pressure rating.



- 1) Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
 - a) NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1.
 - b) NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
 - 2) Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - 3) Lining: Cement **OR** Glass **OR** Nickel plate **OR** Phenolic coating **OR** Sheet copper, **as directed**, complying with NSF 61 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.
 - b. Factory-Installed, Storage-Tank Appurtenances:
 - 1) Anode Rod: Replaceable magnesium.
 - 2) Dip Tube: Provide unless cold-water inlet is near bottom of tank.
 - 3) Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
 - 4) Insulation: Comply with ASHRAE/IESNA 90.1 or ASHRAE 90.2, **as directed**.
 - 5) Jacket: Steel with enameled finish.
 - 6) Temperature Control: Adjustable thermostat.
 - 7) Safety Control: Automatic, high-temperature-limit cutoff device or system.
 - 8) Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3, for combination temperature and pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
 - c. Oil Burner: Comply with UL 296 for use with No. 2 fuel oil.
 - d. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
 - e. Draft Regulator: Barometric type or adjustable-damper device.
 - f. Building Automation System Interface: Normally closed dry contacts for enabling and disabling water heater.
- E. Dual-Fuel Water Heaters
1. Description: Comply with ANSI Z21.10.3/CSA 4.3 or UL 732 requirements appropriate for dual-fuel, gas and oil-fired water heaters.
 - a. Storage-Tank Construction: ASME-code steel with 150-psig (1035-kPa) minimum working-pressure rating.
 - 1) Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
 - a) NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1.
 - b) NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
 - 2) Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - 3) Lining: Cement **OR** Glass **OR** Nickel plate **OR** Phenolic coating **OR** Sheet copper, **as directed**, complying with NSF 61 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.
 - b. Factory-Installed, Storage-Tank Appurtenances:
 - 1) Anode Rod: Replaceable magnesium.
 - 2) Dip Tube: Provide unless cold-water inlet is near bottom of tank.
 - 3) Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
 - 4) Insulation: Comply with ASHRAE/IESNA 90.1 or ASHRAE 90.2, **as directed**.
 - 5) Jacket: Steel with enameled finish.
 - 6) Temperature Control: Adjustable thermostat.



- 7) Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3, for combination temperature and pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
 - c. Dual-Fuel Burners: Combination gas-oil burner assembly, complying with appropriate requirements of UL 795; or comply with UL 296 for oil burners for No. 2 fuel oil and UL 795 for natural-gas **OR** LP-gas, **as directed**, fuel.
 - d. Safety Control: Automatic, high-temperature-limit cutoff device or system.
 - e. Vent Connection: According to standards of authorities having jurisdiction for dual-fuel water heaters.
 - f. Building Automation System Interface: Normally closed dry contacts for enabling and disabling water heater.
- F. Compression Tanks
1. Description: Steel, pressure-rated tank constructed with welded joints and factory-installed, butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
 - a. Construction:
 - 1) Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
 - 2) Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - 3) Air-Charging Valve: Factory installed.
- G. Water Heater Accessories
1. Gas Shutoff Valves: ANSI Z21.15/CGA 9.1, manually operated. Furnish for installation in piping.
 2. Gas Pressure Regulators: ANSI Z21.18, appliance type. Include pressure rating, capacity, and pressure differential required between gas supply and water heater.
 3. Gas Automatic Valves: ANSI Z21.21, appliance, electrically operated, on-off automatic valve.
 4. Combination Temperature and Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select each relief valve with sensing element that extends into storage tank.
 - a. Gas Water Heaters: ANSI Z21.22/CSA 4.4.
 - b. Oil-Fired Water Heaters: ASME rated and stamped and complying with ASME PTC 25.3.
 5. Pressure Relief Valves: Include pressure setting less than working-pressure rating of water heater.
 - a. Gas Water Heaters: ANSI Z21.22/CSA 4.4.
 - b. Oil-Fired Water Heaters: ASME rated and stamped and complying with ASME PTC 25.3.
 6. Water Heater Stand and Drain Pan Units: High-density-polyethylene-plastic, 18-inch- (457-mm-) high, enclosed-base stand complying with IAPMO PS 103 and IAS No. 2. Include integral or separate drain pan with raised edge and NPS 1 (DN 25) drain outlet with ASME B1.20.1 pipe thread.
 7. Water Heater Stands: Water heater manufacturer's factory-fabricated steel stand for floor mounting and capable of supporting water heater and water. Provide dimension that will support bottom of water heater a minimum of 18 inches (457 mm) above the floor.
 8. Water Heater Mounting Brackets: Water heater manufacturer's factory-fabricated steel bracket for wall mounting and capable of supporting water heater and water.
 9. Drain Pans: Corrosion-resistant metal with raised edge. Provide dimensions not less than base of water heater and include drain outlet not less than NPS 3/4 (DN 20).
 10. Piping Manifold Kits: Water heater manufacturer's factory-fabricated inlet and outlet piping arrangement for multiple-unit installation. Include piping and valves for field assembly that is capable of isolating each water heater and of providing balanced flow through each water heater.
 11. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2, **as directed**.
- H. Source Quality Control



1. Test and inspect water heater storage tanks, specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.
2. Hydrostatically test commercial water heater storage tanks before shipment to minimum of one and one-half times pressure rating.
3. Prepare test reports.

1.3 EXECUTION

A. Water Heater Installation

1. Install commercial water heaters on concrete bases.
 - a. Exception: Omit concrete bases for commercial water heaters if installation on stand, bracket, suspended platform, or direct on floor is indicated.
 - b. Concrete base construction requirements are specified in Division 22 Section "Common Work Results For Plumbing".
2. Install water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
3. Install seismic restraints for commercial water heaters. Anchor to substrate.
4. Install gas water heaters according to NFPA 54.
5. Install gas shutoff valves on gas supplies to gas water heaters without shutoff valves.
6. Install gas pressure regulators on gas supplies to gas water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
7. Install automatic gas valves on gas supplies to gas water heaters, if required for operation of safety control.
8. Install oil-fired water heaters according to NFPA 31.
9. Install combination temperature and pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater, relief-valve outlet, with drain piping same as domestic water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
10. Install combination temperature and pressure relief valves in water piping for water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
11. Install water heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for water heaters that do not have tank drains. Refer to Division 22 Section "Domestic Water Piping Specialties" for hose-end drain valves.
12. Install thermometer on outlet piping of water heaters. Refer to Division 22 Section "Meters And Gages For Plumbing Piping" for thermometers.
13. Install pressure gage(s) on inlet and outlet piping of commercial, fuel-fired water heater piping. Refer to Division 22 Section "Meters And Gages For Plumbing Piping" for pressure gages.
14. Assemble and install inlet and outlet piping manifold kits for multiple water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each water heater. Include shutoff valve and thermometer in each water heater inlet and outlet, and throttling valve in each water heater outlet. Refer to Division 22 Section "General-duty Valves For Plumbing Piping" for general-duty valves and to Division 22 Section "Meters And Gages For Plumbing Piping" for thermometers.
15. Install piping-type heat traps on inlet and outlet piping of water heater storage tanks without integral or fitting-type heat traps.
16. Fill water heaters with water.
17. Charge compression tanks with air.

B. Connections



1. Piping installation requirements are specified in other Division 14. Drawings indicate general arrangement of piping, fittings, and specialties.
 2. Install piping adjacent to water heaters to allow service and maintenance. Arrange piping for easy removal of water heaters.
 3. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
 4. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".
- C. Field Quality Control
1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
 2. Perform the following field tests and inspections and prepare test reports:
 - a. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
 - b. Operational Test: After electrical circuitry has been energized, confirm proper operation.
 - c. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 3. Remove and replace water heaters that do not pass tests and inspections and retest as specified above.
- D. Demonstration
1. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain instantaneous and commercial water heaters.

END OF SECTION 22 12 23 13a



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Task	Specification	Specification Description
22 12 23 26	22 05 23 00	Piped Utilities Basic Materials And Methods
22 13 16 00	22 05 23 00	Piped Utilities Basic Materials And Methods
22 13 16 00	22 11 23 39	Water Supply Wells
22 13 16 00	22 05 76 00	Sanitary Sewerage
22 13 16 00	07 63 00 00	Common Work Results for Fire Suppression
22 13 16 00	07 63 00 00a	Common Work Results for Plumbing
22 13 16 00	07 63 00 00b	Common Work Results for HVAC
22 13 16 00	22 11 16 00a	Sanitary Waste And Vent Piping
22 13 16 00	22 11 16 00b	Storm Drainage Piping



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SECTION 22 13 19 00 - HIGH-EFFICIENCY PARTICULATE FILTRATION

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for high-efficiency particulate filtration. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. HEPA rigid-cell box filters.
 - b. HEPA V-bank cell filters.
 - c. HEPA filter diffusers.
 - d. HEPA filter fan modules.
 - e. ULPA filters.
 - f. 95 percent DOP filters.
 - g. Front- and rear-access filter frames.
 - h. Side-service housings.
 - i. Filter gages.

C. Submittals

1. Product Data: For each type of product indicated. Include dimensions; operating characteristics; required clearances and access; rated flow capacity, including initial and final pressure drop at rated airflow; efficiency and test method; fire classification; furnished specialties; and accessories for each model indicated.
2. LEED Submittals:
 - a. Product Data for Prerequisite EQ 1: Documentation indicating that units comply with applicable requirements in ASHRAE 62.1, Section 5, "Systems and Equipment."
3. Shop Drawings: For air filters. Include plans, elevations, sections, details, and attachments to other work.
 - a. Show filter rack assembly, dimensions, materials, and methods of assembly of components.
 - b. Include setting drawings, templates, and requirements for installing anchor bolts and anchorages.
 - c. Wiring Diagrams: For power, signal, and control wiring.
4. Field quality-control reports.
5. Operation and Maintenance Data: For each type of filter and rack to include in emergency, operation, and maintenance manuals.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended use.
2. ASHRAE Compliance:
 - a. Finish of Interior Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
3. Comply with IEST-RP-CC001.3.
4. Comply with UL 586.
5. Comply with IEST-RP-CC007.1.
6. Comply with NFPA 90A and NFPA 90B.

E. Coordination

1. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.



1.2 PRODUCTS

A. HEPA Rigid-Cell Box Filters

1. Description: Factory-fabricated, disposable, packaged air filters with media perpendicular to airflow and with holding frames.
2. Filter Unit Class: UL 900, Class 1 **OR** Class 2, **as directed**.
3. Media: Fibrous material, constructed so individual pleats are maintained under rated-airflow conditions.
 - a. Internal Separators: None **OR** Aluminum in media folds, **as directed**.
 - b. Gasket Material: None **OR** Neoprene **OR** Blue gel, **as directed**.
 - c. Gasket Location: None **OR** Upstream **OR** Upstream and Downstream **OR** Downstream, **as directed**.
 - d. Faceguard Material: Aluminum **OR** Stainless steel, **as directed**.
 - e. Faceguard Location: None **OR** Upstream **OR** Upstream and Downstream **OR** Downstream, **as directed**.
4. Filter-Media Frames:
 - a. Finish of Interior Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
 - b. Materials: Stainless steel **OR** Fire-retardant plywood **OR** Fabricated aluminum **OR** Fire-retardant particleboard **OR** Galvanized sheet **OR** Non-fire-retardant particleboard, **as directed**.
 - c. Style: Box **OR** Double-turned flange **OR** Deep channel **OR** Double-turned flange, one side, **as directed**.
5. Mounting Frames: Welded galvanized steel with gaskets and fasteners; suitable for bolting together into built-up filter banks.

B. HEPA V-Bank Cell Filters

1. Description: Factory-fabricated, disposable, packaged air filters with media at an angle to airflow and with holding frames.
2. Filter Unit Class: UL 900, Class 1 **OR** Class 2, **as directed**.
3. Media: Fibrous material, constructed so individual pleats are maintained under rated-airflow conditions.
 - a. Internal Separators: None **OR** Aluminum in media folds, **as directed**.
 - b. Gasket Material: None **OR** Neoprene **OR** Blue gel, **as directed**.
 - c. Gasket Location: None **OR** Upstream **OR** Upstream and Downstream **OR** Downstream, **as directed**.
 - d. Faceguard Material: Aluminum **OR** Stainless steel, **as directed**.
 - e. Faceguard Location: None **OR** Upstream **OR** Upstream and Downstream **OR** Downstream, **as directed**.
4. Filter-Media Frames:
 - a. Finish of Interior Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
 - b. Materials: Stainless steel **OR** Fire-retardant plywood **OR** Fabricated aluminum **OR** Fire-retardant particleboard **OR** Galvanized sheet **OR** Non-fire-retardant particleboard, **as directed**.
 - c. Style: Box **OR** Double-turned flange **OR** Deep channel **OR** Double-turned flange, one side, **as directed**.
5. Mounting Frames: Welded galvanized steel with gaskets and fasteners; suitable for bolting together into built-up filter banks.

C. HEPA Filter Diffusers

1. Description: Factory-fabricated, individually ducted, HEPA filter-holding ceiling modules.
2. Media: Fibrous glass, constructed of continuous sheets with closely spaced pleats with glass filament separators.
 - a. Media to Module Side Bond: Urethane sealant.



- b. Media to Frame Side Bond: Polyurethane foam **OR** Silicone **OR** Neoprene adhesive **OR** Fiberglass-mat packing **OR** Thermosetting sealant **OR** Knife edge in fluid-filled channel, **as directed**.
 - c. Application: Class 100 **OR** Class 10 **OR** Class 1, **as directed**, clean room.
 - 3. Casing:
 - a. Configuration: Ducted inlet **OR** Plenum inlet **OR** Plenum inlet with prefilter, **as directed**.
 - b. Module Material: Extruded aluminum, 16 gage with mill finish.
 - c. Suspension: Ceiling grid.
 - 4. Accessories:
 - a. Diffusion damper.
 - b. Diffusion-damper adjustment port.
 - c. Filter test port.
- D. HEPA Filter Fan Modules
- 1. Description: Factory-fabricated, HEPA filter ceiling module with fan.
 - 2. Casing:
 - a. Configuration: Ducted inlet **OR** Plenum inlet **OR** Plenum inlet with prefilter, **as directed**.
 - b. Module Material: Extruded aluminum, 16 gage with mill finish.
 - c. Suspension: Ceiling grid **OR** Independent, **as directed**.
 - 3. Media: Fibrous glass, constructed of continuous sheets with closely spaced pleats with aluminum separators **OR** vinyl-coated aluminum separators **OR** separators of ribbons of filter media, **as directed**.
 - a. Frame Material: 3/4-inch- (19-mm-) thick, fire-retardant plywood **OR** 3/4-inch- (19-mm-) thick, fire-retardant particleboard **OR** 3/4-inch- (19-mm-) thick plywood **OR** 3/4-inch- (19-mm-) thick particleboard **OR** Galvanized steel **OR** Aluminized steel **OR** Cadmium-plated steel **OR** Stainless steel **OR** Aluminum, **as directed**.
 - b. Media to Frame Side Bond: Polyurethane foam **OR** Silicone **OR** Neoprene adhesive **OR** Fiberglass-mat packing **OR** Thermosetting sealant **OR** Knife edge in fluid-filled channel, **as directed**.
 - c. Face Gasket: Neoprene expanded rubber **OR** Ceramic fiber **OR** Silicone, **as directed**.
 - d. Faceguard: Plastic **OR** Stainless steel, **as directed**.
 - 4. Accessories: Filter test port.
 - 5. Control: Variable speed.
 - 6. Motor:
 - a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - b. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 22.
 - c. Type: Permanent-split capacitor with SCR for speed adjustment **OR** Electronically commutated motor, **as directed**.
 - d. Fan-Motor Assembly Isolation: Rubber isolators.
 - e. Enclosure: Open dripproof **OR** Totally enclosed, fan cooled **OR** Totally enclosed, air over **OR** Open, externally ventilated **OR** Totally enclosed, nonventilated **OR** Severe duty **OR** Explosion proof **OR** Dust-ignition-proof machine, **as directed**.
 - f. Enclosure Materials: Cast iron **OR** Cast aluminum **OR** Rolled steel, **as directed**.
 - g. Motor Bearings: **<Insert special requirements>**.
 - h. Unusual Service Conditions:
 - 1) Ambient Temperature: **<Insert deg F (deg C)>**.
 - 2) Altitude: **<Insert feet (m)>** above sea level.
 - 3) High humidity.
 - i. Efficiency: Premium efficient.
 - j. NEMA Design: **<Insert designation>**.
 - k. Service Factor: **<Insert value>**.
 - l. Motor Speed: Single speed **OR** Multispeed, **as directed**.
 - 1) Speed Control: Infinitely adjustable with pneumatic-electric and electronic controls.



E. ULPA Filters

1. Description: Factory-fabricated, ULPA filters with holding casing.
2. Media: Fibrous glass, constructed of continuous sheets with closely spaced pleats with aluminum separators **OR** vinyl-coated aluminum separators **OR** separators of ribbons of filter media, **as directed**.
3. Frame Material: 3/4-inch- (19-mm-) thick, fire-retardant plywood **OR** 3/4-inch- (19-mm-) thick, fire-retardant particleboard **OR** 3/4-inch- (19-mm-) thick plywood **OR** 3/4-inch- (19-mm-) thick particleboard **OR** Galvanized steel **OR** Aluminized steel **OR** Cadmium-plated steel **OR** Stainless steel **OR** Aluminum, **as directed**.
4. Media to Frame Side Bond: Polyurethane foam **OR** Silicone **OR** Neoprene adhesive **OR** Fiberglass-mat packing **OR** Thermosetting sealant **OR** Knife-edge in fluid-filled channel, **as directed**.
5. Face Gasket: Neoprene expanded rubber **OR** Ceramic fiber **OR** Silicone, **as directed**.
6. Mounting Frames: Construct downstream corners of holding device with cushion pads to protect media. Provide bolted filter-sealing mechanism to mount and continuously seal each individual filter.

F. 95 Percent DOP Filters

1. Description: Factory-fabricated, 95 percent DOP filters with holding casing.
2. Media: Fibrous glass, constructed of continuous sheets with closely spaced pleats with aluminum separators **OR** vinyl-coated aluminum separators **OR** separators of ribbons of filter media, **as directed**.
3. Frame Material: 3/4-inch- (19-mm-) thick, fire-retardant plywood **OR** 3/4-inch- (19-mm-) thick, fire-retardant particleboard **OR** 3/4-inch- (19-mm-) thick plywood **OR** 3/4-inch- (19-mm-) thick particleboard **OR** Galvanized steel **OR** Aluminized steel **OR** Cadmium-plated steel **OR** Stainless steel **OR** Aluminum, **as directed**.
4. Frame Style: Box single header **OR** Double header **OR** Double turned flange **OR** 3/4-inch- (19-mm-) deep channel, **as directed**.
5. Media to Frame Side Bond: Polyurethane foam **OR** Silicone **OR** Neoprene adhesive **OR** Fiberglass-mat packing **OR** Thermosetting sealant **OR** Knife edge in fluid-filled channel, **as directed**.
6. Face Guard Material: Galvanized **OR** Aluminum, **as directed**, mesh.
7. Face Guard Location: Upstream **OR** Upstream and Downstream **OR** Downstream, **as directed**.
8. Gasket Material: Neoprene expanded rubber **OR** Ceramic fiber **OR** Silicone, **as directed**.
9. Gasket Location: Upstream **OR** Upstream and Downstream **OR** Downstream, **as directed**.
10. Mounting Frames: Construct downstream corners of holding device with cushion pads to protect media. Provide bolted filter-sealing mechanism to mount and continuously seal each individual filter.

G. Front- And Rear-Access Filter Frames

1. Framing System: Aluminum framing members with access for either upstream (front) or downstream (rear) filter servicing, cut to size and prepunched for assembly into modules. Vertically support filters to prevent deflection of horizontal members without interfering with either filter installation or operation.
2. Prefilters: Incorporate a separate track, removable from front or back.
3. Sealing: Factory-installed, positive-sealing device for each row of filters to ensure seal between gasketed filter elements to prevent bypass of unfiltered air.
4. Finish of Interior Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

H. Side-Service Housings

1. Description: Factory-assembled, side-service housings, constructed of 0.064-inch- (1.6-mm-) thick, galvanized steel **OR** stainless steel **OR** double-wall casing with 1-inch (25-mm) insulation, **as directed**, to hold filters. Side servicing is through gasketed access doors on one side, and



housings are capable of connection to other housings. Equip housings with metal slide channel tracks with clamping mechanisms to hold filters, and the following:

- a. Pressure tap and fitting.
 - b. DOP/freon test ports.
 - c. Decontamination ports.
 - d. Isolation dampers.
 - e. Lifting lugs.
2. Prefilters: Integral tracks to accommodate 2-, 4-, and 6-inch- (50-, 100-, and 150-mm-) thick, disposable filters.
 3. Access Doors: Continuous gaskets on perimeter and positive-locking swivel, **as directed**, devices. Provide ribbed bagging rim behind access door and PVC bags for bag-in, bag-out arrangement, **as directed**. Arrange so filter cartridges can be loaded from an access door for each tier and section of the following:
 - a. Combination prefilter and HEPA filter.
OR
Prefilter.
OR
HEPA filter.
 - b. Upstream and downstream test section.
 4. Sealing: Incorporate positive-sealing gasket material on channels to seal top and bottom of filter cartridge frames to prevent bypass of unfiltered air.
 5. Accessories:
 - a. Filter change-out trays.
 - b. Document-storage pocket.
 - c. Filter removal rod.
 6. Finish of Interior Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

I. Filter Gages

1. Diaphragm type with dial and pointer in metal case, vent valves, black figures on white background, and front recalibration adjustment.
 - a. Diameter: 4-1/2 inches (115 mm) **OR** 2 inches (50 mm), **as directed**.
 - b. Scale Range for Filter Media Having a Recommended Final Resistance of 0.5-Inch wg (125 Pa) or Less: 0- to 0.5-inch wg (0 to 125 Pa).
 - c. Scale Range for Filter Media Having a Recommended Final Resistance of 0.5- to 1.0-Inch wg (125 to 250 Pa) or Less: 0- to 1.0-inch wg (0 to 250 Pa).
 - d. Scale Range for Filter Media Having a Recommended Final Resistance of 1.0- to 2.0-Inch wg (250 to 500 Pa) or Less: 0- to 2.0-inch wg (0 to 500 Pa).
 - e. Scale Range for Filter Media Having a Recommended Final Resistance of 2.0- to 3.0-Inch wg (500 to 750 Pa) or Less: 0- to 3.0-inch wg (0 to 750 Pa).
 - f. Scale Range for Filter Media Having a Recommended Final Resistance of 3.0- to 4.0-Inch wg (750 to 1000 Pa) or Less: 0- to 4.0-inch wg (0 to 1000 Pa).
2. Manometer-Type Filter Gage: Molded plastic, with epoxy-coated aluminum scale, logarithmic-curve tube gage with integral leveling gage; graduated to read from 0- to 3.0-inch wg (0 to 750 Pa) and accurate within 3 percent of full-scale range.
3. Accessories: Static-pressure tips, tubing, gage connections, and mounting bracket.

1.3 EXECUTION

A. Installation

1. Position each filter unit with clearance for normal service and maintenance. Anchor filter holding frames to substrate.
2. Install filters in position to prevent passage of unfiltered air.
3. Install filter gage for each filter bank.



4. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters that were used during construction and testing with new, clean filters.
5. Install filter-gage static-pressure taps upstream and downstream from filters. Install filter gages on filter banks with separate static-pressure taps upstream and downstream from filters. Mount filter gages on outside of filter housing or filter plenum in an accessible position. Adjust and level inclined gages.
6. Coordinate filter installations with duct and air-handling unit installations.

B. Field Quality Control

1. Perform tests and inspections.
2. Tests and Inspections:
 - a. Operate automatic roll filters to demonstrate compliance with requirements.
 - b. Test for leakage of unfiltered air while system is operating.
 - c. HEPA Filters: Pressurize housing to a minimum of 3.0-inch wg (750 Pa) or to designed operating pressure, whichever is higher; test housing joints, door seals, and sealing edges of filter with soapy water to check for air leaks.
 - d. HEPA Filters: Pressurize housing to a minimum of 3.0-inch wg (750 Pa) or to designed operating pressure, whichever is higher; and test housing joints, door seals, and sealing edges of filter for air leaks according to pressure-decay method in ASME N510.
3. Air filter will be considered defective if it does not pass tests and inspections.
4. Prepare test and inspection reports.

C. Cleaning

1. After completing system installation and testing, adjusting, and balancing air-handling and air-distribution systems, clean filter housings and install new filter media.

END OF SECTION 22 13 19 00



Task	Specification	Specification Description
22 13 19 13	22 13 19 00	High-Efficiency Particulate Filtration



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SECTION 22 13 19 26 - INTERCEPTORS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for interceptors. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Grease interceptors.
 - b. Oil interceptors.
 - c. Sand interceptors.

C. Definitions

1. FRP: Fiberglass-reinforced plastic.
2. PP: Polypropylene plastic.

D. Submittals

1. Product Data: For each type of metal and plastic interceptor indicated. Include materials of fabrication, dimensions, rated capacities, retention capacities, operating characteristics, size and location of each pipe connection, furnished specialties, and accessories.
2. Shop Drawings: For each type and size of precast-concrete interceptor indicated.
 - a. Include materials of construction, dimensions, rated capacities, retention capacities, location and size of each pipe connection, furnished specialties, and accessories.
3. Coordination Drawings: Interceptors, drawn to scale, on which the following items are shown and coordinated with each other, based on input from Installers of the items involved:
 - a. Interceptors.
 - b. Piping connections. Include size, location, and elevation of each.
 - c. Interface with underground structures and utility services.

E. Project Conditions

1. Interruption of Existing Sewer Services: Do not interrupt services to facilities occupied by the Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sewer services according to requirements indicated:
 - a. Notify the Owner no fewer than seven days in advance of proposed interruption of service.
 - b. Do not proceed with interruption of sewer services without the Owner's written permission.

1.2 PRODUCTS

A. Grease Interceptors

1. Grease Interceptors: Precast concrete complying with ASTM C 913.
 - a. Include rubber-gasketed joints, vent connections (if required), manholes, compartments or baffles, and piping or openings to retain grease and to permit wastewater flow, unless directed otherwise.
 - b. Structural Design Loads:
 - 1) Light-Traffic Load: Comply with ASTM C 890, A-8 (ASSHTO HS10-44).
 - 2) Medium-Traffic Load: Comply with ASTM C 890, A-12 (ASSHTO HS15-44).
 - 3) Heavy-Traffic Load: Comply with ASTM C 890, A-16 (ASSHTO HS20-44).
 - 4) Walkway Load: Comply with ASTM C 890, A-03.



- c. Resilient Pipe Connectors (if required): ASTM C 923 (ASTM C 923M), cast or fitted into interceptor walls, for each pipe connection.
- d. Steps: Individual FRP steps or FRP ladder **OR** Individual FRP steps, FRP ladder, or ASTM A 615/A 615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D 4101, PP **OR** ASTM A 615/A 615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D 4101, PP, **as directed**, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of interceptor to finished grade is less than 60 inches (1500 mm).
- e. Grade Rings (if required): Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, to match diameter of manhole frame and cover.
- f. Manhole Frames and Covers: Ferrous; 24-inch (610-mm) ID by 7- to 9-inch (175- to 225-mm) riser with 4-inch- (100-mm-) minimum width flange and 26-inch- (660-mm-) diameter cover.
 - 1) Ductile Iron: ASTM A 536, Grade 60-40-18, unless otherwise indicated.
 - 2) Gray Iron: ASTM A 48, Class 35, unless otherwise indicated.
 - 3) Include indented top design with lettering cast into cover, using wording equivalent to "INTERCEPTOR," or "GREASE INTERCEPTOR," or "SANITARY SEWER."

B. Oil Interceptors

1. Oil Interceptors: Precast concrete comply with ASTM C 913.
 - a. Include rubber-gasketed joints, vent connections, manholes, compartments or baffles, and piping or openings to retain grease and to permit wastewater flow.
 - b. Structural Design Loads:
 - 1) Light-Traffic Load: Comply with ASTM C 890, A-8 (ASSHTO HS10-44).
 - 2) Medium-Traffic Load: Comply with ASTM C 890, A-12 (ASSHTO HS15-44).
 - 3) Heavy-Traffic Load: Comply with ASTM C 890, A-16 (ASSHTO HS20-44).
 - 4) Walkway Load: Comply with ASTM C 890, A-03.
 - c. Resilient Pipe Connectors (if required): ASTM C 923 (ASTM C 923M), cast or fitted into interceptor walls, for each pipe connection.
 - d. Steps: Individual FRP steps or FRP ladder **OR** Individual FRP steps, FRP ladder, or ASTM A 615/A 615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D 4101, PP **OR** ASTM A 615/A 615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D 4101, PP, **as directed**, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of interceptor to finished grade is less than 60 inches (1500 mm).
 - e. Grade Rings (if required): Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, to match diameter of manhole frame and cover.
 - f. Manhole Frames and Covers: Ferrous; 24-inch (610-mm) ID by 7- to 9-inch (175- to 225-mm) riser with 4-inch- (100-mm-) minimum width flange and 26-inch- (660-mm-) diameter cover.
 - 1) Ductile Iron: ASTM A 536, Grade 60-40-18, unless otherwise indicated.
 - 2) Gray Iron: ASTM A 48, Class 35, unless otherwise indicated.
 - 3) Include indented top design with lettering cast into cover, using wording equivalent to "INTERCEPTOR," or "OIL INTERCEPTOR," or "SANITARY SEWER."
 - g. Waste-oil storage tank and piping are specified in Division 23 Section "Facility Fuel-oil Piping".
2. Oil Interceptors: Factory-fabricated, cast-iron or steel body; with removable sediment bucket or strainer, baffles, vents, and flow-control fitting on inlet.
 - a. Inlet, Outlet, Vent, and Waste-Oil Outlet Piping Connections: Hub, hubless, or threaded, unless otherwise indicated.
 - b. Extension (if required): Cast-iron or steel shroud, full size of interceptor, extending from top of interceptor to grade.



- c. Cover: Cast iron or steel, with steel reinforcement to provide ASTM C 890, A-03, walkway load, **as directed**.
 - d. Comply with requirements in Division 23 Section "Facility Fuel-oil Piping" for waste-oil storage tank and piping
3. Oil Interceptors: Plastic body; with removable sediment bucket or strainer, baffles, vents, and flow-control fitting on inlet.
- a. Inlet, Outlet, Vent, and Waste-Oil Outlet Piping Connections: Hub, hubless, or threaded, unless otherwise indicated.
 - b. Extension (if required): Plastic shroud, full size of interceptor, extending from top of interceptor to grade.
 - c. Cover: Plastic with steel reinforcement to provide ASTM C 890, A-03, walkway load, **as directed**.
 - d. Waste-oil storage tank and piping are specified in Division 23 Section "Facility Fuel-oil Piping".
- C. Sand Interceptors
1. Description: Factory-fabricated, cast-iron or steel body and inlet grate; with settlement chamber and removable basket or strainer.
 2. Outlet Piping Connection: Hub, hubless, or threaded, unless otherwise indicated.
 3. Grate: Cast iron or steel with reinforcement to provide ASTM C 890, A-03, walkway load, **as directed**.
- D. Precast-Concrete Manhole Risers
1. Precast-Concrete Manhole Risers: ASTM C 478 (ASTM C 478M) **OR** ASTM C 913, **as directed**, with rubber-gasket joints.
 - a. Structural Design Loads:
 - 1) Light-Traffic Load: Comply with ASTM C 890, A-8 (ASSHTO HS10-44).
 - 2) Medium-Traffic Load: Comply with ASTM C 890, A-12 (ASSHTO HS15-44).
 - 3) Heavy-Traffic Load: Comply with ASTM C 890, A-16 (ASSHTO HS20-44).
 - 4) Walkway Load: Comply with ASTM C 890, A-03.
 - b. Length: From top of underground concrete structure to grade.
 - c. Riser Sections: 3-inch (75-mm) minimum thickness and 36-inch (915-mm) diameter.
 - d. Top Section: Eccentric cone, unless otherwise indicated. Include top of cone to match grade ring size.
 - e. Gaskets: ASTM C 443 (ASTM C 443M), rubber.
 - f. Steps: Individual FRP steps or FRP ladder **OR** Individual FRP steps, FRP ladder, or ASTM A 615/A 615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D 4101, PP **OR** ASTM A 615/A 615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D 4101, PP, **as directed**, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals.
 2. Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, diameter matching manhole frame and cover, and height as required to adjust the manhole frame and cover to indicated elevation and slope.
 3. Manhole Frames and Covers (if required): Ferrous; 24-inch (610-mm) ID by 7- to 9-inch (175- to 225-mm) riser with 4-inch- (100-mm-) minimum width flange and 26-inch- (660-mm-) diameter cover.
 - a. Ductile Iron: ASTM A 536, Grade 60-40-18, unless otherwise indicated.
 - b. Gray Iron: ASTM A 48, Class 35, unless otherwise indicated.
 - c. Include indented top design with lettering cast into cover, using wording equivalent to the following:
 - 1) Grease Interceptors in Sanitary Sewerage System: "INTERCEPTOR" **OR** "GREASE INTERCEPTOR" **OR** "SANITARY SEWER", **as directed**.
 - 2) Oil Interceptors in Sanitary Sewerage System: "INTERCEPTOR" **OR** "OIL INTERCEPTOR" **OR** "SANITARY SEWER", **as directed**.



1.3 EXECUTION

A. Earthwork

1. Excavating, trenching, and backfilling are specified in Division 31 Section "Earth Moving".

B. Installation

1. Install precast-concrete interceptors according to ASTM C 891. Set level and plumb.
2. Install manhole risers from top of underground concrete interceptors to manholes and gratings at finished grade.
3. Set tops of manhole frames and covers flush with finished surface in pavements. Set tops 3 inches (75 mm) above finish surface elsewhere, unless otherwise indicated.
4. Set tops of grating frames and grates flush with finished surface.
5. Set metal and plastic interceptors level and plumb.
6. Set tops of metal interceptor covers flush with finished surface in pavements. Set tops 3 inches (75 mm) above finish surface elsewhere, unless otherwise indicated.
7. Install piping and oil storage tanks according to Division 23 Section "Facility Fuel-oil Piping".

C. Connections

1. Piping installation requirements are specified in other Division 22. Drawings indicate general arrangement of piping, fittings, and specialties.
2. Make piping connections between interceptors and piping systems.

D. Identification

1. Identification materials and installation are specified in Division 31 Section "Earth Moving". Arrange for installation of green warning tapes directly over piping and at outside edges of underground interceptors.
 - a. Use warning tapes or detectable warning tape over ferrous piping.
 - b. Use detectable warning tape over nonferrous piping and over edges of underground structures.

END OF SECTION 22 13 19 26



Task	Specification	Specification Description
22 13 19 26	22 13 19 00	High-Efficiency Particulate Filtration
22 13 19 33	22 05 23 00	Piped Utilities Basic Materials And Methods
22 13 19 33	22 05 76 00	Sanitary Sewerage
22 13 19 33	22 05 23 00a	General-Duty Valves for Plumbing Piping
22 13 19 33	22 05 23 00b	General-Duty Valves for HVAC Piping
22 13 19 33	22 13 19 00	High-Efficiency Particulate Filtration
22 13 19 36	22 13 19 00	High-Efficiency Particulate Filtration
22 13 23 00	22 13 19 26	Interceptors



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SECTION 22 13 29 13 - PACKAGED SEWAGE PUMPING STATIONS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for packaged sewage pumping stations. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes dry-well, packaged pumping stations with dry-well or vacuum-primed sewage pumps.
2. This Section includes wet-well, packaged pumping stations with submersible or submersible grinder or wet-well-mounting sewage pumps.

C. Performance Requirements

1. Pressure Rating of Sewage Pumps and Discharge Piping Components: At least equal to sewage pump discharge pressure, but not less than 125 psig (860 kPa).
2. Pressure Rating of Other Piping Components: At least equal to system operating pressure.

D. Submittals

1. Product Data: Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.
2. Shop Drawings: Show fabrication and installation details for each packaged pumping station. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - a. Wiring Diagrams: Power, signal, and control wiring.
3. Product Certificates: For sewage pumps, signed by product manufacturer.
4. Manufacturer Seismic Qualification Certification
5. Field quality-control test reports.
6. Maintenance Data: For packaged pumping stations to include in maintenance manuals.

E. Quality Assurance

1. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
2. Testing Agency Qualifications: Nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7.
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
4. Comply with HI 1.1-1.2, "Centrifugal Pumps for Nomenclature and Definitions"; HI 1.3, "Centrifugal Pumps for Design and Application"; and HI 1.4, "Centrifugal Pumps for Installation, Operation and Maintenance," for sewage and sump pumps.
5. Comply with UL 778, "Motor-Operated Water Pumps," for sewage and sump pumps.

F. Project Conditions

1. Interruption of Existing Sanitary Sewer Service: Do not interrupt sanitary sewer service to facilities occupied by the Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sanitary sewer service according to requirements indicated:
 - a. Notify the Owner no fewer than two days in advance of proposed interruption of sanitary sewer service.



- b. Do not proceed with interruption of sanitary sewer service without the Owner's written permission.

1.2 PRODUCTS

A. Dry-Well, Packaged Sewage Pumping Stations

1. Dry-Well, Packaged Sewage Pumping Stations with Dry-Well Sewage Pumps:

- a. Description: Factory fabricated, assembled, and tested with wet well for comminutor and collection of sanitary sewage and with dry equipment chamber for sewage pumps, controls, and accessories.
- 1) Orientation: Shell underground with dry equipment chamber underground with top flush with grade **OR** partially recessed underground **OR** above grade **OR** underground with entrance tube to grade, **as directed**.
 - 2) Shell: Factory fabricated from structural-steel plate **OR** fiberglass, **as directed**.
 - 3) Entrance Tube: From dry compartment to entrance at grade, and of size required to replace largest piece of equipment, but not smaller than 36 inches (914 mm) in diameter.
 - 4) Cathodic Protection: as directed by the Owner, exterior magnesium anode(s).
 - 5) Comminutor: Full size of sewage inlet pipe.
 - 6) Sewage Pumps: Two **OR** Three, **as directed**, dry-well-type, nonclog sewage pumps with controls and piping. Include ASTM A 48/A 48M, Class 25, nonclog, cast-iron impeller capable of passing solids of 3-inch (76-mm) minimum diameter; mechanical or stuffing-box seals; and pedestal-mounted motor.

2. Dry-Well, Packaged Sewage Pumping Stations with Vacuum-Primed Sewage Pumps:

- a. Description: Factory fabricated, assembled, and tested with wet well for comminutor and collection of sanitary sewage and with dry equipment chamber for sewage pumps, vacuum pumps, controls, and accessories.
- 1) Orientation: Shell underground with dry equipment chamber underground with top flush with grade **OR** partially recessed underground **OR** above grade **OR** underground with entrance tube to grade, **as directed**.
 - 2) Shell: Factory fabricated from structural-steel plate **OR** fiberglass, **as directed**.
 - 3) Entrance Tube: From dry compartment to entrance at grade, and of size required to replace largest piece of equipment, but not smaller than 36 inches (914 mm) in diameter.
 - 4) Cathodic Protection: as directed by the Owner, exterior magnesium anode(s).
 - 5) Comminutor: Full size of sewage inlet pipe.
 - 6) Sewage Pumps: Two **OR** Three, **as directed**, dry-chamber-mounting, vacuum-primed, nonclog sewage pumps located in dry compartment above wet pit, with controls and piping. Include ASTM A 48/A 48M, Class 25, nonclog, cast-iron impeller capable of passing solids of 3-inch (76-mm) minimum diameter; mechanical or stuffing-box seals; pedestal-mounted motor; and suction piping extending to bottom of wet pit.
 - 7) Vacuum Pumps: Duplex arrangement with controls, vacuum piping, and vent piping of size and capacity required for system. Include automatic alternator, with manual disconnect switch, to change sequence of lead-lag vacuum pumps at completion of each cycle.

B. Wet-Well, Packaged Sewage Pumping Stations

1. Wet-Well, Packaged Sewage Pumping Stations with Submersible Sewage Pumps:

- a. Description: Factory fabricated, assembled, and tested with wet well for comminutor, sewage pumps and collection of sanitary sewage and with sewage pumps and dry equipment chamber for controls and accessories.



- 1) Orientation: Shell underground with dry equipment chamber underground with top flush with grade **OR** partially recessed underground **OR** above grade **OR** underground with entrance tube to grade, **as directed**.
 - 2) Shell: Factory fabricated from structural-steel plate **OR** fiberglass, **as directed**.
 - 3) Entrance Tube: From dry compartment to entrance at grade, and of size required to replace largest piece of equipment, but not smaller than 36 inches (914 mm) in diameter.
 - 4) Cathodic Protection: as directed by the Owner, exterior magnesium anode(s).
 - 5) Comminutor: Full size of sewage inlet pipe.
 - 6) Sewage Pumps: Two **OR** Three, **as directed**, submersible-type sewage pumps, with guide rail, quick-disconnect system, controls, and piping. Include ASTM A 48/A 48M, Class 25, nonclog, cast-iron impeller capable of passing solids of 3-inch (76-mm) minimum diameter; and hermetically sealed motor with moisture-sensing probe, mechanical seals, and waterproof power cable.
2. Wet-Well, Packaged Sewage Pumping Stations with Submersible Grinder Sewage Pumps:
- a. Description: Factory fabricated, assembled, and tested with wet well for sewage pumps and collection of sanitary sewage and with dry equipment chamber for controls and accessories.
 - 1) Orientation: Shell underground with dry equipment chamber underground with top flush with grade **OR** partially recessed underground **OR** above grade **OR** underground with entrance tube to grade, **as directed**.
 - 2) Shell: Factory fabricated from structural-steel plate **OR** fiberglass, **as directed**.
 - 3) Entrance Tube: From dry compartment to entrance at grade, and of size required to replace largest piece of equipment, but not smaller than 36 inches (914 mm) in diameter.
 - 4) Cathodic Protection: as directed by the Owner, exterior magnesium anode(s).
 - 5) Sewage Pumps: Two **OR** Three, **as directed**, submersible grinder-type sewage pumps, with guide rail, quick-disconnect system, controls, and piping. Include stainless-steel grinder impeller and hermetically sealed motor with moisture-sensing probe, mechanical seals, and waterproof power cable.
 - a) If Project has more than one wet-well, packaged sewage pumping station with submersible grinder sewage pumps,

3. Wet-Well, Packaged Sewage Pumping Stations with Wet-Well-Mounting Sewage Pumps:
- a. Description: Factory fabricated, assembled, and tested with wet well for comminutor, sewage pumps and collection of sanitary sewage and with suspended sewage pumps and dry equipment chamber for pump motors, controls, and accessories.
 - 1) Orientation: Shell underground with dry equipment chamber underground with top flush with grade **OR** partially recessed underground **OR** above grade **OR** underground with entrance tube to grade, **as directed**.
 - 2) Shell: Factory fabricated from structural-steel plate **OR** fiberglass, **as directed**.
 - 3) Entrance Tube: From dry compartment to entrance at grade, and of size required to replace largest piece of equipment, but not smaller than 36 inches (914 mm) in diameter.
 - 4) Cathodic Protection: as directed by XXXXcontractingpositiontheXXX, exterior magnesium anode(s).
 - 5) Comminutor: Full size of sewage inlet pipe.
 - 6) Sewage Pumps: Two **OR** Three, **as directed**, wet-well-mounting-type, nonclog sewage pumps suspended from dry-compartment floor, with controls and piping. Include ASTM A 48/A 48M, Class 25, nonclog, cast-iron impeller capable of passing solids of 3-inch (76-mm) minimum diameter; grease-lubricated bearings and stuffing-box seal; shaft coupling; and pedestal-mounted motor.

C. Comminutors:

1. Description: Motor-operated, single- or twin-shaft, cutter- or grinder-design unit with controls; for pipeline installation.
 - a. Body: Stainless steel or ductile iron with flanged ends and access plate.



- b. Cutting Elements: Motor-driven rotor and stationary cutters or grinders of hardened stainless or heat-treated steel.
- c. Motor: Explosion proof, directly connected to body.
- d. Control Panel: NEMA 250, Type 12 enclosure for installation in dry equipment chamber.

D. Controls

1. Control Sequence of Operation: Cycle each sewage pump on and off automatically to maintain wet-well sewage level. Automatic control operates both pumps in parallel if wet-well level rises above starting point of low-level pump, until shutoff level is reached. Automatic alternator, with manual disconnect switch, changes sequence of lead-lag sewage pumps at completion of each pumping cycle.
2. Self-Purging, Air-Bubbler System: Senses variations of sewage level in wet well. Include duplex-arrangement oilless air compressors to furnish bubbler air; filters; air-storage reservoir; piping; airflow meter with needle valve adjustment for airflow regulation; sewage depth gage; air-bubbler piping to wet well; and pressure-sensing, dustproof mercury switches.
3. Electrode **OR** Float-Switch **OR** Pressure-Switch **OR** Ultrasonic, **as directed**, System: Senses variations of sewage level in wet well. Include high and low adjustments capable of operating on 6-inch (150-mm) minimum differential of liquid level.
4. Motor Controllers: Magnetic, full voltage, nonreversing. Include undervoltage release, thermal-overload heaters in each phase, manual reset buttons, and hand-automatic selector switches. Include circuit breakers to provide branch-circuit protection for each controller.
5. 120-V accessory controls with 15-A, single-phase circuit breakers or fuses for each item.
6. Control Panel: Enclosure complying with UL 508A and with UL 508A, Supplement SB, **as directed**, with separate compartments and covers for controllers, circuit breakers, transformers, alternators, and single-phase controls. Include 20-A duplex receptacle in NEMA WD 1, Configuration 5-20R mounted on exterior of control panel.
 - a. Mounting: Inside, on dry-chamber wall **OR** Outside, on pedestal, at grade, **as directed**.
 - b. Enclosure: NEMA 250, Type 1 **OR** 4 **OR** 4X, **as directed**.
7. Install labels on panel face to identify switches and controls.
8. Wiring: Tin-copper wiring.
9. Connection for Portable Generator: Nonautomatic (manual) transfer switch with receptacle matching generator electrical power requirements. Nonautomatic transfer switches are specified in Division 26 Section "Transfer Switches" and receptacles are specified in Division 26 Section "Wiring Devices".

E. Accessories

1. Lighting: Minimum of 2, UL 1571, heavy-duty, cast-metal, wet-location-type fixtures with 100-W bulbs and guards in service area. Locate switches, with pilot lights, at chamber entrance.
2. Submersible Sump Pump:
 - a. Discharge Size: NPS 1-1/4 (DN 32) minimum.
 - b. Pump End Bell and Motor Shell: Cast iron.
 - c. Motor: 1/3 hp, 1750-rpm, hermetically sealed, capacitor-start, with built-in overload protection.
 - d. Impeller: ASTM B 584, cast bronze or ASTM B 36/B 36M, brass.
 - e. Shaft: Stainless steel.
 - f. Bearings: Grease-lubricated, factory-sealed ball bearings.
 - g. Seals: Mechanical.
 - h. Accessories: Inlet strainer.
 - i. Controls: Float switch.
3. Dehumidifier: Electric refrigeration system, adjustable humidistat, reverse-acting thermostat for low-temperature cutoff controls, and condensate pump with drain piping to sump.
 - a. Dehumidification system capacity adequate to remove at least 15 pints (7 L) of water per day from service area air that is 80 deg F (27 deg C) with a relative humidity of 60 percent.
4. Ventilation: Electrically powered ventilation system. Include centrifugal blower with 4-inch- (100-mm-) round exhaust vent designed to keep out rain, insects, and other foreign matter; limit switch



- to start blower if entrance door or lid is opened; 0- to 15-minute timer; and separate manual switch.
- a. Ventilating system capacity to change air in dry equipment chamber every two minutes.
5. Heater: Electric, 1.5 kW minimum, with fan and thermostat control.
 6. High-Water Audio Alarm: Horn for audio indication of station high-water level, energized by separate level-detecting device. Include alarm silencer switch and relay in station.
 7. Remote Alarm Circuit: Include contacts for connection to remote alarm panel.
- F. Motors
1. General requirements for motors are specified in Division 22 Section "Common Motor Requirements For Plumbing Equipment".
- G. Miscellaneous Materials
1. Structural Steel: ASTM A 6/A 6M, W or HP shapes, or ASTM A 36/A 36M, plates or beams.
 2. Grout: ASTM C 1107, Grade B, nonshrink cement grout.
 - a. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
 3. Concrete: Concrete is specified in Division 03 Section "Cast-in-place Concrete".
- H. Packaged Sewage Pumping Station Fabrication
1. Fabricate shell from structural-steel plate with continuous welds to make watertight and gastight construction.
 - a. Walls: 1/4-inch (6.4-mm) minimum thickness.
 - b. Top and Bottom Heads: 3/8-inch (9.5-mm) minimum thickness. Weld reinforcing steel to top and bottom heads.
 - c. Entrance-Tube Walls: 1/4-inch (6.4-mm) minimum thickness.
 - d. Weld steel access ladder and air vent to shell and entrance tube, **as directed**.
 - e. Apply three coats of epoxy resin to interior and exterior surfaces.
 - f. Include at least two **OR** four, **as directed**, exterior magnesium anode(s) for cathodic protection.
 2. Fabricate shell from fiberglass with structural-steel reinforcement.
 - a. Attach structural-steel reinforcement to top and bottom heads.
 - b. Fabricate shell with continuous joints to make watertight and gastight construction.
 - c. Attach air vent to pump chamber and entrance tube, **as directed**.
 - d. Ladder: Steel **OR** Fiberglass, **as directed**.
 3. Install sump, 18 inches (450 mm) in diameter by 10 inches (254 mm) deep in dry-chamber floor. Slope floor toward sump and fasten rubber mat to floor walkway with cement.
 4. Entrance tube may be furnished separately for field installation.
 5. Entrance Cover: Waterproof and corrosion resistant, with lock. Include way to open cover from inside tube if cover is locked.
 6. Air Vent: Duct fabricated from corrosion-resistant material, extended to above grade, outlet turned down, and with insect screen in outlet.
 7. Factory fabricate piping between unit components.
 - a. Use galvanized-steel pipe and cast-iron fittings or ductile-iron pipe and fittings.
 - b. Use fittings for changes in direction and branch connections.
 - c. Flanged and union joints may be used instead of joints specified.
 - d. Use dielectric fittings for connections between ferrous- and copper-alloy piping.
 8. Piping Connections: Unless otherwise indicated, make the following piping connections:
 - a. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment having NPS 2 (DN 50) or smaller threaded pipe connection.
 - b. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment having flanged pipe connection.
 9. Valves: Ferrous alloy.
 - a. Sewage Pump Piping: Include gate valve on each pump inlet and gate and check valves on each discharge pipe.
 - b. Sump Pump Piping: Include ball or gate and check valves on discharge pipe.



- c. Compressed-Air Piping: Include ball and check valves on discharge pipe from each air compressor.
 - d. Vacuum Piping: Include ball and check valves on inlet pipe to each vacuum pump.
10. Wiring: Tin-coated copper.
- I. Source Quality Control
- 1. Test and inspect sewage and sump, **as directed**, pumps according to HI 1.6, "Centrifugal Pump Tests." Include test recordings that substantiate correct performance of pumps at design head, capacity, suction lift, speed, and horsepower.
 - 2. Test accessories and controls through complete cycle. Include test recordings that substantiate correct performance.

1.3 EXECUTION

A. Earthwork

- 1. Excavation, trenching, and backfilling are specified in Division 31 Section "Earth Moving".

B. Installation

- 1. Install packaged sewage pumping station components where indicated, according to specific equipment and piping arrangement indicated.
- 2. Shell Base Supports: Form from structural-steel beams, of number and lengths required to support bottom of shell and to anchor beams to concrete foundation.
 - a. Use elevator blocks attached to bottom of shell to slope station floor 1 inch in 10 feet (25.4 mm in 3 m) down toward sump.
- 3. Grout under and around shell. Ensure that there are no voids between foundation slab and underslab of pumping station.
- 4. Fill voids between shell sidewalls, sleeves, and piping and make watertight seal with grout.
- 5. Connect anode conductors to grounding lugs on steel housing.
- 6. Join separate sections of housing by field welding.
- 7. Field weld entrance tube to housing.

C. Connections

- 1. Sanitary sewer piping installation requirements are specified in Division 22 Section "Facility Sanitary Sewers". Drawings indicate general arrangement of piping.
- 2. Install piping adjacent to machine to allow service and maintenance.
- 3. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
- 4. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

D. Identification

- 1. Install identifying labels permanently attached to equipment.
- 2. Install operating instruction signs permanently attached to equipment or on pumping station wall near equipment.
- 3. Arrange for installing green warning tape or detectable warning tape over outside edges of underground packaged sewage pumping stations. Tape materials and their installation are specified in Division 31 Section "Earth Moving".

E. Painting

- 1. Prepare and paint ferrous piping in wet wells, structural-steel supports, and anchor devices with coal-tar epoxy-polyamide paint according to SSPC-Paint 16.
- 2. Paint field-welded areas to match factory coating.

F. Field Quality Control



1. Testing Agency: Engage a qualified testing agency to perform field tests and inspections and prepare test reports.
2. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.. Report results in writing.
3. Perform tests and inspections and prepare test reports.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
4. Tests and Inspections:
 - a. After installing packaged sewage pumping stations and after electrical circuitry has been energized, test for compliance with requirements. Furnish water required for pump tests.
 - b. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
 - c. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - d. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
5. Remove and replace packaged sewage pumping stations that do not pass tests and inspections and retest as specified above.

G. Startup Service

1. Engage a factory-authorized service representative to perform startup service.
 - a. Complete installation and startup checks according to manufacturer's written instructions.
 - b. Adjust pump, accessory, and control settings, and safety and alarm devices.

H. Demonstration

1. Engage a factory-authorized service representative to train the Owner's maintenance personnel to adjust, operate, and maintain packaged sewage pumping stations.

END OF SECTION 22 13 29 13



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SECTION 22 13 29 13a - LIFT STATION

1.1 GENERAL

A. Description Of Work

1. This Specification covers the furnishing and installation of sewage lift stations. Work includes but is not limited to earthwork, installation of watertight precast concrete sump basin, basin access cover, submersible sewage pumps, pump guide rail system, pump control system, valves and piping and electrical connections as required. Specific sizes of basins, pumps, and piping shall be as follows or as directed by the Owner.

B. Submittals

1. Product Data: For each type of product indicated.
 - a. Pipe and fittings
 - b. Check valves
 - c. Gate valves
 - d. Submersible sewage grinder pumps
 - e. Pump motor
 - f. Flexible flanged coupling
2. Operation and Maintenance Data: Include pumps, alarms, and motors. Data for submersible sewage grinder pump station data shall include all information on all equipment, alarm panel and controls, pumps and pump performance curves, and station layout.

C. Delivery, Storage, and Handling of Materials

1. Delivery and Storage: Inspect materials delivered to site for damage. Unload and store with minimum handling. Store materials in enclosures or under protective covering. Store rubber gaskets not to be installed immediately under cover, out of direct sunlight. Do not store materials directly on the ground. Keep interior of pipes and fittings free of dirt and debris.
2. Handling: Handle pipe, fittings, valves, and other accessories in such manner as to ensure delivery to the trench in sound, undamaged condition. Avoid injury to coatings and linings on pipe and fittings; make satisfactory repairs if coatings or linings are damaged. Carry pipe to the trench; do not drag it.

1.2 PRODUCTS

A. Precast Concrete Sump Basin(s)

1. Precast Concrete Sump Basin shall be constructed in conformance with Division 26 Section "Underground Ducts And Raceways For Electrical Systems". Basin shall have an integral bottom base section.
2. Joint Sealant: Seal all joints with EZ Stik Butyl Gasket as manufactured by Concrete Products Supply Co., or approved equal. Install in accordance with manufacturer's recommendations.
3. Pipe Opening Seals.
4. Waterproofing: Waterproof interior of concrete sump with one coat of Koppers Coal Tar Bitumastic Black or approved equal. Repair all damaged coating before final backfill. Do not coat cover of basin.
5. Access Hatch - Aluminum Hinged Frame and Cover Model EC-3HD by Syracuse Castings, Cicero, NY (315) 699-2601, or approved equal. Frame and cover shall be heavy duty, rated for H-20 Loadings. Frame shall be angle style frame. Material shall be 6061-T6 aluminum for bars, angles and extrusions. 1/4" diamond plate shall be 5086 aluminum. Unit designed heavy duty, for H-20 wheel loads where not subject to high density traffic. Unit supplied with a heavy duty pneu-spring, for ease of operation when opening cover. Each hatch shall be equipped with a hold open arm. Door shall lock open in the 90 degree position. Hinges shall be of heavy duty design. Material shall be a brass alloy with a 65,000 psi tensile strength. Each hinge shall have



a Grade 316 Stainless Steel, 3/8" diameter hinge pin. Exterior of frame, which comes in contact with concrete shall have one coat black bituminous paint. Unit supplied with a recessed stainless steel slamlock. Angle frame must be completely encased in concrete. Both bearing plates must be fully supported by a bed of concrete.

6. The unit shall be supplied with aluminum safety grate. Safety Grate shall be made of 6061-T6 aluminum with a minimum ultimate strength of 38,000 psi and a minimum yield strength of 35,000 psi as per ASTM B221. Grate design shall use safety factors as defined in the "Specifications for Aluminum Structures", by the Aluminum Association, Inc., 5th edition, DEC. 1986 for "Bridge Type Structures."
 - a. Grating shall be designed to withstand a minimum live load of 300 pounds per square foot. Deflection shall not exceed 1/150th of the span.
 - b. Grate openings shall be 4" x 4", which will allow for visual inspection of the pit once the access hatch is open.
 - c. Each grate shall be provided with a stainless steel, safety check chain. Chain will prevent the grating from falling into the pit.
 - d. Welding shall be in accordance with ANSI/AWS D1.2 "Structural Welding Code for Aluminum."

B. Submersible Sewage Pump System

1. Submersible sewage effluent pumps shall be sized as directed by the Owner and specified herein. Pump shall be heavy duty cast iron with stainless steel fasteners. The impeller shall be semi-open, non-clog, engineered plastic capable of passing 3/4" solids. Pump motor shall be oil filled. Pumps shall be equal to SHEF Series as manufactured by Hydromatic or approved equal. Specific pump performance data shall conform to the following:

1/2 HP Pumps 230 volt/single phase/60 Hz/2" NPT/ 3450 rpm

40 gpm @ 42 ft.	TDH
50 gpm @ 32 ft.	TDH
60 gpm @ 18 ft.	TDH

1 HP Pumps 230 volt/single phase/60 Hz/2" NPT/3450 rpm

20 gpm @ 80 ft.	TDH
30 gpm @ 76 ft.	TDH
40 gpm @ 71 ft.	TDH
50 gpm @ 65 ft.	TDH

C. Duplex Guide Rail System: Complete package system shall be as manufactured by Moran Manufacturing Inc., or approved equal, as follows.

1. The guide rail assembly shall be constructed of Type 304 stainless steel and shall consist of a minimum of two rails, a bottom base plate, a minimum of one cross brace every 18 inches between the rails and a wall brace, all welded together to provide the maximum structural integrity. The rails shall be round to provide a non-binding surface during installation and removal of the pump. The guide rail assembly shall be installed as a one piece unit and shall be bolted with stainless anchor bolts to the basin bottom and the basin wall a minimum of two places each.
2. The pump bracket assembly shall consist of a top bracket and a bottom bracket. The brackets shall be fabricated of 1/4" steel material and shall be painted with coal tar epoxy paint at such rate as to provide a minimum 10 mil thickness. The top bracket shall be attached to the discharge piping above the pump disconnect and shall be constructed in such a manner that pump cannot be removed from the guide rail assembly except when removing pump out the top of the sump basin. The bottom bracket shall be attached to the pump at the discharge connection and shall guide the pump along the guide rail assembly to ensure proper alignment of the pump.



3. A 3/16" min. (7 x 9) stainless steel lifting cable, 10 ft. longer than the sump depth, shall be furnished for lifting and lowering the pump in the sump basin. The stainless steel lifting cable shall be of the 18-8 type 302/304 stainless steel and shall have minimum nominal breaking strength of 15 times the weight of the pump. It shall be substantially attached to the top of the pump and shall have a formed loop at the other end.
4. The discharge piping shall include a cast iron ball check valve, with a natural rubber ball and clean out port with plug for easy access, a brass quick disconnect fitting, with an O-ring stem brass gate valve, per pump. All other piping shall be schedule 40 stainless steel.
5. The station shall have a gate valve extension handle per valve which will allow the gate valve to be operated from a maximum of 6" below the basin cover. The handle shall be constructed of a minimum of 3/8" dia. Type 304 stainless steel. The handle shall be held in place by being attached to the gate valve and by the guide rail wall brace.
6. All internal metal parts that are not brass, galvanized steel, or stainless steel shall be painted with coal-tar epoxy paint to resist corrosion, unless otherwise noted.
7. Mercury level control switches shall be provided for lead pump on, lag pump on and high level alarm, pumps off and low level alarm.
8. The mercury switch shall be encapsulated in polyurethane foam for corrosion and shock resistance. Level switches shall be weighted to hold position in the sump. The cord connecting the control shall be No. 16-2, rated for 13 amps, and shall be type C-SJO. To ensure optimum longevity, mercury contacts shall be of the mercury-to-mercury type and encapsulated in a glass tube and shall be rated for 20 amps at 115 VAC.
9. The manufacturer of the lift station shall furnish a limited warranty for 18 months from the date of shipment or 12 months from start-up (whichever occurs first), that all equipment shall be free from defects in design, materials and workmanship. The lift station manufacturer shall furnish replacement parts for any component proven defective whether of its or other manufacturer during the warranty period, excepting only those items which are normally consumed in service, such as (but not limited to) light bulbs, oil, grease, packing, etc.
10. Installation instructions shall be furnished with the station.

D. Control System

1. This system shall be controlled and protected by a packaged system as manufactured by Rombus, or approved equal. The control shall provide automatic start, stop and alternation of 2 pumps, and shall provide an audible alarm as well as visual indication of high level conditions.
2. The control panel shall be pre-wired in a NEMA 3R weatherproof enclosure, and all necessary components including the following: single phase lightning arrester for protection of the pumps, NEMA rated contractor and thermal magnetic circuit breaker for each pump, a main control/alarm circuit fused disconnect switch, separately fused control and alarm circuits, panel mounted duplex alternating relays, control relays, and terminal blocks for the connection on all external wiring. Provide a 20 amp/115v convenience outlet in each panel on its own GFCI circuit breaker. Multi-colored circuitry is to be used within the control panel to facilitate trouble shooting.
3. Mounted inside the enclosure shall be hand-off-auto switches and run pilot lights for each pump circuit; normal-off-test switch and alarm pilot light for high level alarm; float test toggle switches for each float to override floats to simulate operation; non-resettable elapsed time meters for each pump.
4. Mounted remotely from the Control Panel shall be a 4" 120V alarm bell and a flashing alarm light.

E. System Operation: As the level in the sump rises to the lead pump on level, the pump selected as lead by the alternator will come on line, and will pump the level down to the pump off level. The pump will then turn off, and the alternator will cycle, selecting the other pump as lead for the next cycle. If, with the lead pump running, the level in the tank continues to rise to the lag pump on level, the lag pump will come on line, alarms will sound, and will run with the lead pump until the pumps off level has been reached. The pumps will then be turned off, and the alternator will cycle. If level continues to drop to the low level alarm float, alarm circuits will be activated.

1. Placing the T-O-N switch into the off position will de-energize the alarm bell and flashing light, but the alarm pilot light will remain illuminated until the alarm condition has been cleared. When the



alarm pilot light is extinguished, the T-O-N switch may be reset to the normal position, and the alarm will stand ready for the next alarm.

1.3 EXECUTION

- A. The Contractor shall excavate the station site to the elevations as required to meet project requirements. Compact the subgrade and install crushed stone.
- B. Install lift station in accordance with manufacturer's recommendations. Perform additional exterior waterproofing as required to repair original coating and to achieve a watertight sump basin. The discharge piping shall be extended and connected to the sewage force mains. Backfill material shall be approved by the Owner. No backfill material shall have any dimension greater than 6". Backfill material within 15" of basin shall not have a dimension greater than 2".
- C. The Lift Station control panel shall be mounted to the building nearby and shall have sufficient cord supplied by the Lift Station manufacturer to avoid any splices. All necessary electrical connections between pumps, flow controls and control panel shall be made in accordance with manufacturer's recommendations. No splices shall be made in the basin. Lightning protection shall be provided in the panel.
- D. Install pump power conductors in rigid steel conduit between Lift Station and Control Panel.
- E. Upon completion, the Lift Station shall be tested to assure there is no leakage and that the pumps, controls and alarm are operating satisfactorily. The Lift Station manufacturer's representative shall be present during initial start up and testing. Three (3) Lift Station operation and maintenance manuals shall be provided.

END OF SECTION 22 13 29 13a



SECTION 22 13 29 13b - SEWAGE PUMPS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for sewage pumps. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Submersible effluent pumps.
 - b. Submersible sewage pumps.
 - c. Wet-pit-volute sewage pumps.
 - d. Sewage-pump, reverse-flow assemblies.
 - e. Sewage-pump basins and basin covers.
 - f. Progressing-cavity sewage pumps.
 - g. Packaged, submersible sewage-pump units.
 - h. Packaged wastewater-pump units.

C. Submittals

1. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Wiring Diagrams: For power, signal, and control wiring.
3. Operation and Maintenance Data: For pumps and controls, to include in operation and maintenance manuals.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. UL Compliance: Comply with UL 778 for motor-operated water pumps.

E. Delivery, Storage, And Handling

1. Retain shipping flange protective covers and protective coatings during storage.
2. Protect bearings and couplings against damage.
3. Comply with pump manufacturer's written rigging instructions for handling.

F. Coordination

1. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.2 PRODUCTS

A. Submersible Effluent Pumps

1. Submersible, Fixed-Position, Single-Seal Effluent Pumps:
 - a. Description: Factory-assembled and -tested effluent-pump unit.
 - b. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal effluent pump as defined in HI 1.1-1.2 and HI 1.3.
 - c. Pump Casing: Cast iron, with open inlet, legs that elevate pump to permit flow into impeller, and vertical discharge for piping connection.
 - d. Impeller: Statically and dynamically balanced, ASTM A 48/A 48M, Class No. 25 A cast iron **OR** ASTM A 532/A 532M, abrasion-resistant cast iron **OR** ASTM B 584, cast bronze, **as**



- directed**, and stainless steel, **as directed**, closed or semiopen design for clear wastewater, and keyed and secured to shaft.
- e. Pump and Motor Shaft: Stainless steel **OR** steel, **as directed**, with factory-sealed, grease-lubricated ball bearings.
 - f. Seal: Mechanical.
 - g. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.
 - 1) Motor Housing Fluid: Air **OR** Oil, **as directed**.
 - h. Controls (rod-and-float type):
 - 1) Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**.
 - 2) Switch Type: Pedestal-mounted float switch with float rods and rod buttons.
 - 3) Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - 4) Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches (1500 mm).
 - 5) High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
 - i. Controls (float- and pressure-switch types):
 - 1) Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**; pedestal-mounted **OR** wall-mounted, **as directed**.
 - 2) Switch Type: Mechanical-float **OR** Mercury-float **OR** Pressure, **as directed**, type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
 - 3) Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - 4) High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float, mercury-float, or pressure switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
 - j. Control-Interface Features:
 - 1) Remote Alarm Contacts: For remote alarm interface.
 - 2) Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:
 - a) On-off status of pump.
 - b) Alarm status.
2. Submersible, Fixed-Position, Double-Seal Effluent Pumps:
- a. Description: Factory-assembled and -tested effluent-pump unit.
 - b. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal effluent pump as defined in HI 1.1-1.2 and HI 1.3.
 - c. Pump Casing: Cast iron, with open inlet, legs that elevate pump to permit flow into impeller, and vertical discharge for piping connection.
 - d. Impeller: Statically and dynamically balanced, ASTM A 48/A 48M, Class No. 25 A cast iron **OR** ASTM A 532/A 532M, abrasion-resistant cast iron **OR** ASTM B 584, cast bronze, **as directed**, and stainless steel, **as directed**, closed or semiopen design for clear wastewater, and keyed and secured to shaft.
 - e. Pump and Motor Shaft: Stainless steel **OR** steel, **as directed**, with factory-sealed, grease-lubricated ball bearings.
 - f. Seals: Mechanical.
 - g. Moisture-Sensing Probe: Internal moisture sensor and moisture alarm.
 - h. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.
 - 1) Motor Housing Fluid: Air **OR** Oil, **as directed**.
 - i. Controls (rod-and-float type):
 - 1) Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**.
 - 2) Switch Type: Pedestal-mounted float switch with float rods and rod buttons.



- 3) Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
- 4) Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches (1500 mm).
- 5) High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
- j. Controls (float- and pressure-switch types):
 - 1) Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**; pedestal-mounted **OR** wall-mounted, **as directed**.
 - 2) Switch Type: Mechanical-float **OR** Mercury-float **OR** Pressure, **as directed**, type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
 - 3) Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - 4) High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float, mercury-float, or pressure switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
- k. Control-Interface Features:
 - 1) Remote Alarm Contacts: For remote alarm interface.
 - 2) Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:
 - a) On-off status of pump.
 - b) Alarm status.
3. Submersible, Quick-Disconnect, Single-Seal Effluent Pumps:
 - a. Description: Factory-assembled and -tested effluent-pump unit with guide-rail supports.
 - b. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal effluent pump as defined in HI 1.1-1.2 and HI 1.3.
 - c. Pump Casing: Cast iron, with open inlet, and discharge fittings for connection to guide-rail support.
 - d. Impeller: Statically and dynamically balanced, ASTM A 48/A 48M, Class No. 25 A cast iron **OR** ASTM A 532/A 532M, abrasion-resistant cast iron **OR** ASTM B 584, cast bronze, **as directed**, and stainless steel, **as directed**, closed or semiopen design for clear wastewater, and keyed and secured to shaft.
 - e. Pump and Motor Shaft: Stainless steel **OR** steel, **as directed**, with factory-sealed, grease-lubricated ball bearings.
 - f. Seal: Mechanical.
 - g. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.
 - 1) Motor Housing Fluid: Air **OR** Oil, **as directed**.
 - h. Controls (rod-and-float type):
 - 1) Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**.
 - 2) Switch Type: Pedestal-mounted float switch with float rods and rod buttons.
 - 3) Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - 4) Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches (1500 mm).
 - 5) High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
 - i. Controls (float- and pressure-switch types):
 - 1) Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**; pedestal-mounted **OR** wall-mounted, **as directed**.
 - 2) Switch Type: Mechanical-float **OR** Mercury-float **OR** Pressure, **as directed**, type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
 - 3) Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.



- 4) High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float, mercury-float, or pressure switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
- j. Control-Interface Features:
 - 1) Remote Alarm Contacts: For remote alarm interface.
 - 2) Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:
 - a) On-off status of pump.
 - b) Alarm status.
- k. Guide-Rail Supports:
 - 1) Standard: SWPA's "Submersible Sewage Pumping Systems (SWPA) Handbook."
 - 2) Guide Rails: Vertical pipes or structural members, made of galvanized steel or other corrosion-resistant metal, attached to baseplate and basin sidewall or cover.
 - 3) Baseplate: Corrosion-resistant metal plate, attached to basin floor, supporting guide rails and stationary elbow.
 - 4) Pump Yoke: Motor-mounted or casing-mounted yokes or other attachments for aligning pump during connection of flanges.
 - 5) Movable Elbow: Pump discharge-elbow fitting with flange, seal, and positioning device.
 - 6) Stationary Elbow: Fixed discharge-elbow fitting with flange that mates to movable-elbow flange and support attached to baseplate.
 - 7) Lifting Cable: Stainless steel; attached to pump and cover at manhole.
4. Submersible, Quick-Disconnect, Double-Seal Effluent Pumps:
 - a. Description: Factory-assembled and -tested effluent-pump unit with guide-rail supports.
 - b. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal effluent pump as defined in HI 1.1-1.2 and HI 1.3.
 - c. Pump Casing: Cast iron, with open inlet, and discharge fittings for connection to guide-rail support.
 - d. Impeller: Statically and dynamically balanced, ASTM A 48/A 48M, Class No. 25 A cast iron **OR** ASTM A 532/A 532M, abrasion-resistant cast iron **OR** ASTM B 584, cast bronze, **as directed**, and stainless steel, **as directed**, closed or semiopen design for clear wastewater, and keyed and secured to shaft.
 - e. Pump and Motor Shaft: Stainless steel **OR** steel, **as directed**, with factory-sealed, grease-lubricated ball bearings.
 - f. Seals: Mechanical.
 - g. Moisture-Sensing Probe: Internal moisture sensor and moisture alarm.
 - h. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.
 - 1) Motor Housing Fluid: Air **OR** Oil, **as directed**.
 - i. Controls (rod-and-float type):
 - 1) Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**.
 - 2) Switch Type: Pedestal-mounted float switch with float rods and rod buttons.
 - 3) Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - 4) Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches (1500 mm).
 - 5) High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
 - j. Controls (float- and pressure-switch types):
 - 1) Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**; pedestal-mounted **OR** wall-mounted, **as directed**.
 - 2) Switch Type: Mechanical-float **OR** Mercury-float **OR** Pressure, **as directed**, type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.



- 3) Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - 4) High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float, mercury-float, or pressure switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
 - k. Control-Interface Features:
 - 1) Remote Alarm Contacts: For remote alarm interface.
 - 2) Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:
 - a) On-off status of pump.
 - b) Alarm status.
 - l. Guide-Rail Supports:
 - 1) Standard: SWPA's "Submersible Sewage Pumping Systems (SWPA) Handbook."
 - 2) Guide Rails: Vertical pipes or structural members, made of galvanized steel or other corrosion-resistant metal, attached to baseplate and basin sidewall or cover.
 - 3) Baseplate: Corrosion-resistant metal plate, attached to basin floor, supporting guide rails and stationary elbow.
 - 4) Pump Yoke: Motor-mounted or casing-mounted yokes or other attachments for aligning pump during connection of flanges.
 - 5) Movable Elbow: Pump discharge-elbow fitting with flange, seal, and positioning device.
 - 6) Stationary Elbow: Fixed discharge-elbow fitting with flange that mates to movable-elbow flange and support attached to baseplate.
 - 7) Lifting Cable: Stainless steel; attached to pump and cover at manhole.
- B. Submersible Sewage Pumps
1. Submersible, Fixed-Position, Single-Seal Sewage Pumps:
 - a. Description: Factory-assembled and -tested sewage-pump unit.
 - b. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal sewage pump as defined in HI 1.1-1.2 and HI 1.3.
 - c. Pump Casing: Cast iron, with open inlet, legs that elevate pump to permit flow into impeller, and vertical discharge for piping connection.
 - d. Impeller: Statically and dynamically balanced, ASTM A 48/A 48M, Class No. 25 A cast iron **OR** ASTM A 532/A 532M, abrasion-resistant cast iron **OR** ASTM B 584, cast bronze, **as directed**, and stainless steel, **as directed**, nonclog, open, or semiopen design for solids handling, and keyed and secured to shaft.
 - e. Pump and Motor Shaft: Stainless steel **OR** steel, **as directed**, with factory-sealed, grease-lubricated ball bearings.
 - f. Seal: Mechanical.
 - g. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.
 - 1) Motor Housing Fluid: Air **OR** Oil, **as directed**.
 - h. Controls (rod-and-float type):
 - 1) Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**.
 - 2) Switch Type: Pedestal-mounted float switch with float rods and rod buttons.
 - 3) Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - 4) Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches (1500 mm).
 - 5) High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
 - i. Controls (float- and pressure-switch types):
 - 1) Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**; pedestal-mounted **OR** wall-mounted, **as directed**.



- 2) Switch Type: Mechanical-float **OR** Mercury-float **OR** Pressure, **as directed**, type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
- 3) Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
- 4) High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float, mercury-float, or pressure switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
- j. Control-Interface Features:
 - 1) Remote Alarm Contacts: For remote alarm interface.
 - 2) Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:
 - a) On-off status of pump.
 - b) Alarm status.
2. Submersible, Fixed-Position, Double-Seal Sewage Pumps:
 - a. Description: Factory-assembled and -tested sewage-pump unit.
 - b. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal sewage pump as defined in HI 1.1-1.2 and HI 1.3.
 - c. Pump Casing: Cast iron, with open inlet, legs that elevate pump to permit flow into impeller, and vertical discharge for piping connection.
 - d. Impeller: Statically and dynamically balanced, ASTM A 48/A 48M, Class No. 25 A cast iron **OR** ASTM A 532/A 532M, abrasion-resistant cast iron **OR** ASTM B 584, cast bronze, **as directed**, and stainless steel, **as directed**, nonclog, open, or semiopen design for solids handling, and keyed and secured to shaft.
 - e. Pump and Motor Shaft: Stainless steel **OR** steel, **as directed**, with factory-sealed, grease-lubricated ball bearings.
 - f. Seals: Mechanical.
 - g. Moisture-Sensing Probe: Internal moisture sensor and moisture alarm.
 - h. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.
 - 1) Motor Housing Fluid: Air **OR** Oil, **as directed**.
 - i. Controls (rod-and-float type):
 - 1) Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**.
 - 2) Switch Type: Pedestal-mounted float switch with float rods and rod buttons.
 - 3) Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - 4) Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches (1500 mm).
 - 5) High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
 - j. Controls (float- and pressure-switch types):
 - 1) Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**; pedestal-mounted **OR** wall-mounted, **as directed**.
 - 2) Switch Type: Mechanical-float **OR** Mercury-float **OR** Pressure, **as directed**, type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
 - 3) Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - 4) High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float, mercury-float, or pressure switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
 - k. Control-Interface Features:
 - 1) Remote Alarm Contacts: For remote alarm interface.
 - 2) Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:
 - a) On-off status of pump.



- b) Alarm status.
3. Submersible, Quick-Disconnect, Single-Seal Sewage Pumps:
- a. Description: Factory-assembled and -tested sewage-pump unit with guide-rail supports.
 - b. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal sewage pump as defined in HI 1.1-1.2 and HI 1.3.
 - c. Pump Casing: Cast iron, with open inlet, and discharge fittings for connection to guide-rail support.
 - d. Impeller: Statically and dynamically balanced, ASTM A 48/A 48M, Class No. 25 A cast iron **OR** ASTM A 532/A 532M, abrasion-resistant cast iron **OR** ASTM B 584, cast bronze, **as directed**, and stainless steel, **as directed**, nonclog, open, or semiopen design for solids handling, and keyed and secured to shaft.
 - e. Pump and Motor Shaft: Stainless steel **OR** steel, **as directed**, with factory-sealed, grease-lubricated ball bearings.
 - f. Seal: Mechanical.
 - g. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.
 - 1) Motor Housing Fluid: Air **OR** Oil, **as directed**.
 - h. Controls (rod-and-float type):
 - 1) Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**.
 - 2) Switch Type: Pedestal-mounted float switch with float rods and rod buttons.
 - 3) Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - 4) Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches (1500 mm).
 - 5) High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
 - i. Controls (float- and pressure-switch types):
 - 1) Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**; pedestal-mounted **OR** wall-mounted, **as directed**.
 - 2) Switch Type: Mechanical-float **OR** Mercury-float **OR** Pressure, **as directed**, type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
 - 3) Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - 4) High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float, mercury-float, or pressure switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
 - j. Control-Interface Features:
 - 1) Remote Alarm Contacts: For remote alarm interface.
 - 2) Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:
 - a) On-off status of pump.
 - b) Alarm status.
 - k. Guide-Rail Supports:
 - 1) Standard: SWPA's "Submersible Sewage Pumping Systems (SWPA) Handbook."
 - 2) Guide Rails: Vertical pipes or structural members, made of galvanized steel or other corrosion-resistant metal, attached to baseplate and basin sidewall or cover.
 - 3) Baseplate: Corrosion-resistant metal plate, attached to basin floor, supporting guide rails and stationary elbow.
 - 4) Pump Yoke: Motor-mounted or casing-mounted yokes or other attachments for aligning pump during connection of flanges.
 - 5) Movable Elbow: Pump discharge-elbow fitting with flange, seal, and positioning device.
 - 6) Stationary Elbow: Fixed discharge-elbow fitting with flange that mates to movable-elbow flange and support attached to baseplate.
 - 7) Lifting Cable: Stainless steel; attached to pump and cover at manhole.



4. Submersible, Quick-Disconnect, Double-Seal Sewage Pumps:
 - a. Description: Factory-assembled and -tested sewage-pump unit with guide-rail supports.
 - b. Pump type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal sewage pump as defined in HI 1.1-1.2 and HI 1.3.
 - c. Pump Casing: Cast iron, with open inlet, and discharge fittings for connection to guide-rail support.
 - d. Impeller: Statically and dynamically balanced, ASTM A 48/A 48M, Class No. 25 A cast iron **OR** ASTM A 532/A 532M, abrasion-resistant cast iron **OR** ASTM B 584, cast bronze, **as directed**, and stainless steel, **as directed**, nonclog, open, or semiopen design for solids handling, and keyed and secured to shaft.
 - e. Pump and Motor Shaft: Stainless steel **OR** steel, **as directed**, with factory-sealed, grease-lubricated ball bearings.
 - f. Seals: Mechanical.
 - g. Moisture-Sensing Probe: Internal moisture sensor and moisture alarm.
 - h. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.
 - 1) Motor Housing Fluid: Air **OR** Oil, **as directed**.
 - i. Controls (rod-and-float type):
 - 1) Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**.
 - 2) Switch Type: Pedestal-mounted float switch with float rods and rod buttons.
 - 3) Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - 4) Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches (1500 mm).
 - 5) High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
 - j. Controls (float- and pressure-switch types):
 - 1) Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**; pedestal-mounted **OR** wall-mounted, **as directed**.
 - 2) Switch Type: Mechanical-float **OR** Mercury-float **OR** Pressure, **as directed**, type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
 - 3) Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - 4) High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float, mercury-float, or pressure switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
 - k. Control-Interface Features:
 - 1) Remote Alarm Contacts: For remote alarm interface.
 - 2) Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:
 - a) On-off status of pump.
 - b) Alarm status.
 - l. Guide-Rail Supports:
 - 1) Standard: SWPA's "Submersible Sewage Pumping Systems (SWPA) Handbook."
 - 2) Guide Rails: Vertical pipes or structural members, made of galvanized steel or other corrosion-resistant metal, attached to baseplate and basin sidewall or cover.
 - 3) Baseplate: Corrosion-resistant metal plate, attached to basin floor, supporting guide rails and stationary elbow.
 - 4) Pump Yoke: Motor-mounted or casing-mounted yokes or other attachments for aligning pump during connection of flanges.
 - 5) Movable Elbow: Pump discharge-elbow fitting with flange, seal, and positioning device.
 - 6) Stationary Elbow: Fixed discharge-elbow fitting with flange that mates to movable-elbow flange and support attached to baseplate.



- 7) Lifting Cable: Stainless steel; attached to pump and cover at manhole.
5. Submersible, Quick-Disconnect, Grinder Sewage Pumps:
- a. Description: Factory-assembled and -tested, grinder sewage-pump unit with guide-rail supports.
 - b. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal sewage pump as defined in HI 1.1-1.2 and HI 1.3.
 - c. Pump Casing: Cast iron, with open inlet, and discharge fittings for connection to guide-rail supports.
 - d. Impeller: Bronze or stainless steel; statically and dynamically balanced, with stainless-steel cutter, grinder, or slicer assembly; capable of handling solids; and keyed and secured to shaft.
 - e. Pump and Motor Shaft: Stainless steel **OR** steel, **as directed**, with factory-sealed, grease-lubricated ball bearings.
 - f. Seal: Mechanical.
 - g. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.
 - 1) Motor Housing Fluid: Air **OR** Oil, **as directed**.
 - h. Controls (rod-and-float type):
 - 1) Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**.
 - 2) Switch Type: Pedestal-mounted float switch with float rods and rod buttons.
 - 3) Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - 4) Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches (1500 mm).
 - 5) High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
 - i. Controls (float- and pressure-switch types):
 - 1) Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**; pedestal-mounted **OR** wall-mounted, **as directed**.
 - 2) Switch Type: Mechanical-float **OR** Mercury-float **OR** Pressure, **as directed**, type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
 - 3) Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - 4) High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float, mercury-float, or pressure switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
 - j. Control-Interface Features:
 - 1) Remote Alarm Contacts: For remote alarm interface.
 - 2) Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:
 - a) On-off status of pump.
 - b) Alarm status.
 - k. Guide-Rail Supports:
 - 1) Standard: SWPA's "Submersible Sewage Pumping Systems (SWPA) Handbook."
 - 2) Guide Rails: Vertical pipes or structural members, made of galvanized steel or other corrosion-resistant metal, attached to baseplate and basin sidewall or cover.
 - 3) Baseplate: Corrosion-resistant metal plate, attached to basin floor, supporting guide rails and stationary elbow.
 - 4) Pump Yoke: Motor-mounted or casing-mounted yokes or other attachments for aligning pump during connection of flanges.
 - 5) Movable Elbow: Pump discharge-elbow fitting with flange, seal, and positioning device.
 - 6) Stationary Elbow: Fixed discharge-elbow fitting with flange that mates to movable-elbow flange and support attached to baseplate.
 - 7) Lifting Cable: Stainless steel; attached to pump and cover at manhole.



6. Submersible, Quick-Disconnect, Progressing-Cavity, Grinder Sewage Pumps:
- a. Description: Factory-assembled and -tested progressing-cavity, grinder sewage-pump unit with guide-rail supports.
 - b. Pump Type: Submersible, progressing-cavity, single-screw rotary, grinder sewage pump as defined in HI 3.1-3.5.
 - c. Pump Body: Cast iron.
 - d. Pump Bearings: Radial and thrust types.
 - e. Pump Shaft: Steel.
 - f. Rotor: Stainless steel.
 - g. Stator: Buna-N **OR** Natural rubber, **as directed**.
 - h. Seal: Packing gland and mechanical types.
 - i. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.
 - j. Controls (rod-and-float type):
 - 1) Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**.
 - 2) Switch Type: Pedestal-mounted float switch with float rods and rod buttons.
 - 3) Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - 4) Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches (1500 mm).
 - 5) High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
 - k. Controls (float- and pressure-switch types):
 - 1) Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**; pedestal-mounted **OR** wall-mounted, **as directed**.
 - 2) Switch Type: Mechanical-float **OR** Mercury-float **OR** Pressure, **as directed**, type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
 - 3) Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - 4) High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float, mercury-float, or pressure switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
 - l. Control-Interface Features:
 - 1) Remote Alarm Contacts: For remote alarm interface.
 - 2) Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:
 - a) On-off status of pump.
 - b) Alarm status.
 - m. Guide-Rail Supports:
 - 1) Standard: SWPA's "Submersible Sewage Pumping Systems (SWPA) Handbook."
 - 2) Guide Rails: Vertical pipes or structural members, made of galvanized steel or other corrosion-resistant metal, attached to baseplate and basin sidewall or cover.
 - 3) Baseplate: Corrosion-resistant metal plate, attached to basin floor, supporting guide rails and stationary elbow.
 - 4) Pump Yoke: Motor-mounted or casing-mounted yokes or other attachments for aligning pump during connection of flanges.
 - 5) Movable Elbow: Pump discharge-elbow fitting with flange, seal, and positioning device.
 - 6) Stationary Elbow: Fixed discharge-elbow fitting with flange that mates to movable-elbow flange and support attached to baseplate.
 - 7) Lifting Cable: Stainless steel; attached to pump and cover at manhole.

C. Wet-Pit-Volute Sewage Pumps

1. Description: Factory-assembled and -tested sewage-pump unit.



2. Pump Type: Wet-pit-volute, single-stage, separately-coupled, overhung-impeller, centrifugal sewage pump as defined in HI 1.1-1.2 and HI 1.3.
 3. Pump Casing: Cast iron, with open inlet and threaded or flanged connection for discharge piping.
 4. Pump Shaft: Stainless-steel **OR** steel, **as directed**.
 5. Impeller: Statically and dynamically balanced, ASTM A 48/A 48M, Class No. 25 A cast iron **OR** ASTM A 532/A 532M, abrasion-resistant cast iron **OR** ASTM B 584, cast bronze, **as directed**, nonclog, open, or semiopen design for solids handling, and keyed and secured to shaft.
 6. Sleeve Bearings: Bronze. Include oil-lubricated, intermediate sleeve bearings at 48-inch (1200-mm) maximum intervals if basin depth is more than 48 inches (1200 mm), and grease-lubricated, ball-type thrust bearings.
 7. Pump and Motor Shaft Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.
 8. Pump Discharge Piping: Factory or field fabricated, galvanized, ASTM A 53/A 53M, Schedule 40, steel pipe with ASME B16.1, Class 125, cast-iron flanges and flanged fittings or ASME B16.4, Class 125, gray iron threaded fittings, **as directed**.
 - a. Modify piping configuration to accommodate reverse-flow assembly.
 9. Support Plate: Cast iron or coated steel and strong enough to support pumps, motors, and controls. Refer to Part 1.2 "Sewage-Pump Basins and Basin Covers" Article for requirements.
 10. Shaft Seal: Stuffing box, with graphite-impregnated braided-yarn rings and bronze packing gland.
 11. Motor: Single-speed; grease-lubricated ball bearings and mounted on vertical, cast-iron pedestal.
 12. Controls (rod-and-float type):
 - a. Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**.
 - b. Switch Type: Pedestal-mounted float switch with float rods and rod buttons.
 - c. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - d. Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches (1500 mm).
 - e. High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
 13. Controls (float- and pressure-switch types):
 - a. Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**; pedestal-mounted **OR** wall-mounted, **as directed**.
 - b. Switch Type: Mechanical-float **OR** Mercury-float **OR** Pressure, **as directed**, type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
 - c. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - d. High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float, mercury-float, or pressure switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
 14. Control-Interface Features:
 - a. Remote Alarm Contacts: For remote alarm interface.
 - b. Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:
 - 1) On-off status of pump.
 - 2) Alarm status.
- D. Sewage-Pump, Reverse-Flow Assemblies
1. Description: Factory-fabricated, sewage pump reverse-flow assembly for factory or field assembly and installation in sewage pump basin. Include the following corrosion-resistant-metal components:
 - a. Inlet Fitting: One combination inlet-overflow strainer fitting.
 - b. Valves: Two shutoff valves and two check valves.
 - c. Strainers: Two strainer housings with reverse-flow, self-flushing strainers.
 - d. Pipe and Fittings: Size and configuration required to connect to sewage pumps and piping.

E. Sewage-Pump Basins And Basin Covers



1. Basins: Factory-fabricated, watertight, cylindrical, basin sump with top flange and sidewall openings for pipe connections.
 - a. Material: Cast iron **OR** Fiberglass **OR** Polyethylene, **as directed**.
 - b. Reinforcement: Mounting plates for pumps, fittings, guide-rail supports if used, and accessories.
 - c. Anchor Flange: Same material as or compatible with basin sump, cast in or attached to sump, in location and of size required to anchor basin in concrete slab.
 2. Basin Covers: Fabricate metal cover with openings having gaskets, seals, and bushings; for access to pumps, pump shafts, control rods, discharge piping, vent connections, and power cables.
 - a. Reinforcement: Steel or cast iron, capable of supporting foot traffic for basins installed in foot-traffic areas.
- F. Progressing-Cavity Sewage Pumps
1. Description: Factory-assembled and -tested progressing-cavity, single-screw rotary pump as defined in HI 3.1-3.5.
 2. Pump Body: Cast iron with feet for base or floor installation.
 3. Pump Bearings: Radial and thrust types.
 4. Pump Shaft: Steel.
 5. Rotor: Chrome-plated steel.
 6. Stator: Buna-N **OR** Natural rubber, **as directed**.
 7. Seals: Packing gland and mechanical types.
 8. Coupling: Flexible.
 9. Motor: Single-speed; grease-lubricated ball bearings.
- G. Packaged, Submersible Sewage-Pump Units
1. Packaged, Submersible, Grinder, Sewage-Pump Units:
 - a. Description: Factory-assembled and -tested, automatic-operation, basin-mounted, grinder, sewage-pump unit.
 - b. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller centrifugal pump as defined in HI 1.1-1.2 and HI 1.3.
 - c. Pump Casing: Cast iron.
 - d. Impeller: Stainless-steel grinder, cutter, or slicer type with shredding ring.
 - e. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.
 - f. Control (for simplex pump unit): Manufacturer's standard panel for one pump.
 - g. Controls (for duplex pump unit): Automatic, with mechanical- or mercury-float switches and alternator.
 - h. Pump Discharge Piping: Factory or field fabricated, galvanized, ASTM A 53/A 53M, Schedule 40, steel pipe with ASME B16.4, Class 125, gray iron threaded fittings, **as directed**.
 - i. Basin: Watertight plastic, **as directed**, and of size required for pumps, with inlet pipe connection and gastight cover with pump discharge and vent connections.
 2. Packaged, Submersible, Nonclog, Sewage-Pump Units:
 - a. Description: Factory-assembled and -tested, automatic-operation, basin-mounted, sewage-pump unit.
 - b. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller centrifugal pump as defined in HI 1.1-1.2 and HI 1.3.
 - c. Pump Casing: Cast iron.
 - d. Impeller: Brass or cast iron; statically and dynamically balanced, non-clog design, and capable of handling 2-inch (50-mm) diameter solids.
 - e. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.



- f. Control (for simplex pump units): Manufacturer's standard panel for one pump.
 - g. Controls (for duplex pump unit): Automatic, with mechanical- or mercury-float switches and alternator.
 - h. Pump Discharge Piping: Factory or field fabricated, galvanized, ASTM A 53/A 53M, Schedule 40, steel pipe with ASME B16.4, Class 125, gray iron threaded fittings, **as directed**.
 - i. Basin: Watertight plastic, **as directed**, and of size required for pumps, with inlet pipe connection and gastight cover with pump discharge and vent connections.
- H. Packaged Wastewater-Pump Units
- 1. Packaged, Wet-Pit-Volute, Wastewater-Pump Units:
 - a. Description: Factory-assembled and -tested, automatic-operation, basin-mounted, effluent-pump unit.
 - b. Pump Type: Wet-pit-volute, single-stage, separately-coupled, overhung-impeller centrifugal pump as defined in HI 1.1-1.2 and HI 1.3.
 - c. Pump Body and Impeller: Corrosion-resistant materials.
 - d. Motor: With built-in overload protection and mounted vertically on basin cover.
 - e. Power Cord: Three-conductor, waterproof cable of length required but not less than 72 inches (1830 mm) and with grounding plug and cable-sealing assembly for connection at pump.
 - f. Control: Float switch.
 - g. Pump Discharge Piping: Factory or field fabricated, galvanized, ASTM A 53/A 53M, Schedule 40, steel pipe with ASME B16.4, Class 125, gray iron threaded fittings, **as directed**.
 - h. Basin: Watertight, aluminum, plastic, or coated steel with inlet pipe connection and gastight cover with vent and pump discharge connections.
 - 2. Packaged, Submersible Wastewater-Pump Units:
 - a. Description: Factory-assembled and -tested, automatic-operation, effluent-pump unit with basin.
 - b. Pump Type: Submersible, end-suction, single-stage, overhung-impeller, centrifugal pump as defined in HI 1.1-1.2 and HI 1.3.
 - c. Pump Body and Impeller: Corrosion-resistant materials.
 - d. Pump Seals: Mechanical.
 - e. Motor: Hermetically sealed, capacitor-start type, with built-in overload protection.
 - f. Power Cord: Three-conductor, waterproof cable of length required but not less than 72 inches (1830 mm) and with grounding plug and cable-sealing assembly for connection at pump.
 - g. Control: Float switch.
 - h. Pump Discharge Piping: Factory or field fabricated, galvanized, ASTM A 53/A 53M, Schedule 40, steel pipe with ASME B16.4, Class 125, gray iron threaded fittings, **as directed**.
 - i. Basin: Watertight plastic with inlet pipe connection and gastight cover with vent and pump discharge connections.
- I. Motors
- 1. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 22 Section "Common Motor Requirements For Plumbing Equipment".
 - a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - b. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 22.
 - 2. Motors for submersible pumps shall be hermetically sealed.



1.3 EXECUTION

A. Earthwork

1. Excavation and filling are specified in Division 31 Section "Earth Moving".

B. Examination

1. Examine roughing-in for plumbing piping to verify actual locations of sanitary drainage and vent piping connections before sewage pump installation.

C. Installation

1. Pump Installation Standards:
 - a. Comply with HI 1.4 for installation of centrifugal pumps.
 - b. Comply with HI 3.1-3.5 for installation of progressing-cavity sewage pumps.
2. Equipment Mounting (for equipment supported on slabs-on-grade): Install progressing-cavity sewage pumps on concrete base using elastomeric pads **OR** elastomeric mounts **OR** restrained spring isolators, **as directed**. Comply with requirements for concrete base specified in Division 03 Section "Cast-in-place Concrete".
 - a. Minimum Deflection: 1/4 inch (6 mm) **OR** 1 inch (25 mm), **as directed**.
 - b. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - c. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - d. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - e. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Equipment Mounting: Install progressing-cavity sewage pumps using elastomeric pads **OR** elastomeric mounts **OR** restrained spring isolators, **as directed**. Comply with requirements for vibration isolation devices specified in Division 22 Section "Vibration And Seismic Controls For Plumbing Piping And Equipment".
 - a. Minimum Deflection: 1/4 inch (6 mm) **OR** 1 inch (25 mm), **as directed**.
4. Equipment Mounting: Install progressing-cavity sewage pumps on vibration isolation equipment base. Comply with requirements specified in Division 22 Section "Vibration And Seismic Controls For Plumbing Piping And Equipment".
5. Wiring Method (for pumps with wall-mounted controls): Comply with requirements in Division 26 Section "Low-voltage Electrical Power Conductors And Cables".
6. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

D. Connections

1. Comply with requirements for piping specified in Division 22 Section "Sanitary Waste And Vent Piping". Drawings indicate general arrangement of piping, fittings, and specialties.
2. Install piping adjacent to equipment to allow service and maintenance.

E. Field Quality Control

1. Perform tests and inspections.
2. Tests and Inspections:
 - a. Perform each visual and mechanical inspection.
 - b. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - c. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - d. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Pumps and controls will be considered defective if they do not pass tests and inspections.



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4. Prepare test and inspection reports.
- F. Startup Service
 1. Engage a factory-authorized service representative to perform **OR** Perform, **as directed**, startup service.
 - a. Complete installation and startup checks according to manufacturer's written instructions.
 - G. Adjusting
 1. Adjust pumps to function smoothly, and lubricate as recommended by manufacturer.
 2. Adjust control set points.
 - H. Demonstration
 1. Train Owner's maintenance personnel to adjust, operate, and maintain controls and pumps.

END OF SECTION 22 13 29 13b



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Task	Specification	Specification Description
22 13 29 16	22 13 29 13b	Sewage Pumps
22 13 29 33	01 22 16 00	No Specification Required



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SECTION 22 14 29 13 - SUMP PUMPS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for sump pumps. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Submersible sump pumps.
 - b. Wet-pit-volute sump pumps.
 - c. Sump-pump basins and basin covers.
 - d. Packaged drainage-pump units.

C. Submittals

1. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Wiring Diagrams: For power, signal, and control wiring.
3. Operation and Maintenance Data: For pumps and controls, to include in operation and maintenance manuals.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. UL Compliance: Comply with UL 778 for motor-operated water pumps.

E. Delivery, Storage, And Handling

1. Retain shipping flange protective covers and protective coatings during storage.
2. Protect bearings and couplings against damage.
3. Comply with pump manufacturer's written rigging instructions for handling.

1.2 PRODUCTS

A. Submersible Sump Pumps

1. Submersible, Fixed-Position, Single-Seal Sump Pumps:
 - a. Description: Factory-assembled and -tested sump-pump unit.
 - b. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal sump pump as defined in HI 1.1-1.2 and HI 1.3.
 - c. Pump Casing: Cast iron, with strainer inlet, legs that elevate pump to permit flow into impeller, and vertical discharge for piping connection.
 - d. Impeller: Statically and dynamically balanced, ASTM A 48/A 48M, Class No. 25 A cast iron **OR** ASTM A 532/A 532M, abrasion-resistant cast iron **OR** ASTM B 584, cast bronze, **as directed**, semiopen, **as directed**, design for clear wastewater handling, and keyed and secured to shaft.
 - e. Pump and Motor Shaft: Stainless steel **OR** steel, **as directed**, with factory-sealed, grease-lubricated ball bearings.
 - f. Seal: Mechanical.



- g. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.
 - 1) Motor Housing Fluid: Air **OR** Oil, **as directed**.
 - h. Controls (rod-and-float type):
 - 1) Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**.
 - 2) Switch Type: Pedestal-mounted float switch with float rods and rod buttons.
 - 3) Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - 4) Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches (1500 mm).
 - 5) High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
 - i. Controls (float- and pressure-switch types):
 - 1) Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**; pedestal-mounted **OR** wall-mounted, **as directed**.
 - 2) Switch Type: Mechanical-float **OR** Mercury-float **OR** Pressure, **as directed**, type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
 - 3) Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - 4) High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float, mercury-float, or pressure switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
 - j. Control-Interface Features:
 - 1) Remote Alarm Contacts: For remote alarm interface.
 - 2) Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:
 - a) On-off status of pump.
 - b) Alarm status.
2. Submersible, Fixed-Position, Double-Seal Sump Pumps:
- a. Description: Factory-assembled and -tested sump-pump unit.
 - b. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal sump pump as defined in HI 1.1-1.2 and HI 1.3.
 - c. Pump Casing: Cast iron, with strainer inlet, legs that elevate pump to permit flow into impeller, and vertical discharge for piping connection.
 - d. Impeller: Statically and dynamically balanced, ASTM A 48/A 48M, Class No. 25 A cast iron **OR** ASTM A 532/A 532M, abrasion-resistant cast iron **OR** ASTM B 584, cast bronze, **as directed**, semiopen, **as directed**, design for clear wastewater handling, and keyed and secured to shaft.
 - e. Pump and Motor Shaft: Stainless steel **OR** steel, **as directed**, with factory-sealed, grease-lubricated ball bearings.
 - f. Seals: Mechanical.
 - g. Moisture-Sensing Probe: Internal moisture sensor and moisture alarm.
 - h. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.
 - 1) Motor Housing Fluid: Air **OR** Oil, **as directed**.
 - i. Controls (rod-and-float type):
 - 1) Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**.
 - 2) Switch Type: Pedestal-mounted float switch with float rods and rod buttons.
 - 3) Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - 4) Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches (1500 mm).



- 5) High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
 - j. Controls (float- and pressure-switch types):
 - 1) Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**; pedestal-mounted **OR** wall-mounted, **as directed**.
 - 2) Switch Type: Mechanical-float **OR** Mercury-float **OR** Pressure, **as directed**, type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
 - 3) Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - 4) High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float, mercury-float, or pressure switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
 - k. Control-Interface Features:
 - 1) Remote Alarm Contacts: For remote alarm interface.
 - 2) Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:
 - a) On-off status of pump.
 - b) Alarm status.
- B. Wet-Pit-Volute Sump Pumps
1. Description: Factory-assembled and -tested sump-pump unit.
 2. Pump Type: Wet-pit-volute, single-stage, separately-coupled, overhung-impeller, centrifugal sump pump as defined in HI 1.1-1.2 and HI 1.3.
 3. Pump Casing: Cast iron, with strainer inlet and threaded connection for NPS 2 (DN 50) and smaller and flanged connection for NPS 2-1/2 (DN 65) and larger discharge piping.
 4. Impeller: Statically and dynamically balanced, ASTM A 48/A 48M, Class No. 25 A cast iron **OR** ASTM A 532/A 532M, abrasion-resistant cast iron **OR** ASTM B 584, cast bronze, **as directed**, semiopen, **as directed**, design for clear wastewater handling, and keyed and secured to shaft.
 5. Sleeve Bearings: Bronze. Include oil-lubricated, intermediate sleeve bearings at 48-inch (1200-mm) maximum intervals if basin depth is more than 48 inches (1200 mm), and grease-lubricated, ball-type thrust bearings.
 6. Pump and Motor Shaft Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.
 7. Pump Discharge Piping: Factory or field fabricated, galvanized, ASTM A 53/A 53M, Schedule 40, steel pipe with ASME B16.1, Class 125, cast-iron flanges and flanged fittings or ASME B16.4, Class 125, gray iron threaded fittings, **as directed**.
 8. Support Plate: Cast iron or coated steel and strong enough to support pumps, motors, and controls. Refer to Part 1.2 "Sump-Pump Basins and Basin Covers" Article for requirements.
 9. Shaft Seal: Stuffing box, with graphite-impregnated braided-yarn rings and bronze packing gland.
 10. Motor: Single-speed; grease-lubricated ball bearings and mounting on vertical, cast-iron pedestal.
 11. Controls (rod-and-float type):
 - a. Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**.
 - b. Switch Type: Pedestal-mounted float switch with float rods and rod buttons.
 - c. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - d. Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches (1500 mm).
 - e. High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
 12. Controls (float- and pressure-switch types):
 - a. Enclosure: NEMA 250, Type 1 **OR** Type 4X, **as directed**; pedestal-mounted **OR** wall-mounted, **as directed**.
 - b. Switch Type: Mechanical-float **OR** Mercury-float **OR** Pressure, **as directed**, type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.



- c. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 - d. High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float, mercury-float, or pressure switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
13. Control-Interface Features:
- a. Remote Alarm Contacts: For remote alarm interface.
 - b. Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:
 - 1) On-off status of pump.
 - 2) Alarm status.
- C. Sump-Pump Basins And Basin Covers
1. Basins: Factory-fabricated, watertight, cylindrical, basin sump with top flange and sidewall openings for pipe connections.
 - a. Material: Cast iron **OR** Fiberglass **OR** Polyethylene, **as directed**.
 - b. Reinforcement: Mounting plates for pumps, fittings, and accessories.
 - c. Anchor Flange: Same material as or compatible with basin sump, cast in or attached to sump, in location and of size required to anchor basin in concrete slab.
 2. Basin Covers: Fabricate metal cover with openings having gaskets, seals, and bushings; for access to pumps, pump shafts, control rods, discharge piping, vent connections, and power cables.
 - a. Reinforcement: Steel or cast iron, capable of supporting foot traffic for basins installed in foot-traffic areas.
- D. Packaged Drainage-Pump Units
1. Packaged Pedestal Drainage-Pump Units:
 - a. Description: Factory-assembled and -tested, automatic-operation, freestanding, sump-pump unit.
 - b. Pump Type: Wet-pit-volute, single-stage, separately-coupled, overhung-impeller centrifugal pump as defined in HI 1.1-1.2 and HI 1.3.
 - c. Pump Casing: Corrosion-resistant material, with strainer inlet, design that permits flow into impeller, and vertical discharge for piping connection.
 - d. Impeller: Aluminum, brass, or plastic.
 - e. Motor: With built-in overload protection and mounted vertically on sump pump column.
 - f. Power Cord: Three-conductor, waterproof cable of length required but not less than 72 inches (1830 mm), with grounding plug and cable-sealing assembly for connection at pump.
 - g. Control: Float switch.
 2. Packaged Submersible Drainage-Pump Units:
 - a. Description: Factory-assembled and -tested, automatic-operation, basin-mounted, sump-pump unit.
 - b. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller centrifugal pump as defined in HI 1.1-1.2 and HI 1.3.
 - c. Casing: Metal.
 - d. Impeller: Brass.
 - e. Pump Seal: Mechanical.
 - f. Motor: Hermetically sealed, capacitor-start type, with built-in overload protection.
 - g. Power Cord: Three-conductor, waterproof cable of length required but not less than 72 inches (1830 mm), with grounding plug and cable-sealing assembly for connection at pump.
 - h. Pump Discharge Piping: Factory or field fabricated, galvanized, ASTM A 53/A 53M, Schedule 40, steel pipe with ASME B16.4, Class 125, gray iron threaded fittings, **as directed**.
 - i. Control: Motor-mounted float switch.



j. Basin: Plastic.

E. Motors

1. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 22 Section "Common Motor Requirements For Plumbing Equipment".
 - a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - b. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 22.
2. Motors for submersible pumps shall be hermetically sealed.

1.3 EXECUTION

A. Earthwork

1. Excavation and filling are specified in Division 31 Section "Earth Moving".

B. Examination

1. Examine roughing-in for plumbing piping to verify actual locations of storm drainage piping connections before sump pump installation.

C. Installation

1. Pump Installation Standards: Comply with HI 1.4 for installation of sump pumps.

D. Connections

1. Comply with requirements for piping specified in Division 22 Section "Facility Storm Drainage Piping". Drawings indicate general arrangement of piping, fittings, and specialties.
2. Install piping adjacent to equipment to allow service and maintenance.

E. Field Quality Control

1. Perform tests and inspections.
2. Tests and Inspections:
 - a. Perform each visual and mechanical inspection.
 - b. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - c. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - d. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Pumps and controls will be considered defective if they do not pass tests and inspections.
4. Prepare test and inspection reports.

F. Startup Service

1. Engage a factory-authorized service representative to perform **OR** Perform, **as directed**, startup service.
 - a. Complete installation and startup checks according to manufacturer's written instructions.

G. Adjusting

1. Adjust pumps to function smoothly, and lubricate as recommended by manufacturer.
2. Adjust control set points.

H. Demonstration

1. Train Owner's maintenance personnel to adjust, operate, and maintain controls and pumps.



END OF SECTION 22 14 29 13



Task	Specification	Specification Description
22 14 29 13	22 05 23 00	Piped Utilities Basic Materials And Methods



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**SECTION 22 15 13 00 - GENERAL-SERVICE PACKAGED AIR COMPRESSORS AND RECEIVERS**

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for general-service packaged air compressors and receivers. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Lubricated, reciprocating air compressors.
 - b. Oil-free, reciprocating air compressors.
 - c. Oilless, reciprocating air compressors.
 - d. Oil-free, rotary-screw air compressors.
 - e. Oil-flooded, rotary-screw air compressors.
 - f. Oil-free, rotary, sliding-vane air compressors.
 - g. Oil-sealed, rotary, sliding-vane air compressors.
 - h. Inlet-air filters.
 - i. Air-cooled, compressed-air aftercoolers.
 - j. Water-cooled, compressed-air aftercoolers.
 - k. Refrigerant compressed-air dryers.
 - l. Desiccant compressed-air dryers.
 - m. Computer interface cabinet.

C. Definitions

1. Actual Air: Air delivered from air compressors. Flow rate is delivered compressed air measured in acfm (actual L/s).
2. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.
3. Standard Air: Free air at 68 deg F (20 deg C) and 1 atmosphere (29.92 in. Hg) before compression or expansion and measured in scfm (standard L/s).

D. Performance Requirements

1. Delegated Design: Design compressed-air equipment mounting, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2. Seismic Performance: Compressed-air equipment shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

E. Submittals

1. Product Data: For each type of product indicated.
 - a. Wiring Diagrams: For power, signal, and control wiring.
2. Delegated-Design Submittal: For compressed-air equipment mounting indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - a. Detail fabrication and assembly of supports.
 - b. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.



3. Seismic Qualification Certificates: For compressed-air equipment, accessories, and components, from manufacturers.
4. Operation and Maintenance Data.

F. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. ASME Compliance: Fabricate and label receivers to comply with ASME Boiler and Pressure Vessel Code.

1.2 PRODUCTS

A. General Requirements For Packaged Air Compressors And Receivers

1. General Description: Factory-assembled, -wired, -piped, and -tested; electric-motor-driven; air-cooled; continuous-duty air compressors and receivers that deliver air of quality equal to intake air.
2. Control Panels: Automatic control station with load control and protection functions. Comply with NEMA ICS 2 and UL 508.
 - a. Enclosure: NEMA ICS 6, Type 12 control panel unless otherwise indicated.
 - b. Motor Controllers: Full-voltage, combination magnetic type with undervoltage release feature and motor-circuit-protector-type disconnecting means and short-circuit protective device.
 - c. Control Voltage: 120-V ac or less, using integral control power transformer.
 - d. Motor Overload Protection: Overload relay in each phase.
 - e. Starting Devices: Hand-off-automatic selector switch in cover of control panel, plus pilot device for automatic control.
 - f. Automatic control switches to alternate lead-lag compressors for duplex **OR** sequence lead-lag compressors for multiplex, **as directed**, air compressors.
 - g. Instrumentation: Include discharge-air pressure gage, air-filter maintenance indicator, hour meter, compressor discharge-air and coolant temperature gages, and control transformer.
 - h. Alarm Signal Device: For connection to alarm system to indicate when backup air compressor is operating.
3. Receivers: Steel tank constructed according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 - a. Pressure Rating: At least as high as highest discharge pressure of connected compressors, and bearing appropriate code symbols.
 - b. Interior Finish: Corrosion-resistant coating.
 - c. Accessories: Include safety valve, pressure gage, drain, and pressure-reducing valve.
4. Mounting Frame: Fabricate mounting and attachment to pressure vessel with reinforcement strong enough to resist packaged equipment movement during a seismic event when base is anchored to building structure.

B. Lubricated, Reciprocating Air Compressors

1. Compressor(s): Lubricated, reciprocating-piston type with lubricated compression chamber and crankcase.
 - a. Submerged gear-type oil pump.
 - b. Oil filter.
 - c. Combined high discharge-air temperature and low lubrication-oil pressure switch.
 - d. Belt guard totally enclosing pulleys and belts.

C. Oil-Free, Reciprocating Air Compressors

1. Compressor(s): Oil-free, reciprocating-piston type with nonlubricated compression chamber, lubricated crankcase, and of construction that prohibits oil from entering compression chamber.



- a. Submerged gear-type oil pump.
 - b. Oil filter.
 - c. Combined high discharge-air temperature and low lubrication-oil pressure switch.
 - d. Belt guard totally enclosing pulleys and belts.
- D. Oilless, Reciprocating Air Compressors
1. Compressor(s): Oilless (nonlubricated), reciprocating-piston type, with sealed oil-free bearings, that will deliver air of quality equal to intake air.
 - a. High discharge-air temperature switch.
 - b. Belt guard totally enclosing pulleys and belts.
- E. Oil-Free, Rotary-Screw Air Compressors
1. Compressor(s): Oil-free, rotary-screw type with nonlubricated helical screws and lubricated gear box, and of construction that prohibits oil from entering compression chamber.
 - a. Coupling: Nonlubricated, flexible type.
 - b. Cooling/Lubrication System: Unit-mounted, air-cooled exchanger package prepiped to unit; with air pressure circulation system with coolant stop valve, full-flow coolant filter, and thermal bypass valve.
 - c. Air Filter: Dry type, with maintenance indicator and cleanable replaceable filter element.
 - d. Air/Coolant Receiver and Separation System: 150-psig- (1035-kPa-) rated steel tank with ASME safety valve, coolant-level gage, multistage air-coolant separator element, minimum pressure valve, blowdown valve, discharge check valve, coolant stop valve, full-flow coolant filter, and thermal bypass valve.
 - e. Capacity Control: Capacity modulation between zero and 100 percent air delivery, with operating pressures between 50 and 100 psig (345 and 690 kPa). Include necessary control to hold constant pressure. When air demand is zero, unload compressor by using pressure switch and blowdown valve.
- F. Oil-Flooded, Rotary-Screw Air Compressors
1. Compressor(s): Oil-flooded, rotary-screw type with lubricated helical screws and lubricated gear box.
 - a. Coupling: Nonlubricated, flexible type.
 - b. Cooling/Lubrication System: Unit-mounted, air-cooled exchanger package prepiped to unit; with air pressure circulation system with coolant stop valve, full-flow coolant filter, and thermal bypass valve.
 - c. Air Filter: Dry type, with maintenance indicator and cleanable replaceable filter element.
 - d. Air/Coolant Receiver and Separation System: 150-psig- (1035-kPa-) rated steel tank with ASME safety valve, coolant-level gage, multistage air-coolant separator element, minimum pressure valve, blowdown valve, discharge check valve, coolant stop valve, full-flow coolant filter, and thermal bypass valve.
 - e. Capacity Control: Capacity modulation between zero and 100 percent air delivery, with operating pressures between 50 and 100 psig (345 and 690 kPa). Include necessary control to hold constant pressure. When air demand is zero, unload compressor by using pressure switch and blowdown valve.
- G. Oil-Free, Rotary, Sliding-Vane Air Compressors
1. Compressor(s): Oil-free, nonpulsating, rotary, sliding-vane type with nonlubricated sliding vanes.
 - a. Cleanable inlet screens.
 - b. Outlet silencers on discharge connections.
- H. Oil-Sealed, Rotary, Sliding-Vane Air Compressors
1. Compressor(s): Nonpulsating, rotary, sliding-vane type with oil-sealed sliding vanes.
 - a. Cleanable inlet screens.
 - b. Outlet silencers and oil-mist separators on discharge connections.
- I. Inlet-Air Filters



1. Description: Combination inlet-air filter-silencer, suitable for remote installation, for each air compressor.
 - a. Construction: Weatherproof housing for replaceable, dry-type filter element, with silencer tubes or other method of sound reduction.
 - b. Capacity: Match capacity of air compressor, with filter having collection efficiency of 99 percent retention of particles larger than 10 micrometers.
 2. Description: Combination inlet-air filter-silencer, suitable for remote installation, for multiple air compressors.
 - a. Construction: Weatherproof housing for replaceable, dry-type filter element, with silencer tubes or other method of sound reduction.
 - b. Capacity: Match total capacity of connected air compressors, with filter having collection efficiency of 99 percent retention of particles larger than 10 micrometers.
- J. Air-Cooled, Compressed-Air Aftercoolers
1. Description: Electric-motor-driven, fan-operation, finned-tube unit; rated at 250 psig (1725 kPa) and leak tested at 350-psig (2415-kPa) minimum air pressure; in capacities indicated. Size units to cool compressed air in compressor-rated capacities to 10 deg F (6 deg C) above summertime maximum ambient temperature. Include moisture separator and automatic drain.
- K. Water-Cooled, Compressed-Air Aftercoolers
1. Description: Shell and tube unit, rated at 250 psig (1725 kPa) and leak tested at 350-psig (2415-kPa) minimum air pressure, in capacities indicated. Include moisture separator and automatic drain.
- L. Refrigerant Compressed-Air Dryers
1. Description: Noncycling, air-cooled, electric-motor-driven unit with steel enclosure and capability to deliver 35 deg F (2 deg C), 100-psig (690-kPa) air at dew point. Include automatic ejection of condensate from airstream, step-down transformers, disconnect switches, inlet and outlet pressure gages, thermometers, automatic controls, and filters.
- M. Desiccant Compressed-Air Dryers
1. Description: Twin-tower unit with purge system, mufflers, and capability to deliver plus 10 deg F (minus 12 deg C), 100-psig (690-kPa) air at dew point. Include dew point controlled purge, step-down transformers, disconnect switches, inlet and outlet pressure gages, thermometers, automatic controls, and filters.
- N. Computer Interface Cabinet
1. Description:
 - a. Wall mounting.
 - b. Welded steel with white enamel finish.
 - c. Gasketed door.
 - d. Grounding device.
 - e. Factory-installed, signal circuit boards.
 - f. Power transformer.
 - g. Circuit breaker.
 - h. Wiring terminal board.
 - i. Internal wiring capable of interfacing 20 alarm signals.
- O. Motors
1. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 22 Section "Common Motor Requirements For Plumbing Equipment".
 - a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.



- b. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 22.

1.3 EXECUTION

A. Equipment Installation

1. Equipment Mounting:

- a. Install air compressors, aftercoolers, and air dryers on concrete bases using elastomeric pads **OR** elastomeric mounts **OR** restrained spring isolators, **as directed**. Comply with requirements in Division 03 Section "Cast-in-place Concrete". Comply with requirements for vibration isolation devices specified in Division 22 Section "Vibration And Seismic Controls For Plumbing Piping And Equipment".
 - 1) Minimum Deflection: 1/4 inch (6 mm) **OR** 1 inch (25 mm), **as directed**.
 - 2) Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - 3) For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 4) Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 5) Install anchor bolts to elevations required for proper attachment to supported equipment.
 - b. Install air compressors, aftercoolers, and air dryers using elastomeric pads **OR** elastomeric mounts **OR** restrained spring isolators, **as directed**. Comply with requirements for vibration isolation devices specified in Division 22 Section "Vibration And Seismic Controls For Plumbing Piping And Equipment".
 - 1) Minimum Deflection: 1/4 inch (6 mm) **OR** 1 inch (25 mm), **as directed**.
 - c. Install air compressors, aftercoolers, and air dryers on vibration isolation inertia bases. Comply with requirements specified in Division 22 Section "Vibration And Seismic Controls For Plumbing Piping And Equipment".
 - d. Install air compressors, aftercoolers, and air dryers on concrete bases. Comply with requirements in Division 03 Section "Cast-in-place Concrete".
 - 1) Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - 2) For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 3) Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 4) Install anchor bolts to elevations required for proper attachment to supported equipment.
 - e. Install water-cooled, compressed-air aftercoolers and desiccant compressed-air dryers on concrete bases. Comply with requirements in Division 03 Section "Cast-in-place Concrete".
 - 1) Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - 2) For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 3) Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 4) Install anchor bolts to elevations required for proper attachment to supported equipment.
2. Install compressed-air equipment anchored to substrate.
 3. Arrange equipment so controls and devices are accessible for servicing.



4. Maintain manufacturer's recommended clearances for service and maintenance.
 5. Install the following devices on compressed-air equipment:
 - a. Thermometer, Pressure Gage, and Safety Valve: Install on each compressed-air receiver.
 - b. Pressure Regulators: Install downstream from air compressors and dryers.
 - c. Automatic Drain Valves: Install on aftercoolers, receivers, and dryers. Discharge condensate over nearest floor drain.
- B. Connections
1. Comply with requirements for piping specified in Division 22 Section "General-service Compressed-air Piping". Drawings indicate general arrangement of piping, fittings, and specialties.
 2. Install piping adjacent to machine to allow service and maintenance.
- C. Identification
1. Identify general-service air compressors and components. Comply with requirements for identification specified in Division 22 Section "Identification For Plumbing Piping And Equipment".
- D. Startup Service
1. Perform startup service.
 - a. Complete installation and startup checks according to manufacturer's written instructions.
 - b. Check for lubricating oil in lubricated-type equipment.
 - c. Check belt drives for proper tension.
 - d. Verify that air-compressor inlet filters and piping are clear.
 - e. Check for equipment vibration-control supports and flexible pipe connectors and verify that equipment is properly attached to substrate.
 - f. Check safety valves for correct settings. Ensure that settings are higher than air-compressor discharge pressure but not higher than rating of system components.
 - g. Check for proper seismic restraints.
 - h. Drain receiver tanks.
 - i. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - j. Test and adjust controls and safeties.
- E. Demonstration
1. Train Owner's maintenance personnel to adjust, operate, and maintain air compressors, aftercoolers, and air dryers.

END OF SECTION 22 15 13 00



Task	Specification	Specification Description
22 15 13 00	23 09 00 00	HVAC Instrumentation And Controls
22 15 19 13	22 15 13 00	General-Service Packaged Air Compressors and Receivers
22 15 19 13	23 09 00 00	HVAC Instrumentation And Controls
22 15 19 19	22 15 13 00	General-Service Packaged Air Compressors and Receivers
22 15 19 19	23 09 00 00	HVAC Instrumentation And Controls



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SECTION 22 31 16 00 - WATER SOFTENERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for water softeners. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes household and commercial water softeners.
 - a. Chemicals.
 - b. Water testing kits.

C. Definitions

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. FRP: Fiberglass-reinforced plastic.
3. PE: Polyethylene plastic.
4. PVC: Polyvinyl chloride plastic.

D. Submittals

1. Product Data: For each type of water softener and water testing kit indicated.
2. Shop Drawings: Include plans, elevations, sections, details, and connections to piping systems.
 - a. Include wiring diagrams.
3. Manufacturer Seismic Qualification Certification
4. Field quality-control test reports.
5. Operation and Maintenance Data: For water softeners to include in emergency, operation, and maintenance manuals.
6. Warranty: Special warranty specified in this Section.

E. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. ASME Compliance for Steel Tanks: Fabricate and label mineral tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, where indicated.
3. ASME Compliance for FRP Tanks: Fabricate and label mineral tanks to comply with ASME Boiler and Pressure Vessel Code: Section X, where indicated.

F. Warranty

1. Manufacturer's standard form in which manufacturer agrees to repair or replace components of water softener that fail in materials or workmanship within Five years from date of Final Completion.

1.2 PRODUCTS

A. Household Water Softeners

1. Description: Factory-assembled, fully-automatic, pressure-type water softener.
 - a. Configuration: Unit with one mineral tank and one brine tank or cabinet-style, combination mineral and brine tank unit with equivalent characteristics.
 - b. Mineral Tank: Steel or FRP, with coating or liner suitable for potable-water service and 125-psig (860-kPa) minimum pressure rating.



- c. Comply with NSF 61, "Drinking Water System Components--Health Effects."
- d. Controls: For fully automatic operation.
- e. Brine Tank: Combination measuring and wet-salt storing system.
 - 1) Tank and Cover Material: FRP or molded PE.
 - 2) Brine Valve: Float operated and plastic fitted for automatic control of brine withdrawn and freshwater refill.
 - 3) Size: Large enough for at least two regenerations at full salting.
- f. Factory-Installed Accessories:
 - 1) Piping, valves, tubing, and drains.
 - 2) Sampling cock.
 - 3) Main-operating-valve position indicator.

B. Commercial Water Softeners

1. Description: Factory-assembled, pressure-type water softener.
 - a. Comply with NSF 61, "Drinking Water System Components--Health Effects."
 - b. Configuration: Single unit with one mineral tank **OR** Twin unit with two mineral tanks **OR** Triple unit with three mineral tanks, **as directed**, and one brine tank, factory mounted on skids, **unless directed otherwise**.
 - c. Mineral Tanks: FRP, pressure-vessel quality.
 - 1) Construction: Non-ASME code **OR** Fabricated and stamped to comply with ASME Boiler and Pressure Vessel Code: Section X, "Fiber-Reinforced Plastic Pressure Vessels," **as directed**.
 - 2) Pressure Rating: 100 psig (690 kPa) **OR** 125 psig (860 kPa), **as directed**, minimum.
 - 3) Wetted Components: Suitable for water temperatures from 40 to at least 100 deg F (5 to at least 38 deg C) **OR** 40 to at least 120 deg F (5 to at least 49 deg C) **OR** 40 to at least 150 deg F (5 to at least 66 deg C), **as directed**.
 - 4) Freeboard: 50 percent minimum for backwash expansion above normal resin bed level.
 - 5) Support Legs or Skirt: Constructed of structural steel, welded to tank before testing and labeling.
 - 6) Upper Distribution System: Single, point type, fabricated from galvanized-steel pipe and fittings.
 - 7) Lower Distribution System: Hub and radial-arm or header-lateral type; fabricated from nonmetallic pipe and fittings with individual, fine-slotted, nonclogging plastic strainers; arranged for even flow distribution through resin bed.
 - 8) Liner: PE, ABS, or other material suitable for potable water.
 - d. Mineral Tanks: Steel **OR** Stainless steel, **as directed**, electric welded; pressure-vessel quality.
 - 1) Fabricate supports and attachments to tank with reinforcement strong enough to resist tank movement during seismic event when tank supports are anchored to building structure.
 - 2) Construction: Non-ASME code **OR** Fabricated and stamped to comply with ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," **as directed**.
 - 3) Pressure Rating: 100 psig (690 kPa) **OR** 125 psig (860 kPa) **OR** 150 psig (1035 kPa), **as directed**, minimum.
 - 4) Wetted Components: Suitable for water temperatures from 40 to at least 100 deg F (5 to at least 38 deg C) **OR** 40 to at least 120 deg F (5 to at least 49 deg C) **OR** 40 to at least 150 deg F (5 to at least 66 deg C), **as directed**.
 - 5) Freeboard: 50 percent minimum for backwash expansion above normal resin bed level.
 - 6) Handholes: 4 inches (102 mm) round or 4 by 6 inches (102 by 152 mm) elliptical, in top head and lower sidewall of tanks 30 inches (762 mm) and smaller in diameter.
 - 7) Manhole: 11 by 15 inches (280 by 380 mm) in top head of tanks larger than 30 inches (762 mm) in diameter.



- 8) Support Legs or Skirt: Constructed of structural steel, welded to tank before testing and labeling.
- 9) Finish: Hot-dip galvanized on exterior and interior of tank after fabrication, unless tank is stainless steel.
- 10) Finish: Exterior of tank spray painted with rust-resistant prime coat, 2- to 3-mil (0.051- to 0.076-mm) dry film thickness. Interior sandblasted and lined with epoxy-polyamide coating, 8- to 10-mil (0.203- to 0.254-mm) dry film thickness.
- 11) Upper Distribution System: Single, point type, fabricated from galvanized-steel pipe and fittings.
- 12) Lower Distribution System: Hub and radial-arm or header-lateral type; fabricated from PVC pipe and fittings with individual, fine-slotted, nonclogging PE strainers; arranged for even flow distribution through resin bed.
- 13) Liner: PE, ABS, or other material suitable for potable water.
- e. Controls: Automatic; factory mounted on unit and factory wired.
 - 1) Adjustable duration of various regeneration steps.
 - 2) Push-button start and complete manual operation.
 - 3) Electric time clock and switch for automatic operation, except for manual return to service.
 - 4) Sequence of Operation: Program multiport pilot-control valve to automatically pressure-actuate main operating valve through steps of regeneration.
 - 5) Pointer on pilot-control valve shall indicate cycle of operation.
 - 6) Means of manual operation of pilot-control valve if power fails.
- f. Controls: Fully automatic; factory mounted on unit and factory wired.
 - 1) Adjustable duration of various regeneration steps.
 - 2) Push-button start and complete manual operation.
 - 3) Electric time clock and switch for fully automatic operation, adjustable to initiate regeneration at any hour of day and any day of week or at fixed intervals.
 - 4) Sequence of Operation: Program multiport pilot-control valve to automatically pressure-actuate main operating valve through steps of regeneration and return to service.
 - 5) Pointer on pilot-control valve shall indicate cycle of operation.
 - 6) Means of manual operation of pilot-control valve if power fails.
 - 7) Main Operating Valves: Industrial, automatic, multiport, diaphragm type with the following features:
 - a) Slow opening and closing, nonslam operation.
 - b) Diaphragm guiding on full perimeter from fully open to fully closed.
 - c) Isolated dissimilar metals within valve.
 - d) Self-adjusting, internal, automatic brine injector that draws brine and rinses at constant rate independent of pressure.
 - e) Valve for single mineral-tank unit with internal automatic bypass of raw water during regeneration.
 - f) Sampling cocks for soft water.
 - g) Special tools are not required for service.
 - 8) Flow Control: Automatic, to control backwash and flush rates over wide variations in operating pressures, and that does not require field adjustments.
 - a) Meter Control: Equip each mineral tank with signal-register-head water meter that will produce electrical signal indicating need for regeneration on reaching hand-set total in gallons (liters). Design so signal will continue until reset.
 - b) Demand-Initiated Control:
 - i. Equip single mineral-tank units with automatic-reset-head water meter that electrically activates cycle controller to initiate regeneration at preset total in gallons (liters). Design so head automatically resets to preset total in gallons (liters) for next service run.
 - ii. Equip each mineral tank of twin mineral-tank units with automatic-reset-head water meters that electrically activate cycle controllers to initiate regeneration at preset total in gallons (liters). Design so heads



automatically reset to preset total in gallons (liters) for next service run. Include electrical lockout to prevent simultaneous regeneration of both tanks.

- iii. Equip each mineral tank of twin mineral-tank units with automatic-reset-head water meter in common outlet header that electrically activates cycle controller to automatically regenerate one mineral tank at preset total in gallons (liters) and divert flow to other tank. Set to repeat with other tank. Include electrical lockout to prevent simultaneous regeneration of both tanks.
 - iv. Equip each mineral tank of multiple mineral-tank units with automatic-reset-head water meters that electrically activate cycle controllers to automatically regenerate at preset total in gallons (liters). Design so heads automatically reset to preset total in gallons (liters) for next service run. Include electrical lockouts to prevent simultaneous regeneration of more than one tank.
 - v. Equip each mineral tank of multiple mineral-tank units with automatic-reset-head water meter in common outlet header that electrically activates cycle controller to automatically regenerate one mineral tank at preset total in gallons (liters) and divert flow to other tanks. Set to repeat with other tanks. Include electrical lockouts to prevent simultaneous regeneration of more than one tank.
- g. Brine Tank: Combination measuring and wet-salt storing system.
- 1) Tank and Cover Material: Fiberglass, 3/16 inch (4.8 mm) thick; or molded PE, 3/8 inch (9.5 mm) thick.
 - 2) Brine Valve: Float operated and plastic fitted for automatic control of brine withdrawn and freshwater refill.
 - 3) Size: Large enough for at least four regenerations at full salting.
- h. Factory-Installed Accessories:
- 1) Piping, valves, tubing, and drains.
 - 2) Sampling cocks.
 - 3) Main-operating-valve position indicators.
 - 4) Water meters.
2. Capacity and Characteristics:
- a. Service: Cold **OR** Hot, **as directed**, water.
 - b. Number of Mineral Tanks: One **OR** Two, **as directed**.

C. Chemicals

- 1. Mineral: High-capacity, sulfonated-polystyrene ion-exchange resin that is stable over entire pH range with good resistance to bead fracture from attrition or shock.
 - a. Exchange Capacity: 30,000 grains/cu. ft. (69 kg/cu. m) of calcium carbonate of resin when regenerated with 15 lb (6.8 kg) of salt.
- 2. Salt for Brine Tanks: High-purity sodium chloride; free of dirt and foreign material. Rock and granulated forms are not acceptable.
 - a. Form: Processed, food-grade salt pellets **OR** plain salt pellets **OR** crystallized solar salt from shallow ponds and milled into irregular particles **OR** plain, brine block salt, **as directed**.

D. Water Testing Sets

- 1. Description: Manufacturer's standard water-hardness testing apparatus and chemicals with testing procedure instructions. Include metal container suitable for wall mounting.

1.3 EXECUTION

A. Concrete Bases



1. Install concrete bases of dimensions indicated for commercial water softeners. Refer to Division 22 Section "Common Work Results For Plumbing".
- B. Water Softener Installation
1. Install household water softeners on floor. Anchor water softener and brine tanks to substrate.
 2. Install commercial water softener equipment on concrete bases, level and plumb. Maintain manufacturer's recommended clearances. Arrange units so controls and devices that require servicing are accessible. Anchor mineral and brine tanks and floor-mounting accessories to substrate.
 3. Install seismic restraints for tanks and floor-mounting accessories and anchor to building structure.
 4. Install brine lines and fittings furnished by equipment manufacturer but not specified to be factory installed.
 5. Prepare mineral-tank distribution system and underbed for minerals and place specified mineral into mineral tanks.
 6. Install water testing sets mounted on wall, unless otherwise indicated, and near water softeners.
- C. Connections
1. Piping installation requirements are specified in other Division 14.. Drawings indicate general arrangement of piping, fittings, and specialties.
 2. Install piping adjacent to equipment to allow service and maintenance.
 3. Make piping connections between water-softener-unit headers and dissimilar-metal water piping with dielectric fittings. Dielectric fittings are specified in Division 22 Section "Common Work Results For Plumbing".
 4. Install shutoff valves on raw-water inlet and soft-water outlet piping of each mineral tank, and on inlet and outlet headers.
 - a. Metal general-duty valves are specified in Division 22 Section "General-duty Valves For Plumbing Piping".
 - b. Plastic valves are specified in Division 22 Section "Domestic Water Piping".
 - c. Exception: Water softeners with factory-installed shutoff valves at locations indicated.
 5. Install pressure gages on raw-water inlet and soft-water outlet piping of each mineral tank. Pressure gages are specified in Division 22 Section "Meters And Gages For Plumbing Piping".
 - a. Exception: Water softeners with factory-installed pressure gages at locations indicated.
 - b. Exception: Household water softeners.
 - c. Exception: Water softeners in hot-water service.
 6. Install valved bypass water piping around water softeners.
 - a. Metal general-duty valves are specified in Division 22 Section "General-duty Valves For Plumbing Piping".
 - b. Plastic valves are specified in Division 22 Section "Domestic Water Piping".
 - c. Water piping is specified in Division 22 Section "Domestic Water Piping".
 - d. Exception: Household water softeners.
 - e. Exception: Water softeners in hot-water service.
 7. Install drains as indirect wastes to spill into open drains or over floor drains.
 8. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
 9. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".
- D. Field Quality Control
1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
 2. Perform the following field tests and inspections and prepare test reports:
 - a. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.



- b. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation.
- c. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Remove and replace malfunctioning water softeners that do not pass tests and inspections and retest as specified above.

E. Startup Service

1. Engage a factory-authorized service representative to perform startup service.
 - a. Complete installation and startup checks according to manufacturer's written instructions.
2. Add water to brine tanks and fill with salt.
 - a. Household Water Softeners: Processed food-grade salt pellets **OR** plain salt pellets **OR** crystallized solar salt, **as directed**.
 - b. Commercial Water Softeners: Plain salt pellets **OR** Crystallized solar salt **OR** Plain, brine block salt **OR** Food-grade salt pellets, **as directed**.
3. Sample water softener effluent after startup and at three consecutive seven-day intervals (total of four samples), and prepare certified test reports for required water performance characteristics. Comply with the following:
 - a. ASTM D 859, "Test Method for Silica in Water."
 - b. ASTM D 1067, "Test Methods for Acidity or Alkalinity of Water."
 - c. ASTM D 1068, "Test Methods for Iron in Water."
 - d. ASTM D 1126, "Test Method for Hardness in Water."
 - e. ASTM D 1129, "Terminology Relating to Water."
 - f. ASTM D 3370, "Practices for Sampling Water from Closed Conduits."

F. Demonstration

1. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial water softeners.

END OF SECTION 22 31 16 00



Task	Specification	Specification Description
22 33 00 00	22 12 23 13	Electric, Domestic Water Heaters
22 33 30 16	22 12 23 13	Electric, Domestic Water Heaters
22 33 30 16	22 12 23 13a	Fuel-Fired, Domestic Water Heaters
22 33 33 00	22 12 23 13	Electric, Domestic Water Heaters
22 34 00 00	22 12 23 13a	Fuel-Fired, Domestic Water Heaters
22 34 36 00	22 12 23 13	Electric, Domestic Water Heaters
22 34 36 00	22 12 23 13a	Fuel-Fired, Domestic Water Heaters
22 34 46 00	22 12 23 13a	Fuel-Fired, Domestic Water Heaters



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SECTION 22 35 23 00 - DOMESTIC WATER HEAT EXCHANGERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for heat exchangers. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following heat exchangers:
 - a. Heating-fluid-in-coil, instantaneous heat exchangers.
 - b. Domestic-water-in-coil, instantaneous heat exchangers.
 - c. Heating-fluid-in-U-tube-coil, instantaneous heat exchangers.
 - d. Circulating, compact heat exchangers.
 - e. Circulating, storage heat exchangers.
 - f. Noncirculating, compact heat exchangers.
 - g. Noncirculating, storage heat exchangers.
 - h. Brazed-plate heat exchangers.
 - i. Frame-and-plate heat exchangers.
 - j. Heat reclaimers.
 - k. Compression tanks.
 - l. Heat-exchanger accessories.

C. Submittals

1. Product Data: For each type and size of heat exchanger indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.
2. Shop Drawings: Diagram power, signal, and control wiring.
3. Manufacturer Seismic Qualification Certification
4. Source quality-control test reports.
5. Field quality-control test reports.
6. Operation and Maintenance Data: For heat exchangers to include in emergency, operation, and maintenance manuals.
7. Warranty: Special warranty specified in this Section.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. ASME Compliance: Where ASME-code construction is indicated, fabricate and label heat-exchanger storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
3. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9" for all components that will be in contact with water.

E. Warranty

1. Manufacturer's standard form in which manufacturer agrees to repair or replace components of heat exchangers that fail in materials or workmanship within specified warranty period.
 - a. Failures include, but are not limited to, the following:
 - 1) Structural failures including heat exchanger, storage tank, and supports.
 - 2) Faulty operation of controls.
 - 3) Deterioration of metals, metal finishes, and other materials beyond normal use.
 - b. Warranty Period(s): From date of Final Completion:



- 1) Instantaneous Heat Exchangers:
 - a) Tube Coil and Shell: One year.
 - b) Controls and Other Components: One year.
- 2) Circulating, Storage Heat Exchangers:
 - a) Storage Tank: Five years.
 - b) Tube Coil: Five years.
 - c) Controls and Other Components: Three years.
- 3) Noncirculating, Storage Heat Exchangers:
 - a) Storage Tank: Five years.
 - b) Tube Coil: Five years.
 - c) Controls and Other Components: Three years.
- 4) Plate Heat Exchangers:
 - a) Brazed-Plate Type: One year.
 - b) Plate-and-Frame Type: One year.
- 5) Heat Reclaimers: One year.
- 6) Compression Tanks: One year.

1.2 PRODUCTS

A. Instantaneous Heat Exchangers

1. Heating-Fluid-in-Coil, Instantaneous Heat Exchangers:
 - a. Description: Packaged assembly of tank, heat-exchanger coils, controls, and specialties for heating domestic water with heating hot water **OR** steam, **as directed**, in heat-exchanger coils.
 - b. Construction: ASME-code, negligible-capacity, copper-lined, carbon-steel shell with 150-psig (1035-kPa) minimum working-pressure rating.
 - 1) Tappings: Factory fabricated of materials compatible with heat-exchanger shell. Attach tappings to shell before testing and labeling.
 - a) NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1.
 - b) NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
 - 2) Insulation: Complying with ASHRAE/IESNA 90.1, unless otherwise indicated, and suitable for operating temperature. Surround entire shell and nozzle except connections and controls.
 - 3) Heat-Exchanger Coils: Copper **OR** Copper nickel **OR** Stainless-steel, **as directed**, helix-wound coils for heating fluid with pressure rating equal to or greater than heating-fluid supply pressure.
 - 4) Temperature Control: Adjustable thermostat that operates control valve and that is capable of maintaining outlet-water temperature within 4 deg F (2 deg C) of setting.
 - 5) Safety Control: Automatic, high-temperature-limit cutoff device or system.
 - 6) Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3, for combination temperature and pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of heat exchanger. Select one relief valve with sensing element that extends into storage tank.
 - c. Miscellaneous Components for Heating Hot-Water Unit: Control valve, valves, and piping. Include components fitted for pneumatic control.
 - d. Miscellaneous Components for Steam Unit: Strainers, steam-control valve, steam trap, valves, pressure gage, thermometer, and piping. Include components fitted for pneumatic control.
 - 1) Exception: Steam trap is not required if manufacturer's written instructions direct that it not be used.
 - e. Stand: Factory fabricated for floor mounting.



2. Domestic-Water-in-Coil, Instantaneous Heat Exchangers:
 - a. Description: Tankless, packaged assembly of heat-exchanger coils, controls, and specialties for heating domestic water in coils with steam in shell.
 - b. Construction: ASME code, with cast-iron or steel shell for steam.
 - 1) Cast-Iron Shell Pressure Rating: 75 psig (517 kPa).
 - 2) Steel Shell Pressure Rating: 150 psig (1035 kPa).
 - 3) Insulation: Complying with ASHRAE/IESNA 90.1, unless otherwise indicated, and suitable for operating temperature. Surround entire shell and nozzle except connections and controls.
 - c. Heat-Exchanger Coils: Spiral-wound, copper or copper-alloy **OR** stainless-steel, **as directed**, coils for domestic water.
 - d. Temperature Control: Adjustable thermostat that operates steam-control valve and that is capable of maintaining outlet-water temperature within 3 deg F (2 deg C) of setting.
 - e. Safety Control: Automatic, high-temperature-limit cutoff device or system.
 - f. Miscellaneous Components: Strainers, steam-control valve, steam trap, valves, and piping.
 - g. Stand: Factory fabricated for floor mounting.
3. Heating-Fluid-in-U-Tube-Coil, Instantaneous Heat Exchangers:
 - a. Description: Tankless, packaged assembly of heat-exchanger coil, controls, and specialties for heating domestic water in shell with heating hot water **OR** steam, **as directed**, in coil.
 - b. Construction: ASME-code, negligible-capacity, copper-lined, carbon-steel or copper-alloy shell with 150-psig (1035-kPa) minimum working-pressure rating.
 - 1) Configuration: Horizontal **OR** Vertical, **as directed**.
 - 2) Shell Tappings: Factory fabricated of materials compatible with water heater shell. Attach tappings to shell before testing and labeling.
 - a) NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1.
 - b) NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
 - 3) Insulation: Complying with ASHRAE/IESNA 90.1, unless otherwise indicated, and suitable for operating temperature. Surround entire shell and nozzle except connections and controls.
 - 4) Heat-Exchanger Coil: Copper, double-wall **OR** single-wall, **as directed**, U tubes for heating fluid.
 - a) Tube Pressure Rating: Equal to or greater than heating-fluid supply pressure.
 - c. Temperature Control: Adjustable thermostat that operates steam-control valve and that is capable of maintaining outlet-water temperature within 5 deg F (3 deg C) of setting.
 - d. Safety Control: Automatic, high-temperature-limit cutoff device or system.
 - e. Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3, for combination temperature and pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of heat exchanger. Select one relief valve with sensing element that extends into shell.
 - f. Miscellaneous Components for Heating Hot-Water Unit: Control valve, valves, and piping. Include components fitted for pneumatic control.
 - g. Miscellaneous Components for Steam Unit: Strainers, steam-control valve, steam trap, valves, pressure gage, thermometer, and piping. Include components fitted for pneumatic control.
 - h. Stand: Factory fabricated for floor mounting.

B. Circulating, Storage Heat Exchangers

1. Circulating, Compact Heat Exchangers:
 - a. Description: Packaged, small-capacity, hot-water storage tank with heat-exchanger coil; circulator; controls; and specialties for heating domestic water with heating hot water **OR** steam, **as directed**, in coil.



- b. Flow Pattern: Standard-flow arrangement, with water from bottom of storage tank circulated across heat-exchanger coil and returned to tank. Include hot-water outlet located at top of tank and temperature sensor in tank.
 - c. Storage Tank Construction: ASME-code, vertical; copper-silicon or corrosion-resistant metal with 150-psig (1035-kPa) working-pressure rating. Include nozzle and head for heat-exchanger tube coil.
 - 1) Configuration: Vertical.
 - 2) Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing and labeling.
 - a) NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1.
 - b) NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
 - 3) Insulation: Complying with ASHRAE/IESNA 90.1, unless otherwise indicated, and suitable for operating temperature. Surround entire storage tank and nozzle except connections and controls.
 - d. Heat-Exchanger Coil: NPS 3/4 (DN 20) **OR** NPS 1-1/4 (DN 32), **as directed**, diameter, vented, double-wall, copper or copper-alloy, U tubes with tube sheet and supporting baffles.
 - 1) Heat-Exchanger Pressure Rating: Equal to or greater than heating-fluid supply pressure.
 - e. Temperature Control: Adjustable thermostat.
 - f. Safety Control: Automatic, high-temperature-limit cutoff device or system. Include automatic low-water cutoff device or system.
 - g. Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3, for combination temperature and pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of heat exchanger. Select one relief valve with sensing element that extends into storage tank.
 - h. Gages: Factory-mounted thermometer and pressure gage.
 - i. Circulating Pump: UL 778, all-bronze, centrifugal, overhung-impeller, separately coupled, in-line pump as defined in HI 1.1-1.2 and HI 1.3. Include mechanical seals, 125-psig (860-kPa) minimum working-pressure rating, and 225 deg F (107 deg C) continuous-water-temperature rating.
 - 1) Pump Control: Sensor for operating pump and control valve.
 - j. Miscellaneous Components for Heating Hot-Water Units: Control valve, valves, and piping.
 - k. Miscellaneous Components for Steam Units: Strainers, steam-control valve, steam trap, valves, and piping.
 - l. Support: Factory mounted on skids.
 - m. Energy Management System Interface: Normally closed dry contacts for enabling and disabling heat exchanger.
2. Circulating, Storage Heat Exchangers:
- a. Description: Packaged, large-capacity, hot-water storage tank with heat-exchanger coil, circulator, controls, and specialties for heating domestic water with heating hot water **OR** steam, **as directed**, in coil.
 - b. Flow Pattern: Standard-flow arrangement, with water from bottom of storage tank circulated across heat-exchanger coil and returned to tank. Include hot-water outlet located at top of tank and temperature sensor in tank.
 - c. Flow Pattern: Reverse-flow arrangement, with water from storage tank drawn across heat-exchanger coil and returned to bottom of tank. Include hot-water outlet and temperature sensor located in or at coil shell.
 - d. Storage Tank Construction: ASME-code steel with 125-psig (860-kPa) **OR** 150-psig (1035-kPa), **as directed**, working-pressure rating. Include nozzle and head for heat-exchanger tube coil.



- 1) Configuration: Horizontal **OR** Vertical, **as directed**.
 - 2) Manhole: 11 by 15 inches (280 by 380 mm) in end head of horizontal **OR** sidewall of vertical, **as directed**, storage tank shell.
 - 3) Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing and labeling.
 - a) NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1.
 - b) NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
 - 4) Lining: Cement **OR** Glass **OR** Nickel plate **OR** Phenolic coating **OR** Sheet copper, **as directed**, complying with NSF 61 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.
 - 5) Anode Rods: Factory installed, magnesium.
 - 6) Insulation: Complying with ASHRAE/IESNA 90.1, unless otherwise indicated, and suitable for operating temperature. Surround entire storage tank and nozzle except connections and controls.
 - e. Heat-Exchanger Coil: NPS 3/4 (DN 20) **OR** NPS 1-1/4 (DN 32), **as directed**, diameter, vented, double-wall, copper or copper-alloy, U tubes with tube sheet and supporting baffles.
 - 1) Heat-Exchanger Pressure Rating: Equal to or greater than heating-fluid supply pressure.
 - f. Temperature Control: Adjustable temperature aquastat, mounted in storage tank shell head, unless otherwise indicated.
 - g. Safety Control: Automatic, high-temperature-limit cutoff device or system. Include automatic low-water cutoff device or system.
 - h. Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3, for combination temperature and pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of heat exchanger. Select one relief valve with sensing element that extends into storage tank.
 - i. Gages: Factory-mounted thermometer and pressure gage.
 - j. Circulating Pump: UL 778, all-bronze, centrifugal, overhung-impeller, separately coupled, in-line pump as defined in HI 1.1-1.2 and HI 1.3. Include mechanical seals, 125-psig (860-kPa) minimum working-pressure rating, and 225 deg F (107 deg C) continuous-water-temperature rating.
 - 1) Pump Control: Sensor for operating pump and control valve.
 - k. Support: Factory mounted on skids.
 - l. Energy Management System Interface: Normally closed dry contacts for enabling and disabling heat exchanger.
- C. Noncirculating, Storage Heat Exchangers
1. Compact Heat Exchangers:
 - a. Description: Hot-water storage tank with integral heat-exchanger coil, controls, and specialties for heating domestic water with heating hot water **OR** steam, **as directed**, in coil.
 - b. Storage Tank Shell Construction: Steel or stainless steel with 150-psig (1035-kPa) working-pressure rating.
 - 1) Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
 - 2) Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - 3) Insulation: Complying with ASHRAE/IESNA 90.1 or ASHRAE 90.2, and suitable for operating temperature. Surround entire tank except connections and controls.
 - 4) Jacket: Steel with enameled finish, unless otherwise indicated.
 - 5) Anode Rods for Steel Tanks: Factory installed, magnesium.



- c. Heat-Exchanger Coil: Copper or stainless-steel coil assembly, permanently installed inside storage tank, for heating fluid. Include working-pressure rating equal to or greater than heating-fluid supply pressure.
 - d. Temperature Control: Adjustable thermostat.
 - e. Relief Valve: ASME rated and stamped and complying with ASME PTC 25.3, for combination temperature and pressure relief valves. Include relief valve with relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of heat exchanger. Select relief valve with sensing element that extends into storage tank.
2. Storage Heat Exchangers:
- a. Description: Assembly of hot-water storage tank with separate heat-exchanger coil; controls; and specialties for heating domestic water with heating hot water **OR** steam, **as directed**, in coil.
 - b. Storage Tank Construction: ASME-code steel with 125-psig (860-kPa) **OR** 150-psig (1035-kPa), **as directed**, working-pressure rating. Include nozzle and head for heat-exchanger tube coil.
 - 1) Configuration: Horizontal **OR** Vertical, **as directed**.
 - 2) Manhole: 11 by 15 inches (280 by 380 mm) in end head of horizontal **OR** sidewall of vertical, **as directed**, storage tank shell.
 - 3) Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing and labeling.
 - a) NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1.
 - b) NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
 - 4) Lining: Cement **OR** Glass **OR** Nickel plate **OR** Phenolic coating **OR** Sheet copper, **as directed**, complying with NSF 61 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.
 - 5) Anode Rods: Factory installed, magnesium.
 - 6) Insulation: Complying with ASHRAE/IESNA 90.1, unless otherwise indicated, and suitable for operating temperature. Surround entire storage tank and nozzle except connections and controls.
 - c. Heat-Exchanger Coil: NPS 3/4 (DN 20) **OR** NPS 1-1/4 (DN 32), **as directed**, diameter, vented, double-wall, copper or copper-alloy, U tubes with tube sheet and supporting baffles.
 - 1) Heat-Exchanger Pressure Rating: Equal to or greater than heating-fluid supply pressure.
 - d. Temperature Control: Adjustable temperature aquastat, mounted in storage tank shell head, unless otherwise indicated.
 - e. Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3, for combination temperature and pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of heat exchanger. Select one relief valve with sensing element that extends into storage tank.
 - f. Support: Factory mounted on skids.

D. Plate Heat Exchangers

- 1. Brazed-Plate Heat Exchangers:
 - a. Description: Assembly of heat-exchanger plates, permanently brazed together, for using heating hot water **OR** steam, **as directed**, to heat domestic water.
 - b. Working-Pressure Rating: 150 psig (1035 kPa) **OR** 200 psig (1380 kPa) **OR** 250 psig (1725 kPa) **OR** 400 psig (2760 kPa), **as directed**, minimum.
 - c. Plate Construction: Single **OR** Vented, double, **as directed**, wall.
 - d. Plate Material: ASTM A 666, Type 316 stainless steel.
 - e. Connections: Stainless steel; threaded.



2. Frame-and-Plate Heat Exchangers:
 - a. Description: Assembly of nonfixed-position, heat-exchanger plates, with frame, for using heating hot water **OR** steam, **as directed**, to heat domestic water.
 - b. Working-Pressure Rating: 150 psig (1035 kPa) **OR** 200 psig (1380 kPa) **OR** 250 psig (1725 kPa) **OR** 400 psig (2760 kPa), **as directed**, minimum.
 - c. Frame:
 - 1) Carrying and Guide Bars: Carbon steel **OR** Stainless steel, **as directed**.
 - 2) Fixed, Frame Plate; Pressure Plate; Support Column; and Nuts and Bolts: Carbon steel.
 - d. Channel Plates:
 - 1) Type: Single **OR** Vented, double, **as directed**, wall.
 - 2) Material: ASTM A 666, Type 304 or 316 stainless steel.
 - 3) Gasket Material: Butyl or acrylonitrile-butadiene rubber, suitable for potable water.
 - e. Connections: Stainless steel suitable for potable water.
 - 1) NPS 2 (DN 50) and Smaller: Threaded.
 - 2) NPS 2-1/2 (DN 65) and Larger: Flanged.
 - f. Protective Shroud: Steel, covering channel plates.
 - g. Insulation: Complying with ASHRAE/IESNA 90.1, unless otherwise indicated, and suitable for operating temperature. Surround entire heat exchanger except connections.
- E. Heat Reclaimers
 1. Description: Waste-heat recovery device complying with and listed according to UL 207 for heat reclaimers. Device includes vertical drainage tube with helical, domestic water preheat coil around drainage tube.
 - a. Drainage Tube: ASTM B 306, Type DWV, center, copper drainage tube of size indicated.
 - b. Water Preheat Coil: ASTM B 88, Type L (ASTM B 88M, Type B), copper water tube, of size indicated attached to drainage tube.
 - 1) Working-Pressure Rating: 150 psig (1035 kPa) on potable-water supply tubing.
 - c. Capacity and Characteristics:
 - 1) NPS 2 (DN 50) Drainage Tube:
 - a) Domestic Water Preheat Coil: NPS 3/8 (DN 10).
 - b) Unit Height: 20 inches (508 mm) **OR** 24 inches (610 mm) **OR** 30 inches (762 mm), **as directed**.
 - 2) NPS 3 (DN 80) Drainage Tube:
 - a) Domestic Water Preheat Coil: NPS 1/2 (DN 15) **OR** NPS 3/4 (DN 20), **as directed**.
 - b) Unit Height: 30 inches (762 mm) **OR** 40 inches (1016 mm) **OR** 60 inches (1524 mm), **as directed**.
 - 3) NPS 4 (DN 100) Drainage Tube:
 - a) Domestic-Water Preheat Coil: NPS 1/2 (DN 15) **OR** NPS 3/4 (DN 20), **as directed**.
 - b) Unit Height: 30 inches (762 mm) **OR** 40 inches (1016 mm) **OR** 60 inches (1524 mm), **as directed**.
- F. Compression Tanks
 1. Description: Steel, pressure-rated tank constructed with welded joints and factory-installed, butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
 - a. Construction:
 - 1) Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
 - 2) Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - 3) Air-Charging Valve: Factory installed.
 - b. Capacity and Characteristics:
 - 1) Working-Pressure Rating: 100 psig (690 kPa) **OR** 150 psig (1035 kPa), **as directed**.



- 2) Capacity Acceptable: 2 gal. (7.6 L) **OR** 4 gal. (15.1 L) **OR** 7 gal. (26.5 L) **OR** 10 gal. (37.9 L), **as directed**, minimum.

G. Heat-Exchanger Accessories

1. Combination Temperature and Pressure Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3. Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of heat exchanger. Select relief valves with sensing element that extends into heat-exchanger storage tank.
2. Pressure Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3. Include pressure setting less than working-pressure rating of heat exchanger.
3. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.
4. Source Quality Control
5. Test and inspect heat-exchanger storage tanks, specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.
6. Hydrostatically test commercial heat-exchanger storage tanks before shipment to minimum of one and one-half times pressure rating.
7. Prepare test reports.

1.3 EXECUTION

A. Heat-Exchanger Installation

1. Install heat exchangers on concrete bases.
 - a. Concrete base construction requirements are specified in Division 22 Section "Common Work Results For Plumbing".
2. Install heat exchangers level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
3. Anchor heat exchangers to substrate.
4. Install seismic restraints for heat exchangers. Anchor to substrate.
5. Install temperature and pressure relief valves in top portion of storage tank shells of heat exchangers with domestic water storage. Use relief valves with sensing elements that extend into shells. Extend relief-valve outlet, with drain piping same as water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
6. Install combination temperature and pressure relief valves in water piping for heat exchangers without storage. Extend relief-valve outlet, with drain piping same as water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
7. Install heat-exchanger drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for heat exchangers that do not have tank drains. Refer to Division 22 Section "Domestic Water Piping Specialties" for hose-end drain valves.
8. Install thermometer on each heat-exchanger domestic-water inlet and outlet piping, and install thermometer on each heat-exchanger heating-fluid inlet and outlet piping. Refer to Division 22 Section "Meters And Gages For Plumbing Piping" for thermometers.
9. Install pressure gages on heat-exchanger heating-fluid piping. Refer to Division 22 Section "Meters And Gages For Plumbing Piping" for pressure gages.
10. Fill heat exchangers with water.
11. Charge compression tanks with air.

B. Connections

1. Piping installation requirements are specified in other Division 14. Drawings indicate general arrangement of piping, fittings, and specialties.
2. Install piping adjacent to heat exchangers to allow service and maintenance. Arrange piping for easy removal of heat exchangers.



3. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
 4. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".
- C. Field Quality Control
1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
 2. Perform the following field tests and inspections and prepare test reports:
 - a. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
 - b. Operational Test: After electrical circuitry has been energized, confirm proper operation.
 - c. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 3. Remove and replace heat exchangers that do not pass tests and inspections and retest as specified above.
- D. Demonstration
1. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain heat exchangers.

END OF SECTION 22 35 23 00



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Task	Specification	Specification Description
22 35 23 00	22 12 23 13	Electric, Domestic Water Heaters
22 40 00 00	10 28 19 16	Plumbing Fixtures
22 41 39 00	10 28 19 16	Plumbing Fixtures
22 41 39 00	01 95 22 00	Emergency Plumbing Fixtures



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SECTION 22 42 13 00 - SECURITY PLUMBING FIXTURES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for security plumbing fixtures. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following security plumbing fixtures and related components:
 - a. Combination units.
 - b. Drinking fountains.
 - c. Lavatories.
 - d. Service sinks.
 - e. Shampoo bowls.
 - f. Showers.
 - g. Urinals.
 - h. Water closets.
 - i. Flushometer valves for vitreous-china water closets.
 - j. Fixture supports for front-mounting, stainless-steel fixtures and vitreous-china, wall-mounting fixtures.

C. Definitions

1. Accessible Fixture: Security plumbing fixture that can be approached and used by people with disabilities.
2. Back-Mounting-Type Fixture: Security plumbing fixture designed to mount on wall sleeve built into wall so installation and removal of fixture and piping and other components are only accessible from service space behind wall.
3. Front-Mounting-Type Fixture: Security plumbing fixture designed to mount on fixture support with installation and removal from fixture side of wall, and piping and other components are accessible from access panels in fixture or wall.

D. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittal:
 - a. Product Data for Credit WE 2, 3.1, and 3.2: Documentation indicating flow and water consumption requirements.
3. Shop Drawings: Diagram power, signal, and control wiring.
4. Field quality-control test reports.
5. Operation and maintenance data.

E. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act", **as directed**; about security plumbing fixtures for people with disabilities. Comply with requirements in "Energy Policy Act" about water flow and consumption rates for plumbing fixtures.
3. NSF Standard: Comply with NSF 61, "Drinking Water System Components - Health Effects," for fixture materials that will be in contact with potable water.



4. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

1.2 PRODUCTS

A. Combination Units

1. Security Combination Units:

- a. Description: Back-mounting, cabinet, security plumbing fixture with integral water closet and lavatory; fabricated from 0.078-inch (2.0-mm) minimum **OR** 0.109-inch (2.8-mm), **as directed**, thickness, ASTM A 666, Type 304 stainless steel. Include SSINA No. 4 polished finish on exposed surfaces, and corrosion-resistant metal for internal piping and bracing.
 - 1) Water Closet: Comply with IAPMO PS 61 for water-closet component.
 - a) Bowl: Elongated, with back inlet, integral trap, blowout design with back **OR** siphon-jet design with back **OR** siphon-jet design with floor, **as directed**, outlet and contoured seat.
 - i. Seat Surface: SSINA No. 7 polished finish.
 - ii. Punching: Provide two holes for installation of separate toilet seat.
 - iii. Drain: NPS 4 (DN 100) **OR** NPS 3 (DN 80), **as directed**, horizontal with cleanout and slip joint **OR** vertical, **as directed**.
 - b) Toilet Seat: ANSI Z124.5, white, **OR** black, **as directed**, commercial, heavy-duty, elongated, open front with cover, **as directed**, with check **OR** self-sustaining **OR** self-sustaining, check, **as directed**, hinges.
 - c) Flushing Device: Concealed flushometer valve with stainless-steel access panel, push-button mechanism, and 3.5-gal./flush (13.3-L/flush) **OR** 1.6-gal./flush (6.0-L/flush), **as directed**, consumption. Refer to "Flushometer Valves" Article.
 - 2) Lavatory: In top of cabinet.
 - a) Receptor: Oval **OR** Rectangular, **as directed**, bowl with integral soap depression.
 - b) Hot- and Cold-Water and Bubbler, **as directed**, Supply Valves: Pneumatic **OR** Mechanical-metering **OR** Electric-solenoid, **as directed**, type with push-button actuation and individual check stop.
 - c) Filler Spout: Backsplash **OR** Deck, **as directed**, mounted.
 - d) Drain: Integral punched grid with NPS 1-1/4 (DN 32) minimum horizontal waste and trap complying with ASME A112.18.2 **OR** concealed waste piping to spill into water-closet bowl, **as directed**.
 - e) Toothbrush Holders: One on each **OR** left **OR** right, **as directed**, side of backsplash.
 - f) Towel Hooks: One **OR** Two, **as directed**, on each **OR** left **OR** right, **as directed**, side of fixture.
 - g) Bubbler Location: On backsplash **OR** deck, **as directed**.
 - 3) Cabinet Configuration: Rectangular apron **OR** Five-sided apron with two angled sides **OR** Four-sided apron with angled left side **OR** Four-sided apron with angled right side, **as directed**, made for above-floor **OR** on-floor, **as directed**, installation and with backsplash.
 - a) Water-Closet Bowl Location: Centered on front **OR** Left of center on front **OR** Right of center on front **OR** On angled left side **OR** On angled right side, **as directed**, of apron.
 - b) Toilet Paper Holder: Recessed, 0.063-inch (1.6-mm) minimum thickness, stainless steel complying with ASTM A 666, Type 304 and located above water closet and centered in front **OR** in front **OR** right of center in front **OR** left of center in front **OR** in angled right side **OR** in angled left side **OR** in right side **OR** in left side, **as directed**, of apron.



- 4) Wall Sleeve: Galvanized-steel frame of dimensions required to match and support entire fixture. Include steel bars or other design that will prevent escape if fixture is removed.

B. Drinking Fountains

1. Security Drinking Fountains, Back-Mounting:

- a. Description: Back-mounting, accessible, **as directed**, security plumbing fixture; fabricated from 0.078-inch (2.0-mm) minimum **OR** 0.109-inch (2.8-mm), **as directed**, thickness, ASTM A 666, Type 304 stainless steel. Include SSINA No. 4 polished finish on exposed surfaces, and corrosion-resistant metal for internal piping and bracing.
 - 1) Receptor: Bowl or depression in top and with backsplash.
 - 2) Bubbler Location: On backsplash **OR** deck, **as directed**.
 - 3) Bubbler Water-Supply Valve: Pneumatic type with push-button actuation.
 - 4) Drain: Integral punched grid with NPS 1-1/4 (DN 32) minimum horizontal waste and trap complying with ASME A112.18.2.
 - 5) Wall Sleeve: Galvanized-steel frame of dimensions required to match and support fixture.

2. Security Drinking Fountains, Front-Mounting:

- a. Description: Front-mounting, accessible, **as directed**, security plumbing fixture; fabricated from 0.078-inch (2.0-mm) minimum **OR** 0.109-inch (2.8-mm), **as directed**, thickness, ASTM A 666, Type 304 stainless steel. Include SSINA No. 4 polished finish on exposed surfaces, and corrosion-resistant metal for internal piping and bracing.
 - 1) Receptor: Bowl or depression in top and with backsplash.
 - 2) Bubbler Location: On backsplash **OR** deck, **as directed**.
 - 3) Bubbler Water-Supply Valve: Pneumatic type with push-button actuation.
 - 4) Drain: Integral punched grid with NPS 1-1/4 (DN 32) minimum tailpiece, trap, and waste, and complying with ASME A112.18.2.
 - 5) Access to Internal Components: Vandal-resistant access panels.
 - 6) Mounting Device: Wall bracket.
 - 7) Support: Chair carrier. Refer to "Fixture Supports" Article.

C. Lavatories

1. Security Lavatories, Back-Mounting:

- a. Description: Back-mounting, accessible, **as directed**, security plumbing fixture; fabricated from 0.078-inch (2.0-mm) minimum **OR** 0.109-inch (2.8-mm), **as directed**, thickness, ASTM A 666, Type 304 stainless steel. Include SSINA No. 4 polished finish on exposed surfaces, and corrosion-resistant metal for internal piping and bracing.
 - 1) Receptor: Oval **OR** Rectangular, **as directed**, bowl with integral soap depression and backsplash.
 - 2) Hot- and Cold-Water and Bubbler, **as directed**, Supply Valves: Pneumatic **OR** Mechanical-metering **OR** Electric-solenoid, **as directed**, type with push-button actuation and individual check stop.
 - 3) Filler Spout: Backsplash **OR** Deck, **as directed**, mounted.
 - 4) Drain: Integral punched grid with NPS 1-1/4 (DN 32) minimum horizontal waste and trap complying with ASME A112.18.2.
 - 5) Toothbrush Holders: One on each **OR** left **OR** right, **as directed**, side of backsplash.
 - 6) Towel Hooks: One **OR** Two, **as directed**, on each **OR** left **OR** right, **as directed**, side of fixture.
 - 7) Bubbler Location: On backsplash **OR** deck, **as directed**.
 - 8) Wall Sleeve: Galvanized-steel frame of dimensions required to match and support fixture.

2. Security Lavatories, Front-Mounting:

- a. Description: Front-mounting, accessible, **as directed**, security plumbing fixture; fabricated from 0.078-inch (2.0-mm) minimum **OR** 0.109-inch (2.8-mm), **as directed**, thickness,



ASTM A 666, Type 304, stainless steel. Include SSINA No. 4 polished finish on exposed surfaces, and corrosion-resistant metal for internal piping and bracing.

- 1) Receptor: Oval **OR** Rectangular, **as directed**, bowl with integral soap depression and backsplash.
 - 2) Hot- and Cold-Water and Bubbler, **as directed**, Supply Valves: Pneumatic **OR** Mechanical-metering **OR** Electric-solenoid, **as directed**, type with push-button actuation and individual check stop.
 - 3) Filler Spout: Backsplash **OR** Deck, **as directed**, mounted.
 - 4) Drain: Integral punched grid with NPS 1-1/4 (DN 32) minimum tailpiece, trap, and waste complying with ASME A112.18.2.
 - 5) Toothbrush Holders: One on each **OR** left **OR** right, **as directed**, side of backsplash.
 - 6) Towel Hooks: One **OR** Two, **as directed**, on each **OR** left **OR** right, **as directed**, side of fixture.
 - 7) Bubbler Location: On backsplash **OR** deck, **as directed**.
 - 8) Access to Internal Components: Vandal-resistant access panels.
 - 9) Mounting Device: Wall bracket.
 - 10) Support: Chair carrier. Refer to "Fixture Supports" Article.
3. Security Lavatories, Vitreous-China:
- a. Description: ASME A112.19.2M, vitreous-china security plumbing fixture made for institutional applications, with integral soap depression and NPS 1-1/4 (DN 32) waste outlet and with factory-installed, push-button, self-closing, chrome-plated brass faucets complying with ASME A112.18.1.
 - 1) Waste: NPS 1-1/4 (DN 32) minimum piping and trap complying with ASME A112.18.2.
 - 2) Mounting Device: Wall bracket.
 - 3) Support: Chair carrier. Refer to "Fixture Supports" Article.

D. Service Sinks

1. Security Service Sinks:
 - a. Description: Back-mounting security plumbing fixture made for above-floor **OR** on-floor, **as directed**, installation; fabricated from 0.078-inch (2.0-mm) minimum **OR** 0.109-inch (2.8-mm), **as directed**, thickness, ASTM A 666, Type 304 stainless steel. Include SSINA No. 4 polished finish on exposed surfaces, and corrosion-resistant metal for internal piping and bracing.
 - 1) Receptor: Rectangular bowl with high backsplash.
 - 2) Hot- and Cold-Water-Supply Valves: Pneumatic type with push-button actuation and individual check stop.
 - 3) Filler Spout: Backsplash mounted.
 - 4) Drain: Grid with NPS 2 (DN 50) waste and trap complying with ASME A112.18.2.
 - 5) Wall Sleeve: Galvanized-steel frame of dimensions required to match and support fixture.

E. Shampoo Bowls

1. Security Shampoo Bowls:
 - a. Description: Front-mounting security plumbing fixture made for above-floor **OR** counter-mounting, **as directed**, installation; fabricated from 0.078-inch (2.0-mm) thickness, ASTM A 666, Type 304 stainless steel and corrosion-resistant metal internal piping and bracing.
 - 1) Receptor: Bowl with contoured neck rest.
 - 2) Finish: White **OR** Black, **as directed**, enamel.
 - 3) Exposed Surfaces without Enamel Finish: SSINA No. 4 polished finish.
 - 4) Faucet: Dial single-lever control with vacuum breaker, hose, and spray.
 - 5) Drain: Basket strainer with NPS 1-1/2 (DN 40) tailpiece, trap, and waste to wall complying with ASME A112.18.2.



- 6) Access to Internal Components: Vandal-resistant access panels.
- 7) Mounting Device: Wall bracket.
- 8) Support: Chair carrier. Refer to "Fixture Supports" Article.

F. Showers

1. Security Showers, Back-Mounting, Recessed:
 - a. Description: Back-mounting, accessible, **as directed**, recessed security plumbing fixture made with wall plate for flush installation; fabricated from 0.078-inch (2.0-mm) minimum **OR** 0.109-inch (2.8-mm), **as directed**, thickness, ASTM A 666, Type 304 stainless steel. Include SSINA No. 4 polished finish on exposed surfaces, and corrosion-resistant metal for internal piping and bracing.
 - 1) Configuration: Wall type with shower head and soap dish.
 - 2) Tempered-Water-Supply **OR** Hot- and Cold-Water-Supply, **as directed**, Valves: Pneumatic **OR** Mechanical-metering **OR** Electric-solenoid, **as directed**, type with individual check stop.
 - 3) Shower: Hose with vandal-resistant, hand-held **OR** Vandal-resistant, fixed-type **OR** Vandal-resistant, swivel-type, **as directed**, head.
 - 4) Soap Dish: Recessed, stainless steel.
 - 5) Wall Sleeve: Galvanized-steel frame of dimensions required to match and support fixture.
2. Security Showers, Front-Mounting, Recessed:
 - a. Description: Front-mounting, accessible, **as directed**, recessed security plumbing fixture made with wall plate for flush installation; fabricated from 0.078-inch (2.0-mm) minimum **OR** 0.109-inch (2.8-mm), **as directed**, thickness, ASTM A 666, Type 304 stainless steel. Include SSINA No. 4 polished finish on exposed surfaces, and corrosion-resistant metal for internal piping and bracing.
 - 1) Configuration: Wall type with shower head and soap dish.
 - 2) Tempered-Water-Supply **OR** Hot- and Cold-Water-Supply, **as directed**, Valves: Pneumatic **OR** Mechanical-metering **OR** Electric-solenoid, **as directed**, type with individual check stop.
 - 3) Shower: Hose with vandal-resistant, hand-held **OR** Vandal-resistant, fixed-type **OR** Vandal-resistant, swivel-type, **as directed**, head.
 - 4) Soap Dish: Recessed, stainless steel.
 - 5) Access to Internal Components: Vandal-resistant access panels.
 - 6) Mounting Device: Wall-mounting frame.
3. Security Showers, Front-Mounting, Surface Installation:
 - a. Description: Front-mounting, accessible, **as directed**, security plumbing fixture made for surface installation; fabricated from 0.078-inch (2.0-mm) minimum **OR** 0.109-inch (2.8-mm), **as directed**, thickness, ASTM A 666, Type 304 stainless steel. Include SSINA No. 4 polished finish on exposed surfaces, and corrosion-resistant metal for internal piping and bracing.
 - 1) Configuration: Wall type with shower head and soap dish.
 - 2) Tempered-Water-Supply **OR** Hot- and Cold-Water-Supply, **as directed**, Valves: Pneumatic **OR** Mechanical-metering **OR** Electric-solenoid, **as directed**, type with individual check stops.
 - 3) Soap Dish: Recessed, stainless steel.
 - 4) Access to Internal Components: Vandal-resistant access panels.
 - 5) Mounting Device: Wall-mounting frame.
4. Security Showers, Back-Mounting, Accessible:
 - a. Description: Back-mounting, accessible, cabinet, security plumbing fixture; fabricated from 0.078-inch (2.0-mm) minimum **OR** 0.109-inch (2.8-mm), **as directed**, thickness, ASTM A 666, Type 304 stainless steel. Include SSINA No. 4 polished finish on exposed surfaces, and corrosion-resistant metal for internal piping and bracing.
 - 1) Configuration: Cabinet 42 or 44 by 36 inches (1065 or 1120 by 915 mm) **OR** 48 by 36 inches (1220 by 915 mm), **as directed**, with floor and top, **as directed**, with stainless-steel soap dish, towel hook, drain, seat, and grab bar.



- 2) Tempered-Water-Supply **OR** Hot- and Cold-Water-Supply, **as directed**, Valves: Pneumatic **OR** Mechanical-metering **OR** Electric-solenoid, **as directed**, type with individual check stops.
- 3) Shower: Hose with vandal-resistant, hand-held head.
- 4) Drain: NPS 2 (DN 50) strainer, waste to wall, and trap complying with ASME A112.18.2.
- 5) Wall Sleeve: Galvanized-steel frame of dimensions required to match and support fixture.

5. Security Showers, Back-Mounting:

- a. Description: Back-mounting, cabinet, security plumbing fixture; fabricated from 0.078-inch (2.0-mm) minimum **OR** 0.109-inch (2.8-mm), **as directed**, thickness, ASTM A 666, Type 304 stainless steel. Include SSINA No. 4 polished finish on exposed surfaces, and corrosion-resistant metal for internal piping and bracing.
 - 1) Configuration: Cabinet 30 by 30 inches (760 by 760 mm) **OR** 32 by 32 inches (815 by 815 mm) **OR** 36 by 36 inches (915 by 915 mm), **as directed**, with floor and top, **as directed**, and with stainless-steel soap dish, towel hook, and drain.
 - 2) Tempered-Water-Supply **OR** Hot- and Cold-Water-Supply, **as directed**, Valves: Pneumatic **OR** Mechanical-metering **OR** Electric-solenoid, **as directed**, type with individual check stops.
 - 3) Shower: Vandal-resistant, fixed **OR** Fixed **OR** Swivel, **as directed**, -type head.
 - 4) Drain: NPS 2 (DN 50) strainer, waste to wall, and trap complying with ASME A112.18.2.
 - 5) Wall Sleeve: Galvanized-steel frame of dimensions required to match and support fixture.

G. Urinals

1. Security Urinals, Back-Mounting:

- a. Description: Back-mounting security plumbing fixture; fabricated from 0.078-inch (2.0-mm) minimum **OR** 0.109-inch (2.8-mm), **as directed**, thickness, ASTM A 666, Type 304 stainless steel. Include SSINA No. 4 polished finish on exposed surfaces, and corrosion-resistant metal for internal piping and bracing.
 - 1) Type and Configuration: Blowout **OR** Washout, **as directed**, type with back inlet and extended shields.
OR
Type and Configuration: Washout, trough type, and 36 inches (915 mm) **OR** 48 inches (1220 mm), **as directed**, wide.
 - 2) Drain: Strainer with NPS 2 (DN 50) tailpiece, trap under fixture, and drain piping.
 - 3) Flushing Device: Concealed flushometer valve with stainless-steel access panel, push-button mechanism, and 3.5-gal./flush (13.3-L/flush) **OR** 1.5-gal./flush (5.7-L/flush) **OR** 1.0-gal./flush (3.78-L/flush), **as directed**, consumption. Refer to "Flushometer Valves" Article.
 - 4) Wall Sleeve: Galvanized-steel frame of dimensions required to match and support fixture.

2. Security Urinals, Front-Mounting:

- a. Description: Front-mounting security plumbing fixture; fabricated from 0.078-inch (2.0-mm) minimum **OR** 0.109-inch (2.8-mm), **as directed**, thickness, ASTM A 666, Type 304 stainless steel. Include SSINA No. 4 polished finish on exposed surfaces, and corrosion-resistant metal for internal piping and bracing.
 - 1) Type and Configuration: Blowout **OR** Washout, **as directed**, type with back **OR** top, **as directed**, inlet and extended shields.
OR
Type and Configuration: Washout, trough type, and 36 inches (915 mm) **OR** 48 inches (1220 mm), **as directed**, wide.
 - 2) Drain: Strainer with NPS 2 (DN 50) tailpiece, trap under fixture, and drain piping complying with ASME A112.18.2.



- 3) Flushing Device: Concealed flushometer valve with stainless-steel access panel, push-button **OR** Exposed flushometer valve with oscillating lever-handle, **as directed**, mechanism, and 3.5-gal./flush (13.3-L/flush) **OR** 1.5-gal./flush (5.7-L/flush) **OR** 1.0-gal./flush (3.78-L/flush), **as directed** consumption. Refer to "Flushometer Valves" Article.
 - 4) Support: Chair carrier. Refer to "Fixture Supports" Article.
 3. Security Urinals, Back-Mounting, Wall-And-Floor Installation:
 - a. Description: Back-mounting security plumbing fixture made for wall-and-floor installation; fabricated from 0.078-inch (2.0-mm) minimum **OR** 0.109-inch (2.8-mm), **as directed**, thickness, ASTM A 666, Type 304 stainless steel. Include SSINA No. 4 polished finish on exposed surfaces, and corrosion-resistant metal for internal piping and bracing.
 - 1) Type and Configuration: Washout, stall type with back inlet.
 - 2) Drain: Strainer with NPS 2 (DN 50) outlet.
 - 3) Flushing Device: Concealed flushometer valve with stainless-steel access panel, push-button mechanism, and 1.5-gal./flush (5.7-L/flush) **OR** 1.0-gal./flush (3.78-L/flush), **as directed**, consumption. Refer to "Flushometer Valves" Article.
 4. Security Urinals, Front-Mounting, Wall-And-Floor Installation:
 - a. Description: Front-mounting security plumbing fixture made for wall-and-floor installation; fabricated from 0.078-inch (2.0-mm) minimum **OR** 0.109-inch (2.8-mm), **as directed**, thickness, ASTM A 666, Type 304 stainless steel. Include SSINA No. 4 polished finish on exposed surfaces, and corrosion-resistant metal for internal piping and bracing.
 - 1) Type and Configuration: Washout, stall type with back **OR** top, **as directed**, inlet.
 - 2) Drain: Strainer with NPS 2 (DN 50) outlet.
 - 3) Flushing Device: Concealed flushometer valve with stainless-steel access panel, push-button **OR** Exposed flushometer valve with oscillating lever-handle, **as directed**, mechanism, and 1.5-gal./flush (5.7-L/flush) **OR** 1.0-gal./flush (3.78-L/flush), **as directed**, consumption. Refer to "Flushometer Valves" Article.
 - 4) Support: Chair carrier. Refer to "Fixture Supports" Article.
- H. Water Closets
1. Security Water Closets, Back-Mounting, Above Floor Installation:
 - a. Description: IAPMO PS 61, back-mounting, accessible, **as directed**, security plumbing fixture made for above-floor installation; fabricated from 0.078-inch (2.0-mm) minimum **OR** 0.109-inch (2.8-mm), **as directed**, thickness, ASTM A 666, Type 304 stainless steel. Include SSINA No. 4 polished finish on exposed surfaces, and corrosion-resistant metal for internal piping and bracing.
 - 1) Configuration: Compact design, with bowl on wall flange.
 - 2) Bowl: Elongated, with back inlet, integral trap, blowout design with back outlet and contoured seat.
 - a) Seat Surface: SSINA No. 7 polished finish.
 - b) Punching: Provide two holes for installation of separate toilet seat.
 - c) Drain: NPS 4 (DN 100) **OR** NPS 3 (DN 80), **as directed**, horizontal with cleanout and slip joint.
 - 3) Flushing Device: Concealed flushometer valve with stainless-steel access panel, push-button **OR** Exposed flushometer valve with oscillating lever-handle, **as directed**, mechanism, and 3.5-gal./flush (13.3-L/flush) **OR** 1.6-gal./flush (6.0-L/flush), **as directed**, consumption. Refer to "Flushometer Valves" Article.
 - 4) Toilet Seat, **as directed**: ANSI Z124.5, white, **OR** black, **as directed**, commercial, heavy-duty, elongated, open front with cover, **as directed**, with check **OR** self-sustaining **OR** self-sustaining, check, **as directed**, hinges.
 - 5) Wall Sleeve: Galvanized-steel frame of dimensions required to match and support fixture. Include steel bars or other design that will prevent escape if fixture is removed.
 2. Security Water Closets, Back-Mounting, Off Floor Installation:
 - a. Description: IAPMO PS 61, back-mounting, accessible, **as directed**, security plumbing fixture made for off-floor installation; fabricated from 0.078-inch (2.0-mm) minimum **OR**



- 0.109-inch (2.8-mm), **as directed**, thickness, ASTM A 666, Type 304 stainless steel. Include SSINA No. 4 polished finish on exposed surfaces, and corrosion-resistant metal for internal piping and bracing.
- 1) Configuration: Standard design.
 - 2) Bowl: Elongated, with back **OR** top, **as directed**, inlet, integral trap, blowout **OR** siphon-jet, **as directed**, design with back outlet and contoured seat.
 - a) Seat Surface: SSINA No. 7 polished finish.
 - b) Punching: Provide two holes for installation of separate toilet seat.
 - c) Drain: NPS 4 (DN 100) **OR** NPS 3 (DN 80), **as directed**, horizontal with cleanout and slip joint.
 - 3) Flushing Device: Concealed flushometer valve with stainless-steel access panel, push-button **OR** Exposed flushometer valve with oscillating lever-handle, **as directed**, mechanism, and 3.5-gal./flush (13.3-L/flush) **OR** 1.6-gal./flush (6.0-L/flush), **as directed**, consumption. Refer to "Flushometer Valves" Article.
 - 4) Toilet Seat, **as directed**: ANSI Z124.5, white, **OR** black, **as directed**, commercial, heavy-duty, elongated, open front with cover, **as directed**, with check **OR** self-sustaining **OR** self-sustaining, check, **as directed**, hinges.
 - 5) Wall Sleeve: Galvanized-steel frame of dimensions required to match and support fixture. Include steel bars or other design that will prevent escape if fixture is removed.
3. Security Water Closets, Front-Mounting, Off-Floor Installation:
- a. Description: IAPMO PS 61, front-mounting, accessible, **as directed**, security plumbing fixture made for off-floor installation; fabricated from 0.078-inch (2.0-mm) minimum **OR** 0.109-inch (2.8-mm), **as directed**, thickness, ASTM A 666, Type 304 stainless steel. Include SSINA No. 4 polished finish on exposed surfaces, and corrosion-resistant metal for internal piping and bracing.
 - 1) Configuration: Standard design.
 - 2) Bowl: Elongated, with back **OR** top, **as directed**, inlet, integral trap, blowout **OR** siphon-jet, **as directed**, design with back outlet and contoured seat.
 - a) Seat Surface: SSINA No. 7 polished finish.
 - b) Punching: Provide two holes for installation of separate toilet seat.
 - 3) Access to Internal Components: Vandal-resistant access panels.
 - 4) Flushing Device: Concealed flushometer valve with stainless-steel access panel, push-button **OR** Exposed flushometer valve with oscillating lever-handle, **as directed**, mechanism, and 3.5-gal./flush (13.3-L/flush) **OR** 1.6-gal./flush (6.0-L/flush), **as directed**, consumption. Refer to "Flushometer Valves" Article.
 - 5) Toilet Seat, **as directed**: ANSI Z124.5, white, **OR** black, **as directed**, commercial, heavy-duty, elongated, open front with cover, **as directed**, with check **OR** self-sustaining **OR** self-sustaining, check, **as directed**, hinges.
 - 6) Support: Combination support and waste fitting assembly. Refer to "Fixture Supports" Article.
4. Security Water Closets, Back-Mounting, On-Floor Installation:
- a. Description: IAPMO PS 61, back-mounting security plumbing fixture made for on-floor installation; fabricated from 0.078-inch (2.0-mm) minimum **OR** 0.109-inch (2.8-mm), **as directed**, thickness, ASTM A 666, Type 304 stainless steel. Include SSINA No. 4, polished finish on exposed surfaces, and corrosion-resistant metal for internal piping and bracing.
 - 1) Configuration: Standard design.
 - 2) Bowl: Elongated, with back **OR** top, **as directed**, inlet, integral trap, blowout **OR** siphon-jet, **as directed**, design with back outlet and contoured seat.
 - a) Seat Surface: SSINA No. 7 polished finish.
 - b) Punching: Provide two holes for installation of separate toilet seat.
 - c) Drain: NPS 4 (DN 100) **OR** NPS 3 (DN 80), **as directed**, horizontal with cleanout and slip joint.



- 3) Flushing Device: Concealed flushometer valve with stainless-steel access panel, push-button **OR** Exposed flushometer valve with oscillating lever-handle, **as directed**, mechanism, and 3.5-gal./flush (13.3-L/flush) **OR** 1.6-gal./flush (6.0-L/flush), **as directed**, consumption. Refer to "Flushometer Valves" Article.
 - 4) Toilet Seat, **as directed**: ANSI Z124.5, white, **OR** black, **as directed**, commercial, heavy-duty, elongated, open front with cover, **as directed**, with check **OR** self-sustaining **OR** self-sustaining, check, **as directed**, hinges.
5. Security Water Closets, Front-Mounting, On-Floor Installation:
- a. Description: IAPMO PS 61, front-mounting security plumbing fixture made for on-floor installation; fabricated from 0.078-inch (2.0-mm) minimum **OR** 0.109-inch (2.8-mm), **as directed**, thickness, ASTM A 666, Type 304 stainless steel. Include SSINA No. 4 polished finish on exposed surfaces, and corrosion-resistant metal for internal piping and bracing.
 - 1) Configuration: Standard design.
 - 2) Bowl: Elongated, with back **OR** top, **as directed**, inlet, integral trap, siphon-jet design with back **OR** floor, **as directed**, outlet and contoured seat.
 - a) Seat Surface: SSINA No. 7 polished finish.
 - b) Punching: Provide two holes for installation of separate toilet seat.
 - 3) Access to Internal Components: Vandal-resistant access panels.
 - 4) Flushing Device: Concealed flushometer valve with stainless-steel access panel, push-button **OR** Exposed flushometer valve with oscillating lever-handle, **as directed**, mechanism, and 3.5-gal./flush (13.3-L/flush) **OR** 1.6-gal./flush (6.0-L/flush), **as directed**, consumption. Refer to "Flushometer Valves" Article.
 - 5) Toilet Seat, **as directed**: ANSI Z124.5, white, **OR** black, **as directed**, commercial, heavy-duty, elongated, open front with cover, **as directed**, with check **OR** self-sustaining **OR** self-sustaining, check, **as directed**, hinges.
 - 6) Support: Combination support and waste fitting assembly. Refer to "Fixture Supports" Article.
6. Security Water Closets, Vitreous-China, Wall-Mounting, On-Floor Installation
- a. Description: ASME A112.19.2M, vitreous-china, wall-mounting and on-floor installation, back-inlet, blowout **OR** siphon-jet, **as directed**, fixture with integral contoured seat and made for institutional applications.
 - 1) Flushing Device: Concealed flushometer valve with stainless-steel access panel, push-button mechanism, and 3.5-gal./flush (13.3-L/flush) **OR** 1.6-gal./flush (6.0-L/flush), **as directed**, consumption. Refer to "Flushometer Valves" Article.
 - 2) Support: Combination support and waste fitting assembly. Refer to "Fixture Supports" Article.
7. Security Water Closets, Vitreous-China, Wall-Mounting:
- a. Description: ASME A112.19.2M, vitreous-china, accessible, **as directed**, wall-mounting, back-inlet, blowout fixture with integral contoured seat and made for institutional applications.
 - 1) Flushing Device: Concealed flushometer valve with stainless-steel access panel, push-button mechanism, and 3.5-gal./flush (13.3-L/flush) consumption. Refer to "Flushometer Valves" Article.
 - 2) Support: Combination support and waste fitting assembly. Refer to "Fixture Supports" Article.
- I. Flushometer Valves
1. Flushing Devices for Vitreous-China Water Closets:
 - a. Description: Flushometer valves, trim, and components complying with ASSE 1037. Include brass body, check-stop inlet, diaphragm operation, vacuum breaker, tailpiece, chrome-plated finish on exposed components, and non-hold-open feature on oscillating lever-handle trip mechanism. See fixture type for consumption.
- J. Fixture Supports
1. Back-mounting fixtures are installed on wall sleeves. Front-mounting and wall-mounting fixtures are installed on supports specified herein.



2. Off-Floor, Plumbing Fixture Supports:
 - a. Description: ASME A112.6.1M carriers with dimensions and trim matching fixture.
 - 1) Stainless-Steel, Front-Mounting Fixtures: With modifications.
 - a) Drinking Fountains: Type I drinking fountain carrier.
 - b) Lavatories: Type III lavatory carrier.
 - c) Shampoo Bowls: Type II sink carrier.
 - d) Urinals: Type I urinal carrier with inlet seal unless Type II is required.
 - e) Water Closets: Combination support and waste fitting assembly.
 - 2) Vitreous-China, Wall-Mounting Fixtures:
 - a) Lavatories: Type III lavatory carrier.
 - b) Water Closets: Combination support and waste fitting assembly.
 - 3) Carriers: With vertical steel uprights with feet. Include tie rods, bearing plates, and mounting studs matching fixture to be supported.
 - 4) Combination Support and Waste Fitting Assemblies: With feet and inlet seal.
 - 5) Carriers for Accessible Fixtures: Include rectangular, vertical steel uprights instead of steel pipe uprights.

1.3 EXECUTION

- A. Security Plumbing Fixture Installation
 1. Install back-mounting-type, stainless-steel security plumbing fixtures as follows:
 - a. Install wall sleeve in wall.
 - b. Install fixture on wall sleeve; mount components on or attached to wall sleeve with access from accessible service space.
 - c. Extend supply piping from service space to fixture.
 - d. Install soil and waste piping from fixture and extend into service space.
 - e. Install fixture trap in service space instead of below fixture drain.
 2. Install front-mounting-type, stainless-steel security plumbing fixtures as follows:
 - a. Install fixture support or mounting bracket.
 - b. Install fixture on support; mount components inside of or attached to fixture.
 - c. Extend supply piping from pipe space to fixture.
 - d. Install trap below fixture and extend soil and waste piping into pipe space.
 3. Install vitreous-china security plumbing fixtures onto accessible service space as follows:
 - a. Install fixture support in service space.
 - 1) Use combination support and waste fitting assembly for water closet.
 - 2) Use chair carriers for lavatory.
 - b. Install fixture on support.
 - c. Install components in service space.
 4. Install vitreous-china security plumbing fixtures onto accessible pipe space as follows:
 - a. Install fixture support in pipe space.
 - 1) Use combination support and waste fitting assembly for water closet.
 - 2) Use carrier support for lavatory.
 - b. Install fixture on support.
 - c. Install components in pipe space with access panels. See Division 08 Section "Access Doors And Frames" for access panels not in this Section.
 5. Install security plumbing fixture outlets with gasket seals.
 6. Install fixtures designated "accessible" according to ICC A117.1 for heights, dimensions, and clearances.
 7. Install fixtures level and plumb.
 8. Install shutoff valves in water-supply piping to fixtures. Use ball, gate, or globe valve if specific type valve is not indicated. Install valves in locations where they can be easily reached for operation. Valves are specified in Division 22 Section "General-duty Valves For Plumbing Piping".



9. Install dielectric fittings in water-supply piping to fixtures if piping and fixture connections are made of different metals. See Division 22 Section "Common Work Results For Plumbing" for dielectric fittings.
 10. Install toilet seats on water closets and combination units if seats are indicated.
- B. Connections
1. Piping installation requirements are specified in other Division 14. Drawings indicate general arrangement of piping, fittings, and specialties.
 2. Connect hot- and cold-water supply piping to security plumbing fixtures. Include supply stops, if specified, or ball valve on each supply. Ball valves are specified in Division 22 Section "General-duty Valves For Plumbing Piping".
 3. Connect soil and waste piping to security plumbing fixtures.
 4. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
 5. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".
- C. Field Quality Control
1. Perform the following field tests and inspections and prepare test reports:
 - a. Testing: After installing security plumbing fixtures and after electrical circuitry has been energized, test for compliance with requirements.
 - b. Remove and replace malfunctioning security plumbing fixtures. Retest as specified above after repairs or replacements are made.
- D. Adjusting
1. Operate and adjust water-supply flushometers and flow-control valves on security plumbing fixtures.
- E. Cleaning
1. Clean security plumbing fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:
 - a. Remove faucet spouts and strainers, remove sediment and debris, and reinstall spouts and strainers.
 - b. Remove sediment and debris from drains.
 2. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.
- F. Protection
1. Provide protective covering for installed security plumbing fixtures and fittings.
 2. Do not allow use of security plumbing fixtures for temporary facilities unless approved in writing by the Owner.

END OF SECTION 22 42 13 00



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Task	Specification	Specification Description
22 42 13 00	10 28 19 16	Plumbing Fixtures
22 42 13 00	01 95 22 00	Emergency Plumbing Fixtures
22 42 16 00	10 28 19 16	Plumbing Fixtures
22 42 16 00	01 95 22 00	Emergency Plumbing Fixtures
22 42 16 00	22 42 13 00	Security Plumbing Fixtures
22 42 19 00	10 28 19 16	Plumbing Fixtures
22 42 19 00	01 95 22 00	Emergency Plumbing Fixtures
22 42 19 00	01 95 22 00a	Porcelain Steel Bathtub Liners and Surrounds
22 42 23 00	10 28 19 16	Plumbing Fixtures
22 42 23 00	01 95 22 00	Emergency Plumbing Fixtures
22 42 33 00	10 28 19 16	Plumbing Fixtures
22 42 33 00	01 95 22 00	Emergency Plumbing Fixtures
22 42 39 00	01 22 16 00	No Specification Required
22 42 39 00	10 28 19 16	Plumbing Fixtures
22 42 39 00	01 95 22 00	Emergency Plumbing Fixtures
22 42 43 00	10 28 19 16	Plumbing Fixtures
22 42 43 00	01 95 22 00	Emergency Plumbing Fixtures
22 42 46 00	10 28 19 16	Plumbing Fixtures
22 42 46 00	01 95 22 00	Emergency Plumbing Fixtures



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SECTION 22 43 00 00 - MEDICAL PLUMBING FIXTURES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for medical plumbing fixtures. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following medical plumbing fixtures and related components:
 - a. Faucets for lavatories, showers, and sinks.
 - b. Laminar-flow, faucet-spout outlets.
 - c. Flushometers.
 - d. Toilet seats.
 - e. Protective shielding guards.
 - f. Fixture supports.
 - g. Bedpan washers.
 - h. Water closets.
 - i. Lavatories.
 - j. Individual showers.
 - k. Patients' combination toilets.
 - l. Clinical sinks.
 - m. Plaster sinks.
 - n. Surgeons' scrub sinks.
 - o. Surgeons' instrument sinks.
 - p. Bathing units.
 - q. Sitz baths.
 - r. Bedpan washing equipment.
 - s. Hydrotherapy whirlpools.
 - t. Outlet boxes.
 - u. Morgue equipment.

C. Definitions

1. Accessible Medical Plumbing Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
2. Fitting: Device that controls the flow of water into or out of the medical plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads, drains and tailpieces, and traps and waste pipes.
3. FRP: Fiberglass-reinforced plastic.
4. PMMA: Polymethyl methacrylate (acrylic) plastic.

D. Submittals

1. Product Data: For each type of medical plumbing fixture indicated.
2. LEED Submittal:
 - a. Product Data for Credit WE 2, 3.1, and 3.2: Documentation indicating flow and water consumption requirements.
3. Shop Drawings: Diagram power, signal, and control wiring.
4. Operation and maintenance data.

E. Quality Assurance



1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act", **as directed**; for plumbing fixtures for people with disabilities.
3. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
4. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
5. Select combinations fixtures and trim, faucets, fittings, and other components that are compatible.
6. Comply with the following applicable standards and other requirements specified for medical plumbing fixtures:
 - a. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
 - b. Plastic Bathtubs: ANSI Z124.1.
 - c. Plastic Shower Enclosures: ANSI Z124.2.
 - d. Slip-Resistant Bathing Surfaces: ASTM F 462.
 - e. Vitreous-China Fixtures: ASME A112.19.2M.
7. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:
 - a. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
 - b. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
 - c. Faucets: ASME A112.18.1.
 - d. Hose-Connection Vacuum Breakers: ASSE 1011.
 - e. Hose-Coupling Threads: ASME B1.20.7.
 - f. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
 - g. NSF Materials: NSF 61.
 - h. Pipe Threads: ASME B1.20.1.
 - i. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
 - j. Supply Fittings: ASME A112.18.1.
 - k. Brass Waste Fittings: ASME A112.18.2.
8. Comply with the following applicable standards and other requirements specified for bathtub and shower faucets:
 - a. Backflow Protection Devices for Hand-Held Showers: ASME A112.18.3M.
 - b. Combination, Pressure-Equalizing and Thermostatic-Control Antiscald Faucets: ASSE 1016.
 - c. Faucets: ASME A112.18.1.
 - d. Hand-Held Showers: ASSE 1014.
 - e. High-Temperature-Limit Controls for Thermal-Shock-Preventing Devices: ASTM F 445.
 - f. Hose-Coupling Threads: ASME B1.20.7.
 - g. Manual-Control Antiscald Faucets: ASTM F 444.
 - h. Pipe Threads: ASME B1.20.1.
 - i. Pressure-Equalizing-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
 - j. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
 - k. Thermostatic-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
9. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:
 - a. Atmospheric Vacuum Breakers: ASSE 1001.
 - b. Brass and Copper Supplies: ASME A112.18.1.
 - c. Flexible Water Connectors: ASME A112.18.6.
 - d. Manual-Operation Flushometers: ASSE 1037.
 - e. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.
 - f. Brass Waste Fittings: ASME A112.18.2.
10. Comply with the following applicable standards and other requirements specified for miscellaneous components:



- a. Grab Bars: ASTM F 446.
- b. Hose-Coupling Threads: ASME B1.20.7.
- c. Off-Floor Fixture Supports: ASME A112.6.1M.
- d. Pipe Threads: ASME B1.20.1.
- e. Plastic Toilet Seats: ANSI Z124.5.
- f. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.2 PRODUCTS

A. Lavatory Faucets

1. Description: Faucet for lavatory-type medical plumbing fixture. Coordinate faucet inlets with supplies, connectors, and fixture holes; coordinate outlet with spout and fixture receptor.
 - a. Maximum Flow Rate: 2.2 gpm (8.3 L/min.).
 - b. Body Material: Solid brass.
 - c. Finish: Polished chrome plate.
 - d. Type: Single-control mixing **OR** Single-valve nonmixing **OR** Two-handle mixing, **as directed**.
 - e. Tempering System: Not required **OR** Thermostatic **OR** Pressure balance, **as directed**.
 - f. Supply Centers: Single hole **OR** 4 inches (102 mm) **OR** 6 inches (152 mm) **OR** 8 inches (203 mm) **OR** 12 inches (305 mm) **OR** Adjustable, **as directed**.
 - g. Mounting: Deck, exposed **OR** Deck, concealed **OR** Back/wall, exposed **OR** Back/wall, concealed, **as directed**.
 - h. Handle(s): Single lever **OR** Cross, four arm **OR** Wrist blade, 4 inches (102 mm) **OR** Elbow, 6 inches (152 mm) **OR** Not applicable, **as directed**.
 - i. Temperature Indicators: Color-coded for hot and cold water.
 - j. Inlet(s): NPS 3/8 (DN 10) tubing, plain end **OR** NPS 3/8 (DN 10) tubing, with NPS 1/2 (DN 15) male adaptor **OR** NPS 1/2 (DN 15) male shank **OR** NPS 1/2 (DN 15) female shank, **as directed**.
 - k. Spout: Rigid **OR** Swing **OR** Rigid gooseneck **OR** Swivel gooseneck, **as directed**, brass.
 - l. Spout Outlet: Aerator **OR** Spray **OR** Laminar flow **OR** Plain end **OR** Spray, 0.5 gpm (1.5 L/min.), **as directed**.
 - m. Operation: Compression, manual **OR** Noncompression, manual **OR** Automatic, hard-wired electric sensor, **as directed**.
 - n. Drain: Pop up **OR** See fixture, **as directed**.

B. Shower Faucets

1. Description: Faucet for shower-type medical plumbing fixtures. Include hot- and cold-water indicators; check stops; and shower head, arm, and flange. Coordinate faucet inlets with supplies.
 - a. Maximum Flow Rate: 2.5 gpm (9.5 L/min.), unless otherwise indicated.
 - b. Body Material: Solid brass.
 - c. Finish: Polished chrome plate.
 - d. Type: Thermostatic **OR** Pressure balance **OR** Thermostatic and pressure balance, **as directed**, with integral or field-installed check stops on hot- and cold-water supplies.
 - e. Mounting: Exposed **OR** Concealed, **as directed**.
 - f. Handle(s): Single lever **OR** Cross, four arm **OR** Not applicable, **as directed**.
 - g. Temperature Indicators: Color-coded for hot and cold water.
 - h. Diverter Valve: Not required **OR** Integral with mixing valve **OR** Not integral with mixing valve, **as directed**.
 - i. Backflow Protection Device for Hand-Held Shower: Required **OR** Not required, **as directed**.
 - j. Operation: Compression, manual **OR** Noncompression, manual **OR** Automatic, hard-wired electric sensor, **as directed**.
 - k. Antiscald Device: Integral with mixing valve **OR** Not required, **as directed**.



- l. Supply Connections: NPS 1/2 (DN 15) **OR** NPS 1/2 (DN 15), union **OR** Sweat, **as directed**.
- m. Shower Head Material: Brass with chrome-plated finish.
- n. Head Type: Ball joint **OR** Without ball joint **OR** Hand held, slide-bar mounted **OR** Hand held, hook mounted, **as directed**.
- o. Spray Pattern: Fixed **OR** Adjustable, **as directed**.
- p. Integral Volume Control: Required **OR** Not required, **as directed**.
- q. Shower-Arm, Flow-Control Fitting: Not required **OR** 1.5 gpm (5.7 L/min.) **OR** 2.0 gpm (7.6 L/min.), **as directed**.

C. Sink Faucets

1. Description: Faucet for sink-type medical plumbing fixtures. Coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
 - a. Maximum Flow Rate: 2.5 gpm (9.5 L/min.), unless otherwise indicated.
 - b. Body Material: Solid brass.
 - c. Finish: Polished chrome plate **OR** Rough chrome plate, **as directed**.
 - d. Type: Sink faucet **OR** Clinical-sink faucet with stops in shanks, vacuum breaker, hose-thread outlet, and pail hook, **as directed**.
 - e. Tempering Device: Thermostatic **OR** Pressure balance **OR** Not required, **as directed**.
 - f. Mixing Valve: Single control **OR** Two-lever handle, **as directed**.
 - g. Backflow Protection Device for Hose Outlet: Required **OR** Not required **OR** Not applicable, **as directed**.
 - h. Supply Centers: Single hole **OR** 4 inches (102 mm) **OR** 6 inches (152 mm) **OR** 8 inches (203 mm) **OR** Adjustable, **as directed**.
 - i. Mounting: Deck, exposed **OR** Deck, concealed **OR** Back/wall, exposed **OR** Back/wall, concealed, **as directed**.
 - j. Handle(s): Lever **OR** Knob **OR** Cross, four arm **OR** Wrist blade, 4 inches (102 mm) **OR** Elbow, 6 inches (152 mm) **OR** Not applicable, **as directed**.
 - k. Temperature Indicators: Color-coded for hot water on left and cold water on right.
 - l. Inlet(s): NPS 3/8 (DN 10) plain-end tubing **OR** NPS 3/8 (DN 10) tubing with NPS 1/2 (DN 15) male adapter **OR** NPS 1/2 (DN 15) male shank **OR** NPS 1/2 (DN 15) female shank, **as directed**.
 - m. Spout: Rigid, solid **OR** Swing tubular **OR** Rigid, gooseneck, solid **OR** Swivel, gooseneck, solid, **as directed**, brass with wall brace, **as directed**.
 - n. Spout Outlet: Aerator **OR** Swivel aerator/spray **OR** Spray **OR** Laminar flow **OR** Hose thread **OR** Plain end, **as directed**.
 - o. Vacuum Breaker: Required **OR** Not required, **as directed**.
 - p. Operation: Compression, manual **OR** Noncompression, manual **OR** Automatic, hard-wired electric sensor, **as directed**.

D. Laminar-Flow Faucet-Spout Outlets

1. Description: Chrome-plated-brass faucet-spout outlet that produces non-aerating laminar stream. Include male or female thread that mates with faucet outlet for attachment to faucets where indicated and flow-rate range that includes flow of faucet.

E. Flushometers

1. Description: Flushometer for clinical-sink-type **OR** water-closet-type, **as directed**, medical plumbing fixture. Include brass body with corrosion-resistant internal components, non-hold-open feature, **as directed**, control stop with check valve, vacuum breaker, and copper or brass tubing, and polished chrome-plated finish on exposed parts.
 - a. Internal Design: Diaphragm operation.
 - b. Style: Exposed **OR** Concealed, **as directed**.
 - c. Inlet Size: NPS 1 (DN 25).
 - d. Trip Mechanism: Oscillating, lever-handle actuator **OR** Mechanical, push-button actuator with stainless-steel access plate **OR** Hydraulic, push-button actuator **OR** Foot-pedal



actuator **OR** Hard-wired, electric-sensor actuator **OR** Battery-operated sensor actuator, **as directed**.

- e. Consumption: 1.6 gal./flush (6.0 L/flush) **OR** 3.5 gal./flush (13.3 L/flush), **as directed**.
- f. Tailpiece Size: NPS 1-1/4 (DN 32) **OR** NPS 1-1/2 (DN 40), **as directed**, and standard length to top of bowl.
- g. Integral Bedpan Washer: Not required **OR** Factory fabricated, attached to tailpiece, and with spray head, **as directed**.

F. Toilet Seats

- 1. Description: Plastic toilet seat for water-closet-type medical plumbing fixture.
 - a. Material: Molded, solid plastic with antimicrobial agent, **as directed**.
 - b. Configuration: Closed **OR** Open, **as directed**, front with **OR** without, **as directed**, cover.
 - c. Size: Elongated, unless otherwise indicated.
 - d. Class: Standard **OR** Heavy-duty, **as directed**, commercial.
 - e. Hinge Type: Stainless-steel CK, check **OR** SC, self-sustaining check, **as directed**.
 - f. Color: White **OR** Black, **as directed**.

G. Protective Shielding Guards

- 1. Protective Shielding Pipe Covers:
 - a. Description: Manufactured plastic wraps for covering medical plumbing fixture hot-water supply **OR** hot- and cold-water supplies, **as directed**, and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.
- 2. Protective Shielding Piping Enclosures:
 - a. Description: Manufactured plastic enclosure for covering medical plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

H. Fixture Supports

- 1. Water-Closet Supports:
 - a. Description: Combination carrier designed for accessible **OR** standard, **as directed**, mounting height of wall-mounting, water-closet-type medical plumbing fixture. Include single or double, vertical or horizontal, hub-and-spigot or hubless waste fitting as required for piping arrangement; faceplates; couplings with gaskets; feet; and fixture bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.
- 2. Lavatory Supports:
 - a. Description: Type I, lavatory carrier with exposed arms and tie rods **OR** Type II, lavatory carrier with concealed arms and tie rod **OR** Type III, lavatory carrier with hanger plate and tie rod, **as directed**, for wall-mounting, lavatory-type medical plumbing fixture. Include steel uprights with feet.
 - b. Accessible-Fixture Support: Include rectangular steel uprights.
- 3. Sink Supports:
 - a. Description: Type I, sink carrier with exposed arms and tie rods **OR** Type II, sink carrier with hanger plate, bearing studs, and tie rod **OR** Type III, sink carrier with hanger plate and exposed arms, **as directed**, for sink-type medical plumbing fixture. Include steel uprights with feet.
- 4. Bedpan Washers
 - a. Description: Wall-mounting, hand-held, hand-control **OR** single-pedal, foot-control **OR** double-pedal, hot- and cold-water control, **as directed**, medical plumbing fixture.
 - 1) Hose: 48-inch- (1220-mm-) long rubber or vinyl hose with spray nozzle, wall bracket, and hook.
 - 2) Self-closing valve.
 - 3) Loose-key supply stop.
 - 4) Vacuum Breaker: Wall mounting, atmospheric.
 - 5) Finish: Polished, chrome-plated finish on metal parts exposed after installation.

I. Water Closets



1. Wall-Mounting Water Closets:
 - a. Description: Accessible, wall-mounting **OR** Wall-mounting, **as directed**, back-outlet, vitreous-china medical plumbing fixture designed for bedpan washing and flushometer valve operation.
 - 1) Style: Flushometer valve.
 - a) Bowl Type: Elongated with siphon-jet design and bedpan lugs or slots.
 - b) Design Consumption: 1.6 gal./flush (6 L/flush).
 - c) Color: White.
2. Floor-Mounting Water Closets:
 - a. Description: Accessible, floor-mounting **OR** Floor-mounting, **as directed**, floor-outlet, vitreous-china medical plumbing fixture designed for bedpan washing and flushometer valve operation.
 - 1) Style: Flushometer valve.
 - a) Bowl Type: Elongated with siphon-jet design and bedpan lugs or slots. Include bolt caps matching fixture.
 - b) Height: Standard **OR** Accessible, **as directed**.
 - c) Design Consumption: 1.6 gal./flush (6 L/flush).
 - d) Color: White.

J. Lavatories

1. Wall-Mounting Lavatories:
 - a. Description: Accessible, wall-mounting **OR** Wall-mounting, **as directed**, vitreous-china medical plumbing fixture.
 - 1) Type: With back **OR** Ledge back **OR** Shelf back **OR** Slab, **as directed**.
 - 2) Size: 18 by 15 inches (457 by 381 mm) **OR** 19 by 16 inches (483 by 406 mm) **OR** 20 by 18 inches (508 by 457 mm) **OR** 24 by 20 inches (610 by 508 mm), **as directed**, rectangular.
 - 3) Faucet Hole Punching: One hole **OR** Three holes, 2-inch (51-mm) centers **OR** Three holes, 4-inch (102-mm) centers, **as directed**.
 - 4) Faucet Hole Location: Top **OR** Front wall **OR** Inclined panel, **as directed**.
 - 5) Color: White.
 - 6) Faucet: Lavatory with pop-up waste **OR** for separate drain, **as directed**.
 - 7) Supplies: NPS 3/8 (DN 10) chrome-plated copper tubes or flexible connectors, **as directed**, with stops.
 - 8) Drain: See faucet **OR** Grid **OR** Grid with offset, **as directed**.
 - a) Location: Not applicable.
 - 9) Drain Piping: NPS 1-1/4 (DN 32) **OR** NPS 1-1/4 by NPS 1-1/2 (DN 32 by DN 40), **as directed**, chrome-plated, cast-brass P-trap; NPS 1-1/4 (DN 32) **OR** NPS 1-1/2 (DN 40), **as directed**, 0.032-inch- (0.8-mm-) **OR** 0.045-inch- (1.1-mm-), **as directed**, thick tubular brass waste to wall; and wall escutcheon.
 - 10) Protective Shielding Guard(s): Designation, as directed by the Owner.
 - 11) Fixture Support: Lavatory.
2. Counter-Mounting Lavatories:
 - a. Description: Accessible, **as directed**, Counter-mounting **OR** Undercounter-mounting, **as directed**, vitreous-china, medical plumbing fixture.
 - 1) Type: Flat rim with ledge **OR** Self-rimming, **as directed**.
 - 2) Rectangular Lavatory Size: 18 by 15 inches (457 by 381 mm) **OR** 19 by 16 inches (483 by 406 mm) **OR** 20 by 18 inches (508 by 457 mm) **OR** 24 by 20 inches (610 by 508 mm), **as directed**.
 - 3) Oval Lavatory Size: 19 by 16 inches (483 by 406 mm) **OR** 20 by 17 inches (508 by 432 mm), **as directed**.
 - 4) Round Lavatory Size: 18 inches (457 mm) **OR** 19 inches (483 mm), **as directed**, in diameter.
 - 5) Faucet Hole Punching: One hole **OR** Three holes, 2-inch (51-mm) centers **OR** Three holes, 4-inch (102-mm) centers, **as directed**.



- 6) Faucet Hole Location: Top **OR** Front wall **OR** Inclined panel, **as directed**.
- 7) Color: White.
- 8) Faucet: Lavatory with pop-up waste **OR** for separate drain, **as directed**.
- 9) Supplies: NPS 3/8 (DN 10) chrome-plated copper tubes or flexible connectors, **as directed**, with stops.
- 10) Drain: See faucet **OR** Grid **OR** Grid with offset, **as directed**.
 - a) Location: Not applicable.
- 11) Drain Piping: NPS 1-1/4 (DN 32) **OR** NPS 1-1/4 by NPS 1-1/2 (DN 32 by DN 40), **as directed**, chrome-plated, cast-brass P-trap; NPS 1-1/4 (DN 32) **OR** NPS 1-1/2 (DN 40), **as directed**, 0.032-inch- (0.8-mm-) **OR** 0.045-inch- (1.1-mm-), **as directed**, thick tubular brass waste to wall; and wall escutcheon.
- 12) Protective Shielding Guard(s): Designation, as directed by the Owner.

K. Individual Showers:

1. Description: Accessible, **as directed**, FRP **OR** PMMA, **as directed**, shower enclosure medical plumbing fixture with slip-resistant bathing surface complying with ASTM F 462. Comply with ADA requirements for use by people with disabilities.
 - a. Size: 36 by 34 inches (915 by 865 mm) **OR** 42 by 36 inches (1065 by 915 mm) **OR** 43 by 39 inches (1090 by 990 mm) **OR** 48 by 34 inches (1220 by 865 mm) **OR** 52 by 36 inches (1320 by 915 mm) **OR** 60 by 36 inches (1525 by 915 mm) **OR** 72 by 36 inches (1830 by 915 mm), **as directed**.
 - b. Surround: One piece.
 - c. Color: White.
 - d. Faucet: Shower.
 - e. Drain: Grid, NPS 2 (DN 50).
 - 1) Location: Left side **OR** Center **OR** Right side, **as directed**.
 - f. Accessories: If not furnished as integral components of specified fixture. Accessories are specified in Division 10 Section "Toilet, Bath, And Laundry Accessories".
 - 1) Grab bar(s).
 - 2) Normal-duty **OR** Heavy-duty, **as directed**, shower-curtain rod.
 - 3) Vinyl **OR** Duck **OR** Antibacterial, **as directed**, shower curtain.
 - 4) Shower-curtain hooks.
 - 5) Folding seat, **as directed**.

L. Patients' Combination Toilets

1. Swing-Away, Patients' Combination Toilets:
 - a. Description: Factory-fabricated, combination water closet and lavatory medical plumbing fixture.
 - 1) Cabinet: Fixed installation with storage space and toilet paper holder.
 - a) Material: Stainless steel **OR** Stainless steel, plastic laminate, or fiberglass, **as directed**, with laminated-wood or -plastic **OR** solid-plastic **OR** stainless-steel, **as directed**, top surface.
 - b) Color: Not applicable.
 - c) Mounting: Wall bracket.
 - 2) Water Closet: Swivel, floor-mounting, back-outlet **OR** floor-outlet, **as directed**, flushometer valve design.
 - a) Material: Stainless steel.
 - b) Orientation: Left **OR** Right, **as directed**, hand.
 - c) Color: Not applicable.
 - d) Toilet Seat: White, solid plastic.
 - e) Flushometer: Concealed flushometer valve with push-button trip mechanism, check stop, and vacuum breaker on tailpiece.
 - f) Fixture Support: Floor plate.
 - g) Seal: For outlet.
 - 3) Lavatory: Counter mounting.
 - a) Material: Stainless steel.



- b) Color: Not applicable.
 - c) Faucet: Gooseneck type with wrist-blade handles **OR** Swing-spout type with single lever, **as directed**.
 - d) Drain: Grid, NPS 1-1/4 (DN 32).
 - e) Drain Piping: NPS 1-1/4 (DN 32) chrome-plated, cast-brass P-trap; tubular-brass waste to wall; and wall flange.
 - 4) Bedpan Washer: On flushometer valve tailpiece or separate attachment affixed to unit.
2. Static, Patients' Combination Toilets:
- a. Description: Factory-fabricated, combination water closet and lavatory fixture.
 - 1) Cabinet: Fixed installation; swing-away cabinet or retractable, water-closet cover design with storage space and toilet paper holder.
 - a) Material: Stainless steel **OR** Stainless steel, plastic laminate, or fiberglass, **as directed**, with laminated-wood or -plastic **OR** solid-plastic **OR** stainless-steel, **as directed**, top surface.
 - b) Color: Not applicable.
 - c) Mounting: Wall bracket.
 - 2) Water Closet: Floor-mounting, floor-outlet, flushometer valve design.
 - a) Material: Stainless steel or vitreous china.
 - b) Orientation: Left **OR** Right, **as directed**, hand.
 - c) Color: Not applicable.
 - d) Toilet Seat: White, solid plastic.
 - e) Flushometer: Concealed flushometer valve with push-button trip mechanism, check stop, and vacuum breaker on tailpiece.
 - f) Seal: For outlet.
 - 3) Lavatory: Counter mounting.
 - a) Material: Stainless steel.
 - b) Color: Not applicable.
 - c) Faucet: Gooseneck type with wrist-blade handles **OR** Swing-spout type with single lever, **as directed**.
 - d) Drain: Grid, NPS 1-1/4 (DN 32).
 - e) Drain Piping: NPS 1-1/4 (DN 32) chrome-plated, cast-brass P-trap; tubular-brass waste to wall; and wall flange.
 - 4) Bedpan Washer: On flushometer valve tailpiece or separate attachment affixed to unit.
- M. Clinical Sinks
- 1. Wall-Mounting Clinical Sinks:
 - a. Description: Wall-mounting, back-outlet, vitreous-china, flushing-rim, service-sink-type medical plumbing fixture.
 - 1) Size: Approximately 25 by 20 inches (635 by 510 mm).
 - 2) Color: White.
 - 3) Rim Guard: Stainless steel on front and also on sides if flat rim.
 - 4) Faucet: Sink, polished, chrome-plated, solid-brass, service-sink faucet type, including integral stops in shanks, vacuum breaker, hose-thread outlet, and pail hook.
 - 2. Floor-Mounting Clinical Sinks:
 - a. Description: Floor-mounting, bottom-outlet, vitreous-china, flushing-rim, service-sink-type medical plumbing fixture. Include bolt caps.
 - 1) Size: Approximately 27 by 20 inches (685 by 510 mm).
 - 2) Color: White.
 - 3) Rim Guards: Stainless steel on front and sides.
 - 4) Sink Base: 10-inch (25.4-mm) -high, cast terrazzo if required.



- 5) Faucet: Sink, polished, chrome-plated, solid-brass, service-sink faucet type, including integral stops in shanks, vacuum breaker, hose-thread outlet, and pail hook.

N. Plaster Sinks:

1. Description: Wall-mounting, vitreous-china medical plumbing fixture.
 - a. Size: 24 by 22 inches (610 by 560 mm) **OR** 30 by 22 inches (760 by 560 mm), **as directed**, with back or ledge faucet holes.
 - b. Color: White.
 - c. Faucet Holes: One **OR** Two, **as directed**, in back or ledge.
 - d. Faucet: Sink.
 - e. Supplies: NPS 1/2 (DN 15) chrome-plated copper tubes or flexible connectors, **as directed**, with stops.
 - f. Drain: Grid, NPS 1-1/2 (DN 40) with NPS 1-1/2 (DN 40) to NPS 2 (DN 50) adaptor, **as directed**.
 - g. Drain Piping: NPS 1-1/2 (DN 40) **OR** NPS 2 (DN 50), **as directed**, chrome-plated brass; 0.045-inch- (1.1-mm-) thick waste to interceptor; interceptor to wall; and wall flange.
 - h. Plaster Interceptor:
 - 1) Description: Cast-iron or steel body and removable cover with acid-resistant-enameled interior lining and outside coating; removable, corrosion-resistant metal screens or strainer; and NPS 1-1/2 (DN 40) **OR** NPS 2 (DN 50), **as directed**, inlet and outlet.
2. Fixture Support: Sink with white-enameled-steel brackets.

O. Surgeons' Scrub Sinks

1. Stainless-Steel Surgeons' Scrub Sinks:
 - a. Description: Wall-mounting, sink-type medical plumbing fixture.
 - 1) Size: Approximately 31 by 20 inches (790 by 510 mm) with back with 1 faucet hole.
 - 2) Faucet: Chrome-plated-brass, gooseneck type matching fixture.
 - 3) Operation: Foot-pedal **OR** Knee **OR** Automatic, hard-wired electric sensor, **as directed**, control.
 - 4) Supplies: NPS 1/2 (DN 15) chrome-plated copper tubes or flexible connectors, **as directed**, with stops.
 - 5) Drain: Grid, NPS 1-1/2 (DN 40).
 - 6) Drain Piping: NPS 1-1/2 (DN 40) chrome-plated, cast-brass P-trap; 0.045-inch- (1.1-mm-) thick tubular-brass waste to wall; and wall flange.
 - 7) Fixture Support: Sink.
2. Vitreous-China Surgeons' Scrub Sinks:
 - a. Description: Wall-mounting, sink-type medical plumbing fixture.
 - 1) Size: 28 by 22 inches (710 by 560 mm) **OR** 30 by 22 inches (760 by 560 mm), **as directed**, with back or ledge with 1 faucet hole.
 - 2) Color: White.
 - 3) Faucet: Chrome-plated-brass, gooseneck-type matching fixture.
 - 4) Operation: Foot-pedal **OR** Knee, **as directed**, control.
 - 5) Supplies: NPS 1/2 (DN 15) chrome-plated copper tubes or flexible connectors, **as directed**, with stops.
 - 6) Drain: Grid, NPS 1-1/2 (DN 40).
 - 7) Drain Piping: NPS 1-1/2 (DN 40) chrome-plated, cast-brass P-trap; 0.045-inch- (1.1-mm-) thick tubular-brass waste to wall; and wall flange.
 - 8) Fixture Support: Sink.

P. Surgeons' Instrument Sinks:

1. Description: Wall-mounting, stainless-steel, sink-type medical plumbing fixture. Include instrument tray on each side.
 - a. Size: 28 by 20 inches (710 by 510 mm) with 1 hole for deck-mounting faucet.



- b. Faucet: Chrome-plated-brass, gooseneck type matching fixture with knee **OR** foot-pedal, **as directed**, control for mixing hot- and cold-water supplies.
- c. Supplies: NPS 1/2 (DN 15) chrome-plated copper tubes or flexible connectors, **as directed**, with stops.
- d. Drain: Grid, NPS 1-1/2 (DN 40).
- e. Drain Piping: NPS 1-1/2 (DN 40) chrome-plated, cast-brass P-trap; 0.045-inch- (1.1-mm-) thick tubular-brass waste to wall; and wall flange.
- f. Fixture Support: Sink.

Q. Bathing Units

1. Institutional Bath Tubs:

- a. Description: Enameled, cast-iron, island medical plumbing fixture with separate wall-mounting faucet.
 - 1) Size: 66 by 30 by 18 inches (1680 by 765 by 455 mm).
 - 2) Base: Enameled, cast iron to raise rim of bathtub to 28 inches (710 mm) above the floor.
 - 3) Faucet: Shower **OR** Sink, **as directed**, modified to include tub filler spout.
 - 4) Supplies: NPS 1/2 (DN 15) chrome-plated copper tubes or flexible connectors, **as directed**, with stops. Include atmospheric vacuum breaker.
 - 5) Drain: NPS 1-1/2 (DN 40); chrome-plated exposed parts; brass pop-up waste and overflow.
 - 6) Drain Piping: NPS 1-1/2 (DN 40) chrome-plated, cast-brass P-trap; 0.045-inch- (1.1-mm-) thick tubular-brass waste to wall; and wall flange.

2. Bathing Units:

- a. Description: Plastic-tub, institutional side-entry bath **OR** whirlpool-bath, **as directed**, fixture with integral controls.
 - 1) Tub Size: 60 by 30 inches (1525 by 765 mm).
 - 2) Controls: Vacuum breakers on supplies, thermostatic mixing valve, tub fill spout, and hand-held shower head.
 - 3) Supplies: NPS 3/4 (DN 20) **OR** NPS 1 (DN 25), **as directed**, copper tubing with ball, gate, or globe valves.
 - 4) Drain: NPS 1-1/2 (DN 40) and NPS 2 (DN 50).
 - 5) Drain Piping: NPS 1-1/2 (DN 40) **OR** NPS 2 (DN 50), **as directed**, cast-brass P-trap, waste to wall, and wall flange. Include combined drain piping if two drains.

3. Bathing Units:

- a. Description: Plastic-tub, institutional side-entry **OR** transfer-lift-entry **OR** slide-on-entry, **as directed**, adjustable-height **OR** fixed-height, **as directed**, bath fixture with integral controls.
 - 1) Tub Size: 60 by 30 inches (1525 by 765 mm).
 - 2) Controls: Vacuum breakers on supplies, thermostatic mixing valve, tub fill spout, and hand-held shower head.
 - 3) Supplies: NPS 3/4 (DN 20) **OR** NPS 1 (DN 25), **as directed**, copper tubing with ball, gate, or globe valves.
 - 4) Drain: NPS 1-1/2 (DN 40) and NPS 2 (DN 50).
 - 5) Drain Piping: NPS 1-1/2 (DN 40) **OR** NPS 2 (DN 50), **as directed**, cast-brass P-trap, waste to wall, and wall flange. Include combined drain piping if two drains.
 - 6) Lift System: Not required.

4. Bathing Units:

- a. Description: Plastic-tub, institutional front-entry shower fixture with integral controls.
 - 1) Cabinet Size: 35 by 41 inches (889 by 1041 mm).
 - 2) Controls: Vacuum breakers on supplies, thermostatic mixing valve, tub fill spout, and hand-held shower head.
 - 3) Supplies: NPS 3/4 (DN 20) **OR** NPS 1 (DN 25), **as directed**, copper tubing with ball, gate, or globe valves.
 - 4) Drain: NPS 2 (DN 50).
 - 5) Drain Piping: NPS 2 (DN 50) cast-brass P-trap, waste to wall, and wall flange.



5. Residential Bath Tubs:
- a. Description: Plastic island or against-wall-installation, **as directed**, medical plumbing fixture with side door, seat, and separate wall-mounting faucet.
 - 1) Size 1
 - a) Size: Approximately 60 by 32 by 21 inches (1525 by 815 by 535 mm).
 - b) Seat: Integral.
 - c) Drain Location: Left **OR** Right, **as directed**, end.
 - 2) Size 2
 - a) Size: Approximately 60 by 42 by 24.5 inches (1525 by 1070 by 620 mm).
 - b) Seat: Integral bench **OR** None, **as directed**.
 - c) Drain Location: Right end.
 - 3) Material: PMMA.
 - 4) Skirt: Front only **OR** Full, on three sides, **as directed**.
 - 5) Door: Side opening with rubber sealing gasket.
 - 6) Faucet: Shower **OR** Sink, **as directed**, modified to include tub filler spout.
 - 7) Supplies: NPS 1/2 (DN 15) chrome-plated copper tubes or flexible connectors, **as directed**, with stops. Include atmospheric vacuum breaker.
 - 8) Drain: NPS 1-1/2 (DN 40); chrome-plated exposed parts; brass pop-up waste and overflow.
 - 9) Drain Piping: NPS 1-1/2 (DN 40) cast-brass P-trap and 0.045-inch- (1.1-mm-) thick, tubular-brass waste to wall.

R. Sitz Baths:

1. Description: Pedestal-mounting **OR** Wall-mounting, **as directed**, vitreous-china, perineal bath medical plumbing fixture.
 - a. Color: White.
 - b. Drain: NPS 1-1/2 (DN 40) with removable overflow attachment.
 - c. Drain Piping: NPS 1-1/2 (DN 40) chrome-plated, cast-brass P-trap; waste to wall; and wall flange.
 - d. Fixture Support: Sink.
 - e. Faucet:
 - 1) Description: Wall-mounting, single-lever-handle, thermostatic-mixing-valve faucet with concealed supplies and wall-mounting thermometer.
 - a) Material: Brass body and escutcheon.
 - b) Flow Rate: Modified to 1.5 gpm (5.7 L/min.) maximum, unless otherwise indicated.
 - c) Finish: Polished chrome plate.
 - d) Temperature Indicators: Color-coded for hot and cold water.
 - f. Exposed Piping: Chrome-plated; brass pipe or copper tube.

S. Bedpan Washing Equipment

1. Bedpan Washers/Sanitizers:
 - a. Description: Recessed-mounting **OR** On-wall-mounting **OR** Pedestal-mounting, **as directed**, medical plumbing fixture for cleaning bedpans and urinals having cast-iron chamber and waste assembly with spray nozzles and enameled-steel **OR** stainless-steel, **as directed**, front panel and cover box.
 - 1) Controls: Electric, 120-V ac, automatic operation with timer, solenoid valves, and circuit breaker.
 - 2) Door Mechanism: Foot-pedal operation.
 - 3) Supplies: NPS 1 (DN 25) cold water and NPS 3/8 (DN 10) hot water **OR** steam, **as directed**.
 - 4) Drain: NPS 3 (DN 80) P-trap and soil pipe.
 - 5) Atmospheric Vent: NPS 2 (DN 50).
 - 6) Mounting Hardware: Matching fixture mounting arrangement.
 - 7) Accessories:
 - a) Bedpan Rack(s): One **OR** Two, **as directed**.



- b) Urinal Rack(s): One **OR** Two, **as directed**.
 - c) Drain Tray(s): One **OR** Two, **as directed**.
 - 2. Bedpan Washers/Disinfectors:
 - a. Description: Freestanding-mounting **OR** On-wall-mounting **OR** Undercounter-mounting, **as directed**, medical plumbing fixture for cleaning bedpans and urinals; with steam generator, pump, and spray nozzle.
 - 1) Controls: Electric, automatic operation.
 - 2) Cabinet: Stainless steel.
 - 3) Wash Chamber: Stainless steel.
 - 4) Supplies: NPS 1/2 (DN 15) cold water and NPS 1/2 (DN 15) hot water.
 - 5) Drain: NPS 4 (DN 100) P-trap and soil pipe.
 - 6) Mounting Hardware: Matching fixture mounting arrangement.
- T. Hydrotherapy Whirlpools
 - 1. Podiatry Whirlpools:
 - a. Description: Stationary, stainless-steel tank for feet and ankles.
 - 1) Water Capacity: 15 gal. (57 L).
 - 2) Drain: Waste connection.
 - 3) Controls.
 - 4) Thermometer: Control panel or tank mounted.
 - 5) One electric turbine ejector.
 - 2. Upper-Extremity Whirlpools:
 - a. Description: Stationary, pedestal-mounted, stainless-steel tank for arms, hands, and elbows.
 - 1) Water Capacity: 25 gal. (95 L).
 - 2) Drain: Waste connection.
 - 3) One arm support.
 - 4) Controls.
 - 5) Thermometer: Control panel or tank mounted.
 - 6) One electric turbine ejector.
 - 3. High-Tank Body Whirlpools:
 - a. Description: Stationary, stainless-steel tank for legs, hip, and back.
 - 1) Water Capacity: 105 gal. (397 L).
 - 2) Drain: Waste connection.
 - 3) Controls.
 - 4) Thermometer: Control panel or tank mounted.
 - 5) One electric turbine ejector.
 - 4. Low-Tank Body Whirlpools:
 - a. Description: Stationary, extended-length stainless-steel tank for legs, hip, and lower back.
 - 1) Water Capacity: 105 gal. (397 L).
 - 2) Drain: Waste connection.
 - 3) Controls.
 - 4) Thermometer: Control panel or tank mounted.
 - 5) Head rest.
 - 6) One electric turbine ejector.
 - 5. Small, Hubbard Immersion Tanks:
 - a. Description: Stationary, butterfly-shaped tank, for full-body massage
 - 1) Tank Dimensions: 93 by 64 by 22 inches (2362 by 1626 by 560 mm).
 - 2) Overall Height: 34 to 38 inches (864 to 965 mm).
 - 3) Water Capacity: 268 gal. (1014 L).
 - 4) Material: Stainless steel.
 - 5) Supports: Legs or base.
 - 6) Controls.
 - 7) Thermometer: Control panel or tank rim mounted.
 - 8) Supply: Over-the-rim fill spout.



- 9) Drains: Two waste connections.
 - 10) Electric Turbine Ejectors: Two; one rail mounted on each side.
 - 11) Thermostatic, mixing-valve assembly.
 - 12) Hose and hand-held shower.
 - 13) Wash-out-hose assembly.
 - 14) Stretcher lift.
 - 15) Overhead electric, **as directed**, hoist.
6. Medium, Hubbard Immersion Tanks:
- a. Description: Stationary, butterfly-shaped tank, for full-body massage.
 - 1) Tank Dimensions: 100 by 73 by 24 inches (2540 by 1854 by 610 mm).
 - 2) Overall Height: 34 to 38 inches (864 to 965 mm).
 - 3) Water Capacity: 377 gal. (1468 L).
 - 4) Material: Stainless steel.
 - 5) Supports: Legs or base.
 - 6) Controls.
 - 7) Thermometer: Control panel or tank rim mounted.
 - 8) Supply: Over-the-rim fill spout.
 - 9) Drain: One waste connection.
 - 10) Electric Turbine Ejector: One, panel mounted.
 - 11) Thermostatic, mixing-valve assembly.
 - 12) Hose and hand-held shower.
 - 13) Wash-out-hose assembly.
 - 14) Stretcher lift.
 - 15) Overhead electric, **as directed**, hoist.
7. Large, Hubbard Immersion Tanks:
- a. Description: Stationary, butterfly-shaped tank, for full-body massage.
 - 1) Tank Dimensions: 106 by 77 by 22 inches (2692 by 1956 by 560 mm).
 - 2) Overall Height: 34 inches (864 mm).
 - 3) Water Capacity: 425 gal. (1609 L).
 - 4) Material: Stainless steel.
 - 5) Supports: Legs or base.
 - 6) Controls.
 - 7) Thermometer: Control panel or tank rim mounted.
 - 8) Supply: Over-the-rim fill spout.
 - 9) Drain(s): One or two waste connections.
 - 10) Electric Turbine Ejectors: Two; one rail mounted on each side.
 - 11) Thermostatic, mixing-valve assembly.
 - 12) Hose and hand-held shower.
 - 13) Wash-out-hose assembly.
 - 14) Stretcher lift.
 - 15) Overhead electric, **as directed**, hoist.
8. Full-Body Immersion Tanks:
- a. Description: Stationary, rectangular tank, for full-body massage
 - 1) Tank Dimensions: 90 by 32 by 19 inches (2286 by 813 by 483 mm) **OR** 95 by 41 by 22 inches (2413 by 1041 by 560 mm), **as directed**.
 - 2) Overall Height: 32 or 34 inches (813 or 860 mm).
 - 3) Water Capacity: 195 gal. (738 L) **OR** 260 gal. (984 L), **as directed**.
 - 4) Material: Stainless steel.
 - 5) Supports: Legs or base.
 - 6) Controls.
 - 7) Thermometer: Control panel or tank rim mounted.
 - 8) Supply: Over-the-rim fill spout.
 - 9) Drain(s): One or two waste connections.
 - 10) Electric Turbine Ejector: One, tank mounted at end **OR** on rail **OR** on side, **as directed**.
 - 11) Thermostatic, mixing-valve assembly.



- 12) Hose and hand-held shower.
- 13) Wash-out-hose assembly.
- 14) Stretcher lift.
- 15) Overhead electric, **as directed**, hoist.

U. Outlet Boxes

1. Dialysis Equipment Outlet Boxes:

- a. Description: Recessed-mounting outlet box with water supply and drain connections.
 - 1) Box and Faceplate: Stainless steel.
 - 2) Supply Fitting(s): 1 **OR** 2, **as directed**, NPS 1/2 (DN 15) PVC ball valve(s) and adapter with male hose-thread outlet.
 - 3) Drain: NPS 2 (DN 50) standpipe, P-trap, and direct waste connection to drainage piping.
- b. Reinforcement: 2-by-4-inch (50-by-100-mm) fire-retardant-treated-wood blocking between studs. Fire-retardant-treated wood blocking is specified in Division 06 Section "Rough Carpentry".

V. Morgue Equipment

1. Autopsy Tables:

- a. Description: Pedestal stainless-steel table with sink; designed for downdraft ventilation.
 - 1) Material: Stainless steel.
 - 2) Overall Size: Approximately 88 by 30 inches (2250 by 760 mm) with deck faucet holes.
 - 3) Faucet: Deck mounted with wrist- or elbow-blade handles.
 - 4) Aspirator: Deck mounted.
 - 5) Removable body supports.
 - 6) Rinse Assembly: Deck-mounted faucet with hose.
 - 7) Disposer: Not required **OR** Required, **as directed**.
 - 8) Fixture Support: Sink.
 - 9) Receptacle: Duplex, hospital grade with ground-fault interruption.
 - 10) Supplies: Chrome-plated copper tubes or flexible connectors, **as directed**, with atmospheric vacuum breakers and stops.
 - 11) Drain: Chrome-plated, cast-brass P-trap and waste to wall.

2. Dissecting Sinks:

- a. Description: Wall-mounting sink with backsplash.
 - 1) Material: Stainless steel.
 - 2) Overall Size: 84 by 28 inches (2134 by 711 mm) with back faucet holes.
 - 3) Sink Size: Approximately 30 inches (763 mm) wide.
 - 4) Equipment drawer.
 - 5) Faucet: Back mounted with wrist- or elbow-blade handles.
 - 6) Aspirator: Back mounted.
 - 7) Rinse Assembly: One back-mounted faucet with hose.
 - 8) Disposer: Not required **OR** Required, **as directed**.
 - 9) Fixture Support: Sink.
 - 10) Supplies: Chrome-plated copper tubes or flexible connectors, **as directed**, with atmospheric vacuum breakers and stops.
 - 11) Drain: Chrome-plated, cast-brass P-trap and waste to wall.
 - 12) Back-mounted, hand-held-type eye wash.

1.3 EXECUTION

A. Installation

1. Assemble medical plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.



2. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.
 - a. Use carrier supports with waste fitting and seal for back-outlet fixtures.
 - b. Use carrier supports without waste fitting for fixtures with tubular waste piping.
 - c. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
 3. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.
 4. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
 5. Install wall-mounting fixtures with tubular waste piping attached to supports.
 6. Install counter-mounting fixtures in and attached to casework.
 7. Install fixtures level and plumb according to roughing-in drawings.
 8. Install water-supply piping with stop on each supply to each fixture to be connected to domestic water piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
 - a. Exception: Use ball, gate, or globe valve if stops are not specified with fixture. Valves are specified in Division 22 Section "General-duty Valves For Plumbing Piping".
 9. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
 10. Install flushometer valves for accessible water closets with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.
 11. Install toilet seats on water closets.
 12. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
 13. Install shower flow-control fittings with specified maximum flow rates in shower arms.
 14. Install traps on fixture outlets.
 - a. Exception: Omit trap on fixtures with integral traps.
 15. Install escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Common Work Results For Plumbing".
 16. Set showers in leveling bed of cement grout. Grout is specified in Division 22 Section "Common Work Results For Plumbing".
 17. Seal joints between fixtures and walls, floors, and counters using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants".
- B. Connections
1. Piping installation requirements are specified in other Division 14.. Drawings indicate general arrangement of piping, fittings, and specialties.
 2. Connect water supplies from domestic water piping to medical plumbing fixtures.
 3. Connect drain piping from medical plumbing fixtures to sanitary waste and vent piping.
 4. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
 5. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".
- C. Field Quality Control
1. Verify that installed medical plumbing fixtures are categories and types specified for locations where installed.
 2. Check that medical plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
 3. Inspect installed medical plumbing fixtures for damage. Replace damaged fixtures and components.
 4. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.
 5. Install fresh batteries in sensor-operated mechanisms.



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- D. Adjusting
 - 1. Operate and adjust faucets and controls. Replace damaged and malfunctioning medical plumbing fixtures, fittings, and controls.
 - 2. Adjust water pressure at faucets, shower valves, and flushometer valves to produce proper flow and stream.
 - 3. Replace washers and seals of leaking and dripping faucets and stops.

 - E. Cleaning
 - 1. Clean medical plumbing fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:
 - a. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
 - b. Remove sediment and debris from drains.
 - 2. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

 - F. Protection
 - 1. Provide protective covering for installed fixtures and fittings.
 - 2. Do not allow use of medical plumbing fixtures for temporary facilities unless approved in writing by the Owner.

END OF SECTION 22 43 00 00



Task	Specification	Specification Description
22 43 13 00	10 28 19 16	Plumbing Fixtures
22 43 13 00	01 95 22 00	Emergency Plumbing Fixtures
22 43 16 00	10 28 19 16	Plumbing Fixtures
22 43 16 00	01 95 22 00	Emergency Plumbing Fixtures
22 43 39 00	10 28 19 16	Plumbing Fixtures
22 43 39 00	22 43 00 00	Medical Plumbing Fixtures
22 43 39 00	01 95 22 00	Emergency Plumbing Fixtures
22 43 43 00	10 28 19 16	Plumbing Fixtures
22 45 00 00	01 95 22 00	Emergency Plumbing Fixtures
22 45 13 00	10 28 19 16	Plumbing Fixtures
22 45 13 00	01 95 22 00	Emergency Plumbing Fixtures
22 45 16 00	01 95 22 00	Emergency Plumbing Fixtures
22 45 23 00	10 28 19 16	Plumbing Fixtures
22 45 23 00	01 95 22 00	Emergency Plumbing Fixtures
22 45 26 00	10 28 19 16	Plumbing Fixtures
22 45 26 00	01 95 22 00	Emergency Plumbing Fixtures
22 45 29 00	01 95 22 00	Emergency Plumbing Fixtures
22 45 33 00	10 28 19 16	Plumbing Fixtures
22 45 33 00	01 95 22 00	Emergency Plumbing Fixtures
22 45 36 00	01 95 22 00	Emergency Plumbing Fixtures
22 45 39 00	01 95 22 00	Emergency Plumbing Fixtures



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SECTION 22 47 13 00 - DRINKING FOUNTAINS AND WATER COOLERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for drinking fountains and water coolers. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Style F, freestanding drinking fountains.
 - b. Style W, wall-mounting drinking fountains.
 - c. Type PB, pressure with bubbler, Style F, freestanding water coolers.
 - d. Type PB, pressure with bubbler, Style W, wall-mounting water coolers.
 - e. Fixture supports.

C. Definitions

1. Accessible Drinking Fountain or Water Cooler: Fixture that can be approached and used by people with disabilities.
2. Cast Polymer: Dense, cast-filled-polymer plastic.
3. Drinking Fountain: Fixture with nozzle for delivering stream of water for drinking.
4. Fitting: Device that controls flow of water into or out of fixture.
5. Fixture: Drinking fountain or water cooler unless one is specifically indicated.
6. Remote Water Cooler: Electrically powered equipment for generating cooled drinking water.
7. Water Cooler: Electrically powered fixture for generating and delivering cooled drinking water.

D. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: Diagram power, signal, and control wiring.
3. Operation and maintenance data.

E. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for fixtures for people with disabilities.
3. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
4. ARI Standard: Comply with ARI's "Directory of Certified Drinking Water Coolers" for style classifications.
5. ARI Standard: Comply with ARI 1010, "Self-Contained, Mechanically Refrigerated Drinking-Water Coolers," for water coolers and with ARI's "Directory of Certified Drinking Water Coolers" for type and style classifications.
6. ASHRAE Standard: Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants" for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant unless otherwise indicated.



1.2 PRODUCTS

A. Drinking Fountains

1. Description: Accessible, Style F, freestanding drinking fountain.
 - a. Pedestal:
 - 1) Material: Concrete **OR** Painted cast iron or steel, **as directed**.
 - 2) Shape: Rectangular **OR** Round, **as directed**, with offset to receptor **OR** with side receptor(s), **as directed**.
 - b. Receptor(s):
 - 1) Number: One **OR** Two **OR** Three, **as directed**.
 - 2) Material: Bronze **OR** Chrome-plated brass or stainless steel, **as directed**.
 - 3) Shape: Rectangular **OR** Round **OR** Rounded front, **as directed**.
 - 4) Bubbler: One for each receptor, with adjustable stream regulator, located on deck.
 - c. Controls: Foot pedal **OR** Push bar **OR** Push button, **as directed**, with adjustable stream regulator.
 - d. Access to Internal Components: Panel in pedestal.
 - e. Supply: NPS 3/8 (DN 10) **OR** NPS 1/2 (DN 15), **as directed**, with ball, gate, or globe valve.
 - f. Drain: Grid with NPS 1-1/4 (DN 32) minimum horizontal waste and trap complying with ASME A112.18.2 **OR** waste to drainage system, **as directed**.
2. Description: Accessible, Style F, antifreeze, freestanding drinking fountain designed to operate without draining into ground.
 - a. Pedestal: Rectangular, painted cast iron or steel.
 - b. Receptor: Rectangular, chrome-plated brass or stainless steel with bubbler.
 - c. Control: Foot pedal with control valve assembly.
 - d. Supply: NPS 1/2 (DN 15) with underground shutoff and flow-control valve assembly.
 - e. Drain: Grid with NPS 1 (DN 25) **OR** NPS 1-1/4 (DN 32) **OR** NPS 1-1/2 (DN 40), **as directed**, minimum waste to drainage system.
 - f. Bury Depth, Grade to Valve Components: 36 inches (915 mm) **OR** 48 inches (1220 mm) **OR** 60 inches (1525 mm), **as directed**.
3. Description: Accessible, Style W, wall-mounting drinking fountain.
 - a. Material: Bronze **OR** Metal **OR** Cast polymer **OR** Stainless steel **OR** Vitreous china complying with ASME 112.19.2M for drinking fountains with backsplash, **as directed**.
 - b. Receptor Shape: Rectangular **OR** Round **OR** Rounded front, **as directed**.
 - c. Back Panel: Stainless-steel wall plate behind drinking fountain.
 - d. Bubblers: One **OR** Two **OR** Three, **as directed**, with adjustable stream regulator, located on deck.
 - e. Control: Push button **OR** Push bar, **as directed**.
 - f. Supply: NPS 3/8 (DN 10) with ball, gate, or globe valve.
 - g. Drain: Grid with NPS 1-1/4 (DN 32) minimum horizontal waste and trap complying with ASME A112.18.2.
 - h. Support: Type I, water cooler carrier. Refer to "Fixture Supports" Article.
4. Description: Accessible, Style WS, wall-mounting, semirecessed drinking fountain.
 - a. Material: Stainless steel **OR** Bronze **OR** Vitreous china complying with ASME A112.19.2M for semirecessed drinking fountains, **as directed**.
 - b. Receptor Shape: Concave with projecting bowl.
 - c. Bubbler: One, with adjustable stream regulator, located on deck.
 - d. Control: Push button **OR** Push bar, **as directed**.
 - e. Supply: NPS 3/8 (DN 10) with ball, gate, or globe valve.
 - f. Drain: Integral punched grid with NPS 1-1/4 (DN 32) minimum horizontal waste and trap complying with ASME A112.18.2.
 - g. Support: Mounting frame or brackets for attaching to substrate.
5. Description: Style RE, stainless-steel, recessed drinking fountain.
 - a. Receptor Shape: Concave with flush wall flange.
 - b. Bubbler: One, with adjustable stream regulator, located on deck.



- c. Control: Push button **OR** bar, **as directed**.
 - d. Supply: NPS 3/8 (DN 10) with ball, gate, or globe valve.
 - e. Drain: Grid with NPS 1-1/4 (DN 32) minimum horizontal waste and trap complying with ASME A112.18.2.
 - f. Support: Mounting frame or brackets for attaching to substrate.
- B. Water Coolers
1. Description: ARI 1010, Type PB, pressure with bubbler, Style F, freestanding or Style FW, flush-to-wall water cooler.
 - a. Cabinet: All stainless steel **OR** Steel with powder-coat-finish **OR** Vinyl-covered steel with stainless-steel top, **as directed**.
 - b. Bubbler: One, with adjustable stream regulator, located on deck.
 - c. Control: Push button **OR** Foot pedal, **as directed**.
 - d. Supply: NPS 3/8 (DN 10) with ball, gate, or globe valve.
 - e. Filter: One or more water filters complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards; with capacity sized for unit peak flow rate.
 - f. Drain: Grid with NPS 1-1/4 (DN 32) minimum horizontal waste and trap complying with ASME A112.18.2.
 - g. Cooling System: Electric, with precooler, hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.
 - 1) Capacity: 5 gph (0.0053 L/s) **OR** 8 gph (0.0084 L/s) **OR** 10 gph (0.0105 L/s) **OR** 14 gph (0.0147 L/s), **as directed**, of 50 deg F (10 deg C) cooled water from 80 deg F (27 deg C) inlet water and 90 deg F (32 deg C) ambient air temperature.
 - 2) Electrical Characteristics: 1/6 **OR** 1/5 **OR** 1/4, **as directed**, hp; 120-V ac; single phase; 60 Hz.
 2. Description: ARI 1010, Type PBC, pressure with bubbler and compartment, Style F, freestanding water cooler.
 - a. Cabinet: All stainless steel **OR** Vinyl-covered steel with stainless-steel top, **as directed**, with refrigerated compartment in front panel.
 - b. Bubbler: One, with adjustable stream regulator, located on deck.
 - c. Control: Push button.
 - d. Supply: NPS 3/8 (DN 10) with ball, gate, or globe valve.
 - e. Filter: One or more water filters complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards; with capacity sized for unit peak flow rate.
 - f. Drain: Grid with NPS 1-1/4 (DN 32) minimum horizontal waste and trap complying with ASME A112.18.2.
 - g. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.
 - 1) Capacity: 3 gph (0.0032 L/s) of 50 deg F (10 deg C) cooled water from 80 deg F (27 deg C) inlet water and 90 deg F (32 deg C) ambient air temperature.
 - 2) Electrical Characteristics: 1/8 hp; 120-V ac; single phase; 60 Hz.
 3. Description: Accessible, ARI 1010, Type PB, pressure with bubbler, Style W, wall-mounting water cooler for adult **OR** child, **as directed**, -mounting height.
 - a. Cabinet: Single **OR** Bilevel with two attached cabinets **OR** Bilevel with two attached cabinets and with bilevel skirt kit, **as directed**, all stainless steel **OR** vinyl-covered steel with stainless-steel top, **as directed**.
 - b. Bubbler: One, with adjustable stream regulator, located on each cabinet deck.
 - c. Control: Push button **OR** Push bar, **as directed**.
 - d. Supply: NPS 3/8 (DN 10) with ball, gate, or globe valve.
 - e. Filter: One or more water filters complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards; with capacity sized for unit peak flow rate.
 - f. Drain(s): Grid with NPS 1-1/4 (DN 32) minimum horizontal waste and trap complying with ASME A112.18.1.



- g. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.
 - 1) Capacity: 5 gph (0.0053 L/s) **OR** 8 gph (0.0084 L/s), **as directed**, of 50 deg F (10 deg C) cooled water from 80 deg F (27 deg C) inlet water and 90 deg F (32 deg C) ambient air temperature.
 - 2) Electrical Characteristics: 1/6 **OR** 1/5 **OR** 1/4 **OR** 1/3, **as directed**, hp; 120-V ac; single phase; 60 Hz.
 - h. Support: Type I **OR** II, **as directed**, water cooler carrier. Refer to "Fixture Supports" Article.
4. Description: Accessible, ARI 1010, Type PB, pressure with bubbler, Style WS, semirecessed water cooler.
- a. Cabinet: All stainless steel **OR** Vinyl-covered steel with stainless-steel top, **as directed**.
 - b. Bubbler: One, with adjustable stream regulator, located on deck.
 - c. Control: Push button **OR** Push bar, **as directed**.
 - d. Supply: NPS 3/8 (DN 10) with ball, gate, or globe valve.
 - e. Filter: One or more water filters complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards; with capacity sized for unit peak flow rate.
 - f. Drain: Grid with NPS 1-1/4 (DN 32) minimum horizontal waste and trap complying with ASME A112.18.2.
 - g. Cooling System: Electric, with precooler, hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.
 - 1) Capacity: 8 gph (0.0084 L/s) **OR** 12 gph (0.0126 L/s), **as directed**, of 50 deg F (10 deg C) cooled water from 80 deg F (27 deg C) inlet water and 90 deg F (32 deg C) ambient air temperature.
 - 2) Electrical Characteristics: 1/6 **OR** 1/5, **as directed**, hp; 120-V ac; single phase; 60 Hz.
 - h. Support: Mounting frame or brackets for attaching to substrate.
5. Description: ARI 1010, Type PB, pressure with bubbler, Style RE, recessed water cooler.
- a. Cabinet: All stainless steel.
 - b. Bubbler: One, with adjustable stream regulator, located on deck.
 - c. Control: Push button **OR** bar, **as directed**.
 - d. Supply: NPS 3/8 (DN 10) with ball, gate, or globe valve.
 - e. Filter: One or more water filters complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards; with capacity sized for unit peak flow rate.
 - f. Drain: Grid with NPS 1-1/4 (DN 32) minimum horizontal waste and trap complying with ASME A112.18.2.
 - g. Cooling System: Electric, with precooler, hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.
 - 1) Capacity: 8 gph (0.0084 L/s) **OR** 12 gph (0.0126 L/s), **as directed**, of 50 deg F (10 deg C) cooled water from 80 deg F (27 deg C) inlet water and 90 deg F (32 deg C) ambient air temperature.
 - 2) Electrical Characteristics: 1/6 **OR** 1/5, **as directed**, hp; 120-V ac; single phase; 60 Hz.
 - h. Ventilation Grille: Stainless steel, located above **OR** below, **as directed**, fountain.
 - i. Support: Mounting frame for attaching to substrate.

C. Water Station Water Coolers

- 1. Description: Water-station configuration, freestanding, cabinet water cooler with top-mounting glass fillers.
 - a. Cabinet: All stainless steel **OR** Enameled-steel panels with stainless-steel top, **as directed**, 0.05 inch (1.3 mm) thick; and 32 inches (813 mm) **OR** 36 inches (915 mm), **as directed**, high.



- b. Receptors: Two **OR** Four, **as directed**, stainless-steel bowls, with grid drain and bottom outlet in top; with two facing front and two facing back.
 - c. Glass Fillers: Two **OR** Four, **as directed**, push-back type **OR** pedestal type, **as directed**, on top, over receptors.
 - d. Tray Slides: One on front and one on back, stainless steel.
 - e. Supply: NPS 1/2 (DN 15) with ball, gate, or globe valve, and connected to filter, chiller, and each glass filler.
 - f. Filter: One or more water filters complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards; with capacity sized for unit peak flow rate.
 - g. Drain: Waste piping from each receptor connected to NPS 1-1/4 (DN 32) **OR** NPS 1-1/2 (DN 40), **as directed**, trap and waste to wall **OR** indirect waste to floor receptor, **as directed**, complying with ASME A112.18.2.
 - h. Cooling System: Electric, complying with ARI 1010, for Type R remote water coolers.
 - 1) Chassis: Galvanized or corrosion-resistant-coated steel.
 - 2) Chiller: Hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, and refrigerant.
 - 3) Storage Tank: 2 gal. (7.6 L) **OR** 4 gal. (15.1 L) **OR** 6 gal. (22.7 L) **OR** 14 gal. (53 L) **OR** 25 gal. (95 L), **as directed**, stainless steel.
 - 4) Controls: Adjustable thermostat.
 - 5) One-Hour Peak Capacity Rate: 8 gph (0.0084 L/s) **OR** 12 gph (0.0126 L/s) **OR** 18 gph (0.0189 L/s) **OR** 29 gph (0.0305 L/s) **OR** 50 gph (0.0526 L/s), **as directed**, of 50 deg F (10 deg C) cooled water from 80 deg F (27 deg C) inlet water and 90 deg F (32 deg C) ambient air temperature.
 - 6) Electrical Characteristics: 1/5 **OR** 1/4 **OR** 1/3 **OR** 1/2 **OR** 3/4, **as directed**, hp; 120 **OR** 240 **OR** 277 **OR** 480, **as directed**,-V ac; single phase; 60 Hz.
2. Description: Water-station configuration, freestanding, cabinet water cooler with front-mounting glass fillers.
- a. Cabinet: All stainless steel **OR** Enameled-steel panels with stainless-steel top, **as directed**, 0.05 inch (1.3 mm) thick; and 42 inches (1067 mm) **OR** 48 inches (1219 mm), **as directed**, high.
 - b. Receptors: One **OR** Two, **as directed**, stainless-steel tray(s), with antisplash design, drain, and bottom outlet, in vertical panel(s), with one facing front and one facing back.
 - c. Glass Fillers: Two **OR** Four, **as directed**, push-back type, on vertical panel(s), over receptor(s).
 - d. Shelves: One **OR** Two, **as directed**, stainless steel, on each side panel.
 - e. Supply: NPS 1/2 (DN 15) with ball, gate, or globe valve, and connected to filter, chiller, and each glass filler.
 - f. Filter: One or more water filters complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards; with capacity sized for unit peak flow rate.
 - g. Drain: NPS 1-1/4 (DN 32) **OR** NPS 1-1/2 (DN 40), **as directed**, trap and waste to wall **OR** indirect waste to floor receptor, **as directed**, complying with ASME A112.18.2.
 - h. Cooling System: Electric, complying with ARI 1010, for Type R remote water coolers.
 - 1) Chassis: Galvanized or corrosion-resistant-coated steel.
 - 2) Chiller: Hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, and refrigerant.
 - 3) Storage Tank: 6 gal. (22.7 L) **OR** 14 gal. (53 L) **OR** 25 gal. (95 L) **OR** 30 gal. (113.6 L) **OR** 40 gal. (151.4 L), **as directed**, stainless steel.
 - 4) Controls: Adjustable thermostat.
 - 5) One-Hour Peak Capacity Rate: 18 gph (0.0189 L/s) **OR** 29 gph (0.0305 L/s) **OR** 50 gph (0.0526 L/s) **OR** 65 gph (0.0684 L/s) **OR** 85 gph (0.0894 L/s), **as directed**, of 50 deg F (10 deg C) cooled water from 80 deg F (27 deg C) inlet water and 90 deg F (32 deg C) ambient air temperature.
 - 6) Electrical Characteristics: 1/3 **OR** 1/2 **OR** 3/4 **OR** 1 **OR** 1-1/2, **as directed**, hp; 120 **OR** 240 **OR** 277 **OR** 480, **as directed**,-V ac; single phase; 60 Hz.

D. Remote Water Coolers



1. Description: ARI 1010, Style R, remote chiller equipment for installation separate from drinking fountains. Include filter, reverse-osmosis system and ultra-violet-disinfection equipment, **as directed**.
 - a. Cooling System: Electric.
 - 1) Chassis: Galvanized or corrosion-resistant-coated steel.
 - 2) Chiller: Hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, and refrigerant.
 - 3) Storage Tank: 0.5 gal. (1.9 L) **OR** 4 gal. (15.1 L), **as directed**, stainless steel.
 - 4) Controls: Adjustable thermostat.
 - 5) Capacity: 5 gph (0.0053 L/s) **OR** 8 gph (0.0084 L/s) **OR** 14 gph (0.0147 L/s), **as directed**, of 50 deg F (10 deg C) cooled water from 80 deg F (27 deg C) inlet water and 90 deg F (32 deg C) ambient air temperature.
 - 6) Electrical Characteristics: 1/5 **OR** 1/4 **OR** 1/3, **as directed**, hp; 120 **OR** 240 **OR** 277 **OR** 480, **as directed**,-V ac; single phase; 60 Hz.
 - b. Ventilation Grille: Stainless steel.
 - c. Filter: One or more water filters complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards; with capacity sized for unit peak flow rate.
- E. Fixture Supports
1. Description: ASME A112.6.1M, water cooler carriers. Include vertical, steel uprights with feet and tie rods and bearing plates with mounting studs matching fixture to be supported.
 - a. Type I: Hanger-type carrier with two vertical uprights.
 - b. Type II: Bilevel, hanger-type carrier with three vertical uprights.
 - c. Supports for Accessible Fixtures: Include rectangular, vertical, steel uprights instead of steel pipe uprights.

1.3 EXECUTION

A. Applications

1. Use carrier off-floor supports for wall-mounting fixtures, unless otherwise indicated.
2. Use mounting frames for recessed water coolers, unless otherwise indicated.
3. Set freestanding and pedestal drinking fountains on floor.
4. Set remote water coolers on floor, unless otherwise indicated.
5. Use chrome-plated brass or copper tube, fittings, and valves in locations exposed to view. Plain copper tube, fittings, and valves may be used in concealed locations.

B. Installation

1. Install off-floor supports affixed to building substrate and attach wall-mounting fixtures, unless otherwise indicated.
2. Install mounting frames affixed to building construction and attach recessed water coolers to mounting frames, unless otherwise indicated.
3. Install fixtures level and plumb. For fixtures indicated for children, install at height required by authorities having jurisdiction.
4. Install water-supply piping with shutoff valve on supply to each fixture to be connected to water distribution piping. Use ball, gate, or globe valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Division 22 Section "General-duty Valves For Plumbing Piping".
5. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.
6. Install pipe escutcheons at wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding pipe fittings. Escutcheons are specified in Division 22 Section "Common Work Results For Plumbing".



7. Seal joints between fixtures and walls and floors using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants".
- C. Connections
1. Connect fixtures with water supplies, traps, and risers, and with soil, waste, and vent piping. Use size fittings required to match fixtures.
 2. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
 3. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".
- D. Field Quality Control
1. Water Cooler Testing: After electrical circuitry has been energized, test for compliance with requirements. Test and adjust controls and safeties.
 - a. Remove and replace malfunctioning units and retest as specified above.
 - b. Report test results in writing.
- E. Adjusting
1. Adjust fixture flow regulators for proper flow and stream height.
 2. Adjust water cooler temperature settings.

END OF SECTION 22 47 13 00



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Task	Specification	Specification Description
22 47 16 00	01 22 16 00	No Specification Required
22 47 16 00	10 28 19 16	Plumbing Fixtures
22 47 16 00	01 95 22 00	Emergency Plumbing Fixtures
22 47 16 00	22 47 13 00	Drinking Fountains And Water Coolers
22 47 23 00	22 47 13 00	Drinking Fountains And Water Coolers
22 47 26 00	10 28 19 16	Plumbing Fixtures
22 51 13 00	01 22 16 00	No Specification Required
22 51 16 00	01 22 16 00	No Specification Required
22 51 19 00	01 22 16 00	No Specification Required
22 66 53 00	07 63 00 00	Common Work Results for Fire Suppression
22 66 53 00	07 63 00 00a	Common Work Results for Plumbing
22 66 53 00	07 63 00 00b	Common Work Results for HVAC
22 66 53 00	22 11 16 00a	Sanitary Waste And Vent Piping
22 66 53 00	22 11 16 00f	General-Service Compressed-Air Piping



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**SECTION 22 66 83 16 - CHEMICAL-WASTE SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES****1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for chemical-waste systems for laboratory and healthcare facilities. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

C. Summary

1. Section Includes:
 - a. Single-wall piping.
 - b. Double-containment piping.
 - c. Field-fabrication containment piping.
 - d. Piping specialties.
 - e. Neutralization tanks.
 - f. Neutralization systems.
 - g. Manholes.
 - h. Leak-detection systems.

D. Definitions

1. CR: Chlorosulfonated polyethylene synthetic rubber.
2. FPM: Vinylidene fluoride-hexafluoro propylene copolymer rubber.

E. Performance Requirements

1. Single-Wall Piping Pressure Rating: 10 feet head of water (30 kPa).
2. Double-Containment Piping Pressure Rating:
 - a. Carrier Piping: 5-psig (34.5-kPa) air test pressure.
 - b. Containment Piping: 5-psig (34.5-kPa) air test pressure.
3. Field-Fabrication Containment-Piping Pressure Rating: 5-psig (34.5-kPa) air test pressure.
4. Delegated Design: Design seismic restraints for aboveground piping, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

F. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittal:
 - a. Product Data for Credit EQ 4.1: For solvent cements and adhesive primers, including printed statement of VOC content.
3. Shop Drawings: For neutralization system and leak-detection system. Include plans, elevations, sections, details, and attachments to other work.
 - a. Detail neutralization-system assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - b. Detail leak-detection-system assemblies and indicate required clearances, method of field assembly, components, and location and size of each field connection.
 - c. Wiring Diagrams: For power, signal, and control wiring.
4. Delegated-Design Submittal: For seismic restraints of aboveground piping, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
5. Profile Drawings for Outdoor Underground Piping: Show system piping in elevation. Draw profiles at horizontal scale of not less than 1 inch equals 50 feet (1:500) and vertical scale of not



less than 1 inch equals 5 feet (1:50). Indicate underground structures and pipes. Show types, sizes, materials, and elevations of other utilities crossing system piping.

6. Field quality-control test reports.
7. Operation and Maintenance Data: For chemical-waste specialties and neutralization tanks, neutralization systems, and leak-detection systems to include in emergency, operation, and maintenance manuals.

G. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. NFPA Compliance: Comply with NFPA 70, "National Electrical Code."

H. Delivery, Storage, And Handling

1. Deliver and store piping and specialties with sealing plugs in ends or with end protection.
2. Do not store plastic pipe or fittings in direct sunlight.
3. Protect pipe, fittings, and seals from dirt and damage.

I. Project Conditions

1. Interruption of Existing Chemical-Waste Service: Do not interrupt chemical-waste service to facilities occupied by the Owner or others unless permitted under the following conditions and then only after arranging to provide temporary chemical-waste service according to requirements indicated:
 - a. Notify the Owner no fewer than two days in advance of proposed interruption of chemical-waste service.
 - b. Do not proceed with interruption of chemical-waste service without the Owner's written permission.

1.2 PRODUCTS

A. Single-Wall Pipe And Fittings

1. PE Drainage Pipe and Fittings: Made of ASTM D 4976, PE resin.
 - a. Pipe: ASTM F 1412, Schedule 40.
 - b. Fittings: ASTM F 1412, Schedule 40, socket-fusion, drainage pattern complying with ASTM D 3311.
2. PP Drainage Pipe and Fittings: ASTM F 1412, pipe extruded and drainage-pattern fittings molded, with Schedule 40 dimensions, from PP resin with fire-retardant additive complying with ASTM D 4101; with fusion **OR** fusion- and mechanical **OR** mechanical, **as directed**,-joint ends.
 - a. Exception: Pipe and fittings made from PP resin without fire-retardant additive may be used for underground installation.
3. PVC Drainage Pipe and Fittings: ASTM D 2665, pipe and drainage-pattern fittings.
4. PVDF Drainage Pipe and Fittings: ASTM F 1673, Schedule 40, pipe and drainage-pattern fittings. Include fittings with fusion **OR** fusion- and mechanical **OR** mechanical, **as directed**,-joint ends.
5. Fiberglass Pipe and Fittings, Centrifugally Cast: ASTM D 2997, Type II, Grade 1 **OR** Grade 2, **as directed**, Class A **OR** Class B **OR** Class C, **as directed**, RTRP pipe; with ASTM D 5685, Type 4, RTRF fittings matching pipe; and adhesive-bonding **OR** butt-and-wrap-joint, **as directed**, materials. Include wall thickness that will provide 160-psig (1105-kPa) minimum, sustained water test pressure rating.
6. Fiberglass Pipe and Fittings, Filament Wound: ASTM D 2996, Type I, Grade 1 **OR** Grade 2, **as directed**, Class A **OR** Class B **OR** Class C **OR** Class E **OR** Class F, **as directed**, RTRP pipe; ASTM D 5685, Type 1, RTRF fittings matching pipe; and adhesive-bonding **OR** butt-and-wrap-joint, **as directed**, materials. Include wall thickness that will provide 160-psig (1105-kPa) minimum, sustained water test pressure rating.



7. High-Silicon-Iron, Hub-and-Plain-End Pipe and Fittings: ASTM A 861, pipe and drainage-pattern fittings; acid-resistant packing; and lead caulking materials.
 8. High-Silicon-Iron, Mechanical-Joint Pipe and Fittings: ASTM A 861, pipe and drainage-pattern fittings; and stainless-steel clamps with TFE inner sleeve and CR outer sleeve.
 9. Stainless-Steel Drainage Pipe and Fittings: ASME A112.3.1, ASTM A 666, Type 316L, stainless-steel pipe and drainage-pattern fittings; with socket and spigot ends for gasket joints; and having piping manufacturer's FPM lip-seal rubber gaskets shaped to fit socket groove, with plastic backup ring.
 10. Borosilicate Glass Pipe and Fittings: ASTM C 1053, pipe and drainage-pattern fittings; with manufacturer's standard couplings.
 - a. Covering: Factory-applied polystyrene for pipe installed underground.
 11. Adapters and Transition Fittings: Assemblies with combination of clamps, couplings, adapters, and gaskets; compatible with piping and system liquid; made for joining different piping materials.
- B. Double-Containment Pipe And Fittings
1. Description: Factory-fabricated, double-wall pipe and fittings. Sizes indicate carrier-pipe size; with carrier (inner) pipe and fittings; annular-space, carrier-pipe supports; containment (outer) pipe and fittings; and joining materials and fasteners. Include manufacturer's standard piping materials according to the following:
 - a. PE, Double-Containment Drainage Pipe and Fittings: Made of ASTM D 4976, PE resin.
 - 1) Carrier and Containment Pipes: ASTM F 1412, Schedule 40.
 - 2) Fittings: ASTM F 1412, Schedule 40 drainage pattern complying with ASTM D 3311.
 - b. PP, Double-Containment Drainage Pipe and Fittings: Made of ASTM D 4101, PP resin.
 - 1) Carrier and Containment Pipes: ASTM F 1412, Schedule 40.
 - 2) Fittings: ASTM F 1412, Schedule 40 drainage pattern complying with ASTM D 3311.
 - c. PP/PVC, Double-Containment Drainage Pipe and Fittings:
 - 1) PP Carrier Pipe: ASTM F 1412, Schedule 40; made of ASTM D 4101, PP resin.
 - 2) PP Carrier-Pipe Fittings: ASTM F 1412, Schedule 40 drainage pattern complying with ASTM D 3311; made of ASTM D 4101, PP resin.
 - 3) PVC Containment Pipe: ASTM D 2665, PVC pipe.
 - 4) PVC Containment Pipe Fittings: ASTM D 2665, PVC drainage pattern.
 - d. PVDF, Double-Containment Drainage Pipe and Fittings: Made of ASTM D 3222, PVDF resin.
 - 1) Carrier and Containment Pipes: ASTM F 1673, Schedule 40.
 - 2) Fittings: ASTM F 1673, Schedule 40 drainage pattern complying with ASTM D 3311.
 - e. PVDF/PVC, Double-Containment Drainage Pipe and Fittings:
 - 1) PVDF Carrier Pipe: ASTM F 1673, Schedule 40; made of ASTM D 3222, PVDF resin.
 - 2) PVDF Carrier-Pipe Fittings: ASTM F 1673, Schedule 40 drainage pattern complying with ASTM D 3311; made of ASTM D 3222, PVDF resin.
 - 3) PVC Containment Pipe: ASTM D 2665, PVC pipe.
 - 4) PVC Containment Pipe Fittings: ASTM D 2665, PVC drainage pattern.
 2. Include design and fabrication of double-containment pipe and fitting assemblies with provision for field installation of cable leak-detection system in annular space between carrier and containment piping.
- C. Field-Fabrication Containment Piping
1. Description: Containment split pipe and split fittings with carrier-pipe centralizers. Include manufacturer's fastening devices and materials.
 - a. Material: HDPE **OR** PP **OR** Yellow PVC **OR** Clear PVC, **as directed**, pipe and fittings.
 - b. Fastening System: FPM gaskets, clamps, and pins.



- c. Material: Clear PVC pipe and fittings with adhesive channels, for use with drainage-pattern carrier piping.
- d. Fastening System: Adhesive.

D. Joining Materials

1. Couplings: Assemblies with combination of clamps, gaskets, sleeves, and threaded or flanged parts; compatible with piping and system liquid; and made by piping manufacturer for joining system piping.
2. Adapters and Transition Fittings: Assemblies with combination of clamps, couplings, adapters, gaskets, and threaded or flanged parts; compatible with piping and system liquid; and made for joining different piping materials.
3. Flanges: Assemblies of companion flanges and gaskets complying with ASME B16.21 and compatible with system liquid, and bolts and nuts.
4. Solvent Cement for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 - a. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
5. Fiberglass-Pipe Adhesive: As furnished or recommended by pipe manufacturer.
 - a. Use fiberglass adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Piping Specialties

1. Plastic Dilution Traps:
 - a. Material: Corrosion-resistant PP, with removable base.
 - b. End Connections: Mechanical joint.
 - c. Dilution Tanks: 1-gal. (3.8-L) capacity, with clear base unless colored base is indicated; with two NPS 1-1/2 (DN 40) top inlets and one NPS 1-1/2 (DN 40) side outlet.
 - d. Small Dilution Jars: 1-pint (0.5-L) capacity, with clear base unless colored base is indicated; with NPS 1-1/2 (DN 40) top inlet and NPS 1-1/2 (DN 40) side outlet.
 - e. Large Dilution Jars: 1-quart (1-L) capacity; with NPS 1-1/2 (DN 40) top inlet and NPS 1-1/2 (DN 40) side outlet.
2. High-Silicon-Iron Dilution Traps:
 - a. Standard: ASTM A 861.
 - b. Size: NPS 1-1/2 or NPS 2 (DN 40 or DN 50) as required for fixture and waste.
 - c. End Connections: Mechanical.
3. Glass, Drain-Line, Interceptor Traps:
 - a. Standard: ASTM C 1053.
 - b. Type: Drum trap.
 - c. Size: NPS 1-1/2 (DN 40), NPS 2 by NPS 1-1/2 (DN 50 by DN 40), or NPS 2 (DN 50), as required to match connecting piping.
4. Corrosion-Resistant Traps:
 - a. Type: P-trap or drum trap.
 - b. Size: NPS 1-1/2 or NPS 2 (DN 40 or DN 50), as required to match connected piping.
 - c. High-Silicon Iron: ASTM A 861, with horizontal outlet and hub-and-plain or plain ends to match connecting piping.
 - d. PP: ASTM D 4101, with mechanical-joint pipe connections.
 - e. PVDF: ASTM D 3222, with mechanical-joint pipe connections.
 - f. Glass: ASTM C 1053, with coupling pipe connections.
5. High-Silicon-Iron Floor Drains:
 - a. Standard: ASTM A 861.
 - b. Body: With integral flashing flange and weep holes; and with flashing ring and stainless-steel strip, sediment basin and funnel attachment, **as directed**.



- c. Top: 8-3/4-inch (222-mm) diameter with grate.
 - d. Size: NPS 2, NPS 3, NPS 4, or NPS 6 (DN 50, DN 80, DN 100, or DN 150) outlet as indicated.
6. Stainless-Steel Floor Drains:
 - a. Standard: ASME A112.3.1, ASTM A 666, Type 316L.
 - b. Body: With 8.5-by-8.5-inch (215-by-215-mm) **OR** 12.4-by-12.4-inch (315-by-315-mm), **as directed**, top with grate.
 - c. Outlet: Bottom, of size indicated.
 7. PP Floor Drains:
 - a. Body: With 7- to 9-inch (178- to 230-mm) top diameter, with flashing flange and weep holes; and with flashing clamp, basket strainer, funnel attachment, and trap-primer connection, **as directed**.
 - b. Outlet: Bottom, to match connecting pipe, with NPS 2, NPS 3, NPS 4, or NPS 6 (DN 50, DN 80, DN 100, or DN 150) outlet as indicated.
 8. High-Silicon-Iron Cleanouts:
 - a. Standard: ASTM A 861, fitting with PTFE gasket and closure plug, of design appropriate for piping application.
 9. Stainless-Steel Cleanouts:
 - a. Standard: ASME A112.3.1, ASTM A 666, Type 316L, stainless steel.
 - b. Aboveground Piping: Cleanout tee of size matching piping.
 - c. Underground and Underslab Piping: Floor access cleanout of size matching piping.
 10. High-Silicon-Iron Backwater Valves:
 - a. Standard: ASTM A 861.
 - b. Body: Hub-and-plain end with swing-check valve; and with high-silicon-iron pipe extension of length to reach floor surface, and high-silicon-iron closure plug, **as directed**.
 11. Plastic Backwater Valves:
 - a. Description: Full-port NPS 3 (DN 80) check valve, PP or PVDF, matching or compatible with system piping and compatible with system liquid, with EPDM seals and flanged ends.
 - 1) Exception: PVC material for use with PVC piping systems.
 12. High-Silicon-Iron Sink Outlets:
 - a. Standard: ASTM A 861, high-silicon iron, NPS 1-1/2 (DN 40), with clamping device and 4-, 6-, or 8-inch- (100-, 150-, or 200-mm-) high overflow fitting, as indicated.
 13. PP Sink Outlets:
 - a. Description: NPS 1-1/2 (DN 40), with clamping device, stopper, and 7-inch- (178-mm-) high overflow fitting.
 14. Glass Sink Outlets:
 - a. Standard: ASTM C 1053, components for field assembly, NPS 1-1/2 (DN 40); with sink assembly of outlet, strainer, gasket, and locknut; overflow fitting of length indicated; and tailpiece assembly of borosilicate glass and locknut.
- F. Neutralization Tanks
1. Plastic Neutralization Tanks:
 - a. Description: Corrosion-resistant plastic materials; with removable, gastight cover; interior, sidewall, dip-tube inlet; outlet; vent; and threaded or flanged, sidewall pipe connections.
 - 1) Material: HDPE **OR** ASTM D 4101, PP, **as directed**.
 - 2) Tank Capacity: as directed by the Owner.
 - 3) Dip Tube: On outlet pipe instead of inlet pipe.
 - 4) Extension: HDPE, PE, or PP.
 - 5) Traffic Cover: Light-duty **OR** Heavy-duty pedestrian or light-duty vehicular, steel plate over, **as directed**, plastic, bolted.
 - 6) Limestone: Chips or lumps, with more than 90 percent calcium carbonate content and 1- to 3-inch (25- to 75-mm) diameter.
OR



Dolomitic Limestone: Chips or lumps, with more than 90 percent combined magnesium carbonate and calcium carbonate content and 1- to 3-inch (25- to 75-mm) diameter.

2. Ceramic Neutralization Tanks:
 - a. Description: Corrosion-resistant, cast-ceramic shell; with removable, reinforced-plastic, gastight cover; inlet; interior, sidewall, dip-tube outlet; vent; and bell, sidewall pipe connections.
 - 1) Extension: Ceramic, of size and length indicated, and with cast-iron manhole frame and cover.
OR
Extension: Steel with protective coating, 28-inch (710-mm) diameter, and cast-iron manhole frame and cover.
 - 2) Limestone: Chips or lumps, with more than 90 percent calcium carbonate content and 1- to 3-inch (25- to 75-mm) diameter.
OR
Dolomitic Limestone: Chips or lumps, with more than 90 percent combined magnesium carbonate and calcium carbonate content and 1- to 3-inch (25- to 75-mm) diameter.
3. Collection Tanks: Corrosion-resistant, cast-ceramic shell. Include removable, reinforced-plastic, gastight cover; inlet; vent; and bell, sidewall pipe connections.
 - a. Extension: Ceramic **OR** Steel with protective coating, **as directed**, 28-inch (710-mm) minimum diameter, and cast-iron manhole frame and cover.

G. Neutralization Systems

1. Plastic-Tank Neutralization Systems:
 - a. Description: Automatic system for neutralizing chemical waste.
 - 1) Controls: Factory-wired and -tested, 120-V ac, to operate probes, control valves, and metering pumps and to monitor pH of effluent; with wiring and electrical-power terminals.
 - 2) Panel: NEMA 250, Type 4X enclosure, unless otherwise indicated; with manufacturer's standard features, control devices, and indicators, but not less than the following:
 - a) Power light and on/off switch.
 - b) pH analyzer with meter and high- and low-pH indicators.
 - c) Low caustic- and acid-solution level indicators.
 - d) Alarm horn with silencer and reset switch.
 - e) Agitator running light with on/off switch.
 - f) Running lights with on/off switches for caustic- and acid-solution pumps.
 - 3) Strip chart recorder with capacity for 30-day record.
 - 4) Piping between Tanks: Same material as chemical-waste piping system unless otherwise indicated.
 - 5) Interceptor Tank: Same material as mixing tank; with removable, gastight cover; and sidewall inlet and outlet piping connections.
 - 6) Neutralization Tank: Same material as mixing tank; with removable, gastight cover; sidewall inlet and outlet piping connections; and vent connection in sidewall or top.
 - a) Limestone: Chips or lumps, with more than 90 percent calcium carbonate content and 1- to 3-inch (25- to 75-mm) diameter.
OR
Dolomitic Limestone: Chips or lumps, with more than 90 percent combined magnesium carbonate and calcium carbonate content and 1- to 3-inch (25- to 75-mm) diameter.
 - 7) Mixing Tank: With removable, gastight cover; sidewall inlet and outlet piping connections; vent connection in sidewall or top; neutralizing-solution piping connections; and openings in top for probe and agitator.



- a) Material: HDPE **OR** ASTM D 4101, PP, **as directed**.
 - b) pH Probe: Type and length suitable for mixing-tank size.
 - c) Agitator: Electric, with stainless-steel shaft and propeller.
 - 8) Caustic-Solution Storage Tank: PP.
 - a) Caustic Chemical: Sodium hydroxide solution.
 - 9) Acid Storage Tank: PP.
 - a) Acid Chemical: Sulfuric acid solution.
 - 10) Metering Pumps: Types suitable for neutralizing solutions.
 - 11) Sampling Tank: Same material as mixing tank; with removable, gastight cover; sidewall inlet and outlet piping connections; and opening in top for probe.
 - a) pH probe: Type and length suitable for sampling-tank size.
2. Ceramic-Tank Neutralization Systems:
- a. Description: Automatic system for neutralizing chemical waste.
 - 1) Controls: Factory-wired and -tested, 120-V ac, to operate probes, control valves, and metering pumps and to monitor pH of effluent; with wiring and electrical-power terminals.
 - 2) Panel: NEMA 250, Type 4X enclosure, unless otherwise indicated; with manufacturer's standard features, control devices, and indicators, including the following:
 - a) Power light and on/off switch.
 - b) pH analyzer with meter and high- and low-pH indicators.
 - c) Low caustic- and acid-solution level indicators.
 - d) Alarm horn with silencer and reset switch.
 - e) Agitator running light with on/off switch.
 - f) Running lights with on/off switches for caustic- and acid-solution pumps.
 - 3) Strip chart recorder with capacity for 30-day record.
 - 4) Piping between Tanks: Same material as chemical-waste piping system unless otherwise indicated.
 - 5) Interceptor Tank: Same material as mixing tank; with removable, gastight cover; and sidewall inlet and outlet piping connections.
 - 6) Neutralization Tank: Same material as mixing tank; with removable, gastight cover; sidewall inlet and outlet piping connections; and vent connection in sidewall or top.
 - a) Limestone: Chips or lumps, with more than 90 percent calcium carbonate content and 1- to 3-inch (25- to 75-mm) diameter.
OR
Dolomitic Limestone: Chips or lumps, with more than 90 percent combined magnesium carbonate and calcium carbonate content and 1- to 3-inch (25- to 75-mm) diameter.
 - 7) Mixing Tank: With removable, gastight cover; sidewall inlet and outlet piping connections; vent connection in sidewall or top; neutralizing-solution piping connections; and openings in top for probe and agitator.
 - a) Material: Clay, vitrified into ceramic unit.
 - b) pH Probe: Type and length suitable for mixing tank size.
 - c) Agitator: Electric, with stainless-steel shaft and propeller.
 - 8) Caustic-Solution Storage Tank: PP.
 - a) Caustic Chemical: Sodium hydroxide solution.
 - 9) Acid Storage Tank: PP.
 - a) Acid Chemical: Sulfuric acid solution.
 - 10) Metering Pumps: Types suitable for neutralizing solutions.
 - 11) Sampling Tank: Same material as mixing tank; with removable, gastight cover; sidewall inlet and outlet piping connections; and opening in top for probe.
 - a) pH probe: Type and length suitable for sampling-tank size.

H. Manholes



1. Description: ASTM F 1759, fabricated from PE components. Include bottom, sidewalls, and top sections; corrosion-resistant, manhole frame and cover; fusion or other watertight joints; and design to prohibit flotation.
 - a. Construction: Single wall **OR** Double wall with interstitial space, **as directed**.
 - b. Bottom: Channeled.
 - c. Connections: Inlets and outlet matching or suitable for piping.
 - d. Steps: Manufacturer's standard, fusion welded to sidewall. Omit steps for manholes less than 60 inches (1500 mm) deep.
 - e. Top: Include 24-inch- (610-mm-) nominal-diameter frame and cover.

- I. Leak-Detection Systems
 1. Leak-Detection Systems:
 - a. Description: Cable leak-detection system capable of detecting and annunciating fluid leaks; with controls, panel, wiring, cable sensors, probes if required, and piping.
 - 1) Annunciator Panel: Enclosure with visual and audible alarms and leak location indicator.
 - 2) Sensors: Electric cable, suitable for insertion into double-containment piping annular space, with capability of detecting fluid leaks and signaling locations of leaks.

- J. Sleeves
 1. Cast-Iron Wall Pipes: Cast or fabricated of cast iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
 2. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
 3. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
 4. Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc-coated, plain ends.
 5. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - a. Underdeck Clamp: Clamping ring with set screws.

- K. Sleeve Seals
 1. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - a. Sealing Elements: EPDM **OR** NBR, **as directed**, interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - b. Pressure Plates: Carbon steel **OR** Plastic **OR** Stainless steel, **as directed**.
 - c. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating **OR** Stainless steel, **as directed**, of length required to secure pressure plates to sealing elements.

- L. Escutcheons
 1. General Requirements for Escutcheons: Manufactured wall and ceiling escutcheons and floor plates, with ID to closely fit around pipe and tube and OD that completely covers opening.
 2. One-Piece, Deep-Pattern Escutcheons: Deep-drawn, box-shaped brass with polished chrome-plated finish.
 3. One-Piece, Stamped-Steel Escutcheons: With set screw **OR** spring clips, **as directed**, and chrome-plated finish.
 4. Split-Plate, Stamped-Steel Escutcheons: With concealed **OR** exposed-rivet, **as directed**, hinge, set screw **OR** spring clips, **as directed**, and chrome-plated finish.
 5. One-Piece, Floor-Plate Escutcheons: Cast iron.
 6. Split-Casting, Floor-Plate Escutcheons: Cast brass with concealed hinge and set screw.

- M. Grout
 1. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.



- a. Characteristics: Post-hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
- b. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
- c. Packaging: Premixed and factory packaged.

1.3 EXECUTION

A. Earthwork

1. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

B. Concrete Bases

1. Anchor neutralization tanks and neutralization system tanks to concrete bases.
 - a. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 19-inch (480-mm) centers around full perimeter of base.
 - b. For installed equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be imbedded.
 - d. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - e. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
 - f. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-place Concrete".
 - g. Comply with requirements in Division 31 for cast-in-place concrete materials and placement.

C. Piping Installation

1. Chemical-Waste Sewerage Outside the Building:
 - a. Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground chemical-waste sewerage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
 - b. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.
 - c. Install manholes for changes in direction, unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
 - d. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
 - e. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed by tunneling, jacking, or combination of both.
 - f. Install drainage piping pitched down in direction of flow, at minimum slope of 1 **OR** 2, **as directed**, percent, unless otherwise indicated.
 - g. Install drainage piping with 36-inch (915-mm) **OR** 48-inch (1220-mm) **OR** 60-inch (1524-mm) **OR** 72-inch (1830-mm), **as directed**, minimum cover.
 - h. Install PE drainage piping according to ASTM D 2321 and ASTM F 1668.
 - i. Install PVC drainage piping according to ASTM D 2321 and ASTM F 1668.
 - j. Install PVDF drainage piping according to ASTM D 2321 and ASTM F 1668.
 - k. Install fiberglass piping according to ASTM D 3839 and ASTM F 1668.
 - l. Install field-fabrication containment piping over new and existing carrier piping. Use containment piping manufacturer's fastening system.

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- m. Clear interior of piping and structures of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.
- 2. Chemical-Waste Piping Inside the Building:
 - a. Install piping next to equipment, accessories, and specialties to allow service and maintenance.
 - b. Transition and special fittings with pressure ratings at least equal to piping pressure rating may be used unless otherwise indicated.
 - c. Flanges may be used on aboveground piping unless otherwise indicated.
 - d. Install underground fiberglass piping according to ASTM D 3839.
 - e. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
 - f. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
 - g. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
 - h. Install piping at indicated slopes.
 - i. Install piping free of sags and bends.
 - j. Install fittings for changes in direction and branch connections.
 - k. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - 1) New Piping:
 - a) Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b) Insulated Piping: One-piece, stamped-steel type with spring clips.
 - c) Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
 - d) Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type **OR** Split-plate, stamped-steel type with concealed hinge **OR** One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge, **as directed**, and set screw.
 - e) Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type with set screw **OR** spring clips, **as directed**.
 - f) Bare Piping in Equipment Rooms: One-piece, stamped-steel type with set screw **OR** spring clips, **as directed**.
 - g) Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
 - 2) Existing Piping:
 - a) Insulated Piping: Split-plate, stamped-steel type with concealed **OR** exposed-rivet, **as directed**, hinge and spring clips.
 - b) Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and spring clips.
 - c) Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and set screw.
 - d) Bare Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with concealed **OR** exposed-rivet, **as directed**, hinge and set screw or spring clips.
 - e) Bare Piping in Equipment Rooms: Split-plate, stamped-steel type with set screw or spring clips.
 - f) Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.
 - l. Sleeves are not required for core-drilled holes.
 - m. Permanent sleeves are not required for holes formed by removable PE sleeves.
 - n. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

**OR**

Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

- 1) Cut sleeves to length for mounting flush with both surfaces.
 - a) Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
- 2) Install sleeves in new walls and slabs as new walls and slabs are constructed.
- 3) Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a) PVC **OR** Steel, **as directed**, Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
 - b) Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum board partitions.
 - c) Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing And Trim" for flashing.
 - d) Seal space outside of sleeve fittings with grout.
- 4) Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
- o. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1) Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
 - 2) Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) and larger in diameter.
 - 3) Sleeve-Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- p. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1) Sleeve-Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- q. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
- r. Verify final equipment locations for roughing-in.

D. Piping Specialty Installation

1. Embed floor drains in 4-inch (100-mm) minimum depth of concrete around bottom and sides. Comply with requirements in Division 03 Section "Cast-in-place Concrete" for concrete.
2. Fasten grates to drains if indicated.
3. Set floor drains with tops flush with pavement surface.
4. Install cleanouts and riser extension from sewer pipe to cleanout at grade. Use fittings of same material as sewer pipe at branches for cleanouts and riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in pipe.



- a. Set cleanout bodies in earth in cast-in-place concrete block, 18 by 18 by 12 inches (450 by 450 by 300 mm) deep. Set with tops 1 inch (25 mm) above surrounding grade. Set cleanout plugs in concrete pavement with tops flush with pavement surface. Comply with requirements in Division 03 Section "Cast-in-place Concrete" for formwork, reinforcement, and concrete requirements.
5. Install backwater valves in horizontal position. Include riser to cleanout at grade.

E. Joint Construction

1. Chemical-Waste Sewerage Outside the Building:
 - a. Plastic-Piping, Electrofusion Joints: Make polyolefin drainage-piping joints according to ASTM F 1290.
 - b. Make fiberglass-piping bonded joints according to ASTM D 3839.
 - c. Make fiberglass butt-and-wrap joints according to ASTM D 3839.
 - d. Join dissimilar pipe materials with adapters compatible with pipe materials being joined.
 - e. Join high-silicon-iron, hub-and-plain-end piping with calked joints using acid-resistant packing and lead.
 - f. Join high-silicon-iron, mechanical-joint piping with coupled joints using clamps and sleeves.
 - g. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.
2. Chemical-Waste Piping Inside the Building:
 - a. Plastic-Piping Electrofusion Joints: Make polyolefin drainage-piping joints according to ASTM F 1290.
 - b. Fiberglass-Piping Joints: Make joints with piping manufacturer's bonded adhesive.
 - c. Dissimilar-Material Piping Joints: Make joints using adapters compatible with both system materials.
 - d. Join high-silicon-iron, hub-and-plain-end piping with calked joints using acid-resistant packing and lead.
 - e. Join high-silicon-iron, mechanical-joint piping with coupled joints using clamps and sleeves.
 - f. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

F. Hanger And Support Installation

1. Pipe sizes in this article refer to aboveground, single-wall piping and carrier piping of containment piping, **as directed**.
2. Comply with requirements in Division 22 Section "Vibration And Seismic Controls For Plumbing Piping And Equipment" for seismic-restraint devices.
3. Comply with requirements in Division 22 Section "Hangers And Supports For Plumbing Piping And Equipment" for pipe hanger and support devices. Install the following:
 - a. Vertical Piping: MSS Type 8 or MSS Type 42, riser clamps.
 - b. Individual, Straight, Horizontal Piping Runs:
 - 1) 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
 - 2) Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
 - 3) Longer Than 100 Feet (30 m), if Indicated: MSS Type 49, spring cushion rolls.
 - c. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - d. Base of Vertical Piping: MSS Type 52, spring hangers.
4. Comply with requirements in Division 22 Section "Hangers And Supports For Plumbing Piping And Equipment" for installation of supports.
5. Support horizontal piping and tubing within 12 inches (300 mm) of each fitting and coupling.
6. Support vertical piping and tubing at base and at each floor.
7. Rod diameter may be reduced 1 size for double-rod hangers, to minimum of 3/8 inch (10 mm).
8. Install vinyl-coated hangers for PP piping with the following maximum horizontal spacing and minimum rod diameters:
 - a. NPS 2 (DN 50): 33 inches (840 mm) with 3/8-inch (10-mm) rod.
 - b. NPS 2-1/2 and NPS 3 (DN 65 and DN 80): 42 inches (1067 mm) with 1/2-inch (13-mm) rod.



- c. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1220 mm) with 5/8-inch (16-mm) rod.
- d. NPS 6 (DN 150): 48 inches (1220 mm) with 3/4-inch (19-mm) rod.
- e. NPS 8 (DN 200): 48 inches (1220 mm) with 7/8-inch (22-mm) rod.
9. Install supports for vertical PP piping every 72 inches (1830 mm).
10. Install vinyl-coated hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
 - a. NPS 1-1/4 (DN 32): 36 inches (910 mm) with 3/8-inch (10-mm) rod.
 - b. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 42 inches (1067 mm) with 3/8-inch (10-mm) rod.
 - c. NPS 2-1/2 and NPS 3 (DN 65 and DN 80): 42 inches (1067 mm) with 1/2-inch (13-mm) rod.
 - d. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1220 mm) with 5/8-inch (16-mm) rod.
 - e. NPS 6 (DN 150): 48 inches (1220 mm) with 3/4-inch (19-mm) rod.
 - f. NPS 8 to NPS 12 (DN 200 to DN 300): 48 inches (1220 mm) with 7/8-inch (22-mm) rod.
11. Install supports for vertical PVC piping every 48 inches (1220 mm).
12. Install vinyl-coated hangers for PVDF piping with the following maximum horizontal spacing and minimum rod diameters:
 - a. All Sizes: Install continuous support for piping with liquid waste at temperatures above 140 deg F (60 deg C).
 - b. NPS 1/2 (DN 15) and Smaller: 30 inches (760 mm) with 3/8-inch (10-mm) rod.
 - c. NPS 3/4 to NPS 1-1/2 (DN 20 to DN 40): 36 inches (910 mm) with 3/8-inch (10-mm) rod.
 - d. NPS 2 (DN 50): 36 inches (910 mm) with 3/8-inch (10-mm) rod.
 - e. NPS 2-1/2 and NPS 3 (DN 65 and DN 80): 42 inches (1067 mm) with 1/2-inch (13-mm) rod.
 - f. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1220 mm) with 5/8-inch (16-mm) rod.
 - g. NPS 6 (DN 150): 48 inches (1220 mm) with 3/4-inch (19-mm) rod.
13. Install supports for vertical PVDF piping NPS 1-1/2 (DN 40) every 48 inches (1220 mm) and NPS 2 (DN 50) and larger every 72 inches (1830 mm).
14. Install vinyl-coated hangers for fiberglass piping with the following maximum horizontal spacing and minimum rod diameters:
 - a. NPS 2 (DN 50) and Smaller: 10 feet (3 m) with 3/8-inch (10-mm) rod.
 - b. NPS 2-1/2 and NPS 3 (DN 65 and DN 80): 10 feet (3 m) with 1/2-inch (13-mm) rod.
 - c. NPS 4 and NPS 5 (DN 100 and DN 125): 10 feet (3 m) with 5/8-inch (16-mm) rod.
 - d. NPS 6 (DN 150): 10 feet (3 m) with 3/4-inch (19-mm) rod.
 - e. NPS 8 to NPS 12 (DN 200 to DN 300): 12 feet (3.6 m) with 7/8-inch (22-mm) rod.
15. Install supports for vertical fiberglass piping every 12 feet (3.6 m).
16. Install hangers for stainless-steel drainage piping with the following maximum horizontal spacing and minimum rod diameters:
 - a. NPS 2 (DN 50): 10 feet (3 m) with 3/8-inch (10-mm) rod.
 - b. NPS 2-1/2 (DN 65): 11 feet (3.4 m) with 1/2-inch (13-mm) rod.
 - c. NPS 3 (DN 80): 12 feet (3.6 m) with 1/2-inch (13-mm) rod.
 - d. NPS 4 and NPS 5 (DN 100 and DN 125): 12 feet (3.6 m) with 5/8-inch (16-mm) rod.
 - e. NPS 6 (DN 150): 12 feet (3.6 m) with 3/4-inch (19-mm) rod.
17. Install supports for vertical stainless-steel drainage piping every 15 feet (4.5 m).
18. Install hangers for high-silicon-iron piping with the following maximum horizontal spacing and minimum rod diameters:
 - a. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches (1520 mm) with 3/8-inch (10-mm) rod.
 - b. NPS 3 (DN 80): 60 inches (1520 mm) with 1/2-inch (13-mm) rod.
 - c. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1520 mm) with 5/8-inch (16-mm) rod.
 - d. NPS 6 (DN 150): 60 inches (1520 mm) with 3/4-inch (19-mm) rod.
 - e. NPS 8 to NPS 12 (DN 200 to DN 300): 60 inches (1520 mm) with 7/8-inch (22-mm) rod.
 - f. NPS 15 (DN 375): 60 inches (1520 mm) with 1-inch (25-mm) rod.
 - g. Spacing for horizontal pipe in 84-inch (2134-mm) lengths may be increased to 84 inches (2134 mm). Spacing for fittings is limited to 60 inches (1520 mm).



19. Install supports for vertical high-silicon-iron piping every 15 feet (4.5 m).
 20. Install vinyl-coated hangers for glass piping with the following maximum horizontal spacing and minimum rod diameters:
 - a. NPS 1 and NPS 1-1/4 (DN 25 and DN 32): 72 inches (1830 mm) with 3/8-inch (10-mm) rod.
 - b. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2440 mm) with 3/8-inch (10-mm) rod.
 - c. NPS 3 (DN 80): 96 inches (2440 mm) with 1/2-inch (13-mm) rod.
 - d. NPS 4 and NPS 6 (DN 100 and DN 150): 96 inches (2440 mm) with 5/8-inch (16-mm) rod.
 21. Install supports for vertical glass piping every 96 inches (2440 mm).
 22. Support piping and tubing not listed above according to MSS SP-69.
- G. Neutralization Tank Installation
1. Install exterior collection **OR** neutralization, **as directed**, tanks, complete with appurtenances indicated.
 - a. Set tops of tank covers flush with finished surface where covers occur in pavements. Set covers 3 inches (76 mm) above finished surface elsewhere unless otherwise indicated.
 - b. Include initial fill of limestone for neutralization tanks.
 2. Install interior neutralization tanks on smooth and level concrete base **OR** floor surface, **as directed**. Include full initial charge of limestone.
- H. Neutralization System Installation
1. Install neutralization systems on smooth and level concrete base **OR** floor surface, **as directed**. Include neutralizing solutions and full initial charge of limestone.
- I. Manhole Installation
1. General: Install manholes, complete with appurtenances and accessories indicated. Comply with requirements in Division 22 Section "Facility Sanitary Sewers".
 2. Set tops of manhole frames and covers flush with finished surface where manholes occur in pavements. Set tops 3 inches (76 mm) above finished surface elsewhere unless otherwise indicated.
- J. Leak-Detection System Installation
1. Single-Pipe, Chemical-Waste Sewerage Piping: Install leak-detection system below piping.
 2. Double-Containment Piping: Install leak-detection system in piping annular space.
 3. Manholes: Install leak-detection system around bottom of exterior.
 4. Install panel in location indicated.
- K. Concrete Placement
1. Comply with requirements in Division 03 Section "Cast-in-place Concrete" for concrete supports.
 2. Place cast-in-place concrete according to ACI 318/318R.
- L. Connections
1. Drawings indicate general arrangement of piping, fittings, and specialties.
 2. Make connections to existing piping so finished Work complies as nearly as practical with requirements specified for new Work.
 3. Use commercially manufactured wye fittings for sewerage piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting plus 6-inch (150-mm) overlap, with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).
 4. Protect existing piping to prevent concrete or debris from entering while making connections. Remove debris or other extraneous material that may accumulate.
 5. Install piping adjacent to equipment to allow service and maintenance.

**M. Labeling And Identification**

1. Comply with requirements in Division 22 Section "Identification For Plumbing Piping And Equipment" for labeling of equipment and piping.
 - a. Use warning tape **OR** detectable warning tape, **as directed**, over ferrous piping.
 - b. Use detectable warning tape over nonferrous piping and over edges of underground structures.

N. Field Quality Control

1. Inspect interior of sewerage piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (610 mm) of backfill is in place and again at completion of Project.
 - a. Defects requiring correction include the following:
 - 1) Alignment: Less than full diameter of inside of pipe is visible between inspection points.
 - 2) Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - 3) Crushed, broken, cracked, or otherwise damaged piping.
 - 4) Hydrostatic Tests for Drainage Piping:
 - a) Allowable leakage is a maximum of 50 gal./inch of nominal pipe size per mile (4.6 L/mm of nominal pipe size per kilometer) of pipe, during 24-hour period.
 - b) Close openings in system and fill with water.
 - c) Purge air and refill with water.
 - d) Disconnect water supply.
 - e) Test and inspect joints for leaks.
 - 5) Air Tests for Drainage Piping: Comply with UNI-B-6.
 - b. Leaks and loss in test pressure constitute defects that must be repaired.
 - c. Submit separate reports for each test.
2. Replace leaking sewerage piping using new materials, and repeat testing until leakage is within allowances specified.
3. Perform tests and inspections.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
4. Tests and Inspections:
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect assembled neutralization systems and leak-detection systems and their installation, including piping and electrical connections, and to assist in testing.
 - b. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - c. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
5. Chemical-waste piping will be considered defective if it does not pass tests and inspections.
6. Prepare test and inspection reports.

O. Startup Service

1. Perform startup service for neutralization systems and leak-detection systems.
 - a. Complete installation and startup checks according to manufacturer's written instructions.
 - b. Neutralization Systems:
 - 1) Verify that neutralization system is installed and connected according to the Contract Documents.
 - 2) Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements in Division 22.
 - 3) Install neutralizing solutions and limestone.
 - 4) Energize circuits.
 - 5) Start and run systems through complete sequence of operations.



- 6) Adjust operating controls.
- c. Leak-Detection Systems:
 - 1) Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements in Division 22.
 - 2) Energize circuits.
 - 3) Adjust operating controls.
- P. Adjusting
 - 1. Adjust neutralization-system set points.
 - 2. Adjust leak-detection-system control and device settings.
- Q. Cleaning
 - 1. Use procedures prescribed by authorities having jurisdiction or, if not prescribed, use procedures described below:
 - a. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 - b. Clean piping by flushing with potable water.
- R. Demonstration
 - 1. Train the Owner's maintenance personnel to adjust, operate, and maintain neutralization systems and leak-detection systems.
- S. Piping Schedule
 - 1. Transition and special fittings with pressure ratings at least equal to piping pressure rating may be used in applications below unless otherwise indicated.
 - 2. Single-Wall, Chemical-Waste Sewerage Piping: Use any of the following piping materials for each size range:
 - a. NPS 2 to NPS 4 (DN 50 to DN 100): High-silicon-iron, hub-and-plain-end pipe and fittings and calked **OR** High-silicon-iron, mechanical-joint pipe and fittings and coupled, **as directed**, joints.
 - b. NPS 2 to NPS 4 (DN 50 to DN 100): Stainless-steel drainage pipe and fittings and gasketed joints.
 - c. NPS 1-1/2 to NPS 4 (DN 40 to DN 100): PE drainage pipe and fittings and heat-fusion joints.
 - d. NPS 1-1/2 to NPS 4 (DN 40 to DN 100): PP drainage pipe and fittings and electrofusion joints.
 - e. NPS 1-1/2 to NPS 4 (DN 40 to DN 100): PVC drainage pipe and fittings and solvent-cemented joints.
 - f. NPS 1-1/2 to NPS 4 (DN 40 to DN 100): PVDF drainage pipe and fittings and electrofusion joints.
 - g. NPS 2 to NPS 4 (DN 50 to DN 100): Centrifugally cast **OR** Filament-wound, **as directed**, fiberglass pipe and fittings and butt-and-wrap **OR** bonded, **as directed**, joints.
 - h. NPS 1-1/2 to NPS 4 (DN 40 to DN 100): Glass pipe and fittings and coupled joints.
 - i. NPS 6 (DN 150): High-silicon-iron, hub-and-plain-end pipe and fittings and calked **OR** High-silicon-iron, mechanical-joint pipe and fittings and coupled, **as directed**, joints.
 - j. NPS 6 (DN 150): Stainless-steel drainage pipe and fittings and gasketed joints.
 - k. NPS 6 (DN 150): PE drainage pipe and fittings and heat-fusion joints.
 - l. NPS 6 (DN 150): PP drainage pipe and fittings and electrofusion joints.
 - m. NPS 6 (DN 150): PVC drainage pipe and fittings and solvent-cemented joints.
 - n. NPS 6 (DN 150): PVDF drainage pipe and fittings and electrofusion joints.
 - o. NPS 6 (DN 150): Centrifugally cast **OR** Filament-wound, **as directed**, fiberglass pipe and fittings and butt-and-wrap **OR** bonded, **as directed**, joints.
 - p. NPS 6 (DN 150): Glass pipe and fittings and coupled joints.



- q. NPS 8 to NPS 12 (DN 200 to DN 300): High-silicon-iron, hub-and-plain-end pipe and fittings and calked joints.
 - r. NPS 8 to NPS 12 (DN 200 to DN 300): PP drainage pipe and fittings and electrofusion joints.
 - s. NPS 8 to NPS 12 (DN 200 to DN 300): PVC drainage pipe and fittings and solvent-cemented joints.
 - t. NPS 8 to NPS 12 (DN 200 to DN 300): PVDF drainage pipe and fittings and electrofusion joints.
 - u. NPS 8 to NPS 12 (DN 200 to DN 300): Centrifugally cast **OR** Filament-wound, **as directed**, fiberglass pipe and fittings and butt-and-wrap **OR** bonded, **as directed**, joints.
 - v. NPS 15 (DN 375): High-silicon-iron, hub-and-plain-end pipe and fittings and calked joints.
 - w. NPS 15 (DN 375): NPS 16 (DN 400) centrifugally cast **OR** NPS 14 (DN 350) filament-wound, **as directed**, fiberglass pipe and fittings and butt-and-wrap **OR** bonded, **as directed**, joints.
3. Underground, Double-Containment, Chemical-Waste Sewerage Piping: Use any of the following piping materials for each size range:
 - a. NPS 2 to NPS 12 (DN 50 to DN 300): PE double-containment drainage pipe and fittings.
 - b. NPS 2 to NPS 12 (DN 50 to DN 300): PP double-containment drainage pipe and fittings.
 - c. NPS 2 to NPS 12 (DN 50 to DN 300): PP/PVC double-containment drainage pipe and fittings.
 - d. NPS 2 to NPS 12 (DN 50 to DN 300): PVDF double-containment drainage pipe and fittings.
 - e. NPS 2 to NPS 12 (DN 50 to DN 300): PVDF/PVC double-containment drainage pipe and fittings.
 4. Aboveground Chemical-Waste Piping: Use any of the following piping materials for each size range:
 - a. NPS 1-1/2 to NPS 6 (DN 40 to DN 150): PP drainage piping and electrofusion **OR** mechanical, **as directed**, joints.
 - b. NPS 1-1/2 to NPS 6 (DN 40 to DN 150): PVC drainage piping and solvent-cemented joints.
 - c. NPS 1-1/2 to NPS 6 (DN 40 to DN 150): PVDF drainage piping and electrofusion **OR** mechanical, **as directed**, joints.
 - d. NPS 1-1/2 to NPS 6 (DN 40 to DN 150): NPS 2 to NPS 6 (DN 50 to DN 150) high-silicon-iron piping with hub-and-plain ends and calked joints.
 - e. NPS 1-1/2 to NPS 4 (DN 40 to DN 100): High-silicon-iron piping with mechanical-joint ends, mechanical couplings, and coupled joints.
 - f. NPS 1-1/2 to NPS 6 (DN 40 to DN 150): NPS 2 to NPS 4 (DN 50 to DN 100) stainless-steel drainage piping with socket-and-spigot ends and gasketed joints.
 - g. NPS 1-1/2 to NPS 6 (DN 40 to DN 150): Borosilicate glass pipe and fittings, couplings, and coupled joints.
 - h. NPS 8 to NPS 12 (DN 200 to DN 300): PVC drainage pipe and fittings and solvent-cemented joints.
 - i. NPS 8 to NPS 12 (DN 200 to DN 300): High-silicon-iron piping with hub-and-plain ends and calked joints.
 5. Under Slab-on-Grade, Indoor, Chemical-Waste Piping: Use any of the following piping materials for each size range:
 - a. NPS 1-1/2 to NPS 6 (DN 40 to DN 150): PP drainage piping and electrofusion joints.
 - b. NPS 1-1/2 to NPS 6 (DN 40 to DN 150): PVC drainage piping and solvent-cemented joints.
 - c. NPS 1-1/2 to NPS 6 (DN 40 to DN 150): PVDF drainage piping and electrofusion joints.
 - d. NPS 1-1/2 to NPS 6 (DN 40 to DN 150): NPS 2 to NPS 4 (DN 50 to DN 100) high-silicon-iron piping with hub-and-plain ends and calked joints.
 - e. NPS 1-1/2 to NPS 6 (DN 40 to DN 150): NPS 2 to NPS 4 (DN 50 to DN 100) stainless-steel drainage piping with socket-and-spigot ends and gasketed joints.



- f. NPS 1-1/2 to NPS 6 (DN 40 to DN 150): Borosilicate glass piping with covering, couplings, and coupled joints.
- g. NPS 1-1/2 to NPS 6 (DN 40 to DN 150): PE **OR** PP **OR** PP/PVC **OR** PVDF **OR** PVDF/PVC, **as directed**, double-containment drainage piping and manufacturer's standard joints.
- h. NPS 8 (DN 200): PVC drainage piping and solvent-cemented joints.
- i. NPS 8 (DN 200): High-silicon-iron piping with hub-and-plain ends and calked joints.
- j. NPS 8 (DN 200): PE **OR** PP **OR** PP/PVC **OR** PVDF **OR** PVDF/PVC, **as directed**, double-containment drainage piping and manufacturer's standard joints.
- k. NPS 10 and NPS 12 (DN 250 and DN 300): PVC drainage piping and solvent-cemented joints.
- l. NPS 10 to NPS 15 (DN 250 to DN 375): High-silicon-iron piping with hub-and-plain ends and calked joints.

END OF SECTION 22 66 83 16



SECTION 23 01 10 00 - SEQUENCE OF OPERATION

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for sequence of operation. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes control sequences for HVAC systems, subsystems, and equipment.

C. Definitions

1. DDC: Direct digital control.
2. VAV: Variable air volume.

D. Heating Control Sequences

1. Heating-Water Supply Temperature Control:
 - a. Input Device: Thermostat **OR** Thermistor temperature sensor **OR** Resistance temperature sensor, **as directed**.
 - b. Output Device: Control valve.
 - c. Action: Modulate control valve to maintain heating-water supply temperature.
 - d. Display:
 - 1) Heating-water supply temperature.
 - 2) Heating-water supply temperature set point.
 - 3) Control-valve position.
2. Heating-Water Supply Temperature Reset:
 - a. Input Device: Electric, outdoor-air-reset controller **OR** Outdoor-air sensor, **as directed**.
 - b. Output Device: Unitary controller **OR** DDC system software, **as directed**.
 - c. Action: Reset heating-water supply temperature in straight-line relationship with outdoor-air temperature for the following conditions:
 - 1) 195 deg F (90 deg C) heating water when outdoor-air temperature is minus 30 deg F (minus 35 deg C).
 - 2) 130 deg F (54 deg C) heating water when outdoor-air temperature is 75 deg F (24 deg C).
 - 3) 150 deg F (65 deg C) minimum, heating-water temperature.
 - d. Display:
 - 1) Outdoor-air temperature.
 - 2) Heating-water supply temperature.
 - 3) Heating-water supply temperature set point.
3. Control Primary Circulating Pump(s):
 - a. Input Device: Thermostat **OR** DDC system, **as directed**.
 - b. Output Device: Starter **OR** DDC system command to starter, **as directed**, relay.
 - c. Action: Energize pump(s) at outdoor-air temperatures below 65 deg F (18 deg C).
 - d. Display:
 - 1) Outdoor-air temperature.
 - 2) Operating status of primary circulating pump(s).

E. Central Refrigeration Equipment Sequences

1. Start and Stop Condenser-Water Pump(s):
 - a. Enable: Allow pump to start when water is in cooling tower:
 - 1) Input Device: Water pressure transducer.



- 2) Output Device: Hard wired through motor starter; DDC system binary output, **as directed**.
- 3) Action: Confirm water in cooling-tower sump.
- b. Enable: When outdoor-air temperature conditions are met:
 - 1) Input Device: Space thermostat **OR** DDC system outdoor-air temperature, **as directed**.
 - 2) Output Device: Hard wired through motor starter; DDC system binary output, **as directed**.
 - 3) Action: Confirm outdoor-air temperature is above 50 deg F (10 deg C).
- c. Enable: When demand conditions are met:
 - 1) Input Device: DDC system software demand.
 - 2) Action: Confirm cooling demand from ventilation system(s).
- d. Initiate:
 - 1) Input Device: Time clock **OR** DDC system time schedule, **as directed**.
 - 2) Output Device: Time clock **OR** Binary output, **as directed**.
 - 3) Action: Energize pump(s).
- e. Display:
 - 1) Low-level cooling-tower sump alarm.
 - 2) Outdoor-air temperature.
 - 3) Cooling (software) demand indication.
 - 4) Time and time schedule.
 - 5) Condenser-water pump(s) on-off status.
 - 6) Condenser-water pump(s) on-off indication.
2. Start and Stop Chilled-Water Pump(s):
 - a. Input Device: Flow switch in condenser-water circuit.
 - b. Output Device: Starter **OR** DDC system command to starter, **as directed**, relay.
 - c. Action: Energize pump(s).
 - d. Display:
 - 1) Chilled-water flow indication.
 - 2) Chilled-water pump(s) on-off status.
 - 3) Chilled-water pump(s) on-off indication.
3. Start and Stop Cooling-Tower Fans(s):
 - a. Input Device: Flow switch in condenser-water circuit.
 - b. Output Device: Starter **OR** DDC system command to starter, **as directed**, relay.
 - c. Action: Energize fan(s).
 - d. Display:
 - 1) Condenser-water flow indication.
 - 2) Cooling-tower fan(s) on-off indication.
4. Start and Stop Refrigeration Machine(s):
 - a. Input Device: Flow switch in condenser-water circuit. Flow switch in chilled-water circuit, **as directed**.
 - b. Output Device: Refrigeration **OR** DDC system command to refrigeration, **as directed**, machine terminal strip.
 - c. Action: Energize refrigeration machine(s) internal control circuit.
 - d. Display:
 - e. Condenser-water flow indication.
 - f. Chilled-water flow indication.
 - g. Refrigeration machine on-off indication.
 - h. Chilled-water supply and return temperature.
 - i. Chilled-water temperature control-point adjustment.
5. Start and Stop Chiller(s):
 - a. Input Device: Flow switches in condenser-water and chilled-water circuit.
 - b. Output Device: Chiller **OR** DDC system command to chiller, **as directed**, terminal strip.
 - c. Action: Energize chiller internal control circuit.



- d. Display:
 - 1) Condenser-water flow indication.
 - 2) Chilled-water flow indication.
 - 3) Chiller(s) on-off status.
 - 4) Chiller(s) on-off indication.
 - 5) Chilled-water supply and return temperature.
 - 6) Chilled-water temperature control-point adjustment.
6. Alternate Chiller(s):
 - a. Input Device: Electric alternator **OR** DDC system software, **as directed**.
 - b. Output Device: Chiller **OR** DDC system command to chiller, **as directed**, terminal strip.
 - c. Action: Operate chiller(s) on lead-lag, alternating each startup.
OR
Action: Adding and dropping chiller(s) as follows: **<Insert sequence and parameters.>**
 - d. Display: Chiller(s) on-off indication.
7. Alarm Chiller(s) Start Failure:
 - a. Input Device: Chiller control panel terminal strip contact **OR** software signal, **as directed**.
 - b. Output Device: Analog control panel **OR** DDC system alarm, **as directed**.
 - c. Action: Signal alarm.
 - d. Display: Chiller "failure-to-start" indication.
8. Chilled-Water Level:
 - a. Input Device: Expansion tank level switch **OR** liquid sensor, **as directed**.
 - b. Output Device: Electric relay signal to alarm panel **OR** DDC system alarm, **as directed**.
 - c. Action: Signal alarm.
 - d. Display: Expansion tank low-level alarm.
9. Chilled-Water Supply Temperature:
 - a. Input Device: Temperature sensor **OR** transmitter, **as directed**, in common chilled-water supply piping.
 - b. Output Device: Integral chiller controls **OR** DDC system signal to chiller control panel, **as directed**.
 - c. Action: Maintain constant leaving chilled-water temperature reset according to highest cooling demand, **as directed**.
 - 1) Display: Chilled-water supply temperature.
10. Condenser-Water Temperature:
 - a. Input Device: Temperature sensor **OR** transmitter, **as directed**, in cooling-tower sump.
 - b. Output Device: Bypass control valve **OR** Cooling-tower fan starter relay **OR** DDC system command to cooling-tower fan starter relay, **as directed**.
 - c. Action: Modulate control valve open to cooling tower and closed to bypass and cycle tower fan(s) on and off **OR** and to low speed and then to high speed, **as directed**, to maintain 65 deg F (18 deg C) **OR** 70 deg F (21 deg C), **as directed**, sump temperature. Close valve when unoccupied, **as directed**.
 - d. Display:
 - 1) Condenser-water sump (return) control-point temperature.
 - 2) Condenser-water sump (return) temperature.
 - 3) Control-valve position.
 - 4) Cooling-tower fan(s) on-off indication.
 - 5) Condenser-water supply temperature.
11. Cooling-Tower Sump Heater:
 - a. Input Device: Sump temperature sensor **OR** transmitter, **as directed**.
 - b. Output Device: Electric relay **OR** DDC system command to electric relay, as directed, and solenoid valve, **as directed**.
 - c. Action: Energize sump heater; drain sump on low temperature, **as directed**.
 - d. Display:
 - 1) Cooling-tower sump temperature.
 - 2) Cooling-tower sump heater on-off indication.
 - 3) Cooling-tower dump indication.
12. Operator Station Display: Indicate the following on operator workstation display terminal:



- a. DDC system graphic.
- b. DDC system status, on-off.
- c. Low-level cooling-tower sump alarm.
- d. Outdoor-air temperature.
- e. Cooling (software) demand indication.
- f. Time and time schedule.
- g. Condenser-water pump(s) on-off status.
- h. Condenser-water pump(s) on-off indication.
- i. Condenser-water flow indication.
- j. Chilled-water pump(s) on-off status.
- k. Chilled-water pump(s) on-off indication.
- l. Cooling-tower fan(s) on-off indication.
- m. Chilled-water flow indication.
- n. Refrigeration machine on-off indication.
- o. Chilled-water supply temperature.
- p. Chilled-water return temperature.
- q. Chilled-water temperature control-point adjustment.
- r. Chiller(s) on-off status.
- s. Chiller(s) on-off indication.
- t. Chiller "failure-to-start" indication.
- u. Expansion tank low-level alarm.
- v. Condenser-water sump (return) control-point temperature.
- w. Condenser-water sump (return) temperature.
- x. Condenser-water control-valve position.
- y. Cooling-tower fan(s) on-off indication.
- z. Condenser-water supply temperature.
- aa. Cooling-tower sump temperature.
- bb. Cooling-tower sump heater on-off indication.
- cc. Cooling-tower dump indication.
- dd. Chilled-water pressure drop through chiller.
- ee. Entering condenser-water temperature.
- ff. Leaving condenser-water temperature.
- gg. Condenser-water pressure drop through chiller.
- hh. Chiller condenser-water supply and return temperature.
- ii. Chiller chilled-water supply and return temperature.
- jj. System capacity in tons.

F. Air-Handling-Unit Control Sequences

1. Start and Stop Supply Fan(s):
 - a. Enable: Freeze Protection:
 - 1) Input Device: Duct-mounted averaging element thermostat, located before supply fan.
 - 2) Output Device: Hard wired through motor starter; analog alarm panel **OR** DDC system alarm, **as directed**.
 - 3) Action: Allow start if duct temperature is above 37 deg F (3 deg C); signal alarm if fan fails to start as commanded.
 - b. Enable: High-Temperature Protection:
 - 1) Input Device: Duct-mounted thermostat, located in return air.
 - 2) Output Device: Hard wired through motor starter; analog alarm panel **OR** DDC system alarm, **as directed**.
 - 3) Action: Allow start if duct temperature is below 300 deg F (150 deg C).
 - c. Enable: Smoke Control:
 - 1) Input Device: Duct-mounted smoke detector, located in return **OR** supply, **as directed**, air.



- 2) Output Device: Hard wired through motor starter; analog alarm panel **OR** DDC system alarm, **as directed**.
- 3) Action: Allow start if duct is free of products of combustion.
- d. Initiate: Occupied Time Schedule:
 - 1) Input Device: Time clock **OR** DDC system time schedule, **as directed**.
 - 2) Output Device: Time clock **OR** Binary output, **as directed**, to motor starter.
 - 3) Action: Energize fan(s).
- e. Initiate: Unoccupied Time Schedule:
 - 1) Input Device: Room thermostat **OR** DDC system demand, **as directed**.
 - 2) Output Device: Room thermostat **OR** Binary output, **as directed**, to motor starter.
 - 3) Action: Energize fan(s).
- f. Unoccupied Ventilation:
 - 1) Input Device: Time clock and room thermostat **OR** DDC system time schedule and output, **as directed**.
 - 2) Output Device: Room thermostat **OR** DDC system binary output, **as directed**, to motor starter.
 - 3) Action: Cycle fan(s) during unoccupied periods.
- g. Display: Supply-fan on-off indication.
2. Supply Fan(s) Variable-Volume Control:
 - a. Occupied Time Schedule:
 - 1) Input Device: Time clock **OR** DDC system time schedule, **as directed**.
 - 2) Output Device: Time clock **OR** Binary output, **as directed**.
 - 3) Action: Enable control.
 - b. Volume Control (for fans equipped with variable inlet vanes):
 - 1) Input Device: Static-pressure transmitter **OR** Differential-pressure switch, **as directed**, sensing supply-duct static pressure referenced to conditioned-space static pressure.
 - 2) Output Device: Receiver controller **OR** DDC system analog output **OR** DDC system analog output to digital-to-pneumatic transducer, **as directed**, to modulating damper actuator. Set inlet guide vanes to minimum **OR** closed, **as directed**, position when fan is stopped.
 - 3) Action: Maintain constant supply-duct static pressure.
 - c. Volume Control (for fans equipped with variable-speed drives):
 - 1) Input Device: Static-pressure transmitter **OR** Differential-pressure switch, **as directed**, sensing supply-duct static pressure referenced to conditioned-space static pressure.
 - 2) Output Device: Receiver controller **OR** DDC system analog output, **as directed**, to motor speed controller. Set variable-speed drive to minimum speed when fan is stopped.
 - 3) Action: Maintain constant supply-duct static pressure.
 - d. High Pressure:
 - 1) Input Device: Static-pressure transmitter sensing supply-duct static pressure referenced to static pressure outside the duct.
 - 2) Output Device: Receiver controller **OR** DDC system binary output, **as directed**, to alarm panel **OR** motor starter, **as directed**.
 - 3) Action: Stop fan and signal alarm when static pressure rises above excessive-static-pressure set point.
 - e. Display:
 - 1) Supply-fan-discharge static-pressure indication.
 - 2) Supply-fan-discharge static-pressure set point.
 - 3) Supply-fan airflow rate.
 - 4) Supply-fan inlet vane position **OR** speed, **as directed**.
3. Start and Stop Return Fan(s):
 - a. Initiate: Occupied Time Schedule:
 - 1) Input Device: Time clock **OR** DDC system time schedule, **as directed**.
 - 2) Output Device: Time clock **OR** Binary output, **as directed**, to motor starter.



- 3) Action: Energize fans when supply fans are energized.
- b. Initiate: Unoccupied Time Schedule:
 - 1) Input Device: Room thermostat **OR** DDC system demand, **as directed**.
 - 2) Output Device: Room thermostat **OR** Binary output, **as directed**, to motor starter.
 - 3) Action: Energize fans when supply fans are energized.
- c. Unoccupied Ventilation:
 - 1) Input Device: Time clock and room thermostat **OR** DDC system time schedule and output, **as directed**.
 - 2) Output Device: Room thermostat **OR** DDC system binary output, **as directed**, to motor starter.
 - 3) Action: Cycle fan(s) during unoccupied periods.
- d. Display: Return-fan on-off indication.
4. Return Fan(s) Variable-Volume Control:
 - a. Occupied Time Schedule:
 - 1) Input Device: Time clock **OR** DDC system time schedule, **as directed**.
 - 2) Output Device: Time clock **OR** Binary output, **as directed**.
 - 3) Action: Enable control.
 - b. Volume Control (for fans equipped with variable inlet vanes):
 - 1) Input Device: Static-pressure transmitter **OR** Differential-pressure switch, **as directed**, sensing building static pressure referenced to outdoor static pressure.
 - 2) Output Device: Receiver controller **OR** DDC system analog output **OR** DDC system analog output to digital-to-pneumatic transducer, **as directed**, to modulating damper actuator. Set inlet guide vanes to minimum **OR** closed, **as directed**, position when fan is stopped.
 - 3) Action: Maintain constant building static pressure.
 - c. Volume Control (for fans equipped with variable-speed drives):
 - 1) Input Device: Static-pressure transmitter **OR** Differential-pressure switch, **as directed**, sensing building static pressure referenced to outdoor static pressure.
 - 2) Output Device: Receiver controller **OR** DDC system analog output, **as directed**, to motor speed controller. Set variable-speed drive to minimum speed when fan is stopped.
 - 3) Action: Maintain constant building static pressure.
 - d. Display:
 - 1) Return-air static-pressure indication.
 - 2) Return-air static-pressure set point.
 - 3) Return-fan airflow rate.
 - 4) Return-fan inlet vane position **OR** speed, **as directed**.
 - 5) Building static-pressure indication.
 - 6) Building static-pressure set point.
5. Return Fan(s) Variable-Volume Control:
 - a. Occupied Time Schedule:
 - 1) Input Device: Time clock **OR** DDC system time schedule, **as directed**.
 - 2) Output Device: Time clock **OR** Binary output, **as directed**.
 - 3) Action: Enable control.
 - b. Volume Control (for fans equipped with variable inlet vanes):
 - 1) Input Device: Static-pressure transmitter **OR** Differential-pressure switch, **as directed**, sensing building static pressure referenced to outdoor static pressure.
 - 2) Output Device: Receiver controller **OR** DDC system analog output **OR** DDC system analog output to digital-to-pneumatic transducer, **as directed**, to modulating damper actuator. Set inlet guide vanes to minimum **OR** closed, **as directed**, position when fan is stopped.
 - 3) Action: Maintain constant building static pressure.
 - c. Volume Control (for fans equipped with variable-speed drives):
 - 1) Input Device: Static-pressure transmitter **OR** Differential-pressure switch, **as directed**, sensing building static pressure referenced to outdoor static pressure.



- 2) Output Device: Receiver controller **OR** DDC system analog output, **as directed**, to motor speed controller. Set variable-speed drive to minimum speed when fan is stopped.
- 3) Action: Maintain constant building static pressure.
- d. Display:
 - 1) Return-fan-discharge static-pressure indication.
 - 2) Return-fan-discharge static-pressure set point.
 - 3) Return-fan airflow rate.
 - 4) Return-fan inlet vane position **OR** speed, **as directed**.
6. Preheat Coil:
 - a. Freeze Protection:
 - 1) Input Device: Duct-mounted averaging element thermostat, located after preheat coil.
 - 2) Output Device: Hard wired through motor starter; analog alarm panel **OR** DDC system alarm, **as directed**.
 - 3) Action: Allow start if duct temperature is above 33 deg F (1 deg C).
 - b. Occupied Time Schedule:
 - 1) Input Device: Time clock **OR** DDC system time schedule, **as directed**.
 - 2) Output Device: Time clock **OR** Binary output, **as directed**, to motor starter.
 - 3) Action: Energize coil circulating pump(s).
 - c. Supply **OR** Discharge, **as directed**, -Air Temperature:
 - 1) Input Device: Time clock and duct-mounted thermostat **OR** DDC system time schedule and electronic temperature sensor, **as directed**.
 - 2) Output Device: Modulating control valve.
 - 3) Action: Maintain air temperature set point of 55 deg F (13 deg C).
 - d. Unoccupied Time Schedule:
 - 1) Input Device: Time clock and duct-mounted thermostat mounted in outdoor air **OR** DDC system time schedule and outdoor-air temperature, **as directed**.
 - 2) Output Device: Time clock **OR** Binary output, **as directed**, to motor starter.
 - 3) Action: Energize coil circulating pump(s) when outdoor-air temperature falls below 35 deg F (2 deg C).
 - e. Display:
 - 1) Preheat-coil air-temperature indication.
 - 2) Preheat-coil air-temperature set point.
 - 3) Preheat-coil pump operation indication.
 - 4) Preheat-coil control-valve position.
7. Mixed-Air Control:
 - a. Occupied Time Schedule:
 - 1) Input Device: Time clock **OR** DDC system time schedule, **as directed**.
 - 2) Output Device: Pneumatic relay **OR** DDC system output, **as directed**.
 - 3) Action: Enable control.
 - b. Minimum Position:
 - 1) Input Device: Time clock **OR** DDC system time schedule, **as directed**.
 - 2) Output Device: Receiver controller **OR** DDC system analog output **OR** DDC system analog output to digital-to-pneumatic transducer, **as directed**, to modulating damper actuator(s).
 - 3) Action: Open minimum outdoor-air dampers **OR** outdoor-air dampers to minimum position, **as directed**.
 - c. Heating Reset:
 - 1) Input Device: Room thermostat **OR** DDC system software, **as directed**.
 - 2) Output Device: Receiver controller **OR** DDC system analog output **OR** DDC system analog output to digital-to-pneumatic transducer, **as directed**, to modulating damper actuator(s).
 - 3) Action: Close minimum outdoor-air dampers **OR** Set outdoor-air dampers to minimum position, **as directed**.
 - d. Supply **OR** Mixed, **as directed**, -Air Temperature:



- 1) Input Device: Duct-mounted thermostat **OR** Electronic temperature sensor, **as directed**.
 - 2) Output Device: Receiver controller **OR** DDC system analog output **OR** DDC system analog output to digital-to-pneumatic transducer, **as directed**, to modulating damper actuator(s).
 - 3) Action: Modulate outdoor-, return-, and relief-air dampers to maintain air temperature set point of 55 deg F (13 deg C).
- e. Cooling Reset:
- 1) Input Device: Outdoor- and return-air, duct-mounted thermostats **OR** electronic temperature sensors, **as directed**.
 - 2) Output Device: Receiver controller **OR** DDC system analog output **OR** DDC system analog output to digital-to-pneumatic transducer, **as directed**, to damper actuator(s).
 - 3) Action: Set outdoor-air dampers to minimum position when outdoor-air temperature exceeds return-air temperature **OR** enthalpy exceeds return-air enthalpy, **as directed**.
- f. Unoccupied Time Schedule:
- 1) Input Device: Time clock **OR** DDC system time schedule, **as directed**.
 - 2) Output Device: Receiver controller **OR** DDC system analog output **OR** DDC system analog output to digital-to-pneumatic transducer, **as directed**, to modulating damper actuator(s).
 - 3) Action: Position outdoor- and relief-air dampers closed and return-air dampers open.
- g. Display:
- 1) Mixed-air-temperature indication.
 - 2) Mixed-air-temperature set point.
 - 3) Mixed-air damper position.
8. Humidifier:
- a. Occupied Time Schedule:
- 1) Input Device: Time clock **OR** DDC system time schedule, **as directed**, and airflow switch
 - 2) Output Device: Pneumatic relay **OR** DDC system output, **as directed**.
 - 3) Action: Enable control.
- b. Humidity:
- 1) Input Device: Room humidistat **OR** Return-air, duct-mounted humidistat **OR** DDC system, **as directed**.
 - 2) Output Device: Receiver controller **OR** DDC system analog output **OR** DDC system analog output to digital-to-pneumatic transducer, **as directed**, enables humidifier **OR** modulates control valve to maintain humidity **OR** cycles pump to maintain humidity **OR** cycles pump and modulates control valve to maintain humidity, **as directed**, in straight-line relationship for the following conditions:
 - a) 20 percent when outdoor-air temperature is minus 30 deg F (minus 35 deg C).
 - b) 40 percent when outdoor-air temperature is 75 deg F (24 deg C).
 - 3) Action: Modulate outdoor-, return-, and relief-air dampers to maintain air temperature set point of 55 deg F (13 deg C).
- c. Display:
- 1) Relative humidity indication.
 - 2) Relative humidity set point.
 - 3) Relative humidity control-valve position.
9. Filters: During occupied periods, when fan is running, differential air-pressure transmitters exist.
- a. Occupied Time Schedule:
- 1) Input Device: Time clock **OR** DDC system time schedule, **as directed**.
 - 2) Output Device: Electric relay **OR** DDC system output, **as directed**.
 - 3) Action: Enable control.
- b. Differential Pressure:



- 1) Input Device: Differential-pressure switches **OR** Pressure transmitter, **as directed**.
 - 2) Output Device: Analog alarm panel **OR** DDC system alarm, **as directed**.
 - 3) Action: Signal alarm on low- and high-pressure conditions.
 - c. Display:
 - 1) Filter air-pressure-drop indication.
 - 2) Filter low-air-pressure set point.
 - 3) Filter high-air-pressure set point.
10. Hydronic **OR** Steam, **as directed**, Heating Coil:
- a. Occupied Time Schedule:
 - 1) Input Device: Time clock **OR** DDC system time schedule, **as directed**.
 - 2) Output Device: Time clock **OR** Binary output, **as directed**.
 - 3) Action: Enable control.
 - b. Supply **OR** Discharge, **as directed**, -Air Temperature:
 - 1) Input Device: Duct-mounted thermostat **OR** Electronic temperature sensor, **as directed**.
 - 2) Output Device: Normally open **OR** closed, **as directed**, modulating control valve.
 - 3) Action: Maintain supply-air temperature set point of 55 deg F (13 deg C).
 - c. Temperature Reset (for constant-temperature supply-air systems):
 - 1) Input Device: Duct-mounted thermostat **OR** Electronic temperature sensor, **as directed**, in return air.
 - 2) Output Device: Direct to receiver controller **OR** DDC system, **as directed**, in straight-line relationship for the following conditions:
 - a) 65 deg F (18 deg C) when return-air temperature is 70 deg F (21 deg C).
 - b) 55 deg F (13 deg C) when return-air temperature is 75 deg F (24 deg C).
 - 3) Action: Reset supply-air temperature set point of 55 deg F (13 deg C).
 - d. Temperature Reset (for multizone or dual-duct supply-air systems):
 - 1) Input Device: Load analyzer **OR** DDC system, **as directed**, with input from room thermostats **OR** temperature sensors, **as directed**.
 - 2) Output Device: Direct to receiver controller **OR** DDC system, **as directed**.
 - 3) Action: Reset supply-air temperature in response to greatest heating demand.
 - e. Unoccupied Time Schedule:
 - 1) Input Device: Time clock and room thermostat **OR** DDC system time schedule and output, **as directed**.
 - 2) Output Device: Room thermostat (cycling fan) **OR** DDC system binary output, **as directed**.
 - 3) Action: Enable normal control **OR** Return valve to normal position, **as directed**, when fan is cycled on.
 - f. Display:
 - 1) Fan-discharge air-temperature indication.
 - 2) Fan-discharge air-temperature set point.
 - 3) Heating-coil air-temperature indication.
 - 4) Heating-coil air-temperature set point.
 - 5) Heating-coil pump operation indication.
 - 6) Heating-coil control-valve position.
 - 7) Hot-deck air-temperature indication.
 - 8) Hot-deck air-temperature set point.
11. Hydronic Cooling Coil:
- a. Occupied Time Schedule:
 - 1) Input Device: Time clock **OR** DDC system time schedule, **as directed**.
 - 2) Output Device: Time clock **OR** Binary output, **as directed**.
 - 3) Action: Enable control.
 - b. Supply **OR** Discharge, **as directed**, -Air Temperature:
 - 1) Input Device: Duct-mounted thermostat **OR** Electronic temperature sensor, **as directed**.
 - 2) Output Device: Normally open **OR** closed, **as directed**, modulating control valve.
 - 3) Action: Maintain supply-air temperature set point of 55 deg F (13 deg C).



- c. Temperature Reset (for constant-temperature systems):
 - 1) Input Device: Duct-mounted thermostat **OR** Electronic temperature sensor, **as directed**, in return air.
 - 2) Output Device: Direct to receiver controller **OR** DDC system, **as directed**, in straight-line relationship for the following conditions:
 - a) 65 deg F (18 deg C) when return-air temperature is 70 deg F (21 deg C).
 - b) 55 deg F (13 deg C) when return-air temperature is 75 deg F (24 deg C).
 - 3) Action: Reset supply-air temperature set point of 55 deg F (13 deg C).
 - d. Temperature Reset (for multizone or dual-duct supply-air systems):
 - 1) Input Device: Load analyzer **OR** DDC system, **as directed**, with input from room thermostats **OR** temperature sensors, **as directed**.
 - 2) Output Device: Direct to receiver controller **OR** DDC system, **as directed**.
 - 3) Action: Reset supply-air temperature in response to greatest heating demand.
 - e. Unoccupied Time Schedule:
 - 1) Input Device: Time clock **OR** DDC system time schedule, **as directed**.
 - 2) Output Device: Time clock **OR** Binary output, **as directed**.
 - 3) Action: Disable control.
 - f. Display:
 - 1) Fan-discharge air-temperature indication.
 - 2) Fan-discharge air-temperature set point.
 - 3) Cooling-coil air-temperature indication.
 - 4) Cooling-coil air-temperature set point.
 - 5) Cooling-coil control-valve position.
 - 6) Cold-deck air-temperature indication.
 - 7) Cold-deck air-temperature set point.
12. Multizone Damper Control:
- a. Occupied Time Schedule:
 - 1) Input Device: Time clock **OR** DDC system time schedule, **as directed**.
 - 2) Output Device: Time clock **OR** Binary output, **as directed**.
 - 3) Action: Enable control.
 - b. Room Temperature:
 - 1) Input Device: Room thermostat **OR** Electronic temperature sensor, **as directed**.
 - 2) Output Device: Damper actuator.
 - 3) Action: Maintain room temperature.
 - c. Display:
 - 1) Room temperature indication.
 - 2) Room temperature set point.
 - 3) Multizone damper position.
13. Coordination of Air-Handling Unit Sequences: Ensure that preheat, mixed-air, heating-coil, and cooling-coil controls have common inputs and do not overlap in function.
14. Operator Station Display: Indicate the following on operator workstation display terminal:
- a. DDC system graphic.
 - b. DDC system on-off indication.
 - c. DDC system occupied/unoccupied mode.
 - d. Outdoor-air-temperature indication.
 - e. Supply-fan on-off indication.
 - f. Supply-fan-discharge static-pressure indication.
 - g. Supply-fan-discharge static-pressure set point.
 - h. Supply-fan airflow rate.
 - i. Supply-fan inlet vane position **OR** speed, **as directed**.
 - j. Return-fan on-off indication.
 - k. Return-air static-pressure indication.
 - l. Return-air static-pressure set point.
 - m. Return-fan airflow rate.
 - n. Return-fan inlet vane position **OR** speed, **as directed**.



- o. Building static-pressure indication.
- p. Building static-pressure set point.
- q. Preheat-coil air-temperature indication.
- r. Preheat-coil air-temperature set point.
- s. Preheat-coil pump operation indication.
- t. Preheat-coil control-valve position.
- u. Mixed-air-temperature indication.
- v. Mixed-air-temperature set point.
- w. Mixed-air damper position.
- x. Relative humidity indication.
- y. Relative humidity set point.
- z. Relative humidity control-valve position.
- aa. Filter air-pressure-drop indication.
- bb. Filter low-air-pressure set point.
- cc. Filter high-air-pressure set point.
- dd. Fan-discharge air-temperature indication.
- ee. Fan-discharge air-temperature set point.
- ff. Heating-coil air-temperature indication.
- gg. Heating-coil air-temperature set point.
- hh. Heating-coil pump operation indication.
- ii. Heating-coil control-valve position.
- jj. Hot-deck air-temperature indication.
- kk. Hot-deck air-temperature set point.
- ll. Cooling-coil air-temperature indication.
- mm. Cooling-coil air-temperature set point.
- nn. Cooling-coil control-valve position.
- oo. Cold-deck air-temperature indication.
- pp. Cold-deck air-temperature set point.
- qq. Room temperature indication.
- rr. Room temperature set point.
- ss. Multizone damper position.

G. Terminal Unit Operating Sequence

1. Cabinet Unit Heater, Hydronic **OR** Steam, **as directed**:
 - a. Room Temperature:
 - 1) Input Device: Room thermostat **OR** Electronic temperature sensor, **as directed**.
 - 2) Output Device: Room thermostat **OR** DDC system binary output, **as directed**.
 - 3) Action: Cycle fan to maintain temperature.
 - b. Low-Temperature Safety:
 - 1) Input Device: Line-voltage, on-off thermostat, pipe mounted.
 - 2) Output Device: Hard wired.
 - 3) Action: Stop fan when return heating-water **OR** condensate, **as directed**, temperature falls below 35 deg F (2 deg C).
 - c. Display:
 - 1) Room temperature indication.
 - 2) Room temperature set point.
2. Cabinet Unit Heater, Electric: Room thermostat cycles fan and sequences stages of heating.
3. Unit Heater, Hydronic **OR** Steam, **as directed**:
 - a. Room Temperature:
 - 1) Input Device: Room thermostat **OR** Electronic temperature sensor, **as directed**.
 - 2) Output Device: Room thermostat **OR** DDC system binary output, **as directed**.
 - 3) Action: Cycle fan to maintain temperature.
 - b. Low-Temperature Safety:
 - 1) Input Device: Line-voltage, on-off thermostat, pipe mounted.
 - 2) Output Device: Hard wired.



- 3) Action: Stop fan when return heating-water **OR** condensate, **as directed**, temperature falls below 35 deg F (2 deg C).
- c. Display:
 - 1) Room temperature indication.
 - 2) Room temperature set point.
4. Unit Heater, Electric: Room thermostat cycles fan and sequences stages of heating.
5. Combustion-Air Unit Heaters:
 - a. Room Temperature:
 - 1) Input Device: Room thermostat **OR** Electronic temperature sensor, **as directed**.
 - 2) Output Device: Pneumatic **OR** Electronic, **as directed**, control-valve operator.
 - 3) Action: Modulate valve to maintain temperature.
 - b. Display:
 - 1) Room temperature indication.
 - 2) Room temperature set point.
 - 3) Control-valve position.
6. Radiant Heating Cable, Electric: Room thermostat cycles power.
7. Radiant Heating Panel, Electric: Room thermostat cycles power.
8. Radiant Heating Panel, Hydronic:
 - a. Room Temperature:
 - 1) Input Device: Room thermostat **OR** Electronic temperature sensor, **as directed**.
 - 2) Output Device: Pneumatic **OR** Electronic, **as directed**, control-valve operator.
 - 3) Action: Modulate valve to maintain temperature.
 - b. Display:
 - 1) Room temperature indication.
 - 2) Room temperature set point.
 - 3) Control-valve position.
9. Two-Pipe, Single-Coil, Fan-Coil Unit:
 - a. Occupied Time Schedule:
 - 1) Input Device: Fan switch **OR** Time clock **OR** DDC system time schedule, **as directed**.
 - 2) Output Device: Time clock **OR** Binary output, **as directed**.
 - 3) Action: Start and stop fan and enable control.
 - b. Room Temperature:
 - 1) Input Device: Room thermostat **OR** Electronic temperature sensor, **as directed**, in room **OR** return air, **as directed**.
 - 2) Output Device: Pneumatic **OR** Electronic, **as directed**, control-valve operator.
 - 3) Action: Modulate valve to maintain temperature.
 - c. DDC System Changeover:
 - 1) Input Device: Thermostat **OR** Electronic temperature sensor, **as directed**, in supply-water **OR** on supply-water piping **OR** DDC system, **as directed**.
 - 2) Output Device: Hard-wired relay **OR** DDC system software, **as directed**.
 - 3) Action: Reverse control-valve action to switch from heating to cooling.
 - d. Display:
 - 1) DDC system graphic.
 - 2) DDC system on-off indication.
 - 3) DDC system occupied/unoccupied mode.
 - 4) Room temperature indication.
 - 5) Room temperature set point.
 - 6) Control-valve position.
 - 7) Supply-water temperature indication.
10. Four-Pipe, Hydronic Fan-Coil Unit:
 - a. Occupied Time Schedule:
 - 1) Input Device: Fan switch **OR** Time clock **OR** DDC system time schedule, **as directed**.
 - 2) Output Device: Time clock **OR** Binary output, **as directed**.



- 3) Action: Start and stop fan, and enable control.
 - b. Room Temperature:
 - 1) Input Device: Room thermostat **OR** Electronic temperature sensor, **as directed**.
 - 2) Output Device: Pneumatic **OR** Electronic, **as directed**, control-valve operators.
 - 3) Action: Modulate multiport control valves to maintain temperature.
 - c. Display:
 - 1) DDC system graphic.
 - 2) DDC system on-off indication.
 - 3) DDC system occupied/unoccupied mode.
 - 4) Room temperature indication.
 - 5) Room temperature set point.
 - 6) Control-valve position.
11. Unit Ventilator: Room thermostat modulates heating-and-cooling control valves; airstream thermostats modulate outdoor- and return-air dampers as follows:
 - a. Occupied Time Schedule:
 - 1) Input Device: Fan switch **OR** Time clock **OR** DDC system time schedule, **as directed**.
 - 2) Output Device: Time clock **OR** Binary output, **as directed**.
 - 3) Action: Start and stop fan, move outdoor- and return-air dampers to minimum **OR** maximum, **as directed**, outdoor-air position, and enable control.
 - b. Room Temperature - Valves:
 - 1) Input Device: Room thermostat **OR** Electronic temperature sensor, **as directed**.
 - 2) Output Device: Pneumatic **OR** Electronic, **as directed**, control-valve operators.
 - 3) Action: Modulate heating-water supply control valve and chilled-water supply control valve in sequence to maintain temperature.
 - c. Room Temperature - Dampers:
 - 1) Input Device: Thermostat **OR** Electronic temperature sensor, **as directed**, in mixed air.
 - 2) Output Device: Pneumatic **OR** Electronic, **as directed**, control damper actuators.
 - 3) Action: Modulate outdoor- and return-air dampers to maintain temperature.
 - d. Supply-Air Temperature Limit:
 - 1) Input Device: Thermostat **OR** Electronic temperature sensor, **as directed**, in discharge air.
 - 2) Output Device: Pneumatic **OR** Electronic, **as directed**, control-valve operators and control damper actuators.
 - 3) Action: Override room thermostat to control valves and dampers to prevent discharge air from dropping below a minimum set point.
 - e. Warm-up Cycle:
 - 1) Input Device: Time clock **OR** DDC system time schedule, **as directed**.
 - 2) Output Device: Hard-wired relay **OR** DDC system binary output, **as directed**.
 - 3) Action: Open heating-water supply control valve, close outdoor-air damper, and open return-air damper.
 - f. Display:
 - 1) DDC system graphic.
 - 2) DDC system on-off indication.
 - 3) DDC system occupied/unoccupied mode.
 - 4) Room temperature indication.
 - 5) Room temperature set point.
 - 6) Control-valve position.
 - 7) Damper position.
12. Heating Coils, Hydronic **OR** Steam, **as directed**:
 - a. Room Temperature:
 - 1) Input Device: Room thermostat **OR** Electronic temperature sensor, **as directed**.
 - 2) Output Device: Pneumatic **OR** Electronic **OR** Electric, **as directed**, control-valve operators.
 - 3) Action: Modulate **OR** Cycle, **as directed**, valve to maintain temperature.



- b. Display:
 - 1) Room temperature indication.
 - 2) Room temperature set point.
 - 3) Control-valve position.
- 13. Heating Coils, Electric: Room thermostat cycles coils **OR** sequences stages of heating, **as directed**.
- 14. Radiators and Convectors, Hydronic **OR** Steam, **as directed**:
 - a. Occupancy:
 - 1) Input Device: Occupancy sensor.
 - 2) Output Device: DDC system binary output.
 - 3) Action: Report occupancy and enable occupied temperature set point.
 - b. Room Temperature:
 - 1) Input Device: Room thermostat **OR** Electronic temperature sensor, **as directed**.
 - 2) Output Device: Pneumatic **OR** Electronic **OR** Electric, **as directed**, control-valve operators.
 - 3) Action: Modulate **OR** Cycle, **as directed**, valve to maintain temperature.
 - a) Occupied Temperature: 75 deg F (24 deg C).
 - b) Unoccupied Temperature: 65 deg F (18 deg C).
 - c. Display:
 - 1) Room/area served.
 - 2) Room temperature indication.
 - 3) Room temperature set point.
 - 4) Room temperature set point, occupied.
 - 5) Room temperature set point, occupied standby.
 - 6) Room temperature set point, unoccupied.
 - 7) Control-valve position as percent open.
- 15. Radiators and Convectors, Electric: Room thermostat cycles coils **OR** sequences stages of heating, **as directed**.
- 16. Constant-Volume, Terminal Air Units, Hydronic **OR** Steam, **as directed**:
 - a. Occupancy:
 - 1) Input Device: Occupancy sensor.
 - 2) Output Device: DDC system binary output.
 - 3) Action: Report occupancy and enable occupied temperature set point.
 - a) Occupied Temperature: 75 deg F (24 deg C).
 - b) Unoccupied Temperature: 65 deg F (18 deg C).
 - b. Room Temperature:
 - 1) Input Device: Room thermostat **OR** Electronic temperature sensor, **as directed**.
 - 2) Output Device: Pneumatic **OR** Electronic **OR** Electric, **as directed**, control-valve operators.
 - 3) Action: Modulate **OR** Cycle, **as directed**, valve to maintain temperature.
 - c. Display:
 - 1) Room/area served.
 - 2) Room occupied/unoccupied.
 - 3) Room temperature indication.
 - 4) Room temperature set point.
 - 5) Room temperature set point, occupied.
 - 6) Room temperature set point, unoccupied.
 - 7) Control-valve position as percent open.
- 17. VAV, Terminal Air Units with Hydronic **OR** Steam, **as directed**, Coils:
 - a. Occupancy:
 - 1) Input Device: Occupancy sensor.
 - 2) Output Device: DDC system binary output.
 - 3) Action: Report occupancy and enable occupied temperature set point.
 - a) Occupied Temperature: 75 deg F (24 deg C).
 - b) Unoccupied Temperature: 65 deg F (18 deg C).



- b. Room Temperature:
 - 1) Input Device: Room thermostat **OR** Electronic temperature sensor, **as directed**.
 - 2) Output Device: Pneumatic **OR** Electronic, **as directed**, damper actuators and control-valve operators.
 - 3) Action: Modulate damper and valve to maintain temperature.
 - a) Sequence damper from full open to minimum position, then valve from closed to fully open.
 - c. Display:
 - 1) Room/area served.
 - 2) Room occupied/unoccupied.
 - 3) Room temperature indication.
 - 4) Room temperature set point.
 - 5) Room temperature set point, occupied.
 - 6) Room temperature set point, unoccupied.
 - 7) Air-damper position as percent open.
 - 8) Control-valve position as percent open.
18. Dual-Duct, VAV, Terminal Air Units:
- a. Occupancy:
 - 1) Input Device: Occupancy sensor.
 - 2) Output Device: DDC system binary output.
 - 3) Action: Report occupancy and enable occupied temperature set point.
 - a) Occupied Temperature: 75 deg F (24 deg C).
 - b) Unoccupied Temperature: 65 deg F (18 deg C).
 - b. Room Temperature:
 - 1) Input Device: Room thermostat **OR** Electronic temperature sensor, **as directed**.
 - 2) Output Device: Pneumatic **OR** Electronic, **as directed**, damper actuators.
 - 3) Action: Modulate dampers to maintain temperature.
 - a) Sequence when space temperature is below set point: Close VAV damper to minimum position, open hot-deck dampers and close cold-deck dampers, then open VAV damper.
 - b) Sequence when space temperature is above set point: Close VAV damper to minimum position, close hot-deck dampers and open cold-deck dampers, then open VAV damper.
 - c. Display:
 - 1) Room/area served.
 - 2) Room occupied/unoccupied.
 - 3) Room temperature indication.
 - 4) Room temperature set point.
 - 5) Room temperature set point, occupied.
 - 6) Room temperature set point, unoccupied.
 - 7) VAV damper position as percent open.
 - 8) Hot-deck damper position as percent open.
 - 9) Cold-deck damper position as percent open.

H. Ventilation Sequences

- 1. Combustion-Air, Makeup Unit Control, Electric: Start fan when served appliance burner starts; room thermostat sequences stages of heating.
- 2. Combustion-Air, Makeup Unit Control, Hydronic **OR** Steam, **as directed**: Start fan when served appliance burner starts; room thermostat cycles **OR** modulates, **as directed**, control valve.
- 3. Gravity Roof Ventilator: Occupancy sensor **OR** Room thermostat, **as directed**, opens dampers.
- 4. Exhaust Fan: Occupancy sensor **OR** Interlock with light switch **OR** Room thermostat, **as directed**, cycles fan.
- 5. Kitchen Exhaust Fan: Occupancy sensor starts fan and energizes makeup air unit.

23 - Heating, Ventilating, And Air-Conditioning (HVAC)



1.2 PRODUCTS (Not Applicable)

1.3 EXECUTION (Not Applicable)

END OF SECTION 23 01 10 00



SECTION 23 01 10 00a - TESTING, ADJUSTING, AND BALANCING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for testing, adjusting and balancing. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Balancing Air Systems:
 - 1) Constant-volume air systems.
 - 2) Dual-duct systems.
 - 3) Variable-air-volume systems.
 - 4) Multizone systems.
 - 5) Induction-unit systems.
 - b. Balancing Hydronic Piping Systems:
 - 1) Constant-flow hydronic systems.
 - 2) Variable-flow hydronic systems.
 - 3) Primary-secondary hydronic systems.

C. Definitions

1. AABC: Associated Air Balance Council.
2. NEBB: National Environmental Balancing Bureau.
3. TAB: Testing, adjusting, and balancing.
4. TABB: Testing, Adjusting, and Balancing Bureau.
5. TAB Specialist: An entity engaged to perform TAB Work.

D. Submittals

1. LEED Submittal:
 - a. Air-Balance Report for LEED Prerequisite EQ 1: Documentation of work performed for ASHRAE 62.1, Section 7.2.2, "Air Balancing."
2. Strategies and Procedures Plan: Within 30 **OR** 60 **OR** 90, **as directed**, days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.
3. Certified TAB reports.

E. Quality Assurance

1. TAB Contractor Qualifications: Engage a TAB entity certified by AABC **OR** NEBB **OR** TABB, **as directed**.
 - a. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC **OR** NEBB **OR** TABB, **as directed**.
 - b. TAB Technician: Employee of the TAB contractor and who is certified by AABC **OR** NEBB **OR** TABB, **as directed**, as a TAB technician.
2. Certify TAB field data reports and perform the following:
 - a. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
 - b. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.
3. TAB Report Forms: Use standard TAB contractor's forms approved by the Owner **OR** Commissioning Authority, **as directed**.
4. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."



F. Project Conditions

1. Full the Owner Occupancy: the Owner will occupy the site and existing building during entire TAB period. Cooperate with the Owner during TAB operations to minimize conflicts with the Owner's operations.

OR

Partial the Owner Occupancy: the Owner may occupy completed areas of building before Final Completion. Cooperate with the Owner during TAB operations to minimize conflicts with the Owner's operations.

1.2 PRODUCTS (Not Applicable)

1.3 EXECUTION

A. Examination

1. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
2. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.
3. Examine the approved submittals for HVAC systems and equipment.
4. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
5. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Division 23 Section(s) "Metal Ducts" OR "Nonmetal Ducts", **as directed**, and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
6. Examine equipment performance data including fan and pump curves.
 - a. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
 - b. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.
7. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
8. Examine test reports specified in individual system and equipment Sections.
9. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
10. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.
11. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.
12. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.
13. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
14. Examine system pumps to ensure absence of entrained air in the suction piping.
15. Examine operating safety interlocks and controls on HVAC equipment.
16. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.



B. Preparation

1. Prepare a TAB plan that includes strategies and step-by-step procedures.
2. Complete system-readiness checks and prepare reports. Verify the following:
 - a. Permanent electrical-power wiring is complete.
 - b. Hydronic systems are filled, clean, and free of air.
 - c. Automatic temperature-control systems are operational.
 - d. Equipment and duct access doors are securely closed.
 - e. Balance, smoke, and fire dampers are open.
 - f. Isolating and balancing valves are open and control valves are operational.
 - g. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
 - h. Windows and doors can be closed so indicated conditions for system operations can be met.

C. General Procedures For Testing And Balancing

1. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" **OR** ASHRAE 111 **OR** NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" **OR** SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing", **as directed**, and in this Section.
 - a. Comply with requirements in ASHRAE 62.1, Section 7.2.2, "Air Balancing."
2. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
 - a. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
OR
After testing and balancing, install test ports and duct access doors that comply with requirements in Division 23 Section "Air Duct Accessories".
 - b. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23 Section "Hvac Insulation".
3. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
4. Take and report testing and balancing measurements in inch-pound (IP) **OR** metric (SI) **OR** inch-pound (IP) and metric (SI), **as directed**, units.

D. General Procedures For Balancing Air Systems

1. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
2. Prepare schematic diagrams of systems' "as-built" duct layouts.
3. For variable-air-volume systems, develop a plan to simulate diversity.
4. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
5. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
6. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
7. Verify that motor starters are equipped with properly sized thermal protection.
8. Check dampers for proper position to achieve desired airflow path.
9. Check for airflow blockages.
10. Check condensate drains for proper connections and functioning.
11. Check for proper sealing of air-handling-unit components.
12. Verify that air duct system is sealed as specified in Division 23 Section "Metal Ducts".

E. Procedures For Constant-Volume Air Systems

1. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.



- a. Measure total airflow.
 - 1) Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
 - b. Measure fan static pressures as follows to determine actual static pressure:
 - 1) Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
 - 2) Measure static pressure directly at the fan outlet or through the flexible connection.
 - 3) Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
 - 4) Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
 - c. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
 - 1) Report the cleanliness status of filters and the time static pressures are measured.
 - d. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
 - e. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
 - f. Obtain approval from the Owner **OR** Commissioning Authority, **as directed**, for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Division 21 for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
 - g. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
2. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
 - a. Measure airflow of submain and branch ducts.
 - 1) Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
 - b. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
 - c. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
 3. Measure air outlets and inlets without making adjustments.
 - a. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
 4. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.
 - a. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
 - b. Adjust patterns of adjustable outlets for proper distribution without drafts.
- F. Procedures For Dual-Duct Systems
1. Verify that the cooling coil is capable of full-system airflow, and set mixing boxes at full-cold airflow position for fan volume.



2. Measure static pressure in both hot and cold ducts at the end of the longest duct run to determine that sufficient static pressure exists to operate controls of mixing boxes and to overcome resistance in the ducts and outlets downstream from mixing boxes.
 - a. If insufficient static pressure exists, increase airflow at the fan.
 3. Test and adjust the constant-volume mixing boxes as follows:
 - a. Verify both hot and cold operations by adjusting the thermostat and observing changes in air temperature and volume.
 - b. Verify sufficient inlet static pressure before making volume adjustments.
 - c. Adjust mixing boxes to indicated airflows within specified tolerances. Measure airflow by Pitot-tube traverse readings or by measuring static pressure at mixing-box taps if provided by mixing-box manufacturer.
 4. Do not overpressurize ducts.
 5. Remeasure static pressure in both hot and cold ducts at the end of the longest duct run to determine that sufficient static pressure exists to operate controls of mixing boxes and to overcome resistance in the ducts and outlets downstream from mixing boxes.
 6. Adjust variable-air-volume, dual-duct systems in the same way as constant-volume, dual-duct systems; adjust maximum- and minimum-airflow setting of each mixing box.
- G. Procedures For Variable-Air-Volume Systems
1. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a minimum set-point airflow with the remainder at maximum-airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced-airflow terminal units so they are distributed evenly among the branch ducts.
 2. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
 - a. Set outdoor-air dampers at minimum, and set return- and exhaust-air dampers at a position that simulates full-cooling load.
 - b. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
 - c. Measure total system airflow. Adjust to within indicated airflow.
 - d. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.
 - e. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow the same as described for constant-volume air systems.
 - 1) If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.
 - f. Remeasure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.
 - 1) Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.
 - g. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure that adequate static pressure is maintained at the most critical unit.
 - h. Record final fan-performance data.
 3. Pressure-Dependent, Variable-Air-Volume Systems without Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
 - a. Balance variable-air-volume systems the same as described for constant-volume air systems.
 - b. Set terminal units and supply fan at full-airflow condition.



- c. Adjust inlet dampers of each terminal unit to indicated airflow and verify operation of the static-pressure controller. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.
 - d. Readjust fan airflow for final maximum readings.
 - e. Measure operating static pressure at the sensor that controls the supply fan if one is installed, and verify operation of the static-pressure controller.
 - f. Set supply fan at minimum airflow if minimum airflow is indicated. Measure static pressure to verify that it is being maintained by the controller.
 - g. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow the same as described for constant-volume air systems.
 - 1) If air outlets are out of balance at minimum airflow, report the condition but leave the outlets balanced for maximum airflow.
 - h. Measure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.
 - 1) Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.
4. Pressure-Dependent, Variable-Air-Volume Systems with Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
- a. Set system at maximum indicated airflow by setting the required number of terminal units at minimum airflow. Select the reduced-airflow terminal units so they are distributed evenly among the branch ducts.
 - b. Adjust supply fan to maximum indicated airflow with the variable-airflow controller set at maximum airflow.
 - c. Set terminal units at full-airflow condition.
 - d. Adjust terminal units starting at the supply-fan end of the system and continuing progressively to the end of the system. Adjust inlet dampers of each terminal unit to indicated airflow. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.
 - e. Adjust terminal units for minimum airflow.
 - f. Measure static pressure at the sensor.
 - g. Measure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.
- H. Procedures For Multizone Systems
1. Set unit at maximum airflow through the cooling coil.
 2. Adjust each zone's balancing damper to achieve indicated airflow within the zone.
- I. Procedures For Induction-Unit Systems
1. Balance primary-air risers by measuring static pressure at the nozzles of the top and bottom units of each riser to determine which risers must be throttled. Adjust risers to indicated airflow within specified tolerances.
 2. Adjust each induction unit.
- J. General Procedures For Hydronic Systems
1. Prepare test reports with pertinent design data, and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against the approved pump flow rate. Correct variations that exceed plus or minus 5 percent.
 2. Prepare schematic diagrams of systems' "as-built" piping layouts.
 3. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:
 - a. Open all manual valves for maximum flow.
 - b. Check liquid level in expansion tank.
 - c. Check makeup water-station pressure gage for adequate pressure for highest vent.



- d. Check flow-control valves for specified sequence of operation, and set at indicated flow.
- e. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
- f. Set system controls so automatic valves are wide open to heat exchangers.
- g. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
- h. Check air vents for a forceful liquid flow exiting from vents when manually operated.

K. Procedures For Constant-Flow Hydronic Systems

1. Measure water flow at pumps. Use the following procedures except for positive-displacement pumps:
 - a. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
 - 1) If impeller sizes must be adjusted to achieve pump performance, obtain approval from the Owner **OR** Commissioning Authority, **as directed**, and comply with requirements in Division 23 Section "Hydronic Pumps".
 - b. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.
 - 1) Monitor motor performance during procedures and do not operate motors in overload conditions.
 - c. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
 - d. Report flow rates that are not within plus or minus 10 percent of design.
2. Measure flow at all automatic flow control valves to verify that valves are functioning as designed.
3. Measure flow at all pressure-independent characterized control valves, with valves in fully open position, to verify that valves are functioning as designed.
4. Set calibrated balancing valves, if installed, at calculated presettings.
5. Measure flow at all stations and adjust, where necessary, to obtain first balance.
 - a. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.
6. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.
7. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:
 - a. Determine the balancing station with the highest percentage over indicated flow.
 - b. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
 - c. Record settings and mark balancing devices.
8. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.
9. Measure the differential-pressure-control-valve settings existing at the conclusion of balancing.
10. Check settings and operation of each safety valve. Record settings.

L. Procedures For Variable-Flow Hydronic Systems

1. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

M. Procedures For Primary-Secondary Hydronic Systems

1. Balance the primary circuit flow first and then balance the secondary circuits.

**N. Procedures For Steam Systems**

1. Measure and record upstream and downstream pressure of each piece of equipment.
2. Measure and record upstream and downstream steam pressure of pressure-reducing valves.
3. Check settings and operation of automatic temperature-control valves, self-contained control valves, and pressure-reducing valves. Record final settings.
4. Check settings and operation of each safety valve. Record settings.
5. Verify the operation of each steam trap.

O. Procedures For Heat Exchangers

1. Measure water flow through all circuits.
2. Adjust water flow to within specified tolerances.
3. Measure inlet and outlet water temperatures.
4. Measure inlet steam pressure.
5. Check settings and operation of safety and relief valves. Record settings.

P. Procedures For Motors

1. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
 - a. Manufacturer's name, model number, and serial number.
 - b. Motor horsepower rating.
 - c. Motor rpm.
 - d. Efficiency rating.
 - e. Nameplate and measured voltage, each phase.
 - f. Nameplate and measured amperage, each phase.
 - g. Starter thermal-protection-element rating.
2. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

Q. Procedures For Chillers

1. Balance water flow through each evaporator and condenser, **as directed**, to within specified tolerances of indicated flow with all pumps operating. With only one chiller operating in a multiple chiller installation, do not exceed the flow for the maximum tube velocity recommended by the chiller manufacturer. Measure and record the following data with each chiller operating at design conditions:
 - a. Evaporator-water entering and leaving temperatures, pressure drop, and water flow.
 - b. For water-cooled chillers, condenser-water entering and leaving temperatures, pressure drop, and water flow.
 - c. Evaporator and condenser refrigerant temperatures and pressures, using instruments furnished by chiller manufacturer.
 - d. Power factor if factory-installed instrumentation is furnished for measuring kilowatts.
 - e. Kilowatt input if factory-installed instrumentation is furnished for measuring kilowatts.
 - f. Capacity: Calculate in tons of cooling.
 - g. For air-cooled chillers, verify condenser-fan rotation and record fan and motor data including number of fans and entering- and leaving-air temperatures.

R. Procedures For Cooling Towers

1. Shut off makeup water for the duration of the test, and verify that makeup and blowdown systems are fully operational after tests and before leaving the equipment. Perform the following tests and record the results:
 - a. Measure condenser-water flow to each cell of the cooling tower.
 - b. Measure entering- and leaving-water temperatures.
 - c. Measure wet- and dry-bulb temperatures of entering air.
 - d. Measure wet- and dry-bulb temperatures of leaving air.
 - e. Measure condenser-water flow rate recirculating through the cooling tower.



- f. Measure cooling-tower spray pump discharge pressure.
 - g. Adjust water level and feed rate of makeup water system.
 - h. Measure flow through bypass.
- S. Procedures For Condensing Units
- 1. Verify proper rotation of fans.
 - 2. Measure entering- and leaving-air temperatures.
 - 3. Record compressor data.
- T. Procedures For Boilers
- 1. Hydronic Boilers: Measure and record entering- and leaving-water temperatures and water flow.
 - 2. Steam Boilers: Measure and record entering-water temperature and flow and leaving-steam pressure, temperature, and flow.
- U. Procedures For Heat-Transfer Coils
- 1. Measure, adjust, and record the following data for each water coil:
 - a. Entering- and leaving-water temperature.
 - b. Water flow rate.
 - c. Water pressure drop.
 - d. Dry-bulb temperature of entering and leaving air.
 - e. Wet-bulb temperature of entering and leaving air for cooling coils.
 - f. Airflow.
 - g. Air pressure drop.
 - 2. Measure, adjust, and record the following data for each electric heating coil:
 - a. Nameplate data.
 - b. Airflow.
 - c. Entering- and leaving-air temperature at full load.
 - d. Voltage and amperage input of each phase at full load and at each incremental stage.
 - e. Calculated kilowatt at full load.
 - f. Fuse or circuit-breaker rating for overload protection.
 - 3. Measure, adjust, and record the following data for each steam coil:
 - a. Dry-bulb temperature of entering and leaving air.
 - b. Airflow.
 - c. Air pressure drop.
 - d. Inlet steam pressure.
 - 4. Measure, adjust, and record the following data for each refrigerant coil:
 - a. Dry-bulb temperature of entering and leaving air.
 - b. Wet-bulb temperature of entering and leaving air.
 - c. Airflow.
 - d. Air pressure drop.
 - e. Refrigerant suction pressure and temperature.
- V. Procedures For Testing, Adjusting, And Balancing Existing Systems
- 1. Perform a preconstruction inspection of existing equipment that is to remain and be reused.
 - a. Measure and record the operating speed, airflow, and static pressure of each fan.
 - b. Measure motor voltage and amperage. Compare the values to motor nameplate information.
 - c. Check the refrigerant charge.
 - d. Check the condition of filters.
 - e. Check the condition of coils.
 - f. Check the operation of the drain pan and condensate-drain trap.
 - g. Check bearings and other lubricated parts for proper lubrication.
 - h. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.



2. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished. Verify the following:
 - a. New filters are installed.
 - b. Coils are clean and fins combed.
 - c. Drain pans are clean.
 - d. Fans are clean.
 - e. Bearings and other parts are properly lubricated.
 - f. Deficiencies noted in the preconstruction report are corrected.
3. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.
 - a. Compare the indicated airflow of the renovated work to the measured fan airflows, and determine the new fan speed and the face velocity of filters and coils.
 - b. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.
 - c. If calculations increase or decrease the air flow rates and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated rates. If increase or decrease is 5 percent or less, equipment adjustments are not required.
 - d. Balance each air outlet.

W. Tolerances

- X. Set HVAC system's air flow rates and water flow rates within the following tolerances:
- a. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
 - b. Air Outlets and Inlets: Plus or minus 10 percent.
 - c. Heating-Water Flow Rate: Plus or minus 10 percent.
 - d. Cooling-Water Flow Rate: Plus or minus 10 percent.

Y. Reporting

1. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
2. Status Reports: Prepare weekly **OR** biweekly **OR** monthly, **as directed**, progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

Z. Final Report

1. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
 - a. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
 - b. Include a list of instruments used for procedures, along with proof of calibration.
2. Final Report Contents: In addition to certified field-report data, include the following:
 - a. Pump curves.
 - b. Fan curves.
 - c. Manufacturers' test data.
 - d. Field test reports prepared by system and equipment installers.
 - e. Other information relative to equipment performance; do not include Shop Drawings and product data.
3. General Report Data: In addition to form titles and entries, include the following data:
 - a. Title page.
 - b. Name and address of the TAB contractor.



- c. Project name.
- d. Project location.
- e. Architect's name and address.
- f. Engineer's name and address.
- g. Contractor's name and address.
- h. Report date.
- i. Signature of TAB supervisor who certifies the report.
- j. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
- k. Summary of contents including the following:
 - 1) Indicated versus final performance.
 - 2) Notable characteristics of systems.
 - 3) Description of system operation sequence if it varies from the Contract Documents.
- l. Nomenclature sheets for each item of equipment.
- m. Data for terminal units, including manufacturer's name, type, size, and fittings.
- n. Notes to explain why certain final data in the body of reports vary from indicated values.
- o. Test conditions for fans and pump performance forms including the following:
 - 1) Settings for outdoor-, return-, and exhaust-air dampers.
 - 2) Conditions of filters.
 - 3) Cooling coil, wet- and dry-bulb conditions.
 - 4) Face and bypass damper settings at coils.
 - 5) Fan drive settings including settings and percentage of maximum pitch diameter.
 - 6) Inlet vane settings for variable-air-volume systems.
 - 7) Settings for supply-air, static-pressure controller.
 - 8) Other system operating conditions that affect performance.
4. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
 - a. Quantities of outdoor, supply, return, and exhaust airflows.
 - b. Water and steam flow rates.
 - c. Duct, outlet, and inlet sizes.
 - d. Pipe and valve sizes and locations.
 - e. Terminal units.
 - f. Balancing stations.
 - g. Position of balancing devices.
5. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:
 - a. Unit Data:
 - 1) Unit identification.
 - 2) Location.
 - 3) Make and type.
 - 4) Model number and unit size.
 - 5) Manufacturer's serial number.
 - 6) Unit arrangement and class.
 - 7) Discharge arrangement.
 - 8) Sheave make, size in inches (mm), and bore.
 - 9) Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).
 - 10) Number, make, and size of belts.
 - 11) Number, type, and size of filters.
 - b. Motor Data:
 - 1) Motor make, and frame type and size.
 - 2) Horsepower and rpm.
 - 3) Volts, phase, and hertz.
 - 4) Full-load amperage and service factor.
 - 5) Sheave make, size in inches (mm), and bore.
 - 6) Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).
 - c. Test Data (Indicated and Actual Values):
 - 1) Total air flow rate in cfm (L/s).



- 2) Total system static pressure in inches wg (Pa).
 - 3) Fan rpm.
 - 4) Discharge static pressure in inches wg (Pa).
 - 5) Filter static-pressure differential in inches wg (Pa).
 - 6) Preheat-coil static-pressure differential in inches wg (Pa).
 - 7) Cooling-coil static-pressure differential in inches wg (Pa).
 - 8) Heating-coil static-pressure differential in inches wg (Pa).
 - 9) Outdoor airflow in cfm (L/s).
 - 10) Return airflow in cfm (L/s).
 - 11) Outdoor-air damper position.
 - 12) Return-air damper position.
 - 13) Vortex damper position.
6. Apparatus-Coil Test Reports:
- a. Coil Data:
 - 1) System identification.
 - 2) Location.
 - 3) Coil type.
 - 4) Number of rows.
 - 5) Fin spacing in fins per inch (mm) o.c.
 - 6) Make and model number.
 - 7) Face area in sq. ft. (sq. m).
 - 8) Tube size in NPS (DN).
 - 9) Tube and fin materials.
 - 10) Circuiting arrangement.
 - b. Test Data (Indicated and Actual Values):
 - 1) Air flow rate in cfm (L/s).
 - 2) Average face velocity in fpm (m/s).
 - 3) Air pressure drop in inches wg (Pa).
 - 4) Outdoor-air, wet- and dry-bulb temperatures in deg F (deg C).
 - 5) Return-air, wet- and dry-bulb temperatures in deg F (deg C).
 - 6) Entering-air, wet- and dry-bulb temperatures in deg F (deg C).
 - 7) Leaving-air, wet- and dry-bulb temperatures in deg F (deg C).
 - 8) Water flow rate in gpm (L/s).
 - 9) Water pressure differential in feet of head or psig (kPa).
 - 10) Entering-water temperature in deg F (deg C).
 - 11) Leaving-water temperature in deg F (deg C).
 - 12) Refrigerant expansion valve and refrigerant types.
 - 13) Refrigerant suction pressure in psig (kPa).
 - 14) Refrigerant suction temperature in deg F (deg C).
 - 15) Inlet steam pressure in psig (kPa).
7. Gas- and Oil-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:
- a. Unit Data:
 - 1) System identification.
 - 2) Location.
 - 3) Make and type.
 - 4) Model number and unit size.
 - 5) Manufacturer's serial number.
 - 6) Fuel type in input data.
 - 7) Output capacity in Btu/h (kW).
 - 8) Ignition type.
 - 9) Burner-control types.
 - 10) Motor horsepower and rpm.
 - 11) Motor volts, phase, and hertz.
 - 12) Motor full-load amperage and service factor.



- 13) Sheave make, size in inches (mm), and bore.
- 14) Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).
- b. Test Data (Indicated and Actual Values):
 - 1) Total air flow rate in cfm (L/s).
 - 2) Entering-air temperature in deg F (deg C).
 - 3) Leaving-air temperature in deg F (deg C).
 - 4) Air temperature differential in deg F (deg C).
 - 5) Entering-air static pressure in inches wg (Pa).
 - 6) Leaving-air static pressure in inches wg (Pa).
 - 7) Air static-pressure differential in inches wg (Pa).
 - 8) Low-fire fuel input in Btu/h (kW).
 - 9) High-fire fuel input in Btu/h (kW).
 - 10) Manifold pressure in psig (kPa).
 - 11) High-temperature-limit setting in deg F (deg C).
 - 12) Operating set point in Btu/h (kW).
 - 13) Motor voltage at each connection.
 - 14) Motor amperage for each phase.
 - 15) Heating value of fuel in Btu/h (kW).
8. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:
 - a. Unit Data:
 - 1) System identification.
 - 2) Location.
 - 3) Coil identification.
 - 4) Capacity in Btu/h (kW).
 - 5) Number of stages.
 - 6) Connected volts, phase, and hertz.
 - 7) Rated amperage.
 - 8) Air flow rate in cfm (L/s).
 - 9) Face area in sq. ft. (sq. m).
 - 10) Minimum face velocity in fpm (m/s).
 - b. Test Data (Indicated and Actual Values):
 - 1) Heat output in Btu/h (kW).
 - 2) Air flow rate in cfm (L/s).
 - 3) Air velocity in fpm (m/s).
 - 4) Entering-air temperature in deg F (deg C).
 - 5) Leaving-air temperature in deg F (deg C).
 - 6) Voltage at each connection.
 - 7) Amperage for each phase.
9. Fan Test Reports: For supply, return, and exhaust fans, include the following:
 - a. Fan Data:
 - 1) System identification.
 - 2) Location.
 - 3) Make and type.
 - 4) Model number and size.
 - 5) Manufacturer's serial number.
 - 6) Arrangement and class.
 - 7) Sheave make, size in inches (mm), and bore.
 - 8) Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).
 - b. Motor Data:
 - 1) Motor make, and frame type and size.
 - 2) Horsepower and rpm.
 - 3) Volts, phase, and hertz.
 - 4) Full-load amperage and service factor.
 - 5) Sheave make, size in inches (mm), and bore.
 - 6) Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).



- 7) Number, make, and size of belts.
- c. Test Data (Indicated and Actual Values):
 - 1) Total airflow rate in cfm (L/s).
 - 2) Total system static pressure in inches wg (Pa).
 - 3) Fan rpm.
 - 4) Discharge static pressure in inches wg (Pa).
 - 5) Suction static pressure in inches wg (Pa).
10. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
 - a. Report Data:
 - 1) System and air-handling-unit number.
 - 2) Location and zone.
 - 3) Traverse air temperature in deg F (deg C).
 - 4) Duct static pressure in inches wg (Pa).
 - 5) Duct size in inches (mm).
 - 6) Duct area in sq. ft. (sq. m).
 - 7) Indicated air flow rate in cfm (L/s).
 - 8) Indicated velocity in fpm (m/s).
 - 9) Actual air flow rate in cfm (L/s).
 - 10) Actual average velocity in fpm (m/s).
 - 11) Barometric pressure in psig (Pa).
11. Air-Terminal-Device Reports:
 - a. Unit Data:
 - 1) System and air-handling unit identification.
 - 2) Location and zone.
 - 3) Apparatus used for test.
 - 4) Area served.
 - 5) Make.
 - 6) Number from system diagram.
 - 7) Type and model number.
 - 8) Size.
 - 9) Effective area in sq. ft. (sq. m).
 - b. Test Data (Indicated and Actual Values):
 - 1) Air flow rate in cfm (L/s).
 - 2) Air velocity in fpm (m/s).
 - 3) Preliminary air flow rate as needed in cfm (L/s).
 - 4) Preliminary velocity as needed in fpm (m/s).
 - 5) Final air flow rate in cfm (L/s).
 - 6) Final velocity in fpm (m/s).
 - 7) Space temperature in deg F (deg C).
12. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:
 - a. Unit Data:
 - 1) System and air-handling-unit identification.
 - 2) Location and zone.
 - 3) Room or riser served.
 - 4) Coil make and size.
 - 5) Flowmeter type.
 - b. Test Data (Indicated and Actual Values):
 - 1) Air flow rate in cfm (L/s).
 - 2) Entering-water temperature in deg F (deg C).
 - 3) Leaving-water temperature in deg F (deg C).
 - 4) Water pressure drop in feet of head or psig (kPa).
 - 5) Entering-air temperature in deg F (deg C).
 - 6) Leaving-air temperature in deg F (deg C).



13. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:
 - a. Unit Data:
 - 1) Unit identification.
 - 2) Location.
 - 3) Service.
 - 4) Make and size.
 - 5) Model number and serial number.
 - 6) Water flow rate in gpm (L/s).
 - 7) Water pressure differential in feet of head or psig (kPa).
 - 8) Required net positive suction head in feet of head or psig (kPa).
 - 9) Pump rpm.
 - 10) Impeller diameter in inches (mm).
 - 11) Motor make and frame size.
 - 12) Motor horsepower and rpm.
 - 13) Voltage at each connection.
 - 14) Amperage for each phase.
 - 15) Full-load amperage and service factor.
 - 16) Seal type.
 - b. Test Data (Indicated and Actual Values):
 - 1) Static head in feet of head or psig (kPa).
 - 2) Pump shutoff pressure in feet of head or psig (kPa).
 - 3) Actual impeller size in inches (mm).
 - 4) Full-open flow rate in gpm (L/s).
 - 5) Full-open pressure in feet of head or psig (kPa).
 - 6) Final discharge pressure in feet of head or psig (kPa).
 - 7) Final suction pressure in feet of head or psig (kPa).
 - 8) Final total pressure in feet of head or psig (kPa).
 - 9) Final water flow rate in gpm (L/s).
 - 10) Voltage at each connection.
 - 11) Amperage for each phase.
14. Instrument Calibration Reports:
 - a. Report Data:
 - 1) Instrument type and make.
 - 2) Serial number.
 - 3) Application.
 - 4) Dates of use.
 - 5) Dates of calibration.

AA. Inspections

1. Initial Inspection:
 - a. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
 - b. Check the following for each system:
 - 1) Measure airflow of at least 10 percent of air outlets.
 - 2) Measure water flow of at least 5 percent of terminals.
 - 3) Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
 - 4) Verify that balancing devices are marked with final balance position.
 - 5) Note deviations from the Contract Documents in the final report.
2. Final Inspection:
 - a. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by the Owner **OR** Commissioning Authority, **as directed**.



- b. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of the Owner **OR** Commissioning Authority, **as directed**.
 - c. the Owner **OR** Commissioning Authority, **as directed**, shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
 - d. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
 - e. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
3. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:
 - a. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
 - b. If the second final inspection also fails, the Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.
 4. Prepare test and inspection reports.

BB. Additional Tests

1. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
2. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 23 01 10 00a



23 - Heating, Ventilating, And Air-Conditioning (HVAC)

Task	Specification	Specification Description
23 01 20 00	23 01 10 00	Sequence Of Operation
23 01 20 00	23 01 10 00a	Testing, Adjusting, And Balancing



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SECTION 23 01 30 51 - AIR DUCT CLEANING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for HVAC air-distribution system cleaning. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes cleaning HVAC air-distribution equipment, ducts, plenums, and system components.

C. Definitions

1. ASCS: Air systems cleaning specialist.
2. NADCA: National Air Duct Cleaners Association.

D. Submittals

1. Qualification Data: For an ASCS.
2. Strategies and procedures plan.
3. Cleanliness verification report.

E. Quality Assurance

1. ASCS Qualifications: A certified member of NADCA.
 - a. Certification: Employ an ASCS certified by NADCA on a full-time basis.
 - b. Supervisor Qualifications: Certified as an ASCS by NADCA.
2. UL Compliance: Comply with UL 181 and UL 181A for fibrous-glass ducts.
3. Cleaning Conference: Conduct conference at Project site.

1.2 PRODUCTS (Not Used)

1.3 EXECUTION

A. Examination

1. Examine HVAC air-distribution equipment, ducts, plenums, and system components to determine appropriate methods, tools, and equipment required for performance of the Work.
2. Perform "Project Evaluation and Recommendation" according to NADCA ACR 2006.
3. Prepare written report listing conditions detrimental to performance of the Work.
4. Proceed with work only after unsatisfactory conditions have been corrected.

B. Preparation

1. Prepare a written plan that includes strategies and step-by-step procedures. At a minimum, include the following:
 - a. Supervisor contact information.
 - b. Work schedule including location, times, and impact on occupied areas.
 - c. Methods and materials planned for each HVAC component type.
 - d. Required support from other trades.
 - e. Equipment and material storage requirements.
 - f. Exhaust equipment setup locations.
2. Use the existing service openings, as required for proper cleaning, at various points of the HVAC system for physical and mechanical entry and for inspection.



3. Comply with NADCA ACR 2006, "Guidelines for Constructing Service Openings in HVAC Systems" Section.

C. Cleaning

1. Comply with NADCA ACR 2006.
2. Remove visible surface contaminants and deposits from within the HVAC system.
3. Systems and Components to Be Cleaned:
 - a. Air devices for supply and return air.
 - b. Air-terminal units.
 - c. Ductwork:
 - 1) Supply-air ducts, including turning vanes and reheat coils, to the air-handling unit.
 - 2) Return-air ducts to the air-handling unit.
 - 3) Exhaust-air ducts.
 - d. Air-Handling Units:
 - 1) Interior surfaces of the unit casing.
 - 2) Coil surfaces compartment.
 - 3) Condensate drain pans.
 - 4) Fans, fan blades, and fan housings.
 - e. Filters and filter housings.
4. Collect debris removed during cleaning. Ensure that debris is not dispersed outside the HVAC system during the cleaning process.
5. Particulate Collection:
 - a. For particulate collection equipment, include adequate filtration to contain debris removed. Locate equipment downwind and away from all air intakes and other points of entry into the building.
 - b. HEPA filtration with 99.97 percent collection efficiency for particles sized 0.3 micrometer or larger shall be used where the particulate collection equipment is exhausting inside the building.
6. Control odors and mist vapors during the cleaning and restoration process.
7. Mark the position of manual volume dampers and air-directional mechanical devices inside the system prior to cleaning. Restore them to their marked position on completion of cleaning.
8. System components shall be cleaned so that all HVAC system components are visibly clean. On completion, all components must be returned to those settings recorded just prior to cleaning operations.
9. Clean all air-distribution devices, registers, grilles, and diffusers.
10. Clean visible surface contamination deposits according to NADCA ACR 2006 and the following:
 - a. Clean air-handling units, airstream surfaces, components, condensate collectors, and drains.
 - b. Ensure that a suitable operative drainage system is in place prior to beginning wash-down procedures.
 - c. Clean evaporator coils, reheat coils, and other airstream components.
11. Duct Systems:
 - a. Create service openings in the HVAC system as necessary to accommodate cleaning.
 - b. Mechanically clean duct systems specified to remove all visible contaminants so that the systems are capable of passing the HVAC System Cleanliness Tests (see NADCA ACR 2006).
12. Debris removed from the HVAC system shall be disposed of according to applicable Federal, state, and local requirements.
13. Mechanical Cleaning Methodology:
 - a. Source-Removal Cleaning Methods: The HVAC system shall be cleaned using source-removal mechanical cleaning methods designed to extract contaminants from within the HVAC system and to safely remove these contaminants from the facility. No cleaning method, or combination of methods, shall be used that could potentially damage components of the HVAC system or negatively alter the integrity of the system.



- 1) Use continuously operating vacuum-collection devices to keep each section being cleaned under negative pressure.
 - 2) Cleaning methods that require mechanical agitation devices to dislodge debris that is adhered to interior surfaces of HVAC system components shall be equipped to safely remove these devices. Cleaning methods shall not damage the integrity of HVAC system components or damage porous surface materials such as duct and plenum liners.
 - b. Cleaning Mineral-Fiber Insulation Components:
 - 1) Fibrous-glass thermal or acoustical insulation elements present in equipment or ductwork shall be thoroughly cleaned with HEPA vacuuming equipment while the HVAC system is under constant negative pressure and shall not be permitted to get wet according to NADCA ACR 2006.
 - 2) Cleaning methods used shall not cause damage to fibrous-glass components and will render the system capable of passing the HVAC System Cleanliness Tests (see NADCA ACR 2006).
 - 3) Fibrous materials that become wet shall be discarded and replaced.
14. Coil Cleaning:
- a. Measure static-pressure differential across each coil.
 - b. See NADCA ACR 2006, "Coil Surface Cleaning" Section. Type 1, or Type 1 and Type 2, cleaning methods shall be used to render the coil visibly clean and capable of passing Coil Cleaning Verification (see applicable NADCA ACR 2006).
 - c. Coil drain pans shall be subject to NADCA ACR 2006, "Non-Porous Surfaces Cleaning Verification." Ensure that condensate drain pans are operational.
 - d. Electric-resistance coils shall be de-energized, locked out, and tagged before cleaning.
 - e. Cleaning methods shall not cause any appreciable damage to, cause displacement of, inhibit heat transfer, or cause erosion of the coil surface or fins, and shall comply with coil manufacturer's written recommendations when available.
 - f. Rinse thoroughly with clean water to remove any latent residues.
15. Antimicrobial Agents, Coatings, and Sanitizers:
- a. Apply antimicrobial agents, coatings, and sanitizers if active fungal growth is reasonably suspected or where unacceptable levels of fungal contamination have been verified. Apply antimicrobial agents and coatings according to manufacturer's written recommendations and EPA registration listing after the removal of surface deposits and debris.
 - b. When used, antimicrobial treatments, coatings, and sanitizers shall be applied after the system is rendered clean.
 - c. Apply antimicrobial agents, coatings, and sanitizers directly onto surfaces of interior ductwork. Fogging is prohibited.
 - d. Sanitizing agent products shall be registered by the EPA as specifically intended for use in HVAC systems and ductwork.
- D. Cleanliness Verification
1. Verify cleanliness according to NADCA ACR 2006, "Verification of HVAC System Cleanliness" Section.
 2. Verify HVAC system cleanliness after mechanical cleaning and before applying any treatment or introducing any treatment-related substance to the HVAC system, including biocidal agents, coatings, and sanitizers.
 3. Perform visual inspection for cleanliness. If no contaminants are evident through visual inspection, the HVAC system shall be considered clean. If visible contaminants are evident through visual inspection, those portions of the system where contaminants are visible shall be re-cleaned and subjected to re-inspection for cleanliness.
 4. Additional Verification:
 - a. Perform surface comparison testing or NADCA vacuum test.
 - b. Conduct NADCA vacuum gravimetric test analysis for nonporous surfaces.
 5. Verification of Coil Cleaning:
 - a. Measure static-pressure differential across each coil.



- b. Coil will be considered clean if cleaning restored the coil static-pressure differential within 10 percent of <Insert inches wg (Pa)>, the differential measured when the coil was first installed.

OR

Coil will be considered clean if the coil is free of foreign matter and chemical residue, based on a thorough visual inspection.

- 6. Prepare a written cleanliness verification report. At a minimum, include the following:
 - a. Written documentation of the success of the cleaning.
 - b. Site inspection reports, initialed by supervisor, including notation on areas of inspection, as verified through visual inspection.
 - c. Surface comparison test results if required.
 - d. Gravimetric analysis (nonporous surfaces only).
 - e. System areas found to be damaged.
- 7. Photographic Documentation: Comply with requirements listed in Scope of Work.

E. Restoration

- 1. Restore and repair HVAC air-distribution equipment, ducts, plenums, and components according to NADCA ACR 2006, "Restoration and Repair of Mechanical Systems" Section.
- 2. Restore service openings capable of future reopening. Comply with requirements in Division 23 Section "Metal Ducts". Include location of service openings in Project closeout report.
- 3. Replace fibrous-glass materials that cannot be restored by cleaning or resurfacing. Comply with requirements in Division 23 Section(s) "Metal Ducts" AND "Nonmetal Ducts"
- 4. Replace damaged insulation according to Division 23 Section "Hvac Insulation",
- 5. Ensure that closures do not hinder or alter airflow.
- 6. New closure materials, including insulation, shall match opened materials and shall have removable closure panels fitted with gaskets and fasteners.
- 7. Reseal fibrous-glass ducts. Comply with requirements in Division 23 Section "Nonmetal Ducts".

END OF SECTION 23 01 30 51



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SECTION 23 01 50 00 - CAST-IRON BOILERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for cast-iron boilers. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes packaged cast-iron boilers, trim, and accessories for generating hot water or steam with the following configurations and burners:
 - a. Factory and Field assembled.
 - b. Atmospheric gas, Sealed-combustion, gas, Forced-draft, gas, Oil, and Combination gas and oil burner.

C. Submittals

1. Product Data: Include performance data, operating characteristics, furnished specialties, and accessories.
2. Shop Drawings: For boilers, boiler trim, and accessories. Include plans, elevations, sections, details, and attachments to other work.
 - a. Design calculations and vibration isolation base details, signed and sealed by a qualified professional engineer.
 - 1) Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
 - 2) Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails and equipment mounting frames.
 - b. Wiring Diagrams: Power, signal, and control wiring.
3. Manufacturer Seismic Qualification Certification: Submit certification that boiler, accessories, and components will withstand seismic forces defined in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment". Include the following:
 4. Source quality-control test reports.
 5. Field quality-control test reports.
 6. Operation and maintenance data.
 7. Warranty: Special warranty specified in this Section.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. ASME Compliance: Fabricate and label boilers to comply with ASME Boiler and Pressure Vessel Code.
3. ASHRAE/IESNA 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements."
4. DOE Compliance: Minimum efficiency shall comply with 10 CFR 430, Subpart B, Appendix N, "Uniform Test Method for Measuring the Energy Consumption of Furnaces and Boilers."
5. I=B=R Compliance: Boilers shall be tested and rated according to HI's "Rating Procedure for Heating Boilers" and "Testing Standard for Commercial Boilers," with I=B=R emblem on a nameplate affixed to boiler.
6. UL Compliance: Test boilers for compliance with UL 726, "Oil-Fired Boiler Assemblies **OR** UL 726, "Oil-Fired Boiler Assemblies," and UL 795, "Commercial-Industrial Gas Heating



Equipment **OR** UL 795, "Commercial-Industrial Gas Heating Equipment", **as directed**. Boilers shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.

E. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace controls and heat exchangers of boilers that fail in materials or workmanship within specified warranty period.
 - a. Warranty Period for Controls: Two years from date of Final Completion.
 - b. Warranty Period for Heat Exchangers: Five **OR** 10 **OR** 20, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Manufactured Units

1. Description: Factory fabricated and assembled **OR** field assembled, **as directed**.
 - a. Cast-iron sections shall be sealed pressure tight and held together with tie rods set on an insulated steel base, **as directed**; including insulated jacket and flue-gas vent connection.
OR
Ship cast-iron sections disassembled with all materials and equipment, including seals, tie rods, and insulated jacket and flue-gas vent connection for field assembly.
2. Cast-Iron Section Design:
 - a. Configuration: Wet base **OR** back **OR** leg, **as directed**.
 - b. Number of Passes: Single **OR** Multiple, **as directed**.
 - c. Sectional Joints: High-temperature sealant to seal flue-gas passages not in contact with heating medium, tapered cast-iron push nipples, **OR** O-ring gaskets, **OR** fiber roping, **as directed**, and held together with tie rods.
 - d. Drain and blowdown tappings.
 - e. Return injection tube to equalize water flow to all sections.
 - f. Crown inspection tappings with brass plugs.
 - g. Built-in air separator.
3. Combustion Chamber: Equipped with ceramic-fiber target wall **OR** refractory **OR** insulation, **as directed**, and flame observation ports, front and back.
4. Casing:
 - a. Jacket: Sheet metal **OR** Galvanized sheet metal, **as directed**, with snap-in or interlocking closures and baked-enamel **OR** powder-coated, **as directed**, protective finish.
 - b. Insulation: Minimum 1-inch- (25-mm-) **OR** 2-inch- (50-mm-), **as directed**, thick, mineral-fiber insulation surrounding the heat exchanger.
 - c. Combustion Chamber Access: Refractory lined, hinged, front.
 - d. Access: For cleaning between cast-iron sections.
 - e. Draft Hood: Flue canopy and top **OR** rear, **as directed**, flue connection shall be constructed of aluminized **OR** stainless, **as directed**, steel containing adjustable outlet damper assembly.
 - f. Insulated base constructed of aluminized steel to permit boiler to be installed on combustible floor.
 - g. Mounting Frame: Steel rails to mount assembled boiler package on concrete base.
 - 1) Seismic Fabrication Requirements: Fabricate mounting base and attachment to boiler, accessories, and components with reinforcement strong enough to withstand seismic forces defined in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment" when mounting base is anchored to building structure.
 - h. Control Cabinet: Sheet metal casing shall cover all controls, gas train, and burner.
5. Draft Diverter: Steel assembly integral with boiler casing **OR** Separate galvanized-steel assembly, **as directed**.

B. Burner: For Atmospheric Gas Burners.



1. Burner Tubes and Orifices: Stainless steel **OR** Cast iron, **as directed**, for natural **OR** propane, **as directed**, gas.
 2. Gas Train: Control devices and full-modulation **OR** on-off **OR** low-high-low, **as directed**, control sequence shall comply with requirements in ASME CSD-1 **OR** FMG **OR** IRI **OR** UL, **as directed**.
OR
Gas Train: Combination gas valve with manual shutoff, pressure regulator, and pilot adjustment.
 3. Pilot: Standing **OR** Intermittent-electric-spark, **as directed**, pilot ignition with 100 percent main-valve and pilot-safety shutoff with electronic supervision of burner flame.
- C. Burner: For Residential-Size Boilers With Sealed-Combustion Burners.
1. Burner Tubes and Orifices: Stainless steel **OR** Cast iron, **as directed**, for natural **OR** propane, **as directed**, gas.
 2. Blower: Forward-curved centrifugal fan integral to burner, directly driven by motor; with adjustable, dual-blade damper assembly and locking quadrant to set air-fuel ratio.
 - a. Motors: Comply with requirements specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - 1) Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 3. Gas Train: Combination gas valve with manual shutoff, pressure regulator, and pilot adjustment.
 4. Pilot: Standing **OR** Intermittent-electric-spark, **as directed**, pilot ignition with 100 percent main-valve and pilot-safety shutoff with electronic supervision of burner flame.
- D. Burner: For Forced-Draft Burners.
1. Burner: Welded construction with multivane, stainless-steel, flame-retention diffuser for natural **OR** propane, **as directed**, gas.
 2. Blower: Forward-curved centrifugal fan integral to burner, directly driven by motor; with adjustable, dual-blade damper assembly and locking quadrant to set air-fuel ratio.
 - a. Motors: Comply with requirements specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - 1) Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 3. Gas Train: Control devices and modulating **OR** on-off **OR** low-high-low, **as directed**, control sequence shall comply with requirements in ASME CSD-1 **OR** FMG **OR** IRI **OR** UL, **as directed**.
 4. Pilot: Intermittent **OR** Interrupted, **as directed**, -electric-spark pilot ignition with 100 percent main-valve and pilot-safety shutoff with electronic supervision of burner flame.
 5. Flue-Gas Recirculation: Burner connections shall be equipped for recirculating flue gas.
 - a. Maximum Oxides of Nitrogen Emissions: 20 **OR** 30, **as directed**, ppm.
- E. Burner: For Oil Burners.
1. Burner: Welded construction with multivane, stainless-steel, flame-retention diffuser for fuel oil.
 2. Blower: Forward-curved centrifugal fan integral to burner, directly driven by motor; with adjustable, dual-blade damper assembly and locking quadrant to set air-fuel ratio.
 - a. Motors: Comply with requirements specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - 1) Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 3. Oil Supply: Control devices and modulating **OR** on-off **OR** low-high-low, **as directed**, control sequence shall comply with requirements in ASME CSD-1 **OR** FMG **OR** IRI **OR** UL, **as directed**.
 - a. Oil Pump: Two-stage, gear-type oil pump integral to and directly driven by blower, **as directed**, shall be capable of producing 300-psig (2070-kPa) discharge pressure and 15-inch Hg (50.7-kPa) vacuum.
 - b. Oil Piping Specialties:
 - 1) Suction-line, manual, gate valve.
 - 2) Removable-mesh oil strainer.
 - 3) 0- to 30-inch Hg (0- to 101.3-kPa) vacuum; 0- to 30-psig (0- to 207-kPa) vacuum-pressure gage.



- 4) 0- to 300-psig (0- to 2070-kPa) oil-nozzle pressure gage.
 - 5) Nozzle-line, solenoid-safety-shutoff oil valve.
4. Pilot: Intermittent **OR** Interrupted, **as directed**, -electric-spark pilot ignition with 100 percent main-valve and pilot-safety shutoff solenoid using cadmium sulfide **OR** UV scanner, **as directed**, flame-safety control.
 5. Flue-Gas Recirculation: Burner connections shall be equipped for recirculating flue gas.
 - a. Maximum Oxides of Nitrogen Emissions: 30 ppm.
- F. Burner: For Combination Gas And Oil Burners.
1. Burner: Welded construction with multivane, stainless-steel, flame-retention diffuser for fuel oil and natural **OR** propane, **as directed**, gas.
 2. Blower: Forward-curved centrifugal fan integral to burner, directly driven by motor; with adjustable, dual-blade damper assembly and locking quadrant to set air-fuel ratio.
 - a. Motors: Comply with requirements specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - 1) Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 3. Oil Supply: Control devices and modulating **OR** on-off **OR** low-high-low, **as directed**, control sequence shall comply with requirements in ASME CSD-1 **OR** FMG **OR** IRI **OR** UL, **as directed**.
 - a. Oil Pump: Two-stage, gear-type oil pump integral to and directly driven by blower, **as directed**, shall be capable of producing 300-psig (2070-kPa) discharge pressure and 15-inch Hg (50.7-kPa) vacuum.
 - b. Oil Piping Specialties:
 - 1) Suction-line, manual, gate valve.
 - 2) Removable-mesh oil strainer.
 - 3) 0- to 30-inch Hg (0- to 101.3-kPa) vacuum; 0- to 30-psig (0- to 207-kPa) vacuum-pressure gage.
 - 4) 0- to 300-psig (0- to 2070-kPa) oil-nozzle pressure gage.
 - 5) Nozzle-line, solenoid-safety-shutoff oil valve.
 4. Gas Train: Control devices and modulating **OR** on-off **OR** low-high-low, **as directed**, control sequence shall comply with requirements in ASME CSD-1 **OR** FMG **OR** IRI **OR** UL, **as directed**.
 5. Gas Pilot: Intermittent **OR** Interrupted, **as directed**, -electric-spark pilot ignition with 100 percent main-valve and pilot-safety shutoff with electronic supervision of burner flame.
 6. Oil Pilot: Intermittent **OR** Interrupted, **as directed**, -electric-spark pilot ignition with 100 percent main-valve and pilot-safety shutoff solenoid with cadmium sulfide **OR** UV scanner, **as directed**, flame-safety control.
 7. Flue-Gas Recirculation: Burner connections shall be equipped for recirculating flue gas.
 - a. Maximum Oxides of Nitrogen Emissions: 20 **OR** 30, **as directed**, ppm.
- G. Trim: For Hot-Water Boilers.
1. Include devices sized to comply with ANSI B31.9, "Building Services Piping."
 2. Aquastat Controllers: Operating, firing rate, **as directed**, and high limit.
 3. Safety Relief Valve: ASME rated.
 4. Pressure and Temperature Gage: Minimum 3-1/2-inch- (89-mm-) diameter, combination water-pressure and -temperature gage. Gages shall have operating-pressure and -temperature ranges so normal operating range is about 50 percent of full range.
 5. Boiler Air Vent: Automatic **OR** Manual, **as directed**.
 6. Drain Valve: Minimum NPS 3/4 (DN 20) hose-end gate valve.
 7. Tankless Heater: Carbon-steel header with copper-tube heat exchanger, mounted in an upper port of cast-iron sections and sealed with fiber gasket.
 - a. Tappings NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.
 - b. Tappings NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.



- H. Trim: For Steam Boilers.
1. Include devices sized to comply with ANSI B31.9, "Building Services Piping."
 2. Pressure Controllers: Operating, firing rate, **as directed**, and high limit.
 3. Safety Relief Valve:
 - a. Size and Capacity: As required for equipment according to ASME Boiler and Pressure Vessel Code.
 - b. Description: Fully enclosed steel spring with adjustable pressure range and positive shutoff; factory set and sealed.
 - 1) Drip-Pan Elbow: Cast iron and having threaded inlet and outlet with threads complying with ASME B1.20.1.
 4. Pressure Gage: Minimum 3-1/2-inch (89-mm) diameter. Gage shall have normal operating pressure about 50 percent of full range.
 5. Water Column: Minimum 12-inch (300-mm) glass gage with shutoff cocks.
 6. Drain Valves: Minimum NPS 3/4 (DN 20) or nozzle size with hose-end connection.
 7. Blowdown Valves: Factory-installed bottom and surface, slow-acting blowdown valves same size as boiler nozzle.
 8. Stop Valves: Boiler inlets and outlets, except safety relief valves or preheater inlet and outlet, shall be equipped with stop valve in an accessible location as near as practical to boiler nozzle and same size as or larger than nozzle. Valves larger than NPS 2 (DN 50) shall have rising stem.
 9. Stop-Check Valves: Factory-installed, stop-check valve and stop valve at boiler outlet with free-blow drain valve factory installed between the two valves and visible when operating stop-check valve.
 10. Tankless Heater: Carbon-steel header with copper-tube heat exchanger, mounted in an upper port of cast-iron sections and sealed with fiber gasket.
 - a. Tappings NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.
 - b. Tappings NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
- I. Controls
1. Refer to Division 23 Section "Instrumentation And Control For Hvac".
OR
Boiler operating controls shall include the following devices and features:
 - a. Control transformer.
 - b. Set-Point Adjust: Set points shall be adjustable.
 - c. Operating Pressure Control for Steam Boilers: Factory wired and mounted to cycle burner.
 - d. Low-Water Cutoff and Pump Control for Steam Boilers: Cycle feedwater pump(s) for makeup water control.
 - e. Sequence of Operation for Hot-Water Boilers: Electric, factory-fabricated and field-installed panel to control burner firing rate to maintain space temperature in response to thermostat with heat anticipator located in heated space.
OR
Sequence of Operation for Hot-Water Boilers: Electric, factory-fabricated and field-installed panel to control burner firing rate to reset supply-water temperature inversely with outside-air temperature. At 0 deg F (minus 17 deg C) outside-air temperature, set supply-water temperature at 200 deg F (93 deg C); at 60 deg F (15 deg C) outside-air temperature, set supply-water temperature at 140 deg F (60 deg C).
 - f. Sequence of Operation for Steam Boilers: Electric, factory-fabricated and field-installed panel to control burner firing rate to maintain a constant steam pressure. Maintain pressure set point plus or minus 10 percent.
 - 1) Include automatic, alternating-firing sequence for multiple boilers.
 2. Burner Operating Controls: To maintain safe operating conditions, burner safety controls limit burner operation.
 - a. High Cutoff: Manual **OR** Automatic, **as directed**, reset stops burner if operating conditions rise above maximum boiler design temperature **OR** pressure, **as directed**.



- b. Low-Water Cutoff Switch: Electronic for hot-water boilers or Float and electronic for steam boilers probe shall prevent burner operation on low water. Cutoff switch shall be manual **OR** automatic, **as directed**, -reset type.
- c. Blocked Vent Safety Switch for Atmospheric Burners: Manual-reset switch factory mounted on draft diverter.
- d. Rollout Safety Switch for Atmospheric Burners: Factory mounted on boiler combustion chamber.
- e. Audible Alarm: Factory mounted on control panel with silence switch; shall sound alarm for above conditions.
- 3. Building Automation System Interface: Factory install hardware and software to enable building automation system to monitor, control, and display boiler status and alarms.
 - a. Hardwired Points:
 - 1) Monitoring: On/off status, common trouble alarm **OR** low water level alarm, **as directed**.
 - 2) Control: On/off operation, hot water supply temperature set-point adjustment **OR** steam pressure adjustment, **as directed**.
 - b. A communication interface with building automation system shall enable building automation system operator to remotely control and monitor the boiler from an operator workstation. Control features available, and monitoring points displayed, locally at boiler control panel shall be available through building automation system.

J. Electrical Power

- 1. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 22..
- 2. Single-Point Field Power Connection: Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to boiler.
 - a. House in NEMA 250, Type 1 enclosure.
 - b. Wiring shall be numbered and color-coded to match wiring diagram.
 - c. Install factory wiring outside of an enclosure in a metal raceway.
 - d. Field power interface shall be to wire lugs **OR** fused disconnect switch **OR** nonfused disconnect switch **OR** circuit breaker, **as directed**.
 - e. Provide branch power circuit to each motor and to controls with disconnect switch or circuit breaker, **as directed**.
 - f. Provide each motor with overcurrent protection.

K. Source Quality Control

- 1. Test and inspect factory-assembled boilers, before shipping, according to ASME Boiler and Pressure Vessel Code.
- 2. Burner and Hydrostatic Test: Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency; perform hydrostatic test.
- 3. Allow the Owner access to source quality-control testing of boilers. Notify the Owner 14 days in advance of testing.

1.3 EXECUTION

A. Boiler Installation

- 1. Install boilers level on concrete base. Concrete base is specified in Division 23 Section "Common Work Results For Hvac" and concrete materials and installation requirements are specified in Division 31..
- 2. Vibration Isolation: Elastomeric isolator pads **OR** mounts, **as directed**, with a minimum static deflection of 0.25 inch (6.35 mm). Vibration isolation devices and installation requirements are



specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".

3. Install gas-fired boilers according to NFPA 54.
4. Install oil-fired boilers according to NFPA 31.
5. Assemble boiler sections in sequence and seal between each section if boiler is not delivered fully assembled.
6. Assemble and install boiler trim.
7. Install electrical devices furnished with boiler but not specified to be factory mounted.
8. Install control wiring to field-mounted electrical devices.

B. Connections

1. Piping installation requirements are specified in other Division 21. Drawings indicate general arrangement of piping, fittings, and specialties.
2. Install piping adjacent to boiler to allow service and maintenance.
3. Connect gas piping to boiler gas-train inlet with union. Piping shall be at least full size of gas train connection. Provide a reducer if required.
4. Connect oil piping full size to burner inlet with shutoff valve and union.
5. Connect hot-water piping to supply- and return-boiler tappings with shutoff valve and union or flange at each connection.
6. Connect steam and condensate piping to supply-, return-, and blowdown-boiler tappings with shutoff valve and union or flange at each connection.
7. Install piping from safety relief valves to nearest floor drain, for hot-water boilers.
8. Install piping from safety valves to drip-pan elbow and to nearest floor drain, for steam boilers.
9. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve if required.
10. Connect breeching full size to boiler outlet. Comply with requirements in Division 23 Section "Breechings, Chimneys, And Stacks" for venting materials.
11. Install flue-gas recirculation duct from vent to burner. Comply with requirements in Division 23 Section "Breechings, Chimneys, And Stacks" for recirculation duct materials.
12. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
13. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

C. Field Quality Control

1. Perform tests and inspections and prepare test reports.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Tests and Inspections:
 - a. Perform installation and startup checks according to manufacturer's written instructions.
 - b. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.
 - c. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.
 - d. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 1) Burner Test: Adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency.
 - 2) Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level and water temperature **OR** steam pressure, **as directed**.
 - 3) Set field-adjustable switches and circuit-breaker trip ranges as indicated.
3. Remove and replace malfunctioning units and retest as specified above.
4. Occupancy Adjustments: When requested within 12 months of date of Final Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.



5. Performance Tests, **as directed**:
 - a. Engage a factory-authorized service representative to inspect component assemblies and equipment installations, including connections, and to conduct performance testing.
 - b. Boilers shall comply with performance requirements indicated, as determined by field performance tests. Adjust, modify, or replace equipment to comply.
 - c. Perform field performance tests to determine capacity and efficiency of boilers.
 - 1) For dual-fuel boilers, perform tests for each fuel.
 - 2) Test for full capacity.
 - 3) Test for boiler efficiency at low fire 20, 40, 60, 80, 100, 80, 60, 40, and 20 percent of full capacity. Determine efficiency at each test point.
 - d. Repeat tests until results comply with requirements indicated.
 - e. Provide analysis equipment required to determine performance.
 - f. Provide temporary equipment and system modifications necessary to dissipate the heat produced during tests if building systems are not adequate.
 - g. Notify the Owner in advance of test dates.
 - h. Document test results in a report and submit to the Owner.

D. Demonstration

1. Train the Owner's maintenance personnel to adjust, operate, and maintain boilers.

END OF SECTION 23 01 50 00



23 - Heating, Ventilating, And Air-Conditioning (HVAC)

Task	Specification	Specification Description
23 01 50 00	01 22 16 00	No Specification Required
23 01 50 00	22 11 16 00c	Hydronic Piping



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SECTION 23 01 60 00 - CONDENSING UNITS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for condensing units. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes air-cooled and water-cooled condensing units.

C. Submittals

1. Product Data: For each condensing unit, include rated capacities, operating characteristics, furnished specialties, and accessories. Include equipment dimensions, weights and structural loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Shop Drawings: Signed and sealed by a qualified professional engineer.
 - a. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints, **as directed**, and for designing vibration isolation bases.
 - b. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment.
 - c. Wiring Diagrams: Power, signal, and control wiring.
3. Manufacturer Seismic Qualification Certification: Submit certification that condensing units, accessories, and components will withstand seismic forces defined in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment". Include the following:
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
4. Field quality-control test reports.
5. Operation and maintenance data.
6. Warranty: Special warranty specified in this Section.
7. LEED Submittal:
 - a. Product Data for Credit EA 4: Documentation required by Credit EA 4 indicating that equipment and refrigerants comply.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. Fabricate and label refrigeration system according to ASHRAE 15, "Safety Code for Mechanical Refrigeration."
3. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
4. ASME Compliance: Fabricate and label water-cooled condensing units to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

E. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of condensing units that fail in materials or workmanship within specified warranty period.
 - a. Failures include, but are not limited to, the following:
 - 1) Compressor failure.
 - 2) Condenser coil leak.



- b. Warranty Period: Four **OR** Five **OR** 10, **as directed**, years from date of Final Completion.
- c. Warranty Period (Compressor Only): Five **OR** 10, **as directed**, years from date of Final Completion.
- d. Warranty Period (Condenser Coil Only): Five years from date of Final Completion.

1.2 PRODUCTS

A. Condensing Units, Air Cooled, 1 To 5 Tons (3.5 TO 17.6 kW)

1. Description: Factory assembled and tested, consisting of compressor, condenser coil, fan, motors, refrigerant reservoir, and operating controls.
2. Compressor: Scroll, hermetically sealed, with rubber vibration isolators.
 - a. Motor: Single **OR** Two, **as directed**, speed, and includes thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
 - b. Two-Speed Compressor: Include manual-reset, high-pressure switch and automatic-reset, low-pressure switch.
 - c. Accumulator: Suction tube.
 - d. Refrigerant Charge: R-407C **OR** R-410A, **as directed**.
3. Condenser Coil: Seamless copper-tube, aluminum-fin coil; circuited for integral liquid subcooler, with removable drain pan and brass service valves with service ports.
4. Condenser Fan: Direct-drive, aluminum propeller fan; with permanently lubricated, totally enclosed fan motor with thermal-overload protection and ball bearings, **as directed**.
5. Accessories:
 - a. Coastal Filter: Mesh screen to protect condenser coil from salt damage.
 - b. Crankcase heater.
 - c. Cycle Protector: Automatic-reset timer to prevent rapid compressor cycling.
 - d. Electronic programmable thermostat **OR** Low-voltage thermostat and subbase, **as directed**, to control condensing unit and evaporator fan.
 - e. Evaporator Freeze Thermostat: Temperature-actuated switch that stops unit when evaporator reaches freezing temperature.
 - f. Filter-dryer.
 - g. High-Pressure Switch: Automatic-reset switch cycles compressor off on high refrigerant pressure.
 - h. Liquid-line solenoid.
 - i. Low Ambient Controller: Cycles condenser fan to permit operation down to 0 deg F (minus 18 deg C) with time-delay relay to bypass low-pressure switch, **as directed**.
OR
Low Ambient Controller: Controls condenser fan speed to permit operation down to minus 20 deg F (minus 29 deg C) with time-delay relay to bypass low-pressure switch, **as directed**.
 - j. Low-Pressure Switch: Automatic-reset switch cycles compressor off on low refrigerant pressure.
 - k. PE mounting base to provide a permanent foundation.
 - l. Precharged and insulated suction and liquid tubing.
 - m. Sound Hood: Wraps around sound attenuation cover for compressor.
 - n. Thermostatic expansion valve.
 - o. Time-Delay Relay: Continues operation of evaporator fan after compressor shuts off.
6. Unit Casing: Galvanized steel, finished with baked enamel; with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Mount service valves, fittings, and gage ports on exterior of casing.

B. Condensing Units, Air Cooled, 6 To 120 Tons (21 TO 422 kW)

1. Description: Factory assembled and tested, air cooled; consisting of casing, compressors, condenser coils, condenser fans and motors, and unit controls.



2. Compressor: Hermetic or semihermetic compressor designed for service with crankcase sight glass, crankcase heater, and backseating service access valves on suction and discharge ports.
 - a. Capacity Control: Cylinder unloading **OR** Hot-gas bypass, **as directed**.
 - b. Refrigerant Charge: R-407C **OR** R-410A **OR** HFC-134a, **as directed**.
 3. Condenser Coil: Seamless copper-tube, aluminum-fin coil, including subcooling circuit and backseating liquid-line service access valve. Factory pressure test coils, then dehydrate by drawing a vacuum and fill with a holding charge of nitrogen or refrigerant.
 4. Condenser Fans: Propeller-type vertical discharge; either directly or belt driven. Include the following:
 - a. Permanently lubricated ball-bearing motors.
 - b. Separate motor for each fan.
 - c. Dynamically and statically balanced fan assemblies.
 5. Operating and safety controls include the following:
 - a. Manual-reset, high-pressure cutout switches.
 - b. Automatic-reset, low-pressure cutout switches.
 - c. Low oil pressure cutout switch.
 - d. Compressor-winding thermostat cutout switch.
 - e. Three-leg, compressor-overload protection.
 - f. Control transformer.
 - g. Magnetic contactors for compressor and condenser fan motors.
 - h. Timer to prevent excessive compressor cycling.
 6. Accessories:
 - a. Electronic programmable thermostat **OR** Low-voltage thermostat and subbase, **as directed**, to control condensing unit and evaporator fan.
 - b. Low Ambient Controller: Cycles condenser fan to permit operation down to 0 deg F (minus 18 deg C) with time-delay relay to bypass low-pressure switch, **as directed**.
OR
Low Ambient Controller: Controls condenser fan speed to permit operation down to minus 20 deg F (minus 29 deg C) with time-delay relay to bypass low-pressure switch, **as directed**.
 - c. Gage Panel: Package with refrigerant circuit suction and discharge gages.
 - d. Hot-gas bypass kit.
 - e. Part-winding-start timing relay, circuit breakers, and contactors.
 7. Unit Casings: Designed for outdoor installation with weather protection for components and controls and with removable panels for required access to compressors, controls, condenser fans, motors, and drives. Additional features include the following:
 - a. Steel, galvanized or zinc coated, for exposed casing surfaces; treated and finished with manufacturer's standard paint coating.
 - b. Perimeter base rail with forklift slots and lifting holes to facilitate rigging.
 - c. Gasketed control panel door.
 - d. Nonfused disconnect switch, factory mounted and wired, for single external electrical power connection.
 - e. Condenser coil hail guard **OR** grille, **as directed**, to protect coil from physical damage.
- C. Condensing Units, Water Cooled
1. Description: Factory assembled and tested, water cooled; consisting of compressors, water-cooled condensers, bases, and unit controls.
 2. Compressor: Hermetic or serviceable hermetic type; with oil pump, operating oil charge, and suction and discharge shutoff valves. Factory mounted on base using spring isolators. Include the following:
 - a. Thermally protected compressor motor.
 - b. Crankcase heater.
 - c. Capacity control using cylinder unloading, suction pressure controlled and discharge pressure operated, designed for unloaded start.
 - d. Refrigerant Charge: R-407C **OR** R-410A **OR** HFC-134a, **as directed**.



3. Condenser: Single-pass, tube-in-tube coaxial type; with seamless, integral-finned, copper tube and steel outer shell with water-regulating valve.
OR
Condenser: Multipass, shell-and-tube type; with replaceable, seamless, integral-finned copper tubes; positive-liquid subcooling circuit; pressure relief device; liquid-level test cock; purge connection; liquid-line shutoff valve; and angle valve for connection of water-regulating valve.
 - a. Unit Construction: ASME stamped, **as directed**, for refrigerant-side working pressure of 385 psig (2650 kPa) and water-side working pressure of 250 psig (1720 kPa).
4. Accessories include the following:
 - a. Discharge-line muffler.
 - b. Gage panel containing gages for suction, discharge, and oil pressure.
 - c. Electric solenoid cylinder unloaders.
 - d. Pump-down relay package.
 - e. Crankcase cover plates with equalizer connections.
5. Controls: Factory-mounted and -wired panel with the following:
 - a. Timer to prevent short cycling.
 - b. High- and low-refrigerant-pressure safety controls.
 - c. Power- and control-circuit terminal blocks.
 - d. Compressor motor starter.
 - e. Control-circuit on-off switch.
 - f. Control-circuit fuse.

D. Motors

1. General requirements for motors are specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - b. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 22.

E. Source Quality Control

1. Verification of Performance: Rate condensing units according to ARI 210/240, ARI 340/360, or ARI 365.
 - a. Energy Efficiency: Equal to or greater than prescribed by ASHRAE/IESNA 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."
2. Test and inspect shell and tube condensers according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
3. Testing Requirements: Factory test sound-power-level ratings according to ARI 270.

1.3 EXECUTION

A. Installation

1. Install units level and plumb, firmly anchored in locations indicated; maintain manufacturer's recommended clearances.
2. Install condensing units on concrete base. Concrete base is specified in Division 23 Section "Common Work Results For Hvac" and concrete materials and installation requirements are specified in Division 31.
3. Concrete Bases:
 - a. Install dowel rods to connect concrete base to concrete slab. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of the base.
 - b. For equipment supported on structural slab, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.



- d. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - e. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 4. Install roof-mounting units on equipment supports specified in Division 07.
 5. Vibration Isolation: Mount condensing units on rubber pads with a minimum deflection of 1/4 inch (6.35 mm). Vibration isolation devices and installation requirements are specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
OR
Vibration Isolation: Mount condensing units on restrained spring isolators with a minimum deflection specified by the Owner. Vibration isolation devices and installation requirements are specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 6. Maintain manufacturer's recommended clearances for service and maintenance.
 7. Loose Components: Install electrical components, devices, and accessories that are not factory mounted.
- B. Connections**
1. Piping installation requirements are specified in other Division 21. Drawings indicate general arrangement of piping, fittings, and specialties.
 2. Install piping adjacent to machine to allow service and maintenance.
 3. Connect precharged refrigerant tubing to unit's quick-connect fittings. Install tubing so it does not interfere with access to unit. Install furnished accessories.
 4. Connect refrigerant piping to air-cooled condensing units; maintain required access to unit. Install furnished field-mounted accessories. Refrigerant piping and specialties are specified in Division 23 Section "Refrigerant Piping".
 5. Connect refrigerant and condenser-water piping to water-cooled condensing units. Maintain clear tube removal space. Refrigerant piping and specialties are specified in Division 23 Section "Refrigerant Piping" and condenser-water piping and specialties are specified in Division 22 Section(s) "Domestic Water Piping" OR Division 23 Section(s) "Hydronic Piping", **as directed**.
- C. Field Quality Control**
1. Perform the following field tests and inspections and prepare test reports:
 - a. Perform electrical test and visual and mechanical inspection.
 - b. Leak Test: After installation, charge systems with refrigerant and oil and test for leaks. Repair leaks, replace lost refrigerant and oil, and retest until no leaks exist.
 - c. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation, product capability, and compliance with requirements.
 - d. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - e. Verify proper airflow over coils.
 2. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.
 3. Remove and replace malfunctioning condensing units and retest as specified above.
- D. Startup Service**
1. Complete installation and startup checks according to manufacturer's written instructions and perform the following:
 - a. Inspect for physical damage to unit casing.
 - b. Verify that access doors move freely and are weathertight.
 - c. Clean units and inspect for construction debris.
 - d. Verify that all bolts and screws are tight.
 - e. Adjust vibration isolation and flexible connections.
 - f. Verify that controls are connected and operational.
 2. Lubricate bearings on fans.
 3. Verify that fan wheel is rotating in the correct direction and is not vibrating or binding.
 4. Adjust fan belts to proper alignment and tension.



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5. Start unit according to manufacturer's written instructions and complete manufacturer's startup checklist.
 6. Measure and record airflow over coils.
 7. Verify proper operation of condenser capacity control device.
 8. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.
 9. After startup and performance test, lubricate bearings and adjust belt tension, **as directed**.

E. Demonstration

1. Train Owner's maintenance personnel to adjust, operate, and maintain condensing units.

END OF SECTION 23 01 60 00



SECTION 23 05 13 00 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for common motor requirements for HVAC equipment. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

C. Coordination

1. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - a. Motor controllers.
 - b. Torque, speed, and horsepower requirements of the load.
 - c. Ratings and characteristics of supply circuit and required control sequence.
 - d. Ambient and environmental conditions of installation location.

1.2 PRODUCTS

A. General Motor Requirements

1. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.
2. Comply with NEMA MG 1 unless otherwise indicated.
3. Comply with IEEE 841 for severe-duty motors.

B. Motor Characteristics

1. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet (1000 m) above sea level.
2. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

C. Polyphase Motors

1. Description: NEMA MG 1, Design B, medium induction motor.
2. Efficiency: Energy efficient, as defined in NEMA MG 1.
3. Service Factor: 1.15.
4. Multispeed Motors: Variable torque.
 - a. For motors with 2:1 speed ratio, consequent pole, single winding.
 - b. For motors with other than 2:1 speed ratio, separate winding for each speed.
5. Multispeed Motors: Separate winding for each speed.
6. Rotor: Random-wound, squirrel cage.
7. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
8. Temperature Rise: Match insulation rating.
9. Insulation: Class F.
10. Code Letter Designation:
 - a. Motors 15 HP and Larger: NEMA starting Code F or Code G.



- b. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- 11. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

D. Polyphase Motors With Additional Requirements

- 1. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- 2. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 - a. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
 - b. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - c. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - d. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
- 3. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

E. Single-Phase Motors

- 1. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - a. Permanent-split capacitor.
 - b. Split phase.
 - c. Capacitor start, inductor run.
 - d. Capacitor start, capacitor run.
- 2. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- 3. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- 4. Motors 1/20 HP and Smaller: Shaded-pole type.
- 5. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

1.3 EXECUTION (Not Applicable)

END OF SECTION 23 05 13 00



SECTION 23 05 16 00 - EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for expansion fittings and loops for plumbing piping. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Flexible-hose packless expansion joints.
 - b. Metal-bellows packless expansion joints.
 - c. Rubber packless expansion joints.
 - d. Grooved-joint expansion joints.
 - e. Pipe loops and swing connections.
 - f. Alignment guides and anchors.

C. Performance Requirements

1. Compatibility: Products shall be suitable for piping service fluids, materials, working pressures, and temperatures.
2. Capability: Products to absorb 200 percent of maximum axial movement between anchors.

D. Submittals

1. Product Data: For each type of product indicated.
2. Delegated-Design Submittal: For each anchor and alignment guide indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - a. Design Calculations: Calculate requirements for thermal expansion of piping systems and for selecting and designing expansion joints, loops, and swing connections.
 - b. Anchor Details: Detail fabrication of each anchor indicated. Show dimensions and methods of assembly and attachment to building structure.
 - c. Alignment Guide Details: Detail field assembly and attachment to building structure.
 - d. Schedule: Indicate type, manufacturer's number, size, material, pressure rating, end connections, and location for each expansion joint.
3. Welding certificates.
4. Product Certificates: For each type of expansion joint, from manufacturer.
5. Maintenance Data: For expansion joints to include in maintenance manuals.

E. Quality Assurance

1. Welding Qualifications: Qualify procedures and personnel according to the following:
 - a. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - b. ASME Boiler and Pressure Vessel Code: Section IX.

1.2 PRODUCTS

A. Packless Expansion Joints

1. Flexible-Hose Packless Expansion Joints:
 - a. Description: Manufactured assembly with inlet and outlet elbow fittings and two flexible-metal-hose legs joined by long-radius, 180-degree return bend or center section of flexible hose.
 - b. Flexible Hose: Corrugated-metal inner hoses and braided outer sheaths.



- c. Expansion Joints for Copper Tubing NPS 2 (DN 50) and Smaller: Copper-alloy fittings with solder-joint end connections.
 - 1) Bronze hoses and single-braid bronze sheaths with 450 psig at 70 deg F (3100 kPa at 21 deg C) and 340 psig at 450 deg F (2340 kPa at 232 deg C) ratings.
 - 2) Bronze hoses and double-braid bronze sheaths with 700 psig at 70 deg F (4830 kPa at 21 deg C) and 500 psig at 450 deg F (3450 kPa at 232 deg C) ratings.
- d. Expansion Joints for Copper Tubing NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Copper-alloy fittings with threaded end connections.
 - 1) Stainless-steel hoses and single-braid, stainless-steel sheaths with 300 psig at 70 deg F (2070 kPa at 21 deg C) and 225 psig at 450 deg F (1550 kPa at 232 deg C) ratings.
 - 2) Stainless-steel hoses and double-braid, stainless-steel sheaths with 420 psig at 70 deg F (2890 kPa at 21 deg C) and 315 psig at 450 deg F (2170 kPa at 232 deg C) ratings.
- e. Expansion Joints for Steel Piping NPS 2 (DN 50) and Smaller: Stainless-steel fittings with threaded end connections.
 - 1) Stainless-steel hoses and single-braid, stainless-steel sheaths with 450 psig at 70 deg F (3100 kPa at 21 deg C) and 325 psig at 600 deg F (2250 kPa at 315 deg C) ratings.
 - 2) Stainless-steel hoses and double-braid, stainless-steel sheaths with 700 psig at 70 deg F (4830 kPa at 21 deg C) and 515 psig at 600 deg F (3550 kPa at 315 deg C) ratings.
- f. Expansion Joints for Steel Piping NPS 2-1/2 to NPS 6 (DN 65 to DN 150): Stainless-steel fittings with flanged end connections.
 - 1) Stainless-steel hoses and single-braid, stainless-steel sheaths with 200 psig at 70 deg F (1380 kPa at 21 deg C) and 145 psig at 600 deg F (1000 kPa at 315 deg C) ratings.
 - 2) Stainless-steel hoses and double-braid, stainless-steel sheaths with 275 psig at 70 deg F (1900 kPa at 21 deg C) and 200 psig at 600 deg F (1380 kPa at 315 deg C) ratings.
- g. Expansion Joints for Steel Piping NPS 8 to NPS 12 (DN 200 to DN 300): Stainless-steel fittings with flanged end connections.
 - 1) Stainless-steel hoses and single-braid, stainless-steel sheaths with 125 psig at 70 deg F (860 kPa at 21 deg C) and 90 psig at 600 deg F (625 kPa at 315 deg C) ratings.
 - 2) Stainless-steel hoses and double-braid, stainless-steel sheaths with 165 psig at 70 deg F (1130 kPa at 21 deg C) and 120 psig at 600 deg F (830 kPa at 315 deg C) ratings.
- 2. Metal-Bellows Packless Expansion Joints:
 - a. Standards: ASTM F 1120 and EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."
 - b. Type: Circular, corrugated bellows with external tie rods.
 - c. Minimum Pressure Rating: 150 psig (1035 kPa) **OR** 175 psig (1200 kPa), **as directed**, unless otherwise indicated.
 - d. Configuration: Single joint **OR** Single joint with base and double joint with base, **as directed**, class(es) unless otherwise indicated.
 - e. Expansion Joints for Copper Tubing: Single **OR** Multi, **as directed**, -ply phosphor-bronze bellows, copper pipe ends, and brass shrouds.
 - 1) End Connections for Copper Tubing NPS 2 (DN 50) and Smaller: Solder joint or threaded.
 - 2) End Connections for Copper Tubing NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Solder joint or threaded.
 - 3) End Connections for Copper Tubing NPS 5 (DN 125) and Larger: Flanged.
- 3. Rubber Packless Expansion Joints:



- a. Standards: ASTM F 1123 and FSA's "Technical Handbook: Non-Metallic Expansion Joints and Flexible Pipe Connectors."
 - b. Material: Fabric-reinforced rubber complying with FSA-NMEJ-703.
 - c. Arch Type: Single **OR** Multiple, **as directed**, arches with external control rods, **as directed**.
 - d. Spherical Type: Single **OR** Multiple, **as directed** spheres with external control rods, **as directed**.
 - e. Minimum Pressure Rating for NPS 1-1/2 to NPS 4 (DN 40 to DN 100): 150 psig (1035 kPa) at 220 deg F (104 deg C).
 - f. Minimum Pressure Rating for NPS 5 and NPS 6 (DN 125 and DN 150): 140 psig (966 kPa) at 200 deg F (93 deg C).
 - g. Minimum Pressure Rating for NPS 8 to NPS 12 (DN 200 to DN 300): 140 psig (966 kPa) at 180 deg F (82 deg C).
 - h. Material for Fluids Containing Acids, Alkalies, or Chemicals: BR **OR** CSM **OR** EPDM, **as directed**.
 - i. Material for Fluids Containing Gas, Hydrocarbons, or Oil: Buna-N **OR** CR, **as directed**.
 - j. Material for Water: BR **OR** Buna-N **OR** CR **OR** CSM **OR** EPDM **OR** NR, **as directed**.
 - k. End Connections: Full-faced, integral steel flanges with steel retaining rings.
- B. Grooved-Joint Expansion Joints
1. Description: Factory-assembled expansion joint made of several grooved-end pipe nipples, couplings, and grooved joints.
 2. Standard: AWWA C606, for grooved joints.
 3. Nipples: Galvanized, **as directed**, ASTM A 53/A 53M, Schedule 40, Type E or S, steel pipe with grooved ends.
 4. Couplings: Five **OR** Seven **OR** 10 **OR** 12, **as directed**, flexible type for steel-pipe dimensions. Include ferrous housing sections, Buna-N gasket suitable for diluted acid, alkaline fluids, and cold and hot water **OR** EPDM gasket suitable for cold and hot water, **as directed**, and bolts and nuts.
- C. Alignment Guides And Anchors
1. Alignment Guides:
 - a. Description: Steel, factory-fabricated alignment guide, with bolted two-section outer cylinder and base for attaching to structure; with two-section guiding spider for bolting to pipe.
 2. Anchor Materials:
 - a. Steel Shapes and Plates: ASTM A 36/A 36M.
 - b. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel hex head.
 - c. Washers: ASTM F 844, steel, plain, flat washers.
 - d. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, with tension and shear capacities appropriate for application.
 - 1) Stud: Threaded, zinc-coated carbon steel.
 - 2) Expansion Plug: Zinc-coated steel.
 - 3) Washer and Nut: Zinc-coated steel.
 - e. Chemical Fasteners: Insert-type-stud, bonding-system anchor for use with hardened portland cement concrete, with tension and shear capacities appropriate for application.
 - 1) Bonding Material: ASTM C 881/C 881M, Type IV, Grade 3, two-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.
 - 2) Stud: ASTM A 307, zinc-coated carbon steel with continuous thread on stud unless otherwise indicated.
 - 3) Washer and Nut: Zinc-coated steel.



1.3 EXECUTION

- A. Expansion-Joint Installation
1. Install expansion joints of sizes matching sizes of piping in which they are installed.
 2. Install metal-bellows expansion joints according to EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."
 3. Install rubber packless expansion joints according to FSA-NMEJ-702.
 4. Install grooved-joint expansion joints to grooved-end steel piping
- B. Pipe Loop And Swing Connection Installation
1. Install pipe loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.
 2. Connect risers and branch connections to mains with at least five pipe fittings including tee in main.
 3. Connect risers and branch connections to terminal units with at least four pipe fittings including tee in riser.
 4. Connect mains and branch connections to terminal units with at least four pipe fittings including tee in main.
- C. Alignment-Guide And Anchor Installation
1. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.
 2. Install one **OR** two, **as directed**, guide(s) on each side of pipe expansion fittings and loops. Install guides nearest to expansion joint not more than four pipe diameters from expansion joint.
 3. Attach guides to pipe and secure guides to building structure.
 4. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.
 5. Anchor Attachments:
 - a. Anchor Attachment to Black-Steel Pipe: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - b. Anchor Attachment to Galvanized-Steel Pipe: Attach with pipe hangers. Use MSS SP-69, Type 42, riser clamp welded to anchor.
 - c. Anchor Attachment to Copper Tubing: Attach with pipe hangers. Use MSS SP-69, Type 24, U-bolts bolted to anchor.
 6. Fabricate and install steel anchors by welding steel shapes, plates, and bars. Comply with ASME B31.9 and AWS D1.1/D1.1M.
 - a. Anchor Attachment to Steel Structural Members: Attach by welding.
 - b. Anchor Attachment to Concrete Structural Members: Attach by fasteners. Follow fastener manufacturer's written instructions.
 7. Use grout to form flat bearing surfaces for guides and anchors attached to concrete.

END OF SECTION 23 05 16 00



SECTION 23 05 16 00a - EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for expansion fittings and loops for HVAC piping. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Flexible, ball-joint, packed expansion joints.
 - b. Slip-joint packed expansion joints.
 - c. Expansion-compensator packless expansion joints.
 - d. Flexible-hose packless expansion joints.
 - e. Metal-bellows packless expansion joints.
 - f. Rubber packless expansion joints.
 - g. Grooved-joint expansion joints.
 - h. Pipe loops and swing connections.
 - i. Alignment guides and anchors.

C. Performance Requirements

1. Compatibility: Products shall be suitable for piping service fluids, materials, working pressures, and temperatures.
2. Capability: Products to absorb 200 percent of maximum axial movement between anchors.

D. Submittals

1. Product Data: For each type of product indicated.
2. Delegated-Design Submittal: For each anchor and alignment guide indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - a. Design Calculations: Calculate requirements for thermal expansion of piping systems and for selecting and designing expansion joints, loops, and swing connections.
 - b. Anchor Details: Detail fabrication of each anchor indicated. Show dimensions and methods of assembly and attachment to building structure.
 - c. Alignment Guide Details: Detail field assembly and attachment to building structure.
 - d. Schedule: Indicate type, manufacturer's number, size, material, pressure rating, end connections, and location for each expansion joint.
3. Welding certificates.
4. Product Certificates: For each type of expansion joint, from manufacturer.
5. Maintenance Data: For expansion joints to include in maintenance manuals.

E. Quality Assurance

1. Welding Qualifications: Qualify procedures and personnel according to the following:
 - a. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - b. ASME Boiler and Pressure Vessel Code: Section IX.

1.2 PRODUCTS

A. Packed Expansion Joints

1. Flexible, Ball-Joint, Packed Expansion Joints:



- a. Standards: ASME Boiler and Pressure Vessel Code: Section II, "Materials"; and ASME B31.9, "Building Services Piping," for materials and design of pressure-containing parts and bolting.
 - b. Material: Carbon-steel assembly with asbestos-free composition packing.
 - c. Design: For 360-degree rotation and angular deflection.
 - d. Minimum Pressure Rating: 250 psig at 400 deg F (1725 kPa at 204 deg C).
 - e. Angular Deflection for NPS 6 (DN 150) and Smaller: 30 degree minimum.
 - f. Angular Deflection for NPS 8 (DN 200) and Larger: 15 degree minimum.
 - g. End Connections for NPS 2 (DN 50) and Smaller: Threaded.
 - h. End Connections for NPS 2-1/2 (DN 65) and Larger: Flanged.
2. Slip-Joint Packed Expansion Joints:
 - a. Standard: ASTM F 1007.
 - b. Material: Carbon steel with asbestos-free PTFE packing.
 - c. Design: With internal guide and injection device for repacking under pressure. Include drip connection if used for steam piping.
 - d. Configuration: Single joint **OR** Single joint with base and double joint with base, **as directed**, class(es) unless otherwise indicated.
 - e. End Connections: Flanged or weld ends to match piping system.
- B. Packless Expansion Joints
1. Metal, Expansion-Compensator Packless Expansion Joints:
 - a. Minimum Pressure Rating: 150 psig (1035 kPa) **OR** 175 psig (1200 kPa), **as directed**, unless otherwise indicated.
 - b. Configuration for Copper Tubing: Two-ply, phosphor-bronze bellows with copper pipe ends.
 - 1) End Connections for Copper Tubing NPS 2 (DN 50) and Smaller: Solder joint or threaded.
 - 2) End Connections for Copper Tubing NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Threaded.
 - c. Configuration for Steel Piping: Two-ply, stainless-steel bellows; steel-pipe end connections; and carbon-steel shroud.
 - 1) End Connections for Steel Pipe NPS 2 (DN 50) and Smaller: Threaded.
 - 2) End Connections for Steel Pipe NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged **OR** Weld, **as directed**.
 2. Rubber, Expansion-Compensator Packless Expansion Joints:
 - a. Material: Twin reinforced-rubber spheres with external restraining cables.
 - b. Minimum Pressure Rating: 150 psig at 170 deg F (1035 kPa at 77 deg C) unless otherwise indicated.
 - c. End Connections for NPS 2 (DN 50) and Smaller: Threaded.
 3. Flexible-Hose Packless Expansion Joints:
 - a. Description: Manufactured assembly with inlet and outlet elbow fittings and two flexible-metal-hose legs joined by long-radius, 180-degree return bend or center section of flexible hose.
 - b. Flexible Hose: Corrugated-metal inner hoses and braided outer sheaths.
 - c. Expansion Joints for Copper Tubing NPS 2 (DN 50) and Smaller: Copper-alloy fittings with solder-joint end connections.
 - 1) Bronze hoses and single-braid bronze sheaths with 450 psig at 70 deg F (3100 kPa at 21 deg C) and 340 psig at 450 deg F (2340 kPa at 232 deg C) ratings.
 - 2) Bronze hoses and double-braid bronze sheaths with 700 psig at 70 deg F (4830 kPa at 21 deg C) and 500 psig at 450 deg F (3450 kPa at 232 deg C) ratings.
 - d. Expansion Joints for Copper Tubing NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Copper-alloy fittings with threaded end connections.
 - 1) Stainless-steel hoses and single-braid, stainless-steel sheaths with 300 psig at 70 deg F (2070 kPa at 21 deg C) and 225 psig at 450 deg F (1550 kPa at 232 deg C) ratings.



- 2) Stainless-steel hoses and double-braid, stainless-steel sheaths with 420 psig at 70 deg F (2890 kPa at 21 deg C) and 315 psig at 450 deg F (2170 kPa at 232 deg C) ratings.
- e. Expansion Joints for Steel Piping NPS 2 (DN 50) and Smaller: Carbon-steel fittings with threaded end connections.
 - 1) Stainless-steel hoses and single-braid, stainless-steel sheaths with 450 psig at 70 deg F (3100 kPa at 21 deg C) and 325 psig at 600 deg F (2250 kPa at 315 deg C) ratings.
 - 2) Stainless-steel hoses and double-braid, stainless-steel sheaths with 700 psig at 70 deg F (4830 kPa at 21 deg C) and 515 psig at 600 deg F (3550 kPa at 315 deg C) ratings.
- f. Expansion Joints for Steel Piping NPS 2-1/2 to NPS 6 (DN 65 to DN 150): Carbon-steel fittings with flanged **OR** weld, **as directed**, end connections.
 - 1) Stainless-steel hoses and single-braid, stainless-steel sheaths with 200 psig at 70 deg F (1380 kPa at 21 deg C) and 145 psig at 600 deg F (1000 kPa at 315 deg C) ratings.
 - 2) Stainless-steel hoses and double-braid, stainless-steel sheaths with 275 psig at 70 deg F (1900 kPa at 21 deg C) and 200 psig at 600 deg F (1380 kPa at 315 deg C) ratings.
- g. Expansion Joints for Steel Piping NPS 8 to NPS 12 (DN 200 to DN 300): Carbon-steel fittings with flanged **OR** weld, **as directed**, end connections.
 - 1) Stainless-steel hoses and single-braid, stainless-steel sheaths with 125 psig at 70 deg F (860 kPa at 21 deg C) and 90 psig at 600 deg F (625 kPa at 315 deg C) ratings.
 - 2) Stainless-steel hoses and double-braid, stainless-steel sheaths with 165 psig at 70 deg F (1130 kPa at 21 deg C) and 120 psig at 600 deg F (830 kPa at 315 deg C) ratings.
- h. Expansion Joints for Steel Piping NPS 14 (DN 350) and Larger: Carbon-steel fittings with flanged **OR** weld, **as directed**, end connections.
 - 1) Stainless-steel hoses and double-braid, stainless-steel sheaths with 165 psig at 70 deg F (1130 kPa at 21 deg C) and 120 psig at 600 deg F (830 kPa at 315 deg C) ratings.
4. Metal-Bellows Packless Expansion Joints:
 - a. Standards: ASTM F 1120 and EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."
 - b. Type: Circular, corrugated bellows with external tie rods.
 - c. Minimum Pressure Rating: 150 psig (1035 kPa) **OR** 175 psig (1200 kPa), **as directed**, unless otherwise indicated.
 - d. Configuration: Single joint **OR** Single joint with base and double joint with base, **as directed**, class(es) unless otherwise indicated.
 - e. Expansion Joints for Copper Tubing: Single **OR** Multi, **as directed**,-ply phosphor-bronze bellows, copper pipe ends, and brass shrouds.
 - 1) End Connections for Copper Tubing NPS 2 (DN 50) and Smaller: Solder joint or threaded.
 - 2) End Connections for Copper Tubing NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Solder joint or threaded.
 - 3) End Connections for Copper Tubing NPS 5 (DN 125) and Larger: Flanged.
 - f. Expansion Joints for Steel Piping: Single **OR** Multi, **as directed**,-ply stainless-steel bellows, steel pipe ends, and carbon-steel shroud.
 - 1) End Connections for Steel Pipe NPS 2 (DN 50) and Smaller: Threaded.
 - 2) End Connections for Steel Pipe NPS 2-1/2 (DN 65) and Larger: Flanged **OR** Weld, **as directed**.
5. Rubber Packless Expansion Joints:
 - a. Standards: ASTM F 1123 and FSA's "Technical Handbook: Non-Metallic Expansion Joints and Flexible Pipe Connectors."
 - b. Material: Fabric-reinforced rubber complying with FSA-NMEJ-703.



- c. Arch Type: Single **OR** Multiple, **as directed**, arches with external control rods, **as directed**.
- d. Spherical Type: Single **OR** Multiple, **as directed**, spheres with external control rods, **as directed**.
- e. Minimum Pressure Rating for NPS 1-1/2 to NPS 4 (DN 40 to DN 100): 150 psig (1035 kPa) at 220 deg F (104 deg C).
- f. Minimum Pressure Rating for NPS 5 and NPS 6 (DN 125 and DN 150): 140 psig (966 kPa) at 200 deg F (93 deg C).
- g. Minimum Pressure Rating for NPS 8 to NPS 12 (DN 200 to DN 300): 140 psig (966 kPa) at 180 deg F (82 deg C).
- h. Material for Fluids Containing Acids, Alkalies, or Chemicals: BR **OR** CSM **OR** EPDM, **as directed**.
- i. Material for Fluids Containing Gas, Hydrocarbons, or Oil: Buna-N **OR** CR, **as directed**.
- j. Material for Water: BR **OR** Buna-N **OR** CR **OR** CSM **OR** EPDM **OR** NR, **as directed**.
- k. End Connections: Full-faced, integral steel flanges with steel retaining rings.

C. Grooved-Joint Expansion Joints

- 1. Description: Factory-assembled expansion joint made of several grooved-end pipe nipples, couplings, and grooved joints.
- 2. Standard: AWWA C606, for grooved joints.
- 3. Nipples: Galvanized, **as directed**, ASTM A 53/A 53M, Schedule 40, Type E or S, steel pipe with grooved ends.
- 4. Couplings: Five **OR** Seven **OR** 10 **OR** 12, **as directed**, flexible type for steel-pipe dimensions. Include ferrous housing sections, Buna-N gasket suitable for diluted acid, alkaline fluids, and cold and hot water **OR** EPDM gasket suitable for cold and hot water, **as directed**, and bolts and nuts.

D. Alignment Guides And Anchors

- 1. Alignment Guides:
 - a. Description: Steel, factory-fabricated alignment guide, with bolted two-section outer cylinder and base for attaching to structure; with two-section guiding spider for bolting to pipe.
- 2. Anchor Materials:
 - a. Steel Shapes and Plates: ASTM A 36/A 36M.
 - b. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel hex head.
 - c. Washers: ASTM F 844, steel, plain, flat washers.
 - d. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, with tension and shear capacities appropriate for application.
 - 1) Stud: Threaded, zinc-coated carbon steel.
 - 2) Expansion Plug: Zinc-coated steel.
 - 3) Washer and Nut: Zinc-coated steel.
 - e. Chemical Fasteners: Insert-type-stud, bonding-system anchor for use with hardened portland cement concrete, with tension and shear capacities appropriate for application.
 - 1) Bonding Material: ASTM C 881/C 881M, Type IV, Grade 3, two-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.
 - 2) Stud: ASTM A 307, zinc-coated carbon steel with continuous thread on stud unless otherwise indicated.
 - 3) Washer and Nut: Zinc-coated steel.

1.3 EXECUTION

A. Expansion-Joint Installation

- 1. Install expansion joints of sizes matching sizes of piping in which they are installed.



2. Install packed-type expansion joints with packing suitable for fluid service.
 3. Install metal-bellows expansion joints according to EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."
 4. Install rubber packless expansion joints according to FSA-NMEJ-702.
 5. Install grooved-joint expansion joints to grooved-end steel piping
- B. Pipe Loop And Swing Connection Installation
1. Install pipe loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.
 2. Connect risers and branch connections to mains with at least five pipe fittings including tee in main.
 3. Connect risers and branch connections to terminal units with at least four pipe fittings including tee in riser.
 4. Connect mains and branch connections to terminal units with at least four pipe fittings including tee in main.
- C. Alignment-Guide And Anchor Installation
1. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.
 2. Install one **OR** two, **as directed**, guide(s) on each side of pipe expansion fittings and loops. Install guides nearest to expansion joint not more than four pipe diameters from expansion joint.
 3. Attach guides to pipe and secure guides to building structure.
 4. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.
 5. Anchor Attachments:
 - a. Anchor Attachment to Steel Pipe: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - b. Anchor Attachment to Copper Tubing: Attach with pipe hangers. Use MSS SP-69, Type 24, U-bolts bolted to anchor.
 6. Fabricate and install steel anchors by welding steel shapes, plates, and bars. Comply with ASME B31.9 and AWS D1.1/D1.1M.
 - a. Anchor Attachment to Steel Structural Members: Attach by welding.
 - b. Anchor Attachment to Concrete Structural Members: Attach by fasteners. Follow fastener manufacturer's written instructions.
 7. Use grout to form flat bearing surfaces for guides and anchors attached to concrete.

END OF SECTION 23 05 16 00a



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Task	Specification	Specification Description
23 05 19 00	22 05 23 00	Piped Utilities Basic Materials And Methods
23 05 19 00	07 63 00 00	Common Work Results for Fire Suppression
23 05 19 00	07 63 00 00a	Common Work Results for Plumbing
23 05 19 00	07 63 00 00b	Common Work Results for HVAC
23 05 19 00	21 05 19 00a	Meters and Gages for Plumbing Piping
23 05 19 00	21 05 19 00b	Meters and Gages for HVAC Piping
23 05 23 00	01 22 16 00	No Specification Required
23 05 23 00	22 05 23 00	Piped Utilities Basic Materials And Methods
23 05 23 00	21 05 19 00	Water Distribution
23 05 23 00	22 05 23 00a	General-Duty Valves for Plumbing Piping
23 05 23 00	22 05 23 00b	General-Duty Valves for HVAC Piping
23 05 23 00	22 05 76 00a	Storm Drainage Piping Specialties
23 05 23 00	22 11 16 00c	Hydronic Piping
23 05 23 00	22 11 16 00e	Refrigerant Piping
23 05 23 00	22 11 23 39a	Hydronic Pumps
23 05 23 00	22 11 16 00f	General-Service Compressed-Air Piping



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SECTION 23 05 29 00 - STEAM DISTRIBUTION

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for steam distribution. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes underground piping outside the building for distribution of steam and condensate.

C. Performance Requirements

1. Provide components and installation capable of producing steam piping systems with the following minimum working-pressure ratings:
 - a. Steam Piping: 15 psig (104 kPa) **OR** 125 psig (860 kPa), **as directed**.
 - b. Condensate Piping: 100 psig (690 kPa).

D. Submittals

1. Product Data:
2. Shop Drawings:
3. Welding certificates.
4. Source quality-control test reports.
5. Field quality-control test reports.

E. Quality Assurance

1. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.
2. ASME Compliance: Comply with ASME B31.1, "Power Piping" **OR** ASME B31.9, "Building Services Piping," **as directed**, for materials, products, and installation.
3. ASME Compliance: Safety valves and pressure vessels shall bear appropriate ASME labels.

F. Project Conditions

1. Existing Utilities: Do not interrupt utilities serving facilities occupied by the Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - a. Notify the Owner no fewer than two days in advance of proposed utility interruptions.
 - b. Do not proceed with utility interruptions without written permission.

1.2 PRODUCTS

A. Piping Materials

1. Refer to Article 1.3 "Piping Application" for applications of pipes, tubes, fittings, and joining methods.
2. Refer to Division 33 Section "Common Work Results For Utilities" for commonly used joining materials.

B. Steel Pipes And Fittings

1. Steel Pipe: ASTM A 53/A 53M, Type E, Grade A, Standard Weight; with plain ends.
2. Nipples: ASTM A 733, Standard Weight, seamless, carbon-steel pipe complying with ASTM A 53/A 53M.



3. Malleable-Iron, Threaded Fittings: ASME B16.3, Classes 150 and 300, with threads according to ASME B1.20.1.
4. Cast-Iron, Threaded Fittings: ASME B16.4, Classes 125 and 250, standard pattern, with threads according to ASME B1.20.1.
5. Steel Welding Fittings: ASME B16.9 and ASTM A 234/A 234M, seamless or welded.

C. Conduit Piping

1. Description: Factory-fabricated and -assembled, airtight and watertight, drainable, pressure-tested piping with conduit, inner pipe supports, and insulated carrier piping. Fabricate so insulation can be dried in place by forcing dry air through conduit.
2. Carrier Pipe: Steel pipe complying with ASTM A 53/A 53M, Type E, Grade A with beveled **OR** socket, **as directed**, ends for welded joints.
3. Carrier Pipe Insulation:
 - a. Mineral-Wool Pipe Insulation: ASTM C 547, Type I, molded.
 - 1) Apparent Thermal Conductivity (k-Value): 0.31 at 200 deg F (0.044 at 93 deg C) mean temperature.
 - 2) Density: Maximum 10 lb/cu. ft. (160 kg/cu. m) average.
 - 3) Compressive Strength: 10 psig (69 kPa) minimum at 5 percent deformation.
 - 4) Bands: ASTM A 666, Type 304, stainless steel, 3/4 inch (19 mm) wide, 0.020 inch (0.5 mm) thick.
 - b. Calcium Silicate Pipe Insulation: ASTM C 533, Type I; preformed, incombustible, inorganic, with non-asbestos fibrous reinforcement.
 - 1) Thermal Conductivity (k-Value): 0.60 at 500 deg F (0.087 at 260 deg C).
 - 2) Dry Density: 15 lb/cu. ft. (240 kg/cu. m) maximum.
 - 3) Compressive Strength: 60 psig (414 kPa) minimum at 5 percent deformation.
 - 4) Bands: ASTM A 666, Type 304, stainless steel, 3/4 inch (19 mm) wide, 0.020 inch (0.5 mm) thick.
 - c. Polyisocyanurate Foam Pipe Insulation: ASTM C 591, preformed, rigid, cellular.
 - 1) Thermal Conductivity (k-Value): 0.14 at 75 deg F (0.020 at 24 deg C).
 - 2) Service Temperature: Minus 250 to plus 400 deg F (Minus 156 to plus 204 deg C).
 - 3) Moisture Absorption: ASTM D 2842, maximum 0.054 percent by volume.
 - 4) Minimum 90 percent closed cell.
 - 5) Dry Density: 2 lb/cu. ft. (32 kg/cu. m) maximum.
 - 6) Compressive Strength: 35 psig (242 kPa) minimum at 5 percent deformation.
 - 7) Water-Vapor Transmission: 1.26 perm inches (1.83 ng/Pa x s x m) according to ASTM E 96.
 - d. Polyurethane Foam Pipe Insulation: ASTM C 591, preformed, rigid, cellular.
 - 1) Thermal Conductivity (k-Value): 0.13 at 75 deg F (0.019 at 24 deg C).
 - 2) Service Temperature: Minus 250 to plus 200 deg F (Minus 156 to plus 93 deg C).
 - 3) Moisture Absorption: ASTM D 2842, maximum 0.054 percent by volume.
 - 4) Minimum 90 percent closed cell.
 - 5) Dry Density: 2 lb/cu. ft. (32 kg/cu. m) maximum.
 - 6) Compressive Strength: 35 psig (242 kPa) minimum at 5 percent deformation.
 - 7) Water-Vapor Transmission: 1.26 perm inches (1.83 ng/Pa x s x m) according to ASTM E 96.
4. Minimum Clearance:
 - a. Between Carrier Pipe Insulation and Conduit: 1 inch (25 mm).
 - b. Between Insulation of Multiple Carrier Pipes: 3/16 inch (4.75 mm).
 - c. Between Bottom of Carrier Pipe Insulation and Conduit: 1 inch (25 mm).
 - d. Between Bottom of Bare, Carrier Pipe and Casing: 1-3/8 inches (35 mm).
5. Conduit: Spiral wound, steel. Finish conduit with 2 coats of fusion-bonded epoxy, minimum 20 mils (0.50 mm) thick. Cover with polyurethane foam insulation with a high-density polyethylene jacket; thickness indicated in Part 1.3 "Piping Application" Article, **as directed**.
6. Conduit: Spiral wound, bare steel. Cover with polyurethane foam insulation with a high-density polyethylene jacket; thickness indicated in Part 1.3 "Piping Application" Article.



7. Carrier Piping Supports within Conduit: Corrugated galvanized steel with a maximum spacing of 10 feet (3 m).
8. Fittings: Factory-fabricated and -insulated elbows and tees. Elbows may be bent pipe equal to carrier pipe. Tees shall be factory fabricated and insulated, and shall be compatible with the carrier pipe.
9. Expansion Offsets and Loops: Size casing to contain piping expansion.
10. Conduit accessories include the following:
 - a. Water Shed: Terminal end protector for carrier pipes entering building through floor, 3 inches (75 mm) deep and 2 inches (50 mm) larger than casing; terminate casing 20 inches (500 mm) above the floor level.
 - b. Guides and Anchors: Steel plate welded to carrier pipes and to casing, complete with vent and drainage openings inside casing.
 - c. End Seals: Steel plate welded to carrier pipes and to casing, complete with drain and vent openings on vertical centerline.
 - d. Gland Seals: Packed stuffing box and gland follower mounted on steel plate, welded to end of casing, permitting axial movement of carrier piping, with drain and vent connections on vertical centerline.
 - e. Joint Kit: Half-shell, pourable or split insulation and shrink-wrap sleeve.
11. Source Quality Control: Factory test the conduit to 15 psig (105 kPa) for a minimum of 2 minutes with no change in pressure. Factory test the carrier pipe to 150 percent of the operating pressure of system. Furnish test certificates.

D. Cased Piping

1. Description: Factory-fabricated piping with carrier pipe, insulation, and casing.
2. Carrier Pipe: Steel pipe complying with ASTM A 53/A 53M, Type E, Grade A with beveled **OR** socket, **as directed**, ends for welded joints.
3. Carrier Pipe Insulation:
 - a. Polyurethane Foam Pipe Insulation: ASTM C 591, preformed, rigid, cellular.
 - 1) Thermal Conductivity (k-Value): 0.13 at 75 deg F (0.019 at 24 deg C).
 - 2) Service Temperature: Minus 250 to plus 200 deg F (Minus 156 to plus 93 deg C).
 - 3) Moisture Absorption: ASTM D 2842, maximum 0.054 percent by volume.
 - 4) Minimum 90 percent closed cell.
 - 5) Dry Density: 2 lb/cu. ft. (32 kg/cu. m) maximum.
 - 6) Compressive Strength: 35 psig (242 kPa) minimum at 5 percent deformation.
 - 7) Water-Vapor Transmission: 1.26 perm inches (1.83 ng/Pa x s x m) according to ASTM E 96.
4. Casing: High-density polyethylene **OR** Filament-wound, fiberglass-reinforced polyester resin **OR** PVC, **as directed**.
5. Casing accessories include the following:
 - a. Joint Kit: Half-shell, pourable or split insulation, casing sleeve, and shrink-wrap sleeve.
 - b. Expansion Blanket: Elastomeric foam, formed to fit over piping.
 - c. End Seals: Shrink wrap the casing material to seal watertight around casing and carrier pipe.
6. Source Quality Control: Factory test the carrier pipe to 150 percent of the operating pressure of system. Furnish test certificates.

E. Loose-Fill Insulation

1. Granular, Loose-Fill Insulation: Inorganic, nontoxic, nonflammable, sodium potassium aluminum silicate with calcium carbonate filler. Include chemical treatment that renders insulation hydrophobic.
 - a. Thermal Conductivity (k-Value): 0.60 at 175 deg F (0.087 at 79 deg C) and 0.65 at 300 deg F (0.094 at 149 deg C).
 - b. Application Temperature Range: 35 to 800 deg F (2 to 426 deg C).
 - c. Dry Density: 40 to 42 lb/cu. ft. (640 to 672 kg/cu. m).
 - d. Strength: 12,000 lb/sq. ft. (58 600 kg/sq. m).



2. Powder, Loose-Fill Insulation: Inert, nontoxic, nonflammable, calcium carbonate particles. Include chemical treatment that renders insulation hydrophobic.
 - a. Thermal Conductivity (k-Value): ASTM C 177, 0.58 at 100 deg F (0.084 at 37 deg C) and 0.68 at 300 deg F (0.098 at 149 deg C).
 - b. Application Temperature Range: Minus 273 to plus 480 deg F (Minus 169 to plus 250 deg C).
 - c. Dry Density: Approximately 60 lb/cu. ft. (960 kg/cu. m).
 - d. Strength: 12,000 lb/sq. ft. (58 600 kg/sq. m).

1.3 EXECUTION

- A. Earthwork: Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.
- B. Piping Application
 1. Steam Piping: Schedule 40 **OR** Schedule 80, **as directed**, steel pipe with cast-iron, threaded fittings and threaded **OR** steel fittings and welded **OR** ductile-iron, grooved-end fittings and mechanical, **as directed**, joints; granular **OR** powder, **as directed**, loose-fill insulation.
 2. Steam Piping: Conduit piping with mineral-wool **OR** calcium silicate **OR** polyisocyanurate **OR** polyurethane, **as directed**, carrier-pipe insulation and with coated, **unless directed otherwise to be coated and insulated**, conduit.
 - a. Insulation Thickness: 1 inch (25 mm) **OR** 2 inches (50 mm), **as directed**.
 3. Condensate Piping: Schedule 40 **OR** Schedule 80, **as directed**, steel pipe with cast-iron, threaded fittings and threaded **OR** steel welding fittings and welded **OR** ductile-iron, grooved-end fittings and mechanical, **as directed**, joints; granular **OR** powder, **as directed**, loose-fill insulation.
 4. Condensate Piping: Conduit piping with mineral-wool **OR** calcium silicate **OR** polyisocyanurate **OR** polyurethane, **as directed**, carrier-pipe insulation and with coated **OR** coated and insulated, **as directed**, conduit.
 - a. Insulation Thickness: 1 inch (25 mm) **OR** 2 inches (50 mm), **as directed**.
 5. Condensate Piping: Cased piping with polyurethane carrier-pipe insulation.
- C. Piping Installation
 1. General Locations and Arrangements: Drawings indicate general location and arrangement of piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, unless deviations to layout are approved.
 2. Remove any standing water in the bottom of trench.
 3. Bed the pipe on a minimum 6-inch (150-mm) layer of granular fill material with a minimum 6-inch (150-mm) clearance between the pipes.
 4. Do not insulate piping or backfill piping trench until field quality-control testing has been completed and results approved.
 5. Install piping at uniform grade of 0.2 percent downward in direction of flow or as indicated.
 6. Install condensate piping at uniform grade of 0.4 percent downward in direction of flow.
 7. Install components with pressure rating equal to or greater than system operating pressure.
 8. Install piping free of sags and bends.
 9. Install fittings for changes in direction and branch connections.
 10. Refer to Division 23 Section "Common Work Results For Hvac" for sleeves and mechanical sleeve seals through exterior building walls.
 11. Secure anchors with concrete thrust blocks. Concrete is specified in Division 03 Section "Cast-in-place Concrete".
 12. Connect to steam and condensate piping where it passes through the building wall. Steam and condensate piping inside the building is specified in Division 23 Section "Steam And Condensate Heating Piping".



- D. Loose-Fill Insulation Installation
1. Do not disturb the bottom of trench, or compact and stabilize it to ensure proper support.
 2. Remove any standing water in the bottom of trench.
 3. Form insulation trench by excavation or by installing drywall side forms to establish the required height and width of the insulation.
 4. Support piping with proper pitch, separation, and clearance to backfill or side forms using temporary supporting devices that can be removed after back filling with insulation.
 5. Place insulation and backfill after field quality-control testing has been completed and results approved.
 6. Apply bitumastic coating to carbon-steel anchors and guides. Pour concrete thrust blocks and anchors. Refer to Division 03 Section "Cast-in-place Concrete" for concrete and reinforcement.
 7. Wrap piping at expansion loops and offsets with mineral-wool insulation of thickness appropriate for calculated expansion amount.
 8. Pour loose-fill insulation to required dimension agitating insulation to eliminate voids around piping.
 9. Remove temporary hangers and supports.
 10. Cover loose-fill insulation with polyethylene sheet a minimum of 4 mils (0.10 mm) thick, and empty loose-fill insulation bags on top.
 11. Manually backfill 6 inches (150 mm) of clean backfill. If mechanical compaction is required manually backfill to 12 inches (300 mm) before using mechanical-compaction equipment.
- E. Joint Construction
1. Refer to Division 33 Section "Common Work Results For Utilities" for basic piping joint construction.
 2. Keyed-Coupling Joints: Cut- or roll-groove pipes. Assemble joints with keyed couplings, gaskets, lubricant, and bolts.
 3. Conduit and Cased Piping Joints: Assemble sections and finish joints with pourable or split insulation, exterior jacket sleeve, and apply shrink-wrap seals as required by manufacturer's written installation instructions.
- F. Identification: Install continuous plastic underground warning tapes during back filling of trenches for underground steam and condensate distribution piping. Locate 6 to 8 inches (150 to 200 mm) below finished grade, directly over piping. Refer to Division 31 Section "Earth Moving" for warning-tape materials and devices and their installation.
- G. Field Quality Control
1. Prepare steam and condensate piping for testing according to ASME B31.1 and ASME B31.9 and as follows:
 - a. Leave joints, including welds, uninsulated and exposed for examination during test.
 - b. Isolate equipment. Do not subject equipment to test pressure.
 - c. Install relief valve set at pressure no more than one-third higher than test pressure.
 - d. Fill system with temperature water. Where there is risk of freezing, air or a safe, compatible liquid may be used.
 - e. Use vents installed at high points to release trapped air while filling system. Use drip legs installed at low points for complete removal of liquid.
 2. Test steam and condensate piping as follows:
 - a. Subject steam and condensate piping to hydrostatic test pressure that is not less than 1.5 times the design pressure.
 - b. After hydrostatic test pressure has been applied for 10 minutes, examine joints for leakage. Remake leaking joints using new materials and repeat hydrostatic test until no leaks exist.
 3. Test conduit as follows:
 - a. Seal vents and drains and subject conduit to 15 psig (105 kPa) for 4 hours with no loss of pressure. Repair leaks and retest as required.
 4. Prepare a written report of testing.



END OF SECTION 23 05 29 00



SECTION 23 05 29 00a - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for hangers and supports for plumbing piping and equipment. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Metal pipe hangers and supports.
 - b. Trapeze pipe hangers.
 - c. Fiberglass pipe hangers.
 - d. Metal framing systems.
 - e. Fiberglass strut systems.
 - f. Thermal-hanger shield inserts.
 - g. Fastener systems.
 - h. Pipe stands.
 - i. Pipe positioning systems.
 - j. Equipment supports.

C. Definitions

1. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

D. Performance Requirements

1. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 - a. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 - b. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
 - c. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

E. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:
 - a. Trapeze pipe hangers.
 - b. Metal framing systems.
 - c. Fiberglass strut systems.
 - d. Pipe stands.
 - e. Equipment supports.
3. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - a. Detail fabrication and assembly of trapeze hangers.



- b. Design Calculations: Calculate requirements for designing trapeze hangers.
4. Welding certificates.

F. Quality Assurance

1. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

1.2 PRODUCTS

A. Metal Pipe Hangers And Supports

1. Carbon-Steel Pipe Hangers and Supports:
 - a. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - b. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
 - c. Nonmetallic Coatings: Plastic coating, jacket, or liner.
 - d. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 - e. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel **OR** stainless steel, **as directed**.
2. Stainless-Steel Pipe Hangers and Supports:
 - a. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - b. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 - c. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
3. Copper Pipe Hangers:
 - a. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
 - b. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel **OR** stainless steel, **as directed**.

B. Trapeze Pipe Hangers

1. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

C. Fiberglass Pipe Hangers

1. Clevis-Type, Fiberglass Pipe Hangers:
 - a. Description: Similar to MSS SP-58, Type 1, steel pipe hanger except hanger is made of fiberglass or fiberglass-reinforced resin.
 - b. Hanger Rods: Continuous-thread rod, washer, and nuts made of fiberglass, polyurethane or stainless steel.
2. Strap-Type, Fiberglass Pipe Hangers:
 - a. Description: Similar to MSS SP-58, Type 9 or Type 10, steel pipe hanger except hanger is made of fiberglass-reinforced resin.
 - b. Hanger Rod and Fittings: Continuous-thread rod, washer, and nuts made of stainless steel.

D. Metal Framing Systems

1. MFMA Manufacturer Metal Framing Systems:
 - a. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
 - b. Standard: MFMA-4.



- c. Channels: Continuous slotted steel channel with inturned lips.
 - d. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
 - e. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel **OR** stainless steel, **as directed**.
 - f. Metallic Coating: Electroplated zinc **OR** Hot-dipped galvanized **OR** Mill galvanized **OR** In-line, hot galvanized **OR** Mechanically-deposited zinc, **as directed**.
OR
Paint Coating: Vinyl **OR** Vinyl alkyd **OR** Epoxy **OR** Polyester **OR** Acrylic **OR** Amine **OR** Alkyd, **as directed**.
OR
Plastic Coating: PVC **OR** Polyurethane **OR** Epoxy **OR** Polyester, **as directed**.
OR
Combination Coating: **<Insert coating materials in order of application>**.
2. Non-MFMA Manufacturer Metal Framing Systems:
- a. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
 - b. Standard: Comply with MFMA-4.
 - c. Channels: Continuous slotted steel channel with inturned lips.
 - d. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
 - e. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel **OR** stainless steel, **as directed**.
 - f. Coating: Zinc **OR** Paint **OR** PVC, **as directed**.
- E. Fiberglass Strut Systems
- 1. Description: Shop- or field-fabricated pipe-support assembly similar to MFMA-4 for supporting multiple parallel pipes.
 - a. Channels: Continuous slotted fiberglass or other plastic channel with inturned lips.
 - b. Channel Nuts: Fiberglass nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
 - c. Hanger Rods: Continuous-thread rod, nuts, and washer made of fiberglass **OR** stainless steel, **as directed**.
- F. Thermal-Hanger Shield Inserts
- 1. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength and vapor barrier.
 - 2. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig (688-kPa), ASTM C 552, Type II cellular glass with 100-psig (688-kPa) or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength.
 - 3. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
 - 4. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
 - 5. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.
- G. Fastener Systems
- 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated **OR** stainless-, **as directed**, steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- H. Pipe Stands



1. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
2. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
3. Low-Type, Single-Pipe Stand: One-piece plastic **OR** stainless-steel, **as directed**, base unit with plastic roller, for roof installation without membrane penetration.
4. High-Type, Single-Pipe Stand:
 - a. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
 - b. Base: Plastic **OR** Stainless steel, **as directed**.
 - c. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
 - d. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.
5. High-Type, Multiple-Pipe Stand:
 - a. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
 - b. Bases: One or more; plastic.
 - c. Vertical Members: Two or more protective-coated-steel channels.
 - d. Horizontal Member: Protective-coated-steel channel.
 - e. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.
6. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

I. Pipe Positioning Systems

1. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

J. Equipment Supports

1. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

K. Miscellaneous Materials

1. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
2. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - a. Properties: Nonstaining, noncorrosive, and nongaseous.
 - b. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

1.3 EXECUTION

A. Hanger And Support Installation

1. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
2. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - a. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.



- b. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
3. Fiberglass Pipe-Hanger Installation: Comply with applicable portions of MSS SP-69 and MSS SP-89. Install hangers and attachments as required to properly support piping from building structure.
4. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
5. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled fiberglass struts.
6. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
7. Fastener System Installation:
 - a. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - b. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
8. Pipe Stand Installation:
 - a. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
 - b. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Division 7 Section "Roof Accessories" for curbs.
9. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. See Division 15 plumbing fixture Sections for requirements for pipe positioning systems for plumbing fixtures.
10. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
11. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
12. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
13. Install lateral bracing with pipe hangers and supports to prevent swaying.
14. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
15. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
16. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
17. Insulated Piping:
 - a. Attach clamps and spacers to piping.
 - 1) Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - 2) Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - 3) Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - b. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - 1) Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
 - c. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.



- 1) Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
 - d. Shield Dimensions for Pipe: Not less than the following:
 - 1) NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
 - 2) NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
 - 3) NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
 - 4) NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
 - 5) NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.
 - e. Pipes NPS 8 (DN 200) and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
 - f. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.
- B. Equipment Supports
1. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
 2. Grouting: Place grout under supports for equipment and make bearing surface smooth.
 3. Provide lateral bracing, to prevent swaying, for equipment supports.
- C. Metal Fabrications
1. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
 2. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
 3. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 - a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - b. Obtain fusion without undercut or overlap.
 - c. Remove welding flux immediately.
 - d. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.
- D. Adjusting
1. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
 2. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).
- E. Painting
1. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - a. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).

OR

Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 9 painting Sections **OR** Section "High-Performance Coatings", **as directed**.
 2. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

**F. Hanger And Support Schedule**

1. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
2. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
3. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
4. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
5. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers and metal framing systems and attachments for general service applications.
6. Use stainless-steel pipe hangers and fiberglass pipe hangers and fiberglass strut systems and stainless-steel or corrosion-resistant attachments for hostile environment applications.
7. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
8. Use padded hangers for piping that is subject to scratching.
9. Use thermal-hanger shield inserts for insulated piping and tubing.
10. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - a. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
 - b. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F (566 deg C), pipes NPS 4 to NPS 24 (DN 100 to DN 600), requiring up to 4 inches (100 mm) of insulation.
 - c. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
 - d. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 (DN 15 to DN 600) if little or no insulation is required.
 - e. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.
 - f. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8 (DN 20 to DN 200).
 - g. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
 - h. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
 - i. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
 - j. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8 (DN 10 to DN 200).
 - k. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3 (DN 10 to DN 80).
 - l. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
 - m. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 - n. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
 - o. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
 - p. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 (DN 65 to DN 900) if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.



- q. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30 (DN 25 to DN 750), from two rods if longitudinal movement caused by expansion and contraction might occur.
 - r. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24 (DN 65 to DN 600), from single rod if horizontal movement caused by expansion and contraction might occur.
 - s. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 (DN 50 to DN 1050) if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
 - t. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 (DN 50 to DN 600) if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
 - u. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 (DN 50 to DN 750) if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
11. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
- a. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).
 - b. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.
12. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
- a. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
 - b. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
 - c. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 - d. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 - e. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.
13. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
- a. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 - b. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
 - c. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 - d. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 - e. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 - f. C-Clamps (MSS Type 23): For structural shapes.
 - g. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 - h. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 - i. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 - j. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 - k. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 - l. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:



- 1) Light (MSS Type 31): 750 lb (340 kg).
- 2) Medium (MSS Type 32): 1500 lb (680 kg).
- 3) Heavy (MSS Type 33): 3000 lb (1360 kg).
- m. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
- n. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- o. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
14. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - a. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 - b. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 - c. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
15. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - a. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 - b. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
 - c. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
 - d. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 - e. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
 - f. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
 - g. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
 - h. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - 1) Horizontal (MSS Type 54): Mounted horizontally.
 - 2) Vertical (MSS Type 55): Mounted vertically.
 - 3) Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
16. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
17. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
18. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
19. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 23 05 29 00a



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SECTION 23 05 29 00b - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for hangers and supports for HVAC piping and equipment. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Metal pipe hangers and supports.
 - b. Trapeze pipe hangers.
 - c. Fiberglass pipe hangers.
 - d. Metal framing systems.
 - e. Fiberglass strut systems.
 - f. Thermal-hanger shield inserts.
 - g. Fastener systems.
 - h. Pipe stands.
 - i. Equipment supports.

C. Definitions

1. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

D. Performance Requirements

1. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 - a. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 - b. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
 - c. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

E. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:
 - a. Trapeze pipe hangers.
 - b. Metal framing systems.
 - c. Fiberglass strut systems.
 - d. Pipe stands.
 - e. Equipment supports.
3. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - a. Detail fabrication and assembly of trapeze hangers.
 - b. Design Calculations: Calculate requirements for designing trapeze hangers.



4. Welding certificates.

F. Quality Assurance

1. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

1.2 PRODUCTS

A. Metal Pipe Hangers And Supports

1. Carbon-Steel Pipe Hangers and Supports:
 - a. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - b. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
 - c. Nonmetallic Coatings: Plastic coating, jacket, or liner.
 - d. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 - e. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel **OR** stainless steel, **as directed**.
2. Stainless-Steel Pipe Hangers and Supports:
 - a. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - b. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 - c. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
3. Copper Pipe Hangers:
 - a. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
 - b. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel **OR** stainless steel, **as directed**.

B. Trapeze Pipe Hangers

1. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

C. Fiberglass Pipe Hangers

1. Clevis-Type, Fiberglass Pipe Hangers:
 - a. Description: Similar to MSS SP-58, Type 1, steel pipe hanger except hanger is made of fiberglass or fiberglass-reinforced resin.
 - b. Hanger Rods: Continuous-thread rod, washer, and nuts made of fiberglass, polyurethane or stainless steel.
2. Strap-Type, Fiberglass Pipe Hangers:
 - a. Description: Similar to MSS SP-58, Type 9 or Type 10, steel pipe hanger except hanger is made of fiberglass-reinforced resin.
 - b. Hanger Rod and Fittings: Continuous-thread rod, washer, and nuts made of stainless steel.

D. Metal Framing Systems

1. MFMA Manufacturer Metal Framing Systems:
 - a. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
 - b. Standard: MFMA-4.
 - c. Channels: Continuous slotted steel channel with inturned lips.



- d. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
 - e. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel **OR** stainless steel, **as directed**.
 - f. Metallic Coating: Electroplated zinc **OR** Hot-dipped galvanized **OR** Mill galvanized **OR** In-line, hot galvanized **OR** Mechanically-deposited zinc, **as directed**.
OR
Paint Coating: Vinyl **OR** Vinyl alkyd **OR** Epoxy **OR** Polyester **OR** Acrylic **OR** Amine **OR** Alkyd, **as directed**.
OR
Plastic Coating: PVC **OR** Polyurethane **OR** Epoxy **OR** Polyester, **as directed**.
OR
Combination Coating: as directed by the Owner.
2. Non-MFMA Manufacturer Metal Framing Systems:
- a. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
 - b. Standard: Comply with MFMA-4.
 - c. Channels: Continuous slotted steel channel with inturned lips.
 - d. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
 - e. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel **OR** stainless steel, **as directed**.
 - f. Coating: Zinc **OR** Paint **OR** PVC, **as directed**.
- E. Fiberglass Strut Systems
- 1. Description: Shop- or field-fabricated pipe-support assembly similar to MFMA-4 for supporting multiple parallel pipes.
 - a. Channels: Continuous slotted fiberglass or other plastic channel with inturned lips.
 - b. Channel Nuts: Fiberglass nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
 - c. Hanger Rods: Continuous-thread rod, nuts, and washer made of fiberglass **OR** stainless steel, **as directed**.
- F. Thermal-Hanger Shield Inserts
- 1. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength and vapor barrier.
 - 2. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig (688-kPa), ASTM C 552, Type II cellular glass with 100-psig (688-kPa) or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength.
 - 3. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
 - 4. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
 - 5. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.
- G. Fastener Systems
- 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated **OR** stainless-, **as directed**, steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- H. Pipe Stands



1. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
 2. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
 3. Low-Type, Single-Pipe Stand: One-piece plastic **OR** stainless-steel, **as directed**, base unit with plastic roller, for roof installation without membrane penetration.
 4. High-Type, Single-Pipe Stand:
 - a. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
 - b. Base: Plastic **OR** Stainless steel, **as directed**.
 - c. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
 - d. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.
 5. High-Type, Multiple-Pipe Stand:
 - a. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
 - b. Bases: One or more; plastic.
 - c. Vertical Members: Two or more protective-coated-steel channels.
 - d. Horizontal Member: Protective-coated-steel channel.
 - e. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.
 6. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.
- I. Equipment Supports
1. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.
- J. Miscellaneous Materials
1. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
 2. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - a. Properties: Nonstaining, noncorrosive, and nongaseous.
 - b. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

1.3 EXECUTION

A. Hanger And Support Installation

1. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
2. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - a. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - b. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
3. Fiberglass Pipe-Hanger Installation: Comply with applicable portions of MSS SP-69 and MSS SP-89. Install hangers and attachments as required to properly support piping from building structure.



4. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
5. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled fiberglass struts.
6. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
7. Fastener System Installation:
 - a. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - b. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
8. Pipe Stand Installation:
 - a. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
 - b. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Division 07 Section "Roof Accessories" for curbs.
9. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
10. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
11. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
12. Install lateral bracing with pipe hangers and supports to prevent swaying.
13. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
14. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
15. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
16. Insulated Piping:
 - a. Attach clamps and spacers to piping.
 - 1) Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - 2) Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - 3) Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - b. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - 1) Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
 - c. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - 1) Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
 - d. Shield Dimensions for Pipe: Not less than the following:
 - 1) NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
 - 2) NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
 - 3) NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.



- 4) NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
 - 5) NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.
 - e. Pipes NPS 8 (DN 200) and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
 - f. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.
- B. Equipment Supports
1. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
 2. Grouting: Place grout under supports for equipment and make bearing surface smooth.
 3. Provide lateral bracing, to prevent swaying, for equipment supports.
- C. Metal Fabrications
1. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
 2. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
 3. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 - a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - b. Obtain fusion without undercut or overlap.
 - c. Remove welding flux immediately.
 - d. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.
- D. Adjusting
1. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
 2. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).
- E. Painting
1. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - a. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).

OR

Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 07 OR Division 09 Section(s) "High-performance Coatings", **as directed**.
 2. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.
- F. Hanger And Support Schedule
1. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
 2. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
 3. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.



4. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
5. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers and metal framing systems and attachments for general service applications.
6. Use stainless-steel pipe hangers and fiberglass pipe hangers and fiberglass strut systems and stainless-steel or corrosion-resistant attachments for hostile environment applications.
7. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
8. Use padded hangers for piping that is subject to scratching.
9. Use thermal-hanger shield inserts for insulated piping and tubing.
10. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - a. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
 - b. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F (566 deg C), pipes NPS 4 to NPS 24 (DN 100 to DN 600), requiring up to 4 inches (100 mm) of insulation.
 - c. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
 - d. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 (DN 15 to DN 600) if little or no insulation is required.
 - e. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.
 - f. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8 (DN 20 to DN 200).
 - g. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
 - h. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
 - i. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
 - j. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8 (DN 10 to DN 200).
 - k. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3 (DN 10 to DN 80).
 - l. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
 - m. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 - n. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
 - o. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
 - p. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 (DN 65 to DN 900) if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
 - q. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30 (DN 25 to DN 750), from two rods if longitudinal movement caused by expansion and contraction might occur.
 - r. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24 (DN 65 to DN 600), from single rod if horizontal movement caused by expansion and contraction might occur.



- s. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 (DN 50 to DN 1050) if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
 - t. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 (DN 50 to DN 600) if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
 - u. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 (DN 50 to DN 750) if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
11. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
- a. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).
 - b. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.
12. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
- a. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
 - b. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
 - c. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 - d. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 - e. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.
13. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
- a. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 - b. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction, to attach to top flange of structural shape.
 - c. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 - d. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 - e. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 - f. C-Clamps (MSS Type 23): For structural shapes.
 - g. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 - h. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 - i. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 - j. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 - k. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 - l. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - 1) Light (MSS Type 31): 750 lb (340 kg).
 - 2) Medium (MSS Type 32): 1500 lb (680 kg).
 - 3) Heavy (MSS Type 33): 3000 lb (1360 kg).
 - m. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 - n. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 - o. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.



14. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - a. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 - b. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 - c. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
15. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - a. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 - b. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
 - c. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
 - d. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 - e. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
 - f. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
 - g. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
 - h. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - 1) Horizontal (MSS Type 54): Mounted horizontally.
 - 2) Vertical (MSS Type 55): Mounted vertically.
 - 3) Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
16. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
17. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
18. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 23 05 29 00b



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23 - Heating, Ventilating, And Air-Conditioning (HVAC)

Task	Specification	Specification Description
23 05 29 00	22 05 23 00	Piped Utilities Basic Materials And Methods
23 05 29 00	07 63 00 00	Common Work Results for Fire Suppression
23 05 29 00	07 63 00 00a	Common Work Results for Plumbing
23 05 29 00	07 63 00 00b	Common Work Results for HVAC



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SECTION 23 05 48 00 - VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of vibration and seismic controls for HVAC piping and equipment. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Isolation pads.
 - b. Isolation mounts.
 - c. Restrained elastomeric isolation mounts.
 - d. Freestanding and Restrained spring isolators.
 - e. Housed spring mounts.
 - f. Elastomeric hangers.
 - g. Spring hangers.
 - h. Spring hangers with vertical-limit stops.
 - i. Pipe riser resilient supports.
 - j. Resilient pipe guides.
 - k. Freestanding and Restrained air-mounting system.
 - l. Restrained vibration isolation roof-curb rails.
 - m. Seismic snubbers.
 - n. Restraining braces and cables.
 - o. Steel and Inertia, vibration isolation equipment bases.

C. Definitions

1. IBC: International Building Code.
2. ICC-ES: ICC-Evaluation Service.
3. OSHPD: Office of Statewide Health Planning and Development for the State of California.

D. Performance Requirements

1. Wind-Restraint Loading:
 - a. Basic Wind Speed: As required to meet Project requirements.
 - b. Building Classification Category: **I OR II OR III OR IV, as directed.**
 - c. Minimum 10 lb/sq. ft. (48.8 kg/sq. m) multiplied by the maximum area of the HVAC component projected on a vertical plane that is normal to the wind direction, and 45 degrees either side of normal.
2. Seismic-Restraint Loading:
 - a. Site Class as Defined in the IBC: **A OR B OR C OR D OR E OR F, as directed.**
 - b. Assigned Seismic Use Group or Building Category as Defined in the IBC: **I OR II OR III, as directed.**
 - 1) Component Importance Factor: **1.0 OR 1.5, as directed.**
 - 2) Component Response Modification Factor: **1.5 OR 2.5 OR 3.5 OR 5.0, as directed.**
 - 3) Component Amplification Factor: **1.0 OR 2.5, as directed.**
 - c. Design Spectral Response Acceleration at Short Periods (0.2 Second): Percentage as directed.
 - d. Design Spectral Response Acceleration at 1-Second Period: Percentage as directed.

E. Submittals

1. Product Data: For each product indicated.



2. Delegated-Design Submittal: For vibration isolation and seismic-restraint calculations and details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
3. Welding certificates.
4. Qualification Data: For professional engineer.
5. Field quality-control test reports.

F. Quality Assurance

1. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
2. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
3. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

1.2 PRODUCTS

A. Vibration Isolators

1. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.
 - a. Resilient Material: Oil- and water-resistant neoprene **OR** rubber **OR** hermetically sealed compressed fiberglass, **as directed**.
2. Mounts: Double-deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.
 - a. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
 - b. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.
3. Restrained Mounts: All-directional mountings with seismic restraint.
 - a. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
 - b. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.
4. Spring Isolators: Freestanding, laterally stable, open-spring isolators.
 - a. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - b. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - c. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - d. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - e. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- (6-mm-) thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig (3447 kPa).



- f. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.
5. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.
 - a. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
 - b. Restraint: Seismic or limit stop as required for equipment and authorities having jurisdiction.
 - c. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - d. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - e. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - f. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Housed Spring Mounts: Housed spring isolator with integral seismic snubbers.
 - a. Housing: Ductile-iron or steel housing to provide all-directional seismic restraint.
 - b. Base: Factory drilled for bolting to structure.
 - c. Snubbers: Vertically adjustable to allow a maximum of 1/4-inch (6-mm) travel up or down before contacting a resilient collar.
7. Elastomeric Hangers: Single or double-deflection type, fitted with molded, oil-resistant elastomeric isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.
8. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.
 - a. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
 - b. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - c. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - d. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - e. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - f. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
 - g. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.
9. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.
 - a. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
 - b. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - c. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - d. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - e. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - f. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
 - g. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
 - h. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.



10. Pipe Riser Resilient Support: All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch- (13-mm-) thick neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on the isolation material of 500 psig (3.45 MPa) and for equal resistance in all directions.
11. Resilient Pipe Guides: Telescopic arrangement of 2 steel tubes or post and sleeve arrangement separated by a minimum of 1/2-inch- (13-mm-) thick neoprene. Where clearances are not readily visible, a factory-set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction shall be fitted. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

B. Air-Mounting Systems

1. Air Mounts: Freestanding, single or multiple, compressed-air bellows.
 - a. Assembly: Upper and lower steel sections connected by a replaceable, flexible, nylon-reinforced neoprene bellows.
 - b. Maximum Natural Frequency: 3 Hz.
 - c. Operating Pressure Range: 25 to 100 psig (172 to 690 kPa).
 - d. Burst Pressure: At least three times manufacturer's published maximum operating pressure.
 - e. Leveling Valves: Minimum of 3 required to maintain leveling within plus or minus 1/8 inch (3 mm).
2. Restrained Air Mounts: Housed compressed-air bellows.
 - a. Assembly: Upper and lower steel sections connected by a replaceable, flexible, nylon-reinforced neoprene bellows and spring, with angle-iron frame having vertical-limit stops and channel-section top with leveling adjustment and attachment screws.
 - b. Maximum Natural Frequency: 3 Hz.
 - c. Operating Pressure Range: 25 to 100 psig (172 to 690 kPa).
 - d. Burst Pressure: At least three times manufacturer's published maximum operating pressure.
 - e. Leveling Valves: Minimum of 3 required to maintain leveling within plus or minus 1/8 inch (3 mm).

C. Restrained Vibration Isolation Roof-Curb Rails

1. General Requirements for Restrained Vibration Isolation Roof-Curb Rails: Factory-assembled, fully enclosed, insulated, air- and watertight curb rail designed to resiliently support equipment and to withstand seismic and wind, **as directed**, forces.
2. Lower Support Assembly: Formed sheet-metal section containing adjustable and removable steel springs that support upper frame. Upper frame shall provide continuous support for equipment and shall be captive to resiliently resist seismic and wind, **as directed**, forces. Lower support assembly shall have a means for attaching to building structure and a wood nailer for attaching roof materials, and shall be insulated with a minimum of 2 inches (50 mm) of rigid, glass-fiber insulation on inside of assembly.
3. Spring Isolators: Adjustable, restrained spring isolators shall be mounted on 1/4-inch- (6-mm-) thick, elastomeric vibration isolation pads and shall have access ports, for level adjustment, with removable waterproof covers at all isolator locations. Isolators shall be located so they are accessible for adjustment at any time during the life of the installation without interfering with the integrity of the roof.
 - a. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or wind, **as directed**, restraint.
 - 1) Housing: Steel with resilient vertical-limit stops and adjustable equipment mounting and leveling bolt.
 - 2) Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - 3) Minimum Additional Travel: 50 percent of the required deflection at rated load.



- 4) Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - 5) Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - b. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.
 - 1) Resilient Material: Oil- and water-resistant standard neoprene **OR** natural rubber **OR** hermetically sealed compressed fiberglass, **as directed**.
 4. Snubber Bushings: All-directional, elastomeric snubber bushings at least 1/4 inch (6 mm) thick.
 5. Water Seal: Galvanized sheet metal with EPDM seals at corners, attached to upper support frame, extending down past wood nailer of lower support assembly, and counterflashed over roof materials.
- D. Vibration Isolation Equipment Bases
1. Steel Base: Factory-fabricated, welded, structural-steel bases and rails.
 - a. Design Requirements: Lowest possible mounting height with not less than 1-inch (25-mm) clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.
 - 1) Include supports for suction and discharge elbows for pumps.
 - b. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
 - c. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
 2. Inertia Base: Factory-fabricated, welded, structural-steel bases and rails ready for placement of cast-in-place concrete.
 - a. Design Requirements: Lowest possible mounting height with not less than 1-inch (25-mm) clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.
 - 1) Include supports for suction and discharge elbows for pumps.
 - b. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
 - c. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
 - d. Fabrication: Fabricate steel templates to hold equipment anchor-bolt sleeves and anchors in place during placement of concrete. Obtain anchor-bolt templates from supported equipment manufacturer.
- E. Seismic-Restraint Devices
1. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of ICC-ES **OR** OSHPD **OR** an agency acceptable to authorities having jurisdiction, **as directed**.
 - a. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
 2. Snubbers: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.
 - a. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
 - b. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
 - c. Maximum 1/4-inch (6-mm) air gap, and minimum 1/4-inch- (6-mm-) thick resilient cushion.
 3. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.



4. Restraint Cables: ASTM A 603 galvanized-steel **OR** ASTM A 492 stainless-steel, **as directed**, cables with end connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.
5. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections **OR** Reinforcing steel angle clamped, **as directed**, to hanger rod.
6. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.
7. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.
8. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.
9. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.
10. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

F. Factory Finishes

1. Finish

- a. Manufacturer's standard prime-coat finish ready for field painting.

OR

Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

- 1) Powder coating on springs and housings.
- 2) All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
- 3) Baked enamel or powder coat for metal components on isolators for interior use.
- 4) Color-code or otherwise mark vibration isolation and seismic-control and wind-control, **as directed**, devices to indicate capacity range.

1.3 EXECUTION

A. Applications

1. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an evaluation service member of ICC-ES **OR** OSHPD **OR** an agency acceptable to authorities having jurisdiction, **as directed**.
2. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
3. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

B. Vibration-Control And Seismic-Restraint Device Installation

1. Comply with requirements in Division 07 Section "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.
2. Equipment Restraints:



- a. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
 - b. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
 - c. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES **OR** OSHPD **OR** an agency acceptable to authorities having jurisdiction, **as directed**, providing required submittals for component.
 3. Piping Restraints:
 - a. Comply with requirements in MSS SP-127.
 - b. Space lateral supports a maximum of 40 feet (12 m) o.c., and longitudinal supports a maximum of 80 feet (24 m) o.c.
 - c. Brace a change of direction longer than 12 feet (3.7 m).
 4. Install cables so they do not bend across edges of adjacent equipment or building structure.
 5. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES **OR** OSHPD **OR** an agency acceptable to authorities having jurisdiction, **as directed**, providing required submittals for component.
 6. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
 7. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
 8. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
 9. Drilled-in Anchors:
 - a. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - b. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - c. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 - d. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
 - e. Set anchors to manufacturer's recommended torque, using a torque wrench.
 - f. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.
- C. Accommodation Of Differential Seismic Motion
1. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Division 23 Section "Hydronic Piping" for piping flexible connections.
- D. Field Quality Control
1. Perform tests and inspections.
 2. Tests and Inspections:
 - a. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.



- b. Schedule test with the Owner before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
 - c. Obtain approval before transmitting test loads to structure. Provide temporary load-spreading members.
 - d. Test at least four of each type and size of installed anchors and fasteners selected.
 - e. Test to 90 percent of rated proof load of device.
 - f. Measure isolator restraint clearance.
 - g. Measure isolator deflection.
 - h. Verify snubber minimum clearances.
 - i. Air-Mounting System Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - j. Air-Mounting System Operational Test: Test the compressed-air leveling system.
 - k. Test and adjust air-mounting system controls and safeties.
 - l. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.
3. Remove and replace malfunctioning units and retest as specified above.
 4. Prepare test and inspection reports.
- E. Adjusting
1. Adjust isolators after piping system is at operating weight.
 2. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
 3. Adjust air-spring leveling mechanism.
 4. Adjust active height of spring isolators.
 5. Adjust restraints to permit free movement of equipment within normal mode of operation.
- F. Demonstration
1. Engage a factory-authorized service representative to train the Owner's maintenance personnel to adjust, operate, and maintain air-mounting systems.

END OF SECTION 23 05 48 00



Task	Specification	Specification Description
23 05 48 00	01 22 16 00	No Specification Required
23 05 48 00	22 05 23 00	Piped Utilities Basic Materials And Methods
23 05 48 00	21 05 48 00	Vibration And Seismic Controls For Fire-Suppression Piping And Equipment
23 05 48 00	22 05 48 00	Vibration And Seismic Controls For Plumbing Piping And Equipment
23 05 48 00	22 11 16 00c	Hydronic Piping
23 05 48 00	22 11 16 00d	Steam And Condensate Piping
23 05 48 00	22 11 16 00e	Refrigerant Piping
23 05 48 00	22 11 16 00f	General-Service Compressed-Air Piping



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SECTION 23 05 53 00 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for identification for HVAC piping and equipment. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Equipment labels.
 - b. Warning signs and labels.
 - c. Pipe labels.
 - d. Duct labels.
 - e. Stencils.
 - f. Valve tags.
 - g. Warning tags.

C. Submittals

1. Product Data: For each type of product indicated.

1.2 PRODUCTS

A. Equipment Labels

1. Metal Labels for Equipment:
 - a. Material and Thickness: Brass, 0.032-inch (0.8-mm) **OR** Stainless steel, 0.025-inch (0.64-mm) **OR** Aluminum, 0.032-inch (0.8-mm) **OR** anodized aluminum, 0.032-inch (0.8-mm), **as directed**, minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - b. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
 - c. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - d. Fasteners: Stainless-steel rivets **OR** self-tapping screws, **as directed**.
 - e. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
2. Plastic Labels for Equipment:
 - a. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) **OR** 1/8 inch (3.2 mm), **as directed**, thick, and having predrilled holes for attachment hardware.
 - b. Letter Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 - c. Background Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 - d. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
 - e. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
 - f. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - g. Fasteners: Stainless-steel rivets **OR** self-tapping screws, **as directed**.



- h. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
3. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.
 4. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.
- B. Warning Signs And Labels
1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) **OR** 1/8 inch (3.2 mm), **as directed**, thick, and having predrilled holes for attachment hardware.
 2. Letter Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 3. Background Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
 6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 7. Fasteners: Stainless-steel rivets **OR** self-tapping screws, **as directed**.
 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
 9. Label Content: Include caution and warning information, plus emergency notification instructions.
- C. Pipe Labels
1. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
 2. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover **OR** cover full, **as directed**, circumference of pipe and to attach to pipe without fasteners or adhesive.
 3. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
 4. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
 - a. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
 - b. Lettering Size: At least 1-1/2 inches (38 mm) high.
- D. Duct Labels
1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) **OR** 1/8 inch (3.2 mm), **as directed**, thick, and having predrilled holes for attachment hardware.
 2. Letter Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 3. Background Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
 6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 7. Fasteners: Stainless-steel rivets **OR** self-tapping screws, **as directed**.
 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.



9. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.
 - a. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.
 - b. Lettering Size: At least 1-1/2 inches (38 mm) high.

E. Stencils

1. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches (32 mm) for ducts; and minimum letter height of 3/4 inch (19 mm) for access panel and door labels, equipment labels, and similar operational instructions.
 - a. Stencil Material: Aluminum **OR** Brass **OR** Fiberboard, **as directed**.
 - b. Stencil Paint: Exterior, gloss, alkyd enamel **OR** acrylic enamel, **as directed**, black unless otherwise indicated. Paint may be in pressurized spray-can form.
 - c. Identification Paint: Exterior, alkyd enamel **OR** acrylic enamel, **as directed**, in colors according to ASME A13.1 unless otherwise indicated.

F. Valve Tags

1. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers.
 - a. Tag Material: Brass, 0.032-inch (0.8-mm) **OR** Stainless steel, 0.025-inch (0.64-mm) **OR** Aluminum, 0.032-inch (0.8-mm) **OR** anodized aluminum, 0.032-inch (0.8-mm), **as directed**, minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - b. Fasteners: Brass wire-link chain **OR** beaded chain **OR** S-hook, **as directed**.
2. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 - a. Valve-tag schedule shall be included in operation and maintenance data.

G. Warning Tags

1. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
 - a. Size: 3 by 5-1/4 inches (75 by 133 mm) minimum **OR** Approximately 4 by 7 inches (100 by 178 mm), **as directed**.
 - b. Fasteners: Brass grommet and wire **OR** Reinforced grommet and wire or string, **as directed**.
 - c. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
 - d. Color: Yellow background with black lettering.

1.3 EXECUTION

A. Preparation

1. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

B. Equipment Label Installation

1. Install or permanently fasten labels on each major item of mechanical equipment.
2. Locate equipment labels where accessible and visible.

C. Pipe Label Installation

1. Piping Color-Coding: Painting of piping is specified in Division 09 Section(s) "Interior Painting" **OR** "High-performance Coatings", **as directed**.



2. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels with painted, color-coded bands or rectangles **OR** complying with ASME A13.1, **as directed**, on each piping system.
 - a. Identification Paint: Use for contrasting background.
 - b. Stencil Paint: Use for pipe marking.
 3. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - a. Near each valve and control device.
 - b. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - c. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - d. At access doors, manholes, and similar access points that permit view of concealed piping.
 - e. Near major equipment items and other points of origination and termination.
 - f. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
 - g. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
 4. Pipe Label Color Schedule:
 - a. Chilled-Water Piping:
 - 1) Background Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 - 2) Letter Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 - b. Condenser-Water Piping:
 - 1) Background Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 - 2) Letter Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **asa directed**.
 - c. Heating Water Piping:
 - 1) Background Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 - 2) Letter Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 - d. Refrigerant Piping:
 - 1) Background Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 - 2) Letter Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 - e. Low-Pressure Steam Piping:
 - 1) Background Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 - 2) Letter Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 - f. High-Pressure Steam Piping:
 - 1) Background Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 - 2) Letter Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 - g. Steam Condensate Piping:
 - 1) Background Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
 - 2) Letter Color: Black **OR** Blue **OR** Red **OR** White **OR** Yellow, **as directed**.
- D. Duct Label Installation
1. Install plastic-laminated **OR** self-adhesive, **as directed**, duct labels with permanent adhesive on air ducts in the following color codes:
 - a. Blue: For cold-air supply ducts.
 - b. Yellow: For hot-air supply ducts.
 - c. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
 - d. ASME A13.1 Colors and Designs: For hazardous material exhaust.
 2. Stenciled Duct Label Option: Stenciled labels, showing service and flow direction, may be provided instead of plastic-laminated duct labels, at Installer's option, if lettering larger than 1 inch (25 mm) high is needed for proper identification because of distance from normal location of required identification.
 3. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet (15 m) in each space where ducts are exposed or concealed by removable ceiling system.



E. Valve-Tag Installation

1. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
2. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
 - a. Valve-Tag Size and Shape:
 - 1) Chilled Water: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, round **OR** square, **as directed**.
 - 2) Condenser Water: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, round **OR** square, **as directed**.
 - 3) Refrigerant: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, round **OR** square, **as directed**.
 - 4) Hot Water: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, round **OR** square, **as directed**.
 - 5) Gas: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, round **OR** square, **as directed**.
 - 6) Low-Pressure Steam: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, round **OR** square, **as directed**.
 - 7) High-Pressure Steam: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, round **OR** square, **as directed**.
 - 8) Steam Condensate: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, round **OR** square, **as directed**.
 - b. Valve-Tag Color:
 - 1) Chilled Water: Natural **OR** Green, **as directed**.
 - 2) Condenser Water: Natural **OR** Green, **as directed**.
 - 3) Refrigerant: Natural **OR** Green, **as directed**.
 - 4) Hot Water: Natural **OR** Green, **as directed**.
 - 5) Gas: Natural **OR** Yellow, **as directed**.
 - 6) Low-Pressure Steam: Natural **OR** Yellow, **as directed**.
 - 7) High-Pressure Steam: Natural **OR** Green, **as directed**.
 - 8) Steam Condensate: Natural **OR** Green, **as directed**.
 - c. Letter Color:
 - 1) Chilled Water: Black **OR** White, **as directed**.
 - 2) Condenser Water: Black **OR** White, **as directed**.
 - 3) Refrigerant: Black **OR** White, **as directed**.
 - 4) Hot Water: Black **OR** White, **as directed**.
 - 5) Gas: Black **OR** White, **as directed**.
 - 6) Low-Pressure Steam: Black **OR** White, **as directed**.
 - 7) High-Pressure Steam: Black **OR** White, **as directed**.
 - 8) Steam Condensate: Black **OR** White, **as directed**.

F. Warning-Tag Installation

1. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 23 05 53 00



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23 - Heating, Ventilating, And Air-Conditioning (HVAC)

Task	Specification	Specification Description
23 05 53 00	22 05 53 00	Identification for Plumbing Piping and Equipment
23 05 53 00	23 01 10 00	Sequence Of Operation
23 05 93 00	01 71 23 16	Cutting and Patching
23 05 93 00	02 41 16 13	Selective Demolition
23 05 93 00	23 01 10 00	Sequence Of Operation
23 05 93 00	23 01 10 00a	Testing, Adjusting, And Balancing



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SECTION 23 07 13 00 - HVAC INSULATION

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for HVAC insulation. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Insulation Materials:
 - 1) Calcium silicate.
 - 2) Cellular glass.
 - 3) Flexible elastomeric.
 - 4) Mineral fiber.
 - 5) Phenolic.
 - 6) Polyisocyanurate.
 - 7) Polyolefin.
 - 8) Polystyrene.
 - b. Fire-rated insulation systems.
 - c. Insulating cements.
 - d. Adhesives.
 - e. Mastics.
 - f. Lagging adhesives.
 - g. Sealants.
 - h. Factory-applied jackets.
 - i. Field-applied fabric-reinforcing mesh.
 - j. Field-applied cloths.
 - k. Field-applied jackets.
 - l. Tapes.
 - m. Securements.
 - n. Corner angles.

C. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittal:
 - a. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.
3. Shop Drawings:
 - a. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - b. Detail attachment and covering of heat tracing inside insulation.
 - c. Detail insulation application at pipe expansion joints for each type of insulation.
 - d. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - e. Detail removable insulation at piping specialties, equipment connections, and access panels.
 - f. Detail application of field-applied jackets.
 - g. Detail application at linkages of control devices.
 - h. Detail field application for each equipment type.
4. Field quality-control reports.



D. Quality Assurance

1. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
 - a. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - b. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

E. Delivery, Storage, And Handling

1. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.2 PRODUCTS

A. Insulation Materials

1. Comply with requirements in Part 1.3 schedule articles for where insulating materials shall be applied.
2. Products shall not contain asbestos, lead, mercury, or mercury compounds.
3. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
4. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
5. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
6. Calcium Silicate:
 - a. Preformed Pipe Sections: Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.
 - b. Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.
 - c. Prefabricated Fitting Covers: Comply with ASTM C 450 and ASTM C 585 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.
7. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - a. Block Insulation: ASTM C 552, Type I.
 - b. Special-Shaped Insulation: ASTM C 552, Type III.
 - c. Board Insulation: ASTM C 552, Type IV.
 - d. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
 - e. Preformed Pipe Insulation with Factory-Applied ASJ **OR** ASJ-SSL, **as directed**: Comply with ASTM C 552, Type II, Class 2.
 - f. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
8. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
9. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I **OR** II with factory-applied vinyl jacket **OR** III with factory-applied FSK jacket **OR** III with factory-applied FSP jacket, **as directed**. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
10. High-Temperature, Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type V, without factory-applied jacket.



11. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation without factory-applied jacket **OR** with factory-applied ASJ **OR** with factory-applied FSK jacket, **as directed**. For equipment applications, provide insulation without factory-applied jacket **OR** with factory-applied ASJ **OR** with factory-applied FSK jacket, **as directed**. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
12. High-Temperature, Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type III, without factory-applied jacket.
13. Mineral-Fiber, Preformed Pipe Insulation:
 - a. Type I, 850 deg F (454 deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, without factory-applied jacket **OR** with factory-applied ASJ **OR** with factory-applied ASJ-SSL, **as directed**. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - b. Type II, 1200 deg F (649 deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type II, Grade A, without factory-applied jacket **OR** with factory-applied ASJ **OR** with factory-applied ASJ-SSL, **as directed**. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
14. Mineral-Fiber, Pipe Insulation Wicking System: Preformed pipe insulation complying with ASTM C 547, Type I, Grade A, with absorbent cloth factory applied to the entire inside surface of preformed pipe insulation and extended through the longitudinal joint to outside surface of insulation under insulation jacket. Factory apply a white, polymer, vapor-retarder jacket with self-sealing adhesive tape seam and evaporation holes running continuously along the longitudinal seam, exposing the absorbent cloth.
15. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ **OR** FSK jacket, **as directed**, complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. (40 kg/cu. m) or more. Thermal conductivity (k-value) at 100 deg F (55 deg C) is 0.29 Btu x in./h x sq. ft. x deg F (0.042 W/m x K) or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
16. Phenolic:
 - a. Preformed pipe insulation of rigid, expanded, closed-cell structure. Comply with ASTM C 1126, Type III, Grade 1.
 - b. Block insulation of rigid, expanded, closed-cell structure. Comply with ASTM C 1126, Type II, Grade 1.
 - c. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
 - d. Factory-Applied Jacket: Requirements are specified in "Factory-Applied Jackets" Article.
 - 1) Preformed Pipe Insulation: None **OR** ASJ, **as directed**.
 - 2) Board for Duct and Plenum Applications: None **OR** ASJ, **as directed**.
 - 3) Board for Equipment Applications: None **OR** ASJ, **as directed**.
17. Polyisocyanurate: Unfaced, preformed, rigid cellular polyisocyanurate material intended for use as thermal insulation.
 - a. Comply with ASTM C 591, Type I or Type IV, except thermal conductivity (k-value) shall not exceed 0.19 Btu x in./h x sq. ft. x deg F (0.027 W/m x K) at 75 deg F (24 deg C) after 180 days of aging.
 - b. Flame-spread index shall be 25 or less and smoke-developed index shall be 50 or less for thickness up to 1-1/2 inches (38 mm) as tested by ASTM E 84.
 - c. Fabricate shapes according to ASTM C 450 and ASTM C 585.
 - d. Factory-Applied Jacket: Requirements are specified in "Factory-Applied Jackets" Article.
 - 1) Pipe Applications: None **OR** ASJ **OR** ASJ-SSL **OR** PVDC **OR** PVDC-SSL, **as directed**.
 - 2) Equipment Applications: None **OR** ASJ **OR** ASJ-SSL **OR** PVDC **OR** PVDC-SSL, **as directed**.
18. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials and Type II, Grade 1 for sheet materials.
19. Polystyrene: Rigid, extruded cellular polystyrene intended for use as thermal insulation. Comply with ASTM C 578, Type IV or Type XIII, except thermal conductivity (k-value) shall not exceed



0.26 Btu x in./h x sq. ft. x deg F (0.038 W/m x K) after 180 days of aging. Fabricate shapes according to ASTM C 450 and ASTM C 585.

B. Fire-Rated Insulation Systems

1. Fire-Rated Board: Structural-grade, press-molded, xonolite calcium silicate, fireproofing board suitable for operating temperatures up to 1700 deg F (927 deg C). Comply with ASTM C 656, Type II, Grade 6. tested and certified to provide a 1-hour **OR** 2-hour, **as directed**, fire rating by a NRTL acceptable to authority having jurisdiction.
2. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a 1-hour **OR** 2-hour, **as directed**, fire rating by a NRTL acceptable to authority having jurisdiction.

C. Insulating Cements

1. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
2. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.
3. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

D. Adhesives

1. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
2. Calcium Silicate Adhesive: Fibrous, sodium-silicate-based adhesive with a service temperature range of 50 to 800 deg F (10 to 427 deg C).
 - a. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Cellular-Glass, Phenolic, Polyisocyanurate, and Polystyrene Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F (minus 59 to plus 149 deg C).
 - a. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
4. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 - a. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
5. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - a. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Polystyrene Adhesive: Solvent- or water-based, synthetic resin adhesive with a service temperature range of minus 20 to plus 140 deg F (29 to plus 60 deg C).
7. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - a. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
8. PVC Jacket Adhesive: Compatible with PVC jacket.
 - a. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Mastics

1. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
 - a. For indoor applications, use mastics that have an approved VOC content or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
 - a. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.



- b. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
- c. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
- d. Color: White.
- 3. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.
 - a. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.03 metric perm) at 35-mil (0.9-mm) dry film thickness.
 - b. Service Temperature Range: 0 to 180 deg F (Minus 18 to plus 82 deg C).
 - c. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
 - d. Color: White.
- 4. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.
 - a. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.033 metric perm) at 30-mil (0.8-mm) dry film thickness.
 - b. Service Temperature Range: Minus 50 to plus 220 deg F (Minus 46 to plus 104 deg C).
 - c. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
 - d. Color: White.
- 5. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
 - a. Water-Vapor Permeance: ASTM F 1249, 3 perms (2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
 - b. Service Temperature Range: Minus 20 to plus 200 deg F (Minus 29 to plus 93 deg C).
 - c. Solids Content: 63 percent by volume and 73 percent by weight.
 - d. Color: White.

F. Lagging Adhesives

- 1. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
 - a. For indoor applications, use lagging adhesives that have an approved VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct, equipment, and pipe insulation.
 - c. Service Temperature Range: Minus 50 to plus 180 deg F (Minus 46 to plus 82 deg C).
 - d. Color: White.

G. Sealants

- 1. Joint Sealants:
 - a. Materials shall be compatible with insulation materials, jackets, and substrates.
 - b. Permanently flexible, elastomeric sealant.
 - c. Service Temperature Range: Minus 100 to plus 300 deg F (Minus 73 to plus 149 deg C).
 - d. Color: White or gray.
 - e. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- 2. FSK and Metal Jacket Flashing Sealants:
 - a. Materials shall be compatible with insulation materials, jackets, and substrates.
 - b. Fire- and water-resistant, flexible, elastomeric sealant.
 - c. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
 - d. Color: Aluminum.
 - e. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- 3. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
 - a. Materials shall be compatible with insulation materials, jackets, and substrates.
 - b. Fire- and water-resistant, flexible, elastomeric sealant.
 - c. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
 - d. Color: White.
 - e. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

H. Factory-Applied Jackets



1. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 - a. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
 - b. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
 - c. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
 - d. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
 - e. PVDC Jacket for Indoor Applications: 4-mil- (0.10-mm-) thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms (0.013 metric perms) when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.
 - f. PVDC Jacket for Outdoor Applications: 6-mil- (0.15-mm-) thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perms (0.007 metric perms) when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.
 - g. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.

- I. Vinyl Jacket: White vinyl with a permeance of 1.3 perms (0.86 metric perms) when tested according to ASTM E 96, Procedure A, and complying with NFPA 90A and NFPA 90B.

- J. Field-Applied Fabric-Reinforcing Mesh
 1. Woven Glass-Fiber Fabric for Pipe Insulation: Approximately 2 oz./sq. yd. (68 g/sq. m) with a thread count of 10 strands by 10 strands/sq. inch (4 strands by 4 strands/sq. mm) for covering pipe and pipe fittings.
 2. Woven Glass-Fiber Fabric for Duct and Equipment Insulation: Approximately 6 oz./sq. yd. (203 g/sq. m) with a thread count of 5 strands by 5 strands/sq. inch (2 strands by 2 strands/sq. mm) for covering equipment.
 3. Woven Polyester Fabric: Approximately 1 oz./sq. yd. (34 g/sq. m) with a thread count of 10 strands by 10 strands/sq. inch (4 strands by 4 strands/sq. mm), in a Leno weave, for duct, equipment, and pipe.

- K. Field-Applied Cloths
 1. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd. (271 g/sq. m).

- L. Field-Applied Jackets
 1. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
 2. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.
 3. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
 - a. Adhesive: As recommended by jacket material manufacturer.
 - b. Color: White **OR** Color-code jackets based on system. Color as selected by the Owner, **as directed**.
 - c. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - 1) Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
 - d. Factory-fabricated tank heads and tank side panels.
 4. Metal Jacket:



- a. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105 or 5005, Temper H-14.
 - 1) Sheet and roll stock ready for shop or field sizing **OR** Factory cut and rolled to size, **as directed**.
 - 2) Finish and thickness are indicated in field-applied jacket schedules.
 - 3) Moisture Barrier for Indoor Applications: 1-mil- (0.025-mm-) thick, heat-bonded polyethylene and kraft paper **OR** 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper **OR** 2.5-mil- (0.063-mm-) thick Polysurlyn, **as directed**.
 - 4) Moisture Barrier for Outdoor Applications: 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper **OR** 2.5-mil- (0.063-mm-) thick Polysurlyn, **as directed**.
 - 5) Factory-Fabricated Fitting Covers:
 - a) Same material, finish, and thickness as jacket.
 - b) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - c) Tee covers.
 - d) Flange and union covers.
 - e) End caps.
 - f) Beveled collars.
 - g) Valve covers.
 - h) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.
- b. Stainless-Steel Jacket: ASTM A 167 or ASTM A 240/A 240M.
 - 1) Sheet and roll stock ready for shop or field sizing **OR** Factory cut and rolled to size, **as directed**.
 - 2) Material, finish, and thickness are indicated in field-applied jacket schedules.
 - 3) Moisture Barrier for Indoor Applications: 1-mil- (0.025-mm-) thick, heat-bonded polyethylene and kraft paper **OR** 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper **OR** 2.5-mil- (0.063-mm-) thick Polysurlyn, **as directed**.
 - 4) Moisture Barrier for Outdoor Applications: 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper **OR** 2.5-mil- (0.063-mm-) thick Polysurlyn, **as directed**.
 - 5) Factory-Fabricated Fitting Covers:
 - a) Same material, finish, and thickness as jacket.
 - b) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - c) Tee covers.
 - d) Flange and union covers.
 - e) End caps.
 - f) Beveled collars.
 - g) Valve covers.
 - h) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.
5. Underground Direct-Buried Jacket: 125-mil- (3.2-mm-) thick vapor barrier and waterproofing membrane consisting of a rubberized bituminous resin reinforced with a woven-glass fiber or polyester scrim and laminated aluminum foil.
6. Self-Adhesive Outdoor Jacket: 60-mil- (1.5-mm-) thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a crosslaminated polyethylene film covered with white **OR** stucco-embossed, **as directed**, aluminum-foil facing.
7. PVDC Jacket for Indoor Applications: 4-mil- (0.10-mm-) thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms (0.013 metric perms) when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.
8. PVDC Jacket for Outdoor Applications: 6-mil- (0.15-mm-) thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perms (0.007 metric perms) when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.
9. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.



M. Tapes

1. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
 - a. Width: 3 inches (75 mm).
 - b. Thickness: 11.5 mils (0.29 mm).
 - c. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
 - d. Elongation: 2 percent.
 - e. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
 - f. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
2. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
 - a. Width: 3 inches (75 mm).
 - b. Thickness: 6.5 mils (0.16 mm).
 - c. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
 - d. Elongation: 2 percent.
 - e. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
 - f. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
3. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.
 - a. Width: 2 inches (50 mm).
 - b. Thickness: 6 mils (0.15 mm).
 - c. Adhesion: 64 ounces force/inch (0.7 N/mm) in width.
 - d. Elongation: 500 percent.
 - e. Tensile Strength: 18 lbf/inch (3.3 N/mm) in width.
4. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
 - a. Width: 2 inches (50 mm).
 - b. Thickness: 3.7 mils (0.093 mm).
 - c. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
 - d. Elongation: 5 percent.
 - e. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.
5. PVDC Tape for Indoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.
 - a. Width: 3 inches (75 mm).
 - b. Film Thickness: 4 mils (0.10 mm).
 - c. Adhesive Thickness: 1.5 mils (0.04 mm).
 - d. Elongation at Break: 145 percent.
 - e. Tensile Strength: 55 lbf/inch (10.1 N/mm) in width.
6. PVDC Tape for Outdoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.
 - a. Width: 3 inches (75 mm).
 - b. Film Thickness: 6 mils (0.15 mm).
 - c. Adhesive Thickness: 1.5 mils (0.04 mm).
 - d. Elongation at Break: 145 percent.
 - e. Tensile Strength: 55 lbf/inch (10.1 N/mm) in width.

N. Securements

1. Bands:
 - a. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 **OR** Type 316, **as directed**; 0.015 inch (0.38 mm) thick, 1/2 inch (13 mm) **OR** 3/4 inch (19 mm), **as directed**, wide with wing seal **OR** closed seal, **as directed**.
 - b. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 1/2 inch (13 mm) **OR** 3/4 inch (19 mm), **as directed**, wide with wing seal **OR** closed seal, **as directed**.
 - c. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.
2. Insulation Pins and Hangers:



- a. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- (2.6-mm-) **OR** 0.135-inch- (3.5-mm-), **as directed**, diameter shank, length to suit depth of insulation indicated.
 - b. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- (2.6-mm-) **OR** 0.135-inch- (3.5-mm-), **as directed**, diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch (38-mm) galvanized carbon-steel washer.
 - c. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - 1) Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.
 - 2) Spindle: Copper- or zinc-coated, low carbon steel **OR** Aluminum **OR** Stainless steel, **as directed**, fully annealed, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.
 - 3) Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
 - d. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - 1) Baseplate: Perforated, nylon sheet, 0.030 inch (0.76 mm) thick by 1-1/2 inches (38 mm) in diameter.
 - 2) Spindle: Nylon, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches (63 mm).
 - 3) Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
 - e. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - 1) Baseplate: Galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.
 - 2) Spindle: Copper- or zinc-coated, low carbon steel **OR** Aluminum **OR** Stainless steel, **as directed**, fully annealed, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.
 - 3) Adhesive-backed base with a peel-off protective cover.
 - f. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick, galvanized-steel **OR** aluminum **OR** stainless-steel, **as directed**, sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.
 - 1) Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
 - g. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.
3. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.
 4. Wire: 0.080-inch (2.0-mm) nickel-copper alloy **OR** 0.062-inch (1.6-mm) soft-annealed, stainless steel **OR** 0.062-inch (1.6-mm) soft-annealed, galvanized steel, **as directed**.
- O. Corner Angles
1. PVC Corner Angles: 30 mils (0.8 mm) thick, minimum 1 by 1 inch (25 by 25 mm), PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.



2. Aluminum Corner Angles: 0.040 inch (1.0 mm) thick, minimum 1 by 1 inch (25 by 25 mm), aluminum according to ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105 or 5005; Temper H-14.
3. Stainless-Steel Corner Angles: 0.024 inch (0.61 mm) thick, minimum 1 by 1 inch (25 by 25 mm), stainless steel according to ASTM A 167 or ASTM A 240/A 240M, Type 304 **OR** Type 316, **as directed**.

1.3 EXECUTION

A. Preparation

1. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
OR
Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
 - a. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils (0.127 mm) thick and an epoxy finish 5 mils (0.127 mm) thick if operating in a temperature range between 140 and 300 deg F (60 and 149 deg C). Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
 - b. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F (0 and 149 deg C) with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
3. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

B. General Installation Requirements

1. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.
2. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.
3. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
4. Install insulation with longitudinal seams at top and bottom of horizontal runs.
5. Install multiple layers of insulation with longitudinal and end seams staggered.
6. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
7. Keep insulation materials dry during application and finishing.
8. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
9. Install insulation with least number of joints practical.
10. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - a. Install insulation continuously through hangers and around anchor attachments.
 - b. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - c. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.



- d. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
11. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
12. Install insulation with factory-applied jackets as follows:
 - a. Draw jacket tight and smooth.
 - b. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
 - c. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) **OR** 4 inches (100 mm), **as directed**, o.c.
 - 1) For below ambient services, apply vapor-barrier mastic over staples.
 - d. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
 - e. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.
13. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
14. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
15. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
16. For above ambient services, do not install insulation to the following:
 - a. Vibration-control devices.
 - b. Testing agency labels and stamps.
 - c. Nameplates and data plates.
 - d. Manholes.
 - e. Handholes.
 - f. Cleanouts.

C. Penetrations

1. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 - a. Seal penetrations with flashing sealant.
 - b. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - c. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
 - d. Seal jacket to roof flashing with flashing sealant.
2. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
3. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - a. Seal penetrations with flashing sealant.
 - b. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - c. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
 - d. Seal jacket to wall flashing with flashing sealant.



4. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
 5. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches (50 mm).
 - a. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
 6. Insulation Installation at Floor Penetrations:
 - a. Duct: Install insulation continuously through floor penetrations that are not fire rated. For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches (50 mm).
 - b. Pipe: Install insulation continuously through floor penetrations.
 - c. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping".
- D. Equipment, Tank, And Vessel Insulation Installation
1. Mineral Fiber, Pipe and Tank Insulation Installation for Tanks and Vessels: Secure insulation with adhesive and anchor pins and speed washers.
 - a. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 **OR** 50, **as directed**, percent coverage of tank and vessel surfaces.
 - b. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
 - c. Protect exposed corners with secured corner angles.
 - d. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:
 - 1) Do not weld anchor pins to ASME-labeled pressure vessels.
 - 2) Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
 - 3) On tanks and vessels, maximum anchor-pin spacing is 3 inches (75 mm) from insulation end joints, and 16 inches (400 mm) o.c. in both directions.
 - 4) Do not overcompress insulation during installation.
 - 5) Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
 - 6) Impale insulation over anchor pins and attach speed washers.
 - 7) Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 - e. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
 - f. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches (150 mm) from each end. Install wire or cable between two circumferential girdles 12 inches (300 mm) o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches (1200 mm) o.c. Use this network for securing insulation with tie wire or bands.
 - g. Stagger joints between insulation layers at least 3 inches (75 mm).
 - h. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.



- i. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
- j. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.
2. Flexible Elastomeric Thermal Insulation Installation for Tanks and Vessels: Install insulation over entire surface of tanks and vessels.
 - a. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive.
 - b. Seal longitudinal seams and end joints.
3. Insulation Installation on Pumps:
 - a. Fabricate metal boxes lined with insulation. Fit boxes around pumps and coincide box joints with splits in pump casings. Fabricate joints with outward bolted flanges. Bolt flanges on 6-inch (150-mm) centers, starting at corners. Install 3/8-inch- (10-mm-) diameter fasteners with wing nuts. Alternatively, secure the box sections together using a latching mechanism.
 - b. Fabricate boxes from galvanized steel **OR** aluminum **OR** stainless steel, **as directed**, at least 0.040 inch (1.0 mm) **OR** 0.050 inch (1.3 mm) **OR** 0.060 inch (1.6 mm), **as directed**, thick.
 - c. For below ambient services, install a vapor barrier at seams, joints, and penetrations. Seal between flanges with replaceable gasket material to form a vapor barrier.

E. General Pipe Insulation Installation

1. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
2. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 - a. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
 - b. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 - c. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 - d. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 - e. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
 - f. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 - g. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 - h. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and



- unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
- i. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.
3. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
 4. Install removable insulation covers at locations indicated. Installation shall conform to the following:
 - a. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 - b. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 - c. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
 - d. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
 - e. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.
- F. Calcium Silicate Insulation Installation
1. Insulation Installation on Boiler Breechings and Ducts:
 - a. Secure single-layer insulation with stainless-steel bands at 12-inch (300-mm) intervals and tighten bands without deforming insulation material.
 - b. Install 2-layer insulation with joints tightly butted and staggered at least 3 inches (75 mm). Secure inner layer with wire spaced at 12-inch (300-mm) intervals. Secure outer layer with stainless-steel bands at 12-inch (300-mm) intervals.
 - c. On exposed applications without metal jacket, finish insulation surface with a skim coat of mineral-fiber, hydraulic-setting cement. When cement is dry, apply flood coat of lagging adhesive and press on one layer of glass cloth. Overlap edges at least 1 inch (25 mm). Apply finish coat of lagging adhesive over glass cloth. Thin finish coat to achieve smooth, uniform finish.
 2. Insulation Installation on Straight Pipes and Tubes:
 - a. Secure single-layer insulation with stainless-steel bands at 12-inch (300-mm) intervals and tighten bands without deforming insulation materials.
 - b. Install 2-layer insulation with joints tightly butted and staggered at least 3 inches (75 mm). Secure inner layer with wire spaced at 12-inch (300-mm) intervals. Secure outer layer with stainless-steel bands at 12-inch (300-mm) intervals.
 - c. Apply a skim coat of mineral-fiber, hydraulic-setting cement to insulation surface. When cement is dry, apply flood coat of lagging adhesive and press on one layer of glass cloth or tape. Overlap edges at least 1 inch (25 mm). Apply finish coat of lagging adhesive over glass cloth or tape. Thin finish coat to achieve smooth, uniform finish.
 3. Insulation Installation on Pipe Flanges:
 - a. Install preformed pipe insulation to outer diameter of pipe flange.
 - b. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.



- c. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of same material and thickness as pipe insulation.
 - d. Finish flange insulation same as pipe insulation.
 4. Insulation Installation on Pipe Fittings and Elbows:
 - a. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
 - b. When preformed insulation sections of insulation are not available, install mitered sections of calcium silicate insulation. Secure insulation materials with wire or bands.
 - c. Finish fittings insulation same as pipe insulation.
 5. Insulation Installation on Valves and Pipe Specialties:
 - a. Install mitered segments of calcium silicate insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - b. Install insulation to flanges as specified for flange insulation application.
 - c. Finish valve and specialty insulation same as pipe insulation.
- G. Cellular-Glass Insulation Installation
 1. Insulation Installation on Straight Pipes and Tubes:
 - a. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
 - b. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 - c. For insulation with factory-applied jackets on above ambient services, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
 - d. For insulation with factory-applied jackets on below ambient services, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
 2. Insulation Installation on Pipe Flanges:
 - a. Install preformed pipe insulation to outer diameter of pipe flange.
 - b. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - c. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
 - d. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.
 3. Insulation Installation on Pipe Fittings and Elbows:
 - a. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
 - b. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.
 4. Insulation Installation on Valves and Pipe Specialties:
 - a. Install preformed sections of cellular-glass insulation to valve body.
 - b. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - c. Install insulation to flanges as specified for flange insulation application.
- H. Flexible Elastomeric Insulation Installation
 1. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
 2. Insulation Installation on Pipe Flanges:
 - a. Install pipe insulation to outer diameter of pipe flange.
 - b. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.



- c. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
 - d. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
 3. Insulation Installation on Pipe Fittings and Elbows:
 - a. Install mitered sections of pipe insulation.
 - b. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
 4. Insulation Installation on Valves and Pipe Specialties:
 - a. Install preformed valve covers manufactured of same material as pipe insulation when available.
 - b. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - c. Install insulation to flanges as specified for flange insulation application.
 - d. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- I. Mineral-Fiber Insulation Installation
 1. Insulation Installation on Straight Pipes and Tubes:
 - a. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
 - b. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 - c. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
 - d. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
 2. Insulation Installation on Pipe Flanges:
 - a. Install preformed pipe insulation to outer diameter of pipe flange.
 - b. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - c. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
 - d. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.
 3. Insulation Installation on Pipe Fittings and Elbows:
 - a. Install preformed sections of same material as straight segments of pipe insulation when available.
 - b. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
 4. Insulation Installation on Valves and Pipe Specialties:
 - a. Install preformed sections of same material as straight segments of pipe insulation when available.
 - b. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
 - c. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - d. Install insulation to flanges as specified for flange insulation application.
 5. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.



- a. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 **OR** 50, **as directed**, percent coverage of duct and plenum surfaces.
 - b. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 - c. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - 1) On duct sides with dimensions 18 inches (450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
 - 2) On duct sides with dimensions larger than 18 inches (450 mm), place pins 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - 3) Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - 4) Do not overcompress insulation during installation.
 - 5) Impale insulation over pins and attach speed washers.
 - 6) Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 - d. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - 1) Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - 2) Install vapor stops for ductwork and plenums operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches (75 mm).
 - e. Overlap unfaced blankets a minimum of 2 inches (50 mm) on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches (450 mm) o.c.
 - f. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 - g. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- (150-mm-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches (150 mm) o.c.
6. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
- a. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 **OR** 50, **as directed**, percent coverage of duct and plenum surfaces.
 - b. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 - c. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - 1) On duct sides with dimensions 18 inches (450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
 - 2) On duct sides with dimensions larger than 18 inches (450 mm), space pins 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.



- 3) Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
- 4) Do not overcompress insulation during installation.
- 5) Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
- d. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - 1) Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - 2) Install vapor stops for ductwork and plenums operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches (75 mm).
- e. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
- f. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- (150-mm-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches (150 mm) o.c.

J. Phenolic Insulation Installation

1. General Installation Requirements:
 - a. Secure single-layer insulation with stainless-steel bands at 12-inch (300-mm) intervals and tighten bands without deforming insulation materials.
 - b. Install 2-layer insulation with joints tightly butted and staggered at least 3 inches (75 mm). Secure inner layer with 0.062-inch (1.6-mm) wire spaced at 12-inch (300-mm) intervals. Secure outer layer with stainless-steel bands at 12-inch (300-mm) intervals.
2. Insulation Installation on Straight Pipes and Tubes:
 - a. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
 - b. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 - c. For insulation with factory-applied jackets on above ambient services, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
 - d. For insulation with factory-applied jackets with vapor retarders on below ambient services, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
3. Insulation Installation on Pipe Flanges:
 - a. Install preformed pipe insulation to outer diameter of pipe flange.
 - b. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - c. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of same material and thickness as pipe insulation.
4. Insulation Installation on Pipe Fittings and Elbows:
 - a. Install preformed insulation sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.
5. Insulation Installation on Valves and Pipe Specialties:



- a. Install preformed insulation sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.
 - b. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - c. Install insulation to flanges as specified for flange insulation application.
- K. Polyisocyanurate Insulation Installation
1. Insulation Installation on Straight Pipes and Tubes:
 - a. Secure each layer of insulation to pipe with tape or bands and tighten without deforming insulation materials. Orient longitudinal joints between half sections in 3 and 9 o'clock positions on the pipe.
 - b. For insulation with factory-applied jackets with vapor barriers, do not staple longitudinal tabs but secure tabs with additional adhesive or tape as recommended by insulation material manufacturer and seal with vapor-barrier mastic.
 - c. All insulation shall be tightly butted and free of voids and gaps at all joints. Vapor barrier must be continuous. Before installing jacket material, install vapor-barrier system.
 2. Insulation Installation on Pipe Flanges:
 - a. Install preformed pipe insulation to outer diameter of pipe flange.
 - b. Make width of insulation section same as overall width of flange and bolts, same thickness of adjacent pipe insulation, not to exceed 1-1/2-inch (38-mm) thickness.
 - c. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyisocyanurate block insulation of same thickness as pipe insulation.
 3. Insulation Installation on Fittings and Elbows:
 - a. Install preformed sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.
 4. Insulation Installation on Valves and Pipe Specialties:
 - a. Install preformed sections of polyisocyanurate insulation to valve body.
 - b. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - c. Install insulation to flanges as specified for flange insulation application.
- L. Polyolefin Insulation Installation
1. Insulation Installation on Straight Pipes and Tubes:
 - a. Seal split-tube longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
 2. Insulation Installation on Pipe Flanges:
 - a. Install pipe insulation to outer diameter of pipe flange.
 - b. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - c. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyolefin sheet insulation of same thickness as pipe insulation.
 - d. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
 3. Insulation Installation on Pipe Fittings and Elbows:
 - a. Install mitered sections of polyolefin pipe insulation.
 - b. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
 4. Insulation Installation on Valves and Pipe Specialties:
 - a. Install cut sections of polyolefin pipe and sheet insulation to valve body.
 - b. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - c. Install insulation to flanges as specified for flange insulation application.



- d. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

M. Polystyrene Insulation Installation

1. Insulation Installation on Straight Pipes and Tubes:
 - a. Secure each layer of insulation with tape or bands and tighten bands without deforming insulation materials. Orient longitudinal joints between half sections in 3 and 9 o'clock positions on the pipe.
 - b. For insulation with factory-applied jackets with vapor barriers, do not staple longitudinal tabs but secure tabs with additional adhesive or tape as recommended by insulation material manufacturer and seal with vapor-barrier mastic.
 - c. All insulation shall be tightly butted and free of voids and gaps at all joints. Vapor barrier must be continuous. Before installing jacket material, install vapor-barrier system.
2. Insulation Installation on Pipe Flanges:
 - a. Install preformed pipe insulation to outer diameter of pipe flange.
 - b. Make width of insulation section same as overall width of flange and bolts, same thickness of adjacent pipe insulation, not to exceed 1-1/2-inch (38-mm) thickness.
 - c. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polystyrene block insulation of same thickness as pipe insulation.
3. Insulation Installation on Pipe Fittings and Elbows:
 - a. Install preformed insulation sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.
4. Insulation Installation on Valves and Pipe Specialties:
 - a. Install preformed section of polystyrene insulation to valve body.
 - b. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - c. Install insulation to flanges as specified for flange insulation application.

N. Field-Applied Jacket Installation

1. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
 - a. Draw jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.
 - b. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of lagging adhesive.
 - c. Completely encapsulate insulation with coating, leaving no exposed insulation.
2. Where FSK jackets are indicated, install as follows:
 - a. Draw jacket material smooth and tight.
 - b. Install lap or joint strips with same material as jacket.
 - c. Secure jacket to insulation with manufacturer's recommended adhesive.
 - d. Install jacket with 1-1/2-inch (38-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
 - e. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
3. Where PVC jackets are indicated, install with 1-inch (25-mm) overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.
 - a. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
4. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints.
5. Where PVDC jackets are indicated, install as follows:



- a. Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.
 - b. Wrap factory-presizes jackets around individual pipe insulation sections with one end overlapping the previously installed sheet. Install presized jacket with an approximate overlap at butt joint of 2 inches (50 mm) over the previous section. Adhere lap seal using adhesive or SSL, and then apply 1-1/4 circumferences of appropriate PVDC tape around overlapped butt joint.
 - c. Continuous jacket can be spiral wrapped around a length of pipe insulation. Apply adhesive or PVDC tape at overlapped spiral edge. When electing to use adhesives, refer to manufacturer's written instructions for application of adhesives along this spiral edge to maintain a permanent bond.
 - d. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches (850 mm) or less. The 33-1/2-inch- (850-mm-) circumference limit allows for 2-inch- (50-mm-) overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.
 - e. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.
- O. Fire-Rated Insulation System Installation
1. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.
 2. Insulate duct access panels and doors to achieve same fire rating as duct.
 3. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Division 07 Section "Penetration Firestopping".
- P. Finishes
1. Duct, Equipment, and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 07.
 - a. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - 1) Finish Coat Material: Interior, flat, latex-emulsion size.
 2. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
 3. Color: Final color as selected by the Owner. Vary first and second coats to allow visual inspection of the completed Work.
 4. Do not field paint aluminum or stainless-steel jackets.
- Q. Field Quality Control
1. Perform tests and inspections.
 2. Tests and Inspections:
 - a. Inspect ductwork, randomly selected by the Owner, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.
 - b. Inspect field-insulated equipment, randomly selected by the Owner, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.
 - c. Inspect pipe, fittings, strainers, and valves, randomly selected by the Owner, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations



of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

3. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

R. Boiler Breeching Insulation Schedule

1. Round, exposed breeching and connector insulation shall be one of the following:
 - a. Calcium Silicate: 4 inches (100 mm) thick.
 - b. High-Temperature Mineral-Fiber Blanket: 3 inches (75 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.
 - c. High-Temperature Mineral-Fiber Board: 3 inches (75 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
2. Round, concealed breeching and connector insulation shall be one of the following:
 - a. Calcium Silicate: 4 inches (100 mm) thick.
 - b. High-Temperature Mineral-Fiber Blanket: 3 inches (75 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.
 - c. High-Temperature Mineral-Fiber Board: 3 inches (75 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
3. Rectangular, exposed breeching and connector insulation shall be one of the following:
 - a. Calcium Silicate: 4 inches (100 mm) thick.
 - b. High-Temperature Mineral-Fiber Blanket: 3 inches (75 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.
 - c. High-Temperature Mineral-Fiber Board: 3 inches (75 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
4. Rectangular, concealed breeching and connector insulation shall be one of the following:
 - a. Calcium Silicate: 4 inches (100 mm) thick.
 - b. High-Temperature Mineral-Fiber Blanket: 3 inches (75 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.
 - c. High-Temperature Mineral-Fiber Board: 3 inches (75 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.

S. Duct Insulation Schedule, General

1. Plenums and Ducts Requiring Insulation:
 - a. Indoor, concealed supply and outdoor air.
 - b. Indoor, exposed supply and outdoor air.
 - c. Indoor, concealed return located in nonconditioned space.
 - d. Indoor, exposed return located in nonconditioned space.
 - e. Indoor, concealed, Type I, commercial, kitchen hood exhaust.
 - f. Indoor, exposed, Type I, commercial, kitchen hood exhaust.
 - g. Indoor, concealed oven and warewash exhaust.
 - h. Indoor, exposed oven and warewash exhaust.
 - i. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
 - j. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
 - k. Outdoor, concealed supply and return.
 - l. Outdoor, exposed supply and return.
2. Items Not Insulated:
 - a. Fibrous-glass ducts.
 - b. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
 - c. Factory-insulated flexible ducts.
 - d. Factory-insulated plenums and casings.
 - e. Flexible connectors.
 - f. Vibration-control devices.
 - g. Factory-insulated access panels and doors.



T. Indoor Duct And Plenum Insulation Schedule

1. Concealed, round and flat-oval, supply-air duct insulation shall be one of the following:
 - a. Flexible Elastomeric: 1 inch (25 mm) thick.
 - b. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 0.75-lb/cu. ft. (12-kg/cu. m) **OR** 1.5-lb/cu. ft. (24-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m), **as directed**, nominal density.
 - c. Mineral-Fiber Board: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - d. Phenolic: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.
 - e. Polyolefin: 1 inch (25 mm) thick.
2. Concealed, round and flat-oval, return-air duct insulation shall be one of the following:
 - a. Flexible Elastomeric: 1 inch (25 mm) thick.
 - b. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 0.75-lb/cu. ft. (12-kg/cu. m) **OR** 1.5-lb/cu. ft. (24-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m), **as directed**, nominal density.
 - c. Mineral-Fiber Board: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - d. Phenolic: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.
 - e. Polyolefin: 1 inch (25 mm) thick.
3. Concealed, round and flat-oval, outdoor-air duct insulation shall be one of the following:
 - a. Flexible Elastomeric: 1 inch (25 mm) thick.
 - b. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 0.75-lb/cu. ft. (12-kg/cu. m) **OR** 1.5-lb/cu. ft. (24-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m), **as directed**, nominal density.
 - c. Mineral-Fiber Board: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - d. Phenolic: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.
 - e. Polyolefin: 1 inch (25 mm) thick.
4. Concealed, round and flat-oval, exhaust-air duct insulation shall be one of the following:
 - a. Flexible Elastomeric: 1 inch (25 mm) thick.
 - b. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 0.75-lb/cu. ft. (12-kg/cu. m) **OR** 1.5-lb/cu. ft. (24-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m), **as directed**, nominal density.
 - c. Mineral-Fiber Board: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - d. Phenolic: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.
 - e. Polyolefin: 1 inch (25 mm) thick.
5. Concealed, rectangular, supply-air duct insulation shall be one of the following:
 - a. Flexible Elastomeric: 1 inch (25 mm) thick.
 - b. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 0.75-lb/cu. ft. (12-kg/cu. m) **OR** 1.5-lb/cu. ft. (24-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m), **as directed**, nominal density.
 - c. Mineral-Fiber Board: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - d. Phenolic: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.
 - e. Polyolefin: 1 inch (25 mm) thick.



6. Concealed, rectangular, return-air duct insulation shall be one of the following:
 - a. Flexible Elastomeric: 1 inch (25 mm) thick.
 - b. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 0.75-lb/cu. ft. (12-kg/cu. m) **OR** 1.5-lb/cu. ft. (24-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m), **as directed**, nominal density.
 - c. Mineral-Fiber Board: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - d. Phenolic: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.
 - e. Polyolefin: 1 inch (25 mm), **as directed**, thick.
7. Concealed, rectangular, outdoor-air duct insulation shall be one of the following:
 - a. Flexible Elastomeric: 1 inch (25 mm) thick.
 - b. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 0.75-lb/cu. ft. (12-kg/cu. m) **OR** 1.5-lb/cu. ft. (24-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m), **as directed**, nominal density.
 - c. Mineral-Fiber Board: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - d. Phenolic: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.
 - e. Polyolefin: 1 inch (25 mm), **as directed**, thick.
8. Concealed, rectangular, exhaust-air duct insulation between isolation damper and penetration of building exterior shall be one of the following:
 - a. Flexible Elastomeric: 1 inch (25 mm) thick.
 - b. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 0.75-lb/cu. ft. (12-kg/cu. m) **OR** 1.5-lb/cu. ft. (24-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m), **as directed**, nominal density.
 - c. Mineral-Fiber Board: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - d. Phenolic: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.
 - e. Polyolefin: 1 inch (25 mm) thick.
9. Concealed, Type I, Commercial, Kitchen Hood Exhaust Duct and Plenum Insulation: Fire-rated blanket **OR** board, **as directed**; thickness as required to achieve 2-hour fire rating.
10. Concealed, supply-air plenum insulation shall be one of the following:
 - a. Flexible Elastomeric: 1 inch (25 mm) thick.
 - b. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 0.75-lb/cu. ft. (12-kg/cu. m) **OR** 1.5-lb/cu. ft. (24-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m), **as directed**, nominal density.
 - c. Mineral-Fiber Board: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - d. Phenolic: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.
 - e. Polyolefin: 1 inch (25 mm) thick.
11. Concealed, return-air plenum insulation shall be one of the following:
 - a. Flexible Elastomeric: 1 inch (25 mm) thick.
 - b. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 0.75-lb/cu. ft. (12-kg/cu. m) **OR** 1.5-lb/cu. ft. (24-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m), **as directed**, nominal density.
 - c. Mineral-Fiber Board: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.



- d. Phenolic: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.
 - e. Polyolefin: 1 inch (25 mm) thick.
12. Concealed, outdoor-air plenum insulation shall be one of the following:
- a. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 0.75-lb/cu. ft. (12-kg/cu. m) **OR** 1.5-lb/cu. ft. (24-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m), **as directed**, nominal density.
 - b. Mineral-Fiber Board: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - c. Phenolic: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.
13. Concealed, exhaust-air plenum insulation shall be one of the following:
- a. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 0.75-lb/cu. ft. (12-kg/cu. m) **OR** 1.5-lb/cu. ft. (24-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m), **as directed**, nominal density.
 - b. Mineral-Fiber Board: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - c. Phenolic: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.
14. Exposed, round and flat-oval, supply-air duct insulation shall be one of the following:
- a. Flexible Elastomeric: 1 inch (25 mm) thick.
 - b. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 0.75-lb/cu. ft. (12-kg/cu. m) **OR** 1.5-lb/cu. ft. (24-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m), **as directed**, nominal density.
 - c. Mineral-Fiber Board: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - d. Phenolic: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.
 - e. Polyolefin: 1 inch (25 mm) thick.
15. Exposed, round and flat-oval, return-air duct insulation shall be one of the following:
- a. Flexible Elastomeric: 1 inch (25 mm) thick.
 - b. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 0.75-lb/cu. ft. (12-kg/cu. m) **OR** 1.5-lb/cu. ft. (24-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m), **as directed**, nominal density.
 - c. Mineral-Fiber Board: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - d. Phenolic: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.
 - e. Polyolefin: 1 inch (25 mm) thick.
16. Exposed, round and flat-oval, outdoor-air duct insulation shall be one of the following:
- a. Flexible Elastomeric: 1 inch (25 mm) thick.
 - b. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 0.75-lb/cu. ft. (12-kg/cu. m) **OR** 1.5-lb/cu. ft. (24-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m), **as directed**, nominal density.
 - c. Mineral-Fiber Board: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - d. Phenolic: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.
 - e. Polyolefin: 1 inch (25 mm) thick.
17. Exposed, round and flat-oval, exhaust-air duct insulation shall be one of the following:
- a. Flexible Elastomeric: 1 inch (25 mm) thick.



- b. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 0.75-lb/cu. ft. (12-kg/cu. m) **OR** 1.5-lb/cu. ft. (24-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m), **as directed**, nominal density.
 - c. Mineral-Fiber Board: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - d. Phenolic: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.
 - e. Polyolefin: 1 inch (25 mm) thick.
18. Exposed, rectangular, supply-air duct insulation shall be one of the following:
- a. Flexible Elastomeric: 1 inch (25 mm) thick.
 - b. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 0.75-lb/cu. ft. (12-kg/cu. m) **OR** 1.5-lb/cu. ft. (24-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m), **as directed**, nominal density.
 - c. Mineral-Fiber Board: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96 kg/cu. m), **as directed**, nominal density.
 - d. Phenolic: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.
 - e. Polyolefin: 1 inch (25 mm) thick.
19. Exposed, rectangular, return-air duct insulation shall be one of the following:
- a. Flexible Elastomeric: 1 inch (25 mm) thick.
 - b. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 0.75-lb/cu. ft. (12-kg/cu. m) **OR** 1.5-lb/cu. ft. (24-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m), **as directed**, nominal density.
 - c. Mineral-Fiber Board: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - d. Phenolic: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.
 - e. Polyolefin: 1 inch (25 mm) thick.
20. Exposed, rectangular, outdoor-air duct insulation shall be one of the following:
- a. Flexible Elastomeric: 1 inch (25 mm) thick.
 - b. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 0.75-lb/cu. ft. (12-kg/cu. m) **OR** 1.5-lb/cu. ft. (24-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m), **as directed**, nominal density.
 - c. Mineral-Fiber Board: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - d. Phenolic: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.
 - e. Polyolefin: 1 inch (25 mm) thick.
21. Exposed, rectangular, exhaust-air duct insulation shall be one of the following:
- a. Flexible Elastomeric: 1 inch (25 mm) thick.
 - b. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 0.75-lb/cu. ft. (12-kg/cu. m) **OR** 1.5-lb/cu. ft. (24-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m), **as directed**, nominal density.
 - c. Mineral-Fiber Board: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - d. Phenolic: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.
 - e. Polyolefin: 1 inch (25 mm) thick.
22. Exposed, Type I, Commercial, Kitchen Hood Exhaust Duct and Plenum Insulation: Fire-rated blanket **OR** board, **as directed**; thickness as required to achieve 2-hour fire rating.



23. Exposed, supply-air plenum insulation shall be one of the following:
 - a. Flexible Elastomeric: 1 inch (25 mm) thick.
 - b. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 0.75-lb/cu. ft. (12-kg/cu. m) **OR** 1.5-lb/cu. ft. (24-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m), **as directed**, nominal density.
 - c. Mineral-Fiber Board: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - d. Phenolic: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.
 - e. Polyolefin: 1 inch (25 mm) thick.
 24. Exposed, return-air plenum insulation shall be one of the following:
 - a. Flexible Elastomeric: 1 inch (25 mm) thick.
 - b. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 0.75-lb/cu. ft. (12-kg/cu. m) **OR** 1.5-lb/cu. ft. (24-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m), **as directed**, nominal density.
 - c. Mineral-Fiber Board: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - d. Phenolic: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.
 - e. Polyolefin: 1 inch (25 mm) thick.
 25. Exposed, outdoor-air plenum insulation shall be one of the following:
 - a. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 0.75-lb/cu. ft. (12-kg/cu. m) **OR** 1.5-lb/cu. ft. (24-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m), **as directed**, nominal density.
 - b. Mineral-Fiber Board: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - c. Phenolic: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.
 26. Exposed, exhaust-air plenum insulation shall be one of the following:
 - a. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 0.75-lb/cu. ft. (12-kg/cu. m) **OR** 1.5-lb/cu. ft. (24-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m), **as directed**, nominal density.
 - b. Mineral-Fiber Board: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - c. Phenolic: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.
- U. Aboveground, Outdoor Duct And Plenum Insulation Schedule
1. Insulation materials and thicknesses are identified below. If more than one material is listed for a duct system, selection from materials listed is Contractor's option.
 2. Concealed, round and flat-oval, supply-air duct insulation shall be one of the following:
 - a. Mineral-Fiber Blanket: 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, and 0.75-lb/cu. ft. (12-kg/cu. m) **OR** 1.5-lb/cu. ft. (24-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m), **as directed**, nominal density.
 - b. Mineral-Fiber Board: 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - c. Phenolic: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.
 3. Concealed, round and flat-oval, return-air duct insulation shall be one of the following:
 - a. Mineral-Fiber Blanket: 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, and 0.75-lb/cu. ft. (12-kg/cu. m) **OR** 1.5-lb/cu. ft. (24-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m), **as directed**, nominal density.



- b. Mineral-Fiber Board: 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - c. Phenolic: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.
 4. Concealed, round and flat-oval, outdoor-air duct insulation shall be one of the following:
 - a. Mineral-Fiber Blanket: 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, and 0.75-lb/cu. ft. (12-kg/cu. m) **OR** 1.5-lb/cu. ft. (24-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m), **as directed**, nominal density.
 - b. Mineral-Fiber Board: 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - c. Phenolic: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.
 5. Concealed, rectangular, supply-air duct insulation shall be one of the following:
 - a. Mineral-Fiber Blanket: 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, and 0.75-lb/cu. ft. (12-kg/cu. m) **OR** 1.5-lb/cu. ft. (24-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m), **as directed**, nominal density.
 - b. Mineral-Fiber Board: 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - c. Phenolic: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.
 6. Concealed, rectangular, return-air duct insulation shall be one of the following:
 - a. Mineral-Fiber Blanket: 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, and 0.75-lb/cu. ft. (12-kg/cu. m) **OR** 1.5-lb/cu. ft. (24-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m), **as directed**, nominal density.
 - b. Mineral-Fiber Board: 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - c. Phenolic: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.
 7. Concealed, supply-air plenum insulation shall be one of the following:
 - a. Mineral-Fiber Blanket: 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, and 0.75-lb/cu. ft. (12-kg/cu. m) **OR** 1.5-lb/cu. ft. (24-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m), **as directed**, nominal density.
 - b. Mineral-Fiber Board: 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - c. Phenolic: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.
 8. Concealed, return-air plenum insulation shall be one of the following:
 - a. Mineral-Fiber Blanket: 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, and 0.75-lb/cu. ft. (12-kg/cu. m) **OR** 1.5-lb/cu. ft. (24-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m), **as directed**, nominal density.
 - b. Mineral-Fiber Board: 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - c. Phenolic: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.
 9. Exposed, round and flat-oval, supply-air duct insulation shall be one of the following:
 - a. Mineral-Fiber Blanket: 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, and 0.75-lb/cu. ft. (12-kg/cu. m) **OR** 1.5-lb/cu. ft. (24-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m), **as directed**, nominal density.
 - b. Mineral-Fiber Board: 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - c. Phenolic: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.
 10. Exposed, round and flat-oval, return-air duct insulation shall be one of the following:



- a. Mineral-Fiber Blanket: 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, and 0.75-lb/cu. ft. (12-kg/cu. m) **OR** 1.5-lb/cu. ft. (24-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m), **as directed**, nominal density.
- b. Mineral-Fiber Board: 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
- c. Phenolic: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.
11. Exposed, rectangular, supply-air duct insulation shall be one of the following:
 - a. Mineral-Fiber Blanket: 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, and 0.75-lb/cu. ft. (12-kg/cu. m) **OR** 1.5-lb/cu. ft. (24-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m), **as directed**, nominal density.
 - b. Mineral-Fiber Board: 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - c. Phenolic: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.
12. Exposed, rectangular, return-air duct insulation shall be one of the following:
 - a. Mineral-Fiber Blanket: 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, and 0.75-lb/cu. ft. (12-kg/cu. m) **OR** 1.5-lb/cu. ft. (24-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m), **as directed**, nominal density.
 - b. Mineral-Fiber Board: 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - c. Phenolic: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.
13. Exposed, supply-air plenum insulation shall be one of the following:
 - a. Mineral-Fiber Blanket: 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, and 0.75-lb/cu. ft. (12-kg/cu. m) **OR** 1.5-lb/cu. ft. (24-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m), **as directed**, nominal density.
 - b. Mineral-Fiber Board: 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - c. Phenolic: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.
14. Exposed, return-air plenum insulation shall be one of the following:
 - a. Mineral-Fiber Blanket: 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, and 0.75-lb/cu. ft. (12-kg/cu. m) **OR** 1.5-lb/cu. ft. (24-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m), **as directed**, nominal density.
 - b. Mineral-Fiber Board: 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - c. Phenolic: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.

V. Equipment Insulation Schedule

1. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.
2. Insulate indoor and outdoor equipment in paragraphs below that is not factory insulated.
3. Chillers: Insulate cold surfaces on chillers, including, but not limited to, evaporator bundles, condenser bundles, heat-recovery bundles, suction piping, compressor inlets, tube sheets, water boxes, and nozzles with one of the following:
 - a. Cellular Glass: 2 inches (50 mm) thick.
 - b. Flexible Elastomeric: 1 inch (25 mm) thick.
 - c. Mineral-Fiber Board: 1 inch (25 mm) thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - d. Mineral-Fiber Pipe and Tank: 1 inch (25 mm) thick.
 - e. Phenolic: 1 inch (25 mm) thick.
 - f. Polyisocyanurate: 1 inch (25 mm) thick.
 - g. Polyolefin: 1 inch (25 mm) thick.
4. Heat-exchanger (water-to-water for cooling service) insulation shall be one of the following:



- a. Cellular Glass: 2 inches (50 mm) thick.
 - b. Flexible Elastomeric: 1 inch (25 mm) thick.
 - c. Mineral-Fiber Board: 1 inch (25 mm) thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - d. Mineral-Fiber Pipe and Tank: 1 inch (25 mm) thick.
 - e. Phenolic: 1 inch (25 mm) thick.
 - f. Polyisocyanurate: 1 inch (25 mm) thick.
 - g. Polyolefin: 1 inch (25 mm) thick.
5. Heat-exchanger (water-to-water for heating service) insulation shall be one of the following:
 - a. Calcium Silicate: 3 inches (75 mm) thick.
 - b. Cellular Glass: 3 inches (75 mm) thick.
 - c. Mineral-Fiber Board: 2 inches (50 mm) thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - d. Mineral-Fiber Pipe and Tank: 2 inches (50 mm) thick.
 6. Steam-to-hot-water converter insulation shall be one of the following:
 - a. Calcium Silicate: 3 inches (75 mm) thick.
 - b. Cellular Glass: 3 inches (75 mm) thick.
 - c. Mineral-Fiber Board: 2 inches (50 mm) thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - d. Mineral-Fiber Pipe and Tank: 2 inches (50 mm) thick.
 7. Hot-water-to-steam converter insulation shall be one of the following:
 - a. Calcium Silicate: 3 inches (75 mm) thick.
 - b. Cellular Glass: 3 inches (75 mm) thick.
 - c. Mineral-Fiber Board: 2 inches (50 mm) thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - d. Mineral-Fiber Pipe and Tank: 2 inches (50 mm) thick.
 8. Chilled-water pump insulation shall be one of the following:
 - a. Cellular Glass: 3 inches (75 mm) thick.
 - b. Mineral-Fiber Board: 2 inches (50 mm) thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - c. Phenolic: 2 inches (50 mm) thick.
 - d. Polyisocyanurate: 1-1/2 inches (38 mm) thick.
 9. Condenser-water pump insulation shall be one of the following:
 - a. Cellular Glass: 2 inches (50 mm) thick.
 - b. Mineral-Fiber Board: 1 inch (25 mm) thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - c. Phenolic: 1 inch (25 mm) thick.
 - d. Polyisocyanurate: 1-1/2 inches (38 mm) thick.
 10. Dual-service heating and cooling pump insulation shall be one of the following:
 - a. Cellular Glass: 3 inches (75 mm) thick.
 - b. Mineral-Fiber Board: 2 inches (50 mm) thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - c. Phenolic: 2 inches (50 mm) thick.
 - d. Polyisocyanurate: 1 inch (25 mm) thick.
 11. Heating-hot-water pump insulation shall be one of the following:
 - a. Calcium Silicate: 3 inches (75 mm) thick.
 - b. Cellular Glass: 3 inches (75 mm) thick.
 - c. Mineral-Fiber Board: 2 inches (50 mm) thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 12. Heat-recovery pump insulation shall be one of the following:
 - a. Cellular Glass: 2 inches (50 mm) thick.
 - b. Mineral-Fiber Board: 2 inches (50 mm) thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - c. Phenolic: 1 inch (25 mm) thick.
 - d. Polyisocyanurate: 1-1/2 inches (38 mm) thick.



13. Steam condensate pump and boiler feedwater pump insulation shall be one of the following:
 - a. Calcium Silicate: 3 inches (75 mm) thick.
 - b. Cellular Glass: 3 inches (75 mm) thick.
 - c. Mineral-Fiber Board: 2 inches (50 mm) thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - d. Mineral-Fiber Pipe and Tank: 2 inches (50 mm) thick.
14. Chilled-water expansion/compression tank insulation shall be one of the following:
 - a. Cellular Glass: 1-1/2 inches (38 mm) thick.
 - b. Flexible Elastomeric: 1 inch (25 mm) thick.
 - c. Mineral-Fiber Board: 1 inch (25 mm) thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - d. Mineral-Fiber Pipe and Tank: 1 inch (25 mm) thick.
 - e. Phenolic: 1 inch (25 mm) thick.
 - f. Polyisocyanurate: 1 inch (25 mm) thick.
 - g. Polyolefin: 1 inch (25 mm) thick.
15. Condenser-water expansion/compression tank insulation shall be one of the following:
 - a. Cellular Glass: 1-1/2 inches (38 mm) thick.
 - b. Flexible Elastomeric: 1 inch (25 mm) thick.
 - c. Mineral-Fiber Board: 1 inch (25 mm) thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - d. Mineral-Fiber Pipe and Tank: 1 inch (25 mm) thick.
 - e. Phenolic: 1 inch (25 mm) thick.
 - f. Polyisocyanurate: 1 inch (25 mm) thick.
 - g. Polyolefin: 1 inch (25 mm) thick.
16. Dual-service heating and cooling expansion/compression tank insulation shall be one of the following:
 - a. Cellular Glass: 1-1/2 inches (38 mm) thick.
 - b. Flexible Elastomeric: 1 inch (25 mm) thick.
 - c. Mineral-Fiber Board: 1 inch (25 mm) thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - d. Mineral-Fiber Pipe and Tank: 1 inch (25 mm) thick.
 - e. Phenolic: 1 inch (25 mm) thick.
 - f. Polyisocyanurate: 1 inch (25 mm) thick.
 - g. Polyolefin: 1 inch (25 mm) thick.
17. Heating-hot-water expansion/compression tank insulation shall be one of the following:
 - a. Calcium Silicate: 2 inches (50 mm) thick.
 - b. Cellular Glass: 1-1/2 inches (38 mm) thick.
 - c. Mineral-Fiber Board: 1 inch (25 mm) thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - d. Mineral-Fiber Pipe and Tank: 1 inch (25 mm) thick.
18. Heat-recovery expansion/compression tank insulation shall be one of the following:
 - a. Cellular Glass: 1-1/2 inches (38 mm) thick.
 - b. Flexible Elastomeric: 1 inch (25 mm) thick.
 - c. Mineral-Fiber Board: 1 inch (25 mm) thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - d. Mineral-Fiber Pipe and Tank: 1 inch (25 mm) thick.
 - e. Phenolic: 1 inch (25 mm) thick.
 - f. Polyisocyanurate: 1 inch (25 mm) thick.
 - g. Polyolefin: 1 inch (25 mm) thick.
19. Chilled-water air-separator insulation shall be one of the following:
 - a. Cellular Glass: 2 inches (50 mm) thick.
 - b. Flexible Elastomeric: 1 inch (25 mm) thick.
 - c. Mineral-Fiber Board: 1 inch (25 mm) thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - d. Mineral-Fiber Pipe and Tank: 1 inch (25 mm) thick.
 - e. Phenolic: 1 inch (25 mm) thick.



- f. Polyisocyanurate: 1 inch (25 mm) thick.
 - g. Polyolefin: 1 inch (25 mm) thick.
20. Condenser-water air-separator insulation shall be one of the following:
- a. Cellular Glass: 2 inches (50 mm) thick.
 - b. Flexible Elastomeric: 1 inch (25 mm) thick.
 - c. Mineral-Fiber Board: 1 inch (25 mm) thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - d. Mineral-Fiber Pipe and Tank: 1 inch (25 mm) thick.
 - e. Phenolic: 1 inch (25 mm) thick.
 - f. Polyisocyanurate: 1 inch (25 mm) thick.
 - g. Polyolefin: 1 inch (25 mm) thick.
21. Dual-service heating and cooling air-separator insulation shall be one of the following:
- a. Cellular Glass: 2 inches (50 mm) thick.
 - b. Flexible Elastomeric: 1 inch (25 mm) thick.
 - c. Mineral-Fiber Board: 1 inch (25 mm) thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - d. Mineral-Fiber Pipe and Tank: 1 inch (25 mm) thick.
 - e. Phenolic: 1 inch (25 mm) thick.
 - f. Polyisocyanurate: 1 inch (25 mm) thick.
 - g. Polyolefin: 1 inch (25 mm) thick.
22. Heating-hot-water air-separator insulation shall be one of the following:
- a. Calcium Silicate: 3 inches (75 mm) thick.
 - b. Cellular Glass: 3 inches (75 mm) thick.
 - c. Mineral-Fiber Board: 2 inches (50 mm) thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - d. Mineral-Fiber Pipe and Tank: 2 inches (50 mm) thick.
23. Heat-recovery air-separator insulation shall be one of the following:
- a. Cellular Glass: 2 inches (50 mm) thick.
 - b. Flexible Elastomeric: 1 inch (25 mm) thick.
 - c. Mineral-Fiber Board: 1 inch (25 mm) thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - d. Mineral-Fiber Pipe and Tank: 1 inch (25 mm) thick.
 - e. Phenolic: 1 inch (25 mm) thick.
 - f. Polyisocyanurate: 1 inch (25 mm) thick.
 - g. Polyolefin: 1 inch (25 mm) thick.
24. Thermal storage tank (brine, water, ice) insulation shall be one of the following:
- a. Cellular Glass: 4 inches (100 mm) thick.
 - b. Mineral-Fiber Board: 3 inches (75 mm) thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - c. Mineral-Fiber Pipe and Tank: 3 inches (75 mm) thick.
 - d. Phenolic: 3 inches (75 mm) thick.
 - e. Polyisocyanurate (Outdoor Application Only): 3 inches (75 mm) thick.
 - f. Polystyrene (Outdoor Application Only): 3 inches (75 mm) thick.
25. Deaerator insulation shall be one of the following:
- a. Calcium Silicate: 3 inches (75 mm) thick.
 - b. Cellular Glass: 3 inches (75 mm) thick.
 - c. Mineral-Fiber Board: 2 inches (50 mm) thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - d. Mineral-Fiber Pipe and Tank: 2 inches (50 mm) thick.
26. Steam condensate tank and receiver insulation shall be one of the following:
- a. Calcium Silicate: 3 inches (75 mm) thick.
 - b. Cellular Glass: 3 inches (75 mm) thick.
 - c. Mineral-Fiber Board: 2 inches (50 mm) thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - d. Mineral-Fiber Pipe and Tank: 2 inches (50 mm) thick.



27. Steam flash-tank, flash-separator, and blow-off-tank insulation shall be one of the following:
 - a. Calcium Silicate: 3 inches (75 mm) thick.
 - b. Cellular Glass: 3 inches (75 mm) thick.
 - c. Mineral-Fiber Board: 2 inches (50 mm) thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - d. Mineral-Fiber Pipe and Tank: 2 inches (50 mm) thick.
 28. Piping system filter-housing insulation shall be one of the following:
 - a. Cellular Glass: 3 inches (75 mm) thick.
 - b. Mineral-Fiber Board: 2 inches (50 mm) thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - c. Mineral-Fiber Pipe and Tank: 2 inches (50 mm) thick.
 29. Outdoor, aboveground, heated, fuel-oil storage tank insulation shall be one of the following:
 - a. Cellular Glass: 3 inches (75 mm) thick.
 - b. Mineral-Fiber Board: 2 inches (50 mm) thick and 2-lb/cu. ft. (32-kg/cu. m) **OR** 3-lb/cu. ft. (48-kg/cu. m) **OR** 6-lb/cu. ft. (96-kg/cu. m), **as directed**, nominal density.
 - c. Mineral-Fiber Pipe and Tank: 2 inches (50 mm) thick.
 - d. Polyisocyanurate: 1-1/2 inches (38 mm) thick.
- W. Piping Insulation Schedule, General
1. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
 2. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 - a. Drainage piping located in crawl spaces.
 - b. Underground piping.
 - c. Chrome-plated pipes and fittings unless there is a potential for personnel injury.
- X. Indoor Piping Insulation Schedule
1. Condensate and Equipment Drain Water below 60 Deg F (16 Deg C):
 - a. All Pipe Sizes: Insulation shall be one of the following:
 - 1) Cellular Glass: 1-1/2 inches (38 mm) thick.
 - 2) Flexible Elastomeric: 3/4 inch (19 mm) **OR** 1 inch (25 mm), **as directed**, thick.
 - 3) Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch (13 mm) **OR** 1 inch (25 mm), **as directed**, thick.
 - 4) Phenolic: 1 inch (25 mm) thick.
 - 5) Polyisocyanurate: 1 inch (25 mm) thick.
 - 6) Polyolefin: 3/4 inch (19 mm) **OR** 1 inch (25 mm), **as directed**, thick.
 2. Chilled Water and Brine, 40 Deg F (5 Deg C) and below:
 - a. NPS 3 (DN 80) and Smaller: Insulation shall be one of the following:
 - 1) Cellular Glass: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.
 - 2) Mineral-Fiber, Preformed Pipe, Type I **OR** Pipe Insulation Wicking System, **as directed**: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.
 - 3) Phenolic: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick.
 - 4) Polyisocyanurate: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm), **as directed**, thick.
 - b. NPS 4 (DN 100) to NPS 12 (DN 300): Insulation shall be one of the following:
 - 1) Cellular Glass: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick.
 - 2) Mineral-Fiber, Preformed Pipe, Type I **OR** Pipe Insulation Wicking System, **as directed**: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.
 - 3) Phenolic: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick.
 - 4) Polyisocyanurate: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm), **as directed**, thick.
 - c. NPS 14 (DN 350) and Larger: Insulation shall be one of the following:
 - 1) Cellular Glass: 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick.



- 2) Mineral-Fiber, Preformed Pipe, Type I **OR** Pipe Insulation Wicking System, **as directed**: 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick.
 - 3) Phenolic: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick.
 - 4) Polyisocyanurate: 1-1/2 inches (38 mm) thick.
3. Chilled Water and Brine, above 40 Deg F (5 Deg C):
- a. NPS 12 (DN 300) and Smaller: Insulation shall be one of the following:
 - 1) Cellular Glass: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.
 - 2) Flexible Elastomeric: 1 inch (25 mm) thick.
 - 3) Mineral-Fiber, Preformed Pipe, Type I **OR** Pipe Insulation Wicking System, **as directed**: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.
 - 4) Phenolic: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick.
 - 5) Polyisocyanurate: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm), **as directed**, thick.
 - 6) Polyolefin: 1 inch (25 mm) thick.
 - b. NPS 14 (DN 350) and Larger: Insulation shall be one of the following:
 - 1) Cellular Glass: 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick.
 - 2) Mineral-Fiber Preformed Pipe, Type I **OR** Pipe Insulation Wicking System, **as directed**: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick.
 - 3) Phenolic: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick.
 - 4) Polyisocyanurate: 1-1/2 inches (38 mm) thick.
4. Condenser-Water Supply and Return:
- a. NPS 12 (DN 300) and Smaller: Insulation shall be one of the following:
 - 1) Cellular Glass: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.
 - 2) Flexible Elastomeric: 1 inch (25 mm) thick.
 - 3) Mineral-Fiber, Preformed Pipe, Type I: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.
 - 4) Phenolic: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm), **as directed**, thick.
 - 5) Polyisocyanurate: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm), **as directed**, thick.
 - 6) Polyolefin: 1 inch (25 mm) thick.
 - b. NPS 14 (DN 350) and Larger: Insulation shall be one of the following:
 - 1) Cellular Glass: 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick.
 - 2) Mineral-Fiber, Preformed Pipe, Type I: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick.
 - 3) Phenolic: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick.
 - 4) Polyisocyanurate: 1-1/2 inches (38 mm) thick.
5. Heating-Hot-Water Supply and Return, 200 Deg F (93 Deg C) and below:
- a. NPS 12 (DN 300) and Smaller: Insulation shall be one of the following:
 - 1) Cellular Glass: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.
 - 2) Mineral-Fiber, Preformed Pipe, Type I: 1 inch (25 mm) **OR** 2 inches (50 mm), **as directed**, thick.
 - 3) Phenolic: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick.
 - 4) Polyisocyanurate: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm), **as directed**, thick.
 - b. NPS 14 (DN 350) and Larger: Insulation shall be one of the following:
 - 1) Cellular Glass: 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick.
 - 2) Mineral-Fiber, Preformed Pipe, Type I: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick.
 - 3) Phenolic: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick.
 - 4) Polyisocyanurate: 1-1/2 inches (38 mm) thick.



6. Heating-Hot-Water Supply and Return, above 200 Deg F (93 Deg C):
 - a. NPS 3/4 (DN 20) and Smaller: Insulation shall be one of the following:
 - 1) Calcium Silicate: 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick.
 - 2) Cellular Glass: 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick.
 - 3) Mineral-Fiber, Preformed Pipe, Type I or II: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.
 - b. NPS 1 (DN 25) and Larger: Insulation shall be one of the following:
 - 1) Calcium Silicate: 3 inches (75 mm) **OR** 4 inches (100 mm), **as directed**, thick.
 - 2) Cellular Glass: 3 inches (75 mm) **OR** 4 inches (100 mm), **as directed**, thick.
 - 3) Mineral-Fiber, Preformed Pipe, Type I or II: 3 inches (75 mm) **OR** 4 inches (100 mm), **as directed**, thick.
7. Steam and Steam Condensate, 350 Deg F (177 Deg C) and below:
 - a. NPS 3/4 (DN 20) and Smaller: Insulation shall be one of the following:
 - 1) Calcium Silicate: 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick.
 - 2) Cellular Glass: 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick.
 - 3) Mineral-Fiber, Preformed Pipe, Type I or II: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.
 - b. NPS 1 (DN 25) and Larger: Insulation shall be one of the following:
 - 1) Calcium Silicate: 3 inches (75 mm) **OR** 4 inches (100 mm), **as directed**, thick.
 - 2) Cellular Glass: 3 inches (75 mm) **OR** 4 inches (100 mm), **as directed**, thick.
 - 3) Mineral-Fiber, Preformed Pipe, Type I or II: 3 inches (75 mm) **OR** 4 inches (100 mm), **as directed**, thick.
8. Steam and Steam Condensate, above 350 Deg F (177 Deg C):
 - a. NPS 3/4 (DN 20) and Smaller: Insulation shall be one of the following:
 - 1) Calcium Silicate: 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick.
 - 2) Cellular Glass: 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick.
 - 3) Mineral-Fiber, Preformed Pipe, Type I or II: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.
 - b. NPS 1 (DN 25) and Larger: Insulation shall be one of the following:
 - 1) Calcium Silicate: 3 inches (75 mm) **OR** 4 inches (100 mm), **as directed**, thick.
 - 2) Cellular Glass: 3 inches (75 mm) **OR** 4 inches (100 mm), **as directed**, thick.
 - 3) Mineral-Fiber, Preformed Pipe, Type I or II: 3 inches (75 mm) **OR** 4 inches (100 mm), **as directed**, thick.
9. Refrigerant Suction and Hot-Gas Piping:
 - a. All Pipe Sizes: Insulation shall be one of the following:
 - 1) Cellular Glass: 1-1/2 inches (38 mm) thick.
 - 2) Flexible Elastomeric: 1 inch (25 mm) thick.
 - 3) Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
 - 4) Phenolic: 1 inch (25 mm) thick.
 - 5) Polyisocyanurate: 1 inch (25 mm) thick.
 - 6) Polyolefin: 1 inch (25 mm) thick.
10. Refrigerant Suction and Hot-Gas Flexible Tubing:
 - a. All Pipe Sizes: Insulation shall be one of the following:
 - 1) Flexible Elastomeric: 1 inch (25 mm) thick.
 - 2) Polyolefin: 1 inch (25 mm) thick.
11. Dual-Service Heating and Cooling, 40 to 200 Deg F (5 to 93 Deg C):
 - a. NPS 12 (DN 300) and Smaller: Insulation shall be one of the following:
 - 1) Cellular Glass: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.
 - 2) Mineral-Fiber, Preformed Pipe, Type I: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, thick.
 - 3) Phenolic: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick.
 - 4) Polyisocyanurate: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm), **as directed**, thick.
 - b. NPS 14 (DN 350) and Larger: Insulation shall be one of the following:
 - 1) Cellular Glass: 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick.



- 2) Mineral-Fiber, Preformed Pipe, Type I: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick.
 - 3) Phenolic: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, thick.
 - 4) Polyisocyanurate: 1-1/2 inches (38 mm) thick.
12. Heat-Recovery Piping:
- a. All Pipe Sizes: Insulation shall be one of the following:
 - 1) Cellular Glass: 1-1/2 inches (38 mm) thick.
 - 2) Flexible Elastomeric: 1 inch (25 mm) thick.
 - 3) Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
 - 4) Phenolic: 1 inch (25 mm) thick.
 - 5) Polyisocyanurate: 1 inch (25 mm) thick.
 - 6) Polyolefin: 1 inch (25 mm) thick.
13. Hot Service Drains:
- a. All Pipe Sizes: Insulation shall be one of the following:
 - 1) Calcium Silicate: 1-1/2 inches (38 mm) thick.
 - 2) Cellular Glass: 1-1/2 inches (38 mm) thick.
 - 3) Mineral-Fiber, Preformed Pipe, Type I or II: 1 inch (25 mm) thick.
14. Hot Service Vents:
- a. All Pipe Sizes: Insulation shall be one of the following:
 - 1) Calcium Silicate: 1-1/2 inches (38 mm) thick.
 - 2) Cellular Glass: 1-1/2 inches (38 mm) thick.
 - 3) Mineral-Fiber, Preformed Pipe, Type I or II: 1 inch (25 mm) thick.

Y. Outdoor, Aboveground Piping Insulation Schedule

1. Chilled Water and Brine:
 - a. All Pipe Sizes: Insulation shall be one of the following:
 - 1) Cellular Glass: 3 inches (75 mm) thick.
 - 2) Flexible Elastomeric: 3 inches (75 mm) thick.
 - 3) Mineral-Fiber, Preformed Pipe Insulation, Type I: 3 inches (75 mm) thick.
 - 4) Phenolic: 2 inches (50 mm) thick.
 - 5) Polyisocyanurate: 2 inches (50 mm) thick.
 - 6) Polyolefin: 3 inches (75 mm) thick.
 - 7) Polystyrene: 2 inches (50 mm) thick.
2. Condenser-Water Supply and Return:
 - a. All Pipe Sizes: Insulation shall be one of the following:
 - 1) Cellular Glass: 2 inches (50 mm) thick.
 - 2) Flexible Elastomeric: 2 inches (50 mm) thick.
 - 3) Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches (50 mm) thick.
 - 4) Phenolic: 2 inches (50 mm) thick.
 - 5) Polyisocyanurate: 2 inches (50 mm) thick.
 - 6) Polyolefin: 2 inches (50 mm) thick.
 - 7) Polystyrene: 2 inches (50 mm) thick.
3. Heating-Hot-Water Supply and Return, 200 Deg F (93 Deg C) and below:
 - a. All Pipe Sizes: Insulation shall be one of the following:
 - 1) Cellular Glass: 3 inches (75 mm) thick.
 - 2) Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches (50 mm) thick.
 - 3) Phenolic: 2 inches (50 mm) thick.
 - 4) Polyisocyanurate: 2 inches (50 mm) thick.
4. Heating-Hot-Water Supply and Return, above 200 Deg F (93 Deg C):
 - a. All Pipe Sizes: Insulation shall be one of the following:
 - 1) Calcium Silicate: 3 inches (75 mm) thick.
 - 2) Cellular Glass: 3 inches (75 mm) thick.
 - 3) Mineral-Fiber, Preformed Pipe Insulation, Type I or II: 2 inches (50 mm) thick.
5. Steam and Steam Condensate, 350 Deg F (177 Deg C) and below:



- a. All Pipe Sizes: Insulation shall be one of the following:
 - 1) Calcium Silicate: 4 inches (100 mm) thick.
 - 2) Cellular Glass: 4 inches (100 mm) thick.
 - 3) Mineral-Fiber, Preformed Pipe Insulation, Type I or II: 3 inches (75 mm) thick.
 6. Steam and Steam Condensate, above 350 Deg F (177 Deg C):
 - a. All Pipe Sizes: Insulation shall be one of the following:
 - 1) Calcium Silicate: 5 inches (125 mm) thick.
 - 2) Cellular Glass: 5 inches (125 mm) thick.
 - 3) Mineral-Fiber, Preformed Pipe Insulation, Type I or II: 4 inches (100 mm) thick.
 7. Refrigerant Suction and Hot-Gas Piping:
 - a. All Pipe Sizes: Insulation shall be one of the following:
 - 1) Cellular Glass: 2 inches (50 mm) thick.
 - 2) Flexible Elastomeric: 2 inches (50 mm) thick.
 - 3) Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches (50 mm) thick.
 - 4) Phenolic: 2 inches (50 mm) thick.
 - 5) Polyisocyanurate: 2 inches (50 mm) thick.
 - 6) Polyolefin: 2 inches (50 mm) thick.
 - 7) Polystyrene: 2 inches (50 mm) thick.
 8. Refrigerant Suction and Hot-Gas Flexible Tubing:
 - a. All Pipe Sizes: Insulation shall be one of the following:
 - 1) Flexible Elastomeric: 2 inches (50 mm) thick.
 - 2) Polyolefin: 2 inches (50 mm) thick.
 9. Heat-Recovery Piping:
 - a. All Pipe Sizes: Insulation shall be one of the following:
 - 1) Cellular Glass: 2 inches (50 mm) thick.
 - 2) Flexible Elastomeric: 2 inches (50 mm) thick.
 - 3) Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches (50 mm) thick.
 - 4) Phenolic: 2 inches (50 mm) thick.
 - 5) Polyisocyanurate: 2 inches (50 mm) thick.
 - 6) Polyolefin: 2 inches (50 mm) thick.
 - 7) Polystyrene: 2 inches (50 mm) thick.
 10. Dual-Service Heating and Cooling:
 - a. All Pipe Sizes: Insulation shall be one of the following:
 - 1) Cellular Glass: 3 inches (75 mm) thick.
 - 2) Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches (50 mm) thick.
 - 3) Phenolic: 2 inches (50 mm) thick.
 - 4) Polyisocyanurate: 2 inches (50 mm) thick.
 11. Hot Service Drains:
 - a. All Pipe Sizes: Insulation shall be one of the following:
 - 1) Calcium Silicate: 1-1/2 inches (38 mm) thick.
 - 2) Cellular Glass: 1-1/2 inches (38 mm) thick.
 - 3) Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
 12. Hot Service Vents:
 - a. All Pipe Sizes: Insulation shall be one of the following:
 - 1) Calcium Silicate: 1-1/2 inches (38 mm) thick.
 - 2) Cellular Glass: 1-1/2 inches (38 mm) thick.
 - 3) Mineral-Fiber, Preformed Pipe Insulation, Type II: 1 inch (25 mm) thick.
 13. Fuel Oil Piping, Heated:
 - a. All Pipe Sizes: Insulation shall be one of the following:
 - 1) Cellular Glass: 2 inches (50 mm) thick.
 - 2) Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches (50 mm) thick.
- Z. Outdoor, Underground Piping Insulation Schedule
1. Loose-fill insulation, for belowground piping, is specified in Division 28.
 2. Chilled Water, All Sizes: Cellular glass, 2 inches (50 mm) thick.
 3. Condenser-Water Supply and Return, All Sizes: Cellular glass, 2 inches (50 mm) thick.



4. Heating-Hot-Water Supply and Return, All Sizes, 200 Deg F (93 Deg C) and below: Cellular glass, 3 inches (75 mm) thick.
 5. Heating-Hot-Water Supply and Return, All Sizes, above 200 Deg F (93 Deg C):
 - a. Calcium Silicate: 3 inches (75 mm) thick.
 - b. Cellular Glass: 3 inches (75 mm) thick.
 6. Steam and Steam Condensate, All Sizes, 350 Deg F (177 Deg C) and below:
 - a. Calcium Silicate: 4 inches (100 mm) thick.
 - b. Cellular Glass: 4 inches (100 mm) thick.
 7. Steam and Steam Condensate, All Sizes, above 350 Deg F (177 Deg C):
 - a. Calcium Silicate: 5 inches (125 mm) thick.
 - b. Cellular Glass: 5 inches (125 mm) thick.
 8. Dual-Service Heating and Cooling, All Sizes, 40 to 200 Deg F (4 to 93 Deg C): Cellular glass, 3 inches (75 mm) thick.
 9. Fuel Oil Piping, All Sizes, Heated: Cellular glass, 2 inches (50 mm) thick.
- AA. Indoor, Field-Applied Jacket Schedule
1. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
 2. If more than one material is listed, selection from materials listed is Contractor's option.
 3. Ducts and Plenums, Concealed:
 - a. None.
 - b. PVC **OR** PVC, Color-Coded by System, **as directed**: 20 mils (0.5 mm) **OR** 30 mils (0.8 mm), **as directed**, thick.
 - c. Aluminum, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm) **OR** 0.040 inch (1.0 mm), **as directed**, thick.
 - d. Painted Aluminum, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm), **as directed**, thick.
 - e. Stainless Steel, Type 304 **OR** Type 316, **as directed**, Smooth 2B Finish **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.010 inch (0.25 mm) **OR** 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm), **as directed**, thick.
 4. Ducts and Plenums, Exposed:
 - a. None.
 - b. PVC **OR** PVC, Color-Coded by System, **as directed**: 20 mils (0.5 mm) **OR** 30 mils (0.8 mm), **as directed**, thick.
 - c. Aluminum, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm) **OR** 0.040 inch (1.0 mm), **as directed**, thick.
 - d. Painted Aluminum, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm), **as directed**, thick.
 - e. Stainless Steel, Type 304 **OR** Type 316, **as directed**, Smooth 2B Finish **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.010 inch (0.25 mm) **OR** 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm), **as directed**, thick.
 5. Equipment, Concealed:
 - a. None.
 - b. PVC **OR** PVC, Color-Coded by System, **as directed**: 20 mils (0.5 mm) **OR** 30 mils (0.8 mm), **as directed**, thick.
 - c. Aluminum, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm) **OR** 0.040 inch (1.0 mm), **as directed**, thick.
 - d. Painted Aluminum, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm), **as directed**, thick.



- e. Stainless Steel, Type 304 **OR** Type 316, **as directed**, Smooth 2B Finish **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.010 inch (0.25 mm) **OR** 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm), **as directed**, thick.
6. Equipment, Exposed, up to 48 Inches (1200 mm) in Diameter or with Flat Surfaces up to 72 Inches (1800 mm):
 - a. None.
 - b. PVC **OR** PVC, Color-Coded by System, **as directed**: 20 mils (0.5 mm) **OR** 30 mils (0.8 mm), **as directed**, thick.
 - c. Aluminum, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm) **OR** 0.040 inch (1.0 mm), **as directed**, thick.
 - d. Painted Aluminum, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm), **as directed**, thick.
 - e. Stainless Steel, Type 304 **OR** Type 316, **as directed**, Smooth 2B Finish **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.010 inch (0.25 mm) **OR** 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm), **as directed**, thick.
7. Equipment, Exposed, Larger Than 48 Inches (1200 mm) in Diameter or with Flat Surfaces Larger Than 72 Inches (1800 mm):
 - a. None.
 - b. Aluminum **OR** Painted Aluminum, **as directed**, Smooth **OR** Stucco Embossed, **as directed**, with 1-1/4-Inch- (32-mm-) Deep Corrugations **OR** 2-1/2-Inch- (65-mm-) Deep Corrugations **OR** 4-by-1-Inch (100-by-25-mm) Box Ribs, **as directed**: 0.032 inch (0.81 mm) **OR** 0.040 inch (1.0 mm), **as directed**, thick.
 - c. Stainless Steel, Type 304 **OR** Type 316, **as directed**, Smooth **OR** Stucco Embossed, **as directed**, with 1-1/4-Inch- (32-mm-) Deep Corrugations **OR** 2-1/2-Inch- (65-mm-) Deep Corrugations **OR** 4-by-1-Inch (100-by-25-mm) Box Ribs, **as directed**: 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm), **as directed**, thick.
8. Piping, Concealed:
 - a. None.
 - b. PVC **OR** PVC, Color-Coded by System, **as directed**: 20 mils (0.5 mm) **OR** 30 mils (0.8 mm), **as directed**, thick.
 - c. Aluminum, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm) **OR** 0.040 inch (1.0 mm), **as directed**, thick.
 - d. Painted Aluminum, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm), **as directed**, thick.
 - e. Stainless Steel, Type 304 **OR** Type 316, **as directed**, Smooth 2B Finish **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.010 inch (0.25 mm) **OR** 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm), **as directed**, thick.
9. Piping, Exposed:
 - a. None.
 - b. PVC **OR** PVC, Color-Coded by System, **as directed**: 20 mils (0.5 mm) **OR** 30 mils (0.8 mm), **as directed**, thick.
 - c. Aluminum, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm) **OR** 0.040 inch (1.0 mm), **as directed**, thick.
 - d. Painted Aluminum, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm), **as directed**, thick.
 - e. Stainless Steel, Type 304 **OR** Type 316, **as directed**, Smooth 2B Finish **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.010 inch (0.25 mm) **OR** 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm), **as directed**, thick.

BB. Outdoor, Field-Applied Jacket Schedule



1. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
2. If more than one material is listed, selection from materials listed is Contractor's option.
3. Ducts and Plenums, Concealed:
 - a. None.
 - b. PVC **OR** PVC, Color-Coded by System, **as directed**: 20 mils (0.5 mm) **OR** 30 mils (0.8 mm), **as directed**, thick.
 - c. Aluminum, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm) **OR** 0.040 inch (1.0 mm), **as directed**, thick.
 - d. Painted Aluminum, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm), **as directed**, thick.
 - e. Stainless Steel, Type 304 **OR** Type 316, **as directed**, Smooth 2B Finish **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.010 inch (0.25 mm) **OR** 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm), **as directed**, thick.
4. Ducts and Plenums, Exposed, up to 48 Inches (1200 mm) in Diameter or with Flat Surfaces up to 72 Inches (1800 mm):
 - a. Aluminum, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm) **OR** 0.040 inch (1.0 mm), **as directed**, thick.
 - b. Painted Aluminum, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm), **as directed**, thick.
 - c. Stainless Steel, Type 304 **OR** Type 316, **as directed**, Smooth 2B Finish **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.010 inch (0.25 mm) **OR** 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm), **as directed**, thick.
5. Ducts and Plenums, Exposed, Larger Than 48 Inches (1200 mm) in Diameter or with Flat Surfaces Larger Than 72 Inches (1800 mm):
 - a. Aluminum **OR** Painted Aluminum, **as directed**, Smooth **OR** Stucco Embossed, **as directed**, with 1-1/4-Inch- (32-mm-) Deep Corrugations **OR** 2-1/2-Inch- (65-mm-) Deep Corrugations **OR** 4-by-1-Inch (100-by-25-mm) Box Ribs, **as directed**: 0.032 inch (0.81 mm) **OR** 0.040 inch (1.0 mm), **as directed**, thick.
 - b. Stainless Steel, Type 304 **OR** Type 316, **as directed**, Smooth **OR** Stucco Embossed, **as directed**, with 1-1/4-Inch- (32-mm-) Deep Corrugations **OR** 2-1/2-Inch- (65-mm-) Deep Corrugations **OR** 4-by-1-Inch (100-by-25-mm) Box Ribs, **as directed**: 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm), **as directed**, thick.
6. Equipment, Concealed:
 - a. None.
 - b. PVC **OR** PVC, Color-Coded by System, **as directed**: 20 mils (0.5 mm) **OR** 30 mils (0.8 mm), **as directed**, thick.
 - c. Aluminum, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm) **OR** 0.040 inch (1.0 mm), **as directed**, thick.
 - d. Painted Aluminum, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm), **as directed**, thick.
 - e. Stainless Steel, Type 304 **OR** Type 316, **as directed**, Smooth 2B Finish **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.010 inch (0.25 mm) **OR** 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm), **as directed**, thick.
7. Equipment, Exposed, up to 48 Inches (1200 mm) in Diameter or with Flat Surfaces up to 72 Inches (1800 mm):
 - a. Aluminum **OR** Painted Aluminum, **as directed**, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**, with Z-Shaped Locking Seam, **as directed**: 0.016 inch (0.41 mm)



- OR 0.020 inch (0.51 mm) OR 0.024 inch (0.61 mm) OR 0.032 inch (0.81 mm) OR 0.040 inch (1.0 mm), as directed, thick.**
- b. Stainless Steel, Type 304 **OR** Type 316, **as directed**, Smooth 2B Finish **OR** Corrugated **OR** Stucco Embossed, **as directed** with Z-Shaped Locking Seam, **as directed**: 0.010 inch (0.25 mm) **OR** 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm), **as directed**, thick.
8. Equipment, Exposed, Larger Than 48 Inches (1200 mm) in Diameter or with Flat Surfaces Larger Than 72 Inches (1800 mm):
- a. Aluminum **OR** Painted Aluminum, **as directed**, Smooth **OR** Stucco Embossed, **as directed**, with 1-1/4-Inch- (32-mm-) Deep Corrugations **OR** 2-1/2-Inch- (65-mm-) Deep Corrugations **OR** 4-by-1-Inch (100-by-25-mm) Box Ribs, **as directed**: 0.032 inch (0.81 mm) **OR** 0.040 inch (1.0 mm), **as directed**, thick.
- b. Stainless Steel, Type 304 **OR** Type 316, **as directed**, Smooth **OR** Stucco Embossed, **as directed**, with 1-1/4-Inch- (32-mm-) Deep Corrugations **OR** 2-1/2-Inch- (65-mm-) Deep Corrugations **OR** 4-by-1-Inch (100-by-25-mm) Box Ribs, **as directed**: 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm), **as directed**, thick.
9. Piping, Concealed:
- a. None.
- b. PVC **OR** PVC, Color-Coded by System, **as directed**: 20 mils (0.5 mm) **OR** 30 mils (0.8 mm), **as directed**, thick.
- c. Aluminum, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm) **OR** 0.040 inch (1.0 mm), **as directed**, thick.
- d. Painted Aluminum, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm), **as directed**, thick.
- e. Stainless Steel, Type 304 **OR** Type 316, **as directed**, Smooth 2B Finish **OR** Corrugated **OR** Stucco Embossed, **as directed**: 0.010 inch (0.25 mm) **OR** 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm), **as directed**, thick.
10. Piping, Exposed:
- a. PVC: 20 mils (0.5 mm) **OR** 30 mils (0.8 mm) **OR** 40 mils (1.0 mm), **as directed**, thick.
- b. Aluminum **OR** Painted Aluminum, **as directed**, Smooth **OR** Corrugated **OR** Stucco Embossed, **as directed**, with Z-Shaped Locking Seam, **as directed**: 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm) **OR** 0.032 inch (0.81 mm) **OR** 0.040 inch (1.0 mm), **as directed**, thick.
- c. Stainless Steel, Type 304 **OR** Type 316, **as directed**, Smooth 2B Finish **OR** Corrugated **OR** Stucco Embossed, **as directed**, with Z-Shaped Locking Seam, **as directed**: 0.010 inch (0.25 mm) **OR** 0.016 inch (0.41 mm) **OR** 0.020 inch (0.51 mm) **OR** 0.024 inch (0.61 mm), **as directed**, thick.
- CC. Underground, Field-Installed Insulation Jacket
1. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION 23 07 13 00



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23 - Heating, Ventilating, And Air-Conditioning (HVAC)

Task	Specification	Specification Description
23 07 16 00	23 07 13 00	HVAC Insulation



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SECTION 23 09 00 00 - HVAC INSTRUMENTATION AND CONTROLS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for HVAC instrumentation and controls. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.

C. Definitions

1. DDC: Direct digital control.
2. I/O: Input/output.
3. LonWorks: A control network technology platform for designing and implementing interoperable control devices and networks.
4. MS/TP: Master slave/token passing.
5. PC: Personal computer.
6. PID: Proportional plus integral plus derivative.
7. RTD: Resistance temperature detector.

D. System Performance

1. Comply with the following performance requirements:
 - a. Graphic Display: Display graphic with minimum 20 dynamic points with current data within 10 seconds.
 - b. Graphic Refresh: Update graphic with minimum 20 dynamic points with current data within 8 seconds.
 - c. Object Command: Reaction time of less than two seconds between operator command of a binary object and device reaction.
 - d. Object Scan: Transmit change of state and change of analog values to control units or workstation within six seconds.
 - e. Alarm Response Time: Annunciate alarm at workstation within 45 seconds. Multiple workstations must receive alarms within five seconds of each other.
 - f. Program Execution Frequency: Run capability of applications as often as five seconds, but selected consistent with mechanical process under control.
 - g. Performance: Programmable controllers shall execute DDC PID control loops, and scan and update process values and outputs at least once per second.
 - h. Reporting Accuracy and Stability of Control: Report values and maintain measured variables within tolerances as follows:
 - 1) Water Temperature: Plus or minus 1 deg F (0.5 deg C).
 - 2) Water Flow: Plus or minus 5 percent of full scale.
 - 3) Water Pressure: Plus or minus 2 percent of full scale.
 - 4) Space Temperature: Plus or minus 1 deg F (0.5 deg C).
 - 5) Ducted Air Temperature: Plus or minus 1 deg F (0.5 deg C).
 - 6) Outside Air Temperature: Plus or minus 2 deg F (1.0 deg C).
 - 7) Dew Point Temperature: Plus or minus 3 deg F (1.5 deg C).
 - 8) Temperature Differential: Plus or minus 0.25 deg F (0.15 deg C).
 - 9) Relative Humidity: Plus or minus 5 percent.
 - 10) Airflow (Pressurized Spaces): Plus or minus 3 percent of full scale.
 - 11) Airflow (Measuring Stations): Plus or minus 5 percent of full scale.
 - 12) Airflow (Terminal): Plus or minus 10 percent of full scale.



- 13) Air Pressure (Space): Plus or minus 0.01-inch wg (2.5 Pa).
- 14) Air Pressure (Ducts): Plus or minus 0.1-inch wg (25 Pa).
- 15) Carbon Monoxide: Plus or minus 5 percent of reading.
- 16) Carbon Dioxide: Plus or minus 50 ppm.
- 17) Electrical: Plus or minus 5 percent of reading.

E. Submittals

1. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.
 - a. DDC System Hardware: Bill of materials of equipment indicating quantity, manufacturer, and model number. Include technical data for operator workstation equipment, interface equipment, control units, transducers/transmitters, sensors, actuators, valves, relays/switches, control panels, and operator interface equipment.
 - b. Control System Software: Include technical data for operating system software, operator interface, color graphics, and other third-party applications.
 - c. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram.
2. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - a. Bill of materials of equipment indicating quantity, manufacturer, and model number.
 - b. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
 - c. Wiring Diagrams: Power, signal, and control wiring.
 - d. Details of control panel faces, including controls, instruments, and labeling.
 - e. Written description of sequence of operation.
 - f. Schedule of dampers including size, leakage, and flow characteristics.
 - g. Schedule of valves including flow characteristics.
 - h. DDC System Hardware:
 - 1) Wiring diagrams for control units with termination numbers.
 - 2) Schematic diagrams and floor plans for field sensors and control hardware.
 - 3) Schematic diagrams for control, communication, and power wiring, showing trunk data conductors and wiring between operator workstation and control unit locations.
 - i. Control System Software: List of color graphics indicating monitored systems, data (connected and calculated) point addresses, output schedule, and operator notations.
 - j. Controlled Systems:
 - 1) Schematic diagrams of each controlled system with control points labeled and control elements graphically shown, with wiring.
 - 2) Scaled drawings showing mounting, routing, and wiring of elements including bases and special construction.
 - 3) Written description of sequence of operation including schematic diagram.
 - 4) Points list.
3. Data Communications Protocol Certificates: Certify that each proposed DDC system component complies with ASHRAE 135.
4. Data Communications Protocol Certificates: Certify that each proposed DDC system component complies with LonWorks.
5. Software and Firmware Operational Documentation: Include the following:
 - a. Software operating and upgrade manuals.
 - b. Program Software Backup: On a magnetic media or compact disc, complete with data files.
 - c. Device address list.
 - d. Printout of software application and graphic screens.
 - e. Software license required by and installed for DDC workstations and control systems.



6. Software Upgrade Kit: For the Owner to use in modifying software to suit future systems revisions or monitoring and control revisions.
7. Field quality-control test reports.
8. Operation and maintenance data.

F. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. Comply with ASHRAE 135 for DDC system components.

G. Delivery, Storage, And Handling

1. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to equipment manufacturer.
2. System Software: Update to latest version of software at Project completion.

1.2 PRODUCTS

A. Control System

1. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, and accessories to control mechanical systems.
2. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, accessories, and software connected to distributed controllers operating in multiuser, multitasking environment on token-passing network and programmed to control mechanical systems. An operator workstation permits interface with the network via dynamic color graphics with each mechanical system, building floor plan, and control device depicted by point-and-click graphics.
3. Control system shall include the following:
 - a. Building intrusion detection system specified in Division 28 Section "Intrusion Detection".
 - b. Building clock control system specified in Division 27 Section "Clock Systems".
 - c. Building lighting control system specified in Division 26 Section "Network Lighting Controls".
 - d. Fire alarm system specified in Division 28 Section(s) "Digital, Addressable Fire-alarm System" OR "Zoned (dc Loop) Fire-alarm System", **as directed**.

B. DDC Equipment

1. Operator Workstation: One **OR** Two, **as directed**, PC-based microcomputer(s) with minimum configuration as follows:
 - a. Motherboard: With 8 integrated USB 2.0 ports, integrated Intel Pro 10/100 (Ethernet), integrated audio, bios, and hardware monitoring.
 - b. Processor: Intel Pentium 4, **<Insert clock speed>** MHz.
 - c. Random-Access Memory: 512 MB.
 - d. Graphics: Video adapter, minimum 1280 x 1024 **OR** 1600 x 1200, **as directed**, pixels, 64-MB video memory, with TV out.
 - e. Monitor: 17 inches (430 mm) **OR** 19 inches (480 mm), **as directed**, LCD color.
 - f. Keyboard: QWERTY, 105 keys in ergonomic shape.
 - g. Floppy-Disk Drive: 1.44 MB.
 - h. Hard-Disk Drive: 80 GB.
 - i. CD-ROM Read/Write Drive: 48x24x48.
 - j. Mouse: Three button, optical.
 - k. Uninterruptible Power Supply: 2 kVa.
 - l. Operating System: Microsoft Windows XP Professional with high-speed Internet access.
 - 1) ASHRAE 135 Compliance: Workstation shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.



- 2) LonWorks Compliance: Control units shall use LonTalk protocol and communicate using EIA/CEA 709.1 datalink/physical layer protocol.
- m. Printer: Black-and-white, laser-jet type as follows:
 - 1) Print Head: 1200 x 1200 dpi resolution.
 - 2) Paper Handling: Minimum of 250 sheet trays.
 - 3) Print Speed: Minimum of 120 characters per second.
- n. Printer: Color, ink-jet type as follows:
 - 1) Print Head: 4800 x 1200 dpi optimized color resolution.
 - 2) Paper Handling: Minimum of 100 sheets.
 - 3) Print Speed: Minimum of 17 ppm in black and 12 ppm in color.
- o. Application Software:
 - 1) I/O capability from operator station.
 - 2) System security for each operator via software password and access levels.
 - 3) Automatic system diagnostics; monitor system and report failures.
 - 4) Database creation and support.
 - 5) Automatic and manual database save and restore.
 - 6) Dynamic color graphic displays with up to 10 screen displays at once.
 - 7) Custom graphics generation and graphics library of HVAC equipment and symbols.
 - 8) Alarm processing, messages, and reactions.
 - 9) Trend logs retrievable in spreadsheets and database programs.
 - 10) Alarm and event processing.
 - 11) Object and property status and control.
 - 12) Automatic restart of field equipment on restoration of power.
 - 13) Data collection, reports, and logs. Include standard reports for the following:
 - a) Current values of all objects.
 - b) Current alarm summary.
 - c) Disabled objects.
 - d) Alarm lockout objects.
 - e) Logs.
 - 14) Custom report development.
 - 15) Utility and weather reports.
 - 16) Workstation application editors for controllers and schedules.
 - 17) Maintenance management.
- p. Custom Application Software:
 - 1) English language oriented.
 - 2) Full-screen character editor/programming environment.
 - 3) Allow development of independently executing program modules with debugging/simulation capability.
 - 4) Support conditional statements.
 - 5) Support floating-point arithmetic with mathematic functions.
 - 6) Contains predefined time variables.
2. Diagnostic Terminal Unit: Portable notebook-style, PC-based microcomputer terminal capable of accessing system data by connecting to system network with minimum configuration as follows:
 - a. System: With one integrated USB 2.0 port, integrated Intel Pro 10/100 (Ethernet), integrated audio, bios, and hardware monitoring.
 - b. Processor: Intel Pentium 4, <Insert clock speed> MHz.
 - c. Random-Access Memory: 128 MB.
 - d. Graphics: Video adapter, minimum 800 x 600 **OR** 1024 x 768, **as directed**, pixels, 64-MB video memory.
 - e. Monitor: 17 inches (430 mm) **OR** 19 inches (480 mm), **as directed**, LCD color.
 - f. Keyboard: QWERTY 105 keys in ergonomic shape.
 - g. Floppy-Disk Drive: 1.44 MB.
 - h. Hard-Disk Drive: 800 MB.
 - i. CD-ROM Read/Write Drive: 48x24x48.
 - j. Pointing Device: Touch pad or other internal device.



3. Control Units: Modular, comprising processor board with programmable, nonvolatile, random-access memory; local operator access and display panel; integral interface equipment; and backup power source.
 - a. Units monitor or control each I/O point; process information; execute commands from other control units, devices, and operator stations; and download from or upload to operator workstation or diagnostic terminal unit.
 - b. Stand-alone mode control functions operate regardless of network status. Functions include the following:
 - 1) Global communications.
 - 2) Discrete/digital, analog, and pulse I/O.
 - 3) Monitoring, controlling, or addressing data points.
 - 4) Software applications, scheduling, and alarm processing.
 - 5) Testing and developing control algorithms without disrupting field hardware and controlled environment.
 - c. Standard Application Programs:
 - 1) Electric Control Programs: Demand limiting, duty cycling, automatic time scheduling, start/stop time optimization, night setback/setup, on-off control with differential sequencing, staggered start, antishort cycling, PID control, DDC with fine tuning, and trend logging.
 - 2) HVAC Control Programs: Optimal run time, supply-air reset, and enthalpy switchover.
 - 3) Chiller Control Programs: Control function of condenser-water reset, chilled-water reset, and equipment sequencing.
 - 4) Programming Application Features: Include trend point; alarm processing and messaging; weekly, monthly, and annual scheduling; energy calculations; run-time totalization; and security access.
 - 5) Remote communications.
 - 6) Maintenance management.
 - 7) Units of Measure: Inch-pound and SI (metric).
 - d. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.
 - e. ASHRAE 135 Compliance: Control units shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.
 - f. LonWorks Compliance: Control units shall use LonTalk protocol and communicate using EIA/CEA 709.1 datalink/physical layer protocol.
4. Local Control Units: Modular, comprising processor board with electronically programmable, nonvolatile, read-only memory; and backup power source.
 - a. Units monitor or control each I/O point, process information, and download from or upload to operator workstation or diagnostic terminal unit.
 - b. Stand-alone mode control functions operate regardless of network status. Functions include the following:
 - 1) Global communications.
 - 2) Discrete/digital, analog, and pulse I/O.
 - 3) Monitoring, controlling, or addressing data points.
 - c. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.
 - d. ASHRAE 135 Compliance: Control units shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.
 - e. LonWorks Compliance: Control units shall use LonTalk protocol and communicate using EIA/CEA 709.1 datalink/physical layer protocol.
5. I/O Interface: Hardwired inputs and outputs may tie into system through controllers. Protect points so that shorting will cause no damage to controllers.
 - a. Binary Inputs: Allow monitoring of on-off signals without external power.
 - b. Pulse Accumulation Inputs: Accept up to 10 pulses per second.
 - c. Analog Inputs: Allow monitoring of low-voltage (0- to 10-V dc), current (4 to 20 mA), or resistance signals.



- d. Binary Outputs: Provide on-off or pulsed low-voltage signal, selectable for normally open or normally closed operation with three-position (on-off-auto) override switches and status lights, **as directed**.
- e. Analog Outputs: Provide modulating signal, either low voltage (0- to 10-V dc) or current (4 to 20 mA) with status lights, two-position (auto-manual) switch, and manually adjustable potentiometer, **as directed**.
- f. Tri-State Outputs: Provide two coordinated binary outputs for control of three-point, floating-type electronic actuators.
- g. Universal I/Os: Provide software selectable binary or analog outputs.
- 6. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity. DC power supply shall match output current and voltage requirements and be full-wave rectifier type with the following:
 - a. Output ripple of 5.0 mV maximum peak to peak.
 - b. Combined 1 percent line and load regulation with 100-mic.sec. response time for 50 percent load changes.
 - c. Built-in overvoltage and overcurrent protection and be able to withstand 150 percent overload for at least 3 seconds without failure.
- 7. Power Line Filtering: Internal or external transient voltage and surge suppression for workstations or controllers with the following:
 - a. Minimum dielectric strength of 1000 V.
 - b. Maximum response time of 10 nanoseconds.
 - c. Minimum transverse-mode noise attenuation of 65 dB.
 - d. Minimum common-mode noise attenuation of 150 dB at 40 to 100 Hz.

C. Unitary Controllers

- 1. Unitized, capable of stand-alone operation with sufficient memory to support its operating system, database, and programming requirements, and with sufficient I/O capacity for the application.
 - a. Configuration: Local keypad and display; diagnostic LEDs for power, communication, and processor; wiring termination to terminal strip or card connected with ribbon cable; memory with bios; and 72-hour battery backup.
 - b. Operating System: Manage I/O communication to allow distributed controllers to share real and virtual object information and allow central monitoring and alarms. Perform scheduling with real-time clock, **as directed**. Perform automatic system diagnostics; monitor system and report failures.
 - c. ASHRAE 135 Compliance: Communicate using read (execute and initiate) and write (execute and initiate) property services defined in ASHRAE 135. Reside on network using MS/TP datalink/physical layer protocol and have service communication port for connection to diagnostic terminal unit.
 - d. LonWorks Compliance: Communicate using EIA/CEA 709.1 datalink/physical layer protocol using LonTalk protocol.
 - e. Enclosure: Dustproof rated for operation at 32 to 120 deg F (0 to 50 deg C).
 - f. Enclosure: Waterproof rated for operation at 40 to 150 deg F (5 to 65 deg C).

D. Alarm Panels

- 1. Unitized cabinet with suitable brackets for wall or floor mounting. Fabricate of 0.06-inch- (1.5-mm-) thick, furniture-quality steel or extruded-aluminum alloy, totally enclosed, with hinged doors and keyed lock and with manufacturer's standard shop-painted finish. Provide common keying for all panels, **as directed**.
- 2. Indicating light for each alarm point, single horn, acknowledge switch, and test switch, mounted on hinged cover.
 - a. Alarm Condition: Indicating light flashes and horn sounds.
 - b. Acknowledge Switch: Horn is silent and indicating light is steady.
 - c. Second Alarm: Horn sounds and indicating light is steady.
 - d. Alarm Condition Cleared: System is reset and indicating light is extinguished.
 - e. Contacts in alarm panel allow remote monitoring by independent alarm company.



E. Analog Controllers

1. Step Controllers: 6- or 10-stage type, with heavy-duty switching rated to handle loads and operated by electric motor.
2. Electric, Outdoor-Reset Controllers: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range, adjustable set point, scale range minus 10 to plus 70 deg F (minus 23 to plus 21 deg C), and single- or double-pole contacts.
3. Electronic Controllers: Wheatstone-bridge-amplifier type, in steel enclosure with provision for remote-resistance readjustment. Identify adjustments on controllers, including proportional band and authority.
 - a. Single controllers can be integral with control motor if provided with accessible control readjustment potentiometer.
4. Fan-Speed Controllers: Solid-state model providing field-adjustable proportional control of motor speed from maximum to minimum of 55 percent and on-off action below minimum fan speed. Controller shall briefly apply full voltage, when motor is started, to rapidly bring motor up to minimum speed. Equip with filtered circuit to eliminate radio interference.
5. Receiver Controllers: Single- or multiple-input models with control-point adjustment, direct or reverse acting with mechanical set-point adjustment with locking device, proportional band adjustment, authority adjustment, and proportional control mode.
 - a. Remote-control-point adjustment shall be plus or minus 20 percent of sensor span, input signal of 3 to 13 psig (21 to 90 kPa).
 - b. Proportional band shall extend from 2 to 20 percent for 5 psig (35 kPa).
 - c. Authority shall be 20 to 200 percent.
 - d. Air-supply pressure of 18 psig (124 kPa), input signal of 3 to 15 psig (21 to 103 kPa), and output signal of zero to supply pressure.
 - e. Gages: 1-1/2 inches (38 mm) **OR** 2-1/2 inches (64 mm) **OR** 3-1/2 inches (89 mm), **as directed**, in diameter, 2.5 percent wide-scale accuracy, and range to match transmitter input or output pressure.

F. Time Clocks

1. Seven-day, programming-switch timer with synchronous-timing motor and seven-day dial; continuously charged, nickel-cadmium-battery-driven, eight-hour, power-failure carryover; multiple-switch trippers; minimum of two and maximum of eight signals per day with two normally open and two normally closed output contacts.
2. Solid-state, programmable time control with 4 **OR** 8, **as directed**, separate programs each with up to 100 on-off operations; 1-second resolution; lithium battery backup; keyboard interface and manual override; individual on-off-auto switches for each program; 365-day calendar with 20 programmable holidays; choice of fail-safe operation for each program; system fault alarm; and communications package allowing networking of time controls and programming from PC.

G. Electronic Sensors

1. Description: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.
2. Thermistor Temperature Sensors and Transmitters:
 - a. Accuracy: Plus or minus 0.5 deg F (0.3 deg C) **OR** 0.36 deg F (0.2 deg C), **as directed**, at calibration point.
 - b. Wire: Twisted, shielded-pair cable.
 - c. Insertion Elements in Ducts: Single point, 8 inches (200 mm) **OR** 18 inches (460 mm), **as directed**, long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft. (0.84 sq. m).
 - d. Averaging Elements in Ducts: 36 inches (915 mm) long, flexible **OR** 72 inches (1830 mm) long, flexible **OR** 18 inches (460 mm) long, rigid, **as directed**; use where prone to temperature stratification or where ducts are larger than 10 sq. ft. (1 sq. m).
 - e. Insertion Elements for Liquids: Brass or stainless-steel socket with minimum insertion length of 2-1/2 inches (64 mm).
 - f. Room Sensor Cover Construction: Manufacturer's standard locking covers.
 - 1) Set-Point Adjustment: Concealed **OR** Exposed, **as directed**.
 - 2) Set-Point Indication: Concealed **OR** Keyed **OR** Exposed, **as directed**.



- 3) Thermometer: Concealed **OR** Exposed **OR** Red-reading glass **OR** Spiral bimetal, **as directed**.
 - 4) Color: As selected from manufacturer's full range.
 - 5) Orientation: Vertical **OR** Horizontal, **as directed**.
 - g. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
 - h. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.
3. RTDs and Transmitters:
 - a. Accuracy: Plus or minus 0.2 percent at calibration point.
 - b. Wire: Twisted, shielded-pair cable.
 - c. Insertion Elements in Ducts: Single point, 8 inches (200 mm) **OR** 18 inches (460 mm), **as directed**, long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft. (0.84 sq. m).
 - d. Averaging Elements in Ducts: 18 inches (460 mm) long, rigid **OR** 24 inches (610 mm) long, rigid **OR** 48 inches (1200 mm) long, rigid **OR** 24 feet (7.3 m) long, flexible, **as directed**; use where prone to temperature stratification or where ducts are larger than 9 sq. ft. (0.84 sq. m); length as required.
 - e. Insertion Elements for Liquids: Brass socket with minimum insertion length of 2-1/2 inches (64 mm).
 - f. Room Sensor Cover Construction: Manufacturer's standard locking covers.
 - 1) Set-Point Adjustment: Concealed **OR** Exposed, **as directed**.
 - 2) Set-Point Indication: Concealed **OR** Keyed **OR** Exposed, **as directed**.
 - 3) Thermometer: Concealed **OR** Exposed **OR** Red-reading glass **OR** Spiral bimetal, **as directed**.
 - 4) Color: As selected from manufacturer's full range.
 - 5) Orientation: Vertical **OR** Horizontal, **as directed**.
 - g. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
 - h. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.
 4. Humidity Sensors: Bulk polymer sensor element.
 - a. Accuracy: 5 **OR** 2, **as directed**, percent full range with linear output.
 - b. Room Sensor Range: 20 to 80 percent relative humidity.
 - c. Room Sensor Cover Construction: Manufacturer's standard locking covers.
 - 1) Set-Point Adjustment: Concealed **OR** Exposed, **as directed**.
 - 2) Set-Point Indication: Concealed **OR** Keyed **OR** Exposed, **as directed**.
 - 3) Thermometer: Concealed **OR** Exposed **OR** Red-reading glass **OR** Spiral bimetal, **as directed**.
 - 4) Color: As selected from manufacturer's full range.
 - 5) Orientation: Vertical **OR** Horizontal, **as directed**.
 - d. Duct Sensor: 20 to 80 percent relative humidity range with element guard and mounting plate.
 - e. Outside-Air Sensor: 20 to 80 percent relative humidity range with mounting enclosure, suitable for operation at outdoor temperatures of 32 to 120 deg F (0 to 50 deg C) **OR** minus 22 to plus 185 deg F (minus 30 to plus 85 deg C) **OR** minus 40 to plus 170 deg F (minus 40 to plus 76 deg C), **as directed**.
 - f. Duct and Sensors: With element guard and mounting plate, range of 0 to 100 percent relative humidity.
 5. Pressure Transmitters/Transducers:
 - a. Static-Pressure Transmitter: Nondirectional sensor with suitable range for expected input, and temperature compensated.
 - 1) Accuracy: 2 percent of full scale with repeatability of 0.5 percent.
 - 2) Output: 4 to 20 mA.
 - 3) Building Static-Pressure Range: 0- to 0.25-inch wg (0 to 62 Pa).
 - 4) Duct Static-Pressure Range: 0- to 5-inch wg (0 to 1240 Pa).



- b. Water Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig (1034-kPa) operating pressure; linear output 4 to 20 mA.
- c. Water Differential-Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig (1034-kPa) operating pressure and tested to 300-psig (2070-kPa); linear output 4 to 20 mA.
- d. Differential-Pressure Switch (Air or Water): Snap acting, with pilot-duty rating and with suitable scale range and differential.
- e. Pressure Transmitters: Direct acting for gas, liquid, or steam service; range suitable for system; linear output 4 to 20 mA.
- 6. Room Sensor Cover Construction: Manufacturer's standard locking covers.
 - a. Set-Point Adjustment: Concealed **OR** Exposed, **as directed**.
 - b. Set-Point Indication: Concealed **OR** Keyed **OR** Exposed, **as directed**.
 - c. Thermometer: Concealed **OR** Exposed **OR** Red-reading glass **OR** Spiral bimetal, **as directed**.
 - d. Color: As selected from manufacturer's full range.
 - e. Orientation: Vertical **OR** Horizontal, **as directed**.
- 7. Room sensor accessories include the following:
 - a. Insulating Bases: For sensors located on exterior walls.
 - b. Guards: Locking; heavy-duty, transparent plastic; mounted on separate base **OR** Metal wire, tamperproof **OR** Locking, solid metal, ventilated, **as directed**.
 - c. Adjusting Key: As required for calibration and cover screws.

H. Pneumatic Sensors

- 1. Pneumatic Transmitters: Vibration and corrosion resistant.
 - a. Space-Temperature Sensors: Linear-output type, 50 to 100 deg F (10 to 38 deg C) range, with blank locking covers matching room thermostats.
 - b. Room Return-Air Temperature Sensors: Linear-output type with bimetal sensing element and corrosion-proof construction, 50 to 100 deg F (10 to 38 deg C) range, designed to be mounted in light troffers.
 - c. Duct-Mounted or Immersion-Type Temperature Sensors: Range as required for 3- to 15-psig (21- to 103-kPa) output signal.
 - d. Temperature Transmitters: Rigid-stem type with bimetal sensing elements unless averaging is required, 3- to 15-psig (21- to 103-kPa) output signal.
 - 1) Averaging-Element Sensors: Single- or multiple-unit capillary elements.
 - 2) Tamperproof Sensors: Corrosion-resistant construction, suitable for mounting on vibrating surface with exposed capillary protected with temperature-compensated armor or protective tubing.
 - 3) Pipe-Mounted Temperature-Sensing Elements: Rod-and-tube type; with separable wells filled with heat-conductive compound.
 - 4) Outdoors: Provide bulb shield with mounting bracket.
 - e. Space and Duct Humidity Transmitters: One pipe, directly proportional, with minimum sensing span of 20 to 80 percent relative humidity for 3- to 15-psig (21- to 103-kPa) output signal, corrosion resistant and temperature compensated, and with factory-calibrated adjustment.
 - 1) Space Mounting: With covers to match thermostats.
 - f. Differential-Pressure Transmitters: One pipe, direct acting for gas, liquid, or steam service; pressure sensor and transmitter of linear-output type; with range of 0 to 50 psig (0 to 344 kPa), and 3- to 15-psig (21- to 103-kPa) output signal.
 - g. Differential-Air-Pressure Transmitters: One pipe, direct acting, double bell; unidirectional with suitable range for expected input; and temperature compensated.
 - 1) Accuracy: 5 percent of full range and 2 percent of full scale at midrange.
 - 2) Output Signal: 3 to 15 psig (21 to 103 kPa).
- 2. Digital-to-Pneumatic Transducers: Convert plus or minus 12-V dc pulse-width-modulation outputs, or continuous proportional current or voltage to 0 to 20 psig (0 to 140 kPa).
- 3. Pneumatic Valve/Damper Position Indicator: Potentiometer mounted in enclosure with adjustable crank-arm assembly connected to damper to transmit 0 to 100 percent valve/damper travel.



- I. Status Sensors
1. Status Inputs for Fans: Differential-pressure switch with pilot-duty rating and with adjustable range of 0- to 5-inch wg (0 to 1240 Pa).
 2. Status Inputs for Pumps: Differential-pressure switch with pilot-duty rating and with adjustable pressure-differential range of 8 to 60 psig (55 to 414 kPa), piped across pump.
 3. Status Inputs for Electric Motors: Comply with ISA 50.00.01, current-sensing fixed- or split-core transformers with self-powered transmitter, adjustable and suitable for 175 percent of rated motor current.
 4. Voltage Transmitter (100- to 600-V ac): Comply with ISA 50.00.01, single-loop, self-powered transmitter, adjustable, with suitable range and 1 percent full-scale accuracy.
 5. Power Monitor: 3-phase type with disconnect/shorting switch assembly, listed voltage and current transformers, with pulse kilowatt hour output and 4- to 20-mA kW output, with maximum 2 percent error at 1.0 power factor and 2.5 percent error at 0.5 power factor.
 6. Current Switches: Self-powered, solid-state with adjustable trip current, selected to match current and system output requirements.
 7. Electronic Valve/Damper Position Indicator: Visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.
 8. Water-Flow Switches: Bellows-actuated mercury or snap-acting type with pilot-duty rating, stainless-steel or bronze paddle, with appropriate range and differential adjustment, in NEMA 250, Type 1 enclosure.
- J. Gas Detection Equipment
1. Carbon Monoxide Detectors: Single or multichannel, dual-level detectors using solid-state plug-in sensors with a 3-year minimum life; suitable over a temperature range of 32 to 104 deg F (0 to 40 deg C); with 2 factory-calibrated alarm levels at 50 and 100 **OR** 35 and 200, **as directed**, ppm.
 2. Carbon Dioxide Sensor and Transmitter: Single detectors using solid-state infrared sensors; suitable over a temperature range of 23 to 130 deg F (minus 5 to plus 55 deg C) and calibrated for 0 to 2 percent, with continuous or averaged reading, 4- to 20-mA output, for wall mounting.
 3. Oxygen Sensor and Transmitter: Single detectors using solid-state zircon cell sensing; suitable over a temperature range of minus 32 to plus 1100 deg F (0 to 593 deg C) and calibrated for 0 to 5 percent, with continuous or averaged reading, 4- to 20-mA output; for wall mounting.
 4. Occupancy Sensor: Passive infrared, with time delay, daylight sensor lockout, sensitivity control, and 180-degree field of view with vertical sensing adjustment; for flush mounting.
- K. Flow Measuring Stations
1. Duct Airflow Station: Combination of air straightener and multiport, self-averaging pitot tube station.
 - a. Casing: Galvanized-steel frame.
 - b. Flow Straightener: Aluminum honeycomb, 3/4-inch (20-mm) parallel cell, 3 inches (75 mm) deep.
 - c. Sensing Manifold: Copper manifold with bullet-nosed static pressure sensors positioned on equal area basis.
- L. Thermostats
1. Combination Thermostat and Fan Switches: Line-voltage thermostat with push-button or lever-operated fan switch.
 - a. Label switches "FAN ON-OFF" **OR** "FAN HIGH-LOW-OFF" **OR** "FAN HIGH-MED-LOW-OFF", **as directed**.
 - b. Mount on single electric switch box.
 2. Electric, solid-state, microcomputer-based room thermostat with remote sensor.
 - a. Automatic switching from heating to cooling.
 - b. Preferential rate control to minimize overshoot and deviation from set point.
 - c. Set up for four separate temperatures per day.
 - d. Instant override of set point for continuous or timed period from 1 hour to 31 days.
 - e. Short-cycle protection.



- f. Programming based on weekday, Saturday, and Sunday **OR** every day of week, **as directed**.
- g. Selection features include degree F or degree C display, 12- or 24-hour clock, keyboard disable, remote sensor, and fan on-auto.
- h. Battery replacement without program loss.
- i. Thermostat display features include the following:
 - 1) Time of day.
 - 2) Actual room temperature.
 - 3) Programmed temperature.
 - 4) Programmed time.
 - 5) Duration of timed override.
 - 6) Day of week.
 - 7) System mode indications include "heating," "off," "fan auto," and "fan on."
3. Low-Voltage, On-Off Thermostats: NEMA DC 3, 24-V, bimetal-operated, mercury-switch type, with adjustable or fixed anticipation heater, concealed set-point adjustment, 55 to 85 deg F (13 to 30 deg C) set-point range, and 2 deg F (1 deg C) maximum differential.
4. Line-Voltage, On-Off Thermostats: Bimetal-actuated, open contact or bellows-actuated, enclosed, snap-switch or equivalent solid-state type, with heat anticipator; listed for electrical rating; with concealed set-point adjustment, 55 to 85 deg F (13 to 30 deg C) set-point range, and 2 deg F (1 deg C) maximum differential.
 - a. Electric Heating Thermostats: Equip with off position on dial wired to break ungrounded conductors.
 - b. Selector Switch: Integral, manual on-off-auto.
5. Remote-Bulb Thermostats: On-off or modulating type, liquid filled to compensate for changes in ambient temperature; with copper capillary and bulb, unless otherwise indicated.
 - a. Bulbs in water lines with separate wells of same material as bulb.
 - b. Bulbs in air ducts with flanges and shields.
 - c. Averaging Elements: Copper tubing with either single- or multiple-unit elements, extended to cover full width of duct or unit; adequately supported.
 - d. Scale settings and differential settings are clearly visible and adjustable from front of instrument.
 - e. On-Off Thermostat: With precision snap switches and with electrical ratings required by application.
 - f. Modulating Thermostats: Construct so complete potentiometer coil and wiper assembly is removable for inspection or replacement without disturbing calibration of instrument.
6. Fire-Protection Thermostats: Listed and labeled by an NRTL acceptable to authorities having jurisdiction; with fixed or adjustable settings to operate at not less than 75 deg F (24 deg C) above normal maximum operating temperature, and the following:
 - a. Reset: Manual.
OR
Reset: Automatic, with control circuit arranged to require manual reset at central control panel; with pilot light and reset switch on panel labeled to indicate operation.
7. Pneumatic Room Thermostats: One **OR** Two **OR** Three, **as directed**, pipe(s), fully proportional with adjustable throttling range and tamperproof locking settings, direct or reverse acting as required. Factory calibrated at 2.5 psig/deg F (17.2 kPa/deg C).
 - a. Factory Calibration: 2.5 psig/deg F (17.2 kPa/deg C).
 - b. Range: 45 to 85 deg F (7 to 30 deg C).
 - c. Sensitivity Adjustment Range: 1 to 4 psig/deg F (7 to 27.6 kPa/deg C).
 - d. Dual-Temperature Thermostats: Automatic changeover from normal setting to lower setting for unoccupied cycles, with manual-reset lever to permit return to normal temperatures during unoccupied cycles, with automatic reset to normal during next cycle of operation.
 - e. Limits: Field adjustable, to limit setting cooling set point below 75 deg F (24 deg C), and heating set point above 75 deg F (24 deg C).
 - f. Room Thermostat Cover Construction: Manufacturer's standard locking covers.
 - 1) Set-Point Adjustment: Concealed **OR** Exposed, **as directed**.



- 2) Set-Point Indication: Concealed **OR** Keyed **OR** Exposed, **as directed**.
 - 3) Thermometer: Concealed **OR** Exposed **OR** Red-reading glass **OR** Spiral bimetal, **as directed**.
 - 4) Color: As selected from manufacturer's full range.
 - 5) Orientation: Vertical **OR** Horizontal, **as directed**.
- g. Room thermostat accessories include the following:
- 1) Insulating Bases: For thermostats located on exterior walls.
 - 2) Thermostat Guards: Locking; heavy-duty, transparent plastic; mounted on separate base **OR** Metal wire, tamperproof **OR** Locking, solid metal, ventilated, **as directed**.
 - 3) Adjusting Key: As required for calibration and cover screws.
 - 4) Aspirating Boxes: For flush-mounted aspirating thermostats.
 - 5) Set-Point Adjustment: 1/2-inch- (13-mm-) diameter, adjustment knob.
8. Immersion Thermostat: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range and adjustable set point.
 9. Airstream Thermostats: Two-pipe, fully proportional, single-temperature type; with adjustable set point in middle of range, adjustable throttling range, plug-in test fitting or permanent pressure gage, remote bulb, bimetal rod and tube, or averaging element.
 10. Electric, Low-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual- or automatic-, **as directed**, reset switch that trips if temperature sensed across any 12 inches (300 mm) of bulb length is equal to or below set point.
 - a. Bulb Length: Minimum 20 feet (6 m).
 - b. Quantity: One thermostat for every 20 sq. ft. (2 sq. m) of coil surface.
 11. Electric, High-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual- or automatic-, **as directed**, reset switch that trips if temperature sensed across any 12 inches (300 mm) of bulb length is equal to or above set point.
 - a. Bulb Length: Minimum 20 feet (6 m).
 - b. Quantity: One thermostat for every 20 sq. ft. (2 sq. m) of coil surface.
 12. Heating/Cooling Valve-Top Thermostats: Proportional acting for proportional flow, with molded-rubber diaphragm, remote-bulb liquid-filled element, direct and reverse acting at minimum shutoff pressure of 25 psig (172 kPa), and cast housing with position indicator and adjusting knob.
- M. Humidistats
1. Pneumatic Room Humidistats: Wall-mounting, proportioning type with adjustable throttling range, 20 to 90 **OR** 55 to 95 **OR** 25 to 65, **as directed**, percent operating range, and cover matching room thermostat cover.
 2. Duct-Mounting Humidistats: Electric insertion, 2-position type with adjustable, 2 percent throttling range, 20 to 80 percent operating range, and single- or double-pole contacts.
 3. Pneumatic Duct-Mounting Humidistats: Proportioning type with adjustable throttling range, 20 to 90 **OR** 55 to 95 **OR** 25 to 65, **as directed**, percent operating range, in galvanized-steel duct box.
- N. Actuators
1. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.
 - a. Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - b. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
 - c. Nonspring-Return Motors for Valves Larger Than NPS 2-1/2 (DN 65): Size for running torque of 150 in. x lbf (16.9 N x m) and breakaway torque of 300 in. x lbf (33.9 N x m).
 - d. Spring-Return Motors for Valves Larger Than NPS 2-1/2 (DN 65): Size for running and breakaway torque of 150 in. x lbf (16.9 N x m).
 - e. Nonspring-Return Motors for Dampers Larger Than 25 Sq. Ft. (2.3 sq. m): Size for running torque of 150 in. x lbf (16.9 N x m) and breakaway torque of 300 in. x lbf (33.9 N x m).



- f. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft. (2.3 sq. m): Size for running and breakaway torque of 150 in. x lbf (16.9 N x m).
 2. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
 - a. Valves: Size for torque required for valve close off at maximum pump differential pressure.
 - b. Dampers: Size for running torque calculated as follows:
 - 1) Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. (86.8 kg-cm/sq. m) of damper.
 - 2) Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. (62 kg-cm/sq. m) of damper.
 - 3) Parallel-Blade Damper without Edge Seals: 4 inch-lb/sq. ft (49.6 kg-cm/sq. m) of damper.
 - 4) Opposed-Blade Damper without Edge Seals: 3 inch-lb/sq. ft. (37.2 kg-cm/sq. m) of damper.
 - 5) Dampers with 2- to 3-Inch wg (500 to 750 Pa) of Pressure Drop or Face Velocities of 1000 to 2500 fpm (5 to 13 m/s): Increase running torque by 1.5.
 - 6) Dampers with 3- to 4-Inch wg (750 to 1000 Pa) of Pressure Drop or Face Velocities of 2500 to 3000 fpm (13 to 15 m/s): Increase running torque by 2.0.
 - c. Coupling: V-bolt and V-shaped, toothed cradle.
 - d. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
 - e. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on nonspring-return actuators.
 - f. Power Requirements (Two-Position Spring Return): 24 **OR** 120 **OR** 230, **as directed**, -V ac.
 - g. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
 - h. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
 - i. Temperature Rating: Minus 22 to plus 122 deg F (Minus 30 to plus 50 deg C) **OR** 40 to 104 deg F (5 to 40 deg C), **as directed**.
 - j. Temperature Rating (Smoke Dampers): Minus 22 to plus 250 deg F (Minus 30 to plus 121 deg C).
 - k. Run Time: 12 seconds open, 5 seconds closed **OR** 30 seconds **OR** 60 seconds **OR** 120 seconds, **as directed**.
 3. Pneumatic Valve Operators: Rolling-diaphragm, spring-loaded, piston type with spring range as required and start-point adjustment and positioning relay, **as directed**. Operator shall maintain full shutoff at maximum pump differential pressure.
 4. Pneumatic Damper Operators: Rolling-diaphragm, piston type with adjustable stops and spring return, sized to operate with sufficient reserve power to provide smooth modulating action or two-position action. Where actuators operate in sequence, provide pilot positioners.
 - a. Pilot Positioners: With the following characteristics:
 - 1) Start Point: Adjustable from 2 to 12 psig (14 to 83 kPa).
 - 2) Operating Span: Adjustable from 5 to 13 psig (35 to 90 kPa).
 - 3) Linearity: Plus or minus 10 percent of output signal span.
 - 4) Hysteresis: 3 percent of span.
 - 5) Response: 0.25-psig (1723-Pa) input change.
 - 6) Maximum Pilot Signal Pressure: 20 psig (140 kPa).
 - 7) Maximum Control Air-Supply Pressure: 60 psig (410 kPa).
 - b. Actuator Housing: Molded or die-cast zinc or aluminum. Terminal unit actuators may be high-impact plastic with ambient temperature rating of 50 to 140 deg F (10 to 60 deg C) unless located in return-air plenums, **as directed**.
 - c. Inlet-Vane Operators: High pressure, with pilot positioners.
 - O. Control Valves
 1. Control Valves: Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.
 2. Hydronic system globe valves shall have the following characteristics:



- a. NPS 2 (DN 50) and Smaller: Class 125 **OR** 250, **as directed**, bronze body, bronze trim, rising stem, renewable composition disc, and screwed ends with backseating capacity repackable under pressure.
 - b. NPS 2-1/2 (DN 65) and Larger: Class 125 iron body, bronze trim, rising stem, plug-type disc, flanged ends, and renewable seat and disc.
 - c. Internal Construction: Replaceable plugs and stainless-steel or brass seats.
 - 1) Single-Seated Valves: Cage trim provides seating and guiding surfaces for plug on top and bottom.
 - 2) Double-Seated Valves: Balanced plug; cage trim provides seating and guiding surfaces for plugs on top and bottom.
 - d. Sizing: 3-psig (21-kPa) **OR** 5-psig (35-kPa), **as directed**, maximum pressure drop at design flow rate or the following:
 - 1) Two Position: Line size.
 - 2) Two-Way Modulating: Either the value specified above or twice the load pressure drop, whichever is more.
 - 3) Three-Way Modulating: Twice the load pressure drop, but not more than value specified above.
 - e. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.
 - f. Close-Off (Differential) Pressure Rating: Combination of actuator and trim shall provide minimum close-off pressure rating of 150 percent of total system (pump) head for two-way valves and 100 percent of pressure differential across valve or 100 percent of total system (pump) head.
3. Steam system globe valves shall have the following characteristics:
- a. NPS 2 (DN 50) and Smaller: Class 125 bronze body, bronze trim, rising stem, renewable composition disc, and screwed ends with backseating capacity repackable under pressure.
 - b. NPS 2-1/2 (DN 65) and Larger: Class 125 iron body, bronze trim, rising stem, plug-type disc, flanged ends, and renewable seat and disc.
 - c. Internal Construction: Replaceable plugs and stainless-steel seats.
 - 1) Single-Seated Valves: Cage trim provides seating and guiding surfaces for plug on top and bottom of guided plugs.
 - 2) Double-Seated Valves: Balanced plug; cage trim provides seating and guiding surfaces for plugs on top and bottom of guided plugs.
 - d. Sizing: For pressure drop based on the following services:
 - 1) Two Position: 20 percent of inlet pressure.
 - 2) Modulating 15-psig (103-kPa) Steam: 80 percent of inlet steam pressure.
 - 3) Modulating 16- to 50-psig (110- to 350-kPa) Steam: 50 percent of inlet steam pressure.
 - 4) Modulating More Than 50-psig (350-kPa) Steam: As indicated.
 - e. Flow Characteristics: Modified linear characteristics.
 - f. Close-Off (Differential) Pressure Rating: Combination of actuator and trim shall provide minimum close-off pressure rating of 150 percent of operating (inlet) pressure.
4. Butterfly Valves: 200-psig (1380-kPa), 150-psig (1034-kPa) maximum pressure differential, ASTM A 126 cast-iron or ASTM A 536 ductile-iron body and bonnet, extended neck, stainless-steel stem, field-replaceable EPDM or Buna N sleeve and stem seals.
- a. Body Style: Wafer **OR** Lug **OR** Grooved, **as directed**.
 - b. Disc Type: Nickel-plated ductile iron **OR** Aluminum bronze **OR** Elastomer-coated ductile iron **OR** Epoxy-coated ductile iron, **as directed**.
 - c. Sizing: 1-psig (7-kPa) maximum pressure drop at design flow rate.
5. Terminal Unit Control Valves: Bronze body, bronze trim, two or three ports as indicated, replaceable plugs and seats, and union and threaded ends.
- a. Rating: Class 125 for service at 125 psig (860 kPa) and 250 deg F (121 deg C) operating conditions.
 - b. Sizing: 3-psig (21-kPa) maximum pressure drop at design flow rate, to close against pump shutoff head.



- c. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.
 6. Self-Contained Control Valves: Bronze body, bronze trim, two or three ports as indicated, replaceable plugs and seats, and union and threaded ends.
 - a. Rating: Class 125 for service at 125 psig (860 kPa) and 250 deg F (121 deg C) operating conditions.
 - b. Thermostatic Operator: Wax **OR** Liquid, **as directed**,-filled integral **OR** remote, **as directed**, sensor with integral **OR** remote, **as directed**, adjustable dial.
- P. Dampers
1. Dampers: AMCA-rated, parallel **OR** opposed, **as directed**,-blade design; 0.108-inch- (2.8-mm-) minimum thick, galvanized-steel or 0.125-inch- (3.2-mm-) minimum thick, extruded-aluminum frames with holes for duct mounting; damper blades shall not be less than 0.064-inch- (1.6-mm-) thick galvanized steel with maximum blade width of 8 inches (200 mm) and length of 48 inches (1220 mm).
 - a. Secure blades to 1/2-inch- (13-mm-) diameter, zinc-plated axles using zinc-plated hardware, with oil-impregnated sintered bronze **OR** nylon, **as directed**, blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
 - b. Operating Temperature Range: From minus 40 to plus 200 deg F (minus 40 to plus 93 deg C).
 - c. Edge Seals, Standard Pressure Applications: Closed-cell neoprene.
OR
Edge Seals, Low-Leakage Applications: Use inflatable blade edging or replaceable rubber blade seals and spring-loaded stainless-steel side seals, rated for leakage at less than 10 cfm per sq. ft. (50 L/s per sq. m) of damper area, at differential pressure of 4-inch wg (1000 Pa) when damper is held by torque of 50 in. x lbf (5.6 N x m); when tested according to AMCA 500D.
- Q. Air Supply
1. Control and Instrumentation Tubing: Copper tubing complying with ASTM B 88, Type K (ASTM B 88M, Type A) or ASTM B 280 Type ACR.
 - a. Fittings: Cast-bronze solder fittings complying with ASME B16.18; or wrought-copper solder fittings complying with ASME B16.22, except forged-brass compression-type fittings at connections to equipment.
 - b. Joining Method: Soldered or brazed.
OR
Control and Instrumentation Tubing: ASTM D 2737 Type FR plenum-rated polyethylene, flame-retardant, nonmetallic tubing rated for 30 psig (207 kPa) and ambient temperature range of 10 to 150 deg F (minus 13 to plus 65 deg C) with flame-retardant harness for multiple tubing.
 - c. Fittings: Compression or push-on polyethylene fittings.
 2. Tank: ASME storage tank with drain test cock, automatic moisture removal trap, tank relief valve, and rubber-cork vibration isolation mounting pads.
 3. Duplex Air Compressor: Capacity to supply compressed air to temperature-control system.
 - a. Pressure control with adjustable electric contacts, set to start and stop both compressors at different pressures.
 - b. Electrical alternation set with motor starters and disconnect to operate compressors alternately or on time schedule.
 4. Simplex Air Compressor: Tank-mounting compressor with capacity to supply compressed air to temperature-control system, with starter and disconnect.
 - a. Pressure control with adjustable electric contacts, set to start and stop compressor.
 5. Compressor Type: Reciprocating **OR** Scroll, **as directed**.
 6. Size compressor and tank to operate compressor not more than 20 **OR** 30, **as directed**, minutes during a 60-minute period.
 7. Compressor Accessories: Low-resistance intake-air filter, and belt guards.



8. System Accessories: Air filter rated for 97 percent efficiency at rated airflow, and combination filter/pressure-reducing station or separate filter and pressure-reducing station.
9. Refrigerated Air Dryer: Self-contained, refrigerated air dryer complete with heat exchangers, moisture separator, internal wiring and piping, and with manual bypass valve.
 - a. Heat Exchangers: Air-to-refrigerant coils with centrifugal-type moisture separator and automatic trap assembly.
 - b. Refrigeration Unit: Hermetically sealed, operating to maintain dew point of 13 deg F (minus 11 deg C) at 20 psig (140 kPa), housed in steel cabinet with access door and panel.
 - c. Accessories: Air-inlet temperature gage, air-inlet pressure gage, on-off switch, high-temperature light, power-on light, refrigerant gage on back, air-outlet temperature gage, air-outlet pressure gage, and with contacts for remote indication of power status and high-temperature alarm.
10. Desiccant Dryer: Obtains dew point in pneumatic air piping between compressor and tank at least 15 deg F (minus 9 deg C) below inlet-air dew point at design conditions.
11. Pressure Gages: Black letters on white background, 2-1/2 inches (64 mm) in diameter, flush or surface mounting, with front calibration screw to match sensor, and having a graduated scale in psig (kPa).
12. Instrument Pressure Gages: Black letters on white background, 1-1/2 inches (38 mm) in diameter, stem mounted, with suitable dial range.
13. Diaphragm Control and Instrument Valves: 1/4-inch (6-mm) forged-brass body with reinforced polytetrafluoroethylene diaphragm, stainless-steel spring, and color-coded phenolic handle.
14. Gage Cocks: Tee or level handle, bronze, rated for 125 psig (860 kPa).
15. Relays: For summing, reversing, and amplifying highest or lowest pressure selection; with adjustable I/O ratio.
16. Switches: With indicating plates and accessible adjustment; calibrated and marked.
17. Pressure Regulators: Zinc or aluminum castings with elastomeric diaphragm, balanced construction to automatically prevent pressure buildup, and producing flat reduced-pressure curve.
18. Particle Filters: Zinc or aluminum castings with 97 percent filtration efficiency at rated airflow, quick-disconnect service devices, and aluminum or plastic bowl with metal guard and manual drain cock.
19. Combination Filter/Regulators: Zinc or aluminum castings with elastomeric diaphragm, balanced construction to automatically prevent pressure buildup, and producing flat reduced-pressure curve; with threaded pipe connections, quick-disconnect service devices, and aluminum or plastic bowl with metal guard and manual drain cock.
20. Airborne Oil Filter: Filtration efficiency of 99.9 percent for airborne lubricating oil particles of 0.025 micron or larger.
21. Pressure Relief Valves: ASME rated and labeled.
 - a. High Pressure: Size for installed capacity.
 - b. Low Pressure: Size for installed capacity of pressure regulators and set at 20 percent above low pressure.
22. Pressure-Reducing Stations: Two parallel pressure regulators.

R. Control Cable

1. Electronic and fiber-optic cables for control wiring are specified in Division 27 Section "Communications Horizontal Cabling".

1.3 EXECUTION

A. Installation

1. Install software in control units and operator workstation(s). Implement all features of programs to specified requirements and as appropriate to sequence of operation.
2. Connect and configure equipment and software to achieve sequence of operation specified.



3. Mount compressor and tank unit on elastomeric mounts **OR** spring isolators with 1-inch (25 mm) static deflection **OR** restrained spring isolators with 1-inch (25-mm) static deflection, **as directed**. Vibration isolators are specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment". Isolate air supply with wire-braid-reinforced rubber hose. Secure and anchor according to manufacturer's written instructions and seismic-control requirements.
 - a. Pipe manual and automatic drains to nearest floor drain.
 - b. Supply instrument air from compressor units through filter, pressure-reducing valve, and pressure relief valve, with pressure gages and shutoff and bypass valves.
 4. Verify location of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation. Install devices 48 inches (1220 mm) **OR** 60 inches (1530 mm), **as directed**, above the floor.
 - a. Install averaging elements in ducts and plenums in crossing or zigzag pattern.
 5. Install guards on thermostats in the following locations:
 - a. Entrances.
 - b. Public areas.
 - c. Where indicated.
 6. Install automatic dampers according to Division 23 Section "Air Duct Accessories".
 7. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.
 8. Install labels and nameplates to identify control components according to Division 23 Section "Identification For Hvac Piping And Equipment".
 9. Install hydronic instrument wells, valves, and other accessories according to Division 23 Section "Hydronic Piping".
 10. Install steam and condensate instrument wells, valves, and other accessories according to Division 23 Section "Steam And Condensate Heating Piping".
 11. Install refrigerant instrument wells, valves, and other accessories according to Division 23 Section "Refrigerant Piping".
 12. Install duct volume-control dampers according to Division 21 specifying air ducts.
 13. Install electronic and fiber-optic cables according to Division 27 Section "Communications Horizontal Cabling".
- B. Pneumatic Piping Installation
1. Install piping in mechanical equipment rooms inside mechanical equipment enclosures, in pipe chases, or suspended ceilings with easy access.
 - a. Install copper tubing with maximum unsupported length of 36 inches (915 mm), for tubing exposed to view.
 - b. Install polyethylene tubing in metallic raceways or electrical metallic tubing. Electrical metallic tubing materials and installation requirements are specified in Division 26 Section "Underfloor Raceways For Electrical Systems".
 2. Install terminal single-line connections, less than 18 inches (460 mm) in length, with copper or polyethylene tubing run inside flexible steel protection.
 3. In concealed locations such as pipe chases and suspended ceilings with easy access, install copper **OR** polyethylene bundled and sheathed **OR** polyethylene tubing in electrical metallic, **as directed**, tubing. Electrical metallic tubing materials and installation requirements are specified in Division 26 Section "Raceway And Boxes For Electrical Systems".
 4. In concrete slabs, furred walls, or ceilings with no access, install copper or polyethylene tubing in electrical metallic tubing or vinyl-jacketed polyethylene tubing.
 - a. Protect embedded-copper and vinyl-jacketed polyethylene tubing with electrical metallic tubing extending 6 inches (150 mm) above finished slab and 6 inches (150 mm) into slab. Pressure test tubing before and after pour for leak and pinch.
 - b. Install polyethylene tubing in electrical metallic tubing extending 6 inches (150 mm) above floor line; pull tubing into electrical metallic tubing after pour.
 5. Install tubing with sufficient slack and flexible connections to allow for vibration of piping and equipment.
 6. Purge tubing with dry, oil-free compressed air before connecting control instruments.



- a. Bridge cabinets and doors with flexible connections fastened along hinge side; protect against abrasion. Tie and support tubing.
 7. Number-code or color-code control air piping for future identification and service of control system, except local individual room control tubing.
 8. Pressure Gages or Test Plugs: Install on branch lines at each receiver controller and on signal lines at each transmitter, except individual room controllers.
- C. Electrical Wiring And Connection Installation
1. Install raceways, boxes, and cabinets according to Division 26 Section "Raceway And Boxes For Electrical Systems".
 2. Install building wire and cable according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".
 3. Install signal and communication cable according to Division 27 Section "Communications Horizontal Cabling".
 - a. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
 - b. Install exposed cable in raceway.
 - c. Install concealed cable in raceway.
 - d. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
 - e. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
 - f. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
 - g. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.
 4. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.
 5. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.
- D. Field Quality Control
1. Perform the following field tests and inspections and prepare test reports:
 - a. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
 - b. Test and adjust controls and safeties.
 - c. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - d. Pressure test control air piping at 30 psig (207 kPa) or 1.5 times the operating pressure for 24 hours, with maximum 5-psig (35-kPa) loss.
 - e. Pressure test high-pressure control air piping at 150 psig (1034 kPa) and low-pressure control air piping at 30 psig (207 kPa) for 2 hours, with maximum 1-psig (7-kPa) loss.
 - f. Test calibration of pneumatic **OR** electronic, **as directed**, controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
 - g. Test each point through its full operating range to verify that safety and operating control set points are as required.
 - h. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
 - i. Test each system for compliance with sequence of operation.
 - j. Test software and hardware interlocks.
 2. DDC Verification:
 - a. Verify that instruments are installed before calibration, testing, and loop or leak checks.
 - b. Check instruments for proper location and accessibility.
 - c. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.



- d. Check instrument tubing for proper fittings, slope, material, and support.
 - e. Check installation of air supply for each instrument.
 - f. Check flow instruments. Inspect tag number and line and bore size, and verify that inlet side is identified and that meters are installed correctly.
 - g. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
 - h. Check temperature instruments and material and length of sensing elements.
 - i. Check control valves. Verify that they are in correct direction.
 - j. Check air-operated dampers. Verify that pressure gages are provided and that proper blade alignment, either parallel or opposed, has been provided.
 - k. Check DDC system as follows:
 - 1) Verify that DDC controller power supply is from emergency power supply, if applicable.
 - 2) Verify that wires at control panels are tagged with their service designation and approved tagging system.
 - 3) Verify that spare I/O capacity has been provided.
 - 4) Verify that DDC controllers are protected from power supply surges.
3. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

E. Adjusting

- 1. Calibrating and Adjusting:
 - a. Calibrate instruments.
 - b. Make three-point calibration test for both linearity and accuracy for each analog instrument.
 - c. Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.
 - d. Control System Inputs and Outputs:
 - 1) Check analog inputs at 0, 50, and 100 percent of span.
 - 2) Check analog outputs using milliampere meter at 0, 50, and 100 percent output.
 - 3) Check digital inputs using jumper wire.
 - 4) Check digital outputs using ohmmeter to test for contact making or breaking.
 - 5) Check resistance temperature inputs at 0, 50, and 100 percent of span using a precision-resistant source.
 - e. Flow:
 - 1) Set differential pressure flow transmitters for 0 and 100 percent values with 3-point calibration accomplished at 50, 90, and 100 percent of span.
 - 2) Manually operate flow switches to verify that they make or break contact.
 - f. Pressure:
 - 1) Calibrate pressure transmitters at 0, 50, and 100 percent of span.
 - 2) Calibrate pressure switches to make or break contacts, with adjustable differential set at minimum.
 - g. Temperature:
 - 1) Calibrate resistance temperature transmitters at 0, 50, and 100 percent of span using a precision-resistance source.
 - 2) Calibrate temperature switches to make or break contacts.
 - h. Stroke and adjust control valves and dampers without positioners, following the manufacturer's recommended procedure, so that valve or damper is 100 percent open and closed.
 - i. Stroke and adjust control valves and dampers with positioners, following manufacturer's recommended procedure, so that valve and damper is 0, 50, and 100 percent closed.
 - j. Provide diagnostic and test instruments for calibration and adjustment of system.
 - k. Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.
- 2. Adjust initial temperature and humidity set points.



3. Occupancy Adjustments: When requested within 12 months of date of Final Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to Project during other than normal occupancy hours for this purpose.

F. Demonstration

1. Train the Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls.

END OF SECTION 23 09 00 00



23 - Heating, Ventilating, And Air-Conditioning (HVAC)

Task	Specification	Specification Description
23 09 13 56	23 09 00 00	HVAC Instrumentation And Controls



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SECTION 23 09 23 00 - ENCLOSED CONTROLLERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for enclosed controllers. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes the following enclosed controllers rated 600 V and less:
 - a. Full-voltage manual.
 - b. Full-voltage magnetic.
 - c. Reduced-voltage magnetic.
 - d. Reduced-voltage solid state.
 - e. Multispeed.

C. Definitions

1. CPT: Control power transformer.
2. MCCB: Molded-case circuit breaker.
3. MCP: Motor circuit protector.
4. N.C.: Normally closed.
5. N.O.: Normally open.
6. OCPD: Overcurrent protective device.
7. SCR: Silicon-controlled rectifier.

D. Performance Requirements

1. Seismic Performance: Enclosed controllers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

E. Submittals

1. Product Data: For each type of enclosed controller. Include manufacturer's technical data on features, performance, electrical characteristics, ratings, and enclosure types and finishes.
2. Shop Drawings: For each enclosed controller. Include dimensioned plans, elevations, sections, details, and required clearances and service spaces around controller enclosures.
 - a. Show tabulations of the following:
 - 1) Each installed unit's type and details.
 - 2) Factory-installed devices.
 - 3) Nameplate legends.
 - 4) Short-circuit current rating of integrated unit.
 - 5) Listed and labeled for integrated short-circuit current (withstand) rating of OCPDs in combination controllers by an NRTL acceptable to authorities having jurisdiction.
 - 6) Features, characteristics, ratings, and factory settings of individual OCPDs in combination controllers.
 - b. Wiring Diagrams: For power, signal, and control wiring.
3. Qualification Data: For qualified testing agency.
4. Seismic Qualification Certificates: For enclosed controllers, accessories, and components, from manufacturer.
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.



- b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
5. Field quality-control reports.
 6. Operation and Maintenance Data: For enclosed controllers to include in emergency, operation, and maintenance manuals. Include the following:
 - a. Routine maintenance requirements for enclosed controllers and installed components.
 - b. Manufacturer's written instructions for testing and adjusting circuit breaker and MCP trip settings.
 - c. Manufacturer's written instructions for setting field-adjustable overload relays.
 - d. Manufacturer's written instructions for testing, adjusting, and reprogramming reduced-voltage solid-state controllers.
 7. Load-Current and Overload-Relay Heater List: Compile after motors have been installed, and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.
 8. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed, and arrange to demonstrate that switch settings for motor running overload protection suit actual motors to be protected.
- F. Quality Assurance
1. Testing Agency Qualifications: Member company of NETA or an NRTL.
 - a. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
 2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 3. Comply with NFPA 70.
 4. IEEE Compliance: Fabricate and test enclosed controllers according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
- G. Delivery, Storage, And Handling
1. Store enclosed controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect enclosed controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.
 2. If stored in areas subject to weather, cover enclosed controllers to protect them from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside controllers; install temporary electric heating, with at least 250 W per controller **OR** connect factory-installed space heaters to temporary electrical service, **as directed**.
- H. Project Conditions
1. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - a. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
 - b. Altitude: Not exceeding 6600 feet (2010 m).
 2. Interruption of Existing Electrical Systems: Do not interrupt electrical systems in facilities occupied by the Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
 - a. Notify the Owner no fewer than two days in advance of proposed interruption of electrical systems.
 - b. Indicate method of providing temporary utilities.
 - c. Do not proceed with interruption of electrical systems without the Owner's written permission.
 - d. Comply with NFPA 70E.



I. Coordination

1. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
2. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.
3. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

1.2 PRODUCTS

A. Full-Voltage Controllers

1. General Requirements for Full-Voltage Controllers: Comply with NEMA ICS 2, general purpose, Class A.
2. Motor-Starting Switches: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off or on.
 - a. Configuration: Nonreversing **OR** Reversing **OR** Two speed, **as directed**.
 - b. Flush **OR** Surface, **as directed**, mounting.
 - c. Red **OR** Green, **as directed**, pilot light.
 - d. Additional Nameplates: FORWARD and REVERSE for reversing switches **OR** HIGH and LOW for two-speed switches, **as directed**.
3. Fractional Horsepower Manual Controllers: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.
 - a. Configuration: Nonreversing **OR** Two speed, **as directed**.
 - b. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters matched to nameplate full-load current of actual protected motor; external reset push button; bimetallic type **OR** melting alloy type, **as directed**.
 - c. Flush **OR** Surface, **as directed**, mounting.
 - d. Red **OR** Green, **as directed**, pilot light.
 - e. Additional Nameplates: HIGH and LOW for two-speed controllers.
4. Integral Horsepower Manual Controllers: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.
 - a. Configuration: Nonreversing **OR** Reversing **OR** Two speed, **as directed**.
 - b. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters and sensors in each phase, matched to nameplate full-load current of actual protected motor and having appropriate adjustment for duty cycle; external reset push button; bimetallic type **OR** melting alloy type, **as directed**.
 - c. Flush **OR** Surface, **as directed**, mounting.
 - d. Red **OR** Green, **as directed**, pilot light.
 - e. Additional Nameplates: FORWARD and REVERSE for reversing controllers **OR** HIGH and LOW for two-speed controllers, **as directed**.
 - f. N.O. **OR** N.C., **as directed**, auxiliary contact.
5. Magnetic Controllers: Full voltage, across the line, electrically held.
 - a. Configuration: Nonreversing **OR** Reversing, **as directed**.
 - b. Contactor Coils: Pressure-encapsulated type with coil transient suppressors, **as directed**.
 - 1) Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.
 - c. Power Contacts: Totally enclosed, double-break, silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.
 - d. Control Circuits: 24 **OR** 120, **as directed**, -V ac; obtained from integral CPT, with primary and secondary fuses, **as directed**, with CPT **OR** control power source, **as directed**, of sufficient capacity to operate integral devices and remotely located pilot, indicating, and control devices.
 - 1) CPT Spare Capacity: 50 **OR** 100 **OR** 200, **as directed**, VA.
 - e. Melting Alloy Overload Relays:



- 1) Inverse-time-current characteristic.
 - 2) Class 10 **OR** Class 20 **OR** Class 30, **as directed**, tripping characteristic.
 - 3) Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.
- f. Bimetallic Overload Relays:
- 1) Inverse-time-current characteristic.
 - 2) Class 10 **OR** Class 20 **OR** Class 30, **as directed**, tripping characteristic.
 - 3) Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.
 - 4) Ambient compensated.
 - 5) Automatic resetting.
- g. Solid-State Overload Relay:
- 1) Switch or dial selectable for motor running overload protection.
 - 2) Sensors in each phase.
 - 3) Class 10 **OR** Class 20 **OR** Class 10/20 selectable, **as directed**, tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.
 - 4) Class II ground-fault protection, with start and run delays to prevent nuisance trip on starting.
 - 5) Analog communication module.
- h. N.C. **OR** N.O., **as directed**, isolated overload alarm contact.
- i. External overload reset push button.
6. Combination Magnetic Controller: Factory-assembled combination of magnetic controller, OCPD, and disconnecting means.
- a. Fusible Disconnecting Means:
- 1) NEMA KS 1, heavy-duty, horsepower-rated, fusible switch with clips or bolt pads to accommodate Class J **OR** Class R **OR** indicated, **as directed**, fuses.
 - 2) Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
 - 3) Auxiliary Contacts: N.O./N.C., arranged to activate before switch blades open.
- b. Nonfusible Disconnecting Means:
- 1) NEMA KS 1, heavy-duty, horsepower-rated, nonfusible switch.
 - 2) Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
 - 3) Auxiliary Contacts: N.O./N.C., arranged to activate before switch blades open.
- c. MCP Disconnecting Means:
- 1) UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents, instantaneous-only circuit breaker with front-mounted, field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
 - 2) Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
 - 3) Auxiliary contacts "a" and "b" arranged to activate with MCP handle.
 - 4) N.C. **OR** N.O., **as directed**, alarm contact that operates only when MCP has tripped.
 - 5) Current-limiting module to increase controller short-circuit current (withstand) rating to 100 kA.
- d. MCCB Disconnecting Means:
- 1) UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents; thermal-magnetic MCCB, with inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits.
 - 2) Front-mounted, adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 3) Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
 - 4) Auxiliary contacts "a" and "b" arranged to activate with MCCB handle.



- 5) N.C. **OR** N.O., **as directed**, alarm contact that operates only when MCCB has tripped.
- B. Reduced-Voltage Magnetic Controllers
1. General Requirements for Reduced-Voltage Magnetic Controllers: Comply with NEMA ICS 2, general purpose, Class A; closed-transition; adjustable time delay on transition.
 2. Reduced-Voltage Magnetic Controllers: Reduced voltage, electrically held.
 - a. Configuration:
 - 1) Wye-Delta Controller: Four contactors, with a three-phase starting resistor/reactor bank.
 - 2) Part-Winding Controller: Separate START and RUN contactors, field-selectable for 1/2- or 2/3-winding start mode, with either six- or nine-lead motors; with separate overload relays for starting and running sequences.
 - 3) Autotransformer Reduced-Voltage Controller: Medium-duty service, with integral overtemperature protection; taps for starting at 50, 65, and 80 percent of line voltage; two START and one RUN contactors.
 - b. Contactor Coils: Pressure-encapsulated type with coil transient suppressors, **as directed**.
 - 1) Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.
 - c. Power Contacts: Totally enclosed, double-break, silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.
 - d. Control Circuits: 24 **OR** 120, **as directed**, -V ac; obtained from integral CPT, with primary and secondary fuses, **as directed**, with CPT **OR** control power source, **as directed**, of sufficient capacity to operate integral devices and remotely located pilot, indicating, and control devices.
 - 1) CPT Spare Capacity: 50 **OR** 100 **OR** 200, **as directed**, VA.
 - e. Melting Alloy Overload Relays:
 - 1) Inverse-time-current characteristic.
 - 2) Class 10 **OR** Class 20 **OR** Class 30, **as directed**, tripping characteristic.
 - 3) Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.
 - f. Bimetallic Overload Relays:
 - 1) Inverse-time-current characteristic.
 - 2) Class 10 **OR** Class 20 **OR** Class 30, **as directed**, tripping characteristic.
 - 3) Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.
 - 4) Ambient compensated.
 - 5) Automatic resetting.
 - g. Solid-State Overload Relay:
 - 1) Switch or dial selectable for motor running overload protection.
 - 2) Sensors in each phase.
 - 3) Class 10 **OR** Class 20 **OR** Class 10/20 selectable, **as directed**, tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.
 - 4) Class II ground-fault protection, with start and run delays to prevent nuisance trip on starting.
 - 5) Analog communication module.
 - h. N.C. **OR** N.O., **as directed**, isolated overload alarm contact.
 - i. External overload reset push button.
 3. Combination Reduced-Voltage Magnetic Controller: Factory-assembled combination of reduced-voltage magnetic controller, OCPD, and disconnecting means.
 - a. Fusible Disconnecting Means:
 - 1) NEMA KS 1, heavy-duty, horsepower-rated, fusible switch with clips or bolt pads to accommodate Class J **OR** Class R **OR** indicated, **as directed**, fuses.
 - 2) Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.



- 3) Auxiliary Contacts: N.O./N.C., arranged to activate before switch blades open.
 - b. Nonfusible Disconnecting Means:
 - 1) NEMA KS 1, heavy-duty, horsepower-rated, nonfusible switch.
 - 2) Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
 - 3) Auxiliary Contacts: N.O./N.C., arranged to activate before switch blades open.
 - c. MCP Disconnecting Means:
 - 1) UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents, instantaneous-only circuit breaker with front-mounted, field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
 - 2) Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
 - 3) Auxiliary contacts "a" and "b" arranged to activate with MCP handle.
 - 4) N.C. **OR** N.O., **as directed**, alarm contact that operates only when MCP has tripped.
 - 5) Current-limiting module to increase controller short-circuit current (withstand) rating to 100 kA.
 - d. MCCB Disconnecting Means:
 - 1) UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents; thermal-magnetic MCCB, with inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits.
 - 2) Front-mounted, adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 3) Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
 - 4) Auxiliary contacts "a" and "b" arranged to activate with MCCB handle.
 - 5) N.C. **OR** N.O., **as directed**, alarm contact that operates only when MCCB has tripped.
- C. Reduced-Voltage Solid-State Controllers
1. General Requirements for Reduced-Voltage Solid-State Controllers: Comply with UL 508.
 2. Reduced-Voltage Solid-State Controllers: An integrated unit with power SCRs, heat sink, microprocessor logic board, door-mounted digital display and keypad, bypass contactor, and overload relay; suitable for use with NEMA MG 1, Design B, polyphase, medium induction motors.
 - a. Configuration: Standard duty **OR** Severe duty, **as directed**; nonreversible **OR** reversible, **as directed**.
 - b. Starting Mode: Voltage ramping **OR** Current limit **OR** Torque control **OR** Torque control with voltage boost, **as directed**; field selectable, **as directed**.
 - c. Stopping Mode: Coast to stop **OR** Adjustable torque deceleration **OR** Adjustable braking, **as directed**; field selectable, **as directed**.
 - d. Shorting (Bypass) Contactor: Operates automatically when full voltage is applied to motor, and bypasses the SCRs. Solid-state controller protective features shall remain active when the shorting contactor is in the bypass mode.
 - e. Shorting and Input Isolation, **as directed**, Contactor Coils: Pressure-encapsulated type; manufacturer's standard operating voltage, matching control power or line voltage, depending on contactor size and line-voltage rating. Provide coil transient suppressors, **as directed**.
 - f. Logic Board: Identical for all ampere ratings and voltage classes, with environmental protective coating.
 - g. Control Circuits: 24 **OR** 120, **as directed**, -V ac; obtained from integral CPT, with primary and secondary fuses, **as directed**, with CPT **OR** control power source, **as directed**, of sufficient capacity to operate integral devices and remotely located pilot, indicating, and control devices.
 - 1) CPT Spare Capacity: 100 **OR** 200, **as directed**, VA.



- h. Adjustable acceleration-rate control using voltage or current ramp, and adjustable starting torque control with up to 400 percent current limitation for 20 seconds.
- i. SCR bridge shall consist of at least two SCRs per phase, providing stable and smooth acceleration with **OR** without, **as directed**, external feedback from the motor or driven equipment.
- j. Keypad, front accessible; for programming the controller parameters, functions, and features; shall be manufacturer's standard and include not less than the following functions:
 - 1) Adjusting motor full-load amperes, as a percentage of the controller's rating.
 - 2) Adjusting current limitation on starting, as a percentage of the motor full-load current rating.
 - 3) Adjusting linear acceleration and deceleration ramps, in seconds.
 - 4) Initial torque, as a percentage of the nominal motor torque.
 - 5) Adjusting torque limit, as a percentage of the nominal motor torque.
 - 6) Adjusting maximum start time, in seconds.
 - 7) Adjusting voltage boost, as a percentage of the nominal supply voltage.
 - 8) Selecting stopping mode, and adjusting parameters.
 - 9) Selecting motor thermal overload protection class between 5 and 30.
 - 10) Activating and de-activating protection modes.
 - 11) Selecting or activating communication modes.
- k. Digital display, front accessible; for showing motor, controller, and fault status; shall be manufacturer's standard and include not less than the following:
 - 1) Controller Condition: Ready, starting, running, stopping.
 - 2) Motor Condition: Amperes, voltage, power factor, power, and thermal state.
 - 3) Fault Conditions: Controller thermal fault, motor overload alarm and trip, motor underload, overcurrent, shorted SCRs, line or phase loss, phase reversal, and line frequency over or under normal.
- l. Controller Diagnostics and Protection:
 - 1) Microprocessor-based thermal protection system for monitoring SCR and motor thermal characteristics, and providing controller overtemperature and motor-overload alarm and trip; settings selectable via the keypad.
 - 2) Protection from line-side reverse phasing; line-side and motor-side phase loss; motor jam, stall, and underload conditions; and line frequency over or under normal.
 - 3) Input isolation contactor that opens when the controller diagnostics detect a faulted solid-state component or when the motor is stopped.
OR
Shunt trip that opens the disconnecting means when the controller diagnostics detect a faulted solid-state component.
- m. Remote Output Features:
 - 1) All outputs prewired to terminal blocks.
 - 2) Form C status contacts that change state when controller is running.
 - 3) Form C alarm contacts that change state when a fault condition occurs.
- n. Optional Features:
 - 1) Analog output for field-selectable assignment of motor operating characteristics; 0 to 10-V dc **OR** 4 to 20-mA dc, **as directed**.
 - 2) Additional field-assignable Form C contacts, as indicated, for alarm outputs.
 - 3) Surge suppressors in solid-state power circuits providing three-phase protection against damage from supply voltage surges 10 percent or more above nominal line voltage.
 - 4) Full-voltage bypass contactor operating automatically **OR** manually, with NORMAL/BYPASS selector switch, **as directed**. Power contacts shall be totally enclosed, double break, and silver-cadmium oxide; and assembled to allow inspection and replacement without disturbing line or load wiring.
 - 5) Melting Alloy Overload Relays:
 - a) Inverse-time-current characteristic.
 - b) Class 10 **OR** Class 20 **OR** Class 30, **as directed**, tripping characteristic.



- c) Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.
- 6) Bimetallic Overload Relays:
 - a) Inverse-time-current characteristic.
 - b) Class 10 **OR** Class 20 **OR** Class 30, **as directed**, tripping characteristic.
 - c) Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.
 - d) Ambient compensated.
 - e) Automatic resetting.
- 7) Solid-State Overload Relay:
 - a) Switch or dial selectable for motor running overload protection.
 - b) Sensors in each phase.
 - c) Class 10 **OR** Class 20 **OR** Class 30, **as directed**, tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.
 - d) Class II ground-fault protection, with start and run delays to prevent nuisance trip on starting.
 - e) Analog communication module.
- 8) N.C. **OR** N.O., **as directed**, isolated overload alarm contact.
- 9) External overload reset push button.
- 3. Combination Reduced-Voltage Solid-State Controller: Factory-assembled combination of reduced-voltage solid-state controller, OCPD, and disconnecting means.
 - a. Fusible Disconnecting Means:
 - 1) NEMA KS 1, heavy-duty, horsepower-rated, fusible switch with clips or bolt pads to accommodate Class J **OR** Class L **OR** indicated, **as directed**, fuses.
 - 2) Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
 - 3) Auxiliary Contacts: N.O./N.C., arranged to activate before switch blades open.
 - b. MCP Disconnecting Means:
 - 1) UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents, instantaneous-only circuit breaker with front-mounted, field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
 - 2) Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
 - 3) Auxiliary contacts "a" and "b" arranged to activate with MCP handle.
 - 4) N.C. **OR** N.O., **as directed**, alarm contact that operates only when MCP has tripped.
 - 5) Current-limiting module to increase controller short-circuit current (withstand) rating to 100 kA.
 - c. MCCB Disconnecting Means:
 - 1) UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents; thermal-magnetic MCCB, with inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits.
 - 2) Front-mounted, adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 3) Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
 - 4) Auxiliary contacts "a" and "b" arranged to activate with MCCB handle.
 - 5) N.C. **OR** N.O., **as directed**, alarm contact that operates only when MCCB has tripped.
 - d. Molded-Case Switch Disconnecting Means:
 - 1) UL 489, NEMA AB 1, and NEMA AB 3, with in-line fuse block for Class J or L power fuses (depending on ampere rating), providing an interrupting capacity to comply with available fault currents; MCCB with fixed, high-set instantaneous trip only.
 - 2) Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.



- 3) Auxiliary contacts "a" and "b" arranged to activate with molded-case switch handle.
- 4) N.C. **OR** N.O., **as directed**, alarm contact that operates only when molded-case switch has tripped.

D. Multispeed Magnetic Controllers

1. General Requirements for Multispeed Magnetic Controllers: Comply with NEMA ICS 2, general purpose, Class A.
2. Multispeed Magnetic Controllers: Two speed, full voltage, across the line, electrically held.
 - a. Configuration: Nonreversing **OR** Reversing, **as directed**; consequent pole **OR** two winding, **as directed**.
 - b. Contactor Coils: Pressure-encapsulated type with coil transient suppressors, **as directed**.
 - 1) Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.
 - c. Power Contacts: Totally enclosed, double break, silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.
 - d. Control Circuits: 24 **OR** 120, **as directed**,-V ac; obtained from integral CPT, with primary and secondary fuses, **as directed**, with CPT **OR** control power source, **as directed**, of sufficient capacity to operate integral devices and remotely located pilot, indicating, and control devices.
 - 1) CPT Spare Capacity: 50 **OR** 100 **OR** 200, **as directed**, VA.
 - e. Compelling relays shall ensure that motor will start only at low speed.
 - f. Accelerating timer relays shall ensure properly timed acceleration through speeds lower than that selected.
 - g. Decelerating timer relays shall ensure automatically timed deceleration through each speed.
 - h. Antiplugging timer relays shall ensure a time delay when transferring from FORWARD to REVERSE and back.
 - i. Melting Alloy Overload Relays:
 - 1) Inverse-time-current characteristic.
 - 2) Class 10 **OR** Class 20 **OR** Class 30, **as directed**, tripping characteristic.
 - 3) Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.
 - j. Bimetallic Overload Relays:
 - 1) Inverse-time-current characteristic.
 - 2) Class 10 **OR** Class 20 **OR** Class 30, **as directed**, tripping characteristic.
 - 3) Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.
 - 4) Ambient compensated.
 - 5) Automatic resetting.
 - k. Solid-State Overload Relay:
 - 1) Switch or dial selectable for motor running overload protection.
 - 2) Sensors in each phase.
 - 3) Class 10 **OR** Class 20 **OR** Class 10/20 selectable, **as directed**, tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.
 - 4) Class II ground-fault protection, with start and run delays to prevent nuisance trip on starting.
 - 5) Analog communication module.
 - l. N.C. **OR** N.O., **as directed**, isolated overload alarm contact.
 - m. External overload reset push button.
3. Combination Multispeed Magnetic Controller: Factory-assembled combination of reduced-voltage magnetic controller, OCPD, and disconnecting means.
 - a. Fusible Disconnecting Means:
 - 1) NEMA KS 1, heavy-duty, horsepower-rated, fusible switch with clips or bolt pads to accommodate Class J **OR** Class R **OR** indicated, **as directed**, fuses.



- 2) Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
- 3) Auxiliary Contacts: N.O./N.C., arranged to activate before switch blades open.
- b. Nonfusible Disconnecting Means:
 - 1) NEMA KS 1, heavy-duty, horsepower-rated, nonfusible switch.
 - 2) Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
 - 3) Auxiliary Contacts: N.O./N.C., arranged to activate before switch blades open.
- c. MCP Disconnecting Means:
 - 1) UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents, instantaneous-only circuit breaker with front-mounted, field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
 - 2) Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
 - 3) Auxiliary contacts "a" and "b" arranged to activate with MCP handle.
 - 4) N.C. **OR** N.O., **as directed**, alarm contact that operates only when MCP has tripped.
 - 5) Current-limiting module to increase controller short-circuit current (withstand) rating to 100 kA.
- d. MCCB Disconnecting Means:
 - 1) UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents; thermal-magnetic MCCB, with inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits.
 - 2) Front-mounted, adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 3) Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
 - 4) Auxiliary contacts "a" and "b" arranged to activate with MCCB handle.
 - 5) N.C. **OR** N.O., **as directed**, alarm contact that operates only when MCCB has tripped.

E. Enclosures

1. Enclosed Controllers: NEMA ICS 6, to comply with environmental conditions at installed location.
 - a. Dry and Clean Indoor Locations: Type 1.
 - b. Outdoor Locations: Type 3R **OR** Type 4X, **as directed**.
 - c. Kitchen **OR** Wash-Down, **as directed**, Areas: Type 4X, stainless steel.
 - d. Other Wet or Damp Indoor Locations: Type 4.
 - e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: Type 12.
 - f. Hazardous Areas Indicated on Drawings: Type 7 **OR** Type 9, **as directed**.

F. Accessories

1. General Requirements for Control Circuit and Pilot Devices: NEMA ICS 5; factory installed in controller enclosure cover unless otherwise indicated.
 - a. Push Buttons, Pilot Lights, and Selector Switches: Heavy **OR** Standard, **as directed**, -duty, oiltight, **as directed**, type.
 - 1) Push Buttons: Covered **OR** Lockable **OR** Recessed **OR** Shielded **OR** Shrouded **OR** Unguarded, **as directed**, types; maintained **OR** momentary, **as directed**, as indicated.
 - 2) Pilot Lights: Incandescent **OR** LED **OR** Neon **OR** Resistor **OR** Transformer, **as directed**, types; colors as indicated; push to test, **as directed**.
 - 3) Selector Switches: Rotary type.
 - b. Elapsed Time Meters: Heavy duty with digital readout in hours; nonresettable **OR** resettable, **as directed**.



- c. Meters: Panel type, 2-1/2-inch (64-mm) minimum size with 90- or 120-degree scale and plus or minus two percent accuracy. Where indicated, provide selector switches with an off position.
2. N.C. **OR** N.O. **OR** Reversible N.C./N.O., **as directed**, auxiliary contact(s).
3. Control Relays: Auxiliary and adjustable pneumatic **OR** solid-state, **as directed**, time-delay relays.
4. Phase-Failure, Phase-Reversal, and Undervoltage and Overvoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connections. Provide adjustable undervoltage, overvoltage, and time-delay settings.
5. Breather and drain assemblies, to maintain interior pressure and release condensation in Type 4 **OR** Type 4X **OR** Type 7 **OR** Type 9, **as directed**, enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.
6. Space heaters, with N.C. auxiliary contacts, to mitigate condensation in Type 3R **OR** Type 4X **OR** Type 12, **as directed**, enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.
7. Sun shields installed on fronts, sides, and tops of enclosures installed outdoors and subject to direct and extended sun exposure.
8. Cover gaskets for Type 1 enclosures.
9. Terminals for connecting power factor correction capacitors to the line **OR** load, **as directed**, side of overload relays.
10. Spare control wiring terminal blocks, quantity as indicated; unwired **OR** wired, **as directed**.

1.3 EXECUTION

A. Examination

1. Examine areas and surfaces to receive enclosed controllers, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
2. Examine enclosed controllers before installation. Reject enclosed controllers that are wet, moisture damaged, or mold damaged.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Installation

1. Wall-Mounted Controllers: Install enclosed controllers on walls with tops at uniform height unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Division 26 Section "Hangers And Supports For Electrical Systems".
2. Floor-Mounted Controllers: Install enclosed controllers on 4-inch (100-mm) nominal-thickness concrete base. Comply with requirements for concrete base specified in Division 03 Section "Cast-in-place Concrete".
 - a. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - b. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - d. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Seismic Bracing: Comply with requirements specified in Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
4. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
5. Install fuses in each fusible-switch enclosed controller.
6. Install fuses in control circuits if not factory installed. Comply with requirements in Division 26 Section "Fuses".
7. Install heaters in thermal overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.



8. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.
9. Install power factor correction capacitors. Connect to the line **OR** load, **as directed**, side of overload relays. If connected to the load side of overload relays, adjust overload heater sizes to accommodate the reduced motor full-load currents.
10. Comply with NECA 1.

C. Identification

1. Identify enclosed controllers, components, and control wiring. Comply with requirements for identification specified in Division 26 Section "Identification For Electrical Systems".
 - a. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - b. Label each enclosure with engraved nameplate.
 - c. Label each enclosure-mounted control and pilot device.

D. Control Wiring Installation

1. Install wiring between enclosed controllers and remote devices and facility's central control system, **as directed**. Comply with requirements in Division 26 Section "Control-voltage Electrical Power Cables".
2. Bundle, train, and support wiring in enclosures.
3. Connect selector switches and other automatic-control selection devices where applicable.
 - a. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switch is in manual-control position.
 - b. Connect selector switches with enclosed-controller circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

E. Field Quality Control

1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
2. Perform tests and inspections.
3. Acceptance Testing Preparation:
 - a. Test insulation resistance for each enclosed controller, component, connecting supply, feeder, and control circuit.
 - b. Test continuity of each circuit.
4. Tests and Inspections:
 - a. Inspect controllers, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment, **as directed**.
 - b. Test insulation resistance for each enclosed-controller element, component, connecting motor supply, feeder, and control circuits.
 - c. Test continuity of each circuit.
 - d. Verify that voltages at controller locations are within plus or minus 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify the Owner before starting the motor(s).
 - e. Test each motor for proper phase rotation.
 - f. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - g. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - h. Perform the following infrared (thermographic) scan tests and inspections and prepare reports:
 - 1) Initial Infrared Scanning: After Final Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each multi-pole enclosed controller. Remove front panels so joints and connections are accessible to portable scanner.
 - 2) Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each multi-pole enclosed controller 11 months after date of Final Completion.



- 3) Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - i. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
 5. Enclosed controllers will be considered defective if they do not pass tests and inspections.
 6. Prepare test and inspection reports including a certified report that identifies enclosed controllers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- F. Adjusting
1. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.
 2. Adjust overload-relay heaters or settings if power factor correction capacitors are connected to the load side of the overload relays.
 3. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable instantaneous trip elements. Initially adjust to six times the motor nameplate full-load ampere ratings and attempt to start motors several times, allowing for motor cooldown between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify the Owner before increasing settings.
 4. Set the taps on reduced-voltage autotransformer controllers at 50 **OR** 65 **OR** 80, **as directed**, percent.
 5. Set field-adjustable switches and program microprocessors for required start and stop sequences in reduced-voltage solid-state controllers.
 6. Set field-adjustable circuit-breaker trip ranges as specified in Division 26 Section "Overcurrent Protective Device Coordination Study", **as directed**.
- G. Protection
1. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until enclosed controllers are ready to be energized and placed into service.
 2. Replace controllers whose interiors have been exposed to water or other liquids prior to Final Completion.
- H. Demonstration
1. Train the Owner's maintenance personnel to adjust, operate, and maintain enclosed controllers, and to use and reprogram microprocessor-based, reduced-voltage solid-state controllers, **as directed**.

END OF SECTION 23 09 23 00



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23 - Heating, Ventilating, And Air-Conditioning (HVAC)

Task	Specification	Specification Description
23 09 23 00	23 09 00 00	HVAC Instrumentation And Controls



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SECTION 23 11 23 00 - RELIEF WELLS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for relief wells. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Shop Drawings: Submit shop drawings.
2. Statements
 - a. Before installation, all well screen shall be approved.
 - b. The filter pack material and its gradation shall be approved before it is placed.
 - c. Submit the cement grout mixture proportion to be used in plugging abandoned wells.
3. Reports: Submit sampling and testing reports for each relief well, logs of the borings, well screen and riser pipe, backfill material, and pump tests. Register each well with the state as required by the state in which the well is installed.

- #### C. Regulatory Requirements: The state statutory and regulatory requirements form a part of this specification.

1.2 PRODUCTS

- #### A. Well Screen: The Contractor may, at its option, furnish and install well screen of any of the alternate types specified. The clear inside diameter of the screen shall be as directed by the Owner. Screen openings shall be uniform in size and pattern, and shall be spaced approximately equally around the circumference of the pipe.

1. PVC Pipe Screen: Pipe, fittings, and screen shall be of the size and types specified. Pipe, fittings, and screen shall conform to ASTM D 1784, ASTM D 1785, ASTM D 2466, or ASTM D 2467. All joints in the PVC pipe shall include couplings and shall be glued with a solvent cement conforming to ASTM D 2564. The PVC pipe strength properties shall be equivalent to PVC 1120 Schedule 40 **OR** 80, **as directed**, unthreaded plastic pipe.
 - a. Couplings: Couplings shall be bonded socket **OR** threaded, **OR** certilock, **as directed**, type. Fittings shall be produced of the same material and equal quality as specified for plastic pipe screen. Socket type fitting connections of pipe sections shall be bonded with solvent cement. The determination of the proportions and preparation of adhesives, the method of application, and the procedure used for making and curing the connections shall be the responsibility of the Contractor. The system for making joints at the relief well site shall provide a curing period adequate to develop the ultimate strength of the solvent cement. Self-tapping screws or other devices for holding pipe in the couplings during the setting period may be utilized as long as the screws do not penetrate the inside of the pipe. In no case shall a newly-made joint in the casing be stressed, lowered into the relief well, or be submerged in water prior to complete curing of the solvent cement adhesive.
 - b. Perforations: The PVC well screen shall be mill slot **OR** continuous wire wrapped rod base **OR** continuous wire wrapped rod base on perforated pipe **OR** continuous wire wrapped on perforated pipe screen **OR** similar to that manufactured by Johnson Well Equipment, Inc., Pensacola, FL, telephone (904) 453-3131, **as directed**. All well screen shall have smooth, sharp-edged openings free of burns, chipped edges, or broken areas on the interior and exterior surfaces of the pipe. The slots or groups of slots shall be distributed in a uniform pattern around the periphery of the pipe and shall be oriented with the length of the slot parallel to, normal to, or diagonal with the axis of the pipe.



2. **Fiberglass Pipe Screen:** Fiberglass pipe screen and fittings shall be manufactured from thermosetting epoxy resins and glass fiber by either a centrifugal casting process or by a filament winding process. Glass fiber used shall be continuous filament, electrical glass with a finish compatible with epoxy resins. Each glass fiber or filament shall be thoroughly impregnated with epoxy resin. Fiberglass pipe wall thickness, strength and durability requirements shall be equivalent to the Fiberglass/Epoxy pipe produced by Fiberglass Resources Corporation of Farmingdale, New York or Burgess Well Company, Inc., Minden, Nebraska, telephone (308) 832-1642. All fiberglass pipe and fittings shall be round and straight, of uniform quality and workmanship, and free from all defects including indentation, delamination, bends, cracks, blisters, porosity, dry spots, resin segregation and resin-starved areas. The inside of the pipe and fittings shall be smooth and uniform. The impregnation of the glass fiber with resin shall be such that when the pipe is cut or slotted, no fraying or looseness of glass fiber occurs.
 - a. **Couplings:** Couplings for fiberglass pipe sections shall be socket threaded or mechanical key-type couplings. The couplings shall be manufactured of the same materials used for the fiberglass pipe specified herein and may be either cast integrally with the pipe sections or as separate components for attachment to the pipe in the manufacturers plant. Key-type couplings shall consist of male and female halves designed for joining and locking together by means of a key strip inserted in grooves in the coupling halves. The minimum wall thickness remaining at any grooved section shall not be less than the minimum thickness specified for pipe. Key strips and locking strips shall be of fiberglass, plastic or other non-corrosive material capable of withstanding shearing and bearing stresses equivalent to the design load for the coupling. Socket type fitting connections of the pipe sections shall be bonded with epoxy adhesive. The epoxy materials and bonding agents shall be as recommended by the pipe manufacturer. Self-tapping screws or other devices for holding adhesive-joined pipe in the couplings during the curing period may be utilized. In no case shall a newly-made joint in the casing pipe be lowered into the relief well, or be submerged in water prior to complete curing of the adhesive.
 - b. **Perforations:** All fiberglass well screen shall be mill slot **OR** continuous wire wrapped rod base, **as directed**. All relief well screen shall have smooth, sharp-edged openings free of burrs, chipped edges, or broken areas on the interior and exterior surfaces of the pipe. The slots or groups of slots shall be distributed in a uniform pattern around the periphery of the pipe and shall be oriented with the length of the slot parallel to, normal to, or diagonal with the axis of the pipe.
3. **Steel Pipe Screen:** Steel well screen shall consist of perforated or slotted sections of steel pipe conforming to the requirements of ASTM A 53.
 - a. **Couplings:** Couplings for steel pipe screen shall be welded joints or threaded couplings. Welding shall be performed in accordance with requirements in ASME B31.9. Couplings shall meet the material requirements specified for steel pipe screen, except perforations shall be omitted. All threaded pipe and fittings shall be threaded in accordance with ASME B1.20.1. All threaded pipe sections may be field connected. Couplings shall be given the same protection against corrosion as specified for the well screen pipe. Protective coatings damaged while making couplings shall have the areas recoated.
 - b. **Perforations:** All steel pipe to be used as relief well screen shall be provided with perforations which shall consist of either machine-cut slots; drilled or punched openings. The slots or groups of slots shall be distributed in a uniform pattern around the periphery of the pipe and shall be oriented with the length of the slot parallel to, normal to, or diagonal with the axis of the pipe. The pattern of the openings shall be uniformly spaced around the periphery of the pipe.
4. **Stainless Steel Well Screen:** The perforated well screen and fittings shall be fabricated entirely from stainless steel conforming to ASTM A 312/A 312M, Type 304, 304-L, 316 or 316-L. The well screen shall be of stainless steel with a keystone wire-wrapped continuous slot strainer equivalent to that manufactured by Howard Smith Screen Company, Houston, TX, telephone (713) 869-5771 or Johnson Screens, St. Paul, MN 55164, telephone (612) 636-3900.
 - a. **Couplings:** Couplings for the stainless steel well screen shall consist of the same material as the well screen and shall be threaded, flanged, and/or fitted with a welding ring. The



couplings shall conform in design to the couplings recommended by the manufacturer of the well screen.

- b. Tailpipe for Well Screen: The tailpipe for each well screen shall be made of the same material and at least the same minimum thickness as the riser pipe and shall include a bottom plug.
- B. Riser Pipe: The relief well riser pipe material and method of manufacture shall conform to the requirements specified in paragraph WELL SCREEN, except that the screen perforations or opening shall be omitted. The relief well riser pipe diameter and discharge details shall be as directed. Couplings to the well screen and between riser pipe sections shall be as specified in paragraph COUPLING.
- C. Filter Pack: Material for the filter pack around the riser pipes and screens shall be a washed grave, **OR** washed sand **OR** dry processed sand, **as directed**, composed of hard, tough, and durable particles free from adherent coating. The filter pack shall not be crushed stone. The filter pack material shall contain no detrimental quantities of organic matter nor soft, friable, thin, or elongated particles in accordance with the quality requirements in ASTM C 33, Table 1 and Table 3, Class 5S, and in ASTM E 11, Table 1.
- D. Outlet For Relief Well: Check Valve.
 1. The check valve shall be a one piece reinforced all rubber (neoprene) check valve with an integral elastomer flange similar and equal to the Red Valve Series 35, manufactured by Red Valve Company, Inc., 700 North Bell Ave., Pittsburgh, PA 15106, telephone (412) 279-0044. The backup ring for the check valve shall be stainless steel. Stainless steel bolts, washers, and nuts shall be used to fasten the valves onto the flanged end of the pipes. The check valve shall be installed with the flared end duck bill in a vertical position.
OR
Fabricate check valves of brass **OR** stainless steel **OR** aluminum, **as directed**, plate, threaded fasteners and rods. Fabricate sealing disc of silicone sponge rubber free of porous areas, foreign materials, and visible defects.
 2. Workmanship and metalwork fabrication of check valves shall be as directed. Install check valves accurately vertically and adjust to the required elevation.
- E. Concrete: Concrete shall conform to the requirements specified in Division 03 Section "Cast-in-place Concrete".

1.3 EXECUTION

- A. Drilling: Wells may be drilled by the reverse rotary circulation method or other method approved, which will ensure proper placement of the well screen, riser pipe, and filter pack. Methods which involve radical displacement of the formation, or which may reduce the yield of the well, will not be permitted. Excavated material shall be disposed of as directed.
 1. Reverse Circulation Method: If the reverse circulation method is used for drilling wells, all of the drilling fluid shall be removed from the filter pack and the natural pervious formation. If in the opinion of the Owner the walls of the hole above the top of the filter pack require support during development operations, a temporary casing similar to that specified in paragraph TEMPORARY CASING shall be placed so as to extend from the ground surface to at least 3 ft (1 m) below the top of the filter pack. The diameter of the hole shall be such as will permit the placement of the minimum thickness of filter pack as specified in paragraph FILTER PACK PLACEMENT. The drilling fluid shall be a suspension of fine grained soil or shall be a commercial product of a recognized manufacturer, shall be approved by the Owner, and shall have the characteristic of being readily removable from the filter pack and the walls of the formation by development as specified in paragraph DEVELOPMENT. The use of bentonite will not be permitted.
 2. Temporary Casing: Temporary well casing of either iron or steel of sufficient length to case to the bottom of all borings shall be available at the construction site. the Owner will direct the use of a temporary casing to the bottom of the boring during drilling and placement of screen, riser, and



filter pack when it believes it is necessary to provide adequate support to the sides of the hole. When the walls of the boring will require support only during development operations a temporary casing will be required to extend only to a depth 3 ft (3 m) below the top of the filter pack. The temporary casing, shall have sufficient thickness to retain its shape and maintain a true section throughout its depth, and may be in sections of any convenient length. The temporary casing shall be such as to permit its removal without disturbing the filter pack, riser, or well screen. The setting of temporary casing shall be such that no cavity will be created outside of it at any point along its length. In the event the temporary casing should become unduly distorted or bent it shall be discarded and a new casing shall be used during installation of any additional relief wells.

B. Installation Of Riser Pipe And Screen

1. **Assembly:** All riser pipe and screen shall be in good condition before installation and all couplings and other accessory parts shall be securely fastened in place. The successive lengths of pipe shall be arranged to provide accurate placement of the screen sections in the bore hole. The riser-pipe shall be provided with an approved cap and a flanged top section, the top of which shall be set at the elevation directed. Centralizers shall be attached to the assembled riser pipe and screen in such numbers and of a type that they will satisfactorily center the riser pipe and screen in the well and will hold it securely in position while the filter pack material is being placed.
2. **Joints:** Sections of relief well pipe shall be joined together as specified in paragraph COUPLINGS. Joints shall be designed and constructed to have the strength of the pipe and where possible a strength capable to support the weight of the relief well stem as it is lowered into the hole. When not practicable to construct joints that will support the weight of the relief well stem, the stem shall be supported at the lower end by any approved means that will assure that the joints do not open while being lowered into place in the well.
3. **Installation:** The assembled riser pipe and screen shall be placed in the bore hole in such manner as to avoid jarring impacts and to ensure that the assembly is centered and not damaged or disconnected. The screen shall be suspended in the hole and not resting on the bottom of the hole. After the screen and riser pipe have been placed, a filter pack shall be constructed around the screen section as specified in paragraph FILTER PACK PLACEMENT and the well developed as specified in paragraph DEVELOPMENT. The top of the riser pipe shall be held at the designated elevation during placement of the filter pack.
4. **Check for Plumbness and Alignment:** The well shall be constructed and all casing set round, plumb, and true. The Contractor shall perform the following tests after the installation of the well but prior to backfilling, and before its acceptance. Additional tests may be made during the performance of the work at the option of the Contractor. Should the Contractor fail to correct, at no additional cost to the Owner, any faulty alignment or plumbness disclosed as a result of these tests, the Owner may refuse to accept the well. the Owner may waive the requirements for plumbness if in its judgement the Contractor has exercised all possible care in constructing the well and the defect is due to circumstances beyond its control or if the utility of the completed well is not materially affected or if the cost of necessary remedial measures will be excessive. In no event will the provisions with respect to alignment be waived.
 - a. **Plumbness:** Plumbness shall be tested by use of a plumb line. The plummet shall be suspended from a small diameter wire rope and its point of suspension shall be in the exact center of the plummet. The plummet shall be sufficiently heavy to stretch the wire rope taut. The wire rope shall pass over a guide sheave which shall be positioned above the top of the well and adjusted horizontally so that the plummet hangs in the center of the well. Displacement of the wire rope during the plumbness check shall be measured by means of a transparent plastic sheet on which a number of concentric circles shall be scribed or drawn, and which is centered on the top of the well. The exact center of these circles shall be marked, and then a slot, slightly larger than the plumb line and extending from this center to the edge, shall be cut in the plastic sheet. As the plummet is lowered, any out-of-plumb condition of the well will be indicated by the wire rope tending to drift away from the center, and the plastic sheet shall be rotated until the slot is oriented in the direction of this drift, while at all times maintaining the center of the concentric circles coincident with the center of the well. Measurement of the amount of drift shall be made



along the edge of the slot for each increment by which the plummet is lowered into the well. Drift at any depth shall be determined by multiplying the measured plumb line displacement by the total length of the plumb line and dividing the result by the fixed distance between the guide sheave and the top of the well. If desired, alignment may be calculated from the plumbness data in lieu of the alignment check described in paragraph ALIGNMENT. Should the well vary from the vertical in excess of allowable, the plumbness of the well shall be corrected by the Contractor at no additional cost to the Owner.

- b. Alignment: Alignment shall be tested by lowering into the well a section of cylinder or a dummy of the same length. The outside diameter of cylinder shall be smaller than the inside diameter of the well. Should the cylinder fail to move freely throughout the length of the well, the alignment of the well shall be corrected by the Contractor at no additional expense to the Owner.

- C. Filter Pack Placement: After the well screen and riser pipe have been installed, the filter pack material shall be placed by tremie, when using a well graded material, in an approved manner such that segregation will not occur. When using a uniform graded filter material, the material may be poured around the well screen at a rate that will prevent bridging of the material. The material shall be placed around all sides of the screen to assure that the screen is not pushed against the side of the bore hole causing the screen to come in contact with foundation material or prevent the proper thickness of filter from being placed uniformly around the screen. The filter pack shall be placed at a constant rate from the start of placement until it has reached the elevation directed. If a tremie is required, a double string of tremie pipe shall be used. The pipes shall be placed on opposite sides of the screen and/or casing, that is, 180 degrees apart, and shall be guided in such a manner that they will remain in this position throughout the placing process. The tremie pipes shall be set in place, filled completely with filter pack prior to being lifted off the bottom of the hole. The filter pack in the tremie pipe shall be kept above the water surface in the well throughout the placing process. In no case shall the gradation of the filter pack fall outside of the range specified in paragraph FILTER PACK.

D. Development

1. General: Following placement of filter pack materials, the Contractor shall develop the relief well by jetting, surging, intermittent pumping, or other approved methods as may be necessary to give the maximum yield of water. At the time of development of any relief well, the well shall be free of drawdown or surcharge effects due to pump testing, developing or drilling at another location. The Contractor shall be responsible for maintaining at the relief well the needed access and work area and clearance in the relief well necessary to accomplish development. The Contractor shall furnish, install, or construct the necessary discharge line and troughs to conduct and dispose of the discharge a sufficient distance from the work areas to prevent damage. Development shall be conducted to achieve a stable well of maximum efficiency and shall be continued until a satisfactory sand test, as specified in paragraph SAND TEST, is obtained. As development proceeds, filter pack material shall be added to the annular space around the screen to maintain the top elevation of the filter pack to the specified elevation. The Contractor shall provide an open tube or other approved means for accurately determining the water level in the well under all conditions. If at any time during the development process it becomes apparent in the opinion of the Owner that the well may be damaged, development operations shall be immediately terminated. the Owner may require a change in method if the method selected does not accomplish the desired results. the Owner may order that wells which continue to produce excessive amounts of fines after development for 6 hours be abandoned, plugged, and backfilled, and may require the Contractor to construct new wells nearby. All materials pulled into the well by the development process shall be removed prior to performing the pumping test.
 - a. Jetting: Jetting should be performed using either a single or double ring jet. The jetting tool shall be constructed of high-strength material and conservatively designed and proportioned so that it will withstand high pressures. The jetting tool shall have two hydraulically balanced nozzles spaced 180 degrees **OR** four diameter holes spaced 90 degrees, **as directed**, apart and which shall exert the jetting force horizontally through the screen slots. The rings shall be constructed such that the tips of the jets shall be within 1/2 in. (13 mm) from the inner surface of the well screen. The pump used in conjunction with



the jetting tool shall be capable of providing a minimum jetting fluid exit velocity of 150 feet per second (45 meters per second). Prior to commencing jetting, and following each jetting cycle, all sand and/or other materials shall be removed from inside the screen. All wells shall be pumped during the jetting cycle to remove incoming sand and other material. Such pumping shall be at a rate not less than 115 percent of the rate at which fluid is introduced through the jetting tool. This will allow a flow of material into the well as it is being developed. Water used for development shall be free of sand. the Owner may require other means of developing the well such as intermittent pumping method, variation of the intermittent pumping method, or surge block if it appears that the development of the well is not producing the desired results.

- b. Intermittent Pumping: Intermittent pumping shall be performed by pumping the well at a capacity sufficient to produce a rapid drawdown, stopping the pump (backflow through pump will not be permitted) to permit the water surface to rise to its former elevation, and repeating this procedure. Cycle time for this procedure will vary as directed but will not be more than 3 cycles per minute. A deep well turbine pump, or electric submersible pump with check valve, shall be used with any attachment necessary to accomplish rapid starting and stopping for intermittent pumping. The intake shall be set below the maximum expected drawdown in the well. Prior to commencing intermittent pumping, and periodically during development by this method, all sand and/or other materials shall be removed from inside the screen. The amount of drawdown may be decreased if, in the opinion of the Owner, the efficiency of the well might otherwise be impaired.
 - c. Surging: Surging of the well shall require use of a circular block which is smaller in diameter than the inside diameter of the relief well and is constructed of a material which will not damage the screen if the block comes in contact with the screen, and a bailer or pump to remove materials drawn into the well. The surging shall be continued for a period of approximately one hour or until little or no additional material from the foundation or filter pack can be pulled through the screen. The surge block shall be moved by a steady motion up and down the full length of the well screen. Prior to commencing surging, and periodically during development by this method, all sand and/or other materials shall be removed from inside the screen. All materials pulled into the well by the surging process shall be removed by the Contractor.
- E. Backfilling: After the well has been developed, additional filter pack shall be added if necessary to meet the requirements of paragraph FILTER PACK PLACEMENT. Then the annular space above the filter pack, shall be backfilled by first placing a layer of concrete sand on the filter pack and then filling the remainder of the space up to the finished ground surface **OR** well pit, **as directed**, with grout or concrete. The concrete backfill shall be placed to a depth at least equal to the existing impervious blanket. For PVC riser pipe, after the well has been developed, additional filter pack shall be added if necessary for it to meet the requirements of paragraph FILTER PACK PLACEMENT. Then the remaining annular space above the filter pack shall be backfilled by first placing a layer of concrete sand on the filter pack and then filling the remainder of the space up to the finished ground surface **OR** well pit, **as directed**, with bentonite. The temporary casing, if used, shall be withdrawn in increments as the backfill is placed. The Contractor shall fill with impervious material to original grade all pits such as those incidental to the reverse rotary circulation method of drilling.
- F. Plugging Of Abandoned Wells: The Contractor has the option of attempting to remove the well screen. If the well screen can be removed, the Contractor will grout the bore hole starting from the bottom of the hole. The grouting shall start at the elevation of the bottom of the tailpipe of the well. If the well screen can not be removed or breaks off during the removal attempt, the Contractor shall still be responsible for grouting the well from the bottom of the tailpipe to within 3 ft (1 m) of ground surface. Either of the above abandonment procedures may require the Contractor to redrill the hole so that the bore hole can be grouted. The well shall be grouted from the bottom of the tailpipe. After the grout has setup the riser pipe shall be cutoff. Then the hole shall be backfilled. The cement grout mixture proportion to be used shall be submitted for approval.



G. Tests

1. Pump Test: Upon completion but before acceptance, each well shall be subjected to a pump test of which a sand test will form a part. The Contractor shall provide a deep well turbine pump, capable of producing the specified drawdowns over periods of time sufficient to satisfactorily perform the pump test specified herein. The intake shall be set below the maximum expected drawdown in the well. The amount of sand shall be measured after each test. The pump shall be complete with either gasoline, diesel, or electric motor of adequate size. In case an electric motor is used, the Contractor shall provide, without additional cost to the Owner, the electric power and the necessary wiring. The Contractor shall provide an open tube or other approved means for accurately determining the water level in the well. The Contractor shall furnish and install an orifice meter of approved design or other approved equipment for the purpose of measuring the discharge from the well during the pumping test. The Contractor shall furnish, install, or construct the necessary pipe discharge line, troughs, or ditches necessary to dispose of the pumping test discharge a sufficient distance from the work area to prevent damage. The tests will be conducted under the direction of the Owner and may be made as soon as each well is completed. Test data will be recorded by the Owner. The Contractor shall test each well by pumping continuously for a minimum of 6 hours. Prior to starting the pump test all material shall be removed from the bottom of the well. If the test is interrupted, other than by order of the Owner, prior to the completion of the specified period of continuous operation, the test shall be re-run. In addition to the required pumping test, the Owner may direct the Contractor to perform additional pump tests. Such additional testing shall conform in general to the requirements specified herein except that the duration of the tests and the approximate draw-down will be determined by the Owner. In the event that sand or other material collects in the well as a result of the pump test, accurate measurements shall be taken as to the quantity of material in the well and all such material shall be removed by the Contractor. Upon completion of the pump test, the Contractor shall remove all equipment, discharge lines, electrical lines, lumber, and debris, and shall backfill any excavated areas with impervious material.
2. Sand Test: As part of each Pump Test or at the end of each intermittent pumping a determination of the amount of sand (filter pack and/or foundation material) a well is producing shall be performed. Prior to starting the sand test all material shall be removed from the bottom of the tailpipe. After the pump is at the desired pumping rate the flow from the discharge shall be diverted into a container that will collect all the sand being carried by the water **OR** through a Rossum Sand Tester, **as directed**. Upon completion of the test the amount of sand in the tailpipe shall be determined to verify that no material is being deposited in the bottom of the well.
3. Filter Pack Sampling and Testing: The Contractor shall verify that all materials conform to the specifications before delivery to the project. The particle size distribution of the filter pack shall be sampled and tested by the Contractor in accordance with ASTM C 136 and ASTM D 75. Within 48 hours before being placed in the relief well to be back-filled, the filter pack shall be sampled from the material stockpiled at the project site. There shall be at least one particle size distribution test on the filter pack for each well. A pump test shall be performed in accordance with technical provisions herein specified.
4. Reports: Reports shall include, for each relief well, logs of the boring, elevations of the well screen, top of riser pipe, bottom of the tailpipe, filter pack gradation, quantity of filter pack added during development, pump test, sand test, and report of backfilling. The log of backfill material shall include the filter pack particle size distribution test data, and notes concerning installation and development of the relief well. The pump test log shall include the duration of the test and the draw-down response data with time in the pumped well, in adjacent wells, and in nearby piezometers. The relief well log and the pump test log shall be submitted to the Owner. The Contractor shall also submit a report of the well installation to the appropriate public agency and in the form required by state statutory and/or regulatory requirements specified in paragraph REGULATORY REQUIREMENTS.

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SECTION 23 11 23 00a - MONITORING WELLS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for monitoring wells including drilling, casing, well screen, gravel packing, grouting, development, monitoring device, and incidental related work complete and ready for operation. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. General Requirements

1. Each system, including equipment, materials, installation, and performance, shall be in accordance with local, State, and Federal regulations, ASTM D 5092, and EPA 600-4-89-034 except as modified herein. Consider the advisory or recommended provisions to be mandatory, as though the word "shall" has been substituted for the word "should" wherever it appears. Reference to the "Project Representative" and the "Owner" shall be interpreted to mean the Owner. Additional requirements are included under Division 01 Section "Temporary Facilities And Controls". Mark and secure monitoring wells to avoid unauthorized access and tampering.

C. Submittals:

1. Shop Drawings: Well construction.
2. Product Data
 - a. Well casing
 - b. Well screen
 - c. Filter pack
 - d. Neat cement grout
 - e. Bentonite seal
3. Certificates
 - a. Well Drilling/Development Material Handling Plan
 - b. Health and Safety Plan
 - c. Field Sampling and Laboratory Testing Plan
 - d. Treatment facility permit
 - e. Installation Survey Report
 - f. Well Development Report
 - g. Borehole Analysis Report
4. Closeout Submittals
 - a. Well Construction Permit
 - b. Shipment manifests
 - c. Delivery certificates
 - d. Treatment and disposal certificates

D. Delivery, Storage, And Handling

1. Deliver materials in an undamaged condition. Unload and store with minimal handling. Store materials in on-site enclosures or under protective coverings. Store plastic piping and jointing materials, and rubber gaskets under cover, out of direct sunlight. Store materials off the ground. Keep insides of pipes and fittings free of dirt and debris. Replace defective or damaged materials with new materials.

E. Quality Assurance

1. Required Drawings: Submit well construction drawings showing components and details of well casing, well screen, filter pack, annular seal, and associated items. Drawings shall be prepared by a State certified professional geologist or hydrogeologist, or by a State registered professional



- civil engineer, hereafter referred to as the Contractor's Professional Consultant (CPC). Drawings shall be sealed.
2. Well Drilling/Development Material Handling Plan: A material handling plan shall be furnished by the Contractor 15 days prior to initiation of the work that describes phases of dealing with the potentially contaminated soil and groundwater, including the following: a schedule to be employed in the well drilling and development stages, a sequence of operations, the method of drilling and development, material hauling, proposed equipment, handling of the contaminated materials, soil and water testing requirements, and safety precautions and requirements.
 3. Health and Safety Plan (HASP): Describe safety precautions for each phase of the project as specifically related to handling of soil and water removed during well drilling and development operations. Identify appropriate requirements of 29 CFR 1910 and COE EM-385-1-1. Identify safety equipment and procedures to be available and used during the project. Furnish the name and qualifications based on education, training, and work experience of the proposed Health and Safety Officer (HASO) and the members of the drill crew. The CPC may perform the responsibilities of the HASO if properly qualified.
 4. Field Sampling and Laboratory Testing Plan: Describe field sampling methods and quality control procedures. Identify laboratory and laboratory methods to be used for contamination testing. Sample reports shall show sample identification for location, date, time, sample method, contamination level, name of individual sampler, identification of laboratory, and quality control procedures.
 5. Treatment Facility Permit: Verification that the proposed treatment facility is permitted to accept the contaminated materials specified, prior to the start of excavation.
 6. Well Development Report: Provide report, containing the following data for each well: project name and location, well designation, date and time of well installation, date and time of well development, static water level from top of well casing before development and 24 hours after development, field measurements of pH, temperature, and specific conductivity, depth of well from top of casing to bottom of well, screen length, description of development methodology size/capacity of pump or bailer, pumping rate, and recharge rate.
 7. Well Construction Permit: Submit a completed permit application and a proposed method of construction to the appropriate state agency prior to construction of the well. Construction of the wells will not be allowed until an approved Well Construction Permit has been submitted to the Owner.
 8. Shipment Manifests: Copies of manifests and other documentation required for shipment of waste materials within 24 hours after removal of waste from the site. Shipment manifests shall be signed by the Owner.
 9. Delivery Certificates: Verification that the wastes were actually delivered to the approved treatment facility, within 7 days of shipment.
 10. Treatment and Disposal Certificates: Verification that the wastes were successfully treated and remediated to the levels specified herein.

1.2 PRODUCTS

A. Well Casing

1. Stainless Steel Piping: ASTM A 312/A 312M, Type 304, Schedule 40S, with flush threaded joint end fittings. Threaded joints shall be wrapped with fluoropolymer tape, and provided with nitrile O-ring gaskets.
2. PVC Piping: ASTM F 480, Type 1, Grade 1, PVC 12454, NSF wc or NSF pw, Schedule 40 **OR** 80, **as directed**, with flush threaded joint fittings. Threaded joints shall be wrapped with fluoropolymer tape, and provided with nitrile O-ring gaskets.

- ### B. Well Screen
- Well screens shall be located as directed. The length of each screen shall be as directed. Slot size shall be as required to meet project requirements. Slotted openings shall be distributed uniformly around the circumference of the screen. Open area shall approach the formation's natural porosity.



1. Stainless Steel Screens: ASTM A 312/A 312M, Type 304, Schedule 40S, continuous slot construction, wire wound, with flush threaded joint ends.
 2. PVC Screens: ASTM D 1785, PVC 1120, NSF wc or NSF pw, Schedule 40 **OR** 80, **as directed**, screen, Schedule 80, machine-slotted construction, flush threaded joint ends. Slots shall be even in width, length, and separation.
- C. Primary Filter Pack: Provide clean, durable, well-rounded, and washed quartz or granite, with less than 5 percent non-siliceous material. The filter pack shall not contain organic matter or friable materials. The filter pack shall allow free flow of water in the well, and shall prevent the infiltration of aquifer materials. Filter pack shall have a 30 percent finer than (d-30) grain size size as required to meet project requirements, and a uniformity coefficient less than 2.5, in accordance with ASTM C 117 and ASTM C 136.
- D. Secondary Filter Pack: Gradation in accordance with ASTM D 5092. Provide clean, durable, well-rounded, and washed quartz or granite. Pack shall not contain organic matter or friable materials.
- E. Annular Sealants
1. Bentonite Seal: Provide powdered, granular, pelletized, or chipped sodium **OR** calcium, **as directed**, montmorillonite in sealed containers from a commercial source, free of impurities. Diameter of pellets shall be less than one fifth the diameter of the borehole annular space to prevent bridging. Bentonite base grout shall be in accordance with ASTM D 5092.
 2. Neat Cement Grout: Provide neat cement grout in accordance with ASTM D 5092. Cement shall be in accordance with ASTM C 150. Quick setting admixtures shall not be allowed. Drilling mud or cuttings shall not be used as a sealing material.
- F. Bottom Plugs: Provide flush threaded solid plug at the bottom of the well. Plug shall be the same material as the well casing **OR** screen to which it is attached, **as directed**. Joints shall be wrapped with fluoropolymer tape and provided with nitrile O-ring gaskets.
- G. Locking Well Cap: Provide flush threaded, weatherproof, and non-removable locking well cap on the top of the well. Well cap shall be of the same material as the well casing to which it is attached. Well cap shall accommodate padlock. Provide a long shackled padlock in accordance with ASTM F 883. Provide two keys for the padlock, and turn them over to the Owner. Locks at the well site shall be keyed alike.
- H. Well Head Completions: Clearly mark and secure the well to avoid unauthorized access and tampering. Cast the words "MONITORING WELL" on the well head cover. Provide a sign reading, "WELL IS FOR MONITORING AND IS NOT SAFE FOR DRINKING." Provide stamped metal identification tag as follows:
- DO NOT DISTURB
 - ID #: _____ Date: _____
 - Installed By: _____
 - Total Depth: _____
 - Screened Interval: _____
 - TOC Elevation: _____
 - Other: _____
 - For Information, Call: _____
1. Aboveground Completions: Provide protective outer casing around the well casing extending above grade. The diameter of the protective outer casing shall be a minimum of 4 in. (100 mm) larger than the well casing diameter. The top of the protective outer casing shall extend a minimum of 6 in. (150 mm) above the top of the well casing cap. The protective outer casing shall be set in cement grout and the bottom of the protective well casing shall extend below the depth of the frost line **OR** to the depth indicated, **as directed**. A 1/4 in. (6 mm) diameter weep hole shall be drilled in the protective outer casing 3 in. (75 mm) above the ground surface. The annular space between the protective outer casing and the well casing shall be filled with pea gravel or coarse sand to just below the level of the cap on the well casing. The locking well cap



shall be provided on top of the protective outer casing. Provide 6 in. (150 mm) diameter steel pipe bollards, filled with concrete as indicated to protect the exposed well head.

- a. Protective Outer Casing and Bollards: ASTM A 53, Type E or S, Grade B.
 - b. Well Casing Cap: Provide cap on top of the protective outer casing. Cap shall be flush threaded and of the same material as the protective outer casing. Threaded joints shall be wrapped with fluoropolymer tape and provided with nitrile O-ring gaskets.
2. At-Grade Completions: Provide cast iron **OR** aluminum, **as directed**, vault box, 30 by 30 in. (750 by 750 mm) **OR** 12 in. (300 mm) diameter, **as directed**, with watertight frame and cover. Vault shall support H-20 loading for traffic areas **OR** a 100,000 lb. (45,360 kg) loading for airfield locations, **as directed**. The frame shall be 6 in. (150 mm) deep, and shall be set in a concrete collar a minimum of 8 in. (200 mm) thick, and extending 4 in. (100 mm) beyond the edge of the frame in all directions. Frame and concrete collar shall be set flush with the level of the existing pavement **OR** set 3 in. (75 mm) above the existing grade, **as directed**. Locking well cap shall be provided on top of the well casing, which will terminate inside the vault as indicated.
- I. Polyethylene Sheeting: ASTM D 4397.

1.3 EXECUTION

- A. General: Notify the Owner at least 15 days prior to commencement of work. Locations of wells shall be as indicated. Drilling, installation, and development of the monitoring wells shall be supervised, directed, and monitored by the CPC. Drilling, sampling, and well development equipment introduced to the well shall be decontaminated before and after each use in accordance with ASTM D 5088.
- B. Drilling: Borehole shall be advanced using conventional 10 in. (250 mm) hollow-stem auger **OR** solid auger **OR** rotary wash, **as directed**, drilling methods. If it is the opinion of the CPC that an alternate drilling method is required, justification for a boring method change shall be submitted to the Owner, and approval for the change granted prior to drilling. Drill crew shall be experienced and trained in drilling and safety requirements for contaminated sites.
 1. Sampling: Obtain samples in accordance with ASTM D 1586 or ASTM D 1587. Perform standard penetration tests at the following depths 0.0 to 1.5 ft (0 to 450 mm); 1.5 to 3.0 ft (450 to 900 mm); 3.0 to 4.5 ft (900 to 1350 mm); and 5 ft (1500 mm) centers or at changes in soil formation thereafter. Each soil sample shall be screened in the field with an organic vapor analyzer/flame ionization device (OVA/FID) capable of detecting vapors to a minimum of one ppm. Log boring in accordance with ASTM D 2487 and ASTM D 2488. Groundwater elevation shall be indicated.
 2. Analysis: The CPC shall review the log data from each borehole and compare the data with the well design requirements. The CPC shall verify the adequacy of the well design, or shall offer a proposed modification to the design based on the geologic and hydrogeologic data obtained from the borehole. This review and analysis shall be conducted for each borehole **OR** for one borehole considered representative of the entire project, **as directed**. The CPC shall submit the borehole boring logs, the analysis of the well design, and any proposed design modifications to the Owner in a Borehole Analysis Report. Any modifications to the well design approved by the Owner shall be considered a change to the contract documents and shall be negotiated in accordance with the "CHANGES" clause.
 3. Alignment: Verify that the well is straight by lowering a 10 ft (3 m) section of steel pipe 1/4 in. (6 mm) smaller in diameter than the inside diameter of the casing in to the well. For wells deeper than 200 ft (60 m), Contractor shall verify that the well is plumb.
- C. Soil Removed From The Borehole
 1. Temporary Containment of Soil Removed from the Borehole: Soil removed from the borehole shall be placed in a temporary containment area. Provide a temporary containment area near the well site. Cover containment area with 10 mil (0.25 mm) reinforced polyethylene sheeting. Place soil removed from the borehole[s] on the impervious barrier and cover with 6 mil (0.15 mm) reinforced polyethylene sheeting. Provide a straw bale berm around the outer limits of the



containment area and cover with polyethylene sheets. Secure edges of sheets with weights to keep the polyethylene sheeting in place. Water runoff shall be diverted from the stockpiled material. As an option, soil may be stockpiled in trucks suitable for transporting contaminated soils as specified herein.

2. Testing Requirements for Stockpiled Soils

a. Sampling: A minimum of one composite sample shall be developed and analyzed for each required test for every 100 cu. yds. (76.4 cu. m) or fraction thereof from a composite stockpile of soil removed from all well sites. To develop a composite sample of the size necessary to run the required tests, the Contractor shall take several samples from different areas along the surface and in the center of the stockpile. These samples shall be combined and thoroughly mixed to develop the composite sample.

b. Testing

- 1) The soil shall contain no free liquid as demonstrated by EPA SW-846, Method 9095, paint filter liquids test.
- 2) The sum of benzene, toluene, ethyl benzene, and xylene (BTEX) concentrations shall be determined by using EPA SW-846, Method 5030/8020.
- 3) TPH (total petroleum hydrocarbons) concentrations shall be determined by using EPA SW-846, Method 8015, which has been modified for use with soil.
- 4) Material shall be tested for TOX (total organic halogens) in accordance with EPA SW-846, Method 9020.
- 5) Material shall be analyzed for full TCLP in accordance with EPA SW-846, Method 1311 and for ignitability, corrosivity, and reactivity.
- 6) Material shall be tested for polychlorinated biphenyls (PCB's) in accordance with EPA SW-846, Method 8080.
- 7) Moisture content of the sample shall be determined in accordance with EPA Method 160.3.

c. Disposal of Stockpiled Soils

- 1) Soils exhibiting TPH less than 100 ppm, BTEX less than 10 ppm, TOX less than 100 ppm, passing TCLP tests, and testing negative for PCB's shall be considered clean as shall be disposed of on-site, as directed by the Owner.
- 2) Soils failing the TCLP test or exhibiting TOX greater than 100 ppm shall be managed in accordance with applicable State and local regulations. Payment for disposal of materials failing the TCLP metals test or TOX test shall be made in accordance with the "CHANGES" clause of the General Conditions.
- 3) If the concentration of total BTEX is greater than 10 ppm or TPH greater than 100 ppm, the soil shall be treated and disposed of at a permitted soil recycling facility.

D. Well Installation: Well installation shall be in accordance with ASTM D 5092 and EPA 600-4-89-034, and as indicated on the well construction drawings submitted by the CPC and approved by the Owner. Borehole shall be stable and shall be verified straight before beginning installation.

1. Casings and Screens: Well casings, screens, plugs, and caps shall be decontaminated prior to delivery by the manufacturer and shall be certified clean. Materials shall be delivered, stored, and handled in such manner as to ensure that grease, oil, or other contaminants do not contact any portion of the well screen and casing assembly prior to installation. If directed by the Owner, the well screen and casing assembly shall be cleaned with high pressure water prior to installation. Personnel shall wear clean cotton or surgical gloves while handling the assembly. Centralizers shall be used to ensure that the well screen and casing assembly is installed concentrically in the borehole. When the assembly has been installed at the appropriate elevation, it shall be adequately secured to preclude movement during placement of the filter packs and annular seals. The top of the well casing shall be capped during filter pack placement.
2. Primary and Secondary Filter Packs: Primary and secondary filter packs shall be placed as indicated on the approved well construction drawings to fill the entire annular space between the screen and casing assembly and the outside wall of the borehole. Place both the primary and secondary filters with a tremie pipe in accordance with EPA 600-4-89-034 and ASTM D 5092. Placement of the primary and secondary filters by gravity or free fall methods is not allowed. Control speed of filter placement to prevent bridging and to allow for settlement. Prior to



- commencement of work, equipment and methods required to place filters shall be approved by the Owner.
3. **Bentonite Seal:** Bentonite shall be placed as a slurry through a tremie pipe. Control speed of bentonite placement to prevent bridging or segregation of slurry. Additional water shall be added to the annular space as directed by the CPC to ensure complete hydration of the bentonite. Bentonite shall cure a minimum of 48 hours before the placement of cement grout to ensure complete hydration and expansion of the bentonite.
 4. **Neat Cement Grout:** Cement grout shall be placed in the annular space above the bentonite seal as indicated on the well construction drawings. Cement grout shall be placed as a slurry through a tremie pipe, and injected under pressure to reduce chance of voids. Grout shall be injected in one continuous operation until full strength grout flows out at the ground surface without evidence of drilling cuttings or fluid. Cement grout shall cure a minimum of 48 hours before beginning well development operations.
 5. **Well Head Completions:** Well head completions shall be as indicated and as specified herein.
- E. **Well Development:** Well development shall be in accordance with EPA 600-4-89-034 and ASTM D 5092 except as modified herein. Bailing, surging, and pumping/overpumping/backwashing are acceptable development methods. Air surging and jetting are prohibited. Method of development shall be chosen by the CPC and approved by the Owner. Well development shall not begin until the well installation is complete and accepted by the Owner. Well development operations shall be conducted continuously until development water flows clear and free of drilling fluids, cuttings, or other materials. At such time representative water samples shall be tested for pH, temperature, and specific conductivity in accordance with EPA 600-4-79-20. Samples shall be taken every 3 hours. When stabilized readings of these parameters, as accepted by the Owner, have been achieved for 12 consecutive hours, well development operations shall cease.
- F. **Water From Well Development Operations:** Water from the well development operations shall be containerized in accordance with State and local regulations. One sample shall be taken and analyzed for each required test for every 1000 gallons (3780 liters) of stored water from well development operations.
1. **Testing**
 - a. The sum of benzene, toluene, ethyl benzene, and xylene (BTEX) concentrations shall be determined by using EPA SW-846, Method 8020.
 - b. TPH (total petroleum hydrocarbons) concentrations shall be determined by using EPA SW-846, Method 8015.
 2. **Disposal of Containerized Water**
 - a. Water exhibiting TPH less than 0.5 ppm and BTEX less than 1 ppb shall be considered clean and shall be disposed of on-site as directed by the Owner.
 - b. If the concentration of total BTEX is greater than 1 ppb or TPH greater than 0.5 ppm, the water shall be treated and disposed of at a permitted facility.
- G. **Transportation Of Contaminated Soil And Water:** The Contractor shall be solely responsible for complying with Federal, State, and local requirements for transporting contaminated materials through the applicable jurisdictions and shall bear responsibility and cost for any noncompliance. In addition to those requirements, the Contractor shall do the following:
1. Inspect and document vehicles and containers for proper operation and covering.
 2. Inspect vehicles and containers for proper markings, manifest documents, and other requirements for waste shipment.
 3. Perform and document decontamination procedures prior to leaving the worksite and again before leaving the disposal site.
- H. **Disposal Of Contaminated Soil And Water:** Contaminated materials removed from the site shall be disposed of in a treatment/disposal facility permitted to accept such materials.



- I. Installation Survey: Upon completion of well installation and development and acceptance by the Owner therefor, the Contractor vertical and horizontal position of each well shall be determined by a registered land surveyor licensed in the State where the work is located . The survey shall document the vertical elevations of the top of the casing pipe and the ground surface elevation adjacent to each well. Survey shall be accurate to the nearest 0.01 ft (3 mm). This data shall be submitted with a well location map as the Installation Survey Report.
- J. Cleanup: Upon completion of the well construction, remove debris and surplus materials from the jobsite.

END OF SECTION 23 11 23 00a



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SECTION 23 11 23 00b - FACILITY NATURAL-GAS PIPING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for facility natural gas piping. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Pipes, tubes, and fittings.
 - b. Piping specialties.
 - c. Piping and tubing joining materials.
 - d. Valves.
 - e. Pressure regulators.
 - f. Service meters.
 - g. Mechanical sleeve seals.
 - h. Grout.
 - i. Concrete bases.

C. Definitions

1. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
2. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
3. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Performance Requirements

1. Minimum Operating-Pressure Ratings:
 - a. Piping and Valves: 100 psig (690 kPa) minimum unless otherwise indicated.
 - b. Service Regulators: 65 psig (450 kPa) **OR** 100 psig (690 kPa), **as directed**, minimum unless otherwise indicated.
 - c. Minimum Operating Pressure of Service Meter: 5 psig (34.5 kPa) **OR** 10 psig (69 kPa) **OR** 20 psig (138 kPa) **OR** 65 psig (450 kPa), **as directed**.
2. Natural-Gas System Pressure within Buildings: 0.5 psig (3.45 kPa) or less **OR** More than 0.5 psig (3.45 kPa) but not more than 2 psig (13.8 kPa) **OR** More than 2 psig (13.8 kPa) but not more than 5 psig (34.5 kPa), **as directed**.

OR

Natural-Gas System Pressures within Buildings: Two pressure ranges. Primary pressure is more than 0.5 psig (3.45 kPa) but not more than 2 psig (13.8 kPa), and is reduced to secondary pressure of 0.5 psig (3.45 kPa) or less.

OR

Natural-Gas System Pressures within Buildings: Two pressure ranges. Primary pressure is more than 2 psig (13.8 kPa) but not more than 5 psig (34.5 kPa), and is reduced to secondary pressure of more than 0.5 psig (3.45 kPa) but not more than 2 psig (13.8 kPa).

OR

Natural-Gas System Pressures within Buildings: Three pressure ranges. Primary pressure is more than 2 psig (13.8 kPa) but not more than 5 psig (34.5 kPa), and is reduced to secondary pressures of more than 0.5 psig (3.45 kPa) but not more than 2 psig (13.8 kPa), and is reduced again to pressures of 0.5 psig (3.45 kPa) or less.



3. Delegated Design: Design restraints and anchors for natural-gas piping and equipment, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

E. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.
3. Delegated-Design Submittal: For natural-gas piping and equipment indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - a. Detail fabrication and assembly of seismic restraints.
 - b. Design Calculations: Calculate requirements for selecting seismic restraints.
4. Welding certificates.
5. Field quality-control reports.
6. Operation and maintenance data.

F. Quality Assurance

1. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Delivery, Storage, And Handling

1. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.
2. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
3. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.
4. Protect stored PE pipes and valves from direct sunlight.

H. Project Conditions

1. Interruption of Existing Natural-Gas Service: Do not interrupt natural-gas service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide purging and startup of natural-gas supply according to requirements indicated:
 - a. Notify Owner no fewer than two days in advance of proposed interruption of natural-gas service.
 - b. Do not proceed with interruption of natural-gas service without Owner's written permission.

1.2 PRODUCTS

A. Pipes, Tubes, And Fittings

1. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
 - a. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
 - b. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
 - c. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.



- d. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
 - 1) Material Group: 1.1.
 - 2) End Connections: Threaded or butt welding to match pipe.
 - 3) Lapped Face: Not permitted underground.
 - 4) Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
 - 5) Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.
- e. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
 - 1) Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.
- f. Mechanical Couplings:
 - 1) Stainless-steel **OR** Steel, **as directed**, flanges and tube with epoxy finish.
 - 2) Buna-nitrile seals.
 - 3) Stainless-steel **OR** Steel, **as directed**, bolts, washers, and nuts.
 - 4) Coupling shall be capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
 - 5) Steel body couplings installed underground on plastic pipe shall be factory equipped with anode.
- 2. Corrugated, Stainless-Steel Tubing: Comply with ANSI/IAS LC 1.
 - a. Tubing: ASTM A 240/A 240M, corrugated, Series 300 stainless steel.
 - b. Coating: PE with flame retardant.
 - 1) Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a) Flame-Spread Index: 25 or less.
 - b) Smoke-Developed Index: 50 **OR** 450, **as directed**, or less.
 - c. Fittings: Copper-alloy mechanical fittings with ends made to fit and listed for use with corrugated stainless-steel tubing and capable of metal-to-metal seal without gaskets. Include brazing socket or threaded ends complying with ASME B1.20.1.
 - d. Striker Plates: Steel, designed to protect tubing from penetrations.
 - e. Manifolds: Malleable iron or steel with factory-applied protective coating. Threaded connections shall comply with ASME B1.20.1 for pipe inlet and corrugated tubing outlets.
 - f. Operating-Pressure Rating: 5 psig (34.5 kPa).
- 3. Aluminum Tubing: Comply with ASTM B 210 and ASTM B 241/B 241M.
 - a. Aluminum Alloy: Alloy 5456 is prohibited.
 - b. Protective Coating: Factory-applied coating capable of resisting corrosion on tubing in contact with masonry, plaster, insulation, water, detergents, and sewerage.
 - c. Flare Fittings: Comply with ASME B16.26 and SAE J513.
 - 1) Copper-alloy fittings.
 - 2) Metal-to-metal compression seal without gasket.
 - 3) Dryseal threads shall comply with ASME B1.20.3.
- 4. Drawn-Temper Copper Tube: Comply with ASTM B 88, Type K (ASTM B 88M, Type A) **OR** ASTM B 88, Type L (ASTM B 88M, Type B) **OR** ASTM B 837, Type G, **as directed**.
 - a. Copper Fittings: ASME B16.22, wrought copper, and streamlined pattern.
 - b. Bronze Flanges and Flanged Fittings: ASME B16.24, Class 150.
 - 1) Gasket Material: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
 - 2) Bolts and Nuts: ASME B18.2.1, carbon steel or stainless steel.
 - c. Protective Coating for Underground Tubing: Factory-applied, extruded PE a minimum of 0.022 inch (0.56 mm) thick.
- 5. Annealed-Temper Copper Tube: Comply with ASTM B 88, Type K (ASTM B 88M, Type A) **OR** ASTM B 88, Type L (ASTM B 88M, Type B) **OR** ASTM B 837, Type G, **as directed**.
 - a. Copper Fittings: ASME B16.22, wrought copper, and streamlined pattern.
 - b. Flare Fittings: Comply with ASME B16.26 and SAE J513.



- 1) Copper fittings with long nuts.
- 2) Metal-to-metal compression seal without gasket.
- 3) Dryseal threads complying with ASME B1.20.3.
- c. Protective Coating for Underground Tubing: Factory-applied, extruded PE a minimum of 0.022 inch (0.56 mm) thick.
6. Tin-Lined Copper Tube: ASTM B 280, seamless, annealed, with interior tin-plated lining.
 - a. Flare Fittings: Comply with ASME B16.26 and SAE J513.
 - 1) Copper fittings with long nuts.
 - 2) Metal-to-metal compression seal without gasket.
 - 3) Dryseal threads complying with ASME B1.20.3.
7. PE Pipe: ASTM D 2513, SDR 11.
 - a. PE Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe.
 - b. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11; and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
 - c. Anodeless Service-Line Risers: Factory fabricated and leak tested.
 - 1) Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet.
 - 2) Casing: Steel pipe complying with ASTM A 53/A 53M, Schedule 40, black steel, Type E or S, Grade B, with corrosion-protective coating covering. Vent casing aboveground, **as directed**.
 - 3) Aboveground Portion: PE transition fitting.
 - 4) Outlet shall be threaded or flanged or suitable for welded connection.
 - 5) Tracer wire connection.
 - 6) Ultraviolet shield.
 - 7) Stake supports with factory finish to match steel pipe casing or carrier pipe.
 - d. Transition Service-Line Risers: Factory fabricated and leak tested.
 - 1) Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet connected to steel pipe complying with ASTM A 53/A 53M, Schedule 40, Type E or S, Grade B, with corrosion-protective coating for aboveground outlet.
 - 2) Outlet shall be threaded or flanged or suitable for welded connection.
 - 3) Bridging sleeve over mechanical coupling.
 - 4) Factory-connected anode.
 - 5) Tracer wire connection.
 - 6) Ultraviolet shield.
 - 7) Stake supports with factory finish to match steel pipe casing or carrier pipe.
 - e. Plastic Mechanical Couplings, NPS 1-1/2 (DN 40) and Smaller: Capable of joining PE pipe to PE pipe.
 - 1) PE body with molded-in, stainless-steel support ring.
 - 2) Buna-nitrile seals.
 - 3) Acetal collets.
 - 4) Electro-zinc-plated steel stiffener.
 - f. Plastic Mechanical Couplings, NPS 2 (DN 50) and Larger: Capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
 - 1) Fiber-reinforced plastic body.
 - 2) PE body tube.
 - 3) Buna-nitrile seals.
 - 4) Acetal collets.
 - 5) Stainless-steel bolts, nuts, and washers.
 - g. Steel Mechanical Couplings: Capable of joining plain-end PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
 - 1) Stainless-steel **OR** Steel, **as directed**, flanges and tube with epoxy finish.
 - 2) Buna-nitrile seals.
 - 3) Stainless-steel **OR** Steel, **as directed**, bolts, washers, and nuts.
 - 4) Factory-installed anode for steel-body couplings installed underground.



B. Piping Specialties

1. Appliance Flexible Connectors:
 - a. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
 - b. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
 - c. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
 - d. Corrugated stainless-steel tubing with polymer coating.
 - e. Operating-Pressure Rating: 0.5 psig (3.45 kPa).
 - f. End Fittings: Zinc-coated steel.
 - g. Threaded Ends: Comply with ASME B1.20.1.
 - h. Maximum Length: 72 inches (1830 mm).
2. Quick-Disconnect Devices: Comply with ANSI Z21.41.
 - a. Copper-alloy convenience outlet and matching plug connector.
 - b. Nitrile seals.
 - c. Hand operated with automatic shutoff when disconnected.
 - d. For indoor or outdoor applications.
 - e. Adjustable, retractable restraining cable.
3. Y-Pattern Strainers:
 - a. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
 - b. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.
 - c. Strainer Screen: 40 **OR** 60, **as directed**, -mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
 - d. CWP Rating: 125 psig (862 kPa).
4. Basket Strainers:
 - a. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
 - b. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.
 - c. Strainer Screen: 40 **OR** 60, **as directed**, -mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
 - d. CWP Rating: 125 psig (862 kPa).
5. T-Pattern Strainers:
 - a. Body: Ductile or malleable iron with removable access coupling and end cap for strainer maintenance.
 - b. End Connections: Grooved ends.
 - c. Strainer Screen: 40 **OR** 60, **as directed**, -mesh startup strainer, and perforated stainless-steel basket with 57 percent free area.
 - d. CWP Rating: 750 psig (5170 kPa).
6. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

C. Joining Materials

1. Joint Compound and Tape: Suitable for natural gas.
2. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
3. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F (540 deg C) complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

D. Manual Gas Shutoff Valves

1. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.
2. General Requirements for Metallic Valves, NPS 2 (DN 50) and Smaller: Comply with ASME B16.33.
 - a. CWP Rating: 125 psig (862 kPa).



- b. Threaded Ends: Comply with ASME B1.20.1.
- c. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
- d. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
- e. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch (25 mm) and smaller.
- f. Service Mark: Valves 1-1/4 inches (32 mm) to NPS 2 (DN 50) shall have initials "WOG" permanently marked on valve body.
3. General Requirements for Metallic Valves, NPS 2-1/2 (DN 65) and Larger: Comply with ASME B16.38.
 - a. CWP Rating: 125 psig (862 kPa).
 - b. Flanged Ends: Comply with ASME B16.5 for steel flanges.
 - c. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 - d. Service Mark: Initials "WOG" shall be permanently marked on valve body.
4. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.
 - a. Body: Bronze, complying with ASTM B 584.
 - b. Ball: Chrome-plated brass.
 - c. Stem: Bronze; blowout proof.
 - d. Seats: Reinforced TFE; blowout proof.
 - e. Packing: Separate packnut with adjustable-stem packing threaded ends.
 - f. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 - g. CWP Rating: 600 psig (4140 kPa).
 - h. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 - i. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
5. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.
 - a. Body: Bronze, complying with ASTM B 584.
 - b. Ball: Chrome-plated bronze.
 - c. Stem: Bronze; blowout proof.
 - d. Seats: Reinforced TFE; blowout proof.
 - e. Packing: Threaded-body packnut design with adjustable-stem packing.
 - f. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 - g. CWP Rating: 600 psig (4140 kPa).
 - h. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 - i. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
6. Two-Piece, Regular-Port Bronze Ball Valves with Bronze Trim: MSS SP-110.
 - a. Body: Bronze, complying with ASTM B 584.
 - b. Ball: Chrome-plated bronze.
 - c. Stem: Bronze; blowout proof.
 - d. Seats: Reinforced TFE.
 - e. Packing: Threaded-body packnut design with adjustable-stem packing.
 - f. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 - g. CWP Rating: 600 psig (4140 kPa).
 - h. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 - i. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
7. Bronze Plug Valves: MSS SP-78.
 - a. Body: Bronze, complying with ASTM B 584.
 - b. Plug: Bronze.



- c. Ends: Threaded, socket, or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
- d. Operator: Square head or lug type with tamperproof feature where indicated.
- e. Pressure Class: 125 psig (862 kPa).
- f. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
- g. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
8. Cast-Iron, Nonlubricated Plug Valves: MSS SP-78.
 - a. Body: Cast iron, complying with ASTM A 126, Class B.
 - b. Plug: Bronze or nickel-plated cast iron.
 - c. Seat: Coated with thermoplastic.
 - d. Stem Seal: Compatible with natural gas.
 - e. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 - f. Operator: Square head or lug type with tamperproof feature where indicated.
 - g. Pressure Class: 125 psig (862 kPa).
 - h. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 - i. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
9. Cast-Iron, Lubricated Plug Valves: MSS SP-78.
 - a. Body: Cast iron, complying with ASTM A 126, Class B.
 - b. Plug: Bronze or nickel-plated cast iron.
 - c. Seat: Coated with thermoplastic.
 - d. Stem Seal: Compatible with natural gas.
 - e. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 - f. Operator: Square head or lug type with tamperproof feature where indicated.
 - g. Pressure Class: 125 psig (862 kPa).
 - h. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 - i. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
10. PE Ball Valves: Comply with ASME B16.40.
 - a. Body: PE.
 - b. Ball: PE.
 - c. Stem: Acetal.
 - d. Seats and Seals: Nitrile.
 - e. Ends: Plain or fusible to match piping.
 - f. CWP Rating: 80 psig (552 kPa).
 - g. Operating Temperature: Minus 20 to plus 140 deg F (Minus 29 to plus 60 deg C).
 - h. Operator: Nut or flat head for key operation.
 - i. Include plastic valve extension.
 - j. Include tamperproof locking feature for valves where indicated on Drawings.
11. Valve Boxes:
 - a. Cast-iron, two-section box.
 - b. Top section with cover with "GAS" lettering.
 - c. Bottom section with base to fit over valve and barrel a minimum of 5 inches (125 mm) in diameter.
 - d. Adjustable cast-iron extensions of length required for depth of bury.
 - e. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

E. Motorized Gas Valves

1. Automatic Gas Valves: Comply with ANSI Z21.21.
 - a. Body: Brass or aluminum.
 - b. Seats and Disc: Nitrile rubber.
 - c. Springs and Valve Trim: Stainless steel.



- d. Normally closed.
 - e. Visual position indicator.
 - f. Electrical **OR** Mechanical, **as directed**, operator for actuation by appliance automatic shutoff device.
2. Electrically Operated Valves: Comply with UL 429.
- a. Pilot operated.
 - b. Body: Brass or aluminum.
 - c. Seats and Disc: Nitrile rubber.
 - d. Springs and Valve Trim: Stainless steel.
 - e. 120-V ac, 60 Hz, Class B, continuous-duty molded coil, and replaceable.
 - f. NEMA ICS 6, Type 4, coil enclosure.
 - g. Normally closed.
 - h. Visual position indicator.
- F. Earthquake Valves
1. Earthquake Valves: Comply with ASCE 25.
- a. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 - b. Maximum Operating Pressure: 5 psig (34.5 kPa).
 - c. Cast-aluminum body with nickel-plated chrome steel internal parts.
 - d. Nitrile-rubber valve washer.
 - e. Sight windows for visual indication of valve position.
 - f. Threaded end connections complying with ASME B1.20.1.
 - g. Wall mounting bracket with bubble level indicator.
2. Earthquake Valves: Comply with ASCE 25.
- a. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 - b. Maximum Operating Pressure: 0.5 psig (3.45 kPa) **OR** 7 psig (48 kPa) **OR** 60 psig (414 kPa), **as directed**.
 - c. Cast-aluminum body with stainless-steel internal parts.
 - d. Nitrile-rubber, reset-stem o-ring seal.
 - e. Valve position, open or closed, indicator.
 - f. Composition valve seat with clapper held by spring or magnet locking mechanism.
 - g. Level indicator.
 - h. End Connections: Threaded for valves NPS 2 (DN 50) and smaller; flanged for valves NPS 2-1/2 (DN 65) and larger.
- G. Pressure Regulators
1. General Requirements:
- a. Single stage and suitable for natural gas.
 - b. Steel jacket and corrosion-resistant components.
 - c. Elevation compensator.
 - d. End Connections: Threaded for regulators NPS 2 (DN 50) and smaller; flanged for regulators NPS 2-1/2 (DN 65) and larger.
2. Service Pressure Regulators: Comply with ANSI Z21.80.
- a. Body and Diaphragm Case: Cast iron or die-cast aluminum.
 - b. Springs: Zinc-plated steel; interchangeable.
 - c. Diaphragm Plate: Zinc-plated steel.
 - d. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
 - e. Orifice: Aluminum; interchangeable.
 - f. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
 - g. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
 - h. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
 - i. Overpressure Protection Device: Factory mounted on pressure regulator.



- j. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
 - k. Maximum Inlet Pressure: 100 psig (690 kPa).
 3. Line Pressure Regulators: Comply with ANSI Z21.80.
 - a. Body and Diaphragm Case: Cast iron or die-cast aluminum.
 - b. Springs: Zinc-plated steel; interchangeable.
 - c. Diaphragm Plate: Zinc-plated steel.
 - d. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
 - e. Orifice: Aluminum; interchangeable.
 - f. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
 - g. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
 - h. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
 - i. Overpressure Protection Device: Factory mounted on pressure regulator.
 - j. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
 - k. Maximum Inlet Pressure: 2 psig (13.8 kPa) **OR** 5 psig (34.5 kPa) **OR** 10 psig (69 kPa), **as directed**.
 4. Appliance Pressure Regulators: Comply with ANSI Z21.18.
 - a. Body and Diaphragm Case: Die-cast aluminum.
 - b. Springs: Zinc-plated steel; interchangeable.
 - c. Diaphragm Plate: Zinc-plated steel.
 - d. Seat Disc: Nitrile rubber.
 - e. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
 - f. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
 - g. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
 - h. Maximum Inlet Pressure: 1 psig (6.9 kPa) **OR** 2 psig (13.8 kPa) **OR** 5 psig (34.5 kPa), **as directed**.
- H. Service Meters
 1. Diaphragm-Type Service Meters: Comply with ANSI B109.1 **OR** ANSI B109.2, **as directed**.
 - a. Case: Die-cast aluminum.
 - b. Connections: Steel threads.
 - c. Diaphragm: Synthetic fabric.
 - d. Diaphragm Support Bearings: Self-lubricating.
 - e. Compensation: Continuous temperature and pressure, **as directed**.
 - f. Meter Index: Cubic feet **OR** Liters **OR** Cubic feet and liters, **as directed**.
 - g. Meter Case and Index: Tamper resistant.
 - h. Remote meter reader compatible.
 - i. Maximum Inlet Pressure: 100 psig (690 kPa).
 - j. Pressure Loss: Maximum 0.5-inch wg (124 Pa) **OR** 2.0-inch wg (498 Pa), **as directed**.
 - k. Accuracy: Maximum plus or minus 1.0 percent.
 2. Rotary-Type Service Meters: Comply with ANSI B109.3.
 - a. Case: Extruded aluminum.
 - b. Connection: Flange.
 - c. Impellers: Polished aluminum.
 - d. Rotor Bearings: Self-lubricating.
 - e. Compensation: Continuous temperature and pressure, **as directed**.
 - f. Meter Index: Cubic feet **OR** Liters **OR** Cubic feet and liters, **as directed**.
 - g. Tamper resistant.
 - h. Remote meter reader compatible.
 - i. Maximum Inlet Pressure: 100 psig (690 kPa).
 - j. Accuracy: Maximum plus or minus 2.0 percent.



3. Turbine Meters: Comply with ASME MFC-4M.
 - a. Housing: Cast iron or welded steel.
 - b. Connection Threads or Flanges: Steel.
 - c. Turbine: Aluminum or plastic.
 - d. Turbine Bearings: Self-lubricating.
 - e. Compensation: Continuous temperature and pressure, **as directed**.
 - f. Meter Index: Cubic feet **OR** Liters **OR** Cubic feet and liters, **as directed**.
 - g. Tamper resistant.
 - h. Remote meter reader compatible.
 - i. Maximum Inlet Pressure: 100 psig (690 kPa).
 - j. Accuracy: Maximum plus or minus 2.0 percent.
 4. Service-Meter Bars:
 - a. Malleable- or cast-iron frame for supporting service meter.
 - b. Include offset swivel pipes, meter nuts with o-ring seal, and factory- or field-installed dielectric unions.
 - c. Omit meter offset swivel pipes if service-meter bar dimensions match service-meter connections.
 5. Service-Meter Bypass Fittings:
 - a. Ferrous, tee, pipe fitting with capped side inlet for temporary natural-gas supply.
 - b. Integral ball-check bypass valve.
- I. Dielectric Fittings
1. Dielectric Unions:
 - a. Minimum Operating-Pressure Rating: 150 psig (1034 kPa).
 - b. Combination fitting of copper alloy and ferrous materials.
 - c. Insulating materials suitable for natural gas.
 - d. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.
 2. Dielectric Flanges:
 - a. Minimum Operating-Pressure Rating: 150 psig (1034 kPa).
 - b. Combination fitting of copper alloy and ferrous materials.
 - c. Insulating materials suitable for natural gas.
 - d. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.
 3. Dielectric-Flange Kits:
 - a. Minimum Operating-Pressure Rating: 150 psig (1034 kPa).
 - b. Companion-flange assembly for field assembly.
 - c. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or PE bolt sleeves, phenolic washers, and steel backing washers.
 - d. Insulating materials suitable for natural gas.
 - e. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.
- J. Sleeves
1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
 2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- K. Mechanical Sleeve Seals
1. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - a. Sealing Elements: EPDM **OR** NBR, **as directed**, interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe and sleeve.
 - b. Pressure Plates: Plastic **OR** Carbon steel **OR** Stainless steel, **as directed**.



- c. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating **OR** Stainless steel, **as directed**, of length required to secure pressure plates to sealing elements. Include one nut and bolt for each sealing element.

L. Escutcheons

1. General Requirements for Escutcheons: Manufactured wall and ceiling escutcheons and floor plates, with ID to fit around pipe or tube, and OD that completely covers opening.
2. One-Piece, Deep-Pattern Escutcheons: Deep-drawn, box-shaped brass with polished chrome-plated finish.
3. One-Piece, Cast-Brass Escutcheons: With set screw.
 - a. Finish: Polished chrome-plated **OR** Rough brass, **as directed**.
4. Split-Casting, Cast-Brass Escutcheons: With concealed hinge and set screw.
 - a. Finish: Polished chrome-plated **OR** Rough brass, **as directed**.
5. One-Piece, Stamped-Steel Escutcheons: With set screw **OR** spring clips, **as directed**, and chrome-plated finish.
6. Split-Plate, Stamped-Steel Escutcheons: With concealed **OR** exposed-rivet, **as directed**, hinge, set screw **OR** spring clips, **as directed**, and chrome-plated finish.
7. One-Piece, Floor-Plate Escutcheons: Cast-iron floor plate.
8. Split-Casting, Floor-Plate Escutcheons: Cast brass with concealed hinge and set screw.

M. Grout

1. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - a. Characteristics: Post-hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - b. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
 - c. Packaging: Premixed and factory packaged.

N. Labeling And Identifying

1. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored yellow.

1.3 EXECUTION

A. Preparation

1. Close equipment shutoff valves before turning off natural gas to premises or piping section.
2. Inspect natural-gas piping according to NFPA 54 **OR** the International Fuel Gas Code, **as directed**, to determine that natural-gas utilization devices are turned off in piping section affected.
3. Comply with NFPA 54 **OR** the International Fuel Gas Code, **as directed**, requirements for prevention of accidental ignition.

B. Outdoor Piping Installation

1. Comply with NFPA 54 **OR** the International Fuel Gas Code, **as directed**, for installation and purging of natural-gas piping.
2. Install underground, natural-gas piping buried at least 36 inches (900 mm) below finished grade. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.
 - a. If natural-gas piping is installed less than 36 inches (900 mm) below finished grade, install it in containment conduit.
3. Install underground, PE, natural-gas piping according to ASTM D 2774.
4. Steel Piping with Protective Coating:
 - a. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.



- b. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.

OR

Replace pipe having damaged PE coating with new pipe.

- 5. Copper Tubing with Protective Coating:
 - a. Apply joint cover kits over tubing to cover, seal, and protect joints.
 - b. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
- 6. Install fittings for changes in direction and branch connections.
- 7. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - a. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
 - b. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) and larger in diameter.
- 8. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- 9. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- 10. Install pressure gage downstream **OR** upstream and downstream, **as directed**, from each service regulator. Pressure gages are specified in Division 23 Section "Meters And Gages For Hvac Piping".

C. Indoor Piping Installation

- 1. Comply with NFPA 54 **OR** the International Fuel Gas Code, **as directed**, for installation and purging of natural-gas piping.
- 2. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- 3. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
- 4. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- 5. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- 6. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- 7. Locate valves for easy access.
- 8. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.
- 9. Install piping free of sags and bends.
- 10. Install fittings for changes in direction and branch connections.
- 11. Install escutcheons at penetrations of interior walls, ceilings, and floors.
 - a. New Piping:
 - 1) Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - 2) Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - OR**
 - Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
 - 3) Piping at Ceiling Penetrations in Finished Spaces: One-piece **OR** Split-casting, **as directed**, cast-brass type with polished chrome-plated finish.



- Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type **OR** Split-plate, stamped-steel type with concealed hinge, **as directed**, and set screw.
- 4) Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated **OR** rough-brass, **as directed**, finish.
OR
Piping in Unfinished Service Spaces: One-piece, stamped-steel type with set screw **OR** spring clips, **as directed**.
- 5) Piping in Equipment Rooms: One-piece, cast-brass type.
- Piping in Equipment Rooms: One-piece, stamped-steel type with set screw **OR** spring clips, **as directed**.
- 6) Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
- b. Existing Piping:
- 1) Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
OR
Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and spring clips.
- 2) Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
OR
Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and set screw.
- 3) Piping in Unfinished Service Spaces: Split-casting, cast-brass type with polished chrome-plated **OR** rough-brass, **as directed**, finish.
OR
Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with concealed **OR** exposed-rivet, **as directed**, hinge and set screw or spring clips.
- 4) Piping in Equipment Rooms: Split-casting, cast-brass type.
OR
Piping in Equipment Rooms: Split-plate, stamped-steel type with set screw or spring clips.
- 5) Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.
12. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping".
13. Verify final equipment locations for roughing-in.
14. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
15. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
- a. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches (75 mm) long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
16. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.
17. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.
18. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.



- a. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
 - b. In Floors: Install natural-gas piping with welded or brazed joints and protective coating in cast-in-place concrete floors. Cover piping to be cast in concrete slabs with minimum of 1-1/2 inches (38 mm) of concrete. Piping may not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quick-set additives or cinder aggregate.
 - c. In Floor Channels: Install natural-gas piping in floor channels. Channels must have cover and be open to space above cover for ventilation.
 - d. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.
 - 1) Exception: Tubing passing through partitions or walls does not require striker barriers.
 - e. Prohibited Locations:
 - 1) Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
 - 2) Do not install natural-gas piping in solid walls or partitions.
19. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
 20. Connect branch piping from top or side of horizontal piping.
 21. Install unions in pipes NPS 2 (DN 50) and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.
 22. Do not use natural-gas piping as grounding electrode.
 23. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.
 24. Install pressure gage downstream **OR** upstream and downstream, **as directed**, from each line regulator. Pressure gages are specified in Division 23 Section "Meters And Gages For Hvac Piping".
- D. Service-Meter Assembly Installation
1. Install service-meter assemblies aboveground, on concrete bases.
 2. Install metal shutoff valves upstream from service regulators. Shutoff valves are not required at second regulators if two regulators are installed in series.
 3. Install strainer on inlet of service-pressure regulator and meter set.
 4. Install service regulators mounted outside with vent outlet horizontal or facing down. Install screen in vent outlet if not integral with service regulator.
 5. Install metal shutoff valves upstream from service meters. Install dielectric fittings downstream from service meters.
 6. Install service meters downstream from pressure regulators.
 7. Install metal bollards to protect meter assemblies. Comply with requirements in Division 05 Section "Metal Fabrications" for pipe bollards.
- E. Valve Installation
1. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.
 2. Install underground valves with valve boxes.
 3. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.
 4. Install earthquake valves aboveground outside buildings according to listing.
 5. Install anode for metallic valves in underground PE piping.
- F. Piping Joint Construction
1. Ream ends of pipes and tubes and remove burrs.
 2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.



3. Threaded Joints:
 - a. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
 - b. Cut threads full and clean using sharp dies.
 - c. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
 - d. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
 - e. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
 4. Welded Joints:
 - a. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
 - b. Bevel plain ends of steel pipe.
 - c. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.
 5. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.
 6. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.
 7. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.
 8. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 - a. Plain-End Pipe and Fittings: Use butt fusion.
 - b. Plain-End Pipe and Socket Fittings: Use socket fusion.
- G. Hanger And Support Installation
1. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 2. Comply with requirements for pipe hangers and supports specified in Division 23 Section "Hangers And Supports For Hvac Piping And Equipment".
 3. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
 - a. NPS 1 (DN 25) and Smaller: Maximum span, 96 inches (2438 mm); minimum rod size, 3/8 inch (10 mm).
 - b. NPS 1-1/4 (DN 32): Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch (10 mm).
 - c. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch (10 mm).
 - d. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): Maximum span, 10 feet (3 m); minimum rod size, 1/2 inch (13 mm).
 - e. NPS 4 (DN 100) and Larger: Maximum span, 10 feet (3 m); minimum rod size, 5/8 inch (15.8 mm).
 4. Install hangers for horizontal drawn-temper copper tubing with the following maximum spacing and minimum rod sizes:
 - a. NPS 3/8 (DN 10): Maximum span, 48 inches (1220 mm); minimum rod size, 3/8 inch (10 mm).
 - b. NPS 1/2 and NPS 5/8 (DN 15 and DN 18): Maximum span, 72 inches (1830 mm); minimum rod size, 3/8 inch (10 mm).
 - c. NPS 3/4 and NPS 7/8 (DN 20 and DN 22): Maximum span, 84 inches (2134 mm); minimum rod size, 3/8 inch (10 mm).
 - d. NPS 1 (DN 25): Maximum span, 96 inches (2440 mm); minimum rod size, 3/8 inch (10 mm).
 5. Install hangers for horizontal, corrugated stainless-steel tubing with the following maximum spacing and minimum rod sizes:



- a. NPS 3/8 (DN 10): Maximum span, 48 inches (1220 mm); minimum rod size, 3/8 inch (10 mm).
- b. NPS 1/2 (DN 15): Maximum span, 72 inches (1830 mm); minimum rod size, 3/8 inch (10 mm).
- c. NPS 3/4 (DN 20) and Larger: Maximum span, 96 inches (2440 mm); minimum rod size, 3/8 inch (10 mm).

H. Connections

1. Connect to utility's gas main according to utility's procedures and requirements.
2. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
3. Install piping adjacent to appliances to allow service and maintenance of appliances.
4. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches (1800 mm) of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.
5. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

I. Labeling And Identifying

1. Comply with requirements in Division 23 Section "Identification For Hvac Piping And Equipment" for piping and valve identification.
OR
Install detectable warning tape directly above gas piping, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

J. Painting

1. Comply with requirements in Division 07 for painting interior and exterior natural-gas piping.
2. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.
 - a. Alkyd System: MPI EXT 5.1D.
 - 1) Prime Coat: Alkyd anticorrosive metal primer.
 - 2) Intermediate Coat (for a Premium Grade system): Exterior alkyd enamel matching topcoat.
 - 3) Topcoat: Exterior alkyd enamel (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - 4) Color: Gray, **unless directed otherwise**.
3. Paint exposed, interior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.
 - a. Latex Over Alkyd Primer System: MPI INT 5.1Q.
 - 1) Prime Coat: Alkyd anticorrosive **OR** Quick-drying alkyd, **as directed**, metal primer.
 - 2) Intermediate Coat (for a Premium Grade system): Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
 - 4) Color: Gray, **unless directed otherwise**.
 - b. Alkyd System: MPI INT 5.1E.
 - 1) Prime Coat: Alkyd anticorrosive **OR** Quick-drying alkyd, **as directed**, metal primer.
 - 2) Intermediate Coat (for a Premium Grade system): Interior alkyd matching topcoat.
 - 3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
 - 4) Color: Gray, **unless directed otherwise**.
4. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

K. Concrete Bases

1. Concrete Bases: Anchor equipment to concrete base according to seismic codes at Project.



- a. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
 - b. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of the base.
 - c. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - d. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - e. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - f. Use 3000-psig (20.7-MPa), **unless directed otherwise**, 28-day, compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-place Concrete".
- L. Field Quality Control
1. Perform tests and inspections.
 2. Tests and Inspections:
 - a. Test, inspect, and purge natural gas according to NFPA 54 **OR** the International Fuel Gas Code, **as directed**, and authorities having jurisdiction.
 3. Natural-gas piping will be considered defective if it does not pass tests and inspections.
 4. Prepare test and inspection reports.
- M. Outdoor Piping Schedule
1. Underground natural-gas piping shall be one of the following:
 - a. PE pipe and fittings joined by heat fusion, or mechanical couplings; service-line risers with tracer wire terminated in an accessible location.
 - b. Steel pipe with wrought-steel fittings and welded joints, or mechanical couplings. Coat pipe and fittings with protective coating for steel piping.
 - c. Annealed **OR** Drawn, **as directed**,-temper copper tube with wrought-copper fittings and brazed joints. Coat pipe and fittings with protective coating for copper tubing.
 2. Aboveground natural-gas piping shall be one of the following:
 - a. Steel pipe with malleable-iron fittings and threaded joints.
 - b. Steel pipe with wrought-steel fittings and welded joints.
 - c. Annealed **OR** Drawn, **as directed**,-temper copper tube with wrought-copper fittings and brazed joints.
 3. Branch Piping in Cast-in-Place Concrete to Single Appliance: Annealed-temper copper tube with wrought-copper fittings and brazed **OR** flared, **as directed**, joints. Install piping embedded in concrete with no joints in concrete.
 4. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
- N. Indoor Piping Schedule For System Pressures Less Than 0.5 psig (3.45 kPa)
1. Aboveground, branch piping NPS 1 (DN 25) and smaller shall be one of the following:
 - a. Corrugated stainless-steel tubing with mechanical fittings having socket or threaded ends to match adjacent piping.
 - b. Annealed-temper, tin-lined copper tube with flared joints and fittings.
 - c. Annealed-temper, copper tube with wrought-copper fittings and brazed **OR** flared, **as directed**, joints.
 - d. Aluminum tube with flared fittings and joints.
 - e. Steel pipe with malleable-iron fittings and threaded joints.
 2. Aboveground, distribution piping shall be one of the following:
 - a. Steel pipe with malleable-iron fittings and threaded joints.
 - b. Steel pipe with wrought-steel fittings and welded joints.
 - c. Drawn-temper copper tube with wrought-copper fittings and brazed joints.
 3. Underground, below building, piping shall be one of the following:
 - a. Steel pipe with malleable-iron fittings and threaded joints.
 - b. Steel pipe with wrought-steel fittings and welded joints.



4. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
 5. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.
- O. Indoor Piping Schedule For System Pressures More Than 0.5 psig (3.45 kPa) And Less Than 5 psig (34.5 kPa)
1. Aboveground, branch piping NPS 1 (DN 25) and smaller shall be one of the following:
 - a. Corrugated stainless-steel tubing with mechanical fittings having socket or threaded ends to match adjacent piping.
 - b. Annealed-temper, tin-lined copper tube with flared joints and fittings.
 - c. Annealed-temper, copper tube with wrought-copper fittings and brazed **OR** flared, **as directed**, joints.
 - d. Aluminum tube with flared fittings and joints.
 - e. Steel pipe with malleable-iron fittings and threaded joints.
 2. Aboveground, distribution piping shall be one of the following:
 - a. Steel pipe with malleable-iron fittings and threaded joints.
 - b. Steel pipe with steel welding fittings and welded joints.
 - c. Drawn-temper copper tube with wrought-copper fittings and brazed joints.
 3. Underground, below building, piping shall be one of the following:
 - a. Steel pipe with malleable-iron fittings and threaded joints.
 - b. Steel pipe with wrought-steel fittings and welded joints.
 4. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat underground pipe and fittings with protective coating for steel piping.
 5. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.
- P. Indoor Piping Schedule For System Pressures More Than 5 psig (34.5 kPa)
1. Aboveground Piping: Maximum operating pressure more than 5 psig (34.5 kPa).
 2. Aboveground, Branch Piping: Steel pipe with steel welding fittings and welded joints.
 3. Aboveground, distribution piping shall be one of the following:
 - a. Steel pipe with steel welding fittings and welded joints.
 - b. Drawn-temper copper tube with wrought-copper fittings and brazed joints.
 4. Underground, below building, piping shall be one of the following:
 - a. Steel pipe with malleable-iron fittings and threaded joints.
 - b. Steel pipe with wrought-steel fittings and welded joints.
 5. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
 6. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.
- Q. Underground Manual Gas Shutoff Valve Schedule
1. Connections to Existing Gas Piping: Use valve and fitting assemblies made for tapping utility's gas mains and listed by an NRTL.
 2. Underground:
 - a. PE valves.
 - b. NPS 2 (DN 50) and Smaller: Bronze plug valves.
 - c. NPS 2-1/2 (DN 65) and Larger: Cast-iron, lubricated **OR** nonlubricated, **as directed**, plug valves.
- R. Aboveground Manual Gas Shutoff Valve Schedule
1. Valves for pipe sizes NPS 2 (DN 50) and smaller at service meter shall be one of the following:



- a. One-piece, bronze ball valve with bronze trim.
- b. Two-piece, full **OR** regular, **as directed**, -port, bronze ball valves with bronze trim.
- c. Bronze plug valve.
2. Valves for pipe sizes NPS 2-1/2 (DN 65) and larger at service meter shall be one of the following:
 - a. Two-piece, full **OR** regular, **as directed**, -port, bronze ball valves with bronze trim.
 - b. Bronze plug valve.
 - c. Cast-iron, nonlubricated plug valve.
3. Distribution piping valves for pipe sizes NPS 2 (DN 50) and smaller shall be one of the following:
 - a. One-piece, bronze ball valve with bronze trim.
 - b. Two-piece, full **OR** regular, **as directed**, -port, bronze ball valves with bronze trim.
 - c. Bronze plug valve.
4. Distribution piping valves for pipe sizes NPS 2-1/2 (DN 65) and larger shall be one of the following:
 - a. Two-piece, full **OR** regular, **as directed**, -port, bronze ball valves with bronze trim.
 - b. Bronze plug valve.
 - c. Cast-iron, nonlubricated **OR** lubricated, **as directed**, plug valve.
5. Valves in branch piping for single appliance shall be one of the following:
 - a. One-piece, bronze ball valve with bronze trim.
 - b. Two-piece, full **OR** regular, **as directed**, -port, bronze ball valves with bronze trim.
 - c. Bronze plug valve.

END OF SECTION 23 11 23 00b



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**SECTION 23 11 23 00c - FACILITY LIQUEFIED-PETROLEUM GAS PIPING**

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for facility liquid-petroleum gas piping. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Pipes, tubes, and fittings.
 - b. Piping specialties.
 - c. Piping and tubing joining materials.
 - d. Valves.
 - e. Pressure regulators.
 - f. Service meters.
 - g. Storage containers.
 - h. Transport truck unloading facility specialties.
 - i. Pumps.
 - j. Vaporizers.
 - k. Air mixers.
 - l. Mechanical sleeve seals.
 - m. Grout.
 - n. Concrete bases.

C. Definitions

1. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
2. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
3. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
4. LPG: Liquefied-petroleum gas.

D. Performance Requirements

1. Minimum Operating-Pressure Ratings:
 - a. For Piping Containing Only Vapor:
 - 1) Piping and Valves: 125 psig (862 kPa) unless otherwise indicated.
 - b. For Piping Containing Liquid:
 - 1) Piping between Shutoff Valves: 350 psig (2413 kPa) unless otherwise indicated.
 - 2) Piping Other Than Above: 250 psig (1723 kPa) unless otherwise indicated.
 - 3) Valves and Fittings: 250 psig (1723 kPa) unless otherwise indicated.
 - c. Minimum Operating Pressure of Service Meter: 5 psig (34.5 kPa) **OR** 10 psig (69 kPa) **OR** 20 psig (138 kPa) **OR** 65 psig (450 kPa), **as directed**.
2. LPG System Pressure within Buildings: One pressure range. 0.5 psig (3.45 kPa) or less **OR** More than 0.5 psig (3.45 kPa) but not more than 2 psig (13.8 kPa) **OR** More than 2 psig (13.8 kPa) but not more than 5 psig (34.5 kPa), **as directed**.
OR
LPG System Pressures within Buildings: Two pressure ranges. Primary pressure is more than 0.5 psig (3.45 kPa) but not more than 2 psig (13.8 kPa) and is reduced to secondary pressure of 0.5 psig (3.45 kPa) or less.

**OR**

LPG System Pressures within Buildings: Two pressure ranges. Primary pressure is more than 2 psig (13.8 kPa) but not more than 5 psig (34.5 kPa) and is reduced to secondary pressure of more than 0.5 psig (3.45 kPa) but not more than 2 psig (13.8 kPa).

OR

LPG System Pressures within Buildings: Three pressure ranges. Primary pressure is more than 2 psig (13.8 kPa) but not more than 5 psig (34.5 kPa) and is reduced to secondary pressures of more than 0.5 psig (3.45 kPa) but not more than 2 psig (13.8 kPa) and is reduced again to pressures of 0.5 psig (3.45 kPa) or less.

3. Delegated Design: Design restraints and anchors for LPG piping and equipment, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
4. Seismic Performance: Vaporizers and storage container supports shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

E. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: For facility LPG piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.
3. Delegated-Design Submittal: For LPG piping and equipment indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - a. Detail fabrication and assembly of seismic restraints.
 - b. Design Calculations: Calculate requirements for selecting seismic restraints.
4. Seismic Qualification Certificates: Submit certification that vaporizer, air mixer, storage container supports, accessories, and components will withstand seismic forces defined in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment". Include the following:
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
5. Welding certificates.
6. Field quality-control reports.
7. Operation and maintenance data.

F. Quality Assurance

1. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Delivery, Storage, And Handling

1. Handling Flammable Liquids: Remove and dispose of liquids from existing LPG piping according to requirements of authorities having jurisdiction.
2. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.



3. Store pipes and tubes with protective PE coating to avoid damaging coating and protect from direct sunlight.
4. Protect stored PE pipes and valves from direct sunlight.

H. Project Conditions

1. Interruption of Existing LPG Service: Do not interrupt LPG service to facilities occupied by the Owner or others unless permitted under the following conditions and then only after arranging to provide purging and startup of LPG supply according to requirements indicated:
 - a. Notify the Owner no fewer than two days in advance of proposed interruption of LPG service.
 - b. Do not proceed with interruption of LPG service without the Owner's written permission.

1.2 PRODUCTS

A. Pipes, Tubes, And Fittings

1. Steel Pipe: ASTM A 53/A 53M, black steel, Schedules 40 and 80, Type E or S, Grade B.
 - a. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
 - b. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
 - c. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
 - d. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
 - 1) Material Group: 1.1.
 - 2) End Connections: Threaded or butt welding to match pipe.
 - 3) Lapped Face: Not permitted underground.
 - 4) Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
 - 5) Bolts and Nuts: ASME B18.2.1, carbon steel aboveground, and stainless steel underground.
 - e. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
 - 1) Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.
 - f. Mechanical Couplings:
 - 1) Stainless-steel **OR** Steel, **as directed**, flanges and tube with epoxy finish.
 - 2) Buna-nitrile seals.
 - 3) Stainless-steel **OR** Steel, **as directed**, bolts, washers, and nuts.
 - 4) Coupling shall be capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
 - 5) Steel body couplings installed underground on plastic pipe shall be factory equipped with anode.
2. Corrugated, Stainless-Steel Tubing: Comply with ANSI/IAS LC 1.
 - a. Tubing: ASTM A 240/A 240M, corrugated, Series 300 stainless steel.
 - b. Coating: PE with flame retardant.
 - 1) Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a) Flame-Spread Index: 25 or less.
 - b) Smoke-Developed Index: 50 **OR** 450, **as directed**, or less.
 - c. Fittings: Copper-alloy mechanical fittings with ends made to fit and listed for use with corrugated stainless-steel tubing and capable of metal-to-metal seal without gaskets. Include brazing socket or threaded ends complying with ASME B1.20.1.
 - d. Striker Plates: Steel, designed to protect tubing from penetrations.
 - e. Manifolds: Malleable iron or steel with factory-applied protective coating. Threaded connections shall comply with ASME B1.20.1 for pipe inlet and corrugated tubing outlets.
 - f. Operating-Pressure Rating: 5 psig (34.5 kPa).



3. Aluminum Tubing: Comply with ASTM B 210 and ASTM B 241/B 241M.
 - a. Aluminum Alloy: Alloy 5456 is prohibited.
 - b. Protective Coating: Factory-applied coating capable of resisting corrosion on tubing in contact with masonry, plaster, insulation, water, detergents, and sewerage.
 - c. Flare Fittings: Comply with ASME B16.26 and SAE J513.
 - 1) Copper-alloy fittings.
 - 2) Metal-to-metal compression seal without gasket.
 - 3) Dryseal threads shall comply with ASME B1.20.3.
4. Drawn-Temper Copper Tube: Comply with ASTM B 88, Type K (ASTM B 88M, Type A) **OR** ASTM B 88, Type L (ASTM B 88M, Type B) **OR** ASTM B 837, Type G, **as directed**.
 - a. Copper Fittings: ASME B16.22, wrought copper, and streamlined pattern.
 - b. Bronze Flanges and Flanged Fittings: ASME B16.24, Class 150.
 - 1) Gasket Material: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
 - 2) Bolts and Nuts: ASME B18.2.1, carbon steel or stainless steel.
 - c. Protective Coating for Underground Tubing: Factory-applied, extruded PE a minimum of 0.022 inch (0.56 mm) thick.
5. Annealed-Temper Copper Tube: Comply with ASTM B 88, Type K (ASTM B 88M, Type A) **OR** ASTM B 88, Type L (ASTM B 88M, Type B) **OR** ASTM B 837, Type G, **as directed**.
 - a. Copper Fittings: ASME B16.22, wrought copper, and streamlined pattern.
 - b. Flare Fittings: Comply with ASME B16.26 and SAE J513.
 - 1) Copper fittings with long nuts.
 - 2) Metal-to-metal compression seal without gasket.
 - 3) Dryseal threads complying with ASME B1.20.3.
 - c. Protective Coating for Underground Tubing: Factory-applied, extruded PE a minimum of 0.022 inch (0.56 mm) thick.
6. Tin-Lined Copper Tube: ASTM B 280, seamless, annealed, with interior tin-plated lining.
 - a. Flare Fittings: Comply with ASME B16.26 and SAE J513.
 - 1) Copper fittings with long nuts.
 - 2) Metal-to-metal compression seal without gasket.
 - 3) Dryseal threads complying with ASME B1.20.3.
7. PE Pipe: ASTM D 2513, SDR 11.
 - a. PE Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe.
 - b. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11; and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
 - c. Anodeless Service-Line Risers: Factory fabricated and leak tested.
 - 1) Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet.
 - 2) Casing: Steel pipe complying with ASTM A 53/A 53M, Schedule 40, black steel, Type E or S, Grade B with corrosion-protective coating covering. Vent casing aboveground, **as directed**.
 - 3) Aboveground Portion: PE transition fitting.
 - 4) Outlet shall be threaded or flanged or suitable for welded connection.
 - 5) Tracer wire connection.
 - 6) Ultraviolet shield.
 - 7) Stake supports with factory finish to match steel pipe casing or carrier pipe.
 - d. Transition Service-Line Risers: Factory fabricated and leak tested.
 - 1) Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet connected to steel pipe complying with ASTM A 53/A 53M, Schedule 40, Type E or S, Grade B, with corrosion-protective coating for aboveground outlet.
 - 2) Outlet shall be threaded or flanged or suitable for welded connection.
 - 3) Bridging sleeve over mechanical coupling.
 - 4) Factory-connected anode.
 - 5) Tracer wire connection.



- 6) Ultraviolet shield.
- 7) Stake supports with factory finish to match steel pipe casing or carrier pipe.
- e. Plastic Mechanical Couplings, NPS 1-1/2 (DN 40) and Smaller: Capable of joining PE pipe to PE pipe.
 - 1) PE body with molded-in, stainless-steel support ring.
 - 2) Buna-nitrile seals.
 - 3) Acetal collets.
 - 4) Electro-zinc-plated steel stiffener.
- f. Plastic Mechanical Couplings, NPS 2 (DN 50) and Larger: Capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
 - 1) Fiber-reinforced plastic body.
 - 2) PE body tube.
 - 3) Buna-nitrile seals.
 - 4) Acetal collets.
 - 5) Stainless-steel bolts, nuts, and washers.
8. Steel Mechanical Couplings: Capable of joining plain-end PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
 - 1) Stainless-steel **OR** Steel, **as directed**, flanges and tube with epoxy finish.
 - 2) Buna-nitrile seals.
 - 3) Stainless-steel **OR** Steel, **as directed**, bolts, washers, and nuts.
 - 4) Factory-installed anode for steel-body couplings installed underground.

B. Piping Specialties

1. Flexible Piping Joints:
 - a. Approved for LPG service.
 - b. Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
 - c. Minimum working pressure of 250 psig (1723 kPa) and 250 deg F (121 deg C) operating temperature.
 - d. Flanged- or threaded-end connections to match equipment connected and shall be capable of minimum 3/4-inch (20-mm) misalignment.
 - e. Maximum 36-inch (914-mm) length for liquid LPG lines.
2. Appliance Flexible Connectors:
 - a. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
 - b. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
 - c. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
 - d. Corrugated stainless-steel tubing with polymer coating.
 - e. Operating-Pressure Rating: 0.5 psig (3.45 kPa).
 - f. End Fittings: Zinc-coated steel.
 - g. Threaded Ends: Comply with ASME B1.20.1.
 - h. Maximum Length: 72 inches (1830 mm).
3. Quick-Disconnect Devices: Comply with ANSI Z21.41.
 - a. Copper-alloy convenience outlet and matching plug connector.
 - b. Nitrile seals.
 - c. Hand operated with automatic shutoff when disconnected.
 - d. For indoor or outdoor applications.
 - e. Adjustable, retractable restraining cable.
4. Y-Pattern Strainers:
 - a. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
 - b. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.
 - c. Strainer Screen: 40 **OR** 60, **as directed**,-mesh startup strainer and perforated stainless-steel basket with 50 percent free area.
 - d. CWP Rating: 125 psig (862 kPa).
5. Basket Strainers:



- a. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
 - b. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.
 - c. Strainer Screen: 40 **OR** 60, **as directed**, -mesh startup strainer and perforated stainless-steel basket with 50 percent free area.
 - d. CWP Rating: 125 psig (862 kPa).
6. T-Pattern Strainers:
- a. Body: Ductile or malleable iron with removable access coupling and end cap for strainer maintenance.
 - b. End Connections: Grooved ends.
 - c. Strainer Screen: 40 **OR** 60, **as directed**, -mesh startup strainer and perforated stainless-steel basket with 57 percent free area.
 - d. CWP Rating: 750 psig (5170 kPa).
7. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.
- C. Joining Materials
1. Joint Compound and Tape: Suitable for LPG.
 2. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
 3. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F (540 deg C) complying with AWS A5.8/A5.8M.
- D. Manual Gas Shutoff Valves
1. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.
 2. Metallic Valves, NPS 2 (DN 50) and Smaller for Liquid Service: Comply with ASME B16.33 and UL 842.
 - a. CWP Rating: 250 psig (1723 kPa).
 - b. Threaded Ends: Comply with ASME B1.20.1.
 - c. Socket ends for brazed joints.
 - d. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 - e. Listing by CSA or agency acceptable to authorities having jurisdiction for valves 1 inch (25 mm) and smaller.
 - f. Valves 1-1/4 inch (32 mm) and larger shall be suitable for LPG service, with "WOG" indicated on valve body.
 3. General Requirements for Metallic Valves, NPS 2 (DN 50) and Smaller for Vapor Service: Comply with ASME B16.33.
 - a. CWP Rating: 125 psig (862 kPa).
 - b. Threaded Ends: Comply with ASME B1.20.1.
 - c. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
 - d. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 - e. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch (25 mm) and smaller.
 - f. Service Mark: Valves 1-1/4 inch (32 mm) to NPS 2 (DN 50) shall have initials "WOG" permanently marked on valve body.
 4. General Requirements for Metallic Valves, NPS 2-1/2 (DN 65) and Larger: Comply with ASME B16.38.
 - a. CWP Rating: 125 psig (862 kPa).
 - b. Flanged Ends: Comply with ASME B16.5 for steel flanges.



- c. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
- d. Service Mark: Initials "WOG" shall be permanently marked on valve body.
- 5. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.
 - a. Body: Bronze, complying with ASTM B 584.
 - b. Ball: Chrome-plated brass.
 - c. Stem: Bronze; blowout proof.
 - d. Seats: Reinforced TFE; blowout proof.
 - e. Packing: Separate packnut with adjustable-stem packing threaded ends.
 - f. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 - g. CWP Rating: 600 psig (4143 kPa).
 - h. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 - i. Service: Suitable for LPG service with "WOG" indicated on valve body.
- 6. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.
 - a. Body: Bronze, complying with ASTM B 584.
 - b. Ball: Chrome-plated bronze.
 - c. Stem: Bronze; blowout proof.
 - d. Seats: Reinforced TFE; blowout proof.
 - e. Packing: Threaded-body packnut design with adjustable-stem packing.
 - f. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 - g. CWP Rating: 600 psig (4143 kPa).
 - h. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 - i. Service: Suitable for LPG service with "WOG" indicated on valve body.
- 7. Two-Piece, Regular-Port Bronze Ball Valves with Bronze Trim: MSS SP-110.
 - a. Body: Bronze, complying with ASTM B 584.
 - b. Ball: Chrome-plated bronze
 - c. Stem: Bronze; blowout proof.
 - d. Seats: Reinforced TFE.
 - e. Packing: Threaded-body packnut design with adjustable-stem packing.
 - f. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 - g. CWP Rating: 600 psig (4140 kPa).
 - h. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 - i. Service: Suitable for LPG service with "WOG" indicated on valve body.
- 8. Bronze Plug Valves: MSS SP-78.
 - a. Body: Bronze, complying with ASTM B 584.
 - b. Plug: Bronze.
 - c. Ends: Threaded, socket, or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 - d. Operator: Square head or lug type with tamperproof feature where indicated.
 - e. Pressure Class: 125 psig (862 kPa).
 - f. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 - g. Service: Suitable for LPG service with "WOG" indicated on valve body.
- 9. Cast-Iron, Nonlubricated Plug Valves: MSS SP-78.
 - a. Body: Cast iron, complying with ASTM A 126, Class B.
 - b. Plug: Bronze or nickel-plated cast iron.
 - c. Seat: Coated with thermoplastic.
 - d. Stem Seal: Compatible with LPG.
 - e. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.



- f. Operator: Square head or lug type with tamperproof feature where indicated.
 - g. Pressure Class: 125 psig (862 kPa).
 - h. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 - i. Service: Suitable for LPG service with "WOG" indicated on valve body.
10. Cast-Iron, Lubricated Plug Valves: MSS SP-78.
- a. Body: Cast iron, complying with ASTM A 126 Class B.
 - b. Plug: Bronze or nickel-plated cast iron.
 - c. Seat: Coated with thermoplastic.
 - d. Stem Seal: Compatible with LPG.
 - e. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 - f. Operator: Square head or lug type with tamperproof feature where indicated.
 - g. Pressure Class: 125 psig (862 kPa).
 - h. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 - i. Service: Suitable for LPG service with "WOG" indicated on valve body.
11. PE Ball Valves: Comply with ASME B16.40.
- a. Body: PE.
 - b. Ball: PE.
 - c. Stem: Acetal.
 - d. Seats and Seals: Nitrile.
 - e. Ends: Plain or fusible to match piping.
 - f. CWP Rating: 80 psig (552 kPa).
 - g. Operating Temperature: Minus 20 to plus 140 deg F (Minus 29 to plus 60 deg C).
 - h. Operator: Nut or flat head for key operation.
 - i. Include plastic valve extension.
 - j. Include tamperproof locking feature for valves where indicated on Drawings.
12. Valve Boxes:
- a. Cast-iron, two-section box.
 - b. Top section with cover with "GAS" lettering.
 - c. Bottom section with base to fit over valve and barrel a minimum of 5 inches (125 mm) in diameter.
 - d. Adjustable cast-iron extensions of length required for depth of bury.
 - e. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head and with stem of length required to operate valve.
- E. Motorized Gas Valves
1. Hydrostatic Relief Valves: Comply with NFPA 58.
- a. Operating Pressure: 350 psig (2413 kPa).
 - b. Body: Brass.
 - c. Spring: Stainless steel.
 - d. Disc and Seat: Nitrile.
 - e. Brass body and stainless-steel, spring-operated valve with resilient rubber disc seat and protective cap.
 - f. Factory set and tested.
 - g. Listing: Valves listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 - h. Valve shall reseal after relieving pressure.
2. Automatic Gas Valves: Comply with ANSI Z21.21.
- a. Body: Brass or aluminum.
 - b. Seats and Disc: Nitrile rubber.
 - c. Springs and Valve Trim: Stainless steel.
 - d. Normally closed.
 - e. Visual position indicator.



- f. Electrical **OR** Mechanical, **as directed**, operator for actuation by appliance automatic shutoff device.
- 3. Electrically Operated Valves: Comply with UL 429.
 - a. Pilot operated.
 - b. Body: Brass or aluminum.
 - c. Seats and Disc: Nitrile rubber.
 - d. Springs and Valve Trim: Stainless steel.
 - e. 120-V ac, 60 Hz, Class B, continuous-duty molded coil, replaceable.
 - f. NEMA ICS 6, Type 4, coil enclosure.
 - g. Normally closed.
 - h. Visual position indicator.
- F. Earthquake Valves
 - 1. Earthquake Valves: Comply with ASCE 25.
 - a. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 - b. Maximum Operating Pressure: 5 psig (34.5 kPa).
 - c. Cast-aluminum body with nickel-plated chrome steel internal parts.
 - d. Nitrile-rubber valve washer.
 - e. Sight windows for visual indication of valve position.
 - f. Threaded-end connections complying with ASME B1.20.1.
 - 2. Earthquake Valves: Comply with ASCE 25.
 - a. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 - b. Maximum Operating Pressure: 0.5 psig (3.45 kPa) **OR** 7 psig (48 kPa) **OR** 60 psig (414 kPa), **as directed**.
 - c. Cast-aluminum body with stainless-steel internal parts.
 - d. Nitrile-rubber, reset-stem o-ring seal.
 - e. Valve position, open or closed, indicator.
 - f. Composition valve seat with clapper held by spring or magnet locking mechanism.
 - g. Level indicator.
 - h. End Connections: Threaded for valves NPS 2 (DN 50) and smaller; flanged for valves NPS 2-1/2 (DN 65) and larger.
- G. Pressure Regulators
 - 1. General Requirements:
 - a. Single stage and suitable for LPG.
 - b. Steel jacket and corrosion-resistant components.
 - c. Elevation compensator.
 - d. End Connections: Threaded for regulators NPS 2 (DN 50) and smaller; flanged for regulators NPS 2-1/2 (DN 65) and larger.
 - 2. Service Pressure Regulators: Comply with ANSI Z21.80.
 - a. Body and Diaphragm Case: Cast iron or die-cast aluminum.
 - b. Springs: Zinc-plated steel; interchangeable.
 - c. Diaphragm Plate: Zinc-plated steel.
 - d. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
 - e. Orifice: Aluminum; interchangeable.
 - f. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
 - g. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet and no pressure sensing piping external to the regulator.
 - h. Pressure regulator shall maintain discharge pressure setting downstream and not exceed 150 percent of design discharge pressure at shutoff.
 - i. Overpressure Protection Device: Factory mounted on pressure regulator.
 - j. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
 - k. Maximum Inlet Pressure: 100 psig (690 kPa).
 - 3. Line Pressure Regulators: Comply with ANSI Z21.80.



- a. Body and Diaphragm Case: Cast iron or die-cast aluminum.
 - b. Springs: Zinc-plated steel; interchangeable.
 - c. Diaphragm Plate: Zinc-plated steel.
 - d. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
 - e. Orifice: Aluminum; interchangeable.
 - f. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
 - g. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet and no pressure sensing piping external to the regulator.
 - h. Pressure regulator shall maintain discharge pressure setting downstream and not exceed 150 percent of design discharge pressure at shutoff.
 - i. Overpressure Protection Device: Factory mounted on pressure regulator.
 - j. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
 - k. Maximum Inlet Pressure: 2 psig (13.8 kPa) **OR** 5 psig (34.5 kPa) **OR** 10 psig (69 kPa), **as directed**.
4. Appliance Pressure Regulators: Comply with ANSI Z21.18.
- a. Body and Diaphragm Case: Die-cast aluminum.
 - b. Springs: Zinc-plated steel; interchangeable.
 - c. Diaphragm Plate: Zinc-plated steel.
 - d. Seat Disc: Nitrile rubber.
 - e. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
 - f. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
 - g. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
 - h. Maximum Inlet Pressure: 1 psig (6.9 kPa) **OR** 2 psig (13.8 kPa) **OR** 5 psig (34.5 kPa-), **as directed**.

H. Service Meters

1. Diaphragm-Type Service Meters: Comply with ANSI B109.1 **OR** ANSI B109.2, **as directed**.
 - a. Case: Die-cast aluminum.
 - b. Connections: Steel threads.
 - c. Diaphragm: Synthetic fabric.
 - d. Diaphragm Support Bearings: Self-lubricating.
 - e. Compensation: Continuous temperature and pressure, **as directed**.
 - f. Meter Index: Cubic feet **OR** Liters **OR** Cubic feet and liters, **as directed**.
 - g. Meter Case and Index: Tamper resistant.
 - h. Remote meter reader compatible.
 - i. Maximum Inlet Pressure: 100 psig (690 kPa).
 - j. Pressure Loss: Maximum 0.5-inch wg (124 Pa) **OR** 2.0-inch wg (498 Pa), **as directed**.
 - k. Accuracy: Maximum plus or minus 1.0 percent.
2. Rotary-Type Service Meters: Comply with ANSI B109.3.
 - a. Case: Extruded aluminum.
 - b. Connection: Flange.
 - c. Impellers: Polished aluminum.
 - d. Rotor Bearings: Self-lubricating.
 - e. Compensation: Continuous temperature and pressure, **as directed**.
 - f. Meter Index: Cubic feet **OR** Liters **OR** Cubic feet and liters, **as directed**.
 - g. Tamper resistant.
 - h. Remote meter reader compatible.
 - i. Maximum Inlet Pressure: 100 psig (690 kPa).
 - j. Accuracy: Maximum plus or minus 2.0 percent.
3. Turbine Meters: Comply with ASME MFC-4M.
 - a. Housing: Cast iron or welded steel.
 - b. Connection Threads or Flanges: Steel.



- c. Turbine: Aluminum or plastic.
 - d. Turbine Bearings: Self-lubricating.
 - e. Compensation: Continuous temperature and pressure, **as directed**.
 - f. Meter Index: Cubic feet **OR** Liters **OR** Cubic feet and liters, **as directed**.
 - g. Tamper resistant.
 - h. Remote meter reader compatible.
 - i. Maximum Inlet Pressure: 100 psig (690 kPa).
 - j. Accuracy: Maximum plus or minus 2.0 percent.
4. Service-Meter Bars:
- a. Malleable- or cast-iron frame for supporting service meter.
 - b. Include offset swivel pipes, meter nuts with o-ring seal, and factory- or field-installed dielectric unions.
 - c. Omit meter offset swivel pipes if service-meter bar dimensions match service-meter connections.
5. Service-Meter Bypass Fittings:
- a. Ferrous, tee, pipe fitting with capped side inlet for temporary LPG supply.
 - b. Integral ball-check bypass valve.
- I. Dielectric Fittings
1. Dielectric Unions:
- a. Minimum Operating-Pressure Rating: 150 psig (1034 kPa).
 - b. Combination fitting of copper alloy and ferrous materials.
 - c. Insulating materials suitable for LPG.
 - d. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.
2. Dielectric Flanges:
- a. Minimum Operating-Pressure Rating: 150 psig (1034 kPa).
 - b. Combination fitting of copper alloy and ferrous materials.
 - c. Insulating materials suitable for LPG.
 - d. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.
3. Dielectric-Flange Kits:
- a. Minimum Operating-Pressure Rating: 150 psig (1034 kPa).
 - b. Companion-flange assembly for field assembly.
 - c. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or PE bolt sleeves, phenolic washers, and steel backing washers.
 - d. Insulating materials suitable for LPG.
 - e. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.
- J. Storage Containers
1. Description: Factory fabricated, complying with requirements in NFPA 58 and ASME Boiler and Pressure Vessel Code and bearing the ASME label. Tanks shall be rated for 250-psig (1723-kPa) minimum working pressure.
- a. Liquid outlet and vapor inlet and outlet connections shall have shutoff valves with excess-flow safety shutoff valves and bypass and back-pressure check valves with smaller than 0.039-inch (1-mm) drill-size hole to equalize pressure. Liquid-fill connection shall have backflow check valve.
 - 1) Connections: Color-code and tag valves to indicate type.
 - a) Liquid fill and outlet, red.
 - b) Vapor inlet and outlet, yellow.
 - b. Level gage shall indicate current level of liquid in the container. Gages shall also indicate storage container contents; e.g., "Butane," "50-50 LPG Mix," or "Propane."
 - c. Pressure relief valves, type and number as required by NFPA 58, connected to vapor space and having discharge piping same size as relief-valve outlet and long enough to extend at least 84 inches (2130 mm) directly overhead. Identify relief valves as follows:



- 1) Discharge pressure in psig (kPa).
 - 2) Rate of discharge for standard air in cfm (L/s).
 - 3) Manufacturer's name.
 - 4) Catalog or model number.
 - d. Container pressure gage.
 - e. For outdoor installation, exposed metal surfaces mechanically cleaned, primed, and painted for resistance to corrosion.
 - f. Ladders for access to valves more than 72 inches (1830 mm) aboveground.
 - g. Stainless-Steel Nameplate: Attach to aboveground storage container or to adjacent structure for underground storage container.
 - 1) Name and address of supplier or trade name of container.
 - 2) Water capacity in gallons and liters.
 - 3) Design pressure in psig (kPa).
 - 4) Statement, "This container shall not contain a product having a vapor pressure in excess of **<Insert maximum pressure in psig (kPa) at 100 deg F (37.8 deg C)>**."
 - 5) Outside surface area in sq. ft. (sq. m).
 - 6) Year of manufacture.
 - 7) Shell thickness in inches (mm).
 - 8) Overall length in feet (m).
 - 9) OD in feet (m).
 - 10) Manufacturer's serial number.
 - 11) ASME Code label.
 - h. Felt support pads and two concrete or painted-steel saddles per storage container. Corrosion protection required at container-to-felt contact.
 - i. Tie straps for each saddle.
 - j. Straps and anchors for tie-down slab.
 - k. Asphalt-based coating for corrosion protection.
 - l. Container connections and valves protected in manway at top of storage container.
 - m. Manway equipped with ventilation louvers.
- K. Transport Truck Unloading Facility
1. Description: Comply with requirements in NFPA 58.
 - a. Support structure consisting of a minimum 6-inch (150-mm) steel channel or 6-by-4-inch (150-by-100-mm) rectangular steel tubing, a minimum of 36 inches (914 mm) above and below grade.
 - b. Liquid-fill and vapor-return, quick-disconnect fittings.
 - c. Liquid and vapor shutoff valves with hydrostatic relief valves mounted between the quick-disconnect fittings and shutoff valves.
 - d. Excess-flow safety shutoff valve in vapor-return line.
 - e. Backflow check valve in liquid-fill line.
 - f. Remote emergency shutoff valve station with underground cable to the vapor emergency shutoff valve.
- L. Pumps
1. Description: Factory-assembled and -tested, duplex, positive-displacement, belt drive.
 2. Pump Construction:
 - a. Casing: Ductile-iron casing with threaded gage tappings at inlet and outlet.
 - b. Internal Pressure Relief Valve: For pump protection in addition to the external pressure relief valves.
 - c. Impeller: Carbon or composite vane in cast-iron rotor.
 - d. Pump Shaft: Carbon steel.
 - e. Seal: Mechanical with Buna-N o-ring.
 - f. Pump Bearings: Ball bearings with grease fittings.
 - g. Baseplate: Bent carbon-steel channel or structural channel.



3. Motor: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - b. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 22.
 - c. Motor Speeds: Single.
 - d. Bearings: Permanently lubricated **OR** Grease-lubricated, **as directed**, ball bearings.
 - e. Class I, Division 1, Group D requirements per NFPA 70.
4. Factory-Installed Piping and Specialties:
 - a. Pipe: ASTM A 53/A 53M, Type E or S, Grade B; Schedule 40 black steel with welded fittings and joints or Schedule 80 for threaded malleable-iron fittings and joints.
 - b. Piping Specialties for Each Pump:
 - 1) Bypass valve.
 - 2) Isolation valves.
 - 3) Unions for each connection.
 - 4) Check valve.
 - 5) Basket strainer.
 - 6) Pressure gages for suction and discharge connections.
 - 7) Hydrostatic relief valve.
 - 8) Pilot-operated, pressure-regulating valve.
5. Braided-jacket flexible connectors for suction and discharge connections.
6. Pump and Piping Finish: For outdoor installation, exposed metal surfaces mechanically cleaned, primed, and painted for resistance to corrosion.
7. Controls:
 - a. Explosion-proof controls enclosure.
 - b. Magnetic starter package with automatic alternator.
 - c. Pressure-activated start and stop.
 - d. Lag pump starts if lead pump fails.
 - e. Audible and visual indication of pump failure.

M. Vaporizers

1. Description: Factory-fabricated, -assembled, and -tested vaporizer with heat exchanger sealed pressure-tight, built on a steel base; including insulated jacket, flue-gas vent, liquid fuel supply and vapor connections, and controls. Assembly shall be FMG labeled and comply with NFPA 58 and NFPA 70.
2. Fabricate base and attachment to vaporizers with reinforcement strong enough to resist vaporizer movement during a seismic event when steel base is anchored to a concrete base.
3. Casing:
 - a. Mineral-fiber insulation, a minimum of 2 inches (50 mm) thick, surrounding the heat exchanger.
 - b. Integral one-piece skid with forklift access holes.
 - c. Lifting lugs on top of vaporizer.
 - d. Flue rain cap and bird screen.
 - e. Sheet metal jacket with screw-fastened closures and baked-enamel **OR** powder-coat, **as directed**, protective finish.
 - f. Mounting base to secure boiler to concrete base.
 - g. Control Compartment Enclosure: NEMA 250, Type 4, enclosure housing control panels for LPG-fired vaporizers. Explosion-proof control compartment construction required for electric vaporizers.
4. LPG Liquid and Vapor Circuit Specialties:
 - a. Y-type strainer with drain valve at inlet.
 - b. Vaporizer coil safety pressure relief valve.
 - c. Vaporizer coil blowdown valve.
 - d. Vapor outlet isolation valve.



- e. Pressure gages, a minimum of 2-1/2 inches (63 mm) in diameter, at liquid inlet and vapor discharge. Gages shall have operating-temperature ranges so normal operating range is at approximately 50 percent of full range.
 - f. Inlet safety solenoid valve to close with off-normal operation alarm.
 - g. Backflow check valve in bypass around inlet safety solenoid valve.
 - h. Liquid carryover or float-type safety shutoff switch.
 - i. LPG Vapor Filter: Steel shell designed and manufactured per ASME Boiler and Pressure Vessel Code, Section VIII, Division 1; factory mounted on vaporizer discharge. Shells larger than 5 inches (125 mm) shall be ASME "U" stamped. Fill with stainless-steel, woven-mesh coalescing element to remove 99 percent of particles larger than 10 microns. 250-psig (1723-kPa) minimum working pressure. Finish with corrosion-resistant coating for an exterior application. Include factory-mounted and -piped, differential pressure gage with gage cocks in and out, and minimum NPS 3/4 (DN 20) full-port, ball-type drain valve.
5. Direct-Type, Direct-Fired Heat Exchanger:
- a. Description: ASME-rated and -stamped, LPG, vaporizer coil contained in an enclosure insulated with at least 2-inch- (50-mm-) thick, mineral-fiber board enclosure with a burner.
 - b. Burner Tubes and Orifices: Stainless steel.
 - 1) Gas Train: Control devices and burner control sequence shall be FMG labeled. Include shutoff valve, high- and low-pressure safety switches, pressure regulator, and main- and pilot-control valves.
 - 2) Pilot: Standing pilot with 100 percent main-valve and pilot safety shutoff.
 - c. Burner Operating Controls:
 - 1) Controls shall maintain safe operating conditions. Mechanical burner safety controls limit operation of the burner.
 - 2) High-Pressure Cutoff: Manual reset stops burner if operating conditions rise above maximum design pressure.
 - 3) Operating Vapor-Pressure Control: Factory piped and mounted to control burner.
6. Indirect-Type, Direct-Fired Heat Exchanger:
- a. Description: ASME-rated and -stamped, LPG, vaporizer vessel with a replaceable, immersion-type, electric heating element.
 - b. Heating Element Operating Controls:
 - 1) Operating controls shall maintain safe operating conditions. Safety controls limit operation of the element. Microprocessor-based control system integrates safety and operating controls, **as directed**.
 - 2) Operating Vapor-Pressure Control: Factory wired and mounted to control heating element.
 - 3) High-Pressure Cutoff: Manual reset stops burner if operating conditions rise above maximum design pressure.
 - 4) Alarm Bell and Rotary Beacon: Factory mounted on control panel with silence switch; shall sound alarm for out-of-normal conditions.
 - 5) Control Transformer: 115-V maximum control voltage.
7. Direct-Type, Water-Bath Heat Exchanger:
- a. Description: Straight, steel fire tubes welded into steel headers with ASME-rated and -stamped, helical, LPG, vaporizer coil submerged in water bath. Include the following:
 - 1) Water bath filled with water/glycol solution designed to prevent freezing at minus 30 deg F (minus 34 deg C).
 - 2) Water-bath, high- and low-level sight glasses.
 - 3) Low-water cutoff to stop burner and annunciate alarm.
 - 4) Water/glycol fill and vent fitting.
 - 5) Minimum NPS 3/4 (DN 20) hose-end drain valves.
 - 6) Operating high- and low-limit aquastat controllers.
 - 7) Water-bath temperature gage; a minimum of 2-1/2 inches (63 mm) in diameter. Gages shall have operating-temperature ranges so normal operating range is at approximately 50 percent of full range.
 - b. Burner Tubes and Orifices: Stainless steel.



- 1) Gas Train: Control devices and burner modulation control sequence shall be FMG labeled. Include shutoff valve, high- and low-pressure safety switches, pressure regulator, and main- and pilot-control valves.
- 2) Pilot: Intermittent-electric-spark **OR** Hot-surface, **as directed**, pilot ignition with 100 percent main-valve and pilot safety shutoff with electronic supervision of burner flame.
- c. Burner Operating Controls:
 - 1) Operating controls shall maintain safe operating conditions. Safety controls limit operation of the burner. Microprocessor-based control system integrates safety and operating controls, **as directed**.
 - 2) Operating Water-Bath Temperature Control: Factory wired and mounted to control burner.
 - 3) High-Temperature and High-Pressure Cutoff: Manual reset stops burner if operating conditions rise above maximum design temperature or vapor pressure.
 - 4) Alarm Bell and Rotary Beacon: Factory mounted on control panel with silence switch; shall sound alarm for out-of-normal conditions.
 - 5) Control Transformer: 115-V maximum control voltage.
8. Indirect-Type, Water-Bath Heat Exchanger:
 - a. Description: Immersion-type, electric heating element with ASME-rated and -stamped, helical, LPG, vaporizer coil submerged in water bath. Include the following:
 - 1) Water bath filled with water/glycol solution designed to prevent freezing at minus 30 deg F (minus 34 deg C).
 - 2) Water-bath, high- and low-level sight glasses.
 - 3) Low-water cutoff to stop electric heater and annunciate alarm.
 - 4) Water/glycol fill and vent fitting.
 - 5) Minimum NPS 3/4 (DN 20) hose-end drain valves.
 - 6) Operating high- and low-limit aquastat controllers.
 - 7) Water-bath temperature gage; a minimum of 2-1/2 inches (63 mm) in diameter. Gages shall have operating-temperature ranges so normal operating range is at approximately 50 percent of full range.
 - b. Electric Heater Operating Controls:
 - 1) Controls shall maintain safe operating conditions. Safety controls limit operation of the electric element. Microprocessor-based control system integrates safety and operating controls, **as directed**.
 - 2) Operating Water-Bath Temperature Control: Factory wired and mounted to control burner.
 - 3) High-Temperature and High-Pressure Cutoff: Manual reset stops burner if operating conditions rise above maximum design temperature or pressure.
 - 4) Alarm Bell and Rotary Beacon: Factory mounted on control panel with silence switch; shall sound alarm for out-of-normal conditions.
 - 5) Control Transformer: 115-V maximum control voltage.
9. Building Management System Interface: Factory-installed hardware and software to enable building management system to monitor and control set points and display vaporizer status and alarms.

N. Air Mixers

1. Description: Factory-fabricated, -assembled, -calibrated, and -tested, blower-assisted, **as directed**, air mixer with surge tank, built on a steel base; including vapor supply and discharge connections, and controls. Assembly shall be FMG labeled and comply with NFPA 58 and NFPA 70.
2. Fabricate base and attachment to mixers with reinforcement strong enough to resist air mixer movement during a seismic event when steel base is anchored to a concrete base.
3. Mounting Skid, Panels, and Surge Tank:
 - a. Integral one-piece skid with forklift access holes.
 - b. Lifting lugs on top of air mixer.
 - c. Baked-enamel **OR** Powder-coat, **as directed**, protective finish.



- d. Mounting base to secure boiler to concrete base.
 - e. Control Compartment Enclosure: NEMA 250, Type 4, enclosure housing control panels.
 - f. ASME-stamped surge tank with venturi, isolation valves, excess-flow safeties, and safety relief valves.
4. Blower: Positive-displacement, rotary-lobe type.
- a. Motor: Single speed, with permanently lubricated **OR** grease-lubricated, **as directed**, ball bearings. Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".
5. LPG Circuit Specialties:
- a. Venturi solenoid valves.
 - b. Venturi nozzles, minimum of 3, for minimum of 10:1 turndown capacity.
 - c. Venturi silencers.
 - d. Mist filter and strainer with pressure differential gage, and blowdown ball valve.
 - e. Inlet and outlet isolation valves.
 - f. Pressure gages, a minimum of 2-1/2 inches (63 mm) in diameter, at inlet and discharge. Gages shall have operating-temperature ranges so normal operating range is at approximately 50 percent of full range.
6. Air-Mixer Controls:
- a. Controls shall maintain safe operating conditions. The following safety controls limit the operation of the air mixer. All safety controls are manual reset.
 - 1) Low-inlet-vapor pressure.
 - 2) High- or low-discharge pressure.
 - b. Alarm Bell and Rotary Beacon: Factory mounted on control panel with silence switch; shall sound alarm for out-of-normal conditions.
 - c. Control Transformer: 115-V maximum control voltage.
7. Mount on common skid with vaporizer.
- O. Sleeves
- 1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
 - 2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- P. Mechanical Sleeve Seals
- 1. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - a. Sealing Elements: EPDM **OR** NBR, **as directed**, interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe and sleeve.
 - b. Pressure Plates: Plastic **OR** Carbon steel **OR** Stainless steel, **as directed**.
 - c. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating **OR** Stainless steel, **as directed**, of length required to secure pressure plates to sealing elements. Include one nut and bolt for each sealing element.
- Q. Escutcheons
- 1. General Requirements for Escutcheons: Manufactured wall and ceiling escutcheons and floor plates, with ID to fit around pipe or tube, and OD that completely covers opening.
 - 2. One-Piece, Deep-Pattern Escutcheons: Deep-drawn brass with polished chrome-plated finish.
 - 3. One-Piece, Cast-Brass Escutcheons: With set screw.
 - a. Finish: Polished chrome-plated **OR** Rough brass, **as directed**.
 - 4. Split-Casting, Cast-Brass Escutcheons: With concealed hinge and set screw.
 - a. Finish: Polished chrome-plated **OR** Rough brass, **as directed**.
 - 5. One-Piece, Stamped-Steel Escutcheons: With set screw **OR** spring clips, **as directed**, and chrome-plated finish.
 - 6. Split-Plate, Stamped-Steel Escutcheons: With concealed **OR** exposed-rivet, **as directed**, hinge, set screw **OR** spring clips, **as directed**, and chrome-plated finish.



7. One-Piece, Floor-Plate Escutcheons: Cast-iron floor plate.
8. Split-Casting, Floor-Plate Escutcheons: Cast brass with concealed hinge and set screw.

R. Grout

1. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - a. Characteristics: Post-hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - b. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
 - c. Packaging: Premixed and factory packaged.

S. Labeling And Identifying

1. Detectable Warning Tape: Acid- and alkali-resistant PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored yellow.

1.3 EXECUTION

A. Earthwork

1. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

B. Preparation

1. Close equipment shutoff valves before turning off LPG to premises or piping section.
2. Inspect LPG piping according to NFPA 58 and NFPA 54 **OR** the International Fuel Gas Code, **as directed**, to determine that LPG utilization devices are turned off in piping section affected.
3. Comply with NFPA 58 and NFPA 54 **OR** the International Fuel Gas Code, **as directed**, requirements for prevention of accidental ignition.

C. Outdoor Piping Installation

1. Comply with NFPA 58 and NFPA 54 **OR** the International Fuel Gas Code, **as directed**, requirements for installation and purging of LPG piping.
2. Install underground, LPG piping buried at least 36 inches (900 mm) below finished grade. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.
 - a. If LPG piping is installed less than 36 inches (914 mm) below finished grade, install it in containment conduit.
3. Install underground, PE, LPG piping according to ASTM D 2774.
4. Steel Piping with Protective Coating:
 - a. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
 - b. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.

OR

Replace pipe having damaged PE coating with new pipe.
5. Copper Tubing with Protective Coating:
 - a. Apply joint cover kits over tubing to cover, seal, and protect joints.
 - b. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
6. Install fittings for changes in direction and branch connections.
7. Joints for connection to inlets and outlets on vaporizers, air mixers, regulators, and valves may be flanged or threaded to match the equipment.
8. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.



- a. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
 - b. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) and larger in diameter.
9. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 10. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
 11. Install pressure gage downstream **OR** upstream and downstream, **as directed**, from each service regulator. Pressure gages are specified in Division 23 Section "Meters And Gages For Hvac Piping".
- D. Indoor Piping Installation
1. Comply with NFPA 54 **OR** the International Fuel Gas Code, **as directed**, for installation and purging of LPG piping.
 2. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
 3. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
 4. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
 5. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
 6. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
 7. Locate valves for easy access.
 8. Install LPG piping at uniform grade of 2 percent down toward drip and sediment traps.
 9. Install piping free of sags and bends.
 10. Install fittings for changes in direction and branch connections.
 11. Install escutcheons for penetrations of interior walls, ceilings, and floors.
 - a. New Piping:
 - 1) Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - 2) Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
OR
Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
 - 3) Piping at Ceiling Penetrations in Finished Spaces: One-piece **OR** Split-casting, **as directed**, cast-brass type with polished chrome-plated finish.
OR
Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type **OR** Split-plate, stamped-steel type with concealed hinge, **as directed**, and set screw.
 - 4) Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated **OR** rough-brass, **as directed**, finish.
OR
Piping in Unfinished Service Spaces: One-piece, stamped-steel type with set screw **OR** spring clips, **as directed**.
 - 5) Piping in Equipment Rooms: One-piece, cast-brass type.
OR
Piping in Equipment Rooms: One-piece, stamped-steel type with set screw **OR** spring clips, **as directed**.



- 6) Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
- b. Existing Piping:
 - 1) Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
OR
Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and spring clips.
 - 2) Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
OR
Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and set screw.
 - 3) Piping in Unfinished Service Spaces: Split-casting, cast-brass type with polished chrome-plated **OR** rough-brass, **as directed**, finish.
OR
Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with concealed **OR** exposed-rivet, **as directed**, hinge and set screw or spring clips.
 - 4) Piping in Equipment Rooms: Split-casting, cast-brass type.
OR
Piping in Equipment Rooms: Split-plate, stamped-steel type with set screw or spring clips.
 - 5) Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.
12. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping" for materials.
13. Verify final equipment locations for roughing-in.
14. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
15. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where readily accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
 - a. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches (75 mm) long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
16. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.
17. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.
18. Concealed Location Installations: Except as specified below, install concealed LPG piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.
 - a. Above Accessible Ceilings: LPG piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
 - b. In Floors: Install LPG piping with welded or brazed joints and protective coating in cast-in-place concrete floors. Cover piping to be cast in concrete slabs with minimum of 1-1/2 inches (38 mm) of concrete. Piping may not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quick-set additives or cinder aggregate.
 - c. In Floor Channels: Install LPG piping in floor channels. Channels must have cover and be open to space above cover for ventilation.
 - d. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.
 - 1) Exception: Tubing passing through partitions or walls does not require striker barriers.



- e. Prohibited Locations:
- 1) Do not install LPG piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
 - 2) Do not install LPG piping in solid walls or partitions.
19. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
 20. Connect branch piping from top or side of horizontal piping.
 21. Install unions in pipes NPS 2 (DN 50) and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.
 22. Do not use LPG piping as grounding electrode.
 23. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.
 24. Install pressure gage downstream **OR** upstream and downstream, **as directed**, from each line regulator. Pressure gages are specified in Division 23 Section "Meters And Gages For Hvac Piping".
- E. Service-Meter Assembly Installation
1. Install service-meter assemblies aboveground, on concrete bases, **as directed**.
 2. Install metal shutoff valves upstream from service regulators. Shutoff valves are not required at second regulators if two regulators are installed in series.
 3. Install strainer on inlet of service-pressure regulator and meter set.
 4. Install service regulators mounted outside with vent outlet horizontal or facing down. Install screen in vent outlet if not integral with service regulator.
 5. Install metal shutoff valves upstream from service meters. Install dielectric fittings downstream from service meters.
 6. Install service meters downstream from pressure regulators.
 7. Install metal bollards to protect meter assemblies. Comply with requirements in Division 05 Section "Metal Fabrications" for pipe bollards.
- F. Valve Installation
1. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.
 2. Install underground valves with valve boxes.
 3. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.
 4. Install earthquake valves aboveground outside buildings according to listing.
 5. Install anode for metallic valves in underground PE piping.
- G. Piping Joint Construction
1. Ream ends of pipes and tubes and remove burrs.
 2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
 3. Threaded Joints:
 - a. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
 - b. Cut threads full and clean using sharp dies.
 - c. Ream threaded pipe ends to remove burrs and restore full ID of pipe.
 - d. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
 - e. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
 4. Welded Joints:
 - a. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
 - b. Bevel plain ends of steel pipe.
 - c. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.



5. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Ch. 22, "Pipe and Tube."
6. Flanged Joints: Install gasket material, size, type, and thickness appropriate for LPG service. Install gasket concentrically positioned.
7. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.
8. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 - a. Plain-End Pipe and Fittings: Use butt fusion.
 - b. Plain-End Pipe and Socket Fittings: Use socket fusion.

H. Hanger And Support Installation

1. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
2. Comply with requirements for pipe hangers and supports specified in Division 23 Section "Hangers And Supports For Hvac Piping And Equipment".
3. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
 - a. NPS 1 (DN 25) and Smaller: Maximum span, 96 inches (2438 mm); minimum rod size, 3/8 inch (10 mm).
 - b. NPS 1-1/4 (DN 32): Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch (10 mm).
 - c. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch (10 mm).
 - d. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): Maximum span, 10 feet (3 m); minimum rod size, 1/2 inch (13 mm).
 - e. NPS 4 (DN 100) and Larger: Maximum span, 10 feet (3 m); minimum rod size, 5/8 inch (16 mm).
4. Install hangers for horizontal, drawn-temper copper tubing with the following maximum spacing and minimum rod sizes:
 - a. NPS 3/8 (DN 10): Maximum span, 48 inches (1220 mm); minimum rod size, 3/8 inch (10 mm).
 - b. NPS 1/2 and NPS 5/8 (DN 15 and DN 18): Maximum span, 72 inches (1830 mm); minimum rod size, 3/8 inch (10 mm).
 - c. NPS 3/4 and NPS 7/8 (DN 20 and DN 22): Maximum span, 84 inches (2134 mm); minimum rod size, 3/8 inch (10 mm).
 - d. NPS 1 (DN 25): Maximum span, 96 inches (2440 mm); minimum rod size, 3/8 inch (10 mm).
5. Install hangers for horizontal, corrugated stainless-steel tubing with the following maximum spacing and minimum rod sizes:
 - a. NPS 3/8 (DN 10): Maximum span, 48 inches (1220 mm); minimum rod size, 3/8 inch (10 mm).
 - b. NPS 1/2 (DN 15): Maximum span, 72 inches (1830 mm); minimum rod size, 3/8 inch (10 mm).
 - c. NPS 3/4 (DN 20) and Larger: Maximum span, 96 inches (2440 mm); minimum rod, 3/8 inch (10 mm).

I. Connections

1. Connect to utility's gas main according to utility's procedures and requirements.
2. Install LPG piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
3. Install piping adjacent to appliances to allow service and maintenance of appliances.
4. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches (1830 mm) of each gas-fired appliances and equipment. Install union between valve and appliances or equipment.



5. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.
- J. Transport Truck Unloading Facility
1. Install transport truck unloading in a cast-in-place concrete base, 48 inches (1220 mm) square by 36 inches (914 mm) deep. Set top of concrete base at least 6 inches (150 mm) above finished grade.
 2. Install remote emergency shutoff station with cable release in an accessible location, a minimum of 25 feet (7.6 m) and a maximum of 100 feet (30 m) away from transport truck unloading.
 3. Install at least two 6-inch- (150-mm-) diameter metal bollards set in and filled with concrete on both sides of transport truck unloading. Bollard length shall be at least 48 inches (1220 mm) above and below grade, with concrete encasement a minimum of 12 inches (305 mm) in diameter.
- K. Storage Container Installation
1. Fill storage container to at least 80 percent capacity with butane **OR** propane, **as directed**.
 2. Install piping connections with swing joints or flexible connectors to allow for storage container settlement and for thermal expansion and contraction.
 3. Ground containers according to NFPA 780. Grounding is specified in Division 26 Section "Lightning Protection For Structures".
 4. Set storage containers in felt pads on concrete or steel saddles. Install corrosion protection at container-to-felt contact.
 5. Install tie-downs over storage containers on saddles with proper tension.
 6. Set concrete saddles on dowels set in concrete base. Anchor steel saddles to concrete base.
 7. Set storage container on concrete ballast base large enough to offset buoyancy of empty storage container immersed in water.
 8. Install tie-down straps over container anchored in ballast base and repair damaged coating.
 9. Backfill with a minimum coverage for underground or mounded storage containers according to NFPA 58.
 10. Backfill with pea gravel as required in Division 31 Section "Earth Moving".
 11. Install cathodic protection for storage container. Cathodic protection is specified in Division 26 Section "Cathodic Protection".
- L. Pump Installation
1. Install pumps with access space for periodic maintenance including removal of motors, impellers, and accessories.
 2. Set pumps on and anchored to concrete base.
 3. Install suction piping with minimum fittings and change of direction.
 4. Connect liquid suction to container, supply to vaporizer, and return line to container.
- M. Vaporizer Installation
1. Install vaporizer with access space for periodic maintenance.
 2. Set vaporizers on and anchor to concrete base.
 3. Connect liquid line from pump set, and vapor supply to distribution piping.
 4. Install backup connection from vapor space of container to inlet of pressure-regulating valve at vaporizer discharge to bypass the vaporizer during maintenance. Install shutoff valves to change source from vaporizer to storage container.
- N. Air Mixer With Vaporizer Installation
1. Install air mixer with vaporizer with access space for periodic maintenance.
 2. Set air mixer with vaporizer on and anchor to concrete base.
 3. Connect liquid line from pump set, and mixed gas supply to distribution piping.
 4. Install backup connection from vapor space of container to inlet of pressure-regulating valve at vaporizer discharge to bypass vaporizer during maintenance. Install shutoff valves to change source from vaporizer to storage container.



5. Replace filters at Final Completion if air mixer was operated during construction.
- O. Labeling And Identifying
1. Comply with requirements in Division 23 Section "Identification For Hvac Piping And Equipment" for piping and valve identification.
OR
Install detectable warning tape directly above gas piping, 12 inches (305 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.
- P. Painting
1. Comply with requirements in Division 07 for painting interior and exterior LPG piping.
 2. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components with factory-applied paint or protective coating.
 - a. Alkyd System: MPI EXT 5.1D.
 - 1) Prime Coat: Alkyd anticorrosive metal primer.
 - 2) Intermediate Coat (for a Premium Grade system): Exterior alkyd enamel matching topcoat.
 - 3) Topcoat: Exterior alkyd enamel (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - 4) Color: Gray, **unless directed otherwise**.
 3. Paint exposed, interior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components with factory-applied paint or protective coating.
 - a. Latex Over Alkyd Primer System: MPI INT 5.1Q.
 - 1) Prime Coat: Alkyd anticorrosive **OR** Quick-drying alkyd, **as directed**, metal primer.
 - 2) Intermediate Coat (for a Premium Grade system): Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
 - 4) Color: Gray, **unless directed otherwise**.
 - b. Alkyd System: MPI INT 5.1E.
 - 1) Prime Coat: Alkyd anticorrosive **OR** Quick-drying alkyd, **as directed**, metal primer.
 - 2) Intermediate Coat (for a Premium Grade system): Interior alkyd matching topcoat.
 - 3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
 - 4) Color: Gray, **unless directed otherwise**.
 4. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

Q. Concrete Bases

 1. Concrete Bases: Anchor equipment to concrete base according to seismic codes at Project.
 - a. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
 - b. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (451-mm) centers around the full perimeter of the base.
 - c. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - d. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - e. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - f. Use 3000-psig (20.7-MPa), **unless directed otherwise**, 28-day, compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-place Concrete".

R. Field Quality Control

 1. Perform tests and inspections.
 2. Tests and Inspections:



- a. Test, inspect, and purge LPG according to NFPA 58 and NFPA 54 **OR** the International Fuel Gas Code, **as directed**, and requirements of authorities having jurisdiction.
3. LPG piping will be considered defective if it does not pass tests and inspections.
4. Prepare test and inspection reports.

S. Outdoor Piping Schedule

1. Underground LPG liquid piping shall be one of the following:
 - a. Schedule 40 steel pipe with wrought-steel fittings and welded joints, or mechanical couplings. Coat pipe and fittings with protective coating for steel piping.
 - b. Annealed **OR** Drawn, **as directed**,-temper copper tube, Type K (Type A) **OR** Type L (Type B), **as directed**, with wrought-copper fittings and brazed joints. Coat pipe and fittings with protective coating for copper tubing.
2. Aboveground LPG liquid piping shall be one of the following:
 - a. NPS 2 (DN 50) and Smaller: Schedule 40 **OR** Schedule 80, **as directed**, steel pipe, malleable-iron threaded fittings and threaded and seal welded, **as directed**, joints. Coat pipe and fittings with protective coating for steel piping.
 - b. NPS 2-1/2 (DN 65) and Larger: Schedule 40, steel pipe with wrought-steel fittings and welded joints, or mechanical couplings. Coat pipe and fittings with protective coating for steel piping.
 - c. Annealed **OR** Drawn, **as directed**,-temper copper tube, Type L (Type B), with wrought-copper fittings and brazed joints. Coat pipe and fittings with protective coating for copper tubing.
3. Underground LPG vapor piping shall be one of the following:
 - a. PE pipe and fittings joined by heat-fusion, or mechanical couplings; service-line risers with tracer wire terminated in an accessible location.
 - b. Schedule 40, steel pipe with wrought-steel fittings and welded joints, or mechanical couplings. Coat pipe and fittings with protective coating for steel piping.
 - c. Annealed **OR** Drawn, **as directed**,-temper copper tube, Type L (Type B) with wrought-copper fittings and brazed joints. Coat pipe and fittings with protective coating for copper tubing.
4. Aboveground LPG vapor piping shall be one of the following:
 - a. Schedule 40, steel pipe with malleable-iron fittings and threaded joints.
 - b. Schedule 40, steel pipe with wrought-steel fittings and welded joints, or mechanical couplings.
 - c. Annealed **OR** Drawn, **as directed**,-temper copper tube, Type L (Type B), with wrought-copper fittings and brazed joints. Coat pipe and fittings with protective coating for copper tubing.
5. Branch Piping in Cast-in-Place Concrete to Single Appliance: Annealed-temper copper, with wrought-copper fittings and brazed **OR** flared, **as directed**, joints. Install piping embedded in concrete with no joints in concrete.
6. Containment Conduit: Schedule 40, steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

T. Indoor Piping Schedule For System Pressures Less Than 0.5 psig (3.45 kPa)

1. Aboveground, branch piping NPS 1 (DN 25) and smaller shall be one of the following:
 - a. Corrugated stainless-steel tubing with mechanical fittings having socket or threaded ends to match adjacent piping.
 - b. Annealed-temper, tin-lined copper tube with flared joints and fittings.
 - c. Annealed-temper copper tube with wrought-copper fittings and brazed **OR** flared, **as directed**, joints.
 - d. Aluminum tube with flared fittings and joints.
 - e. Schedule 40, steel pipe with malleable-iron fittings and threaded joints.
2. Aboveground, distribution piping shall be one of the following:
 - a. Schedule 40, steel pipe with malleable-iron fittings and threaded joints.
 - b. Schedule 40, steel pipe with wrought-steel fittings and welded joints.



- c. Drawn-temper copper tube, Type L (Type B) with wrought-copper fittings and brazed joints.
 3. Underground, below building, piping shall be one of the following:
 - a. Schedule 40, steel pipe with malleable-iron fittings and threaded joints.
 - b. Schedule 40, steel pipe with wrought-steel fittings and welded joints.
 4. Containment Conduit: Schedule 40, steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
 5. Containment Conduit Vent Piping: Schedule 40, steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.
- U. Indoor Piping Schedule For System Pressures More Than 0.5 psig (3.45 kPa) And Less Than 5 psig (34.5 kPa)
 1. Aboveground, branch piping NPS 1 (DN 25) and smaller shall be one of the following:
 - a. Corrugated stainless-steel tubing with mechanical fittings having socket or threaded ends to match adjacent piping.
 - b. Annealed-temper, tin-lined copper tube with flared joints and fittings.
 - c. Annealed-temper copper tube, Type L (Type B) with wrought-copper fittings and brazed **OR** flared, **as directed**, joints.
 - d. Aluminum tube with flared fittings and joints.
 - e. Schedule 40, steel pipe with malleable-iron fittings and threaded joints.
 2. Aboveground, distribution piping shall be one of the following:
 - a. Schedule 40, steel pipe with malleable-iron fittings and threaded joints.
 - b. Schedule 40, steel pipe with steel welding fittings and welded joints.
 - c. Drawn-temper copper tube, Type L (Type B) **OR** Type G, **as directed**, with wrought-copper fittings and brazed joints.
 3. Underground, below building, piping shall be one of the following:
 - a. Schedule 40, steel pipe with malleable-iron fittings and threaded joints.
 - b. Schedule 40, steel pipe with wrought-steel fittings and welded joints.
 4. Containment Conduit: Schedule 40, steel pipe with wrought-steel fittings and welded joints. Coat underground pipe and fittings with protective coating for steel piping.
 5. Containment Conduit Vent Piping: Schedule 40, steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.
- V. Indoor Piping Schedule For System Pressures More Than 5 psig (34.5 kPa)
 1. Aboveground Piping: Maximum operating pressure more than 5 psig (34.5 kPa).
 2. Aboveground, Branch Piping: Schedule 40, steel pipe with steel welding fittings and welded joints.
 3. Aboveground, distribution piping shall be one of the following:
 - a. Schedule 40, steel pipe with steel welding fittings and welded joints.
 - b. Drawn-temper copper tube, Type L (Type B) **OR** Type G, **as directed**, with wrought-copper fittings and brazed joints.
 4. Underground, below building, piping shall be one of the following:
 - a. Schedule 40, steel pipe with malleable-iron fittings and threaded joints.
 - b. Schedule 40, steel pipe with wrought-steel fittings and welded joints.
 5. Containment Conduit: Schedule 40, steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
 6. Containment Conduit Vent Piping: Schedule 40, steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.
- W. Underground Manual Gas Shutoff Valve Schedule
 1. Connections to Existing Gas Piping: Use valve and fitting assemblies made for tapping utility's gas mains and listed by an NRTL.
 2. Underground Vapor Piping:
 - a. PE valves.



- b. NPS 2 (DN 50) and Smaller: Bronze, lubricated **OR** nonlubricated, **as directed**, plug valves.
- c. NPS 2-1/2 (DN 65) and Larger: Cast-iron, lubricated **OR** nonlubricated, **as directed**, plug valves.

X. Aboveground Manual Gas Shutoff Valve Schedule

- 1. Aboveground Liquid Piping:
 - a. Two-piece, full **OR** regular, **as directed**, -port, bronze ball valves with bronze trim.
- 2. Valves for pipe NPS 2 (DN 50) and smaller at service meter shall be one of the following:
 - a. One-piece, bronze ball valve with bronze trim.
 - b. Two-piece, full **OR** regular, **as directed**, -port, bronze ball valves with bronze trim.
 - c. Bronze plug valve.
- 3. Valves for pipe NPS 2-1/2 (DN 65) and larger at service meter shall be one of the following:
 - a. Two-piece, full **OR** regular, **as directed**, -port, bronze ball valves with bronze trim.
 - b. Bronze plug valve.
 - c. Cast-iron, nonlubricated plug valve.
- 4. Distribution piping valves for pipe NPS 2 (DN 50) and smaller shall be one of the following:
 - a. One-piece, bronze ball valve with bronze trim.
 - b. Two-piece, full **OR** regular, **as directed**, -port, bronze ball valves with bronze trim.
 - c. Bronze plug valve.
- 5. Distribution piping valves for pipe NPS 2-1/2 (DN 65) and larger shall be one of the following:
 - a. Two-piece, full **OR** regular, **as directed**, -port, bronze ball valves with bronze trim.
 - b. Bronze plug valve.
 - c. Cast-iron, nonlubricated **OR** lubricated, **as directed**, plug valve.
- 6. Valves in branch piping for single appliance shall be one of the following:
 - a. One-piece, bronze ball valve with bronze trim.
 - b. Two-piece, full **OR** regular, **as directed**, -port, bronze ball valves with bronze trim.
 - c. Bronze plug valve.

END OF SECTION 23 11 23 00c



Task	Specification	Specification Description
23 11 23 00	22 05 23 00	Piped Utilities Basic Materials And Methods
23 11 23 00	22 11 23 39	Water Supply Wells
23 11 23 00	22 05 76 00	Sanitary Sewerage
23 11 23 00	07 63 00 00	Common Work Results for Fire Suppression
23 11 23 00	07 63 00 00a	Common Work Results for Plumbing
23 11 23 00	07 63 00 00b	Common Work Results for HVAC
23 12 13 00	22 05 23 00	Piped Utilities Basic Materials And Methods
23 12 23 00	22 05 23 00	Piped Utilities Basic Materials And Methods
23 13 13 13	22 05 23 00	Piped Utilities Basic Materials And Methods
23 13 13 23	22 05 23 00	Piped Utilities Basic Materials And Methods
23 13 23 16	22 05 23 00	Piped Utilities Basic Materials And Methods
23 13 23 26	22 05 23 00	Piped Utilities Basic Materials And Methods
23 13 33 00	22 05 23 00	Piped Utilities Basic Materials And Methods



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SECTION 23 21 13 23 - FACILITY FUEL-OIL PIPING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for facility fuel-oil piping. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes fuel-oil, fuel-oil and diesel-fuel-oil, and diesel-fuel-oil distribution systems and the following:
 - a. Pipes, tubes, and fittings.
 - b. Piping and tubing joining materials.
 - c. Piping specialties.
 - d. Valves.
 - e. Vertical, steel, fuel-oil ASTs.
 - f. Horizontal, steel, fuel-oil ASTs.
 - g. Containment-dike, steel, fuel-oil ASTs.
 - h. Insulated, steel, fuel-oil ASTs.
 - i. Concrete-vaulted, steel, fuel-oil ASTs.
 - j. Steel, fuel-oil USTs with STI-P3.
 - k. Composite, steel, fuel-oil USTs.
 - l. Jacketed, steel, fuel-oil USTs.
 - m. FRP fuel-oil USTs.
 - n. Fuel-oil AST accessories.
 - o. Fuel-oil UST accessories.
 - p. Fuel-oil storage tank piping specialties.
 - q. Fuel-oil storage tank pumps.
 - r. Fuel-transfer pumps.
 - s. Fuel maintenance system.
 - t. Liquid-level gage system.
 - u. Leak-detection and monitoring system.
 - v. Mechanical sleeve seals.
 - w. Grout.
 - x. Concrete bases.

C. Definitions

1. AST: Aboveground storage tank.
2. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
3. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
4. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
5. FPM: Vinylidene fluoride-hexafluoropropylene copolymer rubber.
6. FRP: Glass-fiber-reinforced plastic.
7. UST: Underground storage tank.

D. Performance Requirements

1. Maximum Operating-Pressure Ratings: 3-psig (21-kPa) fuel-oil supply pressure at oil-fired appliances.



2. Delegated Design: Design restraint and anchors for fuel-oil piping, ASTs, and equipment, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
3. Seismic Performance: Factory-installed support attachments for AST shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event, **as directed**."

E. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: For facility fuel-oil piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.
3. Delegated-Design Submittal: For fuel-oil piping and equipment indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - a. Detail fabrication and assembly of anchors and seismic restraints.
 - b. Design Calculations: Calculate requirements for selecting seismic restraints.
 - c. Detail fabrication and assembly of pipe anchors, hangers, supports for multiple pipes, and attachments of the same to building structure.
4. Seismic Qualification Certificates: For ASTs, accessories, and components, from manufacturer.
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
5. Brazing certificates.
6. Welding certificates.
7. Field quality-control reports.
8. Operation and Maintenance Data.
9. Warranty: Sample of special warranty.

F. Quality Assurance

1. Brazing: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
2. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
3. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
4. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
5. Comply with ASME B31.9, "Building Services Piping," for fuel-oil piping materials, installation, testing, and inspecting.
6. Comply with requirements of the EPA and of state and local authorities having jurisdiction. Include recording of fuel-oil storage tanks and monitoring of tanks and piping.

G. Delivery, Storage, And Handling

1. Lift and support fuel-oil storage tanks only at designated lifting or supporting points, as shown on Shop Drawings. Do not move or lift tanks unless empty.
2. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.



3. Store pipes and tubes with protective PE coating to avoid damaging the coating and to protect from direct sunlight.
4. Store PE pipes and valves protected from direct sunlight.

H. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-oil storage tanks and flexible, double-containment piping and related equipment that fail in materials or workmanship within specified warranty period.
 - a. Storage Tanks:
 - 1) Failures include, but are not limited to, the following when used for storage of fuel oil at temperatures not exceeding 150 deg F (66 deg C):
 - a) Structural failures including cracking, breakup, and collapse.
 - b) Corrosion failure including external and internal corrosion of steel tanks.
 - 2) Warranty Period: 30 years from date of Final Completion.
 - b. Flexible, Double-Containment Piping and Related Equipment:
 - 1) Failures due to defective materials or workmanship for materials installed together, including piping, dispenser sumps, entry boots, and sump mounting adapters.
 - 2) Warranty Period: 10 **OR** 30, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Pipes, Tubes, And Fittings

1. See Part 1.3 piping schedule articles for where pipes, tubes, fittings, and joining materials are applied in various services.
2. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
 - a. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
 - b. Wrought-Steel Welding Fittings: ASTM A 234/A 234M, for butt and socket welding.
 - c. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
 - d. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
 - 1) Material Group: 1.1.
 - 2) End Connections: Threaded or butt welding to match pipe.
 - 3) Lapped Face: Not permitted underground.
 - 4) Gasket Materials: Asbestos free, ASME B16.20 metallic, or ASME B16.21 nonmetallic, gaskets compatible with fuel oil.
 - 5) Bolts and Nuts: ASME B18.2.1, cadmium-plated steel.
 - e. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
 - 1) Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.
3. Drawn-Temper Copper Tube: Comply with ASTM B 88, Type K (ASTM B 88M, Type A) **OR** ASTM B 88, Type L (ASTM B 88M, Type B), **as directed**.
 - a. Copper Fittings: ASME B16.22, wrought copper, streamlined pattern.
 - b. Bronze Flanges and Flanged Fittings: ASME B16.24, Class 150.
 - 1) Gasket Material: Asbestos free, ASME B16.20, metallic, or ASME B16.21 nonmetallic, gaskets compatible with fuel oil.
 - 2) Bolts and Nuts: ASME B18.2.1, cadmium-plated steel.
4. Annealed-Temper Copper Tube: Comply with ASTM B 88, Type K (ASTM B 88M, Type A) **OR** ASTM B 88, Type L (ASTM B 88M, Type B), **as directed**.
 - a. Copper Fittings: ASME B16.22, wrought copper, streamlined pattern.
 - b. Flare Fittings: Comply with ASME B16.26 and SAE J513.
 - 1) Copper fittings with long nuts.
 - 2) Metal-to-metal compression seal without gasket.
 - 3) Dryseal threads complying with ASME B1.20.3.



B. Double-Containment Pipe And Fittings

1. Flexible, Double-Containment Piping: Comply with UL 971.
 - a. Pipe Materials: PVDF complying with ASTM D 3222 for carrier pipe with mechanical couplings to seal carrier, and PE pipe complying with ASTM D 4976 for containment piping.
 - b. Fiberglass **OR** PE, **as directed**, sumps.
 - c. Watertight sump entry boots, pipe adapters with test ports and tubes, coaxial fittings, and couplings.
 - d. Minimum Operating Pressure Rating: 10 psig (69 kPa).
 - e. Plastic to Steel Pipe Transition Fittings: Factory-fabricated fittings with plastic end matching or compatible with carrier piping, and steel pipe end complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
 - f. Include design and fabrication of double-containment pipe and fitting assemblies with provision for field installation of cable leak-detection system in annular space between carrier and containment piping.
2. Rigid, Double-Containment Piping: Comply with UL 971.
 - a. RTRP: ASTM D 2996 or ASTM D 2997 carrier and containment piping and mechanical couplings to seal carrier and containment piping or individually bonded joints.
 - 1) Minimum Operating-Pressure Rating for RTRP NPS 2 and NPS 3 (DN 50 and DN 80): 150 psig (1035 kPa).
 - 2) Minimum Operating-Pressure Rating for RTRP NPS 4 and NPS 6 (DN 100 and DN 150): 125 psig (860 kPa). Compliance with UL 971 is not required for NPS 6 (DN 150) and larger piping.
 - 3) Fittings: RTRF complying with ASTM D 2996 or ASTM D 2997, and made by RTRP manufacturer; watertight sump entry boots, termination, or other end fittings.
 - b. Include design and fabrication of double-containment pipe and fitting assemblies with provision for field installation of cable leak-detection system in annular space between carrier and containment piping.

C. Piping Specialties

1. Flexible Connectors: Comply with UL 567.
 - a. Metallic Connectors:
 - 1) Listed and labeled for aboveground and underground applications by an NRTL acceptable to authorities having jurisdiction.
 - 2) Stainless-steel bellows with woven, flexible, bronze or stainless-steel, wire-reinforcing protective jacket.
 - 3) Minimum Operating Pressure: 150 psig (1035 kPa).
 - 4) End Connections: Socket, flanged, or threaded end to match connected piping.
 - 5) Maximum Length: 30 inches (762 mm).
 - 6) Swivel end, 50-psig (345-kPa) maximum operating pressure.
 - 7) Factory-furnished anode.
 - b. Nonmetallic Connectors:
 - 1) Listed and labeled for underground applications by an NRTL acceptable to authorities having jurisdiction.
 - 2) PTFE bellows with woven, flexible, bronze or stainless-steel, wire-reinforcing protective jacket.
 - 3) Minimum Operating Pressure: 150 psig (1035 kPa).
 - 4) End Connections: Socket, flanged, or threaded end to match connected piping.
 - 5) Maximum Length: 30 inches (762 mm).
 - 6) Swivel end, 50-psig (345-kPa) maximum operating pressure.
 - 7) Factory-furnished anode.
2. Y-Pattern Strainers:
 - a. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
 - b. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.



- c. Strainer Screen: 60 **OR** 80, **as directed**, -mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
 - d. CWP Rating: 125 psig (860 kPa).
 3. Basket Strainers:
 - a. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
 - b. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.
 - c. Strainer Screen: 60 **OR** 80, **as directed**, -mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
 - d. CWP Rating: 125 psig (860 kPa).
 4. T-Pattern Strainers:
 - a. Body: Ductile or malleable iron with removable access coupling and end cap for strainer maintenance.
 - b. End Connections: Grooved ends.
 - c. Strainer Screen: 60 **OR** 80, **as directed**, -mesh startup strainer, and perforated stainless-steel basket with 57 percent free area.
 - d. CWP Rating: 750 psig (5170 kPa).
 5. Manual Air Vents:
 - a. Body: Bronze.
 - b. Internal Parts: Nonferrous.
 - c. Operator: Screwdriver or thumbscrew.
 - d. Inlet Connection: NPS 1/2 (DN 15).
 - e. Discharge Connection: NPS 1/8 (DN 6).
 - f. CWP Rating: 150 psig (1035 kPa).
 - g. Maximum Operating Temperature: 225 deg F (107 deg C).
- D. Joining Materials
 1. Joint Compound and Tape: Suitable for fuel oil.
 2. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
 3. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F (540 deg C) complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.
 4. Bonding Adhesive for Fiberglass Piping: As recommended by fiberglass piping manufacturer.
- E. Manual Fuel-Oil Shutoff Valves
 1. See valve schedule in Part 1.3 for where each valve type is applied in various services.
 2. General Requirements for Metallic Valves, NPS 2 (DN 50) and Smaller for Liquid Service: Comply with UL 842.
 - a. CWP Rating: 125 psig (860 kPa).
 - b. Threaded Ends: Comply with ASME B1.20.1.
 - c. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
 - d. Tamperproof Feature: Locking feature for valves indicated in the valve schedule.
 - e. Service Mark: Initials "WOG" shall be permanently marked on valve body.
 3. General Requirements for Metallic Valves, NPS 2-1/2 (DN 65) and Larger: Comply with UL 842.
 - a. CWP Rating: 125 psig (860 kPa).
 - b. Flanged Ends: Comply with ASME B16.5 for steel flanges.
 - c. Tamperproof Feature: Locking feature for valves indicated in the valve schedule.
 - d. Service Mark: Initials "WOG" shall be permanently marked on valve body.
 4. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.
 - a. Body: Bronze, complying with ASTM B 584.
 - b. Ball: Chrome-plated brass.
 - c. Stem: Bronze; blowout proof.
 - d. Seats: Reinforced TFE; blowout proof.
 - e. Packing: Separate packnut with adjustable-stem packing threaded ends.



- f. Ends: Threaded, flared, or socket as indicated in the valve schedule.
- g. CWP Rating: 600 psig (4140 kPa).
- h. Service Mark: Initials "WOG" shall be permanently marked on valve body.
- 5. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.
 - a. Body: Bronze, complying with ASTM B 584.
 - b. Ball: Chrome-plated bronze.
 - c. Stem: Bronze; blowout proof.
 - d. Seats: Reinforced TFE; blowout proof.
 - e. Packing: Threaded-body packnut design with adjustable-stem packing.
 - f. Ends: Threaded, flared, or socket as indicated in the valve schedule.
 - g. CWP Rating: 600 psig (4140 kPa).
 - h. Service Mark: Initials "WOG" shall be permanently marked on valve body.
- 6. Two-Piece, Regular-Port Bronze Ball Valves with Bronze Trim: MSS SP-110.
 - a. Body: Bronze, complying with ASTM B 584.
 - b. Ball: Chrome-plated bronze.
 - c. Stem: Bronze; blowout proof.
 - d. Seats: Reinforced TFE.
 - e. Packing: Threaded-body packnut design with adjustable-stem packing.
 - f. Ends: Threaded, flared, or socket as indicated in the valve schedule.
 - g. CWP Rating: 600 psig (4140 kPa).
 - h. Service Mark: Initials "WOG" shall be permanently marked on valve body.

F. Specialty Valves

- 1. Pressure Relief Valves: Comply with UL 842.
 - a. Listed and labeled for fuel-oil service by an NRTL acceptable to authorities having jurisdiction.
 - b. Body: Brass, bronze, or cast steel.
 - c. Springs: Stainless steel, interchangeable.
 - d. Seat and Seal: Nitrile rubber.
 - e. Orifice: Stainless steel, interchangeable.
 - f. Factory-Applied Finish: Baked enamel.
 - g. Maximum Inlet Pressure: 150 psig (1035 kPa).
 - h. Relief Pressure Setting: 60 psig (414 kPa).
- 2. Oil Safety Valves: Comply with UL 842.
 - a. Listed and labeled for fuel-oil service by an NRTL acceptable to authorities having jurisdiction.
 - b. Body: Brass, bronze, or cast steel.
 - c. Springs: Stainless steel.
 - d. Seat and Diaphragm: Nitrile rubber.
 - e. Orifice: Stainless steel, interchangeable.
 - f. Factory-Applied Finish: Baked enamel.
 - g. Manual override port.
 - h. Maximum Inlet Pressure: 60 psig (414 kPa).
 - i. Maximum Outlet Pressure: 3 psig (21 kPa).
- 3. Emergency Shutoff Valves: Comply with UL 842.
 - a. Listed and labeled for fuel-oil service by an NRTL acceptable to authorities having jurisdiction.
 - b. Single **OR** Double, **as directed**, poppet valve.
 - c. Body: ASTM A 126, cast iron.
 - d. Disk: FPM.
 - e. Poppet Spring: Stainless steel.
 - f. Stem: Plated brass.
 - g. O-Ring: FPM.
 - h. Packing Nut: PTFE-coated brass.
 - i. Fusible link to close valve at 165 deg F (74 deg C).



- j. Thermal relief to vent line pressure buildup due to fire.
- k. Air test port.
- l. Maximum Operating Pressure: 0.5 psig (3.45 kPa).
- 4. Mechanical Leak Detector: Comply with UL 842.
 - a. Listed and labeled for fuel-oil service by an NRTL acceptable to authorities having jurisdiction.
 - b. Body: ASTM A 126, cast iron.
 - c. O-Rings: Elastomeric compatible with fuel oil.
 - d. Piston and Stem Seals: PTFE.
 - e. Stem and Spring: Stainless steel.
 - f. Piston Cylinder: Burnished brass.
 - g. Indicated Leak Rate: Maximum 3 gph (3 mL/s) at 10 psig (69 kPa).
 - h. Leak Indication: Reduced flow.
- G. Vertical, Steel, Fuel-Oil AST
 - 1. Description:
 - a. UL 142, single-wall, vertical, steel tank.
 - b. UL 142 and STI F921, **as directed**, double-wall, vertical, steel tank; with primary- and secondary-containment walls and interstitial space.
 - 2. Construction: Fabricated with welded, carbon steel suitable for operation at atmospheric pressure and for storing fuel oil with specific gravity up to 1.1 and maintained temperature up to 150 deg F (66 deg C).
- H. Horizontal, Steel, Fuel-Oil AST
 - 1. Description:
 - a. UL 142, single-wall, horizontal, steel tank.
 - b. UL 142 and STI F921, **as directed**, double-wall, horizontal, steel tank; with primary- and secondary-containment walls and interstitial space.
 - 2. Construction: Fabricated with welded, carbon steel; suitable for operation at atmospheric pressure and for storing fuel oil with specific gravity up to 1.1 and with maintained temperature up to 150 deg F (66 deg C).
 - 3. Supports:
 - a. Manufacturer's standard structural steel welded to tank.
 - b. Manufacturer's standard type and number, steel or cast-iron cradles, for field installation.
- I. Containment-Dike, Steel, Fuel-Oil AST
 - 1. Description: UL 142 and STI F911, single-wall, horizontal, steel tank; with open or enclosed **OR** enclosed, **as directed**, secondary-containment dike with capacity greater than tank capacity.
 - 2. Construction: Fabricated with welded, carbon steel; suitable for operation at atmospheric pressure and for storing fuel oil with specific gravity up to 1.1 and with maintained temperature up to 150 deg F (66 deg C).
- J. Insulated, Steel, Fuel-Oil AST
 - 1. Description: UL 142 and UL 2085 **OR** UL 142, UL 2085, and STI F941, **as directed**, thermally insulated and fire-resistant, double-wall, horizontal, steel tank; with primary- and secondary-containment walls and insulation and with interstitial space.
 - 2. Construction: Fabricated with welded, carbon steel and insulation; suitable for operation at atmospheric pressure and for storing fuel oil with specific gravity up to 1.1 and with test temperature according to UL 2085.
- K. Concrete-Vaulted, Steel, Fuel-Oil AST
 - 1. Description: UL 142 and UL 2085 **OR** UL 142, UL 2085, and STI F941, **as directed**; thermally insulated, fire-resistant and protected, double-wall, horizontal, steel tank; with primary- and secondary-containment walls and insulation and with interstitial space.



2. Construction: Fabricated with welded, carbon steel and insulation and encased in concrete that will protect from bullets; suitable for operation at atmospheric pressure and for storing fuel oil with specific gravity up to 1.1 and with test temperature according to UL 2085.
- L. Steel, Fuel-Oil UST With STI-P3
1. Description: UL 58 and STI P3, double-wall, horizontal, steel tank; with cathodic protection and electrical isolation.
 - a. Containment Method: STI-P3, Type I, with primary and secondary walls in contact **OR** Type II, with interstitial space, **as directed**.
 2. Construction: Fabricated with welded steel; suitable for operation at atmospheric pressure and for storing liquids with specific gravity up to 1.1; fabricated for the following loads:
 - a. Depth of Bury: 3 feet (1 m) from top of tank to finished surface.
 - b. External Hydrostatic Pressure: To withstand general buckling with safety factor of 2:1 if hole is fully flooded.
 - c. Surface Loads: AASHTO's "Specifications for Highway Bridges," H-20 axle loads of 32,000 lb (14 515 kg).
 3. Corrosion-Protection System: Protect tank and factory-installed piping by engineered and installed corrosion-protection system according to STI P3, with means of monitoring cathodic protection.
- M. Composite, Steel, Fuel-Oil UST
1. Description: UL 58, double-wall, horizontal, composite tank; with coating complying with UL 1746 and STI F894.
 - a. Containment Method: STI F894, Type I, with primary and secondary walls in contact **OR** Type II, with interstitial space, **as directed**.
 2. Construction: Fabricated with welded steel and factory coating according to UL 1746 and STI F894; suitable for operation at atmospheric pressure and for storing liquids with specific gravity up to 1.1; fabricated for the following loads:
 - a. Depth of Bury: 3 feet (1 m) from top of tank to finished surface.
 - b. External Hydrostatic Pressure: To withstand general buckling with safety factor of 2:1 if hole is fully flooded.
 - c. Surface Loads: AASHTO's "Specifications for Highway Bridges," H-20 axle loads of 32,000 lb (14 515 kg).
- N. Jacketed, Steel, Fuel-Oil UST
1. Description: Jacketed, horizontal, steel tank; complying with UL 58, and with plastic or fiberglass jacket and corrosion-protection system according to UL 1746 and STI F922, **as directed**.
 2. Construction: Tank fabricated with welded carbon steel, and jacket fabricated with plastic or fiberglass and vacuum-sealed interstitial space; suitable for operation at atmospheric pressure and with integral leak-detection device. Tank fabricated for the following loads:
 - a. Depth of Bury: 3 feet (1 m) from top of tank to finished surface.
 - b. External Hydrostatic Pressure: To withstand general buckling with safety factor of 2:1 if hole is fully flooded.
 - c. Surface Loads: AASHTO's "Specifications for Highway Bridges," H-20 axle loads of 32,000 lb (14 515 kg).
- O. FRP Fuel-Oil UST
1. Description: Horizontal, FRP UST; UL 1316, double wall, with interstitial space and integral, hydrostatic, leak-detection and monitoring system, **as directed**.
 2. Construction: Fabricated with fiberglass-reinforced polyester resins; suitable for operation at atmospheric pressure; fabricated for the following loads:
 - a. Depth of Bury: 3 feet (1 m) from top of tank to finished surface.
 - b. External Hydrostatic Pressure: To withstand general buckling with safety factor of 2:1 if hole is fully flooded.



- c. Surface Loads: AASHTO's "Specifications for Highway Bridges," H-20 axle loads of 32,000 lb (14 515 kg).

P. Shop Painting Of AST

1. Apply manufacturer's standard prime coat to exterior steel surface of AST and supports.
2. Prepare exterior steel surface of AST and tank supports.
3. Shop Cleaning: After fabrication, blast clean according to SSPC-SP 6/NACE No. 3 **OR** SSPC-SP 10/NACE No. 2, **as directed**.
4. After cleaning, remove dust or residue from cleaned surfaces.
5. If surface develops rust before prime coat is applied, repeat surface preparation.
6. Apply manufacturer's standard prime coat to shop-cleaned, dry surface same day as surface preparation.
7. Apply manufacturer's standard two-component, epoxy finish coats.

Q. Fuel-Oil AST Accessories

1. Tank Manholes (for horizontal tanks and some vertical tanks): 22-inch- (560-mm-) minimum diameter; bolted, flanged, and gasketed; centered on top of tank.
2. Tank Manholes (for vertical tanks): 22-inch- (560-mm-) minimum diameter; bolted, flanged, and gasketed; on top and at side of tank.
3. For Horizontal Tanks: Threaded pipe connection fittings on top of tank, for fill, supply, return, vent, sounding, and gaging. Include cast-iron plugs for shipping.
4. For Vertical Tanks: Threaded pipe connection fittings on top or sides of tank as indicated, for fill, supply, return, vent, sounding, and gaging. Include cast-iron plugs for shipping.
5. Striker Plates: Inside tank, on bottom below fill, vent, sounding, gage, and other tube openings.
6. Lifting Lugs: For handling and installation.
7. Ladders (for horizontal tanks and some vertical tanks): Carbon-steel ladder inside tank, anchored to top and bottom, and located as indicated. Include reinforcement of tank at bottom of ladder.
8. Ladders (for vertical tanks): Carbon-steel ladder outside tank, anchored to top and side wall. Comply with requirements in Division 05 Section "Metal Fabrications" for exterior steel ladder.
 - a. Cage: Include welded steel cage around ladders for tanks 20 feet (6 m) high or higher.
9. Supply Tube: Extension of supply piping fitting into tank, terminating 6 inches (150 mm) above tank bottom and cut at a 45-degree angle (1:1 slope).
10. Sounding and Gage Tubes: Extension of fitting into tank, terminating 6 inches (150 mm) above tank bottom and cut at a 45-degree angle (1:1 slope).

R. Fuel-Oil UST Accessories

1. Tank Manholes: 22-inch- (560-mm-) minimum diameter; bolted, flanged, and gasketed, with extension collar; for access to inside of tank.
2. Steel Tank Masonry Supports: Two 6-by-6-by-3/8-inch (150-by-150-by-10-mm) steel angles, 72 inches (1800 mm) long, located longitudinally on tank on each side of manholes and continuously welded in place.
3. Threaded pipe connection fittings on top of tank for fill, supply, return, vent, sounding, and gaging, in locations and of sizes indicated. Include cast-iron plugs for shipping.
4. Striker Plates: Inside tank, on bottom below fill, vent, sounding, gage, and other tube openings.
5. Lifting Lugs: For handling and installation.
6. Ladders: Carbon-steel ladder inside tank, anchored to top and bottom. Include reinforcement of tank at bottom of ladder.
7. Supply Tube: Extension of supply piping fitting into tank, terminating 6 inches (150 mm) above tank bottom and cut at a 45-degree angle (1:1 slope).
8. Sounding and Gage Tubes: Extension of fitting into tank, terminating 6 inches (150 mm) above tank bottom and cut at a 45-degree angle (1:1 slope).
9. Containment Sumps: Fiberglass **OR** PE, **as directed**, with sump base, add-on extension pieces as required, sump top, lid, and gasket-seal joints. Include sump entry boots for pipe penetrations through sidewalls.



10. Sump Entry Boots: Two-part pipe fitting for field assembly and of size required to fit over pipe. Include gaskets shaped to fit sump sidewall, sleeves, seals, and clamps as required for liquid-tight pipe penetrations.
11. Anchor Straps: Storage tank manufacturer's standard anchoring system, with straps, strap-insulating material, cables and turnbuckles, of strength at least one and one-half times maximum uplift force of empty tank without backfill in place.
12. Filter Mat: Geotextile woven or spun filter fabric, in 1 or more layers, for minimum total weight of 3 oz./sq. yd. (101.7 g/sq. m).
13. Overfill Prevention Valves: Factory fabricated or shop or field assembled from manufacturer's standard components. Include drop tube, cap, fill nozzle adaptor, check valve mechanism or other devices, and vent if required to restrict flow at 95 percent of tank capacity and to provide complete shutoff of filling at 98 **OR** 99, **as directed**, percent of tank capacity.

S. Fuel-Oil Storage Tank Piping Specialties

1. Fitting Materials: Cast iron, malleable iron, brass, or corrosion-resistant metal; suitable for fuel-oil service.
 - a. Surface, Flush-Mounted Fittings: Waterproof and suitable for truck traffic.
 - b. Aboveground-Mounted Fittings: Weatherproof.
2. Spill-Containment Fill Boxes: Flush mounting, with drainage feature to drain oil into tank, threaded fill-pipe connection, and wrench operation.
3. Fill Boxes: Flush mounting, with threaded fill-pipe connection and wrench operation.
4. Locking Fill Boxes: Flush mounting, with locking-type inner fill cap for standard padlock and threaded fill-pipe connection.
5. Supply and Sounding Drop Tubes: Fuel-oil supply piping or fitting, inside tank, terminating 6 inches (150 mm) above bottom of tank, and with end cut at a 45-degree angle (1:1 slope).
6. Pipe Adapters and Extensions: Compatible with piping and fittings.
7. Suction Strainers and Check Valves: Bronze or corrosion-resistant metal components.
8. Foot Valves and Antisiphon Valves: Poppet-type, bronze or corrosion-resistant metal components.
9. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.
10. Metal Manholes: 22-inch- (560-mm-) minimum diameter frame and cover. Furnish manhole units of adequate size for access to fittings if size is not indicated.
11. Monitoring Well Caps: Locking pipe plug and manhole.

T. Submersible Fuel-Oil Pumps

1. Description: Comply with UL 79, UL 87, and UL 343.
 - a. Listed and labeled for fuel-oil service by an NRTL acceptable to authorities having jurisdiction.
 - b. Impeller: Turbine.
 - c. Housing and Volute: Cast iron.
 - d. Bearings: Bronze, self-lubricating.
 - e. Seals: Mechanical.
 - f. Shaft: Polished steel.
 - g. Suspension Piping: Telescoping to accommodate tank diameter and depth of bury.
 - h. Base: Steel.
 - i. Pressure Relief: Built in.
 - j. Discharge Check Valve: Built in.
 - k. Drive: Direct, close coupled.
2. Controls: Pump controller panel complying with UL 353 and UL 508C and with interlock and terminals for connections to fuel-oil-burning equipment **OR** diesel-driven fire pumps **OR** diesel-driven emergency generators **OR** diesel-fuel-oil dispenser, **as directed**.
 - a. Run pumps to maintain minimum manifold pressure with outdoor-air temperature less than 60 deg F (16 deg C).



- b. Run pumps on seven-day schedule.
 - c. Stage pumps on pressure at a common supply manifold.
 - d. Alternate pumps to equalize run time.
 - e. Alarm motor failure.
 - f. Manual reset dry-run protection. Stop pumps if fuel level falls below pump suction.
 - g. Deenergize and alarm pump locked rotor condition.
 - h. Alarm open circuit, high and low voltage.
 - i. Indicating lights for power on, run, and off normal conditions.
 - j. Interface with automatic control system is specified in Division 23 Section "Instrumentation And Control For Hvac" to control and indicate the following:
 - 1) Start/stop pump set when required by schedule, fuel-fired appliance operation, day tank level control, or weather conditions.
 - 2) Operating status.
 - 3) Alarm off-normal status.
3. Motor: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
- a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - b. Thermal-Overload Protection: Motor-winding temperature sensor.
 - c. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 22.

U. Simplex Fuel-Oil Transfer Pumps

1. Description: Comply with UL 343, and HI M109.
 - a. Listed and labeled for fuel-oil service by an NRTL acceptable to authorities having jurisdiction.
 - b. Type: Positive-displacement, rotary type.
 - c. Impeller: Steel gear with crescent **OR** Carbon vane, **as directed**.
 - d. Housing: Cast-iron foot mounted.
 - e. Bearings: Bronze, self-lubricating.
 - f. Shaft: Polished steel.
 - g. Seals: Mechanical.
 - h. Base: Steel.
 - i. Pressure Relief: Built in.
 - j. Discharge Check Valve: Built in.
2. Drive: V-belt with guard; gear reducer; or direct, close coupled **OR** V-belt with guard **OR** Gear reducer **OR** Direct, close coupled, **as directed**.
3. Controls:
 - a. Run pump to maintain minimum manifold pressure with outdoor-air temperature less than 60 deg F (16 deg C).
 - b. Run pump on seven-day schedule.
 - c. Alarm motor failure.
 - d. Manual reset dry-run protection. Stop pump if fuel level falls below pump suction.
 - e. Deenergize and alarm pump locked rotor condition.
 - f. Alarm open circuit, high and low voltage.
 - g. Indicating lights for power on, run, and off normal conditions.
 - h. Interface with automatic control system is specified in Division 23 Section "Instrumentation And Control For Hvac" to control and indicate the following:
 - 1) Start/stop pump set when required by schedule, fuel-fired appliance operation, day tank level control, or weather conditions.
 - 2) Operating status.
 - 3) Alarm off-normal status.
4. Motor: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".



- a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
- b. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 22.

V. Duplex **OR** Triplex, **as directed**, Fuel-Oil Transfer Pump Sets

1. Description: Comply with HI M109.
 - a. Listed and labeled for fuel-oil service by an NRTL acceptable to authorities having jurisdiction.
 - b. Type: Positive-displacement, rotary type.
 - c. Impeller: Steel gear with crescent **OR** Carbon vane, **as directed**.
 - d. Housing: Cast-iron foot mounted.
 - e. Bearings: Bronze, self-lubricating.
 - f. Shaft: Polished steel.
 - g. Seals: Mechanical.
 - h. Base: Steel.
 - i. Pressure Relief: Built in.
 - j. Discharge Check Valve: Built in.
2. Drive: V-belt with guard, gear reducer, or direct close coupled **OR** V-belt with guard **OR** Gear reducer **OR** Direct close coupled, **as directed**.
3. Controls:
 - a. Run pumps to maintain minimum manifold pressure with outdoor-air temperature less than 60 deg F (16 deg C).
 - b. Run pumps on seven-day schedule.
 - c. Stage pumps on pressure at a common supply manifold.
 - d. Alternate pumps to equalize run time.
 - e. Alarm motor failure.
 - f. Manual reset dry-run protection. Stop pumps if fuel level falls below pump suction.
 - g. Deenergize and alarm pump locked rotor condition.
 - h. Alarm open circuit, high and low voltage.
 - i. Indicating lights for power on, run, and off normal conditions.
 - j. Interface with automatic control system is specified in Division 23 Section "Instrumentation And Control For Hvac" to control and indicate the following:
 - 1) Start/stop pump set when required by schedule, fuel-fired appliance operation, day tank level control, or weather conditions.
 - 2) Operating status.
 - 3) Alarm off-normal status.
4. Motor: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - b. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 22.
5. Piping Furnished with Pumps: Steel with ferrous fittings and threaded or welded joints.
6. Strainers Furnished with Pumps: Duplex, basket type with corrosion-resistant-metal-screen baskets.

W. Fuel Maintenance System

1. Description: Factory fabricated and wired fuel maintenance system for fuel-oil filtration; with enclosure, filter, fuel-oil pump, and controls; FMG approved, listed, and labeled by an NRTL acceptable to authorities having jurisdiction.
 - a. Enclosure: NEMA 250, Type 3R, painted steel containing pumps, filters, accessories, and controls. Hinged door on the front of enclosure.



- b. Pump: Comply with HI M109, steel-gear-with-crescent, positive-displacement, direct-coupled, rotary-type.
 - c. Materials: Cast-iron housing; bronze bearings; steel shaft; mechanical seals; and built-in, pressure relief bypass valve.
 - d. Motor: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - 1) Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - 2) Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 22.
 - e. Piping: Steel with malleable-iron fittings and threaded joints or wrought-steel fittings and welded joints.
 - f. Multistage Filter: Spin-on, replaceable types.
 - 1) Stage 1: 100-mesh strainer.
 - 2) Stage 2: Centrifuge to separate particulates and water from oil.
 - 3) Stage 3: Coalescing water and particulate filter.
 - 4) Stage 4: 30-micron particulate removal.
 - 5) Stage 5: 10-micron particulate removal.
 - 6) Stage 6: Minimum 99.5 percent water removal with see-through bowl and water-sensor probe.
 - 7) Stage 7: 1.5 **OR** 3, **as directed**, -micron particulate removal.
 - g. Multiple-Tank Manifolds:
 - 1) Manifold fabricated of Schedule 80, black steel pipe and threaded nipples for two **OR** three **OR** four, **as directed**, tanks.
 - 2) Solenoid valves for supply and return piping to each tank.
 - 3) Strainers for each tank supply connection.
 - h. Programmable Logic Controller:
 - 1) Alarm on maximum 15-in. Hg (51-kPa) vacuum at pump suction indicating plugged filter.
 - 2) Alarm on high water level in filter.
 - 3) Alarm leak in enclosure.
 - 4) Touch screen; with minimum 2-line, 20-character, backlit, LCD display.
 - 5) Controller strip heater with thermostat.
 - i. Interface with automatic control system is specified in Division 23 Section "Instrumentation And Control For Hvac" to control and indicate the following:
 - 1) Start/stop system when required by schedule.
 - 2) Operating status.
 - 3) Alarm off-normal status.
- X. Liquid-Level Gage System
- 1. Description: Calibrated, liquid-level gage system complying with UL 180 with floats **OR** UL 1238 with probes, **as directed**, or other sensors and remote annunciator panel.
 - 2. Annunciator Panel: With visual and audible, high-tank-level and low-tank-level alarms, fuel indicator with registration in gallons (liters), and overfill alarm. Include gage volume range that covers fuel-oil storage capacity.
 - 3. Controls: Electrical, operating on 120-V ac.
- Y. Leak-Detection And Monitoring System
- 1. Cable and Sensor System: Comply with UL 1238.
 - a. Calibrated, leak-detection and monitoring system with probes and other sensors and remote alarm panel for fuel-oil storage tanks and fuel-oil piping.
 - b. Include fittings and devices required for testing.
 - c. Controls: Electrical, operating on 120-V ac.
 - d. Calibrated, liquid-level gage complying with UL 180 with floats **OR** UL 1238 with probes, **as directed**, or other sensors and remote annunciator panel.



- e. Remote Annunciator Panel: With visual and audible, high-tank-level and low-tank-level alarms, fuel indicator with registration in gallons (liters), and overfill alarm. Include gage volume range that covers fuel-oil storage capacity.
 - f. Controls: Electrical, operating on 120-V ac.
2. Hydrostatic System: Comply with UL 1238.
- a. Calibrated, leak-detection and monitoring system with brine antifreeze solution, reservoir sensor, and electronic control panel to monitor leaks in inner and outer tank walls.
 - b. Include fittings and devices required for testing.
 - c. Controls: Electrical, operating on 120-V ac.
 - d. Calibrated, liquid-level gage complying with UL 180 with floats **OR** UL 1238 with probes, **as directed**, or other sensors and remote annunciator panel.
 - e. Remote Annunciator Panel: With visual and audible, high-tank-level and low-tank-level alarms, fuel indicator with registration in gallons (liters), and overfill alarm. Include gage volume range that covers fuel-oil storage capacity.
 - f. Controls: Electrical, operating on 120-V ac.
- Z. Fuel Oil
- 1. Fuel Oil: ASTM D 396, Grade No. 1 **OR** No. 2, **as directed**.
 - 2. Diesel Fuel Oil: ASTM D 975, Grade Low Sulfur **OR** No. 1-D, special-purpose **OR** No. 2-D, general-purpose, **as directed**, high volatility.
- AA. Sleeves
- 1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
 - 2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- BB. Mechanical Sleeve Seals
- 1. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - a. Sealing Elements: EPDM **OR** NBR, **as directed**, interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe and sleeve.
 - b. Pressure Plates: Plastic **OR** Carbon steel **OR** Stainless steel, **as directed**.
 - c. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating **OR** Stainless steel, **as directed**, of length required to secure pressure plates to sealing elements. Include one nut and bolt for each sealing element.
- CC. Escutcheons
- 1. General Requirements for Escutcheons: Manufactured wall and ceiling escutcheons and floor plates, with ID to fit around pipe or tube and with OD that completely covers opening.
 - 2. One-Piece, Deep-Pattern Escutcheons: Deep-drawn brass with polished chrome-plated finish.
 - 3. One-Piece, Cast-Brass Escutcheons: With set screw.
 - a. Finish: Polished chrome-plated **OR** Rough brass, **as directed**.
 - 4. Split-Casting, Cast-Brass Escutcheons: With concealed hinge and set screw.
 - a. Finish: Polished chrome-plated **OR** Rough brass, **as directed**.
 - 5. One-Piece, Stamped-Steel Escutcheons: With set screw **OR** spring clips, **as directed**, and chrome-plated finish.
 - 6. Split-Plate, Stamped-Steel Escutcheons: With concealed **OR** exposed-rivet, **as directed**, hinge, set screw **OR** spring clips, **as directed**, and chrome-plated finish.
 - 7. One-Piece, Floor-Plate Escutcheons: Cast-iron floor plate.
 - 8. Split-Casting, Floor-Plate Escutcheons: Cast brass with concealed hinge and set screw.
- DD. Grout
- 1. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.



- a. Characteristics: Posthardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
- b. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
- c. Packaging: Premixed and factory packaged.

EE. Labeling And Identifying

1. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (152 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (762 mm) deep; colored yellow.

FF. Concrete Manholes

1. Precast Concrete Manhole Sections: ASTM C 478 (ASTM C 478M), base and concentric-cone sections with integral ladder or steps.
2. Cast-Iron Frame and Cover: Heavy-duty, water-resistant, cast-iron manhole frame, gasket, and bolted cover; 24-inch- (609-mm-) diameter, inside opening dimension; 8-inch (203-mm) frame riser height.

GG. Source Quality Control

1. Pressure test and inspect fuel-oil storage tanks, after fabrication and before shipment, according to ASME and the following:
 - a. Vertical **OR** Horizontal, **as directed**, Single-Wall Steel ASTs: UL 142.
 - b. Vertical **OR** Horizontal, **as directed**, Double-Wall Steel ASTs: UL 142, STI F921, and STI R931.
 - c. Horizontal, Containment-Dike, Steel ASTs: UL 142 and STI F911.
 - d. Horizontal, Concrete-Vaulted **OR** Concrete-Vaulted and Insulated **OR** Insulated, **as directed**, Steel ASTs: UL 142 and UL 2085.
 - e. Horizontal, Steel USTs with the STI-P3 Corrosion-Protection System: UL 58 and STI P3.
 - f. Composite **OR** Composite and Jacketed **OR** Jacketed, **as directed**, Steel USTs: UL 58.
 - g. FRP USTs: UL 1316.
2. Affix standards organization's code stamp.

1.3 EXECUTION

A. Earthwork

1. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

B. Preparation

1. Close equipment shutoff valves before turning off fuel oil to premises or piping section.
2. Comply with NFPA 30 and NFPA 31 requirements for prevention of accidental ignition.

C. Outdoor Piping Installation

1. Install underground fuel-oil piping buried at least 18 inches (457 mm) below finished grade. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.
 - a. If fuel-oil piping is installed with less than 12 inches (305 mm) of cover to finished grade, install in containment piping.
2. Steel Piping with Protective Coating:
 - a. Apply joint cover kits to pipe after joining, to cover, seal, and protect joints.
 - b. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer. Review protective coating damage prior to repair.

OR

Replace pipe having damaged PE coating with new pipe.



3. Install double-containment, fuel-oil pipe at a minimum slope of 1 percent downward toward fuel-oil storage tank sump.
4. Install vent pipe at a minimum slope of 2 percent downward toward fuel-oil storage tank sump.
5. Assemble and install entry boots for pipe penetrations through sump sidewalls for liquid-tight joints.
6. Install metal pipes and tubes, fittings, valves, and flexible connectors at piping connections to AST and UST.
7. Install fittings for changes in direction in rigid pipe.
8. Install system components with pressure rating equal to or greater than system operating pressure.
9. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Install sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
10. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
11. Mechanical Sleeve Seal Installation: Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
12. Install pressure gage on suction **OR** suction and discharge, **as directed**, from each pump. Pressure gages are specified in Division 23 Section "Meters And Gages For Hvac Piping".

D. Indoor Piping Installation

1. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
2. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
3. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
4. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
5. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
6. Install piping free of sags and bends.
7. Install fittings for changes in direction and branch connections.
8. Install escutcheons for penetrations of walls, ceilings, and floors.
 - a. New Piping:
 - 1) Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - 2) Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
OR
Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
 - 3) Piping at Ceiling Penetrations in Finished Spaces: One-piece **OR** Split-casting, **as directed**, cast-brass type with polished chrome-plated finish.
OR
Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type **OR** Split-plate, stamped-steel type with concealed hinge, **as directed**, and set screw.
 - 4) Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated **OR** rough-brass, **as directed**, finish.
OR



- Piping in Unfinished Service Spaces: One-piece, stamped-steel type with set screw **OR** spring clips, **as directed**.
 - 5) Piping in Equipment Rooms: One-piece, cast-brass type.
OR
Piping in Equipment Rooms: One-piece, stamped-steel type with set screw **OR** spring clips, **as directed**.
 - 6) Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
9. Existing Piping:
- 1) Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
OR
Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and spring clips.
 - 2) Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
OR
Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and set screw.
 - 3) Piping in Unfinished Service Spaces: Split-casting, cast-brass type with polished chrome-plated **OR** rough-brass, **as directed**, finish.
OR
Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with concealed **OR** exposed-rivet, **as directed**, hinge and set screw or spring clips.
 - 4) Piping in Equipment Rooms: Split-casting, cast-brass type.
OR
Piping in Equipment Rooms: Split-plate, stamped-steel type with set screw or spring clips.
 - 5) Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.
10. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping".
11. Verify final equipment locations for roughing-in.
12. Comply with requirements for equipment specifications in Division 14 AND Division 21 for roughing-in requirements.
13. Conceal pipe installations in walls, pipe spaces, or utility spaces; above ceilings; below grade or floors; and in floor channels unless indicated to be exposed to view.
14. Prohibited Locations:
- a. Do not install fuel-oil piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
 - b. Do not install fuel-oil piping in solid walls or partitions.
15. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
16. Connect branch piping from top or side of horizontal piping.
17. Install unions in pipes NPS 2 (DN 50) and smaller at final connection to each piece of equipment and elsewhere as indicated. Unions are not required on flanged devices.
18. Do not use fuel-oil piping as grounding electrode.
19. Install Y-pattern **OR** basket **OR** T-pattern, **as directed**, strainer on inlet side of fuel-oil pump.

E. Valve Installation

- 1. Install manual fuel-oil shutoff valves on branch connections to fuel-oil appliance.
- 2. Install valves in accessible locations.
- 3. Protect valves from physical damage.
- 4. Install metal tag attached with metal chain indicating fuel-oil piping systems.
- 5. Identify valves as specified in Division 23 Section "Identification For Hvac Piping And Equipment".
- 6. Install oil safety valves at inlet of each oil-fired appliance.



7. Install pressure relief valves in distribution piping between the supply and return lines.
8. Install one-piece, bronze ball valve with hose end connection at low points in fuel-oil piping.
9. Install manual air vents at high points in fuel-oil piping.
10. Install emergency shutoff valves at dispensers (for systems with fuel-oil or diesel-fuel-oil dispensers).

F. Piping Joint Construction

1. Ream ends of pipes and tubes and remove burrs.
2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
3. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
4. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to "Quality Assurance" Article.
 - a. Bevel plain ends of steel pipe.
 - b. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.
5. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.
6. Flanged Joints: Install gasket material, size, type, and thickness for service application. Install gasket concentrically positioned.
7. Flared Joints: Comply with SAE J513. Tighten finger tight, then use wrench according to fitting manufacturer's written recommendations. Do not overtighten.
8. Fiberglass-Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

G. Fuel-Oil AST Installation

1. Install tank bases and supports.
2. Connect piping and vent fittings.
3. Install ground connections.
4. Install tank leak-detection and monitoring devices.
5. Install steel ASTs according to STI R912.
6. Install insulated and concrete-vaulted, steel ASTs according to STI R942.
7. Fill storage tanks with fuel oil.

H. Fuel-Oil UST Installation

1. Excavate to sufficient depth for a minimum of 3 feet (1 m) of earth cover from top of tank to finished grade. Allow for cast-in-place, concrete-ballast base plus 6 inches (150 mm) of sand or pea gravel between ballast base and tank. Extend excavation at least 12 inches (300 mm) around perimeter of tank.
2. Set tie-down eyelets for hold-down straps in concrete-ballast base and tie to reinforcing steel.
3. Place 6 inches (152 mm) of clean sand or pea gravel on top of concrete-ballast base.
4. Set tank on fill materials and install hold-down straps.
5. Connect piping.
6. Install tank leak-detection and monitoring devices.
7. Install containment sumps.
8. Backfill excavation with clean sand or pea gravel in 12-inch (305-mm) lifts and tamp backfill lift to consolidate.
9. Install filter mat between top of backfill material and earth fill.
10. Install steel USTs with the STI-P3 corrosion-protection system according to STI R821 and STI R891. Protect anodes during tank placement and backfilling operations.



11. Install composite, steel USTs according to STI R913 and STI R891.
12. Install jacketed, steel USTs according to STI R923 and STI R891.
13. Install FRP USTs with FRP hold-down straps, manhole extensions, and manhole risers.
14. Fill storage tanks with fuel oil.

I. Hanger And Support Installation

1. Pipe hanger and support and equipment support materials and installation requirements are specified in Division 23 Section "Hangers And Supports For Hvac Piping And Equipment".
2. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
 - a. NPS 1-1/4 (DN 32) and Smaller: Maximum span, 84 inches (2130 mm); minimum rod size, 3/8 inch (10 mm).
 - b. NPS 1-1/2 (DN 40): Maximum span, 108 inches (2740 mm); minimum rod size, 3/8 inch (10 mm).
 - c. NPS 2 (DN 50): Maximum span, 10 feet (3 m); minimum rod size, 3/8 inch (10 mm).
 - d. NPS 2-1/2 (DN 65): Maximum span, 11 feet (3.4 m); minimum rod size, 1/2 inch (13 mm).
 - e. NPS 3 (DN 80): Maximum span, 12 feet (3.7 m); minimum rod size, 1/2 inch (13 mm).
 - f. NPS 4 (DN 100): Maximum span, 13 feet (4 m); minimum rod size, 5/8 inch (16 mm).
3. Support vertical steel pipe at each floor and at spacing not greater than 15 feet (4.5 m).
4. Install hangers for horizontal, drawn-temper copper tubing with the following maximum spacing and minimum rod sizes:
 - a. NPS 3/4 (DN 20) and Smaller: Maximum span, 60 inches (1524 mm); minimum rod size, 3/8 inch (10 mm).
 - b. NPS 1 (DN 25): Maximum span, 72 inches (1830 mm); minimum rod size, 3/8 inch (10 mm).
 - c. NPS 1-1/4 (DN 32): Maximum span, 84 inches (2130 mm); minimum rod size, 3/8 inch (10 mm).
 - d. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): Maximum span, 96 inches (2440 mm); minimum rod size, 3/8 inch (10 mm).
 - e. NPS 2-1/2 (DN 65): Maximum span, 108 inches (2740 mm); minimum rod size, 1/2 inch (13 mm).
 - f. NPS 3 (DN 80): Maximum span, 10 feet (3 m); minimum rod size, 1/2 inch (13 mm).
 - g. NPS 4 (DN 100): Maximum span, 11 feet (3.4 m); minimum rod size, 5/8 inch (16 mm).
5. Support vertical copper tube at each floor and at spacing not greater than 10 feet (3 m).

J. Fuel-Oil Pump Installation

1. Submersible Pumps:
 - a. Suspend pumps from supply piping and anchored to bottom of tank.
2. Transfer Pumps:
 - a. Install pumps with access space for periodic maintenance including removal of motors, impellers, and accessories.
 - b. Set pumps on and anchor to concrete base.
3. Install two-piece, full-port ball valves at suction and discharge of pumps.
4. Install mechanical leak-detector valves at pump discharge.
5. Install Y-pattern **OR** basket **OR** T-pattern, **as directed**, strainer on inlet side of simplex fuel-oil pumps.
6. Install check valve on discharge of simplex fuel-oil pumps.
7. Install suction piping with minimum fittings and change of direction.
8. Install vacuum and pressure gage, upstream and downstream respectively, at each pump to measure the differential pressure across the pump. Pressure gages are specified in Division 23 Section "Meters And Gages For Hvac Piping".

K. Fuel Maintenance System Installation

1. Install suction line, with foot valve, at one end of storage tank, 1 inch (25 mm) from the bottom of tank.
2. Install return line at the opposite end of storage tank from suction line.



- L. Liquid-Level Gage System Installation
1. Install liquid-level gage system. Locate panel inside building where indicated.
- M. Leak-Detection And Monitoring System Installation
1. Install leak-detection and monitoring system. Install alarm panel inside building where indicated.
 - a. Double-Wall, Fuel-Oil Storage Tanks: Install probes **OR** Install probes or use factory-installed integral probes **OR** Use factory-installed integral probes, **as directed**, in interstitial space.
 - b. Single-Wall, Fuel-Oil Storage Tanks: Install probes as indicated.
 - c. Double-Containment, Fuel-Oil Piping: Install leak-detection sensor probes in fuel-oil storage tank containment sumps and at low points in piping **OR** cable probes in interstitial space of double-containment piping, **as directed**.
 - d. Install liquid-level gage.
- N. Connections
1. Install piping adjacent to equipment to allow service and maintenance.
 2. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment having threaded pipe connection.
 3. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment having flanged pipe connection.
 4. Connect piping to equipment with ball valve and union. Install union between valve and equipment.
 5. Install flexible piping connectors at final connection to burners or oil-fired appliances that must be moved for maintenance access.
- O. Labeling And Identifying
1. Nameplates, pipe identification, and signs are specified in Division 23 Section "Identification For Hvac Piping And Equipment".
OR
Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplates and signs on or near each service regulator, service meter, and earthquake valve.
 - a. Text: In addition to identifying unit, distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.
 2. Install detectable warning tape directly above fuel-oil piping, 12 inches (304 mm) below finished grade, except 6 inches (152 mm) below subgrade under pavements and slabs. Terminate tracer wire in an accessible area, and identify as "tracer wire" for future use with plastic-laminate sign.
 - a. Piping: Over underground fuel-oil distribution piping.
 - b. Fuel-Oil Storage Tanks: Over edges of each UST.
- P. Field Painting Of AST
1. If shop painting AST, prepare and touch up damaged exterior surface of AST and supports, **as directed**, as specified in "Shop Painting of AST" Article.
 2. If field painting AST, prepare exterior steel surface of AST and tank supports, **as directed**.
 3. Field Cleaning: After fabrication, blast clean according to SSPC-SP 6/NACE No. 3 **OR** SSPC-SP 10/NACE No. 2, **as directed**.
 4. After cleaning, remove dust or residue from cleaned surfaces.
 5. If surfaces develop rust before prime coat is applied, repeat surface preparation.
 6. Prepare surface of AST and supports, **as directed**, and apply painting systems according to specifications in Division 09 Section "High-performance Coatings" for severe **OR** moderate **OR** mild, **as directed**, environment high-gloss **OR** semigloss, **as directed**, finish for ferrous metal.
- Q. Field Painting Of Aboveground Piping
1. Comply with requirements in Division 07 for painting interior and exterior fuel-oil piping.



2. Paint exposed, exterior metal piping, valves, and piping specialties, except components with factory-applied paint or protective coating.
 - a. Alkyd System: MPI EXT 5.1D.
 - 1) Prime Coat: Alkyd anticorrosive metal primer.
 - 2) Intermediate Coat (for a Premium Grade system): Exterior alkyd enamel matching topcoat.
 - 3) Topcoat: Exterior alkyd enamel (flat) **OR** (semigloss) **OR** (gloss), **as directed**.
 - 4) Color: Gray, **as directed**.
3. Paint exposed, interior metal piping, valves, and piping specialties, except components with factory-applied paint or protective coating.
 - a. Latex Over Alkyd Primer System: MPI INT 5.1Q.
 - 1) Prime Coat: Alkyd anticorrosive **OR** Quick-drying alkyd, **as directed**, metal primer.
 - 2) Intermediate Coat (for a Premium Grade system): Interior latex matching topcoat.
 - 3) Topcoat: Interior latex (flat) **OR** (low sheen) **OR** (eggshell) **OR** (satin) **OR** (semigloss) **OR** (gloss), **as directed**.
 - 4) Color: Gray, **as directed**.
 - b. Alkyd System: MPI INT 5.1E.
 - 1) Prime Coat: Alkyd anticorrosive **OR** Quick-drying alkyd, **as directed**, metal primer.
 - 2) Intermediate Coat (for a Premium Grade system): Interior alkyd matching topcoat.
 - 3) Topcoat: Interior alkyd (flat) **OR** (eggshell) **OR** (semigloss) **OR** (gloss), **as directed**.
 - 4) Color: Gray, **as directed**.
4. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

R. Concrete Bases

1. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 - a. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
 - b. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (457-mm) centers around the full perimeter of the base.
 - c. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - d. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - e. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - f. Use 3000-psig (20.7-MPa), **unless directed otherwise**, 28-day, compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-place Concrete".

S. Field Quality Control

1. Perform tests and inspections.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Tests and Inspections:
 - a. Tanks: Minimum hydrostatic or compressed-air test pressures for fuel-oil storage tanks that have not been factory tested and do not bear the ASME code stamp or a listing mark acceptable to authorities having jurisdiction:
 - 1) Single-Wall Tanks: Minimum 3 psig (20.7 kPa) and maximum 5 psig (34.5 kPa).
 - 2) Double-Wall Tanks:
 - a) Inner Tanks: Minimum 3 psig (20.7 kPa) and maximum 5 psig (34.5 kPa).
 - b) Interstitial Space: Minimum 3 psig (20.7 kPa) and maximum 5 psig (34.5 kPa), or 5.3-in. Hg (18-kPa) vacuum.



- 3) Where vertical height of fill and vent pipes is such that the static head imposed on the bottom of the tank is greater than 10 psig (69 kPa), hydrostatically test the tank and fill and vent pipes to a pressure equal to the static head thus imposed.
- 4) Maintain the test pressure for one hour.
- b. Piping: Minimum hydrostatic or pneumatic test-pressures measured at highest point in system:
 - 1) Fuel-Oil Distribution Piping: Minimum 5 psig (34.5 kPa) for minimum 30 minutes.
 - 2) Fuel-Oil, Double-Containment Piping:
 - a) Carrier Pipe: Minimum 5 psig (34.5 kPa) for minimum 30 minutes.
 - b) Containment Conduit: Minimum 5 psig (34.5 kPa) for minimum 60 minutes.
 - 3) Suction Piping: Minimum 20-in. Hg (68 kPa) for minimum 30 minutes.
 - 4) Isolate storage tanks if test pressure in piping will cause pressure in storage tanks to exceed 10 psig (69 kPa).
- c. Inspect and test fuel-oil piping according to NFPA 31, "Tests of Piping" Paragraph; and according to requirements of authorities having jurisdiction.
- d. Test liquid-level gage for accuracy by manually measuring fuel-oil levels at not less than three **OR** four **OR** five, **as directed**, different depths while filling tank and checking against gage indication.
- e. Test leak-detection and monitoring system for accuracy by manually operating sensors and checking against alarm panel indication.
- f. Start fuel-oil transfer pumps to verify for proper operation of pump and check for leaks.
- g. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- h. Bleed air from fuel-oil piping using manual air vents.
3. Fuel-oil piping and equipment will be considered defective if it does not pass tests and inspections.
4. Prepare test and inspection reports.

T. Outdoor Piping Schedule

1. Underground fuel-oil piping shall be one of the following. Size indicated is carrier-pipe size.
 - a. Flexible, double-containment piping.
 - b. Rigid, double-containment piping.
2. Underground fuel-oil-tank fill and vent piping shall be one of the following:
 - a. NPS 2 (DN 50) and Smaller: Steel pipe, steel or malleable-iron threaded fittings, and threaded joints. Coat pipe and fittings with protective coating for steel piping.
 - b. NPS 2-1/2 (DN 65) and Larger: Steel pipe, steel welding fittings, and welded joints. Coat pipe and fittings with protective coating for steel piping.
3. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
4. Aboveground fuel-oil piping shall be one of the following:
 - a. NPS 2 (DN 50) and Smaller: Steel pipe, steel or malleable-iron threaded fittings, and threaded joints.
 - b. NPS 2-1/2 (DN 65) and Larger: Steel pipe, steel welding fittings, and welded joints.
 - c. Annealed **OR** Drawn, **as directed**,-temper copper tube with wrought-copper fittings and brazed joints.

U. Indoor Piping Schedule

1. Aboveground fuel-oil piping shall be one of the following:
 - a. NPS 1/2 (DN 15) and Smaller: Steel pipe, steel or malleable-iron threaded fittings, and threaded joints **OR** Annealed-temper copper pipe, wrought copper fittings, and brazed or flared joints, **as directed**.
 - b. NPS 5/8 to NPS 2 (DN 18 to DN 50): Steel pipe, steel or malleable-iron threaded fittings, and threaded joints **OR** Drawn temper copper pipe, wrought copper fittings, and brazed joints, **as directed**.



- c. NPS 2-1/2 (DN 65) and Larger: Steel pipe, steel fittings, and welded or flanged joints **OR** Drawn temper copper pipe, wrought copper fittings, and brazed or flanged joints, **as directed**.
 - d. Steel pipe with malleable-iron fittings and threaded joints.
 - e. Steel pipe with wrought-steel fittings and welded joints.
 - f. Annealed-temper copper tube, brass fittings, and flared joints.
 - g. Drawn-temper copper tubing, copper fittings, and brazed joints.
- V. Aboveground Manual Fuel-Oil Shutoff Valve Schedule
- 1. Distribution piping valves for pipe NPS 2 (DN 50) and smaller shall be one of the following:
 - a. One-piece, bronze ball valve with bronze trim.
 - b. Two-piece, full **OR** regular, **as directed**, -port, bronze ball valves with bronze trim.
 - 2. Distribution piping valves for pipe NPS 2-1/2 (DN 65) and larger shall be one of the following:
 - a. Two-piece, full **OR** regular, **as directed**, -port, bronze ball valves with bronze trim.
 - b. Bronze, nonlubricated **OR** lubricated, **as directed**, plug valve.
 - 3. Valves in branch piping for single appliance shall be one of the following:
 - a. One-piece, bronze ball valve with bronze trim.
 - b. Two-piece, full **OR** regular, **as directed**, -port, bronze ball valves with bronze trim.

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SECTION 23 21 13 23a - RADIANT HEATING PIPING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for radiant heating piping. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes radiant heating piping, including pipes, fittings, and piping specialties.

C. Definitions

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. PEX: Crosslinked polyethylene.
3. PEX/AL/PEX: Crosslinked polyethylene/aluminum/crosslinked polyethylene.

D. Submittals

1. Product Data: For each type of radiant heating pipe, fitting, manifold, specialty, and control.
 - a. For radiant heating piping and manifolds, include pressure and temperature rating, oxygen-barrier performance, fire-performance characteristics, and water flow and pressure drop characteristics.
2. Shop Drawings: Show piping layout and details drawn to scale, including valves, manifolds, controls, and support assemblies, and their attachments to building structure.
3. Operation and Maintenance Data.

1.2 PRODUCTS

A. PEX Pipe And Fittings

1. Pipe Material: PEX plastic according to ASTM F 876.
2. Oxygen Barrier: Limit oxygen diffusion through the tube to maximum 0.10 mg per cu. m/day at 104 deg F (40 deg C) according to DIN 4726.
3. Fittings: ASTM F 1807, metal insert and copper crimp rings.
4. Pressure/Temperature Rating: Minimum 100 psig (690 kPa) and 180 deg F (82 deg C).

B. PEX/AL/PEX Pipe And Fittings

1. Pipe Material: PEX plastic bonded to the inside and outside of a welded aluminum tube according to ASTM F 1281.
2. Oxygen Barrier: Limit oxygen diffusion through the pipe to maximum 0.10 mg per cu. m/day at 104 deg F (40 deg C) according to DIN 4726.
3. Fittings: ASTM F 1974, metal insert fittings with split ring and compression nut (compression joint) or metal insert fittings with copper crimp rings (crimp joint).
4. Flame-Spread and Smoke-Developed Indexes: 25 and 50 or less, respectively, tested according to ASTM E 84.
5. Pressure/Temperature Rating: Minimum 100 psig (690 kPa) and 210 deg F (99 deg C).

C. EPDM Pipe And Fittings

1. Pipe Material: Crosslinked EPDM inner and outer tubes.
2. Wall Thickness: Minimum 0.125 inch (3.2 mm).
3. Oxygen Barrier: Ductile aluminum foil layer applied to the inner tube to limit oxygen diffusion through the pipe to maximum 0.10 mg per cu. m/day at 104 deg F (40 deg C) according to DIN 4726.



4. Reinforcing Braid: Braided-aluminum wire between the inner and outer tube.
5. Fittings: ASTM F 1807, copper with stainless-steel crimps or clamps.
6. Pressure/Temperature Rating: Minimum 100 psig (690 kPa) and 210 deg F (99 deg C).

D. Distribution Manifolds

1. Manifold: Minimum NPS 1 (DN 25), brass **OR** copper **OR** modular plastic **OR** stainless steel, **as directed**.
2. Main Shutoff Valves:
 - a. Factory installed on supply and return connections.
 - b. Two **OR** Three, **as directed**, -piece body.
 - c. Body: Brass or bronze.
 - d. Ball: Chrome-plated bronze.
 - e. Seals: PTFE.
 - f. CWP Rating: 150 psig (1035 kPa).
 - g. Maximum Operating Temperature: 225 deg F (107 deg C).
3. Manual Air Vents:
 - a. Body: Bronze.
 - b. Internal Parts: Nonferrous.
 - c. Operator: Key furnished with valve, or screwdriver bit.
 - d. Inlet Connection: NPS 1/2 (DN 15).
 - e. Discharge Connection: NPS 1/8 (DN 6).
 - f. CWP Rating: 150 psig (1035 kPa).
 - g. Maximum Operating Temperature: 225 deg F (107 deg C).
4. Balancing Valves:
 - a. Body: Plastic or bronze, ball or plug, or globe cartridge type.
 - b. Ball or Plug: Brass or stainless steel.
 - c. Globe Cartridge and Washer: Brass with EPDM composition washer.
 - d. Seat: PTFE.
 - e. Visual Flow Indicator: Flowmeter with visible indication in a clear plastic cap at top of valve.
OR
Differential Pressure Gage Connections: Integral seals for portable meter to measure loss across calibrated orifice.
 - f. Handle Style: Lever or knob, with memory stop to retain set position if used for shutoff.
 - g. CWP Rating: Minimum 125 psig (860 kPa).
 - h. Maximum Operating Temperature: 250 deg F (121 deg C).
5. Zone Control Valves:
 - a. Body: Plastic or bronze, ball or plug, or globe cartridge type.
 - b. Ball or Plug: Brass or stainless steel.
 - c. Globe Cartridge and Washer: Brass with EPDM composition washer.
 - d. Seat: PTFE.
 - e. Actuator: Replaceable electric motor.
 - f. CWP Rating: Minimum 125 psig (860 kPa).
 - g. Maximum Operating Temperature: 250 deg F (121 deg C).
6. Thermometers:
 - a. Mount on supply and return connections.
 - b. Case: Dry type, metal or plastic, 2-inch (50-mm) diameter.
 - c. Element: Bourdon tube or other type of pressure element.
 - d. Movement: Mechanical, connecting element and pointer.
 - e. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
 - f. Pointer: Black metal.
 - g. Window: Plastic.
 - h. Connector: Rigid, back type.
 - i. Thermal System: Liquid- or mercury-filled bulb in copper-plated steel, aluminum, or brass stem.



- j. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.
 - 7. Mounting Brackets: Copper, or plastic or copper-clad steel, where in contact with manifold.
- E. Piping Specialties
- 1. Cable Ties:
 - a. Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
 - b. Minimum Width: 1/8 inch (3 mm).
 - c. Tensile Strength: 20 lb (9 kg), minimum.
 - d. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
 - 2. Floor-Mounting Staples:
 - a. Steel, with corrosion-resistant coating and smooth finish without sharp edges.
 - b. Minimum Thickness: 3/32 inch (2.4 mm).
 - c. Width: Minimum, wider than tubing.
 - 3. Floor-Mounting Clamps:
 - a. Two bolt, steel, with corrosion-resistant coating and smooth finish without sharp edges.
 - b. Minimum Thickness: 3/32 inch (2.4 mm).
 - c. Width: Minimum, wider than tubing.
 - 4. Floor Mounting Tracks:
 - a. Aluminum or plastic channel track with smooth finish, no sharp edges.
 - b. Minimum Thickness: 1/16 inch (1.6 mm).
 - c. Slot Width: Snap fit to hold tubing.
 - d. Slot Spacing: 2-inch (50-mm) **OR** 3-inch (75-mm), **as directed**, intervals.
 - 5. Channeled Subfloor:
 - a. Plywood, APA-rated subfloor panel, composed of premium, tongue-and-groove, 7-layer, Douglas fir structural subfloor panels.
 - b. Particleboard manufactured to meet Federal Housing Authority standards of less than 0.3-ppm formaldehyde.
 - c. Clad panel with minimum 0.025-inch- (0.635-mm-) thick aluminum recessed in the grooves sized to maintain contact with radiant piping.
 - 6. Modular Interlocking Blocks:
 - a. Polypropylene snap-together blocks with grooves to support piping.
 - b. Galvanized sheet metal or aluminum emission plates.
 - c. Natural mineralboard cover panel.
 - 7. Heat-Emission Plates:
 - a. Formed aluminum suitable for radiant heating piping.
 - b. Minimum Thickness: 1/16 inch (1.6 mm).
 - c. Slot Width: Snap fit to maintain pressure fit on tubing.
- F. Controls
- 1. Temperature-control devices and sequence of operations are specified in Division 23 Section(s) "Instrumentation And Control For Hvac" AND "Sequence Of Operations For Hvac Controls".
 - 2. Wall-Mounting Thermostat:
 - a. Minimum temperature range from 50 to 90 deg F (10 to 32 deg C).
 - b. Manually operated with on-off switch.
 - c. Day and night setback and clock program with minimum four periods per day.
 - d. Operate pumps or open zone control valves if room temperature falls below the thermostat setting, and stop pumps or close zone control valves when room temperature rises above the thermostat setting.
 - 3. Heated-Panel Thermostat:
 - a. Remote bulb unit with adjustable temperature range from 50 to 90 deg F (10 to 32 deg C).
 - b. Snap action; open-on-rise, single-pole switch with minimum current rating adequate for connected pump or zone control valve.
 - c. Remote bulb on capillary tube, resistance temperature device, or thermistor for directly sensing radiant panel temperature.
 - d. Stop pump or close zone control valves if heated-panel thermostat setting is exceeded.



- e. Corrosion-resistant, waterproof control enclosure.
- 4. Heated-Panel Thermostat with Outdoor Temperature Reset:
 - a. Remote bulb unit with adjustable temperature range from 50 to 90 deg F (10 to 32 deg C).
 - b. Snap action; open-on-rise, single-pole switch with minimum current rating adequate for connected pump and zone control valve.
 - c. Remote bulb on capillary tube, resistance temperature device, or thermistor for directly sensing radiant panel temperature.
 - d. Remote bulb on capillary tube, resistance temperature device, or thermistor for directly sensing outdoor-air temperature.
 - e. Operate zone control valves to reset supply-water temperature inversely with outdoor-air temperature as follows:
 - 1) Low outdoor-air temperature, zero deg F (minus 18 deg C) with high supply-water temperature 110 deg F (43 deg C).
 - 2) High outdoor-air temperature, 60 deg F (16 deg C) with low supply-water temperature 70 deg F (21 deg C).
 - f. Corrosion-resistant, waterproof control enclosure.
- 5. Precipitation and Temperature Sensor:
 - a. Microprocessor-based **OR** Automatic, **as directed**, control with manual on, automatic, and standby/reset switch.
 - b. Precipitation and temperature sensors shall sense the surface conditions of pavement and shall be programmed to operate pump and zone control valves as follows:
 - 1) Temperature Span: 34 to 44 deg F (1 to 7 deg C).
 - 2) Adjustable Delay Off Span: 30 to 90 minutes.
 - 3) Start Pump or Open Zone Control Valves: Following two-minute delay if ambient temperature is below set point and precipitation is detected.
 - 4) Stop Pump or Close Zone Control Valves: On detection of a dry surface plus time delay.
 - c. Corrosion-proof and waterproof enclosure suitable for outdoor mounting, for controls and precipitation and temperature sensors.
 - d. Minimum 30-A contactor to start pump and open valves.
 - e. Precipitation sensor shall be mounted in pavement.
 - f. Provide relay with contacts to indicate operational status, on or off, for interface with central HVAC control system workstation.

1.3 EXECUTION

A. Applications

- 1. Install the following types of radiant heating piping for the applications described:
 - a. Piping in Exterior Pavement: EPDM **OR** PEX **OR** PEX/AL/PEX, **as directed**.
 - b. Piping in Interior Reinforced-Concrete Floors: EPDM **OR** PEX **OR** PEX/AL/PEX, **as directed**.
 - c. Piping in Level Fill Concrete Floors (Not Reinforced): EPDM **OR** PEX **OR** PEX/AL/PEX, **as directed**.
 - d. Piping in Ceilings: EPDM **OR** PEX **OR** PEX/AL/PEX, **as directed**.
 - e. Piping in Subfloors: EPDM **OR** PEX **OR** PEX/AL/PEX, **as directed**.
 - f. Piping below Wood Floors: EPDM **OR** PEX **OR** PEX/AL/PEX, **as directed**.

B. Installation

- 1. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop or Coordination Drawings.
- 2. Install radiant heating piping continuous from the manifold through the heated panel and back to the manifold without piping joints in heated panels.



3. Connect radiant piping to manifold in a reverse-return arrangement.
4. Do not bend pipes in radii smaller than manufacturer's minimum bend radius dimensions.
5. Install manifolds in accessible locations, or install access panels to provide maintenance access as required in Division 08 Section "Access Doors And Frames".
6. Refer to Division 23 Section "Hydronic Piping" for pipes and connections to hydronic systems and for glycol-solution fill requirements.
7. Fire- and Smoke-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials according to Division 07 Section "Penetration Firestopping".
8. Piping in Exterior Pavement:
 - a. Secure piping in concrete floors by attaching pipes to reinforcement using cable ties.
 - b. Space cable ties a maximum of 18 inches (457 mm) o.c., and at center of turns or bends.
 - c. Maintain 3-inch (75-mm) minimum cover.
 - d. Install a sleeve of 3/8-inch- (9.5-mm-) thick, foam-type insulation or PE pipe around tubing and extending for a minimum of 10 inches (250 mm) on each side of slab joints to protect the tubing passing through expansion or control joints. Anchor sleeve to slab form at control joints to provide maximum clearance for saw cut.
 - e. Maintain minimum 40-psig (275-kPa) pressure in piping during concrete placement and continue for 24 hours after placement.
9. Piping in Interior Reinforced-Concrete Floors:
 - a. Secure piping in concrete floors by attaching pipes to reinforcement using cable ties.
 - b. Space cable ties a maximum of 18 inches (457 mm) o.c., and at center of turns or bends.
 - c. Maintain 2-inch (50-mm) minimum cover.
 - d. Install a sleeve of 3/8-inch- (9.5-mm-) thick, foam-type insulation or PE pipe around tubing and extending for a minimum of 10 inches (250 mm) on each side of slab joints to protect the tubing passing through expansion or control joints. Anchor sleeve to slab form at control joints to provide maximum clearance for saw cut.
 - e. Maintain minimum 40-psig (275-kPa) pressure in piping during concrete placement and continue for 24 hours after placement.
10. Piping in Level Fill Concrete Floors (Not Reinforced):
 - a. Secure piping in concrete floors by attaching pipes to subfloor using tracks, clamps, or staples.
 - b. Space tracks, clamps, or staples a maximum of 18 inches (457 mm) o.c., and at center of turns or bends.
 - c. Maintain 3/4-inch (19-mm) minimum cover.
 - d. Install a sleeve of 3/8-inch- (9.5-mm-) thick, foam-type insulation or PE pipe around tubing and extending for a minimum of 10 inches (250 mm) on each side of slab joints to protect the tubing passing through expansion or control joints. Anchor sleeve to slab form at control joints to provide maximum clearance for saw cut.
 - e. Maintain minimum 40-psig (275-kPa) pressure in piping during the concrete pour and continue for 24 hours during curing.
11. Piping in Ceiling:
 - a. Secure piping by attaching pipes to ceiling substrate using clamps or staples.
 - b. Space clamps or staples a maximum of 18 inches (457 mm) o.c., and at center of turns or bends.
 - c. Maintain 1-1/2-inch (38-mm) minimum plaster cover.
 - d. Maintain minimum 40-psig (275-kPa) pressure in piping during the plaster application and continue for 24 hours during curing.
12. Piping in Subfloor:
 - a. Secure piping by laying piping in subfloor channels or modular interlocking blocks.
 - b. Use straight channel panels or blocks in the center, and curved channel panels or blocks at the ends.
 - c. Finish floor with mineralboard panel cover or finished floor surface.
13. Piping below Wood Floor:
 - a. Secure piping by attaching pipes to subfloor using heat-emission plates, clamps, or staples.



- b. Space heat-emission plates, clamps, or staples a maximum of 4 inches (100 mm) o.c., and at center of turns or bends.
 - c. Install heat-emission plates on underside of wood subfloor with maximum space between plates, as noted above, to maintain pipe contact with floor.
 14. Revise locations and elevations from those indicated as required to suit field conditions and ensure integrity of piping and as approved.
 15. After system balancing has been completed, mark balancing valves to permanently indicate final position.
 16. Perform the following adjustments before operating the system:
 - a. Open valves to fully open position.
 - b. Check operation of automatic valves.
 - c. Set temperature controls so all zones call for full flow.
 - d. Purge air from piping.
 17. After the concrete or plaster heating panel has cured as recommended by concrete or plaster supplier, operate radiant heating system as follows:
 - a. Start system heating at a maximum of 10 deg F (6 deg C) above the ambient radiant panel temperature, and increase 10 deg F (6 deg C) each following day until design temperature is achieved.
 - b. For freeze protection, operate at a maximum of 60 deg F (16 deg C) supply-water temperature.
- C. Field Quality Control
1. Prepare radiant heating piping for testing as follows:
 - a. Open all isolation valves and close bypass valves.
 - b. Open and verify operation of zone control valves.
 - c. Flush with clean water, and clean strainers.
 2. Tests and Inspections:
 - a. Leak Test: After installation, charge system and test for leaks. Subject piping to hydrostatic test pressure that is not less than 1.5 times the design pressure but not more than 100 psig (690 kPa). Repair leaks and retest until no leaks exist.
 - b. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 3. Remove and replace malfunctioning radiant heating piping components that do not pass tests, and retest as specified above.
 4. Prepare a written report of testing.

END OF SECTION 23 21 13 23a



Task	Specification	Specification Description
23 21 13 23	22 05 23 00	Piped Utilities Basic Materials And Methods
23 21 13 23	23 11 23 00	Relief Wells
23 21 13 23	21 05 19 00	Water Distribution
23 21 13 23	23 11 23 00a	Monitoring Wells
23 21 13 23	22 11 23 39	Water Supply Wells
23 21 13 23	22 05 76 00	Sanitary Sewerage
23 21 13 23	23 05 29 00	Steam Distribution
23 21 13 23	07 63 00 00	Common Work Results for Fire Suppression
23 21 13 23	07 63 00 00a	Common Work Results for Plumbing
23 21 13 23	07 63 00 00b	Common Work Results for HVAC
23 21 13 23	22 11 16 00	Domestic Water Piping
23 21 13 23	22 11 16 00a	Sanitary Waste And Vent Piping
23 21 13 23	22 11 16 00b	Storm Drainage Piping
23 21 13 23	22 11 16 00c	Hydronic Piping
23 21 13 23	22 11 16 00d	Steam And Condensate Piping
23 21 13 23	22 11 16 00e	Refrigerant Piping
23 21 13 23	23 11 23 00b	Facility Natural-Gas Piping
23 21 13 23	23 11 23 00c	Facility Liquefied-Petroleum Gas Piping
23 21 13 23	22 11 16 00f	General-Service Compressed-Air Piping
23 21 13 23	22 11 16 00g	Compressed-Air Piping For Laboratory And Healthcare Facilities
23 21 13 23	22 11 16 00h	Vacuum Piping For Laboratory And Healthcare Facilities
23 21 13 23	22 11 16 00i	Gas Piping For Laboratory And Healthcare Facilities
23 21 16 00	01 22 16 00	No Specification Required
23 21 16 00	22 05 23 00	Piped Utilities Basic Materials And Methods
23 21 16 00	21 05 19 00	Water Distribution
23 21 16 00	23 05 29 00	Steam Distribution
23 21 16 00	07 63 00 00	Common Work Results for Fire Suppression
23 21 16 00	07 63 00 00a	Common Work Results for Plumbing
23 21 16 00	07 63 00 00b	Common Work Results for HVAC
23 21 16 00	22 11 16 00c	Hydronic Piping
23 21 16 00	22 11 16 00d	Steam And Condensate Piping
23 21 16 00	22 11 16 00e	Refrigerant Piping
23 21 16 00	22 11 23 39a	Hydronic Pumps
23 21 16 00	23 21 13 23	Facility Fuel-Oil Piping
23 21 16 00	22 11 16 00f	General-Service Compressed-Air Piping
23 21 23 13	22 05 23 00	Piped Utilities Basic Materials And Methods
23 21 23 13	22 11 23 39	Water Supply Wells
23 21 23 13	22 11 23 39a	Hydronic Pumps
23 21 23 16	22 05 23 00	Piped Utilities Basic Materials And Methods
23 21 23 16	22 11 23 39	Water Supply Wells
23 21 23 16	22 11 23 39a	Hydronic Pumps



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SECTION 23 21 23 23 - ELECTRIC-DRIVE, VERTICAL-TURBINE FIRE PUMPS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for electric-drive, vertical-turbine fire pumps. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Vertical-turbine fire pumps.
 - b. Fire-pump accessories and specialties.
 - c. Flowmeter systems.

C. Performance Requirements

1. Seismic Performance: Fire pumps shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
2. Pump Equipment, Accessory, and Specialty Pressure Rating: 175 psig (1200 kPa) minimum unless higher pressure rating is indicated.

D. Submittals

1. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, performance curves, electrical characteristics, and furnished specialties and accessories.
2. Shop Drawings: For fire pumps, motor drivers, and fire-pump accessories and specialties. Include plans, elevations, sections, details, and attachments to other work.
 - a. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - b. Wiring Diagrams: For power, signal, and control wiring.
3. Seismic Qualification Certificates: For fire pumps, accessories, and components, from manufacturer.
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
4. Product Certificates: For each fire pump, from manufacturer.
5. Source quality-control reports.
6. Field quality-control reports.
7. Operation and maintenance data.

E. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. NFPA Compliance: Comply with NFPA 20, "Installation of Stationary Pumps for Fire Protection."

1.2 PRODUCTS



- A. General Requirements For Vertical-Turbine Fire Pumps
1. Description: Factory-assembled and -tested fire-pump and driver unit.
 2. Base: Fabricated and attached to fire-pump and driver unit with reinforcement to resist movement of pump during seismic events when base is anchored to building substrate.
 3. Finish: Red paint applied to factory-assembled and -tested unit before shipping.
- B. Vertical-Turbine Fire Pumps
1. Pump Head: Cast iron, for surface discharge.
 - a. Discharge Outlet: With flange according to ASME B16.1 except connections may be threaded according to ASME B1.20.1, in sizes where flanges are not available.
 - b. Pump Head Seal: Stuffing box and packing.
 - c. Base: Cast iron or steel with hole for electrical cable.
 2. Pump:
 - a. Standard: UL 448, for vertical-turbine pumps for fire service.
 - b. Line Shaft: Stainless steel or steel, with corrosion-resistant shaft sleeves.
 - c. Line Shaft Bearings: Rubber sleeve, water lubricated.
 - d. Line Shaft: Steel.
 - e. Line Shaft Bearings: Corrosion resistant, oil lubricated.
 - f. Impeller Shaft: Monel metal or stainless steel.
 - g. Bowl Section: Multiple cast-iron bowls with closed-type bronze or stainless-steel impellers.
 - h. Column Pipe: ASTM A 53/A 53M, Schedule 40, galvanized-steel pipe with threaded ends and cast-iron or steel fittings, in sections 10 feet (3 m) or less.
 - i. Suction Strainer: Cast or fabricated, bronze or stainless steel, and sized to restrict passage of 0.5-inch (12.7-mm) spheres.
 3. Driver:
 - a. Standard: UL 1004A.
 - b. Type: Electric motor; NEMA MG 1, polyphase Design B.
 - c. Mounting: On pump head above pump.
- C. Fire-Pump Accessories And Specialties
1. Automatic Air-Release Valves: Comply with NFPA 20 for installation in fire-pump discharge piping.
 2. Relief Valves:
 - a. Description: UL 1478, bronze or cast iron, spring loaded; for installation in fire-suppression water-supply piping.
 3. Outlet Fitting: Concentric tapered reducer at pump-head discharge outlet.
 4. Discharge Cone: Closed **OR** Open, **as directed**, type.
 5. Hose Valve Manifold Assembly:
 - a. Standard: Comply with requirements in NFPA 20.
 - b. Header Pipe: ASTM A 53/A 53M, Schedule 40, galvanized steel with ends threaded according to ASME B1.20.1.
 - c. Header Pipe Fittings: ASME B16.4, galvanized cast-iron threaded fittings.
 - d. Automatic Drain Valve: UL 1726.
 - e. Manifold:
 - 1) Test Connections: Comply with UL 405 except provide outlets without clappers instead of inlets.
 - 2) Body: Flush type, brass or ductile iron, with number of outlets required by NFPA 20.
 - 3) Nipples: ASTM A 53/A 53M, Schedule 40, galvanized-steel pipe with ends threaded according to ASME B1.20.1.
 - 4) Adapters and Caps with Chain: Brass or bronze, with outlet threaded according to NFPA 1963 and matching local fire-department threads.
 - 5) Escutcheon Plate: Brass or bronze; rectangular.
 - 6) Hose Valves: UL 668, bronze, with outlet threaded according to NFPA 1963 and matching local fire-department threads.



- 7) Exposed Parts Finish: Polished **OR** Rough, **as directed**, brass, **as directed**, chrome plated, **as directed**.
- 8) Escutcheon Plate Marking: Equivalent to "FIRE PUMP TEST."
OR
Manifold:
 - 1) Test Connections: Comply with UL 405 except provide outlets without clappers instead of inlets.
 - 2) Body: Exposed type, brass, with number of outlets required by NFPA 20.
 - 3) Escutcheon Plate: Brass or bronze; round.
 - 4) Hose Valves: UL 668, bronze, with outlet threaded according to NFPA 1963 and matching local fire-department threads. Include caps and chains.
 - 5) Exposed Parts Finish: Polished **OR** Rough, **as directed**, brass, **as directed**, chrome plated, **as directed**.
 - 6) Escutcheon Plate Marking: Equivalent to "FIRE PUMP TEST."

D. Flowmeter Systems

1. Description: UL-listed or FM-Approved, fire-pump flowmeter system with capability to indicate flow to not less than 175 percent of fire-pump rated capacity.
2. Pressure Rating: 175 psig (1200 kPa) minimum **OR** 250 psig (1725 kPa), **as directed**.
3. Sensor: Annubar probe, orifice plate, or venturi unless otherwise indicated. Sensor size shall match pipe, tubing, flowmeter, and fittings.
4. Permanently Mounted Flowmeter: Compatible with flow sensor; with dial not less than 4-1/2 inches (115 mm) in diameter. Include bracket or device for wall mounting.
 - a. Tubing Package: NPS 1/8 or NPS 1/4 (DN 6 or DN 10) soft copper **OR** plastic, **as directed**, tubing with copper or brass fittings and valves.

OR

Portable Flowmeter: Compatible with flow sensor; with dial not less than 4-1/2 inches (115 mm) in diameter and with two 12-foot- (3.7-m-) long hoses in carrying case.

E. Grout

1. Standard: ASTM C 1107, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
2. Characteristics: Nonshrink and recommended for interior and exterior applications.
3. Design Mix: 5000-psi (34-MPa), 28-day compressive strength.
4. Packaging: Premixed and factory packaged.

F. Source Quality Control

1. Testing: Test and inspect fire pumps according to UL 448 requirements for "Operation Test" and "Manufacturing and Protection Tests."
 - a. Verification of Performance: Rate fire pumps according to UL 448.
2. Fire pumps will be considered defective if they do not pass tests and inspections.
3. Prepare test and inspection reports.

1.3 EXECUTION

A. Installation

1. Fire-Pump Installation Standard: Comply with NFPA 20 for installation of fire pumps, relief valves, and related components.
2. Equipment Mounting: Install fire pumps on concrete bases. Comply with requirements for concrete bases specified in Division 03 Section "Cast-in-place Concrete".
 - a. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - b. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.



- c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - d. Install anchor bolts to elevations required for proper attachment to supported equipment.
 3. Install fire-pump discharge piping equal to or larger than size required by NFPA 20.
 4. Support piping and pumps separately so weight of piping does not rest on pumps.
 5. Install valves that are same size as connecting piping. Comply with requirements for fire-protection valves specified in Division 21 Section(s) "Fire-suppression Standpipes" OR "Wet-pipe Sprinkler Systems", **as directed**.
 6. Install pressure gage on pump head discharge flange pressure-gage tapping. Comply with requirements for pressure gages specified in Division 21 Section(s) "Fire-suppression Standpipes" OR "Wet-pipe Sprinkler Systems", **as directed**.
 7. Install flowmeters and sensors. Install flowmeter-system components and make connections according to NFPA 20 and manufacturer's written instructions.
 8. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not factory mounted. Furnish copies of manufacturers' wiring diagram submittals to electrical Installer.
 9. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- B. Alignment
1. Align pump and driver shafts after complete unit has been leveled on concrete base, grout has set, and anchor bolts have been tightened.
 2. After alignment is correct, tighten anchor bolts evenly. Fill baseplate completely with grout, with metal blocks and shims or wedges in place. Tighten anchor bolts after grout has hardened. Check alignment and make required corrections.
 3. Align piping connection.
 4. Align pump and driver shafts for angular and parallel alignment according to HI 2.4 and to tolerances specified by manufacturer.
- C. Connections
1. Comply with requirements for piping and valves specified in Division 21 Section(s) "Fire-suppression Standpipes" OR "Wet-pipe Sprinkler Systems", **as directed**. Drawings indicate general arrangement of piping, fittings, and specialties.
 2. Install piping adjacent to pumps and equipment to allow service and maintenance.
 3. Connect relief-valve discharge to drainage piping or point of discharge.
 4. Connect flowmeter-system meters, sensors, and valves to tubing.
 5. Connect fire pumps to their controllers.
- D. Identification
1. Identify system components. Comply with requirements for fire-pump marking according to NFPA 20.
- E. Field Quality Control
1. Test each fire pump with its controller as a unit. Comply with requirements for electric-motor-driver fire-pump controllers specified in Division 21 Section(s) "Electric-drive, Centrifugal Fire Pumps" OR "Diesel-drive, Centrifugal Fire Pumps" OR "Electric-drive, Vertical-turbine Fire Pumps" OR "Diesel-drive, Vertical-turbine Fire Pumps"
 2. Perform tests and inspections.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
 3. Tests and Inspections:
 - a. After installing components, assemblies, and equipment including controller, test for compliance with requirements.
 - b. Test according to NFPA 20 for acceptance and performance testing.



- c. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - d. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - e. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 4. Components, assemblies, and equipment will be considered defective if they do not pass tests and inspections.
 5. Prepare test and inspection reports.
 6. Furnish fire hoses in number, size, and length required to reach storm drain or other acceptable location to dispose of fire-pump test water. Hoses are for tests only and do not convey to the Owner.
- F. Startup Service
1. Perform startup service.
 - a. Complete installation and startup checks according to manufacturer's written instructions.
- G. Demonstration
1. Train the Owner's maintenance personnel to adjust, operate, and maintain fire pumps.

END OF SECTION 23 21 23 23



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SECTION 23 21 23 23a - DIESEL-DRIVE, VERTICAL-TURBINE FIRE PUMPS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for diesel-drive, vertical-turbine fire pumps. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Vertical-turbine fire pumps.
 - b. Fire-pump accessories and specialties.
 - c. Flowmeter systems.

C. Performance Requirements

1. Seismic Performance: Fire pumps shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
2. Pump Equipment, Accessory, and Specialty Pressure Rating: 175 psig (1200 kPa) minimum unless higher pressure rating is indicated.

D. Submittals

1. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, performance curves, electrical characteristics, and furnished specialties and accessories.
2. Shop Drawings: For fire pumps, right-angle gear drives, engine drivers, and fire-pump accessories and specialties. Include plans, elevations, sections, details, and attachments to other work.
 - a. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - b. Wiring Diagrams: For power, signal, and control wiring.
3. Seismic Qualification Certificates: For fire pumps, accessories, and components, from manufacturer.
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
4. Product Certificates: For each fire pump, from manufacturer.
5. Source quality-control reports.
6. Field quality-control reports.
7. Operation and maintenance data

E. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for location and application.
2. NFPA Compliance: Comply with NFPA 20, "Installation of Stationary Pumps for Fire Protection."



1.2 PRODUCTS

- A. General Requirements For Vertical-Turbine Fire Pumps
1. Description: Factory-assembled and -tested fire pump, right-angle gear drive, and driver.
 2. Base: Fabricated and attached to fire pump, right-angle gear drive, and driver with reinforcement to resist movement of pump, gear drive, and driver during seismic events when base is anchored to building substrate.
 3. Finish: Red paint applied to factory-assembled and -tested unit before shipping.
- B. Vertical-Turbine Fire Pumps
1. Pump Head: Cast iron, for surface discharge.
 - a. Discharge Outlet: With flange according to ASME B16.1 except connections may be threaded according to ASME B1.20.1, in sizes where flanges are not available.
 - b. Pump Head Seal: Stuffing box and packing.
 - c. Base: Cast iron or steel with hole for electrical cable.
 2. Pump:
 - a. Standard: UL 448, for vertical-turbine pumps for fire service.
 - b. For static water levels of 50 feet (15 m) or less and for water-lubricated bearings.
 - 1) Line Shaft: Stainless steel or steel, with corrosion-resistant shaft sleeves.
 - 2) Line Shaft Bearings: Rubber sleeve, water lubricated.
 - c. For static water levels between 50 and 200 feet (15 and 61 m) and for oil-lubricated bearings.
 - 1) Line Shaft: Steel.
 - 2) Line Shaft Bearings: Corrosion resistant, oil lubricated.
 - d. Impeller Shaft: Monel metal or stainless steel.
 - e. Bowl Section: Multiple cast-iron bowls with closed-type bronze or stainless-steel impellers.
 - f. Column Pipe: ASTM A 53/A 53M, Schedule 40, galvanized-steel pipe with threaded ends and cast-iron or steel fittings, in sections 10 feet (3 m) or less.
 - g. Suction Strainer: Cast or fabricated, bronze or stainless steel, and sized to restrict passage of 0.5-inch (12.7-mm) spheres.
 3. Right-Angle Gear Drive:
 - a. Description: FM-Approved, speed-reduction gear drive for pump speed control. Provide ratio for outlet speed of approximately 1760 rpm.
 4. Engine-to-Gear Drive Shaft: FM-Approved, telescoping, steel drive shaft with universal joint and grease fitting at each end. Include metal shaft guard.
 5. Driver:
 - a. Standard: UL 1247.
 - b. Type: Diesel engine.
 - c. Emergency Manual Operator: Factory wired for starting and operating standby engine in case of malfunction in main controller or wiring.
 - d. Engine Cooling System: Factory-installed radiator.
 - 1) Coolant: Type recommended by driver manufacturer.

OR

Engine Cooling System: Factory-installed water piping, valves, strainer, pressure regulator, heat exchanger, coolant pump, bypass piping, and fittings.
 - 1) Piping: ASTM B 88, Type L (ASTM B 88M, Type B), copper water tube; ASME B16.22, wrought-copper, solder-joint pressure fittings; AWS A5.8/A5.8M, BCuP Series brazing filler metal; and brazed joints.
 - e. Engine-Jacket Water Heater: Factory-installed electric elements.
 - f. Dual Batteries: Lead-acid-storage type with 100 percent standby reserve capacity.
 - g. Fuel System: According to NFPA 20.
 - 1) Fuel Storage Tank: Size indicated but not less than required by NFPA 20. Include floor legs, direct-reading level gage, and secondary containment tank with capacity at least equal to fuel storage tank.



- h. Exhaust System: ASTM A 53/A 53M, Type E or S, Schedule 40, black steel pipe; ASME B16.9, weld-type pipe fittings; ASME B16.5, steel flanges; and ASME B16.21, nonmetallic gaskets. Fabricate double-wall, ventilated thimble from steel pipe.
 - 1) Exhaust Connector: Flexible type.
 - 2) Exhaust Silencer: Industrial **OR** Residential, **as directed**, type.

 - C. Fire-Pump Accessories And Specialties
 - 1. Automatic Air-Release Valves: Comply with NFPA 20 for installation in fire-pump discharge piping.
 - 2. Relief Valves:
 - a. Description: UL 1478, bronze or cast iron, spring loaded; for installation in fire-suppression water-supply piping.
 - 3. Outlet Fitting: Concentric tapered reducer at pump-head discharge outlet.
 - 4. Discharge Cone: Closed **OR** Open, **as directed**, type.
 - 5. Hose Valve Manifold Assembly:
 - a. Standard: Comply with requirements in NFPA 20.
 - b. Header Pipe: ASTM A 53/A 53M, Schedule 40, galvanized steel with ends threaded according to ASME B1.20.1.
 - c. Header Pipe Fittings: ASME B16.4, galvanized cast-iron threaded fittings.
 - d. Automatic Drain Valve: UL 1726.
 - e. Manifold:
 - 1) Test Connections: Comply with UL 405 except provide outlets without clappers instead of inlets.
 - 2) Body: Flush type, brass or ductile iron, with number of outlets required by NFPA 20.
 - 3) Nipples: ASTM A 53/A 53M, Schedule 40, galvanized-steel pipe with ends threaded according to ASME B1.20.1.
 - 4) Adapters and Caps with Chain: Brass or bronze, with outlet threaded according to NFPA 1963 and matching local fire-department threads.
 - 5) Escutcheon Plate: Brass or bronze; rectangular.
 - 6) Hose Valves: UL 668, bronze, with outlet threaded according to NFPA 1963 and matching local fire-department threads.
 - 7) Exposed Parts Finish: Polished **OR** Rough, **as directed**, brass, **as directed**, chrome plated, **as directed**.
 - 8) Escutcheon Plate Marking: Equivalent to "FIRE PUMP TEST."

 - OR**
 - Manifold:
 - 1) Test Connections: Comply with UL 405 except provide outlets without clappers instead of inlets.
 - 2) Body: Exposed type, brass, with number of outlets required by NFPA 20.
 - 3) Escutcheon Plate: Brass or bronze; round.
 - 4) Hose Valves: UL 668, bronze, with outlet threaded according to NFPA 1963 and matching local fire-department threads. Include caps and chains.
 - 5) Exposed Parts Finish: Polished **OR** Rough, **as directed**, brass, **as directed**, chrome plated, **as directed**.
 - 6) Escutcheon Plate Marking: Equivalent to "FIRE PUMP TEST."
-
- D. Flowmeter Systems
 - 1. Description: UL-listed or FM-Approved, fire-pump flowmeter system with capability to indicate flow to not less than 175 percent of fire-pump rated capacity.
 - 2. Pressure Rating: 175 psig (1200 kPa) minimum **OR** 250 psig (1725 kPa), **as directed**.
 - 3. Sensor: Annubar probe, orifice plate, or venturi unless otherwise indicated. Sensor size shall match pipe, tubing, flowmeter, and fittings.
 - 4. Permanently Mounted Flowmeter: Compatible with flow sensor; with dial not less than 4-1/2 inches (115 mm) in diameter. Include bracket or device for wall mounting.
 - a. Tubing Package: NPS 1/8 or NPS 1/4 (DN 6 or DN 10) soft copper **OR** plastic, **as directed**, tubing with copper or brass fittings and valves.

**OR**

Portable Flowmeter: Compatible with flow sensor; with dial not less than 4-1/2 inches (115 mm) in diameter and with two 12-foot- (3.7-m-) long hoses in carrying case.

E. Grout

1. Standard: ASTM C 1107, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
2. Characteristics: Nonshrink and recommended for interior and exterior applications.
3. Design Mix: 5000-psi (34-MPa), 28-day compressive strength.
4. Packaging: Premixed and factory packaged.

F. Source Quality Control

1. Testing: Test and inspect fire pumps according to UL 448 requirements for "Operation Test" and "Manufacturing and Production Tests."
 - a. Verification of Performance: Rate fire pumps according to UL 448.
2. Fire pumps will be considered defective if they do not pass tests and inspections.
3. Prepare test and inspection reports.

1.3 EXECUTION

A. Installation

1. Fire-Pump Installation Standard: Comply with NFPA 20 for installation of fire pumps, relief valves, and related components.
2. Equipment Mounting: Install fire pumps on concrete bases. Comply with requirements for concrete bases specified in Division 03 Section "Cast-in-place Concrete".
 - a. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - b. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - d. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install fire-pump discharge piping equal to or larger than size required by NFPA 20.
4. Support piping and pumps separately so weight of piping does not rest on pumps.
5. Install valves that are same size as connecting piping. Comply with requirements for fire-protection valves specified in Division 21 Section(s) "Fire-suppression Standpipes" OR "Wet-pipe Sprinkler Systems", **as directed**.
6. Install pressure gage on pump head discharge flange pressure-gage tapping. Comply with requirements for pressure gages specified in Division 21 Section(s) "Fire-suppression Standpipes" OR "Wet-pipe Sprinkler Systems", **as directed**.
7. Install piping hangers and supports, anchors, valves, gages, and equipment supports according to NFPA 20.
8. Install fuel system according to NFPA 20.
9. Install water supply and drain piping for diesel-engine heat exchangers. Extend drain piping from heat exchangers to point of disposal.
10. Install exhaust system piping for diesel engines. Extend to point of termination outside structure. Install pipe and fittings with welded joints; install components having flanged connections with gasketed joints.
11. Install condensate drain piping for diesel-engine exhaust system. Extend drain piping from low points of exhaust system to condensate traps and to point of disposal.
12. Install flowmeters and sensors. Install flowmeter-system components and make connections according to NFPA 20 and manufacturer's written instructions.
13. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not factory mounted. Furnish copies of manufacturers' wiring diagram submittals to electrical Installer.



14. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- B. Alignment
1. Align fire-pump-driver, right-angle gear-drive, and fire-pump shafts after complete unit has been leveled on concrete base, grout has set, and anchor bolts have been tightened.
 2. After alignment is correct, tighten anchor bolts evenly. Fill baseplate completely with grout, with metal blocks and shims or wedges in place. Tighten anchor bolts after grout has hardened. Check alignment and make required corrections.
 3. Align piping connections.
 4. Align pump and driver shafts for angular and parallel alignment according to HI 2.4 and to tolerances specified by manufacturer.
- C. Connections
1. Comply with requirements for piping and valves specified in Division 21 Section(s) "Fire-suppression Standpipes" OR "Wet-pipe Sprinkler Systems", **as directed**. Drawings indicate general arrangement of piping, fittings, and specialties.
 2. Install piping adjacent to pumps and equipment to allow service and maintenance.
 3. Connect relief-valve discharge to drainage piping or point of discharge.
 4. Connect flowmeter-system meters, sensors, and valves to tubing.
 5. Connect fire pumps to their controllers.
- D. Identification
1. Identify system components. Comply with requirements for fire-pump marking according to NFPA 20.
- E. Field Quality Control
1. Test each fire pump with its right-angle gear drive and controller as a unit. Comply with requirements for electric-motor-driver fire-pump controllers specified in Division 21 Section(s) "Electric-drive, Centrifugal Fire Pumps" OR "Diesel-drive, Centrifugal Fire Pumps" OR "Electric-drive, Vertical-turbine Fire Pumps" OR "Diesel-drive, Vertical-turbine Fire Pumps".
 2. Perform tests and inspections.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
 3. Tests and Inspections:
 - a. After installing components, assemblies, and equipment including controller, test for compliance with requirements.
 - b. Test according to NFPA 20 for acceptance and performance testing.
 - c. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - d. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - e. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 4. Components, assemblies, and equipment will be considered defective if they do not pass tests and inspections.
 5. Prepare test and inspection reports.
 6. Furnish fire hoses in number, size, and length required to reach storm drain or other acceptable location to dispose of fire-pump test water. Hoses are for tests only and do not convey to the Owner.
- F. Startup Service
1. Perform startup service.
 - a. Complete installation and startup checks according to manufacturer's written instructions.



G. Demonstration

1. Train the Owner's maintenance personnel to adjust, operate, and maintain fire pumps, right-angle gear drives, and fire-pump controllers.

END OF SECTION 23 21 23 23a



Task	Specification	Specification Description
23 21 23 23	22 05 23 00	Piped Utilities Basic Materials And Methods
23 21 23 23	22 11 23 39	Water Supply Wells
23 21 29 00	22 05 23 00	Piped Utilities Basic Materials And Methods
23 21 29 00	22 11 23 39a	Hydronic Pumps
23 22 13 00	22 11 16 00d	Steam And Condensate Piping
23 22 16 00	22 05 23 00	Piped Utilities Basic Materials And Methods
23 22 16 00	21 05 19 00	Water Distribution
23 22 16 00	23 05 29 00	Steam Distribution
23 22 16 00	21 05 19 00a	Meters and Gages for Plumbing Piping
23 22 16 00	21 05 19 00b	Meters and Gages for HVAC Piping
23 22 16 00	22 11 16 00d	Steam And Condensate Piping
23 22 16 00	22 11 16 00e	Refrigerant Piping
23 22 16 00	22 11 16 00f	General-Service Compressed-Air Piping



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SECTION 23 22 23 13 - STEAM CONDENSATE PUMPS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for steam condensate pumps. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes electric-driven and pressure-powered steam condensate pumps.

C. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: Include details of installation.
 - a. Include wiring diagrams.
3. Operation and maintenance data.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. ASME Compliance: Fabricate and label steam condensate pumps to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

E. Delivery, Storage, and Handling

1. Manufacturer's Preparation for Shipping: Clean flanges and exposed machined metal surfaces and treat with anticorrosion compound after assembly and testing. Protect flanges, pipe openings, and nozzles with wooden flange covers or with screwed-in plugs.
2. Store steam condensate pumps in dry location.
3. Retain protective covers for flanges and protective coatings during storage.
4. Protect bearings and couplings against damage from sand, grit, and other foreign matter.
5. Comply with pump manufacturer's written rigging instructions.

1.2 PRODUCTS

A. Electric-Driven Steam Condensate Pumps

1. Description: Factory-fabricated, packaged, electric-driven pumps; with receiver, pump(s), controls, and accessories suitable for operation with steam condensate.
2. Configuration: Simplex **OR** Duplex, **as directed**, floor-mounting pump with receiver and float switch(es); rated to pump 200 deg F (93 deg C) steam condensate.
 - a. Receiver: Floor-mounting, close-grained cast iron **OR** welded steel, **as directed**; with externally adjustable float switch(es), and flange(s) for pump mounting.
 - b. Pump(s): Centrifugal, close coupled, vertical design, permanently aligned, and bronze fitted; with replaceable bronze case ring and mechanical seal; mounted on receiver flange.
 - c. Factory Wiring: Between pump(s) and float switch(es), for single external electrical connection. Fused control power transformer if voltage exceeds 230 V.
 - d. Electrical **OR** Mechanical, **as directed**, pump alternator to operate pumps in lead-lag sequence and allow both pumps to operate if the normal start level for a single pump is exceeded.
3. Configuration: Duplex floor-mounting pump with receiver and float switches; rated to pump 210 deg F (99 deg C) steam condensate.



- a. Receiver: Floor-mounting, close-grained cast iron **OR** welded steel, **as directed**; with externally adjustable float switches and flanges for pump mounting.
 - b. Pumps: Regenerative turbine, close coupled, permanently aligned, and bronze fitted; with mechanical seals and an independent pump control circuit for each pump; mounted on base or receiver flange; rated to operate with a minimum of 2 feet (6 kPa) of NPSH.
 - c. Factory Wiring: Between pumps and float switches, for single external electrical connection. Fused control power transformer if voltage exceeds 230 V.
 - d. Electrical **OR** Mechanical, **as directed**, pump alternator to operate pumps in lead-lag sequence and allow both pumps to operate if the normal start level for a single pump is exceeded.
4. Configuration: Duplex floor-mounting pumps with receiver and float switches; rated to pump minimum 200 deg F (93 deg C) **OR** 210 deg F (99 deg C), **as directed**, steam condensate.
- a. Receiver: Floor-mounting, close-grained cast iron **OR** welded steel, **as directed**; externally adjustable float switches; with water-level gage, steam condensate thermometer, discharge-pressure gage for each pump, bronze gate valves between receiver and pumps, flanges for pump mounting, and lifting eyebolts.
 - b. Inlet Strainer: Cast iron with self-cleaning bronze screen, dirt pocket, and cleanout plug on receiver inlet.
 - c. Pumps: Centrifugal, close coupled, vertical design, permanently aligned, and bronze fitted; with replaceable bronze case rings, stainless-steel shafts, and mechanical seals; mounted on receiver flanges; rated to operate with a minimum of 2 feet (6 kPa) of NPSH.
 - d. Control Panel: NEMA 250, Type 1 **OR** 2 **OR** 12, **as directed**, enclosure with hinged door and grounding lug, mounted on pump; factory wired for single external electrical connection; and with the following components within cabinet:
 - 1) Motor controller for each pump.
 - 2) Electrical pump alternator to operate pumps in lead-lag sequence and allow both pumps to operate on receiver high level.
 - 3) Manual lead-lag control to override electrical pump alternator to manually select the lead pump.
 - 4) Momentary contact "TEST" push button on cover for each pump.
 - 5) Numbered terminal strip.
 - 6) Disconnect switch.
 - 7) Fused transformer for control circuit.
5. Configuration: Duplex floor-mounting pump with elevated receiver, float switches, and connecting piping; rated to pump 212 deg F (100 deg C) steam condensate.
- a. Receiver: Close-grained cast iron **OR** Welded steel, **as directed**, mounted on fabricated-steel supports; externally adjustable float switches; with water-level gage, steam condensate thermometer, pump discharge pressure gages, bronze isolation valves between receiver and pumps, and lifting eyebolts.
 - b. Inlet Strainer: Cast iron with self-cleaning bronze screen, dirt pocket, and cleanout plug on receiver inlet.
 - c. Pumps: Centrifugal, close coupled, permanently aligned, and bronze fitted; with replaceable bronze case rings, stainless-steel shafts, and mechanical seals; mounted on base below receiver; rated to operate with a minimum of 2 feet (6 kPa) of NPSH.
 - d. Pipe: ASTM A 53/A 53M, Type S, Grade B or ASTM A 106; Schedule 80; seamless steel.
 - e. Fittings NPS 2 (DN 50) and Smaller: ASME B16.1, Class 125 cast iron, threaded.
 - f. Fittings NPS 2-1/2 (DN 65) and Larger: ASTM A 234/A 234M, steel, for welded connections.
 - g. Control Panel: NEMA 250, Type 1 **OR** 2 **OR** 12, **as directed**, enclosure with hinged door and grounding lug; mounted on pump; factory wired for single external electrical connection; and with the following components within cabinet:
 - 1) Motor controller for each pump.
 - 2) Electrical pump alternator to operate pumps in lead-lag sequence and allow both pumps to operate on receiver high level.



- 3) Manual lead-lag control to override electrical alternator to manually select the lead pump.
 - 4) Momentary contact "TEST" push button on cover for each pump.
 - 5) Numbered terminal strip.
 - 6) Disconnect switch.
 - 7) Fused transformer for control circuit.
6. Configuration: Underground duplex pump with basin and float switches; rated to pump 200 deg F (93 deg C) steam condensate.
- a. Basin: Cast iron, with hub-type inlets.
 - b. Basin Cover: Cast iron or steel with gasketed openings for access, pumps, pump shafts, control rods, discharge piping, and vent connections.
 - 1) Anchor Flange: Cast iron, attached to basin, in location and of size required to anchor basin to concrete slab.
 - c. Pumps: Wet-pit mounted, vertical, flexible coupled, and suspended.
 - 1) Casing: Cast iron with open inlet.
 - 2) Shaft and Bearings: Stainless-steel shaft with oil-lubricated, bronze, intermediate sleeve bearings; 48-inch (1200-mm) maximum intervals where basin depth is more than 48 inches (1200 mm); and grease-lubricated, ball-type, thrust bearings.
 - 3) Shaft Couplings: Flexible, capable of absorbing vibration.
 - 4) Seals: Mechanical; with carbon rotating ring, bearing on a ceramic seat held by a stainless-steel spring, and enclosed by a flexible bellows and gasket.
 - 5) Motors: Vertically mounted on cast-iron pedestal.
 - 6) Pump Discharge Piping: Manufacturer's standard steel or bronze pipe, unless otherwise indicated.
 - d. Control Panel: NEMA 250, Type 1 **OR** 2 **OR** 12, **as directed**, enclosure with hinged door and grounding lug; mounted on pump; factory wired for single external electrical connection; and with the following components within cabinet:
 - 1) Motor controller for each pump.
 - 2) Electrical pump alternator to operate pumps in lead-lag sequence and allow both pumps to operate on receiver high level.
 - 3) Manual lead-lag control to override electrical alternator to manually select the lead pump.
 - 4) Momentary contact "TEST" push button on cover for each pump.
 - 5) Numbered terminal strip.
 - 6) Disconnect switch.
 - 7) Fused transformer for control circuit.
- B. Pressure-Powered Steam Condensate Pumps
1. Description: Factory-fabricated, pressure-powered pumps with mechanical controls, valves, piping connections, and accessories suitable for pumping steam condensate using steam **OR** compressed air, **as directed**.
 2. Configuration: Simplex **OR** Duplex, **as directed**, pump with float-operated valve control.
 - a. Pump Body: Cast iron **OR** Welded steel, **as directed**.
 - b. Piping Connections: Threaded; for steam condensate, operating medium, vent, and indicated accessories.
 - c. Level Gage: Glass site gage with shutoff cocks.
 - d. Valves: Manufacturer's standard check valves on inlet and outlet.
 - e. Internal Parts: Stainless-steel float, springs, and actuating mechanism.
 - f. Valve Seals: Replaceable from exterior.
 - g. Receiver: Cast iron **OR** Welded steel, **as directed**, factory mounted on steel supports; with water-level site glass and threaded piping connections.
 - h. Pipe: ASTM A 53/A 53M, Type S, Grade B or ASTM A 106; Schedule 80; seamless steel.
 - i. Fittings: ASME B16.1, Class 125 cast iron, threaded.
- C. Motors



1. Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".

1.3 EXECUTION

A. Installation

1. Install pumps according to HI 1.1-1.5, "Centrifugal Pumps for Nomenclature, Definitions, Application and Operation."
2. Install pumps to provide access for periodic maintenance including removing motors, impellers, couplings, and accessories.
3. Support pumps and piping separately so piping is not supported by pumps.
4. Install pumps on concrete bases. Anchor pumps to bases using inserts or anchor bolts.
5. Install thermometers and pressure gages.

B. Connections

1. Install piping adjacent to machine to allow service and maintenance.
2. Install steam supply for pressure-powered pumps as required by Division 23 Section "Steam And Condensate Heating Piping".
3. Install compressed-air supply for pressure-powered pumps as required by Division 22 Section "General-service Compressed-air Piping".
4. Install gate and check valves on inlet and outlet of pressure-powered pumps.
5. Install check valve, gate valve, and globe valve at pump discharge connections for each electric-driven pump.
6. Pipe drain to nearest floor drain for overflow and drain piping connections.
7. Install full-size vent piping to outdoors, terminating in 180-degree elbow at point above highest steam system connection or as indicated.
8. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
9. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

END OF SECTION 23 22 23 13



23 - Heating, Ventilating, And Air-Conditioning (HVAC)

Task	Specification	Specification Description
23 23 13 00	22 05 23 00	Piped Utilities Basic Materials And Methods
23 23 13 00	22 11 16 00e	Refrigerant Piping
23 23 16 00	07 63 00 00	Common Work Results for Fire Suppression
23 23 16 00	07 63 00 00a	Common Work Results for Plumbing
23 23 16 00	07 63 00 00b	Common Work Results for HVAC
23 23 16 00	22 11 16 00a	Sanitary Waste And Vent Piping
23 23 16 00	22 11 16 00b	Storm Drainage Piping
23 23 16 00	22 11 16 00c	Hydronic Piping
23 23 16 00	22 11 16 00e	Refrigerant Piping
23 23 16 00	23 01 60 00	Condensing Units
23 23 23 00	23 01 60 00	Condensing Units



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SECTION 23 25 13 00 - HVAC WATER TREATMENT

- A. Description Of Work
 - 1. This specification covers the furnishing and installation of materials for HVAC water treatment. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work

- B. Summary
 - 1. This Section includes the following HVAC water-treatment systems:
 - a. Bypass chemical-feed equipment and controls.
 - b. Biocide chemical-feed equipment and controls.
 - c. Ozone-generator biocide equipment and controls.
 - d. UV-irradiation unit, biocide equipment, and controls.
 - e. Chemical treatment test equipment.
 - f. HVAC water-treatment chemicals.
 - g. Makeup water softeners.
 - h. RO equipment for HVAC makeup water.
 - i. Water filtration units for HVAC makeup water.

- C. Definitions
 - 1. EEPROM: Electrically erasable, programmable read-only memory.
 - 2. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.
 - 3. RO: Reverse osmosis.
 - 4. TDS: Total dissolved solids.
 - 5. UV: Ultraviolet.

- D. Performance Requirements
 - 1. Water quality for HVAC systems shall minimize corrosion, scale buildup, and biological growth for optimum efficiency of HVAC equipment without creating a hazard to operating personnel or the environment.
 - 2. Base HVAC water treatment on quality of water available at Project site, HVAC system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction.
 - 3. Closed hydronic systems, including hot-water heating, chilled water, dual-temperature water, and glycol cooling, shall have the following water qualities:
 - a. pH: Maintain a value within 9.0 to 10.5.
 - b. "P" Alkalinity: Maintain a value within 100 to 500 ppm.
 - c. Boron: Maintain a value within 100 to 200 ppm.
 - d. Chemical Oxygen Demand: Maintain a maximum value of 100 ppm.
 - e. Soluble Copper: Maintain a maximum value of 0.20 ppm.
 - f. TDS: Maintain a maximum value of 10 ppm.
 - g. Ammonia: Maintain a maximum value of 20 ppm.
 - h. Free Caustic Alkalinity: Maintain a maximum value of 20 ppm.
 - i. Microbiological Limits:
 - 1) Total Aerobic Plate Count: Maintain a maximum value of 1000 organisms/ml.
 - 2) Total Anaerobic Plate Count: Maintain a maximum value of 100 organisms/ml.
 - 3) Nitrate Reducers: Maintain a maximum value of 100 organisms/ml.
 - 4) Sulfate Reducers: Maintain a maximum value of 0 organisms/ml.
 - 5) Iron Bacteria: Maintain a maximum value of 0 organisms/ml.
 - 4. Steam Boiler and Steam Condensate:
 - a. Steam Condensate:
 - 1) pH: Maintain a value within 7.8 to 8.4.
 - 2) Total Alkalinity: Maintain a value within 5 to 50 ppm.



- 3) Chemical Oxygen Demand: Maintain a maximum value of 15 ppm.
- 4) Soluble Copper: Maintain a maximum value of 0.20 ppm.
- 5) TDS: Maintain a maximum value of 10 ppm.
- 6) Ammonia: Maintain a maximum value of 20 ppm.
- 7) Total Hardness: Maintain a maximum value of 2 ppm.
- b. Steam boiler operating at 15 psig (104 kPa) and less shall have the following water qualities:
 - 1) "OH" Alkalinity: Maintain a value within 200 to 400 ppm.
 - 2) TDS: Maintain a value within 600 to 3000 ppm.
- c. Steam boiler operating at more than 15 psig (104 kPa) shall have the following water qualities:
 - 1) "OH" Alkalinity: 200 to 400 ppm.
 - 2) TDS: Maintain a value within 600 to 1200 ppm to maximum 30 times RO water TDS.
5. Open hydronic systems, including condenser **OR** fluid-cooler spray, **as directed**, water, shall have the following water qualities:
 - a. pH: Maintain a value within 8.0 to 9.1.
 - b. "P" Alkalinity: Maintain a maximum value of 100 ppm.
 - c. Chemical Oxygen Demand: Maintain a maximum value of 100ppm.
 - d. Soluble Copper: Maintain a maximum value of 0.20 ppm.
 - e. TDS: Maintain a maximum value of 10 ppm.
 - f. Ammonia: Maintain a maximum value of 20 ppm.
 - g. Free "OH" Alkalinity: Maintain a maximum value of 0 ppm.
 - h. Microbiological Limits:
 - 1) Total Aerobic Plate Count: Maintain a maximum value of 10,000 organisms/ml.
 - 2) Total Anaerobic Plate Count: Maintain a maximum value of 1000 organisms/ml.
 - 3) Nitrate Reducers: Maintain a maximum value of 100 organisms/ml.
 - 4) Sulfate Reducers: Maintain a maximum value of 0 organisms/ml.
 - 5) Iron Bacteria: Maintain a maximum value of 0 organisms/ml.
 - i. Polymer Testable: Maintain a minimum value within 10 to 40.
6. Passivation for Galvanized Steel: For the first 60 days of operation.
 - a. pH: Maintain a value within 7 to 8.
 - b. Calcium Carbonate Hardness: Maintain a value within 100 to 300 ppm.
 - c. Calcium Carbonate Alkalinity: Maintain a value within 100 to 300 ppm.

E. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: Pretreatment and chemical treatment equipment showing tanks, maintenance space required, and piping connections to HVAC systems. Include plans, elevations, sections, details, and attachments to other work.
 - a. Wiring Diagrams: Power and control wiring.
3. Field quality-control test reports.
4. Manufacturer Seismic Qualification Certification
5. Other Informational Submittals:
 - a. Water-Treatment Program: Written sequence of operation on an annual basis for the application equipment required to achieve water quality defined in the "Performance Requirements" Article above.
 - b. Water Analysis: Illustrate water quality available at Project site.
 - c. Passivation Confirmation Report: Verify passivation of galvanized-steel surfaces, and confirm this observation in a letter to the Owner.

F. Quality Assurance

1. HVAC Water-Treatment Service Provider Qualifications: An experienced HVAC water-treatment service provider capable of analyzing water qualities, installing water-treatment equipment, and applying water treatment as specified in this Section.



2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.2 PRODUCTS

A. Manual Chemical-Feed Equipment

1. Bypass Feeders: Steel, with corrosion-resistant exterior coating, minimum 3-1/2-inch (89-mm) fill opening in the top, and NPS 3/4 (DN 20) bottom inlet and top side outlet. Quarter turn or threaded fill cap with gasket seal and diaphragm to lock the top on the feeder when exposed to system pressure in the vessel.
 - a. Capacity: 2 gal. (7.6 L) **OR** 5 gal. (19 L), **as directed**.
 - b. Minimum Working Pressure: 125 psig (860 kPa) **OR** 175 psig (1210 kPa), **as directed**.

B. Automatic Chemical-Feed Equipment

1. Water Meter:
 - a. AWWA C700, oscillating-piston, magnetic-drive, totalization meter.
 - b. Body: Bronze.
 - c. Maximum Pressure Loss at Design Flow: 3 psig (20 kPa).
 - d. Registration: Gallons (Liters) or cubic feet (cubic meters).
 - e. Controls: Flow-control switch with normally open contacts; rated for maximum 10 A, 250-V ac; and that will close at adjustable increments of total flow.
2. Water Meter:
 - a. AWWA C701, turbine-type, totalization meter.
 - b. Body: Bronze.
 - c. Minimum Working-Pressure Rating: 100 psig (690 kPa).
 - d. Maximum Pressure Loss at Design Flow: 3 psig (20 kPa).
 - e. Registration: Gallons (Liters) or cubic feet (cubic meters).
 - f. End Connections: Threaded.
 - g. Control: Low-voltage signal capable of transmitting 1000 feet (305 m).
3. Water Meter:
4. AWWA C701, turbine-type, totalization meter.
 - a. Body: Bronze **OR** Epoxy-coated cast iron, **as directed**.
 - b. Minimum Working-Pressure Rating: 150 psig (1035 kPa).
 - c. Maximum Pressure Loss at Design Flow: 3 psig (20 kPa).
 - d. Registration: Gallons (Liters) or cubic feet (cubic meters).
 - e. End Connections: Flanged.
 - f. Controls: Flow-control switch with normally open contacts; rated for maximum 10 A, 250-V ac; and that will close at adjustable increments of total flow.
5. Inhibitor Injection Timers:
 - a. Microprocessor-based controller with LCD display in NEMA 250, Type 12 enclosure with gasketed and lockable door. Interface for start/stop and status indication at central workstation as described in Division 23 Section "Instrumentation And Control For Hvac".
 - b. Programmable timers with infinite adjustment over full range, and mounted in cabinet with hand-off-auto switches and status lights.
 - c. Test switch.
 - d. Hand-off-auto switch for chemical pump.
 - e. Illuminated legend to indicate feed when pump is activated.
 - f. Programmable lockout timer with indicator light. Lockout timer to deactivate the pump and activate alarm circuits.
 - g. LCD makeup totalizer to measure amount of makeup and bleed-off water from two water meter inputs.
6. pH Controller:



- a. Microprocessor-based controller, 1 percent accuracy in a range from zero to 14 units. Incorporate solid-state integrated circuits and digital LCD display in NEMA 250, Type 12 enclosure with gasketed and lockable door. Interface for start/stop and status indication at central workstation as described in Division 23 Section "Instrumentation And Control For Hvac".
 - b. Digital display and touch pad for input.
 - c. Sensor probe adaptable to sample stream manifold.
 - d. High, low, and normal pH indication.
 - e. High or low pH alarm light, trip points field adjustable; with silence switch.
 - f. Hand-off-auto switch for acid pump.
 - g. Internal adjustable hysteresis or deadband.
7. TDS Controller:
- a. Microprocessor-based controller, 1 percent accuracy in a range from zero to 5000 micromhos. Incorporate solid-state integrated circuits and digital LCD display in NEMA 250, Type 12 enclosure with gasketed and lockable door. Interface for start/stop and status indication at central workstation as described in Division 23 Section "Instrumentation And Control For Hvac".
 - b. Digital display and touch pad for input.
 - c. Sensor probe adaptable to sample stream manifold.
 - d. High, low, and normal conductance indication.
 - e. High or low conductance alarm light, trip points field adjustable; with silence switch.
 - f. Hand-off-auto switch for solenoid bleed-off valve.
 - g. Bleed-off valve activated indication.
 - h. Internal adjustable hysteresis or deadband.
 - i. Bleed Valves:
 - 1) Cooling Systems: Forged-brass body, globe pattern, general-purpose solenoid with continuous-duty coil, or motorized valve.
 - 2) Steam Boilers: Motorized ball valve, steel body, and TFE seats and seals.
8. Biocide Feeder Timer:
- a. Microprocessor-based controller with digital LCD display in NEMA 250, Type 12 enclosure with gasketed and lockable door. Interface for start/stop and status indication at central workstation as described in Division 23 Section "Instrumentation And Control For Hvac".
 - b. 24-hour timer with 14-day skip feature to permit activation any hour of day.
 - c. Precision, solid-state, bleed-off lockout timer and clock-controlled biocide pump timer. Prebleed and bleed lockout timers.
 - d. Solid-state alternator to enable use of two different formulations.
 - e. 24-hour display of time of day.
 - f. 14-day display of day of week.
 - g. Battery backup so clock is not disturbed by power outages.
 - h. Hand-off-auto switches for biocide pumps.
 - i. Biocide A and Biocide B pump running indication.
9. Chemical Solution Tanks:
- a. Chemical-resistant reservoirs fabricated from high-density opaque polyethylene with minimum 110 percent containment vessel.
 - b. Molded cover with recess for mounting pump.
 - c. Capacity: 30 gal. (114 L) **OR** 50 gal. (189 L) **OR** 120 gal. (454 L), **as directed**.
10. Chemical Solution Injection Pumps:
- a. Self-priming, positive-displacement; rated for intended chemical with minimum 25 percent safety factor for design pressure and temperature.
 - b. Adjustable flow rate.
 - c. Metal and thermoplastic construction.
 - d. Built-in relief valve.
 - e. Fully enclosed, continuous-duty, single-phase motor. Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".



11. Chemical Solution Tubing: Polyethylene tubing with compression fittings and joints except ASTM A 269, Type 304, stainless steel for steam boiler injection assemblies.
 12. Injection Assembly:
 - a. Quill: Minimum NPS 1/2 (DN 15) with insertion length sufficient to discharge into at least 25 percent of pipe diameter.
 - b. Ball Valve: Three **OR** Two, **as directed**,-piece, stainless steel; selected to fit quill.
 - c. Packing Gland: Mechanical seal on quill of sufficient length to allow quill removal during system operation.
 - d. Assembly Pressure/Temperature Rating: Minimum 600 psig (4137 kPa) at 200 deg F (93 deg C).
- C. Ozone-Generator Biocide Equipment
1. Corona discharge generator with stainless-steel generating cells, and transformer housed in a NEMA 250, Type 4 enclosure. Assembly shall be suitable for continuous duty. Provide site glasses to verify proper operation of generator.
 2. Water-cooled generators shall be provided with cooling water at maximum 70 deg F (21 deg C) and 35 psig (241 kPa).
 3. Generator vessels exposed to system pressure shall be constructed according to ASME Boiler and Pressure Vessel Code and be equipped with pressure relief valve.
 4. External air compressor or induced airflow through a cleanable prefilter supplies concentrated oxygen through a molecular sieve with minus 62 deg F (minus 52 deg C) dew point to avoid the formation of nitric acid.
 5. Microprocessor-based control with software in EEPROM, surge protection, high-temperature cutout, and operational status lights. Interface for start/stop and status indication at central workstation as described in Division 23 Section "Instrumentation And Control For Hvac".
 6. Ozone Contactors:
 - a. Bubble diffusers.
 - b. Induction injection nozzle.
 - c. Injectors with static mixers.
 7. Ozone Detector and Alarm Devices:
 - a. Detector:
 - 1) Sensor: Metal dioxide semiconductor.
 - 2) Concentration Range: 0.01 to 0.14 ppm.
 - 3) Accuracy: Plus or minus 20 percent of range.
 - 4) Sensitivity: 0.01 ppm.
 - 5) Response Time: Maximum 10 seconds.
 - 6) Operating Temperature: 50 to 100 deg F (10 to 38 deg C).
 - 7) Relatively Humidity: 20 to 95 percent, noncondensing over the operating temperature range.
 - b. Horns:
 - 1) Electric-vibrating-polarized type.
 - 2) 24-V dc; with provision for housing the operating mechanism behind a grille.
 - 3) Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet (3 m) from the horn.
 - c. Visible Alarm Devices:
 - 1) Xenon strobe lights listed in UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate.
 - 2) Rated Light Output: 75 **OR** 110, **as directed**, candela.
 - 3) Strobe Leads: Factory connected to screw terminals.
 8. Self-Contained Breathing Apparatus: Open-circuit, pressure-demand, compressed air includes completely assembled, portable, self-contained devices designed for hazardous breathing environment application.
 - a. Face Piece: EPDM or silicone rubber construction material, one-size-fits-all with double-sealing edge, stainless-steel speaking diaphragm and lens retainer, five adjustable straps to hold face piece to head (two straps on each side and one on top), exhalation valve in



mask, close-fitting nose piece to ensure no CO₂ buildup, and perspiration drain to avoid skin irritation and to prevent eyepiece, spectacle, and lens fogging.

- b. Backplate: Orthopedically designed of chemical and impact-resistant, glass-fiber composite **OR** aluminum, **as directed**.
- c. Harness and Carrier Assembly: Large triangular back pad, backplate, and adjustable waist and shoulder straps. Modular in design, detachable components, and easy to clean and maintain. Shoulder straps padded with flame-resistant material, reinforced with stainless-steel cable, and attached with T-nuts, washers, and screws.
- d. Air Cylinder: 30 **OR** 45 **OR** 60, **as directed**, -minute, low-pressure, air-supply-loaded fiberglass **OR** aluminum **OR** steel, **as directed**, cylinders fitted with quick-fill assembly for refilling and air transfer.
- e. Wall-Mounting Cabinet: Leakproof, corrosion-resistant, clear, plastic case.
- f. Tested and Certified: By the National Institute for Occupational Safety and Health and by the Mine Safety and Health Administration, according to 42 CFR 84, Subpart H.

D. Stainless-Steel Pipes And Fittings

1. Stainless-Steel Tubing: Comply with ASTM A 269, Type 316.
2. Stainless-Steel Fittings: Complying with ASTM A 815/A 815M, Type 316, Grade WP-S.
3. Two-Piece, Full-Port, Stainless-Steel Ball Valves: ASTM A 351, Type 316 stainless-steel body; ASTM A 276, Type 316 stainless-steel stem and vented ball, carbon-filled TFE seats, threaded body design with adjustable stem packing, threaded ends, and 250-psig (1725-kPa) SWP and 600-psig (4140-kPa) CWP ratings.
4. Three-Piece, Full-Port, Stainless-Steel Ball Valves: ASTM A 351, Type 316 stainless-steel body; ASTM A 276, Type 316 stainless-steel stem and vented ball, threaded body design with adjustable stem packing, threaded ends, and 150-psig (1035-kPa) SWP and 600-psig (4140-kPa) CWP rating.

E. UV Biocide Equipment

1. Target Irradiation: Minimum 30,000 microwatts x s/sq. cm.
2. Light Source Vessels:
 - a. ASTM A 666, Type 304 stainless steel.
 - b. Construct for minimum 150 psig (1035 kPa) at 150 deg F (65 deg C) according to ASME Boiler and Pressure Vessel Code, and equipped with pressure relief valve.
 - c. Light Source Sleeve: Quartz, with EPDM O-ring seals.
 - d. Light Source: Replaceable UV lamp producing minimum target irradiation of 254-nm wavelength light.
3. Controls: Interlock with pumps to operate when water is circulating.

F. Chemical Treatment Test Equipment

1. Test Kit: Manufacturer-recommended equipment and chemicals in a wall-mounting cabinet for testing pH, TDS, inhibitor, chloride, alkalinity, and hardness; sulfite and testable polymer tests for high-pressure boilers, and oxidizing biocide test for open cooling systems.
2. Sample Cooler:
 - a. Tube: Sample.
 - 1) Size: NPS 1/4 (DN 8) tubing.
 - 2) Material: ASTM A 666, Type 316 stainless steel.
 - 3) Pressure Rating: Minimum 2000 psig (13 790 kPa).
 - 4) Temperature Rating: Minimum 850 deg F (454 deg C).
 - b. Shell: Cooling water.
 - 1) Material: ASTM A 666, Type 304 stainless steel.
 - 2) Pressure Rating: Minimum 250 psig (1725 kPa).
 - 3) Temperature Rating: Minimum 450 deg F (232 deg C).
 - c. Capacities and Characteristics:
 - 1) Tube: Sample.
 - a) Flow Rate: 0.25 gpm (0.016 L/s).



- b) Entering Temperature: 400 deg F (204 deg C).
 - c) Leaving Temperature: 88 deg F (31 deg C).
 - d) Pressure Loss: 6.5 psig (44.8 kPa).
 - 2) Shell: Cooling water.
 - a) Flow Rate: 3 gpm (0.19 L/s).
 - b) Entering Temperature: 70 deg F (21 deg C).
 - c) Pressure Loss: 1.0 psig (6.89 kPa).
 3. Corrosion Test-Coupon Assembly: Constructed of corrosive-resistant material, complete with piping, valves, and mild steel and copper coupons. Locate copper coupon downstream from mild steel coupon in the test-coupon assembly.
 - a. Two-station rack for closed-loop systems.
 - b. Four-station rack for open systems.
- G. Chemicals
 1. Chemicals shall be as recommended by water-treatment system manufacturer that are compatible with piping system components and connected equipment, and that can attain water quality specified in Part 1.1 "Performance Requirements" Article.
 2. Water Softener Chemicals:
 - a. Mineral: High-capacity, sulfonated-polystyrene ion-exchange resin that is stable over entire pH range with good resistance to bead fracture from attrition or shock. Resin exchange capacity minimum 30,000 grains/cu. ft. (69 kg/cu. m) of calcium carbonate of resin when regenerated with 15 lb (6.8 kg) of salt.
 - b. Salt for Brine Tanks: High-purity sodium chloride, free of dirt and foreign material. Rock and granulated forms are not acceptable.
- H. HVAC Makeup Water Softener
 1. Description: Twin mineral tanks and one brine tank, factory mounted on skid.
 2. Fabricate supports and attachments to tanks with reinforcement strong enough to resist tank movement during seismic event when tank supports are anchored to building structure as recommended in writing by manufacturer.
 3. Mineral Tanks:
 - a. Fabricate and label steel filter tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 - b. Fabricate and label FRP filter tanks to comply with ASME Boiler and Pressure Vessel Code: Section X, if indicated.
 - c. Pressure Rating: 100 psig (690 kPa) **OR** 125 psig (860 kPa) **OR** 150 psig (1035 kPa), **as directed**, minimum.
 - d. Wetted Components: Suitable for water temperatures from 40 to at least 100 deg F (5 to at least 38 deg C).
 - e. Freeboard: 50 percent, minimum, for backwash expansion above the normal resin bed level.
 - f. Support Legs or Skirt: Constructed of structural steel, welded or bonded to tank before testing and labeling.
 - g. Finish: Hot-dip galvanized on exterior and interior of tank after fabrication.
 - h. Upper Distribution System: Single-point type, fabricated from galvanized-steel pipe and fittings.
 - i. Lower Distribution System: Hub and radial-arm or header-lateral type; fabricated from PVC pipe and fittings with individual, fine-slotted, nonclogging PE strainers; arranged for even-flow distribution through resin bed.
 4. Controls: Automatic; factory mounted on mineral tanks and factory wired.
 - a. Adjustable duration of regeneration steps.
 - b. Push-button start and complete manual operation override.
 - c. Pointer on pilot-control valve shall indicate cycle of operation.
 - d. Means of manual operation of pilot-control valve if power fails.
 - e. Main Operating Valves: Industrial, automatic, multiport, diaphragm type with the following features:



- 1) Slow opening and closing, nonslam operation.
 - 2) Diaphragm guiding on full perimeter from fully open to fully closed.
 - 3) Isolated dissimilar metals within valve.
 - 4) Self-adjusting, internal, automatic brine injector that draws brine and rinses at constant rate independent of pressure.
 - 5) Float-operated brine valve to automatically measure the correct amount of brine to the softener and refill with fresh water.
 - 6) Sampling cocks for soft water.
 - f. Flow Control: Automatic control of backwash and flush rates over variations in operating pressures that do not require field adjustments. Equip mineral tanks with automatic-reset-head water meter that electrically activates cycle controller to initiate regeneration at preset total in gallons (liters), and automatically resets after regeneration to preset total in gallons (liters) for next service run. Include alternator to regenerate one mineral tank with the other in service.
 5. Brine Tank: Combination measuring and wet-salt storing system.
 - a. Tank and Cover Material: Fiberglass a minimum of 3/16 inch (4.8 mm) thick; or molded PE a minimum of 3/8 inch (9.5 mm) thick.
 - b. Brine Valve: Float operated and plastic fitted for automatic control of brine withdrawn and freshwater refill.
 - c. Size: Large enough for at least four regenerations at full salting.
 6. Factory-Installed Accessories:
 - a. Piping, valves, tubing, and drains.
 - b. Sampling cocks.
 - c. Main-operating-valve position indicators.
 - d. Water meters.
 7. Water Test Kit: Include water test kit in wall-mounting enclosure for water softener.
- I. RO Equipment For HVAC Makeup Water
1. Description: Factory fabricated and tested with RO membrane elements in housings, high-pressure pumps and motors, controls, valves, and prefilter; mounted on skid.
 2. Fabricate supports and attachments to tanks with reinforcement strong enough to resist tank movement during seismic event when tank supports are anchored to building structure as recommended in writing by manufacturer.
 3. Skid Assembly: Welded-steel frame coated with epoxy protective finish.
 4. RO Membrane and Housing:
 - a. Element: Thin-film composite with U-cup brine seal with minimum 98 percent salt rejection based on 2000-ppm water supplied at 225 psig (1551 kPa) and 77 deg F (25 deg C).
 - b. Housing: ASTM A 666, Type 304 stainless steel with PVC end caps held in place with stainless-steel straps.
 5. High-Pressure Pumps and Motors:
 - a. Pump:
 - 1) Vertical, multistage centrifugal operating at 3500 rpm with ASTM A 666, Type 304 stainless-steel casing, shaft, impellers, and inlet and discharge casting.
 - 2) Bearings shall be tungsten carbide and ceramic.
 - 3) Cast-iron frame and flanged suction and discharge connections.
 - b. Motor: NEMA-standard, C-faced TEFC motor supported on the pump-bearing frame. General requirements for motors are specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 6. Controls:
 - a. Microprocessor-based controller with LCD display.
 - b. Interlock for remote start/stop control.
 - c. Membrane flush sequence when pumps shut down.
 - d. Run time indicator.
 - e. Low-pressure safety cutoff.
 - f. Panel-mounted gages as follows:



- 1) Product and concentrate.
 - 2) Inlet, cartridge filter outlet, RO feed, RO concentrate, and RO product pressures.
 - 3) Product conductivity monitor.
7. Valves:
- a. Stainless-steel pump, concentrate, and recycle throttling valves rated for minimum 300 psig (2068 kPa).
 - b. Automatic inlet shutoff valve, diaphragm type; solenoid actuated, normally closed, and constructed of glass-reinforced noryl thermoplastic.
 - c. PVC valves with EPDM seats and seals for isolation at inlet, and check and sample valves at product and concentrate. Sample valves at cartridge filter outlet, concentrate, and product outlet.
8. Prefilter:
- a. Housing: Polypropylene with built-in relief or vent valve.
 - b. Element: Spun-wound polypropylene.
9. Inlet Water Tempering Valve: Thermostatic water-tempering valve to maintain 77 deg F (25 deg C), **as directed**, inlet water temperature to RO unit.
10. Activated Carbon Filter:
- a. Media Tank: Fiberglass-reinforced polyester rated for minimum 150 psig (1035 kPa) with internal backwash distributor and filtered water collector.
 - b. Media: 12 x 40-mesh, bituminous coal-based activated carbon.
 - c. Backwash Valve: Piston-operated control valve with drain-line, flow-control orifice.
 - d. Backwash Control: Seven-day time clock.
11. Atmospheric Storage Tank:
- a. Tank: Polyethylene single piece with closed top and flat bottom with manway in top, 0.2-micron filter vent, inlet, discharge, and drain piping connections, and bulkhead fittings for level controls.
 - b. Control: Level switches start and stop RO unit. Low-level limit shall stop repressurization pumps, and signal an alarm.
12. Repressurization Pumps:
- a. Pumps: Two close-coupled, single-stage centrifugal pumps, with mechanical seals. Wetted components ASTM A 666, Type 316 stainless steel.
 - b. Controls: NEMA-4X pump control panel constructed of fiberglass to control pumps, one operating, one standby, with automatic alternator and fail-over control.
 - c. Motor: ODP motor supported on the pump-bearing frame. General requirements for motors are specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
13. Water Test Kit: Include water test kit in wall-mounting cabinet for RO unit.
- J. Filtration Equipment
1. Multimedia Filters:
- a. Description: Factory-fabricated and -tested, simplex, multimedia filter system of filter tank, media, strainer, circulating pump, piping, and controls for removing particles from water.
 - 1) Filter Tank: Corrosion resistant with distribution system and media.
 - a) Fabricate and label steel filter tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 - b) Fabricate and label FRP filter tanks to comply with ASME Boiler and Pressure Vessel Code: Section X, if indicated.
 - c) Pipe Connections NPS 2 (DN 50) and Smaller: Threaded according to ASME B1.20.1.
 - d) Steel Tank Pipe Connections NPS 2-1/2 (DN 65) and Larger: Steel, Class 150 flanges according to ASME B16.5 or grooved according to AWWA C606.
 - e) FRP Tank Pipe Connections NPS 2-1/2 (DN 65) and Larger: Type A, integral; Designation E, 125-psig (0.862-MPa) or F, 150-psig (1.034-MPa) pressure category flanges of grade same as tank material according to ASTM D 5421.



- 2) Motorized Valves: Flanged or grooved-end, ductile-iron butterfly type with EPDM valve seat and stem seal; with ASTM B 148 aluminum bronze disc.
 - 3) Strainer: Basket type mounted on pump suction.
 - 4) Piping: ASTM A 53/A 53M, Type S, F, or E; Grade B, Schedule 40 black steel, with flanged, grooved, or threaded joints and malleable, steel welding, or ductile-iron fittings.
 - 5) Piping: ASTM B 88, Type L (ASTM B 88M, Type B) copper water tube, copper-alloy solder-joint fittings, and brazed, flanged, or grooved joints.
 - 6) Safety Valves: Automatic pressure relief.
 - 7) Circulating Pump: Overhung impeller, close coupled, single stage, end suction, centrifugal. Comply with UL 778 and with HI 1.1-1.2 and HI 1.3.
 - a) Casing: Radially split, cast iron.
 - b) Pressure Rating: 125 psig (860 kPa) **OR** 150 psig (1035 kPa), **as directed**, minimum.
 - c) Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, closed, and keyed to shaft.
 - d) Shaft and Shaft Sleeve: Steel shaft, with copper-alloy shaft sleeve.
 - e) Seal: Mechanical.
 - f) Motor: ODP motor supported on the pump-bearing frame. General requirements for motors are specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - 8) Controls: Automatic control of circulating pump and tank backwash; factory wired for single electrical connection.
 - a) Panel: NEMA 250, Type 4 enclosure with time clock and pressure gages.
 - b) Pump: Automatic and manual switching; manual switch position bypasses safeties and controls.
 - c) Backwash: Automatic; with time clock and differential pressure switch.
 - d) Backwash Valve: Tank mounted with valves interlocked to single actuator.
 - 9) Support: Skid mounting. Fabricate supports and base and attachment to tank with reinforcement strong enough to resist filter movement during a seismic event when filter base is anchored to building structure.
2. Self-Cleaning Strainers:
- a. Description: Factory-fabricated and -tested, ASTM A 126, Class B, cast-iron or steel, self-cleaning strainer system of tank, strainer, backwash arm or cleaning spiral, drive and motor, piping, and controls for removing particles from water.
 - 1) Fabricate and label ASTM A 126, Class B, cast-iron or steel strainer tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 - 2) Pipe Connections:
 - a) NPS 2 (DN 50) and Smaller: Threaded according to ASME B1.20.1.
 - b) NPS 2-1/2 (DN 65) and Larger: Steel, Class 150 flanges according to ASME B16.5 or grooved according to AWWA C606.
 - b. Motorized Valves: Flanged or grooved-end, ductile-iron angle type with EPDM valve seat and stem seal; with ASTM B 148 aluminum bronze disc.
 - c. Strainer: ASTM A 666, Type 316 stainless steel.
 - d. Piping: ASTM A 53/A 53M, Type S, F, or E; Grade B, Schedule 40 black steel, with flanged, grooved, or threaded joints and malleable, steel welding, or ductile-iron fittings.
 - e. Safety Valves: Automatic pressure relief.
 - f. Backwash Arm Drive:
 - 1) Drive Casing: Cast iron.
 - 2) Worm Gears: Immersed in oil.
 - 3) Motor: ODP motor supported on the strainer-bearing frame. General requirements for motors are specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - g. Controls: Automatic control of backwash; factory wired for single electrical connection.
 - 1) Panel: NEMA 250, Type 4 enclosure with time clock and pressure gages.



- 2) Backwash Arm Drive: Automatic and manual switching; manual switch position bypasses safeties and controls.
 - 3) Backwash: Automatic; with time clock and differential pressure switch.
 - 4) Backwash Valve: Electric actuator.
 - h. Support: Skid mounting. Fabricate supports and base and attachment to tank with reinforcement strong enough to resist strainer movement during a seismic event when strainer base is anchored to building structure.
3. Bag **OR** Cartridge, **as directed**, -Type Filters:
- a. Description: Floor-mounting housing with filter bags **OR** cartridges, **as directed**, for removing particles from water.
 - 1) Housing: Corrosion resistant; designed to separate inlet from outlet and to direct inlet through bag **OR** cartridge, **as directed**, -type water filter; with bag support and base, feet, or skirt.
 - a) Pipe Connections NPS 2 (DN 50) and Smaller: Threaded according to ASME B1.20.1.
 - b) Steel Housing Pipe Connections NPS 2-1/2 (DN 65) and Larger: Steel, Class 150 flanges according to ASME B16.5 or grooved according to AWWA C606.
 - c) Plastic Housing Pipe Connections NPS 2-1/2 (DN 65) and Larger: 150-psig (1035-kPa) plastic flanges.
 - 2) Bag **OR** Cartridge, **as directed**: Replaceable; of shape to fit housing.
4. Centrifugal Separators:
- a. Description: Simplex separator housing with baffles and chambers for removing particles from water by centrifugal action and gravity.
 - b. Housing: With manufacturer's proprietary system of baffles and chambers.
 - 1) Construction: Fabricate and label steel separator housing to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 - 2) Inlet: Designed with tangential entry to produce centrifugal flow of feedwater.
 - 3) Vortex Chamber: Designed for downward vortex flow and gravity separation of particles.
 - 4) Collection Chamber: Designed to hold separated particles.
 - 5) Outlet: Near top of unit.
 - 6) Purge: At bottom of collection chamber.
 - 7) Pipe Connections NPS 2 (DN 50) and Smaller: Threaded according to ASME B1.20.1.
 - 8) Pipe Connections NPS 2-1/2 (DN 65) and Larger: Steel, Class 150 flanges according to ASME B16.5 or grooved according to AWWA C606. Provide stainless-steel flanges if tank is stainless steel.
 - c. Motorized Purge Valve: Gate or plug pattern valve.
 - 1) Motorized Valves: Butterfly-type, flanged or grooved-end, ductile-iron body, with EPDM valve seat and stem seal; with ASTM B 148 aluminum bronze disc.
 - d. Strainer: Stainless-steel basket type mounted on pump suction.
 - e. Piping: ASTM A 53/A 53M, Type S, F, or E; Grade B, Schedule 40 black steel, with flanged, grooved, or threaded joints and malleable, steel welding, or ductile-iron fittings.
 - f. Piping: ASTM B 88, Type L (ASTM B 88M, Type B) copper water tube, copper-alloy solder-joint fittings, and brazed, flanged, or grooved joints.
 - g. Circulating Pump: Overhung impeller, close coupled, single stage, end suction, centrifugal. Comply with UL 778 and with HI 1.1-1.2 and HI 1.3.
 - 1) Casing: Radially split, cast iron.
 - 2) Pressure Rating: 125 psig (860 kPa) **OR** 150 psig (1035 kPa), **as directed**, minimum.
 - 3) Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, closed, and keyed to shaft.
 - 4) Shaft and Shaft Sleeve: Steel shaft, with copper-alloy shaft sleeve.
 - 5) Seal: Mechanical.



- 6) Motor: ODP motor supported on the pump-bearing frame. General requirements for motors are specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
- h. Controls: Automatic control of circulating pump and separator purge; factory wired for single electrical connection.
 - 1) Panel: NEMA 250, Type 4 enclosure.
 - 2) Pump: Automatic and manual switching; manual switch position bypasses safeties and controls.
 - 3) Separator Purge: Automatic and manual.
 - 4) TDS Controller Interlock: Open separator purge valve with bleed-off control.
- i. Support: Skid mounting. Fabricate supports and base and attachment to separator housing with reinforcement strong enough to resist separator movement during a seismic event when separator base is anchored to building structure.

1.3 EXECUTION

A. Water Analysis

1. Perform an analysis of supply water to determine quality of water available at Project site.

B. Installation

1. Install chemical application equipment on concrete bases, level and plumb. Maintain manufacturer's recommended clearances. Arrange units so controls and devices that require servicing are accessible. Anchor chemical tanks and floor-mounting accessories to substrate.
2. Install seismic restraints for equipment and floor-mounting accessories and anchor to building structure. Refer to Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment" for seismic restraints.
3. Install water testing equipment on wall near water chemical application equipment.
4. Install interconnecting control wiring for chemical treatment controls and sensors.
5. Mount sensors and injectors in piping circuits.
6. Bypass Feeders: Install in closed hydronic systems, including hot-water heating, chilled water, dual-temperature water, and glycol cooling, and equipped with the following:
 - a. Install bypass feeder in a bypass circuit around circulating pumps, unless otherwise indicated on Drawings.
 - b. Install water meter in makeup water supply.
 - c. Install test-coupon assembly in bypass circuit around circulating pumps, unless otherwise indicated on Drawings.
 - d. Install a gate or full-port ball isolation valves on inlet, outlet, and drain below feeder inlet.
 - e. Install a swing check on inlet after the isolation valve.
7. Install automatic chemical-feed equipment for steam boiler and steam condensate systems and include the following:
 - a. Install makeup water softener.
 - b. Install water meter in makeup water supply.
 - c. Install inhibitor injection pumps and solution tanks with injection timer sensing contacts in water meter.
 - 1) Pumps shall operate for timed interval when contacts close at water meter in makeup water supply connection. Injection pump shall discharge into boiler feedwater tank or feedwater supply connection at boiler.
 - d. Install test equipment and furnish test-kit to the Owner.
 - e. Install RO unit for makeup water.
 - f. Install TDS controller with sensor and bleed valves.
 - 1) Bleed valves shall cycle to maintain maximum TDS concentration.
 - g. Install inhibitor injection timer with injection pumps and solution tanks.



- 1) Pumps shall operate for timed interval on contact closure at water meter in makeup water supply connection. Injection pump shall discharge into main steam supply header.
8. Install automatic chemical-feed equipment for condenser **OR** fluid-cooler spray, **as directed**, water and include the following:
 - a. Install makeup water softener.
 - b. Install water meter in makeup water supply.
 - c. Install inhibitor injection pumps and solution tanks with injection timer sensing contacts in water meter.
 - 1) Pumps shall operate for timed interval on contact closure at water meter in makeup water supply connection. Injection pump shall discharge into boiler feedwater tank or feedwater supply connection at boiler.
 - d. Install test equipment and provide test-kit to the Owner. Install test-coupon assembly in bypass circuit around circulating pumps, unless otherwise indicated on Drawings.
 - e. Install TDS controller with sensor and bleed valves.
 - 1) Bleed valves shall cycle to maintain maximum TDS concentration.
 - f. Install pH sensor and controller with injection pumps and solution tanks.
 - 1) Injector pumps shall operate to maintain required pH.
 - g. Install biocide feeder alternating timer with two sets of injection pumps and solution tanks.
 - 1) Injection pumps shall operate to feed biocide on an alternating basis.
 - h. Install ozone generator with diffusers in condenser-water piping.
 - i. Ozone generator shall operate continuously with condenser-water flow.
 - j. Install UV-irradiation lamps in condenser-water piping.
 - 1) UV lights shall operate continuously with condenser-water flow.

C. Ozone-Generator Installation

1. Install ozone generator and equipment on concrete bases, level and plumb. Maintain manufacturer's recommended clearances. Arrange units so controls and devices that require servicing are accessible. Anchor mineral and brine tanks and floor-mounting accessories to substrate.
2. Install seismic restraints for equipment and floor-mounting accessories and anchor to building structure. Refer to Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment" for seismic restraints.
3. Pipe ozone from ozone generator to condenser water with stainless-steel pipe and fittings with welded joints.
4. Install two **OR** three, **as directed**,-piece, stainless-steel ball valve in ozone supply to condenser water.
5. Pipe cooling water to ozone generator, and to air-gap drain fitting with stainless-steel pipe and fittings with welded joints where enclosed in ozone-generator room.
6. Install two **OR** three, **as directed**,-piece, stainless-steel ball valve in cooling water supply to ozone generator.
7. Mounting supports for ozone generator shall be ASTM A 666, Type 316 stainless steel.
8. Mount breathing apparatus outside ozone-generator room.
9. Mount and install ozone detector, warning lights, and audible alarm inside ozone-generator room. Mount another set of warning lights and audible alarm just outside the main entrance to ozone-generator room.

D. UV-Irradiation Unit Installation

1. Install UV-irradiation units on concrete bases, level and plumb. Maintain manufacturer's recommended clearances. Arrange units so controls and devices that require servicing are accessible. Anchor mineral and brine tanks and floor-mounting accessories to substrate.
2. Install seismic restraints for UV-irradiation units and floor-mounting accessories and anchor to building structure. Refer to Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment" for seismic restraints.

E. Water Softener Installation



1. Install water softener equipment on concrete bases, level and plumb. Maintain manufacturer's recommended clearances. Arrange units so controls and devices that require servicing are accessible. Anchor mineral and brine tanks and floor-mounting accessories to substrate.
2. Install seismic restraints for tanks and floor-mounting accessories and anchor to building structure. Refer to Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment" for seismic restraints.
3. Install brine lines and fittings furnished by equipment manufacturer but not factory installed.
4. Prepare mineral-tank distribution system and underbed for minerals and place specified mineral into mineral tanks.
5. Install water-testing sets on wall adjacent to water softeners.

F. RO Unit Installation

1. Install RO unit and storage tank on concrete bases, level and plumb. Maintain manufacturer's recommended clearances. Arrange units so controls and devices that require servicing are accessible. Anchor RO unit and storage tank with pumps to substrate.
2. Install seismic restraints for tanks and floor-mounting accessories and anchor to building structure. Refer to Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment" for seismic restraints.
3. Install interconnecting piping and controls furnished by equipment manufacturer but not factory installed.
4. Install water testing sets on wall adjacent to RO unit.

G. Connections

1. Piping installation requirements are specified in other Division 21. Drawings indicate general arrangement of piping, fittings, and specialties.
2. Install piping adjacent to equipment to allow service and maintenance.
3. Make piping connections between HVAC water-treatment equipment and dissimilar-metal piping with dielectric fittings. Dielectric fittings are specified in Division 23 Section "Common Work Results For Hvac".
4. Install shutoff valves on HVAC water-treatment equipment inlet and outlet. Metal general-duty valves are specified in Division 23 Section "General-duty Valves For Hvac Piping".
5. Refer to Division 22 Section "Domestic Water Piping Specialties" for backflow preventers required in makeup water connections to potable-water systems.
6. Confirm applicable electrical requirements in Division 22 for connecting electrical equipment.
7. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
8. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

H. Field Quality Control

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
2. Perform tests and inspections and prepare test reports.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
3. Tests and Inspections:
 - a. Inspect field-assembled components and equipment installation, including piping and electrical connections.
 - b. Inspect piping and equipment to determine that systems and equipment have been cleaned, flushed, and filled with water, and are fully operational before introducing chemicals for water-treatment system.
 - c. Place HVAC water-treatment system into operation and calibrate controls during the preliminary phase of HVAC systems' startup procedures.



- d. Do not enclose, cover, or put piping into operation until it is tested and satisfactory test results are achieved.
- e. Test for leaks and defects. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
- f. Leave uncovered and unconcealed new, altered, extended, and replaced water piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.
- g. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow test pressure to stand for four hours. Leaks and loss in test pressure constitute defects.
- h. Repair leaks and defects with new materials and retest piping until no leaks exist.
4. Remove and replace malfunctioning units and retest as specified above.
5. Sample boiler water at one-week intervals after boiler startup for a period of five weeks, and prepare test report advising the Owner of changes necessary to adhere to Part 1 "Performance Requirements" Article for each required characteristic. Sample boiler water at four **OR** six **OR** eight, **as directed**,-week intervals following the testing noted above to show that automatic chemical-feed systems are maintaining water quality within performance requirements specified in this Section.
6. At four **OR** six **OR** eight, **as directed**,-week intervals following Final Completion, perform separate water analyses on hydronic systems to show that automatic chemical-feed systems are maintaining water quality within performance requirements specified in this Section. Submit written reports of water analysis advising the Owner of changes necessary to adhere to Part 1.1 "Performance Requirements" Article.
7. Comply with ASTM D 3370 and with the following standards:
 - a. Silica: ASTM D 859.
 - b. Steam System: ASTM D 1066.
 - c. Acidity and Alkalinity: ASTM D 1067.
 - d. Iron: ASTM D 1068.
 - e. Water Hardness: ASTM D 1126.
- I. Demonstration
 1. Engage a factory-authorized service representative to train the Owner's maintenance personnel to adjust, operate, and maintain HVAC water-treatment systems and equipment.

END OF SECTION 23 25 13 00



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23 - Heating, Ventilating, And Air-Conditioning (HVAC)

Task	Specification	Specification Description
23 25 13 00	22 05 23 00	Piped Utilities Basic Materials And Methods
23 25 13 00	22 11 16 00c	Hydronic Piping



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SECTION 23 31 13 13 - METAL DUCTS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for metal ducts. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Single-wall rectangular ducts and fittings.
 - b. Double-wall rectangular ducts and fittings.
 - c. Single-wall round and flat-oval ducts and fittings.
 - d. Double-wall round and flat-oval ducts and fittings.
 - e. Sheet metal materials.
 - f. Duct liner.
 - g. Sealants and gaskets.
 - h. Hangers and supports.
 - i. Seismic-restraint devices.

C. Performance Requirements

1. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.
2. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and ASCE/SEI 7 **OR** SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems", **as directed**.
 - a. Seismic Hazard Level A: Seismic force to weight ratio, 0.48.
OR
Seismic Hazard Level B: Seismic force to weight ratio, 0.30.
OR
Seismic Hazard Level C: Seismic force to weight ratio, 0.15.
3. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

D. Submittals

1. Product Data: For each type of the following products:
 - a. Liners and adhesives.
 - b. Sealants and gaskets.
 - c. Seismic-restraint devices.
2. LEED Submittals:
 - a. Product Data for Prerequisite EQ 1: Documentation indicating that duct systems comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
 - b. Product Data for Prerequisite EA 2: Documentation indicating that duct systems comply with ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."
 - c. Leakage Test Report for Prerequisite EA 2: Documentation of work performed for compliance with ASHRAE/IESNA 90.1, Section 6.4.4.2.2 - "Duct Leakage Tests."
 - d. Duct-Cleaning Test Report for Prerequisite EQ 1: Documentation of work performed for compliance with ASHRAE 62.1, Section 7.2.4 - "Ventilation System Start-Up."



- e. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.
 3. Shop Drawings:
 - a. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
 - b. Factory- and shop-fabricated ducts and fittings.
 - c. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
 - d. Elevation of top of ducts.
 - e. Dimensions of main duct runs from building grid lines.
 - f. Fittings.
 - g. Reinforcement and spacing.
 - h. Seam and joint construction.
 - i. Penetrations through fire-rated and other partitions.
 - j. Equipment installation based on equipment being used on Project.
 - k. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
 - l. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.
 4. Delegated-Design Submittal:
 - a. Sheet metal thicknesses.
 - b. Joint and seam construction and sealing.
 - c. Reinforcement details and spacing.
 - d. Materials, fabrication, assembly, and spacing of hangers and supports.
 - e. Design Calculations: Calculations, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation for selecting hangers and supports and seismic restraints.
 5. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - a. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
 - b. Suspended ceiling components.
 - c. Structural members to which duct will be attached.
 - d. Size and location of initial access modules for acoustical tile.
 - e. Penetrations of smoke barriers and fire-rated construction.
 - f. Items penetrating finished ceiling including the following:
 - 1) Lighting fixtures.
 - 2) Air outlets and inlets.
 - 3) Speakers.
 - 4) Sprinklers.
 - 5) Access panels.
 - 6) Perimeter moldings.
 6. Welding certificates.
 7. Field quality-control reports.
- E. Quality Assurance
1. Welding Qualifications: Qualify procedures and personnel according to the following:
 - a. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
 - b. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
 - c. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
 2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."
 3. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."



1.2 PRODUCTS

A. Single-Wall Rectangular Ducts And Fittings

1. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
2. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
3. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
4. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Double-Wall Rectangular Ducts And Fittings

1. Rectangular Ducts: Fabricate ducts with indicated dimensions for the inner duct.
 2. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
 3. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 4. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 5. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
 - a. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F (0.039 W/m x K) at 75 deg F (24 deg C) mean temperature.
 - b. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
 - c. Coat insulation with antimicrobial coating.
 - d. Cover insulation with polyester film complying with UL 181, Class 1.
- OR**
6. Interstitial Insulation: Flexible elastomeric duct liner complying with ASTM C 534, Type II for sheet materials, and with NFPA 90A or NFPA 90B.
 - a. Maximum Thermal Conductivity: 0.25 Btu x in./h x sq. ft. x deg F (0.034 W/m x K) at 75 deg F (24 deg C) mean temperature.
 7. Inner Duct: Minimum 0.028-inch (0.7-mm) perforated galvanized sheet steel having 3/32-inch (2.4-mm-) diameter perforations, with overall open area of 23 percent **OR** solid sheet steel, **as directed**.
 8. Formed-on Transverse Joints (Flanges): Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."



9. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Single-Wall Round And Flat-Oval Ducts And Fittings
1. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
 2. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).
 3. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - a. Transverse Joints in Ducts Larger Than 60 Inches (1524 mm) in Diameter: Flanged.
 4. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - a. Fabricate round ducts larger than 90 inches (2286 mm) in diameter with butt-welded longitudinal seams.
 - b. Fabricate flat-oval ducts larger than 72 inches (1830 mm) in width (major dimension) with butt-welded longitudinal seams.
 5. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Double-Wall Round And Flat-Oval Ducts And Fittings
1. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension) of the inner duct.
 2. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on static-pressure class unless otherwise indicated.
 - a. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 1) Transverse Joints in Ducts Larger Than 60 Inches (1524 mm) in Diameter: Flanged.
 - b. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 1) Fabricate round ducts larger than 90 inches (2286 mm) in diameter with butt-welded longitudinal seams.
 - 2) Fabricate flat-oval ducts larger than 72 inches (1830 mm) in width (major dimension) with butt-welded longitudinal seams.
 - c. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements,



- materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
3. Inner Duct: Minimum 0.028-inch (0.7-mm) perforated galvanized sheet steel having 3/32-inch-(2.4-mm-) diameter perforations, with overall open area of 23 percent **OR** solid sheet steel, **as directed**.
 4. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
 - a. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F (0.039 W/m x K) at 75 deg F (24 deg C) mean temperature.
 - b. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
 - c. Coat insulation with antimicrobial coating.
 - d. Cover insulation with polyester film complying with UL 181, Class 1.**OR**
 5. Interstitial Insulation: Flexible elastomeric duct liner complying with ASTM C 534, Type II for sheet materials, and with NFPA 90A or NFPA 90B.
 - a. Maximum Thermal Conductivity: 0.25 Btu x in./h x sq. ft. x deg F (0.034 W/m x K) at 75 deg F (24 deg C) mean temperature.
- E. Sheet Metal Materials
1. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
 2. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - a. Galvanized Coating Designation: G60 (Z180) **OR** G90 (Z275), **as directed**.
 - b. Finishes for Surfaces Exposed to View: Mill phosphatized.
 3. PVC-Coated, Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - a. Galvanized Coating Designation: G60 (Z180) **OR** G90 (Z275), **as directed**.
 - b. Minimum Thickness for Factory-Applied PVC Coating: 4 mils (0.10 mm) thick on sheet metal surface of ducts and fittings exposed to corrosive conditions, and minimum 1 mil (0.025 mm) thick on opposite surface, **as directed**.
 - c. Coating Materials: Acceptable to authorities having jurisdiction for use on ducts listed and labeled by an NRTL for compliance with UL 181, Class 1.
 4. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.
 5. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.
 6. Aluminum Sheets: Comply with ASTM B 209 (ASTM B 209M) Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.
 7. Factory- or Shop-Applied Antimicrobial Coating:
 - a. Apply to the surface of sheet metal that will form the interior surface of the duct. An untreated clear coating shall be applied to the exterior surface.
 - b. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
 - c. Coating containing the antimicrobial compound shall have a hardness of 2H, minimum, when tested according to ASTM D 3363.
 - d. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
 - e. Shop-Applied Coating Color: Black **OR** White, **as directed**.
 - f. Antimicrobial coating on sheet metal is not required for duct containing liner treated with antimicrobial coating.
 8. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.



- a. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
9. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

F. Duct Liner

1. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
 - a. Maximum Thermal Conductivity:
 - 1) Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F (0.039 W/m x K) at 75 deg F (24 deg C) mean temperature.
 - 2) Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F (0.033 W/m x K) at 75 deg F (24 deg C) mean temperature.
 - b. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
 - c. Solvent-Based **OR** Water-Based, **as directed**, Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
 - 1) For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Flexible Elastomeric Duct Liner: Preformed, cellular, closed-cell, sheet materials complying with ASTM C 534, Type II, Grade 1; and with NFPA 90A or NFPA 90B.
 - a. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
 - b. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.
 - 1) For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Natural-Fiber Duct Liner: 85 percent cotton, 10 percent borate, and 5 percent polybinding fibers, treated with a microbial growth inhibitor and complying with NFPA 90A or NFPA 90B.
 - a. Maximum Thermal Conductivity: 0.24 Btu x in./h x sq. ft. x deg F (0.034 W/m x K) at 75 deg F (24 deg C) mean temperature when tested according to ASTM C 518.
 - b. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to ASTM E 84; certified by an NRTL.
 - c. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.
 - 1) For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
4. Insulation Pins and Washers:
 - a. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- (2.6-mm-) **OR** 0.135-inch- (3.5-mm-), **as directed**, diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch (38-mm) galvanized carbon-steel washer.
 - b. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick galvanized steel **OR** aluminum **OR** stainless steel, **as directed**; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.
5. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-19, "Flexible Duct Liner Installation."
 - a. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
 - b. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.



- c. Butt transverse joints without gaps, and coat joint with adhesive.
- d. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
- e. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
- f. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm (12.7 m/s).
- g. Secure liner with mechanical fasteners 4 inches (100 mm) from corners and at intervals not exceeding 12 inches (300 mm) transversely; at 3 inches (75 mm) from transverse joints and at intervals not exceeding 18 inches (450 mm) longitudinally.
- h. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
 - 1) Fan discharges.
 - 2) Intervals of lined duct preceding unlined duct.
 - 3) Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm (12.7 m/s) or where indicated.
- i. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.
 - 1) Sheet Metal Inner Duct Perforations: 3/32-inch (2.4-mm) diameter, with an overall open area of 23 percent.
- j. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

G. Sealant And Gaskets

- 1. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- 2. Two-Part Tape Sealing System:
 - a. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
 - b. Tape Width: 3 inches (76 mm) **OR** 4 inches (102 mm) **OR** 6 inches (152 mm), **as directed**.
 - c. Sealant: Modified styrene acrylic.
 - d. Water resistant.
 - e. Mold and mildew resistant.
 - f. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
 - g. Service: Indoor and outdoor.
 - h. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).
 - i. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
 - j. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- 3. Water-Based Joint and Seam Sealant:
 - a. Application Method: Brush on.
 - b. Solids Content: Minimum 65 percent.
 - c. Shore A Hardness: Minimum 20.
 - d. Water resistant.
 - e. Mold and mildew resistant.
 - f. VOC: Maximum 75 g/L (less water).
 - g. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
 - h. Service: Indoor or outdoor.



- i. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
 - 4. Solvent-Based Joint and Seam Sealant:
 - a. Application Method: Brush on.
 - b. Base: Synthetic rubber resin.
 - c. Solvent: Toluene and heptane.
 - d. Solids Content: Minimum 60 percent.
 - e. Shore A Hardness: Minimum 60.
 - f. Water resistant.
 - g. Mold and mildew resistant.
 - h. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - i. VOC: Maximum 395 g/L.
 - j. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive or negative.
 - k. Service: Indoor or outdoor.
 - l. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
 - 5. Flanged Joint Sealant: Comply with ASTM C 920.
 - a. General: Single-component, acid-curing, silicone, elastomeric.
 - b. Type: S.
 - c. Grade: NS.
 - d. Class: 25.
 - e. Use: O.
 - f. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 6. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
 - 7. Round Duct Joint O-Ring Seals:
 - a. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg (0.14 L/s per sq. m at 250 Pa) and shall be rated for 10-inch wg (2500-Pa) static-pressure class, positive or negative.
 - b. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
 - c. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.
- H. Hangers And Supports
 - 1. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
 - 2. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
 - 3. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1 (Table 4-1M), "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."
 - 4. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
 - 5. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
 - 6. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
 - 7. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
 - 8. Trapeze and Riser Supports:
 - a. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
 - b. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
 - c. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.
- I. Seismic-Restraint Devices
 - 1. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of the ICC Evaluation Service **OR**



the Office of Statewide Health Planning and Development for the State of California **OR** an agency acceptable to authorities having jurisdiction, **as directed**.

- a. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
2. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.
3. Restraint Cables: ASTM A 603, galvanized-steel **OR** ASTM A 492, stainless-steel, **as directed**, cables with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips.
4. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections **OR** Reinforcing steel angle clamped, **as directed**, to hanger rod.
5. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

1.3 EXECUTION

A. Duct Installation

1. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
2. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
3. Install round and flat-oval ducts in maximum practical lengths.
4. Install ducts with fewest possible joints.
5. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
6. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
7. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
8. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.
9. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
10. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches (38 mm).
11. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.
12. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines", **as directed**.

B. Installation Of Exposed Ductwork

1. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
2. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.



3. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
 4. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
 5. Repair or replace damaged sections and finished work that does not comply with these requirements.
- C. Additional Installation Requirements For Commercial Kitchen Hood Exhaust Duct
1. Install commercial kitchen hood exhaust ducts without dips and traps that may hold grease, and sloped a minimum of 2 percent to drain grease back to the hood.
 2. Install fire-rated access panel assemblies at each change in direction and at maximum intervals of 20 feet (6 m) **OR** 12 feet (3.7 m), **as directed**, in horizontal ducts, and at every floor for vertical ducts, or as indicated on Drawings. Locate access panel on top or sides of duct a minimum of 1-1/2 inches (38 mm) from bottom of duct.
 3. Do not penetrate fire-rated assemblies except as allowed by applicable building codes and authorities having jurisdiction.
- D. Duct Sealing
1. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
OR
 Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
 - a. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - b. Outdoor, Supply-Air Ducts: Seal Class A.
 - c. Outdoor, Exhaust Ducts: Seal Class C.
 - d. Outdoor, Return-Air Ducts: Seal Class C.
 - e. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg (500 Pa) and Lower: Seal Class B.
 - f. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg (500 Pa): Seal Class A.
 - g. Unconditioned Space, Exhaust Ducts: Seal Class C.
 - h. Unconditioned Space, Return-Air Ducts: Seal Class B.
 - i. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg (500 Pa) and Lower: Seal Class C.
 - j. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg (500 Pa): Seal Class B.
 - k. Conditioned Space, Exhaust Ducts: Seal Class B.
 - l. Conditioned Space, Return-Air Ducts: Seal Class C.
- E. Hanger And Support Installation
1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."
 2. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - a. Where practical, install concrete inserts before placing concrete.
 - b. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 - c. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches (100 mm) thick.
 - d. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.
 - e. Do not use powder-actuated concrete fasteners for seismic restraints.



3. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1 (Table 4-1M), "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches (610 mm) of each elbow and within 48 inches (1200 mm) of each branch intersection.
 4. Hangers Exposed to View: Threaded rod and angle or channel supports.
 5. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet (5 m).
 6. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- F. Seismic-Restraint-Device Installation
1. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems" **OR** ASCE/SEI 7, **as directed**.
 - a. Space lateral supports a maximum of 40 feet (12 m) o.c., and longitudinal supports a maximum of 80 feet (24 m) o.c.
 - b. Brace a change of direction longer than 12 feet (3.7 m).
 2. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.
 3. Install cables so they do not bend across edges of adjacent equipment or building structure.
 4. Install cable restraints on ducts that are suspended with vibration isolators.
 5. Install seismic-restraint devices using methods approved by an evaluation service member of the ICC Evaluation Service **OR** the Office of Statewide Health Planning and Development for the State of California **OR** an agency acceptable to authorities having jurisdiction, **as directed**.
 6. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.
 7. Drilling for and Setting Anchors:
 - a. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify the the Owner if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - b. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - c. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 - d. Set anchors to manufacturer's recommended torque, using a torque wrench.
 - e. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.
- G. Connections
1. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories".
 2. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.
- H. Painting
1. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 07.
- I. Field Quality Control
1. Perform tests and inspections.



2. Leakage Tests:
 - a. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
 - b. Test the following systems:
 - 1) Ducts with a Pressure Class Higher Than 3-Inch wg (750 Pa): Test representative duct sections, selected by the Owner from sections installed, **as directed**, totaling no less than 25 percent of total installed duct area for each designated pressure class.
 - 2) Supply Ducts with a Pressure Class of 2-Inch wg (500 Pa) **OR** 3-Inch wg (750 Pa) **OR** 4-Inch wg (1000 Pa), **as directed**, or Higher: Test representative duct sections, selected by the Owner from sections installed, **as directed**, totaling no less than 50 **OR** 100, **as directed**, percent of total installed duct area for each designated pressure class.
 - 3) Return Ducts with a Pressure Class of 2-Inch wg (500 Pa) **OR** 3-Inch wg (750 Pa) **OR** 4-Inch wg (1000 Pa), **as directed**, or Higher: Test representative duct sections, selected by the Owner from sections installed, **as directed**, totaling no less than 50 **OR** 100, **as directed**, percent of total installed duct area for each designated pressure class.
 - 4) Exhaust Ducts with a Pressure Class of 2-Inch wg (500 Pa) **OR** 3-Inch wg (750 Pa) **OR** 4-Inch wg (1000 Pa), **as directed**, or Higher: Test representative duct sections, selected by the Owner from sections installed, **as directed**, totaling no less than 50 **OR** 100, **as directed**, percent of total installed duct area for each designated pressure class.
 - 5) Outdoor Air Ducts with a Pressure Class of 2-Inch wg (500 Pa) **OR** 3-Inch wg (750 Pa) **OR** 4-Inch wg (1000 Pa), **as directed**, or Higher: Test representative duct sections, selected by the Owner from sections installed, **as directed**, totaling no less than 50 **OR** 100, **as directed**, percent of total installed duct area for each designated pressure class.
 - c. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
 - d. Test for leaks before applying external insulation.
 - e. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
 - f. Give seven days' advance notice for testing.
3. Duct System Cleanliness Tests:
 - a. Visually inspect duct system to ensure that no visible contaminants are present.
 - b. Test sections of metal duct system, chosen randomly by the Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
 - 1) Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.
4. Duct system will be considered defective if it does not pass tests and inspections.
5. Prepare test and inspection reports.

J. Duct Cleaning

1. Clean new **OR** existing **OR** new and existing, **as directed**, duct system(s) before testing, adjusting, and balancing.
2. Use service openings for entry and inspection.
 - a. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Division 23 Section "Air Duct Accessories" for access panels and doors.
 - b. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
 - c. Remove and reinstall ceiling to gain access during the cleaning process.



3. Particulate Collection and Odor Control:
 - a. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
 - b. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.
4. Clean the following components by removing surface contaminants and deposits:
 - a. Air outlets and inlets (registers, grilles, and diffusers).
 - b. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
 - c. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
 - d. Coils and related components.
 - e. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
 - f. Supply-air ducts, dampers, actuators, and turning vanes.
 - g. Dedicated exhaust and ventilation components and makeup air systems.
5. Mechanical Cleaning Methodology:
 - a. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
 - b. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
 - c. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
 - d. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
 - e. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
 - f. Provide drainage and cleanup for wash-down procedures.
 - g. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

K. Start Up

1. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, And Balancing For Hvac".

L. Duct Schedule

1. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:
 - a. Underground Ducts: Concrete-encased, galvanized sheet steel **OR** PVC-coated, galvanized sheet steel with thicker coating on duct exterior **OR** stainless steel, **as directed**.
2. Supply Ducts:
 - a. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
 - 1) Pressure Class: Positive 1-inch wg (250 Pa) **OR** 2-inch wg (500 Pa), **as directed**.
 - 2) Minimum SMACNA Seal Class: A **OR** B **OR** C, **as directed**.
 - 3) SMACNA Leakage Class for Rectangular: 12 **OR** 24, **as directed**.
 - 4) SMACNA Leakage Class for Round and Flat Oval: 12 **OR** 24, **as directed**.
 - b. Ducts Connected to Constant-Volume Air-Handling Units:
 - 1) Pressure Class: Positive 2-inch wg (500 Pa) **OR** 3-inch wg (750 Pa), **as directed**.
 - 2) Minimum SMACNA Seal Class: A **OR** B, **as directed**.
 - 3) SMACNA Leakage Class for Rectangular: 6 **OR** 12 **OR** 24, **as directed**.



- 4) SMACNA Leakage Class for Round and Flat Oval: 6 **OR** 12 **OR** 24, **as directed**.
- c. Ducts Connected to Variable-Air-Volume Air-Handling Units:
 - 1) Pressure Class: Positive 3-inch wg (750 Pa) **OR** 4-inch wg (1000 Pa), **as directed**.
 - 2) Minimum SMACNA Seal Class: A **OR** B, **as directed**.
 - 3) SMACNA Leakage Class for Rectangular: 3 **OR** 6, **as directed**.
 - 4) SMACNA Leakage Class for Round and Flat Oval: 3 **OR** 6, **as directed**.
- d. Ducts Connected to Equipment Not Listed Above:
 - 1) Pressure Class: Positive 2-inch wg (500 Pa) **OR** 3-inch wg (750 Pa) **OR** 4-inch wg (1000 Pa), **as directed**.
 - 2) Minimum SMACNA Seal Class: A **OR** B, **as directed**.
 - 3) SMACNA Leakage Class for Rectangular: 3 **OR** 6 **OR** 12, **as directed**.
 - 4) SMACNA Leakage Class for Round and Flat Oval: 3 **OR** 6 **OR** 12, **as directed**.
3. Return Ducts:
 - a. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
 - 1) Pressure Class: Positive or negative 1-inch wg (250 Pa) **OR** 2-inch wg (500 Pa), **as directed**.
 - 2) Minimum SMACNA Seal Class: A **OR** B **OR** C, **as directed**.
 - 3) SMACNA Leakage Class for Rectangular: 12 **OR** 24, **as directed**.
 - 4) SMACNA Leakage Class for Round and Flat Oval: 12 **OR** 24, **as directed**.
 - b. Ducts Connected to Air-Handling Units:
 - 1) Pressure Class: Positive or negative 2-inch wg (500 Pa) **OR** 3-inch wg (750 Pa), **as directed**.
 - 2) Minimum SMACNA Seal Class: A **OR** B, **as directed**.
 - 3) SMACNA Leakage Class for Rectangular: 6 **OR** 12 **OR** 24, **as directed**.
 - 4) SMACNA Leakage Class for Round and Flat Oval: 6 **OR** 12 **OR** 24, **as directed**.
 - c. Ducts Connected to Equipment Not Listed Above:
 - 1) Pressure Class: Positive or negative 2-inch wg (500 Pa) **OR** 3-inch wg (750 Pa) **OR** 4-inch wg (1000 Pa), **as directed**.
 - 2) Minimum SMACNA Seal Class: A **OR** B, **as directed**.
 - 3) SMACNA Leakage Class for Rectangular: 3 **OR** 6 **OR** 12, **as directed**.
 - 4) SMACNA Leakage Class for Round and Flat Oval: 3 **OR** 6 **OR** 12, **as directed**.
4. Exhaust Ducts:
 - a. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
 - 1) Pressure Class: Negative 1-inch wg (250 Pa) **OR** 2-inch wg (500 Pa) **OR** 3-inch wg (750 Pa), **as directed**.
 - 2) Minimum SMACNA Seal Class: A **OR** B **OR** C, **as directed**, if negative pressure, and A if positive pressure.
 - 3) SMACNA Leakage Class for Rectangular: 12 **OR** 24, **as directed**.
 - 4) SMACNA Leakage Class for Round and Flat Oval: 6 **OR** 12 **OR** 24, **as directed**.
 - b. Ducts Connected to Air-Handling Units:
 - 1) Pressure Class: Positive or negative 2-inch wg (500 Pa) **OR** 3-inch wg (750 Pa) **as directed**.
 - 2) Minimum SMACNA Seal Class: A **OR** B, **as directed**, if negative pressure, and A if positive pressure.
 - 3) SMACNA Leakage Class for Rectangular: 6 **OR** 12 **OR** 24, **as directed**.
 - 4) SMACNA Leakage Class for Round and Flat Oval: 3 **OR** 6 **OR** 12 **OR** 24, **as directed**.
 - c. Ducts Connected to Commercial Kitchen Hoods: Comply with NFPA 96.
 - 1) Exposed to View: Type 304, stainless-steel sheet, No. 4 **OR** No. 3, **as directed**, finish.
 - 2) Concealed: Type 304, stainless-steel sheet, No. 2D finish **OR** Carbon-steel sheet, **as directed**.
 - 3) Welded seams and joints.
 - 4) Pressure Class: Positive or negative 2-inch wg (500 Pa) **OR** 3-inch wg (750 Pa) **OR** 4-inch wg (1000 Pa), **as directed**.



- 5) Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
- 6) SMACNA Leakage Class: 3.
- d. Ducts Connected to Dishwasher Hoods:
 - 1) Type 304, stainless-steel sheet.
 - 2) Exposed to View: No. 4 **OR** No. 3, **as directed**, finish.
 - 3) Concealed: No. 2D finish.
 - 4) Welded seams and flanged joints with watertight EPDM gaskets.
 - 5) Pressure Class: Positive or negative 2-inch wg (500 Pa) **OR** 3-inch wg (750 Pa), **as directed**.
 - 6) Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
 - 7) SMACNA Leakage Class: 3.
- e. Ducts Connected to Fans Exhausting Laboratory and Process (ASHRAE 62.1, Class 3 and 4) Air:
 - 1) Type 316 **OR** Type 304, **as directed**, stainless-steel sheet.
 - a) Exposed to View: No. 4 **OR** No. 3, **as directed**, finish.
 - b) Concealed: No. 2B **OR** No. 2D, **as directed**, finish.
 - OR**
 - PVC-coated, galvanized sheet steel with thicker coating on duct interior.
 - 2) Pressure Class: Positive or negative 3-inch wg (750 Pa) **OR** 4-inch wg (1000 Pa) **OR** 6-inch wg (1500 Pa), **as directed**.
 - 3) Minimum SMACNA Seal Class: A **OR** Welded seams, joints, and penetrations, **as directed**.
 - 4) SMACNA Leakage Class: 3.
- f. Ducts Connected to Equipment Not Listed Above:
 - 1) Pressure Class: Positive or negative 2-inch wg (500 Pa) **OR** 3-inch wg (750 Pa) **OR** 4-inch wg (1000 Pa), **as directed**.
 - 2) Minimum SMACNA Seal Class: A **OR** B, **as directed**, if negative pressure, and A if positive pressure.
 - 3) SMACNA Leakage Class for Rectangular: 6 **OR** 12 **OR** 24, **as directed**.
 - 4) SMACNA Leakage Class for Round and Flat Oval: 3 **OR** 6 **OR** 12 **OR** 24, **as directed**.
- 5. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:
 - a. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
 - 1) Pressure Class: Positive or negative 1-inch wg (250 Pa) **OR** 2-inch wg (500 Pa), **as directed**.
 - 2) Minimum SMACNA Seal Class: A **OR** B **OR** C, **as directed**.
 - 3) SMACNA Leakage Class for Rectangular: 12 **OR** 24, **as directed**.
 - 4) SMACNA Leakage Class for Round and Flat Oval: 6 **OR** 12 **OR** 24, **as directed**.
 - b. Ducts Connected to Air-Handling Units:
 - 1) Pressure Class: Positive or negative 2-inch wg (500 Pa) **OR** 3-inch wg (750 Pa), **as directed**.
 - 2) Minimum SMACNA Seal Class: A **OR** B, **as directed**.
 - 3) SMACNA Leakage Class for Rectangular: 6 **OR** 12 **OR** 24, **as directed**.
 - 4) SMACNA Leakage Class for Round and Flat Oval: 3 **OR** 6 **OR** 12 **OR** 24, **as directed**.
 - c. Ducts Connected to Equipment Not Listed Above:
 - 1) Pressure Class: Positive or negative 2-inch wg (500 Pa) **OR** 3-inch wg (750 Pa) **OR** 4-inch wg (1000 Pa), **as directed**.
 - 2) Minimum SMACNA Seal Class: A **OR** B, **as directed**.
 - 3) SMACNA Leakage Class for Rectangular: 3 **OR** 6 **OR** 12, **as directed**.
 - 4) SMACNA Leakage Class for Round and Flat Oval: 3 **OR** 6 **OR** 12, **as directed**.
- 6. Intermediate Reinforcement:
 - a. Galvanized-Steel Ducts: Galvanized steel **OR** Carbon steel coated with zinc-chromate primer **OR** Galvanized steel or carbon steel coated with zinc-chromate primer, **as directed**.
 - b. PVC-Coated Ducts:
 - 1) Exposed to Airstream: Match duct material.



- 2) Not Exposed to Airstream: Galvanized **OR** Match duct material, **as directed**.
 - c. Stainless-Steel Ducts:
 - 1) Exposed to Airstream: Match duct material.
 - 2) Not Exposed to Airstream: Galvanized **OR** Match duct material, **as directed**.
 - d. Aluminum Ducts: Aluminum **OR** galvanized sheet steel coated with zinc chromate, **as directed**.
7. Liner:
- a. Supply Air Ducts: Fibrous glass, Type I **OR** Flexible elastomeric **OR** Natural fiber, **as directed**, 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (51 mm), **as directed**, thick.
 - b. Return Air Ducts: Fibrous glass, Type I **OR** Flexible elastomeric **OR** Natural fiber, **as directed**, 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (51 mm), **as directed**, thick.
 - c. Exhaust Air Ducts: Fibrous glass, Type I **OR** Flexible elastomeric **OR** Natural fiber, **as directed**, 1 inch (25 mm) thick.
 - d. Supply Fan Plenums: Fibrous glass, Type II **OR** Flexible elastomeric **OR** Natural fiber, **as directed**, 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (51 mm), **as directed**, thick.
 - e. Return- and Exhaust-Fan Plenums: Fibrous glass, Type II **OR** Flexible elastomeric **OR** Natural fiber, **as directed**, 2 inches (51 mm) thick.
 - f. Transfer Ducts: Fibrous glass, Type I **OR** Flexible elastomeric **OR** Natural fiber, **as directed**, 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (51 mm), **as directed**, thick.
8. Double-Wall Duct Interstitial Insulation:
- a. Supply Air Ducts: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (51 mm), **as directed**, thick.
 - b. Return Air Ducts: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (51 mm), **as directed**, thick.
 - c. Exhaust Air Ducts: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (51 mm), **as directed**, thick.
9. Elbow Configuration:
- a. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."
 - 1) Velocity 1000 fpm (5 m/s) or Lower:
 - a) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
 - b) Mitered Type RE 4 without vanes.
 - 2) Velocity 1000 to 1500 fpm (5 to 7.6 m/s):
 - a) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
 - b) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
 - c) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."
 - 3) Velocity 1500 fpm (7.6 m/s) or Higher:
 - a) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - b) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - c) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."
 - OR**
 - b. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."
 - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.



- 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."
- c. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-3, "Round Duct Elbows."
 - 1) Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
 - a) Velocity 1000 fpm (5 m/s) or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
 - b) Velocity 1000 to 1500 fpm (5 to 7.6 m/s): 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
 - c) Velocity 1500 fpm (7.6 m/s) or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
 - d) Radius-to Diameter Ratio: 1.5.
 - 2) Round Elbows, 12 Inches (305 mm) and Smaller in Diameter: Stamped or pleated.
 - 3) Round Elbows, 14 Inches (356 mm) and Larger in Diameter: Standing seam **OR** Welded, **as directed**.
10. Branch Configuration:
 - a. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-6, "Branch Connections."
 - 1) Rectangular Main to Rectangular Branch: 45-degree entry.
 - 2) Rectangular Main to Round Branch: Spin in.
 - b. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees." Saddle taps are permitted in existing duct.
 - 1) Velocity 1000 fpm (5 m/s) or Lower: 90-degree tap.
 - 2) Velocity 1000 to 1500 fpm (5 to 7.6 m/s): Conical tap.
 - 3) Velocity 1500 fpm (7.6 m/s) or Higher: 45-degree lateral.

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**SECTION 23 31 13 13a - HVAC CASINGS**

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for HVAC casings. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Factory- and Shop-fabricated, field-assembled, single- and double-wall casings for HVAC equipment.

C. Performance Requirements

1. Static-Pressure Classes:
 - a. Upstream from Fan(s): 2-inch wg (500 Pa).
 - b. Downstream from Fan(s): 2-inch wg (500 Pa) **OR** 3-inch wg (750 Pa) **OR** 4-inch wg (1000 Pa) **OR** 6-inch wg (1500 Pa) **OR** 10-inch wg (2500 Pa), **as directed**.
2. Acoustical Performance:
 - a. NRC: 1.09 **OR** 0.94, **as directed**, according to ASTM C 423.
 - b. STC: 40 **OR** 34, **as directed**, according to ASTM E 90.
3. Structural Performance:
 - a. Casings shall be fabricated to withstand 133 percent of the indicated static pressure without structural failure. Wall and roof deflection at the indicated static pressure shall not exceed 1/8 inch per foot (0.97 mm per meter) of width.
 - 1) Fabricate outdoor casings to withstand wind load of 15 lbf/sq. ft. (720 N/sq. m) and snow load of 30 lbf/sq. ft. (1440 N/sq. m).
4. Seismic Performance: HVAC casings shall withstand the effects of earthquake motions determined according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and ASCE/SEI 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

D. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:
 - a. Product Data for Prerequisite EQ 1: Documentation indicating that duct systems comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
 - b. Product Data for Prerequisite EA 2: Documentation indicating that duct systems comply with ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."
 - c. Leakage Test Report for Prerequisite EA 2: Documentation of work performed for compliance with ASHRAE/IESNA 90.1, Section 6.4.4.2.2 - "Duct Leakage Tests."
 - d. Duct-Cleaning Test Report for Prerequisite EQ 1: Documentation of work performed for compliance with ASHRAE 62.1, Section 7.2.4 - "Ventilation System Start-Up."
 - e. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.
3. Shop Drawings: For HVAC casings. Include plans, elevations, sections, components, and attachments to other work.
4. Welding certificates.
5. Field quality-control reports.



E. Quality Assurance

1. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports **OR** AWS D9.1M/D9.1, "Sheet Metal Welding Code," for casing joint and seam welding, **as directed**.
2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."
3. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

1.2 PRODUCTS

A. General Casing Fabrication Requirements

1. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 6, "Equipment and Casings," for acceptable materials, material thicknesses, and casing construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
 - a. Fabricate casings with more than 3-inch wg (750-Pa) negative static pressure according to SMACNA's "Rectangular Industrial Duct Construction Standards."
 - b. Casings with more than 2-inch wg (500-Pa) positive static pressure may be fabricated according to SMACNA's "Rectangular Industrial Duct Construction Standards."
2. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - a. Exterior Surface Galvanized Coating Designation: G60 (Z180) **OR** G90 (Z275), **as directed**.
 - b. Interior Surface Galvanized Coating Designation:
 - 1) Sections Not Exposed to Moisture: G60 (Z180) **OR** G90 (Z275), **as directed**.
 - 2) Sections Housing and Downstream from Cooling Coil and Humidifiers: G90 (Z275).
3. Stainless Steel: ASTM A 480/A 480M, Type 304 **OR** Type 316, **as directed**, and having a No. 2D, **as directed**, finish.
4. Factory- or Shop-Applied Antimicrobial Coating:
 - a. Apply to the interior sheet metal surfaces of casing in contact with the airstream. Apply untreated clear coating to the exterior surface.
 - b. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
 - c. Coating containing the antimicrobial compound shall have a hardness of 2H minimum when tested according to ASTM D 3363.
 - d. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 according to UL 723; certified by an NRTL.
 - e. Applied Coating Color: Standard **OR** Black **OR** White, **as directed**.
5. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
6. Sealing Requirement: SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Seal Class A. Seal all seams, joints, connections, and abutments to building.
7. Penetrations: Seal all penetrations airtight. Cover with escutcheons and gaskets, or fill with suitable compound so there is no exposed insulation. Provide shaft seals where fan shafts penetrate casing.
8. Access Doors: Fabricate access doors according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 6-11, "Casing Access Doors - 2-inch wg (500 Pa)," and Figure 6.12, "Casing Access Doors - 3-10-inch wg (750-2500 Pa)"; and according to pressure class of the plenum or casing section in which access doors are to be installed.
 - a. Size: 20 by 54 inches (500 by 1370 mm).
 - b. Vision Panel: Double-glazed, wire-reinforced safety glass with an airspace between panes and sealed with interior and exterior rubber seals.
 - c. Hinges: Piano or butt hinges and latches, number and size according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."



- d. Latches: Minimum of two wedge-lever-type latches, operable from inside and outside.
 - e. Neoprene gaskets around entire perimeters of door frames.
 - f. Doors shall open against air pressure.
9. Condensate Drain Pans: Formed sections of Type 304, stainless-steel sheet **OR** G90 (Z275) coated, galvanized sheet steel, **as directed**, complying with requirements in ASHRAE 62.1. Pans shall extend a minimum of 12 inches (300 mm) past coil.
- a. Double-wall construction shall have space between walls filled with foam insulation and sealed moisture tight.
 - b. Intermediate drain pan or drain trough shall collect condensate from top coil for units with stacked coils or stacked eliminators.
 - c. Insulation: Polystyrene or polyurethane.
 - d. Slopes shall be in a minimum of two planes to collect condensate from cooling coils (including coil piping connections and return bends), eliminators, and humidifiers when units are operating at maximum catalogued face velocity across cooling coil.
 - e. Each drain pan connection shall have a trap. Drain traps with depth and height differential between inlet and outlet equal or greater to the design static pressure plus 2-inch wg (500 Pa), **as directed**. Include slab height in trap calculation.
- B. Shop-Fabricated Casings
1. Single- and Double-Wall Casings: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for sheet metal thickness based on indicated static-pressure class unless otherwise indicated.
 2. Double-Wall Casing Inner Panel: Perforated, galvanized sheet steel having 3/32-inch- (2.4-mm-) diameter perforations, with overall open area of 23 percent. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for sheet metal thickness based on indicated static-pressure class unless otherwise indicated.
OR
Double-Wall Casing Inner Panel: Solid sheet steel. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for sheet metal thickness based on indicated static-pressure class unless otherwise indicated.
 3. Interstitial Insulation: Polyurethane foam complying with NFPA 90A or NFPA 90B.
OR
Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
 - a. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F (0.039 W/m x K) at 75 deg F (24 deg C) mean temperature.
 - b. Coat insulation with antimicrobial coating.
 - c. Cover insulation with polyester film complying with UL 181, Class 1.**OR**
Interstitial Insulation: Flexible-elastomeric duct liner complying with ASTM C 534, Type II for sheet materials and with NFPA 90A or NFPA 90B.
 - a. Maximum Thermal Conductivity: 0.25 Btu x in./h x sq. ft. x deg F (0.034 W/m x K) at 75 deg F (24 deg C) mean temperature.
 4. Fabricate casings with standing seams and angle-iron reinforcements unless otherwise indicated.
 5. Fabricate close-off sheets from casing to dampers, filter frames, and coils and between stacked coils. Use galvanized sheet steel of same thickness as casing and with a galvanized coating designation of G90 (Z275).
 6. Bolt close-off sheets to frame flanges and housings. Support coils on stands fabricated from galvanized-steel angles or channels.
 7. Reinforce casings with galvanized-steel angles.
- C. Manufactured Casings
1. Description: Double-wall, insulated, pressurized equipment casing.
 2. Double-Wall Panel Fabrication: Solid, galvanized sheet steel exterior wall and solid **OR** perforated, **as directed**, galvanized sheet steel interior wall; with space between wall filled with insulation.



- a. Wall Thickness: 2 inches (50 mm) **OR** 4 inches (100 mm), **as directed**.
 - b. Fabricate with a minimum number of joints.
 - c. Weld exterior and interior walls to perimeter; to interior, longitudinal, galvanized-steel channels; and to box-end internal closures. Paint welds.
 - d. Sheet metal thickness shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for static-pressure class indicated for casing.
OR
Sheet Metal Thicknesses:
 - 1) Exterior Wall Thickness: 0.040 inch (1.0 mm) minimum.
 - 2) Interior Wall Thickness: 0.034 inch (0.85 mm) minimum.
 - e. Double-Wall Casing Inner Panel: Perforated, galvanized sheet steel having 3/32-inch- (2.4-mm-) diameter perforations, with overall open area of 23 percent.
OR
Double-Wall Casing Inner Panel: Solid sheet steel.
 - f. Fill each panel assembly with insulating material that is noncombustible, inert, mildew resistant and vermin proof and that complies with NFPA 90A.
 - g. Fabricate panels with continuous tongue-and-groove **OR** self-locking, **as directed**, joints effective inside and outside each panel.
3. Trim Items: Fabricate from a minimum of 0.052-inch (1.3-mm) galvanized sheet steel, furnished in standard lengths for field cutting.

D. Casing Liner

1. Fibrous-Glass Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
 - a. Maximum Thermal Conductivity:
 - 1) Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F (0.039 W/m x K) at 75 deg F (24 deg C) mean temperature.
 - 2) Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F (0.033 W/m x K) at 75 deg F (24 deg C) mean temperature.
 - b. Antimicrobial Erosion-Resistant Coating: Apply to surface of the liner that will form the interior surface of casing to act as a moisture repellent and an erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
 - c. Solvent **OR** Water, **as directed**, -Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
 - 1) For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Flexible-Elastomeric Casing Liner: Preformed, cellular, closed-cell, sheet materials complying with ASTM C 534, Type II, Grade 1, and with NFPA 90A or NFPA 90B.
 - a. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
 - b. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.
 - 1) For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Natural-Fiber Casing Liner: 85 percent cotton, 10 percent borate, and 5 percent polybinding fibers, treated with a microbial growth inhibitor, and complying with NFPA 90A or NFPA 90B.
 - a. Maximum Thermal Conductivity: 0.24 Btu x in./h x sq. ft. x deg F (0.034 W/m x K) at 75 deg F (24 deg C) mean temperature when tested according to ASTM C 518.
 - b. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
 - c. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.
 - 1) For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).



4. Insulation Pins and Washers:
 - a. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- (2.6-mm-) **OR** 0.135-inch- (3.5-mm-), **as directed**, diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch (38-mm) galvanized carbon-steel washer.
 - b. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick, galvanized **OR** stainless, **as directed**, steel, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.
 5. Shop or Factory Application of Casing Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-19, "Flexible Duct Liner Installation."
 - a. Adhere a single layer of indicated thickness of casing liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of casing liner is prohibited.
 - b. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
 - c. Butt transverse joints without gaps, and coat joint with adhesive.
 - d. Fold and compress liner in corners of casings or cut and fit to ensure butted-edge overlapping.
 - e. Apply adhesive coating on longitudinal seams in casings with air velocity of 2500 fpm (12.7 m/s).
 - f. Secure liner with mechanical fasteners 4 inches (100 mm) from corners and at intervals not exceeding 12 inches (300 mm) transversely; at 3 inches (75 mm) from transverse joints and at intervals not exceeding 18 inches (450 mm) longitudinally.
 - g. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from casing wall. Fabricate edge facings at the following locations:
 - 1) Fan discharges.
 - 2) Intervals of lined casing preceding unlined duct.
 - 3) Upstream edges of transverse joints in casings where air velocities are higher than 2500 fpm (12.7 m/s) or where indicated.
 - h. Secure insulation between perforated sheet metal inner wall of same thickness as specified for outer wall. Use mechanical fasteners that maintain inner wall at uniform distance from outer wall without compressing insulation.
- E. Sealant Materials
1. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
 2. Water-Based Joint and Seam Sealant:
 - a. Application Method: Brush on.
 - b. Solids Content: Minimum 65 percent.
 - c. Shore A Hardness: Minimum 20.
 - d. Water resistant.
 - e. Mold and mildew resistant.
 - f. VOC: Maximum 75 g/L (less water).
OR
For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - g. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive or negative.
 - h. Service: Indoor or outdoor.
 - i. Substrate: Compatible with galvanized sheet steel or stainless steel.
 3. Solvent-Based Joint and Seam Sealant:
 - a. Application Method: Brush on.
 - b. Base: Synthetic rubber resin.
 - c. Solvent: Toluene and heptane.
 - d. Solids Content: Minimum 60 percent.



- e. Shore A Hardness: Minimum 60.
- f. Water resistant.
- g. Mold and mildew resistant.
- h. VOC: Maximum 395 g/L.
- OR**
- For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- i. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive or negative.
- j. Service: Indoor or outdoor.
- k. Substrate: Compatible with galvanized sheet steel or stainless steel.
- 4. Flanged Joint Sealant: Comply with ASTM C 920.
 - a. General: Single component, acid curing, silicone, elastomeric.
 - b. Type: S.
 - c. Grade: NS.
 - d. Class: 25.
 - e. Use: O.
 - f. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- 5. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

1.3 EXECUTION

A. Installation

1. Install casings according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Equipment Mounting: Install HVAC casings on concrete base. Comply with requirements for concrete base specified in Division 07 Section "Manufactured Roof Expansion Joints".
 - a. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - b. For supported casings, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - d. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install seismic restraints on casings. Comply with requirements for seismic-restraint devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment"
4. Apply sealant to joints, connections, and mountings.
5. Field-cut openings for pipe and conduit penetrations; insulate and seal according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
6. Support casings on floor or foundation system. Secure and seal to base.
7. Support components rigidly with ties, braces, brackets, seismic restraints, **as directed**, and anchors of types that will maintain housing shape and prevent buckling.
8. Align casings accurately at connections, with 1/8-inch (3-mm) misalignment tolerance and with smooth interior surfaces.

B. Field Quality Control

1. Tests and Inspections:
 - a. Perform field tests and inspections according to SMACNA's "HVAC Air Duct Leakage Test Manual."
 - b. Test the following systems:
 - 1) Systems required by ASHRAE/IESNA 90.1.
 - 2) Supply Air: 100 **OR** 50, **as directed**, percent of total installed duct area with a pressure class of 3-inch wg (750 Pa) **OR** 4-inch wg (1000 Pa), **as directed**, or higher.



- c. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If pressure classes are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing.
 - d. Determine leakage from entire system or section of system by relating leakage to surface area of test section. Comply with requirements for leakage classification of ducts connected to casings.
 - e. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
2. HVAC casings will be considered defective if they do not pass tests and inspections.
 3. Prepare test and inspection reports.
- C. Cleaning
1. Comply with requirements for cleaning in Division 23 Section "Metal Ducts".

END OF SECTION 23 31 13 13a



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23 - Heating, Ventilating, And Air-Conditioning (HVAC)

Task	Specification	Specification Description
23 31 13 16	23 31 13 13	Metal Ducts
23 31 13 16	23 31 13 13a	HVAC Casings
23 31 13 19	23 31 13 13	Metal Ducts
23 31 13 19	23 31 13 13a	HVAC Casings
23 31 13 23	23 31 13 13	Metal Ducts
23 31 13 23	23 31 13 13a	HVAC Casings



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SECTION 23 31 13 33 - DUCT ACCESSORIES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for duct accessories. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Backdraft and pressure relief dampers.
 - b. Barometric relief dampers.
 - c. Manual volume dampers.
 - d. Control dampers.
 - e. Fire dampers.
 - f. Ceiling dampers.
 - g. Smoke dampers.
 - h. Combination fire and smoke dampers.
 - i. Corridor dampers.
 - j. Flange connectors.
 - k. Duct silencers.
 - l. Turning vanes.
 - m. Remote damper operators.
 - n. Duct-mounted access doors.
 - o. Flexible connectors.
 - p. Flexible ducts.
 - q. Duct security bars.
 - r. Duct accessory hardware.

C. Submittals

1. Product Data: For each type of product indicated.
 - a. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.
2. LEED Submittal:
 - a. Product Data for Prerequisite EQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
3. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.
 - a. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
 - 1) Special fittings.
 - 2) Manual volume damper installations.
 - 3) Control damper installations.
 - 4) Fire-damper, smoke-damper, combination fire- and smoke-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
 - 5) Duct security bars.
 - 6) Wiring Diagrams: For power, signal, and control wiring.
4. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.



5. Source quality-control reports.
6. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

D. Quality Assurance

1. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
2. Comply with AMCA 500-D testing for damper rating.

1.2 PRODUCTS

A. Materials

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
2. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - a. Galvanized Coating Designation: G60 (Z180) **OR** G90 (Z275), **as directed**.
 - b. Exposed-Surface Finish: Mill phosphatized.
3. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and **<Insert finish designation>** finish for exposed ducts.
4. Aluminum Sheets: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
5. Extruded Aluminum: Comply with ASTM B 221 (ASTM B 221M), Alloy 6063, Temper T6.
6. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
7. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

B. Backdraft And Pressure Relief Dampers

1. Description: Gravity balanced.
2. Maximum Air Velocity: 2000 fpm (10 m/s) **OR** 3000 fpm (15 m/s), **as directed**.
3. Maximum System Pressure: 1-inch wg (0.25 kPa) **OR** 2-inch wg (0.5 kPa), **as directed**.
4. Frame: 0.052-inch- (1.3-mm-) thick, galvanized sheet steel **OR** 0.063-inch- (1.6-mm-) thick extruded aluminum **OR** 0.052-inch- (1.3-mm-) thick stainless steel, **as directed**, with welded corners and mounting flange, **as directed**.
5. Blades: Multiple single-piece blades, center-pivoted, **as directed**, maximum 6-inch (150-mm) width, 0.025-inch- (0.6-mm-) thick, roll-formed aluminum **OR** 0.050-inch- (1.2-mm-) thick aluminum sheet **OR** noncombustible, tear-resistant, neoprene-coated fiberglass, **as directed**, with sealed edges.
6. Blade Action: Parallel.
7. Blade Seals: Felt **OR** Vinyl foam **OR** Extruded vinyl, mechanically locked **OR** Neoprene, mechanically locked, **as directed**.
8. Blade Axles:
 - a. Material: Nonferrous metal **OR** Galvanized steel **OR** Plated steel **OR** Stainless steel **OR** Non-metallic **OR** Aluminum, **as directed**.
 - b. Diameter: 0.20 inch (5 mm).
9. Tie Bars and Brackets: Aluminum **OR** Galvanized steel, **as directed**.
10. Return Spring: Adjustable tension.
11. Bearings: Steel ball **OR** Synthetic pivot bushings **OR** Steel ball or synthetic pivot bushings, **as directed**.
12. Accessories:
 - a. Adjustment device to permit setting for varying differential static pressure.
 - b. Counterweights and spring-assist kits for vertical airflow installations.



- c. Electric actuators.
- d. Chain pulls.
- e. Screen Mounting: Front mounted in sleeve.
 - 1) Sleeve Thickness: 20-gage (1.0-mm) minimum.
 - 2) Sleeve Length: 6 inches (152 mm) minimum.**OR**
Screen Mounting: Rear mounted.
- f. Screen Material: Galvanized steel **OR** Aluminum, **as directed**.
- g. Screen Type: Bird **OR** Insect, **as directed**.
- h. 90-degree stops.

C. Barometric Relief Dampers

- 1. Suitable for horizontal or vertical mounting.
- 2. Maximum Air Velocity: 2000 fpm (10 m/s) **OR** 2500 fpm (13 m/s), **as directed**.
- 3. Maximum System Pressure: 2-inch wg (0.5 kPa).
- 4. Frame: 0.064-inch- (1.6-mm-) thick, galvanized sheet steel **OR** 0.063-inch- (1.6-mm-) thick extruded aluminum, **as directed**, with welded corners and mounting flange, **as directed**.
- 5. Blades:
 - a. Multiple, 0.025-inch- (0.6-mm-) thick, roll-formed aluminum **OR** 0.050-inch- (1.2-mm-) thick aluminum sheet, **as directed**.
 - b. Maximum Width: 6 inches (150 mm).
 - c. Action: Parallel.
 - d. Balance: Gravity.
 - e. Eccentrically pivoted.
- 6. Blade Seals: Vinyl **OR** Neoprene, **as directed**.
- 7. Blade Axles: Galvanized steel **OR** Nonferrous metal, **as directed**.
- 8. Tie Bars and Brackets:
 - a. Material: Aluminum **OR** Galvanized steel, **as directed**.
 - b. Rattle free with 90-degree stop.
- 9. Return Spring: Adjustable tension.
- 10. Bearings: Synthetic **OR** Stainless steel **OR** Bronze, **as directed**.
- 11. Accessories:
 - a. Flange on intake.
 - b. Adjustment device to permit setting for varying differential static pressures.

D. Manual Volume Dampers

- 1. Standard, Steel, Manual Volume Dampers:
 - a. Standard leakage rating, with linkage outside airstream, **as directed**.
 - b. Suitable for horizontal or vertical applications.
 - c. Frames:
 - 1) Hat-shaped, galvanized-steel **OR** stainless-steel, **as directed**, channels, 0.064-inch (1.62-mm) minimum thickness.
 - 2) Mitered and welded corners.
 - 3) Flanges for attaching to walls and flangeless frames for installing in ducts.
 - d. Blades:
 - 1) Multiple or single blade.
 - 2) Parallel- or opposed-blade design.
 - 3) Stiffen damper blades for stability.
 - 4) Galvanized-steel **OR** Stainless-steel, **as directed**, 0.064 inch (1.62 mm) thick.
 - e. Blade Axles: Galvanized steel **OR** Stainless steel **OR** Nonferrous metal, **as directed**.
 - f. Bearings:
 - 1) Oil-impregnated bronze **OR** Molded synthetic **OR** Stainless-steel sleeve, **as directed**.
 - 2) Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
 - g. Tie Bars and Brackets: Galvanized steel.



2. Standard, Aluminum, Manual Volume Dampers:
 - a. Standard leakage rating, with linkage outside airstream, **as directed**.
 - b. Suitable for horizontal or vertical applications.
 - c. Frames: Hat-shaped, 0.10-inch- (2.5-mm-) thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts.
 - d. Blades:
 - 1) Multiple or single blade.
 - 2) Parallel- or opposed-blade design.
 - 3) Stiffen damper blades for stability.
 - 4) Roll-Formed Aluminum Blades: 0.10-inch- (2.5-mm-) thick aluminum sheet.
OR
Extruded-Aluminum Blades: 0.050-inch- (1.2-mm-) thick extruded aluminum.
 - e. Blade Axles: Galvanized steel **OR** Stainless steel **OR** Nonferrous metal, **as directed**.
 - f. Bearings:
 - 1) Oil-impregnated bronze **OR** Molded synthetic **OR** Stainless-steel sleeve, **as directed**.
 - 2) Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
 - g. Tie Bars and Brackets: Aluminum.
3. Low-Leakage, Steel, Manual Volume Dampers:
 - a. Low-leakage rating, with linkage outside airstream, **as directed**, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
 - b. Suitable for horizontal or vertical applications.
 - c. Frames:
 - 1) Hat **OR** U **OR** Angle, **as directed**, shaped.
 - 2) Galvanized-steel **OR** Stainless-steel, **as directed**, channels, 0.064 inch (1.62 mm) thick.
 - 3) Mitered and welded corners.
 - 4) Flanges for attaching to walls and flangeless frames for installing in ducts.
 - d. Blades:
 - 1) Multiple or single blade.
 - 2) Parallel- or opposed-blade design.
 - 3) Stiffen damper blades for stability.
 - 4) Galvanized **OR** Stainless, **as directed**, roll-formed steel, 0.064 inch (1.62 mm) thick.
 - e. Blade Axles: Galvanized steel **OR** Stainless steel **OR** Nonferrous metal, **as directed**.
 - f. Bearings:
 - 1) Oil-impregnated bronze **OR** Molded synthetic **OR** Stainless-steel sleeve, **as directed**.
 - 2) Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
 - g. Blade Seals: Felt **OR** Vinyl **OR** Neoprene, **as directed**.
 - h. Jamb Seals: Cambered stainless steel **OR** aluminum, **as directed**.
 - i. Tie Bars and Brackets: Galvanized steel **OR** Aluminum, **as directed**.
 - j. Accessories:
 - 1) Include locking device to hold single-blade dampers in a fixed position without vibration.
4. Low-Leakage, Aluminum, Manual Volume Dampers:
 - a. Low-leakage rating, with linkage outside airstream, **as directed**, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
 - b. Suitable for horizontal or vertical applications.
 - c. Frames: Hat **OR** U **OR** Angle, **as directed**, -shaped, 0.10-inch- (2.5-mm-) thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts.
 - d. Blades:
 - 1) Multiple or single blade.



- 2) Parallel- or opposed-blade design.
 - 3) Roll-Formed Aluminum Blades: 0.10-inch- (2.5-mm-) thick aluminum sheet.
OR
Extruded-Aluminum Blades: 0.050-inch- (1.2-mm-) thick extruded aluminum.
 - e. Blade Axles: Galvanized steel **OR** Stainless steel **OR** Nonferrous metal, **as directed**.
 - f. Bearings:
 - 1) Oil-impregnated bronze **OR** Molded synthetic **OR** Stainless-steel sleeve, **as directed**.
 - 2) Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
 - g. Blade Seals: Felt **OR** Vinyl **OR** Neoprene, **as directed**.
 - h. Jamb Seals: Cambered stainless steel **OR** aluminum, **as directed**.
 - i. Tie Bars and Brackets: Galvanized steel **OR** Aluminum, **as directed**.
 - j. Accessories:
 - 1) Include locking device to hold single-blade dampers in a fixed position without vibration.
5. Jackshaft:
- a. Size: 1-inch (25-mm) diameter.
 - b. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
 - c. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.
6. Damper Hardware:
- a. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- (2.4-mm-) thick zinc-plated steel, and a 3/4-inch (19-mm) hexagon locking nut.
 - b. Include center hole to suit damper operating-rod size.
 - c. Include elevated platform for insulated duct mounting.
- E. Control Dampers
1. Low-leakage rating, with linkage outside airstream, **as directed**, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
 2. Frames:
 - a. Hat **OR** U **OR** Angle, **as directed**, shaped.
 - b. Galvanized-steel **OR** Stainless-steel, **as directed**, channels, 0.064 inch (1.62 mm) thick.
 - c. Mitered and welded corners.
 3. Blades:
 - a. Multiple blade with maximum blade width of 8 inches (200 mm).
 - b. Parallel **OR** Parallel- and opposed **OR** Opposed, **as directed**,-blade design.
 - c. Galvanized **OR** Stainless, **as directed**, steel.
 - d. 0.064 inch (1.62 mm) thick.
 - e. Blade Edging: Closed-cell neoprene edging.
OR
Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.
 4. Blade Axles: 1/2-inch- (13-mm-) diameter; galvanized steel **OR** stainless steel **OR** nonferrous metal, **as directed**; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.
 - a. Operating Temperature Range: From minus 40 to plus 200 deg F (minus 40 to plus 93 deg C).
 5. Bearings:
 - a. Oil-impregnated bronze **OR** Molded synthetic **OR** Stainless-steel sleeve, **as directed**.
 - b. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
 - c. Thrust bearings at each end of every blade.
- F. Fire Dampers



1. Type: Static **OR** Dynamic **OR** Static and dynamic, **as directed**; rated and labeled according to UL 555 by an NRTL.
2. Closing rating in ducts up to 4-inch wg (1-kPa) static pressure class and minimum 4000-fpm (20-m/s) velocity.
3. Fire Rating: 1-1/2 **OR** 3, **as directed**, hours.
4. Frame: Curtain type with blades inside airstream **OR** Curtain type with blades outside airstream **OR** Multiple-blade type **OR** Curtain type with blades outside airstream except when located behind grille where blades may be inside airstream, **as directed**; fabricated with roll-formed, 0.034-inch- (0.85-mm-) thick galvanized steel; with mitered and interlocking corners.
5. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
 - a. Minimum Thickness: 0.052 or 0.138 inch (1.3 or 3.5 mm) thick, as indicated, and of length to suit application.
 - b. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.
6. Mounting Orientation: Vertical or horizontal as indicated.
7. Blades: Roll-formed, interlocking, 0.034-inch- (0.85-mm-) thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- (0.85-mm-) thick, galvanized-steel blade connectors.
8. Horizontal Dampers: Include blade lock and stainless-steel closure spring.
9. Heat-Responsive Device: Replaceable, 165 deg F (74 deg C) **OR** 212 deg F (100 deg C), **as directed**, rated, fusible links.
OR
Heat-Responsive Device: Electric **OR** Pneumatic, **as directed**, resettable link and switch package, factory installed, 165 deg F (74 deg C) **OR** 212 deg F (100 deg C), **as directed**, rated.

G. Ceiling Dampers

1. General Requirements:
 - a. Labeled according to UL 555C by an NRTL.
 - b. Comply with construction details for tested floor- and roof-ceiling assemblies as indicated in UL's "Fire Resistance Directory."
2. Frame: Galvanized sheet steel, round or rectangular, style to suit ceiling construction.
3. Blades: Galvanized sheet steel with refractory insulation.
4. Heat-Responsive Device: Replaceable, 165 deg F (74 deg C) **OR** 212 deg F (100 deg C), **as directed**, rated, fusible links.
5. Fire Rating: 2 **OR** 3, **as directed**, hours.

H. Smoke Dampers

1. General Requirements: Label according to UL 555S by an NRTL.
2. Smoke Detector: Integral, factory wired for single-point connection.
3. Frame: Curtain type with blades inside airstream **OR** Curtain type with blades outside airstream **OR** Multiple-blade type **OR** Curtain type with blades outside airstream except when located behind grille where blades may be inside airstream, **as directed**; fabricated with roll-formed, 0.034-inch- (0.85-mm-) thick galvanized steel; with mitered and interlocking corners.
4. Blades: Roll-formed, horizontal, interlocking, 0.034-inch- (0.85-mm-) thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- (0.85-mm-) thick, galvanized-steel blade connectors.
5. Leakage: Class I **OR** Class II, **as directed**.
6. Rated pressure and velocity to exceed design airflow conditions.
7. Mounting Sleeve: Factory-installed, 0.052-inch- (1.3-mm-) thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone caulking, **as directed**.
8. Damper Motors: Modulating **OR** Two-position, **as directed**, action.
9. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".



- a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - b. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 23 Section(s) "Instrumentation And Control For Hvac" OR Division 22, **as directed**.
 - c. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
 - d. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 150 in. x lbf (17 N x m).
 - e. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F (minus 40 deg C).
 - f. Nonspring-Return Motors: For dampers larger than 25 sq. ft. (2.3 sq. m), size motor for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 300 in. x lbf (34 N x m).
 - g. Electrical Connection: 115 V, single phase, 60 Hz.
10. Accessories:
- a. Auxiliary switches for signaling **OR** fan control **OR** position indication, **as directed**.
 - b. Momentary test switch **OR** Test and reset switches, **as directed**, damper **OR** remote, **as directed**, mounted.
- I. Combination Fire And Smoke Dampers
1. Type: Static **OR** Dynamic **OR** Static and dynamic, **as directed**; rated and labeled according to UL 555 and UL 555S by an NRTL.
 2. Closing rating in ducts up to 4-inch wg (1-kPa) static pressure class and minimum 4000-fpm (20-m/s) velocity.
 3. Fire Rating: 1-1/2 **OR** 3, **as directed**, hours.
 4. Frame: Curtain type with blades inside airstream **OR** Curtain type with blades outside airstream **OR** Multiple-blade type **OR** Curtain type with blades outside airstream except when located behind grille where blades may be inside airstream, **as directed**; fabricated with roll-formed, 0.034-inch- (0.85-mm-) thick galvanized steel; with mitered and interlocking corners.
 5. Heat-Responsive Device: Replaceable, 165 deg F (74 deg C) **OR** 212 deg F (100 deg C), **as directed**, rated, fusible links.
OR
Heat-Responsive Device: Electric **OR** Pneumatic, **as directed**, resettable link and switch package, factory installed, rated.
 6. Smoke Detector: Integral, factory wired for single-point connection.
 7. Frame: Curtain type with blades inside airstream **OR** Curtain type with blades outside airstream **OR** Multiple-blade type **OR** Curtain type with blades outside airstream except when located behind grille where blades may be inside airstream, **as directed**; fabricated with roll-formed, 0.034-inch- (0.85-mm-) thick galvanized steel; with mitered and interlocking corners.
 8. Blades: Roll-formed, horizontal, interlocking, 0.034-inch- (0.85-mm-) thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- (0.85-mm-) thick, galvanized-steel blade connectors.
 9. Leakage: Class I **OR** Class II, **as directed**.
 10. Rated pressure and velocity to exceed design airflow conditions.
 11. Mounting Sleeve: Factory-installed, 0.052-inch- (1.3-mm-) thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone caulking, **as directed**.
 12. Master control panel for use in dynamic smoke-management systems.
 13. Damper Motors: Modulating **OR** Two-position, **as directed**, action.
 14. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".



- a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - b. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 23 Section(s) "Instrumentation And Control For Hvac" OR Division 22, **as directed**.
 - c. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
 - d. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 150 in. x lbf (17 N x m).
 - e. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F (minus 40 deg C).
 - f. Nonspring-Return Motors: For dampers larger than 25 sq. ft. (2.3 sq. m), size motor for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 300 in. x lbf (34 N x m).
 - g. Electrical Connection: 115 V, single phase, 60 Hz.
15. Accessories:
- a. Auxiliary switches for signaling **OR** fan control **OR** position indication, **as directed**.
 - b. Momentary test switch **OR** Test and reset switches, **as directed**, damper **OR** remote, **as directed**, mounted.

J. Corridor Dampers

1. General Requirements: Label combination fire and smoke dampers according to UL 555 for 1-1/2-hour rating by an NRTL.
2. Heat-Responsive Device: Replaceable, 165 deg F (74 deg C) **OR** 212 deg F (100 deg C), **as directed**, rated, fusible links.
OR
Heat-Responsive Device: Electric **OR** Pneumatic, **as directed**, resettable link and switch package, factory installed, rated.
3. Frame: Curtain type with blades inside airstream **OR** Curtain type with blades outside airstream **OR** Multiple-blade type **OR** Curtain type with blades outside airstream except when located behind grille where blades may be inside airstream, **as directed**; fabricated with roll-formed, 0.034-inch- (0.85-mm-) thick galvanized steel; with mitered and interlocking corners.
4. Blades: Roll-formed, horizontal, interlocking, 0.034-inch- (0.85-mm-) thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- (0.85-mm-) thick, galvanized-steel blade connectors.
5. Mounting Sleeve: Factory-installed, 0.052-inch- (1.3-mm-) thick, galvanized sheet steel; length to suit wall or floor application.
6. Damper Motors: Modulating **OR** Two-position, **as directed**, action.
7. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - b. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 23 Section(s) "Instrumentation And Control For Hvac" OR Division 22, **as directed**.
 - c. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
 - d. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 150 in. x lbf (17 N x m).



- e. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F (minus 40 deg C).
 - f. Nonspring-Return Motors: For dampers larger than 25 sq. ft. (2.3 sq. m), size motor for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 300 in. x lbf (34 N x m).
 - g. Electrical Connection: 115 V, single phase, 60 Hz.
- K. Flange Connectors
- 1. Description: Add-on **OR** Roll-formed, **as directed**, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
 - 2. Material: Galvanized steel.
 - 3. Gage and Shape: Match connecting ductwork.
- L. Duct Silencers
- 1. General Requirements:
 - a. Factory fabricated.
 - b. Fire-Performance Characteristics: Adhesives, sealants, packing materials, and accessory materials shall have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested according to ASTM E 84.
 - c. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
 - 2. Shape:
 - a. Rectangular straight with splitters or baffles.
 - b. Round straight with center bodies or pods.
 - c. Rectangular elbow with splitters or baffles.
 - d. Round elbow with center bodies or pods.
 - e. Rectangular transitional with splitters or baffles.
 - 3. Rectangular Silencer Outer Casing: ASTM A 653/A 653M, G90 (Z275) **OR** G60 (Z180), **as directed**, galvanized sheet steel, 0.034 inch (0.85 mm) **OR** 0.040 inch (1.02 mm), **as directed**, thick.
 - 4. Round Silencer Outer Casing: ASTM A 653/A 653M, G90 (Z275) **OR** G60 (Z180), **as directed**, galvanized sheet steel.
 - a. Sheet Metal Thickness for Units up to 24 Inches (600 mm) in Diameter: 0.034 inch (0.85 mm) thick.
 - b. Sheet Metal Thickness for Units 26 through 40 Inches (660 through 1000 mm) in Diameter: 0.040 inch (1.02 mm) thick.
 - c. Sheet Metal Thickness for Units 42 through 52 Inches (1060 through 1300 mm) in Diameter: 0.052 inch (1.3 mm) thick.
 - d. Sheet Metal Thickness for Units 54 through 60 Inches (1370 through 1500 mm) in Diameter: 0.064 inch (1.62 mm) thick.
 - 5. Inner Casing and Baffles: ASTM A 653/A 653M, G90 (Z275) **OR** G60 (Z180), **as directed**, galvanized sheet metal, 0.034 inch (0.85 mm) thick, and with 1/8-inch- (3-mm-) diameter perforations.
 - 6. Special Construction:
 - a. Suitable for outdoor use.
 - b. High transmission loss to achieve STC 45, **as directed**.
 - 7. Connection Sizes: Match connecting ductwork unless otherwise indicated.
 - 8. Principal Sound-Absorbing Mechanism:
 - a. Controlled impedance membranes and broadly tuned resonators without absorptive media.
 - b. Dissipative **OR** Film-lined, **as directed**, type with fill material.
 - 1) Fill Material: Inert and vermin-proof fibrous material, packed under not less than 5 percent compression **OR** Inert and vermin-proof fibrous material, packed under not less than 15 percent compression **OR** Moisture-proof nonfibrous material, **as directed**.
 - 2) Erosion Barrier: Polymer bag enclosing fill, and heat sealed before assembly.



- c. Lining: None **OR** Mylar **OR** Tedlar **OR** Fiberglas cloth, **as directed**.
9. Fabricate silencers to form rigid units that will not pulsate, vibrate, rattle, or otherwise react to system pressure variations. Do not use mechanical fasteners for unit assemblies.
 - a. Lock form and seal or continuously weld joints **OR** Flange connections, **as directed**.
 - b. Suspended Units: Factory-installed suspension hooks or lugs attached to frame in quantities and spaced to prevent deflection or distortion.
 - c. Reinforcement: Cross or trapeze angles for rigid suspension.
10. Accessories:
 - a. Integral 1-1/2 **OR** 3, **as directed**,-hour fire damper with access door. Access door to be high transmission loss to match silencer, **as directed**.
 - b. Factory-installed end caps to prevent contamination during shipping.
 - c. Removable splitters.
 - d. Airflow measuring devices.
 - e. Source Quality Control: Test according to ASTM E 477.
 - f. Testing to be witnessed by the Owner.
 - g. Record acoustic ratings, including dynamic insertion loss and generated-noise power levels with an airflow of at least 2000-fpm (10-m/s) face velocity.
 - h. Leak Test: Test units for airtightness at 200 percent of associated fan static pressure or 6-inch wg (1500-Pa) static pressure, whichever is greater.

M. Turning Vanes

1. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
 - a. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
2. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
3. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."
4. Vane Construction: Single **OR** Double, **as directed**, wall.
OR
Vane Construction: Single wall for ducts up to 48 inches (1200 mm) wide and double wall for larger dimensions.

N. Remote Damper Operators

1. Description: Cable system designed for remote manual damper adjustment.
2. Tubing: Brass.
3. Cable: Stainless steel.
4. Wall-Box Mounting: Recessed, 3/4 inches (19 mm) deep **OR** Recessed, 2 inches (50 mm) deep **OR** Surface, **as directed**.
5. Wall-Box Cover-Plate Material: Steel **OR** Stainless steel, **as directed**.

O. Duct-Mounted Access Doors

1. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-10, "Duct Access Doors and Panels," and 2-11, "Access Panels - Round Duct."
 - a. Door:
 - 1) Double wall, rectangular.
 - 2) Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
 - 3) Vision panel.
 - 4) Hinges and Latches: 1-by-1-inch (25-by-25-mm) butt or piano hinge and cam latches.
 - 5) Fabricate doors airtight and suitable for duct pressure class.



- b. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
- c. Number of Hinges and Locks:
 - 1) Access Doors Less Than 12 Inches (300 mm) Square: No hinges and two sash locks.
 - 2) Access Doors up to 18 Inches (460 mm) Square: Two hinges and two sash locks.
 - 3) Access Doors up to 24 by 48 Inches (600 by 1200 mm): Three hinges and two compression latches with outside and inside handles, **as directed**.
 - 4) Access Doors Larger Than 24 by 48 Inches (600 by 1200 mm): Four hinges and two compression latches with outside and inside handles.
- 2. Pressure Relief Access Door:
 - a. Door and Frame Material: Galvanized sheet steel.
 - b. Door: Single wall **OR** Double wall with insulation fill, **as directed**, with metal thickness applicable for duct pressure class.
 - c. Operation: Open outward for positive-pressure ducts and inward for negative-pressure ducts.
 - d. Factory set at 10-inch wg (2500 Pa).
 - e. Doors close when pressures are within set-point range.
 - f. Hinge: Continuous piano.
 - g. Latches: Cam.
 - h. Seal: Neoprene or foam rubber.
 - i. Insulation Fill: 1-inch- (25-mm-) thick, fibrous-glass or polystyrene-foam board.
- P. Duct Access Panel Assemblies
 - 1. Labeled according to UL 1978 by an NRTL.
 - 2. Panel and Frame: Minimum thickness 0.0528-inch (1.3-mm) carbon **OR** 0.0428-inch (1.1-mm) stainless, **as directed**, steel.
 - 3. Fasteners: Carbon **OR** Stainless, **as directed**, steel. Panel fasteners shall not penetrate duct wall.
 - 4. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F (1093 deg C).
 - 5. Minimum Pressure Rating: 10-inch wg (2500 Pa), positive or negative.
- Q. Flexible Connectors
 - 1. Materials: Flame-retardant or noncombustible fabrics.
 - 2. Coatings and Adhesives: Comply with UL 181, Class 1.
 - 3. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches (89 mm) **OR** 5-3/4 inches (146 mm), **as directed**, wide attached to 2 strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized sheet steel or 0.032-inch- (0.8-mm-) thick aluminum sheets. Provide metal compatible with connected ducts.
 - 4. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
 - a. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
 - b. Tensile Strength: 480 lbf/inch (84 N/mm) in the warp and 360 lbf/inch (63 N/mm) in the filling.
 - c. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).
 - 5. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
 - a. Minimum Weight: 24 oz./sq. yd. (810 g/sq. m).
 - b. Minimum Tensile Strength: 500 lbf/inch (88 N/mm) in the warp and 440 lbf/inch (77 N/mm) in the filling.
 - c. Service Temperature: Minus 50 to plus 250 deg F (Minus 45 to plus 121 deg C).
 - 6. High-Temperature System, Flexible Connectors: Glass fabric coated with silicone rubber.
 - a. Minimum Weight: 16 oz./sq. yd. (542 g/sq. m).
 - b. Tensile Strength: 285 lbf/inch (50 N/mm) in the warp and 185 lbf/inch (32 N/mm) in the filling.
 - c. Service Temperature: Minus 67 to plus 500 deg F (Minus 55 to plus 260 deg C).



7. High-Corrosive-Environment System, Flexible Connectors: Glass fabric with chemical-resistant coating.
 - a. Minimum Weight: 14 oz./sq. yd. (474 g/sq. m).
 - b. Tensile Strength: 450 lbf/inch (79 N/mm) in the warp and 340 lbf/inch (60 N/mm) in the filling.
 - c. Service Temperature: Minus 67 to plus 500 deg F (Minus 55 to plus 260 deg C).
8. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.
 - a. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
 - b. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - c. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - d. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - e. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - f. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
 - g. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch (6-mm) movement at start and stop.

R. Flexible Ducts

1. Noninsulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire.
 - a. Pressure Rating: 10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative.
 - b. Maximum Air Velocity: 4000 fpm (20 m/s).
 - c. Temperature Range: Minus 10 to plus 160 deg F (Minus 23 to plus 71 deg C).
2. Noninsulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire.
 - a. Pressure Rating: 4-inch wg (1000 Pa) positive and 0.5-inch wg (125 Pa) negative.
 - b. Maximum Air Velocity: 4000 fpm (20 m/s).
 - c. Temperature Range: Minus 20 to plus 175 deg F (Minus 29 to plus 79 deg C).
3. Noninsulated, Flexible Duct: UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound, spring-steel wire.
 - a. Pressure Rating: 10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative.
 - b. Maximum Air Velocity: 4000 fpm (20 m/s).
 - c. Temperature Range: Minus 20 to plus 210 deg F (Minus 29 to plus 99 deg C).
4. Noninsulated, Flexible Duct: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound, spring-steel wire.
 - a. Pressure Rating: 10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative.
 - b. Maximum Air Velocity: 4000 fpm (20 m/s).
 - c. Temperature Range: Minus 20 to plus 210 deg F (Minus 29 to plus 99 deg C).
5. Noninsulated, Flexible Duct: UL 181, Class 0, interlocking spiral of aluminum foil.
 - a. Pressure Rating: 8-inch wg (2280 Pa) positive or negative.
 - b. Maximum Air Velocity: 5000 fpm (25 m/s).
 - c. Temperature Range: Minus 100 to plus 435 deg F (Minus 73 to plus 224 deg C).
6. Insulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene **OR** aluminized, **as directed**, vapor-barrier film.
 - a. Pressure Rating: 10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative.
 - b. Maximum Air Velocity: 4000 fpm (20 m/s).
 - c. Temperature Range: Minus 10 to plus 160 deg F (Minus 23 to plus 71 deg C).
 - d. Insulation R-value: Comply with ASHRAE/IESNA 90.1.
7. Insulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene **OR** aluminized, **as directed**, vapor-barrier film.



- a. Pressure Rating: 4-inch wg (1000 Pa) positive and 0.5-inch wg (125 Pa) negative.
 - b. Maximum Air Velocity: 4000 fpm (20 m/s).
 - c. Temperature Range: Minus 20 to plus 175 deg F (Minus 29 to plus 79 deg C).
 - d. Insulation R-Value: Comply with ASHRAE/IESNA 90.1.
8. Insulated, Flexible Duct: UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene **OR** aluminized, **as directed**, vapor-barrier film.
- a. Pressure Rating: 10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative.
 - b. Maximum Air Velocity: 4000 fpm (20 m/s).
 - c. Temperature Range: Minus 20 to plus 210 deg F (Minus 29 to plus 99 deg C).
 - d. Insulation R-value: Comply with ASHRAE/IESNA 90.1.
9. Insulated, Flexible Duct: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene **OR** aluminized, **as directed**, vapor-barrier film.
- a. Pressure Rating: 10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative.
 - b. Maximum Air Velocity: 4000 fpm (20 m/s).
 - c. Temperature Range: Minus 20 to plus 210 deg F (Minus 29 to plus 99 deg C).
 - d. Insulation R-value: Comply with ASHRAE/IESNA 90.1.
10. Insulated, Flexible Duct: UL 181, Class 0, interlocking spiral of aluminum foil; fibrous-glass insulation; polyethylene **OR** aluminized, **as directed**, vapor-barrier film.
- a. Pressure Rating: 8-inch wg (2280 Pa) positive or negative.
 - b. Maximum Air Velocity: 5000 fpm (25 m/s).
 - c. Temperature Range: Minus 20 to plus 250 deg F (Minus 29 to plus 121 deg C).
 - d. Insulation R-value: Comply with ASHRAE/IESNA 90.1.
11. Flexible Duct Connectors:
- a. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action **OR** Nylon strap, **as directed**, in sizes 3 through 18 inches (75 through 460 mm), to suit duct size.
 - b. Non-Clamp Connectors: Adhesive **OR** Liquid adhesive plus tape **OR** Adhesive plus sheet metal screws, **as directed**.
- S. Duct Security Bars
1. Description: Field-fabricated **OR** Factory-fabricated and field-installed **OR** Field- or factory-fabricated and field-installed, **as directed**, duct security bars.
 2. Configuration:
 - a. Frame: 10 gage by 2 inches (3.57 mm by 50 mm).
 - b. Sleeve: 3/16-inch (4.8-mm), continuously welded **OR** bent, **as directed**, steel frames with 1-by-1-by-3/16-inch (25-by-25-by-4.8-mm) angle frame factory welded to 1 end **OR** furnished loose for field welding on other end, **as directed**. To be poured in place or set with concrete block or welded or bolted to wall, one side only. Duct connections on both sides.
 - c. Horizontal Bars: 1/2 inch (13 mm) **OR** 2 by 1/4 inch (50 by 6 mm), **as directed**.
 - d. Vertical Bars: 1/2 inch (13 mm) **OR** 3/4 inch (19 mm) **OR** 1 inch (25 mm), **as directed**.
 - e. Bar Spacing: 6 inches (150 mm).
 - f. Mounting: Metal deck or roofing **OR** Bolted or welded **OR** Bolted or welded with masonry anchors **OR** Ductwork or other framing **OR** Poured in place or set with concrete block **OR** Welded or bolted to one wall (one side only) **OR** Bar extends 6 inches (150 mm) into wall, **as directed**.
- T. Duct Accessory Hardware
1. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
 2. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.



1.3 EXECUTION

A. Installation

1. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
2. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
3. Install backdraft **OR** control, **as directed**, dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
4. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
 - a. Install steel volume dampers in steel ducts.
 - b. Install aluminum volume dampers in aluminum ducts.
5. Set dampers to fully open position before testing, adjusting, and balancing.
6. Install test holes at fan inlets and outlets and elsewhere as indicated.
7. Install fire and smoke, **as directed**, dampers according to UL listing.
8. Install duct security bars. Construct duct security bars from 0.164-inch (4.18-mm) steel sleeve, continuously welded at all joints and 1/2-inch- (13-mm-) diameter steel bars, 6 inches (150 mm) o.c. in each direction in center of sleeve. Weld each bar to steel sleeve and each crossing bar. Weld 2-1/2-by-2-1/2-by-1/4-inch (63-by-63-by-6-mm) steel angle to 4 sides and both ends of sleeve. Connect duct security bars to ducts with flexible connections. Provide 12-by-12-inch (300-by-300-mm) hinged access panel with cam lock in duct in each side of sleeve.
9. Connect ducts to duct silencers with flexible duct connectors **OR** rigidly, **as directed**.
10. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 - a. On both sides of duct coils.
 - b. Upstream **OR** Upstream and downstream, **as directed**, from duct filters.
 - c. At outdoor-air intakes and mixed-air plenums.
 - d. At drain pans and seals.
 - e. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
 - f. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
 - g. At each change in direction and at maximum 50-foot (15-m) spacing.
 - h. Upstream **OR** Upstream and downstream, **as directed**, from turning vanes.
 - i. Upstream or downstream from duct silencers.
 - j. Control devices requiring inspection.
 - k. Elsewhere as indicated.
11. Install access doors with swing against duct static pressure.
12. Access Door Sizes:
 - a. One-Hand or Inspection Access: 8 by 5 inches (200 by 125 mm).
 - b. Two-Hand Access: 12 by 6 inches (300 by 150 mm).
 - c. Head and Hand Access: 18 by 10 inches (460 by 250 mm).
 - d. Head and Shoulders Access: 21 by 14 inches (530 by 355 mm).
 - e. Body Access: 25 by 14 inches (635 by 355 mm).
 - f. Body plus Ladder Access: 25 by 17 inches (635 by 430 mm).
13. Label access doors according to Division 21 Section "Fire-suppression Systems Insulation" to indicate the purpose of access door.
14. Install flexible connectors to connect ducts to equipment.



15. For fans developing static pressures of 5-inch wg (1250 Pa) and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
16. Connect terminal units to supply ducts directly or, **as directed**, with maximum 12-inch (300-mm) lengths of flexible duct. Do not use flexible ducts to change directions.
17. Connect diffusers or light troffer boots to ducts directly or, **as directed**, with maximum 60-inch (1500-mm) lengths of flexible duct clamped or strapped in place.
18. Connect flexible ducts to metal ducts with adhesive **OR** liquid adhesive plus tape **OR** draw bands **OR** adhesive plus sheet metal screws, **as directed**.
19. Install duct test holes where required for testing and balancing purposes.
20. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch (6-mm) movement during start and stop of fans.

B. Field Quality Control

1. Tests and Inspections:
 - a. Operate dampers to verify full range of movement.
 - b. Inspect locations of access doors and verify that purpose of access door can be performed.
 - c. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
 - d. Inspect turning vanes for proper and secure installation.
 - e. Operate remote damper operators to verify full range of movement of operator and damper.

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SECTION 23 31 16 13 - NONMETAL DUCTS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for nonmetal ducts. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Fibrous-glass ducts and fittings.
 - b. Phenolic-foam ducts and fittings.
 - c. Thermoset FRP ducts and fittings.
 - d. PVC ducts and fittings.

C. Performance Requirements

1. Delegated Duct Design: Duct construction, including duct closure, reinforcements, and hangers and supports, shall comply with SMACNA's "Fibrous Glass Duct Construction Standards" and performance requirements and design criteria indicated.
 - a. Static-Pressure Classes:
 - 1) Supply Ducts (except in Mechanical Rooms): 1-inch wg (250 Pa).
 - 2) Supply Ducts (Upstream from Air Terminal Units): 2-inch wg (500 Pa).
 - 3) Supply Ducts (Downstream from Air Terminal Units): 1-inch wg (250 Pa).
 - 4) Supply Ducts (in Mechanical Equipment Rooms): 2-inch wg (500 Pa).
 - 5) Return Ducts (Negative Pressure): 1-inch wg (250 Pa).
 - 6) Exhaust Ducts (Negative Pressure): 1-inch wg (250 Pa).
2. Structural Performance: Duct hangers and supports and seismic restraints, **as directed**, shall withstand the effects of gravity and seismic, **as directed**, loads and stresses within limits and under conditions to comply with ASCE/SEI 7 **OR** SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems", **as directed**.
 - a. Seismic Hazard Level A: Seismic force to weight ratio, 0.48.
OR
Seismic Hazard Level B: Seismic force to weight ratio, 0.30.
OR
Seismic Hazard Level C: Seismic force to weight ratio, 0.15.
3. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

D. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:
 - a. Product Data for Prerequisite EQ 1: Documentation indicating that duct systems comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
 - b. Product Data for Prerequisite EA 2: Documentation indicating that duct systems comply with ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."
 - c. Leakage Test Report for Prerequisite EA 2: Documentation of work performed for compliance with ASHRAE/IESNA 90.1, Section 6.4.4.2.2 - "Duct Leakage Tests."
 - d. Duct-Cleaning Test Report for Prerequisite EQ 1: Documentation of work performed for compliance with ASHRAE 62.1, Section 7.2.4 - "Ventilation System Start-Up."
 - e. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.
3. Shop Drawings:



- a. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
 - b. Duct layout indicating sizes and pressure classes.
 - c. Elevation of top of ducts.
 - d. Dimensions of main duct runs from building grid lines.
 - e. Fittings.
 - f. Reinforcement and spacing.
 - g. Seam and joint construction.
 - h. Penetrations through fire-rated and other partitions.
 - i. Equipment installation based on equipment being used on Project.
 - j. Hangers and supports, including methods for duct and building attachment, seismic restraints, **as directed**, and vibration isolation.
4. Delegated-Design Submittal:
 - a. Duct materials and thicknesses.
 - b. Joint and seam construction and sealing.
 - c. Reinforcement details and spacing.
 - d. Design Calculations: Calculations, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation, **as directed**, for selecting hangers and supports and seismic restraints, **as directed**.
 5. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - a. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
 - b. Suspended ceiling components.
 - c. Structural members to which duct will be attached.
 - d. Size and location of initial access modules for acoustical tile.
 - e. Penetrations of smoke barriers and fire-rated construction.
 - f. Items penetrating finished ceiling including the following:
 - 1) Lighting fixtures.
 - 2) Air outlets and inlets.
 - 3) Speakers.
 - 4) Sprinklers.
 - 5) Access panels.
 - 6) Perimeter moldings.
 6. Welding certificates.
 7. Field quality-control reports.

E. Quality Assurance

1. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports **OR** AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports, **as directed**.
2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."
3. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."
4. NFPA Compliance:
 - a. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
 - b. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

1.2 PRODUCTS

A. Fibrous-Glass Ducts And Fittings



1. Fibrous-Glass Duct Materials: Resin-bonded fiberglass, faced on the outside surface with fire-resistant FSK vapor retarder and with a smooth fiberglass mat finish on the air-side surface.
 - a. Duct Board: Factory molded into rectangular boards.
 - b. Round Duct: Factory molded into straight round duct and smooth fittings.
 - c. Temperature Limits: 40 to 250 deg F (5 to 121 deg C) inside ducts; 150 deg F (66 deg C) ambient temperature surrounding ducts.
 - d. Maximum Thermal Conductivity: 0.24 Btu x in./h x sq. ft. x deg F (0.035 W/m x K) at 75 deg F (24 deg C) mean temperature.
 - e. Moisture Absorption: Not exceeding 5 percent by weight at 120 deg F (49 deg C) and 95 percent relative humidity for 96 hours when tested according to ASTM C 1104/C 1104M.
 - f. Permeability: 0.02 perms (1.15 ng/Pa x s x sq. m) maximum when tested according to ASTM E 96/E 96M, Procedure A.
 - g. Antimicrobial Agent: Compound shall be tested for efficacy by an NRTL, and registered by the EPA for use in HVAC systems.
 - h. Noise-Reduction Coefficient: 0.65 minimum when tested according to ASTM C 423, Mounting A.
 - i. Required Markings: EI rating, UL label, and other markings required by UL 181 on each full sheet of duct board.
2. Closure Materials:
 - a. Pressure-Sensitive Tape: Comply with UL 181A; imprinted by the manufacturer with the coding "181A-P," the manufacturer's name, and a date code.
 - 1) Tape: Aluminum foil-scrim tape imprinted with listing information.
 - 2) Minimum Tape Width: 2-1/2 inches (64 mm); 3 inches (76 mm) for duct board thicker than 1 inch (25 mm).
 - 3) Staples: 1/2-inch (13-mm) outward clinching, 2 inches (51 mm) o.c. in tabs, one tab per joint.
 - 4) Water resistant.
 - 5) Mold and mildew resistant.
 - b. Heat-Activated Tape: Comply with UL 181A; imprinted by the manufacturer with the coding "181A-H," the manufacturer's name, and a date code.
 - 1) Tape: Aluminum foil-scrim tape imprinted with listing information.
 - 2) Minimum Tape Width: 3 inches (76 mm).
 - 3) Heat-Sensitive Imprint: Printed indicator on tape to show proper heating during application has been achieved.
 - 4) Water resistant.
 - 5) Mold and mildew resistant.
 - c. Two-Part Tape Sealing System: Comply with UL 181A; imprinted by the manufacturer with the coding "181A-M," the manufacturer's name, and a date code.
 - 1) Tape: Woven glass fiber impregnated with mineral gypsum.
 - 2) Minimum Tape Width: 3 inches (76 mm).
 - 3) Sealant: Modified styrene acrylic.
 - 4) Water resistant.
 - 5) Mold and mildew resistant.
 - 6) For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Fabrication:
 - a. Select joints, seams, transitions, elbows, and branch connections and fabricate according to SMACNA's "Fibrous Glass Duct Construction Standards," Chapter 2, "Specifications and Closure," and Chapter 4, "Fittings and Connections" **OR** NAIMA AH116, "Fibrous Glass Duct Construction Standards," Section II, "Fabrication of Straight Duct Modules," Section III, "Fabrication of Fittings from Modules or Flat Board," and Section IV, "Closure", **as directed**.
 - b. Fabricate 90-degree mitered elbows to include turning vanes.
 - c. Reinforcements: Comply with requirements in SMACNA's "Fibrous Glass Duct Construction Standards," Chapter 5, "Reinforcement" **OR** NAIMA AH116, "Fibrous Glass



Duct Construction Standards," Section V, "Reinforcement", **as directed**, for channel- and tie-rod reinforcement materials, spacing, and fabrication.

- d. Preformed Round Duct: Comply with NAIMA AH116, "Fibrous Glass Duct Construction Standards," Section VII, "Preformed Round Duct."

B. Phenolic-Foam Ducts And Fittings

1. Duct Panel: CFC-free phenolic-foam bonded on both sides with factory-applied 0.001-inch-(0.025-mm-) thick, aluminum foil reinforced with fiberglass scrim.
 - a. Maximum Temperature: 158 deg F (70 deg C) inside ducts or ambient temperature surrounding ducts.
 - b. Maximum Thermal Conductivity: 0.13 Btu x in./h x sq. ft. x deg F (0.019 W/m x K) at 75 deg F (24 deg C) mean temperature.
 - c. Permeability: 0.0002 perms (0.0115 ng/Pa x s x sq. m) maximum when tested according to ASTM E 96/E 96M, Procedure A.
 - d. Antimicrobial Agent: Compound shall be tested for efficacy by an NRTL, and registered by the EPA for use in HVAC systems.
 - e. Noise-Reduction Coefficient: 0.65 minimum when tested according to ASTM C 423, Mounting A.
 - f. Required Markings: UL label and other markings required by UL 181 on each full sheet of duct panel; UL ratings for closure materials.
2. Closure Materials:
 - a. V-Groove Adhesive: Silicone.
 - 1) For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Pressure-Sensitive Tape: Comply with UL 181A; imprinted by the manufacturer with the coding "181A-P," the manufacturer's name, and a date code.
 - 1) Tape: Aluminum foil tape imprinted with listing information.
 - 2) Minimum Tape Width: 3 inches (76 mm).
 - 3) Water resistant.
 - 4) Mold and mildew resistant.
 - c. Polymeric Sealing System:
 - 1) Structural Membrane: Woven glass fiber.
 - 2) Minimum Tape Width: 3 inches (76 mm).
 - 3) Sealant: Water based.
 - 4) Color: White.
 - 5) Water resistant.
 - 6) Mold and mildew resistant.
 - 7) For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Fabrication:
 - a. Fabricate joints, seams, transitions, reinforcement, elbows, branch connections, access doors and panels, and damage repairs according to Knauf Insulation's "Knauf KoolDuct System Design Guide," Section 4, "Duct Construction," and Section 5, "Ductwork System General."
 - b. Fabricate 90-degree mitered elbows to include turning vanes.

C. Thermoset FRP Ducts And Fittings

1. Duct and Fittings:
 - a. Thermoset FRP Resin: Manufacture duct with resin that complies with UL 181, Class 1, maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested by an NRTL according to ASTM E 84.
 - b. Inner Liner: FSK liner rated by an NRTL to comply with UL 181, Class 1.
 - c. Round Duct: ASTM D 2996, Type I, Grade 2, Class E, filament-wound duct, minimum 0.125-inch (3.2-mm) wall thickness, with tapered bell and spigot ends for adhesive joints, or plain ends with couplings.



- d. Round Fittings: Compression or spray-up/contact, molded of same material, pressure class, and joining method as duct.
 - e. Rectangular Fittings: Minimum 0.125-inch- (3.2-mm-) thick flat sheet with fiberglass roving and resin-reinforced joints and seams.
 - f. Double-Wall Insulated Duct: Inner and outer duct complying with requirements for "Round Duct" description above. Polyurethane foam or isocyanurate insulation with maximum thermal conductivity of 0.14 Btu x in./h x sq. ft. x deg F (0.020 W/m x K) at 75 deg F (24 deg C) mean temperature.
2. Joining Materials: Roving and polyester resin.
 - a. Use fiberglass adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Fabrication:
 - a. Fabricate joints, seams, transitions, reinforcement, elbows, branch connections, and access doors and panels according to SMACNA's "Thermoset FRP Duct Construction Manual," Chapter 7, "Requirements."
 - b. Fabricate 90-degree rectangular mitered elbows to include turning vanes, 90-degree round elbows with a minimum of three segments for 12 inches (300 mm) and smaller and a minimum of five segments for 14 inches (350 mm) and larger.
 4. Drains: Formed drain pockets with a minimum of NPS 1 (DN 25) threaded pipe connections.
- D. PVC Ducts And Fittings
1. Duct and Fittings:
 - a. Round Duct: Comply with cell Classification 12454-B in ASTM D 1784, with external loading properties of ASTM D 2412.
 - b. Round Fittings: Socket end molded of same material, pressure class, and joining method as duct.
 - c. Rectangular Fittings: Minimum 0.125-inch- (3.2-mm-) thick flat sheet with heat-formed corners and continuous welded butt joints.
 2. Joining Materials: PVC solvent cement complying with ASTM D 2564.
 - a. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Fabrication:
 - a. Fabricate joints, seams, transitions, reinforcement, elbows, branch connections, and access doors and panels according to SMACNA's "Thermoplastic Duct (PVC) Construction Manual," Chapter 3, "Standards of Construction for PVC Duct Systems."
 - b. Fabricate 90-degree rectangular mitered elbows to include turning vanes, 90-degree round elbows with a minimum of three segments for 12 inches (300 mm) and smaller and a minimum of five segments for 14 inches (350 mm) and larger.
 4. Drains: PVC drain pockets with a minimum of NPS 1 (DN 25) threaded PVC pipe connections.
- E. Hangers And Supports
1. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
 2. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
 3. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1 (Table 4-1M), "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."
 4. Steel Cables: ASTM A 603, galvanized **OR** ASTM A 492, stainless, **as directed**, steel with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
 5. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
 6. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.



F. Seismic-Restraint Devices

1. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of the ICC Evaluation Service **OR** the Office of Statewide Health Planning and Development for the State of California **OR** an agency acceptable to authorities having jurisdiction, **as directed**.
 - a. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
2. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.
3. Restraint Cables: ASTM A 603, galvanized **OR** ASTM A 492, stainless, **as directed**, steel cables with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips.
4. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections **OR** Reinforcing steel angle clamped, **as directed**, to hanger rod.
5. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

1.3 EXECUTION

A. Duct Installation

1. Install ducts with fewest possible joints.
2. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
3. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
4. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.
5. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges. Overlap openings on four sides by at least 1-1/2 inches (38 mm).
6. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.
7. Protect duct interiors from the moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines", **as directed**.
8. Install fibrous-glass ducts and fittings to comply with NAIMA AH116, "Fibrous Glass Duct Construction Standards" **OR** SMACNA's "Fibrous Glass Duct Construction Standards", **as directed**.
9. Install foam ducts and fittings to comply with Knauf Insulation's "Knauf KoolDuct System Design Guide."
10. Install thermoset FRP ducts and fittings to comply with SMACNA's "Thermoset FRP Duct Construction Manual."
11. Install PVC ducts and fittings to comply with SMACNA's "Thermoplastic Duct (PVC) Construction Manual."

B. Hanger And Support Installation

1. Install hangers and supports for fibrous-glass ducts and fittings to comply with SMACNA's "Fibrous Glass Duct Construction Standards," Chapter 6, "Hangers and Supports" **OR** NAIMA AH116, "Fibrous Glass Duct Construction Standards," Section VI, "Hangers and Supports", **as directed**.
2. Install hangers and supports for phenolic-foam ducts and fittings to comply with Knauf Insulation's "Knauf KoolDuct System Design Guide," Section 5, "Ductwork System General."



3. Install hangers and supports for thermoset FRP ducts and fittings to comply with SMACNA's "Thermoset FRP Duct Construction Manual," Chapter 7, "Requirements."
 4. Install hangers and supports for PVC ducts and fittings to comply with SMACNA's "Thermoplastic Duct (PVC) Construction Manual," Chapter 3, "Standards of Construction for PVC Duct Systems."
 5. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - a. Install concrete inserts before placing concrete.
 - b. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 - c. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches (100 mm) thick.
 - d. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.
 - e. Do not use powder-actuated concrete fasteners for seismic restraints.
 6. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- C. Seismic-Restraint-Device Installation
1. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems" **OR** ASCE/SEI 7, **as directed**.
 - a. Space lateral supports a maximum of 40 feet (12 m) o.c., and longitudinal supports a maximum of 80 feet (24 m) o.c.
 - b. Brace a change of direction longer than 12 feet (3.7 m).
 2. Select sizes of components so strength will be adequate to carry present and future static and seismic loads within restraint device capacity.
 3. Install cables so they do not bend across edges of adjacent equipment or building structure.
 4. Install cable restraints where ducts are suspended with vibration isolators.
 5. Install seismic-restraint devices using methods approved by an evaluation service member of the ICC Evaluation Service **OR** the Office of Statewide Health Planning and Development for the State of California **OR** an agency acceptable to authorities having jurisdiction, **as directed**.
 6. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure to flanges of beams, to upper truss chords of bar joists, or to concrete members.
 7. Drilling for and Setting Anchors:
 - a. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify the the Owner if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - b. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - c. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 - d. Set anchors to manufacturer's recommended torque, using a torque wrench.
 - e. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.
- D. Painting
1. Paint interior of thermoset FRP and PVC ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 07.
- E. Field Quality Control
1. Perform tests and inspections.
 2. Leakage Tests:



- a. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
 - b. Test the following systems:
 - 1) Ducts with a Pressure Class Higher Than 3-Inch wg (750 Pa): Test representative duct sections, selected by the Owner from sections installed, **as directed**, totaling no less than 25 percent of total installed duct area for each designated pressure class.
 - 2) Supply Ducts with a Pressure Class of 2-Inch wg (500 Pa) **OR** 3-Inch wg (750 Pa) **OR** 4-Inch wg (1000 Pa), **as directed**, or Higher: Test representative duct sections, selected by the Owner from sections installed, **as directed**, totaling no less than 50 **OR** 100, **as directed**, percent of total installed duct area for each designated pressure class.
 - 3) Return Ducts with a Pressure Class of 2-Inch wg (500 Pa) **OR** 3-Inch wg (750 Pa) **OR** 4-Inch wg (1000 Pa), **as directed**, or Higher: Test representative duct sections, selected by the Owner from sections installed, **as directed**, totaling no less than 50 **OR** 100, **as directed**, percent of total installed duct area for each designated pressure class.
 - 4) Exhaust Ducts with a Pressure Class of 2-Inch wg (500 Pa) **OR** 3-Inch wg (750 Pa) **OR** 4-Inch wg (1000 Pa), **as directed**, or Higher: Test representative duct sections, selected by the Owner from sections installed, **as directed**, totaling no less than 50 **OR** 100, **as directed**, percent of total installed duct area for each designated pressure class.
 - 5) Outdoor Air Ducts with a Pressure Class of 2-Inch wg (500 Pa) **OR** 3-Inch wg (750 Pa) **OR** 4-Inch wg (1000 Pa), **as directed**, or Higher: Test representative duct sections, selected by the Owner from sections installed, **as directed**, totaling no less than 50 **OR** 100, **as directed**, percent of total installed duct area for each designated pressure class.
 - c. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
 - d. Test for leaks before applying external insulation.
 - e. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing.
 3. Duct System Cleanliness Tests:
 - a. Visually inspect duct system to ensure that no visible contaminants are present.
 - b. Test sections of nonmetal duct system, chosen randomly by the Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
 - 1) Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.
 4. Duct system will be considered defective if it does not pass tests and inspections.
 5. Prepare test and inspection reports.
- F. Duct Cleaning
1. Clean new **OR** existing **OR** new and existing, **as directed**, duct system(s) before testing, adjusting, and balancing.
 2. Use service openings for entry and inspection.
 - a. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch duct as recommended by duct manufacturer. Comply with Division 23 Section "Air Duct Accessories" for access panels and doors.
 - b. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
 - c. Remove and reinstall ceiling to gain access during the cleaning process.
 3. Particulate Collection and Odor Control:



- a. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
- b. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.
4. Clean the following components by removing surface contaminants and deposits:
 - a. Air outlets and inlets (registers, grilles, and diffusers).
 - b. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
 - c. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
 - d. Coils and related components.
 - e. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
 - f. Supply-air ducts, dampers, actuators, and turning vanes.
 - g. Dedicated exhaust and ventilation components and makeup air systems.
5. Mechanical Cleaning Methodology:
 - a. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
 - b. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of ducts or duct accessories.
 - c. Clean fibrous-glass duct with HEPA vacuuming equipment; do not permit duct to get wet. Replace fibrous-glass duct that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
 - d. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
 - e. Provide drainage and cleanup for wash-down procedures.
 - f. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

G. Start Up

1. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, And Balancing For Hvac".

H. Duct Schedule

1. Indoor Ducts and Fittings:
 - a. Fibrous-Glass Rectangular Ducts and Fittings:
 - 1) Minimum Flexural Rigidity: EI-475 **OR** 800 **OR** 1400, **as directed**.
 - 2) Minimum Board Thickness: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (51 mm), **as directed**.
 - b. Fibrous-Glass Round Ducts and Fittings:
 - 1) Minimum Thickness: 1 inch (25 mm).
 - c. Phenolic-Foam Rectangular Ducts and Fittings:
 - 1) Minimum Panel Thickness: 7/8 inch (22 mm) **OR** 1-3/32 inches (28 mm), **as directed**.
 - 2) Aluminum Cladding: Minimum 0.025 inch (0.635 mm) thick.
2. Outdoor Ducts and Fittings:
 - a. Phenolic-Foam Rectangular Ducts and Fittings:
 - 1) Minimum Panel Thickness: 7/8 inch (22 mm) **OR** 1-3/32 inches (28 mm), **as directed**.
 - 2) Aluminum Cladding: Minimum 0.032 inch (0.813 mm) thick.



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- 3) Polymeric Sealing System: Coat ducts, including gang-nail couplings, grip flanges, and couplings.
 - b. Thermoset FRP Round Ducts and Fittings:
 - 1) Double-Wall Insulated Ducts: Minimum 5/8-inch (15.9-mm) **OR** 7/8-inch (22.2-mm), **as directed**, insulation thickness.
 - c. PVC Round Ducts and Fittings:
 - 3. Underground Ducts:
 - a. Thermoset FRP Round Ducts and Fittings:
 - 1) Insulation Thickness: 1 inch (25 mm).
 - 2) Drain: Minimum NPS 1 (DN 25) PVC pipe with P-trap to air-gap drain.
 - b. PVC Round Ducts and Fittings:
 - 1) Drain: Minimum NPS 1 (DN 25) PVC pipe with P-trap to air-gap drain.

END OF SECTION 23 31 16 13



23 - Heating, Ventilating, And Air-Conditioning (HVAC)

Task	Specification	Specification Description
23 31 16 13	23 31 13 13	Metal Ducts
23 31 16 16	23 31 13 13	Metal Ducts
23 31 16 16	23 31 16 13	Nonmetal Ducts



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SECTION 23 33 13 13 - DRAFT CONTROL DEVICES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for draft control devices. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Draft inducer fans.
 - b. Venturi-draft inducer fans.
 - c. Mechanical-draft vent fans.
 - d. Vent exhaust fans.
 - e. Barometric dampers.
 - f. Vent dampers.
 - g. Combustion-air fans.

C. Submittals

1. Product Data: For each type of product indicated.
2. Wiring Diagrams: Power, signal, and control wiring.
3. Operation and Maintenance Data.
4. Warranty: Warranty specified in this Section.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Warranty

1. Manufacturer's standard form in which manufacturer agrees to repair or replace components of draft inducer fans, venturi-draft inducer fans, mechanical-draft vent fans, vent exhaust fans, barometric dampers, vent dampers, and/or combustion-air fans that fail in materials or workmanship within two **OR 10, as directed**, years from date of Final Completion.
 - a. Failures include failure of the fan due to corrosion.

1.2 PRODUCTS

A. Draft Inducer Fans

1. Fan Construction: Galvanized **OR** Aluminized, **as directed**,-steel housing and radial-blade centrifugal fan.
 - a. Fan Motor: Permanent split-capacitor type.
2. Controls:
 - a. Draft proving switch.
 - b. Control kit to cycle fan with gas flow to a single burner.

B. Venturi-Draft Inducer Fans

1. Fan Construction: Enameled-steel venturi tube for vents 20 inches (508 mm) in diameter and smaller, and ASTM A 666, Type 304, stainless-steel venturi tube for vents 22 to 48 inches (559 to 1219 mm) in diameter. Galvanized **OR** Enameled, **as directed**,-steel fan housing with radial-blade centrifugal wheel.



- a. Fan Motor: Permanent split-capacitor type.
 2. Controls:
 - a. Draft proving switch.
 - b. Control kit to cycle fan with gas flow to a single burner.
- C. Mechanical-Draft Vent Fans
1. Fan Construction: Forward-curved centrifugal fan and scroll fabricated of aluminized **OR** galvanized, **as directed**, steel; direct-drive, ball-bearing motor lubricated with synthetic oil; internal cooling fan; stainless-steel shaft; and integral pressure-sensing switch.
 - a. Fan Motor: Permanent split-capacitor type.
 2. Controls:
 - a. Draft proving switch.
 - b. Control kit to cycle fan with gas flow to single **OR** multiple, **as directed**, burner(s).
 3. Accessories:
 - a. Aluminized **OR** Stainless, **as directed**, -steel, wall-vent hood.
- D. Vent Exhaust Fans
1. General: Centrifugal fan with variable **OR** constant, **as directed**, -speed control mounted at end of sidewall **OR** vertical, **as directed**, vent.
 2. Test Standard: UL 378, for fans exposed to flue gases up to 640 deg F (337 deg C).
 3. Fan Construction: Cast-aluminum **OR** Galvanized-steel **OR** Stainless-steel, **as directed**, housing painted manufacturer's standard color of baked enamel, **as directed**. Galvanized **OR** Stainless, **as directed**, -steel vent. Cast-aluminum **OR** Stainless-steel, **as directed**, wheel. Backward-inclined centrifugal or axial fan wheel statically and dynamically balanced. Provide access to clean the discharge area. Concentric makeup air inlet duct surrounding the vent to allow zero clearance to combustibles, **as directed**.
 4. Motor: Fully enclosed, variable-speed duty, **as directed**, permanent split capacitor, out of the airstream, with prelubricated and sealed ball bearings.
 5. Constant-Speed Controls: Boiler interlock relay starts fan when burner control cycles on. Pressure switch permits burner operation via interlock with boiler. Fan proving switch is adjustable between minus 0.07- and minus 0.15-inch wg (minus 17 and minus 37 Pa).
 6. Variable-Speed Controls: Boiler interlock relay starts fan when burner control cycles on. Pressure controller, control transformer, and miscellaneous controls for automatic modulation of fan speed to maintain preset negative pressure between 0- and minus 1.0-inch wg (0 and minus 249 Pa). Include controller with indicator lights, pressure differential transmitter, chimney pressure sensor probe, and fan proving switch adjustable between minus 0.07- and minus 0.15-inch wg (minus 17 and minus 37 Pa). Include tubing.
- E. Barometric Dampers
1. Damper Construction: High-temperature-enamel-painted steel damper and housing with galvanized-steel breeching connection. Adjustable counterweight with lock. Include knife-edge bearings that do not require lubrication.
- F. Vent Dampers
1. Damper Construction: Stainless-steel damper blade, shaft, and vent pipe with metal, prelubricated bearings.
 - a. Electric motor sized to power damper open and closed in approximately 15 seconds in each direction. Power is off when damper is at rest.
 - b. Comply with ANSI Z21.66.
 2. Controls:
 - a. Control transformer.
 - b. Keyed wiring harness.
 - c. Damper end-switch to prove damper is open.
 - d. Interlock with boiler to permit burner operation when damper is open.
 - e. Hold-open switch for troubleshooting boiler controls.



G. Combustion-Air Fans

1. Fan Construction: Galvanized **OR** Aluminized, **as directed**, -steel housing; steel forward-curved fan and scroll; direct-drive, totally enclosed, fan-cooled motor with ball bearings; stainless-steel shaft; and integral pressure-sensing switch.
 - a. Internal bypass to temper supply-air temperature to room.
2. Controls:
 - a. Fan proving switch to permit burner operation when combustion-air fan is operating.
 - b. Multiple appliance control starts fan with operation of any one of three **OR** four, **as directed**, appliances.
 - c. Modulating combustion-air fan speed to control pressure differential in room with respect to outdoors.
 - d. Manual-reset, high-limit switch stops operation with 160 deg F (71 deg C) room temperature.
 - e. Optional Controls:
 - 1) Alarm circuit.
 - 2) Excessive negative pressure limit.
 - 3) Interface relay for vent exhaust fan, draft inducer fan, or mechanical-draft vent fan.
 - 4) Galvanized-steel **OR** Aluminum, **as directed**, intake hood.

H. Motors

1. Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".

1.3 EXECUTION

A. Installation

1. Install listed components in a manner complying with the listing.
2. Secure barometric dampers to breechings with hardware compatible with connected materials.
3. Locate barometric and motorized vent dampers as close to draft hood collar as possible.
4. Secure barometric and motorized vent dampers to appliances, breechings, or chimneys with hardware compatible with connected materials.
5. Install draft inducer fans in single-wall vent section that is designed to couple with other vent materials.
6. Secure draft inducer fans to appliances, breechings, or stacks with hardware compatible with connected materials.
7. Install draft inducer fans with clearances for service and maintenance.
8. Install PVC, **as directed**, intake duct that is sized according to manufacturer's written instructions.

B. Connections

1. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
2. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

C. Startup Service

1. Engage a factory-authorized service representative to perform startup service.
 - a. Complete installation and startup checks according to manufacturer's written instructions.
2. Remove and replace malfunctioning components and recheck.

D. Adjusting

1. Set field-adjustable switches and controls as indicated.

E. Demonstration

1. Engage a factory-authorized service representative to train **OR** Train, **as directed**, Owner's maintenance personnel to adjust, operate, and maintain draft control devices.



END OF SECTION 23 33 13 13



Task	Specification	Specification Description
23 33 13 13	23 31 13 33	Duct Accessories
23 33 13 16	23 31 13 33	Duct Accessories
23 33 13 29	23 33 13 13	Draft Control Devices
23 33 13 29	23 31 13 33	Duct Accessories
23 33 13 33	23 31 13 33	Duct Accessories
23 33 13 43	23 31 13 33	Duct Accessories
23 33 23 00	23 31 13 33	Duct Accessories
23 33 33 00	23 31 13 33	Duct Accessories
23 33 43 00	23 31 13 33	Duct Accessories
23 33 46 00	23 31 13 13	Metal Ducts
23 33 46 00	23 31 13 33	Duct Accessories
23 33 53 00	01 22 16 00	No Specification Required
23 33 53 00	23 31 13 13	Metal Ducts
23 33 53 00	23 31 13 13a	HVAC Casings
23 33 56 00	23 31 13 13	Metal Ducts
23 33 56 00	23 31 13 33	Duct Accessories
23 33 59 00	23 31 13 33	Duct Accessories



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SECTION 23 34 13 00 - AXIAL FANS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for axial fans. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Tubeaxial fans.
 - b. Vaneaxial fans.
 - c. Mixed-flow fans.

C. Performance Requirements

1. Project Altitude: Base fan performance ratings on actual Project site elevations above sea level.
2. Operating Limits: Classify according to AMCA 99.

D. Submittals

1. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:
 - a. Certified fan performance curves with system operating conditions indicated.
 - b. Certified fan sound-power ratings.
 - c. Motor ratings and electrical characteristics, plus motor and electrical accessories.
 - d. Material thickness and finishes, including color charts.
 - e. Dampers, including housings, linkages, and operators.
 - f. Fan speed controllers.
2. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - a. Wiring Diagrams: Power, signal, and control wiring.
 - b. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
 - c. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.
3. Coordination Drawings: Show fan room layout and relationships between components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate and certify field measurements.
4. Field quality-control test reports.
5. Operation and Maintenance Data: For axial fans to include in emergency, operation, and maintenance manuals.

E. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.
3. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

F. Delivery, Storage, And Handling



1. Deliver fans as factory-assembled units, to the extent allowable by shipping limitations, with protective crating and covering.
2. Disassemble and reassemble units, as required for moving to final locations, according to manufacturer's written instructions.
3. Lift and support units with manufacturer's designated lifting or supporting points.

G. Coordination

1. Coordinate size and location of structural-steel support members.
2. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 31..
3. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories".

1.2 PRODUCTS

A. Tubeaxial Fans

1. Description: Fan wheel and housing, factory-mounted motor with belt drive or direct drive, an inlet cone section, and accessories.
2. Housings: Steel **OR** Galvanized steel **OR** Aluminum **OR** Fiberglass-reinforced plastic **OR** Stainless steel, **as directed**, with flanged inlet and outlet connections.
3. Wheel Assemblies: Cast or extruded aluminum with airfoil-shaped blades mounted on cast-iron wheel plate keyed to shaft with solid-steel key **OR** Fiberglass-reinforced plastic cured under pressure with airfoil-shaped blades keyed to stainless steel shaft **OR** Cast aluminum, machined and fitted to shaft, **as directed**.
4. Drives: Factory mounted, with final alignment and belt adjustment made after installation.
 - a. Service Factor Based on Fan Motor Size: 1.2 **OR** 1.3 **OR** 1.4 **OR** 1.5, **as directed**.
 - b. Fan Shaft: Turned, ground, and polished steel designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.
 - c. Fan Pulleys: Cast iron with split, tapered bushing; dynamically balanced at factory.
 - d. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
 - e. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
 - f. Belt Guards: Fabricate of steel for motors mounted on outside of fan cabinet.
 - g. Motor Mount: Adjustable base.
 - h. Shaft Bearings: Radial, self-aligning ball or roller bearings.
 - 1) Ball-Bearing Rating Life: ABMA 9, L10 of 100,000 hours.
OR
Roller-Bearing Rating Life: ABMA 11, L10 of 100,000 hours.
 - 2) Extend lubrication lines to outside of casing and terminate with grease fittings.
5. Accessories:
 - a. Companion Flanges: Rolled flanges of same material as housing.
 - b. Inspection Door: Bolted door allowing limited access to internal parts of fan, of same material as housing.
 - c. Propeller Access Section Door: Short duct section bolted to fan inlet **OR** outlet **OR** inlet and outlet, **as directed**, allowing access to internal parts of fan for inspection and cleaning, of same material as housing.
 - d. Swingout Construction: Assembly allowing entire fan section to swing out from duct for cleaning and servicing, of same material as housing.
 - e. Mounting Clips: Horizontal ceiling **OR** Vertical mounting, **as directed**, clips welded to fan housing, of same material as housing.
 - f. Horizontal Support: Pair of supports bolted to fan housing, of same material as housing.
 - g. Vertical Support: Short duct section with welded brackets bolted to fan housing, of same material as housing.



- h. Inlet and Outlet Screens: Wire-mesh screen on fans not connected to ductwork, of same material as housing.
 - i. Backdraft Dampers: Butterfly style, for bolting to the discharge of fan or outlet cone, of same material as housing.
 - j. Shaft Seal: Elastomeric seal and Teflon wear plate, suitable for up to 300 deg F (149 deg C).
 - k. Motor Cover: Cover with side vents to dissipate motor heat, of same material as housing.
 - l. Inlet Vanes: Adjustable; with peripheral control linkage operated from outside of airstream, bronze sleeve bearings on each end of vane support, and provision for manual or automatic operation of same material as housing.
 - m. Inlet Bell: Curved inlet for when fan is not attached to duct, of same material as housing **OR** aluminum, **as directed**.
 - n. Inlet Cones: Round-to-round transition of same material as housing.
 - o. Outlet Cones: Round-to-round transition of same material as housing.
 - p. Stack Cap: Vertical discharge assembly with backdraft dampers, of same material as housing.
6. Motors: Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".
- a. Enclosure Type: Totally enclosed, fan cooled **OR** Totally enclosed, nonventilated, **as directed**.
 - b. Direct-Driven Units: Encase motor in housing outside of airstream, factory wired to disconnect switch located on outside of fan housing, **as directed**.
7. Factory Finishes:
- a. Sheet Metal Parts: Prime coat before final assembly.
 - b. Exterior Surfaces: Baked-enamel finish coat after assembly.
 - c. Coatings: Thermoplastic vinyl **OR** Epoxy **OR** Zinc **OR** Synthetic resin **OR** Phenolic **OR** Color-match enamel **OR** Polytetrafluoroethylene **OR** Vinyl ester **OR** Hot-dip galvanized **OR** Powder-baked enamel, **as directed**.
 - 1) Apply to finished housings.
 - 2) Apply to fan wheels.
- B. Vaneaxial Fans
- 1. Description: Fan wheel and housing, straightening vane section, factory-mounted motor with belt drive or direct drive, an inlet cone section, and accessories.
 - a. Variable-Pitch Fans: Internally mounted pneumatic **OR** electric **OR** electronic, **as directed**, actuator, externally mounted positive positioner, and mechanical-blade-pitch indicator.
 - 2. Housings: Steel **OR** Galvanized steel **OR** Aluminum **OR** Fiberglass-reinforced plastic **OR** Stainless steel, **as directed**.
 - a. Inlet and Outlet Connections: Flanges.
 - b. Guide Vane Section: Integral guide vanes downstream from fan wheel designed to straighten airflow.
 - 3. Wheel Assemblies: Cast aluminum with airfoil-shaped blades mounted on cast-iron wheel plate keyed to shaft with solid-steel key **OR** Fiberglass-reinforced plastic cured under pressure with airfoil-shaped blades keyed to stainless steel shaft **OR** Cast-aluminum hub assembly, machined and fitted with threaded bearing wells to receive blade-bearing assemblies with replaceable, cast-aluminum blades; factory mounted and balanced, **as directed**.
 - 4. Drives: Factory mounted, with final alignment and belt adjustment made after installation.
 - a. Service Factor Based on Fan Motor Size: 1.2 **OR** 1.3 **OR** 1.4 **OR** 1.5, **as directed**.
 - b. Fan Shaft: Turned, ground, and polished steel designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.
 - c. Fan Pulleys: Cast iron with split, tapered bushing; dynamically balanced at factory.
 - d. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
 - e. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.



- f. Belt Guards: Fabricate of steel for motors mounted on outside of fan cabinet.
 - g. Motor Mount: Adjustable base.
 - h. Shaft Bearings: Radial, self-aligning ball or roller bearings.
 - 1) Ball-Bearing Rating Life: ABMA 9, L10 of 100,000 hours.
 - OR**
 - Roller-Bearing Rating Life: ABMA 11, L10 of 100,000 hours.
 - 2) Extend lubrication lines to outside of casing and terminate with grease fittings.
5. Accessories:
- a. Companion Flanges: Rolled flanges of same material as housing.
 - b. Inspection Door: Bolted door allowing limited access to internal parts of fan, of same material as housing.
 - c. Propeller Access Section Door: Short duct section bolted to fan inlet **OR** outlet **OR** inlet and outlet, **as directed**, allowing access to internal parts of fan for inspection and cleaning, of same material as housing.
 - d. Swingout Construction: Assembly allowing entire fan section to swing out from duct for cleaning and servicing, of same material as housing.
 - e. Mounting Clips: Horizontal ceiling **OR** Vertical mounting, **as directed**, clips welded to fan housing, of same material as housing.
 - f. Horizontal Support: Pair of supports bolted to fan housing, of same material as housing.
 - g. Vertical Support: Short duct section with welded brackets bolted to fan housing, of same material as housing.
 - h. Inlet and Outlet Screens: Wire-mesh screen on fans not connected to ductwork of same material as housing.
 - i. Backdraft Dampers: Butterfly style, for mounting with flexible connection to the discharge of fan or direct mounted to the discharge diffuser section of same material as housing.
 - j. Stall Alarm Probe: Sensing probe capable of detecting fan operation in stall and signaling control devices. Control devices and sequence of operation are specified in Division 23 Section(s) "Instrumentation And Control For Hvac" AND "Sequence Of Operations For Hvac Controls".
 - k. Flow Measurement Port: Pressure measurement taps installed in the inlet of fan to detect and signal airflow readings to temperature-control systems. Control devices and sequence of operation are specified in Division 23 Section(s) "Instrumentation And Control For Hvac" AND "Sequence Of Operations For Hvac Controls".
 - l. Shaft Seal: Elastomeric seal and Teflon wear plate, suitable for up to 300 deg F (148 deg C).
 - m. Motor Cover: Cover with side vents to dissipate motor heat, of same material as housing.
 - n. Inlet Vanes: Adjustable; with peripheral control linkage operated from outside of airstream, bronze sleeve bearings on each end of vane support, and provision for manual or automatic operation of same material as housing.
 - o. Inlet Bell: Curved inlet for when fan is not attached to duct, of same material as housing.
 - p. Inlet Cones: Round-to-round transition of same material as housing.
 - q. Outlet Cones: Round-to-round transition of same material as housing.
 - r. Stack Cap: Vertical discharge assembly with backdraft dampers, of same material as housing.
6. Motors: Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".
- a. Enclosure Type: Totally enclosed, fan cooled **OR** Totally enclosed, nonventilated, **as directed**.
 - b. Direct-Driven Units: Encase motor in housing outside of airstream, factory wired to disconnect switch located on outside of fan housing, **as directed**.
7. Factory Finishes:
- a. Sheet Metal Parts: Prime coat before final assembly.
 - b. Exterior Surfaces: Baked-enamel finish coat after assembly.



- c. Coatings: Thermoplastic vinyl **OR** Epoxy **OR** Zinc **OR** Synthetic resin **OR** Phenolic **OR** Color-match enamel **OR** Polytetrafluoroethylene **OR** Vinyl ester **OR** Hot-dip galvanized **OR** Powder-baked enamel, **as directed**.
 - 1) Apply to finished housings.
 - 2) Apply to fan wheels.
- C. Mixed-Flow Fans
- 1. Description: Fan wheel and housing, straightening vane section, **as directed**, factory-mounted motor with belt drive, and accessories.
 - 2. Housings: Steel **OR** Galvanized steel **OR** Aluminum, **as directed**.
 - a. Inlet and Outlet Connections: Outer mounting frame and companion flanges.
 - b. Guide Vane Section: Integral guide vanes downstream from fan wheel designed to straighten airflow.
 - c. Mixed-Flow Outlet Connection: One **OR** Two, **as directed**, flanged discharge(s) perpendicular to fan inlet.
 - 3. Wheel Assemblies: Cast aluminum with airfoil-shaped blades mounted on cast-iron wheel plate keyed to shaft with solid-steel key.
 - 4. Drives: Factory mounted, with final alignment and belt adjustment made after installation.
 - a. Service Factor Based on Fan Motor Size: 1.2 **OR** 1.3 **OR** 1.4 **OR** 1.5, **as directed**.
 - b. Fan Shaft: Turned, ground, and polished steel designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.
 - c. Fan Pulleys: Cast iron with split, tapered bushing; dynamically balanced at factory.
 - d. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
 - e. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
 - f. Motor Mount: Adjustable base.
 - g. Shaft Bearings: Radial, self-aligning ball or roller bearings.
 - 1) Ball-Bearing Rating Life: ABMA 9, L10 of 100,000 hours.
OR
Roller-Bearing Rating Life: ABMA 11, L10 of 100,000 hours.
 - 2) Extend lubrication lines to outside of casing and terminate with grease fittings.
 - 5. Accessories:
 - a. Mounting Clips: Horizontal ceiling **OR** Vertical mounting, **as directed**, clips welded to fan housing, of same material as housing.
 - b. Inlet and Outlet Screens: Wire-mesh screen on fans not connected to ductwork of same material as housing.
 - c. Backdraft Dampers: Butterfly style, for mounting with flexible connection to the discharge of fan or direct mounted to the discharge diffuser section of same material as housing.
 - d. Motor Cover: Cover with side vents to dissipate motor heat, of same material as housing.
 - e. Inlet Bell: Curved inlet for when fan is not attached to duct, of same material as housing.
 - f. Inlet Cones: Round-to-round transition of same material as housing.
 - g. Outlet Cones: Round-to-round transition of same material as housing.
 - h. Stack Cap: Vertical discharge assembly with backdraft dampers, of same material as housing.
 - 6. Motors: Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - a. Enclosure Type: Totally enclosed, fan cooled **OR** Totally enclosed, nonventilated, **as directed**.
 - b. Direct-Driven Units: Encase motor in housing outside of airstream, factory wired to disconnect switch located on outside of fan housing.
 - 7. Factory Finishes:
 - a. Sheet Metal Parts: Prime coat before final assembly.
 - b. Exterior Surfaces: Baked-enamel finish coat after assembly.



- c. Coatings: Thermoplastic vinyl **OR** Epoxy **OR** Zinc **OR** Synthetic resin **OR** Phenolic **OR** Color-match enamel **OR** Polytetrafluoroethylene **OR** Vinyl ester **OR** Hot-dip galvanized **OR** Powder-baked enamel, **as directed**.
 - 1) Apply to finished housings.
 - 2) Apply to fan wheels.

D. Source Quality Control

- 1. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
- 2. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

1.3 EXECUTION

A. Installation

- 1. Install axial fans level and plumb.
- 2. Support floor-mounting units using spring isolators **OR** restrained spring isolators, **as directed**, having a static deflection of 1 inch (25 mm). Vibration- and seismic-control devices are specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 - a. Secure vibration and seismic controls to concrete bases using anchor bolts cast in concrete base.
- 3. Install floor-mounting units on concrete bases. Concrete, reinforcement, and formwork requirements are specified in Division 03 Section "Cast-in-place Concrete".
- 4. Install floor-mounting units on concrete bases designed to withstand, without damage to equipment, the seismic force required by authorities having jurisdiction. Concrete, reinforcement, and formwork requirements are specified in Division 03 Section "Cast-in-place Concrete".
- 5. Support suspended units from structure using threaded steel rods and elastomeric hangers **OR** spring hangers **OR** spring hangers with vertical-limit stops, **as directed**, having a static deflection of 1 inch (25 mm). Vibration-control devices are specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
- 6. Install units with clearances for service and maintenance.
- 7. Label fans according to requirements specified in Division 23 Section "Identification For Hvac Piping And Equipment".

B. Connections

- 1. Duct installation and connection requirements are specified in other Division 21. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Air Duct Accessories".
- 2. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
- 3. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

C. Field Quality Control

- 1. Perform the following field tests and inspections and prepare test reports:
 - a. Verify that shipping, blocking, and bracing are removed.
 - b. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 - c. Verify that cleaning and adjusting are complete.



- d. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
 - e. Adjust belt tension.
 - f. Adjust damper linkages for proper damper operation.
 - g. Verify lubrication for bearings and other moving parts.
 - h. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
 - i. Disable automatic temperature-control operators, energize motor and confirm proper motor rotation and unit operation, adjust fan to indicated rpm, and measure and record motor voltage and amperage.
 - j. Shut unit down and reconnect automatic temperature-control operators.
 - k. Remove and replace malfunctioning units and retest as specified above.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Adjusting

1. Adjust damper linkages for proper damper operation.
2. Adjust belt tension.
3. Lubricate bearings.

END OF SECTION 23 34 13 00



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SECTION 23 34 16 00 - CENTRIFUGAL FANS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for centrifugal fans. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Airfoil centrifugal fans.
 - b. Backward-inclined centrifugal fans.
 - c. Forward-curved centrifugal fans.
 - d. Plenum fans.
 - e. Plug fans.

C. Performance Requirements

1. Project Altitude: Base fan performance ratings on actual Project site elevations above sea level.
2. Operating Limits: Classify according to AMCA 99.

D. Submittals

1. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated.
2. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Field quality-control test reports.
4. Operation and maintenance data.

E. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.
3. NEMA Compliance: Motors and electrical accessories shall comply with NEMA 1.

F. Delivery, Storage, And Handling

1. Deliver fans as factory-assembled units, to the extent allowable by shipping limitations, with protective crating and covering.
2. Disassemble and reassemble units, as required for moving to the final location, according to manufacturer's written instructions.
3. Lift and support units with manufacturer's designated lifting or supporting points.

1.2 PRODUCTS

A. Airfoil Centrifugal Fans

1. Description: Factory-fabricated, -assembled, -tested, and -finished, belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, **as directed**, drive assembly, and support structure.



2. Housings: Formed panels to make curved-scroll housings with shaped cutoff, with doors or panels to allow access to internal parts and components.
 - a. Panel Bracing: Steel angle- or channel-iron member supports for mounting and supporting fan scroll, wheel, motor, and accessories.
 - b. Horizontally split, bolted-flange housing.
 - c. Spun inlet cone with flange.
 - d. Outlet flange.
3. Airfoil Wheels: Single-width-single-inlet and double-width-double-inlet construction with curved inlet flange; heavy backplate; hollow die-formed, airfoil-shaped blades continuously welded at tip flange and backplate; and cast-iron or cast-steel hub riveted to backplate and fastened to shaft with set screws; and special coating, **as directed**.
4. Shafts: Statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.
 - a. Turned, ground, and polished hot-rolled steel with keyway. Ship with protective coating of lubricating oil.
 - b. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.
5. Prelubricated and Sealed Shaft Bearings: Self-aligning, pillow-block-type ball bearings.
 - a. Ball-Bearing Rating Life: ABMA 9, L10 at 50,000 hours **OR** 120,000 hours, **as directed**.
 - b. Roller-Bearing Rating Life: ABMA 11, L10 at 50,000 hours **OR** 120,000 hours, **as directed**.
6. Grease-Lubricated Shaft Bearings: Self-aligning, pillow-block-type, tapered roller bearings with double-locking collars and two-piece, cast-iron housing.
 - a. Ball-Bearing Rating Life: ABMA 9, L10 at 50,000 hours **OR** 120,000 hours, **as directed**.
 - b. Roller-Bearing Rating Life: ABMA 11, L10 at 50,000 hours **OR** 120,000 hours, **as directed**.
7. Grease-Lubricated Shaft Bearings: Self-aligning, pillow-block-type, ball or roller bearings with adapter mount and two-piece, cast-iron housing.
 - a. Ball-Bearing Rating Life: ABMA 9, L10 at 50,000 hours **OR** 120,000 hours, **as directed**.
 - b. Roller-Bearing Rating Life: ABMA 11, L10 at 50,000 hours **OR** 120,000 hours, **as directed**.
8. Belt Drives: Factory mounted, with final alignment and belt adjustment made after installation.
 - a. Service Factor Based on Fan Motor Size: 1.5 **OR** 1.4 **OR** 1.3 **OR** 1.2, **as directed**.
 - b. Fan Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.
 - c. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
 - d. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
 - e. Belt Guards: Fabricate to comply with OSHA and SMACNA requirements of diamond-mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation. Include provisions for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
 - f. Motor Mount: Adjustable for belt tensioning.
9. Accessories:
 - a. Scroll Access Doors: Shaped to conform to scroll, with quick-opening latches and gaskets.
 - b. Cleanout Door: Bolted **OR** Quick-opening, latch-type, **as directed**, gasketed door allowing access to fan scroll, of same material as housing.
 - c. Scroll Drain Connection: NPS 1 (DN 25) steel pipe coupling welded to low point of fan scroll.
 - d. Companion Flanges: Rolled flanges for duct connections of same material as housing.
 - e. Variable Inlet Vanes: With blades supported at both ends with two permanently lubricated bearings of same material as housing. Variable mechanism terminating in single control lever with control shaft for double-width fans.
 - f. Discharge Dampers: Assembly with parallel **OR** opposed, **as directed**, blades constructed of two plates formed around and to shaft, channel frame, and sealed ball bearings; with blades linked outside of airstream to single control lever of same material as housing.



- g. Inlet Screens: Grid screen of same material as housing.
- h. Shaft Cooler: Metal disk between bearings and fan wheel, designed to dissipate heat from shaft.
- i. Spark-Resistant Construction: AMCA 99.
- j. Shaft Seals: Airtight seals installed around shaft on drive side of single-width fans.
- k. Weather Cover: Enameled-steel sheet with ventilation slots, bolted to housing.
- 10. Motors: Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - a. Enclosure Type: Totally enclosed, fan cooled.

B. Backward-Inclined Centrifugal Fans

- 1. Description: Factory-fabricated, -assembled, -tested, and -finished, belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, and support structure.
- 2. Housings: Formed panels to make curved-scroll housings with shaped cutoff; with doors or panels to allow access to internal parts and components.
 - a. Panel Bracing: Steel angle- or channel-iron member supports for mounting and supporting fan scroll, wheel, motor, and accessories.
 - b. Spun inlet cone with flange.
 - c. Outlet flange.
- 3. Backward-Inclined Wheels: Single-width-single-inlet and double-width-double-inlet construction with curved inlet flange, backplate, backward-inclined blades welded or riveted to flange and backplate; cast-iron or cast-steel hub riveted to backplate, **as directed**, and fastened to shaft with set screws.
- 4. Shafts: Statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.
 - a. Turned, ground, and polished hot-rolled steel with keyway. Ship with a protective coating of lubricating oil.
 - b. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.
- 5. Prelubricated and Sealed Shaft Bearings: Self-aligning, pillow-block-type ball bearings.
 - a. Ball-Bearing Rating Life: ABMA 9, L10 at 50,000 hours **OR** 120,000 hours, **as directed**.
 - b. Roller-Bearing Rating Life: ABMA 11, L10 at 50,000 hours **OR** 120,000 hours, **as directed**.
- 6. Grease-Lubricated Shaft Bearings: Self-aligning, pillow-block-type, tapered roller bearings with double-locking collars and two-piece, cast-iron housing.
 - a. Ball-Bearing Rating Life: ABMA 9, L10 at 50,000 hours **OR** 120,000 hours, **as directed**.
 - b. Roller-Bearing Rating Life: ABMA 11, L10 at 50,000 hours **OR** 120,000 hours, **as directed**.
- 7. Grease-Lubricated Shaft Bearings: Self-aligning, pillow-block-type, ball or roller bearings with adapter mount and two-piece, cast-iron housing.
 - a. Ball-Bearing Rating Life: ABMA 9, L10 at 50,000 hours **OR** 120,000 hours, **as directed**.
 - b. Roller-Bearing Rating Life: ABMA 11, L10 at 50,000 hours **OR** 120,000 hours, **as directed**.
- 8. Belt Drives: Factory mounted, with final alignment and belt adjustment made after installation.
 - a. Service Factor Based on Fan Motor Size: 1.5 **OR** 1.4 **OR** 1.3 **OR** 1.2, **as directed**].
 - b. Fan Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.
 - c. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
 - d. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
 - e. Belt Guards: Fabricate to comply with OSHA and SMACNA requirements of diamond-mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation. Include provisions for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
 - f. Motor Mount: Adjustable for belt tensioning.
- 9. Accessories:



- a. Scroll Access Doors: Shaped to conform to scroll, with quick-opening latches and gaskets.
 - b. Cleanout Door: Bolted **OR** Quick-opening, latch-type, **as directed**, gasketed door allowing access to fan scroll, of same material as housing.
 - c. Scroll Drain Connection: NPS 1 (DN 25) steel pipe coupling welded to low point of fan scroll.
 - d. Companion Flanges: Rolled flanges for duct connections of same material as housing.
 - e. Variable Inlet Vanes: With blades supported at both ends with two permanently lubricated bearings of same material as housing. Variable mechanism terminating in single control lever with control shaft for double-width fans.
 - f. Discharge Dampers: Assembly with parallel **OR** opposed, **as directed**, blades constructed of two plates formed around and to shaft, channel frame, and sealed ball bearings; with blades linked outside of airstream to single control lever of same material as housing.
 - g. Inlet Screens: Grid screen of same material as housing.
 - h. Shaft Cooler: Metal disk between bearings and fan wheel, designed to dissipate heat from shaft.
 - i. Spark-Resistant Construction: AMCA 99.
 - j. Shaft Seals: Airtight seals installed around shaft on drive side of single-width fans.
 - k. Weather Cover: Enameled-steel sheet with ventilation slots, bolted to housing.
10. Motors: Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".
- a. Enclosure Type: Totally enclosed, fan cooled.

C. Forward-Curved Centrifugal Fans

1. Description: Factory-fabricated, -assembled, -tested, and -finished, belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, **as directed**, drive assembly, and support structure.
2. Housings: Formed panels to make curved-scroll housings with shaped cutoff; with doors or panels to allow access to internal parts and components.
 - a. Panel Bracing: Steel angle- or channel-iron member supports for mounting and supporting fan scroll, wheel, motor, and accessories.
 - b. Horizontally split, bolted-flange housing.
 - c. Spun inlet cone with flange.
 - d. Outlet flange.
3. Forward-Curved Wheels: Black-enameled or galvanized steel construction with inlet flange, backplate, shallow blades with inlet and tip curved forward in direction of airflow, mechanically secured to flange and backplate; cast-steel hub swaged to backplate and fastened to shaft with set screws.
4. Shafts: Statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.
 - a. Turned, ground, and polished hot-rolled steel with keyway. Ship with protective coating of lubricating oil.
 - b. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.
5. Prelubricated and Sealed Shaft Bearings: Self-aligning, pillow-block-type ball bearings.
 - a. Ball-Bearing Rating Life: ABMA 9, L10 at 50,000 hours **OR** 120,000 hours, **as directed**.
 - b. Roller-Bearing Rating Life: ABMA 11, L10 at 50,000 hours **OR** 120,000 hours, **as directed**.
6. Grease-Lubricated Shaft Bearings: Self-aligning, pillow-block-type, tapered roller bearings with double-locking collars and two-piece, cast-iron housing.
 - a. Ball-Bearing Rating Life: ABMA 9, L10 at 50,000 hours **OR** 120,000 hours, **as directed**.
 - b. Roller-Bearing Rating Life: ABMA 11, L10 at 50,000 hours **OR** 120,000 hours, **as directed**.
7. Grease-Lubricated Shaft Bearings: Self-aligning, pillow-block-type, ball or roller bearings with adapter mount and two-piece, cast-iron housing.
 - a. Ball-Bearing Rating Life: ABMA 9, L10 at 50,000 hours **OR** 120,000 hours, **as directed**.
 - b. Roller-Bearing Rating Life: ABMA 11, L10 at 50,000 hours **OR** 120,000 hours, **as directed**.



8. Belt Drives: Factory mounted, with final alignment and belt adjustment made after installation.
 - a. Service Factor Based on Fan Motor Size: 1.5.
 - b. Fan Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.
 - c. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
 - d. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
 - e. Belt Guards: Fabricate to comply with OSHA and SMACNA requirements of diamond-mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation. Include provisions for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
 - f. Motor Mount: Adjustable for belt tensioning.
9. Accessories:
 - a. Scroll Access Doors: Shaped to conform to scroll, with quick-opening latches and gaskets.
 - b. Cleanout Door: Bolted **OR** Quick-opening, latch-type, **as directed**, gasketed door allowing access to fan scroll, of same material as housing.
 - c. Scroll Drain Connection: NPS 1 (DN 25) steel pipe coupling welded to low point of fan scroll.
 - d. Companion Flanges: Rolled flanges for duct connections of same material as housing.
 - e. Variable Inlet Vanes: With blades supported at both ends with two permanently lubricated bearings of same material as housing. Variable mechanism terminating in single control lever with control shaft for double-width fans.
 - f. Discharge Dampers: Assembly with parallel **OR** opposed, **as directed**, blades constructed of two plates formed around and to shaft, channel frame, and sealed ball bearings; with blades linked outside of airstream to single control lever of same material as housing.
 - g. Inlet Screens: Grid screen of same material as housing.
 - h. Shaft Cooler: Metal disk between bearings and fan wheel, designed to dissipate heat from shaft.
 - i. Spark-Resistant Construction: AMCA 99.
 - j. Shaft Seals: Airtight seals installed around shaft on drive side of single-width fans.
 - k. Weather Cover: Enameled-steel sheet with ventilation slots, bolted to housing.
10. Motors: Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - a. Enclosure Type: Totally enclosed, fan cooled.

D. Plenum Fans

1. Description: Factory-fabricated, -assembled, -tested, and -finished, belt-driven centrifugal fans consisting of wheel, fan shaft, bearings, motor and disconnect switch, **as directed**, drive assembly, and support structure.
2. Airfoil Wheels: Single-width-single-inlet construction with smooth-curved inlet flange; heavy backplate; hollow die-formed, airfoil-shaped blades continuously welded at tip flange and backplate; and cast-iron or cast-steel hub riveted to backplate and fastened to shaft with set screws; and special coating.
3. Shafts: Statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.
 - a. Turned, ground, and polished hot-rolled steel with keyway. Ship with protective coating of lubricating oil.
 - b. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.
4. Prelubricated and Sealed Shaft Bearings: Self-aligning, pillow-block-type ball bearings.
 - a. Ball-Bearing Rating Life: ABMA 9, L10 at 50,000 hours **OR** 120,000 hours, **as directed**.
 - b. Roller-Bearing Rating Life: ABMA 11, L10 at 50,000 hours **OR** 120,000 hours, **as directed**.
5. Grease-Lubricated Shaft Bearings: Self-aligning, pillow-block-type, tapered roller bearings with double-locking collars and two-piece, cast-iron housing.



- a. Ball-Bearing Rating Life: ABMA 9, L10 at 50,000 hours **OR** 120,000 hours, **as directed**.
- b. Roller-Bearing Rating Life: ABMA 11, L10 at 50,000 hours **OR** 120,000 hours, **as directed**.
6. Grease-Lubricated Shaft Bearings: Self-aligning, pillow-block-type, ball or roller bearings with adapter mount and two-piece, cast-iron housing.
 - a. Ball-Bearing Rating Life: ABMA 9, L10 at 50,000 hours **OR** 120,000 hours, **as directed**.
 - b. Roller-Bearing Rating Life: ABMA 11, L10 at 50,000 hours **OR** 120,000 hours, **as directed**.
7. Belt Drives: Factory mounted, with final alignment and belt adjustment made after installation.
 - a. Service Factor Based on Fan Motor Size: 1.5 **OR** 1.4 **OR** 1.3 **OR** 1.2, **as directed**.
 - b. Fan Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.
 - c. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
 - d. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
 - e. Belt Guards: Fabricate to comply with OSHA and SMACNA requirements of diamond-mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation. Include provisions for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
 - f. Motor Mount: Adjustable for belt tensioning.
8. Accessories:
 - a. Shaft Cooler: Metal disk between bearings and fan wheel, designed to dissipate heat from shaft.
 - b. Spark-Resistant Construction: AMCA 99.
 - c. Shaft Seals: Airtight seals installed around shaft on drive side of single-width fans.
9. Motors: Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - a. Enclosure Type: Totally enclosed, fan cooled.

E. Plug Fans

1. Description: Factory-fabricated, -assembled, -tested, and -finished, belt-driven centrifugal fans consisting of wheel, fan shaft, bearings, motor and disconnect switch, **as directed**, drive assembly, and support structure.
2. Airfoil Wheels: Single-width-single-inlet construction with smooth-curved inlet flange; heavy backplate; hollow die-formed, airfoil-shaped blades continuously welded at tip flange and backplate; and cast-iron or cast-steel hub riveted to backplate and fastened to shaft with set screws; and special coating, **as directed**.
3. Shafts: Statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.
 - a. Turned, ground, and polished hot-rolled steel with keyway. Ship with protective coating of lubricating oil.
 - b. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.
4. Prelubricated and Sealed Shaft Bearings: Self-aligning, pillow-block-type ball bearings.
 - a. Ball-Bearing Rating Life: ABMA 9, L10 at 50,000 hours **OR** 120,000 hours, **as directed**.
 - b. Roller-Bearing Rating Life: ABMA 11, L10 at 50,000 hours **OR** 120,000 hours, **as directed**.
5. Grease-Lubricated Shaft Bearings: Self-aligning, pillow-block-type, tapered roller bearings with double-locking collars and two-piece, cast-iron housing.
 - a. Ball-Bearing Rating Life: ABMA 9, L10 at 50,000 hours **OR** 120,000 hours, **as directed**.
 - b. Roller-Bearing Rating Life: ABMA 11, L10 at 50,000 hours **OR** 120,000 hours, **as directed**.
6. Grease-Lubricated Shaft Bearings: Self-aligning, pillow-block-type, ball or roller bearings with adapter mount and two-piece, cast-iron housing.
 - a. Ball-Bearing Rating Life: ABMA 9, L10 at 50,000 hours **OR** 120,000 hours, **as directed**.
 - b. Roller-Bearing Rating Life: ABMA 11, L10 at 50,000 hours **OR** 120,000 hours, **as directed**.
7. Belt Drives: Factory mounted, with final alignment and belt adjustment made after installation.



- a. Service Factor Based on Fan Motor Size: 1.5 **OR** 1.4 **OR** 1.3 **OR** 1.2, **as directed**.
 - b. Fan Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.
 - c. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
 - d. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
 - e. Belt Guards: Fabricate to comply with OSHA and SMACNA requirements of diamond-mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation. Include provisions for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
 - f. Motor Mount: Adjustable for belt tensioning.
8. Accessories:
- a. Shaft Cooler: Metal disk between bearings and fan wheel, designed to dissipate heat from shaft.
 - b. Spark-Resistant Construction: AMCA 99.
 - c. Shaft Seals: Airtight seals installed around shaft on drive side of single-width fans.
9. Motors: Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".
- a. Enclosure Type: Totally enclosed, fan cooled.

F. Source Quality Control

1. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
2. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

1.3 EXECUTION

A. Installation

1. Install centrifugal fans level and plumb.
2. Support floor-mounting units using spring isolators **OR** restrained spring isolators, **as directed**, having a static deflection of 1 inch (25 mm). Vibration- and seismic-control devices are specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 - a. Secure vibration and seismic controls to concrete bases using anchor bolts cast in concrete base.
3. Install floor-mounting units on concrete bases. Concrete, reinforcement, and formwork requirements are specified in Division 03 Section "Cast-in-place Concrete".
4. Install floor-mounting units on concrete bases designed to withstand, without damage to equipment, the seismic force required by authorities having jurisdiction. Concrete, reinforcement, and formwork requirements are specified in Division 03 Section "Cast-in-place Concrete".
5. Support suspended units from structure using threaded steel rods and elastomeric hangers **OR** spring hangers **OR** spring hangers with vertical-limit stops, **as directed**, having a static deflection of 1 inch (25 mm). Vibration-control devices are specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
6. Install units with clearances for service and maintenance.
7. Label fans according to requirements specified in Division 23 Section "Identification For Hvac Piping And Equipment".

B. Connections

1. Duct installation and connection requirements are specified in other Division 21. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with



flexible connectors. Flexible connectors are specified in Division 23 Section "Air Duct Accessories".

2. Install ducts adjacent to fans to allow service and maintenance.
3. Install line-sized piping from scroll drain connection, with trap with seal equal to 1.5 times specified static pressure, to nearest floor drain.
4. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
5. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

C. Field Quality Control

1. Perform the following field tests and inspections and prepare test reports:
 - a. Verify that shipping, blocking, and bracing are removed.
 - b. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 - c. Verify that cleaning and adjusting are complete.
 - d. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
 - e. Adjust belt tension.
 - f. Adjust damper linkages for proper damper operation.
 - g. Verify lubrication for bearings and other moving parts.
 - h. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
 - i. Refer to Division 23 Section "Testing, Adjusting, And Balancing For Hvac" for testing, adjusting, and balancing procedures.
 - j. Remove and replace malfunctioning units and retest as specified above.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

END OF SECTION 23 34 16 00



23 - Heating, Ventilating, And Air-Conditioning (HVAC)

Task	Specification	Specification Description
23 34 16 00	01 22 16 00	No Specification Required
23 34 16 00	01 95 26 00	Power Ventilators
23 34 23 00	01 95 26 00	Power Ventilators



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SECTION 23 34 33 00 - AIR CURTAINS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for air curtains. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes air curtains with hot-water heat, steam heat, electric heat, and gas-fired heater.

C. Submittals

1. Product Data: Include rated capacities, furnished specialties, and accessories for each unit indicated.
2. Shop Drawings: For air curtains. Include plans, elevations, sections, details, and attachments to other work.
 - a. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - b. Wiring Diagrams: Power, signal, and control wiring.
3. Delegated-Design Submittal: For air curtains indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - a. Detail fabrication and assembly of air-curtain mounting assemblies.
 - b. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints.
4. Operation and maintenance data: For air curtains to include in maintenance manuals.
5. Warranties: Sample of special warranties.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified and marked for intended location and application.
2. Comply with AMCA 220, "Laboratory Methods of Testing Air Curtains for Aerodynamic Performance Ratings," for airflow, outlet velocity, and power consumption.
3. Comply with ARI 410, "Forced-Circulation Air-Cooling and Air-Heating Coils," for components, construction, and rating.
 - a. Certify coils according to ARI 410.
4. Comply with NSF 37, "Air Curtains for Entranceways in Food and Food Service Establishments."

E. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of air curtains that fail in materials or workmanship within specified warranty period.
 - a. Warranty Period (Nonheating Units): 24 months.
 - b. Warranty Period (Water or Steam Heating Units): 18 **OR** 24 months, **as directed**.
 - c. Warranty Period (Gas Heating Units): 18 **OR** 24 months, **as directed**.

1.2 PRODUCTS

A. Air-Curtain Unit

1. Housing:



- a. Materials: Galvanized steel with electrostatically applied epoxy enamel finish over powdered mirror
 - b. Materials: One-piece, molded, high-impact, white polymer material
 - c. Materials: Heavy-gage, electroplated-zinc steel with welded construction and polyester-coated finish.
 - d. Materials: Heavy-gage, aluminum construction.
 - 1) Anodized Finish: Match finish and color of adjacent architectural metals. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 2) Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
 - a) Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: Nonspecular as fabricated; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.
 - b) Class II, Color Anodic Finish: AA-M12C22A32/A34 (Mechanical Finish: Nonspecular as fabricated; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class II, integrally colored or electrolytically deposited color coating 0.010 mm or thicker).
 - e. Materials: Stainless steel.
 - f. Discharge Nozzle: Integral part of the housing, containing fixed air-directional vanes.
 - g. Discharge Nozzle: Integral part of the housing, containing adjustable air-directional vanes with 40 **OR** 20 **OR** 15-degree sweep front to back, **as directed**.
 - h. Discharge Nozzle: Integral part of the housing, containing air-directional vanes adjustable in 5-degree increments through a 45-degree sweep front to back.
2. Mounting Brackets: Steel, for wall **OR** ceiling mounting, **as directed**.
 3. Air-Intake Louvers: Comply with requirements in Division 08 Section "Louvers And Vents".
 4. Air-Intake Louvers **OR** Grille, **as directed**.
 - a. Louvers: Integral part of the housing, mechanically field adjustable and capable of reducing air-outlet velocity by 60 percent with louver in totally closed position.
 - b. Grille: Integral part of and same material as the housing.
 - c. Insect Screen: Aluminum **OR** Stainless steel, **as directed**, removable.
 5. Fans
 - a. Centrifugal, forward curved, double width, double inlet **OR** Vane axial, **as directed**.
 - b. Galvanized steel **OR** Painted steel **OR** Aluminum, **as directed**.
 - c. Statically and dynamically balanced.
 - d. Direct drive **OR** Belt drive and equipped with belt guards and adjustable sheaves and pulleys for adjusting air-outlet velocity, **as directed**.
 6. Motors: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - b. Single speed **OR** Two speed Multispeed, **as directed**.
 - c. Resiliently mounted.
 - d. Continuous duty.
 - e. Totally enclosed, air over **OR** totally enclosed, fan cooled, **OR**, open, dripproof **OR** explosion proof, **as directed**.
 - f. Integral thermal-overload protection.
 - g.
 - h. Bearings: Permanently sealed, lifetime, prelubricated, ball bearings.
 - i. Disconnect: Internal power cord with plug and receptacle.
 7. Water Coils
 - a. Type: Continuous-circuit **OR** Self-draining **OR** Cleanable, **as directed**.
 - b. Piping Connections: Threaded on same end **OR** opposite ends, **as directed**.



- c. Tubes: Copper, complying with ASTM B 75 (ASTM B 75M).
 - 1) Tube Diameter: 0.625 inch (15.9 mm).
- d. Fins: Aluminum **OR** Copper, **as directed** with fin spacing 0.167 inch (4.23 mm) **OR** 0.125 inch (3.18 mm) **OR** 0.091 inch (2.31 mm) **OR** 0.071 inch (1.80 mm) **OR** 0.067 inch (1.70 mm) **OR** 0.056 inch (1.42 mm) **OR** 0.0075 inch (0.19 mm), **as directed**.
- e. Fin and Tube Joint: Mechanical bond **OR** Silver brazed, **as directed**.
- f. Headers: Cast iron with drain and air vent tappings **OR** Cast iron with cleaning plugs, and drain and air vent tappings **OR** Seamless copper tube with brazed joints, prime coated **OR** Fabricated steel with brazed joints, prime coated, **as directed**.
- g. Frames: Galvanized-steel channel frame 0.052 inch (1.3 mm) **OR** 0.064 inch (1.6 mm) **OR** 0.079 inch (2.0 mm) **OR** 0.0625 inch (1.59 mm), **as directed**.
- h. Ratings: According to ASHRAE 33.
- i. Working-Pressure Ratings: 200 psig (1380 kPa), 325 deg F (163 deg C).
- 8. Steam Coils Distribution header coil **OR** Single-tube coil, **as directed** with threaded steam supply and condensate connections.
 - a. Piping Connections: Same end **OR** Opposite ends **OR** Steam supply on both ends; condensate on one end, **as directed**.
 - b. Tube Material: Copper, complying with ASTM B 75 (ASTM B 75M).
 - c. Tube Diameter: 0.625 inch (15.9 mm).
 - d. Fins: Aluminum **OR** Copper, **as directed** 0.167 inch (4.23 mm) **OR** 0.125 inch (3.18 mm) **OR** 0.091 inch (2.31 mm) **OR** 0.071 inch (1.80 mm) **OR** 0.067 inch (1.70 mm) **OR** 0.056 inch (1.42 mm) **OR** 0.0075 inch (0.19 mm), **as directed**.
 - e. Fin and Tube Joint: Mechanical bond **OR** Silver brazed, **as directed**.
 - f. Headers: Cast iron with drain and air vent tappings **OR** Cast iron with cleaning plugs, and drain and air vent tappings **OR** Seamless copper tube with brazed joints, prime coated **OR** Fabricated steel with brazed joints, prime coated, **as directed**.
 - g. Frames: Galvanized-steel channel frame, 0.052 inch (1.3 mm) **OR** 0.064 inch (1.6 mm) **OR** 0.079 inch (2.0 mm) **OR** 0.0625 inch (1.59 mm) , **as directed**.
 - h. Pressure and Temperature Ratings: 100 psig (690 kPa), 400 deg F (205 deg C) according to ASHRAE 33.
- 9. Electric-Resistance Coils:
 - a. Coil Assembly: Comply with UL 1995.
 - b. Frame: Galvanized-steel frame.
 - c. Heating Elements: Coiled resistance wire of 80 percent nickel and 20 percent chromium; surrounded by compacted magnesium-oxide powder in tubular-steel sheath; with spiral-wound, copper-plated, steel fins continuously brazed to sheath.
 - d. Heating Elements: Open-coil resistance wire of 80 percent nickel and 20 percent chromium, supported and insulated by floating ceramic bushings recessed into casing openings, fastened to supporting brackets, and mounted in galvanized-steel frame.
 - e. Overtemperature Protection: Disk-type, automatically reset, thermal-cutout, safety device; serviceable through terminal box without removing heater from duct or unit.
 - 1) Secondary Protection: Load-carrying, manually reset or manually replaceable, thermal cutouts; factory wired in series with each heater stage.
 - f. Control Panel: Unit **OR** Remote, **as directed**, mounted with disconnecting means and overcurrent protection. Include the following controls:
 - 1) Magnetic contactor.
 - 2) Mercury contactor.
 - 3) Solid-state stepless pulse controller.
 - 4) Toggle switches; one per step.
 - 5) Step controller.
 - 6) Time-delay relay.
 - 7) Pilot lights; one per step.
 - 8) Airflow proving switch.
- 10. Gas-Fired Heaters:
 - a. Comply with ANSI Z83.8/CSA, "Gas Unit Heaters and Gas-Fired Duct Furnaces."
 - 1) CSA Approval: Bear AGA label.



- 2) Type of Gas: Natural **OR** LP, **as directed**.
 - b. Assembly and Wiring: Heaters factory assembled, piped, wired, and tested for 120-V ac.
 - c. Housing: Steel, with integral draft hood and inserts for suspension-mounting rods.
 - d. External Casings and Cabinets: Baked enamel over corrosion-resistant-treated surface.
 - e. Heat Exchanger: Aluminized **OR** Stainless, **as directed**, steel.
 - f. Burners: Cast iron or aluminized steel with stainless-steel inserts.
 - g. Gravity vent.
 - h. Power Venter: 120-V ac, with stainless-steel shaft.
 - i. Automatic Gas Control: Single **OR** 2-stage, **as directed**, 24-V ac valve.
 - j. Ignition: Standing pilot **OR** Electronically controlled spark with flame sensor, **as directed**.
 11. Filters:
 - a. Disposable Panel Filters: Factory-fabricated, viscous-coated, flat-panel-type, disposable air filters with glass-fiber media sprayed with nonflammable adhesive in cardboard **OR** galvanized-steel, **as directed**, frame.
 - b. Washable Panel Filters: Removable, stainless-steel, baffle-type filters with spring-loaded fastening; with minimum 0.0781-inch- (1.984-mm-) thick, stainless-steel filter frame.
 - c. Mounting Frames: Welded, galvanized steel with gaskets and fasteners and suitable for bolting together into built-up filter banks.
 12. Controls:
 - a. Built-in **OR** Field-Installed, **as directed**, Thermostat: Line voltage, factory installed and wired to the junction box on air curtain **OR** motor-control panel, **as directed**.
 - b. Automatic Door Switch: Plunger type installed in door area to activate air curtain when door opens and to deactivate air curtain when door closes.
 - c. Start-Stop, Push-Button Switch: Manually activates and deactivates air curtain.
 - d. Three-Speed Switch: Manually activates, deactivates, and controls air-curtain fan speed.
 - e. Time-Delay Relay: Factory installed and adjustable to allow air curtain to operate from 0.5 seconds to 10 hours.
 - f. Motor-Control Panel: Complete with motor starter, 115-V ac transformer with primary and secondary fuses, terminal strip, and NEMA 250, Type 1 **OR** 12, **as directed**, enclosure.
 13. Accessories:
 - a. Mounting Brackets: Adjustable mounting brackets for drum-type roll-up doors.
 - b. Discharge Extension Neck: For ceiling-recessed installation.
 - B. Source Quality Control
 1. Source Quality Control: Test to 300 psig (2070 kPa) and to 200 psig (1380 kPa) underwater.
 2. Testing: Test and inspect steam coils according to ASHRAE 33.
 3. Steam coils will be considered defective if it does not pass tests and inspections.
 4. Prepare test and inspection reports.
- 1.3 EXECUTION
- A. Examination
 1. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance.
 2. Examine roughing-in for hot-water **OR** steam **OR** gas, **as directed**, piping systems to verify actual locations of piping connections before air-curtain installation.
 3. Proceed with installation only after unsatisfactory conditions have been corrected.
 - B. Installation
 1. Install air curtains with clearance for equipment service and maintenance.
 2. Equipment Installation: Install air curtains with seismic-restraint devices. Comply with requirements for seismic-restraint devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".



3. Comply with requirements for hangers and supports specified in Division 23 Section "Hangers And Supports For Hvac Piping And Equipment".

C. Connections

1. Comply with requirements for piping specified in Division 26 Section "Grounding And Bonding For Electrical Systems" and Division 26 Section "Low-voltage Electrical Power Conductors And Cables".
2. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
3. Breaching: Comply with applicable requirements in Division 23 Section "Breechings, Chimneys, And Stacks". Connect breaching to full size at flue outlet.

D. Field Quality Control

1. Perform tests and inspections.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Tests and Inspections:
 - a. After installing air curtains completely, perform visual and mechanical check of individual components.
 - b. After electrical circuitry has been energized, start unit to confirm motor rotation and unit operation. Certify compliance with test parameters.
 - c. Inspect for water leaks.
 - d. Test gas train and verify that there are no gas leaks.
 - e. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Air-curtain unit will be considered defective if it does not pass tests and inspections.
4. Prepare test and inspection reports.

E. Adjusting

1. Adjust belt tension.
2. Adjust motor and fan speed to achieve specified airflow.
3. Adjust discharge louver and dampers to regulate airflow.
4. Adjust air-directional vanes.

END OF SECTION 23 34 33 00



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23 - Heating, Ventilating, And Air-Conditioning (HVAC)

Task	Specification	Specification Description
23 35 13 00	01 22 16 00	No Specification Required



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SECTION 23 36 13 00 - DIFFUSERS, REGISTERS, AND GRILLES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for diffusers, registers and grilles. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Round ceiling diffusers.
 - b. Rectangular and square ceiling diffusers.
 - c. Perforated diffusers.
 - d. Louver face diffusers.
 - e. Linear bar diffusers.
 - f. Linear slot diffusers.
 - g. Ceiling-integral continuous diffusers.
 - h. Light troffer diffusers.
 - i. Round induction diffusers.
 - j. Linear floor diffuser plenums.
 - k. Drum louvers.
 - l. Modular core supply grilles.
 - m. Continuous tubular diffusers.
 - n. Adjustable bar registers and grilles.
 - o. Security registers and grilles.
 - p. Fixed face registers and grilles.
 - q. Linear bar grilles.

C. Submittals

1. Product Data: For each type of product indicated, include the following:
 - a. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
 - b. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.
2. Samples: For each exposed product and for each color and texture specified.

1.2 PRODUCTS

A. Ceiling Diffusers

1. Round Ceiling Diffuser:
 - a. Devices shall be specifically designed for variable-air-volume flows.
 - b. Material: Steel **OR** Aluminum, **as directed**.
 - c. Finish: Baked enamel, white **OR** Baked enamel, color selected **OR** Anodized aluminum, **as directed**.
 - d. Face Style: Four **OR** Three **OR** Two, **as directed**, cone.
 - e. Mounting: Duct connection.
 - f. Pattern: Fully adjustable **OR** Two-position horizontal, **as directed**.
 - g. Dampers: Radial opposed blade **OR** Butterfly **OR** Combination damper and grid, **as directed**.
 - h. Accessories:
 - 1) Equalizing grid.



- 2) Plaster ring.
 - 3) Safety chain.
 - 4) Wire guard.
 - 5) Sectorizing baffles.
 - 6) Operating rod extension.
2. Rectangular and Square Ceiling Diffusers:
 - a. Devices shall be specifically designed for variable-air-volume flows.
 - b. Material: Steel **OR** Aluminum, **as directed**.
 - c. Finish: Baked enamel, white **OR** Baked enamel, color selected **OR** Anodized aluminum, **as directed**.
 - d. Face Size: 24 by 24 inches (600 by 600 mm) **OR** 20 by 20 inches (500 by 500 mm) **OR** 12 by 12 inches (300 by 300 mm), **as directed**.
 - e. Face Style: Three cone **OR** Four cone **OR** Plaque, **as directed**.
 - f. Mounting: Surface **OR** T-bar **OR** Snap in **OR** Spline **OR** Mounting panel, **as directed**.
 - g. Pattern: Fixed **OR** Two position **OR** Adjustable, **as directed**.
 - h. Dampers: Radial opposed blade **OR** Butterfly **OR** Combination damper and grid, **as directed**.
 - i. Accessories:
 - 1) Equalizing grid.
 - 2) Plaster ring.
 - 3) Safety chain.
 - 4) Wire guard.
 - 5) Sectorizing baffles.
 - 6) Operating rod extension.
 3. Perforated Diffuser:
 - a. Devices shall be specifically designed for variable-air-volume flows.
 - b. Material: Steel backpan and pattern controllers, with steel **OR** aluminum, **as directed**, face.
 - c. Finish: Baked enamel, white **OR** Baked enamel, color selected **OR** Anodized aluminum, **as directed**.
 - d. Face Size: 12 by 12 inches (300 by 300 mm) **OR** 24 by 12 inches (600 by 300 mm) **OR** 36 by 12 inches (900 by 300 mm) **OR** 48 by 12 inches (1200 by 300 mm) **OR** 16 by 16 inches (400 by 400 mm) **OR** 20 by 20 inches (500 by 500 mm) **OR** 24 by 24 inches (600 by 600 mm) **OR** 36 by 24 inches (900 by 600 mm) **OR** 48 by 24 inches (1200 by 600 mm), **as directed**.
 - e. Duct Inlet: Round **OR** Square, **as directed**.
 - f. Face Style: Flush **OR** Drop extended, **as directed**.
 - g. Mounting: Surface **OR** T-bar **OR** Snap in **OR** Spline **OR** Mounting panel, **as directed**.
 - h. Pattern Controller: Four louvered deflector patches **OR** Fixed with curved blades at inlet **OR** Adjustable with louvered pattern modules at inlet **OR** None, **as directed**.
 - i. Dampers: Opposed blade **OR** Radial opposed blade **OR** Butterfly **OR** Combination damper and grid **OR** Combination volume and fire, **as directed**.
 - j. Accessories:
 - 1) Equalizing grid.
 - 2) Plaster ring.
 - 3) Safety chain.
 - 4) Wire guard.
 - 5) Sectorizing baffles.
 - 6) Operating rod extension.
 4. Louver Face Diffuser:
 - a. Devices shall be specifically designed for variable-air-volume flows.
 - b. Material: Steel **OR** Aluminum, **as directed**.
 - c. Finish: Baked enamel, white **OR** Baked enamel, color selected **OR** Anodized aluminum, **as directed**.
 - d. Face Size: as directed by the Owner.



- e. Mounting: Surface **OR** Surface with beveled frame **OR** T-bar **OR** Snap in **OR** Spline **OR** Mounting panel, **as directed**.
 - f. Pattern: One-way **OR** Two-way **OR** Two-way corner **OR** Three-way **OR** Four-way **OR** Adjustable, **as directed**, core style.
 - g. Dampers: Radial opposed blade **OR** Butterfly **OR** Combination damper and grid, **as directed**.
 - h. Accessories:
 - 1) Square to round neck adaptor.
 - 2) Adjustable pattern vanes.
 - 3) Throw reducing vanes.
 - 4) Equalizing grid.
 - 5) Plaster ring.
 - 6) Safety chain.
 - 7) Wire guard.
 - 8) Sectorizing baffles.
 - 9) Operating rod extension.
- B. Ceiling Linear Slot Outlets
- 1. Linear Bar Diffuser:
 - a. Devices shall be specifically designed for variable-air-volume flows.
 - b. Material: Steel **OR** Aluminum **OR** Stainless steel, **as directed**.
 - c. Finish: Baked enamel, white **OR** Baked enamel, color selected, **as directed**.
 - d. Narrow Core Spacing Arrangement: 1/8-inch- (3-mm-) thick blades spaced 1/4 inch (6 mm) apart, zero **OR** 15, **as directed**, -degree deflection.
 - e. Wide Core Spacing Arrangement: 1/8-inch- (3-mm-) thick blades spaced 1/2 inch (13 mm) apart, zero **OR** 15, **as directed**, -degree deflection.
 - f. Wide Core Spacing Arrangement: 3/16-inch- (5-mm-) thick blades spaced 1/2 inch (13 mm) apart, zero **OR** 15 **OR** 30, **as directed**, -degree deflection.
 - g. Pencil-Proof Core Spacing Arrangement: 3/16-inch- (5-mm-) thick blades spaced 7/16 inch (11 mm) apart, zero **OR** 15 **OR** 30, **as directed**, -degree deflection.
 - h. One **OR** Two, **as directed**, -Way Deflection Vanes: Extruded construction fixed louvers with removable core.
 - i. Frame: 1-1/4 inches (32 mm) **OR** 1 inch (25 mm) **OR** 3/4 inch (19 mm) **OR** 1/2 inch (13 mm) **OR** 3/16 inch (5 mm), **as directed**, wide.
 - j. Mounting Frame: Filter.
 - k. Mounting: Countersunk screw **OR** Concealed bracket **OR** Spring clip, **as directed**.
 - l. Damper Type: Adjustable opposed-blade assembly **OR** Hinged single blade, **as directed**.
 - m. Accessories: Plaster frame **OR** Directional vanes **OR** Alignment pins **OR** Core clips **OR** Blank-off strips, **as directed**.
 - 2. Linear Slot Diffuser:
 - a. Devices shall be specifically designed for variable-air-volume flows.
 - b. Material - Shell: Steel **OR** Aluminum, **as directed**, insulated **OR** noninsulated, **as directed**.
 - c. Material - Pattern Controller and Tees: Aluminum.
 - d. Finish - Face and Shell: Baked enamel, black.
 - e. Finish - Pattern Controller: Baked enamel, black.
 - f. Finish - Tees: Baked enamel, white **OR** Baked enamel, color selected, **as directed**.
 - g. Slot Width: 1/2 inch (13 mm) **OR** 3/4 inch (19 mm) **OR** 1 inch (25 mm) **OR** 1-1/2 inches (38 mm), **as directed**.
 - h. Number of Slots: One **OR** Two **OR** Three **OR** Four, **as directed**.
 - i. Length: 24 inches (600 mm) **OR** 30 inches (750 mm) **OR** 36 inches (900 mm) **OR** 48 inches (1200 mm) **OR** 60 inches (1500 mm), **as directed**.
 - j. Accessories: Plaster frame **OR** T-bar slot **OR** Center notch **OR** T-bar on inlet side **OR** T-bar on both sides **OR** T-bar clip on one side **OR** T-bar clips on both sides, **as directed**.
 - 3. Ceiling-Integral Continuous Diffuser:



- a. Slot Width: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 2-1/2 inches (63 mm) **OR** 3 inches (76 mm), **as directed**.
 - b. Section Length: 12 feet (3.7 m).
 - c. Straight and curved sections as required to accommodate layout.
 - d. Mitered tees and corners.
 - e. Pattern Controllers: 24 inches (600 mm) o.c.
 - f. Material: Aluminum, extruded, heavy wall.
 - g. Finishes:
 - 1) Exterior: Standard white.
 - 2) Interior: Standard black.
 - h. Throw: Standard **OR** High, **as directed**.
 - i. Mounting: Ceiling **OR** Sidewall, **as directed**.
 - j. Plenum: Noninsulated **OR** Insulated, **as directed**.
 - k. Other Features:
 - 1) Painted interior.
 - 2) Blank-offs.
4. Light Troffer Diffuser:
- a. Devices shall be specifically designed for variable-air-volume flows.
 - b. Material: Steel with external insulation, **as directed**.
 - c. Finish: None **OR** Black enamel on visible surfaces, **as directed**.
 - d. Slot Width: 1/2 inch (13 mm) **OR** 3/4 inch (19 mm) **OR** 1 inch (25 mm) **OR** 1-1/2 inches (38 mm), **as directed**.
 - e. Number of Sides: One **OR** Two, **as directed**.
 - f. Length: 24 inches (600 mm) **OR** 36 inches (900 mm) **OR** 48 inches (1200 mm), **as directed**.
 - g. Pattern: Fixed **OR** Adjustable, **as directed**.
 - h. Inlet: Top **OR** Side, **as directed**.
 - i. Inlet Size: 5 inches (125 mm) **OR** 6 inches (150 mm) **OR** 8 inches (200 mm), **as directed**.
- C. Underfloor Air Distribution Diffusers
1. Round Induction Diffusers:
 - a. Airflow Principle: Swirl-pattern induction.
 - b. Material: Plastic, high impact, and resistant to cart and foot traffic.
 - c. Color: Gray **OR** Black, **as directed**.
 - d. Components:
 - 1) Diffuser core.
 - 2) Flow regulator.
 - 3) Dirt and liquid catch pan.
 - 4) Spacer flange.
 - 5) Gasketed, underfloor compression ring.
 2. Linear Floor Diffuser Plenums:
 - a. Material: Steel.
 - b. Finish: White baked acrylic.
 - c. Deflection: Zero **OR** 15, **as directed**, degrees.
 - d. Components:
 - 1) Aluminum diffuser core.
 - 2) Diffuser frame.
 - 3) Plenum, 0.034-inch (0.85-mm) steel.
- D. High-Capacity Diffusers
1. Drum Louver:
 - a. Airflow Principle: Extended distance for high airflow rates.
 - b. Material: Aluminum, heavy gage extruded.
 - c. Finish: White baked acrylic.
 - d. Border: 1-1/4-inch (32-mm) width with countersunk screw holes.



- e. Gasket between drum and border.
 - f. Body: Drum shaped; adjustable vertically.
 - g. Blades: Individually adjustable horizontally.
 - h. Mounting: Surface to duct **OR** wall, **as directed**.
 - i. Inlet Width: 6 inches (150 mm) **OR** 10 inches (250 mm) **OR** 12 inches (300 mm) **OR** 15 inches (380 mm), **as directed**.
 - j. Inlet Length: 12 inches (300 mm) **OR** 24 inches (600 mm) **OR** 36 inches (900 mm) **OR** 60 inches (1500 mm), **as directed**.
 - k. Accessories:
 - 1) Opposed-blade steel damper.
 - 2) Duct-mounting collars with countersunk screw holes.
2. Modular Core Supply Grilles:
- a. Throw: Extended distance for airflow rates.
 - b. Material: Steel.
 - c. Grilles per Unit: One **OR** Two **OR** Three **OR** Four, **as directed**.
 - d. Finish: White baked acrylic.
 - e. Border: 1-1/2-inch (38-mm) width with countersunk screw holes.
 - f. Blades:
 - 1) Airfoil, individually adjustable horizontally.
 - 2) Double deflection.
 - 3) Set in modules.
 - g. Modules: Removable; rotatable.
 - h. Mounting: Surface.
 - i. Accessory: Opposed-blade steel damper.
- E. Flexible Diffusion Outlets
1. Continuous Tubular Diffuser:
- a. Material: Flame-retardant, woven polyethylene fabric **OR** Flame-retardant, coated polyester and fiberglass fabric **OR** Flame-retardant, permeable polyester and fiberglass fabric **OR** Polyethylene, **as directed**.
 - b. Duct Connection: Round.
 - c. Duct Connection Size: as directed by the Owner.
 - d. Diffusion Hole Size: as directed by the Owner.
 - e. Diffusion Hole Frequency - Number per 100 Feet (30 m): **<Insert number>**.
 - f. Accessories:
 - 1) Quick-connect joint.
 - 2) Snap hooks.
 - 3) Cleanout zipper.
 - 4) Condensate drain.
- F. Registers And Grilles
1. Adjustable Bar Register:
- a. Material: Steel **OR** Aluminum **OR** Stainless steel, **as directed**.
 - b. Finish: Baked enamel, white **OR** Baked enamel, color selected, **as directed**.
 - c. Face Blade Arrangement: Horizontal **OR** Vertical, **as directed**, spaced 3 inches (76 mm) **OR** 1-1/2 inches (38 mm) **OR** 3/4 inch (19 mm) **OR** 1/2 inch (13 mm), **as directed**, apart.
 - d. Core Construction: Integral **OR** Removable, **as directed**.
 - e. Rear-Blade Arrangement: Horizontal **OR** Vertical, **as directed**, spaced 3/4 inch (19 mm) **OR** 1/2 inch (13 mm), **as directed**, apart.
 - f. Frame: 1-1/4 inches (32 mm) **OR** 1 inch (25 mm), **as directed**, wide.
 - g. Mounting Frame: Filter.
 - h. Mounting: Countersunk screw **OR** Concealed **OR** Lay in, **as directed**.
 - i. Damper Type: Adjustable opposed blade **OR** NRTL listed, opposed blade, spring closing, and with fusible link for 160 deg F (71 deg C), **as directed**.
 - j. Accessories:
 - 1) Front **OR** Rear, **as directed**, -blade gang operator.



- 2) Filter.
2. Adjustable Bar Grille:
 - a. Material: Steel **OR** Aluminum **OR** Stainless steel, **as directed**.
 - b. Finish: Baked enamel, white **OR** Baked enamel, color selected, **as directed**.
 - c. Face Blade Arrangement: Horizontal **OR** Vertical, **as directed**, spaced 3 inches (76 mm) **OR** 1-1/2 inches (38 mm) **OR** 3/4 inch (19 mm) **OR** 1/2 inch (13 mm), **as directed**, apart.
 - d. Core Construction: Integral **OR** Removable, **as directed**.
 - e. Rear-Blade Arrangement: Horizontal **OR** Vertical, **as directed**, spaced 3/4 inch (19 mm) **OR** 1/2 inch (13 mm), **as directed**, apart.
 - f. Frame: 1-1/4 inches (32 mm) **OR** 1 inch (25 mm), **as directed**, wide.
 - g. Mounting Frame: Filter.
 - h. Mounting: Countersunk screw **OR** Concealed **OR** Lay in, **as directed**.
3. Security Register:
 - a. Security Level: Maximum **OR** Medium **OR** Minimum, **as directed**, and suicide deterrent, **as directed**.
 - b. Application: Ducted return **OR** Air transfer **OR** Barrier, **as directed**.
 - c. Material: Steel **OR** Aluminum, **as directed**.
 - d. Material Thickness: 0.19 inch (4.8 mm).
 - e. Finish: Baked enamel, white **OR** Baked enamel, color selected, **as directed**.
 - f. Face Arrangement:
 - 1) Shape: Square **OR** Rectangular **OR** Round, **as directed**.
 - 2) Design: Fixed bar **OR** Perforated **OR** Lattice, **as directed**.
 - 3) Frame: Yes **OR** No, **as directed**.
 - 4) Deflection: Zero **OR** 38, **as directed**, degrees.
 - 5) Core: None **OR** Louvered, **as directed**.
 - 6) 3/16-inch- (5-mm-) thick, front lattice plate with 2-by-2-inch- (50-by-50-mm-) square holes and 1-inch (25-mm) frets, 0.135-inch (3.43-mm) wire mesh, and 1/4-inch- (6-mm-) thick backer plate.
 - 7) 3/16-inch- (5-mm-) thick, perforated faceplate with 5/16-inch- (8-mm-) diameter holes spaced 7/16 inch (11 mm) o.c., staggered at 60 degrees.
 - 8) 1-1/2-inch (38-mm) bars and mandrel tubes and rods with zero **OR** 15, **as directed**, -degree deflection in 1-1/4-by-1-1/4-by-3/16-inch (32-by-32-by-5-mm) angle border.
 - 9) 1-3/8-inch (35-mm) bars and double mandrel tubes with zero **OR** 15, **as directed**, -degree deflection in 1-3/4-inch (45-mm) angle border.
 - g. Damper Operation: None **OR** Face operated **OR** Rear operated, **as directed**.
 - h. Damper Type: Adjustable opposed blade **OR** NRTL listed, opposed blade, spring closing, and with fusible link for 160 deg F (71 deg C), **as directed**.
 - i. Wall Sleeve: 3/16 inch (5 mm) welded to face **OR** 1/8 inch (3 mm) welded to face **OR** Mechanically fastened to border, **as directed**.
 - j. Mounting: 1-by-1-by-3/16-inch (25-by-25-by-5-mm) retaining angle frame **OR** 1-1/4-by-1-1/4-by-3/16-inch (32-by-32-by-5-mm) retaining angle frame **OR** 1-1/4-by-1-1/4-by-3/16-inch (32-by-32-by-5-mm) cast-in-place frame and tamperproof machine screws, **as directed**.
4. Security Grille:
 - a. Security Level: Maximum **OR** Medium **OR** Minimum, **as directed**, and suicide deterrent, **as directed**.
 - b. Application: Ducted return **OR** Air transfer **OR** Barrier, **as directed**.
 - c. Material: Steel **OR** Aluminum, **as directed**.
 - d. Material Thickness: 0.19 inch (4.8 mm).
 - e. Finish: Baked enamel, white **OR** Baked enamel, color selected, **as directed**.
 - f. Face Arrangement:
 - 1) Shape: Square **OR** Rectangular **OR** Round, **as directed**.
 - 2) Design: Fixed bar **OR** Perforated **OR** Lattice, **as directed**.
 - 3) Frame: Yes **OR** No, **as directed**.
 - 4) Deflection: Zero **OR** 38, **as directed**, degrees.
 - 5) Core: None **OR** Louvered, **as directed**.



- 6) 3/16-inch- (5-mm-) thick, front lattice plate with 2-by-2-inch- (50-by-50-mm-) square holes and 1-inch (25-mm) frets, 0.135-inch (3.43-mm) wire mesh, and 1/4-inch- (6-mm-) thick backer plate.
- 7) 3/16-inch- (5-mm-) thick perforated faceplate with 5/16-inch- (8-mm-) diameter holes spaced 7/16 inch (11 mm) o.c., staggered at 60 degrees.
- 8) 1-1/2-inch (38-mm) bars and mandrel tubes and rods with zero **OR 15, as directed**, -degree deflection in 1-1/4-by-1-1/4-by-3/16-inch (32-by-32-by-5-mm) angle border.
- 9) 1-3/8-inch (35-mm) bars and double mandrel tubes with zero **OR 15, as directed**, -degree deflection in 1-3/4-inch (45-mm) angle border.
- g. Wall Sleeve: 3/16 inch (5 mm) welded to face **OR 1/8 inch (3 mm) welded to face OR Mechanically fastened to border, as directed.**
- h. Mounting: 1-by-1-by-3/16-inch (25-by-25-by-5-mm) retaining angle frame **OR 1-1/4-by-1-1/4-by-3/16-inch (32-by-32-by-5-mm) retaining angle frame OR 1-1/4-by-1-1/4-by-3/16-inch (32-by-32-by-5-mm) cast-in-place frame and tamperproof machine screws, as directed.**
- 5. Fixed Face Register:
 - a. Material: Steel **OR Aluminum, as directed.**
 - b. Finish: Baked enamel, white **OR Baked enamel, color selected, as directed.**
 - c. Face Arrangement: 1/2-by-1/2-by-1/2-inch (13-by-13-by-13-mm) grid **OR Perforated, as directed, core.**
 - d. Core Construction: Integral **OR Removable, as directed.**
 - e. Frame: 1-1/4 inches (32 mm) **OR 1 inch (25 mm), as directed, wide.**
 - f. Mounting Frame: Filter.
 - g. Mounting: Countersunk screw **OR Concealed OR Lay in, as directed.**
 - h. Damper Type: Adjustable opposed blade **OR NRTL listed, opposed blade, spring closing, and with fusible link for 160 deg F (71 deg C), as directed.**
 - i. Accessory: Filter.
- 6. Fixed Face Grille:
 - a. Material: Steel **OR Aluminum, as directed.**
 - b. Finish: Baked enamel, white **OR Baked enamel, color selected.**
 - c. Face Arrangement: 1/2-by-1/2-by-1/2-inch (13-by-13-by-13-mm) grid **OR Perforated, as directed, core.**
 - d. Core Construction: Integral **OR Removable, as directed.**
 - e. Frame: 1-1/4 inches (32 mm) **OR 1 inch (25 mm), as directed, wide.**
 - f. Mounting Frame: Filter.
 - g. Mounting: Countersunk screw **OR Concealed OR Lay in, as directed.**
 - h. Accessory: Filter.
- 7. Linear Bar Grille:
 - a. Material: Steel **OR Aluminum, as directed.**
 - b. Finish: Baked enamel, white **OR Baked enamel, color selected, as directed.**
 - c. Face Arrangement: 1/2-by-1/2-by-1/2-inch (13-by-13-by-13-mm) grid **OR Perforated, as directed, core.**
 - d. Distribution plenum.
 - 1) Internal insulation.
 - 2) Inlet damper.
 - e. Frame: 1-1/4 inches (32 mm) **OR 1 inch (25 mm), as directed, wide.**
 - f. Mounting Frame: Filter.
 - g. Mounting: Countersunk screw **OR Concealed OR Lay in, as directed.**
 - h. Damper Type: Adjustable opposed blade **OR NRTL listed, opposed blade, spring closing, and with fusible link for 160 deg F (71 deg C), as directed.**
- G. Source Quality Control
 - 1. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."



1.3 EXECUTION

A. Installation

1. Install diffusers, registers, and grilles level and plumb.
2. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify the Owner for a determination of final location.
3. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

B. Adjusting

1. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 23 36 13 00



SECTION 23 36 16 00 - AIR TERMINAL UNITS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for air terminal units. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Bypass, single-duct air terminal units.
 - b. Dual-duct air terminal units.
 - c. Fan-powered air terminal units.
 - d. Induction air terminal units.
 - e. Shutoff, single-duct air terminal units.
 - f. Diffuser-type air terminal units.

C. Performance Requirements

1. Structural Performance: Hangers and supports and seismic restraints, **as directed**, shall withstand the effects of gravity and seismic, **as directed**, loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and ASCE/SEI 7 **OR** SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems", **as directed**.
 - a. Seismic Hazard Level A: Seismic force to weight ratio, 0.48.
 - b. Seismic Hazard Level B: Seismic force to weight ratio, 0.30.
 - c. Seismic Hazard Level C: Seismic force to weight ratio, 0.15.

D. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittal:
 - a. Product Data for Prerequisite EQ 1: Documentation indicating that units comply with ASHRAE 62.1-2004, Section 5 - "Systems and Equipment."
3. Shop Drawings: For air terminal units. Include plans, elevations, sections, details, and attachments to other work.
 - a. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - b. Wiring Diagrams: For power, signal, and control wiring.
 - c. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.
4. Delegated-Design Submittal:
 - a. Materials, fabrication, assembly, and spacing of hangers and supports.
 - b. Design Calculations: Calculations, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation, **as directed**, for selecting hangers and supports and seismic restraints, **as directed**.
5. Field quality-control reports.
6. Operation and maintenance data.

E. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."



1.2 PRODUCTS

A. Bypass, Single-Duct Air Terminal Units

1. Configuration: Diverting-damper assembly inside unit casing with control components inside a protective metal shroud.
2. Casing: 0.034-inch (0.85-mm) steel **OR** 0.032-inch (0.8-mm) aluminum, **as directed**, single **OR** double, **as directed**, wall.
 - a. Casing Lining: Adhesive attached, 1/2-inch- (13-mm-) **OR** 3/4-inch- (19-mm-) **OR** 1-inch- (25-mm-), **as directed**, thick, coated, fibrous-glass duct liner complying with ASTM C 1071, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.
 - 1) Cover liner with nonporous foil.
OR
Cover liner with nonporous foil and perforated metal.

OR

 Casing Lining: Adhesive attached, 1/2-inch- (13-mm-) **OR** 3/4-inch- (19-mm-) **OR** 1-inch- (25-mm-), **as directed**, thick, polyurethane foam insulation complying with UL 181 erosion requirements, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.
 - b. Air Inlet: Round stub connection for duct attachment.
 - c. Air Outlet: S-slip and drive connections.
 - d. Access: Removable panels for access to diverting damper and other parts requiring service, adjustment, or maintenance; with airtight gasket.
 - e. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.
3. Diverter Assembly: Galvanized-steel gate, with polyethylene linear bearings **OR** Aluminum blade, with nylon-fitted pivot points, **as directed**.
4. Multioutlet Attenuator Section: With two **OR** three **OR** four, **as directed**, 6-inch- (150-mm-) **OR** 8-inch- (200-mm-) **OR** 10-inch- (250-mm-), **as directed**, diameter collars, each with locking butterfly balancing damper.
5. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm), and rated for a minimum working pressure of 200 psig (1380 kPa) and a maximum entering-water temperature of 220 deg F (104 deg C). Include manual air vent and drain valve.
OR
Electric-Resistance Heating Coils: Nickel-chromium heating wire, free of expansion noise and hum, mounted in ceramic inserts in a galvanized-steel housing; with primary automatic, and secondary manual, reset thermal cutouts. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware.
 - a. Access door interlocked disconnect switch.
 - b. Downstream air temperature sensor with local connection to override discharge-air temperature to not exceed a maximum temperature set point (adjustable.)
 - c. Nickel chrome 80/20 heating elements.
 - d. Airflow switch for proof of airflow.
 - e. Fuses in terminal box for overcurrent protection (for coils more than 48 A).
 - f. Mercury contactors.
 - g. Pneumatic-electric switches and relays.
 - h. Magnetic contactor for each step of control (for three-phase coils).
6. Electric Controls: Damper actuator and thermostat.
 - a. Damper Actuator: 24 V, powered closed, powered open with microswitch to energize heating control circuit, **as directed**.
 - b. Thermostat: Wall-mounted electric type with temperature display in Fahrenheit and Celsius, and space temperature set point.



- c. Changeover Thermostat: Duct-mounted, field-adjustable, electric type reverses action of zone thermostat when air temperature reaches 70 deg F (21 deg C).

OR

Electronic Controls: Bidirectional damper operator and microprocessor-based thermostat. Control devices shall be compatible with temperature controls specified in Division 23 Section "Instrumentation And Control For Hvac" and shall have the following features:

- d. Damper Actuator: 24 V, powered closed, powered open.
- e. Thermostat: Wall-mounted electronic type with the following features:
 - 1) Temperature set-point display in Fahrenheit and Celsius.
 - 2) Auxiliary switch to energize heating control circuit.
 - 3) Changeover thermistor to reverse action.

B. Dual-Duct Air Terminal Units

- 1. Configuration: Two volume dampers inside unit casing with mixing attenuator section and control components inside a protective metal shroud with a third primary air inlet with volume damper, **as directed**.
- 2. Casing: 0.034-inch (0.85-mm) steel **OR** 0.032-inch (0.8-mm) aluminum, **as directed**, single **OR** double, **as directed**, wall.
 - a. Casing Lining: Adhesive attached, 1/2-inch- (13-mm-) **OR** 3/4-inch- (19-mm-) **OR** 1-inch- (25-mm-), **as directed**, thick, coated, fibrous-glass duct liner complying with ASTM C 1071, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.
 - 1) Cover liner with nonporous foil.

OR

Cover liner with nonporous foil and perforated metal.

OR

Casing Lining: Adhesive attached, 1/2-inch- (13-mm-) **OR** 3/4-inch- (19-mm-) **OR** 1-inch- (25-mm-), **as directed**, thick, polyurethane foam insulation complying with UL 181 erosion requirements, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.
 - b. Air Inlets: Round stub connections or S-slip and drive connections for duct attachment.
 - c. Air Outlet: S-slip and drive connections.
 - d. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket.
 - e. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.
- 3. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.
 - a. Maximum Damper Leakage: ARI 880 rated, 3 percent of nominal airflow at 3-inch wg (750-Pa) **OR** 6-inch wg (1500-Pa), **as directed**, inlet static pressure.
- 4. Velocity Sensors: Multipoint array with velocity sensors in cold- and hot-deck air inlets and air outlets.
- 5. Attenuator Section: 0.034-inch (0.85-mm) steel **OR** 0.032-inch (0.8-mm) aluminum, **as directed**, sheet.
 - a. Lining: Adhesive attached, 1/2-inch- (13-mm-) **OR** 3/4-inch- (19-mm-) **OR** 1-inch- (25-mm-), **as directed**, thick, coated, fibrous-glass duct liner complying with ASTM C 1071, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.
 - 1) Cover liner with nonporous foil.

OR

Cover liner with nonporous foil and perforated metal.

OR

Lining: Adhesive attached, 3/4-inch- (19-mm-) thick, polyurethane foam insulation complying with UL 181 erosion requirements, and having a maximum flame-spread index



- of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.
- b. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.
6. Multioutlet Attenuator Section: With two **OR** three **OR** four, **as directed**, 6-inch- (150-mm-) **OR** 8-inch- (200-mm-) **OR** 10-inch- (250-mm-) **OR** 12-inch- (300-mm-), **as directed**, diameter collars, each with locking butterfly balancing damper.
 7. Pneumatic Controls: Damper operator, velocity controllers, and thermostat. Control devices shall be compatible with temperature controls specified in Division 23 Section "Instrumentation And Control For Hvac" and shall have the following features:
 - a. Pneumatic Damper Operator: 0- to 13-psig (0- to 90-kPa) spring range.
 - b. Velocity Controllers: Factory calibrated and field adjustable to minimum and maximum air volumes; shall maintain constant airflow dictated by thermostat within 5 percent of set point while compensating for inlet static-pressure variations up to 4-inch wg (1000 Pa); and shall have a multipoint velocity sensor. Locate velocity sensors in cold- and hot-deck **OR** cold-, hot-, and ventilation- deck **OR** cold-deck, **as directed**, air inlets and supply air outlets.
 - c. Thermostat: Wall-mounted pneumatic type with appropriate mounting hardware.

OR

Electronic Controls: Bidirectional damper operator and microprocessor-based thermostat with integral airflow transducer and room sensor. Control devices shall be compatible with temperature controls specified in Division 23 Section "Instrumentation And Control For Hvac" and shall have the following features:

 - a. Damper Actuator: 24 V, powered closed, spring return open **OR** powered open, **as directed**.
 - b. Velocity Controller: Factory calibrated and field adjustable to minimum and maximum air volumes; shall maintain constant airflow dictated by thermostat within 5 percent of set point while compensating for inlet static-pressure variations up to 4-inch wg (1000 Pa); and shall have a multipoint velocity sensor. Locate velocity sensors in cold-deck air inlets and air outlets.
 - c. Thermostat: Wall-mounted electronic type with temperature set-point display in Fahrenheit and Celsius, **as directed**.

OR

Direct Digital Controls: Single-package unitary controller and actuator specified in Division 23 Section "Instrumentation And Control For Hvac"

OR

Direct Digital Controls: Bidirectional damper operators and microprocessor-based controller and room sensor. Control devices shall be compatible with controls specified in Division 23 Section "Instrumentation And Control For Hvac" and shall have the following features:

 - d. Damper Actuators: 24 V, powered closed, spring return open **OR** powered open, **as directed**.
 - e. Terminal Unit Controller: Pressure-independent, variable-air **OR** constant, **as directed**, -volume controller with electronic airflow transducers factory calibrated to minimum and maximum air volumes, and having the following features:
 - 1) Occupied and unoccupied operating mode.
 - 2) Remote reset of airflow or temperature set points.
 - 3) Adjusting and monitoring with portable terminal.
 - 4) Communication with temperature-control system specified in Division 23 Section "Instrumentation And Control For Hvac".
 - f. Room Sensor: Wall mounted with temperature set-point adjustment and access for connection of portable operator terminal.
 8. Control Sequence:
 - a. Modulate cold-air damper to maintain room temperature.
 - b. Modulate warm-air damper to maintain constant airflow.

C. Parallel Fan-Powered Air Terminal Units



1. Configuration: Volume-damper assembly and fan in parallel arrangement inside unit casing with control components inside a protective metal shroud.
2. Casing: 0.034-inch (0.85-mm) steel **OR** 0.032-inch (0.8-mm) aluminum, **as directed**, single **OR** double, **as directed**, wall.
 - a. Casing Lining: Adhesive attached, 1/2-inch- (13-mm-) **OR** 3/4-inch- (19-mm-) **OR** 1-inch- (25-mm-), **as directed**, thick, coated, fibrous-glass duct liner complying with ASTM C 1071, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.
 - 1) Cover liner with nonporous foil.
OR
Cover liner with nonporous foil and perforated metal.
 - OR**
Casing Lining: Adhesive attached, 1/2-inch- (13-mm-) **OR** 3/4-inch- (19-mm-) **OR** 1-inch- (25-mm-), **as directed**, thick, polyurethane foam insulation complying with UL 181 erosion requirements, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.
 - b. Air Inlets: Round stub connections or S-slip and drive connections for duct attachment.
 - c. Air Outlet: S-slip and drive connections.
 - d. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket and quarter-turn latches.
 - e. Fan: Forward-curved centrifugal, located at plenum air inlet.
 - f. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.
3. Volume Damper: Galvanized steel with flow-sensing ring and peripheral gasket and self-lubricating bearings.
 - a. Maximum Damper Leakage: ARI 880 rated, 2 **OR** 3, **as directed**, percent of nominal airflow at 3-inch wg (750-Pa) **OR** 6-inch wg (1500-Pa), **as directed**, inlet static pressure.
 - b. Damper Position: Normally open **OR** closed, **as directed**.
4. Velocity Sensors: Multipoint array with velocity sensors in cold- and hot-deck air inlets and air outlets.
5. Motor:
 - a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - b. Type: Permanent-split capacitor with SCR for speed adjustment **OR** Electronically commutated motor, **as directed**.
 - c. Fan-Motor Assembly Isolation: Rubber isolators.
 - d. Enclosure: Open dripproof **OR** Totally enclosed, fan cooled **OR** Totally enclosed, air over **OR** Open, externally ventilated **OR** Totally enclosed, nonventilated **OR** Severe duty **OR** Explosion proof **OR** Dust-ignition-proof machine, **as directed**.
 - e. Enclosure Materials: Cast iron **OR** Cast aluminum **OR** Rolled steel, **as directed**.
6. Filters: Minimum arrestance according to ASHRAE 52.1 and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
 - a. Material: Polyurethane foam having 70 percent arrestance and 3 MERV.
OR
Material: Glass fiber treated with adhesive; having 80 percent arrestance and 5 MERV.
OR
Material: Pleated cotton-polyester media having 90 percent arrestance and 7 MERV.
 - b. Thickness: 2 inches (50 mm) **OR** 1 inch (25 mm), **as directed**.
7. Attenuator Section: 0.034-inch (0.85-mm) steel **OR** 0.032-inch (0.8-mm) aluminum, **as directed**, sheet.
 - a. Lining: Adhesive attached, 1/2-inch- (13-mm-) **OR** 3/4-inch- (19-mm-) **OR** 1-inch- (25-mm-), **as directed**, thick, coated, fibrous-glass duct liner complying with ASTM C 1071, and



having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.

- 1) Cover liner with nonporous foil.

OR

Cover liner with nonporous foil and perforated metal.

- b. Lining: Adhesive attached, 3/4-inch- (19-mm-) thick, polyurethane foam insulation complying with UL 181 erosion requirements, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.
 - c. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.
8. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm), and rated for a minimum working pressure of 200 psig (1380 kPa) and a maximum entering-water temperature of 220 deg F (104 deg C). Include manual air vent and drain valve.
- a. Location: Plenum air inlet.

OR

Electric-Resistance Heating Coils: Nickel-chromium heating wire, free of expansion noise and hum, mounted in ceramic inserts in a galvanized-steel housing; with primary automatic, and secondary manual, reset thermal cutouts. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware.

- a. Location: Plenum air inlet.
 - b. Stage(s): 1 **OR** 2 **OR** 3, **as directed**.
 - c. Access door interlocked disconnect switch.
 - d. Downstream air temperature sensor with local connection to override discharge-air temperature to not exceed a maximum temperature set point (adjustable.)
 - e. Nickel chrome 80/20 heating elements.
 - f. Airflow switch for proof of airflow.
 - g. Fan interlock contacts.
 - h. Fuses in terminal box for overcurrent protection (for coils more than 48 A).
 - i. Mercury contactors.
 - j. Pneumatic-electric switches and relays.
 - k. Magnetic contactor for each step of control (for three-phase coils).
9. Factory-Mounted and -Wired Controls: Electrical components mounted in control box with removable cover. Incorporate single-point electrical connection to power source.
- a. Control Transformer: Factory mounted for control voltage on electric and electronic control units with terminal strip in control box for field wiring of thermostat and power source.
 - b. Wiring Terminations: Fan and controls to terminal strip. Terminal lugs to match quantities, sizes, and materials of branch-circuit conductors. Enclose terminal lugs in terminal box that is sized according to NFPA 70.
 - c. Disconnect Switch: Factory-mounted, fuse type.
10. Control Panel Enclosure: NEMA 250, Type 1, with access panel sealed from airflow and mounted on side of unit.
11. Electric Controls: 24-V damper actuator with wall-mounted electric thermostat and appropriate mounting hardware.

OR

Pneumatic Controls: Damper operator, velocity controller, and thermostat. Control devices shall be compatible with temperature controls specified in Division 23 Section "Instrumentation And Control For Hvac" and shall have the following features:

- a. Pneumatic Damper Operator: 0- to 13-psig (0- to 90-kPa) spring range.
- b. Velocity Controller: Factory calibrated and field adjustable to minimum and maximum air volumes; shall maintain constant airflow dictated by thermostat within 5 percent of set point while pressure independent up to 4-inch wg (1000 Pa); and shall have a multipoint velocity sensor at air inlet.
- c. Thermostat: Wall-mounted pneumatic type with appropriate mounting hardware.

OR



Electronic Controls: Bidirectional damper operator and microprocessor-based controller with integral airflow transducer and room sensor. Control devices shall be compatible with temperature controls specified in Division 23 Section "Instrumentation And Control For Hvac" and shall have the following features:

- a. Occupied and unoccupied operating mode.
- b. Remote reset of airflow or temperature set points.
- c. Adjusting and monitoring with portable terminal.
- d. Communication with temperature-control system specified in Division 23 Section "Instrumentation And Control For Hvac".

12. Control Sequence:

- a. Occupied (Primary Airflow On):
 - 1) Operate as throttling control for cooling.
 - 2) As cooling requirement decreases, control valve throttles toward minimum airflow.
 - 3) As heating requirement increases, fan energizes to draw in warm plenum air and electric heat is energized in steps, **as directed**.
- b. Unoccupied (Primary Airflow Off):
 - 1) When pressure at primary inlet is zero or less, fan is de-energized.
 - 2) As heating requirement increases, fan energizes to draw in warm plenum air and electric heat is energized in steps, **as directed**.

D. Series Fan-Powered Air Terminal Units

1. Configuration: Volume-damper assembly and fan in series arrangement inside unit casing with control components inside a protective metal shroud for installation above a ceiling and within a raised access floor, **as directed**.
2. Casing: 0.034-inch (0.85-mm) steel **OR** 0.032-inch (0.8-mm) aluminum, **as directed**, single **OR** double, **as directed**, wall.
 - a. Casing Lining: Adhesive attached, 1/2-inch- (13-mm-) **OR** 3/4-inch- (19-mm-) **OR** 1-inch- (25-mm-), **as directed**, thick, coated, fibrous-glass duct liner complying with ASTM C 1071, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.
 - 1) Cover liner with nonporous foil.
OR
Cover liner with nonporous foil and perforated metal.**OR**
Casing Lining: Adhesive attached, 1/2-inch- (13-mm-) **OR** 3/4-inch- (19-mm-) **OR** 1-inch- (25-mm-), **as directed**, thick, polyurethane foam insulation complying with UL 181 erosion requirements, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.
 - b. Air Inlets: Round stub connections or S-slip and drive connections for duct attachment.
 - c. Air Outlet: S-slip and drive connections.
 - d. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket and quarter-turn latches.
 - e. Fan: Forward-curved centrifugal.
 - f. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.
3. Volume Damper: Galvanized steel with flow-sensing ring and peripheral gasket and self-lubricating bearings.
 - a. Maximum Damper Leakage: ARI 880 rated, 2 **OR** 3, **as directed**, percent of nominal airflow at 3-inch wg (750-Pa) **OR** 6-inch wg (1500-Pa), **as directed**, inlet static pressure.
 - b. Damper Position: Normally open **OR** closed, **as directed**.
4. Velocity Sensors: Multipoint array with velocity sensors in cold- and hot-deck air inlets and air outlets.
5. Motor:



- a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - b. Type: Permanent-split capacitor with SCR for speed adjustment **OR** Electronically commutated motor, **as directed**.
 - c. Fan-Motor Assembly Isolation: Rubber isolators.
 - d. Enclosure: Open dripproof **OR** Totally enclosed, fan cooled **OR** Totally enclosed, air over **OR** Open, externally ventilated **OR** Totally enclosed, nonventilated **OR** Severe duty **OR** Explosion proof **OR** Dust-ignition-proof machine, **as directed**.
 - e. Enclosure Materials: Cast iron **OR** Cast aluminum **OR** Rolled steel, **as directed**.
6. Filters: Minimum arrestance according to ASHRAE 52.1 and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
- a. Material: Polyurethane foam having 70 percent arrestance and 3 MERV.
OR
Material: Glass fiber treated with adhesive; having 80 percent arrestance and 5 MERV.
OR
Material: Pleated cotton-polyester media having 90 percent arrestance and 7 MERV.
 - b. Thickness: 2 inches (50 mm) **OR** 1 inch (25 mm), **as directed**.
7. Attenuator Section: 0.034-inch (0.85-mm) steel **OR** 0.032-inch (0.8-mm) aluminum, **as directed**, sheet.
- a. Lining: Adhesive attached, 1/2-inch- (13-mm-) **OR** 3/4-inch- (19-mm-) **OR** 1-inch- (25-mm-), **as directed**, thick, coated, fibrous-glass duct liner complying with ASTM C 1071, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.
 - 1) Cover liner with nonporous foil.
OR
Cover liner with nonporous foil and perforated metal.
OR
Lining: Adhesive attached, 3/4-inch- (19-mm-) thick, polyurethane foam insulation complying with UL 181 erosion requirements, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.
 - b. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.
8. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm), and rated for a minimum working pressure of 200 psig (1380 kPa) and a maximum entering-water temperature of 220 deg F (104 deg C). Include manual air vent and drain valve.
OR
Electric-Resistance Heating Coils: Nickel-chromium heating wire, free of expansion noise and hum, mounted in ceramic inserts in a galvanized-steel housing; with primary automatic, and secondary manual, reset thermal cutouts. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware.
- a. Stage(s): 1 **OR** 2 **OR** 3, **as directed**.
 - b. Access door interlocked disconnect switch.
 - c. Downstream air temperature sensor with local connection to override discharge-air temperature to not exceed a maximum temperature set point (adjustable.)
 - d. Nickel chrome 80/20 heating elements.
 - e. Airflow switch for proof of airflow.
 - f. Fan interlock contacts.
 - g. Fuses in terminal box for overcurrent protection (for coils more than 48 A).
 - h. Mercury contactors.
 - i. Pneumatic-electric switches and relays.
 - j. Magnetic contactor for each step of control (for three-phase coils).
9. Factory-Mounted and -Wired Controls: Electrical components mounted in control box with removable cover. Incorporate single-point electrical connection to power source.



- a. Control Transformer: Factory mounted for control voltage on electric and electronic control units with terminal strip in control box for field wiring of thermostat and power source.
 - b. Wiring Terminations: Fan and controls to terminal strip. Terminal lugs to match quantities, sizes, and materials of branch-circuit conductors. Enclose terminal lugs in terminal box that is sized according to NFPA 70.
 - c. Disconnect Switch: Factory-mounted, fuse type.
10. Control Panel Enclosure: NEMA 250, Type 1, with access panel sealed from airflow and mounted on side of unit.
11. Electric Controls: 24-V damper actuator with wall-mounted electric thermostat and appropriate mounting hardware.

OR

Pneumatic Controls: Damper operator, velocity controller, and thermostat. Control devices shall be compatible with temperature controls specified in Division 23 Section "Instrumentation And Control For Hvac" and shall have the following features:

- a. Pneumatic Damper Operator: 0- to 13-psig (0- to 90-kPa) spring range.
- b. Velocity Controller: Factory calibrated and field adjustable to minimum and maximum air volumes; shall maintain constant airflow dictated by thermostat within 5 percent of set point while pressure independent up to 4-inch wg (1000 Pa); and shall have a multipoint velocity sensor at air inlet.
- c. Thermostat: Wall-mounted pneumatic type with appropriate mounting hardware.

OR

Electronic Controls: Bidirectional damper operator and microprocessor-based controller with integral airflow transducer and room sensor. Control devices shall be compatible with temperature controls specified in Division 23 Section "Instrumentation And Control For Hvac" and shall have the following features:

- a. Occupied and unoccupied operating mode.
- b. Remote reset of airflow or temperature set points.
- c. Adjusting and monitoring with portable terminal.
- d. Communication with temperature-control system specified in Division 23 Section "Instrumentation And Control For Hvac".

12. Control Sequence:

- a. Occupied (Primary Airflow On):
 - 1) When pressure at inlet is at least 1.2-inch wg (300 Pa).
 - 2) As cooling requirement decreases, control valve throttles toward minimum airflow.
- b. Unoccupied (Primary Airflow Off):
 - 1) When pressure at primary inlet is zero or less, fan is de-energized.

E. Induction Air Terminal Units

1. Configuration: Volume-damper assembly inside unit casing with mechanical induction damper mounted on casing and control components inside a protective metal shroud.
 2. Casing: 0.034-inch (0.85-mm) steel **OR** 0.032-inch (0.8-mm) aluminum, **as directed**, single **OR** double, **as directed**, wall.
 - a. Casing Lining: Adhesive attached, 1/2-inch- (13-mm-) **OR** 3/4-inch- (19-mm-) **OR** 1-inch- (25-mm-), **as directed**, thick, coated, fibrous-glass duct liner complying with ASTM C 1071, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.
 - 1) Cover liner with nonporous foil.
- OR**
- Cover liner with nonporous foil and perforated metal.
- OR**
- Casing Lining: Adhesive attached, 1/2-inch- (13-mm-) **OR** 3/4-inch- (19-mm-) **OR** 1-inch- (25-mm-), **as directed**, thick, polyurethane foam insulation complying with UL 181 erosion requirements, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.



- b. Air Inlet: Round stub connection for duct attachment.
 - c. Air Outlet: S-slip and drive connections, size matching inlet size, **as directed**.
 - d. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket.
 - e. Fan: Forward-curved centrifugal.
 - f. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.
3. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.
- a. Maximum Damper Leakage: ARI 880 rated, 2 **OR** 3, **as directed**, percent of nominal airflow at 3-inch wg (750-Pa) **OR** 6-inch wg (1500-Pa), **as directed**, inlet static pressure.
 - b. Damper Position: Normally open **OR** closed, **as directed**.
4. Induction Damper: Galvanized-steel, multiblade assembly with self-lubricating bearings.
5. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm), and rated for a minimum working pressure of 200 psig (1380 kPa) and a maximum entering-water temperature of 220 deg F (104 deg C). Include manual air vent and drain valve.
- OR**
- Electric-Resistance Heating Coils: Nickel-chromium heating wire, free of expansion noise and hum, mounted in ceramic inserts in a galvanized-steel housing; with primary automatic, and secondary manual, reset thermal cutouts. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware.
- a. Access door interlocked disconnect switch.
 - b. Downstream air temperature sensor with local connection to override discharge-air temperature to not exceed a maximum temperature set point (adjustable.)
 - c. Nickel chrome 80/20 heating elements.
 - d. Airflow switch for proof of airflow.
 - e. Fan interlock contacts.
 - f. Fuses in terminal box for overcurrent protection (for coils more than 48 A).
 - g. Mercury contactors.
 - h. Pneumatic-electric switches and relays.
 - i. Magnetic contactor for each step of control (for three-phase coils).
6. Pneumatic Controls: Damper operator, velocity controller, and induction damper operator. Control devices shall be compatible with temperature controls specified in Division 23 Section "Instrumentation And Control For Hvac" and shall have the following features:
- a. Damper Operator: Pneumatic, 0- to 13-psig (0- to 90-kPa) spring range.
 - b. Velocity Controller: Factory calibrated and field adjustable to minimum and maximum air volumes; shall maintain constant airflow dictated by thermostat within 5 percent of set point while compensating for inlet static-pressure variations up to 4-inch wg (1000 Pa); and shall have a multipoint velocity sensor at air inlet.
 - c. Induction Damper Operator: Pneumatic, spring range matching reset range of controller.
 - d. Thermostat: Wall-mounted pneumatic type with appropriate mounting hardware.
- OR**
- Electronic Controls: Pneumatic damper operators, electronic controller integral airflow transducer, and electronic thermostat. Control devices shall be compatible with temperature controls specified in Division 23 Section "Instrumentation And Control For Hvac" and shall have the following features:
- a. Damper Actuator: Pneumatic, 0- to 13-psig (0- to 90-kPa) spring range.
 - b. Velocity Controller: Factory calibrated and field adjustable to minimum and maximum air volumes; shall maintain constant airflow dictated by thermostat within 5 percent of set point while compensating for inlet static-pressure variations up to 4-inch wg (1000 Pa); and shall have a multipoint velocity sensor at air inlet.
 - c. Induction Damper Operator: Pneumatic, spring range matching reset range of controller.
 - d. Thermostat: Wall-mounted electronic type with the following features:
 - 1) Proportional, plus integral control of room temperature.
 - 2) Time-proportional reheat-coil control.
 - 3) Temperature set-point display in Fahrenheit and Celsius.



F. Shutoff, Single-Duct Air Terminal Units

1. Configuration: Volume-damper assembly inside unit casing with control components inside a protective metal shroud.
2. Casing: 0.034-inch (0.85-mm) steel **OR** 0.032-inch (0.8-mm) aluminum, **as directed**, single **OR** double, **as directed**, wall.
 - a. Casing Lining: Adhesive attached, 1/2-inch- (13-mm-) **OR** 3/4-inch- (19-mm-) **OR** 1-inch- (25-mm-), **as directed**, thick, coated, fibrous-glass duct liner complying with ASTM C 1071, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.
 - 1) Cover liner with nonporous foil.
OR
Cover liner with nonporous foil and perforated metal.
 - OR**
Casing Lining: Adhesive attached, 1/2-inch- (13-mm-) **OR** 3/4-inch- (19-mm-) **OR** 1-inch- (25-mm-), **as directed**, thick, polyurethane foam insulation complying with UL 181 erosion requirements, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.
 - b. Air Inlet: Round stub connection or S-slip and drive connections for duct attachment.
 - c. Air Outlet: S-slip and drive connections, size matching inlet size, **as directed**.
 - d. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket.
 - e. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.
3. Regulator Assembly: System-air-powered bellows section incorporating polypropylene bellows for volume regulation and thermostatic control. Bellows shall operate at temperatures from 0 to 140 deg F (minus 18 to plus 60 deg C), shall be impervious to moisture and fungus, shall be suitable for 10-inch wg (2500-Pa) static pressure, and shall be factory tested for leaks.
4. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.
 - a. Maximum Damper Leakage: ARI 880 rated, 2 **OR** 3, **as directed**, percent of nominal airflow at 3-inch wg (750-Pa) **OR** 6-inch wg (1500-Pa), **as directed**, inlet static pressure.
 - b. Damper Position: Normally open **OR** closed, **as directed**.
5. Attenuator Section: 0.034-inch (0.85-mm) steel **OR** 0.032-inch (0.8-mm) aluminum, **as directed**, sheet.
 - a. Lining: Adhesive attached, 1/2-inch- (13-mm-) **OR** 3/4-inch- (19-mm-) **OR** 1-inch- (25-mm-), **as directed**, thick, coated, fibrous-glass duct liner complying with ASTM C 1071, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.
 - 1) Cover liner with nonporous foil.
OR
Cover liner with nonporous foil and perforated metal.
 - OR**
Lining: Adhesive attached, 3/4-inch- (19-mm-) thick, polyurethane foam insulation complying with UL 181 erosion requirements, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.
 - b. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.
6. Multioutlet Attenuator Section: With two **OR** three **OR** four, **as directed**, 6-inch- (150-mm-) **OR** 8-inch- (200-mm-) **OR** 10-inch- (250-mm-), **as directed**, diameter collars, each with locking butterfly balancing damper.
7. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm), and rated for a minimum working pressure of 200 psig (1380 kPa) and a maximum entering-water temperature of 220 deg F (104 deg C). Include manual air vent and drain valve.
OR



Electric-Resistance Heating Coils: Nickel-chromium heating wire, free of expansion noise and hum, mounted in ceramic inserts in a galvanized-steel housing; with primary automatic, and secondary manual, reset thermal cutouts. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware.

- a. Access door interlocked disconnect switch.
 - b. Downstream air temperature sensor with local connection to override discharge-air temperature to not exceed a maximum temperature set point (adjustable.)
 - c. Nickel chrome 80/20 heating elements.
 - d. Airflow switch for proof of airflow.
 - e. Fan interlock contacts.
 - f. Fuses in terminal box for overcurrent protection (for coils more than 48 A).
 - g. Mercury contactors.
 - h. Pneumatic-electric switches and relays.
 - i. Magnetic contactor for each step of control (for three-phase coils).
8. Electric Controls: Damper actuator and thermostat.
- a. Damper Actuator: 24 V, powered closed, spring return open **OR** powered open, **as directed**.
 - b. Thermostat: Wall-mounted electronic type with clock display, temperature display in Fahrenheit and Celsius, and space temperature set point.

OR

Pneumatic Controls: Damper operator and velocity controller. Control devices shall be compatible with temperature controls specified in Division 23 Section "Instrumentation And Control For Hvac" and shall have the following features:

- a. Pneumatic Damper Operator: 0- to 13-psig (0- to 90-kPa) spring range.
- b. Velocity Controller: Factory calibrated and field adjustable to minimum and maximum air volumes; shall maintain constant airflow dictated by thermostat within 5 percent of set point while compensating for inlet static-pressure variations up to 4-inch wg (1000 Pa); and shall have a multipoint velocity sensor at air inlet.
- c. Thermostat: Wall-mounted pneumatic type with appropriate mounting hardware.

OR

Electronic Controls: Bidirectional damper operator and microprocessor-based thermostat with integral airflow transducer and room sensor. Control devices shall be compatible with temperature controls specified in Division 23 Section "Instrumentation And Control For Hvac" and shall have the following features:

- a. Damper Actuator: 24 V, powered closed, spring return open **OR** powered open, **as directed**.
- b. Velocity Controller: Factory calibrated and field adjustable to minimum and maximum air volumes; shall maintain constant airflow dictated by thermostat within 5 percent of set point while compensating for inlet static-pressure variations up to 4-inch wg (1000 Pa); and shall have a multipoint velocity sensor at air inlet.
- c. Thermostat: Wall-mounted electronic type with temperature set-point display in Fahrenheit and Celsius.

OR

Direct Digital Controls: Single-package unitary controller and actuator specified in Division 23 Section "Instrumentation And Control For Hvac".

OR

Direct Digital Controls: Bidirectional damper operators and microprocessor-based controller and room sensor. Control devices shall be compatible with temperature controls specified in Division 23 Section "Instrumentation And Control For Hvac" and shall have the following features:

- a. Damper Actuator: 24 V, powered closed, spring return open **OR** powered open, **as directed**.
- b. Terminal Unit Controller: Pressure-independent, variable-air-volume controller with electronic airflow transducer with multipoint velocity sensor at air inlet, factory calibrated to minimum and maximum air volumes, and having the following features:
 - 1) Occupied and unoccupied operating mode.



- 2) Remote reset of airflow or temperature set points.
 - 3) Adjusting and monitoring with portable terminal.
 - 4) Communication with temperature-control system specified in Division 23 Section "Instrumentation And Control For Hvac".
 - c. Room Sensor: Wall mounted with temperature set-point adjustment and access for connection of portable operator terminal.
 9. Control Sequence:
 - a. Suitable for operation with duct pressures between 0.25- and 3.0-inch wg (60- and 750-Pa) inlet static pressure.
 - b. System-powered, wall-mounted thermostat.
- G. Diffuser-Type Air Terminal Units
 1. Configuration: Volume-damper, diffuser, controller assembly and electric heater, **as directed**, and wall-mounted thermostat with master-slave capability, **as directed**.
 2. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.
 - a. Damper Position: Normally open **OR** closed, **as directed**.
 3. Diffuser: Galvanized steel with white baked-enamel finish.
 4. Electronic Controls: Bidirectional damper operator and microprocessor-based thermostat with integral airflow transducer and room sensor. Control devices shall be compatible with temperature controls specified in Division 23 Section "Instrumentation And Control For Hvac" and shall have the following features:
 - a. Damper Actuator: 24 V, powered closed, spring return open **OR** powered open, **as directed**.
 - b. Velocity Controller: Factory calibrated and field adjustable to minimum and maximum air volumes; shall maintain constant airflow dictated by thermostat within 5 percent of set point while compensating for inlet static-pressure variations up to 4-inch wg (1000 Pa); and shall have a multipoint velocity sensor at air inlet.
 - c. Thermostat: Wall-mounted electronic type with the following features:
 - 1) Proportional, plus integral control of room temperature.
 - 2) Temperature set-point display in Fahrenheit and Celsius.
 5. Integral thermally powered actuators control diffusion dampers based on duct and room temperature.
- H. Hangers And Supports
 1. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
 2. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
 3. Steel Cables: Galvanized steel complying with ASTM A 603 **OR** Stainless steel complying with ASTM A 492, **as directed**.
 4. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
 5. Air Terminal Unit Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
 6. Trapeze and Riser Supports: Steel shapes and plates for units with steel casings; aluminum for units with aluminum casings.
- I. Seismic-Restraint Devices
 1. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of the ICC Evaluation Service **OR** the Office of Statewide Health Planning and Development for the State of California **OR** an agency acceptable to authorities having jurisdiction, **as directed**.
 - a. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
 2. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to



braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.

3. Restraint Cables: ASTM A 603, galvanized **OR** ASTM A 492, stainless, **as directed**, -steel cables with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts designed for restraining cable service; with an automatic-locking and clamping device or double-cable clips.
4. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections **OR** Reinforcing steel angle clamped, **as directed**, to hanger rod.
5. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

J. Source Quality Control

1. Factory Tests, as directed: Test factory-assembled air terminal units according to ARI 880.
 - a. Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory-set airflows, coil type, **as directed**, and ARI certification seal.

1.3 EXECUTION

A. Installation

1. Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."
2. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.
3. Install wall-mounted thermostats.

B. Hanger And Support Installation

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."
2. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - a. Where practical, install concrete inserts before placing concrete.
 - b. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 - c. Use powder-actuated concrete fasteners for standard-weight aggregate concretes and for slabs more than 4 inches (100 mm) thick.
 - d. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes and for slabs less than 4 inches (100 mm) thick.
 - e. Do not use powder-actuated concrete fasteners for seismic restraints.
3. Hangers Exposed to View: Threaded rod and angle or channel supports.
4. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

C. Seismic-Restraint-Device Installation

1. Install hangers and braces designed to support the air terminal units and to restrain against seismic forces required by applicable building codes. Comply with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems" **OR** ASCE/SEI 7, **as directed**.
2. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.
3. Install cables so they do not bend across edges of adjacent equipment or building structure.
4. Install cable restraints on air terminal units that are suspended with vibration isolators.
5. Install seismic-restraint devices using methods approved by an evaluation service member of the ICC Evaluation Service **OR** the Office of Statewide Health Planning and Development for the State of California **OR** an agency acceptable to authorities having jurisdiction, **as directed**.
6. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.



7. Drilling for and Setting Anchors:
 8. Identify position of reinforcing steel and other embedded items before drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify the the Owner if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 9. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 10. Wedge Anchors: Protect threads from damage during anchor installation. Install heavy-duty sleeve anchors with sleeve fully engaged in the structural element to which anchor is to be fastened.
 11. Set anchors to manufacturer's recommended torque, using a torque wrench.
 12. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.
- D. Connections
1. Install piping adjacent to air terminal unit to allow service and maintenance.
 2. Hot-Water Piping: In addition to requirements in Division 23 Section "Hydronic Piping", connect heating coils to supply with shutoff valve, strainer, control valve, and union or flange; and to return with balancing valve and union or flange.
 3. Connect ducts to air terminal units according to Division 23 Section(s) "Metal Ducts" OR "Nonmetal Ducts", **as directed**.
 4. Make connections to air terminal units with flexible connectors complying with requirements in Division 23 Section "Air Duct Accessories".
- E. Identification
1. Label each air terminal unit with plan number, nominal airflow, and maximum and minimum factory-set airflows. Comply with requirements in Division 23 Section "Identification For Hvac Piping And Equipment" for equipment labels and warning signs and labels.
- F. Field Quality Control
1. Perform tests and inspections.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
 2. Tests and Inspections:
 - a. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.
 - b. Leak Test: After installation, fill water coils and test for leaks. Repair leaks and retest until no leaks exist.
 - c. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - d. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 3. Air terminal unit will be considered defective if it does not pass tests and inspections.
 4. Prepare test and inspection reports.
- G. Startup Service
1. Perform startup service.
 - a. Complete installation and startup checks according to manufacturer's written instructions.
 - b. Verify that inlet duct connections are as recommended by air terminal unit manufacturer to achieve proper performance.
 - c. Verify that controls and control enclosure are accessible.
 - d. Verify that control connections are complete.
 - e. Verify that nameplate and identification tag are visible.
 - f. Verify that controls respond to inputs as specified.



H. Demonstration

1. Train Owner's maintenance personnel to adjust, operate, and maintain air terminal units.

END OF SECTION 23 36 16 00



23 - Heating, Ventilating, And Air-Conditioning (HVAC)

Task	Specification	Specification Description
23 37 13 00	23 31 13 33	Duct Accessories
23 37 13 00	23 36 13 00	Diffusers, Registers, And Grilles
23 38 13 16	01 22 16 00	No Specification Required
23 38 13 16	11 21 63 00	Food Service Equipment
23 38 13 16	23 31 13 13	Metal Ducts
23 38 13 16	07 72 13 00a	Intake and Relief Ventilators



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SECTION 23 41 13 00 - AIR FILTERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for particulate air infiltration. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Metal panel filters.
 - b. Flat panel filters.
 - c. Pleated panel filters.
 - d. Ring panel filters.
 - e. Nonsupported bag filters.
 - f. Supported bag filters.
 - g. Rigid cell box filters.
 - h. V-bank cell filters.
 - i. Self-supported pocket filters.
 - j. Automatic roll filters.
 - k. Bulk media.
 - l. Front- and rear-access filter frames.
 - m. Side-service housings.
 - n. Filter gages.

C. Submittals

1. Product Data: For each type of product indicated. Include dimensions; operating characteristics; required clearances and access; rated flow capacity, including initial and final pressure drop at rated airflow; efficiency and test method; fire classification; furnished specialties; and accessories for each model indicated.
2. LEED Submittals:
 - a. Product Data for Prerequisite EQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
 - b. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.
3. Shop Drawings: For air filters. Include plans, elevations, sections, details, and attachments to other work.
 - a. Show filter rack assembly, dimensions, materials, and methods of assembly of components.
 - b. Include setting drawings, templates, and requirements for installing anchor bolts and anchorages.
 - c. Wiring Diagrams: For power, signal, and control wiring.
4. Operation and Maintenance Data: For each type of filter and rack to include in emergency, operation, and maintenance manuals.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. ASHRAE Compliance:
 - a. Comply with applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality"; Section 5 - "Systems and Equipment"; and Section 7 - "Construction and Startup."



- b. Comply with ASHRAE 52.1 for arrestance and ASHRAE 52.2 for MERV for methods of testing and rating air-filter units.
3. Comply with NFPA 90A and NFPA 90B.

E. Coordination

1. Coordinate sizes and locations of concrete bases. Cast anchor-bolt inserts into bases.

1.2 PRODUCTS

A. Metal Panel Filters

1. Description: Factory-fabricated, self-supported, cleanable, all-metal, impingement-type, panel-type, permanent air filters with holding frames.
2. Media: Four **OR** Six, **as directed**, alternate layers of galvanized-steel **OR** aluminum **OR** stainless-steel, **as directed**, flat and herringbone-crimp screen.
 - a. Nonoiled for grease removal application.
 - b. Adhesive coating.
 - 1) Adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Filter-Media Frame: Galvanized steel **OR** Hot-dip galvanized steel **OR** Aluminum **OR** Stainless steel, **as directed**, hinged, and with pull and retaining handles fastened to the media.
 - a. Drain holes.

B. Flat Panel Filters

1. Description: Factory-fabricated, self-supported, flat, nonpleated, panel-type, disposable air filters with holding frames.
2. Filter Unit Class: UL 900, Class 1 **OR** Class 2, **as directed**.
3. Media: Interlaced glass or synthetic fibers **OR** Cotton and synthetic fibers, **as directed**, coated with nonflammable adhesive.
 - a. Adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Media shall be coated with an antimicrobial agent.
 - c. Metal Retainer: Upstream side and downstream side.
4. Filter-Media Frame: Cardboard with perforated metal retainer **OR** Galvanized steel with metal grid on outlet side and steel rod grid on inlet side, hinged, with pull and retaining handles, **as directed**, sealed or bonded to the media.
5. Mounting Frames: Welded galvanized steel, with gaskets and fasteners; suitable for bolting together into built-up filter banks.

C. Pleated Panel Filters

1. Description: Factory-fabricated, self-supported, extended-surface, pleated, panel-type, disposable air filters with holding frames.
2. Filter Unit Class: UL 900, Class 1 **OR** Class 2, **as directed**.
3. Media: Interlaced glass or synthetic fibers **OR** Cotton and synthetic fibers, **as directed**, coated with nonflammable adhesive.
 - a. Adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Media shall be coated with an antimicrobial agent.
 - c. Separators shall be bonded to the media to maintain pleat configuration.
 - d. Welded wire grid shall be on downstream side to maintain pleat.
 - e. Media shall be bonded to frame to prevent air bypass.
 - f. Support members on upstream and downstream sides to maintain pleat spacing.
4. Filter-Media Frame: Cardboard frame with perforated metal retainer **OR** Galvanized steel **OR** Aluminized steel, **as directed**, with metal grid on outlet side and steel rod grid on inlet side, hinged, with pull and retaining handles, **as directed**, sealed or bonded to the media.



5. Mounting Frames: Welded galvanized steel, with gaskets and fasteners; suitable for bolting together into built-up filter banks.
- D. Ring Panel Filters
1. Description: Internally supported, flat panel filters for installation in a filter track.
 2. Filter Unit Class: UL 900, Class 1 **OR** Class 2, **as directed**.
 3. Media: Two **OR** Three **OR** Four, **as directed**, -ply polyester with sealed edges.
 - a. Panel Construction: Single with one edge unsealed for support removal, **as directed**, **OR** Linked, **as directed**.
 - b. Media shall be coated with an antimicrobial agent.
 4. Internal Support: 9-gage steel wire frame.
- E. Nonsupported Bag Filters
1. Description: Factory-fabricated, dry, extended-surface, nonsupported filters with header frames.
 2. Filter Unit Class: UL 900, Class 1 **OR** Class 2, **as directed**.
 3. Media: Glass-fiber **OR** Synthetic, **as directed**, material constructed so individual pockets are maintained in tapered form under rated-airflow conditions by flexible internal supports.
 - a. Media shall be coated with an antimicrobial agent.
 4. Filter-Media Frame: Galvanized steel **OR** Hard polyurethane foam, **as directed**.
 5. Mounting Frames: Welded galvanized steel, with gaskets and fasteners; suitable for bolting together into built-up filter banks.
- F. Supported Bag Filters
1. Description: Factory-fabricated, dry, extended-surface, self-supported filters with holding frames in steel, basket-type retainers.
 2. Filter Unit Class: UL 900, Class 1 **OR** Class 2, **as directed**.
 3. Media: Fibrous material constructed so individual pleats are maintained in tapered form under rated-airflow conditions by flexible internal supports.
 - a. Media shall be coated with an antimicrobial agent.
 4. Filter-Media Frame: Galvanized steel **OR** Hard polyurethane foam, **as directed**.
 5. Mounting Frames: Welded galvanized steel, with gaskets and fasteners; suitable for bolting together into built-up filter banks.
- G. Rigid Cell Box Filters
1. Description: Factory-fabricated, adhesive-coated, **as directed**, disposable, packaged air filters with media perpendicular to airflow, and with holding frames.
 2. Filter Unit Class: UL 900, Class 1 **OR** Class 2, **as directed**.
 3. Media: Fibrous material constructed so individual pleats are maintained in tapered form under rated-airflow conditions by flexible internal supports.
 - a. Adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Media shall be coated with an antimicrobial agent.
 4. Filter-Media Frames: Galvanized steel **OR** Hard polyurethane foam, **as directed**.
 5. Mounting Frames: Welded galvanized steel, with gaskets and fasteners; suitable for bolting together into built-up filter banks.
- H. V-Bank Cell Filters
1. Description: Factory-fabricated, adhesive-coated, **as directed**, disposable, packaged air filters with media angled to airflow, and with holding frames.
 2. Filter Unit Class: UL 900, Class 1 **OR** Class 2, **as directed**.
 3. Media: Fibrous material constructed so individual pleats are maintained in tapered form under rated-airflow conditions by flexible internal supports.
 - a. Adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Media shall be coated with an antimicrobial agent.
 4. Filter-Media Frames: Galvanized steel **OR** Hard polyurethane foam, **as directed**.



5. Mounting Frames: Welded galvanized steel, with gaskets and fasteners; suitable for bolting together into built-up filter banks.
- I. Self-Supported Pocket Filters
1. Description: Factory-fabricated, panel-type, disposable air filters with contoured media for extended surface.
 2. Filter Unit Class: UL 900, Class 1 **OR** Class 2, **as directed**.
 3. Media: Fibrous material constructed so individual pleats are maintained in tapered form under rated-airflow conditions by flexible internal supports.
 - a. Media shall be coated with an antimicrobial agent.
 4. Configuration: Single-pocket cube **OR** Multipocket, **as directed**.
 5. Filter-Media Frame: Galvanized steel **OR** Hard polyurethane foam, **as directed**.
 6. Mounting Frames: Welded galvanized steel, with gaskets and fasteners; suitable for bolting together into built-up filter banks.
- J. Automatic Roll Filters
1. Description: Factory-fabricated, automatic, motor-driven, roll-type filters with holding casing.
 2. Arrangement: Horizontal **OR** Vertical, **as directed**.
 3. Filter Unit Class: UL 900, Class 1 **OR** Class 2, **as directed**.
 4. Media: Compressed and rolled, fibrous-glass material; viscous coated.
 - a. Media shall be coated with an antimicrobial agent.
 5. Holding Frame: Galvanized steel with enclosed, clean media roll arranged to allow upstream replacement of filter media.
 - a. Auxiliary Frame: Locate on downstream side of unit with downstream **OR** side, **as directed**, access.
 - b. Final Filter: Extended-surface, retained **OR** nonsupported, **as directed**, media.
 6. Control and Drive: Electric, gear-reducer, motor-driven, feed-control mechanism equipped with manual media advance and runout switches for stopping media movement of filter bank and operating remote warning signal lights.
 - a. Manual Control: Manual switch to advance media, and wired to override automatic controls.
 - b. Automatic Control: Prewired control package to advance media when filter resistance exceeds preselected high limit **OR** after preselected operating time, **as directed**.
- K. Bulk Media
1. Description: Air-filter media, factory custom cut or rolled.
 2. Filter Unit Class: UL 900, Class 1 **OR** Class 2, **as directed**.
 3. Media: Spun glass **OR** Synthetic **OR** Polyester, **as directed**, in a roll **OR** cut into pads, **as directed**.
- L. Front- And Rear-Access Filter Frames
1. Framing System: Galvanized-steel **OR** Aluminum, **as directed**, framing members with access for either upstream (front) or downstream (rear) filter servicing, cut to size and prepunched for assembly into modules. Vertically support filters to prevent deflection of horizontal members without interfering with either filter installation or operation.
 2. Prefilters: Incorporate a separate track with spring clips, **as directed**, removable from front or back, **as directed**.
 3. Sealing: Factory-installed, positive-sealing device for each row of filters, to ensure seal between gasketed filter elements and to prevent bypass of unfiltered air.
- M. Side-Service Housings
1. Description: Factory-assembled, side-service housings, constructed of galvanized steel **OR** aluminum, **as directed**, with flanges to connect to duct or casing system.
 2. Prefilters: Integral tracks to accommodate 2-inch- (50-mm-) deep, disposable or washable, **as directed**, filters.



3. Access Doors: Hinged, with continuous **OR** Continuous, **as directed**, gaskets on perimeter and positive-locking devices, and arranged so filter cartridges can be loaded from either access door.
4. Sealing: Incorporate positive-sealing gasket material on channels to seal top and bottom of filter cartridge frames and to prevent bypass of unfiltered air.

N. Filter Gages

1. Diaphragm-type gage with dial and pointer in metal case, vent valves, black figures on white background, and front recalibration adjustment.
 - a. Diameter: 4-1/2 inches (115 mm) **OR** 2 inches (50 mm), **as directed**.
 - b. Scale Range for Filter Media Having a Recommended Final Resistance of 0.5-Inch wg (125 Pa) or Less: 0- to 0.5-inch wg (0 to 125 Pa).
 - c. Scale Range for Filter Media Having a Recommended Final Resistance of 0.5- to 1.0-Inch wg (125 to 250 Pa) or Less: 0- to 1.0-inch wg (0 to 250 Pa).
 - d. Scale Range for Filter Media Having a Recommended Final Resistance of 1.0- to 2.0-Inch wg (250 to 500 Pa) or Less: 0- to 2.0-inch wg (0 to 500 Pa).
 - e. Scale Range for Filter Media Having a Recommended Final Resistance of 2.0- to 3.0-Inch wg (500 to 750 Pa) or Less: 0- to 3.0-inch wg (0 to 750 Pa).
 - f. Scale Range for Filter Media Having a Recommended Final Resistance of 3.0- to 4.0-Inch wg (750 to 1000 Pa) or Less: 0- to 4.0-inch wg (0 to 1000 Pa).
2. Manometer-Type Filter Gage: Molded plastic, with epoxy-coated aluminum scale and logarithmic-curve tube gage with integral leveling gage, graduated to read from 0- to 3.0-inch wg (0 to 750 Pa), and accurate within 3 percent of the full scale range.
3. Accessories: Static-pressure tips, tubing, gage connections, and mounting bracket.

1.3 EXECUTION

A. Installation

1. Position each filter unit with clearance for normal service and maintenance. Anchor filter holding frames to substrate.
2. Install filters in position to prevent passage of unfiltered air.
3. Install filter gage for each filter bank.
4. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing with new, clean filters.
5. Install filter-gage, static-pressure taps upstream and downstream from filters. Install filter gages on filter banks with separate static-pressure taps upstream and downstream from filters. Mount filter gages on outside of filter housing or filter plenum in an accessible position. Adjust and level inclined gages.
6. Coordinate filter installations with duct and air-handling-unit installations.

B. Field Quality Control

1. Perform tests and inspections.
2. Tests and Inspections:
 - a. Operate automatic roll filters to demonstrate compliance with requirements.
 - b. Test for leakage of unfiltered air while system is operating.
3. Air filter will be considered defective if it does not pass tests and inspections.
4. Prepare test and inspection reports.

C. Cleaning

1. After completing system installation and testing, adjusting, and balancing of air-handling and air-distribution systems, clean filter housings and install new filter media.

END OF SECTION 23 41 13 00



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SECTION 23 41 13 00a - ELECTRONIC AIR CLEANERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for electronic air cleaners. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Electronic air cleaners.
 - b. Side-service housings.
 - c. Front- and rear-access filter frames.
 - d. Filter gages.

C. Submittals

1. Product Data: For each type of product indicated. Include dimensions; operating characteristics; required clearances and access; rated flow capacity, including initial and final pressure drop at rated airflow; efficiency and test method; fire classification; furnished specialties; and accessories for each model indicated.
2. LEED Submittal:
 - a. Product Data for Prerequisite EQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
3. Shop Drawings: For each electronic air cleaner. Include plans, elevations, sections, details, and attachments to other work.
 - a. Show filter assembly, dimensions, materials, and methods of assembly of components.
 - b. Include setting drawings, templates, and requirements for installing anchor bolts and anchorages.
 - c. Wiring Diagrams: For power, signal, and control wiring.
4. Field quality-control reports.
5. Operation and Maintenance Data: For each type of filter and housing to include in emergency, operation, and maintenance manuals.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. ASHRAE Compliance:
 - a. Comply with applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," and Section 7 - "Construction and Startup."
 - b. Comply with ASHRAE 52.1 for arrestance and with ASHRAE 52.2 for MERV for methods of testing and rating air-filter units.
3. Comply with NFPA 90A and NFPA 90B.
4. Comply with ARI 850.
5. Comply with UL 867.

1.2 PRODUCTS

A. Electronic Air Cleaners

1. Description: Factory-fabricated electronic air cleaner operating by electrostatic precipitation principles.



2. Prefilter Media: Four **OR** Six, **as directed**, alternate layers of galvanized-steel **OR** aluminum **OR** stainless-steel, **as directed**, flat and herringbone-crimp screen.
3. Prefilter: Comply with requirements in Division 23 Section "Particulate Air Filtration" for flat **OR** pleated **OR** ring, **as directed**, panel. Size and airflow capacity shall match those of electronic air cleaners.
 - a. Depth: 1 inch (25 mm) **OR** 2 inches (50 mm) **OR** 4 inches (100 mm), **as directed**.
 - b. Filter Unit Class: UL 900, Class 1 **OR** Class 2, **as directed**.
 - c. Arrestance: 85 percent when tested according to ASHRAE 52.1.
 - d. MERV: 8 when tested according to ASHRAE 52.2.
4. Final Filter: Comply with requirements in Division 23 Section "Particulate Air Filtration" for supported bag **OR** unsupported bag **OR** rigid-cell box **OR** V-bank cell **OR** self-supported pocket, **as directed**. Size and airflow capacity shall match those of gas-phase filters.
 - a. Depth: 12 inches (300 mm) **OR** 18 inches (450 mm) **OR** 24 inches (600 mm), **as directed**.
 - b. Filter Unit Class: UL 900, Class 1 **OR** Class 2, **as directed**.
 - c. Arrestance: 85 percent when tested according to ASHRAE 52.1.
 - d. MERV: 13 when tested according to ASHRAE 52.2.
5. Collection Cells: Aluminum, independently supported and nested.
 - a. Ionizing Section: Alternately spaced grounded struts and charged ionizing wires.
 - b. Collecting Section: Alternately grounded and charged plates, with insulators located out of airstream.
6. Power Pack: Self-contained, prewired rectifying unit to convert 120 **OR** 208/240 **OR** 480, **as directed**, -V ac, single-phase, 60-Hz power to approximately 12,000-V dc for ionizer and 6000-V dc for collector; include overload protection, on-off switch, pilot light showing operating status, and access door interlock.
7. Safety Accessories: Manual-reset safety switches and warning lights for filter plenum access doors, signal lights and safety switching upstream and downstream from unit within duct, and enameled high-voltage warning signs.
8. Collection Section Cleaning System:
 - a. Detergent Reservoir Tank: 30 gal. (110 L) **OR** 55 gal. (200 L), **as directed**, with pump, motor, solenoid valve, level sensor, backflow preventer, wye-strainer, and ball valve.
 - b. Detergent.
 - c. Dispensing System: Motor-driven oscillating copper manifolds with brass spray nozzles on each side of the collector.
9. Mist Eliminators: Upstream **OR** Upstream and downstream **OR** Downstream, **as directed**.
10. Controls: Programmable logic controller in remotely mounted NEMA 250, Type 12 enclosure; with integral time clock and manual override.
 - a. Contacts for enable-disable control by building automation system.
11. Finish of Interior Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

B. Fan Section

1. Fan: Forward curved, belt driven.
2. Motor:
 - a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - b. Type: Permanent-split capacitor with SCR for speed adjustment **OR** Electronically commutated motor, **as directed**.
 - c. Fan-Motor Assembly Isolation: Rubber isolators.
 - d. Enclosure: Totally enclosed, fan cooled, and explosion proof **OR** dust-ignition proof, **as directed**.
 - e. Enclosure Materials: Cast iron **OR** Cast aluminum **OR** Rolled steel, **as directed**.
 - f. Motor Bearings: Sealed ball.
 - g. Unusual Service Conditions:
 - 1) Ambient Temperature: <Insert deg F (deg C)>.



- 2) Altitude: **<Insert feet (m)>** above sea level.
 - 3) High humidity.
 - h. Efficiency: Premium efficient.
 - i. NEMA Design: **<Insert designation>**.
 - j. Service Factor: **<Insert value>**.
 - k. Motor Speed: Single speed **OR** Multispeed, **as directed**.
 - 1) Speed Control: Infinitely adjustable with pneumatic-electric and electronic controls.
- C. Cabinet
1. Description: 16-gage galvanized steel with epoxy powder finish for suspended, wall, frame, or duct mounting.
- D. Side-Service Housings
1. Description: Factory-assembled, side-service housings, with bottom drain, **as directed**, constructed of galvanized steel **OR** aluminum, **as directed**, and configured for stacking, with flanges to connect to duct or casing system.
 2. Access Doors: Hinged with continuous **OR** Continuous, **as directed**, gaskets on perimeter and positive-locking devices.
 3. Sealing: Incorporate positive-sealing gasket material on channels to seal top and bottom of filter cartridge frames to prevent bypass of unfiltered air.
 4. Finish of Interior Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- E. Front- And Rear-Access Filter Frames
1. Framing System: Galvanized-steel **OR** Aluminum, **as directed**, framing members with access for either upstream (front) or downstream (rear) filter servicing, cut to size and prepunched for assembly into modules with bottom drain, **as directed**, and configured for stacking. Vertically support filters to prevent deflection of horizontal members without interfering with either filter installation or operation.
 2. Prefilters: Incorporate a separate track with spring clips, **as directed**, removable from front or back, **as directed**.
 3. Final Filters: Integral tracks to accommodate particulate **OR** gas-phase, **as directed**, disposable filters.
 4. Sealing: Factory-installed, positive-sealing device for each row of filters to ensure seal between gasketed filter elements to prevent bypass of unfiltered air.
 5. Finish of Interior Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- F. Filter Gages
1. Diaphragm type, with dial and pointer in metal case, vent valves, black figures on white background, and front recalibration adjustment.
 - a. Diameter: 4-1/2 inches (115 mm) **OR** 2 inches (50 mm), **as directed**.
 - b. Scale Range for Filter Media Having a Recommended Final Resistance of 0.5-Inch wg (125 Pa) or Less: 0- to 0.5-inch wg (0 to 125 Pa).
 - c. Scale Range for Filter Media Having a Recommended Final Resistance of 0.5- to 1-Inch wg (125 to 250 Pa) or Less: 0- to 1.0-inch wg (0 to 250 Pa).
 - d. Scale Range for Filter Media Having a Recommended Final Resistance of 1.0- to 2.0-Inch wg (250 to 500 Pa) or Less: 0- to 2.0-inch wg (0 to 500 Pa).
 - e. Scale Range for Filter Media Having a Recommended Final Resistance of 2.0- to 3.0-Inch wg (500 to 750 Pa) or Less: 0- to 3.0-inch wg (0 to 750 Pa).
 - f. Scale Range for Filter Media Having a Recommended Final Resistance of 3.0- to 4.0-Inch wg (750 to 1000 Pa) or Less: 0- to 4.0-inch wg (0 to 1000 Pa).
 2. Manometer-Type Filter Gage: Molded plastic, with epoxy-coated aluminum scale, logarithmic-curve tube gage, with integral leveling indicator, graduated to read from 0- to 3.0-inch wg (0 to 750 Pa), and accurate within 3 percent of full-scale range.
 3. Accessories: Static-pressure tips, tubing, gage connections, and mounting bracket.



1.3 EXECUTION

A. Installation

1. Position each filter unit with clearance for normal service and maintenance. Anchor filter holding frames to substrate.
2. Install filters in position to prevent passage of unfiltered air.
3. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing with new, clean filters.
4. Operate electronic air cleaners for 24 hours as part of startup before filters are put into operation.
5. Install filter-gage, static-pressure taps upstream and downstream from filters. Install filter gages on filter banks with separate static-pressure taps upstream and downstream from filters. Mount filter gages on outside of filter housing or filter plenum in an accessible position. Adjust and level inclined gages.
6. Install and connect water-supply and drainage piping.
7. Coordinate filter installations with duct and air-handling-unit installations.

B. Field Quality Control

1. Perform tests and inspections.
2. Tests and Inspections: Test for leakage of unfiltered air while system is operating.
3. Air filter will be considered defective if it does not pass tests and inspections.
4. Prepare test and inspection reports.

C. Cleaning

1. After completing system installation and testing, adjusting, and balancing air-handling and air-distribution systems, clean filter housings and install new prefilter and final-filter media.

END OF SECTION 23 41 13 00a



23 - Heating, Ventilating, And Air-Conditioning (HVAC)

Task	Specification	Specification Description
23 41 16 00	23 41 13 00	Air Filters
23 41 16 00	23 41 13 00a	Electronic Air Cleaners
23 41 19 00	23 41 13 00	Air Filters
23 41 19 00	23 41 13 00a	Electronic Air Cleaners
23 41 33 00	23 41 13 00	Air Filters
23 41 33 00	22 13 19 00	High-Efficiency Particulate Filtration



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SECTION 23 42 13 00 - GAS-PHASE AIR FILTRATION

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for gas-phase air infiltration. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Activated-carbon panel filters.
 - b. Activated-carbon, deep-V filters.
 - c. Activated carbon, V-cell filters.
 - d. Cylindrical-canister filters.
 - e. Permanganate filters.
 - f. Supported adsorber bag filters.
 - g. Front-access filter housings.
 - h. Side-service housings.
 - i. Filter gages.

C. Submittals

1. Product Data: For each type of product indicated. Include dimensions; operating characteristics; required clearances and access; rated flow capacity, including initial and final pressure drop at rated airflow; efficiency and test method; fire classification; furnished specialties; and accessories for each model indicated.
2. LEED Submittal:
 - a. Product Data for Prerequisite EQ 1: Documentation indicating that units comply with applicable requirements in ASHRAE 62.1, Section 5, "Systems and Equipment."
3. Shop Drawings: For air filters. Include plans, elevations, sections, details, and attachments to other work.
 - a. Show filter rack assembly, dimensions, materials, and methods of assembly of components.
 - b. Include setting drawings, templates, and requirements for installing anchor bolts and anchorages.
4. Field quality-control reports.
5. Operation and Maintenance Data: For each type of filter and rack to include in emergency, operation, and maintenance manuals.

D. Quality Assurance

1. ASHRAE Compliance:
 - a. Finish of Interior Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
2. Comply with NFPA 90A and NFPA 90B.

1.2 PRODUCTS

A. Activated-Carbon Panel Filters

1. Description: Factory-fabricated unit with activated-carbon media.
2. Media: Flat-panel, disposable multilayer filter with an inlet layer of polyester fibers, a layer of activated-carbon granules bonded to fibers, and a layer of polyurethane foam; housed in a cardboard frame.



3. Media: Flat-panel, disposable honeycombed cellulose with cells filled with activated-carbon granules and a perforated mesh grid; housed in a cardboard frame.
4. Media: Pleated, multilayer filter with an inlet layer of cotton and synthetic fibers and a layer of activated-carbon granules bonded to synthetic fibers; media formed into deep-V-shaped pleats, held by self-wire grid, and housed in a cardboard frame.
5. Mounting Frames: Welded, galvanized, sheet-steel frame and galvanized-steel fasteners with polyurethane, **as directed**, gaskets; capable of bolting together into built-up filter banks.

B. Activated-Carbon, Deep-V Filters

1. Description: Factory-fabricated unit with activated-carbon trays in deep-V arrangement with disposable panel prefilter, **as directed**, and final filter, **as directed**.
2. Module Housing: 0.064-inch- (1.6-mm-) thick, galvanized steel **OR** stainless steel **OR** double-wall casing with 1-inch- (25-mm-) thick insulation, **as directed**, to hold media-filled panels; with side servicing through gasketed access doors on both sides and able to connect to other housings. Equip housings with metal slide channel tracks to hold activated-carbon trays and particulate prefilter, **as directed**, and final filter, **as directed**.
 - a. Finish: Factory primed **OR** primed and painted, **as directed**, outside **OR** inside and outside **OR** inside, **as directed**.
 - b. Pressure tap and fitting.
3. Media-Holding Panels: 1-inch- (25-mm-) thick, perforated polystyrene to allow airflow through contained loose-fill media; with removable service cap for recharging.
OR
Media-Holding Panels: 1 inch (25 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**, deep and containing granular carbon bonded into a briquette form with a galvanized **OR** stainless, **as directed**, -steel frame.
4. Media: 45 lb (20.3 kg) per 1000 cfm (470 L/s) of loose-fill **OR** loose-fill or bonded-briquette **OR** bonded-briquette, **as directed**, coconut-shell activated carbon.
 - a. Ash Content: 2 to 3 percent.
 - b. Percent Carbon Tetrachloride Activity: 35 to 70 percent when tested according to ASTM D 3467.
 - c. Bulk Density: 32 lb/cu. ft. (510 kg/cu. m).
 - d. Mesh Size: 4 by 6 inches (100 by 150 mm), 90 percent minimum.
 - e. Hardness Factor: 95 when tested according to ASTM D 3802.
5. Media: loose-fill **OR** loose-fill or bonded-briquette **OR** bonded-briquette, **as directed**, activated alumina impregnated with potassium permanganate.
 - a. Ash Content: 2 to 3 percent.
 - b. Percent Carbon Tetrachloride Activity: 35 to 70 percent when tested according to ASTM D 3467.
 - c. Bulk Density: 32 lb/cu. ft. (510 kg/cu. m).
 - d. Mesh Size: 4 by 6 inches (100 by 150 mm), 90 percent minimum.
 - e. Hardness Factor: 95 when tested according to ASTM D 3802.
6. Media: loose-fill **OR** loose-fill or bonded-briquette **OR** bonded-briquette, **as directed**, impregnated carbon.
 - a. Ash Content: 2 to 3 percent.
 - b. Percent Carbon Tetrachloride Activity: 35 to 70 percent when tested according to ASTM D 3467.
 - c. Bulk Density: 32 lb/cu. ft. (510 kg/cu. m).
 - d. Mesh Size: 4 by 6 inches (100 by 150 mm), 90 percent minimum.
 - e. Hardness Factor: 95 when tested according to ASTM D 3802.
7. Media: loose-fill **OR** loose-fill or bonded-briquette **OR** bonded-briquette, **as directed**, blended carbon and alumina impregnated with potassium permanganate.
 - a. Ash Content: 2 to 3 percent.
 - b. Percent Carbon Tetrachloride Activity: 35 to 70 percent when tested according to ASTM D 3467.
 - c. Bulk Density: 32 lb/cu. ft. (510 kg/cu. m).



- d. Mesh Size: 4 by 6 inches (100 by 150 mm), 90 percent minimum.
- e. Hardness Factor: 95 when tested according to ASTM D 3802.

C. Activated-Carbon, V-Cell Filters

- 1. Description: Factory-fabricated, dry, V-shaped cartridges containing loose-fill media with holding frames.
- 2. Cartridges: V-cell configuration, plastic enclosure caps, galvanized-steel frame with vertical galvanized-steel channel supports. Integral, 1-inch- (25-mm-) deep panels constructed of honeycombed paper and nylon mesh.
- 3. Fill Media: Coconut-shell activated carbon; 45 lb (20.3 kg) of activated carbon per 1000 cfm (470 L/s) of airflow.
 - a. Ash Content: 2 to 3 percent.
 - b. Percent Carbon Tetrachloride Activity: 35 to 70 percent when tested according to ASTM D 3467.
 - c. Bulk Density: 32 lb/cu. ft. (510 kg/cu. m).
 - d. Mesh Size: 4 by 6 inches (100 by 150 mm), 90 percent minimum.
 - e. Hardness Factor: 95 when tested according to ASTM D 3802.
- 4. Fill Media: Activated alumina impregnated with potassium permanganate; 10.5 lb (4.8 kg) of adsorbent per 500 cfm (236 L/s) of airflow.
 - a. Ash Content: 2 to 3 percent.
 - b. Percent Carbon Tetrachloride Activity: 35 to 70 percent when tested according to ASTM D 3467.
 - c. Bulk Density: 32 lb/cu. ft. (510 kg/cu. m).
 - d. Mesh Size: 4 by 6 inches (100 by 150 mm), 90 percent minimum.
 - e. Hardness Factor: 95 when tested according to ASTM D 3802.
- 5. Fill Media: Impregnated carbon; 8.0 lb (3.6 kg) of adsorbent per 500 cfm (236 L/s) of airflow.
 - a. Ash Content: 2 to 3 percent.
 - b. Percent Carbon Tetrachloride Activity: 35 to 70 percent when tested according to ASTM D 3467.
 - c. Bulk Density: 32 lb/cu. ft. (510 kg/cu. m).
 - d. Mesh Size: 4 by 6 inches (100 by 150 mm), 90 percent minimum.
 - e. Hardness Factor: 95 when tested according to ASTM D 3802.
- 6. Fill Media: Blended carbon and alumina impregnated with potassium permanganate; 7.0 lb (3.1 kg) of adsorbent per 500 cfm (236 L/s) of airflow.
 - a. Ash Content: 2 to 3 percent.
 - b. Percent Carbon Tetrachloride Activity: 35 to 70 percent when tested according to ASTM D 3467.
 - c. Bulk Density: 32 lb/cu. ft. (510 kg/cu. m).
 - d. Mesh Size: 4 by 6 inches (100 by 150 mm), 90 percent minimum.
 - e. Hardness Factor: 95 when tested according to ASTM D 3802.
- 7. Mounting Frames: Welded, galvanized, sheet-steel frame and galvanized-steel fasteners with gaskets; capable of bolting together into built-up filter banks.

D. Cylindrical-Canister Filters

- 1. Description: Factory-fabricated, dry, cylindrical canisters containing loose-fill adsorbent with holding frames.
- 2. Cylinders: 0.0455-inch- (1.2-mm-) thick, perforated, electroplated **OR** stainless, **as directed**, steel, with end plate.
- 3. Fill Media: 5.0 lb (2.3 kg) **OR** 6.7 lb (3.0 kg), **as directed**, of coconut-shell activated carbon **OR** activated alumina impregnated with potassium permanganate **OR** impregnated carbon **OR** blended carbon and alumina impregnated with potassium permanganate, **as directed**, per canister.
 - a. Ash Content: 2 to 3 percent.
 - b. Percent Carbon Tetrachloride Activity: 35 to 70 percent when tested according to ASTM D 3467.
 - c. Bulk Density: 32 lb/cu. ft. (510 kg/cu. m).



- d. Mesh Size: 4 by 6 inches (100 by 150 mm), 90 percent minimum.
- e. Hardness Factor: 95 when tested according to ASTM D 3802.
- 4. Mounting Frames: Welded galvanized, sheet steel with galvanized-steel fasteners **OR** stainless steel with stainless-steel fasteners, **as directed**, with gaskets; designed for bolting together into built-up filter banks.

E. Permanganate Filters

- 1. Description: Factory-fabricated modules containing loose-fill adsorbent with holding frames.
- 2. Modules: Permanent type, 24 inches wide by 24 inches high by 24 inches deep (600 mm wide by 600 mm high by 600 mm deep); shall hold both potassium permanganate and activated carbon. Manufactured in two pieces, each 12 inches (300 mm) wide for ease of installation.
- 3. Media: Porous spherical pellets formed from a combination of powdered, activated carbon and other binders, impregnated with potassium permanganate.
 - a. Leach Test: 180 minutes.
 - b. Potassium Permanganate Content: 4 percent minimum.
 - c. Moisture Content: 20 percent maximum.
 - d. Bulk Density: 34 lb/cu. ft. (0.54 g/mL) **OR** 50 lb/cu. ft. (0.8 g/mL), **as directed**.
 - e. Crush Strength: 40 **OR** 50 **OR** 60, **as directed**, percent maximum.
 - f. Abrasion: 4 percent maximum.
 - g. Nominal Pellet Diameter: 0.125 inch (3.175 mm).
 - h. Percent of Pellet Sizes: 80 to 85 percent after screening.
- 4. Media: High-grade carbon, manufactured from coconut shells, bituminous coal, or a combination of both.
 - a. Ash Content: 2 to 3 percent.
 - b. Percent Carbon Tetrachloride Activity: 35 to 70 percent when tested according to ASTM D 3467.
 - c. Bulk Density: 32 lb/cu. ft. (510 kg/cu. m).
 - d. Mesh Size: 4 by 6 inches (100 by 150 mm), 90 percent minimum.
 - e. Hardness Factor: 95 when tested according to ASTM D 3802.
- 5. Frame: Galvanized steel **OR** Hot-dip galvanized steel **OR** Aluminum **OR** Stainless steel, **as directed**, hinged, and with pull and retaining handles fastened to the media.

F. Supported Adsorber Bag Filters

- 1. Description: Factory-fabricated, dry, extended-surface, self-supporting filters with holding frames.
- 2. Media: Carbon-filled fibrous material constructed so individual pleats are maintained under rated-airflow conditions in tapered form by flexible internal supports.
- 3. Filter-Media Frame: Galvanized steel.
- 4. Mounting Frames: Welded, galvanized, sheet-steel frame and galvanized-steel fasteners with gaskets; capable of bolting together into built-up filter banks.

G. Front-Access Filter Frames

- 1. Framing System: Galvanized-steel **OR** Aluminum, **as directed**, framing members with access for upstream (front) filter servicing, cut to size and prepunched for assembly into modules. Vertically support filters to prevent deflection of horizontal members without interfering with either filter installation or operation.
- 2. Prefilters: Incorporate a separate track with spring clips, **as directed**, removable from front or back, **as directed**.
- 3. Sealing: Factory-installed, positive-sealing device for each row of filters to ensure seal between gasketed filter elements to prevent bypass of unfiltered air.

H. Side-Service Housings

- 1. Description: Factory-assembled, side-service housings constructed of galvanized steel **OR** aluminum, **as directed**, with flanges to connect to duct or casing system.
- 2. Prefilters: Integral tracks to accommodate 2-inch- (50-mm-) thick, disposable or washable, **as directed**, filters.



3. Access Doors: Hinged with continuous **OR** Continuous, **as directed**, gaskets on perimeter and with positive-locking devices. Arrange so filter cartridges can be loaded from either access door.
4. Sealing: Incorporate positive-sealing gasket material on channels to seal top and bottom of filter cartridge frames to prevent bypass of unfiltered air.

I. Filter Gages

1. Diaphragm type, with dial and pointer in metal case, vent valves, black figures on white background, and front recalibration adjustment.
 - a. Diameter: 4-1/2 inches (115 mm) **OR** 2 inches (50 mm), **as directed**.
 - b. Scale Range for Filter Media Having a Recommended Final Resistance of 0.5-Inch wg (125 Pa) or Less: 0- to 0.5-inch wg (0 to 125 Pa).
 - c. Scale Range for Filter Media Having a Recommended Final Resistance of 0.5- to 1.0-Inch wg (125 to 250 Pa) or Less: 0- to 1.0-inch wg (0 to 250 Pa).
 - d. Scale Range for Filter Media Having a Recommended Final Resistance of 1.0- to 2.0-Inch wg (250 to 500 Pa) or Less: 0- to 2.0-inch wg (0 to 500 Pa).
 - e. Scale Range for Filter Media Having a Recommended Final Resistance of 2.0- to 3.0-Inch wg (500 to 750 Pa) or Less: 0- to 3.0-inch wg (0 to 750 Pa).
 - f. Scale Range for Filter Media Having a Recommended Final Resistance of 3.0- to 4.0-Inch wg (750 to 1000 Pa) or Less: 0- to 4.0-inch wg (0 to 1000 Pa).
2. Manometer-Type Filter Gage: Molded plastic, with epoxy-coated aluminum scale, logarithmic-curve tube gage with integral leveling gage; graduated to read from 0- to 3.0-inch wg (0 to 750 Pa) and accurate within 3 percent of full-scale range.
3. Accessories: Static-pressure tips, tubing, gage connections, and mounting bracket.

1.3 EXECUTION

A. Installation

1. Position each filter unit with clearance for normal service and maintenance. Anchor filter holding frames to substrate.
2. Install filters in position to prevent passage of unfiltered air.
3. Install filter gage for each filter bank.
4. Do not operate fan system until particulate filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing with new, clean filters.
5. Do not install gas-phase filters until fan system is clean and there is no risk of construction debris loading the filter.
6. Install filter-gage, static-pressure taps upstream and downstream from filters. Install filter gages on filter banks with separate static-pressure taps upstream and downstream of filters. Mount filter gages on outside of filter housing or filter plenum in an accessible position. Adjust and level inclined gages.
7. Coordinate filter installations with duct and air-handling unit installations.

B. Field Quality Control

1. Perform tests and inspections.
2. Tests and Inspections:
 - a. Test for leakage of unfiltered air while system is operating.
3. Air filter will be considered defective if it does not pass tests and inspections.
4. Prepare test and inspection reports.

C. Cleaning

1. After completing system installation and testing, adjusting, and balancing air-handling and air-distribution systems, clean filter housings and install new particulate filter media.

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23 - Heating, Ventilating, And Air-Conditioning (HVAC)

Task	Specification	Specification Description
23 42 13 00	23 41 13 00	Air Filters



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SECTION 23 51 13 00 - BREECHINGS, CHIMNEYS, AND STACKS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for breechings, chimneys, and stacks. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Listed chimney liners.
 - b. Listed single-wall and double-wall vents and chimneys.
 - c. Listed, refractory-lined breechings and stacks.
 - d. Field-fabricated metal breechings and chimneys.
 - e. Listed grease and dishwasher ducts.

C. Submittals

1. Product Data: For the following:
 - a. Chimney liners.
 - b. Type B and BW vents.
 - c. Type L vents.
 - d. Special gas vents.
 - e. Building-heating-appliance chimneys.
 - f. Grease ducts.
 - g. Refractory-lined metal breechings and chimneys.
 - h. Guy wires and connectors.
2. Shop Drawings: For vents, breechings, chimneys, and stacks. Include plans, elevations, sections, details, and attachments to other work.
3. Welding certificates.
4. Manufacturer Seismic Qualification Certification: Submit certification that factory-fabricated breeching, chimneys, and stacks; accessories; and components will withstand seismic forces defined in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
5. Warranty: Warranty specified in this Section.

D. Quality Assurance

1. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," for hangers and supports and AWS D9.1/D9.1M, "Sheet Metal Welding Code," for shop and field welding of joints and seams in vents, breechings, and stacks.

E. Warranty

1. Manufacturer's standard form in which manufacturer agrees to repair or replace components of venting system that fail in materials or workmanship within 10 **OR** 15 **OR** 25, **as directed**, years from date of Final Completion. Failures include, but are not limited to, structural failures caused by expansion and contraction.

1.2 PRODUCTS

A. Listed Chimney Liners

1. Description: Straight **OR** Corrugated, **as directed**, single-wall chimney liner tested according to UL 1777 and rated for 1000 deg F (538 deg C) continuously, or 2100 deg F (1150 deg C) for 10 minutes; with negative or positive flue pressure complying with NFPA 211.



2. Straight Liner Materials: ASTM A 666, Type 304 **OR** Type 316, **as directed**, stainless steel.
 3. Corrugated Liner Materials: ASTM A 240/A 240M, Type 321 **OR** ASTM A 240/A 240M, Type 430 **OR** ASTM A 959, Type 29-4C, **as directed**, stainless steel.
 4. Accessories:
 - a. Fittings: Tees, elbows, increasers, draft-hood connectors, metal caps with bird barriers, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar or compatible materials and designs.
 - b. Sealant: Manufacturer's standard high-temperature sealant.
 - c. Insulating Fill: Manufacturer's standard high-temperature insulation fill material in annular space surrounding chimney liner including high-temperature, ceramic-fiber insulation required to seal chimney at top and bottom.
- B. Listed Type B And BW Vents
1. Description: Double-wall metal vents tested according to UL 441 and rated for 480 deg F (248 deg C) continuously for Type B, or 550 deg F (288 deg C) continuously for Type BW; with neutral or negative flue pressure complying with NFPA 211.
 2. Construction: Inner shell and outer jacket separated by at least a 1/4-inch (6-mm) airspace.
 3. Inner Shell: ASTM B 209 (ASTM B 209M), Type 1100 aluminum **OR** ASTM B 209 (ASTM B 209M), Type 3003 aluminum **OR** ASTM B 209 (ASTM B 209M), Type 3105 aluminum **OR** ASTM A 666, Type 430 stainless steel, **as directed**.
 4. Outer Jacket: Galvanized **OR** Aluminized, **as directed**, steel.
 5. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.
 - a. Termination:
 - 1) Stack cap designed to exclude minimum 90 percent of rainfall.
OR
Round chimney top designed to exclude minimum 98 percent of rainfall.
OR
Exit cone with drain section incorporated into riser.
OR
Antibackdraft.
- C. Listed Type L Vents
1. Description: Double-wall metal vents tested according to UL 641 and rated for 570 deg F (300 deg C) continuously, or 1700 deg F (926 deg C) for 10 minutes; with neutral or negative flue pressure complying with NFPA 211.
 2. Construction: Inner shell and outer jacket separated by at least a 1/4-inch (6-mm) **OR** 1-inch (25-mm) **OR** 2-inch (50-mm) **OR** 4-inch (100-mm), **as directed**, airspace filled with high-temperature, ceramic-fiber **OR** mineral-wool, **as directed**, insulation.
 3. Inner Shell: ASTM A 666, Type 304 **OR** Type 316, **as directed**, stainless steel.
 4. Outer Jacket: Galvanized **OR** Aluminized **OR** Stainless, **as directed**, steel.
 5. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.
 - a. Termination:
 - 1) Stack cap designed to exclude 90 percent of rainfall.
OR
Round chimney top designed to exclude 98 percent of rainfall.
OR
Exit cone with drain section incorporated into riser.
- D. Listed Special Gas Vents
1. Description: Double-wall metal vents tested according to UL 1738 and rated for 480 deg F (248 deg C) continuously, with positive or negative flue pressure complying with NFPA 211.



2. Construction: Inner shell and outer jacket separated by at least a 1/2-inch (13-mm) airspace.
 3. Inner Shell: ASTM A 959, Type 29-4C stainless steel.
 4. Outer Jacket: Aluminized **OR** Stainless, **as directed**, steel.
 5. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.
 - a. Termination:
 - 1) Stack cap designed to exclude minimum 90 percent of rainfall.
OR
Round chimney top designed to exclude minimum 98 percent of rainfall.
OR
Exit cone with drain section incorporated into riser.
- E. Listed Building-Heating-Appliance Chimneys
1. Description for building-heating-appliance chimneys suitable for dual-fuel boilers, oven vents, water heaters, or exhaust for engines: Double-wall metal vents tested according to UL 103 and rated for 1000 deg F (538 deg C) continuously, or 1700 deg F (926 deg C) for 10 minutes; with neutral or negative flue pressure complying with NFPA 211.
 - a. Construction: Inner shell and outer jacket separated by at least a 1/2-inch (25-mm) **OR** 1-inch (50-mm) **OR** 2-inch (50-mm) **OR** 3-inch (75-mm) **OR** 4-inch (100-mm), **as directed**, annular space filled with high-temperature, ceramic-fiber insulation, **as directed**.
 - b. Inner Shell: ASTM A 666, Type 304 **OR** Type 316, **as directed**, stainless steel.
 2. Description for 1400 deg F (760 deg C) chimneys suitable for dual-fuel boilers, oven vents, water heaters, or exhaust for engines: Double-wall metal vents tested according to UL 103 and UL 959 and rated for 1400 deg F (760 deg C) continuously, or 1800 deg F (982 deg C) for 10 minutes; with positive or negative flue pressure complying with NFPA 211.
 - a. Construction: Inner shell and outer jacket separated by at least a 1-inch (25-mm) **OR** 2-inch (50-mm) **OR** 3-inch (75-mm) **OR** 4-inch (100-mm), **as directed**, annular space filled with high-temperature, ceramic-fiber insulation.
 - b. Inner Shell: ASTM A 666, Type 304 **OR** Type 316, **as directed**, stainless steel.
 3. Description for Type HT chimneys suitable for fireplaces and other solid-fuel-burning appliances: Double-wall metal vents tested according to UL 103 and rated for 1000 deg F (538 deg C) continuously, or 2100 deg F (1150 deg C) for 10 minutes; with neutral or negative flue pressure complying with NFPA 211.
 - a. Construction: Inner shell and outer jacket separated by at least a 1-inch (25-mm) **OR** 1-1/2-inch (38-mm) **OR** 2-inch (50-mm) **OR** 4-inch (100-mm), **as directed**, annular space filled with high-temperature, ceramic-fiber insulation.
 - b. Inner Shell: ASTM A 666, Type 304 **OR** ASTM A 666, Type 316 **OR** ASTM A 240/A 240M, Type 430, **as directed**, stainless steel.
 4. Outer Jacket: Galvanized **OR** Aluminized **OR** Stainless, **as directed**, steel.
 5. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.
 - a. Termination:
 - 1) Stack cap designed to exclude minimum 90 percent of rainfall.
OR
Round chimney top designed to exclude minimum 98 percent of rainfall.
OR
Exit cone with drain section incorporated into riser.
- F. Listed Grease Ducts
1. Description: Double-wall metal vents tested according to UL 1978 and rated for 500 deg F (260 deg C) continuously, or 2000 deg F (1093 deg C) for 30 minutes; with positive or negative duct pressure and complying with NFPA 211.



2. Construction: Inner shell and outer jacket separated by at least a 1-inch (25-mm) **OR** 2-inch (50-mm) **OR** 3-inch (75-mm) **OR** 4-inch (100-mm), **as directed**, annular space filled with high-temperature, ceramic-fiber insulation.
 3. Inner Shell: ASTM A 666, Type 304 **OR** Type 316, **as directed**, stainless steel.
 4. Outer Jacket: Aluminized **OR** Stainless, **as directed**, steel where concealed. Stainless steel where exposed.
 5. Accessories: Tees, elbows, increasers, hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly. Include unique components required to comply with NFPA 96 including cleanouts, transitions, adapters and drain fittings.
- G. Listed, Refractory-Lined Metal Breechings And Chimneys
1. Comply with ASME STS-1.
 2. Design Wind Loads: 150 mph (241 km/h), **as directed**.
 3. Design for seismic conditions at Project site.
 4. Chimney Outer Jacket: Aluminized **OR** Galvanized, **as directed**, steel with riveted **OR** welded, **as directed**, seams.
 5. Refractory Lining: Tested according to UL 959 for temperature and acid resistance, and bearing the testing laboratory label.
 - a. Temperature Rating: 1800 deg F (982 deg C) continuously, and 2000 deg F (1093 deg C) intermittently.
 - b. Acid Extraction: Maximum of 0.2 percent.
 - c. Cold Crushing Strength: Minimum of 3200 psig (22 MPa).
 - d. Thickness: Minimum of 2 inches (50 mm).
 6. Finish: Factory-applied, high-heat-resistant paint; color as selected.
 7. Base Section: Acid-resistant-coated, cast-iron anchor lugs for securing stack to foundation with anchorage designed by manufacturer, **as directed**.
 8. Reinforced Cleanout Section: Smoke-tight connection, with gasketed and bolt-tightened inspection plate; neck shall be welded to stack section.
 9. T or Y Sections: Smoke-tight connection, with welded joints and refractory lining; finished with smooth transition and with no exposed metal on inside.
 10. Spark Screen: ASTM A 666, Type 316 stainless steel, 0.0625 inch (1.6 mm) thick, maximum 1/2-by-1/2-inch (13-by-13-mm) mesh, with ASTM A 666, Type 304 stainless-steel rolled angle and drawband.
 11. Guy Bands: 8-inch- (200-mm-) wide bands of same material as jacket, with bolted fasteners.
 12. Roof Penetration: Factory-fabricated thimbles, flashings, and counterflashings.
 13. Fabricate sections, fittings, and accessories as individual pieces or in combination lengths for field handling.
 14. Fabricate components with centrifugally cast refractory lining in lengths suitable for connection with drawbands.
 15. Bond refractory to steel jacket with calcium aluminate cement to prevent separation in finished product during shipping, handling, and installation.
 16. Fabricate stacks with anchor lugs; cleanout; T sections; flashings and counterflashings; and provisions for support, expansion, and contraction.
- H. Field-Fabricated Metal Breechings And Chimneys
1. Fabricate freestanding chimneys according to SMACNA's "Guide for Steel Stack Design and Construction."
 2. Fabricate breechings and chimneys from ASTM A 1011/A 1011M hot-rolled steel with continuously welded joints, complying with NFPA 211 for minimum metal thickness.
 - a. Equal to or Less Than 1.069 Sq. Ft. (0.099 Sq. m.) or 14 Inches (356 mm) in Diameter: 0.053 inch (1.35 mm).
 - b. Up to 1.396 Sq. Ft. (0.129 Sq. m) or 16 Inches (406 mm) in Diameter: 0.067 inch (1.7 mm).



- c. Up to 1.764 Sq. Ft. (0.164 Sq. m.) or 18 Inches (457 mm) in Diameter: 0.093 inch (2.36 mm).
 - d. Larger Than Above: 0.123 inch (3.12 mm).
 3. Fabricate chimneys and vent connectors from galvanized steel, complying with NFPA 211 for minimum metal thickness.
 - a. Equal to or Less Than 6 Inches (152 mm) in Diameter: 0.019 inch (0.48 mm).
 - b. Up to 10 Inches (254 mm) in Diameter: 0.024 inch (0.61 mm).
 - c. Up to 16 Inches (406 mm) in Diameter: 0.029 inch (0.74 mm).
 - d. Larger Than Above: 0.056 inch (1.42 mm).
 4. Fabricate chimneys and vent connectors from ASTM B 209 (ASTM B 209M), Type 1100 or 3003, aluminum or stainless steel, complying with NFPA 211 for the following minimum metal thicknesses:
 - a. Aluminum: 0.027 inch (0.69 mm).
 - b. Stainless Steel: 0.012 inch (0.31 mm).
 5. Fabricate cleanout doors from compatible material, same thickness as breeching, bolted and gasketed.
 6. Fabricate engine exhaust from ASTM A 53/A 53M, Type E (electric-resistance welded), Grade B; or ASTM A 106, Type S, Grade B, Schedule 40 **OR** Schedule 80, **as directed**, pipe; with welded joints and carbon-steel fittings and flanges.
 - a. Wrought-Steel Fittings: ASME B16.9, wall thickness to match adjoining pipe.
 - b. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, Class 150, including bolts, nuts, and gaskets.
- I. Guying And Bracing Materials
 1. Cable: Three **OR** Four, **as directed**, galvanized, stranded wires of the following thickness:
 - a. Minimum Size: 1/4 inch (6 mm) in diameter.
 - b. For ID Sizes 4 to 15 Inches (100 to 381 mm): 5/16 inch (8 mm).
 - c. For ID Sizes 18 to 24 Inches (457 to 610 mm): 3/8 inch (9.5 mm).
 - d. For ID Sizes 27 to 30 Inches (685 to 762 mm): 7/16 inch (11 mm).
 - e. For ID Sizes 33 to 36 Inches (838 to 915 mm): 1/2 inch (13 mm).
 - f. For ID Sizes 39 to 48 Inches (990 to 1220 mm): 9/16 inch (14.3 mm).
 - g. For ID Sizes 51 to 60 Inches (1295 to 1524 mm): 5/8 inch (16 mm).
 2. Pipe: Two **OR** Three, **as directed**, galvanized steel, NPS 1-1/4 (DN 32).
 3. Angle Iron: Two **OR** Three, **as directed**, galvanized steel, 2 by 2 by 0.25 inch (50 by 50 by 6 mm).

1.3 EXECUTION

A. Application

1. Listed Chimney Liners: High-efficiency boiler or furnace vents in masonry chimney, dishwasher exhaust, or Type II commercial kitchen hood.
2. Listed Type B and BW Vents: Vents for certified gas appliances.
3. Listed Type L Vents: Vents for low-heat appliances.
4. Listed Special Gas Vents: Condensing gas appliances.
5. Listed Building-Heating-Appliance Chimneys: Dual-fuel boilers, oven vents, water heaters, and exhaust for engines. Fireplaces and other solid-fuel-burning appliances.
6. Listed Grease Ducts: Type I commercial kitchen grease duct.
7. Listed, Refractory-Lined Metal Breechings and Chimneys: Freestanding dual-fuel boiler vents, oven vents, water heaters, exhaust for engines, fireplaces, and other solid-fuel-burning appliances.
8. Field-Fabricated Metal Breechings and Chimneys: Dual-fuel boilers, oven vents, water heaters, exhaust for engines, fireplaces, and other solid-fuel-burning appliances.
9. Field-Fabricated Metal Breechings and Chimneys: Steel pipe for use with engine exhaust.

B. Installation Of Listed Vents And Chimneys



1. Locate to comply with minimum clearances from combustibles and minimum termination heights according to product listing or NFPA 211, whichever is most stringent.
 2. Seal between sections of positive-pressure vents and grease exhaust ducts according to manufacturer's written installation instructions, using sealants recommended by manufacturer.
 3. Support vents at intervals recommended by manufacturer to support weight of vents and all accessories, without exceeding appliance loading.
 4. Slope breechings down in direction of appliance, with condensate drain connection at lowest point piped to nearest drain.
 5. Lap joints in direction of flow.
 6. Connect base section to foundation using anchor lugs of size and number recommended by manufacturer.
 7. Join sections with acid-resistant joint cement to provide continuous joint and smooth interior finish.
 8. Erect stacks plumb to finished tolerance of no more than 1 inch (25 mm) out of plumb from top to bottom.
- C. Installation Of Unlisted, Field-Fabricated Breechings And Chimneys
1. Suspend breechings and chimneys independent of their appliance connections.
 2. Install, support, and restrain according to seismic requirements.
 3. Align breechings at connections, with smooth internal surface and a maximum 1/8-inch (3-mm) misalignment tolerance.
 4. Slope breechings down in direction of appliance, with condensate drain connection at lowest point piped to nearest drain.
 5. Lap joints in direction of flow.
 6. Support breechings and chimneys from building structure with bolts, concrete inserts, steel expansion anchors, welded studs, C-clamps, or beam clamps according to manufacturer's written instructions.
- D. Cleaning
1. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.
 2. Clean breechings internally, during and after installation, to remove dust and debris. Clean external surfaces to remove welding slag and mill film. Grind welds smooth and apply touchup finish to match factory or shop finish.
 3. Provide temporary closures at ends of breechings, chimneys, and stacks that are not completed or connected to equipment.

END OF SECTION 23 51 13 00



23 - Heating, Ventilating, And Air-Conditioning (HVAC)

Task	Specification	Specification Description
23 51 16 00	23 51 13 00	Breechings, Chimneys, And Stacks



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SECTION 23 52 16 00 - CONDENSING BOILERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for condensing boilers. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes packaged, factory-fabricated and -assembled, gas-fired, pulse-combustion, fire-tube, water-tube, and water-jacketed condensing boilers, trim, and accessories for generating hot water or steam.

C. Submittals

1. Product Data: Include performance data, operating characteristics, furnished specialties, and accessories.
2. Shop Drawings: For boilers, boiler trim, and accessories. Include plans, elevations, sections, details, and attachments to other work.
 - a. Design calculations and vibration isolation base details, signed and sealed by a qualified professional engineer.
 - 1) Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
 - 2) Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails and equipment mounting frames.
 - b. Wiring Diagrams: Power, signal, and control wiring.
3. Manufacturer Seismic Qualification Certification: Submit certification that boiler, accessories, and components will withstand seismic forces defined in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment". Include the following:
 4. Source quality-control test reports.
 5. Field quality-control test reports.
 6. Operation and maintenance data.
 7. Warranty: Special warranty specified in this Section.
8. Other Informational Submittals:
 - a. ASME Stamp Certification and Report: Submit "A," "S," or "PP" stamp certificate of authorization, as required by authorities having jurisdiction, and document hydrostatic testing of piping external to boiler.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. ASME Compliance: Fabricate and label boilers to comply with ASME Boiler and Pressure Vessel Code.
3. ASHRAE/IESNA 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements."
4. DOE Compliance: Minimum efficiency shall comply with 10 CFR 430, Subpart B, Appendix N, "Uniform Test Method for Measuring the Energy Consumption of Furnaces and Boilers."
5. UL Compliance: Test boilers for compliance with UL 795, "Commercial-Industrial Gas Heating Equipment." Boilers shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.



E. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of boilers that fail in materials or workmanship within specified warranty period.
 - a. Warranty Period for Pulse-Combustion Boilers:
 - 1) Heat Exchanger Damaged by Thermal Shock: 10 years from date of Final Completion.
 - 2) Heat-Exchanger Corrosion: Prorated **OR** Nonprorated, **as directed**, for five years from date of Final Completion.
 - b. Warranty Period for Fire-Tube Condensing Boilers:
 - 1) Leakage and Materials: 10 years from date of Final Completion.
 - 2) Heat Exchanger Damaged by Thermal Stress and Corrosion: Prorated **OR** Nonprorated for five years from date of Final Completion.
 - c. Warranty Period for Water-Tube Condensing Boilers: 20 years from date of Final Completion.
 - d. Warranty Period for Water-Jacketed Condensing Boilers:
 - 1) Leakage and Materials: Eight years from date of Final Completion.
 - 2) Heat Exchanger Damaged by Thermal Stress and Corrosion: Prorated **OR** Nonprorated, **as directed**, for five years from date of Final Completion.

1.2 PRODUCTS

A. Manufactured Units: Pulse-Combustion Condensing Boilers.

1. Description: Factory-fabricated, -assembled, and -tested, pulse-combustion condensing boiler with heat exchanger sealed pressure tight, built on a steel base; including insulated jacket; flue-gas vent; combustion-air intake connections; water supply, return, and condensate drain connections; and controls.
2. Heat Exchanger: Type 316L, stainless-steel **OR** Carbon-steel, **as directed**, primary and secondary combustion chamber.
3. Pressure Vessel: Carbon steel with welded heads and tube connections.
4. Exhaust Decoupler: Fiberglass composite material in a corrosion-resistant steel box.
5. Burner: Natural **OR** Propane, **as directed**, gas, self-aspirating and self-venting after initial start.
6. Blower: Centrifugal fan to operate only during start of each burner sequence.
 - a. Motors: Comply with requirements specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - 1) Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
7. Gas Train: Combination gas valve with manual shutoff and pressure regulator.
8. Ignition: Spark ignition with 100 percent main-valve shutoff with electronic flame supervision.
9. Casing:
 - a. Jacket: Sheet metal, with snap-in or interlocking closures.
 - b. Control Compartment Enclosure: NEMA 250, Type 1A.
 - c. Finish: Baked-enamel **OR** Powder-coated, **as directed**, protective finish.
 - d. Insulation: Minimum 2-inch- (50-mm-) thick, mineral-fiber insulation surrounding the heat exchanger.
 - e. Draft Hood: Integral **OR** External, **as directed**.
 - f. Combustion-Air Connection: Inlet duct collar and sheet metal closure over burner compartment.
 - g. Mounting base to secure boiler to concrete base.
 - 1) Seismic Fabrication Requirements: Fabricate mounting base and attachment to boiler pressure vessel, accessories, and components with reinforcement strong enough to withstand seismic forces defined in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment" when mounting base is anchored to building structure.



10. Mufflers: Carbon-steel intake muffler and stainless-steel exhaust.
 11. Condensate Trap: Cast-iron body with stainless-steel internal parts.
- B. Manufactured Units: Fire-Tube Condensing Boilers.
1. Description: Factory-fabricated, -assembled, and -tested, fire-tube condensing boiler with heat exchanger sealed pressure tight, built on a steel base; including insulated jacket; flue-gas vent; combustion-air intake connections; water supply, return, and condensate drain connections; and controls. Water heating service only.
 2. Heat Exchanger: Nonferrous, corrosion-resistant combustion chamber.
 3. Pressure Vessel: Carbon steel with welded heads and tube connections.
 4. Burner: Natural **OR** Propane, **as directed**, gas, forced draft.
 5. Blower: Centrifugal fan to operate during each burner firing sequence and to prepurge and postpurge the combustion chamber.
 - a. Motors: Comply with requirements specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - 1) Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 6. Gas Train: Combination gas valve with manual shutoff and pressure regulator.
 7. Ignition: Spark ignition with 100 percent main-valve shutoff with electronic flame supervision.
 8. Casing:
 - a. Jacket: Sheet metal **OR** Plastic, **as directed**, with snap-in or interlocking closures.
 - b. Control Compartment Enclosures: NEMA 250, Type 1A.
 - c. Finish: Baked-enamel **OR** Powder-coated, **as directed**, protective finish for sheet metal jacket.
 - d. Insulation: Minimum 2-inch- (50-mm-) thick, mineral-fiber **OR** polyurethane-foam, **as directed**, insulation surrounding the heat exchanger.
 - e. Combustion-Air Connections: Inlet and vent duct collars.
 - f. Mounting base to secure boiler.
 - 1) Seismic Fabrication Requirements: Fabricate mounting base and attachment to boiler pressure vessel, accessories, and components with reinforcement strong enough to withstand seismic forces defined in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment" when mounting base is anchored to building structure.
- C. Manufactured Units: Water-Tube Condensing Boilers.
1. Description: Factory-fabricated, -assembled, and -tested, water-tube condensing boiler with heat exchanger sealed pressure tight, built on a steel base; including insulated jacket; flue-gas vent; combustion-air intake connections; water supply, return, and condensate drain connections; and controls. Water heating service only.
 2. Heat Exchanger: Finned-copper primary and stainless-steel secondary heat exchangers.
 3. Combustion Chamber: Stainless steel, sealed.
 4. Burner: Natural **OR** Propane, **as directed**, gas, forced draft drawing from gas premixing valve.
 5. Blower: Centrifugal fan to operate during each burner firing sequence and to prepurge and postpurge the combustion chamber.
 - a. Motors: Comply with requirements specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - 1) Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 6. Gas Train: Combination gas valve with manual shutoff and pressure regulator.
 7. Ignition: Silicone carbide hot-surface ignition that includes flame safety supervision and 100 percent main-valve shutoff.
 8. Integral Circulator: Cast-iron body and stainless-steel impeller sized for minimum flow required in heat exchanger.
 9. Casing:
 - a. Jacket: Sheet metal, with snap-in or interlocking closures.
 - b. Control Compartment Enclosures: NEMA 250, Type 1A.



- c. Finish: Textured epoxy.
 - d. Insulation: Minimum 1-inch- (25-mm-) **OR** 2-inch- (50-mm-), **as directed**, thick, mineral-fiber insulation surrounding the heat exchanger.
 - e. Combustion-Air Connections: Inlet and vent duct collars.
 - f. Mounting base to secure boiler.
 - 1) Seismic Fabrication Requirements: Fabricate mounting base and attachment to boiler pressure vessel, accessories, and components with reinforcement strong enough to withstand seismic forces defined in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment" when mounting base is anchored to building structure.
- D. Manufactured Units: Water-Jacketed Condensing Boilers.
1. Description: Factory-fabricated, -assembled, and -tested, water-jacketed condensing boiler with heat exchanger sealed pressure tight, built on a steel base; including insulated jacket; flue-gas vent; water supply, return, and condensate drain connections; and controls. Water heating service only.
 2. Heat Exchanger: Stainless-steel primary and secondary combustion chamber.
 3. Pressure Vessel: Carbon steel with welded heads and tube connections where not in contact with combustion or flue gases.
 4. Burner: Natural **OR** Propane, **as directed**, gas, forced draft; swing-open front and burner observation port.
 5. Blower: Centrifugal fan, forced draft. Include prepurge and postpurge of the combustion chamber.
 - a. Motors: Comply with requirements specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - 1) Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 6. Gas Train: Combination gas valve with manual shutoff and pressure regulator. Include 100 percent safety shutoff with electronic flame supervision.
 7. Ignition: Electric-spark ignition with 100 percent main-valve shutoff with electronic flame supervision.
 8. Casing:
 - a. Jacket: Sheet metal, with snap-in or interlocking closures.
 - b. Control Compartment Enclosures: NEMA 250, Type 1A.
 - c. Finish: Powder-coated protective finish.
 - d. Insulation: Minimum 4-inch- (100-mm-) thick, mineral-fiber insulation surrounding the heat exchanger.
 - e. Combustion-Air Connections: Inlet and vent duct collars.
 - f. Mounting base to secure boiler.
 - 1) Seismic Fabrication Requirements: Fabricate mounting base and attachment to boiler pressure vessel, accessories, and components with reinforcement strong enough to withstand seismic forces defined in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment" when mounting base is anchored to building structure.
- E. Trim: For Hot-Water Boilers.
1. Include devices sized to comply with ANSI B31.1, "Power Piping **OR** ANSI B31.9, "Building Services Piping", **as directed**.
 2. Aquastat Controllers: Operating, firing rate, **as directed**, and high limit.
 3. Safety Relief Valve: ASME rated.
 4. Pressure and Temperature Gage: Minimum 3-1/2-inch- (89-mm-) diameter, combination water-pressure and -temperature gage. Gages shall have operating-pressure and -temperature ranges so normal operating range is about 50 percent of full range.
 5. Boiler Air Vent: Automatic **OR** Manual, **as directed**.
 6. Drain Valve: Minimum NPS 3/4 (DN 20) hose-end gate valve.



7. Circulation Pump: Non-overloading, in-line pump with split-capacitor motor having thermal-overload protection and lubricated bearings; designed to operate at specified boiler pressures and temperatures.
- F. Trim: For Steam Boilers.
1. Include devices sized to comply with ANSI B31.1, "Power Piping **OR** ANSI B31.9, "Building Services Piping", **as directed**.
 2. Pressure Controllers: Operating, firing rate, **as directed**, and high limit.
 3. Safety Relief Valve:
 - a. Size and Capacity: As required for equipment according to ASME Boiler and Pressure Vessel Code.
 - b. Description: Fully enclosed steel spring with adjustable pressure range and positive shutoff; factory set and sealed.
 - 1) Drip-Pan Elbow: Cast iron and having threaded inlet and outlet with threads complying with ASME B1.20.1.
 4. Pressure Gage: Minimum 3-1/2-inch (89-mm) diameter. Gage shall have normal operating pressure about 50 percent of full range.
 5. Water Column: Minimum 12-inch (300-mm) glass gage with shutoff cocks.
 6. Drain Valves: Minimum NPS 3/4 (DN 20) or nozzle size with hose-end connection.
 7. Blowdown Valves: Factory-installed bottom and surface, slow-acting blowdown valves same size as boiler nozzle. Blowdown valves shall be combination of slow and quick acting as required by ANSI B31.1, **as directed**.
 8. Stop Valves: Boiler inlets and outlets, except safety relief valves or preheater inlet and outlet, shall be equipped with stop valve in an accessible location as near as practical to boiler nozzle and same size or larger than nozzle. Valves larger than NPS 2 (DN 50) shall have rising stem.
 9. Stop-Check Valves: Factory-installed, stop-check valve and stop valve at boiler outlet with free-blow drain valve factory installed between the two valves and visible when operating stop-check valve.
- G. Controls
1. Refer to Division 23 Section "Instrumentation And Control For Hvac".
OR
Boiler operating controls shall include the following devices and features:
 - a. Operating Pressure Control for Steam Boilers: Factory wired and mounted to cycle burner.
 - b. Low-Water Cutoff and Pump Control for Steam Boilers: Cycle feedwater pump(s) for makeup water control.
 - c. Sequence of Operation for Hot-Water Boilers: Electric, factory-fabricated and field-installed panel to control burner firing rate to maintain space temperature in response to thermostat with heat anticipator located in heated space.
OR
Sequence of Operation for Hot-Water Boilers: Electric, factory-fabricated and field-installed panel to control burner firing rate to reset supply-water temperature inversely with outside-air temperature. At 0 deg F (minus 17 deg C) outside-air temperature, set supply-water temperature at 200 deg F (93 deg C); at 60 deg F (15 deg C) outside-air temperature, set supply-water temperature at 140 deg F (60 deg C).
 - d. Sequence of Operation for Steam Boilers: Electric, factory-fabricated and field-installed panel to control burner firing rate to maintain a constant steam pressure. Maintain pressure set point plus or minus 10 percent.
 - 1) Include automatic, alternating-firing sequence for multiple boilers to ensure maximum system efficiency throughout the load range and to provide equal runtime for boilers.
 2. Burner Operating Controls: To maintain safe operating conditions, burner safety controls limit burner operation.
 - a. High Cutoff: Manual **OR** Automatic, **as directed**, reset stops burner if operating conditions rise above maximum boiler design temperature for hot-water boiler or pressure for steam boiler.



- b. Low-Water Cutoff Switch: Electronic for hot-water boilers or Float and electronic for steam boilers probe shall prevent burner operation on low water. Cutoff switch shall be manual **OR** automatic, **as directed**, -reset type.
- c. Blocked Inlet Safety Switch: Manual-reset pressure switch field mounted on boiler combustion-air inlet.
- d. Audible Alarm: Factory mounted on control panel with silence switch; shall sound alarm for above conditions.
- 3. Building Automation System Interface: Factory install hardware and software to enable building automation system to monitor, control, and display boiler status and alarms.
 - a. Hardwired Points:
 - 1) Monitoring: On/off status, common trouble alarm **OR** low water level alarm, **as directed**.
 - 2) Control: On/off operation, hot water supply temperature set-point adjustment **OR** steam pressure adjustment, **as directed**.
 - b. A communication interface with building automation system shall enable building automation system operator to remotely control and monitor the boiler from an operator workstation. Control features available, and monitoring points displayed, locally at boiler control panel shall be available through building automation system.

H. Electrical Power

- 1. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 22.
OR
Single-Point Field Power Connection: Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to boiler.
 - a. House in NEMA 250, Type 1 enclosure.
 - b. Wiring shall be numbered and color-coded to match wiring diagram.
 - c. Install factory wiring outside of an enclosure in a metal raceway.
 - d. Field power interface shall be to wire lugs **OR** fused disconnect switch **OR** nonfused disconnect switch **OR** circuit breaker, **as directed**.
 - e. Provide branch power circuit to each motor and to controls with a disconnect switch or circuit breaker, **as directed**.
 - f. Provide each motor with overcurrent protection.

I. Venting Kits

- 1. Kit: Complete system, ASTM A 959, Type 29-4C stainless steel, pipe, vent terminal, thimble, indoor plate, vent adapter, condensate trap and dilution tank, and sealant.
- 2. Combustion-Air Intake: Complete system, stainless steel, pipe, vent terminal with screen, inlet air coupling, and sealant.

J. Source Quality Control

- 1. Burner and Hydrostatic Test: Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency; perform hydrostatic test.
- 2. Test and inspect factory-assembled boilers, before shipping, according to ASME Boiler and Pressure Vessel Code.
- 3. Allow the Owner access to source quality-control testing of boilers. Notify the Owner 14 days in advance of testing.

1.3 EXECUTION

A. Boiler Installation



1. Install boilers level on concrete base. Concrete base is specified in Division 23 Section "Common Work Results For Hvac", and concrete materials and installation requirements are specified in Division 31..
 2. Vibration Isolation for Equipment Supported on Slabs-On -Grade: Elastomeric isolation pads **OR** mounts, **as directed**, with a minimum static deflection of 0.25 inch (6.35 mm). Vibration isolation devices and installation requirements are specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 3. Install gas-fired boilers according to NFPA 54.
 4. Assemble and install boiler trim.
 5. Install electrical devices furnished with boiler but not specified to be factory mounted.
 6. Install control wiring to field-mounted electrical devices.
- B. Connections
1. Piping installation requirements are specified in other Division 21. Drawings indicate general arrangement of piping, fittings, and specialties.
 2. Install piping adjacent to boiler to allow service and maintenance.
 3. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve if required.
 4. Connect piping to boilers, except safety relief valve connections, with flexible connectors of materials suitable for service. Flexible connectors and their installation are specified in Division 23 Section "Common Work Results For Hvac".
 5. Connect gas piping to boiler gas-train inlet with union. Piping shall be at least full size of gas train connection. Provide a reducer if required.
 6. Connect hot-water piping to supply- and return-boiler tapplings with shutoff valve and union or flange at each connection.
 7. Connect steam and condensate piping to supply-, return-, and blowdown-boiler tapplings with shutoff valve and union or flange at each connection.
 8. Install piping from safety relief valves to nearest floor drain.
 9. Install piping from safety valves to drip-pan elbow and to nearest floor drain.
 10. Boiler Venting:
 - a. Install flue venting kit and combustion-air intake.
 - b. Connect full size to boiler connections. Comply with requirements in Division 23 Section "Breechings, Chimneys, And Stacks".
 11. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
 12. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".
- C. Field Quality Control
1. Perform tests and inspections and prepare test reports.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
 2. Tests and Inspections:
 - a. Perform installation and startup checks according to manufacturer's written instructions.
 - b. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.
 - c. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.
 - d. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 1) Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level and water temperature **OR** steam pressure, **as directed**.
 - 2) Set field-adjustable switches and circuit-breaker trip ranges as indicated.
 3. Remove and replace malfunctioning units and retest as specified above.



-
4. Occupancy Adjustments: When requested within 12 months of date of Final Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.
 5. Performance Tests, **as directed**:
 - a. Engage a factory-authorized service representative to inspect component assemblies and equipment installations, including connections, and to conduct performance testing.
 - b. Boilers shall comply with performance requirements indicated, as determined by field performance tests. Adjust, modify, or replace equipment to comply.
 - c. Perform field performance tests to determine capacity and efficiency of boilers.
 - 1) Test for full capacity.
 - 2) Test for boiler efficiency at low fire 20, 40, 60, 80, 100, 80, 60, 40, and 20 percent of full capacity. Determine efficiency at each test point.
 - d. Repeat tests until results comply with requirements indicated.
 - e. Provide analysis equipment required to determine performance.
 - f. Provide temporary equipment and system modifications necessary to dissipate the heat produced during tests if building systems are not adequate.
 - g. Notify the Owner in advance of test dates.
 - h. Document test results in a report and submit to the Owner.

D. Demonstration

1. Train the Owner's maintenance personnel to adjust, operate, and maintain boilers.

END OF SECTION 23 52 16 00



23 - Heating, Ventilating, And Air-Conditioning (HVAC)

Task	Specification	Specification Description
23 52 16 13	23 52 16 00	Condensing Boilers
23 52 16 16	23 52 16 00	Condensing Boilers
23 52 16 19	23 52 16 00	Condensing Boilers
23 52 16 23	23 52 16 00	Condensing Boilers



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SECTION 23 52 33 13 - WATER-TUBE BOILERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for water-tube boilers. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes packaged, factory-fabricated and -assembled, gas-fired, finned water-tube boilers, trim, and accessories for generating hot water.
2. This Section includes packaged, water-tube boilers, trim, and accessories for generating hot water or steam with the following configurations, burners, and outputs:
 - a. Factory and Field assembled.
 - b. Atmospheric gas, Forced-draft gas, Oil, and Combination gas and oil burner.

C. Submittals

1. Product Data: Include performance data, operating characteristics, furnished specialties, and accessories.
2. Shop Drawings: For boilers, boiler trim, and accessories. Include plans, elevations, sections, details, and attachments to other work.
 - a. Design calculations and vibration isolation base details, signed and sealed by a qualified professional engineer.
 - 1) Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
 - 2) Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails and equipment mounting frames.
 - b. Wiring Diagrams: Power, signal, and control wiring.
3. Manufacturer Seismic Qualification Certification: Submit certification that boiler, accessories, and components will withstand seismic forces defined in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment". Include the following:
4. Source quality-control test reports.
5. Field quality-control test reports.
6. Operation and maintenance data.
7. Warranty: Special warranty specified in this Section.
8. Other Informational Submittals:
 - a. ASME "A" Stamp Certification and Report: Submit "A" stamp certificate of authorization as required by authorities having jurisdiction, and document hydrostatic testing of piping external to boiler.
 - b. Startup service reports.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. ASME Compliance: Fabricate and label boilers to comply with ASME Boiler and Pressure Vessel Code.
3. ASHRAE/IESNA 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements."
4. DOE Compliance: Minimum efficiency shall comply with 10 CFR 430, Subpart B, Appendix N, "Uniform Test Method for Measuring the Energy Consumption of Furnaces and Boilers."



5. I=B=R Compliance: Boilers shall be tested and rated according to HI's "Rating Procedure for Heating Boilers" and "Testing Standard for Commercial Boilers," with I=B=R emblem on a nameplate affixed to boiler.
6. UL Compliance: Test boilers for compliance with UL 726, "Oil-Fired Boiler Assemblies" **OR** UL 726, "Oil-Fired Boiler Assemblies" and UL 795, "Commercial-Industrial Gas Heating Equipment" **OR** UL 795, "Commercial-Industrial Gas Heating Equipment", **as directed**. Boilers shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.

E. Warranty

1. Special Warranty for Finned Water-Tube Boilers: Manufacturer's standard form in which manufacturer agrees to repair or replace heat exchangers damaged by thermal shock and vent dampers of boilers that fail in materials or workmanship within specified warranty period.
 - a. Warranty Period for Heat Exchangers: 20 years from date of Final Completion.
 - b. Warranty Period for Vent Dampers: Five years from date of Final Completion.
2. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace drums, tubes, headers, cabinets, atmospheric gas burners, and pressure vessels of boilers that fail in materials or workmanship within specified warranty period.
 - a. Warranty Period for Drums, Tubes, Headers, Cabinets, and Atmospheric Gas Burner: Five years from date of Final Completion, pro rata.
 - b. Warranty Period for Pressure Vessel: 20 years from date of Final Completion, for thermal shock.

1.2 PRODUCTS

A. Finned Water-Tube Boilers

1. Description: Factory-fabricated, -assembled, and -tested boiler with tubes sealed into headers pressure tight, and set on a steel base; including insulated jacket, flue-gas vent, combustion-air intake connections, water supply and return connections, and controls.
2. Heat Exchanger:
 - a. Finned copper **OR** steel **OR** copper-nickel, **as directed**, tubing with stainless-steel baffles.
 - b. Bronze **OR** Cast-iron **OR** Steel, **as directed**, headers.
 - c. Single-pass **OR** Two-pass, **as directed**, horizontal **OR** vertical **OR** coil, **as directed**, configuration.
 - d. Tubes shall be sealed in header with silicone O-ring gaskets **OR** by welding **OR** by mechanically rolling tubes in header, **as directed**.
3. Combustion Chamber Internal Insulation: Interlocking panels of refractory insulation, high-temperature cements, mineral fiber, and ceramic refractory tile for service temperatures to 2000 deg F (1100 deg C).
4. Casing:
 - a. Jacket: Sheet metal **OR** Stainless steel, **as directed**, with snap-in or interlocking closures.
 - b. Control Compartment Enclosure: NEMA 250, Type 1A.
 - c. Finish: Baked enamel over primer **OR** Baked enamel over galvanizing **OR** Powder coated, **as directed**.
 - d. Insulation: Minimum 1-inch- (25-mm-) **OR** 2-inch- (50-mm-), **as directed**, thick, mineral-fiber insulation surrounding the heat exchanger.
 - e. Draft Hood: Integral **OR** External, **as directed**.
 - f. Combustion-Air Connection: Inlet duct collar and sheet metal closure over burner compartment.
 - g. Mounting base to secure boiler with accessory for mounting on combustible surface, **as directed**.
 - 1) Seismic Fabrication Requirements: Fabricate mounting base and attachment to boiler pressure vessel, accessories, and components with reinforcement strong enough to withstand seismic forces defined in Division 23 Section "Vibration And



Seismic Controls For Hvac Piping And Equipment" when mounting base is anchored to building structure.

5. Burner:
 - a. Burner Tubes and Orifices: Stainless steel, for natural **OR** propane, **as directed**, gas. Mount burner tubes in a slide-out burner drawer for ease of inspection, **as directed**.
 - 1) Sealed Combustion: Factory-mounted centrifugal fan to draw outside air into boiler and discharge into burner compartment.
 - 2) Direct Vent: Factory-mounted centrifugal fan to draw flue gas out of boiler and discharge into boiler vent.
 - b. Vertical Burner:
 - 1) High-temperature stainless steel **OR** Ceramic, **as directed**, to fire in a 360-degree pattern.
 - 2) Burner shall have a viewing port for observation of burner operation and a factory-mounted centrifugal fan to supply room **OR** outside, **as directed**, air through a replaceable 99 percent efficient (1-micrometer particles) filter, **as directed**, to boiler burner.
 - 3) Fan shall be controlled to prepurge and postpurge the combustion chamber before firing.
 - c. Gas Train for Commercial Boilers: Control devices and full-modulation **OR** on-off **OR** low-high-low **OR** proportional, **as directed**, control sequence shall comply with requirements in AGA **OR** ASME CSD-1 **OR** FMG **OR** IRI **OR** UL, **as directed**. In addition to these requirements, include shutoff cock, pressure regulator, and control valve.
 - d. Gas Train for Residential Boilers: Combination gas valve with manual shutoff, pressure regulator, and pilot adjustment.
 - e. Pilot: Standing **OR** Intermittent-electric-spark **OR** Hot-surface, **as directed**, pilot ignition with 100 percent main-valve and pilot-safety shutoff with electronic supervision of burner flame.
 - f. Flue-Gas Recirculation Fans: Centrifugal fans on burner assembly to recirculate flue gas to decrease oxides of nitrogen emissions to less than 30 ppm.
 - g. Motors: Comply with requirements specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
6. Trim:
 - a. Aquastat Controllers: Operating, firing rate, **as directed**, and high limit.
 - b. Safety Relief Valve: ASME rated.
 - c. Pressure and Temperature Gage: Minimum 3-1/2-inch- (89-mm-) diameter, combination water-pressure and -temperature gage. Gages shall have operating-pressure and -temperature ranges so normal operating range is about 50 percent of full range.
 - d. Boiler Air Vent: Automatic **OR** Manual, **as directed**.
 - e. Drain Valve: Minimum NPS 3/4 (DN 20) hose-end gate valve.
 - f. Circulation Pump: Non-overloading, in-line pump with split-capacitor motor having thermal-overload protection and lubricated bearings; designed to operate at specified boiler pressures and temperatures.
7. Controls:
 - a. Refer to Division 23 Section "Instrumentation And Control For Hvac".
OR
Boiler operating controls shall include the following devices and features:
 - 1) Control transformer.
 - 2) Motorized Vent Damper: Interlocked with burner to open before burner starts. If damper fails to open, stop burner operation.
 - 3) Set-Point Adjust: Set points shall be adjustable.
 - 4) Sequence of Operation: Electric, factory-fabricated and field-installed panel to control burner firing rate to maintain space temperature in response to thermostat with heat anticipator located in heated space.**OR**



Sequence of Operation: Electric, factory-fabricated and field-installed panel to control burner firing rate to reset supply-water temperature inversely with outside-air temperature. At 0 deg F (minus 17 deg C) outside-air temperature, set supply-water temperature at 200 deg F (93 deg C); at 60 deg F (15 deg C) outside-air temperature, set supply-water temperature at 140 deg F (60 deg C).

- 5) Include automatic, alternating-firing sequence for multiple boilers to ensure maximum system efficiency throughout the load range and to provide equal runtime for boilers.
 - b. Burner Operating Controls: To maintain safe operating conditions, burner safety controls limit burner operation.
 - 1) High Cutoff: Manual **OR** Automatic, **as directed**, reset stops burner if operating conditions rise above maximum boiler design temperature.
 - 2) Water Flow Switch: Automatic-reset paddle-switch shall prevent burner operation on low water flow.
 - 3) Blocked Vent Safety Switch: Manual-reset switch factory mounted on draft diverter.
 - 4) Rollout Safety Switch: Factory mounted on boiler combustion chamber.
 - 5) Audible Alarm: Factory mounted on control panel with silence switch; shall sound alarm for above conditions.
 - c. Building Automation System Interface: Factory install hardware and software to enable building automation system to monitor, control, and display boiler status and alarms.
 - 1) Monitoring: On/off status, common trouble alarm **OR** low water level alarm, **as directed**.
 - 2) Control: On/off operation, hot water supply temperature set-point adjustment, **as directed**.
 - 3) A communication interface with building automation system shall enable building automation system operator to remotely control and monitor the boiler from an operator workstation. Control features available, and monitoring points displayed, locally at boiler control panel shall be available through building automation system.
- B. Steel **OR** Flexible, **as directed**, Water-Tube Boilers
1. Description: Factory-fabricated and assembled **OR** Field-assembled, **as directed**, water-tube boiler with heat exchanger sealed pressure tight, built on a steel base; including insulated jacket, flue-gas vent, supply and return connections, and controls.
 2. Heat-Exchanger Design: Straight steel tubes rolled into steel headers.
 - a. Accessible head plates at both ends.
 - b. Handholes or couplings, **as directed**, in headers for water-side inspections.
 - c. Accessible drain and blowdown tappings, both high and low, for surface and mud removal.
 - d. Lifting lugs on top of boiler.
 - e. Built-in air separator.
 3. Heat-Exchanger Design: Bent steel tubes swaged **OR** welded, **as directed**, into steel headers with membrane waterwall design, **as directed**.
 - a. Limit tube configurations to two **OR** four, **as directed**.
 - b. Accessible drain and blowdown tappings, both high and low, for surface and mud removal.
 - c. Accessible inspection ports in drum, mud legs, and tube manifolds.
 - d. Lifting lugs on top of boiler.
 - e. Built-in air separator.
 4. Combustion Chamber: Equipped with minimum 2-1/2-inch (64-mm) **OR** 3-inch (75-mm) **OR** 4-inch (100-mm), **as directed**, 2700 deg F (1482 deg C) poured refractory on floor and minimum 2-inch (50-mm) **OR** 3-1/2-inch (89-mm), **as directed**, lap-jointed cast refractory with fiber-blanket joint seals on side walls. Combustion chamber shall have flame observation ports in front and back **OR** back, **as directed**.
 5. Casing:
 - a. Insulation: Minimum 2-inch (50-mm) thick, lightweight refractory; 1-inch (25-mm) thick insulating board; galvanized-steel membrane, and 2-inch (50-mm) thick, mineral-fiber insulation surrounding the heat exchanger and combustion chamber **OR** 2-inch (50-mm)



- thick, mineral-fiber insulation surrounding the heat exchanger and combustion chamber, **as directed**.
- b. Top Flue Connection: Constructed of aluminized steel **OR** stainless steel, **as directed**.
 - c. Jacket: Mirror-finish stainless steel, with screw-fastened closures.
OR
Jacket: Sheet metal **OR** Galvanized sheet metal, **as directed**, with screw-fastened closures and baked-enamel **OR** powder-coated, **as directed**, protective finish.
 - d. Mounting base to secure boiler to concrete base.
 - 1) Seismic Fabrication Requirements: Fabricate mounting base and attachment to boiler, accessories, and components with reinforcement strong enough to withstand seismic forces defined in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment" when mounting base is anchored to building structure.
 - e. Control Compartment Enclosure: NEMA 250, Type 1A.
6. Draft Diverter **OR** Barometric Damper, **as directed**: Galvanized-steel assembly with flue-gas thermometer.
7. Burner - Atmospheric Gas Burners:
- a. Burner and Orifices: Stainless steel **OR** Cast iron, **as directed**, for natural **OR** propane, **as directed**, gas.
 - b. Gas Train for Commercial Boilers: Control devices and full-modulation **OR** on-off **OR** low-high-low, **as directed**, control sequence shall comply with requirements in AGA **OR** ASME CSD-1 **OR** FMG **OR** IRI **OR** UL, **as directed**.
 - c. Gas Train for Residential Boilers: Combination gas valve with manual shutoff, pressure regulator, and pilot adjustment.
 - d. Pilot: Standing **OR** Intermittent-electric-spark, **as directed**, pilot ignition with 100 percent main-valve and pilot-safety shutoff with electronic supervision of burner flame.
8. Burner - Forced-Draft Gas Burners:
- a. Burner: Welded construction with multivane, stainless-steel, flame-retention diffuser for natural **OR** propane, **as directed**, gas. Mount burner on hinged access door to permit access to combustion chamber, **as directed**.
 - b. Blower: Forward-curved centrifugal fan integral to burner, directly driven by motor; with adjustable, dual-blade damper assembly and locking quadrant to set air-fuel ratio.
 - 1) Motors: Comply with requirements specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - a) Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - c. Gas Train: Control devices and modulating **OR** on-off **OR** low-high-low, **as directed**, control sequence shall comply with requirements in AGA **OR** ASME CSD-1 **OR** FMG **OR** IRI **OR** UL, **as directed**.
 - d. Pilot: Intermittent **OR** Interrupted, **as directed**, -electric-spark pilot ignition with 100 percent main-valve and pilot-safety shutoff with electronic supervision of burner flame.
 - e. Flue-Gas Recirculation: Burner connections shall be equipped for recirculating flue gas.
 - 1) Maximum Oxides of Nitrogen Emissions: 20 **OR** 30, **as directed**, ppm.
9. Burner - Oil Burners:
- a. Burner: Welded construction with multivane, stainless-steel, flame-retention diffuser for fuel oil. Mount burner on hinged access door to permit access to combustion chamber, **as directed**.
 - b. Blower: Forward-curved centrifugal fan integral to burner, directly driven by motor; with adjustable, dual-blade damper assembly and locking quadrant to set air-fuel ratio.
 - 1) Motors: Comply with requirements specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - a) Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - c. Oil Supply: Control devices and modulating **OR** on-off **OR** low-high-low, **as directed**, control sequence shall comply with requirements in ASME CSD-1 **OR** FMG **OR** IRI **OR** UL, **as directed**.



- 1) Oil Pump: Two-stage, gear-type oil pump integral to and directly driven by blower, **as directed**, shall be capable of producing 300-psig (2070-kPa) discharge pressure and 15-inch Hg (50.7-kPa) vacuum.
 - 2) Oil Piping Specialties:
 - a) Suction-line, manual, gate valve.
 - b) Removable-mesh oil strainer.
 - c) 0- to 30-inch Hg (0- to 101.3-kPa) vacuum; 0- to 30-psig (0- to 207-kPa) vacuum-pressure gage.
 - d) 0- to 300-psig (0- to 2070-kPa) oil-nozzle pressure gage.
 - e) Nozzle-line, solenoid-safety-shutoff oil valve.
 - d. Pilot: Intermittent **OR** Interrupted, **as directed**, -electric-spark pilot ignition with 100 percent main-valve and pilot-safety shutoff solenoid using cadmium sulfide **OR** UV scanner, **as directed**, flame-safety control.
 - e. Flue-Gas Recirculation: Burner connections shall be equipped for recirculating flue gas.
 - 1) Maximum Oxides of Nitrogen Emissions: 30 ppm.
10. Burner - Combination Gas and Oil Burners:
- a. Burner: Welded construction with multivane, stainless-steel, flame-retention diffuser for fuel oil and natural **OR** propane, **as directed** gas. Mount burner on hinged access door to permit access to combustion chamber, **as directed**.
 - b. Blower: Forward-curved centrifugal fan integral to burner, directly driven by motor; with adjustable, dual-blade damper assembly and locking quadrant to set air-fuel ratio.
 - 1) Motors: Comply with requirements specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - a) Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - c. Oil Supply: Control devices and modulating **OR** on-off **OR** low-high-low, **as directed**, control sequence shall comply with requirements in ASME CSD-1 **OR** FMG **OR** IRI, **as directed**.
 - 1) Oil Pump: Two-stage, gear-type oil pump integral to and directly driven by blower, **as directed**, shall be capable of producing 300-psig (2070-kPa) discharge pressure and 15-inch Hg (50.7-kPa) vacuum.
 - 2) Oil Piping Specialties:
 - a) Suction-line, manual, gate valve.
 - b) Removable-mesh oil strainer.
 - c) 0- to 30-inch Hg (0- to 101.3-kPa) vacuum; 0- to 30-psig (0- to 207-kPa) vacuum-pressure gage.
 - d) 0- to 300-psig (0- to 2070-kPa) oil-nozzle pressure gage.
 - e) Nozzle-line, solenoid-safety-shutoff oil valve.
 - d. Gas Train: Control devices and modulating **OR** on-off **OR** low-high-low, **as directed**, control sequence shall comply with requirements in ASME CSD-1 **OR** FMG **OR** IRI **OR** UL, **as directed**.
 - e. Gas Pilot: Intermittent **OR** Interrupted, **as directed**, -electric-spark pilot ignition with 100 percent main-valve and pilot-safety shutoff with electronic supervision of burner flame.
 - f. Oil Pilot: Intermittent **OR** Interrupted, **as directed**, -electric-spark pilot ignition with 100 percent main-valve and pilot-safety shutoff solenoid with cadmium sulfide **OR** UV scanner, **as directed**, flame-safety control.
 - g. Flue-Gas Recirculation: Burner connections shall be equipped for recirculating flue gas.
 - 1) Maximum Oxides of Nitrogen Emissions: 20 **OR** 30, **as directed**, ppm.
11. Trim for Hot-Water Boilers:
- a. Include devices sized to comply with ANSI B31.1, "Power Piping **OR** ANSI B31.9, "Building Services Piping", **as directed**.
 - b. Aquastat Controllers: Operating, firing rate, **as directed**, and high limit.
 - c. Safety Relief Valve: ASME rated.



- d. Pressure and Temperature Gage: Minimum 3-1/2-inch- (89-mm-) diameter, combination water-pressure and -temperature gage. Gages shall have operating-pressure and -temperature ranges so normal operating range is about 50 percent of full range.
 - e. Boiler Air Vent: Automatic **OR** Manual, **as directed**.
 - f. Drain Valve: Minimum NPS 3/4 (DN 20) hose-end gate valve.
 - g. Tankless Heater: Carbon-steel **OR** Bronze, **as directed**, header with copper-tube heat exchanger, mounted in a port of upper drum and sealed with fiber gasket.
 - 1) Tappings NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.
 - 2) Tappings NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
12. Trim for Steam Boilers:
- a. Include devices sized to comply with ANSI B31.1, "Power Piping **OR** ANSI B31.9, "Building Services Piping", **as directed**.
 - b. Pressure Controllers: Operating, firing rate, **as directed**, and high limit.
 - c. Safety Relief Valve:
 - 1) Size and Capacity: As required for equipment according to ASME Boiler and Pressure Vessel Code.
 - 2) Description: Fully enclosed steel spring with adjustable pressure range and positive shutoff; factory set and sealed.
 - a) Drip-Pan Elbow: Cast iron and having threaded inlet and outlet with threads complying with ASME B1.20.1.
 - d. Pressure Gage: Minimum 3-1/2-inch (89-mm) diameter. Gage shall have normal operating pressure about 50 percent of full range.
 - e. Water Column: Minimum 12-inch (300-mm) glass gage with shutoff cocks.
 - f. Drain Valves: Minimum NPS 3/4 (DN 20) or nozzle size with hose-end connection.
 - g. Blowdown Valves: Factory-installed bottom and surface, slow-acting blowdown valves same size as boiler nozzle. Blowdown valves shall be combination of slow and quick acting as required by ANSI B31.1, **as directed**.
 - h. Stop Valves: Boiler inlets and outlets, except safety relief valves or preheater inlet and outlet, shall be equipped with stop valve in an accessible location as near as practical to boiler nozzle and same size or larger than nozzle. Valves larger than NPS 2 (DN 50) shall have rising stem.
 - i. Stop-Check Valves: Factory-installed, stop-check valve and stop valve at boiler outlet with free-blow drain valve factory installed between the two valves and visible when operating stop-check valve.
 - j. Tankless Heater: Carbon-steel header with copper-tube heat exchanger, mounted in a port of upper manifold and sealed with fiber gasket.
 - 1) Tappings NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.
 - 2) Tappings NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
13. Controls:
- a. Refer to Division 23 Section "Instrumentation And Control For Hvac".
OR
Boiler operating controls shall include the following devices and features:
 - 1) Control transformer.
 - 2) Set-Point Adjust: Set points shall be adjustable.
 - 3) Operating Pressure Control for Steam Boilers: Factory wired and mounted to cycle burner.
 - 4) Low-Water Cutoff and Pump Control for Steam Boilers: Cycle feedwater pump(s) for makeup water control.



- 5) Sequence of Operation for Hot-Water Boilers: Electric, factory-fabricated and field-installed panel to control burner firing rate to maintain space temperature in response to thermostat with heat anticipator located in heated space.
OR
Sequence of Operation for Hot-Water Boilers: Electric, factory-fabricated and field-installed panel to control burner firing rate to reset supply-water temperature inversely with outside-air temperature. At 0 deg F (minus 17 deg C) outside-air temperature, set supply-water temperature at 200 deg F (93 deg C); at 60 deg F (15 deg C) outside-air temperature, set supply-water temperature at 140 deg F (60 deg C).
 - 6) Sequence of Operation for Steam Boilers: Electric, factory-fabricated and field-installed panel to control burner firing rate to maintain a constant steam pressure. Maintain pressure set point plus or minus 10 percent.
 - 7) Include automatic, alternating-firing sequence for multiple boilers to ensure maximum system efficiency throughout the load range and to provide equal runtime for boilers.
- b. Burner Operating Controls: To maintain safe operating conditions, burner safety controls limit burner operation.
- 1) High Cutoff: Manual **OR** Automatic, **as directed**, reset stops burner if operating conditions rise above maximum boiler design temperature for hot-water boiler or design pressure for steam boiler.
 - 2) Low-Water Cutoff Switch: Electronic (for hot-water boilers) or Float and electronic (for steam boilers) probe shall prevent burner operation on low water. Cutoff switch shall be manual **OR** automatic, **as directed**, -reset type.
 - 3) Blocked Vent Safety Switch (Atmospheric Boilers): Manual-reset switch factory mounted on draft diverter.
 - 4) Rollout Safety Switch (Atmospheric Boilers): Factory mounted on boiler combustion chamber.
 - 5) Audible Alarm: Factory mounted on control panel with silence switch; shall sound alarm for above conditions.
- c. Building Automation System Interface: Factory install hardware and software to enable building automation system to monitor, control, and display boiler status and alarms.
- 1) Monitoring: On/off status, common trouble alarm **OR** low water level alarm, **as directed**.
 - 2) Control: On/off operation, hot water supply temperature set-point adjustment **OR** steam pressure adjustment, **as directed**.
 - 3) A communication interface with building automation system shall enable building automation system operator to remotely control and monitor the boiler from an operator workstation. Control features available, and monitoring points displayed, locally at boiler control panel shall be available through building automation system.
- C. Electrical Power
1. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 22.
OR
Single-Point Field Power Connection: Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to boiler.
 - a. House in NEMA 250, Type 1 enclosure.
 - b. Wiring shall be numbered and color-coded to match wiring diagram.
 - c. Install factory wiring outside of an enclosure in a metal, **as directed**, raceway.
 - d. Field power interface shall be to wire lugs **OR** fused disconnect switch **OR** nonfused disconnect switch **OR** circuit breaker, **as directed**.
 - e. Provide branch power circuit to each motor and to controls with disconnect switch or circuit breaker, **as directed**.



- f. Provide each motor with overcurrent protection.

D. Venting Kits

1. Vent Damper (for Finned Water-Tube Boilers): Motorized, UL listed for use on atmospheric burner boiler equipped with draft hood; motor to open and close damper; stainless-steel vent coupling and damper blade; keyed wiring harness connector plug; and dual-position switches to permit burner operation.
2. Kit: Complete system, ASTM A 959, Type 29-4C, **as directed**, stainless steel, pipe, vent terminal, thimble, indoor plate, vent adapter, condensate trap, and sealant.
3. Combustion-Air Intake: Stainless steel, pipe, vent terminal with screen, inlet air coupling, and sealant.

E. Source Quality Control

1. Test and inspect factory-assembled boilers, before shipping, according to ASME Boiler and Pressure Vessel Code.
2. Burner and Hydrostatic Test (for Factory-Assembled Boilers): Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency; perform hydrostatic test.
3. Allow the Owner access to source quality-control testing of boilers. Notify the Owner 14 days in advance of testing.

1.3 EXECUTION

A. Boiler Installation

1. Install boilers level on concrete base. Concrete base is specified in Division 23 Section "Common Work Results For Hvac", and concrete materials and installation requirements are specified in Division 31.
2. Vibration Isolation: Elastomeric isolator pads **OR** mounts, **as directed**, with a minimum static deflection of 0.25 inch (6.35 mm). Vibration isolation devices and installation requirements are specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
3. Install gas-fired boilers according to NFPA 54.
4. Install oil-fired boilers according to NFPA 31.
5. Assemble boiler tubes in sequence and seal each tube joint.
6. Assemble and install boiler trim.
7. Install electrical devices furnished with boiler but not specified to be factory mounted.
8. Install control wiring to field-mounted electrical devices.

B. Connections

1. Piping installation requirements are specified in other Division 21. Drawings indicate general arrangement of piping, fittings, and specialties.
2. Install piping adjacent to boiler to allow service and maintenance.
3. Connect gas piping to boiler gas-train inlet with union. Piping shall be at least full size of gas train connection. Provide a reducer if required.
4. Connect oil piping full size to burner inlet with shutoff valve and union.
5. Connect hot-water piping to supply- and return-boiler tappings with shutoff valve and union or flange at each connection.
6. Connect steam and condensate piping to supply-, return-, and blowdown-boiler tappings with shutoff valve and union or flange at each connection.
7. Install piping from safety relief valves to nearest floor drain (for hot-water boilers).
8. Install piping from safety valves to drip-pan elbow and to nearest floor drain (for steam boilers).
9. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve if required.
10. Boiler Flue Venting (for Finned Water-Tube Boilers):
 - a. Install venting kit and combustion-air intake.



- b. Connect full size to boiler connections. Comply with requirements in Division 23 Section "Breechings, Chimneys, And Stacks".
 11. Connect breeching to full size of boiler outlet. Comply with requirements in Division 23 Section "Breechings, Chimneys, And Stacks" for venting materials.
 12. Install flue-gas recirculation duct from vent to burner. Comply with requirements in Division 23 Section "Breechings, Chimneys, And Stacks" for recirculation duct materials.
 13. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
 14. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".
- C. Field Quality Control
 1. Perform tests and inspections and prepare test reports.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
 2. Tests and Inspections:
 - a. Perform installation and startup checks according to manufacturer's written instructions.
 - b. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.
 - c. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.
 - d. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 1) Burner Test (for Field-Assembled Boilers): Adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency.
 - 2) Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level, and water temperature **OR** steam pressure, **as directed**.
 - 3) Set field-adjustable switches and circuit-breaker trip ranges as indicated.
 3. Remove and replace malfunctioning units and retest as specified above.
 4. Occupancy Adjustments: When requested within 12 months of date of Final Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.
 5. Performance Tests, as directed:
 - a. Engage a factory-authorized service representative to inspect component assemblies and equipment installations, including connections, and to conduct performance testing.
 - b. Boilers shall comply with performance requirements indicated, as determined by field performance tests. Adjust, modify, or replace equipment in order to comply.
 - c. Perform field performance tests to determine the capacity and efficiency of the boilers.
 - 1) For dual-fuel boilers, perform tests for each fuel.
 - 2) Test for full capacity.
 - 3) Test for boiler efficiency at low fire 20, 40, 60, 80, 100, 80, 60, 40 and 20, **as directed**, percent of full capacity. Determine efficiency at each test point.
 - d. Repeat tests until results comply with requirements indicated.
 - e. Provide analysis equipment required to determine performance.
 - f. Provide temporary equipment and system modifications necessary to dissipate the heat produced during tests if building systems are not adequate.
 - g. Notify the Owner in advance of test dates.
 - h. Document test results in a report and submit to the Owner.
- D. Demonstration
 1. Train the Owner's maintenance personnel to adjust, operate, and maintain boilers.

END OF SECTION 23 52 33 13



23 - Heating, Ventilating, And Air-Conditioning (HVAC)

Task	Specification	Specification Description
23 52 33 16	23 52 33 13	Water-Tube Boilers



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SECTION 23 52 36 00 - FIRE-TUBE BOILERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for fire-tube boilers. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes packaged, factory-fabricated and -assembled boilers, trim, and accessories for generating hot water **OR** steam, **as directed**, with the following configurations and burners:
 - a. Horizontal, fire-tube, Vertical, fire-tube, and Fire-box boiler.
 - b. Gas, Oil, and Combination gas and oil burner.

C. Submittals

1. Product Data: Include performance data, operating characteristics, furnished specialties, and accessories.
2. Shop Drawings: For boilers, boiler trim, and accessories. Include plans, elevations, sections, details, and attachments to other work.
 - a. Design calculations and vibration isolation base details, signed and sealed by a qualified professional engineer.
 - 1) Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
 - 2) Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails and equipment mounting frames.
 - b. Wiring Diagrams: Power, signal, and control wiring.
3. Manufacturer Seismic Qualification Certification: Submit certification that boiler, accessories, and components will withstand seismic forces defined in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment". Include the following:
4. Source quality-control test reports.
5. Field quality-control test reports.
6. Operation and maintenance data.
7. Warranty: Special warranty specified in this Section.
8. Other Informational Submittals:
 - a. ASME Stamp Certification and Report: Submit "A," "S," or "PP" stamp certificate of authorization, as required by authorities having jurisdiction, and document hydrostatic testing of piping external to boiler.
 - b. Startup service reports.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. ASME Compliance: Fabricate and label boilers to comply with ASME Boiler and Pressure Vessel Code.
3. ASHRAE/IESNA 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements."
4. UL Compliance: Test Boilers for compliance with UL 726, "Oil-Fired Boiler Assemblies" **OR** UL 726, "Oil-Fired Boiler Assemblies" and UL 795, "Commercial-Industrial Gas Heating Equipment" **OR** UL 795, "Commercial-Industrial Gas Heating Equipment", **as directed**. Boilers shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.



E. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace front- and rear-door refractories and heat exchangers of boilers that fail in materials or workmanship within specified warranty period.
 - a. Horizontal, Fire-Tube and Fire-Box Boilers: Refractory in front and rear doors, 10 years from date of startup by factory-authorized personnel.
 - b. Vertical, Fire-Tube Boilers and Heat Exchanger: Five years from date of Final Completion, if following water-treatment program recommended by manufacturer.

1.2 PRODUCTS

A. Manufactured Units - Horizontal, Fire-Tube Boilers

1. Description: Factory-fabricated, -assembled, and -tested, horizontal, fire-tube boilers with heat exchanger sealed pressure tight, built on a steel base; including insulated jacket, flue-gas vent, water supply and return connections, and controls.
2. Pressure Vessel Design: Straight, steel tubes rolled **OR** welded, **as directed**, into steel headers. Three **OR** Four, **as directed**, passes with dry-back **OR** wet-back, **as directed**, design. Minimum heat-exchanger surface of 5 sq. ft./bhp (2.1 sq. m/10 kW). Include the following accessories:
 - a. Handholes for water-side inspections.
 - b. Lifting lugs on top of boiler.
 - c. Minimum NPS 1 (DN 25) hose-end drain valves at shell low point.
 - d. For hot-water boilers only:
 - 1) Tappings or flanges for supply- and return-water piping.
 - 2) Built-in air separator.
 - e. For steam boilers only:
 - 1) Accessible drain and blowdown tappings, both high and low, for surface and mud removal.
 - 2) Tappings for steam supply, makeup, level controls, and chemical treatment.
3. Front and Rear Doors:
 - a. Bolted **OR** Hinged **OR** Davited, **as directed**, sealed with heat-resistant gaskets and fastened with lugs and cap screws.
 - b. Designed so tube sheets and flues are fully accessible for inspection or cleaning when doors are open.
 - c. Include observation ports in doors at both ends of boiler for inspection of flame conditions.
 - d. Door refractory **OR** insulation, **as directed**, shall be accessible for inspection and maintenance.
4. Casing:
 - a. Insulation: Minimum 2-inch- (50-mm-) thick, mineral-fiber insulation surrounding the boiler shell.
 - b. Flue Connection: Flange at top of boiler.
 - c. Jacket: Galvanized sheet **OR** Sheet, **as directed**, metal, with screw-fastened closures and baked-enamel **OR** powder-coated, **as directed**, protective finish.
 - d. Mounting base to secure boiler to concrete base.
 - 1) Seismic Fabrication Requirements: Fabricate mounting base and attachment to boiler, accessories, and components with reinforcement strong enough to withstand seismic forces defined in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment" when mounting base is anchored to building structure.
 - e. Control Compartment Enclosure: NEMA 250, Type 1 **OR** 4 **OR** 4X **OR** 12, **as directed**.
5. Barometric Damper: Galvanized-steel assembly with flue-gas thermometer having a minimum 3-1/2-inch- (89-mm-) diameter dial.

B. Manufactured Units - Vertical, Fire-Tube Boilers



1. Description: Factory-fabricated, -assembled, and -tested, vertical, fire-tube boilers with heat exchanger sealed pressure tight, built on a steel base; including insulated jacket, flue-gas vent, water supply and return connections, and controls.
 2. Pressure Vessel Design: Straight, steel pipe welded in a concentric pattern to separate flue-gas and heating media to form two **OR** four, **as directed**, passes with welded fins to improve heat transfer in secondary flue-gas passages. Include the following accessories:
 - a. Handholes for water-side inspections.
 - b. Lifting lugs on top of boiler.
 - c. Minimum NPS 1 (DN 25) hose-end drain valves at water passage low point.
 - d. For hot-water boilers only:
 - 1) Tappings or flanges for supply- and return-water piping.
 - 2) Built-in air separator.
 - e. For steam boilers only:
 - 1) Accessible drain and blowdown tappings, both high and low, for surface and mud removal.
 - 2) Tappings for steam supply, makeup, level controls, and chemical treatment.
 3. Combustion Chamber: Equipped with flame retainer to lengthen flame-residence time.
 4. Casing:
 - a. Insulation: Minimum 4-inch- (100-mm-) thick, mineral-fiber insulation surrounding the heat exchanger and combustion chamber.
 - b. Flue Connection: Top connection, constructed of aluminized **OR** stainless, **as directed**, steel.
 - c. Jacket: Mirror-finish stainless steel with screw-fastened closures.
OR
Jacket: Galvanized sheet **OR** Sheet, **as directed**, metal, with screw-fastened closures and baked-enamel **OR** powder-coated, **as directed**, protective finish.
 - d. Mounting base to secure boiler to concrete base.
 - 1) Seismic Fabrication Requirements: Fabricate mounting base and attachment to boiler, accessories, and components with reinforcement strong enough to withstand seismic forces defined in Division 22 Section "Identification For Plumbing Piping And Equipment" when mounting base is anchored to building structure.
 - e. Control Compartment Enclosure: NEMA 250, Type 1 **OR** 4 **OR** 4X **OR** 12, **as directed**.
 5. Barometric Damper: Galvanized-steel assembly with flue-gas thermometer having a minimum 3-1/2-inch- (89-mm-) diameter dial.
- C. Manufactured Units - Fire-Box Boilers
1. Description: Factory-fabricated, -assembled, and -tested, fire-box boilers with heat exchanger sealed pressure tight, built on a steel base; including insulated jacket, flue-gas vent, water supply and return connections, and controls.
 2. Pressure Vessel Design: Straight, steel tubes rolled **OR** welded, **as directed**, into steel headers. Three passes with wet-back design. Minimum heat-exchanger surface of 5 sq. ft./bhp (2.1 sq. m/10 kW). Include the following features and accessories:
 - a. Tube Size and Thickness: Minimum NPS 2 (DN 50), minimum 0.105 inch (2.667 mm) thick.
 - b. Brass washout plugs.
 - c. Steel turbulators.
 - d. Lifting lugs on top of boiler.
 - e. Minimum NPS 1 (DN 25) hose-end drain valves at shell low point.
 - f. For hot-water boilers only:
 - 1) Tappings or flanges for supply- and return-water piping.
 - 2) Built-in air separator.
 - g. For steam boilers only:
 - 1) Accessible drain and blowdown tappings, both high and low, for surface and mud removal.
 - 2) Tappings for steam supply, makeup, level controls, and chemical treatment.



3. Combustion Chamber: Welded steel, waterwall and -floor design **OR** water-leg design with refractory insulation poured in the floor, **as directed**. Flame observation port.
4. Casing:
 - a. Insulation: Minimum 2-inch- (50-mm-) thick, foil-backed, **as directed**, mineral-fiber insulation surrounding the boiler shell.
 - b. Insulated removable smoke boxes and reversing chamber cover.
 - c. Flue Connection: Steel top **OR** rear, **as directed**.
 - d. Jacket: Sheet metal, with screw-fastened closures and baked-enamel **OR** powder-coated, **as directed**, protective finish.
 - e. Control Compartment Enclosure: NEMA 250, Type 1 **OR** 1A **OR** 4 **OR** 4X **OR** 12, **as directed**.
 - f. Mounting base to secure boiler to concrete base.
 - 1) Seismic Fabrication Requirements: Fabricate mounting base and attachment to boiler, accessories, and components with reinforcement strong enough to withstand seismic forces defined in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment" when mounting base is anchored to building structure.
5. Barometric Damper: Galvanized-steel assembly with flue-gas thermometer having a minimum 3-1/2-inch- (89-mm-) diameter dial.

D. Burner For Forced-Draft Gas Burners

1. Burner: Welded construction with multivane, stainless-steel, flame-retention diffuser for natural **OR** propane, **as directed**, gas. Mount burner on hinged access door to permit access to combustion chamber, **as directed**.
2. Blower: Forward-curved centrifugal fan integral to burner, directly driven by motor; with adjustable, dual-blade damper assembly and locking quadrant to set air-fuel ratio.
 - a. Motors: Comply with requirements specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - 1) Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
3. Gas Train: Control devices and modulating **OR** on-off **OR** low-high-low, **as directed**, control sequence shall comply with requirements in ASME CSD-1 **OR** FMG **OR** IRI **OR** UL, **as directed**.
4. Pilot: Intermittent **OR** Interrupted, **as directed**, -electric-spark pilot ignition with 100 percent main-valve and pilot-safety shutoff with electronic supervision of burner flame.
5. Flue-Gas Recirculation: Burner connections shall be equipped for recirculating flue gas.
 - a. Maximum Oxides of Nitrogen Emissions: 20 **OR** 30, **as directed**, ppm.

E. Burner For Oil Burners

1. Burner: Welded construction with multivane, stainless-steel, flame-retention diffuser for fuel oil. Mount burner on hinged access door to permit access to combustion chamber, **as directed**.
2. Blower: Forward-curved centrifugal fan integral to burner, directly driven by motor; with adjustable, dual-blade damper assembly and locking quadrant to set air-fuel ratio.
 - a. Motors: Comply with requirements specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - 1) Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
3. Oil Supply: Control devices and modulating **OR** on-off **OR** low-high-low, **as directed**, control sequence shall comply with requirements in ASME CSD-1 **OR** FMG **OR** IRI **OR** UL, **as directed**.
 - a. Oil Pump: Two-stage, gear-type oil pump integral to and directly driven by blower, **as directed**, shall be capable of producing 300-psig (2070-kPa) discharge pressure and 15-inch Hg (50.7-kPa) vacuum.
 - b. Oil Piping Specialties:
 - 1) Suction-line, manual, gate valve.
 - 2) Removable-mesh oil strainer.
 - 3) 0- to 30-inch Hg (0- to 101.3-kPa) vacuum; 0- to 30-psig (0- to 207-kPa) vacuum-pressure gage.



- 4) 0- to 300-psig (0- to 2070-kPa) oil-nozzle pressure gage.
 - 5) Nozzle-line, solenoid-safety-shutoff oil valve.
 4. Pilot: Intermittent **OR** Interrupted, **as directed**, -electric-spark pilot ignition with 100 percent main-valve and pilot-safety shutoff solenoid with cadmium sulfide **OR** UV scanner, **as directed**, flame-safety control.
 5. Flue-Gas Recirculation: Burner connections shall be equipped for recirculating flue gas.
 - a. Maximum Oxides of Nitrogen Emissions: 30 ppm.
- F. Burner For Combination Gas And Oil Burners
1. Burner: Welded construction with multivane, stainless-steel, flame-retention diffuser for fuel oil and natural **OR** propane, **as directed**, gas. Mount burner on hinged access door to permit access to combustion chamber, **as directed**.
 2. Blower: Forward-curved centrifugal fan integral to burner, directly driven by motor; with adjustable, dual-blade damper assembly and locking quadrant to set air-fuel ratio.
 - a. Motors: Comply with requirements specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - 1) Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 3. Oil Supply: Control devices and modulating **OR** on-off **OR** low-high-low, **as directed**, control sequence shall comply with requirements in ASME CSD-1 **OR** FMG **OR** IRI **OR** UL, **as directed**.
 - a. Oil Pump: Two-stage, gear-type oil pump integral to and directly driven by blower, **as directed**, shall be capable of producing 300-psig (2070-kPa) discharge pressure and 15-inch Hg (50.7-kPa) vacuum.
 - b. Oil Piping Specialties:
 - 1) Suction-line, manual, gate valve.
 - 2) Removable-mesh oil strainer.
 - 3) 0- to 30-inch Hg (0- to 101.3-kPa) vacuum; 0- to 30-psig (0- to 207-kPa) vacuum-pressure gage.
 - 4) 0- to 300-psig (0- to 2070-kPa) oil-nozzle pressure gage.
 - 5) Nozzle-line, solenoid-safety-shutoff oil valve.
 4. Gas Train: Control devices and modulating **OR** on-off **OR** low-high-low, **as directed**, control sequence shall comply with requirements in ASME CSD-1 **OR** FMG **OR** IRI **OR** UL, **as directed**.
 5. Gas Pilot: Intermittent **OR** Interrupted, **as directed**, -electric-spark pilot ignition with 100 percent main-valve and pilot-safety shutoff with electronic supervision of burner flame.
 6. Oil Pilot: Intermittent **OR** Interrupted, **as directed**, -electric-spark pilot ignition with 100 percent main-valve and pilot-safety shutoff solenoid with cadmium sulfide **OR** UV scanner, **as directed**, flame-safety control.
 7. Flue-Gas Recirculation: Burner connections shall be equipped for recirculating flue gas.
 - a. Maximum Oxides of Nitrogen Emissions: 20 **OR** 30, **as directed**, ppm.
- G. Trim For Hot-Water Boilers
1. Include devices sized to comply with ANSI B31.1, "Power Piping **OR** ANSI B31.9, "Building Services Piping", **as directed**.
 2. Aquastat Controllers: Operating, firing rate, **as directed**, and high limit.
 3. Safety Relief Valve: ASME rated.
 4. Pressure and Temperature Gage: Minimum 3-1/2-inch- (89-mm-) diameter, combination water-pressure and -temperature gage. Gages shall have operating-pressure and -temperature ranges so normal operating range is about 50 percent of full range.
 5. Boiler Air Vent: Automatic **OR** Manual, **as directed**.
 6. Drain Valve: Minimum NPS 3/4 (DN 20) hose-end gate valve.
 7. Tankless Heater: Carbon-steel **OR** Bronze, **as directed**, header with copper-tube heat exchanger, mounted in a port of upper drum and sealed with fiber gasket.
 - a. Tappings NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.



- b. Tappings NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.

H. Trim For Steam Boilers

1. Include devices sized to comply with ANSI B31.1, "Power Piping **OR** ANSI B31.9, "Building Services Piping", **as directed**.
2. Pressure Controllers: Operating, firing rate, **as directed**, and high limit.
3. Safety Relief Valve:
 - a. Size and Capacity: As required for equipment according to ASME Boiler and Pressure Vessel Code.
 - b. Description: Fully enclosed steel spring with adjustable pressure range and positive shutoff; factory set and sealed.
 - 1) Drip-Pan Elbow: Cast iron and having threaded inlet and outlet with threads complying with ASME B1.20.1.
4. Pressure Gage: Minimum 3-1/2-inch (89-mm) diameter. Gage shall have normal operating pressure about 50 percent of full range.
5. Water Column: Minimum 12-inch (300-mm) glass gage with shutoff cocks.
6. Drain Valves: Minimum NPS 3/4 (DN 20) or nozzle size with hose-end connection.
7. Blowdown Valves: Factory-installed bottom and surface, slow-acting blowdown valves same size as boiler nozzle. Blowdown valves shall be combination of slow and quick acting as required by ANSI B31.1, **as directed**.
8. Stop Valves: Boiler inlets and outlets, except safety relief valves or preheater inlet and outlet, shall be equipped with stop valve in an accessible location as near as practical to boiler nozzle and same size or larger than nozzle. Valves larger than NPS 2 (DN 50) shall have rising stem.
9. Stop-Check Valves: Factory-installed, stop-check valve and stop valve for field installation at boiler outlet with free-blow drain valve for field installation between the two valves and visible when operating stop-check valve.
10. Tankless Heater: Carbon-steel header with copper-tube heat exchanger, mounted in a port of upper manifold and sealed with fiber gasket.
 - a. Tappings NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.
 - b. Tappings NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.

I. Controls

1. Refer to Division 23 Section "Instrumentation And Control For Hvac".
OR
Boiler operating controls shall include the following devices and features:
 - a. Control transformer.
 - b. Set-Point Adjust: Set points shall be adjustable.
 - c. Operating Pressure Control for steam boilers: Factory wired and mounted to cycle burner.
 - d. Low-Water Cutoff and Pump Control for steam boilers: Cycle feedwater pump(s) **OR** Operate feedwater pump(s) continuously and modulate valve, **as directed**, for makeup water control.
 - e. Sequence Of Operation For Hot-Water Boilers: Electric, factory-fabricated and field-installed panel to control burner firing rate to maintain space temperature in response to thermostat with heat anticipator located in heated space.
OR
Sequence Of Operation For Hot-Water Boilers: Electric, factory-fabricated and field-installed panel to control burner firing rate to reset supply-water temperature inversely with outside-air temperature. At 0 deg F (minus 17 deg C) outside-air temperature, set supply-water temperature at 200 deg F (93 deg C); at 60 deg F (15 deg C) outside-air temperature, set supply-water temperature at 140 deg F (60 deg C).



- f. Sequence Of Operation For Steam Boilers: Electric, factory-fabricated and field-installed panel to control burner firing rate to maintain a constant steam pressure. Maintain pressure set point plus or minus 10 percent.
 - 1) Include automatic, alternating-firing sequence for multiple boilers to ensure maximum system efficiency throughout the load range and to provide equal runtime for boilers.
 2. Burner Operating Controls: To maintain safe operating conditions, burner safety controls limit burner operation.
 - a. High Cutoff: Manual **OR** Automatic, **as directed**, reset stops burner if operating conditions rise above maximum boiler design temperature for hot-water boiler **OR** design pressure for steam boiler, **as directed**.
 - b. Low-Water Cutoff Switch: Electronic for hot-water boilers **OR** Float and electronic for steam boilers, **as directed**, probe shall prevent burner operation on low water. Cutoff switch shall be manual **OR** automatic, **as directed**, -reset type.
 - c. Audible Alarm: Factory mounted on control panel with silence switch; shall sound alarm for above conditions.
 3. Building Automation System Interface: Factory-install hardware and software to enable building automation system to monitor, control, and display boiler status and alarms.
 - a. Hardwired Points:
 - 1) Monitoring: On/off status, common trouble alarm **OR** low water level alarm, **as directed**.
 - 2) Control: On/off operation, hot water supply temperature set-point adjustment **OR** steam pressure adjustment, **as directed**.
 - b. A communication interface with building automation system shall enable building automation system operator to remotely control and monitor the boiler from an operator workstation. Control features available, and monitoring points displayed, locally at boiler control panel shall be available through building automation system.
- J. Electrical Power
1. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 22..
OR
Single-Point Field Power Connection: Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to boiler.
 - a. House in NEMA 250, Type 1 **OR** 4 **OR** 4X **OR** 12, **as directed**, enclosure.
 - b. Wiring shall be numbered and color-coded to match wiring diagram.
 - c. Install wiring outside of an enclosure in a metal, **as directed**, raceway.
 - d. Field power interface shall be to wire lugs **OR** fused disconnect switch **OR** nonfused disconnect switch **OR** circuit breaker, **as directed**.
 - e. Provide branch power circuit to each motor and to controls with a disconnect switch or circuit breaker, **as directed**.
 - f. Provide each motor with overcurrent protection.
- K. Source Quality Control
1. Test and inspect factory-assembled boilers, before shipping, according to ASME Boiler and Pressure Vessel Code.
 2. Burner and Hydrostatic Test for factory-assembled boilers: Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency; perform hydrostatic test.
 3. Allow the Owner access to source quality-control testing of boilers. Notify the Owner 14 days in advance of testing.



1.3 EXECUTION

A. Boiler Installation

1. Install boilers level on concrete base. Concrete base is specified in Division 23 Section "Common Work Results For Hvac", and concrete materials and installation requirements are specified in Division 31.
2. Vibration Isolation: Elastomeric isolator pads **OR** mounts, **as directed**, with a minimum static deflection of 0.25 inch (6.35 mm). Vibration isolation devices and installation requirements are specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
3. Install gas-fired boilers according to NFPA 54.
4. Install oil-fired boilers according to NFPA 31.
5. Assemble and install boiler trim.
6. Install electrical devices furnished with boiler but not specified to be factory mounted.
7. Install control wiring to field-mounted electrical devices.

B. Connections

1. Piping installation requirements are specified in other Division 21. Drawings indicate general arrangement of piping, fittings, and specialties.
2. Install piping adjacent to boiler to allow service and maintenance.
3. Connect gas piping to boiler gas-train inlet with union. Piping shall be at least full size of gas train connection. Provide a reducer if required.
4. Connect oil piping full size to burner inlet with shutoff valve and union.
5. Connect hot-water piping to supply- and return-boiler tapplings with shutoff valve and union or flange at each connection.
6. Connect steam and condensate piping to supply-, return-, and blowdown-boiler tapplings with shutoff valve and union or flange at each connection.
7. Install piping from safety relief valves to nearest floor drain, for hot-water boilers.
8. Install piping from safety valves to drip-pan elbow and to nearest floor drain, for steam boilers.
9. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve if required.
10. Connect breeching full size to boiler outlet. Comply with requirements in Division 23 Section "Breechings, Chimneys, And Stacks" for venting materials.
11. Install flue-gas recirculation duct from vent to burner. Comply with requirements in Division 23 Section "Breechings, Chimneys, And Stacks" for recirculation duct materials.
12. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
13. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

C. Field Quality Control

1. Perform tests and inspections and prepare test reports.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Tests and Inspections:
 - a. Perform installation and startup checks according to manufacturer's written instructions.
 - b. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.
 - c. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.
 - d. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 1) Burner Test for field-assembled boilers: Adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency.



- 2) Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level, and water temperature **OR** steam pressure, **as directed**.
- 3) Set field-adjustable switches and circuit-breaker trip ranges as indicated.
3. Remove and replace malfunctioning units and retest as specified above.
4. Occupancy Adjustments: When requested within 12 months of date of Final Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.
5. Performance Tests, **as directed**:
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect component assemblies and equipment installations, including connections, and to conduct performance testing.
 - b. Boilers shall comply with performance requirements indicated, as determined by field performance tests. Adjust, modify, or replace equipment in order to comply.
 - c. Perform field performance tests to determine the capacity and efficiency of boilers.
 - 1) For dual-fuel boilers, perform tests for each fuel.
 - 2) Test for full capacity.
 - 3) Test for boiler efficiency at low fire, 20, 40, 60, 80, 100, 80, 60, 40 and 20, **as directed**, percent of full capacity. Determine efficiency at each test point.
 - d. Repeat tests until results comply with requirements indicated.
 - e. Provide analysis equipment required to determine performance.
 - f. Provide temporary equipment and system modifications necessary to dissipate the heat produced during tests if building systems are not adequate.
 - g. Notify the Owner in advance of test dates.
 - h. Document test results in a report and submit to the Owner.

D. Demonstration

1. Train the Owner's maintenance personnel to adjust, operate, and maintain boilers.

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SECTION 23 53 16 00 - FEEDWATER EQUIPMENT

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for feedwater equipment. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Feedwater pumps and receivers.
 - b. Vacuum-type feedwater pumps and receivers.

C. Definition

1. NPSH: Net-positive suction head.

D. Submittals

1. Product Data: For each type of product indicated. Include rated capacity, temperature and NPSH required, pump performance curves with selection points clearly indicated, and furnished specialties and accessories.
2. Shop Drawings: Include plans, elevations, sections, details, dimensions, weights, loadings, required clearances, method of field assembly, and attachments to other work.
 - a. Wiring Diagrams: Power, signal, and control wiring.
3. Manufacturer Seismic Qualification Certification: Submit certification that feedwater equipment, accessories, and components will withstand seismic forces defined in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
4. Field quality-control test reports.
5. Operation and Maintenance Data.

E. Quality Assurance

1. Regulatory Requirements: Fabricate and test unit according to ASME PTC 12.1, "Closed Feedwater Heaters."
2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
3. ASME Compliance: ASME B31.1, "Power Piping," for systems more than 15 psig (104 kPa); ASME B31.9, "Building Services Piping," for systems equal to or less than 15 psig (104 kPa). Safety valves and pressure vessels shall bear the appropriate ASME label.

F. Delivery, Storage, And Handling

1. Preparation for Shipping: Clean flanges and exposed-metal surfaces and treat with anticorrosion compound after assembly and testing. Protect flanges, pipe openings, and nozzles with wooden flange covers or with screwed-in plugs.
2. Store units in dry location.
3. Retain protective flange covers and machined-surface protective coatings during storage.
4. Protect bearings and couplings against damage from sand, grit, and other foreign matter.
5. Comply with manufacturer's written rigging instructions.

1.2 PRODUCTS

A. Feedwater Units



1. Description: Factory-assembled and -tested unit consisting of a receiver, simplex **OR** duplex, **as directed**, feedwater pumps, controls, and the following features and accessories:
 - a. Liquid-filled industrial **OR** Bimetal dial-type, **as directed**, thermometer graduated in Fahrenheit **OR** Celsius **OR** both Fahrenheit and Celsius, **as directed**.
 - b. Level gage glass, reflex flat type, **as directed**, with stops at top and bottom.
 - c. Lifting eyes.
 - d. Companion flanges.
 - e. Pump, suction and discharge isolation valve, inlet strainer, discharge check valve, and liquid-filled pressure gage.
 - f. Makeup Water Assembly: Float operated with integral valve **OR** Electric level controller and valve, **as directed**; with inlet strainer and three-valve bypass.
 - g. Feedwater Heater: Sparge tube, thermostat, and control valve.
 - h. Factory-Installed Pipe, NPS 2-1/2 (DN 65) and Smaller: ASTM A 53/A 53M, Type S (seamless), Grade B; or ASTM A 106, Type S, Grade B, Schedule 40 **OR** 80, **as directed**; with threaded joints and fittings.
 - 1) Cast-Iron Threaded Fittings: ASME B16.4; Class 125 **OR** 250, **as directed**.
 - 2) Malleable-Iron Threaded Fittings: ASME B16.3, Class 150 **OR** 300, **as directed**.
 - 3) Forged-Steel Fittings: ASME B16.11, Class 3000.
 - 4) Malleable-Iron Unions: ASME B16.39; Class 150 **OR** 300, **as directed**.
 - 5) Forged-Steel Unions: MSS SP-83, Class 3000.
 - i. Factory-Installed Pipe, NPS 3 (DN 80) and Larger: ASTM A 53/A 53M, Type E (electric-resistance welded), Grade B; or ASTM A 106, Type S, Grade B, Schedule 40 **OR** 80, **as directed**; with welded joints and carbon-steel fittings and flanges.
 - 1) Wrought-Steel Fittings: ASME B16.9, wall thickness to match adjoining pipe.
 - 2) Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, Class 150 **OR** 300, **as directed**, including bolts, nuts, and gaskets.
2. Receiver:
 - a. Material: Close-grain cast iron **OR** Welded carbon steel **OR** Welded carbon steel galvanized after fabrication **OR** Stainless steel, **as directed**.
 - b. Additional corrosion protection:
 - 1) 0.07-inch (1.8-mm) **OR** 0.13-inch (3.3-mm) **OR** 0.19-inch (4.8-mm), **as directed**, thickness allowance.
 - 2) Electrolytic corrosion-inhibitor anode.
 - c. Finish: Primer **OR** Primer under enamel topcoat **OR** Primer under epoxy topcoat, **as directed**.
 - d. Factory-Applied Insulation and Jacket: Minimum thickness of 2 inches (50 mm) for mineral-fiber pipe and tank insulation. Cover insulation with painted steel **OR** stucco-embossed aluminum **OR** stainless-steel, **as directed**, jacket.
 - e. Mounting Arrangement: Recessed below floor **OR** Floor mounted, **as directed**.
 - f. Mounting Frame: Structural-steel stand to support receiver and pumps. Fabricate stand with bracing adequate for seismic forces according to authorities having jurisdiction and to allow anchoring mounting frame to floor, **as directed**.
3. Vertical Feedwater Pump: Flange-mounted, close-coupled, single-stage, **OR** multistage, **as directed**, radially split-case-design centrifugal pump; rated for 175-psig (1205-kPa) minimum working pressure and a continuous water temperature of at least 225 deg F (107 deg C); with the following features:
 - a. Impeller: Bronze **OR** Stainless steel, **as directed**.
 - b. Seals: Mechanical.
 - c. Motor: Open dripproof **OR** Totally enclosed **OR** Totally enclosed fan-cooled, **as directed**, enclosure. Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".
4. Horizontal Feedwater Pump: Base-mounted, single-stage, **OR** multistage, **as directed**, radially split-case-design centrifugal pump; rated for 175-psig (1205-kPa) minimum working pressure and a continuous water temperature of at least 225 deg F (107 deg C); with the following features:
 - a. Impeller: Bronze **OR** Stainless steel, **as directed**.



- b. Coupling: Close **OR** Flexible, **as directed**.
 - c. Seals: Mechanical.
 - d. Motor: Open dripproof **OR** Totally enclosed **OR** Totally enclosed fan-cooled, **as directed**, enclosure. Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".
5. Control panel shall be unit mounted and factory wired and include the following:
- a. NEMA 250, Type 1 **OR** 4 **OR** 4X **OR** 12, **as directed**, enclosure.
 - b. Single-point field power interface to fused disconnect switch **OR** nonfused disconnect switch **OR** circuit breaker, **as directed**.
 - 1) Branch power circuit to each motor and to controls with a disconnect switch or circuit breaker, **as directed**.
 - c. NEMA-rated motor controller for each motor, and include a hand-off-auto switch and overcurrent protection.
 - 1) Alternating controls for duplex units with intermittent operation as indicated by control sequence.
 - d. Terminal blocks with numbered and color-coded wiring to match wiring diagram.
 - e. Wiring outside of an enclosure in a metal, **as directed**, raceway. Make connections to motor with liquidtight conduit.
 - f. Removable control mounting plate.
 - g. Visual indication of status and alarm with momentary test push button, **as directed**.
 - h. Audible alarm and silence switch.
 - i. Visual indication of elapsed run time, graduated in hours.
 - j. Fused control-circuit transformer.
 - k. Microprocessor-based controller.
6. Feedwater Simplex-Pump Control Sequence:
- a. Boiler water-level controller starts and stops pump to maintain boiler water-level set point.
 - b. Visual indication of pump on and off, **as directed**, status.
 - c. Visual and audible, **as directed**, alarm indication of pump failure.
7. Feedwater Duplex-Pump Control Sequence (for duplex-pump units with operating and standby pump):
- a. Boiler water-level controller starts and stops lead pump to maintain boiler water-level set point.
 - b. Lead and lag pumps alternate after each start **OR** to equalize run time, **as directed**.
 - c. Lead pump failure, lag pump automatically starts if lead pump cannot maintain set point **OR** is started manually, **as directed**.
 - d. Visual indication of pump on and off, **as directed**, status.
 - e. Visual indication of pump lead/lag status.
 - f. Visual and audible, **as directed**, alarm indication of pump failure.
8. Feedwater Duplex-Pump Control Sequence (for duplex-pump units with continuous pump operation and modulating control valve):
- a. Pump runs continuously while boiler operates. Electric interlock with boiler control starts lead pump when boiler starts.
 - b. Boiler water-level controller modulates feedwater control valve to maintain boiler water-level set point. Valve closes when boiler is off.
 - c. Lead and lag pumps alternate after each start **OR** to equalize run time, **as directed**.
 - d. Lead pump failure automatically starts lag pump.
OR
Feedwater pressure controller starts and stops lag pump to maintain feedwater pressure set point.
 - e. Visual indication of pump on and off, **as directed**, status.
 - f. Visual indication of pump lead/lag status.
 - g. Visual and audible, **as directed**, alarm indication of pump failure.
9. Receiver Makeup Water Control Sequence:
- a. Electric level controller operates electric control valve to maintain receiver water-level set point.
OR



- Mechanical float operates integral valve to maintain water-level set point.
- b. Visual and audible, **as directed**, alarm indication of low and high, **as directed**, receiver-water level.
10. Building Management System Interface: Factory install hardware to enable building management system to monitor and display points.
- a. Hardwired Monitoring Points: On/off status for each pump, failure alarm for each pump, receiver low-water-level alarm, receiver high-water-level alarm, feedwater temperature, **as directed**.
- B. Feedwater Unit With Vacuum Producer
1. Description: Receiver mounted, consisting of multijet vacuum producer, centrifugal pump and motor assembly mounted on separation chamber, and automatic pressure and water temperature controls. Include the following accessories:
 - a. Liquid-filled industrial **OR** Bimetal dial-type, **as directed**, thermometer graduated in Fahrenheit **OR** Celsius **OR** both Fahrenheit and Celsius, **as directed**.
 - b. Vacuum Gage: Dial-type register in inches of mercury (kPa).
 - c. Level Gage Glass: Stops top and bottom.
 - d. Air-suction check valve.
 - e. Lifting eyes.
 - f. Companion flanges.
 - g. Low-water cutoff switch.
 - h. Cooling-Water Control: Aquastat, inlet strainer, and electric valve.
 - i. Air vent.
 - j. Overflow drain from vacuum-producer receiver.
 - k. Factory-Installed Pipe, NPS 2-1/2 (DN 65) and Smaller: ASTM A 53/A 53M, Type S (seamless), Grade B; or ASTM A 106, Type S, Grade B, Schedule 40 **OR** 80, **as directed**; with threaded joints and fittings.
 - 1) Cast-Iron Threaded Fittings: ASME B16.4; Class 125 **OR** 250, **as directed**.
 - 2) Malleable-Iron Threaded Fittings: ASME B16.3, Class 150 **OR** 300, **as directed**.
 - 3) Forged-Steel Fittings: ASME B16.11, Class 3000.
 - 4) Malleable-Iron Unions: ASME B16.39; Class 150 **OR** 300, **as directed**.
 - 5) Forged-Steel Unions: MSS SP-83, Class 3000.
 - l. Factory-Installed Pipe, NPS 3 (DN 80) and Larger: ASTM A 53/A 53M, Type E (electric-resistance welded), Grade B; or ASTM A 106, Type S, Grade B, Schedule 40 **OR** 80, **as directed**; with welded joints and carbon-steel fittings and flanges.
 - 1) Wrought-Steel Fittings: ASME B16.9, wall thickness to match adjoining pipe.
 - 2) Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, Class 150 **OR** 300, **as directed**, including bolts, nuts, and gaskets.
 2. Vacuum-Producer Reservoir and Vacuum Receiver:
 - a. Material: Close-grain cast iron **OR** Welded carbon steel **OR** Welded carbon steel galvanized after fabrication **OR** Stainless steel, **as directed**.
 - b. Additional corrosion protection:
 - 1) 0.07-inch (1.8-mm) **OR** 0.13-inch (3.3-mm) **OR** 0.19-inch (4.8-mm), **as directed**, thickness allowance.
 - 2) Electrolytic corrosion-inhibitor anode.
 - c. Finish: Primer **OR** Primer under enamel topcoat **OR** Primer under epoxy topcoat, **as directed**.
 - d. Factory-Applied Insulation and Jacket: Minimum thickness of 2 inches (50 mm) for mineral-fiber pipe and tank insulation. Cover insulation with painted steel **OR** stucco-embossed aluminum **OR** stainless-steel, **as directed**, jacket.
 - e. Mounting Arrangement: Recessed below floor **OR** Floor mounted, **as directed**.
 - f. Mounting Frame: Structural-steel stand to support receiver and pumps. Fabricate stand with bracing adequate for seismic forces according to authorities having jurisdiction and to allow anchoring mounting frame to floor, **as directed**.



3. Vertical Vacuum-Producer Pump: Flange-mounted, close-coupled, single-stage, radially split-case-design centrifugal pump; rated for 175-psig (1205-kPa) minimum working pressure and a continuous water temperature of at least 225 deg F (107 deg C); with the following features:
 - a. Impeller: Bronze.
 - b. Shaft: Stainless steel.
 - c. Seals: Mechanical.
 - d. Motor: Open dripproof **OR** Totally enclosed **OR** Totally enclosed fan-cooled, **as directed**, enclosure. Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".
4. Horizontal Vacuum-Producer Pump: Base-mounted, single-stage, radially split-case-design centrifugal pump; rated for 175-psig (1205-kPa) minimum working pressure and a continuous water temperature of at least 225 deg F (107 deg C); with the following features:
 - a. Impeller: Bronze.
 - b. Shaft: Stainless steel.
 - c. Coupling: Close **OR** Flexible, **as directed**.
 - d. Seals: Mechanical.
 - e. Motor: Open dripproof **OR** Totally enclosed **OR** Totally enclosed fan-cooled, **as directed**, enclosure. Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".
5. Vertical Feedwater Pump: Flange-mounted, close-coupled, single-stage, **OR** multistage, **as directed**, radially split-case-design centrifugal pump; rated for 175-psig (1205-kPa) minimum working pressure and a continuous water temperature of at least 225 deg F (107 deg C); with the following features:
 - a. Impeller: Bronze **OR** Stainless steel, **as directed**.
 - b. Seals: Mechanical.
 - c. Motor: Open dripproof **OR** Totally enclosed **OR** Totally enclosed fan-cooled, **as directed**, enclosure. Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".
6. Horizontal Feedwater Pump: Base-mounted, single-stage, **OR** multistage, **as directed**, radially split-case-design centrifugal pump; rated for 175-psig (1205-kPa) minimum working pressure and a continuous water temperature of at least 225 deg F (107 deg C); with the following features:
 - a. Impeller: Bronze **OR** Stainless steel, **as directed**.
 - b. Coupling: Close **OR** Flexible, **as directed**.
 - c. Seals: Mechanical.
 - d. Motor: Open dripproof **OR** Totally enclosed **OR** Totally enclosed fan-cooled, **as directed**, enclosure. Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".
7. Control panel shall be unit mounted and factory wired and include the following:
 - a. Vacuum Switches for Simplex Vacuum-Producer Pumps: Include pressure adjustment, and test push button. Factory set to operate pump between 3 and 6 inches of mercury (10.1 and 20.2 kPa).
OR
Vacuum Switches for Duplex Vacuum-Producer Pumps: Include pressure adjustment, and test push button. Factory set so one pump operates for 3 to 5 inches of mercury (10.1 to 16.9 kPa) and both pumps operate for 4 to 6 inches of mercury (13.5 to 20.2 kPa).
 - b. NEMA 250, Type 1 **OR** 4 **OR** 4X **OR** 12, **as directed**, enclosure.
 - c. Single-point field power interface to fused disconnect switch **OR** nonfused disconnect switch **OR** circuit breaker, **as directed**.
 - 1) Branch power circuit to each motor and to controls with a disconnect switch or circuit breaker, **as directed**.
 - d. NEMA-rated motor controller for each motor and include a hand-off-auto switch and overcurrent protection.
 - 1) Alternating control for units with intermittent operation as indicated by control sequence.
 - e. Terminal blocks with numbered and color-coded wiring to match wiring diagram.



- f. Wiring outside of an enclosure in a metal, **as directed**, raceway. Make connections to motor with liquidtight conduit.
- g. Removable control mounting plate.
- h. Visual indication of status and alarm with momentary test push button, **as directed**.
- i. Audible alarm and silence switch.
- j. Visual indication of elapsed run time, graduated in hours.
- k. Fused control-circuit transformer.
8. Vacuum-Producer Control Sequence:
 - a. Cycle pumps to maintain vacuum-pressure set point.
 - b. Visual indication of pump on and off, **as directed**, status.
 - c. Visual and audible, **as directed**, alarm indication of pump failure.
9. Feedwater Simplex-Pump Control Sequence:
 - a. Boiler water-level controller starts and stops pump to maintain boiler water-level set point.
 - b. Visual indication of pump on and off, **as directed**, status.
 - c. Visual and audible, **as directed**, alarm indication of pump failure.
10. Feedwater Duplex-Pump Control Sequence (for duplex-pump units with operating and standby pump):
 - a. Boiler water-level controller starts and stops lead pump to maintain boiler water-level set point.
 - b. Lead and lag pumps alternate after each start **OR** to equalize run time, **as directed**.
 - c. Lead pump failure, lag pump automatically starts if lead pump cannot maintain set point **OR** is started manually, **as directed**.
 - d. Visual indication of pump on and off, **as directed**, status.
 - e. Visual indication of pump lead/lag status.
 - f. Visual and audible, **as directed**, alarm indication of pump failure.
11. Feedwater Duplex-Pump Control Sequence (for duplex-pump units with continuous pump operation and modulating control valve):
 - a. Pump runs continuously while boiler operates. Electric interlock with boiler control starts lead pump when boiler starts.
 - b. Boiler water-level controller modulates feedwater control valve to maintain boiler water-level set point. Valve closes when boiler is off.
 - c. Lead and lag pumps alternate after each start **OR** to equalize run time, **as directed**.
 - d. Lead pump failure automatically starts lag pump.
OR
Feedwater pressure controller starts and stops lag pump to maintain feedwater pressure set point.
 - e. Visual indication of pump on and off, **as directed**, status.
 - f. Visual indication of pump lead/lag status.
 - g. Visual and audible, **as directed**, alarm indication of pump failure.
12. Makeup Water Control Sequence:
 - a. Electric level controller operates electric control valve to maintain water temperature set point.
 - b. Visual and audible, **as directed**, alarm indication of low and high, **as directed**, water level.
13. Building Management System Interface: Factory install hardware to enable building management system to monitor and display points.
 - a. Hardwired Monitoring Points: On/off status for each pump, failure alarm for each pump, receiver low-water-level alarm, receiver high-water-level alarm, feedwater temperature, **as directed**.

1.3 EXECUTION

A. Installation



1. Install feedwater unit level on concrete base. Concrete base is specified in Division 23 Section "Common Work Results For Hvac", and concrete materials and installation requirements are specified in Division 31.
 2. Vibration Isolation: Elastomeric isolator pads **OR** mounts, **as directed**, with a minimum static deflection of 0.25 inch (6.35 mm). Vibration isolation devices and installation requirements are specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 3. Install unit to permit access for maintenance.
 4. Support piping independent of pumps.
 5. Install base-mounted pumps on concrete bases with grouted base frames.
 6. Install parts and accessories shipped loose.
 7. Piping installation requirements are specified in other Division 21. Drawings indicate general arrangement of piping, fittings, and specialties.
 8. Install piping adjacent to machine to allow service and maintenance.
 9. Connect makeup water piping and cooling-water piping with reduced-pressure backflow preventers.
 10. Install overflow drain piping to nearest floor drain.
 11. Install vents and extend to outdoors; terminate with elbow turned down and an insect screen.
 12. Adjust boiler water-level controls to properly stage unit.
 13. Set field-adjustable, makeup water and cooling-water controls.
 14. Clean equipment internally; remove coatings applied for protection during shipping and storage, foreign material, and oily residue according to manufacturer's written instructions.
 15. Clean strainers.
- B. Field Quality Control
1. Perform tests and inspections and prepare test reports.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
 2. Tests and Inspections:
 - a. Inspect field-assembled components, equipment installation, and piping and electrical connections for compliance with manufacturer's written instructions.
 - b. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - c. Check bearing lubrication.
 - d. Verify proper motor rotation.
 - e. Start up service.
 - f. Report results in writing.
 3. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 23 53 16 00



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SECTION 23 53 16 00a - DEAERATORS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for deaerators. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes packaged, factory-assembled deaerators.

C. Definitions

1. Feedwater Pump: Pump that moves feedwater from the deaerator to the boiler.
2. Transfer Pump: Pump that moves feedwater from the surge tank to the deaerator.
3. NPSH: Net-positive suction head.

D. Submittals

1. Product Data: For each type of product indicated. Include rated makeup water, feedwater, and steam flow rates; working pressure; tank capacities; storage capacity in minutes; temperature and NPSH required; pump performance curves with selection points clearly indicated; furnished specialties; and accessories.
2. Shop Drawings: For deaerators, signed and sealed by a qualified professional engineer; include plans, elevations, sections, details, dimensions, weights, loadings, required clearances, and attachments to other work.
 - a. For installed products indicated to comply with design loads, include structural analysis data.
 - b. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing deaerator bases.
 - c. Wiring Diagrams: Power, signal, and control wiring.
3. Manufacturer Seismic Qualification Certification: Submit certification that deaerators, accessories, and components will withstand seismic forces as indicated in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
4. Field quality-control test reports.
5. Operation and Maintenance Data: For deaerators to include in emergency, operation, and maintenance manuals.

E. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. ASME Compliance: ASME B31.1, "Power Piping," for systems more than 15 psig (104 kPa); ASME B31.9, "Building Services Piping," for systems equal to or less than 15 psig (104 kPa). Safety valves and pressure vessels shall bear the appropriate ASME label.

F. Delivery, Storage, And Handling

1. Protect flanges, pipe openings, nozzles, bearings, and couplings from damage during shipping and storage.
2. Comply with manufacturer's written rigging instructions.
3. Deliver deaerators as factory-assembled units with protective crating and covering.



1.2 PRODUCTS

A. Manufactured Units

1. Horizontal **OR** Vertical, **as directed**, packed-column **OR** spray **OR** tray, **as directed**, single-compartment deaerator, and a separate packaged surge tank with transfer and feedwater pumps and controls to supply feedwater to deaerator, **as directed**.
OR
Horizontal **OR** Vertical, **as directed**, packed-column **OR** spray **OR** tray, **as directed**, two-compartment deaerator. One compartment for deaeration and one for surge volume, each with its own transfer and feedwater pumps and controls.
OR
Horizontal **OR** Vertical, **as directed**, packed-column **OR** spray **OR** tray, **as directed**, single-compartment deaerator and separate surge tank, both mounted on same factory-fabricated stand with necessary transfer and feedwater pumps and controls.
2. Material for Wetted Components: Components in contact with water that has not been deaerated shall be made of Type 304 **OR** 316, **as directed**, stainless steel.
3. Adjustable Spray Valves: Type 316 stainless steel. Arrange spray valves for counterflow of steam and condensate and so corrosive gases being vented do not contact deaerator's head or shell.
4. Vent Condenser: Stainless steel, with automatic and manual vent valves.
5. Deaerator and Storage Tank:
 - a. Material: Welded carbon steel **OR** Welded carbon steel galvanized after fabrication **OR** Stainless steel, **as directed**.
 - b. Additional Corrosion Protection:
 - 1) 0.07-inch (1.8-mm) **OR** 0.13-inch (3.3-mm) **OR** 0.19-inch (4.8-mm), **as directed**, thickness allowance.
 - 2) Electrolytic corrosion-inhibitor anode.
 - c. Access: Manhole in deaerator and storage tank for access to internal components for inspection and service.
 - d. Factory-Applied Insulation and Jacket: Minimum thickness of 2 inches (50 mm), **as directed**, for mineral-fiber pipe and tank insulation. Cover insulation with painted steel **OR** stucco-embossed aluminum **OR** stainless-steel, **as directed**, jacket.
 - e. Factory-Installed Pipe, NPS 2-1/2 (DN 65) and Smaller: ASTM A 53/A 53M, Type S (seamless), Grade B; or ASTM A 106, Type S, Grade B, Schedule 40 **OR** 80, **as directed**; with threaded joints and fittings.
 - 1) Cast-Iron Threaded Fittings: ASME B16.4, Class 125 **OR** 250, **as directed**.
 - 2) Malleable-Iron Threaded Fittings: ASME B16.3, Class 150 **OR** 300, **as directed**.
 - 3) Forged-Steel Fittings: ASME B16.11, Class 3000.
 - 4) Malleable-Iron Unions: ASME B16.39, Class 150 **OR** 300, **as directed**.
 - 5) Forged-Steel Unions: MSS SP-83, Class 3000.
 - f. Factory-Installed Pipe, NPS 3 (DN 80) and Larger: ASTM A 53/A 53M, Type E (electric-resistance welded), Grade B; or ASTM A 106, Type S, Grade B, Schedule 40 **OR** 80, **as directed**; with welded joints and carbon-steel fittings and flanges.
 - 1) Wrought-Steel Fittings: ASME B16.9, wall thickness to match adjoining pipe.
 - 2) Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, Class 150 **OR** 300, **as directed**, including bolts, nuts, and gaskets.
6. Accessories:
 - a. Lifting eyes.
 - b. Companion flanges.
 - c. Pump suction piping with vortex breaker, isolation valve, strainer, and flexible connector.
 - d. Pump discharge piping with check valve, isolation valve, and liquid-filled pressure gage graduated in pounds force per square inch **OR** kilopascals **OR** both pounds force per square inch and kilopascals, **as directed**.
 - e. Pump-discharge bypass relief valve **OR** orifice plate **OR** relief valve with orifice plate, **as directed**.



- f. Makeup Water Assembly:
 - 1) Factory-mounted modulating valve with mechanical level control, external float cage, and stainless-steel float.
OR
Factory **OR** Field, **as directed**, -mounted, electric, pilot-operated, solenoid **OR** modulating, **as directed**, valve with factory-mounted, probe-type, **as directed**, water-level controller.
OR
Factory **OR** Field, **as directed**, -mounted, pneumatic modulating valve with factory-mounted water-level controller.
 - 2) Factory **OR** Field, **as directed**, -mounted, three-valve bypass and inlet strainer.
 - g. Steam Pressure-Reducing Valve(s): Steam **OR** Electric **OR** Pneumatic, **as directed**, operated with three-valve bypass, **as directed**, and sized to reduce boiler outlet pressure to the deaerator design pressure.
 - h. Tank Overflow Drain: Sized to relieve full capacity at operating pressure.
 - i. Safety Valve(s): ASME labeled and sized to relieve full capacity of pressure-reducing valve.
 - j. Vents: Manual and automatic vent valves.
 - k. Vacuum breaker.
 - l. Meters and Gages:
 - 1) Full-height, water-level gage glass, reflex flat type, **as directed**, and stop valve set.
 - 2) Liquid-filled industrial **OR** Bimetal dial-type, **as directed**, thermometer graduated in Fahrenheit **OR** Celsius **OR** both Fahrenheit and Celsius, **as directed**, mounted to measure temperature in storage and steam, **as directed**, section of tank.
 - 3) Pressure gage graduated in pounds force per square inch **OR** kilopascals **OR** both pounds force per square inch and kilopascals, **as directed**, mounted to measure pressure in steam section of tank.
 - m. Provision for chemical injection quill.
 - n. Chemical injection quill.
 - o. Sampling connection with valve.
 - p. Tank drain connection with valve.
 - q. Oxygen test kit.
7. Support Frame: Structural-steel frame for supporting tank and pumps. Weld or bolt to tank.
- a. Fabricate support frame with bracing adequate for seismic forces according to authorities having jurisdiction and to allow installation by anchoring deaerators to floor only, **as directed**.
8. Feedwater Pump: Cast-iron, flange **OR** base, **as directed**, -mounted volute; with bronze **OR** stainless-steel, **as directed**, multistage centrifugal **OR** turbine, **as directed**, impeller, renewable bronze case ring, and stainless-steel shaft.
- a. Seals: Mechanical, suitable for 250 deg F (121 deg C).
 - b. Pump Motor: Vertical **OR** Horizontal, **as directed**, open dripproof **OR** totally enclosed **OR** totally enclosed fan-cooled, **as directed**, enclosure, close **OR** flexible, **as directed**, coupled to pump. Comply with requirements in Division 15 Section "Motors."
9. Feedwater Pump Control Panel: Factory mounted and wired and including the following:
- a. NEMA 250, Type 1 **OR** 4 **OR** 4X **OR** 12, **as directed**, enclosure.
 - b. Single-point, field power connection to fused disconnect switch **OR** nonfused disconnect switch **OR** circuit breaker, **as directed**.
 - 1) Branch power circuit to each motor and to controls with a disconnect switch or circuit breaker, **as directed**.
 - c. NEMA-rated motor controller, hand-off-auto switch, and overcurrent protection for each motor.
 - 1) Alternating control as indicated by control sequence for each pump.
 - d. Terminal blocks with numbered and color-coded wiring to match wiring diagram.
 - e. Metal raceway **OR** Raceway, **as directed**, for factory-installed wiring outside of enclosures. Make connections to motor with liquidtight conduit.
 - f. Removable control mounting plate.



- g. Visual indication of status and alarm with momentary test push button, **as directed**.
 - h. Audible alarm and silence switch.
 - i. Visual indication of elapsed run time, graduated in hours.
 - j. Fusible, control-circuit transformer.
 - k. Microprocessor-based controller.
10. Feedwater Pump Start-Stop Control Sequence (for intermittent pump operation):
- a. Boiler water-level controller starts and stops lead pump to maintain boiler water-level set point.
 - b. Lead and lag pumps alternate after each start **OR** to equalize run time, **as directed**.
 - c. Lead pump failure, lag pump automatically starts if lead pump cannot maintain set point **OR** is started manually, **as directed**.
 - d. Visual indication of pump on **OR** on and off, **as directed**, status.
 - e. Visual indication of pump lead/lag status.
 - f. Visual **OR** Visual and audible, **as directed**, alarm indication of pump failure.
11. Feedwater Pump Continuous Control Sequence (for continuous pump operation and modulating control valve):
- a. Pump runs continuously while boiler operates. Electric interlock with boiler control starts lead pump when boiler starts.
 - b. Boiler water-level controller modulates feedwater control valve to maintain boiler water-level set point. Valve closes when boiler is off.
 - c. Lead and lag pumps alternate after each start **OR** to equalize run time, **as directed**.
 - d. Lead pump failure automatically starts lag pump.
OR
Feedwater pressure controller starts and stops lag pump to maintain feedwater pressure set point.
 - e. Visual indication of pump on **OR** on and off, **as directed**, status.
 - f. Visual indication of pump lead/lag status.
 - g. Visual **OR** Visual and audible, **as directed**, alarm indication of pump failure.
12. Makeup Water Control Sequence:
- a. Electric level controller operates electric control valve to maintain tank water-level set point.
OR
Pneumatic level controller operates pneumatic control valve to maintain tank water-level set point.
OR
Mechanical float operates valve to maintain water-level set point.
 - b. Visual **OR** Visual and audible, **as directed**, alarm indication of low **OR** low and high, **as directed**, tank water level.
13. Building Management System Interface: Factory install hardware to enable building management system to monitor and display points.
- a. Hardwired Monitoring Points: On/off status for each pump, failure alarm for each pump, low-water level alarm, high-water level alarm, feedwater temperature, **as directed**.

B. Surge Tank

- 1. Description: Factory-assembled and -tested unit consisting of a condensate receiver, transfer pumps, and controls.
- 2. Accessories:
 - a. Liquid-filled industrial **OR** Bimetal dial-type, **as directed**, thermometer graduated in Fahrenheit **OR** Celsius **OR** both Fahrenheit and Celsius, **as directed**.
 - b. Level gage glass, reflex flat type, **as directed**, with stops at top and bottom.
 - c. Lifting eyes.
 - d. Companion flanges.
 - e. Pump suction piping with vortex breaker, isolation valve, strainer, and flexible connector.
 - f. Pump discharge piping with check valve, isolation valve, and liquid-filled pressure gage graduated in pounds force per square inch **OR** kilopascals **OR** both pounds force per square inch and kilopascals, **as directed**.



- g. Pump-discharge bypass relief valve **OR** orifice plate **OR** relief valve with orifice plate, **as directed**.
3. Factory-Installed Pipe, NPS 2-1/2 (DN 65) and Smaller: ASTM A 53/A 53M, Type S (seamless), Grade B; or ASTM A 106, Type S, Grade B, Schedule 40 **OR** 80, **as directed**; with threaded joints and fittings.
- a. Cast-Iron Threaded Fittings: ASME B16.4, Class 125 **OR** 250, **as directed**.
 - b. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150 **OR** 300, **as directed**.
 - c. Forged-Steel Fittings: ASME B16.11, Class 3000.
 - d. Malleable-Iron Unions: ASME B16.39, Class 150 **OR** 300, **as directed**.
 - e. Forged-Steel Unions: MSS SP-83, Class 3000.
4. Factory-Installed Pipe, NPS 3 (DN 80) and Larger: ASTM A 53/A 53M, Type E (electric-resistance welded), Grade B; or ASTM A 106, Type S, Grade B, Schedule 40 **OR** 80, **as directed**; with welded joints and carbon-steel fittings and flanges.
- a. Wrought-Steel Fittings: ASME B16.9, wall thickness to match adjoining pipe.
 - b. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, Class 150 **OR** 300, **as directed**, including bolts, nuts, and gaskets.
5. Tank:
- a. Material: Welded carbon steel **OR** Welded carbon steel galvanized after fabrication **OR** Stainless steel, **as directed**.
 - b. Additional Corrosion Protection:
 - 1) 0.07-inch (1.8-mm) **OR** 0.13-inch (3.3-mm) **OR** 0.19-inch (4.8-mm), **as directed**, thickness allowance.
 - 2) Electrolytic corrosion-inhibitor anode.
 - c. Access: Manhole in tank for access to internal components for inspection and service.
 - d. Factory-Applied Insulation and Jacket: Minimum thickness of 2 inches (50 mm) for mineral-fiber pipe and tank insulation. Cover insulation with painted steel **OR** stucco-embossed aluminum **OR** stainless-steel, **as directed**, jacket.
6. Support Frame: Structural-steel frame for supporting tank. Weld or bolt to tank.
- a. Fabricate support frame with bracing adequate for seismic forces according to authorities having jurisdiction and to allow installation by anchoring deaerators to floor only.
7. Transfer Pump: Vertical, flange-mounted, close-coupled, single-stage **OR** multistage, **as directed**, radially split-case centrifugal pump; rated for 175-psig (1205-kPa) minimum working pressure and a continuous water temperature of 225 deg F (107 deg C); with the following features:
- a. Impeller: Bronze **OR** Stainless steel, **as directed**.
 - b. Seals: Mechanical.
 - c. Motor: Open dripproof **OR** Totally enclosed **OR** Totally enclosed fan-cooled, **as directed**, enclosure. Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".
8. Transfer Pump: Horizontal, base-mounted, single-stage **OR** multistage, **as directed**, radially split-case centrifugal pump; rated for 175-psig (1205-kPa) minimum working pressure and a continuous water temperature of 225 deg F (107 deg C); with the following features:
- a. Impeller: Bronze **OR** Stainless steel, **as directed**.
 - b. Coupling: Close **OR** Flexible, **as directed**.
 - c. Seals: Mechanical.
 - d. Motor: Open dripproof **OR** Totally enclosed **OR** Totally enclosed fan-cooled, **as directed**, enclosure. Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".
9. Transfer Pump Control Panel: Factory mounted and wired and including the following:
- a. NEMA 250, Type 1 **OR** 4 **OR** 4X **OR** 12, **as directed**, enclosure.
 - b. Single-point, field power connection to fused disconnect switch **OR** nonfused disconnect switch **OR** circuit breaker, **as directed**.
 - 1) Branch power circuit to each motor and to controls with a disconnect switch or circuit breaker, **as directed**.
 - c. NEMA-rated motor controller, hand-off-auto switch, and overcurrent protection for each motor.



- 1) Alternating control indicated by control sequence for each pump.
- d. Terminal blocks with numbered and color-coded wiring to match wiring diagram.
- e. Metal raceway **OR** Raceway, **as directed**, for factory-installed wiring outside of enclosures. Make connections to motor with liquidtight conduit.
- f. Removable control mounting plate.
- g. Visual indication of on/off status and pump failure alarm with momentary test push button, **as directed**.
- h. Audible alarm and silence switch.
- i. Visual indication of elapsed run time, graduated in hours.
- j. Fusible, control-circuit transformer.
- k. Microprocessor-based controller.
10. Transfer Pump Start-Stop Control Sequence: Deaerator water-level controller controls lead pump; alternator switches lead and lag pump(s) after each start **OR** to equalize run time, **as directed**; failure of lead pump switches to lag pump and sounds audible alarm, **as directed**.
11. Transfer Pump Continuous-Run Control Sequence: Lead pump runs continuously while deaerator is operating; deaerator water-level controller modulates water-level-control valve; lead and lag pump(s) switch to equalize run time; lag pump operates if lead pump fails; pump failure sounds audible alarm, **as directed**.
12. Building Management System Interface: Factory install hardware to enable building management system to monitor and display points.
 - a. Hardwired Monitoring Points: On/off status for each pump, failure alarm for each pump, low-water level alarm, high-water level alarm, **as directed**.

C. Factory Finishes

1. Manufacturer's standard prime-coat finish ready for field painting.
2. Manufacturer's standard paint in standard colors, applied to factory-assembled and -tested unit before shipping.
3. Do not paint aluminum, galvanized-steel, and stainless-steel surfaces.

D. Source Quality Control

1. Fabricate and label deaerator tanks according to ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," Division 1.
2. Factory install and test piping that connects pumps to tanks according to ASME B31.1, "Power Piping" **OR** ASME B31.9, "Building Services Piping," **as directed**.
3. Factory test performance and certify test results on packaged deaerator units, according to ASME PTC 12.3, before shipping to Project.

1.3 EXECUTION

A. Examination

1. Before deaerator installation, examine roughing-in for concrete equipment bases, anchor-bolt sizes and locations, and piping and electrical connections to verify actual locations, sizes, and other conditions affecting performance, maintenance, and operations.
 - a. Final deaerator locations indicated on Drawings are approximate. Determine exact locations before roughing-in for piping and electrical connections.
 - b. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Installation

1. Install deaerators level on concrete base. Concrete base is specified in Division 23 Section "Common Work Results For Hvac", and concrete materials and installation requirements are specified in Division 31.
2. Vibration Isolation: Elastomeric isolator pads **OR** mounts, **as directed**, with a minimum static deflection of 0.25 inch (6.35 mm). Vibration isolation devices and installation requirements are



specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".

3. Install deaerators to permit access for service and maintenance.
4. Support piping independent of pumps.
5. Install base-mounted pumps on concrete base with grouted base frame.
6. Install all parts and materials not factory installed.
7. Extend overflow drains to floor drains.
8. Extend vent piping to outside and terminate with manufacturer-approved cap furnished with deaerator.
9. Install piping adjacent to machine to allow service and maintenance.

C. Connections

1. Steam and condensate piping installation requirements are specified in other Division 21. Drawings indicate general arrangement of piping, fittings, and specialties.
2. Connect steam and condensate piping to tank tappings with shutoff valves and unions or flanges at each connection.
3. Connect condensate drains, pump-discharge piping, vents, overflow drains, makeup water, steam supply, and cooling water piping.

D. Field Quality Control

1. Perform tests and inspections and prepare test reports.
2. Tests and Inspections:
 - a. Inspect field-assembled components and equipment installation, including piping and electrical connections, for compliance with requirements.
 - b. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - c. Verify bearing lubrication.
 - d. Verify proper motor rotation.
 - e. Test Reports: Prepare a written report to record the following:
 - 1) Test procedures used.
 - 2) Test results that comply with requirements.
 - 3) Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
3. Remove and replace malfunctioning equipment and retest as specified above.

E. Startup Service

1. Engage a factory-authorized service representative to perform startup service.
2. Complete installation and startup checks according to manufacturer's written instructions and do the following:
 - a. Set deaerator makeup water-level controls.
 - b. Verify bearing lubrication.
 - c. Verify proper motor rotation.
 - d. Start pumps according to manufacturer's written instructions.

F. Adjusting And Cleaning

1. Adjust initial temperature and pressure set points.
2. Set field-adjustable switches and circuit-breaker trip ranges.
3. Clean strainers.

G. Demonstration

1. Train Owner's maintenance personnel to adjust, operate, and maintain deaerators.

END OF SECTION 23 53 16 00a



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SECTION 23 54 16 13 - FURNACES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for furnaces. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Gas-fired, noncondensing, Gas-fired, condensing, Oil-fired, and Electric furnaces and accessories complete with controls.
 - b. Air filters.
 - c. Air cleaners.
 - d. Ultraviolet germicidal lights.
 - e. Humidifiers.
 - f. Ventilation heat exchangers.
 - g. Refrigeration components.

C. Submittals

1. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each of the following:
 - a. Furnace.
 - b. Thermostat.
 - c. Humidistat.
 - d. Air filter.
 - e. Air cleaner.
 - f. Ultraviolet germicidal light.
 - g. Humidifier.
 - h. Ventilation heat exchanger.
 - i. Refrigeration components.
2. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - a. Wiring Diagrams: Power, signal, and control wiring.
3. Operation and maintenance data.
4. LEED Submittals:
 - a. Product Data for Credit EA 4: Documentation required by Credit EA 4 indicating that equipment and refrigerants comply.
 - b. Product Data for Prerequisite EQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
 - c. Product Data for Credit EQ 4.1: For solvent cements and adhesive primers, including printed statement of VOC content.
5. Warranty: Special warranty specified in this Section.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."



3. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
4. Comply with NFPA 70.

E. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace the following components of furnaces that fail in materials or workmanship within specified warranty period:
 - a. Warranty Period, Commencing on Date of Final Completion:
 - 1) Furnace Heat Exchanger: 10 years **OR** 20 years **OR** Lifetime, **as directed**.
 - 2) Integrated Ignition and Blower Control Circuit Board: Five years.
 - 3) Draft-Inducer Motor: Five years.
 - 4) High-Efficiency Oil Furnace Burner: Three years.
 - 5) Refrigeration Compressors: 10 years **OR** Lifetime, **as directed**.
 - 6) Evaporator and Condenser Coils: Five years.

1.2 PRODUCTS

A. Gas-Fired Furnaces, Noncondensing

1. General Requirements for Gas-Fired, Noncondensing Furnaces: Factory assembled, piped, wired, and tested; complying with ANSI Z21.47/CSA 2.3, "Gas-Fired Central Furnaces," and with NFPA 54.
2. Cabinet: Steel **OR** Galvanized steel, **as directed**.
 - a. Cabinet interior around heat exchanger shall be factory-installed insulation.
 - b. Lift-out panels shall expose burners and all other items requiring access for maintenance.
 - c. Factory paint external cabinets in manufacturer's standard color.
 - d. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
3. Fan: Centrifugal, factory balanced, resilient mounted, direct drive **OR** belt drive **OR** direct or belt drive **OR** drive type indicated on Drawings, **as directed**.
 - a. Fan Motors: Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - b. Special Motor Features: Single speed, Premium (TM) efficiency, as defined in Division 23 Section "Common Motor Requirements For Hvac Equipment", and with internal thermal protection and permanent lubrication.

OR

 Special Motor Features: Multitapped, multispeed with internal thermal protection and permanent lubrication.

OR

 Special Motor Features: Electronically controlled motor (ECM) controlled by integrated furnace/blower control.
4. Type of Gas: Natural **OR** Propane, **as directed**.
5. Heat Exchanger: Aluminized **OR** Stainless, **as directed**, steel.
6. Burner:
 - a. Gas Valve: 100 percent safety two-stage **OR** modulating, **as directed**, main gas valve, main shutoff valve, pressure regulator, safety pilot with electronic flame sensor, limit control, transformer, and combination ignition/fan timer control board.
 - b. Ignition: Electric pilot ignition, with hot-surface igniter or electric spark ignition.
7. Gas-Burner Safety Controls:
 - a. Electronic Flame Sensor: Prevents gas valve from opening until pilot flame is proven; stops gas flow on ignition failure.
 - b. Flame Rollout Switch: Installed on burner box; prevents burner operation.
 - c. Limit Control: Fixed stop at maximum permissible setting; de-energizes burner on excessive bonnet temperature; automatic reset.



8. Combustion-Air Inducer: Centrifugal fan with thermally protected motor and sleeve bearings prepurges heat exchanger and vents combustion products; pressure switch prevents furnace operation if combustion-air inlet or flue outlet is blocked.
 9. Furnace Controls: Solid-state board integrates ignition, heat, cooling, and fan speeds; and adjustable fan-on and fan-off timing; terminals for connection to accessories.
 10. Vent Materials: Comply with requirements in Division 23 Section "Breechings, Chimneys, And Stacks", for Type B metal vents.
- B. Gas-Fired Furnaces, Condensing
1. General Requirements for Gas-Fired, Condensing Furnaces: Factory assembled, piped, wired, and tested; complying with ANSI Z21.47/CSA 2.3, "Gas-Fired Central Furnaces," and with NFPA 54.
 2. Cabinet: Steel **OR** Galvanized steel, **as directed**.
 - a. Cabinet interior around heat exchanger shall be factory-installed insulation.
 - b. Lift-out panels shall expose burners and all other items requiring access for maintenance.
 - c. Factory paint external cabinets in manufacturer's standard color.
 - d. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
 3. Fan: Centrifugal, factory balanced, resilient mounted, direct drive.
 - a. Fan Motors: Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - b. Special Motor Features: Single speed, Premium (TM) efficiency, as defined in Division 23 Section "Common Motor Requirements For Hvac Equipment", and with internal thermal protection and permanent lubrication.

OR

Special Motor Features: Multitapped, multispeed with internal thermal protection and permanent lubrication.

OR

Special Motor Features: Electronically controlled motor (ECM) controlled by integrated furnace/blower control.
 4. Type of Gas: Natural **OR** Propane, **as directed**.
 5. Heat Exchanger:
 - a. Primary: Aluminized **OR** Stainless, **as directed**, steel.
 - b. Secondary: Polyethylene-coated **OR** Stainless, **as directed**, steel.
 6. Burner:
 - a. Gas Valve: 100 percent safety two-stage **OR** modulating, **as directed**, main gas valve, main shutoff valve, pressure regulator, safety pilot with electronic flame sensor, limit control, transformer, and combination ignition/fan timer control board.
 - b. Ignition: Electric pilot ignition, with hot-surface igniter or electric spark ignition.
 7. Gas-Burner Safety Controls:
 - a. Electronic Flame Sensor: Prevents gas valve from opening until pilot flame is proven; stops gas flow on ignition failure.
 - b. Flame Rollout Switch: Installed on burner box; prevents burner operation.
 - c. Limit Control: Fixed stop at maximum permissible setting; de-energizes burner on excessive bonnet temperature; automatic reset.
 8. Combustion-Air Inducer: Centrifugal fan with thermally protected motor and sleeve bearings prepurges heat exchanger and vents combustion products; pressure switch prevents furnace operation if combustion-air inlet or flue outlet is blocked.
 9. Furnace Controls: Solid-state board integrates ignition, heat, cooling, and fan speeds; adjustable fan-on and fan-off timing; terminals for connection to accessories; diagnostic light with viewport, **as directed**.
 10. Accessories:
 - a. Combination Combustion-Air Intake and Vent: PVC plastic fitting to combine combustion-air inlet and vent through outside wall **OR** roof, **as directed**.
 - b. CPVC Plastic Vent Materials.
 - 1) CPVC Plastic Pipe: Schedule 40, complying with ASTM F 441/F 441M.



- 2) CPVC Plastic Fittings: Schedule 40, complying with ASTM F 438, socket type.
- 3) CPVC Solvent Cement: ASTM F 493.
 - a) Use CPVC solvent cement that has a VOC content of 490 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b) Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- c. PVC Plastic Vent Materials:
 - 1) PVC Plastic Pipe: Schedule 40, complying with ASTM D 1785.
 - 2) PVC Plastic Fittings: Schedule 40, complying with ASTM D 2466, socket type.
 - 3) PVC Solvent Cement: ASTM D 2564.
 - a) Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b) Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Oil-Fired Furnaces

1. General Requirements for Oil-Fired Furnaces: Factory assembled, piped, wired, and tested; complying with UL 727 and with NFPA 31.
2. Cabinet: Steel **OR** Galvanized steel, **as directed**.
 - a. Cabinet interior around heat exchanger shall be factory-installed insulation.
 - b. Lift-out panels shall expose burners and all other items requiring access for maintenance.
 - c. Factory paint external cabinets in manufacturer's standard color.
 - d. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
3. Fan: Centrifugal, factory balanced, resilient mounted, direct drive **OR** belt drive **OR** drive type indicated on Drawings, **as directed**.
 - a. Fan Motors: Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".
4. Special Motor Features: Single speed, Premium (TM) efficiency, as defined in Division 23 Section "Common Motor Requirements For Hvac Equipment", and with internal thermal protection and permanent lubrication.

OR

 Special Motor Features: Multitapped, multispeed with internal thermal protection and permanent lubrication.
5. Heat Exchanger: Welded steel with ceramic-fiber liner **OR** refractory insert, **as directed**, at the burner in the combustion chamber. Minimum 2-inch- (50-mm-) diameter access ports in heat exchanger to permit access for cleaning.
6. Burner: High-pressure atomizing type, with rubber-mounted, adjustable, combustion-air blower; integrated fuel pump; hinged, flame-inspection port; cadmium-sulfide flame sensor; electrodes; ignition transformer; and oil nozzle.
 - a. Time-Delay Relay: Limits time for establishing main flame.
 - b. Flame Sensor: Monitors flame and stops burner on flame failure.
 - c. Limit Control: Fixed stop at maximum permissible setting; de-energizes burner on excessive bonnet temperature; automatic reset.
7. Barometric Draft Regulator: Match furnace; for mounting in flue.
8. Furnace Controls: Solid-state board integrates ignition, heat, cooling, and fan speeds; and adjustable fan-on and fan-off timing; terminals for connection to accessories.
9. Vent Materials: Comply with requirements in Division 23 Section "Breechings, Chimneys, And Stacks" for Type B metal vents.

D. Electric Furnaces

1. General Requirements for Electric Furnaces: Factory assembled, piped, wired, and tested.
2. Cabinet: Steel, with duct liner downstream from cooling coil, **as directed**.
 - a. Duct Liner: Fiberglass, minimum 1/2 inch (13 mm) **OR** 3/4 inch (19 mm), **as directed**, thick, complying with ASTM C 1071 and having a coated surface exposed to airstream



complying with NFPA 90A or NFPA 90B and with NAIMA's "Fibrous Glass Duct Liner Standard."

- 1) Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- b. Factory paint external cabinets in manufacturer's standard color.
3. Fan: Centrifugal, factory balanced, resilient mounted, direct drive.
 - a. Fan Motors: Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - b. Special Motor Features: Single speed, Premium (TM) efficiency, as defined in Division 23 Section "Common Motor Requirements For Hvac Equipment", and with internal thermal protection and permanent lubrication.

OR

Special Motor Features: Multitapped, multispeed with internal thermal protection and permanent lubrication.

OR

Special Motor Features: Electronically controlled motor (ECM) controlled by integrated furnace/blower control.
4. Electric-Resistant Heating Elements: Helix-wound, nickel-chromium wire-heating elements in ceramic insulators mounted on steel supports.
5. Heating-Element Control: Sequencer relay with relay for each element; switches elements on and off, with delay between each increment; initiates, stops, or changes fan speed.
6. Summer Fan Switch: Connected to permit independent on-off switch of unit fan.

E. Thermostats And Humidistats

1. Solid-State Thermostat: Wall-mounting **OR** Freestanding **OR** Wireless, **as directed**, programmable, microprocessor-based unit with automatic **OR** manual, **as directed**, switching from heating to cooling, preferential rate control, seven-day programmability with minimum of four temperature presets per day, vacation mode, **as directed**, and battery backup protection against power failure for program settings.

OR

Single-Stage, Heating-Cooling Thermostat: Adjustable, heating-cooling, wall-mounting unit with fan on-automatic selector.

OR

Two-Stage, Heating-Cooling Thermostat: Adjustable, heating-cooling, wall-mounting unit with fan on-automatic selector.

OR

Single-Stage **OR** Two-Stage, **as directed**, Heating-Only Thermostat: Wall-mounting unit with fan on-automatic selector.

OR

Solid-State, Combination Thermostat and Humidistat: Wall-mounting **OR** Freestanding **OR** Wireless, **as directed**, programmable, microprocessor-based unit with automatic switching from heating to cooling and humidifying to dehumidifying, preferential rate control, seven-day programmability with minimum of four temperature presets per day, vacation mode, **as directed**, and battery backup protection against power failure for program settings.
2. Humidistat: Adjustable, wall-mounting **OR** duct-mounting, **as directed**, unit.
3. Control Wiring: Unshielded twisted-pair cabling.
 - a. No. 24 AWG, 100 ohm, four pair.
 - b. Cable Jacket Color: Blue.
4. Controls shall comply with requirements in ASHRAE/IESNA 90.1, "Controls."

F. Air Filters

1. Washable Filters: 1-inch- (25-mm-) thick, urethane pad.
2. Disposable Filters: 1-inch- (25-mm-) thick fiberglass media with ASHRAE 52.2 MERV rating of 6 or higher, **as directed**, in sheet metal frame.
3. Charged Media Air Filters: Sheet metal housing arranged to be ducted in return-air duct connection to furnace, generates electrostatic charge; MERV 10 rating.



4. HEPA Air Filter Units: Sheet metal housing with fan arranged to be ducted to return-air duct connection to furnace, with activated carbon prefilter, high-efficiency particulate air (HEPA) disposable filter, and carbon VOC, **as directed**. HEPA shall be as follows:
 - a. Standard: UL 586, "High-Efficiency, Particulate, Air Filter Units."
 - b. Rating: ASHRAE 52.1, dust-spot efficiency of 65 percent; ASHRAE 52.2, 99.97 percent efficiency to 0.03-micrometer particle size.
- G. Air Cleaners
1. Electronic Air Cleaners: Packaged system, including sheet metal housing, prefilter, power supply, and automatic control device, arranged for mounting in return-air duct at furnace; equip with on-off and test switches and pilot light.
 - a. Standard: UL 586, "High-Efficiency, Particulate, Air Filter Units."
 - b. Rating: ASHRAE 52.2, particle size to 0.01 micrometer.
 - c. Static Pressure Drop: Maximum 0.14-inch wg (35 Pa) at 300-fpm (1.52-m/s) air velocity.
- H. Ultraviolet Germicidal Lights
1. Description: Lighting unit in metal housing arranged for installation in supply-air duct and controlled to cycle on and off with furnace fan, with one **OR** two, **as directed**, 75-W ultraviolet-light bulb(s).
- I. Humidifiers
1. Minimum capacity rating indicated according to ARI 610, "Central System Humidifiers for Residential Applications."
 2. Media-wheel bypass type with bypass damper and motor-driven media wheel in reservoir with float-valve level control; arranged for mounting on return duct or plenum with bypass connection to supply duct.

OR

Wetted-pad, continuous-drain, bypass type with bypass damper and water-flow control orifice; arranged for mounting on return duct or plenum with bypass connection to supply duct.

OR

Fan-powered, wetted-pad, continuous-drain type with water-flow control orifice and motor; arranged for mounting on duct or plenum.

OR

Pumped, fan-powered, wetted-pad type with reservoir-level control and pump and fan motors; arranged for mounting on duct or plenum.

OR

Steam type with electric heating element in stainless-steel reservoir with float-valve level control; arranged for attachment to duct or plenum and for control by humidistat.
 3. Comply with applicable requirements in ASHRAE 62.1.
- J. Ventilation Air Heat Exchanger
1. Cabinet: Steel, with factory-installed interior insulation and manufacturer's standard factory finish. Fabricate with space for piping and electrical conduits.
 2. Heat-Recovery Device: Fixed-plate, polypropylene copolymer (high-density plastic) heat-exchanger plates evenly spaced and sealed and arranged for counter airflow.
 3. Supply and Exhaust Fans: Forward curved centrifugal with direct drive. Motors comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 4. Filters: 1-inch- (25-mm-) thick disposable type with ASHRAE 52.2 MERV rating of 6 or higher, **as directed**, in galvanized-steel frame, mounted upstream of unit in both supply and exhaust airstreams.
 5. Wiring: Wire motors and controls so only external connections are required during installation.
- K. Refrigeration Components
1. General Refrigeration Component Requirements:



- a. Refrigeration compressor, coils, and specialties shall be designed to operate with CFC-free refrigerants.
- b. Energy Efficiency: Equal to or greater than prescribed by ASHRAE/IESNA 90.1, "Energy Standard for Buildings except Low-Rise Residential Buildings."
2. Refrigerant Coil: Copper tubes mechanically expanded into aluminum fins. Comply with ARI 210/240, "Unitary Air-Conditioning and Air-Source Heat Pump Equipment." Match size with furnace. Include condensate drain pan with accessible drain outlet complying with ASHRAE 62.1, **as directed**.
 - a. Refrigerant Coil Enclosure: Steel, matching furnace and evaporator coil, with access panel and flanges for integral mounting at or on furnace cabinet and galvanized sheet metal drain pan coated with black asphaltic base paint.
3. Refrigerant Line Kits: Annealed-copper suction and liquid lines factory cleaned, dried, pressurized with nitrogen, sealed, and with suction line insulated. Provide in standard lengths for installation without joints, except at equipment connections.
 - a. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I, 1/2 inch (13 mm) **OR** 1 inch (25 mm), **as directed**, thick.
4. Refrigerant Piping: Comply with requirements in Division 23 Section "Refrigerant Piping".
5. Air-Cooled, Compressor-Condenser Unit:
 - a. Casing: Steel, finished with baked enamel, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
 - b. Compressor: Hermetically sealed reciprocating **OR** scroll, **as directed**, type.
 - 1) Crankcase heater.
 - 2) Restrained vibration **OR** Vibration, **as directed**, isolation mounts for compressor.
 - 3) Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
 - 4) Two-speed compressor motors shall have manual-reset high-pressure switch and automatic-reset low-pressure switch.
 - 5) Refrigerant Charge: R-407C **OR** R-410A, **as directed**.
 - c. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid subcooler.
 - d. Heat-Pump Components: Reversing valve and low-temperature air cut-off thermostat.
 - e. Fan: Aluminum-propeller type, directly connected to motor.
 - f. Motor: Permanently lubricated, with integral thermal-overload protection.
 - g. Low Ambient Kit: Permits operation down to 45 deg F (7 deg C).
 - h. Mounting Base: Polyethylene.

1.3 EXECUTION

A. Installation

1. Install gas-fired furnaces and associated fuel and vent features and systems according to NFPA 54.
2. Install oil-fired furnaces and associated fuel and vent piping according to NFPA 31.
3. Suspended Units: Suspend from structure using threaded rods, spring hangers, and building attachments. Secure rods to unit hanger attachments. Adjust hangers so unit is level and plumb.
 - a. Install seismic restraints to limit movement of furnace by resisting code-required seismic acceleration.
4. Base-Mounted Units: Secure units to substrate. Provide optional bottom closure base if required by installation conditions.
 - a. Anchor furnace to substrate to resist code-required seismic acceleration.
5. Controls: Install thermostats and humidistats at mounting height of 60 inches (1500 mm) above floor.
6. Wiring Method: Install control wiring in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal control wiring except in unfinished spaces.



7. Install ground-mounted, compressor-condenser components on 4-inch- (100-mm-) thick, reinforced concrete base; 4 inches (100 mm) larger on each side than unit. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-place Concrete". Coordinate anchor installation with concrete base.
OR
Install ground-mounted, compressor-condenser components on polyethylene mounting base.
8. Install roof-mounted, compressor-condenser components on equipment supports specified in Division 07 Section "Roof Accessories". Anchor units to supports with removable, cadmium-plated fasteners.

B. Connections

1. Gas piping installation requirements are specified in Division 23 Section(s) "Facility Natural-gas Piping" OR "Facility Liquefied-petroleum Gas Piping", **as directed**. Drawings indicate general arrangement of piping, fittings, and specialties. Connect gas piping with union or flange and appliance connector valve.
2. Oil piping installation requirements are specified in Division 23 Section "Facility Fuel-oil Piping". Drawings indicate general arrangement of piping, fittings, and specialties. Connect oil piping with union or flange and ball **OR** gate, **as directed**, valve.
3. Install piping adjacent to equipment to allow service and maintenance.
4. Water piping installation requirements for furnaces with humidifiers are specified in Division 22 Section "Domestic Water Piping". Drawings indicate general arrangement of piping, fittings, and specialties. Connect water piping with union and ball valve.
5. Vent Connection, Noncondensing, Gas-Fired Furnaces: Connect Type B vents to furnace vent connection and extend outdoors. Type B vents and their installation requirements are specified in Division 23 Section "Breechings, Chimneys, And Stacks".
6. Vent and Outside-Air Connection, Condensing, Gas-Fired Furnaces: Connect plastic piping vent material to furnace connections and extend outdoors. Terminate vent outdoors with a cap and in an arrangement that will protect against entry of birds, insects, and dirt.
 - a. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
 - b. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
 - c. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1) Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2) CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - 3) PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 - 4) Requirements for Low-Emitting Materials:
 - a) Use CPVC solvent cement that has a VOC content of 490 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b) Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - c) Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - d. Slope pipe vent back to furnace or to outside terminal.
7. Vent Connections, Oil-Fired Furnaces: Connect Type L vents to furnace vent connection and extend outdoors. Type L vents and their installation requirements are specified in Division 23 Section "Breechings, Chimneys, And Stacks".
8. Connect ducts to furnace with flexible connector. Comply with requirements in Division 23 Section "Air Duct Accessories".
9. Connect refrigerant tubing kits to refrigerant coil in furnace and to air-cooled, compressor-condenser unit.



- a. Flared Joints: Use ASME B16.26 fitting and flared ends, following procedures in CDA's "Copper Tube Handbook."
OR
Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
OR
Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
 10. Comply with requirements in Division 23 Section "Refrigerant Piping" for installation and joint construction of refrigerant piping.
- C. Field Quality Control
1. Perform the following field tests and inspections and prepare test reports:
 - a. Perform electrical test and visual and mechanical inspection.
 - b. Leak Test: After installation, charge systems with refrigerant and oil and test for leaks. Repair leaks, replace lost refrigerant and oil, and retest until no leaks exist.
 - c. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation, product capability, and compliance with requirements.
 - d. Verify that fan wheel is rotating in the correct direction and is not vibrating or binding.
 - e. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 2. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.
- D. Startup Service
1. Complete installation and startup checks according to manufacturer's written instructions and perform the following:
 - a. Inspect for physical damage to unit casings.
 - b. Verify that access doors move freely and are weathertight.
 - c. Clean units and inspect for construction debris.
 - d. Verify that all bolts and screws are tight.
 - e. Adjust vibration isolation and flexible connections.
 - f. Verify that controls are connected and operational.
 2. Adjust fan belts to proper alignment and tension.
 3. Start unit according to manufacturer's written instructions and complete manufacturer's operational checklist.
 4. Measure and record airflows.
 5. Verify proper operation of capacity control device.
 6. After startup and performance test, lubricate bearings and adjust belt tension, **as directed**.
- E. Adjusting
1. Adjust initial temperature and humidity set points.
 2. Set controls, burner, and other adjustments for optimum heating performance and efficiency. Adjust heat-distribution features, including shutters, dampers, and relays, to provide optimum heating performance and system efficiency.
- F. Cleaning
1. After completing installation, clean furnaces internally according to manufacturer's written instructions.
 2. Install new filters in each furnace within 14 days after Final Completion.
- G. Demonstration
1. Train Owner's maintenance personnel to adjust, operate, and maintain condensing units.



END OF SECTION 23 54 16 13



23 - Heating, Ventilating, And Air-Conditioning (HVAC)

Task	Specification	Specification Description
23 54 19 00	23 54 16 13	Furnaces



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SECTION 23 55 23 13 - RADIANT HEATING AND COOLING UNITS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for radiant heating and cooling units. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Electric radiant heaters.
 - b. Prefabricated electric radiant heating panels.
 - c. Hydronic heating and cooling panels.

C. Definitions

1. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling and power-limited circuits.

D. Submittals

1. Product Data: Include rated capacities, specialties, and accessories for each product indicated.
2. Manufacturer Seismic Qualification Certification.
3. Field quality-control test reports.
4. Operation and maintenance data.

E. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.2 PRODUCTS

A. Electric Radiant Heaters

1. Quartz Lamp Heating Elements: Coiled tungsten-wire heating element enclosed in clear quartz tube.
2. Quartz Tube Heating Elements: Nickel-chromium-wire heating element enclosed in quartz tube.
3. Metal-Sheathed Heating Elements: Nickel-chromium-wire heating element embedded in magnesium oxide powder and enclosed in metal sheath. Comply with UL 1030.
4. Comply with UL 499 and UL 2021, **as directed**.
5. Enclosures: Aluminized **OR** Stainless **OR** Painted, **as directed**,-steel housing with anodized-aluminum reflector.
 - a. Finish: Baked-enamel finish in manufacturer's standard **OR** custom, **as directed**, paint color as selected.
6. Unit Controls:
 - a. Line-voltage thermostat.
 - b. Enclosed contactor for remote thermostat.
 - c. Snow and ice detector with moisture sensor and integral temperature sensor.

B. Prefabricated Electric Radiant Heating Panels

1. Description: Sheet-metal-enclosed panel with heating element suitable for lay-in installation flush with T-bar ceiling grid **OR** surface mounting **OR** recessed mounting, **as directed**. Comply with UL 2021.



- a. Panel: Minimum 0.0276-inch- (0.7-mm-) thick, galvanized-steel sheet back panel riveted to minimum 0.0396-inch- (1.0-mm-) thick, galvanized-steel sheet front panel with fused-on crystalline surface.
 - b. Heating Element: Powdered graphite sandwiched between sheets of electric insulation **OR** Insulated resistive wires, **as directed**.
 - c. Electrical Connections: Nonheating, high-temperature, insulated-copper leads, factory connected to heating element.
 - d. Exposed-Side Panel Finish:
 - 1) Apply silk-screened finish to match appearance of Architect-selected acoustical ceiling tiles.
OR
Factory prime coated, ready for field painting.
OR
Baked-enamel finish in manufacturer's standard **OR** custom, **as directed**, paint color as selected.
 - e. Surface-Mounting Trim: Sheet metal with baked-enamel finish in manufacturer's standard **OR** custom, **as directed**, paint color as selected.
2. Wall Thermostat: Bimetal, sensing elements calibrated from 55 to 90 deg F (13 to 32 deg C); with contacts suitable for low **OR** line, **as directed**, -voltage circuit, and manually operated on-off switch with contactors, relays, and control transformers.
 3. Capacities and Characteristics:
 - a. Nominal Panel Size: 24 by 24 inches (600 by 600 mm) **OR** 24 by 36 inches (600 by 900 mm) **OR** 24 by 48 inches (600 by 1200 mm) **OR** 24 by 60 inches (600 by 1500 mm), **as directed**.
 - b. Heating Capacity: 250 **OR** 375 **OR** 500 **OR** 570 **OR** 625 **OR** 750 **OR** 950, **as directed**, kW.
- C. Hydronic Heating And Cooling, **as directed**, Panels
1. Description: Modular **OR** Linear, **as directed**, sheet metal panel with serpentine water piping, suitable for lay-in installation flush with T-bar ceiling grid **OR** surface mounting **OR** recessed mounting, **as directed**.
 - a. Panels: Minimum 0.0336-inch- (0.86-mm-) thick, galvanized-steel **OR** 0.0396-inch- (1.0-mm-) thick, aluminum, **as directed**, sheet.
 - b. Backing Insulation: Minimum 1-inch- (25-mm-) **OR** 2-inch- (50-mm-), **as directed**, thick, mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB with factory-applied jacket.
 - c. Exposed-Side Panel Finish:
 - 1) Apply silk-screened finish to match appearance of selected acoustical ceiling tiles.
OR
Factory prime coated, ready for field painting.
OR
Baked-enamel finish in manufacturer's standard **OR** custom, **as directed**, paint color as selected.
 - d. Factory Piping: ASTM B 88, Type L (ASTM B 88M, Type B) **OR** ASTM B 88, Type M (ASTM B 88M, Type C), **as directed**, copper tube with ASME B16.22 wrought-copper fittings and brazed joints. Piping shall be mechanically bonded to panel.
 - e. Surface-Mounting Trim: Sheet metal with baked-enamel finish in manufacturer's standard **OR** custom, **as directed**, paint color as selected.
 - f. Accessories:
 - 1) 5-inch (127-mm) **OR** 6-inch (152-mm) **OR** 8-inch (203-mm), **as directed**, panel with drape track recess.
 - 2) 5-inch (127-mm) male bullnose panel.
 - 3) 5-inch (127-mm) female bullnose panel.
 - 4) 4-inch (102-mm) male corner panel.
 - 5) 4-inch (102-mm) female corner panel.



- 6) Inside corner panel.
- 7) 1/2-inch (13-mm) filler panel.
2. Capacities and Characteristics:
 - a. Nominal Panel Size: 24 by 24 inches (600 by 600 mm) **OR** 24 by 36 inches (600 by 900 mm) **OR** 24 by 48 inches (600 by 1200 mm) **OR** 24 by 60 inches (600 by 1500 mm), **as directed**.
 - b. Piping Inlet and Outlet: NPS 1/2 (DN 15).

1.3 EXECUTION

A. Installation

1. Install radiant heating and cooling units level and plumb.
2. Suspend radiant heaters from structure.
3. Support for Radiant Heating and Cooling Panels in or on Grid-Type Suspended Ceilings: Use grid as a support element.
 - a. Install a minimum of four ceiling support system rods or wires for each panel. Locate not more than 6 inches (150 mm) from panel corners.
 - b. Support Clips: Fasten to panel and to ceiling grid members at or near each panel corner with clips designed for the application.
 - c. Panels of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support panels independently with at least two 3/4-inch (19-mm) metal channels spanning and secured to ceiling tees.
 - d. Install at least one independent support rod or wire from structure to a tab on panel. Wire or rod shall have breaking strength of the weight of panel at a safety factor of 3.
4. Verify locations of thermostats with Drawings and room details before installation. Install devices 48 inches (1220 mm) **OR** 60 inches (1525 mm), **as directed**, above finished floor.
5. Piping installation requirements are specified in Division 23 Section "Hydronic Piping". Drawings indicate general arrangement of piping, fittings, and specialties.
6. Unless otherwise indicated, install shutoff valve and union or flange at each connection.
7. Install piping adjacent to unit to allow service and maintenance.
8. Ground electric units according to Division 26 Section "Grounding And Bonding For Electrical Systems".
9. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

B. Field Quality Control

1. Testing: Perform the following field tests and inspections and prepare test reports:
 - a. Operate electric heating elements through each stage to verify proper operation and electrical connections.
 - b. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and units.
2. Remove and replace malfunctioning units and retest as specified above.
3. After installing panels, inspect unit cabinet for damage to finish. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

END OF SECTION 23 55 23 13



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SECTION 23 55 23 13a - RADIANT-HEATING ELECTRIC PANELS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for radiant-heating electric panels. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes prefabricated radiant-heating electric panels.

C. Submittals

1. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each type of product indicated.
2. Shop Drawings: For electric heating panels. Include plans, sections, details, and attachments to other work.
 - a. Wiring Diagrams: Power, signal, and control wiring.
3. Field quality-control test reports.
4. Operation and Maintenance Data: For electric heating panels to include in operation and maintenance manuals.
5. Warranty: Special warranty specified in this Section.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.2 PRODUCTS

A. Prefabricated Radiant-Heating Electric Panels

1. Description: Sheet-metal-enclosed panel with heating element suitable for lay-in installation flush with T-bar ceiling grid **OR** surface mounting **OR** recessed mounting, **as directed**. Comply with UL 2021.
 - a. Panel: Minimum 0.0276-inch- (0.7-mm-) thick, galvanized-steel sheet back panel riveted to minimum 0.0396-inch- (1.0-mm-) thick, galvanized-steel sheet front panel with fused-on crystalline surface.
 - b. Heating Element:
 - 1) Powdered graphite sandwiched between sheets of electric insulation.
OR
Insulated resistive wires.
 - c. Electrical Connections: Nonheating, high-temperature, insulated-copper leads, factory connected to heating element.
 - d. Exposed-Side Panel Finish:
 - 1) Apply silk-screened finish to match appearance of selected acoustical ceiling tiles.
 - 2) Factory prime coated, ready for field painting.
 - 3) Baked-enamel finish in manufacturer's standard **OR** custom, **as directed**, paint color as selected.
 - e. Surface-Mounting Trim: Sheet metal with baked-enamel finish in manufacturer's standard **OR** custom, **as directed**, paint color as selected.



2. Wall Thermostat: Bimetal, sensing elements calibrated from 55 to 90 deg F (13 to 32 deg C); with contacts suitable for low **OR** line, **as directed**, -voltage circuit, and manually operated on-off switch with contactors, relays, and control transformers.

1.3 EXECUTION

A. Installation

1. Install radiant-heating panels level and plumb.
2. Support for Radiant-Heating Panels in or on Grid-Type Suspended Ceilings: Use grid as a support element.
 - a. Install a minimum of four ceiling support system rods or wires for each panel. Locate not more than 6 inches (150 mm) from panel corners.
 - b. Support Clips: Fasten to panel and to ceiling grid members at or near each panel corner with clips designed for the application.
 - c. Panels of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support panels independently with at least two 3/4-inch (19-mm) metal channels spanning and secured to ceiling tees.
 - d. Install at least one independent support rod or wire from structure to a tab on panel. Wire or rod shall have breaking strength of the weight of panel at a safety factor of 3.
3. Verify locations of thermostats with Drawings and room details before installation. Install devices 48 inches (1220 mm) **OR** 60 inches (1525 mm), **as directed**, above finished floor.

B. Connections

1. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
2. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

C. Field Quality Control

1. Testing: Perform the following field tests and inspections and prepare test reports:
 - a. Operate electric heating elements through each stage to verify proper operation and electrical connections.
 - b. Test and adjust controls and safeties.
2. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 23 55 23 13a



SECTION 23 55 33 00 - FUEL-FIRED UNIT HEATERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for fuel-fired unit heaters. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes gas and oil-fired unit heaters.

C. Submittals

1. Product Data: For each type of fuel-fired unit heater indicated. Include rated capacities, operating characteristics, and accessories.
2. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - a. Wiring Diagrams: Power, signal, and control wiring.
3. Manufacturer Seismic Qualification Certification: Submit certification that fuel-fired unit heaters, accessories, and components will withstand seismic forces defined in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
4. Field quality-control test reports.
5. Operation and maintenance data.
6. Warranty: Special warranty specified in this Section.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

E. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace heat exchanger of fuel-fired unit heater that fails in materials or workmanship within Two **OR** Five, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Gas-Fired Unit Heaters

1. Description: Factory assembled, piped, and wired, and complying with ANSI Z83.8/CSA 2.6.
2. Fuel Type: Design burner for natural **OR** propane, **as directed**, gas having characteristics same as those of gas available at Project site.
3. Type of Venting: Gravity **OR** Powered **OR** Indoor, separated combustion, power, **as directed**, vented.
4. Housing: Steel, with integral draft hood and inserts for suspension mounting rods.
 - a. External Casings and Cabinets: Baked enamel **OR** Powder coating, **as directed**, over corrosion-resistant-treated surface.
 - b. Suspension Attachments: Reinforce suspension attachments at connection to fuel-fired unit heaters.



- 1) Seismic Fabrication Requirements: Fabricate suspension attachments of fuel-fired unit heaters, accessories mountings, and components with reinforcement strong enough to withstand seismic forces defined in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment" when fuel-fired unit heater is anchored to building structure.
5. Heat Exchanger: Aluminized **OR** Stainless, **as directed**, steel.
6. Burner Material: Aluminized steel with stainless-steel inserts **OR** Stainless steel, **as directed**.
7. Unit Fan: Formed-steel **OR** Aluminum, **as directed**, propeller blades riveted to heavy-gage steel spider bolted to cast-iron hub, dynamically balanced, and resiliently mounted.
 - a. Fan-Blade Guard: Galvanized steel, complying with OSHA specifications, removable for maintenance.
 - b. General requirements for motors are specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - 1) Motors: Totally enclosed with internal thermal-overload protection and complying with Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - 2) Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - 3) Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 22.
8. Unit Fan: Steel, centrifugal fan dynamically balanced and resiliently mounted.
 - a. Belt-Driven Drive Assembly: Resiliently mounted to housing, with the following features:
 - 1) Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
 - 2) Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
 - 3) Pulleys: Cast-iron, adjustable-pitch motor pulley.
 - b. General requirements for motors are specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - 1) Motors: Totally enclosed with internal thermal-overload protection and complying with Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - 2) Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - 3) Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 22.
9. Controls: Regulated redundant gas valve containing pilot solenoid valve, electric gas valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff all in one body.
 - a. Gas Control Valve: Single stage **OR** Two stage **OR** Modulating, **as directed**.
 - b. Ignition: Standing pilot **OR** Electronically controlled electric spark with flame sensor, **as directed**.
 - c. Fan Thermal Switch: Operates fan on heat-exchanger temperature.
 - d. Vent Flow Verification: Flame rollout switch **OR** Differential pressure switch to verify open vent, **as directed**.
 - e. Control transformer.
 - f. High Limit: Thermal switch or fuse to stop burner.
 - g. Thermostats: Devices and wiring are specified in Division 23 Section "Instrumentation And Control For Hvac".

OR

Thermostat: Single-stage, wall-mounting type with 50 to 90 deg F (10 to 32 deg C) operating range and fan on switch.

OR

Thermostat: 2-stage, wall-mounting type with 50 to 90 deg F (10 to 32 deg C) operating range and fan on switch.

OR

Thermostat: Single-stage type with duct-mounting sensor and 50 to 90 deg F (10 to 32 deg C) operating range.

OR



- Thermostat: 2-stage type with duct-mounting sensor and 50 to 90 deg F (10 to 32 deg C) operating range.
10. Discharge Louvers: Independently adjustable horizontal blades.
 11. Accessories:
 - a. Vertical discharge louvers.
 - b. Discharge Nozzle: Discharge at 25 to 65 degrees (0.44 to 1.13 radians) **OR** 50 to 90 degrees (0.87 to 1.57 radians), **as directed**, from horizontal.
 - c. Four-point suspension kit.
 - d. Summer fan switch.
 - e. Unit-mounted thermostat bracket.
 - f. Power Venter: Centrifugal aluminized-steel fan, with stainless-steel shaft; 120-V ac motor.
 - g. Concentric, Terminal Vent Assembly: Combined combustion-air inlet and power-vent outlet with wall or roof caps. Include adapter assembly for connection to inlet and outlet pipes, and flashing for wall or roof penetration.
- B. Oil-Fired Unit Heaters
1. Description: Factory assembled, piped, and wired, and complying with UL 731.
 2. Housing: Steel, with inserts for suspension mounting rods.
 - a. External Casings and Cabinets: Baked enamel **OR** Powder coating, **as directed**, over corrosion-resistant-treated surface.
 - b. Suspension Attachments: Reinforce suspension attachments at connection to fuel-fired unit heaters.
 - 1) Seismic Fabrication Requirements: Fabricate suspension attachments of fuel-fired unit heaters, accessories mountings, and components with reinforcement strong enough to withstand seismic forces defined in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment" when fuel-fired unit heater is anchored to building structure.
 3. Heat Exchanger: Minimum 0.09-inch (2.2-mm) steel.
 4. Burners: Flame-retention, pressure-atomizing, forced-draft, gun type; with integral fuel pump and electronic spark ignition and flame safety.
 - a. Safety Device: Oil-pressure switch.
 5. Unit Fan: Propeller fan with aluminum blades dynamically balanced and resiliently mounted.
 - a. Steel fan-blade guard.
 - b. General requirements for motors are specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - 1) Motors: Totally enclosed with internal thermal-overload protection and complying with Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - 2) Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - 3) Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 22.
 6. Unit Fan: Steel, centrifugal fan dynamically balanced and resiliently mounted.
 - a. Belt driven with adjustable-pitch motor sheave.
 - b. General requirements for motors are specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - 1) Motors: Totally enclosed with internal thermal-overload protection and complying with Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - 2) Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - 3) Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 22.
 7. Controls: Factory piped and prewired to electrical junction box mounted on unit, including the following:
 - a. Control Transformer: Integrally mounted, 120 to 24 V ac.
 - b. Cad-cell safety system.
 - c. Manual reset safety.



- d. Thermostat: Devices and wiring are specified in Division 23 Section "Instrumentation And Control For Hvac".
OR
 Thermostat: Single-stage, 24-V ac, wall-mounting type with 50 to 90 deg F (10 to 32 deg C) operating range and fan on switch.
OR
 Thermostat: 2-stage, 24-V ac, wall-mounting type with 50 to 90 deg F (10 to 32 deg C) operating range and fan on switch.
OR
 Thermostat: Single-stage, 24-V ac type with duct-mounting sensor and 50 to 90 deg F (10 to 32 deg C) operating range.
OR
 Thermostat: 2-stage, 24-V ac type with duct-mounting sensor and 50 to 90 deg F (10 to 32 deg C) operating range.
8. Automatic Fan Thermal Switch: Fan operates with heat-exchanger temperature more than 135 deg F (58 deg C).
9. Discharge Louvers: Independently adjustable horizontal blades.
10. Accessories:
- Vertical discharge louvers.
 - Discharge Nozzle: Discharge at 25 to 65 degrees (0.44 to 1.13 radians) **OR** 50 to 90 degrees (0.87 to 1.57 radians), **as directed**, from horizontal.
 - Summer fan switch.
 - Unit-mounted thermostat bracket.
 - Oil Booster Pump: 30-gph (108-L/h) **OR** 70-gph (252-L/h), **as directed**, capacity; motor and 2-stage fuel unit with pressure-regulating valve and strainer.
 - Oil safety valve.
 - Outdoor Combustion-Air Adapter: Sealed to housing and fitted with quick access cover or door and fitting for terminating outdoor-air duct.

1.3 EXECUTION

A. Installation

- Install and connect gas-fired unit heaters and associated fuel and vent features and systems according to NFPA 54 **OR** CAN/CSA B149.1, **as directed**, applicable local codes and regulations, and manufacturer's written installation instructions.
- Install and connect oil-fired unit heaters and associated fuel and vent piping according to NFPA 31 **OR** CAN/CSA B139, **as directed**, applicable local codes and regulations, and manufacturer's written installation instructions.
- Suspended Units: Suspend from substrate using threaded rods, spring hangers, and building attachments. Secure rods to unit hanger attachments. Adjust hangers so unit is level and plumb.
 - Restrain the unit to resist code-required horizontal acceleration.
- Substrate-Mounted Units: Provide supports connected to substrate. Secure units to supports.
 - Spring hangers and seismic restraints are specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 - Anchor the unit to resist code-required horizontal acceleration.

B. Connections

- Piping installation requirements are specified in other Division 21. Drawings indicate general arrangement of piping, fittings, and specialties.
- Install piping adjacent to fuel-fired unit heater to allow service and maintenance.
- Gas Piping: Comply with Division 23 Section(s) "Facility Natural-gas Piping" **OR** "Facility Liquefied-petroleum Gas Piping", **as directed**. Connect gas piping to gas train inlet; provide union with enough clearance for burner removal and service.



4. Fuel Oil Piping: Comply Division 23 Section "Facility Fuel-oil Piping". Connect to fuel oil supply and return piping with shutoff valve and union at each connection.
 5. Vent Connections: Comply with Division 23 Section "Breechings, Chimneys, And Stacks".
 6. Electrical Connections: Comply with applicable requirements in Division 22.
 - a. Install electrical devices furnished with heaters but not specified to be factory mounted.
- C. Field Quality Control
1. Perform tests and inspections and prepare test reports.
 2. Tests and Inspections:
 - a. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - b. Verify bearing lubrication.
 - c. Verify proper motor rotation.
 - d. Test Reports: Prepare a written report to record the following:
 - 1) Test procedures used.
 - 2) Test results that comply with requirements.
 - 3) Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
 3. Remove and replace malfunctioning units and retest as specified above.
- D. Adjusting
1. Adjust initial temperature set points.
 2. Adjust burner and other unit components for optimum heating performance and efficiency.
- E. Demonstration
1. Train Owner's maintenance personnel to adjust, operate, and maintain fuel-fired unit heaters.

END OF SECTION 23 55 33 00



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SECTION 23 55 33 00a - UNIT HEATERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for unit heaters. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Cabinet unit heaters with centrifugal fans and hot-water, steam, and electric-resistance heating coils.
 - b. Propeller unit heaters with hot-water, steam, and electric-resistance heating coils.
 - c. Wall and ceiling heaters with propeller fans and electric-resistance heating coils.

C. Definitions

1. BAS: Building automation system.
2. CWP: Cold working pressure.
3. PTFE: Polytetrafluoroethylene plastic.
4. TFE: Tetrafluoroethylene plastic.

D. Submittals

1. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each product indicated.
2. LEED Submittal:
 - a. Product Data for Prerequisite EQ 1: Documentation indicating that units comply with ASHRAE 62.1-2004, Section 5 - "Systems and Equipment."
3. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - a. Plans, elevations, sections, and details.
 - b. Location and size of each field connection.
 - c. Details of anchorages and attachments to structure and to supported equipment.
 - d. Equipment schedules to include rated capacities, operating characteristics, furnished specialties, and accessories.
 - e. Location and arrangement of piping valves and specialties.
 - f. Location and arrangement of integral controls.
 - g. Wiring Diagrams: Power, signal, and control wiring.
4. Manufacturer Seismic Qualification Certification: Submit certification that cabinet unit heaters, accessories, and components will withstand seismic forces defined in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
5. Field quality-control test reports.
6. Operation and maintenance data.

E. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
3. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6 - "Heating, Ventilating, and Air-Conditioning."



1.2 PRODUCTS

A. Cabinet Unit Heaters

1. Description: A factory-assembled and -tested unit complying with ARI 440.
 - a. Comply with UL 2021.
2. Coil Section Insulation (for duct-liner-type, glass-fiber insulation): ASTM C 1071; surfaces exposed to airstream shall be aluminum-foil facing **OR** erosion-resistant coating, **as directed**, to prevent erosion of glass fibers.
 - a. Thickness: 1/2 inch (13 mm) **OR** 1 inch (25 mm) **OR** 1-1/2 inches (38 mm), **as directed**.
 - b. Thermal Conductivity (k-Value): 0.26 Btu x in./h x sq. ft. at 75 deg F (0.037 W/m x K at 24 deg C) mean temperature.
 - c. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.
 - d. Adhesive: Comply with ASTM C 916 and with NFPA 90A or NFPA 90B.
 - e. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.
3. Coil Section Insulation (for flexible elastomeric insulation): Comply with NFPA 90A or NFPA 90B. Unicellular polyethylene thermal plastic, preformed sheet insulation complying with ASTM C 534, Type II, except for density.
 - a. Thickness: 3/8 inch (9 mm) **OR** 1/2 inch (13 mm) **OR** 3/4 inch (19 mm) **OR** 1 inch (25 mm), **as directed**.
 - b. Thermal Conductivity (k-Value): 0.24 Btu x in./h x sq. ft. at 75 deg F (0.034 W/m x K at 24 deg C) mean temperature.
 - c. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM C 411.
 - d. Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.
 - e. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.
4. Cabinet (for surface, semi-recessed, and fully recessed units): Steel with factory prime coating, ready for field painting **OR** baked-enamel finish with manufacturer's standard paint, in color selected by the Owner **OR** baked-enamel finish with manufacturer's custom paint, in color selected by the Owner, **as directed**.
 - a. Vertical Unit, Exposed Front Panels: Minimum 0.0528-inch- (1.35-mm-) **OR** 0.0677-inch- (1.7-mm-), **as directed**, thick, galvanized, **as directed**, sheet steel, removable panels with channel-formed edges secured with tamperproof cam fasteners.
 - b. Horizontal Unit, Exposed Bottom Panels: Minimum 0.0528-inch- (1.35-mm-) **OR** 0.0677-inch- (1.7-mm-), **as directed**, thick, galvanized, **as directed**, sheet steel, removable panels secured with tamperproof cam fasteners and safety chain.
 - c. Recessing Flanges (for units that are semirecessed or fully recessed in walls or ceilings): Steel, finished to match cabinet.
 - d. Control Access Door: Key operated.
 - e. Base (for surface, vertical, wall-mounting units): Minimum 0.0528-inch- (1.35-mm-) thick steel, finished to match cabinet, 4 inches (100 mm) **OR** 6 inches (150 mm), **as directed**, high with leveling bolts.
 - f. Extended Piping Compartment: 8-inch- (200-mm-), **as directed**, wide piping end pocket.
 - g. False Back (for vertical, wall-mounting units only): Minimum 0.0428-inch- (1.1-mm-) thick steel, finished to match cabinet.
 - h. Outdoor-Air Wall Box (for vertical, wall-mounting units only): Minimum 0.1265-inch- (3.2-mm-) thick, aluminum, rain-resistant louver and box with integral eliminators and bird screen. Aluminum louver with anodized **OR** baked-enamel, **as directed**, finish in color selected by the Owner from manufacturer's standard **OR** custom, **as directed**, colors.
 - 1) Outdoor-Air Damper: Galvanized-steel blades with edge and end seals and nylon bearings; with manual **OR** electronic **OR** pneumatic, **as directed**, two-position actuators.



5. Filters: Minimum arrestance according to ASHRAE 52.1 and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
 - a. Washable Foam: 70 percent arrestance and 3 MERV.
 - b. Glass Fiber Treated with Adhesive: 80 percent arrestance and 5 MERV.
 - c. Pleated: 90 percent arrestance and 7 MERV.
6. Hot-Water Coil: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm) and rated for a minimum working pressure of 200 psig (1378 kPa) and a maximum entering-water temperature of 220 deg F (104 deg C). Include manual air vent and drain.

OR

Steam Coil: Copper distributing, **as directed**, tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm) and rated for a minimum working pressure of 75 psig (517 kPa).

OR

Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and hum, mounted in ceramic inserts in a galvanized-steel housing; with fuses in terminal box for overcurrent protection and limit controls for high-temperature protection. Terminate elements in stainless-steel machine-staked terminals secured with stainless-steel hardware.
7. Fan and Motor Board: Removable.
 - a. Fan: Forward curved, high static, **as directed**, double width, centrifugal; directly connected to motor. Thermoplastic or painted-steel wheels, and aluminum, painted-steel, or galvanized-steel fan scrolls.
 - b. Motor: Permanently lubricated, multispeed; resiliently mounted on motor board. Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - c. Wiring Terminations: Connect motor to chassis wiring with plug connection.
8. Factory, Hot-Water Piping Package: ASTM B 88, Type L (ASTM B 88M, Type B) **OR** ASTM B 88, Type M (ASTM B 88M Type C), **as directed**, copper tube with wrought-copper fittings and brazed joints. Label piping to indicate service, inlet and outlet.
 - a. Two **OR** Three, **as directed**,-way, two-position **OR** modulating, **as directed**, control valve. Three-way valve packages shall include bypass line with manually adjustable balance device, **as directed**.
 - b. Hose Kits: Minimum 400-psig (2758-kPa) working pressure, and operating temperatures from 33 to 211 deg F (0.5 to 99 deg C). Tag hose kits to equipment designations.
 - 1) Length: 24 inches (600 mm) **OR** 36 inches (900 mm), **as directed**.
 - 2) Minimum Diameter: Equal to cabinet unit heater connection size.
 - c. Two-Piece, Ball Valves: Bronze body with full-port, chrome-plated bronze ball; PTFE or TFE seats; and 600-psig (4140-kPa) minimum CWP rating and blowout-proof stem.
 - d. Calibrated-Orifice Balancing Valves: Bronze body, ball type, 125-psig (860-kPa) working pressure, 250 deg F (121 deg C) maximum operating temperature; with calibrated orifice or venturi, connection for portable differential pressure meter with integral seals, threaded ends, and equipped with a memory stop to retain set position.
 - e. Automatic Flow-Control Valve: Brass or ferrous-metal body, 300-psig (2068-kPa) working pressure at 250 deg F (121 deg C), with removable, corrosion-resistant, tamperproof, self-cleaning, piston-spring; factory set to maintain constant indicated flow with plus or minus 10 percent over differential pressure range of 2 to 80 psig (13.8 to 552 kPa).
 - f. Y-Pattern, Hot-Water Strainers: Cast-iron body (ASTM A 126, Class B); 125-psig (860-kPa) minimum working pressure; with threaded connections, bolted cover, perforated stainless-steel basket, and bottom drain connection. Include minimum NPS 1/2 (DN 15) threaded pipe and full-port ball valve in strainer drain connection.
 - g. Wrought-Copper Unions: ASME B16.22.
9. Control devices and operational sequences are specified in Division 23 Section(s) "Instrumentation And Control For Hvac" AND "Sequence Of Operations For Hvac Controls".
10. Basic Unit Controls:
 - a. Control voltage transformer.
 - b. Wall-mounting **OR** Unit-mounted, **as directed**, thermostat with the following features.
 - 1) Heat-off switch.



- 2) Fan on-auto switch.
 - 3) Manual fan speed switch (for use with multispeed motors).
 - 4) Adjustable deadband.
 - 5) Concealed **OR** Exposed, **as directed**, set point.
 - 6) Concealed **OR** Exposed, **as directed**, indication.
 - 7) Deg F (Deg C) indication.
 - c. Wall-mounting **OR** Unit-mounted, **as directed**, temperature sensor.
 - d. Unoccupied period override push button.
 - e. Data entry and access port.
 - 1) Input data includes room temperature, and occupied and unoccupied periods.
 - 2) Output data includes room temperature, supply-air temperature, entering-water temperature, operating mode, and status.
11. DDC, **as directed**, Terminal Controller:
- a. Scheduled Operation: Occupied and unoccupied periods on seven-day clock with a minimum of four programmable periods per day.
 - b. Unoccupied Period Override: Two, **as directed**, hours.
 - c. Unit Supply-Air Fan Operations:
 - 1) Occupied Periods: Fan runs continuously.
 - 2) Unoccupied Periods: Fan cycles to maintain setback room temperature.
 - d. Heating Coil Operations:
 - 1) Occupied Periods: Open control valve **OR** Modulate control valve **OR** Energize electric-resistance coil, **as directed**, to provide heating if room temperature falls below thermostat set point.
 - 2) Unoccupied Periods: Start fan and open control valve **OR** modulate control valve **OR** energize electric-resistance coil, **as directed**, if room temperature falls below setback temperature.
 - e. Outdoor-Air Damper Operation:
 - 1) Occupied Periods: Open dampers. Delay damper opening if room temperature is more than three degrees below set point.
 - 2) Unoccupied Periods: Close damper.
 - f. Controller shall have volatile-memory backup.
12. BAS Interface Requirements:
- a. Interface relay for scheduled operation.
 - b. Interface relay to provide indication of fault at central workstation.
 - c. Interface shall be BAC-net **OR** LonWorks, **as directed**, compatible for central BAS workstation and include the following functions:
 - 1) Adjust set points.
 - 2) Cabinet unit heater start, stop, and operating status.
 - 3) Data inquiry, including outdoor-air damper position, **as directed**, supply-air and room-air temperature.
 - 4) Occupied and unoccupied schedules.
13. Electrical Connection: Factory wire motors and controls for a single field connection.
- B. Propeller Unit Heaters
1. Description: An assembly including casing, coil, fan, and motor in vertical **OR** horizontal **OR** vertical and horizontal, **as directed**, discharge configuration with adjustable discharge louvers.
 2. Comply with UL 2021, for electric unit heaters.
 3. Comply with UL 823, for explosion-proof electric unit heaters.
 4. Cabinet: Removable panels for maintenance access to controls.
 5. Cabinet Finish: Manufacturer's standard **OR** custom, **as directed**, baked enamel applied to factory-assembled and -tested propeller unit heater before shipping.
 6. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.
 7. Discharge Louver: Adjustable fin diffuser for horizontal units and conical diffuser for vertical units.



8. General Coil Requirements: Test and rate hot-water **OR** steam, **as directed**, propeller unit heater coils according to ASHRAE 33.
9. Hot-Water Coil: Copper tube, minimum 0.025-inch (0.635-mm) wall thickness, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm) and rated for a minimum working pressure of 200 psig (1380 kPa) and a maximum entering-water temperature of 325 deg F (163 deg C), with manual air vent. Test for leaks to 350 psig (2413 kPa) underwater.
OR
Hot-Water Coil: Cupronickel tube, minimum 0.031-inch (0.78-mm) wall thickness, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm) and rated for a minimum working pressure of 400 psig (2760 kPa) and a maximum entering-water temperature of 450 deg F (232 deg C), with manual air vent. Test for leaks to 600 psig (4137 kPa) underwater.
OR
Hot-Water Coil: Red brass tube, minimum 0.049-inch (1.24-mm) wall thickness, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm) and rated for a minimum working pressure of 260 psig (1793 kPa) and a maximum entering-water temperature of 390 deg F (199 deg C), with manual air vent. Test for leaks to 390 psig (2689 kPa) underwater.
OR
Hot-Water Coil: Steel tube, minimum 0.049-inch (1.24-mm) wall thickness, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm) and rated for a minimum working pressure of 400 psig (2760 kPa) and a maximum entering-water temperature of 450 deg F (232 deg C), with manual air vent. Test for leaks to 600 psig (4137 kPa) underwater.
OR
Hot-Water Coil: Vertical steel tube, minimum 0.065-inch (1.65-mm) wall thickness, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm) and rated for a minimum working pressure of 400 psig (2760 kPa) and a maximum entering-water temperature of 450 deg F (232 deg C), with steel headers at top and bottom. Test for leaks to 600 psig (4137 kPa) underwater.
OR
Steam Coil: Copper tube, minimum 0.025-inch (0.635-mm) wall thickness, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm) and rated for a minimum working pressure of 75 psig (520 kPa).
OR
Steam Coil: Red brass tube, minimum 0.049-inch (1.24-mm) wall thickness, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm) and rated for a minimum working pressure of 75 psig (520 kPa).
OR
Steam Coil: Vertical steel tube, minimum 0.065-inch (1.65-mm) wall thickness, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm) and rated for a minimum working pressure of 100 psig (690 kPa) **OR** 200 psig (1380 kPa), **as directed**, with steel headers at top and bottom.
10. Electric-Resistance Heating Elements: Nickel-chromium heating wire, free from expansion noise and 60-Hz hum, embedded in magnesium oxide refractory and sealed in steel or corrosion-resistant metallic sheath with fins no closer than 0.16 inch (4 mm). Element ends shall be enclosed in terminal box. Fin surface temperature shall not exceed 550 deg F (288 deg C) at any point during normal operation.
 - a. Circuit Protection: One-time fuses in terminal box for overcurrent protection and limit controls for high-temperature protection of heaters.
 - b. Wiring Terminations: Stainless-steel or corrosion-resistant material.
11. Fan: Propeller type with aluminum wheel directly mounted on motor shaft in the fan venturi.
12. Fan Motors: Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - a. Motor Type: Permanently lubricated, explosion proof **OR** multispeed **OR** variable speed, **as directed**.
13. Control Devices:
 - a. Unit-mounted **OR** Wall-mounting, **as directed**, variable, **as directed**, fan-speed switch.
 - b. Unit-mounted **OR** Wall-mounting, **as directed**, thermostat.



C. Wall And Ceiling Heaters

1. Description: An assembly including chassis, electric heating coil, fan, motor, and controls. Comply with UL 2021.
2. Cabinet:
 - a. Front Panel: Stamped-steel louver **OR** Extruded-aluminum bar grille, **as directed**, with removable panels fastened with tamperproof fasteners.
 - b. Finish: Baked enamel over baked-on primer with manufacturer's standard **OR** custom, **as directed**, color selected by the Owner, applied to factory-assembled and -tested wall and ceiling heaters before shipping.
 - c. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.
3. Surface-Mounting Cabinet Enclosure: Steel with finish to match cabinet.
4. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and hum, embedded in magnesium oxide refractory and sealed in corrosion-resistant metallic sheath. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware, and limit controls for high temperature protection. Provide integral circuit breaker for overcurrent protection, **as directed**.
5. Fan: Aluminum propeller directly connected to motor.
 - a. Motor: Permanently lubricated, multispeed, **as directed**. Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".
6. Controls: Unit-mounted thermostat. Low-voltage relay with transformer kit, **as directed**.
7. Electrical Connection: Factory wire motors and controls for a single field connection with disconnect switch, **as directed**.

1.3 EXECUTION

A. Installation

1. Install wall boxes in finished wall assembly; seal and weatherproof. Joint-sealant materials and applications are specified in Division 07 Section "Joint Sealants".
2. Install cabinet unit heaters to comply with NFPA 90A.
3. Install propeller unit heaters level and plumb.
4. Suspend cabinet unit heaters from structure with elastomeric hangers and seismic restraints, **as directed**. Vibration isolators and seismic restraints, **as directed**, are specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
5. Suspend propeller unit heaters from structure with all-thread hanger rods and elastomeric hangers **OR** spring hangers **OR** spring hangers with vertical-limit stop, **as directed**. Hanger rods and attachments to structure are specified in Division 23 Section "Hangers And Supports For Hvac Piping And Equipment". Vibration hangers are specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
6. Install wall-mounting thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.
7. Install new filters in each fan-coil unit within two weeks of Final Completion.

B. Connections

1. Piping installation requirements are specified in other Division 21. Drawings indicate general arrangement of piping, fittings, and specialties.
2. Install piping adjacent to machine to allow service and maintenance.
3. Connect piping to cabinet unit heater's factory, hot-water piping package. Install the piping package if shipped loose.
4. Connect supply and return ducts to cabinet unit heaters with flexible duct connectors specified in Division 23 Section "Air Duct Accessories".
5. Comply with safety requirements in UL 1995.



6. Unless otherwise indicated, install union and gate or ball valve on supply-water connection and union and calibrated balancing valve on return-water connection of unit heater. Hydronic specialties are specified in Division 23 Section "Hydronic Piping".
 7. Unless otherwise indicated, install union and gate or ball valve on steam-supply connection and union, strainer, steam trap, and gate or ball valve on condensate-return connection of unit heater. Steam specialties are specified in Division 23 Section "Steam And Condensate Heating Piping".
 8. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
 9. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".
- C. Field Quality Control
1. Perform the following field tests and inspections and prepare test reports:
 - a. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - b. Operate electric heating elements through each stage to verify proper operation and electrical connections.
 - c. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.
 2. Remove and replace malfunctioning units and retest as specified above.
- D. Adjusting
1. Adjust initial temperature set points.
 2. Occupancy Adjustments: When requested within 12 months of date of Final Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.
- E. Demonstration
1. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain cabinet unit heaters.

END OF SECTION 23 55 33 00a



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23 - Heating, Ventilating, And Air-Conditioning (HVAC)

Task	Specification	Specification Description
23 55 33 00	01 22 16 00	No Specification Required



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SECTION 23 57 13 00 - HEAT EXCHANGERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for hydronic and steam heat exchangers. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes shell-and-tube and plate heat exchangers.

C. Submittals

1. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories.
2. Coordination Drawings: Equipment room, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - a. Tube-removal space.
 - b. Structural members to which heat exchangers will be attached.
3. Manufacturer Seismic Qualification Certification: Submit certification that heat exchanger, accessories, and components will withstand seismic forces defined in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".

D. Quality Assurance

1. ASME Compliance: Fabricate and label heat exchangers to comply with ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," Division 1.

1.2 PRODUCTS

A. Shell-And-Tube Heat Exchangers

1. Configuration: U-tube with removable bundle.
2. Shell Materials: Steel.
3. Head:
 - a. Materials: Cast iron **OR** Cast stainless steel **OR** Fabricated steel **OR** Fabricated steel with removable cover **OR** Fabricated stainless steel **OR** Fabricated stainless steel with removable cover, **as directed**.
 - b. Flanged and bolted to shell.
4. Tube:
 - a. Seamless copper **OR** Steel **OR** Stainless-steel **OR** Cupronickel **OR** Admiralty-metal, **as directed**, tubes.
 - b. Tube diameter is determined by manufacturer based on service.
5. Tubesheet Materials: Steel **OR** Stainless-steel, **as directed**, tubesheets.
6. Baffles: Steel **OR** Stainless steel, **as directed**.
7. Piping Connections:
 - a. Shell: Flanged inlet and threaded **OR** Threaded inlet and **OR** Flanged inlet and, **as directed**, outlet fluid connections, threaded drain, and vent connections.
 - b. Head: Threaded **OR** Flanged, **as directed**, inlet and outlet fluid connections.
8. Support Saddles:
 - a. Fabricated of material similar to shell.
 - b. Foot mount with provision for anchoring to support.



- c. Fabricate attachment of saddle supports to pressure vessel with reinforcement strong enough to resist heat-exchanger movement during a seismic event when heat-exchanger saddles are anchored to building structure.

B. Gasketed Plate Heat Exchangers

1. Configuration: Freestanding assembly consisting of frame support, top and bottom carrying and guide bars, fixed and movable end plates, tie rods, individually removable plates, and one-piece gaskets.
2. Frame:
 - a. Capacity to accommodate 20 percent additional plates.
 - b. Painted carbon steel with provisions for anchoring to support.
3. Top and Bottom Carrying and Guide Bars: Painted carbon steel, aluminum, or stainless steel.
 - a. Fabricate attachment of heat-exchanger carrying and guide bars with reinforcement strong enough to resist heat-exchanger movement during a seismic event when heat-exchanger carrying and guide bars are anchored to building structure.
4. End-Plate Material: Painted carbon steel.
5. Tie Rods and Nuts: Steel or stainless steel.
6. Plate Material: 0.024 inch (0.6 mm) **OR** 0.031 inch (0.8 mm) **OR** 0.039 inch (1 mm), **as directed**, thick before stamping; Type 304 **OR** 304L **OR** 316 **OR** 316L, **as directed**, stainless steel.
7. Gasket Material: Nitrile rubber **OR** EPDM, **as directed**.
8. Piping Connections:
 - a. Threaded port for NPS 2 (DN 50) and smaller. For larger sizes, furnish end-plate port with threaded studs suitable for flanged connection.
 - b. End plate with welded carbon-steel nozzles. Threaded pipe connection for NPS 2 (DN 50) and smaller; carbon-steel flanged pipe connection for larger sizes.
 - c. Line wetted surfaces with same material as plates.
9. Enclose plates in a solid aluminum **OR** stainless-steel, **as directed**, removable shroud.

C. Brazed Plate Heat Exchangers

1. Configuration: Brazed assembly consisting of two end plates, one with threaded nozzles and pattern-embossed plates.
2. End-Plate Material: Type 316 stainless steel.
3. Threaded Nozzles: Type 316 stainless steel.
4. Plate Material: Type 316 stainless steel.
5. Brazing Material: Copper or nickel.

1.3 EXECUTION

A. Heat-Exchanger Installation

1. Install shell-and-tube heat exchangers on saddle supports.
2. Install shell-and-tube heat exchangers on, and anchor to, concrete base.

B. Connections

1. Install shutoff valves at heat-exchanger inlet and outlet connections.
2. Install relief valves on heat-exchanger heated-fluid connection and install pipe relief valves, full size of valve connection, to floor drain.
3. Install vacuum breaker at heat-exchanger steam inlet connection.
4. Install hose end valve to drain shell.

END OF SECTION 23 57 13 00



23 - Heating, Ventilating, And Air-Conditioning (HVAC)

Task	Specification	Specification Description
23 57 16 00	23 57 13 00	Heat Exchangers
23 57 19 19	23 57 13 00	Heat Exchangers
23 57 19 23	23 57 13 00	Heat Exchangers



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SECTION 23 61 16 00 - CENTRIFUGAL WATER CHILLERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for centrifugal water chillers. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Packaged, water-cooled, electric-motor-driven centrifugal chillers.
 - b. Packaged, portable refrigerant recovery units.
 - c. Heat-exchanger, brush-cleaning system.

C. Definitions

1. BAS: Building automation system.
2. COP: Coefficient of performance. The ratio of the rate of heat removal to the rate of energy input using consistent units for any given set of rating conditions.
3. EER: Energy-efficiency ratio. The ratio of the cooling capacity given in terms of Btu/h to the total power input given in terms of watts at any given set of rating conditions.
4. IPLV: Integrated part-load value. A single-number part-load efficiency figure of merit calculated per the method defined by ARI 550/590 and referenced to ARI standard rating conditions.
5. kW/Ton (kW/kW): The ratio of total power input of the chiller in kilowatts to the net refrigerating capacity in tons (kW) at any given set of rating conditions.
6. NPLV: Nonstandard part-load value. A single-number part-load efficiency figure of merit calculated per the method defined by ARI 550/590 and intended for operating conditions other than the ARI standard rating conditions.

D. Performance Requirements

1. Seismic Performance: Centrifugal chillers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
2. Condenser-Fluid Temperature Performance:
 - a. Startup Condenser-Fluid Temperature: Chiller shall be capable of starting with an entering condenser-fluid temperature of 60 deg F (16 deg C) **OR** 55 deg F (13 deg C) **OR** 40 deg F (4 deg C), **as directed**, and providing stable operation until the system temperature is elevated to the minimum operating entering condenser-fluid temperature.
 - b. Minimum Operating Condenser-Fluid Temperature: Chiller shall be capable of continuous operation over the entire capacity range indicated with an entering condenser-fluid temperature of 65 deg F (18 deg C) **OR** 60 deg F (16 deg C) **OR** 55 deg F (13 deg C), **as directed**.
 - c. Make factory modifications to standard chiller design if necessary to comply with performance indicated.
3. Site Altitude: Chiller shall be suitable for altitude at which installed without affecting performance indicated. Make adjustments to affected chiller components to account for site altitude.
4. Performance Tolerance: Comply with the following in lieu of ARI 550/590, **as directed**:
 - a. Allowable Capacity Tolerance: Zero percent.
 - b. Allowable IPLV/NPLV Performance Tolerance: Zero percent.

E. Submittals



1. Product Data: For each type of product indicated. Include refrigerant, rated capacities, operating characteristics, furnished specialties, and accessories.
2. LEED Submittal:
 - a. Product Data for Credit EA 4: Documentation required by Credit EA 4 indicating that equipment and refrigerants comply.
3. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - a. Detail equipment assemblies and indicate dimensions, weights, load distribution, required clearances, method of field assembly, components, and location and size of each field connection.
 - b. Wiring Diagrams: For power, signal, and control wiring.
4. Certificates: For certification required in "Quality Assurance" Article.
5. Seismic Qualification Certificates: For chillers, accessories, and components, from manufacturer.
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
6. Startup service reports.
7. Operation and maintenance data.
8. Warranty: Sample of special warranty.

F. Quality Assurance

1. ARI Certification: Certify chiller according to ARI 550 certification program.
2. ARI Rating: Rate chiller performance according to requirements in ARI 550/590.
3. ASHRAE Compliance:
 - a. ASHRAE 15 for safety code for mechanical refrigeration.
 - b. ASHRAE 147 for refrigerant leaks, recovery, and handling and storage requirements.
4. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.
5. ASME Compliance: Fabricate and label chillers to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, as applicable to chiller design. For chillers charged with R-134a refrigerant, include an ASME U-stamp and nameplate certifying compliance.
6. Comply with NFPA 70.
7. Comply with requirements of UL and UL Canada, and include label by a qualified testing agency showing compliance.
8. Green Seal Compliance: Signed by manufacturer **OR** Green Seal, **as directed**, certifying compliance with GS-31.

G. Delivery, Storage, And Handling

1. Ship chillers from the factory fully charged with refrigerant.
OR
Ship each chiller with a full charge of refrigerant. Charge each chiller with nitrogen if refrigerant is shipped in containers separate from chiller.
2. Ship each oil-lubricated chiller with a full charge of oil.
 - a. Ship oil factory installed in chiller **OR** in containers separate from chiller, **as directed**.
3. Package chiller for export shipping in totally enclosed bagging **OR** crate **OR** crate with bagging, **as directed**.

H. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of chillers that fail in materials or workmanship within specified warranty period.
 - a. Extended warranties include, but are not limited to, the following:
 - 1) Complete chiller including refrigerant and oil charge.
- OR**



- Complete compressor and drive assembly including refrigerant and oil charge.
OR
Refrigerant **OR** Refrigerant and oil, **as directed**, charge.
- 2) Parts only **OR** Parts and labor, **as directed**.
- 3) Loss of refrigerant charge for any reason.
- b. Warranty Period: Two **OR** Three **OR** Four **OR** Five, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Manufactured Unit

1. Description: Factory-assembled and -tested chiller complete with compressor, compressor motor, compressor motor controller, evaporator **OR** lubrication system evaporator, **as directed**, condenser, heat-reclaim condenser as indicated, controls, interconnecting unit piping and wiring, and indicated accessories.
 - a. Disassemble chiller into major assemblies as required by the installation after factory testing and before packaging for shipment.
 - b. For chillers with dual compressors, provide each compressor with a dedicated motor and motor controller, and provide for continued operation when either compressor-drive assembly fails or is being serviced.
2. Fabricate chiller mounting base with reinforcement strong enough to resist chiller movement during a seismic event when chiller is anchored to field support structure.

B. Compressor-Drive Assembly

1. Description: Single-stage or multistage, variable-displacement, centrifugal-type compressor driven by an electric motor.
 - a. Where indicated, provide oil-free compressor technology using a permanent magnet synchronous motor, magnetic bearings, integral variable frequency controller, and digital electronic controls.
2. Compressor:
 - a. Casing: Cast iron, precision ground.
 - b. Impeller: High-strength cast aluminum or cast-aluminum alloy on carbon- or alloy-steel shaft.
3. Drive: Direct-drive, hermetic **OR** Gear-drive, hermetic **OR** Gear-drive, open **OR** Direct- or gear-drive, hermetic **OR** Direct- or gear-drive, open or hermetic, **as directed**, design using an electric motor as the driver.
 - a. Gear Drives: For chillers with gear drives, provide single- or double-helical gear design continuously coated with oil while chiller is operating. Gears shall comply with American Gear Manufacturer Association standards.
 - b. Drive Coupling: For chillers with open drives, provide flexible disc with all-metal construction and no wearing parts to ensure long life without the need for lubrication.
 - c. Seals: Seal drive assembly to prevent refrigerant leakage.
4. Compressor Motor:
 - a. Continuous-duty, squirrel-cage, induction-type, two-pole motor with energy efficiency required to suit chiller energy efficiency indicated.
 - b. Factory mounted, aligned, and balanced as part of compressor assembly before shipping.
 - c. Motor shall be of sufficient capacity to drive compressor throughout entire operating range without overload and with sufficient capacity to start and accelerate compressor without damage.
 - d. For chillers with open drives, provide motor with open-dripproof **OR** weather-protected, Type I **OR** weather-protected, Type II **OR** totally enclosed, **as directed**, enclosure.
 - e. Provide motor with thermistor or RTD in single motor winding **OR** each of three-phase motor windings, **as directed**, to monitor temperature and report information to chiller control panel.



- f. Provide motor with thermistor or RTD to monitor bearing temperature and report information to chiller control panel.
- g. Provide open-drive motor with internal electric heater, internally powered from chiller power supply.
5. Vibration Balance: Balance chiller compressor and drive assembly to provide a precision balance that is free of noticeable vibration over the entire operating range.
 - a. Overspeed Test: 25 percent above design operating speed.
6. Service: Easily accessible for inspection and service.
 - a. Compressor's internal components shall be accessible without having to remove compressor-drive assembly from chiller.
 - b. Provide lifting lugs or eyebolts attached to casing.
7. Economizers: For multistage chillers, provide interstage economizers.
8. Capacity Control: Modulating, variable-inlet, guide-vane assembly combined with hot-gas bypass, if necessary, to achieve performance indicated.
 - a. Maintain stable operation that is free of surge, cavitation, and vibration throughout range of operation. Configure to achieve most energy-efficient operation possible.
 - b. Operating Range: From 100 to 15 **OR** 10 **OR** 5 **OR** zero, **as directed**, percent of design capacity.
 - c. Condenser-Fluid Unloading Requirements over Operating Range: Constant-design entering condenser-fluid temperature **OR** Drop-in entering condenser-fluid temperature of 2.5 deg F (1.4 deg C) for each 10 percent in capacity reduction, **as directed**.
 - d. Chillers with variable frequency controllers shall modulate compressor speed with variable-inlet, guide-vane control to achieve optimum energy efficiency.
9. Oil Lubrication System: Consisting of pump, filtration, heater, **as directed**, cooler, factory-wired power connection, and controls.
 - a. Provide lubrication to bearings, gears, and other rotating surfaces at all operating, startup, coastdown, and standby conditions including power failure.
 - b. Manufacturer's standard method **OR** Thermostatically controlled oil heater properly sized, **as directed**, to remove refrigerant from oil.
 - c. Oil filter **OR** Dual oil filters, one redundant, **as directed**, shall be the easily replaceable cartridge type, minimum 0.5-micron efficiency, with means of positive isolation while servicing.
 - d. Refrigerant **OR** Water, **as directed**, -cooled oil cooler.
 - e. Factory-installed and pressure-tested piping with isolation valves and accessories.
 - f. Oil compatible with refrigerant and chiller components.
 - g. Positive visual indication of oil level.

C. Refrigeration

1. Refrigerant:
 - a. Type: R-123; ASHRAE 34, Class B1 **OR** R-134a; ASHRAE 34, Class A1, as directed.
 - b. Compatibility: Chiller parts exposed to refrigerants shall be fully compatible with refrigerants, and pressure components shall be rated for refrigerant pressures.
2. Refrigerant Flow Control: Manufacturer's standard refrigerant flow-control device satisfying performance requirements indicated.
3. Pressure Relief Device:
 - a. Comply with requirements in ASHRAE 15 and in applicable portions of ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 - b. For Chillers Using R-123: Rupture disc constructed of frangible carbon **OR** Spring-loaded, pressure relief valve; single- or multiple-reseating type, **as directed**.
 - c. For Chillers Using R-134a: ASME-rated, spring-loaded, pressure relief valve; single- or multiple-reseating type. Pressure relief valve(s) shall be provided for each heat exchanger. Condenser shall have dual valves with one being redundant and configured to allow either valve to be replaced without loss of refrigerant.



4. Refrigeration Transfer: Provide service valves and other factory-installed accessories required to facilitate transfer of refrigerant from chiller to a remote refrigerant storage and recycling system. Comply with requirements in ASHRAE 15 and ASHRAE 147.
 5. Refrigerant Isolation for Chillers Using R-134a: Factory install positive shutoff, manual, **as directed**, isolation valves in the compressor discharge line to the condenser and the refrigerant liquid line leaving the condenser to allow for isolation and storage of full refrigerant charge in the chiller condenser shell. In addition, provide isolation valve on suction side of compressor from evaporator to allow for isolation and storage of full refrigerant charge in the chiller evaporator shell, **as directed**.
 6. Purge System:
 - a. For chillers operating at subatmospheric pressures (using R-123 refrigerant), factory install an automatic purge system for collection and return of refrigerant and lubricating oil and for removal of noncondensables including, but not limited to, water, water vapor, and noncondensable gases.
 - b. System shall be a thermal purge design, refrigerant or air cooled, equipped with a carbon filter that includes an automatic regeneration cycle.
 - c. Factory wire to chiller's main power supply and system complete with controls, piping, and refrigerant valves to isolate the purge system from the chiller.
 - d. Construct components of noncorrodible materials.
 - e. Controls shall interface with chiller control panel to indicate modes of operation, set points, data reports, diagnostics, and alarms.
 - f. Efficiency of not more than 0.02 lb of refrigerant per pound of air (9 g of refrigerant per gram of air) when rated according to ARI 580.
 - g. Operation independent of chiller per ASHRAE 147.
 7. Positive-Pressure System:
 - a. For chillers operating at subatmospheric pressures (using R-123 refrigerant), factory install an automatic positive-pressure system.
 - b. During nonoperational periods, positive-pressure system shall automatically maintain a positive pressure for atmosphere in the refrigerant pressure vessel of not less than 0.5 psig (3 kPa) (adjustable) up to a pressure that remains within the vessel design pressure limits.
 - c. System shall be factory wired and include controller, electric heat, pressure transmitter, or switch.
- D. Evaporator
1. Description: Shell-and-tube design with water in tubes and refrigerant surrounding tubes within shell. Shell is separate from condenser.
 2. Shell Material: Carbon-steel rolled plates with continuously welded seams or seamless pipe.
 3. Designed to prevent liquid refrigerant carryover from entering compressor.
 4. Provide evaporator with sight glass or other form of positive visual verification of liquid-refrigerant level.
 5. Tubes:
 - a. Individually replaceable from either end and without damage to tube sheets and other tubes.
 - b. Mechanically expanded into end sheets and physically attached to intermediate tube sheets.
 - c. Material: Copper **OR** Copper-nickel alloy **OR** Stainless steel **OR** Titanium, **as directed**.
 - d. Nominal OD: Manufacturer's choice **OR** 3/4 inch (19 mm) **OR** 1 inch (25 mm), **as directed**.
 - e. Minimum Wall Thickness: Manufacturer's choice **OR** 0.025 inch (0.6 mm) **OR** 0.028 inch (0.7 mm) **OR** 0.035 inch (0.9 mm), **as directed**.
 - f. External Finish: Manufacturer's standard.
 - g. Internal Finish: Enhanced **OR** Smooth, **as directed**.
 6. End Tube Sheets: Continuously welded to each end of shell; drilled and reamed to accommodate tubes with positive seal between fluid in tubes and refrigerant in shell.
 7. Intermediate Tube Sheets: Installed in shell and spaced along length of tube at intervals required to eliminate vibration and to avoid contact of tubes resulting in abrasion and wear.



8. Water Box:
 - a. Cast-iron or carbon-steel construction; arranged to provide visual inspection and cleaning of tubes from either end without disturbing refrigerant in shell.
 - b. Standard **OR** Marine, **as directed**, type for water box with piping connections. Standard type for water box without piping connections.
 - c. Provide water boxes and marine water-box covers, **as directed**, with lifting lugs or eyebolts.
 - d. Hinged **OR** Davited, **as directed**, water boxes.
OR
Hinged **OR** Davited, **as directed**, marine water-box covers.
 - e. Nozzle Pipe Connections: Welded, ASME B16.5, flat-face flange **OR** Welded, ASME B16.5, raised-face flange **OR** Grooved for mechanical-joint coupling **OR** Grooved with mechanical-joint coupling and flange adapter, **as directed**.
 - f. Thermistor or RTD temperature sensor factory installed in each nozzle.
 - g. Fit each water box with 3/4-inch (19-mm) **OR** 1-inch (25-mm), **as directed**, drain connection at low point and vent connection at high point, each with threaded plug.
9. Additional Corrosion Protection:
 - a. Electrolytic corrosion-inhibitor anode.
 - b. Coat wetted surfaces with a corrosion-resistant finish.
OR
Using same material as tubes, clad surfaces of end tube sheets in contact with fluid. Coat other wetted surfaces, including water boxes, with a corrosion-resistant finish.

E. Condenser

1. Description: Shell-and-tube design with water in tubes and refrigerant surrounding tubes within shell. Shell is separate from evaporator.
2. Shell Material: Carbon-steel rolled plates with continuously welded seams or seamless pipe.
3. Designed to prevent direct impingement of high-velocity hot gas from compressor discharge on tubes.
4. Provide condenser with sight glass or other form of positive visual verification of refrigerant charge and condition.
5. Tubes:
 - a. Individually replaceable from either end and without damage to tube sheets and other tubes.
 - b. Mechanically expanded into end sheets and physically attached to intermediate tube sheets.
 - c. Material: Copper **OR** Copper-nickel alloy **OR** Stainless steel **OR** Titanium, **as directed**.
 - d. Nominal OD: Manufacturer's choice **OR** 3/4 inch (19 mm) **OR** 1 inch (25 mm), **as directed**
 - e. Minimum Wall Thickness: Manufacturer's choice **OR** 0.025 inch (0.6 mm) **OR** 0.028 inch (0.7 mm) **OR** 0.035 inch (0.9 mm), **as directed**.
 - f. External Finish: Manufacturer's standard.
 - g. Internal Finish: Enhanced **OR** Smooth, **as directed**.
6. End Tube Sheets: Continuously welded to each end of shell; drilled and reamed to accommodate tubes with positive seal between fluid in tubes and refrigerant in shell.
7. Intermediate Tube Sheets: Installed in shell and spaced along length of tube at intervals required to eliminate vibration and to avoid contact of tubes resulting in abrasion and wear.
8. Water Box:
 - a. Cast-iron or carbon-steel construction; arranged to provide visual inspection and cleaning of tubes from either end without disturbing refrigerant in shell.
 - b. Standard **OR** Marine, **as directed**, type for water box with piping connections. Standard type for water box without piping connections.
 - c. Provide water boxes and marine water-box covers, **as directed**, with lifting lugs or eyebolts.
 - d. Hinged **OR** Davited, **as directed**, water boxes.
OR



- e. Hinged **OR** Davited, **as directed**, marine water-box covers.
 - e. Nozzle Pipe Connections: Welded, ASME B16.5, flat-face flange **OR** Welded, ASME B16.5, raised-face flange **OR** Grooved for mechanical-joint coupling **OR** Grooved with mechanical-joint coupling and flange adapter, **as directed**.
 - f. Thermistor or RTD temperature sensor factory installed in each nozzle.
 - g. Fit each water box with 3/4-inch (19-mm) **OR** 1-inch (25-mm), **as directed**, drain connection at low point and vent connection at high point, each with threaded plug.
 - 9. Additional Corrosion Protection:
 - a. Electrolytic corrosion-inhibitor anode.
 - b. Coat wetted surfaces with a corrosion-resistant finish.
OR
Using same material as tubes, clad surfaces of end tube sheets in contact with fluid. Coat other wetted surfaces, including water boxes, with a corrosion-resistant finish.
- F. Heat-Reclaim Condenser
- 1. Description: Shell-and-tube design with water in tubes and refrigerant surrounding tubes within shell. Shell is separate from evaporator and condenser.
 - 2. Shell Material: Carbon-steel rolled plates with continuously welded seams or seamless pipe.
 - 3. Designed to prevent direct impingement of high-velocity hot gas from compressor discharge on tubes.
 - 4. Tubes:
 - a. Individually replaceable from either end and without damage to tube sheets and other tubes.
 - b. Mechanically expanded into end sheets and physically attached to intermediate tube sheets.
 - c. Material: Copper **OR** Copper-nickel alloy **OR** Stainless steel **OR** Titanium, **as directed**.
 - d. Nominal OD: Manufacturer's choice **OR** 3/4 inch (19 mm) **OR** 1 inch (25 mm), **as directed**.
 - e. Minimum Wall Thickness: Manufacturer's choice **OR** 0.025 inch (0.6 mm) **OR** 0.028 inch (0.7 mm) **OR** 0.035 inch (0.9 mm), **as directed**.
 - f. External Finish: Manufacturer's standard.
 - g. Internal Finish: Enhanced **OR** Smooth, **as directed**.
 - 5. End Tube Sheets: Continuously welded to each end of shell; drilled and reamed to accommodate tubes with positive seal between fluid in tubes and refrigerant in shell.
 - 6. Intermediate Tube Sheets: Installed in shell and spaced along length of tube at intervals required to eliminate vibration and to avoid contact of tubes resulting in abrasion and wear.
 - 7. Water Box:
 - a. Cast-iron or carbon-steel construction; arranged to provide visual inspection and cleaning of tubes from either end without disturbing refrigerant in shell.
 - b. Standard **OR** Marine, **as directed**, type for water box with piping connections. Standard type for water box without piping connections.
 - c. Provide water boxes and marine water-box covers, **as directed**, with lifting lugs or eyebolts.
 - d. Hinged **OR** Davited, **as directed**, water boxes.
OR
Hinged **OR** Davited, **as directed**, marine water-box covers.
 - e. Nozzle Pipe Connections: Welded, ASME B16.5, flat-face flange **OR** Welded, ASME B16.5, raised-face flange **OR** Grooved for mechanical-joint coupling **OR** Grooved with mechanical-joint coupling and flange adapter, **as directed**.
 - f. Thermistor or RTD temperature sensor factory installed in each nozzle.
 - g. Fit each water box with 3/4-inch (19-mm) **OR** 1-inch (25-mm), **as directed**, drain connection at low point and vent connection at high point, each with threaded plug.
 - 8. Additional Corrosion Protection:
 - a. Electrolytic corrosion-inhibitor anode.
 - b. Coat wetted surfaces with a corrosion-resistant finish.
OR



Using same material as tubes, clad surfaces of end tube sheets in contact with fluid. Coat other wetted surfaces, including water boxes, with a corrosion-resistant finish.

G. Insulation

1. Closed-cell, flexible elastomeric thermal insulation complying with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
 - a. Thickness: 3/4 inch (19 mm) **OR** 1-1/2 inches (38 mm), **as directed**.
2. Adhesive: As recommended by insulation manufacturer.
3. Factory-applied insulation over all cold surfaces of chiller capable of forming condensation. Components shall include, but not be limited to, evaporator shell and end tube sheets, evaporator water boxes including nozzles, refrigerant suction pipe from evaporator to compressor, cold surfaces of compressor, refrigerant-cooled motor, and auxiliary piping.
 - a. Apply adhesive to 100 percent of insulation contact surface.
 - b. Before insulating steel surfaces, prepare surfaces for paint, and prime and paint as indicated for other painted components. Do not insulate unpainted steel surfaces.
 - c. Seal seams and joints to provide a vapor barrier.
 - d. After adhesive has fully cured, paint exposed surfaces of insulation to match other painted parts.

H. Electrical

1. Factory installed and wired, and functionally tested at factory before shipment.
2. Single-point, field-power connection to fused disconnect switch **OR** nonfused disconnect switch **OR** circuit breaker, **as directed**. Minimum withstand rating shall be as required by electrical power distribution system, but not less than 42,000 **OR** 65,000, **as directed**, A.
 - a. Branch power circuit to each motor, electric heater, dedicated electrical load, and controls with disconnect switch or circuit breaker, **as directed**.
 - 1) NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 60947-4-1.
 - 2) NEMA AB 1, motor-circuit protector (circuit breaker) with field-adjustable, short-circuit-trip set point.
 - b. NEMA ICS 2-rated motor controller for auxiliary motors, hand-off-auto switch, and overcurrent protection for each motor. Provide variable frequency controller for each variable-speed motor furnished.
 - c. Control-circuit transformer with primary and secondary side fuses.
3. Terminal blocks with numbered and color-coded, **as directed**, wiring to match wiring diagram. Spare wiring terminal block for connection to external controls or equipment.
4. Factory-installed wiring outside of enclosures shall be in metal raceway except make terminal connections with not more than a 24-inch (610-mm) length of liquidtight **OR** flexible metallic, **as directed**, conduit.
5. Factory install and wire capacitor bank for the purpose of power factor correction to 0.95 at all operating conditions.
 - a. If capacitors are mounted in a dedicated enclosure, use same NEMA enclosure type as motor controller. Provide enclosure with service entrance knockouts and bushings for conduit.
 - b. Capacitors shall be non-PCB dielectric fluid, metallized electrode design, low loss with low-temperature rise. The kVAR ratings shall be indicated and shall not exceed the maximum limitations set by NFPA 70. Provide individual cells as required.
 - c. Provide each cell with current-limiting replaceable fuses and carbon-film discharge resistors to reduce residual voltage to less than 50 V within one minute after de-energizing.
 - d. Provide a ground terminal and a terminal block or individual connectors for phase connection.

I. Motor Controller



1. Enclosure: Factory installed, unit mounted **OR** Factory furnished, field mounted, **as directed**, NEMA 250 **OR** NEMA ICS 6, **as directed**, Type 1 **OR** Type 4 **OR** Type 4X **OR** Type 12, **as directed**, with hinged full-front access door with lock and key or padlock and key, **as directed**.
2. Control Circuit: Obtained from integral control power transformer, **as directed**, with a control power transformer **OR** source, **as directed**, of enough capacity to operate connected control devices.
3. Overload Relay: Shall be sized according to UL 1995 or shall be an integral component of chiller control microprocessor.
4. Across-the-Line Controller: NEMA ICS 2, Class A, full voltage, nonreversing; include isolation switch and current-limiting fuses.
5. Star-Delta, Reduced-Voltage Controller: NEMA ICS 2, closed transition.
6. Autotransformer Reduced-Voltage Controller: NEMA ICS 2, closed transition; include isolation switch and current-limiting fuses.
7. Solid-State, Reduced-Voltage Controller: NEMA ICS 2.
 - a. Surge suppressor in solid-state power circuits providing three-phase protection against damage from supply voltage surges 10 percent or more above nominal line voltage.
 - b. Visual indication of motor and control status, including the following conditions:
 - 1) Controller on.
 - 2) Overload trip.
 - 3) Loss of phase.
 - 4) Starter fault.
8. Accessories: Devices shall be factory installed in controller enclosure unless otherwise indicated.
 - a. Externally Operated, Door-Interlocked, **as directed**, Disconnect: Fused disconnect switch **OR** Nonfused disconnect switch **OR** Circuit breaker, **as directed**. Minimum withstand rating shall be as required by electrical power distribution system, but not less than 42,000 **OR** 65,000, **as directed**, A.
 - b. Push-Button Stations, Pilot Lights, and Selector Switches: NEMA ICS 2, heavy-duty type.
 - c. Stop and Lockout Push-Button Station: Momentary-break, push-button station with a factory-applied hasp arranged so padlock can be used to lock push button in depressed position with control circuit open.
 - d. Control Relays: Time-delay relays.
 - e. Elapsed-Time Meters: Numerical readout in hours on face of enclosure.
 - f. Number-of-Starts Counter: Numerical readout on face of enclosure.
 - g. Meters: Panel type, 2-1/2 inches (64 mm) **OR** 4-1/4 inches (108 mm), **as directed**, with 90 **OR** 120 **OR** 270, **as directed**,-degree scale and 1 **OR** 2, **as directed**, percent accuracy. Where indicated, provide transfer device with an off position. Meters shall indicate the following:
 - 1) Ammeter: Output current for each phase, with current sensors rated to suit application.
 - 2) Voltmeter: Output voltage for each phase.
 - 3) Frequency Meter, **as directed**: Output frequency.
 - 4) Real-time clock with current time and date.
 - 5) Total run time.

OR

Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four-wire systems and with the following features:

 - 1) Selectable, digital display of the following:
 - a) Phase Currents, Each Phase: Plus or minus 1 percent.
 - b) Phase-to-Phase Voltages, Three Phase: Plus or minus 1 percent.
 - c) Phase-to-Neutral Voltages, Three Phase: Plus or minus 1 percent.
 - d) Three-Phase Real Power: Plus or minus 2 percent.
 - e) Three-Phase Reactive Power: Plus or minus 2 percent.
 - f) Power Factor: Plus or minus 2 percent.
 - g) Frequency: Plus or minus 0.5 percent.
 - h) Integrated Demand with Demand Interval Selectable from Five to 60 Minutes: Plus or minus 2 percent.



- i) Accumulated energy, in megawatt hours (joules), plus or minus 2 percent; stored values unaffected by power outages for up to 72 hours.
 - 2) Mounting: Display and control unit flush or semirecessed in instrument compartment door.
 - h. Phase-Failure, Phase-Reversal, Undervoltage Relays: Solid-state sensing circuit with adjustable undervoltage setting and isolated output contacts for hardwired connection.
 - i. Power Protection: Chiller shall shut down within six cycles of power interruption.
- J. Variable Frequency Controller
 - 1. Motor controller shall be factory mounted and wired on the chiller to provide a single-point, field-power termination to the chiller and its auxiliaries.
 - 2. Description: NEMA ICS 2; listed and labeled as a complete unit and arranged to provide variable speed by adjusting output voltage and frequency.
 - 3. Enclosure: Unit mounted, NEMA 250, Type 1 **OR** Type 4 **OR** Type 4x **OR** Type 12, **as directed**, with hinged full-front access door with lock and key.
 - 4. Integral Disconnecting Means: Door-interlocked, **as directed**, NEMA AB 1, instantaneous-trip circuit breaker with lockable handle. Minimum withstand rating shall be as required by electrical power distribution system, but not less than 42,000 **OR** 65,000, **as directed**, A.
 - 5. Technology: Pulse width modulated (PWM) output with insulated gate bipolar transistors (IGBT); suitable for variable torque loads.
 - 6. Controller shall consist of a rectifier converter section, a digital/analog driver regulator section, and an inverter output section.
 - a. Rectifier section shall be a full-wave diode bridge that changes fixed-voltage, fixed-frequency, ac line power to a fixed dc voltage. Silicon controller rectifiers, current source inverters, and paralleling of devices are unacceptable. Rectifier shall be insensitive to phase rotation of the ac line.
 - b. Regulator shall provide full digital control of frequency and voltage.
 - c. Inverter section shall change fixed dc voltage to variable-frequency, variable ac voltage, for application to a squirrel-cage motor. Inverter shall produce a sine-coded, pulse width modulated (PWM) output wave form and shall conduct no radio-frequency interference back to the input power supply.
 - 7. Output Rating: Three phase; with voltage proportional to frequency throughout voltage range.
 - 8. Operating Requirements:
 - a. Input AC Voltage Tolerance: 460-V ac, plus 10 percent or 506 V maximum, **as directed**.
 - b. Input frequency tolerance of 60 Hz, plus or minus 2 Hz.
 - c. Capable of driving full load, without derating, under the following conditions:
 - 1) Ambient Temperature: 0 to 50 deg C.
 - 2) Relative Humidity: Up to 90 **OR** 95, **as directed**, percent (noncondensing).
 - 3) Altitude: 3300 feet (1005 m) **OR** 6600 feet (2010 m), **as directed**.
 - d. Minimum Efficiency: 96 percent at 60 Hz, full load.
 - e. Minimum Displacement Primary-Side Power Factor: 95 percent without harmonic filter, 98 percent with harmonic filter.
 - f. Overload Capability: 1.05 times the full-load current for 7 seconds.
 - g. Starting Torque: As required by compressor-drive assembly.
 - h. Speed Regulation: Plus or minus 1 percent.
 - i. Isolated control interface to allow controller to follow control signal over a 10:1 speed range.
 - j. To avoid equipment resonant vibrations, provide critical speed lockout circuitry to allow bands of operating frequency at which controller shall not operate continuously.
 - k. Capable of being restarted into a motor coasting in either the forward or reverse direction without tripping.
 - 9. Internal Adjustability Capabilities:
 - a. Minimum Output Frequency: 6 Hz.
 - b. Maximum Output Frequency: 60 Hz.
 - c. Acceleration: 2 seconds to a minimum of 60 seconds.



- d. Deceleration: 2 seconds to a minimum of 60 seconds.
- e. Current Limit: 30 percent to a minimum of 100 percent of maximum rating.
10. Self-Protection and Reliability Features: Subjecting the controller to any of the following conditions shall not result in component failure or the need for replacement:
 - a. Overtemperature.
 - b. Short circuit at controller output.
 - c. Ground fault at controller output. Variable frequency controller shall be able to start a grounded motor.
 - d. Open circuit at controller output.
 - e. Input undervoltage.
 - f. Input overvoltage.
 - g. Loss of input phase.
 - h. Reverse phase.
 - i. AC line switching transients.
 - j. Instantaneous overload, line to line or line to ground.
 - k. Sustained overload exceeding 100 percent of controller rated current.
 - l. Starting a rotating motor.
11. Motor Protection: Controller shall protect motor against overvoltage and undervoltage, phase loss, reverse phase, overcurrent, overtemperature, and ground fault.
12. Automatic Reset and Restart: Capable of three restarts after controller fault or on return of power after an interruption and before shutting down for manual reset or fault correction. Controller shall be capable of automatic restart on phase-loss and overvoltage and undervoltage trips.
13. Visual Indication: On face of controller enclosure or chiller control enclosure; indicating the following conditions:
 - a. Power on.
 - b. Run.
 - c. Overvoltage.
 - d. Line fault.
 - e. Overcurrent.
 - f. External fault.
 - g. Motor speed (percent).
 - h. Fault or alarm status (code).
 - i. DC-link voltage.
 - j. Motor output voltage.
 - k. Input kilovolt amperes.
 - l. Total power factor.
 - m. Input kilowatts.
 - n. Input kilowatt-hours.
 - o. Three-phase input voltage.
 - p. Three-phase output voltage.
 - q. Three-phase input current.
 - r. Three-phase output current.
 - s. Three-phase input voltage total harmonic distortion.
 - t. Three-phase input current total harmonic distortion.
 - u. Output frequency (Hertz).
 - v. Elapsed operating time (hours).
 - w. Diagnostic and service parameters.
14. Operator Interface: At controller or chiller control panel; with start-stop and auto-manual selector with manual-speed-control potentiometer.
15. Control Signal Interface:
 - a. Electric Input Signal Interface: A minimum of two analog inputs (0 to 10 V or 0/4-20 mA) and six programmable digital inputs.
16. Active Harmonic Distortion Filter: Factory mounted and wired to limit total voltage and current distortion to 5 percent.

OR

Input Line Conditioning: <Insert requirements>.



17. Cooling: Air **OR** Refrigerant **OR** Water, **as directed**, cooled.
18. Accessories: Devices shall be factory installed in controller enclosure unless otherwise indicated.
 - a. Control Relays: Auxiliary and adjustable time-delay relays.
19. Chiller Capacity Control Interface: Equip chiller with adaptive control logic to automatically adjust the compressor motor speed and the compressor pre-rotation inlet vane position independently to achieve maximum part-load efficiency in response to sensor inputs that are integral to the chiller controls.

K. Controls

1. Control: Standalone and microprocessor based, with all memory stored in nonvolatile memory so that reprogramming is not required on loss of electrical power.
2. Enclosure: Unit mounted, NEMA 250, Type 1 **OR** Type 4 **OR** Type 4x **OR** Type 12, **as directed**, hinged or lockable; factory wired with a single-point, field-power connection and a separate control circuit.
3. Operator Interface: Multiple-character digital or graphic display with dynamic update of information and with keypad or touch-sensitive display located on front of control enclosure. In either imperial or metric units selectable through the interface, display the following information:
 - a. Date and time.
 - b. Operating or alarm status.
 - c. Fault history with not less than last 10 faults displayed.
 - d. Set points of controllable parameters.
 - e. Trend data.
 - f. Operating hours.
 - g. Number of chiller starts.
 - h. Outdoor-air temperature or space temperature if required for chilled-water reset.
 - i. Entering- and leaving-fluid temperatures of evaporator and condenser.
 - j. Difference in fluid temperatures of evaporator and condenser.
 - k. Fluid flow of evaporator and condenser.
 - l. Fluid pressure drop of evaporator and condenser.
 - m. Refrigerant pressures in evaporator and condenser.
 - n. Refrigerant saturation temperature in evaporator and condenser shell.
 - o. Compressor refrigerant suction and discharge temperature.
 - p. Compressor bearing temperature.
 - q. Motor bearing temperature.
 - r. Motor winding temperature.
 - s. Oil temperature.
 - t. Oil discharge pressure.
 - u. Phase current.
 - v. Percent of motor rated load amperage.
 - w. Phase voltage.
 - x. Demand power (kilowatts).
 - y. Energy use (kilowatt-hours).
 - z. Power factor.
 - aa. For chillers equipped with variable frequency controllers and harmonic filters, include the following:
 - 1) Output voltage and frequency.
 - 2) Voltage total harmonic distortion for each phase.
 - 3) Supply current total demand distortion for each phase.
 - 4) Inlet vane position.
 - 5) Controller internal ambient temperature.
 - 6) Heatsink temperature.
 - bb. Purge suction temperature if purge system is provided.
 - cc. Purge elapsed time if purge system is provided.
4. Control Functions:
 - a. Manual or automatic startup and shutdown time schedule.



- b. Entering and leaving chilled-water temperatures, control set points, and motor load limits. Evaporator fluid temperature shall be reset based on return-water **OR** outdoor-air **OR** space, **as directed**, temperature.
 - c. Current limit and demand limit.
 - d. Condenser-fluid temperature.
 - e. External chiller emergency stop.
 - f. Variable evaporator flow.
 - g. Thermal storage.
 - h. Heat reclaim.
5. Manually Reset Safety Controls: The following conditions shall shut down chiller and require manual reset:
- a. Low evaporator pressure **OR** temperature, **as directed**; high condenser pressure.
 - b. Low evaporator fluid temperature.
 - c. Low oil differential pressure.
 - d. High or low oil pressure.
 - e. High oil temperature.
 - f. High compressor-discharge temperature.
 - g. Loss of condenser-fluid flow.
 - h. Loss of evaporator fluid flow.
 - i. Motor overcurrent.
 - j. Motor overvoltage.
 - k. Motor undervoltage.
 - l. Motor phase reversal.
 - m. Motor phase failure.
 - n. Sensor- or detection-circuit fault.
 - o. Processor communication loss.
 - p. Motor controller fault.
 - q. Extended compressor surge.
 - r. Excessive air-leakage detection for chillers using R-123 refrigerant.
6. Trending: Capability to trend analog data of up to five parameters simultaneously over an adjustable period and frequency of polling.
7. Security Access: Provide electronic security access to controls through identification and password with at least three levels of access: view only; view and operate; and view, operate, and service.
8. Control Authority: At least four conditions: Off, local manual control at chiller, local automatic control at chiller, and automatic control through a remote source.
9. Communication Port: RS-232 port, USB 2.0 port, or equivalent connection capable of connecting a printer and a notebook computer, **as directed**.
10. BAS Interface: Factory-installed hardware and software to enable the BAS to monitor, control, and display chiller status and alarms.
- a. Hardwired Points:
 - 1) Monitoring: On-off status, common trouble alarm **OR** electrical power demand (kilowatts) **OR** electrical power consumption (kilowatt-hours) **OR** power factor, **as directed**.
 - 2) Control: On-off operation, chilled-water, discharge temperature set-point adjustment **OR** electrical power demand limit, **as directed**.
 - b. ASHRAE 135 (BACnet) **OR** LonTalk **OR** Modbus **OR** Industry-accepted, open-protocol, **as directed**, communication interface with the BAS shall enable the BAS operator to remotely control and monitor the chiller from an operator workstation. Control features and monitoring points displayed locally at chiller control panel shall be available through the BAS.

L. Finish

- 1. Paint chiller, using manufacturer's standard procedures, except comply with the following minimum requirements:



- a. Provide at least one coat of primer with a total dry film thickness of at least 2 mils (0.05 mm).
 - b. Provide at least two coats of alkyd-modified, vinyl enamel **OR** epoxy **OR** polyurethane, **as directed**, finish with a total dry film thickness of at least 4 mils (0.10 mm).
 - c. Paint surfaces that are to be insulated before applying the insulation.
 - d. Paint installed insulation to match adjacent uninsulated surfaces.
 - e. Color of finish coat to be manufacturer's standard **OR** custom color selected by the Owner, **as directed**.
2. Provide the Owner with quart container of paint used in application of topcoat to use in touchup applications after Project Closeout.

M. Accessories

1. Flow Switches:

- a. Chiller manufacturer shall furnish a switch for each condenser **OR** evaporator and condenser, **as directed**, and verify field-mounting location before installation.
- b. Paddle Flow Switches:
 - 1) Vane operated to actuate a double-pole, double-throw switch with one pole field wired to the chiller control panel and the other pole field wired to the BAS.
 - 2) Contacts: Platinum alloy, silver alloy, or gold-plated switch contacts with a rating of 10 A at 120-V ac.
 - 3) Pressure rating equal to pressure rating of heat exchanger.
 - 4) Construct body and wetted parts of Type 316 stainless steel.
 - 5) House switch in a NEMA 250, Type 4, **as directed**, enclosure constructed of die-cast aluminum.
 - 6) Vane length to suit installation.

OR

Pressure Differential Switches:

- 1) Construction: Wetted parts of body and trim constructed of Type 316 stainless steel.
 - 2) Performance: Switch shall withstand, without damage, the full-pressure rating of the heat exchanger applied to either port and exhibit zero set-point shift due to variation in working pressure.
 - 3) Set Point: Screw type, field adjustable.
 - 4) Electrical Connections: Internally mounted screw-type terminal blocks.
 - 5) Switch Enclosure: NEMA 250, Type 4, **as directed**.
 - 6) Switch Action: Double-pole, double-throw switch with one pole field wired to the chiller control panel and the other pole field wired to the BAS.
2. Vibration Isolation:

- a. Chiller manufacturer shall furnish vibration isolation for each chiller.
- b. Neoprene Pad:

- 1) Two layers of 0.375-inch- (10-mm-) thick, ribbed- or waffle-pattern neoprene pads separated by a 16-gage, stainless-steel plate.
- 2) Fabricate pads from 40- to 50-durometer neoprene.
- 3) Provide stainless-steel square bearing plate to load the pad uniformly between 20 and 40 psig (138 and 276 kPa) with a 0.12- to 0.16-inch (3- to 4-mm) deflection.

OR

Spring Isolator:

- 1) Stable in operation and designed for not less than 30 percent reserve deflection beyond actual operating conditions. Isolators shall be designed so that the Kx/Ky ratio shall be 1.0 or more for stability.
- 2) Provide PVC or neoprene-coated springs and hot-dip, galvanized-steel components. Aluminum components shall be etched and painted. Nuts, bolts, and washers shall be zinc electroplated.
- 3) Isolators shall be adjustable and with an open spring, having one or more coil springs attached to a top compression plate and a baseplate. An elastomeric pad with a minimum thickness of 0.25 inch (6 mm) shall be bonded to the baseplate.



- 4) Spring assembly shall be removable and shall fit within a welded steel enclosure consisting of a top plate and rigid lower housing, which serves as a blocking device during installation. Isolated restraining bolts shall not be engaged during normal operation and shall connect the top plate and lower housing to prevent the isolated equipment from rising when drained of fluid.
 - 5) Isolators shall be selected for a nominal 1-inch (25-mm) **OR** 2-inch (50-mm), **as directed**, deflection.
3. Sound Barrier:
- a. Furnish removable and reusable sound-barrier covers over the compressor housing, hermetic motor, compressor suction and discharge piping, and condenser shell.
 - b. Provide for repeated installation and removal without use of tape or calk.
 - c. Inner and outer cover shall consist of a PTFE-impregnated fiberglass cloth enclosing heavy-density, needled fiberglass insulation material with a mass-loaded vinyl acoustic barrier.
 - d. Covers shall be double sewn and lock stitched with edges folded and sewn so no raw cut edges are exposed.
 - e. Form covers around control devices, gages, conduit, piping, and supports without degrading sound-barrier performance.
 - f. Continuously lap all exposed seams at least 2 inches (50 mm) for better sound containment.
 - g. Permanently label each section of cover to indicate its location, description, size, and number sequence.
 - h. Randomly place stainless-steel quilting pins to prevent covers from shifting and sagging.
- N. Packaged Refrigerant Recovery Units
1. Packaged portable unit consisting of compressor, air-cooled condenser, recovery system, tank pressure gages, filter-dryer, and valving that allows for switching between liquid and vapor recovery mode. Refrigerant recovery unit shall be factory mounted on an ASME-constructed and -stamped refrigerant storage vessel that is sized to hold the full refrigerant charge of the largest chiller furnished.
- O. Heat-Exchanger, Brush-Cleaning System
1. Furnish for field installation a brush-cleaning system on each chiller condenser, **as directed**, for tube cleaning and improved heat transfer.
 2. System shall maintain tube fouling at or below design conditions without interrupting normal equipment operation.
 3. System shall consist of a brush inserted in each tube and a catch basket attached to each end of the tube. A four-way valve shall operate to reverse the direction of water flow to push the brush through the tube while removing tube deposits. Four-way reversing valve's actuator shall be controlled by a preset time cycle that provides regular tube brushing during equipment operation. Frequency of the brushing cycle shall be set up to match Project requirements.
 4. Components:
 - a. Brush: Each brush shall have nylon bristles, titanium wires, and polypropylene tips. Brush interference fit with the ID of the tube shall not exceed 0.025 inch (0.6 mm).
 - b. Basket: Single-piece polypropylene basket with neck OD to press fit inner diameter of tube. Design shall provide for insertion of eddy current probe or removal of brushes without removing baskets from the valve.
 - c. Four-Way Valve:
 - 1) Construct valve body of carbon steel with internal sealing parts of hard rubber and Type 304 stainless steel.
 - 2) Configure valve with parallel flow connections to minimize field installation piping.
 - 3) Construct to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, at a system working pressure equal to condenser.
 - 4) Pipe connections shall be flanged.



- 5) Valve manufacturer to test and certify a maximum leakage rate of less than 0.05 percent of the design flow rate at operation conditions of maximum differential pressure.
 - 6) Hydrostatically test to 1.5 times the design working pressure.
 - 7) Design the valve to cause no more than 0.5-psig (3-kPa) pressure drop at design flow conditions.
 - 8) Provide valve with valve-mounted indicating/warning light, which shall light before the valve begins rotation.
 - 9) Valve Actuator: Mount electric actuator to operate valve.
OR
Valve Actuator: Mount pneumatic piston-type actuator to operate valve. Actuator shall be suitable for operation using field-supplied air pressure.
 - 10) Position Switches: Factory mount microswitches on the valve to indicate the complete turn of valve in both normal and reverse flow.
- d. Control Panel: Factory or field mount a control panel on chiller. Control panel shall include the following features:
- 1) NEMA 250, Type 1 **OR** Type 4 **OR** Type 4x **OR** Type 12, **as directed**, enclosure.
 - 2) Timer to automatically initiate the cleaning cycle over a 24-hour period.
 - 3) Manual override of preset cleaning cycle.
 - 4) Visual indication of "Power On," "Diverter Position," "Normal Flow," "Reverse Flow," and "Valve Malfunction" indicating a slow turn or incomplete valve turn.
 - 5) For pneumatic actuators, mount four-way solenoid valve for actuator operation in the control panel.
 - 6) Flow switch bypass.
 - 7) Unloading signal to chiller.

P. Source Quality Control

1. Perform functional **OR** functional run, **as directed**, tests of chillers before shipping.
2. Factory performance test chillers, before shipping, according to ARI 550/590.
 - a. Test the following conditions:
 - 1) Design conditions indicated.
 - 2) Reduction in capacity from design to minimum load in steps of 10 **OR** 25 **OR** 33, **as directed**, with condenser fluid at design conditions.
OR
Reduction in capacity from design to minimum load in steps of 10 **OR** 25 **OR** 33, **as directed**, with varying entering condenser-fluid temperature from design to minimum conditions in 5 deg F (3 deg C) increments.
OR
At one **OR** two **OR** three **OR** four **OR** five **OR** 10, **as directed**, point(s) of varying part-load performance to be selected by the Owner at time of test.
 - b. Allow the Owner access to place where chillers are being tested. Notify the Owner 14 days in advance of testing.
 - c. Prepare test report indicating test procedures, instrumentation, test conditions, and results. Submit copy of results within one week of test date.
3. Factory sound test chillers, before shipping, according to ARI 575, **s directed**.
 - a. Test the following conditions:
 - 1) Design conditions indicated.
 - 2) Chiller operating at calculated worst-case sound condition.
 - 3) At one **OR** two **OR** three **OR** four **OR** five, **as directed**, point(s) of varying part-load performance to be selected by the Owner at time of test.
 - b. Allow the Owner access to place where chillers are being tested. Notify the Owner 14 days in advance of testing.
 - c. Prepare test report indicating test procedures, instrumentation, test conditions, and results. Submit copy of results within one week of test date.



4. For chillers using R-134a refrigerant, factory test and inspect evaporator and condenser **OR** condenser, and heat-reclaim condenser, **as directed**, according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
5. For chillers using R-123 refrigerant, factory test and inspect evaporator and condenser **OR** condenser and heat-reclaim condenser, **as directed**, according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1. Pressure test fluid side of heat exchangers, including water boxes, to 1.5 times the rated pressure. Pressure proof test refrigerant side of heat exchangers to a minimum of 45 psig (310 kPa). Vacuum and pressure test for leaks.
6. For chillers located indoors, rate sound power level according to ARI 575.

1.3 EXECUTION

A. Chiller Installation

1. Install chillers on support structure indicated.
2. Equipment Mounting: Install chiller on concrete bases using elastomeric pads **OR** restrained spring isolators, **as directed**. Comply with requirements for concrete bases specified in Division 03 Section "Cast-in-place Concrete". Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 - a. Minimum Deflection: 1/4 inch (6 mm) **OR** 1/2 inch (13 mm) **OR** 1 inch (25 mm) **OR** 2 inches (50 mm), **as directed**.
 - b. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - c. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - d. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - e. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Equipment Mounting: Install chiller using elastomeric pads **OR** restrained spring isolators, **as directed**. Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 - a. Minimum Deflection: 1/4 inch (6 mm) **OR** 1/2 inch (13 mm) **OR** 1 inch (25 mm) **OR** 2 inches (50 mm), **as directed**.
4. Equipment Mounting: Install chiller on concrete bases. Comply with requirements for concrete bases specified in Division 03 Section "Cast-in-place Concrete".
 - a. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - b. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - d. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Maintain manufacturer's recommended clearances for service and maintenance.
6. Charge chiller with refrigerant and fill with oil if not factory installed.
7. Install separate devices furnished by manufacturer and not factory installed.

B. Heat-Exchanger, Brush-Cleaning System Installation

1. Install brush-cleaning system control panel adjacent to chiller control panel.
2. Arrange piping to provide service access to four-way valve assembly without affecting access to chiller. Secure valve to prevent lateral movement and vibration during operation.
3. Provide field electric power, as required, to each system control panel and electric actuated valve.
4. Provide pneumatic piping with pressure regulator and isolation valve to each pneumatic supply connection. Coordinate field source of air with manufacturer to ensure that requirements are satisfied for proper valve operation.



5. Interconnect brush-cleaning system controls with chiller controls. Coordinate requirements to ensure safe, trouble-free operation.
6. Functionally test the entire brush-cleaning system, including the valve, actuator, position indicator, and control panel, with chiller in operation.

C. Connections

1. Comply with requirements for piping specified in Division 23 Section(s) "Hydronic Piping" AND "Refrigerant Piping". Drawings indicate general arrangement of piping, fittings, and specialties.
2. Install piping adjacent to chiller to allow service and maintenance.
3. Evaporator Fluid Connections: Connect to evaporator inlet with shutoff valve, strainer, **as directed**, flexible connector, **as directed**, thermometer, and plugged tee with pressure gage. Connect to evaporator outlet with shutoff valve, balancing valve, flexible connector, **as directed**, flow switch, thermometer, plugged tee with shutoff valve and pressure gage, flow meter, **as directed**, and drain connection with valve. Make connections to chiller with a flange **OR** mechanical coupling, **as directed**.
4. Condenser-Fluid Connections: Connect to condenser inlet with shutoff valve, strainer, **as directed**, flexible connector, **as directed**, thermometer, and plugged tee with pressure gage. Connect to condenser outlet with shutoff valve, balancing valve, flexible connector, **as directed**, flow switch, thermometer, plugged tee with shutoff valve and pressure gage, flow meter, **as directed**, and drain connection with valve. Make connections to chiller with a flange **OR** mechanical coupling, **as directed**.
5. Heat-Reclaim Condenser-Fluid Connections: Connect to condenser inlet with shutoff valve, strainer, **as directed**, flexible connector, **as directed**, thermometer, and plugged tee with pressure gage. Connect to condenser outlet with shutoff valve, balancing valve, flexible connector, **as directed**, flow switch, thermometer, plugged tee with shutoff valve and pressure gage, flow meter, **as directed**, and drain connection with valve. Make connections to chiller with a flange **OR** mechanical coupling, **as directed**.
6. Refrigerant Pressure Relief Device Connections: For chillers installed indoors, extend vent piping **OR** separate vent piping for each chiller, **as directed** to the outdoors without valves or restrictions. Comply with ASHRAE 15. Connect to chiller pressure relief device with flexible connector and dirt leg with drain valve.
7. For chillers equipped with a purge system, extend purge vent piping **OR** separate purge vent piping for each chiller, **as directed**, to the outdoors. Comply with ASHRAE 15 and ASHRAE 147.
8. Connect each chiller drain connection with a union and drain pipe, and extend pipe, full size of connection, to floor drain. Provide a shutoff valve at each connection.

D. Startup Service

1. Engage a factory-authorized service representative to perform startup service.
 - a. Complete installation and startup checks according to manufacturer's written instructions.
 - b. Verify that refrigerant charge is sufficient and chiller has been leak tested.
 - c. Verify that pumps are installed and functional.
 - d. Verify that thermometers and gages are installed.
 - e. Operate chiller for run-in period.
 - f. Check bearing lubrication and oil levels.
 - g. Verify that refrigerant pressure relief device is vented outside.
 - h. Verify proper motor rotation.
 - i. Verify static deflection of vibration isolators, including deflection during chiller startup and shutdown.
 - j. Verify and record performance of fluid flow and low-temperature interlocks for evaporator and condenser **OR** condenser, and heat-reclaim condenser, **as directed**.
 - k. Verify and record performance of chiller protection devices.
 - l. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.
2. Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assembly, installation, and connection.



3. Prepare test and inspection startup reports.

END OF SECTION 23 61 16 00



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SECTION 23 61 16 00a - ROTARY-SCREW WATER CHILLERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for rotary screw water chillers. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Packaged, water-cooled, single-compressor chillers.
 - b. Packaged, water-cooled, multiple-compressor chillers.
 - c. Packaged, air-cooled chillers.
 - d. Packaged, portable refrigerant recovery units.
 - e. Heat-exchanger, brush-cleaning system.

C. Definitions

1. BAS: Building automation system.
2. COP: Coefficient of performance. The ratio of the rate of heat removal to the rate of energy input using consistent units for any given set of rating conditions.
3. EER: Energy-efficiency ratio. The ratio of the cooling capacity given in terms of Btu/h to the total power input given in terms of watts at any given set of rating conditions.
4. IPLV: Integrated part-load value. A single-number part-load efficiency figure of merit calculated per the method defined by ARI 550/590 and referenced to ARI standard rating conditions.
5. kW/Ton (kW/kW): The ratio of total power input of the chiller in kilowatts to the net refrigerating capacity in tons (kW) at any given set of rating conditions.
6. NPLV: Nonstandard part-load value. A single-number part-load efficiency figure of merit calculated per the method defined by ARI 550/590 and intended for operating conditions other than ARI standard rating conditions.

D. Performance Requirements

1. Seismic Performance: Chillers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
2. Condenser-Fluid Temperature Performance:
 - a. Startup Condenser-Fluid Temperature: Chiller shall be capable of starting with an entering condenser-fluid temperature of 60 deg F (16 deg C) **OR** 55 deg F (13 deg C) **OR** 40 deg F (4 deg C), **as directed**, and providing stable operation until the system temperature is elevated to the minimum operating entering condenser-fluid temperature.
 - b. Minimum Operating Condenser-Fluid Temperature: Chiller shall be capable of continuous operation over the entire capacity range indicated with an entering condenser-fluid temperature of 65 deg F (18 deg C) **OR** 60 deg F (16 deg C) **OR** 55 deg F (13 deg C), **as directed**.
 - c. Make factory modifications to standard chiller design if necessary to comply with performance indicated.
3. Site Altitude: Chiller shall be suitable for altitude in which installed without affecting performance indicated. Make adjustments to affected chiller components to account for site altitude.
4. Performance Tolerance: Comply with the following in lieu of ARI 550/590, **as directed**:
 - a. Allowable Capacity Tolerance: Zero percent.
 - b. Allowable IPLV/NPLV Performance Tolerance: Zero percent.



E. Submittals

1. Product Data: For each type of product indicated. Include refrigerant, rated capacities, operating characteristics, furnished specialties, and accessories.
2. LEED Submittal:
 - a. Product Data for Credit EA 4: Documentation required by Credit EA 4 indicating that equipment and refrigerants comply.
3. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - a. Detail equipment assemblies and indicate dimensions, weights, load distribution, required clearances, method of field assembly, components, and location and size of each field connection.
 - b. Wiring Diagrams: For power, signal, and control wiring.
4. Certificates: For certification required in "Quality Assurance" Article.
5. Seismic Qualification Certificates: For chillers, accessories, and components, from manufacturer.
6. Startup service reports.
7. Operation and maintenance data.
8. Warranty: Sample of special warranty.

F. Quality Assurance

1. ARI Certification: Certify chiller according to ARI 550 and ARI 590, **as directed**, certification program(s).
2. ARI Rating: Rate chiller performance according to requirements in ARI 550/590.
3. ASHRAE Compliance:
 - a. ASHRAE 15 for safety code for mechanical refrigeration.
 - b. ASHRAE 147 for refrigerant leaks, recovery, and handling and storage requirements.
4. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.
5. ASME Compliance: Fabricate and label chiller to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, and include an ASME U-stamp and nameplate certifying compliance.
6. Comply with NFPA 70.
7. Comply with requirements of UL and UL Canada and include label by a qualified testing agency showing compliance.

G. Delivery, Storage, And Handling

1. Ship chillers from the factory fully charged with refrigerant.
OR
Ship each chiller with a full charge of refrigerant. Charge each chiller with nitrogen if refrigerant is shipped in containers separate from chiller.
2. Ship each oil-lubricated chiller with a full charge of oil.
 - a. Ship oil factory installed in chiller **OR** in containers separate from chiller, **as directed**.
3. Package chiller for export shipping in totally enclosed crate and bagging, **as directed**.

H. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of chillers that fail in materials or workmanship within specified warranty period.
 - a. Extended warranties include, but are not limited to, the following:
 - 1) Complete chiller including refrigerant and oil charge.
OR
Complete compressor and drive assembly including refrigerant and oil charge.
OR
Refrigerant **OR** Refrigerant and oil charge, **as directed**.
 - 2) Parts only **OR** Parts and labor, **as directed**.
 - 3) Loss of refrigerant charge for any reason.
 - b. Warranty Period: Two **OR** Three **OR** Four **OR** Five, **as directed**, years from date of Final Completion.



1.2 PRODUCTS

A. Packaged, Water-Cooled, Single-Compressor Chillers

1. Description: Factory-assembled and factory-tested **OR** run-tested, **as directed**, chiller with compressor, compressor motor, compressor motor controller, lubrication system, evaporator, condenser, heat-reclaim condenser as indicated, controls, interconnecting unit piping and wiring, and indicated accessories.
 - a. Disassemble chiller into major assemblies as required by the installation after factory testing and before packaging for shipment.
2. Fabricate chiller mounting base with reinforcement strong enough to resist chiller movement during a seismic event when chiller is anchored to field support structure.
3. Compressor:
 - a. Description: Hermetic **OR** Open, **as directed**, positive displacement, and oil lubricated.
 - b. Casing: Cast iron, precision machined for minimum clearance about periphery of rotors.
 - c. Rotors: Manufacturer's standard one-, two-, or three-rotor design.
 - d. Drive Coupling: For chillers with open drives, provide flexible disc with all-metal construction and no wearing parts to ensure long life without the need for lubrication.
 - e. Seals: Seal drive assembly to prevent refrigerant leakage.
4. Compressor Motor:
 - a. Continuous-duty, squirrel-cage, induction-type motor with energy efficiency required to suit chiller energy efficiency indicated.
 - b. Factory mounted, aligned, and balanced as part of compressor assembly before shipping.
 - c. Motor shall be of sufficient capacity to drive compressor throughout entire operating range without overload and with sufficient capacity to start and accelerate compressor without damage.
 - d. For chillers with open drives, provide motor with open-dripproof **OR** weather-protected, Type I **OR** weather-protected, Type II **OR** totally enclosed, **as directed**, enclosure.
 - e. Provide motor with thermistor or RTD in single motor winding **OR** each of three-phase motor windings, **as directed**, to monitor temperature and report information to chiller control panel.
 - f. Provide motor with thermistor or RTD to monitor bearing temperature and report information to chiller control panel.
 - g. Provide open-drive motor with internal electric heater, internally powered from chiller power supply.
5. Vibration Balance: Balance chiller compressor and drive assembly to provide a precision balance that is free of noticeable vibration over the entire operating range.
 - a. Overspeed Test: 25 percent above design operating speed.
6. Service: Easily accessible for inspection and service.
 - a. Compressor's internal components shall be accessible without having to remove compressor-drive assembly from chiller.
 - b. Provide lifting lugs or eyebolts attached to casing.
7. Capacity Control: Modulating slide-valve assembly or port unloaders combined with a variable frequency controller, if applicable, and hot-gas bypass, if necessary, to achieve performance indicated.
 - a. Maintain stable operation throughout range of operation. Configure to achieve most energy-efficient operation possible.
 - b. Operating Range: From 100 to 20 **OR** 15 **OR** 10 **OR** 5 **OR** zero, **as directed**, percent of design capacity.
 - c. Condenser-Fluid Unloading Requirements over Operating Range: Constant-design entering condenser-fluid temperature **OR** Drop-in entering condenser-fluid temperature of 2.5 deg F/1.4 deg C drop for each 10 percent in capacity reduction, **as directed**.
8. Oil Lubrication System: Consisting of pump if required, filtration, heater, cooler, factory-wired power connection, and controls.
 - a. Provide lubrication to bearings, gears, and other rotating surfaces at all operating, startup, shutdown, and standby conditions including power failure.
 - b. Thermostatically controlled oil heater properly sized to remove refrigerant from oil.



- c. Oil filter **OR** Dual oil filters, one redundant, **as directed**, shall be the easily replaceable cartridge type, minimum 0.5-micron efficiency, with means of positive isolation while servicing.
- d. Refrigerant **OR** Water, **as directed**, -cooled oil cooler.
- e. Factory-installed and pressure-tested piping with isolation valves and accessories.
- f. Oil compatible with refrigerant and chiller components.
- g. Positive visual indication of oil level.
- 9. Refrigerant Circuit:
 - a. Refrigerant: Type as indicated on Drawings.
OR
Refrigerant Type: R-134a **OR** HFC, **as directed**. Classified as Safety Group A1 according to ASHRAE 34.
 - b. Refrigerant Compatibility: Chiller parts exposed to refrigerants shall be fully compatible with refrigerants, and pressure components shall be rated for refrigerant pressures.
 - c. Refrigerant Flow Control: Manufacturer's standard refrigerant flow-control device satisfying performance requirements indicated.
 - d. Pressure Relief Device:
 - 1) Comply with requirements in ASHRAE 15 and in applicable portions of ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 - 2) ASME-rated, spring-loaded pressure relief valve; single- or multiple-reseating type. Pressure relief valve(s) shall be provided for each heat exchanger. Condenser shall have dual valves with one being redundant and configured to allow either valve to be replaced without loss of refrigerant.
 - e. Refrigeration Transfer: Provide service valves and other factory-installed accessories required to facilitate transfer of refrigerant from chiller to a remote refrigerant storage and recycling system. Comply with requirements in ASHRAE 15 and ASHRAE 147.
 - f. Refrigerant Isolation: Factory install positive shutoff isolation valves in the compressor discharge line to the condenser and the refrigerant liquid line leaving the condenser to allow for isolation and storage of full refrigerant charge in the chiller condenser shell. In addition, provide isolation valve on suction side of compressor from evaporator to allow for isolation and storage of full refrigerant charge in the chiller evaporator shell, **as directed**.
- 10. Evaporator:
 - a. Description: Shell-and-tube design with water in tubes and refrigerant surrounding tubes within shell. Shell is separate from condenser.
 - b. Shell Material: Carbon-steel rolled plates with continuously welded seams or seamless pipe.
 - c. Designed to prevent liquid refrigerant carryover from entering compressor.
 - d. Provide evaporator with sight glass or other form of positive visual verification of liquid-refrigerant level.
 - e. Tubes:
 - 1) Individually replaceable from either end and without damage to tube sheets and other tubes.
 - 2) Mechanically expanded into end sheets and physically attached to intermediate tube sheets.
 - 3) Material: Copper **OR** Copper-nickel alloy, **as directed**.
 - 4) Nominal OD: Manufacturer's choice **OR** 3/4 inch (19 mm) **OR** 1 inch (25 mm), **as directed**.
 - 5) Minimum Wall Thickness: Manufacturer's choice **OR** 0.025 inch (0.6 mm) **OR** 0.028 inch (0.7 mm) **OR** 0.035 inch (0.9 mm), **as directed**.
 - 6) External Finish: Manufacturer's standard.
 - 7) Internal Finish: Enhanced **OR** Smooth, **as directed**.
 - f. End Tube Sheets: Continuously welded to each end of shell; drilled and reamed to accommodate tubes with positive seal between fluid in tubes and refrigerant in shell.
 - g. Intermediate Tube Sheets: Installed in shell and spaced along length of tube at intervals required to eliminate vibration and to avoid contact of tubes resulting in abrasion and wear.



- h. Water Box:
 - 1) Cast-iron or carbon-steel construction; arranged to provide visual inspection and cleaning of tubes from either end without disturbing refrigerant in shell.
 - 2) Standard **OR** Marine, **as directed**, type for water box with piping connections. Standard type for water box without piping connections.
 - 3) Provide water boxes and marine water-box covers, **as directed**, with lifting lugs or eyebolts.
 - 4) Hinged **OR** Davited, **as directed**, water boxes.
OR
Hinged **OR** Davited, **as directed**, marine water-box covers.
 - 5) Nozzle Pipe Connections: Welded, ASME B16.5, flat-face flange **OR** Welded, ASME B16.5, raised-face flange **OR** Grooved for mechanical-joint coupling **OR** Grooved with mechanical-joint coupling and flange adapter, **as directed**.
 - 6) Thermistor or RTD temperature sensor factory installed in each nozzle.
 - 7) Fit each water box with 3/4-inch (19-mm) **OR** 1-inch (25-mm), **as directed**, drain connection at low point and vent connection at high point, each with threaded plug.
- i. Additional Corrosion Protection:
 - 1) Electrolytic corrosion-inhibitor anode.
 - 2) Coat wetted surfaces with a corrosion-resistant finish.
- 11. Condenser:
 - a. Description: Shell-and-tube design with water in tubes and refrigerant surrounding tubes within shell. Shell is separate from evaporator.
 - b. Shell Material: Carbon-steel rolled plates with continuously welded seams or seamless pipe.
 - c. Designed to prevent direct impingement of high-velocity hot gas from compressor discharge on tubes.
 - d. Provide condenser with sight glass or other form of positive visual verification of refrigerant charge and condition.
 - e. Tubes:
 - 1) Individually replaceable from either end and without damage to tube sheets and other tubes.
 - 2) Mechanically expanded into end sheets and physically attached to intermediate tube sheets.
 - 3) Material: Copper **OR** Copper-nickel alloy, **as directed**.
 - 4) Nominal OD: Manufacturer's choice **OR** 3/4 inch (19 mm) **OR** 1 inch (25 mm), **as directed**.
 - 5) Minimum Wall Thickness: Manufacturer's choice **OR** 0.025 inch (0.6 mm) **OR** 0.028 inch (0.7 mm) **OR** 0.035 inch (0.9 mm), **as directed**.
 - 6) External Finish: Manufacturer's standard.
 - 7) Internal Finish: Enhanced **OR** Smooth, **as directed**.
 - f. End Tube Sheets: Continuously welded to each end of shell; drilled and reamed to accommodate tubes with positive seal between fluid in tubes and refrigerant in shell.
 - g. Intermediate Tube Sheets: Installed in shell and spaced along length of tube at intervals required to eliminate vibration and to avoid contact of tubes resulting in abrasion and wear.
 - h. Water Box:
 - 1) Cast-iron or carbon-steel construction; arranged to provide visual inspection and cleaning of tubes from either end without disturbing refrigerant in shell.
 - 2) Standard **OR** Marine, **as directed**, type for water box with piping connections. Standard type for water box without piping connections.
 - 3) Provide water boxes and marine water-box covers, **as directed**, with lifting lugs or eyebolts.
 - 4) Hinged **OR** Davited, **as directed**, water boxes.
OR
Hinged **OR** Davited, **as directed**, marine water-box covers.



- 5) Nozzle Pipe Connections: Welded, ASME B16.5, flat-face flange **OR** Welded, ASME B16.5, raised-face flange **OR** Grooved for mechanical-joint coupling **OR** Grooved with mechanical-joint coupling and flange adapter, **as directed**.
 - 6) Thermistor or RTD temperature sensor factory installed in each nozzle.
 - 7) Fit each water box with 3/4-inch (19-mm) **OR** 1-inch (25-mm), **as directed**, drain connection at low point and vent connection at high point, each with threaded plug.
 - i. Additional Corrosion Protection:
 - 1) Electrolytic corrosion-inhibitor anode.
 - 2) Coat wetted surfaces with a corrosion-resistant finish.
12. Heat-Reclaim Condenser:
- a. Description: Shell-and-tube design with water in tubes and refrigerant surrounding tubes within shell. Shell is separate from evaporator and condenser.
 - b. Shell Material: Carbon-steel rolled plates with continuously welded seams or seamless pipe.
 - c. Designed to prevent direct impingement of high-velocity hot gas from compressor discharge on tubes.
 - d. Tubes:
 - 1) Individually replaceable from either end and without damage to tube sheets and other tubes.
 - 2) Mechanically expanded into end sheets and physically attached to intermediate tube sheets.
 - 3) Material: Copper **OR** Copper-nickel alloy, **as directed**.
 - 4) Nominal OD: Manufacturer's choice **OR** 3/4 inch (19 mm) **OR** 1 inch (25 mm), **as directed**.
 - 5) Minimum Wall Thickness: Manufacturer's choice **OR** 0.025 inch (0.6 mm) **OR** 0.028 inch (0.7 mm) **OR** 0.035 inch (0.9 mm), **as directed**.
 - 6) External Finish: Manufacturer's standard.
 - 7) Internal Finish: Enhanced **OR** Smooth, **as directed**.
 - e. End Tube Sheets: Continuously welded to each end of shell; drilled and reamed to accommodate tubes with positive seal between fluid in tubes and refrigerant in shell.
 - f. Intermediate Tube Sheets: Installed in shell and spaced along length of tube at intervals required to eliminate vibration and to avoid contact of tubes resulting in abrasion and wear.
 - g. Water Box:
 - 1) Cast-iron or carbon-steel construction; arranged to provide visual inspection and cleaning of tubes from either end without disturbing refrigerant in shell.
 - 2) Standard **OR** Marine, **as directed**, type for water box with piping connections. Standard type for water box without piping connections.
 - 3) Provide water boxes and marine water-box covers, **as directed**, with lifting lugs or eyebolts.
 - 4) Hinged **OR** Davited, **as directed**, water boxes.
OR
Hinged **OR** Davited, **as directed**, marine water-box covers.
 - 5) Nozzle Pipe Connections: Welded, ASME B16.5, flat-face flange **OR** Welded, ASME B16.5, raised-face flange **OR** Grooved for mechanical-joint coupling **OR** Grooved with mechanical-joint coupling and flange adapter, **as directed**.
 - 6) Thermistor or RTD temperature sensor factory installed in each nozzle.
 - 7) Fit each water box with 3/4-inch (19-mm) **OR** 1-inch (25-mm), **as directed**, drain connection at low point and vent connection at high point, each with threaded plug.
 - h. Additional Corrosion Protection:
 - 1) Electrolytic corrosion-inhibitor anode.
 - 2) Coat wetted surfaces with a corrosion-resistant finish.
13. Electrical Power:
- a. Factory installed and wired, and functionally tested at factory before shipment.



- b. Single-point, field-power connection to fused disconnect switch **OR** nonfused disconnect switch **OR** circuit breaker, **as directed**. Minimum withstand rating shall be as required by electrical power distribution system, but not less than 42,000 **OR** 65,000, **as directed**, A.
 - 1) Provide branch power circuit to each motor, electric heater, dedicated electrical load, and controls with disconnect switch or circuit breaker, **as directed**.
 - 2) NEMA- and ICS 2-rated motor controller for auxiliary motors, hand-off-auto switch, and overcurrent protection for each motor. Provide variable frequency controller for each variable-speed motor furnished.
 - 3) Control-circuit transformer with primary and secondary side fuses.
 - c. Terminal blocks with numbered and color-coded, **as directed**, wiring to match wiring diagram. Spare wiring terminal block for connection to external controls or equipment.
 - d. Factory-installed wiring outside of enclosures shall be in metal raceway except make connections to each motor and heater with not more than a 24-inch (610-mm) length of liquidtight conduit.
 - e. Factory install and wire capacitor bank for the purpose of power factor correction to 0.95 at all operating conditions.
 - 1) If capacitors are mounted in a dedicated enclosure, use same NEMA enclosure type as motor controller. Provide enclosure with service entrance knockouts and bushings for conduit.
 - 2) Capacitors shall be non-PCB dielectric fluid, metallized electrode design, low loss with low-temperature rise. The kVAr ratings shall be indicated and shall not exceed the maximum limitations set by NFPA 70. Provide individual cells as required.
 - 3) Provide each cell with current-limiting replaceable fuses and carbon-film discharge resistors to reduce residual voltage to less than 50 V within 1 minute after de-energizing.
 - 4) Provide a ground terminal and a terminal block or individual connectors for phase connection.
14. Motor Controller:
- a. Enclosure: Factory installed, unit mounted **OR** Factory furnished, field mounted, **as directed**, NEMA 250 **OR** NEMA ICS 6, **as directed**, Type 1 **OR** Type 4 **OR** Type 4X **OR** Type 12, **as directed**, with hinged full-front access door with lock and key or padlock and key, **as directed**.
 - b. Control Circuit: Obtained from integral control power transformer, **as directed**, with a control power transformer **OR** source, **as directed**, of enough capacity to operate connected control devices.
 - c. Overload Relay: Shall be sized according to UL 1995 or shall be an integral component of chiller control microprocessor.
 - d. Across-the-Line Controller: NEMA ICS 2, Class A, full voltage, nonreversing; include isolation switch and current-limiting fuses.
 - e. Star-Delta, Reduced-Voltage Controller: NEMA ICS 2, closed transition.
 - f. Autotransformer Reduced-Voltage Controller: NEMA ICS 2, closed transition; include isolation switch and current-limiting fuses.
 - g. Solid-State, Reduced-Voltage Controller: NEMA ICS 2.
 - 1) Surge suppressor in solid-state power circuits providing three-phase protection against damage from supply voltage surges 10 percent or more above nominal line voltage.
 - 2) Visual indication of motor and control status, including the following conditions:
 - a) Controller on.
 - b) Overload trip.
 - c) Loss of phase.
 - d) Starter fault.
 - h. Accessories: Devices shall be factory installed in controller enclosure unless otherwise indicated.
 - 1) Externally Operated, Door-Interlocked, **as directed**, Disconnect: Fused disconnect switch **OR** Nonfused disconnect switch **OR** Circuit breaker, **as directed**. Minimum



- withstand rating shall be as required by electrical power distribution system, but not less than 42,000 **OR** 65,000, **as directed**, A.
- 2) Push-Button Stations, Pilot Lights, and Selector Switches: NEMA ICS 2, heavy-duty type.
 - 3) Stop and Lockout Push-Button Station: Momentary-break, push-button station with a factory-applied hasp arranged so padlock can be used to lock push button in depressed position with control circuit open.
 - 4) Control Relays: Time-delay relays.
 - 5) Elapsed-Time Meters: Numerical readout in hours on face of enclosure.
 - 6) Number-of-Starts Counter: Numerical readout on face of enclosure.
 - 7) Meters: Panel type, 2-1/2 inches (64 mm) **OR** 4-1/4 inches (108 mm), **as directed**, with 90 **OR** 120 **OR** 270, **as directed**,-degree scale and 1 **OR** 2, **as directed**, percent accuracy. Where indicated, provide transfer device with an off position. Meters shall indicate the following:
 - a) Ammeter: Output current for each phase, with current sensors rated to suit application.
 - b) Voltmeter: Output voltage for each phase.
 - c) Frequency Meter: Output frequency.
 - d) Real-time clock with current time and date.
 - e) Total run time.

OR

Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four-wire systems and with the following features:

 - a) Selectable, digital display of the following:
 - i. Phase Currents, Each Phase: Plus or minus 1 percent.
 - ii. Phase-to-Phase Voltages, Three Phase: Plus or minus 1 percent.
 - iii. Phase-to-Neutral Voltages, Three Phase: Plus or minus 1 percent.
 - iv. Three-Phase Real Power: Plus or minus 2 percent.
 - v. Three-Phase Reactive Power: Plus or minus 2 percent.
 - vi. Power Factor: Plus or minus 2 percent.
 - vii. Frequency: Plus or minus 0.5 percent.
 - viii. Integrated Demand with Demand Interval Selectable from 5 to 60 Minutes: Plus or minus 2 percent.
 - ix. Accumulated energy, in megawatt hours (joules), plus or minus 2 percent; stored values unaffected by power outages for up to 72 hours.
 - b) Mounting: Display and control unit flush or semirecessed in instrument compartment door.
 - 8) Phase-Failure, Phase-Reversal, Undervoltage Relays: Solid-state sensing circuit with adjustable undervoltage setting and isolated output contacts for hardwired connection.
 - 9) Power Protection: Chiller shall shut down within six cycles of power interruption.
15. Variable Frequency Controller:
- a. Motor controller shall be factory mounted and wired on the chiller to provide a single-point, field-power termination to the chiller and its auxiliaries.
 - b. Description: NEMA ICS 2; listed and labeled as a complete unit and arranged to provide variable speed by adjusting output voltage and frequency.
 - c. Enclosure: Unit mounted, NEMA 250, Type 1, **as directed**, with hinged full-front access door with lock and key.
 - d. Integral Disconnecting Means: Door-interlocked, **as directed**, NEMA AB 1, instantaneous-trip circuit breaker with lockable handle. Minimum withstand rating shall be as required by electrical power distribution system, but not less than 42,000 **OR** 65,000 **OR** 100,000, **as directed**, A.
 - e. Technology: Pulse width modulated (PWM) output suitable for constant or variable torque loads.



- f. Output Rating: Three phase; with voltage proportional to frequency throughout voltage range.
- g. Operating Requirements:
 - 1) Input AC Voltage Tolerance: 460-V ac, plus 10 percent or 506 V maximum, **as directed**.
 - 2) Input frequency tolerance of 60 Hz, plus or minus 2 Hz.
 - 3) Capable of driving full load, without derating, under the following conditions:
 - a) Ambient Temperature: 0 to 40 deg C.
 - b) Relative Humidity: Up to 90 **OR** 95, **as directed**, percent (noncondensing).
 - c) Altitude: 3300 feet (1005 m) **OR** 6600 feet (2010 m), **as directed**.
 - 4) Minimum Efficiency: 96 percent at 60 Hz, full load.
 - 5) Minimum Displacement Primary-Side Power Factor: 98 percent.
 - 6) Overload Capability: 1.05 times the full-load current for 7 seconds.
 - 7) Starting Torque: As required by compressor-drive assembly.
 - 8) Speed Regulation: Plus or minus 1 percent.
 - 9) Isolated control interface to allow controller to follow control signal over a 10:1 speed range.
 - 10) To avoid equipment resonant vibrations, provide critical speed lockout circuitry to allow bands of operating frequency at which controller shall not operate continuously.
 - 11) Capable of being restarted into a motor coasting in either the forward or reverse direction without tripping.
- h. Internal Adjustability Capabilities:
 - 1) Minimum Output Frequency: 6 Hz.
 - 2) Maximum Output Frequency: 60 Hz.
 - 3) Acceleration: 2 seconds to 60 seconds.
 - 4) Deceleration: Zero seconds to 60 seconds.
 - 5) Current Limit: 30 to a minimum of 100 percent of maximum rating.
- i. Self-Protection and Reliability Features: Subjecting the controller to any of the following conditions shall not result in component failure or the need for replacement:
 - 1) Overtemperature.
 - 2) Short circuit at controller output.
 - 3) Ground fault at controller output. Variable frequency controller shall be able to start a grounded motor.
 - 4) Open circuit at controller output.
 - 5) Input undervoltage.
 - 6) Input overvoltage.
 - 7) Loss of input-phase.
 - 8) Reverse phase.
 - 9) AC line switching transients.
 - 10) Instantaneous overload, line to line or line to ground.
 - 11) Sustained overload exceeding 100 percent of controller rated current.
 - 12) Starting a rotating motor.
- j. Motor Protection: Controller shall protect motor against overvoltage and undervoltage, phase loss, reverse phase, overcurrent, overtemperature, and ground fault.
- k. Automatic Reset and Restart: Capable of three restarts after controller fault or on return of power after an interruption and before shutting down for manual reset or fault correction. Controller shall be capable of automatic restart on phase-loss, and overvoltage and undervoltage trips.
- l. Visual Indication: On face of controller enclosure or chiller control enclosure; indicating the following conditions:
 - 1) Power on.
 - 2) Run.
 - 3) Overvoltage.
 - 4) Line fault.
 - 5) Overcurrent.



- 6) External fault.
 - 7) Motor speed (percent).
 - 8) Fault or alarm status (code).
 - 9) Motor output voltage.
 - 10) Input kilovolt amperes.
 - 11) Total power factor.
 - 12) Input kilowatts.
 - 13) Input kilowatt-hours.
 - 14) Three-phase input voltage.
 - 15) Three-phase output voltage.
 - 16) Three-phase input current.
 - 17) Three-phase output current.
 - 18) Output frequency (Hertz).
 - 19) Elapsed operating time (hours).
 - 20) Diagnostic and service parameters.
- m. Operator Interface: At controller or chiller control panel; with start-stop and auto-manual selector with manual-speed-control potentiometer.
- n. Harmonic Distortion Filter: Factory mounted and wired to limit total voltage and current distortion to 5 percent.
16. Controls:
- a. Standalone and microprocessor based with all memory stored in nonvolatile memory so that reprogramming is not required on loss of electrical power.
 - b. Enclosure: Unit mounted, NEMA 250, Type 1 **OR** Type 4 **OR** Type 4x **OR** Type 12, **as directed**, hinged or lockable; factory wired with a single-point, field-power connection and a separate control circuit.
 - c. Operator Interface: Multiple-character digital or graphic display with dynamic update of information and with keypad or touch-sensitive display located on front of control enclosure. In either imperial or metric units, display the following information:
 - 1) Date and time.
 - 2) Operating or alarm status.
 - 3) Fault history with not less than last 10 faults displayed.
 - 4) Set points of controllable parameters.
 - 5) Trend data.
 - 6) Operating hours.
 - 7) Number of chiller starts.
 - 8) Outdoor-air temperature or space temperature if required for chilled-water reset.
 - 9) Temperature and pressure of operating set points.
 - 10) Entering- and leaving-fluid temperatures of evaporator and condenser.
 - 11) Difference in fluid temperatures of evaporator and condenser.
 - 12) Fluid flow of evaporator and condenser.
 - 13) Fluid pressure drop of evaporator and condenser.
 - 14) Refrigerant pressures in evaporator and condenser.
 - 15) Refrigerant saturation temperature in evaporator and condenser.
 - 16) Pump status.
 - 17) Antirecycling timer status.
 - 18) Percent of maximum motor amperage.
 - 19) Current-limit set point.
 - 20) Compressor bearing temperature.
 - 21) Motor bearing temperature.
 - 22) Motor winding temperature.
 - 23) Oil temperature.
 - 24) Oil discharge pressure.
 - 25) Phase current.
 - 26) Percent of motor rated load amperes.
 - 27) Phase voltage.



- 28) Demand power (kilowatts).
 - 29) Energy use (kilowatt-hours).
 - 30) Power factor.
- d. Control Functions:
- 1) Manual or automatic startup and shutdown time schedule.
 - 2) Entering and leaving chilled-water temperatures, control set points, and motor load limits. Evaporator fluid temperature shall be reset based on return-water **OR** outdoor-air **OR** space, **as directed**, temperature.
 - 3) Current limit and demand limit.
 - 4) Condenser-fluid temperature.
 - 5) External chiller emergency stop.
 - 6) Antirecycling timer.
 - 7) Variable evaporator flow.
 - 8) Thermal storage.
 - 9) Heat reclaim.
- e. Manually Reset Safety Controls: The following conditions shall shut down chiller and require manual reset:
- 1) Low evaporator pressure or temperature; high condenser pressure.
 - 2) Low evaporator fluid temperature.
 - 3) Low oil differential pressure.
 - 4) High or low oil pressure.
 - 5) High oil temperature.
 - 6) High compressor-discharge temperature.
 - 7) Loss of condenser-fluid flow.
 - 8) Loss of evaporator-fluid flow.
 - 9) Motor overcurrent.
 - 10) Motor overvoltage.
 - 11) Motor undervoltage.
 - 12) Motor phase reversal.
 - 13) Motor phase failure.
 - 14) Sensor- or detection-circuit fault.
 - 15) Processor communication loss.
 - 16) Motor controller fault.
 - 17) Extended compressor surge.
- f. Trending: Capability to trend analog data of up to five parameters simultaneously over an adjustable period and frequency of polling.
- g. Security Access: Provide electronic security access to controls through identification and password with at least three levels of access: view only; view and operate; and view, operate, and service.
- h. Control Authority: At least four conditions: Off, local manual control at chiller, local automatic control at chiller, and automatic control through a remote source.
- i. Communication Port: RS-232 port or equivalent connection capable of connecting a printer and a notebook computer, **as directed**.
- j. BAS Interface: Factory-installed hardware and software to enable the BAS to monitor, control, and display chiller status and alarms.
- 1) Hardwired Points:
 - a) Monitoring: On-off status, common trouble alarm **OR** electrical power demand (kilowatts) **OR** electrical power consumption (kilowatt-hours) **OR** power factor, **as directed**.
 - b) Control: On-off operation, chilled-water, discharge temperature set-point adjustment **OR** electrical power demand limit, **as directed**.
 - 2) ASHRAE 135 (BACnet) **OR** LonTalk **OR** Modbus **OR** Industry-accepted, open-protocol, **as directed**, communication interface with the BAS shall enable the BAS operator to remotely control and monitor the chiller from an operator workstation. Control features and monitoring points displayed locally at chiller control panel shall be available through the BAS.



17. Insulation:
- a. Material: Closed-cell, flexible elastomeric, thermal insulation complying with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
 - b. Thickness: 3/4 inch (19 mm) **OR** 1-1/2 inches (38 mm), **as directed**.
 - c. Adhesive: As recommended by insulation manufacturer and applied to 100 percent of insulation contact surface. Seal seams and joints.
 - d. Factory-applied insulation over cold surfaces of chiller capable of forming condensation. Components shall include, but not be limited to, evaporator shell and end tube sheets, evaporator water boxes including nozzles, refrigerant suction pipe from evaporator to compressor, cold surfaces of compressor, refrigerant-cooled motor, and auxiliary piping.
 - 1) Before insulating steel surfaces, prepare surfaces for paint, and prime and paint as indicated for other painted components. Do not insulate unpainted steel surfaces.
 - 2) Seal seams and joints to provide a vapor barrier.
 - 3) After adhesive has fully cured, paint exposed surfaces of insulation to match other painted parts.
18. Finish:
- a. Paint chiller, using manufacturer's standard procedures, except comply with the following minimum requirements:
 - 1) Provide at least one coat of primer with a total dry film thickness of at least 2 mils (0.05 mm).
 - 2) Provide at least two coats of alkyd-modified, vinyl enamel **OR** epoxy **OR** polyurethane, **as directed**, finish with a total dry film thickness of at least 4 mils (0.10 mm).
 - 3) Paint surfaces that are to be insulated before applying the insulation.
 - 4) Paint installed insulation to match adjacent uninsulated surfaces.
 - 5) Color of finish coat to be manufacturer's standard **OR** custom color selected by the Owner, **as directed**.
 - b. Provide the Owner with quart container of paint used in application of topcoat to use in touchup applications after Project Closeout.
19. Accessories:
- a. Flow Switches:
 - 1) If required and not factory installed, chiller manufacturer shall furnish a switch for each condenser **OR** evaporator and condenser, **as directed**, and verify field-mounting location before installation.
 - 2) Paddle Flow Switches:
 - a) Vane operated to actuate a double-pole, double-throw switch with one pole field wired to the chiller control panel and the other pole field wired to the BAS.
 - b) Contacts: Platinum alloy, silver alloy, or gold-plated switch contacts with a rating of 10 A at 120-V ac.
 - c) Pressure rating equal to pressure rating of heat exchanger.
 - d) Construct body and wetted parts of Type 316 stainless steel.
 - e) House switch in a NEMA 250, Type 4, **as directed**, enclosure constructed of die-cast aluminum.
 - f) Vane length to suit installation.
 - OR**
 - Pressure Differential Switches:
 - g) Construction: Wetted parts of body and trim constructed of Type 316 stainless steel.
 - h) Performance: Switch shall withstand, without damage, the full-pressure rating of the heat exchanger applied to either port and exhibit zero set-point shift due to variation in working pressure.
 - i) Set Point: Screw type, field adjustable.
 - j) Electrical Connections: Internally mounted screw-type terminal blocks.
 - k) Switch Enclosure: NEMA 250, Type 4, **as directed**.



- l) Switch Action: Double-pole, double-throw switch with one pole field wired to the chiller control panel and the other pole field wired to the BAS.
 - b. Vibration Isolation:
 - c. Chiller manufacturer shall furnish vibration isolation for each chiller.
 - 1) Neoprene Pad:
 - a) Two layers of 0.375-inch- (10-mm-) thick, ribbed- or waffle-pattern neoprene pads separated by a 16-gage, stainless-steel plate.
 - b) Fabricate pads from 40- to 50-durometer neoprene.
 - c) Provide stainless-steel square bearing plate to load the pad uniformly between 20 and 40 psig (138 and 276 kPa) with a 0.12- to 0.16-inch (3- to 4-mm) deflection.
 - OR**
 - Spring Isolator:
 - d) Stable in operation and designed for not less than 30 percent reserve deflection beyond actual operating conditions. Isolators shall be designed such that the Kx/Ky ratio shall be 1.0 or more for stability.
 - e) Provide PVC or neoprene-coated springs and hot-dip, galvanized-steel components. Aluminum components shall be etched and painted. Nuts, bolts, and washers shall be zinc electroplated.
 - f) Isolators shall be adjustable and with an open spring, having one or more coil springs attached to a top compression plate and a baseplate. An elastomeric pad with a minimum thickness of 0.25 inch (6 mm) shall be bonded to the baseplate.
 - g) Spring assembly shall be removable and shall fit within a welded steel enclosure consisting of a top plate and rigid lower housing, which serves as a blocking device during installation. Isolated restraining bolts shall not be engaged during normal operation and shall connect the top plate and lower housing to prevent the isolated equipment from rising when drained of fluid.
 - h) Isolators shall be selected for a nominal 1-inch (25-mm) **OR** 2-inch (50-mm), **as directed**, deflection.
 - d. Sound Barrier:
 - 1) Furnish removable and reusable sound-barrier covers over the compressor housing, hermetic motor, compressor suction and discharge piping, and condenser shell.
 - 2) Provide for repeated installation and removal without use of tape or caulk.
 - 3) Inner and outer cover shall consist of a PTFE-impregnated fiberglass cloth enclosing heavy-density, needled fiberglass insulation material with a mass-loaded vinyl acoustic barrier.
 - 4) Covers shall be double sewn and lock stitched with edges folded and sewn so no raw cut edges are exposed.
 - 5) Form covers around control devices, gages, conduit, piping, and supports without degrading sound-barrier performance.
 - 6) Continuously lap all exposed seams at least 2 inches (50 mm) for better sound containment.
 - 7) Permanently label each section of cover to indicate its location, description, size, and number sequence.
 - 8) Randomly place stainless-steel quilting pins to prevent covers from shifting and sagging.
- B. Packaged, Water-Cooled, Multiple-Compressor Chillers
- 1. Description: Factory-assembled and -tested **OR** run-tested, **as directed**, chiller with compressor(s), compressor motors and motor controllers, evaporator, condenser where indicated, electrical power, controls, and indicated accessories.
 - a. Disassemble chiller into major assemblies as required by the installation after factory testing and before packaging for shipment.



2. Fabricate chiller mounting base with reinforcement strong enough to resist chiller movement during a seismic event when chiller is anchored to field support structure.
3. Compressors:
 - a. Description: Positive displacement, hermetically sealed.
 - b. Casing: Cast iron, precision machined for minimum clearance about periphery of rotors.
 - c. Rotors: Manufacturer's standard one- or two-rotor design.
4. Service: Easily accessible for inspection and service.
 - a. Compressor's internal components shall be accessible without having to remove compressor-drive assembly from chiller.
 - b. Provide lifting lugs or eyebolts attached to casing.
5. Capacity Control: On-off compressor cycling and modulating slide-valve assembly or port unloaders combined with hot-gas bypass, if necessary, to achieve performance indicated.
 - a. Maintain stable operation throughout range of operation. Configure to achieve most energy-efficient operation possible.
 - b. Operating Range: From 100 to 20 **OR** 15 **OR** 10 **OR** 5 **OR** zero, **as directed**, percent of design capacity.
 - c. Condenser-Fluid Unloading Requirements over Operating Range: Constant-design entering condenser-fluid temperature **OR** Drop-in entering condenser-fluid temperature of 2.5 deg F (1.4 deg C) drop for each 10 percent in capacity reduction, **as directed**.
6. Oil Lubrication System: Consisting of pump if required, filtration, heater, cooler, factory-wired power connection, and controls.
 - a. Provide lubrication to bearings, gears, and other rotating surfaces at all operating, startup, shutdown, and standby conditions including power failure.
 - b. Thermostatically controlled oil heater properly sized to remove refrigerant from oil.
 - c. Factory-installed and pressure-tested piping with isolation valves and accessories.
 - d. Oil compatible with refrigerant and chiller components.
 - e. Positive visual indication of oil level.
7. Vibration Control:
 - a. Vibration Balance: Balance chiller compressor and drive assembly to provide a precision balance that is free of noticeable vibration over the entire operating range.
 - 1) Overspeed Test: 25 percent above design operating speed.
 - b. Isolation: Mount individual compressors on vibration isolators.
8. Sound Control: Sound-reduction package shall consist of removable acoustic enclosures around the compressors and drive assemblies that are designed to reduce sound levels without affecting performance.
9. Compressor Motors:
 - a. Hermetically sealed and cooled by refrigerant suction gas.
 - b. High-torque, induction type with inherent thermal-overload protection on each phase.
10. Refrigerant Circuits:
 - a. Refrigerant: Type as indicated on Drawings.
OR
Refrigerant Type: R-134a **OR** HFC, **as directed**. Classified as Safety Group A1 according to ASHRAE 34.
 - b. Refrigerant Compatibility: Chiller parts exposed to refrigerants shall be fully compatible with refrigerants, and pressure components shall be rated for refrigerant pressures.
 - c. Refrigerant Circuit: Each shall include a thermal- or electronic-expansion valve, refrigerant charging connections, a hot-gas muffler, compressor suction, **as directed**, and discharge shutoff valves, a liquid-line shutoff valve, a replaceable-core, **as directed**, filter-dryer, a sight glass with moisture indicator, a liquid-line solenoid valve, and an insulated suction line.
 - d. Pressure Relief Device:
 - 1) Comply with requirements in ASHRAE 15 and in applicable portions of ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 - 2) ASME-rated, spring-loaded pressure relief valve; single- or multiple-reseating type.



- e. Refrigerant Isolation: Factory install positive shutoff isolation valves in the compressor discharge line to the condenser and the refrigerant liquid-line leaving the condenser to allow for isolation and storage of full refrigerant charge in the chiller condenser shell.
11. Evaporator:
- a. Description: Shell-and-tube design.
 - 1) Direct-expansion (DX) type with fluid flowing through the shell, and refrigerant flowing through the tubes within the shell.
 - 2) Flooded type with fluid flowing through tubes and refrigerant flowing around tubes within the shell.
 - b. Code Compliance: Tested and stamped according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 - c. Shell Material: Carbon steel.
 - d. Shell Heads: Removable carbon-steel heads with multipass baffles, and located at each end of the tube bundle.
 - e. Fluid Nozzles: Terminated with mechanical-coupling or flanged end connections for connection to field piping.
 - f. Tube Construction: Individually replaceable copper tubes with enhanced fin design, expanded into tube sheets.
12. Condenser:
- a. Shell and tube, or without integral condenser; as indicated.
OR
Shell and Tube:
 - 1) Description: Shell-and-tube design with refrigerant flowing through shell, and fluid flowing through tubes within shell.
 - 2) Provides positive subcooling of liquid refrigerant.
 - 3) Code Compliance: Tested and stamped according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 - 4) Shell Material: Carbon steel.
 - 5) Water Boxes: Removable, of carbon-steel construction, located at each end of the tube bundle with fluid nozzles terminated with mechanical-coupling end connections for connection to field piping.
 - 6) Tube Construction: Individually replaceable copper tubes with enhanced fin design, expanded into tube sheets.
 - 7) Provide each condenser with a pressure relief device, purge cock, and liquid-line shutoff valve.
 - b. Provide chiller without an integral condenser and design chiller for field connection to remote condenser. Coordinate requirements with Division 23 Section "Air-cooled Refrigerant Condensers".
13. Electrical Power:
- a. Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a multipoint **OR** single-point, **as directed**, field-power connection to chiller.
 - b. House in a unit-mounted, NEMA 250, Type 1, **as directed**, enclosure with hinged access door with lock and key or padlock and key, **as directed**.
 - c. Wiring shall be numbered and color-coded, **as directed**, to match wiring diagram.
 - d. Install factory wiring outside of an enclosure in a raceway.
 - e. Field-power interface shall be to wire lugs **OR** NEMA KS 1, heavy-duty, nonfused disconnect switch **OR** NEMA AB 1, instantaneous-trip circuit breaker with lockable handle, **as directed**.
 - 1) Disconnect means shall be interlocked with door operation.
 - 2) Minimum withstand rating shall be as required by electrical power distribution system, but not less than 42,000 **OR** 65,000 **OR** 100,000, **as directed**, A.
 - f. Provide branch power circuit to each motor and to controls with one of the following disconnecting means:
 - 1) NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 60947-4-1.



- 2) NEMA AB 1, motor-circuit protector (circuit breaker) with field-adjustable, short-circuit-trip set point.
 - g. Provide each motor with overcurrent protection.
 - h. Overload relay sized according to UL 1995 or an integral component of chiller control microprocessor.
 - i. Phase-Failure and Undervoltage Relays: Solid-state sensing with adjustable settings.
 - j. Control Transformer: Unit-mounted transformer with primary and secondary fuses and sized with enough capacity to operate electrical load plus spare capacity.
 - k. Control Relays: Auxiliary and adjustable time-delay relays.
 - l. For chiller electrical power supply, indicate the following:
 - 1) Current and phase to phase for all three phases.
 - 2) Voltage, phase to phase, and phase to neutral for all three phases.
 - 3) Three-phase real power (kilowatts).
 - 4) Three-phase reactive power (kilovolt amperes reactive).
 - 5) Power factor.
 - 6) Running log of total power versus time (kilowatt-hours).
 - 7) Fault log, with time and date of each.
14. Compressor Motor Controllers:
- a. Across the Line: NEMA ICS 2, Class A, full voltage, nonreversing, or solid state, **as directed**.
 - b. Star-Delta, Reduced-Voltage Controller: NEMA ICS 2, closed or open transition, or solid state, **as directed**.
15. Controls:
- a. Standalone and microprocessor based.
 - b. Enclosure: Share enclosure with electrical-power devices or provide a separate enclosure of matching construction.
 - c. Operator Interface: Multiple-character digital or graphic display with dynamic update of information and with keypad or touch-sensitive display located on front of control enclosure. In either imperial or metric units, display the following information:
 - 1) Date and time.
 - 2) Operating or alarm status.
 - 3) Fault history with not less than last 10 faults displayed.
 - 4) Set points of controllable parameters.
 - 5) Trend data.
 - 6) Operating hours.
 - 7) Number of chiller starts.
 - 8) Outdoor-air temperature or space temperature if required for chilled-water reset.
 - 9) Temperature and pressure of operating set points.
 - 10) Entering- and leaving-fluid temperatures of evaporator and condenser.
 - 11) Difference in fluid temperatures of evaporator and condenser.
 - 12) Refrigerant pressures in evaporator and condenser.
 - 13) Refrigerant saturation temperature in evaporator and condenser.
 - 14) No cooling load condition.
 - 15) Elapsed time meter (compressor run status).
 - 16) Pump status.
 - 17) Antirecycling timer status.
 - 18) Percent of maximum motor amperage.
 - 19) Current-limit set point.
 - 20) Number of compressor starts.
 - 21) Compressor refrigerant suction and discharge temperature.
 - 22) Oil temperature.
 - 23) Oil discharge pressure.
 - 24) Phase current.
 - 25) Percent of motor rated load amperes.
 - 26) Phase voltage.



- d. Control Functions:
 - 1) Manual or automatic startup and shutdown time schedule.
 - 2) Entering and leaving chilled-water temperatures, control set points, and motor load limits. Chilled-water leaving temperature shall be reset based on return-water **OR** outdoor-air **OR** space, **as directed**, temperature.
 - 3) Current limit and demand limit.
 - 4) Condenser-fluid temperature.
 - 5) External chiller emergency stop.
 - 6) Antirecycling timer.
 - 7) Automatic lead-lag switching.
 - 8) Variable evaporator flow.
 - 9) Thermal storage.
 - e. Manually Reset Safety Controls: The following conditions shall shut down chiller and require manual reset:
 - 1) Low evaporator pressure, or high condenser pressure.
 - 2) Low chilled-water temperature.
 - 3) Refrigerant high pressure.
 - 4) High or low oil pressure.
 - 5) High oil temperature.
 - 6) Loss of chilled-water flow.
 - 7) Loss of condenser-fluid flow.
 - 8) Control device failure.
 - f. Trending: Capability to trend analog data of up to five parameters simultaneously over an adjustable period and frequency of polling.
 - g. Security Access: Provide electronic security access to controls through identification and password with at least three levels of access: view only; view and operate; and view, operate, and service.
 - h. Control Authority: At least four conditions: Off, local manual control at chiller, local automatic control at chiller, and automatic control through a remote source.
 - i. BAS Interface: Factory-installed hardware and software to enable the BAS to monitor, control, and display chiller status and alarms.
 - 1) Hardwired Points:
 - a) Monitoring: On-off status, common trouble alarm **OR** electrical power demand (kilowatts) **OR** electrical power consumption (kilowatt-hours), **as directed**.
 - b) Control: On-off operation, chilled-water, discharge temperature set-point adjustment **OR** electrical power demand limit, **as directed**.
 - 2) ASHRAE 135 (BACnet) **OR** LonTalk **OR** Modbus **OR** Industry-accepted, open-protocol, **as directed**, communication interface with the BAS shall enable the BAS operator to remotely control and monitor the chiller from an operator workstation. Control features and monitoring points displayed locally at chiller control panel shall be available through the BAS.
16. Insulation:
- a. Material: Closed-cell, flexible elastomeric, thermal insulation complying with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
 - b. Thickness: 3/4 inch (19 mm).
 - c. Adhesive: As recommended by insulation manufacturer and applied to 100 percent of insulation contact surface. Seal seams and joints.
 - d. Factory-applied insulation over cold surfaces of chiller capable of forming condensation. Components shall include, but not be limited to, evaporator shell and end tube sheets, evaporator water boxes including nozzles, refrigerant suction pipe from evaporator to compressor, cold surfaces of compressor, refrigerant-cooled motor, and auxiliary piping.
 - 1) Before insulating steel surfaces, prepare surfaces for paint, prime and paint as indicated for other painted components. Do not insulate unpainted steel surfaces.
 - 2) Seal seams and joints to provide a vapor barrier.



- 3) After adhesive has fully cured, paint exposed surfaces of insulation to match other painted parts.
17. Finish:
 - a. Paint chiller, using manufacturer's standard procedures, except comply with the following minimum requirements:
 - 1) Provide at least one coat of primer.
 - 2) Provide finish coat of alkyd-modified, vinyl enamel, **as directed**.
 - 3) Paint surfaces that are to be insulated before applying the insulation.
 - 4) Paint installed insulation to match adjacent uninsulated surfaces.
 18. Accessories:
 - a. Factory-furnished, chilled- and condenser-, **as directed**, water flow switches for field installation.
 - b. Individual compressor suction and discharge pressure gages with shutoff valves for each refrigerant circuit.
 - c. Factory-furnished neoprene **OR** spring, **as directed**, isolators for field installation.
- C. Packaged, Air-Cooled Chillers
1. Description: Factory-assembled and run-tested chiller complete with base and frame, condenser casing, compressors, compressor motors and motor controllers, evaporator, condenser coils, condenser fans and motors, electrical power, controls, and accessories.
 2. Fabricate base, frame, and attachment to chiller components strong enough to resist chiller movement during a seismic event when chiller base is anchored to field support structure.
 3. Cabinet:
 - a. Base: Galvanized-steel base extending the perimeter of chiller. Secure frame, compressors, and evaporator to base to provide a single-piece unit.
 - b. Frame: Rigid galvanized-steel frame secured to base and designed to support cabinet, condenser, control panel, and other chiller components not directly supported by base.
 - c. Casing: Galvanized steel.
 - d. Finish: Coat base, frame, and casing with a corrosion-resistant coating capable of withstanding a 500 **OR** 1000, **as directed**,-hour salt-spray test according to ASTM B 117.
 - e. Sound-reduction package designed to reduce sound level without affecting performance and consisting of the following:
 - 1) Acoustic enclosure around compressors.
 - 2) Reduced-speed fans with acoustic treatment.
 - f. Security Package: Provide removable grilles **OR** louvered panels, **as directed**, with fasteners for additional protection of compressors, evaporator, and condenser coils without inhibiting service access. Finish to match cabinet.
 4. Compressors:
 - a. Description: Positive displacement, hermetically sealed.
 - b. Casing: Cast iron, precision machined for minimum clearance about periphery of rotors.
 - c. Rotors: Manufacturer's standard one- or two-rotor design.
 - d. Each compressor provided with suction and, **as directed**, discharge shutoff valves, crankcase oil heater, and suction strainer.
 5. Service: Easily accessible for inspection and service.
 6. Capacity Control: On-off compressor cycling and modulating slide-valve assembly or port unloaders combined with hot-gas bypass, if necessary, to achieve performance indicated.
 7. Maintain stable operation throughout range of operation. Configure to achieve most energy-efficient operation possible.
 - a. Operating Range: From 100 to 20 **OR** 15 **OR** 10 **OR** 5 **OR** zero, **as directed**, percent of design capacity.
 - b. Condenser-Air Unloading Requirements over Operating Range: Constant-design entering condenser-air temperature **OR** Drop-in entering condenser-air temperature of 5 deg F (3 deg C) drop for each 10 percent in capacity reduction, **as directed**.



- c. For units equipped with a variable frequency controller, capacity control shall be both "valveless" and "stepless," requiring no slide valve or capacity-control valve(s) to operate at reduced capacity.
8. Oil Lubrication System: Consisting of pump if required, filtration, heater, cooler, factory-wired power connection, and controls.
 - a. Provide lubrication to bearings, gears, and other rotating surfaces at all operating, startup, shutdown, and standby conditions including power failure.
 - b. Thermostatically controlled oil heater properly sized to remove refrigerant from oil.
 - c. Factory-installed and pressure-tested piping with isolation valves and accessories.
 - d. Oil compatible with refrigerant and chiller components.
 - e. Positive visual indication of oil level.
9. Vibration Control:
 - a. Vibration Balance: Balance chiller compressors and drive assemblies to provide a precision balance that is free of noticeable vibration over the entire operating range.
 - 1) Overspeed Test: 25 percent above design operating speed.
 - b. Isolation: Mount individual compressors on vibration isolators.
10. Compressor Motors:
 - a. Hermetically sealed and cooled by refrigerant suction gas.
 - b. High-torque, induction type with inherent thermal-overload protection on each phase.
11. Compressor Motor Controllers:
 - a. Across the Line: NEMA ICS 2, Class A, full voltage, nonreversing, or solid state, **as directed**.
 - b. Star-Delta, Reduced-Voltage Controller: NEMA ICS 2, closed transition, or solid state, **as directed**.
 - c. Variable Frequency Controller:
 - 1) Motor controller shall be factory mounted and wired on the chiller to provide a single-point, field-power termination to the chiller and its auxiliaries.
 - 2) Description: NEMA ICS 2; listed and labeled as a complete unit and arranged to provide variable speed by adjusting output voltage and frequency.
 - 3) Enclosure: Unit mounted, NEMA 250, Type 3R, **as directed**, with hinged full-front access door with lock and key.
 - 4) Integral Disconnecting Means: Door-interlocked, **as directed**, NEMA AB 1, instantaneous-trip circuit breaker with lockable handle. Minimum withstand rating shall be as required by electrical power distribution system, but not less than 42,000 **OR** 65,000 **OR** 100,000, **as directed**, A.
 - 5) Technology: Pulse width modulated (PWM) output suitable for constant or variable torque loads.
 - 6) Motor current at start shall not exceed the rated load amperes, providing no electrical inrush.
12. Refrigerant Circuits:
 - a. Refrigerant: Type as indicated on Drawings.
OR
Refrigerant Type: R-134a **OR** R-407c **OR** HFC, **as directed**: Classified as Safety Group A1 according to ASHRAE 34.
 - b. Refrigerant Compatibility: Chiller parts exposed to refrigerants shall be fully compatible with refrigerants, and pressure components shall be rated for refrigerant pressures.
 - c. Refrigerant Circuit: Each shall include a thermal- or electronic-expansion valve, refrigerant charging connections, a hot-gas muffler, compressor suction, **as directed**, and discharge shutoff valves, a liquid-line shutoff valve, a replaceable-core, **as directed**, filter-dryer, a sight glass with moisture indicator, a liquid-line solenoid valve, and an insulated suction line.
 - d. Pressure Relief Device:
 - 1) Comply with requirements in ASHRAE 15 and in applicable portions of ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 - 2) ASME-rated, spring-loaded pressure relief valve; single- or multiple-reseating type.
13. Evaporator:



- a. Description: Shell-and-tube design.
 - 1) Direct-expansion (DX) type with fluid flowing through the shell, and refrigerant flowing through the tubes within the shell.
 - 2) Flooded type with fluid flowing through tubes and refrigerant flowing around tubes within the shell.
 - b. Code Compliance: Tested and stamped according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 - c. Shell Material: Carbon steel.
 - d. Shell Heads: Removable carbon-steel heads located at each end of the tube bundle.
 - e. Fluid Nozzles: Terminated with mechanical-coupling **OR** flanged, **as directed**, end connections for connection to field piping.
 - f. Tube Construction: Individually replaceable copper tubes with enhanced fin design, expanded into tube sheets.
 - g. Heater: Factory-installed and -wired electric heater with integral controls designed to protect the evaporator to minus 20 deg F (minus 29 deg C).
 - h. Remote Mounting: Designed for remote field mounting where indicated. Provide kit for field installation.
14. Air-Cooled Condenser:
- a. Plate-fin coil with integral subcooling on each circuit, rated at 450 psig (3103 kPa).
 - 1) Construct coil casing of galvanized **OR** stainless, **as directed**, steel.
 - 2) Construct coils of copper tubes mechanically bonded to aluminum **OR** aluminum with precoated epoxy-phenolic **OR** copper, **as directed**, fins.
 - 3) Coat coils with a baked-epoxy, corrosion-resistant coating after fabrication.
 - 4) Hail Protection: Provide condenser coils with louvers, baffles, or hoods to protect against hail damage.
 - b. Fans: Direct-drive propeller type with statically and dynamically balanced fan blades, arranged for vertical air discharge.
 - c. Fan Motors: Totally enclosed nonventilating (TENV) or totally enclosed air over (TEAO) enclosure, with permanently lubricated bearings. Equip each motor with overload protection integral to either the motor or chiller controls.
 - d. Fan Guards: Steel safety guards with corrosion-resistant coating.
15. Electrical Power:
- a. Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a multipoint **OR** single-point, **as directed**, field-power connection to chiller.
 - b. House in a unit-mounted, NEMA 250, Type 3R, **as directed**, enclosure with hinged access door with lock and key or padlock and key, **as directed**.
 - c. Wiring shall be numbered and color-coded, **as directed**, to match wiring diagram.
 - d. Install factory wiring outside of an enclosure in a raceway.
 - e. Field-power interface shall be to wire lugs **OR** NEMA KS 1, heavy-duty, nonfused disconnect switch **OR** NEMA AB 1, instantaneous-trip circuit breaker with lockable handle, **as directed**.
 - 1) Disconnect means shall be interlocked with door operation.
 - 2) Minimum withstand rating shall be as required by electrical power distribution system, but not less than 42,000 **OR** 65,000 **OR** 100,000, **as directed**, A.
 - f. Provide branch power circuit to each motor and to controls with one of the following disconnecting means:
 - 1) NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 60947-4-1.
 - 2) NEMA AB 1, motor-circuit protector (circuit breaker) with field-adjustable, short-circuit-trip set point.
 - g. Provide each motor with overcurrent protection.
 - h. Overload relay sized according to UL 1995 or an integral component of chiller control microprocessor.
 - i. Phase-Failure and Undervoltage Relays: Solid-state sensing with adjustable settings.



- j. Provide power factor correction capacitors to correct power factor to 0.90 **OR** 0.95, **as directed**, at full load.
 - k. Control Transformer: Unit-mounted transformer with primary and secondary fuses and sized with enough capacity to operate electrical load plus spare capacity.
 - 1) Power unit-mounted controls where indicated.
 - 2) Power unit-mounted, ground fault interrupt (GFI) duplex receptacle.
 - l. Control Relays: Auxiliary and adjustable time-delay relays.
 - m. For chiller electrical power supply, indicate the following:
 - 1) Current and phase to phase for all three phases.
 - 2) Voltage, phase to phase, and phase to neutral for all three phases.
 - 3) Three-phase real power (kilowatts).
 - 4) Three-phase reactive power (kilovolt amperes reactive).
 - 5) Power factor.
 - 6) Running log of total power versus time (kilowatt-hours).
 - 7) Fault log, with time and date of each.
16. Controls:
- a. Standalone and microprocessor based.
 - b. Enclosure: Share enclosure with electrical power devices or provide a separate enclosure for remote mounting in the field, **as directed**.
 - c. Operator Interface: Multiple-character digital or graphic display with dynamic update of information and with keypad or touch-sensitive display located on front of control enclosure. In either imperial or metric units, display the following information:
 - 1) Date and time.
 - 2) Operating or alarm status.
 - 3) Operating hours.
 - 4) Outdoor-air temperature if required for chilled-water reset.
 - 5) Temperature and pressure of operating set points.
 - 6) Entering and leaving temperatures of chilled water.
 - 7) Refrigerant pressures in evaporator and condenser.
 - 8) Saturation temperature in evaporator and condenser.
 - 9) No cooling load condition.
 - 10) Elapsed time meter (compressor run status).
 - 11) Pump status.
 - 12) Antirecycling timer status.
 - 13) Percent of maximum motor amperage.
 - 14) Current-limit set point.
 - 15) Number of compressor starts.
 - d. Control Functions:
 - 1) Manual or automatic startup and shutdown time schedule.
 - 2) Entering and leaving chilled-water temperatures, control set points, and motor load limits. Chilled-water leaving temperature shall be reset based on return-water **OR** outdoor-air **OR** space, **as directed**, temperature.
 - 3) Current limit and demand limit.
 - 4) External chiller emergency stop.
 - 5) Antirecycling timer.
 - 6) Automatic lead-lag switching.
 - 7) Variable evaporator flow.
 - 8) Thermal storage.
 - e. Manually Reset Safety Controls: The following conditions shall shut down chiller and require manual reset:
 - 1) Low evaporator pressure or high condenser pressure.
 - 2) Low chilled-water temperature.
 - 3) Refrigerant high pressure.
 - 4) High or low oil pressure.
 - 5) High oil temperature.
 - 6) Loss of chilled-water flow.



- 7) Control device failure.
 - f. Trending: Capability to trend analog data of up to five parameters simultaneously over an adjustable period and frequency of polling.
 - g. Security Access: Provide electronic security access to controls through identification and password with at least three levels of access: view only; view and operate; and view, operate, and service.
 - h. Control Authority: At least four conditions: Off, local manual control at chiller, local automatic control at chiller, and automatic control through a remote source.
 - i. BAS Interface: Factory-installed hardware and software to enable the BAS to monitor, control, and display chiller status and alarms.
 - 1) Hardwired Points:
 - a) Monitoring: On-off status, common trouble alarm **OR** electrical power demand (kilowatts) **OR** electrical power consumption (kilowatt-hours), **as directed**.
 - b) Control: On-off operation, chilled-water, discharge temperature set-point adjustment **OR** electrical power demand limit, **as directed**.
 - 2) ASHRAE 135 (BACnet) **OR** LonTalk **OR** Modbus **OR** Industry-accepted, open-protocol, **as directed**, communication interface with the BAS shall enable the BAS operator to remotely control and monitor the chiller from an operator workstation. Control features and monitoring points displayed locally at chiller control panel shall be available through the BAS.
17. Insulation:
- a. Material: Closed-cell, flexible elastomeric, thermal insulation complying with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
 - b. Thickness: 3/4 inch (19 mm) **OR** 1-1/2 inches (38 mm), **as directed**.
 - c. Factory-applied insulation over cold surfaces of chiller components.
 - 1) Adhesive: As recommended by insulation manufacturer and applied to 100 percent of insulation contact surface. Seal seams and joints.
 - d. Apply protective coating to exposed surfaces of insulation to protect insulation from weather.
18. Accessories:
- a. Factory-furnished, chilled-water flow switches for field installation.
 - b. Individual compressor suction and discharge pressure gages with shutoff valves for each refrigerant circuit.
 - c. Factory-furnished neoprene **OR** spring, **as directed**, isolators for field installation.
- D. Packaged Refrigerant Recovery Units
1. Packaged portable unit consisting of compressor, air-cooled condenser, recovery system, tank pressure gages, filter-dryer, and valving that allows for switching between liquid and vapor recovery mode. Refrigerant recovery unit shall be factory mounted on an ASME-constructed and -stamped refrigerant storage vessel that is sized to hold the full refrigerant charge of the largest chiller furnished.
- E. Heat-Exchanger, Brush-Cleaning System
1. Furnish for field installation a brush-cleaning system on each chiller condenser, **as directed**, for tube cleaning and improved heat transfer.
 2. System shall maintain tube fouling at or below design conditions without interrupting normal equipment operation.
 3. System shall consist of a brush inserted in each tube and a catch basket attached to each end of the tube. A four-way valve shall operate to reverse the direction of water flow to push the brush through the tube while removing tube deposits. Four-way reversing valve's actuator shall be controlled by a preset time cycle that provides regular tube brushing during equipment operation. Frequency of the brushing cycle shall be set up to match Project requirements.
 4. Components:



- a. Brush: Each brush shall have nylon bristles, titanium wires, and polypropylene tips. Brush interference fit with the ID of the tube shall not exceed 0.025 inch (0.6 mm).
- b. Basket: Single-piece polypropylene basket with neck OD to press fit ID of tube. Design shall provide for insertion of eddy current probe or removal of brushes without removing baskets from the valve.
- c. Four-Way Valve:
 - 1) Construct valve body of carbon steel with internal sealing parts of hard rubber and Type 304 stainless steel.
 - 2) Configure valve with parallel flow connections to minimize field installation piping.
 - 3) Construct to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, at a system working pressure equal to condenser.
 - 4) Pipe connections shall be flanged.
 - 5) Valve manufacturer to test and certify a maximum leakage rate of less than 0.05 percent of the design flow rate at operation conditions of maximum differential pressure.
 - 6) Hydrostatically test to 1.5 times the design working pressure.
 - 7) Design the valve to cause no more than 0.5-psig (3-kPa) pressure drop at design flow conditions.
 - 8) Provide valve with valve-mounted indicating/warning light, which shall light before valve begins rotation.
 - 9) Valve Actuator: Mount electric actuator to operate valve.
OR
Valve Actuator: Mount pneumatic piston-type actuator to operate valve. Actuator shall be suitable for operation using field-supplied air pressure.
 - 10) Position Switches: Factory mount microswitches on valve to indicate the complete turn of valve in both normal and reverse flow.
- d. Control Panel: Factory or field mount a control panel on chiller. Control panel shall include the following features:
 - 1) NEMA 250, Type 1 **OR** Type 4 **OR** Type 4x **OR** Type 12, **as directed**, enclosure.
 - 2) Timer to automatically initiate the cleaning cycle over a 24-hour period.
 - 3) Manual override of preset cleaning cycle.
 - 4) Visual indication of "Power On," "Diverter Position," "Normal Flow," "Reverse Flow," and "Valve Malfunction" indicating a slow turn or incomplete valve turn.
 - 5) For pneumatic actuators, mount four-way solenoid valve for actuator operation in the control panel.
 - 6) Flow switch bypass.
 - 7) Unloading signal to chiller.

F. Source Quality Control

1. Perform functional tests of chillers before shipping.
2. Factory run test each air-cooled chiller with water flowing through evaporator.
3. Factory performance test water-cooled chillers, before shipping, according to ARI 550/590.
 - a. Test the following conditions:
 - 1) Design conditions indicated.
 - 2) Reduction in capacity from design to minimum load in steps of 10 **OR** 25 **OR** 33, **as directed**, with condenser fluid at design conditions.
OR
Reduction in capacity from design to minimum load in steps of 10 **OR** 25 **OR** 33, **as directed**, with varying entering condenser-fluid temperature from design to minimum conditions in 5 deg F (3 deg C) increments.
OR
At one **OR** two **OR** three **OR** four **OR** five **OR** 10, **as directed**, point(s) of varying part-load performance to be selected by the Owner at time of test.
 - b. Allow the Owner access to place where chillers are being tested. Notify the Owner 14 days in advance of testing.



- c. Prepare test report indicating test procedures, instrumentation, test conditions, and results. Submit copy of results within one week of test date.
4. Factory performance test air-cooled chillers, **as directed**, before shipping, according to ARI 550/590.
 - a. Test the following conditions:
 - 1) Design conditions indicated.
 - 2) Reduction in capacity from design to minimum load in steps of 10 **OR** 25 **OR** 33, **as directed**, with condenser air at design conditions.

OR

At one **OR** two **OR** three **OR** four **OR** five, **as directed**, point(s) of varying part-load performance to be selected by the Owner at time of test.
 - b. Allow the Owner access to place where chillers are being tested. Notify the Owner 14 days in advance of testing.
 - c. Prepare test report indicating test procedures, instrumentation, test conditions, and results. Submit copy of results within one week of test date.
5. Factory sound test water-cooled chillers, **as directed**, before shipping, according to ARI 575 **OR** air-cooled chillers, before shipping, according to ARI 370, **as directed**.
 - a. Test the following conditions:
 - 1) Design conditions indicated.
 - 2) Chiller operating at calculated worst-case sound condition.

OR

At one **OR** two **OR** three **OR** four **OR** five, **as directed**, point(s) of varying part-load performance to be selected by the Owner at time of test.
 - b. Allow the Owner access to place where chillers are being tested. Notify the Owner 14 days in advance of testing.
 - c. Prepare test report indicating test procedures, instrumentation, test conditions, and results. Submit copy of results within one week of test date.
6. Factory test and inspect evaporator and condenser **OR** condenser, and heat-reclaim condenser, **as directed**, according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
7. For chillers located indoors, rate sound power level according to ARI 575.
8. For chillers located outdoors, rate sound power level according to ARI 370.

1.3 EXECUTION

A. Chiller Installation

1. Install chillers on support structure indicated.
2. Equipment Mounting: Install chiller on concrete bases using elastomeric pads **OR** restrained spring isolators, **as directed**. Comply with requirements for concrete bases specified in Division 03 Section "Cast-in-place Concrete". Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 - a. Minimum Deflection: 1/4 inch (6 mm) **OR** 1/2 inch (13 mm) **OR** 1 inch (25 mm) **OR** 2 inches (50 mm), **as directed**.
 - b. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - c. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - d. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - e. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Equipment Mounting: Install chiller using elastomeric pads **OR** restrained spring isolators, **as directed**. Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".



- a. Minimum Deflection: 1/4 inch (6 mm) **OR** 1/2 inch (13 mm) **OR** 1 inch (25 mm) **OR** 2 inches (50 mm), **as directed**.
 4. Equipment Mounting: Install chiller on concrete bases. Comply with requirements for concrete bases specified in Division 03 Section "Cast-in-place Concrete".
 - a. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - b. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - d. Install anchor bolts to elevations required for proper attachment to supported equipment.
 5. Maintain manufacturer's recommended clearances for service and maintenance.
 6. Charge chiller with refrigerant and fill with oil if not factory installed.
 7. Install separate devices furnished by manufacturer and not factory installed.
- B. Heat-Exchanger, Brush-Cleaning System Installation
1. Install brush-cleaning system control panel adjacent to chiller control panel.
 2. Arrange piping to provide service access to four-way valve assembly without affecting access to chiller. Secure valve to prevent lateral movement and vibration during operation.
 3. Provide field electric power, as required, to each system control panel and electric actuated valve.
 4. Provide pneumatic piping with pressure regulator and isolation valve to each pneumatic supply connection. Coordinate field source of air with manufacturer to ensure that requirements are satisfied for proper valve operation.
 5. Interconnect brush-cleaning system controls with chiller controls. Coordinate requirements to ensure safe, trouble-free operation.
 6. Functionally test the entire brush-cleaning system, including the valve, actuator, position indicator, and control panel, with chiller in operation.
- C. Connections
1. Comply with requirements for piping specified in Division 23 Section(s) "Hydronic Piping" AND "Refrigerant Piping". Drawings indicate general arrangement of piping, fittings, and specialties.
 2. Install piping adjacent to chiller to allow service and maintenance.
 3. Evaporator Fluid Connections: Connect to evaporator inlet with shutoff valve, strainer, **as directed**, flexible connector, **as directed**, thermometer, and plugged tee with pressure gage. Connect to evaporator outlet with shutoff valve, balancing valve, flexible connector, **as directed**, flow switch, thermometer, plugged tee with shutoff valve and pressure gage, flow meter, **as directed**, and drain connection with valve. Make connections to chiller with a flange **OR** mechanical coupling, **as directed**.
 4. Condenser Fluid Connections: Connect to condenser inlet with shutoff valve, strainer, **as directed**, flexible connector, **as directed**, thermometer, and plugged tee with pressure gage. Connect to condenser outlet with shutoff valve, balancing valve, flexible connector, **as directed**, flow switch, thermometer, plugged tee with shutoff valve and pressure gage, flow meter, **as directed**, and drain connection with valve. Make connections to chiller with a flange **OR** mechanical coupling, **as directed**.
 5. Heat-Reclaim Condenser Fluid Connections: Connect to condenser inlet with shutoff valve, strainer, **as directed**, flexible connector, **as directed**, thermometer, and plugged tee with pressure gage. Connect to condenser outlet with shutoff valve, balancing valve, flexible connector, **as directed**, flow switch, thermometer, plugged tee with shutoff valve and pressure gage, flow meter, **as directed**, and drain connection with valve. Make connections to chiller with a flange **OR** mechanical coupling, **as directed**.
 6. Refrigerant Pressure Relief Device Connections: For chillers installed indoors, extend vent piping **OR** separate vent piping for each chiller, **as directed**, to the outdoors without valves or restrictions. Comply with ASHRAE 15. Connect vent to chiller pressure relief device with flexible connector and dirt leg with drain valve.
 7. Connect each chiller drain connection with a union and drain pipe, and extend pipe, full size of connection, to floor drain. Provide a shutoff valve at each connection.



D. Startup Service

1. Engage a factory-authorized service representative to perform startup service.
 - a. Complete installation and startup checks according to manufacturer's written instructions.
 - b. Verify that refrigerant charge is sufficient and chiller has been leak tested.
 - c. Verify that pumps are installed and functional.
 - d. Verify that thermometers and gages are installed.
 - e. Operate chiller for run-in period.
 - f. Check bearing lubrication and oil levels.
 - g. For chillers installed indoors, verify that refrigerant pressure relief device is vented outdoors.
 - h. Verify proper motor rotation.
 - i. Verify static deflection of vibration isolators, including deflection during chiller startup and shutdown.
 - j. Verify and record performance of fluid flow and low-temperature interlocks for evaporator and condenser **OR** condenser, and heat-reclaim condenser, **as directed**.
 - k. Verify and record performance of chiller protection devices.
 - l. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.
2. Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assembly, installation, and connection.
3. Prepare test and inspection startup reports.

END OF SECTION 23 61 16 00a



23 - Heating, Ventilating, And Air-Conditioning (HVAC)

Task	Specification	Specification Description
23 62 23 00	23 01 60 00	Condensing Units



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SECTION 23 63 13 00 - AIR-COOLED CONDENSERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for air-cooled condensers. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes packaged, air-cooled condensers for outdoor and indoor installation.

C. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: Signed and sealed by a qualified professional engineer.
 - a. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints, **as directed**, and for designing vibration isolation bases.
 - b. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails and equipment mounting frames.
 - c. Wiring Diagrams: Power, signal, and control wiring.
3. Manufacturer Seismic Qualification Certification: Submit certification that air-cooled condensers, accessories, and components will withstand seismic forces defined in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment". Include the following:
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
4. Field quality-control test reports.
5. Operation and maintenance data.
6. LEED Submittal:
 - a. Product Data for Credit EA 4: Documentation required by Credit EA 4 indicating that equipment and refrigerants comply.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. Fabricate and label refrigeration system according to ASHRAE 15, "Safety Code for Mechanical Refrigeration."
3. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.2 PRODUCTS

A. Manufactured Units

1. Description: Factory assembled and tested; consisting of casing, condenser coils, condenser fans and motors, and unit controls.
2. Condenser Coil: Seamless copper-tube, finned coil; factory tested at 425 psig (2930 kPa).
 - a. Coil Fin: Aluminum **OR** Copper, **as directed**.
 - b. Coil Coating: **As directed**.
 - c. Circuit: To match compressors with liquid subcooling coil, **as directed**.
 - d. Refrigerant Accessories, **as directed**: Provide receiver, pressure control, and solenoid valve for each circuit.



3. Condenser Fans and Drives: Propeller fans with aluminum or galvanized-steel **OR** galvanized-steel **OR** stainless-steel, **as directed**, fan blades, for vertical **OR** horizontal, **as directed**, air discharge; directly driven with permanently lubricated ballbearing motors with integral current- and thermal-overload protection.
OR
Condenser Fans and Drives: Forward-curved centrifugal fans for vertical **OR** horizontal, **as directed**, air discharge.
 - a. Fan on steel shaft with self-aligning ball bearings.
 - b. V-belt drive with minimum of two belts; variable pitch drive pulley.
 - c. Motor mounted on adjustable slide base.
4. Operating and Safety Controls: Include condenser fan motor thermal and overload cutouts; 115-V control transformer, if required; magnetic contactors for condenser fan motors and a nonfused factory-mounted and -wired disconnect switch for single external electrical power connection.
5. Unit Casings: Galvanized or zinc-coated steel treated and finished with manufacturer's standard paint coating **OR** Stainless steel, **as directed**, designed for outdoor installation with weather protection for components and controls **OR** indoor installation, **as directed**, and with the following:
 - a. Removable panels for access to controls, condenser fans, motors, and drives.
 - b. Plated-steel **OR** Stainless-steel, **as directed**, fan guards.
 - c. Lifting eyes.
 - d. Removable legs.
 - e. 1-inch- (25-mm-) thick inlet filter.

B. Motors

1. General requirements for motors are specified in Division 14 Section "Facility Chutes".
 - a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - b. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 22.

C. Source Quality Control

1. Verification of Performance: Rate air-cooled condensers according to ARI 460.
2. Testing Requirements: Factory test sound-power-level ratings according to ARI 270.

1.3 EXECUTION

A. Installation

1. Install units level and plumb, firmly anchored in locations indicated; maintain manufacturer's recommended clearances.
2. Install air-cooled condensers on concrete base. Concrete base is specified in Division 23 Section "Common Work Results For Hvac" and concrete materials and installation requirements are specified in Division 31.
3. Concrete Bases:
 - a. Install dowel rods to connect concrete base to concrete slab. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of the base.
 - b. For equipment supported on structural slab, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - d. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - e. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
4. Install roof-mounting units on equipment supports specified in Division 07.



5. Vibration Isolation: Mount air-cooled condensers on rubber pads with a minimum deflection of 1/4 inch (6.35 mm). Vibration isolation devices and installation requirements are specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
OR
Vibration Isolation: Mount air-cooled condensers on restrained spring isolators with a minimum deflection of <Insert measurement>. Vibration isolation devices and installation requirements are specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 6. Support suspended units from structure using threaded steel rods and spring hangers having a static deflection of 1 inch (25 mm). Vibration- and seismic-control devices are specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 - a. Secure vibration and seismic controls, and suspended units to structure.**OR**
Support suspended units from structure using threaded steel rods.
 7. Maintain manufacturer's recommended clearances for service and maintenance.
 8. Loose Components: Install electrical components, devices, and accessories that are not factory mounted.
- B. Connections
1. Piping installation requirements are specified in other Division 21. Drawings indicate general arrangement of piping, fittings, and specialties.
 2. Install piping adjacent to machine to allow service and maintenance.
 3. Refrigerant Piping: Connect piping to unit with pressure relief, service valve, filter-dryer, and moisture indicator on each refrigerant-circuit liquid line. Refrigerant piping and specialties are specified in Division 23 Section "Refrigerant Piping".
- C. Field Quality Control
1. Perform the following field tests and inspections and prepare test reports:
 - a. Perform electrical test and visual and mechanical inspection.
 - b. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - c. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Complete manufacturer's starting checklist.
 - d. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - e. Verify proper airflow over coils.
 2. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.
 3. Remove and replace malfunctioning air-cooled condensers and retest as specified above.
- D. Startup Service
1. Complete installation and startup checks according to manufacturer's written instructions and perform the following:
 - a. Inspect for physical damage to unit casing.
 - b. Verify that access doors move freely and are weathertight.
 - c. Clean units and inspect for construction debris.
 - d. Verify that all bolts and screws are tight.
 - e. Adjust vibration isolation and flexible connections.
 - f. Verify that controls are connected and operational.
 2. Lubricate bearings on fans.
 3. Verify that fan wheel is rotating in the correct direction and is not vibrating or binding.
 4. Start unit according to manufacturer's written instructions and complete manufacturer's startup checklist.
 5. Measure and record airflow over coils.
 6. Verify proper operation of capacity control device.



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7. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.
 8. After startup and performance test, lubricate bearings.
- E. Demonstration
1. Train Owner's maintenance personnel to adjust, operate, and maintain air-cooled condensers.

END OF SECTION 23 63 13 00



SECTION 23 63 13 00a - SPLIT-SYSTEM AIR-CONDITIONING UNITS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for split-system air-conditioning units. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes split-system air-conditioning and heat pump units consisting of separate evaporator-fan and compressor-condenser components. Units are designed for exposed or concealed mounting, and may be connected to ducts.

C. Submittals

1. Product Data: For each unit indicated. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.
2. LEED Submittals:
 - a. Product Data for Credit EA 4: Documentation required by Credit EA 4 indicating that equipment and refrigerants comply.
 - b. Product Data for Prerequisite EQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
3. Shop Drawings: Diagram power, signal, and control wiring.
4. Field quality-control test reports.
5. Operation and maintenance data.
6. Warranty: Special warranty specified in this Section.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
3. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

E. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within five years from date of Final Completion.

1.2 PRODUCTS

A. Concealed Evaporator-Fan Components

1. Chassis: Galvanized steel with flanged edges, removable panels for servicing, and insulation on back of panel.
 - a. Insulation: Faced, glass-fiber duct liner.
 - b. Drain Pans: Galvanized steel, with connection for drain; insulated and complying with ASHRAE 62.1, **as directed**.
 - c. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.



2. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with thermal-expansion valve.
 3. Water **OR** Steam, **as directed**, Coil: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm); leak tested to 300 psig (2070 kPa) underwater; and having a two-position control valve.
OR
Electric Coil: Helical, nickel-chrome, resistance-wire heating elements with refractory ceramic support bushings; automatic-reset thermal cutout; built-in magnetic contactors; manual-reset thermal cutout; airflow proving device; and one-time fuses in terminal box for overcurrent protection.
 4. Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.
 5. Fan Motors: Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - a. Special Motor Features: Multitapped, multispeed with internal thermal protection and permanent lubrication.
 6. Disposable Filters: 1 inch (25 mm) thick, in fiberboard frames with ASHRAE 52.2 MERV rating of 6 or higher, **as directed**.
 7. Wiring Terminations: Connect motor to chassis wiring with plug connection.
- B. Floor-Mounting, Evaporator-Fan Components
1. Cabinet: Enameled steel with removable panels on front and ends in color selected by the Owner.
 - a. Discharge Grille: Steel with surface-mounted frame **OR** Welded steel bars forming a linear grille and welded into supporting panel, **as directed**.
 - b. Insulation: Faced, glass-fiber, duct liner.
 - c. Drain Pans: Galvanized steel, with connection for drain; insulated and complying with ASHRAE 62.1, **as directed**.
 - d. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
 2. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with thermal-expansion valve.
 3. Water **OR** Steam, **as directed**, Coil: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm); leak tested to 300 psig (2070 kPa) underwater; and having a 2-position control valve.
OR
Electric Coil: Helical, nickel-chrome, resistance-wire heating elements with refractory ceramic support bushings; automatic-reset thermal cutout; built-in magnetic contactors; manual-reset thermal cutout; airflow proving device; and one-time fuses in terminal box for overcurrent protection.
 4. Fan: Direct drive, centrifugal, with power-induced outside air, **as directed**.
 5. Fan Motors: Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - a. Special Motor Features: Multitapped, multispeed with internal thermal protection and permanent lubrication.
 6. Filters: Permanent, cleanable **OR** Disposable, with ASHRAE 52.2 MERV rating of 6 or higher, **as directed**.
- C. Wall-Mounting, Evaporator-Fan Components
1. Cabinet: Enameled steel with removable panels on front and ends in color selected by the Owner, and discharge drain pans with drain connection.
 - a. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
 - b. Drain Pan and Drain Connection: Comply with ASHRAE 62.1.
 2. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with thermal-expansion valve.



3. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements with refractory ceramic support bushings; automatic-reset thermal cutout; built-in magnetic contactors; manual-reset thermal cutout; airflow proving device; and one-time fuses in terminal box for overcurrent protection.
 4. Fan: Direct drive, centrifugal fan.
 5. Fan Motors: Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - a. Special Motor Features: Multitapped, multispeed with internal thermal protection and permanent lubrication.
 6. Filters: Permanent, cleanable **OR** Disposable, with ASHRAE 52.2 MERV rating of 6 or higher, **as directed**.
- D. Ceiling-Mounting, Evaporator-Fan Components
1. Cabinet: Enameled steel with removable panels on front and ends in color selected by the Owner, and discharge drain pans with drain connection.
 - a. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
 - b. Drain Pan and Drain Connection: Comply with ASHRAE 62.1.
 2. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with thermal-expansion valve.
 3. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements with refractory ceramic support bushings; automatic-reset thermal cutout; built-in magnetic contactors; manual-reset thermal cutout; airflow proving device; and one-time fuses in terminal box for overcurrent protection.
 4. Fan: Direct drive, centrifugal fan, with power-induced outside air, **as directed**, and integral condensate pump.
 5. Fan Motors: Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - a. Special Motor Features: Multitapped, multispeed with internal thermal protection and permanent lubrication.
 6. Filters: Permanent, cleanable **OR** Disposable, with ASHRAE 52.2 MERV rating of 6 or higher, **as directed**.
- E. Air-Cooled, Compressor-Condenser Components
1. Casing: Steel, finished with baked enamel in color selected by the Owner, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
 2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
 - a. Compressor Type: Reciprocating **OR** Scroll, **as directed**.
 - b. Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.
 - c. Refrigerant: R-407C **OR** R-410A, **as directed**.
 3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid subcooler.
 4. Heat Pump Components: Reversing valve and low-temperature air cut-off thermostat.
 5. Fan: Aluminum-propeller type, directly connected to motor.
 6. Motor: Permanently lubricated, with integral thermal-overload protection.
 7. Low Ambient Kit: Permits operation down to 45 deg F (7 deg C).
 8. Mounting Base: Polyethylene.
 9. Minimum Energy Efficiency: Comply with ASHRAE/IESNA 90.1, "Energy Standard for Buildings except Low-Rise Residential Buildings."
- F. Water-Cooled, Compressor-Condenser Components



1. Casing: Steel, with baked-enamel finish in color selected by the Owner, removable panels for access to controls, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
 - a. Compressor Type: Reciprocating **OR** Scroll, **as directed**.
 - b. Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.
 - c. Refrigerant: R-407C **OR** R-410A, **as directed**.
3. Heat Pump Components: Reversing valve.
4. Heat Exchanger: Copper tubes in copper tube or in steel shell, with water-temperature-actuated, water-regulating valve.
5. Minimum Energy Efficiency: Comply with ASHRAE/IESNA 90.1, "Energy Standard for Buildings except Low-Rise Residential Buildings."

G. Accessories

1. Control equipment and sequence of operation are specified in Division 23 Section(s) "Instrumentation And Control For Hvac" AND "Sequence Of Operations For Hvac Controls".
2. Thermostat: Low voltage with subbase to control compressor and evaporator fan.
3. Thermostat: Wireless infrared functioning to remotely control compressor and evaporator fan, with the following features:
 - a. Compressor time delay.
 - b. 24-hour time control of system stop and start.
 - c. Liquid-crystal display indicating temperature, set-point temperature, time setting, operating mode, and fan speed.
 - d. Fan-speed selection, including auto setting.
4. Automatic-reset timer to prevent rapid cycling of compressor.
5. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.
 - a. Minimum Insulation Thickness: 1/2 inch (13 mm) **OR** 1 inch (25 mm), **as directed**, thick.

1.3 EXECUTION

A. Installation

1. Install units level and plumb.
2. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.
3. Install ground-mounting, compressor-condenser components on 4-inch- (100-mm-) thick, reinforced concrete base; 4 inches (100 mm) larger on each side than unit. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-place Concrete". Coordinate anchor installation with concrete base.
OR
Install ground-mounting, compressor-condenser components on polyethylene mounting base.
4. Install roof-mounting compressor-condenser components on equipment supports specified in Division 07 Section "Roof Accessories". Anchor units to supports with removable, cadmium-plated fasteners.
5. Install seismic restraints.
6. Install compressor-condenser components on restrained, spring isolators with a minimum static deflection of 1 inch (25 mm). Refer to Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
7. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.



B. Connections

1. Piping installation requirements are specified in other Division 21. Drawings indicate general arrangement of piping, fittings, and specialties.
 - a. Water Coil Connections: Comply with requirements in Division 23 Section "Hydronic Piping". Connect to supply and return coil with shutoff-duty valve and union or flange on the supply connection and with throttling-duty valve and union or flange on the return connection.
 - b. Remote Water-Cooled Condenser Connections: Comply with requirements in Division 23 Section "Hydronic Piping". Connect to supply and return with shutoff-duty valve and union or flange on the supply connection and with throttling-duty valve and union or flange on the return connection.
 - c. Steam Coil Connections: Comply with requirements in Division 23 Section "Steam And Condensate Heating Piping". Connect to steam piping with shutoff valve and union or flange; for condensate piping, starting from the coil connection, connect with union or flange, strainer, trap, and shutoff valve.
2. Install piping adjacent to unit to allow service and maintenance.
3. Duct Connections: Duct installation requirements are specified in Division 23 Section "Metal Ducts". Drawings indicate the general arrangement of ducts. Connect supply and return, **as directed**, ducts to split-system air-conditioning units with flexible duct connectors. Flexible duct connectors are specified in Division 23 Section "Air Duct Accessories".
4. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
5. Electrical Connections: Comply with requirements in Division 22 for power wiring, switches, and motor controls.

C. Field Quality Control

1. Perform the following field tests and inspections and prepare test reports:
 - a. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - b. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - c. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
2. Remove and replace malfunctioning units and retest as specified above.

D. Startup Service

1. Engage a factory-authorized service representative to perform startup service.
 - a. Complete installation and startup checks according to manufacturer's written instructions.

E. Demonstration

1. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 23 63 13 00a



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23 - Heating, Ventilating, And Air-Conditioning (HVAC)

Task	Specification	Specification Description
23 63 13 00	23 01 60 00	Condensing Units



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**SECTION 23 64 13 16 - INDIRECT-FIRED ABSORPTION WATER CHILLERS**

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for indirect-fired absorption water chillers. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Packaged, water-cooled, single-effect and double-effect absorption chillers.
 - b. Heat-exchanger, brush-cleaning system.

C. Definitions

1. BAS: Building automation system.
2. COP: Coefficient of performance. The ratio of the rate of heat removal to the rate of energy input using consistent units for any given set of rating conditions.
3. IPLV: Integrated part-load value. A single-number part-load efficiency figure of merit calculated per the method defined by ARI 560 and referenced to ARI standard rating conditions.
4. NPLV: Nonstandard part-load value. A single-number part-load efficiency figure of merit calculated per the method defined by ARI 560 and intended for operating conditions other than the ARI standard rating conditions.

D. Performance Requirements

1. Seismic Performance: Indirect-fired absorption chillers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
2. Condenser-Fluid Temperature Performance:
 - a. Startup Condenser-Fluid Temperature: Chiller shall be capable of starting with an entering condenser-fluid temperature of 60 deg F (16 deg C) **OR** 55 deg F (13 deg C) **OR** 40 deg F (4.4 deg C), **as directed**, and providing stable operation until the system temperature is elevated to the minimum operating entering condenser-fluid temperature.
 - b. Minimum Operating Condenser-Fluid Temperature: Chiller shall be capable of continuous operation over the entire capacity range indicated with an entering condenser-fluid temperature of 65 deg F (18 deg C) **OR** 60 deg F (16 deg C) **OR** 55 deg F (13 deg C), **as directed**.
 - c. Make factory modifications to standard chiller design if necessary to comply with performance indicated.
3. Site Altitude: Chiller shall be suitable for altitude at which installed without affecting performance indicated. Make adjustments to affected chiller components to account for site altitude.
4. Performance Tolerance: Comply with the following in lieu of ARI 560, **as directed**:
 - a. Allowable Capacity Tolerance: Zero percent.
 - b. Allowable IPLV/NPLV Performance Tolerance: Zero percent.

E. Submittals

1. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, furnished specialties and accessories.
2. LEED Submittals:
 - a. Product Data for LEED-NC Prerequisite EA 2: Documentation indicating that units comply with ASHRAE 90.1.



- b. Product Data for LEED-NC Prerequisite EA 3: Documentation indicating that refrigerants comply.
- c. Product Data for LEED-NC Credit EA 4: Documentation indicating that equipment and refrigerants comply.
3. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
4. Certificates: For certification required in "Quality Assurance" Article.
5. Seismic Qualification Certificates: For chillers, accessories, and components, from manufacturer.
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
6. Startup service reports.
7. Operation and maintenance data.
8. Warranty: Sample of special warranty.

F. Quality Assurance

1. ARI Rating: Rate chiller performance according to requirements in ARI 560.
2. ASHRAE Compliance:
 - a. ASHRAE 15 for safety code for mechanical refrigeration.
 - b. ASHRAE/IESNA 90.1.
3. ASME Compliance: Fabricate and label chiller pressure vessels to comply with applicable portions of ASME Boiler and Pressure Vessel Code.
4. Comply with NFPA 70.
5. Comply with requirements of UL and UL Canada, and include label by a qualified testing agency showing compliance.

G. Delivery, Storage, And Handling

1. Ship chillers factory charged with nitrogen.
2. Ship absorbent and refrigerant in chillers or in containers separate from chillers.
OR
Ship absorbent and refrigerant, **as directed**, in containers separate from chillers.
3. Package chiller for export shipping in totally enclosed bagging **OR** crate **OR** crate with bagging, **as directed**.

H. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of chillers that fail in materials or workmanship within specified warranty period.
 - a. Extended warranties include, but are not limited to, the following:
 - 1) Complete chiller.
OR
Pumps and motors **OR** Purge unit, **as directed**.
OR
Absorbent **OR** Absorbent and refrigerant, **as directed**, only.
 - 2) Parts only **OR** Parts and labor, **as directed**.
 - 3) Loss of absorbent and refrigerant for any reason.
2. Warranty Period: Two **OR** Three **OR** Four **OR** Five, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Manufactured Unit



1. Description: Factory-assembled and -tested, hermetic-design chiller complete with absorber, evaporator, condenser, generator, solution heat exchanger, controls, absorbent solution pump with motor, refrigerant pump with motor, purge unit with motor, motor controllers, rupture disk, interconnecting unit piping and wiring, indicated accessories, and mounting frame.
 - a. Disassemble chiller into major assemblies as required by the installation after factory testing and before packaging for shipment.
 2. Absorbent and Refrigerant:
 - a. Absorbent: Lithium bromide solution with corrosion inhibitor.
 - b. Refrigerant: Deionized or distilled, **as directed**, water.
 - c. Performance Enhancer: Heat and mass transfer enhancer to improve performance.
 3. Seismic Fabrication Requirements: Fabricate mounting base and attachment to chiller, accessories, and components with reinforcement strong enough to withstand seismic forces defined in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment" when mounting base is anchored to building structure.
- B. Pumps
1. Hermetically sealed, self-lubricating, and fitted with self-adjusting, spring-loaded, wear-compensating tapered carbon bearings.
 2. Pump motor assembly shall be designed to operate for not less than 25,000 **OR** 50,000, **as directed**, hours between inspections.
 3. Pump motors cooled, and bearings lubricated, either by fluid being pumped or by a filtered supply of liquid refrigerant.
 4. Pump suction and discharge equipped with isolation valves.
 5. Separate and dedicated pumps for absorbent solution and refrigerant.
 - a. Absorbent solution and refrigerant flow-control method shall be manufacturer's choice to comply with operating requirements indicated.
 6. Purge System: Unit mounted and factory wired, equipped with controls and a pump to automatically remove noncondensable vapors.
 - a. Purge Pump Motor: Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - 1) Enclosure: Open dripproof **OR** Totally enclosed, **as directed**.
- C. Heat-Exchanger Shells
1. Configuration for Single-Effect Chillers: Two shells; one shell consists of the absorber/evaporator and the other shell consists of the condenser/generator.
 2. Configuration for Double-Effect Chillers: Two shells; one shell consists of the absorber/evaporator, low-stage generator/condenser and the other shell consists of the high-stage generator.
 3. Construction: Fabricated from continuously welded carbon-steel sheet or plate, or from seamless pipe.
 4. Design Pressure and Temperature Rating: Comply with applicable requirements in ASME Boiler and Pressure Vessel Code.
 5. End Tube Sheets: Carbon-steel plates continuously welded to each end of shell; drilled and reamed to accommodate tubes with positive seal between fluid in tubes and refrigerant in shell.
 6. Intermediate Tube Sheets: Carbon-steel plates installed in shell and spaced along length of tube at intervals required to eliminate vibration and to avoid contact of tubes resulting in abrasion and wear.
 7. Generator/Condenser Shell Pressure Relief Device: Manufacturers standard rupture disk complying with requirements in ASHRAE 15 and in applicable portions of ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- D. Absorber
1. Nozzle or Dispersion Trays: Designed to evenly distribute absorbent solution over tubes. Constructed of brass, stainless steel, or another material that will not corrode.
 2. Tubes:



- a. Individually replaceable, straight tubes expanded into tube sheets. Replaceable from either end and without damage to tube sheets and other tubes.
 - b. Material: Copper **OR** Copper-nickel alloy **OR** Stainless steel **OR** Titanium, **as directed**.
 - c. Minimum Wall Thickness: Manufacturer's choice **OR** 0.025 inch (0.6 mm) **OR** 0.028 inch (0.7 mm) **OR** 0.035 inch (0.9 mm), **as directed**.
 - d. External Finish: Manufacturer's standard.
 - e. Internal Finish: Enhanced **OR** Smooth, **as directed**.
3. Water Boxes:
- a. Carbon-steel construction; arranged to provide visual inspection and cleaning of tubes from either end without disturbing refrigerant in shell.
 - b. Standard **OR** Marine, **as directed**, type for water box with piping connections.
 - 1) Water boxes and marine water-box covers, **as directed**, shall have lifting lugs or eyebolts.
 - 2) Hinged **OR** davited, **as directed**, water boxes.
OR
Hinged **OR** davited, **as directed**, marine water-box covers.
 - OR**
Standard type for water box without piping connections.
 - 1) Water boxes shall have lifting lugs or eyebolts.
 - 2) Hinged **OR** davited, **as directed**, water boxes.
OR
Hinged **OR** davited, **as directed**, marine water-box covers.
 - c. Nozzle Pipe Connections: Welded, ASME B16.5, flat-face flange **OR** Welded, ASME B16.5, raised-face flange **OR** Grooved for mechanical-joint coupling **OR** Grooved with mechanical-joint coupling and flange adapter, **as directed**.
 - d. Thermistor or RTD temperature sensor factory installed in each nozzle.
 - e. Fit each water box with 3/4-inch (19-mm) **OR** 1-inch (25-mm) **OR** 3/4- or 1-inch (19- or 25-mm), **as directed**, drain connection at low point and vent connection at high point, each with threaded plug.
4. Additional Corrosion Protection:
- a. Electrolytic corrosion-inhibitor anode.
 - b. Coat wetted surfaces with a corrosion-resistant finish.
OR
Using same material as tubes, clad surfaces of end tube sheets in contact with fluid. Coat other wetted surfaces, including water boxes, with a corrosion-resistant finish.
5. Absorber/Condenser Crossover Piping: Factory furnished **OR** installed, **as directed**, piping connecting fluid connection of absorber discharge to condenser inlet.
- E. Evaporator
1. Nozzle or Dispersion Trays: Designed to evenly distribute refrigerant over tubes. Constructed of brass, stainless steel, or another material that will not corrode.
 2. Refrigerant Holding Pan: Steel **OR** Stainless steel, **as directed**.
 3. Tubes:
 - a. Individually replaceable, straight tubes expanded into tube sheets. Replaceable from either end and without damage to tube sheets and other tubes.
 - b. Material: Copper **OR** Copper-nickel alloy **OR** Stainless steel **OR** Titanium, **as directed**.
 - c. Minimum Wall Thickness: Manufacturer's choice **OR** 0.025 inch (0.6 mm) **OR** 0.028 inch (0.7 mm) **OR** 0.035 inch (0.9 mm), **as directed**.
 - d. External Finish: Manufacturer's standard.
 - e. Internal Finish: Enhanced **OR** Smooth, **as directed**.
 4. Water Boxes:
 - a. Carbon-steel construction; arranged to provide visual inspection and cleaning of tubes from either end without disturbing refrigerant in shell.
 - b. Standard **OR** Marine, **as directed**, type for water box with piping connections.



- 1) Water boxes and marine water-box covers, **as directed**, shall have lifting lugs or eyebolts.
 - 2) Hinged **OR** davited, **as directed**, water boxes.
OR
Hinged **OR** davited, **as directed**, marine water-box covers.
- OR**
Standard type for water box without piping connections.
- 1) Water boxes shall have lifting lugs or eyebolts.
 - 2) Hinged **OR** davited, **as directed**, water boxes.
OR
Hinged **OR** davited, **as directed**, marine water-box covers.
- c. Nozzle Pipe Connections: Welded, ASME B16.5, flat-face flange **OR** Welded, ASME B16.5, raised-face flange **OR** Grooved for mechanical-joint coupling **OR** Grooved with mechanical-joint coupling and flange adapter, **as directed**.
 - d. Thermistor or RTD temperature sensor factory installed in each nozzle.
 - e. Fit each water box with 3/4-inch (19-mm) **OR** 1-inch (25-mm) **OR** 3/4- or 1-inch (19- or 25-mm), **as directed**, drain connection at low point and vent connection at high point, each with threaded plug.

F. Condenser

1. Refrigerant Holding Pan: Steel **OR** Stainless steel, **as directed**.
2. Tubes:
 - a. Individually replaceable, straight tubes expanded into tube sheets. Replaceable from either end and without damage to tube sheets and other tubes.
 - b. Material: Copper **OR** Copper-nickel alloy **OR** Stainless steel **OR** Titanium, **as directed**.
 - c. Minimum Wall Thickness: Manufacturer's choice **OR** 0.025 inch (0.6 mm) **OR** 0.028 inch (0.7 mm) **OR** 0.035 inch (0.9 mm), **as directed**.
 - d. External Finish: Manufacturer's standard.
 - e. Internal Finish: Enhanced **OR** Smooth, **as directed**.
3. Water Boxes:
 - a. Carbon-steel construction; arranged to provide visual inspection and cleaning of tubes from either end without disturbing refrigerant in shell.
 - b. Standard **OR** Marine, **as directed**, type for water box with piping connections.
 - 1) Water boxes and marine water-box covers, **as directed**, shall have lifting lugs or eyebolts.
 - 2) Hinged **OR** davited, **as directed**, water boxes.
OR
Hinged **OR** davited, **as directed**, marine water-box covers.

OR
Standard type for water box without piping connections.

 - 1) Water boxes shall have lifting lugs or eyebolts.
 - 2) Hinged **OR** davited, **as directed**, water boxes.
OR
Hinged **OR** davited, **as directed**, marine water-box covers.
 - c. Nozzle Pipe Connections: Welded, ASME B16.5, flat-face flange **OR** Welded, ASME B16.5, raised-face flange **OR** Grooved for mechanical-joint coupling **OR** Grooved with mechanical-joint coupling and flange adapter, **as directed**.
 - d. Thermistor or RTD temperature sensor factory installed in each nozzle.
 - e. Fit each water box with 3/4-inch (19-mm) **OR** 1-inch (25-mm), **as directed**, drain connection at low point and vent connection at high point, each with threaded plug.
4. Additional Corrosion Protection:
 - a. Electrolytic corrosion-inhibitor anode.
 - b. Coat wetted surfaces with a corrosion-resistant finish.
OR
Using same material as tubes, clad surfaces of end tube sheets in contact with fluid. Coat other wetted surfaces, including water boxes, with a corrosion-resistant finish.



G. Generator For Single-Effect Chillers

1. Tubes:
 - a. Individually replaceable, straight tubes expanded into tube sheets. Replaceable from either end and without damage to tube sheets and other tubes.
 - b. Material: 90/10 copper-nickel alloy **OR** Stainless steel **OR** Titanium, as directed.
 - c. Minimum Wall Thickness: Manufacturer's choice **OR** 0.035 inch (0.9 mm), **as directed**.
 - d. External Finish: Manufacturer's standard.
 - e. Internal Finish: Smooth **OR** Enhanced, **as directed**
2. Water Boxes:
 - a. Carbon-steel construction; arranged to provide visual inspection and cleaning of tubes from either end without disturbing refrigerant in shell.
 - b. Standard type water box.
 - c. Water boxes shall have lifting lugs or eyebolts.
 - d. Nozzle Pipe Connections: Welded, ASME B16.5, flat-face flange **OR** Welded, ASME B16.5, raised-face flange **OR** Grooved for mechanical-joint coupling **OR** Grooved with mechanical-joint coupling and flange adapter, **as directed**.
 - e. Thermistor or RTD temperature sensor factory installed in each nozzle.
 - f. Fit each water box with 3/4-inch (19-mm) **OR** 1-inch (25-mm), **as directed**, drain connection at low point and vent connection at high point, each with threaded plug.
3. Additional Corrosion Protection:
 - a. Electrolytic corrosion-inhibitor anode.
 - b. Coat wetted surfaces with a corrosion-resistant finish.
OR
Using same material as tubes, clad surfaces of end tube sheets in contact with fluid. Coat other wetted surfaces, including water boxes, with a corrosion-resistant finish.

H. First-Stage Generator For Double-Effect Chillers

1. Tubes:
 - a. Replaceable, straight, or U tubes expanded into tube sheets.
 - b. Material: Manufacturer's standard **OR** 70/30 copper-nickel alloy **OR** Type 409 stainless steel **OR** Titanium, **as directed**.
 - c. Minimum Wall Thickness: Manufacturer's choice **OR** 0.028 inch (0.7 mm) **OR** 0.035 inch (0.9 mm), **as directed**.
 - d. External Finish: Manufacturer's standard.
 - e. Internal Finish: Smooth **OR** Enhanced, **as directed**.
2. Water Boxes:
 - a. Carbon-steel construction; arranged to provide visual inspection and cleaning of tubes from either end without disturbing refrigerant in shell.
 - b. Standard type water box.
 - c. Water boxes shall have lifting lugs or eyebolts.
 - d. Nozzle Pipe Connections: Welded, ASME B16.5, flat-face flange **OR** Welded, ASME B16.5, raised-face flange **OR** Grooved for mechanical-joint coupling **OR** Grooved with mechanical-joint coupling and flange adapter, **as directed**.
 - e. Thermistor or RTD temperature sensor factory installed in each nozzle.
 - f. Fit each water box with 3/4-inch (19-mm) **OR** 1-inch (25-mm), **as directed**, drain connection at low point and vent connection at high point, each with threaded plug.
3. Additional Corrosion Protection:
 - a. Electrolytic corrosion-inhibitor anode.
 - b. Coat wetted surfaces with a corrosion-resistant finish.
OR
Using same material as tubes, clad surfaces of end tube sheets in contact with fluid. Coat other wetted surfaces, including water boxes, with a corrosion-resistant finish.

I. Second-Stage Generator For Double-Effect Chillers

1. Tubes:



- a. Individually replaceable, straight tubes expanded into tube sheets. Replaceable from either end and without damage to tube sheets and other tubes.
 - b. Material: Copper **OR** Copper-nickel alloy **OR** Stainless steel **OR** Titanium, **as directed**.
 - c. Minimum Wall Thickness: Manufacturer's choice **OR** 0.025 inch (0.6 mm) **OR** 0.028 inch (0.7 mm) **OR** 0.035 inch (0.9 mm), **as directed**.
 - d. External Finish: Manufacturer's standard.
 - e. Internal Finish: Smooth **OR** Enhanced, **as directed**.
2. Water Boxes:
- a. Carbon-steel construction; arranged to provide visual inspection and cleaning of tubes from either end without disturbing refrigerant in shell.
 - b. Standard type water box.
 - c. Water boxes shall have lifting lugs or eyebolts.
 - d. Nozzle Pipe Connections: Welded, ASME B16.5, flat-face flange **OR** Welded, ASME B16.5, raised-face flange **OR** Grooved for mechanical-joint coupling **OR** Grooved with mechanical-joint coupling and flange adapter, **as directed**.
 - e. Thermistor or RTD temperature sensor factory installed in each nozzle.
 - f. Fit each water box with 3/4-inch (19-mm) **OR** 1-inch (25-mm), **as directed**, drain connection at low point and vent connection at high point, each with threaded plug.
3. Additional Corrosion Protection:
- a. Electrolytic corrosion-inhibitor anode.
 - b. Coat wetted surfaces with a corrosion-resistant finish.
OR
Using same material as tubes, clad surfaces of end tube sheets in contact with fluid. Coat other wetted surfaces, including water boxes, with a corrosion-resistant finish.
- J. Solution Heat Exchanger
1. Description: Shell-and-tube or brazed-plate heat exchanger; integral part of chiller to increase cycle efficiency by preheating the weak solution on its way to the generator while precooling the strong solution returning from the generator.
- K. Steam Condensate Drain Cooler
1. Description: Shell-and-tube heat exchanger constructed of carbon-steel shell and copper-nickel-alloy or stainless-steel tubes.
- L. Factory-Applied Insulation
1. Factory-Applied Insulation on Cold Surfaces:
 - a. Closed-cell, flexible elastomeric thermal insulation complying with ASTM C 534, Type I for tube and Type II for sheet materials.
 - 1) Thickness: 3/4 inch (19 mm) **OR** 1-1/2 inches (38 mm), **as directed**.
 - b. Adhesive: As recommended by insulation manufacturer.
 - c. Factory apply insulation over all cold surfaces of chiller capable of forming condensation. Components shall include, but not be limited to, evaporator shell and end tube sheets; evaporator water boxes including nozzles; refrigerant pump; cold surfaces of motor; and cold piping.
 - 1) Apply adhesive to 100 percent of insulation contact surface.
 - 2) Before insulating steel surfaces, prepare surfaces for paint, and prime and paint as indicated for other painted components. Do not insulate unpainted steel surfaces.
 - 3) Seal seams and joints to provide a vapor barrier.
 - 4) After adhesive has fully cured, paint exposed surfaces of insulation to match other painted parts.
 2. Factory-Applied Insulation on Hot Surfaces:
 - a. Mineral-fiber board, pipe or tank insulation complying with one of following:
 - 1) ASTM C 547, Type I or Type II, Grade A.
 - 2) ASTM C 612, Type IB.
 - 3) ASTM C 1393, Type II or Type IIIA, Category 2.
 - 4) Thickness: 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**.



- b. Adhesive: As recommended by insulation manufacturer.
- c. Factory apply materials over all hot surfaces to provide smooth, straight, and even surfaces; free of voids.
 - 1) Apply adhesive to insulation contact surface as recommended by insulation manufacturer.
 - 2) Install insulation anchor pins and washers if required by insulation manufacturer to secure insulation to surfaces to be insulated.
 - 3) Completely encapsulate insulation with metal jacket, leaving no exposed insulation. Provide removable jacket on components requiring access for service and inspection.
 - 4) Paint exposed surfaces of metal jacket to match other painted parts unless jacket material is aluminum or stainless steel.

M. Electrical

- 1. Factory installed and wired, and functionally tested at factory before shipment.
- 2. Single-point, field-power connection to fused disconnect switch **OR** nonfused disconnect switch **OR** circuit breaker, **as directed**. Minimum withstand rating shall be as required by electrical power distribution system, but not less than 42,000 **OR** 65,000, **as directed**, A.
 - a. Branch power circuit to each motor, dedicated electrical load, and controls with disconnect switch or circuit breaker, **as directed**.
 - 1) NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 60947-4-1.
 - 2) NEMA AB 1, motor-circuit protector (circuit breaker) with field-adjustable, short-circuit-trip set point.
 - b. NEMA ICS 2, Class A, full-voltage, nonreversing motor controller, hand-off-auto switch, and overcurrent protection for each motor.
 - c. Control-circuit transformer with primary and secondary side fuses.
- 3. Terminal blocks with numbered and color-coded, **as directed**, wiring to match wiring diagram. Spare wiring terminal block for connection to external controls or equipment.
- 4. Wiring Outside of Enclosures: Factory installed in metal raceway except make terminal connections with not more than a 24-inch (610-mm) length of liquidtight **OR** flexible metallic, **as directed**, conduit.

N. Controls

- 1. Control: Standalone and microprocessor based, with all memory stored in nonvolatile memory so that reprogramming is not required on loss of electrical power.
- 2. Enclosure: Unit mounted, NEMA 250, Type 1 **OR** Type 4 **OR** Type 4x, **as directed**, hinged or lockable.
- 3. Operator Interface: Multiple-character digital or graphic display with dynamic update of information and with keypad or touch-sensitive display located on front of control enclosure. In either imperial or metric units selectable through the interface, display the following information:
 - a. Date and time.
 - b. Operating or alarm status.
 - c. Operating hours.
 - d. Outdoor-air temperature if required for chilled-water reset.
 - e. Temperature and pressure of operating set points.
 - f. Entering and leaving temperatures of chilled and condenser water.
 - g. Refrigerant temperature.
 - h. Solution concentration and temperature.
 - i. Indication of solution and purge-pump operation.
 - j. Generator shell pressure.
 - k. Number of starts.
 - l. Number of purge cycles.
 - m. Hot-water valve actuator potentiometer position (percentage).
 - n. Entering and leaving hot-water temperatures.



- o. Steam demand limit.
- p. Inlet steam pressure and temperature.
- q. Steam valve actuator potentiometer position (percentage).
- r. First-stage generator pressure and temperature.
- 4. Control Functions:
 - a. Manual or automatic startup and shutdown time schedule.
 - b. Automatic cycle to prevent crystallization.
 - c. Entering and leaving chilled-water temperatures and control set points. Chilled-water temperature shall be reset based on return-water **OR** outdoor-air **OR** space, **as directed**, temperature.
 - d. Condenser-fluid temperature.
 - e. Cooling provided and heating energy used within programmable time periods, minimum monthly.
- 5. Capacity Control: Automatically controls input flow rate of heat source to maintain chilled-water temperature set point for cooling loads ranging from 10 to 100 percent.
- 6. Control Valve Package: Factory-furnished, for field installation, **OR** Factory-installed, **as directed**, control valve package suitable for energy source indicated.
 - a. Body: Cast-iron, carbon-steel, or stainless-steel body with flanged connections.
 - b. Type: Manufacturer's choice **OR** V-notch ball **OR** Butterfly **OR** Globe style with cage-guide plug, **as directed**, constructed of stainless steel.
 - c. Rating: Pressure and temperature rating to match heat exchanger.
 - d. Shutoff: Capable of bubble-tight shutoff against maximum system pressure.
 - e. Size: Determined by chiller manufacturer.
 - f. Modulation: Two-way **OR** Three-way, **as directed**.
 - g. Turndown: As required to achieve stable control through the indicated operating range.
 - h. Actuator: Electric powered from chiller control panel and installed on valve.
- 7. Safety Shutdowns:
 - a. Crystallization.
 - b. Low refrigerant temperature.
 - c. Loss of chilled- or condenser-water flow.
 - d. Low leaving chilled-water temperature, 2 deg F (1 deg C) below set point, **as directed**.
 - e. First-stage generator low-solution level.
 - f. First-stage generator high temperature or pressure.
 - g. Power failure.
 - h. Solution pump overloads.
 - i. External auxiliary safety shutdown.
 - j. High solution concentration.
 - k. Incomplete dilution cycle.
 - l. High entering-water temperature.
 - m. High inlet steam pressure and temperature.
- 8. Warning Conditions: Control panel shall close warning contacts and generate a message when one of the following operating conditions is detected:
 - a. Low refrigerant temperature.
 - b. High generator temperature or pressure.
 - c. High entering generator-water temperature (single-stage generator only).
 - d. High or low entering condenser-water temperature.
 - e. Solution temperature sensor failure.
 - f. Low chilled-water flow.
- 9. Trending: Capability to trend analog data of up to five parameters simultaneously over an adjustable period and frequency of polling.
- 10. Security Access: Provide electronic security access to controls through identification and password with at least three levels of access: view only; view and operate; and view, operate, and service.
- 11. Control Authority: At least four conditions: Off, local manual control at chiller, local automatic control at chiller, and automatic control through a remote source.



12. Communication Port: RS-232 port, USB 2.0 port, or equivalent connection capable of connecting a printer and a notebook computer, **as directed**.
13. BAS Interface: Factory-installed hardware and software to enable the BAS to monitor, control, and display chiller status and alarms.
 - a. Hardwired Points:
 - 1) Monitoring: On-off status, common trouble alarm.
 - 2) Control: On-off operation, chilled-water, discharge temperature set-point adjustment **OR** generator heat source capacity limiting, **as directed**.
 - b. ASHRAE 135 (BACnet) **OR** LonTalk **OR** Modbus **OR** Industry-accepted, open-protocol, **as directed**, communication interface with the BAS shall enable the BAS operator to remotely control and monitor the chiller from an operator workstation. Control features and monitoring points displayed locally at chiller control panel shall be available through the BAS.

O. Finish

1. Paint chiller, using manufacturer's standard procedures, except comply with the following minimum requirements:
 - a. Provide at least one coat of primer with a total dry film thickness of at least 2 mils (0.05 mm).
 - b. Provide at least two coats of alkyd-modified, vinyl enamel **OR** epoxy **OR** polyurethane, **as directed**, finish with a total dry film thickness of at least 4 mils (0.10 mm).
 - c. Paint surfaces that are to be insulated before applying the insulation.
 - d. Paint installed insulation to match adjacent uninsulated surfaces.
 - e. Color of finish coat to be manufacturer's standard **OR** custom color selected by the Owner.
2. Provide the Owner with quart container of paint used in application of topcoat to use in touchup applications after Project Closeout.

P. Accessories

1. Sight Glasses: Equip unit with sight glasses for visual inspection of absorbent solution and refrigerant levels. Provide at least one sight glass in absorber and evaporator sections.
2. Flow Switches:
 - a. Chiller manufacturer shall furnish a switch for each condenser **OR** evaporator and condenser, **as directed**, and verify field-mounting location before installation.
 - b. Paddle Flow Switches:
 - 1) Vane operated to actuate a double-pole, double-throw switch with one pole field wired to the chiller control panel and the other pole field wired to the BAS.
 - 2) Contacts: Platinum alloy, silver alloy, or gold-plated switch contacts with a rating of 10 A at 120-V ac.
 - 3) Pressure rating equal to pressure rating of heat exchanger.
 - 4) Construct body and wetted parts of Type 316 stainless steel.
 - 5) House switch in a NEMA 250, Type 4 enclosure constructed of die-cast aluminum.
 - 6) Vane length to suit installation.

OR

Pressure Differential Switches:

 - 1) Construction: Wetted parts of body and trim constructed of Type 316 stainless steel.
 - 2) Performance: Switch shall withstand, without damage, the full-pressure rating of the heat exchanger applied to either port and exhibit zero set-point shift due to variation in working pressure.
 - 3) Set Point: Screw type, field adjustable.
 - 4) Electrical Connections: Internally mounted screw-type terminal blocks.
 - 5) Switch Enclosure: NEMA 250, Type 4.
 - 6) Switch Action: Double-pole, double-throw switch with one pole field wired to the chiller control panel and the other pole field wired to the BAS.
3. Vibration Isolation:
 - a. Chiller manufacturer shall furnish neoprene-pad vibration isolation for each chiller.



- 1) Two layers of 0.375-inch- (10-mm-) thick, ribbed- or waffle-pattern neoprene pads separated by a 16-gage, stainless-steel plate.
 - 2) Fabricate pads from 40- to 50-durometer neoprene.
 - 3) Provide stainless-steel square bearing plate to load the pad uniformly between 20 and 40 psig (138 and 276 kPa) with a 0.12- to 0.16-inch (3- to 4-mm) deflection.
4. Lithium Bromide Filter, **as directed**:
- a. Factory install a filter, isolation valves, and associated piping.
 - b. Filter shall consist of a stainless-steel body, with removable and cleanable 150-micron, stainless-steel element.
 - c. Isolation valves shall provide isolation for filter servicing without disturbing operation of chiller.
- Q. Heat-Exchanger, Brush-Cleaning System
1. Furnish for field installation a brush-cleaning system on each chiller condenser, **as directed**, for tube cleaning and improved heat transfer.
 2. System shall maintain tube fouling at or below design conditions without interrupting normal equipment operation.
 3. System shall consist of a brush inserted in each tube and a catch basket attached to each end of the tube. A four-way valve shall operate to reverse the direction of water flow to push the brush through the tube while removing tube deposits. Four-way reversing valve's actuator shall be controlled by a preset time cycle that provides regular tube brushing during equipment operation. Frequency of the brushing cycle shall be set up to match Project requirements.
 4. Components:
 - a. Brush: Each brush shall have nylon bristles, titanium wires, and polypropylene tips. Brush interference fit with the ID of the tube shall not exceed 0.025 inch (0.6 mm).
 - b. Basket: Single-piece polypropylene basket with neck OD to press fit inner diameter of tube. Design shall provide for insertion of eddy current probe or removal of brushes without removing baskets from the valve.
 - c. Four-Way Valve:
 - 1) Construct valve body of carbon steel with internal sealing parts of hard rubber and Type 304 stainless steel.
 - 2) Configure valve with parallel flow connections to minimize field installation piping.
 - 3) Construct to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, at a system working pressure equal to condenser.
 - 4) Pipe connections shall be flanged.
 - 5) Valve manufacturer to test and certify a maximum leakage rate of less than 0.05 percent of the design flow rate at operation conditions of maximum differential pressure.
 - 6) Hydrostatically test to 1.5 times the design working pressure.
 - 7) Design the valve to cause no more than 0.5-psig (3-kPa) pressure drop at design flow conditions.
 - 8) Provide valve with valve-mounted indicating/warning light, which shall light before the valve begins rotation.
 - 9) Valve Actuator: Mount electric actuator to operate valve.
OR
Valve Actuator: Mount pneumatic piston-type actuator to operate valve. Actuator shall be suitable for operation using field-supplied air pressure.
 - 10) Position Switches: Factory mount microswitches on the valve to indicate the complete turn of valve in both normal and reverse flow.
 - d. Control Panel: Factory or field mount a control panel on chiller. Control panel shall include the following features:
 - 1) NEMA 250, Type 1 **OR** Type 4 **OR** Type 4x **OR** Type 12, **as directed**, enclosure.
 - 2) Timer to automatically initiate the cleaning cycle over a 24-hour period.
 - 3) Manual override of preset cleaning cycle.
 - 4) Visual indication of "Power On," "Diverter Position," "Normal Flow," "Reverse Flow," and "Valve Malfunction" indicating a slow turn or incomplete valve turn.



- 5) For pneumatic actuators, mount four-way solenoid valve for actuator operation in the control panel.
- 6) Flow-switch bypass.
- 7) Unloading signal to chiller.

R. Source Quality Control

1. Perform functional tests **OR** run tests, **as directed**, of chillers before shipping.
2. Factory test and inspect absorber, generator, evaporator and condenser according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1. Pressure test tube-side of heat exchangers, including water boxes, to 1.5 times the rated pressure. Vacuum and pressure test shells for leaks.
3. Rate sound power level according to ARI 575.
4. Factory performance test chillers, before shipping, according to ARI 560, **as directed**.
 - a. Test the following conditions:
 - 1) Design conditions indicated.
 - 2) Reduction in capacity from design to minimum load in steps of 10 **OR** 25 **OR** 33, **as directed**, with condenser fluid at design conditions.
OR
Reduction in capacity from design to minimum load in steps of 10 **OR** 25 **OR** 33, **as directed**, with varying entering condenser-fluid temperature from design to minimum conditions in 5 deg F (3 deg C) increments.
OR
At one **OR** two **OR** three **OR** four **OR** five **OR** 10, **as directed**, point(s) of varying part-load performance to be selected by the Owner at time of test.
5. Factory sound test chillers, before shipping, according to ARI 575, **as directed**.
 - a. Test the following conditions:
 - 1) Design conditions indicated.
 - 2) Chiller operating at calculated worst-case sound condition.
 - 3) At one **OR** two **OR** three **OR** four **OR** five, **as directed**, point(s) of varying part-load performance to be selected by the Owner at time of test.
6. Allow the Owner access to place where chillers are being tested. Notify the Owner 14 days in advance of testing.
7. Prepare test report indicating test procedures, instrumentation, test conditions, and results. Submit copy of results within one week of test date.

1.3 EXECUTION

A. Chiller Installation

1. Install chillers on support structure indicated.
2. Equipment Mounting: Install chiller on concrete bases using elastomeric pads. Comply with requirements for concrete bases specified in Division 03 Section "Cast-in-place Concrete". Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 - a. Minimum Deflection: 1/4 inch (6 mm) **OR** 1/2 inch (13 mm), **as directed**.
 - b. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - c. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - d. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - e. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Equipment Mounting: Install chiller using elastomeric pads. Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".



- a. Minimum Deflection: 1/4 inch (6 mm) **OR** 1/2 inch (13 mm), **as directed**.
 4. Equipment Mounting: Install chiller on concrete bases. Comply with requirements for concrete bases specified in Division 03 Section "Cast-in-place Concrete".
 - a. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - b. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - d. Install anchor bolts to elevations required for proper attachment to supported equipment.
 5. Install chillers with seismic-restraint device. Comply with requirements for seismic-restraint devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 6. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 7. Maintain manufacturer's recommended clearances for service and maintenance.
 8. Charge chiller with absorbent and refrigerant if not factory charged.
 9. Install separate devices furnished by manufacturer and not factory installed.
 10. Insulate hot and cold chiller surfaces that are recommended by chiller manufacturer to be insulated, and are not factory insulated. Comply with requirements in Division 23 Section "Hvac Insulation".
- B. Heat-Exchanger, Brush-Cleaning System Installation
1. Install brush-cleaning system control panel adjacent to chiller control panel.
 2. Arrange piping to provide service access to four-way valve assembly without affecting access to chiller. Secure valve to prevent lateral movement and vibration during operation.
 3. Provide field electric power, as required, to each system control panel and electric actuated valve.
 4. Provide pneumatic piping with pressure regulator and isolation valve to each pneumatic supply connection. Coordinate field source of air with manufacturer to ensure that requirements are satisfied for proper valve operation.
 5. Interconnect brush-cleaning system controls with chiller controls. Coordinate requirements to ensure safe, trouble-free operation.
 6. Functionally test the entire brush-cleaning system, including the valve, actuator, position indicator, and control panel, with chiller in operation.
- C. Connections
1. Comply with requirements in Division 23 Section "Hydronic Piping" for hydronic piping. Drawings indicate general arrangement of piping, fittings, and specialties.
 2. Comply with requirements in Division 23 Section "Steam And Condensate Heating Piping" for steam and condensate piping. Drawings indicate general arrangement of piping, fittings, and specialties.
 3. Install piping adjacent to chiller to allow service and maintenance.
 4. Generator Steam Piping Connections:
 - a. Connect steam piping with trapped drip leg, gate valve, strainer, control valve, and pressure gage. Install pressure reducing valve and safety relief valve upstream from steam-control valve to protect control valve from excessive steam pressure. Make connections to chiller with a flange **OR** union, **as directed**.
 - b. Connect steam condensate piping with vacuum breaker, trapped drip leg, gate valve, strainer, float and thermostatic trap(s), condensate cooler, **as directed**, condensate receiver, **as directed**, condensate receiver and pump, **as directed**, and check valve. Make connections to chiller with a flange **OR** union, **as directed**.
 5. Generator Hot-Water Connections: Connect to generator inlet with shutoff valve, strainer, **as directed**, flexible connector, **as directed**, control valve, thermometer, and plugged tee with shutoff valve and pressure gage. Connect to generator outlet with shutoff valve, check valve, balancing valve, flexible connector, **as directed**, flow switch, thermometer, plugged tee with



shutoff valve and pressure gage, flow meter, **as directed**, and drain connection with valve. Make connections to chiller with a flange **OR** mechanical coupling, **as directed**.

6. Evaporator-Fluid Connections: Connect to evaporator inlet with shutoff valve, strainer, **as directed**, flexible connector, **as directed**, thermometer, and plugged tee with shutoff valve and pressure gage. Connect to evaporator outlet with shutoff valve, balancing valve, flexible connector, **as directed**, flow switch, thermometer, plugged tee with shutoff valve and pressure gage, flow meter, **as directed**, and drain connection with valve. Make connections to chiller with a flange **OR** mechanical coupling, **as directed**.
7. Absorber/Condenser-Fluid Connections: Connect to inlet with shutoff valve, strainer, **as directed**, flexible connector, **as directed**, thermometer, and plugged tee with shutoff valve and pressure gage. Connect to outlet with shutoff valve, balancing valve, flexible connector, **as directed**, flow switch, thermometer, plugged tee with shutoff valve and pressure gage, flow meter, **as directed**, and drain connection with valve. Make connections to chiller with a flange **OR** mechanical coupling, **as directed**.
 - a. If not factory furnished or installed, provide pipe connecting fluid connection of absorber discharge and condenser inlet.
8. Refrigerant Pressure Relief Device Connections: Extend vent piping **OR** separate vent piping for each chiller, **as directed**, to the outdoors without valves or restrictions. Comply with ASHRAE 15. Connect to chiller pressure relief device with flexible connector and dirt leg with drain valve.
9. Extend purge vent piping **OR** separate purge vent piping for each chiller, **as directed**, to the outdoors. Comply with ASHRAE 15.
10. Connect each chiller drain connection with a union and drain pipe, and extend pipe, full size of connection, to floor drain. Provide a shutoff valve at each connection.

D. Startup Service

1. Engage a factory-authorized service representative to perform startup service.
 - a. Complete installation and startup checks according to manufacturer's written instructions.
 - b. Operate chiller for run-in period.
 - c. Verify that absorbent and refrigerant charge is sufficient and chiller has been leak tested.
 - d. Verify that pumps are installed and functional.
 - e. Verify that thermometers and gages are installed.
 - f. Operate chiller for run-in period.
 - g. Verify that refrigerant pressure relief device is vented outside.
 - h. Verify proper motor rotation.
 - i. Verify static deflection of vibration isolators including deflection during chiller startup and shutdown.
 - j. Verify and record performance of fluid flow and low-temperature interlocks for evaporator and condenser.
 - k. Verify and record performance of chiller protection devices.
 - l. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.
2. Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assembly, installation, and connection.
3. Prepare test and inspection startup reports.

E. Demonstration

1. Engage a factory-authorized service representative to train the Owner's maintenance personnel to adjust, operate, and maintain chillers.

END OF SECTION 23 64 13 16



SECTION 23 64 13 16a - DIRECT-FIRED ABSORPTION WATER CHILLERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for direct-fired absorption water chillers. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Packaged, water-cooled, direct-fired absorption chillers.
 - b. Heat-exchanger, brush-cleaning system.

C. Definitions

1. BAS: Building automation system.
2. COP: Coefficient of performance. The ratio of the rate of heat removal to the rate of energy input using consistent units for any given set of rating conditions.
3. IPLV: Integrated part-load value. A single-number, part-load efficiency figure of merit calculated per the method defined by ARI 560 and referenced to ARI standard rating conditions.
4. NPLV: Nonstandard part-load value. A single-number, part-load efficiency figure of merit calculated per the method defined by ARI 560 and intended for operating conditions other than the ARI standard rating conditions.

D. Performance Requirements

1. Seismic Performance: Direct-fired absorption chillers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
2. Condenser-Fluid Temperature Performance:
 - a. Startup Condenser-Fluid Temperature: Chiller shall be capable of starting with an entering condenser-fluid temperature of 60 deg F (16 deg C) and providing stable operation until the system temperature is elevated to the minimum operating entering condenser-fluid temperature.
 - b. Minimum Operating Condenser-Fluid Temperature: Chiller shall be capable of continuous operation over the entire capacity range indicated with an entering condenser-fluid temperature of 70 deg F (21 deg C).
 - c. Make factory modifications to standard chiller design if necessary to comply with performance indicated.
3. Site Altitude: Chiller shall be suitable for altitude at which it is installed without affecting performance indicated. Make adjustments to affected chiller components to account for site altitude.
4. Performance Tolerance: Comply with the following in lieu of ARI 560:
 - a. Allowable Capacity Tolerance: Zero percent.
 - b. Allowable IPLV/NPLV Performance Tolerance: Zero percent.

E. Submittals

1. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, furnished specialties and accessories, and the following:
 - a. Performance at ARI standard conditions and at conditions indicated.
 - b. Performance at ARI standard unloading conditions.
 - c. Minimum evaporator flow rate.



- d. Absorbent capacity of chiller.
- e. Refrigerant capacity of chiller.
- f. Fluid capacity of evaporator and condenser.
- g. Fluid capacity of generator.
- h. Characteristics of safety relief devices.
- i. Minimum entering condenser-fluid temperature.
- j. Performance at varying capacities with constant design condenser-fluid temperature. Repeat performance at varying capacities for different condenser-fluid temperatures from design to minimum in 5 deg F (3 deg C) increments.
- k. If equipped, fluid capacity of dedicated hot-water heater exchanger.
- l. Combustion-air flow.
- m. Exhaust gas airflow.
- n. Exhaust gas minimum and maximum operating temperature.
2. LEED Submittals:
 - a. Product Data for Prerequisite EA 2: Documentation indicating that units comply with applicable requirements in ASHRAE/IESNA 90.1.
 - b. Product Data for Prerequisite EA 3: Documentation indicating that refrigerants comply.
 - c. Product Data for Credit EA 4: Documentation indicating that equipment and refrigerants comply.
3. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - a. Detail equipment assemblies and indicate dimensions, weights, load distribution, required clearances, method of field assembly, components, and location and size of each field connection.
 - b. Wiring Diagrams: For power, signal, and control wiring.
 - c. Insulated Surface Diagrams: Indicating cold and hot surfaces requiring field-applied insulation with area tabulated for each.
4. Coordination Drawings: Floor plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - a. Structural supports.
 - b. Piping roughing-in requirements.
 - c. Wiring roughing-in requirements, including spaces reserved for electrical equipment.
 - d. Access requirements, including working clearances for mechanical controls and electrical equipment, and clearances for tube pull and service.
5. Certificates: For certification required in "Quality Assurance" Article.
6. Seismic Qualification Certificates: For chillers, accessories, and components, from manufacturer.
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
7. Source quality-control reports.
8. Startup service reports.
9. Operation and Maintenance Data: For each chiller to include in emergency, operation, and maintenance manuals.
10. Warranty: Sample of special warranty.

F. Quality Assurance

1. ARI Rating: Rate chiller performance according to requirements in ARI 560.
2. ASHRAE Compliance:
 - a. ASHRAE 15 for safety code for mechanical refrigeration.
 - b. ASHRAE/IESNA 90.1.
3. ASME Compliance: Fabricate and label chiller pressure vessels to comply with applicable portions of ASME Boiler and Pressure Vessel Code.
4. Comply with NFPA 70.



5. Comply with requirements of UL and UL Canada, and include label by a qualified testing agency showing compliance.
 - a. UL Compliance: UL 726, "Oil-Fired Boiler Assemblies" **OR** UL 726, "Oil-Fired Boiler Assemblies"; and UL 795, "Commercial-Industrial Gas Heating Equipment" **OR** UL 795, "Commercial-Industrial Gas Heating Equipment", **as directed**.

G. Delivery, Storage, And Handling

1. Ship chillers factory charged with nitrogen.
2. Ship absorbent and refrigerant in chillers or in containers separate from chillers.
OR
Ship absorbent and refrigerant in containers separate from chillers.
3. Package chiller for export shipping in totally enclosed bagging **OR** crate **OR** crate with bagging, **as directed**.

H. Coordination

1. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases.
2. Coordinate sizes, locations, and anchoring attachments of structural-steel support structures.

I. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of chillers that fail in materials or workmanship within specified warranty period.
 - a. Extended warranties include, but are not limited to, the following:
 - 1) Complete chiller.
OR
Pumps and motors **OR** Purge unit **OR** Burner assembly, **as directed**.
OR
Absorbent **OR** Absorbent and refrigerant, **as directed**, only.
 - 2) Parts only **OR** only and labor, **as directed**.
 - 3) Loss of absorbent and refrigerant for any reason.
 - b. Warranty Period: Two **OR** Three **OR** Four **OR** Five, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Manufactured Unit

1. Description: Factory-assembled and -tested, hermetic-design chiller complete with absorber, evaporator, condenser, generator, solution heat exchanger, controls, absorbent solution pump with motor, refrigerant pump with motor, purge unit with motor, burner assembly, motor controllers, rupture disk, interconnecting unit piping and wiring, indicated accessories, and mounting frame.
 - a. Disassemble chiller into major assemblies, as required by the installation, after factory testing and before packaging for shipment.
2. Absorbent and Refrigerant:
 - a. Absorbent: Lithium bromide solution with corrosion inhibitor.
 - b. Refrigerant: Deionized or distilled, **as directed**, water.
 - c. Performance Enhancer: Heat and mass transfer enhancer to improve performance.
3. Seismic Fabrication Requirements: Fabricate mounting base and attachment to chiller, accessories, and components with reinforcement strong enough to withstand seismic forces defined in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment" when mounting base is anchored to building structure.

B. Pumps



1. Hermetically sealed, self-lubricating, and fitted with self-adjusting, spring-loaded, wear-compensating, tapered carbon bearings.
2. Pump motor assembly shall be designed to operate for not less than 50,000 hours between inspections.
3. Pump motors shall be cooled and bearings lubricated, either by fluid being pumped or by a filtered supply of liquid refrigerant.
4. Pump suction and discharge shall be equipped with isolation valves.
5. Absorbent solution and refrigerant shall have separate and dedicated pumps.
 - a. Absorbent solution and refrigerant flow-control method shall be manufacturer's choice to comply with operating requirements indicated.
6. Purge System: Unit mounted and factory wired, equipped with controls and a pump to automatically remove noncondensable vapors.
 - a. Purge Pump Motor: Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - 1) Enclosure: Open dripproof **OR** Totally enclosed, **as directed**.

C. Heat-Exchanger Shells

1. Configuration: Two shells; one shell consists of the absorber/evaporator, low-stage generator/condenser and the other shell consists of the high-stage generator. Where indicated, equip chiller with a dedicated hot-water heat exchanger.
2. Construction: Fabricated from continuously welded carbon-steel sheet or plate, or from seamless pipe.
3. Design Pressure and Temperature Rating: Comply with applicable requirements in ASME Boiler and Pressure Vessel Code.
4. End Tube Sheets: Carbon-steel plates continuously welded to each end of shell; drilled and reamed to accommodate tubes, with positive seal between fluid in tubes and refrigerant in shell.
5. Intermediate Tube Sheets: Carbon-steel plates installed in shell and spaced along length of tube at intervals required to eliminate vibration and to avoid tube contact resulting in abrasion and wear.
6. Generator/Condenser Shell Pressure Relief Device: Manufacturer's standard rupture disk complying with requirements in ASHRAE 15 and in applicable portions of ASME Boiler and Pressure Vessel Code.

D. Absorber

1. Nozzle or Dispersion Trays: Designed to evenly distribute absorbent solution over tubes; constructed of brass, stainless steel, or another material that will not corrode.
2. Tubes:
 - a. Individually replaceable, straight tubes expanded into tube sheets. Replaceable from either end without damage to tube sheets and other tubes.
 - b. Material: Copper **OR** Copper-nickel alloy, **as directed**.
 - c. Minimum Wall Thickness: Manufacturer's choice **OR** 0.025 inch (0.6 mm) **OR** 0.028 inch (0.7 mm) **OR** 0.035 inch (0.9 mm), **as directed**.
 - d. External Finish: Manufacturer's standard.
 - e. Internal Finish: Enhanced **OR** Smooth, **as directed**.
3. Water Boxes:
 - a. Carbon-steel construction; arranged to provide visual inspection and cleaning of tubes from either end without disturbing refrigerant in shell.
 - b. Standard **OR** Marine-type, **as directed**, water box with piping connections.
 - 1) Water boxes and marine-type water-box covers, **as directed**, shall have lifting lugs or eyebolts.
 - 2) Hinged **OR** Davited, **as directed**, water boxes.
OR
Hinged **OR** Davited, **as directed**, marine-type water-box covers.
 - c. Standard water box without piping connections.



- 1) Water boxes shall have lifting lugs or eyebolts.
 - 2) Hinged **OR** Davited, **as directed**, water boxes.
 - d. Nozzle Pipe Connections: Welded, ASME B16.5, flat-face flange **OR** Welded, ASME B16.5, raised-face flange **OR** Grooved for mechanical-joint coupling **OR** Grooved with mechanical-joint coupling and flange adapter, **as directed**.
 - e. Thermistor or RTD temperature sensor factory installed in each nozzle.
 - f. Fit each water box with 3/4-inch (19-mm) **OR** 1-inch (25-mm), **as directed**, drain connection at low point and vent connection at high point, each with threaded plug.
 4. Additional Corrosion Protection:
 - a. Electrolytic corrosion-inhibitor anode.
 - b. Coat wetted surfaces with a corrosion-resistant finish.
OR
Using same material as tubes, clad surfaces of end tube sheets in contact with fluid. Coat other wetted surfaces, including water boxes, with a corrosion-resistant finish.
 5. Absorber/Condenser Crossover Piping: Factory-furnished and -installed piping connecting fluid connection of absorber discharge to condenser inlet.
- E. Evaporator
1. Nozzle or Dispersion Trays: Designed to evenly distribute refrigerant over tubes; constructed of brass, stainless steel, or another material that will not corrode.
 2. Refrigerant Holding Pan: Steel or stainless steel.
 3. Tubes:
 - a. Individually replaceable, straight tubes expanded into tube sheets. Replaceable from either end without damage to tube sheets and other tubes.
 - b. Material: Copper **OR** Copper-nickel alloy, **as directed**.
 - c. Minimum Wall Thickness: Manufacturer's choice **OR** 0.025 inch (0.6 mm) **OR** 0.028 inch (0.7 mm) **OR** 0.035 inch (0.9 mm), **as directed**.
 - d. External Finish: Manufacturer's standard.
 - e. Internal Finish: Enhanced **OR** Smooth, **as directed**.
 4. Water Boxes:
 - a. Carbon-steel construction; arranged to provide visual inspection and cleaning of tubes from either end without disturbing refrigerant in shell.
 - b. Standard **OR** Marine-type, **as directed**, water box with piping connections.
 - 1) Water boxes and marine-type water-box covers, **as directed**, shall have lifting lugs or eyebolts.
 - 2) Hinged **OR** Davited, **as directed**, water boxes.
OR
Hinged **OR** Davited, **as directed**, marine-type water-box covers.
 - c. Standard water box without piping connections.
 - 1) Water boxes shall have lifting lugs or eyebolts.
 - 2) Hinged **OR** Davited, **as directed**, water boxes.
 - d. Nozzle Pipe Connections: Welded, ASME B16.5, flat-face flange **OR** Welded, ASME B16.5, raised-face flange **OR** Grooved for mechanical-joint coupling **OR** Grooved with mechanical-joint coupling and flange adapter, **as directed**.
 - e. Thermistor or RTD temperature sensor factory installed in each nozzle.
 - f. Fit each water box with 3/4-inch (19-mm) **OR** 1-inch (25-mm), **as directed**, drain connection at low point and vent connection at high point, each with threaded plug.
- F. Condenser
1. Refrigerant Holding Pan: Steel or stainless steel.
 2. Tubes:
 - a. Individually replaceable, straight tubes expanded into tube sheets. Replaceable from either end without damage to tube sheets and other tubes.
 - b. Material: Copper **OR** Copper-nickel alloy, **as directed**.
 - c. Minimum Wall Thickness: Manufacturer's choice **OR** 0.025 inch (0.6 mm) **OR** 0.028 inch (0.7 mm) **OR** 0.035 inch (0.9 mm), **as directed**.



- d. External Finish: Manufacturer's standard.
- e. Internal Finish: Enhanced **OR** Smooth, **as directed**.
- 3. Water Boxes:
 - a. Carbon-steel construction; arranged to provide visual inspection and cleaning of tubes from either end without disturbing refrigerant in shell.
 - b. Standard **OR** Marine-type, **as directed**, water box with piping connections.
 - 1) Water boxes and marine-type water-box covers, **as directed**, shall have lifting lugs or eyebolts.
 - 2) Hinged **OR** Davited, **as directed**, water boxes.
 - OR**
 - Hinged **OR** Davited, **as directed**, marine-type water-box covers.
 - c. Standard water box without piping connections.
 - 1) Water boxes shall have lifting lugs or eyebolts.
 - 2) Hinged **OR** Davited, **as directed**, water boxes.
 - d. Nozzle Pipe Connections: Welded, ASME B16.5, flat-face flange **OR** Welded, ASME B16.5, raised-face flange **OR** Grooved for mechanical-joint coupling **OR** Grooved with mechanical-joint coupling and flange adapter, **as directed**.
 - e. Thermistor or RTD temperature sensor factory installed in each nozzle.
 - f. Fit each water box with 3/4-inch (19-mm) **OR** 1-inch (25-mm), **as directed**, drain connection at low point and vent connection at high point, each with threaded plug.
- 4. Additional Corrosion Protection:
 - a. Electrolytic corrosion-inhibitor anode.
 - b. Coat wetted surfaces with a corrosion-resistant finish.
 - OR**
 - Using same material as tubes, clad surfaces of end tube sheets in contact with fluid. Coat other wetted surfaces, including water boxes, with a corrosion-resistant finish.

G. First-Stage Generator

- 1. Tubes:
 - a. Replaceable, **as directed**, straight, or U tubes expanded into tube sheets.
 - b. Material: Manufacturer's standard **OR** Steel, **as directed**.
 - c. Minimum Wall Thickness: Manufacturer's choice.
 - d. External Finish: Manufacturer's standard.
 - e. Internal Finish: Manufacturer's choice; enhanced or smooth.
- 2. Water Boxes:
 - a. Carbon-steel construction; arranged to provide visual inspection and cleaning of tubes from either end without disturbing refrigerant in shell.
 - b. Standard water box.
 - c. Water boxes shall have lifting lugs or eyebolts.
 - d. Nozzle Pipe Connections: Welded, ASME B16.5, flat-face flange **OR** Welded, ASME B16.5, raised-face flange **OR** Grooved for mechanical-joint coupling **OR** Grooved with mechanical-joint coupling and flange adapter, **as directed**.
 - e. Thermistor or RTD temperature sensor factory installed in each nozzle.
 - f. Fit each water box with 3/4-inch (19-mm) **OR** 1-inch (25-mm), **as directed**, drain connection at low point and vent connection at high point, each with threaded plug.

H. Second-Stage Generator

- 1. Tubes:
 - a. Individually replaceable, straight tubes expanded into tube sheets. Replaceable from either end without damage to tube sheets and other tubes.
 - b. Material: Copper **OR** Copper-nickel alloy, **as directed**.
 - c. Minimum Wall Thickness: Manufacturer's choice **OR** 0.025 inch (0.6 mm) **OR** 0.028 inch (0.7 mm) **OR** 0.035 inch (0.9 mm), **as directed**.
 - d. External Finish: Manufacturer's standard.
 - e. Internal Finish: Manufacturer's standard.



2. Water Boxes:
 - a. Carbon-steel construction; arranged to provide visual inspection and cleaning of tubes from either end without disturbing refrigerant in shell.
 - b. Standard type.
 - c. Water boxes shall have lifting lugs or eyebolts.
 - d. Nozzle Pipe Connections: Welded, ASME B16.5, flat-face flange **OR** Welded, ASME B16.5, raised-face flange **OR** Grooved for mechanical-joint coupling **OR** Grooved with mechanical-joint coupling and flange adapter, **as directed**.
 - e. Thermistor or RTD temperature sensor factory installed in each nozzle.
 - f. Fit each water box with 3/4-inch (19-mm) **OR** 1-inch (25-mm), **as directed**, drain connection at low point and vent connection at high point, each with threaded plug.
- I. Dedicated Hot-Water Heat Exchanger
 1. Tubes:
 - a. Individually replaceable, straight tubes expanded into tube sheets. Replaceable from either end without damage to tube sheets and other tubes.
 - b. Material: Copper **OR** Copper-nickel alloy, **as directed**.
 - c. Minimum Wall Thickness: Manufacturer's choice **OR** 0.025 inch (0.6 mm) **OR** 0.028 inch (0.7 mm) **OR** 0.035 inch (0.9 mm), **as directed**.
 - d. External Finish: Manufacturer's standard.
 - e. Internal Finish: Manufacturer's standard.
 2. Water Boxes:
 - a. Carbon-steel construction; arranged to provide visual inspection and cleaning of tubes from either end without disturbing refrigerant in shell.
 - b. Standard type.
 - c. Water boxes shall have lifting lugs or eyebolts.
 - d. Nozzle Pipe Connections: Welded, ASME B16.5, flat-face flange **OR** Welded, ASME B16.5, raised-face flange **OR** Grooved for mechanical-joint coupling **OR** Grooved with mechanical-joint coupling and flange adapter, **as directed**.
 - e. Thermistor or RTD temperature sensor factory installed in each nozzle.
 - f. Fit each water box with 3/4-inch (19-mm) **OR** 1-inch (25-mm), **as directed**, drain connection at low point and vent connection at high point, each with threaded plug.
- J. Solution Heat Exchanger
 1. Description: Shell-and-tube or brazed-plate heat exchanger, an integral part of chiller, increases cycle efficiency by preheating the weak solution on its way to the generator while precooling the strong solution returning from the generator.
- K. Burner Assembly
 1. Burner: Welded construction with multivane, stainless-steel, flame-retention diffuser suitable for natural gas **OR** propane **OR** fuel oil, **as directed**. Mount burner on hinged access door to permit access to combustion chamber, **as directed**.
 2. Blower: Centrifugal fan integral to burner, directly driven by motor; with adjustable damper assembly and locking quadrant to set air-fuel ratio.
 - a. Motors: Comply with requirements specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - 1) Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 3. Oil Supply: Control devices and modulating control sequence shall comply with requirements of ASME CSD-1 **OR** FMG **OR** IRI **OR** UL, **as directed**.
 - a. Oil Pump: Two-stage, gear-type oil pump shall be capable of producing 300-psig (2070-kPa) discharge pressure and 15-in. Hg (50.7-kPa) vacuum.
 - b. Oil Piping Specialties:
 - 1) Suction-line, manual, gate valve.
 - 2) Removable-mesh oil strainer.



- 3) 0- to 30-in. Hg (0- to 101.3-kPa) vacuum; 0- to 30-psig (0- to 207-kPa) vacuum-pressure gage.
- 4) 0- to 300-psig (0- to 2070-kPa) oil-nozzle pressure gage.
- 5) Nozzle-line, solenoid-safety-shutoff oil valve.
4. Oil Pilot: Intermittent-electric-spark **OR** Interrupted-electric-spark, **as directed**, pilot ignition with 100 percent main-valve and pilot-safety shutoff solenoid with cadmium sulfide **OR** UV scanner, **as directed**, flame-safety control.
5. Gas Train: Control devices and modulating control sequence shall comply with requirements of ASME CSD-1 **OR** FMG **OR** IRI **OR** UL, **as directed**.
6. Gas Pilot: Intermittent-electric-spark **OR** Interrupted-electric-spark, **as directed**, pilot ignition with 100 percent main-valve and pilot-safety shutoff with electronic supervision of burner flame.
7. Burner assembly shall be equipped to limit nitrogen oxide emissions to 20 **OR** 30, **as directed**, ppm.

L. Electrical

1. Factory installed and wired, and functionally tested at factory before shipment.
2. Single-point, field-power connection to fused disconnect switch **OR** nonfused disconnect switch **OR** circuit breaker, **as directed**. Minimum withstand rating shall be as required by electrical power distribution system, but not less than 42,000 **OR** 65,000, **as directed**, A.
 - a. Branch power circuit to each motor, dedicated electrical load, and to controls with disconnect switch or circuit breaker, **as directed**.
 - 1) NEMA KS 1, heavy-duty fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 60947-4-1.
 - 2) NEMA AB 1, motor-circuit protector (circuit breaker) with field-adjustable, short-circuit-trip set point.
 - b. NEMA ICS 2, Class A, full-voltage, nonreversing motor controller, hand-off-auto switch, and overcurrent protection for each motor.
 - c. Control-circuit transformer with primary and secondary side fuses.
3. Terminal blocks with numbered and color-coded, **as directed**, wiring to match wiring diagram. Spare wiring terminal block for connection to external controls or equipment.
4. Wiring Outside of Enclosures: Factory installed in metal raceway except make terminal connections with not more than a 24-inch (610-mm) length of liquidtight **OR** flexible metallic, **as directed**, conduit.

M. Controls

1. Chiller control panel shall be separate from burner control panel.
2. Burner Control Panel: Factory or field, **as directed**, mounted. Maintains safe operating conditions, burner safety limits, burner operation, and interface with chiller controls; include the following components:
 - a. On-off switch.
 - b. Flame safeguard.
 - c. Contacts for remote monitoring of flame failure.
 - d. Contacts for proof of combustion air.
 - e. Exhaust gas temperature limit switch.
 - f. Control-circuit transformer.
 - g. Burner motor controls.
 - h. Fuel-oil pump controls, if chiller is equipped with fuel-oil pump.
 - i. Visual indication of on/off status of ignition, blower, and main fuel.
 - j. Alarm bell.
3. Control: Standalone and microprocessor based, with all memory stored in nonvolatile memory so that reprogramming is not required on loss of electrical power.
4. Enclosure: Unit mounted, NEMA 250, Type 1 **OR** Type 4 **OR** Type 4x, **as directed**, hinged or lockable.



5. Operator Interface: Multiple-character digital or graphic display with dynamic update of information and with keypad or touch-sensitive display located on front of control enclosure. Display the following information in either imperial or metric units selectable through the interface:
 - a. Date and time.
 - b. Operating or alarm status.
 - c. Operating hours.
 - d. Outdoor-air temperature if required for chilled-water reset.
 - e. Temperature and pressure of operating set points.
 - f. Entering and leaving temperatures of chilled and condenser water.
 - g. Refrigerant temperature.
 - h. Solution concentration and temperature.
 - i. Indication of solution and purge-pump operation.
 - j. Generator shell pressure.
 - k. Number of starts.
 - l. Number of purge cycles.
 - m. Entering and leaving hot-water temperatures.
 - n. Burner firing rate displayed in percent.
6. Control Functions:
 - a. Manual or automatic startup and shutdown time schedule.
 - b. Automatic cycle to prevent crystallization.
 - c. Entering and leaving chilled-water temperatures and control set points. Chilled-water temperature shall be reset based on return-water **OR** outdoor-air **OR** space, **as directed**, temperature.
 - d. Entering and leaving hot-water temperatures and control set points. Hot-water temperature shall be reset based on return-water **OR** outdoor-air **OR** space, **as directed**, temperature.
 - e. Condenser-fluid temperature.
 - f. Cooling provided and heating energy used within programmable time periods, minimum monthly.
 - g. Heating provided and heating energy used within programmable time periods, minimum monthly.
7. Capacity Control: Automatically controls burner firing rate to maintain chilled-water temperature set point for cooling loads and heating-water temperature set point for heating loads ranging from 30 to 100 percent.
8. Safety Shutdowns: Chiller shall automatically shut down and require manual restart. Display a message following each safety shutdown.
 - a. Crystallization.
 - b. Low refrigerant temperature.
 - c. Loss of chilled- or condenser-water flow.
 - d. Low leaving chilled-water temperature, 2 deg F (1 deg C) below set point.
 - e. First-stage generator low-solution level.
 - f. First-stage generator high temperature or pressure.
 - g. Burner alarm or control malfunction.
 - h. Power failure.
 - i. Solution pump overloads.
 - j. External auxiliary safety shutdown.
 - k. High solution concentration.
 - l. Incomplete dilution cycle.
9. Warning Conditions: Chiller shall remain operational but inhibit burner firing rate to prevent safety shutdown. Control panel shall close warning contacts and generate a message when one of the following operating conditions is detected:
 - a. Low refrigerant temperature.
 - b. High generator temperature or pressure.
 - c. High or low entering condenser-water temperature.
 - d. Solution temperature sensor failure.
 - e. Low chilled-water flow.



- f. Purge-pump current overload.
 10. Cycling Shutdowns: Permit automatic restart when preprogrammed limits are reached. Display a message following each cycle shutdown.
 - a. Cooling Mode:
 - 1) Loss of condenser-water flow.
 - 2) Low leaving chilled-water temperature.
 - 3) Power failure.
 - b. Heating Mode:
 - 1) Loss of hot-water flow.
 - 2) High leaving hot-water temperature.
 - 3) Power failure.
 11. Trending: Capability to trend analog data up to five parameters simultaneously over an adjustable period and frequency of polling.
 12. Security Access: Provide electronic security access to controls through identification and password with at least three levels of access: view only; view and operate; and view, operate, and service.
 13. Control Authority: At least four conditions: Off, local manual control at chiller, local automatic control at chiller, and automatic control through a remote source.
 14. Communication Port: RS-232 port, USB 2.0 port, or equivalent connection capable of connecting a printer and a notebook computer.
 15. BAS Interface: Factory-installed hardware and software to enable the BAS to monitor, control, and display chiller status and alarms.
 - a. Hardwired Points:
 - 1) Monitoring: On-off status, common trouble alarm.
 - 2) Control: On-off operation, chilled-water, discharge temperature set-point adjustment **OR** hot-water, discharge temperature set-point adjustment, **as directed**.
 - b. ASHRAE 135 (BACnet) **OR** LonTalk **OR** Modbus **OR** Industry-accepted, open-protocol, **as directed**, communication interface with the BAS shall enable the BAS operator to remotely control and monitor the chiller from an operator workstation. Control features and monitoring points displayed locally at chiller control panel shall be available through the BAS.
- N. Finish
1. Paint chiller, using manufacturer's standard procedures, except comply with the following minimum requirements:
 - a. Provide at least one coat of primer with a total dry film thickness of at least 2 mils (0.05 mm).
 - b. Provide at least two coats of alkyd-modified, vinyl enamel **OR** epoxy **OR** polyurethane, **as directed**, finish with a total dry film thickness of at least 4 mils (0.10 mm).
 - c. Paint surfaces that are to be insulated before applying the insulation.
 - d. Paint installed insulation to match adjacent uninsulated surfaces.
 - e. Color of finish coat to be manufacturer's standard **OR** custom color selected by the Owner.
- O. Accessories
1. Sight Glasses: Equip unit with sight glasses for visual inspection of absorbent solution and refrigerant levels. Provide at least one sight glass in absorber and evaporator sections.
 2. Flow Switches:
 - a. Chiller manufacturer shall furnish a switch for each condenser **OR** evaporator and condenser, **as directed**, and shall verify field-mounting location before installation.
 - b. Paddle Flow Switches:
 - 1) Vane operated to actuate a double-pole, double-throw switch with one pole field wired to the chiller control panel and the other pole field wired to the BAS.
 - 2) Contacts: Platinum alloy, silver alloy, or gold-plated switch contacts with a rating of 10 A at 120-V ac.
 - 3) Pressure rating equal to pressure rating of heat exchanger.



- 4) Construct body and wetted parts of Type 316 stainless steel.
- 5) House switch in an NEMA 250, Type 4 enclosure constructed of die-cast aluminum.
- 6) Vane length to suit installation.
- c. Pressure Differential Switches:
 - 1) Construction: Wetted parts of body and trim constructed of Type 316 stainless steel.
 - 2) Performance: Switch shall withstand, without damage, the full-pressure rating of the heat exchanger applied to either port and exhibit zero set point shift due to variation in working pressure.
 - 3) Set Point: Screw type, field adjustable.
 - 4) Electrical Connections: Internally mounted, screw-type terminal blocks.
 - 5) Switch Enclosure: NEMA 250, Type 4.
 - 6) Switch Action: Double-pole, double-throw switch with one pole field wired to the chiller control panel and the other pole field wired to the BAS.
3. Vibration Isolation:
 - a. Chiller manufacturer shall furnish neoprene-pad vibration isolation for each chiller.
 - 1) Two layers of 0.375-inch- (10-mm-) thick, ribbed- or waffle-pattern neoprene pads separated by a 16-gage, stainless-steel plate.
 - 2) Fabricate pads from 40- to 50-durometer neoprene.
 - 3) Provide stainless-steel square bearing plate to load the pad uniformly between 20 and 40 psig (138 and 276 kPa) with a 0.12- to 0.16-inch (3- to 4-mm) deflection.
- P. Heat-Exchanger, Brush-Cleaning System
 1. Furnish for field installation a brush-cleaning system on each chiller condenser for tube cleaning and improved heat transfer.
 2. System shall maintain tube fouling at or below design conditions without interrupting normal equipment operation.
 3. System shall consist of a brush inserted in each tube and a catch basket attached to each end of the tube. A four-way valve shall operate to reverse the direction of water flow to push the brush through the tube while removing tube deposits. Four-way reversing valve's actuator shall be controlled by a preset time cycle that provides regular tube brushing during equipment operation. Frequency of the brushing cycle shall be set up to match Project requirements.
 4. Components:
 - a. Brush: Each brush shall have nylon bristles, titanium wires, and polypropylene tips. Brush interference fit with the ID of the tube shall not exceed 0.025 inch (0.6 mm).
 - b. Basket: Single-piece polypropylene basket with neck OD to press fit inner diameter of tube. Design shall provide for insertion of eddy current probe or removal of brushes without removing baskets from the valve.
 - c. Four-Way Valve:
 - 1) Construct valve body of carbon steel with internal sealing parts of hard rubber and Type 304 stainless steel.
 - 2) Configure valve with parallel flow connections to minimize field installation piping.
 - 3) Construct valve to comply with ASME Boiler and Pressure Vessel Code , at a system working pressure equal to condenser.
 - 4) Pipe connections shall be flanged.
 - 5) Valve manufacturer to test and certify a maximum leakage rate of less than 0.05 percent of the design flow rate at operation conditions of maximum differential pressure.
 - 6) Hydrostatically test valve to 1.5 times the design working pressure.
 - 7) Design the valve to cause no more than 0.5-psig (3-kPa) pressure drop at design flow conditions.
 - 8) Provide valve with valve-mounted indicating/warning light, which shall light before the valve begins rotation.
 - 9) Valve Actuator: Mount electric actuator to operate valve.
OR
Valve Actuator: Mount pneumatic piston-type actuator to operate valve. Actuator shall be suitable for operation using field-supplied air pressure.



- 10) Position Switches: Factory mount microswitches on valve to indicate the complete turn of valve in both normal and reverse flow.
- d. Control Panel: Factory or field mount a control panel on chiller. Control panel shall include the following features:
 - 1) NEMA 250, Type 1 **OR** Type 4 **OR** Type 4x **OR** Type 12, **as directed**, enclosure.
 - 2) Timer to automatically initiate the cleaning cycle over a 24-hour period.
 - 3) Manual override of preset cleaning cycle.
 - 4) Visual indication of "Power On," "Diverter Position," "Normal Flow," "Reverse Flow," and "Valve Malfunction" indicating a slow or incomplete valve turn.
 - 5) For pneumatic actuators, mount four-way solenoid valve for actuator operation in the control panel.
 - 6) Flow-switch bypass.
 - 7) Unloading signal to chiller.

Q. Source Quality Control

1. Perform functional run tests of chillers before shipping.
2. Factory test and inspect absorber, generator, evaporator, and condenser according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1. Pressure test tube-side of heat exchangers, including water boxes, to 1.5 times the rated pressure. Vacuum and pressure test shells for leaks.
3. Rate sound power level according to ARI 575.
4. Burner Test: Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion requirements indicated.
5. Factory performance test chillers, before shipping, according to ARI 560.
 - a. Test the following conditions:
 - 1) Design conditions indicated.
 - 2) Reduction in capacity from design to minimum load in steps of 10 **OR** 25 **OR** 33, **as directed**, with condenser fluid at design conditions.
OR
Reduction in capacity from design to minimum load in steps of 10 **OR** 25 **OR** 33, **as directed**, with varying entering condenser-fluid temperature from design to minimum conditions in 5 deg F (3 deg C) increments.
OR
At one **OR** two **OR** three **OR** four **OR** five **OR** 10, **as directed**, point(s) of varying part-load performance to be selected by the Owner at time of test.
6. Factory sound test chillers, before shipping, according to ARI 575.
 - a. Test the following conditions:
 - 1) Design conditions indicated.
 - 2) Chiller operating at calculated worst-case sound condition.
 - 3) At one **OR** two **OR** three **OR** four **OR** five, **as directed**, point(s) of varying part-load performance to be selected by the Owner at time of test.
7. Allow the Owner access to place where chillers are being tested. Notify the Owner 14 days in advance of testing.
8. Prepare test report indicating test procedures, instrumentation, test conditions, and results. Submit copy of results within one week of test date.

1.3 EXECUTION

A. Examination

1. Examine chillers before installation. Reject chillers that are damaged.
2. Examine roughing-in for equipment support, anchor-bolt sizes and locations, piping, and electrical connections to verify actual locations, sizes, and other conditions affecting chiller performance, maintenance, and operations before equipment installation.



- a. Final chiller locations indicated on Drawings are approximate. Determine exact locations before roughing-in for piping and electrical connections.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Chiller Installation

1. Install chillers on support structure indicated.
2. Equipment Mounting (for equipment supported on concrete bases and vibration isolation devices): Install chiller on concrete bases using elastomeric pads. Comply with requirements for concrete bases specified in Division 03 Section "Cast-in-place Concrete". Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 - a. Minimum Deflection: 1/4 inch (6 mm) **OR** 1/2 inch (13 mm), **as directed**.
 - b. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - c. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base, and anchor into structural concrete floor.
 - d. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - e. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Equipment Mounting (for equipment supported on vibration isolation devices without a concrete base): Install chiller using elastomeric pads. Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 - a. Minimum Deflection: 1/4 inch (6 mm) **OR** 1/2 inch (13 mm), **as directed**.
4. Equipment Mounting (for equipment installed on concrete bases without vibration isolation devices): Install chiller on concrete bases. Comply with requirements for concrete bases specified in Division 03 Section "Cast-in-place Concrete".
 - a. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - b. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base, and anchor into structural concrete floor.
 - c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - d. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Install chillers with seismic-restraint device. Comply with requirements for seismic-restraint devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
6. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
7. Maintain manufacturer's recommended clearances for service and maintenance.
8. Charge chiller with absorbent and refrigerant if not factory charged.
9. Install separate devices furnished by manufacturer and not factory installed.
10. Insulate hot and cold chiller surfaces that are recommended by chiller manufacturer to be insulated. Comply with requirements in Division 23 Section "Hvac Insulation".
11. Install electrical devices furnished with chiller but not specified to be factory mounted.
12. Install control wiring to field-mounted electrical devices.

C. Heat-Exchanger, Brush-Cleaning System Installation

1. Install brush-cleaning system control panel adjacent to chiller control panel.
2. Arrange piping to provide service access to four-way valve assembly without affecting access to chiller. Secure valve to prevent lateral movement and vibration during operation.
3. Provide field electric power, as required, to each system control panel and electric-actuated valve.



4. Provide pneumatic piping with pressure regulator and an isolation valve to each pneumatic supply connection. Coordinate field source of air with manufacturer to ensure that requirements are satisfied for proper valve operation.
5. Interconnect brush-cleaning system controls with chiller controls. Coordinate requirements to ensure safe, trouble-free operation.
6. Functionally test the entire brush-cleaning system, including the valve, actuator, position indicator, and control panel, with chiller in operation.

D. Connections

1. Comply with requirements for hydronic piping in Division 23 Section "Hydronic Piping". Drawings indicate general arrangement of piping, fittings, and specialties.
2. Comply with requirements for gas piping in Division 23 Section(s) "Facility Natural-gas Piping" OR "Facility Liquefied-petroleum Gas Piping". Drawings indicate general arrangement of piping, fittings, and specialties.
3. Connect gas piping full size to gas-train inlet with shutoff valve and union.
4. Install gas-fired boilers according to NFPA 54.
5. Comply with requirements for fuel-oil piping in Division 23 Section "Facility Fuel-oil Piping". Drawings indicate general arrangement of piping, fittings, and specialties.
6. Connect oil piping full size to burner inlet with shutoff valve and union.
7. Install oil-fired boilers according to NFPA 31.
8. Install piping adjacent to chiller to allow service and maintenance.
9. Hot-Water Heat-Exchanger Connections: Connect to heat-exchanger inlet with shutoff valve, strainer, flexible connector, thermometer, and plugged tee with shutoff valve and pressure gage. Connect to heat-exchanger outlet with shutoff valve, check valve, balancing valve, flexible connector, flow switch, thermometer, plugged tee with shutoff valve and pressure gage, flow meter, and drain connection with valve. Make connections to chiller with a flange or mechanical coupling.
10. Evaporator-Fluid Connections: Connect to evaporator inlet with shutoff valve, strainer, flexible connector, thermometer, and plugged tee with shutoff valve and pressure gage. Connect to evaporator outlet with shutoff valve, balancing valve, flexible connector, flow switch, thermometer, plugged tee with shutoff valve and pressure gage, flow meter, and drain connection with valve. Make connections to chiller with a flange or mechanical coupling.
11. Absorber/Condenser-Fluid Connections: Connect to inlet with shutoff valve, strainer, flexible connector, thermometer, and plugged tee with shutoff valve and pressure gage. Connect to outlet with shutoff valve, balancing valve, flexible connector, flow switch, thermometer, plugged tee with shutoff valve and pressure gage, flow meter, and drain connection with valve. Make connections to chiller with a flange or mechanical coupling.
 - a. If not factory furnished or installed, provide pipe connecting fluid connection of absorber discharge and condenser inlet.
12. Refrigerant Pressure Relief Device Connections: Extend vent piping **OR** separate vent piping for each chiller, **as directed**, to the outdoors without valves or restrictions. Comply with ASHRAE 15. Connect to chiller pressure relief device with flexible connector and dirt leg with drain valve.
13. Extend purge vent piping **OR** separate purge vent piping for each chiller, **as directed**, to the outdoors. Comply with ASHRAE 15.
14. Connect each chiller drain connection with a union and drain pipe, and extend pipe, full size of connection, to floor drain. Provide a shutoff valve at each connection.
15. Comply with requirements for chimney system in Division 23 Section "Breechings, Chimneys, And Stacks". Drawings indicate general arrangement of pipe, fittings, and specialties. Connect chimney system to chiller burner outlet and extend to the outdoors.
16. Connect fuel-fired burner assembly and blower and associated damper for combustion air.

E. Startup Service

1. Perform startup service.
 - a. Complete installation and startup checks according to manufacturer's written instructions.



- b. Operate chiller for run-in period.
 - c. Verify that absorbent and refrigerant charge is sufficient and chiller has been leak tested.
 - d. Verify that pumps are installed and functional.
 - e. Verify that thermometers and gages are installed.
 - f. Operate chiller for run-in period.
 - g. Verify that refrigerant pressure relief device is vented to the outdoors.
 - h. Verify proper motor rotation.
 - i. Verify proper fuel supply. Adjust air-fuel ratio and combustion.
 - j. Verify proper combustion-air source.
 - k. Verify proper exhaust emissions.
 - l. Verify static deflection of vibration isolators including deflection during chiller startup and shutdown.
 - m. Verify and record performance of fluid flow and low-temperature interlocks for evaporator and condenser.
 - n. Verify and record performance of chiller protection devices.
 - o. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.
 - p. Burner Test: Adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas.
2. Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assembly, installation, and connection.
 3. Prepare test and inspection startup reports.
- F. Demonstration
1. Train the Owner's maintenance personnel to adjust, operate, and maintain chillers. Video record the training sessions, **as directed**.

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SECTION 23 64 16 16 - FAN-COIL UNITS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for fan-coil units. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes fan-coil units and accessories.

C. Definitions

1. BAS: Building automation system.

D. Submittals

1. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories.
2. LEED Submittals:
 - a. Product Data for Credit EA 4: Documentation required by Credit EA 4 indicating that equipment and refrigerants comply.
 - b. Product Data for Prerequisite EQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
3. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - a. Wiring Diagrams: Power, signal, and control wiring.
4. Manufacturer Seismic Qualification Certification: Submit certification that fan-coil units, accessories, and components will withstand seismic forces defined in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
5. Field quality-control test reports.
6. Operation and maintenance data.
7. Warranty: Special warranty specified in this Section.

E. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
3. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

F. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of condensing units that fail in materials or workmanship within specified warranty period.
 - a. Failures include, but are not limited to, the following:
 - 1) Compressor failure.
 - 2) Condenser coil leak.
 - b. Warranty Period: Four **OR** Five **OR** 10, **as directed**, years from date of Final Completion.
 - c. Warranty Period (Compressor Only): Five **OR** 10, **as directed**, years from date of Final Completion.



- d. Warranty Period (Condenser Coil Only): Five years from date of Final Completion.

1.2 PRODUCTS

A. Fan-Coil Units

1. Description: Factory-packaged and -tested units rated according to ARI 440, ASHRAE 33, and UL 1995.
2. Coil Section Insulation: 1/2-inch (13-mm) **OR** 1-inch (25-mm), **as directed**, thick, coated glass fiber **OR** foil-covered, closed-cell foam **OR** matte-finish, closed-cell foam, **as directed**, complying with ASTM C 1071 and attached with adhesive complying with ASTM C 916.
 - a. Fire-Hazard Classification: Insulation and adhesive shall have a combined maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.
 - b. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
3. Main and Auxiliary Drain Pans: Plastic **OR** Stainless steel **OR** Insulated galvanized steel with plastic liner, **as directed**. Fabricate pans and drain connections to comply with ASHRAE 62.1. Drain pans shall be removable, **as directed**.
4. Chassis: Galvanized steel where exposed to moisture. Floor-mounting units shall have leveling screws.
5. Cabinet: Steel with factory prime coating, ready for field painting **OR** baked-enamel finish in manufacturer's standard paint color as selected by the Owner **OR** baked-enamel finish in manufacturer's custom paint color as selected by the Owner, **as directed**.
 - a. Vertical Unit Front Panels: Removable, steel, with integral stamped **OR** polyethylene **OR** steel, **as directed**, discharge grille and channel-formed edges, cam fasteners, and insulation on back of panel.
 - b. Horizontal Unit Bottom Panels: Fastened to unit with cam fasteners and hinge and attached with safety chain; with integral stamped **OR** cast-aluminum, **as directed**, discharge grilles.
 - c. Stack Unit Discharge and Return Grille: Aluminum double-deflection discharge grille, and louvered- or panel-type return grille; color as selected by the Owner from manufacturer's standard **OR** custom, **as directed**, colors. Return grille shall provide maintenance access to fan-coil unit.
 - d. Steel recessing flanges for recessing fan-coil units into ceiling or wall.
6. Outdoor-Air Wall Box: Minimum 0.1265-inch- (3.2-mm-) thick, aluminum, rain-resistant louver and box with integral eliminators and bird screen.
 - a. Louver Configuration: Horizontal **OR** Vertical, **as directed**, rain-resistant louver.
 - b. Louver Material: Aluminum **OR** Steel, **as directed**.
 - c. Bird Screen: 1/2-inch (13-mm) mesh screen on interior side of louver.
 - d. Decorative Grille: On outside of intake.
 - e. Finish: Anodized aluminum **OR** Baked enamel, **as directed**, color as selected by the Owner from manufacturer's standard **OR** custom, **as directed**, colors.
7. Outdoor-Air Damper: Galvanized-steel blades with edge and end seals and nylon bearings; with electronic **OR** pneumatic, **as directed**, two-position **OR** modulating, **as directed**, actuators.
8. Filters: Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
 - a. Washable Foam: 70 percent arrestance and 3 MERV.
 - b. Glass Fiber Treated with Adhesive: 80 percent arrestance and 5 MERV.
 - c. Pleated Cotton-Polyester Media: 90 percent arrestance and 7 MERV.
9. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm), rated for a minimum working pressure of 200 psig (1378 kPa) and a maximum entering-water temperature of 220 deg F (104 deg C). Include manual air vent and drain valve.



10. Steam Coils: Copper distributing, **as directed**, tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm), rated for a minimum working pressure of 75 psig (517 kPa).
11. Electric-Resistance Heating Coils: Nickel-chromium heating wire, free of expansion noise and hum, mounted in ceramic inserts in a galvanized-steel housing; with fuses in terminal box for overcurrent protection and limit controls for high-temperature protection. Terminate elements in stainless-steel machine-staked terminals secured with stainless-steel hardware.
12. Fan and Motor Board: Removable.
 - a. Fan: Forward curved, double width, centrifugal; directly connected to motor. Thermoplastic or painted-steel wheels, and aluminum, painted-steel, or galvanized-steel fan scrolls.
 - b. Motor: Permanently lubricated, multispeed; resiliently mounted on motor board. Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - c. Wiring Termination: Connect motor to chassis wiring with plug connection.
13. Factory, Hydronic Piping Package: ASTM B 88, Type L (ASTM B 88M, Type B) **OR** ASTM B 88, Type M (ASTM B 88M Type C), **as directed**, copper tube with wrought-copper fittings and brazed joints. Label piping to indicate service, inlet, and outlet.
 - a. Two **OR** Three, **as directed**, -way, two-position **OR** modulating, **as directed**, control valve for dual-temperature coil.
 - b. Two **OR** Three, **as directed**, -way, two-position **OR** modulating, **as directed**, control valve for chilled-water coil.
 - c. Two **OR** Three, **as directed**, -way, two-position **OR** modulating, **as directed**, control valve for heating coil.
 - d. Two **OR** Three, **as directed**, -way two-position **OR** modulating, **as directed**, control valve for hot-water reheat coil.
 - e. Hose Kits: Minimum 400-psig (2758-kPa) working pressure, and operating temperatures from 33 to 211 deg F (0.5 to 99 deg C). Tag hose kits to equipment designations.
 - 1) Length: 24 inches (600 mm) **OR** 36 inches (900 mm), **as directed**.
 - 2) Minimum Diameter: Equal to fan-coil-unit connection size.
 - f. Two-Piece Ball Valves: Bronze body with full-port, chrome-plated bronze ball; PTFE or TFE seats; and 600-psig (4140-kPa) minimum CWP rating and blowout-proof stem.
 - g. Calibrated-Orifice Balancing Valves: Bronze body, ball type; 125-psig (860-kPa) working pressure, 250-deg F (121-deg C) maximum operating temperature; with calibrated orifice or venturi, connections for portable differential pressure meter with integral seals, threaded ends, and equipped with a memory stop to retain set position.
 - h. Automatic Flow-Control Valve: Brass or ferrous-metal body; 300-psig (2070-kPa) working pressure at 250 deg F (121 deg C), with removable, corrosion-resistant, tamperproof, self-cleaning piston spring; factory set to maintain constant indicated flow with plus or minus 10 percent over differential pressure range of 2 to 80 psig (13.8 to 552 kPa).
 - i. Y-Pattern Hydronic Strainers: Cast-iron body (ASTM A 126, Class B); 125-psig (860-kPa) working pressure; with threaded connections, bolted cover, perforated stainless-steel basket, and bottom drain connection. Include minimum NPS 1/2 (DN 15) hose-end, full-port, ball-type blowdown valve in drain connection.
 - j. Wrought-Copper Unions: ASME B16.22.
 - k. Risers: ASTM B 88, Type L (ASTM B 88M, Type B) **OR** ASTM B 88, Type M (ASTM B 88M Type C), **as directed**, copper pipe with hose and ball valve for system flushing.
14. Control devices and operational sequences are specified in Division 23 Section(s) "Instrumentation And Control For Hvac" AND "Sequence Of Operations For Hvac Controls".
15. Basic Unit Controls:
 - a. Control voltage transformer.
 - b. Wall-mounting **OR** Unit-mounted, **as directed**, thermostat with the following features:
 - 1) Heat-cool-off switch.
 - 2) Fan on-auto switch.
 - 3) Fan-speed switch.



- 4) Manual **OR** Automatic, **as directed**, changeover.
 - 5) Adjustable deadband.
 - 6) Concealed **OR** Exposed, **as directed**, set point.
 - 7) Concealed **OR** Exposed, **as directed**, indication.
 - 8) Degree F **OR** Degree C, **as directed**, indication.
 - c. Wall-mounting **OR** Unit-mounted, **as directed**, humidistat.
 - 1) Concealed **OR** Exposed, **as directed**, set point.
 - 2) Concealed **OR** Exposed, **as directed**, indication.
 - d. Wall-mounting **OR** Unit-mounted, **as directed**, temperature sensor.
 - e. Unoccupied-period-override push button.
 - f. Data entry and access port.
 - 1) Input data includes room temperature, and humidity set points and occupied and unoccupied periods.
 - 2) Output data includes room temperature and humidity, supply-air temperature, entering-water temperature, operating mode, and status.
16. DDC, **as directed**, Terminal Controller:
- a. Scheduled Operation: Occupied and unoccupied periods on seven-day clock with a minimum of four programmable periods per day.
 - b. Unoccupied Period Override Operation: Two, **as directed**, hours.
 - c. Unit Supply-Air Fan Operation:
 - 1) Occupied Periods: Fan runs continuously.
 - 2) Unoccupied Periods: Fan cycles to maintain room setback temperature.
 - d. Hydronic-Cooling-Coil Operation:
 - 1) Occupied Periods: Open **OR** Modulate, **as directed**, control valve to maintain room temperature.
 - 2) Unoccupied Periods: Close control valve.
 - e. Heating-Coil Operation:
 - 1) Occupied Periods: Open control valve **OR** Modulate control valve **OR** Energize electric-resistance coil, **as directed**, to provide heating if room temperature falls below thermostat set point.
 - 2) Unoccupied Periods: Start fan and open control valve **OR** modulate control valve **OR** energize electric-resistance coil, **as directed**, if room temperature falls below setback temperature.
 - f. Dual-Temperature Hydronic-Coil Operation:
 - 1) Occupied Periods: When chilled water is available, open **OR** modulate, **as directed**, control valve if room temperature exceeds thermostat set point. When hot water is available, open control valve if temperature falls below thermostat set point.
 - 2) Unoccupied Periods: When chilled water is available, close control valve. When hot water is available, open **OR** modulate, **as directed**, control valve if room temperature falls below thermostat setback temperature.
 - g. Reheat-Coil Operation:
 - 1) Humidity Control for Occupied Periods:
 - a) Humidistat opens control valve **OR** modulates control valve **OR** energizes electric-resistance coil, **as directed**, to provide heating. As space temperature rises above the set point, cooling coil valve opens **OR** modulates, **as directed**, to maintain room temperature.
 - 2) Humidity Control for Unoccupied Periods: Close control valve **OR** De-energize, **as directed**.
 - 3) Occupied Periods:
 - a) Heating Operations: Open control valve **OR** Modulate control valve **OR** Energize electric-resistance coil, **as directed**, to provide heating if room temperature falls below thermostat set point.
 - b) Humidity-Control Operations: Humidistat opens control valve **OR** modulates control valve **OR** energizes electric-resistance coil, **as directed**, to provide



- heating. As space temperature rises above the set point, cooling coil valve opens **OR** modulates, **as directed**, to maintain room temperature.
- 4) Unoccupied Periods: Start fan and open control valve **OR** modulate control valve **OR** energize electric-resistance coil, **as directed**, if room temperature falls below setback temperature. Humidity control is not available.
- h. Outdoor-Air Damper Operation:
- 1) Occupied Periods: Open damper to fixed position for 25 percent outdoor air.
 - 2) Unoccupied periods: Close damper.
- i. Outdoor-Air Damper Operation:
- 1) Occupied Periods:
 - a) Outdoor-Air Temperature below Room Temperature: If room temperature is above thermostat set point, modulate outdoor-air damper to maintain room temperature (outdoor-air economizer). If room temperature is below thermostat set point, position damper to fixed minimum position.
 - b) Outdoor-Air Temperature above Room Temperature: Position damper to fixed minimum position for 25 percent outdoor air.
 - 2) Unoccupied Periods: Close damper.
- j. Controller shall have volatile-memory backup.
17. BAS Interface Requirements:
- a. Interface relay for scheduled operation.
 - b. Interface relay to provide indication of fault at the central workstation.
 - c. Provide BACnet **OR** LonWorks, **as directed**, interface for central BAS workstation for the following functions:
 - 1) Adjust set points.
 - 2) Fan-coil-unit start, stop, and operating status.
 - 3) Data inquiry, including outdoor-air damper position, **as directed**, supply- and room-air temperature and humidity, **as directed**.
 - 4) Occupied and unoccupied schedules.
18. Electrical Connection: Factory wire motors and controls for a single electrical connection.

B. Ducted Fan-Coil Units

1. Description: Factory-packaged and -tested units rated according to ARI 440, ASHRAE 33, and UL 1995.
2. Coil Section Insulation: 1/2-inch (13-mm) **OR** 1-inch (25-mm), **as directed**, thick coated **OR** foil-faced, **as directed**, glass fiber complying with ASTM C 1071 and attached with adhesive complying with ASTM C 916.
 - a. Fire-Hazard Classification: Insulation and adhesive shall have a combined maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.
 - b. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
3. Drain Pans: Plastic **OR** Stainless steel **OR** Insulated galvanized steel with plastic liner, **as directed**. Fabricate pans and drain connections to comply with ASHRAE 62.1.
4. Chassis: Galvanized steel where exposed to moisture, with baked-enamel finish and removable access panels.
5. Cabinets: Steel with baked-enamel finish in manufacturer's standard paint color.
 - a. Supply-Air Plenum: Sheet metal plenum finished and insulated to match the chassis with mill-finish, aluminum, double-deflection grille, **as directed**.
 - b. Return-Air Plenum: Sheet metal plenum finished to match the chassis.
 - c. Mixing Plenum: Sheet metal plenum finished and insulated to match the chassis with outdoor- and return-air, formed-steel dampers.
 - d. Dampers: Galvanized steel with extruded-vinyl blade seals, flexible-metal jamb seals, and interlocking linkage.
6. Filters: Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
 - a. Washable Foam: 70 percent arrestance and 3 MERV.



- b. Glass Fiber Treated with Adhesive: 80 percent arrestance and 5 MERV.
- c. Pleated Cotton-Polyester Media: 90 percent arrestance and 7 MERV.
- 7. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm), rated for a minimum working pressure of 200 psig (1378 kPa) and a maximum entering-water temperature of 220 deg F (104 deg C). Include manual air vent and drain.
- 8. Indoor Refrigerant Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm), and brazed joints at fittings. Comply with ARI 210/240, and leak test to minimum 450 psig (3105 kPa) for a minimum 300-psig (2070-kPa) working pressure. Include thermal expansion valve.
- 9. Steam Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm), rated for a minimum working pressure of 75 psig (517 kPa).
- 10. Electric-Resistance Heating Coils: Nickel-chromium heating wire, free of expansion noise and hum, mounted in ceramic inserts in a galvanized-steel housing; with fuses in terminal box for overcurrent protection and limit controls for high-temperature protection of heaters. Terminate elements in stainless-steel machine-staked terminals secured with stainless-steel hardware.
- 11. Direct-Driven Fans: Double width, forward curved, centrifugal; with permanently lubricated, multispeed motor resiliently mounted in the fan inlet. Aluminum or painted-steel wheels, and painted-steel or galvanized-steel fan scrolls.

OR

- Belt-Driven Fans: Double width, forward curved, centrifugal; with permanently lubricated, single-speed motor installed on an adjustable fan base resiliently mounted in the cabinet. Aluminum or painted-steel wheels, and painted-steel or galvanized-steel fan scrolls.
- a. Motors: Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".
- 12. Factory, Hydronic Piping Package: ASTM B 88, Type L (ASTM B 88M, Type B) **OR** ASTM B 88, Type M (ASTM B 88M Type C), **as directed**, copper tube with wrought-copper fittings and brazed joints. Label piping to indicate service, inlet, and outlet.
 - a. Two **OR** Three, **as directed**, -way, two-position **OR** modulating, **as directed**, control valve for chilled-water coil.
 - b. Two **OR** Three, **as directed**, -way, two-position **OR** modulating, **as directed**, control valve for heating coil.
 - c. Two **OR** Three, **as directed**, -way, two-position **OR** modulating, **as directed**, control valve for dual-temperature coil.
 - d. Two **OR** Three, **as directed**, -way, two-position **OR** modulating, **as directed**, control valve for reheat coil.
 - e. Hose Kits: Minimum 400-psig (2758-kPa) working pressure, and operating temperatures from 33 to 211 deg F (0.5 to 99 deg C). Tag hose kits to equipment designations.
 - 1) Length: 24 inches (600 mm) **OR** 36 inches (900 mm), **as directed**.
 - 2) Minimum Diameter: Equal to fan-coil-unit connection size.
 - f. Two-Piece Ball Valves: Bronze body with full-port, chrome-plated bronze ball; PTFE or TFE seats; and 600-psig (4140-kPa) minimum CWP rating and blowout-proof stem.
 - g. Calibrated-Orifice Balancing Valves: Bronze body, ball type; 125-psig (860-kPa) working pressure, 250 deg F (121 deg C) maximum operating temperature; with calibrated orifice or venturi, connections for portable differential pressure meter with integral seals, threaded ends, and equipped with a memory stop to retain set position.
 - h. Automatic Flow-Control Valve: Brass or ferrous-metal body; 300-psig (2070-kPa) working pressure at 250 deg F (121 deg C); with removable, corrosion-resistant, tamperproof, self-cleaning piston spring; factory set to maintain constant indicated flow with plus or minus 10 percent over differential pressure range of 2 to 80 psig (13.8 to 552 kPa).
 - i. Y-Pattern Hydronic Strainers: Cast-iron body (ASTM A 126, Class B); 125-psig (860-kPa) working pressure, with threaded connections, bolted cover, perforated stainless-steel basket, and bottom drain connection. Include minimum NPS 1/2 (DN 15) hose-end, full-port, ball-type blowdown valve in drain connection.
 - j. Wrought-Copper Unions: ASME B16.22.



13. Remote condensing units are specified in Division 23 Section "Packaged Compressor And Condenser Units".
14. Remote Condensing Units: Factory assembled and tested, consisting of compressors, condenser coils, fans, motors, refrigerant receiver, and operating controls. Construct, test, and rate condensing units according to ARI 210/240 and ASHRAE 15.
 - a. Casing: Steel with baked-enamel finish, removable panels for access to controls, weep holes for water drainage, and mounting holes in base.
 - b. Compressor: Hermetic, scroll **OR** reciprocating, **as directed**, type; internally isolated for vibration with factory-installed safety devices as follows:
 - 1) Antirecycle timer.
 - 2) High-pressure cutout.
 - 3) Low-pressure cutout or loss-of-charge switch.
 - 4) Internal thermal-overload protection.
 - 5) Current and voltage sensitive safety devices.
 - c. Compressor Motor: Start capacitor, relay, and contactor. Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - d. Energy Efficiency: Equal to or greater than prescribed by ASHRAE/IESNA 90.1, "Energy Standard for Buildings except Low-Rise Residential Buildings."
 - e. Refrigerant Piping Materials: ASTM B 743 copper tube with wrought-copper fittings and brazed joints.
 - f. Refrigerant: R-407C **OR** R-410A, **as directed**.
 - g. Low ambient controls to permit operation down to 45 deg F (7 deg C).
 - h. Crankcase heater.
 - i. Charging and service fittings on exterior of casing.
 - j. Filter dryer.
 - k. Air-to-Air Heat Pump: Pilot-operated, sliding-type reversing valve with replaceable magnetic coil, and controls for air-to-air heat pump operation with supplemental heat operation.
 - l. Hot-gas-bypass, constant-pressure expansion valve and controls to maintain continuous refrigeration system operation at 10 percent of full load.
 - m. Condenser: Copper-tube, aluminum-fin coil, with liquid subcooler.
 - n. Condenser Fan: Direct-drive, aluminum propeller fan.
 - 1) Motor: Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - o. Accessories: Polyethylene mounting base to provide a permanent foundation.
15. Control devices and operational sequence are specified in Division 23 Section(s) "Instrumentation And Control For Hvac" AND "Sequence Of Operations For Hvac Controls".
16. Basic Unit Controls:
 - a. Control voltage transformer.
 - b. Wall-mounting **OR** Unit-mounted, **as directed**, thermostat with the following features.
 - 1) Heat-cool-off switch.
 - 2) Fan on-auto switch.
 - 3) Fan-speed switch.
 - 4) Manual **OR** Automatic, **as directed**, changeover.
 - 5) Adjustable deadband.
 - 6) Concealed **OR** Exposed, **as directed**, set point.
 - 7) Concealed **OR** Exposed, **as directed**, indication.
 - 8) Degree F **OR** Degree C, **as directed**, indication.
 - c. Wall-mounting **OR** Unit-mounted, **as directed**, humidistat.
 - 1) Concealed **OR** Exposed, **as directed**, set point.
 - 2) Concealed **OR** Exposed, **as directed**, indication.
 - d. Wall-mounting **OR** Unit-mounted, **as directed**, temperature sensor.
 - e. Unoccupied-period-override push button.
 - f. Data entry and access port.
 - 1) Input data includes room temperature, and humidity set points and occupied and unoccupied periods.



- 2) Output data includes room temperature and humidity, supply-air temperature, entering-water temperature, operating mode, and status.
17. DDC, **as directed**, Terminal Controller:
- a. Scheduled Operation: Occupied and unoccupied periods on seven-day clock with a minimum of four programmable periods per day.
 - b. Unoccupied Period Override Operation: Two, **as directed**, hours.
 - c. Unit Supply-Air Fan Operation:
 - 1) Occupied Periods: Fan runs continuously.
 - 2) Unoccupied Periods: Fan cycles to maintain room setback temperature.
 - d. Hydronic-Cooling-Coil Operation:
 - 1) Occupied Periods: Open **OR** Modulate, **as directed**, control valve to maintain room temperature.
 - 2) Unoccupied Periods: Close control valve.
 - e. Refrigerant-Coil Operation:
 - 1) Occupied Periods: Start compressor to maintain room temperature or humidistat set point.
 - 2) Unoccupied Periods: Stop compressor cooling and cycle compressor for heating to maintain setback temperature.
 - f. Supplemental, **as directed**, Heating-Coil Operation:
 - 1) Occupied Periods: Open control valve **OR** Modulate control valve **OR** Energize electric-resistance coil, **as directed**, to provide heating if room temperature falls below thermostat set point.
 - 2) Unoccupied Periods: Start fan and open control valve **OR** modulate control valve **OR** energize electric-resistance coil, **as directed**, if room temperature falls below setback temperature.
 - 3) Switch refrigerant-reversing valve to operate supplemental coil for heating when outdoor temperature is below 25 deg F (4 deg C).
 - g. Dual-Temperature Hydronic-Coil Operation:
 - 1) Occupied Periods: When chilled water is available, open **OR** modulate, **as directed**, control valve if room temperature exceeds thermostat set point. When hot water is available, open **OR** modulate, **as directed**, control valve if temperature falls below thermostat set point.
 - 2) Unoccupied Periods: When chilled water is available, close valve. When hot water is available, open **OR** modulate, **as directed**, control valve if room temperature falls below thermostat setback temperature.
 - h. Reheat-Coil Operation:
 - 1) Humidity Control for Occupied Periods: Humidistat opens control valve **OR** modulates control valve **OR** energizes electric-resistance coil, **as directed**, to provide heating. As room temperature rises above the set point, cooling coil valve opens **OR** modulates, **as directed**, to maintain room temperature.
 - 2) Humidity Control for Unoccupied Periods: Close control valve **OR** De-energize, **as directed**.
 - 3) Occupied Periods:
 - a) Heating Operations: Open control valve **OR** Modulate control valve **OR** Energize electric-resistance coil, **as directed**, to provide heating if room temperature falls below thermostat set point.
 - b) Humidity-Control Operations: Humidistat opens control valve **OR** modulates control valve **OR** energizes electric-resistance coil, **as directed**, to provide heating. As room temperature rises above the set point, cooling coil valve opens **OR** modulates, **as directed**, to maintain room temperature.
 - 4) Unoccupied Periods: Start fan and open control valve **OR** modulate control valve **OR** energize electric-resistance coil, **as directed**, if room temperature falls below setback temperature. Humidity control is not available.
 - i. Outdoor-Air Damper Operation (for fixed, minimum outdoor-air intake):
 - 1) Occupied Periods: Open damper to fixed position for 25 percent outdoor air.



- 2) Unoccupied Periods: Close damper.
 - j. Outdoor-Air Damper Operation (for outdoor-air economizer cycle based on temperature):
 - 1) Occupied Periods:
 - a) Outdoor-Air Temperature below Room Temperature: If room temperature is above room-temperature set point, modulate outdoor- and return-air dampers to maintain room-temperature set point (outdoor-air economizer). If room temperature is below set point, position damper to fixed minimum setting.
 - b) Outdoor-Air Temperature above Room Temperature: Position damper to fixed minimum position for 25 percent outdoor air.
 - 2) Unoccupied Periods: Close outdoor-air damper and open return-air damper.
 - k. Outdoor-Air Damper Operation (for outdoor-air economizer cycle based on enthalpy):
 - 1) Occupied Periods:
 - a) Outdoor-Air Enthalpy below Room Enthalpy: If room temperature is above room-temperature set point, modulate outdoor-air damper to maintain room temperature (outdoor-air economizer). If room temperature is below set point, position damper to fixed minimum position for 25 percent outdoor air.
 - b) Outdoor-Air Enthalpy above Room Enthalpy: Position damper to fixed minimum position for 25 percent outdoor air.
 - 2) Unoccupied Periods: Close outdoor-air damper and open return-air damper.
 - l. Controller shall have volatile-memory backup.
18. BAS Interface Requirements:
- a. Interface relay for scheduled operation.
 - b. Interface relay to provide indication of fault at the central workstation.
 - c. Provide BACnet **OR** LonWorks, **as directed**, interface for central BAS workstation for the following functions:
 - 1) Adjust set points.
 - 2) Fan-coil-unit start, stop, and operating status.
 - 3) Data inquiry including outdoor-air damper position,, **as directed** supply- and room-air temperature and humidity, **as directed**.
 - 4) Occupied and unoccupied schedules.
19. Electrical Connection: Factory wire motors and controls for a single electrical connection.

1.3 EXECUTION

A. Installation

- 1. Install fan-coil units level and plumb.
- 2. Install fan-coil units to comply with NFPA 90A.
- 3. Suspend fan-coil units from structure with elastomeric hangers. Vibration isolators are specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
- 4. Verify locations of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation. Install devices 48 inches (1220 mm) **OR** 60 inches (1525 mm), **as directed**, above finished floor.
- 5. Install new filters in each fan-coil unit within two weeks after Final Completion.

B. Connections

- 1. Piping installation requirements are specified in other Division 21. Drawings indicate general arrangement of piping, fittings, and specialties. Specific connection requirements are as follows:
 - a. Install piping adjacent to machine to allow service and maintenance.
 - b. Connect piping to fan-coil-unit factory hydronic piping package. Install piping package if shipped loose.
 - c. Connect condensate drain to indirect waste.
 - 1) Install condensate trap of adequate depth to seal against the pressure of fan. Install cleanouts in piping at changes of direction.



2. Connect supply and return ducts to fan-coil units with flexible duct connectors specified in Division 23 Section "Air Duct Accessories". Comply with safety requirements in UL 1995 for duct connections.
3. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
4. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

C. Field Quality Control

1. Perform the following field tests and inspections and prepare test reports:
 - a. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - b. Operate electric heating elements through each stage to verify proper operation and electrical connections.
 - c. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.
2. Remove and replace malfunctioning units and retest as specified above.

D. Adjusting

1. Adjust initial temperature and humidity set points.
2. Occupancy Adjustments: When requested within 12 months of date of Final Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

E. Demonstration

1. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fan-coil units.

END OF SECTION 23 64 16 16



23 - Heating, Ventilating, And Air-Conditioning (HVAC)

Task	Specification	Specification Description
23 64 16 16	23 61 16 00	Centrifugal Water Chillers



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SECTION 23 64 19 00 - RECIPROCATING WATER CHILLERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for reciprocating water chillers. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Packaged, water-cooled, electric-motor-driven, reciprocating water chillers.
 - b. Packaged, air-cooled, electric-motor-driven, reciprocating water chillers.
 - c. Packaged refrigerant recovery units.

C. Definitions

1. COP: Coefficient of performance. The ratio of the rate of heat removal to the rate of energy input using consistent units for any given set of rating conditions.
2. EER: Energy-efficiency ratio. The ratio of the cooling capacity given in terms of Btu/h to the total power input given in terms of watts at any given set of rating conditions.
3. IPLV: Integrated part-load value. A single number part-load efficiency figure of merit calculated per the method defined by ARI 550/590 and referenced to ARI standard rating conditions.
4. kW/Ton: The ratio of total power input of the chiller in kilowatts to the net refrigerating capacity in tons at any given set of rating conditions.
5. NPLV: Nonstandard part-load value. A single number part-load efficiency figure of merit calculated per the method defined by ARI 550/590 and intended for operating conditions other than the ARI standard rating conditions.

D. Performance Requirements

1. Seismic Performance: Reciprocating water chillers shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

E. Submittals

1. Product Data: Include refrigerant, rated capacities, operating characteristics, furnished specialties, and accessories.
2. Seismic Qualification Certificates: For water chillers, accessories, and components, from manufacturer.
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
3. Source quality-control test reports.
4. Startup service reports.
5. Operation and maintenance data.
6. Warranty: Sample of special warranty.

F. Quality Assurance

1. ARI Certification: Certify chiller according to ARI 590 certification program.



2. ARI Rating: Rate water chiller performance according to requirements in ARI 550/590, "Water Chilling Packages Using the Vapor Compression Cycle."
3. ASHRAE Compliance: ASHRAE 15 for safety code for mechanical refrigeration.
4. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
5. ASME Compliance: Fabricate and stamp water chiller heat exchangers to comply with ASME Boiler and Pressure Vessel Code.
6. Comply with NFPA 70.

G. Delivery, Storage, And Handling

1. Ship water chillers from the factory fully charged with refrigerant and filled with oil.
2. Package water chiller for export shipping.

H. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of water chillers that fail in materials or workmanship within five years from date of Final Completion.

1.2 PRODUCTS

A. Packaged Water-Cooled Water Chillers

1. Description: Factory-assembled and run-tested water chiller complete with compressor(s), compressor motors and motor controllers, evaporator, condenser where indicated, electrical power, controls, and indicated accessories.
2. Fabricate water chiller mounting base with reinforcement strong enough to resist water chiller movement during a seismic event when water chiller is anchored to field support structure.
3. Compressors:
 - a. Description: Positive-displacement direct drive with semihermetically sealed and accessible bolted casings.
 - b. Each compressor provided with suction and discharge service valves, crankcase oil heater, and suction strainer.
 - c. Operating Speed: 1750 rpm for 60-Hz applications.
 - d. Capacity Control: Combinations of cylinder unloading and on-off compressor cycling of multiple compressors, **as directed**, plus hot-gas bypass, **as directed**. Compressor shall be capable of operating at part-load conditions without increased vibration over normal vibration at full-load operation and shall be capable of continuous operation at its lowest step of unloading.
 - e. Oil Lubrication System: Automatically reversible, positive-displacement pump with strainer, sight glass, filling connection, filter with magnetic plug, and initial oil charge.
 - f. Vibration Isolation: Mount individual compressors on either neoprene or spring isolators.
 - g. Sound-reduction package shall consist of acoustic enclosures around the compressors that are designed to reduce sound level without affecting performance.
4. Compressor Motors:
 - a. Hermetically sealed and cooled by refrigerant suction gas.
 - b. High-torque, four-pole induction type with inherent thermal-overload protection on each phase.
5. Compressor Motor Controllers:
 - a. Across the Line: NEMA ICS 2, Class A, full voltage, nonreversing.
OR
Part-Wind Start: NEMA ICS 2, Class A, reduced voltage, nonreversing.
6. Refrigeration:
 - a. Refrigerant: R-407C **OR** R-410A, **as directed**. Classified as Safety Group A1 according to ASHRAE 34.



- b. Refrigerant Compatibility: Parts exposed to refrigerants shall be fully compatible with refrigerants, and pressure components shall be rated for refrigerant pressures.
 - c. Refrigerant Circuit: Each circuit shall include a thermal **OR** an electronic, **as directed**, expansion valve, refrigerant charging connections, a hot-gas muffler, compressor suction and discharge shutoff valves, a liquid-line shutoff valve, a replaceable-core filter-dryer, a sight glass with moisture indicator, a liquid-line solenoid valve, and an insulated suction line.
 - d. Refrigerant Isolation: Factory install positive shutoff isolation valves in the compressor discharge line and the refrigerant liquid-line to allow the isolation and storage of the refrigerant charge in the chiller condenser.
7. Evaporator:
- a. Brazed-plate or shell-and-tube design, as indicated.
 - b. Shell and Tube:
 - 1) Description: Direct-expansion, shell-and-tube design with fluid flowing through the shell and refrigerant flowing through the tubes within the shell.
 - 2) Code Compliance: Tested and stamped according to ASME Boiler and Pressure Vessel Code.
 - 3) Shell Material: Carbon steel.
 - 4) Shell Heads: Removable carbon-steel heads with multipass baffles designed to ensure positive oil return and located at each end of the tube bundle.
 - 5) Shell Nozzles: Fluid nozzles located along the side of the shell and terminated with mechanical-coupling end connections for connection to field piping.
 - 6) Tube Construction: Individually replaceable copper tubes with enhanced fin design, expanded into tube sheets.
 - c. Brazed Plate:
 - 1) Direct-expansion, single-pass, brazed-plate design.
 - 2) Type 316 stainless-steel construction.
 - 3) Code Compliance: Tested and stamped according to ASME Boiler and Pressure Vessel Code.
 - 4) Fluid Nozzles: Terminate with mechanical-coupling end connections for connection to field piping.
8. Condenser:
- a. Shell and tube, brazed plate, or without integral condenser; as indicated.
 - b. Shell and Tube:
 - 1) Description: Shell-and-tube design with refrigerant flowing through the shell and fluid flowing through the tubes within the shell.
 - 2) Provides positive subcooling of liquid refrigerant.
 - 3) Code Compliance: Tested and stamped according to ASME Boiler and Pressure Vessel Code.
 - 4) Shell Material: Carbon steel.
 - 5) Water Boxes: Removable, of carbon-steel construction, located at each end of the tube bundle with fluid nozzles terminated with mechanical-coupling end connections for connection to field piping.
 - 6) Tube Construction: Individually replaceable copper tubes with enhanced fin design, expanded into tube sheets.
 - 7) Provide each condenser with a pressure relief device, purge cock, and liquid-line shutoff valve.
 - c. Brazed Plate:
 - 1) Single-pass, brazed-plate design provides positive subcooling of liquid refrigerant.
 - 2) Type 316 stainless-steel construction.
 - 3) Code Compliance: Tested and stamped according to ASME Boiler and Pressure Vessel Code.
 - 4) Fluid Nozzles: Terminate with mechanical-coupling end connections for connection to field piping.
 - 5) Provide each condenser with a liquid-line shutoff valve.



- d. Provide water chiller without an integral condenser and design chiller for field connection to remote condenser. Coordinate requirements with Division 23 Section "Air-cooled Refrigerant Condensers".
9. Electrical Power:
- a. Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to water chiller.
 - b. House in a unit-mounted, NEMA 250, Type 1, **as directed**, enclosure with hinged access door with lock and key or padlock and key.
 - c. Wiring shall be numbered and color-coded to match wiring diagram.
 - d. Install factory wiring outside of an enclosure in a raceway.
 - e. Field power interface shall be to wire lugs **OR** NEMA KS 1, heavy-duty, nonfused disconnect switch, **as directed**.
 - f. Provide branch power circuit to each motor and to controls with one of the following disconnecting means:
 - 1) NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 60947-4-1.
 - 2) NEMA KS 1, heavy-duty, nonfusible switch.
 - 3) NEMA AB 1, motor-circuit protector (circuit breaker) with field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
 - g. Provide each motor with overcurrent protection.
 - h. Overload relay sized according to UL 1995, or an integral component of water chiller control microprocessor.
 - i. Phase-Failure and Undervoltage: Solid-state sensing with adjustable settings.
 - j. Controls Transformer: Unit-mounted transformer with primary and secondary fuses and sized with enough capacity to operate electrical load plus spare capacity.
 - k. Control Relays: Auxiliary and adjustable time-delay relays.
 - l. Indicate the following for water chiller electrical power supply:
 - 1) Current, phase to phase, for all three phases.
 - 2) Voltage, phase to phase and phase to neutral for all three phases.
 - 3) Three-phase real power (kilowatts).
 - 4) Three-phase reactive power (kilovolt amperes reactive).
 - 5) Power factor.
 - 6) Running log of total power versus time (kilowatt hours).
 - 7) Fault log, with time and date of each.
10. Controls:
- a. Stand-alone, microprocessor based.
 - b. Enclosure: Share enclosure with electrical power devices or provide a separate enclosure of matching construction.
 - c. Operator Interface: Keypad or pressure-sensitive touch screen. Multiple-character, backlit, liquid-crystal display or light-emitting diodes. Display the following:
 - 1) Date and time.
 - 2) Operating or alarm status.
 - 3) Operating hours.
 - 4) Outside-air temperature if required for chilled-water reset.
 - 5) Temperature and pressure of operating set points.
 - 6) Entering and leaving temperatures of chilled water.
 - 7) Entering and leaving temperatures of condenser water.
 - 8) Refrigerant pressures in evaporator and condenser.
 - 9) Saturation temperature in evaporator and condenser.
 - 10) No cooling load condition.
 - 11) Elapsed time meter (compressor run status).
 - 12) Pump status.
 - 13) Antirecycling timer status.
 - 14) Percent of maximum motor amperage.
 - 15) Current-limit set point.



- 16) Number of compressor starts.
 - d. Control Functions:
 - 1) Manual or automatic startup and shutdown time schedule.
 - 2) Entering and leaving chilled-water temperatures, control set points, and motor load limit. Chilled-water leaving temperature shall be reset based on return-water **OR** outside-air **OR** space, **as directed**, temperature.
 - 3) Current limit and demand limit.
 - 4) Condenser-water temperature.
 - 5) External water chiller emergency stop.
 - 6) Antirecycling timer.
 - 7) Automatic lead-lag switching.
 - e. Manual-Reset Safety Controls: The following conditions shall shut down water chiller and require manual reset:
 - 1) Low evaporator pressure or high condenser pressure.
 - 2) Low chilled-water temperature.
 - 3) Refrigerant high pressure.
 - 4) High or low oil pressure.
 - 5) High oil temperature.
 - 6) Loss of chilled-water flow.
 - 7) Loss of condenser-water flow.
 - 8) Control device failure.
 - f. Building Automation System Interface: Factory-installed hardware and software to enable building automation system to monitor, control, and display water chiller status and alarms.
 - 1) Hardwired Points:
 - a) Monitoring: On/off status, common trouble alarm **OR** electrical power demand (kilowatts) **OR** electrical power consumption (kilowatt hours), **as directed**.
 - b) Control: On/off operation, chilled-water discharge temperature set-point adjustment **OR** electrical power demand limit, **as directed**.
 - 2) ASHRAE 135 (BACnet) **OR** LonTalk **OR** Industry-accepted open-protocol, **as directed**, communication interface with building automation system shall enable building automation system operator to control and monitor the water chiller from a remote operator workstation. Control features and monitoring points displayed locally at water chiller control panel shall be available through building automation system.
11. Insulation:
- a. Material: Closed-cell, flexible elastomeric, thermal insulation complying with ASTM C 534, Type I, for tubular materials and Type II, for sheet materials.
 - b. Thickness: 3/4 inch (19 mm).
 - c. Factory-applied insulation over cold surfaces of water chiller components.
 - 1) Adhesive: As recommended by insulation manufacturer and applied to 100 percent of insulation contact surface. Seal seams and joints.
 - d. Apply protective coating to exposed surfaces of insulation.
12. Accessories:
- a. Factory-furnished, chilled-water and condenser-water, **as directed**, flow switches for field installation.
 - b. Individual compressor suction and discharge pressure gages with shutoff valves.
 - c. Factory-furnished spring isolators for field installation.
- B. Packaged Air-Cooled Water Chillers
- 1. Description: Factory-assembled and run-tested water chiller complete with base and frame, condenser casing, compressors, compressor motors and motor controllers, evaporator, condenser coils, condenser fans and motors, electrical power, controls, and accessories.
 - 2. Fabricate base, frame, and attachment to water chiller components strong enough to resist movement during a seismic event when water chiller base is anchored to field support structure.
 - 3. Cabinet:



- a. Base: Galvanized-steel base extending the perimeter of water chiller. Secure frame, compressors, and evaporator to base to provide a single-piece unit. Base shall be designed to limit deflection to L/200 and shall be a minimum of 4 inches (100 mm) high.
 - b. Frame: Rigid galvanized-steel frame secured to base and designed to support cabinet, condenser, control panel, and other chiller components not directly supported from base.
 - c. Casing: Galvanized steel.
 - d. Finish: Coat base, frame, and casing with a corrosion-resistant coating capable of withstanding a 500-hour salt-spray test according to ASTM B 117.
 - e. Sound-reduction package consisting of the following:
 - 1) Acoustic enclosure around compressors.
 - 2) Reduced-speed fans with acoustic treatment.
 - 3) Designed to reduce sound level without affecting performance.
 - f. Security Package: Provide security grilles with fasteners for additional protection of compressors, evaporator, and condenser coils. Grilles shall be coated for corrosion resistance and shall be removable for service access.
4. Compressors:
- a. Description: Positive-displacement direct drive with semihermetically sealed and accessible bolted casings.
 - b. Each compressor provided with suction and discharge service valves, crankcase oil heater, and suction strainer.
 - c. Operating Speed: 1750 rpm for 60-Hz applications.
 - d. Capacity Control: Combinations of cylinder unloading and on-off compressor cycling of multiple compressors, plus hot-gas bypass, **as directed**. Compressor shall be capable of operating at part-load conditions without increased vibration over normal vibration at full-load operation and shall be capable of continuous operation at its lowest step of unloading.
 - e. Oil Lubrication System: Automatically reversible, positive-displacement pump with strainer, sight glass, filling connection, filter with magnetic plug, and initial oil charge.
 - f. Vibration Isolation: Mount individual compressors on spring isolators with an isolation efficiency of 95 percent.
5. Compressor Motors:
- a. Hermetically sealed and cooled by refrigerant suction gas.
 - b. High-torque, four-pole induction type with inherent thermal-overload protection on each phase.
6. Compressor Motor Controllers:
- a. Across the Line: NEMA ICS 2, Class A, full voltage, nonreversing.
OR
Part-Wind Start: NEMA ICS 2, Class A, reduced voltage, nonreversing.
7. Refrigeration:
- a. Refrigerant: R-407C **OR** R-410A, **as directed**. Classified as Safety Group A1 according to ASHRAE 34.
 - b. Refrigerant Compatibility: Parts exposed to refrigerants shall be fully compatible with refrigerants, and pressure components shall be rated for refrigerant pressures.
 - c. Refrigerant Circuit: Each circuit shall include a thermal **OR** an electronic, **as directed**, expansion valve, refrigerant charging connections, a hot-gas muffler, compressor suction and discharge shutoff valves, a liquid-line shutoff valve, a replaceable-core filter-dryer, a sight glass with moisture indicator, a liquid-line solenoid valve, and an insulated suction line.
 - d. Refrigerant Isolation: Factory install positive shutoff isolation valves in the compressor discharge line and the refrigerant liquid-line to allow the isolation and storage of the refrigerant charge in the chiller condenser.
8. Evaporator:
- a. Description: Direct-expansion shell-and-tube design with fluid flowing through the shell and refrigerant flowing through the tubes within the shell.
 - b. Code Compliance: Tested and stamped according to ASME Boiler and Pressure Vessel Code.



- c. Shell Material: Carbon steel.
 - d. Shell Heads: Removable carbon-steel heads with multipass baffles designed to ensure positive oil return and located at each end of the tube bundle.
 - e. Shell Nozzles: Fluid nozzles located along the side of the shell and terminated with mechanical-coupling end connections for connection to field piping.
 - f. Tube Construction: Individually replaceable copper tubes with enhanced fin design, expanded into tube sheets.
 - g. Heater: Factory-installed and -wired electric heater with integral controls designed to protect the evaporator to minus 20 deg F (minus 29 deg C).
 - h. Remote Mounting: Designed for remote field mounting where indicated. Provide kit for field installation.
9. Air-Cooled Condenser:
- a. Plate-fin coil with integral subcooling circuit, leak tested at 150 psig (1034 kPa).
 - 1) Construct coils of copper tubes mechanically bonded to aluminum **OR** aluminum with precoated epoxy-phenolic **OR** copper, **as directed**, fins.
 - 2) Coat coils with a baked epoxy corrosion-resistant coating after fabrication.
 - 3) Hail Protection: Provide condenser coils with louvers, baffles, or hoods to protect against hail damage.
 - b. Fans: Direct-drive propeller type with statically and dynamically balanced fan blades, arranged for vertical air discharge.
 - c. Fan Motors: Totally enclosed air over (TEAO) enclosure, with permanently lubricated bearings, and having built-in overcurrent- and thermal-overload protection.
 - d. Fan Guards: Steel safety guards with corrosion-resistant coating.
10. Electrical Power:
- a. Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to water chiller.
 - b. House in a unit-mounted, NEMA 250, Type 3R **OR** Type 4, **as directed**, enclosure with hinged access door with lock and key or padlock and key.
 - c. Wiring shall be numbered and color-coded to match wiring diagram.
 - d. Install factory wiring outside of an enclosure in a raceway.
 - e. Field power interface shall be to wire lugs **OR** NEMA KS 1, heavy-duty, nonfused disconnect switch, **as directed**.
 - f. Provide branch power circuit to each motor and to controls with one of the following disconnecting means:
 - 1) NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 60947-4-1.
 - 2) NEMA KS 1, heavy-duty, nonfusible switch.
 - 3) NEMA AB 1, motor-circuit protector (circuit breaker) with field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
 - g. Provide each motor with overcurrent protection.
 - h. Overload relay sized according to UL 1995, or an integral component of water chiller control microprocessor.
 - i. Phase-Failure and Undervoltage: Solid-state sensing with adjustable settings.
 - j. Transformer: Unit-mounted transformer with primary and secondary fuses and sized with enough capacity to operate electrical load plus spare capacity.
 - 1) Power unit-mounted controls where indicated.
 - 2) Power unit-mounted, ground-fault interrupt (GFI) duplex receptacle.
 - k. Control Relays: Auxiliary and adjustable time-delay relays.
 - l. Indicate the following for water chiller electrical power supply:
 - 1) Current, phase to phase, for all three phases.
 - 2) Voltage, phase to phase and phase to neutral for all three phases.
 - 3) Three-phase real power (kilowatts).
 - 4) Three-phase reactive power (kilovolt amperes reactive).
 - 5) Power factor.
 - 6) Running log of total power versus time (kilowatt hours).
 - 7) Fault log, with time and date of each.



11. Controls:
- a. Stand-alone, microprocessor based.
 - b. Enclosure: Share enclosure with electrical power devices or provide a separate enclosure of matching construction.
 - c. Operator Interface: Keypad or pressure-sensitive touch screen. Multiple-character, backlit, liquid-crystal display or light-emitting diodes. Display the following:
 - 1) Date and time.
 - 2) Operating or alarm status.
 - 3) Operating hours.
 - 4) Outside-air temperature if required for chilled-water reset.
 - 5) Temperature and pressure of operating set points.
 - 6) Entering and leaving temperatures of chilled water.
 - 7) Refrigerant pressures in evaporator and condenser.
 - 8) Saturation temperature in evaporator and condenser.
 - 9) No cooling load condition.
 - 10) Elapsed time meter (compressor run status).
 - 11) Pump status.
 - 12) Antirecycling timer status.
 - 13) Percent of maximum motor amperage.
 - 14) Current-limit set point.
 - 15) Number of compressor starts.
 - d. Control Functions:
 - 1) Manual or automatic startup and shutdown time schedule.
 - 2) Entering and leaving chilled-water temperature, control set points, and motor load limit. Chilled-water leaving temperature shall be reset based on return-water **OR** outside-air **OR** space, **as directed**, temperature.
 - 3) Current limit and demand limit.
 - 4) External water chiller emergency stop.
 - 5) Antirecycling timer.
 - 6) Automatic lead-lag switching.
 - e. Manual-Reset Safety Controls: The following conditions shall shut down water chiller and require manual reset:
 - 1) Low evaporator pressure or high condenser pressure.
 - 2) Low chilled-water temperature.
 - 3) Refrigerant high pressure.
 - 4) High or low oil pressure.
 - 5) High oil temperature.
 - 6) Loss of chilled-water flow.
 - 7) Control device failure.
 - f. Building Automation System Interface: Factory-installed hardware and software to enable building automation system to monitor, control, and display water chiller status and alarms.
 - 1) Hardwired Points:
 - a) Monitoring: On/off status, common trouble alarm **OR** electrical power demand (kilowatts) **OR** electrical power consumption (kilowatt hours), **as directed**.
 - b) Control: On/off operation, chilled-water discharge temperature set-point adjustment **OR** electrical power demand limit, **as directed**.
 - 2) ASHRAE 135 (BACnet) **OR** LonTalk **OR** Industry-accepted open-protocol, **as directed**, communication interface with building automation system shall enable building automation system operator to control and monitor the water chiller from a remote operator workstation. Control features and monitoring points displayed locally at water chiller control panel shall be available through building automation system.

12. Insulation:



- a. Material: Closed-cell, flexible elastomeric, thermal insulation complying with ASTM C 534, Type I, for tubular materials and Type II, for sheet materials.
 - b. Thickness: 3/4 inch (19 mm).
 - c. Factory-applied insulation over cold surfaces of water chiller components.
 - 1) Adhesive: As recommended by insulation manufacturer and applied to 100 percent of insulation contact surface. Seal seams and joints.
 - d. Apply protective coating to exposed surfaces of insulation.
13. Accessories:
- a. Factory-furnished, chilled-water and condenser-water, **as directed**, flow switches for field installation.
 - b. Individual compressor suction and discharge pressure gages with shutoff valves.
 - c. Factory-furnished spring isolators for field installation.

C. Packaged Refrigerant Recovery Units

1. Packaged portable unit shall consist of compressor, air-cooled condenser, recovery system, tank pressure gages, filter-dryer, and valving that allows for switching between liquid and vapor recovery mode. Refrigerant recovery unit shall be factory mounted on an ASME-constructed and -stamped refrigerant storage vessel that is sized to hold the full refrigerant charge of the largest water chiller.

D. Source Quality Control

1. Perform functional test of water chillers before shipping.
2. Factory performance test water chillers, **as directed**, before shipping, according to ARI 550/590, "Water Chilling Packages Using the Vapor Compression Cycle."
 - a. Allow the Owner access to place where water chillers are being tested. Notify the Owner 14 days in advance of testing.
3. Factory test and inspect evaporator and water-cooled condenser, **as directed**, according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1. Stamp with ASME label.
4. For water chillers located indoors, rate sound power level according to ARI 575 procedure.
5. For water chillers located outdoors, rate sound power level according to ARI 370 procedure.

1.3 EXECUTION

A. Water Chiller Installation

1. Install water chillers on support structure indicated.
2. Equipment Mounting: Install water chiller on concrete bases using elastomeric pads **OR** elastomeric mounts **OR** restrained spring isolators, **as directed**. Comply with requirements in Division 03 Section "Cast-in-place Concrete". Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 - a. Minimum Deflection: 1/4 inch (6 mm) **OR** 1 inch (25 mm), **as directed**.
 - b. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - c. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - d. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - e. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Equipment Mounting: Install water chiller using elastomeric pads **OR** elastomeric mounts **OR** restrained spring isolators, **as directed**. Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 - a. Minimum Deflection: 1/4 inch (6 mm) **OR** 1 inch (25 mm), **as directed**.



4. Equipment Mounting: Install water chiller on vibration isolation inertia bases. Comply with requirements specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 5. Equipment Mounting: Install water chiller on concrete bases. Comply with requirements in Division 03 Section "Cast-in-place Concrete".
 - a. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - b. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - d. Install anchor bolts to elevations required for proper attachment to supported equipment.
 6. Maintain manufacturer's recommended clearances for service and maintenance.
 7. Charge water chiller with refrigerant if not factory charged and fill with oil if not factory installed.
 8. Install separate devices furnished by manufacturer and not factory installed.
- B. Connections
1. Comply with requirements in Division 23 Section "Hydronic Piping". Drawings indicate general arrangement of piping, fittings, and specialties.
 2. Comply with requirements in Division 23 Section "Refrigerant Piping". Drawings indicate general arrangement of piping, fittings, and specialties.
 3. Install piping adjacent to chiller to allow service and maintenance.
 4. Evaporator Fluid Connections: Connect to evaporator inlet with shutoff valve, strainer, **as directed**, flexible connector, **as directed**, thermometer, and plugged tee with pressure gage. Connect to evaporator outlet with shutoff valve, balancing valve, flexible connector, **as directed**, flow switch, thermometer, plugged tee with pressure gage, flow meter, **as directed**, and drain connection with valve. Make connections to water chiller with a union **OR** flange **OR** mechanical coupling, **as directed**.
 5. Condenser Fluid Connections: Connect to condenser inlet with shutoff valve, strainer, **as directed**, flexible connector, **as directed**, thermometer, and plugged tee with pressure gage. Connect to condenser outlet with shutoff valve, balancing valve, flexible connector, **as directed**, flow switch, thermometer, plugged tee with pressure gage, flow meter, **as directed**, and drain connection with valve. Make connections to water chiller with a union **OR** flange **OR** mechanical coupling, **as directed**.
 6. Refrigerant Pressure Relief Valve Connections: For water chillers installed indoors, extend vent piping to the outside without valves or restrictions. Comply with ASHRAE 15, **as directed**.
 7. Connect each drain connection with a union and drain pipe, and extend pipe, full size of connection, to floor drain. Provide a shutoff valve at each connection if required.
- C. Startup Service
1. Perform startup service.
 2. Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assemblies, installations, and connections.
 3. Complete installation and startup checks according to manufacturer's written instructions and perform the following:
 - a. Verify that refrigerant charge is sufficient and water chiller has been leak tested.
 - b. Verify that pumps are installed and functional.
 - c. Verify that thermometers and gages are installed.
 - d. Operate water chiller for run-in period.
 - e. Check bearing lubrication and oil levels.
 - f. Verify that refrigerant pressure relief for chillers installed indoors is vented outside.
 - g. Verify proper motor rotation.
 - h. Verify static deflection of vibration isolators, including deflection during water chiller startup and shutdown.



- i. Verify and record performance of chilled-water and condenser-water, **as directed**, flow and low-temperature interlocks.
 - j. Verify and record performance of water chiller protection devices.
 - k. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.
4. Prepare a written startup report that records results of tests and inspections.

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SECTION 23 64 23 00 - SCROLL WATER CHILLERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for scroll water chillers. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Packaged, water-cooled, electric-motor-driven, scroll water chillers.
 - b. Packaged, air-cooled, electric-motor-driven, scroll water chillers.
 - c. Packaged refrigerant recovery units.

C. Definitions

1. COP: Coefficient of performance. The ratio of the rate of heat removal to the rate of energy input using consistent units for any given set of rating conditions.
2. EER: Energy-efficiency ratio. The ratio of the cooling capacity given in terms of Btu/h to the total power input given in terms of watts at any given set of rating conditions.
3. IPLV: Integrated part-load value. A single number part-load efficiency figure of merit calculated per the method defined by ARI 550/590 and referenced to ARI standard rating conditions.
4. kW/Ton: The ratio of total power input of the chiller in kilowatts to the net refrigerating capacity in tons at any given set of rating conditions.
5. NPLV: Nonstandard part-load value. A single number part-load efficiency figure of merit calculated per the method defined by ARI 550/590 and intended for operating conditions other than the ARI standard rating conditions.

D. Performance Requirements

1. Seismic Performance: Scroll water chillers shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

E. Submittals

1. Product Data: Include refrigerant, rated capacities, operating characteristics, furnished specialties, and accessories.
2. LEED Submittal:
 - a. Product Data for Credit EA 4: Documentation required by Credit EA 4 indicating that equipment and refrigerants comply.
3. Certificates: For certification required in "Quality Assurance" Article.
4. Seismic Qualification Certificates: For water chillers, accessories, and components from manufacturers.
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
5. Startup service reports.
6. Operation and maintenance data.
7. Warranty: Sample of special warranty.



F. Quality Assurance

1. ARI Certification: Certify chiller according to ARI 590 certification program.
2. ARI Rating: Rate water chiller performance according to requirements in ARI 550/590, "Water Chilling Packages Using the Vapor Compression Cycle."
3. ASHRAE Compliance: ASHRAE 15 for safety code for mechanical refrigeration.
4. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
5. ASME Compliance: Fabricate and stamp water chiller heat exchangers to comply with ASME Boiler and Pressure Vessel Code.
6. Comply with NFPA 70.

G. Delivery, Storage, And Handling

1. Ship water chillers from the factory fully charged with refrigerant and filled with oil.
2. Package water chiller for export shipping.

H. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of water chillers that fail in materials or workmanship within five years from date of Final Completion.

1.2 PRODUCTS

A. Packaged Water-Cooled Water Chillers

1. Description: Factory-assembled and run-tested water chiller complete with compressor(s), compressor motors and motor controllers, evaporator, condenser where indicated, electrical power, controls, and indicated accessories.
2. Fabricate water chiller mounting base with reinforcement strong enough to resist water chiller movement during a seismic event when water chiller is anchored to field support structure.
3. Compressors:
 - a. Description: Positive-displacement direct drive with hermetically sealed casing.
 - b. Each compressor provided with suction and discharge service valves, crankcase oil heater, and suction strainer.
 - c. Operating Speed: Nominal 3600 rpm for 60-Hz applications.
 - d. Capacity Control: On-off compressor cycling, plus hot-gas bypass, **as directed**.
 - e. Oil Lubrication System: Automatic pump with strainer, sight glass, filling connection, filter with magnetic plug, and initial oil charge.
 - f. Vibration Isolation: Mount individual compressors on vibration isolators.
 - g. Sound-reduction package shall consist of acoustic enclosures around the compressors that are designed to reduce sound level without affecting performance.
4. Compressor Motors:
 - a. Hermetically sealed and cooled by refrigerant suction gas.
 - b. High-torque, two-pole induction type with inherent thermal-overload protection on each phase.
5. Compressor Motor Controllers:
 - a. Across the Line: NEMA ICS 2, Class A, full voltage, nonreversing.
6. Refrigeration:
 - a. Refrigerant: R-407C **OR** R-410A, **as directed**. Classified as Safety Group A1 according to ASHRAE 34.
 - b. Refrigerant Compatibility: Parts exposed to refrigerants shall be fully compatible with refrigerants, and pressure components shall be rated for refrigerant pressures.
 - c. Refrigerant Circuit: Each circuit shall include a thermal-expansion valve, refrigerant charging connections, a hot-gas muffler, compressor suction and discharge shutoff valves, a liquid-line shutoff valve, a replaceable-core filter-dryer, a sight glass with moisture indicator, a liquid-line solenoid valve, and an insulated suction line.



- d. Refrigerant Isolation: Factory install positive shutoff isolation valves in the compressor discharge line and the refrigerant liquid-line to allow the isolation and storage of the refrigerant charge in the chiller condenser.
- 7. Evaporator:
 - a. Brazed-plate or shell-and-tube design, as indicated.
 - b. Shell and Tube:
 - 1) Description: Direct-expansion, shell-and-tube design with fluid flowing through the shell and refrigerant flowing through the tubes within the shell.
 - 2) Code Compliance: Tested and stamped according to ASME Boiler and Pressure Vessel Code.
 - 3) Shell Material: Carbon steel.
 - 4) Shell Heads: Removable carbon-steel heads with multipass baffles designed to ensure positive oil return and located at each end of the tube bundle.
 - 5) Shell Nozzles: Fluid nozzles located along the side of the shell and terminated with mechanical-coupling end connections for connection to field piping.
 - 6) Tube Construction: Individually replaceable copper tubes with enhanced fin design, expanded into tube sheets.
 - c. Brazed Plate:
 - 1) Direct-expansion, single-pass, brazed-plate design.
 - 2) Type 316 stainless-steel construction.
 - 3) Code Compliance: Tested and stamped according to ASME Boiler and Pressure Vessel Code.
 - 4) Fluid Nozzles: Terminate with mechanical-coupling end connections for connection to field piping.
- 8. Condenser:
 - a. Shell and tube or without integral condenser; as indicated.
 - b. Shell and Tube:
 - 1) Description: Shell-and-tube design with refrigerant flowing through the shell and fluid flowing through the tubes within the shell.
 - 2) Provides positive subcooling of liquid refrigerant.
 - 3) Code Compliance: Tested and stamped according to ASME Boiler and Pressure Vessel Code.
 - 4) Shell Material: Carbon steel.
 - 5) Water Boxes: Removable, of carbon-steel construction, located at each end of the tube bundle with fluid nozzles terminated with mechanical-coupling end connections for connection to field piping.
 - 6) Tube Construction: Individually replaceable copper tubes with enhanced fin design, expanded into tube sheets.
 - 7) Provide each condenser with a pressure relief device, purge cock, and liquid-line shutoff valve.
 - c. Provide water chiller without an integral condenser and design chiller for field connection to remote condenser. Coordinate requirements with Division 23 Section "Air-cooled Refrigerant Condensers".
- 9. Electrical Power:
 - a. Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to water chiller.
 - b. House in a unit-mounted, NEMA 250, Type 1, **as directed**, enclosure with hinged access door with lock and key or padlock and key.
 - c. Wiring shall be numbered and color-coded to match wiring diagram.
 - d. Install factory wiring outside of an enclosure in a raceway.
 - e. Field power interface shall be to wire lugs **OR** NEMA KS 1, heavy-duty, nonfused disconnect switch, **as directed**.
 - f. Provide branch power circuit to each motor and to controls with one of the following disconnecting means:
 - 1) NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 60947-4-1.



- 2) NEMA KS 1, heavy-duty, nonfusible switch.
- 3) NEMA AB 1, motor-circuit protector (circuit breaker) with field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
- g. Provide each motor with overcurrent protection.
- h. Overload relay sized according to UL 1995, or an integral component of water chiller control microprocessor.
- i. Phase-Failure and Undervoltage: Solid-state sensing with adjustable settings.
- j. Controls Transformer: Unit-mounted transformer with primary and secondary fuses and sized with enough capacity to operate electrical load plus spare capacity.
- k. Control Relays: Auxiliary and adjustable time-delay relays.
- l. Indicate the following for water chiller electrical power supply:
 - 1) Current, phase to phase, for all three phases.
 - 2) Voltage, phase to phase and phase to neutral for all three phases.
 - 3) Three-phase real power (kilowatts).
 - 4) Three-phase reactive power (kilovolt amperes reactive).
 - 5) Power factor.
 - 6) Running log of total power versus time (kilowatt hours).
 - 7) Fault log, with time and date of each.
10. Controls:
 - a. Stand-alone, microprocessor based.
 - b. Enclosure: Share enclosure with electrical power devices or provide a separate enclosure of matching construction.
 - c. Operator Interface: Keypad or pressure-sensitive touch screen. Multiple-character, backlit, liquid-crystal display or light-emitting diodes. Display the following:
 - 1) Date and time.
 - 2) Operating or alarm status.
 - 3) Operating hours.
 - 4) Outside-air temperature if required for chilled-water reset.
 - 5) Temperature and pressure of operating set points.
 - 6) Entering and leaving temperatures of chilled water.
 - 7) Entering and leaving temperatures of condenser water.
 - 8) Refrigerant pressures in evaporator and condenser.
 - 9) Saturation temperature in evaporator and condenser.
 - 10) No cooling load condition.
 - 11) Elapsed time meter (compressor run status).
 - 12) Pump status.
 - 13) Antirecycling timer status.
 - 14) Percent of maximum motor amperage.
 - 15) Current-limit set point.
 - 16) Number of compressor starts.
 - d. Control Functions:
 - 1) Manual or automatic startup and shutdown time schedule.
 - 2) Entering and leaving chilled-water temperatures, control set points, and motor load limit. Chilled-water leaving temperature shall be reset based on return-water **OR** outside-air **OR** space, **as directed**, temperature.
 - 3) Current limit and demand limit.
 - 4) Condenser-water temperature.
 - 5) External water chiller emergency stop.
 - 6) Antirecycling timer.
 - 7) Automatic lead-lag switching.
 - e. Manual-Reset Safety Controls: The following conditions shall shut down water chiller and require manual reset:
 - 1) Low evaporator pressure or high condenser pressure.
 - 2) Low chilled-water temperature.
 - 3) Refrigerant high pressure.



- 4) High or low oil pressure.
- 5) High oil temperature.
- 6) Loss of chilled-water flow.
- 7) Loss of condenser-water flow.
- 8) Control device failure.
- f. Building Automation System Interface: Factory-installed hardware and software to enable building automation system to monitor, control, and display water chiller status and alarms.
 - 1) Hardwired Points:
 - a) Monitoring: On/off status, common trouble alarm **OR** electrical power demand (kilowatts) **OR** electrical power consumption (kilowatt hours), **as directed**.
 - b) Control: On/off operation, chilled-water discharge temperature set-point adjustment **OR** electrical power demand limit, **as directed**.
 - 2) ASHRAE 135 (BACnet) **OR** LonTalk **OR** Modbus **OR** Industry-accepted open-protocol, **as directed**, communication interface with building automation system shall enable building automation system operator to remotely control and monitor the water chiller from an operator workstation. Control features and monitoring points displayed locally at water chiller control panel shall be available through building automation system.
- 11. Insulation:
 - a. Material: Closed-cell, flexible elastomeric, thermal insulation complying with ASTM C 534, Type I, for tubular materials and Type II, for sheet materials.
 - b. Thickness: 3/4 inch (19 mm).
 - c. Factory-applied insulation over cold surfaces of water chiller components.
 - 1) Adhesive: As recommended by insulation manufacturer and applied to 100 percent of insulation contact surface. Seal seams and joints.
 - d. Apply protective coating to exposed surfaces of insulation.
- 12. Accessories:
 - a. Factory-furnished, chilled-water and condenser-water, **as directed**, flow switches for field installation.
 - b. Individual compressor suction and discharge pressure gages with shutoff valves for each refrigeration circuit.
 - c. Factory-furnished neoprene **OR** spring, **as directed**, isolators for field installation.
- B. Packaged Air-Cooled Water Chillers
 - 1. Description: Factory-assembled and run-tested water chiller complete with base and frame, condenser casing, compressors, compressor motors and motor controllers, evaporator, condenser coils, condenser fans and motors, electrical power, controls, and accessories.
 - 2. Fabricate base, frame, and attachment to water chiller components strong enough to resist movement during a seismic event when water chiller base is anchored to field support structure.
 - 3. Cabinet:
 - a. Base: Galvanized-steel base extending the perimeter of water chiller. Secure frame, compressors, and evaporator to base to provide a single-piece unit.
 - b. Frame: Rigid galvanized-steel frame secured to base and designed to support cabinet, condenser, control panel, and other chiller components not directly supported from base.
 - c. Casing: Galvanized steel.
 - d. Finish: Coat base, frame, and casing with a corrosion-resistant coating capable of withstanding a 500-hour salt-spray test according to ASTM B 117.
 - e. Sound-reduction package consisting of the following:
 - 1) Acoustic enclosure around compressors.
 - 2) Reduced-speed fans with acoustic treatment.
 - 3) Designed to reduce sound level without affecting performance.
 - f. Security Package: Provide security grilles with fasteners for additional protection of compressors, evaporator, and condenser coils. Grilles shall be coated for corrosion resistance and shall be removable for service access.
 - 4. Compressors:



- a. Description: Positive-displacement direct drive with hermetically sealed casing.
 - b. Each compressor provided with suction and discharge service valves, crankcase oil heater, and suction strainer.
 - c. Operating Speed: Nominal 3600 rpm for 60-Hz applications.
 - d. Capacity Control: On-off compressor cycling, plus hot-gas bypass, **as directed**.
 - e. Oil Lubrication System: Automatic pump with strainer, sight glass, filling connection, filter with magnetic plug, and initial oil charge.
 - f. Vibration Isolation: Mount individual compressors on vibration isolators.
5. Compressor Motors:
- a. Hermetically sealed and cooled by refrigerant suction gas.
 - b. High-torque, two-pole induction type with inherent thermal-overload protection on each phase.
6. Compressor Motor Controllers:
- a. Across the Line: NEMA ICS 2, Class A, full voltage, nonreversing.
7. Refrigeration:
- a. Refrigerant: R-407c **OR** R-410a, **as directed**. Classified as Safety Group A1 according to ASHRAE 34.
 - b. Refrigerant Compatibility: Parts exposed to refrigerants shall be fully compatible with refrigerants, and pressure components shall be rated for refrigerant pressures.
 - c. Refrigerant Circuit: Each circuit shall include a thermal-expansion valve, refrigerant charging connections, a hot-gas muffler, compressor suction and discharge shutoff valves, a liquid-line shutoff valve, a replaceable-core filter-dryer, a sight glass with moisture indicator, a liquid-line solenoid valve, and an insulated suction line.
 - d. Refrigerant Isolation: Factory install positive shutoff isolation valves in the compressor discharge line and the refrigerant liquid-line to allow the isolation and storage of the refrigerant charge in the chiller condenser.
8. Evaporator:
- a. Brazed-plate or shell-and-tube design, as indicated.
 - b. Shell and Tube:
 - 1) Description: Direct-expansion, shell-and-tube design with fluid flowing through the shell and refrigerant flowing through the tubes within the shell.
 - 2) Code Compliance: Tested and stamped according to ASME Boiler and Pressure Vessel Code.
 - 3) Shell Material: Carbon steel.
 - 4) Shell Heads: Removable carbon-steel heads with multipass baffles designed to ensure positive oil return and located at each end of the tube bundle.
 - 5) Shell Nozzles: Fluid nozzles located along the side of the shell and terminated with mechanical-coupling end connections for connection to field piping.
 - 6) Tube Construction: Individually replaceable copper tubes with enhanced fin design, expanded into tube sheets.
 - c. Brazed Plate:
 - 1) Direct-expansion, single-pass, brazed-plate design.
 - 2) Type 316 stainless-steel construction.
 - 3) Code Compliance: Tested and stamped according to ASME Boiler and Pressure Vessel Code.
 - 4) Fluid Nozzles: Terminate with mechanical-coupling end connections for connection to field piping.
 - d. Heater: Factory-installed and -wired electric heater with integral controls designed to protect the evaporator to minus 20 deg F (minus 29 deg C).
 - e. Remote Mounting: Designed for remote field mounting where indicated. Provide kit for field installation.
9. Air-Cooled Condenser:
- a. Plate-fin coil with integral subcooling on each circuit, rated at 450 psig (3103 kPa).
 - 1) Construct coils of copper tubes mechanically bonded to aluminum **OR** aluminum with precoated epoxy-phenolic **OR** copper, **as directed**, fins.



- 2) Coat coils with a baked epoxy corrosion-resistant coating after fabrication.
 - 3) Hail Protection: Provide condenser coils with louvers, baffles, or hoods to protect against hail damage.
 - b. Fans: Direct-drive propeller type with statically and dynamically balanced fan blades, arranged for vertical air discharge.
 - c. Fan Motors: Totally enclosed nonventilating (TENV) or totally enclosed air over (TEAO) enclosure, with permanently lubricated bearings, and having built-in overcurrent- and thermal-overload protection.
 - d. Fan Guards: Steel safety guards with corrosion-resistant coating.
10. Electrical Power:
- a. Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to water chiller.
 - b. House in a unit-mounted, NEMA 250, Type 3R, **as directed**, enclosure with hinged access door with lock and key or padlock and key.
 - c. Wiring shall be numbered and color-coded to match wiring diagram.
 - d. Install factory wiring outside of an enclosure in a raceway.
 - e. Field power interface shall be to wire lugs **OR** NEMA KS 1, heavy-duty, nonfused disconnect switch, **as directed**.
 - f. Provide branch power circuit to each motor and to controls with one of the following disconnecting means:
 - 1) NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 60947-4-1.
 - 2) NEMA KS 1, heavy-duty, nonfusible switch.
 - 3) NEMA AB 1, motor-circuit protector (circuit breaker) with field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
 - g. Provide each motor with overcurrent protection.
 - h. Overload relay sized according to UL 1995, or an integral component of water chiller control microprocessor.
 - i. Phase-Failure and Undervoltage: Solid-state sensing with adjustable settings.
 - j. Provide power factor correction capacitors to correct power factor to 0.90 **OR** 0.95, **as directed**, at full load.
 - k. Transformer: Unit-mounted transformer with primary and secondary fuses and sized with enough capacity to operate electrical load plus spare capacity.
 - 1) Power unit-mounted controls where indicated.
 - 2) Power unit-mounted, ground fault interrupt (GFI) duplex receptacle.
 - l. Control Relays: Auxiliary and adjustable time-delay relays.
 - m. Indicate the following for water chiller electrical power supply:
 - 1) Current, phase to phase, for all three phases.
 - 2) Voltage, phase to phase and phase to neutral for all three phases.
 - 3) Three-phase real power (kilowatts).
 - 4) Three-phase reactive power (kilovolt amperes reactive).
 - 5) Power factor.
 - 6) Running log of total power versus time (kilowatt hours).
 - 7) Fault log, with time and date of each.
11. Controls:
- a. Stand-alone, microprocessor based.
 - b. Enclosure: Share enclosure with electrical power devices or provide a separate enclosure of matching construction.
 - c. Operator Interface: Keypad or pressure-sensitive touch screen. Multiple-character, backlit, liquid-crystal display or light-emitting diodes. Display the following:
 - 1) Date and time.
 - 2) Operating or alarm status.
 - 3) Operating hours.
 - 4) Outside-air temperature if required for chilled-water reset.
 - 5) Temperature and pressure of operating set points.
 - 6) Entering and leaving temperatures of chilled water.



- 7) Refrigerant pressures in evaporator and condenser.
 - 8) Saturation temperature in evaporator and condenser.
 - 9) No cooling load condition.
 - 10) Elapsed time meter (compressor run status).
 - 11) Pump status.
 - 12) Antirecycling timer status.
 - 13) Percent of maximum motor amperage.
 - 14) Current-limit set point.
 - 15) Number of compressor starts.
 - d. Control Functions:
 - 1) Manual or automatic startup and shutdown time schedule.
 - 2) Entering and leaving chilled-water temperatures, control set points, and motor load limit. Chilled-water leaving temperature shall be reset based on return-water **OR** outside-air **OR** space, **as directed**, temperature.
 - 3) Current limit and demand limit.
 - 4) External water chiller emergency stop.
 - 5) Antirecycling timer.
 - 6) Automatic lead-lag switching.
 - e. Manual-Reset Safety Controls: The following conditions shall shut down water chiller and require manual reset:
 - 1) Low evaporator pressure or high condenser pressure.
 - 2) Low chilled-water temperature.
 - 3) Refrigerant high pressure.
 - 4) High or low oil pressure.
 - 5) High oil temperature.
 - 6) Loss of chilled-water flow.
 - 7) Control device failure.
 - f. Building Automation System Interface: Factory-installed hardware and software to enable building automation system to monitor, control, and display water chiller status and alarms.
 - 1) Hardwired Points:
 - a) Monitoring: On/off status, common trouble alarm **OR** electrical power demand (kilowatts) **OR** electrical power consumption (kilowatt hours), **as directed**.
 - b) Control: On/off operation, chilled-water discharge temperature set-point adjustment **OR** electrical power demand limit, **as directed**.
 - 2) ASHRAE 135 (BACnet) **OR** LonTalk **OR** Industry-accepted open-protocol, **as directed**, communication interface with building automation system shall enable building automation system operator to remotely control and monitor the water chiller from an operator workstation. Control features and monitoring points displayed locally at water chiller control panel shall be available through building automation system.
12. Insulation:
- a. Material: Closed-cell, flexible elastomeric, thermal insulation complying with ASTM C 534, Type I, for tubular materials and Type II, for sheet materials.
 - b. Thickness: 3/4 inch (19 mm) **OR** 1-1/2 inches (38 mm), **as directed**.
 - c. Factory-applied insulation over cold surfaces of water chiller components.
 - 1) Adhesive: As recommended by insulation manufacturer and applied to 100 percent of insulation contact surface. Seal seams and joints.
 - d. Apply protective coating to exposed surfaces of insulation.
13. Accessories:
- a. Factory-furnished, chilled-water and condenser-water, **as directed**, flow switches for field installation.
 - b. Individual compressor suction and discharge pressure gages with shutoff valves for each refrigeration circuit.
 - c. Factory-furnished neoprene **OR** spring, **as directed**, isolators for field installation.



C. Packaged Refrigerant Recovery Units

1. Packaged portable unit shall consist of compressor, air-cooled condenser, recovery system, tank pressure gages, filter-dryer, and valving that allows for switching between liquid and vapor recovery mode. Refrigerant recovery unit shall be factory mounted on an ASME-constructed and -stamped refrigerant storage vessel that is sized to hold the full refrigerant charge of the largest water chiller.

D. Source Quality Control

1. Perform functional test of water chillers before shipping.
2. Factory performance test water chillers, **as directed**, before shipping, according to ARI 550/590, "Water Chilling Packages Using the Vapor Compression Cycle."
 - a. Allow the Owner access to place where water chillers are being tested. Notify the Owner 14 days in advance of testing.
3. Factory test and inspect evaporator and water-cooled condenser, **as directed**, according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1. Stamp with ASME label.
4. For water chillers located indoors, rate sound power level according to ARI 575 procedure.
5. For water chillers located outdoors, rate sound power level according to ARI 370 procedure.

1.3 EXECUTION

A. Water Chiller Installation

1. Install water chillers on support structure indicated.
2. Equipment Mounting: Install water chiller on concrete bases using elastomeric pads **OR** elastomeric mounts **OR** restrained spring isolators, **as directed**. Comply with requirements in Division 03 Section "Cast-in-place Concrete". Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 - a. Minimum Deflection: 1/4 inch (6 mm) **OR** 1 inch (25 mm), **as directed**.
 - b. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - c. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - d. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - e. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Equipment Mounting: Install water chiller using elastomeric pads **OR** elastomeric mounts **OR** restrained spring isolators, **as directed**. Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 - a. Minimum Deflection: 1/4 inch (6 mm) **OR** 1 inch (25 mm), **as directed**.
4. Equipment Mounting: Install water chiller on vibration isolation inertia bases. Comply with requirements specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
5. Equipment Mounting: Install water chiller on concrete bases. Comply with requirements in Division 03 Section "Cast-in-place Concrete".
 - a. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - b. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - d. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Maintain manufacturer's recommended clearances for service and maintenance.
7. Charge water chiller with refrigerant if not factory charged and fill with oil if not factory installed.
8. Install separate devices furnished by manufacturer and not factory installed.

**B. Connections**

1. Comply with requirements in Division 23 Section "Hydronic Piping". Drawings indicate general arrangement of piping, fittings, and specialties.
2. Comply with requirements in Division 23 Section "Refrigerant Piping". Drawings indicate general arrangement of piping, fittings, and specialties.
3. Install piping adjacent to chiller to allow service and maintenance.
4. Evaporator Fluid Connections: Connect to evaporator inlet with shutoff valve, strainer, **as directed**, flexible connector, **as directed**, thermometer, and plugged tee with pressure gage. Connect to evaporator outlet with shutoff valve, balancing valve, flexible connector, **as directed**, flow switch, thermometer, plugged tee with pressure gage, flow meter, **as directed**, and drain connection with valve. Make connections to water chiller with a union **OR** flange **OR** mechanical coupling, **as directed**.
5. Condenser Fluid Connections: Connect to condenser inlet with shutoff valve, strainer, **as directed**, flexible connector, **as directed**, thermometer, and plugged tee with pressure gage. Connect to condenser outlet with shutoff valve, balancing valve, flexible connector, **as directed**, flow switch, thermometer, plugged tee with pressure gage, flow meter, **as directed**, and drain connection with valve. Make connections to water chiller with a union **OR** flange **OR** mechanical coupling, **as directed**.
6. Refrigerant Pressure Relief Valve Connections: For water chillers installed indoors, extend vent piping to the outside without valves or restrictions. Comply with ASHRAE 15, **as directed**.
7. Connect each drain connection with a union and drain pipe and extend pipe, full size of connection, to floor drain. Provide a shutoff valve at each connection if required.

C. Startup Service

1. Perform startup service.
2. Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assemblies, installations, and connections.
3. Complete installation and startup checks according to manufacturer's written instructions and perform the following:
 - a. Verify that refrigerant charge is sufficient and water chiller has been leak tested.
 - b. Verify that pumps are installed and functional.
 - c. Verify that thermometers and gages are installed.
 - d. Operate water chiller for run-in period.
 - e. Check bearing lubrication and oil levels.
 - f. Verify that refrigerant pressure relief device for chillers installed indoors is vented outside.
 - g. Verify proper motor rotation.
 - h. Verify static deflection of vibration isolators, including deflection during water chiller startup and shutdown.
 - i. Verify and record performance of chilled-water and condenser-water, **as directed**, flow and low-temperature interlocks.
 - j. Verify and record performance of water chiller protection devices.
 - k. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.
4. Prepare a written startup report that records results of tests and inspections.

END OF SECTION 23 64 23 00



23 - Heating, Ventilating, And Air-Conditioning (HVAC)

Task	Specification	Specification Description
23 64 23 00	23 64 19 00	Reciprocating Water Chillers
23 64 26 00	23 61 16 00a	Rotary-Screw Water Chillers



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SECTION 23 65 00 00 - COOLING TOWERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for cooling towers. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Closed-circuit, forced-draft, counterflow cooling towers.
 - b. Closed-circuit, induced-draft, combined-flow cooling towers.
 - c. Closed-circuit, induced-draft, counterflow cooling towers.
 - d. Open-circuit, forced-draft, counterflow cooling towers.
 - e. Open-circuit, induced-draft, counterflow cooling towers.
 - f. Open-circuit, induced-draft, crossflow cooling towers.

C. Definitions

1. BMS: Building management system.
2. FRP: Fiber-reinforced polyester.

D. Performance Requirements

1. Delegated Design: Design cooling tower support structure and seismic restraints, **as directed**, and wind restraints, **as directed**, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2. Structural Performance: Cooling tower support structure shall withstand the effects of gravity loads and loads and stresses within limits and under conditions indicated according to SEI/ASCE 7.
3. Seismic Performance: Cooling towers shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

E. Submittals

1. Product Data: For each type of product indicated. Include rated capacities, pressure drop, fan performance data, rating curves with selected points indicated, furnished specialties, and accessories.
 - a. Maximum flow rate.
 - b. Minimum flow rate.
 - c. Drift loss as percent of design flow rate.
 - d. Volume of water in suspension for purposes of sizing a remote storage tank.
 - e. Sound power levels in eight octave bands for operation with fans off, fans at minimum, and design speed.
 - f. Performance curves for the following:
 - 1) Varying entering-water temperatures from design to minimum.
 - 2) Varying ambient wet-bulb temperatures from design to minimum.
 - 3) Varying water flow rates from design to minimum.
 - 4) Varying fan operation (off, minimum, and design speed).
 - g. Fan airflow, brake horsepower, and drive losses.
 - h. Pump flow rate, head, brake horsepower, and efficiency.



- i. Motor amperage, efficiency, and power factor at 100, 75, 50, and 25 percent of nameplate horsepower.
- j. Electrical power requirements for each cooling tower component requiring power.
2. Shop Drawings: Complete set of manufacturer's prints of cooling tower assemblies, control panels, sections and elevations, and unit isolation. Include the following:
 - a. Assembled unit dimensions.
 - b. Weight and load distribution.
 - c. Required clearances for maintenance and operation.
 - d. Sizes and locations of piping and wiring connections.
 - e. Wiring Diagrams: For power, signal, and control wiring.
3. Delegated-Design Submittal: For cooling tower support structure indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - a. Detail fabrication and assembly of support structure.
 - b. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
 - c. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints, **as directed**, and wind restraints, **as directed**, and for designing vibration isolation bases.
 - d. Coordination Drawings: Floor plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
 - e. Structural supports.
 - f. Piping roughing-in requirements.
 - g. Wiring roughing-in requirements, including spaces reserved for electrical equipment.
 - h. Access requirements, including working clearances for mechanical controls and electrical equipment, and tube pull and service clearances.
4. Certificates: For certification required in "Quality Assurance" Article.
5. Seismic Qualification Certificates: For cooling towers, accessories, and components, from manufacturers.
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
6. Source quality-control reports.
7. Field quality-control reports.
8. Startup service reports.
9. Operation and Maintenance Data: For each cooling tower to include in emergency, operation, and maintenance manuals.
10. Warranty: Sample of special warranty.

F. Quality Assurance

1. Testing Agency Qualifications: Certified by CTI **OR** An NRTL, **as directed**.
2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
4. ASME Compliance: Fabricate and label heat-exchanger coils to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
5. CTI Certification: Cooling tower thermal performance according to CTI STD 201, "Certification Standard for Commercial Water-Cooling Towers Thermal Performance."
6. FMG approval and listing in the latest edition of FMG's "Approval Guide."



- G. Coordination
1. Coordinate sizes and locations of concrete bases with actual equipment provided.
 2. Coordinate sizes, locations, and anchoring attachments of structural-steel support structures.
 3. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.
- H. Warranty
1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace the following components of cooling towers that fail in materials or workmanship within specified warranty period:
 - a. Fan assembly including fan, drive, and motor.
 - b. All components of cooling tower.
 - c. Warranty Period: Five years from date of Final Completion.

1.2 PRODUCTS

- A. Closed-Circuit, Forced-Draft, Counterflow Cooling Towers
1. Fabricate cooling tower mounting base with reinforcement strong enough to resist cooling tower movement during a seismic event when cooling tower is anchored to field support structure.
 2. Cooling tower designed to resist wind load of 30 lbf/sq. ft. (1.44 kPa) **OR as directed**.
 3. Casing and Frame:
 - a. Casing **OR** Casing and Frame, **as directed**, Material: FRP with UV inhibitors **OR** Galvanized steel, ASTM A 653/A 653M, G210 (Z600) coating **OR** Galvanized steel, ASTM A 653/A 653M, G235 (Z700) coating **OR** Polymer-coated galvanized steel **OR** Stainless steel, **as directed**.
 - b. Frame Material: FRP with UV inhibitors **OR** Galvanized steel, ASTM A 653/A 653M, G210 (Z600) coating **OR** Galvanized steel, ASTM A 653/A 653M, G235 (Z700) coating **OR** Polymer-coated galvanized steel **OR** Stainless steel, **as directed**.
 - c. Fasteners: Galvanized **OR** Stainless, **as directed**, steel.
 - d. Joints and Seams: Sealed watertight.
 - e. Welded Connections: Continuous and watertight.
 4. Collection Basin: Configure tower for installation with a field-constructed collection basin. **OR**
Collection Basin:
 - a. Material: FRP with UV inhibitors **OR** Galvanized steel, ASTM A 653/A 653M, G210 (Z600) coating **OR** Galvanized steel, ASTM A 653/A 653M, G235 (Z700) coating **OR** Polymer-coated galvanized steel **OR** Stainless steel, **as directed**.
 - b. Strainer: Removable stainless-steel, **as directed**, strainer with openings smaller than nozzle orifices.
 - c. Overflow and drain connections.
 - d. Makeup water connection.
 - e. Basin Sweeper Distribution Piping and Nozzles:
 - 1) Pipe Material: PVC.
 - 2) Nozzle Material: Plastic.
 - 3) Configure piping and nozzles to minimize sediment from collecting in the collection basin.
 5. Mechanically Operated, Collection Basin Water-Level Control: Manufacturer's standard adjustable, mechanical float assembly and valve. **OR**
Electric/Electronic, Collection Basin Water-Level Controller with Solenoid Valve:
 - a. Enclosure: NEMA 250, Type 4 **OR** Type 4X, **as directed**.
 - b. Sensor: Solid-state controls with multiple electrode probes and relays factory wired to a terminal strip to provide control of water makeup valve **OR** control of water makeup valve and low-level alarm **OR** control of water makeup valve and low- and high-level alarms **OR**



- control of water makeup valve, low- and high-level alarms, and output for shutoff of pump on low level, **as directed**.
- c. Electrode Probes: Stainless steel.
 - d. Water Stilling Chamber: Corrosion-resistant material **OR FRP OR Galvanized steel OR PVC pipe OR Stainless steel, as directed**.
 - e. Solenoid Valve: Slow closing with stainless-steel body, **as directed**, controlled and powered through level controller in response to water-level set point.
 - f. Electrical Connection Requirements: 120 V, single phase, 60 Hz.
6. Electric Basin Heater:
- a. Stainless-Steel Electric Immersion Heaters: Installed in a threaded coupling on the side of the collection basin.
 - b. Heater Control Panel: Mounted on the side of each cooling tower cell.
 - c. Enclosure: NEMA 250, Type 3R **OR Type 4 OR Type 4X, as directed**.
 - d. Magnetic contactors controlled by a temperature sensor/controller to maintain collection basin water-temperature set point. Water-level probe shall monitor cooling tower water level and de-energize the heater when the water reaches low-level set point.
 - e. Control-circuit transformer with primary and secondary side fuses.
 - f. Terminal blocks with numbered and color-coded wiring to match wiring diagram.
 - g. Single-point, field-power connection to a fused disconnect switch **OR** nonfused disconnect switch **OR** circuit breaker, **as directed**, and heater branch circuiting complying with NFPA 70.
 - h. Factory Wiring Method: Metal raceway for factory-installed wiring outside of enclosures, except make connections to each electric basin heater with liquidtight conduit.
- OR**
Hot-Water-Coil Basin Heater: Manufacturer's standard offering to provide capacity indicated.
- OR**
Steam-Coil Basin Heater: Manufacturer's standard offering to provide capacity indicated.
- OR**
Steam-Injector Basin Heater: Manufacturer's standard offering to provide capacity indicated.
7. Water Distribution Piping: Main header and lateral branch piping designed for even distribution over fill throughout the flow range without the need for balancing valves and for connecting individual, removable, nonclogging spray nozzles.
 - a. Pipe Material: Fiberglass **OR PVC OR Galvanized steel, as directed**.
 - b. Spray Nozzle Material: Plastic **OR Polypropylene OR PVC, as directed**.
 - c. Piping Supports: Corrosion-resistant hangers and supports designed to resist movement during operation and shipment.
 8. Recirculating Piping: PVC, **as directed**, with connections for separately provided, remote spray pump, **as directed**.
 9. Spray Pump: Close-coupled, end-suction, single-stage, bronze-fitted centrifugal pump; with suction strainer and flow balancing valve, and mechanical seal suitable for outdoor service.
 - a. General Requirements for Spray Pump Motor: Comply with NEMA designation and temperature-rating requirements specified in Division 15 Section "Common Motor Requirements for HVAC Equipment" and not indicated below.
 - b. Motor Enclosure: Totally enclosed **OR** Totally enclosed nonventilated (TENV) **OR** Totally enclosed fan cooled (TEFC), **as directed**, with epoxy or polyurethane finish, **as directed**.
 - c. Energy Efficiency: Comply with ASHRAE/IESNA 90.1 **OR** NEMA Premium Efficient, **as directed**.
 - d. Service Factor: 1.0 **OR** 1.15, **as directed**.
 10. Heat-Exchanger Coils:
 - a. Tube and Tube Sheet Materials: Copper tube with stainless-steel sheet **OR** Stainless-steel tube and sheet **OR** Prime-coated steel tube and sheet with outer surface of tube and sheet hot-dip galvanized after fabrication, **as directed**.
 - b. Heat-Exchanger Arrangement: Serpentine tubes **OR** Serpentine tubes with removable cover plate on inlet and outlet headers **OR** Straight tubes with removable header cover



- plate on both ends of heat exchanger for straight-through access to each tube, **as directed**; and sloped for complete drainage of fluid by gravity.
- OR**
- ASME Compliance: Designed, manufactured, and tested according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, and bearing ASME "U" stamp; and sloped for complete drainage of fluid by gravity.
- c. Field Piping Connections: Vent, supply, and return suitable for mating to ASME B16.5, Class 150 flange, **as directed**.
11. Removable, **as directed**, Drift Eliminator:
- a. Material: FRP **OR** PVC, **as directed**; with maximum flame-spread index of 5 **OR** 25, **as directed**, according to ASTM E 84.
- b. UV Treatment: Inhibitors to protect against damage caused by UV radiation.
- c. Configuration: Multipass, designed and tested to reduce water carryover to achieve performance indicated.
12. Removable, **as directed**, Air-Intake Screens: Galvanized **OR** Polymer-coated, galvanized **OR** Stainless, **as directed**, -steel wire mesh.
13. Centrifugal Fan: Double-width, double-inlet, forward-curved blades, and statically and dynamically balanced at the factory after assembly.
- a. Number of Fans: Each cooling tower cell shall have a single fan or multiple fans connected to a common shaft.
- b. Fan Wheel and Housing Materials: Galvanized steel.
- c. Fan Shaft: Steel, coated to resist corrosion.
- d. Protective Enclosure: Removable, galvanized-steel, wire-mesh screens complying with OSHA regulations.
- e. Fan Shaft Bearings: Self-aligning, grease-lubricated ball or roller bearings with moisture-proof seals and premium, moisture-resistant grease suitable for temperatures between minus 20 and plus 300 deg F (minus 29 and plus 149 deg C). Bearings designed for an L-10 life of 40,000 **OR** 50,000, **as directed**, hours.
- f. Bearings Grease Fittings: Extended lubrication lines to an easily accessible location.
14. Belt Drive:
- a. Belt-Drive Service Factor: 1.5 based on motor nameplate horsepower.
- b. Sheaves: Fan and motor shafts shall have taper-lock sheaves fabricated from corrosion-resistant materials.
- c. Belt: Multiple V-belt design with a matched set of cogged, **as directed**, belts.
- OR**
- Belt: One-piece, multigrooved, solid-back belt.
- d. Belt Material: Oil resistant, nonstatic conducting, and constructed of neoprene polyester cord.
- e. Belt-Drive Guard: Comply with OSHA regulations.
- f. Two-Motor, Single-Fan Drive:
- 1) Two single-speed motors per fan, one sized for full speed and load, and the other sized for 67 percent of full-load speed.
- 2) Belt Drives: Each motor shall have belt drive complying with requirements for belt drives and configured for operation when other motor fails.
- 3) Motor controller and wiring same as two-speed, two-winding motor.
15. Fan Motor:
- a. General Requirements for Fan Motors: Comply with NEMA designation and temperature-rating requirements specified in Division 23 Section "Common Motor Requirements For Hvac Equipment" and not indicated below.
- b. Motor Enclosure: Totally enclosed **OR** Totally enclosed air over (TEAO) **OR** Totally enclosed fan cooled (TEFC), **as directed**, with epoxy or polyurethane finish, **as directed**.
- c. Energy Efficiency: Comply with ASHRAE/IESNA 90.1 **OR** NEMA Premium Efficient, **as directed**.
- d. Service Factor: 1.15.
- e. Insulation: Class F **OR** Class H, **as directed**.



- f. Variable-Speed Motors: Inverter-duty rated per NEMA MG-1, Section IV, "Performance Standard Applying to All Machines," Part 31, "Definite-Purpose, Inverter-Fed, Polyphase Motors."
 - g. Severe-duty rating with the following features:
 - 1) Rotor and stator protected with corrosion-inhibiting epoxy resin.
 - 2) Double-shielded, vacuum-degassed bearings lubricated with premium moisture-resistant grease suitable for temperatures between minus 20 and plus 300 deg F (minus 29 and plus 149 deg C).
 - 3) Internal heater automatically energized when motor is de-energized.
 - h. Motor Base: Adjustable, or other suitable provision for adjusting belt tension.
16. Discharge Hoods:
- a. Hood Configuration: Tapered **OR** Straight, **as directed**; totally surrounding drift eliminators and constructed of same material as casing; and having factory-installed insulation, **as directed**, and access doors.
 - b. Discharge Dampers: Positive-closure, automatic, isolation dampers with electric actuators.
 - 1) Provide field power and controls to open dampers when pump is energized and close dampers when pump is de-energized.
17. Capacity-Control Dampers: Galvanized-steel **OR** Stainless-steel, **as directed**, dampers, with linkages, electric operator, controller, limit switches, transformer, and weatherproof enclosure.
18. Vibration Switch: For each fan drive.
- a. Enclosure: NEMA 250, Type 4 **OR** Type 4X, **as directed**.
 - b. Vibration Detection: Sensor with a field-adjustable acceleration sensitivity set point in a range of 0 to 1 g and frequency range of 0 to 3000 cycles per minute. Cooling tower manufacturer shall recommend switch set point for proper operation and protection.
 - c. Provide switch with manual-reset button, **as directed**, for field connection to a BMS and, **as directed**, hardwired connection to fan motor electrical circuit.
 - d. Switch shall, on sensing excessive vibration, signal an alarm through the BMS and, **as directed**, shut down the fan.
19. Controls: Comply with requirements in Division 23 Section "Instrumentation And Control For Hvac".
- OR**
- Control Package: Factory installed and wired, and functionally tested at factory before shipment.
- a. NEMA 250, Type 3R **OR** Type 4 **OR** Type 4X, **as directed**, enclosure with removable internally mount backplate.
 - b. Control-circuit transformer with primary and secondary side fuses.
 - c. Terminal blocks with numbered and color-coded wiring to match wiring diagram. Spare wiring terminal block for connection to external controls or equipment.
 - d. Microprocessor-based controller for automatic control of fan and spray pump, **as directed**, based on cooling tower leaving-water temperature with control features to improve operating efficiency based on outdoor ambient wet-bulb temperature by using adaptive logic.
 - e. Fan motor sequencer for multiple-cell and two-speed applications with automatic lead stage rotation.
 - f. Collection basin, electric/electronic level controller complying with requirements in "Electric/Electronic, Collection Basin Water-Level Controller with Solenoid Valve" Paragraph.
 - g. Electric basin heaters with temperature control and low-water-level safety switch for each cell, complying with requirements in "Electric Basin Heater" Paragraph.
 - h. Vibration switch for each fan, complying with requirements in "Vibration Switch" Paragraph.
 - i. Controls and wiring for "two-motor, single-fan drives" shall be same as two-speed, two-winding motor.
 - j. Power and controls to open discharge hood dampers when pump is energized and close dampers when pump is de-energized.
 - k. Single-point, field-power connection to a fused disconnect switch **OR** nonfused disconnect switch **OR** circuit breaker, **as directed**, for each cooling tower cell, **as directed**.



- 1) Branch power circuit to each motor and electric basin heater and to controls with a disconnect switch or circuit breaker, **as directed**.
 - 2) NEMA-rated motor controller, hand-off-auto switch, and overcurrent protection for each motor. Provide variable frequency controller with manual bypass and line reactors for each variable-speed motor indicated.
 - l. Factory-installed wiring outside of enclosures shall be in metal raceway, except make connections to each motor and electric basin heater with liquidtight conduit.
 - m. Visual indication of status and alarm with momentary test push button, **as directed**, for each motor.
 - n. Audible alarm and silence switch.
 - o. Visual indication of elapsed run time, graduated in hours for each motor.
 - p. Cooling tower shall have hardware to enable BMS to remotely monitor and display the following:
 - 1) Operational status of each motor.
 - 2) Position of dampers.
 - 3) Cooling tower leaving-fluid temperature.
 - 4) Fan vibration alarm.
 - 5) Collection basin high **OR** low **OR** high- and low, **as directed**, -water-level alarms.
20. Personnel Access Components:
- a. Doors: Large enough for personnel to access cooling tower internal components from both, **as directed**, cooling tower end walls. Doors shall be operable from both sides of the door, **as directed**.
 - b. External Ladders with Safety Cages: Aluminum, galvanized- or stainless-steel, fixed ladders with ladder extensions to access external platforms and top of cooling tower from adjacent grade without the need for portable ladders. Comply with 29 CFR 1910.27.
 - c. External Platforms with Handrails: Aluminum, FRP, or galvanized-steel bar grating at cooling tower access doors when cooling towers are elevated and not accessible from grade.
 - d. Handrail: Aluminum, galvanized steel, or stainless steel complete with kneerail and toeboard at platforms and around top of cooling tower. Comply with 29 CFR 1910.23.
 - e. Internal Platforms: Aluminum, FRP, or galvanized-steel bar grating.
 - 1) Spanning the collection basin from one end of cooling tower to the other and positioned to form a path between the access doors. Platform shall be elevated so that all parts are above the high water level of the collection basin.
- B. Closed-Circuit, Induced-Draft, Combined-Flow Cooling Towers
1. Fabricate cooling tower mounting base with reinforcement strong enough to resist cooling tower movement during a seismic event when cooling tower is anchored to field support structure.
 2. Cooling tower designed to resist wind load of 30 lbf/sq. ft. (1.44 kPa) **OR as directed**.
 3. Casing and Frame:
 - a. Casing and Frame, **as directed**, Material: FRP with UV inhibitors **OR** Galvanized steel, ASTM A 653/A 653M, G235 (Z700) coating **OR** Polymer-coated galvanized steel **OR** Stainless steel, **as directed**.
 - b. Frame Material: FRP with UV inhibitors **OR** Galvanized steel, ASTM A 653/A 653M, G235 (Z700) coating **OR** Polymer-coated galvanized steel **OR** Stainless steel, **as directed**.
 - c. Fasteners: Galvanized **OR** Stainless, **as directed**, steel.
 - d. Joints and Seams: Sealed watertight.
 - e. Welded Connections: Continuous and watertight.
 4. Collection Basin: Configure tower for installation with a field-constructed collection basin.
OR
Collection Basin:
 - a. Material: FRP with UV inhibitors **OR** Galvanized steel, ASTM A 653/A 653M, G235 (Z700) coating **OR** Polymer-coated galvanized steel **OR** Stainless steel, **as directed**.
 - b. Strainer: Removable stainless-steel, **as directed**, strainer with openings smaller than nozzle orifices.
 - c. Overflow and drain connections.



- d. Makeup water connection.
 - e. Basin Sweeper Distribution Piping and Nozzles:
 - 1) Pipe Material: PVC, **as directed**.
 - 2) Nozzle Material: Plastic, **as directed**.
 - 3) Configure piping and nozzles to minimize sediment from collecting in the collection basin.
5. Mechanically Operated, Collection Basin Water-Level Control: Manufacturer's standard adjustable, mechanical float assembly and valve.
- OR**
- Electric/Electronic, Collection Basin Water-Level Controller with Solenoid Valve:
- a. Enclosure: NEMA 250, Type 4 **OR** Type 4X, **as directed**.
 - b. Sensor: Solid-state controls with multiple electrode probes and relays factory wired to a terminal strip to provide control of water makeup valve **OR** control of water makeup valve and low-level alarm **OR** control of water makeup valve and low- and high-level alarms **OR** control of water makeup valve, low- and high-level alarms, and output for shutoff of pump on low level, **as directed**.
 - c. Electrode Probes: Stainless steel.
 - d. Water Stilling Chamber: Corrosion-resistant material **OR** FRP **OR** Galvanized steel **OR** PVC pipe **OR** Stainless steel, **as directed**.
 - e. Solenoid Valve: Slow closing with stainless-steel body, **as directed**, controlled and powered through level controller in response to water-level set point.
 - f. Electrical Connection Requirements: 120 V, single phase, 60 Hz.
- OR**
- Ultrasonic Collection Basin Water-Level Controller with Solenoid Valve:
- a. Enclosure: NEMA 250, Type 4 **OR** Type 4X, **as directed**.
 - b. Controller: Ultrasonic level sensor/transmitter and relays factory wired to a terminal strip to control water makeup valve and signal a level alarm. Controller shall provide continuous level indication through a 4- to 20-mA signal for connection to BMS, **as directed**.
 - c. Water Stilling Chamber: Corrosion-resistant material **OR** FRP **OR** Galvanized steel **OR** PVC pipe **OR** Stainless steel, **as directed**.
 - d. Solenoid Valve: Slow closing with stainless-steel body, **as directed**, controlled and powered through level controller in response to water-level set point.
 - e. Electrical Connection Requirements: 120 V, single phase, 60 Hz.
6. Electric Basin Heater:
- a. Stainless-Steel Electric Immersion Heaters: Installed in a threaded coupling on the side of the collection basin.
 - b. Heater Control Panel: Mounted on the side of each cooling tower cell.
 - c. Enclosure: NEMA 250, Type 3R **OR** Type 4 **OR** Type 4X, **as directed**.
 - d. Magnetic contactors controlled by a temperature sensor/controller to maintain collection basin water-temperature set point. Water-level probe shall monitor cooling tower water level and de-energize the heater when the water reaches low-level set point.
 - e. Control-circuit transformer with primary and secondary side fuses.
 - f. Terminal blocks with numbered and color-coded wiring to match wiring diagram.
 - g. Single-point, field-power connection to a fused disconnect switch **OR** nonfused disconnect switch **OR** circuit breaker, **as directed**, and heater branch circuiting complying with NFPA 70.
 - h. Factory Wiring Method: Metal raceway for factory-installed wiring outside of enclosures, except make connections to each electric basin heater with liquidtight conduit.
- OR**
- Hot-Water-Coil Basin Heater: Manufacturer's standard offering to provide capacity indicated.
- OR**
- Steam-Coil Basin Heater: Manufacturer's standard offering to provide capacity indicated.
- OR**
- Steam-Injector Basin Heater: Manufacturer's standard offering to provide capacity indicated.



7. Gravity Water Distribution Basin: Nonpressurized design with head of water level in basin adequate to overcome spray nozzle losses and designed to evenly distribute water over fill throughout the flow range indicated.
 - a. Material: FRP with UV inhibitors **OR** Galvanized steel, ASTM A 653/A 653M, G210 (Z600) coating **OR** Galvanized steel, ASTM A 653/A 653M, G235 (Z700) coating **OR** Polymer-coated galvanized steel **OR** Stainless steel, **as directed**.
 - b. Location: Over each bank of fill with easily replaceable plastic, **as directed**, spray nozzles mounted in bottom of basin.
 - c. Joints and Seams: Sealed watertight.
 - d. Partitioning Dams: Same material as basin to distribute water over the fill to minimize icing while operating throughout the flow range indicated.
 - e. Removable Panels: Same material as basin to completely cover top of basin. Secure panels to basin with removable corrosion-resistant **OR** stainless-steel, **as directed**, hardware.
 - f. Valves: Manufacturer's standard valve installed at each inlet connection and arranged to balance or shut off flow to each gravity water distribution basin.
8. Pressurized Water Distribution Piping: Main header and lateral branch piping designed for even distribution over heat-exchanger coil or fill throughout the flow range without the need for balancing valves and for connecting individual, removable, nonclogging spray nozzles.
 - a. Pipe Material: PVC **OR** Galvanized steel, **as directed**.
 - b. Spray Nozzle Material: Plastic **OR** Polypropylene, **as directed**.
 - c. Piping Supports: Corrosion-resistant hangers and supports to resist movement during operation and shipment.
9. Recirculating Piping: PVC, **as directed**, with connections for separately provided, remote spray pump, **as directed**.
10. Spray Pump: Close-coupled, end-suction, single-stage, bronze-fitted centrifugal pump; with suction strainer and flow balancing valve, and mechanical seal suitable for outdoor service.
 - a. General Requirements for Spray Pump Motor: Comply with NEMA designation and temperature-rating requirements specified in Division 23 Section "Common Motor Requirements For Hvac Equipment" and not indicated below.
 - b. Motor Enclosure: Totally enclosed **OR** Totally enclosed nonventilated (TENV) **OR** Totally enclosed fan cooled (TEFC), **as directed**, with epoxy or polyurethane finish, **as directed**.
 - c. Energy Efficiency: Comply with ASHRAE/IESNA 90.1 **OR** NEMA Premium Efficient, **as directed**.
 - d. Service Factor: 1.0 **OR** 1.15, **as directed**.
11. Fill:
 - a. Materials: PVC, **as directed**, with maximum flame-spread index of 5 **OR** 25, **as directed**, according to ASTM E 84.
 - b. Minimum Thickness: 15 mils (0.4 mm) **OR** 20 mils (0.5 mm), **as directed**, before forming.
 - c. Fabrication: Fill-type sheets fabricated, formed, and bonded together after forming into removable assemblies that are factory installed by manufacturer.
 - d. Fill Material Operating Temperature: Suitable for entering-water temperatures up through 120 deg F (49 deg C).
12. Heat-Exchanger Coils:
 - a. Tube and Tube Sheet Materials: Copper tube with stainless-steel sheet **OR** Stainless-steel tube and sheet **OR** Prime-coated steel tube and sheet with outer surface of tube and sheet hot-dip galvanized after fabrication, **as directed**.
 - b. Heat-Exchanger Arrangement: Serpentine tubes **OR** Serpentine tubes with removable cover plate on inlet and outlet headers **OR** Straight tubes with removable header cover plate on both ends of heat exchanger for straight-through access to each tube, **as directed**; and sloped for complete drainage of fluid by gravity.
OR
ASME Compliance: Designed, manufactured, and tested according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1 and bearing ASME "U" stamp; and sloped for complete drainage of fluid by gravity.



- c. Field Piping Connections: Vent, supply, and return suitable for mating to ASME B16.5, Class 150 flange, **as directed**.
- 13. Drift Eliminator:
 - a. Material: FRP **OR** PVC, **as directed**; with maximum flame-spread index of 5 according to ASTM E 84.
 - b. UV Treatment: Inhibitors to protect against damage caused by UV radiation.
 - c. Configuration: Multipass, designed and tested to reduce water carryover to achieve performance indicated.
 - d. Fill Drift Eliminators: Integral to **OR** Separate and removable from, **as directed**, fill.
 - e. Heat-Exchanger Coil Drift Eliminators: Located on discharge side and removable.
- 14. Air-Intake Louvers:
 - a. Material: FRP **OR** PVC **OR** Matching casing, **as directed**.
 - b. UV Treatment: Inhibitors to protect against damage caused by UV radiation.
 - c. Louver Blades: Arranged to uniformly direct air into cooling tower, to minimize air resistance, and to prevent water from splashing out of tower during all modes of operation including operation with fans off.
 - d. Location: Integral to **OR** Separate from, **as directed**, fill.
- 15. Removable, **as directed**, Air-Intake Screens: Galvanized **OR** Polymer-coated, galvanized **OR** Stainless, **as directed**, -steel wire mesh.
- 16. Axial Fan: Balanced at the factory after assembly.
 - a. Blade Material: Aluminum **OR** FRP, **as directed**.
 - b. Hub Material: Aluminum **OR** FRP, **as directed**.
 - c. Blade Pitch: Field adjustable.
 - d. Protective Enclosure: Removable, galvanized-steel, wire-mesh screens complying with OSHA regulations.
 - e. Fan Shaft Bearings: Self-aligning ball or roller bearings with moisture-proof seals and premium, moisture-resistant grease suitable for temperatures between minus 20 and plus 300 deg F (minus 29 and plus 149 deg C). Bearings designed for an L-10 life of 40,000 **OR** 50,000, **as directed**, hours.
 - f. Bearings Grease Fittings: Extended lubrication lines to an easily accessible location.
- 17. Belt Drive:
 - a. Service Factor: 1.5 based on motor nameplate horsepower.
 - b. Sheaves: Fan and motor shafts shall have taper-lock sheaves fabricated from corrosion-resistant materials.
 - c. Belt: Multiple V-belt design with a matched set of cogged, **as directed**, belts.
OR
Belt: One-piece, multigrooved, solid-back belt.
 - d. Belt Material: Oil resistant, nonstatic conducting, and constructed of neoprene polyester cord.
 - e. Belt-Drive Guard: Comply with OSHA regulations.
 - f. Two-Motor, Single-Fan Drive:
 - 1) Two single-speed motors per fan, one sized for full speed and load and the other sized for 67 percent of full-load speed.
 - 2) Each motor with belt drive and configured for operation when other motor fails.
 - 3) Controls and wiring same as two-speed, two-winding motor.
- 18. Gear Drive: Right angle, reduced speed, and designed for cooling tower applications according to CTI STD 111. Motor and gear drive shall be aligned before shipment.
 - a. Gear Drive and Coupling Service Factor: 2.0 based on motor nameplate horsepower.
 - b. Housing: Cast iron, with epoxy or polyurethane finish, beveled high-strength steel gears continuously bathed in oil, and with lubrication to other internal parts at all operating speeds.
 - c. Mounting: Directly mounted to fan hub and connected to motor so motor shaft is in horizontal position.
 - d. Operation: Able to operate both forward and in reverse.



- e. Drive-to-Motor Connection: Close coupled to motor using a flexible coupling **OR** Connected to motor located outside of cooling tower casing by a full-floating drive shaft, **as directed**.
 - f. Drive Shaft Material: Corrosion resistant **OR** Stainless steel, **as directed**, and fitted with flexible couplings on both ends. Provide exposed shaft and couplings with guards according to OSHA regulations.
 - g. Extend oil fill, drain, and vent to outside of cooling tower casing using galvanized-steel piping. Provide installation with oil-level sight glass.
19. Fan Motor:
- a. General Requirements for Fan Motors: Comply with NEMA designation and temperature-rating requirements specified in Division 23 Section "Common Motor Requirements For Hvac Equipment" and not indicated below.
 - b. Motor Enclosure: Totally enclosed **OR** Totally enclosed air over (TEAO) **OR** Totally enclosed fan cooled (TEFC), **as directed**, with epoxy or polyurethane finish, **as directed**.
 - c. Energy Efficiency: Comply with ASHRAE/IESNA 90.1 **OR** NEMA Premium Efficient, **as directed**.
 - d. Service Factor: 1.15.
 - e. Insulation: Class F **OR** Class H, **as directed**.
 - f. Variable-Speed Motors: Inverter-duty rated per NEMA MG-1, Section IV, "Performance Standard Applying to All Machines," Part 31, "Definite-Purpose, Inverter-Fed, Polyphase Motors."
 - g. Motor Location: Mounted outside of cooling tower casing and cooling tower discharge airstream.
 - h. Severe-duty rating with the following features:
 - 1) Rotor and stator protected with corrosion-inhibiting epoxy resin.
 - 2) Double-shielded, vacuum-degassed bearings lubricated with premium, moisture-resistant grease suitable for temperatures between minus 20 and plus 300 deg F (minus 29 and plus 149 deg C).
 - 3) Internal heater automatically energized when motor is de-energized.
 - i. Motor Base: Adjustable, or other suitable provision for adjusting belt tension.
20. Fan Discharge Stack: Material shall match casing, manufacturer's standard **OR** velocity recovery, **as directed**, design.
- a. Stack Extension: Fabricated to extend above fan deck unless otherwise indicated.
 - b. Stack Termination: Wire-mesh, galvanized-steel screens; complying with OSHA regulations.
21. Vibration Switch: For each fan drive.
- a. Enclosure: NEMA 250, Type 4 **OR** Type 4X, **as directed**.
 - b. Vibration Detection: Sensor with a field-adjustable, acceleration-sensitivity set point in a range of 0 to 1 g and frequency range of 0 to 3000 cycles per minute. Cooling tower manufacturer shall recommend switch set point for proper operation and protection.
 - c. Provide switch with manual-reset button, **as directed**, for field connection to a BMS, **as directed**, and hardwired connection to fan motor electrical circuit.
 - d. Switch shall, on sensing excessive vibration, signal an alarm through the BMS, **as directed**, and shut down the fan.
22. Gear-Drive, Oil-Level Switch: Low-oil-level warning switch for connection to a BMS, **as directed**.
- a. Switch shall, on reaching a low-oil-level set point recommended by cooling tower manufacturer, signal an alarm through the BMS, **as directed**.
23. Controls: Comply with requirements in Division 23 Section "Instrumentation And Control For Hvac".
- OR**
- Control Package: Factory installed and wired, and functionally tested at factory before shipment.
- a. NEMA 250, Type 3R **OR** Type 4 **OR** Type 4X, **as directed**, enclosure with removable internally mount backplate.
 - b. Control-circuit transformer with primary and secondary side fuses.
 - c. Terminal blocks with numbered and color-coded wiring to match wiring diagram. Spare wiring terminal block for connection to external controls or equipment.



- d. Microprocessor-based controller for automatic control of fan and spray pump, **as directed**, based on cooling tower leaving-water temperature with control features to improve operating efficiency based on outdoor ambient wet-bulb temperature by using adaptive logic.
 - e. Fan motor sequencer for multiple-cell and two-speed applications with automatic lead stage rotation.
 - f. Collection basin level controller complying with requirements in "Electric/Electronic, Collection Basin Water-Level Controller with Solenoid Valve" **OR** "Ultrasonic Collection Basin Water-Level Controller with Solenoid Valve", **as directed**, Paragraph.
 - g. Electric basin heaters with temperature control and low-water-level safety switch for each cell, complying with requirements in "Electric Basin Heater" Paragraph.
 - h. Vibration switch for each fan, complying with requirements in "Vibration Switch" Paragraph.
 - i. Oil-level switch for each fan with a gear drive, complying with requirement in "Gear-Drive, Oil-Level Switch" Paragraph.
 - j. Single-point, field-power connection to a fused disconnect switch **OR** nonfused disconnect switch **OR** circuit breaker, **as directed**, for each cooling tower cell, **as directed**.
 - 1) Branch power circuit to each motor and electric basin heater and to controls with a disconnect switch or circuit breaker, **as directed**.
 - 2) NEMA-rated motor controller, hand-off-auto switch, and overcurrent protection for each motor. Provide variable frequency controller with manual bypass and line reactors for each variable-speed motor indicated.
 - k. Factory-installed wiring outside of enclosures shall be in metal raceway, except make connections to each motor and electric basin heater with liquidtight conduit.
 - l. Visual indication of status and alarm with momentary test push button, **as directed**, for each motor.
 - m. Audible alarm and silence switch.
 - n. Visual indication of elapsed run time, graduated in hours for each motor.
 - o. Cooling tower shall have hardware to enable BMS to remotely monitor and display the following:
 - 1) Operational status of each motor.
 - 2) Position of dampers.
 - 3) Cooling tower leaving-fluid temperature.
 - 4) Fan vibration alarm.
 - 5) Oil-level alarm.
 - 6) Collection basin high **OR** low **OR** high- and low, **as directed**, -water-level alarms.
24. Personnel Access Components:
- a. Doors: Large enough for personnel to access cooling tower internal components from both cooling tower end walls. Doors shall be operable from both sides of the door.
 - b. External Ladders with Safety Cages: Aluminum, galvanized- or stainless-steel, fixed ladders with ladder extensions to access external platforms and top of cooling tower from adjacent grade without the need for portable ladders. Comply with 29 CFR 1910.27.
 - c. External Platforms with Handrails: Aluminum, FRP, or galvanized-steel bar grating at cooling tower access doors when cooling towers are elevated and not accessible from grade.
 - d. Handrail: Aluminum, galvanized steel, or stainless steel complete with kneerail and toeboard, around top of cooling tower. Comply with 29 CFR 1910.23.
 - e. Internal Platforms: Aluminum, FRP, or galvanized-steel bar grating.
 - 1) Spanning the collection basin from one end of cooling tower to the other and positioned to form a path between the access doors. Platform shall be elevated so that all parts are above the high water level of the collection basin.
 - 2) Elevated internal platforms with handrails accessible from fixed vertical ladders to access the fan drive assembly when out of reach from collection basin platform.

C. Closed-Circuit, Induced-Draft, Counterflow Cooling Towers



1. Fabricate cooling tower mounting base with reinforcement strong enough to resist cooling tower movement during a seismic event when cooling tower is anchored to field support structure.
2. Cooling tower designed to resist wind load of 30 lbf/sq. ft. (1.44 kPa) **OR as directed**.
3. Casing and Frame:
 - a. Casing and Frame, **as directed**, Material: FRP with UV inhibitors **OR** Galvanized steel, ASTM A 653/A 653M, G210 (Z600) coating **OR** Galvanized steel, ASTM A 653/A 653M, G235 (Z700) coating **OR** Stainless steel, **as directed**.
 - b. Frame Material: FRP with UV inhibitors **OR** Galvanized steel, ASTM A 653/A 653M, G210 (Z600) coating **OR** Galvanized steel, ASTM A 653/A 653M, G235 (Z700) coating **OR** Polymer-coated galvanized steel **OR** Stainless steel, **as directed**.
 - c. Fasteners: Galvanized **OR** Stainless, **as directed**, steel.
 - d. Joints and Seams: Sealed watertight.
 - e. Welded Connections: Continuous and watertight.
4. Collection Basin: Configure tower for installation with a field-constructed collection basin.
OR
Collection Basin:
 - a. Material: Galvanized steel, ASTM A 653/A 653M, G210 (Z600) coating **OR** Galvanized steel, ASTM A 653/A 653M, G235 (Z700) coating **OR** Stainless steel, **as directed**.
 - b. Overflow and drain connections.
 - c. Makeup water connection.
5. Mechanically Operated, Collection Basin Water-Level Control: Manufacturer's standard adjustable, mechanical float assembly and valve.
OR
Electric/Electronic, Collection Basin Water-Level Controller with Solenoid Valve:
 - a. Enclosure: NEMA 250, Type 4 **OR** Type 4X, **as directed**.
 - b. Sensor: Solid-state controls with multiple electrode probes and relays factory wired to a terminal strip to provide control of water makeup valve **OR** control of water makeup valve and low-level alarm **OR** control of water makeup valve and low- and high-level alarms **OR** control of water makeup valve, low- and high-level alarms, and output for shutoff of pump on low level, **as directed**.
 - c. Electrode Probes: Stainless steel.
 - d. Water Stilling Chamber: Corrosion-resistant material **OR** FRP **OR** Galvanized steel **OR** PVC pipe **OR** Stainless steel, **as directed**.
 - e. Solenoid Valve: Slow closing with stainless-steel body, **as directed**; controlled and powered through level controller in response to water-level set point.
 - f. Electrical Connection Requirements: 120 V, single phase, 60 Hz.
6. Electric Basin Heater:
 - a. Stainless-Steel Electric Immersion Heaters: Installed in a threaded coupling on the side of the collection basin.
 - b. Heater Control Panel: Mounted on the side of each cooling tower cell.
 - c. Enclosure: NEMA 250, Type 3R **OR** Type 4 **OR** Type 4X, **as directed**.
 - d. Magnetic contactors controlled by a temperature sensor/controller to maintain collection basin water-temperature set point. Water-level probe shall monitor cooling tower water level and de-energize the heater when the water reaches low-level set point.
 - e. Control-circuit transformer with primary and secondary side fuses.
 - f. Terminal blocks with numbered and color-coded wiring to match wiring diagram.
 - g. Single-point, field-power connection to a fused disconnect switch **OR** nonfused disconnect switch **OR** circuit breaker, **as directed**, and heater branch circuiting complying with NFPA 70.
 - h. Factory Wiring Method: Metal raceway for factory-installed wiring outside of enclosures, except make connections to each electric basin heater with liquidtight conduit.
OR
Hot-Water-Coil Basin Heater: Manufacturer's standard offering to provide capacity indicated.
OR
Steam-Coil Basin Heater: Manufacturer's standard offering to provide capacity indicated.
OR



- Steam-Injector Basin Heater: Manufacturer's standard offering to provide capacity indicated.
7. Pressurized Water Distribution Piping: Main header and lateral branch piping designed for even distribution over heat-exchanger coil or fill throughout the flow range without the need for balancing valves and for connecting individual, removable, nonclogging spray nozzles.
 - a. Pipe Material: Fiberglass **OR** PVC **OR** Galvanized steel, **as directed**.
 - b. Spray Nozzle Material: Plastic **OR** Polypropylene **OR** PVC, **as directed**.
 - c. Piping Supports: Corrosion-resistant hangers and supports to resist movement during operation and shipment.
 8. Recirculating Piping: PVC, **as directed**, with connections for separately provided, remote spray pump, **as directed**.
 9. Spray Pump: Close-coupled, end-suction, single-stage, bronze-fitted centrifugal pump; with suction strainer and flow balancing valve, and mechanical seal suitable for outdoor service.
 10. General Requirements for Spray Pump Motor: Comply with NEMA designation and temperature-rating requirements specified in Division 23 Section "Common Motor Requirements For Hvac Equipment" and not indicated below.
 - a. Motor Enclosure: Totally enclosed **OR** Totally enclosed nonventilated (TENV) **OR** Totally enclosed fan cooled (TEFC), **as directed**, with epoxy or polyurethane finish, **as directed**.
 - b. Energy Efficiency: Comply with ASHRAE/IESNA 90.1 **OR** NEMA Premium Efficient, **as directed**.
 - c. Service Factor: 1.0 **OR** 1.15, **as directed**.
 11. Heat-Exchanger Coils:
 - a. Tube and Tube Sheet Materials: Copper tube with stainless-steel sheet **OR** Stainless-steel tube and sheet **OR** Prime-coated steel tube and sheet with outer surface of tube and sheet hot-dip galvanized after fabrication, **as directed**.
 - b. Heat-Exchanger Arrangement: Serpentine tubes **OR** Serpentine tubes with removable cover plate on inlet and outlet headers **OR** Straight tubes with removable header cover plate on both ends of heat exchanger for straight-through access to each tube, **as directed**; and sloped for complete drainage of fluid by gravity.

OR

ASME Compliance: Designed, manufactured, and tested according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1 and bearing ASME "U" stamp; and sloped for complete drainage of fluid by gravity.
 - c. Field Piping Connections: Vent, supply, and return suitable for mating to ASME B16.5, Class 150 flange, **as directed**.
 12. Removable, **as directed**, Drift Eliminator:
 - a. Material: FRP **OR** PVC, **as directed**; with maximum flame-spread index of 5 **OR** 25, **as directed**, according to ASTM E 84.
 - b. UV Treatment: Inhibitors to protect against damage caused by UV radiation.
 - c. Configuration: Multipass, designed and tested to reduce water carryover to achieve performance indicated.
 13. Air-Intake Louvers:
 - a. Material: FRP **OR** PVC **OR** Matching casing, **as directed**.
 - b. UV Treatment: Treat louvers with inhibitors to protect against damage caused by UV radiation.
 - c. Louver Blades: Arranged to uniformly direct air into cooling tower, to minimize air resistance, and to prevent water from splashing out during all modes of operation including operation with fans off.
 14. Axial Fan: Balanced at the factory after assembly.
 - a. Blade Material: Aluminum **OR** FRP **OR** Galvanized steel, **as directed**.
 - b. Hub Material: Aluminum **OR** FRP **OR** Galvanized steel, **as directed**.
 - c. Blade Pitch: Field adjustable.
 - d. Protective Enclosure: Removable, galvanized-steel, wire-mesh screens complying with OSHA regulations.
 - e. Fan Shaft Bearings: Self-aligning ball or roller bearings with moisture-proof seals and premium, moisture-resistant grease suitable for temperatures between minus 20 and plus



- 300 deg F (minus 29 and plus 149 deg C). Bearings designed for an L-10 life of 40,000 **OR** 50,000, **as directed**, hours.
- f. Bearings Grease Fittings: Extended lubrication lines to an easily accessible location.
15. Belt Drive:
- a. Service Factor: 1.5 based on motor nameplate horsepower.
- b. Sheaves: Fan and motor shafts shall have taper-lock sheaves fabricated from corrosion-resistant materials.
- c. Belt: Multiple V-belt design with a matched set of cogged, **as directed**, belts.
OR
Belt: One-piece, multigrooved, solid-back belt.
- d. Belt Material: Oil resistant, nonstatic conducting, and constructed of neoprene polyester cord.
- e. Belt-Drive Guard: Comply with OSHA regulations.
- f. Two-Motor, Single-Fan Drive:
- 1) Two single-speed motors per fan, one sized for full speed and load and the other sized for 67 percent of full-load speed.
 - 2) Each motor with belt drive and configured for operation when other motor fails.
 - 3) Controls and wiring same as two-speed, two-winding motor.
16. Fan Motor:
- a. General Requirements for Fan Motors: Comply with NEMA designation and temperature-rating requirements specified in Division 23 Section "Common Motor Requirements For Hvac Equipment" and not indicated below.
- b. Motor Enclosure: Totally enclosed **OR** Totally enclosed air over (TEAO) **OR** Totally enclosed fan cooled (TEFC), **as directed**, with epoxy or polyurethane finish, **as directed**.
- c. Energy Efficiency: Comply with ASHRAE/IESNA 90.1 **OR** NEMA Premium Efficient, **as directed**.
- d. Service Factor: 1.15.
- e. Insulation: Class F **OR** Class H, **as directed**.
- f. Variable-Speed Motors: Inverter-duty rated per NEMA MG-1, Section IV, "Performance Standard Applying to All Machines," Part 31, "Definite-Purpose, Inverter-Fed, Polyphase Motors."
- g. Severe-duty rating with the following features:
- 1) Rotor and stator protected with corrosion-inhibiting epoxy resin.
 - 2) Double-shielded, vacuum-degassed bearings lubricated with premium, moisture-resistant grease suitable for temperatures between minus 20 and plus 300 deg F (minus 29 and plus 149 deg C).
 - 3) Internal heater automatically energized when motor is de-energized.
- h. Motor Base: Adjustable, or other suitable provision for adjusting belt tension.
17. Fan Discharge Stack: Material shall match casing, manufacturer's standard **OR** velocity recovery, **as directed**, design.
- a. Stack Extension: Fabricated to extend above fan deck unless otherwise indicated.
- b. Stack Termination: Wire-mesh, galvanized-steel screens; complying with OSHA regulations.
18. Vibration Switch: For each fan drive.
- a. Enclosure: NEMA 250, Type 4 **OR** Type 4X, **as directed**.
- b. Vibration Detection: Sensor with a field-adjustable, acceleration-sensitivity set point in a range of 0 to 1 g and frequency range of 0 to 3000 cycles per minute. Cooling tower manufacturer shall recommend switch set point for proper operation and protection.
- c. Provide switch with manual-reset button, **as directed**, for field connection to a BMS, **as directed**, and hardwired connection to fan motor electrical circuit.
- d. Switch shall, on sensing excessive vibration, signal an alarm through the BMS, **as directed**, and shut down the fan.
19. Controls: Comply with requirements in Division 23 Section "Instrumentation And Control For Hvac".
OR
Control Package: Factory installed and wired, and functionally tested at factory before shipment.



- a. NEMA 250, Type 3R **OR** Type 4 **OR** Type 4X, **as directed**, enclosure with removable internally mount backplate.
 - b. Control-circuit transformer with primary and secondary side fuses.
 - c. Terminal blocks with numbered and color-coded wiring to match wiring diagram. Spare wiring terminal block for connection to external controls or equipment.
 - d. Microprocessor-based controller for automatic control of fan and spray pump, **as directed**, based on cooling tower leaving-water temperature with control features to improve operating efficiency based on outdoor ambient wet-bulb temperature by using adaptive logic.
 - e. Fan motor sequencer for multiple-cell and two-speed applications with automatic lead stage rotation.
 - f. Collection basin electric/electronic level controller complying with requirements in "Electric/Electronic, Collection Basin Water-Level Controller with Solenoid Valve" Paragraph.
 - g. Electric basin heaters with temperature control and low-water-level safety switch for each cell, complying with requirements in "Electric Basin Heater" Paragraph.
 - h. Vibration switch for each fan, complying with requirements in "Vibration Switch" Paragraph.
 - i. Single-point, field-power connection to a fused disconnect switch **OR** nonfused disconnect switch **OR** circuit breaker **OR** for each cooling tower cell, **as directed**.
 - 1) Branch power circuit to each motor and electric basin heater and to controls with a disconnect switch or circuit breaker, **as directed**.
 - 2) NEMA-rated motor controller, hand-off-auto switch, and overcurrent protection for each motor. Provide variable frequency controller with manual bypass and line reactors for each variable-speed motor indicated.
 - j. Factory-installed wiring outside of enclosures shall be in metal raceway, except make connections to each motor and electric basin heater with liquidtight conduit.
 - k. Visual indication of status and alarm with momentary test push button, **as directed**, for each motor.
 - l. Audible alarm and silence switch.
 - m. Visual indication of elapsed run time, graduated in hours for each motor.
 - n. Cooling tower shall have hardware to enable BMS to remotely monitor and display the following:
 - 1) Operational status of each motor.
 - 2) Cooling tower leaving-fluid temperature.
 - 3) Fan vibration alarm.
 - 4) Collection basin high **OR** low **OR** high- and low, **as directed**, -water-level alarms.
20. Personnel Access Components:
- a. Doors: Large enough for personnel to access cooling tower internal components from both cooling tower end walls. Doors shall be operable from both sides of the door.
 - b. External Ladders with Safety Cages: Aluminum, galvanized- or stainless-steel, fixed ladders with ladder extensions to access external platforms and top of cooling tower from adjacent grade without the need for portable ladders. Comply with 29 CFR 1910.27.
 - c. External Platforms with Handrails: Aluminum, FRP, or galvanized-steel bar grating at cooling tower access doors when cooling towers are elevated and not accessible from grade.
 - d. Handrail: Aluminum, galvanized steel, or stainless steel complete with kneerail and toeboard, around top of cooling tower. Comply with 29 CFR 1910.23.
 - e. Internal Platforms: Aluminum, FRP, or galvanized-steel bar grating.
 - 1) Spanning the collection basin from one end of cooling tower to the other and positioned to form a path between the access doors. Platform shall be elevated so that all parts are above the high water level of the collection basin.
 - 2) Elevated internal platforms with handrails accessible from fixed vertical ladders to access the fan drive assembly when out of reach from collection basin platform.

D. Open-Circuit, Forced-Draft, Counterflow Cooling Towers



1. Fabricate cooling tower mounting base with reinforcement strong enough to resist cooling tower movement during a seismic event when cooling tower is anchored to field support structure.
2. Cooling tower designed to resist wind load of 30 lbf/sq. ft. (1.44 kPa) **OR as directed**.
3. Casing and Frame:
 - a. Casing and Frame, **as directed**, Material: FRP with UV inhibitors **OR** Galvanized steel, ASTM A 653/A 653M, G210 (Z600) coating **OR** Galvanized steel, ASTM A 653/A 653M, G235 (Z700) coating **OR** Polymer-coated galvanized steel **OR** Stainless steel, **as directed**.
 - b. Frame Material: FRP with UV inhibitors **OR** Galvanized steel, ASTM A 653/A 653M, G210 (Z600) coating **OR** Galvanized steel, ASTM A 653/A 653M, G235 (Z700) coating **OR** Polymer-coated galvanized steel **OR** Stainless steel, **as directed**.
 - c. Fasteners: Galvanized **OR** Stainless, **as directed**, steel.
 - d. Joints and Seams: Sealed watertight.
 - e. Welded Connections: Continuous and watertight.
4. Collection Basin: Configure tower for installation with a field-constructed collection basin.
OR
Collection Basin:
 - a. Material: FRP with UV inhibitors **OR** Galvanized steel, ASTM A 653/A 653M, G210 (Z600) coating **OR** Galvanized steel, ASTM A 653/A 653M, G235 (Z700) coating **OR** Polymer-coated galvanized steel **OR** Stainless steel, **as directed**.
 - b. Strainer: Removable stainless-steel, **as directed**, strainer with openings smaller than nozzle orifices.
 - c. Overflow and drain connections.
 - d. Makeup water connection.
 - e. Basin Sweeper Distribution Piping and Nozzles:
 - 1) Pipe Material: PVC, **as directed**.
 - 2) Nozzle Material: Plastic, **as directed**.
 - 3) Configure piping and nozzles to minimize sediment from collecting in the collection basin.
5. Mechanically Operated, Collection Basin Water-Level Control: Manufacturer's standard adjustable, mechanical float assembly and valve.
6. Electric/Electronic, Collection Basin Water-Level Controller with Solenoid Valve:
 - a. Enclosure: NEMA 250, Type 4 **OR** Type 4X, **as directed**.
 - b. Sensor: Solid-state controls with multiple electrode probes and relays factory wired to a terminal strip to provide control of water makeup valve **OR** control of water makeup valve and low-level alarm **OR** control of water makeup valve and low- and high-level alarms **OR** control of water makeup valve, low- and high-level alarms, and output for shutoff of pump on low level, **as directed**.
 - c. Electrode Probes: Stainless steel.
 - d. Water Stilling Chamber: Corrosion-resistant material **OR** FRP **OR** Galvanized steel **OR** PVC pipe **OR** Stainless steel, **as directed**.
 - e. Solenoid Valve: Slow closing with stainless-steel body, **as directed**, controlled and powered through level controller in response to water-level set point.
 - f. Electrical Connection Requirements: 120 V, single phase, 60 Hz.
7. Electric Basin Heater:
 - a. Stainless-Steel Electric Immersion Heaters: Installed in a threaded coupling on the side of the collection basin.
 - b. Heater Control Panel: Mounted on the side of each cooling tower cell.
 - c. Enclosure: NEMA 250, Type 3R **OR** Type 4 **OR** Type 4X, **as directed**.
 - d. Magnetic contactors controlled by a temperature sensor/controller to maintain collection basin water-temperature set point. Water-level probe shall monitor cooling tower water level and de-energize the heater when the water reaches low-level set point.
 - e. Control-circuit transformer with primary and secondary side fuses.
 - f. Terminal blocks with numbered and color-coded wiring to match wiring diagram.
 - g. Single-point, field-power connection to a fused disconnect switch **OR** nonfused disconnect switch **OR** circuit breaker, **as directed**, and heater branch circuiting complying with NFPA 70.



- h. Factory Wiring Method: Metal raceway for factory-installed wiring outside of enclosures, except make connections to each electric basin heater with liquidtight conduit.
 - i. Hot-Water-Coil Basin Heater: Manufacturer's standard offering to provide capacity indicated.
- OR**
- Steam-Coil Basin Heater: Manufacturer's standard offering to provide capacity indicated.
- OR**
- Steam-Injector Basin Heater: Manufacturer's standard offering to provide capacity indicated.
8. Pressurized Water Distribution Piping: Main header and lateral branch piping designed for even distribution over heat-exchanger coil or fill throughout the flow range without the need for balancing valves and for connecting individual, removable, nonclogging spray nozzles.
 - a. Pipe Material: Fiberglass **OR** PVC **OR** Galvanized steel, **as directed**.
 - b. Spray Nozzle Material: Plastic **OR** Polypropylene **OR** PVC, **as directed**.
 - c. Piping Supports: Corrosion-resistant hangers and supports to resist movement during operation and shipment.
 9. Fill:
 - a. Materials: PVC, **as directed**, with maximum flame-spread index of 5 according to ASTM E 84.
 - b. Minimum Thickness: 15 mils (0.4 mm) **OR** 20 mils (0.5 mm), **as directed**, before forming.
 - c. Fabrication: Fill-type sheets, fabricated, formed, and bonded together after forming into removable assemblies that are factory installed by manufacturer.
 - d. Fill Material Operating Temperature: Suitable for entering-water temperatures up through 120 deg F (49 deg C).
 10. Removable, **as directed**, Drift Eliminator:
 - a. Material: FRP **OR** PVC, **as directed**; with maximum flame-spread index of 5 **OR** 25, **as directed**, according to ASTM E 84.
 - b. UV Treatment: Inhibitors to protect against damage caused by UV radiation.
 - c. Configuration: Multipass, designed and tested to reduce water carryover to achieve performance indicated.
 11. Removable, **as directed**, Air-Intake Screens: Galvanized **OR** Polymer-coated, galvanized **OR** Stainless, **as directed**,-steel wire mesh.
 12. Centrifugal Fan: Double-width, double-inlet, forward-curved blades, and statically and dynamically balanced at the factory after assembly.
 - a. Number of Fans: Each cooling tower cell shall have a single fan or multiple fans connected to a common shaft.
 - b. Fan Wheel and Housing Materials: Galvanized steel.
 - c. Fan Shaft: Steel, coated to resist corrosion.
 - d. Protective Enclosure: Removable, galvanized-steel, wire-mesh screens complying with OSHA regulations.
 - e. Fan Shaft Bearings: Self-aligning, grease-lubricated ball or roller bearings with moisture-proof seals and premium, moisture-resistant grease suitable for temperatures between minus 20 and plus 300 deg F (minus 29 and plus 149 deg C). Bearings designed for an L-10 life of 40,000 **OR** 50,000, **as directed**, hours.
 - f. Bearings Grease Fittings: Extended lubrication lines to an easily accessible location.
 13. Axial Fan: Balanced at the factory after assembly.
 - a. Blade Material: FRP, **as directed**.
 - b. Hub Material: Aluminum **OR** FRP, **as directed**.
 - c. Blade Pitch: Field adjustable.
 - d. Protective Enclosure: Removable, galvanized-steel, wire-mesh screens complying with OSHA regulations.
 - e. Fan Shaft Bearings: Self-aligning ball or roller bearings with moisture-proof seals and premium, moisture-resistant grease suitable for temperatures between minus 20 and plus 300 deg F (minus 29 and plus 149 deg C). Bearings designed for an L-10 life of 40,000 **OR** 50,000, **as directed**, hours.
 - f. Bearings Grease Fittings: Extended lubrication lines to an easily accessible location.



14. Belt Drive:
 - a. Service Factor: 1.5 based on motor nameplate horsepower.
 - b. Sheaves: Fan and motor shafts shall have taper-lock sheaves fabricated from corrosion-resistant materials.
 - c. Belt: Multiple V-belt design with a matched set of cogged, **as directed**, belts.
OR
Belt: One-piece, multigrooved, solid-back belt.
 - d. Belt Material: Oil resistant, nonstatic conducting, and constructed of neoprene polyester cord.
 - e. Belt-Drive Guard: Comply with OSHA regulations.
 - f. Two-Motor, Single-Fan Drive:
 - 1) Two single-speed motors per fan, one sized for full speed and load and the other sized for 67 percent of full-load speed.
 - 2) Each motor with belt drive and configured for operation when other motor fails.
 - 3) Controls and wiring same as two-speed, two-winding motor.
15. Direct Drive: Fan hub directly connected, and properly secured, to motor shaft.
16. Fan Motor:
 - a. General Requirements for Fan Motors: Comply with NEMA designation and temperature-rating requirements specified in Division 15 Section "Common Motor Requirements for HVAC Equipment" and not indicated below.
 - b. Motor Enclosure: Totally enclosed **OR** Totally enclosed air over (TEAO) **OR** Totally enclosed fan cooled (TEFC), **as directed**, with epoxy or polyurethane finish, **as directed**.
 - c. Energy Efficiency: Comply with ASHRAE/IESNA 90.1 **OR** NEMA Premium Efficient, **as directed**.
 - d. Service Factor: 1.15.
 - e. Insulation: Class F **OR** Class H, **as directed**.
 - f. Variable-Speed Motors: Inverter-duty rated per NEMA MG-1, Section IV, "Performance Standard Applying to All Machines," Part 31, "Definite-Purpose, Inverter-Fed, Polyphase Motors."
 - g. Severe-duty rating with the following features:
 - 1) Rotor and stator protected with corrosion-inhibiting epoxy resin.
 - 2) Double-shielded, vacuum-degassed bearings lubricated with premium, moisture-resistant grease suitable for temperatures between minus 20 and 300 deg F (minus 29 and 149 deg C).
 - 3) Internal heater automatically energized when motor is de-energized.
 - h. Motor Base: Adjustable, or other suitable provision for adjusting belt tension.
17. Discharge Hoods:
 - a. Hood Configuration: Tapered **OR** Straight, **as directed**; totally surrounding drift eliminators and constructed of same material as casing; and having factory-installed insulation, **as directed**, and access doors.
 - b. Discharge Dampers: Positive-closure, automatic, isolation dampers with electric actuators.
 - 1) Provide field power and controls to open dampers when pump is energized and close dampers when pump is de-energized.
18. Capacity-Control Dampers: Galvanized-steel **OR** Stainless-steel, **as directed**, dampers, with linkages, electric operator, controller, limit switches, transformer, and weatherproof enclosure.
19. Vibration Switch: For each fan drive.
 - a. Enclosure: NEMA 250, Type 4 **OR** Type 4X, **as directed**.
 - b. Vibration Detection: Sensor with a field-adjustable, acceleration-sensitivity set point in a range of 0 to 1 g and frequency range of 0 to 3000 cycles per minute. Cooling tower manufacturer shall recommend switch set point for proper operation and protection.
 - c. Provide switch with manual-reset button, **as directed**, for field connection to a BMS, **as directed**, and hardwired connection to fan motor electrical circuit.
 - d. Switch shall, on sensing excessive vibration, signal an alarm through the BMS, **as directed**, and shut down the fan.
20. Controls: Comply with requirements in Division 23 Section "Instrumentation And Control For Hvac".

**OR**

Control Package: Factory installed and wired, and functionally tested at factory before shipment.

- a. NEMA 250, Type 3R **OR** Type 4 **OR** Type 4X, **as directed**, enclosure with removable internally mount backplate.
 - b. Control-circuit transformer with primary and secondary side fuses.
 - c. Terminal blocks with numbered and color-coded wiring to match wiring diagram. Spare wiring terminal block for connection to external controls or equipment.
 - d. Microprocessor-based controller for automatic control of fan based on cooling tower leaving-water temperature with control features to improve operating efficiency based on outdoor ambient wet-bulb temperature by using adaptive logic.
 - e. Fan motor sequencer for multiple-cell and two-speed applications with automatic lead stage rotation.
 - f. Factory-installed and -wired, collection basin electric/electronic level controller.
 - g. Collection basin electric/electronic level controller complying with requirements in "Electric/Electronic, Collection Basin Water-Level Controller with Solenoid Valve" Paragraph.
 - h. Electric basin heaters with temperature control and low-water-level safety switch for each cell, complying with requirements in "Electric Basin Heater" Paragraph.
 - i. Vibration switch for each fan, complying with requirements in "Vibration Switch" Paragraph.
 - j. Controls and wiring for "two-motor, single-fan drives" shall be same as two-speed, two-winding motor.
 - k. Single-point, field-power connection to a fused disconnect switch **OR** nonfused disconnect switch **OR** circuit breaker, **as directed**, for each cooling tower cell, **as directed**.
 - 1) Branch power circuit to each motor and electric basin heater and to controls with a disconnect switch or circuit breaker, **as directed**.
 - 2) NEMA-rated motor controller, hand-off-auto switch, and overcurrent protection for each motor. Provide variable frequency controller with manual bypass and line reactors for each variable-speed motor indicated.
 - l. Factory-installed wiring outside of enclosures shall be in metal raceway, except make connections to each motor and electric basin heater with liquidtight conduit.
 - m. Visual indication of status and alarm with momentary test push button, **as directed**, for each motor.
 - n. Audible alarm and silence switch.
 - o. Visual indication of elapsed run time, graduated in hours for each motor.
 - p. Cooling tower shall have hardware to enable BMS to remotely monitor and display the following:
 - 1) Operational status of each motor.
 - 2) Position of dampers.
 - 3) Cooling tower leaving-fluid temperature.
 - 4) Fan vibration alarm.
 - 5) Collection basin high **OR** low **OR** high- and low, **as directed**, -water-level alarms.
21. Personnel Access Components:
- a. Doors: Large enough for personnel to access cooling tower internal components from both cooling tower end walls. Doors shall be operable from both sides of the door.
 - b. External Ladders with Safety Cages: Aluminum, galvanized- or stainless-steel, fixed ladders with ladder extensions to access external platforms and top of cooling tower from adjacent grade without the need for portable ladders. Comply with 29 CFR 1910.27.
 - c. External Platforms with Handrails: Aluminum, FRP, or galvanized-steel bar grating at cooling tower access doors when cooling towers are elevated and not accessible from grade.
 - d. Handrail: Aluminum, galvanized steel, or stainless steel complete with kneerail and toeboard, around top of cooling tower. Comply with 29 CFR 1910.23.
 - e. Internal Platforms: Aluminum, FRP, or galvanized-steel bar grating.



- 1) Spanning the collection basin from one end of cooling tower to the other and positioned to form a path between the access doors. Platform shall be elevated so that all parts are above the high water level of the collection basin.
 - 2) Elevated internal platforms with handrails accessible from fixed vertical ladders to access the fan drive assembly when out of reach from collection basin platform.
- E. Open-Circuit, Induced-Draft, Counterflow Cooling Towers
1. Fabricate cooling tower mounting base with reinforcement strong enough to resist cooling tower movement during a seismic event when cooling tower is anchored to field support structure.
 2. Cooling tower designed to resist wind load of 30 lbf/sq. ft. (1.44 kPa) **OR as directed**.
 3. Casing and Frame:
 - a. Casing and Frame, **as directed**, Material: FRP with UV inhibitors **OR** Galvanized steel, ASTM A 653/A 653M, G210 (Z600) coating **OR** Galvanized steel, ASTM A 653/A 653M, G235 (Z700) coating **OR** Stainless steel, **as directed**.
 - b. Frame Material: FRP with UV inhibitors **OR** Galvanized steel, ASTM A 653/A 653M, G210 (Z600) coating **OR** Galvanized steel, ASTM A 653/A 653M, G235 (Z700) coating **OR** Stainless steel, **as directed**.
 - c. Fasteners: Galvanized **OR** Stainless, **as directed**, steel.
 - d. Joints and Seams: Sealed watertight.
 - e. Welded Connections: Continuous and watertight.
 4. Collection Basin: Configure tower for installation with a field-constructed collection basin.
OR
Collection Basin:
 - a. Material: FRP with UV inhibitors **OR** Galvanized steel, ASTM A 653/A 653M, G210 (Z600) coating **OR** Galvanized steel, ASTM A 653/A 653M, G235 (Z700) coating **OR** Polymer-coated galvanized steel **OR** Stainless steel, **as directed**.
 - b. Strainer: Removable stainless-steel, **as directed**, strainer with openings smaller than nozzle orifices.
 - c. Overflow and drain connections.
 - d. Makeup water connection.
 - e. Outlet Connection: ASME B16.5, Class 150 flange.
 - f. Removable equalization flume plate between adjacent cells of multiple-cell towers.
 - g. Equalizer connection for field-installed equalizer piping.
 - h. Basin Sweeper Distribution Piping and Nozzles:
 - 1) Pipe Material: PVC, **as directed**.
 - 2) Nozzle Material: Plastic, **as directed**.
 - 3) Configure piping and nozzles to minimize sediment from collecting in the collection basin.
 5. Mechanically Operated, Collection Basin Water-Level Control: Manufacturer's standard adjustable, mechanical float assembly and valve.
OR
Electric/Electronic, Collection Basin Water-Level Controller with Solenoid Valve:
 - a. Enclosure: NEMA 250, Type 4 **OR** Type 4X, **as directed**.
 - b. Sensor: Solid-state controls with multiple electrode probes and relays factory wired to a terminal strip to provide control of water makeup valve **OR** control of water makeup valve and low-level alarm **OR** control of water makeup valve and low- and high-level alarms **OR** control of water makeup valve, low- and high-level alarms, and output for shutoff of pump on low level, **as directed**.
 - c. Electrode Probes: Stainless steel.
 - d. Water Stilling Chamber: Corrosion-resistant material **OR** FRP **OR** Galvanized steel **OR** PVC pipe **OR** Stainless steel, **as directed**.
 - e. Solenoid Valve: Slow closing with stainless-steel body, **as directed**; controlled and powered through level controller in response to water-level set point.
 - f. Electrical Connection Requirements: 120 V, single phase, 60 Hz.
OR
Ultrasonic Collection Basin Water-Level Controller with Solenoid Valve:



- a. Enclosure: NEMA 250, Type 4 **OR** Type 4X, **as directed**.
 - b. Controller: Ultrasonic level sensor/transmitter and relays factory wired to a terminal strip to control water makeup valve and signal a level alarm. Controller shall provide continuous level indication through a 4- to 20-mA signal for connection to BMS, **as directed**.
 - c. Water Stilling Chamber: Corrosion-resistant material **OR** FRP **OR** Galvanized steel **OR** PVC pipe **OR** Stainless steel, **as directed**.
 - d. Solenoid Valve: Slow closing with stainless-steel body, **as directed**; controlled and powered through level controller in response to water-level set point.
 - e. Electrical Connection Requirements: 120 V, single phase, 60 Hz.
6. Electric Basin Heater:
- a. Stainless-Steel Electric Immersion Heaters: Installed in a threaded coupling on the side of the collection basin.
 - b. Heater Control Panel: Mounted on the side of each cooling tower cell.
 - c. Enclosure: NEMA 250, Type 3R **OR** Type 4 **OR** Type 4X, **as directed**.
 - d. Magnetic contactors controlled by a temperature sensor/controller to maintain collection basin water-temperature set point. Water-level probe shall monitor cooling tower water level and de-energize the heater when the water reaches low-level set point.
 - e. Control-circuit transformer with primary and secondary side fuses.
 - f. Terminal blocks with numbered and color-coded wiring to match wiring diagram.
 - g. Single-point, field-power connection to a fused disconnect switch **OR** nonfused disconnect switch **OR** circuit breaker, **as directed**, and heater branch circuiting complying with NFPA 70.
 - h. Factory Wiring Method: Metal raceway for factory-installed wiring outside of enclosures, except make connections to each electric basin heater with liquidtight conduit.
- OR**
Hot-Water-Coil Basin Heater: Manufacturer's standard offering to provide capacity indicated.
- OR**
Steam-Coil Basin Heater: Manufacturer's standard offering to provide capacity indicated.
- OR**
Steam-Injector Basin Heater: Manufacturer's standard offering to provide capacity indicated.
7. Pressurized Water Distribution Piping: Main header and lateral branch piping designed for even distribution over heat-exchanger coil or fill throughout the flow range without the need for balancing valves and for connecting individual, removable, nonclogging spray nozzles.
- a. Pipe Material: Fiberglass **OR** PVC **OR** Galvanized steel, **as directed**.
 - b. Spray Nozzle Material: Plastic **OR** Polypropylene **OR** PVC, **as directed**.
 - c. Piping Supports: Corrosion-resistant hangers and supports to resist movement during operation and shipment.
8. Fill:
- a. Materials: CPVC **OR** PVC, **as directed**, resistant to rot, decay, and biological attack; with maximum flame-spread index of 5 **OR** 25, **as directed**, according to ASTM E 84.
 - b. Minimum Thickness: 15 mils (0.4 mm) **OR** 20 mils (0.5 mm), **as directed**, before forming.
 - c. Fabrication: Fill-type sheets, fabricated, formed, and bonded together after forming into removable assemblies that are factory installed by manufacturer.
 - d. Fill Material Operating Temperature: Suitable for entering-water temperatures up through 120 deg F (49 deg C).
9. Removable, **as directed**, Drift Eliminator:
- a. Material: FRP **OR** PVC, **as directed**; resistant to rot, decay, and biological attack; with maximum flame-spread index of 5 **OR** 25, **as directed**, according to ASTM E 84.
 - b. UV Treatment: Inhibitors to protect against damage caused by UV radiation.
 - c. Configuration: Multipass, designed and tested to reduce water carryover to achieve performance indicated.
10. Air-Intake Louvers:
- a. Material: FRP **OR** PVC **OR** Matching casing, **as directed**.
 - b. UV Treatment: Inhibitors to protect against damage caused by UV radiation.



- c. Louver Blades: Arranged to uniformly direct air into cooling tower, to minimize air resistance, and to prevent water from splashing out of tower during all modes of operation including operation with fans off.
- 11. Removable, **as directed**, Air-Intake Screens: Galvanized **OR** Polymer-coated, galvanized **OR** Stainless, **as directed**, -steel wire mesh.
- 12. Axial Fan: Balanced at the factory after assembly.
 - a. Blade Material: Aluminum **OR** FRP **OR** Galvanized steel, **as directed**.
 - b. Hub Material: Aluminum **OR** FRP **OR** Galvanized steel, **as directed**.
 - c. Blade Pitch: Field adjustable.
 - d. Protective Enclosure: Removable, galvanized-steel, wire-mesh screens, complying with OSHA regulations.
 - e. Fan Shaft Bearings: Self-aligning ball or roller bearings with moisture-proof seals and premium, moisture-resistant grease suitable for temperatures between minus 20 and plus 300 deg F (minus 29 and plus 149 deg C). Bearings designed for an L-10 life of 40,000 **OR** 50,000, **as directed**, hours.
 - f. Bearings Grease Fittings: Extended lubrication lines to an easily accessible location.
- 13. Belt Drive:
 - a. Service Factor: 1.5 based on motor nameplate horsepower.
 - b. Sheaves: Fan and motor shafts shall have taper-lock sheaves fabricated from corrosion-resistant materials.
 - c. Belt: Multiple V-belt design with a matched set of cogged, **as directed**, belts.
OR
Belt: One-piece, multigrooved, solid-back belt.
 - d. Belt Material: Oil resistant, nonstatic conducting, and constructed of neoprene polyester cord.
 - e. Belt-Drive Guard: Comply with OSHA regulations.
- 14. Direct Drive: Fan hub directly connected, and properly secured, to motor shaft.
- 15. Gear Drive: Right angle, reduced speed, and designed for cooling tower applications according to CTI STD 111. Motor and gear drive shall be aligned before shipment.
 - a. Gear Drive and Coupling Service Factor: 2.0 based on motor nameplate horsepower.
 - b. Housing: Cast iron, with epoxy or polyurethane finish, beveled high-strength steel gears continuously bathed in oil, and with lubrication to other internal parts at all operating speeds.
 - c. Mounting: Directly mounted to fan hub and connected to motor so motor shaft is in horizontal position.
 - d. Operation: Able to operate both forward and in reverse.
 - e. Drive-to-Motor Connection: Close coupled to motor using a flexible coupling **OR** Connected to motor located outside of cooling tower casing by a full-floating drive shaft, **as directed**.
 - f. Drive Shaft Material: Corrosion resistant **OR** Stainless steel, **as directed**, and fitted with flexible couplings on both ends. Provide exposed shaft and couplings with guards according to OSHA regulations.
 - g. Extend oil fill, drain, and vent to outside of cooling tower casing using galvanized-steel piping. Provide installation with oil-level sight glass.
- 16. Fan Motor:
 - a. General Requirements for Fan Motors: Comply with NEMA designation and temperature-rating requirements specified in Division 15 Section "Common Motor Requirements for HVAC Equipment" and not indicated below.
 - b. Motor Enclosure: Totally enclosed **OR** Totally enclosed air over (TEAO) **OR** Totally enclosed fan cooled (TEFC), **as directed**, with epoxy or polyurethane finish, **as directed**.
 - c. Energy Efficiency: Comply with ASHRAE/IESNA 90.1 **OR** NEMA Premium Efficient, **as directed**.
 - d. Service Factor: 1.15.
 - e. Insulation: Class F **OR** Class H, **as directed**.



- f. Variable-Speed Motors: Inverter-duty rated per NEMA MG-1, Section IV, "Performance Standard Applying to All Machines," Part 31, "Definite-Purpose, Inverter-Fed, Polyphase Motors."
- g. Motor Location: Mounted outside of cooling tower casing and cooling tower discharge airstream.
- h. Severe-duty rating with the following features:
 - 1) Rotor and stator protected with corrosion-inhibiting epoxy resin.
 - 2) Double-shielded, vacuum-degassed bearings lubricated with premium, moisture-resistant grease suitable for temperatures between minus 20 and plus 300 deg F (minus 29 and plus 149 deg C).
 - 3) Internal heater automatically energized when motor is de-energized.
- i. Motor Base: Adjustable, or other suitable provision for adjusting belt tension.
- 17. Fan Discharge Stack: Material shall match casing, manufacturer's standard **OR** velocity recovery, **as directed**, design.
 - a. Stack Extension: Fabricated to extend above fan deck unless otherwise indicated.
 - b. Stack Termination: Wire-mesh, galvanized-steel screens; complying with OSHA regulations.
- 18. Vibration Switch: For each fan drive.
 - a. Enclosure: NEMA 250, Type 4 **OR** Type 4X, **as directed**.
 - b. Vibration Detection: Sensor with a field-adjustable, acceleration-sensitivity set point in a range of 0 to 1 g and frequency range of 0 to 3000 cycles per minute. Cooling tower manufacturer shall recommend switch set point for proper operation and protection.
 - c. Provide switch with manual-reset button, **as directed**, for field connection to a BMS, **as directed**, and hardwired connection to fan motor electrical circuit.
 - d. Switch shall, on sensing excessive vibration, signal an alarm through the BMS, **as directed**, and shut down the fan.
- 19. Gear-Drive, Oil-Level Switch: Low-oil-level warning switch for connection to a BMS, **as directed**.
 - a. Switch shall, on reaching a low-oil-level set point recommended by cooling tower manufacturer, signal an alarm through the BMS, **as directed**.
- 20. Controls: Comply with requirements in Division 23 Section "Instrumentation And Control For Hvac".
OR
Control Package: Factory installed and wired, and functionally tested at factory before shipment.
 - a. NEMA 250, Type 3R **OR** Type 4 **OR** Type 4X, **as directed**, enclosure with removable internally mount backplate.
 - b. Control-circuit transformer with primary and secondary side fuses.
 - c. Terminal blocks with numbered and color-coded wiring to match wiring diagram. Spare wiring terminal block for connection to external controls or equipment.
 - d. Microprocessor-based controller for automatic control of fan based on cooling tower leaving-water temperature with control features to improve operating efficiency based on outdoor ambient wet-bulb temperature by using adaptive logic.
 - e. Fan motor sequencer for multiple-cell and two-speed applications with automatic lead stage rotation.
 - f. Collection basin level controller complying with requirements in "Electric/Electronic, Collection Basin Water-Level Controller with Solenoid Valve" **OR** "Ultrasonic Collection Basin Water-Level Controller with Solenoid Valve", **as directed**, Paragraph.
 - g. Electric basin heaters with temperature control and low-water-level safety switch for each cell, complying with requirements in "Electric Basin Heater" Paragraph.
 - h. Vibration switch for each fan, complying with requirements in "Vibration Switch" Paragraph.
 - i. Oil-level switch for each fan with a gear drive, complying with requirement in "Gear-Drive, Oil-Level Switch" Paragraph.
 - j. Single-point, field-power connection to a fused disconnect switch **OR** nonfused disconnect switch **OR** circuit breaker, **as directed**, for each cooling tower cell, **as directed**.
 - 1) Branch power circuit to each motor and electric basin heater and to controls with a disconnect switch or circuit breaker, **as directed**.



- 2) NEMA-rated motor controller, hand-off-auto switch, and overcurrent protection for each motor. Provide variable frequency controller with manual bypass and line reactors for each variable-speed motor indicated.
 - k. Factory-installed wiring outside of enclosures shall be in metal raceway, except make connections to each motor and electric basin heater with liquidtight conduit.
 - l. Visual indication of status and alarm with momentary test push button, **as directed**, for each motor.
 - m. Audible alarm and silence switch.
 - n. Visual indication of elapsed run time, graduated in hours for each motor.
 - o. Cooling tower shall have hardware to enable BMS to remotely monitor and display the following:
 - 1) Operational status of each motor.
 - 2) Position of dampers.
 - 3) Cooling tower leaving-fluid temperature.
 - 4) Fan vibration alarm.
 - 5) Oil-level alarm.
 - 6) Collection basin high **OR** low **OR** high- and low, **as directed**, -water-level alarms.
21. Personnel Access Components:
- a. Doors: Large enough for personnel to access cooling tower internal components from both cooling tower end walls. Doors shall be operable from both sides of the door.
 - b. External Ladders with Safety Cages: Aluminum, galvanized- or stainless-steel, fixed ladders with ladder extensions to access external platforms and top of cooling tower from adjacent grade without the need for portable ladders. Comply with 29 CFR 1910.27.
 - c. External Platforms with Handrails: Aluminum, FRP, or galvanized-steel bar grating at cooling tower access doors when cooling towers are elevated and not accessible from grade.
 - d. Handrail: Aluminum, galvanized steel, or stainless steel complete with kneerail and toeboard, around top of cooling tower. Comply with 29 CFR 1910.23.
 - e. Internal Platforms: Aluminum, FRP, or galvanized-steel bar grating.
 - 1) Spanning the collection basin from one end of cooling tower to the other and positioned to form a path between the access doors. Platform shall be elevated so that all parts are above the high water level of the collection basin.
 - 2) Elevated internal platforms with handrails accessible from fixed vertical ladders to access the fan drive assembly when out of reach from collection basin platform.
- F. Open-Circuit, Induced-Draft, Crossflow Cooling Towers
1. Fabricate cooling tower mounting base with reinforcement strong enough to resist cooling tower movement during a seismic event when cooling tower is anchored to field support structure.
 2. Cooling tower designed to resist wind load of 30 lbf/sq. ft. (1.44 kPa), **as directed**.
 3. Casing and Frame:
 - a. Casing and Frame, **as directed**, Material: FRP with UV inhibitors **OR** Galvanized steel, ASTM A 653/A 653M, G235 (Z700) coating **OR** Polymer-coated galvanized steel **OR** Stainless steel, **as directed**.
 - b. Frame Material: FRP with UV inhibitors **OR** Galvanized steel, ASTM A 653/A 653M, G235 (Z700) coating **OR** Polymer-coated galvanized steel **OR** Stainless steel, **as directed**.
 - c. Fasteners: Galvanized **OR** Stainless, **as directed**, steel.
 - d. Joints and Seams: Sealed watertight.
 - e. Welded Connections: Continuous and watertight.
 4. Collection Basin: Configure tower for installation with a field-constructed collection basin.
OR
Collection Basin:
 - a. Material: FRP with UV inhibitors **OR** Galvanized steel, ASTM A 653/A 653M, G235 (Z700) coating **OR** Polymer-coated galvanized steel **OR** Stainless steel, **as directed**.
 - b. Removable stainless-steel, **as directed**, strainer with openings smaller than nozzle orifices.
 - c. Overflow and drain connections.



- d. Makeup water connection.
 - e. Outlet Connection: ASME B16.5, Class 150 flange.
 - f. Removable equalization flume plate between adjacent cells of multiple-cell towers.
 - g. Equalizer connection for field-installed equalizer piping.
 - h. Basin Sweeper Distribution Piping and Nozzles:
 - 1) Pipe Material: PVC, **as directed**.
 - 2) Nozzle Material: Plastic, **as directed**.
 - 3) Configure piping and nozzles to minimize sediment from collecting in the collection basin.
5. Mechanically Operated, Collection Basin Water-Level Control: Manufacturer's standard adjustable, mechanical float assembly and valve.
- OR**
- Electric/Electronic, Collection Basin Water-Level Controller with Solenoid Valve:
- a. Enclosures: NEMA 250, Type 4 **OR** Type 4X, **as directed**.
 - b. Sensor: Solid-state controls with multiple electrode probes and relays factory wired to a terminal strip to provide control of water makeup valve **OR** control of water makeup valve and low-level alarm **OR** control of water makeup valve and low- and high-level alarms **OR** control of water makeup valve, low- and high-level alarms, and output for shutoff of pump on low level, **as directed**.
 - c. Electrode Probes: Stainless steel.
 - d. Water Stilling Chamber: Corrosion-resistant material **OR** FRP **OR** Galvanized steel **OR** PVC pipe **OR** Stainless steel, **as directed**.
 - e. Solenoid Valve: Slow closing with stainless-steel body, **as directed**, controlled and powered through level controller in response to water-level set point.
 - f. Electrical Connection Requirements: 120 V, single phase, 60 Hz.
- OR**
- Ultrasonic Collection Basin Water-Level Controller with Solenoid Valve:
- a. Enclosure: NEMA 250, Type 4 **OR** Type 4X, **as directed**.
 - b. Controller: Ultrasonic level sensor/transmitter and relays factory wired to a terminal strip to control water makeup valve and signal a level alarm. Controller shall provide continuous level indication through a 4- to 20-mA signal for connection to BMS, **as directed**.
 - c. Water Stilling Chamber: Corrosion-resistant material **OR** FRP **OR** Galvanized steel **OR** PVC pipe **OR** Stainless steel, **as directed**.
 - d. Solenoid Valve: Slow closing with stainless-steel body, **as directed**; controlled and powered through level controller in response to water-level set point.
 - e. Electrical Connection Requirements: 120 V, single phase, 60 Hz.
6. Electric Basin Heater:
- a. Stainless-Steel Electric Immersion Heaters: Installed in a threaded coupling on the side of the collection basin.
 - b. Heater Control Panel: Mounted on the side of each cooling tower cell.
 - c. Enclosure: NEMA 250, Type 3R **OR** Type 4 **OR** Type 4X, **as directed**.
 - d. Magnetic contactors controlled by a temperature sensor/controller to maintain collection basin water-temperature set point. Water-level probe shall monitor cooling tower water level and de-energize the heater when the water reaches low-level set point.
 - e. Control-circuit transformer with primary and secondary side fuses.
 - f. Terminal blocks with numbered and color-coded wiring to match wiring diagram.
 - g. Single-point, field-power connection to a fused disconnect switch **OR** nonfused disconnect switch **OR** circuit breaker, **as directed**, and heater branch circuiting complying with NFPA 70.
 - h. Factory Wiring Method: Metal raceway for factory-installed wiring outside of enclosures, except make connections to each electric basin heater with liquidtight conduit.
- OR**
- Hot-Water-Coil Basin Heater: Manufacturer's standard offering to provide capacity indicated.
- OR**
- Steam-Coil Basin Heater: Manufacturer's standard offering to provide capacity indicated.

**OR**

Steam-Injector Basin Heater: Manufacturer's standard offering to provide capacity indicated.

7. Gravity Water Distribution Basin: Nonpressurized design with head of water level in basin adequate to overcome spray nozzle losses and designed to evenly distribute water over fill throughout the flow range indicated.
 - a. Material: FRP with UV inhibitors **OR** Galvanized steel, ASTM A 653/A 653M, G235 (Z700) coating **OR** Polymer-coated galvanized steel **OR** Stainless steel, **as directed**.
 - b. Location: Over each bank of fill with easily replaceable plastic, **as directed**, spray nozzles mounted in bottom of basin.
 - c. Inlet Connection: ASME B16.5, Class 150 flange.
 - d. Joints and Seams: Sealed watertight.
 - e. Partitioning Dams: Same material as basin to distribute water over the fill to minimize icing while operating throughout the flow range indicated.
 - f. Removable Panels: Same material as basin to completely cover top of basin. Secure panels to basin with removable corrosion-resistant **OR** stainless-steel, **as directed**, hardware.
 - g. Valves: Manufacturer's standard valve installed at each inlet connection and arranged to balance or shut off flow to each gravity distribution basin.
 - h. Single-Inlet, Field Pipe Connection: Galvanized-steel **OR** PVC, **as directed**, pipe arranged to provide balancing of flow within cooling tower cell without the need for additional balancing valves. Pipe each cooling tower cell internally to a single, field connection suitable for mating to ASME B16.5, Class 150 flange and located on the bottom **OR** side, **as directed**, unless otherwise indicated.
8. Fill:
 - a. Materials: PVC, with maximum flame-spread index of 5 **OR** 25, **as directed**, according to ASTM E 84.
 - b. Minimum Thickness: 15 mils (0.4 mm) **OR** 20 mils (0.5 mm), **as directed**, before forming.
 - c. Fabrication: Fill-type sheets, fabricated, formed, and bonded together after forming into removable assemblies that are factory installed by manufacturer.
 - d. Fill Material Operating Temperature: Suitable for entering-water temperatures up through 120 deg F (49 deg C).
9. Drift Eliminator:
 - a. Material: FRP **OR** PVC, **as directed**; with maximum flame-spread index of 5 **OR** 25, **as directed**, according to ASTM E 84.
 - b. UV Treatment: Inhibitors to protect against damage caused by UV radiation.
 - c. Configuration: Multipass, designed and tested to reduce water carryover to achieve performance indicated.
 - d. Location: Integral to **OR** Separate and removable from, **as directed**, fill.
10. Air-Intake Louvers:
 - a. Material: FRP **OR** PVC **OR** Matching casing, **as directed**.
 - b. UV Treatment: Inhibitors to protect against damage caused by UV radiation.
 - c. Louver Blades: Arranged to uniformly direct air into cooling tower, to minimize air resistance, and to prevent water from splashing out of tower during all modes of operation including operation with fans off.
 - d. Location: Integral to **OR** Separate from, **as directed**, fill.
11. Removable, **as directed**, Air-Intake Screens: Galvanized **OR** Polymer-coated, galvanized **OR** Stainless, **as directed**,-steel wire mesh.
12. Axial Fan: Balanced at the factory after assembly.
 - a. Blade Material: Aluminum **OR** FRP **OR** Galvanized steel, **as directed**.
 - b. Hub Material: Aluminum **OR** FRP **OR** Galvanized steel, **as directed**.
 - c. Blade Pitch: Field adjustable.
 - d. Protective Enclosure: Removable, galvanized-steel, wire-mesh screens complying with OSHA regulations.
 - e. Fan Shaft Bearings: Self-aligning ball or roller bearings with moisture-proof seals and premium, moisture-resistant grease suitable for temperatures between minus 20 and plus



- 300 deg F (minus 29 and plus 149 deg C). Bearings designed for an L-10 life of 40,000 **OR** 50,000, **as directed**, hours.
- f. Bearings Grease Fittings: Extended lubrication lines to an easily accessible location.
13. Belt Drive:
- a. Service Factor: 1.5 based on motor nameplate horsepower.
 - b. Sheaves: Fan and motor shafts shall have taper-lock sheaves fabricated from corrosion-resistant materials.
 - c. Belt: Multiple V-belt design with a matched set of cogged, **as directed**, belts.
OR
Belt: One-piece, multigrooved, solid-back belt.
 - d. Belt Material: Oil resistant, nonstatic conducting, and constructed of neoprene polyester cord.
 - e. Belt-Drive Guard: Comply with OSHA regulations.
 - f. Two-Motor, Single-Fan Drive:
 - 1) Two single-speed motors per fan, one sized for full speed and load and the other sized for 67 percent of full-load speed.
 - 2) Each motor with belt drive and configured for operation when other motor fails.
 - 3) Controls and wiring same as two-speed, two-winding motor.
14. Gear Drive: Right angle, reduced speed, and designed for cooling tower applications according to CTI STD 111. Motor and gear drive shall be aligned before shipment.
- a. Gear Drive and Coupling Service Factor: 2.0 based on motor nameplate horsepower.
 - b. Housing: Cast iron, with epoxy or polyurethane finish, beveled high-strength steel gears continuously bathed in oil, and with lubrication to other internal parts at all operating speeds.
 - c. Mounting: Directly mounted to fan hub and connected to motor so motor shaft is in horizontal position.
 - d. Operation: Able to operate both forward and in reverse.
 - e. Drive-to-Motor Connection: Close coupled to motor using a flexible coupling **OR** Connected to motor located outside of cooling tower casing by a full-floating drive shaft, **as directed**.
 - f. Drive Shaft Material: Corrosion resistant **OR** Stainless steel, **as directed**, and fitted with flexible couplings on both ends. Provide exposed shaft and couplings with guards according to OSHA regulations.
 - g. Extend oil fill, drain, and vent to outside of cooling tower casing using galvanized-steel piping. Provide installation with oil-level sight glass.
15. Fan Motor:
- a. General Requirements for Fan Motors: Comply with NEMA designation and temperature-rating requirements specified in Division 23 Section "Common Motor Requirements For Hvac Equipment" and not indicated below.
 - b. Motor Enclosure: Totally enclosed **OR** Totally enclosed air over (TEAO) **OR** Totally enclosed fan cooled (TEFC), **as directed**, with epoxy or polyurethane finish, **as directed**.
 - c. Energy Efficiency: Comply with ASHRAE/IESNA 90.1 **OR** NEMA Premium Efficient, **as directed**.
 - d. Service Factor: 1.15.
 - e. Insulation: Class F **OR** Class H, **as directed**.
 - f. Variable-Speed Motors: Inverter-duty rated per NEMA MG-1, Section IV, "Performance Standard Applying to All Machines," Part 31, "Definite-Purpose, Inverter-Fed, Polyphase Motors."
 - g. Motor Location: Mounted outside of cooling tower casing and cooling tower discharge airstream.
 - h. Severe-duty rating with the following features:
 - 1) Rotor and stator protected with corrosion-inhibiting epoxy resin.
 - 2) Double-shielded, vacuum-degassed bearings lubricated with premium, moisture-resistant grease suitable for temperatures between minus 20 and plus 300 deg F (minus 29 and plus 149 deg C).



- 3) Internal heater automatically energized when motor is de-energized.
- i. Motor Base: Adjustable, or other suitable provision for adjusting belt tension.
- 16. Fan Discharge Stack: Material shall match casing, manufacturer's standard **OR** velocity recovery, **as directed**, design.
 - a. Stack Extension: Fabricated to extend above fan deck unless otherwise indicated.
 - b. Stack Termination: Wire-mesh, galvanized-steel screens; complying with OSHA regulations.
- 17. Vibration Switch: For each fan drive.
 - a. Enclosure: NEMA 250, Type 4 **OR** Type 4X, **as directed**.
 - b. Vibration Detection: Sensor with a field-adjustable, acceleration-sensitivity set point in a range of 0 to 1 g and frequency range of 0 to 3000 cycles per minute. Cooling tower manufacturer shall recommend switch set point for proper operation and protection.
 - c. Provide switch with manual-reset button, **as directed**, for field connection to a BMS, **as directed**, and hardwired connection to fan motor electrical circuit.
 - d. Switch shall, on sensing excessive vibration, signal an alarm through the BMS, **as directed**, and shut down the fan.
- 18. Gear-Drive, Oil-Level Switch: Low-oil-level warning switch for connection to a BMS, **as directed**.
 - a. Switch shall, on reaching a low-oil-level set point recommended by cooling tower manufacturer, signal an alarm through the BMS, **as directed**.
- 19. Capacity-Control Dampers: Galvanized-steel **OR** Stainless-steel, **as directed**, dampers, with linkages, electric operator, controller, limit switches, transformer, and weatherproof enclosure.
- 20. Controls: Comply with requirements in Division 23 Section "Instrumentation And Control For Hvac".

OR

Control Package: Factory installed and wired, and functionally tested at factory before shipment.

- a. NEMA 250, Type 3R **OR** Type 4 **OR** Type 4X, **as directed**, enclosure with removable internally mount backplate.
- b. Control-circuit transformer with primary and secondary side fuses.
- c. Terminal blocks with numbered and color-coded wiring to match wiring diagram. Spare wiring terminal block for connection to external controls or equipment.
- d. Microprocessor-based controller for automatic control of fan based on cooling tower leaving-water temperature with control features to improve operating efficiency based on outdoor ambient wet-bulb temperature by using adaptive logic.
- e. Fan motor sequencer for multiple-cell and two-speed applications with automatic lead stage rotation.
- f. Collection basin level controller complying with requirements in "Electric/Electronic, Collection Basin Water-Level Controller with Solenoid Valve" **OR** "Ultrasonic Collection Basin Water-Level Controller with Solenoid Valve", **as directed**, Paragraph.
- g. Electric basin heaters with temperature control and low-water-level safety switch for each cell, complying with requirements in "Electric Basin Heater" Paragraph.
- h. Vibration switch for each fan, complying with requirements in "Vibration Switch" Paragraph.
- i. Oil-level switch for each fan with a gear drive, complying with requirement in "Gear-Drive, Oil-Level Switch" Paragraph.
- j. Single-point, field-power connection to a fused disconnect switch **OR** nonfused disconnect switch **OR** circuit breaker, **as directed**, for each cooling tower cell, **as directed**.
 - 1) Branch power circuit to each motor and electric basin heater and to controls with a disconnect switch or circuit breaker, **as directed**.
 - 2) NEMA-rated motor controller, hand-off-auto switch, and overcurrent protection for each motor. Provide variable frequency controller with manual bypass and line reactors for each variable-speed motor indicated.
- k. Factory-installed wiring outside of enclosures shall be in metal raceway, except make connections to each motor and electric basin heater with liquidtight conduit.
- l. Visual indication of status and alarm with momentary test push button, **as directed**, for each motor.
- m. Audible alarm and silence switch.
- n. Visual indication of elapsed run time, graduated in hours for each motor.



- o. Cooling tower shall have hardware to enable BMS to remotely monitor and display the following:
 - 1) Operational status of each motor.
 - 2) Position of dampers.
 - 3) Cooling tower leaving-fluid temperature.
 - 4) Fan vibration alarm.
 - 5) Oil-level alarm.
 - 6) Collection basin high **OR** low **OR** high- and low, **as directed**, -water-level alarms.
- 21. Personnel Access Components:
 - a. Doors: Large enough for personnel to access cooling tower internal components from both cooling tower end walls. Doors shall be operable from both sides of the door.
 - b. External Ladders with Safety Cages: Aluminum, galvanized- or stainless-steel, fixed ladders with ladder extensions to access external platforms and top of cooling tower from adjacent grade without the need for portable ladders. Comply with 29 CFR 1910.27.
 - c. External Platforms with Handrails: Aluminum, FRP, or galvanized-steel bar grating at cooling tower access doors when cooling towers are elevated and not accessible from grade.
 - d. Handrail: Aluminum, galvanized steel, or stainless steel complete with kneerail and toeboard, around top of cooling tower. Comply with 29 CFR 1910.23.
 - e. Internal Platforms: Aluminum, FRP, or galvanized-steel bar grating.
 - 1) Spanning the collection basin from one end of cooling tower to the other and positioned to form a path between the access doors. Platform shall be elevated so that all parts are above the high water level of the collection basin.
 - 2) Elevated internal platforms with handrails accessible from fixed vertical ladders to access the fan drive assembly when out of reach from collection basin platform.
- G. Source Quality Control
 - 1. Verification of Performance: Test and certify cooling tower performance according to CTI STD 201, "Certification Standard for Commercial Water-Cooling Towers Thermal Performance."
 - 2. Factory pressure test heat exchangers after fabrication and prove to be free of leaks.

1.3 EXECUTION

A. Examination

- 1. Before cooling tower installation, examine roughing-in for tower support, anchor-bolt sizes and locations, piping, and electrical connections to verify actual locations, sizes, and other conditions affecting tower performance, maintenance, and operation.
 - a. Cooling tower locations indicated on Drawings are approximate. Determine exact locations before roughing-in for piping and electrical connections.
- 2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Installation

- 1. Install cooling towers on support structure indicated.
- 2. Equipment Mounting: Install cooling tower on concrete bases using elastomeric pads **OR** elastomeric mounts **OR** restrained spring isolators, **as directed**. Comply with requirements in Division 03 Section "Cast-in-place Concrete". Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 - a. Minimum Deflection: 1/2 inch (13 mm) **OR** 1 inch (25 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**.
 - b. Provide galvanized **OR** stainless, **as directed**, -steel plate to equally distribute weight over elastomeric pad.



- c. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
- d. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
- e. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
3. Equipment Mounting: Install cooling tower using elastomeric pads **OR** elastomeric mounts **OR** restrained spring isolators, **as directed**. Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 - a. Minimum Deflection: 1/2 inch (13 mm) **OR** 1 inch (25 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**.
 - b. Provide galvanized **OR** stainless, **as directed**, -steel plate to equally distribute weight over elastomeric pad.
4. Equipment Mounting: Install cooling tower on concrete bases. Comply with requirements in Division 03 Section "Cast-in-place Concrete".
 - a. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - b. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Maintain manufacturer's recommended clearances for service and maintenance.
7. Loose Components: Install electrical components, devices, and accessories that are not factory mounted.

C. Connections

1. Piping installation requirements are specified in other Division 21. Drawings indicate general arrangement of piping, fittings, and specialties.
2. Install piping adjacent to cooling towers to allow service and maintenance.
3. Install flexible pipe connectors at pipe connections of cooling towers mounted on vibration isolators.
4. Provide drain piping with valve at cooling tower drain connections and at low points in piping.
5. Connect cooling tower overflows and drains, and piping drains to sanitary sewage system.
6. Domestic Water Piping: Comply with applicable requirements in Division 22 Section "Domestic Water Piping". Connect to water-level control with shutoff valve and union, flange, or mechanical coupling at each connection.
7. Supply and Return Piping: Comply with applicable requirements in Division 23 Section "Hydronic Piping". Connect to entering cooling tower connections with shutoff valve, balancing valve, thermometer, plugged tee with pressure gage, flow meter, **as directed**, and drain connection with valve. Connect to leaving cooling tower connection with shutoff valve. Make connections to cooling tower with a union **OR** flange **OR** mechanical coupling, **as directed**.
8. Equalizer Piping: Piping requirements to match supply and return piping. Connect an equalizer pipe, full size of cooling tower connection, between tower cells. Connect to cooling tower with shutoff valve.
9. Hot-Water Piping: Comply with applicable requirements in Division 23 Section "Hydronic Piping". Connect to supply and return basin heater with shutoff valve, strainer, control valve, and union or flange on supply connection and union or flange and balancing valve on return connection. Provide supply and return piping with pressure gage and thermometer.
10. Steam and Condensate Piping: Comply with applicable requirements in Division 23 Section "Steam And Condensate Heating Piping". Connect steam supply to basin heater with shutoff valve, strainer, control valve, and union or flange and condensate piping with union or flange, shutoff valve, strainer, and an appropriate steam trap.

D. Field Quality Control



1. Perform tests and inspections.
2. Tests and Inspections: Comply with ASME PTC 23, "ASME Performance Test Codes - Code on Atmospheric Water Cooling Equipment **OR** CTI ATC 105, "Acceptance Test Code for Water Cooling Towers", **as directed**.
3. Cooling towers will be considered defective if they do not pass tests and inspections.
4. Prepare test and inspection reports.

E. Startup Service

1. Perform startup service.
2. Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assemblies, installations, and connections.
3. Obtain performance data from manufacturer.
 - a. Complete installation and startup checks according to manufacturer's written instructions and perform the following:
 - 1) Clean entire unit including basins.
 - 2) Verify that accessories are properly installed.
 - 3) Verify clearances for airflow and for cooling tower servicing.
 - 4) Check for vibration isolation and structural support.
 - 5) Lubricate bearings.
 - 6) Verify fan rotation for correct direction and for vibration or binding and correct problems.
 - 7) Adjust belts to proper alignment and tension.
 - 8) Verify proper oil level in gear-drive housing. Fill with oil to proper level.
 - 9) Operate variable-speed fans through entire operating range and check for harmonic vibration imbalance. Set motor controller to skip speeds resulting in abnormal vibration.
 - 10) Check vibration switch setting. Verify operation.
 - 11) Verify water level in tower basin. Fill to proper startup level. Check makeup water-level control and valve.
 - 12) Verify operation of basin heater and control.
 - 13) Verify that cooling tower air discharge is not recirculating air into tower or HVAC air intakes. Recommend corrective action.
 - 14) Replace defective and malfunctioning units.
4. Start cooling tower and associated water pumps. Follow manufacturer's written starting procedures.
5. Prepare a written startup report that records the results of tests and inspections.

F. Adjusting

1. Set and balance water flow to each tower inlet.
2. Adjust water-level control for proper operating level.

G. Demonstration

1. Train Owner's maintenance personnel to adjust, operate, and maintain cooling towers.

END OF SECTION 23 65 00 00



SECTION 23 72 16 00 - AIR-TO-AIR ENERGY RECOVERY UNITS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for air-to-air energy recovery equipment. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Heat wheels.
 - b. Heat-pipe heat exchangers.
 - c. Fixed-plate sensible heat exchangers.
 - d. Fixed-plate total heat exchangers.
 - e. Packaged energy recovery units.

C. Performance Requirements

1. Delegated Design: Design vibration isolation and seismic-restraint details, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2. Seismic Performance: Air-to-air energy recovery equipment shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

D. Submittals

1. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.
2. LEED Submittals:
 - a. Product Data for Credit EA 4: Documentation required by Credit EA 4 indicating that equipment and refrigerants comply.
 - b. Product Data for Prerequisite EQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
3. Shop Drawings: For air-to-air energy recovery equipment. Include plans, elevations, sections, details, and attachments to other work.
 - a. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - b. Wiring Diagrams: For power, signal, and control wiring.
4. Delegated-Design Submittal: For air-to-air energy recovery equipment indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - a. Detail fabrication and assembly of air-to-air energy recovery equipment.
 - b. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
 - c. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
5. Coordination Drawings: Plans, elevations, and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
 - a. Suspended ceiling components.



- b. Structural members to which equipment or suspension systems will be attached.
- 6. Seismic Qualification Certificates: For air-to-air energy recovery equipment, accessories, and components, from manufacturer.
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- 7. Field quality-control reports.
- 8. Operation and Maintenance Data: For air-to-air energy recovery equipment to include in maintenance manuals.

E. Quality Assurance

- 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- 2. ARI Compliance:
 - a. Capacity ratings for air-to-air energy recovery equipment shall comply with ARI 1060, "Performance Rating of Air-to-Air Heat Exchangers for Energy Recovery Ventilation Equipment."
 - b. Capacity ratings for air coils shall comply with ARI 410, "Forced-Circulation Air- Cooling and Air-Heating Coils."
- 3. ASHRAE Compliance:
 - a. Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
 - b. Capacity ratings for air-to-air energy recovery equipment shall comply with ASHRAE 84, "Method of Testing Air-to-Air Heat Exchangers."
- 4. NRCA Compliance: Roof curbs for roof-mounted equipment shall be constructed according to recommendations of NRCA.
- 5. UL Compliance:
 - a. Packaged heat recovery ventilators shall comply with requirements in UL 1812, "Ducted Heat Recovery Ventilators"; or UL 1815, "Nonducted Heat Recovery Ventilators."
 - b. Electric coils shall comply with requirements in UL 1995, "Heating and Cooling Equipment."

F. Coordination

- 1. Coordinate layout and installation of air-to-air energy recovery equipment and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.
- 2. Coordinate sizes and locations of concrete bases with actual equipment provided.
- 3. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

G. Warranty

- 1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of air-to-air energy recovery equipment that fail in materials or workmanship within specified warranty period.
 - a. Warranty Period for Packaged Energy Recovery Units: Two years.
 - b. Warranty Period for Fixed-Plate Total Heat Exchangers: 10 years.

1.2 PRODUCTS

A. Heat Wheels

- 1. Casing:
 - a. Steel with standard factory-painted finish.



- b. Integral purge section limiting carryover of exhaust air to between 0.05 percent at 1.6-inch wg and 0.20 percent at 4-inch wg (0.05 percent at 400-Pa and 0.20 percent at 1000-Pa) differential pressure.
- c. Casing seals on periphery of rotor and on duct divider and purge section.
- d. Support vertical rotors on grease-lubricated ball bearings having extended grease fittings or permanently lubricated bearings. Support horizontal rotors on tapered roller bearing.
2. Rotor: Aluminum segmented wheel strengthened with radial spokes, with nontoxic, noncorrosive, silica-gel desiccant coating, **as directed**.
- a. Maximum Solid Size for Media to Pass: 500 **OR** 800 **OR** 1200, **as directed**, micrometer.
3. Rotor: Glass-fiber **OR** Polymer, **as directed**, segmented wheel strengthened with radial spokes impregnated with nonmigrating, water-selective, molecular-sieve desiccant coating.
- a. Maximum Solid Size for Media to Pass: 800 **OR** 1200, **as directed**, micrometer.
4. Drive: Fractional horsepower motor and gear reducer, with speed changed by variable frequency controller, **as directed**, and self-adjusting multilink belt around outside of rotor.
- a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
- b. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
5. Controls:
 - a. Starting relay, factory mounted and wired, and manual motor starter for field wiring.
 - b. Variable frequency controller, factory mounted and wired, permitting input of field connected 4-20 mA or 1-10-V control signal.

OR

Variable frequency controller, factory mounted and wired, with exhaust-air sensor to vary rotor speed and maintain exhaust temperature above freezing.

OR

Variable frequency controller, factory mounted and wired, with exhaust- and outdoor-air sensors, automatic changeover thermostat and set-point adjuster, to vary rotor speed and maintain exhaust temperature above freezing and, **as directed**, air differential temperature above set point. Rotor speed shall increase to maximum when exhaust-air temperature is less than outdoor-air temperature.
 - c. Pilot-Light Indicator: Display rotor rotation and speed.
 - d. Speed Settings: Adjustable settings for maximum and minimum rotor speed limits.
6. Disposable Panel Filters:
 - a. Comply with NFPA 90A.
 - b. Filter Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lift out from access plenum.
 - c. Factory-fabricated, viscous-coated, flat-panel type.
 - d. Thickness: 1 inch (25 mm) **OR** 2 inches (50 mm), **as directed**.
 - e. Minimum Arrestance: 80, according to ASHRAE 52.1.
 - f. Minimum Merv: 5, according to ASHRAE 52.2.
 - g. Media: Interlaced glass fibers sprayed with nonflammable adhesive and antimicrobial agent, **as directed**.
 - h. Frame: Galvanized steel with metal grid on outlet side, steel rod grid on inlet side, hinged, and with pull and retaining handles.
7. Extended-Surface, Disposable Panel Filters:
 - a. Comply with NFPA 90A.
 - b. Filter Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lift out from access plenum.
 - c. Factory-fabricated, dry, extended-surface type.
 - d. Thickness: 1 inch (25 mm) **OR** 2 inches (50 mm) **OR** 4 inches (100 mm), **as directed**.
 - e. Minimum Arrestance: 90, according to ASHRAE 52.1.
 - f. Minimum Merv: 7, according to ASHRAE 52.2.



- g. Media: Fibrous material formed into deep-V-shaped pleats with antimicrobial agent, **as directed**, and held by self-supporting wire grid.
 - h. Media-Grid Frame: Nonflammable cardboard **OR** Galvanized steel **OR** Fire-retardant, 3/4-inch (20-mm) particleboard with gaskets, **as directed**.
 - i. Mounting Frames: Welded, galvanized steel with gaskets and fasteners, suitable for bolting together into built-up filter banks.
8. Extended-Surface, Nonsupported-Media Filters:
- a. Comply with NFPA 90A.
 - b. Filter Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lift out from access plenum.
 - c. Factory-fabricated, dry, extended-surface, self-supporting type.
 - d. Minimum Arrestance: 95, according to ASHRAE 52.1.
 - e. Minimum Merv: 13, according to ASHRAE 52.2.
 - f. Media: Fibrous material constructed so individual pleats are maintained in tapered form by flexible internal supports under rated-airflow conditions and antimicrobial agent, **as directed**.
 - g. Filter-Media Frame: Galvanized steel **OR** Hard polyurethane foam, **as directed**.
 - h. Mounting Frames: Welded, galvanized steel with gaskets and fasteners, suitable for bolting together into built-up filter banks with space for prefilter, **as directed**.
- B. Heat-Pipe Heat Exchangers
- 1. Casing: Galvanized-steel flanged casing, with airtight partition between airstreams.
 - 2. Refrigerant: ASHRAE 15, Group 1..
 - 3. Tubes: 5/8-inch- (16-mm-) **OR** 1-inch- (25-mm-), **as directed**, diameter, aluminum **OR** copper, **as directed**.
 - 4. Fins: Aluminum **OR** Integral aluminum **OR** Copper, **as directed**.
 - a. Fin Spacing: 0.125 inch (3.18 mm) **OR** 0.091 inch (2.31 mm) **OR** 0.071 inch (1.80 mm) **OR** 0.067 inch (1.70 mm) **OR** 0.056 inch (1.42 mm) **OR** 0.0075 inch (0.19 mm), **as directed**.
 - b. Fin and Tube Joint: Mechanical bond **OR** Silver brazed, **as directed**.
 - 5. Coating: Thermoplastic vinyl **OR** Epoxy **OR** Synthetic resin **OR** Phenolic **OR** Polytetrafluoroethylene **OR** Vinyl ester, **as directed**; apply to supply and exhaust.
 - 6. Control: Integral plenum containing heat-pipe coil and gasketed, face-and-bypass, opposed-blade dampers with rods extended outside casing for damper operator and linkage.

OR

Control: Pivot center of bottom of heat-pipe coil on shaft and bearings to tilt coil. Include tilt controls with electronic controller, electric actuator and linkage, thermostats, sensors, and polyester fabric with PVC-coated flexible connector for automatic supply temperature regulation, summer/winter changeover, and frost protection.
- C. Fixed-Plate Sensible Heat Exchangers
- 1. Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
 - 2. Casing: Aluminum **OR** Galvanized steel **OR** Enameled steel, with galvanized-steel liner **OR** Enameled steel, **as directed**, with duct collars.
 - 3. Casing Insulation: 1/2-inch- (13-mm-) thick, foil-faced glass fiber **OR** 1-inch- (25-mm-) thick, foil-faced glass fiber **OR** 1 inch (25 mm) thick, ASTM C 1071 with coated surface **OR** 1 inch (25 mm) thick, fiber free, **as directed**.
 - 4. Drain Pan: Same material as casing, with drain connections on exhaust and supply side **OR** Molded ABS covering bottom of case, with drain connections on exhaust and supply side, **as directed**.
 - a. Comply with requirements in ASHRAE 62.1.
 - 5. Plates: Evenly spaced and sealed and arranged for counter airflow.
 - a. Plate Material: Embossed aluminum **OR** Stainless steel **OR** Polypropylene copolymer (high-density plastic), **as directed**.
 - b. Plate Coating: Epoxy **OR** Air-dried phenolic, **as directed**.



6. Bypass Plenum: Within casing, with gasketed face-and-bypass dampers having operating rods extended outside casing.
 7. Water Wash: Automatic system, with spray manifold to individual spray tubes or traversing type with stainless-steel-screw operating mechanism and electric motor drive; activated by time clock, with detergent injection, **as directed**.
 8. Disposable Panel Filters:
 - a. Comply with NFPA 90A.
 - b. Filter Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lift out from access plenum.
 - c. Factory-fabricated, viscous-coated, flat-panel type.
 - d. Thickness: 1 inch (25 mm) **OR** 2 inches (50 mm), **as directed**.
 - e. Minimum Arrestance: 80, according to ASHRAE 52.1.
 - f. Minimum Merv: 5, according to ASHRAE 52.2.
 - g. Media: Interlaced glass fibers sprayed with nonflammable adhesive and antimicrobial agent, **as directed**.
 - h. Frame: Galvanized steel with metal grid on outlet side, steel rod grid on inlet side, hinged, and with pull and retaining handles.
 9. Extended-Surface, Disposable Panel Filters:
 - a. Comply with NFPA 90A.
 - b. Filter Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lift out from access plenum.
 - c. Factory-fabricated, dry, extended-surface type.
 - d. Thickness: 1 inch (25 mm) **OR** 2 inches (50 mm) **OR** 4 inches (100 mm), **as directed**.
 - e. Minimum Arrestance: 90, according to ASHRAE 52.1.
 - f. Minimum Merv: 7, according to ASHRAE 52.2.
 - g. Media: Fibrous material formed into deep-V-shaped pleats with antimicrobial agent, **as directed**, and held by self-supporting wire grid.
 - h. Media-Grid Frame: Nonflammable cardboard **OR** Galvanized steel **OR** Fire-retardant, 3/4-inch (20-mm) particleboard with gaskets, **as directed**.
 - i. Mounting Frames: Welded, galvanized steel with gaskets and fasteners, suitable for bolting together into built-up filter banks.
 10. Extended-Surface, Nonsupported-Media Filters:
 - a. Comply with NFPA 90A.
 - b. Filter Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lift out from access plenum.
 - c. Factory-fabricated, dry, extended-surface, self-supporting type.
 - d. Minimum Arrestance: 95, according to ASHRAE 52.1.
 - e. Minimum Merv: 13, according to ASHRAE 52.2.
 - f. Media: Fibrous material constructed so individual pleats are maintained in tapered form by flexible internal supports under rated-airflow conditions and antimicrobial agent, **as directed**.
 - g. Filter-Media Frame: Galvanized steel **OR** Hard polyurethane foam, **as directed**.
 - h. Mounting Frames: Welded, galvanized steel with gaskets and fasteners, suitable for bolting together into built-up filter banks with space for prefilter, **as directed**.
- D. Fixed-Plate Total Heat Exchangers
1. Casing: Galvanized steel.
 2. Plates: Evenly spaced and sealed and arranged for counter airflow.
 - a. Plate Material: Chemically treated paper with selective hydroscopicity and moisture permeability, and gas barrier properties.
 3. Bypass Plenum: Within casing, with gasketed face-and-bypass dampers having operating rods extended outside casing.
 4. Disposable Panel Filters:
 - a. Comply with NFPA 90A.
 - b. Filter Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lift out from access plenum.



- c. Factory-fabricated, viscous-coated, flat-panel type.
 - d. Thickness: 1 inch (25 mm) **OR** 2 inches (50 mm), **as directed**.
 - e. Minimum Arrestance: 80, according to ASHRAE 52.1.
 - f. Minimum Merv: 5, according to ASHRAE 52.2.
 - g. Media: Interlaced glass fibers sprayed with nonflammable adhesive and antimicrobial agent, **as directed**.
 - h. Frame: Galvanized steel with metal grid on outlet side, steel rod grid on inlet side, hinged, and with pull and retaining handles.
5. Extended-Surface, Disposable Panel Filters:
- a. Comply with NFPA 90A.
 - b. Filter Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lift out from access plenum.
 - c. Factory-fabricated, dry, extended-surface type.
 - d. Thickness: 1 inch (25 mm) **OR** 2 inches (50 mm) **OR** 4 inches (100 mm), **as directed**.
 - e. Minimum Arrestance: 90, according to ASHRAE 52.1.
 - f. Minimum Merv: 7, according to ASHRAE 52.2.
 - g. Media: Fibrous material formed into deep-V-shaped pleats with antimicrobial agent, **as directed**, and held by self-supporting wire grid.
 - h. Media-Grid Frame: Nonflammable cardboard **OR** Galvanized steel **OR** Fire-retardant, 3/4-inch (20-mm) particleboard with gaskets, **as directed**.
 - i. Mounting Frames: Welded, galvanized steel with gaskets and fasteners, suitable for bolting together into built-up filter banks.

E. Packaged Energy Recovery Units

1. Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
2. Housing: Manufacturer's standard construction with corrosion-protection coating and exterior finish, gasketed and calked weathertight, **as directed**, hinged access doors **OR** removable panels, **as directed**, with neoprene gaskets for inspection and access to internal parts, minimum 1-inch- (25-mm-) **OR** 2-inch- (50-mm-), **as directed**, thick thermal insulation, knockouts for electrical and piping connections, exterior drain connection, and lifting lugs.
 - a. Inlet: Weatherproof hood **OR** louver, **as directed**, with damper for exhaust and supply.
 - 1) Exhaust: Gravity backdraft damper **OR** Spring-return, two-position, motor-operated damper, **as directed**.
 - 2) Supply: Gravity backdraft damper **OR** Spring-return, two-position, motor-operated damper, **as directed**.
 - b. Roof Curb: Refer to Division 07 Section "Roof Accessories" for roof curbs and equipment supports.
3. Heat Recovery Device: Heat wheel **OR** Heat-pipe heat exchanger **OR** Fixed-plate heat exchanger, **as directed**.
4. Supply and Exhaust Fans: Forward-curved, centrifugal **OR** Propeller **OR** Backward-inclined, SWSI centrifugal **OR** Backward-inclined, plenum centrifugal, **as directed**, fan with spring isolators **OR** restrained, spring isolators **OR** spring hangers **OR** spring hangers with vertical-limit stops, **as directed**, and insulated, **as directed**, flexible duct connections.
 - a. Motor and Drive: Direct driven **OR** Belt driven with adjustable sheaves, motor mounted on adjustable base **OR** Drive type indicated on Drawings, **as directed**.
 - b. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - c. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - d. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 22.
 - e. Spring isolators on each fan having 1-inch (25-mm) static deflection.
5. Disposable Panel Filters:
 - a. Comply with NFPA 90A.



- b. Filter Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lift out from access plenum.
 - c. Factory-fabricated, viscous-coated, flat-panel type.
 - d. Thickness: 1 inch (25 mm) **OR** 2 inches (50 mm), **as directed**.
 - e. Minimum Arrestance: 80, according to ASHRAE 52.1.
 - f. Minimum Merv: 5, according to ASHRAE 52.2.
 - g. Media: Interlaced glass fibers sprayed with nonflammable adhesive and antimicrobial agent, **as directed**.
 - h. Frame: Galvanized steel with metal grid on outlet side, steel rod grid on inlet side, hinged, and with pull and retaining handles.
6. Extended-Surface, Disposable Panel Filters:
- a. Comply with NFPA 90A.
 - b. Filter Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lift out from access plenum.
 - c. Factory-fabricated, dry, extended-surface type.
 - d. Thickness: 1 inch (25 mm) **OR** 2 inches (50 mm) **OR** 4 inches (100 mm), **as directed**.
 - e. Minimum Arrestance: 90, according to ASHRAE 52.1.
 - f. Minimum Merv: 7, according to ASHRAE 52.2.
 - g. Media: Fibrous material formed into deep-V-shaped pleats with antimicrobial agent, **as directed**, and held by self-supporting wire grid.
 - h. Media-Grid Frame: Nonflammable cardboard **OR** Galvanized steel **OR** Fire-retardant, 3/4-inch (20-mm) particleboard with gaskets, **as directed**.
 - i. Mounting Frames: Welded, galvanized steel with gaskets and fasteners, suitable for bolting together into built-up filter banks.
7. Extended-Surface, Nonsupported-Media Filters:
- a. Comply with NFPA 90A.
 - b. Filter Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lift out from access plenum.
 - c. Factory-fabricated, dry, extended-surface, self-supporting type.
 - d. Minimum Arrestance: 95, according to ASHRAE 52.1.
 - e. Minimum Merv: 13, according to ASHRAE 52.2.
 - f. Media: Fibrous material constructed so individual pleats are maintained in tapered form by flexible internal supports under rated-airflow conditions and antimicrobial agent, **as directed**.
 - g. Filter-Media Frame: Galvanized steel **OR** Hard polyurethane foam, **as directed**.
 - h. Mounting Frames: Welded, galvanized steel with gaskets and fasteners, suitable for bolting together into built-up filter banks with space for prefilter, **as directed**.
8. Cooling Coils: Rated according to ARI 410 and ASHRAE 33, and bearing the ARI label, **as directed**.
- a. Access: Fabricate coil section to allow removal and replacement of coil and to allow in-place access for service and maintenance of coil(s).
 - b. Casing: Manufacturer's standard material **OR** Aluminum **OR** Galvanized steel **OR** Stainless steel, **as directed**.
 - c. Tubes: Copper.
 - d. Tube Headers: Manufacturer's standard material **OR** Copper **OR** Carbon steel **OR** Red brass, **as directed**.
 - e. Fins: Aluminum **OR** Copper, **as directed**.
 - f. Fin and Tube Joint: Mechanical bond.
 - g. Leak Test: Coils shall be leak tested with air under water.
 - h. Refrigerant Coils:
 - 1) Capacity Reduction: Circuit coils for face **OR** row **OR** interleaved, **as directed**, control.
 - 2) Suction and Distributor: Seamless copper tube with brazed joints.
 - i. Coating: Phenolic epoxy corrosion-protection coating after assembly.
9. Cooling-Coil Condensate Drain Pans:



- a. Fabricated from galvanized steel **OR** stainless-steel, **as directed**, sheet and sloped in multiple planes to collect and drain condensate from cooling coils, coil piping connections, coil headers, and return bends.
 - b. Complying with requirements in ASHRAE 62.1.
 - c. Drain Connections: At low point of pan with minimum **<Insert size>** threaded nipple.
 - d. Units with stacked coils shall have an intermediate drain pan to collect and drain condensate from top coil.
10. Hot-Water Coils: Rated according to ARI 410 and ASHRAE 33, and bearing the ARI label, **as directed**.
- a. Access: Fabricate coil section to allow removal and replacement of coil and to allow in-place access for service and maintenance of coil(s).
 - b. Casing: Manufacturer's standard material **OR** Aluminum **OR** Galvanized steel **OR** Stainless steel, **as directed**.
 - c. Tubes: Copper.
 - d. Tube Headers: Manufacturer's standard material **OR** Copper **OR** Carbon steel **OR** Red brass, **as directed**.
 - e. Fins: Aluminum **OR** Copper, **as directed**.
 - f. Fin and Tube Joint: Mechanical bond.
 - g. Leak Test: Coils shall be leak tested with air under water.
 - h. Coating: Phenolic epoxy corrosion-protection coating after assembly.
11. Nonfreeze Type, **as directed**, Steam Coils: Rated according to ARI 410 and ASHRAE 33, and bearing the ARI label, **as directed**.
- a. Access: Fabricate coil section to allow removal and replacement of coil and to allow in-place access for service and maintenance of coil(s).
 - b. Casing: Manufacturer's standard material **OR** Aluminum **OR** Galvanized steel **OR** Stainless steel, **as directed**.
 - c. Tubes: Copper.
 - d. Tube Headers: Manufacturer's standard material **OR** Copper **OR** Carbon steel **OR** Red brass, **as directed**.
 - e. Fins: Aluminum **OR** Copper, **as directed**.
 - f. Fin and Tube Joint: Mechanical bond.
 - g. Leak Test: Coils shall be leak tested with air under water.
 - h. Coating: Phenolic epoxy corrosion-protection coating after assembly.
12. Electrical Coils, Controls, and Accessories: Comply with UL 1995.
- a. Casing Assembly: Slip-in **OR** Flanged, **as directed**, type with galvanized-steel frame.
 - b. Access: Fabricate coil section to allow removal and replacement of coil and to allow in-place access for service.
 - c. Sheathed Heating Elements: Coiled resistance wire of 80 percent nickel and 20 percent chromium surrounded by compacted magnesium-oxide powder in tubular-steel sheath; with spiral-wound, copper-plated, steel fins continuously brazed to sheath.
OR
Open Heating Elements: Resistance wire of 80 percent nickel and 20 percent chromium supported and insulated by floating ceramic bushings recessed into casing openings, fastened to supporting brackets, and mounted in galvanized-steel frame.
 - d. Overtemperature Protection: Disk-type, automatically resetting, thermal-cutout, safety device; serviceable through terminal box without removing heater from coil section.
 - e. Secondary Protection: Load-carrying, manually resetting or manually replaceable, thermal cutouts; factory wired in series with each heater stage.
 - f. Control Panel: Unit **OR** Remote, **as directed**, mounted with disconnecting means and overcurrent protection.
 - 1) Magnetic **OR** Mercury, **as directed**, contactor.
 - 2) Solid-state, stepless pulse controller.
 - 3) Toggle switches, one per step.
 - 4) Step controller.
 - 5) Time-delay relay.



- 6) Pilot lights, one per step.
- 7) Airflow proving switch.
- 13. Indirect-Fired Gas Furnaces:
 - a. Description: Factory assembled, piped, and wired; complying with NFPA 54, "National Fuel Gas Code," and ANSI Z21.47, "Gas-Fired Central Furnaces."
 - 1) AGA Approval: Furnace shall bear label of AGA.
 - b. Burners: Aluminized steel with stainless-steel inserts **OR** Stainless steel, **as directed**.
 - 1) Ignition: Electronically controlled electric spark with flame sensor.
 - 2) High-Altitude Model **OR** Kit, **as directed**: For Project at elevations more than 2000 feet (610 m) above sea level.
 - c. Heat-Exchanger Drain Pan: Stainless steel.
 - d. Venting: Gravity vented.
OR
Power Vent: Integral, motorized centrifugal fan interlocked with gas valve.
 - e. Gas Control Valve: Single stage **OR** Two stage **OR** Electronic modulating, **as directed**.
 - f. Gas Train: Single-body, regulated, redundant, 24-V ac gas valve assembly containing pilot solenoid valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff. Control devices and control sequence shall comply with requirements of FMG **OR** IRI, **as directed**.
 - g. Access: Fabricate section to allow removal and replacement of furnace and to allow in-place access for service.
- 14. Piping and Wiring: Fabricate units with space within housing for piping and electrical conduits. Wire motors and controls so only external connections are required during installation.
 - a. Indoor Enclosure: NEMA 250, Type 12 enclosure contains relays, starters, and terminal strip.
 - b. Outdoor Enclosure: NEMA 250, Type 3R enclosure contains relays, starters, and terminal strip.
 - c. Include fused **OR** nonfused, **as directed**, disconnect switches.
 - d. Variable-speed controller to vary fan capacity from 100 to approximately 50 percent.
- 15. Accessories:
 - a. Roof Curb: Steel **OR** Galvanized steel **OR** Aluminum, **as directed**, with gasketing, and factory-installed wood nailer; complying with NRCA standards; minimum height of 14 inches (350 mm) **OR** 24 inches (600 mm), **as directed**.
 - b. Intake weather hood with 2-inch- (50-mm-) thick filters.
 - c. Louvered intake weather hood with 2-inch- (50-mm-) thick filters in V-bank configuration.
 - d. Exhaust weather hood with birdscreen.
 - e. Low-Leakage, Isolation Dampers: Double-skin, airfoil-blade, galvanized-steel **OR** aluminum **OR** extruded-aluminum, **as directed**, dampers with compressible jamb seals and extruded-vinyl blade edge seals, in opposed-blade **OR** parallel-blade, **as directed**, arrangement with steel **OR** cadmium-plated steel, **as directed**, operating rods rotating in stainless-steel sleeve **OR** sintered bronze or nylon, **as directed**, bearings mounted in a single galvanized-steel **OR** aluminum **OR** extruded-aluminum, **as directed**, frame, with operating rods connected with a common linkage, and electric damper operator factory wired. Leakage rate shall not exceed 5 cfm/sq. ft. (0.22 L/s per sq. m) at 1-inch wg (250 Pa) and 9 cfm/sq. ft. (0.4 L/s per sq. m) at 4-inch wg (1.0 MPa).
OR
Isolation Dampers: Opposed-blade, galvanized-steel **OR** aluminum **OR** extruded-aluminum, **as directed**, dampers with steel **OR** cadmium-plated steel, **as directed**, operating rods rotating in sintered bronze or nylon bearings mounted in a single galvanized-steel **OR** aluminum **OR** extruded-aluminum, **as directed**, frame with operating rods connected with a common linkage, and electric damper operator factory wired. Blades shall have gaskets and edge seals, and shall be mechanically fastened to operating rod.
 - f. Duct flanges.
 - g. Rubber-in-shear isolators for ceiling-mounted units.
 - h. Hinged access doors with quarter-turn latches.
 - i. Drain pans for condensate removal complying with ASHRAE 62.1, **as directed**.



- j. Automatic, in-place, spray-wash system.
- k. Weatherproofing for tilt-control system.

F. Controls

1. Time Clock: Solid-state, programmable, microprocessor-based unit for wall mounting **OR** mounting in outdoor NEMA 250, Type 3R enclosure, **as directed**, with up to eight on/off cycles per day and battery backup protection of program settings against power failure to energize unit.
2. Motion (Occupancy) Sensor: Passive infrared sensor for wall **OR** ceiling, **as directed**, mounting with adjustable time-off delay of up to 30 minutes to energize unit.
3. Carbon Monoxide Sensor: Adjustable control from 600 to 2000 ppm for wall **OR** duct, **as directed**, mounting with digital display and computer/building management system interface to energize unit.
4. Humidistat: Adjustable, wall-mounted instrument to energize unit when space relative humidity exceeds 50 percent.
5. Chilled-Water-Cooling-Coils Controls:
 - a. For chilled-water cooling coils with discharge-air temperature control: Factory-mounted sensor in unit discharge **OR** Remote-mounted sensor for field installation in supply-air duct, **as directed**, with sensor adjustment located in control panel to modulate factory-mounted **OR** furnished, **as directed**, coil-control valve to maintain temperature.
 - b. For chilled-water cooling coils with remote temperature control: Wall-mounted, space-temperature sensor with temperature adjustment **OR** unit-mounted temperature adjustment **OR** adjustment on remote-control panel, **as directed**, to modulate factory-mounted **OR** furnished, **as directed**, coil-control valve to maintain temperature.
6. Refrigerant-Cooling-Coils Controls:
 - a. For refrigerant cooling coils with discharge-air temperature control: Factory-mounted sensor in unit discharge **OR** Remote-mounted sensor for field installation in supply-air duct, **as directed**, with sensor adjustment located in control panel to control remote condensing unit to maintain temperature.
 - b. For refrigerant cooling coils with remote temperature control: Wall-mounted, space-temperature sensor with temperature adjustment **OR** unit-mounted temperature adjustment **OR** adjustment on remote-control panel, **as directed**, controls remote condensing unit to maintain temperature.
 - c. Cooling Capacity Control: On/off **OR** Multiple steps, **as directed**.
7. Hot-Water- and Steam-Coils Controls:
 - a. For hot-water or steam coils with discharge-air temperature control: Factory-mounted sensor in unit discharge **OR** Remote-mounted sensor for field installation in supply-air duct, **as directed**, with sensor adjustment located in control panel to modulate factory-mounted **OR** furnished, **as directed**, coil-control valve to maintain temperature.
 - b. For hot-water or steam coils with remote temperature control: Wall-mounted, space-temperature sensor with temperature adjustment **OR** unit-mounted temperature adjustment **OR** adjustment on remote-control panel, **as directed**, to modulate factory-mounted **OR** furnished, **as directed**, coil-control valve to maintain temperature.
8. Electric-Coils Controls:
 - a. For electric coils with discharge-air temperature control: Factory-mounted sensor in unit discharge **OR** Remote-mounted sensor for field installation in supply-air duct, **as directed**, with sensor adjustment located in control panel to control electric coil to maintain temperature.
 - b. For electric coils with remote temperature control: Wall-mounted, space-temperature sensor with temperature adjustment **OR** unit-mounted temperature adjustment **OR** adjustment on remote-control panel, **as directed**, to control electric coil to maintain temperature.
 - c. Coil Controls: On/off **OR** Multiple steps **OR** Modulating SCR, **as directed**.
9. Indirect-Fired-Gas-Furnaces Controls:
 - a. For indirect-fired gas furnaces with discharge-air temperature control: Factory-mounted sensor in unit discharge **OR** Remote-mounted sensor for field installation in supply-air duct,



- as directed**, with sensor adjustment located in control panel to control gas furnace burner to maintain temperature.
- b. For indirect-fired gas furnaces with remote temperature control: Wall-mounted, space-temperature sensor with temperature adjustment **OR** unit-mounted temperature adjustment **OR** adjustment on remote-control panel, **as directed**, to control gas furnace burner to maintain temperature.
- c. Burner Controls: On/off **OR** Multiple steps **OR** Modulating, **as directed**.

1.3 EXECUTION

A. Examination

1. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
2. Examine casing insulation materials and filter media before air-to-air energy recovery equipment installation. Reject insulation materials and filter media that are wet, moisture damaged, or mold damaged.
3. Examine roughing-in for electrical services to verify actual locations of connections before installation.
4. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Installation

1. Install heat wheels so supply and exhaust airstreams flow in opposite directions and rotation is away from exhaust side to purge section to supply side.
 - a. Install access doors in both supply and exhaust ducts, both upstream and downstream, for access to wheel surfaces, drive motor, and seals.
 - b. Install removable panels or access doors between supply and exhaust ducts on building side for bypass during startup.
 - c. Access doors and panels are specified in Division 23 Section "Air Duct Accessories".
2. Install heat-pipe heat exchangers so supply and exhaust airstreams flow in opposite directions. Install flexible connectors on ducts to enable tilt control; make connections airtight and with slack to compensate for full tilt.
 - a. Install heat exchanger with clearance space for heat-pipe coil removal.
 - b. Install duct access doors in both supply and exhaust ducts, both upstream and downstream, for access to both sides of heat-pipe coil. Access doors and panels are specified in Division 23 Section "Air Duct Accessories".
 - c. Install tilt-control components, including electronic controller, electric actuator and linkage, thermostats, and sensors.
3. Install fixed-plate heat exchangers so supply and exhaust airstreams flow in opposite directions.
 - a. Install duct access doors in both supply and exhaust ducts, both upstream and downstream, for access to heat exchanger. Access doors and panels are specified in Division 23 Section "Air Duct Accessories".
4. Install gas-fired furnaces according to NFPA 54, "National Fuel Gas Code."
5. Install floor-mounted units on 4-inch- (100-mm-) high concrete base designed to withstand, without damage to equipment, seismic force required by code, **as directed**.
6. Equipment Mounting (for equipment supported on a concrete base on grade without vibration isolation devices): Install air-to-air energy recovery equipment on concrete bases. Comply with requirements for concrete bases specified in Division 03 Section "Cast-in-place Concrete".
 - a. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - b. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
7. Roof Curb: Install on roof structure or concrete base, level and secure, according to The NRCA "Roofing and Waterproofing Manual - Volume 4: Construction Details - Low-Slope Roofing,"



Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts" **OR** ARI Guideline B, **as directed**. Install air-to-air energy recovery equipment on curbs and coordinate roof penetrations and flashing with roof construction specified in Division 07 Section "Roof Accessories". Secure air-to-air energy recovery equipment to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts.

8. Unit Support: Install unit level on structural curbs **OR** pilings, **as directed**. Coordinate wall penetrations and flashing with wall construction. Secure air-to-air energy recovery equipment to structural support with anchor bolts.
9. Install wind and seismic restraints according to manufacturers' written instructions. Wind and seismically restrained vibration isolation roof-curb rails are specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
10. Suspended Units: Suspend and brace, **as directed**, units from structural-steel support frame using threaded steel rods and spring hangers. Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
11. Install units with clearances for service and maintenance.
12. Install new filters at completion of equipment installation and before testing, adjusting, and balancing.
13. Pipe drains from units and drain pans to nearest floor drain; use ASTM B 88, Type L (ASTM B 88M, Type B), drawn-temper copper water tubing with soldered joints **OR** ASTM D 1785, Schedule 40 PVC pipe and solvent-welded fittings, **as directed**, same size as condensate drain connection.
 - a. Requirements for Low-Emitting Materials:
 - 1) Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2) Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Connections

1. Comply with requirements for piping specified in Division 23 Section "Hydronic Piping". Drawings indicate general arrangement of piping, fittings, and specialties.
2. Install piping adjacent to unit to allow service and maintenance.
3. Connect piping to units mounted on vibration isolators with flexible connectors.
4. Connect cooling condensate drain pans with air seal trap at connection to drain pan and install cleanouts at changes in pipe direction.
5. Chilled and Hot Water Piping: Comply with applicable requirements in Division 23 Section "Hydronic Piping". Install shutoff valve and union or flange at each coil supply connection. Install balancing valve and union or flange at each coil return connection.
6. Steam and Condensate Piping: Comply with applicable requirements in Division 23 Section "Steam And Condensate Heating Piping". Install shutoff valve at steam coil connections, float and thermostatic trap, and union or flange at each coil return connection.
7. Refrigerant Piping: Comply with applicable requirements in Division 23 Section "Refrigerant Piping".
8. Gas Piping: Comply with requirements in Division 23 Section(s) "Facility Natural-gas Piping" **OR** "Facility Liquefied-petroleum Gas Piping", **as directed**. Connect gas piping with shutoff valve and union and with sufficient clearance for burner removal and service. Make connection with AGA-approved flexible connectors.
9. Comply with requirements for ductwork specified in Division 23 Section "Metal Ducts".
10. Indirect-Fired Furnace Vent Connections: Comply with Division 23 Section "Breechings, Chimneys, And Stacks".
11. Electrical Connections: Comply with applicable requirements in Division 22.
 - a. Install electrical devices furnished with units but not factory mounted.

D. Field Quality Control

1. Perform tests and inspections.



2. Tests and Inspections:
 - a. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - b. Adjust seals and purge.
 - c. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - d. Set initial temperature and humidity set points.
 - e. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
 3. Air-to-air energy recovery equipment will be considered defective if it does not pass tests and inspections.
 4. Prepare test and inspection reports.
- E. Demonstration
1. Train Owner's maintenance personnel to adjust, operate, and maintain air-to-air energy recovery units.

END OF SECTION 23 72 16 00



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SECTION 23 73 13 00 - MODULAR INDOOR CENTRAL-STATION AIR-HANDLING UNITS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for modular indoor central-station air-handling units. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Constant-air-volume, single-zone air-handling units.
 - b. Constant-air-volume, multizone air-handling units.
 - c. Constant-air-volume, dual-duct air-handling units.
 - d. Variable-air-volume, single-zone air-handling units.
 - e. Variable-air-volume, dual-duct air-handling units.

C. Performance Requirements

1. Delegated Design: Design vibration isolation and seismic-restraint details, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2. Structural Performance: Casing panels shall be self-supporting and capable of withstanding 133 percent of internal static pressures indicated, without panel joints exceeding a deflection of $L/200$ **OR** $L/100$, **as directed**, where "L" is the unsupported span length within completed casings.
3. Seismic Performance: Air-handling units shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

D. Submittals

1. Product Data: For each air-handling unit indicated.
 - a. Unit dimensions and weight.
 - b. Cabinet material, metal thickness, finishes, insulation, and accessories.
 - c. Fans:
 - 1) Certified fan-performance curves with system operating conditions indicated.
 - 2) Certified fan-sound power ratings.
 - 3) Fan construction and accessories.
 - 4) Motor ratings, electrical characteristics, and motor accessories.
 - d. Certified coil-performance ratings with system operating conditions indicated.
 - e. Dampers, including housings, linkages, and operators.
 - f. Filters with performance characteristics.
2. LEED Submittal:
 - a. Product Data for Prerequisite EQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
3. Delegated-Design Submittal: For vibration isolation and seismic restraints, **as directed**, indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - a. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
 - b. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints, **as directed**, and for designing vibration isolation bases.



4. Seismic Qualification Certificates: For air-handling units, accessories, and components, from manufacturer.
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
5. Source quality-control reports.
6. Field quality-control reports.
7. Operation and maintenance data

E. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of air-handling units and components.
3. ARI Certification: Air-handling units and their components shall be factory tested according to ARI 430, "Central-Station Air-Handling Units," and shall be listed and labeled by ARI.
4. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
5. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
6. Comply with NFPA 70.

1.2 PRODUCTS

A. Unit Casings

1. General Fabrication Requirements for Casings:
 - a. Forming: Form walls, roofs, and floors with at least two breaks at each joint.
 - b. Casing Joints: Sheet metal screws or pop rivets.
 - c. Sealing: Seal all joints with water-resistant sealant.
 - d. Factory Finish for Steel and Galvanized-Steel Casings: Apply manufacturer's standard primer immediately after cleaning and pretreating.
OR
 Factory Finish for Steel and Galvanized-Steel Casings: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on enamel finish, consisting of prime coat and thermosetting topcoat.
OR
 Casing Coating: Thermoplastic vinyl **OR** Epoxy **OR** Zinc **OR** Synthetic resin **OR** Phenolic **OR** Polytetrafluoroethylene **OR** Vinyl ester **OR** Hot-dip galvanized **OR** Powder-baked enamel, **as directed**.
 - e. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
2. Casing Insulation and Adhesive:
 - a. Materials: ASTM C 1071, Type I **OR** Type II, **as directed**.
 - b. Location and Application: Factory applied with adhesive and mechanical fasteners to the internal surface of section panels downstream from, and including, the cooling-coil section.
 - 1) Liner Adhesive: Comply with ASTM C 916, Type I.
 - 2) Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.



- 3) Liner materials applied in this location shall have air-stream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service-air velocity.
- OR**
- Location and Application: Encased between outside and inside casing.
3. Inspection and Access Panels and Access Doors:
 - a. Panel and Door Fabrication: Formed and reinforced, single- or double-wall and insulated panels of same materials and thicknesses as casing.
 - b. Inspection and Access Panels:
 - 1) Fasteners: Two or more camlock type for panel lift-out operation. Arrangement shall allow panels to be opened against air-pressure differential.
 - 2) Gasket: Neoprene, applied around entire perimeters of panel frames.
 - 3) Size: Large enough to allow inspection and maintenance of air-handling unit's internal components.
 - c. Access Doors:
 - 1) Hinges: A minimum of two ball-bearing hinges or stainless-steel piano hinge and two wedge-lever-type latches, operable from inside and outside. Arrange doors to be opened against air-pressure differential.
 - 2) Gasket: Neoprene, applied around entire perimeters of panel frames.
 - 3) Fabricate windows in fan section doors of double-glazed, wire-reinforced safety glass with an air space between panes and sealed with interior and exterior rubber seals.
 - 4) Size: At least 18 inches (450 mm) **OR** 24 inches (600 mm), **as directed**, wide by full height of unit casing up to a maximum height of 60 inches (1500 mm) **OR** 72 inches (1800 mm), **as directed**.
 - d. Locations and Applications:
 - 1) Fan Section: Inspection and access panels **OR** Doors **OR** Doors and inspection and access panels, **as directed**.
 - 2) Access Section: Doors.
 - 3) Coil Section: Inspection and access panel.
 - 4) Damper Section: Inspection and access panels **OR** Doors, **as directed**.
 - 5) Filter Section: Inspection and access panels **OR** Doors, **as directed**, large enough to allow periodic removal and installation of filters.
 - 6) Mixing Section: Doors.
 - 7) Humidifier Section: Doors.
 - e. Service Light: 100-W vaporproof fixture with switched junction box located outside **OR** inside, **as directed**, adjacent to door.
 - 1) Locations: Each section accessed with door **OR** Fan section, **as directed**.
 4. Condensate Drain Pans:
 - a. Fabricated with one **OR** two, **as directed**, percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and from humidifiers and to direct water toward drain connection.
 - 1) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.
 - 2) Depth: A minimum of 2 inches (50 mm) deep.
 - b. Formed sections **OR** Integral part of floor plating, **as directed**.
 - c. Single-wall, galvanized-steel **OR** stainless-steel, **as directed**, sheet.

OR

Double-wall, galvanized-steel **OR** stainless-steel, **as directed**, sheet with space between walls filled with foam insulation and moisture-tight seal.
 - d. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end **OR** both ends, **as directed**, of pan.
 - 1) Minimum Connection Size: NPS 1 (DN 25) **OR** NPS 2 (DN 50), **as directed**.
 - e. Pan-Top Surface Coating: Asphaltic waterproofing compound, for galvanized-steel drain pans.



- f. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.
5. Service Platform: Steel **OR** Galvanized steel **OR** Aluminum, **as directed**, 42 inches (1070 mm) wide running entire length of unit and located on service access side, with angle side rails, 4-inch (100-mm) kick plates, and expanded metal floor. Provide platform with a fixed ladder that extends from the top of the side rail to the floor.
 6. Air-Handling-Unit Mounting Frame: Formed galvanized-steel channel or structural channel supports, designed for low deflection, welded with integral lifting lugs.
 - a. Seismic Fabrication Requirements: Fabricate mounting base and attachment to air-handling unit sections, accessories, and components with reinforcement strong enough to withstand seismic forces defined in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment" when air-handling unit frame is anchored to building structure.
- B. Fan, Drive, And Motor Section
1. Fan and Drive Assemblies: Statically and dynamically balanced and designed for continuous operation at maximum-rated fan speed and motor horsepower.
 - a. Shafts: Designed for continuous operation at maximum-rated fan speed and motor horsepower, and with field-adjustable alignment.
 - 1) Turned, ground, and polished hot-rolled steel with keyway. Ship with a protective coating of lubricating oil.
 - 2) Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.
 2. Centrifugal Fan Housings: Formed- and reinforced-steel panels to form curved scroll housings with shaped cutoff and spun-metal inlet bell.
 - a. Bracing: Steel angle or channel supports for mounting and supporting fan scroll, wheel, motor, and accessories.
 - b. Horizontal-Flanged, Split Housing: Bolted construction.
 - c. Housing for Supply Fan: Attach housing to fan-section casing with metal-edged flexible duct connector.
 - d. Flexible Connector: Factory fabricated with a fabric strip 3-1/2 inches (89 mm) **OR** 5-3/4 inches (146 mm), **as directed**, wide attached to 2 strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized-steel sheet or 0.032-inch- (0.8-mm-) thick aluminum sheets; select metal compatible with casing.
 - 1) Flexible Connector Fabric: Glass fabric, double coated with neoprene. Fabrics, coatings, and adhesives shall comply with UL 181, Class 1.
 - a) Fabric Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
 - b) Fabric Tensile Strength: 480 lbf/inch (84 N/mm) in the warp and 360 lbf/inch (63 N/mm) in the filling.
 - c) Fabric Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).
 3. Plenum Fan Housings: Steel frame and panel; fabricated without fan scroll and volute housing.
 4. Backward-Inclined, Centrifugal Fan Wheels: Single-width-single-inlet and double-width-double-inlet construction with curved inlet flange, backplate, backward-inclined blades welded or riveted to flange and backplate; cast-iron or cast-steel hub riveted to backplate and fastened to shaft with set screws.

OR

Forward-Curved, Centrifugal Fan Wheels: Inlet flange, backplate, and shallow blades with inlet and tip curved forward in direction of airflow and mechanically fastened to flange and backplate; cast-steel hub swaged to backplate and fastened to shaft with set screws.

OR

Airfoil, Centrifugal Fan Wheels: Smooth-curved inlet flange, backplate, and hollow die-formed airfoil-shaped blades continuously welded at tip flange and backplate; cast-iron or cast-steel hub riveted to backplate and fastened to shaft with set screws.

OR



- Axial Fans: Fan wheel and housing, straightening-vane section, factory-mounted motor with belt drive or direct drive, an inlet cone section, and accessories.
- a. Variable-Pitch Fans: Internally mounted pneumatic **OR** electric **OR** electronic, **as directed**, actuator, externally mounted positive positioner, and mechanical-blade-pitch indicator.
 - b. Housings: Steel **OR** Galvanized steel **OR** Aluminum, **as directed**.
 - 1) Inlet and Outlet Connections: Flanges.
 - 2) Guide Vane Section: Integral guide vanes downstream from fan wheel designed to straighten airflow.
5. Fan Shaft Bearings:
- a. Prelubricated and Sealed, Ball Bearings: Self-aligning, pillow-block type with a rated life of 50,000 **OR** 120,000, **as directed**, hours according to ABMA 9.
OR
Grease-Lubricated, Tapered-Roller Bearings: Self-aligning, pillow-block type with double-locking collars and 2-piece, cast-iron housing with grease lines extended to outside unit, **as directed**, and a rated life of 50,000 **OR** 120,000, **as directed**, hours according to ABMA 11.
OR
Grease-Lubricated Bearings: Self-aligning, pillow-block-type, ball or roller bearings with adapter mount and two-piece, cast-iron housing with grease lines extended to outside unit, **as directed**.
6. Belt Drives: Factory mounted, with adjustable alignment and belt tensioning, and with 1.5 **OR** 1.4 **OR** 1.3 **OR** 1.2, **as directed**, service factor based on fan motor.
- a. Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.
 - b. Motor Pulleys: Adjustable pitch for use with 5-hp motors and smaller; fixed pitch for use with motors larger than 5 hp. Select pulley size so pitch adjustment is at the middle of adjustment range at fan design conditions.
 - c. Belts: Oil resistant, nonsparking, and nonstatic; in matched sets for multiple-belt drives.
 - d. Belt Guards: Comply with requirements specified by OSHA and fabricate according to SMACNA's "HVAC Duct Construction Standards"; 0.1046-inch- (2.7-mm-) thick, 3/4-inch (20-mm) diamond-mesh wire screen, welded to steel angle frame; prime coated.
7. Variable-Inlet Vanes: Steel, with blades supported at both ends with permanently lubricated bearings. Variable mechanism terminating in single lever for connection to control actuator with connecting shaft for second set of variable inlet vanes on double-width fans.
OR
Discharge Dampers: Heavy-duty steel assembly with channel frame and sealed ball bearings, and opposed **OR** parallel, **as directed**, blades constructed of two plates formed around and welded to shaft, with blades linked out of air stream to single control lever.
8. Internal Vibration Isolation and Seismic Control, **as directed**: Fans shall be factory mounted with manufacturer's standard restrained, **as directed**, vibration isolation mounting devices having a minimum static deflection of 1 inch (25 mm) **OR** 2 inches (50 mm), **as directed**.
- a. Seismic Fabrication Requirements: Fabricate fan section, internal mounting frame and attachment to fans, fan housings, motors, casings, accessories, and other fan section components with reinforcement strong enough to withstand seismic forces defined in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment" when fan-mounting frame and air-handling-unit mounting frame are anchored to building structure.
9. Motor: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
- a. Enclosure Type: Totally enclosed, fan cooled.
 - b. NEMA Premium (TM) efficient motors as defined in NEMA MG 1.
 - c. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.



- d. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 21.
 - e. Mount unit-mounted disconnect switches on exterior **OR** interior, **as directed**, of unit.
10. Variable Frequency Controllers:
- a. Description: NEMA ICS 2, IGBT, PWM, VFC; listed and labeled as a complete unit and arranged to provide variable speed of an NEMA MG 1, Design B, 3-phase induction motor by adjusting output voltage and frequency.
 - b. Output Rating: 3-phase; 6 to 60 Hz, with voltage proportional to frequency throughout voltage range **OR** 66 Hz, with torque constant as speed changes **OR** 120 Hz, with horsepower constant throughout speed range, **as directed**.
 - c. Unit Operating Requirements:
 - 1) Input ac voltage tolerance of 208 V, plus or minus 5 **OR** 380 to 500 V, plus or minus 10 **OR** 525 to 575 V, plus or minus 10, **as directed**, percent.
 - 2) Input frequency tolerance of 50/60 Hz, plus or minus 6 percent.
 - 3) Minimum Efficiency: 96 percent at 60 Hz, full load.
 - 4) Minimum Displacement Primary-Side Power Factor: 96 percent.
 - 5) Overload Capability: 1.1 times the base load current for 60 seconds; 2.0 times the base load current for 3 seconds.
 - 6) Starting Torque: 100 percent of rated torque or as indicated.
 - 7) Speed Regulation: Plus or minus 1 percent.
 - d. Isolated control interface to allow controller to follow control signal over an 11:1 speed range.
 - e. Internal Adjustability Capabilities:
 - 1) Minimum Speed: 5 to 25 percent of maximum rpm.
 - 2) Maximum Speed: 80 to 100 percent of maximum rpm.
 - 3) Acceleration: 2 to a minimum of 22 seconds.
 - 4) Deceleration: 2 to a minimum of 22 seconds.
 - 5) Current Limit: 50 to a minimum of 110 percent of maximum rating.
 - f. Self-Protection and Reliability Features:
 - 1) Input transient protection by means of surge suppressors.
 - 2) Undervoltage and overvoltage trips; inverter overtemperature, overload, and overcurrent trips.
 - 3) Adjustable motor overload relays capable of NEMA ICS 2, Class 10 **OR** Class 20 **OR** Class 30, **as directed**, performance.
 - 4) Notch filter to prevent operation of the controller-motor-load combination at a natural frequency of the combination.
 - 5) Instantaneous line-to-line and line-to-ground overcurrent trips.
 - 6) Loss-of-phase protection.
 - 7) Reverse-phase protection.
 - 8) Short-circuit protection.
 - 9) Motor overtemperature fault.
 - g. Automatic Reset/Restart: Attempts three restarts after controller fault or on return of power after an interruption and before shutting down for manual reset or fault correction. Bidirectional autospeed search shall be capable of starting into rotating loads spinning in either direction and returning motor to set speed in proper direction, without damage to controller, motor, or load.
 - h. Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped.
 - i. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.
 - j. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.
 - k. Door-mounted LED status lights shall indicate the following conditions:
 - 1) Power on.



- 2) Run.
 - 3) Overvoltage.
 - 4) Line fault.
 - 5) Overcurrent.
 - 6) External fault.
- l. Panel-Mounted Operator Station: Start-stop and auto-manual selector switches with manual-speed-control potentiometer and elapsed time meter.
- m. Meters or digital readout devices and selector switch, mounted flush in controller door and connected to indicate the following controller parameters:
- 1) Output frequency (Hertz).
 - 2) Motor speed (rpm).
 - 3) Motor status (running, stop, fault).
 - 4) Motor current (amperes).
 - 5) Motor torque (percent).
 - 6) Fault or alarming status (code).
 - 7) Proportional-integral-derivative (PID) feedback signal (percent).
 - 8) DC-link voltage (volts direct current).
 - 9) Set-point frequency (Hertz).
 - 10) Motor output voltage (volts).
- n. Control Signal Interface:
- 1) Electric Input Signal Interface: A minimum of 2 analog inputs (0 to 10 V or 0/4-20 mA) and 6 programmable digital inputs.
 - 2) Remote signal inputs capable of accepting any of the following speed-setting input signals from the control system:
 - a) 0 to 10-V dc.
 - b) 0-20 or 4-20 mA.
 - c) Potentiometer using up/down digital inputs.
 - d) Fixed frequencies using digital inputs.
 - e) RS485.
 - f) Keypad display for local hand operation.
 - 3) Output signal interface with a minimum of 1 analog output signal (0/4-20 mA), which can be programmed to any of the following:
 - a) Output frequency (Hertz).
 - b) Output current (load).
 - c) DC-link voltage (volts direct current).
 - d) Motor torque (percent).
 - e) Motor speed (rpm).
 - f) Set-point frequency (Hertz).
 - 4) Remote indication interface with a minimum of 2 dry circuit relay outputs (120-V ac, 1 A) for remote indication of the following:
 - a) Motor running.
 - b) Set-point speed reached.
 - c) Fault and warning indication (overtemperature or overcurrent).
 - d) High- or low-speed limits reached.
- o. Communications: RS485 interface allows VFC to be used with an external system within a multidrop LAN configuration. Interface shall allow all parameter settings of VFC to be programmed via BMS control. Provide capability for VFC to retain these settings within the nonvolatile memory.
- p. Integral Disconnecting Means: NEMA AB 1, instantaneous-trip circuit breaker **OR** NEMA AB 1, molded-case switch **OR** NEMA KS 1, nonfusible switch **OR** NEMA KS 1, fusible switch, **as directed**, with lockable handle.
- q. Accessories:
- 1) Devices shall be factory installed in controller enclosure unless otherwise indicated.
 - 2) Push-Button Stations, Pilot Lights, and Selector Switches: NEMA ICS 2, heavy-duty type.
 - 3) Standard Displays:



- a) Output frequency (Hertz).
- b) Set-point frequency (Hertz).
- c) Motor current (amperes).
- d) DC-link voltage (volts direct current).
- e) Motor torque (percent).
- f) Motor speed (rpm).
- g) Motor output voltage (volts).

C. Coil Section

1. General Requirements for Coil Section:
 - a. Comply with ARI 410.
 - b. Fabricate coil section to allow removal and replacement of coil for maintenance and to allow in-place access for service and maintenance of coil(s).
 - c. For multizone units, provide air deflectors and air baffles to balance airflow across coils.
 - d. Coils shall not act as structural component of unit.
 - e. Seismic Fabrication Requirements: Fabricate coil section, internal mounting frame and attachment to coils, and other coil section components with reinforcement strong enough to withstand seismic forces defined in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment" when coil-mounting frame and air-handling-unit mounting frame are anchored to building structure.
2. Electrical Heating Coils, Controls, and Accessories: Comply with UL 1995.
 - a. Casing Assembly: Slip-in **OR** Flanged, **as directed**, type with galvanized-steel frame.
 - b. Sheathed Heating Elements: Coiled resistance wire of 80 percent nickel and 20 percent chromium surrounded by compacted magnesium-oxide powder in tubular-steel sheath; with spiral-wound, copper-plated, steel fins continuously brazed to sheath.
OR
Open Heating Elements: Resistance wire of 80 percent nickel and 20 percent chromium supported and insulated by floating ceramic bushings recessed into casing openings, fastened to supporting brackets, and mounted in galvanized-steel frame.
 - c. Overtemperature Protection: Disk-type, automatically resetting, thermal-cutout, safety device; serviceable through terminal box without removing heater from coil section.
 - d. Secondary Protection: Load-carrying, manually resetting or manually replaceable, thermal cutouts; factory wired in series with each heater stage.
 - e. Control Panel: Unit **OR** Remote, **as directed**, mounted with disconnecting means and overcurrent protection.
 - 1) Magnetic **OR** Mercury, **as directed**, contactor.
 - 2) Solid-state, stepless pulse controller.
 - 3) Toggle switches, one per step.
 - 4) Step controller.
 - 5) Time-delay relay.
 - 6) Pilot lights, one per step.
 - 7) Airflow proving switch.

D. Air Filtration Section

1. General Requirements for Air Filtration Section:
 - a. Comply with NFPA 90A.
 - b. Provide minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
 - c. Provide filter holding frames arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lifted out from access plenum.
2. Disposable Panel Filters:
 - a. Factory-fabricated, viscous-coated, flat-panel type.
 - b. Thickness: 1 inch (25 mm) **OR** 2 inches (50 mm), **as directed**.
 - c. Dust-Holding Capacity: as directed by the Owner.



- d. Initial Resistance: as directed by the Owner.
 - e. Recommended Final Resistance: as directed by the Owner.
 - f. Arrestance (ASHRAE 52.1): 80.
 - g. Merv (ASHRAE 52.2): 5.
 - h. Media: Interlaced glass fibers sprayed with nonflammable adhesive and antimicrobial agent, **as directed**.
 - i. Frame: Galvanized steel, with metal grid on outlet side, steel rod grid on inlet side, hinged, and with pull and retaining handles.
3. Extended-Surface, Disposable Panel Filters:
- a. Factory-fabricated, dry, extended-surface type.
 - b. Thickness: 1 inch (25 mm) **OR** 2 inches (50 mm) **OR** 4 inches (100 mm), **as directed**.
 - c. Dust-Holding Capacity: as directed by the Owner.
 - d. Initial Resistance: as directed by the Owner.
 - e. Recommended Final Resistance: as directed by the Owner.
 - f. Arrestance (ASHRAE 52.1): 90.
 - g. Merv (ASHRAE 52.2): 7.
 - h. Media: Fibrous material formed into deep-V-shaped pleats with antimicrobial agent, **as directed**, and held by self-supporting wire grid.
 - i. Media-Grid Frame: Nonflammable cardboard **OR** Galvanized steel **OR** Fire-retardant, 3/4-inch (20-mm) particleboard with gaskets, **as directed**.
 - j. Mounting Frames: Welded, galvanized steel, with gaskets and fasteners, suitable for bolting together into built-up filter banks.
4. Extended-Surface, Nonsupported-Media Filters:
- a. Factory-fabricated, dry, extended-surface, self-supporting type.
 - b. Dust-Holding Capacity: as directed by the Owner.
 - c. Initial Resistance: as directed by the Owner.
 - d. Recommended Final Resistance: as directed by the Owner.
 - e. Arrestance (ASHRAE 52.1): 95.
 - f. Merv (ASHRAE 52.2): 13.
 - g. Media: Fibrous material with antimicrobial agent, **as directed**, constructed so individual pleats are maintained in tapered form by flexible internal supports under rated-airflow conditions.
 - h. Filter-Media Frame: Galvanized steel **OR** Hard polyurethane foam, **as directed**.
 - i. Mounting Frames: Welded, galvanized steel, with gaskets and fasteners, suitable for bolting together into built-up filter banks with space for prefilter, **as directed**.
5. Automatic Roll Filters:
- a. Factory-fabricated, automatic, motor-driven, roll type.
 - b. Arrangement: Horizontal **OR** Vertical, **as directed**.
 - c. Dust-Holding Capacity: as directed by the Owner.
 - d. Initial Resistance: as directed by the Owner.
 - e. Recommended Final Resistance: as directed by the Owner.
 - f. Arrestance (ASHRAE 52.1): 80.
 - g. Merv (ASHRAE 52.2): 5.
 - h. Media: Compressed and rolled, fibrous-glass material viscous coated, and with antimicrobial agent, **as directed**.
 - i. Holding Frame: Galvanized steel, with enclosed, clean media roll arranged to allow upstream replacement of filter media.
 - j. Auxiliary Frame: Locate on downstream side of unit with downstream **OR** side, **as directed**, access.
 - k. Final Filter: Extended-surface, retained-media **OR** nonsupported-media **OR** HEPA, **as directed**, filters.
 - l. Control and Drive:
 - 1) Mechanism: Electric, gear-reducer, motor-driven, feed control equipped with manual media advance and runout switches for stopping media movement of filter bank and operating remote warning signal lights.



- 2) Manual Control: Manual switch to advance media and wired to override automatic controls.
 - 3) Automatic Control: Prewired control package to advance media when filter resistance exceeds adjustable high limit **OR** after adjustable operating time, **as directed**.
6. Activated-Carbon Panel Filters:
- a. Factory-fabricated unit with activated-carbon media.
 - b. Flat-Panel Media: Multilayer filter with inlet layer of polyester fibers, layer of activated-carbon granules bonded to fibers, layer of polyurethane foam, and housed in cardboard frame.
 - c. Pleated Media: Multilayer filter with inlet layer of cotton and synthetic fibers and layer of activated-carbon granules bonded to synthetic fibers, formed into deep-V-shaped pleats and held by self-wire grid, and housed in nonflammable cardboard frame.
 - d. Mounting Frames: Welded galvanized steel, with polyurethane gaskets and fasteners, capable of holding media and media frame in place and suitable for bolting together into built-up filter banks.
7. Activated-Carbon Filters:
- a. Factory-fabricated unit in deep-V arrangement with disposable panel prefilter.
 - b. Media: Activated carbon mounted in removable carbon-cell trays of epoxy-coated steel.
 - c. Activated-Carbon Capacity: 12 lb (5.4 kg) of activated carbon per 500 cfm (236 L/s) **OR** 8.8 lb (4.0 kg) of activated carbon per 2000 cfm (944 L/s), **as directed**, of airflow.
 - d. Housing: 0.064-inch- (1.6-mm-) thick, galvanized steel, for side servicing through gasketed access doors on both sides. Equip housings with metal slide channel tracks to hold activated-carbon trays.
8. HEPA Filters:
- a. Factory-fabricated unit.
 - b. Dust-Holding Capacity: as directed by the Owner.
 - c. Initial Resistance: as directed by the Owner.
 - d. Recommended Final Resistance: as directed by the Owner.
 - e. Arrestance (ASHRAE 52.1): 95 percent on 0.3-micrometer D.O.P. particles **OR** 99.97 percent on 0.3-micrometer D.O.P. particles **OR** 99.9995 percent on 0.1- and 0.2-micrometer D.O.P. particles **OR** 99.99995 percent on 0.1- and 0.2-micrometer D.O.P. particles, **as directed**.
 - f. Media: UL 586, fibrous glass, constructed of continuous sheets with closely spaced pleats with aluminum separators **OR** vinyl-coated aluminum separators **OR** separators of ribbons of filter media, **as directed**.
 - g. Frame Material: 3/4-inch- (19-mm-) thick, fire-retardant plywood **OR** 3/4-inch- (19-mm-) thick, fire-retardant particleboard **OR** 3/4-inch- (19-mm-) thick plywood **OR** 3/4-inch- (19-mm-) thick particleboard **OR** Galvanized steel **OR** Aluminized steel **OR** Cadmium-plated steel **OR** Stainless steel **OR** Aluminum, **as directed**.
 - h. Media to Frame Side Bond: Polyurethane foam **OR** Silicone **OR** Neoprene adhesive **OR** Fiberglass-mat packing **OR** Thermosetting sealant **OR** Knife edge in fluid-filled channel, **as directed**.
 - i. Face Gasket: Neoprene expanded rubber **OR** Ceramic fiber **OR** Silicone, **as directed**.
 - j. Mounting Frames: Downstream corners of holding device shall have cushion pads to protect media. Bolted filter-sealing mechanism shall mount and continuously seal each individual filter.
9. Filter Gage:
- a. 3-1/2-inch- (90-mm-) **OR** 2-inch- (50-mm-), **as directed**, diameter, diaphragm-actuated dial in metal case.
 - b. Vent valves.
 - c. Black figures on white background.
 - d. Front recalibration adjustment.
 - e. 2 **OR** 3, **as directed**, percent of full-scale accuracy.



- f. Range: 0- to 0.5-inch wg (0 to 125 Pa) **OR** 0- to 1.0-inch wg (0 to 250 Pa) **OR** 0- to 2.0-inch wg (0 to 500 Pa) **OR** 0- to 3.0-inch wg (0 to 750 Pa) **OR** 0- to 4.0-inch wg (0 to 1000 Pa), **as directed**.
- g. Accessories: Static-pressure tips with integral compression fittings, 1/4-inch (6-mm) aluminum **OR** plastic, **as directed**, tubing, and 2- or 3-way vent valves.

E. Dampers

- 1. General Requirements for Dampers: Leakage rate, according to AMCA 500, "Laboratory Methods for Testing Dampers for Rating," shall not exceed 2 percent of air quantity at 2000-fpm (10-m/s) face velocity through damper and 4-inch wg (1000-Pa) pressure differential.
- 2. Damper Operators: Comply with requirements in Division 23 Section "Instrumentation And Control For Hvac".

OR

Electronic Damper Operators:

- a. Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
- b. Electronic damper position indicator shall have visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.
- c. Operator Motors:
 - 1) Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Work Results For Hvac".
 - 2) Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.
 - 3) Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
- d. Nonspring-Return Motors for Dampers Larger Than 25 Sq. Ft. (2.3 sq. m): Size for running torque of 150 in. x lbf (16.9 N x m) and breakaway torque of 300 in. x lbf (33.9 N x m).
- e. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft. (2.3 sq. m): Size for running and breakaway torque of 150 in. x lbf (16.9 N x m).
- f. Size dampers for running torque calculated as follows:
 - 1) Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. (86.8 kg-cm/sq. m) of damper.
 - 2) Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. (62 kg-cm/sq. m) of damper.
 - 3) Parallel-Blade Damper without Edge Seals: 4 inch-lb/sq. ft (49.6 kg-cm/sq. m) of damper.
 - 4) Opposed-Blade Damper without Edge Seals: 3 inch-lb/sq. ft. (37.2 kg-cm/sq. m) of damper.
 - 5) Dampers with 2- to 3-Inch wg (500 to 750 Pa) of Pressure Drop or Face Velocities of 1000 to 2500 fpm (5 to 13 m/s): Increase running torque by 1.5.
 - 6) Dampers with 3- to 4-Inch wg (750 to 1000 Pa) of Pressure Drop or Face Velocities of 2500 to 3000 fpm (13 to 15 m/s): Increase running torque by 2.0.
- g. Coupling: V-bolt and V-shaped, toothed cradle.
- h. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
- i. Fail-Safe Operation: Mechanical, spring-return mechanism with external, manual gear release on nonspring-return actuators.
- j. Power Requirements (Two-Position Spring Return): 24 **OR** 120 **OR** 230, **as directed**, -V ac.
- k. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
- l. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
- m. Temperature Rating: Minus 22 to plus 122 deg F (Minus 30 to plus 50 deg C) **OR** 40 to 104 deg F (5 to 40 deg C), **as directed**.



- n. Run Time: 12 seconds open, 5 seconds closed **OR** 30 seconds **OR** 60 seconds **OR** 120 seconds, **as directed**.
- OR**
- Pneumatic Damper Operators:
- a. Rolling-diaphragm piston type with adjustable stops and spring return, sized to operate with sufficient reserve power to provide smooth modulating action or two-position action. Where actuators operate in sequence, provide pilot positioners.
 - b. Pneumatic Damper Position Indicator: Potentiometer mounted in enclosure with adjustable crank-arm assembly connected to damper to transmit 0 to 100 percent valve/damper travel.
 - c. Pilot Positioners:
 - 1) Start Point: Adjustable from 2 to 12 psig (14 to 83 kPa).
 - 2) Operating Span: Adjustable from 5 to 13 psig (35 to 90 kPa).
 - 3) Linearity: Plus or minus 10 percent of output signal span.
 - 4) Hysteresis: 3 percent of span.
 - 5) Response: 0.25-psig (1723-Pa) input change.
 - 6) Maximum Pilot Signal Pressure: 20 psig (140 kPa).
 - 7) Maximum Control Air-Supply Pressure: 60 psig (410 kPa).
 - d. Actuator Housing: Molded or die-cast zinc or aluminum. Terminal unit actuators may be high-impact plastic with ambient temperature rating of 50 to 140 deg F (10 to 60 deg C) unless located in return-air plenums, **as directed**.
 - e. Inlet-Vane Operators: High pressure, with pilot positioners.
3. Zone Dampers: Two single-blade, galvanized-steel **OR** aluminum **OR** extruded-aluminum, **as directed**, dampers offset 90 degrees from each other on cadmium-plated, **as directed**, steel operating rod rotating in sintered bronze or nylon bearings mounted in a single galvanized-steel **OR** aluminum **OR** extruded-aluminum, **as directed**, frame. Provide blade gaskets and edge seals, and mechanically fasten blades to operating rod.
 4. Face-and-Bypass Dampers: Opposed-blade, galvanized-steel **OR** aluminum **OR** extruded-aluminum, **as directed**, dampers with cadmium-plated, **as directed**, steel operating rods rotating in sintered bronze or nylon bearings mounted in a single galvanized-steel **OR** aluminum **OR** extruded-aluminum, **as directed**, frame and with operating rods connected with a common linkage. Provide blade gaskets and edge seals, and mechanically fasten blades to operating rod.
 5. Outdoor- and Return-Air Mixing Dampers: Parallel-blade, galvanized-steel **OR** aluminum **OR** extruded-aluminum, **as directed**, dampers mechanically fastened to cadmium-plated, **as directed**, steel operating rod in reinforced cabinet. Connect operating rods with common linkage and interconnect linkages so dampers operate simultaneously.
 6. Outdoor- and Return-Air Dampers: Low-leakage, double-skin, airfoil-blade, galvanized-steel **OR** aluminum **OR** extruded-aluminum, **as directed**, dampers with compressible jamb seals and extruded-vinyl blade edge seals in opposed-blade **OR** parallel-blade, **as directed**, arrangement with cadmium-plated, **as directed**, steel operating rods rotating in stainless-steel sleeve **OR** sintered bronze or nylon, **as directed**, bearings mounted in a single galvanized-steel **OR** aluminum **OR** extruded-aluminum, **as directed**, frame, and with operating rods connected with a common linkage. Leakage rate shall not exceed 5 cfm/sq. ft. (0.22 L/s per sq. m) at 1-inch wg (250 Pa) and 9 cfm/sq. ft. (0.4 L/s per sq. m) at 4-inch wg (1.0 MPa).
 7. Mixing Section: Multiple-blade, air-mixer assembly located immediately downstream of mixing section.
 8. Combination Filter and Mixing Section:
 - a. Cabinet support members shall hold 2-inch- (50-mm-) thick, pleated, flat, permanent or throwaway filters.
 - b. Multiple-blade, air-mixer assembly shall mix air to prevent stratification, located immediately downstream of mixing box.

F. Humidifiers

1. Steam Grid Humidifier:
 - a. Manifold:



- 1) ASTM A 666, Type 304 stainless steel.
- 2) Steam jacketed.
- 3) Insulated with 1/2-inch (13-mm) fiberglass and stainless-steel jacket.
- 4) Manifold shall extend the full width of unit with mounting brackets at ends.
- b. Steam Separator: Cast iron, **OR** ASTM A 666, Type 304 stainless steel, **as directed**, with separate, **as directed**, humidifier control valve.
- c. Humidifier Control Valve: Actuator: Pneumatic **OR** Electric, **as directed**, modulating with spring return.
OR
Humidifier Control Valve: Actuator: As specified in Division 23 Section "Instrumentation And Control For Hvac".
- d. Steam Trap: Inverted-bucket type, sized for a minimum of three times the maximum rated condensate flow of humidifier at 1/2-psig (3.4-kPa) inlet pressure.
- e. Aquastat: For separate mounting on steam condensate, return piping to prevent cold operation of humidifier.
- f. Strainer: In-line type.
- g. Airflow Switch: To prevent humidifier operation in the absence of airflow.
2. Wet Glass Cell Washer Section:
 - a. 3-inch- (75-mm-) deep cells with random packed, glass-fiber media in galvanized-steel **OR** stainless-steel, **as directed**, frames.
 - b. Access Door: Watertight with brass fittings, wire glass window, **as directed**, and locking handles.
 - c. Spray Tree Assembly: Brass **OR** Stainless-steel, **as directed**, nozzles and galvanized-steel **OR** stainless-steel, **as directed**, piping.
 - d. Eliminator: Galvanized-steel **OR** Stainless-steel, **as directed**, plates.
 - e. Tank:
 - 1) Welded steel **OR** stainless steel, **as directed**, with interior and exterior surfaces blasted and painted with zinc-chromate paint, **as directed**.
 - 2) Copper suction screen.
 - 3) Drain, overflow, and suction connections.
 - 4) Makeup connection with brass, **as directed**, float valve, and with quick-fill connection.
 - f. Insulate exterior with duct insulation and mount on 2-inch (-50-mm-) thick, rigid insulation board.
3. Evaporative Humidifier Section:
 - a. Access Door: Watertight cast iron, **as directed**, with brass fittings, wire glass window, and locking handles.
 - b. Spray Tree Assembly: Brass nozzles and galvanized piping, galvanized eliminator plates with flooding nozzles and header, and galvanized antisplash baffles **OR** cross-fluted cellulose media, **as directed**.
 - c. Tank:
 - 1) Welded steel tank with interior and exterior surfaces blasted and painted with zinc-chromate paint.
 - 2) Copper suction screen, drain, overflow, and suction connections.
 - 3) Makeup connection with brass, **as directed**, float valve, and with quick-fill connection.
 - d. Insulation: Insulate with duct insulation on exterior and mount on 2-inch (-50-mm-) thick, rigid insulation board.

G. Air-To-Air Energy Recovery

1. Heat Wheels:
 - a. Casing:
 - 1) Steel, with manufacturer's standard paint coating.
 - 2) Integral purge section limiting carryover of exhaust air to between 0.05 percent at 1.6-inch wg and 0.20 percent at 4-inch wg (0.05 percent at 400-Pa and 0.20 percent at 1000-Pa) differential pressure.



- 3) Casing seals on periphery of rotor, on duct divider, and on purge section.
- 4) Support rotor on grease-lubricated ball bearings with extended grease fittings. Mount horizontal wheels on tapered roller bearing.
- b. Rotor: Aluminum, segmented wheel, strengthened with radial spokes, with nontoxic, noncorrosive, silica-gel desiccant coating, **as directed**. Construct media for passing maximum 500 **OR** 800 **OR** 1200, **as directed**, -micrometer solids.
OR
Rotor: Glass-fiber **OR** Polymer, **as directed**, segmented wheel, strengthened with radial spokes impregnated with nonmigrating, water-selective, molecular-sieve desiccant coating. Construct media for passing maximum 800 **OR** 1200, **as directed**, -micrometer solids.
- c. Drive: Fractional horsepower motor and gear reducer, with speed changed by variable frequency controller, **as directed**, and self-adjusting multilink belt around outside of rotor.
- d. Controls:
 - 1) Starting relay, factory mounted and wired, and manual motor starter for field wiring.
 - 2) Variable frequency controller, factory mounted and wired, permitting input of field connected 4-20 mA or 1-10-V control signal.
OR
Variable frequency controller, factory mounted and wired, with exhaust-air sensor to vary rotor speed and maintain exhaust temperature above freezing.
OR
Variable frequency controller, factory mounted and wired, with exhaust- and outdoor-air sensors, automatic changeover thermostat and set-point adjuster, to vary rotor speed and maintain exhaust temperature above freezing, **as directed**, and air differential temperature above set point. Provide maximum rotor speed when exhaust-air temperature is less than outdoor-air temperature.
 - 3) Pilot-Light Indicator: Display rotor rotation and speed.
 - 4) Speed Settings: Adjustable settings for maximum and minimum rotor speed limits.
2. Fixed-Plate Sensible Heat Exchangers:
 - a. Casing: Aluminum **OR** Galvanized steel **OR** Enameled steel, with galvanized-steel liner **OR** Enameled steel, **as directed**.
 - b. Plates: Evenly spaced and sealed and arranged for counter airflow.
 - c. Plate Material: Embossed aluminum **OR** Stainless steel **OR** Polypropylene copolymer (high-density plastic), **as directed**.
 - 1) Plate Coating: Epoxy **OR** Air-dried phenolic, **as directed**.
 - d. Bypass: Plenum within casing, with gasketed face-and-bypass dampers that have operating rods extended outside casing.
 - e. Water Wash: Automatic system, with spray manifold to individual spray tubes or traversing type with stainless-steel-screw operating mechanism and electric motor drive; activated by time clock, with detergent injection, **as directed**.
 - f. Heat-Exchanger Prefilters: 1 inch (25 mm) thick, disposable **OR** 2 inches (50 mm) thick, disposable **OR** Medium efficiency **OR** Electrostatic, **as directed**.
- H. Source Quality Control
 1. Fan Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Fans shall bear AMCA-certified sound ratings seal.
 2. Fan Performance Rating: Factory test fan performance for airflow, pressure, power, air density, rotation speed, and efficiency. Rate performance according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating."
 3. Water Coils: Factory tested to 300 psig (2070 kPa) according to ARI 410 and ASHRAE 33.
 4. Steam Coils: Factory tested to 300 psig (2070 kPa) and to 200 psig (1380 kPa) underwater according to ARI 410 and ASHRAE 33.
 5. Refrigerant Coils: Factory tested to 450 psig (3105 kPa) according to ARI 410 and ASHRAE 33.



1.3 EXECUTION

A. Installation

1. Equipment Mounting: Install air-handling units on concrete bases using elastomeric pads **OR** using elastomeric mounts **OR** using restrained spring isolators **OR** without vibration isolation devices, **as directed**. Secure units to anchor bolts installed in concrete bases. Comply with requirements for concrete bases specified in Division 03 Section "Cast-in-place Concrete". Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 - a. Minimum Deflection: 1/2 inch (13 mm) **OR** 1 inch (25 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**.
 - b. Install galvanized-steel **OR** stainless-steel, **as directed**, plate to equally distribute weight over elastomeric pad.
 - c. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - d. Install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - e. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - f. Install anchor bolts to elevations required for proper attachment to supported equipment.

OR

- Equipment Mounting: Install air-handling unit using elastomeric pads **OR** using elastomeric mounts **OR** using restrained spring isolators **OR** without vibration isolation devices, **as directed**. Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
- g. Minimum Deflection: 1/4 inch (6 mm) **OR** 1/2 inch (13 mm) **OR** 1 inch (25 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**.
 - h. Install galvanized-steel **OR** stainless-steel, **as directed**, plate to equally distribute weight over elastomeric pad.
2. Suspended Units: Suspend and brace, **as directed**, units from structural-steel support frame using threaded steel rods and spring hangers. Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 3. Arrange installation of units to provide access space around air-handling units for service and maintenance.
 4. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with new, clean filters.
 5. Install filter-gage, static-pressure taps upstream and downstream of filters. Mount filter gages on outside of filter housing or filter plenum in accessible position. Provide filter gages on filter banks, installed with separate static-pressure taps upstream and downstream of filters.

B. Connections

1. Comply with requirements for piping specified in other Division 21. Drawings indicate general arrangement of piping, fittings, and specialties.
2. Install piping adjacent to air-handling unit to allow service and maintenance.
3. Connect piping to air-handling units mounted on vibration isolators with flexible connectors.
4. Connect condensate drain pans using NPS 1-1/4 (DN 32), ASTM B 88, Type M (ASTM B 88M, Type C) copper tubing. Extend to nearest equipment or floor drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.
5. Hot- and Chilled-Water Piping: Comply with applicable requirements in Division 23 Section "Hydronic Piping". Install shutoff valve and union or flange at each coil supply connection. Install balancing valve and union or flange at each coil return connection.
6. Steam and Condensate Piping: Comply with applicable requirements in Division 23 Section "Steam And Condensate Heating Piping". Install shutoff valve at steam supply connections, float and thermostatic trap, and union or flange at each coil return connection. Install gate valve and



inlet strainer at supply connection of dry steam humidifiers, and inverted bucket steam trap to condensate return connection.

7. Refrigerant Piping: Comply with applicable requirements in Division 23 Section "Refrigerant Piping". Install shutoff valve and union or flange at each supply and return connection.
8. Connect duct to air-handling units with flexible connections. Comply with requirements in Division 23 Section "Air Duct Accessories".

C. Field Quality Control

1. Perform tests and inspections.
2. Tests and Inspections:
 - a. Leak Test: After installation, fill water and steam coils with water, and test coils and connections for leaks.
 - b. Charge refrigerant coils with refrigerant and test for leaks.
 - c. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - d. Automatic-Roll-Filter Operational Test: Operate filters to demonstrate compliance with requirements. Test for leakage of unfiltered air while system is operating.
 - e. HEPA-Filter Operational Test: Pressurize housing to a minimum of 3-inch wg (750 Pa) or to designed operating pressure, whichever is higher; test housing joints, door seals, and sealing edges of filter with soapy water to check for air leaks.
 - f. HEPA-Filter Operational Test: Pressurize housing to a minimum of 3-inch wg (750 Pa) or to designed operating pressure, whichever is higher; test housing joints, door seals, and sealing edges of filter for air leaks according to ASME N510, pressure-decay method.
 - g. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Air-handling unit or components will be considered defective if unit or components do not pass tests and inspections.
4. Prepare test and inspection reports.

D. Startup Service

1. Perform startup service.
 - a. Complete installation and startup checks according to manufacturer's written instructions.
 - b. Verify that shipping, blocking, and bracing are removed.
 - c. Verify that unit is secure on mountings and supporting devices and that connections to piping, ducts, and electrical systems are complete. Verify that proper thermal-overload protection is installed in motors, controllers, and switches.
 - d. Verify proper motor rotation direction, free fan wheel rotation, and smooth bearing operations. Reconnect fan drive system, align belts, and install belt guards.
 - e. Verify that bearings, pulleys, belts, and other moving parts are lubricated with factory-recommended lubricants.
 - f. Verify that zone dampers fully open and close for each zone.
 - g. Verify that face-and-bypass dampers provide full face flow.
 - h. Verify that outdoor- and return-air mixing dampers open and close, and maintain minimum outdoor-air setting.
 - i. Comb coil fins for parallel orientation.
 - j. Verify that proper thermal-overload protection is installed for electric coils.
 - k. Install new, clean filters.
 - l. Verify that manual and automatic volume control and fire and smoke dampers in connected duct systems are in fully open position.
2. Starting procedures for air-handling units include the following:
 - a. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated rpm. Replace fan and motor pulleys as required to achieve design conditions, **as directed**.
 - b. Measure and record motor electrical values for voltage and amperage.



- c. Manually operate dampers from fully closed to fully open position and record fan performance.

- E. Adjusting
 - 1. Adjust damper linkages for proper damper operation.
 - 2. Comply with requirements in Division 23 Section "Testing, Adjusting, And Balancing For Hvac" for air-handling system testing, adjusting, and balancing.

- F. Cleaning
 - 1. After completing system installation and testing, adjusting, and balancing air-handling unit and air-distribution systems and after completing startup service, clean air-handling units internally to remove foreign material and construction dirt and dust. Clean fan wheels, cabinets, dampers, coils, and filter housings, and install new, clean filters.

- G. Demonstration
 - 1. Train Owner's maintenance personnel to adjust, operate, and maintain air-handling units.

END OF SECTION 23 73 13 00



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23 - Heating, Ventilating, And Air-Conditioning (HVAC)

Task	Specification	Specification Description
23 73 13 00	07 72 23 00	Roof Accessories



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SECTION 23 74 13 00 - SELF-CONTAINED AIR-CONDITIONERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for self-contained air-conditioners. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes packaged air **OR** water-cooled air-conditioning units, **as directed**, with refrigerant compressors and controls, intended for indoor installations.

C. Submittals

1. Product Data: For each unit indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories.
2. LEED Submittals:
 - a. Product Data for Credit EA 4: Documentation required by Credit EA 4 indicating that equipment and refrigerants comply.
 - b. Product Data for Prerequisite EQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
3. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - a. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - b. Wiring Diagrams: For power, signal, and control wiring.
4. Samples for Initial Selection: For units with factory-applied color finishes.
5. Operation and Maintenance Data: For self-contained air conditioners to include in emergency, operation, and maintenance manuals.
6. Warranty: Sample of special warranty.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency and marked for intended locations and application.
2. ARI Compliance:
 - a. Applicable requirements in ARI 210/240.
 - b. Applicable requirements in ARI 340/360.
 - c. Applicable requirements in ARI 390.
3. ASHRAE Compliance:
 - a. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
 - b. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - "Ventilation Rate Procedures," and Section 7 - "Construction and Startup."
4. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

E. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of self-contained air conditioners that fail in materials or workmanship within specified warranty period.
 - a. Warranty Period:
 - 1) For Compressor: One **OR** Five year(s), **as directed**, from date of Final Completion.
 - 2) For Parts: One **OR** Five year(s), **as directed**, from date of Final Completion.
 - 3) For Labor: One **OR** Five year(s), **as directed**, from date of Final Completion.



1.2 PRODUCTS

A. Packaged Units

1. Description: Factory-assembled, wired, and tested, and fully charged with refrigerant and oil.
2. Configuration: Horizontal, ceiling-plenum mounted.
3. Configuration: Vertical, floor mounted; vertical and horizontal discharge.
4. Configuration: Horizontal, ceiling mounted and vertical, floor mounted; vertical and horizontal discharge.
5. Disconnect Switch: Factory mounted in control panel **OR** on equipment, **as directed**.

B. Cabinet

1. Frame and Panels: Structural-steel frame with galvanized-steel panels and access doors or panels.
 - a. Exterior-Surface Finish: Factory painted in color selected by Architect.
 - b. Interior-Surface Finish: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
2. Insulation: Minimum 1-inch- (25-mm-), thick, glass-fiber duct liner complying with ASTM C 1091 and having a microbial coating on cabinet interior and control panel. 1/2-inch- (13-mm-) thick liner is acceptable for units smaller than 15 tons (50 kW).
3. Return-Air Opening: Rear, open **OR** flange for duct connection, **as directed**.
4. Corrosion-Resistant Treatment: Phenolic coating on unit interior and exterior.

C. Supply-Air Fan

1. Fan Material: Galvanized steel.
2. Configuration: Double-width, double-inlet, forward-curved **OR** airfoil, **as directed**, centrifugal fan; statically and dynamically balanced. Vertical **OR** Horizontal discharge, **as directed**, with flexible discharge collar.
3. Drive: Belt, with fan mounted on permanently lubricated bearings **OR** Direct, with fan and motor resiliently mounted, **as directed**.
4. Fan Sheaves: Variable pitch, dynamically balanced, bored to fit shafts and keyed for initial startup.
5. Motor Sheave: Variable and adjustable pitch dynamically balanced, and selected to achieve specified rpm when set at midposition.
6. Belt Rating: As recommended by the manufacturer or a minimum of one and one-half times nameplate rating of motor.
7. Bearings: Grease lubricated with grease lines extended to exterior of unit with L-50 life at 200,000 hours.
8. Variable Air Volume: Variable-frequency motor controller with bypass.
9. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - a. Special Motor Features: Premium efficiency, as defined in Division 23 Section "Common Motor Requirements For Hvac Equipment".
10. Isolation: Mount fan and motor on common subbase and mount assembly on spring isolators with minimum static deflection of **1 inch (25 mm)**.
11. Outdoor-Air-Intake Accessories:
 - a. Barometric Outdoor-Air Damper: Adjustable-blade damper allowing induction of up to 25 percent outdoor air when evaporator fan is running.
 - b. Motorized Outdoor-Air Damper: Motorized, two-position blade damper allowing induction of up to 25 percent outdoor air; with spring-return, low-voltage damper motor.
 - c. Energy-Recovery Ventilator: Assembly of desiccant-coated, heat-recovery wheels and centrifugal exhaust fans to transfer approximately 67 percent of the difference between the sensible and latent heat of outdoor and exhaust air.



- d. Air-Side Economizer: Damper assembly allowing induction of up to 100 percent outdoor air to maintain a selected mixed-air temperature; and exhaust damper and spring-return, low-voltage, modulating damper motor with minimum position adjustment.

D. Refrigeration System

1. Compressor: Scroll type, hermetically sealed, 3600 rpm maximum, and resiliently mounted with positive lubrication and internal motor protection.
2. Refrigerant Coils (Indoor and Outdoor for Air-Cooled Units): Seamless copper tubes expanded into aluminum fins.
 - a. Corrosion-Resistant Treatment: Phenolic coating applied with multiple dips and baked.
 - b. Refrigerant Circuits: A separate circuit for each compressor, with externally equalized thermal-expansion valve with adjustable superheat, filter dryer, sight glass, high-pressure relief valve, and charging valves.
 - c. Mount coil assembly over stainless-steel drain pan complying with ASHRAE 62.1 and having a condensate pump unit with integral float switch, pump-motor assembly, and condensate reservoir.
 - d. Refrigerant: R-407C or R-410A.
 - e. Expansion valve with replaceable thermostatic element.
 - f. Refrigerant dryer.
 - g. High-pressure switch.
 - h. Low-pressure switch.
 - i. Thermostat for coil freeze-up protection during low ambient temperature operation or loss of air.
 - j. Low ambient temperature switch.
 - k. Brass service valves installed in discharge and liquid lines.
3. Water-Cooled Condenser:
 - a. Description: Factory assembled and tested; tube in tube coaxial type with water-regulating valve.
 - b. Tubing: Nonferrous **OR** Copper **OR** Cupro-nickel, **as directed**, inner tube; steel with corrosion-resistant coating; refrigerant and water-side leak tested to 400 psig (2760 kPa) underwater.
4. Water-Side Economizer Section:
 - a. Description: Factory assembled and tested; consisting of water coil, modulating valves, controls, piping with cleanouts, and access panels.
 - b. Water Coil: Two **OR** Four rows, **as directed**, copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm), and copper **OR** cast-iron, **as directed** headers; leak tested to 300 psig (2070 kPa) underwater; and having a two-position control valve.

E. Heating Coil

1. Water Coil: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm); leak tested to 300 psig (2070 kPa) underwater; and having a two-position control valve.
2. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements with refractory ceramic support bushings; automatic-reset thermal cutout; built-in magnetic contactors; manual-reset thermal cutout; airflow-proving device; and one-time fuses in terminal box for overcurrent protection.

F. Controls

1. Control Package: Factory wired, including contactor, high- and low-pressure cutouts, internal-winding thermostat for compressor, control-circuit transformer, and noncycling reset relay.
2. Time-Delay Relay: Five-minute delay to prevent compressor cycling.
3. Adjustable Thermostat: Unit mounted **OR** Remote, **as directed**, to control the following:
 - a. Supply fan.
 - b. Compressor.
 - c. Condenser.



- d. Hot-water coil valve.
 - e. Electric heater.
 4. System Selector Switch: Heat-off-cool **OR** Off-heat-auto-cool, **as directed**.
 5. Fan Control Switch: Auto-on.
 6. Time Clock, **as directed**: Cycle unit on and off.
 7. Microprocessor Control Panel: Controls unit functions, including refrigeration and safety controls, and the following:
 - a. Supply fan.
 - b. Supply-fan motor speed.
 - c. Compressors.
 - d. Air-cooled condenser.
 - e. Cooling tower pump.
 - f. Modulating, hot-water coil valve.
 - g. Multistep, electric heater.
 - h. Time-of-day control to cycle unit on and off.
 - i. Night-heat, morning warm-up cycle.
 - j. Economizer control.
 - k. Panel-mounted control switch to operate unit in remote or local control mode, or to stop or reset.
 - l. Panel-mounted indication of the following:
 - 1) Operating status.
 - 2) System diagnostics and safety alarms.
 - 3) Supply-air temperature set point.
 - 4) Zone heating-temperature set point.
 - 5) Supply-air pressure set point.
 - 6) Economizer minimum position set point.
 - 7) Supply-air-pressure, high-limit set point.
 - 8) Monitor constant and variable motor loads.
 - 9) Monitor variable-frequency drive operation.
 - 10) Monitor economizer cycle.
 - 11) Monitor cooling load.
 - 12) Monitor air distribution static pressure and ventilation air volumes.
- G. Evaporator Coil
1. Direct-Expansion Coil: Seamless copper tubes expanded into aluminum fins.
 - a. Corrosion-Resistant Treatment, **as directed**: Phenolic coating applied with multiple dips and baked.
 2. Refrigerant Circuits: A separate circuit for each compressor, with externally equalized thermal-expansion valve with adjustable superheat, **as directed**, filter-dryer, sight glass, high-pressure relief valve, **as directed**, and charging valves.
- H. Remote Air-Cooled Condenser
1. Description: Factory assembled and tested; consisting of condenser coil, fans and motors, and operating controls; suitable for roof mounting.
 - a. Condenser Coil: Aluminum-fin copper tube with integral subcooler; leak tested to 450 psig (3110 kPa).
 - b. Condenser Fans: Direct-drive propeller type.
 - c. Fan Motors: Three-phase, permanently lubricated, ball-bearing motors with built-in thermal-overload protection. Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - d. Refrigerant Line Kits: Annealed-copper suction and liquid lines that are factory cleaned, dried, pressurized, and sealed; insulated suction line; flared fittings at evaporator end, no fitting at condenser end; and service valves for both suction and liquid lines.
 - e. Terminate suction and liquid refrigerant piping with service valves within unit.
 - f. Low Ambient Control: Cycles fans to permit operation down to 45 deg F (7 deg C).



OR

Low Ambient Control: Cycles fans and modulates condenser fan damper assembly to permit operation down to 0 deg F (minus 18 deg C).

- g. Coil Guard: Painted galvanized steel with louvered grilles.
- h. Corrosion-Resistant Treatment: Phenolic coating applied in multiple dips and baked.

I. Integral Air-Cooled Condenser For Units 15 Tons (50 kW) And Smaller

- 1. Description: Factory assembled and tested; consisting of condenser coil, fans and motors, and cabinet.
 - a. Condenser Coil: Aluminum-fin copper tube with integral subcooler; leak tested to 425 psig (2930 kPa).
 - b. Condenser Fan: Direct-drive propeller type with permanently lubricated motor with built-in thermal-overload protection.
 - c. Low Ambient Control: Cycles fans to permit operation down to 0 deg F (minus 18 deg C).

J. Air Filters

- 1. Permanent Filters: 1-inch- (25-mm-) thick, cleanable panel filters.

OR

Disposable Filters: 1-inch- (25-mm-) **OR** 2-inch- (50-mm-), **as directed**, thick, glass-fiber, flat **OR** pleated, **as directed**, panel filters.

OR

Extended-Surface, Disposable Panel Filters: 2-inch- (50-mm-) **OR** 4-inch- (100-mm-), **as directed**, thick, dry, filters with fibrous media material formed into deep-V-shaped pleats and held by self-supporting wire grid holding frames, with nonflammable cardboard media and media-grid frame.

- a. Efficiency: ASHRAE 52.2 MERV rating of 6 or higher.
- 2. Air-Pressure Switch (for units larger than 15 tons (50 kW)): Indicates dirty filters.

K. Accessories:

- 1. Manual outdoor-air damper.
- 2. Motorized outdoor-air damper.
- 3. Air-side economizer.
- 4. Water-side economizer.
- 5. Hot-gas bypass.
- 6. Air Pressure Switch: Indicates when differential pressure exceeds set point representing dirty filters.

L. Single-Point Electrical Characteristics:

- 1. Volts: 120 **OR** 208 **OR** 230 **OR** 460, **as directed**.
- 2. Phase: Single **OR** Three, **as directed**.
- 3. Hertz: 60.
- 4. Full-Load Amperes: **as directed**.
- 5. Minimum Circuit Ampacity: **as directed**.
- 6. Maximum Overcurrent Protection: **as directed**.

1.3 EXECUTION

A. Installation

- 1. Install units level and plumb.
- 2. Anchor units to structure.
- 3. Install seismic restraints.
- 4. Install static-pressure probe (for units larger than 15 tons (50 kW) equipped with inlet vanes).



5. Install water-cooled units with thermometer and pressure gage at the water supply and return connection.
6. Install vibration spring isolators under base of unit, with minimum static deflection of 1 inch (25 mm). Refer to Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".

B. Connections

1. Piping installation requirements are specified in other Division 21. Drawings indicate general arrangement of piping, fittings, and specialties.
 - a. Water Coil Connections: Comply with requirements in Division 23 Section "Hydronic Piping". Connect to supply and return coil with shutoff-duty valve and union or flange on the supply connection and with throttling-duty valve and union or flange on the return connection.
 - b. Water-Cooled Condenser Connections: Comply with requirements in Division 23 Section "Hydronic Piping". Connect to supply and return with shutoff-duty valve and union or flange on the supply connection and with throttling-duty valve and union or flange on the return connection.
2. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
3. Duct Connections: Duct installation requirements are specified in Division 23 Section "Metal Ducts". Drawings indicate the general arrangement of ducts. Connect supply and return, **as directed**, ducts to self-contained air-conditioners with flexible duct connectors. Flexible duct connectors are specified in Division 23 Section "Air Duct Accessories".

C. Field Quality Control

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
2. Perform tests and inspections.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
3. Tests and Inspections:
 - a. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - b. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
4. Units will be considered defective if they do not pass tests and inspections.
5. Prepare test and inspection reports.

D. Startup Service

1. Engage a factory-authorized service representative to perform **OR** perform startup service, **as directed**.

E. Demonstration

1. Engage a factory-authorized service representative to train **OR train** the Owner's maintenance personnel, **as directed** to adjust, operate, and maintain units.

END OF SECTION 23 74 13 00



SECTION 23 74 23 00 - DIRECT-FIRED, MAKEUP AIR UNITS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for direct-fired H&V units. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes direct-fired H&V units with an evaporative cooling package, **as directed**.

C. Submittals

1. Product Data: Include rated capacities, furnished specialties, and accessories.
2. LEED Submittal:
 - a. Product Data for Prerequisite EQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
3. Shop Drawings:
 - a. Mounting Details: For securing and flashing roof curb to roof structure. Indicate coordinating requirements with roof membrane system.
 - b. Wiring Diagrams: Power, signal, and control wiring.
4. Operation and maintenance data.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. Comply with NFPA 70.
3. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
4. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.2 PRODUCTS

A. Packaged Units

1. Factory-assembled, prewired, self-contained unit consisting of cabinet, supply fan, controls, filters, **as directed**, evaporative cooling package, **as directed**, and direct-fired gas furnace to be installed outside **OR** inside, **as directed**, the building.

B. Cabinet

1. Cabinet: Single-wall **OR** Double-wall, **as directed**, galvanized-steel panels, formed to ensure rigidity and supported by galvanized-steel channels or structural channel supports with lifting lugs. Cabinet shall be fully weatherized for outside installation, **as directed**.
2. Access Panels: Lift-out **OR** Piano hinged with cam-lock fasteners, **as directed**, for furnace and fan motor assemblies on both sides of unit.
3. Internal Insulation: Fibrous-glass duct lining, comply with ASTM C 1071, Type II, applied on complete unit **OR** furnace and fan sections only, **as directed**.
 - a. Thickness: 1 inch (25 mm) **OR** 2 inches (50 mm), **as directed**.
 - b. Insulation Adhesive: Comply with ASTM C 916, Type I.



- c. Mechanical Fasteners: Galvanized steel suitable for adhesive attachment, mechanical attachment, or welding attachment to casing without damaging liner when applied as recommended by manufacturer and without causing air leakage.
 4. Finish: Heat-resistant, baked enamel.
 5. Discharge: Horizontal **OR** Vertical, **as directed**, -pattern, galvanized-steel assembly with diffusers incorporating individually adjustable vanes.
 6. Roof Curb: Full-perimeter curb of sheet metal, minimum 16 inches (400 mm) high, with wood nailer, neoprene sealing strip, and welded Z-bar flashing.
 7. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- C. Supply-Air Fan
1. Fan Type: Centrifugal, rated according to AMCA 210; statically and dynamically balanced, galvanized steel; mounted on solid-steel shaft with heavy-duty, self-aligning, permanently lubricated ball bearings **OR** pillow-block bearings rated for L50 or 200,000 hours with external grease fittings, **as directed**.
 2. Motor: Open dripproof **OR** Totally enclosed, **as directed**, single **OR** two, **as directed**, -speed motor.
 3. Drive: V-belt drive with matching fan pulley and adjustable motor sheaves and belt assembly.
 4. Mounting: Fan wheel, motor, and drives shall be mounted in fan casing with restrained, **as directed**, elastomeric **OR** spring, **as directed**, isolators.
- D. Outdoor-Air Intake
1. Outdoor-Air Hood: Galvanized steel with rain baffles, bird screen complying with ASHRAE 62.1, **as directed**, and finish to match cabinet; and sized to supply maximum 100 percent outdoor air.
- E. Air Filters
1. Comply with NFPA 90A.
 2. Cleanable Filters: 1-inch- (25-mm-) **OR** 2-inch-0 (50-mm-), **as directed**, thick, cleanable metal mesh.
 3. Disposable Panel Filters: 1-inch- (25-mm-) **OR** 2-inch- (50-mm-), **as directed**, thick, factory-fabricated, flat-panel-type, disposable air filters with holding frames, with a minimum efficiency report value of 6 according to ASHRAE 52.2 and 90 percent average arrestance according to ASHRAE 52.1, **as directed**.
 - a. Media: Interlaced glass **OR** polyester, **as directed**, fibers.
 - b. Frame: Galvanized steel.
- F. Dampers
1. Outdoor-Air and Return-Air, **as directed**, Damper: Galvanized-steel, opposed-blade dampers with vinyl blade seals and stainless-steel jamb seals, having a maximum leakage of 10 cfm/sq. ft. (51 L/s per sq. m) of damper area, at differential pressure of 2-inch wg (448 Pa).
 2. Fan-Discharge Dampers: Galvanized-steel, opposed-blade damper.
 3. Balancing/Bypass Dampers: Galvanized-steel, opposed-blade damper.
 4. Damper Operator: Direct coupled, electronic with spring return or fully modulating as required by the control sequence.
- G. Direct-Fired Gas Furnace
1. Description: Factory assembled, piped, and wired; and complying with ANSI Z83.4, "Direct Gas-Fired Make-Up Air Heaters"; ANSI Z83.18, "Direct Gas-Fired Industrial Air Heaters"; and NFPA 54, "National Fuel Gas Code."
 2. Inside Unit External Housing: Steel cabinet with integral support inserts.
 3. Outside Unit External Housing: Weatherproof steel cabinet with integral support inserts.
 - a. External Casing and Cabinet Finish: Baked enamel **OR** Powder coating, **as directed**, over corrosion-resistant-treated surface in color to match fan section.
 4. Burners: Cast-iron burner with stainless-steel mixing plates.



- a. Control Valve: Single stage **OR** Two stage **OR** Modulating with minimum turndown ratio of 25:1 or as otherwise directed, **as directed**.
 - b. Fuel: Natural **OR** Propane, **as directed**, gas.
 - c. Pilot: Electrically ignited by hot-surface ceramic igniter.
5. Safety Controls:
- a. Gas Manifold: Safety switches and controls to comply with ANSI standards **OR** FMG **OR** IRI, **as directed**.
 - b. Purge-Period Timer: Automatically delays burner ignition and bypasses low-limit control.
 - c. Airflow Proving Switch: Dual pressure switch senses correct airflow before energizing pilot and requires airflow to be maintained within minimum and maximum pressure settings across burner.
 - d. Manual-Reset, High-Limit Control Device: Stops burner and closes main gas valve if high-limit temperature is exceeded.
 - e. Gas Train: Redundant, automatic main gas valves, electric pilot valve, hydraulic **OR** electronic, **as directed**, -modulating temperature control valve, main and pilot gas regulators, main and pilot manual shutoff valves, main and pilot pressure taps, and high-low gas pressure switches, **as directed**, to comply with IRI requirements **OR** to comply with FMG requirements, **as directed**.
 - f. Safety Lockout Switch: Locks out ignition sequence if burner fails to light after three tries. Controls are reset manually by turning the unit off and on.
 - g. Control Transformer: Integrally mounted 24-V ac.
- H. Evaporative Cooling Package
1. Cabinet: Single-wall **OR** Double-wall, **as directed**, galvanized- or aluminized-steel panels lined with ABS polymer, **as directed**, formed to ensure rigidity and supported by galvanized-steel channels or structural channel supports with lifting lugs and having a stainless-steel reservoir with overflow and drain with full-port, brass-fitted ball valve. Cabinet shall be fully weatherized for outside installation, **as directed**.
 - a. External Casing and Cabinet Finish: Baked enamel **OR** Powder coating, **as directed**, over corrosion-resistant-treated surface in color to match fan section.
 2. Media: UL 900, Class 2, 6-inch- (150-mm-) **OR** 8-inch- (200-mm-) **OR** 12-inch- (300-mm-), **as directed**, thick cellulose **OR** glass-fiber, **as directed**, media with rigidizing agents, fungicides, and wetting agents. Minimum 90 percent contact factor.
 - a. Moisture elimination pad.
 3. Water-Circulation System: Submersible centrifugal sump pump with inlet strainer, brass balancing valve located in pump discharge, and thermally protected motor; water distribution troughs or piping at top of media pads; and float-operated, makeup water and bleed-off valves.
 - a. Automatic Fill and Drain Kit: Water supply and drain, solenoid valves for initial sump fill and for draining sump.
 4. Water-Saver System: Timer, solenoid valve, and water distribution piping to apply the water supply to the media.
 5. Comply with applicable requirements in ASHRAE 62.1.
- I. Controls
1. Factory-wired, fuse-protected control transformer, connection for power supply and field-wired unit to remote control panel.
 2. Control Panel: Surface-mounted **OR** Recessed, with trim ring, **as directed**, remote panel, with engraved plastic cover, and the following lights and switches:
 - a. On-off **OR** On-off-auto, **as directed**, switch.
 - b. Summer-winter **OR** Heat-off-cool, **as directed**, switch. Automatic changeover, **as directed**.
 - c. Supply-fan operation indicating light.
 - d. Heating operation indicating light.
 - e. Damper position potentiometer.
 - f. Thermostat.
 - g. Cooling operation indicating light.



- h. Dirty-filter indicating light operated by unit-mounted differential pressure switch.
 - i. Safety-lockout indicating light.
3. Refer to Division 23 Section "Instrumentation And Control For Hvac" for control equipment and sequence of operation.
4. Control Devices:
- a. Remote Thermostat: Adjustable room thermostat with temperature readout.
 - b. Remote Setback Thermostat: Adjustable room thermostat without temperature readout.
 - c. Static-Pressure Transmitter: Nondirectional sensor with suitable range for expected input, and temperature compensated.
 - d. Fire-Protection Thermostats: Fixed or adjustable settings to operate at not less than 75 deg F (24 deg C) above normal maximum operating temperature.
 - e. Timers: Seven-day, programming-switch timer with synchronous-timing motor and seven-day dial; continuously charged, nickel-cadmium-battery-driven, eight-hour, power-failure carryover; multiple-switch trippers; minimum of two and maximum of eight signals per day with two normally open and two normally closed output contacts.
- OR**
- Timers: Solid-state, programmable time control with 4 separate programs; 24-hour battery carryover; individual on-off-auto switches for each program; 365-day calendar with 20 programmable holidays; choice of fail-safe operation for each program; and system fault alarm.
- f. Ionization-Type Smoke Detectors: 24-V dc, nominal; self-restoring; plug-in arrangement; integral visual-indicating light; sensitivity that can be tested and adjusted in place after installation; integral addressable module; remote controllability; responsive to both visible and invisible products of combustion; self-compensating for changes in environmental conditions.
 - g. Fan-Speed Controllers: Solid-state model providing field-adjustable proportional control of motor speed. Equip with filtered circuit to eliminate radio interference.
5. Fan Control: Interlock fan to start with exhaust fan(s). See Division 23 Section(s) "Axial Hvac Fans" OR "Centrifugal Hvac Fans" OR "Hvac Power Ventilators" OR "Sequence Of Operations For Hvac Controls", **as directed**, for exhaust fan controls.
- OR**
- Fan Control: Timer starts and stops direct-fired H&V unit and exhaust fan(s).
- a. Fan-Discharge Thermostat: Stops fan when discharge-air temperature is less than 40 deg F (4 deg C).
 - b. Smoke detectors, located in supply and return, **as directed**, air, shall stop fans when the presence of smoke is detected.
 - c. Controls two **OR** variable, **as directed**, -speed motor controller using speed switch on control panel **OR** variable-speed potentiometer on control panel **OR** static-pressure transmitter, **as directed**.
6. Outdoor-Air Damper Control, 100 Percent Outdoor-Air Units: Outdoor-air damper shall open when supply fan starts, and close when fan stops.
- OR**
- Outdoor-Air and Fan-Discharge Damper Control, 100 Percent Outdoor-Air Units:
- a. Outdoor-air damper shall open when supply fan starts, and close when fan stops.
 - b. Fan-discharge dampers shall operate to vary the amount of outdoor air to match exhaust-fan operation.
- OR**
- Outdoor-Air and Balancing/Bypass Damper Control, Variable Outdoor-Air Units:
- a. Outdoor-air damper shall open when supply fan starts, and close when fan stops.
 - b. Balancing/bypass dampers shall modulate to maintain minimum air velocity through burner.
- OR**
- Outdoor-Air, Balancing/Bypass, and Return-Air Damper Control:
- a. Outdoor-air damper shall open when supply fan starts, and close when fan stops.



- b. Return-air dampers shall modulate in response to potentiometer on control panel **OR** building pressure control, **as directed**.
- c. Balancing/bypass dampers shall modulate to maintain minimum air velocity through the burner.
- 7. Temperature Control: Operates gas valve to maintain supply-air or room temperature.
 - a. Operates gas valve to maintain discharge-air temperature with factory-mounted sensor in fan outlet.
OR
Operates gas valve to maintain space temperature with wall-mounting, field-wired sensor with temperature adjustment, **as directed**, and unit-mounted control adjustment **OR** and adjustment on remote control panel, **as directed**.
 - b. Timer shall select remote setback thermostat to maintain space temperature at 50 deg F (10 deg C).
- 8. Evaporative Cooling Controls:
 - a. Start and stop water-circulation-system sump pump to maintain space temperature.
 - b. Automatic Fill Control: A switch in the unit control panel shall close sump drain valve and open makeup water valve.
 - c. Automatic Drain Control: Opens sump drain valve and closes makeup water valve from a switch in the unit control panel **OR** when an outside thermostat senses 40 deg F (4 deg C) or less, **as directed**.
 - d. Water-Saver System: Remote thermostat shall open water-supply valve to maintain dry-bulb temperature in space. Timer shall activate thermostat circuit.
- 9. DDC: Stand-alone control module for link between unit controls and DDC system. Control module shall be compatible with temperature-control system specified in Division 23 Section "Instrumentation And Control For Hvac".
 - a. Provide start and stop interface relay, and relay to notify DDC system alarm condition.
 - b. Provide hardware interface or additional sensors as follows:
 - 1) Room temperature.
 - 2) Discharge-air temperature.
 - 3) Furnace operating.

J. Motors

- 1. Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".

1.3 EXECUTION

A. Installation

- 1. Install gas-fired units according to NFPA 54, "National Fuel Gas Code."
- 2. Install roof curb on roof structure, according to ARI Guideline B **OR** NRCA's "Low-Slope Membrane Roofing Construction Details Manual," Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts", **as directed**. Install and secure direct-fired H&V units on curbs, and coordinate roof penetrations and flashing with roof construction.
OR
Install restrained vibration isolation roof-curb rails on roof structure according to ARI Guideline B **OR** NRCA's "Low-Slope Membrane Roofing Construction Details Manual," Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts", **as directed**. Install and secure direct-fired H&V units on rails, and coordinate roof penetrations and flashing with roof construction. Restrained isolation roof-curb rails are specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
- 3. Install suspended units from spring hangers with minimum 1-inch (25-mm) static deflection; refer to Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
OR



Install floor-mounted units on restrained, **as directed**, spring isolators with minimum 1-inch (25-mm) static deflection; refer to Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".

4. Install controls and equipment shipped by manufacturer for field installation with direct-fired H&V units.

B. Connections

1. Piping Connections: Drawings indicate general arrangement of piping, fittings, and specialties. Install piping adjacent to machine to allow service and maintenance.
 - a. Gas Piping: Comply with requirements in Division 23 Section(s) "Facility Natural-gas Piping" OR "Facility Liquefied-petroleum Gas Piping", **as directed**. Connect gas piping with shutoff valve and union and with sufficient clearance for burner removal and service. Provide AGA-approved flexible connectors.
 - b. Makeup Water: Comply with requirements in Division 22 Section "Domestic Water Piping" for valves and accessories on piping connections to evaporative cooling units.
 - c. Drain: Comply with requirements in Division 22 Section "Sanitary Waste And Vent Piping" for traps and accessories on piping connections to evaporative cooling units.
2. Duct Connections: Duct installation requirements are specified in Division 23 Section "Metal Ducts". Drawings indicate the general arrangement of ducts. Connect supply and return, **as directed**, ducts to direct-fired H&V units with flexible duct connectors. Flexible duct connectors are specified in Division 23 Section "Air Duct Accessories".
3. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
4. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

C. Startup Service

1. Complete installation and startup checks according to manufacturer's written instructions and perform the following:
 - a. Inspect for visible damage to furnace combustion chamber.
 - b. Inspect casing insulation for integrity, moisture content, and adhesion.
 - c. Verify that clearances have been provided for servicing.
 - d. Verify that controls are connected and operable.
 - e. Verify that filters are installed.
 - f. Purge gas line.
 - g. Inspect and adjust vibration isolators and seismic restraints, **as directed**.
 - h. Verify bearing lubrication.
 - i. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
 - j. Adjust fan belts to proper alignment and tension.
 - k. Start unit according to manufacturer's written instructions.
 - l. Complete startup sheets and attach copy with Contractor's startup report.
 - m. Inspect and record performance of interlocks and protective devices; verify sequences.
 - n. Operate unit for run-in period recommended by manufacturer.
 - o. Perform the following operations for both minimum and maximum firing and adjust burner for peak efficiency:
 - 1) Measure gas pressure on manifold.
 - 2) Measure combustion-air temperature at inlet to combustion chamber.
 - 3) Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.
 - p. Calibrate thermostats.
 - q. Adjust and inspect high-temperature limits.
 - r. Inspect dampers, if any, for proper stroke and interlock with return-air dampers.
 - s. Start evaporative cooler system and measure and record the following:
 - 1) Leaving-air, dry- and wet-bulb temperatures.
 - 2) Entering-air, dry- and wet-bulb temperatures.



- t. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
 - u. Measure and record airflow. Plot fan volumes on fan curve.
 - v. Verify operation of remote panel, including pilot-operation and failure modes. Inspect the following:
 - 1) High-limit heat.
 - 2) Alarms.
 - w. After startup and performance testing, change filters, verify bearing lubrication, and adjust belt tension.
- 2. Remove and replace malfunctioning components that do not pass tests and inspections and retest as specified above.
 - 3. Prepare written report of the results of startup services.
- D. Adjusting
- 1. Adjust initial temperature set points.
 - 2. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
 - 3. Occupancy Adjustments: When requested within 12 months of date of Final Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.
- E. Demonstration
- 1. Train Owner's maintenance personnel to adjust, operate, and maintain direct-fired H&V units.

END OF SECTION 23 74 23 00



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SECTION 23 74 23 00a - INDIRECT-FIRED, PACKAGED H&V UNITS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for indirect-fired, H&V units. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes indirect-fired H&V units with the following accessories:
 - a. Gas or Oil furnace.
 - b. Evaporative cooling package.

C. Submittals

1. Product Data: Include rated capacities, furnished specialties, and accessories.
2. Shop Drawings:
 - a. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
 - b. Mounting Details: For securing and flashing roof curb to roof structure. Indicate coordinating requirements with roof membrane system.
 - c. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.
 - d. Wiring Diagrams: Power, signal, and control wiring.
3. Operation and maintenance data.
4. Warranty: Special warranty specified in this Section.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. Comply with NFPA 70.

E. Warranty

1. Manufacturer's standard form in which manufacturer agrees to replace heat exchangers of indirect-fired H&V units that fail in materials or workmanship within five years **OR** 10 years, **as directed**, from date of Final Completion.

1.2 PRODUCTS

A. Packaged Units

1. Factory-assembled, prewired, self-contained unit consisting of cabinet, supply fan, controls, filters, evaporative cooling package, **as directed**, and indirect-fired gas **OR** oil, **as directed**, furnace to be installed outside **OR** inside, **as directed**, the building.

B. Cabinet

1. Cabinet: Single-wall **OR** Double-wall, **as directed**, galvanized-steel panels, formed to ensure rigidity and supported by galvanized-steel channels or structural channel supports with lifting lugs. Cabinet shall be fully weatherized for outside installation, **as directed**.
2. Access Panels: Lift-out **OR** Piano hinged with cam-lock fasteners, **as directed**, for furnace and fan motor assemblies on both sides of unit.



3. Internal Insulation: Fibrous-glass duct lining, comply with ASTM C 1071, Type II, applied on complete unit for outside unit or furnace and fan sections only for inside unit.
 - a. Thickness: 1 inch (25 mm) **OR** 2 inches (50 mm), **as directed**.
 - b. Insulation Adhesive: Comply with ASTM C 916, Type I.
 - c. Mechanical Fasteners: Galvanized steel suitable for adhesive attachment, mechanical attachment, or welding attachment to casing without damaging liner when applied as recommended by manufacturer and without causing air leakage.
 4. Finish: Heat-resistant, baked enamel.
 5. Discharge: Horizontal-pattern **OR** Vertical-pattern, **as directed**, galvanized-steel assembly with diffusers incorporating individually adjustable vanes.
 6. Roof Curb: Full-perimeter curb of sheet metal, minimum 16 inches (400 mm), unless directed otherwise, high, with wood nailer, neoprene sealing strip, and welded Z-bar flashing.
- C. Supply-Air Fan
1. Fan Type: Centrifugal, rated according to AMCA 210; statically and dynamically balanced, galvanized steel; mounted on solid-steel shaft with heavy-duty, self-aligning, permanently lubricated ball bearings **OR** pillow-block bearings rated for L50 or 200,000 hours with external grease fittings, **as directed**.
 2. Motor: Open dripproof **OR** Totally enclosed, **as directed**, single-speed motor.
 3. Drive: V-belt drive with matching fan pulley and adjustable motor sheaves and belt assembly.
 4. Mounting: Fan wheel, motor, and drives shall be mounted in fan casing with restrained (for seismic areas), elastomeric **OR** spring, **as directed**, isolators.
- D. Outdoor-Air Intake
1. Outdoor-Air Hood: Galvanized steel with rain baffles, bird screen, and finish to match cabinet; and sized to supply maximum 30 percent **OR** 100 percent, **as directed**, outdoor air.
- E. Air Filters
1. Comply with NFPA 90A.
 2. Cleanable Filters: 1-inch- (25-mm-) **OR** 2-inch- (50-mm-), **as directed**, thick, cleanable metal mesh.
 3. Disposable Panel Filters: 1-inch- (25-mm-) **OR** 2-inch- (50-mm-), **as directed**, thick, factory-fabricated, flat-panel-type, disposable air filters with holding frames, with a minimum efficiency report value of 6 according to ASHRAE 52.2 and 90 percent average arrestance according to ASHRAE 52.1.
 - a. Media: Interlaced glass **OR** polyester, **as directed**, fibers.
 - b. Frame: Galvanized steel.
- F. Dampers
1. Outdoor-Air and Return-Air, **as directed**, Damper: Galvanized-steel, opposed-blade dampers with vinyl blade seals and stainless-steel jamb seals, having a maximum leakage of 10 cfm/sq. ft. (51 L/s per sq. m) of damper area, at differential pressure of 2-inch wg (448 Pa).
 2. Damper Operator: Direct coupled, electronic with spring return or fully modulating as required by the control sequence.
- G. Indirect-Fired Gas Furnace
1. Description: Factory assembled, piped, and wired; and complying with ANSI Z21.47, "Gas-Fired Central Furnaces," and NFPA 54, "National Fuel Gas Code."
 - a. AGA Approval: Designed and certified by and bearing label of AGA.
 - b. Burners: Aluminized steel with stainless-steel inserts **OR** Stainless steel, **as directed**.
 - 1) Gas Control Valve: Single stage **OR** Two stage **OR** Modulating, **as directed**.
 - 2) Fuel: Natural **OR** Propane, **as directed**, gas.
 - 3) Minimum Thermal Efficiency: 80 percent.
 - 4) Ignition: Electronically controlled electric spark with flame sensor.
 - 5) High-Altitude Model **OR** Kit, **as directed**: For Project elevation above sea level.



2. Venting: Gravity vented.
3. Power Vent: Integral, motorized centrifugal fan interlocked with gas valve.
4. Combustion-Air Intake: Separate combustion-air intake and vent terminal assembly.
5. Inside Unit External Housing: Steel cabinet with integral support inserts and removable bottom arranged to serve as drain pan.
6. Outside Unit External Housing: Weatherproof steel cabinet with integral support inserts and removable bottom arranged to serve as drain pan.
 - a. External Casing and Cabinet Finish: Baked enamel **OR** Powder coating, **as directed**, over corrosion-resistant-treated surface in color to match fan section.
7. Internal Casing: Aluminized steel, arranged to contain airflow, with duct flanges at inlet and outlet.
8. Heat Exchanger: Aluminized **OR** Stainless steel, **as directed**.
9. Heat-Exchanger Drain Pan: Stainless steel.
10. Safety Controls:
 - a. Vent Flow Verification: Differential pressure switch to verify open vent **OR** Flame rollout switch, **as directed**.
 - b. Control Transformer: 24-V ac.
 - c. High Limit: Thermal switch or fuse to stop burner.
 - d. Gas Train: Regulated, redundant, 24-V ac gas valve assembly containing pilot solenoid valve, hydraulic-modulating **OR** electronic-modulating, **as directed**, temperature control valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff all in one body.
 - e. Purge-period timer shall automatically delay burner ignition and bypass low-limit control.
 - f. Gas Manifold: Safety switches and controls to comply with ANSI standards and FMG **OR** IRI, **as directed**.
 - g. Airflow Proving Switch: Differential pressure switch senses correct airflow before energizing pilot.
 - h. Automatic-Reset, High-Limit Control Device: Stops burner and closes main gas valve if high-limit temperature is exceeded.
 - i. Safety Lockout Switch: Locks out ignition sequence if burner fails to light after three tries. Controls are reset manually by turning the unit off and on.

H. Oil-Fired Furnace

1. Description: Factory assembled, piped, and wired; and complying with UL 727, "Oil-Fired Central Furnaces."
2. Inside Unit External Housing: Steel cabinet with integral support inserts and removable bottom arranged to serve as a drain pan.
3. Outside Unit External Housing: Weatherproof steel cabinet with integral support inserts and removable bottom arranged to serve as drain pan.
 - a. External Casing and Cabinet Finish: Baked enamel **OR** Powder coating, **as directed**, over corrosion-resistant-treated surface in color to match fan section.
4. Internal Casing: Aluminized steel, arranged to contain airflow, with duct flanges at inlet and outlet.
5. Heat Exchanger: Welded, stainless steel, unless directed otherwise, with flame observation port, carbon dioxide sample port, and access panels for clean-out and service.
6. Burners: Flame-retention, pressure-atomizing, forced-draft, gun type; with integral fuel pump and electronic spark ignition.
 - a. Fuel: No. 2, unless directed otherwise, fuel oil.
 - b. Minimum Thermal Efficiency: 80 percent **OR** 81 percent, **as directed**.
 - c. Ignition: Electronically controlled electric spark with flame sensor.
7. Safety Controls:
 - a. Factory piped and wired to electrical junction box mounted on unit.
 - b. Oil-pressure switch.
 - c. Control Transformer: Integrally mounted 24-V ac.
 - d. Cad-cell safety system.
 - e. Manual reset flame safety.
8. Accessories:



- a. Factory mounted and wired to electrical junction box on unit.
 - b. Oil Booster Pump: 30-gph (108-L/h) **OR** 70-gph (252-L/h), **as directed**, capacity; motor and 2-stage fuel unit with pressure-regulating valve and strainer.
 - c. Oil-pressure relief valve.
 - d. Outdoor Combustion-Air Adapter: Sealed to housing and fitted with quick access cover, or door and fitting for terminating outdoor-air duct.
- I. Evaporative Cooling Package
1. Cabinet: Single-wall **OR** Double-wall, **as directed**, galvanized- or aluminized-steel panels lined with ABS polymer, as required, formed to ensure rigidity and supported by galvanized-steel channels or structural channel supports with lifting lugs and having a stainless-steel reservoir with overflow and drain with full-port, brass-fitted ball valve. Cabinet shall be fully weatherized for outside installation, **as directed**.
 - a. External Casing and Cabinet Finish: Baked enamel, **unless directed otherwise to be** Powder coating, over corrosion-resistant-treated surface in color to match fan section.
 2. Media: UL 900, Class 2, 6-inch- (150-mm-) **OR** 8-inch- (200-mm-) **OR** 12-inch- (300-mm-), **as directed**, thick cellulose **OR** glass-fiber, **as directed**, media with rigidizing agents, fungicides, and wetting agents. Minimum 90 percent contact factor.
 - a. Moisture elimination pad.
 3. Water-Circulation System: Submersible centrifugal sump pump with inlet strainer, brass balancing valve located in pump discharge, and thermally protected motor; water distribution troughs or piping at top of media pads; and float-operated, makeup water and bleed-off valves.
 - a. Automatic Fill and Drain Kit: Water supply and drain, solenoid valves for initial sump fill and for draining sump.
 4. Water-Saver System: Timer, solenoid valve, and water distribution piping to apply the water supply to the media.
- J. Controls
1. Factory-wired, fuse-protected control transformer, connection for power supply and field-wired unit to remote control panel.
 2. Control Panel: Surface-mounted **OR** Recessed, **as directed**, with trim ring, remote panel, with engraved plastic cover, and the following lights and switches:
 - a. On-off **OR** On-off-auto, **as directed**, fan switch.
 - b. Summer-winter **OR** Heat-off-cool, **as directed**, switch. Automatic changeover, **as directed**.
 - c. Supply-fan operation indicating light.
 - d. Heating operation indicating light.
 - e. Damper position potentiometer.
 - f. Thermostat.
 - g. Cooling operation indicating light.
 - h. Dirty-filter indicating light operated by unit-mounted differential pressure switch.
 - i. Safety-lockout indicating light.
 3. Control Devices:
 - a. Remote Thermostat: Adjustable room thermostat with temperature readout.
 - b. Remote Setback Thermostat: Adjustable room thermostat without temperature readout.
 - c. Static-Pressure Transmitter: Nondirectional sensor with suitable range for expected input, and temperature compensated.
 - d. Fire-Protection Thermostats: Fixed or adjustable settings to operate at not less than 75 deg F (24 deg C) above normal maximum operating temperature.
 - e. Timers: Seven-day, programming-switch timer with synchronous-timing motor and seven-day dial; continuously charged, nickel-cadmium-battery-driven, eight-hour, power-failure carryover; multiple-switch trippers; minimum of two and maximum of eight signals per day with two normally open and two normally closed output contacts.

OR



- Timers: Solid-state, programmable time control with 4 separate programs; 24-hour battery carryover; individual on-off-auto switches for each program; 365-day calendar with 20 programmable holidays; choice of fail-safe operation for each program; and system fault alarm.
- f. Ionization-Type Smoke Detectors: 24-V dc, nominal; self-restoring; plug-in arrangement; integral visual-indicating light; sensitivity that can be tested and adjusted in place after installation; integral addressable module; remote controllability; responsive to both visible and invisible products of combustion; self-compensating for changes in environmental conditions.
4. Fan Control: Interlock fan to start with exhaust fan(s). See Division 23 Section(s) "Axial Hvac Fans" OR "Centrifugal Hvac Fans" OR "Hvac Power Ventilators" OR "Sequence Of Operations For Hvac Controls", **as directed**, for exhaust fan controls.
 5. Fan Control: Timer starts and stops direct-fired H&V unit and exhaust fan(s).
 - a. Fan-Discharge Thermostat (for units with evaporative cooling package): Stops fan when discharge-air temperature is less than 40 deg F (4 deg C).
 - b. Smoke detectors, located in supply and return, **as directed**, air, shall stop fans when the presence of smoke is detected.
 6. Outdoor-Air Damper Control, 100 Percent Outdoor-Air Units: Outdoor-air damper shall open when supply fan starts, and close when fan stops.
 7. Mixed Outdoor- and Return-Air Damper Control: When fan is running, outdoor- and return-air dampers shall modulate to supply minimum outdoor air as follows:
 - a. Minimum 30 percent outdoor air.
 - b. Outdoor-air quantity adjusted by potentiometer on control panel.
 - c. Outdoor-air quantity to maintain minimum building static pressure.
 8. Temperature Control: Operates gas valve to maintain supply-air temperature.
 - a. Operates gas valve to maintain discharge-air temperature with factory-mounted sensor in blower outlet.
 - b. Operates gas valve to maintain space temperature with wall-mounting, field-wired sensor with temperature adjustment, **as directed**, and unit-mounted control adjustment, **OR** and adjustment on remote-control panel, **as directed**.
 - c. Timer shall select remote setback thermostat to maintain space temperature at 50 deg F (10 deg C).
 - d. Furnace Control: Two or four steps of control using one or two furnace sections in series.
OR
Furnace Control: 20 to 100 percent modulation of the firing rate. 10 to 100 percent with dual furnace units.
 9. Evaporative Cooling Controls:
 - a. Start and stop water-circulation-system sump pump to maintain space temperature.
 - b. Automatic Fill Control: A switch in the unit control panel shall close sump drain valve and open makeup water valve.
 - c. Automatic Drain Control: Opens sump drain valve and closes makeup water valve from a switch in the unit control panel **OR** when an outside thermostat senses 40 deg F (4 deg C) or less, **as directed**.
 - d. Water-Saver System: Remote thermostat shall open water-supply valve to maintain dry-bulb temperature in space. Timer shall activate thermostat circuit.
 10. DDC: Stand-alone control module for link between unit controls and DDC system. Control module shall be compatible with temperature-control system specified in Division 23 Section "Instrumentation And Control For Hvac".
 - a. Provide start and stop interface relay, and relay to notify DDC system alarm condition.
 - b. Provide hardware interface or additional sensors as follows:
 - 1) Room temperature.
 - 2) Discharge-air temperature.
 - 3) Furnace operating.

K. Motors



1. Comply with requirements are specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".

1.3 EXECUTION

A. Installation

1. Install gas-fired units according to NFPA 54, "National Fuel Gas Code."
2. Install oil-fired duct heaters and associated fuel and vent piping according to NFPA 31 and applicable local codes and regulations.
3. Install roof curb on roof structure, according to ARI Guideline B **OR** NRCA's "Low-Slope Membrane Roofing Construction Details Manual," Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts," **as directed**. Install and secure direct-fired H&V units on curbs, and coordinate roof penetrations and flashing with roof construction.
OR
Install restrained vibration isolation roof-curb rails on roof structure according to ARI Guideline B **OR** NRCA's "Low-Slope Membrane Roofing Construction Details Manual," Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts," **as directed**. Install and secure indirect-fired H&V units on rails, and coordinate roof penetrations and flashing with roof construction. Restrained isolation roof-curb rails are specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
4. Install suspended units from spring hangers with minimum 1-inch (25-mm) static deflection; refer to Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
5. Install floor-mounted units on restrained, **as directed**, spring isolators with minimum 1-inch (25-mm) static deflection; refer to Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
6. Install controls and equipment shipped by manufacturer for field installation with indirect-fired H&V units.
7. Piping Connections: Drawings indicate general arrangement of piping, fittings, and specialties. Install piping adjacent to machine to allow service and maintenance.
 - a. Gas Piping: Comply with requirements in Division 23 Section(s) "Facility Natural-gas Piping" **OR** "Facility Liquefied-petroleum Gas Piping", **as directed**. Connect gas piping with shutoff valve and union and with sufficient clearance for burner removal and service. Provide AGA-approved flexible connectors.
 - b. Fuel Oil Piping: Comply with requirements in Division 23 Section "Facility Fuel-oil Piping". Connect to fuel oil supply and return piping with shutoff valve and union at each connection.
 - c. Makeup Water: Comply with requirements in Division 22 Section "Domestic Water Piping" for valves and accessories on piping connections to evaporative cooling units.
 - d. Drain: Comply with requirements in Division 22 Section "Sanitary Waste And Vent Piping" for traps and accessories on piping connections to evaporative cooling units.
8. Duct Connections: Duct installation requirements are specified in Division 23 Section "Metal Ducts". Drawings indicate the general arrangement of ducts. Connect supply and return, **as directed**, ducts to indirect-fired H&V units with flexible duct connectors. Flexible duct connectors are specified in Division 23 Section "Air Duct Accessories".
9. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
10. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

END OF SECTION 23 74 23 00a



SECTION 23 76 13 00 - DEHUMIDIFICATION UNITS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for mechanical dehumidification units. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes packaged, factory-assembled and -tested, refrigerant-type, mechanical dehumidification units designed for outdoor and indoor installation.

C. Performance Requirements

1. Seismic Performance: Dehumidification units shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

D. Submittals

1. Product Data: For each dehumidification unit indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. LEED Submittals:
 - a. Product Data for Credit EA 4: Documentation required by Credit EA 4 indicating that equipment and refrigerants comply.
 - b. Product Data for Prerequisite EQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5, "Systems and Equipment."
3. Shop Drawings: For each dehumidification unit indicated. Include plans, elevations, sections, details, and attachments to other work.
 - a. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - b. Wiring Diagrams: For power, signal, and control wiring.
4. Delegated-Design Submittal: For dehumidification units indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - a. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
 - b. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
5. Seismic Qualification Certificates: For accessories, and components, from manufacturer.
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
6. Source quality-control reports.
7. Field quality-control reports.
8. Operation and Maintenance Data: For dehumidification units to include in emergency, operation, and maintenance manuals.
9. Warranty: Sample of special warranty.



- E. Quality Assurance
1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. ASHRAE Compliance:
 - a. Applicable requirements in ASHRAE 62.1, Section 5, "Systems and Equipment" and Section 7, "Construction and Startup."
 - b. Applicable requirements in ASHRAE 15, "Safety Standard for Refrigeration Systems."
 3. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6, "Heating, Ventilating, and Air-Conditioning."
- F. Coordination
1. Coordinate sizes and locations of concrete bases. Cast anchor-bolt inserts into bases.
 2. Coordinate installation of roof curbs, equipment supports, and roof penetrations.
- G. Warranty
1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of dehumidification units that fail in materials or workmanship within specified warranty period.
 - a. Warranty Period for Compressors: Manufacturer's standard, but not less than two **OR** five, **as directed**, years from date of Final Completion.
 - b. Warranty Period for Refrigerant Coils: Manufacturer's standard, but not less than five years from date of Final Completion.

1.2 PRODUCTS

- A. Casings
1. Casing: Single-wall **OR** Double-wall, **as directed**, construction with corrosion-protective coating and exterior baked-enamel **OR** powder-coated, **as directed**, finish, stainless-steel fasteners, knockouts for electrical and piping connections, condensate drain connection, and lifting lugs.
 - a. Access: Removable panels **OR** Hinged access doors, **as directed**, with neoprene gaskets.
 - b. Insulation: Minimum 1/2-inch- (13-mm-) thick thermal insulation **OR** 2-inch- (50-mm-) thick, glass-fiber-insulation fill with no metal structure through the insulation, **as directed**.
 - c. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
 2. Drain Pan and Connection: Plastic **OR** Stainless steel, **as directed**; insulated and complying with ASHRAE 62.1, **as directed**.
- B. Fans
1. Supply Fans: Forward curved **OR** Backward inclined, **as directed**, centrifugal; galvanized steel with baked-enamel **OR** powder-coated, **as directed**, finish; belt driven with adjustable sheaves and self-aligning, grease-lubricated ball bearings with extended grease fittings easily accessible inside the casing of dehumidification unit.
 2. Exhaust **OR** Return, **as directed**, Fans: Forward curved **OR** Backward inclined, **as directed**, centrifugal; galvanized steel with baked-enamel **OR** powder-coated, **as directed**, finish; belt driven with adjustable sheaves and self-aligning, grease-lubricated ball bearings with extended grease fittings easily accessible inside the casing of dehumidification unit.
 3. Fan Motor: Comply with requirements in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - a. Enclosure Type: Totally enclosed, fan cooled.
- C. Filters
1. Glass Fiber: Minimum 80 percent arrestance according to ASHRAE 52.1, and MERV 5 according to ASHRAE 52.2.



2. Pleated: Minimum 90 percent arrestance according to ASHRAE 52.1, and MERV 7 according to ASHRAE 52.2.

D. Refrigeration System

1. Energy Efficiency: Equal to or greater than prescribed by ASHRAE/IESNA 90.1.
2. Refrigerant Coils: Copper tubes with mechanically bonded aluminum fins; factory fabricated and tested to comply with ASHRAE 33 and ARI 410; with multiple refrigerant circuits, seamless-copper headers with brazed connections, and galvanized **OR** stainless, **as directed**, -steel frame. Coil and fins shall have a polyester coating. Coils shall have a minimum 300-psig (2070-kPa) working-pressure rating and be factory tested to 450 psig (3105 kPa) and to 300 psig (2070 kPa) while underwater.
3. Compressors: Hermetic, scroll compressors with integral vibration isolators and crankcase heaters that de-energize during compressor operation; with thermal-expansion valves, filter-driers, sight glasses, compressor service valves, and liquid- and suction-line service valves.
 - a. Number of Refrigerant Circuits: Two for compressor capacities more than 7-1/2 tons (26.4 kW).
 - b. Refrigerant: R-134a **OR** R-407C **OR** R-410A, **as directed**.
 - c. Capacity Control:
 - 1) Hot-gas bypass valve and piping on one compressor.
 - 2) Cycle compressor.
 - d. Low-Pressure Cutout: Manual reset after three automatic-reset failures.
 - e. High-Pressure Cutout: Manual reset.
 - f. Compressor Motor Overload Protection: Manual reset.
 - g. Antirecycling Timing Device: Prevent compressor restart for five minutes after shutdown.
 - h. Defrost Cycle (for ice rinks): Adjustable timer shuts off supply fan. Compressor cycles until suction line temperature confirms thawed evaporator coil. Timer limits defrost time to 10 minutes.
4. Energy Recovery Heat Exchanger (Pool Heater): Cupronickel, coaxial, vented, double-wall construction for potable-water service.

E. Remote-Mounted, Air-Cooled Condenser Unit

1. Casing: Steel, finished with baked enamel; with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
2. Refrigerant Coil: ARI 210/240, copper tube with mechanically bonded aluminum fins; with liquid subcooler.
3. Fan: Aluminum-propeller type, directly connected to permanently lubricated motor with integral thermal-overload protection.
4. Adjustable, Low Ambient Head-Pressure Control: Designed to operate at temperatures as low as 0 deg F (minus 18 deg C) by cycling condenser fans and controlling speed of last fan of each circuit.
5. Mounting Base: Polyethylene.

F. Heating Coils

1. Hot-Water Coil: Continuous circuit coil fabricated according to ARI 410.
 - a. Tubes: Copper.
 - b. Fins: Aluminum **OR** Copper, **as directed**, with fin spacing 0.125 inch (3.18 mm) **OR** 0.091 inch (2.31 mm) **OR** 0.071 inch (1.80 mm) **OR** 0.067 inch (1.70 mm) **OR** 0.056 inch (1.42 mm) **OR** 0.0075 inch (0.19 mm), **as directed**.
 - c. Fin and Tube Joints: Mechanical bond.
 - d. Headers: Cast iron with drain and air vent tappings.
 - e. Frames: Galvanized-steel channel, 0.052 inch (1.3 mm).
 - f. Ratings: Design tested and rated according to ASHRAE 33 and ARI 410.
 - 1) Working-Pressure Ratings: 200 psig (1380 kPa), 325 deg F (163 deg C).
 - g. Source Quality Control: Test to 300 psig (2070 kPa).



2. Steam Coil: Distribution header coil fabricated according to ARI 410, with threaded steam supply and condensate connections.
 - a. Tubes: Copper.
 - b. Fins: Aluminum **OR** Copper, **as directed**, with fin spacing 0.125 inch (3.18 mm) **OR** 0.091 inch (2.31 mm) **OR** 0.071 inch (1.80 mm) **OR** 0.067 inch (1.70 mm) **OR** 0.056 inch (1.42 mm) **OR** 0.0075 inch (0.19 mm), **as directed**.
 - c. Fin and Tube Joints: Mechanical bond.
 - d. Headers: Cast iron with drain and air vent tappings.
 - e. Frames: Galvanized-steel channel, 0.052 inch (1.3 mm).
 - f. Ratings: Design tested and rated according to ASHRAE 33 and ARI 410.
 - 1) Working-Pressure Ratings: 100 psig (690 kPa), 400 deg F (205 deg C).
 - g. Source Quality Control: Test to 200 psig (1380 kPa).
3. Electric-Resistance Heating Coil: Comply with UL 1995.
 - a. Heating Element: Coiled resistance wire of 80 percent nickel and 20 percent chromium; surrounded by compacted magnesium oxide powder in tubular-steel sheath; with spiral-wound, copper-plated steel fins continuously brazed to sheath.
OR
Heating Element: Open-coil resistance wire of 80 percent nickel and 20 percent chromium; supported and insulated by floating ceramic bushings recessed into casing openings; fastened to supporting brackets and mounted in galvanized-steel frame.
 - b. Overtemperature Protection: Disk-type, automatic-reset, thermal-cutout safety device; serviceable through terminal box without removing heater from unit.
 - c. Thermal Cutouts: Load carrying, manual reset or replaceable, and factory wired in series with each heater stage.
 - d. Control: Disconnecting means, overcurrent protection, and airflow proving switch.

G. Dampers

1. Outdoor-Air Dampers: Opposed-blade, galvanized-steel **OR** aluminum **OR** extruded-aluminum, **as directed**, dampers with steel **OR** cadmium-plated steel, **as directed**, operating rod rotating in sintered bronze or nylon bearings. Provide blade gaskets and edge seals, and mechanically fasten blades to operating rod. Size for 0 to 25 percent outdoor air, with manual **OR** motorized, **as directed**, operator and filter.
2. Face-and-Bypass Dampers: Opposed-blade, galvanized-steel **OR** aluminum **OR** extruded-aluminum, **as directed**, dampers with steel **OR** cadmium-plated steel, **as directed**, operating rods rotating in sintered bronze or nylon bearings with operating rods connected with a common linkage. Provide blade gaskets and edge seals, and mechanically fasten blades to operating rod.
3. Outdoor- and Return-Air **OR** Outdoor-, Return-, and Exhaust-Air, **as directed**, Dampers: Parallel-blade, galvanized-steel **OR** aluminum **OR** extruded-aluminum, **as directed**, dampers mechanically fastened to steel **OR** cadmium-plated steel, **as directed**, operating rod in reinforced cabinet. Connect operating rods with common linkage and interconnect linkages so dampers operate simultaneously.
4. Outdoor- and Return-Air **OR** Outdoor-, Return-, and Exhaust-Air, **as directed**, Dampers: Low-leakage, double-skin, airfoil-blade, galvanized-steel **OR** aluminum **OR** extruded-aluminum, **as directed**, dampers with compressible jamb seals and extruded-vinyl blade edge seals in opposed-blade **OR** parallel-blade, **as directed**, arrangement with steel **OR** cadmium-plated steel, **as directed**, operating rods rotating in stainless-steel sleeve **OR** sintered bronze or nylon, **as directed**, bearings mounted in a single galvanized-steel **OR** aluminum **OR** extruded-aluminum, **as directed**, frame, and with operating rods connected with a common linkage. Leakage rate shall not exceed 5 cfm/sq. ft. (0.22 L/s per sq. m) at 1-inch wg (250 Pa) and 9 cfm/sq. ft. (0.4 L/s per sq. m) at 4-inch wg (1.0 MPa).
5. Damper Operator: 115 **OR** 24, **as directed**, -V ac, close coupled, with gear train sealed in oil and with spring return.

H. Controls



1. Comply with requirements in Division 23 Section "Instrumentation And Control For Hvac" for control equipment and in Division 23 Section "Sequence Of Operations For Hvac Controls".
2. Control Panel: Integral service compartment containing fan-motor thermal and overload cutouts, compressor thermal and overload cutouts, 115-V control transformer if required, magnetic contactors for fan and compressor motors, and a nonfused factory-mounted and -wired disconnect switch for single external electrical power connection.
3. Building Automation System Interface: Factory-installed hardware and software to enable the building automation system to monitor, control, and display status and alarms.
4. Operating Control: Space humidistat cycles the compressor. Humidistat shall incorporate fan on-off-auto switch.
5. Operating Controls (for indoor pool units with typical manufacturer's control panel): Factory-installed microprocessor controller, capable of being remotely mounted.
 - a. Display the following on the face of controller:
 - 1) System on.
 - 2) System dehumidifying mode.
 - 3) System air-conditioning mode.
 - 4) System outdoor-air (economizer) mode.
 - 5) System heating pool water.
 - 6) Auxiliary space heat is operating.
 - 7) Unit requires service.
 - 8) Return-air (space) temperature.
 - 9) Return-air (space) humidity.
 - 10) Pool-water temperature.
 - 11) Outdoor-air temperature.
 - b. Indicate the following sensor failures on panel:
 - 1) Airflow: Dirty air filter, blocked airflow, and fan failure.
 - 2) Refrigerant high and low pressure.
 - 3) High water temperature.
 - 4) High and low evaporator temperature.
 - 5) Low water flow.
 - 6) Communication fault.
 - 7) System off.
 - 8) Antishort cycle delay.
 - 9) Power failure.
 - c. Provide access to the following set points on panel:
 - 1) Space temperature.
 - 2) Space relative humidity.
 - 3) Outdoor ventilation/air-conditioning changeover temperature.
 - 4) Airflow alarm.
 - d. Provide the following displays on panel:
 - 1) Space temperature.
 - 2) Space relative humidity.
 - 3) Outdoor-air temperature.
 - 4) Supply-air temperature.
 - 5) Return-air temperature.
 - 6) Airflow rating.
 - 7) Air-off evaporator temperature.
 - 8) Return-air relative humidity.
 - 9) Service codes.
 - e. Provide the following controls on panel:
 - 1) System on-off, fan continues to run.
 - 2) Fan on-off.
 - 3) Service code access.
 - 4) System dehumidifying mode.
 - 5) System air-conditioning mode.
 - 6) System outdoor-air (economizer) mode.



- 7) Auxiliary space heat is operating.
 - 8) Outdoor-air-temperature, conditioned-space-temperature, and control set-point-temperature digital display.
 - 9) Outdoor enthalpy digital display.
 - 10) Filter pressure drop digital display.
 - 11) Status: Airflow, fans, system, unit operation, and operating mode.
 - 12) Alarm digital display.
6. Operating Controls: Factory-installed microprocessor controller.
- a. Factory-installed operator panel with backlit display, capable of being remotely mounted, allows menu-driven display for navigation and control of unit.
 - b. Integral clock.
 - c. Personal computer interface.
 - d. Integral local area network for direct connection to BACnet **OR** LonWorks **OR** MODBUS, **as directed**.
 - e. Factory programmed.
 - f. Unit-Mounted Sensors:
 - 1) Airflow switch.
 - 2) Compressor-discharge temperature.
 - 3) Evaporator-air temperature.
 - 4) Pool-water-out temperature.
 - 5) Pool-water-in temperature.
 - 6) Relative humidity.
 - 7) Return-air temperature.
 - 8) Supply-air temperature.
 - g. Integral diagnostics.
 - h. Nonvolatile memory.
 - i. IP or SI display.
 - j. Provide the following status and alarm functions:
 - 1) System: On-off.
 - 2) Power failure.
 - 3) Fan: Off, overload.
 - 4) Compressor: On, turned off, overload, high pressure, low pressure, overheat, oil failure, and pumpdown.
 - 5) Evaporator damper closed.
 - 6) Pool: Low water flow, heating on.
 - 7) Dehumidification: Call for, on.
 - 8) Air Conditioning: Call for, on.
 - 9) System outdoor-air (economizer) mode.
 - 10) Auxiliary space heat on.
 - 11) Alarms: Firestat, freezestat, and filters.
 - k. Provide the following controls via operator panel:
 - 1) Compressor auto-off.
 - 2) Fan auto-off.
 - 3) Set-Point Adjustments: Relative humidity, temperatures, deadbands, and differentials.
 - 4) Sensor calibration.
 - l. Monitor constant and variable motor loads.
 - m. Monitor cooling load.
 - n. Monitor economizer cycles.
 - o. Monitor ventilation air volumes.
- I. Accessories
1. Water-Cooling Heat Exchanger: Coaxial, vented, double-wall construction; with three-way refrigerant control valve.
 2. Smoke Detectors: Photoelectric detector located in return-air plenum, to de-energize unit.



- a. Operating Voltage: 24-V dc, nominal.
 - b. Self-Restoring: Detectors do not require resetting or readjusting after actuation to restore them to normal operation.
 - c. Plug-in Arrangement: Detector and associated electronic components mounted in module with tamper-resistant connection to fixed base with twist-locking plug. Terminals in fixed base accept building wiring.
 - d. Integral Visual-Indicating Light: Digital-display type indicating detector operation.
 - e. Sensitivity: Can be tested and adjusted in-place after installation.
 - f. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the fire-alarm control panel.
 - g. Sensor: Digital display or infrared light source with matching silicon-cell receiver.
 - h. Detector Sensitivity: Between 2.5 and 3.5 percent/foot (0.008 and 0.011 percent/mm) of smoke obscuration when tested according to UL 268A.
 - i. Integral Thermal Detector: Fixed-temperature type with 135 deg F (57 deg C) setting.
3. Electrical Convenience Outlet: 115-V ac fused, duplex, straight-blade receptacles, separately fused and located inside casing of dehumidification unit or in roof-curb perimeter.

J. Roof Curbs

1. Roof curbs with vibration isolators and wind or seismic restraints are specified in Division 15 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."
2. Materials: Galvanized steel with corrosion-protection coating, watertight gaskets, and factory-installed wood nailer; complying with NRCA standards.
3. Curb Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.
 - a. Materials: ASTM C 1071, Type I or II.
 - b. Thickness: 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**.
 - c. Application: Factory applied with adhesive and mechanical fasteners to the internal surface of curb.
 - d. Liner Adhesive: Comply with ASTM C 916, Type I.
 - e. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.
 - f. Liner materials applied in this location shall have airstream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric, depending on service-air velocity.
4. Curb Height: 14 inches (355 mm) **OR** 24 inches (610 mm) **OR** 36 inches (910 mm), **as directed**.
5. Wind and Seismic Restraints: Metal brackets compatible with the curb and casing, painted to match dehumidification unit; used to anchor unit to the curb and designed for loads at Project site. Comply with requirements in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment" for wind-load requirements.

K. Source Quality Control

1. Verification of Performance: Factory test and rate dehumidification units according to ARI 910.
2. Sound-Power-Level Ratings: Factory test and rate dehumidification units according to ARI 575.

1.3 EXECUTION

A. Examination

1. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
2. Examine roughing-in for hot-water **OR** steam **OR** refrigerant, **as directed**, piping systems to verify actual locations of piping connections before equipment installation.
3. Examine walls, floors, and roofs for suitable conditions where dehumidification units will be installed.
4. Proceed with installation only after unsatisfactory conditions have been corrected.



B. Installation

1. Equipment Mounting (for indoor or outdoor equipment supported on slabs-on-grade without vibration isolation devices): Install dehumidification units on concrete base(s). Comply with requirements for concrete base(s) specified in Division 03 Section "Cast-in-place Concrete".
 - a. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - b. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base, and anchor into structural concrete floor.
 - c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - d. Install anchor bolts to elevations required for proper attachment to supported equipment.
2. Equipment Mounting (for indoor or outdoor equipment supported on concrete equipment base with vibration isolation devices): Install dehumidification units on concrete base(s) using elastomeric pads **OR** elastomeric mounts **OR** restrained spring isolators, **as directed**. Comply with requirements for concrete base(s) specified in Division 03 Section "Cast-in-place Concrete". Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 - a. Minimum Deflection: 1/4 inch (6 mm) **OR** 1 inch (25 mm), **as directed**.
 - b. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - c. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base, and anchor into structural concrete floor.
 - d. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - e. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Equipment Mounting (for installation of indoor or outdoor equipment on vibration isolation devices without concrete base): Install dehumidification units using elastomeric pads **OR** elastomeric mounts **OR** restrained spring isolators, **as directed**. Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 - a. Minimum Deflection: 1/4 inch (6 mm) **OR** 1 inch (25 mm), **as directed**.
4. Equipment Mounting (for installation of indoor or outdoor equipment on vibration isolation equipment base): Install dehumidification units on vibration isolation equipment base. Comply with requirements specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
5. For installation of indoor or outdoor equipment without vibration isolation devices, with seismic restraints, and without concrete base: Install dehumidification units with **<Insert seismic-restraint device>**. Comply with requirements for seismic-restraint devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
6. For indoor units suspended from structure: Install continuous-thread hanger rods and elastomeric hangers **OR** spring hangers **OR** spring hangers with vertical-limit stop, **as directed**, of size required to support weight of dehumidification unit.
 - a. Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment". Fabricate brackets or supports as required.
 - b. Comply with requirements for hangers and supports specified in Division 23 Section "Hangers And Supports For Hvac Piping And Equipment".
7. Curb Support (if curbs are furnished with dehumidification units for rooftop installations): Install roof curb on roof structure, level and secure, according to NRCA's "The NRCA Roofing and Waterproofing Manual, Fifth Edition." Install and secure dehumidification units on curbs, and coordinate roof penetrations and flashing with roof construction. Secure units to curb support with anchor bolts.
8. Unit Support: Install dehumidification units level on structural curbs **OR** pilings, **as directed**. Coordinate wall penetrations and flashing with wall construction. Secure units to structural support with anchor bolts.



9. Isolation Curb Support (for units mounted on isolation curbs): Install dehumidification units on isolation curbs, and install flexible duct connectors and vibration isolation and seismic-control devices. Flexible duct connectors are specified in Division 23 Section "Air Duct Accessories". Vibration isolation and seismic-control devices are specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".

C. Connections

1. Where piping is installed adjacent to dehumidification units, allow space for service and maintenance of dehumidification units.
2. Connect piping to dehumidification units mounted on vibration isolators with flexible connectors.
3. Connect condensate drain pans using minimum NPS 1-1/4 (DN 32) copper tubing. Extend to nearest equipment or floor drain. Construct deep trap at connection to drain pan, and install cleanout at changes in direction.
4. Refrigerant Piping: Comply with requirements in Division 23 Section "Refrigerant Piping". Connect to supply and return coil tapplings with shutoff valve and union or flange at each connection.
5. Hot-Water Piping: Comply with requirements in Division 23 Section "Hydronic Piping". Connect to supply coil tapplings with shutoff valve, return coil tapplings with balancing valve, and union or flange at each connection.
6. Steam and Condensate Piping: Comply with requirements in Division 23 Section "Steam And Condensate Heating Piping". Connect with shutoff valve and union or flange.
7. Duct installation requirements are specified in other Division 21. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:
 - a. Install ducts to termination in roof-mounted frames. Where indicated, terminate return-air duct through roof structure and insulate the space between roof and bottom of dehumidification unit.

D. Field Quality Control

1. Perform tests and inspections.
2. Tests and Inspections:
 - a. Leak Test: After installation, fill water coils with water, and test coils and connections for leaks. Repair leaks and retest until no leaks exist.
 - b. Charge refrigerant coils with refrigerant and test for leaks. Repair leaks and retest until no leaks exist.
 - c. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Dehumidification unit will be considered defective if it does not pass tests and inspections.
4. Prepare test and inspection reports.

E. Startup Service

1. Perform startup service.
 - a. Complete installation and startup checks according to manufacturer's written instructions.
2. Perform the following final checks before startup:
 - a. Verify that shipping, blocking, and bracing are removed.
 - b. Verify that unit is secure on mountings and supporting devices and that connections to piping, ducts, and electrical systems are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 - c. Perform cleaning and adjusting specified in this Section.
 - d. Disconnect fan drive from motor, verify proper motor rotation direction, and verify free fan wheel rotation and smooth bearing operations. Reconnect fan drive system, align belts, and install belt guards.
 - e. Check lubrication of bearings, pulleys, belts, and other moving parts.
 - f. Set outside- and return-air mixing dampers to minimum outside-air setting.
 - g. Install clean filters.
 - h. Verify that manual and automatic volume control and fire and smoke dampers in connected duct systems are in fully open position.



3. Starting procedures for dehumidification units include the following:
 - a. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated rpm. Replace malfunctioning motors, bearings, and fan wheels.
 - b. Measure and record motor's electrical values for voltage and amperage.
 - c. Manually operate dampers from fully closed to fully open position and record fan performance.
 4. Comply with requirements in Division 23 Section "Testing, Adjusting, And Balancing For Hvac" for testing, adjusting, and balancing of dehumidification unit.
 5. Startup Report: Report findings during startup. Identify startup steps, corrective measures taken, and final results.
- F. Adjusting
1. Adjust damper linkages for proper damper operation.
 2. Adjust initial temperature and humidity set points.
- G. Cleaning
1. Clean dehumidification units internally, on completion of installation, according to manufacturer's written instructions. Clean fan interiors to remove foreign material and construction dirt and dust. Vacuum clean fan wheels, cabinets, and coils' entering-air face.
 2. After completing system installation, testing, and startup service of dehumidification units, clean filter housings and install new filters.
- H. Demonstration
1. Train Owner's maintenance personnel to adjust, operate, and maintain dehumidification units.

END OF SECTION 23 76 13 00



23 - Heating, Ventilating, And Air-Conditioning (HVAC)

Task	Specification	Specification Description
23 76 13 00	23 74 23 00	Direct-Fired, Makeup Air Units
23 76 13 00	23 74 23 00a	Indirect-Fired, Packaged H&V Units
23 81 13 00	01 95 23 00	Packaged Terminal Air Conditioners
23 81 16 00	01 95 23 00	Packaged Terminal Air Conditioners



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SECTION 23 81 23 00 - COMPUTER-ROOM AIR-CONDITIONERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for computer-room air-conditioners. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Floor-mounted computer-room air conditioners, 6 tons (21 kW) and larger.
 - b. Floor-mounted computer-room air conditioners, 5 tons (18 kW) and smaller.
 - c. Ceiling-mounted computer-room air conditioners.
 - d. Console computer-room air conditioners.

C. Definition

1. BAS: Building automation system.

D. Performance Requirements

1. Seismic Performance: Computer-room air conditioners shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

E. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:
 - a. Product Data for Credit EA 4: Documentation required by Credit EA 4 indicating that equipment and refrigerants comply.
 - b. Product Data for Prerequisite EQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
3. Shop Drawings: For computer-room air conditioners. Include plans, elevations, sections, details, and attachments to other work.
 - a. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - b. Wiring Diagrams: For power, signal, and control wiring.
4. Color Samples: For unit cabinet, discharge grille, and exterior louver and for each color and texture specified.
5. Seismic Qualification Certificates: For computer-room air conditioners, accessories, and components, from manufacturer.
6. Field quality-control reports.
7. Operation and maintenance data.
8. Warranty: Sample of special warranty.

F. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. ASHRAE Compliance:
 - a. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."



- b. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - "Ventilation Rate Procedures," and Section 7 - "Construction and Startup."
- 3. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.
- 4. ASME Compliance: Fabricate and label water-cooled condenser shell to comply with ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," Division 1.

G. Warranty

- 1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of computer-room air conditioners that fail in materials or workmanship within specified warranty period.
 - a. Warranty Period for Compressors: Manufacturer's standard, but not less than five **OR** 10, **as directed**, years from date of Final Completion.
 - b. Warranty Period for Humidifiers: Manufacturer's standard, but not less than three years from date of Final Completion.
 - c. Warranty Period for Control Boards: Manufacturer's standard, but not less than three years from date of Final Completion.

1.2 PRODUCTS

A. Floor-Mounted Units 6 Tons (21 kW) And Larger

- 1. Description: Packaged, factory assembled, prewired, and prepiped; consisting of cabinet, fans, filters, humidifier, and controls.
- 2. Cabinet and Frame: Welded steel, braced for rigidity, and supporting compressors and other mechanical equipment and fittings.
 - a. Doors and Access Panels: Galvanized steel with polyurethane gaskets, hinges, and concealed fastening devices.
 - b. Insulation: Thermally and acoustically insulate cabinet interior with 1-inch- (25-mm-) thick duct liner.
 - c. Finish of Interior Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
 - d. Finish of Exterior Surfaces: Baked-on, textured vinyl enamel; color as selected from manufacturer's standard colors **OR** to match computer equipment, **as directed**.
 - e. Floor Stand: Welded tubular steel with adjustable legs and vibration isolation pads.
- 3. Supply-Air Fan(s):
 - a. Double-inlet, forward-curved centrifugal fan(s); statically and dynamically balanced.
 - b. Drive: V-belt, with steel shaft with self-aligning ball bearings and cast-iron or steel sheaves, variable- and adjustable-pitch motor sheave, minimum of two matched belts, with drive rated at a minimum of two times the nameplate rating of motor.
- 4. Refrigeration System:
 - a. Compressors: Semihermetic reciprocating; with suction-gas-cooled, 1750-rpm motors; thermal overloads; oil sight glass; suction-line strainer; and reversible oil pumps; with oil strainer, internal motor overload protection, **as directed**, resilient suspension system, crankcase heater, manual-reset high-pressure switch, and pump-down low-pressure switch.
OR
Compressors: Hermetic reciprocating; with oil strainer, internal motor overload protection, **as directed**, resilient suspension system, crankcase heater, manual-reset high-pressure switch, and pump-down low-pressure switch.

Compressors: Hermetic scroll; with oil strainer, internal motor overload protection, **as directed**, resilient suspension system, crankcase heater, manual-reset high-pressure switch, and pump-down low-pressure switch.



- b. Refrigeration Circuits: Two; each with hot-gas mufflers, thermal-expansion valve with external equalizer, liquid-line solenoid valve, liquid-line filter-dryer, sight glass with moisture indicator, service shutoff valves, charging valves, and charge of refrigerant.
- c. Refrigerant: R-407C **OR** R-410A, **as directed**.
- d. Refrigerant Evaporator Coil: Alternate-row or split-face-circuit, direct-expansion coil of seamless copper tubes expanded into aluminum fins.
 - 1) Mount coil assembly over stainless-steel drain pan complying with ASHRAE 62.1, **as directed**, and having a condensate pump unit with integral float switch, pump-motor assembly, and condensate reservoir, **as directed**.
- e. Integral, Water-Cooled Refrigerant Condenser: Shell-and-tube type fabricated and labeled according to ASME Boiler and Pressure Vessel Code: Section VIII **OR** Coaxial tube-in-tube type, **as directed**, with liquid-line stop valve and head-pressure-actuated, two-way **OR** three-way, **as directed**, regulating valve. Terminate fluid connections outside cabinet.
 - 1) Cooling Medium: Water **OR** Glycol solution, **as directed**.

OR

Remote Air-Cooled Refrigerant Condenser: Corrosion-resistant cabinet, copper-tube aluminum-fin coils arranged for two circuits, multiple direct-drive propeller fans with permanently lubricated ball bearings, and single-phase motors with internal overload protection and integral electric control panel and disconnect switch, **as directed**. Control capacity by cycling fans **OR** modulating fan speeds **OR** three-way refrigerant bypass with receiver and isolation valve, **as directed**.
- 5. Hydronic Cooling Coil: Seamless copper tubes expanded into aluminum fins with modulating two-way **OR** three-way, **as directed**, control valve.
 - a. Cooling Medium: Water **OR** Glycol solution, **as directed**.
 - b. Control Valve: Class 125 body.
 - 1) Maximum Pressure Drop: 3 psig (21 kPa) **OR** 5 psig (35 kPa), **as directed**, at design flow rate.
 - 2) Close-Off (Differential) Pressure Rating: 100 percent of pressure differential across valve or 100 percent of total system (pump) head.
 - c. Mount coil assembly over stainless-steel drain pan complying with ASHRAE 62.1, **as directed**, and having a condensate pump unit with integral float switch, pump-motor assembly, and condensate reservoir, **as directed**.

OR

Remote, Air-Cooled, Glycol-Solution Cooler: Corrosion-resistant cabinet, copper-tube aluminum-fin coil, multiple direct-drive propeller fans with fan guards, and single-phase motors with internal overload protection and integral electric control panel. Control capacity by cycling fans.

- d. Disconnect Switch: Nonautomatic, molded-case circuit breaker with handle accessible when panel is closed and capable of preventing access until switched to off position.
- 6. Glycol-Solution Pump Package: Weatherproof and vented enclosure of enameled, galvanized steel on structural base frame containing one **OR** two, **as directed**, centrifugal pump(s) with mechanical seals; electrical-control cabinet with starters, lead-lag switch, automatic switchover, and alarm light.
 - a. Piping: Interconnecting piping, to and from remote, air-cooled, glycol-solution cooler, with shutoff valves, flow switches, check valves in pump discharge, unions, and pressurized expansion tank with air purge vent and system-charging connection.
 - b. Glycol: Inhibited ethylene glycol and water solution mixed 50:50, suitable for operating temperature of minus 40 deg F (minus 40 deg C).
 - c. Disconnect Switch: Nonautomatic, molded-case circuit breaker with handle accessible when panel is closed and capable of preventing access until switched to off position.
- 7. Electric-Resistance Heating Coil: Enclosed finned-tube electric elements arranged for minimum of three stages, with thermal safety switches, manual-reset overload protection, and branch-circuit overcurrent protection.

OR

Refrigerant Heating Coil: Hot-gas coil of seamless copper tubes expanded into aluminum fins with three-way solenoid valve on first-stage refrigerant circuit.

OR



Hot-Water Heating Coil: Seamless copper tubes expanded into aluminum fins with two-way modulating control valve and strainer.

- a. Control Valve: Class 125 body.
 - 1) Maximum Pressure Drop: 3 psig (21 kPa) **OR** 5 psig (35 kPa), **as directed**, at design flow rate.
 - 2) Close-Off (Differential) Pressure Rating: 100 percent of pressure differential across valve or 100 percent of total system (pump) head.

OR

Steam Heating Coil: Seamless copper tubes expanded into aluminum fins with two-way modulating control valve, strainer, and float-and-thermostatic trap.

- b. Control Valve: Class 125 body.
 - 1) Maximum Pressure Drop (15-psig (103-kPa) Steam): 80 percent of inlet steam pressure.
 - 2) Close-Off (Differential) Pressure Rating: 150 percent of operating (inlet) pressure.
8. Extended-Surface, Disposable, Panel Filter: Pleated, lofted, nonwoven, reinforced cotton fabric; supported and bonded to welded-wire grid; enclosed in cardboard frame with 2-inch- (50-mm-) thick, disposable, glass-fiber prefilter, **as directed**.
 - a. Thickness: 2 inches (50 mm) **OR** 4 inches (100 mm), **as directed**.
 - b. Initial Resistance: as directed by the Owner.
 - c. Recommended Final Resistance: as directed by the Owner.
 - d. Arrestance (ASHRAE 52.1): 90 percent.
 - e. Merv (ASHRAE 52.2): 7.
9. Infrared Humidifier: High-intensity quartz lamps mounted above stainless-steel evaporator pan, serviceable without disconnecting water, drain, or electrical connections; prepiped and using condensate water from cooling coils with stainless-steel or brass float-valve mechanism; located in bypass airstream; with flush-cycle timer and solenoid drain valve.
10. Evaporative Pan Humidifier: Stainless-steel pan and cover, serviceable without disconnecting water, drain, or electrical connections; prepiped with stainless-steel or brass float-valve mechanism; electric-resistance heating coil; low-water-cutoff switch; flush-cycle timer; and solenoid drain valve.
11. Electrode Steam Humidifier: Self-contained, microprocessor-controlled unit with disposable, polypropylene-plastic cylinders, and having field-adjustable steel electrodes and stainless-steel steam dispersion tube.
 - a. Plumbing Components and Valve Bodies: Plastic, linked by flexible rubber hosing, with water fill with air gap and solenoid valve incorporating built-in strainer, pressure-reducing and flow-regulating orifice, and drain with integral air gap.
 - b. Control: Fully modulating to provide gradual 0 to 100 percent capacity with field-adjustable maximum capacity; with high-water probe.
 - c. Drain Cycle: Field-adjustable drain duration and drain interval.
12. Integral Electrical Controls: Unit-mounted electrical enclosure with piano-hinged door, grounding lug, combination magnetic starters with overload relays, circuit breakers and cover interlock, and fusible control-circuit transformer.
13. Disconnect Switch: Nonautomatic, molded-case circuit breaker with handle accessible when panel is closed and capable of preventing access until switched to off position.
14. Electronic-Control System: Solid state, with start button, stop button, temporary loss of power indicator, manual-reset circuit breakers, temperature control, humidity control, and monitor panel.
 - a. Monitor Panel: Backlighted, with no visible indicator lights until operating function is activated; indicators include cooling, humidification, loss of airflow, change filters, high temperature, low temperature, high humidity, low humidity, high head pressure (each compressor), and low suction pressure (each compressor).
 - b. Temperature- and Humidity-Control Modules: Solid state, plug-in; with adjustable set point, push-to-test calibration check button, and built-in visual indicators to show mode of operation.
 - c. Location: Behind hinged door in front of unit; isolated from conditioned airstream to allow service while system is operating.



15. Microprocessor-Control System: Continuously monitors operation of process cooling system; continuously displays room temperature and room relative humidity; sounds alarm on system malfunction and simultaneously displays problem. If more than one malfunction occurs, system displays fault in sequence with room temperature and continues to display fault when malfunction is cleared until system is reset.
 - a. Malfunctions:
 - 1) Power loss.
 - 2) Loss of airflow.
 - 3) Clogged air filter.
 - 4) High room temperature.
 - 5) Low room temperature.
 - 6) High humidity.
 - 7) Low humidity.
 - 8) Smoke/fire.
 - 9) Water under floor.
 - 10) Supply fan overload.
 - 11) Compressor No. 1 - Overload.
 - 12) Compressor No. 1 - Low Pressure.
 - 13) Compressor No. 1 - High Pressure.
 - 14) Compressor No. 2 - Overload.
 - 15) Compressor No. 2 - Low Pressure.
 - 16) Compressor No. 2 - High Pressure.
 - b. Digital Display:
 - 1) Control power on.
 - 2) Humidifying.
 - 3) Dehumidifying.
 - 4) Compressor No. 1 - Operating.
 - 5) Compressor No. 2 - Operating.
 - 6) Heat operating.
 - 7) Economy cooling.
 - c. Push buttons shall stop and start process cooling system, silence audible alarm, test indicators, and display room's relative humidity.
 - d. BAS Interface: Factory-installed hardware and software to enable the BAS to monitor, control, and display unit status and alarms.
 - 1) Hardwired Points:
 - a) Monitoring: On-off status, common trouble alarm **OR** space temperature **OR** space relative humidity, **as directed**.
 - b) Control: On-off operation, space temperature set-point adjustment **OR** space relative humidity set-point adjustment, **as directed**.
 - 2) ASHRAE 135 (BACnet) **OR** LonTalk **OR** Modbus **OR** Industry-accepted, open-protocol, **as directed**, communication interface with the BAS shall enable the BAS operator to remotely control and monitor the unit from an operator workstation. Control features and monitoring points displayed locally at unit control panel shall be available through the BAS.

B. Floor-Mounted Units 5 Tons (18 kW) And Smaller

1. Description: Self-contained, factory assembled, prewired, and prepiped; consisting of cabinet, fan, filters, and controls; for vertical floor mounting in upflow or downflow configuration.
2. Cabinet and Frame: Welded tubular-steel frame with removable steel panels with baked-enamel finish, insulated with 1-inch- (25-mm-) thick duct liner.
 - a. Floor Stand: Welded tubular steel with adjustable legs and vibration isolation pads.
 - b. Finish of Interior Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
3. Supply-Air Fan: Forward curved, centrifugal, and with adjustable V-belt drive.
4. Refrigeration System:



- a. Compressor: Hermetic, with oil strainer, internal motor overload protection, resilient suspension system, and crankcase heater.
 - b. Refrigeration Circuit: Low-pressure switch, manual-reset high-pressure switch, thermal-expansion valve with external equalizer, sight glass with moisture indicator, service shutoff valves, charging valves, and charge of refrigerant.
 - c. Refrigerant: R-407C **OR** R-410A, **as directed**.
 - d. Refrigerant Evaporator Coil: Direct-expansion coil of seamless copper tubes expanded into aluminum fins, with two circuits, each with solenoid valve.
 - 1) Mount coil assembly over stainless-steel drain pan complying with ASHRAE 62.1, **as directed**, and having a condensate pump unit with integral float switch, pump-motor assembly, and condensate reservoir, **as directed**.
 - e. Integral, Water-Cooled Refrigerant Condenser: Brazed-plate type with liquid-line stop valve and head-pressure-actuated, two-way regulating valve.
 - 1) Cooling Medium: Water **OR** Glycol solution, **as directed**.

OR

Remote Air-Cooled Refrigerant Condenser: Integral, copper-tube aluminum-fin coil with propeller **OR** centrifugal, **as directed**, fan, direct **OR** belt, **as directed**, driven.

 - 2) Split system shall have suction- and liquid-line compatible fittings and refrigerant piping for field interconnection.
5. Hydronic Cooling Coil: Seamless copper tubes expanded into aluminum fins with modulating three-way control valve.
- a. Cooling Medium: Water **OR** Glycol solution, **as directed**.
 - b. Mount coil assembly over stainless-steel drain pan complying with ASHRAE 62.1, **as directed**, and having a condensate pump unit with integral float switch, pump-motor assembly, and condensate reservoir, **as directed**.
- OR**
- Remote Air-Cooled, Glycol-Solution Cooler: Corrosion-resistant cabinet, copper-tube aluminum-fin coil, direct-drive propeller fan with fan guards, and single-phase motors with internal overload protection.
- c. Disconnect Switch: Nonautomatic, molded-case circuit breaker with handle accessible when panel is closed and capable of preventing access until switched to off position.
6. Glycol-Solution Pump Package: Weatherproof and vented enclosure of enameled, galvanized steel on structural base frame containing centrifugal pump with mechanical seal.
- a. Piping: Interconnecting piping, from suction to discharge, with shutoff valves, flow switches, unions, and pressurized expansion tank with air purge vent and system-charging connection.
 - b. Glycol: Inhibited ethylene glycol and water solution mixed 50:50, suitable for operating temperature of minus 40 deg F (minus 40 deg C).
 - c. Disconnect Switch: Nonautomatic, molded-case circuit breaker with handle accessible when panel is closed and capable of preventing access until switched to off position.
7. Electric-Resistance Heating Coil: Finned-tube electric elements with contactor and high-temperature-limit switches.
8. Filter: 2-inch- (50-mm-) thick, disposable, glass-fiber media.
- a. Initial Resistance: as directed by the Owner.
 - b. Recommended Final Resistance: as directed by the Owner.
 - c. Arrestance (ASHRAE 52.1): 90 percent.
 - d. Merv (ASHRAE 52.2): 7.
9. Infrared Humidifier: High-intensity quartz lamps mounted above stainless-steel evaporator pan, serviceable without disconnecting water, drain, or electrical connections; prepiped and located in bypass airstream; with flush-cycle timer and solenoid drain valve.
10. Electrode Steam Humidifier: Self-contained, microprocessor-controlled unit with disposable, polypropylene-plastic cylinders and having field-adjustable steel electrodes and stainless-steel steam dispersion tube.



- a. Plumbing Components and Valve Bodies: Plastic, linked by flexible rubber hosing, with water fill with air gap and solenoid valve incorporating built-in strainer, pressure-reducing and flow-regulating orifice, and drain with integral air gap.
 - b. Control: Fully modulating to provide gradual 0 to 100 percent capacity with field-adjustable maximum capacity; with high-water probe.
 - c. Drain Cycle: Field-adjustable drain duration and drain interval.
 11. Disconnect Switch: Nonautomatic, molded-case circuit breaker with handle accessible when panel is closed and capable of preventing access until switched to off position.
 12. Control System: Unit-mounted panel with main fan contactor, compressor contactor, compressor start capacitor, control transformer with circuit breaker, solid-state temperature- and humidity-, **as directed**, control modules, humidity contactor, **as directed**, time-delay relay, heating contactor, and high-temperature thermostat. Provide solid-state, wall-mounted control panel with start-stop switch, adjustable humidity set point, **as directed**, and adjustable temperature set point.
- C. Ceiling-Mounted Units
1. Description: Self-contained, factory assembled, prewired, and prepiped; consisting of cabinet, fan, filters, and controls; for horizontal ceiling mounting to fit T-bar ceiling opening of 24 by 48 inches (610 by 1220 mm).
 2. Cabinet: Galvanized steel with baked-enamel finish, insulated with 1/2-inch- (13-mm-) thick duct liner.
 - a. Integral factory-supplied supply and return grille to fit ceiling grid kit of 24 by 48 inches (610 by 1220 mm), with filter.
 - b. Finish of Interior Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
 3. Supply-Air Fan: Forward curved, centrifugal, and directly driven by two-speed motor.
 4. Refrigeration System:
 - a. Compressor: Hermetic, with oil strainer, internal motor overload protection, resilient suspension system, and crankcase heater.
 - b. Refrigeration Circuit: Low-pressure switch, manual-reset high-pressure switch, thermal-expansion valve with external equalizer, sight glass with moisture indicator, service shutoff valves, charging valves, and charge of refrigerant.
 - c. Refrigerant: R-407C **OR** R-410A, **as directed**.
 - d. Refrigerant Evaporator Coil: Direct-expansion coil of seamless copper tubes expanded into aluminum fins.
 - 1) Mount coil assembly over stainless-steel drain pan complying with ASHRAE 62.1, **as directed**, and having a condensate pump unit with integral float switch, pump-motor assembly, and condensate reservoir, **as directed**.
 - e. Integral, Water-Cooled Refrigerant Condenser: Coaxial, counterflow, tube-in-tube **OR** Brazed-plate, **as directed**, type with liquid-line stop valve and head-pressure-actuated, water-regulating valve.
 - 1) Cooling Medium: Water **OR** Glycol solution, **as directed**.**OR**
Remote Air-Cooled Refrigerant Condenser: Integral, copper-tube aluminum-fin coil with propeller **OR** centrifugal, **as directed**, fan, direct driven.
 - f. Split system shall have suction- and liquid-line compatible fittings and refrigerant piping for field interconnection.
 5. Hydronic Cooling Coil: Seamless copper tubes expanded into aluminum fins with two-way control valve.
 - a. Cooling Medium: Water **OR** Glycol solution, **as directed**.
 - b. Mount coil assembly over stainless-steel drain pan complying with ASHRAE 62.1, **as directed**, and having a condensate pump unit with integral float switch, pump-motor assembly, and condensate reservoir, **as directed**.**OR**
Remote, Air-Cooled, Glycol-Solution Cooler: Corrosion-resistant cabinet, copper-tube aluminum-fin coil, direct-drive propeller fan with fan guards, and single-phase motors with internal overload protection.



6. Glycol-Solution Pump Package: Weatherproof and vented enclosure of enameled, galvanized steel on structural base frame containing centrifugal pump with mechanical seal.
 - a. Piping: Interconnecting piping, to and from remote, air-cooled glycol-solution cooler, with shutoff valves, flow switches, unions, and pressurized expansion tank with air purge vent and system-charging connection.
 - b. Glycol: Inhibited ethylene glycol and water solution mixed 50:50, suitable for operating temperature of minus 40 deg F (minus 40 deg C).
 7. Electric-Resistance Heating Coil: Finned-tube electric elements with contactor, dehumidification relay, and high-temperature-limit switches.
 8. Filter: 1-inch- (25-mm-) thick, disposable, glass-fiber media.
 - a. Initial Resistance: as directed by the Owner.
 - b. Recommended Final Resistance: as directed by the Owner.
 - c. Arrestance (ASHRAE 52.1): 90 percent.
 - d. Merv (ASHRAE 52.2): 7.
 9. Atomizing Humidifier: Centrifugal atomizer with stainless-steel pan, demister pad, and solenoid valve.
 10. Electrode Steam Humidifier: Self-contained, microprocessor-controlled unit with disposable, polypropylene-plastic cylinders, and having field-adjustable steel electrodes and stainless-steel steam dispersion tube.
 - a. Plumbing Components and Valve Bodies: Plastic, linked by flexible rubber hosing, with water fill with air gap and solenoid valve incorporating built-in strainer, pressure-reducing and flow-regulating orifice, and drain with integral air gap.
 - b. Control: Fully modulating to provide gradual 0 to 100 percent capacity with field-adjustable maximum capacity; with high-water probe.
 - c. Drain Cycle: Field-adjustable drain duration and drain interval.
 11. Disconnect Switch: Nonautomatic, molded-case circuit breaker with handle accessible when panel is closed and capable of preventing access until switched to off position.
 12. Control System: Unit-mounted panel with main fan contactor, compressor contactor, compressor start capacitor, control transformer with circuit breaker, solid-state temperature- and humidity-, **as directed**, control modules, humidity contactor, **as directed**, time-delay relay, heating contactor, and high-temperature thermostat. Provide solid-state, wall-mounted control panel with start-stop switch, adjustable humidity set point, **as directed**, and adjustable temperature set point.
- D. Console Units
1. Description: Split system consisting of evaporator section for floor or wall mounting and remote condensing section.
 2. Evaporator Cabinet: Furniture-grade steel with baked-enamel finish; with front access and containing direct-drive centrifugal fans and two-speed motor.
 - a. Finish of Interior Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
 3. Condenser Cabinet: Steel with baked-enamel finish and containing compressor and condenser.
 4. Refrigeration System:
 - a. Compressor: Hermetic, with oil strainer, internal motor overload protection, resilient suspension system, and crankcase heater.
 - b. Refrigeration Circuit: Filter/dryer, manual-reset high-pressure switch, thermal-expansion valve with external equalizer, sight glass with moisture indicator, service shutoff valves, charging valves, and charge of refrigerant.
 - c. Refrigerant: R-407C **OR** R-410A, **as directed**.
 - d. Refrigerant Evaporator Coil: Direct-expansion coil of seamless copper tubes expanded into aluminum fins.
 - 1) Mount coil assembly over stainless-steel drain pan complying with ASHRAE 62.1, **as directed**, and having a condensate pump unit with integral float switch, pump-motor assembly, and condensate reservoir, **as directed**.



- e. Integral, Water-Cooled Refrigerant Condenser: Coaxial, counterflow, tube-in-tube **OR** Brazed-plate, **as directed**, type with liquid-line stop valve and head-pressure-actuated, water-regulating valve.
OR
Remote Air-Cooled Refrigerant Condenser: Integral, copper-tube aluminum-fin coil with propeller **OR** centrifugal, **as directed**, fan, direct driven.
 - f. Split system shall have suction- and liquid-line compatible fittings and refrigerant piping for field interconnection.
 - 5. Hydronic Cooling Coil: Seamless copper tubes expanded into aluminum fins with modulating control valve.
 - a. Cooling Medium: Water **OR** Glycol solution, **as directed**.
 - b. Mount coil assembly over stainless-steel drain pan complying with ASHRAE 62.1, **as directed**, and having a condensate pump unit with integral float switch, pump-motor assembly, and condensate reservoir, **as directed**.**OR**
Remote, Air-Cooled, Glycol-Solution Cooler: Corrosion-resistant cabinet, copper-tube aluminum-fin coil, direct-drive propeller fan with fan guards, and single-phase motor with internal overload protection.
 - 6. Glycol-Solution Pump Package: Weatherproof and vented enclosure of enameled, galvanized steel on structural base frame containing centrifugal pump with mechanical seal.
 - a. Piping: Interconnecting piping, to and from remote, air-cooled, glycol-solution cooler, with shutoff valves, flow switches, unions, and pressurized expansion tank with air purge vent and system-charging connection.
 - b. Glycol: Inhibited ethylene glycol and water solution mixed 50:50, suitable for operating temperature of minus 40 deg F (minus 40 deg C).
 - 7. Electric-Resistance Heating Coil: Finned-tube electric elements with contactor and high-temperature-limit switches.
 - 8. Filter: Cleanable.
OR
Filter: 1-inch- (25-mm-) thick, disposable, glass-fiber media.
 - a. Initial Resistance: as directed by the Owner.
 - b. Recommended Final Resistance: as directed by the Owner.
 - c. Arrestance (ASHRAE 52.1): 90 percent.
 - d. Merv (ASHRAE 52.2): 7.
 - 9. Electrode Steam Humidifier: Self-contained and microprocessor controlled; with replaceable cylinder.
 - 10. Disconnect Switch: Nonautomatic, molded-case circuit breaker with handle accessible when panel is closed and capable of preventing access until switched to off position.
 - 11. Control System: Unit-mounted panel with contactors, control transformer with circuit breaker, and solid-state temperature- and humidity-, **as directed**, control modules. Provide solid-state, unit-mounted control panel with start-stop switch, adjustable humidity set point, **as directed**, and adjustable temperature set point.
- E. Fan Motors
- 1. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - b. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 22.

1.3 EXECUTION

A. Installation



1. Install computer-room air conditioners level and plumb, maintaining manufacturer's recommended clearances. Install according to ARI Guideline B, **as directed**.
 2. Computer-Room Air-Conditioner Mounting: Install using elastomeric pads **OR** elastomeric mounts **OR** restrained spring isolators, **as directed**. Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 - a. Minimum Deflection: 1/4 inch (6 mm) **OR** 1 inch (25 mm), **as directed**.
 3. Suspended Computer-Room Air Conditioners: Install using continuous-thread hanger rods and elastomeric hangers **OR** spring hangers **OR** spring hangers with vertical-limit stop, **as directed**, of size required to support weight of computer-room air conditioner.
 - a. Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment". Fabricate brackets or supports as required.
 - b. Comply with requirements for hangers and supports specified in Division 23 Section "Hangers And Supports For Hvac Piping And Equipment".
 4. Air-Cooled Refrigerant Condenser Mounting: Install using elastomeric pads **OR** elastomeric mounts **OR** restrained spring isolators, **as directed**. Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 - a. Minimum Deflection: 1/4 inch (6 mm) **OR** 1 inch (25 mm), **as directed**.
 5. Remote, Air-Cooled, Glycol-Solution Cooler Mounting: Install using elastomeric pads **OR** elastomeric mounts **OR** restrained spring isolators, **as directed**. Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
 - a. Minimum Deflection: 1/4 inch (6 mm) **OR** 1 inch (25 mm), **as directed**.
 6. Glycol-Solution Pump Package Mounting: Install using elastomeric pads **OR** elastomeric mounts, **as directed**. Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
- B. Connections
1. Piping installation requirements are specified in other Division 21. Drawings indicate general arrangement of piping, fittings, and specialties.
 2. Install piping adjacent to machine to allow service and maintenance.
 3. Water and Drainage Connections: Comply with applicable requirements in Division 22 Section "Domestic Water Piping". Provide adequate connections for water-cooled units, condensate drain, and humidifier flushing system.
 4. Hot-Water Heating Piping: Comply with applicable requirements in Division 23 Section "Hydronic Piping". Provide shutoff valves in inlet and outlet piping to heating coils.
 5. Steam and Condensate Piping: Comply with applicable requirements in Division 23 Section "Steam And Condensate Heating Piping". Provide shutoff valves in steam inlet and steam trap in condensate outlet piping to heating coils.
 6. Condenser-Water Piping: Comply with applicable requirements in Division 23 Section "Hydronic Piping". Provide shutoff valves in water inlet and outlet piping on water-cooled units.
 7. Refrigerant Piping: Comply with applicable requirements in Division 23 Section "Refrigerant Piping". Provide shutoff valves and piping.
- C. Field Quality Control
1. Perform tests and inspections.
 2. Tests and Inspections:
 - a. Inspect for and remove shipping bolts, blocks, and tie-down straps.
 - b. After installing computer-room air conditioners and after electrical circuitry has been energized, test for compliance with requirements.
 - c. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.



- d. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 3. Computer-room air conditioners will be considered defective if they do not pass tests and inspections.
 4. Prepare test and inspection reports.
 5. After startup service and performance test, change filters and flush humidifier.
- D. Adjusting
1. Adjust initial temperature and humidity, **as directed**, set points.
 2. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
 3. Occupancy Adjustments: When requested within 12 months of date of Final Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.
- E. Demonstration
1. Train Owner's maintenance personnel to adjust, operate, and maintain computer-room air conditioners.

END OF SECTION 23 81 23 00



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23 - Heating, Ventilating, And Air-Conditioning (HVAC)

Task	Specification	Specification Description
23 81 43 00	01 95 23 00	Packaged Terminal Air Conditioners
23 81 49 00	23 63 13 00a	Split-System Air-Conditioning Units



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SECTION 23 82 16 00 - AIR COILS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for air coils. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following types of air coils that are not an integral part of air-handling units:
 - a. Hot-water.
 - b. Chilled-water.
 - c. Steam.
 - d. Refrigerant.
 - e. Electric.

C. Submittals

1. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each air coil. Include rated capacity and pressure drop for each air coil.
2. Shop Drawings: Diagram power, signal, and control wiring.
3. Field quality-control test reports.
4. Operation and maintenance data.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. ASHRAE Compliance:
 - a. Comply with ASHRAE 15 for refrigeration system safety.
 - b. Comply with ASHRAE 33 for methods of testing cooling and heating coils.
 - c. Comply with applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

1.2 PRODUCTS

A. Water Coils

1. Performance Ratings: Tested and rated according to ARI 410 and ASHRAE 33.
2. Minimum Working-Pressure/Temperature Ratings: 200 psig (1380 kPa), 325 deg F (163 deg C).
3. Source Quality Control: Factory tested to 300 psig (2070 kPa).
4. Tubes: ASTM B 743 copper, minimum 0.020 inch (0.508 mm) **OR** 0.035 inch (0.889 mm) **OR** 0.049 inch (1.245 mm), **as directed**, thick.
5. Fins: Aluminum **OR** Copper, **as directed**, minimum 0.006 inch (0.152 mm) **OR** 0.010 inch (0.254 mm), **as directed**, thick.
6. Headers: Cast iron with drain and air vent tapplings **OR** Cast iron with cleaning plugs, and drain and air vent tapplings **OR** Seamless copper tube with brazed joints, prime coated **OR** Steel with brazed joints, prime coated, **as directed**.
7. Frames: Galvanized-steel channel frame, minimum 0.052 inch (1.3 mm) **OR** 0.064 inch (1.6 mm) **OR** 0.079 inch (2.0 mm) **OR** 0.0625 inch (1.6 mm), **as directed**, thick for slip-in **OR** flanged, **as directed**, mounting.

**OR**

Frames: ASTM A 666, Type 304 **OR** 316, **as directed**, stainless steel, minimum 0.0625 inch (1.6 mm) thick for slip-in **OR** flanged, **as directed**, mounting.

8. Hot-Water Coil and Steam Coil, Face-and-Bypass Dampers: Alternating arrangement of coil segments and dampers.
 - a. Coil Configuration: Horizontal **OR** Vertical, **as directed**, tubes.
 - b. Dampers: Extruded-aluminum **OR** Galvanized-steel, **as directed**, blades with edge and end seals; full-length drive rod and mount for actuator in **OR** outside, **as directed**, the airstream.

B. Steam Coils

1. Performance Ratings: Tested and rated according to ARI 410 and ASHRAE 33.
2. Minimum Working-Pressure/Temperature Ratings: 100 psig (690 kPa), 400 deg F (204 deg C).
3. Source Quality Control: Factory tested to 300 psig (2070 kPa).
4. Tubes: ASTM B 743 copper, minimum 0.025 inch (0.635 mm) **OR** 0.035 inch (0.889 mm) **OR** 0.049 inch (1.245 mm), **as directed**, thick.
5. Fins: Aluminum **OR** Copper, **as directed**, minimum 0.006 inch (0.152 mm) **OR** 0.010 inch (0.254 mm), **as directed**, thick.
6. Headers: Cast iron with drain and air vent tapplings **OR** Cast iron with cleaning plugs, and drain and air vent tapplings **OR** Seamless copper tube with brazed joints, prime coated **OR** Steel with brazed joints, prime coated, **as directed**.
7. Tube Type: Single or distributing as indicated.
8. Frames: Galvanized-steel channel frame, minimum 0.052 inch (1.3 mm) **OR** 0.064 inch (1.6 mm) **OR** 0.079 inch (2.0 mm) **OR** 0.0625 inch (1.6 mm), **as directed**, thick for slip-in **OR** flanged, **as directed**, mounting.

OR

Frames: ASTM A 666, Type 304 **OR** 316, **as directed**, stainless steel, minimum 0.0625 inch (1.6 mm) thick for slip-in **OR** flanged, **as directed**, mounting.

9. Face-and-Bypass Dampers: Alternating arrangement of coil segments and dampers.
 - a. Coil Configuration: Horizontal **OR** Vertical, **as directed**, tubes.
 - b. Dampers: Extruded-aluminum **OR** Galvanized-steel, **as directed**, blades with edge and end seals; full-length drive rod and mount for actuator in **OR** outside, **as directed**, the airstream.

C. Refrigerant Coils

1. Performance Ratings: Tested and rated according to ARI 410 and ASHRAE 33.
2. Minimum Working-Pressure Rating: 300 psig (2070 kPa).
3. Source Quality Control: Factory tested to 450 psig (3105 kPa).
4. Tubes: ASTM B 743 copper, minimum 0.020 inch (0.508 mm) **OR** 0.035 inch (0.889 mm) **OR** 0.049 inch (1.245 mm), **as directed**, thick.
5. Fins: Aluminum **OR** Copper, **as directed**, minimum 0.006 inch (0.152 mm) **OR** 0.010 inch (0.254 mm), **as directed**, thick.
6. Suction and Distributor Piping: ASTM B 88, Type L (ASTM B 88M, Type B) copper tube with brazed joints.
7. Frames: Galvanized-steel channel frame, minimum 0.052 inch (1.3 mm) **OR** 0.064 inch (1.6 mm) **OR** 0.079 inch (2.0 mm) **OR** 0.0625 inch (1.6 mm), **as directed**, thick for slip-in **OR** flanged, **as directed**, mounting.

OR

Frames: ASTM A 666, Type 304 **OR** 316, **as directed**, stainless steel, minimum 0.0625 inch (1.6 mm) thick for slip-in **OR** flanged, **as directed**, mounting.

D. Electric Coils

1. Coil Assembly: Comply with UL 1995.



2. Heating Elements: Coiled resistance wire of 80 percent nickel and 20 percent chromium; surrounded by compacted magnesium-oxide powder in tubular-steel sheath; with spiral-wound, copper-plated, steel fins continuously brazed to sheath.
OR
Heating Elements: Open-coil resistance wire of 80 percent nickel and 20 percent chromium, supported and insulated by floating ceramic bushings recessed into casing openings, and fastened to supporting brackets.
3. High-Temperature Coil Protection: Disk-type, automatically reset, thermal-cutout, safety device; serviceable through terminal box without removing heater from duct or casing.
 - a. Secondary Protection: Load-carrying, manually reset or manually replaceable, thermal cutouts; factory wired in series with each heater stage.
4. Frames: Galvanized-steel channel frame, minimum 0.052 inch (1.3 mm) **OR** 0.064 inch (1.6 mm) **OR** 0.079 inch (2.0 mm) **OR** 0.0625 inch (1.6 mm), **as directed**, thick for slip-in **OR** flanged, **as directed**, mounting.
5. Control Panel: Unit **OR** Remote, **as directed**, mounted with disconnecting means and overcurrent protection. Include the following controls:
 - a. Magnetic contactor.
 - b. Mercury contactor.
 - c. Toggle switches; one per step.
 - d. Step controller.
 - e. Time-delay relay.
 - f. Pilot lights; one per step.
 - g. Airflow proving switch.
6. Refer to Division 23 Section "Instrumentation And Control For Hvac" for thermostat.
OR
Thermostats: Wall-mounted thermostats, with temperature range from 50 to 90 deg F (10 to plus 32 deg C), and 2.5 deg F (1.4 deg C) throttling range.

1.3 EXECUTION

A. Installation

1. Install coils level and plumb.
2. Install coils in metal ducts and casings constructed according to SMACNA's "HVAC Duct Construction Standards, Metal and Flexible."
3. Install galvanized-steel **OR** stainless-steel, **as directed**, drain pan under each cooling coil.
 - a. Construct drain pans with connection for drain; insulated and complying with ASHRAE 62.1, **as directed**.
 - b. Construct drain pans to extend beyond coil length and width and to connect to condensate trap and drainage.
 - c. Extend drain pan upstream and downstream from coil face.
 - d. Extend drain pan under coil headers and exposed supply piping.
4. Install moisture eliminators for cooling coils. Extend drain pan under moisture eliminator.
5. Straighten bent fins on air coils.
6. Clean coils using materials and methods recommended in writing by manufacturers, and clean inside of casings and enclosures to remove dust and debris.

B. Connections

1. Piping installation requirements are specified in other Division 21. Drawings indicate general arrangement of piping, fittings, and specialties.
2. Install piping adjacent to coils to allow service and maintenance.
3. Connect water piping with unions and shutoff valves to allow coils to be disconnected without draining piping. Control valves are specified in Division 23 Section "Instrumentation And Control For Hvac", and other piping specialties are specified in Division 23 Section "Hydronic Piping".
4. Connect steam piping with gate valve and union and steam condensate piping with union, strainer, trap, and gate valve to allow coils to be disconnected without draining piping. Control



valves are specified in Division 23 Section "Instrumentation And Control For Hvac", and other piping specialties are specified in Division 23 Section "Steam And Condensate Heating Piping".

5. Connect refrigerant piping according to Division 23 Section "Refrigerant Piping".
6. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
7. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

C. Field Quality Control

1. Perform the following field tests and inspections and prepare test reports:
 - a. Operational Test: After electrical circuitry has been energized, operate electric coils to confirm proper unit operation.
 - b. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

END OF SECTION 23 82 16 00



23 - Heating, Ventilating, And Air-Conditioning (HVAC)

Task	Specification	Specification Description
23 82 19 00	23 64 16 16	Fan-Coil Units
23 82 39 13	01 22 16 00	No Specification Required
23 82 39 13	23 55 33 00a	Unit Heaters
23 82 39 16	01 22 16 00	No Specification Required
23 82 39 16	23 55 33 00a	Unit Heaters
23 82 39 19	23 55 33 00a	Unit Heaters



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SECTION 23 84 13 00 - HUMIDIFIERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for humidifiers. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following humidifiers:
 - a. Atomizing.
 - b. Steam injection.
 - c. Self-contained.
 - d. Heated pan.
 - e. Heat exchanger.

C. Definition

1. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

D. Submittals

1. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories.
2. Shop Drawings: Detail fabrication and installation of humidifiers. Include piping details, plans, elevations, sections, details of components, manifolds, and attachments to other work.
 - a. Wiring Diagrams: Power, signal, and control wiring.
3. Field quality-control test reports.
4. Operation and maintenance data.

E. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. Comply with ARI 640, "Commercial and Industrial Humidifiers."

1.2 Products

A. Water-Pressure Atomizing Humidifiers

1. Nozzles: ASTM A 666, Type 304 **OR** 316, **as directed**, stainless steel.
2. Manifold: ASTM A 269, Type 304 **OR** 316, **as directed**, stainless-steel piping.
3. Droplet Filter: Biocide-treated polyethylene with maximum 0.30-inch wg (75-Pa) resistance.
4. Piping and Fittings: ASTM A 269, Type 304 **OR** 316, **as directed**, stainless-steel pipe and fittings.
OR
Piping and Fittings: ASTM B 88 (ASTM B 88M), Type L copper pipe and wrought-copper fittings with brazed joints.
5. Water Pump: Enclosed belt-drive ceramic plunger pump with stainless-steel **OR** bronze, **as directed**, heads, and single **OR** variable, **as directed**, -speed, totally enclosed, fan-cooled motor.
6. Final Water-Filter Efficiency: Minimum 98 percent retention of suspended particles 10 **OR** 20, **as directed**, microns and larger from makeup water.



7. Final Water-Filter Pressure Drop: Maximum 2 psig (14 kPa) at design flow when clean, and **<Insert value>** when dirty, **as directed**.
 8. Pump Controls:
 - a. Cycle **OR** Vary speed of, **as directed**, motor to satisfy humidistat.
 - b. High-pressure solenoid valve for each control zone shown on Drawings.
 - c. Building automation system interface for each control zone for start/stop and status indication and control at central workstation.
 9. Dispersion Fan:
 - a. Aluminum blade propeller fan with finger guard and single-speed motor interlocked to operate with humidifier.
 - b. Fan Mounting: Above and behind manifold on bracket integral to wall-mounting manifold.
 10. Accessories:
 - a. Humidistat: Wall **OR** Return-duct, **as directed**, -mounting, solid-state, electronic-sensor controller capable of full-modulation or cycling control.
 - b. Duct-mounting, high-limit humidistat.
 - c. Airflow switch for preventing humidifier operation without airflow.
- B. Compressed-Air Atomizing Humidifiers
1. Nozzles: ASTM A 666, Type 304 **OR** 316, **as directed**, stainless steel.
 2. Manifold: ASTM A 269, Type 304 **OR** 316, **as directed**, stainless-steel piping.
 3. Droplet Filter: Biocide-treated polyethylene with maximum 0.30-inch wg (75-Pa) resistance.
 4. Piping and Fittings: ASTM A 269, Type 304 **OR** 316, **as directed**, stainless-steel pipe and fittings.
 5. Compressed-Air and Water, **as directed**, Piping and Fittings: ASTM B 88 (ASTM B 88M), Type L copper pipe and wrought-copper fittings with soldered joints.
 6. Final Water-Filter Efficiency: Minimum 98 percent retention of suspended particles 10 **OR** 20, **as directed**, microns and larger from makeup water.
 7. Final Water-Filter Pressure Drop: Maximum 2 psig (14 kPa) at design flow when clean, and **<Insert value>** when dirty, **as directed**.
 8. Air and Water Solenoid Controls:
 - a. Cycle valves to satisfy humidistat.
 - b. Solenoid valves for each control zone shown on Drawings.
 - c. Building automation system interface for each control zone for start/stop and status indication and control at central workstation.
 9. Dispersion Fan:
 - a. Aluminum blade propeller fan with finger guard and single-speed motor interlocked to operate with humidifier.
 - b. Fan Mounting: Above and behind manifold on bracket integral to wall-mounting manifold.
 10. Accessories:
 - a. Humidistat: Wall **OR** Return-duct, **as directed**, -mounting, solid-state, electronic-sensor controller capable of full-modulation or cycling control.
 - b. Duct-mounting, high-limit humidistat.
 - c. Airflow switch for preventing humidifier operation without airflow.
- C. Steam-Injection Humidifiers
1. Manifold: ASTM A 666, Type 304 stainless steel, steam jacketed, **as directed**; insulated with 1/2-inch (13-mm) fiberglass and stainless-steel jacket; and , **as directed**, extending the full width of duct or plenum with mounting brackets at ends.
 2. Discharge Nozzle and Dispersion Fan:
 - a. Steam-jacketed discharge nozzle, aluminum blade propeller fan with finger guard, and single-speed motor interlocked to operate with humidifier.
 - b. Fan Mounting: Above and behind discharge outlet on bracket integral to discharge outlet.
 3. Steam Separator: Cast iron **OR** ASTM A 666, Type 304 stainless steel, **as directed**, with separate, **as directed**, humidifier control valve.
 4. Humidifier Control Valve:



- a. Actuator: Pneumatic **OR** Electric, **as directed**, modulating with spring return.
OR
Actuator: As specified in Division 23 Section "Instrumentation And Control For Hvac".
5. Steam Trap: Inverted-bucket type, sized for a minimum of 3 times the maximum rated condensate flow of humidifier at 1/2-psig (3.4-kPa) inlet pressure.
6. Accessories:
 - a. Wall **OR** Return-duct, **as directed**, -mounting humidistat.
 - b. Duct-mounting, high-limit humidistat.
 - c. Aquastat mounted on steam condensate return piping to prevent cold operation of humidifier.
 - d. In-line strainer.
 - e. Airflow switch for preventing humidifier operation without airflow.
- D. Self-Contained Humidifiers
 1. Electric-Resistance Heater Container: Cleanable, ASTM A 666, Type 304 **OR** 316, **as directed**, stainless steel. Comply with UL 499.
 2. Electrode Cylinder: Replaceable plastic assembly with disposable ionic bed inserts, **as directed**. Comply with UL 499.
 3. Gas-Fired Steam Generator: Factory assembled and tested.
 - a. Standard: Fabricate and label steam generator to comply with CSA.
 - b. Maximum Steam Pressure: 10 inches wg (2488 Pa).
 - c. Burner Type: Natural-gas **OR** Propane, **as directed**, fired with modulating, low NOx infrared burner, minimum 82 percent efficient.
 - d. Gas Train: Safety shutoff valves, gas cock, strainer, pressure-regulating valve.
 - e. Ignition: Hot-surface ignition with flame safety system.
 - f. Combustion Chamber: Sealed with outdoor-air and flue-vent connections.
 - g. Heat-Exchanger Tank: Cleanable, ASTM A 666, Type 304 **OR** 316, **as directed**, stainless steel with corrosion-resistant coating and disposable ionic bed inserts, **as directed**.
 4. Manifold: Stainless-steel tube with integral fan to discharge vapor directly into occupied space.
OR
Manifold: ASTM A 666, Type 304 **OR** 316, **as directed**, stainless-steel tube extending across entire width of duct or plenum and equipped with mounting brackets on ends.
 5. Cabinet: Sheet metal enclosure for housing heater cylinder, electrical wiring, components, controls, and control panel. Enclosure shall include baked-enamel finish, hinged or removable access door, and threaded outlet in bottom of cabinet for drain piping.
 6. Control Panel:
 - a. Factory-wired disconnect switch.
 - b. Liquid-crystal display.
 - c. Programmable keyboard.
 - d. Set-point adjustment.
 - e. Warning signal indicating end of replaceable cylinder or ionic bed insert, **as directed**, life.
 - f. Low-voltage, control circuit.
 - g. Diagnostic, maintenance, alarm, and status features.
 - h. High-water sensor **OR** float, **as directed**, to prevent overfilling.
 7. Controls:
 - a. Microprocessor-based control system for modulating or cycling control, and start/stop and status monitoring for interface to central HVAC instrumentation and controls.
 - b. Solenoid-fill and automatic drain valves to maintain water level and temper hot drain water.
 - c. Field-adjustable timer to control drain cycle for flush duration and interval.
 - d. Controls shall drain tanks if no demand for humidification for more than 72 hours.
 - e. Conductivity **OR** Float, **as directed**, -type level controls.
 8. Accessories:
 - a. Humidistat: Wall **OR** Return-duct, **as directed**, -mounting, solid-state, electronic-sensor controller capable of full modulation or cycling control.
 - b. Duct-mounting, high-limit humidistat.
 - c. Airflow switch for preventing humidifier operation without airflow.



E. Heated-Pan Humidifiers

1. Heat Source: Hot water **OR** Steam **OR** Electric resistance, **as directed**.
2. Comply with UL 499.
3. Pan and Heat-Exchange Piping: ASTM A 666, Type 304 **OR** 316, **as directed**, stainless steel with corrosion-resistant coating, overflow, and drain fittings. Include disposable ionic bed inserts, **as directed**.
4. Manifold: ASTM A 666, Type 304 **OR** 316, **as directed**, stainless-steel, duct-mounting, single- or manifold-grid connected to heated-pan housing with flexible hose and extending across width of duct or plenum. Manifold shall have mounting brackets at both ends.
OR
 Manifold: Inverted, ASTM A 666, Type 304 **OR** 316, **as directed**, stainless-steel U-tube with humidifier mounted directly under the duct.
OR
 Manifold: ASTM A 666, Type 304 **OR** 316, **as directed**, stainless-steel tube with flexible hose to connect to humidifier, integral fan to discharge vapor directly into occupied space, and wall- or ceiling-mounting brackets.
5. Controls:
 - a. Solenoid-fill and automatic drain valves to maintain water level and temper hot drain water.
 - b. Field-adjustable timer to control drain cycle for flush duration and interval.
 - c. Conductivity **OR** Float, **as directed**, -type level controls.
6. Piping Specialties: Inlet strainer, control valve, and steam trap.
7. Piping Specialties: Inlet strainer and control valve.
8. Accessories:
 - a. Humidistat: Wall **OR** Return-duct, **as directed**, -mounting, solid-state, electronic-sensor controller capable of full modulation or cycling control.
 - b. Duct-mounting, high-limit humidistat.
 - c. Airflow switch for preventing humidifier operation without airflow.

F. Heat-Exchanger Humidifiers

1. Fabricate and label steam generator to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Heat Exchanger: ASTM A 666, Type 304 **OR** 316, **as directed**, stainless steel with corrosion-resistant coating, overflow, and drain fittings. Include disposable ionic bed inserts, **as directed**.
3. Manifold: ASTM A 666, Type 304 **OR** 316, **as directed**, stainless-steel, steam-jacketed, **as directed**, duct-mounting, single- or manifold-grid connected to steam generator with flexible hose and extending across width of duct or plenum. Manifold shall have mounting brackets for both ends. Insulate with 1/2-inch (13-mm) fiberglass and stainless-steel jacket extending full width of duct or plenum with mounting brackets at ends, **as directed**.
OR
 Manifold: ASTM A 666, Type 304 **OR** 316, **as directed**, stainless-steel tube with flexible hose to connect to humidifier and integral fan to discharge vapor directly into occupied space. Manifold shall have wall- or ceiling-mounting brackets.
4. Controls:
 - a. Solenoid-fill and automatic drain valves to maintain water level and temper hot drain water.
 - b. Field-adjustable timer to control drain cycle for flush duration and interval.
 - c. Conductivity **OR** Float, **as directed**, -type level controls.
5. Accessories:
 - a. Humidistat: Wall **OR** Return-duct, **as directed**, -mounting, solid-state, electronic-sensor controller capable of full modulation.
 - b. Duct-mounting, high-limit humidistat.
 - c. Airflow switch for preventing humidifier operation without airflow.



1.3 EXECUTION

A. Installation

1. Install humidifiers with required clearance for service and maintenance. Maintain path, downstream from humidifiers, clear of obstructions as required by ASHRAE 62.1, **as directed**.
2. Seal humidifier manifold duct or plenum penetrations with flange.
3. Install humidifier manifolds in metal ducts and casings constructed according to SMACNA's "HVAC Duct Construction Standards, Metal and Flexible."
4. Install galvanized **OR** stainless, **as directed**, -steel drain pan under each manifold mounted in duct.
 - a. Construct drain pans with connection for drain; insulated and complying with ASHRAE 62.1, **as directed**.
 - b. Connect to condensate trap and drainage piping.
 - c. Extend drain pan upstream and downstream from manifold a minimum distance recommended by manufacturer but not less than required by ASHRAE 62.1.
5. Install manifold supply piping pitched to drain condensate back to humidifier.
6. Install drip leg upstream from steam trap a minimum of 12 inches (300 mm) tall for proper operation of trap.
7. Install steam generator level on concrete base. Concrete base is specified in Division 23 Section "Common Work Results For Hvac".
8. Concrete Bases: Anchor steam generator to concrete base.
 - a. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of base.
 - b. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - d. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - e. Cast-in-place concrete materials and placement requirements are specified in Division 31.
9. Install seismic restraints on humidifiers. Seismic restraints are specified in Division 23 Section "Vibration And Seismic Controls For Hvac Piping And Equipment".
10. Install gas-fired steam generators according to NFPA 54.

B. Connections

1. Piping installation requirements are specified in other Division 21. Drawings indicate general arrangement of piping, fittings, and specialties.
 - a. Install piping adjacent to humidifiers to allow service and maintenance.
 - b. Install shutoff valve, strainer, backflow preventer, and union in humidifier makeup line.
2. Install electrical devices and piping specialties furnished by manufacturer but not factory mounted.
3. Install piping from safety relief valves to nearest floor drain.
4. Connect gas piping full size to steam-generator, gas-train inlet with union. Gas piping materials and specialties are specified in Division 23 Section(s) "Facility Natural-gas Piping" OR "Facility Liquefied-petroleum Gas Piping", **as directed**.
5. Connect breeching full size to steam-generator outlet. Venting materials are specified in Division 23 Section "Breechings, Chimneys, And Stacks".
6. Connect combustion-air inlet to intake terminal using PVC piping with solvent-cemented joints. Run from boiler connection to outside and terminate adjacent to flue termination.
7. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
8. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

C. Field Quality Control

1. Perform tests and inspections and prepare test reports.
2. Tests and Inspections:



- a. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - b. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - c. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Remove and replace malfunctioning units and retest as specified above.

D. Demonstration

1. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain humidifiers.

END OF SECTION 23 84 13 00



Task	Specification	Specification Description
25 55 00 00	23 09 00 00	HVAC Instrumentation And Controls



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Task	Specification	Specification Description
26 01 30 00	01 22 16 00	No Specification Required
26 01 50 51	01 22 16 00	No Specification Required
26 01 50 51	02 84 16 00	Removal of Fluorescent Light Ballasts/Capacitors and Fluorescent Light Tubes
26 01 50 51	01 95 26 00a	Interior Lighting
26 01 50 51	02 84 16 00a	Exterior Lighting
26 01 50 52	02 84 16 00	Removal of Fluorescent Light Ballasts/Capacitors and Fluorescent Light Tubes
26 01 50 52	01 95 26 00a	Interior Lighting
26 01 50 52	02 84 16 00a	Exterior Lighting
26 01 50 53	02 84 16 00	Removal of Fluorescent Light Ballasts/Capacitors and Fluorescent Light Tubes
26 01 50 53	01 95 26 00a	Interior Lighting
26 01 50 53	02 84 16 00a	Exterior Lighting



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SECTION 26 05 13 00 - CONDUCTORS AND CABLES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of conductors and cables. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Building wires and cables rated 600 V and less.
 - b. Connectors, splices, and terminations rated 600 V and less.
 - c. Sleeves and sleeve seals for cables.

C. Definitions

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

D. Submittals

1. Product Data: For each type of product indicated.
2. Field quality-control test reports.

E. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. Comply with NFPA 70.

1.2 PRODUCTS

A. Conductors And Cables

1. Aluminum and Copper, **as directed**, Conductors: Comply with NEMA WC 70.
2. Conductor Insulation: Comply with NEMA WC 70 for Types THW **OR** THHN-THWN **OR** XHHW **OR** UF **OR** USE **OR** SO, **as directed**.
3. Multiconductor Cable: Comply with NEMA WC 70 for armored cable, Type AC **OR** metal-clad cable, Type MC **OR** mineral-insulated, metal-sheathed cable, Type MI **OR** nonmetallic-sheathed cable, Type NM **OR** Type SO **OR** Type USE, **as directed**, with ground wire.

B. Connectors And Splices

1. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

C. Sleeves For Cables

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
3. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch (1.3- or 3.5-mm) thickness as indicated and of length to suit application.
4. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping".



D. Sleeve Seals

1. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.
 - a. Sealing Elements: EPDM **OR** NBR, **as directed**, interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 - b. Pressure Plates: Plastic **OR** Carbon steel **OR** Stainless steel, **as directed**. Include two for each sealing element.
 - c. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating **OR** Stainless steel, **as directed**, of length required to secure pressure plates to sealing elements. Include one for each sealing element.

1.3 EXECUTION

A. Conductor Material Applications

1. Feeders: Copper **OR** Aluminum for feeders smaller than No. 4 AWG; copper or aluminum for feeders No. 4 AWG and larger, **as directed**. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
2. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Conductor Insulation And Multiconductor Cable Applications And Wiring Methods

1. Service Entrance: Type THHN-THWN, single conductors in raceway **OR** Type XHHW, single conductors in raceway **OR** Mineral-insulated, metal-sheathed cable, Type MI **OR** Type SE or USE multiconductor cable, **as directed**.
2. Exposed Feeders: Type THHN-THWN, single conductors in raceway **OR** Armored cable, Type AC **OR** Metal-clad cable, Type MC **OR** Mineral-insulated, metal-sheathed cable, Type MI **OR** Nonmetallic-sheathed cable, Type NM, **as directed**.
3. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-THWN, single conductors in raceway **OR** Armored cable, Type AC **OR** Metal-clad cable, Type MC **OR** Mineral-insulated, metal-sheathed cable, Type MI **OR** Nonmetallic-sheathed cable, Type NM, **as directed**.
4. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway **OR** Underground feeder cable, Type UF, **as directed**.
5. Feeders Installed below Raised Flooring: Type THHN-THWN, single conductors in raceway **OR** Armored cable, Type AC **OR** Metal-clad cable, Type MC **OR** Mineral-insulated, metal-sheathed cable, Type MI, **as directed**.
6. Feeders in Cable Tray: Type THHN-THWN, single conductors in raceway **OR** Armored cable, Type AC **OR** Metal-clad cable, Type MC **OR** Mineral-insulated, metal-sheathed cable, Type MI **OR** Nonmetallic-sheathed cable, Type NM, **as directed**.
7. Exposed Branch Circuits, Including in Crawlspace: Type THHN-THWN, single conductors in raceway **OR** Armored cable, Type AC **OR** Metal-clad cable, Type MC **OR** Mineral-insulated, metal-sheathed cable, Type MI **OR** Nonmetallic-sheathed cable, Type NM, **as directed**.
8. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway **OR** Armored cable, Type AC **OR** Metal-clad cable, Type MC **OR** Mineral-insulated, metal-sheathed cable, Type MI **OR** Nonmetallic-sheathed cable, Type NM, **as directed**.
9. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway **OR** Underground branch-circuit cable, Type UF, **as directed**.
10. Branch Circuits Installed below Raised Flooring: Type THHN-THWN, single conductors in raceway **OR** Armored cable, Type AC **OR** Metal-clad cable, Type MC **OR** Mineral-insulated, metal-sheathed cable, Type MI, **as directed**.



11. Branch Circuits in Cable Tray: Type THHN-THWN, single conductors in raceway **OR** Armored cable, Type AC **OR** Metal-clad cable, Type MC **OR** Mineral-insulated, metal-sheathed cable, Type MI, **as directed**.
 12. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
 13. Class 1 Control Circuits: Type THHN-THWN, in raceway.
 14. Class 2 Control Circuits: Type THHN-THWN, in raceway **OR** Power-limited cable, concealed in building finishes **OR** Power-limited tray cable, in cable tray, **as directed**.
- C. Installation Of Conductors And Cables
1. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
 2. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
 3. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
 4. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
 5. Support cables according to Division 26 Section "Hangers And Supports For Electrical Systems".
 6. Identify and color-code conductors and cables according to Division 26 Section "Identification For Electrical Systems".
 7. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
 8. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
 - a. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.
 9. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) **OR** 12 inches (300 mm), **as directed**, of slack.
- D. Sleeve Installation For Electrical Penetrations
1. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping".
 2. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
 3. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
 4. Rectangular Sleeve Minimum Metal Thickness:
 - a. For sleeve rectangle perimeter less than 50 inches (1270 mm) and no side greater than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
 - b. For sleeve rectangle perimeter equal to, or greater than, 50 inches (1270 mm) and 1 or more sides equal to, or greater than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).
 5. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
 6. Cut sleeves to length for mounting flush with both wall surfaces.
 7. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.
 8. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and cable unless sleeve seal is to be installed or unless seismic criteria require different clearance, **as directed**.
 9. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies, **as directed**.
 10. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and cable, using joint sealant appropriate for size, depth, and location of joint according to Division 07 Section "Joint Sealants".



11. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at cable penetrations. Install sleeves and seal with firestop materials according to Division 07 Section "Penetration Firestopping".
12. Roof-Penetration Sleeves: Seal penetration of individual cables with flexible boot-type flashing units applied in coordination with roofing work.
13. Aboveground Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeves to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
14. Underground Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between cable and sleeve for installing mechanical sleeve seals.

E. Sleeve-Seal Installation

1. Install to seal underground exterior-wall penetrations.
2. Use type and number of sealing elements recommended by manufacturer for cable material and size. Position cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

F. Firestopping

1. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 Section "Penetration Firestopping".

G. Field Quality Control

1. Perform tests and inspections and prepare test reports.
2. Tests and Inspections:
 - a. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors, and conductors feeding the following critical equipment and services, **as directed**, for compliance with requirements.
 - b. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - c. Infrared Scanning: After Final Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.
 - 1) Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Final Completion.
 - 2) Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - 3) Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
3. Test Reports: Prepare a written report to record the following:
 - a. Test procedures used.
 - b. Test results that comply with requirements.
 - c. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
4. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 26 05 13 00



SECTION 26 05 13 00a - UNDERCARPET CABLES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of undercarpet cables. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Undercarpet cable and service fittings for branch circuits.
 - b. Undercarpet cable and service fittings for communication and data transmission.

C. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: Include plans, elevations, sections, details of components, and attachments to other work.
 - a. Indicate cable types, accessories, and transition boxes.
 - b. Indicate proposed layering of cables, cable dimensions, and installation requirements.
3. Field quality-control test reports.
4. Operation and maintenance data.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. Comply with NEMA UC 2, "Undercarpet Power Distribution Systems" and with NFPA 70.

1.2 PRODUCTS

A. Power Distribution Cable

1. Cable: Factory laminated and complying with NEMA UC 2; three-piece assembly including bottom shield, conductor assembly, and top shield.
 - a. Bottom Shield: Abrasion resistant, nonmetallic **OR** Metallic, **as directed**.
 - b. Conductor Assembly: Two **OR** Three **OR** Four, **as directed**, -wire branch circuit with insulated ground, **as directed**.
 - c. Top Shield: Copper or copper alloy.
2. Current Rating: 20 **OR** 30 **OR** 20 and 30, **as directed**, A.

B. Communication And Data Cable

1. Category 5e Communication and Data Cable: Extruded-vinyl jacket over 4 unshielded, twisted pairs, No. 24 AWG, copper; complying with TIA/EIA 568-B; and tested to 300-lb (136-kg) rollover test.

C. Pedestals

1. Description: Manufacturer's standard low **OR** regular, **as directed**, -profile type, single **OR** two **OR** three, **as directed**, gang with single **OR** duplex, **as directed**, receptacles and Category 5e modular connectors, **as directed**.
 - a. Pedestal Colors: As selected from manufacturer's full range.

D. Power Cable Transition Unit



1. Description: Interface transition unit, with junction box, for connecting three-, four-, or five-conductor, flat-conductor cable to building wiring system.

E. Communication And Data Cable Transition Unit

1. Description: Category 5 transition termination circuit board in wall-mounted box to convert round incoming cable to outgoing flat-undercarpet cable.

1.3 EXECUTION

A. Installation

1. Do not begin installation until heavy construction is completed and wheeled traffic is no longer a threat.
2. Do not stack cables in circulation routes.
3. Limit total installed height to 0.09 inch (2.29 mm).
4. Install cables in proper order with power-transmission cable first, followed by telephone cable and then data cable. Cross cables at 90-degree angles.
5. Install undercarpet cables and accessories using special tools as recommended by undercarpet cable manufacturer.

B. Connections

1. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
2. Connect undercarpet cable and components to branch circuits and to ground as indicated and instructed by manufacturer.

C. Field Quality Control

1. Perform tests and inspections and prepare test reports.
2. Tests and Inspections:
 - a. Branch-Circuit Cables: After cables have been installed and energized, perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - b. Communication and Data Cables: After cables have been installed and connected between telecommunications outlet and system cross-connect panel, test each cable according to TIA/EIA TSB67. Certify compliance with test parameters.
3. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 26 05 13 00a



SECTION 26 05 13 00b - MEDIUM-VOLTAGE CABLES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of medium-voltage cables. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes cables and related splices, terminations, and accessories for medium-voltage electrical distribution systems.

C. Definitions

1. NETA ATS: Acceptance Testing Specification.

D. Submittals

1. Product Data: For each type of cable indicated. Include splices and terminations for cables and cable accessories.
2. Field quality-control test reports.

E. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. Comply with IEEE C2 and NFPA 70.

1.2 PRODUCTS

A. Cables

1. Cable Type: MV90 **OR** MV105, **as directed**.
2. Comply with UL 1072, AEIC CS 8, ICEA S-93-639, and ICEA S-97-682, **OR** ICEA S-94-649, **as directed**.
3. Conductor: Copper **OR** Aluminum, **as directed**.
4. Conductor Stranding: Compact round, concentric lay, Class B) **OR** Concentric lay, Class B, **as directed**.
5. Strand Filling: Conductor interstices are filled with impermeable compound.
6. Conductor Insulation: Crosslinked polyethylene **OR** Ethylene-propylene rubber, **as directed**.
 - a. Voltage Rating: 5 **OR** 8 **OR** 15 **OR** 25 **OR** 35, **as directed**, kV.
 - b. Insulation Thickness: 100 **OR** 133, **as directed**, percent insulation level.
7. Shielding: Copper tape **OR** Solid copper wires, **as directed**, helically applied over semiconducting insulation shield.
8. Shielding and Jacket: Corrugated copper drain wires embedded in extruded, chlorinated, polyethylene jacket.
9. Three-Conductor Cable Assembly: Three insulated, shielded conductors cabled together with ground conductors, **as directed**.
 - a. Circuit Identification: Color-coded tape (black, red, blue) under the metallic shielding.
10. Cable Armor: Interlocked aluminum **OR** Interlocked galvanized steel **OR** Corrugated aluminum tube, **as directed**, applied over cable.
11. Cable Jacket: Sunlight-resistant PVC **OR** Chlorosulfonated polyethylene, CPE, **as directed**.

B. Splice Kits



1. Connectors and Splice Kits: Comply with IEEE 404; type as recommended by cable or splicing kit manufacturer for the application.
2. Splicing Products: As recommended, in writing, by splicing kit manufacturer for specific sizes, ratings, and configurations of cable conductors. Include all components required for complete splice, with detailed instructions.
 - a. Combination tape and cold-shrink-rubber sleeve kit with re-jacketing by cast-epoxy-resin encasement or other waterproof, abrasion-resistant material.
 - b. Heat-shrink splicing kit of uniform, cross-section, polymeric construction with outer heat-shrink jacket.
 - c. Premolded, cold-shrink-rubber, in-line splicing kit.
 - d. Premolded EPDM splicing body kit with cable joint sealed by interference fit of mating parts and cable.

C. Solid Terminations

1. Multiconductor Cable Sheath Seals: Type recommended by seal manufacturer for type of cable and installation conditions, including orientation.
 - a. Compound-filled, cast-metal body, metal-clad cable terminator for metal-clad cable with **OR** without, **as directed**, external plastic jacket.
 - b. Cold-shrink sheath seal kit with preformed sleeve openings sized for cable and insulated conductors.
 - c. Heat-shrink sheath seal kit with phase- and ground-conductor re-jacketing tubes, cable-end sealing boot, and sealing plugs for unused ground-wire openings in boot.
 - d. Cast-epoxy-resin sheath seal kit with wraparound mold and packaged, two-part, epoxy-resin casting material.
2. Shielded-Cable Terminations: Comply with the following classes of IEEE 48. Insulation class is equivalent to that of cable. Include shield ground strap for shielded cable terminations.
 - a. Class 1 Terminations: Modular type, furnished as a kit, with stress-relief tube; multiple, molded-silicone rubber, insulator modules; shield ground strap; and compression-type connector.
 - b. Class 1 Terminations: Heat-shrink type with heat-shrink inner stress control and outer nontracking tubes; multiple, molded, nontracking skirt modules; and compression-type connector.
 - c. Class 1 Terminations: Modular type, furnished as a kit, with stress-relief shield terminator; multiple-wet-process, porcelain, insulator modules; shield ground strap; and compression-type connector.
 - d. Class 1 Terminations, Indoors: Kit with stress-relief tube, nontracking insulator tube, shield ground strap, compression-type connector, and end seal.
 - e. Class 2 Terminations, Indoors: Kit with stress-relief tube, nontracking insulator tube, shield ground strap, and compression-type connector. Include silicone-rubber tape, cold-shrink-rubber sleeve, or heat-shrink plastic-sleeve moisture seal for end of insulation whether or not supplied with kits.
 - f. Class 3 Terminations: Kit with stress cone and compression-type connector.
3. Nonshielded-Cable Terminations: Kit with compression-type connector. Include silicone-rubber tape, cold-shrink-rubber sleeve, or heat-shrink plastic-sleeve moisture seal for end of insulation whether or not supplied with kits.

D. Separable Insulated Connectors

1. Description: Modular system, complying with IEEE 386, with disconnecting, single-pole, cable terminators and with matching, stationary, plug-in, dead-front terminals designed for cable voltage and for sealing against moisture.
2. Terminations at Distribution Points: Modular type, consisting of terminators installed on cables and modular, dead-front, terminal junctions for interconnecting cables.
3. Load-Break Cable Terminators: Elbow-type units with 200-A load make/break and continuous-current rating; coordinated with insulation diameter, conductor size, and material of cable being terminated. Include test point on terminator body that is capacitance coupled.



4. Dead-Break Cable Terminators: Elbow-type unit with 600-A continuous-current rating; designed for de-energized disconnecting and connecting; coordinated with insulation diameter, conductor size, and material of cable being terminated. Include test point on terminator body that is capacitance coupled.
5. Dead-Front Terminal Junctions: Modular bracket-mounted groups of dead-front stationary terminals that mate and match with above cable terminators. Two-, three-, or four-terminal units as indicated, with fully rated, insulated, watertight conductor connection between terminals and complete with grounding lug, manufacturer's standard accessory stands, stainless-steel mounting brackets, and attaching hardware.
 - a. Protective Cap: Insulating, electrostatic-shielding, water-sealing cap with drain wire.
 - b. Portable Feed-Through Accessory: Two-terminal, dead-front junction arranged for removable mounting on accessory stand of stationary terminal junction.
 - c. Grounding Kit: Jumpered elbows, portable feed-through accessory units, protective caps, test rods suitable for concurrently grounding three phases of feeders, and carrying case.
 - d. Standoff Insulator: Portable, single dead-front terminal for removable mounting on accessory stand of stationary terminal junction. Insulators suitable for fully insulated isolation of energized cable-elbow terminator.
6. Test-Point Fault Indicators: Applicable current-trip ratings and arranged for installation in test points of load-break separable connectors, and complete with self-resetting indicators capable of being installed with shotgun hot stick and tested with test tool.
7. Tool Set: Shotgun hot stick with energized terminal indicator, fault-indicator test tool, and carrying case.

E. Arc-Proofing Materials

1. Tape for First Course on Metal Objects: 10-mil- (250-micrometer-) thick, corrosion-protective, moisture-resistant, PVC pipe-wrapping tape.
2. Arc-Proofing Tape: Fireproof tape, flexible, conformable, intumescent to 0.3 inch (8 mm) thick, compatible with cable jacket.
3. Glass-Cloth Tape: Pressure-sensitive adhesive type, 1/2 inch (13 mm) wide.

F. Fault Indicators

1. Indicators: Automatically **OR** Manually, **as directed**, reset fault indicator with inrush restraint feature, arranged to clamp to cable sheath and provide a display after a fault has occurred in cable. Instrument shall not be affected by heat, moisture, and corrosive conditions and shall be recommended by manufacturer for installation conditions.
2. Resetting Tool: Designed for use with fault indicators, with moisture-resistant storage and carrying case.

G. Source Quality Control

1. Test and inspect cables according to ICEA S-97-682 **OR** ICEA S-94-649, **as directed**, before shipping.
2. Test strand-filled cables for water-penetration resistance according to ICEA T-31-610, using a test pressure of 5 psig (35 kPa).

1.3 EXECUTION

A. Installation

1. Install cables according to IEEE 576.
2. Pull Conductors: Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
 - a. Where necessary, use manufacturer-approved pulling compound or lubricant that will not deteriorate conductor or insulation.
 - b. Use pulling means, including fish tape, cable, rope, and basket-weave cable grips that will not damage cables and raceways. Do not use rope hitches for pulling attachment to cable.



3. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.
 4. Support cables according to Division 26 Section "Common Work Results For Electrical".
 5. Install direct-buried cables on leveled and tamped bed of 3-inch- (75-mm-) thick, clean sand. Separate cables crossing other cables or piping by a minimum of 4 inches (100 mm) of tamped earth. Install permanent markers at ends of cable runs, changes in direction, and buried splices.
 6. Install "buried-cable" warning tape 12 inches (305 mm) above cables.
 7. In manholes, handholes, pull boxes, junction boxes, and cable vaults, train cables around walls by the longest route from entry to exit and support cables at intervals adequate to prevent sag.
 8. Install cable splices at pull points and elsewhere as indicated; use standard kits.
 9. Install terminations at ends of conductors and seal multiconductor cable ends with standard kits.
 10. Install separable insulated-connector components as follows:
 - a. Protective Cap: At each terminal junction, with one on each terminal to which no feeder is indicated to be connected.
 - b. Portable Feed-Through Accessory: Three.
 - c. Standoff Insulator: Three.
 11. Arc Proofing: Unless otherwise indicated, arc proof medium-voltage cable at locations not protected by conduit, cable tray, direct burial, or termination materials. In addition to arc-proofing tape manufacturer's written instructions, apply arc proofing as follows:
 - a. Clean cable sheath.
 - b. Wrap metallic cable components with 10-mil (250-micrometer) pipe-wrapping tape.
 - c. Smooth surface contours with electrical insulation putty.
 - d. Apply arc-proofing tape in one half-lapped layer with coated side toward cable.
 - e. Band arc-proofing tape with 1-inch- (25-mm-) wide bands of half-lapped, adhesive, glass-cloth tape 2 inches (50 mm) o.c.
 12. Seal around cables passing through fire-rated elements according to Division 07 Section "Penetration Firestopping".
 13. Install fault indicators on each phase where indicated.
 14. Ground shields of shielded cable at terminations, splices, and separable insulated connectors. Ground metal bodies of terminators, splices, cable and separable insulated-connector fittings, and hardware.
 15. Identify cables according to Division 26 Section "Identification For Electrical Systems".
- B. Field Quality Control
1. Perform the following field tests and inspections and prepare test reports:
 - a. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters.
 - b. After installing medium-voltage cables and before electrical circuitry has been energized, test for compliance with requirements.
 2. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 26 05 13 00b



SECTION 26 05 19 16 - COMMON WORK RESULTS FOR ELECTRICAL

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for common work results for electrical. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Electrical equipment coordination and installation.
 - b. Sleeves for raceways and cables.
 - c. Sleeve seals.
 - d. Grout.
 - e. Common electrical installation requirements.

C. Definitions

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

D. Submittals

1. Product Data: For sleeve seals.

1.2 PRODUCTS

A. Sleeves For Raceways And Cables

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
3. Sleeves for Rectangular Openings: Galvanized sheet steel.
 - a. Minimum Metal Thickness:
 - 1) For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
 - 2) For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

B. Sleeve Seals

1. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 - a. Sealing Elements: EPDM **OR** NBR, **as directed**, interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 - b. Pressure Plates: Plastic **OR** Carbon steel **OR** Stainless steel, **as directed**. Include two for each sealing element.
 - c. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating **OR** Stainless steel, **as directed**, of length required to secure pressure plates to sealing elements. Include one for each sealing element.

C. Grout



1. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

1.3 EXECUTION

A. Common Requirements For Electrical Installation

1. Comply with NECA 1.
2. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
3. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
4. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
5. Right of Way: Give to piping systems installed at a required slope.

B. Sleeve Installation For Electrical Penetrations

1. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
2. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
3. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
4. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
5. Cut sleeves to length for mounting flush with both surfaces of walls.
6. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.
7. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable, unless indicated otherwise.
8. Seal space outside of sleeves with grout for penetrations of concrete and masonry
 - a. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
9. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants".
10. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping".
11. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
12. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel **OR** cast-iron, **as directed**, pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
13. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

C. Sleeve-Seal Installation

1. Install to seal exterior wall penetrations.
2. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve



seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

D. Firestopping

1. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping".

END OF SECTION 26 05 19 16



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SECTION 26 05 19 16a - COMMON WORK RESULTS FOR COMMUNICATIONS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for common work results for communications. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Communications equipment coordination and installation.
 - b. Sleeves for pathways and cables.
 - c. Sleeve seals.
 - d. Grout.
 - e. Common communications installation requirements.

C. Definitions

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

D. Submittals

1. Product Data: For sleeve seals.

1.2 PRODUCTS

A. Sleeves For Pathways And Cables

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
3. Sleeves for Rectangular Openings: Galvanized sheet steel.
 - a. Minimum Metal Thickness:
 - 1) For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
 - 2) For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

B. Sleeve Seals

1. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and pathway or cable.
 - a. Sealing Elements: EPDM **OR** NBR, **as directed**, interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of pathway or cable.
 - b. Pressure Plates: Plastic **OR** Carbon steel **OR** Stainless steel, **as directed**. Include two for each sealing element.
 - c. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating **OR** Stainless steel, **as directed**, of length required to secure pressure plates to sealing elements. Include one for each sealing element.

C. Grout



1. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

1.3 EXECUTION

A. Common Requirements For Communications Installation

1. Comply with NECA 1.
2. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
3. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
4. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both communications equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
5. Right of Way: Give to piping systems installed at a required slope.

B. Sleeve Installation For Communications Penetrations

1. Communications penetrations occur when pathways, cables, wireways, or cable trays penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
2. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
3. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
4. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
5. Cut sleeves to length for mounting flush with both surfaces of walls.
6. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.
7. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pathway or cable, unless indicated otherwise.
8. Seal space outside of sleeves with grout for penetrations of concrete and masonry
 - a. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
9. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and pathway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants".
10. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pathway and cable penetrations. Install sleeves and seal pathway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping".
11. Roof-Penetration Sleeves: Seal penetration of individual pathways and cables with flexible boot-type flashing units applied in coordination with roofing work.
12. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel **OR** cast-iron, **as directed**, pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
13. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between pathway or cable and sleeve for installing mechanical sleeve seals.

C. Sleeve-Seal Installation

1. Install to seal exterior wall penetrations.
2. Use type and number of sealing elements recommended by manufacturer for pathway or cable material and size. Position pathway or cable in center of sleeve. Assemble mechanical sleeve



seals and install in annular space between pathway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

D. Firestopping

1. Apply firestopping to penetrations of fire-rated floor and wall assemblies for communications installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping".

END OF SECTION 26 05 19 16a



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SECTION 26 05 19 16b - COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for common work results for electronic safety and security. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Electronic safety and security equipment coordination and installation.
 - b. Sleeves for raceways and cables.
 - c. Sleeve seals.
 - d. Grout.
 - e. Common electronic safety and security installation requirements.

C. Definitions

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

D. Submittals

1. Product Data: For sleeve seals.

1.2 PRODUCTS

A. Sleeves For Raceways And Cables

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
3. Sleeves for Rectangular Openings: Galvanized sheet steel.
 - a. Minimum Metal Thickness:
 - 1) For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
 - 2) For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

B. Sleeve Seals

1. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 - a. Sealing Elements: EPDM **OR** NBR, **as directed**, interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 - b. Pressure Plates: Plastic **OR** Carbon steel **OR** Stainless steel, **as directed**. Include two for each sealing element.
 - c. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating **OR** Stainless steel, **as directed**, of length required to secure pressure plates to sealing elements. Include one for each sealing element.

C. Grout



1. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

1.3 EXECUTION

A. Common Requirements For Electronic Safety And Security Installation

1. Comply with NECA 1.
2. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
3. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
4. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electronic safety and security equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
5. Right of Way: Give to piping systems installed at a required slope.

B. Sleeve Installation For Electronic Safety And Security Penetrations

1. Electronic safety and security penetrations occur when raceways, pathways, cables, wireways, or cable trays penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
2. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
3. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
4. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
5. Cut sleeves to length for mounting flush with both surfaces of walls.
6. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.
7. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable, unless indicated otherwise.
8. Seal space outside of sleeves with grout for penetrations of concrete and masonry
 - a. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
9. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants".
10. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping".
11. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
12. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel **OR** cast-iron, **as directed**, pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
13. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

C. Sleeve-Seal Installation

1. Install to seal exterior wall penetrations.



-
2. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- D. Firestopping
1. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electronic safety and security installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping".

END OF SECTION 26 05 19 16b



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SECTION 26 05 19 16c - ELECTRICAL RENOVATION

DESCRIPTION OF WORK

This specification covers the furnishing and installation of materials for electrical renovation. Products shall be as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

GENERAL

Quality Assurance

1. Regulatory Requirements: Comply with following:
 - a. Electrical: National Fire Protection Association (NFPA): NFPA 70 - National Electrical Code (NEC).
 - b. Accessibility:
 - 1) Architectural Barriers Act of 1968 as amended (42 USC 4152-4157) and HUD implementing regulations (24 CFR Part 40).
 - a) Uniform Federal Accessibility Standards (UFAS).
 - 2) Section 504 of the Rehabilitation Act of 1973 as amended (29 USC 794) and HUD implementing regulations 24 CFR Part 8.
 - 3) Fair Housing Accessibility Guidelines (24 CFR Chapter 1).
 - 4) Americans with Disabilities Act of 1990 (ADA) (28 CFR Part 35).

Project Conditions

2. Existing Conditions: Buildings will be occupied during construction. See Division 1 Section "Summary of Work." Do not interfere with use of occupied portions of building. Maintain free and safe passage to and from occupied areas.

Scheduling And Sequencing

3. Scheduling and Completion: Comply with requirements of Detailed Scope of Work.

Alterations, Cutting And Protection

4. Protection: Protect existing finishes, equipment, utilities and adjacent work, which is scheduled to remain, from damage.
5. Existing Operating Facilities: Confine operations to immediate vicinity of new work and do not interfere with or obstruct ingress or egress to and from adjacent facilities.

PRODUCTS

Materials

6. Electrical Materials and Devices: Comply with NFPA 70 (NEC):
 - a. Boxes: Galvanized steel, not less than 1.6 mm (0.0625 inch) thickness (NEC 370-20) grounded in accordance with NEC, Article 250, suitable for recess mounting.
 - 1) Provide boxes of appropriate shape and size for intended purpose.
 - b. Devices:
 - 1) Duplex Receptacles: 15 A or 20 A 115 V, UL Listed with screw side connections and corrugated bearing pads.
 - a) GFIC Outlets: 115 V, 60 Hz, 15/20 A rating, UL Listed.
 - 2) Switches: 15 A, 115 V, single pole, single throw switch, UL Listed, with side screw connections and corrugated bearing pads.



- a) Garbage Disposal: Heavy duty, 120/277 VAC, 60 Hz, single pole, single throw, 20 A rate, UL listed and CSA certified.
- 3) Cover Plates: Smooth plastic in color to match existing.
- c. Wiring: Insulated wire, Type NM 600 V with ground wire, sized as appropriate for intended purpose and in accordance with NEC.
 - 1) Aluminum Wire: Not allowed unless existing wiring is aluminum.
 - 2) Provide necessary fittings in accordance with NEC.

EXECUTION

Examination

- 7. Units, Spaces and Areas to be Renovated: Inspect to become familiar with existing conditions and to take measurements which are necessary for renovation work to be completed in accordance with contract requirements.
 - a. Carefully inspect condition of existing spaces including, but not limited to walls, floors, plumbing, electrical, etc. as essential to successful completion of renovation work.
 - b. Survey each space and verify dimensions for work.

Preparation

- 8. Building Occupation: Carry out renovation work to cause as little inconvenience to occupants as possible. See Division 1 Section "Summary of Work."
- 9. Protection: Protect and be responsible for existing buildings, facilities, utilities, and improvements within areas of construction operations.
 - a. Tenant's Property: Be responsible for any damage or loss to residents' property and to other work. Replace any material, which, in opinion of the Owner, has become damaged to extent that it could not be restored to its original condition.
 - b. Take precautions to protect residents and public from injury from construction operations.

Laying Out Work

- 10. Discrepancies: Verify dimensions and elevations indicated in layout of existing work.
 - a. Prior to commencing work, carefully compare and check Drawings (if any), for discrepancies in locations or elevations of work to be executed.
 - b. Refer discrepancies among Drawings (if any), Specifications and existing conditions to the Owner for adjustment before work affected is performed.
 - 1) Failure to make such notification shall place responsibility on Contractor to carry out work in satisfactory, workmanlike manner.
- 11. Contractor: Responsible for location and elevation of construction contemplated by Construction Documents.

Location Of Equipment And Piping

- 12. Drawings (if any) indicating location of equipment, piping, ductwork, etc. are diagrammatic and job conditions shall not always permit their installation in location shown. When this situation occurs, bring condition to the Owner's attention immediately. Relocation will be determined in joint conference.
- 13. Contractor: Do not relocate any items without first obtaining the Owner's acceptance. Remove and relocate such relocated items at own expense if so directed.

Electrical Work

- 14. General: Install boxes, wiring, and devices as indicated and required to connect and control electrical devices in accordance with NFPA 70 (NEC).
 - a. Boxes: Solidly anchor to framing or blocking.
- 15. Removing Electrical Switch or Duplex Outlet (Non-Hazardous Locations):
 - a. Box to Remain:
 - 1) Remove electrical device; cap hot and neutral with set-screw wire connectors.



- 2) Attach ground wire to remaining box with solid screw attachment.
- 3) Provide and install natural finish aluminum blank cover plate with screw fasteners integral to match size of box remaining.
- b. Box to be removed:
 - 1) Remove electrical device and box and pull wire out of wall back to first circuit panel, disconnecting from circuit panel.
 - 2) Patch and repair hole in partition to match existing.
16. Garbage Disposal Electrical Hook-up: See Section "Plumbing." Comply with NFPA 70 (NEC):
 - a. Wiring: Install from disposal through concealed spaces to house panel, anchoring wire, and providing necessary fittings.
 - b. Switch: Install above counter top backsplash.
17. Range Hood Electrical Hook-up: See Section "Residential Appliances." Comply with NFPA 70 (NEC):
 - a. Electric service: Install insulated wire from range hood through concealed spaces to house panel, anchoring wire, and providing necessary fittings.
18. Water Heater Electrical Hook-up: See Division 15 Section "Domestic Water Heaters." Comply with NFPA 70 (NEC).
19. Furnace Electrical Hook-up: See Section "Furnaces." Comply with NFPA 70 (NEC).
20. Smoke Detector Electrical Hook-up: See "Fire Alarm." Comply with NFPA 70 (NEC).

Integrating Existing Work

21. Protection: Protect existing improvements from damage.
 - a. Where new work is to be connected to existing work, exercise special care not to disturb or damage existing work more than necessary.
 - b. Damaged Work: Replace, repair and restored to its original condition at no cost to the Owner.

END OF SECTION 26 05 19 16c



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SECTION 26 05 19 16d - CONTROL-VOLTAGE ELECTRICAL POWER CABLES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of control-voltage electrical power cables. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. UTP cabling.
 - b. 50/125 **OR** 62.5/125, **as directed**,-micrometer, multimode optical fiber cabling.
 - c. RS-232 cabling.
 - d. RS-485 cabling.
 - e. Low-voltage control cabling.
 - f. Control-circuit conductors.
 - g. Identification products.

C. Definitions

1. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.
2. Channel Cable Tray: A fabricated structure consisting of a one-piece, ventilated-bottom or solid-bottom channel section.
3. EMI: Electromagnetic interference.
4. IDC: Insulation displacement connector.
5. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).
6. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.
7. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).
8. RCDD: Registered Communications Distribution Designer.
9. Solid-Bottom or Nonventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal side rails, and a bottom without ventilation openings.
10. Trough or Ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal rails and a bottom having openings sufficient for the passage of air and using 75 percent or less of the plan area of the surface to support cables.
11. UTP: Unshielded twisted pair.

D. Submittals

1. Product Data: For each type of product indicated.
2. Field quality-control reports.
3. Maintenance data.

E. Quality Assurance

1. Testing Agency Qualifications: Member company of an NRTL.
 - a. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.
2. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 50 **OR** 450, **as directed**, or less.



3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Delivery, Storage, And Handling

1. Test cables upon receipt at Project site.
 - a. Test optical fiber cable to determine the continuity of the strand end to end. Use optical fiber flashlight **OR** optical loss test set, **as directed**.
 - b. Test optical fiber cable on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector; include the loss value of each. Retain test data and include the record in maintenance data.
 - c. Test each pair of UTP cable for open and short circuits.

1.2 PRODUCTS

A. Pathways

1. Support of Open Cabling: NRTL labeled for support of Category 5e **OR** Category 6, **as directed**, cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
 - a. Support brackets with cable tie slots for fastening cable ties to brackets.
 - b. Lacing bars, spools, J-hooks, and D-rings.
 - c. Straps and other devices.
2. Cable Trays:
 - a. Cable Tray Materials: Metal, suitable for indoors and protected against corrosion by electroplated zinc galvanizing, complying with ASTM B 633, Type 1, not less than 0.000472 inch (0.012 mm) thick **OR** hot-dip galvanizing, complying with ASTM A 123/A 123M, Grade 0.55, not less than 0.002165 inch (0.055 mm) thick, **as directed**.
 - 1) Basket Cable Trays: 6 inches (150 mm) wide and 2 inches (50 mm) deep. Wire mesh spacing shall not exceed 2 by 4 inches (50 by 100 mm).
 - 2) Trough or Ventilated Cable Trays: Nominally 6 inches (150 mm) wide.
 - 3) Ladder Cable Trays: Nominally 18 inches (455 mm) wide, and a rung spacing of 12 inches (305 mm).
 - 4) Channel Cable Trays: One-piece construction, nominally 4 inches (100 mm) wide. Slot spacing shall not exceed 4-1/2 inches (115 mm) o.c.
 - 5) Solid-Bottom or Nonventilated Cable Trays: One-piece construction, nominally 12 inches (305 mm) wide. Provide with **OR** without, **as directed**, solid covers.
3. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway And Boxes For Electrical Systems". Flexible metal conduit shall not be used, **as directed**.
 - a. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

B. Backboards

1. Description: Plywood, fire-retardant treated, **as directed**, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements for plywood backing panels in Division 06 Section "Rough Carpentry".

C. UTP Cable

1. Description: 100-ohm, four-pair UTP, formed into 25-pair binder groups covered with a blue thermoplastic jacket, **as directed**.
 - a. Comply with ICEA S-90-661 for mechanical properties.
 - b. Comply with TIA/EIA-568-B.1 for performance specifications.
 - c. Comply with TIA/EIA-568-B.2, Category 5e **OR** Category 6, **as directed**.
 - d. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:



- 1) Communications, General Purpose: Type CM or Type CMG; or Type MPP, Type CMP, Type MPR, Type CMR, Type MP, or Type MPG, **as directed**.
 - 2) Communications, Plenum Rated: Type CMP or Type MPP, **as directed**, complying with NFPA 262.
 - 3) Communications, Riser Rated: Type CMR; or Type MPP, Type CMP, or Type MPR, **as directed**; complying with UL 1666.
 - 4) Communications, Limited Purpose: Type CMX; or Type MPP, Type CMP, Type MPR, Type CMR, Type MP, Type MPG, Type CM, or Type CMG, **as directed**.
 - 5) Multipurpose: Type MP or Type MPG; or Type MPP or Type MPR, **as directed**.
 - 6) Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
 - 7) Multipurpose, Riser Rated: Type MPR or Type MPP, **as directed**, complying with UL 1666.
- D. UTP Cable Hardware
1. UTP Cable Connecting Hardware: IDC type, using modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of the same category or higher.
 2. Connecting Blocks: 110 style for Category 5e **OR** 110 style for Category 6 **OR** 66 style for Category 5e, **as directed**. Provide blocks for the number of cables terminated on the block, plus 25 percent spare; integral with connector bodies, including plugs and jacks where indicated.
- E. Optical Fiber Cable
1. Description: Multimode, 50/125 **OR** 62.5/125, **as directed**,-micrometer, 24-fiber, nonconductive, **as directed**, tight buffer, optical fiber cable.
 - a. Comply with ICEA S-83-596 for mechanical properties.
 - b. Comply with TIA/EIA-568-B.3 for performance specifications.
 - c. Comply with TIA/EIA-492AAAA-B **OR** TIA/EIA-492AAAA-A, **as directed**, for detailed specifications.
 - d. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:
 - 1) General Purpose, Nonconductive: Type OFN or OFNG, or Type OFNR or Type OFNP, **as directed**.
 - 2) Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
 - 3) Riser Rated, Nonconductive: Type OFNR or Type OFNP, **as directed**, complying with UL 1666.
 - 4) General Purpose, Conductive: Type OFC or Type OFCG; or Type OFNG, Type OFN, Type OFCR, Type OFNR, Type OFCP, or Type OFNP, **as directed**.
 - 5) Plenum Rated, Conductive: Type OFCP or Type OFNP, **as directed**, complying with NFPA 262.
 - 6) Riser Rated, Conductive: Type OFCR; or Type OFNR, Type OFCP, or Type OFNP, **as directed**; complying with UL 1666.
 - e. Conductive cable shall be steel **OR** aluminum, **as directed**,-armored type.
 - f. Maximum Attenuation: 3.5 dB/km at 850 nm; 1.5 dB/km at 1300 nm.
 - g. Minimum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz-km at 1300 nm.
 2. Jacket:
 - a. Jacket Color: Aqua for 50/125 **OR** Orange for 62.5/125, **as directed**,-micrometer cable.
 - b. Cable cordage jacket, fiber, unit, and group color shall be according to TIA/EIA-598-B.
 - c. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).
- F. Optical Fiber Cable Hardware
1. Cable Connecting Hardware: Comply with the Fiber Optic Connector Intermateability Standards (FOCIS) specifications of TIA/EIA-604-2, TIA/EIA-604-3-A, and TIA/EIA-604-12. Comply with TIA/EIA-568-B.3.
 - a. Quick-connect, simplex and duplex, Type SC **OR** Type ST **OR** Type LC **OR** Type MT-RJ, **as directed**, connectors. Insertion loss not more than 0.75 dB.
 - b. Type SFF connectors may be used in termination racks, panels, and equipment packages.



- G. RS-232 Cable
1. Standard Cable: NFPA 70, Type CM.
 - a. Paired, two pairs, No. 22 AWG, stranded (7x30) tinned-copper conductors.
 - b. Polypropylene insulation.
 - c. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
 - d. PVC jacket.
 - e. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned-copper drain wire.
 - f. Flame Resistance: Comply with UL 1581.
 2. Plenum-Rated Cable: NFPA 70, Type CMP.
 - a. Paired, two pairs, No. 22 AWG, stranded (7x30) tinned-copper conductors.
 - b. Plastic insulation.
 - c. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
 - d. Plastic jacket.
 - e. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned-copper drain wire.
 - f. Flame Resistance: Comply with NFPA 262.
- H. RS-485 Cable
1. Standard Cable: NFPA 70, Type CM or Type CMG, **as directed**.
 - a. Paired, two pairs, twisted, No. 22 AWG, stranded (7x30) tinned-copper conductors.
 - b. PVC insulation.
 - c. Unshielded.
 - d. PVC jacket.
 - e. Flame Resistance: Comply with UL 1581.
 2. Plenum-Rated Cable: NFPA 70, Type CMP.
 - a. Paired, two pairs, No. 22 AWG, stranded (7x30) tinned-copper conductors.
 - b. Fluorinated ethylene propylene insulation.
 - c. Unshielded.
 - d. Fluorinated ethylene propylene jacket.
 - e. Flame Resistance: NFPA 262, Flame Test.
- I. Low-Voltage Control Cable
1. Paired Cable: NFPA 70, Type CMG.
 - a. One pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.
 - b. PVC insulation.
 - c. Unshielded.
 - d. PVC jacket.
 - e. Flame Resistance: Comply with UL 1581.
 2. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.
 - a. One pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.
 - b. PVC insulation.
 - c. Unshielded.
 - d. PVC jacket.
 - e. Flame Resistance: Comply with NFPA 262.
 3. Paired Cable: NFPA 70, Type CMG.
 - a. One pair, twisted, No. 18 AWG, stranded (19x30) tinned-copper conductors.
 - b. PVC insulation.
 - c. Unshielded.
 - d. PVC jacket.
 - e. Flame Resistance: Comply with UL 1581.
 4. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.
 - a. One pair, twisted, No. 18 AWG, stranded (19x30) tinned-copper conductors.
 - b. Fluorinated ethylene propylene insulation.
 - c. Unshielded.



- d. Plastic jacket.
- e. Flame Resistance: NFPA 262, Flame Test.

J. Control-Circuit Conductors

- 1. Class 1 Control Circuits: Stranded copper, Type THHN-THWN **OR** Type XHHN, **as directed**, in raceway, complying with UL 83 **OR** UL 44, **as directed**.
- 2. Class 2 Control Circuits: Stranded copper, Type THHN-THWN, in raceway **OR** Type XHHN, in raceway **OR** power-limited cable, concealed in building finishes **OR** power-limited tray cable, in cable tray, **as directed**, complying with UL 83 **OR** UL 44, **as directed**.
- 3. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or Type TF, complying with UL 83.

K. Identification Products

- 1. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- 2. Comply with requirements in Division 26 Section "Identification For Electrical Systems".

L. Source Quality Control

- 1. Testing Agency: Engage a qualified testing agency to evaluate cables.
- 2. Factory test UTP and optical fiber cables on reels according to TIA/EIA-568-B.1.
- 3. Factory test UTP cables according to TIA/EIA-568-B.2.
- 4. Factory test multimode optical fiber cables according to TIA/EIA-526-14-A and TIA/EIA-568-B.3.
- 5. Cable will be considered defective if it does not pass tests and inspections.
- 6. Prepare test and inspection reports.

1.3 EXECUTION

A. Installation Of Pathways

- 1. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.
- 2. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.
- 3. Comply with requirements in Division 26 Section "Raceway And Boxes For Electrical Systems" for installation of conduits and wireways.
- 4. Install manufactured conduit sweeps and long-radius elbows if possible.
- 5. Pathway Installation in Equipment Rooms:
 - a. Position conduit ends adjacent to a corner on backboard if a single piece of plywood is installed or in the corner of room if multiple sheets of plywood are installed around perimeter walls of room.
 - b. Install cable trays to route cables if conduits cannot be located in these positions.
 - c. Secure conduits to backboard if entering room from overhead.
 - d. Extend conduits 3 inches (75 mm) above finished floor.
 - e. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.
- 6. Backboards: Install backboards with 96-inch (2440-mm) dimension vertical. Butt adjacent sheets tightly and form smooth gap-free corners and joints.

B. Installation Of Conductors And Cables

- 1. Comply with NECA 1.
- 2. General Requirements for Cabling:
 - a. Comply with TIA/EIA-568-B.1.
 - b. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
 - c. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.



- d. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 - e. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
 - f. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
 - g. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
 - h. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
3. UTP Cable Installation:
 - a. Comply with TIA/EIA-568-B.2.
 - b. Install 110-style IDC termination hardware unless otherwise indicated.
 - c. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.
 4. Installation of Control-Circuit Conductors:
 - a. Install wiring in raceways. Comply with requirements specified in Division 26 Section "Raceway And Boxes For Electrical Systems".
 5. Optical Fiber Cable Installation:
 - a. Comply with TIA/EIA-568-B.3.
 - b. Cable shall be terminated on connecting hardware that is rack or cabinet mounted.
 6. Open-Cable Installation:
 - a. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
 - b. Suspend copper cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 60 inches (1525 mm) apart.
 - c. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
 7. Installation of Cable Routed Exposed under Raised Floors:
 - a. Install plenum-rated cable only.
 - b. Install cabling after the flooring system has been installed in raised floor areas.
 - c. Coil cable 72 inches (1830 mm) long shall be neatly coiled not less than 12 inches (305 mm) in diameter below each feed point.
 8. Separation from EMI Sources:
 - a. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
 - b. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
 - 1) Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
 - 2) Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (305 mm).
 - 3) Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (600 mm).
 - c. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
 - 1) Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
 - 2) Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
 - 3) Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (305 mm).
 - d. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:



- 1) Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - 2) Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (75 mm).
 - 3) Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
 - e. Separation between Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
 - f. Separation between Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).
- C. Removal Of Conductors And Cables
1. Remove abandoned conductors and cables.
- D. Control-Circuit Conductors
1. Minimum Conductor Sizes:
 - a. Class 1 remote-control and signal circuits, No 14 AWG.
 - b. Class 2 low-energy, remote-control, and signal circuits, No. 16 AWG.
 - c. Class 3 low-energy, remote-control, alarm, and signal circuits, No 12 AWG.
- E. Firestopping
1. Comply with requirements in Division 07 Section "Penetration Firestopping".
 2. Comply with TIA/EIA-569-A, Annex A, "Firestopping."
 3. Comply with BICSI TDMM, "Firestopping Systems" Article.
- F. Grounding
1. For data communication wiring, comply with ANSI-J-STD-607-A and with BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
 2. For low-voltage wiring and cabling, comply with requirements in Division 26 Section "Grounding And Bonding For Electrical Systems".
- G. Identification
- H. Identify system components, wiring, and cabling according to TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section "Identification For Electrical Systems".
- I. Field Quality Control
1. Perform tests and inspections.
 2. Tests and Inspections:
 - a. Visually inspect UTP and optical fiber cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA/EIA-568-B.1.
 - b. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
 - c. Test UTP cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not after cross connection.
 - 1) Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
 - d. Optical Fiber Cable Tests:
 - 1) Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
 - 2) Link End-to-End Attenuation Tests:
 - a) Multimode Link Measurements: Test at 850 or 1300 nm in one direction according to TIA/EIA-526-14-A, Method B, One Reference Jumper.



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- b) Attenuation test results for links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in TIA/EIA-568-B.1.
 3. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.
 4. End-to-end cabling will be considered defective if it does not pass tests and inspections.
 5. Prepare test and inspection reports.

END OF SECTION 26 05 19 16d



SECTION 26 05 19 16e - COMMUNICATIONS EQUIPMENT ROOM FITTINGS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for communications equipment room fittings. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Telecommunications mounting elements.
 - b. Backboards.
 - c. Telecommunications equipment racks and cabinets.
 - d. Telecommunications service entrance pathways.
 - e. Grounding.

C. Definitions

1. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.
2. BICSI: Building Industry Consulting Service International.
3. Channel Cable Tray: A fabricated structure consisting of a one-piece, ventilated-bottom or solid-bottom channel not exceeding 6 inches (152 mm) in width.
4. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).
5. LAN: Local area network.
6. RCDD: Registered Communications Distribution Designer.
7. Solid-Bottom or Nonventilated Cable Tray: A fabricated structure consisting of a bottom without ventilation openings within integral or separate longitudinal side rails.
8. Trough or Ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal rails and a bottom having openings sufficient for the passage of air and using 75 percent or less of the plan area of the surface to support cables.

D. Performance Requirements

1. Seismic Performance: Floor-mounted cabinets and cable pathways shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

E. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: For communications equipment room fittings. Include plans, elevations, sections, details, and attachments to other work.
 - a. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - b. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
 - c. Grounding: Indicate location of grounding bus bar and its mounting detail showing standoff insulators and wall mounting brackets.
3. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.
4. Seismic Qualification Certificates: For floor-mounted cabinets, accessories, and components, from manufacturer.



- a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
- b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions. Base certification on the maximum number of components capable of being mounted in each rack type. Identify components on which certification is based.
- c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

F. Quality Assurance

1. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
 - a. Layout Responsibility: Preparation of Shop Drawings shall be under the direct supervision of RCDD **OR** RCDD/NTS **OR** Commercial Installer, Level 2, **as directed**.
 - b. Installation Supervision: Installation shall be under the direct supervision of Registered Technician **OR** Level 2 Installer, **as directed**, who shall be present at all times when Work of this Section is performed at Project site.
 - c. Field Inspector: Currently registered by BICSI as RCDD **OR** Commercial Installer, Level 2, **as directed**, to perform the on-site inspection.
2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.
4. Grounding: Comply with ANSI-J-STD-607-A.

G. Project Conditions

1. Environmental Limitations: Do not deliver or install equipment frames and cable trays until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and work above ceilings is complete.

H. Coordination

1. Coordinate layout and installation of communications equipment with the Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier.
 - a. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and the Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
 - b. Record agreements reached in meetings and distribute them to other participants.
 - c. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.
 - d. Adjust arrangements and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in the equipment room.
2. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

1.2 PRODUCTS

A. Pathways

1. General Requirements: Comply with TIA/EIA-569-A.
2. Cable Support: NRTL labeled. Cable support brackets shall be designed to prevent degradation of cable performance and pinch points that could damage cable. Cable tie slots fasten cable ties to brackets.
 - a. Comply with NFPA 70 and UL 2043 for fire-resistant and low-smoke-producing characteristics.



- b. Support brackets with cable tie slots for fastening cable ties to brackets.
 - c. Lacing bars, spools, J-hooks, and D-rings.
 - d. Straps and other devices.
3. Cable Trays:
- a. Cable Tray Materials: Metal, suitable for indoors and protected against corrosion by electroplated zinc galvanizing, complying with ASTM B 633, Type 1, not less than 0.000472 inch (0.012 mm) thick **OR** hot-dip galvanizing, complying with ASTM A 123/A 123M, Grade 0.55, not less than 0.002165 inch (0.055 mm) thick, **as directed**.
 - 1) Basket Cable Trays: 6 inches (150 mm) wide and 2 inches (50 mm) deep. Wire mesh spacing shall not exceed 2 by 4 inches (50 by 100 mm).
 - 2) Trough Cable Trays: Nominally 6 inches (150 mm) wide.
 - 3) Ladder Cable Trays: Nominally 18 inches (455 mm) wide, and a rung spacing of 12 inches (305 mm).
 - 4) Channel Cable Trays: One-piece construction, nominally 4 inches (100 mm) wide. Slot spacing shall not exceed 4-1/2 inches (115 mm) o.c.
 - 5) Solid-Bottom Cable Trays: One-piece construction, nominally 12 inches (305 mm) wide. Provide with **OR** without, **as directed**, solid covers.
4. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway And Boxes For Electrical Systems". Flexible metal conduit shall not be used.
- a. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.
- B. Backboards
- 1. Backboards: Plywood, fire-retardant treated, **as directed**, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements for plywood backing panels specified in Division 06 Section "Rough Carpentry".
- C. Equipment Frames
- 1. General Frame Requirements:
 - a. Distribution Frames: Freestanding and wall-mounting, modular-steel units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
 - b. Module Dimension: Width compatible with EIA 310 standard, 19-inch (480-mm) panel mounting.
 - c. Finish: Manufacturer's standard, baked-polyester powder coat.
 - 2. Floor-Mounted Racks: Modular-type, steel **OR** aluminum, **as directed**, construction.
 - a. Vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug, and a power strip, **as directed**.
 - b. Baked-polyester powder coat finish.
 - 3. Modular Freestanding Cabinets:
 - a. Removable and lockable side panels.
 - b. Hinged and lockable front and rear doors.
 - c. Adjustable feet for leveling.
 - d. Screened ventilation openings in the roof and rear door.
 - e. Cable access provisions in the roof and base.
 - f. Grounding bus bar.
 - g. Rack **OR** Roof, **as directed**, -mounted, 550-cfm (260-L/s) fan with filter.
 - h. Power strip.
 - i. Baked-polyester powder coat finish.
 - j. All cabinets keyed alike.
 - 4. Modular Wall Cabinets:
 - a. Wall mounting.
 - b. Steel **OR** Aluminum, **as directed**, construction.
 - c. Treated to resist corrosion.
 - d. Lockable front and rear doors.



- e. Louvered side panels.
 - f. Cable access provisions top and bottom.
 - g. Grounding lug.
 - h. Rack **OR** Roof, **as directed**, -mounted, 250-cfm (118-L/s) fan.
 - i. Power strip.
 - j. All cabinets keyed alike.
5. Cable Management for Equipment Frames:
- a. Metal, with integral wire retaining fingers.
 - b. Baked-polyester powder coat finish.
 - c. Vertical cable management panels shall have front and rear channels, with covers.
 - d. Provide horizontal crossover cable manager at the top of each relay rack, with a minimum height of two rack units each.

D. Power Strips

- 1. Power Strips: Comply with UL 1363.
 - a. Rack mounting.
 - b. Six, 15-A, 120-V ac, NEMA WD 6, Configuration 5-15R **OR** 20-A, 120-V ac, NEMA WD 6, Configuration 5-20R, **as directed**, receptacles.
 - c. LED indicator lights for power and protection status.
 - d. LED indicator lights for reverse polarity and open outlet ground.
 - e. Circuit Breaker and Thermal Fusing:
 - 1) When protection is lost, circuit opens and cannot be reset.

OR

 - Unit continues to supply power if protection is lost.
 - f. Close-coupled, direct plug-in **OR** Cord connected with 15-foot (4.5-m), **as directed**, line cord.
 - g. Rocker-type on-off switch, illuminated when in on position.
 - h. Peak Single-Impulse Surge Current Rating: 33 **OR** 26 **OR** 13, **as directed**, kA per phase.
 - i. Protection modes shall be line to neutral, line to ground, and neutral to ground. UL 1449 clamping voltage for all 3 modes shall be not more than 330 V.

E. Grounding

- 1. Comply with requirements in Division 26 Section "Grounding And Bonding For Electrical Systems" for grounding conductors and connectors.
- 2. Telecommunications Main Bus Bar:
 - a. Connectors: Mechanical type, cast silicon bronze, solderless compression **OR** exothermic, **as directed**, -type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
 - b. Ground Bus Bar: Copper, minimum 1/4 inch thick by 4 inches wide (6 mm thick by 100 mm wide) with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart.
 - c. Stand-Off Insulators: Comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.
- 3. Comply with ANSI-J-STD-607-A.

F. Labeling

- 1. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

1.3 EXECUTION

A. Entrance Facilities

- 1. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and a housing when so directed by service provider.
- 2. Install underground **OR** buried **OR** aerial, **as directed**, pathways complying with recommendations in TIA/EIA-569-A, "Entrance Facilities" Article.



- a. Install underground **OR** buried, **as directed**, entrance pathway complying with Division 26 Section "Raceway And Boxes For Electrical Systems".

B. Installation

1. Comply with NECA 1.
2. Comply with BICSI TDMM for layout and installation of communications equipment rooms.
3. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.
4. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

C. Firestopping

1. Comply with requirements in Division 07 Section "Penetration Firestopping".
2. Comply with TIA/EIA-569-A, Annex A, "Firestopping."
3. Comply with BICSI TDMM, "Firestopping Systems" Article.

D. Grounding

1. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
2. Comply with ANSI-J-STD-607-A.
3. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
4. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.
 - a. Bond the shield of shielded cable to the grounding bus bar in communications rooms and spaces.

E. Identification

1. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements in Division 26 Section "Identification For Electrical Systems".
2. Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
3. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 2 **OR** Class 3 **OR** Class 4, **as directed**, level of administration including optional identification requirements of this standard, **as directed**.
4. Labels shall be preprinted or computer-printed type.

END OF SECTION 26 05 19 16e



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SECTION 26 05 19 16f - COMMUNICATIONS BACKBONE CABLING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for communications backbone cabling. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Pathways.
 - b. UTP cable.
 - c. 50/125 and 62.5/125-micrometer, optical fiber cabling.
 - d. Coaxial cable.
 - e. Cable connecting hardware, patch panels, and cross-connects.
 - f. Cabling identification products.

C. Definitions

1. BICSI: Building Industry Consulting Service International.
2. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
3. EMI: Electromagnetic interference.
4. IDC: Insulation displacement connector.
5. LAN: Local area network.
6. RCDD: Registered Communications Distribution Designer.
7. UTP: Unshielded twisted pair.

D. Backbone Cabling Description

1. Backbone cabling system shall provide interconnections between communications equipment rooms, main terminal space, and entrance facilities in the telecommunications cabling system structure. Cabling system consists of backbone cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection.
2. Backbone cabling cross-connects may be located in communications equipment rooms or at entrance facilities. Bridged taps and splitters shall not be used as part of backbone cabling.

E. Performance Requirements

1. General Performance: Backbone cabling system shall comply with transmission standards in TIA/EIA-568-B.1, when tested according to test procedures of this standard.

F. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings:
 - a. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by the Owner.
 - b. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
 - c. Cabling administration drawings and printouts.
 - d. Wiring diagrams to show typical wiring schematics including the following:
 - 1) Cross-connects.
 - 2) Patch panels.
 - 3) Patch cords.



- e. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.
- f. Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements.
3. Qualification Data: For Installer, **as directed**, qualified layout technician, installation supervisor, and field inspector.
4. Source quality-control reports.
5. Field quality-control reports.
6. Maintenance Data.
7. Software and Firmware Operational Documentation:
 - a. Software operating and upgrade manuals.
 - b. Program Software Backup: On magnetic media or compact disk, complete with data files.
 - c. Device address list.
 - d. Printout of software application and graphic screens.

G. Quality Assurance

1. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
 - a. Layout Responsibility: Preparation of Shop Drawings, Cabling Administration Drawings, and field testing program development by an RCDD.
 - b. Installation Supervision: Installation shall be under the direct supervision of Registered Technician **OR** Level 2 Installer, **as directed**, who shall be present at all times when Work of this Section is performed at Project site.
2. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 50 **OR** 450, **as directed**, or less.
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
4. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.
5. Grounding: Comply with ANSI-J-STD-607-A.

H. Delivery, Storage, And Handling

1. Test cables upon receipt at Project site.
 - a. Test optical fiber cable to determine the continuity of the strand end to end. Use optical fiber flashlight or optical loss test set.
 - b. Test optical fiber cable while on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector, including the loss value of each. Retain test data and include the record in maintenance data.
 - c. Test each pair of UTP cable for open and short circuits.

I. Software Service Agreement

1. Technical Support: Beginning with Final Completion, provide software support for two years.
2. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Final Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
 - a. Provide 30 days' notice to the Owner to allow scheduling and access to system and to allow the Owner to upgrade computer equipment if necessary.

1.2 PRODUCTS

A. Pathways

1. General Requirements: Comply with TIA/EIA-569-A.



2. Cable Support: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
 - a. Support brackets with cable tie slots for fastening cable ties to brackets.
 - b. Lacing bars, spools, J-hooks, and D-rings.
 - c. Straps and other devices.
 3. Cable Trays:
 - a. Cable Tray Material: Metal, suitable for indoors, and protected against corrosion by electroplated zinc galvanizing, complying with ASTM B 633, Type 1, not less than 0.000472 inches (0.012 mm) thick **OR** hot-dip galvanizing, complying with ASTM A 123/A 123M, Grade 0.55, not less than 0.002165 inches (0.055 mm) thick, **as directed**.
 - 1) Basket Cable Trays: 6 inches (150 mm) wide and 2 inches (50 mm) deep. Wire mesh spacing shall not exceed 2 by 4 inches (50 by 100 mm).
 - 2) Trough Cable Trays: Nominally 6 inches (150 mm) wide.
 - 3) Ladder Cable Trays: Nominally 18 inches (455 mm) wide, and a rung spacing of 12 inches (305 mm).
 - 4) Channel Cable Trays: One-piece construction, nominally 4 inches (100 mm) wide. Slot spacing shall not exceed 4-1/2 inches (115 mm) o.c.
 - 5) Solid-Bottom Cable Trays: One-piece construction, nominally 12 inches (305 mm) wide. Provide with **OR** without, **as directed**, solid covers.
 4. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway And Boxes For Electrical Systems". Flexible metal conduit shall not be used.
 - a. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.
- B. Backboards
1. Backboards: Plywood, fire-retardant treated, **as directed**, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements in Division 06 Section "Rough Carpentry" for plywood backing panels.
- C. UTP Cable
1. Description: 100-ohm, 100-pair UTP, formed into 25-pair binder groups covered with a gray thermoplastic jacket and overall metallic shield.
 - a. Comply with ICEA S-90-661 for mechanical properties.
 - b. Comply with TIA/EIA-568-B.1 for performance specifications.
 - c. Comply with TIA/EIA-568-B.2, Category 5e **OR** Category 6, **OR** Category 6e **as directed**.
 - d. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
 - 1) Communications, General Purpose: Type CM or CMG; or MPP, CMP, MPR, CMR, MP, or MPG, **as directed**.
 - 2) Communications, Plenum Rated: Type CMP or MPP, **as directed**, complying with NFPA 262.
 - 3) Communications, Riser Rated: Type CMR; or MPP, CMP, or MPR, **as directed**, complying with UL 1666.
 - 4) Communications, Limited Purpose: Type CMX; or MPP, CMP, MPR, CMR, MP, MPG, CM, or CMG, **as directed**.
 - 5) Multipurpose: Type MP or MPG; or MPP or MPR, **as directed**.
 - 6) Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
 - 7) Multipurpose, Riser Rated: Type MPR or MPP, **as directed**, complying with UL 1666.
- D. UTP Cable Hardware
1. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.



2. Connecting Blocks: 110-style IDC for Category 5e **OR** 110-style IDC for Category 6 **OR** 66-style IDC for Category 5e, **OR** 110-style IDC for Category 6e **as directed**. Provide blocks for the number of cables terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.
3. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.
 - a. Number of Terminals per Field: One for each conductor in assigned cables.
4. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.
 - a. Number of Jacks per Field: One for each four-pair UTP cable indicated **OR** conductor group of indicated cables, plus spares and blank positions adequate to suit specified expansion criteria, **as directed**.
5. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.
6. Patch Cords: Factory-made, 4-pair cables in 36-inch (900-mm) **OR** 48-inch (1200-mm), **as directed**, lengths; terminated with 8-position modular plug at each end.
 - a. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.
 - b. Patch cords shall have color-coded boots for circuit identification.

E. Optical Fiber Cable

1. Description: Multimode, 50/125 **OR** 62.5/125, **as directed**,-micrometer, 24-fiber, nonconductive, **as directed**, tight buffer, optical fiber cable.
 - a. Comply with ICEA S-83-596 for mechanical properties.
 - b. Comply with TIA/EIA-568-B.3 for performance specifications.
 - c. Comply with TIA/EIA-492AAAA-B **OR** TIA/EIA-492AAAA-A, **as directed**, for detailed specifications.
 - d. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:
 - 1) General Purpose, Nonconductive: Type OFN or OFNG, or OFNR, OFNP, **as directed**.
 - 2) Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
 - 3) Riser Rated, Nonconductive: Type OFNR or OFNP, **as directed**, complying with UL 1666.
 - 4) General Purpose, Conductive: Type OFC or OFCG; or OFNG, OFN, OFCR, OFNR, OFCP, or OFNP, **as directed**.
 - 5) Plenum Rated, Conductive: Type OFCP or OFNP, **as directed**, complying with NFPA 262.
 - 6) Riser Rated, Conductive: Type OFCR; or OFNR, OFCP, or OFNP, **as directed**, complying with UL 1666.
 - e. Conductive cable shall be steel **OR** aluminum, **as directed**, armored type.
 - f. Maximum Attenuation: 3.50 dB/km at 850 nm; 1.5 dB/km at 1300 nm.
 - g. Minimum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz-km at 1300 nm.
2. Jacket:
 - a. Jacket Color: Aqua for 50/125-micrometer cable **OR** Orange for 62.5/125-micrometer cable, **as directed**.
 - b. Cable cordage jacket, fiber, unit, and group color shall be according to TIA/EIA-598-B.
 - c. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).

F. Optical Fiber Cable Hardware

1. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.
 - a. Number of Connectors per Field: One for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit specified expansion criteria.



2. Patch Cords: Factory-made, dual-fiber cables in 36-inch (900-mm) lengths.
 3. Cable Connecting Hardware:
 - a. Comply with Optical Fiber Connector Intermateability Standards (FOCIS) specifications of TIA/EIA-604-2, TIA/EIA-604-3-A, and TIA/EIA-604-12. Comply with TIA/EIA-568-B.3.
 - b. Quick-connect, simplex and duplex, Type SC **OR** Type ST **OR** Type LC **OR** Type MT-RJ, **as directed**, connectors. Insertion loss not more than 0.75 dB.
 - c. Type SFF connectors may be used in termination racks, panels, and equipment packages.
- G. Coaxial Cable
1. General Coaxial Cable Requirements: Broadband type, recommended by cable manufacturer specifically for broadband data transmission applications. Coaxial cable and accessories shall have 75-ohm nominal impedance with a return loss of 20 dB maximum from 7 to 806 MHz.
 2. RG-11/U: NFPA 70, Type CATV.
 - a. No. 14 AWG, solid, copper-covered steel conductor.
 - b. Gas-injected, foam-PE insulation.
 - c. Double shielded with 100 percent aluminum polyester tape and 60 percent aluminum braid.
 - d. Jacketed with sunlight-resistant, black PVC or PE.
 - e. Suitable for outdoor installations in ambient temperatures ranging from minus 40 to plus 85 deg C.
 3. RG59/U: NFPA 70, Type CATVR.
 - a. No. 20 AWG, solid, silver-plated, copper-covered steel conductor.
 - b. Gas-injected, foam-PE insulation.
 - c. Triple shielded with 100 percent aluminum polyester tape and 95 percent aluminum braid; covered by aluminum foil with grounding strip.
 - d. Color-coded PVC jacket.
 4. RG-6/U: NFPA 70, Type CATV or CM.
 - a. No. 16 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
 - b. Double shielded with 100 percent aluminum-foil shield and 60 percent aluminum braid.
 - c. Jacketed with black PVC or PE.
 - d. Suitable for indoor installations.
 5. RG59/U: NFPA 70, Type CATV.
 - a. No. 20 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
 - b. Double shielded with 100 percent aluminum polyester tape and 40 percent aluminum braid.
 - c. PVC jacket.
 6. RG59/U (Plenum Rated): NFPA 70, Type CMP.
 - a. No. 20 AWG, solid, copper-covered steel conductor; foam fluorinated ethylene propylene insulation.
 - b. Double shielded with 100 percent aluminum-foil shield and 65 percent aluminum braid.
 - c. Copolymer jacket.
 7. NFPA and UL compliance, listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1655 and with NFPA 70, "Radio and Television Equipment" and "Community Antenna Television and Radio Distribution" Articles. Types are as follows:
 - a. CATV Cable: Type CATV, or CATVP or CATVR, **as directed**.
 - b. CATV Plenum Rated: Type CATVP, complying with NFPA 262.
 - c. CATV Riser Rated: Type CATVR; or CATVP, CATVR, or CATV, **as directed**, complying with UL 1666.
 - d. CATV Limited Rating: Type CATVX.
- H. Coaxial Cable Hardware
1. Coaxial-Cable Connectors: Type BNC, 75 ohms.
- I. Grounding
1. Comply with requirements in Division 26 Section "Grounding And Bonding For Electrical Systems" for grounding conductors and connectors.
 2. Comply with ANSI-J-STD-607-A.



- J. Identification Products
 - 1. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- K. Source Quality Control
 - 1. Testing Agency: Engage a qualified testing agency to evaluate cables.
 - 2. Factory test cables on reels according to TIA/EIA-568-B.1.
 - 3. Factory test UTP cables according to TIA/EIA-568-B.2.
 - 4. Factory test multimode optical fiber cables according to TIA/EIA-526-14-A and TIA/EIA-568-B.3.
 - 5. Cable will be considered defective if it does not pass tests and inspections.
 - 6. Prepare test and inspection reports.

1.3 EXECUTION

- A. Entrance Facilities
 - 1. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.
- B. Wiring Methods
 - 1. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces, in attics, and in gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces.
 - a. Install plenum cable in environmental air spaces, including plenum ceilings.
 - b. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceway And Boxes For Electrical Systems".
 - 2. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
 - 3. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.
- C. Installation Of Pathways
 - 1. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A.
 - 2. Comply with requirements for demarcation point, pathways, cabinets, and racks specified in Division 27 Section "Communications Equipment Room Fittings". Drawings indicate general arrangement of pathways and fittings.
 - 3. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.
 - 4. Comply with requirements in Division 26 Section "Raceway And Boxes For Electrical Systems" for installation of conduits and wireways.
 - 5. Install manufactured conduit sweeps and long-radius elbows whenever possible.
 - 6. Pathway Installation in Communications Equipment Rooms:
 - a. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
 - b. Install cable trays to route cables if conduits cannot be located in these positions.
 - c. Secure conduits to backboard when entering room from overhead.
 - d. Extend conduits 3 inches (76 mm) above finished floor.
 - e. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.
 - 7. Backboards: Install backboards with 96-inch (2440-mm) dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.



D. Installation Of Cables

1. Comply with NECA 1.
2. General Requirements for Cabling:
 - a. Comply with TIA/EIA-568-B.1.
 - b. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
 - c. Install 110-style IDC termination hardware unless otherwise indicated.
 - d. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
 - e. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 - f. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
 - g. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Use lacing bars and distribution spools.
 - h. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
 - i. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
 - j. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.
 - k. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
3. UTP Cable Installation:
 - a. Comply with TIA/EIA-568-B.2.
 - b. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.
4. Optical Fiber Cable Installation:
 - a. Comply with TIA/EIA-568-B.3.
 - b. Cable may be terminated on connecting hardware that is rack or cabinet mounted.
5. Open-Cable Installation:
 - a. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
 - b. Suspend UTP cable not in a wireway or pathway, a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 60 inches (1524 mm) apart.
 - c. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
6. Installation of Cable Routed Exposed under Raised Floors:
 - a. Install plenum-rated cable only.
 - b. Install cabling after the flooring system has been installed in raised floor areas.
 - c. Coil cable 6 feet (1800 mm) long not less than 12 inches (300 mm) in diameter below each feed point.
7. Outdoor Coaxial Cable Installation:
 - a. Install outdoor connections in enclosures complying with NEMA 250, Type 4X. Install corrosion-resistant connectors with properly designed O-rings to keep out moisture.
 - b. Attach antenna lead-in cable to support structure at intervals not exceeding 36 inches (915 mm).
8. Group connecting hardware for cables into separate logical fields.
9. Separation from EMI Sources:
 - a. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
 - b. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:



- 1) Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
 - 2) Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
 - 3) Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (610 mm).
- c. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
- 1) Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
 - 2) Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
 - 3) Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).
- d. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
- 1) Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - 2) Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
 - 3) Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
- e. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
- f. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).
- E. Firestopping
1. Comply with requirements in Division 07 Section "Penetration Firestopping".
 2. Comply with TIA/EIA-569-A, Annex A, "Firestopping."
 3. Comply with BICSI TDMM, "Firestopping Systems" Article.
- F. Grounding
1. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
 2. Comply with ANSI-J-STD-607-A.
 3. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
 4. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.
- G. Identification
1. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section "Identification For Electrical Systems".
 - a. Administration Class: **1 OR 2 OR 3 OR 4, as directed.**
 - b. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.
 2. Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
 3. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 2 **OR** Class 3 **OR** Class 4, **as directed**, level of administration including optional identification requirements of this standard.
 4. Comply with requirements in Division 27 Section "Communications Horizontal Cabling" for cable and asset management software.
 5. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.



6. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.
7. Cable and Wire Identification:
 - a. Label each cable within 4 inches (100 mm) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
 - b. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
 - c. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet (4.5 m).
 - d. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
 - 1) Individually number wiring conductors connected to terminal strips and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device with name and number of particular device as shown.
 - 2) Label each unit and field within distribution racks and frames.
 - e. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
8. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA 606-A, for the following:
 - a. Cables use flexible vinyl or polyester that flexes as cables are bent.

H. Field Quality Control

1. Tests and Inspections:
 - a. Visually inspect UTP and optical fiber jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1.
 - b. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
 - c. Test UTP copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
 - 1) Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
 - d. Optical Fiber Cable Tests:
 - 1) Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
 - 2) Link End-to-End Attenuation Tests:
 - a) Horizontal and multimode backbone link measurements: Test at 850 or 1300 nm in 1 direction according to TIA/EIA-526-14-A, Method B, One Reference Jumper.
 - b) Attenuation test results for backbone links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in TIA/EIA-568-B.1.



2. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.
3. Remove and replace cabling where test results indicate that they do not comply with specified requirements.
4. End-to-end cabling will be considered defective if it does not pass tests and inspections.
5. Prepare test and inspection reports.

END OF SECTION 26 05 19 16f



SECTION 26 05 19 16g - COMMUNICATIONS HORIZONTAL CABLING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for communications horizontal cabling. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Pathways.
 - b. UTP cabling.
 - c. 50/125 and 62.5/125-micrometer, optical fiber cabling.
 - d. Coaxial cable.
 - e. Multiuser telecommunications outlet assemblies.
 - f. Cable connecting hardware, patch panels, and cross-connects.
 - g. Telecommunications outlet/connectors.
 - h. Cabling system identification products.
 - i. Cable management system.

C. Definitions

1. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.
2. BICSI: Building Industry Consulting Service International.
3. Channel Cable Tray: A fabricated structure consisting of a one-piece, ventilated-bottom or solid-bottom channel.
4. Consolidation Point: A location for interconnection between horizontal cables extending from building pathways and horizontal cables extending into furniture pathways.
5. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
6. EMI: Electromagnetic interference.
7. IDC: Insulation displacement connector.
8. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).
9. LAN: Local area network.
10. MUTOA: Multiuser telecommunications outlet assembly, a grouping in one location of several telecommunications outlet/connectors.
11. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.
12. RCDD: Registered Communications Distribution Designer.
13. Solid-Bottom or Nonventilated Cable Tray: A fabricated structure consisting of longitudinal side rails and a bottom without ventilation openings.
14. Trough or Ventilated Cable Tray: A fabricated structure consisting of longitudinal side rails and a bottom having openings for the passage of air.
15. UTP: Unshielded twisted pair.

D. Horizontal Cabling Description

1. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called "permanent link," a term that is used in the testing protocols.
 - a. TIA/EIA-568-B.1 requires that a minimum of two telecommunications outlet/connectors be installed for each work area.



- b. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.
 - c. Bridged taps and splices shall not be installed in the horizontal cabling.
 - d. Splitters shall not be installed as part of the optical fiber cabling.
2. A work area is approximately 100 sq. ft. (9.3 sq. m), and includes the components that extend from the telecommunications outlet/connectors to the station equipment.
 3. The maximum allowable horizontal cable length is 295 feet (90 m). This maximum allowable length does not include an allowance for the length of 16 feet (4.9 m) to the workstation equipment. The maximum allowable length does not include an allowance for the length of 16 feet (4.9 m) in the horizontal cross-connect.
- E. Performance Requirements
1. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-B.1, when tested according to test procedures of this standard.
- F. Submittals
1. Product Data: For each type of product indicated.
 2. Shop Drawings:
 - a. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by the Owner.
 - b. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
 - c. Cabling administration drawings and printouts.
 - d. Wiring diagrams to show typical wiring schematics, including the following:
 - 1) Cross-connects.
 - 2) Patch panels.
 - 3) Patch cords.
 - e. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.
 - f. Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements.
 3. Samples: For workstation outlets, jacks, jack assemblies, in specified finish, one for each size and outlet configuration and faceplates for color selection and evaluation of technical features.
 4. Qualification Data: For Installer, **as directed**, qualified layout technician, installation supervisor, and field inspector.
 5. Source quality-control reports.
 6. Field quality-control reports.
 7. Maintenance Data.
 8. Software and Firmware Operational Documentation:
 - a. Software operating and upgrade manuals.
 - b. Program Software Backup: On magnetic media or compact disk, complete with data files.
 - c. Device address list.
 - d. Printout of software application and graphic screens.
- G. Quality Assurance
1. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
 - a. Layout Responsibility: Preparation of Shop Drawings, Cabling Administration Drawings, and field testing program development by an RCDD.
 - b. Installation Supervision: Installation shall be under the direct supervision of Registered Technician **OR** Level 2 Installer, **as directed**, who shall be present at all times when Work of this Section is performed at Project site.
 2. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.



- b. Smoke-Developed Index: 50 **OR** 450, **as directions**, or less.
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
4. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.
5. Grounding: Comply with ANSI-J-STD-607-A.

H. Delivery, Storage, And Handling

1. Test cables upon receipt at Project site.
 - a. Test optical fiber cables to determine the continuity of the strand end to end. Use optical fiber flashlight or optical loss test set.
 - b. Test optical fiber cables while on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector; including the loss value of each. Retain test data and include the record in maintenance data.
 - c. Test each pair of UTP cable for open and short circuits.

I. Software Service Agreement

1. Technical Support: Beginning with Final Completion, provide software support for two years.
2. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Final Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
 - a. Provide 30 days' notice to the Owner to allow scheduling and access to system and to allow the Owner to upgrade computer equipment if necessary.

1.2 PRODUCTS

A. Pathways

1. General Requirements: Comply with TIA/EIA-569-A.
2. Cable Support: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
 - a. Support brackets with cable tie slots for fastening cable ties to brackets.
 - b. Lacing bars, spools, J-hooks, and D-rings.
 - c. Straps and other devices.
3. Cable Trays:
 - a. Cable Tray Materials: Metal, suitable for indoors, and protected against corrosion by electroplated zinc galvanizing, complying with ASTM B 633, Type 1, not less than 0.000472 inch (0.012 mm) thick **OR** hot-dip galvanizing, complying with ASTM A 123/A 123M, Grade 0.55, not less than 0.002165 inch (0.055 mm) thick, **as directed**.
 - 1) Basket Cable Trays: 6 inches (150 mm) wide and 2 inches (50 mm) deep. Wire mesh spacing shall not exceed 2 by 4 inches (50 by 100 mm).
 - 2) Trough Cable Trays: Nominally 6 inches (150 mm) wide.
 - 3) Ladder Cable Trays: Nominally 18 inches (455 mm) wide, and a rung spacing of 12 inches (305 mm).
 - 4) Channel Cable Trays: One-piece construction, nominally 4 inches (100 mm) wide. Slot spacing shall not exceed 4-1/2 inches (115 mm) o.c.
 - 5) Solid-Bottom Cable Trays: One-piece construction, nominally 12 inches (305 mm) wide. Provide with **OR** without, **as directed**, solid covers.
4. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway And Boxes For Electrical Systems". Flexible metal conduit shall not be used.
 - a. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

B. Backboards



1. Backboards: Plywood, fire-retardant treated, **as directed**, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements in Division 06 Section "Rough Carpentry" for plywood backing panels.

C. UTP Cable

1. Description: 100-ohm, 4-pair UTP, formed into 25-pair, binder groups covered with a blue thermoplastic jacket.
 - a. Comply with ICEA S-90-661 for mechanical properties.
 - b. Comply with TIA/EIA-568-B.1 for performance specifications.
 - c. Comply with TIA/EIA-568-B.2, Category 5e **OR** Category 6, **OR** Category 6e **as directed**.
 - d. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
 - 1) Communications, General Purpose: Type CM or CMG; or MPP, CMP, MPR, CMR, MP, or MPG, **as directed**.
 - 2) Communications, Plenum Rated: Type CMP or MPP, **as directed**, complying with NFPA 262.
 - 3) Communications, Riser Rated: Type CMR; or MPP, CMP, or MPR, **as directed**, complying with UL 1666.
 - 4) Communications, Limited Purpose: Type CMX; or MPP, CMP, MPR, CMR, MP, MPG, CM, or CMG, **as directed**.
 - 5) Multipurpose: Type MP or MPG; or MPP or MPR, **as directed**.
 - 6) Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
 - 7) Multipurpose, Riser Rated: Type MPR or MPP, **as directed**, complying with UL 1666.

D. UTP Cable Hardware

1. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.
2. Connecting Blocks: 110-style IDC for Category 5e **OR** 110-style IDC for Category 6 **OR** 66-style IDC for Category 5e, **OR** 110-style IDC for Category 6e **as directed**. Provide blocks for the number of cables terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.
3. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.
 - a. Number of Terminals per Field: One for each conductor in assigned cables.
4. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.
 - a. Number of Jacks per Field: One for each four-pair UTP cable indicated **OR** conductor group of indicated cables, plus spares and blank positions adequate to suit specified expansion criteria, **as directed**.
5. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.
6. Patch Cords: Factory-made, four-pair cables in 36-inch (900 mm) **OR** 48-inch (1200-mm), **as directed**, lengths; terminated with eight-position modular plug at each end.
 - a. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.
 - b. Patch cords shall have color-coded boots for circuit identification.

E. Optical Fiber Cable

1. Description: Multimode, 50/125 **OR** 62.5/125, **as directed**, -micrometer, 24-fiber, nonconductive, **as directed**, tight buffer, optical fiber cable.
 - a. Comply with ICEA S-83-596 for mechanical properties.
 - b. Comply with TIA/EIA-568-B.3 for performance specifications.



- c. Comply with TIA/EIA-492AAAA-B **OR** TIA/EIA-492AAAA-A, **as directed**, for detailed specifications.
 - d. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:
 - 1) General Purpose, Nonconductive: Type OFN or OFNG, or OFNR, OFNP, **as directed**.
 - 2) Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
 - 3) Riser Rated, Nonconductive: Type OFNR or OFNP, **as directed**, complying with UL 1666.
 - 4) General Purpose, Conductive: Type OFC or OFCG; or OFNG, OFN, OFCR, OFNR, OFCP, or OFNP, **as directed**.
 - 5) Plenum Rated, Conductive: Type OFCP or OFNP, **as directed**, complying with NFPA 262.
 - 6) Riser Rated, Conductive: Type OFCR; or OFNR, OFCP, or OFNP, **as directed**, complying with UL 1666.
 - e. Conductive cable shall be steel **OR** aluminum, **as directed**, armored type.
 - f. Maximum Attenuation: 3.50 dB/km at 850 nm; 1.5 dB/km at 1300 nm.
 - g. Minimum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz-km at 1300 nm.
 2. Jacket:
 - a. Jacket Color: Aqua for 50/125-micrometer cable **OR** Orange for 62.5/125-micrometer cable, **as directed**.
 - b. Cable cordage jacket, fiber, unit, and group color shall be according to TIA/EIA-598-B.
 - c. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).
- F. Optical Fiber Cable Hardware
1. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.
 - a. Number of Connectors per Field: One for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit specified expansion criteria.
 2. Patch Cords: Factory-made, dual-fiber cables in 36-inch (900-mm) lengths.
 3. Cable Connecting Hardware:
 - a. Comply with Optical Fiber Connector Intermateability Standards (FOCIS) specifications of TIA/EIA-604-2, TIA/EIA-604-3-A, and TIA/EIA-604-12. Comply with TIA/EIA-568-B.3.
 - b. Quick-connect, simplex and duplex, Type SC **OR** Type ST **OR** Type LC **OR** Type MT-RJ, **as directed**, connectors. Insertion loss not more than 0.75 dB.
 - c. Type SFF connectors may be used in termination racks, panels, and equipment packages.
- G. Coaxial Cable
1. Cable Characteristics: Broadband type, recommended by cable manufacturer specifically for broadband data transmission applications. Coaxial cable and accessories shall have 75-ohm nominal impedance with a return loss of 20 dB maximum from 7 to 806 MHz.
 2. RG-11/U: NFPA 70, Type CATV.
 - a. No. 14 AWG, solid, copper-covered steel conductor.
 - b. Gas-injected, foam-PE insulation.
 - c. Double shielded with 100 percent aluminum polyester tape and 60 percent aluminum braid.
 - d. Jacketed with sunlight-resistant, black PVC or PE.
 - e. Suitable for outdoor installations in ambient temperatures ranging from minus 40 to plus 85 deg C.
 3. RG59/U: NFPA 70, Type CATVR.
 - a. No. 20 AWG, solid, silver-plated, copper-covered steel conductor.
 - b. Gas-injected, foam-PE insulation.
 - c. Triple shielded with 100 percent aluminum polyester tape and 95 percent aluminum braid; covered by aluminum foil with grounding strip.
 - d. Color-coded PVC jacket.
 4. RG-6/U: NFPA 70, Type CATV or CM.



- a. No. 16 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
 - b. Double shielded with 100 percent aluminum-foil shield and 60 percent aluminum braid.
 - c. Jacketed with black PVC or PE.
 - d. Suitable for indoor installations.
5. RG59/U: NFPA 70, Type CATV.
- a. No. 20 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
 - b. Double shielded with 100 percent aluminum polyester tape and 40 percent aluminum braid.
 - c. PVC jacket.
6. RG59/U (Plenum Rated): NFPA 70, Type CMP.
- a. No. 20 AWG, solid, copper-covered steel conductor; foam fluorinated ethylene propylene insulation.
 - b. Double shielded with 100 percent aluminum-foil shield and 65 percent aluminum braid.
 - c. Copolymer jacket.
7. NFPA and UL compliance, listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1655 and with NFPA 70 "Radio and Television Equipment" and "Community Antenna Television and Radio Distribution" Articles. Types are as follows:
- a. CATV Cable: Type CATV or CATVP or CATVR, **as directed**.
 - b. CATV Plenum Rated: Type CATVP, complying with NFPA 262.
 - c. CATV Riser Rated: Type CATVR; or CATVP, CATVR, or CATV, **as directed**, complying with UL 1666.
 - d. CATV Limited Rating: Type CATVX.
- H. Coaxial Cable Hardware
1. Coaxial-Cable Connectors: Type BNC, 75 ohms.
- I. Consolidation Points
1. Description: Consolidation points shall comply with requirements for cable connecting hardware.
 - a. Number of Terminals per Field: One for each conductor in assigned cables.
 - b. Number of Connectors per Field:
 - 1) One for each four-pair UTP cable indicated.
 - 2) One for each four-pair conductor group of indicated cables, plus 25 percent spare positions.
 - c. Mounting: Recessed in ceiling **OR** Wall **OR** Desk **OR** Furniture, **as directed**.
 - d. NRTL listed as complying with UL 50 and UL 1863.
 - e. When installed in plenums used for environmental air, NRTL listed as complying with UL 2043.
- J. Multiuser Telecommunications Outlet Assembly (MUTOA)
1. Description: MUTOAs shall meet the requirements for cable connecting hardware.
 - a. Number of Terminals per Field: One for each conductor in assigned cables.
 - b. Number of Connectors per Field:
 - 1) One for each four-pair UTP cable indicated.
 - 2) One for each four-pair conductor group of indicated cables, plus 25 percent spare positions.
 - c. Mounting: Recessed in ceiling **OR** Wall **OR** Desk **OR** Furniture, **as directed**.
 - d. NRTL listed as complying with UL 50 and UL 1863.
 - e. Label shall include maximum length of work area cords, based on TIA/EIA-568-B.1.
 - f. When installed in plenums used for environmental air, NRTL listed as complying with UL 2043.
- K. Telecommunications Outlet/Connectors
1. Jacks: 100-ohm, balanced, twisted-pair connector; four-pair, eight-position modular. Comply with TIA/EIA-568-B.1.
 2. Workstation Outlets: Two **OR** Four, **as directed**, -port-connector assemblies mounted in single or multigang faceplate.



- a. Plastic Faceplate: High-impact plastic. Coordinate color with Division 26 Section "Wiring Devices".
 - b. Metal Faceplate: Stainless steel **OR** Brass, **as directed**, complying with requirements in Division 26 Section "Wiring Devices".
 - c. For use with snap-in jacks accommodating any combination of UTP, optical fiber, and coaxial work area cords.
 - 1) Flush mounting jacks, positioning the cord at a 45-degree angle.
 - d. Legend:
 - 1) Factory labeled by silk-screening or engraving for stainless steel **OR** brass, **as directed**, faceplates.
OR
Machine printed, in the field, using adhesive-tape label.
OR
Snap-in, clear-label covers and machine-printed paper inserts.
- L. Grounding
1. Comply with requirements in Division 26 Section "Grounding And Bonding For Electrical Systems" for grounding conductors and connectors.
 2. Comply with ANSI-J-STD-607-A.
- M. Identification Products
1. Comply with TIA/EIA-606-A and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
 2. Comply with requirements in Division 26 Section "Identification For Electrical Systems".
- N. Cable Management System
1. Description: Computer-based cable management system, with integrated database and graphic, **as directed**, capabilities.
 2. Document physical characteristics by recording the network, TIA/EIA details, and connections between equipment and cable.
 3. Information shall be presented in database view, schematic plans, or technical drawings.
 - a. Microsoft Visio Professional or AutoCAD drawing software shall be used as drawing and schematic plans software.
 4. System shall interface with the following testing and recording devices:
 - a. Direct upload tests from circuit testing instrument into the personal computer.
 - b. Direct download circuit labeling into labeling printer.
- O. Source Quality Control
1. Testing Agency: Engage a qualified testing agency to evaluate cables.
 2. Factory test UTP and optical fiber cables on reels according to TIA/EIA-568-B.1.
 3. Factory test UTP cables according to TIA/EIA-568-B.2.
 4. Factory test multimode optical fiber cables according to TIA/EIA-526-14-A and TIA/EIA-568-B.3.
 5. Factory-sweep test coaxial cables at frequencies from 5 MHz to 1 GHz. Sweep test shall test the frequency response, or attenuation over frequency, of a cable by generating a voltage whose frequency is varied through the specified frequency range and graphing the results.
 6. Cable will be considered defective if it does not pass tests and inspections.
 7. Prepare test and inspection reports.
- 1.3 EXECUTION
- A. Entrance Facilities
1. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.
- B. Wiring Methods



1. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces, in attics, and in gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces.
 - a. Install plenum cable in environmental air spaces, including plenum ceilings.
 - b. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceway And Boxes For Electrical Systems".
2. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
3. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

C. Installation Of Pathways

1. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.
2. Comply with requirements for demarcation point, pathways, cabinets, and racks specified in Division 27 Section "Communications Equipment Room Fittings". Drawings indicate general arrangement of pathways and fittings.
3. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.
4. Comply with requirements in Division 26 Section "Raceway And Boxes For Electrical Systems" for installation of conduits and wireways.
5. Install manufactured conduit sweeps and long-radius elbows whenever possible.
6. Pathway Installation in Communications Equipment Rooms:
 - a. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
 - b. Install cable trays to route cables if conduits cannot be located in these positions.
 - c. Secure conduits to backboard when entering room from overhead.
 - d. Extend conduits 3 inches (76 mm) above finished floor.
 - e. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.
7. Backboards: Install backboards with 96-inch (2440-mm) dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

D. Installation Of Cables

1. Comply with NECA 1.
2. General Requirements for Cabling:
 - a. Comply with TIA/EIA-568-B.1.
 - b. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
 - c. Install 110-style IDC termination hardware unless otherwise indicated.
 - d. MUTOA shall not be used as a cross-connect point.
 - e. Consolidation points may be used only for making a direct connection to telecommunications outlet/connectors:
 - 1) Do not use consolidation point as a cross-connect point, as a patch connection, or for direct connection to workstation equipment.
 - 2) Locate consolidation points for UTP at least 49 feet (15 m) from communications equipment room.
 - f. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
 - g. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 - h. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.



- i. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
 - j. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
 - k. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
 - l. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.
 - m. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
3. UTP Cable Installation:
 - a. Comply with TIA/EIA-568-B.2.
 - b. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.
 4. Optical Fiber Cable Installation:
 - a. Comply with TIA/EIA-568-B.3.
 - b. Cable may be terminated on connecting hardware that is rack or cabinet mounted.
 5. Open-Cable Installation:
 - a. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
 - b. Suspend UTP cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 60 inches (1524 mm) apart.
 - c. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
 6. Installation of Cable Routed Exposed under Raised Floors:
 - a. Install plenum-rated cable only.
 - b. Install cabling after the flooring system has been installed in raised floor areas.
 - c. Coil cable 6 feet (1800 mm) long not less than 12 inches (300 mm) in diameter below each feed point.
 7. Outdoor Coaxial Cable Installation:
 - a. Install outdoor connections in enclosures complying with NEMA 250, Type 4X. Install corrosion-resistant connectors with properly designed O-rings to keep out moisture.
 - b. Attach antenna lead-in cable to support structure at intervals not exceeding 36 inches (915 mm).
 8. Group connecting hardware for cables into separate logical fields.
 9. Separation from EMI Sources:
 - a. Comply with BICSI TDMM and TIA/EIA-569-A for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
 - b. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
 - 1) Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
 - 2) Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
 - 3) Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (610 mm).
 - c. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
 - 1) Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
 - 2) Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
 - 3) Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).
 - d. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:



- 1) Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - 2) Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
 - 3) Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
- e. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
 - f. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).
- E. Firestopping
1. Comply with requirements in Division 07 Section "Penetration Firestopping".
 2. Comply with TIA/EIA-569-A, Annex A, "Firestopping."
 3. Comply with BICSI TDMM, "Firestopping Systems" Article.
- F. Grounding
1. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
 2. Comply with ANSI-J-STD-607-A.
 3. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
 4. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.
- G. Identification
1. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section "Identification For Electrical Systems".
 - a. Administration Class: **1 OR 2 OR 3 OR 4, as directed.**
 - b. Color-code cross-connect fields. Apply colors to voice and data service backboards, connections, covers, and labels.
 2. Using cable management system software specified in Part 2, develop Cabling Administration Drawings for system identification, testing, and management. Use unique, alphanumeric designation for each cable and label cable, jacks, connectors, and terminals to which it connects with same designation. At completion, cable and asset management software shall reflect as-built conditions.
 3. Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
 4. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 2 **OR** Class 3 **OR** Class 4, **as directed**, level of administration, including optional identification requirements of this standard.
 5. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
 6. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of TIA/EIA-606-A. Furnish electronic record of all drawings, in software and format selected by the Owner.
 7. Cable and Wire Identification:
 - a. Label each cable within 4 inches (100 mm) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.



- b. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
 - c. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet (4.5 m).
 - d. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
 - 1) Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
 - 2) Label each unit and field within distribution racks and frames.
 - e. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
 - f. Uniquely identify and label work area cables extending from the MUTOA to the work area. These cables may not exceed the length stated on the MUTOA label.
8. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA-606-A.
- a. Cables use flexible vinyl or polyester that flex as cables are bent.

H. Field Quality Control

1. Tests and Inspections:

- a. Visually inspect UTP and optical fiber cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1.
- b. Visually confirm Category 5e **OR** Category 6, **OR** Category 6e **as directed**, marking of outlets, cover plates, outlet/connectors, and patch panels.
- c. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
- d. Test UTP backbone copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
 - 1) Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
- e. Optical Fiber Cable Tests:
 - 1) Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
 - 2) Link End-to-End Attenuation Tests:
 - a) Horizontal and multimode backbone link measurements: Test at 850 or 1300 nm in 1 direction according to TIA/EIA-526-14-A, Method B, One Reference Jumper.
 - b) Attenuation test results for backbone links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in TIA/EIA-568-B.1.
- f. UTP Performance Tests:
 - 1) Test for each outlet and MUTOA. Perform the following tests according to TIA/EIA-568-B.1 and TIA/EIA-568-B.2:
 - a) Wire map.
 - b) Length (physical vs. electrical, and length requirements).
 - c) Insertion loss.



- d) Near-end crosstalk (NEXT) loss.
 - e) Power sum near-end crosstalk (PSNEXT) loss.
 - f) Equal-level far-end crosstalk (ELFEXT).
 - g) Power sum equal-level far-end crosstalk (PSELFEXT).
 - h) Return loss.
 - i) Propagation delay.
 - j) Delay skew.
- g. Optical Fiber Cable Performance Tests: Perform optical fiber end-to-end link tests according to TIA/EIA-568-B.1 and TIA/EIA-568-B.3.
 - h. Coaxial Cable Tests: Conduct tests according to Division 27 Section "Master Antenna Television System".
 - i. Final Verification Tests: Perform verification tests for UTP and optical fiber systems after the complete communications cabling and workstation outlet/connectors are installed.
 - 1) Voice Tests: These tests assume that dial tone service has been installed. Connect to the network interface device at the demarcation point. Go off-hook and listen and receive a dial tone. If a test number is available, make and receive a local, long distance, and digital subscription line telephone call.
 - 2) Data Tests: These tests assume the Information Technology Staff has a network installed and is available to assist with testing. Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.
 - 2. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.
 - 3. End-to-end cabling will be considered defective if it does not pass tests and inspections.
 - 4. Prepare test and inspection reports.

END OF SECTION 26 05 19 16g

**SECTION 26 05 19 16h - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY****1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for conductors and cables for electronic safety and security. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. UTP cabling.
 - b. 50/125 and 62.5/125-micrometer, multimode optical fiber cabling.
 - c. Coaxial cabling.
 - d. RS-232 cabling.
 - e. RS-485 cabling.
 - f. Low-voltage control cabling.
 - g. Control-circuit conductors.
 - h. Fire alarm wire and cable.
 - i. Identification products.

C. Definitions

1. BICSI: Building Industry Consulting Service International.
2. EMI: Electromagnetic interference.
3. IDC: Insulation displacement connector.
4. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.
5. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).
6. RCDD: Registered Communications Distribution Designer.

D. Performance Requirements

1. Seismic Performance: Pathways shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

E. Submittals

1. Product Data: For each type of product indicated.
 - a. For coaxial cable, include the following installation data for each type used:
 - 1) Nominal OD.
 - 2) Minimum bending radius.
 - 3) Maximum pulling tension.
2. Shop Drawings: Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:
 - a. Vertical and horizontal offsets and transitions.
 - b. Clearances for access above and to side of cable trays.
 - c. Vertical elevation of cable trays above the floor or bottom of ceiling structure.
3. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.
4. Seismic Qualification Certificates: For pathways, accessories, and components, from manufacturer.



- a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
5. Source quality-control reports.
 6. Field quality-control reports.
 7. Operation and Maintenance Data: For wire and cable to include in operation and maintenance manuals. Include the following:
 - a. Allowable pulling tension of cable.
 - b. Cable connectors and terminations recommended by the manufacturer.

F. Quality Assurance

1. Testing Agency Qualifications: An NRTL.
 - a. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.
2. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 50 **OR** 450, **as directed**, or less.
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Delivery, Storage, And Handling

1. Test cables upon receipt at Project site.
 - a. Test optical fiber cable to determine the continuity of the strand end to end. Use optical-fiber flashlight or optical loss test set.
 - b. Test optical fiber cable on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector; include the loss value of each. Retain test data and include the record in maintenance data.
 - c. Test each pair of UTP cable for open and short circuits.

H. Project Conditions

1. Do not install conductors and cables that are wet, moisture damaged, or mold damaged.
 - a. Indications that wire and cables are wet or moisture damaged include, but are not limited to, discoloration and sagging of factory packing materials.
2. Environmental Limitations: Do not deliver or install UTP, optical fiber, and coaxial cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.2 PRODUCTS

A. Pathways

1. Support of Open Cabling: NRTL labeled for support of Category 5e **OR** Category 6, **OR** Category 6e **as directed**, cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
 - a. Support brackets with cable tie slots for fastening cable ties to brackets.
 - b. Lacing bars, spools, J-hooks, and D-rings.
 - c. Straps and other devices.
2. Cable Trays:



- a. Cable Tray Materials: Metal, suitable for indoors, and protected against corrosion by electroplated zinc galvanizing, complying with ASTM B 633, Type 1, not less than 0.000472 inch (0.012 mm) thick **OR** hot-dip galvanizing, complying with ASTM A 123/A 123M Grade 0.55, not less than 0.002165 inch (0.055 mm) thick, **as directed**.
 - 1) Basket Cable Trays: 6 inches (150 mm) wide and 2 inches (50 mm) deep, **as directed**. Wire mesh spacing shall not exceed 2 by 4 inches (50 by 100 mm).
 - 2) Trough Cable Trays: Nominally 6 inches (150 mm), **as directed**, wide.
 - 3) Ladder Cable Trays: Nominally 18 inches (455 mm), **as directed**, wide, and a rung spacing of 12 inches (305 mm), **as directed**.
 - 4) Channel Cable Trays: One-piece construction, nominally 4 inches (100 mm), **as directed**, wide. Slot spacing shall not exceed 4-1/2 inches (115 mm) o.c.
 - 5) Solid-Bottom Cable Trays: One-piece construction, nominally 12 inches (305 mm), **as directed**, wide. Provide with **OR** without, **as directed**, solid covers.
 3. Conduit and Boxes: Comply with requirements in Division 16 Section "Raceways and Boxes." Flexible metal conduit shall not be used, **as directed**.
 4. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.
- B. Backboards
1. Backboards: Plywood, fire-retardant treated, **as directed**, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements for plywood backing panels in Division 06 Section "Rough Carpentry".
- C. UTP Cable
1. Description: 100-ohm, 4-pair UTP, covered with a blue thermoplastic jacket.
 - a. Comply with ICEA S-90-661 for mechanical properties.
 - b. Comply with TIA/EIA-568-B.1 for performance specifications.
 - c. Comply with TIA/EIA-568-B.2, Category 5e **OR** Category 6, **OR** Category 6e **as directed**.
 - d. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
 - 1) Communications, General Purpose: Type CM or CMG; **OR** MPP, CMP, MPR, CMR, MP, or MPG, **as directed**.
 - 2) Communications, Plenum Rated: Type CMP **OR** MPP, **as directed**, complying with NFPA 262.
 - 3) Communications, Riser Rated: Type CMR; **OR** MPP, CMP, or MPR, **as directed**, complying with UL 1666.
 - 4) Communications, Limited Purpose: Type CMX; **OR** MPP, CMP, MPR, CMR, MP, MPG, CM, or CMG, **as directed**.
 - 5) Multipurpose: Type MP or MPG; **OR** MPP or MPR, **as directed**.
 - 6) Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
 - 7) Multipurpose, Riser Rated: Type MPR **OR** MPP, **as directed**, complying with UL 1666.
- D. UTP Cable Hardware
1. UTP Cable Connecting Hardware: IDC type, using modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of the same category or higher.
 2. Connecting Blocks: 110-style for Category 5e **OR** 110-style for Category 6 **OR** 66-style for Category 5e, **OR** 110-style for Category 6e **as directed**. Provide blocks for the number of cables terminated on the block, plus 25, **as directed**, percent spare. Integral with connector bodies, including plugs and jacks where indicated.
- E. Optical Fiber Cable
1. Description: Multimode, 50/125 **OR** 62.5/125, **as directed**,-micrometer, 24-fiber, **as directed**, nonconductive, **as directed**, tight buffer, optical fiber cable.



- a. Comply with ICEA S-83-596 for indoor cable OR ICEA S-87-640 for outside plant, as directed, for mechanical properties.
 - b. Comply with TIA/EIA-568-B.3 for performance specifications.
 - c. Comply with TIA-492AAAB **OR** TIA-492AAAA-A, **as directed**, for detailed specifications.
 - d. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:
 - 1) General Purpose, Nonconductive: Type OFN or OFNG, **OR** OFNR, OFNP, **as directed**.
 - 2) Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
 - 3) Riser Rated, Nonconductive: Type OFNR or OFNP, complying with UL 1666.
 - 4) General Purpose, Conductive: Type OFC or OFCG; **OR** OFNG, OFN, OFCR, OFNR, OFCP, or OFNP, **as directed**.
 - 5) Plenum Rated, Conductive: Type OFCP or OFNP, complying with NFPA 262.
 - 6) Riser Rated, Conductive: Type OFCR; or OFNR, OFCP, or OFNP, **asa directed**, complying with UL 1666.
 - e. Conductive cable shall be steel **OR** aluminum, **as directed**, armored type.
 - f. Maximum Attenuation: 3.50 dB/km at 850 nm; 1.5 dB/km at 1300 nm.
 - g. Minimum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz-km at 1300 nm.
2. Jacket:
- a. Jacket Color: Aqua for 50/125-micrometer cable **OR** Orange for 62.5/125-micrometer cable, **as directed**.
 - b. Cable cordage jacket, fiber, unit, and group color shall be according to TIA-598-C.
 - c. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).

F. Optical Fiber Cable Hardware

1. Cable Connecting Hardware: Meet the Optical Fiber Connector Intermateability Standards (FOCIS) specifications of TIA-604-2-B, TIA-604-3-B, and TIA/EIA-604-12. Comply with TIA/EIA-568-B.3.
 - a. Quick-connect, simplex and duplex, Type SC **OR** Type ST **OR** Type LC **OR** Type MT-RJ, **as directed**, connectors. Insertion loss not more than 0.75 dB.
 - b. Type SFF connectors may be used in termination racks, panels, and equipment packages.

G. Coaxial Cable

1. General Coaxial Cable Requirements: Broadband type, recommended by cable manufacturer specifically for broadband data transmission applications. Coaxial cable and accessories shall have 75-ohm nominal impedance with a return loss of 20 dB maximum from 7 to 806 MHz.
2. RG-11/U: NFPA 70, Type CATV.
 - a. No. 14 AWG, solid, copper-covered steel conductor.
 - b. Gas-injected, foam-PE insulation.
 - c. Double shielded with 100 percent aluminum polyester tape and 60 percent aluminum braid.
 - d. Jacketed with sunlight-resistant, black PVC or PE.
 - e. Suitable for outdoor installations in ambient temperatures ranging from minus 40 to plus 85 deg C.
3. RG59/U: NFPA 70, Type CATVR.
 - a. No. 20 AWG, solid, silver-plated, copper-covered steel conductor.
 - b. Gas-injected, foam-PE insulation.
 - c. Triple shielded with 100 percent aluminum polyester tape and 95 percent aluminum braid; covered by aluminum foil with grounding strip.
 - d. Color-coded PVC jacket.
4. RG-6/U: NFPA 70, Type CATV or CM.
 - a. No. 16 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
 - b. Double shielded with 100 percent aluminum-foil shield and 60 percent aluminum braid.
 - c. Jacketed with black PVC or PE.



- d. Suitable for indoor installations.
 5. RG59/U: NFPA 70, Type CATV.
 - a. No. 20 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
 - b. Double shielded with 100 percent aluminum polyester tape and 40 percent aluminum braid.
 - c. PVC jacket.
 6. RG59/U (Plenum Rated): NFPA 70, Type CMP.
 - a. No. 20 AWG, solid, copper-covered steel conductor; foam fluorinated ethylene propylene insulation.
 - b. Double shielded with 100 percent aluminum-foil shield and 65 percent aluminum braid.
 - c. Copolymer jacket.
 7. NFPA and UL Compliance: Coaxial cables shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1655, and with NFPA 70 "Radio and Television Equipment" and "Community Antenna Television and Radio Distribution" Articles. Types are as follows:
 - a. CATV Cable: Type CATV, **OR** CATVP or CATVR, **as directed**.
 - b. CATV Plenum Rated: Type CATVP, complying with NFPA 262.
 - c. CATV Riser Rated: Type CATVR; **OR** CATVP, CATVR, or CATV, **as directed**, complying with UL 1666.
 - d. CATV Limited Rating: Type CATVX.
- H. Coaxial Cable Hardware
1. Coaxial-Cable Connectors: Type BNC, 75 ohms.
- I. RS-232 Cable
1. Standard Cable: NFPA 70, Type CM.
 - a. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
 - b. Polypropylene insulation.
 - c. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
 - d. PVC jacket.
 - e. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
 - f. Flame Resistance: Comply with UL 1581.
 2. Plenum-Rated Cable: NFPA 70, Type CMP.
 - a. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
 - b. Plastic insulation.
 - c. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
 - d. Plastic jacket.
 - e. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
 - f. Flame Resistance: Comply with NFPA 262.
- J. RS-485 Cable
1. Standard Cable: NFPA 70, Type CM **OR** CMG, **as directed**.
 - a. Paired, 2 pairs, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors.
 - b. PVC insulation.
 - c. Unshielded.
 - d. PVC jacket.
 - e. Flame Resistance: Comply with UL 1581.
 2. Plenum-Rated Cable: NFPA 70, Type CMP.
 - a. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
 - b. Fluorinated ethylene propylene insulation.
 - c. Unshielded.
 - d. Fluorinated ethylene propylene jacket.
 - e. Flame Resistance: NFPA 262, Flame Test.
- K. Low-Voltage Control Cable



1. Paired Cable: NFPA 70, Type CMG.
 - a. 1 pair, twisted, No. 16 AWG, stranded (19x29) and No. 18 AWG, stranded (19x30) tinned copper conductors.
 - b. PVC insulation.
 - c. Unshielded.
 - d. PVC jacket.
 - e. Flame Resistance: Comply with UL 1581.
 2. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.
 - a. 1 pair, twisted, No. 16 AWG, stranded (19x29) and No. 18 AWG, stranded (19x30) tinned copper conductors.
 - b. PVC insulation.
 - c. Unshielded.
 - d. PVC jacket.
 - e. Flame Resistance: Comply with NFPA 262.
- L. Control-Circuit Conductors
1. Class 1 Control Circuits: Stranded copper, Type THHN-THWN, complying with UL 83, in raceway **OR** Type XHHN, complying with UL 44, in raceway, **as directed**.
 2. Class 2 Control Circuits: Stranded copper, Type THHN-THWN, complying with UL 83, in raceway **OR** power-limited cable, complying with UL 83, concealed in building finishes **OR** power-limited tray cable, complying with UL 83, in cable tray **OR** Type XHHN, complying with UL 44, in raceway, **as directed**.
 3. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or TF, complying with UL 83.
- M. Fire Alarm Wire And Cable
1. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.
 2. Signaling Line Circuits: Twisted, shielded pair, not less than **OR** No. 18 AWG **OR** size as recommended by system manufacturer, **as directed**.
 - a. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a 2-hour rating.
 3. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.
 - a. Low-Voltage Circuits: No. 16 AWG, minimum.
 - b. Line-Voltage Circuits: No. 12 AWG, minimum.
 - c. Multiconductor Armored Cable: NFPA 70, Type MC, copper conductors, Type TFN/THHN conductor insulation, copper drain wire, copper armor with outer jacket, **as directed**, with red identifier stripe, NRTL listed for fire alarm and cable tray installation, plenum rated, and complying with requirements in UL 2196 for a 2-hour rating.
- N. Identification Products
1. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
 2. Comply with requirements in Division 26 Section "Identification For Electrical Systems".
- O. Source Quality Control
1. Testing Agency: Engage a qualified testing agency to evaluate cables.
 2. Factory test UTP and optical fiber cables on reels according to TIA/EIA-568-B.1.
 3. Factory test UTP cables according to TIA/EIA-568-B.2.
 4. Factory test multimode optical fiber cables according to TIA-526-14-A and TIA/EIA-568-B.3.



5. Factory sweep test coaxial cables at frequencies from 5 MHz to 1 GHz. Sweep test shall test the frequency response, or attenuation over frequency, of a cable by generating a voltage whose frequency is varied through the specified frequency range and graphing the results.
6. Cable will be considered defective if it does not pass tests and inspections.
7. Prepare test and inspection reports.

1.3 EXECUTION

A. Installation Of Pathways

1. Cable Trays: Comply with NEMA VE 2 and TIA-569-B.
2. Comply with TIA-569-B for pull-box sizing and length of conduit and number of bends between pull points.
3. Comply with requirements in Division 26 Section "Raceway And Boxes For Electrical Systems" for installation of conduits and wireways.
4. Install manufactured conduit sweeps and long-radius elbows whenever possible.
5. Pathway Installation in Equipment Rooms:
 - a. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
 - b. Install cable trays to route cables if conduits cannot be located in these positions.
 - c. Secure conduits to backboard when entering room from overhead.
 - d. Extend conduits 3 inches (75 mm) above finished floor.
 - e. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.
6. Backboards: Install backboards with 96-inch (2440-mm) dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

B. Installation Of Hangers And Supports

1. Comply with requirements in Division 26 Section "Hangers And Supports For Electrical Systems" for installation of supports for pathways, conductors and cables.

C. Wiring Method

1. Install wiring in metal raceways and wireways. Conceal raceway except in unfinished spaces and as indicated. Minimum conduit size shall be 3/4 inch (21 mm). Control and data transmission wiring shall not share conduit with other building wiring systems.
2. Install wiring in raceways except in accessible indoor ceiling spaces and in interior hollow gypsum board partitions where cable may be used. Conceal raceways and wiring except in unfinished spaces and as indicated. Minimum conduit size shall be 3/4 inch (21 mm). Control and data transmission wiring shall not share conduit with other building wiring systems.
3. Install cable, concealed in accessible ceilings, walls, and floors when possible.
4. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Use lacing bars and distribution spools. Separate power-limited and non-power-limited conductors as recommended in writing by manufacturer. Install conductors parallel with or at right angles to sides and back of enclosure. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with intrusion system to terminal blocks. Mark each terminal according to system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

D. Installation Of Conductors And Cables

1. Comply with NECA 1.
2. Conductors: Size according to system manufacturer's written instructions unless otherwise indicated.
3. General Requirements for Cabling:
 - a. Comply with TIA/EIA-568-B.1.
 - b. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."



- c. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
 - d. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 - e. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
 - f. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
 - g. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
 - h. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
4. UTP Cable Installation: Install using techniques, practices, and methods that are consistent with Category 5e **OR** Category 6, **OR** Category 6e **as directed**, rating of components and that ensure Category 5e **OR** Category 6, **OR** Category 6e **as directed**, performance of completed and linked signal paths, end to end.
 - a. Comply with TIA/EIA-568-B.2.
 - b. Install 110-style IDC termination hardware unless otherwise indicated.
 - c. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.
 5. Optical Fiber Cable Installation:
 - a. Comply with TIA/EIA-568-B.3.
 - b. Cable shall be terminated on connecting hardware that is rack or cabinet mounted.
 6. Outdoor Coaxial Cable Installation:
 - a. Install outdoor connections in enclosures complying with NEMA 250, Type 4X. Install corrosion-resistant connectors with properly designed O-rings to keep out moisture.
 - b. Attach antenna lead-in cable to support structure at intervals not exceeding 36 inches (915 mm).
 7. Open-Cable Installation:
 - a. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
 - b. Suspend copper cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 60 inches (1525 mm) apart.
 - c. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
 8. Installation of Cable Routed Exposed under Raised Floors:
 - a. Install plenum-rated cable only.
 - b. Install cabling after the flooring system has been installed in raised floor areas.
 - c. Coil cable 72 inches (1830 mm) long shall be neatly coiled not less than 12 inches (300 mm) in diameter below each feed point.
 9. Separation from EMI Sources:
 - a. Comply with BICSI TDMM and TIA-569-B recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
 - b. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
 - 1) Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
 - 2) Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
 - 3) Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (600 mm).



- c. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
 - 1) Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
 - 2) Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
 - 3) Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).
 - d. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
 - 1) Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - 2) Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (75 mm).
 - 3) Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
 - e. Separation between Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
 - f. Separation between Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).
- E. Fire Alarm Wiring Installation
1. Comply with NECA 1 and NFPA 72.
 2. Wiring Method: Install wiring in metal raceway according to Division 26 Section "Raceway And Boxes For Electrical Systems".
 - a. Install plenum cable in environmental air spaces, including plenum ceilings.
 - b. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated raceway system. This system shall not be used for any other wire or cable.
 3. Wiring Method:
 - a. Cables and raceways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable.
 - b. Fire-Rated Cables: Use of 2-hour, fire-rated fire alarm cables, NFPA 70, Types MI and CI, is **OR** is not, **as directed**, permitted.
 - c. Signaling Line Circuits: Power-limited fire alarm cables may **OR** shall not, **as directed**, be installed in the same cable or raceway as signaling line circuits.
 4. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
 5. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.
 6. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.
 7. Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signals from other floors or zones.
 8. Wiring to Remote Alarm Transmitting Device: 1-inch (25-mm) conduit between the fire alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.
- F. Power And Control-Circuit Conductors
1. 120-V Power Wiring: Install according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables" unless otherwise indicated.
 2. Minimum Conductor Sizes:
 - a. Class 1 remote-control and signal circuits, No. 14 AWG.



- b. Class 2 low-energy, remote-control and signal circuits, No. 16 AWG.
- c. Class 3 low-energy, remote-control, alarm and signal circuits, No. 12 AWG.

G. Connections

1. Comply with requirements in Division 28 Section "Perimeter Security Systems" for connecting, terminating, and identifying wires and cables.
2. Comply with requirements in Division 28 Section "Intrusion Detection" for connecting, terminating, and identifying wires and cables.
3. Comply with requirements in Division 28 Section "Access Control" for connecting, terminating, and identifying wires and cables.
4. Comply with requirements in Division 28 Section "Video Surveillance" for connecting, terminating, and identifying wires and cables.
5. Comply with requirements in Division 28 Section "Plc Electronic Detention Monitoring And Control Systems" for connecting, terminating, and identifying wires and cables.
6. Comply with requirements in Division 28 Section(s) "Digital, Addressable Fire-alarm System" OR "Zoned (dc Loop) Fire-alarm System", **as directed**, for connecting, terminating, and identifying wires and cables.
7. Comply with requirements in Division 28 Section "Refrigerant Detection And Alarm" for connecting, terminating, and identifying wires and cables.

H. Firestopping

1. Comply with requirements in Division 07 Section "Penetration Firestopping".
2. Comply with TIA-569-B, "Firestopping" Annex A.
3. Comply with BICSI TDMM, "Firestopping Systems" Article.

I. Grounding

1. For communications wiring, comply with ANSI-J-STD-607-A and with BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
2. For low-voltage wiring and cabling, comply with requirements in Division 26 Section "Grounding And Bonding For Electrical Systems".

J. Identification

1. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section "Identification For Electrical Systems".

K. Field Quality Control

1. Perform tests and inspections.
2. Tests and Inspections:
 - a. Visually inspect UTP and optical fiber cable jacket materials for NRTL certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA/EIA-568-B.1.
 - b. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
 - c. Test UTP cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross connection.
 - 1) Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
 - d. Optical Fiber Cable Tests:



- 1) Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
- 2) Link End-to-End Attenuation Tests:
 - a) Multimode Link Measurements: Test at 850 or 1300 nm in 1 direction according to TIA-526-14-A, Method B, One Reference Jumper.
 - b) Attenuation test results for links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in TIA/EIA-568-B.1.
- e. Coaxial Cable Tests: Comply with requirements in Division 27 Section "Master Antenna Television System".
3. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.
4. End-to-end cabling will be considered defective if it does not pass tests and inspections.
5. Prepare test and inspection reports.

END OF SECTION 26 05 19 16h



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Task	Specification	Specification Description
26 05 19 16	01 22 16 00	No Specification Required
26 05 19 16	26 05 13 00	Conductors And Cables
26 05 19 16	26 05 13 00a	Undercarpet Cables
26 05 19 16	26 05 13 00b	Medium-Voltage Cables
26 05 23 00	26 05 19 16d	Control-Voltage Electrical Power Cables



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SECTION 26 05 26 00 - LIGHTNING PROTECTION**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for lightning protection. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes lightning protection for structures, structure elements and building site components.

C. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: For air terminals and mounting accessories.
 - a. Layout of the lightning protection system, along with details of the components to be used in the installation.
 - b. Include indications for use of raceway, data on how concealment requirements will be met, and calculations required by NFPA 780 for bonding of grounded and isolated metal bodies.
3. Qualification Data: For qualified Installer and manufacturer. Include data on listing or certification by UL.
4. Certification, signed by Contractor, that roof adhesive is approved by manufacturer of roofing material.
5. Field quality-control reports.
6. Comply with recommendations in NFPA 780, Annex D, "Inspection and Maintenance of Lightning Protection Systems," for maintenance of the lightning protection system.
7. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features, including the following:
 - a. Ground rods.
 - b. Ground loop conductor.

D. Quality Assurance

1. Installer Qualifications: Certified by UL or LPI as a Master Installer/Designer, trained and approved for installation of units required for this Project.
2. System Certificate:
 - a. UL Master Label.
OR
LPI System Certificate.
OR
UL Master Label Recertification.
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 780, "Definitions" Article.

E. Coordination

1. Coordinate installation of lightning protection with installation of other building systems and components, including electrical wiring, supporting structures and building materials, metal bodies requiring bonding to lightning protection components, and building finishes.
2. Coordinate installation of air terminals attached to roof systems with roofing manufacturer and Installer.
3. Flashings of through-roof assemblies shall comply with roofing manufacturers' specifications.



1.2 PRODUCTS

- A. Lightning Protection System Components
1. Comply with UL 96 and NFPA 780, **as directed**.
 2. Roof-Mounted Air Terminals: NFPA 780, Class I **OR** Class II, **as directed**, aluminum **OR** copper, **as directed**, unless otherwise indicated.
 - a. Air Terminals More than 24 Inches (600 mm) Long: With brace attached to the terminal at not less than half the height of the terminal.
 - b. Single-Membrane, Roof-Mounted Air Terminals: Designed specifically for single-membrane roof system materials. Comply with requirements in Division 07.
 3. Main and Bonding Conductors: Copper **OR** Aluminum, **as directed**.
 4. Ground Loop Conductor: The same size and type as the main conductor except tinned.
 5. Ground Rods: Copper-clad **OR** Zinc-coated **OR** Stainless, **as directed**, steel, sectional type, **as directed**; 3/4 inch (19 mm) in diameter by 10 feet (3 m) **OR** 5/8 inch (16 mm) in diameter by 96 inches (2400 mm), **as directed**, long.
 6. Heavy-Duty, Stack-Mounted, Lightning Protection Components: Stainless steel **OR** Solid copper **OR** Monel metal **OR** Lead sheathed, **as directed**.

1.3 EXECUTION

- A. Installation
1. Install lightning protection components and systems according to UL 96A and NFPA 780.
 2. Install conductors with direct paths from air terminals to ground connections. Avoid sharp bends.
 3. Conceal the following conductors:
 - a. System conductors.
 - b. Down conductors.
 - c. Interior conductors.
 - d. Conductors within normal view of exterior locations at grade within 200 feet (60 m) of building.
 4. Cable Connections: Use crimped or bolted connections for all conductor splices and connections between conductors and other components. Use exothermic-welded connections in underground portions of the system.

OR

 Cable Connections: Use exothermic-welded connections for all conductor splices and connections between conductors and other components.
 - a. Exception: In single-ply membrane roofing, exothermic-welded connections may be used only below the roof level.
 5. Air Terminals on Single-Ply Membrane Roofing: Comply with roofing membrane and adhesive manufacturer's written instructions.
 6. Bond extremities of vertical metal bodies exceeding 60 feet (18 m) in length to lightning protection components.
 7. Ground Loop: Install ground-level, potential equalization conductor and extend around the perimeter of structure **OR** area or item indicated, **as directed**.
 - a. Bury ground ring not less than 24 inches (600 mm) from building foundation.
 - b. Bond ground terminals to the ground loop.
 - c. Bond grounded building systems to the ground loop conductor within 12 feet (3.6 m) of grade level.
 8. Bond lightning protection components with intermediate-level interconnection loop conductors to grounded metal bodies of building at 60-foot (18-m) intervals.
- B. Corrosion Protection
1. Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture unless moisture is permanently excluded from junction of such materials.



2. Use conductors with protective coatings where conditions cause deterioration or corrosion of conductors.

C. Field Quality Control

1. Notify the Owner at least 48 hours in advance of inspection before concealing lightning protection components.
2. UL Inspection: Meet requirements to obtain a UL Master Label for system.
OR
LPI System Inspection: Meet requirements to obtain an LPI System Certificate.

END OF SECTION 26 05 26 00



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SECTION 26 05 26 00a - GROUNDING AND BONDING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for grounding and bonding. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes methods and materials for grounding systems and equipment, plus the following special applications, **as directed**:
 - a. Overhead-lines grounding.
 - b. Underground distribution grounding.
 - c. Common ground bonding with lightning protection system.

C. Submittals

1. Product Data: For each type of product indicated.
2. Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:
 - a. Test wells.
 - b. Ground rods.
 - c. Ground rings.
 - d. Grounding arrangements and connections for separately derived systems.
 - e. Grounding for sensitive electronic equipment.
3. Qualification Data: For qualified testing agency and testing agency's field supervisor.
4. Field quality-control test reports.
5. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation And Maintenance Data", include the following:
 - a. Instructions for periodic testing and inspection of grounding features at test wells **OR** ground rings **OR** grounding connections for separately derived systems, **as directed** based on NETA MTS **OR** NFPA 70B, **as directed**.
 - 1) Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
 - 2) Include recommended testing intervals.

D. Quality Assurance

1. Testing Agency Qualifications: Member company of NETA or an NRTL.
 - a. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
3. Comply with UL 467 for grounding and bonding materials and equipment.

1.2 PRODUCTS

A. Conductors

1. Insulated Conductors: Copper **OR** Tinned-copper, **as directed**, wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
2. Bare Copper Conductors:



- a. Solid Conductors: ASTM B 3.
 - b. Stranded Conductors: ASTM B 8.
 - c. Tinned Conductors: ASTM B 33.
 - d. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
 - e. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - f. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
 - g. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
3. Bare Grounding Conductor and Conductor Protector for Wood Poles:
 - a. No. 4 AWG minimum, soft-drawn copper.
 - b. Conductor Protector: Half-round PVC or wood molding. If wood, use pressure-treated fir or cypress or cedar.
 4. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 2 inches (6 by 50 mm), **as directed**, in cross section, with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

B. Connectors

1. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
2. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.
 - a. Pipe Connectors: Clamp type, sized for pipe.
3. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
4. Bus-bar Connectors: Mechanical type, cast silicon bronze, solderless compression **OR** exothermic-type wire terminals, **as directed**, and long-barrel, two-bolt connection to ground bus bar.

C. Grounding Electrodes

1. Ground Rods: Copper-clad **OR** Zinc-coated **OR** Stainless, **as directed**, steel, sectional type, **as directed**; 3/4 inch by 10 feet (19 mm by 3 m) **OR** 5/8 by 96 inches (16 by 2400 mm), **as directed**, in diameter.
2. Chemical-Enhanced Grounding Electrodes: Copper tube, straight or L-shaped, charged with nonhazardous electrolytic chemical salts.
 - a. Termination: Factory-attached No. 4/0 AWG bare conductor at least 48 inches (1200 mm) long.
 - b. Backfill Material: Electrode manufacturer's recommended material.

1.3 EXECUTION

A. Applications

1. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.
2. Underground Grounding Conductors: Install bare copper **OR** tinned-copper, **as directed**, conductor, No. 2/0 AWG minimum. Bury at least 24 inches (600 mm) below grade.
 - a. Bury at least 24 inches (600 mm) below grade.
 - b. Duct-Bank Grounding Conductor: Bury 12 inches (300 mm) above duct bank when indicated as part of duct-bank installation.
3. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection,



- with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
4. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
 - a. Install bus on insulated spacers 1 inch (25 mm), minimum, from wall 6 inches (150 mm) above finished floor, unless otherwise indicated.
 - b. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, down to specified height above floor, and connect to horizontal bus.
 5. Conductor Terminations and Connections:
 - a. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - b. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
 - c. Connections to Ground Rods at Test Wells: Bolted connectors.
 - d. Connections to Structural Steel: Welded connectors.
- B. Grounding Overhead Lines
1. Comply with IEEE C2 grounding requirements.
 2. Install 2 parallel ground rods if resistance to ground by a single, ground-rod electrode exceeds 25 ohms.
 3. Drive ground rods until tops are 12 inches (300 mm) below finished grade in undisturbed earth.
 4. Ground-Rod Connections: Install bolted connectors for underground connections and connections to rods.
 5. Lightning Arrester Grounding Conductors: Separate from other grounding conductors.
 6. Secondary Neutral and Transformer Enclosure: Interconnect and connect to grounding conductor.
 7. Protect grounding conductors running on surface of wood poles with molding extended from grade level up to and through communication service and transformer spaces.
- C. Grounding Underground Distribution System Components
1. Comply with IEEE C2 grounding requirements.
 2. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches (100 mm) will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches (50 mm) above to 6 inches (150 mm) below concrete. Seal floor opening with waterproof, nonshrink grout.
 3. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.
 4. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches (150 mm) from the foundation.
- D. Equipment Grounding
1. Install insulated equipment grounding conductors with all feeders and branch circuits.
 2. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 - a. Feeders and branch circuits.
 - b. Lighting circuits.
 - c. Receptacle circuits.



- d. Single-phase motor and appliance branch circuits.
 - e. Three-phase motor and appliance branch circuits.
 - f. Flexible raceway runs.
 - g. Armored and metal-clad cable runs.
 - h. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
 - i. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.
 - j. X-Ray Equipment Circuits: Install insulated equipment grounding conductor in circuits supplying x-ray equipment.
3. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
 4. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
 5. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
 6. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
 7. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
 - a. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch (6-by-50-by-300-mm) grounding bus.
 - b. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
 8. Metal and Wood Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

E. Installation

1. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
2. Common Ground Bonding with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.
3. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade, unless otherwise indicated.
 - a. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.



- b. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
4. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Division 26 Section "Underground Ducts And Raceways For Electrical Systems" and shall be at least 12 inches (300 mm) deep, with cover.
 - a. Test Wells: Install at least one test well for each service, unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.
5. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
 - a. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - b. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
 - c. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.
6. Grounding and Bonding for Piping:
 - a. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 - b. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
 - c. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
7. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.
8. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet (18 m) apart.
9. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column **OR** indicated item, **as directed**, extending around the perimeter of building **OR** area or item indicated, **as directed**.
 - a. Install tinned-copper conductor not less than No. 2/0 AWG for ground ring and for taps to building steel.
 - b. Bury ground ring not less than 24 inches (600 mm) from building foundation.
10. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70, using a minimum of 20 feet (6 m) of bare copper conductor not smaller than No. 4 AWG.
 - a. If concrete foundation is less than 20 feet (6 m) long, coil excess conductor within base of foundation.
 - b. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to grounding electrode external to concrete.

F. Labeling

1. Comply with requirements in Division 26 Section "Identification For Electrical Systems" for instruction signs. The label or its text shall be green.
2. Install labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.
 - a. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."



- G. Field Quality Control
1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
 2. Tests and Inspections:
 - a. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 - b. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells.
 - 1) Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - 2) Perform tests by fall-of-potential method according to IEEE 81.
 - c. Prepare dimensioned drawings locating each test well, ground rod and ground rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
 3. Report measured ground resistances that exceed the following values:
 - a. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10 ohms.
 - b. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: 5 ohms.
 - c. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
 - d. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 **OR** 3, **as directed**, ohm(s).
 - e. Substations and Pad-Mounted Equipment: 5 ohms.
 - f. Manhole Grounds: 10 ohms.
 4. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify the Owner promptly and include recommendations to reduce ground resistance.

END OF SECTION 26 05 26 00a



SECTION 26 05 26 00b - OVERHEAD ELECTRICAL DISTRIBUTION

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for overhead electrical distribution. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Conductors, connectors, and splices.
 - b. Poles and crossarms.
 - c. Hardware and accessories.
 - d. Surge arresters.
 - e. Cutouts, switches, and fuses.
 - f. Pole-mounted distribution transformers.
 - g. Primary metering equipment.

C. Definitions

1. BIL: Basic impulse level, stated in kilovolts.
2. RUS: Department of Agriculture, Rural Utilities Service.
3. Sag: The distance measured vertically from a conductor to the straight line joining its two points of support, measured at the midpoint of the span, unless otherwise indicated.
 - a. Final Sag: The sag of a conductor under specified conditions of loading and temperature applied after it has been subjected, for an appreciable period, to the loading prescribed for the loading district in which it is situated, or equivalent loading, and the loading removed. Final sag includes the effect of inelastic deformation (creep).
 - b. Initial Unloaded Sag: The sag of a conductor before the application of an external load.
4. Secondary: Conductors and components for circuits operating at the utilization voltage of 600 V or less.
5. Service: Set of insulated conductors extending from a pole to the metering point or service entrance connection at the location of utilization of electricity.

D. Submittals

1. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Qualification Data: For qualified manufacturer **OR** testing agency, **as directed**.
3. Material Certificates: For the following items, from manufacturers:
 - a. Wood poles.
 - b. Concrete poles.
 - c. Wood crossarms.
4. Listing Documentation: Indicate that products comply with RUS listing requirements specified in "Quality Assurance" Article.
 - a. Time-Current Coordination Curves: Illustrate optimum coordination of protective devices involved in the Work of this Section.
 - b. Source quality-control test reports.
5. Field quality-control reports.
6. Operation and Maintenance Data: For switches **OR** transformers, **as directed**, to include in emergency, operation, and maintenance manuals.
7. Survey records for locations of pole, anchors, and other features for inclusion in Project Record Documents.



E. Quality Assurance

1. Concrete Pole Manufacturer Qualifications: Certified by PCI as a qualified manufacturer of concrete utility poles of type and size indicated for this Project.
2. Inspection Agency Qualifications for Pole and Crossarm Inspection: An independent agency, acceptable to authorities having jurisdiction, qualified to conduct inspections indicated.
3. Testing Agency Qualifications: Member company of NETA or an NRTL.
4. Testing Agency's Field Supervisor: Currently certified by NETA or an NRTL.
5. Treatment Technician Qualifications for Field Treatment of Wood Poles and Crossarms: Certified by authorities having jurisdiction over environmental protection at the location of Project for field application of chemicals required.
6. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
7. Overhead-Line Components, Devices, and Accessories: Currently listed in RUS Informational Publication 202-1 without restriction for the intended application.
8. Comply with IEEE C2 **OR** CPUC General Order 95, **as directed**, except where stricter requirements are indicated or where local requirements that are stricter apply.
9. Strength of Line and Line Components Selected by Contractor: Provide grades of construction and strength required by IEEE C2 for conditions encountered at Project site for heavy **OR** medium **OR** light, **as directed**, line loading unless otherwise indicated.

F. Delivery, Storage, And Handling

1. Wood Pole Storage and Handling: Comply with ATIS O5.1. Do not use pointed handling tools capable of producing indentations greater than 1 inch (25 mm).

G. Project Conditions

1. Interruption of Existing Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - a. Notify Owner no fewer than two days in advance of proposed interruption of service.
 - b. Do not proceed with interruption of service without Owner's written permission.

H. Coordination

1. Coordinate with utility supplying electricity to lines specified in this Section, and make final connections **OR** arrangements for final connections by utility, **as directed**.
2. Coordinate with those responsible for voice **OR** data **OR** video, **as directed**, systems that will have cables supported by poles installed according to this Section.

1.2 PRODUCTS

A. Conductors, Connectors, And Splices

1. Conductor Type AAC: Bare **OR** Bare and covered, **as directed**, all-aluminum, Alloy 1350-H19, complying with ASTM B 230/B 230M and ASTM B 231/B 231M.
OR
Conductor Type AAAC: Bare **OR** Bare and covered, **as directed**, all-aluminum-alloy, Alloy 6201-T81, complying with ASTM B 398/B 398M and ASTM B 399/B 399M.
OR
Conductor Type ACSR: Bare **OR** Bare and covered, **as directed**, aluminum conductor, steel reinforced, complying with ASTM B 232/B 232M.
OR
Conductor Type CU: Bare **OR** Bare and covered, **as directed**, hard-drawn copper, complying with ASTM B 1 and ASTM B 8.
2. Conductor Covering: UV resistant, complying with ICEA-S-70-547. HDPE **OR** XLP, **as directed**, 150 mils (3.81 mm) thick.



3. Self-Supported, Multiconductor, Insulated Medium-Voltage Wiring: Factory-assembled, messenger-supported type, listed under UL 1072 as sunlight-resistant Type MV cable for cable tray use.
 - a. Conductors: Aluminum, Alloy 1350, complying with ASTM B 230/B 230M and ASTM B 231/B 231M **OR** Hard-drawn copper, complying with ASTM B 1 and ASTM B 8, **as directed**; stranded for No. 2 AWG and larger.
 - b. Conductor Insulation: XLP, complying with NEMA WC 70/ICEA S-95-658 **OR** EPR, complying with NEMA WC 70/ICEA S-95-658, **as directed**.
 - c. Insulation Level: 100 **OR** 133, **as directed**, percent of rated circuit line-to-line voltage.
 - d. Conductor Shield: Extruded, nonconducting, thermoset material, complying with NEMA WC 70/ICEA S-95-658; 18-mil (0.046-mm) minimum thickness.
 - e. Insulation Shield: Include the following two components:
 - 1) Nonmetallic conducting, material complying with NEMA WC 70/ICEA S-95-658 and UL 1072, extruded over, and free stripping from the insulation.
 - 2) Metallic Tape Shield: Bare copper, 5-mil (0.127-mm) minimum thickness, helically applied with a 15 percent minimum overlap.
 - f. Conductor Jacket: Extruded, chlorosulfonated-polyethylene-based material, complying with NEMA WC 70/ICEA S-95-658.
 - g. Messenger: Copper **OR** Composite copper and copper, **as directed**, -clad steel.
 - h. Conductor Support Strap: Copper strap, wound around conductors and messenger the full length of the cable.
4. Secondary-Voltage Line Conductors: Aluminum conductor, steel **reinforced**, complying with ASTM B 232/B 232M **OR** Covered aluminum conductor, steel reinforced, complying with ICEA S-70-547, with HDPE or XLP covering, **as directed**, 60 mils (1.52 mm) thick.

OR

Secondary-Voltage Line Conductors: Bare hard-drawn copper, complying with ASTM B 1 and ASTM B 8 **OR** Covered hard-drawn copper, complying with ICEA S-70-547, with HDPE or XLP covering, **as directed**, 60 mils (1.52 mm) thick. Neutral-supported, secondary service-drop cable, **as directed**.

OR

Racked Secondary Conductors, 600 V and Less: Copper, insulated with XLP, complying with NEMA WC 70/ICEA S-95-658, **as directed**.
5. Neutral-Supported, Secondary Service-Drop Cable, 600 V and Less: Insulated conductors with bare neutral, complying with ICEA S-76-474, and using the following combination of materials:
 - a. Conductors and Neutral: Copper with copper-clad-steel neutral **OR** Aluminum with bare Alloy 1350 aluminum neutral **OR** Aluminum with ACSR neutral, **as directed**.
 - b. Insulation: XLP, complying with NEMA WC 70/ICEA S-95-658 **OR** High-modular-weight, low-density polyethylene **OR** Weather-resistant polyolefin, complying with ICEA S-70-547, **as directed**.
6. Connectors, Splices, and Conductor Securing and Protecting Components: Items include wire clamps, ties, conductor armor, fittings, connectors, and terminals. Listed for the specific applications and conductor types and combinations of materials used. Descriptions as follows for various applications:
 - a. Copper to Copper: Copper alloy, complying with UL 486A-486B.
 - b. Aluminum Composition to Aluminum Composition: Aluminum alloy, complying with UL 486A-486B.
 - c. Copper to Aluminum Composition: Type suitable for this purpose, complying with UL 486A-486B.
 - d. Connectors and Splices for Secondary Conductors: Listed and labeled for the conditions and materials involved in each application.
 - e. Taps for Medium-Voltage Line Conductors: Hot-line clamps, screw type, with concealed threads and bare, hard-drawn copper stirrups. Listed for the combination of materials being connected.
 - f. Splices under Tension: Compression type with strength exceeding the conductors spliced.



- g. Splices and Terminations for Covered Conductors: As recommended by conductor manufacturer for conductor and covering combination and for specific materials and physical arrangement of each splice.
 - h. Splices and Terminations for Insulated Medium-Voltage Conductors: Comply with requirements in Division 26 Section "Medium-voltage Cables".
- B. Wood Poles
- 1. Comply with ATIS O5.1 and RUS Bulletin 1728F-700, for wood poles pressure treated with creosote **OR** pentachlorophenol, **as directed**, **OR** ammoniacal copper arsenate, **OR** ammoniacal copper zinc arsenate **OR** chromated copper arsenate, **as directed**.
 - 2. Wood Species: Douglas fir **OR** Lodgepole pine **OR** Western larch **OR** Southern yellow pine, **as directed**.
 - 3. Pole Marking:
 - a. Manufacturer's Mark: Comply with ATIS O5.1; locate 10 feet (3 m) from the pole butt for poles 50 feet (15 m) long or less.
 - b. Pole Number: Machine-embossed aluminum, alphanumeric characters not less than 2-1/2 inches (65 mm) high, with aluminum nails.
 - 4. Factory Operations: Machine trim poles by turning smooth, full length. Roof, gain, and bore poles before pressure treatment.
- C. Concrete Poles
- 1. Description: Spun-cast prestressed concrete, complying with requirements of ASTM C 1089.
 - a. Comply with requirements of RUS Bulletin 1724E-216.
 - 2. Design: Base design on calculation of strength required by IEEE C2 or indicated on Drawings, whichever is greater. Design shall be suitable for installation at a location where annual temperature range is between minus 4 deg F and plus 100 deg F (minus 20 deg C and plus 38 deg C). Include pole design for embedded attachments matching fittings, brackets, and other items installed in the field.
 - 3. Shaft: Hollow, for poles at overhead-to-underground connections. Provide 3-1/2-inch- (89-mm-) minimum cable raceway capacity, with conduit elbow **OR** cable entry port, **as directed**, at base.
 - 4. Water Absorption: Not more than 3 percent.
 - 5. Surface: Smooth, hard, nonporous, and resistant to soil acids **OR** road salts **OR** frost and freezing damage, **as directed**.
 - 6. Pole Marking:
 - a. Manufacturer's Mark: Comply with ATIS O5.1; locate 10 feet (3 m) from the pole butt for poles 50 feet (15 m) long or less.
 - b. Pole Number: Machine-embossed aluminum, alphanumeric characters not less than 2-1/2 inches (65 mm) high.
- D. Crossarms
- 1. Description: Solid-wood distribution type, complying with RUS Bulletin 1728H-701 for specified construction grade **OR** Galvanized, steel angles, **as directed**, and complying with IEEE C2 for required climbing space and wire clearances.
 - 2. Braces: Galvanized, flat, ferrous-metal units; 1/4 inch (6 mm) thick by 1-1/4 inches (30 mm) wide, minimum, with length to suit crossarm dimensions.
- E. Guys And Anchors
- 1. Guy Strand Assemblies: Cable and attachment assemblies shall have uniform minimum breaking strength of the cable.
 - 2. Cable: Seven strands. Zinc-coated steel, complying with ASTM A 475 **OR** Aluminum-clad steel, complying with ASTM B 416 **OR** Copper-clad steel, complying with ASTM B 228, **as directed**. Breaking strength shall be not less than 10,000 lb (45 kN).
 - 3. Cable Termination:
 - 1) Thimble eye.

OR



- 2) Hooks and guy strain plates, complying with IEEE C135.1.
 - 2) Preformed galvanized-steel guy grips, matching material, galvanizing, and strength of the guy strand assembly.
 4. Anchor and Anchor-Rod Assemblies: Hot-dip galvanized steel.
 - a. Power-installed screw-type anchors.
 - 1) 15-inch (380-mm) screw; with rod 96 inches (2400 mm) long by 1-1/2 inches (38 mm) in diameter. Rated at 10,000 lb (45 kN) when installed.
 - 2) Guy anchors shall have strength and holding area as required for anchor load and soil conditions at location of that anchor.
 5. Strain Insulators: Epoxy-bonded fiberglass of length to meet clearance requirements specified in "Guy Installation" Article.
 6. Guy Markers: Round, of vinyl or PVC material, white **OR** yellow, **as directed**, color, 96 inches (2440 mm) long. Shatter resistant at temperatures below 0 deg F (minus 18 deg C).
- F. Hardware And Accessories
1. Description: Ferrous-metal items include, but are not limited to, bolts, nuts, washers, crossarm gains and braces, insulator pins, anchor rods, anchors, eyebolts, staples, and transformer brackets.
 - a. Comply with IEEE C135.1, IEEE C135.2, ANSI C135.4, ANSI C135.22, and RUS Informational Publication 202-1 listings with the exception that base material shall be malleable iron or ductile iron, and finish shall be hot-dip galvanized, **as directed**.
 2. Insulator Brackets: Hot-dip galvanized steel, style as indicated, designed to hold vertical-post-type or pin-type insulators, with one **OR** two, **as directed**, -bolt attachment to pole.
 3. Secondary Insulator Racks: Hot-dip galvanized steel, style as indicated, with smooth, rounded 12-gage struts designed to support two **OR** three **OR** four, **as directed**, spool insulators for attachment of secondary drop conductors. Spool spacing of 4 inches (100 mm) **OR** 8 inches (200 mm) **OR** 12 inches (300 mm), **as directed**.
 4. Pole Riser Shields: Galvanized steel with boot **OR** backplate **OR** vent, **as directed**.
 5. Padlocks: ASTM F 883.
 - a. Class: PO1 **OR** PO2, **as directed**.
 - b. Grade: 1 **OR** 2 **OR** 3 **OR** 4 **OR** 5 **OR** 6, **as directed**.
 - c. Option: A **OR** B **OR** C **OR** D **OR** E **OR** F **OR** G, **as directed**.
 6. Insulators: Units rated 6 kV and above shall be free from radio interference.
 - a. Porcelain insulators shall be wet-process type, complying with the following:
 - 1) Pin: ANSI C29.5.
 - 2) Line Post: ANSI C29.7. Include mounting stud of length suitable for each mounting arrangement used.
 - 3) Suspension: ANSI C29.2.
 - 4) Guy Strain: ANSI C29.4.
 - 5) Secondary Spool: ANSI C29.3, Class 53-2.
 - b. Polymer-composite, fiberglass-reinforced insulators shall comply with the following:
 - 1) Line Post: CEA LWIWG-02.
 - 2) Dead End/Suspension: CEA LWIWG-01.
 - 3) Guy Strain: Fiberglass reinforced, epoxy finished. Designed specifically for use in guy assemblies.
 7. Grounding Materials: Comply with Division 26 Section "Grounding And Bonding For Electrical Systems", using materials listed by RUS for the intended purpose without restriction.
 - a. Conductors: No. 4 AWG, minimum; bare, solid, annealed copper, complying with ASTM B 8 unless otherwise indicated.
 - b. Ground Conductor Protectors: PVC or half-round wood molding, fir, pressure treated according to AWPAC 25 **OR** cypress **OR** cedar, **as directed**.
- G. Surge Arresters
1. Distribution-Class Surge Arresters: Porcelain **OR** Polymer, **as directed**,-enclosed, gapless, metal-oxide type with automatic-indicating type, ground-lead disconnection feature, **as directed**, complying with IEEE C62.11 and NEMA LA 1.



2. Intermediate-Class Surge Arresters: Porcelain **OR** Polymer, **as directed**,-enclosed, gapless, metal-oxide type, complying with IEEE C62.11 and NEMA LA 1.
 - a. Voltage Rating: 3 **OR** 6 **OR** 9 **OR** 10 **OR** 12 **OR** 15 **OR** 27 **OR** 30 **OR** 36, **as directed**, kV, at the altitude of Project, unless otherwise indicated.

H. Cutouts, Switches, And Fuses

1. Description: Medium-voltage disconnect, protective, and bypass, **as directed**, units shall be rated for the line-to-line voltage of the systems in which installed, unless higher ratings are indicated. BIL ratings are 45 **OR** 60 **OR** 75 **OR** 95 **OR** 150 **OR** 200, **as directed**, kV.
 - a. Momentary Current Rating of Switching Devices: 20 **OR** 40, **as directed**, kA, asymmetrical at nominal system operating voltage.
 - b. Fuse Characteristics: Time-current characteristics for each set of fuses selected according to written recommendations of manufacturer of component protected by the fuses and coordinated with upstream and downstream protective devices. Prepare time-current coordination curves according to IEEE 242 that illustrate optimum coordination of devices in this Project.
 - c. Interrupting Rating of Fuses: **<Insert value>** symmetrical A at nominal system operating voltage.
2. Fuse Cutouts: Open **OR** enclosed, **as directed**, type, rated 100 **OR** 200, **as directed**, A, continuous, complying with ANSI C37.42.
 - a. Fuses: Enclosed link, Type K **OR** Type T, **as directed**, complying with ANSI C37.42.
 - b. Fuse Current Rating: 150 percent of the transformer full-load current unless otherwise indicated.
 - c. Switching Application: Include switch link instead of fuse.
 - d. Switch Current Interrupting Rating: Transformer magnetizing current.
3. Fused Switches: Single-pole, manual units.
 - a. Switch Rating: 400 **OR** 600, **as directed**,-A rms continuous and load-current interrupting.
 - b. Fuses: Dropout-type power fuses.
4. Nonfused Switches: Single-pole, manual units, rated 100 **OR** 200 **OR** 400 **OR** 600, **as directed**, -A rms continuous.
5. Group-Operated, Load-Interrupter Switches: Fused **OR** Nonfused, **as directed**, three-pole, single-throw units, manually operated by handle through insulated mechanical linkage.
 - a. High-pressure contact type, complying with ANSI C37.32.
 - b. Factory assembled to suit specific configuration and mounting conditions for this Project.
 - c. Operating Handle: Padlock equipped.
 - d. Current Interrupting Rating: Equal to continuous current rating of switch.
 - e. Fuses: Nondropout power type.
6. Group-Operated, Air-Break (Nonloadbreak) Switches: Three-pole, single-throw units, manually operated by handle through insulated mechanical linkage.
 - a. Comply with ANSI C37.32.
 - b. Factory assembled to suit specific configuration and mounting conditions for this Project.
 - c. Operating Handle: Padlock equipped.
 - d. Suitable for field conversion to load-interrupter switch by adding interrupter modules.

I. Distribution Transformers

1. Description: Single-phase, two-winding, single **OR** two, **as directed**,-bushing, liquid-filled, self-cooled, pole-mounting distribution type, suitable for external fuse and surge suppressor protection; complying with IEEE C 57.12.00, and tested according to IEEE C 57.12.90 and with the following additional requirements, **as directed**:
 - a. Cooling Class: OA.
 - b. Temperature Rise: 65 deg C.
 - c. Insulating Liquid: Mineral oil, ASTM D 3487, Type II.
OR
Insulating Liquid: High molecular weight, mineral oil based, and UL listed as less-flammable type.

**OR**

Insulating Liquid: Biodegradable insulating and cooling liquid, UL listed as less flammable type.

- d. Identification: Label the transformer as "non-PCB" and place manufacturer's name and type of fluid on the nameplate.
 2. BIL: 95 **OR** 75 **OR** 60, **as directed**, kV.
 3. Taps: Two, 2.5 percent above and below **OR** Four, 2.5 percent below, **as directed**, high-voltage and full-load rated. Tap changer shall have an external operating handle, **as directed**.
 4. Mounting Brackets: Single **OR** Double, **as directed**, integral; suitable for pole mounting, individually or in cluster, or on crossarm.
 5. Minimum Efficiency: Class 1, as defined by NEMA TP 1, based on test results that comply with requirements of NEMA TP 2.
 6. Bushings: Creepage distance shall exceed nominal value standard for unit rating by at least 75 percent.
 7. Hardware: Stainless steel.
 8. Tank and Cover: Stainless steel, complying with ASTM A 167, Type 304 or 304L, with paint coating exterior finish system complying with IEEE C57.12.28, including manufacturer's standard color finish coat.
 9. Show transformer kiloampere capacity using 2-1/2-inch (65-mm) numerals placed near the low-voltage bushings.
- J. Primary Metering Equipment
1. Metering Transformers: Outdoor current and potential transformers, designed for crossarm mounting, complying with IEEE C57.13, and having the following features:
 - a. BIL: 45 **OR** 60 **OR** 75 **OR** 95 **OR** 150 **OR** 200, **as directed**, kV.
 - b. Secondary connection box arranged for conduit connection.
 - c. Potential-Transformer Voltage Rating: 2.4 **OR** 4.16 **OR** 7.2 **OR** 12.0 **OR** 12.47, **as directed**, kV to 120-V ac, 60 Hz.
 - d. Potential-Transformer Accuracy Class: Minimum 0.3 at 75-VA burden.
 - e. Voltage Rating: 2.4 **OR** 4.16 **OR** 7.2 **OR** 12.0 **OR** 12.47, **as directed**, kV.
 - f. Current Rating: **<Insert value>** to 5 A.
 - g. Accuracy Class: Minimum 0.2 at 50-VA burden.
 2. Watt-Hour Meter: Outdoor solid-state unit, with demand register, **OR** arranged for pulse initiation, **as directed**, complying with ANSI C12.10, and including the following ratings and features:
 - a. Form: 8S **OR** 9S, **as directed**.
 - b. Element: 2 **OR** 2-1/2 **OR** 3, **as directed**.
 - c. Voltage: 120 V.
 - d. Current: 2-1/2 A.
 - e. Frequency: 60 Hz.
 - f. Kilowatt-Hour Register: Five-digit type.
 - g. Demand-Register Multiplier: A quantity in even hundreds, indicated on meter face.
 - h. Demand-Register Interval: 15 **OR** 30, **as directed**, minutes.
 - i. Mounting: On matching socket, complying with ANSI C12.7, and complete with automatic current short-circuiting device.
 - j. Meter Test Block: Matched to meter, and furnished and equipped with open knife switches designed to isolate each metering component for test.
 - k. Meter Cabinet: Galvanized steel; weatherproof enclosure with pole-mounting bracket and the following features:
 - 1) Hinged Door: Arranged for padlocking in closed position.
 - 2) Size: Adequate to house meter and other equipment indicated, but not less than 20 by 30 by 11 inches (510 by 760 by 280 mm) deep.
- K. Source Quality Control
1. Factory Tests: Conduct routine tests of transformers **OR** medium-voltage switches **OR** metering equipment, **as directed**, according to referenced standards.



2. Testing Agency: Engage a qualified testing agency to inspect poles and crossarms before and after preservative treatment for compliance of wood poles and crossarms with requirements indicated. RUS quality mark "WQC" on each item is acceptable in place of inspection as evidence of compliance.
3. Poles and crossarms will be considered defective if they do not pass tests and inspections.
4. Prepare test and inspection reports.

1.3 EXECUTION

A. Right-Of-Way Clearance And Tree Trimming

1. Clear right of way according to Division 01 Section(s) "Temporary Tree And Plant Protection" AND Division 31 Section(s) "Site Clearing".
2. Clear right of way to maintain minimum clearances required by IEEE C2, unless Drawings indicate greater clearances or greater clearances are required by state or local codes or regulations. If no minimum requirements are mandated, maintain a minimum of 15 feet (4.5 m) on both sides horizontally and below medium-voltage conductors and 60 inches (1500 mm) on both sides horizontally and below secondary-voltage conductors. Remove overhanging branches.

B. General Installation Requirements

1. Install underground power and metering circuits and those circuits indicated to be in raceways according to Division 26 Section "Underground Ducts And Raceways For Electrical Systems" and Division 26 Section "Medium-voltage Cables", and make splices and terminations for those circuits according to the applicable Sections.
2. Engage the services of a licensed surveyor to verify dimensions by field measurement, to identify locations of poles, anchors, and other features, and to verify all clearances. The survey document shall also identify locations of connections to new and existing supply lines and to primary and secondary services. Notify the Owner of discrepancies and field conditions that are not indicated and that will affect installation.
3. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
4. Apply warning signs and equipment labels according to Division 26 Section "Identification For Electrical Systems".

C. Conductor Installation, General

1. Handle and string conductors to prevent cuts, gouges, scratches, kinks, flattening, or deformation. Remove damaged sections and splice conductors.
 - a. String new conductors to "initial" sag values recommended by manufacturer for type and size of conductor except as otherwise indicated.
 - b. Conductors Reinstalled or Resagged: String to "final" sag values recommended by manufacturer for type and size of conductor except as otherwise indicated.
2. Connections, Splices, and Terminations: Use kits listed for the specific type of connection and combination of materials in the connection or recommended for the specific use by manufacturer of material on which applied.
 - a. Splice Location: Do not install within 10 feet (3 m) of a support.
 - b. Line Conductors and Service Drops: Install so strength exceeds ultimate rated strength of conductor.
 - c. Splices and Terminations of Covered Conductors: Comply with manufacturer's written instructions.
 - d. Splices and Terminations of Insulated Conductors of Self-Supported, Medium-Voltage Cable: Comply with manufacturer's written instructions.

D. Medium-Voltage Line Conductor Installation

1. Application: Install bare conductors unless otherwise indicated.



2. Armor Rod: Install to protect conductors if line conductors are supported by insulators.
 3. Flat Aluminum Armor Wire: Install to protect conductors if they are supported by, or attached to, galvanized or coated iron or steel clamps or fittings.
 4. Support line conductors and taps as follows:
 - a. Use wire ties for conductor attachment to pin and vertical post insulators unless otherwise indicated.
 - b. Install wire ties tight against conductor and insulator, and turn ends back and flat against conductor, to eliminate exposed wire ends.
 - c. Use wire clamps on horizontal post, dead end, and suspension insulators unless otherwise indicated.
- E. Pole And Crossarm Installation
1. Pole Orientation: Align curve of curved wood poles with straight-line runs of three or more poles. Align gained surfaces perpendicular to runs.
 2. Elevation of Line above Grade: Install poles with top at same elevation, unless grade changes dictate elevation change in poles, and according to the following:
 - a. On level ground, set poles so tops of consecutive poles vary not more than 60 inches (1500 mm) in elevation.
 - b. Shorten wood poles by cutting off the top and make cuts to shed water. Apply preservative to cuts.
 3. Set poles according to the following:
 - a. Make pole holes vertical, uniform in diameter, and large enough to permit effective use of tamping bars all around. Bore or excavate holes with an average diameter at grade less than twice the diameter of the pole at the same grade.
 - b. Use minimum depths indicated, except at locations where hole is partly or entirely in rock and if hole is not vertical or has a diameter at grade more than two times the pole diameter at the same level; in these conditions, increase the depth of the hole by the following increments before setting the pole:
 - 1) Poles up to 35 Feet (10.6 m) Long: 24 inches (600 mm).
 - 2) Poles 36 to 60 Feet (11 to 18.3 m) Long: 30 inches (760 mm).
 - 3) Poles 61 to 75 Feet (18.6 to 22.9 m) Long: 36 inches (900 mm).
 - c. For poles on slopes, indicated hole depth is from finished grade at lowest side of hole.
 - d. Set poles in alignment and plumb except at dead ends, angles, and points of extra strain; rake poles against conductor strain 1 inch (25 mm) minimum, 2 inches (51 mm) maximum, (after conductors are installed at required tension) for each 10 feet (3 m) of pole length. Rake poles so they will not lean or bend in direction of strain when loaded.
 - e. Backfill holes in 6-inch (150-mm) maximum lifts, and thoroughly tamp each layer before starting the next.
 - f. Place surplus earth around pole in a conical shape, and tamp thoroughly to provide drainage away from pole.
 - g. Set poles so alternate crossarm gains face in alternate directions, except at terminals and dead ends; place gains on last two poles on side facing terminal or dead end.
 - h. Poles Set in Concrete Paved Areas: Install poles with minimum of 6-inch- (150-mm-) wide, unpaved gap between the pole and the edge of adjacent concrete slab. Fill unpaved ring with pea gravel to a level 1 inch (25 mm) below top of concrete slab.
 4. Field treat factory-treated poles and crossarms as follows:
 - a. Poles Treated More Than One Year before Installation: Treat portion from 24 inches (600 mm) above ground line to butt.
 - b. Field-Bored Holes and Field-Cut Gains and Pole Tops: Treat cut portions.
 - c. Unused Holes: Treat and plug with treated-wood-dowel drive pins.
 - d. Engage the services of a technician certified according to "Quality Assurance" Article to apply treatment. Comply with requirements in AWPA standards that govern original factory treatment for field-applied treatment and application of chemicals.
 5. Crossarm Installation: Set line crossarms at right angle to line for straight runs and for angles 45 degrees and more. Bisect angles less than 45 degrees.
 - a. Buck Arms: Install at corners and junction poles unless otherwise indicated.



- b. Double Crossarms: Install at dead ends, corners, angles, and line crossings.
 - c. Equipment Arms: Locate below lines and set parallel or at right angles to them, whichever provides best climbing space.
 - d. Gains: Install factory-cut or metal-pole gains only. Do not cut gains in field without specific written approval.
6. Locate pole numbers to provide maximum visibility from the road or patrol route.
- F. Guy Installation
1. Install guys to resist unbalanced loads, including those developed at angles, corners, and dead ends. Install two or more guys if a single guy will not provide adequate strength. Install separate guys if unbalanced loads are separated by 36 inches (900 mm) or more. Comply with IEEE C2.
 - a. Unless a thimble eye is used, at the pole end, install a minimum of two guy hooks and two guy strain plates.
 - b. At the anchor end, attach guy strand assembly with preformed grips.
 2. Protect guy strands from damage. Replace damaged guy strands. Install guy insulators where required to comply with IEEE C2 clearance requirements.
 3. Install guys with a lead-to-height ratio of 1 to 1 unless otherwise indicated. The minimum lead-to-height ratio shall be 1/2 to 1. When less than 1 to 1, increase guy strength by the ratio of the sine of the lead angle indicated to the sine of the lead angle provided.
 4. Install screw-type guy anchors aligned in soil with guy. Set with anchor rod pointing at guy attachment on pole and rod projecting 6 to 9 inches (150 to 230 mm) from ground.
 5. Install strain insulators to provide a minimum of 12 inches (300 mm) of clearance between the nearest energized surface and the strain insulator fitting farthest from the pole. When loaded to the tension indicated, fiberglass strain insulators shall be loaded to not more than two-thirds of manufacturer's published rating.
 6. Guy Markers: Install at anchor end of guys to visually mark the guy wire at all accessible locations. Clamp to guy strand or anchor at top and bottom of marker.
- G. Hardware And Accessories Installation
1. Install washers against wood and under nuts, including eyenuts and locknuts.
 2. Install nuts and locknuts wrench-tight on threaded connections.
- H. Insulator Installation
1. Medium-Voltage Line Application: Install pin **OR** post, **as directed**, type, except install suspension type at corners, angles, dead ends, and other locations where horizontal forces exceed rated values for pin or line-post-type units.
 - a. Install suspension insulators and hardware that have mechanical strength exceeding rated breaking strength of attached conductors.
 - b. Install horizontal line-post insulators for armless construction.
 2. Post-Insulator Conductor Support: Where installed horizontally and for line angles more than 15 degrees, install clamp-top conductor clamps.
 3. Install spool-type insulators for secondary lines mounted on clevis attachments or secondary racks.
 4. Guy Strain Type: Install porcelain **OR** fiberglass-reinforced, **as directed**, units.
- I. Surge Arresters
1. Install surge arresters to protect distribution **OR** metering equipment **OR** reclosers, **as directed**, group-operated, load-interrupter switches, **as directed**, aerial-to-underground transitions, **as directed**, and other items indicated.
 - a. Units Installed 6000 Feet (1800 m) or More above Sea Level: Use arresters specifically rated for this service.
- J. Cutout, Switch, And Fuse Installation
1. Hook-Stick-Operated Switches: Install to maximize safe operating access.



2. Group-Operated, Load-Interrupter Switches and Air-Break Switches: Install operating handle 42 inches (1067 mm) above finished grade.
 - a. Locking Provisions: Install padlock at hasp.
- K. Metering Component Installation
 1. Current and Voltage Transformers: Install secondary conductors between transformers and cabinet in sleeves made of galvanized rigid steel **OR** intermediate metal **OR** PVC, **as directed**, conduit. Install to prevent collection of moisture in raceway and cabinet system.
 2. Meter Cabinet: Mount on pole, 72 inches (1825 mm) above finished grade to center of cabinet.
 - a. Make conduit connections with raintight hubs.
 - b. Install metering transformer secondary leads without splices. Train leads at sides and bottom of enclosure, and secure with wire ties.
 - c. Install meter and meter test block within cabinet.
 - d. Install identical phase sequence, and color-code for both potential and current leads.
 - e. Identify leads using designations consistent with marking on transformer terminals.
- L. Field Quality Control
 1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
 2. Perform tests and inspections.
 3. Tests and Inspections:
 - a. Furnish instruments and equipment required for tests that comply with NETA Acceptance Testing Specification.
 - b. Guy Anchors: Test one of each type and capacity installed, plus additional units specifically indicated for testing, **as directed**. Apply rated pull-out force in the same pull direction applied by the guy at the test location.
 - 1) Acceptable Test Results: Denoted by movement of less than 3/8 inch (10 mm) by the holding component of the anchor in the earth or other medium in which it is installed.
 - 2) Replace or reinstall, at the Owner 's option, all anchors of same type and capacity as anchor type that fails this test.
 - c. Ground Resistance: Comply with Division 26 Section "Grounding And Bonding For Electrical Systems". Measure resistance of each separate grounding electrode, including pole grounds. Also measure resistance of separate grounding electrode systems before bonding together.
 - 1) Perform tests and obtain acceptable results before energizing any portion of overhead electrical distribution system.
 - 2) Results and Follow-up: If ground resistance for a single ground electrode or pole ground, tested individually, exceeds 25 ohms, add a ground electrode not less than 10 feet (3 m) away and interconnect with No. 2 AWG, minimum, bare conductor buried at least 12 inches (300 mm) below furnished grade.
 - d. Aerial Conductor Sag and Tension: Observe procedures used by Contractor to verify that initial stringing sags and tensions comply with IEEE C2 and conductor manufacturer's product data and written recommendations.
 - e. Self-Supported, Medium-Voltage Cable: After installation, while cable is isolated, and after terminations are installed and before connecting or energizing, apply dc voltage between each phase conductor and grounding connections of sheath or metallic shield. Comply with NEMA WC 70/ICEA S-95-658 for method, voltage, duration, pass-fail performance, and other test criteria. Perform other field inspections and tests recommended by manufacturer.
 - f. Neutral-Supported, Secondary Service-Drop Cable: Test for insulation resistance while cable is isolated, before connecting or energizing. Minimum acceptable resistance is 100 megohms.
 - g. Existing Surge Arresters: Disconnect and measure resistance between line and ground terminals with a megger test rated 600 V or more. Acceptable resistance values are 300 megohms and more.



- h. New Surge Arresters, Cutouts, and Switches: Inspect after installation and connection to wiring. Verify that ratings and characteristics match approved submittals and comply with system requirements. Verify that installation complies with requirements and that clearances of units and connecting wiring comply with IEEE C2 requirements.
 - 1) Verify proper grounding of metallic equipment parts.
 - 2) Fuses and Disconnect Links: Verify that ratings and characteristics match submittals and comply with system requirements.
 - 3) Switches:
 - a) Manually operate each cutout and switch at least three times, to verify proper operation.
 - b) Verify correct contact alignment, blade penetration, travel stops, and arc interrupter operation.
 - 4) Group-Operated, Load-Interrupter Switches and Air-Break Switches:
 - a) Perform mechanical operator tests according to manufacturer's written instructions.
 - b) Test resistance to ground of parts to be energized. Acceptable value is 200,000 megohms.
 - c) Perform contact-resistance test across all switch blade contacts. Refer to manufacturer's data for acceptable contact resistance.
 - 5) Verify that clearances of energized parts and connecting wires comply with IEEE C2 requirements.
 - i. Distribution Transformers: Inspect after installation and connection to wiring and verify that ratings and characteristics match approved submittals and comply with system requirements. Verify the integrity and good condition of unit.
 - 1) Inspect for physical damage, cracked insulators, leaks, tightness of connections, and overall mechanical and electrical integrity.
 - 2) Perform preenergizing inspections and tests recommended by manufacturer.
 - 3) Verify proper equipment grounding.
 - 4) Verify that clearances of terminals and connecting wires comply with IEEE C2.
 - j. Metering Transformers: Inspect after installation and connection to wires, and verify that ratings and characteristics match approved submittals and comply with system requirements. Verify the integrity and good condition of unit.
 - 1) Verify proper connections, tightness of bolted connections, and integrity of mounting provisions.
 - 2) Verify that required grounding and shorting connections provide good contact.
 - 3) Verify that clearances of terminals and connecting wires comply with IEEE C2.
 - 4) Perform electrical tests according to manufacturer's written instructions, including insulation-resistance tests, polarity tests, and turns-ratio and ratio-verification tests.
 - k. Meters: Inspect after installation and connection to wiring and verify that ratings and characteristics match approved submittals and comply with system requirements. Verify the integrity and good condition of unit.
 - 1) Verify tightness of electrical connections.
 - 2) Verify accuracy at 25, 50, 75, and 100 percent of full-rated load and verify all instrument multipliers according to manufacturer's written instructions.
4. Prepare test and inspection reports.
- M. Adjusting
1. Distribution Transformers: Set voltage taps as directed by the Owner.
- N. Cleaning
1. After completing equipment installation, inspect equipment. Remove spots, dirt, and debris. Repair damaged finish to match original finish. For distribution transformer, use tank touchup paint provided by manufacturer.
 - a. Clean enclosures internally, on completion of installation, according to manufacturer's written instructions.



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- O. Demonstration
 - 1. Train Owner's maintenance personnel to adjust, operate, and maintain overhead electrical distribution.

END OF SECTION 26 05 26 00b



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Task	Specification	Specification Description
26 05 26 00	01 22 16 00	No Specification Required



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SECTION 26 05 29 00 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for hangers and supports for electrical systems. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Hangers and supports for electrical equipment and systems.
 - b. Construction requirements for concrete bases.

C. Definitions

1. EMT: Electrical metallic tubing.
2. IMC: Intermediate metal conduit.
3. RMC: Rigid metal conduit.

D. Performance Requirements

1. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
3. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
4. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

E. Submittals

1. Product Data: For the following:
 - a. Steel slotted support systems.
 - b. Nonmetallic slotted support systems.
2. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:
 - a. Trapeze hangers. Include Product Data for components.
 - b. Steel slotted channel systems. Include Product Data for components.
 - c. Nonmetallic slotted channel systems. Include Product Data for components.
 - d. Equipment supports.
3. Welding certificates.

F. Quality Assurance

1. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. Comply with NFPA 70.

1.2 PRODUCTS**A. Support, Anchorage, And Attachment Components**



1. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 - a. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - b. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 - c. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 - d. Channel Dimensions: Selected for applicable load criteria.
2. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch- (14-mm-) diameter holes at a maximum of 8 inches (200 mm) o.c., in at least 1 surface.
 - a. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
 - b. Fitting and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.
 - c. Rated Strength: Selected to suit applicable load criteria.
3. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
4. Conduit and Cable Support Devices: Steel **OR** Steel and malleable-iron, **as directed**, hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
5. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
6. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
7. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - a. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - b. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel **OR** stainless steel, **as directed**, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - c. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
 - d. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
 - e. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
 - f. Toggle Bolts: All-steel springhead type.
 - g. Hanger Rods: Threaded steel.

B. Fabricated Metal Equipment Support Assemblies

1. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
2. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

1.3 EXECUTION

A. Application

1. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
2. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by **OR** scheduled in NECA 1, where its Table 1 lists maximum



- spacings less than stated in, **as directed**, NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.
3. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 - a. Secure raceways and cables to these supports with two-bolt conduit clamps **OR** single-bolt conduit clamps **OR** single-bolt conduit clamps using spring friction action for retention in support channel, **as directed**.
 4. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.
- B. Support Installation
1. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
 2. Raceway Support Methods: In addition to methods described in NECA 1, EMT **OR** IMC **OR** RMC, **as directed**, may be supported by openings through structure members, as permitted in NFPA 70.
 3. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).
 4. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - a. To Wood: Fasten with lag screws or through bolts.
 - b. To New Concrete: Bolt to concrete inserts.
 - c. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - d. To Existing Concrete: Expansion anchor fasteners.
 - e. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
 - f. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts **OR** Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69 **OR** Spring-tension clamps, **as directed**.
 - g. To Light Steel: Sheet metal screws.
 - h. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.
 5. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.
- C. Installation Of Fabricated Metal Supports
1. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.
 2. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
 3. Field Welding: Comply with AWS D1.1/D1.1M.
- D. Concrete Bases
1. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.



2. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Cast-in-place Concrete".
3. Anchor equipment to concrete base.
 - a. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - b. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - c. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

E. Painting

1. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - a. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).
2. Touchup: Comply with requirements in Division 07 OR Division 09 Section(s) "High-performance Coatings" **as directed**, for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
3. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 26 05 29 00



SECTION 26 05 29 00a - VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for vibration and seismic controls for electrical systems. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Isolation pads.
 - b. Spring isolators.
 - c. Restrained spring isolators.
 - d. Channel support systems.
 - e. Restraint cables.
 - f. Hanger rod stiffeners.
 - g. Anchorage bushings and washers.

C. Definitions

1. The IBC: International Building Code.
2. ICC-ES: ICC-Evaluation Service.
3. OSHPD: Office of Statewide Health Planning and Development for the State of California.

D. Performance Requirements

1. Seismic-Restraint Loading:
 - a. Site Class as Defined in the IBC: **A OR B OR C OR D OR E OR F, as directed.**
 - b. Assigned Seismic Use Group or Building Category as Defined in the IBC: **I OR II OR III, as directed.**
 - 1) Component Importance Factor: **1.0 OR 1.5, as directed.**
 - 2) Component Response Modification Factor: **1.5 OR 2.5 OR 3.5 OR 5.0, as directed.**
 - 3) Component Amplification Factor: **1.0 OR 2.5, as directed.**
 - c. Design Spectral Response Acceleration at Short Periods (0.2 Second): As required to meet Project requirements.
 - d. Design Spectral Response Acceleration at 1.0-Second Period: As required to meet Project requirements.

E. Submittals

1. Product Data: For the following:
 - a. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
 - b. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
 - 1) Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an evaluation service member of ICC-ES **OR** OSHPD **OR** an agency acceptable to authorities having jurisdiction, **as directed.**
 - 2) Annotate to indicate application of each product submitted and compliance with requirements.
 - c. Restrained-Isolation Devices: Include ratings for horizontal, vertical, and combined loads.
2. Delegated-Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.



- a. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators and seismic restraints.
 - 1) Coordinate design calculations with wind-load calculations required for equipment mounted outdoors. Comply with requirements in other Division 22 for equipment mounted outdoors.
- b. Indicate materials and dimensions and identify hardware, including attachment and anchorage devices.
- c. Field-fabricated supports.
- d. Seismic-Restraint Details:
 - 1) Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
 - 2) Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
 - 3) Preapproval and Evaluation Documentation: By an evaluation service member of ICC-ES **OR** OSHPD **OR** an agency acceptable to authorities having jurisdiction, **as directed**, showing maximum ratings of restraint items and the basis for approval (tests or calculations).
3. Welding certificates.
4. Field quality-control test reports.

F. Quality Assurance

1. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
2. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
3. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.
4. Comply with NFPA 70.

1.2 PRODUCTS

A. Vibration Isolators

1. Pads: Arrange in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.
 - a. Resilient Material: Oil- and water-resistant neoprene **OR** rubber **OR** hermetically sealed compressed fiberglass, **as directed**.
2. Spring Isolators: Freestanding, laterally stable, open-spring isolators.
 - a. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - b. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - c. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - d. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.



- e. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- (6-mm-) thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig (3447 kPa).
 - f. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.
3. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.
- a. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
 - b. Restraint: Seismic or limit-stop as required for equipment and authorities having jurisdiction.
 - c. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - d. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - e. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - f. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

B. Seismic-Restraint Devices

1. General Requirements for Restraint Components: Rated strengths, features, and application requirements shall be as defined in reports by an evaluation service member of ICC-ES **OR** OSHPD **OR** an agency acceptable to authorities having jurisdiction, **as directed**.
 - a. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
2. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.
3. Restraint Cables: ASTM A 603 galvanized-steel **OR** ASTM A 492 stainless-steel, **as directed**, cables with end connections made of steel assemblies with thimbles, brackets, swivels, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.
4. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections **OR** Reinforcing steel angle clamped, **as directed**, to hanger rod. Do not weld stiffeners to rods.
5. Bushings for Floor-Mounted Equipment Anchor: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchors and studs.
6. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices.
7. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.
8. Mechanical Anchor: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchors with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.
9. Adhesive Anchor: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

C. Factory Finishes



1. Finish:
 - a. Manufacturer's standard prime-coat finish ready for field painting.
 - b. Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.
 - 1) Powder coating on springs and housings.
 - 2) All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
 - 3) Baked enamel or powder coat for metal components on isolators for interior use.
 - 4) Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

1.3 EXECUTION

A. Applications

1. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an evaluation service member of ICC-ES **OR** OSHPD **OR** an agency acceptable to authorities having jurisdiction, **as directed**.
2. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
3. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

B. Seismic-Restraint Device Installation

1. Equipment and Hanger Restraints:
 - a. Install restrained isolators on electrical equipment.
 - b. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
 - c. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES **OR** OSHPD **OR** an agency acceptable to authorities having jurisdiction, **as directed**, providing required submittals for component.
2. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
3. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
4. Drilled-in Anchors:
 - a. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - b. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - c. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 - d. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
 - e. Set anchors to manufacturer's recommended torque, using a torque wrench.
 - f. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.



- C. Accommodation Of Differential Seismic Motion
1. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where they terminate with connection to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.
- D. Field Quality Control
1. Tests and Inspections:
 - a. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 - b. Schedule test with the Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
 - c. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 - d. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
 - e. Test to 90 percent of rated proof load of device.
 - f. Measure isolator restraint clearance.
 - g. Measure isolator deflection.
 - h. Verify snubber minimum clearances.
 - i. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.
 2. Remove and replace malfunctioning units and retest as specified above.
 3. Prepare test and inspection reports.
- E. Adjusting
1. Adjust isolators after isolated equipment is at operating weight.
 2. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
 3. Adjust active height of spring isolators.
 4. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 26 05 29 00a



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Task	Specification	Specification Description
26 05 33 13	26 05 19 16	Common Work Results for Electrical
26 05 33 13	26 05 19 16a	Common Work Results for Communications
26 05 33 13	26 05 19 16b	Common Work Results for Electronic Safety and Security
26 05 33 13	26 05 19 16c	Electrical Renovation
26 05 33 13	26 05 13 00	Conductors And Cables
26 05 33 13	26 05 19 16e	Communications Equipment Room Fittings
26 05 33 13	26 05 19 16f	Communications Backbone Cabling
26 05 33 13	26 05 19 16g	Communications Horizontal Cabling
26 05 33 13	26 05 19 16h	Conductors and Cables for Electronic Safety and Security



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SECTION 26 05 33 16 - RACEWAYS AND BOXES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of raceways and boxes. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

C. Definitions

1. EMT: Electrical metallic tubing.
2. ENT: Electrical nonmetallic tubing.
3. EPDM: Ethylene-propylene-diene terpolymer rubber.
4. FMC: Flexible metal conduit.
5. IMC: Intermediate metal conduit.
6. LFMC: Liquidtight flexible metal conduit.
7. LFNC: Liquidtight flexible nonmetallic conduit.
8. NBR: Acrylonitrile-butadiene rubber.
9. RNC: Rigid nonmetallic conduit.

D. Submittals

1. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
2. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.
 - a. Custom enclosures and cabinets.
 - b. For handholes and boxes for underground wiring, including the following:
 - 1) Duct entry provisions, including locations and duct sizes.
 - 2) Frame and cover design.
 - 3) Grounding details.
 - 4) Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
 - 5) Joint details.
3. Samples: For each type of exposed finish required for wireways, nonmetallic wireways and surface raceways, prepared on Samples of size indicated below.
4. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - a. Structural members in the paths of conduit groups with common supports.
 - b. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.
5. Manufacturer Seismic Qualification Certification: Submit certification that enclosures and cabinets and their mounting provisions, including those for internal components, will withstand seismic forces defined in Division 26 Section(s) "Hangers And Supports For Electrical Systems" AND "Vibration And Seismic Controls For Electrical Systems". Include the following:
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 1) The term "withstand" means "the cabinet or enclosure will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will retain its enclosure characteristics, including its interior accessibility, after the seismic event."



- b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
- c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- 6. Qualification Data: For professional engineer and testing agency.
- 7. Source quality-control test reports.

E. Quality Assurance

- 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- 2. Comply with NFPA 70.

1.2 PRODUCTS

A. Metal Conduit And Tubing

- 1. Rigid Steel Conduit: ANSI C80.1.
- 2. Aluminum Rigid Conduit: ANSI C80.5.
- 3. IMC: ANSI C80.6.
- 4. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit **OR** IMC, **as directed**.
 - a. Comply with NEMA RN 1.
 - b. Coating Thickness: 0.040 inch (1 mm), minimum.
- 5. EMT: ANSI C80.3.
- 6. FMC: Zinc-coated steel **OR** Aluminum **OR** Zinc-coated steel or aluminum, **as directed**.
- 7. LFMC: Flexible steel conduit with PVC jacket.
- 8. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
 - a. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
 - b. Fittings for EMT: Steel **OR** Die-cast, **as directed**, set-screw **OR** compression, **as directed**, type.
 - c. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.
- 9. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

B. Nonmetallic Conduit And Tubing

- 1. ENT: NEMA TC 13.
- 2. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.
- 3. LFNC: UL 1660.
- 4. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.
- 5. Fittings for LFNC: UL 514B.

C. Optical Fiber/Communications Cable Raceway And Fittings

- 1. Description: Comply with UL 2024; flexible type, approved for plenum **OR** riser **OR** general-use, **as directed**, installation.

D. Metal Wireways

- 1. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1 **OR** 12 **OR** 3R, **as directed**, unless otherwise indicated.
- 2. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.



3. Wireway Covers: Hinged type **OR** Screw-cover type **OR** Flanged-and-gasketed type **OR** As indicated, **as directed**.
 4. Finish: Manufacturer's standard enamel finish.
- E. Nonmetallic Wireways
1. Description: Fiberglass polyester, extruded and fabricated to size and shape indicated, with no holes or knockouts. Cover is gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections are flanged, with stainless-steel screws and oil-resistant gaskets.
OR
Description: PVC plastic, extruded and fabricated to size and shape indicated, with snap-on cover and mechanically coupled connections with plastic fasteners.
 2. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- F. Surface Raceways
1. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected **OR** Prime coating, ready for field painting, **as directed**.
 2. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC with texture and color selected from manufacturer's standard **OR** custom, **as directed**, colors.
- G. Boxes, Enclosures, And Cabinets
1. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
 2. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy **OR** aluminum, **as directed**, Type FD, with gasketed cover.
 3. Nonmetallic Outlet and Device Boxes: NEMA OS 2.
 4. Metal Floor Boxes: Cast metal **OR** Sheet metal, **as directed**, fully adjustable **OR** semi-adjustable, **as directed**, rectangular.
 5. Nonmetallic Floor Boxes: Nonadjustable, round.
 6. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
 7. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum **OR** galvanized, cast iron, **as directed**, with gasketed cover.
 8. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
 - a. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 - b. Nonmetallic Enclosures: Plastic, finished inside with radio-frequency-resistant paint, **as directed**.
 9. Cabinets:
 - a. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 - b. Hinged door in front cover with flush latch and concealed hinge.
 - c. Key latch to match panelboards.
 - d. Metal barriers to separate wiring of different systems and voltage.
 - e. Accessory feet where required for freestanding equipment.
- H. Handholes And Boxes For Exterior Underground Wiring
1. Description: Comply with SCTE 77.
 - a. Color of Frame and Cover: Gray **OR** Green **as directed**.
 - b. Configuration: Units shall be designed for flush burial and have open **OR** closed **OR** integral closed, **as directed**, bottom, unless otherwise indicated.
 - c. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
 - d. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 - e. Cover Legend: Molded lettering, "ELECTRIC" **OR** "TELEPHONE" **OR** as indicated for each service, **as directed**.



- f. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
- g. Handholes 12 inches wide by 24 inches long (300 mm wide by 600 mm long) and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.
2. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel or fiberglass or a combination of the two.
3. Fiberglass Handholes and Boxes with Polymer-Concrete Frame and Cover: Sheet-molded, fiberglass-reinforced, polyester-resin enclosure joined to polymer-concrete top ring or frame.
4. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with covers of polymer concrete **OR** reinforced concrete **OR** cast iron **OR** hot-dip galvanized-steel diamond plate **OR** fiberglass, **as directed**.

I. Sleeves For Raceways

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
3. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch (1.3- or 3.5-mm) thickness as indicated and of length to suit application.
4. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping".

J. Sleeve Seals

1. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.
 - a. Sealing Elements: EPDM **OR** NBR, **as directed**, interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 - b. Pressure Plates: Plastic **OR** Carbon steel **OR** Stainless steel, **as directed**. Include two for each sealing element.
 - c. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating **OR** Stainless steel, **as directed**, of length required to secure pressure plates to sealing elements. Include one for each sealing element.

K. Source Quality Control For Underground Enclosures

1. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
 - a. Tests of materials shall be performed by a independent testing agency.
 - b. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
 - c. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

1.3 EXECUTION

A. Raceway Application

1. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
 - a. Exposed Conduit: Rigid steel conduit **OR** IMC **OR** RNC, Type EPC-40-PVC **OR** RNC, Type EPC-80-PVC, **as directed**.
 - b. Concealed Conduit, Aboveground: Rigid steel conduit **OR** IMC **OR** EMT **OR** RNC, Type EPC-40-PVC, **as directed**.
 - c. Underground Conduit: RNC, Type EPC-40 **OR** 80, **as directed**, -PVC, direct buried.



- d. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LPMC **OR** LFNC, **as directed**.
- e. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R **OR** 4, **as directed**.
- f. Application of Handholes and Boxes for Underground Wiring:
 - 1) Handholes and Pull Boxes in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Polymer concrete **OR** Fiberglass enclosures with polymer-concrete frame and cover **OR** Fiberglass-reinforced polyester resin, **as directed**, SCTE 77, Tier 15 structural load rating.
 - 2) Handholes and Pull Boxes in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Polymer-concrete units **OR** Heavy-duty fiberglass units with polymer-concrete frame and cover, **as directed**, SCTE 77, Tier 8 structural load rating.
 - 3) Handholes and Pull Boxes Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested according to SCTE 77 with 3000-lbf (13 345-N) vertical loading.
2. Comply with the following indoor applications, unless otherwise indicated:
 - a. Exposed, Not Subject to Physical Damage: EMT **OR** ENT **OR** RNC, **as directed**.
 - b. Exposed, Not Subject to Severe Physical Damage: EMT **OR** RNC identified for such use, **as directed**.
 - c. Exposed and Subject to Severe Physical Damage: Rigid steel conduit **OR** IMC, **as directed**. Includes raceways in the following locations:
 - 1) Loading dock.
 - 2) Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - 3) Mechanical rooms.
 - d. Concealed in Ceilings and Interior Walls and Partitions: EMT **OR** ENT **OR** RNC, Type EPC-40-PVC, **as directed**.
 - e. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LPMC in damp or wet locations.
 - f. Damp or Wet Locations: Rigid steel conduit **OR** IMC, **as directed**.
 - g. Raceways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air: Plenum-type, optical fiber/communications cable raceway **OR** EMT, **as directed**.
 - h. Raceways for Optical Fiber or Communications Cable Risers in Vertical Shafts: Riser-type, optical fiber/communications cable raceway **OR** EMT, **as directed**.
 - i. Raceways for Concealed General Purpose Distribution of Optical Fiber or Communications Cable: General-use, optical fiber/communications cable raceway **OR** Riser-type, optical fiber/communications cable raceway **OR** Plenum-type, optical fiber/communications cable raceway **OR** EMT, **as directed**.
 - j. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel **OR** nonmetallic, **as directed**, in damp or wet locations.
3. Minimum Raceway Size: 1/2-inch (16-mm) **OR** 3/4-inch (21-mm), **as directed**, trade size.
4. Raceway Fittings: Compatible with raceways and suitable for use and location.
 - a. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
 - b. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.
5. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
6. Do not install aluminum conduits in contact with concrete.

B. Installation

1. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.
2. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.



3. Complete raceway installation before starting conductor installation.
4. Support raceways as specified in Division 26 Section(s) "Hangers And Supports For Electrical Systems" AND "Vibration And Seismic Controls For Electrical Systems".
5. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
6. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.
7. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
8. Raceways Embedded in Slabs:
 - a. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
 - b. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 - c. Change from ENT to RNC, Type EPC-40-PVC, rigid steel conduit, or IMC before rising above the floor.
9. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
10. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
11. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire.
12. Raceways for Optical Fiber and Communications Cable: Install raceways, metallic and nonmetallic, rigid and flexible, as follows:
 - a. 3/4-Inch (19-mm) Trade Size and Smaller: Install raceways in maximum lengths of 50 feet (15 m).
 - b. 1-Inch (25-mm) Trade Size and Larger: Install raceways in maximum lengths of 75 feet (23 m).
 - c. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
13. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
 - a. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - b. Where otherwise required by NFPA 70.
14. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F (17 deg C), and that has straight-run length that exceeds 25 feet (7.6 m).
 - a. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:
 - 1) Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
 - 2) Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
 - 3) Indoor Spaces: Connected with the Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
 - 4) Attics: 135 deg F (75 deg C) temperature change.
 - b. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change.



- c. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.
 15. Flexible Conduit Connections: Use maximum of 72 inches (1830 mm) of flexible conduit for recessed and semirecessed lighting fixtures, **as directed**, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
 - a. Use LFMC in damp or wet locations subject to severe physical damage.
 - b. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
 16. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.
 17. Set metal floor boxes level and flush with finished floor surface.
 18. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.
- C. Installation Of Underground Conduit
1. Direct-Buried Conduit:
 - a. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 31 Section "Earth Moving" for pipe less than 6 inches (150 mm) in nominal diameter.
 - b. Install backfill as specified in Division 31 Section "Earth Moving"
 - c. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving".
 - d. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.

OR

Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
 - 1) Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete.

OR

For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
 - e. Warning Planks: Bury warning planks approximately 12 inches (300 mm) above direct-buried conduits, placing them 24 inches (600 mm) o.c. Align planks along the width and along the centerline of conduit.
- D. Installation Of Underground Handholes And Boxes
1. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
 2. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.
 3. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.
 4. Install handholes and boxes with bottom below the frost line, **<Insert depth of frost line below grade at Project site>** below grade.
 5. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.



6. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

E. Sleeve Installation For Electrical Penetrations

1. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping".
2. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
3. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
4. Rectangular Sleeve Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side greater than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
 - b. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches (1270 mm) and 1 or more sides equal to, or greater than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).
5. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
6. Cut sleeves to length for mounting flush with both surfaces of walls.
7. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.
8. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway unless sleeve seal is to be installed or unless seismic criteria require different clearance.
9. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies, **as directed**.
10. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
11. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Division 07 Section "Penetration Firestopping".
12. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.
13. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
14. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway and sleeve for installing mechanical sleeve seals.

F. Sleeve-Seal Installation

1. Install to seal underground, exterior wall penetrations.
2. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

G. Firestopping

1. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping".

H. Protection

1. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Final Completion.



-
- a. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - b. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 26 05 33 16



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SECTION 26 05 33 16a - WIRING DEVICES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of wiring devices. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Receptacles, receptacles with integral GFCI, and associated device plates.
 - b. Twist-locking receptacles.
 - c. Receptacles with integral surge suppression units.
 - d. Wall-box motion sensors.
 - e. Isolated-ground receptacles.
 - f. Hospital-grade receptacles.
 - g. Snap switches and wall-box dimmers.
 - h. Solid-state fan speed controls.
 - i. Wall-switch and exterior occupancy sensors.
 - j. Communications outlets.
 - k. Pendant cord-connector devices.
 - l. Cord and plug sets.
 - m. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.

C. Definitions

1. EMI: Electromagnetic interference.
2. GFCI: Ground-fault circuit interrupter.
3. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
4. RFI: Radio-frequency interference.
5. TVSS: Transient voltage surge suppressor.
6. UTP: Unshielded twisted pair.

D. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
3. Samples: One for each type of device and wall plate specified, in each color specified.
4. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

E. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. Comply with NFPA 70.

1.2 PRODUCTS

A. Straight Blade Receptacles

1. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.



2. Hospital-Grade, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498 Supplement SD.
 3. Isolated-Ground, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
 - a. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.
 4. Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
 - a. Description: Labeled to comply with NFPA 70, "Health Care Facilities" Article, "Pediatric Locations" Section.
- B. GFCI Receptacles
1. General Description: Straight blade, feed **OR** non-feed, **as directed**,-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.
 2. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
 3. Hospital-Grade, Duplex GFCI Convenience Receptacles, 125 V, 20 A: Comply with UL 498 Supplement SD.
- C. TVSS Receptacles
1. General Description: Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 1449, with integral TVSS in line to ground, line to neutral, and neutral to ground.
 - a. TVSS Components: Multiple metal-oxide varistors; with a nominal clamp-level rating of 400 volts and minimum single transient pulse energy dissipation of 240 J, according to IEEE C62.41.2 and IEEE C62.45.
 - b. Active TVSS Indication: Visual and audible, with light visible in face of device to indicate device is "active" or "no longer in service."
 2. Duplex TVSS Convenience Receptacles:
 - a. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R.
 3. Isolated-Ground, Duplex Convenience Receptacles:
 - a. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.
 4. Hospital-Grade, Duplex Convenience Receptacles: Comply with UL 498 Supplement SD.
 - a. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R.
 5. Isolated-Ground, Hospital-Grade, Duplex Convenience Receptacles:
 - a. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R. Comply with UL 498 Supplement SD. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.
- D. Hazardous (Classified) Location Receptacles
1. Available Wiring Devices for Hazardous (Classified) Locations: Comply with NEMA FB 11 and UL 1010.
- E. Twist-Locking Receptacles
1. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498.
 2. Isolated-Ground, Single Convenience Receptacles, 125 V, 20 A:
 - a. Description: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498. Equipment grounding contacts shall be connected only to the green grounding screw



terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

F. Pendant Cord-Connector Devices

1. Description: Matching, locking-type plug and receptacle body connector; NEMA WD 6 configurations L5-20P and L5-20R, heavy-duty grade.
 - a. Body: Nylon with screw-open cable-gripping jaws and provision for attaching external cable grip.
 - b. External Cable Grip: Woven wire-mesh type made of high-strength galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

G. Cord And Plug Sets

1. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.
 - a. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30 percent.
 - b. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

H. Snap Switches

1. Comply with NEMA WD 1 and UL 20.
2. Switches, 120/277 V, 20 A:
3. Pilot Light Switches, 20 A:
 - a. Description: Single pole, with neon-lighted handle, illuminated when switch is "ON."
4. Key-Operated Switches, 120/277 V, 20 A:
 - a. Description: Single pole, with factory-supplied key in lieu of switch handle.
5. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.
6. Key-Operated, Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.

I. Wall-Box Dimmers

1. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
2. Control: Continuously adjustable slider **OR** toggle switch **OR** rotary knob, **as directed**; with single-pole or three-way switching. Comply with UL 1472.
3. Incandescent Lamp Dimmers: 120 V; control shall follow square-law dimming curve. On-off switch positions shall bypass dimmer module.
 - a. 600 W; dimmers shall require no derating when ganged with other devices. Illuminated when "OFF," **as directed**.
4. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

J. Fan Speed Controls

1. Modular, 120-V, full-wave, solid-state units with integral, quiet on-off switches and audible frequency and EMI/RFI filters. Comply with UL 1917.
 - a. Continuously adjustable slider **OR** toggle switch **OR** rotary knob, **as directed**, 5 A **OR** 1.5 A, **as directed**.
 - b. Three-speed adjustable slider **OR** rotary knob, **as directed**, 1.5 A.

K. Occupancy Sensors

1. Wall-Switch Sensors:



- a. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft. (84 sq. m).
 2. Wall-Switch Sensors:
 - a. Description: Adaptive-technology type, 120/277 V, adjustable time delay up to 20 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft. (84 sq. m).
 3. Long-Range Wall-Switch Sensors:
 - a. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, with a minimum coverage area of 1200 sq. ft. (111 sq. m).
 4. Long-Range Wall-Switch Sensors:
 - a. Description: Dual technology, with both passive-infrared- and ultrasonic-type sensing, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, and a minimum coverage area of 1200 sq. ft. (111 sq. m).
 5. Wide-Range Wall-Switch Sensors:
 - a. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 150-degree field of view, with a minimum coverage area of 1200 sq. ft. (111 sq. m).
 6. Exterior Occupancy Sensors:
 - a. Description: Passive-infrared type, 120/277 V, weatherproof, adjustable time delay up to 15 minutes, 180-degree field of view, and 110-foot (34-m) detection range. Minimum switch rating: 1000-W incandescent, 500-VA fluorescent.
- L. Communications Outlets
1. Telephone Outlet:
 - a. Description: Single RJ-45 jack for terminating 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 5e. Comply with UL 1863.
 2. Combination TV and Telephone Outlet:
 - a. Description: Single RJ-45 jack for 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 5e; and one Type F coaxial cable connector.
- M. Wall Plates
1. Single and combination types to match corresponding wiring devices.
 - a. Plate-Securing Screws: Metal with head color to match plate finish.
 - b. Material for Finished Spaces: Steel with white baked enamel, suitable for field painting **OR** Smooth, high-impact thermoplastic **OR** 0.035-inch- (1-mm-) thick, satin-finished stainless steel **OR** 0.04-inch- (1-mm-) thick, brushed brass with factory polymer finish **OR** 0.05-inch- (1.2-mm-) thick anodized aluminum **OR** 0.04-inch- (1-mm-) thick steel with chrome-plated finish, **as directed**.
 - c. Material for Unfinished Spaces: Galvanized steel **OR** Smooth, high-impact thermoplastic, **as directed**.
 - d. Material for Damp Locations: Thermoplastic **OR** Cast aluminum, **as directed**, with spring-loaded lift cover, and listed and labeled for use in "wet locations."
 2. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum **OR** thermoplastic, **as directed**, with lockable cover.
- N. Floor Service Fittings
1. Type: Modular, flush-type **OR** flap-type **OR** above-floor, **as directed**, dual-service units suitable for wiring method used.
 2. Compartments: Barrier separates power from voice and data communication cabling.
 3. Service Plate: Rectangular **OR** Round, **as directed**, die-cast aluminum **OR** solid brass, **as directed**, with satin finish.
 4. Power Receptacle: NEMA WD 6 configuration 5-20R, gray finish, unless otherwise indicated.
 5. Voice and Data Communication Outlet: Blank cover with bushed cable opening **OR** Two modular, keyed, color-coded, RJ-45 Category 5e jacks for UTP cable, **as directed**.
- O. Poke-Through Assemblies



1. Description: Factory-fabricated and -wired assembly of below-floor junction box with multichanneled, through-floor raceway/firestop unit and detachable matching floor service outlet assembly.
 - a. Service Outlet Assembly: Pedestal type with services indicated **OR** Flush type with two simplex receptacles and space for two RJ-45 jacks **OR** Flush type with four simplex receptacles and space for four RJ-45 jacks, **as directed**.
 - b. Size: Selected to fit nominal 3-inch (75-mm) **OR** 4-inch (100-mm), **as directed**, cored holes in floor and matched to floor thickness.
 - c. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.
 - d. Closure Plug: Arranged to close unused 3-inch (75-mm) **OR** 4-inch (100-mm), **as directed**, cored openings and reestablish fire rating of floor.
 - e. Wiring Raceways and Compartments: For a minimum of four No. 12 AWG conductors and a minimum of two **OR** four, **as directed**, 4-pair, Category 5e voice and data communication cables.

P. Multioutlet Assemblies

1. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.
2. Raceway Material: Metal, with manufacturer's standard finish **OR** PVC, **as directed**.
3. Wire: No. 12 AWG.

Q. Service Poles

1. Description: Factory-assembled and -wired units to extend power and voice and data communication from distribution wiring concealed in ceiling to devices or outlets in pole near floor.
 - a. Poles: Nominal 2.5-inch- (65-mm-) square cross section, with height adequate to extend from floor to at least 6 inches (150 mm) above ceiling, and with separate channels for power wiring and voice and data communication cabling.
 - b. Mounting: Ceiling trim flange with concealed bracing arranged for positive connection to ceiling supports; with pole foot and carpet pad attachment.
 - c. Finishes: Manufacturer's standard painted finish and trim combination **OR** Satin-anodized aluminum, **as directed**.
 - d. Wiring: Sized for minimum of five No. 12 AWG power and ground conductors and a minimum of four, 4-pair, Category 3 or 5 voice and data communication cables.
 - e. Power Receptacles: Two duplex, 20-A, heavy-duty, NEMA WD 6 configuration 5-20R units.
 - f. Voice and Data Communication Outlets: Blank insert with bushed cable opening **OR** Two RJ-45 Category 5e jacks **OR** Four RJ-45 Category 5e jacks, **as directed**.

R. Finishes

1. Color: Wiring device catalog numbers in Section Text do not designate device color.
 - a. Wiring Devices Connected to Normal Power System: Almond **OR** Black **OR** Brown **OR** Gray **OR** Ivory **OR** White **OR** As selected, **as directed**, unless otherwise indicated or required by NFPA 70 or device listing.
 - b. Wiring Devices Connected to Emergency Power System: Red.
 - c. TVSS Devices: Blue.
 - d. Isolated-Ground Receptacles: Orange **OR** As specified above, with orange triangle on face, **as directed**.

1.3 EXECUTION

A. Installation

1. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
2. Coordination with Other Trades:



- a. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
- b. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
- c. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
- d. Install wiring devices after all wall preparation, including painting, is complete.
3. Conductors:
 - a. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
 - b. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
 - c. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
 - d. Existing Conductors:
 - 1) Cut back and pigtail, or replace all damaged conductors.
 - 2) Straighten conductors that remain and remove corrosion and foreign matter.
 - 3) Pigtailing existing conductors is permitted provided the outlet box is large enough.
4. Device Installation:
 - a. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
 - b. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
 - c. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
 - d. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
 - e. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
 - f. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
 - g. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
 - h. Tighten unused terminal screws on the device.
 - i. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.
5. Receptacle Orientation:
 - a. Install ground pin of vertically mounted receptacles up **OR** down, **as directed**, and on horizontally mounted receptacles to the right **OR** left, **as directed**.
 - b. Install hospital-grade receptacles in patient-care areas with the ground pin or neutral blade at the top.
6. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
7. Dimmers:
 - a. Install dimmers within terms of their listing.
 - b. Verify that dimmers used for fan speed control are listed for that application.
 - c. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.
8. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
9. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.



B. Identification

1. Comply with Division 26 Section "Identification For Electrical Systems".
 - a. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black **OR** white **OR** red, **as directed**,-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

C. Field Quality Control

1. Perform tests and inspections and prepare test reports.
 - a. In healthcare facilities, prepare reports that comply with recommendations in NFPA 99.
 - b. Test Instruments: Use instruments that comply with UL 1436.
 - c. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.
2. Tests for Convenience Receptacles:
 - a. Line Voltage: Acceptable range is 105 to 132 V.
 - b. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
 - c. Ground Impedance: Values of up to 2 ohms are acceptable.
 - d. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 - e. Using the test plug, verify that the device and its outlet box are securely mounted.
 - f. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.
3. Test straight blade convenience outlets in patient-care areas **OR** hospital-grade convenience outlets, **as directed**, for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz. (115 g).

END OF SECTION 26 05 33 16a



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Task	Specification	Specification Description
26 05 33 16	26 05 19 16c	Electrical Renovation



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SECTION 26 05 33 23 - UNDERFLOOR RACEWAYS FOR ELECTRICAL SYSTEMS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of underfloor raceways for electrical systems. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Flat-top, single-channel, underfloor raceways.
 - b. Flat-top, multichannel, underfloor raceways.
 - c. Flush, flat-top underfloor raceways.
 - d. Cellular metal underfloor raceways.
 - e. Trench-type underfloor raceways.
 - f. Electrical connection components for precast concrete, hollow-core, floor decks.
 - g. Electrical connection components for electrified cellular steel floor decks.
 - h. Service fittings.

C. Definitions

1. Flush Outlet: Underfloor raceway outlet installed so the top of the fixed portions of the receptacles, jacks, and connector assemblies is located approximately at the surface of the floor or floor covering, and with the bodies of connected plugs exposed above the surface of the floor.
2. Flush Underfloor Raceway: Rectangular cross-section, flat-top raceway installed with the top of the raceway flush with the surface of the concrete in which it is embedded.
3. Header Raceway: Rectangular cross-section, single-channel or multichannel, underfloor raceway arranged as feeder raceway to bring wires and cables to service raceways from panelboards and communication terminal components.
4. Recessed Outlet: Underfloor raceway outlet installed with the top of the fixed portion of the connector assemblies located below the surface of the floor or floor covering and arranged to receive plug connectors with the bodies of the plugs concealed below the floor level.
5. Service Raceway: Underfloor distribution raceway providing direct connection to service fittings using preset or afterset inserts.
6. Trench Header: Trench-type raceway arranged as feeder raceway to bring wires and cables to service raceways from panelboards and communication terminal equipment.
7. Underfloor Raceway: A conduit, duct, or cell assembly, or trench located within the floor material or with its top at the floor surface.

D. Submittals

1. Product Data: For underfloor raceway components, fittings, and accessories.
2. Shop Drawings: For underfloor raceways. Include floor plans, assembly drawings, sections, and details.
 - a. Identify components and accessories such as expansion-joint assemblies, straight raceway lengths, preset and afterset inserts, and service fittings.
 - b. Provide dimensions locating raceway header and distribution elements. Include spacing between preset inserts and between preset inserts and ends of duct runs, walls, columns, junction boxes, and header duct connections.
 - c. Show connections between raceway elements and relationships between components and adjacent structural and architectural elements including slab reinforcement, floor finish work, permanent partitions, architectural module lines, and pretensioning or post-tensioning components.



- d. Indicate height of preset inserts, junction boxes, and raceways coordinated with depth of concrete slab and floor fill.
 - e. Indicate thickening of slabs where required for adequate encasement of raceway components.
 - f. Document coordination of exposed components with floor-covering materials to ensure that fittings and trim are suitable for indicated floor-covering material.
 - g. Revise locations from those indicated in the Contract Documents, as required to suit field conditions and to ensure a functioning layout. Identify proposed deviations from the Contract Documents.
 - h. Show details of connections and terminations of underfloor raceways at panelboards and communication terminal equipment in equipment rooms, wire closets, and similar spaces.
 - i. Identify those cells of cellular floor deck that are to be connected and fitted for the following underfloor distribution:
 - 1) Power.
 - 2) Voice.
 - 3) Data.
 - 4) Signal.
 - 5) Communications.
3. Samples: For typical underfloor raceway products, in specified finish, including the following:
 - a. Service fittings and flush and recessed outlet and junction-box covers.
 - b. A section of each service raceway configuration with specified preset insert and service fitting installed.
 - c. A junction box of each size and type for use with underfloor raceway.
 - d. A section of each header raceway configuration, complete with provisions for connection with service raceway.
 - e. A section of trench-type raceway, complete with cover and required trim.
 - f. A junction box of each size and type, complete with cover and trim.
 4. Operation and Maintenance Data: For underfloor raceways, to include in emergency, operation, and maintenance manuals. Include the following:
 - a. Manufacturer's written instructions for locating preset inserts and for installing afterset inserts.

E. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with NFPA 70.

1.2 PRODUCTS

A. Flat-Top, Single-Channel, Underfloor Raceways

1. Description:
 - a. Material: Steel.
 - b. Cross-Section Shape: Rectangular.
 - c. Number of Levels: One **OR** Two, **as directed**.
 - d. Minimum Bending Radius for Communication Cables: Combination of raceways, fittings, inserts, junction boxes, service fittings, and mounting and connection arrangements for wiring devices and jacks shall provide a 2-inch- (50-mm-) minimum bending radius for communication cables.
2. Service Raceways: Fitted with preset inserts.
 - a. Nominal Raceway Dimensions:
 - 1) Depth: 1-1/2 inches (38 mm).
 - 2) Power Service Raceway Width: 3-1/2 inches (90 mm).
 - 3) Communication Service Raceway Width: 3-1/2 inches (90 mm) **OR** 6-1/2 inches (165 mm), **as directed**.



- b. Number of Single-Channel Raceways per Run: One **OR** Two **OR** Three **OR** Four **OR** Five, **as directed**, unless otherwise indicated.
 - c. Preset Inserts: Rectangular **OR** Round, **as directed**.
 - 1) Spacing: 24 inches (600 mm) **OR** 12 inches (300 mm), **as directed**, o.c.
 - 2) Size: Rectangular dimensions as required to accommodate mounting and connection of flush-mounted, duplex receptacle or dual communication-jack or connector service fitting.
 - 3) Size: 2 inches (50 mm) in diameter.
 - 4) Equip each insert with a disposable cover and select insert height so cover is 1/8 inch (3 mm) below surface of concrete.
 - 5) Arrange insert for optional attachment of flush-, surface-, or wiring- extension service fitting to replace disposable cover.
 3. Header Raceways: Single channel, without preset inserts (blank raceway).
 - a. Nominal Raceway Dimensions:
 - 1) Depth: 1-1/2 inches (38 mm).
 - 2) Power Header Raceway Width: 3-1/2 inches (90 mm).
 - 3) Communication Header Raceway Width: 3-1/2 inches (90 mm) **OR** 6-1/2 inches (165 mm), **as directed**.
 - b. Arrangement: In same plane as **OR** Below, **as directed**, service raceways.
 - c. Connections: Arranged to connect with service raceways at single-level **OR** two-level, **as directed**, junction boxes.
- B. Flat-Top, Multichannel, Underfloor Raceways
1. Description:
 - a. Material: Steel.
 - b. Cross-Section Shape: Rectangular.
 - c. Number of Longitudinal Channels: Two **OR** Three **OR** Four, **as directed**, separated by steel wall(s).
 - d. Number of Levels: One **OR** Two, **as directed**.
 - e. Minimum Bending Radius for Communication Cables: Combination of raceways, fittings, inserts, junction boxes, service fittings, and mounting and connection arrangements for wiring devices and jacks shall provide a 2-inch- (50-mm-) minimum bending radius for communication cables.
 2. Service Raceways: Fitted with preset inserts.
 - a. Nominal Raceway Dimensions:
 - 1) Depth: 1-3/8 inches (35 mm).
 - 2) Power Service Channel Width: 3-1/2 inches (90 mm) **OR** 4-3/8-inches (111 mm), **as directed**.
 - 3) Communication Service Channel Width: 3-1/2 inches (90 mm) **OR** 4 inches (102 mm) **OR** 6-1/2 inches (165 mm), **as directed**.
 - b. Preset Inserts:
 - 1) Spacing: 24 inches (600 mm) **OR** 12 inches (300 mm), **as directed**, o.c.
 - 2) Size: Dimensions as required to accommodate mounting and connection of flush- and surface-mounted, single- and multiple-system service fittings or to connect to wiring extensions for feeding wall outlets for power **OR** communications **OR** power and communications, **as directed**.
 - 3) Equip each insert with a disposable cover arranged for installation with top 1/8 inch (3 mm) below surface of concrete.
 - 4) Arrange inserts for optional attachment of flush-, surface-, or wiring-extension service fitting to replace disposable cover. Arrange brackets, mountings, barriers, and floor access covers to support, isolate, and provide access to flush or surface outlet-mounting connector, jack, and receptacle devices.
 3. Header Raceways: Multichannel, without preset inserts (blank raceway).
 - a. Nominal Raceway Dimensions:
 - 1) Header Raceway Depth: Same as service raceways **OR** 2-1/2 inches (64 mm) **OR** 2-3/4 inches (70 mm) **OR** 3 inches (76 mm) **OR** 3-1/2 inches (90 mm), **as directed**.



- 2) Power Header Channel Width: 3-1/2 inches (90 mm) **OR** 4-3/8-inches (111 mm), **as directed**.
 - 3) Communication Header Channel Width: 3-1/2 inches (90 mm) **OR** 4 inches (102 mm) **OR** 6-1/2 inches (165 mm), **as directed**.
 - b. Arrangement: In same plane as **OR** Below, **as directed**, service raceways.
 - c. Connections: Arranged to connect with service raceways at single-level **OR** two-level, **as directed**, junction boxes.
- C. Flush, Flat-Top Underfloor Raceways
1. Description:
 - a. Material: Steel.
 - b. Cross-Section Shape: Rectangular, single channel and multichannel, separated by steel wall(s).
 - c. Listed and labeled for installation with top flush with concrete floor.
 - d. Number of Levels: One.
 2. Service Raceways: Fitted with preset inserts.
 - a. Number of Longitudinal Channels per Multichannel Raceway: Two **OR** Three, **as directed**.
 - b. Number of Single-Channel Raceways per Run: One **OR** Two **OR** Three, **as directed**, unless otherwise indicated.
 - c. Nominal Channel Dimensions: 3 inches (76 mm) wide by 1-1/4 inches (32 mm) deep.
 - d. Preset Inserts: Threaded opening with removable steel plug that is flush with top of raceway when screwed in place.
 - 1) Spacing: 24 inches (600 mm) **OR** 12 inches (300 mm), **as directed**, o.c., full length of each service raceway.
 - 2) Arrangement: Stagger insert locations on parallel raceways or channels to accommodate placement of adjacent service fittings.
 - 3) Size: 1-5/8-inch (41-mm) diameter.
 3. Header Raceways: Raceways same as service raceways except without preset inserts (blank raceway).
 - a. Nominal Channel Dimensions: Same as service raceways.
 - b. Arrangement: In same plane as service raceways.
 - c. Connections: Arranged to connect with service raceways at junction boxes.
- D. Cellular Metal Underfloor Raceways
1. Service Raceways: Fitted with preset inserts.
 - a. Material: Steel.
 - b. Number of Longitudinal Cells: Three, separated by steel walls.
 - c. Nominal Dimensions of Cells:
 - 1) Overall Depth: 1-1/4 inches (32 mm) unless otherwise indicated.
 - 2) Cross-Sectional Area of Cells: Power cells: 5-1/2 sq. in. (35.5 sq. cm); communication system cells: 16 sq. in. (103 sq. cm).
 - d. Minimum Bending Radius for Communication Cables: Combination of raceways, fittings, inserts, junction boxes, service fittings, and mounting and connection arrangements for wiring devices and jacks shall provide a 2-inch- (50-mm-) minimum bending radius for communication cables.
 - e. Preset Inserts: Rectangular-shaped metal housing assemblies arranged to provide electrical outlet access to each cell of each raceway designated for service raceway use. Inserts shall be provided throughout the entire length of each such raceway.
 - 1) Spacing: 30 inches (762 mm) **OR** 24 inches (600 mm) **OR** 12 inches (300 mm), **as directed**, o.c.
 - 2) Include housing and connecting provisions for a flush or recessed, single-, double-, or triple-system service fitting.
 - 3) Include mounting and connecting provisions for a surface, single- or multiple-system service fitting.



- 4) Include connecting provisions for a wiring-extension service fitting to feed wall outlets.
 - 5) Equip each insert with a disposable cover plate arranged for installation with top 1/8 inch (3 mm) below surface of concrete. Arrange insert to receive a flush-, recessed-, or wiring-extension service fitting to replace disposable top.
2. Header Assembly: A junction box and raceway arrangement arranged to feed wires and cables to service raceways.
 - a. Three-compartment junction box connecting blank, multicell cellular header raceway (no inserts) with cellular service raceways.
 - 1) Arrange junction box in the center of a 60-inch (152-cm) length of header raceway.
 - 2) Cellular header raceway shall have same dimensions as service raceways.
 - 3) Provide capability for service raceways to be run in both directions from intersection with header raceway.
 - b. Three-compartment junction box preassembled with blank, flat-top, multichannel header raceway (no inserts) and fitted to connect with cellular service raceway at right angles to header raceway.
 - 1) Arrange junction box in the center of a 60-inch (152-cm) length of header raceway.
 - 2) Provide capability for service raceways to be run in both directions from intersection with header raceway.
- E. Trench-Type Underfloor Raceways
1. Trench: Steel, shop or factory welded and fabricated to indicated sizes. Include the following features:
 - a. Slab Depth Adjustment: Minimum of minus 1/8 inch (3 mm) to plus 5/8 inch (16 mm) before and during concrete placement.
 - b. Cover Supports: Height adjustable, with leveling screws to rigidly support cover assembly.
 - c. Screed Strip: Extruded aluminum along both edges at proper elevation without requiring shim material.
 - d. Trim Strip: Select to accommodate floor finish material.
 - e. Partitions: Arranged to separate channels and isolate wiring of different systems.
 - f. Grommeted openings in active floor cells or service raceways.
 - g. Manufacturer's standard corrosion-resistant finish, applied after fabrication.
 2. Cover Plates: Removable, steel plates, 1/4 inch (6 mm) thick, each weighing 60 lb (27 kg) or less with full gasket attached to side units. Fabricate intermediate supports to limit unsupported spans to 15 inches (380 mm) or less. Fabricate covers with appropriate depth recess to receive indicated floor finish.
- F. Electrical Connection Components For Cellular Steel Floor Deck
1. Preset Inserts: Rectangular metal-housing assemblies.
 - a. Spacing: 30 inches (762 mm) **OR** 24 inches (600 mm) **OR** 12 inches (300 mm), **as directed**, o.c.
 - b. Size: As required to provide electrical outlet access to each cell of each group of three cells that is designated for electrical service raceway use.
 - c. Equip each insert with a disposable cover arranged for installation with top 1/8 inch (3 mm) below surface of concrete. Arrange insert to receive a flush-, recessed-, or wiring-extension service fitting to replace disposable cover.
 - d. Include housing and connecting provisions for a flush or recessed, single-, double-, or triple-system service fitting.
 - e. Include mounting and connecting provisions for a surface, single-, double-, or triple-system service fitting.
 - f. Include connecting provisions for a wiring-extension service fitting to feed wall outlets.
- G. Electrical Connection Components For Cellular Concrete Floor Deck
1. Afterset Inserts: Round metal-nipple assembly with internal and external threading, arranged to screw into plug driven into 1-7/8-inch (48-mm) hole drilled through floor fill, where present, and deck-cell wall into floor raceway cell.



- a. Inserts shall be compatible with floor-mounting service fittings.
 - b. Inserts shall provide wiring path from cell to power **OR** communication **OR** power and communication, **as directed**, wall and ceiling outlets.
 - c. Inserts shall provide wiring path from cell to header raceway.
- H. Supports, Fittings, And Hardware
1. Supports, fittings, and hardware shall be compatible with raceway and outlet system and shall be listed for use with raceway systems and components specified.
 2. Supports: Adjustable for height and arranged to maintain alignment and spacing of raceways during concrete placement. Include hold-down straps.
 3. Raceway Fittings: Couplings, expansion-joint sleeves, cross-under offsets, vertical and horizontal elbows, grounding screws, adapters, end caps, and other fittings suitable for use with basic components to form a complete installation.
- I. Junction Boxes
1. Description: Manufacturer's standard enclosure for indicated type, quantity, arrangement, and configuration of raceways at each raceway junction, intersection, and access location. Include the following accessories and features:
 - a. Mounting brackets.
 - b. Escutcheons and holders to accommodate surrounding floor covering.
 - c. Means for leveling and height adjustment more than 3/8 inch (10 mm) before and after concrete is placed.
 - d. Raceway Openings: For underfloor raceways and conduits arranged to accommodate raceway layout.
 - e. Covers shall have appropriate depth recess to receive specific floor finish material.
 - f. Partitions to separate wiring of different systems.
- J. Service Fittings
1. Exposed Parts Finish: Brass **OR** Brushed Aluminum, **as directed**.
 2. Flush, Single-System Service Fitting for Round Inserts: Include mounting and cover to support and provide access to single connector, jack, or receptacle device; mounted flush with floor within body of insert.
 - a. Connector, Jack, and Receptacle Devices: Single modular type; complying with Division 26 Section(s) "Wiring Devices" AND Division 27 Section(s) "Communications Horizontal Cabling".
 - b. Power Receptacle Outlet: Suitable for 20-A device.
 3. Flush, Single- or Multiple-System Service Fitting for Rectangular Inserts: Include mounting, hinged cover, and trim to support and provide access to connector, jack, or receptacle devices mounted flush with floor within insert.
 - a. Connector, Jack, and Receptacle Devices: Modular type; complying with Division 26 Section(s) "Wiring Devices" AND Division 27 Section(s) "Communications Horizontal Cabling".
 - b. Power Receptacle Rating: 20 A, 120 V unless otherwise indicated.
 4. Recess-Mounted Service Fitting: Modular fittings compatible with preset inserts and shall include covers; provisions for receptacles, jacks, and connectors; and associated device plates for indicated systems. Include hinged flush handhole covers with recessed depth to match thickness of floor finish material. Provide for internally mounted receptacle- and communication-jack and connector assemblies complying with requirements in Division 26 Section(s) "Wiring Devices" AND Division 27 Section(s) "Communications Horizontal Cabling".
 - a. Duplex receptacle.
 - b. Duplex telephone-data jacks.
 - c. Double duplex receptacles.
 - d. Duplex receptacle and duplex telephone-data jacks.
 - e. Double duplex telephone-data jacks, Category 5 **OR** Category 5e **OR** Category 6, **as directed**.



- f. Fiber-optic cable connector.
5. Surface-Mounted Service Fitting: Modular pedestal type, with locking attachment matched to insert floor opening.
 - a. Power-outlet, double-faced, surface-mounted unit for duplex receptacle on both sides.
 - b. Power-outlet, single-faced, surface-mounted unit for duplex receptacle on one side.
 - c. Communication-outlet, double-faced, surface-mounted unit.
 - 1) Include bushed openings on both sides; 1-inch (25-mm) minimum diameter; insulated with nonconducting material.
 - 2) Include provisions for modular dual fiber-optic connector assembly on both sides.
 - 3) Include provisions for modular dual jack-connector assembly, rated for Category 5 **OR** Category 5e **OR** Category 6, **as directed**, on both sides.
 - d. Communication-outlet, single-faced, surface-mounted unit with bushed opening on one side; 1-inch (25-mm) minimum diameter; insulated with nonconducting material.
 - e. Combination surface-mounted unit for duplex receptacle on one side and with communication cable connection provision on opposite side.
 - 1) Communication Side: Include bushed opening; 1-inch (25-mm) minimum diameter; insulated with nonconducting material.
 - 2) Communication Side: Include provisions for modular dual fiber-optic connector assembly.
 - 3) Communication Side: Include provisions for modular dual jack-connector assembly, rated for Category 5 **OR** Category 5e **OR** Category 6, **as directed**.
6. Flush-Mounted Service Fittings: Modular fittings compatible with preset inserts and shall include covers, provisions for receptacles jacks and connector assemblies and wiring extensions to wall-mounted outlets, and associated device plates for indicated systems. Include flush handhole covers, recessed to suit floor finish material. Internally mounted, modular, receptacle, jack and connector assemblies shall comply with requirements in Division 26 Section(s) "Wiring Devices" AND Division 27 Section(s) "Communications Horizontal Cabling".
 - a. Duplex convenience receptacle.
 - b. Duplex telephone-data outlets.
 - c. Double duplex convenience receptacles.
 - d. Duplex convenience receptacle and duplex telephone-data outlets.
 - e. Double duplex telephone-data outlets.
 - f. Duplex communication jack, rated for Category 5 **OR** Category 5e **OR** Category 6, **as directed**.
 - g. Duplex fiber-optic communication connector.
 - h. Wiring-Extension Service Fittings: Arrangement of brackets and mountings to support, and provide access to wiring or cabling of a cell, and to connect the cable or raceway that extends the system to an individual wall outlet. Provide for connection of FMC **OR** ENT **OR** Type MC cable, **as directed**, for power extensions, and FMC **OR** ENT **OR** optical fiber/communication cable raceway, **as directed**, for communication system extensions.

1.3 EXECUTION

A. Installation

1. Install raceways aligned and leveled and, unless otherwise indicated, parallel or perpendicular to building walls.
2. Provide a concrete base for support of cellular metal raceway.
3. Arrange supports to attain proper elevation, alignment, and spacing of raceways. Install supports securely at ends and at intervals not to exceed 60 inches (1500 mm), to prevent movement during concrete pour.
4. Level raceway components with finished slab and make adjustments for floor finishes.
5. Adjust supports to maintain a 1/16- to 3/8-inch (1.6- to 10-mm) finished concrete cover over preset inserts.
6. Remove burrs, sharp edges, dents, and mechanical defects.
7. Cap or plug boxes, insert- and service-fitting openings, and open ends of raceways.



8. Seal raceways, cells, junction boxes, and inserts to prevent water, concrete, or foreign matter from entering raceways before and during pouring slab or placing fill. Tape joints, or seal with compound, as recommended in writing by underfloor raceway manufacturer.
 9. Junction Boxes: Install tops level and flush with finished floor. Install blank closure plates or plugs to close unused junction-box openings. Grout boxes in place to prevent movement during construction. Place top covers in inverted position during construction to prevent damage to surface of cover. Reinstall covers in proper position prior to final acceptance of Work.
 10. Afterset Inserts: Cut, hole saw, and drill slab and raceways to allow for installation.
 11. Ground underfloor raceway components.
 12. Install a marker at the center of the last insert of each cell and channel of each straight run of metal underfloor service raceway to locate the insert and identify the system.
 - a. Install markers at last inserts on both sides of permanent walls and at first inserts adjacent to each junction box.
 - b. Install markers flush at screed line before pouring slab or placing fill. Extend marker with grommited screw when floor covering is placed. Do not extend through carpet.
 - c. Use slotted-head screw to identify electrical power; use Phillips-head screw to identify conventional communications.
 - d. Use another distinctive screw head to identify third system such as special-purpose wiring.
 13. Level raceway components with finished slab and make adjustments in raceway component elevation to accommodate indicated floor finishes.
- B. Field Quality Control
1. Perform tests and inspections.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
 2. Tests and Inspections:
 - a. Perform visual inspection of interior of each junction box **OR** section of trench raceway, **as directed**, to verify absence of dirt, dust, construction debris, and moisture. Replace damaged and malfunctioning components.
 - b. Perform point-to-point tests of ground continuity and resistance of ground path between the most remote accessible fitting on each branch of each underfloor raceway system and the main electrical distribution grounding system.
 - 1) Determine cause and perform correction of any point-to-point resistance value that exceeds 0.05 ohms.
 - 2) Comply with NETA Acceptance Testing Specifications about safety, suitability of test equipment, test instrument calibration, and test report and records.
- C. Cleaning
1. Clean and swab out underfloor raceways, inserts, and junction boxes after finish has been applied to floor slab, and remove foreign material, dirt, and moisture. Leave interiors clean and dry.

END OF SECTION 26 05 33 23



Task	Specification	Specification Description
26 05 33 23	26 05 33 16	Raceways And Boxes



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SECTION 26 05 36 00 - CABLE TRAYS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of cable trays. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes steel, aluminum, stainless-steel, and fiberglass cable trays and accessories.

C. Submittals

1. Product Data: Include data indicating dimensions and finishes for each type of cable tray indicated.
2. Shop Drawings: For each type of cable tray.
 - a. Show fabrication and installation details of cable tray, including plans, elevations, and sections of components and attachments to other construction elements. Designate components and accessories, including clamps, brackets, hanger rods, splice-plate connectors, expansion-joint assemblies, straight lengths, and fittings.
 - b. Seismic-Restraint Details, **as directed**: Signed and sealed by a qualified professional engineer, licensed in the state where Project is located, who is responsible for their preparation.
 - 1) Design Calculations: Calculate requirements for selecting seismic restraints.
 - 2) Detail fabrication, including anchorages and attachments to structure and to supported cable trays.
3. Field quality-control reports.
4. Operation and Maintenance Data.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. Comply with NFPA 70.

E. Delivery, Storage, And Handling

1. Steel cable tray, hot dip galvanized after fabrication, **OR** Aluminum cable tray **OR** Stainless-steel cable tray **OR** Fiberglass cable tray, **as directed** may be stored outside without cover, but shall be loosely stacked, elevated off the ground, and ventilated to prevent staining during storage.
2. Store indoors to prevent water or other foreign materials from staining or adhering to cable tray. Unpack and dry wet materials before storage.
3. Steel, mill galvanized **OR** electrogalvanized **OR** factory-primed, **as directed**, cable tray shall be stored in a well-ventilated, dry location. Unpack and dry wet materials before storage.
4. PVC-coated **OR** Field-painted, **as directed**, cable tray shall be stored indoors. Protect cable tray from scratching and marring of finish. Unpack and dry wet materials before storage.

1.2 PRODUCTS

A. Materials And Finishes

1. Cable Trays, Fittings, and Accessories: Steel, complying with NEMA VE 1.



- a. Factory-standard primer, ready for field painting; with cadmium-plated hardware according to ASTM B 766.
 - b. Mill galvanized before fabrication, complying with ASTM A 653/A 653M, G90 (Z275) coating; with hardware galvanized according to ASTM B 633 **OR** cadmium plated according to ASTM B 766, **as directed**.
 - c. Electrogalvanized before fabrication, complying with ASTM B 633; with hardware galvanized according to ASTM B 633.
 - d. Hot-dip galvanized after fabrication, complying with ASTM A 123/A 123M, Class B2; with chromium-zinc, ASTM F 1136, **OR** Type 316 stainless-steel, **as directed**, hardware.
 - e. PVC coating applied in a fluidized bed or by electrostatic spray; with chromium-zinc, ASTM F 1136 **OR** Type 316 stainless-steel, **as directed**, hardware.
 - f. Epoxy-resin paint over paint manufacturer's recommended primer and corrosion-inhibiting treatment; with cadmium-plated hardware according to ASTM B 766 **OR** Type 316 stainless-steel hardware, **as directed**.
2. Cable Trays, Fittings, and Accessories: Aluminum, complying with NEMA VE 1, Aluminum Association's Alloy 6063-T6 for rails, rungs, and cable trays, and Alloy 5052-H32 or Alloy 6061-T6 for fabricated parts; with chromium-zinc, ASTM F 1136, **OR** Type 316 stainless-steel, **as directed**, splice-plate fasteners, bolts, and screws
 3. Cable Trays, Fittings, and Accessories: Stainless steel, Type 304 **OR** 316, **as directed**, complying with NEMA VE 1.
 4. Cable Trays, Fittings, and Accessories: Fiberglass, complying with NEMA FG 1 and UL 568. Splice-plate fasteners, bolts, and screws shall be fiberglass-encapsulated stainless steel. Design fasteners so that no metal is visible when fully assembled and tightened. Fastener encapsulation shall not be damaged when torqued to manufacturer's recommended value.
 5. Sizes and Configurations: Refer to the Cable Tray Schedule on Drawings for specific requirements for types, materials, sizes, and configurations.
 - a. Center-hanger supports may be used only when specifically indicated.

B. Cable Tray Accessories

1. Fittings: Tees, crosses, risers, elbows, and other fittings as indicated, of same materials and finishes as cable tray.
2. Covers: Solid **OR** Louvered **OR** Ventilated-hat **OR** 2-in-3 pitch cover, **as directed**, type of same materials and finishes as cable tray.
3. Barrier Strips: Same materials and finishes as cable tray.
4. Cable tray supports and connectors, including bonding jumpers, as recommended by cable tray manufacturer.

C. Warning Signs

1. Lettering: 1-1/2-inch- (40-mm-) high, black letters on yellow background with legend "WARNING! NOT TO BE USED AS WALKWAY, LADDER, OR SUPPORT FOR LADDERS OR PERSONNEL."
2. Materials and fastening are specified in Division 26 Section "Identification For Electrical Systems".

1.3 EXECUTION

A. Cable Tray Installation

1. Comply with recommendations in NEMA VE 2. Install as a complete system, including all necessary fasteners, hold-down clips, splice-plate support systems, barrier strips, hinged horizontal and vertical splice plates, elbows, reducers, tees, and crosses.
2. Remove burrs and sharp edges from cable trays.
3. Fasten cable tray supports to building structure and install seismic restraints, **as directed**.



- a. Design each fastener and support to carry load indicated by seismic requirements and to comply with seismic-restraint details according to Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
 - b. Place supports so that spans do not exceed maximum spans on schedules.
 - c. Construct supports from channel members, threaded rods, and other appurtenances furnished by cable tray manufacturer. Arrange supports in trapeze or wall-bracket form as required by application.
 - d. Support bus assembly to prevent twisting from eccentric loading.
 - e. Manufacture center-hung support, designed for 60 percent versus 40 percent eccentric loading condition, with a safety factor of 3.
 - f. Locate and install supports according to NEMA FG 1 **OR** NEMA VE 1, **as directed**.
4. Make connections to equipment with flanged fittings fastened to cable tray and to equipment. Support cable tray independent of fittings. Do not carry weight of cable tray on equipment enclosure.
 5. Install expansion connectors where cable tray crosses building expansion joint and in cable tray runs that exceed dimensions recommended in NEMA FG 1 **OR** NEMA VE 1, **as directed**. Space connectors and set gaps according to applicable standard.
 6. Make changes in direction and elevation using standard fittings.
 7. Make cable tray connections using standard fittings.
 8. Seal penetrations through fire and smoke barriers according to Division 07 Section "Penetration Firestopping".
 9. Sleeves for Future Cables: Install capped sleeves for future cables through firestop-sealed cable tray penetrations of fire and smoke barriers.
 10. Workspace: Install cable trays with enough space to permit access for installing cables.
 11. Install barriers to separate cables of different systems, such as power, communications, and data processing; or of different insulation levels, such as 600, 5000, and 15 000 V.
 12. After installation of cable trays is completed, install warning signs in visible locations on or near cable trays.
- B. Cable Installation
1. Install cables only when cable tray installation has been completed and inspected.
 2. Fasten cables on horizontal runs with cable clamps or cable ties as recommended by NEMA VE 2. Tighten clamps only enough to secure the cable, without indenting the cable jacket. Install cable ties with a tool that includes an automatic pressure-limiting device.
 3. On vertical runs, fasten cables to tray every 18 inches (457 mm). Install intermediate supports when cable weight exceeds the load-carrying capacity of the tray rungs.
 4. In existing construction, remove inactive or dead cables from cable tray.
 5. Install covers after installation of cable is completed.
- C. Connections
1. Ground cable trays according to manufacturer's written instructions.
 2. Install an insulated equipment grounding conductor with cable tray, in addition to those required by NFPA 70.
- D. Field Quality Control
1. After installing cable trays and after electrical circuitry has been energized, survey for compliance with requirements. Perform the following field quality-control survey:
 - a. Visually inspect cable insulation for damage. Correct sharp corners, protuberances in cable tray, vibration, and thermal expansion and contraction conditions, which may cause or have caused damage.
 - b. Verify that the number, size, and voltage of cables in cable tray do not exceed that permitted by NFPA 70. Verify that communication or data-processing circuits are separated from power circuits by barriers.
 - c. Verify that there is no intrusion of such items as pipe, hangers, or other equipment that could damage cables.



- d. Remove deposits of dust, industrial process materials, trash of any description, and any blockage of tray ventilation.
 - e. Visually inspect each cable tray joint and each ground connection for mechanical continuity. Check bolted connections between sections for corrosion. Clean and retorqued in suspect areas.
 - f. Check for missing or damaged bolts, bolt heads, or nuts. When found, replace with specified hardware.
 - g. Perform visual and mechanical checks for adequacy of cable tray grounding; verify that all takeoff raceways are bonded to cable tray.
2. Report results in writing.

E. Protection

1. Protect installed cable trays.
 - a. Repair damage to galvanized finishes with zinc-rich paint recommended by cable tray manufacturer.
 - b. Repair damage to PVC or paint finishes with matching touchup coating recommended by cable tray manufacturer.
 - c. Install temporary protection for cables in open trays to protect exposed cables from falling objects or debris during construction. Temporary protection for cables and cable tray can be constructed of wood or metal materials until the risk of damage is over.

END OF SECTION 26 05 36 00



Task	Specification	Specification Description
26 05 39 00	26 05 33 23	Underfloor Raceways For Electrical Systems
26 05 43 00	26 05 19 16	Common Work Results for Electrical
26 05 43 00	26 05 19 16a	Common Work Results for Communications
26 05 43 00	26 05 19 16b	Common Work Results for Electronic Safety and Security
26 05 43 00	26 05 13 00	Conductors And Cables
26 05 43 00	26 05 19 16e	Communications Equipment Room Fittings
26 05 43 00	26 05 19 16f	Communications Backbone Cabling
26 05 43 00	26 05 19 16g	Communications Horizontal Cabling
26 05 43 00	26 05 19 16h	Conductors and Cables for Electronic Safety and Security



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SECTION 26 05 53 00 - ELECTRICAL IDENTIFICATION

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for electrical identification. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Identification for raceways.
 - b. Identification of power and control cables.
 - c. Identification for conductors.
 - d. Underground-line warning tape.
 - e. Warning labels and signs.
 - f. Instruction signs.
 - g. Equipment identification labels.
 - h. Miscellaneous identification products.

C. Submittals

1. Product Data: For each electrical identification product indicated.
2. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.
3. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

D. Quality Assurance

1. Comply with ANSI A13.1 and IEEE C2, **as directed**.
2. Comply with NFPA 70.
3. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
4. Comply with ANSI Z535.4 for safety signs and labels.
5. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.2 PRODUCTS

A. Power Raceway Identification Materials

1. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
2. Colors for Raceways Carrying Circuits at 600 V or Less:
 - a. Black letters on an orange field.
 - b. Legend: Indicate voltage and system or service type, **as directed**.
3. Colors for Raceways Carrying Circuits at More Than 600 V:
 - a. Black letters on an orange field.
 - b. Legend: "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch- (75-mm-) high letters on 20-inch (500-mm) centers.
4. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.



5. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
 6. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
 7. Tape and Stencil for Raceways Carrying Circuits More Than 600 V: 4-inch- (100-mm-) wide black stripes on 10-inch (250-mm) centers diagonally over orange background that extends full length of raceway or duct and is 12 inches (300 mm) wide. Stop stripes at legends.
 8. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch (50 by 50 by 1.3 mm), with stamped legend, punched for use with self-locking cable tie fastener.
 9. Write-On Tags: Polyester tag, 0.010 inch (0.25 mm) **OR** 0.015 inch (0.38 mm), **as directed**, thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
 - a. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

OR

Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.
- B. Armored And Metal-Clad Cable Identification Materials
1. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
 2. Colors for Raceways Carrying Circuits at 600 V and Less:
 - a. Black letters on an orange field.
 - b. Legend: Indicate voltage and system or service type, **as directed**.
 3. Colors for Raceways Carrying Circuits at More Than 600 V:
 - a. Black letters on an orange field.
 - b. Legend: "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch- (75-mm-) high letters on 20-inch (500-mm) centers.
 4. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

OR

Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches (50 mm) wide; compounded for outdoor use.
- C. Power And Control Cable Identification Materials
1. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
 2. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
 3. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch (50 by 50 by 1.3 mm), with stamped legend, punched for use with self-locking cable tie fastener.
 4. Write-On Tags: Polyester tag, 0.010 inch (0.25 mm) **OR** 0.015 inch (0.38 mm), **as directed**, thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
 - a. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

OR

Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.
 5. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.



6. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- D. Conductor Identification Materials
1. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.
 2. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
 3. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
 4. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
 5. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
 6. Write-On Tags: Polyester tag, 0.010 inch (0.25 mm) **OR** 0.015 inch (0.38 mm), **as directed**, thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
 - a. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
OR
Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.
- E. Floor Marking Tape
1. 2-inch- (50-mm-) wide, 5-mil (0.125-mm) pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.
- F. Underground-Line Warning Tape
1. Tape:
 - a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
 - b. Printing on tape shall be permanent and shall not be damaged by burial operations.
 - c. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.
 2. Color and Printing:
 - a. Comply with ANSI Z535.1 through ANSI Z535.5.
 - b. Inscriptions for Red-Colored Tapes: **ELECTRIC LINE, HIGH VOLTAGE.**
 - c. Inscriptions for Orange-Colored Tapes: **TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.**
 3. Tag: Type I:
 - a. Pigmented polyolefin, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
 - b. Thickness: 4 mils (0.1 mm).
 - c. Weight: 18.5 lb/1000 sq. ft. (9.0 kg/100 sq. m).
 - d. 3-Inch (75-mm) Tensile According to ASTM D 882: 30 lbf (133.4 N), and 2500 psi (17.2 MPa).
 4. Tag: Type II:
 - a. Multilayer laminate consisting of high-density polyethylene scrim coated with pigmented polyolefin, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
 - b. Thickness: 12 mils (0.3 mm).
 - c. Weight: 36.1 lb/1000 sq. ft. (17.6 kg/100 sq. m).



- d. 3-Inch (75-mm) Tensile According to ASTM D 882: 400 lbf (1780 N), and 11,500 psi (79.2 MPa).
5. Tag: Type ID:
 - a. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
 - b. Overall Thickness: 5 mils (0.125 mm).
 - c. Foil Core Thickness: 0.35 mil (0.00889 mm).
 - d. Weight: 28 lb/1000 sq. ft. (13.7 kg/100 sq. m).
 - e. 3-Inch (75-mm) Tensile According to ASTM D 882: 70 lbf (311.3 N), and 4600 psi (31.7 MPa).
6. Tag: Type IID:
 - a. Reinforced, detectable three-layer laminate, consisting of a printed pigmented woven scrim, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
 - b. Overall Thickness: 8 mils (0.2 mm).
 - c. Foil Core Thickness: 0.35 mil (0.00889 mm).
 - d. Weight: 34 lb/1000 sq. ft. (16.6 kg/100 sq. m).
 - e. 3-Inch (75-mm) Tensile According to ASTM D 882: 300 lbf (1334 N), and 12,500 psi (86.1 MPa).

G. Warning Labels And Signs

1. Comply with NFPA 70 and 29 CFR 1910.145.
2. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.
3. Baked-Enamel Warning Signs:
 - a. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
 - b. 1/4-inch (6.4-mm) grommets in corners for mounting.
 - c. Nominal size, 7 by 10 inches (180 by 250 mm).
4. Metal-Backed, Butyrate Warning Signs:
 - a. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for application.
 - b. 1/4-inch (6.4-mm) grommets in corners for mounting.
 - c. Nominal size, 10 by 14 inches (250 by 360 mm).
5. Warning label and sign shall include, but are not limited to, the following legends:
 - a. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
 - b. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

H. Instruction Signs

1. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. inches (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.
 - a. Engraved legend with black letters on white face.
 - b. Punched or drilled for mechanical fasteners.
 - c. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.
2. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm).
3. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.



- I. Equipment Identification Labels
 1. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm).
 2. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.
 3. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).
 4. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).
 5. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch (25 mm).

- J. Cable Ties
 1. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.
 - a. Minimum Width: 3/16 inch (5 mm).
 - b. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
 - c. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
 - d. Color: Black except where used for color-coding.
 2. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self extinguishing, one piece, self locking, Type 6/6 nylon.
 - a. Minimum Width: 3/16 inch (5 mm).
 - b. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
 - c. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
 - d. Color: Black.
 3. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.
 - a. Minimum Width: 3/16 inch (5 mm).
 - b. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 7000 psi (48.2 MPa).
 - c. UL 94 Flame Rating: 94V-0.
 - d. Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).
 - e. Color: Black.

- K. Miscellaneous Identification Products
 1. Paint: Comply with requirements in Division 07 for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).
 2. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

1.3 EXECUTION

- A. Installation
 1. Verify identity of each item before installing identification products.
 2. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
 3. Apply identification devices to surfaces that require finish after completing finish work.
 4. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
 5. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
 6. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot



(15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

7. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
8. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
 - a. Outdoors: UV-stabilized nylon.
 - b. In Spaces Handling Environmental Air: Plenum rated.
9. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.
10. Painted Identification: Comply with requirements in Division 07 for surface preparation and paint application.

B. Identification Schedule

1. Concealed Raceways, Duct Banks, More Than 600 V, within Buildings: Tape and stencil 4-inch- (100-mm-) wide black stripes on 10-inch (250-mm) centers over orange background that extends full length of raceway or duct and is 12 inches (300 mm) wide. Stencil legend "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch- (75-mm-) high black letters on 20-inch (500-mm) centers. Stop stripes at legends. Apply to the following finished surfaces:
 - a. Floor surface directly above conduits running beneath and within 12 inches (300 mm) of a floor that is in contact with earth or is framed above unexcavated space.
 - b. Wall surfaces directly external to raceways concealed within wall.
 - c. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.
2. Accessible Raceways, Armored and Metal-Clad Cables, More Than 600 V: Self-adhesive vinyl **OR** Snap-around, **as directed**, labels. Install labels at 10-foot (3-m) **OR** 30-foot (10-m), **as directed**, maximum intervals.
3. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Identify with self-adhesive vinyl label **OR** self-adhesive vinyl tape applied in bands, **as directed**. Install labels at 10-foot (3-m) **OR** 30-foot (10-m), **as directed**, maximum intervals.
4. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:
 - a. Emergency Power.
 - b. Power.
 - c. UPS.
5. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
 - a. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder, and branch-circuit conductors.
 - 1) Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
 - 2) Colors for 208/120-V Circuits:
 - a) Phase A: Black.
 - b) Phase B: Red.
 - c) Phase C: Blue.
 - 3) Colors for 480/277-V Circuits:
 - a) Phase A: Brown.
 - b) Phase B: Orange.
 - c) Phase C: Yellow.
 - 4) Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where



- splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
6. Power-Circuit Conductor Identification, More than 600 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use write-on tags **OR** nonmetallic plastic tag holder with adhesive-backed phase tags, and a separate tag with the circuit designation, **as directed**.
 7. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.
 8. Conductors to Be Extended in the Future: Attach write-on tags **OR** marker tape, **as directed**, to conductors and list source.
 9. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
 - a. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 - b. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 - c. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.
 10. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
 - a. Limit use of underground-line warning tape to direct-buried cables.
 - b. Install underground-line warning tape for both direct-buried cables and cables in raceway.
 11. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
 12. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels **OR** Baked-enamel warning signs **OR** Metal-backed, butyrate warning signs, **as directed**.
 - a. Comply with 29 CFR 1910.145.
 - b. Identify system voltage with black letters on an orange background.
 - c. Apply to exterior of door, cover, or other access.
 - d. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
 - 1) Power transfer switches.
 - 2) Controls with external control power connections.
 13. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
 14. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for power transfer **OR** load shedding, **as directed**.
 15. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
 - a. Labeling Instructions:
 - 1) Indoor Equipment: Adhesive film label **OR** Adhesive film label with clear protective overlay **OR** Self-adhesive, engraved, laminated acrylic or melamine label **OR** Engraved, laminated acrylic or melamine label, **as directed**. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.
 - 2) Outdoor Equipment: Engraved, laminated acrylic or melamine label **OR** Stenciled legend 4 inches (100 mm) high, **as directed**.



- 3) Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
 - 4) Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
- b. Equipment to Be Labeled:
- 1) Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be self-adhesive, engraved **OR** engraved, **as directed**, laminated acrylic or melamine label.
 - 2) Enclosures and electrical cabinets.
 - 3) Access doors and panels for concealed electrical items.
 - 4) Switchgear.
 - 5) Switchboards.
 - 6) Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
 - 7) Substations.
 - 8) Emergency system boxes and enclosures.
 - 9) Motor-control centers.
 - 10) Enclosed switches.
 - 11) Enclosed circuit breakers.
 - 12) Enclosed controllers.
 - 13) Variable-speed controllers.
 - 14) Push-button stations.
 - 15) Power transfer equipment.
 - 16) Contactors.
 - 17) Remote-controlled switches, dimmer modules, and control devices.
 - 18) Battery-inverter units.
 - 19) Battery racks.
 - 20) Power-generating units.
 - 21) Monitoring and control equipment.
 - 22) UPS equipment.

END OF SECTION 26 05 53 00



Task	Specification	Specification Description
26 05 83 00	26 05 13 00	Conductors And Cables
26 05 83 00	26 05 13 00a	Undercarpet Cables
26 05 83 00	26 05 13 00b	Medium-Voltage Cables



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SECTION 26 09 23 00 - LIGHTING CONTROLS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for lighting controls. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes manually operated lighting controls with relays, electrically operated circuit breakers, and control module.
2. This Section includes manually operated, PC-based, digital lighting controls with external signal source, relays, electrically operated circuit breakers, and control module.
3. This Section includes individually addressable lighting control devices communicating with data-entry and -retrieval devices using DALI protocol.

C. Definitions

1. BACnet: A networking communication protocol that complies with ASHRAE 135.
2. BAS: Building automation system.
3. DALI: Digital addressable lighting interface.
4. LonWorks: A control network technology platform for designing and implementing interoperable control devices and networks.
5. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling and power-limited circuits.
6. Monitoring: Acquisition, processing, communication, and display of equipment status data, metered electrical parameter values, power quality evaluation data, event and alarm signals, tabulated reports, and event logs.
7. PC: Personal computer; sometimes plural as "PCs."
8. Power Line Carrier: Use of radio-frequency energy to transmit information over transmission lines whose primary purpose is the transmission of power.
9. RS-485: A serial network protocol, similar to RS-232, complying with TIA/EIA-485-A.

D. Submittals

1. Product Data: For control modules, power distribution components, DALI network materials, manual switches and plates, and conductors and cables.
2. Shop Drawings: Detail assemblies of standard components, custom assembled for specific application on this Project.
 - a. Outline Drawings: Indicate dimensions, weights, arrangement of components, and clearance and access requirements.
 - b. Block Diagram: Show interconnections between components specified in this Section and devices furnished with power distribution system components. Indicate data communication paths and identify networks, data buses, data gateways, concentrators, and other devices to be used. Describe characteristics of network and other data communication lines.
 - c. Wiring Diagrams: Power, signal, and control wiring. Coordinate nomenclature and presentation with a block diagram.
3. Coordination Drawings: Submit evidence that lighting controls are compatible with connected monitoring and control devices and systems specified in other Sections.
 - a. Show interconnecting signal and control wiring and interfacing devices that prove compatibility of inputs and outputs.
 - b. For networked controls, list network protocols and provide statements from manufacturers that input and output devices meet interoperability requirements of the network protocol.



4. Software and Firmware Operational Documentation:
 - a. Software operating and upgrade manuals.
 - b. Program Software Backup: On a magnetic media or compact disc, complete with data files.
 - c. Device address list.
 - d. Printout of software application and graphic screens.
 5. Field quality-control test reports.
 6. Software licenses and upgrades required by and installed for operation and programming of digital and analog devices.
 7. Operation and maintenance data.
 8. Warranty: Special warranty specified in this Section.
- E. Quality Assurance
1. Source Limitations: Obtain lighting control module and power distribution components through one source from a single manufacturer.
 2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
 3. Comply with 47 CFR, Subparts A and B, for Class A digital devices.
 4. Comply with protocol described in IEC 60929, Annex E, for DALI lighting control devices, wiring, and computer hardware and software.
 5. Comply with NFPA 70.
- F. Coordination
1. Coordinate lighting control components to form an integrated interconnection of compatible components. Match components and interconnections for optimum performance of lighting control functions.
 - a. Coordinate lighting controls with BAS **OR** HVAC controls, **as directed**. Design display graphics showing building areas controlled; include the status of lighting controls in each area.
 - b. Coordinate lighting controls with that in Sections specifying distribution components that are monitored or controlled by power monitoring and control equipment.
 2. Coordinate lighting control components specified in this Section with components specified in Division 26 Section "Panelboards".
- G. Warranty
1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of lighting controls that fail in materials or workmanship or from transient voltage surges within specified warranty period.
 - a. Failures include, but are not limited to, the following:
 - 1) Failure of software input/output to execute switching or dimming commands.
 - 2) Failure of modular relays to operate under manual or software commands.
 - 3) Damage of electronic components due to transient voltage surges.
 - b. Warranty Period: Two years from date of Final Completion.
 - c. Extended Warranty Period Failure Due to Transient Voltage Surges: Eight years.
 - d. Extended Warranty Period for Electrically Held Relays: 10 years from date of Final Completion.
- H. Software Service Agreement (May Not Be Allowed For Publicly Funded Projects)
1. Technical Support: Beginning with Final Completion, provide software support for two years.
 2. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Final Completion. Upgrading software shall include operating system. Upgrade shall include new or revise licenses for use of the software.



- a. Provide 30-day notice to the Owner to allow scheduling and access to system and to allow the Owner to upgrade computer equipment, if necessary.

1.2 PRODUCTS

A. System Requirements

1. Expandability: System shall be capable of increasing the number of control functions in the future by 25 percent of current capacity; to include equipment ratings, housing capacities, spare relays, terminals, number of conductors in control cables, and control software.
2. Performance Requirements (for programmable system that controls manual and automatic operation that is not PC based): Manual switch operation sends a signal to programmable-system control module that processes the signal according to its programming and routes an open or close command to one or more relays **OR** electrically operated circuit breakers, **as directed**, in the power-supply circuits to groups of lighting fixtures or other loads.
3. Performance Requirements (for PC-based programmable system that controls manual and automatic operation): Manual switches, an internal timing and control unit, and external sensors or other control signal sources send a signal to a PC-based programmable-system control module that processes the signal according to its programming and routes an open or close command to one or more relays **OR** electrically operated circuit breakers, **as directed**, in the power-supply circuits, or routes variable commands to one or more dimmers, for groups of lighting fixtures or other loads.
4. Performance Requirements (for DALI-compliant program): Individually addressable devices (such as electronic ballasts, dimmers, and manual switches) are operated from digital signals received through a DALI-compliant bus, from data-entry and -retrieval devices (such as PCs, personal digital assistants (PDAs), hand-held infrared programming devices, wired Ethernet hubs, wireless IEEE 802.11 hubs). Devices also report status to data-entry and -retrieval devices through the bus.
5. BAS Interface: Provide hardware and software to enable the BAS to monitor, control, display, and record data for use in processing reports.
 - a. Hardwired Points:
 - 1) Monitoring: On-off status, <Insert monitoring point>.
 - 2) Control: On-off operation, <Insert control point>.
 - b. ASHRAE 135 (BACnet) **OR** LonTalk **OR** Modbus **OR** Industry-accepted, open-protocol, **as directed**, communication interface with the BAS shall enable the BAS operator to remotely control and monitor lighting from a BAS operator workstation. Control features and monitoring points displayed locally at lighting panel shall be available through the BAS.

B. Control Module

1. Control Module Description: (This is a generic, nonproprietary control module that is not PC based.) Comply with UL 916 (CSA C22.2, No. 205); microprocessor-based, solid-state, 365-day timing and control unit. Output circuits shall be switched on or off by internally programmed time signals or by program-controlled analog or digital signals from external sources. Output circuits shall be pilot-duty relays compatible with power switching devices. An integral keypad shall provide local programming and control capability. A key-locked cover and a programmed security access code shall protect keypad use. An integral alphanumeric LCD or LED shall display menu-assisted programming and control.
2. Control Module Description: (These are typical systems developed by time-switch manufacturers as an expansion and refinement of their microprocessor-based, digital, time-switch product lines - controls are not PC based.) Comply with UL 916 (CSA C22.2, No. 205); microprocessor-based, solid-state, 365-day timing and control unit. Unit shall be programmable for control of indicated number of output circuits. Output circuits shall be switched on or off by internally programmed time signals or by program-controlled analog or digital signals from external sources. Output circuits shall be pilot-duty relays compatible with power switching devices, all located in other enclosures. An integral keypad shall provide local programming and control capability. A key-locked cover and a programmed security access code shall protect keypad use. An integral



alphanumeric LCD shall display manual-control and programming steps. Modules and their associated control panels shall include the following features:

- a. Multichannel output with **<Insert number>** channels.
OR
 Multiple inputs and multichannel output arranged for **<Insert number>** channels.
- b. Multiple inputs for indicated occupancy sensors and hand-held programming device.
3. Control Module Description: (These are low-voltage control systems developed by high-end, remote-control dimmer system manufacturers - controls are not PC based.) Comply with UL 916 (CSA C22.2, No. 205); microprocessor-based, solid-state, 365-day timing and control unit. Control units shall be programmable and capable of receiving inputs from indicated sensors and hand-held programmer. Output circuits shall be pilot-duty relays compatible with power switching devices. Output circuits shall include digital circuits arranged to transmit control commands to remote preset dimmers. Modules and their associated control panels shall include the following features:
 - a. Multichannel output with **<Insert number>** channels.
OR
 Multiple inputs and multichannel output arranged for **<Insert number>** channels.
 - b. Multiple inputs for occupancy sensors, daylight sensors, and dimming systems with associated daylight sensors.
4. Control Module Description: (This is a low-voltage control system developed around panelboards with electrically operated, molded-case circuit breakers and control module installed in panelboard - controls are not PC based.) Panelboard mounted; comply with UL 916 (CSA C22.2, No. 205); microprocessor based, solid-state, 365-day timing and control unit. Control units shall be programmable and capable of receiving inputs from sensors and other sources. Panelboard shall use low-voltage-controlled, electrically operated, molded-case branch circuit breakers as prime power-circuit switching devices. Circuit breakers and a limited number of digital or analog, low-voltage control-circuit outputs shall be individually controlled by control module. Line-voltage components and wiring shall be separated from low-voltage components and wiring by barriers. Control module shall be locally programmable. Panelboard shall also comply with Division 26 Section "Panelboards".
5. Control Module Description: (This is a refinement of classic low-voltage control system originally developed for manual, multipoint lighting control using latching-type, single-pole relays to switch 120- and 277-V circuits - controls are not PC based.) Comply with UL 508 (CSA C22.2, No. 14); microprocessor-based, programmable, control unit; mounted in preassembled, modular relay panel. Low-voltage-controlled, latching-type, single-pole lighting circuit relays shall be prime output circuit devices. Where indicated, a limited number of digital or analog, low-voltage control-circuit outputs shall be supported by control unit and circuit boards associated with relays. Control units shall be capable of receiving inputs from sensors and other sources. Line-voltage components and wiring shall be separated from low-voltage components and wiring by barriers. Control module shall be locally programmable.
6. Control Module Description: (This is a typical PC-based software control system developed to operate panelboards with electrically operated circuit breakers, relay boards with latching-type control relays, and individually addressable DALI-compliant devices. This control scheme is also suitable for integrating one or more of these boards to a PC-based control network (such as BAS, detention monitoring and control system, and HVAC control system) specified in another Section.) Programmable, PC-based unit with 17-inch color video monitor **OR** 15-inch color LCD, **as directed**, and keyboard for graphic display and programming of system status and to override breaker status; and to display status of local override controls and diagnostic information. If the control module is applied to emergency lighting units, control unit shall indicate failure of normal power and that the lighting units are, or are not, powered by the alternate power source.
 - a. Display: Single graphic display for programming lighting control panelboards.
OR
 Display: Separate graphic displays for programming each lighting control panelboard.
 - b. Interoperability: Control module shall be configured to connect with other control systems using RS-485 network to enable remote workstations to use control module functions.

**OR**

Interoperability: Control module shall be configured to connect to LonWorks-compliant **OR** BACnet-compliant, **as directed**, network, resulting in extending control to any network-compliant devices such as occupancy switches.

OR

Interoperability: Lighting control shall be configured to allow individual users to turn lighting on and off with their PCs. Software shall be written for Windows operating system, with Web page as the display and ActiveX controls that can be accessed through an Internet browser. Include at least three levels of password protection. Include an egress lighting option that will provide each user with a lighted path for exiting the building after normal working hours.

OR

Interoperability: Lighting control shall be configured to allow individual users to turn lighting on and off with DALI-compliant, digital-communication devices. Software shall be written for Windows operating system, with the full suite of DALI commands and device parameter settings.

- c. System Memory: Nonvolatile. System shall reboot program and reset time automatically without errors after power outages up to 90 days' duration.
- d. Software: Lighting control software shall be capable of linking switch inputs to relay outputs, retrieving links, viewing relay output status, controlling relay outputs, simulating switch inputs, setting device addresses, and assigning switch input and relay output modes.
- e. Automatic Time Adjustment: System shall automatically adjust for leap year and daylight saving time and shall provide weekly routine and annual holiday scheduling.
- f. Astronomic Control: Automatic adjustment of dawn and dusk switching.
- g. Demand Control: Demand shall be monitored through pulses from a remote meter and shall be controlled by programmed switching of loads. System capability shall include sliding window averaging and programming of load priorities and characteristics. Minimum of two different time-of-day demand schedules shall execute load-management control actions by switching output circuits or by transmitting other types of load-control signals.
- h. Confirmation: Each relay or contactor device operated by system shall have auxiliary contacts that provide a confirmation signal to the system of on or off status of device. On or off status confirmation for each electrically operated circuit breaker shall be provided by an auxiliary contact or by a sensing device at load terminal.
 - 1) Software shall interpret status signals, provide for their display, and initiate failure signals.

OR

Lamp or LED at control module or display panel shall identify status of each controlled circuit.

- i. Remote Communication Capability: Allow programming, data-gathering interrogation, status display, and controlled command override from a PC at a remote location over telephone lines **OR** data links **OR** DALI networks **OR** power line carrier, **as directed**. System shall include modem, communications and control software, and remote computer compatibility verification for this purpose.
- j. Telephone Override Capability: Override programmed lighting shutdown commands by telephoning computer and shall enter a voice-menu-guided, override touch-tone code specific to zone being controlled.
- k. Local Override Capability: Manual, low-voltage control devices shall override programmed shutdown of lighting and shall override other programmed control for intervals that may be duration programmed.
- l. Automatic Control of Local Override: Automatic control shall switch lighting off if lighting has been switched on by local override. Comply with provisions in California Code of Regulations, Title 24, Part 6, **as directed**.
- m. Automatic battery backup shall provide power to maintain program and system clock operation for 90 days' minimum duration when power is off.
- n. Programmed time signals shall change preset scenes and dimmer settings.



- o. Daylight Balancing Dimming Control: Control module shall interpret variable analog signal from photoelectric sensor and shall route dimming signals to dimming fluorescent ballast control circuits. Signal shall control dimming of fixture so illumination level remains constant as daylight contribution varies.
- p. Daylight Compensating Switch Control: Control module shall interpret a preset threshold illumination-level signal from a photoelectric relay and shall activate relays controlling power to selected groups of lighting fixtures to turn them on and off to maintain adjustable minimum illumination level as daylight contribution varies.
- q. Energy Conservation: Bilevel control of special ballasts or dimming circuits to comply with local energy codes.
- r. Flick Warning: Programmable momentary turnoff of lights shall warn that programmed shutoff will occur after a preset interval. Warning shall be repeated after a second preset interval before end of programmed override period.
- s. Diagnostics: When system operates improperly, software shall initiate factory-programmed diagnosis of failure and display messages identifying problem and possible causes.
- t. Additional Programming: In addition to system programming by the PC, individual control modules shall be programmable using data-entry and -retrieval (such as PCs, personal digital assistants (PDAs), hand-held infrared programming devices, wired Ethernet hubs, wireless IEEE 802.11 hubs).

C. Power Distribution Components (For DALI-Compliant Networks)

1. Modular Relay Panel: Comply with UL 508 (CSA C22.2, No. 14) and UL 916 (CSA C22.2, No. 205); factory assembled with modular single-pole relays, power supplies, and accessory components required for specified performance.
 - a. Cabinet: Steel with hinged, locking door.
 - 1) Barriers separate low-voltage and line-voltage components.
 - 2) Directory: Mounted on back of door. Identifies each relay as to load groups controlled and each programmed pilot device if any.
 - 3) Control Power Supply: Transformer and full-wave rectifier with filtered dc output.
 - b. Single-Pole Relays: Mechanically held unless otherwise indicated; split-coil, momentary-pulsed type.
 - 1) Low-Voltage Leads: Plug connector to the connector strip in cabinet and pilot light power where indicated.
 - 2) Rated Capacity (Mounted in Relay Panel): 20 A, 125-V ac for tungsten filaments; 20 A, 277-V ac for ballasts.
 - 3) Endurance: 50,000 cycles at rated capacity.
 - 4) Mounting: Provision for easy removal and installation in relay cabinet.
2. Electrically Operated, Molded-Case Circuit-Breaker Panelboard: Comply with NEMA PB 1 and UL 50 (CSA C22.2, No. 94), UL 67 (CSA C22.2, No. 29), UL 489 (CSA C22.2, No. 65), and UL 916 (CSA C22.2, No. 205).
 - a. Cabinets: In addition to requirements specified below, comply with Division 26 Section "Panelboards".
 - b. Electrically Operated, Molded-Case Circuit Breakers: Bolt-on type.
 - 1) Switching Endurance Ratings: Certified by manufacturer or by a nationally recognized testing laboratory (NRTL) for at least 20,000 open and close operations under rated load at 0.8 power factor.
 - 2) Minimum 30,000 open and close operations with load equal to circuit-breaker trip rating and consisting of 100 percent tungsten filament load.
 - 3) Minimum 30,000 open and close operations with load equal to circuit-breaker trip rating and consisting of 100 percent fluorescent ballasts rated for 10 percent total harmonic distortion.
 - 4) Listed and labeled as complying with UL SWD, HCAR, and HID ratings by a national recognized testing laboratory (NRTL) acceptable to authorities having jurisdiction.
3. Line-Voltage Surge Suppression: Factory installed as an integral part of 120- and 277-V ac, solid-state control panels.

**OR**

Line-Voltage Surge Suppression: Field-mounting surge suppressors that comply with Division 26 Section "Transient-voltage Suppression For Low-voltage Electrical Power Circuits" for Category A locations.

OR

Line-Voltage Surge Suppression: Factory installed as an integral part of 120- and 277-V ac, solid-state control panels or field-mounting surge suppressors that comply with Division 26 Section "Transient-voltage Suppression For Low-voltage Electrical Power Circuits" for Category A locations.

D. DALI Network Materials

1. Network Power Supply and Router: Interface device connecting TCP/IP control networks to DALI-compliant network.
 - a. DALI-Compliant Network Power Rating: One full-rated network for **OR** Two full-rated networks, each capable of, **as directed**, powering up to 64 addressable devices for each network; suitable for use with NFPA 70, Class 1 and Class 2 control circuits; and 16 V dc, 250 mA.
 - b. Primary Power: 120 or 277 V, field selectable; 12 VA.
 - c. 10basT Ethernet port.
 - d. LED indicator lights for Ethernet status (link, send, and receive), power-on, and DALI network failure.
2. Lighting Control Software:
 - a. Five-tier hierarchical architecture; high-speed, parallel query; and distributed-logic processing scalable from single rooms to full campuses.
 - b. Automatic backup for all settings and parameters.
 - c. TCP/IP network protocol.
 - d. Interactive with other building management systems at TCP/IP level.
 - e. At least three security levels.
 - f. Support the full suite of DALI commands and device parameter settings.
 - g. Scheduling modules to provide building-wide scene scheduling.
 - h. Billing modules to track energy use for multiple tenants and able to produce monthly billing statements.
 - i. Support load shedding, peak shaving, sweeps with local override, and other energy-conservation measures.
 - j. Able to report individual device status, including inoperative lamps, ballast failure detection, and dimmer position.

E. Manual Switches And Plates

1. Push-Button Switches: Modular, momentary-contact, low-voltage type.
 - a. Match color specified in Division 26 Section "Wiring Devices".
 - b. Integral green LED **OR** neon, **as directed**, pilot light to indicate when circuit is on.
 - c. Internal white LED **OR** neon, **as directed**, locator light to illuminate when circuit is off.
2. Manual, Maintained Contact, Full- or Low-Voltage Switch: Comply with Division 26 Section "Wiring Devices".
3. Wall-Box Dimmers: Comply with Division 26 Section "Wiring Devices".
4. Wall Plates: Single and multigang plates as specified in Division 26 Section "Wiring Devices"
5. Legend: Engraved or permanently silk-screened on wall plate where indicated. Use designations indicated on Drawings.

F. Conductors And Cables

1. Power Wiring to Supply Side of Class 2 Power Source: Not smaller than No. 12 AWG, complying with Division 26 Section "Low-voltage Electrical Power Conductors And Cables".
2. Classes 2 and 3 Control Cables: Multiconductor cable with copper conductors not smaller than No. 18 **OR** 22 **OR** 24, **as directed**, AWG, complying with Division 26 Section "Low-voltage Electrical Power Conductors And Cables".



3. Class 1 Control Cables: Multiconductor cable with copper conductors not smaller than No. 14 **OR** 16 **OR** 18, **as directed**, AWG, complying with Division 26 Section "Low-voltage Electrical Power Conductors And Cables".
4. Digital and Multiplexed Signal Cables: Unshielded, twisted-pair cable with copper conductors, complying with TIA/EIA-568-B.2, Category 5e **OR** 6, **as directed**, for horizontal copper cable and with Division 28 Section "Conductors And Cables For Electronic Safety And Security".

1.3 EXECUTION

A. Wiring Installation

1. Comply with NECA 1.
2. Wiring Method: Install wiring in raceways except where installed in accessible ceilings and gypsum board partitions. Comply with Division 26 Section "Low-voltage Electrical Power Conductors And Cables". Minimum conduit size shall be 1/2 inch (13 mm).
3. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and non-power-limited conductors according to conductor manufacturer's written instructions.
4. Install field-mounting transient voltage suppressors for lighting control devices in Category A locations that do not have integral line-voltage surge protection.
5. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
6. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in terminal cabinets, equipment enclosures, and in junction, pull, and outlet boxes.
7. Identify components and power and control wiring according to Division 26 Section "Identification For Electrical Systems".

B. Field Quality Control

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and assist in field testing. Report results in writing.
2. Perform the following field tests and inspections and prepare test reports:
 - a. Test for circuit continuity.
 - b. Verify that the control module features are operational.
 - c. Check operation of local override controls.
 - d. Test system diagnostics by simulating improper operation of several components selected by the Owner.

C. Software Installation

1. Install and program software with initial settings of adjustable values. Make backup copies of software and user-supplied values. Provide current licenses for software.

D. Adjusting

1. Occupancy Adjustments: When requested within 12 months of date of Final Completion, provide on-site assistance in adjusting sensors and to assist the Owner's personnel in making program changes to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

E. Demonstration

1. Engage a factory-authorized service representative to train the Owner's maintenance personnel to adjust, operate, and maintain lighting controls and software training for PC-based control systems.

END OF SECTION 26 09 23 00



SECTION 26 09 23 00a - LIGHTING CONTROL DEVICES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for lighting control devices. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following lighting control devices:
 - a. Time switches.
 - b. Outdoor and Indoor photoelectric switches.
 - c. Indoor occupancy sensors.
 - d. Outdoor motion sensors.
 - e. Lighting contactors.
 - f. Emergency shunt relays.

C. Definitions

1. LED: Light-emitting diode.
2. PIR: Passive infrared.

D. Submittals

1. Product Data: For each type of product indicated.
2. Field quality-control test reports.
3. Operation and maintenance data.

E. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.2 PRODUCTS

A. Time Switches

1. Electronic Time Switches: Electronic, solid-state programmable units with alphanumeric display; complying with UL 917.
 - a. Contact Configuration: SPST **OR** DPST **OR** DPDT, **as directed**.
 - b. Contact Rating: 30-A inductive or resistive, 240-V ac **OR** 20-A ballast load, 120/240-V ac, **as directed**.
 - c. Program: 8 on-off set points on a 24-hour schedule and an annual holiday schedule that overrides the weekly operation on holidays, **as directed**.
OR
Program: 2 on-off set points on a 24-hour schedule, allowing different set points for each day of the week and an annual holiday schedule that overrides the weekly operation on holidays, **as directed**.
OR
Programs: channels; each channel shall be individually programmable with 8 on-off set points on a 24-hour schedule.
OR
Programs: channels; each channel shall be individually programmable with 2 on-off set points on a 24-hour schedule with skip-a-day weekly schedule.

**OR**

Programs: channels; each channel shall be individually programmable with 2 on-off set points on a 24-hour schedule, allowing different set points for each day of the week.

OR

Programs: channels; each channel shall be individually programmable with 40 on-off operations per week and an annual holiday schedule that overrides the weekly operation on holidays.

OR

Programs: channels; each channel shall be individually programmable with 40 on-off operations per week, plus 4 seasonal schedules that modify the basic program, and an annual holiday schedule that overrides the weekly operation on holidays.

OR

Program: Configuration, as directed by the Owner and an annual holiday schedule that overrides the weekly operation on holidays, **as directed**.

- d. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program on selected channels, **as directed**.
 - e. Astronomic Time: All **OR** Selected, **as directed**, channels.
 - f. Battery Backup: For schedules and time clock.
2. Electromechanical-Dial Time Switches: Type complying with UL 917.
- a. Contact Configuration: SPST **OR** DPST **OR** SPDT **OR** DPDT, **as directed**.
 - b. Contact Rating: 30-A inductive or resistive, 240-V ac **OR** 20-A ballast load, 120/240-V ac, **as directed**.
 - c. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program.
 - d. Astronomic time dial.
 - e. Eight-Day Program: Uniquely programmable for each weekday and holidays.
 - f. Skip-a-day mode.
 - g. Wound-spring reserve carryover mechanism to keep time during power failures, minimum of 16 hours.

B. Outdoor Photoelectric Switches

1. Description: Solid state, with SPST **OR** DPST, **as directed**, dry contacts rated for 1800-VA tungsten or 1000-VA inductive, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.
 - a. Light-Level Monitoring Range: 1.5 to 10 fc (16.14 to 108 lx), with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of photocell to prevent fixed light sources from causing turn-off, **as directed**.
 - b. Time Delay: 15-second minimum, to prevent false operation.
 - c. Surge Protection: Metal-oxide varistor, complying with IEEE C62.41.1, IEEE C62.41.2, and IEEE 62.45 for Category A1 locations.
 - d. Mounting: Twist lock complying with IEEE C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

OR

Description: Solid state, with SPST **OR** DPST, **as directed**, dry contacts rated for 1800 VA to operate connected load, relay, or contactor coils; complying with UL 773.

- a. Light-Level Monitoring Range: 1.5 to 10 fc (16.14 to 108 lx), with an adjustment for turn-on and turn-off levels within that range.
- b. Time Delay: 30-second minimum, to prevent false operation.
- c. Lightning Arrester: Air-gap type.
- d. Mounting: Twist lock complying with IEEE C136.10, with base.

C. Indoor Photoelectric Switches



1. Ceiling-Mounted Photoelectric Switch: Solid-state, light-level sensor unit, with separate relay unit mounted on luminaire, **as directed**, to detect changes in lighting levels that are perceived by the eye. Cadmium sulfide photoresistors are not acceptable.
 - a. Sensor Output: Contacts rated to operate the associated relay, complying with UL 773A. Sensor shall be powered from the relay unit.
 - b. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
 - c. Light-Level Monitoring Range: 10 to 200 fc (108 to 2152 lx) **OR** 100 to 1000 fc (1080 to 10 800 lx), **as directed**, with an adjustment for turn-on and turn-off levels within that range.
 - d. Time Delay: Adjustable from 5 to 300 seconds to prevent cycling, with deadband adjustment.
 - e. Indicator: Two LEDs to indicate the beginning of on-off cycles.
 2. Skylight Photoelectric Sensors: Solid-state, light-level sensor; housed in a threaded, plastic fitting for mounting under skylight, facing up at skylight; with separate relay unit mounted on luminaire, **as directed**, to detect changes in lighting levels that are perceived by the eye. Cadmium sulfide photoresistors are not acceptable.
 - a. Sensor Output: Contacts rated to operate the associated relay, complying with UL 773A. Sensor shall be powered from the relay unit.
 - b. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
 - c. Light-Level Monitoring Range: 1000 to 10,000 fc (10 800 to 108 000 lx), with an adjustment for turn-on and turn-off levels within that range.
 - d. Time Delay: Adjustable from 5 to 300 seconds to prevent cycling, with deadband adjustment.
 - e. Indicator: Two LEDs to indicate the beginning of on-off cycles.
- D. Indoor Occupancy Sensors
1. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit.
 - a. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 - b. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
 - c. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
 - d. Mounting:
 - 1) Sensor: Suitable for mounting in any position on a standard outlet box.
 - 2) Relay: Externally mounted through a 1/2-inch (13-mm) knockout in a standard electrical enclosure.
 - 3) Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
 - e. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
 - f. Bypass Switch: Override the on function in case of sensor failure.
 - g. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (21.5 to 2152 lx); keep lighting off when selected lighting level is present.
 2. PIR Type: Ceiling mounting; detect occupancy by sensing a combination of heat and movement in area of coverage.
 - a. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm).
 - b. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.



- c. Detection Coverage (Corridor): Detect occupancy within 90 feet (27.4 m) when mounted on a 10-foot- (3-m-) high ceiling.
 3. Ultrasonic Type: Ceiling mounting; detect occupancy by sensing a change in pattern of reflected ultrasonic energy in area of coverage.
 - a. Detector Sensitivity: Detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
 - b. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. (56 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
 - c. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
 - d. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. (186 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
 - e. Detection Coverage (Corridor): Detect occupancy anywhere within 90 feet (27.4 m) when mounted on a 10-foot- (3-m-) high ceiling in a corridor not wider than 14 feet (4.3 m).
 4. Dual-Technology Type: Ceiling mounting; detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on-off functions shall be selectable in the field by operating controls on unit.
 - a. Sensitivity Adjustment: Separate for each sensing technology.
 - b. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm), and detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
 - c. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
- E. Outdoor Motion Sensors (PIR)
 1. Performance Requirements: Suitable for operation in ambient temperatures ranging from minus 40 to plus 130 deg F (minus 40 to plus 54 deg C), rated as raintight according to UL 773A.
 - a. Operation: Turn lights on when sensing infrared energy changes between background and moving body in area of coverage; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 - b. Mounting:
 - 1) Sensor: Suitable for mounting in any position on a standard outdoor junction box.
 - 2) Relay: Internally mounted in a standard weatherproof electrical enclosure.
 - 3) Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
 - c. Bypass Switch: Override the on function in case of sensor failure.
 - d. Automatic Light-Level Sensor: Adjustable from 1 to 20 fc (11 to 215 lx); keep lighting off during daylight hours.
 2. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm).
 3. Detection Coverage: Up to 35 feet (11 m), with a field of view of 90 degrees **OR** Up to 100 feet (30 m), with a field of view of 60 degrees **OR** Up to 35 feet (11 m), with a field of view of 180 degrees **OR** Up to 52.5 feet (16 m), with a field of view of 270 degrees, **as directed**.
 4. Lighting Fixture Mounted Sensor: Suitable for switching 300 W of tungsten load at 120- or 277-V ac.
 5. Individually Mounted Sensor: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
 - a. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.



- b. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.

F. Lighting Contactors

1. Description: Electrically operated and mechanically **OR** electrically, **as directed**, held, combination type with fusible switch **OR** nonfused disconnect, **as directed**, complying with NEMA ICS 2 and UL 508.
 - a. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
 - b. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
 - c. Enclosure: Comply with NEMA 250.
 - d. Provide with control and pilot devices as indicated on Drawings **OR** scheduled, **as directed**, matching the NEMA type specified for the enclosure.
2. BAS Interface: Provide hardware interface to enable the BAS to monitor and control lighting contactors.
 - a. Monitoring: On-off status, as directed by the Owner.
 - b. Control: On-off operation, as directed by the Owner.

G. Emergency Shunt Relay

1. Description: Normally closed, electrically held relay, arranged for wiring in parallel with manual or automatic, **as directed**, switching contacts; complying with UL 924.
 - a. Coil Rating: 120 **OR** 277, **as directed**, V.

H. Conductors And Cables

1. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-voltage Electrical Power Conductors And Cables".
2. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 **OR** 22 **OR** 24, **as directed**, AWG. Comply with requirements in Division 26 Section "Low-voltage Electrical Power Conductors And Cables".
3. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 **OR** 16 **OR** 18, **as directed**, AWG. Comply with requirements in Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

1.3 EXECUTION

A. Sensor Installation

1. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

B. Contactor Installation

1. Mount electrically held lighting contactors with elastomeric isolator pads, to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

C. Wiring Installation

1. Wiring Method: Comply with Division 26 Section "Low-voltage Electrical Power Conductors And Cables". Minimum conduit size shall be 1/2 inch (13 mm).
2. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
3. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.



4. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

D. Identification

1. Identify components and power and control wiring according to Division 26 Section "Identification For Electrical Systems".
 - a. Identify controlled circuits in lighting contactors.
 - b. Identify circuits or luminaries controlled by photoelectric and occupancy sensors at each sensor.
2. Label time switches and contactors with a unique designation.

E. Field Quality Control

1. Perform the following field tests and inspections and prepare test reports:
 - a. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
 - b. Operational Test: Verify operation of each lighting control device, and adjust time delays.
2. Lighting control devices that fail tests and inspections are defective work.

END OF SECTION 26 09 23 00a



SECTION 26 09 23 00b - ELECTRICAL POWER MONITORING AND CONTROL

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for electrical power monitoring and control. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following for monitoring and control of electrical power system:
 - a. PC-based workstation(s) and software.
 - b. Communication network and interface modules for RS-232; RS-485, Modbus TCP/IP; and IEEE 802.3 data transmission protocols.

C. Definitions

1. Ethernet: Local area network based on IEEE 802.3 standards.
2. Firmware: Software (programs or data) that has been written onto read-only memory (ROM). Firmware is a combination of software and hardware. Storage media with ROMs that have data or programs recorded on them are firmware.
3. HTML: Hypertext markup language.
4. I/O: Input/output.
5. KB: Short for kilobyte. When used to describe data storage, "KB" represents 1024 bytes.
6. KY Pulse: A term used by the metering industry to describe a method of measuring consumption of electricity that is based on a relay changing status in response to the rotation of the disk in the meter.
7. LAN: Local area network; sometimes plural as "LANs."
8. LCD: Liquid crystal display.
9. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or remote-control, signaling and power-limited circuits.
10. Modbus TCP/IP: An open protocol for exchange of process data.
11. Monitoring: Acquisition, processing, communication, and display of equipment status data, metered electrical parameter values, power quality evaluation data, event and alarm signals, tabulated reports, and event logs.
12. PC: Personal computer; sometimes plural as "PCs."
13. rms: Root-mean-square value of alternating voltage, which is the square root of the mean value of the square of the voltage values during a complete cycle.
14. RS-232: A TIA standard for asynchronous serial data communications between terminal devices.
15. RS-485: A TIA standard for multipoint communications using two twisted-pairs.
16. TCP/IP: Transport control protocol/Internet protocol incorporated into Microsoft Windows.
17. THD: Total harmonic distortion.
18. UPS: Uninterruptible power supply; used both in singular and plural context.
19. WAN: Wide area network.

D. Submittals

1. Product Data: For each type of product indicated.
 - a. Attach copies of approved Product Data submittals for products (such as switchboards and switchgear) that describe power monitoring and control features to illustrate coordination among related equipment and power monitoring and control.
2. Shop Drawings: For power monitoring and control equipment. Include plans, elevations, sections, details, and attachments to other work.
 - a. Outline Drawings: Indicate arrangement of components and clearance and access requirements.



- b. Block Diagram: Show interconnections between components specified in this Section and devices furnished with power distribution system components. Indicate data communication paths and identify networks, data buses, data gateways, concentrators, and other devices to be used. Describe characteristics of network and other data communication lines.
 - c. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - d. Wiring Diagrams: Power, signal, and control wiring. Coordinate nomenclature and presentation with a block diagram.
 - e. UPS sizing calculations for workstation.
 3. Software and Firmware Operational Documentation:
 - a. Self-study guide describing the process for setting equipment's network address; setting the Owner's options; procedures to ensure data access from any PC on the network, using a standard Web browser; and recommended firewall setup.
 - b. Software operating and upgrade manuals.
 - c. Software Backup: On a magnetic media or compact disc, complete with the Owner-selected options.
 - d. Device address list and the set point of each device and operator option, as set in applications software.
 - e. Graphic file and printout of graphic screens and related icons, with legend.
 4. Software Upgrade Kit: For the Owner to use in modifying software to suit future power system revisions or power monitoring and control revisions.
 5. Software licenses and upgrades required by and installed for operating and programming digital and analog devices.
 6. Field quality-control test reports.
 7. Operation and Maintenance Data: For power monitoring and control units, to include in emergency, operation, and maintenance manuals. Include the following:
 - a. Operating and applications software documentation.
 - b. Software licenses.
 - c. Software service agreement.
 - d. PC installation and operating documentation, manuals, and software for the PC and all installed peripherals. Software shall include system restore, emergency boot diskettes, and drivers for all installed hardware. Provide separately for each PC.
 - e. Hard copies of manufacturer's specification sheets, operating specifications, design guides, user's guides for software and hardware, and PDF files on CD-ROM of the hard-copy submittal.
 8. Other Informational Submittals:
 - a. System installation and setup guides, with data forms to plan and record options and setup decisions.
- E. Quality Assurance
1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- F. Software Service Agreement
1. Technical Support: Beginning with Final Completion, provide software support for two years.
 2. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Final Completion. Upgrading software shall include the operating systems. Upgrade shall include new or revised licenses for use of software.
 - a. Provide 30-day notice to the Owner to allow scheduling and access to system and to allow the Owner to upgrade computer equipment if necessary.



1.2 PRODUCTS

A. Functional Description

1. Instrumentation and Recording Devices: Monitor and record load profiles and chart energy consumption patterns.
 - a. Calculate and Record the Following:
 - 1) Load factor.
 - 2) Peak demand periods.
 - 3) Consumption correlated with facility activities.
 - b. Measure and Record Metering Data for the Following:
 - 1) Electricity.
 - 2) Domestic water.
 - 3) Natural gas.
2. Software: Calculate allocation of utility costs.
 - a. Automatically Import Energy Usage Records to Allocate Energy Costs for the Following:
 - 1) At least 15 departments.
 - 2) At least 30 tenants.
 - 3) At least five processes.
 - 4) At least five buildings.
 - b. Verify utility bills and analyze alternate energy rates, **as directed**.
3. Power Quality Monitoring: Identify power system anomalies and measure, display, and record trends and alarms of the following power quality parameters:
 - a. Voltage regulation and unbalance.
 - b. Continuous three-phase rms voltage.
 - c. Periodic max./min./avg. samples.
 - d. Harmonics.
 - e. Voltage excursions.
4. Emergency Load Shedding. Preserve critical loads or avoid total shutdown due to unforeseen loss of power sources according to the following logic:
 - a. Determine system topology.
 - b. Evaluate remaining loads and sources.
 - c. Shed loads in less than 100 ms.
5. Demand Management:
 - a. Peaking or co-generator control.
 - b. Load interlocking.
 - c. Load shedding.
 - d. Load trimming.
6. System: Report equipment status and power system control.

B. System Requirements

1. Monitoring and Control System: Include PC-based workstation **OR** multiple PC-based workstations **OR** multiple PC-based workstations with graphics capability and Web access, **as directed**, with its operating system and application software, connected to data transmission network.
2. Surge Protection: For external wiring of each conductor entry connection to components to protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads.
 - a. Minimum Protection for Power Lines 120 V and More: Auxiliary panel suppressors complying with requirements in Division 26 Section "Transient-voltage Suppression For Low-voltage Electrical Power Circuits".
 - b. Minimum Protection for Communication, Signal, Control, and Low-Voltage Power Lines: Comply with requirements as recommended by manufacturer for type of line being protected.
3. Addressable Devices: All transmitters and receivers shall communicate unique device identification and status reports to monitoring and control clients.



4. BAS Interface: Provide factory-installed hardware and software to enable the BAS to monitor, display, and record data for use in processing reports.
 - a. Hardwired Monitoring Points: Electrical power demand (kilowatts), electrical power consumption (kilowatt-hours), power factor, **as directed**.
OR
 ASHRAE 135 (BACnet) **OR** LonTalk **OR** Modbus **OR** Industry-accepted, open-protocol, **as directed**, communication interface with the BAS shall enable the BAS operator to remotely monitor meter information from a BAS operator workstation. Control features and monitoring points displayed locally at metering panel shall be available through the BAS.

C. Operating System

1. Software: Configured to run on a portable laptop computer, a single PC, or a palm computer, with capability for accessing a single meter at a time. System is not connected to a LAN. Modbus TCP/IP, RS-232, and RS-485 digital communications.
OR
 Software: Configured to run on a single PC, with capability for accessing multiple devices simultaneously. Modbus TCP/IP, RS-232, and RS-485 digital communications.
OR
 Software: Configured for a server and multiple client PCs, each with capability for accessing multiple devices simultaneously. Ethernet, Modbus TCP/IP, RS-232, and RS-485 digital communications.
OR
 Software: Configured for a server and multiple client PCs, each with capability for accessing multiple devices simultaneously. Software shall include interactive graphics client and shall be Web enabled. Workstations and portable computers shall not require any software except for an Internet browser to provide connectivity and full functionality. Include a firewall recommended by manufacturer. 100 Base-T Ethernet, Modbus TCP/IP RS-232, and RS-485 digital communications.
2. Operating System Software: Based on 32-bit, Microsoft Windows workstation operating system. Software shall have the following features:
 - a. Multiuser and multitasking to allow independent activities and monitoring to occur simultaneously at different workstations.
 - b. Graphical user interface to show pull-down menus and a menu tree format.
 - c. Capability for future additions within the indicated system size limits.
3. Peer Computer Control Software: Shall detect a failure of workstation and associated server, **as directed**, and shall cause other workstation and associated server, **as directed**, to assume control of all system functions without interruption of operation. Drivers shall be provided in both central computers to support this mode of operation.

D. Applications Software

1. Basic Requirements:
 - a. Fully compatible with and based on the approved operating system.
 - b. Password-protected operator login and access; three levels, minimum.
 - c. Password-protected setup functions.
 - d. Context sensitive on-line help.
 - e. Capability of creating, deleting, and copying files; and automatically maintaining a directory of all files, including size and location of each sequential and random-ordered record.
 - f. Capability for importing custom icons into graphic views to represent alarms and I/O devices.
 - g. Automatic and encrypted backups for database and history; automatically stored at central control PC **OR** selected workstation, **as directed**, and encrypted with a nine-character alphanumeric password, which must be used to restore or read data contained in backup.
 - h. Operator audit trail for recording and reporting all changes made to user-defined system options.
2. Workstation Server Functions:



- a. Support other client PCs on the LAN and WAN, **as directed**.
- b. Maintain recorded data in databases accessible from other PCs on the LAN and WAN, **as directed**.
3. Data Formats:
 - a. User-programmable export and import of data to and from commonly used Microsoft Windows spreadsheet, database, billing, and other applications; using dynamic data exchange technology.
 - b. Option to convert reports and graphics to HTML format.
 - c. Interactive graphics.
 - d. Option to send preprogrammed or operator designed e-mail reports.
4. Metered Data: Display metered values in real time.
5. Remote Control:
 - a. Display circuit-breaker status and allow breaker control.
 - b. User defined with load-shedding automatically initiated and executed schemes responding to programmed time schedules, set points of metered demands, utility contracted load shedding, or combinations of these.
6. Equipment Documentation: Database for recording of equipment ratings and characteristics; with capability for graphic display on monitors.
7. Graphics: Interactive color-graphics platform with pull-down menus and mouse-driven generation of power system graphics, in formats widely used for such drafting; to include the following:
 - a. Site plan.
 - b. Floor plans.
 - c. Equipment elevations.
 - d. Single-line diagrams.
8. User-Defined Monitoring and Control Events: Display and record with date and time stamps accurate to 0.1 second, and including the following:
 - a. Operator log on/off.
 - b. Attempted operator log on/off.
 - c. All alarms.
 - d. Equipment operation counters.
 - e. Out-of-limit, pickup, trip, and no-response events.
9. Trending Reports: Display data acquired in real-time from different meters or devices, in historical format over user-defined time; unlimited as to interval, duration, or quantity of trends.
 - a. Spreadsheet functions of sum, delta, percent, average, mean, standard deviation, and related functions applied to recorded data.
 - b. Charting, statistical, and display functions of standard Windows-based spreadsheet.
10. Alarms: Display and record alarm messages from discrete input and controls outputs, according to user programmable protocol.
 - a. Functions requiring user acknowledgment shall run in background during computer use for other applications and override other presentations when they occur.
11. Waveform Data: Display and record waveforms on demand or automatically on an alarm or programmed event; include the graphic displays of the following, based on user-specified criteria:
 - a. Phase voltages, phase currents, and residual current.
 - b. Overlay of three-phase currents, and overlay each phase voltage and current.
 - c. Waveforms ranging in length from 2 cycles to 5 minutes.
 - d. Disturbance and steady-state waveforms up to 512 points per cycle.
 - e. Transient waveforms up to 83,333 points per cycle on 60-Hz base.
 - f. Calculated waveform on a minimum of four cycles of data of the following:
 - 1) THD.
 - 2) rms magnitudes.
 - 3) Peak values.
 - 4) Crest factors.
 - 5) Magnitude of individual harmonics.
12. Data Sharing: Allow export of recorded displays and tabular data to third-party applications software.
13. Tenant or Activity Billing Software:



- a. Automatically compute and prepare tenant bills **OR** activity demand and energy-use statements, **as directed**, based on metering of energy use and peak demand integrated over user-defined interval.
 - b. Intervals shall be same as used by electric utilities, including current vendor.
 - c. Import metered data from saved records that were generated by metering and monitoring software.
 - d. Maintain separate directory for each tenant's historical billing information.
 - e. Prepare summary reports in user-defined formats and time intervals.
14. Reporting: User commands initiate the reporting of a list of current alarm, supervisory, and trouble conditions in system or a log of past events.
- a. Print a record of user-defined alarm, supervisory, and trouble events on workstation printer.
 - b. Sort and report by device name and by function.
 - c. Report type of signal (alarm, supervisory, or trouble), description, date, and time of occurrence.
 - d. Differentiate alarm signals from other indications.
 - e. When system is reset, report reset event with same information concerning device, location, date, and time.
- E. Communication Components And Networks
1. Transient Voltage Surge Suppression and Electromagnetic-Interference Immunity: Include in solid-state equipment. Comply with IEEE C37.90.
 2. Network Configuration: High-speed, multi-access, open nonproprietary, industry standard communication protocol; LANs complying with EIA 485, 100 Base-T Ethernet, and Modbus TCP/IP.
- F. Power Monitors
1. Separately mounted, permanently installed instrument for power monitoring and control.
 - a. Enclosure: NEMA 250, Type 1 **OR** 12, **as directed**.
 2. Environmental Conditions: System components shall be capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
 - a. Indoor installation in non-air-conditioned **OR** nontemperature-controlled, **as directed**, spaces that have environmental controls to maintain ambient conditions of 0 to 122 deg F (minus 18 to plus 50 deg C) dry bulb and 20 to 90 percent relative humidity, noncondensing.
 3. rms Real-Time Measurements:
 - a. Current: Each phase, neutral, average of three phases, percent unbalance.
 - b. Voltage: Line-to-line each phase, line-to-line average of three phases, line-to-neutral each phase, line-to-neutral average of three phases, line-to-neutral percent unbalance.
 - c. Power: Per phase and three-phase total.
 - d. Reactive Power: Per phase and three-phase total.
 - e. Apparent Power: Per phase and three-phase total.
 - f. Power Factor: Per phase and three-phase total.
 - g. Displacement Power Factor: Per phase and three-phase total.
 - h. Frequency.
 - i. THD: Current and voltage.
 - j. Accumulated Energy: Real kWh, reactive kVARh, apparent kVAh (signed/absolute).
 - k. Incremental Energy: Real kWh, reactive kVARh, apparent kVAh (signed/absolute).
 - l. Conditional Energy: Real kWh, reactive kVARh, apparent kVAh (signed/absolute).
 4. Demand Current Calculations, per Phase, Three-Phase Average and Neutral:
 - a. Present.
 - b. Running average.
 - c. Last completed interval.
 - d. Peak.
 5. Demand Real Power Calculations, Three-Phase Total:



- a. Present.
- b. Running average.
- c. Last completed interval.
- d. Predicted.
- e. Peak.
- f. Coincident with peak kVA demand.
- g. Coincident with kVAR demand.
6. Demand Reactive Power Calculations, Three-Phase Total:
 - a. Present.
 - b. Running average.
 - c. Last completed interval.
 - d. Predicted.
 - e. Peak.
 - f. Coincident with peak kVA demand.
 - g. Coincident with kVAR demand.
7. Demand Apparent Power Calculations, Three-Phase Total:
 - a. Present.
 - b. Running average.
 - c. Last completed interval.
 - d. Predicted.
 - e. Peak.
 - f. Coincident with peak kVA demand.
 - g. Coincident with kVAR demand.
8. Average Power Factor Calculations, Demand Coincident, Three-Phase Total:
 - a. Last completed interval.
 - b. Coincident with kW peak.
 - c. Coincident with kVAR peak.
 - d. Coincident with kVA peak.
9. Power Analysis Values:
 - a. THD, Voltage and Current: Per phase, three phase, and neutral.
 - b. Displacement Power Factor: Per phase, three phase.
 - c. Fundamental Voltage, Magnitude and Angle: Per phase.
 - d. Fundamental Currents, Magnitude and Angle: Per phase.
 - e. Fundamental Real Power: Per phase, three phase.
 - f. Fundamental Reactive Power: Per phase.
 - g. Harmonic Power: Per phase, three phase.
 - h. Phase rotation.
 - i. Unbalance: Current and voltage.
 - j. Harmonic Magnitudes and Angles for Current and Voltages: Per phase, up to 31st **OR** 63rd, **as directed**, harmonic.
10. Power Demand Calculations: According to one of the following calculation methods, selectable by the user:
 - a. Thermal Demand: Sliding window updated every second for the present demand and at end of the interval for the last interval. Adjustable window that can be set in 1-minute intervals, from 1 to 60 minutes.
 - b. Block Interval with Optional Subintervals: Adjustable for 1-minute intervals, from 1 to 60 minutes. User-defined parameters for the following block intervals:
 - 1) Sliding block that calculates demand every second, with intervals less than 15 minutes, and every 15 seconds with an interval between 15 and 60 minutes.
 - 2) Fixed block that calculates demand at end of the interval.
 - 3) Rolling block subinterval that calculates demand at end of each subinterval and displays it at end of the interval.
 - c. Demand Calculation Initiated by a Synchronization Signal:
 - 1) Signal is a pulse from an external source. Demand period begins with every pulse. Calculation shall be configurable as either a block or rolling block calculation.



- 2) Signal is a communication signal. Calculation shall be configurable as either a block or rolling block calculation.
 - 3) Demand can be synchronized with clock in the power meter.
11. Sampling:
 - a. Current and voltage shall be digitally sampled at a rate high enough to provide accuracy to 63rd harmonic of 60-Hz fundamental.
 - b. Power monitor shall provide continuous sampling at a rate of 128 samples per cycle on all voltage and current channels in the meter.
12. Minimum and Maximum Values: Record monthly minimum and maximum values, including date and time of record. For three-phase measurements, identify phase of recorded value. Record the following parameters:
 - a. Line-to-line voltage.
 - b. Line-to-neutral voltage.
 - c. Current per phase.
 - d. Line-to-line voltage unbalance.
 - e. Line-to-neutral voltage unbalance.
 - f. Power factor.
 - g. Displacement power factor.
 - h. Total power.
 - i. Total reactive power.
 - j. Total apparent power.
 - k. THD voltage L-L.
 - l. THD voltage L-N.
 - m. THD current.
 - n. Frequency.
13. Harmonic Calculation: Display and record the following:
 - a. Harmonic magnitudes and angles for each phase voltage and current through 31st **OR** 63rd, **as directed**, harmonic. Calculate for all three phases, current and voltage, and residual current. Current and voltage information for all phases shall be obtained simultaneously from same cycle.
 - b. Harmonic magnitude reported as a percentage of the fundamental or as a percentage of rms values, as selected by user.
14. Current and Voltage Ratings:
 - a. Designed for use with current inputs from standard instrument current transformers with 5-A secondary and shall have a metering range of 0-10 A.
 - b. Withstand ratings shall be not less than 15 A, continuous; 50 A, lasting over 10 seconds, no more frequently than once per hour; 500 A, lasting 1 second, no more frequently than once per hour.
 - c. Designed for use with voltage inputs from standard instrument potential transformers with a 120-V secondary.
15. Accuracy:
 - a. Comply with ANSI C12.20, Class 0.5; and IEC 60687, Class 0.5 for revenue meters.
 - b. Accuracy from Light to Full Rating:
 - 1) Power: Accurate to 0.25 percent of reading, plus 0.025 percent of full scale.
 - 2) Voltage and Current: Accurate to 0.075 percent of reading, plus 0.025 percent of full scale.
 - 3) Power Factor: Plus or minus 0.002, from 0.5 leading to 0.5 lagging.
 - 4) Frequency: Plus or minus 0.01 Hz at 45 to 67 Hz.
16. Waveform Capture:
 - a. Capture and store steady-state waveforms of voltage and current channels; initiated manually. Each capture shall be for 3 cycles, 128 data points for each cycle, allowing resolution of harmonics to 31st harmonic of basic 60 Hz.
 - b. Store captured waveforms in internal nonvolatile memory; available for PC display, archiving, and analysis.
17. Input: One digital input signal(s).



- a. Normal mode for on/off signal.
 - b. Demand interval synchronization pulse, accepting a demand synchronization pulse from a utility demand meter.
 - c. Conditional energy signal to control conditional energy accumulation.
18. Outputs:
- a. Operated either by user command sent via communication link, or set to operate in response to user-defined alarm or event.
 - b. Closed in either a momentary or latched mode as defined by user.
 - c. Each output relay used in a momentary contact mode shall have an independent timer that can be set by user.
 - d. One digital KY pulse to a user-definable increment of energy measurement. Output ratings shall be up to 120-V ac, 300-V dc, 50 mA, and provide 3500-V rms isolation.
 - e. One relay output module(s), providing a load voltage range from 20- to 240-V ac or from 20- to 30-V dc, supporting a load current of 2 A.
 - f. Output Relay Control:
 - 1) Relay outputs shall operate either by user command sent via communication link or in response to user-defined alarm or event.
 - 2) Normally open and normally closed contacts, field configured to operate as follows:
 - a) Normal contact closure where contacts change state for as long as signal exists.
 - b) Latched mode when contacts change state on receipts of a pickup signal; changed state is held until a dropout signal is received.
 - c) Timed mode when contacts change state on receipt of a pickup signal; changed state is held for a preprogrammed duration.
 - d) End of power demand interval when relay operates as synchronization pulse for other devices.
 - e) Energy Pulse Output: Relay pulses quantities used for absolute kWh, absolute kVARh, kVAh, kWh In, kVARh In, kWh Out, and kVARh Out.
 - f) Output controlled by multiple alarms using Boolean-type logic.
19. Onboard Data Logging:
- a. Store logged data, alarms, events, and waveforms in 80 **OR** 800, **as directed**, KB of onboard nonvolatile memory.
 - b. Stored Data:
 - 1) Billing Log: User configurable; data shall be recorded every 15 minutes, identified by month, day, and 15-minute interval. Accumulate 24 months of monthly data, 32 days of daily data, and between 2 to 52 days of 15-minute interval data, depending on number of quantities selected.
 - 2) Custom Data Logs: One **OR** Three, **as directed**, user-defined log(s) holding up to 96 parameters. Date and time stamp each entry to the second and include the following user definitions:
 - a) Schedule interval.
 - b) Event definition.
 - c) Configured as "fill-and-hold" or "circular, first-in first-out."
 - 3) Alarm Log: Include time, date, event information, and coincident information for each defined alarm or event.
 - 4) Waveform Log: Store captured waveforms configured as "fill-and-hold" or "circular, first-in first-out."
 - c. Default values for all logs shall be initially set at factory, with logging to begin on device power up.
20. Alarms.
- a. User Options:
 - 1) Define pickup, dropout, and delay.
 - 2) Assign one of four severity levels to make it easier for user to respond to the most important events first.
 - 3) Allow for combining up to four alarms using Boolean-type logic statements for outputting a single alarm.



- b. Alarm Events:
 - 1) Over/undercurrent.
 - 2) Over/undervoltage.
 - 3) Current imbalance.
 - 4) Phase loss, current.
 - 5) Phase loss, voltage.
 - 6) Voltage imbalance.
 - 7) Over kW demand.
 - 8) Phase reversal.
 - 9) Digital input off/on.
 - 10) End of incremental energy interval.
 - 11) End of demand interval.
 - 21. Control Power: 90- to 457-V ac or 100- to 300-V dc.
 - 22. Communications:
 - a. Power monitor shall be permanently connected to communicate via Modbus TCP via a 100 Base-T Ethernet **OR** RS-485 Modbus TCP/IP, **as directed**.
 - b. Local plug-in connections shall be for RS-232 and 100 Base-T Ethernet.
 - 23. Display Monitor:
 - a. Backlighted LCD to display metered data with touch-screen **OR** touch-pad, **as directed**, selecting device.
 - b. Touch-screen display shall be a minimum 12-inch diagonal, resolution of 800 by 600 RGB pixels, 256 colors; NEMA 250, Type 1 display enclosure.
 - c. Display four values on one screen at same time.
 - 1) Current, per phase rms, three-phase average and neutral, **as directed**.
 - 2) Voltage, phase to phase, phase to neutral, and three-phase averages of phase to phase and phase to neutral.
 - 3) Real power, per phase and three-phase total.
 - 4) Reactive power, per phase and three-phase total.
 - 5) Apparent power, per phase and three-phase total.
 - 6) Power factor, per phase and three-phase total.
 - 7) Frequency.
 - 8) Demand current, per phase and three-phase average.
 - 9) Demand real power, three-phase total.
 - 10) Demand apparent power, three-phase total.
 - 11) Accumulated energy (MWh and MVARh).
 - 12) THD, current and voltage, per phase.
 - d. Reset: Allow reset of the following parameters at the display:
 - 1) Peak demand current.
 - 2) Peak demand power (kW) and peak demand apparent power (kVA).
 - 3) Energy (MWh) and reactive energy (MVARh).
- G. Standalone, Web-Enabled Monitoring And Control Instrument
- 1. Separately mounted, permanently installed instrument for power monitoring and control.
 - a. Enclosure: NEMA 250, Type 1 **OR** 12, **as directed**.
 - 2. Environmental Conditions: System components shall be capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability.
 - a. Indoor installation in non-air-conditioned **OR** nontemperature-controlled, **as directed**, spaces that have environmental controls to maintain ambient conditions of 0 to 122 deg F (minus 18 to plus 50 deg C) dry bulb and 20 to 90 percent relative humidity, noncondensing.
 - 3. Power-Distribution Equipment Monitor: Web enabled, with integral network port and embedded Web server with factory-configured firmware and HTML-formatted Web pages for viewing of power monitoring and equipment status information from connected devices equipped with digital communication ports.



4. LAN Connectivity: Multipoint, RS-485 Modbus serial communication network, interconnecting all breaker trip units, protective relays, drives, and metering devices equipped with communications. Serial communication network connected to Ethernet server that functions as a gateway and server, providing data access via 10 Base-T **OR** 100 Base-T **OR** 100 Base-FX, **as directed**, LAN.
5. Communication Devices within the Equipment: Addressed at factory and tested to verify reliable communication with network server.
6. Server Configuration:
 - a. Initial network parameters set using a standard Web browser. Connect via a local operator interface, or an RJ-45 port accessible from front of equipment.
 - b. Network server shall be factory programmed with embedded HTML-formatted Web pages that are user configurable and that provide detailed communication diagnostic information for serial and Ethernet ports as status of RS-485 network; with internal memory management information pages for viewing using a standard Web browser.
 - c. Login: Password protected; password administration accessible from the LAN using a standard Web browser.
 - d. Operating Software: Suitable for local access; firewall protected.
7. Data Access:
 - a. Network server shall include embedded HTML pages providing real-time information from devices connected to RS-485 network ports via a standard Web browser.
8. Equipment Monitoring Options: Login shall be followed by a main menu for selecting summary Web pages that follow.
9. Summary Web pages shall be factory configured to display the following information for each communicating device within the power equipment lineup:
 - a. User-Configured Custom Home Page: Provide for the lineup, showing status-at-a-glance of key operating values, **as directed**.
 - b. Circuit Summary Page: Circuit name, three-phase average rms current, power (kW), power factor, and breaker status.
 - c. Load Current Summary Page: Circuit name, Phase A, B, and C rms current values.
 - d. Demand Current Summary Page: Circuit name, Phase A, B, and C average demand current values.
 - e. Power Summary Page: Circuit name, present demand power (kW), peak demand power (kW), and recorded time and date.
 - f. Energy Summary Page: Circuit name, energy (kWh), reactive energy (kVARh), and time/date of last reset.
 - g. Transformer Status Page: Transformer tag, coil temperatures, and cooling fan status.
 - h. Motor-Control Center Status Page: Circuit name, three-phase average rms current, thermal capacity (percentage), and drive output frequency (Hz) contactor status.
 - i. Specific Device Pages: Each individual communicating device shall display detailed, real-time information, as appropriate for device type.
 - 1) Display historical energy data that shall be logged automatically for each device, as appropriate for device type.
 - 2) Display historical data logged from each device in graphical time-trend plots. Value to be displayed on time-trend plot shall be user selectable. Time interval to be displayed on scale shall be for previous day or week.
 - j. Export historical energy data to a PC or workstation through network using FTP (File Transfer Protocol). Format exported data in a CSV (Comma Separated Variable) file format for importing into spreadsheet applications.
10. Communications:
 - a. Power monitor: Permanently connected to communicate via RS-485 Modbus TCP/IP **OR** Modbus TCP via an 100 Base-T Ethernet, **as directed**.
 - b. Local Plug-in Connections: RS-232 and 100 Base-T Ethernet.
 - c. Monitor Display: Backlighted LCD to display metered data with touch-screen **OR** touch-pad, **as directed**, selecting device.

H. Workstation Hardware



1. Environmental Conditions: System components shall be capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
 - a. Indoor installation in spaces that have environmental controls to maintain ambient conditions of 36 to 122 deg F (2 to 50 deg C) dry bulb and 20 to 90 percent relative humidity, noncondensing.
2. Computer: Standard unmodified PC of modular design. CPU word size shall be 32 bytes or larger; CPU operating speed shall be at least 66 MHz **OR** GHz, **as directed**.
 - a. Memory: 256 MB of usable installed memory, expandable to a minimum of 1024 MB without additional chassis or power supplies.
 - b. Real-Time Clock:
 - 1) Accuracy: Plus or minus 1 minute per month.
 - 2) Time Keeping Format: 24-hour time format including seconds, minutes, hours, date, day, and month; automatic reset by software.
 - 3) Clock shall function for one year without power.
 - 4) Provide automatic time correction once every 24 hours by synchronizing clock with the Time Service Department of the U.S. Naval Observatory.
 - c. Serial Ports: Two RS-232-F serial ports for general use, with additional ports as required. Data transmission rates shall be selectable under program control.
 - d. Parallel Port: Enhanced.
 - e. LAN Adapter Card: 10/100-Mbps PCI bus, internal network interface card.
 - f. Sound Card: For playback and recording of digital WAV sound files associated with audible warning and alarm functions.
 - g. Color Monitor: PC compatible, not less than 18 inches (455 mm), LCD type, with a minimum resolution of 1280 by 1024 pixels, noninterlaced, and a maximum dot pitch of 0.28 mm.
 - h. Keyboard: Minimum of 64 characters, standard ASCII character set based on ANSI INCITS 154.
 - i. Mouse: Standard, compatible with installed software.
 - j. Disk Storage: Include the following, each with appropriate controller:
 - 1) Minimum 80-GB hard disk, maximum average access time of 10 ms.
 - 2) Floppy Disk Drive: High density, 3-1/2-inch (90-mm) size.
 - 3) PCMCIA slot with removable 500-MB media.
 - 4) 100-MB Iomega Zip drive.
 - 5) 250-MB Iomega Jaz drive.
 - k. Magnetic Tape System, **as directed**: 4-mm cartridge magnetic tape system with minimum 2 **OR** 4 **OR** 20, **as directed**, -GB formatted capacity per tape. Provide 10 tapes, each in a rigid cartridge with spring-loaded cover and operator-selectable write-protect feature.
 - l. Modem: 56,600 bps, full duplex for asynchronous communications. With error detection, auto answer/autodial, and call-in-progress detection. Modem shall comply with requirements in ITU-T v.34, ITU-T v.42, ITU-T v.42 Appendix VI for error correction, and ITU-T v.42 BIS for data compression standards; and shall be suitable for operating on unconditioned voice-grade telephone lines complying with 47 CFR 68.
 - m. Audible Alarm: Manufacturer's standard.
 - n. CD-ROM Drive:
 - 1) Nominal Storage Capacity: 650 MB.
 - 2) Data Transfer Rate: 1.2 Mbps.
 - 3) Average Access Time: 150 ms.
 - 4) Cache Memory: 256 KB.
 - 5) Data Throughput: 1 MB/second, minimum.
 - o. Report Printer: Minimum resolution 600 dpi laser printer.
 - 1) Connected to central station and designated workstations.
 - 2) RAM: 2 MB, minimum.
 - 3) Printing Speed: Minimum 12 pages per minute.



- 4) Paper Handling: Automatic sheet feeder with 250-sheet paper cassette and with automatic feed.
 - p. Interface: Bidirectional parallel and universal serial bus.
 - q. LAN Adapter Card: 10/100-Mbps internal network interface card.
 3. Redundant Central Computer: Connected in a hot standby, peer configuration; automatically maintains copies of system software, application software, and data files. System transactions and other activities that alter system data files shall be updated to system files of redundant computer in near real-time. If central computer fails, redundant computer shall assume control immediately and automatically.
 4. UPS: Self-contained; complying with requirements in Division 26 Section "Static Uninterruptible Power Supply".
 - a. Size: Provide a minimum of 6 hours of operation of workstation station equipment, including 2 hours of alarm printer operation, **as directed**.
 - b. Batteries: Sealed, valve regulated, recombinant, lead calcium.
 - c. Accessories:
 - 1) Transient voltage suppression.
 - 2) Input-harmonics reduction.
 - 3) Rectifier/charger.
 - 4) Battery disconnect device.
 - 5) Static bypass transfer switch.
 - 6) Internal maintenance bypass/isolation switch.
 - 7) External maintenance bypass/isolation switch.
 - 8) Output isolation transformer.
 - 9) Remote UPS monitoring.
 - 10) Battery monitoring.
 - 11) Remote battery monitoring.
- I. RS-232 ASCII Interface
1. ASCII interface shall allow RS-232 connections to be made between a meter or circuit monitor operating as the host PC and any equipment that will accept RS-232 ASCII command strings, such as local display panels **OR** dial-up modems **OR** alarm transmitters, **as directed**.
 2. Pager System Interface: Alarms shall be able to activate a pager system with customized message for each input alarm.
 - a. RS-232 output shall be capable of connection to a pager interface that can be used to call a paging system or service and send a signal to a portable pager. System shall allow an individual alphanumeric message per alarm input to be sent to paging system. This interface shall support both numeric and alphanumeric pagers.
 3. Alarm System Interface:
 - a. RS-232 output shall be capable of transmitting alarms from other monitoring and alarm systems to workstation software.
 4. Cables:
 - a. PVC-Jacketed, RS-232 Cable: Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors, polypropylene insulation, and individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage; PVC jacket. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
 - 1) NFPA 70, Type CM.
 - 2) Flame Resistance: UL 1581, Vertical Tray.
 - b. Plenum-Type, RS-232 Cable: Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors, plastic insulation, and individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage; plastic jacket. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
 - 1) NFPA 70, Type CMP.
 - 2) Flame Resistance: NFPA 262, Flame Test.
- J. LAN Cables
1. Comply with Division 27 Section "Communications Horizontal Cabling".



2. RS-485 Cable:
 - a. PVC-Jacketed, RS-485 Cable: Paired, 2 pairs, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors, PVC insulation, unshielded, PVC jacket, and NFPA 70, Type CMG.
 - b. Plenum-Type, RS-485 Cable: Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors, fluorinated-ethylene-propylene insulation, unshielded, and fluorinated-ethylene-propylene jacket, and NFPA 70, Type CMP.
3. Unshielded Twisted Pair Cables: Category 5e **OR 6, as directed**, as specified for horizontal cable for data service in Division 27 Section "Communications Horizontal Cabling".

K. Low-Voltage Wiring

1. Low-Voltage Control Cable: Multiple conductor, color-coded, No. 20 AWG copper, minimum.
 - a. Sheath: PVC; except in plenum-type spaces, use sheath listed for plenums.
 - b. Ordinary Switching Circuits: Three conductors, unless otherwise indicated.
 - c. Switching Circuits with Pilot Lights or Locator Feature: Five conductors, unless otherwise indicated.

1.3 EXECUTION

A. Cabling

1. Comply with NECA 1.
2. Install cables and wiring according to requirements in Division 27 Section "Communications Horizontal Cabling".
3. Wiring Method: Install wiring in raceway and cable tray except within consoles, cabinets, desks, and counters. Conceal raceway and wiring except in unfinished spaces.
OR
Wiring Method: Install wiring in raceway and cable tray except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Use NRTL-listed plenum cable in environmental air spaces, including plenum ceilings. Conceal raceway and cables except in unfinished spaces.
4. Install LAN cables using techniques, practices, and methods that are consistent with specified category rating of components and that ensure specified category performance of completed and linked signal paths, end to end.
5. Install cables without damaging conductors, shield, or jacket.

B. Identification

1. Identify components and power and control wiring according to Division 26 Section "Identification For Electrical Systems".
2. Label each power monitoring and control module with a unique designation.

C. Grounding

1. Comply with IEEE 1100, "Power and Grounding Sensitive Electronic Equipment."

D. Field Quality Control

1. Perform tests and inspections and prepare test reports.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Tests and Inspections:
 - a. Electrical Tests: Use caution when testing devices containing solid-state components.
 - b. Continuity tests of circuits.
 - c. Operational Tests: Set and operate controls at workstation and at monitored and controlled devices to demonstrate their functions and capabilities. Use a methodical sequence that cues and reproduces actual operating functions as recommended by



manufacturer. Submit sequences for approval. Note response to each test command and operation. Note time intervals between initiation of alarm conditions and registration of alarms at central-processing workstation.

- 1) Coordinate testing required by this Section with that required by Sections specifying equipment being monitored and controlled.
 - 2) Test LANs according to requirements in Division 27 Section "Communications Horizontal Cabling".
 - 3) System components with battery backup shall be operated on battery power for a period of not less than 10 percent of calculated battery operating time.
 - 4) Verify accuracy of graphic screens and icons.
 - 5) Metering Test: Load feeders, measure loads on feeder conductor with an rms reading clamp-on ammeter, and simultaneously read indicated current on the same phase at central-processing workstation. Record and compare values measured at the two locations. Resolve discrepancies greater than 5 percent and record resolution method and results.
 - 6) Record metered values, control settings, operations, cues, time intervals, and functional observations and submit test reports printed by workstation printer.
3. Correct deficiencies, make necessary adjustments, and retest. Verify that specified requirements are met.
 4. Test Labeling: After satisfactory completion of tests and inspections, apply a label to tested components indicating test results, date, and responsible agency and representative.
 5. Reports: Written reports of tests and observations. Record defective materials and workmanship and unsatisfactory test results. Record repairs and adjustments.
 6. Remove and replace malfunctioning devices and circuits and retest as specified above.

E. Demonstration

1. Engage a factory-authorized service representative to train the Owner's maintenance personnel to adjust, operate, and maintain systems.
 - a. Train the Owner's management and maintenance personnel in interpreting and using monitoring displays and in configuring and using software and reports. Include troubleshooting, servicing, adjusting, and maintaining equipment. Provide a minimum of 12 hours' training.
 - b. Training Aid: Use approved final versions of software and maintenance manuals as training aids.

END OF SECTION 26 09 23 00b



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SECTION 26 09 23 00c - MOTOR-CONTROL CENTERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for motor-control centers. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes MCCs for use with ac circuits rated 600 V and less and having the following factory-installed components:
 - a. Incoming main lugs and OCPDs.
 - b. Full-voltage magnetic controllers.
 - c. Reduced-voltage magnetic controllers.
 - d. Reduced-voltage, solid-state controllers.
 - e. Multispeed controllers.
 - f. VFCs.
 - g. Feeder-tap units.
 - h. TVSS.
 - i. Instrumentation.
 - j. Auxiliary devices.

C. Definitions

1. BAS: Building automation system.
2. CE: Conformance Europeene (European Compliance).
3. CPT: Control power transformer.
4. EMI: Electromagnetic interference.
5. GFCI: Ground fault circuit interrupting.
6. IGBT: Insulated-gate bipolar transistor.
7. LAN: Local area network.
8. LED: Light-emitting diode.
9. MCC: Motor-control center.
10. MCCB: Molded-case circuit breaker.
11. MCP: Motor-circuit protector.
12. NC: Normally closed.
13. NO: Normally open.
14. OCPD: Overcurrent protective device.
15. PCC: Point of common coupling.
16. PID: Control action, proportional plus integral plus derivative.
17. PT: Potential transformer.
18. PWM: Pulse-width modulated.
19. RFI: Radio-frequency interference.
20. SCR: Silicon-controlled rectifier.
21. TDD: Total demand (harmonic current) distortion.
22. THD(V): Total harmonic voltage demand.
23. TVSS: Transient voltage surge suppressor.
24. VFC: Variable-frequency controller.

D. Performance Requirements

1. Seismic Performance: MCCs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.



- a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

E. Submittals

1. Product Data: For each type of controller and each type of MCC. Include shipping and operating weights, features, performance, electrical ratings, operating characteristics, and furnished specialties and accessories.
2. LEED Submittals:
 - a. Product Data for Credit EA 5: For continuous metering equipment for energy consumption.
3. Shop Drawings: For each MCC, manufacturer's approval, custom and production drawings as defined in UL 845. In addition to requirements specified in UL 845, include dimensioned plans, elevations, and sections; and conduit entry locations and sizes, mounting arrangements, and details, including required clearances and service space around equipment.
 - a. Show tabulations of installed devices, equipment features, and ratings. Include the following:
 - 1) Each installed unit's type and details.
 - 2) Factory-installed devices.
 - 3) Enclosure types and details.
 - 4) Nameplate legends.
 - 5) Short-circuit current (withstand) rating of complete MCC, and for bus structure and each unit.
 - 6) Features, characteristics, ratings, and factory settings of each installed controller and feeder device, and installed devices.
 - 7) Specified optional features and accessories.
 - b. Schematic and Connection Wiring Diagrams: For power, signal, and control wiring for each installed controller.
 - c. Nameplate legends.
 - d. Vertical and horizontal bus capacities.
 - e. Features, characteristics, ratings, and factory settings of each installed unit.
4. Harmonic Analysis Study and Report: Comply with IEEE 399 and NETA Acceptance Testing Specification; identify the effects of nonlinear loads and their associated harmonic contributions on the voltages and currents throughout the electrical system. Analyze possible **OR** designated, **as directed**, operating scenarios, including recommendations for VFC input filtering to limit TDD and THD(V) at each VFC **OR** at the defined PCC, **as directed**, to specified levels.
5. Standard Drawings: For each MCC, as defined in UL 845.
6. Production Drawings: For each MCC, as defined in UL 845.
7. Coordination Drawings: Floor plans, drawn to scale, showing dimensioned layout, required working clearances, and required area above and around MCCs where pipe and ducts are prohibited. Show MCC layout and relationships between electrical components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate field measurements.
8. Seismic Qualification Certificates: For MCCs, accessories, and components, from manufacturer.
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
9. Qualification Data: For qualified testing agency.
10. Product Certificates: For each MCC, from manufacturer.
11. Source quality-control reports.
12. Field quality-control reports.
13. Operation and Maintenance Data: For MCCs, all installed devices, and components to include in emergency, operation, and maintenance manuals. Include the following:



- a. Manufacturer's Record Drawings: As defined in UL 845. In addition to requirements specified in UL 845, include field modifications and field-assigned wiring identification incorporated during construction by manufacturer, Contractor, or both.
 - b. Manufacturer's written instructions for testing and adjusting circuit breaker and MCP trip settings.
 - c. Manufacturer's written instructions for setting field-adjustable overload relays.
 - d. Manufacturer's written instructions for testing, adjusting, and reprogramming reduced-voltage, solid-state controllers.
 - e. Manufacturer's written instructions for testing, adjusting, and reprogramming microprocessor control modules.
 - f. Manufacturer's written instructions for setting field-adjustable timers, controls, and status and alarm points.
14. Load-Current and Overload-Relay Heater List: Compile after motors have been installed, and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.
 15. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed, and arrange to demonstrate that switch settings for motor running overload protection suit actual motors to be protected.
 16. Warranty: Sample of special warranty.
- F. Quality Assurance
1. Testing Agency Qualifications: Member company of NETA or an NRTL.
 - a. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
 2. Source Limitations: Obtain MCCs and controllers of a single type from single source from single manufacturer.
 3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 4. Comply with NFPA 70.
 5. IEEE Compliance: Fabricate and test enclosed controllers according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
- G. Delivery, Storage, And Handling
1. Deliver MCCs in shipping splits of lengths that can be moved past obstructions in delivery paths.
 2. Handle MCCs according to the following:
 - a. NEMA ICS 2.3, "Instructions for the Handling, Installation, Operation, and Maintenance of Motor Control Centers Rated Not More Than 600 Volts."
 - b. NECA 402, "Recommended Practice for Installing and Maintaining Motor Control Centers."
 3. If stored in space that is not permanently enclosed and air conditioned, remove loose packing and flammable materials from inside MCCs; install temporary electric heating, with at least 250 W per vertical section **OR** connect factory-installed space heaters to temporary electrical service, **as directed**.
- H. Project Conditions
1. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - a. Ambient Temperature: Less than 0 deg F (minus 18 deg C) or exceeding 104 deg F (40 deg C), with an average value exceeding 95 deg F (35 deg C) over a 24-hour period.
 - b. Ambient Storage Temperature: Not less than minus 4 deg F (minus 20 deg C) and not exceeding 140 deg F (60 deg C).
 - c. Humidity: Less than 95 percent (noncondensing).
 - d. Altitude: Exceeding 6600 feet (2000 m), or 3300 feet (1000 m) if MCC includes solid-state devices.
 2. Interruption of Existing Electrical Service or Distribution Systems: Do not interrupt electrical service to, or distribution systems within, a facility occupied by the Owner or others unless



permitted under the following conditions, and then only after arranging to provide temporary electrical service according to requirements indicated:

- a. Notify the Owner no fewer than two days in advance of proposed interruption of electrical service.
 - b. Indicate method of providing temporary electrical service.
 - c. Do not proceed with interruption of electrical service without the Owner's written permission.
 - d. Comply with NFPA 70E.
3. Product Selection for Restricted Space: Drawings indicate maximum dimensions for MCCs, including clearances between MCCs and adjacent surfaces and other items.

I. Coordination

1. Coordinate sizes and locations of concrete bases. Cast anchor-bolt inserts into bases.
2. Coordinate features of MCCs, installed units, and accessory devices with remote pilot devices and control circuits to which they connect.
3. Coordinate features, accessories, and functions of each MCC, each controller, and each installed unit with ratings and characteristics of supply circuits, motors, required control sequences, and duty cycle of motors and loads.

J. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace TVSS **OR** VFCs, **as directed**, that fail in materials or workmanship within specified warranty period.
 - a. Warranty Period: Five years from date of Final Completion.

1.2 PRODUCTS

A. Manufactured Units

1. General Requirements for MCCs: Comply with NEMA ICS 18 and UL 845, **as directed**.

B. Functional Features

1. Description: Modular arrangement of main units, controller units, control devices, feeder-tap units, instruments, metering, auxiliary devices, and other items mounted in vertical sections of MCC.
2. Controller Units: Combination controller units.
 - a. Install units up to and including Size 3 on drawout mountings with connectors that automatically line up and connect with vertical-section buses while being racked into their normal, energized positions.
 - b. Equip units in Type B and Type C MCCs with pull-apart terminal strips for external control connections.
3. Feeder-Tap Units: Through 225-A rating shall have drawout mountings with connectors that automatically line up and connect with vertical-section buses while being racked into their normal, energized positions.
4. Future Units: Compartments fully bused and equipped with guide rails or equivalent, ready for insertion of drawout units.
5. Spare Units: Installed in compartments indicated "spare."

C. Incoming Mains

1. Incoming Mains Location: Top and bottom, **as directed**.
2. Main Lugs Only: Conductor connectors suitable for use with conductor material and sizes.
 - a. Material: Tin-plated aluminum **OR** Hard-drawn copper, 98 percent conductivity, **as directed**.
 - b. Main and Neutral Lugs: Compression **OR** Mechanical, **as directed**, type.



3. MCCB: Comply with UL 489, with series-connected rating **OR** interrupting capacity, **as directed**, to meet available fault currents.
 - a. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - b. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 - c. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replaceable electronic trip; and the following field-adjustable settings:
 - 1) Instantaneous trip.
 - 2) Long- and short-time pickup levels.
 - 3) Long- and short-time time adjustments.
 - 4) Ground-fault pickup level, time delay, and I^2t response.
 - d. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
 - e. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker; trip activation on fuse opening or on opening of fuse compartment door.
 - f. MCCB Features and Accessories:
 - 1) Standard frame sizes, trip ratings, and number of poles.
 - 2) Lugs: Mechanical **OR** Compression, **as directed**, style, suitable for number, size, trip ratings, and conductor material.
 - 3) Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
 - 4) Ground-Fault Protection: Integrally mounted **OR** Remote-mounted, **as directed**, relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - 5) Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
 - 6) Communication Capability: Circuit-breaker-mounted **OR** Universal-mounted **OR** Integral **OR** Din-rail-mounted, **as directed**, communication module with functions and features compatible with power monitoring and control system specified in Division 16 Section "Electrical Power Monitoring and Control."
 - 7) Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 **OR** 75, **as directed**, percent of rated voltage.
 - 8) Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
 - 9) Auxiliary Contacts: One SPDT switch **OR** Two SPDT switches, **as directed**, with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
 - 10) Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
4. Insulated-Case Circuit Breaker: 80 **OR** 100, **as directed**, percent rated, sealed, insulated-case power circuit breaker with interrupting capacity rating to meet available fault current.
 - a. Fixed **OR** Drawout, **as directed**, circuit-breaker mounting.
 - b. Two-step, stored-energy closing.
 - c. Standard **OR** Full, **as directed**, -function, microprocessor-based trip units with interchangeable rating plug, trip indicators, and the following field-adjustable settings:
 - 1) Instantaneous trip.
 - 2) Long- and short-time time adjustments.
 - 3) Ground-fault pickup level, time delay, and I^2t response.
 - d. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
 - e. Remote trip indication and control.



- f. Communication Capability: Integral communication module with functions and features compatible with power monitoring and control system specified in Division 16 Section "Electrical Power Monitoring and Control."
- g. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
- h. Control Voltage: 40-V dc **OR** 125-V dc **OR** 250-V dc **OR** 120-V ac, **as directed**.

D. Combination Controllers

1. Full-Voltage Controllers:
 - a. General Requirements for Full-Voltage Enclosed Controllers: Comply with NEMA ICS 2, general purpose, Class A.
 - b. Magnetic Controllers: Full voltage, across the line, electrically held.
 - 1) Configuration: Nonreversing and reversing.
2. Reduced-Voltage Magnetic Controllers:
 - a. General Requirements for Reduced-Voltage Magnetic Controllers: Comply with NEMA ICS 2, general purpose, Class A; closed transition; adjustable time delay on transition.
 - b. Reduced-Voltage Magnetic Controllers: Reduced voltage, electrically held.
 - 1) Configuration:
 - a) Wye-Delta Controller: Four contactors, with a three-phase starting resistor/reactor bank.
 - b) Part-Winding Controller: Separate START and RUN contactors, field-selectable for one-half or two-thirds winding start mode, with either six- or nine-lead motors; with separate overload relays for starting and running sequences.
 - c) Autotransformer Reduced-Voltage Controller: Medium-duty service, with integral overtemperature protection; taps for starting at 50, 65, and 80 percent of line voltage; two START and one RUN contactors.
3. Reduced-Voltage, Solid-State Controllers:
 - a. General Requirements for Reduced-Voltage, Solid-State Controllers: Comply with UL 508.
 - b. Reduced-Voltage, Solid-State Controllers: An integrated unit with power SCRs, heat sink, microprocessor logic board, door-mounted digital display and keypad, bypass contactor, and overload relay; suitable for use with NEMA MG 1, Design B, polyphase, medium-induction motors.
 - 1) Configuration: Standard duty **OR** Severe duty, **as directed**; nonreversible **OR** reversible, **as directed**.
 - 2) Starting Mode: Voltage ramping **OR** Current limit **OR** Torque control **OR** Torque control with voltage boost, **as directed**; field selectable, **as directed**.
 - 3) Stopping Mode: Coast to stop **OR** Adjustable torque deceleration **OR** Adjustable braking, **as directed**; field selectable, **as directed**.
 - 4) Shorting (Bypass) Contactor: Operates automatically when full voltage is applied to motor, and bypasses the SCRs. Solid-state controller protective features shall remain active when the shorting contactor is in the bypass mode.
 - 5) Shorting and Input Isolation, **as directed**, Contactor Coils: Pressure-encapsulated type; manufacturer's standard operating voltage, matching control power or line voltage, depending on contactor size and line-voltage rating. Provide coil transient suppressors, **as directed**.
 - 6) Logic Board: Identical for all ampere ratings and voltage classes, with environmental protective coating.
 - 7) Adjustable acceleration-rate control using voltage or current ramp, and adjustable starting torque control with up to 400 percent current limitation for 20 seconds.
 - 8) SCR bridge shall consist of at least two SCRs per phase, providing stable and smooth acceleration with **OR** without, **as directed**, external feedback from the motor or driven equipment.



- 9) Keypad, front accessible; for programming the controller parameters, functions, and features; shall be manufacturer's standard and include not less than the following functions:
 - a) Adjusting motor full-load amperes, as a percentage of the controller's rating.
 - b) Adjusting current limitation on starting, as a percentage of the motor full-load current rating.
 - c) Adjusting linear acceleration and deceleration ramps, in seconds.
 - d) Initial torque, as a percentage of the nominal motor torque.
 - e) Adjusting torque limit, as a percentage of the nominal motor torque.
 - f) Adjusting maximum start time, in seconds.
 - g) Adjusting voltage boost, as a percentage of the nominal supply voltage.
 - h) Selecting stopping mode, and adjusting parameters.
 - i) Selecting motor thermal-overload protection class between 5 and 30.
 - j) Activating and de-activating protection modes.
 - k) Selecting or activating communications modes.
 - 10) Digital display, front accessible; for showing motor, controller, and fault status; shall be manufacturer's standard and include not less than the following:
 - a) Controller Condition: Ready, starting, running, stopping.
 - b) Motor Condition: Amperes, voltage, power factor, power, and thermal state.
 - c) Fault Conditions: Controller thermal fault, motor overload alarm and trip, motor underload, overcurrent, shorted SCRs, line or phase loss, phase reversal, and line frequency over or under normal.
 - 11) Controller Diagnostics and Protection:
 - a) Microprocessor-based thermal protection system for monitoring SCR and motor thermal characteristics, and providing controller overtemperature and motor overload alarm and trip; settings selectable via the keypad.
 - b) Protection from line-side reverse phasing; line-side and motor-side phase loss; motor jam, stall, and underload conditions; and line frequency over or under normal.
 - c) Input isolation contactor that opens when the controller diagnostics detect a faulted solid-state component, or when the motor is stopped.
OR
Shunt trip that opens the disconnecting means when the controller diagnostics detect a faulted solid-state component.
 - 12) Remote Output Features:
 - a) All outputs prewired to terminal blocks.
 - b) Form C status contacts that change state when controller is running.
 - c) Form C alarm contacts that change state when a fault condition occurs.
 - 13) Optional Features:
 - a) Analog output for field-selectable assignment of motor operating characteristics; 0 to 10-V dc **OR** 4 to 20-mA dc, **as directed**.
 - b) Additional field-assignable Form C contacts for alarm outputs.
 - c) Surge suppressors in solid-state power circuits providing three-phase protection against damage from supply voltage surges 10 percent or more above nominal line voltage.
 - d) Full-voltage bypass contactor operating automatically **OR** manually, with NORMAL/BYPASS selector switch, **as directed**. Power contacts shall be totally enclosed, double break, and silver-cadmium oxide; and assembled to allow inspection and replacement without disturbing line or load wiring.
4. Multispeed Magnetic Controllers:
- a. General Requirements for Multispeed Magnetic Controllers: Comply with NEMA ICS 2, general purpose, Class A.
 - b. Multispeed Magnetic Controllers: Two speed, full voltage, across the line, electrically held. Compelling relay to ensure that motor will start only at low speed.
 - 1) Configuration: Nonreversing **OR** Reversing, **as directed**; consequent pole **OR** two winding, **as directed**.



- 2) Compelling relays shall ensure that motor starts only at low speed.
 - 3) Accelerating timer relays shall ensure properly timed acceleration through speeds lower than that selected.
 - 4) Decelerating timer relays shall ensure automatically timed deceleration through each speed.
 - 5) Antiplugging timer relays shall ensure a time delay when transferring from FORWARD to REVERSE and back.
5. Disconnecting Means and OCPDs:
- a. Fusible Disconnecting Means:
 - 1) NEMA KS 1, heavy-duty, horsepower-rated, fusible switch with clips or bolt pads to accommodate Class J **OR** Class L, **as directed**, fuses.
 - 2) Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
 - 3) Auxiliary Contacts: NO/NC, arranged to activate before switch blades open.
 - b. MCP Disconnecting Means:
 - 1) UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents, instantaneous-only circuit breaker with front-mounted, field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
 - 2) Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
 - 3) Auxiliary contacts "a" and "b" arranged to activate with MCP handle.
 - 4) NC **OR** NO, **as directed**, alarm contact that operates only when MCP has tripped.
 - 5) Current-limiting module to increase controller short-circuit current (withstand) rating to 100 kA.
 - c. MCCB Disconnecting Means:
 - 1) UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents; thermal-magnetic MCCB, with inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits.
 - 2) Front-mounted, adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 3) Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
 - 4) Auxiliary contacts "a" and "b" arranged to activate with MCCB handle.
 - 5) NC **OR** NO, **as directed**, alarm contact that operates only when MCCB has tripped.
 - d. Molded-Case Switch Disconnecting Means:
 - 1) UL 489, NEMA AB 1, and NEMA AB 3, with in-line fuse block for Class J or L power fuses (depending on ampere rating), providing an interrupting capacity to comply with available fault currents; MCCB with fixed, high-set instantaneous trip only.
 - 2) Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
 - 3) Auxiliary contacts "a" and "b" arranged to activate with molded-case switch handle.
 - 4) NC **OR** NO, **as directed**, alarm contact that operates only when molded-case switch has tripped.
6. Overload Relays:
- a. Melting-Alloy Overload Relays:
 - 1) Inverse-time-current characteristic.
 - 2) Class 10 **OR** Class 20 **OR** Class 30, **as directed**, tripping characteristic.
 - 3) Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.
 - b. Bimetallic Overload Relays:
 - 1) Inverse-time-current characteristic.
 - 2) Class 10 **OR** Class 20 **OR** Class 30, **as directed**, tripping characteristic.
 - 3) Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.
 - 4) Ambient compensated.



- 5) Automatic resetting.
 - c. Solid-State Overload Relays:
 - 1) Switch or dial selectable for motor running overload protection.
 - 2) Sensors in each phase.
 - 3) Class 10 **OR** Class 20 **OR** Class 10/20 selectable, **as directed**, tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.
 - a) Class II ground-fault protection, with start and run delays to prevent nuisance trip on starting.
 - b) Analog communication module.
 - d. NC **OR** NO, **as directed**, isolated overload alarm contact.
 - e. External overload reset push button.
7. Control Power:
- a. Control Circuits: 24 **OR** 120, **as directed**, -V ac; obtained from integral CPT, with primary and secondary fuses, with CPT **OR** control power source, **as directed**, of sufficient capacity to operate integral devices and remotely located pilot, indicating, and control devices.
 - 1) CPT Spare Capacity: 50 **OR** 100 **OR** 200, **as directed**, VA.
- E. VFCS
1. General Requirements for VFCs: Comply with NEMA ICS 7, NEMA ICS 61800-2, and UL 508C, **as directed**.
 2. Application: Constant torque and variable torque, **as directed**.
 3. VFC Description: Variable-frequency power converter (rectifier, dc bus, and IGBT PWM inverter) factory packaged in an enclosure, with integral disconnecting means and overcurrent and overload protection; listed and labeled by an NRTL as a complete unit; arranged to provide self-protection, protection, and variable-speed control of one or more three-phase induction motors by adjusting output voltage and frequency.
 - a. Units suitable for operation of NEMA MG 1, Design A and Design B motors as defined by NEMA MG 1, Section IV, Part 30, "Application Considerations for Constant Speed Motors Used on a Sinusoidal Bus with Harmonic Content and General Purpose Motors Used with Adjustable-Voltage or Adjustable-Frequency Controls or Both."
 - b. Units suitable for operation of inverter-duty motors as defined by NEMA MG 1, Section IV, Part 31, "Definite-Purpose Inverter-Fed Polyphase Motors."
 - c. Listed and labeled for integrated short-circuit current (withstand) rating by an NRTL acceptable to authorities having jurisdiction.
 - d. Listed and labeled for single-phase use by an NRTL acceptable to authorities having jurisdiction.
 4. Design and Rating: Match load type such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection.
 5. Output Rating: Three-phase; 10 to 60 Hz, with voltage proportional to frequency throughout voltage range **OR** 66 Hz, with torque constant as speed changes, **as directed**; maximum voltage equals input voltage.
 6. Unit Operating Requirements:
 - a. Input AC Voltage Tolerance: Plus 10 and minus 10 **OR** 15, **as directed**, percent of VFC input voltage rating.
 - b. Input AC Voltage Unbalance: Not exceeding 3 **OR** 5, **as directed**, percent.
 - c. Input Frequency Tolerance: Plus or minus 3 percent of VFC frequency rating.
 - d. Minimum Efficiency: 96 **OR** 97, **as directed**, percent at 60 Hz, full load.
 - e. Minimum Displacement Primary-Side Power Factor: 96 **OR** 98, **as directed**, percent under any load or speed condition.
 - f. Overload Capability: 1.1 **OR** 1.5, **as directed**, times the base load current for 60 seconds; minimum of 1.8 times the base load current for three seconds.
 - g. Starting Torque: Minimum of 100 percent of rated torque from 3 to 60 Hz.
 - h. Speed Regulation: Plus or minus 5 **OR** 10, **as directed**, percent.
 - i. Output Carrier Frequency: Selectable; 0.5 to 15 kHz.



- j. Stop Modes: Programmable; includes fast, free-wheel, and dc injection braking.
- 7. Inverter Logic: Microprocessor based, 16 **OR** 32, **as directed**, bit, isolated from all power circuits.
- 8. Isolated Control Interface: Allows VFCs to follow remote-control signal over a minimum 40:1 speed range.
 - a. Signal: Electrical.
OR
Signal: Pneumatic.
- 9. Internal Adjustability Capabilities:
 - a. Minimum Speed: 5 to 25 percent of maximum rpm.
 - b. Maximum Speed: 80 to 100 percent of maximum rpm.
 - c. Acceleration: 0.1 to 999.9 seconds.
 - d. Deceleration: 0.1 to 999.9 seconds.
 - e. Current Limit: 30 to a minimum of 150 percent of maximum rating.
- 10. Self-Protection and Reliability Features:
 - a. Input transient protection by means of surge suppressors to provide three-phase protection against damage from supply voltage surges 10 percent or more above nominal line voltage.
 - b. Loss of Input Signal Protection: Selectable response strategy including speed default to a percent of the most recent speed, a preset speed, or stop; with alarm.
 - c. Under- and overvoltage trips.
 - d. Inverter overcurrent trips.
 - e. VFC and Motor Overload/Overtemperature Protection: Microprocessor-based thermal protection system for monitoring VFCs and motor thermal characteristics, and for providing VFC overtemperature and motor overload alarm and trip; settings selectable via the keypad; NRTL approved.
 - f. Critical frequency rejection, with three selectable, adjustable deadbands.
 - g. Instantaneous line-to-line and line-to-ground overcurrent trips.
 - h. Loss-of-phase protection.
 - i. Reverse-phase protection.
 - j. Short-circuit protection.
 - k. Motor overtemperature fault.
- 11. Automatic Reset/Restart: Attempt three restarts after drive fault or on return of power after an interruption and before shutting down for manual reset or fault correction; adjustable delay time between restart attempts.
- 12. Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped, unless "Bidirectional Autospeed Search" feature is available and engaged.
- 13. Bidirectional Autospeed Search: Capable of starting VFC into rotating loads spinning in either direction and returning motor to set speed in proper direction, without causing damage to drive, motor, or load.
- 14. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.
- 15. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.
- 16. Integral Input Disconnecting Means and OCPD: NEMA AB 1, instantaneous-trip circuit breaker **OR** NEMA AB 1, molded-case switch, with power fuse block and current-limiting fuses **OR** NEMA AB 1, thermal-magnetic circuit breaker **OR** NEMA KS 1, nonfusible switch, with power fuse block and current-limiting fuses **OR** NEMA KS 1, fusible switch, **as directed**, with pad-lockable, door-mounted handle mechanism.
 - a. Disconnect Rating (for VFCs without bypass systems): Not less than 115 percent of VFC input current rating.
 - b. Disconnect Rating (for VFCs with bypass systems): Not less than 115 percent of NFPA 70 motor full-load current rating or VFC input current rating, whichever is larger.
 - c. Auxiliary Contacts: NO/NC, arranged to activate before switch blades open.



- d. Auxiliary contacts "a" and "b" arranged to activate with circuit-breaker handle.
- e. NC **OR** NO, **as directed**, alarm contact that operates only when circuit breaker has tripped.

F. VFC Controls And Indication

1. Status Lights: Door-mounted LED indicators displaying the following conditions:
 - a. Power on.
 - b. Run.
 - c. Overvoltage.
 - d. Line fault.
 - e. Overcurrent.
 - f. External fault.
2. Panel-Mounted Operator Station: Manufacturer's standard front-accessible, sealed keypad and plain-English language digital display; allows complete programming, program copying, operating, monitoring, and diagnostic capability.
 - a. Keypad: In addition to required programming and control keys, include keys for HAND, OFF, and AUTO modes.
 - b. Security Access: Provide electronic security access to controls through identification and password with at least three levels of access: View only; view and operate; and view, operate, and service.
 - 1) Control Authority: Supports at least four conditions: Off, local manual control at VFC, local automatic control at VFC, and automatic control through a remote source.
3. Historical Logging Information and Displays:
 - a. Running log of total power versus time.
 - b. Total run time.
 - c. Fault log, maintaining last four faults with time and date stamp for each.
4. Indicating Devices: Digital display and additional readout devices as required, mounted flush in VFC door and connected to display VFC parameters, including, but not limited to:
 - a. Output frequency (Hz).
 - b. Motor speed (rpm).
 - c. Motor status (running, stop, fault).
 - d. Motor current (amperes).
 - e. Motor torque (percent).
 - f. Fault or alarming status (code).
 - g. PID feedback signal (percent).
 - h. DC-link voltage (V dc).
 - i. Set point frequency (Hz).
 - j. Motor output voltage (V ac).
5. Control Signal Interfaces:
 - a. Electric Input Signal Interface:
 - 1) A minimum of two programmable analog inputs: 0- to 10-V dc **OR** 4- to 20-mA dc **OR** Operator-selectable "x"- to "y"-mA dc, **as directed**.
 - 2) A minimum of six multifunction programmable digital inputs.
 - b. Pneumatic Input Signal Interface: 3 to 15 psig (20 to 104 kPa).
 - c. Remote Signal Inputs: Capability to accept any of the following speed-setting input signals from the BAS or other control systems:
 - 1) 0- to 10-V dc.
 - 2) 4- to 20-mA dc.
 - 3) Potentiometer using up/down digital inputs.
 - 4) Fixed frequencies using digital inputs.
 - d. Output Signal Interface: A minimum of one programmable analog output signal(s) (0- to 10-V dc **OR** 4- to 20-mA dc **OR** operator-selectable "x"- to "y"-mA dc, **as directed**), which can be configured for any of the following:
 - 1) Output frequency (Hz).
 - 2) Output current (load).



- 3) DC-link voltage (V dc).
 - 4) Motor torque (percent).
 - 5) Motor speed (rpm).
 - 6) Set point frequency (Hz).
 - e. Remote Indication Interface: A minimum of two programmable dry-circuit relay outputs (120-V ac, 1 A) for remote indication of the following:
 - 1) Motor running.
 - 2) Set point speed reached.
 - 3) Fault and warning indication (overtemperature or overcurrent).
 - 4) PID high- or low-speed limits reached.
 6. PID Control Interface: Provides closed-loop set point, differential feedback control in response to dual feedback signals. Allows for closed-loop control of fans and pumps for pressure, flow, or temperature regulation.
 - a. Number of Loops: One **OR** Two, **as directed**.
 7. BAS Interface: Factory-installed hardware and software to enable the BAS to monitor, control, and display VFC status and alarms and energy usage, **as directed**. Allows VFC to be used with an external system within a multidrop LAN configuration; settings retained within VFC's nonvolatile memory.
 - a. Network Communications Ports: Ethernet and RS-422/485.
 - b. Embedded BAS Protocols for Network Communications: ASHRAE 135 BACnet **OR** Echelon LonWorks **OR** Ethernet TCP/IP **OR** Johnson Metasys N2 **OR** Modbus/Memobus **OR** Siemens System 600 APOGEE, **as directed**; protocols accessible via the communications ports.
- G. VFC Line Conditioning And Filtering
1. Input Line Conditioning: Based on the harmonic analysis study and report, provide input filtering, as required, to limit TDD at input terminals of VFCs to less than 5 **OR** 8, **as directed**, percent and THD(V) to 3 **OR** 5, **as directed**, percent.
 2. Input Line Conditioning: Based on the harmonic analysis study and report, provide input filtering, as required, to limit TDD and THD(V) at the defined PCC per IEEE 519.
 3. Input Line Conditioning: **<Insert requirements>**.
 4. VFC Output Filtering: **<Insert requirements>**.
 5. EMI/RFI Filtering: CE marked; certify compliance with IEC 61800-3 for Category C2.
- H. VFC Bypass Systems
1. Bypass Operation: Safely transfers motor between power converter output and bypass circuit, manually, automatically, or both. Selector switches set modes, and indicator lights indicate mode selected. Unit is capable of stable operation (starting, stopping, and running) with motor completely disconnected from power converter.
 2. Bypass Mode: Manual operation only; requires local operator selection at VFC. Transfer between power converter and bypass contactor and retransfer shall only be allowed with the motor at zero speed.
OR
Bypass Mode: Field-selectable automatic or manual, allows local and remote transfer between power converter and bypass contactor and retransfer, either via manual operator interface or automatic control system feedback.
 3. Bypass Controller: Two-contactor-style bypass allows motor operation via the power converter or the bypass controller; with input isolating switch and barrier arranged to isolate the power converter and permit safe troubleshooting and testing, both energized and de-energized, while motor is operating in bypass mode, **as directed**.
 - a. Bypass Contactor: Load-break, IEC **OR** NEMA, **as directed**, -rated contactor.
 - b. Output Isolating Contactor: Non-load-break, IEC **OR** NEMA, **as directed**, -rated contactor.
 - c. Isolating Switch: Non-load-break switch arranged to isolate power converter and permit safe troubleshooting and testing of the power converter, both energized and de-energized, while motor is operating in bypass mode; pad-lockable, door-mounted handle mechanism.

**OR**

Bypass Controller: Three-contactor-style bypass allows motor operation via the power converter or the bypass controller; with input isolating switch and barrier, **as directed**, arranged to isolate the power converter input and output and permit safe testing and troubleshooting of the power converter, both energized and de-energized, while motor is operating in bypass mode.

- a. Bypass Contactor: Load-break, IEC **OR** NEMA, **as directed**, -rated contactor.
 - b. Input and Output Isolating Contactors: Non-load-break, IEC **OR** NEMA, **as directed**, -rated contactors.
 - c. Isolating Switch: Non-load-break switch arranged to isolate power converter and permit safe troubleshooting and testing of the power converter, both energized and de-energized, while motor is operating in bypass mode; pad-lockable, door-mounted handle mechanism.
4. Bypass Contactor Configuration: Full-voltage (across-the-line) **OR** Reduced-voltage (autotransformer), **as directed**, type.
- a. NORMAL/BYPASS selector switch.
 - b. HAND/OFF/AUTO selector switch.
 - c. NORMAL/TEST Selector Switch: Allows testing and adjusting of VFC while the motor is running in the bypass mode.
 - d. Contactor Coils: Pressure-encapsulated type with coil transient suppressors, **as directed**.
 - 1) Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.
 - 2) Power Contacts: Totally enclosed, double break, and silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.
 - e. Control Circuits: 120-V ac; obtained from integral CPT, with primary and secondary fuses **as directed**, with CPT **OR** control power source, **as directed**, of sufficient capacity to operate all integral devices and remotely located pilot, indicating, and control devices.
 - f. CPT Spare Capacity: 50 **OR** 100 **OR** 200, **as directed**, VA.
5. Overload Relays: NEMA ICS 2.
- a. Melting-Alloy Overload Relays:
 - 1) Inverse-time-current characteristic.
 - 2) Class 10 **OR** Class 20 **OR** Class 30, **as directed**, tripping characteristic.
 - 3) Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.
 - b. Bimetallic Overload Relays:
 - 1) Inverse-time-current characteristic.
 - 2) Class 10 **OR** Class 20 **OR** Class 30, **as directed**, tripping characteristic.
 - 3) Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.
 - 4) Ambient compensated.
 - 5) Automatic resetting.
 - c. Solid-State Overload Relays:
 - 1) Switch or dial selectable for motor-running overload protection.
 - 2) Sensors in each phase.
 - 3) Class 10 **OR** Class 20 **OR** Class 10/20 selectable, **as directed**, tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.
 - 4) Class II ground-fault protection, with start and run delays to prevent nuisance trip on starting.
 - 5) Analog communication module.
 - 6) NC **OR** NO, **as directed**, isolated overload alarm contact.
 - 7) External overload reset push button.
- I. Optional VFC Features
1. Multiple-Motor Capability: VFC suitable for variable-speed service to multiple motors. Overload protection shuts down VFC and motors served by it, and generates fault indications, when overload protection activates.



- a. Configure to allow two or more motors to operate simultaneously at the same speed; separate overload relay for each controlled motor.
 - b. Configure to allow two motors to operate separately; operator selectable via local or remote switch or contact closures; single overload relay for both motors; separate output magnetic contactors for each motor.
 - c. Configure to allow two motors to operate simultaneously and in a lead/lag mode, with one motor operated at variable speed via the power converter and the other at constant speed via the bypass controller; separate overload relay for each controlled motor.
2. Damper control circuit with end of travel feedback capability.
 3. Sleep Function: Senses a minimal deviation of a feedback signal and stops the motor. On an increase in speed-command signal deviation, VFC resumes normal operation.
 4. Motor Preheat Function: Preheats motor when idle to prevent moisture accumulation in the motor.
 5. Firefighter's Override (Smoke Purge) Input: On a remote contact closure from the firefighter's control station **OR** smoke-control fan controller, **as directed**, this password-protected input:
 - a. Overrides all other local and external inputs (analog/digital, serial communication, and all keypad commands).
 - b. Forces VFC to operate motor, without any other run or speed command, at a field-adjustable, preset speed.
OR
Forces VFC to transfer to Bypass Mode and operate motor at full speed.
 - c. Causes display of Override Mode on the VFC display.
 - d. Reset VFC to normal operation on removal of override signal automatically **OR** manually, **as directed**.
 6. Remote Indicating Circuit Terminals: Mode selection, controller status, and controller fault.
 7. Remote digital operator kit.
 8. Communication Port: RS-232 port, USB 2.0 port, or equivalent connection capable of connecting a printer and a notebook computer.
- J. Feeder-Tap Units
1. MCCB: Comply with UL 489, with series-connected rating **OR** interrupting capacity, **as directed**, to meet available fault currents.
 - a. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - b. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 - c. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
 - 1) Instantaneous trip.
 - 2) Long- and short-time pickup levels.
 - 3) Long- and short-time time adjustments.
 - 4) Ground-fault pickup level, time delay, and I^2t response.
 - d. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
 - e. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker; trip activation on fuse opening or on opening of fuse compartment door.
 - f. MCCB Features and Accessories:
 - 1) Standard frame sizes, trip ratings, and number of poles.
 - 2) Lugs: Mechanical **OR** Compression, **as directed**, style, suitable for number, size, trip ratings, and conductor material.
 - 3) Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.



- 4) Ground-Fault Protection: Integrally mounted **OR** Remote-mounted, **as directed**, relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - 5) Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
 - 6) Communication Capability: Circuit-breaker-mounted **OR** Universal-mounted **OR** Integral **OR** Din-rail-mounted, **as directed**, communication module with functions and features compatible with power monitoring and control system specified in Division 26 Section "Electrical Power Monitoring And Control".
 - 7) Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 **OR** 75, **as directed**, percent of rated voltage.
 - 8) Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
 - 9) Auxiliary Contacts: One SPDT switch **OR** Two SPDT switches, **as directed**, with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
 - 10) Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
2. Fusible Switch: NEMA KS 1, Type HD, clips to accommodate specified fuses with lockable handle.
 3. Fuses are specified in Division 26 Section "Fuses".

K. Transient Voltage Suppression Devices

1. Surge Protection Device Description: IEEE C62.41-compliant, integrally mounted, wired-in **OR** plug-in **OR** bolt-on, **as directed**, solid-state, parallel-connected, modular (with field-replaceable modules) **OR** non-modular, **as directed**, type, with sine-wave tracking suppression and filtering modules, UL 1449, second edition, short-circuit current rating matching or exceeding the MCC short-circuit rating, and with the following features and accessories:
 - a. Fuses, rated at 200-kA interrupting capacity.
 - b. Fabrication using bolted compression lugs for internal wiring.
 - c. Integral disconnect switch.
 - d. Redundant suppression circuits.
 - e. Redundant replaceable modules.
 - f. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
 - g. LED indicator lights for power and protection status.
 - h. Audible alarm, with silencing switch, to indicate when protection has failed.
 - i. Form-C contacts rated at 5 A and 250-V ac, one NO and one NC, for remote monitoring of system operation. Contacts shall reverse position on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
 - j. Four **OR** Six, **as directed**, -digit, transient-event counter set to totalize transient surges.
2. Peak Single-Impulse Surge Current Rating: 160 kA per mode/320 kA per phase **OR** 120 kA per mode/240 kA per phase **OR** 80 kA per mode/160 kA per phase, **as directed**.
3. Withstand Capabilities: 12,000 IEEE C62.41, Category C3 (10 kA), 8-by-20-mic.sec. surges with less than 5 percent change in clamping voltage.
4. Protection modes and UL 1449 SVR for grounded wye circuits with 480Y/277 **OR** 208Y/120 **OR** 600Y/347, **as directed**, -V, three-phase, four-wire circuits shall be as follows:
 - a. Line to Neutral: 800 V for 480Y/277 **OR** 400 V for 208Y/120 **OR** 1200 V for 600Y/347, **as directed**.
 - b. Line to Ground: 800 V for 480Y/277 **OR** 400 V for 208Y/120 **OR** 1200 V for 600Y/347, **as directed**.
 - c. Neutral to Ground: 800 V for 480Y/277 **OR** 400 V for 208Y/120 **OR** 1200 V for 600Y/347, **as directed**.

OR

Protection modes and UL 1449 SVR for 240/120-V, three-phase, four-wire circuits with high leg shall be as follows:



- a. Line to Neutral: 400 V, 800 V from high leg.
- b. Line to Ground: 400 V.
- c. Neutral to Ground: 400 V.

OR

Protection modes and UL 1449 SVR for 240-, 480-, or 600-V, three-phase, three-wire, delta circuits shall be as follows:

- a. Line to Line: 2000 V for 480 V **OR** 1000 V for 240 V **OR** 2500 V for 600 V, **as directed**.
- b. Line to Ground: 1500 V for 480 V **OR** 800 V for 240 V **OR** 2500 V for 600 V, **as directed**.

L. Instrumentation

1. Instrument Transformers (for the Owner metering): IEEE C57.13, NEMA EI 21.1, and the following:
 - a. PTs: IEEE C57.13; 120 V, 60 Hz, single **OR** tapped **OR** double, **as directed**, secondary; disconnecting type with integral fuse mountings. Burden and accuracy shall be consistent with connected metering and relay devices.
 - b. Current Transformers: IEEE C57.13; 5 A, 60 Hz, secondary; wound **OR** bushing **OR** bar or window, **as directed**, type; single **OR** double, **as directed**, secondary winding and secondary shorting device. Burden and accuracy shall be consistent with connected metering and relay devices.
 - c. CPTs: Dry type, mounted in separate compartments for units larger than 3 kVA.
 - d. Current Transformers for Neutral and Ground-Fault Current Sensing: Connect secondary wiring to ground overcurrent relays, via shorting terminals, to provide selective tripping of main and tie circuit breaker. Coordinate with feeder circuit-breaker, ground-fault protection.
2. Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four-wire systems and with the following features:
 - a. Listed or recognized by a nationally recognized testing laboratory.
 - b. Inputs from sensors or 5-A current-transformer secondaries, and potential terminals rated to 600 V.
 - c. Switch-selectable digital display of the following values with the indicated maximum accuracy tolerances:
 - 1) Phase Currents, Each Phase: Plus or minus 1 percent.
 - 2) Phase-to-Phase Voltages, Three Phase: Plus or minus 1 percent.
 - 3) Phase-to-Neutral Voltages, Three Phase: Plus or minus 1 percent.
 - 4) Three-Phase Real Power (Megawatts): Plus or minus 2 percent.
 - 5) Three-Phase Reactive Power (Megavars): Plus or minus 2 percent.
 - 6) Power Factor: Plus or minus 2 percent.
 - 7) Frequency: Plus or minus 0.5 percent.
 - 8) Accumulated Energy, Megawatt Hours: Plus or minus 2 percent; accumulated values unaffected by power outages up to 72 hours.
 - 9) Megawatt Demand: Plus or minus 2 percent; demand interval programmable from five to 60 minutes.
 - 10) Contact devices to operate remote impulse-totalizing demand meter.
 - d. Mounting: Display and control unit flush or semiflush mounted in instrument compartment door.
3. Ammeters, Voltmeters, and Power-Factor Meters: ANSI C39.1.
 - a. Meters: 4-inch (100-mm) diameter or 6 inches (150 mm) square, flush or semiflush, with antiparallax 250-degree scale and external zero adjustment.
 - b. Voltmeters: Cover an expanded-scale range of nominal voltage plus 10 percent.
4. Instrument Switches: Rotary type with off position.
 - a. Voltmeter Switches: Permit reading of all phase-to-phase voltages and phase-to-neutral voltages where a neutral is included.
 - b. Ammeter Switches: Permit reading of current in each phase and maintain current-transformer secondaries in a closed-circuit condition at all times.



5. Feeder Ammeters: 2-1/2-inch (64-mm) minimum size with 90- or 120-degree scale. Meter and transfer device with off position, located on overcurrent device door for feeder circuits, unless otherwise indicated.
 6. Watt-Hour Meters and Wattmeters:
 - a. Comply with ANSI C12.1.
 - b. Three-phase induction type with two stators, each with current and potential coil, rated 5 A, 120 V, 60 Hz.
 - c. Suitable for connection to three- and four-wire circuits.
 - d. Potential indicating lamps.
 - e. Adjustments for light and full load, phase balance, and power factor.
 - f. Four-dial clock register.
 - g. Integral demand indicator.

OR

Contact devices to operate remote impulse-totalizing demand meter.

 - h. Ratchets to prevent reverse rotation.
 - i. Removable meter with drawout test plug.
 - j. Semiflush mounted case with matching cover.
 - k. Appropriate multiplier tag.
 7. Impulse-Totalizing Demand Meter:
 - a. Comply with ANSI C12.1.
 - b. Suitable for use with MCC watt-hour meter, including two-circuit totalizing relay.
 - c. Cyclometer.
 - d. Four-dial, totalizing kilowatt-hour register.
 - e. Positive chart drive mechanism.
 - f. Capillary pen holding a minimum of one month's ink supply.
 - g. Roll chart with minimum 31-day capacity; appropriate multiplier tag.
 - h. Capable of indicating and recording five **OR 15 OR 30, as directed**,-minute integrated demand of totalized system.
- M. MCC Control Power
1. Control Circuits: 120-V ac, supplied through secondary disconnecting devices from CPT.
OR
Control Circuits: 120-V ac, supplied from remote branch circuit.
 2. Electrically Interlocked Main and Tie Circuit Breakers: Two CPTs in separate compartments, with interlocking relays, connected to the primary side of each CPT at the line side of the associated main circuit breaker. 120-V secondaries connected through automatic transfer relays to ensure a fail-safe automatic transfer scheme.
 3. Control Power Fuses: Primary and secondary fuses for current-limiting and overload protection of transformer and fuses for protection of control circuits.
 4. Control Wiring: Factory installed, with bundling, lacing, and protection included. Provide flexible conductors for No. 8 AWG and smaller, for conductors across hinges, and for conductors for interconnections between shipping units.
- N. Enclosures
1. Indoor Enclosures: Freestanding steel cabinets unless otherwise indicated. NEMA 250, Type 1 **OR** Type 1A **OR** Type 2 **OR** Type 12, **as directed**, unless otherwise indicated to comply with environmental conditions at installed location.
 2. Space Heaters: Factory-installed electric space heaters of sufficient wattage in each vertical section to maintain enclosure temperature above expected dew point.
 - a. Space-Heater Control: Thermostats to maintain temperature of each section above expected dew point **OR** Manual switching of branch-circuit protective device, **as directed**.
 - b. Space-Heater Power Source: Transformer, factory installed in MCC **OR** 120-V external branch circuit, **as directed**.
 3. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray **OR** custom color, **as directed**, finish over a rust-inhibiting primer on treated metal surface.



4. Outdoor Enclosures: Type 3R, non-walk-in aisle **OR** Type 3R, with interior-lighted walk-in aisle, **as directed**.
 - a. Finish: Factory-applied finish in manufacturer's standard **OR** custom, **as directed**, color; undersurfaces treated with corrosion-resistant undercoating.
 - b. Enclosure: Flat **OR** Downward, rearward sloping, **as directed**, roof; bolt-on rear covers **OR** rear hinged doors, **as directed**, for each section, with provisions for padlocking.
 - c. Doors: Personnel door at each end of aisle, minimum width of 30 inches (762 mm); opening outwards; with panic hardware and provisions for padlocking **OR** cylinder lock, **as directed**.
 - d. Accessories: Fluorescent lighting fixtures, ceiling mounted; wired to a three-way light switch at each end of aisle; GFCI duplex receptacle; emergency battery pack lighting fixture installed on wall of aisle midway between personnel doors.
 - e. Walk-in Aisle Heating and Ventilating:
 - 1) Factory-installed electric unit heater(s), wall or ceiling mounted, with integral thermostat and disconnect and with capacities to maintain switchboard interior temperature of 40 deg F (5 deg C) with outside design temperature of 104 deg F (40 deg C).
 - 2) Factory-installed exhaust fan with capacities to maintain switchboard interior temperature of 100 deg F (38 deg C) with outside design temperature of 23 deg F (minus 5 deg C).
 - 3) Ventilating openings complete with replaceable fiberglass air filters, **as directed**.
 - 4) Thermostat: Single stage; wired to control heat and exhaust fan.
 - f. Power for Space Heaters, Ventilation, Lighting, and Receptacle: Include a CPT within the switchboard. Supply voltage shall be 120 **OR** 120/240 **OR** 120/208, **as directed**, -V ac.
OR
Power for space heaters, ventilation, lighting, and receptacle provided by a remote source.
 5. Compartments: Modular; individual lift-off, **as directed**, doors with concealed hinges and quick-captive screw fasteners. Interlocks on units requiring disconnecting means in off position before door can be opened or closed, except by operating a permissive release device.
 6. Interchangeability: Compartments constructed to allow for removal of units without opening adjacent doors, disconnecting adjacent compartments, or disturbing operation of other units in MCC; same size compartments to permit interchangeability and ready rearrangement of units, such as replacing three single units with a unit requiring three spaces, without cutting or welding.
 7. Wiring Spaces:
 - a. Vertical wireways in each vertical section for vertical wiring to each unit compartment; supports to hold wiring in place.
 - b. Horizontal wireways in bottom **OR** top **OR** bottom and top, **as directed**, of each vertical section for horizontal wiring between vertical sections; supports to hold wiring in place.
- O. Auxiliary Devices
1. General Requirements for Control-Circuit and Pilot Devices: NEMA ICS 5; factory installed in controller enclosure cover unless otherwise indicated.
 - a. Push Buttons, Pilot Lights, and Selector Switches: Heavy **OR** Standard, **as directed**, -duty, oiltight, **as directed**, type.
 - 1) Push Buttons: Covered **OR** Lockable **OR** Recessed **OR** Shielded **OR** Shrouded **OR** Unguarded, **as directed**, types; maintained **OR** momentary, **as directed**, contact unless otherwise indicated.
 - 2) Pilot Lights: Incandescent **OR** LED **OR** Neon **OR** Resistor **OR** Transformer, **as directed**, types; <Insert color(s)>; push to test, **as directed**.
 - 3) Selector Switches: Rotary type.
 - b. Elapsed-Time Meters: Heavy duty with digital readout in hours; nonresettable **OR** resettable, **as directed**.
 - c. Meters: Panel type, 2-1/2-inch (64-mm) minimum size with 90- or 120-degree scale and plus or minus 2 percent accuracy with selector switches having an off position.
 2. NC **OR** NO **OR** Reversible NC/NO, **as directed**, contactor auxiliary contact(s).



3. Control Relays: Auxiliary and adjustable pneumatic **OR** solid-state, **as directed**, time-delay relays.
4. Phase-Failure, Phase-Reversal, and Undervoltage and Overvoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connections. Provide adjustable undervoltage, overvoltage, and time-delay settings.
5. Space heaters, with NC auxiliary contacts, to mitigate condensation in enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.
6. Sun shields installed on fronts, sides, and tops of enclosures installed outdoors and subject to direct and extended sun exposure.
7. Cover gaskets for Type 1 enclosures.
8. Terminals for connecting power factor correction capacitors to the line **OR** load, **as directed**, side of overload relays.
9. Spare control-wiring terminal blocks; unwired **OR** wired, **as directed**.
10. Spare-Fuse Cabinet: Identified and compartmented steel box **OR** cabinet with hinged lockable door, **as directed**.

P. Characteristics And Ratings

1. Wiring: NEMA ICS 18, Class I **OR** Class I-S, **as directed**, Type A **OR** Type B, for starters above Size 3 **OR** Type B-D, for starter Size 3 and below **OR** Type B-T, for starter Size 3 and below **OR** Type C, **as directed**.
OR
Wiring: NEMA ICS 18, Class II **OR** Class II-S, **as directed**, Type B, for starters above Size 3 **OR** Type B-D, for starter Size 3 and below **OR** Type B-T, for starter Size 3 and below **OR** Type C, **as directed**.
2. Control and Load Wiring: Factory installed, with bundling, lacing, and protection included. Provide flexible conductors for No. 8 AWG and smaller, for conductors across hinges, and for conductors for interconnections between shipping units.
3. Nominal System Voltage: 480 V, three phase, three wire **OR** 480Y/277 V, three phase, four wire, **as directed**.
OR
Nominal System Voltage: 208 V, three phase, three wire **OR** 208/120 V, three phase, four wire, **as directed**.
4. Short-Circuit Current Rating for Each Unit: Combination series rated **OR** Fully rated, **as directed**; 22 **OR** 42 **OR** 65 **OR** 100, **as directed**, kA.
5. Short-Circuit Current Rating of MCC: Combination series rated **OR** Fully rated, **as directed**, with its main overcurrent device; 22 **OR** 42 **OR** 65 **OR** 100, **as directed**, kA.
6. Environmental Ratings:
 - a. Ambient Temperature Rating: Not less than 0 deg F (minus 18 deg C) and not exceeding 104 deg F (40 deg C), with an average value not exceeding 95 deg F (35 deg C) over a 24-hour period.
 - b. Ambient Storage Temperature Rating: Not less than minus 4 deg F (minus 20 deg C) and not exceeding 140 deg F (60 deg C)
 - c. Humidity Rating: Less than 95 percent (noncondensing).
 - d. Altitude Rating: Not exceeding 6600 feet (2000 m), or 3300 feet (1000 m) if MCC includes solid-state devices.
7. Main-Bus Continuous Rating: 600 **OR** 800 **OR** 1000 **OR** 1200 **OR** 1600 **OR** 2000, **as directed**, A.
8. Vertical-Bus Minimum, **as directed**, Continuous Rating: 300 **OR** 600 **OR** 1200, **as directed**, A.
9. Horizontal and Vertical Bus Bracing (Short-Circuit Current Rating): Match MCC short-circuit current rating.
10. Main Horizontal and Equipment Ground Buses: Uniform capacity for entire length of MCC's main and vertical sections. Provide for future extensions from both ends, **as directed**. Brace bus extensions for busway feeder bus, **as directed**.
11. Vertical Phase and Equipment Ground Buses: Uniform capacity for entire usable height of vertical sections, except for sections incorporating single units.



12. Phase- and Neutral-, **as directed**, Bus Material: Hard-drawn copper of 98 percent conductivity, silver **OR** tin, **as directed**, plated.
OR
Phase- and Neutral-, **as directed**, Bus Material: Tin-plated, high-strength, electrical-grade aluminum alloy.
 13. Neutral Buses: 50 percent of the ampacity of phase buses unless otherwise indicated, equipped with mechanical **OR** compression, **as directed**, connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus, **as directed**.
OR
Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with mechanical **OR** compression, **as directed**, connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus, **as directed**.
 14. Ground Bus: Minimum size required by UL 845, hard-drawn copper of 98 percent conductivity, equipped with mechanical **OR** compression, **as directed**, connectors for feeder and branch-circuit equipment grounding conductors. For busway feeders, extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run, **as directed**.
 15. Front-Connected, Front-Accessible MCCs:
 - a. Main Devices: Drawout **OR** Fixed, **as directed**, mounted.
 - b. Controller Units: Drawout and fixed, **as directed**, mounted.
 - c. Feeder-Tap Units: Drawout and fixed, **as directed**, mounted.
 - d. Sections front and rear aligned.
 16. Utility Metering Compartment: Fabricated, barrier compartment and section complying with utility company's requirements; hinged sealed door; buses provisioned for mounting utility company's current transformers and potential transformers or potential taps as required by utility company. If separate vertical section is required for utility metering, match and align with basic MCC. Provide service entrance label and necessary applicable service entrance features.
 17. the Owner Metering Compartment: A separate customer metering compartment and section with front hinged door, metering, and current transformers for each meter. Current transformer secondary wiring shall be terminated on shorting-type terminal blocks. Include potential transformers having primary and secondary fuses with disconnecting means and secondary wiring terminated on terminal blocks, **as directed**.
 18. Bus Transition and Incoming Pull Sections: Matched and aligned with basic MCC.
 19. Pull Box on Top of an MCC:
 - a. Adequate ventilation to maintain temperature in pull box within same limits as MCC.
 - b. Set back from front to clear circuit-breaker removal mechanism.
 - c. Removable covers forming top, front, and sides. Top covers at rear easily removable for drilling and cutting.
 - d. Insulated bottom of fire-resistive material with separate holes for cable drops into MCC.
 - e. Cable supports arranged to facilitate cabling and adequate to support cables, including those for future installation.
 - f. Isolation Barrier Access Provisions: Permit checking of bus-bolt tightness.
 20. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of unit.
 21. Bus-Bar Insulation: Factory-applied, flame-retardant, tape wrapping of individual bus bars or flame-retardant, spray-applied insulation. Minimum insulation temperature rating of 105 deg C.
 22. Fungus Proofing: Permanent fungicidal treatment for OCPDs and other components including instruments and instrument transformers.
- Q. Source Quality Control
1. MCC Testing: Inspect and test MCCs according to requirements in NEMA ICS 18.
 2. VFC Testing: Test and inspect VFCs according to requirements in NEMA ICS 61800-2.
 - a. Test each VFC while connected to its specified motor **OR** a motor that is comparable to that for which the VFC is rated, **as directed**.



- b. Verification of Performance: Rate VFCs according to operation of functions and features specified.
3. MCCs will be considered defective if they do not pass tests and inspections.
4. Prepare test and inspection reports.

1.3 EXECUTION

A. Examination

1. Examine areas and surfaces to receive MCCs, with Installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance of the Work.
2. Examine enclosed controllers before installation. Reject enclosed controllers that are wet, moisture damaged, or mold damaged.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Harmonic Analysis Study

1. Perform a harmonic analysis study to identify the effects of nonlinear loads and their associated harmonic contributions on the voltages and currents throughout the electrical system. Analyze possible **OR** designated, **as directed**, operating scenarios, including recommendations for VFC input filtering to limit TDD and THD(V) at the defined PCC to specified levels.
2. Prepare a harmonic analysis study report complying with IEEE 399 and NETA Acceptance Testing Specification.

C. Installation

1. Coordinate layout and installation of MCCs with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
2. Floor-Mounting Controllers: Install MCCs on 4-inch (100-mm) nominal thickness concrete base. Comply with requirements for concrete base specified in Division 03 Section "Cast-in-place Concrete".
 - a. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - b. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - d. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Seismic Bracing: Comply with requirements specified in Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
4. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
5. Install fuses in each fusible switch.
6. Install fuses in control circuits if not factory installed. Comply with requirements in Division 26 Section "Fuses".
7. Install heaters in thermal-overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.
8. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.
9. Install power factor correction capacitors. Connect to the line **OR** load, **as directed**, side of overload relays. If connected to the load side of overload relays, adjust overload heater sizes to accommodate the reduced motor full-load currents.
10. Comply with NECA 1.

D. Identification

1. Comply with requirements in Division 26 Section "Identification For Electrical Systems" for identification of MCC, MCC components, and control wiring.



- a. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - b. Label MCC and each cubicle with engraved nameplate.
 - c. Label each enclosure-mounted control and pilot device.
 - d. Mark up a set of manufacturer's connection wiring diagrams with field-assigned wiring identifications and return to manufacturer for inclusion in Record Drawings.
2. Operating Instructions: Frame printed operating instructions for MCCs, including control sequences and emergency procedures. Fabricate frame of finished metal, and cover instructions with clear acrylic plastic. Mount on front of MCCs.
- E. Control Wiring Installation
1. Install wiring between enclosed controllers **OR** master terminal boards, **as directed**, and remote devices and facility's BAS **OR** and facility's central-control system, **as directed**. Comply with requirements in Division 26 Section "Control-voltage Electrical Power Cables".
 2. Bundle, train, and support wiring in enclosures.
 3. Connect selector switches and other automatic-control selection devices where applicable.
 - a. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switch is in manual-control position.
 - b. Connect selector switches within enclosed controller circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.
- F. Connections
1. Comply with requirements for installation of conduit in Division 26 Section "Raceway And Boxes For Electrical Systems". Drawings indicate general arrangement of conduit, fittings, and specialties.
 2. Comply with requirements in Division 26 Section "Grounding And Bonding For Electrical Systems".
- G. Field Quality Control
1. Perform tests and inspections.
 2. Acceptance Testing Preparation:
 - a. Test insulation resistance for each enclosed controller, component, connecting supply, feeder, and control circuit.
 - b. Test continuity of each circuit.
 3. Tests and Inspections:
 - a. Inspect controllers, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.
 - b. Test insulation resistance for each enclosed controller element, component, connecting motor supply, feeder, and control circuits.
 - c. Test continuity of each circuit.
 - d. Verify that voltages at controller locations are within 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify the Owner before starting the motor(s).
 - e. Test each motor for proper phase rotation.
 - f. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - g. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - h. Perform the following infrared (thermographic) scan tests and inspections and prepare reports:
 - 1) Initial Infrared Scanning: After Final Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each multipole enclosed controller. Remove front panels so joints and connections are accessible to portable scanner.
 - 2) Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each multipole enclosed controller 11 months after date of Final Completion.



- 3) Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - i. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
 - j. Mark up a set of manufacturer's drawings with all field modifications incorporated during construction and return to manufacturer for inclusion in Record Drawings.
 4. Enclosed controllers will be considered defective if they do not pass tests and inspections.
 5. Prepare test and inspection reports, including a certified report that identifies enclosed controllers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- H. Startup Service
1. Perform startup service.
 - a. Complete installation and startup checks according to manufacturer's written instructions.
- I. Adjusting
1. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.
 2. Adjust overload relay heaters or settings if power factor correction capacitors are connected to the load side of the overload relays.
 3. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable, instantaneous trip elements. Initially adjust to six times the motor nameplate full-load amperes and attempt to start motors several times, allowing for motor cool-down between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify the Owner before increasing settings.
 4. Set the taps on reduced-voltage autotransformer controllers at 50 **OR** 65 **OR** 80, **as directed**, percent.
 5. Set field-adjustable switches and program microprocessors for required start and stop sequences in reduced-voltage, solid-state controllers.
 6. Program microprocessors in VFCs for required operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing and prior to Final Completion.
 7. Set field-adjustable circuit-breaker trip ranges as specified in Division 26 Section "Overcurrent Protective Device Coordination Study".
- J. Protection
1. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until enclosed controllers are ready to be energized and placed into service.
 2. Replace controllers whose interiors have been exposed to water or other liquids prior to Final Completion.
- K. Demonstration
1. Train the Owner's maintenance personnel to adjust, operate, and maintain enclosed controllers, and to use and reprogram microprocessor-based, reduced-voltage, solid-state controllers, **as directed**.

END OF SECTION 26 09 23 00c



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SECTION 26 09 23 00d - CENTRAL DIMMING CONTROLS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for central dimming controls. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes microprocessor-based central dimming controls with the following components:
 - a. Control network.
 - b. Master-control stations.
 - c. Partitioned-space master-control stations.
 - d. Wall stations.
 - e. Dimmer cabinets.
 - f. Manual switches and plates for controlling dimmers.

C. Definitions

1. Fade Override: The ability to temporarily set fade times to zero for all lighting scenes.
2. Fade Rate: The time it takes each zone to arrive at the next scene, dependent on the degree of change in lighting level.
3. Fade Time: The time it takes all zones to fade from one lighting scene to another, with all zones arriving at the next scene at the same time.
4. Low Voltage: As defined in NFPA 70, term for circuits and equipment operating at less than 50 V or for remote-control, signaling, and power-limited circuits.
5. Scene: The lighting effect created by adjusting several zones of lighting to the desired intensity.
6. SCR: Silicon-controlled rectifier.
7. Zone: A fixture or group of fixtures controlled simultaneously as a single entity. Also known as a "channel."

D. Submittals

1. Product Data: For each type of product indicated.
 - a. For central dimming controls; include elevation, features, characteristics, and labels.
 - b. For dimmer panels; include dimensions, features, dimmer characteristics, ratings, and directories.
 - c. Device plates, plate color, and material.
 - d. Ballasts and lamp combinations compatible with dimmer controls.
 - e. Sound data including results of operational tests of central dimming controls.
 - f. Operational documentation for software and firmware.
2. Shop Drawings: Detail assemblies of standard components, custom assembled for specific application on Project. Indicate dimensions, weights, arrangement of components, and clearance and access requirements.
 - a. Include elevation views of front panels of control and indicating devices and control stations.
 - b. Wiring Diagrams: Power, signal, and control wiring.
3. Samples: For master-control stations, partitioned-space master-control stations, wall stations, dimmer cabinets, and faceplates with factory-applied color finishes and technical features.
 - a. Operation and Maintenance Data: For central dimming controls with remote-mounting dimmers to include in emergency, operation, and maintenance manuals.
4. Warranty: Special warranty specified in this Section.



- E. Quality Assurance
1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
 2. Comply with 47 CFR 15, Subparts A and B, for Class A digital devices.
 3. Comply with NFPA 70.
- F. Warranty
1. Manufacturer's standard form in which manufacturer agrees to repair or replace components of central dimming controls that fail in materials or workmanship within specified warranty period.
 - a. Failures include, but are not limited to, the following:
 - 1) Damage from transient voltage surges.
 - b. Warranty Period: Cost to repair or replace any parts for two years from date of Final Completion.
 - c. Extended Warranty Period: Cost of replacement parts (materials only, f.o.b. the nearest shipping point to Project site), for eight years, that failed in service due to transient voltage surges.
- G. Software Service Agreement
1. Services in this Article may not be allowed for publicly funded projects.
 2. Technical Support: Beginning with Final Completion, provide software support for two years.
 3. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Final Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
 - a. Provide 30 days' notice to the Owner to allow scheduling and access to system and to allow the Owner to upgrade computer equipment if necessary.

1.2 PRODUCTS

- A. General System Requirements
1. Compatibility: Dimming control components shall be compatible with other elements of lighting fixtures, ballasts, transformers, and lighting controls.
 2. Line-Voltage Surge Suppression: Factory installed as an integral part of 120- and 277-V ac, solid-state dimmers and control panels.
 - a. Alternative Line-Voltage Surge Suppression: Comply with requirements in Division 26 Section "Transient-voltage Suppression For Low-voltage Electrical Power Circuits" for Category A **OR** B, **as directed**, locations.
 3. Dimmers and Dimmer Modules: Comply with UL 508.
 - a. Audible Noise and Radio-Frequency Interference Suppression: Solid-state dimmers shall operate smoothly over their operating ranges without audible lamp or dimmer noise or radio-frequency interference. Modules shall include integral or external filters to suppress audible noise and radio-frequency interference.
 - b. Dimmer or Dimmer-Module Rating: Not less than 125 percent of connected load unless otherwise indicated.
- B. System Description
1. Description: Microprocessor-based, solid-state controls consisting of control stations and a separately mounted dimmer cabinet.
 - a. Operation: Change variable dimmer settings of indicated number of zones simultaneously from one preset scene to another when a rocker switch **OR** pushbutton **OR** slider, **as directed**, is operated.
 - b. System control shall include master station(s), wall stations, and dimmer panels.
 - c. Each zone shall be configurable to control the following light sources:



- 1) Fluorescent lamps with electronic **OR** magnetic, **as directed**, ballasts.
 - 2) Line-voltage incandescent lamps.
 - 3) Low-voltage incandescent lamps.
 - 4) Cold cathode lamps.
 - 5) Non-dimmed loads.
 - 6) LED lamps.
- d. Control of each zone shall interface with controls for the following accessory functions:
- 1) Curtains and drapes.
 - 2) Blackout curtains.
 - 3) Projector screens.
 - 4) Motorized partitions.
 - 5) Manually positioned partitions.
- e. Memory: Retain preset scenes and fade settings through power failures for at least 90 days by retaining physical settings of controls or by an on-board, automatically recharged battery.
- C. Control Network
1. Dimmers shall receive signals from control stations that are linked to dimmer cabinet with a common network data cable.
 2. Functions of network control stations shall be set up at master station that include the number and arrangement of scene presets, zones, and fade times at wall stations.
 - a. Control Voltage: 24- or 10-V dc.
 - b. Comply with USITT AMX 192 **OR** USITT DMX 512, **as directed**, for data transmission.
- D. Master-Control Stations
1. Functions and Features:
 - a. Control adjustment of the lighting level for each scene of each zone, and adjustment of fade-time setting for each scene change from one preset scene to another. Controls shall use analog manual sliders **OR** digital rocker switches with LCD graphic display of light level, **as directed**.
 - b. Master channel shall raise and lower lighting level of all zones.
 - c. Fade rate for each scene shall be adjustable from zero to 60 seconds.
 - d. Fade override control for each scene.
 - e. Recall each preset scene and allow adjustment of zone controls associated with that scene.
 - f. Lockout switch to prevent changes when set.
 - g. On and off scene controls for non-dim channel contactors.
 - h. Emergency-control pushbutton to bypass all controls, turning all dimmers to full bright and turning on non-dim channel contactors.
 - i. Master on and off switch; off position enables housekeeping controls.
 - j. Housekeeping controls to turn on selected lighting fixtures for housekeeping functions.
 - k. Pushbuttons for accessory functions.
 - l. Enable and disable wall stations.
 - m. Communications link to other master stations.
 - n. Provide for connecting a portable computer to program the master station.
 - o. Rear-illuminate all scene-select buttons.
 - p. Show lighting-level setting and fade-rate setting graphically using LEDs or backlighted bar-graph indicator.
 2. Mounting: Single, flush wall box with manufacturer's standard faceplate with hinged transparent locking cover, **as directed**.
- E. Partitioned-Space Master-Control Station
1. Functions and Features:
 - a. Automatically combine and separate lighting and accessory function controls as spaces are configured with movable partitions; with controls for adjustment of the lighting level for



- each scene of each dimmer, and adjustment of fade-rate setting for each scene change from one preset scene to another.
- b. Master controls shall accommodate partitioning the space into six adjacent rooms.
 - c. Manual controls to set up six scenes for each room. Include wall stations in each room to control scenes.
 - d. Master channel to raise and lower the lighting level of all zones.
 - e. Adjustable fade rate for each scene from zero to 60 seconds.
 - f. Fade override control for each scene.
 - g. On and off scene controls for non-dim channel contactors.
 - h. Emergency-control pushbutton to bypass all controls, turning all dimmers to full bright and turning on non-dim channel contactors.
 - i. Master on and off switch; off position enables housekeeping controls.
 - j. Housekeeping controls to turn on selected lighting fixtures for housekeeping functions.
 - k. Pushbuttons for accessory functions.
 - l. Provide for connecting a portable computer to program the master station.
 - m. Rear-illuminate all scene-select buttons.
 - n. Show lighting-level setting and fade-rate setting graphically using LEDs or backlighted bar-graph indicator.
2. Custom Graphics. Include a graphical display of room configurations and the names for each. Indicate the current spaces configuration with LCD graphic or LED-illuminated indicators, and show which wall stations are active. Inactive wall stations shall be automatically deactivated.
 3. Mounting: Single, flush wall box with manufacturer's standard faceplate with hinged transparent locking cover, **as directed**.

F. Wall Stations

1. Functions and Features:
 - a. Wall stations shall function as a submaster to a master station, containing limited control of selected scenes of the master station.
 - b. Controls to adjust the lighting level of each dimmer for each scene, and the fade time setting for each scene change from one preset scene to another.
 - c. Numbered pushbuttons to select scenes.
 - d. Off switch to turn master station off. Operating the off switch at any remote station shall automatically turn on selected housekeeping lighting, **as directed**.
 - e. On switch turns all scenes of master station to full bright.
 - f. Pushbutton controls for accessory functions.
2. Mounting: Flush, wall box with manufacturer's standard faceplate.
3. Hand-held Cordless Control: Scene-select and accessory function pushbuttons using infrared **OR** radio-frequency, **as directed**, transmission.

G. Dimmer Cabinets

1. Factory wired, convection cooled without fans, with barriers to accommodate 120- and 277-V feeders and suitable to control designated lighting equipment or accessory functions.
2. Ambient Conditions:
 - a. Temperature: 60 to 95 deg F (15 to 35 deg C).
 - b. Relative Humidity: 10 to 90 percent, noncondensing.
 - c. Filtered air supply.
3. Dimmer Cabinet Assembly: NRTL listed and labeled.
4. Cabinet Type: Plug in, modular, and accepting dimmers of each specified type in any plug-in position.
 - a. Integrated Fault-Current Rating: 10,000-A RMS symmetrical.
5. Lighting Dimmers: Solid-state SCR dimmers.
 - a. Primary Protection: Magnetic or thermal-magnetic circuit breaker, also serving as the disconnecting means.
 - b. Dimmer response to control signal shall follow the "Square Law Dimming Curve" specified in IESNA's "IESNA Lighting Handbook."



- c. Dimming Range: 0 to 100 percent, full output voltage not less than 98 percent of line voltage.
 - d. Dimmed circuits shall be filtered to provide a minimum 350-mic.sec. current-rise time at a 90-degree conduction angle and 50 percent of rated dimmer capacity. Rate of current rise shall not exceed 30 mA/mic.sec., measured from 10 to 90 percent of load-current waveform.
 - e. Protect controls of each dimmer with a fuse and transient voltage surge suppression, **as directed**.
6. Non-dim modules shall include relays with contacts rated to switch 20-A tungsten-filament load at 120-V ac and 20-A electronic ballast load at 277-V ac.
 7. Accessory function control modules shall be compatible with requirement of the accessory being controlled.
 8. Digital Control Network:
 - a. Dimmers shall receive digital signals from digital network control stations that are linked to the dimmer cabinet with a common network data cable.
 - b. Functions of digital network control stations shall be set up at the dimmer cabinet's electronic controls that include indicated number and arrangement of scene presets, channels, and fade times.
 9. Emergency Power Transfer Switch: Comply with UL 1008; factory prewired and pretested to automatically transfer load circuits from normal to emergency power supply when normal supply fails.
 - a. Transfer from normal to emergency supply when normal-supply voltage drops to 55 percent or less.
 - b. Retransfer immediately to normal on failure of emergency supply and after an adjustable time-delay of 10 to 90 seconds on restoration of normal supply while emergency supply is available.
 - c. Integrated Fault-Current Rating: Same value as listed for the panel.
 - d. Test Switch: Simulate failure of normal supply to test controls associated with transfer scheme.
 - e. Fabricate and test dimmer boards to withstand seismic forces defined in Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
- H. Portable Computer
1. Description: As recommended by master-control station manufacturer, to program master station and associated wall stations, and all interconnected master stations, **as directed**. Portable computer shall be laptop style with a battery runtime of at least two hours. Display shall be an 11-inch (280-mm) interactive-matrix LCD and shall have required hardware, firmware, and software to program specified control functions of master-control stations.
 2. Software shall be configured and customized by master-station manufacturer.
- I. Manual Switches And Plates
1. Switches: Modular, momentary pushbutton, low-voltage type.
 - a. Color: White unless otherwise indicated.
 - b. Integral Pilot Light: Indicate when circuit is on. Use where indicated.
 - c. Locator Light: Internal illumination.
 - d. Wall Plates: Comply with requirements in Division 26 Section "Wiring Devices" for materials, finish, and color. Use multigang plates if more than one switch is indicated at a location.
 - e. Legend: Engraved or permanently silk-screened on wall plate where indicated. Use designations indicated on Drawings.
- J. Conductors And Cables
1. Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-voltage Electrical Power Conductors And Cables".



2. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 **OR** 22 **OR** 24, **as directed**, AWG. Comply with requirements in Division 26 Section "Low-voltage Electrical Power Conductors And Cables".
3. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 **OR** 16 **OR** 18, **as directed**, AWG. Comply with requirements in Division 26 Section "Low-voltage Electrical Power Conductors And Cables".
4. Unshielded, Twisted-Pair Data Cable: Category 5e **OR** 6, **as directed**. Comply with requirements in Division 27 Section "Communications Horizontal Cabling".

1.3 EXECUTION

A. Wiring Installation

1. Comply with NECA 1.
2. Wiring Method:
 - a. Comply with requirements in Division 26 Section "Low-voltage Electrical Power Conductors And Cables"
 - b. Install unshielded, twisted-pair cable for control and signal transmission conductors, complying with Division 27 Section "Communications Horizontal Cabling".
 - c. Minimum conduit size shall be 1/2 inch (13 mm).
3. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
4. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.
5. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.
6. Install dimmer cabinets for each zone.

B. Identification

1. Comply with requirements in Division 26 Section "Identification For Electrical Systems" for identifying components and power and control wiring.
2. Label each dimmer module with a unique designation.
3. Label each scene control button with approved scene description.

C. Field Quality Control

1. Perform tests and inspections and prepare test reports.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Tests and Inspections:
 - a. Continuity tests of circuits.
 - b. Operational Test: Set and operate controls to demonstrate their functions and capabilities in a methodical sequence that cues and reproduces actual operating functions.
 - 1) Include testing of dimming control equipment under conditions that simulate actual operational conditions. Record control settings, operations, cues, and functional observations.
 - c. Emergency Power Transfer: Test listed functions.
3. Remove and replace malfunctioning dimming control components and retest as specified above.
4. Test Labeling: After satisfactory completion of tests and inspections, apply a label to tested components indicating test results, date, and responsible agency and representative.
5. Reports: Written reports of tests and observations. Record defective materials and workmanship and unsatisfactory test results. Record repairs and adjustments.

D. Demonstration



1. Engage a factory-authorized service representative to train **OR** Train, **as directed**, the Owner's maintenance personnel to adjust, operate, and maintain central dimming controls. Laptop portable computer shall be used in training, **as directed**.
2. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control system specified in Division 26 Section "Network Lighting Controls".

END OF SECTION 26 09 23 00d



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SECTION 26 09 23 00e - MODULAR DIMMING CONTROLS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for modular dimming controls. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Manual modular dimming controls.
 - b. Integrated, multipreset modular dimming controls.

C. Definitions

1. Fade Rate: The time it takes each zone to arrive at the next scene, dependent on the degree of change in lighting level.
2. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling and power-limited circuits.
3. Scene: The lighting effect created by adjusting several zones of lighting to the desired intensity.
4. SCR: Silicon-controlled rectifier.
5. Zone: A fixture or group of fixtures controlled simultaneously as a single entity. Also known as a "channel."

D. Submittals

1. Product Data: For each type of product indicated.
 - a. For modular dimming controls; include elevation, dimensions, features, characteristics, ratings, and labels.
 - b. Device plates and plate color and material.
 - c. Ballasts and lamp combinations compatible with dimmers.
 - d. Wiring Diagrams: Power, signal, and control wiring.
2. Samples: For master and remote-control stations, and faceplates with factory-applied color finishes and technical features.

E. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. Comply with NFPA 70.

1.2 PRODUCTS

A. General Dimming Device Requirements

1. Compatibility: Dimming control components shall be compatible with other elements of lighting fixtures, ballasts, transformers, and lighting controls.
2. Dimmers and Dimmer Modules: Comply with UL 508.
 - a. Audible Noise and Radio-Frequency Interference Suppression: Solid-state dimmers shall operate smoothly over their operating ranges without audible lamp or dimmer noise or radio-frequency interference. Modules shall include integral or external filters to suppress audible noise and radio-frequency interference.
 - b. Dimmer or Dimmer-Module Rating: Not less than 125 percent of connected load unless otherwise indicated.



B. Manual Modular Multiscene Dimming Controls

1. Description: Factory-fabricated equipment providing manual modular dimming control consisting of a wall-box-mounted, master-scene controller and indicated number of wall-box zone stations. Controls and dimmers shall be integrated for mounting in one-, two-, or three-gang wall box under a single wall plate. Each zone station shall be adjustable to indicated number of scenes, which shall be recorded on the zone controller.
2. Operation: Automatically change variable dimmer settings of indicated number of zones simultaneously from one preset scene to another when a push button is operated.
3. Each manual modular multiscene dimming controller shall include a master control and remote controls.
4. Each zone shall be configurable to control the following:
 - a. Fluorescent lamps with electronic **OR** magnetic, **as directed**, ballasts.
 - b. Incandescent lamps.
 - c. Low-voltage incandescent lamps.
5. Memory: Retain preset scenes through power failures for at least seven days.
6. Device Plates: Style, material, and color shall comply with Division 26 Section "Wiring Devices".
7. Master-Scene Controller: Suitable for mounting in a single flush wall box.
 - a. Switches: Master off, group dim, group bright, and selectors for each scene.
 - b. LED indicator lights, one associated with each scene switch, and one for the master off switch.
8. Fluorescent Zone Dimmer: Suitable for operating lighting fixtures and ballasts specified in Division 26 Section "Interior Lighting", and arranged to dim number of scenes indicated for the master-scene controller. Scene selection is at the master-scene controller for setting light levels of each zone associated with scene.
 - a. Switch: Rocker **OR** Slider, **as directed**, style for setting the light level for each scene.
 - b. LED indicator lights, one associated with each scene.
 - c. Electrical Rating: 1000 **OR** 2000, **as directed**, VA, 120 V.
9. Incandescent Zone Dimmer: Suitable for operating incandescent lamps at line-voltage or low-voltage lamps connected to a transformer and arranged to dim number of scenes indicated for the master-scene controller. Scene selection shall be at the master-scene controller for setting light levels of each zone associated with scene.
 - a. Switch: Rocker **OR** Slider, **as directed**, style for setting the light level for each scene.
 - b. LED indicator lights, one associated with each scene.
 - c. Voltage Regulation: Dimmer shall maintain a constant light level, with no visible flicker, when the source voltage varies plus or minus 2 percent in RMS voltage.

C. Integrated, Multipreset Modular Dimming Controls

1. Indicate number of wall-box, remote-control stations.
2. Description: Factory-fabricated, microprocessor-based, solid-state controls providing manual dimming control consisting of a master station and multiple wall-box, remote-control stations.
3. Operation: Automatically changes variable dimmer settings of indicated number of zones simultaneously from one preset scene to another when a push button is operated.
4. Each zone shall be configurable to control the following:
 - a. Fluorescent lamps with electronic **OR** magnetic, **as directed**, ballasts.
 - b. Incandescent lamps.
 - c. Low-voltage incandescent lamps.
5. Memory: Retain preset scenes and fade settings through power failures by retaining physical settings of controls.
6. Master Station:
 - a. Contains control panel and multiple control and dimmer modules.
 - b. Controls and commands adjustment of each dimmer-zone setting for each scene change from one preset scene to another.
 - 1) Master zone raises and lowers lighting level.
 - 2) Adjustable fade rate for each scene from 1 to 60 seconds.
 - c. Rear-illuminated, scene-select buttons.



- d. Lighting-level setting and fade-rate setting shall be graphically shown using LEDs or backlighted bar-graph indicator.
- e. Mounting: Flush wall box with manufacturer's standard faceplate.
7. Remote-Control Stations:
 - a. Numbered push buttons to select scenes.
 - b. Off switch to turn master station off. Operating the off switch at any remote station shall automatically turn on selected housekeeping lighting, **as directed**.
 - c. On switch turns all scenes of master station to full bright.
 - d. Control Wiring: NFPA 70, Class 2.
 - e. Mounting: Single flush wall box with manufacturer's standard faceplate.
8. Infrared Remote-Control Station: Same functions as for standard remote-control station, except that functions are input by a hand-held infrared transmitter.
9. Dimmers: Modular, plug-in type, with circuit breaker to protect the dimmer and branch circuit.
 - a. Dimming Circuit: Two SCR dimmers, in inverse parallel configuration.
 - b. Dimming Curve: Modified "square law" as specified in IESNA's "IESNA Lighting Handbook"; control voltage is 0- to 10-V dc.
 - c. Dimming Range: 0 to 100 percent, full output voltage not less than 98 percent of line voltage.
 - d. Voltage Regulation: Dimmer shall maintain a constant light level, with no visible flicker, when the source voltage varies plus or minus 2 percent in RMS voltage.
 - e. Short-Circuit Rating: 10 kA for 120 V, 14 kA for 277 V.

D. Conductors And Cables

1. Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-voltage Electrical Power Conductors And Cables".
2. Class 2 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 **OR** 22 **OR** 24, **as directed**, AWG. Comply with requirements in Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

1.3 EXECUTION

A. Wiring Installation

1. Comply with NECA 1.
2. Wiring Method: Comply with requirements in Division 26 Section "Low-voltage Electrical Power Conductors And Cables". Minimum conduit size shall be 1/2 inch (13 mm).
3. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
4. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.
5. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

B. Identification

1. Comply with requirements in Division 26 Section "Identification For Electrical Systems" for identifying components and power and control wiring.
2. Label each dimmer module with a unique designation.
3. Label each scene control button with approved scene description.

C. Field Quality Control

1. Perform tests and inspections and prepare test reports.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.



2. Tests and Inspections:
 - a. Continuity tests of circuits.
 - b. Operational Test: Set and operate controls to demonstrate their functions and capabilities in a methodical sequence that cues and reproduces actual operating functions.
 - 1) Include testing of modular dimming control equipment under conditions that simulate actual operational conditions. Record control settings, operations, cues, and functional observations.
3. Remove and replace malfunctioning modular dimming control components and retest as specified above.
4. Test Labeling: After satisfactory completion of tests and inspections, apply a label to tested components indicating test results, date, and responsible agency and representative.
5. Reports: Written reports of tests and observations. Record defective materials and workmanship and unsatisfactory test results. Record repairs and adjustments.

D. Demonstration

1. Engage a factory-authorized service representative to train **OR** Train, **as directed**, Owner's maintenance personnel to adjust, operate, and maintain modular dimming controls. Laptop portable computer shall be used in training, **as directed**.
2. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control system specified in Division 26 Section "Network Lighting Controls".

END OF SECTION 26 09 23 00e



Task	Specification	Specification Description
26 21 13 00	26 05 13 00	Conductors And Cables
26 21 13 00	26 05 13 00a	Undercarpet Cables
26 21 13 00	26 05 13 00b	Medium-Voltage Cables



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SECTION 26 22 13 00 - MEDIUM-VOLTAGE TRANSFORMERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for medium-voltage transformers. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following types of transformers with medium-voltage primaries:
 - a. Liquid-filled distribution and power transformers.
 - b. Dry-type distribution and power transformers.
 - c. Pad-mounted, liquid-filled transformers.

C. Definitions

1. NETA ATS: Acceptance Testing Specification.

D. Submittals

1. Product Data: Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, location of each field connection, and performance for each type and size of transformer indicated.
2. Shop Drawings: Diagram power signal and control wiring.
3. Manufacturer Seismic Qualification Certification: Submit certification that transformer assembly and components will withstand seismic forces defined in Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
4. Field quality-control test reports.
5. Follow-up service reports.
6. Operation and Maintenance Data: For transformer and accessories to include in emergency, operation, and maintenance manuals.

E. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. Comply with IEEE C2.
3. Comply with ANSI C57.12.10, ANSI C57.12.28, IEEE C57.12.70, and IEEE C57.12.80.
4. Comply with NFPA 70.

F. Delivery, Storage, And Handling

1. Store transformers protected from weather and so condensation will not form on or in units. Provide temporary heating according to manufacturer's written instructions.

G. Project Conditions

1. Service Conditions: IEEE C37.121, usual service conditions except for the following:
 - a. Exposure to significant solar radiation.
 - b. Altitudes above 3300 feet (1000 m).
 - c. Exposure to fumes, vapors, or dust.
 - d. Exposure to explosive environments.
 - e. Exposure to hot and humid climate or to excessive moisture, including steam, salt spray, and dripping water.
 - f. Exposure to seismic shock or to abnormal vibration, shock, or tilting.
 - g. Exposure to excessively high or low temperatures.



- h. Unusual transportation or storage conditions.
- i. Unusual grounding-resistance conditions.
- j. Unusual space limitations.

1.2 PRODUCTS

A. Liquid-Filled Distribution And Power Transformers

1. Description: IEEE C57.12.00 and UL 1062, liquid-filled, 2-winding transformers.
2. Insulating Liquid: Mineral oil, complying with ASTM D 3487, Type II, and tested according to ASTM D 117.
OR
 Insulating Liquid: Less flammable, edible-seed-oil based, and UL listed as complying with NFPA 70 requirements for fire point of not less than 300 deg C when tested according to ASTM D 92. Liquid shall be biodegradable and nontoxic.
OR
 Insulating Liquid: Less flammable, dielectric, and UL listed as complying with NFPA 70 requirements for fire point of not less than 300 deg C when tested according to ASTM D 92. Liquid shall be biodegradable and nontoxic.
OR
 Insulating Liquid: Less flammable, silicone-based dielectric, and UL listed as complying with NFPA 70 requirements for fire point of not less than 300 deg C when tested according to ASTM D 92. Liquid shall have low toxicity and be nonhazardous.
3. Insulation Temperature Rise: 65/55 deg C, based on an average ambient temperature of 30 deg C over 24 hours with a maximum ambient temperature of 40 deg C. Insulation system shall be rated to continuously allow an additional 12 percent kilovolt-ampere output, at 65 deg C temperature rise, without decreasing rated transformer life.
OR
 Insulation Temperature Rise: 65 deg C, based on an average ambient temperature of 30 deg C over 24 hours with a maximum ambient temperature of 40 deg C.
4. Basic Impulse Level: Comply with UL 1062.
OR
 Basic Impulse Level: 60 **OR** 75 **OR** 95 **OR** 110, **as directed** kV.
5. Full-Capacity Voltage Taps: Four nominal 2.5 percent taps, 2 above and 2 below rated primary voltage; with externally operable tap changer for de-energized use and with position indicator and padlock hasp.
OR
 Full-Capacity Voltage Taps: Four nominal 2.5 percent taps below rated primary voltage, with externally operable tap changer for de-energized use and with position indicator and padlock hasp.
6. Cooling System: Class OA, self-cooled **OR** OA/FA, self-cooled, and with forced-air-cooled rating **OR** OA/FFA, self-cooled, and with provisions for future forced-air-cooled rating, **as directed**. Cooling systems shall include auxiliary cooling equipment, automatic controls, and status indicating lights.
7. Sound level may not exceed sound levels listed in NEMA TR 1, without fans operating.
8. Accessories: Grounding pads, lifting lugs, and provisions for jacking under base. Transformers shall have a steel base and frame allowing use of pipe rollers in any direction, and an insulated, low-voltage, neutral bushing with removable ground strap. Include the following additional accessories:
 - a. Liquid-level gage.
 - b. Pressure-vacuum gage.
 - c. Liquid temperature indicator.
 - d. Drain and filter valves.
 - e. Pressure relief device.

**B. Dry-Type Distribution And Power Transformers**

1. Description: NEMA ST 20, IEEE C57.12.01, ANSI C57.12.50 for dry-type transformers rated up to 500 kVA, ANSI C57.12.51 for dry-type transformers rated 501 kVA and larger, or ANSI C57.12.52 for sealed dry-type transformers rated 501 kVA and larger, UL 1562 listed and labeled, dry-type, 2-winding transformers.
 - a. Indoor, ventilated **OR** Outdoor, ventilated **OR** Totally enclosed, nonventilated, **as directed**, cast coil/encapsulated coil, with primary and secondary windings individually cast in epoxy; with insulation system rated at 185 deg C with an 80 deg C average winding temperature rise above a maximum ambient temperature of 40 deg C.
 - b. Indoor, ventilated **OR** Outdoor, ventilated **OR** Totally enclosed, nonventilated, **as directed**, vacuum-pressure impregnated and with insulation system rated at 220 deg C with an 80 deg C average winding temperature rise above a maximum ambient temperature of 40 deg C.
2. Primary Connection: Air terminal compartment with removable **OR** hinged, **as directed**, door. Tin-plated copper bar for incoming line termination, predrilled to accept terminals for indicated conductors.
OR
Primary Connection: Transition terminal compartment with connection pattern to match switchgear.
3. Secondary Connection: Air terminal compartment with removable **OR** hinged, **as directed**, door. Tin-plated copper bar for incoming line termination, predrilled to accept terminals for indicated conductors.
OR
Secondary Connection: Transition terminal compartment with connection pattern to match switchgear **OR** bus duct, **as directed**.
4. Insulation Materials: IEEE C57.12.01, rated at 220 deg C.
5. Insulation Temperature Rise: 80 **OR** 115 **OR** 150, **as directed**, deg C, maximum rise above 40 deg C.
6. Basic Impulse Level: 60 **OR** 75 **OR** 95 **OR** 110, **as directed**, kV.
7. Full-Capacity Voltage Taps: Four nominal 2.5 percent taps, 2 above and 2 below rated primary voltage.
OR
Full-Capacity Voltage Taps: Four nominal 2.5 percent taps below rated primary voltage.
8. Cooling System: Class AA, self-cooled **OR** AA/FA, self-cooled, and with forced-air-cooled rating **OR** AA/FFA, self-cooled, and with provisions for future forced-air-cooled rating, **as directed**, complying with IEEE C57.12.01.
 - a. Automatic forced-air cooling system controls, including thermal sensors, fans, control wiring, temperature controller with test switch, power panel with current-limiting fuses, indicating lights, alarm, and alarm silencing relay.
 - b. Include mounting provision for fans.
9. Sound level may not exceed sound levels listed in NEMA TR 1, without fans operating.
10. High-Temperature Alarm: Sensor at transformer with local audible and visual alarm and contacts for remote alarm.

C. Pad-Mounted, Liquid-Filled Transformers

1. Description: ANSI C57.12.13, ANSI C57.12.26 for pad-mounted transformers with dead-front, separable, insulated, high-voltage, load-break cable connectors, IEEE C57.12.00 IEEE C57.12.22 for pad-mounted transformers with live-front high-voltage bushings pad-mounted, 2-winding transformers. Stainless-steel tank base and cabinet, **OR** cabinet, and sills, **as directed**.
2. Insulating Liquid: Mineral oil, complying with ASTM D 3487, Type II, and tested according to ASTM D 117.
OR
Insulating Liquid: Less flammable, edible-seed-oil based, and UL listed as complying with NFPA 70 requirements for fire point of not less than 300 deg C when tested according to ASTM D 92. Liquid shall be biodegradable and nontoxic.

**OR**

Insulating Liquid: Less flammable, dielectric, and UL listed as complying with NFPA 70 requirements for fire point of not less than 300 deg C when tested according to ASTM D 92. Liquid shall be biodegradable and nontoxic.

OR

Insulating Liquid: Less flammable, silicone-based dielectric, and UL listed as complying with NFPA 70 requirements for fire point of not less than 300 deg C when tested according to ASTM D 92. Liquid shall have low toxicity and be nonhazardous.

3. Insulation Temperature Rise: 55 **OR** 65, **as directed**, deg C when operated at rated kVA output in a 40 deg C ambient temperature. Transformer shall be rated to operate at rated kilovolt ampere in an average ambient temperature of 30 deg C over 24 hours with a maximum ambient temperature of 40 deg C without loss of service life expectancy.
4. Basic Impulse Level: 30 **OR** 60 **OR** 95, **as directed**, kV.
5. Full-Capacity Voltage Taps: Four 2.5 percent taps, 2 above and 2 below rated high voltage; with externally operable tap changer for de-energized use and with position indicator and padlock hasp.
6. High-Voltage Switch: 200 **OR** 300 **OR** 400, **as directed**, A, make-and-latch rating of 10-kA RMS, symmetrical, arranged for radial feed with 3-phase, 2-position, gang-operated, load-break switch that is oil immersed in transformer tank with hook-stick operating handle in primary compartment.
- OR**
High-Voltage Switch: 200 **OR** 300 **OR** 400, **as directed**, A, make-and-latch rating of 10-kA RMS, symmetrical, arranged for loop feed with 3-phase, 4-position, gang-operated, load-break switch that is oil immersed in transformer tank with hook-stick operating handle in primary compartment.
7. Primary Fuses: 150-kV fuse assembly with fuses complying with IEEE C37.47. Rating of current-limiting fuses shall be 50-kA RMS at specified system voltage.
 - a. Current-limiting type in dry-fuse holder wells, mechanically interlocked with liquid-immersed switch in transformer tank to prevent disconnect under load.
 - b. Internal liquid-immersed cartridge fuses.
 - c. Bay-O-Net liquid-immersed fuses that are externally replaceable without opening transformer tank.
 - d. Bay-O-Net liquid-immersed fuses in series with liquid-immersed current-limiting fuses. Bay-O-Net fuses shall be externally replaceable without opening transformer tank.
 - e. Bay-O-Net liquid-immersed current-limiting fuses that are externally replaceable without opening transformer tank.
8. Surge Arresters: Distribution class, one for each primary phase; complying with IEEE C62.11 and NEMA LA 1; support from tank wall within high-voltage compartment. Transformers shall have three arresters for radial-feed **OR** three arresters for loop-feed **OR** six arresters for loop-feed, **as directed**, circuits.
9. High-Voltage Terminations and Equipment: Live front with externally clamped porcelain bushings and cable connectors suitable for terminating primary cable.

OR

High-Voltage Terminations and Equipment: Dead front with universal-type bushing wells for dead-front bushing-well inserts, complying with IEEE 386 and including the following:

- a. Bushing-Well Inserts: One for each high-voltage bushing well.
 - b. Surge Arresters: Dead-front, elbow-type, metal-oxide-varistor units.
 - c. Parking Stands: One for each high-voltage bushing well.
 - d. Portable Insulated Bushings: Arranged for parking insulated, high-voltage, load-break cable terminators; one for each primary feeder conductor terminating at transformer.
10. Accessories:
 - a. Drain Valve: 1 inch (25 mm), with sampling device.
 - b. Dial-type thermometer.
 - c. Liquid-level gage.
 - d. Pressure-vacuum gage.
 - e. Pressure Relief Device: Self-sealing with an indicator.
 - f. Mounting provisions for low-voltage current transformers.



- g. Mounting provisions for low-voltage potential transformers.
- h. Busway terminal connection at low-voltage compartment.
- i. Alarm contacts for gages and thermometer listed above.

D. Identification Devices

- 1. Nameplates: Engraved, laminated-plastic or metal nameplate for each transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Division 26 Section "Identification For Electrical Systems".

E. Source Quality Control

- 1. Factory Tests: Perform design and routine tests according to standards specified for components. Conduct transformer tests according to ANSI C57.12.50 for ventilated dry-type distribution transformers 1 to 500 kVA, single phase, and 15 to 500 kVA, 3 phase, with high voltage 601 to 34,500 V and low voltage 208Y/120 to 4160 V; ANSI C57.12.51 for ventilated dry-type power transformers 501 kVA and larger, 3 phase, with high voltage 601 to 34,500 V and low voltage 208Y/120 to 4160 V; IEEE C57.12.90 for liquid-filled transformers; and IEEE C57.12.91 for dry-type distribution and power transformers.
- 2. Factory Tests: Perform the following factory-certified tests on each transformer:
 - a. Resistance measurements of all windings on rated-voltage connection and on tap extreme connections.
 - b. Ratios on rated-voltage connection and on tap extreme connections.
 - c. Polarity and phase relation on rated-voltage connection.
 - d. No-load loss at rated voltage on rated-voltage connection.
 - e. Excitation current at rated voltage on rated-voltage connection.
 - f. Impedance and load loss at rated current on rated-voltage connection and on tap extreme connections.
 - g. Applied potential.
 - h. Induced potential.
 - i. Temperature Test: If transformer is supplied with auxiliary cooling equipment to provide more than one rating, test at lowest kilovolt-ampere Class OA or Class AA rating and highest kilovolt-ampere Class OA/FA or Class AA/FA rating.
 - 1) Temperature test is not required if record of temperature test on an essentially duplicate unit is available.

1.3 EXECUTION

A. Installation

- 1. Install transformers on concrete bases.
 - a. Anchor transformers to concrete bases according to manufacturer's written instructions, seismic codes at Project, and requirements in Division 26 Section "Hangers And Supports For Electrical Systems".
 - b. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit and 4 inches (100 mm) high.
 - c. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-place Concrete".
 - d. Install dowel rods to connect concrete bases to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of base.
 - e. Install epoxy-coated anchor bolts, for supported equipment, that extend through concrete base and anchor into structural concrete floor.
 - f. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - g. Tack-weld or bolt transformers to channel-iron sills embedded in concrete bases. Install sills level and grout flush with floor or base.



2. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and NFPA 70.
- B. Identification
1. Identify field-installed wiring and components and provide warning signs as specified in Division 26 Section "Identification For Electrical Systems", **as directed**.
- C. Connections
1. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
 2. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".
- D. Field Quality Control
1. Perform the following field tests and inspections and prepare test reports:
 - a. After installing transformers but before primary is energized, verify that grounding system at substation is tested at specified value or less.
 - b. After installing transformers and after electrical circuitry has been energized, test for compliance with requirements.
 - c. Perform visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters.
 - d. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 2. Remove and replace malfunctioning units and retest as specified above.
 3. Test Reports: Prepare written reports to record the following:
 - a. Test procedures used.
 - b. Test results that comply with requirements.
 - c. Test results that do not comply with requirements and corrective actions taken to achieve compliance with requirements.
- E. Follow-Up Service
1. Voltage Monitoring and Adjusting: If requested by the Owner, perform the following voltage monitoring after Final Completion but not more than six months after Final Acceptance:
 - a. During a period of normal load cycles as evaluated by the Owner, perform seven days of three-phase voltage recording at secondary terminals of each transformer. Use voltmeters with calibration traceable to National Institute of Science and Technology standards and with a chart speed of not less than 1 inch (25 mm) per hour. Voltage unbalance greater than 1 percent between phases, or deviation of any phase voltage from nominal value by more than plus or minus 5 percent during test period, is unacceptable.
 - b. Corrective Actions: If test results are unacceptable, perform the following corrective actions, as appropriate:
 - 1) Adjust transformer taps.
 - 2) Prepare written request for voltage adjustment by electric utility.
 - c. Retests: After corrective actions have been performed, repeat monitoring until satisfactory results are obtained.
 - d. Report: Prepare written report covering monitoring and corrective actions performed.
 2. Infrared Scanning: Perform as specified in Division 26 Section "Medium-voltage Switchgear".

END OF SECTION 26 22 13 00



SECTION 26 22 13 00a - LOW-VOLTAGE TRANSFORMERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for low-voltage transformers. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:
 - a. Distribution transformers.
 - b. Buck-boost transformers.

C. Submittals

1. Product Data: For each product indicated.
2. Shop Drawings: Indicate dimensions and weights.
 - a. Wiring Diagrams: Power, signal, and control wiring.
3. Manufacturer Seismic Qualification Certification: Submit certification that transformers, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
4. Field quality-control test reports.
5. Operation and maintenance data.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. Comply with IEEE C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers."

E. Delivery, Storage, And Handling

1. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

1.2 PRODUCTS

A. General Transformer Requirements

1. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.
2. Cores: Grain-oriented, non-aging silicon steel.
3. Coils: Continuous windings without splices except for taps.
 - a. Internal Coil Connections: Brazed or pressure type.
 - b. Coil Material: Aluminum **OR** Copper, **as directed**.

B. Distribution Transformers

1. Comply with NEMA ST 20, and list and label as complying with UL 1561.
2. Provide transformers that are constructed to withstand seismic forces specified in Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
3. Cores: One leg per phase.
4. Enclosure: Ventilated **OR** Totally enclosed, nonventilated, **as directed**, NEMA 250, Type 2.



- a. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.
5. Enclosure: Ventilated **OR** Totally enclosed, nonventilated, **as directed**, NEMA 250, Type 3R **OR** Type 4X, stainless steel, **as directed**.
 - a. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.
6. Transformer Enclosure Finish: Comply with NEMA 250.
 - a. Finish Color: Gray **OR** ANSI 49 gray **OR** ANSI 61 gray, **as directed**.
7. Taps for Transformers Smaller Than 3 kVA: None **OR** One 5 percent tap above normal full capacity, **as directed**.
8. Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above and one 5 percent tap below normal full capacity **OR** Two 5 percent taps below rated voltage, **as directed**.
9. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity **OR** Two 2.5 percent taps above and four 2.5 percent taps below normal full capacity, **as directed**.
10. Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of 150 **OR** 115 **OR** 80, **as directed**, deg C rise above 40 deg C ambient temperature.
11. Energy Efficiency for Transformers Rated 15 kVA and Larger:
 - a. Complying with NEMA TP 1, Class 1 efficiency levels.
 - b. Tested according to NEMA TP 2.
12. K-Factor Rating: Transformers indicated to be K-factor rated shall comply with UL 1561 requirements for nonsinusoidal load current-handling capability to the degree defined by designated K-factor.
 - a. Unit shall not overheat when carrying full-load current with harmonic distortion corresponding to designated K-factor.
 - b. Indicate value of K-factor on transformer nameplate.
13. Electrostatic Shielding: Each winding shall have an independent, single, full-width copper electrostatic shield arranged to minimize interwinding capacitance.
14. Wall Brackets: Manufacturer's standard brackets.
15. Fungus Proofing: Permanent fungicidal treatment for coil and core.
16. Low-Sound-Level Requirements: Minimum of 3 dBA less than NEMA ST 20 standard sound levels when factory tested according to IEEE C57.12.91.

C. Buck-Boost Transformers

1. Description: Self-cooled, two-winding dry type, rated for continuous duty and with wiring terminals suitable for connection as autotransformer. Transformers shall comply with NEMA ST 1 and shall be listed and labeled as complying with UL 506 or UL 1561.
2. Enclosure: Ventilated, NEMA 250, Type 2.
 - a. Finish Color: Gray **OR** ANSI 49 gray **OR** ANSI 61 gray, **as directed**.

D. Identification Devices

1. Nameplates: Engraved, laminated-plastic or metal nameplate. Nameplates are specified in Division 26 Section "Identification For Electrical Systems".

1.3 EXECUTION

A. Installation

1. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.
 - a. Brace wall-mounting transformers as specified in Division 26 Section "Hangers And Supports For Electrical Systems".
2. Construct concrete bases and anchor floor-mounting transformers according to manufacturer's written instructions, seismic codes applicable to Project, **as directed**, and requirements in Division 26 Section "Hangers And Supports For Electrical Systems".

B. Field Quality Control



1. Perform tests and inspections.
2. Tests and Inspections:
 - a. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - b. Infrared Scanning: Two months after Final Completion, perform an infrared scan of transformer connections.
 - 1) Use an infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.
 - 2) Perform 2 follow-up infrared scans of transformers, one at 4 months and the other at 11 months after Final Completion.
 - 3) Prepare a certified report identifying transformer checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and scanning observations after remedial action.
- C. Adjusting
 1. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.
 2. Connect buck-boost transformers to provide nameplate voltage of equipment being served, plus or minus 5 percent, at secondary terminals.
 3. Output Settings Report: Prepare a written report recording output voltages and tap settings.
- D. Cleaning
 1. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION 26 22 13 00a



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SECTION 26 24 13 00 - ELECTRICITY METERING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for electricity metering. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes equipment for electricity metering by utility company and electricity metering by the Owner.

C. Definitions

1. KY Pulse: Term used by the metering industry to describe a method of measuring consumption of electricity that is based on a relay opening and closing in response to the rotation of the disk in the meter.
2. PC: Personal computer.

D. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: For electricity-metering equipment.
 - a. Wiring Diagrams: For power, signal, and control wiring. Identify terminals and wiring designations and color-codes to facilitate installation, operation, and maintenance. Indicate recommended types, wire sizes, and circuiting arrangements for field-installed wiring, and show circuit protection features.
3. Field quality-control reports.
4. Operation and Maintenance Data. Include the following:
 - a. Application and operating software documentation.
 - b. Software licenses.
 - c. Software service agreement.
 - d. Hard copies of manufacturer's operating specifications, design user's guides for software and hardware, and PDF files on CD-ROM of the hard-copy Submittal.

E. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Delivery, Storage, And Handling

1. Receive, store, and handle modular meter center according to NECA 400.

G. Project Conditions

1. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by the Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
 - a. Notify the Owner no fewer than two days in advance of proposed interruption of electrical service.
 - b. Do not proceed with interruption of electrical service without the Owner's written permission.

H. Coordination

1. Electrical Service Connections: Coordinate with utility companies and components they furnish as follows:



- a. Comply with requirements of utilities providing electrical power services.
 - b. Coordinate installation and connection of utilities and services, including provision for electricity-metering components.
- I. Software Service Agreement (May Not Be Allowed For Publicly Funded Projects)
1. Technical Support: Beginning with Final Completion, provide software support for two years.
 2. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Final Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
 - a. Provide 30 days' notice to the Owner to allow scheduling and access to system and to allow the Owner to upgrade its computer equipment if necessary.

1.2 PRODUCTS

- A. Equipment For Electricity Metering By Utility Company
1. Meters will be furnished by utility company.
 2. Current-Transformer Cabinets: Comply with requirements of electrical-power utility company.
 3. Meter Sockets: Comply with requirements of electrical-power utility company.
- OR**
4. Meter Sockets: Steady-state and short-circuit current ratings shall meet indicated circuit ratings.
 4. Modular Meter Center: Factory-coordinated assembly of a main service terminal box with lugs only **OR** disconnect device, **as directed**, wireways, tenant meter socket modules, and tenant feeder circuit breakers arranged in adjacent vertical sections. Assembly shall be complete with interconnecting buses and other features as specified below.
 - a. Comply with requirements of utility company for meter center.
 - b. Housing: NEMA 250, Type 1 **OR** Type 3R, **as directed**, enclosure.
 - c. Minimum Short-Circuit Rating: 22,000 **OR** 42,000 **OR** 65,000 **OR** 100,000, **as directed**, A symmetrical at rated voltage.
 - d. Main Disconnect Device: Circuit breaker, series-combination rated for use with downstream feeder and branch circuit breakers.

OR

 Main Disconnect Device: Fusible switch, series-combination rated by circuit-breaker manufacturer to protect downstream feeder and branch circuit breakers.
 - e. Tenant Feeder Circuit Breakers: Series-combination-rated molded-case units, rated to protect circuit breakers in downstream tenant and to house loadcenters and panelboards that have 10,000-A interrupting capacity.
 - 1) Identification: Complying with requirements in Division 26 Section "Identification For Electrical Systems" with legend identifying tenant's address.
 - 2) Physical Protection: Tamper resistant, with hasp for padlock.
 - f. Meter Socket: Rating coordinated with indicated tenant feeder circuit rating.
 - g. Surge Protection: For main disconnect device, comply with requirements in Division 26 Section "Transient-voltage Suppression For Low-voltage Electrical Power Circuits".
- B. Equipment For Electricity Metering By the Owner
1. General Requirements for the Owner's Meters:
 - a. Comply with UL 1244.
 - b. Meters used for billing shall have an accuracy of 0.2 **OR** 0.5 **OR** 1.0, **as directed**, percent of reading, complying with requirements in ANSI C12.20.
 - c. Meters shall be certified by California Type Evaluation Program, **as directed**, as complying with Title 4, California Code of Regulations, Article 2.2, **as directed**.
 - d. Enclosure: NEMA 250, Type 1 **OR** Type 3R, **as directed**, minimum, with hasp for padlocking or sealing.



- e. Identification: Comply with requirements in Division 26 Section "Identification For Electrical Systems".
 - f. Memory Backup: Self-contained to maintain memory throughout power outages of 72 hours, minimum.
 - g. Sensors: Current-sensing type, with current or voltage output, selected for optimum range and accuracy for meters indicated for this application.
 - 1) Type: Split **OR** Split and solid, **as directed**, core.
 - h. Current-Transformer Cabinet: Listed or recommended by metering equipment manufacturer for use with sensors indicated.
 - i. Building Automation System (BAS) Interface: One digital KY pulse to a user-definable increment of energy measurement. Match signal to BAS input and arrange to convey the instantaneous, integrated, demand level measured by meter to provide data for processing and possible programmed demand control action by destination system.
2. Kilowatt-hour Meter: Electronic single **OR** three **OR** single- and three, **as directed**, -phase meters, measuring electricity used.
 - a. Voltage and Phase Configuration: Meter shall be designed for use on circuits with voltage rating and phase configuration indicated for its application.
 - b. Display: LCD with characters not less than 0.25 inch (6 mm) high, indicating accumulative kilowatt-hours and current kilowatt load. Retain accumulated kilowatt-hour in a nonvolatile memory, until reset.

OR

Display: Digital electromechanical counter, indicating accumulative kilowatt-hours.
 3. Kilowatt-hour/Demand Meter: Electronic single **OR** three **OR** single- and three, **as directed**, -phase meters, measuring electricity use and demand. Demand shall be integrated over a 15-minute interval.
 - a. Voltage and Phase Configuration: Meter shall be designed for use on circuits with voltage rating and phase configuration indicated for its application.
 - b. Display: LCD with characters not less than 0.25 inch (6 mm) high, indicating accumulative kilowatt-hours, current time and date, current demand, and historic peak demand, and time and date of historic peak demand. Retain accumulated kilowatt-hour and historic peak demand in a nonvolatile memory, until reset.
 4. Data Transmission Cable: Transmit KY pulse data over Class 1 control-circuit conductors in raceway. Comply with Division 26 Section "Control-voltage Electrical Power Cables".
 5. Software: PC based, a product of meter manufacturer, suitable for calculation of utility cost allocation and billing, **as directed**.
 - a. Utility Cost Allocation: Automatically import energy-usage records to allocate energy costs for the following:
 - 1) At least 15 departments.
 - 2) At least 30 tenants.
 - 3) At least five processes.
 - 4) At least five buildings.
 - b. Tenant or Activity Billing Software: Automatically import energy-usage records to automatically compute and prepare tenant bills **OR** activity demand and energy-use statements, **as directed**, based on metering of energy use and peak demand, **as directed**. Maintain separate directory for each tenant's historical billing information. Prepare summary reports in user-defined formats and time intervals.

1.3 EXECUTION

A. Installation

1. Comply with equipment installation requirements in NECA 1.
2. Install meters furnished by utility company. Install raceways and equipment according to utility company's written requirements. Provide empty conduits for metering leads and extend grounding connections as required by utility company.
3. Install modular meter center according to NECA 400 switchboard installation requirements.



- B. Identification
1. Comply with requirements for identification specified in Division 26 Section "Identification For Electrical Systems".
 - a. Series Combination Warning Label: Self-adhesive type, with text as required by NFPA 70.
 - b. Equipment Identification Labels: Adhesive film labels with clear protective overlay. For residential meters, provide an additional card holder suitable for printed, weather-resistant card **OR** typewritten card, **as directed**, with occupant's name.
- C. Field Quality Control
1. Perform tests and inspections.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
 2. Tests and Inspections:
 - a. Connect a load of known kilowatt rating, 1.5 kW minimum, to a circuit supplied by metered feeder.
 - b. Turn off circuits supplied by metered feeder and secure them in off condition.
 - c. Run test load continuously for eight hours minimum, or longer, to obtain a measurable meter indication. Use test-load placement and setting that ensures continuous, safe operation.
 - d. Check and record meter reading at end of test period and compare with actual electricity used, based on test-load rating, duration of test, and sample measurements of supply voltage at test-load connection. Record test results.
 3. Electricity metering will be considered defective if it does not pass tests and inspections.
 4. Prepare test and inspection reports.

END OF SECTION 26 24 13 00



SECTION 26 24 13 00a - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for enclosed switches and circuit breakers. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Fusible switches.
 - b. Nonfusible switches.
 - c. Receptacle switches.
 - d. Shunt trip switches.
 - e. Molded-case circuit breakers (MCCBs).
 - f. Molded-case switches.
 - g. Enclosures.

C. Definitions

1. NC: Normally closed.
2. NO: Normally open.
3. SPDT: Single pole, double throw.

D. Performance Requirements

1. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event," **as directed**.

E. Submittals

1. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated.
2. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.
 - a. Wiring Diagrams: For power, signal, and control wiring.
3. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.
4. Field quality-control reports.
5. Operation and maintenance data.

F. Quality Assurance

1. Testing Agency Qualifications: Member company of NETA or an NRTL.
 - a. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. Comply with NFPA 70.

G. Project Conditions

1. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:



- a. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
- b. Altitude: Not exceeding 6600 feet (2010 m).
2. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by the Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
 - a. Notify the Owner no fewer than seven days in advance of proposed interruption of electric service.
 - b. Indicate method of providing temporary electric service.
 - c. Do not proceed with interruption of electric service without the Owner's written permission.
 - d. Comply with NFPA 70E.

1.2 PRODUCTS

A. Fusible Switches

1. Type GD, General Duty, Single Throw, 240-V ac, 800 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with cartridge **OR** plug, **as directed**, fuse interiors to accommodate specified **OR** indicated, **as directed**, fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
2. Type HD, Heavy Duty, Single Throw, 240 **OR** 600, **as directed**, -V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified **OR** indicated, **as directed**, fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
3. Type HD, Heavy Duty, Six Pole, Single Throw, 240 **OR** 600, **as directed**, -V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified **OR** indicated, **as directed**, fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
4. Type HD, Heavy Duty, Double Throw, 240 **OR** 600, **as directed**, -V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified **OR** indicated, **as directed**, fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
5. Accessories:
 - a. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - b. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - c. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - d. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
 - e. Auxiliary Contact Kit: One **OR** Two, **as directed**, NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
 - f. Hookstick Handle: Allows use of a hookstick to operate the handle.
 - g. Lugs: Mechanical **OR** Compression, **as directed**, type, suitable for number, size, and conductor material.
 - h. Service-Rated Switches: Labeled for use as service equipment.
 - i. Accessory Control Power Voltage: Remote mounted and powered; 24-V ac **OR** 120-V ac **OR** 208-V ac **OR** 240-V ac **OR** 6-V dc **OR** 12-V dc **OR** 24-V dc, **as directed**.

B. Nonfusible Switches

1. Type GD, General Duty, Single Throw, 600 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.



2. Type HD, Heavy Duty, Single Throw, 240 **OR** 600, **as directed**,-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
3. Type HD, Heavy Duty, Six Pole, Single Throw, 240 **OR** 600, **as directed**,-V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
4. Type HD, Heavy Duty, Double Throw, 240 **OR** 600, **as directed**,-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
5. Accessories:
 - a. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - b. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - c. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - d. Auxiliary Contact Kit: One **OR** Two, **as directed**, NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
 - e. Hookstick Handle: Allows use of a hookstick to operate the handle.
 - f. Lugs: Mechanical **OR** Compression, **as directed**, type, suitable for number, size, and conductor material.
 - g. Accessory Control Power Voltage: Remote mounted and powered; 24-V ac **OR** 120-V ac **OR** 208-V ac **OR** 240-V ac **OR** 6-V dc **OR** 12-V dc **OR** 24-V dc, **as directed**.

C. Receptacle Switches

1. Type HD, Heavy-Duty, Single-Throw Fusible Switch: 240 **OR** 600, **as directed**,-V ac, 30 **OR** 60 **OR** 100, **as directed**, A; UL 98 and NEMA KS 1; horsepower rated, with clips or bolt pads to accommodate specified **OR** indicated, **as directed**, fuses; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.
2. Type HD, Heavy-Duty, Single-Throw Nonfusible Switch: 240 **OR** 600, **as directed**,-V ac, 30 **OR** 60 **OR** 100, **as directed**, A; UL 98 and NEMA KS 1; horsepower rated, lockable handle with capability to accept three padlocks; interlocked with cover in closed position.
3. Interlocking Linkage: Provided between the receptacle and switch mechanism to prevent inserting or removing plug while switch is in the on position, inserting any plug other than specified, and turning switch on if an incorrect plug is inserted or correct plug has not been fully inserted into the receptacle.
4. Receptacle: Polarized, three-phase, four-wire receptacle (fourth wire connected to enclosure ground lug).

D. Shunt Trip Switches

1. General Requirements: Comply with ASME A17.1, **as directed**, UL 50, and UL 98, with 200-kA interrupting and short-circuit current rating when fitted with Class J fuses.
2. Switches: Three-pole, horsepower rated, with integral shunt trip mechanism and Class J fuse block; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.
3. Control Circuit: 120-V ac; obtained from integral control power transformer, with primary and secondary fuses, with a control power transformer **OR** source, **as directed**, of enough capacity to operate shunt trip, connected pilot, and indicating and control devices.
4. Accessories:
 - a. Oiltight key switch for key-to-test function.
 - b. Oiltight red **OR** green **OR** white **OR** yellow, **as directed**, ON pilot light.
 - c. Isolated neutral lug; 100 **OR** 200, **as directed**, percent rating.
 - d. Mechanically interlocked auxiliary contacts that change state when switch is opened and closed.
 - e. Form C alarm contacts that change state when switch is tripped.



- f. Three-pole, double-throw, fire-safety and alarm relay; 120-V ac **OR** 24-V dc, **as directed**, coil voltage.
- g. Three-pole, double-throw, fire-alarm voltage monitoring relay complying with NFPA 72.

E. Molded-Case Circuit Breakers

1. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.
2. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
3. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
4. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long- and short-time time adjustments.
 - d. Ground-fault pickup level, time delay, and I^2t response.
5. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.
6. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.
7. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
8. Ground-Fault, Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).
9. Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Lugs: Mechanical **OR** Compression, **as directed**, type, suitable for number, size, trip ratings, and conductor material.
 - c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
 - d. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered **OR** remote-mounted and powered, **as directed**, type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
 - e. Communication Capability: Circuit-breaker-mounted **OR** Universal-mounted **OR** Integral **OR** Din-rail-mounted, **as directed**, communication module with functions and features compatible with power monitoring and control system, specified in Division 26 Section "Electrical Power Monitoring And Control".
 - f. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
 - g. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
 - h. Auxiliary Contacts: One SPDT switch **OR** Two SPDT switches, **as directed**, with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
 - i. Alarm Switch: One NO **OR** NC, **as directed**, contact that operates only when circuit breaker has tripped.
 - j. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
 - k. Zone-Selective Interlocking: Integral with electronic **OR** ground-fault, **as directed**, trip unit; for interlocking ground-fault protection function.
 - l. Electrical Operator: Provide remote control for on, off, and reset operations.



- m. Accessory Control Power Voltage: Integrally mounted, self-powered **OR** Remote mounted and powered, **as directed**; 24-V ac **OR** 120-V ac **OR** 208-V ac **OR** 240-V ac **OR** 6-V dc **OR** 12-V dc **OR** 24-V dc, **as directed**.

F. Molded-Case Switches

1. General Requirements: MCCB with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.
2. Features and Accessories:
 - a. Standard frame sizes and number of poles.
 - b. Lugs: Mechanical **OR** Compression, **as directed**, type, suitable for number, size, trip ratings, and conductor material.
 - c. Ground-Fault Protection: Comply with UL 1053; remote-mounted and powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
 - d. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
 - e. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
 - f. Auxiliary Contacts: One SPDT switch **OR** Two SPDT switches, **as directed**, with "a" and "b" contacts; "a" contacts mimic switch contacts, "b" contacts operate in reverse of switch contacts.
 - g. Alarm Switch: One NO **OR** NC, **as directed**, contact that operates only when switch has tripped.
 - h. Key Interlock Kit: Externally mounted to prohibit switch operation; key shall be removable only when switch is in off position.
 - i. Zone-Selective Interlocking: Integral with ground-fault shunt trip unit; for interlocking ground-fault protection function.
 - j. Electrical Operator: Provide remote control for on, off, and reset operations.
 - k. Accessory Control Power Voltage: Integrally mounted, self-powered **OR** Remote mounted and powered, **as directed**; 24-V ac **OR** 120-V ac **OR** 208-V ac **OR** 240-V ac **OR** 6-V dc **OR** 12-V dc **OR** 24-V dc, **as directed**.

G. Enclosures

1. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
 - a. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
 - b. Outdoor Locations: NEMA 250, Type 3R.
 - c. Kitchen **OR** Wash-Down, **as directed**, Areas: NEMA 250, Type 4X, stainless steel.
 - d. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
 - e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
 - f. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7 **OR** Type 9, **as directed**.

1.3 EXECUTION

A. Installation

1. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
2. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
3. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
4. Install fuses in fusible devices.
5. Comply with NECA 1.



- B. Identification
1. Comply with requirements in Division 26 Section "Identification For Electrical Systems".
 - a. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - b. Label each enclosure with engraved metal or laminated-plastic nameplate.
- C. Field Quality Control
1. Perform tests and inspections.
 2. Acceptance Testing Preparation:
 - a. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
 - b. Test continuity of each circuit.
 3. Tests and Inspections:
 - a. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - b. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - c. Perform the following infrared scan tests and inspections and prepare reports:
 - 1) Initial Infrared Scanning: After Final Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
 - 2) Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Final Completion.
 - 3) Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - d. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
 4. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
 5. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- D. Adjusting
1. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
 2. Set field-adjustable circuit-breaker trip ranges as specified in Division 26 Section "Overcurrent Protective Device Coordination Study".

END OF SECTION 26 24 13 00a



SECTION 26 24 13 00b - SWITCHBOARDS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for switchboards. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Service and distribution switchboards rated 600 V and less.
 - b. Transient voltage suppression devices.
 - c. Disconnecting and overcurrent protective devices.
 - d. Instrumentation.
 - e. Control power.
 - f. Accessory components and features.
 - g. Identification.
 - h. Mimic bus.

C. Performance Requirements

1. Seismic Performance: Switchboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

D. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: For each switchboard and related equipment.
 - a. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.
 - b. Detail enclosure types for types other than NEMA 250, Type 1.
 - c. Detail bus configuration, current, and voltage ratings.
 - d. Detail short-circuit current rating of switchboards and overcurrent protective devices.
 - e. Include descriptive documentation of optional barriers specified for electrical insulation and isolation.
 - f. Detail utility company's metering provisions with indication of approval by utility company.
 - g. Include evidence of NRTL listing for series rating of installed devices.
 - h. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - i. Include time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graph paper; include selectable ranges for each type of overcurrent protective device.
 - j. Include diagram and details of proposed mimic bus.
 - k. Include schematic and wiring diagrams for power, signal, and control wiring.
3. Samples: Representative portion of mimic bus with specified material and finish, for color selection.
4. Seismic Qualification Certificates: Submit certification that switchboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
5. Field Quality-Control Reports.



6. Operation and maintenance data.

E. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with NEMA PB 2.
3. Comply with NFPA 70.
4. Comply with UL 891.

F. Delivery, Storage, And Handling

1. Deliver switchboards in sections or lengths that can be moved past obstructions in delivery path.
2. Remove loose packing and flammable materials from inside switchboards and install temporary electric heating (250 W per section) **OR** connect factory-installed space heaters to temporary electrical service, **as directed**, to prevent condensation.
3. Handle and prepare switchboards for installation according to NECA 400 **OR** NEMA PB 2.1, **as directed**.

G. Project Conditions

1. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by the Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
 - a. Notify the Owner no fewer than seven days in advance of proposed interruption of electric service.
 - b. Indicate method of providing temporary electric service.
 - c. Do not proceed with interruption of electric service without the Owner's written permission.
 - d. Comply with NFPA 70E.

H. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within five years from date of Final Completion.

1.2 PRODUCTS

A. Manufactured Units

1. Front-Connected, Front-Accessible Switchboards:
 - a. Main Devices: Panel **OR** Fixed, individually, **as directed**, mounted.
 - b. Branch Devices: Panel mounted.
 - c. Sections front and rear aligned.
2. Front- and Side-Accessible Switchboards:
 - a. Main Devices: Fixed, individually mounted.
 - b. Branch Devices: Panel mounted.
 - c. Sections front and rear aligned.
3. Front- and Rear-Accessible Switchboards:
 - a. Main Devices: Fixed, individually **OR** Drawout, **as directed**, mounted.
 - b. Branch Devices: Panel **OR** Fixed, individually **OR** Panel and fixed, individually **OR** Fixed and individually compartmented **OR** Individually compartmented and drawout, **as directed**, mounted.
 - c. Sections front and rear **OR** rear, **as directed**, aligned.
4. Nominal System Voltage: 480Y/277 V **OR** 208Y/120 V, **as directed**.
5. Main-Bus Continuous: 5000 **OR** 4000 **OR** 3000 **OR** 2500 **OR** 2000 **OR** 1600 **OR** 1200, **as directed**, A.



6. Seismic Requirements: Fabricate and test switchboards according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
7. Indoor Enclosures: Steel, NEMA 250, Type 1 **OR** Type 5, **as directed**.
8. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray **OR** custom color, **as directed**, finish over a rust-inhibiting primer on treated metal surface.
9. Outdoor Enclosures: Type 3R **OR** Type 3R, with interior-lighted walk-in aisle, **as directed**.
 - a. Finish: Factory-applied finish in manufacturer's standard **OR** custom, **as directed**, color; undersurfaces treated with corrosion-resistant undercoating.
 - b. Enclosure: Flat **OR** Downward, rearward sloping, **as directed**, roof; bolt-on rear covers **OR** rear hinged doors, **as directed**, for each section, with provisions for padlocking.
 - c. Doors: Personnel door at each end of aisle, minimum width of 30 inches (762 mm); opening outwards; with panic hardware and provisions for padlocking **OR** cylinder lock, **as directed**.
 - d. Accessories: Fluorescent lighting fixtures, ceiling mounted; wired to a three-way light switch at each end of aisle; ground-fault circuit interrupter (GFCI) duplex receptacle; emergency battery pack lighting fixture installed on wall of aisle midway between personnel doors.
 - e. Walk-in Aisle Heating and Ventilating:
 - 1) Factory-installed electric unit heater(s), wall or ceiling mounted, with integral thermostat and disconnect and with capacities to maintain switchboard interior temperature of 40 deg F (5 deg C) with outside design temperature of 104 deg F (40 deg C).
 - 2) Factory-installed exhaust fan with capacities to maintain switchboard interior temperature of 100 deg F (38 deg C) with outside design temperature of 23 deg F (minus 5 deg C).
 - 3) Ventilating openings complete with replaceable fiberglass air filters.
 - 4) Thermostat: Single stage; wired to control heat and exhaust fan.
 - f. Power for Space Heaters, Ventilation, Lighting, and Receptacle: Include a control-power transformer within the switchboard. Supply voltage shall be 120 **OR** 120/240 **OR** 120/208, **as directed**, -V ac.
 - g. Power for space heaters, ventilation, lighting, and receptacle provided by a remote source.
10. Barriers: Between adjacent switchboard sections.
11. Insulation and isolation for main bus of main section, **as directed**, and main and vertical buses of feeder sections.
12. Cubical Space Heaters: Factory-installed electric space heaters of sufficient wattage in each vertical section to maintain enclosure temperature above expected dew point.
 - a. Space-Heater Control: Thermostats to maintain temperature of each section above expected dew point **OR** Manual switching of branch-circuit protective device, **as directed**.
 - b. Space-Heater Power Source: Transformer, factory installed in switchboard **OR** 120-V external branch circuit, **as directed**.
13. Utility Metering Compartment: Fabricated, barrier compartment and section complying with utility company's requirements; hinged sealed door; buses provisioned for mounting utility company's current transformers and potential transformers or potential taps as required by utility company. If separate vertical section is required for utility metering, match and align with basic switchboard. Provide service entrance label and necessary applicable service entrance features.
14. Customer Metering Compartment: A separate customer metering compartment and section with front hinged door, for indicated metering, and current transformers for each meter. Current transformer secondary wiring shall be terminated on shorting-type terminal blocks. Include potential transformers having primary and secondary fuses with disconnecting means and secondary wiring terminated on terminal blocks, **as directed**.
15. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.
16. Removable, Hinged Rear Doors and Compartment Covers: Secured by captive thumb screws **OR** standard bolts, **as directed**, for access to rear interior of switchboard.
17. Hinged Front Panels: Allow access to circuit breaker, metering, accessory, and blank compartments.



18. Pull Box on Top of Switchboard:
 - a. Adequate ventilation to maintain temperature in pull box within same limits as switchboard.
 - b. Set back from front to clear circuit-breaker removal mechanism.
 - c. Removable covers shall form top, front, and sides. Top covers at rear shall be easily removable for drilling and cutting.
 - d. Bottom shall be insulating, fire-resistive material with separate holes for cable drops into switchboard.
 - e. Cable supports shall be arranged to facilitate cabling and adequate to support cables indicated, including those for future installation.
19. Buses and Connections: Three phase, four wire unless otherwise indicated.
 - a. Phase- and Neutral-Bus Material: One of the following:
 - 1) Hard-drawn copper of 98 percent conductivity, silver-plated, **as directed**, with tin-plated aluminum or copper feeder circuit-breaker line connections.
 - 2) Tin-plated, high-strength, electrical-grade aluminum alloy with tin-plated aluminum circuit-breaker line connections.
 - 3) Hard-drawn copper of 98 percent conductivity, silver-plated, **as directed**, or tin-plated, high-strength, electrical-grade aluminum alloy.
 - b. Load Terminals: Insulated, rigidly braced, runback bus extensions, of same material as through buses, equipped with mechanical **OR** compression, **as directed**, connectors for outgoing circuit conductors. Provide load terminals for future circuit-breaker positions at full-ampere rating of circuit-breaker position.
 - c. Ground Bus: 1/4-by-2-inch- (6-by-50-mm-) **OR** 1/4-by-1-inch- (6-by-25-mm-) **OR** Minimum-size required by UL 891, **as directed**, hard-drawn copper of 98 percent conductivity, equipped with mechanical **OR** compression, **as directed**, connectors for feeder and branch-circuit ground conductors. For busway feeders, extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run.
 - d. Main Phase Buses and Equipment Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.
 - e. Neutral Buses: 50 percent of the ampacity of phase buses unless otherwise indicated, equipped with mechanical **OR** compression, **as directed**, connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus.
 - f. Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with mechanical **OR** compression, **as directed**, connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus.
 - g. Isolation Barrier Access Provisions: Permit checking of bus-bolt tightness.
20. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment.
21. Bus-Bar Insulation: Factory-applied, flame-retardant, tape wrapping of individual bus bars or flame-retardant, spray-applied insulation. Minimum insulation temperature rating of 105 deg C.
22. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components including instruments and instrument transformers.

B. Transient Voltage Suppression Devices

1. Surge Protection Device Description: IEEE C62.41-compliant, integrally mounted, wired-in **OR** plug-in **OR** bolt-on, **as directed**, solid-state, parallel-connected, modular (with field-replaceable modules) **OR** non-modular, **as directed**, type, with sine-wave tracking suppression and filtering modules, UL 1449, second edition, short-circuit current rating matching or exceeding the switchboard short-circuit rating, and with the following features and accessories:
 - a. Fuses, rated at 200-kA interrupting capacity.
 - b. Fabrication using bolted compression lugs for internal wiring.
 - c. Integral disconnect switch.
 - d. Redundant suppression circuits.
 - e. Redundant replaceable modules.
 - f. Arrangement with wire connections to phase buses, neutral bus, and ground bus.



- g. LED indicator lights for power and protection status.
 - h. Audible alarm, with silencing switch, to indicate when protection has failed.
 - i. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of system operation. Contacts shall reverse position on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
 - j. Four **OR** Six, **as directed**, -digit, transient-event counter set to totalize transient surges.
- 2. Peak Single-Impulse Surge Current Rating: 160 kA per mode/320 kA per phase **OR** 120 kA per mode/240 kA per phase **OR** 80 kA per mode/160 kA per phase, **as directed**.
 - 3. Withstand Capabilities: 12,000 IEEE C62.41, Category C3 (10 kA), 8-by-20-mic.sec. surges with less than 5 percent change in clamping voltage.
 - 4. Protection modes and UL 1449 SVR for grounded wye circuits with 480Y/277 **OR** 208Y/120 **OR** 600Y/347, **as directed**, -V, three-phase, four-wire circuits shall be as follows:
 - a. Line to Neutral: 800 V for 480Y/277 **OR** 400 V for 208Y/120 **OR** 1200 V for 600Y/347, **as directed**.
 - b. Line to Ground: 800 V for 480Y/277 **OR** 400 V for 208Y/120 **OR** 1200 V for 600Y/347, **as directed**.
 - c. Neutral to Ground: 800 V for 480Y/277 **OR** 400 V for 208Y/120 **OR** 1200 V for 600Y/347, **as directed**.
 - 5. Protection modes and UL 1449 SVR for 240/120-V, three-phase, four-wire circuits with high leg shall be as follows:
 - a. Line to Neutral: 400 V, 800 V from high leg.
 - b. Line to Ground: 400 V.
 - c. Neutral to Ground: 400 V.
 - 6. Protection modes and UL 1449 SVR for 240-, 480-, or 600-V, three-phase, three-wire, delta circuits shall be as follows:
 - a. Line to Line: 2000 V for 480 V **OR** 1000 V for 240 V **OR** 2500 V for 600 V, **as directed**.
 - b. Line to Ground: 1500 V for 480 V **OR** 800 V for 240 V **OR** 2500 V for 600 V, **as directed**.
- C. Disconnecting And Overcurrent Protective Devices
- 1. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with series-connected rating **OR** interrupting capacity, **as directed**, to meet available fault currents.
 - a. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - b. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 - c. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
 - 1) Instantaneous trip.
 - 2) Long- and short-time pickup levels.
 - 3) Long- and short-time time adjustments.
 - 4) Ground-fault pickup level, time delay, and I^2t response.
 - d. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
 - e. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker; trip activation on fuse opening or on opening of fuse compartment door.
 - f. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
 - g. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
 - h. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
 - 1) Standard frame sizes, trip ratings, and number of poles.
 - 2) Lugs: Mechanical **OR** Compression, **as directed**, style, suitable for number, size, trip ratings, and conductor material.



- 3) Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
 - 4) Ground-Fault Protection: Integrally mounted **OR** Remote-mounted, **as directed**, relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - 5) Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
 - 6) Communication Capability: Circuit-breaker-mounted **OR** Universal-mounted **OR** Integral **OR** Din-rail-mounted, **as directed**, communication module with functions and features compatible with power monitoring and control system specified in Division 26 Section "Electrical Power Monitoring And Control".
 - 7) Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 **OR** 75, **as directed**, percent of rated voltage.
 - 8) Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
 - 9) Auxiliary Contacts: One SPDT switch **OR** Two SPDT switches, **as directed**, with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
 - 20) Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
2. Insulated-Case Circuit Breaker (ICCB): 80 **OR** 100, **as directed**, percent rated, sealed, insulated-case power circuit breaker with interrupting capacity rating to meet available fault current.
- a. Fixed **OR** Drawout, **as directed**, circuit-breaker mounting.
 - b. Two-step, stored-energy closing.
 - c. Standard **OR** Full, **as directed**,-function, microprocessor-based trip units with interchangeable rating plug, trip indicators, and the following field-adjustable settings:
 - 1) Instantaneous trip.
 - 2) Long- and short-time time adjustments.
 - 3) Ground-fault pickup level, time delay, and I^2t response.
 - d. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
 - e. Remote trip indication and control.
 - f. Communication Capability: Integral communication module with functions and features compatible with power monitoring and control system specified in Division 26 Section "Electrical Power Monitoring And Control".
 - g. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
 - h. Control Voltage: 40-V dc **OR** 125-V dc **OR** 250-V dc **OR** 120-V ac, **as directed**.
3. Bolted-Pressure Contact Switch: Operating mechanism uses rotary-mechanical-bolting action to produce and maintain high clamping pressure on the switch blade after it engages the stationary contacts.
- a. Main-Contact Interrupting Capability: Minimum of 12 times the switch current rating.
 - b. Operating Mechanism: Manual handle operation to close switch; stores energy in mechanism for opening and closing.
 - 1) Electrical Trip: Operation of lever or push-button trip switch, or trip signal from ground-fault relay or remote-control device, causes switch to open.
 - 2) Mechanical Trip: Operation of mechanical lever, push button, or other device causes switch to open.
 - c. Auxiliary Switches: Factory installed, single pole, double throw, with leads connected to terminal block, and including one set more than quantity required for functional performance indicated.
 - d. Service-Rated Switches: Labeled for use as service equipment.



- e. Ground-Fault Relay: Comply with UL 1053; self-powered type with mechanical ground-fault indicator, test function, tripping relay with internal memory, and three-phase current transformer/sensor.
 - 1) Configuration: Integrally mounted **OR** Remote-mounted, **as directed**, relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - 2) Internal Memory: Integrates the cumulative value of intermittent arcing ground-fault currents and uses the effect to initiate tripping.
 - 3) No-Trip Relay Test: Permits ground-fault simulation test without tripping switch.
 - 4) Test Control: Simulates ground fault to test relay and switch (or relay only if "no-trip" mode is selected).
- f. Open-Fuse Trip Device: Arranged to trip switch open if a phase fuse opens.
- 4. High-Pressure, Butt-Type Contact Switch: Operating mechanism uses butt-type contacts and a spring-charged mechanism to produce and maintain high-pressure contact when switch is closed.
 - a. Main-Contact Interrupting Capability: Minimum of 12 times the switch current rating.
 - b. Operating Mechanism: Manual handle operation to close switch; stores energy in mechanism for opening and closing.
 - 1) Electrical Trip: Operation of lever or push-button trip switch, or trip signal from ground-fault relay or remote-control device, causes switch to open.
 - 2) Mechanical Trip: Operation of mechanical lever, push button, or other device causes switch to open.
 - c. Auxiliary Switches: Factory installed, single pole, double throw, with leads connected to terminal block, and including one set more than quantity required for functional performance indicated.
 - d. Service-Rated Switches: Labeled for use as service equipment.
 - e. Ground-Fault Relay: Comply with UL 1053; self-powered type with mechanical ground-fault indicator, test function, tripping relay with internal memory, and three-phase current transformer/sensor.
 - 1) Configuration: Integrally mounted **OR** Remote-mounted, **as directed**, relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - 2) Internal Memory: Integrates the cumulative value of intermittent arcing ground-fault currents and uses the effect to initiate tripping.
 - 3) No-Trip Relay Test: Permits ground-fault simulation test without tripping switch.
 - 4) Test Control: Simulates ground fault to test relay and switch (or relay only if "no-trip" mode is selected).
 - f. Open-Fuse Trip Device: Arranged to trip switch open if a phase fuse opens.
- 5. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.
- 6. Fuses are specified in Division 26 Section "Fuses".

D. Instrumentation

- 1. Instrument Transformers: IEEE C57.13, NEMA EI 21.1, and the following:
 - a. Potential Transformers: IEEE C57.13; 120 V, 60 Hz, single **OR** tapped **OR** double, **as directed**, secondary; disconnecting type with integral fuse mountings. Burden and accuracy shall be consistent with connected metering and relay devices.
 - b. Current Transformers: IEEE C57.13; 5 A, 60 Hz, secondary; wound **OR** bushing **OR** bar or window, **as directed**, type; single **OR** double, **as directed**, secondary winding and secondary shorting device. Burden and accuracy shall be consistent with connected metering and relay devices.
 - c. Control-Power Transformers: Dry type, mounted in separate compartments for units larger than 3 kVA.
 - d. Current Transformers for Neutral and Ground-Fault Current Sensing: Connect secondary wiring to ground overcurrent relays, via shorting terminals, to provide selective tripping of main and tie circuit breaker. Coordinate with feeder circuit-breaker, ground-fault protection.



2. Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four-wire systems and with the following features:
 - a. Switch-selectable digital display of the following values with maximum accuracy tolerances as indicated:
 - 1) Phase Currents, Each Phase: Plus or minus 1 percent.
 - 2) Phase-to-Phase Voltages, Three Phase: Plus or minus 1 percent.
 - 3) Phase-to-Neutral Voltages, Three Phase: Plus or minus 1 percent.
 - 4) Megawatts: Plus or minus 2 percent.
 - 5) Megavars: Plus or minus 2 percent.
 - 6) Power Factor: Plus or minus 2 percent.
 - 7) Frequency: Plus or minus 0.5 percent.
 - 8) Accumulated Energy, Megawatt Hours: Plus or minus 2 percent; accumulated values unaffected by power outages up to 72 hours.
 - 9) Megawatt Demand: Plus or minus 2 percent; demand interval programmable from five to 60 minutes.
 - 10) Contact devices to operate remote impulse-totalizing demand meter.
 - b. Mounting: Display and control unit flush or semiflush mounted in instrument compartment door.
3. Ammeters, Voltmeters, and Power-Factor Meters: ANSI C39.1.
 - a. Meters: 4-inch (100-mm) diameter or 6 inches (150 mm) square, flush or semiflush, with antiparallax 250-degree scales and external zero adjustment.
 - b. Voltmeters: Cover an expanded-scale range of nominal voltage plus 10 percent.
4. Instrument Switches: Rotary type with off position.
 - a. Voltmeter Switches: Permit reading of all phase-to-phase voltages and, where a neutral is indicated, phase-to-neutral voltages.
 - b. Ammeter Switches: Permit reading of current in each phase and maintain current-transformer secondaries in a closed-circuit condition at all times.
5. Feeder Ammeters: 2-1/2-inch (64-mm) minimum size with 90- or 120-degree scale. Meter and transfer device with off position, located on overcurrent device door for indicated feeder circuits only.
6. Watt-Hour Meters and Wattmeters:
 - a. Comply with ANSI C12.1.
 - b. Three-phase induction type with two stators, each with current and potential coil, rated 5 A, 120 V, 60 Hz.
 - c. Suitable for connection to three- and four-wire circuits.
 - d. Potential indicating lamps.
 - e. Adjustments for light and full load, phase balance, and power factor.
 - f. Four-dial clock register.
 - g. Integral demand indicator.
 - h. Contact devices to operate remote impulse-totalizing demand meter.
 - i. Ratchets to prevent reverse rotation.
 - j. Removable meter with drawout test plug.
 - k. Semiflush mounted case with matching cover.
 - l. Appropriate multiplier tag.
7. Impulse-Totalizing Demand Meter:
 - a. Comply with ANSI C12.1.
 - b. Suitable for use with switchboard watt-hour meter, including two-circuit totalizing relay.
 - c. Cyclometer.
 - d. Four-dial, totalizing kilowatt-hour register.
 - e. Positive chart drive mechanism.
 - f. Capillary pen holding a minimum of one month's ink supply.
 - g. Roll chart with minimum 31-day capacity; appropriate multiplier tag.
 - h. Capable of indicating and recording five **OR** 15 **OR** 30, **as directed**,-minute integrated demand of totalized system.



E. Control Power

1. Control Circuits: 120-V ac, supplied through secondary disconnecting devices from control-power transformer **OR** 120-V ac, supplied from remote branch circuit, **as directed**.
2. Electrically Interlocked Main and Tie Circuit Breakers: Two control-power transformers in separate compartments, with interlocking relays, connected to the primary side of each control-power transformer at the line side of the associated main circuit breaker. 120-V secondaries connected through automatic transfer relays to ensure a fail-safe automatic transfer scheme.
3. Control-Power Fuses: Primary and secondary fuses for current-limiting and overload protection of transformer and fuses for protection of control circuits.
4. Control Wiring: Factory installed, with bundling, lacing, and protection included. Provide flexible conductors for No. 8 AWG and smaller, for conductors across hinges, and for conductors for interconnections between shipping units.

F. Accessory Components And Features

1. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
2. Portable Test Set: For testing functions of solid-state trip devices without removing from switchboard. Include relay and meter test plugs suitable for testing switchboard meters and switchboard class relays.
3. Portable Circuit-Breaker Lifting Device: Floor-supported, roller-based, elevating carriage arranged for movement of circuit breakers in and out of compartments for present and future circuit breakers.
4. Overhead Circuit-Breaker Lifting Device: Mounted at top front of switchboard, with hoist and lifting yokes matching each drawout circuit breaker.
5. Spare-Fuse Cabinet: Suitably identified, wall-mounted, lockable, compartmented steel box or cabinet. Arrange for wall mounting.

G. Identification

1. Mimic Bus: Entire single-line switchboard bus work, as depicted on factory record drawing, on a photoengraved nameplate.
 - a. Nameplate: At least 0.032-inch- (0.813-mm-) thick anodized aluminum, located at eye level on front cover of the switchboard incoming service section.
2. Mimic Bus: Entire single-line switchboard bus work, as depicted on factory record drawing, on an engraved laminated-plastic (Gravoply) nameplate.
 - a. Nameplate: At least 0.0625-inch- (1.588 mm-) thick laminated plastic (Gravoply), located at eye level on front cover of the switchboard incoming service section.
3. Mimic Bus: Continuously integrated mimic bus factory applied to front of switchboard. Arrange in single-line diagram format, using symbols and letter designations consistent with final mimic-bus diagram.
4. Coordinate mimic-bus segments with devices in switchboard sections to which they are applied. Produce a concise visual presentation of principal switchboard components and connections.
5. Presentation Media: Painted graphics in color contrasting with background color to represent bus and components, complete with lettered designations.
6. Service Equipment Label: NRTL labeled for use as service equipment for switchboards with one or more service disconnecting and overcurrent protective devices.

1.3 EXECUTION

A. Installation

1. Install switchboards and accessories according to NECA 400 **OR** NEMA PB 2.1, **as directed**.
2. Equipment Mounting: Install switchboards on concrete base, 4-inch (100-mm) nominal thickness. Comply with requirements for concrete base specified in Division 03 Section "Cast-in-place Concrete".
 - a. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.



- b. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - d. Install anchor bolts to elevations required for proper attachment to switchboards.
3. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchboard units and components.
 4. Comply with mounting and anchoring requirements specified in Division 26 Section "Hangers And Supports For Electrical Systems".
 5. Operating Instructions: Frame and mount the printed basic operating instructions for switchboards, including control and key interlocking sequences and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of switchboards.
 6. Install filler plates in unused spaces of panel-mounted sections.
 7. Install overcurrent protective devices, transient voltage suppression devices, and instrumentation.
 - a. Set field-adjustable switches and circuit-breaker trip ranges.
 8. Install spare-fuse cabinet.
 9. Comply with NECA 1.
- B. Connections
1. Comply with requirements for terminating feeder bus specified in Division 26 Section "Enclosed Bus Assemblies". Drawings indicate general arrangement of bus, fittings, and specialties.
 2. Comply with requirements for terminating cable trays specified in Division 26 Section "Cable Trays For Electrical Systems". Drawings indicate general arrangement of cable trays, fittings, and specialties.
- C. Identification
1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with requirements for identification specified in Division 26 Section "Identification For Electrical Systems".
 2. Switchboard Nameplates: Label each switchboard compartment with a nameplate complying with requirements for identification specified in Division 26 Section "Identification For Electrical Systems".
 3. Device Nameplates: Label each disconnecting and overcurrent protective device and each meter and control device mounted in compartment doors with a nameplate complying with requirements for identification specified in Division 26 Section "Identification For Electrical Systems".
- D. Field Quality Control
1. Acceptance Testing Preparation:
 - a. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit.
 - b. Test continuity of each circuit.
 2. Tests and Inspections:
 - a. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - b. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - c. Perform the following infrared scan tests and inspections and prepare reports:
 - 1) Initial Infrared Scanning: After Final Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switchboard. Remove front **OR** front and rear, **as directed**, panels so joints and connections are accessible to portable scanner.
 - 2) Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switchboard 11 months after date of Final Completion.
 - 3) Instruments and Equipment:



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- a) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - d. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
 3. Switchboard will be considered defective if it does not pass tests and inspections.
 4. Prepare test and inspection reports, including a certified report that identifies switchboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- E. Adjusting
1. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
 2. Set field-adjustable circuit-breaker trip ranges as indicated **OR** as specified in Division 26 Section "Overcurrent Protective Device Coordination Study", **as directed**.
- F. Protection
1. Temporary Heating: Apply temporary heat, to maintain temperature according to manufacturer's written instructions, until switchboard is ready to be energized and placed into service.

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SECTION 26 24 16 00 - PANELBOARDS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for panelboards. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Distribution panelboards.
 - b. Lighting and appliance branch-circuit panelboards.
 - c. Load centers.
 - d. Electronic-grade panelboards.

C. Definitions

1. SVR: Suppressed voltage rating.
2. TVSS: Transient voltage surge suppressor.

D. Performance Requirements

1. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

E. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: For each panelboard and related equipment.
 - a. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
 - b. Detail enclosure types and details for types other than NEMA 250, Type 1.
 - c. Detail bus configuration, current, and voltage ratings.
 - d. Short-circuit current rating of panelboards and overcurrent protective devices.
 - e. Include evidence of NRTL listing for series rating of installed devices.
 - f. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - g. Include wiring diagrams for power, signal, and control wiring.
 - h. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graph paper; include selectable ranges for each type of overcurrent protective device.
3. Seismic Qualification Certificates: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
4. Panelboard Schedules: For installation in panelboards.
5. Operation and maintenance data

F. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with NEMA PB 1.
3. Comply with NFPA 70.



- G. Delivery, Storage, And Handling
1. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.
 2. Handle and prepare panelboards for installation according to NECA 407 **OR** NEMA PB 1.
- H. Project Conditions
1. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by the Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
 - a. Notify the Owner no fewer than two days in advance of proposed interruption of electric service.
 - b. Do not proceed with interruption of electric service without the Owner's written permission.
 - c. Comply with NFPA 70E.
- I. Warranty
1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within five years from date of Final Completion.

1.2 PRODUCTS

- A. General Requirements For Panelboards
1. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
 2. Enclosures: Flush **OR** Surface **OR** Flush- and surface, **as directed**, -mounted cabinets.
 - a. Rated for environmental conditions at installed location.
 - 1) Indoor Dry and Clean Locations: NEMA 250, Type 1.
 - 2) Outdoor Locations: NEMA 250, Type 3R.
 - 3) Kitchen or Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
 - 4) Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 - 5) Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 5 **OR** Type 12, **as directed**.
 - b. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
 - c. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
 - d. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
 - e. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
 - f. Finishes:
 - 1) Panels and Trim: Steel and galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
 - 2) Back Boxes: Galvanized steel **OR** Same finish as panels and trim, **as directed**.
 - 3) Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.
 - g. Directory Card: Inside panelboard door, mounted in transparent card holder **OR** metal frame with transparent protective cover, **as directed**.
 3. Incoming Mains Location: Top **OR** Bottom **OR** Top and bottom, **as directed**.
 4. Phase, Neutral, and Ground Buses:
 - a. Material: Tin-plated aluminum **OR** Hard-drawn copper, 98 percent conductivity, **as directed**.



- b. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
 - c. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.
 - d. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.
 - e. Split Bus: Vertical buses divided into individual vertical sections.
 5. Conductor Connectors: Suitable for use with conductor material and sizes.
 - a. Material: Tin-plated aluminum **OR** Hard-drawn copper, 98 percent conductivity, **as directed**.
 - b. Main and Neutral Lugs: Compression **OR** Mechanical, **as directed**, type.
 - c. Ground Lugs and Bus-Configured Terminators: Compression **OR** Mechanical, **as directed**, type.
 - d. Feed-Through Lugs: Compression **OR** Mechanical, **as directed**, type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 - e. Subfeed (Double) Lugs: Compression **OR** Mechanical, **as directed**, type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
 - f. Gutter-Tap Lugs: Compression **OR** Mechanical, **as directed**, type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
 - g. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.
 6. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.
 7. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
 8. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, listed and labeled for series-connected short-circuit rating by an NRTL.
 9. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.
- B. Distribution Panelboards
1. Panelboards: NEMA PB 1, power and feeder distribution type.
 2. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
 - a. For doors more than 36 inches (914 mm) high, provide two latches, keyed alike.
 3. Mains: Circuit breaker **OR** Fused switch **OR** Lugs only, **as directed**.
 4. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Plug-in **OR** Bolt-on, **as directed**, circuit breakers.
 5. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.
 6. Branch Overcurrent Protective Devices: Fused switches.
 7. Contactors in Main Bus: NEMA ICS 2, Class A, electrically **OR** mechanically, **as directed**, held, general-purpose controller, with same short-circuit interrupting rating as panelboard.
 - a. Internal Control-Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.
 - b. External Control-Power Source: 120-V branch circuit **OR** 24-V control circuit, **as directed**.
- C. Lighting And Appliance Branch-Circuit Panelboards
1. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
 2. Mains: Circuit breaker **OR** Lugs only, **as directed**.
 3. Branch Overcurrent Protective Devices: Plug-in **OR** Bolt-on, **as directed**, circuit breakers, replaceable without disturbing adjacent units.
 4. Contactors in Main Bus: NEMA ICS 2, Class A, electrically **OR** mechanically, **as directed**, held, general-purpose controller, with same short-circuit interrupting rating as panelboard.



- a. Internal Control-Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.
 - b. External Control-Power Source: 120-V branch circuit **OR** 24-V control circuit, **as directed**.
5. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.
 6. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.
- D. Load Centers
1. Load Centers: Comply with UL 67.
 2. Mains: Circuit breaker **OR** Lugs only, **as directed**.
 3. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.
 4. Conductor Connectors: Mechanical type for main, neutral, and ground lugs and buses.
- E. Electronic-Grade Panelboards
1. Panelboards: NEMA PB 1; with factory-installed, integral TVSS; labeled by an NRTL for compliance with UL 67 after installing TVSS.
 2. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
 3. Main Overcurrent Protective Devices: Bolt-on thermal-magnetic circuit breakers.
 4. Branch Overcurrent Protective Devices: Bolt-on thermal-magnetic circuit breakers.
 5. Buses:
 - a. Copper phase and neutral buses; 200 percent capacity neutral bus and lugs.
 - b. Copper equipment and isolated ground buses.
 6. Surge Protection Device: IEEE C62.41-compliant, integrally mounted, plug-in **OR** wired-in **OR** bolt-on, **as directed**, solid-state, parallel-connected, modular (with field-replaceable modules) **OR** non-modular, **as directed**, type, with sine-wave tracking suppression and filtering modules, short-circuit current rating complying with UL 1449, second edition, and matching or exceeding the panelboard short-circuit rating, redundant suppression circuits, with individually fused metal-oxide varistors.
 - a. Accessories:
 - 1) Fuses rated at 200-kA interrupting capacity.
 - 2) Fabrication using bolted compression lugs for internal wiring.
 - 3) Integral disconnect switch.
 - 4) Redundant suppression circuits.
 - 5) Redundant replaceable modules.
 - 6) Arrangement with wire connections to phase buses, neutral bus, and ground bus.
 - 7) LED indicator lights for power and protection status.
 - 8) Audible alarm, with silencing switch, to indicate when protection has failed.
 - 9) Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of system operation. Contacts shall reverse position on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
 - 10) Four **OR** Six, **as directed**,-digit, transient-event counter set to totalize transient surges.
 - b. Peak Single-Impulse Surge Current Rating: 160 kA per mode/320 kA per phase **OR** 120 kA per mode/240 kA per phase **OR** 80 kA per mode/160 kA per phase, **as directed**.
 - c. Minimum single-impulse current ratings, using 8-by-20-mic.sec. waveform described in IEEE C62.41.2.
 - 1) Line to Neutral: 70,000 A.
 - 2) Line to Ground: 70,000 A.
 - 3) Neutral to Ground: 50,000 A.
 - d. Withstand Capabilities: 12,000 IEEE C62.41, Category C3 (10 kA), 8-by-20-mic.sec. surges with less than 5 percent change in clamping voltage.
 - e. Protection modes and UL 1449 SVR for grounded wye circuits with 480Y/277 **OR** 208Y/120 **OR** 600Y/347, **as directed**,-V, three-phase, four-wire circuits shall be as follows:



- 1) Line to Neutral: 800 V for 480Y/277 **OR** 400 V for 208Y/120 **OR** 1200 V for 600Y/347, **as directed**.
 - 2) Line to Ground: 800 V for 480Y/277 **OR** 400 V for 208Y/120 **OR** 1200 V for 600Y/347, **as directed**.
 - 3) Neutral to Ground: 800 V for 480Y/277 **OR** 400 V for 208Y/120 **OR** 1200 V for 600Y/347, **as directed**.
- f. Protection modes and UL 1449 SVR for 240/120-V, single-phase, three-wire circuits shall be as follows:
- 1) Line to Neutral: 400 V.
 - 2) Line to Ground: 400 V.
 - 3) Neutral to Ground: 400 V.
- g. Protection modes and UL 1449 SVR for 240/120-V, three-phase, four-wire circuits with high leg shall be as follows:
- 1) Line to Neutral: 400 V, 800 V from high leg.
 - 2) Line to Ground: 400 V.
 - 3) Neutral to Ground: 400 V.
- h. Protection modes and UL 1449 SVR for 240-, 480-, or 600-V, three-phase, three-wire, delta circuits shall be as follows:
- 1) Line to Line: 2000 V for 480 V **OR** 1000 V for 240 V **OR** 2500 V for 600 V, **as directed**.
 - 2) Line to Ground: 1500 V for 480 V **OR** 800 V for 240 V **OR** 2500 V for 600 V, **as directed**.

F. Disconnecting And Overcurrent Protective Devices

1. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with series-connected rating **OR** interrupting capacity, **as directed**, to meet available fault currents.
 - a. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - b. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 - c. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replaceable electronic trip; and the following field-adjustable settings:
 - 1) Instantaneous trip.
 - 2) Long- and short-time pickup levels.
 - 3) Long- and short-time time adjustments.
 - 4) Ground-fault pickup level, time delay, and I^2t response.
 - d. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
 - e. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
 - f. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
 - g. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
 - h. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
 - 1) Standard frame sizes, trip ratings, and number of poles.
 - 2) Lugs: Compression **OR** Mechanical, **as directed**, style, suitable for number, size, trip ratings, and conductor materials.
 - 3) Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
 - 4) Ground-Fault Protection: Integrally mounted **OR** Remote-mounted, **as directed**, relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.



- 5) Communication Capability: Circuit-breaker-mounted **OR** Universal-mounted **OR** Integral **OR** Din-rail-mounted, **as directed**, communication module with functions and features compatible with power monitoring and control system specified in Division 26 Section "Electrical Power Monitoring And Control".
 - 6) Shunt Trip: 120 **OR** 24, **as directed**, -V trip coil energized from separate circuit, set to trip at 55 **OR** 75, **as directed**, percent of rated voltage.
 - 7) Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional **OR** with field-adjustable 0.1- to 0.6-second, **as directed**, time delay.
 - 8) Auxiliary Contacts: One SPDT switch **OR** Two SPDT switches, **as directed**, with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.
 - 9) Alarm Switch: Single-pole, normally open contact that actuates only when circuit breaker trips.
 - 10) Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
 - 11) Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function with other upstream or downstream devices.
 - 12) Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
 - 13) Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on **OR** off, **as directed**, position.
 - 14) Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.
2. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.
- a. Fuses, and Spare-Fuse Cabinet: Comply with requirements specified in Division 26 Section "Fuses".
 - b. Fused Switch Features and Accessories: Standard ampere ratings and number of poles.
 - c. Auxiliary Contacts: One **OR** Two, **as directed**, normally open and normally closed contact(s) that operate with switch handle operation.

G. Panelboard Suppressors

1. Surge Protection Device: IEEE C62.41-compliant, integrally mounted, solid-state, parallel-connected, non-modular type, with sine-wave tracking suppression and filtering modules, UL 1449, second edition, short-circuit current rating matching or exceeding the panelboard short-circuit rating, and with the following features and accessories:
 - a. Accessories:
 - 1) LED indicator lights for power and protection status.
 - 2) Audible alarm, with silencing switch, to indicate when protection has failed.
 - 3) One set of dry contacts rated at 5 A and 250-V ac, for remote monitoring of protection status.
2. Surge Protection Device: IEEE C62.41-compliant, integrally mounted, plug-in **OR** wired-in **OR** bolt-on, **as directed**, solid-state, parallel-connected, modular (with field-replaceable modules) **OR** non-modular, **as directed**, type, with sine-wave tracking suppression and filtering modules, UL 1449, second edition, short-circuit current rating matching or exceeding the panelboard short-circuit rating, and with the following features and accessories:
 - a. Accessories:
 - 1) Fuses rated at 200-kA interrupting capacity.
 - 2) Fabrication using bolted compression lugs for internal wiring.
 - 3) Integral disconnect switch.
 - 4) Redundant suppression circuits.
 - 5) Redundant replaceable modules.
 - 6) Arrangement with wire connections to phase buses, neutral bus, and ground bus.
 - 7) LED indicator lights for power and protection status.
 - 8) Audible alarm, with silencing switch, to indicate when protection has failed.
 - 9) Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of system operation. Contacts shall reverse position



- on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
- 10) Four **OR** Six, **as directed**, -digit, transient-event counter set to totalize transient surges.
 - b. Peak Single-Impulse Surge Current Rating: 160 kA per mode/320 kA per phase **OR** 120 kA per mode/240 kA per phase **OR** 80 kA per mode/160 kA per phase, **as directed**.
 - c. Minimum single-impulse current ratings, using 8-by-20-mic.sec. waveform described in IEEE C62.41.2.
 - 1) Line to Neutral: 70,000 A.
 - 2) Line to Ground: 70,000 A.
 - 3) Neutral to Ground: 50,000 A.
 - d. Withstand Capabilities: 12,000 IEEE C62.41, Category C3 (10 kA), 8-by-20-mic.sec. surges with less than 5 percent change in clamping voltage.
 - e. Protection modes and UL 1449 SVR for grounded wye circuits with 480Y/277 **OR** 208Y/120 **OR** 600Y/347, **as directed**, -V, three-phase, four-wire circuits shall be as follows:
 - 1) Line to Neutral: 800 V for 480Y/277 **OR** 400 V for 208Y/120 **OR** 1200 V for 600Y/347, **as directed**.
 - 2) Line to Ground: 800 V for 480Y/277 **OR** 400 V for 208Y/120 **OR** 1200 V for 600Y/347, **as directed**.
 - 3) Neutral to Ground: 800 V for 480Y/277 **OR** 400 V for 208Y/120 **OR** 1200 V for 600Y/347, **as directed**.
 - f. Protection modes and UL 1449 SVR for 240/120-V, single-phase, three-wire circuits shall be as follows:
 - 1) Line to Neutral: 400 V.
 - 2) Line to Ground: 400 V.
 - 3) Neutral to Ground: 400 V.
 - g. Protection modes and UL 1449 SVR for 240/120-V, three-phase, four-wire circuits with high leg shall be as follows:
 - 1) Line to Neutral: 400 V, 800 V from high leg.
 - 2) Line to Ground: 400 V.
 - 3) Neutral to Ground: 400 V.
 - h. Protection modes and UL 1449 SVR for 240-, 480-, or 600-V, three-phase, three-wire, delta circuits shall be as follows:
 - 1) Line to Line: 2000 V for 480 V **OR** 1000 V for 240 V **OR** 2500 V for 600 V, **as directed**.
 - 2) Line to Ground: 1500 V for 480 V **OR** 800 V for 240 V **OR** 2500 V for 600 V, **as directed**.
- H. Accessory Components And Features
1. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
 2. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

1.3 EXECUTION

A. Installation

1. Install panelboards and accessories according to NECA 407 **OR** NEMA PB 1.1, **as directed**.
2. Equipment Mounting: Install panelboards on concrete bases, 4-inch (100-mm) nominal thickness. Comply with requirements for concrete base specified in Division 03 Section "Cast-in-place Concrete".
 - a. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of base.



- b. For panelboards, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
- c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
- d. Install anchor bolts to elevations required for proper attachment to panelboards.
- e. Attach panelboard to the vertical finished or structural surface behind the panelboard.
3. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
4. Comply with mounting and anchoring requirements specified in Division 26 Section "Hangers And Supports For Electrical Systems".
5. Mount top of trim 90 inches (2286 mm) above finished floor unless otherwise indicated.
6. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
7. Install overcurrent protective devices and controllers not already factory installed.
 - a. Set field-adjustable, circuit-breaker trip ranges.
8. Install filler plates in unused spaces.
9. Stub four 1-inch (27-GRC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-GRC) empty conduits into raised floor space or below slab not on grade.
10. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing, **as directed**.
11. Comply with NECA 1.

B. Identification

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification For Electrical Systems".
2. Create a directory to indicate installed circuit loads after balancing panelboard loads, **as directed**; incorporate the Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
3. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification For Electrical Systems".
4. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification For Electrical Systems".

C. Field Quality Control

1. Perform tests and inspections.
2. Acceptance Testing Preparation:
 - a. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - b. Test continuity of each circuit.
3. Tests and Inspections:
 - a. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - b. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - c. Perform the following infrared scan tests and inspections and prepare reports:
 - 1) Initial Infrared Scanning: After Final Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
 - 2) Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Final Completion.
 - 3) Instruments and Equipment:



- a) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 4. Panelboards will be considered defective if they do not pass tests and inspections.
 5. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- D. Adjusting
1. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.
 2. Set field-adjustable circuit-breaker trip ranges as indicated **OR** as specified in Division 26 Section "Overcurrent Protective Device Coordination Study", **as directed**.
 3. Load Balancing: After Final Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.
 - a. Measure as directed during period of normal system loading.
 - b. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
 - c. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
 - d. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.
- E. Protection
1. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

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SECTION 26 24 19 00 - SWITCHGEAR

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for switchgear. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes metal-enclosed, low-voltage power circuit-breaker switchgear rated 1000 V and less for use in ac systems.

C. Definitions

1. ATS: Acceptance Testing Service.
2. GFCI: Ground-fault circuit interrupter.

D. Submittals

1. Product Data: For each type of switchgear, circuit breaker, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
2. Shop Drawings: For each type of switchgear and related equipment.
 - a. Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Include the following:
 - b. Wiring Diagrams: Power, signal, and control wiring.
3. Coordination Drawings: Floor plans showing dimensioned layout, required working clearances, and required area above and around switchgear where pipe and ducts are prohibited. Show switchgear layout and relationships between components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate field measurements.
4. Samples: Representative portion of mimic bus with specified finish. Manufacturer's color charts showing colors available for mimic bus.
5. Manufacturer Seismic Qualification Certification: Submit certification that switchgear, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
6. Field quality-control test reports.
7. Updated mimic-bus diagram reflecting field changes after final switchgear load connections have been made, for record.
8. Operation and Maintenance Data: For switchgear and components to include in emergency, operation, and maintenance manuals. Include the following:
 - a. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 - b. Time-current curves, including selectable ranges for each type of overcurrent protective device.

E. Quality Assurance

1. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
 - a. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.



2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
3. Comply with NFPA 70.

F. Delivery, Storage, And Handling

1. Deliver switchgear in sections of lengths that can be moved past obstructions in delivery path.
2. Store switchgear indoors in clean dry space with uniform temperature to prevent condensation. Protect switchgear from exposure to dirt, fumes, water, corrosive substances, and physical damage.
3. If stored in areas subjected to weather, cover switchgear to provide protection from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside switchgear; install electric heating (250 W per section) to prevent condensation.

G. Project Conditions

1. Installation Pathway: Remove and replace building components and structures to provide pathway for moving switchgear into place.
2. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by the Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service.
3. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchgear, including clearances between switchgear, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
4. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:
 - a. Ambient Temperature: Not exceeding 40 deg C.
 - b. Altitude: Not exceeding 6600 feet (2010 m).

1.2 PRODUCTS

A. Ratings

1. Nominal System Voltage: 480 V, 3 wire **OR** 480/277 V, 4 wire **OR** 240 V, 3 wire **OR** 208/120 V, 4 wire, **as directed**, 60 Hz.
2. Main-Bus Continuous: 4000 **OR** 3200 **OR** 2000 **OR** 1600, **as directed**, A.
3. Short-Time and Short-Circuit Current: Match rating of highest-rated circuit breaker in switchgear assembly.

B. Fabrication

1. Factory assembled and tested and complying with IEEE C37.20.1.
2. Indoor Enclosure Material: Steel.
3. Outdoor Enclosure Material: Galvanized steel.
4. Outdoor Enclosure Fabrication Requirements: Weatherproof; integral structural-steel base frame with factory-applied asphaltic undercoating; and each compartment equipped with the following features:
 - a. Structural design and anchorage adequate to resist loads imposed by 125-mph (200-km/h), **as directed**, wind.
 - b. Space heater operating at one-half or less of rated voltage, sized to prevent condensation.
 - c. Louvers equipped with insect and rodent screen and filter; arranged to permit air circulation while excluding insects, rodents, and exterior dust.
 - d. Hinged front door with padlocking provisions.
 - e. Interior light with switch.
 - f. Weatherproof duplex receptacle.



- g. Common internal aisle of sufficient width to permit protective-device withdrawal, disassembly, and servicing in aisle.
 - h. Aisle access doors with outside padlocking provisions and interior panic latches.
 - i. Aisle space heaters operating at one-half or less of rated voltage, thermostatically controlled.
 - j. Vaporproof fluorescent aisle lights with low-temperature ballasts, controlled by wall switch at each entrance.
 - k. GFCI duplex receptacles, a minimum of two, located in aisle.
 - l. Aisle ventilation louvers equipped with insect and rodent screen and filter and arranged to permit air circulation while excluding insects, rodents, and exterior dust.
5. Finish: IEEE C37.20.1, manufacturer's standard gray finish over a rust-inhibiting primer on phosphatizing-treated metal surfaces.
 6. Section barriers between main and tie circuit-breaker compartments shall be extended to rear of section.
 7. Bus isolation barriers shall be arranged to isolate line bus from load bus at each main and tie circuit breaker.
 8. Circuit-breaker compartments shall be equipped to house drawout-type circuit breakers and shall be fitted with hinged outer doors.
 9. Fabricate enclosure with removable, hinged, rear cover panels to allow access to rear interior of switchgear.
 10. Auxiliary Compartments: Match and align with basic switchgear assembly. Include the following:
 - a. Utility metering compartment that complies with utility company requirements.
 - b. Bus transition sections.
 - c. Incoming-line pull sections.
 - d. Hinged front panels for access to metering, accessory, and blank compartments.
 - e. Pull box on top of switchgear for extra room for pulling cable, with removable top, front, and side covers and ventilation provisions adequate to maintain air temperature in pull box within same limits as switchgear.
 - 1) Set pull box back from front to clear circuit-breaker lifting mechanism.
 - 2) Bottom: Insulating, fire-resistant material with separate holes for cable drops into switchgear.
 - 3) Cable Supports: Arranged to ease cabling and adequate to support cables indicated, including those for future installation.
 11. Bus bars connect between vertical sections and between compartments. Cable connections are not permitted.
 - a. Main Phase Bus: Uniform capacity the entire length of assembly.
 - b. Neutral Bus: 50 **OR** 100, **as directed**, percent of phase-bus ampacity, except as indicated. Equip bus with pressure-connector terminations for outgoing circuit neutral conductors. Include braces for neutral-bus extensions for busway feeders.
 - c. Vertical Section Bus Size: Comply with IEEE C37.20.1, including allowance for spare circuit breakers and spaces for future circuit breakers.
 - d. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent minimum conductivity, with copper feeder circuit-breaker line connections.

OR

Phase- and Neutral-Bus Material: Silver- or tin-plated, high-strength, electrical-grade aluminum alloy, with copper or tin-plated aluminum circuit-breaker line connections.

OR

Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent minimum conductivity or tin-plated, high-strength, electrical-grade aluminum alloy.
 - e. Use silver-plated copper or tin-plated aluminum for connecting circuit-breaker line to aluminum bus.
 - f. Use copper for connecting circuit-breaker line to copper bus.
 - g. Contact Surfaces of Buses: Silver plated.
 - h. Feeder Circuit-Breaker Load Terminals: Silver-plated copper bus extensions equipped with pressure connectors for outgoing circuit conductors.



- i. Ground Bus: Hard-drawn copper of 98 percent minimum conductivity, with pressure connector for feeder and branch-circuit ground conductors, minimum size 1/4 by 2 inches (6 by 50 mm).
- j. Supports and Bracing for Buses: Adequate strength for indicated short-circuit currents.
- k. Neutral bus equipped with pressure-connector terminations for outgoing circuit neutral conductors. Neutral-bus extensions for busway feeders are braced.
- l. Neutral Disconnect Link: Bolted, uninsulated, 1/4-by-2-inch (6-by-50-mm) copper bus, arranged to connect neutral bus to ground bus.
- m. Provide for future extensions from either end of main phase, neutral, and ground bus by means of predrilled bolt-holes and connecting links.
- n. Bus-Bar Insulation: Individual bus bars wrapped with factory-applied, flame-retardant tape or spray-applied, flame-retardant insulation.
 - 1) Sprayed Insulation Thickness: 3 mils (0.08 mm), minimum.
 - 2) Bolted Bus Joints: Insulate with secure joint covers that can easily be removed and reinstalled.

C. Components

1. Instrument Transformers: Comply with IEEE C57.13.
 - a. Potential Transformers: Secondary-voltage rating of 120 V and NEMA accuracy class of 0.3 with burdens of W, X, and Y.
 - b. Current Transformers: Ratios as indicated; burden and accuracy class suitable for connected relays, meters, and instruments.
2. Multifunction Digital-Metering Monitor: UL-listed or -recognized, microprocessor-based unit suitable for three- or four-wire systems and with the following features:
 - a. Inputs from sensors or 5-A current-transformer secondaries, and potential terminals rated to 600 V.
 - b. Switch-selectable digital display of the following:
 - 1) Phase Currents, Each Phase: Plus or minus 1 percent.
 - 2) Phase-to-Phase Voltages, Three Phase: Plus or minus 1 percent.
 - 3) Phase-to-Neutral Voltages, Three Phase: Plus or minus 1 percent.
 - 4) Three-Phase Real Power: Plus or minus 2 percent.
 - 5) Three-Phase Reactive Power: Plus or minus 2 percent.
 - 6) Power Factor: Plus or minus 2 percent.
 - 7) Frequency: Plus or minus 0.5 percent.
 - 8) Integrated Demand, with Demand Interval Selectable from 5 to 60 Minutes: Plus or minus 2 percent.
 - 9) Accumulated energy, in megawatt hours (joules), plus or minus 2 percent; stored values unaffected by power outages for up to 72 hours.
 - c. Mounting: Display and control unit flush or semiflush mounted in instrument compartment door.
3. Analog Instruments: Rectangular, 4-1/2-inch (115-mm) square, accurate within 1 percent, semiflush mounting, with antiparallax 250-degree scale and external zero adjustment, complying with ANSI C39.1.
 - a. Voltmeters: Cover an expanded scale range of normal voltage plus 10 percent.
 - b. Voltmeter Selector Switch: Rotary type with off position to provide readings of phase-to-phase and phase-to-neutral voltages.
 - c. Ammeters: Cover an expanded scale range of bus rating plus 10 percent.
 - d. Ammeter Selector Switch: Permits current reading in each phase and keeps current-transformer secondary circuits closed in off position.
 - e. Locate meter and selector switch on circuit-breaker compartment door for indicated feeder circuits only.
 - f. Watt-Hour Meters: Flush- or semiflush-mounting type, 5 A, 120 V, 3 phase, 3 wire; with 3 elements, 15-minute indicating demand register, and provision for testing and adding pulse initiation.



- g. Pickup Points: Five minimum, for instantaneous-trip functions.
 - h. Ground-fault protection with at least three short-time-delay settings and three trip-time-delay bands; adjustable current pickup. Arrange to provide protection for the following:
 - 1) Three-wire circuit or system.
 - 2) Four-wire circuit or system.
 - 3) Four-wire, double-ended substation.
 - i. Trip Indication: Labeled, battery-powered lights or mechanical targets on trip device to indicate type of fault.
5. Auxiliary Contacts: For interlocking or remote indication of circuit-breaker position, with spare auxiliary switches and other auxiliary switches required for normal circuit-breaker operation, quantity as indicated. Each consists of two Type "a" and two Type "b" stages (contacts) wired through secondary disconnect devices to a terminal block in stationary housing.
 6. Drawout Features: Circuit-breaker mounting assembly equipped with a racking mechanism to position circuit breaker and hold it rigidly in connected, test, and disconnected positions. Include the following features:
 - a. Interlocks: Prevent movement of circuit breaker to or from connected position when it is closed, and prevent closure of circuit breaker unless it is in connected, test, or disconnected position.
 - b. Circuit-Breaker Positioning: An open circuit breaker may be racked to or from connected, test, and disconnected positions only with the associated compartment door closed unless live parts are covered by a full dead-front shield. An open circuit breaker may be manually withdrawn to a position for removal from the structure with the door open. Status for connection devices for different positions includes the following:
 - 1) Test Position: Primary disconnect devices disengaged, and secondary disconnect devices and ground contact engaged.
 - 2) Disconnected Position: Primary and secondary devices and ground contact disengaged.
 7. Arc Chutes: Readily removable from associated circuit breaker when it is in disconnected position, and arranged to permit inspection of contacts without removing circuit breaker from switchgear.
 8. Padlocking Provisions: For installing at least three padlocks on each circuit breaker to secure its enclosure and prevent movement of drawout mechanism.
 9. Operating Handle: One for each circuit breaker capable of manual operation.
 10. Electric Close Button: One for each electrically operated circuit breaker.
 11. Mechanical Interlocking of Circuit Breakers: Uses a mechanical tripping lever or equivalent design and electrical interlocks.
 12. Key Interlocks: Arranged so keys are attached at devices indicated. Mountings and hardware are included where future installation of key-interlock devices is indicated.
 13. Undervoltage Trip Devices: Instantaneous, with adjustable pickup voltage **OR** Adjustable time-delay and pickup voltage, **as directed**.
 14. Shunt-Trip Devices: Where indicated.
 15. Fused Circuit Breakers: Circuit breaker and fuse combinations complying with requirements for circuit breakers and trip devices and with the following:
 - a. Fuses: NEMA FU 1, Class L current limiting, sized to coordinate with and protect associated circuit breaker.
 - b. Circuit Breakers with Frame Size 1600 A and Smaller: Fuses on line side of associated circuit breaker, on a common drawout mounting, arranged so fuses are accessible only when circuit breaker is in disconnected position.
 - c. Circuit Breakers with Frame Sizes More Than 1600 A: Fuses and circuit breakers may be installed in separate compartments on separate drawout mountings. Fuse drawout element is interlocked with associated power circuit breaker to prevent drawing out fuse element unless circuit breaker is in open position.
 - d. Open-Fuse Trip Device: Positive means of tripping and holding circuit breaker in open position when a fuse opens. Open-fuse status is indicated at front of circuit breaker or fuse drawout element.



16. Indicating Lights: To indicate circuit breaker is open or closed, for main and bus tie circuit breakers interlocked either with each other or with external devices.

E. Accessories

1. Accessory Set: Furnish tools and miscellaneous items required for circuit-breaker and switchgear test, inspection, maintenance, and operation.
 - a. Racking handle to manually move circuit breaker between connected and disconnected positions.
 - b. Portable test set for testing all functions of circuit-breaker, solid-state trip devices without removal from switchgear.
 - c. Relay and meter test plugs suitable for testing switchgear meters and switchgear class relays.
2. Circuit-Breaker Removal Apparatus: Portable, floor-supported, roller-base, elevating carriage arranged for moving circuit breakers in and out of compartments.
3. Circuit-Breaker Removal Apparatus: Overhead-circuit-breaker lifting device, track mounted at top front of switchgear and complete with hoist and lifting yokes matching each size of drawout circuit breaker installed.
4. Spare-Fuse Cabinet: Identified and compartmented steel box or cabinet with lockable door.
5. Storage for Manual: Include a rack or holder, near the operating instructions, for a copy of maintenance manual.

F. Identification

1. Mimic Bus: Continuous mimic bus, arranged in single-line diagram format, using symbols and lettered designations consistent with approved mimic-bus diagram.
 - a. Mimic-bus segments coordinated with devices in switchgear sections to which applied, to produce a concise visual presentation of principal switchgear components and connections.
 - b. Medium: Painted graphics, as selected by Architect.
 - c. Color: Contrasting with factory-finish background; as selected by Architect from manufacturer's full range.
2. System Power Riser Diagrams: Depict power sources, feeders, distribution components, and major loads. Include as-built data for low-voltage power switchgear and connections as follows:
 - a. Frame size of each circuit breaker.
 - b. Trip rating for each circuit breaker.
 - c. Conduit and wire size for each feeder.

1.3 EXECUTION

A. Installation

1. Comply with applicable portions of NECA 400.
2. Anchor switchgear assembly to 4-inch (100-mm), channel-iron floor sill embedded in floor **OR** concrete base, **as directed**, and attach by bolting.
 - a. Sills: Select to suit switchgear; level and grout flush into floor **OR** concrete base, **as directed**.
 - b. Design each fastener and support to carry load indicated by seismic requirements and according to seismic-restraint details. See Division 26 Section "Hangers And Supports For Electrical Systems" for seismic-restraint requirements.
 - c. Concrete Bases: 4 inches (100 mm) high, reinforced, with chamfered edges. Extend base no more than 3 inches (75 mm) in all directions beyond the maximum dimensions of switchgear unless otherwise indicated or unless required for seismic anchor support. Construct concrete bases according to Division 26 Section "Hangers And Supports For Electrical Systems".
3. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, brackets, and temporary blocking of moving parts from switchgear units and components.



- B. Identification
1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Identification For Electrical Systems".
 2. Diagram and Instructions:
 - a. Frame and mount under clear acrylic plastic on the front of switchgear.
 - 1) Operating Instructions: Printed basic instructions for switchgear, including control and key-interlock sequences and emergency procedures.
 - 2) System Power Riser Diagrams: Depict power sources, feeders, distribution components, and major loads.
 - b. Storage for Maintenance: Include a rack or holder, near the operating instructions, for a copy of maintenance manual.
- C. Connections
1. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
 2. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".
- D. Field Quality Control
1. Prepare for acceptance tests as follows:
 - a. Test insulation resistance for each switchgear bus, component, connecting supply, feeder, and control circuit.
 - b. Test continuity of each circuit.
 2. Manufacturer's Field Service: Engage a factory-authorized service representative to perform the following:
 - a. Inspect switchgear installation, including wiring, components, connections, and equipment. Test and adjust components and equipment.
 - b. Verify that electrical control wiring installation complies with manufacturer's submittal by means of point-to-point continuity testing. Verify that wiring installation complies with requirements in Division 22.
 - c. Complete installation and startup checks according to manufacturer's written instructions.
 - d. Assist in field testing of equipment including pretesting and adjusting of equipment and components.
 - e. Report results in writing.
 3. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
 - a. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters. Perform NETA tests and inspections for each of the following NETA categories:
 - 1) Switchgear.
 - 2) Circuit breakers.
 - 3) Protective relays.
 - 4) Instrument transformers.
 - 5) Metering and instrumentation.
 - 6) Ground-fault systems.
 - 7) Battery systems.
 - 8) Surge arresters.
 - 9) Capacitors.
 - b. Remove and replace malfunctioning units and retest as specified above.
 4. Infrared Scanning: After Final Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switchgear. Remove front and rear panels so joints and connections are accessible to portable scanner.
 - a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switchgear 11 months after date of Final Completion.



- b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - c. Record of Infrared Scanning: Prepare a certified report that identifies switchgear checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- E. Adjusting
- 1. Set field-adjustable, protective-relay trip characteristics according to results in Division 26 Section "Overcurrent Protective Device Coordination Study".
 - 2. Set field-adjustable, protective-relay trip characteristics.
- F. Cleaning
- 1. On completion of installation, inspect interior and exterior of switchgear. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.
- G. Protection
- 1. Temporary Heating: Apply temporary heat to switchgear, according to manufacturer's written instructions, throughout periods when switchgear environment is not controlled for temperature and humidity within manufacturer's stipulated service conditions.

END OF SECTION 26 24 19 00



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SECTION 26 24 19 00a - POWER DISTRIBUTION UNITS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for power distribution units. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes freestanding, prepackaged, power distribution units for transforming, conditioning, and distributing electrical power.

C. Definitions

1. TVSS: Transient voltage surge suppression.
2. UPS: Uninterrupted power supply.

D. Submittals

1. Product Data: For power distribution units.
2. Shop Drawings: Include dimensioned plans, sections, and elevations. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - a. Wiring Diagrams: Power, signal, and control wiring.
3. Manufacturer Seismic Qualification Certification: Submit certification that power distribution units, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration And Seismic Controls For Electrical Systems". Include the following:
4. Field quality-control test reports.
5. Operation and Maintenance Data: For power distribution units to include in emergency, operation, and maintenance manuals.

E. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. Comply with NFPA 70.

F. Delivery, Storage, And Handling

1. Deliver equipment in fully enclosed vehicles after specified environmental conditions have been permanently established in spaces where equipment is to be placed.
2. Store equipment in spaces with environments controlled within manufacturer's ambient temperature and humidity tolerances for non-operating equipment.

1.2 PRODUCTS

A. Manufactured Units

1. Description: Integrated and coordinated assembly of power-line-conditioning and distribution components packaged in a single cabinet or modular assembly of cabinets each with full-swivel casters mounted to bottom frame, **as directed**. Include the following components:
 - a. Input-power, circuit-breaker section.
 - b. Isolation transformer.
 - c. TVSS system.
 - d. Output panelboard(s).



- e. Alarm, monitoring, and control system.
 2. Provide units that are constructed to withstand seismic forces specified in Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
 3. Unit Capacity Rating: Unit shall carry indicated rms kilovolt-ampere load continuously without exceeding rated insulation temperature for the following input voltage and load current:
 - a. Input Voltage: Within rated input-voltage tolerance band of unit.
 - b. Load Current: Minimum of 3.0 crest factor and 85 percent total harmonic distortion.
- B. Input-Power, Circuit-Breaker Section
1. Description: 3-pole, shunt-tripped, thermal-magnetic-type circuit breaker, rated for indicated interrupting capacity and 125 percent of input current of unit at 100 percent rated load.
 - a. Dual-Input Units:
 - 1) Two input circuit breakers arranged to provide transfer between two input-voltage sources.
 - 2) Controls and interfaces to allow both open- and closed-transition transfer between two input-voltage sources.
 - 3) Use a 120-V permissive signal from both upstream voltage sources to indicate acceptable conditions for closed-transition transfer.
 - 4) Open second circuit breaker automatically after closed-transition transfer is completed.
- C. Isolation Transformer Section
1. Description: Dry-type, electrostatically shielded, three-phase, common-core, convection-air-cooled isolation transformer.
 - a. Comply with UL 1561 including requirements for nonsinusoidal load-current-handling capability defined by designated K-factor, **as directed**.
 - b. Cores: Grain-oriented, non-aging silicon steel, one leg per phase.
 - c. Coil Material and Insulation: Copper windings with a 220 deg C insulation class.
 - d. Temperature Rise: Designed for 80 **OR** 115 **OR** 150, **as directed**, deg C rise above 40 deg C ambient.
 - e. Output Impedance: 3.5 plus or minus 0.5 percent.
 - f. Regulation: 2 to 4 percent maximum, at full-resistive load; 5 percent maximum, at rated nonlinear load.
 - g. Taps: 6 full-capacity compensation taps at 2.5 percent increments; 2 above and 4 below nominal voltage.
 - h. Full-Load Efficiency: Minimum 96 percent at rated nonlinear, **as directed**, load.
 - i. Magnetic-Field Strength External to Transformer Enclosure: Less than 0.1 gauss at 450 mm.
 - j. Audible Noise: Comply with NEMA ST 20.
 - k. Electrostatic Shielding: Independently shield each winding with a double-copper, electrostatic shield arranged to minimize interwinding capacitance.
 - 1) Coil leads and terminal trips shall be arranged to minimize capacitive coupling between input and output connections.
 - 2) Shield Terminal: Separate, and marked "Shield" for grounding connection.
 - 3) Capacitance: Limit capacitance between primary and secondary windings to a maximum of 33 picofarads over a frequency range of 20 Hz to 1 MHz.
 - 4) Common-Mode Noise Attenuation: 120 dB minimum, 0.5 to 1.5 kHz; minus 65 dB minimum, 1.5 to 100 kHz.
 - 5) Normal-Mode Noise Attenuation: Minus 52 dB minimum, 1.5 to 10 kHz.
 - l. Neutral Rating: 1.732 times the system full-load ampere rating.
- D. TVSS System
1. Description: Integrated TVSS system complying with Division 26 Section "Transient-voltage Suppression For Low-voltage Electrical Power Circuits", to protect unit panelboard, and having the following features:



- a. Disconnect Device: Manual, three-pole, fused disconnect switch to de-energize TVSS system while permitting power distribution units to continue operation. Fuses are rated at 200-kA interrupting capacity.
 - b. Nonlinear Loading: System shall accommodate rated-load current with a minimum 3.0 crest factor and 85 percent total harmonic distortion.
- E. Output Panelboards
1. Description: Panelboards complying with Division 26 Section "Panelboards", except for mounting provisions. Mount in front of power distribution units behind flush doors. Include the following features:
 - a. Construction: 42 pole, 240 V, 3 phase; capable of accepting branch circuit breakers rated to 100 A.
 - b. Panelboard Rating: 225 A, with main circuit breaker.
 - c. Panelboard Phase, Neutral and Ground Buses: Copper, with neutral bus at least 1.732 times the nominal phase bus rating.
 - d. Isolated Ground Bus: Copper, adequate for branch-circuit equipment ground conductors; insulated from supports.
 - e. Branch Circuit Breakers: Bolt **OR** Plug, **as directed**, on.
 - f. Cable Racks: Removable and arranged for supporting and routing cables for panelboard entrance.
 - g. Access Panels: Arranged so additional branch-circuit wiring can be installed and connected in the future.
- F. Power Distribution Unit Controls
1. Include the following control features:
 - a. Emergency, power-off switch integral with power distribution unit.
 - b. Emergency, power-off input terminals for connection to remote power-off switch.
 - c. Over-under alarm shutdown with automatic unit disconnection for the following alarm conditions:
 - 1) High temperature.
 - 2) High and low input or output voltage.
 - 3) Phase loss.
 - 4) Ground fault.
 - 5) Reverse phase rotation.
 - d. Ground-fault protection with automatic system shutdown.
 - e. Alarm Contacts: Electrically isolated, Form C (one normally open and one normally closed), summary alarm; contact set shall change state if any monitored function goes into alarm mode.
 - f. Remote Power-Off Control: Control circuit with connection to shunt trip of power distribution unit main power circuit breaker and terminals for connection to one or more remote power-off, push-button stations.
- G. Monitoring, Status, And Alarm Annunciation
1. Description: Microprocessor-based monitoring, status, and alarm annunciation panel mounted flush in front of power distribution unit to provide status display and failure-indicating interface for the following:
 - a. Power Monitoring:
 - 1) Input Voltage: Line to line, rms.
 - 2) Output Voltage: Line to line, rms.
 - 3) Output Voltage: Line to neutral, rms.
 - 4) Output current.
 - b. Status Indication: Unit on.
 - c. Alarm Annunciation:
 - 1) High temperature.
 - 2) High and low input voltage.
 - 3) High and low output voltage.



- 4) Phase loss.
 - 5) Ground fault.
 - 6) Frequency.
 - 7) Phase rotation.
 - 8) TVSS module failure.
- d. Audible Alarm and Silencing Switch: Alarm sounds when alarm indication occurs. Silencing switch shall silence audible alarm but leave visual indication active until failure or other alarm conditions are corrected.

H. Sound Level

1. General: Fully assembled products comply with minimum sound-level requirements in NEMA ST 20 for transformers of corresponding ratings when factory tested according to IEEE C57.12.91.
2. General: Fully assembled products have a minimum of 3 dB less than the maximum sound levels prescribed for transformers of corresponding ratings when factory tested according to IEEE C57.12.91.

I. Finishes

1. Manufacturer's standard finish over corrosion-resistant pretreatment and primer.

J. Source Quality Control

1. Factory Tests: Design and routine tests shall comply with referenced standards.
2. Factory Sound-Level Tests: Conduct sound-level tests on equipment. Comply with IEEE C57.12.91 and NEMA ST 20.

1.3 EXECUTION

A. Installation

1. Arrange power distribution units to provide adequate access to equipment and circulation of cooling air.
2. Anchor or restrain floor-mounting power distribution units according to manufacturer's written instructions, seismic codes applicable to Project, **as directed**, and requirements in Division 26 Section "Hangers And Supports For Electrical Systems".
3. Identify equipment and install warning signs according to Division 26 Section "Identification For Electrical Systems".

B. Connections

1. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
 - a. Separately Derived Systems: Make grounding connections to grounding electrodes as indicated; comply with NFPA 70.
2. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

C. Field Quality Control

1. Perform tests and inspections and prepare test reports.
2. Tests and Inspections:
 - a. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification for circuit breakers, molded case; and for transformers, dry type, air cooled, low voltage, small. Certify compliance with test parameters.
 - b. Perform functional tests of power distribution units throughout their operating ranges. Test each monitoring, status, and alarm function.
 - c. Infrared Scanning: Two months after Final Completion, perform an infrared scan of conductor and bus connections.



- 1) Use an infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.
 - 2) Perform 2 follow-up infrared scans of transformers, one at 4 months and the other at 11 months after Final Completion.
 - 3) Prepare a certified report identifying connections checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and scanning observations after remedial action.
3. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

D. Adjusting

1. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
2. Adjust power distribution units to provide optimum voltage to equipment served throughout normal operating cycle of loads served. Record input and output voltages and adjustment settings, and incorporate into test results.

E. Cleaning

1. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION 26 24 19 00a



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Task	Specification	Specification Description
26 24 19 00	01 22 16 00	No Specification Required
26 24 19 00	26 09 23 00b	Electrical Power Monitoring And Control
26 24 19 00	23 09 23 00	Enclosed Controllers
26 24 19 00	26 09 23 00c	Motor-Control Centers



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SECTION 26 25 00 00 - ENCLOSED BUS ASSEMBLIES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for enclosed bus assemblies. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Feeder-bus assemblies.
 - b. Plug-in bus assemblies.
 - c. Bus plug-in devices.

C. Definitions

1. TVSS: Transient voltage surge suppressor.

D. Submittals

1. Shop Drawings: For each type of bus assembly **OR** bus assembly and plug-in device, **as directed**.
 - a. Show fabrication and installation details for enclosed bus assemblies. Include plans, elevations, and sections of components. Designate components and accessories, including clamps, brackets, hanger rods, connectors, straight lengths, and fittings.
 - b. Show fittings, materials, fabrication, and installation methods for listed fire-stop barriers and weather barriers.
 - c. Indicate required clearances, method of field assembly, and location and size of each field connection.
 - d. Detail connections to switchgear, switchboards, transformers, and panelboards.
 - e. Wiring Diagrams: Power and signal **OR** and control, **OR** signal, and control, **as directed**, wiring.
 - f. Seismic-Restraint Details: Signed and sealed by a qualified professional engineer.
 - 1) Design Calculations: Calculate requirements for selecting seismic restraints.
 - 2) Detail fabrication, including anchorages and attachments to structure and to supported equipment.
2. Coordination Drawings: Floor plans and sections, drawn to scale. Include scaled bus-assembly layouts and relationships between components and adjacent structural, mechanical, and electrical elements. Show the following:
 - a. Vertical and horizontal enclosed bus-assembly runs, offsets, and transitions.
 - b. Clearances for access above and to the side of enclosed bus assemblies.
 - c. Vertical elevation of enclosed bus assemblies above the floor or bottom of structure.
 - d. Support locations, type of support, and weight on each support.
3. Location of adjacent construction elements including light fixtures, HVAC and plumbing equipment, fire sprinklers and piping, signal and control devices, and other equipment.
4. Product Certificates: For each type of enclosed bus assembly, signed by product manufacturer.
5. Manufacturer Seismic Qualification Certification: Submit certification that enclosed bus assemblies, plug-in devices, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration And Seismic Controls For Electrical Systems" Include the following:
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 1) The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."



- 2) The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
6. Qualification Data: For professional engineer and testing agency.
7. Field quality-control test reports.
8. Operation and Maintenance Data: For enclosed bus assemblies to include in emergency, operation, and maintenance manuals.

E. Quality Assurance

1. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
 - a. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 1.3.
2. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
3. Source Limitations: Obtain enclosed bus assemblies and plug-in devices through one source from a single manufacturer.
4. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
5. Comply with NEMA BU 1, "Busways."
6. Comply with NFPA 70.

F. Delivery, Storage, And Handling

1. Deliver, store, and handle enclosed bus assemblies according to NEMA BU 1.1, "General Instructions for Proper Handling, Installation, Operation and Maintenance of Busway Rated 600 Volts or Less."

G. Project Conditions

1. Derate enclosed bus assemblies for continuous operation at indicated ampere ratings for ambient temperature not exceeding 122 deg F (50 deg C) **OR** 140 deg F (60 deg C), **as directed**.

H. Coordination

1. Coordinate layout and installation of enclosed bus assemblies and suspension system with other construction that penetrates ceilings or floors or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.
2. Coordinate size and location of concrete curbs around openings for vertical bus. Concrete, reinforcement, and formwork requirements are specified in Division 31.

1.2 PRODUCTS

A. Enclosed Bus Assemblies

1. Feeder-Bus Assemblies: NEMA BU 1, low-impedance bus assemblies in nonventilated housing; single-bolt joints; ratings as indicated.
 - a. Seismic Fabrication Requirements: Fabricate mounting provisions and attachments for feeder-bus assemblies with reinforcement strong enough to withstand seismic forces



- defined in Division 26 Section "Vibration And Seismic Controls For Electrical Systems" when mounting provisions and attachments are anchored to building structure
- b. Voltage: 120/208 **OR** 240 **OR** 480 **OR** 277/480, **as directed**, V; 3 phase; 100 **OR** 200 **OR** percent neutral capacity, **as directed**.
 - c. Temperature Rise: 55 deg C above 40 deg C ambient maximum for continuous rated current.
 - d. Bus Materials: Current-carrying copper **OR** aluminum, **as directed**, conductors, fully insulated with Class 130C insulation except at joints; plated surface at joints.
 - e. Ground:
 - 1) 50 percent capacity integral with housing.
 - 2) 50 percent capacity internal bus bars of material matching bus material.
 - 3) 50 percent capacity isolated, internal bus bar of material matching bus material.
 - f. Enclosure: Steel with manufacturer's standard finish **OR** Aluminum with manufacturer's standard finish **OR** Weatherproof, steel or aluminum with manufacturer's standard finish, sealed seams, drains, and removable closures, **as directed**.
 - g. Fittings and Accessories: Manufacturer's standard.
 - h. Mounting: Arranged flat, edgewise, or vertically without derating.
2. Plug-in Bus Assemblies: NEMA BU 1, low-impedance bus assemblies in nonventilated housing; single-bolt joints; ratings as indicated.
- a. Seismic Fabrication Requirements: Fabricate mounting provisions and attachments for switchboards with reinforcement strong enough to withstand seismic forces defined in Division 26 Section "Vibration And Seismic Controls For Electrical Systems" when mounting provisions and attachments are anchored to building structure.
 - b. Voltage: 120/208 **OR** 240 **OR** 480 **OR** 277/480, **as directed**, V; 3 phase; 100 **OR** 200 **OR** percent neutral capacity, **as directed**.
 - c. Temperature Rise: 55 deg C above 40 deg C ambient maximum for continuous rated current.
 - d. Bus Materials: Current-carrying copper **OR** aluminum, **as directed**, conductors, fully insulated with Class 130C insulation except at stabs and joints; plated surface at stabs and joints.
 - e. Ground:
 - 1) 50 percent capacity integral with housing.
 - 2) 50 percent capacity internal bus bar of material matching bus material.
 - 3) 50 percent capacity isolated, internal bus bar of material matching bus material.
 - f. Enclosure: Steel, with manufacturer's standard finish, plug-in openings 24 inches (610 mm) o.c., and hinged covers over unused openings **OR** Aluminum, with manufacturer's standard finish, plug-in openings 24 inches (610 mm) o.c., and hinged covers over unused openings, **as directed**.
 - g. Fittings and Accessories: Manufacturer's standard.
 - h. Mounting: Arranged flat, edgewise, or vertically without derating.
- B. Plug-In Devices
1. Fusible Switches: NEMA KS 1, heavy duty; with R-type rejection **OR** J-type **OR** L-type, **as directed**, fuse clips to accommodate specified fuses; hookstick-operated handle, lockable with two padlocks, and interlocked with cover in closed position. See Division 16 Section "Fuses" for fuses and fuse installation requirements.
 2. Molded-Case Circuit Breakers: NEMA AB 1; hookstick-operated handle, lockable with two padlocks, and interlocked with cover in closed position.
 3. TVSS: NEMA 250, Type 1 enclosure with NEMA KS 1, fusible, disconnect switch and external handle to isolate TVSS from busway. TVSS product and installation requirements are specified in Division 16 Section "Transient Voltage Suppression."
 4. Motor Controllers: NEMA ICS 2, Class A, full voltage, nonreversing, across the line, unless otherwise indicated.
 - a. Control Circuit: 120 V; obtained from integral control power transformer, **as directed**, with a control power transformer **OR** source, **as directed**, of enough capacity to operate connected pilot, indicating and control devices, plus 100 percent spare capacity.



- b. Combination Controller: Factory-assembled combination controller and disconnect switch with or without overcurrent protection as indicated.
 - 1) Fusible Disconnecting Means: NEMA KS 1, heavy-duty, fusible switch with R-type rejection **OR** J-type, **as directed**, fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 947-4-1, as certified by a nationally recognized testing laboratory (NRTL) acceptable to authorities having jurisdiction. See Division 26 Section "Fuses" for fuses and fuse installation requirements.
OR
Nonfusible Disconnecting Means: NEMA KS 1, heavy-duty, nonfusible switch.
OR
Circuit-Breaker Disconnecting Means: NEMA AB 1, motor-circuit protector with field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
- c. Overload Relay: Ambient-compensated type with inverse-time-current characteristic and NEMA ICS 2, Class 10 **OR** Class 20 **OR** Class 30, **as directed**, tripping characteristic. Overload relays shall have heaters or sensors in each phase matched to nameplate full-load current of specific motor to which they connect and with appropriate adjustment for duty cycle.
- d. Adjustable Overload Relay: Dipswitch selected for motor running overload protection with NEMA ICS 2, Class 10 **OR** Class 20 **OR** Class 30, **as directed**, tripping characteristic, and selected to protect motor against voltage and current unbalance and single phasing. Adjustable overload relays shall have Class II ground-fault protection with start and run delays to prevent nuisance trip on starting.
- 5. Multispeed Motor Controllers: Match controller to motor type, application, and number of speeds; include the following accessories:
 - a. Compelling relay ensures motor starts only at low speed.
 - b. Accelerating relay ensures properly timed acceleration through speeds lower than that selected.
 - c. Decelerating relay ensures automatically timed deceleration through each speed.
- 6. Accessories: Hookstick operator, adjustable to maximum extension of 14 feet (4.3 m), **as directed**.

1.3 EXECUTION

A. Installation

- 1. Support bus assemblies independent of supports for other elements such as equipment enclosures at connections to panelboards and switchboards, pipes, conduits, ceilings, and ducts.
 - a. Design each fastener and support to carry load indicated by seismic requirements and to comply with seismic-restraint details according to Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
 - b. Design each fastener and support to carry 200 lb (90 kg) or 4 times the weight of bus assembly, whichever is greater.
 - c. Support bus assembly to prevent twisting from eccentric loading.
 - d. Support bus assembly with not less than 3/8-inch (10-mm) steel rods. Install side bracing to prevent swaying or movement of bus assembly. Modify supports after completion to eliminate strains and stresses on bus bars and housings.
 - e. Fasten supports securely to building structure according to Division 26 Section "Hangers And Supports For Electrical Systems".
- 2. Install expansion fittings at locations where bus assemblies cross building expansion joints. Install at other locations so distance between expansion fittings does not exceed manufacturer's recommended distance between fittings.
- 3. Construct rated fire-stop assemblies where bus assemblies penetrate fire-rated elements such as walls, floors, and ceilings. Seal around penetrations according to Division 07 Section "Penetration Firestopping".



4. Install weatherseal fittings and flanges where bus assemblies penetrate exterior elements such as walls or roofs. Seal around openings to make weathertight. See Division 07 Section "Joint Sealants" for materials and application.
 5. Install a concrete curb at least 4 inches (100 mm) high around bus-assembly floor penetrations.
 6. Coordinate bus-assembly terminations to equipment enclosures to ensure proper phasing, connection, and closure.
 7. Tighten bus-assembly joints with torque wrench or similar tool recommended by bus-assembly manufacturer. Tighten joints again after bus assemblies have been energized for 30 days.
 8. Install bus-assembly, plug-in units. Support connecting conduit independent of plug-in unit.
- B. Connections
1. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
 2. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".
- C. Field Quality Control
1. Perform tests and inspections and prepare test reports.
 2. Tests and Inspections:
 - a. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 3. Remove and replace units that do not pass tests and inspections and retest as specified above.
 4. Infrared Scanning: Two months after Final Completion, perform an infrared scan of bus assembly including joints and plug-in units.
 - a. Use an infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.
 - b. Perform 2 follow-up infrared scans of bus assembly, one at 4 months and the other at 11 months after Final Completion.
 - c. Prepare a certified report identifying bus assembly checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and scanning observations after remedial action.
 5. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.
- D. Adjusting
1. Set field-adjustable, circuit-breaker trip ranges and overload relay trip settings, **as directed**, as indicated.
- E. Cleaning
1. Vacuum dirt and debris; do not use compressed air to assist in cleaning.
- F. Protection
1. Provide final protection to ensure that moisture does not enter bus assembly.

END OF SECTION 26 25 00 00



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Task	Specification	Specification Description
26 26 00 00	26 24 19 00a	Power Distribution Units
26 27 13 00	26 05 26 00b	Overhead Electrical Distribution
26 27 16 00	26 05 33 16	Raceways And Boxes
26 27 16 00	26 09 23 00b	Electrical Power Monitoring And Control
26 27 16 00	26 09 23 00c	Motor-Control Centers
26 27 23 00	26 05 33 16a	Wiring Devices
26 27 26 00	01 22 16 00	No Specification Required
26 27 26 00	26 05 33 16	Raceways And Boxes
26 27 26 00	26 05 33 16a	Wiring Devices
26 27 26 00	26 09 23 00b	Electrical Power Monitoring And Control
26 27 73 00	26 05 33 16a	Wiring Devices



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SECTION 26 28 13 00 - FUSES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for fuses. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Cartridge fuses rated 600-V ac and less for use in control circuits, enclosed switches, panelboards, switchboards, enclosed controllers, and motor-control centers.
 - b. Plug fuses rated 125-V ac and less for use in plug-fuse-type enclosed switches, fuseholders, and panelboards.
 - c. Plug-fuse adapters for use in Edison-base, plug-fuse sockets.
 - d. Spare-fuse cabinets.

C. Submittals

1. Product Data: For each type of product indicated.
2. Operation and maintenance data.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with NEMA FU 1 for cartridge fuses.
3. Comply with NFPA 70.
4. Comply with UL 248-11 for plug fuses.

E. Project Conditions

1. Where ambient temperature to which fuses are directly exposed is less than 40 deg F (5 deg C) or more than 100 deg F (38 deg C), apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.2 PRODUCTS

A. Cartridge Fuses

1. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

B. Plug Fuses

1. Characteristics: UL 248-11, nonrenewable plug fuses; 125-V ac.

C. Plug-Fuse Adapters

1. Characteristics: Adapters for using Type S, rejection-base plug fuses in Edison-base fuseholders or sockets; ampere ratings matching fuse ratings; irremovable once installed.

D. Spare-Fuse Cabinet

1. Characteristics: Wall-mounted steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.
 - a. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.



- b. Finish: Gray, baked enamel.
- c. Identification: "SPARE FUSES" in 1-1/2-inch- (38-mm-) high letters on exterior of door.
- d. Fuse Pullers: For each size of fuse, where applicable and available, from fuse manufacturer.

1.3 EXECUTION

A. Fuse Applications

1. Cartridge Fuses:
 - a. Service Entrance: Class L, fast acting **OR** Class L, time delay **OR** Class RK1, fast acting **OR** Class RK1, time delay **OR** Class J, fast acting **OR** Class J, time delay **OR** Class T, fast acting, **as directed**.
 - b. Feeders: Class L, fast acting **OR** Class L, time delay **OR** Class RK1, fast acting **OR** Class RK1, time delay **OR** Class RK5, fast acting **OR** Class RK5, time delay **OR** Class J, fast acting **OR** Class J, time delay, **as directed**.
 - c. Motor Branch Circuits: Class RK1 **OR** Class RK5, **as directed**, time delay.
 - d. Other Branch Circuits: Class RK1, time delay **OR** Class RK5, time delay **OR** Class J, fast acting **OR** Class J, time delay, **as directed**.
 - e. Control Circuits: Class CC, fast acting **OR** time delay, **as directed**.
2. Plug Fuses:
 - a. Motor Branch Circuits: Edison-base type, dual **OR** Edison-base type, single **OR** Type S, dual **OR** Type S, single, **as directed**, -element time delay.
 - b. Other Branch Circuits: Edison-base type, single-element fast acting **OR** Edison-base type, dual-element time delay **OR** Edison-base type, single-element time delay **OR** Type S, dual-element time delay **OR** Type S, single-element time delay, **as directed**.

B. Installation

1. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.
2. Install plug-fuse adapters in Edison-base fuseholders and sockets. Ensure that adapters are irremovable once installed.
3. Install spare-fuse cabinet(s).

C. Identification

1. Install labels complying with requirements for identification specified in Division 26 Section "Identification For Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 26 28 13 00



Task	Specification	Specification Description
26 28 13 00	26 24 19 00	Switchgear
26 29 13 13	01 22 16 00	No Specification Required
26 29 13 13	23 09 23 00	Enclosed Controllers



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SECTION 26 29 23 00 - VARIABLE FREQUENCY CONTROLLERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for variable frequency controllers. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes separately enclosed, pre-assembled, combination VFCs, rated 600 V and less, for speed control of three-phase, squirrel-cage induction motors.

C. Definitions

1. BAS: Building automation system.
2. CE: Conformite Europeene (European Compliance).
3. CPT: Control power transformer.
4. EMI: Electromagnetic interference.
5. IGBT: Insulated-gate bipolar transistor.
6. LAN: Local area network.
7. LED: Light-emitting diode.
8. MCP: Motor-circuit protector.
9. NC: Normally closed.
10. NO: Normally open.
11. OCPD: Overcurrent protective device.
12. PCC: Point of common coupling.
13. PID: Control action, proportional plus integral plus derivative.
14. PWM: Pulse-width modulated.
15. RFI: Radio-frequency interference.
16. TDD: Total demand (harmonic current) distortion.
17. THD(V): Total harmonic voltage demand.
18. VFC: Variable-frequency motor controller.

D. Performance Requirements

1. Seismic Performance: VFCs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

E. Submittals

1. Product Data: For each type and rating of VFC indicated. Include features, performance, electrical ratings, operating characteristics, shipping and operating weights, and furnished specialties and accessories.
2. LEED Submittals:
 - a. Product Data for Credit EA 5: For continuous metering equipment for energy consumption.
3. Shop Drawings: For each VFC indicated. Include dimensioned plans, elevations, and sections; and conduit entry locations and sizes, mounting arrangements, and details, including required clearances and service space around equipment.
 - a. Show tabulations of installed devices, equipment features, and ratings. Include the following:
 - 1) Each installed unit's type and details.
 - 2) Factory-installed devices.



- 3) Enclosure types and details.
 - 4) Nameplate legends.
 - 5) Short-circuit current (withstand) rating of enclosed unit.
 - 6) Features, characteristics, ratings, and factory settings of each VFC and installed devices.
 - 7) Specified modifications.
- b. Schematic and Connection Wiring Diagrams: For power, signal, and control wiring.
4. Harmonic Analysis Study and Report: Comply with IEEE 399 and NETA Acceptance Testing Specification; identify the effects of nonlinear loads and their associated harmonic contributions on the voltages and currents throughout the electrical system. Analyze possible **OR** designated, **as directed**, operating scenarios, including recommendations for VFC input filtering to limit TDD and THD(V) at each VFC **OR** at the defined PCC, **as directed**, to specified levels.
 5. Coordination Drawings: Floor plans, drawn to scale, showing dimensioned layout, required working clearances, and required area above and around VFCs. Show VFC layout and relationships between electrical components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate field measurements.
 6. Qualification Data: For qualified testing agency.
 7. Seismic Qualification Certificates: For VFCs, accessories, and components, from manufacturer.
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based, and their installation requirements.
 8. Product Certificates: For each VFC, from manufacturer.
 9. Source quality-control reports.
 10. Field quality-control reports.
 11. Operation and Maintenance Data: For VFCs to include in emergency, operation, and maintenance manuals. Include the following:
 - a. Manufacturer's written instructions for testing and adjusting thermal-magnetic circuit breaker and MCP trip settings.
 - b. Manufacturer's written instructions for setting field-adjustable overload relays.
 - c. Manufacturer's written instructions for testing, adjusting, and reprogramming microprocessor control modules.
 - d. Manufacturer's written instructions for setting field-adjustable timers, controls, and status and alarm points.
 12. Load-Current and Overload-Relay Heater List: Compile after motors have been installed, and arrange to demonstrate that selection of heaters suits actual motor nameplate, full-load currents.
 13. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed and arrange to demonstrate that switch settings for motor-running overload protection suit actual motors to be protected.
- F. Quality Assurance
1. Testing Agency Qualifications: Member company of NETA or an NRTL.
 - a. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
 2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 3. Comply with NFPA 70.
 4. IEEE Compliance: Fabricate and test VFC according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
- G. Delivery, Storage, And Handling



1. If stored in space that is not permanently enclosed and air conditioned, remove loose packing and flammable materials from inside controllers and install temporary electric heating, with at least 250 W per controller **OR** connect factory-installed space heaters to temporary electrical service, **as directed**.

H. Project Conditions

1. Environmental Limitations: Rate equipment for continuous operation, capable of driving full load without derating, under the following conditions unless otherwise indicated:
 - a. Ambient Temperature: Not less than 14 deg F (minus 10 deg C) and not exceeding 104 deg F (40 deg C).
 - b. Ambient Storage Temperature: Not less than minus 4 deg F (minus 20 deg C) and not exceeding 140 deg F (60 deg C)
 - c. Humidity: Less than 95 percent (noncondensing).
 - d. Altitude: Not exceeding 3300 feet (1005 m).
2. Interruption of Existing Electrical Systems: Do not interrupt electrical systems in facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
 - a. Notify Owner no fewer than two days in advance of proposed interruption of electrical systems.
 - b. Indicate method of providing temporary electrical service.
 - c. Do not proceed with interruption of electrical systems without Owner's written permission.
 - d. Comply with NFPA 70E.
3. Product Selection for Restricted Space: Drawings indicate maximum dimensions for VFCs, including clearances between VFCs, and adjacent surfaces and other items.

I. Coordination

1. Coordinate features of motors, load characteristics, installed units, and accessory devices to be compatible with the following:
 - a. Torque, speed, and horsepower requirements of the load.
 - b. Ratings and characteristics of supply circuit and required control sequence.
 - c. Ambient and environmental conditions of installation location.
2. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases.
3. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

J. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace VFCs that fail in materials or workmanship within specified warranty period.
 - a. Warranty Period: Five years from date of Final Completion.

1.2 PRODUCTS

A. Manufactured Units

1. General Requirements for VFCs: Comply with NEMA ICS 7, NEMA ICS 61800-2, and UL 508C.
2. Application: Constant torque and variable torque.
3. VFC Description: Variable-frequency power converter (rectifier, dc bus, and IGBT, PWM inverter) factory packaged in an enclosure, with integral disconnecting means and overcurrent and overload protection; listed and labeled by an NRTL as a complete unit; arranged to provide self-protection, protection, and variable-speed control of one or more three-phase induction motors by adjusting output voltage and frequency.
 - a. Units suitable for operation of NEMA MG 1, Design A and Design B motors as defined by NEMA MG 1, Section IV, Part 30, "Application Considerations for Constant Speed Motors Used on a Sinusoidal Bus with Harmonic Content and General Purpose Motors Used with Adjustable-Voltage or Adjustable-Frequency Controls or Both."



- b. Units suitable for operation of inverter-duty motors as defined by NEMA MG 1, Section IV, Part 31, "Definite-Purpose Inverter-Fed Polyphase Motors."
- c. Listed and labeled for integrated short-circuit current (withstand) rating by an NRTL acceptable to authorities having jurisdiction.
- 4. Design and Rating: Match load type, such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection.
- 5. Output Rating: Three-phase; 10 to 60 Hz, with voltage proportional to frequency throughout voltage range **OR** 66 Hz, with torque constant as speed changes, **as directed**; maximum voltage equals input voltage.
- 6. Unit Operating Requirements:
 - a. Input AC Voltage Tolerance: Plus 10 and minus 10 **OR** 15, **as directed**, percent of VFC input voltage rating.
 - b. Input AC Voltage Unbalance: Not exceeding 3 **OR** 5, **as directed**, percent.
 - c. Input Frequency Tolerance: Plus or minus 3 percent of VFC frequency rating.
 - d. Minimum Efficiency: 96 **OR** 97, **as directed**, percent at 60 Hz, full load.
 - e. Minimum Displacement Primary-Side Power Factor: 96 **OR** 98, **as directed**, percent under any load or speed condition.
 - f. Minimum Short-Circuit Current (Withstand) Rating: 10 **OR** 22 **OR** 65 **OR** 100, **as directed**, kA.
 - g. Ambient Temperature Rating: Not less than 14 deg F (minus 10 deg C) and not exceeding 104 deg F (40 deg C).
 - h. Ambient Storage Temperature Rating: Not less than minus 4 deg F (minus 20 deg C) and not exceeding 140 deg F (60 deg C)
 - i. Humidity Rating: Less than 95 percent (noncondensing).
 - j. Altitude Rating: Not exceeding 3300 feet (1005 m).
 - k. Vibration Withstand: Comply with IEC 60068-2-6.
 - l. Overload Capability: 1.1 **OR** 1.5, **as directed**, times the base load current for 60 seconds; minimum of 1.8 times the base load current for three seconds.
 - m. Starting Torque: Minimum 100 percent of rated torque from 3 to 60 Hz.
 - n. Speed Regulation: Plus or minus 5 **OR** 10, **as directed**, percent.
 - o. Output Carrier Frequency: Selectable; 0.5 to 15, **as directed**, kHz.
 - p. Stop Modes: Programmable; includes fast, free-wheel, and dc injection braking.
- 7. Inverter Logic: Microprocessor based, 16 **OR** 32, **as directed**, bit, isolated from all power circuits.
- 8. Isolated Control Interface: Allows VFCs to follow remote-control signal over a minimum 40:1 speed range.
 - a. Signal: Electrical.
 - b. Signal: Pneumatic.
- 9. Internal Adjustability Capabilities:
 - a. Minimum Speed: 5 to 25 percent of maximum rpm.
 - b. Maximum Speed: 80 to 100 percent of maximum rpm.
 - c. Acceleration: 0.1 to 999.9 seconds.
 - d. Deceleration: 0.1 to 999.9 seconds.
 - e. Current Limit: 30 to minimum of 150 percent of maximum rating.
- 10. Self-Protection and Reliability Features:
 - a. Input transient protection by means of surge suppressors to provide three-phase protection against damage from supply voltage surges 10 percent or more above nominal line voltage.
 - b. Loss of Input Signal Protection: Selectable response strategy, including speed default to a percent of the most recent speed, a preset speed, or stop; with alarm.
 - c. Under- and overvoltage trips.
 - d. Inverter overcurrent trips.
 - e. VFC and Motor Overload/Overtemperature Protection: Microprocessor-based thermal protection system for monitoring VFCs and motor thermal characteristics, and for providing



- VFC overtemperature and motor overload alarm and trip; settings selectable via the keypad; NRTL approved.
- f. Critical frequency rejection, with three selectable, adjustable deadbands.
 - g. Instantaneous line-to-line and line-to-ground overcurrent trips.
 - h. Loss-of-phase protection.
 - i. Reverse-phase protection.
 - j. Short-circuit protection.
 - k. Motor overtemperature fault.
11. Automatic Reset/Restart: Attempt three restarts after drive fault or on return of power after an interruption and before shutting down for manual reset or fault correction; adjustable delay time between restart attempts.
 12. Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped, unless "Bidirectional Autospeed Search" feature is available and engaged.
 13. Bidirectional Autospeed Search: Capable of starting VFC into rotating loads spinning in either direction and returning motor to set speed in proper direction, without causing damage to drive, motor, or load.
 14. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.
 15. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.
 16. Integral Input Disconnecting Means and OCPD: NEMA AB 1, instantaneous-trip circuit breaker **OR** NEMA AB 1, molded-case switch, with power fuse block and current-limiting fuses **OR** NEMA AB 1, thermal-magnetic circuit breaker **OR** NEMA KS 1, nonfusible switch, with power fuse block and current-limiting fuses **OR** NEMA KS 1, fusible switch, **as directed**, with pad-lockable, door-mounted handle mechanism.
 - a. Disconnect Rating: Not less than 115 percent of VFC input current rating.
 - b. Disconnect Rating: Not less than 115 percent of NFPA 70 motor full-load current rating or VFC input current rating, whichever is larger.
 - c. Auxiliary Contacts: NO/NC, arranged to activate before switch blades open.
 - d. Auxiliary contacts "a" and "b" arranged to activate with circuit-breaker handle.
 - e. NC **OR** NO, **as directed**, alarm contact that operates only when circuit breaker has tripped.
- B. Controls And Indication
1. Status Lights: Door-mounted LED indicators displaying the following conditions:
 - a. Power on.
 - b. Run.
 - c. Overvoltage.
 - d. Line fault.
 - e. Overcurrent.
 - f. External fault.
 2. Panel-Mounted Operator Station: Manufacturer's standard front-accessible, sealed keypad and plain-English language digital display; allows complete programming, program copying, operating, monitoring, and diagnostic capability.
 - a. Keypad: In addition to required programming and control keys, include keys for HAND, OFF, and AUTO modes.
 - b. Security Access: Provide electronic security access to controls through identification and password with at least three levels of access: View only; view and operate; and view, operate, and service.
 - 1) Control Authority: Supports at least four conditions: Off, local manual control at VFC, local automatic control at VFC, and automatic control through a remote source.
 3. Historical Logging Information and Displays:
 - a. Real-time clock with current time and date.
 - b. Running log of total power versus time.



- c. Total run time.
- d. Fault log, maintaining last four faults with time and date stamp for each.
- 4. Indicating Devices: Digital display and additional readout devices as required, mounted flush in VFC door and connected to display VFC parameters including, but not limited to:
 - a. Output frequency (Hz).
 - b. Motor speed (rpm).
 - c. Motor status (running, stop, fault).
 - d. Motor current (amperes).
 - e. Motor torque (percent).
 - f. Fault or alarming status (code).
 - g. PID feedback signal (percent).
 - h. DC-link voltage (V dc).
 - i. Set point frequency (Hz).
 - j. Motor output voltage (V ac).
- 5. Control Signal Interfaces:
 - a. Electric Input Signal Interface:
 - 1) A minimum of two programmable analog inputs: 0- to 10-V dc **OR** 4- to 20-mA dc **OR** Operator-selectable "x"- to "y"-mA dc, **as directed**.
 - 2) A minimum of six multifunction programmable digital inputs.
 - b. Pneumatic Input Signal Interface: 3 to 15 psig (20 to 104 kPa).
 - c. Remote Signal Inputs: Capability to accept any of the following speed-setting input signals from the BAS or other control systems:
 - 1) 0- to 10-V dc.
 - 2) 4- to 20-mA dc.
 - 3) Potentiometer using up/down digital inputs.
 - 4) Fixed frequencies using digital inputs.
 - d. Output Signal Interface: A minimum of one programmable analog output signal(s) (0- to 10-V dc **OR** 4- to 20-mA dc **OR** operator-selectable "x"- to "y"-mA dc, **as directed**), which can be configured for any of the following:
 - 1) Output frequency (Hz).
 - 2) Output current (load).
 - 3) DC-link voltage (V dc).
 - 4) Motor torque (percent).
 - 5) Motor speed (rpm).
 - 6) Set point frequency (Hz).
 - e. Remote Indication Interface: A minimum of two programmable dry-circuit relay outputs (120-V ac, 1 A) for remote indication of the following:
 - 1) Motor running.
 - 2) Set point speed reached.
 - 3) Fault and warning indication (overtemperature or overcurrent).
 - 4) PID high- or low-speed limits reached.
- 6. PID Control Interface: Provides closed-loop set point, differential feedback control in response to dual feedback signals. Allows for closed-loop control of fans and pumps for pressure, flow, or temperature regulation.
 - a. Number of Loops: One **OR** Two, **as directed**.
- 7. BAS Interface: Factory-installed hardware and software to enable the BAS to monitor, control, and display VFC status and alarms and energy usage. Allows VFC to be used with an external system within a multidrop LAN configuration; settings retained within VFC's nonvolatile memory.
 - a. Network Communications Ports: Ethernet and RS-422/485.
 - b. Embedded BAS Protocols for Network Communications: ASHRAE 135 BACnet **OR** Echelon LonWorks **OR** Johnson Metasys N2 **OR** Modbus/Memobus **OR** Siemens System 600 APOGEE, **as directed**; protocols accessible via the communications ports.

C. Line Conditioning And Filtering



1. Input Line Conditioning: Based on the harmonic analysis study and report, provide input filtering, as required, to limit TDD at input terminals of all **OR** indicated, **as directed**, VFCs to less than 5 **OR** 8, **as directed**, percent and THD(V) to 3 **OR** 5, **as directed**, percent.
OR
Input Line Conditioning: Based on the harmonic analysis study and report, provide input filtering, as required, to limit TDD and THD(V) at the defined PCC per IEEE 519.
2. Output Filtering: **<Insert requirements>**.
3. EMI/RFI Filtering: CE marked; certify compliance with IEC 61800-3 for Category C2.

D. Bypass Systems

1. Bypass Operation: Safely transfers motor between power converter output and bypass circuit, manually, automatically, or both. Selector switches set modes and indicator lights indicate mode selected. Unit is capable of stable operation (starting, stopping, and running) with motor completely disconnected from power converter.
2. Bypass Mode: Manual operation only; requires local operator selection at VFC. Transfer between power converter and bypass contactor and retransfer shall only be allowed with the motor at zero speed.
OR
Bypass Mode: Field-selectable automatic or manual, allows local and remote transfer between power converter and bypass contactor and retransfer, either via manual operator interface or automatic control system feedback.
3. Bypass Controller: Two-contactor-style bypass allows motor operation via the power converter or the bypass controller; with input isolating switch and barrier arranged to isolate the power converter and permit safe troubleshooting and testing, both energized and de-energized, while motor is operating in bypass mode.
 - a. Bypass Contactor: Load-break, IEC **OR** NEMA **as directed**, -rated contactor.
 - b. Output Isolating Contactor: Non-load-break, IEC **OR** NEMA, **as directed**, -rated contactor.
 - c. Isolating Switch: Non-load-break switch arranged to isolate power converter and permit safe troubleshooting and testing of the power converter, both energized and de-energized, while motor is operating in bypass mode; pad-lockable, door-mounted handle mechanism.**OR**
Bypass Controller: Three-contactor-style bypass allows motor operation via the power converter or the bypass controller; with input isolating switch and barrier arranged to isolate the power converter input and output and permit safe testing and troubleshooting of the power converter, both energized and de-energized, while motor is operating in bypass mode.
 - a. Bypass Contactor: Load-break, IEC **OR** NEMA, **as directed**, -rated contactor.
 - b. Input and Output Isolating Contactors: Non-load-break, IEC **OR** NEMA, **as directed**, -rated contactors.
 - c. Isolating Switch: Non-load-break switch arranged to isolate power converter and permit safe troubleshooting and testing of the power converter, both energized and de-energized, while motor is operating in bypass mode; pad-lockable, door-mounted handle mechanism.
4. Bypass Contactor Configuration: Full-voltage (across-the-line) **OR** Reduced-voltage (autotransformer), **as directed**, type.
 - a. NORMAL/BYPASS selector switch.
 - b. HAND/OFF/AUTO selector switch.
 - c. NORMAL/TEST Selector Switch: Allows testing and adjusting of VFC while the motor is running in the bypass mode.
 - d. Contactor Coils: Pressure-encapsulated type with coil transient suppressors, **as directed**.
 - 1) Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.
 - 2) Power Contacts: Totally enclosed, double break, and silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.
 - e. Control Circuits: 120-V ac; obtained from integral CPT, with primary and secondary fuses, with CPT **OR** control power source, **as directed**, of sufficient capacity to operate all integral devices and remotely located pilot, indicating, and control devices.
 - 1) CPT Spare Capacity: 50 **OR** 100 **OR** 200, **as directed**, VA.



- f. Overload Relays: NEMA ICS 2.
- 1) Melting-Alloy Overload Relays:
 - a) Inverse-time-current characteristic.
 - b) Class 10 **OR** Class 20 **OR** Class 30, **as directed**, tripping characteristic.
 - c) Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.
 - 2) Bimetallic Overload Relays:
 - a) Inverse-time-current characteristic.
 - b) Class 10 **OR** Class 20 **OR** Class 30, **as directed**, tripping characteristic.
 - c) Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.
 - d) Ambient compensated.
 - e) Automatic resetting.
 - 3) Solid-State Overload Relays:
 - a) Switch or dial selectable for motor-running overload protection.
 - b) Sensors in each phase.
 - c) Class 10 **OR** Class 20 **OR** Class 10/20 selectable, **as directed**, tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.
 - d) Class II ground-fault protection, with start and run delays to prevent nuisance trip on starting.
 - e) Analog communication module.
 - 4) NC **OR** NO, **as directed**, isolated overload alarm contact.
 - 5) External overload reset push button.

E. Optional Features

1. Multiple-Motor Capability: VFC suitable for variable-speed service to multiple motors. Overload protection shuts down VFC and motors served by it, and generates fault indications, when overload protection activates.
 - a. Configure to allow two or more motors to operate simultaneously at the same speed; separate overload relay for each controlled motor.
OR
Configure to allow two motors to operate separately; operator selectable via local or remote switch or contact closures; single overload relay for both motors; separate output magnetic contactors for each motor.
OR
Configure to allow two motors to operate simultaneously and in a lead/lag mode, with one motor operated at variable speed via the power converter and the other at constant speed via the bypass controller; separate overload relay for each controlled motor.
2. Damper control circuit with end of travel feedback capability.
3. Sleep Function: Senses a minimal deviation of a feedback signal and stops the motor. On an increase in speed-command signal deviation, VFC resumes normal operation.
4. Motor Preheat Function: Preheats motor when idle to prevent moisture accumulation in the motor.
5. Firefighter's Override (Smoke Purge) Input: On a remote contact closure from the firefighter's control station **OR** smoke-control fan controller, **as directed**, this password-protected input:
 - a. Overrides all other local and external inputs (analog/digital, serial communication, and all keypad commands).
 - b. Forces VFC to operate motor, without any other run or speed command, at a field-adjustable, preset speed.
OR
Forces VFC to transfer to Bypass Mode and operate motor at full speed.
 - c. Causes display of Override Mode on the VFC display.
 - d. Reset VFC to normal operation on removal of override signal automatically **OR** manually, **as directed**.



6. Remote Indicating Circuit Terminals: Mode selection, controller status, and controller fault.
7. Remote digital operator kit.
8. Communication Port: RS-232 port, USB 2.0 port, or equivalent connection capable of connecting a printer and a notebook computer.

F. Enclosures

1. VFC Enclosures: NEMA 250, to comply with environmental conditions at installed location.
 - a. Dry and Clean Indoor Locations: Type 1.
 - b. Outdoor Locations: Type 3R **OR** Type 4X, **as directed**.
 - c. Kitchen **OR** Wash-Down, **as directed**, Areas: Type 4X, stainless steel.
 - d. Other Wet or Damp Indoor Locations: Type 4.
 - e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: Type 12.
2. Plenum Rating: UL 1995; NRTL certification label on enclosure, clearly identifying VFC as "Plenum Rated."

G. Accessories

1. General Requirements for Control-Circuit and Pilot Devices: NEMA ICS 5; factory installed in VFC enclosure cover unless otherwise indicated.
 - a. Push Buttons, Pilot Lights, and Selector Switches: Heavy **OR** Standard, **as directed**, -duty, oiltight, **as directed**, type.
 - 1) Push Buttons: Covered **OR** Lockable **OR** Recessed **OR** Shielded **OR** Shrouded **OR** Unguarded, **as directed**, types; momentary, **as directed**.
 - 2) Pilot Lights: Incandescent **OR** LED **OR** Neon **OR** Resistor **OR** Transformer, **as directed**, types; push to test.
 - 3) Selector Switches: Rotary type.
 - 4) Stop and Lockout Push-Button Station: Momentary-break, push-button station with a factory-applied hasp arranged so padlock can be used to lock push button in depressed position with control circuit open.
2. NC **OR** NO **OR** Reversible NC/NO, **as directed**, bypass contactor auxiliary contact(s).
3. Control Relays: Auxiliary and adjustable pneumatic **OR** solid-state, **as directed**, time-delay relays.
4. Phase-Failure, Phase-Reversal, and Undervoltage and Overvoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connections. Provide adjustable undervoltage, overvoltage, and time-delay settings.
 - a. Current Transformers: Continuous current rating, basic impulse insulating level (BIL) rating, burden, and accuracy class suitable for connected circuitry. Comply with IEEE C57.13.
5. Supplemental Analog **OR** Digital, **as directed**, Meters:
 - a. Elapsed-time meter.
 - b. Kilowatt meter.
 - c. Kilowatt-hour meter.
6. Breather and drain assemblies, to maintain interior pressure and release condensation in NEMA 250, Type 4 **OR** Type 4X **OR** Type 12, **as directed**, enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.
7. Space heaters, with NC auxiliary contacts, to mitigate condensation in NEMA 250, Type 3R **OR** Type 4X **OR** Type 12, **as directed**, enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.
8. Cooling Fan and Exhaust System: For NEMA 250, Type 1 **OR** Type 12, **as directed**; UL 508 component recognized: Supply fan, with composite **OR** stainless steel, **as directed**, intake and exhaust grills and filters, **as directed**; 120-V ac; obtained from integral CPT.
9. Sun shields installed on fronts, sides, and tops of enclosures installed outdoors and subject to direct and extended sun exposure.
10. Spare control-wiring terminal blocks; unwired **OR** wired, **as directed**.

H. Source Quality Control



1. Testing: Test and inspect VFCs according to requirements in NEMA ICS 61800-2.
 - a. Test each VFC while connected to its specified motor **OR** a motor that is comparable to that for which the VFC is rated, **as directed**.
 - b. Verification of Performance: Rate VFCs according to operation of functions and features specified.
2. VFCs will be considered defective if they do not pass tests and inspections.
3. Prepare test and inspection reports.

1.3 EXECUTION

A. Examination

1. Examine areas, surfaces, and substrates to receive VFCs, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
2. Examine VFC before installation. Reject VFCs that are wet, moisture damaged, or mold damaged.
3. Examine roughing-in for conduit systems to verify actual locations of conduit connections before VFC installation.
4. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Harmonic Analysis Study

1. Perform a harmonic analysis study to identify the effects of nonlinear loads and their associated harmonic contributions on the voltages and currents throughout the electrical system. Analyze possible **OR** designated, **as directed**, operating scenarios, including recommendations for VFC input filtering to limit TDD and THD(V) at each VFC **OR** at the defined PCC, **as directed**, to specified levels.
2. Prepare a harmonic analysis study and report complying with IEEE 399 and NETA Acceptance Testing Specification.

C. Installation

1. Coordinate layout and installation of VFCs with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
2. Wall-Mounting Controllers: Install VFCs on walls with tops at uniform height and with disconnect operating handles not higher than 79 inches (2000 mm) above finished floor unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not on walls, provide freestanding racks complying with Division 26 Section "Hangers And Supports For Electrical Systems".
3. Floor-Mounting Controllers: Install VFCs on 4-inch (100-mm) nominal thickness concrete base. Comply with requirements for concrete base specified in Division 03 Section "Cast-in-place Concrete".
 - a. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - b. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - d. Install anchor bolts to elevations required for proper attachment to supported equipment.
4. Roof-Mounting Controllers: Install VFC on roofs with tops at uniform height and with disconnect operating handles not higher than 79 inches (2000 mm) above finished roof surface unless otherwise indicated, and by bolting units to curbs or mounting on freestanding, lightweight, structural-steel channels bolted to curbs. Seal roof penetrations after raceways are installed.
 - a. Curbs and roof penetrations are specified in Division 07 Section "Roof Accessories".
 - b. Structural-steel channels are specified in Division 26 Section "Hangers And Supports For Electrical Systems".



5. Seismic Bracing: Comply with requirements specified in Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
 6. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
 7. Install fuses in each fusible-switch VFC.
 8. Install fuses in control circuits if not factory installed. Comply with requirements in Division 26 Section "Fuses".
 9. Install heaters in thermal-overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.
 10. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.
 11. Comply with NECA 1.
- D. Identification
1. Identify VFCs, components, and control wiring. Comply with requirements for identification specified in Division 26 Section "Identification For Electrical Systems".
 - a. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - b. Label each VFC with engraved nameplate.
 - c. Label each enclosure-mounted control and pilot device.
 2. Operating Instructions: Frame printed operating instructions for VFCs, including control sequences and emergency procedures. Fabricate frame of finished metal, and cover instructions with clear acrylic plastic. Mount on front of VFC units.
- E. Control Wiring Installation
1. Install wiring between VFCs and remote devices and facility's central-control system, **as directed**. Comply with requirements in Division 26 Section "Control-voltage Electrical Power Cables"
 2. Bundle, train, and support wiring in enclosures.
 3. Connect selector switches and other automatic control devices where applicable.
 - a. Connect selector switches to bypass only those manual- and automatic control devices that have no safety functions when switches are in manual-control position.
 - b. Connect selector switches with control circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.
- F. Field Quality Control
1. Perform tests and inspections.
 2. Acceptance Testing Preparation:
 - a. Test insulation resistance for each VFC element, bus, component, connecting supply, feeder, and control circuit.
 - b. Test continuity of each circuit.
 3. Tests and Inspections:
 - a. Inspect VFC, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.
 - b. Test insulation resistance for each VFC element, component, connecting motor supply, feeder, and control circuits.
 - c. Test continuity of each circuit.
 - d. Verify that voltages at VFC locations are within 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Owner before starting the motor(s).
 - e. Test each motor for proper phase rotation.
 - f. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - g. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.



- h. Perform the following infrared (thermographic) scan tests and inspections and prepare reports:
 - 1) Initial Infrared Scanning: After Final Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each VFC. Remove front panels so joints and connections are accessible to portable scanner.
 - 2) Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each VFC 11 months after date of Final Completion.
 - 3) Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - i. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
 4. VFCs will be considered defective if they do not pass tests and inspections.
 5. Prepare test and inspection reports, including a certified report that identifies the VFC and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.
- G. Startup Service
1. Perform startup service.
 - a. Complete installation and startup checks according to manufacturer's written instructions.
- H. Adjusting
1. Program microprocessors for required operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing and prior to Final Completion.
 2. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.
 3. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable, instantaneous trip elements. Initially adjust to six times the motor nameplate full-load amperes and attempt to start motors several times, allowing for motor cool-down between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Owner before increasing settings.
 4. Set the taps on reduced-voltage autotransformer controllers.
 5. Set field-adjustable circuit-breaker trip ranges as specified in Division 26 Section "Overcurrent Protective Device Coordination Study".
 6. Set field-adjustable pressure switches.
- I. Protection
1. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until controllers are ready to be energized and placed into service.
 2. Replace VFCs whose interiors have been exposed to water or other liquids prior to Final Completion.
- J. Demonstration
1. Train Owner's maintenance personnel to adjust, operate, reprogram, and maintain VFCs.

END OF SECTION 26 29 23 00



SECTION 26 31 00 00 - PHOTOVOLTAIC ENERGY EQUIPMENT**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for Photovoltaic Energy Equipment. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. PV laminates (cells laminated into rigid sheets, with connecting cables).
 - b. PV modules (laminates in mounting frames).
 - c. Charge controllers.
 - d. Inverters.
 - e. Mounting structures.

C. Definitions

1. CEC: California Energy Commission.
2. ETFE: Ethylene tetrafluoroethylene.
3. FEP: Fluorinated ethylene propylene.
4. IP Code: Required ingress protection to comply with IEC 60529.
5. MPPT: Maximum power point tracking.
6. PTC: USA standard conditions for PV.
7. PV: Photovoltaic.
8. STC: Standard Test Conditions defined in IEC 61215.

D. Action Submittals

1. Product Data: For each type of product.
 - a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for PV panels.
 - b. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Shop Drawings: For PV modules.
 - a. Include plans, elevations, sections, and mounting details.
 - b. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - c. Detail fabrication and assembly.
 - d. Include diagrams for power, signal, and control wiring.

E. Informational Submittals

1. Field quality-control reports.
2. Sample Warranty: For manufacturer's special materials and workmanship warranty and minimum power output warranty.

F. Closeout Submittals

1. Operation and Maintenance Data: For PV modules to include in operation and maintenance manuals.

G. Warranty



1. Manufacturer's Special Materials and Workmanship Warranty: Manufacturer agrees to repair or replace components of PV modules that fail in materials or workmanship within specified warranty period.
 - a. Manufacturer's materials and workmanship warranties include, but are not limited to, the following:
 - 1) Faulty operation of PV modules.
 - b. Warranty Period: Two **OR** Five years from date of Final Completion.
2. Manufacturer's Special Minimum Power Output Warranty: Manufacturer agrees to repair or replace components of PV modules that fail to exhibit the minimum power output within specified warranty period. Special warranty, applying to modules only, applies to materials only, on a prorated basis, for period specified.
 - a. Manufacturer's minimum power output warranties include, but are not limited to, the following warranty periods, from date of Final Completion:
 - 1) Specified minimum power output to 80 percent or more, for a period of 25 years.

1.2 PRODUCTS

A. Performance Requirements

1. NRTL (Nationally Recognized Testing Laboratory) Listing: Entire assembly shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for electrical and fire safety, Class A **OR** Class C, according to UL 1703.
2. FM approved for NFPA 70, Class 1, Division 2, Group C and Group D hazardous locations.

B. System Description

1. Grid-Tied PV System:
 - a. Connected via a utility meter to the electrical utility.
 - b. An array of six modules to generate a total nominal 1000 rated W.
 - c. System Components:
 - 1) Cell materials.
 - 2) PV modules.
 - 3) Array frame.
 - 4) Charge controller.
 - 5) Inverter.
 - 6) Overcurrent protection/combiner box.
 - 7) Mounting structure.
 - 8) Utility meter.
2. Battery-Storage PV System:
 - a. Connected to a battery bank to provide electricity to Project.
 - b. An array of six modules to generate a total nominal 1000 rated W.
 - c. System Components:
 - 1) Cell materials.
 - 2) PV modules.
 - 3) Array frame.
 - 4) Charge controller.
 - 5) Inverter.
 - 6) Overcurrent protection/combiner box.
 - 7) Mounting structure.
 - 8) Battery charge controller(s).
 - 9) Batteries.
 - 10) Battery-storage structure.

C. Manufactured Units

1. Cell Materials: Amorphous silicon (a-Si) **OR** Cell Materials: Copper indium (di)selenide (CIS) **OR** Cell Materials: Copper indium gallium (di)selenide (CIGS) **OR** Cadmium telluride (CdTe) **OR**



- Cadmium sulfide **OR** Polycrystalline (c-Si) **OR** Polycrystalline (Gallium arsenide (GaAs) **OR** Monocrystalline (c-Si) **OR** Monocrystalline (Gallium arsenide (GaAs), **as directed**.
2. Module Construction:
 - a. Nominal Size: 32 inches (800 mm) wide by 64 inches (1600 mm) long.
 - b. Weight: 42.8 lb (19.4 kg).
 3. Insulating Substrate Film: Flexible **OR** Rigid, polyester **OR** polyimide, **as directed**.
 4. Conducting Substrate Film: Flexible **OR** Rigid **OR** luoropolymer, ETFE **OR** FEP, **as directed**.
 5. Encapsulant: Ethyl vinyl acetate.
 6. Front Panel: Fully tempered glass.
 7. Front Panel: 0.125-inch- (3.2-mm-) thick glass.
 8. Front Panel: Low iron glass.
 9. Front Panel: Antireflective coating glass.
 10. Front Panel: Laminating film.
 11. Front Panel: Laminating material.
 12. Backing Material: Tempered glass.
 13. Backing Material: 0.125-inch- (3.2-mm-) thick glass; color **as directed**.
 14. Backing Material: Polyester film.
 - a. Layers: **as directed**.
 - b. Color: White **OR as directed**.
 15. Backing Material: PVC film.
 - a. Layers: **as directed**.
 - b. Color: White **OR as directed**.
 16. Bypass Diode Protection: Internal.
 17. Junction Box:
 - a. Size: 1.56 by 3.96 by 0.52 inch (39.6 by 100.6 by 13.2 mm).
 - b. Fully potted, vandal resistant.
 - c. IP Code: IP65 **OR** IP66 **OR** IP67, **as directed**.
 - d. Flammability Test: UL 1703.
 18. Output Cabling:
 - a. **0.158 inch (4 mm)**.
 - b. Quick, multiconnect, polarized connectors.
 - c. Two-Conductor Harness: No traditional return wire is needed from the end of a row back to the source combiner.
 19. Series Fuse Rating: **as directed**.
- D. Capacities And Characteristics
1. Minimum Electrical Characteristics:
 - a. Rated Open Circuit Voltage (V_{oc}): **as directed**.
 - b. Maximum System Voltage: **as directed**.
 - c. Maximum Power at Voltage (V_{pm}): **as directed**.
 - d. Short-Circuit Temperature Coefficient: **as directed**.
 - e. Rated Short-Circuit Current (I_{sc}): **as directed**.
 - f. Maximum System: **as directed**.
 - g. Rated Operation Current (I_{mp}): **as directed**.
 - h. Maximum Power at STC (P_{max}): **as directed**.
 2. Additional Electrical Characteristics:
 - a. PTC Rating: **as directed**.
 - b. Peak Power per Unit Area: **as directed**.
 - c. Tolerance of Pmax: **as directed**.
 - d. Minimum Peak Power: **as directed**.
 - e. Series Fuse Rating: **as directed**.
 - f. Module Efficiency: **as directed**.
 - g. Temperature Cycling Range: **as directed**.
 - h. Humidity, Freeze, Damp Heat Condition: **as directed**.
 - i. Wind Loading or Surface Pressure: **as directed**.
 - j. Maximum Distortion Angle: **as directed**.



- k. Hailstone Impact Withstand: **as directed.**
- l. Series Fuse Rating: **as directed.**
- 3. Normal Operating Temperature Characteristics (NOTC):
 - a. Temperature at Nominal Operating Cell Temperature: **as directed.**
 - b. Temperature Coefficient (NOTC P_{max}): **as directed.**
 - c. Temperature Coefficient (NOTC V_{oc}): **as directed.**
 - d. Temperature Coefficient (NOTC I_{sc}): **as directed.**
 - e. Temperature Coefficient (NOTC V_{mp}): **as directed.**
 - f. Temperature Coefficient (NOTC I_{mp}): **as directed.**
- E. Module Framing
 - 1. PV laminates mounted in anodized extruded-aluminum frames.
 - a. Entire assembly UL listed for electrical and fire safety, Class A **OR** Class C, according to UL 1703, complying with IEC 61215.
 - b. Frame strength exceeding requirements of certifying agencies in subparagraph above.
 - c. Finish: Anodized aluminum.
 - 1) Alloy and temper recommended by framing manufacturer for strength, corrosion resistance, and application of required finish.
 - 2) Color: As indicated by manufacturer's designations.
 - d. Finish: High-performance organic finish.
 - 1) Fluoropolymer Two-Coat System: Manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent PVC resin by weight.
 - 2) Color: As indicated by manufacturer's designations.
 - e. Finish: Baked-enamel finish.
 - 1) Color: As indicated by manufacturer's designations.
- F. Array Construction
 - 1. Framing:
 - a. Material: Extruded aluminum **OR** Galvanized steel **OR** Coated steel, **as directed.**
 - b. Maximum System Weight: Less than 4 lb/sq. ft. (19.53 kg/sq. m).
 - c. Minimum Distance to Connectors: **as directed.**
 - d. Raceway Cover Plates: Plastic **OR** Aluminum **OR** Galvanized steel, **as directed.**
 - 2. Flat-Roof Mounting:
 - a. No roof penetrations.
 - b. Self-ballasting.
 - c. Wind-tunnel tested to 110-mph (160-km/h) wind.
 - d. Service Life: **25** years.
 - e. Freestanding system.
- G. Charge Controller
 - 1. Charge Controller Electrical Characteristics:
 - a. Output Current Rating: **as directed.**
 - b. Nominal Battery Voltage: **as directed.**
 - c. PV Maximum Open Circuit Voltage: **as directed.**
 - d. Equalization Voltage: **as directed.**
 - e. Voltage Step-Down Capability: **as directed.**
 - f. Power Conversion Efficiency: **as directed.**
 - 2. Charge controllers shall have the following:
 - a. Digital display.
 - b. Data logging.
 - c. Remote interface.
 - d. External sensors.
 - e. Temperature compensation.



H. Inverter

1. Control Type: Pulse width modulation control.
2. Control Type: Maximum power point tracker control.
3. Inverter Electrical Characteristics:
 - a. Maximum Recommended PV Input Power: **as directed**.
 - b. Maximum Voc: **as directed**.
 - c. PV Start Voltage: **as directed**.
 - d. MPPT Voltage Range: **as directed**.
 - e. Maximum Input Current: **as directed**.
 - f. Number of String Inputs: **as directed**.
 - g. Number of Independent MPPT Circuits: **as directed**.
 - h. Nominal Output Voltage: **as directed**.
 - i. CEC Rated Power: **as directed**.
 - j. Nominal Output Voltage: **as directed**.
 - k. Maximum Output Current: **as directed**.
 - l. Peak Efficiency: **as directed**.
 - m. CEC Weighted Efficiency: **as directed**.
 - n. CEC Night Tare Loss: **as directed**.
 - o. DC/AC Terminal Range (AWG): **as directed**.
 - p. NEMA 250 Enclosure Rating: **as directed**.
4. Operating Conditions:
 - a. Operating Ambient Temperatures: Minus 4 to plus 122 deg F (20 to plus 50 deg C).
 - b. Storage Temperature: Minus 40 to plus 122 deg F (minus 40 to plus 50 deg C).
 - c. Relative Humidity: 0 to 95 percent, noncondensing.
5. Charge controllers shall have the following:
 - a. Overcurrent protection.
 - b. Generator input breaker box.
 - c. Automatic transfer relay.
 - d. Digital display.
 - e. Transformer.
 - f. Disconnect switch.
 - g. Shunt controller.
 - h. Shunt regulator.
 - i. Surge overload protection.
6. Enclosure:
 - a. NEMA 250, Type 3R.
 - b. Enclosure Material: Galvanized steel **OR** Steel, **as directed**.
 - c. Cooling Methods:
 - 1) Fan convection cooling.
 - 2) Passive cooling.
 - d. Protective Functions:
 - 1) AC over/under voltage.
 - 2) AC over/under frequency.
 - 3) Ground over current.
 - 4) Overtemperature.
 - 5) AC and dc overcurrent.
 - 6) DC over voltage.
 - e. Standard liquid crystal display, four lines, 20 characters, with user display and on/off toggle switch.
 - f. Weight: 260 lb (118 kg).
 - g. Dimensions: 54 by 36 by 19 inches (137 by 91 by 48 cm).
7. Disconnects:
 - a. Low-voltage disconnect.
 - b. Low-voltage reconnect.
 - c. High-temperature disconnect.
 - d. High-temperature reconnect.



8. Regulatory Approvals:
 - a. IEEE 1547.1.
 - b. IEEE 1547.3.
 - c. UL 1741.
9. Characteristics:
 - a. Inverter Dimensions: **as directed.**
 - b. Inverter Weight: **as directed.**

I. System Overcurrent Protection

1. Combiner Box:
 - a. Fuses: **as directed.**
 - b. Circuit Breakers: **as directed.**

J. Mounting Structures

1. Roof Mount: Extruded aluminum, two **OR** four rails, **as directed**, tilt legs, and roof standoffs.
2. Pole Mount: Top **OR** Panel tops **OR** Side, **as directed.**
3. Tracking Mounts: One **OR** Two axis, **as directed.**

1.3 EXECUTION

A. Examination

1. Examine substrate areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
2. Do not begin installation until mounting surfaces have been properly prepared.
3. If preparation of mounting surfaces is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
4. Examine modules and array frame before installation. Reject modules and arrays that are wet, moisture damaged, or mold damaged.
5. Examine roofs, supports, and supporting structures for suitable conditions where PV system will be installed.
6. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Field Quality Control

1. Perform tests and inspections **with the assistance of a factory-authorized service representative.**
2. PV module will be considered defective if it does not pass tests and inspections.
3. Prepare test and inspection reports.

END OF SECTION 26 31 00 00



Task	Specification	Specification Description
26 31 00 00	01 22 16 00	No Specification Required



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SECTION 26 32 13 13 - PACKAGED ENGINE GENERATORS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for packaged engine generators. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes packaged engine-generator sets for emergency **OR** standby, **as directed**, power supply with the following features:
 - a. Gas and Diesel engine.
 - b. Unit-mounted and Remote-mounting cooling system.
 - c. Unit-mounted and Remote-mounting control and monitoring.
 - d. Performance requirements for sensitive loads.
 - e. Load banks.
 - f. Outdoor enclosure.

C. Definitions

1. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.
2. LP: Liquid petroleum.

D. Submittals

1. Product Data: For each type of packaged engine generator and accessory indicated.
2. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Manufacturer Seismic Qualification Certification: Submit certification that day tank, engine-generator set, batteries, battery racks, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
4. Source quality-control test reports.
5. Field quality-control test reports.
6. Operation and maintenance data.
7. Warranty: Special warranty specified in this Section.

E. Quality Assurance

1. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
2. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 200 miles (321 km) of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
4. Comply with ASME B15.1.
5. Comply with NFPA 37.
6. Comply with NFPA 70.
7. Comply with NFPA 99 for healthcare facilities.
8. Comply with NFPA 110 requirements for Level 1 **OR** 2, **as directed**, emergency power supply system.



9. Comply with UL 2200.
10. Engine Exhaust Emissions: Comply with applicable state and local government requirements.
11. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at adjacent property boundaries due to sound emitted by generator set including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

F. Project Conditions

1. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
 - a. Ambient Temperature: 5 to 40 deg C **OR** Minus 15 to plus 40 deg C, **as directed**.
 - b. Relative Humidity: 0 to 95 percent for outdoor units.
 - c. Altitude: Sea level to 1000 feet (300 m).
2. Unusual Service Conditions: Engine-generator equipment and installation are required to operate under the following conditions:
 - a. High salt-dust content in the air due to sea-spray evaporation.

1.2 PRODUCTS

A. Engine-Generator Set

1. Factory-assembled and -tested, engine-generator set.
2. Mounting Frame: Maintain alignment of mounted components without depending on concrete foundation; and have lifting attachments.
 - a. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and generator-set center of gravity.
3. Capacities and Characteristics:
 - a. Power Output Ratings: Nominal ratings as indicated, with capacity as required to operate as a unit as evidenced by records of prototype testing.
 - b. Output Connections: Three-phase, three **OR** four, **as directed**, wire.
 - c. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.
4. Generator-Set Performance:
 - a. Steady-State Voltage Operational Bandwidth: 3 percent of rated output voltage from no load to full load.
 - b. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three seconds.
 - c. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
 - d. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
 - e. Transient Frequency Performance: Less than 5 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.
 - f. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
 - g. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.
 - h. Start Time: Comply with NFPA 110, Type 10, system requirements.



5. Generator-Set Performance for Sensitive Loads:
 - a. Oversizing generator compared with the rated power output of the engine is permissible to meet specified performance.
 - 1) Nameplate Data for Oversized Generator: Show ratings required by the Contract Documents rather than ratings that would normally be applied to generator size installed.
 - b. Steady-State Voltage Operational Bandwidth: 1 percent of rated output voltage from no load to full load.
 - c. Transient Voltage Performance: Not more than 10 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within 0.5 second.
 - d. Steady-State Frequency Operational Bandwidth: Plus or minus 0.25 percent of rated frequency from no load to full load.
 - e. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
 - f. Transient Frequency Performance: Less than 2-Hz variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within three seconds.
 - g. Output Waveform: At no load, harmonic content measured line to neutral shall not exceed 2 percent total with no slot ripple. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
 - h. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 300 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to winding insulation or other generator system components.
 - i. Excitation System: Performance shall be unaffected by voltage distortion caused by nonlinear load.
 - 1) Provide permanent magnet excitation for power source to voltage regulator.
 - j. Start Time: Comply with NFPA 110, Type 10, system requirements.

B. Engine

1. Fuel: Fuel oil, Grade DF-2 **OR** Natural gas with automatic LP-gas standby **OR** Natural gas, **as directed**.
2. Rated Engine Speed: 1800 rpm.
3. Maximum Piston Speed for Four-Cycle Engines: 2250 fpm (11.4 m/s).
4. Lubrication System: The following items are mounted on engine or skid:
 - a. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
 - b. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
 - c. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.
5. Engine Fuel System:
 - a. Main Fuel Pump For Diesel-Fueled Engine: Mounted on engine. Pump ensures adequate primary fuel flow under starting and load conditions.
 - b. Relief-Bypass Valve For Diesel-Fueled Engine: Automatically regulates pressure in fuel line and returns excess fuel to source.
 - c. Dual Natural Gas with LP-Gas Backup (Vapor-Withdrawal) System:
 - 1) Carburetor.
 - 2) Secondary Gas Regulators: One for each fuel type.
 - 3) Fuel-Shutoff Solenoid Valves: One for each fuel source.
 - 4) Flexible Fuel Connectors: One for each fuel source.
6. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity.
7. Governor: Adjustable isochronous, with speed sensing.



8. Cooling System:
 - a. Closed loop, liquid cooled, with radiator factory mounted on engine-generator-set mounting frame and integral engine-driven coolant pump.
 - 1) Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
 - 2) Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
 - 3) Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gage glass and petcock.
 - 4) Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
 - 5) Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.
 - a) Rating: 50-psig (345-kPa) maximum working pressure with coolant at 180 deg F (82 deg C), and noncollapsible under vacuum.
 - b) End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.
 - b. Closed loop, liquid cooled, with remote radiator and integral engine-driven coolant pump.
 - 1) Configuration: Vertical **OR** Horizontal, **as directed**, air discharge.
 - 2) Radiator Core Tubes: Aluminum **OR** Nonferrous-metal construction other than aluminum, **as directed**.
 - 3) Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
 - 4) Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gage glass and petcock.
 - 5) Fan: Driven by multiple belts from engine shaft **OR** totally enclosed electric motor with sealed bearings, **as directed**.
 - 6) Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
 - 7) Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
9. Muffler/Silencer:
 - a. Critical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.
 - 1) Minimum sound attenuation of 25 dB at 500 Hz.
 - 2) Sound level measured at a distance of 10 feet (3 m) from exhaust discharge after installation is complete shall be 85 dBA or less.
 - b. Residential type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.
 - 1) Minimum sound attenuation of 18 dB at 500 Hz.
 - 2) Sound level measured at a distance of 10 feet (3 m) from exhaust discharge after installation is complete shall be 95 dBA or less.
 - c. Industrial type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.
 - 1) Minimum sound attenuation of 12 dB at 500 Hz.
 - 2) Sound level measured at a distance of 25 feet (8 m) from exhaust discharge after installation is complete shall be 87 dBA or less.
10. Air-Intake Filter: Standard **OR** Heavy, **as directed**, -duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.
11. Starting System: 12 **OR** 24, **as directed**, -V electric, with negative ground.



- a. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in Part 1 "Project Conditions" Article.
- b. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
- c. Cranking Cycle: As required by NFPA 110 for system level specified **OR** 60 seconds, **as directed**.
- d. Battery: Adequate capacity within ambient temperature range specified in Part 1.1 "Project Conditions" Article to provide specified cranking cycle at least twice **OR** three times, **as directed**, without recharging.
- e. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
- f. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Thermostatically controlled heater shall be arranged to maintain battery above 10 deg C regardless of external ambient temperature within range specified in Part 1.1 "Project Conditions" Article. Include accessories required to support and fasten batteries in place.
- g. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.
- h. Battery Charger: Current-limiting, automatic-equalizing and float-charging type. Unit shall comply with UL 1236.
 - 1) Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
 - 2) Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg C to plus 60 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.
 - 3) Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
 - 4) Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.
 - 5) Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
 - 6) Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.

C. Fuel Oil Storage

1. Comply with NFPA 30.
2. Day Tank: Comply with UL 142, freestanding, factory-fabricated fuel tank assembly, with integral, float-controlled transfer pump and the following features:
 - a. Containment: Integral rupture basin with a capacity of 150 percent of nominal capacity of day tank.
 - 1) Leak Detector: Locate in rupture basin and connect to provide audible and visual alarm in the event of day-tank leak.
 - b. Tank Capacity: As recommended by engine manufacturer for an uninterrupted period of 4 hours' operation at 100 percent of rated power output of engine-generator system without being refilled.
 - c. Pump Capacity: Exceeds maximum flow of fuel drawn by engine-mounted fuel supply pump at 110 percent of rated capacity, including fuel returned from engine.
 - d. Low-Level Alarm Sensor: Liquid-level device operates alarm contacts at 25 percent of normal fuel level.
 - e. High-Level Alarm Sensor: Liquid-level device operates alarm and redundant fuel shutoff contacts at midpoint between overflow level and 100 percent of normal fuel level.



- f. Piping Connections: Factory-installed fuel supply and return lines from tank to engine; local fuel fill, vent line, overflow line; and tank drain line with shutoff valve.
- g. Redundant High-Level Fuel Shutoff: Actuated by high-level alarm sensor in day tank to operate a separate motor device that disconnects day-tank pump motor. Sensor shall signal solenoid valve, located in fuel suction line between fuel storage tank and day tank, to close. Both actions shall remain in shutoff state until manually reset. Shutoff action shall initiate an alarm signal to control panel but shall not shut down engine-generator set.
- 3. Base-Mounted Fuel Oil Tank: Factory installed and piped, complying with UL 142 fuel oil tank. Features include the following:
 - a. Tank level indicator.
 - b. Capacity: Fuel for eight hours' continuous operation at 100 percent rated power output.
 - c. Vandal-resistant fill cap.
 - d. Containment Provisions: Comply with requirements of authorities having jurisdiction.

D. Control And Monitoring

- 1. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of generator set. When mode-selector switch is switched to the on position, generator set starts. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms.
- 2. Manual Starting System Sequence of Operation: Switching on-off switch on the generator control panel to the on position starts generator set. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms.
- 3. Configuration:
 - a. Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common control and monitoring panel mounted on the generator set. Mounting method shall isolate the control panel from generator-set vibration.
 - b. Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common wall-mounted control and monitoring panel.
 - c. Operating and safety indications, protective devices, basic system controls, engine gages, instrument transformers, generator disconnect switch or circuit breaker, and other indicated components shall be grouped in a combination control and power panel. Control and monitoring section of panel shall be isolated from power sections by steel barriers. Panel features shall include the following:
 - 1) Wall-Mounting Cabinet Construction: Rigid, self-supporting steel unit complying with NEMA ICS 6. Power bus shall be copper. Bus, bus supports, control wiring, and temperature rise shall comply with UL 891.
 - 2) Switchboard Construction: Freestanding unit complying with Division 26 Section "Switchboards".
 - 3) Switchgear Construction: Freestanding unit complying with Division 26 Section "Low-voltage Switchgear".
 - 4) Current and Potential Transformers: Instrument accuracy class.
- 4. Indicating and Protective Devices and Controls: As required by NFPA 110 for Level 1 **OR 2, as directed**, system, and the following:
 - a. AC voltmeter.
 - b. AC ammeter.
 - c. AC frequency meter.
 - d. DC voltmeter (alternator battery charging).
 - e. Engine-coolant temperature gage.
 - f. Engine lubricating-oil pressure gage.
 - g. Running-time meter.
 - h. Ammeter-voltmeter, phase-selector switch(es).



- i. Generator-voltage adjusting rheostat.
- j. Fuel tank derangement alarm.
- k. Fuel tank high-level shutdown of fuel supply alarm.
- l. Generator overload.
5. Indicating and Protective Devices and Controls:
 - a. AC voltmeter.
 - b. AC ammeter.
 - c. AC frequency meter.
 - d. DC voltmeter (alternator battery charging).
 - e. Engine-coolant temperature gage.
 - f. Engine lubricating-oil pressure gage.
 - g. Running-time meter.
 - h. Ammeter-voltmeter, phase-selector switch(es).
 - i. Generator-voltage adjusting rheostat.
 - j. Start-stop switch.
 - k. Overspeed shutdown device.
 - l. Coolant high-temperature shutdown device.
 - m. Coolant low-level shutdown device.
 - n. Oil low-pressure shutdown device.
 - o. Fuel tank derangement alarm.
 - p. Fuel tank high-level shutdown of fuel supply alarm.
 - q. Generator overload.
6. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.
7. Connection to Data Link: A separate terminal block, factory wired to Form C dry contacts, for each alarm and status indication is reserved for connections for data-link transmission of indications to remote data terminals. Data system connections to terminals are covered in Division 26 Section "Electrical Power Monitoring And Control".
8. Common Remote Audible Alarm:
 - a. Comply with NFPA 110 requirements for Level 1 systems. Include necessary contacts and terminals in control and monitoring panel.
 - 1) Overcrank shutdown.
 - 2) Coolant low-temperature alarm.
 - 3) Control switch not in auto position.
 - 4) Battery-charger malfunction alarm.
 - 5) Battery low-voltage alarm.
 - b. Common Remote Audible Alarm for manually starting systems or for automatically starting systems not specified to comply with NFPA 110, Level 1, but where some remote alarm functions are needed. Signal the occurrence of any events listed below without differentiating between event types. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset.
 - 1) Engine high-temperature shutdown.
 - 2) Lube-oil, low-pressure shutdown.
 - 3) Overspeed shutdown.
 - 4) Remote emergency-stop shutdown.
 - 5) Engine high-temperature prealarm.
 - 6) Lube-oil, low-pressure prealarm.
 - 7) Fuel tank, low-fuel level.
 - 8) Low coolant level.
9. Remote Alarm Annunciator: Comply with NFPA 99. An LED labeled with proper alarm conditions shall identify each alarm event and a common audible signal shall sound for each alarm condition. Silencing switch in face of panel shall silence signal without altering visual indication. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Cabinet and faceplate are surface- or flush-mounting type to suit mounting conditions indicated.



10. Remote Emergency-Stop Switch: Flush; wall mounted, unless otherwise indicated; and labeled. Push button shall be protected from accidental operation.

E. Generator Overcurrent And Fault Protection

1. Generator Circuit Breaker:

- a. Molded-case, thermal-magnetic type; 100 percent rated; complying with NEMA AB 1 and UL 489.
 - 1) Tripping Characteristic: Designed specifically for generator protection.
 - 2) Trip Rating: Matched to generator rating.
 - 3) Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
 - 4) Mounting: Adjacent to or integrated with control and monitoring panel.
- b. Molded-case, electronic-trip type; 100 percent rated; complying with UL 489.
 - 1) Tripping Characteristics: Adjustable long-time and short-time delay and instantaneous.
 - 2) Trip Settings: Selected to coordinate with generator thermal damage curve.
 - 3) Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
 - 4) Mounting: Adjacent to or integrated with control and monitoring panel.
- c. Insulated-case, electronic-trip type; 100 percent rated; complying with UL 489.
- d. Tripping Characteristics: Adjustable long-time and short-time delay and instantaneous.
- e. Trip Settings: Selected to coordinate with generator thermal damage curve.
- f. Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
- g. Mounting: Adjacent to or integrated with control and monitoring panel.

2. Generator Disconnect Switch: Molded-case type, 100 percent rated.

- a. Rating: Matched to generator output rating.
- b. Shunt Trip: Connected to trip switch when signaled by generator protector or by other protective devices.

3. Generator Protector: Microprocessor-based unit shall continuously monitor current level in each phase of generator output, integrate generator heating effect over time, and predict when thermal damage of alternator will occur. When signaled by generator protector or other generator-set protective devices, a shunt-trip device in the generator disconnect switch shall open the switch to disconnect the generator from load circuits. Protector shall perform the following functions:

- a. Initiates a generator overload alarm when generator has operated at an overload equivalent to 110 percent of full-rated load for 60 seconds. Indication for this alarm is integrated with other generator-set malfunction alarms.
- b. Under single or three-phase fault conditions, regulates generator to 300 percent of rated full-load current for up to 10 seconds.
- c. As overcurrent heating effect on the generator approaches the thermal damage point of the unit, protector switches the excitation system off, opens the generator disconnect device, and shuts down the generator set.
- d. Senses clearing of a fault by other overcurrent devices and controls recovery of rated voltage to avoid overshoot.
- e. Ground-Fault Indication: Comply with NFPA 70, "Emergency System" signals for ground-fault. Integrate ground-fault alarm indication with other generator-set alarm indications.

F. Generator, Exciter, And Voltage Regulator

1. Comply with NEMA MG 1.
2. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.
3. Electrical Insulation: Class H or Class F.
4. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.



5. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.
6. Enclosure: Dripproof.
7. Instrument Transformers: Mounted within generator enclosure.
8. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified.
 - a. Adjusting rheostat on control and monitoring panel shall provide plus or minus 5 percent adjustment of output-voltage operating band.
9. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.
10. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.
11. Subtransient Reactance: 12 percent, maximum.

G. Load Bank

1. Description: Permanent, outdoor, weatherproof, remote-controlled, forced-air-cooled, resistive **OR** resistive and reactive, **as directed**, unit capable of providing a balanced 3-phase, delta-connected load to generator set at 100 percent rated-system capacity, at 80 percent power factor, lagging. Unit may be composed of separate resistive and reactive load banks controlled by a common control panel. Unit shall be capable of selective control of load in 25 percent steps and with minimum step changes of approximately 5 and 10 percent available.
2. Resistive Load Elements: Corrosion-resistant chromium alloy with ceramic and steel supports. Elements shall be double insulated and designed for repetitive on-off cycling. Elements shall be mounted in removable aluminized-steel heater cases.
3. Reactive Load Elements: Epoxy-encapsulated reactor coils.
4. Load-Bank Heat Dissipation: Integral fan with totally enclosed motor shall provide uniform cooling airflow through load elements. Airflow and coil operating current shall be such that, at maximum load, with ambient temperature at the upper end of specified range, load-bank elements operate at not more than 50 percent of maximum continuous temperature rating of resistance elements.
5. Load Element Switching: Remote-controlled contactors switch groups of load elements. Contactor coils are rated 120 V. Contactors shall be located in a separate NEMA 250, Type 3R enclosure within load-bank enclosure, accessible from exterior through hinged doors with tumbler locks.
6. Contactor Enclosures: Heated by thermostatically controlled strip heaters to prevent condensation.
7. Load-Bank Enclosures: NEMA 250, Type 3R, complying with NEMA ICS 6. Louvers at cooling-air intake and discharge openings shall prevent entry of rain and snow. Openings for airflow shall be screened with 1/2-inch- (13-mm-) square, galvanized-steel mesh. Reactive load bank shall include automatic shutters at air intake and discharge.
8. Protective Devices: Power input circuits to load banks shall be fused, and fuses shall be selected to coordinate with generator circuit breaker. Fuse blocks shall be located in contactor enclosure. Cooling airflow and overtemperature sensors shall automatically shut down and lock out load bank until manually reset. Safety interlocks on access panels and doors shall disconnect load power, control, and heater circuits. Fan motor shall be separately protected by overload and short-circuit devices. Short-circuit devices shall be noninterchangeable fuses with 200,000-A interrupting capacity.
9. Remote-Control Panel: Separate from load bank in NEMA 250, Type 1 enclosure with a control power switch and pilot light, and switches controlling groups of load elements.
10. Control Sequence: Control panel may be preset for adjustable single-step loading of generator during automatic exercising.

H. Outdoor Generator-Set Enclosure

1. Description:
 - a. Vandal-resistant, weatherproof steel housing, wind resistant up to 100 mph (160 km/h). Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Panels shall be removable by one person without tools. Instruments and control shall be mounted within enclosure.



- b. Prefabricated or preengineered walk-in enclosure with the following features:
 - 1) Construction: Galvanized-steel, metal-clad, integral structural-steel-framed building erected on concrete foundation.
 - 2) Structural Design and Anchorage: Comply with ASCE 7 for wind loads.
 - 3) Space Heater: Thermostatically controlled and sized to prevent condensation.
 - 4) Louvers: Equipped with bird screen and filter arranged to permit air circulation when engine is not running while excluding exterior dust, birds, and rodents.
 - 5) Hinged Doors: With padlocking provisions.
 - 6) Ventilation: Louvers equipped with bird screen and filter arranged to permit air circulation while excluding exterior dust, birds, and rodents.
 - 7) Thermal Insulation: Manufacturer's standard materials and thickness selected in coordination with space heater to maintain winter interior temperature within operating limits required by engine-generator-set components.
 - 8) Muffler Location: Within **OR** External to, **as directed**, enclosure.
 2. Engine Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for 2 hours with ambient temperature at top of range specified in system service conditions.
 - a. Louvers: Fixed-engine, cooling-air inlet and discharge. Storm-proof and drainable louvers prevent entry of rain and snow.
 - b. Automatic Dampers: At engine cooling-air inlet and discharge. Dampers shall be closed to reduce enclosure heat loss in cold weather when unit is not operating.
 3. Interior Lights with Switch: Factory-wired, vaporproof-type fixtures within housing; arranged to illuminate controls and accessible interior. Arrange for external electrical connection.
 - a. AC lighting system and connection point for operation when remote source is available.
 - b. DC lighting system for operation when remote source and generator are both unavailable.
 4. Convenience Outlets: Factory wired, GFCI. Arrange for external electrical connection.
- I. Motors
1. General requirements for motors are specified in Division 23 Section "Common Motor Requirements For Hvac Equipment".
 - a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - b. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 22.
- J. Vibration Isolation Devices
1. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized-steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.
 - a. Material: Standard neoprene **OR** Natural rubber **OR** Bridge-bearing neoprene, complying with AASHTO M 251, **as directed**.
 - b. Durometer Rating: 30 **OR** 40 **OR** 45 **OR** 50 **OR** 60 **OR** 65 **OR** 70, **as directed**.
 - c. Number of Layers: One **OR** Two **OR** Three **OR** Four, **as directed**.
 2. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.
 - a. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, elastomeric isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
 - b. Outside Spring Diameter: Not less than 80 percent of compressed height of the spring at rated load.
 - c. Minimum Additional Travel: 50 percent of required deflection at rated load.
 - d. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - e. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.



- K. Finishes
 - 1. Indoor and Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.
- L. Source Quality Control
 - 1. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.
 - a. Tests: Comply with NFPA 110, Level 1 Energy Converters and with IEEE 115.
 - b. Report factory test results within 10 days of completion of test.

1.3 EXECUTION

- A. Installation
 - 1. Comply with packaged engine-generator manufacturers' written installation and alignment instructions and with NFPA 110.
 - 2. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.
 - 3. Install packaged engine generator with elastomeric isolator pads **OR** restrained spring isolators, **as directed**, having a minimum deflection of 1 inch (25 mm) on 4-inch- (100-mm-) high concrete base. Secure sets to anchor bolts installed in concrete bases. Concrete base construction is specified in Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
 - 4. Install remote radiator with elastomeric isolator pads **OR** restrained spring isolators, **as directed**, having a minimum deflection of 1 inch (25 mm) on concrete base on grade **OR** roof equipment supports on roof, **as directed**.
 - 5. Install Schedule 40, black steel piping with welded joints for cooling water piping between engine-generator set and heat exchanger **OR** remote radiator, **as directed**. Piping materials and installation requirements are specified in Division 23 Section "Hydronic Piping".
 - 6. Install Schedule 40, black steel piping with welded joints and connect to engine muffler. Install thimble at wall. Piping shall be same diameter as muffler outlet. Flexible connectors and steel piping materials and installation requirements are specified in Division 23 Section "Hydronic Piping".
 - a. Install condensate drain piping to muffler drain outlet full size of drain connection with a shutoff valve, stainless-steel flexible connector, and Schedule 40, black steel pipe with welded joints. Flexible connectors and piping materials and installation requirements are specified in Division 23 Section "Hydronic Piping".
 - 7. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.
 - 8. Piping installation requirements are specified in Division 21. Drawings indicate general arrangement of piping and specialties.
 - 9. Connect fuel, cooling-system, and exhaust-system piping adjacent to packaged engine generator to allow service and maintenance.
 - 10. Connect cooling-system water piping to engine-generator set and remote radiator **OR** heat exchanger, **as directed** with flexible connectors.
 - 11. Connect engine exhaust pipe to engine with flexible connector.
 - 12. Connect fuel piping to engines with a gate valve and union and flexible connector.
 - a. Natural-gas piping, valves, and specialties for gas distribution are specified in Division 23 Section "Facility Natural-gas Piping".
 - b. LP-gas piping, valves, and specialties for gas piping are specified in Division 23 Section "Facility Liquefied-petroleum Gas Piping".
 - 13. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
 - 14. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".
 - 15. Identify system components according to Division 23 Section "Identification For Hvac Piping And Equipment" and Division 26 Section "Identification For Electrical Systems".



B. Field Quality Control

1. Perform tests and inspections and prepare test reports.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Tests and Inspections:
 - a. Perform tests recommended by manufacturer and each electrical test and visual and mechanical inspection (except those indicated to be optional) for "AC Generators and for Emergency Systems" specified in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - b. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, single-step full-load pickup test.
 - c. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.
 - 1) Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
 - 2) Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
 - 3) Verify acceptance of charge for each element of the battery after discharge.
 - 4) Verify that measurements are within manufacturer's specifications.
 - d. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
 - e. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine-generator system before and during system operation. Check for air, exhaust, and fluid leaks.
 - f. Exhaust-System Back-Pressure Test: Use a manometer with a scale exceeding 40-inch wg (120 kPa). Connect to exhaust line close to engine exhaust manifold. Verify that back pressure at full-rated load is within manufacturer's written allowable limits for the engine.
 - g. Exhaust Emissions Test: Comply with applicable government test criteria.
 - h. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.
 - i. Harmonic-Content Tests: Measure harmonic content of output voltage under 25 percent and at 100 percent of rated linear load. Verify that harmonic content is within specified limits.
 - j. Noise Level Tests: Measure A-weighted level of noise emanating from generator-set installation, including engine exhaust and cooling-air intake and discharge, at four locations on the property line, and compare measured levels with required values.
3. Coordinate tests with tests for transfer switches and run them concurrently.
4. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
5. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
6. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
7. Remove and replace malfunctioning units and retest **OR** reinspect, **as directed**, as specified above.
8. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.
9. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.

C. Demonstration



1. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators.

END OF SECTION 26 32 13 13



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Task	Specification	Specification Description
26 32 13 19	26 32 13 13	Packaged Engine Generators
26 32 13 26	26 32 13 13	Packaged Engine Generators
26 32 29 00	26 32 13 13	Packaged Engine Generators



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SECTION 26 33 43 00 - CENTRAL BATTERY INVERTERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for central battery inverters. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes slow-transfer, fast-transfer, and UPS central battery inverters with the following features:
 - a. Output distribution section.
 - b. Internal maintenance bypass/isolation switch.
 - c. External maintenance bypass/isolation switch.
 - d. Multiple output voltages.
 - e. Emergency-only circuits.
 - f. Remote monitoring provisions.

C. Definitions

1. LCD: Liquid-crystal display.
2. LED: Light-emitting diode.
3. THD: Total harmonic distortion.
4. UPS: Uninterruptible power supply.

D. Submittals

1. Product Data: For the following:
 - a. Electrical ratings, including the following:
 - 1) Capacity to provide power during failure of normal ac.
 - 2) Inverter voltage regulation and THD of output current.
 - 3) Rectifier data.
 - 4) Transfer time of transfer switch.
 - 5) Data for specified optional features.
 - b. Transfer switch.
 - c. Inverter.
 - d. Battery charger.
 - e. Batteries.
 - f. Battery monitoring.
 - g. Battery-cycle warranty monitor.
2. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, components, and location and identification of each field connection. Show access, workspace, and clearance requirements; details of control panels; and battery arrangement.
 - a. Wiring Diagrams: Detail internal and interconnecting wiring; and power, signal, and control wiring.
 - b. Elevation and details of control and indication displays.
 - c. Output distribution section.
3. Manufacturer Seismic Qualification Certification: Submit certification that central battery inverter equipment will withstand seismic forces defined in Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
4. Operation and Maintenance Data.

E. Quality Assurance



1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. Central Battery Inverter System: UL 924 and UL 1778, **as directed**, listed.
3. Comply with NFPA 70 and NFPA 101.

F. Delivery, Storage, And Handling

1. Deliver equipment in fully enclosed vehicles.
2. Store equipment in spaces having environments controlled within manufacturers' written instructions for ambient temperature and humidity conditions for non-operating equipment.

G. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace batteries that fail in materials or workmanship within specified warranty period. Special warranty, applying to batteries only, applies to materials only, on a prorated basis, for period specified.
 - a. Warranty Period: Include the following warranty periods, from date of Final Completion:
 - 1) Premium, Valve-Regulated, Recombinant, Lead-Calcium Batteries:
 - a) Full Warranty: One year.
 - b) Pro Rata: 19 years.
 - 2) Standard, Valve-Regulated, Recombinant, Lead-Calcium Batteries:
 - a) Full Warranty: One year.
 - b) Pro Rata: Nine years.
 - 3) Nickel-Cadmium, Wet-Cell Batteries:
 - a) Full Warranty: Five years.
 - b) Pro Rata: 15 years.
 - 4) Lead-Calcium, Wet-Cell Batteries:
 - a) Full Warranty: One year.
 - b) Pro Rata: Nine years.
 - 5) Lead-Antimony, Wet-Cell Batteries:
 - a) Full Warranty: One year.
 - b) Pro Rata: Nine years.

1.2 PRODUCTS

A. Inverter Performance Requirements

1. Slow-Transfer Central Battery Inverters: Automatically sense loss of normal ac supply and use an electromechanical switch to transfer loads. Transfer in one second or less from normal supply to battery-inverter supply.
 - a. Operation: Unit supplies power to output circuits from a single, external, normal supply source. Unit automatically transfers load from normal source to internal battery/inverter source. Retransfer to normal is automatic when normal power is restored.
2. Fast-Transfer Central Battery Inverters: Automatically sense loss of normal ac supply and use a solid-state switch to transfer loads. Transfer in 0.004 second or less from normal supply to battery-inverter supply.
 - a. Operation: Unit supplies power to output circuits from a single, external, normal supply source. Unit automatically transfers load from normal source to internal battery/inverter source. Retransfer to normal is automatic when normal power is restored.
3. UPS-Type Central Battery Inverters: Continuously provide ac power to connected electrical system.
 - a. Automatic Operation:
 - 1) Normal Conditions: Supply the load with ac power flowing from normal ac power input terminals, through rectifier-charger and inverter, with battery connected in parallel with rectifier-charger output.



- 2) Abnormal Supply Conditions: If normal ac supply deviates from specified and adjustable voltage, voltage waveform, or frequency limits, battery supplies constant, regulated, inverter ac power output to the load without switching or disturbance.
 - 3) If normal power fails, battery continues supply-regulated ac power through the inverter to the load without switching or disturbance.
 - 4) When power is restored at normal supply terminals of system, controls automatically synchronize inverter with the external source before transferring the load. Rectifier-charger then supplies power to the load through the inverter and simultaneously recharges battery.
 - 5) If battery becomes discharged and normal supply is available, rectifier-charger charges battery. When battery is fully charged, rectifier-charger automatically shifts to float-charge mode.
 - 6) If any element of central battery inverter system fails and power is available at normal supply terminals of system, static bypass transfer switch transfers the load to normal ac supply circuit without disturbance or interruption of supply.
 - 7) If a fault occurs in system supplied by central battery inverter and current flows in excess of the overload rating of central battery inverter system, static bypass transfer switch operates to bypass fault current to normal ac supply circuit for fault clearing.
 - 8) When fault has cleared, static bypass transfer switch returns the load to central battery inverter system.
 - 9) If battery is disconnected, central battery inverter continues to supply power to the load with no degradation of its regulation of voltage and frequency of output bus.
- b. Manual Operation:
- 1) Turning inverter off causes static bypass transfer switch to transfer the load directly to normal ac supply circuit without disturbance or interruption.
 - 2) Turning inverter on causes static bypass transfer switch to transfer the load to inverter.
4. Maximum Acoustical Noise: **<Insert value>** dB, "A" weighting, emanating from any UPS component under any condition of normal operation, measured 39 inches (990 mm) from nearest surface of component enclosure.
- B. Service Conditions
1. Environmental Conditions: Inverter system shall be capable of operating continuously in the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
 - a. Ambient Temperature for Electronic Components: 32 to 98 deg F (0 to 37 deg C).
 - b. Relative Humidity: 0 to 95 percent, noncondensing.
 - c. Altitude: Sea level to 4000 feet (1220 m).
- C. Inverters
1. Description: Solid-state type, with the following operational features:
 - a. Automatically regulate output voltage to within plus or minus 5 percent.
 - b. Automatically regulate output frequency to within plus or minus 1 Hz, from no load to full load at unit power factor over the operating range of battery voltage.
 - c. Output Voltage Waveform of Unit: Sine wave with maximum 10 percent THD throughout battery operating-voltage range, from no load to full load.
 - 1) THD may not exceed 5 percent when serving a resistive load of 100 percent of unit rating.
 - d. Output Protection: Current-limiting and short-circuit protection.
OR
Output Protection: Ferroresonant transformer to provide inherent overload and short-circuit protection.
 - e. Surge Protection: Panelboard **OR** Auxiliary panel, **as directed**, suppressors specified in Division 26 Section "Transient-voltage Suppression For Low-voltage Electrical Power Circuits".



- f. Overload Capability: 125 percent for 10 minutes; 150 percent surge.
- g. Brownout Protection: Produces rated power without draining batteries when input voltage is down to 75 percent of normal.

D. Battery Charger

- 1. Description: Solid-state, automatically maintaining batteries in fully charged condition when normal power is available. With LED indicators for "float" and "high-charge" modes.

E. Batteries

- 1. Description: Premium, valve-regulated, recombinant, lead-calcium **OR** Standard, valve-regulated, recombinant, lead-calcium **OR** Nickel-cadmium, wet-cell **OR** Lead-calcium, wet-cell **OR** Lead-antimony, wet-cell, **as directed**, batteries.
 - a. Capable of sustaining full-capacity output of inverter unit for minimum of 90 minutes.

F. Enclosures

- 1. NEMA 250, Type 1 steel cabinets with access to components through hinged doors with flush tumbler lock and latch.
- 2. Finish: Manufacturer's standard baked-enamel finish over corrosion-resistant prime treatment.

G. Seismic Requirements

- 1. Central battery inverter assemblies, subassemblies, components, fastenings, supports, and mounting and anchorage devices shall be designed and fabricated to withstand seismic forces, **as directed**. The term "withstand" is defined in the "Manufacturer Seismic Qualification Certification" Paragraph in Part 1.1 "Submittals" Article.

H. Control And Indication

- 1. Description: Group displays, indications, and basic system controls on common control panel on front of central battery inverter enclosure.
- 2. Minimum displays, indicating devices, and controls shall include those in lists below. Provide sensors, transducers, terminals, relays, and wiring required to support listed items. Alarms shall include an audible signal and a visual display.
- 3. Indications: Labeled LED **OR** Plain-language messages on a digital LCD or LED, **as directed**.
 - a. Quantitative Indications:
 - 1) Input voltage, each phase, line to line.
 - 2) Input current, each phase, line to line.
 - 3) System output voltage, each phase, line to line.
 - 4) System output current, each phase.
 - 5) System output frequency.
 - 6) DC bus voltage.
 - 7) Battery current and direction (charge/discharge).
 - 8) Elapsed time-discharging battery.
 - b. Basic Status Condition Indications:
 - 1) Normal operation.
 - 2) Load-on bypass.
 - 3) Load-on battery.
 - 4) Inverter off.
 - 5) Alarm condition exists.
 - c. Alarm Indications:
 - 1) Battery system alarm.
 - 2) Control power failure.
 - 3) Fan failure.
 - 4) Overload.
 - 5) Battery-charging control faulty.
 - 6) Input overvoltage or undervoltage.
 - 7) Approaching end of battery operation.



- 8) Battery undervoltage shutdown.
 - 9) Inverter fuse blown.
 - 10) Inverter transformer overtemperature.
 - 11) Inverter overtemperature.
 - 12) Static bypass transfer switch overtemperature.
 - 13) Inverter power supply fault.
 - 14) Inverter output overvoltage or undervoltage.
 - 15) System overload shutdown.
 - 16) Inverter output contactor open.
 - 17) Inverter current limit.
- d. Controls:
- 1) Inverter on-off.
 - 2) Start.
 - 3) Battery test.
 - 4) Alarm silence/reset.
 - 5) Output-voltage adjustment.
4. Dry-form "C" contacts shall be available for remote indication of the following conditions:
- a. Inverter on battery.
 - b. Inverter on-line.
 - c. Inverter load-on bypass.
 - d. Inverter in alarm condition.
 - e. Inverter off (maintenance bypass closed).
5. Include the following minimum array:
- a. Ready, normal-power on light.
 - b. Charge light.
 - c. Inverter supply load light.
 - d. Battery voltmeter.
 - e. AC output voltmeter with minimum accuracy of 2 percent of full scale.
 - f. Load ammeter.
 - g. Test switch to simulate ac failure.
6. Enclosure: Steel, with hinged lockable doors, suitable for wall **OR** floor, **as directed**, mounting. Manufacturer's standard corrosion-resistant finish.
- I. Optional Features
1. Multiple Output Voltages: Supply unit branch circuits at different voltage levels if required. Transform voltages internally as required to produce indicated output voltages.
 2. Emergency-Only Circuits: Automatically energize only when normal supply has failed. Disconnect emergency-only circuits when normal power is restored.
 3. Maintenance Bypass/Isolation Switch: Load is supplied, bypassing central battery inverter system. Normal supply, electromechanical transfer switch, and system load terminals are completely disconnected from external circuits.
 4. Maintenance Bypass/Isolation Switch: Switch is interlocked so it cannot be operated unless static bypass transfer switch is in bypass mode. Switch provides manual selection among the following three conditions without interrupting supply to the load during switching:
 - a. Full Isolation: Load is supplied, bypassing central battery inverter system. Normal ac input circuit, static bypass transfer switch, and central battery inverter load terminals are completely disconnected from external circuits.
 - b. Maintenance Bypass: Load is supplied, bypassing central battery inverter system. Central battery inverter ac supply terminals are energized to permit operational checking, but system load terminals are isolated from the load.
 - c. Normal: Normal central battery inverter ac supply terminals are energized and the load is supplied either through static bypass transfer switch and central battery inverter rectifier-charger and inverter or through battery and inverter.
- J. Output Distribution Section



1. Panelboard: Comply with Division 26 Section "Panelboards" except provide assembly integral to equipment cabinet.

K. System Monitoring And Alarms

1. Remote Status and Alarm Panel: Labeled LEDs on panel faceplate shall indicate five basic status conditions. Audible signal indicates alarm conditions. Silencing switch in face of panel silences signal without altering visual indication.
 - a. Cabinet and Faceplate: Surface or flush mounted to suit mounting conditions indicated.
2. Provisions for Remote Computer Monitoring: Communication module in unit control panel provides capability for remote monitoring of status, parameters, and alarms specified in Part 1.2 "Control and Indication" Article. Remote computer and connecting signal wiring will be provided by the Owner. Include the following features:
 - a. Connectors and network interface units or modems for data transmission via RS-232 link.
 - b. Software shall be designed to control and monitor inverter system functions and to provide on-screen explanations, interpretations, diagnosis, action guidance, and instructions for use of monitoring indications and development of reports. Include capability for storage and analysis of power-line transient records. Software shall be compatible with requirements in Division 26 Section "Electrical Power Monitoring And Control" and the operating system and configuration of the Owner-furnished computers.
3. Battery Ground-Fault Detector: Initiates alarm when resistance to ground of positive or negative bus of battery is less than 5000 ohms.
 - a. Annunciation of Alarms: At inverter system control panel.
4. Battery-Cycle Warranty Monitoring: Electronic device, acceptable to battery manufacturer as a basis for warranty action, for monitoring charge-discharge cycle history of batteries covered by cycle-life warranty.
 - a. Basic Functional Performance: Automatically measures and records each discharge event, classifies it according to duration category, and totals discharges according to warranty criteria, displaying remaining warranted battery life on integral LCD.
 - b. Additional monitoring functions and features shall include the following:
 - 1) Measuring and recording of total voltage at battery terminals; providing alarm for excursions outside proper float voltage level.
 - 2) Monitoring of ambient temperature at battery and initiating an alarm if temperature deviates from normally acceptable range.
 - 3) Keypad on device front panel provides access to monitored data using front panel display.
 - 4) Alarm contacts arranged to provide local **OR** remote, **as directed**, alarm for battery discharge events **OR** abnormal temperature **OR** abnormal battery voltage or temperature, **as directed**.
 - 5) Memory device to store recorded data in nonvolatile electronic memory.
 - 6) RS-232 port to permit downloading of data to a portable personal computer.
 - 7) Modem to make measurements and recorded data accessible to remote personal computer via telephone line. Computer will be provided by the Owner.

L. Source Quality Control

1. Factory test complete inverter system, including battery, before shipment. Include the following:
 - a. Functional test and demonstration of all functions, controls, indicators, sensors, and protective devices.
 - b. Full-load test.
 - c. Transient-load response test.
 - d. Overload test.
 - e. Power failure test.
2. Observation of Test: Give 14 days' advance notice of tests and provide access for the Owner's representative to observe tests at the Owner's option.
3. Report test results. Include the following data:



- a. Description of input source and output loads used. Describe actions required to simulate source load variation and various operating conditions and malfunctions.
- b. List of indications, parameter values, and system responses considered satisfactory for each test action. Include tabulation of actual observations during test.
- c. List of instruments and equipment used in factory tests.

1.3 EXECUTION

A. Installation

1. Install system components on floor **OR** concrete base, **as directed**, and attach by bolting.
 - a. Design each fastener and support to carry load indicated by seismic requirements and according to seismic-restraint details. See Division 26 Section "Vibration And Seismic Controls For Electrical Systems" for seismic-restraint requirements.
 - b. Concrete Bases: 4 inches (100 mm) high, reinforced, with chamfered edges. Extend base no more than 3 inches (75 mm) in all directions beyond the maximum dimensions of switchgear unless otherwise indicated or unless required for seismic anchor support. Construct concrete bases according to Division 26 Section "Hangers And Supports For Electrical Systems".
 - c. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - d. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 - e. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-place Concrete".
2. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and NFPA 70.

B. Connections

1. Connections: Interconnect system components. Make connections to supply and load circuits according to manufacturer's wiring diagrams, unless otherwise indicated.
2. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
 - a. Separately Derived Systems: Make grounding connections to grounding electrodes and bonding connections to metallic piping systems as indicated; comply with NFPA 70.
3. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

C. Identification

1. Identify equipment and components according to Division 26 Section "Identification For Electrical Systems".

D. Field Quality Control

1. Perform tests and inspections and prepare test reports.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Tests and Inspections:
 - a. Inspect interiors of enclosures for integrity of mechanical and electrical connections, component type and labeling verification, and ratings of installed components.
 - b. Test manual and automatic operational features and system protective and alarm functions.
 - c. Test communication of status and alarms to remote monitoring equipment.
 - d. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specifications. Certify compliance with test parameters.



- e. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Remove and replace malfunctioning units and retest as specified above.

E. Startup Service

1. Engage a factory-authorized service representative to perform startup service.
2. Verify that central battery inverter is installed and connected according to the Contract Documents.
3. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements in Division 22.
4. Complete installation and startup checks according to manufacturer's written instructions.

F. Adjusting And Cleaning

1. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
2. Install new filters in each equipment cabinet within 14 days from date of Final Completion.

END OF SECTION 26 33 43 00



SECTION 26 33 43 00a - NURSE CALL

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for nurse call. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes visual/tone and audiovisual/voice nurse-call system.

C. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - a. Detail equipment cabinets and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - b. Cabling Diagrams: Single-line block diagrams showing cabling interconnection of all components for this specific equipment. Include cable type for each interconnection.
 - c. Station Installation Details: For built-in equipment, dimensioned and to scale.
3. Qualification Data: For qualified Installer.
4. Field quality-control reports.
5. Operation and Maintenance Data: For nurse-call equipment to include in emergency, operation, and maintenance manuals.
6. Warranty: Sample of special warranty.

D. Quality Assurance

1. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
2. Compatibility: System shall be capable of integration with any brand of phone system (wired or wireless), staff locating system, CCTV, and fire-alarm system.
3. Electrical Components, Devices, and Accessories: Listed and labeled according to UL 1069 as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace batteries that fail in materials or workmanship within specified warranty period. Special warranty for batteries applies to materials only, on a prorated basis for specified period.
 - a. Warranty Period: Include the following warranty periods, from date of Final Completion:
 - 1) Nickel-Cadmium Batteries, Lithium Batteries, and Wet-Cell Batteries:
 - a) Full Warranty: Five years.
 - b) Pro Rata: 15 years.

1.2 PRODUCTS

A. Nurse-Call System General Requirements

1. Station Zones: Able to program 256 station zones for each master station in the network with eight priority levels and addressable visual and audible annunciation of audible devices such as smoke detectors and door contacts.
2. System shall provide integrated and centralized "Code Blue" and "Staff Emergency" calls.



3. Expansion Capability: Equipment ratings, housing volume, spare keys, switches, relays, annunciator modules, terminals, and cable conductor quantities adequate to increase the number of stations in the future by 25 percent above those indicated without adding internal or external components or main trunk cable conductors.
4. Existing System Compatibility: Functionally and electrically compatible with existing system so components and wiring operate as an extension or upgrade of the existing system and existing or upgraded functional performance of the existing system applies to the entire final system. Colors, tones, types, and durations of signal manifestation shall be common among new and existing systems.
5. Resistance to Electrostatic Discharge: System, components, and cabling, and the selection, arrangement, and connection of materials and circuits, shall be protected against damage or diminished performance when subjected to electrostatic discharges of up to 25,000 V in an environment with a relative humidity of 20 percent or less.
6. Equipment: Microprocessor, electronic, modular.
7. Master Nurse-Call Station: Programmed via a PC.
8. Wall-Mounted Component Connection Method: Components connect to system wiring in back boxes with factory-wired plug connectors.
9. Telephone Interface: Permit use of wired and wireless telephones to execute nurse-call master station functions.
10. Third-Party Pager Interface: Programmable to send tone, numeric, and alphanumeric message to pocket pagers or personal digital assistants and to use industry standard-protocol, RS-485 interface.

B. Visual/Tone Nurse-Call System

1. Operational Requirements:
 - a. Patient Station Call: Lights a steady call-placed lamp on the station, steady lamps in the zone light and corridor dome light associated with the patient's room, and steady lamps at the central annunciator and other system display devices and displays message on master and staff/duty stations. At the same time, it sounds a programmed tone at intervals, at the respective annunciator and master and staff/duty stations. Legends at the central annunciator and master station identify the calling station.
 - b. Pull-Cord-Call Station Call: Flashes a call-placed lamp on the station and distinctive-color lamps in the zone light and corridor dome light and at the central annunciator and staff/duty stations. At the same time, it sounds a programmed tone at intervals, at the central annunciator and master and staff/duty stations. A legend at the master station identifies the calling station, priority as programmed, and bed identification.
 - c. Emergency-Call Station Call: Produces the same responses as pull-cord-call station calls except rapidly flashing red emergency digital display and tone repetition rates are more frequent, tone frequency is higher, and lamps in the zone light and corridor dome light are a different color. Indicator lamps may be extinguished and the system reset only at the calling station. Displays message on pocket pagers, sounds programmed tone on phones, and displays message on display equipped phones.
 - d. System Reset: Operating reset button at the originating station cancels signals associated with the call. Illuminates a green digital display on the patient station and log presence on the master station.
 - e. Cord-Set Removal: Initiates a patient station call when the cord set is removed from the jack in the patient station faceplate. Displays location and "cord removed" message on master station, pocket pagers, and display equipped phones. Inserting a cord-set plug or a dummy plug into the jack and operating the station reset button resets the call.
 - f. Patient Control Unit: Controls entertainment volume and channel selection. Nurse button on the unit initiates a patient station call. Integral speaker reproduces entertainment sound.
 - g. Emergency Bath Station Call: Illuminates the digital display on the emergency bath station; rapidly flashes white dome lamp; displays location, priority, and bath on master



- station; and sounds programmed tone on master station display equipped phones and pocket pagers.
- h. Staff/Duty Station Operation: Operation shall be identified to patient station except the message staff shall display on all devices when the staff call button is activated.
 - i. Privacy Key Activation: When privacy key is activated on patient station, the system shall disconnect the patient station microphone and slowly flash yellow privacy digital display on the patient station. Displays "privacy" on master station when selecting this room/bed.
2. Central Annunciator:
 - a. Lamp type.
 - b. Lamp Legends: Machine lettered and legible from a distance of at least 48 inches (1200 mm) when a call is present. Legend shall identify initiating station and priority of call.
 - c. Power-on Indicator: Digital, or push-to-test switch.
 - d. Audible Signal: Electronic tone.
 3. Central Equipment Cabinet:
 - a. Lockable metal.
 - b. Houses power supplies, controls, terminal strips, and other components.
 - c. Power-on indicator lamp.
 - d. Battery Backup Unit: Sealed nickel-cadmium, wet-cell battery supplies power through an automatic switch when normal power fails, for a period of not less than six minutes at rated output. System shall lose no unanswered calls or calls in progress during the transfer operation.
 - 1) Automatic retransfer to normal power, after a 15-minute time delay.
 - 2) Two-rate battery charger with an automatic trickle rate and a recharge rate.
 4. Single-Patient Station: Call-placed lamp, reset push button, and polarized receptacle matching cord-set plug; mounted in a single faceplate.
 5. Dual-Patient Station: Single call-placed lamp, single reset push button, and two polarized receptacles matching cord-set plug; mounted in a single faceplate.
 6. Ambulatory-Patient Station: Call push-button switch, call-placed lamp, and reset push button; mounted in a single faceplate.
 7. Staff/Duty Stations: A minimum of two call lamps, one for routine calls and one for emergency calls; and an audible tone signal device.
- C. Audiovisual/Voice Nurse-Call System
1. Operational Requirements:
 - a. Station Selection from Master Station: Capable of selectively communicating with other stations or groups of stations on its system by touch screen, mouse click, or manual switch; and capable of programming up to 256 stations for each master station in the network.
 - b. Master Station Privacy: Capable of conversing with individual stations in complete privacy.
 - c. Called Station:
 - 1) Capable of hands-free and two-way conversation.
 - 2) Pressing "talk/listen" key shall cause the annunciation tone to cease.
 - 3) Pressing "cancel" key terminates normal calls and conversations.
 - 4) Terminating of high-priority level 1 **OR** 2 **OR** 3 **OR** 4, **as directed**, shall not be allowed except at calling station location and shall send "remind" message if the call is not acknowledged at point of origin in programmed time frame.
 - d. Annunciation:
 - 1) At the master station, a programmable tone announces an incoming call; an annunciator light or digital display identifies the calling station and indicates the priority of the call.
 - 2) Call type indications include alarm assist, bath, bed, code, communication fault, cord out, door, emergency, and fire.
 - 3) Memory lamps or lighted displays identify stations selected for outgoing calls.
 - e. System Reset at Master Station: A normal, incoming call can be canceled, associated lights and audible tones extinguished, and the system reset when the station switch is returned to the normal position.



- f. Patient Station Calls:
 - 1) Lights the call-placed lamp at patient station, zone, and corridor dome lights.
 - 2) Sounds a tone and lights the call lights at staff/duty stations and actuates annunciation at the master station.
 - 3) When the calling station is selected at the master station, the patient can converse with the master station without moving and without raising or directing the voice.
 - 4) During voice communications, entertainment audio at the calling station is automatically muted.
- g. Pull-Cord-Call Station Calls and Emergency-Call Station Calls:
 - 1) Lights call-placed lamp and corridor dome light and flashes zone light.
 - 2) Master station tone pulses and annunciator light for that room flashes.
 - 3) When master station acknowledges the call by touch screen or switch, the tone stops but lights continue to flash until the call is canceled at the initiating point.
- h. Code Blue and Staff/Duty Station Calls:
 - 1) Lights the call-placed lamp at the station and actuates annunciation at the master station.
 - 2) When the called station is selected at the master station, the caller and the master station operator can converse.
 - 3) Code Blue: Unique sound and light pattern indicating the highest priority emergency.
 - 4) Staff Station: Unique sound and light pattern indicating an emergency.
 - 5) Duty Station: Sound and light pattern indicating a call to the nurse station.
- i. Handset Operation: Lifting the handset on master station disconnects speaker/microphone and transfers conversation to the handset.
- j. Station Privacy: No patient or staff/duty station can be remotely monitored without lighting a warning lamp at the monitored station.
- k. Patient Station Cord-Set Removal:
 - 1) A patient station call is initiated as described above when a patient station cord-set plug is removed from the jack in the station faceplate.
 - 2) Tone stops but lights continue to flash until the call is canceled at the initiating point or the plug is reinserted or replaced with a dummy plug when the master station call button for the station is pressed.
- l. Patient Control Unit:
 - 1) Controls entertainment volume and channel selection.
 - 2) Speaker is used for both nurse communication and entertainment sound.
 - 3) Entertainment sound is automatically muted when station is communicating with master station.
 - 4) Nurse button on the unit initiates a patient station call.
- m. Selective Paging: Master station is capable of initiating a message to selected groups of stations or speakers simultaneously by using station group switches.
- n. Staff Reminder:
 - 1) Master station can initiate a staff reminder that a patient requires direct staff response by operating a reminder control while in contact with the patient station.
 - 2) This reminder will light a distinctive-color lamp in the corridor dome light at the patient's room and in the appropriate zone lights.
 - 3) Reminder calls are canceled by operating a staff reminder cancel switch in the patient's room.
- o. Call Priority Indication:
 - 1) Capable of eight call priority levels in addition to normal.
 - 2) Call priority switch near each patient station, or integral with the master station, shall control priority status of the call transmitted by individual stations.
 - 3) Switch selects one of the following status levels:
 - a) Normal: No change to the normal call initiation and canceling sequence.



- b) Emergency: Call initiation produces signals and indications identical to those of emergency-call stations. Indicator lamps are extinguished and the system is reset only at the originating station.
- c) Priority: System response is the same for emergency status except voice communication between the master station and the calling station is locked in from the time of call initiation until the system is reset at the originating station.
- p. Additional Call:
 - 1) Waiting display window on the master station similar to current call window displays incoming calls.
 - 2) Master station shall have a call-overflow indicator when incoming calls exceed <Insert number> calls.
 - 3) System shall store unlimited number of incoming calls.
 - 4) System shall be capable of automatically answering incoming calls in order of priority.
- q. Calling Intercom Stations:
 - 1) Master station shall be capable of calling any intercom station using the handset or the hands-free speaker/microphone.
 - 2) Receipt of a call at the intercom station shall be preceded by an optional pre-announce tone.
 - 3) If there is a call in process, system shall place the active call on automatic hold while the new call is placed, then reestablish the previous call when the new call has ended.
- r. Privacy Override:
 - 1) Temporarily deactivates the "Privacy" mode of a called station by calling the station and instructing the called party to press the call-cord button.
 - 2) On completion of the conversation, the called station shall automatically return to the "Privacy" mode.
 - 3) When in "Privacy" mode, a called station shall be capable of hearing the master station; however, the master station shall not be capable of hearing the called station; a privacy message shall be indicated on the master station display.
- s. Master-Station-to-Master-Station Calls:
 - 1) Master stations shall be capable of calling other master stations using the handset.
 - 2) Calls from master stations shall be answered using the handset only.
 - 3) Busy master stations shall be indicated by a master station intercom busy tone.
- t. Voice Paging:
 - 1) Capable of voice paging to all stations using a single "All Call" key. The page shall be preceded by an optional pre-announce tone, **as directed**.
 - 2) Capable of voice paging to eight user-defined groups of stations by selecting the group and then the "All Call" key. The page shall be preceded by a pre-announce tone, **as directed**.
 - 3) Capable of voice paging to all staff/duty stations and all patient stations where staff has registered presence using a single "Public Address (PA)/Staff" key. The page shall be preceded by a pre-announce tone, **as directed**.
 - 4) Capable of voice paging through a third-party PA system.
 - 5) Capable of including or excluding any station from the voice paging function(s).
 - 6) Automatically places an active station call on hold during any page and reestablishes the connection at the end of the page.
 - 7) Automatically cancels a page if the talk mode is inactive for more than 15 seconds.
- u. Station Monitor:
 - 1) An audio monitor feature shall allow a user to sequentially or simultaneously listen to one or all stations that are included in the user-created list.
 - 2) Master station display shall indicate which station is being monitored when in sequential mode.
 - 3) The dwell time each station is monitored shall be user programmable.
 - 4) The user shall be able to stop the monitoring sequence by activating a "pause" key.



- 5) The user shall be able to manually sequence through stations using a "next" key.
- v. Night Service:
- 1) Functions shall be adaptable for nighttime staffing levels, patient traffic, and day/night operations.
 - 2) Staff Follow:
 - a) Capable of locating roving staff; forwarding visual and audible annunciation of incoming calls to station(s) where personnel have registered presence.
 - b) Master station shall display locations where staff have registered presence.
 - c) Incorporates a programmable timer that automatically cancels a forgotten staff presence registration.
 - 3) Tones:
 - a) Deactivates audio signals from a duty station and mini-master display telephones.
 - b) Capable of changing the tone volume at the master and duty stations.
 - c) Satellite function shall permit the user to deactivate audio signals from duty stations and other remote annunciator devices.
 - 4) Transfer:
 - a) Permits one nurse station to take control of all or individually selected bed call cords from another nurse station. It shall be possible to view transfer status of a nurse station.
 - b) Includes a minimum of three transfer modes to allow one nurse station to take control or share calls and operations from another nurse station.
 - i. Parallel Transfer Mode: Permits both nurse stations to share all calls and operations.
 - ii. Supervised Transfer Mode: Permits the transferred nurse station to share all calls and operations with the controlling nurse station; however, the controlling nurse station calls are not shared with the transferring station.
 - iii. Capture Transfer Mode: Transfers all calls and operations from the transferred nurse station to the controlling nurse station.
 - iv. Transferred station shall have no control over calls, and its display shall indicate calls have been transferred to another station.
 - c) Includes two "patient swing" modes to allow one nurse station to take control or share calls from one or many calls from another nurse station.
 - i. Supervised Transfer Mode: Permits the transferred calls to be shared with the controlling nurse station.
 - ii. Capture Transfer Mode: Transfers all calls from the call cord from the transferred nurse station to the controlling nurse station.
 - iii. Transferred station has no control over those transferred calls.
- w. Service Request:
- 1) Permits users to assign a service request to a substation, at programmable priority level.
 - 2) Displays service request on the nurse station display and light the green flashing corridor lamp at the respective substation and automatically generate a service reminder request.
 - 3) Cancels service requests only at the initiating point.
 - 4) Recall calls shall sound and be displayed at the master station if the service request has not been cancelled at the initiating point within the programmed period of time.
- x. Call Reminder Function:
- 1) Automatically generates a reminder call for a patient- or staff-initiated, high-priority 2 **OR 3 OR 4, as directed**, request that has had the call tones silenced, allowing time to physically attend to the request and cancel the call at the initiating point.
 - 2) Regenerated calls shall display the same tones and visual indications and priority as the original call and shall also display a "regenerated call" message.
 - 3) Capable of manually adding low-priority calls to the reminder list.



- 4) "Call Reminder" function and reminder timer shall be programmable by call priority.
- y. Hide Function: Prevents a selected station from displaying calls or generating tones on the nurse station.
- z. Door Control Function: Capable of being programmed to enable the user to remotely activate electric door locks.
- aa. Test and Diagnostics Feature:
 - 1) Able to automatically diagnose system faults and categorize them as warnings, communication errors, or fatal errors.
 - 2) Warnings shall indicate possible system problems.
 - 3) Communication errors shall indicate the inability of the master station to communicate with a substation or another nurse-call station.
 - 4) Fatal errors shall indicate a major hardware or software failure.
- bb. User-Configured System Programming - Access Code Not Required:
 - 1) Patient call-cord priority levels.
 - 2) Monitor list.
 - 3) "All Call" list.
 - 4) Master station communication parameters (volume, filtering, talk/listen, sensitivity).
 - 5) Master and duty station call annunciation tone volume.
 - 6) Date/time.
 - 7) Staff-follow operating mode.
 - 8) Transfer type.
 - 9) Pocket pager list assignment.
 - 10) Presence mode.
- cc. User-Configured System Programming - Access Code Required:
 - 1) Master station number.
 - 2) Room device type.
 - 3) Room number.
 - 4) Bed number.
 - 5) Bed alpha or numeric.
 - 6) Reminder duration.
 - 7) Staff presence registration cancel duration.
 - 8) Display language.
 - 9) Paging group assignment(s).
 - 10) Zone group assignments.
 - 11) Monitoring duration.
 - 12) Pocket pager number.
 - 13) Call tone assignment by priority.
 - 14) Pretone activation.
 - 15) Call tones minimum volume.
 - 16) Clock mode (12 h/24 h).
- 2. Master Station:
 - a. Speaker/microphone unit with operating controls.
 - b. Indicator lamps with legends or by digital display designate identification and priority of calling stations and called stations.
 - c. Pulse rate of incoming-call lights denotes priority of calls awaiting response.
 - d. Station Selection Controls: Touchpad select stations for two-way voice communications.
 - e. Signal Tones: Programmable to announce incoming calls.
 - f. Pulse rate and frequency of tone identify the highest priority call awaiting response at one time.
 - g. Volume Control: Regulates incoming-call volume.
 - h. Privacy Handset with Hook Switch: Of the type that does not require push-to-talk switch attached to each station unless otherwise indicated.
 - i. Staff Reminder Control: Initiates flashing of corresponding corridor dome lights for patients requiring service. Permits scanning equipment to indicate which patients are currently in reminder status.



- j. Call Priority Selection: Controls associated with patient-station selection switches determine the priority displayed when a call is initiated at a patient station.
- 3. Central Equipment Cabinet:
 - a. Lockable metal.
 - b. Houses amplifiers, tone generators, power supplies, controls, terminal strips, and other components.
 - c. Amplifier: With fidelity and overall gain necessary to achieve the sound-transmission and reproduction characteristics specified, considering interoperability with the installed speakers/microphones and wiring.
 - 1) Power Output: Not less than 3 W at a total harmonic distortion not exceeding 5 percent.
 - 2) Hum and Noise: 60 dB below full output with normal input open.
 - 3) Volume Control: Concealed within the amplifier unit to control the volume of sound reproduced at all stations.
 - 4) Protection: Circuit to prevent damage to the amplifier in case of shorted or open circuit.
 - d. Selective Paging Amplifiers: Plug-in card mounted in central equipment cabinet, rated 15 W.
 - e. System Power Supply:
 - 1) 24-V dc for operation of the call system.
 - 2) Equipment Rating: Suitable for continuous operation between 32 and 120 deg F (0 and 49 deg C), from a primary line voltage between 105- to 125-V ac, 60 Hz.
 - 3) Output: Regulated 24-V dc with protection against overloads. Line-to-load regulation shall not exceed 2-1/2 percent with ripple and noise remaining below the 10-mV, rms level.
 - 4) Overload Protection: Electronic fold-back circuit set to limit the volt-ampere output to less than 100 VA during overloaded or shorted output. Restore power output automatically on removal of overload without resetting circuit breakers or replacing fuses.
 - f. Power-on indicator lamp.
 - g. Surge Protector Device: Comply with Division 26 Section "Transient-voltage Suppression For Low-voltage Electrical Power Circuits" for auxiliary panel suppressors, with digital indicator lights for power and protection status.
 - h. Battery Backup Unit: Sealed nickel-cadmium, wet-cell battery supplies power through an automatic switch when normal power fails, for a period of not less than six minutes at rated output.
 - 1) Automatic retransfer to normal power, after a 15-minute time delay.
 - 2) Two-rate battery charger with an automatic trickle rate and a recharge rate.
- 4. Speaker/Microphones:
 - a. Type: Permanent-magnet, dynamic or ceramic, protected against dust and humidity.
 - b. Sound Reproduction: Sound level of 90 dB plus or minus 3 dB at a distance of 48 inches (1220 mm) on the axis without overdriving or distorting any frequencies between 300 and 3000 Hz when installed in an enclosure or in the pillow speaker.
 - c. Power Handling Capacity: Not susceptible to damage from overdriving within the range of power available from the amplifier.
 - d. Impedance Matching: Coordinated and matched to the input and output circuits of the amplifier, both for single connection and for group monitoring, to provide the sound reproduction specified. Subsystems or components shall not be combined, which could cause unacceptable distortion such as feedback between pillow speakers and unmuted room speaker/microphone combinations. This protection shall extend throughout the entire range of operation (volume control) of all components.
- 5. Single-Patient Station: Speaker/microphone with 2-inch (50-mm) dynamic cone, a polarized receptacle to match the cord-set plug, monitor lamp, reset switch, and call-placed lamp; assembled under a single faceplate.
- 6. Dual-Patient Station:



- a. Speaker/microphone with 2-inch (50-mm) dynamic cone, two polarized receptacles to match cord-set plugs, monitor lamp, and reset switch; assembled under a single faceplate.
 - b. Single call-placed lamp serves both beds.
OR
Dual call-placed lamps, one for each bed.
7. Staff/Duty Stations: Audible call-tone signal device, speaker/microphone with 2-inch (50-mm) dynamic cone, monitor lamp, reset switch, routine-call lamp, emergency-call lamp, and call push button; assembled under a single faceplate.
 8. Code Blue Station: Audible call-tone signal device, speaker/microphone with 2-inch (50-mm) dynamic cone, monitor lamp, reset switch, Code Blue emergency-call lamp, and call push button; assembled under a single faceplate.
 9. Ambulatory-Patient Station: Speaker/microphone with 2-inch (50-mm) dynamic cone, monitor lamp, reset switch, call-placed lamp, and call push button; assembled under a single faceplate.
 10. Selective Paging Speakers: 8-inch (200-mm) cone type with 1-inch (25-mm) voice coil and minimum 5-oz. (140-g) ceramic magnet, multitap matching transformer, flush-mounted steel back-box, and white enamel-finished metal ceiling grille.
 11. Call Priority Switch Station: Three-position, tamper-resistant priority selection switch. Positions designated by labeling "Normal," "Emergency," and "Priority."
 12. Staff Reminder Cancel Switch Station: Momentary contact.
- D. System Components
1. Emergency-Call Station: Locking-type push button, labeled "Push to Call Help"; reset trigger to release push button and cancel call; and call-placed lamp, mounted in a single faceplate.
 2. Emergency-Bath Station:
 - a. Consists of a sliding, chemical-resistant, ABS red fascia marked with the word "URGENT" in bold letters.
 - b. Capable of being activated with nylon pull cord or by sliding the face of the unit downwards.
 - c. Activation of the station shall illuminate a reassurance digital display on the face of the unit in addition to notifying the master station.
 - d. Water resistant and able to withstand routine cleaning and chemical disinfectants.
 - e. Uses magnetic reed switch technology for reliability and corrosion resistance.
 - f. Mounts on a single-gang electrical box wire to the respective patient station or input controller.
 3. Code Blue Station:
 - a. Consists of a sliding, chemical-resistant, ABS blue fascia marked with the word "CODE" in bold letters.
 - b. Capable of being activated with nylon pull cord or by sliding the face of the unit downwards.
 - c. Activation of the station shall illuminate a reassurance digital display on the face of the unit in addition to notifying the master station.
 - d. Water resistant and able to withstand routine cleaning and chemical disinfectants.
 - e. Uses magnetic reed switch technology for reliability and corrosion resistance.
 - f. Mounts on a single-gang electrical box wire to the respective patient station or input controller.
 4. Staff, Emergency Station:
 - a. Consists of a sliding, chemical-resistant, ABS red fascia marked with the word "EMERGENCY" in bold letters.
 - b. Capable of being activated with nylon pull cord or by sliding the face of the unit downwards.
 - c. Activation of the station shall illuminate a reassurance digital display on the face of the unit in addition to notifying the master station.
 - d. Mounts on a single-gang electrical box wire to the input controller.
 5. Pull-Cord-Call Station:
 - a. Pull-Down Switch: Lever-locking type, labeled "Pull Down to Call Help."
 - b. Reset trigger.



- c. Call-placed lamp.
- d. Water-resistant construction.
6. Patient Control Unit:
 - a. Equipped with plug and 96-inch- (2400-mm-) long white cord.
 - b. Ethylene oxide, sterilizable.
 - c. Light-Control Switch: Arranged for independent on-off control of patient's up and down light.
 - d. Integral Speaker: 2 inches (50 mm), with 0.35-oz. (9.9-g) magnet, rated 0.2 W.
 - e. Controls: Speaker volume, TV control, and nurse call.
 - f. Housing: High-impact white plastic.
 - g. Attachment: Stainless-steel bed clamp with permanently attached polyester film strap.
 - h. Quantity: 12 units for every 10 patient beds.
7. Call-Button Cord Set:
 - a. Plug and 72-inch (1800-mm) white cord; cord set shall be resistant to medical gas environment equipped with momentary-action, call-button switch.
 - b. Ethylene oxide, sterilizable.
 - c. Washable cord.
 - d. Palladium switch contacts in high-impact white housing with cord-set strain relief.
 - e. Attachment: Stainless-steel bed clamp with permanently attached polyester film strap.
 - f. Quantity: Three cord sets for every 10 patient beds.
8. Geriatric Call-Button Cord Set:
 - a. Plug and 72-inch (1800-mm) white cord.
 - b. Resistant to medical gas environment equipped with momentary-action, light-pressure switch in soft outer jacket.
 - c. Ethylene oxide, sterilizable.
 - d. Washable cord.
 - e. Palladium switch contacts in high-impact white housing with cord-set strain relief.
 - f. Attachment: Stainless-steel bed clamp with permanently attached polyester film strap.
 - g. Quantity: Two cord sets for every 10 patient beds.
9. Squeeze-Bulb Switch Cord Set:
 - a. Plug and 72-inch (1800-mm) washable tube with white cord set.
 - b. Resistant to medical gas environment; washable; equipped with neoprene squeeze-bulb activator, and plug-mounted, momentary contact switch.
 - c. Ethylene oxide, sterilizable.
 - d. Attachment: Stainless-steel bed clamp with permanently attached polyester film strap.
 - e. Quantity: Two cord sets for every 10 patient beds.
10. Breath Call Cord:
 - a. Flexible PVC jacketed cable and a momentary contact air-pressure sensitive switch.
 - b. Cord: 108 inches (2700 mm) long.
 - c. Include an adjustable arm for clamping and suitable for use in oxygen atmospheres.
 - d. Include 12 replacement straws.
11. Pillow Speakers:
 - a. Eight-conductor, DIN, flexible PVC jacketed cable.
 - b. Contain nurse-call button, volume control, speaker, and channel control in molded flame-retardant ABS housing.
 - c. Cord: 96 inches (2400 mm) long with sheet clip.
12. Call-Button Plug:
 - a. Designed to plug into patient station cord-set receptacle.
 - b. Button switches call circuit.
 - c. Two plugs for every 10 patient beds.
13. Dummy Plugs:
 - a. Designed to plug into patient station cord-set receptacle when call-button plug or patient cord set is not used.
 - b. Three plugs for every 10 patient beds.
14. Indicator Lamps: Digital type with rated life of 20 years unless otherwise indicated.



15. Station Faceplates:
 - a. Stainless steel, a minimum of 0.0375 inch (0.95 mm) thick.
 - b. Finish: Brushed.
 - c. Machine-engraved labeling identifies indicator lamps and controls.

OR

Station Faceplates:

 - a. High-impact plastic.
 - b. Color: Beige.
 - c. Molded or machine-engraved labeling identifies indicator lamps and controls.
16. Corridor Dome Lights and Zone Lights:
 - a. Three-lamp signal lights.
 - b. Lamps: Front replaceable without tools, low voltage with rated life of 7500 hours. Barriers are such that only one color is displayed at a time.
 - c. Lenses: Heat-resistant, shatterproof, translucent polymer that will not deform, discolor, or craze when exposed to hospital cleaning agents.
 - d. Filters: Two per unit, amber and red.
17. Cable:
 - a. Conductors: Jacketed single and multiple, twisted-pair copper cables.
 - b. Sizes and Types: As recommended by equipment manufacturer.
 - c. Cable for Use in Plenums: Listed and labeled for plenum installation.
18. Grounding Components: Comply with requirements in Division 26 Section "Grounding And Bonding For Electrical Systems".

E. Software Requirements

1. Telephone System Interface:
 - a. Permits use of wired and/or wireless telephones to execute nurse-call master station.
 - b. Two-way communication with patient and staff stations.
 - c. Two-way communication with the master nurse station.
 - d. "All Call," group call, and staff call paging.
 - e. Capable of being programmed to forward calls destined for a master nurse station to any connected telephone.
 - f. Telephones connected to the telephone interface shall have the same call tone ring patterns as those generated at the master nurse station.
 - g. Telephones having a display shall indicate the call type, priority code, and the calling station number of incoming calls.
 - h. Telephones shall be capable of initiating a service request for a particular patient station, logging calls on the master station's reminder list, and activating door lock mechanisms associated with a call station.
 - i. Capable of routine setup and configuration changes using the keypads on display telephone and/or the master station.
2. Display Telephones:
 - a. Digital telephones for use as mini-master nurse-call stations.
 - b. Digital display shall indicate the call type, priority code, and calling station number of incoming calls.
 - c. Ring patterns shall be identical to those generated at the master station.
 - d. Capable of two-way communication with patient and staff stations and the master station, and other telephones interfaced with the system.
 - e. Capable of placing or answering outside calls when interfaced with the facility telephone system.
 - f. Capable of "All Call," group call, and staff call paging and of initiating service requests, logging calls to the reminder list, and activating optional door controls.
3. Third-Party Pocket Pager Interface:
 - a. Equipped with a standalone pocket pager interface.
 - b. Connects with the facility paging system and transmit alphanumeric messages to the pocket pagers as preprogrammed in the system.
4. Statistical Software:



- a. Includes a data statistical software package that stores, sorts, and analyzes activities occurring on the nurse-call system network.
 - b. Windows based and operated on a PC that is connected to the nurse-call system network.
 - c. Stores events on the PC's hard disk. Accumulation of these stored events shall make up the database that is used to generate reports and statistics.
 - d. Events stored by the software shall include date, day of week, time, ward, priority, and room number.
 - e. Capable of assigning a patient name to bed number.
 - f. Stored events shall include, but not be limited to, calls placed, call priority, calls cancelled at the nurse station, calls cancelled at the point of origin, regenerated calls, calls answered, calls sent to pager interface, staff presence registration, staff presence cancellation, service request, service cancellation, and system and network error messages.
5. Data Analysis Software:
- a. Capable of analyzing the stored information and generating computed analysis.
 - b. Analysis of the database can be conducted by specifying one, many, or all of the following parameters of the database: date, day of week, time, wards, priority, and room number.
 - c. Analysis shall include, but not be limited to, total number of calls placed, average call response time (from call placed to call cancellation), total number of presence registrations, average presence time in a room, total number of service requests, average response time (from audio answer to call cancellation), and average ring time (from call placed to audio answer).
6. Statistical Software Package:
- a. Capable of displaying multiple calls/events on a PC monitor or on a RS-485 data-bus-driven digital display panel.
 - b. Calls from patient or staff stations and associated devices shall be displayed by priority. Display shall be customizable as follows:
 - 1) Choice of color by type of call.
 - 2) Choice of display size (character size).
 - 3) Choice of priority levels, type of events, points of origin.
 - 4) Identification of facility.
 - 5) Identification of ward.
 - 6) Identification of patient with specific patient information.

F. Conductors And Cables

1. Audio Cables:
 - a. Conductors: Jacketed, twisted-pair and twisted-multipair, untinned solid copper. Sizes as recommended by system manufacturer, but no smaller than No. 22 AWG.
 - b. Insulation: Thermoplastic, not less than 1/32 inch (0.8 mm) thick.
 - c. Shielding: For speaker/microphone leads and elsewhere where recommended by manufacturer; No. 34 AWG, tinned, soft-copper strands formed into a braid or equivalent foil.
 - d. Minimum Shielding Coverage on Conductors: 60 percent.
 - e. Plenum Cable: Listed and labeled for plenum installation.
2. Data Cable and Hardware: Category 5e **OR** Category 6, **as directed**, UTP and UTP hardware. Comply with requirements in Division 27 Section "Communications Horizontal Cabling".
3. Power Conductors and Cables: Copper, solid, No. 20 AWG. Comply with requirements in Division 26 Section "Low-voltage Electrical Power Conductors And Cables".
4. Grounding Conductors and Cables: Copper, stranded, No. 16 AWG. Comply with requirements in Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

1.3 EXECUTION

A. Installation

1. Wiring Method:



- a. Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used, **as directed**.
 - 1) Install plenum cable in environmental air spaces, including plenum ceilings.
 - 2) Conceal raceway and cables except in unfinished spaces.
 - b. Cable Trays: Comply with requirements in Division 27 Section "Communications Horizontal Cabling".
 - c. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway And Boxes For Electrical Systems". Flexible metal conduit shall not be used, **as directed**.
 - 1) Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.
2. Install cables without damaging conductors, shield, or jacket.
 3. Do not bend cables, while handling or installing, to radii smaller than as recommended by manufacturer.
 4. Pull cables without exceeding cable manufacturer's recommended pulling tensions.
 - a. Pull cables simultaneously if more than one is being installed in same raceway.
 - b. Use pulling compound or lubricant if necessary. Use compounds that will not damage conductor or insulation.
 - c. Use pulling means, including fish tape, cable, rope, and basket-weave wire or cable grips, that will not damage media or raceway.
 5. Install exposed raceways and cables parallel and perpendicular to surfaces or exposed structural members, and follow surface contours. Secure and support cables by straps, staples, or similar fittings designed and installed so as not to damage cables. Secure cable at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, or fittings.
 6. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.
 7. Separation of Wires: Separate speaker/microphone, line-level, speaker-level, and power-wiring runs. Run in separate raceways or, if exposed or in same enclosure, provide 12-inch (300-mm) minimum separation between conductors to speaker/microphones and adjacent parallel power and telephone wiring. Provide separation as recommended by equipment manufacturer for other conductors.
 8. Splices, Taps, and Terminations: Make splices, taps, and terminations on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Install terminal cabinets where there are splices, taps, or terminations for eight or more conductors.
 9. Impedance and Level Matching: Carefully match input and output impedances and signal levels at signal interfaces. Provide matching networks if required.
 10. Identification of Conductors and Cables: Comply with requirements in Division 27 Section "Communications Horizontal Cabling" for cable administration, cable schedule, and cable and wire identification.
 11. Equipment Identification:
 - a. Comply with requirements in Division 26 Section "Identification For Electrical Systems" for equipment labels and signs and labeling installation requirements.
 - b. Label stations, controls, and indications using approved consistent nomenclature.
- B. Existing Systems
1. Examine existing systems for proper operation, compatibility with new equipment, and deficiencies. If discrepancies or impairments to successful connection and operation of interconnected equipment are found, report them and do not proceed with installation until directed. Schedule existing systems' examination so there is reasonable time to resolve problems without delaying construction.
- C. Grounding
1. Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other signal impairments.



2. Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding except at connection to main building ground bus.
3. Grounding Provisions: Comply with requirements in Division 26 Section "Grounding And Bonding For Electrical Systems".

D. Field Quality Control

1. Perform tests and inspections.
2. Tests and Inspections:
 - a. Schedule tests a minimum of seven days in advance.
 - b. Report: Submit a written record of test results.
 - c. Operational Test: Perform an operational system test and demonstrate proper operations, adjustment, and sensitivity of each station. Perform tests that include originating station-to-station and "All Call" messages and pages at each nurse-call station. Verify proper routing, volume levels, and freedom from noise and distortion. Test each available message path from each station on the system. Meet the following criteria:
 - 1) Speaker Output: 90 dB plus or minus 3 dB, 300 to 3000 Hz, reference level threshold of audibility 0 dB at 0.02 mPa of sound pressure.
 - 2) Gain from patient's bedside station to nurse station, with distortion less than 65 dB (plus or minus 3 dB, 300 to 3000 Hz).
 - 3) Signal-to-Noise Ratio: Hum and noise level at least 45 dB below full output.
 - d. Test Procedure:
 - 1) Frequency Response: Determine frequency response of two transmission paths by transmitting and recording audio tones.
 - 2) Signal-to-Noise Ratio: Measure the ratio of signal to noise of the complete system at normal gain settings using the following procedure: Disconnect a speaker/microphone and replace it in the circuit with a signal generator using a 1000-Hz signal. Measure the ratio of signal to noise and repeat the test for four speaker microphones.
 - 3) Distortion Test: Measure distortion at normal gain settings and rated power. Feed signals at frequencies of 300, 400, 1000, and 3000 Hz into each nurse-call equipment amplifier, and measure the distortion in the amplifier output.
3. Retesting: Rectify deficiencies indicated by tests and completely retest work affected by such deficiencies at Contractor's expense. Verify, by the system test, that the total system meets these Specifications and complies with applicable standards. Report results in writing.
4. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.
5. Prepare test and inspection reports.

E. Adjusting

1. Occupancy Adjustments: When requested within 12 months of date of Final Completion, provide on-site assistance in adjusting sound levels and controls to suit actual occupied conditions. Provide up to three visits to Project during other-than-normal operating hours for this purpose.

F. Demonstration

1. Train Owner's maintenance personnel and caregiver staff to adjust, operate, and maintain nurse-call equipment.

END OF SECTION 26 33 43 00a



SECTION 26 33 43 00b - PUBLIC ADDRESS AND MASS NOTIFICATION SYSTEMS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of public address and mass notification systems. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Preamplifiers.
 - b. Power amplifiers.
 - c. Transfer to standby amplifier.
 - d. Microphones.
 - e. Volume limiter/compressors.
 - f. Control console.
 - g. Equipment cabinet.
 - h. Equipment rack.
 - i. Telephone paging adapters.
 - j. Tone generator.
 - k. Monitor panel.
 - l. Loudspeakers.
 - m. Noise-operated gain controllers.
 - n. Microphone and headphone outlets.
 - o. Battery backup power unit.
 - p. Conductors and cables.
 - q. Raceways.

C. Definitions

1. Channels: Separate parallel signal paths, from sources to loudspeakers or loudspeaker zones, with separate amplification and switching that permit selection between paths for speaker alternative program signals.
2. VU: Volume unit.
3. Zone: Separate group of loudspeakers and associated supply wiring that may be arranged for selective switching between different channels.

D. Performance Requirements

1. Delegated Design: Design supports and seismic restraints for control consoles, equipment cabinets and racks, and components, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2. Seismic Performance: Supports and seismic restraints for control consoles, equipment cabinets and racks, and components shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

E. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: For supports and seismic restraints for control consoles, equipment cabinets and racks, and components. Include plans, elevations, sections, details, and attachments to other work.



- a. Detail equipment assemblies and indicate dimensions, weights, required clearances, method of field assembly, components, and location and size of each field connection.
 - b. Console layouts.
 - c. Control panels.
 - d. Rack arrangements.
 - e. Calculations: For sizing backup battery.
 - f. Wiring Diagrams: For power, signal, and control wiring.
 - 1) Identify terminals to facilitate installation, operation, and maintenance.
 - 2) Single-line diagram showing interconnection of components.
 - 3) Cabling diagram showing cable routing.
3. Delegated-Design Submittal: For supports and seismic restraints for control consoles, equipment cabinets and racks, and components indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - a. Detail fabrication and assembly of supports and seismic restraints for control consoles, equipment cabinets and racks, and components.
 4. Seismic Qualification Certificates: For control consoles, equipment cabinets and racks, accessories, and components, from manufacturer.
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
 5. Field quality-control reports.
 6. Operation and maintenance data.
- F. Quality Assurance
1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Comply with NFPA 70.

1.2 PRODUCTS

A. Functional Description Of System

1. System Functions:
 - a. Selectively connect any zone to any available signal channel.
 - b. Selectively control sound from microphone outlets and other inputs.
 - c. "All-call" feature shall connect the all-call sound signal simultaneously to all zones regardless of zone or channel switch settings.
 - d. Telephone paging adapter shall allow paging by dialing an extension from any local telephone instrument and speaking into the telephone.
 - e. Produce a program-signal tone that is amplified and sounded over all speakers, overriding signals currently being distributed.
 - f. Reproduce high-quality sound that is free of noise and distortion at all loudspeakers at all times during equipment operation including standby mode with inputs off; output free of non-uniform coverage of amplified sound.

B. General Equipment And Material Requirements

1. Compatibility of Components: Coordinate component features to form an integrated system. Match components and interconnections for optimum performance of specified functions.
2. Equipment: Comply with UL 813. Equipment shall be modular, using solid-state components, and fully rated for continuous duty unless otherwise indicated. Select equipment for normal operation on input power usually supplied at 110 to 130 V, 60 Hz.



3. Equipment Mounting: Where rack, cabinet, or console mounting is indicated, equipment shall be designed to mount in a 19-inch (483-mm) housing complying with TIA/EIA-310-D.
 4. Weather-Resistant Equipment: Listed and labeled by a qualified testing agency for duty outdoors or in damp locations.
- C. Preamplifiers
1. Preamplifier: Separately mounted.
 2. Preamplifier: Integral to power amplifier.
 3. Output Power: Plus 4 dB above 1 mW at matched power-amplifier load.
 4. Total Harmonic Distortion: Less than 1 percent.
 5. Frequency Response: Within plus or minus 2 dB from 20 to 20,000 Hz.
 6. Input Jacks: Minimum of two. One matched for low-impedance microphone; the other matchable to cassette deck, CD player, or radio tuner signals without external adapters.
 7. Minimum Noise Level: Minus 55 dB below rated output.
 8. Controls: On-off, input levels, and master gain.
- D. Power Amplifiers
1. Mounting: Console **OR** Rack, **as directed**.
 2. Output Power: 70-V balanced line. 80 percent of the sum of wattage settings of connected for each station and speaker connected in all-call mode of operation, plus an allowance for future stations.
 3. Total Harmonic Distortion: Less than 3 percent at rated power output from 50 to 12,000 Hz.
 4. Minimum Signal-to-Noise Ratio: 60 dB, at rated output.
 5. Frequency Response: Within plus or minus 2 dB from 50 to 12,000 Hz.
 6. Output Regulation: Less than 2 dB from full to no load.
 7. Controls: On-off, input levels, and low-cut filter.
 8. Input Sensitivity: Matched to preamplifier and to provide full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on speaker microphone or handset transmitter.
- E. Transfer To Standby Amplifier
1. Monitoring Circuit and Sensing Relay: Detect reduction in output of power amplifier of 40 percent or more and, in such event, transfer load and signal automatically to standby amplifier.
- F. Microphones
1. Paging Microphone:
 - a. Type: Dynamic, with cardioid **OR** omni, **as directed**, polar characteristic.
 - b. Impedance: 150 ohms.
 - c. Frequency Response: Uniform, 50 to 14,000 Hz.
 - d. Output Level: Minus 58 dB, minimum.
 - e. Finish: Satin chrome.
 - f. Cable: C25J.
 - g. Mounting: Desk stand with integral-locking, press-to-talk switch.
- G. Volume Limiter/Compressor
1. Minimum Performance Requirements:
 - a. Frequency Response: 45 to 15,000 Hz, plus or minus 1 dB minimum.
 - b. Signal Reduction Ratio: At least a 10:1 and 5:1 selectable capability.
 - c. Distortion: 1 percent, maximum.
 - d. Rated Output: Minimum of plus 14 dB.
 - e. Inputs: Minimum of two inputs with variable front-panel gain controls and VU or decibel meter for input adjustment.
 - f. Rack mounting.
- H. Control Console
1. Cabinet: Modular, desktop **OR** desk style, **as directed**; complying with TIA/EIA-310-D.



2. Housing: Steel, 0.0478 inch (1.2 mm) minimum, with removable front and rear panels. Side panels are removable for interconnecting side-by-side mounting.
 3. Panel for Equipment and Controls: Rack mounted.
 4. Controls:
 - a. Switching devices to select signal sources for distribution channels.
 - b. Program selector switch to select source for each program channel.
 - c. Switching devices to select zones for paging.
 - d. All-call selector switch.
 5. Indicators: A visual annunciation for each distribution channel to indicate source being used.
 6. Self-Contained Power and Control Unit: A single assembly of basic control, electronics, and power supply necessary to accomplish specified functions.
 7. Spare Positions: 20 percent spare zone control and annunciation positions on console.
 8. Microphone jack.
- I. Equipment Cabinet
1. Comply with TIA/EIA-310-D.
 2. House amplifiers and auxiliary equipment at each location.
 3. Cabinet Housing:
 - a. Constructed of 0.0478-inch (1.2-mm) steel, minimum, with front- and rear-locking doors and standard TIA/EIA-310-D-compliant, 19-inch (483-mm) racks.
 - b. Arranged for floor or wall mounting as indicated.
 - c. Sized to house all equipment indicated, plus spare capacity.
 - d. Include 20 percent minimum spare capacity for future equipment in addition to space required for future cassette deck and CD player.
 4. Power Provisions: A single switch in cabinet shall disconnect cabinet power distribution system and electrical outlets, which shall be uniformly spaced to accommodate ac-power cords for each item of equipment.
 5. Ventilation: A low-noise fan for forced-air cabinet ventilation. Fan shall be equipped with a filtered input vent and shall be connected to operate from 105- to 130-V ac, 60 Hz; separately fused and switched; arranged to be powered when main cabinet power switch is on.
- J. Equipment Rack
1. Racks: 19 inches (483 mm) standard, complying with TIA/EIA-310-D.
 2. Power-Supply Connections: Compatible plugs and receptacles.
 3. Enclosure Panels: Ventilated rear and sides and solid top. Use louvers in panels to ensure adequate ventilation.
 4. Finish: Uniform, baked-enamel factory finish over rust-inhibiting primer.
 5. Power-Control Panel: On front of equipment housing, with master power on-off switch and pilot light; and with socket for 5-A cartridge fuse for rack equipment power.
 6. Service Light: At top rear of rack with an adjacent control switch.
 7. Vertical Plug Strip: Grounded receptacles, 12 inches (300 mm) o.c.; the full height of rack.
 8. Maintenance Receptacles: Duplex convenience outlets supplied independent of vertical plug strip and located in front and bottom rear of rack.
 9. Spare Capacity: 20 percent in rack for future equipment.
- K. Telephone Paging Adapter
1. Adapters shall accept voice signals from telephone extension dialing access and automatically provide amplifier input and program override for preselected zones.
 - a. Minimum Frequency Response: Flat, 200 to 2500 Hz.
 - b. Impedance Matching: Adapter matches telephone line to public address equipment input.
 - c. Rack mounting.
- L. Tone Generator
1. Generator shall provide clock and program interface with public address and mass notification system.



2. Signals: Minimum of seven distinct, audible signal types including wail, warble, high/low, alarm, repeating and single-stroke chimes, and tone.
 3. Pitch Control: Chimes and tone.
 4. Volume Control: All outputs.
 5. Activation-Switch Network: Establishes priority and hierarchy of output signals produced by different activation setups.
 6. Mounting: Rack.
- M. Monitor Panel
1. Monitor power amplifiers.
 2. Components: VU or dB meter, speaker with volume control, and multiple-position rotary selector switch.
 3. Selector Switch and Volume Control: Selective monitoring of output of each separate power amplifier via VU or dB meter and speaker.
 4. Mounting: Rack.
- N. Loudspeakers
1. Cone-Type Loudspeakers:
 - a. Minimum Axial Sensitivity: 91 dB at one meter, with 1-W input.
 - b. Frequency Response: Within plus or minus 3 dB from 50 to 15,000 Hz.
 - c. Size: 8 inches (200 mm) with 1-inch (25-mm) voice coil and minimum 5-oz. (140-g) ceramic magnet.
 - d. Minimum Dispersion Angle: 100 degrees.
 - e. Rated Output Level: 10 W.
 - f. Matching Transformer: Full-power rated with four taps. Maximum insertion loss of 0.5 dB.
 - g. Surface-Mounting Units: Ceiling, wall, or pendant mounting, as indicated, in steel back boxes, acoustically dampened. Front face of at least 0.0478-inch (1.2-mm) steel and whole assembly rust proofed and shop primed for field painting.
 - h. Flush-Ceiling-Mounting Units: In steel back boxes, acoustically dampened. Metal ceiling grille with white baked enamel.
 2. Horn-Type Loudspeakers:
 - a. Type: Single-horn units, double-reentrant design, with minimum full-range power rating of 15 W.
 - b. Matching Transformer: Full-power rated with four standard taps. Maximum insertion loss of 0.5 dB.
 - c. Frequency Response: Within plus or minus 3 dB from 250 to 12,000 Hz.
 - d. Dispersion Angle: 130 by 110 degrees.
 - e. Mounting: Integral bracket.
 - f. Units in Hazardous (Classified) Locations: Listed and labeled for environment in which they are located.
- O. Noise-Operated Gain Controller
1. Gain controller shall be designed to continuously sense space noise level and automatically adjust signal level to local speakers.
 2. Frequency Response: 20 to 20,000 Hz, plus or minus 1 dB.
 3. Level Adjustment Range: 20 dB minimum.
 4. Maximum Distortion: 1 percent.
 5. Control: Permits adjustment of sensing level of device.
- P. Outlets
1. Volume Attenuator Station: Wall-plate-mounted autotransformer type with paging priority feature.
 - a. Wattage Rating: 10 W unless otherwise indicated.
 - b. Attenuation per Step: 3 dB, with positive off position.
 - c. Insertion Loss: 0.4 dB maximum.



- d. Attenuation Bypass Relay: Single pole, double throw. Connected to operate and bypass attenuation when all-call, paging, program signal, or prerecorded message features are used. Relay returns to normal position at end of priority transmission.
- e. Label: "PA Volume."
2. Microphone Outlet: Three-pole, polarized, locking-type, microphone receptacles in single-gang boxes. Equip wall outlets with brushed stainless-steel device plates. Equip floor outlets with gray tapered rubber or plastic cable nozzles and fixed outlet covers.
3. Headphone Outlet (for the Hearing Impaired): Microphone receptacles in single-gang boxes. Equip wall outlets with brushed stainless-steel device plates. Equip floor outlets with gray tapered rubber or plastic cable nozzles and fixed-outlet covers.

Q. Battery Backup Power Unit

1. Unit shall be rack mounted, consisting of time-delay relay, sealed lead-calcium battery, battery charger, on-off switch, "normal" and "emergency" indicating lights, and adequate capacity to supply maximum equipment power requirements for one hour of continuous full operation.
2. Unit shall supply public address equipment with 12- to 15-V dc power automatically during an outage of normal 120-V ac power.
3. Battery shall be on float charge when not supplying system and to transfer automatically to supply system after three to five seconds of continuous outage of normal power, as sensed by time-delay relay.
4. Unit shall automatically retransfer system to normal supply when normal power has been reestablished for three to five seconds continuously.

R. Conductors And Cables

1. Jacketed, twisted pair and twisted multipair, untinned solid copper.
 - a. Insulation for Wire in Conduit: Thermoplastic, not less than 1/32 inch (0.8 mm) thick.
 - b. Microphone Cables: Neoprene jacketed, not less than 2/64 inch (0.8 mm) thick, over shield with filled interstices. Shield No. 34 AWG, tinned, soft-copper strands formed into a braid or approved equivalent foil. Shielding coverage on conductors is not less than 60 percent.
 - c. Plenum Cable: Listed and labeled for plenum installation.

S. Raceways

1. Conduit and Boxes: Comply with Division 26 Section "Raceway And Boxes For Electrical Systems". Flexible metal conduit shall not be used, unless directed otherwise.
 - a. Outlet boxes shall be not less than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

1.3 EXECUTION

A. Wiring Methods

1. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters, and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used, **as directed**. Conceal raceway and cables except in unfinished spaces.
 - a. Install plenum cable in environmental air spaces, including plenum ceilings.
 - b. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceway And Boxes For Electrical Systems".
2. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
3. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.



- B. Installation Of Raceways
1. Comply with requirements in Division 26 Section "Raceway And Boxes For Electrical Systems" for installation of conduits and wireways.
 2. Install manufactured conduit sweeps and long-radius elbows whenever possible.
- C. Installation Of Cables
1. Comply with NECA 1.
 2. General Cable Installation Requirements:
 - a. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at outlets and terminals.
 - b. Splices, Taps, and Terminations: Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Cables may not be spliced.
 - c. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 - d. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
 - e. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
 - f. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used.
 3. Open-Cable Installation:
 - a. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
 - b. Suspend speaker cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceiling by cable supports not more than 60 inches (1524 mm) apart.
 - c. Cable shall not be run through structural members or be in contact with pipes, ducts, or other potentially damaging items.
 4. Separation of Wires: Separate speaker-microphone, line-level, speaker-level, and power wiring runs. Install in separate raceways or, where exposed or in same enclosure, separate conductors at least 12 inches (300 mm) apart for speaker microphones and adjacent parallel power and telephone wiring. Separate other intercommunication equipment conductors as recommended by equipment manufacturer.
- D. Installation
1. Match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.
 2. Identification of Conductors and Cables: Color-code conductors and apply wire and cable marking tape to designate wires and cables so they identify media in coordination with system wiring diagrams.
 3. Equipment Cabinets and Racks:
 - a. Group items of same function together, either vertically or side by side, and arrange controls symmetrically. Mount monitor panel above the amplifiers.
 - b. Arrange all inputs, outputs, interconnections, and test points so they are accessible at rear of rack for maintenance and testing, with each item removable from rack without disturbing other items or connections.
 - c. Blank Panels: Cover empty space in equipment racks so entire front of rack is occupied by panels.
 4. Volume Limiter/Compressor: Equip each zone with a volume limiter/compressor. Install in central equipment cabinet. Arrange to provide a constant input to power amplifiers.
 5. Wall-Mounted Outlets: Flush mounted.
 6. Floor-Mounted Outlets: Conceal in floor and install cable nozzles through outlet covers. Secure outlet covers in place. Trim with carpet in carpeted areas.



7. Conductor Sizing: Unless otherwise indicated, size speaker circuit conductors from racks to loudspeaker outlets not smaller than No. 18 AWG and conductors from microphone receptacles to amplifiers not smaller than No. 22 AWG.
 8. Weatherproof Equipment: For units that are mounted outdoors, in damp locations, or where exposed to weather, install consistent with requirements of weatherproof rating.
 9. Speaker-Line Matching Transformer Connections: Make initial connections using tap settings indicated on Drawings.
 10. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".
- E. Grounding
1. Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
 2. Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding.
 3. Install grounding electrodes as specified in Division 26 Section "Grounding And Bonding For Electrical Systems".
- F. Field Quality Control
1. Perform tests and inspections.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
 2. Tests and Inspections:
 - a. Schedule tests with at least seven days' advance notice of test performance.
 - b. After installing public address and mass notification systems and after electrical circuitry has been energized, test for compliance with requirements.
 - c. Operational Test: Perform tests that include originating program and page messages at microphone outlets, preamplifier program inputs, and other inputs. Verify proper routing and volume levels and that system is free of noise and distortion.
 - d. Signal-to-Noise Ratio Test: Measure signal-to-noise ratio of complete system at normal gain settings as follows:
 - 1) Disconnect microphone at connector or jack closest to it and replace it in the circuit with a signal generator using a 1000-Hz signal. Replace all other microphones at corresponding connectors with dummy loads, each equal in impedance to microphone it replaces. Measure signal-to-noise ratio.
 - 2) Repeat test for each separately controlled zone of loudspeakers.
 - 3) Minimum acceptance ratio is 50 dB.
 - e. Distortion Test: Measure distortion at normal gain settings and rated power. Feed signals at frequencies of 50, 200, 400, 1000, 3000, 8000, and 12,000 Hz into each preamplifier channel. For each frequency, measure distortion in the paging and all-call amplifier outputs. Maximum acceptable distortion at any frequency is 3 percent total harmonics.
 - f. Acoustic Coverage Test: Feed pink noise into system using octaves centered at 500 and 4000 Hz. Use sound-level meter with octave-band filters to measure level at five locations in each zone. For spaces with seated audiences, maximum permissible variation in level is plus or minus 2 dB. In addition, the levels between locations in same zone and between locations in adjacent zones must not vary more than plus or minus 3 dB.
 - g. Power Output Test: Measure electrical power output of each power amplifier at normal gain settings of 50, 1000, and 12,000 Hz. Maximum variation in power output at these frequencies must not exceed plus or minus 1 dB.
 - h. Signal Ground Test: Measure and report ground resistance at public address equipment signal ground. Comply with testing requirements specified in Division 26 Section "Grounding And Bonding For Electrical Systems".



3. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified. Prepare a list of final tap settings of paging speaker-line matching transformers.
4. Public address and mass notification systems will be considered defective if they do not pass tests and inspections.
5. Prepare test and inspection reports.
 - a. Include a record of final speaker-line matching transformer-tap settings, and signal ground-resistance measurement certified by Installer.

END OF SECTION 26 33 43 00b



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SECTION 26 33 53 00 - STATIC UNINTERRUPTIBLE POWER SUPPLY

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for static uninterruptible power supply. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Three-phase, on-line, double-conversion, static-type, UPS units with the following features:
 - 1) Surge suppression.
 - 2) Input harmonics reduction.
 - 3) Rectifier-charger.
 - 4) Inverter.
 - 5) Static bypass transfer switch.
 - 6) Battery and battery disconnect device.
 - 7) Internal and External maintenance bypass/isolation switch.
 - 8) Output isolation transformer.
 - 9) Remote UPS monitoring provisions.
 - 10) Battery monitoring.
 - 11) Remote monitoring.

C. Definitions

1. EMI: Electromagnetic interference.
2. LCD: Liquid-crystal display.
3. LED: Light-emitting diode.
4. PC: Personal computer.
5. THD: Total harmonic distortion.
6. UPS: Uninterruptible power supply.

D. Performance Requirements

1. Seismic Performance: UPS shall withstand the effects of earthquake motions determined according to ASCE/SEI 7, **as directed**.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

E. Submittals

1. Product Data: For each type of product indicated. Include data on features, components, ratings, and performance.
2. Shop Drawings: For UPS. Include plans, elevations, sections, details, and attachments to other work.
 - a. Detail equipment assemblies and indicate dimensions, weights, components, and location and identification of each field connection. Show access, workspace, and clearance requirements; details of control panels; and battery arrangement.
 - b. Wiring Diagrams: For power, signal, and control wiring.
3. Seismic Qualification Certificates: For UPS equipment, from manufacturer.
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.



- c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- 4. Factory Test Reports: Comply with specified requirements.
- 5. Field quality-control reports.
- 6. Operation and maintenance data.
- 7. Warranties: Sample of special warranties.

F. Quality Assurance

- 1. Testing Agency Qualifications: Member company of NETA or an NRTL.
 - a. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
- 2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- 3. UL Compliance: Listed and labeled under UL 1778 by an NRTL.
- 4. NFPA Compliance: Mark UPS components as suitable for installation in computer rooms according to NFPA 75.

G. Warranty

- 1. Special Battery Warranties: Specified form in which manufacturer and Installer agree to repair or replace UPS system storage batteries that fail in materials or workmanship within specified warranty period.
 - a. Warranted Cycle Life for Valve-Regulated, Lead-Calcium Batteries: Equal to or greater than that represented in manufacturer's published table, including figures corresponding to the following, based on annual average battery temperature of 77 deg F (25 deg C):

Discharge Rate	Discharge Duration	Discharge End Voltage	Cycle Life
8 hours	8 hours	1.67	6 cycles
30 minutes	30 minutes	1.67	20 cycles
15 minutes	45 seconds	1.67	120 cycles

OR

Warranted Cycle Life for Premium Valve-Regulated, Lead-calcium Batteries: Equal to or greater than that represented in manufacturer's published table, including figures corresponding to the following, based on annual average battery temperature of 77 deg F (25 deg C):

Discharge Rate	Discharge Duration	Discharge End Voltage	Cycle Life
8 hours	8 hours	1.67	40 cycles
30 minutes	30 minutes	1.67	125 cycles
15 minutes	1.5 minutes	1.67	750 cycles

OR

Warranted Cycle Life for Flooded Batteries: Equal to or greater than that represented in manufacturer's published table, including figures corresponding to the following, based on annual average battery temperature of 77 deg F (25 deg C):

Discharge Rate	Discharge Duration	Discharge End Voltage	Cycle Life
8 hours	8 hours	1.75	40 cycles
1 hour	1 hour	1.75	80 cycles
15 minutes	45 seconds	1.67	2700 cycles



2. Special UPS Warranties: Specified form in which manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within Two **OR** Three, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Operational Requirements

1. Automatic operation includes the following:
 - a. Normal Conditions: Load is supplied with power flowing from the normal power input terminals, through the rectifier-charger and inverter, with the battery connected in parallel with the rectifier-charger output.
 - b. Abnormal Supply Conditions: If normal supply deviates from specified and adjustable voltage, voltage waveform, or frequency limits, the battery supplies energy to maintain constant, regulated inverter power output to the load without switching or disturbance.
 - c. If normal power fails, energy supplied by the battery through the inverter continues supply-regulated power to the load without switching or disturbance.
 - d. When power is restored at the normal supply terminals of the system, controls automatically synchronize the inverter with the external source before transferring the load. The rectifier-charger then supplies power to the load through the inverter and simultaneously recharges the battery.
 - e. If the battery becomes discharged and normal supply is available, the rectifier-charger charges the battery. On reaching full charge, the rectifier-charger automatically shifts to float-charge mode.
 - f. If any element of the UPS system fails and power is available at the normal supply terminals of the system, the static bypass transfer switch switches the load to the normal ac supply circuit without disturbance or interruption.
 - g. If a fault occurs in the system supplied by the UPS, and current flows in excess of the overload rating of the UPS system, the static bypass transfer switch operates to bypass the fault current to the normal ac supply circuit for fault clearing.
 - h. When the fault has cleared, the static bypass transfer switch returns the load to the UPS system.
 - i. If the battery is disconnected, the UPS continues to supply power to the load with no degradation of its regulation of voltage and frequency of the output bus.
2. Manual operation includes the following:
 - a. Turning the inverter off causes the static bypass transfer switch to transfer the load directly to the normal ac supply circuit without disturbance or interruption.
 - b. Turning the inverter on causes the static bypass transfer switch to transfer the load to the inverter.
3. Maintenance Bypass/Isolation Switch Operation: Switch is interlocked so it cannot be operated unless the static bypass transfer switch is in the bypass mode. Device provides manual selection among the three conditions in subparagraphs below without interrupting supply to the load during switching:
 - a. Full Isolation: Load is supplied, bypassing the UPS. Normal UPS ac input circuit, static bypass transfer switch, and UPS load terminals are completely disconnected from external circuits.
 - b. Maintenance Bypass: Load is supplied, bypassing the UPS. UPS ac supply terminals are energized to permit operational checking, but system load terminals are isolated from the load.
 - c. Normal: Normal UPS ac supply terminals are energized and the load is supplied through either the static bypass transfer switch and the UPS rectifier-charger and inverter, or the battery and the inverter.
4. Environmental Conditions: The UPS shall be capable of operating continuously in the following environmental conditions without mechanical or electrical damage or degradation of operating capability, except battery performance.
 - a. Ambient Temperature for Electronic Components: 32 to 104 deg F (0 to 40 deg C).



- b. Ambient Temperature for Battery: 41 to 95 deg F (5 to 35 deg C).
- c. Relative Humidity: 0 to 95 percent, noncondensing.
- d. Altitude: Sea level to 4000 feet (1220 m).

B. Performance Requirements

1. The UPS shall perform as specified in this article while supplying rated full-load current, composed of any combination of linear and nonlinear load, up to 100 percent nonlinear load with a load crest factor of 3.0, under the following conditions or combinations of the following conditions:
 - a. Inverter is switched to battery source.
 - b. Steady-state ac input voltage deviates up to plus or minus 10 percent from nominal voltage.
 - c. Steady-state input frequency deviates up to plus or minus 5 percent from nominal frequency.
 - d. THD of input voltage is 15 percent or more with a minimum crest factor of 3.0, and the largest single harmonic component is a minimum of 5 percent of the fundamental value.
 - e. Load is 30 **OR** 50 **OR** 100, **as directed**, percent unbalanced continuously.
2. Minimum Duration of Supply: If battery is sole energy source supplying rated full UPS load current at 80 percent power factor, duration of supply is five **OR** 10 **OR** 15, **as directed**, minutes.
3. Input Voltage Tolerance: System steady-state and transient output performance remains within specified tolerances when steady-state ac input voltage varies plus 10, minus 15 **OR** 20 **OR** 30, **as directed**, percent from nominal voltage.
4. Overall UPS Efficiency:

NOMINAL OVERALL UPS EFFICIENCY RATINGS

SIZE RANGE OF UPS UNITS	EFFICIENCY AT 100% RATED LOAD	EFFICIENCY AT 75% RATED LOAD	EFFICIENCY AT 50% RATED LOAD
30 kVA and Smaller	86	85	84
37.5 to 74 kVA	89	88	87
75 to 124 kVA	90	88	87
125 to 224 kVA	90	89	88
225 kVA and Larger	90	89	88

5. Maximum Acoustical Noise:

NOMINAL OVERALL UPS AUDIBLE NOISE RATINGS

SIZE RANGE OF UPS UNITS	MAXIMUM NOISE VALUE	DISTANCE AT WHICH MEASURED
10 kVA and Smaller	58 dB	36 inches (900 mm)
20 to 125 kVA	60 dB	48 inches (1200 mm)
150 to 300 kVA	78 dB	48 inches (1200 mm)
300 kVA and Larger	83 dB	48 inches (1200 mm)

6. Maximum Energizing Inrush Current: Six **OR** Eight, **as directed**, times the full-load current.
7. Maximum AC Output-Voltage Regulation for Loads up to 50 Percent Unbalanced: Plus or minus 2 percent over the full range of battery voltage.
8. Output Frequency: 60 Hz, plus or minus 0.5 percent over the full range of input voltage, load, and battery voltage.
9. Limitation of harmonic distortion of input current to the UPS shall be as follows:



- a. Description: Either a tuned harmonic filter or an arrangement of rectifier-charger circuits shall limit THD to 5 **OR** 10, **as directed**, percent, maximum, at rated full UPS load current, for power sources with X/R ratio between 2 and 30.
OR
Description: THD is limited to a maximum of 32 percent, at rated full UPS load current, for power sources with X/R ratio between 2 and 30.
10. Maximum Harmonic Content of Output-Voltage Waveform: 5 percent rms total and 3 percent rms for any single harmonic, for 100 percent rated nonlinear load current with a load crest factor of 3.0.
OR
Maximum Harmonic Content of Output-Voltage Waveform: 5 percent rms total and 3 percent rms for any single harmonic, for rated full load with THD up to 50 percent, with a load crest factor of 3.0.
11. Minimum Overload Capacity of UPS at Rated Voltage: 125 percent of rated full load for 10 minutes, and 150 percent for 30 seconds in all operating modes.
12. Maximum Output-Voltage Transient Excursions from Rated Value: For the following instantaneous load changes, stated as percentages of rated full UPS load, voltage shall remain within stated percentages of rated value and recover to, and remain within, plus or minus 2 percent of that value within 100 ms:
 - a. 50 Percent: Plus or minus 5 percent.
 - b. 100 Percent: Plus or minus 5 percent.
 - c. Loss of AC Input Power: Plus or minus 1 percent.
 - d. Restoration of AC Input Power: Plus or minus 1 percent.
13. Input Power Factor: A minimum of 0.70 **OR** 0.85, **as directed**, lagging when supply voltage and current are at nominal rated values and the UPS is supplying rated full-load current.
14. EMI Emissions: Comply with FCC Rules and Regulations and with 47 CFR 15 for Class A equipment.

C. UPS Systems

1. Electronic Equipment: Solid-state devices using hermetically sealed, semiconductor elements. Devices include rectifier-charger, inverter, static bypass transfer switch, and system controls.
2. Enclosures: Comply with NEMA 250, Type 1, unless otherwise indicated.
3. Control Assemblies: Mount on modular plug-ins, readily accessible for maintenance.
4. Surge Suppression: Protect internal UPS components from surges that enter at each ac power input connection including main disconnect switch, static bypass transfer switch, and maintenance bypass/isolation switch, **as directed**. Protect rectifier-charger, inverter, controls, and output components.
 - a. Use factory-installed surge suppressors tested according to IEEE C62.41.1 and IEEE C62.41.2, Category B **OR** Category C, **as directed**.
 - b. Additional Surge Protection: Protect internal UPS components from low-frequency, high-energy voltage surges described in IEEE C62.41.1 and IEEE C62.41.2. Design the circuits connecting with external power sources and select circuit elements, conductors, conventional surge suppressors, and rectifier components and controls so input assemblies will have adequate mechanical strength and thermal and current-carrying capacity to withstand stresses imposed by 40-Hz, 180 percent voltage surges described in IEEE C62.41.1 and IEEE C62.41.2.
5. Maintainability Features (for units rated more than approximately 100 kVA): Mount rectifier-charger and inverter sections and the static bypass transfer switch on modular plug-ins, readily accessible for maintenance.
6. Capacity Upgrade Capability: Arrange wiring, controls, and modular component plug-in provisions to permit future 25 percent increase in UPS capacity.
7. Seismic-Restraint Design: UPS assemblies, subassemblies, and components (and fastenings and supports, mounting, and anchorage devices for them) shall be designed and fabricated to withstand static and seismic forces.
8. UPS Cabinet Ventilation: Redundant fans or blowers draw in ambient air near the bottom of cabinet and discharge it near the top rear.



- 9. Output Circuit Neutral Bus, Conductor, and Terminal Ampacity (for a UPS with heavy nonlinear loading): Rated phase current times a multiple of 1.73, minimum.

D. Rectifier-Charger

- 1. Capacity: Adequate to supply the inverter during rated full output load conditions and simultaneously recharge the battery from fully discharged condition to 95 percent of full charge within 10 times the rated discharge time for duration of supply under battery power at full load.
- 2. Output Ripple: Limited by output filtration to less than 0.5 percent of rated current, peak to peak.
- 3. Control Circuits: Immune to frequency variations within rated frequency ranges of normal and emergency power sources.
 - a. Response Time: Field adjustable for maximum compatibility with local generator-set power source.
- 4. Battery Float-Charging Conditions: Comply with battery manufacturer's written instructions for battery terminal voltage and charging current required for maximum battery life.

E. Inverter

- 1. Description: Pulse-width modulated, with sinusoidal output.
OR
 Description (if the UPS may be supplied power from a standby engine-generator set): Pulse-width modulated, with sinusoidal output. Include a bypass phase synchronization window adjustment to optimize compatibility with local engine-generator-set power source.

F. Static Bypass Transfer Switch

- 1. Description: Solid-state switching device providing uninterrupted transfer. A contactor or electrically operated circuit breaker automatically provides electrical isolation for the switch.
- 2. Switch Rating: Continuous duty at the rated full UPS load current, minimum.

G. Battery

ALTERNATIVE BATTERY TYPES FOR UPS SYSTEMS

TYPE	NOMINAL LIFE EXPECTANCY (YEARS)*	TYPICAL WARRANTY (YEARS)*		MINIMUM NOMINAL MAINTENANCE INTERVAL	APPROX. INITIAL COST FACTOR**	SPECIAL FEATURES
		FULL	PRO RATA			
Premium quality, valve regulated, recombinant, lead calcium	20	1	19	1 year	2.5	Spill proof.
Standard quality, valve regulated, recombinant, lead calcium	10	1	9	1 year	1.0	Spill proof.
Nickel cadmium, flooded	25	5	15	3 years	4.0	Can operate in high ambient temperatures. Can be completely discharged without damage.
Lead calcium, flooded	20	1	9	6 months	2.5	-

*Life expectancy and warranty data apply to installations where batteries are considered to be in a "float-service"



application. Use the data only as a general guide because UPS batteries are typically considered to be in a separate service application category that accounts for the numerous discharges of varying duration they experience.

**Cost includes an allowance for space requirements and environmental control.

1. Description: Valve-regulated, recombinant, lead-calcium units, factory assembled in an isolated compartment of UPS cabinet, complete with battery disconnect switch.
 - a. Arrange for drawout removal of battery assembly from cabinet for testing and inspecting.

OR

Description: Valve-regulated, premium, heavy-duty, recombinant, lead-calcium units; factory assembled in an isolated compartment or in a separate matching cabinet, complete with battery disconnect switch.

 - a. Arrange for drawout removal of battery assembly from cabinet for testing and inspecting.

OR

Description: Flooded, lead-calcium, heavy-duty industrial units in styrene acrylonitrile containers mounted on three-tier, **as directed**, acid-resistant, painted steel racks. Assembly includes battery disconnect switch, intercell connectors, hydrometer syringe, and thermometer with specific gravity-correction scales.
2. Seismic-Restraint Design: Battery racks, cabinets, assemblies, subassemblies, and components (and fastenings and supports, mounting, and anchorage devices for them) shall be designed and fabricated to withstand static and seismic forces.

H. Controls And Indications

1. Description: Group displays, indications, and basic system controls on a common control panel on front of UPS enclosure.
2. Minimum displays, indicating devices, and controls include those in lists below. Provide sensors, transducers, terminals, relays, and wiring required to support listed items. Alarms include audible signals and visual displays.
3. Indications: Labeled LED **OR** Plain-language messages on a digital LCD or LED, **as directed**.
 - a. Quantitative indications shall include the following:
 - 1) Input voltage, each phase, line to line.
 - 2) Input current, each phase, line to line.
 - 3) Bypass input voltage, each phase, line to line.
 - 4) Bypass input frequency.
 - 5) System output voltage, each phase, line to line.
 - 6) System output current, each phase.
 - 7) System output frequency.
 - 8) DC bus voltage.
 - 9) Battery current and direction (charge/discharge).
 - 10) Elapsed time discharging battery.
 - b. Basic status condition indications shall include the following:
 - 1) Normal operation.
 - 2) Load-on bypass.
 - 3) Load-on battery.
 - 4) Inverter off.
 - 5) Alarm condition.
 - c. Alarm indications shall include the following:
 - 1) Bypass ac input overvoltage or undervoltage.
 - 2) Bypass ac input overfrequency or underfrequency.
 - 3) Bypass ac input and inverter out of synchronization.
 - 4) Bypass ac input wrong-phase rotation.
 - 5) Bypass ac input single-phase condition.
 - 6) Bypass ac input filter fuse blown.
 - 7) Internal frequency standard in use.
 - 8) Battery system alarm.
 - 9) Control power failure.
 - 10) Fan failure.



- 11) UPS overload.
 - 12) Battery-charging control faulty.
 - 13) Input overvoltage or undervoltage.
 - 14) Input transformer overtemperature.
 - 15) Input circuit breaker tripped.
 - 16) Input wrong-phase rotation.
 - 17) Input single-phase condition.
 - 18) Approaching end of battery operation.
 - 19) Battery undervoltage shutdown.
 - 20) Maximum battery voltage.
 - 21) Inverter fuse blown.
 - 22) Inverter transformer overtemperature.
 - 23) Inverter overtemperature.
 - 24) Static bypass transfer switch overtemperature.
 - 25) Inverter power supply fault.
 - 26) Inverter transistors out of saturation.
 - 27) Identification of faulty inverter section/leg.
 - 28) Inverter output overvoltage or undervoltage.
 - 29) UPS overload shutdown.
 - 30) Inverter current sensor fault.
 - 31) Inverter output contactor open.
 - 32) Inverter current limit.
- d. Controls shall include the following:
- 1) Inverter on-off.
 - 2) UPS start.
 - 3) Battery test.
 - 4) Alarm silence/reset.
 - 5) Output-voltage adjustment.
4. Dry-form "C" contacts shall be available for remote indication of the following conditions:
- a. UPS on battery.
 - b. UPS on-line.
 - c. UPS load-on bypass.
 - d. UPS in alarm condition.
 - e. UPS off (maintenance bypass closed).
5. Emergency Power Off Switch: Capable of local operation and operation by means of activation by external dry contacts.
- I. Maintenance Bypass/Isolation Switch
1. Description: Manually operated switch or arrangement of switching devices with mechanically actuated contact mechanism arranged to route the flow of power to the load around the rectifier-charger, inverter, and static bypass transfer switch.
 - a. Switch shall be electrically and mechanically interlocked to prevent interrupting power to the load when switching to bypass mode.
 - b. Switch shall electrically isolate other UPS components to permit safe servicing.
 2. Comply with NEMA PB 2 and UL 891.
 3. Switch Rating: Continuous duty at rated full UPS load current.
 4. Mounting Provisions: Internal to system cabinet **OR** Separate wall- or floor-mounted unit, **as directed**.
 5. Key interlock requires unlocking maintenance bypass/isolation switch before switching from normal position with key that is released only when the UPS is bypassed by the static bypass transfer switch. Lock is designed specifically for mechanical and electrical component interlocking.
- J. Output Isolation Transformer



1. Description: Shielded unit **OR** Unit, **as directed**, with low forward transfer impedance up to 3 kHz, minimum. Include the following features:
 - a. Comply with applicable portions of UL 1561, including requirements for nonlinear load current-handling capability for a K-factor of approximately 4 **OR** 9 **OR** 13 **OR** 20, **as directed**.
 - b. Output Impedance at Fundamental Frequency: Between 3 and 4 percent.
 - c. Regulation: 5 percent, maximum, at rated nonlinear load current.
 - d. Full-Load Efficiency at Rated Nonlinear Load Current: 96 percent, minimum.
 - e. Electrostatic Shielding of Windings: Independent for each winding.
 - f. Coil Leads: Physically arranged for minimum interlead capacitance.
 - g. Shield Grounding Terminal: Separately mounted; labeled "Shield Ground."
 - h. Capacitive Coupling between Primary and Secondary: 33 picofarads, maximum, over a frequency range of 20 Hz to 1 MHz.

- K. Output Distribution Section
 1. Panelboards: Comply with Division 26 Section "Panelboards" except provide assembly integral to UPS cabinet.

- L. Monitoring By Remote Status And Alarm Panel
 1. Description: Labeled LEDs on panel faceplate indicate five basic status conditions. Audible signal indicates alarm conditions. Silencing switch in face of panel silences signal without altering visual indication.
 - a. Cabinet and Faceplate: Surface or flush mounted to suit mounting conditions indicated.

- M. Monitoring By Remote Computer
 1. Description: Communication module in unit control panel provides capability for remote monitoring of status, parameters, and alarms specified in "Controls and Indications" Article. The remote computer and the connecting signal wiring are not included in this Section. Include the following features:
 - a. Connectors and network interface units or modems for data transmission via RS-232 link.
 - b. Software designed for control and monitoring of UPS functions and to provide on-screen explanations, interpretations, diagnosis, action guidance, and instructions for use of monitoring indications and development of meaningful reports. Permit storage and analysis of power-line transient records. Designs for Windows applications, software, and computer are not included in this Section.
 - c. Software and Hardware: Compatible with that specified in Division 26 Section "Electrical Power Monitoring And Control".

- N. Basic Battery Monitoring
 1. Battery Ground-Fault Detector: Initiates alarm when resistance to ground of positive or negative bus of battery is less than 5000 ohms.
 2. Battery compartment smoke/high-temperature detector initiates an alarm when smoke or a temperature greater than 75 deg C occurs within the compartment.
 3. Annunciation of Alarms: At UPS control panel.

- O. Additional Battery Monitoring
 1. Monitoring features and components shall include the following:
 - a. Factory-wired sensing leads to cell and battery terminals and cell temperature sensors.
 - b. Connections for data transmission via RS-232 link, network interface and, **as directed**, modem and, **as directed**, external signal wiring to computer **OR** electrical power monitoring and control equipment, **as directed**. External signal wiring and computer are not specified in this Section.
 - c. PC-based software designed to store and analyze battery data. Software compiles reports on individual-cell parameters and total battery performance trends, and provides data for scheduling and prioritizing battery maintenance.



2. Performance: Automatically measures and electronically records the following parameters on a routine schedule and during battery discharge events. During discharge events, records measurements timed to nearest second; includes measurements of the following parameters:
 - a. Total battery voltage and ambient temperature.
 - b. Individual-cell voltage, impedance, and temperature. During battery-discharging events such as utility outages, measures battery and cell voltages timed to nearest second.
 - c. Individual-cell electrolyte levels.

P. Battery-Cycle Warranty Monitoring

1. Description: Electronic device, acceptable to battery manufacturer as a basis for warranty action, for monitoring of charge-discharge cycle history of batteries covered by cycle-life warranties.
2. Performance: Automatically measures and records each discharge event, classifies it according to duration category, and totals discharges according to warranty criteria, displaying remaining warranted battery life on front panel display.
3. Additional monitoring functions and features shall include the following:
 - a. Measuring and Recording: Total voltage at battery terminals; initiates alarm for excursions outside the proper float-voltage level.
 - b. Monitors: Ambient temperature at battery; initiates alarm if temperature deviates from normally acceptable range.
 - c. Keypad on Device Front Panel: Provides access to monitored data using front panel display.
 - d. Alarm Contacts: Arranged to initiate local **OR** remote, **as directed**, alarm for battery discharge events **OR** abnormal temperature **OR** abnormal battery voltage or temperature, **as directed**.
 - e. Memory: Stores recorded data in nonvolatile electronic memory.
 - f. RS-232 Port: Permits downloading of data to a portable PC.
 - g. Modem: Makes measurements and recorded data accessible to a remote PC via telephone line. Computer is not specified in this Section.

Q. Source Quality Control

1. Factory test complete UPS system before shipment. Use actual batteries that are part of final installation **OR** simulated battery testing, **as directed**. Include the following:
 - a. Test and demonstration of all functions, controls, indicators, sensors, and protective devices.
 - b. Full-load test.
 - c. Transient-load response test.
 - d. Overload test.
 - e. Power failure test.
2. Observation of Test: Give 14 days' advance notice of tests and provide opportunity for Owner's representative to observe tests at Owner's choice.
3. Report test results. Include the following data:
 - a. Description of input source and output loads used. Describe actions required to simulate source load variation and various operating conditions and malfunctions.
 - b. List of indications, parameter values, and system responses considered satisfactory for each test action. Include tabulation of actual observations during test.
 - c. List of instruments and equipment used in factory tests.

1.3 EXECUTION

A. Installation

1. Equipment Mounting: Install UPS on concrete base. Comply with requirements for concrete base specified in Division 03 Section "Cast-in-place Concrete".
 - a. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.



- b. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - d. Install anchor bolts to elevations required for proper attachment to supported equipment.
 2. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and NFPA 70.
 3. Connections: Interconnect system components. Make connections to supply and load circuits according to manufacturer's wiring diagrams unless otherwise indicated.
- B. Grounding
1. Separately Derived Systems: If not part of a listed power supply for a data-processing room, comply with NFPA 70 requirements for connecting to grounding electrodes and for bonding to metallic piping near isolation transformer.
- C. Identification
1. Identify components and wiring according to Division 26 Section "Identification For Electrical Systems".
 - a. Identify each battery cell individually.
- D. Battery Equalization
1. Equalize charging of battery cells according to manufacturer's written instructions. Record individual-cell voltages.
- E. Field Quality Control
1. Perform tests and inspections.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
 2. Tests and Inspections:
 - a. Comply with manufacturer's written instructions.
 - b. Inspect interiors of enclosures, including the following:
 - 1) Integrity of mechanical and electrical connections.
 - 2) Component type and labeling verification.
 - 3) Ratings of installed components.
 - c. Inspect batteries and chargers according to requirements in NETA Acceptance Testing Specifications.
 - d. Test manual and automatic operational features and system protective and alarm functions.
 - e. Test communication of status and alarms to remote monitoring equipment.
 - f. Load the system using a variable-load bank to simulate kilovolt amperes, kilowatts, and power factor of loads for unit's rating. Use instruments calibrated within the previous six months according to NIST standards.
 - 1) Simulate malfunctions to verify protective device operation.
 - 2) Test duration of supply on emergency, low-battery voltage shutdown, and transfers and restoration due to normal source failure.
 - 3) Test harmonic content of input and output current less than 25, 50, and 100 percent of rated loads.
 - 4) Test output voltage under specified transient-load conditions.
 - 5) Test efficiency at 50, 75, and 100 percent of rated loads.
 - 6) Test remote status and alarm panel functions.
 - 7) Test battery-monitoring system functions.
 3. Seismic-restraint tests and inspections shall include the following:
 - a. Inspect type, size, quantity, arrangement, and proper installation of mounting or anchorage devices.



-
- b. Test mounting and anchorage devices according to requirements in Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
 4. The UPS system will be considered defective if it does not pass tests and inspections.
 5. Record of Tests and Inspections: Maintain and submit documentation of tests and inspections, including references to manufacturers' written instructions and other test and inspection criteria. Include results of tests, inspections, and retests.
 6. Prepare test and inspection reports.
- F. Demonstration
1. Train Owner's maintenance personnel to adjust, operate, and maintain the UPS.

END OF SECTION 26 33 53 00



Task	Specification	Specification Description
26 33 53 00	26 33 43 00	Central Battery Inverters



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SECTION 26 35 33 00 - POWER FACTOR CORRECTION CAPACITORS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for power factor correction capacitors. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes power and automatic power factor correction equipment rated 600 V and less.

C. Performance Requirements

1. Seismic Performance: Power factor correction equipment shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

D. Submittals

1. Product Data: For each type of product indicated. Include dimensions, operating characteristics of multiple capacitor cells or elements, and data on features, ratings, and performance.
2. Shop Drawings: For automatic power factor correction units.
 - a. Detail equipment assemblies and indicate dimensions, weights, method of field assembly, components, and location and size of each field connection. Show access and workspace requirements and required clearances.
 - b. Wiring Diagrams: For power, signal, and control wiring.
3. Qualification Data: For qualified testing agency.
4. Seismic Qualification Certificates: For capacitors, accessories, and components, from manufacturer.
 - a. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
5. Field quality-control reports.
6. Operation and Maintenance Data: For equipment to include in emergency, operation, and maintenance manuals. Include the following:
 - a. Lists of spare parts and replacement components recommended for storage at Project site.
 - b. Detailed instructions covering operation under both normal and abnormal conditions.
7. Warranty: Sample of special warranty.

E. Quality Assurance

1. Testing Agency Qualifications: Member company of NETA or an NRTL.
 - a. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. Comply with IEEE 18 and NEMA CP 1.
4. Comply with NFPA 70.

F. Coordination



1. Coordinate sensor-communication module package with data network and with monitoring equipment specified in Division 26 Section "Electrical Power Monitoring And Control" for successful transmission and remote readout of remote monitoring data specified in this Section.

G. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace capacitor-bank components that fail in materials or workmanship within five years from date of Final Completion.

1.2 PRODUCTS

A. Capacitors, General

1. Comply with UL 810.
2. Service Conditions: Capacitor equipment suitable for the following conditions:
 - a. Operating Temperature: Minus 40 to plus 115 deg F (Minus 40 to plus 46 deg C).
 - b. Maximum Altitude: 6000 feet (1800 m).
 - c. Humidity: 0 to 95 percent, noncondensing.
3. Construction: Multiple capacitor cells or elements, factory wired in three-phase groups and mounted in metal enclosures.
4. Cells: Dry metallized-dielectric, self-healing type. Each cell shall be encapsulated in thermosetting resin inside plastic container.
5. Rupture Protection: Pressure-sensitive circuit interrupter for each cell.

B. Fixed Capacitors

1. Description: Factory wired, ready for field connection to external circuits at a single set of pressure terminals. Comply with UL 810.
2. Fuses: Current-limiting, noninterchangeable type; factory installed in each phase and located within the equipment enclosure. Features include the following:
 - a. Interrupting Capacity: 100,000 **OR** 200,000, **as directed**, A
 - b. Fuse Ratings and Characteristics: As recommended by capacitor manufacturer.
 - c. Neon Indicator Lamp for Each Fuse: Connect to illuminate when fuse has opened, but is still in place, and locate so it is visible from outside the enclosure.
3. Discharge Resistors: Factory installed and wired.
4. Enclosure: NEMA 250, steel **OR** aluminum, **as directed**, arranged to contain the fluid leakage from capacitor cells; factory equipped with mounting brackets suitable for type of mounting indicated.
 - a. Indoor Enclosures: NEMA 250, Type 12 or as indicated.
OR
Outdoor Enclosures: NEMA 250, Type 3R or as indicated.
OR
Outdoor Enclosures: NEMA 250, Type 4, equipped with watertight conduit connections.

C. Automatic Power Factor Correction Units

1. Description: Capacitors, contactors, controls, and accessories factory installed in independent enclosures **OR** motor-control center, with a connection to motor-control center bus, **as directed**, complying with NEMA ICS 2. Comply with UL 810.
2. Performance Requirements: Controls permit selection of a target power factor, adjustable to any value between unity and 0.80 lagging. Controls continuously sense the power factor on circuits being corrected and, when the power factor differs from the target setting for more than 10 seconds, operate a contractor to switch a capacitor bank into or out of the circuit. Contactors are opened or closed as required to bring the corrected circuit power factor closer to the target setting. Provide number of switching steps indicated on the Three-Phase Capacitor-Bank Schedule.
3. Current Transformer: Type, configuration, and ratio to suit sensing and mounting conditions.



4. Main Circuit Breaker: Thermal-magnetic, inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger. Operable from outside the enclosure to disconnect the unit.
 5. Controls: Solid-state, microprocessor-based controls, including the following:
 - a. Undervoltage relay that interrupts capacitor switching and disconnects capacitors for power-supply interruptions longer than 15 minutes.
 - b. "Advance" and "Retard" push buttons on the control panel to permit manually controlled capacitor-bank switching.
 6. Contactors: Three pole; rated for the repetitive high-inrush-switching duty in the capacitor application.
 7. Fuses for Protection of Capacitor Banks: Rated to protect contactor, interconnecting wiring, and capacitors.
 - a. Spare-Fuse Cabinet: Identified and compartmented steel box **OR** cabinet with hinged lockable door, **as directed**.
 8. Discharge Resistors: Factory installed and wired.
OR
Inductors: Air-core type, connected in capacitor circuits; rated to limit switching surges to within contactor ratings.
 9. Precharge Capacitor Circuit: Resistive, precharge circuit to charge capacitors prior to switching and to limit switching surges to within contactor ratings.
 10. Enclosure: NEMA 250, Type 1 **OR** Type 3R **OR** Type 12, **as directed**, steel or aluminum, with hinged door and hand-operated catch. Door shall be interlocked with controls or main circuit breaker to de-energize capacitors when door is opened.
 - a. Factory Finish: Manufacturer's standard enamel over corrosion-resistant treatment or primer coat.
 11. Local Display: LED or liquid-crystal digital type, mounted in door of enclosure, indicating the following:
 - a. Target and actual power factors accurate to plus or minus 1 percent of reading.
 - b. Steps energized.
 - c. Step reconnection delay.
 - d. Real and reactive currents.
 - e. Voltage total harmonic distortion.
 - f. Alarm codes.
 12. System Alarms: Alarm relay and local display indication of the following conditions:
 - a. Low power factor.
 - b. Leading power factor.
 - c. Frequency not detected.
 - d. Overcurrent.
 - e. Overvoltage.
 - f. Overtemperature.
 - g. Excessive voltage total harmonic distortion.
 - h. Capacitor overload.
 - i. Loss of capacitance.
 13. Remote Monitoring Components: Sensors, associated communication modules, and network interface units, matched to and compatible with electrical power monitoring and control network. Communication module shall have capability to transmit the following data to remote monitoring devices:
 - a. System in alarm.
 - b. Power factor set point.
 - c. Corrected power factor.
 - d. Number of capacitor steps activated.
- D. Source Quality Control
1. Factory test power factor correction equipment before shipment. Comply with NEMA CP 1. Include the following:



- a. Routine capacitor production tests, including short-time overvoltage, capacitance, leak, and dissipation-factor tests.
- b. Functional test of all operations, controls, indicators, sensors, and protective devices.

1.3 EXECUTION

A. Installation

1. Install freestanding equipment on concrete bases. Cast-in-place concrete is specified in Division 3.
2. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
3. Maintain minimum workspace according to manufacturer's written instructions.
4. Connect remote monitoring communication module to electrical power monitoring and control data network through appropriate network interface unit.
5. Identify components according to Division 26 Section "Identification For Electrical Systems".

B. Field Quality Control

1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
2. Perform tests and inspections.
3. Tests and Inspections: Perform each visual and mechanical inspection and electrical test stated in the following Sections, except optional tests, in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - a. Current Transformers.
 - b. Capacitors and Reactors, Capacitors.

C. Startup Service

1. Perform startup service.
 - a. Complete installation and startup checks according to manufacturer's written instructions.
 - b. Connect and run installed motors and equipment to verify the automatic switching of the capacitors. Verification shall include automatic switching of the total capacity of installed capacitors.
 - 1) Provide sufficient inductive/reactive load banks, in combination with resistive load banks, for the test.

D. Demonstration

1. Train Owner's maintenance personnel to adjust, operate, and maintain automatic power factor correction units.

END OF SECTION 26 35 33 00



Task	Specification	Specification Description
26 35 33 00	26 09 23 00b	Electrical Power Monitoring And Control
26 35 53 00	26 32 13 13	Packaged Engine Generators



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SECTION 26 36 13 00 - TRANSFER SWITCHES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for transfer switches. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes transfer switches rated 600 V and less, including the following:
 - a. Automatic transfer switches.
 - b. Bypass/isolation switches.
 - c. Nonautomatic transfer switches.
 - d. Remote annunciation systems.
 - e. Remote annunciation and control systems.

C. Submittals

1. Product Data: Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.
2. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.
3. Manufacturer Seismic Qualification Certification: Submit certification that transfer switches accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration And Seismic Controls For Electrical Systems". Include the following:
4. Field quality-control test reports.
5. Operation and maintenance data.

D. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. Comply with NEMA ICS 1.
3. Comply with NFPA 70.
4. Comply with NFPA 99.
5. Comply with NFPA 110.
6. Comply with UL 1008 unless requirements of these Specifications are stricter.

1.2 PRODUCTS

A. General Transfer-Switch Product Requirements

1. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.
2. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.
 - a. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.
3. Solid-State Controls: Repetitive accuracy of all settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.



4. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.
5. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.
6. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
 - a. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are not acceptable.
 - b. Switch Action: Double throw; mechanically held in both directions.
 - c. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units, rated 225 A and higher, shall have separate arcing contacts.
7. Neutral Switching. Where four-pole switches are indicated, provide neutral pole switched simultaneously with phase poles **OR** overlapping neutral contacts, **as directed**.
8. Neutral Terminal: Solid and fully rated, unless otherwise indicated.
9. Oversize Neutral: Ampacity and switch rating of neutral path through units indicated for oversize neutral shall be double the nominal rating of circuit in which switch is installed.
10. Heater: Equip switches exposed to outdoor temperatures and humidity, and other units indicated, with an internal heater. Provide thermostat within enclosure to control heater.
11. Battery Charger: For generator starting batteries.
 - a. Float type rated 2 **OR** 10, **as directed**, A.
 - b. Ammeter to display charging current.
 - c. Fused ac inputs and dc outputs.
12. Annunciation, Control, and Programming Interface Components: Devices at transfer switches for communicating with remote programming devices, annunciators, or annunciator and control panels shall have communication capability matched with remote device.
13. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, either by color-code or by numbered or lettered wire and cable tape markers at terminations. Color-coding and wire and cable tape markers are specified in Division 26 Section "Identification For Electrical Systems".
 - a. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
 - b. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
 - c. Control Wiring: Equipped with lugs suitable for connection to terminal strips.
14. Enclosures: General-purpose NEMA 250, Type 1 **OR** 3R **OR** 12, **as directed**, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

B. Automatic Transfer Switches

1. Comply with Level 1 equipment according to NFPA 110.
2. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.
3. Manual Switch Operation: Under load, with door closed and with either or both sources energized. Transfer time is same as for electrical operation. Control circuit automatically disconnects from electrical operator during manual operation.
4. Manual Switch Operation: Unloaded. Control circuit automatically disconnects from electrical operator during manual operation.
5. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval is adjustable from 1 to 30 seconds.
6. Digital Communication Interface: Matched to capability of remote annunciator or annunciator and control panel.
7. Transfer Switches Based on Molded-Case-Switch Components: Comply with NEMA AB 1, UL 489, and UL 869A.
8. Automatic Closed-Transition Transfer Switches: Include the following functions and characteristics:



- a. Fully automatic make-before-break operation.
 - b. Load transfer without interruption, through momentary interconnection of both power sources not exceeding 100 ms.
 - c. Initiation of No-Interruption Transfer: Controlled by in-phase monitor and sensors confirming both sources are present and acceptable.
 - 1) Initiation occurs without active control of generator.
 - 2) Controls ensure that closed-transition load transfer closure occurs only when the 2 sources are within plus or minus 5 electrical degrees maximum, and plus or minus 5 percent maximum voltage difference.
 - d. Failure of power source serving load initiates automatic break-before-make transfer.
9. In-Phase Monitor: Factory-wired, internal relay controls transfer so it occurs only when the two sources are synchronized in phase. Relay compares phase relationship and frequency difference between normal and emergency sources and initiates transfer when both sources are within 15 electrical degrees, and only if transfer can be completed within 60 electrical degrees. Transfer is initiated only if both sources are within 2 Hz of nominal frequency and 70 percent or more of nominal voltage.
10. Motor Disconnect and Timing Relay: Controls designate starters so they disconnect motors before transfer and reconnect them selectively at an adjustable time interval after transfer. Control connection to motor starters is through wiring external to automatic transfer switch. Time delay for reconnecting individual motor loads is adjustable between 1 and 60 seconds, and settings are as indicated. Relay contacts handling motor-control circuit inrush and seal currents are rated for actual currents to be encountered.
11. Programmed Neutral Switch Position: Switch operator has a programmed neutral position arranged to provide a midpoint between the two working switch positions, with an intentional, time-controlled pause at midpoint during transfer. Pause is adjustable from 0.5 to 30 seconds minimum and factory set for 0.5 second, unless otherwise indicated. Time delay occurs for both transfer directions. Pause is disabled unless both sources are live.
12. Automatic Transfer-Switch Features:
- a. Undervoltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
 - b. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.
 - c. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
 - d. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes, and factory set for 10 minutes to automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
 - e. Test Switch: Simulate normal-source failure.
 - f. Switch-Position Pilot Lights: Indicate source to which load is connected.
 - g. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.
 - 1) Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
 - 2) Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."
 - h. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.
 - i. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.



- j. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.
- k. Engine Shutdown Contacts: Instantaneous; shall initiate shutdown sequence at remote engine-generator controls after retransfer of load to normal source.
- l. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.
- m. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings are for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:
 - 1) Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
 - 2) Push-button programming control with digital display of settings.
 - 3) Integral battery operation of time switch when normal control power is not available.

C. Bypass/Isolation Switches

1. Comply with requirements for Level 1 equipment according to NFPA 110.
2. Description: Manual type, arranged to select and connect either source of power directly to load, isolating transfer switch from load and from both power sources. Include the following features for each combined automatic transfer switch and bypass/isolation switch:
 - a. Means to lock bypass/isolation switch in the position that isolates transfer switch with an arrangement that permits complete electrical testing of transfer switch while isolated. While isolated, interlocks prevent transfer-switch operation, except for testing or maintenance.
 - b. Drawout Arrangement for Transfer Switch: Provide physical separation from live parts and accessibility for testing and maintenance operations.
 - c. Bypass/Isolation Switch Current, Voltage, Closing, and Short-Circuit Withstand Ratings: Equal to or greater than those of associated automatic transfer switch, and with same phase arrangement and number of poles.
 - d. Contact temperatures of bypass/isolation switches shall not exceed those of automatic transfer-switch contacts when they are carrying rated load.
 - e. Operability: Constructed so load bypass and transfer-switch isolation can be performed by 1 person in no more than 2 operations in 15 seconds or less.
 - f. Legend: Manufacturer's standard legend for control labels and instruction signs shall describe operating instructions.
 - g. Maintainability: Fabricate to allow convenient removal of major components from front without removing other parts or main power conductors.
3. Interconnection of Bypass/Isolation Switches with Automatic Transfer Switches: Factory-installed copper bus bars; plated at connection points and braced for the indicated available short-circuit current.

D. Nonautomatic Transfer Switches

1. Operation: Electrically actuated by push buttons designated "Normal Source" and "Alternate Source." Switch shall be capable of transferring load in either direction with either or both sources energized.
2. Operation: Electrically actuated by push buttons designated "Normal Source" and "Alternate Source." In addition, removable manual handle provides quick-make, quick-break manual-switching action. Switch shall be capable of electrically or manually transferring load in either direction with either or both sources energized. Control circuit disconnects from electrical operator during manual operation.
3. Double-Throw Switching Arrangement: Incapable of pauses or intermediate position stops during switching sequence.



4. Nonautomatic Transfer-Switch Accessories:
 - a. Pilot Lights: Indicate source to which load is connected.
 - b. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and alternate-source sensing circuits.
 - 1) Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
 - 2) Emergency Power Supervision: Red light with nameplate engraved "Alternate Source Available."
 - c. Unassigned Auxiliary Contacts: One set of normally closed contacts for each switch position, rated 10 A at 240-V ac.
- E. Remote Annunciator System
 1. Functional Description: Remote annunciator panel shall annunciate conditions for indicated transfer switches. Annunciation shall include the following:
 - a. Sources available, as defined by actual pickup and dropout settings of transfer-switch controls.
 - b. Switch position.
 - c. Switch in test mode.
 - d. Failure of communication link.
 2. Annunciator Panel: LED-lamp type with audible signal and silencing switch.
 - a. Indicating Lights: Grouped for each transfer switch monitored.
 - b. Label each group, indicating transfer switch it monitors, location of switch, and identity of load it serves.
 - c. Mounting: Flush, modular, steel cabinet, unless otherwise indicated.
 - d. Lamp Test: Push-to-test or lamp-test switch on front panel.
- F. Remote Annunciator And Control System
 1. Functional Description: Include the following functions for indicated transfer switches:
 - a. Indication of sources available, as defined by actual pickup and dropout settings of transfer-switch controls.
 - b. Indication of switch position.
 - c. Indication of switch in test mode.
 - d. Indication of failure of digital communication link.
 - e. Key-switch or user-code access to control functions of panel.
 - f. Control of switch-test initiation.
 - g. Control of switch operation in either direction.
 - h. Control of time-delay bypass for transfer to normal source.
 2. Malfunction of annunciator, annunciation and control panel, or communication link shall not affect functions of automatic transfer switch. In the event of failure of communication link, automatic transfer switch automatically reverts to stand-alone, self-contained operation. Automatic transfer-switch sensing, controlling, or operating function shall not depend on remote panel for proper operation.
 3. Remote Annunciation and Control Panel: Solid-state components. Include the following features:
 - a. Controls and indicating lights grouped together for each transfer switch.
 - b. Label each indicating light control group. Indicate transfer switch it controls, location of switch, and load it serves.
 - c. Digital Communication Capability: Matched to that of transfer switches supervised.
 - d. Mounting: Flush, modular, steel cabinet, unless otherwise indicated.
- G. Source Quality Control
 1. Factory test and inspect components, assembled switches, and associated equipment. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.



1.3 EXECUTION

A. Installation

1. Design each fastener and support to carry load indicated by seismic requirements and according to seismic-restraint details. See Division 26 Section "Hangers And Supports For Electrical Systems".
2. Floor-Mounting Switch: Anchor to floor by bolting.
 - a. Concrete Bases: 4 inches (100 mm) high, reinforced, with chamfered edges. Extend base no more than 4 inches (100 mm) in all directions beyond the maximum dimensions of switch, unless otherwise indicated or unless required for seismic support. Construct concrete bases according to Division 26 Section "Hangers And Supports For Electrical Systems".
3. Annunciator and Control Panel Mounting: Flush in wall, unless otherwise indicated.
4. Identify components according to Division 26 Section "Identification For Electrical Systems".
5. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

B. Connections

1. Wiring to Remote Components: Match type and number of cables and conductors to control and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to the Owner if necessary to accommodate required wiring.
2. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".
3. Connect wiring according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables".

C. Field Quality Control

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
2. Perform tests and inspections and prepare test reports.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installation, including connections, and to assist in testing.
 - b. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
 - c. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - d. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.
 - 1) Check for electrical continuity of circuits and for short circuits.
 - 2) Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
 - 3) Verify that manual transfer warnings are properly placed.
 - 4) Perform manual transfer operation.
 - e. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.
 - 1) Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
 - 2) Simulate loss of phase-to-ground voltage for each phase of normal source.
 - 3) Verify time-delay settings.
 - 4) Verify pickup and dropout voltages by data readout or inspection of control settings.
 - 5) Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for 1 pole deviating by more than 50 percent from other poles.



- 6) Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.
 - f. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.
 - 1) Verify grounding connections and locations and ratings of sensors.
 3. Coordinate tests with tests of generator and run them concurrently.
 4. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.
 5. Remove and replace malfunctioning units and retest as specified above.
 6. Infrared Scanning: After Final Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switch. Remove all access panels so joints and connections are accessible to portable scanner.
 - a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Final Completion.
 - b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - c. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- D. Demonstration
1. Engage a factory-authorized service representative to train the Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment as specified below.
 2. Coordinate this training with that for generator equipment.

END OF SECTION 26 36 13 00



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Task	Specification	Specification Description
26 36 13 00	26 24 13 00a	Enclosed Switches And Circuit Breakers
26 36 23 00	26 24 13 00a	Enclosed Switches And Circuit Breakers
26 36 23 00	26 36 13 00	Transfer Switches



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SECTION 26 43 13 00 - TRANSIENT VOLTAGE SUPPRESSION

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for transient voltage suppression. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes field-mounted TVSS for low-voltage (120 to 600 V) power distribution and control equipment.

C. Definitions

1. ATS: Acceptance Testing Specifications.
2. SVR: Suppressed voltage rating.
3. TVSS: Transient voltage surge suppressor(s), both singular and plural; also, transient voltage surge suppression.

D. Submittals

1. Product Data: For each type of product indicated. Include rated capacities, operating weights, electrical characteristics, furnished specialties, and accessories.
2. Field quality-control reports.
3. Operation and maintenance data.
4. Warranties: Sample of special warranties.

E. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency, and marked for intended location and application.
2. Comply with IEEE C62.41.2 and test devices according to IEEE C62.45.
3. Comply with NEMA LS 1.
4. Comply with UL 1283, **as directed**, and UL 1449.
5. Comply with NFPA 70.

F. Project Conditions

1. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
 - a. Notify Owner no fewer than two days in advance of proposed electrical service interruptions.
 - b. Do not proceed with interruption of electrical service without Owner's written permission.
2. Service Conditions: Rate TVSS devices for continuous operation under the following conditions unless otherwise indicated:
 - a. Maximum Continuous Operating Voltage: Not less than 115 percent of nominal system operating voltage.
 - b. Operating Temperature: 30 to 120 deg F (0 to 50 deg C).
 - c. Humidity: 0 to 85 percent, noncondensing.
 - d. Altitude: Less than 20,000 feet (6090 m) above sea level.

G. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of surge suppressors that fail in materials or workmanship within Five years from date of Final Completion.



2. Special Warranty for Cord-Connected, Plug-in Surge Suppressors: Manufacturer's standard form in which manufacturer agrees to repair or replace electronic equipment connected to circuits protected by surge suppressors.

1.2 PRODUCTS

A. Service Entrance Suppressors

1. Surge Protection Devices:

- a. Non-modular.
- b. LED indicator lights for power and protection status.
- c. Audible alarm, with silencing switch, to indicate when protection has failed.
- d. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.

OR

Surge Protection Devices:

- e. Comply with UL 1449.
 - f. Modular design (with field-replaceable modules) **OR** Non-modular design, **as directed**.
 - g. Fuses, rated at 200-kA interrupting capacity.
 - h. Fabrication using bolted compression lugs for internal wiring.
 - i. Integral disconnect switch (if a fused switch or circuit breaker is not provided for the TVSS in the panelboard and the TVSS will not have a direct bus bar connection).
 - j. Redundant suppression circuits.
 - k. Redundant replaceable modules.
 - l. Arrangement with copper bus bars and for bolted connections to phase buses, neutral bus, and ground bus.
- #### OR
- Arrangement with wire connections to phase buses, neutral bus, and ground bus.
- m. LED indicator lights for power and protection status.
 - n. Audible alarm, with silencing switch, to indicate when protection has failed.
 - o. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
 - p. Four **OR** Six, **as directed**, -digit transient-event counter set to totalize transient surges.
2. Peak Single-Impulse Surge Current Rating: 320 kA per mode/640 kA **OR** 240 kA per mode/480 kA **OR** 160 kA per mode/320 kA, **as directed**, per phase.
 3. Minimum single impulse current ratings, using 8-by-20-mic.sec waveform described in IEEE C62.41.2
 - a. Line to Neutral: 70,000 A.
 - b. Line to Ground: 70,000 A.
 - c. Neutral to Ground: 50,000 A.
 4. Protection modes and UL 1449 SVR for grounded wye circuits with 480Y/277 V **OR** 208Y/120 V **OR** 600Y/347 V, **as directed**, 3-phase, 4-wire circuits shall be as follows:
 - a. Line to Neutral: 800 V for 480Y/277 V **OR** 400 V for 208Y/120 V **OR** 1200 V for 600Y/347 V, **as directed**.
 - b. Line to Ground: 800 V for 480Y/277 V **OR** 400 V for 208Y/120 V **OR** 1200 V for 600Y/347 V, **as directed**.
 - c. Neutral to Ground: 800 V for 480Y/277 V **OR** 400 V for 208Y/120 V **OR** 1200 V for 600Y/347 V, **as directed**.

OR

Protection modes and UL 1449 SVR for 240/120 V, single-phase, 3-wire circuits shall be as follows:



- a. Line to Neutral: 400 V.
- b. Line to Ground: 400 V.
- c. Neutral to Ground: 400 V.

OR

Protection modes and UL 1449 SVR for 240/120-V, 3-phase, 4-wire circuits with high leg shall be as follows:

- a. Line to Neutral: 400 V, 800 V from high leg.
- b. Line to Ground: 400 V.
- c. Neutral to Ground: 400 V.

OR

Protection modes and UL 1449 SVR for 240 V, 480 V, or 600 V, 3-phase, 3-wire, delta circuits shall be as follows:

- a. Line to Line: 2000 V for 480 V **OR** 1000 V for 240 V **OR** 2500 V for 600 V, **as directed**.
- b. Line to Ground: 2000 V for 480 V **OR** 1000 V for 240 V **OR** 2500 V for 600 V, **as directed**.

B. Panelboard Suppressors**1. Surge Protection Devices:**

- a. Non-modular.
- b. LED indicator lights for power and protection status.
- c. Audible alarm, with silencing switch, to indicate when protection has failed.
- d. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.

OR

Surge Protection Devices:

- a. Comply with UL 1449.
 - b. Modular design (with field-replaceable modules) **OR** Non-modular design, **as directed**.
 - c. Short-circuit current rating complying with UL 1449, and matching or exceeding the panelboard short-circuit rating and redundant suppression circuits; with individually fused metal-oxide varistors.
 - d. Fuses, rated at 200-kA interrupting capacity.
 - e. Fabrication using bolted compression lugs for internal wiring.
 - f. Integral disconnect switch (if a fused switch or circuit breaker is not provided for the TVSS in the panelboard and the TVSS will not have a direct bus bar connection).
 - g. Redundant suppression circuits.
 - h. Redundant replaceable modules.
 - i. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
 - j. LED indicator lights for power and protection status.
 - k. Audible alarm, with silencing switch, to indicate when protection has failed.
 - l. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
 - m. Four **OR** Six, **as directed**, -digit transient-event counter set to totalize transient surges.
2. Peak Single-Impulse Surge Current Rating: 160 kA per mode/320 kA **OR** 120 kA per mode/240 kA **OR** 80 kA per mode/160 kA, **as directed**, per phase.
 3. Minimum single impulse current ratings, using 8-by-20-mic.sec waveform described in IEEE C62.41.2:
 - a. Line to Neutral: 70,000 A.
 - b. Line to Ground: 70,000 A.
 - c. Neutral to Ground: 50,000 A.
 4. Protection modes and UL 1449 SVR for grounded wye circuits with 480Y/277 V **OR** 208Y/120 V **OR** 600Y/347 V, **as directed**, 3-phase, 4-wire circuits shall be as follows:
 - a. Line to Neutral: 800 V for 480Y/277 V **OR** 400 V for 208Y/120 V **OR** 1200 V for 600Y/347 V, **as directed**.



- b. Line to Ground: 800 V for 480Y/277 V **OR** 400 V for 208Y/120 V **OR** 1200 V for 600Y/347 V, **as directed**.
- c. Neutral to Ground: 800 V for 480Y/277 V **OR** 400 V for 208Y/120 V **OR** 1200 V for 600Y/347 V, **as directed**.

OR

Protection modes and UL 1449 SVR for 240/120-V, single-phase, 3-wire circuits shall be as follows:

- a. Line to Neutral: 400 V.
- b. Line to Ground: 400 V.
- c. Neutral to Ground: 400 V.

OR

Protection modes and UL 1449 SVR for 240/120-V, 3-phase, 4-wire circuits with high leg shall be as follows:

- a. Line to Neutral: 400 V, 800 V from high leg.
- b. Line to Ground: 400 V.
- c. Neutral to Ground: 400 V.

OR

Protection modes and UL 1449 SVR for 240 V, 480 V, or 600 V, 3-phase, 3-wire, delta circuits shall be as follows:

- a. Line to Line: 2000 V for 480 V **OR** 1000 V for 240 V **OR** 2500 V for 600 V, **as directed**.
- b. Line to Ground: 1500 V for 480 V **OR** 800 V for 240 V **OR** 2500 V for 600 V, **as directed**.

C. Enclosures

- 1. Indoor Enclosures: NEMA 250 Type 1 **OR** Type 12, **as directed**.
- 2. Outdoor Enclosures: NEMA 250 Type 3R **OR** Type 4 **OR** Type 4X, **as directed**.

1.3 EXECUTION

A. Installation

- 1. Install TVSS devices at service entrance on load side, with ground lead bonded to service entrance ground.
- 2. Install TVSS devices for panelboards and auxiliary panels with conductors or buses between suppressor and points of attachment as short and straight as possible. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.
 - a. Provide multiple, 30 **OR** 60 **OR** 100, **as directed**, -A circuit breaker as a dedicated disconnecting means for TVSS unless otherwise indicated.

B. Field Quality Control

- 1. Perform tests and inspections.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- 2. Tests and Inspections:
 - a. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, "Surge Arresters, Low-Voltage Surge Protection Devices" Section. Certify compliance with test parameters.
 - b. After installing TVSS devices but before electrical circuitry has been energized, test for compliance with requirements.
 - c. Complete startup checks according to manufacturer's written instructions.
- 3. TVSS device will be considered defective if it does not pass tests and inspections.
- 4. Prepare test and inspection reports.

C. Startup Service



-
- a. Do not energize or connect service entrance equipment **OR** panelboards **OR** control terminals **OR** data terminals, **as directed**, to their sources until TVSS devices are installed and connected.
 - b. Do not perform insulation resistance tests of the distribution wiring equipment with the TVSS installed. Disconnect before conducting insulation resistance tests, and reconnect immediately after the testing is over.

D. Demonstration

- a. Train Owner's maintenance personnel to maintain TVSS devices.

END OF SECTION 26 43 13 00



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Task	Specification	Specification Description
26 51 13 00	02 84 16 00	Removal of Fluorescent Light Ballasts/Capacitors and Fluorescent Light Tubes
26 51 13 00	01 95 26 00a	Interior Lighting
26 51 13 00	02 84 16 00a	Exterior Lighting
26 53 00 00	01 95 26 00a	Interior Lighting



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SECTION 26 55 61 00 - STAGE LIGHTING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for stage lighting. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Dimmer racks.
 - b. Control console and control devices.
 - c. Lighting fixtures and accessories.
 - d. Distribution components.

C. Performance Requirements

1. Seismic Performance: Dimmer racks shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event," **as directed**.

D. Submittals

1. Product Data: For each type of product indicated.
2. Seismic Qualification Certificates: For **<Insert equipment,>** accessories, and components, from manufacturer.
3. Field quality-control reports.
4. Operation and maintenance data.
5. Software and Firmware Operational Documentation.

E. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with NECA 1.
3. Comply with NFPA 70.

F. Software Service Agreement (if allowed)

1. Technical Support: Beginning with Final Completion, provide software support for two years.
2. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Final Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
 - a. Provide 30 days' notice to the Owner to allow scheduling and access to system and to allow the Owner to upgrade computer equipment if necessary.

1.2 PRODUCTS

A. Plug Connectors

1. Pin Type: USITT S3, two-pole, three-wire, 20-A.
2. Twist-Locking Type: NEMA WD 6, two-pole, three-wire, 20-A.



B. Lighting Fixtures And Accessories

1. General:

- a. Comply with UL 1573 and listed and labeled by an NRTL.
- b. Fixtures: Equipped with pigtail, yoke with pipe clamp, safety cable for batten mounting, and filter holder.
- c. Metal Parts: Free of burrs, sharp corners, and edges.
- d. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.
- e. Fixture Doors and Their Internal Access: Smooth operating, free of light leakage under operating conditions, and arranged to permit relamping without use of tools. Doors, lenses, diffusers, and other pieces arranged to prevent accidental falling during relamping and when secured in operating position.
- f. Pigtail: Factory wired, 36-inch- (900-mm-) long, three-wire cord and plug connector assembly with cord encased in woven fiberglass or silicone tubing.
- g. Lamp Sockets: Relampable without disturbing alignment or focus adjustment.
- h. Fixture Ventilation Openings: Baffled against light leaks.
- i. Fixture Operating Controls and Handles: Thermally insulated.
- j. Lenses: Borosilicate glass in silicone mountings.
- k. Framing Shutters: Stainless steel, four way; with each blade in a separate plane under adjustable tension mounting. Blades adjust plus or minus 30 degrees of rotation in gate, for 120-degree-minimum total angular rotation between adjacent blades.
- l. Color Filter Frame Holder: Attached to front of fixture.
- m. Fixture Yoke: Rigid metal, arranged for vertical aiming of unit and equipped with T-bolt or hand screw to lock alignment.

2. Ellipsoidal Spotlights: Fixtures with an elliptical reflector mounted in a fixed relationship to the lamp. Light shall be projected through a gate where the beam is shaped by using shutters, a gobo, or an iris. The shaped beam shall then be focused by a system of lenses.

a. Tag: ES-1:

- 1) Lamp: 1000 W Q1000/4CL, ANSI FEL.
- 2) Pattern Holders: Three for each fixture, with framing shutters.
- 3) Color Frame: Black, metal.
- 4) Minimum Cosine Illumination Performance Ratings When Operated with ANSI C78 Series, FEL Lamp:
 - a) 171,000 beam candlepower at 20-degree field angle.
 - b) 48,000 beam candlepower at 40-degree field angle.

3. Zoom Ellipsoidal Spotlights: Fixtures with an elliptical reflector mounted in an adjustable relationship to the lamp. Light shall be projected through a gate where the beam is shaped by using shutters, a gobo, or an iris. The shaped beam shall then be focused by a system of lenses.

a. Tag: ZES-1:

- 1) Lamp: 1000 W Q1000/4CL, ANSI FEL.
- 2) Pattern Holders: Three for each fixture, with framing shutters.
- 3) Operator adjustable from 25- to 50-degree field angle.
- 4) Field-angle adjustment scale label on instrument housing for field reference.
- 5) Minimum Cosine Illumination Performance Rating When Operated with ANSI C78 Series, FEL Lamp: 82,000 beam candlepower at 35-degree field angle.

4. Fresnel Lens Spotlights:

a. Die-cast extruded-aluminum housing, with hinged front for relamping.

b. Tag: FLS-1.

- 1) Lamp: 1000 W Q1000T7/4CL, ANSI EGT.
- 2) Lens: 6 inches (152 mm).
- 3) Illumination Performance Rating When Operated with ANSI C78 Series, EGT Lamp:
 - a) 175,000 beam candlepower at 12.5-degree field angle in spot focus.
 - b) 12,000 beam candlepower at 74.6-degree field angle in flood focus.
- 4) Barn Doors: Two 4-leaf rotatable metal flaps for every three fixtures.

5. Follow Spotlights:



- a. Tag: FS-1:
 - 1) Lamp: Metal halide, G22 medium bi-post, CRI: 90, color: 6000 K, life: 750 hours, HMI 575 W/GS 95 V.
 - 2) Adjustable lenses in metal housing.
 - 3) Lamp: Quartz-projector type, Adjustable, underslung base stand mounted on 3-inch (75-mm), locking-type, rubber-tired, ball-bearing casters.
 - 4) Adjustable lamp holder and socket assembly with precision tuning adjustment; relampable without tools.
 - 5) Three-leaf, full-range mechanical dimmer.
 - 6) Adjustable iris and framing shutters.
 - 7) Automatic color boom.
 - 8) Removable power cable, 25 feet (8 m) long.
 - 9) Iris Open, Spot-Focus Performance: 800,000, **as directed**, beam candlepower at 7.2, **as directed**, -degree field angle.
 - 10) Iris Open, Flood-Focus Performance: 330,000, **as directed**, beam candlepower at 12.2, **as directed**, -degree field angle.
6. PAR Lamp Holders:
 - a. Tag: PLH-1:
 - 1) Lamp: 300 W PAR 38.
 - 2) Housing: Steel or aluminum, flat black color, **as directed**, with porcelain-plated shell socket.
 - 3) Barn Doors: Two 4-leaf rotatable metal flaps for every three fixtures.
 - b. Tag: **<Insert drawing designation>**.
 - 1) Lamp: 575 W tungsten halogen, 90 GLA 575 W, 230 V, color: 3200 K, ANSI GKV.
 - 2) Housing: Steel or aluminum, with porcelain-plated shell socket and color frame, **as directed**.
 - 3) Barn Doors: Two 4-leaf rotatable metal flaps for every three fixtures.
 - 4) With Lens Holder and Replaceable Lenses:
 - a) **<Insert drawing designation>**: Very narrow spot.
 - b) **<Insert drawing designation>**: Narrow spot.
 - c) **<Insert drawing designation>**: Medium flood.
 - d) **<Insert drawing designation>**: Wide flood.
 - e) **<Insert drawing designation>**: Very wide.
 - 5) Motorized **OR** Manual, **as directed**, color wheel.
7. Borderlight Units: Compartmented, three-circuit striplight with nine 150-W, PAR 38/SP **OR** 150-W, PAR 38/FL **OR** 250-W, PAR 38/SP **OR** 150-W, R40/FL, **as directed**, lamps in porcelain sockets and steel sheet housing, 90 inches (2286 mm) long. Compartments shall be in line and wired on two **OR** three **OR** four, **as directed**, alternate circuits, each producing a different color.
 - a. Front Door: Spring loaded; designed to hold either filter frames or color roundels.
 - b. Color Roundels: One for each lamp; alternating red, blue, and clear, **as directed**.
 - 1) Additional Roundels: **<Insert number>** amber and **<Insert number>** green.
 - c. Hanger: Adjustable, steel-strap type equipped at each end with pipe clamp and safety cable for suspension from a batten.
8. Cyclorama Lights: Suitable for lighting cycloramas from above.
 - a. Tag: CL-1:
 - 1) Lamp: 1000 W Q1000T3/1CL, ANSI FFT.
 - 2) Housing: Aluminum or steel, **as directed**, flat black color, **as directed**, with color frame, **as directed**.
9. Black Lights: Portable, producing a wash of UV light for special effects.
 - a. Tag: BL-1:
 - 1) Lamp: 250 W blacklight flood, H37KB-250, with integral filter to eliminate far-UV effect while maximizing the near-UV effect.
 - 2) Housing: Steel or aluminum, **as directed**, flat black color, **as directed**, with carry handle.
 - 3) C-clamp for using on light pipe.
10. Moving Lights:



- a. Tag: ML-1:
 - 1) General: 700-W, 120-V, metal halide, motorized remote-controlled lighting instrument; NRTL listed.
 - 2) Lamp: Short-arc metal halide, 14,500 lumens; color temperature of 5600 K, CRI of 80.
 - 3) Color System: Three-filter CYM (cyan, yellow, magenta) cross-fading mechanism, and 11 standard colors on a fixed wheel.
 - 4) Optics: Zoom optics with continuously variable field angle from 18.5 to 42 degrees, programmable over a timed range of 2 seconds to 20 minutes; with a mechanical iris for beam-size control. Variable beam focus to soften the edges of gobos and light beams. Zoom combined with iris can project a beam with a field angle of 8 degrees.
 - 5) Dimming: Coated glass dimmer wheel, with controls to provide smooth timed fades.
 - 6) Strobe for strobe lighting effects.
 - 7) Gobo: One rotating wheel with five rotatable wheel positions and one open position. One fixed gobo wheel with 11 pattern positions and one open position.
 - 8) Beam Orientation Control: Smooth pan and tilt using a three-phase stepper motor system. Pan, 540 degrees; tilt, 270 degrees at 0.3-degree repeatability on either axis.
 - 9) Control: ANSI E1.11 (USITT DMX512-A) protocol using five pin connectors.

C. Distribution Components

1. Connector Strip: Listed and labeled by an NRTL; factory-wired wireway and receptacle assembly.
 - a. Wireway: Steel or extruded aluminum, with removable cover and nominal cross-section dimensions of 3 by 4-1/2 inches (75 by 115 mm).
 - b. Accessories: Cable clamps, support cradles, and cable strain relief grips for each cable.
 - c. Receptacles: Pigtail mounted, 18 inches (450 mm) long, with strain relief at wireway wall penetration.
OR
Receptacles: Flush mounted in wireway cover.
 - d. Receptacle Wiring: For connecting to terminal blocks; with 125 deg C, crosslinked, PE-insulated, identification-labeled wire.
 - e. Terminal Blocks: Molded-barrier type with screw lugs to suit supply conductors.
 - f. Mounting Hardware: Furnished with each unit; permits surface, single-pipe-bracket, or double-pipe-bracket mounting.
 - g. Finish: Semigloss or matte black.
2. Plug-in Boxes: Listed and labeled by an NRTL; factory-wired wireway and receptacle assembly, 24 inches (600 mm) long unless otherwise indicated; with the following features:
 - a. Wireway: Steel or extruded aluminum, with removable cover and nominal cross-section dimensions of 3 by 4-1/2 inches (75 by 115 mm).
 - b. Accessories: Cable clamps, support cradles, and cable strain relief grips for each cable.
 - c. Receptacles: Pigtail mounted, 18 inches (450 mm) long, with strain relief at wireway wall penetration.
OR
Receptacles: Flush mounted in wireway cover.
 - d. Receptacle Wiring: For connecting to terminal blocks; with 125 deg C, crosslinked, PE-insulated, identification-labeled wire.
 - e. Terminal Blocks: Molded-barrier type with screw lugs to suit supply conductors.
 - f. Surface or Grid Mounting: With accessories for surface mounting or with pipe-mounting accessory bracket.
 - g. Recessed Mounting: With flanged cover suitable for recessed mounting in wall.
 - h. Finish: Semigloss or matte black.
3. Gridiron Junction Boxes: Listed and labeled by an NRTL; factory wired with terminal strips and concentric knockouts on all sides.
 - a. Terminal Blocks: Molded-barrier type with screw lugs to suit supply conductors.



- b. Accessories: Cable clamps, support cradles, and cable strain relief grips for each cable, and brackets for surface or pipe mounting.
 - c. Finish: Semigloss or matte black.
 - 4. Floor Pockets: Listed and labeled by an NRTL; flush-mounted, receptacle outlet assembly.
 - a. Box: 0.0598-inch (1.5-mm) steel sheet, 10 inches (250 mm) deep.
 - b. Cover Plate: Steel, cast iron, or cast aluminum with nonskid safety tread surface and self-closing, hinged door with cable notches.
 - c. Barrier for allowing installation of low-voltage control receptacle for console input or handheld remotes.
- D. Wire And Cable
- 1. Building Wire in Raceways: Comply with requirements specified in Division 26 Section "Low-voltage Electrical Power Conductors And Cables".
 - 2. Portable Power Cable: Listed and labeled by an NRTL; flexible stage and lighting power cable; Type SC, SCE, or SCT; 600 V; multiconductor; 60 deg C temperature rating.
 - 3. Ethernet Cabling: Comply with requirements specified in Division 26 Section "Control-voltage Electrical Power Cables".
 - a. For 10/100BaseT, comply with provisions for UTP cable and hardware.
 - b. For 10Base-FL, comply with provisions for 50/125 **OR** 62.5/125, **as directed**,-micrometer, multimode, optical-fiber cable and hardware.
 - 4. ANSI E1.11 (USITT DMX512-A) Control Cabling: Comply with requirements specified in Division 26 Section "Control-voltage Electrical Power Cables".
 - a. Standard Cable: NFPA 70, Type CM **OR** Type CMG, **as directed**.
 - 1) Paired, low-capacitance computer cable for ANSI E1.11 (USITT DMX512-A) applications. Two pairs, twisted, No. 22 AWG **OR** No. 24 AWG, **as directed**, stranded, tinned-copper conductors.
 - 2) PE insulation.
 - 3) Inner Shield: 100 percent coverage, aluminum foil-polyester tape.
 - 4) Outer Shield: 90 percent coverage, tinned-copper braid.
 - 5) Outer Shield Drain Wire: Stranded, tinned copper.
 - 6) PVC jacket.
 - 7) Flame Resistance: Comply with UL 1581.
 - b. Plenum-Rated Cable: NFPA 70, Type CMP.
 - 1) Paired, low-capacitance computer cable for ANSI E1.11 (USITT DMX512-A) applications. Two pairs, twisted, No. 22 AWG **OR** No. 24 AWG, **as directed**, stranded, tinned-copper conductors.
 - 2) Insulation: Foam fluoridated ethylene propylene.
 - 3) Inner Shield: 100 percent coverage, aluminum foil-polyester tape.
 - 4) Outer Shield: 90 percent coverage, tinned-copper braid.
 - 5) Outer Shield Drain Wire: Stranded, tinned copper.
 - 6) Low-smoke PVC jacket.
 - 7) Flame Resistance: Comply with NFPA 262.
 - 5. Low-Voltage Control Cabling:
 - a. Control-Cable Conductors:
 - 1) Class 1 Control Circuits: Stranded copper, Type THHN-THWN, in raceway; complying with UL 83.
OR
Class 1 Control Circuits: Stranded copper, Type THHN, in raceway; complying with UL 44.
 - 2) Class 2 Control Circuits: Stranded copper, Type THHN-THWN, in raceway **OR** power-limited cable, concealed in building finishes **OR** power-limited tray cable, in cable tray, **as directed**; complying with UL 83.
OR
Class 2 Control Circuits: Stranded copper, Type THHN, in raceway **OR** power-limited cable, concealed in building finishes **OR** power-limited tray cable, in cable tray, **as directed**; complying with UL 44.



- 3) Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or Type TF; complying with UL 83.
- b. Paired Cable: NFPA 70, Type CMG.
 - 1) One pair, twisted, No. 16 AWG, stranded, tinned-copper conductors.
 - 2) PVC insulation.
 - 3) Unshielded.
 - 4) PVC jacket.
 - 5) Flame Resistance: Comply with UL 1581.
- c. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.
 - 1) One pair, twisted, No. 16 AWG, stranded (19x29), tinned-copper conductors.
 - 2) PVC insulation.
 - 3) Unshielded.
 - 4) PVC jacket.
 - 5) Flame Resistance: Comply with NFPA 262.
- d. Paired Cable: NFPA 70, Type CMG.
 - 1) One pair, twisted, No. 18 AWG, stranded (19x30), tinned-copper conductors.
 - 2) PVC insulation.
 - 3) Unshielded.
 - 4) PVC jacket.
 - 5) Flame Resistance: Comply with UL 1581.
- e. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.
 - 1) One pair, twisted, No. 18 AWG, stranded (19x30), tinned-copper conductors.
 - 2) Fluorinated ethylene propylene insulation.
 - 3) Unshielded.
 - 4) Plastic jacket.
 - 5) Flame Resistance: Comply with NFPA 262.

E. Lighting Control System

1. Description: Microprocessor-based modular system consisting of dimmer and control modules operated from remote-control stations and a control console.
 - a. Comply with UL 508.
 - b. Comply with USITT AMX192 **OR** ANSI E1.11 (USITT DMX512-A), **as directed**, for data transmission.
2. Dimmer Racks: Listed and labeled by an NRTL; dead-front, front-access, wall-mounted **OR** freestanding, **as directed**, rack for mounting modular dimmers; formed-steel or extruded-aluminum structural members; completely enclosed with steel or aluminum panels. Painted with manufacturer's standard corrosion-resistant primer and finish coats, and having the following features:
 - a. Primary Circuit Breaker: Fault-current withstand rating of the rack; not less than 10,000 **OR** 50,000, **as directed**, A, symmetrical.
 - b. Hinged, locking front door, with openings to allow air intake across the face of all dimmer modules.
 - c. Individual rack sections shall not exceed 84 inches high by 25 inches deep by 30 inches wide (2134 mm high by 635 mm deep by 762 mm wide). Multisection racks shall be interconnected with busbars.
 - d. For each module position, provide support rails and control-pin configurations, constructed for precise alignment of dimmer modules into power and signal connector sockets.
 - e. Forced-air cooling of each rack for maintaining operating temperature at each dimmer, assuming full load, in ambient temperature not to exceed 40 deg C. Exhaust rates shall be variable, using temperature sensors and fan-speed control electronics. Individual control of multiple fans is acceptable in lieu of fan-speed control. Fan(s) shall start and stop automatically. Fan noise at full load shall be less than 3.1 sones.
 - f. Each rack shall have an automatic air-temperature sensor to shut off all dimmers in the rack should the internal temperature rise above maximum safe operating limits. In an



- overheat condition, the fan shall continue operating. When a safe operating temperature is restored, the system shall automatically reset to allow normal user control.
- g. Fabricate and test dimmer racks to withstand seismic forces defined in Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
3. Dimmers: Modular solid-state units that operate smoothly over their operating ranges without audible lamp noise or radio-frequency interference at any setting. Modules shall be dead-front, draw-out type with floating line, load, and control sockets for smooth insertion and withdrawal; with load-side thermal-magnetic circuit breaker, speed-controlled cooling fan, and overtemperature sensor.
- a. Non-Dim Units: On-off relay control only. Capable of serving inductive loads such as motors or high-intensity-discharge fixtures.
- b. Surge Protection: Modules shall withstand power-line surges of 6000 V/3000 A according to IEEE C62.41.1 and IEEE C62.41.2.
- c. Filter each dimmed circuit to provide a minimum 350-mic.sec., current-rise time at a 90-degree conduction angle at 50 percent of rated dimmer capacity. At any load within rating, rate of current rise shall not exceed 30 mA/mic.sec., measured from 10 to 90 percent of load current waveform.
4. Control System: Microprocessor-based control system, ANSI E1.11 (USITT DMX512-A) protocol, with a nonvolatile system memory to adjust dimmer channel settings for different scenes, to patch dimmers to channels, and to manually or automatically change dimmer settings from one preset scene to another.
- a. Control shall support Ethernet-based LAN at every control device.
- b. Provide means to create and monitor show data on a PC using software by console manufacturer. Software shall be capable of the following:
- 1) Creating show and providing for use of USITT show files.
 - 2) Playing back show in a console-simulation mode.
 - 3) Accessing all remote-control stations associated with the console and control system.
 - 4) Providing standard Ethernet connection between the console control system and the PC.
- c. Display the following system status information on a color, 17-inch (430-mm) LCD monitor associated with the control console:
- 1) Current channel intensities.
 - 2) Cue information.
 - 3) Monitor.
- d. Moving Lights: Include a standard control library, a program patch specific to fixture(s) provided, and selective programming with ANSI E1-11 (USITT DMX512-A) addressing of fade, focus points, beam, image, color, <Insert attributes> and position.
5. Control Console: Tabletop unit with manual and computer-based programming controls, memory units, indicating devices, and the following features:
- a. Servicing access through hinged top panel.
 - b. Grand-master level control.
 - c. Blackout switch.
 - d. 12 submaster level controls with overlapping pile-on performance.
OR
24 submaster level controls with overlapping pile-on performance.
 - e. Bump buttons for momentary control of channels or submasters, one for each submaster level control.
 - f. Two cross-fade controls for split dipless fade between scenes, each with its own fade progress indicator.
 - g. One set of scene level controls for each scene when used in two-scene preset mode. Second set of scene level controls to allow setting levels into memory for expanded single scenes when used in multiple single-channel scene mode. Each set shall have same quantity of scene level controls as is used for submaster level controls.
 - h. Multibutton keypad for programming in multiscene memory mode.



- i. Fade time control for assigning fade time to cues, with individual cue adjustment from one second to five minutes, minimum.
 - j. Light-emitting diode **OR** LCD **OR** Computer monitor cathode-ray tube, **as directed**, with associated display controls, for displaying operating menus and memory readout.
 - k. Controls for setting levels into memory.
 - l. Cord and connector for connecting console to outlets for console power and control.
6. System Operation: Selectable between multichannel two-scene preset and four-channel single-scene memory. Console features include electronic patching of control signals for up to 512 dimmers and off-line data storage using internal, 3-1/2-inch (90-mm) disk-drive unit. Operational capability includes the following:
- a. Live and blind programming.
 - b. Special effects programmability for automatic operation of lights in pulsating, sequential dimming and brightening, and other special operating modes. Special effects menu displays operator guidance for programming and individual step levels.
 - c. Signal from fire-alarm control panel that automatically brings selected circuits to fully on or fully bright condition, overriding normal dimming and on-off controls.
 - d. Inserting cues between designated cues without renumbering.
 - e. Out-of-sequence playback of cues.
 - f. Controlling houselights and stage lights from console by assigning their dimmers or non-dim on-off controls to a channel.
 - g. Retaining programmed cues in memory for minimum of one year after power outage.
 - h. Automatic sequential execution of programmed cues.
 - i. Printing cues using parallel or serial printer port, cable, and printer. Cable and printer are not included with this system.
7. PC: Standard, unmodified, with accessories and peripherals that are configured to install and run control-console manufacturer's written requirements, but not less than the following:
- a. CPU operating speed shall be at least 1.6 GHz.
 - b. Memory: 1024 MB.
 - c. Serial Ports: Provide two for general use.
 - d. Parallel Port: Enhanced.
 - e. LAN Adapter: 10/100/1000 Mbps, internal network interface card.
 - f. Three USB 2.0 ports.
 - g. Sound Card: For playback and recording of digital WAV sound files that are associated with audible warning and alarm functions.
 - h. Color Monitor: Not less than 17 inches (430 mm), with a minimum resolution of 1280 by 1024 pixels, noninterlaced, and a maximum dot pitch of 0.28 mm. Video card shall support at least 256 colors at a resolution of 1280 by 1024 pixels at a minimum refresh rate of 70 Hz.
 - i. Keyboard: With a minimum of 64 characters; standard ASCII character set based on ANSI INCITS 154 (formerly ANSI X3.154).
 - j. Mouse: Standard, compatible with installed software.
 - k. Disk storage shall include the following, each with appropriate controller:
 - 1) Minimum 60 GB hard disk, 5400 rpm.
 - 2) Floppy Disk Drive: High density, 3-1/2-inch (90-mm) size.
 - 3) **<Insert disk drives>**.
 - l. CD-ROM Drive: 24x/10x/24x CD-RW/8x DVD combination.
8. Console Power and Control Outlets: Multiple receptacles matched to connector on console connector cord.
9. House Lighting Control Station: Architectural-type, multichannel, remote-dimmer-control station with the following features:
- a. System controls designated houselights, stage lights, and other lights.
 - b. Stage lighting controls compatible with dimming and control system.
 - c. Flush mounting.
 - d. Brushed-aluminum wall plate.
 - e. Five **OR** Six, **as directed**, channels, each with slider potentiometer control.



- f. Master-slider potentiometer that controls lights on all channels proportionally from completely dimmed to degree of brightness that corresponds to individual slider positions.
 - g. Fully on switch that turns all channels on at full brightness regardless of slider position.
 - h. Take-control/off switch that places station in control of channels and sets lighting to levels dictated by channel and master-slider controls.
 - i. Legend on face of wall plate that identifies items as "House Lighting Control Station" and identifies functions of each slider and switch position, with slider positions individually graduated from zero to 10.
 - j. Illuminated push buttons for activating preset scenes of house lighting and labeled "Entry" **OR** "Panic" **OR** "Entry" and "Panic," **as directed**.
 - k. Flush wall mounted unless otherwise indicated.
10. Entry Station: Push button activates or deactivates indicating light and presets scene of house lighting control system.
 - a. Light-emitting-diode indicating light illuminates when preset command is executed.
 - b. Labeled "Entry."
 - c. Flush wall mounted unless otherwise indicated.
 11. Key-Entry Station: Key-operated switch controls station to activate or deactivate indicating light and presets scene of lighting control system.
 - a. Light-emitting-diode indicating light illuminates when preset command is executed.
 - b. Labeled "Entry."
 - c. Flush wall mounted unless otherwise indicated.
 12. Emergency Lighting Control Station: Key-operated, **as directed**, push button activates indicating light and brings selected dimmers to fully bright condition, i.e., the "Panic" preset. Operating push button a second time returns dimmers to previous setting.
 - a. Emergency mode indicating light.
 - b. Labeled "Emergency Lights."
 - c. Flush wall mounted unless otherwise indicated.

F. Rigging Components

1. Pipe Clamps: Malleable iron, suitable for clamping fixtures or items to pipe from 3/4 to 2 inches (20 to 51 mm) in OD. Arranged for horizontal rotation of yoke for aiming; equipped with T-bolt to lock alignment.
2. Safety Cables: Heavy-duty, flexible steel; 30-inch (762-mm) nominal length, with spring clip at one end and steel ring at the other end.
3. Cable Grips: Stainless **OR** Galvanized, **as directed**, steel; basket-weave type for supporting stage cables.

1.3 EXECUTION

A. Installation

1. Set permanently mounted items level, plumb, and square with ceilings and walls.
2. Indicated mounting heights are to bottom of unit for suspended items and to center of unit for wall-mounted items.
3. Mount and connect fixtures, and install and connect distribution devices.
 - a. If arrangement is not indicated, install so each fixture, dimmer, house lighting circuit, control channel, and outlet circuit can be operated, and complete system demonstrated, in all operating modes.
 - b. Install safety cables secured to stage rigging or gridiron for all pipe-mounted electrical fixtures and equipment.
4. Dimmer Rack Mounting: Install and anchor dimmer racks level on 4-inch- (100-mm-) high concrete base. Comply with requirements for concrete base specified in Division 03 Section "Cast-in-place Concrete".
 - a. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of base.



- b. For dimmer racks, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - d. Install anchor bolts to elevations required for proper attachment to dimmer racks.
5. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration And Seismic Controls For Electrical Systems".

B. Wiring

1. Power Wiring:
 - a. Install wiring as specified in Division 26 Section "Low-voltage Electrical Power Conductors And Cables" for hardwired connections. Install wiring in raceways except cable and plug connections.
 - b. Install power wiring with a separate neutral for each output circuit from main dimmer and for each house and stage lighting circuit.
2. Signaling, Remote-Control, and Power-Limited Circuits:
 - a. Comply with requirements specified in Division 26 Section "Control-voltage Electrical Power Cables" for installation of wiring. Install wiring in raceways except cable and plug connections.
 - b. Comply with the following unless otherwise indicated:
 - 1) Size conductors according to lighting control device manufacturer's written instructions.
 - 2) Select cable insulation, shielding, drain wire, and jacket complying with lighting control device manufacturer's written instructions.
 - 3) Install circuits to eliminate radio-frequency interference and electromagnetic interference.
 - c. Remote-control circuits associated with emergency lighting control shall be installed complying with Class 1 Circuit standards in NFPA 70.
3. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points.
4. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes and in terminal cabinets and equipment enclosures.
5. Remove wall plates and protect devices and assemblies during painting.
6. Support lighting fixtures, distribution components, and accessories as specified in Division 26 Section "Hangers And Supports For Electrical Systems". Equip all pipe-mounted equipment with safety cables that are secured to supporting pipe.
7. Ground equipment according to Division 26 Section "Grounding And Bonding For Electrical Systems".

C. Identification

1. Identify components, power, and control wiring according to Division 26 Section "Identification For Electrical Systems".
2. Label each fixture, lighting outlet, distribution device, and dimmer module with unique designation. Labels on elevated components shall be readable from the floor.

D. Field Quality Control

1. Perform tests and inspections.
2. Tests and Inspections:
 - a. Schedule visual and mechanical inspections and electrical tests with at least seven days' advance notice.
 - b. Visual and Mechanical Tests and Inspections:
 - 1) Inspect each fixture, outlet, module, control, and device for defects, finish failure, corrosion, physical damage, labeling by an NRTL, and nameplate.
 - 2) Exercise and perform operational tests on mechanical parts and operable devices according to manufacturer's written instructions.
 - 3) Check tightness of electrical connections with torque wrench.



- 4) Verify proper protective device settings, fuse types, and ratings.
 - 5) Record results of tests and inspections.
 - c. Electrical Tests: Perform tests according to manufacturer's written instructions.
 - 1) Continuity tests of circuits.
 - 2) Operational Tests: Connect each outlet to a fixture and a dimmer output circuit so each dimmer module, dimmer control and output circuit, outlet, and fixture in a typical operating mode will be sequentially tested. Set and operate controls to demonstrate fixtures, outlets, dimmers, and controls in a sequence that cues and reproduces actual operating functions for a typical system of the size and scope installed. Include operation and control of houselights and stage lights from each control location and station including optional plug-in, control-console outlet locations. Record fixture and outlet assignments, control settings, operations, cues, and observations of performance.
 - d. Test Labeling: After satisfactory completion of tests and inspections, apply a label to tested components indicating test results, date, and responsible organization and individual.
 3. Stage lighting will be considered defective if it does not pass tests and inspections.
 4. Prepare test and inspection reports.
 - a. Prepare a schedule of lighting outlets by number; indicate circuits, dimmers, connected fixtures, and control-channel assignments. Prepare a schedule of control settings and circuit assignments for house control channels. Prepare written reports of tests and observations. Report defective materials, workmanship, and unsatisfactory test results. Include records of repairs and adjustments made.
- E. Adjusting
1. Occupancy Adjustments: When requested within 12 months of date of Final Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

END OF SECTION 26 55 61 00



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Task	Specification	Specification Description
26 56 13 00	01 22 16 00	No Specification Required
26 56 13 00	26 05 26 00b	Overhead Electrical Distribution
26 56 13 00	02 84 16 00a	Exterior Lighting
26 56 19 00	02 84 16 00a	Exterior Lighting
26 56 23 00	01 22 16 00	No Specification Required
26 56 23 00	26 05 26 00b	Overhead Electrical Distribution
26 56 23 00	01 95 26 00a	Interior Lighting
26 56 23 00	02 84 16 00a	Exterior Lighting
26 56 26 00	01 22 16 00	No Specification Required
26 56 26 00	02 84 16 00a	Exterior Lighting
26 56 33 00	01 95 26 00a	Interior Lighting
26 56 33 00	02 84 16 00a	Exterior Lighting
26 56 36 00	02 84 16 00a	Exterior Lighting



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SECTION 26 56 68 00 - SPORTS LIGHTING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for exterior athletic lighting. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes lighting for the following outdoor sports venues:
 - a. Baseball fields.
 - b. Softball fields.
 - c. Football fields.
 - d. Soccer fields.
 - e. Outdoor tennis courts.

C. Definitions

1. CV: Coefficient of variation; a statistical measure of the weighted average of all relevant illumination values for the playing area, expressed as the ratio of the standard deviation for all illuminance values to the mean illuminance value.
2. Delegated-Design Submittals: Documents, including drawings, calculations, and material and product specifications prepared as a responsibility of Contractor to obtain acceptance by the Owner and authorities having jurisdiction.
3. Illuminance: The metric most commonly used to evaluate lighting systems. It is the density of luminous flux, or flow of light, reaching a surface divided by the area of that surface.
 - a. Horizontal Illuminance: Measurement in foot-candles (lux), on a horizontal surface 36 inches (914 mm) above ground unless otherwise indicated.
 - b. Target Illuminance: Average maintained illuminance level, calculated by multiplying initial illuminance by LLF.
 - c. Vertical Illuminance: Measurement in foot-candles (lux), in two **OR** four, **as directed**, directions on a vertical surface, at an elevation coinciding with plane height of horizontal measurements.
4. LC: Lighting Certified.
5. Light Trespass: Light spill into areas and properties outside the playing areas, which is either annoying or unwanted.
6. LLD: Lamp lumen depreciation, which is the decrease in lamp output as the lamp ages.
7. LLF: Light loss factor, which is the product of all factors that contribute to light loss in the system.
8. Luminaire: Complete lighting fixture, including ballast housing if integral.
9. UG: Uniformity gradient; the rate of change of illuminance on the playing field, expressed as a ratio between the illuminances of adjacent measuring points on a uniform grid.

D. Performance Requirements

1. Facility Type: Professional **OR** College **OR** Semiprofessional **OR** Sports club **OR** Amateur league **OR** High school **OR** Training facility **OR** Elementary school **OR** Recreational or social facility, **as directed**.
2. Illumination Criteria:
 - a. Minimum average target illuminance level for each lighted area for each sports venue and for the indicated class of play according to IESNA RP-6.
 - b. CV and maximum-to-minimum uniformity ratios for each lighted area equal to or less than those listed in IESNA RP-6 for the indicated class of play.
 - c. UG levels within each lighted area equal to or less than those listed in IESNA RP-6 for the indicated speed of sport.



3. Illumination Criteria:
 - a. Minimum Average Target Illumination: <Insert value>.
 - b. CV: <Insert value>.
 - c. Maximum-to-Minimum Uniformity Ratio: <Insert value>.
 - d. UG Level: <Insert value>.
4. Illumination Calculations: Computer-analyzed point method complying with IESNA RP-6 to optimize selection, location, and aiming of luminaires.
 - a. Grid Pattern Dimensions: For playing areas of each sport and areas of concern for spill-light control, correlate and reference calculated parameters to the grid areas. Each grid point represents the center of the grid area defined by the length and width of the grid spacing.
 - b. Spill-Light Control: Minimize spill light for each playing area on adjacent and nearby areas.
 - 1) Prevent light trespass on properties near Project as defined by <Insert name(s) of authorities having jurisdiction>.
 - 2) For areas indicated on Drawings as "spill-light critical," limit the level of illuminance directed into the area from any luminaire or group of luminaires, and measured 36 inches (914 mm) above grade to the following:
 - a) Maximum Horizontal Illuminance: 0.25 fc (2.7 lux) **OR** 0.5 fc (5.4 lux) **OR** 0.75 fc (8.1 lux), **as directed**.
 - b) Maximum Vertical Illuminance from the Direction of the Greatest Contribution of Light: 1.0 fc (10.8 lux) **OR** 2.0 fc (21.5 lux) **OR** 3.0 fc (32.3 lux), **as directed**.
 - 3) Calculate the horizontal and vertical illuminance due to spill light for points spaced 20 feet (6 m) apart in areas indicated on Drawings as "spill-light critical," to ensure that design meets the above limits.
 - c. Glare Control: Design illumination for each playing area to minimize direct glare in adjacent and nearby areas.
 - 1) Design source intensity of luminaires that may be observed at an elevation of 60 inches (1524 mm) above finished grade from nearby properties to be less than 12,000 **OR** 20,000 **OR** 30,000, **as directed**, candela when so observed.
 - 2) Design source intensity of luminaires that may be observed at an elevation of 60 inches (1524 mm) above finished grade from designated "spill-light critical" areas to be less than 12,000 **OR** 20,000 **OR** 30,000, **as directed**, candela when so observed.
 - d. Determine LLF according to IESNA RP-6 and manufacturer's test data.
 - 1) Use LLD at 100 percent of rated lamp life. LLF shall be applied to initial illumination to ensure that target illumination is achieved at 100 percent of lamp life and shall include consideration of field factor.
 - 2) LLF shall not be higher than 70 percent, and may be lower when determined by manufacturer after application of the ballast output and optical system output according to IESNA RP-6.
 - e. Luminaire Mounting Height: Comply with IESNA RP-6, with consideration for requirements to minimize spill light and glare.
 - f. Luminaire Placement: Luminaire clusters shall be outside the glare zones defined by IESNA RP-6.
5. Baseball Fields:
 - a. IESNA RP-6, Class of Play: I **OR** II **OR** III **OR** IV, **as directed**.
 - b. Speed of Sport: Fast **OR** Moderate **OR** Slow, **as directed**.
 - c. Grid Pattern Dimensions: 30 by 30 feet (9 by 9 m).
6. Softball Fields:
 - a. IESNA RP-6, Class of Play: I **OR** II **OR** III **OR** IV, **as directed**.
 - b. Speed of Sport: Fast **OR** Moderate **OR** Slow, **as directed**.
 - c. Grid Pattern Dimensions: 20 by 20 feet (6 by 6 m).
7. Football Fields:
 - a. IESNA RP-6, Class of Play: I **OR** II **OR** III **OR** IV, **as directed**.



- b. Speed of Sport: Fast **OR** Moderate **OR** Slow, **as directed**.
 - c. Grid Pattern Dimensions: 30 by 30 feet (9 by 9 m).
 8. Soccer Fields:
 - a. IESNA RP-6, Class of Play: I **OR** II **OR** III **OR** IV, **as directed**.
 - b. Speed of Sport: Fast **OR** Moderate **OR** Slow, **as directed**.
 - c. Grid Pattern Dimensions: 30 by 30 feet (9 by 9 m).
 9. Outdoor Tennis Courts:
 - a. IESNA RP-6, Class of Play: I **OR** II **OR** III **OR** IV, **as directed**.
 - b. Speed of Sport: Fast **OR** Moderate **OR** Slow, **as directed**.
 - c. Grid Pattern Dimensions: 10 by 10 feet (3 by 3 m).
 10. Egress Lighting: In case of power failure, provide a minimum of 1.0-fc (10.8-lux) illumination, within 30 seconds, measured at grade in spectator and spectator egress areas.
 - a. Duration of emergency illumination shall be not less than 15 minutes.
 - b. Momentary Power Interruptions: Provide emergency illumination immediately following restoration of power to the lighting circuits. Emergency illumination shall automatically extinguish after 15 minutes.
 11. Lighting Control: Manual, low voltage, or digital; providing the following functions, integrated into a single control station, with multiple subcontrol stations as indicated:
 - a. Control Station: Key-operated master switch, manual push-button controls, and system status indicator lights. Test switch of egress lighting system, **as directed**.
 - b. Light Levels: Two levels of control - 100/50 percent of minimum target illumination.
 12. Electric Power Distribution Requirements:
 - a. Electric Power: 208 **OR** 230 **OR** 480, **as directed**, V; three phase.
 - 1) Include roughing-in of service indicated for nonsports improvements on Project site.
 - 2) Balance load between phases. Install wiring to balance three phases at each support structure.
 - 3) Include required overcurrent protective devices and individual lighting control for each sports field or venue.
 - 4) Include indicated feeder capacity and panelboard provisions for future lighted sports field construction.
 13. Maximum Total Load: **<Insert number> A**.
 - a. Maximum Total Voltage Drop from Source to Load: 5 percent, including voltage drops in branch circuit, subfeeder, and feeder.
 14. Seismic Performance: Luminaires, ballasts, and support structures shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
 15. Life-Cycle Cost Criteria:
 - a. Estimated life-cycle cost of lighting system for period of **<Insert number>** years based on the parameters below:
 - 1) Energy Cost: **<Insert value>** {Calculate energy costs by multiplying (number of luminaires) x (kilowatt demand per luminaire) x (power cost at \$/kilowatts) x (number of annual usage hours) x (number of years)}.
 - 2) Lamp Replacement Cost: **<Insert value>** (Calculate replacement costs by multiplying (cost to replace a lamp) x (number of luminaires) x (number of relamps over the period of years used in calculating the energy cost)).
 - 3) General Maintenance: **<Insert value>** (Calculate maintenance costs by multiplying (number of repairs) x (cost per repair) over the life cycle).

OR

Life-Cycle Cost Criteria: **<Insert value>** (Calculate according to Federal Energy Management Program's "Building Life-Cycle Cost").

E. Submittals

1. Product Data: For each type of lighting product indicated. Include the following:



- a. Lamp life, output, and energy-efficiency data. Lamp data certified by NVLAP or NRTL; comply with IESNA LM-47.
 - b. Photometric data based on laboratory tests of each luminaire type, complete with lamps, ballasts, and accessories; comply with IESNA LM-5.
 - 1) Photometric data shall be certified by a qualified independent testing agency.

OR

 Photometric data shall be certified by manufacturer's laboratory with a current accreditation under the NVLAP for Energy Efficient Lighting Products.
 2. Delegated-Design Submittal: For exterior athletic lighting indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - a. Drawings and specifications for construction of lighting system.
 - b. Manufacturer's determination of LLF used in design calculations.
 - c. Lighting system design calculations for the following:
 - 1) Target illuminance.
 - 2) Point calculations of horizontal and vertical illuminance, CV, and UG at minimum grid size and area.
 - 3) Point calculations of horizontal and vertical illuminance in indicated areas of concern for spill light.
 - 4) Calculations of source intensity of luminaires observed at eye level from indicated properties near the playing fields.
 - d. Electrical system design calculations for the following:
 - 1) Short-circuit current calculations for rating of panelboards.
 - 2) Total connected and estimated peak-demand electrical load, in kilowatts, of lighting system.
 - 3) Capacity of feeder **OR** service, **as directed**, required to supply lighting system.
 - e. Wiring requirements, including required conductors and cables and wiring methods.
 - f. Structural analysis data and calculations used for pole selection.
 - 1) Manufacturer Wind-Load Strength Certification: Submit certification that selected total support system, including poles, complies with AASHTO LTS-4-M for location of Project.
 3. Qualification Data: For qualified Installer, manufacturer, professional engineer, luminaire photometric data testing laboratory and field testing agency.
 4. Seismic Qualification Certificates: For luminaires, accessories, and components, from manufacturer.
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
 5. Manufacturer Certificates: For support structures, including brackets, arms, appurtenances, bases, anchorages, and foundations, from manufacturer.
 6. Welding certificates.
 7. Field quality-control reports.
 8. Operation and Maintenance Data: For sports lighting system components to include in emergency, operation, and maintenance manuals.
 9. Warranty: Sample of special warranty.
- F. Quality Assurance
1. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
 2. Manufacturer Qualifications: Manufacturer's responsibilities include fabricating sports lighting and providing professional engineering services needed to assume engineering responsibility.



- a. Engineering Responsibility: Preparation of delegated-design submittals and comprehensive engineering analysis by a qualified professional engineer who is additionally LC by the National Council on Qualifications for the Lighting Professions, **as directed**.
3. Luminaire Photometric Data Testing Laboratory: By manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.
4. Luminaire Photometric Data Testing Laboratory: By an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL.
5. Field Testing Agency Qualifications: An independent testing agency that is accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products, or an NRTL as defined in 29 CFR 1910, with the experience and capability to conduct field testing according to IESNA LM-5.

OR

Field Testing Agency Qualifications: A qualified independent professional engineer not associated with Contractor or lighting equipment manufacturer, who is additionally LC by the National Council on Qualifications for the Lighting Professions, **as directed**.

6. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel" and AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
7. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of luminaires, lamps, and luminaire alignment products and to correct misalignment that occurs subsequent to successful acceptance tests. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, and unauthorized repairs and alterations from special warranty coverage.
 - a. Luminaire Warranty: Luminaire and luminaire assembly (excluding fuses and lamps) shall be free from defects in materials and workmanship for a period of five years from date of Final Completion.
 - b. Lamp Warranty:
 - 1) Replace lamps and fuses that fail within 12 months from date of Final Completion.
 - 2) Provide replacement lamps for lamps that fail within the second 12 months from date of Final Completion.
 - c. Alignment Warranty: Accuracy of alignment of luminaires shall remain within specified illuminance uniformity ratios for a period of five years from date of successful completion of acceptance tests.
 - 1) Realign luminaires that become misaligned during the warranty period.
 - 2) Replace alignment products that fail within the warranty period.
 - 3) Verify successful realignment of luminaires by retesting as specified in "Field Quality Control" Article.

1.2 PRODUCTS

A. Luminaires, Lamps, And Ballasts

1. Luminaires: Listed and labeled, by an NRTL acceptable to authorities having jurisdiction, for compliance with UL 1598 for installation in wet locations.
 - a. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without using tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent their accidental falling during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lens.
 - b. Exposed Hardware: Stainless-steel latches, fasteners, and hinges.



- c. Spill-Light Control Devices: Internal louvers and external baffles furnished by manufacturer and designed for secure attachment to specific luminaire.
 - d. Luminaires for tennis courts shall be bracket-mounted, full-cutoff type with integral ballasts.
 - e. Lamps for Tennis Court Luminaires: Metal halide, rated 1000 W.
2. Ballast Mounting: Grouped in cabinets, remote from **OR** At, **as directed**, location of associated luminaires unless otherwise indicated.

B. Support Structures

1. Support-Structure Wind-Load Strength: Poles and other support structures, brackets, arms, appurtenances, bases, anchorages, and foundations shall comply with AASHTO LTS-4-M and shall be certified by manufacturers to withstand winds up to 100 mph (160 km/h) without permanent deflection or whipping.
2. Support-Structure Seismic Strength: Poles or other support structures, brackets, arms, appurtenances, bases, anchorages, and foundations shall be designed to prevent separation of components or fracture of poles, luminaire supports, or pole foundations during a seismic event.
3. Mountings, Fasteners, and Appurtenances:
 - a. Corrosion resistant, compatible with support components, and which shall not cause galvanic action at contact points.
 - 1) Steel Components: Hot-dip galvanized after fabrication, complying with ASTM A 123/A 123M.
 - 2) Mounting Hardware Fasteners: Hot-dip galvanized, complying with ASTM A 153/A 153M, or minimum 18-8 grade stainless steel.
 - b. Accommodate attachments and wiring of other indicated systems.
4. Concrete for Pole Foundations: 3000-psi (20.7-MPa), 28-day minimum compressive strength. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-place Concrete".
5. Direct-buried steel structures or poles shall not be used.

C. Power Distribution And Control

1. Wiring Method for Feeders, Subfeeders, Branch Circuits, and Control Wiring: Underground nonmetallic raceway; No. 10 AWG minimum conductor size for power wiring.
2. Overhead-, pole-, or structure-supported wiring and transformers are **OR** are not, **as directed**, permitted.
3. Electrical Enclosures Exposed to Weather: NEMA 250, Type 3R enclosure constructed from stainless steel **OR** corrosion-resistant material, **as directed**, with hinged doors fitted with padlock hasps or lockable latches.

D. Surge Protection

1. Surge Protection: Comply with requirements in Division 26 Section "Transient-voltage Suppression For Low-voltage Electrical Power Circuits" and include surge suppressors with the following requirements:
 - a. Panelboard type.
 - b. Nonmodular, with digital indicator lights and one set of dry contacts, **as directed**.
 - c. Peak Single-Impulse Surge Current Rating: **<Insert number>** kA per phase.

E. Pole And Base Protection

1. Pole Pads: Wraparound pad, with 4 inches (100 mm) of extra-firm polyfoam, 360-degree coverage of ground-mounted poles and supports, continuous hook-and-loop fastening, and not less than 72 inches (1820 mm) high.

1.3 EXECUTION

A. Installation



1. Use web fabric slings (not chain or cable) to raise and set structural members. Protect equipment during installation to prevent corrosion.
 2. Install poles and other structural units level, plumb, and square.
 3. Except for embedded structural members, grout void between pole base and foundation. Use nonshrinking or expanding concrete grout firmly packed in entire void space. Use a short piece of 1/2-inch- (13-mm-) diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole. Nonshrink grout is specified in Division 05 Section "Metal Fabrications".
 4. Install pole pads at all poles inside playing field boundaries and when located within 20 feet (6 m) of the field boundary.
 5. Extend cast-in-place bolted base foundations 36 inches (914 mm) above grade, minimum.
 6. Install protective pipe bollards on two **OR** three, **as directed**, sides of each embedded pole installed in paved areas. See Division 05 Section "Metal Fabrications" for pipe bollards.
 7. Install controls and ballast housings in cabinets mounted on support structure at least 10 feet (3 m) above finished grade.
- B. Field Quality Control
1. Perform tests, inspections, and analysis according to IESNA RP-6 and IESNA LM-5 where applicable.
 2. Tests and Inspections:
 - a. After installing sports lighting system and after electrical circuits have been energized, perform proof-of-performance field measurements and analysis for compliance with requirements.
 - b. Playing and Other Designated Areas: Make field measurements at intersections of grids, dimensioned and located as specified in "Performance Requirements" Article and as described below:
 - 1) Baseball Fields: Measure at least 25 points of the infield and 87 points of the outfield. Extend the grid 15 feet (5 m) outside the foul lines, extending to outfield boundary or fence.
 - 2) Softball Fields: Measure at least 16 points of the infield and 48 points of the outfield. Extend the grid 15 feet (5 m) outside the foul lines, extending to outfield boundary.
 - 3) Football Fields: Lighted area is 180 by 360 feet (55 by 110 m). Measure at least 91 points.
 - 4) Soccer Fields: Lighted area is 210 by 370 feet (64 by 113 m). Measure at least 91 points.
 - 5) Tennis Courts: Measure at least 30 points for a double court.
 - c. Make field measurements at established test points in areas of concern for spill light and glare.
 - d. Perform analysis to demonstrate correlation of field measurements with specified illumination quality and quantity values and corresponding computer-generated values that were submitted with engineered design documents. Submit a report of the analysis. For computer-generated values, use manufacturer's lamp lumens that are adjusted to lamp age at time of field testing.
 3. Correction of Illumination Deficiencies for Playing Areas: Make corrections to illumination quality or quantity, measured in field quality-control tests, that varies from specified illumination criteria by plus or minus 10 percent.
 - a. Add or replace luminaires, or change mounting height, revise aiming, or install louvers, shields, or baffles.
 - b. If luminaires are added or mounting height is changed, revise aiming and recalculate and modify or replace support structures if indicated.
 - c. Do not replace luminaires with units of higher or lower wattage without the Owner's approval.
 - d. Retest as specified above after repairs, adjustments, or replacements are made.
 - e. Report results in writing.



-
4. Correction of Excessive Illumination in Spill-Light-Critical Areas: If measurements indicate that specified limits for spill light are exceeded, make corrections to illumination quantity, measured in field quality-control tests, that reduce levels to within specified maximum values.
 - a. Replace luminaires, or change mounting heights, revise aiming, or install louvers, shields, or baffles.
 - b. Obtain the Owner's approval to replace luminaires with units of higher or lower wattage.
 - c. If mounting height is changed, revise aiming and recalculate and modify or replace support structures if indicated.
 - d. Retest as specified above after repairs, adjustments, or replacements are made.
 - e. Report results in writing.
 5. Sports lighting will be considered defective if it does not pass tests and inspections.
 6. Prepare test and inspection reports.

C. Demonstration

1. Train the Owner's maintenance personnel to adjust, operate, and maintain exterior athletic lighting.

END OF SECTION 26 56 68 00



SECTION 27 05 26 00 - INTERCOMMUNICATIONS AND PROGRAM SYSTEMS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for intercommunications and program systems. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes: Manually switched and Microprocessor-switched intercommunications and program systems with the following components:
 - a. Master stations.
 - b. Speaker-microphone stations.
 - c. Call-switch unit.
 - d. All-call amplifier.
 - e. Intercommunication amplifier.
 - f. Paging amplifier.
 - g. Loudspeakers/speaker microphones.
 - h. Conductors and cables.
 - i. Raceways.

C. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: For intercommunications and program systems. Include plans, elevations, sections, details, and attachments to other work.
 - a. Wiring Diagrams: For power, signal, and control wiring.
 - 1) Identify terminals to facilitate installation, operation, and maintenance.
 - 2) Single-line diagram showing interconnection of components.
 - 3) Cabling diagram showing cable routing.
3. Field quality-control reports.
4. Operation and maintenance data.

D. Quality Assurance

1. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. Comply with NFPA 70.

1.2 PRODUCTS**A. Functional Description Of Manually Switched Systems**

1. Master Station:
 - a. Communicating selectively with other master and speaker-microphone stations by actuating selector switches.
 - b. Communicating simultaneously with all other stations by actuating a single all-call switch.
 - c. Communicating with individual stations in privacy.
 - d. Including other master-station connections in a multiple-station conference call.
 - e. Accessing separate paging speakers or groups of paging speakers by actuating selector switches.
 - f. Overriding any conversation by a designated master station.



2. Speaker-Microphone Station:
 - a. Having privacy from remote monitoring without a warning tone signal at monitored station. Designated speaker-microphone stations have a privacy switch to prevent another station from listening and to permit incoming calls.
 - b. Communicating hands free.
 - c. Calling master station by actuating call switch.
 - d. Returning a busy signal to indicate that station is already in use.
 - e. Being free of noise and distortion during operation and when in standby mode.
 3. Speakers: Free of noise and distortion during operation and when in standby mode.
- B. Functional Description Of Microprocessor-Switched Systems
1. Master Station:
 - a. Communicating selectively with other master and speaker-microphone stations by dialing station's number on a 12-digit keypad.
 - b. Communicating simultaneously with all other stations by dialing a designated number on a 12-digit keypad.
 - c. Communicating with individual stations in privacy.
 - d. Including other master-station connections in a multiple-station conference call.
 - e. Accessing separate paging speakers or groups of paging speakers by dialing designated numbers on a 12-digit keypad.
 - f. Overriding any conversation by a designated master station.
 - g. Displaying selected station.
 2. Speaker-Microphone Station:
 - a. Having privacy from remote monitoring without a warning tone signal at monitored station. Designated speaker-microphone stations have a privacy switch to prevent another station from listening and to permit incoming calls.
 - b. Communicating hands free.
 - c. Calling master station by actuating call switch.
 - d. Returning a busy signal to indicate that station is already in use.
 - e. Being free of noise and distortion during operation and when in standby mode.
 3. Speakers: Free of noise and distortion during operation and when in standby mode.
- C. General Requirements For Equipment And Materials
1. Coordinate features and select components to form an integrated system. Match components and interconnections for optimum performance of specified functions.
 2. Expansion Capability: Increase number of stations in the future by 25 percent above those indicated without adding any internal or external components or main trunk cable conductors.
 3. Equipment: Modular type using solid-state components, fully rated for continuous duty unless otherwise indicated. Select equipment for normal operation on input power usually supplied at 110 to 130 V, 60 Hz.
 4. Weather-Resistant Equipment: Listed and labeled by an NRTL for duty outdoors or in damp locations.
- D. Master Station For Manually Switched Systems
1. Station-Selector and Talk-Listen Switches: Heavy-duty type with gold-plated contacts rated for five million operations.
 2. Volume Control: Regulates incoming-call volume.
 3. LED Annunciation: Identifies calling stations and stations in use. LED remains on until call is answered.
 4. Tone Annunciation: Momentary audible tone signal announces incoming calls.
 5. Speaker Microphone: Transmits and receives calls.
 6. Handset with Hook Switch: Telephone type with 18-inch- (450-mm-) long, permanently coiled cord. Arrange to disconnect speaker when handset is lifted.
 7. Equipment Cabinet: Comply with TIA/EIA-310-D. Lockable, ventilated metal cabinet houses terminal strips, power supplies, amplifiers, system volume control, and auxiliary equipment.



- E. Master Station For Microprocessor-Switched Systems
1. 12-Digit Keypad Selector: Transmits calls to other stations and initiates commands for programming and operation.
 2. Volume Control: Regulates incoming-call volume.
 3. LED Annunciation: Identifies calling stations and stations in use. LED remains on until call is answered.
 4. Tone Annunciation: Momentary audible tone signal announces incoming calls.
 5. Handset with Hook Switch: Telephone type with 18-inch- (450-mm-) long, permanently coiled cord. Arrange to disconnect speaker when handset is lifted.
 6. Reset Control: Cancels call and resets system for next call.
 7. Equipment Cabinet: Comply with TIA/EIA-310-D. Lockable, ventilated metal cabinet houses terminal strips, power supplies, amplifiers, system volume control, and other switching and control devices required for conversation channels and control functions.
- F. Speaker-Microphone Stations
1. Mounting: Flush unless otherwise indicated, and suitable for mounting conditions indicated.
 2. Faceplate: Stainless steel or anodized aluminum with tamperproof mounting screws.
 3. Back Box: Two-gang galvanized steel with 2-1/2-inch (64-mm) minimum depth.
 4. Speaker: 3 inches (76 mm), 2.3 oz. (65 g) minimum; permanent magnet.
 5. Tone Annunciation: Recurring momentary tone indicates incoming calls.
 6. Call Switch: Mount on faceplate. Permits calls to master station.
 7. Privacy Switch: Mount on faceplate. When in on position, switch prevents transmission of sound from remote station to system; when in off position, without further switch manipulation, response can be made to incoming calls.
 8. Handset with Hook Switch: Telephone type with 18-inch- (450-mm-) long, permanently coiled cord. Arrange to disconnect speaker when handset is lifted.
- G. Call-Switch Unit
1. Enclosure: Single-gang box with stainless-steel faceplate.
 2. Call Switch: Momentary contact signals system that a call has been placed.
 3. Privacy Switch: Prevents transmission of sound signals from station to system.
 4. Volume Control: Operated by screwdriver blade through a hole in faceplate to adjust output level of associated speaker.
 5. Handset with Hook Switch: Telephone type with 18-inch- (450-mm-) long, permanently coiled cord. Arrange to disconnect speaker when handset is lifted.
- H. All-Call Amplifier
1. Output Power: 70-V balanced line. 80 percent of the sum of wattage settings of connected for each station and speaker connected in all-call mode of operation, plus an allowance for future stations.
 2. Total Harmonic Distortion: Less than 5 percent at rated output power with load equivalent to quantity of stations connected in all-call mode of operation.
 3. Minimum Signal-to-Noise Ratio: 45 dB, at rated output.
 4. Frequency Response: Within plus or minus 3 dB from 70 to 12,000 Hz.
 5. Output Regulation: Maintains output level within 2 dB from full to no load.
 6. Input Sensitivity: Compatible with master stations and central equipment so amplifier delivers full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on master stations, speaker microphones, or handset transmitters.
 7. Amplifier Protection: Prevents damage from shorted or open output.
- I. Intercommunication Amplifier
1. Minimum Output Power: 2 W; adequate for all functions.
 2. Total Harmonic Distortion: Less than 5 percent at rated output power with load equivalent to one station connected to output terminals.
 3. Minimum Signal-to-Noise Ratio: 45 dB, at rated output.
 4. Frequency Response: Within plus or minus 3 dB from 70 to 10,000 Hz.



5. Output Regulation: Maintains output level within 2 dB from full to no load.
 6. Input Sensitivity: Matched to input circuit and to provide full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on master stations, speaker microphones, or handset transmitters.
 7. Amplifier Protection: Prevents damage from shorted or open output.
- J. Paging Amplifier
1. Input Voltage: 120-V ac, 60 Hz.
 2. Frequency Response: Within plus or minus 3 dB from 60 to 10,000 Hz.
 3. Minimum Signal-to-Noise Ratio: 60 dB, at rated output.
 4. Total Harmonic Distortion: Less than 3 percent at rated power output from 70 to 12,000 Hz.
 5. Output Regulation: Less than 2 dB from full to no load.
 6. Controls: On-off, input levels, and low-cut filter.
 7. Input Sensitivity: Matched to input circuit and to provide full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on speaker microphones or handset transmitters.
 8. Amplifier Protection: Prevents damage from shorted or open output.
 9. Output Circuit: 70-V line.
- K. Cone-Type Loudspeakers/Speaker Microphones
1. Minimum Axial Sensitivity: 91 dB at one meter, with 1-W input.
 2. Frequency Response: Within plus or minus 3 dB from 70 to 15,000 Hz.
 3. Minimum Dispersion Angle: 100 degrees.
 4. Line Transformer: Maximum insertion loss of 0.5 dB, power rating equal to speaker's, and at least four level taps.
 5. Enclosures: Steel housings or back boxes, acoustically dampened, with front face of at least 0.0478-inch (1.2-mm) steel and whole assembly rust proofed and factory primed; complete with mounting assembly and suitable for surface ceiling, flush ceiling, pendant or wall mounting; with relief of back pressure.
 6. Baffle: For flush speakers, minimum thickness of 0.032-inch (0.8-mm) aluminum brushed to a satin sheen and lacquered **OR** with textured white finish, **as directed**.
 7. Vandal-Proof, High-Strength Baffle: For flush **OR** surface, **as directed**, -mounted speakers, self-aging cast aluminum with tensile strength of 44,000 psi (303 MN/sq. m), 0.025-inch (0.65-mm) minimum thickness; countersunk heat-treated alloy mounting screws; and textured white epoxy finish.
 8. Size: 8 inches (200 mm) with 1-inch (25-mm) voice coil and minimum 5-oz. (140-g) ceramic magnet.
- L. Horn-Type Loudspeakers/Speaker Microphones
1. Speakers shall be all-metal, weatherproof construction; complete with universal mounting brackets.
 2. Frequency Response: Within plus or minus 3 dB from 275 to 14,000 Hz.
 3. Minimum Power Rating of Driver: 15 W, continuous.
 4. Minimum Dispersion Angle: 110 degrees.
 5. Line Transformer: Maximum insertion loss of 0.5 dB, power rating equal to speaker's, and at least four level taps.
- M. Horn-Type Explosion-Proof Loudspeakers
1. Speakers shall be all-metal construction; complete with universal mounting brackets.
 2. Units in Hazardous (Classified) Locations: Listed and labeled for environment in which they are located.
 3. Frequency Response: Within plus or minus 3 dB from 300 to 12,000 Hz.
 4. Minimum Power Rating of Driver: 30 **OR** 60, **as directed**, W, continuous.
 5. Minimum Dispersion Angle: 95 **OR** 60 by 120, **as directed**, degrees.
 6. Line Transformer: Internally mounted and factory installed, power rating equal to speaker's, and at least four level taps.



N. Conductors And Cables

1. Conductors: Jacketed, twisted pair and twisted multipair, untinned solid copper. Sizes as recommended by system manufacturer, but no smaller than No. 22 AWG.
2. Insulation: Thermoplastic, not less than 1/32 inch (0.8 mm) thick.
3. Shielding: For speaker-microphone leads and elsewhere where recommended by manufacturer; No. 34 AWG, tinned, soft-copper strands formed into a braid or equivalent foil.
 - a. Minimum Shielding Coverage on Conductors: 60 percent.
4. Plenum Cable: Listed and labeled for plenum installation.

O. Raceways

1. Intercommunication and Program System Raceways and Boxes: Comply with requirements in Division 26 Section "Raceway And Boxes For Electrical Systems".
2. Intercommunication and Program System Raceways and Boxes: Same as required for electrical branch circuits specified in Division 26 Section "Raceway And Boxes For Electrical Systems".
3. Intercommunication and Program System Raceways and Boxes: EMT **OR** ENT **OR** RNC **OR** Optical-fiber/communication raceways and fittings **OR** Metal wireways **OR** Nonmetal wireways **OR** Surface metal raceways **OR** Surface nonmetal raceways, **as directed**.
4. Outlet boxes shall be not less than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.
5. Flexible metal conduit is prohibited.

1.3 EXECUTION

A. Wiring Methods

1. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters, and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces.
 - a. Install plenum cable in environmental air spaces, including plenum ceilings.
 - b. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceway And Boxes For Electrical Systems".
2. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
3. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

B. Installation Of Raceways

1. Comply with requirements in Division 26 Section "Raceway And Boxes For Electrical Systems" for installation of conduits and wireways.
2. Install manufactured conduit sweeps and long-radius elbows whenever possible.

C. Installation Of Cables

1. Comply with NECA 1.
2. General Requirements:
 - a. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at outlets and terminals.
 - b. Splices, Taps, and Terminations: Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Cables may not be spliced.
 - c. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 - d. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.



- e. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
 - f. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used.
3. Open-Cable Installation:
 - a. Install cabling with horizontal and vertical cable guides in telecommunication spaces with terminating hardware and interconnection equipment.
 - b. Suspend speaker cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceiling by cable supports not more than 60 inches (1524 mm) apart.
 - c. Cable shall not be run through structural members or be in contact with pipes, ducts, or other potentially damaging items.
 4. Separation of Wires: Separate speaker-microphone, line-level, speaker-level, and power wiring runs. Install in separate raceways or, where exposed or in same enclosure, separate conductors at least 12 inches (300 mm) apart for speaker microphones and adjacent parallel power and telephone wiring. Separate other intercommunication equipment conductors as recommended by equipment manufacturer.
- D. Installation
1. Match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.
 2. Identification of Conductors and Cables: Color-code conductors and apply wire and cable marking tape to designate wires and cables so they identify media in coordination with system wiring diagrams.
 3. Weatherproof Equipment: For units that are mounted outdoors, in damp locations, or where exposed to weather, install consistent with requirements of weatherproof rating.
 4. Speaker-Line Matching Transformer Connections: Make initial connections using tap settings indicated on Drawings.
 5. Connect wiring according to Division 26 Section "Grounding And Bonding For Electrical Systems".
- E. Grounding
1. Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
 2. Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding.
 3. Install grounding electrodes as specified in Division 26 Section "Grounding And Bonding For Electrical Systems".
- F. System Programming
1. Programming: Fully brief the Owner on available programming options. Record the Owner's decisions and set up initial system program. Prepare a written record of decisions, implementation methodology, and final results.
- G. Field Quality Control
1. Perform tests and inspections.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
 2. Tests and Inspections:
 - a. Schedule tests with at least seven days' advance notice of test performance.
 - b. After installing intercommunications and program systems and after electrical circuitry has been energized, test for compliance with requirements.
 - c. Operational Test: Test originating station-to-station, all-call, and page messages at each intercommunication station. Verify proper routing and volume levels and that system is



- free of noise and distortion. Test each available message path from each station on system.
- d. Frequency Response Test: Determine frequency response of two transmission paths, including all-call and paging, by transmitting and recording audio tones. Minimum acceptable performance is within 3 dB from 150 to 2500 Hz.
 - e. Signal-to-Noise Ratio Test: Measure signal-to-noise ratio of complete system at normal gain settings as follows:
 - 1) Disconnect speaker microphone and replace it in the circuit with a signal generator using a 1000-Hz signal. Measure signal-to-noise ratio at speakers or paging speakers.
 - 2) Repeat test for four speaker microphones and for each separately controlled zone of paging loudspeakers.
 - 3) Minimum acceptable ratio is 35 dB.
 - f. Distortion Test: Measure distortion at normal gain settings and rated power. Feed signals at frequencies of 150, 200, 400, 1000, and 2500 Hz into each paging and all-call amplifier, and a minimum of two selected intercommunication amplifiers. For each frequency, measure distortion in the paging and all-call amplifier outputs. Maximum acceptable distortion at any frequency is 5 percent total harmonics.
 - g. Acoustic Coverage Test: Feed pink noise into system using octaves centered at 500 and 4000 Hz. Use sound-level meter with octave-band filters to measure level at three locations in each paging zone. Maximum permissible variation in level is plus or minus 3 dB; in levels between adjacent zones, plus or minus 5 dB.
 - h. Power Output Test: Measure electrical power output of each paging amplifier at normal gain settings of 150, 1000, and 2500 Hz. Maximum variation in power output at these frequencies is plus or minus 3 dB.
 - i. Signal Ground Test: Measure and report ground resistance at system signal ground. Comply with testing requirements in Division 26 Section "Grounding And Bonding For Electrical Systems".
3. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified. Prepare a list of final tap settings of paging speaker-line matching transformers.
 4. Intercommunications and program systems will be considered defective if they do not pass tests and inspections.
 5. Prepare test and inspection reports.

END OF SECTION 27 05 26 00



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Task	Specification	Specification Description
27 11 16 00	27 05 26 00	Intercommunications and Program Systems



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SECTION 27 11 19 00 - LOOSE-TUBE GEL-FILLED FIBER OPTIC CABLES

GENERAL

Description Of Work

1. This specification covers the furnishing and installation of loose-tube gel-filled fiber optic cables. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

Shop Drawings And Samples

2. The following shall be submitted:
 - a. Complete bill of materials.
 - b. Drawings indicating the locations of all pull boxes with station numbers.
 - c. Catalog data on all testing devices proposed for use plus certifications of accuracy, calibration, and traceability to standards of the National Institute for Standards and Testing.
 - d. Cable pulling calculations for all conduit runs. Indicate on the submittal any additional pull boxes that are required, including station number and a written description, of the location.
 - e. A cable pulling and splicing work plan shall be submitted a minimum of 45 days prior to the planned initiation of cable pulling. The pulling plan and pull tension calculations may be prepared by using a software program such as Pull-Planner 2000 by American Polywater Corporation. The cable pulling and splicing work plan must be approved a minimum of 15 days prior to pulling cable. Work plan shall include the following:
 - 1) Pull tension calculations
 - 2) Calculated amount of lubrication required
 - 3) Detailed description of pull operation methods for all conduit runs

Quality Assurance

3. All work described in this section shall meet or exceed the applicable provisions of the following documents:
 - a. ANSI C8.471983, American National Standard for Polyolefin Insulated Thermoplastic Jacketed Communication Cables.
 - b. EIA-455 (addendum 1 through 5) Standard Test Procedures for Fiber Optics, Cables, Transducers, Connecting and Terminating Devices.
 - c. EIA-455-27A, Method of Measuring (Uncoated) Diameter of Optical Waveguide Fibers.
 - d. EIA-455-28A, Method For Measuring Tensile Failure Point of Optical Waveguide Fibers.
 - e. EIA-455-34, Interconnection Device Insertion Loss Test.
 - f. EIA-455-89, Fiber Optic Cable Jacket Elongation and Tensile Strength.

Warranty

4. The Contractor shall provide an unconditional warranty on all installed cable for a minimum period of two (2) years.

PRODUCTS

Materials

5. Fiber Optic Cable - 24 strand
 - a. Cable type: Outdoor Plant Stranded Loose-Tube, Gel-Filled Fiber Optic Cable, Corning Altos 024RW4-14101A20 or Lucent Lightpack 7D1X-024-BXD.
 - b. Number of fibers: 24 fibers.
 - c. Buffer Tubes: All optical fibers shall be placed inside a loose buffer tube. The optical cable shall contain three buffer tubes, numbered 1, 2, and 3. The tubes shall be color coded according to the table below:



Buffer Tube Number	Buffer Tube Color
1	Blue
2	Orange
3	Green

- d. Each buffer tube shall contain 8 singlemode fibers. Each fiber shall be numbered and distinguishable by means of the color coding established in the main body of the specification.
 - e. The colors of the individual fibers shall be stable across the specified storage and operating temperature range and not subject to fading or smearing onto each other or into the gel filling material. Colors shall not cause fibers to stick together.
 - f. The fibers shall not adhere to the inside walls of the loose buffer tube. Buffer tubes shall be kink resistant within the specified minimum bend radius.
 - g. Filler may be included in the cable core composition to lend symmetry to the cable cross-section where needed.
 - h. A central anti-buckling member shall be included into the cable to prevent buckling of the cable. The anti-buckling member shall be composed of a glass reinforced plastic rod.
 - i. Each buffer tube shall be filled with a non-hygroscopic, non-nutritive to fungus, electrically non-conductive, homogenous gel. The gel shall be free from dirt and foreign matter. The gel shall be readily removable with conventional nontoxic solvents.
 - j. Buffer tubes shall be stranded around a central member using the reverse oscillation, or "S-Z", stranding process.
 - k. The cable core shall contain a water-blocking material. The water blocking material shall be non-nutritive to fungus, electrically non-conductive and homogenous. It shall also be free from dirt and foreign matter and shall be readily removable with conventional nontoxic solvents.
 - l. Binders shall be applied with sufficient tension to secure the buffer tubes to the member without crushing the buffer tubes. The binders shall be non-hygroscopic, non-wicking and dialectic with low shrinkage.
 - m. Tensile strength shall be provided by a combination of high tensile strength dielectric yarns. The high tensile strength dielectric yarns shall be helically stranded evenly around the cable core.
 - n. The all-dielectric cable shall be sheathed with medium density polyethylene (MDPE). The minimum nominal jacket thickness shall be 1.4 mm. Jacketing material shall be applied directly over the tensile strength members and water blocking material. The jacket or sheath shall be free of holes, splits, and blisters. The cable jacket shall contain no metallic elements and shall be of a consistent thickness.
 - o. The cable shall contain at least one ripcord under the sheath for easy sheath removal.
6. Fiber Optic Cable - 36 Strand
- a. Cable type: Outdoor Plant Stranded Loose-Tube, Gel-Filled Fiber Optic Cable, Corning Altos 036RW4-14101A20 or Lucent Lightpack 7D1X-036-BXD.
 - b. Number of fibers: 36 fibers.
 - c. Buffer Tubes: All optical fibers shall be placed inside a loose buffer tube. The optical cable shall contain three buffer tubes, numbered 1, 2, and 3. The tubes shall be color coded according to the table below:

Buffer Tube Number	Buffer Tube Color
1	Blue
2	Orange
3	Green

- d. Each buffer tube shall contain 12 single mode fibers. Each fiber shall be numbered and distinguishable by means of the color coding established in the main body of the specification.



- e. The colors of the individual fibers shall be stable across the specified storage and operating temperature range and not subject to fading or smearing onto each other or into the gel filling material. Colors shall not cause fibers to stick together.
 - f. The fibers shall not adhere to the inside walls of the loose buffer tube. Buffer tubes shall be kink resistant within the specified minimum bend radius.
 - g. Filler may be included in the cable core composition to lend symmetry to the cable cross-section where needed.
 - h. A central anti-buckling member shall be included into the cable to prevent buckling of the cable. The anti-buckling member shall be composed of a glass reinforced plastic rod.
 - i. Each buffer tube shall be filled with a non-hygroscopic, non-nutritive to fungus, electrically non-conductive, homogenous gel. The gel shall be free from dirt and foreign matter. The gel shall be readily removable with conventional nontoxic solvents.
 - j. Buffer tubes shall be stranded around a central member using the reverse oscillation, or "S-Z", stranding process.
 - k. The cable core shall contain a water-blocking material. The water blocking material shall be non-nutritive to fungus, electrically non-conductive and homogenous. It shall also be free from dirt and foreign matter and shall be readily removable with conventional nontoxic solvents.
 - l. Binders shall be applied with sufficient tension to secure the buffer tubes to the member without crushing the buffer tubes. The binders shall be non-hygroscopic, non-wicking and dielectric with low shrinkage.
 - m. Tensile strength shall be provided by a combination of high tensile strength dielectric yarns. The high tensile strength dielectric yarns shall be helically stranded evenly around the cable core.
 - n. The all-dielectric cable shall be sheathed with medium density polyethylene (MDPE). The minimum nominal jacket thickness shall be 1.4 mm. Jacketing material shall be applied directly over the tensile strength members and water blocking material. The jacket or sheath shall be free of holes, splits, and blisters. The cable jacket shall contain no metallic elements and shall be of a consistent thickness.
 - o. The cable shall contain at least one ripcord under the sheath for easy sheath removal.
7. Fan-Out Termination for Loose Tube Cables
- a. Individual fibers within the loose tube cable require handling protection inside the termination cabinets. Fan-out kits shall be installed in the patch panel enclosures to transition the loose tube fibers to ruggedized tight-buffered fiber pigtail cables. Fan-out tubes or furcation kits shall not be used. Optical fusion splices shall connect the loose tube fibers to the tight-buffered pigtail cables. The optical splice loss shall comply with the specifications for optical splices. Splice protection sleeves shall be employed on all splices to protect the splices. A wall-mountable splice center shall house the splices and serve to fully protect excess lengths of loose tube fibers from exposure.
 - b. The tight-buffered pigtails shall be terminated with ST connectors as specified.
8. Fan-out Pigtail Cable Specifications
- a. Singlemode fiber (Corning SMF-28) shall be used in the pigtails. Optical characteristics shall comply with the optical fiber performance specifications.

Buffer material	Thermoplastic
Buffer O.D.	900 um
Strength Member	Kevlar
Jacket Material	PVC
Jacket O.D.	3.0 mm
Temperature Range	-20 to +70 C

9. Fiber Optic Termination Patch Panels:
- a. Where shown on the plans or in the Appendix, the fiber optic cable shall terminate inside a communications cabinet on a termination patch panel. All fiber sub-cables within the cable shall be terminated with "ST™ compatible" connectors. The patch panel shall have a 24-fiber capacity, and shall facilitate fiber-optic cable cross-connection between outside plant



- cables and opto-electronic interface equipment cabling. The patch panel shall contain "STTM" type bayonet couplings. All unused couplings shall have protective dust covers. Factory-terminated, tight-buffered, aramid-reinforced fiber optic jumper assemblies or interconnect cables, standard 3.0-mm O.D., shall connect the optical cable terminations to the patch panel couplings.
- b. The termination panel shall be equipped with a suitable means for routing and securing of cables and shall provide a suitable means of protection for the mounted fiber connectors, to prevent damage to fibers and connectors during all regular operation and maintenance functions. Bend diameters on cable fibers and jumpers must be greater than four (4) inches at all times to ensure optical and mechanical integrity of the optical fibers.
10. Optical Connectors
- a. All connectors shall be field-installable and perfectly matched to the cable used. The connectors shall provide tight fitting termination, to the cladding and buffer coating. Epoxy-based or "hot melt" adhesives shall be used to bond the fiber and buffer to the connector ferrule and body prior to polishing the end face. No dry-termination or "quick crimp" connectors are allowed.
 - b. After termination with connectors, the fiber ends must be visually inspected at a magnification of not less than 100 power to check for cracks or pits in the end face of the fiber. If any irregularities found cannot be removed by further polishing, the entire process must be redone by cutting off and disposing the connector body.
 - c. Connectors shall have a maximum allowable connection loss of 0.3 dB per mated pair, as measured per EIA-455-34. No index-matching gel is to be used, dry interfaces only. Singlemode connectors shall be capable of field installation on 9/125 micron fibers with 900 micron buffers (OD).
 - d. Each connector shall be of the industry standard ST type compatible, designed for singlemode tolerances, and shall meet or exceed the applicable provisions of EIA-455-5, 455-2A, and 455-34, and shall be capable of 100 repeated matings with a maximum loss increase of 0.1 dB. Connectors shall incorporate a key-way design and shall have a zirconia ceramic ferrule. Connector bodies and couplings shall be made of corrosion-resistant and oxidation-resistant materials, such as nickel plated zinc, designed to operate in humid environments without degradation of surface finishes.
11. Splice Closures:
- a. Splice closures shall be of the re-enterable type, with an external moisture-proof shell, inner closure and encapsulant.
 - b. Closure shall have removable interior splice trays.
 - c. Closures shall be Corning Cable Systems (Sicor) type SCN or equal.

EXECUTION

Fiber Optic Cable Installation

12. General:
- a. The Contractor shall determine a suitable cable installation method to ensure that all cable installation requirements shall be met in all conduit sections. All work shall be carried out in accordance and consistent with the highest standards of quality and craftsmanship in the communication industry with regard to the electrical and mechanical integrity of the connections; the finished appearance of the installation; as well as the accuracy and completeness of the documentation.
 - b. The Contractor shall make a physical survey of the project site for the purpose of establishing the exact cable routing and cutting lengths prior to the commencement of any work or committing any materials.
 - c. The cable shall be carefully inspected for jacket defects as it is removed from the reel. If defects are noticed, the pulling operation shall be terminated immediately and the the Owner notified.



- d. Precautions shall be taken during installation to prevent the cable from being kinked or crushed. Crushed or kinked cable shall be replaced with new cable. As the cable is pulled into the conduit system, it shall be sufficiently lubricated with a lubricant that shall be the water-based type and approved by the cable manufacturer. Lubricant shall be applied at a rate to provide a continuous 10-mil coating, as recommended by the manufacturer. Lubricant shall be Polywater F® manufactured by American Polywater, or approved equivalent.
 - e. The mechanical stress placed upon the cable during installation shall not be such that the cable is twisted and stretched or exceeds manufacturer's specifications.
 - f. The pulling of the cable shall be hand assisted at each handhole or pullbox. When pulling through intermediate pullboxes, the cable shall be placed on the ground near the pullbox and care taken to prevent damage by vehicles or other objects. The cable shall not be crushed, kinked or forced around a sharp corner. A minimum of 3 foot slack shall be left in each pullbox and enough left at each end of the cable to allow proper cable termination.
13. Fiber optic cables shall be installed in continuous lengths without intermediate splices throughout the project. Cable installation personnel shall be familiar with the manufacturer's recommended procedures including, but not limited to the following:
- a. Proper attachment to the cable strength elements for pulling during installation. Depending on cable design, this will involve direct attachment to internal strength members or attaching an external "Kellums" or split mesh grip using a 600 lb breakaway swivel.
 - b. Cable tensile limitations and tension monitoring procedures.
 - c. Cable bending radius limitations.
 - d. Cable twisting limitations.
14. The Contractor shall comply with the cable manufacturer's recommended installation procedures at all times. Cable installation procedures shall conform to Belcore guidelines.
15. To accommodate long continuous installation lengths, bi-directional "center pull" techniques for pulling of the fiber optic cable is acceptable and shall be implemented as follows:
- a. From the midpoint, pull the fiber optic cable into the conduit from the shipping reel in accordance with the manufacturer's specifications.
 - b. When this portion of the pull is complete, the remainder of the cable must be removed from the reel to make the inside end available for pulling in the opposite direction.
 - c. This is accomplished by hand pulling the cable from the reel and laying into large "figure eight" loops on the ground.
 - d. The purpose of the figure eight pattern is to avoid cable tangling and kinking.
 - e. The loops shall be laid carefully one upon the other (to prevent subsequent tangling) and shall be in a protected area.
 - f. The inside reel end of the cable is then available for installation.
 - g. In some cases, it may be necessary to set up a winch at an intermediate cable vault.
 - h. The required length of cable shall be pulled to that point, and brought out of the cable vault and coiled into a figure eight.
 - i. The figure eight is then turned over to gain access to the free cable end. This can then be reinserted into the duct system for installation into the next section.
16. At pullboxes, the Contractor shall provide 30 feet of cable slack. The fiber optic cable shall be coiled and secured with cable ties in the pullbox. The Contractor shall ensure that the minimum bending radius of the fiber optic cable is not compromised when preparing this stored cable slack.
17. The pulling eye/sheath termination hardware on the fiber optic cables shall not be pulled over any sheave blocks.
18. When power equipment is used to install fiber optic cabling, the pulling speed shall not exceed 30 meters per minute. The pulling tension, bending radius and twist limitation for fiber optic cable shall not be exceeded under any circumstances.
19. Large diameter wheels, pulling sheaves, and cable guides shall be used to maintain the appropriate bending radius. Tension monitoring shall be accomplished using commercial dynamometers or loadcell instruments.
- a. All pulls shall be documented by a graph which is annotated with the following information:
 - 1) Reel number
 - 2) Station from and station to



- 3) Date and tune
- 4) Explanations of abnormalities in readings or interruptions
- 5) Sign-off by Contractor and the Owner
- b. Under no conditions shall the FOC be left exposed or unattended.
20. Repairs: Repair of cable jacket will not be permitted. Jacket damage will require removal and re-installation of a new cable run at the Contractor's expense.
21. Splicing:
 - a. Splicing of fiber optic cable shall not be permitted except in emergency conditions or as specified on the plans or in the special conditions for a specified project. Fiber optic cable runs and required looping of the cable shall be provided in one continuous length. When splicing is authorized by the the Owner, splicing shall be by trained, authorized persons only. Any allowed splicing of fiber optic cable shall be by fusion splice only, no mechanical splices are permitted.
 - b. All fusion splicing equipment shall be in good working order, properly calibrated, and meeting all industry standards and safety regulations. Cable preparation, closure installation and splicing shall be accomplished in accordance with accepted and approved industry standards.
 - c. Spices shall be made in pullboxes and shall use re-enterable splice closures.
 - d. The average splice loss shall be 0.1 dB or less per splice. The average splice loss is defined as the summation of the loss as measured in both directions using an optical time domain reflectometer (OTDR) through the fusion splice, divided by two. No individual splice loss measured in a single direction shall exceed 0.15 dB.
 - e. Upon completion of the splicing operation, all waste material shall be deposited in suitable containers, removed from the job site, arid disposed of in an environmentally acceptable manner.
22. After the cables are installed and spliced, they shall be racked and all conduits sealed. A minimum of 30 feet of FOC shall be stored at each end of one splice. Racking shall conform to the following:
 - a. Cables shall be loosely secured in racked position with Ty-Raps or equal.
 - b. Imprinted plastic coated cloth identification/warning tags shall be securely attached to the cables in at least two locations in each handhole. Tags shall be by Brady or Thomas & Betts.
 - c. All coiled cable shall be suitably protected to prevent damage to the cable and fibers. Racking shall include securing cables to brackets and racking hardware that extend from the sidewalls of the handhole.
 - d. When all cables at each handhole are securely racked, unused conduits and void areas around conduit containing cables shall be sealed.

Cable Protection During Installation

23. All fiber optic cable shall be pulled in conduit except as specified on the plans. Care shall be exercised during cable pulls through conduit bends and looping in pull boxes.
24. To reduce the possibility of damage to the outer jacket of the fiber optic cable, protective measures shall be used when the cable is installed. The requirements herein shall be followed, but does not limit the installation to only those identified. The purpose of the installation specifications is to ensure protection, of the fiber optic cable when it is installed. Other protective measures not specified herein may be taken during installation if it will ensure protection of the cable.
25. A cable feeder guide shall be used between the cable reel and the face of the duct and conduit to protect the cable and guide it off the reel and into the duct. The cable shall be carefully inspected for jacket defects as it is removed from the reel. If defects are noticed, the pulling operation shall be terminated immediately and the the Owner notified.
26. Precautions shall be taken during installation to prevent the cable from being kinked, crushed or twisted. A pulling eye shall be attached to the cable end and be used to pull the cable through the duct and conduit system. As the cable is pulled off the reel and into the cable feeder guide, it shall



- be sufficiently lubricated with a lubricant that shall be of the water based type and approved by the cable manufacturer.
27. Dynamometers or break away pulling swings shall be used to ensure the pulling line tension does not exceed the installation tension values specified by the cable manufacturer. The mechanical stress placed upon the cable during installation shall not be such that the cable is twisted and stretched. Maximum allowable cable strain during installation shall be less than 0.75%.
 28. The pulling of the cable shall be hand assisted at each handhole or pullbox. The cable shall not be crushed, kinked or forced around a sharp corner. Sufficient slack shall be left at each end of the cable to allow proper cable termination.
 29. The cable shall be looped in all pull boxes as noted on the plans to provide approximately thirty (30) feet of extra cable in the pull box. At termination points, such as at cabinets or computers, a thirty (30) foot loop shall also be provided wherever space permits.
 30. Cable Marking: At each pullbox and at each cabinet, the cable shall be visibly marked with yellow warning tape as follows:

"CAUTION - FIBER OPTIC CABLE"

Fiber Optic Cable Testing

31. General: The Contractor shall perform pre-installation and post-installation FOC tests. The the Owner shall be notified a minimum of 10 days in advance so that these tests are witnessed. All test equipment shall be traceable to NIST standards.
32. Test equipment: The Contractor, shall use the following to perform pre-installation and post-installation FOC tests:
 - a. Optical time domain reflectometer (OTDR). The OTDR shall be laser precision, ALT Inc. MODEL 5200 LRFL, or equal.
33. Pre-installation tests
 - a. The purpose of these tests is to perform acceptance tests on the cable prior to installation to verify that the cable conforms to the manufacturer's specifications, and is free of defects, breaks and damages by transportation and manufacturing processes.
 - b. Prior to removal of each cable from the delivery reel, all optical fibers within the cables shall be tested by the Contractor using an OTDR. The OTDR tests shall consist of end-to-end length and fiber attenuation (dB/km) measurements to ensure proper performance of the fiber optic cable. The tests shall be performed from both ends of each fiber to ensure complete fiber continuity within the cable structure.
 - c. Pre-installation, "on-reel" test results shall be compared with the manufacturer's test report delivered with the cable. Gross dissimilarities shall be noted and remedied between the Contractor and manufacturer. In all cases, all fibers must meet the optical attenuation specifications prior to cable installation.
 - d. The Contractor shall perform tests on all reels of cable. The the Owner shall be notified a minimum of 15 days prior to any test.
 - e. The Contractor shall document each test and submit the report to the the Owner for review. Documentation shall consist of both hard copy and 3-1/2 inch electronic disk complete with all application software.
 - f. Cable shall not be installed until the the Owner has reviewed the test report.
 - g. Maximum allowable attenuation is 0.5 dB/km at 1310 and 1550 nm.
34. Post-installation tests: After FOC has been installed the following tests shall be performed:
 - a. A recording OTDR shall be used to test for end-to-end continuity and attenuation of each optical fiber. The OTDR shall be equipped with a 1310 nm and 1550 nm light source for the single mode fiber (SMF). The OTDR shall have an X-Y plotter to provide a hard copy record of each trace of each fiber: The OTDR shall be equipped with sufficient internal masking to allow the entire cable section to be tested. This may be achieved by using an optical fiber pigtail of 30 feet or more to display the required cable section.
 - b. The OTDR shall be calibrated for the correct index of refraction to provide proper length measurement for the known length of reference fiber.



- c. A transmission test shall be performed with the use of a 1310 and 1550 nm stabilized light sources and 1310 nm/1550 nm power meters for SMF. This test shall be conducted in both directions on each fiber of each cable.
 - d. Hard and electronic copy of test documentation shall be submitted to the the Owner. The documentation shall include the trace plot, index, dB/km loss, cable length, date and time of test, wavelength, pulse width, the test site, cable ID, fiber number and type, and operator's initials. The Contractor shall compare the pre-installation test results to the post-installation results. If a deviation of greater than one dB occurs, the the Owner shall be notified in writing by the Contractor, and the cable shall be removed and replaced at no additional cost to the Owner.
 - e. Upon completion of the previous tests all FOC coils shall be secured with ends capped to prevent intrusion of dirt and water.
35. Required OTDR Trace Information:
- a. All traces shall display the entire length of cable under test, highlighting any localized loss discontinuities (installation-induced losses and/or connector losses). The trace shall display fiber length (in kilofeet), fiber loss (dB), and average fiber attenuation (in dB/km) as measured between two markers placed as near to the opposite ends of the fiber under test as is possible while still allowing an accurate reading. Care shall be taken to ensure that the markers are placed in the linear region of the trace: away from the front-end response and far-end Fresnel reflection spike. Time averaging shall be used to improve the display signal to noise ratio. The pulse width of the OTDR shall be set to a sufficient width to provide adequate injected power to measure the entire length the fiber under test.
 - b. If connectors exist in the cable under test, then two traces shall be recorded. One trace shall record the fiber loss (dB) and average attenuation (dB/km) of the entire cable segment under test, including connectors. The second trace shall display a magnified view of the connector regions, revealing the connector losses (dB). All connector losses shall be measured using the 5-point splice loss measurement technique.
 - c. The OTDR trace shall also include the following information:
 - 1) The date and time of the test
 - 2) The cable ID number
 - 3) The cable segment ID number
 - 4) The fiber color or sub-cable number
 - 5) Launch point connector number
 - 6) The optical wavelength used for the test
 - 7) The refractive index setting of the OTDR
 - 8) The pulse width setting of the OTDR
 - 9) The averaging interval of the test

END OF SECTION 27 11 19 00



Task	Specification	Specification Description
27 11 19 00	27 05 26 00	Intercommunications and Program Systems
27 11 23 00	27 05 26 00	Intercommunications and Program Systems
27 14 13 13	26 05 13 00	Conductors And Cables
27 14 13 13	26 05 13 00a	Undercarpet Cables
27 14 13 13	26 05 13 00b	Medium-Voltage Cables
27 14 13 13	27 05 26 00	Intercommunications and Program Systems
27 14 13 16	26 05 13 00	Conductors And Cables
27 14 13 16	26 05 13 00a	Undercarpet Cables
27 14 13 16	26 05 19 16d	Control-Voltage Electrical Power Cables
27 14 13 16	26 05 13 00b	Medium-Voltage Cables
27 14 23 13	27 11 19 00	Loose-Tube Gel-Filled Fiber Optic Cables
27 14 33 16	26 05 13 00	Conductors And Cables
27 14 43 00	27 05 26 00	Intercommunications and Program Systems
27 14 53 00	27 11 19 00	Loose-Tube Gel-Filled Fiber Optic Cables
27 16 16 00	27 11 19 00	Loose-Tube Gel-Filled Fiber Optic Cables
27 16 19 00	26 05 13 00	Conductors And Cables
27 16 19 00	27 11 19 00	Loose-Tube Gel-Filled Fiber Optic Cables
27 21 16 00	27 11 19 00	Loose-Tube Gel-Filled Fiber Optic Cables
27 21 16 00	27 05 26 00	Intercommunications and Program Systems
27 31 13 00	27 05 26 00	Intercommunications and Program Systems
27 32 19 00	26 05 33 16a	Wiring Devices
27 32 19 00	27 05 26 00	Intercommunications and Program Systems
27 32 26 00	27 05 26 00	Intercommunications and Program Systems



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SECTION 27 51 33 00 - EDUCATIONAL INTERCOMMUNICATIONS AND PROGRAM SYSTEMS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for educational intercommunications and program systems. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes: Manually switched intercommunications, Microprocessor-switched intercommunications, Microprocessor-switched telephone/intercommunications and program systems with the following components:
 - a. Master stations.
 - b. Call control console.
 - c. Speaker-microphone stations.
 - d. Call-switch unit.
 - e. All-call amplifier.
 - f. Intercommunication amplifier.
 - g. Paging amplifier.
 - h. Loudspeakers/speaker microphones.
 - i. Conductors and cables.
 - j. Raceways.

C. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: For educational intercommunications and program systems. Include plans, elevations, sections, details, and attachments to other work.
 - a. Wiring Diagrams: For power, signal, and control wiring.
 - 1) Identify terminals to facilitate installation, operation, and maintenance.
 - 2) Single-line diagram showing interconnection of components.
 - 3) Cabling diagram showing cable routing.
3. Field quality-control reports.
4. Operation and maintenance data.

D. Quality Assurance

1. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for location and application.
3. Comply with NFPA 70.

1.2 PRODUCTS

A. Functional Description Of Manually Switched Systems

1. Master Station:
 - a. Communicating selectively with other master and speaker-microphone stations by actuating selector switches.
 - b. Communicating simultaneously with all other stations by actuating a single all-call switch.
 - c. Communicating with individual stations in privacy.
 - d. Including other master-station connections in a multiple-station conference call.



- e. Accessing separate paging speakers or groups of paging speakers by actuating selector switches.
 - f. Overriding any conversation by a designated master station.
 2. Speaker-Microphone Station:
 - a. Having privacy from remote monitoring without a warning tone signal at monitored station. Designated speaker-microphone stations have a privacy switch to prevent another station from listening and to permit incoming calls.
 - b. Communicating hands free.
 - c. Calling master station by actuating call switch.
 - d. Returning a busy signal to indicate that station is already in use.
 - e. Being free of noise and distortion during operation and when in standby mode.
 3. Speakers: Free of noise and distortion during operation and when in standby mode.
- B. Functional Description Of Microprocessor-Switched Systems
1. Master Station:
 - a. Communicating selectively with other master and speaker-microphone stations by dialing station's number on a 12-digit keypad.
 - b. Communicating with individual stations in privacy.
 - c. Communicating on a minimum of three voice channels with up to two simultaneous conversations between master stations and one conversation between a master station and a speaker-microphone station.
 - d. Increasing the number of conversation channels by adding a module in central-control cabinet.
 - e. Including up to three other station connections in a conference call.
 - f. Accessing separate paging speakers or groups of paging speakers by dialing designated numbers on a 12-digit keypad.
 - g. Overriding any conversation by a designated master station.
 - h. Displaying selected station.
 - i. Communicating simultaneously with all other stations by dialing a designated number on a 12-digit keypad.
 - j. Automatically controlling gain to ensure constant intercom speech level.
 - k. Controlling the simultaneous distribution of program material to various combinations of speaker-microphone stations or groups over two program channels by using keypad to control sources and distribute programs.
 - l. Operating and correcting secondary clocks and controlling class-change signals to speakers and bells by using keypad.
 - m. User-programmable features include the following:
 - 1) Station calling by room number.
 - 2) Room station call-in priority levels.
 - 3) Clock signal schedule functions.
 - 4) Schedule characteristics of audible signals.
 - 5) Call-in tone characteristic.
 - 6) Precedence among master stations as destinations for incoming calls from room stations.
 - 7) Grouping of rooms and speakers into zones for paging and program distribution purposes.
 2. Speaker-Microphone Station:
 - a. Having privacy from remote monitoring without a warning tone signal at monitored station. Designated speaker-microphone stations have a privacy switch to prevent another station from listening and to permit incoming calls.
 - b. Communicating hands free.
 - c. Calling master station by actuating call switch.
 - d. Returning a busy signal to indicate that station is already in use.
 3. Speakers: Free of noise and distortion during operation and when in standby mode.



C. Functional Description Of Telephone/Intercommunication Systems

1. Integrated central system with the following:
 - a. Direct-dial, full duplex private telephone communications between all locations equipped with telephones. Call initiation among master stations and between master and remote stations by dialing station's number on a 12-digit keypad.
 - b. 16 channels for unrestricted simultaneous communications.
 - c. Initial system operation with <Insert number> master and remote stations, expandable to 360 stations.
 - d. Direct-dial, two-way amplified voice intercommunication between master telephones and remote stations without use of press-to-talk or talk-listen switches.
 - e. Automatic queuing for intercommunication channels, with automatic call waiting.
 - f. Call transfer among master stations.
 - g. Display of selected station and answering calling station by pressing a single "response button."
 - h. Simultaneous communication with other stations on system by dialing a designated number on a 12-digit keypad.
 - i. Automatic gain control to ensure constant intercom speech level.
 - j. Simultaneous distribution of emergency announcements to all locations equipped with speakers by dialing a predetermined code number.
 - k. User-selectable facility for providing selected telephones with dial tone.
 - l. User-selectable facility for permitting linkage of selected stations to media retrieval center and for permitting on- and off-premise computer linkage.
 - m. Assignment of speaker locations within any one or more of eight zones for zone paging or time signal reception.
 - n. Digital readout displays on which up to three incoming calls are displayed with additional calls stored for subsequent display.
 - o. Off-site diagnostics through a serial data port on central-control station.
 - p. Control of simultaneous distribution of program material to various combinations of remote stations or groups by using keypad to control sources and distribute programs.
 - q. Operation and correction of secondary clocks and control of class-change signals to speakers and bells by using keypad.
 - r. User-programmable features include the following:
 - 1) Station calling by room number.
 - 2) Room station call-in priority levels.
 - 3) Clock signal schedule functions.
 - 4) Schedule characteristics of audible signals.
 - 5) Call-in tone characteristic.
 - 6) Precedence among master stations as destinations for incoming calls from room stations.
 - 7) Grouping rooms and speakers into zones for paging and program distribution purposes.
 - s. Telephone interconnect features include the following:
 - 1) Direct connection to central office trunk lines with initial system wiring for <Insert number> trunk lines.
 - 2) Routing of outside trunk lines for "attendant answer incoming" and "direct inward line" functions.
 - 3) Station programming for access to outside trunk lines to be any of the following:
 - a) Totally unrestricted access.
 - b) Restricted access.
 - c) No access.
 - 4) System programming to allow or disallow local prefixes, and to authorize access for as many as three area codes.
 - 5) Discriminating ringing for identifying internal and outside calls.
 - 6) Circular hunting for outside trunks to prevent excess usage of any one trunk.
 - 7) Direct connection of a single trunk to designated telephone with transfer to attendant if unanswered.



- 8) Call parking allowing paged party to remotely pick up outside call from any master station.
 - 9) Night-answer mode to allow one or all of the following:
 - a) Incoming call transferred to predetermined extension.
 - b) Tone transmitted to speakers to notify key personnel to answer telephone.
 - c) Dial tone to remote stations to allow answering call from all locations.
 - 10) Call control console to do as follows:
 - a) Identify, answer, and route incoming outside calls, with reminder and recall features.
 - b) Directly access outside trunk lines.
 - c) Hold, park, and transfer calls.
 - d) Screen outside calls.
2. Remote Stations:
- a. Speaker-Microphone Station:
 - 1) Having privacy from remote monitoring without a warning tone signal at monitored station. Designated speaker-microphone stations have a privacy switch to prevent another station from listening and to permit incoming calls.
 - 2) Communicating hands free.
 - 3) Calling master station by actuating call switch.
 - 4) Returning a busy signal to indicate that station is already in use.
 3. Speakers: Free of noise and distortion during operation and when in standby mode.
- D. General Requirements For Equipment And Materials
1. Coordinate features and select components to form an integrated system. Match components and interconnections for optimum performance of specified functions.
 2. Expansion Capability: Increase number of stations in the future by 25 percent above those indicated without adding any internal or external components or main trunk cable conductors.
 3. Equipment: Modular type using solid-state components, fully rated for continuous duty unless otherwise indicated. Select equipment for normal operation on input power usually supplied at 110 to 130 V, 60 Hz. Comply with UL 813.
 4. Weather-Resistant Equipment: Listed and labeled by an NRTL for duty outdoors or in damp locations.
- E. Master Station For Manually Switched Systems
1. Station-Selector and Talk-Listen Switches: Heavy-duty type with gold-plated contacts rated for five million operations.
 2. Volume Control: Regulates incoming-call volume.
 3. LED Annunciation: Identifies calling stations and stations in use. LED remains on until call is answered.
 4. Tone Annunciation: Momentary audible tone signal announces incoming calls.
 5. Speaker Microphone: Transmits and receives calls.
 - a. Minimum Speaker Sensitivity: 91 dB at one meter, with 1-W input.
 6. Handset with Hook Switch: Telephone type with 18-inch- (450-mm-) long, permanently coiled cord. Arrange to disconnect speaker when handset is lifted.
 7. Central-Equipment Cabinet: Comply with TIA/EIA-310-D. Lockable, ventilated metal cabinet houses terminal strips, power supplies, amplifiers, system volume control, and auxiliary equipment.
- F. Master Station For Microprocessor-Switched Systems
1. 12-Digit Keypad Selector: Transmits calls to other stations and initiates commands for programming and operation.
 2. Volume Control: Regulates incoming-call volume.
 3. Tone Annunciation: Momentary audible tone signal announces incoming calls.
 4. Lamp Annunciation: Identifies calling stations and stations in use. Lamp remains on until call is answered.



5. Speaker Microphone: Transmits intercom voice signals when used via a voice-operated switch.
 - a. Minimum Speaker Sensitivity: 91 dB at one meter, with 1-W input.
 6. Link Button: To transfer calls.
 7. Reset Control: Cancels call and resets system for next call.
 8. Digital Display: 16-digit alphanumeric LCD readout to register up to four three-digit station numbers.
 9. Central-Equipment Cabinet: Comply with TIA/EIA-310-D. Lockable, ventilated metal cabinet houses terminal strips, power supplies, amplifiers, system volume control, and other switching and control devices required for conversation channels and control functions.
- G. Call Control Console
1. Microprocessor-based instrument to process outside and internal calls with a 12-digit keypad selector.
 2. 20-character alphanumeric display for the following:
 - a. Simultaneous display of up to three calling stations plus last station dialed.
 - b. Display of calls in order received with emergency calls taking precedence on the display.
 - c. Review of calls stored in groups of four.
 - d. Display of prompt messages to assist in system operation.
 3. Programmable Keys: Minimum of 20 with LED indicators for ringing/busy status; programmable for trunk and operator functions.
 4. Transfer Button: Calls to busy extensions and unanswered calls automatically returned to call control console.
 5. Hold Button: With reminder feature every 30 seconds for parked calls or calls placed on hold.
 6. Release Button: For use with parked calls or calls placed on hold.
 7. Page Button: For engaging system paging functions.
 8. Programmable for night answer, remote answer, and remote pickup features.
 9. Programmable for distribution of emergency announcements, all-page announcements, zone-page announcements, and emergency/evacuation alert.
 10. Central-Control Cabinet Equipment: Central switching equipment, central office adapter module, line link modules, power supplies, chassis adapters, and other switching and control devices required for trunk and internal conversation channels and control functions.
- H. Speaker-Microphone Stations
1. Mounting: Flush unless otherwise indicated, and suitable for mounting conditions indicated.
 2. Faceplate: Stainless steel or anodized aluminum with tamperproof mounting screws.
 3. Back Box: Two-gang galvanized steel with 2-1/2-inch (64-mm) minimum depth.
 4. Speaker: Minimum axial sensitivity shall be 91 dB at one meter, with 1-W input. Voice coil shall be not less than 3 inches (76 mm), 2.3 oz. (65 g) minimum; permanent magnet.
 5. Tone Annunciation: Recurring momentary tone indicates incoming calls.
 6. Call Switch: Mount on faceplate. Permits calls to master station.
 7. Privacy Switch: Mount on faceplate. When in on position, switch prevents transmission of sound from remote station to system; when in off position, without further switch manipulation, response can be made to incoming calls.
- I. Call-Switch Unit
1. Enclosure: Single-gang box with stainless-steel faceplate.
 2. Call Switch: Momentary contact signals system that a call has been placed.
 3. Privacy Switch: Prevents transmission of sound signals from station to system.
 4. Volume Control: Operated by screwdriver blade through a hole in faceplate to adjust output level of associated speaker.
- J. All-Call Amplifier
1. Output Power: 70-V balanced line. 80 percent of the sum of wattage settings of connected for each station and speaker connected in all-call mode of operation, plus an allowance for future stations.



2. Total Harmonic Distortion: Less than 5 percent at rated output power with load equivalent to quantity of stations connected in all-call mode of operation.
 3. Minimum Signal-to-Noise Ratio: 60 dB, at rated output.
 4. Frequency Response: Within plus or minus 2 dB from 50 to 12,000 Hz.
 5. Output Regulation: Maintains output level within 2 dB from full to no load.
 6. Input Sensitivity: Compatible with master stations and central equipment so amplifier delivers full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on master stations, speaker microphones, or handset transmitters.
 7. Amplifier Protection: Prevents damage from shorted or open output.
- K. Intercommunication Amplifier
1. Minimum Output Power: 15 W; adequate for all functions.
 2. Total Harmonic Distortion: Less than 5 percent at rated output power with load equivalent to one station connected to output terminals.
 3. Minimum Signal-to-Noise Ratio: 50 dB, at rated output.
 4. Frequency Response: Within plus or minus 3 dB from 70 to 10,000 Hz.
 5. Output Regulation: Maintains output level within 2 dB from full to no load.
 6. Input Sensitivity: Matched to input circuit and to provide full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on microphones in master stations, speaker microphones, or handset transmitters.
 7. Amplifier Protection: Prevents damage from shorted or open output.
- L. Paging Amplifier
1. Input Voltage: 120-V ac, 60 Hz.
 2. Frequency Response: Within plus or minus 3 dB from 60 to 10,000 Hz.
 3. Minimum Signal-to-Noise Ratio: 60 dB, at rated output.
 4. Total Harmonic Distortion: Less than 3 percent at rated output power from 70 to 12,000 Hz.
 5. Output Regulation: Less than 2 dB from full to no load.
 6. Controls: On-off, input levels, and low-cut filter.
 7. Input Sensitivity: Matched to input circuit and to provide full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on speaker microphones or handset transmitters.
 8. Amplifier Protection: Prevents damage from shorted or open output.
- M. Cone-Type Loudspeakers/Speaker Microphones
1. Minimum Axial Sensitivity: 91 dB at one meter, with 1-W input.
 2. Frequency Response: Within plus or minus 3 dB from 70 to 15,000 Hz.
 3. Minimum Dispersion Angle: 100 degrees.
 4. Line Transformer: Maximum insertion loss of 0.5 dB, power rating equal to speaker's, and at least four level taps.
 5. Enclosures: Steel housings or back boxes, acoustically dampened, with front face of at least 0.0478-inch (1.2-mm) steel and whole assembly rust proofed and factory primed; complete with mounting assembly and suitable for surface ceiling, flush ceiling, pendant or wall mounting; with relief of back pressure.
 6. Baffle: For flush speakers, minimum thickness of 0.032-inch (0.8-mm) aluminum brushed to a satin sheen and lacquered **OR** with textured white finish, **as directed**.
 7. Vandal-Proof, High-Strength Baffle: For flush **OR** surface, **as directed**, -mounted speakers, self-aging cast aluminum with tensile strength of 44,000 psi (303 MN/sq. m), 0.025-inch (0.65-mm) minimum thickness; countersunk heat-treated alloy mounting screws; and textured white epoxy finish.
 8. Size: 8 inches (200 mm) with 1-inch (25-mm) voice coil and minimum 5-oz. (140-g) ceramic magnet.
- N. Horn-Type Loudspeakers/Speaker Microphones
1. Speakers shall be all-metal, weatherproof construction; complete with universal mounting brackets.



2. Frequency Response: Within plus or minus 3 dB from 275 to 14,000 Hz.
3. Minimum Power Rating of Driver: 15 W, continuous.
4. Minimum Dispersion Angle: 110 degrees.
5. Line Transformer: Maximum insertion loss of 0.5 dB, power rating equal to speaker's, and at least four level taps.

O. Conductors And Cables

1. Conductors: Jacketed, twisted pair and twisted multipair, untinned solid copper. Sizes as recommended by system manufacturer, but no smaller than No. 22 AWG.
2. Insulation: Thermoplastic, not less than 1/32 inch (0.8 mm) thick.
3. Shielding: For speaker-microphone leads and elsewhere where recommended by manufacturer; No. 34 AWG, tinned, soft-copper strands formed into a braid or equivalent foil.
 - a. Minimum Shielding Coverage on Conductors: 60 percent.
4. Plenum Cable: Listed and labeled for plenum installation.

P. Raceways

1. Educational Intercommunication and Program System Raceways and Boxes: Comply with requirements in Division 26 Section "Raceway And Boxes For Electrical Systems".
2. Educational Intercommunication and Program System Raceways and Boxes: Same as required for electrical branch circuits specified in Division 26 Section "Raceway And Boxes For Electrical Systems".
3. Educational Intercommunication and Program System Raceways and Boxes: EMT **OR** ENT **OR** RNC **OR** Optical-fiber/communication raceways and fittings **OR** Metal wireways **OR** Nonmetal wireways **OR** Surface metal raceways **OR** Surface nonmetal raceways, **as directed**.
4. Outlet boxes shall be not less than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.
5. Flexible metal conduit is prohibited.

1.3 EXECUTION

A. Wiring Methods

1. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters, and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used, **as directed**. Conceal raceway and cables except in unfinished spaces.
 - a. Install plenum cable in environmental air spaces, including plenum ceilings.
 - b. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceway And Boxes For Electrical Systems".
2. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
3. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

B. Installation Of Raceways

1. Comply with requirements in Division 26 Section "Raceway And Boxes For Electrical Systems" for installation of conduits and wireways.
2. Install manufactured conduit sweeps and long-radius elbows whenever possible.

C. Installation Of Cables

1. Comply with NECA 1.
2. General Requirements:
 - a. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at outlets and terminals.



- b. Splices, Taps, and Terminations: Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Cables may not be spliced.
 - c. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 - d. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
 - e. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
 - f. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used.
3. Open-Cable Installation:
 - a. Install cabling with horizontal and vertical cable guides in telecommunication spaces with terminating hardware and interconnection equipment.
 - b. Suspend speaker cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceiling by cable supports not more than 60 inches (1524 mm) apart.
 - c. Cable shall not be run through structural members or be in contact with pipes, ducts, or other potentially damaging items.
 4. Separation of Wires: Separate speaker-microphone, line-level, speaker-level, and power wiring runs. Install in separate raceways or, where exposed or in same enclosure, separate conductors at least 12 inches (300 mm) apart for speaker microphones and adjacent parallel power and telephone wiring. Separate other intercommunication equipment conductors as recommended by equipment manufacturer.
- D. Installation
1. Match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.
 2. Identification of Conductors and Cables: Color-code conductors and apply wire and cable marking tape to designate wires and cables so they identify media in coordination with system wiring diagrams.
 3. Weatherproof Equipment: For units that are mounted outdoors, in damp locations, or where exposed to weather, install consistent with requirements of weatherproof rating.
 4. Connect wiring according to Division 26 Section "Grounding And Bonding For Electrical Systems".
- E. Grounding
1. Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
 2. Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding.
 3. Install grounding electrodes as specified in Division 26 Section "Grounding And Bonding For Electrical Systems".
- F. System Programming
1. Programming: Fully brief the Owner on available programming options. Record the Owner's decisions and set up initial system program. Prepare a written record of decisions, implementation methodology, and final results.
- G. Field Quality Control
1. Perform tests and inspections.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.



2. Tests and Inspections:
 - a. Schedule tests with at least seven days' advance notice of test performance.
 - b. After installing educational intercommunications and program systems and after electrical circuitry has been energized, test for compliance with requirements.
 - c. Operational Test: Test originating station-to-station **OR** originating station-to-station, all-call, and page, **as directed**, messages at each intercommunication station. Verify proper routing and volume levels and that system is free of noise and distortion. Test each available message path from each station on system.
 - d. Frequency Response Test: Determine frequency response of two transmission paths, including all-call and paging, **as directed**, by transmitting and recording audio tones. Minimum acceptable performance is within 3 dB from 150 to 2500 Hz.
 - e. Signal-to-Noise Ratio Test: Measure signal-to-noise ratio of complete system at normal gain settings as follows:
 - 1) Disconnect speaker microphone and replace it in the circuit with a signal generator using a 1000-Hz signal. Measure signal-to-noise ratio at paging, **as directed**, speakers.
 - 2) Repeat test for three speaker microphones, one master station microphone, and for each separately controlled zone of paging loudspeakers.
 - 3) Minimum acceptable ratio is 45 dB.
 - f. Distortion Test: Measure distortion at normal gain settings and rated power. Feed signals at frequencies of 150, 200, 400, 1000, and 2500 Hz into each intercom **OR** intercom, paging, and all-call amplifier, **as directed**. For each frequency, measure distortion in the paging and all-call amplifier outputs. Maximum acceptable distortion at any frequency is 5 percent total harmonics.
 - g. Acoustic Coverage Test: Feed pink noise into system using octaves centered at 500 and 4000 Hz. Use sound-level meter with octave-band filters to measure level at five locations in each paging zone. Maximum permissible variation in level is plus or minus 3 dB; in levels between adjacent zones, plus or minus 5 dB.
 - h. Power Output Test: Measure electrical power output of each paging amplifier at normal gain settings of 150, 1000, and 2500 Hz. Maximum variation in power output at these frequencies is plus or minus 3 dB.
 - i. Signal Ground Test: Measure and report ground resistance at system signal ground. Comply with testing requirements in Division 26 Section "Grounding And Bonding For Electrical Systems".
3. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified. Prepare a list of final tap settings of paging and independent room speaker-line matching transformers.
4. Educational intercommunications and program systems will be considered defective if they do not pass tests and inspections.
5. Prepare test and inspection reports.

END OF SECTION 27 51 33 00



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Task	Specification	Specification Description
27 51 33 00	26 33 43 00b	Public Address and Mass Notification Systems
27 53 13 00	08 74 16 00	Clock And Program Control



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SECTION 28 13 33 16 - PERIMETER SECURITY

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for perimeter security. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Perimeter detection and alarm system.
 - b. Integration of other electronic and electrical systems and equipment.

C. Definitions

1. CCTV: Closed-circuit television.
2. EMI: Electromagnetic interference.
3. PIR: Passive infrared.
4. RFI: Radio-frequency interference.
5. UPS: Uninterruptible power supply.
6. Control Unit: System component that monitors inputs and controls outputs through various circuits.
7. Master Control Unit: System component that accepts inputs from other control units and may also perform control-unit functions. The unit has limited capacity for the number of protected zones and is installed at an unattended location or at a location where it is not the attendant's primary function to monitor the security system.
8. Monitoring Station: Facility that receives signals and has personnel in attendance at all times to respond to signals. A central station is a monitoring station that is listed.
9. Protected Zone: A protected premises or an area within a protected premise that is provided with means to prevent an unwanted event.
10. Standard Intruder: A person who weighs 100 lb (45 kg) or less and whose height is 60 inches (1525 mm) or less; dressed in a long-sleeved shirt, slacks, and shoes unless environmental conditions at the site require protective clothing.
11. Standard-Intruder Movement: Any movement, such as walking, running, crawling, rolling, or jumping, of a "standard intruder" in a protected zone.
12. Systems Integration: The bringing together of components of several systems containing interacting components to achieve indicated functional operation of combined systems.
13. Zone. A defined area within a protected premise. It is a space or area for which an intrusion must be detected and uniquely identified. The sensor or group of sensors must then be assigned to perform the detection, and any interface equipment between sensors and communication must link to master control unit.

D. Action Submittals

1. Product Data: Components for sensing, detecting, systems integration, and control, including dimensions and data on features, performance, electrical characteristics, ratings, and finishes.
2. Shop Drawings: Detail assemblies of standard components that are custom assembled for specific application on this Project.
 - a. Functional Block Diagram: Show single-line interconnections between components including interconnections between components specified in this Section and those furnished under other Sections. Indicate methods used to achieve systems integration. Indicate control, signal, and data communication paths and identify programmable logic controllers **OR** networks, **as directed**, and control interface devices and media to be used. Describe characteristics of network and other data communication lines.



- 1) Indicate methods used to achieve systems integration.
 - 2) Indicate control, signal, and data communication paths and identify PLCs, networks, control interface devices, and media to be used.
 - 3) Describe characteristics of network and other data communication lines.
 - 4) Describe methods used to protect against power outages and transient voltages including types and ratings of isolation and surge suppression devices used in data, communication, signal, control, and ac and dc power circuits.
- b. Raceway Riser Diagrams: Detail raceway runs required for perimeter security and for systems integration. Include designation of devices connected by raceway, raceway type, and size, and type and size of wire and cable fill for each raceway run.
 - c. UPS: Sizing calculations.
 - d. Site and Floor Plans: Indicate final outlet and device locations, routing of raceways, and cables inside and outside the building. Include room layout for central-station control-unit console, terminal cabinet, racks, and UPS.
 - e. Master Control Unit Console Layout: Show required artwork and device identification.
 - f. Device Address List: Coordinate with final system programming.
 - g. System Wiring Diagrams: Include system diagrams unique to Project. Show connections for all devices, components, and auxiliary equipment. Include diagrams for equipment and for system with all terminals and interconnections identified.
 - h. Details of surge-protection devices and their installation.
 - i. Sensor detection patterns and adjustment ranges.
3. Equipment and System Operation Description: Include method of operation and supervision of each component and each type of circuit. Show sequence of operations for manually and automatically initiated system or equipment inputs. Description must cover this specific Project; manufacturer's standard descriptions for generic systems are not acceptable.
 4. Samples for Initial Selection: For units with factory-applied color finishes.
 5. Samples for Verification: For each type of exposed finish required.

E. Informational Submittals

1. Qualification Data: For Installer, security systems integrator, and testing agency.
2. Field quality-control test reports.
3. Warranty: Sample of special warranty.
4. Other Information Submittals:
 - a. Test Plan and Schedule: Test plan defining all tests required to ensure that system meets technical, operational, and performance specifications within 60 days of date of Contract award.
 - b. Examination reports documenting inspections of substrates, areas, and conditions.
 - c. Anchor inspection reports documenting inspections of built-in and cast-in anchors.

F. Closeout Submittals

1. Operation and Maintenance Data: For perimeter security system to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation And Maintenance Data", include the following:
 - a. Data for each type of product, including features and operating sequences, both automatic and manual.
 - b. Master control-unit hardware and software data.

G. Maintenance Material Submittals

1. One spare control-unit board(s) for strain-sensitive cable system and one cable repair and splice kit(s).
2. One of each type of microwave sensor and one of each type of power supply for microwave perimeter security system.
3. One of each spare sensor and PIR unit and one alignment telescope(s) for long-range PIR system.
4. One spare control-unit board(s) for electrostatic-field system.



5. One spare control-unit board(s) for buried, ported coaxial cable system, 10 feet (3 m) of cable; and one cable repair and splice kit(s).
6. Fuses: Three of each kind and size.
7. Tool Kit: Provide six sets of tools for use with security fasteners, each packaged in a compartmented kit configured for easy handling and storage.
8. Security Fasteners: Furnish no fewer than 1 box for every 50 boxes or fraction thereof, of each type and size of security fastener installed.

H. Quality Assurance

1. Installer Qualifications:
 - a. An employer of workers, at least one of whom is a technician certified by the National Burglar & Fire Alarm Association.
 - b. Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
2. Security Systems Integrator Qualifications: An experienced perimeter security equipment supplier and Installer who has completed systems integration work for installations similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
3. Testing Agency Qualifications: Member company of NETA or an NRTL.
 - a. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
4. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
5. FMG Compliance: FMG-approved and -labeled perimeter security devices and equipment.
6. Comply with NFPA 70.

I. Project Conditions

1. Environmental Conditions: Capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
 - a. Altitude: Sea level to 4000 feet (1220 m).
 - b. Master Control Unit: Rated for continuous operation in an ambient of 60 to 85 deg F (16 to 29 deg C) and a relative humidity of 20 to 80 percent, noncondensing.
 - c. Exterior Environment: System components installed in locations exposed to weather shall be rated for continuous operation in ambients of minus 30 to plus 122 deg F (minus 34 to plus 50 deg C) dry bulb and 20 to 90 percent relative humidity, condensing. Comply with UL 294 and UL 639 for outdoor-use equipment. Rate for continuous operation when exposed to rain as specified in NEMA 250, winds up to 85 mph (137 km/h) and snow cover up to 24 inches (610 mm) thick.
 - d. Hazardous Environment: System components located in areas where fire or explosion hazards may exist because of flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers or flyings shall be rated, listed, and installed according to NFPA 70.

J. Warranty:

1. Special Warranty: Manufacturer's standard form in which manufacturer and Installer agree to repair or replace components of perimeter security devices and equipment that fail in materials or workmanship within specified warranty period.
 - a. Warranty Period: Two years from date of Final Completion.

1.2 PRODUCTS

A. Functional Description Of System

1. Description: Perimeter protection system with fence-mounted systems **OR** buried sensors **OR** volumetric detectors, **as directed**, integrated into a single perimeter detection and alarm system.
2. Supervision: System components shall be continuously monitored for normal, alarm, supervisory and trouble conditions. Indicate deviations from normal conditions at any location in



- system. Indication includes identification of device or circuit in which deviation has occurred and whether deviation is an alarm or malfunction.
- a. Alarm Signal: Display at central-station control unit and actuate audible and visual alarm devices.
 - b. Trouble Condition Signal: Distinct from other signals, indicating that system is not fully functional. Trouble signal shall indicate system problems such as battery failure, open or shorted transmission line conductors, or controller failure.
 - c. Supervisory Condition Signal: Distinct from other signals, indicating an abnormal condition as specified for the particular device or controller.
3. System Control: Central-station control unit shall directly monitor gate detection devices, perimeter detection units, and connecting wiring.
- OR**
- System Control: One or more remote, addressable controllers operate under control of a central-station control-unit microcomputer in a multiplexed distributed control system or as part of a network. Controllers shall receive programming by multiplexed signal transmission from a central-station control-unit microprocessor or microcomputer and hold data in nonvolatile memory. System shall automatically reboot program without error or loss of status or alarm data after any system disturbance, **as directed**.
4. Operator Commands:
 - a. Help with System Operation: Display all commands available to operator. Help command, followed by a specific command, shall produce a short explanation of the purpose, use, and system reaction to that command.
 - b. Acknowledge Alarm: To indicate that alarm message has been observed by operator.
 - c. Place Protected Zone in Access: Disable all intrusion-alarm circuits of a specific protected zone. Tamper circuits may not be disabled by operator.
 - d. Place Protected Zone in Secure: Activate all intrusion-alarm circuits of a protected zone.
 - e. Protected Zone Test: Initiate operational test of a specific protected zone.
 - f. System Test: Initiate system-wide operational test.
 - g. Print Reports.
 5. Timed Control at Central-Station Control Unit: Allow automatically timed "secure" and "access" functions of selected protected zones.
 6. Automatic Control of Related Systems: Alarm or supervisory signals from certain perimeter security devices control the following functions in related systems:
 - a. Switch selected lights.
 - b. Open a signal path between certain intercommunication stations.
 - c. Shift sound system to "listening mode" and open a signal path to certain system speakers.
 - d. Switch signal to selected monitor from closed-circuit television camera in vicinity of sensor signaling an alarm.
 7. Printed Record of Events: Print a record of alarm, supervisory, and trouble events on system printer. Sort and report by protected zone, device, and function. When central-station control unit receives a signal, print a report of alarm, supervisory, or trouble condition. Report type of signal (alarm, supervisory, or trouble), protected zone description, date, and time of occurrence. Differentiate alarm signals from other indications. When system is reset, report reset event with the same information concerning device, location, date, and time. Commands shall initiate the reporting of a list of current alarm, supervisory, and trouble conditions in system or a log of past events.
 8. Response Time: Two seconds between actuation of any alarm and its indication at central-station control unit.
 9. Circuit Supervision: Supervise all signal and data transmission lines, links with other systems, controllers, and sensors from central-station control unit. Indicate circuit and detection device faults with both protected zone and trouble signals, sound a distinctive audible tone, and illuminate an LED. Maximum permissible elapsed time between occurrence of a trouble condition and indication at central-station control unit is 20 seconds. Initiate an alarm in response to opening, closing, shorting, or grounding of a signal or data transmission line.



10. Programmed Secure-Access Control: System shall be programmable to automatically change status of various combinations of protected zones between secure and access conditions at scheduled times. Status changes may be preset for repetitive, daily, and weekly; specially scheduled operations may be preset up to a year in advance. Manual secure-access control stations shall override programmed settings.
 11. Manual Secure-Access Control: Coded entries at manual stations shall change status of associated protected zone between secure and access conditions.
- B. System Component Requirements
1. Compatibility: Detection devices and their communication features, connecting wiring, and master control unit shall be selected and configured with accessories for full compatibility with the existing equipment.
 2. Perimeter Security Units: Listed and labeled by a qualified testing agency for compliance with UL 639.
 3. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor entry connection to components.
 - a. Minimum Protection for Power Lines 120 V and More: Auxiliary panel suppressors complying with requirements in Division 26 Section "Transient-voltage Suppression For Low-voltage Electrical Power Circuits".
 - b. Minimum Protection for Communication, Signal, Control, and Low-Voltage Power Lines: Comply with requirements in Division 26 Section "Transient-voltage Suppression For Low-voltage Electrical Power Circuits" as recommended by manufacturer for type of line being protected.
 4. Interference Protection: Components shall be unaffected by radiated RFI and electrical induction of 15 V/m over a frequency range of 10 to 10,000 MHz and conducted interference signals up to 0.25-V RMS injected into power supply lines at 10 to 10,000 MHz.
 5. Tamper Protection: Tamper switches on detection devices, controllers, annunciators, pull boxes, junction boxes, cabinets, and other system components shall initiate a tamper-alarm signal when unit is opened or partially disassembled and when entering conductors are cut or disconnected. Central-station control-unit alarm display shall identify tamper alarms and indicate locations.
 6. Self-Testing Devices: Automatically test themselves periodically, but not less than once per hour, to verify normal device functioning and alarm initiation capability. Devices transmit test failure to central-station control unit.
 7. Antimasking Devices: Automatically check operation continuously or at intervals of a minute or less, and use signal-processing logic to detect blocking, masking, jamming, tampering, or other operational dysfunction. Devices transmit detection of operational dysfunction to central-station control unit as an alarm signal.
 8. Addressable Devices: Transmitter and receivers shall communicate unique device identification and status reports to central-station control unit.
 9. Remote-Controlled Devices: Individually and remotely adjustable for sensitivity and individually monitored at central-station control unit for calibration, sensitivity, and alarm condition.
- C. Enclosures
1. Interior Sensors: Enclosures that protect against dust, falling dirt, and dripping noncorrosive liquids.
 2. Interior Electronics: NEMA 250, Type 12.
 3. Exterior Electronics: NEMA 250, Type 4X fiberglass **OR** stainless steel, **as directed**.
 4. Corrosion Resistant: NEMA 250, Type 4X PVC **OR** stainless steel, **as directed**.
 5. Terminal cabinets in handholes and manholes shall be NEMA 250, Type 6 **OR** 6P, **as directed**.
 6. Screw Covers: Where enclosures are accessible to inmates, secure with security fasteners of type appropriate for enclosure.
- D. Secure And Access Devices
1. Keypad and Display Module: Arranged for entering and executing commands for system-status changes and for displaying system-status and command-related data.



2. Key-Operated Switch: Change protected zone between secure and access conditions.

E. Strain-Sensitive Cable

1. Description: Strain-sensitive, coaxial transducer cable shall monitor chain-link-type and welded-mesh-type fence and generate an alarm when a standard intruder attempts to climb over, cut through, or lift fence fabric.
2. Environment: Suitable for exterior installation and the following conditions:
 - a. Ambient Temperatures: Ranging from minus 22 to plus 158 deg F (minus 30 to plus 70 deg C).
3. Transducer Cable:
 - a. Ultraviolet-resistant cable furnished by system manufacturer.
 - b. Suitable for up to 1000 feet (300 m) of sensor cable per single-zone controller and up to 2000 feet (600 m) of sensor cable per dual-zone processor.
 - c. Sensitivity shall be uniform throughout its entire length, requiring only one variable sensitivity adjustment throughout its entire length.
4. Control Unit:
 - a. Field mounted, with tamper switch at controller board.
 - b. Electronic circuitry shall discriminate between acceptable fence movement and intrusion-related disturbances.
 - c. Sensitivity, count control, and climb-over processors shall be adjustable with a minimum of five individual count-control and climb-over adjustments.
 - d. Controller output shall have adjustable pulse width to adjust the time the alarm relay will activate per detected intrusion attempt.
5. System Performance:
 - a. Immune to RFI and EMI environments; interference shall have no effect on normal operational characteristics.
 - b. Trouble and Tamper: Entire sensor system shall be fully supervised with individually monitored tamper and supervision alarms. Disconnecting, cutting, or shorting of strain-sensitive cable results in supervisory alarm.
 - c. Intrusion Simulation: Each zone shall have a self-test feature that, when activated by a signal from central-station control unit, will produce an intrusion alarm and verify operation of sensor.

F. Microwave Intrusion Detectors

1. Description: Volumetric microwave detection system.
2. Device Performance: Microwave transmitter establishes an electromagnetic field in an adjustable detection pattern and detects intrusion by monitoring changes in that pattern.
 - a. Movement Sensitivity: Adjustable, able to detect standard-intruder movement within sensor's detection pattern at any speed between 0.1 to 50 fps (0.03 to 15.2 m/s). Sensor sensitivity adjustments shall be accessible only when sensor housing is removed, and sensors shall comply with 47 CFR 15.
 - b. Detection range: 15 to 600 feet (5 to 180 m).
 - c. Range Sensitivity: Adjustable for setting area of protection between 15 to 500 feet (5 to 152 m) in range and from 2 to 40 feet (0.6 to 12 m) in beam diameter.
 - d. Trouble and Tamper: Fully supervised with individually monitored tamper and supervision alarms. System failure shall result in tamper alarm. System jamming or wrong modulation shall result in supervisory alarm.
 - e. Activation Indicator: LED indicator shall not be visible during normal operation. Indicator shall light when sensor detects a standard intruder. Locate test-enabling switch under sensor housing cover.
 - f. Remote Test: When initiated by central-station control unit, start a test sequence for each detector element that simulates standard-intruder movement within sensor's detection patterns, causing an alarm.
3. Environment: Suitable for exterior installation and the following conditions:



- a. Ambient Temperatures: Ranging from minus 30 to plus 158 deg F (minus 34 to plus 70 deg C) and in rainfall up to 4 inches (100 mm).
- G. Electrostatic Field
1. Description: Electronically balanced phase electrostatic-field detection system consisting of a field generator that generates an electrical field in one or more field wires and that has two or more sensing wires, a sense filter, amplifier, and a controller. Detection fields shall have a minimum of four different frequencies so adjacent zones cannot interfere with each other.
 2. Environment: Suitable for exterior installation and the following conditions:
 - a. Ambient Temperatures: Ranging from minus 22 to plus 158 deg F (minus 30 to plus 70 deg C).
 3. System Performance:
 - a. Detect, via sense wires, a compound signal form consisting of amplitude change, rate of change, and pre-set time disturbance that forms a "signature" of human movement. Generate an alarm when all exist simultaneously. Provide detection fields of not less than four different frequencies so adjacent zones do not interfere with each other.
 - b. Control Units: Single or multiple zone, with sense filter. Front panel with calibration meter, status of alarm transmitter, sensitivity selector, test point selector, power indicator, and power control. Control unit shall reject signals due to wind and small objects striking the wires.
 - c. Motion Detection: Sense standard-intruder movement at rates from 0.15 to 26 fps (0.045 to 8.0 m/s).
 - d. Zone Length: Not to exceed 500 feet (152 m) **OR** 325 feet (100 m), **as directed**.
 - e. Supervision: Generate trouble signal if field or sense wires are cut or shorted to ground or to each other. Generate supervisory alarm if received signal is substantially reduced.
 4. Insulators, Wire-Tensioning Devices, and Brackets: Manufacturer's standard for mounting and tensioning of wires.
 5. Field and Sensing Wires: Stainless steel.
- H. Buried, Ported Coaxial Cable
1. Description: Buried electrostatic-field detection system consisting of parallel, ported coaxial cables that generate a detection field between cables.
 2. Environment: Suitable for exterior installation and the following conditions:
 - a. Ambient Temperatures: Ranging from minus 22 to plus 158 deg F (minus 30 to plus 70 deg C).
 3. System Performance: One of two parallel cables receives a continuous wave signal from a transmitter module. Second cable, connected to a sensor module, detects, preamplifies, and analyzes variations in signal. When system senses "signature" of a standard intruder in the detection zone, based on mass, motion, and time of day, it generates an alarm.
 - a. Transmitter: Locate at one end of zone, with standby battery.
 - b. Preamplifier-Sensor: Locate at opposite end from transmitter, with standby battery.
 - c. Front panel with sensitivity calibration meter, calibrated self-test potentiometer, power switch, and LED normal and malfunction indicators.
 - d. Electromagnetic Radiation: Less than 50 mV per meter at 30 m.
 - e. Motion Detection: Sense standard-intruder movement at rates from 0.17 to 26 fps (0.05 to 8.0 m/s).
 - f. Zone Length: Not to exceed 500 feet (152 m) **OR** 325 feet (100 m), **as directed**.
 - g. Zone Width: Not to exceed 15 feet (4.6 m), with an average width of 12 feet (3.7 m).
 - h. Zone Height: Approximately 3.3 feet (1.0 m), depending on sensitivity setting.
 - i. Supervision: Generate trouble signal if cable is cut or shorted to ground. Generate supervisory alarm if cabinets are tampered with.
 4. Enclosures: Hinged cover with tamper switch and security fasteners.
 5. Buried, Ported Coaxial Cable: Approximately 1/2-inch (1.3-mm) diameter, minimum 10 AWG center conductor, foam polyethylene dielectric, braided copper outer conductor, and polyethylene jacket.



- I. Long-Range PIR Detectors
1. Description: Volumetric passive infrared detection system.
 2. Listed and labeled by a qualified testing agency for compliance with SIA PIR-01.
 3. Environment: Suitable for exterior installation and the following conditions:
 - a. Ambient Temperatures: Ranging from minus 30 to plus 150 deg F (minus 34 to plus 65 deg C).
 4. System Performance: Detect an interruption of dual-infrared light beams that link transmitters and receivers. Generate an alarm when signal is interrupted due to presence of an object that interrupts both beams.
 - a. Sensitivity: Field adjustable to allow adjustment of range from 25 to 500 feet (7.6 to 152 m), generating an alarm within 20 to 50 ms when both beams are interrupted.
 - b. Detection system shall adjust automatically to compensate for weather, including fog, rain, snow, blowing dust, and rapid temperature changes.
 - c. Motion Detection: Detect standard-intruder movement at rates from 0.1 to 50 fps (0.03 to 15.2 m/s).
 - d. Supervision: Generate supervisory alarm if any portion of system is tampered with.
 - e. Remote Test: When initiated by central-station control unit, start a test sequence for each detector element that simulates standard-intruder movement within sensor's detection patterns, causing an alarm.
- J. Geophone Fence Detection
1. Description: Fence-mounted system to detect attempts to cut or climb the protected fence, using geophone sensors that respond to specific shock or vibrations.
 2. Environment: Suitable for exterior installation and the following conditions:
 - a. Ambient Temperatures: Ranging from minus 30 to plus 150 deg F (minus 34 to plus 65 deg C).
 3. System Performance:
 - a. Controller: 10 zone capacity for processing geophone generated analog signals. Each zone shall consist of not more than 10 sensors.
 - 1) Adjustments: For each zone provide stepped gain control for sensitivity, and switches for geophone signal filters to minimize nuisance alarms. System shall adjust automatically to compensate for weather, including fog, rain, snow, blowing dust, and rapid temperature changes.
 - 2) Trouble Condition Signal: Generate when any zone fails.
 - 3) Supervisory Condition Signal: Generate on interference with controller operation or when detecting a break-in into a enclosure housing electronics.
 - b. Sensors: Fence mounted 20 feet (6 m) o.c.
 - c. Cable for Interconnection of System Components: Shielded, PVC jacketed and armored, as supplied by system manufacturer.
 - d. Test each zone simulating an alarm condition. Test by command from central-station control **OR** test switch at controller inside the enclosure, **as directed**.
- K. Video Motion Sensor
1. Description: Video-surveillance based detection system.
 2. Device Performance: Detect changes in video signal within a user-defined protected zone. Provide an alarm output for each video input.
 - a. Detect movement within protected zone of standard intruders wearing clothing with a reflectivity that differs from that of background scene by a factor of 2. Reject all other changes in video signal.
 - b. Modular design that allows for expansion or modification of number of inputs.
 - c. Adjustable Controls:
 - 1) Number of detection zones.
 - 2) Size of detection zones.
 - 3) Sensitivity of detection of each protected zone.
 - d. Mounting: Standard 19-inch (480-mm) rack as described in EIA 310.



3. Environment: Suitable for installation in interior air-conditioned spaces.

L. Gate Units

1. Description: Fence mounted gate-movement detector, balanced-magnetic type, UL listed for outdoor locations. Units shall be designed for mounting on single- or double-leaf swinging or rolling gates and have armored jumper cables between switch and stationary junction box for wiring to central-station control unit and tamper switches in junction box.
2. Device Performance: Bias magnet and at least three encapsulated-reed switches that resist compromise from introduction of foreign magnetic fields, with integral overcurrent protective device to limit current to 80 percent of switch capacity.
3. Remote Test: Simulate movement of actuating magnet from central-station control unit.

M. Field-Mounted Control Units

1. Field-mounted control units shall include the power supply and detector specific functions, and provide for communications with the master control unit. Control unit shall include read-only resident software needed for startup, a time clock, and all automatic operations. Software shall be downloaded from the master control unit.
2. Battery Backup: UPS, providing 6 hours of run time during a power outage, with 2-rate automatic battery charger to fully recharge batteries within 12 hours after normal power is restored.
 - a. Batteries: Rechargeable, valve-regulated, recombinant, sealed, lead-acid type with nominal 10-year life expectancy.
 - b. Battery Charger: Solid-state, fully automatic, variable-charging-rate type. Charger shall recharge fully discharged battery within 24 hours.
3. Annunciation: Indicate a change in system condition and switching of system or component to backup power.

N. Master Control Unit

1. Description: Supervise sensors and detection subsystems and their connecting communication links, status control (secure or access) of sensors and detector subsystems, activation of alarms and supervisory and trouble signals, and other indicated functions.
 - a. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
 - b. Include a real-time clock for time annotation of events on the event recorder and printer.
 - c. Addressable initiation devices that communicate device identity and status.
 - d. Control circuits for operation of mechanical equipment in response to an alarm.
2. Construction: Freestanding equipment rack **OR** Desk-mounted console, **as directed**, modular, with separate and independent alarm and supervisory system modules. Alarm-initiating protected zone boards shall be plug-in cards. Arrangements that require removal of field wiring for module replacement are unacceptable.
3. Comply with UL 609 **OR** UL 681 **OR** UL 1076, **as directed**.
4. Console Controls and Displays: Arranged for interface between human operator at master control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
 - a. Annunciator and Display: LCD type, one **OR** two **OR** three line(s) of 40 **OR** 80 characters, minimum, **as directed**.
 - b. Keypad: Arranged to permit entry and execution of programming, display, and control commands
 - c. Control-Unit Network: Automatic communication of alarm, status changes, commands, and other communications required for system operation. Communication shall return to normal after partial or total network interruption such as power loss or transient event. Total or partial signaling network failures shall identify the failure and record the failure at the annunciator display and at the system printer.
 - d. Field Device Network: Communicate between the control unit and field devices of the system. Communications shall consist of alarm, network status, and status and control of



- field-mounted processors. Each field-mounted device shall be interrogated during each interrogation cycle.
- e. Operator Controls: Manual switches and push-to-test buttons that do not require a key to operate. Prevent resetting of alarm, supervisory, or trouble signals while alarm or trouble condition persists. Include the following:
 - 1) Acknowledge alarm.
 - 2) Silence alarm.
 - 3) System reset.
 - 4) LED test.
 - f. Timing Unit: Solid state, programmable, 365 days.
 - g. Confirmation: Relays, contactors, and other control devices shall have auxiliary contacts that provide confirmation signals to system for their on or off status. Software shall interpret such signals, display equipment status, and initiate failure signals.
 - h. Alarm Indication: An audible signal sounds and an LED lights at master control unit identifying the protected zone **OR** addressable detector, **as directed**, originating the alarm. Annunciator panel displays a common alarm light and sounds an audible tone.
 - i. Alarm Indication: An audible signal sounds and a plain-language identification of the protected zone **OR** addressable detector, **as directed** originating the alarm appears on LED or LCD display at master control unit. Annunciator panel displays a common alarm light and sounds an audible tone.
 - j. Alarm Indication: An audible signal sounds and a plain-language identification of the protected zone **OR** addressable detector, **as directed** originating the alarm appears on LED, LCD or cathode-ray-tube display, **as directed** at master control unit. Annunciator panel alarm light and audible tone identify protected zone signaling an alarm.
 - k. Alarm activation sounds a bell **OR** siren **OR** strobe **OR** bell or siren and strobe, **as directed**.
5. Protected Zones: Quantity of alarm and supervisory zones as indicated, with capacity for expanding number of protected zones by a minimum of 25 percent.
 6. Power Supply Circuits: Master control units shall provide power for remote power-consuming detection devices. Circuit capacity shall be adequate for at least a 25 percent increase in load.
 7. UPS: Comply with Division 26 Section "Static Uninterruptible Power Supply". UPS shall be sized to provide a minimum of six hours of master control-unit operation.
 8. Cabinet: Lockable, steel enclosure arranged so operations required for testing, normal operation, and maintenance are performed from front of enclosure. If more than a single cabinet is required to form a complete control unit, provide exactly matching modular enclosures. Accommodate all components and allow ample gutter space for field wiring. Identify each enclosure by an engraved, laminated, phenolic-resin nameplate. Lettering on enclosure nameplate shall not be less than 1 inch (25 mm) high. Identify, with permanent labels, individual components and modules within cabinets.
 9. Transmission to Monitoring Station: A communications device to automatically transmit alarm, supervisory, and trouble signals to the monitoring station, operating over a standard voice grade telephone leased line. Comply with UL 1635.
 10. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also print system reset event, including same information for device, location, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.
- O. Audible And Visual Alarm Devices
1. Bell: UL listed, 10 inches (254 mm) in diameter, rated to produce a minimum sound output of 84 dB at 10 feet (3 m) from central-station control unit.
 - a. Enclosure: Weather-resistant steel box equipped with tamper switches on cover and on back of box.



2. Klaxon Weatherproof Motor-Driven Hooter: UL listed, rated to produce a minimum sound output of 120 dB at 3 feet (1 m), plus or minus 3 dB, at a frequency of 470 Hz. Rated for intermittent use - two minutes on, five minutes off.
 - a. Designed for use in industrial areas and in high noise, severe weather marine environments.
3. Siren: 30-W speaker with siren driver, rated to produce a minimum sound output of 103 dB at 10 feet (3 m) from central-station control unit.
 - a. Enclosure: Weather-resistant steel box with tamper switches on cover and on back of box.
4. Strobe: Xenon light complying with UL 1638, with a clear polycarbonate lens.
 - a. Light Output: 115 cd, minimum.
 - b. Flash Rate: 60 per minute.

P. Security Fasteners

1. Operable only by tools produced for use on specific type of fastener by fastener manufacturer or other licensed fabricator. Drive system type, head style, material, and protective coating as required for assembly, installation, and strength.
2. Drive System Types: Pinned Torx-Plus, pinned Torx, or pinned hex (Allen).
3. Socket Flat Countersunk Head Fasteners:
 - a. Heat-treated alloy steel, ASTM F 835 (ASTM F 835M).
 - b. Stainless steel, ASTM F 879 (ASTM F 879M), Group 1 CW.
4. Socket Button Head Fasteners:
 - a. Heat-treated alloy steel, ASTM F 835 (ASTM F 835M).
 - b. Stainless steel, ASTM F 879 (ASTM F 879M), Group 1 CW.
5. Socket Head Cap Fasteners:
 - a. Heat-treated alloy steel, ASTM A 574 (ASTM A 574M).
 - b. Stainless steel, ASTM F 837 (ASTM F 837M), Group 1 CW.
6. Protective Coatings for Heat-Treated Alloy Steel:
 - a. Zinc chromate, ASTM F 1135, Grade 3 or 4; for exterior applications and interior applications where indicated.
 - b. Zinc phosphate with oil, ASTM F 1137, Grade I, or black oxide, unless otherwise indicated.

Q. Source Quality Control

1. Electrostatic-Field and Buried, Ported Coaxial Cable Systems Electronics: Precondition at factory by subjecting modules to at least 4 days' operational burn-in at temperatures not less than 140 deg F (60 deg C).

1.3 EXECUTION

A. Examination

1. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of perimeter security.
2. Examine roughing-in for embedded and built-in anchors to verify actual locations of perimeter security connections before perimeter security installation.
3. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of perimeter security.
4. Inspect built-in and cast-in anchor installations, before installing perimeter security, to verify that anchor installations comply with requirements. Prepare inspection reports.
 - a. Remove and replace anchors where inspections indicate that they do not comply with requirements. Reinspect after repairs or replacements are made.
 - b. Perform additional inspections to determine compliance of replaced or additional anchor installations. Prepare inspection reports.
5. For material whose orientation is critical for its performance as a ballistic barrier, verify installation orientation.
6. Proceed with installation only after unsatisfactory conditions have been corrected.



B. Systems Integration

1. Integrate perimeter security system with the following systems and equipment:
 - a. Electronic door hardware.
 - b. Elevators.
 - c. Network lighting controls.
 - d. Intercommunications and program systems.
 - e. Public address and mass notification systems.
 - f. Access control.
 - g. Fire-alarm system.
 - h. Intrusion detection system.
 - i. Video surveillance.

C. System Installation

1. Comply with UL 681 and NFPA 731.
2. Equipment Mounting: Install master control unit on finished floor with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.
 - a. Comply with requirements for seismic-restraint devices specified in Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
3. Install wall-mounted equipment, with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.
 - a. Comply with requirements for seismic-restraint devices specified in Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
4. Connecting to Existing Equipment: Verify that existing perimeter security system is operational before making changes or connections.
 - a. Connect new equipment to existing control panel in existing part of the building.
 - b. Connect new equipment to existing monitoring equipment at the Supervising Station.
 - c. Expand, modify, and supplement existing **control** or **monitoring** equipment as necessary to extend existing **control** or **monitoring**] functions to the new points. New components shall be capable of merging with existing configuration without degrading the performance of either system.
5. Security Fasteners: Where accessible to inmates, install perimeter security components using security fasteners with head style appropriate for fabrication requirements, strength, and finish of adjacent materials except that a maximum of two different sets of tools shall be required to operate security fasteners for Project. Provide stainless-steel security fasteners in stainless-steel materials.
6. Wiring Method: Install power, signal, and data transmission wire and cable in raceways according to Division 26 Section(s) "Underground Ducts And Raceways For Electrical Systems" AND "Raceway And Boxes For Electrical Systems". Minimum conduit size shall be 1/2 inch (13 mm). Control and data transmission wiring shall not share raceways with any other system.
7. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Use lacing bars and distribution spools. Separate power-limited and non-power-limited conductors as recommended in writing by manufacturer. Install conductors parallel with or at right angles to sides and back of enclosure. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with perimeter security system to terminal blocks. Mark each terminal according to system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
8. Wires and Cables:
 - a. Conductors: Size as recommended in writing by system manufacturer, unless otherwise indicated.
 - b. 120-V Power Wiring: Install according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables", unless otherwise indicated.
 - c. Cable for Low-Voltage Control and Signal Circuits: Install unshielded, twisted-pair cable, unless otherwise indicated or if manufacturer recommends shielded cable, according to Division 28 Section "Conductors And Cables For Electronic Safety And Security".



- d. Data and Television Signal Transmission Cables: Install according to Division 28 Section "Conductors And Cables For Electronic Safety And Security"
 9. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.
 10. Install power supplies and other auxiliary components for detection devices at controllers, unless otherwise indicated or required by manufacturer. Do not install such items near devices they serve.
 11. Stain-Sensitive Transducer Cable: Attached to fence at 12-inch (300-mm) intervals with tie wraps.
 12. Electrostatic-Field System: Install field and sense wires on insulators and standoffs on a fence, wall, or roof. Provide intermediate supports recommended in writing by manufacturer as needed for specified performance.
 13. Buried, Ported Coaxial Cable: Transmitters may be located at one end of parallel coaxial cables, and preamplifier-sensor module may be located at opposite end. Install cable so shield is uniform throughout the length, without twisting or distorting cable during installation. Field-cut cables to exact zone length at the site. To attach data transmission cable to sensing cable, use heat-shrink splice kits approved by manufacturer. Provide sufficient overlap of detector cables to eliminate the possibility of entry between zones.
- D. Identification
1. Identify system components wiring, cabling, and terminals. Comply with identification requirements in Division 26 Section "Identification For Electrical Systems".
 2. Install instructions frame in a location visible from master control unit.
- E. Grounding
1. Ground the master control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to master control unit.
 2. Ground system components and conductor and cable shields to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
 3. Signal Ground Terminal: Locate at main equipment rack or cabinet. Isolate from power system and equipment grounding. Provide 5-ohm ground. Measure, record, and report ground resistance.
 4. Install grounding electrodes of type, size, location, and quantity indicated. Comply with installation requirements in Division 26 Section "Grounding And Bonding For Electrical Systems".
- F. Field Quality Control
1. Pretesting: After installation, align, adjust, and balance system and perform complete pretesting to determine compliance of system with requirements in the Contract Documents. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new ones and retest until satisfactory performance and conditions are achieved. Prepare forms for systematic recording of acceptance test results.
 - a. Report of Pretesting: After pretesting is complete, provide a letter certifying that installation is complete and fully operable; include names and titles of witnesses to preliminary tests.
 2. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections.
 3. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components and equipment installations, including connections.
 4. Tests and Inspections: Comply with provisions in NFPA 731, Ch.9, "Testing and Inspections."
 - a. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.
 - b. Operational Tests: Schedule tests after pretesting has been successfully completed. Test all modes of system operation and perimeter security at each detection device. Test for detection of intrusion and for false alarms in each protected zone. Test for false alarms by simulating activities outside indicated detection patterns.
 - c. Electrical Tests: Comply with NFPA 72, Section A-7. Minimum required tests are as follows:



- 1) Verify the absence of unwanted voltages between circuit conductors and ground.
 - 2) Test all conductors for short circuits using an insulation-testing device.
 - 3) With each circuit pair, short circuit at the far end of circuit and measure circuit resistance with an ohmmeter. Record circuit resistance of each circuit on Record Drawings.
 - 4) Verify that each controller is in normal condition as detailed in manufacturer's operation and maintenance manual.
 - 5) Test signal and data transmission circuits complying with requirements in Division 28 Section "Conductors And Cables For Electronic Safety And Security" for proper signal transmission under open-circuit conditions. One connection each should be opened at not less than 10 percent of initiating and indicating devices. Observe proper signal transmission according to class of wiring used.
 - 6) Verify that transient surge-protection devices are installed according to manufacturer's written instructions.
 - 7) Test each initiating and indicating device for alarm operation and proper response at central-station control unit.
 - 8) Test both primary and secondary power. Verify, by test, that UPS is capable of operating the system for period and in manner specified.
- d. Geophone System Tests: Test each zone at a minimum of two different locations. Test each zone as follows:
- 1) Horizontal Movement: Adjust sensitivity to screen out alarms from wind.
 - 2) Vertical Climb: 100 percent detection required. Set count at 3 occurrences within 90-second window.
 - 3) Cut Test: 100 percent detection required. Set count at 2 occurrences within 120-second window.
 - 4) Set sensitivity to value as low as possible, consistent with reliable detection.
 - 5) If performance tests fail, make adjustments to sensors to comply with requirements. Retest failing and adjacent zones to comply with test.
- e. Strain-Sensitive Cable System Tests: Adjust sensitivity and count control to value as low as possible, consistent with reliable detection.
- f. Microwave Perimeter Security System Tests: Adjust sensitivity to value as low as possible, consistent with reliable detection.
- g. Long-Range PIR System Tests: Adjust sensitivity and hold time between activity duration to value as low as possible, consistent with reliable detection.
5. Report of Tests and Inspections: Prepare a written record of tests, inspections, and detailed test results in the form of a test log.
 6. Tag all equipment, stations, and other components at which tests have been satisfactorily completed.
- G. Demonstration
1. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain perimeter security.
- H. Adjusting
1. Occupancy Adjustments: When requested within 12 months of date of Final Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose. Visits for this purpose shall be in addition to any required by warranty.

END OF SECTION 28 13 33 16



SECTION 28 13 33 16a - INTRUSION DETECTION

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for intrusion detection. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes:
 - a. Intrusion detection with communication links to perform monitoring, alarm, and control functions.
2. Integration of other electronic and electrical systems and equipment.

C. Definitions

1. CCTV: Closed-circuit television.
2. PIR: Passive infrared.
3. RFI: Radio-frequency interference.
4. UPS: Uninterruptible power supply.
5. Control Unit: System component that monitors inputs and controls outputs through various circuits.
6. Master Control Unit: System component that accepts inputs from other control units and may also perform control-unit functions. The unit has limited capacity for the number of protected zones and is installed at an unattended location or at a location where it is not the attendant's primary function to monitor the security system.
7. Monitoring Station: Facility that receives signals and has personnel in attendance at all times to respond to signals. A central station is a monitoring station that is listed.
8. Protected Zone: A protected premises or an area within a protected premises that is provided with means to prevent an unwanted event.
9. Standard Intruder: A person who weighs 100 lb (45 kg) or less and whose height is 60 inches (1525 mm) or less; dressed in a long-sleeved shirt, slacks, and shoes unless environmental conditions at the site require protective clothing.
10. Standard-Intruder Movement: Any movement, such as walking, running, crawling, rolling, or jumping, of a "standard intruder" in a protected zone.
11. Systems Integration: The bringing together of components of several systems containing interacting components to achieve indicated functional operation of combined systems.
12. Zone. A defined area within a protected premises. It is a space or area for which an intrusion must be detected and uniquely identified. The sensor or group of sensors must then be assigned to perform the detection, and any interface equipment between sensors and communication must link to master control unit.

D. Action Submittals

1. Product Data: Components for sensing, detecting, systems integration, and control, including dimensions and data on features, performance, electrical characteristics, ratings, and finishes.
2. Show Drawings: Detail assemblies of standard components that are custom assembled for specific application on the Project.
 - a. Functional Block Diagram: Show single-line interconnections between components including interconnections between components specified in this Section and those furnished under other Sections. Indicate methods used to achieve systems integration. Indicate control, signal, and data communication paths and identify programmable logic controllers **OR** networks, **as directed** and control interface devices and media to be used. Describe characteristics of network and other data communication lines.



- 1) Indicate methods used to achieve systems integration.
 - 2) Indicate control, signal, and data communication paths and identify PLCs, networks, control interface devices, and media to be used.
 - 3) Describe characteristics of network and other data communication lines.
 - 4) Describe methods used to protect against power outages and transient voltages including types and ratings of isolation and surge suppression devices used in data, communication, signal, control, and ac and dc power circuits.
- b. Raceway Riser Diagrams: Detail raceway runs required for intrusion detection and for systems integration. Include designation of devices connected by raceway, raceway type and size, and type and size of wire and cable fill for each raceway run.
 - c. UPS: Sizing calculations.
 - d. Site and Floor Plans: Indicate final outlet and device locations, routing of raceways, and cables inside and outside the building. Include room layout for master control-unit console, terminal cabinet, racks, and UPS.
 - e. Master Control-Unit Console Layout: Show required artwork and device identification.
 - f. Device Address List: Coordinate with final system programming.
 - g. System Wiring Diagrams: Include system diagrams unique to Project. Show connections for all devices, components, and auxiliary equipment. Include diagrams for equipment and for system with all terminals and interconnections identified.
 - h. Details of surge-protection devices and their installation.
 - i. Sensor detection patterns and adjustment ranges.
3. Equipment and System Operation Description: Include method of operation and supervision of each component and each type of circuit. Show sequence of operations for manually and automatically initiated system or equipment inputs. Description must cover this specific Project; manufacturer's standard descriptions for generic systems are unacceptable.
 4. Samples for Initial Selection: For units with factory-applied color finishes.
 5. Samples for Verification: For each type of exposed finish required.

E. Information Submittals

1. Qualification Data: For Installer **OR** intrusion detection systems integrator **OR** testing agency, **as directed**.
2. Field quality-control reports.
3. Warranty: Sample of special warranty.
4. Other Information Submittals:
 - a. Test Plan and Schedule: Test plan defining all tests required to ensure that system meets technical, operational, and performance specifications within 60 days of date of Contract award.
 - b. Examination reports documenting inspections of substrates, areas, and conditions.
 - c. Anchor inspection reports documenting inspections of built-in and cast-in anchors.

F. Closeout Submittals

1. Operation and Maintenance Data: For intrusion detection system to include in emergency, operation, and maintenance manuals," include the following:
 - a. Data for each type of product, including features and operating sequences, both automatic and manual.
 - b. Master control-unit hardware and software data.

G. Quality Assurance

1. Installer Qualifications:
 - a. An employer of workers, at least one of whom is a technician certified by the National Burglar & Fire Alarm Association.
 - b. Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
2. Intrusion Detection Systems Integrator Qualifications: An experienced intrusion detection equipment supplier and Installer who has completed systems integration work for installations



similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

3. Testing Agency Qualifications: An independent testing agency, with the experience and capability to conduct the testing indicated, that is a member company of the National Burglar & Fire Alarm Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to Owner's insurance underwriter.
 - a. Testing Agency's Field Supervisor: Person currently certified as an advanced alarm technician by the National Burglar & Fire Alarm Association to supervise on-site testing specified in Part 3.
4. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
5. Control Units, Devices, and Communications with Monitoring Station: Listed and labeled by a qualified testing agency for compliance with SIA CP-01.
6. FM Global Compliance: FMG-Approved and -labeled intrusion detection devices and equipment.
7. Comply with NFPA 70.

H. Project Conditions

1. Environmental Conditions: Capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
 - a. Altitude: Sea level to 4000 feet (1220 m).
 - b. Master Control Unit: Rated for continuous operation in an ambient of 60 to 85 deg F (16 to 29 deg C) and a relative humidity of 20 to 80 percent, noncondensing.
 - c. Interior, Controlled Environment: System components, except master station control unit, installed in air-conditioned **OR** temperature-controlled, **as directed**, interior environments shall be rated for continuous operation in ambients of 36 to 122 deg F (2 to 50 deg C) dry bulb and 20 to 90 percent relative humidity, noncondensing.
 - d. Interior, Uncontrolled Environment: System components installed in non-air-conditioned **OR** non-temperature-controlled, **as directed**, interior environments shall be rated for continuous operation in ambients of 0 to 122 deg F (minus 18 to plus 50 deg C) dry bulb and 20 to 90 percent relative humidity, noncondensing.
 - e. Exterior Environment: System components installed in locations exposed to weather shall be rated for continuous operation in ambients of minus 30 to plus 122 deg F (minus 34 to plus 50 deg C) dry bulb and 20 to 90 percent relative humidity, condensing. Comply with UL 294 and UL 639 for outdoor-use equipment. Rate for continuous operation when exposed to rain as specified in NEMA 250, winds up to 85 mph (137 km/h) and snow cover up to 24 inches (610 mm) thick.
 - f. Hazardous Environment: System components located in areas where fire or explosion hazards may exist because of flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers or flyings shall be rated, listed, and installed according to NFPA 70.

I. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer and Installer agree to repair or replace components of intrusion detection devices and equipment that fail in materials or workmanship within specified warranty period.
2. Warranty Period: Two years from date of Final Completion.

1.2 PRODUCTS

A. Functional Description Of System

1. Description: Hard-wired **OR** Multiplexed, modular, microprocessor-based controls, intrusion sensors and detection devices, and communication links to perform monitoring, alarm, and control functions.
2. Supervision: System components shall be continuously monitored for normal, alarm, supervisory, and trouble conditions. Indicate deviations from normal conditions at any location in



- system. Indication includes identification of device or circuit in which deviation has occurred and whether deviation is an alarm or malfunction.
- a. Alarm Signal: Display at master station control unit and actuate audible and visual alarm devices.
 - b. Trouble Condition Signal: Distinct from other signals, indicating that system is not fully functional. Trouble signal shall indicate system problems such as battery failure, open or shorted transmission line conductors, or controller failure.
 - c. Supervisory Condition Signal: Distinct from other signals, indicating an abnormal condition as specified for the particular device or controller.
3. System Control: Master station control unit shall directly monitor intrusion detection units and connecting wiring.
- OR**
- System Control: Master station control unit shall directly monitor intrusion detection devices, perimeter detection units **OR** controllers associated with perimeter detection units, **as directed**, and connecting wiring in a multiplexed distributed control system or as part of a network.
4. System shall automatically reboot program without error or loss of status or alarm data after any system disturbance.
 5. Operator Commands:
 - a. Help with System Operation: Display all commands available to operator. Help command, followed by a specific command, shall produce a short explanation of the purpose, use, and system reaction to that command.
 - b. Acknowledge Alarm: To indicate that alarm message has been observed by operator.
 - c. Place Protected Zone in Access: Disable all intrusion-alarm circuits of a specific protected zone. Tamper circuits may not be disabled by operator.
 - d. Place Protected Zone in Secure: Activate all intrusion-alarm circuits of a protected zone.
 - e. Protected Zone Test: Initiate operational test of a specific protected zone.
 - f. System Test: Initiate system-wide operational test.
 - g. Print Reports.
 6. Timed Control at Master station control unit: Allow automatically timed "secure" and "access" functions of selected protected zones.
 7. Automatic Control of Related Systems: Alarm or supervisory signals from certain intrusion detection devices control the following functions in related systems:
 - a. Switch selected lights.
 - b. Shift elevator control to a different mode.
 - c. Open a signal path between certain intercommunication stations.
 - d. Shift sound system to "listening mode" and open a signal path to certain system speakers.
 - e. Switch signal to selected monitor from closed-circuit television camera in vicinity of sensor signaling an alarm.
 8. Printed Record of Events: Print a record of alarm, supervisory, and trouble events on system printer. Sort and report by protected zone, device, and function. When master station control unit receives a signal, print a report of alarm, supervisory, or trouble condition. Report type of signal (alarm, supervisory, or trouble), protected zone description, date, and time of occurrence. Differentiate alarm signals from other indications. When system is reset, report reset event with the same information concerning device, location, date, and time. Commands shall initiate the reporting of a list of current alarm, supervisory, and trouble conditions in system or a log of past events.
 9. Response Time: Two seconds between actuation of any alarm and its indication at master station control unit.
 10. Circuit Supervision: Supervise all signal and data transmission lines, links with other systems, and sensors from master station control unit. Indicate circuit and detection device faults with both protected zone and trouble signals, sound a distinctive audible tone, and illuminate an LED. Maximum permissible elapsed time between occurrence of a trouble condition and indication at master station control unit is 20 seconds. Initiate an alarm in response to opening, closing, shorting, or grounding of a signal or data transmission line.



11. Programmed Secure-Access Control: System shall be programmable to automatically change status of various combinations of protected zones between secure and access conditions at scheduled times. Status changes may be preset for repetitive, daily, and weekly; specially scheduled operations may be preset up to a year in advance. Manual secure-access control stations shall override programmed settings.
 12. Manual Secure-Access Control: Coded entries at manual stations shall change status of associated protected zone between secure and access conditions.
- B. System Component Requirements
1. Compatibility: Detection devices and their communication features, connecting wiring, and master station control unit shall be selected and configured with accessories for full compatibility with existing equipment:
 2. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor entry connection to components.
 - a. Minimum Protection for Power Lines 120 V and More: Auxiliary panel suppressors complying with requirements in Division 26 Section "Transient-voltage Suppression For Low-voltage Electrical Power Circuits".
 - b. Minimum Protection for Communication, Signal, Control, and Low-Voltage Power Lines: Comply with requirements in Division 26 Section "Transient-voltage Suppression For Low-voltage Electrical Power Circuits" as recommended by manufacturer for type of line being protected.
 3. Intrusion Detection Units: Listed and labeled by a qualified testing agency for compliance with UL 639.
 4. Interference Protection: Components shall be unaffected by radiated RFI and electrical induction of 15 V/m over a frequency range of 10 to 10,000 MHz and conducted interference signals up to 0.25-V RMS injected into power supply lines at 10 to 10,000 MHz.
 5. Tamper Protection: Tamper switches on detection devices, controllers, annunciators, pull boxes, junction boxes, cabinets, and other system components shall initiate a tamper-alarm signal when unit is opened or partially disassembled and when entering conductors are cut or disconnected. Central-station control-unit alarm display shall identify tamper alarms and indicate locations.
 6. Self-Testing Devices: Automatically test themselves periodically, but not less than once per hour, to verify normal device functioning and alarm initiation capability. Devices transmit test failure to master station control unit.
 7. Antimasking Devices: Automatically check operation continuously or at intervals of a minute or less, and use signal-processing logic to detect blocking, masking, jamming, tampering, or other operational dysfunction. Devices transmit detection of operational dysfunction to master station control unit as an alarm signal.
 8. Addressable Devices: Transmitter and receivers shall communicate unique device identification and status reports to master station control unit.
 9. Remote-Controlled Devices: Individually and remotely adjustable for sensitivity and individually monitored at master station control unit for calibration, sensitivity, and alarm condition.
- C. Enclosures
1. Interior Sensors: Enclosures that protect against dust, falling dirt, and dripping noncorrosive liquids.
 2. Interior Electronics: NEMA 250, Type 12.
 3. Exterior Electronics: NEMA 250, Type 4X fiberglass **OR** stainless steel, **as directed**.
 4. Corrosion Resistant: NEMA 250, Type 4X PVC **OR** stainless steel, **as directed**.
 5. Screw Covers: Where enclosures are accessible to inmates, secure with security fasteners of type appropriate for enclosure.
- D. Secure And Access Devices
1. Keypad and Display Module: Arranged for entering and executing commands for system-status changes and for displaying system-status and command-related data.
 2. Key-Operated Switch: Change protected zone between secure and access conditions.



E. Door And Window Switches

1. Description: Balanced-magnetic switch, complying with UL 634, installed on frame with integral overcurrent device to limit current to 80 percent of switch capacity. Bias magnet and minimum of two **OR** three, **as directed**, encapsulated reed switches shall resist compromise from introduction of foreign magnetic fields.
2. Flush-Mounted Switches: Unobtrusive and flush with surface of door and window frame.
3. Overhead Door Switch: Balanced-magnetic type, listed for outdoor locations, and having door-mounting magnet and floor-mounting switch unit.
4. Remote Test: Simulate movement of actuating magnet from master station control unit.

F. PIR Sensors

1. Listed and labeled by a qualified testing agency for compliance with SIA PIR-01.
2. Description: Sensors detect intrusion by monitoring infrared wavelengths emitted from a human body within their protected zone and by being insensitive to general thermal variations.
 - a. Wall-Mounting Unit Maximum Detection Range: 125 percent of indicated distance for individual units and not less than 50 feet (15 m). Provide adjustable coverage pattern as indicated.
 - b. Ceiling-Mounting Unit Spot-Detection Pattern: Full 360-degree conical.
 - c. Ceiling-Mounting Unit Pattern Size: 84-inch (2135-mm) diameter at floor level for units mounted 96 inches (2440 mm) above floor; 18-foot (5.5-m) diameter at floor level for units mounted 25 feet (7.6 m) above floor.
3. Device Performance:
 - a. Sensitivity: Adjustable pattern coverage to detect a change in temperature of 2 deg F (1deg C) or less, and standard-intruder movement within sensor's detection patterns at any speed between 0.3 to 7.5 fps (0.09 to 2.3 m/s) across 2 adjacent segments of detector's field of view.
 - b. Test Indicator: LED test indicator that is not visible during normal operation. When visible, indicator shall light when sensor detects an intruder. Locate test enabling switch under sensor housing cover.
 - c. Remote Test: When initiated by master station control unit, start a test sequence for each detector element that simulates standard-intruder movement within sensor's detection patterns, causing an alarm.

G. Microwave Intrusion Detectors (Interior)

1. Device Performance: Microwave transmitter establishes an electromagnetic field in an adjustable detection pattern and detects intrusion by monitoring changes in that pattern.
 - a. Sensitivity: Adjustable, able to detect standard-intruder movement within sensor's detection pattern at any speed between 0.3 to 7.5 fps (0.09 to 2.3 m/s). Sensor sensitivity adjustments shall be accessible only when sensor housing is removed, and sensors shall comply with 47 CFR 15.
 - b. Activation Indicator: LED indicator shall not be visible during normal operation. Indicator shall light when sensor detects a standard intruder. Locate test-enabling switch under sensor housing cover.
 - c. Remote Test: When initiated by master station control unit, start a test sequence for each detector element that simulates standard-intruder movement within sensor's detection patterns, causing an alarm.

H. Acoustic-Type, Glass-Break Sensors

1. Listed and labeled by a qualified testing agency for compliance with SIA GB-01.
2. Device Performance: Detect unique, airborne acoustic energy spectrum caused by breaking glass.
 - a. Sensor Element: Microprocessor-based, digital device to detect breakage of plate, laminate, tempered, and wired glass while rejecting common causes of false alarms. Detection pattern shall be at least a 20-foot (6-m) range.
 - b. Hookup Cable: Factory installed, not less than 72 inches (1830 mm).



- c. Activation Indicator: LED on sensor housing that lights when responding to vibrations, remaining on until manually reset at sensor controller or at master station control unit.
 - d. Controller: Integral with sensor housing or in a separate assembly, locally adjustable by control under housing cover.
 - e. Glass-Break Simulator: A device to induce frequencies into protected glass pane that simulate breaking glass without causing damage to glass.
- I. Piezoelectric-Type, Glass-Break Sensors
1. Listed and labeled by a qualified testing agency for compliance with SIA GB-01.
 2. Device Performance: Detect unique, high-frequency vibrations caused by breaking glass.
 - a. Sensor Element: Piezoelectric crystals in a housing designed to mount directly to glass surface with adhesive provided by element manufacturer. Circular detection pattern, with at least a 60-inch (1525-mm) radius on a continuous glass pane. Sensor element shall not be larger than 4 sq. in. (25.80 sq. cm).
 - b. Hookup Cable: Factory installed, not less than 72 inches (1830 mm).
 - c. Activation Indicator: LED on sensor housing that lights when responding to vibrations, remaining on until manually reset at sensor controller or at master station control unit.
 - d. Controller: Integral with sensor housing or in a separate assembly, locally adjustable by control under housing cover.
 - e. Glass-Break Simulator: A device to induce frequencies into protected glass pane that simulate breaking glass without causing damage to glass.
- J. Vibration Sensors
1. Listed and labeled by a qualified testing agency for compliance with SIA GB-01.
 2. Description: A sensor controller and piezoelectric crystal sensor elements that are designed to be rigidly mounted to structure being protected.
 3. Device Performance: Detects high-frequency vibrations generated by use of such tools as oxyacetylene torches, oxygen lances, high-speed drills and saws, and explosives that penetrate a structure while not responding to any other mechanical vibration.
 - a. Circular detection pattern, with at least a 72-inch (1830-mm) radius on protected structure.
 - b. Hookup Cable: Factory installed, not less than 72 inches (1830 mm).
 - c. Controller: Integral with sensor housing or in a separate assembly, locally adjustable by control under housing cover.
 - d. Glass-Break Simulator: A device to induce frequencies to protected glass pane that simulate breaking glass without causing damage to glass.
- K. Photoelectric Sensors
1. Device Performance: Detect an interruption of a pulsed, infrared, light beam that links transmitter and receiver.
 - a. Sensitivity: Detect standard-intruder movement within sensor's detection patterns at any speed of less than 7.5 fps (2.3 m/s) though the beam. Allow installation of multiple sensors within same protected zone that will not interfere with each other.
 - b. Activation Indicator: LED indicator shall not be visible during normal operation. Indicator shall light when sensor detects a standard intruder. Locate test enabling switch under sensor housing cover.
 - c. Remote Test: When initiated by master station control unit, start a test sequence for each detector element that simulates standard-intruder movement within sensor's detection patterns, causing an alarm.
- L. Microwave-PIR Dual-Technology Motion Sensors
1. Description: Single unit combining a sensor that detects changes in microwave signals and a PIR sensor that detects changes in ambient level of infrared emissions caused by standard-intruder movement within detection pattern.
 2. Device Performance: An alarm is transmitted when either sensor detects a standard intruder within a period of three to eight seconds from when the other sensor detects a standard intruder.
 - a. Minimum Detection Pattern: A room 20 by 30 feet (6 by 9 m).



- b. PIR Sensor Sensitivity: Adjustable pattern coverage to detect a change in temperature of 2 deg F (1 deg C) or less, and standard-intruder movement within sensor's detection patterns at any speed between 0.3 to 7.5 fps (0.09 to 2.3 m/s) across 2 adjacent segments of detector's field of view.
 - c. Microwave Sensor Sensitivity: Adjustable, able to detect standard-intruder movement within sensor's detection pattern at any speed between 0.3 to 7.5 fps (0.09 to 2.3 m/s). Sensor sensitivity adjustments shall be accessible only when sensor housing is removed, and sensors shall comply with 47 CFR 15.
 - d. Activation Indicator: LED indicator shall not be visible during normal operation. Indicator shall light when sensor detects a standard intruder. Locate test enabling switch under sensor housing cover.
 - e. Remote Test: When initiated by master station control unit, start a test sequence for each detector element that simulates standard-intruder movement within sensor's detection patterns, causing an alarm.
- M. Duress-Alarm Switches
- 1. Description: A switch with a shroud over the activating lever that allows an individual to covertly send a duress signal to master station control unit, with no visible or audible indication when activated. Switch shall lock in activated position until reset with a key.
 - a. Minimum Switch Rating: 50,000 operations.
 - b. Foot Rail: Foot activated, floor mounting.
 - c. Push Button: Finger activated, suitable for mounting on horizontal or vertical surface.
- N. Video Motion Sensor (Interior)
- 1. Device Performance: Detect changes in video signal within a user-defined protected zone. Video inputs shall be composite video as defined in EIA 170. Provide an alarm output for each video input.
 - a. Detect movement within protected zone of standard intruders wearing clothing with a reflectivity that differs from that of background scene by a factor of 2. Reject all other changes in video signal.
 - b. Modular design that allows for expansion or modification of number of inputs.
 - c. Controls:
 - 1) Number of detection zones.
 - 2) Size of detection zones.
 - 3) Sensitivity of detection of each protected zone.
 - d. Mounting: Standard 19-inch (480-mm) rack as described in EIA 310.
- O. Master Control Units
- 1. Description: Supervise sensors and detection subsystems and their connecting communication links, status control (secure or access) of sensors and detector subsystems, activation of alarms and supervisory and trouble signals, and other indicated functions.
 - a. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
 - b. Include a real-time clock for time annotation of events on the event recorder and printer.
 - c. Addressable initiation devices that communicate device identity and status.
 - d. Control circuits for operation of mechanical equipment in response to an alarm.
 - 2. Construction: Freestanding equipment rack **OR** Desk-mounted console, **as directed** modular, with separate and independent alarm and supervisory system modules. Alarm-initiating protected zone boards shall be plug-in cards. Arrangements that require removal of field wiring for module replacement are unacceptable.
 - 3. Comply with UL 609 **OR** UL 1023 **OR** UL 1076, **as directed**.
 - 4. Console Controls and Displays: Arranged for interface between human operator at master control unit and addressable system components including annunciation and supervision.



- Display alarm, supervisory, and component status messages and the programming and control menu.
- a. Annunciator and Display: LCD, one **OR** two **OR** three line(s), as directed of 40 **OR** 80 characters, as directed, minimum.
 - b. Keypad: Arranged to permit entry and execution of programming, display, and control commands.
 - c. Control-Unit Network: Automatic communication of alarm, status changes, commands, and other communications required for system operation. Communication shall return to normal after partial or total network interruption such as power loss or transient event. Total or partial signaling network failures shall identify the failure and record the failure at the annunciator display and at the system printer.
 - d. Field Device Network: Communicate between the control unit and field devices of the system. Communications shall consist of alarm, network status, and status and control of field-mounted processors. Each field-mounted device shall be interrogated during each interrogation cycle.
 - e. Operator Controls: Manual switches and push-to-test buttons that do not require a key to operate. Prevent resetting of alarm, supervisory, or trouble signals while alarm or trouble condition persists. Include the following:
 - 1) Acknowledge alarm.
 - 2) Silence alarm.
 - 3) System reset.
 - 4) LED test.
 - f. Timing Unit: Solid state, programmable, 365 days.
 - g. Confirmation: Relays, contactors, and other control devices shall have auxiliary contacts that provide confirmation signals to system for their on or off status. Software shall interpret such signals, display equipment status, and initiate failure signals.
 - h. Alarm Indication: Audible signal sounds and a plain-language identification **OR** LED **OR** LCD **OR** cathode ray-tube display at master control unit identifying the protected zone **OR** addressable detector, **as directed** originating the alarm. Annunciator panel displays a common alarm light and sounds an audible tone.
 - i. Alarm activation sounds a bell or siren or strobe **OR** bell or siren and strobe, **as directed**.
5. Protected Zones: Quantity of alarm and supervisory zones as indicated, with capacity for expanding number of protected zones by a minimum of 25 percent.
 6. Power Supply Circuits: Master station control units shall provide power for remote power-consuming detection devices. Circuit capacity shall be adequate for at least a 25 percent increase in load.
 7. UPS: Comply with Division 26 Section "Static Uninterruptible Power Supply". UPS shall be sized to provide a minimum of six hours of central-station control-unit operation.
 8. Cabinet: Lockable, steel enclosure arranged so operations required for testing, normal operation, and maintenance are performed from front of enclosure. If more than a single cabinet is required to form a complete control unit, provide exactly matching modular enclosures. Accommodate all components and allow ample gutter space for field wiring. Identify each enclosure by an engraved, laminated, phenolic-resin nameplate. Lettering on enclosure nameplate shall not be less than 1 inch (25 mm) high. Identify, with permanent labels, individual components and modules within cabinets.
 9. Transmission to Monitoring Station: A communications device to automatically transmit alarm, supervisory, and trouble signals to the monitoring station, operating over a standard voice grade telephone leased line. Comply with UL 1635.
 10. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also print system reset event, including same information for device, location, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.

P. Audible And Visual Alarm Devices



1. Bell: 10 inches (254 mm) in diameter, rated to produce a minimum sound output of 84 dB at 10 feet (3 m) from master control unit.
 - a. Enclosure: Weather-resistant steel box equipped with tamper switches on cover and on back of box.
2. Klaxon Weatherproof Motor-Driven Hooter: UL listed, rated to produce a minimum sound output of 120 dB at 3 feet (1 m), plus or minus 3 dB, at a frequency of 470 Hz. Rated for intermittent use: two minutes on and five minutes off.
 - a. Designed for use in industrial areas and in high-noise, severe-weather marine environments.
3. Siren: 30-W speaker with siren driver, rated to produce a minimum sound output of 103 dB at 10 feet (3 m) from master control unit.
 - a. Enclosure: Weather-resistant steel box with tamper switches on cover and on back of box.
4. Strobe: Xenon light complying with UL 1638, with a clear polycarbonate lens.
 - a. Light Output: 115 cd, minimum.
 - b. Flash Rate: 60 per minute.

Q. Security Fasteners

1. Operable only by tools produced for use on specific type of fastener by fastener manufacturer or other licensed fabricator. Drive system type, head style, material, and protective coating as required for assembly, installation, and strength.
2. Drive System Types: Pinned Torx-Plus **OR** pinned Torx **OR** pinned hex (Allen), **as directed**.
3. Socket Flat Countersunk Head Fasteners:
 - a. Heat-treated alloy steel, ASTM F 835 (ASTM F 835M).
 - b. Stainless steel, ASTM F 879 (ASTM F 879M), Group 1 CW.
4. Socket Button Head Fasteners:
 - a. Heat-treated alloy steel, ASTM F 835 (ASTM F 835M).
 - b. Stainless steel, ASTM F 879 (ASTM F 879M), Group 1 CW.
5. Socket Head Cap Fasteners:
 - a. Heat-treated alloy steel, ASTM A 574 (ASTM A 574M).
 - b. Stainless steel, ASTM F 837 (ASTM F 837M), Group 1 CW.
6. Protective Coatings for Heat-Treated Alloy Steel:
 - a. Zinc chromate, ASTM F 1135, Grade 3 or Grade 4, for exterior applications and interior applications where indicated.
 - b. Zinc phosphate with oil, ASTM F 1137, Grade I, or black oxide unless otherwise indicated.

1.3 EXECUTION

A. Examination

1. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of intrusion detection.
2. Examine roughing-in for embedded and built-in anchors to verify actual locations of intrusion detection connections before intrusion detection installation.
3. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of intrusion detection.
4. Inspect built-in and cast-in anchor installations, before installing intrusion detection, to verify that anchor installations comply with requirements. Prepare inspection reports.
 - a. Remove and replace anchors where inspections indicate that they do not comply with requirements. Reinspect after repairs or replacements are made.
 - b. Perform additional inspections to determine compliance of replaced or additional anchor installations. Prepare inspection reports.
5. For material whose orientation is critical for its performance as a ballistic barrier, verify installation orientation.
6. Proceed with installation only after unsatisfactory conditions have been corrected.



B. System Integration

1. Electronic door hardware.
2. Elevators.
3. Network lighting controls.
4. Intercommunications and program systems.
5. Public address and mass notification systems.
6. Access control.
7. Fire-alarm system.
8. Perimeter security system.
9. Video surveillance.

C. System Installation

1. Comply with UL 681 and NFPA 731.
2. Equipment Mounting: Install master control unit on finished floor with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.
 - a. Comply with requirements for seismic-restraint devices specified in Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
3. Install wall-mounted equipment, with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.
 - a. Comply with requirements for seismic-restraint devices specified in Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
4. Connecting to Existing Equipment: Verify that existing perimeter security system is operational before making changes or connections.
 - a. Connect new equipment to existing control panel in existing part of the building.
 - b. Connect new equipment to existing monitoring equipment at the Supervising Station.
 - c. Expand, modify, and supplement existing control **OR** monitoring equipment, **as directed** as necessary to extend existing control **OR** monitoring functions, **as directed** to the new points. New components shall be capable of merging with existing configuration without degrading the performance of either system.
5. Security Fasteners: Where accessible to inmates, install intrusion detection components using security fasteners with head style appropriate for fabrication requirements, strength, and finish of adjacent materials except that a maximum of two different sets of tools shall be required to operate security fasteners for Project. Provide stainless-steel security fasteners in stainless-steel materials.

D. Wiring Installation

1. Wiring Method: Install wiring in metal raceways according to Division 26 Section "Raceway And Boxes For Electrical Systems". Conceal raceway except in unfinished spaces and as indicated. Minimum conduit size shall be 1/2 inch (13 mm). Control and data transmission wiring shall not share conduit with other building wiring systems.
2. Wiring Method: Install wiring in raceways except in accessible indoor ceiling spaces and in interior hollow gypsum board partitions where cable may be used. Conceal raceways and wiring except in unfinished spaces and as indicated. Minimum conduit size shall be 1/2 inch (13 mm). Control and data transmission wiring shall not share conduit with other building wiring systems.
3. Wiring Method: Cable, concealed in accessible ceilings, walls, and floors when possible.
4. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Use lacing bars and distribution spools. Separate power-limited and non-power-limited conductors as recommended in writing by manufacturer. Install conductors parallel with or at right angles to sides and back of enclosure. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with intrusion system to terminal blocks. Mark each terminal according to system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
5. Wires and Cables:
 - a. Conductors: Size as recommended in writing by system manufacturer, unless otherwise indicated.



- b. 120-V Power Wiring: Install according to Division 26 Section "Low-voltage Electrical Power Conductors And Cables", unless otherwise indicated.
 - c. Control and Signal Transmission Conductors: Install unshielded, twisted-pair cable, unless otherwise indicated or if manufacturer recommends shielded cable, according to Division 28 Section "Conductors And Cables For Electronic Safety And Security".
 - d. Data and Television Signal Transmission Cables: Install according to Division 28 Section "Conductors And Cables For Electronic Safety And Security".
6. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.
 7. Install power supplies and other auxiliary components for detection devices at controllers, unless otherwise indicated or required by manufacturer. Do not install such items near devices they serve.
 8. Identify components with engraved, laminated-plastic or metal nameplate for master station control unit and each terminal cabinet, mounted with corrosion-resistant screws. Nameplates and label products are specified in Division 26 Section "Identification For Electrical Systems".
- E. Identification
1. Identify system components, wiring, cabling, and terminals. Comply with identification requirements as specified in Division 26 Section "Identification For Electrical Systems".
 2. Install instructions frame in a location visible from master control unit.
- F. Grounding
1. Ground the master control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to master control unit.
 2. Ground system components and conductor and cable shields to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
 3. Signal Ground Terminal: Locate at main equipment rack or cabinet. Isolate from power system and equipment grounding. Provide 5-ohm ground. Measure, record, and report ground resistance.
 4. Install grounding electrodes of type, size, location, and quantity indicated. Comply with installation requirements in Division 26 Section "Grounding And Bonding For Electrical Systems".
- G. Field Quality Control
1. Pretesting: After installation, align, adjust, and balance system and perform complete pretesting to determine compliance of system with requirements in the Contract Documents. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new ones and retest until satisfactory performance and conditions are achieved. Prepare forms for systematic recording of acceptance test results.
 - a. Report of Pretesting: After pretesting is complete, provide a letter certifying that installation is complete and fully operable; include names and titles of witnesses to preliminary tests.
 2. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections.
 3. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect test, and adjust components, assemblies, and equipment installations connections.
 4. Perform tests and inspections.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
 5. Test and Inspections: Comply with provisions in NFPA 731, Ch.9, "Testing and Inspections."
 - a. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.
 - b. Test Methods: Intrusion detection systems and other systems and equipment that are associated with detection and accessory equipment shall be tested according to Table "Test Methods" and Table "Test Methods of Initiating Devices."
 6. Documentation: Comply with provisions in NFPA 731, Ch. 4, "Documentation."



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7. Tag all equipment, stations, and other components for which tests have been satisfactorily completed.
 - 8.
- H. Adjusting
1. Occupancy Adjustments: When requested within 12 months of Final Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to Project during other than normal occupancy hours for this purpose. Visits for this purpose shall be in addition to any required by warranty.
- I. Demonstration
1. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain intrusion detection system. Comply with documentation provisions in NFPA 731, Ch.4, "Documentation and User Training."

END OF SECTION 28 13 33 16a



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SECTION 28 13 33 16b - SECURITY ACCESS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for security access. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Security access central-control station.
 - b. One or more security access networked workstations.
 - c. Security access operating system and application software.
 - d. Security access controllers connected to high-speed electronic-data transmission network.

C. Definitions

1. CCTV: Closed-circuit television.
2. CPU: Central processing unit.
3. Credential: Data assigned to an entity and used to identify that entity.
4. dpi: Dots per inch.
5. DTS: Digital Termination Service. A microwave-based, line-of-sight communication provided directly to the end user.
6. GFI: Ground fault interrupter.
7. Identifier: A credential card; keypad personal identification number; or code, biometric characteristic, or other unique identification entered as data into the entry-control database for the purpose of identifying an individual. Where this term is presented with an initial capital letter, this definition applies.
8. I/O: Input/Output.
9. LAN: Local area network.
10. Location: A Location on the network having a PC-to-controller communications link, with additional controllers at the Location connected to the PC-to-controller link with a TIA 485-A communications loop. Where this term is presented with an initial capital letter, this definition applies.
11. PC: Personal computer. Applies to the central station, workstations, and file servers.
12. PCI Bus: Peripheral Component Interconnect. A peripheral bus providing a high-speed data path between the CPU and the peripheral devices such as a monitor, disk drive, or network.
13. PDF: Portable Document Format. The file format used by the Acrobat document-exchange-system software from Adobe.
14. RAS: Remote access services.
15. RF: Radio frequency.
16. ROM: Read-only memory. ROM data are maintained through losses of power.
17. TCP/IP: Transport control protocol/Internet protocol incorporated into Microsoft Windows.
18. TWAIN: Technology without an Interesting Name. A programming interface that lets a graphics application, such as an image editing program or desktop publishing program, activate a scanner, frame grabber, or other image-capturing device.
19. UPS: Uninterruptible power supply.
20. USB: Universal serial bus.
21. WAN: Wide area network.
22. WAV: The digital audio format used in Microsoft Windows.
23. WMP: Windows media player.
24. Wiegand: Patented magnetic principle that uses specially treated wires embedded in the credential card.



25. Windows: Operating system by Microsoft Corporation.
26. Workstation: A PC with software that is configured for specific, limited security-system functions.
27. WYSIWYG: What You See Is What You Get. Text and graphics appear on the screen the same as they will in print.

D. Submittals

1. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Reference each product to a location on Drawings. Test and evaluation data presented in Product Data shall comply with SIA BIO-01.
2. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - a. Diagrams for cable management system.
 - b. System labeling schedules, including electronic copy of labeling schedules that are part of the cable and asset identification system of the software specified in Parts 1.2 and 1.3.
 - c. Wiring Diagrams. For power, signal, and control wiring. Show typical wiring schematics including the following:
 - 1) Workstation outlets, jacks, and jack assemblies.
 - 2) Patch cords.
 - 3) Patch panels.
 - d. Cable Administration Drawings: As specified in Part 1.3 "Identification" Article.
 - e. Battery and charger calculations for Central Station, workstations, and Controllers.
3. Samples: For workstation outlets, jacks, jack assemblies, and faceplates. For each exposed product and for each color and texture specified.
4. Other Action Submittals:
 - a. Project planning documents as specified in Part 1.3.
5. Field quality-control test reports.
6. Operation and Maintenance Data: For security system to include in emergency, operation, and maintenance manuals. Include the following:
 - a. Microsoft Windows software documentation.
 - b. PC installation and operating documentation, manuals, and software for the PC and all installed peripherals. Software shall include system restore, emergency boot diskettes, and drivers for all installed hardware. Provide separately for each PC.
 - c. Hard copies of manufacturer's specification sheets, operating specifications, design guides, user's guides for software and hardware, and PDF files on CD-ROM of the hard-copy submittal.
 - d. System installation and setup guides, with data forms to plan and record options and setup decisions.

E. Quality Assurance

1. Installer Qualifications: An employer of workers trained and approved by manufacturer.
 - a. Cable installer must have on staff a registered communication distribution designer certified by Building Industry Consulting Service International.
2. Source Limitations: Obtain Central Station, workstations, Controllers, Identifier readers, and all software through one source from a single manufacturer.
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70 by a qualified testing agency, and marked for intended use.
4. Comply with NFPA 70, "National Electrical Code."
5. Comply with SIA DC-01 and SIA DC-03 and SIA DC-07, **as directed**.

F. Delivery, Storage, And Handling

1. Central Station, Workstations, and Controllers:
 - a. Store in temperature- and humidity-controlled environment in original manufacturer's sealed containers. Maintain ambient temperature between 50 and 85 deg F (10 and 30 deg C), and not more than 80 percent relative humidity, noncondensing.
 - b. Open each container; verify contents against packing list, and file copy of packing list, complete with container identification for inclusion in operation and maintenance data.



- c. Mark packing list with designations that have been assigned to materials and equipment for recording in the system labeling schedules that are generated by cable and asset management system specified in Part 2.
- d. Save original manufacturer's containers and packing materials and deliver as directed under provisions covering extra materials.

G. Project Conditions

1. Environmental Conditions: System shall be capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
 - a. Control Station: Rated for continuous operation in ambient conditions of 60 to 85 deg F (16 to 30 deg C) and a relative humidity of 20 to 80 percent, noncondensing.
 - b. Indoor, Controlled Environment: NEMA 250, Type 1 enclosure. System components, except central-station control unit, installed in air-conditioned **OR** temperature-controlled, **as directed**, indoor environments shall be rated for continuous operation in ambient conditions of 36 to 122 deg F (2 to 50 deg C) dry bulb and 20 to 90 percent relative humidity, noncondensing.
 - c. Indoor, Uncontrolled Environment: NEMA 250, Type 3R **OR** 4 **OR** 12 **OR** 12K, **as directed**, enclosures. System components installed in non-air-conditioned **OR** non-temperature-controlled, **as directed**, interior environments shall be rated for continuous operation in ambient conditions of 0 to 122 deg F (minus 18 to plus 50 deg C) dry bulb and 20 to 90 percent relative humidity, noncondensing.
 - d. Outdoor Environment: NEMA 250, Type 3 **OR** 3R **OR** 3S **OR** 4 **OR** 4X, **as directed**, enclosures. System components installed in locations exposed to weather shall be rated for continuous operation in ambient conditions of minus 30 to plus 122 deg F (minus 34 to plus 50 deg C) dry bulb and 20 to 90 percent relative humidity, condensing. Rate for continuous operation where exposed to rain as specified in NEMA 250, winds up to 85 mph (137 km/h) and snow cover up to 24 inches (610 mm) thick.
 - e. Hazardous Environment: System components located in areas where fire or explosion hazards may exist because of flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers shall be rated, listed, and installed according to NFPA 70.
 - f. Corrosive Environment: For system components subjected to corrosive fumes, vapors, and wind-driven salt spray in coastal zones, provide NEMA 250, Type 4X **OR** 6P, **as directed**, enclosures.

1.2 PRODUCTS

A. Description

1. Security Access System: PC-based central station, one or more networked PC-based workstations, and field-installed controllers, connected by a high-speed electronic-data transmission network.
2. System Software: Based on 32-bit, central-station, workstation operating system, server operating system, and application software. Software shall have the following capabilities:
 - a. Multiuser and multitasking to allow for independent activities and monitoring to occur simultaneously at different workstations.
 - b. Graphical user interface to show pull-down menus and a menu-tree format that complies with interface guidelines of Microsoft Windows.
 - c. System license for the entire system including capability for future additions that are within the indicated system size limits specified in this Section.
 - d. Open-architecture system that allows importing and exporting of data and interfacing with other systems that are compatible with Microsoft Windows.
 - e. Password-protected operator login and access.
 - f. Open-database-connectivity compliant.
3. Network connecting the central station and workstations shall be a LAN **OR** WAN, **as directed**, using Microsoft Windows-based TCP/IP with a capacity of connecting up to 99 workstations.



System shall be portable across multiple communication platforms without changing system software.

4. Network(s) connecting PCs and controllers shall consist of one or more of the following:
 - a. Local area, IEEE 802.3 Fast Ethernet Gigabit-Ethernet **OR** 100 BASE-TX, **as directed**, star topology network based on TCP/IP.
 - b. Direct-connected, RS-232 cable from the COM port of the central station to the first controller, then RS-485 cable to interconnect the remaining controllers at that Location.
 - c. Dial-up and cable modem connection using a standard cable or dial-up telephone line.

B. Operation

1. Security access system shall use a single database for access-control and credential-creation functions.
2. Distributed Processing: A fully distributed processing system.
 - a. Access-control information, including time, date, valid codes, access levels, and similar data, shall be downloaded to controllers so each controller can make access-control decisions.
 - b. Intermediate controllers for access control are prohibited.
 - c. In the event that communications with the central controller are lost, controllers shall automatically buffer event transactions until communications are restored, at which time buffered events shall be uploaded to the central station.
3. Number of Locations:
 - a. Support at least 32,000 separate Locations using a single PC with combinations of direct-connect, dial-up, or TCP/IP LAN connections to each Location.
 - b. Each Location shall have its own database and history in the central station.
 - c. Locations may be combined to share a common database.
4. Data Capacity:
 - a. 130 different card-reader formats.
 - b. 999 comments.
 - c. 48 graphic file types for importing maps.
5. Location Capacity:
 - a. 128 reader-controlled doors.
 - b. 50,000 total-access credentials.
 - c. 2048 supervised alarm inputs.
 - d. 2048 programmable outputs.
 - e. 32,000 custom action messages per Location to instruct operator on action required when alarm is received.
6. System Network Requirements:
 - a. System components shall be interconnected and shall provide automatic communication of status changes, commands, field-initiated interrupts, and other communications required for proper system operation.
 - b. Communication shall not require operator initiation or response and shall return to normal after partial- or total-network interruption such as power loss or transient upset.
 - c. System shall automatically annunciate communication failures to the operator and shall identify the communications link that has experienced a partial or total failure.
 - d. Communications controller may be used as an interface between the central-station display systems and the field device network. Communications controller shall provide functions required to attain the specified network communications performance.
7. Central station shall provide operator interface, interaction, display, control, and dynamic and real-time monitoring. Central station shall control system networks to interconnect all system components, including workstations and field-installed controllers.
8. Field equipment shall include controllers, sensors, and controls.
 - a. Controllers shall serve as an interface between the central station and sensors and controls.
 - b. Data exchange between the central station and the controllers shall include down-line transmission of commands, software, and databases to controllers.



- c. The up-line data exchange from the controller to the central station shall include status data such as intrusion alarms, status reports, and entry-control records.
 - d. Controllers are classified as alarm-annunciation or entry-control type.
 9. System Response to Alarms:
 - a. Field device network shall provide a system end-to-end response time of one second(s) or less for every device connected to the system.
 - b. Alarms shall be annunciated at the central station within one second of the alarm occurring at a controller or at a device controlled by a local controller, and within 100 ms if the alarm occurs at the central station.
 - c. Alarm and status changes shall be displayed within 100 ms after receipt of data by the central station.
 - d. All graphics shall be displayed, including graphics-generated map displays, on the console monitor within five seconds of alarm receipt at the security console.
 - e. This response time shall be maintained during system heavy load.
 10. False-Alarm Reduction: The design of the central station and controllers shall contain features to reduce false alarms. Equipment and software shall comply with SIA CP-01.
 11. Error Detection:
 - a. Use a cyclic code method to detect single- and double-bit errors, burst errors of eight bits or fewer, and at least 99 percent of all other multibit and burst errors between controllers and the central station.
 - b. Interactive or product error-detection codes alone will not be acceptable.
 - c. A message shall be in error if one bit is received incorrectly.
 - d. Retransmit messages with detected errors.
 - e. Allow for an operator-assigned two-digit decimal number to each communications link representing the number of retransmission attempts.
 - f. Central station shall print a communication failure alarm message when the number of consecutive retransmission attempts equals the assigned quantity.
 - g. Monitor the frequency of data transmission failure for display and logging.
 12. Data Line Supervision: System shall initiate an alarm in response to opening, closing, shorting, or grounding of data transmission lines.
 13. Door Hardware Interface:
 - a. Comply with requirements in Division 8 Sections for door hardware required to be monitored or controlled by the security access system.
 - b. Electrical characteristics of controllers shall match the signal and power requirements of door hardware.
- C. Application Software
 1. System Software: Based on 32-bit, Microsoft Windows central-station and workstation operating system and application software.
 - a. Multiuser multitasking shall allow independent activities and monitoring to occur simultaneously at different workstations.
 - b. Graphical user interface shall show pull-down menus and a menu-tree format.
 - c. Capability for future additions within the indicated system size limits.
 - d. Open architecture that allows importing and exporting of data and interfacing with other systems that are compatible with operating system.
 - e. Password-protected operator login and access.
 2. Peer Computer Control Software: Detect a failure of a central computer and cause the other central computer to assume control of all system functions without interruption of operation. Both central computers shall have drivers to support this mode of operation.
 3. Application Software: Interface between the alarm annunciation and entry-control controllers to monitor sensors and DTS links, operate displays, report alarms, generate reports, and help train system operators.
 - a. Reside at the central station, workstations, and controllers as required to perform specified functions.
 - b. Operate and manage peripheral devices.



- c. Manage files for disk I/O, including creating, deleting, and copying files; and automatically maintain a directory of all files, including size and location of each sequential and random-ordered record.
 - d. Import custom icons into graphics to represent alarms and I/O devices.
 - e. Globally link I/O so that any I/O can link to any other I/O within the same Location without requiring interaction with the host PC. This operation shall be at the controller.
 - f. Globally code I/O links so that any access-granted event can link to any I/O with the same Location without requiring interaction with the host PC. This operation shall be at the controller.
 - g. Messages from PC to controllers and controllers to controllers shall be on a polled network that utilizes check summing and acknowledgment of each message. Communication shall be automatically verified, buffered, and retransmitted if message is not acknowledged.
 - h. Selectable poll frequency and message time-out settings shall handle bandwidth and latency issues for TCP/IP, RF, and other PC-to-controller communications methods by changing the polling frequency and the amount of time the system waits for a response.
 - i. Automatic and encrypted backups for database and history backups shall be automatically stored at the central-control PC **OR** a selected workstation, **as directed**, and encrypted with a nine-character alphanumeric password that must be used to restore or read data contained in backup.
 - j. Operator audit trail for recording and reporting all changes made to database and system software.
 - k. Support network protocol and topology, TCP/IP, Novel Netware, Digital Pathworks, Banyan Vines, LAN/WAN, and RAS.
4. Workstation Software:
- a. Password levels shall be individually customized at each workstation to allow or disallow operator access to program functions for each Location.
 - b. Workstation event filtering shall allow user to define events and alarms that will be displayed at each workstation. If an alarm is unacknowledged (not handled by another workstation) for a preset amount of time, the alarm will automatically appear on the filtered workstation.
5. Controller Software:
- a. Controllers shall operate as autonomous, intelligent processing units.
 - 1) Controllers shall make decisions about access control, alarm monitoring, linking functions, and door-locking schedules for their operation, independent of other system components.
 - 2) Controllers shall be part of a fully distributed processing-control network.
 - 3) The portion of the database associated with a controller, and consisting of parameters, constraints, and the latest value or status of points connected to that controller, shall be maintained in the controller.
 - b. The following functions shall be fully implemented and operational within each controller:
 - 1) Monitoring inputs.
 - 2) Controlling outputs.
 - 3) Automatically reporting alarms to the central station.
 - 4) Reporting of sensor and output status to the central station on request.
 - 5) Maintaining real time, automatically updated by the central station at least once a day.
 - 6) Communicating with the central station.
 - 7) Executing controller resident programs.
 - 8) Diagnosing.
 - 9) Downloading and uploading data to and from the central station.
 - c. Controller Operations at a Location:
 - 1) Up to 64 controllers connected to TIA 485-A communications loop. Globally operating I/O linking and anti-passback functions between controllers within the same Location without central-station or workstation intervention. Linking and anti-



- passback shall remain fully functional within the same Location even when the central station or workstations are off-line.
- 2) In the event of communication failure between the central station and a Location, there shall be no degradation in operations at the controllers at that Location. Controllers at each Location shall be connected to a memory buffer with a capacity to store up to 10,000 events; there shall be no loss of transactions in system history files until the buffer overflows.
 - 3) Buffered events shall be handled in a first-in-first-out mode of operation.
- d. Individual Controller Operation:
- 1) Controllers shall transmit alarms, status changes, and other data to the central station when communications circuits are operable. If communications are not available, controllers shall function in a stand-alone mode; operational data, including the status and alarm data normally transmitted to the central station, shall be stored for later transmission to the central station. Storage capacity for the latest 1024 events shall be provided at each controller.
 - 2) Card-reader ports of a controller shall be custom configurable for at least 120 different card-reader or keypad formats. Multiple reader or keypad formats may be used simultaneously at different controllers or within the same controller.
 - 3) Controllers shall provide a response to card readers or keypad entries in less than 0.25 seconds, regardless of system size.
 - 4) Controllers that are reset, or powered up from a nonpowered state, shall automatically request a parameter download and reboot to their proper working state. This shall happen without any operator intervention.
 - 5) Initial Startup: When controllers are brought on-line, database parameters shall be automatically downloaded to them. After initial download is completed, only database changes shall be downloaded to each controller.
 - 6) On failure for any reason, controllers shall perform an orderly shutdown and force controller outputs to a predetermined failure-mode state, consistent with the failure modes shown and the associated control device.
 - 7) After power is restored, following a power failure, startup software shall initiate self-test diagnostic routines, after which controllers shall resume normal operation.
 - 8) After controller failure, if the database and application software are no longer resident, controllers shall not restart but shall remain in the failure mode until repaired. If database and application programs are resident, controllers shall immediately resume operation. If not, software shall be restored automatically from the central station.
- e. Communications Monitoring:
- 1) System shall monitor and report status of TIA 485-A communications loop of each Location.
 - 2) Communication status window shall display which controllers are currently communicating, a total count of missed polls since midnight, and which controller last missed a poll.
 - 3) Communication status window shall show the type of CPU, the type of I/O board, and the amount of RAM for each controller.
- f. Operating systems shall include a real-time clock function that maintains seconds, minutes, hours, day, date, and month. The real-time clock shall be automatically synchronized with the central station at least once a day to plus or minus 10 seconds. The time synchronization shall be automatic, without operator action and without requiring system shutdown.
6. PC-to-Controller Communications:
- a. Central-station or workstation communications shall use the following:
 - 1) Direct connection using serial ports of the PC.
 - 2) TCP/IP LAN interface cards.
 - 3) Dial-up or cable modems for connections to Locations.
 - b. Each serial port used for communications shall be individually configurable for "direct communications," "modem communications incoming and outgoing," or "modem



- communications incoming only," or as an ASCII output port. Serial ports shall have adjustable data transmission rates and shall be selectable under program control.
- c. Use multipoint communications board if more than two serial ports are needed.
 - 1) Use a 4-, 8-, or 16-serial port configuration that is expandable to 32- or 64-serial ports.
 - 2) Connect the first board to an internal PCI bus adapter card.
 - d. Direct serial, TCP/IP, and dial-up, cable, or satellite communications shall be alike in the monitoring or control of the system except for the connection that must first be made to a dial-up or voice-over IP Location.
 - e. TCP/IP network interface card (NIV) shall have an option to set the poll-frequency and message-response time-out settings.
 - f. PC-to-controller and controller-to-controller communications (direct, dial-up, or TCP/IP) shall use a polled-communication protocol that checks sum and acknowledges each message. All communications in this subparagraph shall be verified and buffered, and retransmitted if not acknowledged.
7. Direct Serial or TCP/IP PC-to-Controller Communications:
- a. Communication software on the PC shall supervise the PC-to-controller communications link.
 - b. Loss of communications to any controller shall result in an alarm at all PCs running the communication software.
 - c. When communications are restored, all buffered events shall automatically upload to the PC, and any database changes shall be automatically sent to the controller.
8. Dial-up Modem or Cable Modem PC-to-Controller Communications:
- a. Communication software on the PC shall supervise the PC-to-controller communications link during dial-up modem connect times.
 - b. Communication software shall be programmable to routinely poll each of the remote dial-up or cable modem Locations, collecting event logs and verifying phone lines at operator-selectable time intervals for each Location.
 - c. System shall be programmable for dialing and connecting to all dial-up or cable modem Locations and for retrieving the accrued history transactions on an automatic basis as often as once every 10 minutes and up to once every 9999 minutes.
 - d. Failure to communicate to a dial-up Location three times in a row shall result in an alarm at the PC.
 - e. Time offset capabilities shall be present so that Locations in a different geographical time zone than the host PC will be set to, and maintained at, the proper local time. This feature shall allow for geographical time zones that are ahead of or behind the host PC.
 - f. The controller connected to a dial-up or cable modem shall automatically buffer all normal transactions until its buffer reaches 80 percent of capacity. When the transaction buffer reaches 80 percent, the controller shall automatically initiate a call to the central station and upload all transactions.
 - g. Alarms shall be reported immediately.
 - h. Dial-up or cable modems shall be provided by manufacturer of the system. Modems used at the controller shall be powered by the controller. Power to the modem shall include battery backup if the controller is so equipped.
9. Controller-to-Controller Communications:
- a. TIA 485-A, four-wire, point-to-point, regenerative (repeater) communications network methodology.
 - b. TIA 485-A communications signal shall be regenerated at each controller.
10. Database Downloads:
- a. All data transmissions from PCs to a Location, and between controllers at a Location, shall include a complete database checksum to check the integrity of the transmission. If the data checksum does not match, a full data download shall be automatically retransmitted.
 - b. If a controller is reset for any reason, it shall automatically request and receive a database download from the PC. The download shall restore data stored at the controller to their normal working state and shall take place with no operator intervention.



- c. Software shall provide for setting downloads via dial-up connection to once per 24-hour period, with time selected by the operator.
 - d. Software shall provide for setting delays of database downloads for dial-up connections. Delays change the download from immediately to a delay ranging from one to 999 minutes.
11. Operator Interface:
- a. Inputs in system shall have two icon representations, one for the normal state and one for the abnormal state.
 - b. When viewing and controlling inputs, displayed icons shall automatically change to the proper icon to display the current system state in real time. Icons shall also display the input's state, whether armed or bypassed, and if the input is in the armed or bypassed state due to a time zone or a manual command.
 - c. Outputs in system shall have two icon representations, one for the secure (locked) state and one for the open (unlocked) state.
 - d. Icons displaying status of the I/O points shall be constantly updated to show their current real-time condition without prompting by the operator.
 - e. The operator shall be able to scroll the list of I/Os and press the appropriate toolbar button, or right click, to command the system to perform the desired function.
 - f. Graphic maps or drawings containing inputs, outputs, and override groups shall include the following:
 - 1) Database to import and store full-color maps or drawings and allow for input, output, and override group icons to be placed on maps.
 - 2) Maps to provide real-time display animation and allow for control of points assigned to them.
 - 3) System to allow inputs, outputs, and override groups to be placed on different maps.
 - 4) Software to allow changing the order or priority in which maps will be displayed.
 - g. Override Groups Containing I/Os:
 - 1) System shall incorporate override groups that provide the operator with the status and control over user-defined "sets" of I/Os with a single icon.
 - 2) Icon shall change automatically to show the live summary status of points in that group.
 - 3) Override group icon shall provide a method to manually control or set to time-zone points in the group.
 - 4) Override group icon shall allow the expanding of the group to show icons representing the live status for each point in the group, individual control over each point, and the ability to compress the individual icons back into one summary icon.
 - h. Schedule Overrides of I/Os and Override Groups:
 - 1) To accommodate temporary schedule changes that do not fall within the holiday parameters, the operator shall have the ability to override schedules individually for each input, output, or override group.
 - 2) Each schedule shall be composed of a minimum of two dates with separate times for each date.
 - 3) The first time and date shall be assigned the override state that the point shall advance to when the time and date become current.
 - 4) The second time and date shall be assigned the state that the point shall return to when the time and date become current.
 - i. Copy command in database shall allow for like data to be copied and then edited for specific requirements, to reduce redundant data entry.
12. Operator Access Control:
- a. Control operator access to system controls through three password-protected operator levels. System operators and managers with appropriate password clearances shall be able to change operator levels for operators.
 - b. Three successive attempts by an operator to execute functions beyond their defined level during a 24-hour period shall initiate a software tamper alarm.
 - c. A minimum of 32 passwords shall be available with the system software. System shall display the operator's name or initials in the console's first field. System shall print the operator's name or initials, action, date, and time on the system printer at login and logoff.



- d. The password shall not be displayed or printed.
 - e. Each password shall be definable and assignable for the following:
 - 1) Selected commands to be usable.
 - 2) Access to system software.
 - 3) Access to application software.
 - 4) Individual zones that are to be accessed.
 - 5) Access to database.
13. Operator Commands:
- a. Command Input: Plain-language words and acronyms shall allow operators to use the system without extensive training or data-processing backgrounds. System prompts shall be a word, a phrase, or an acronym.
 - b. Command inputs shall be acknowledged and processing shall start in not less than one second(s).
 - c. Tasks that are executed by operator's commands shall include the following:
 - 1) Acknowledge Alarms: Used to acknowledge that the operator has observed the alarm message.
 - 2) Place Zone in Access: Used to remotely disable intrusion-alarm circuits emanating from a specific zone. System shall be structured so that console operator cannot disable tamper circuits.
 - 3) Place Zone in Secure: Used to remotely activate intrusion-alarm circuits emanating from a specific zone.
 - 4) System Test: Allows the operator to initiate a system-wide operational test.
 - 5) Zone Test: Allows the operator to initiate an operational test for a specific zone.
 - 6) Print reports.
 - 7) Change Operator: Used for changing operators.
 - 8) Security Lighting Controls: Allows the operator to remotely turn on or turn off security lights.
 - 9) Display Graphics: Used to show any graphic displays implemented in the system. Graphic displays shall be completed within 20 seconds from time of operator command.
 - 10) Run system tests.
 - 11) Generate and format reports.
 - 12) Request help with the system operation.
 - a) Include in main menus.
 - b) Provide unique, descriptive, context-sensitive help for selections and functions with the press of one function key.
 - c) Provide navigation to specific topic from within the first help window.
 - d) Help shall be accessible outside the application program.
 - 13) Entry-Control Commands:
 - a) Lock (secure) or unlock (open) each controlled entry and exit up to four times a day through time-zone programming.
 - b) Arm or disarm each monitored input up to four times a day through time-zone programming.
 - c) Enable or disable readers or keypads up to two times a day through time-zone programming.
 - d) Enable or disable cards or codes up to four times a day per entry point through access-level programming.
 - d. Command Input Errors: Show operator input assistance when a command cannot be executed because of operator input errors. Assistance screen shall use plain-language words and phrases to explain why the command cannot be executed. Error responses that require an operator to look up a code in a manual or other document are not acceptable. Conditions causing operator assistance messages include the following:
 - 1) Command entered is incorrect or incomplete.
 - 2) Operator is restricted from using that command.
 - 3) Command addresses a point that is disabled or out of service.



- 4) Command addresses a point that does not exist.
 - 5) Command is outside the system's capacity.
14. Alarms:
- a. System Setup:
 - 1) Assign manual and automatic responses to incoming-point status change or alarms.
 - 2) Automatically respond to input with a link to other inputs, outputs, or operator-response plans; unique sound with use of WAV files; and maps or images that graphically represent the point location.
 - 3) Sixty-character message field for each alarm.
 - 4) Operator-response-action messages shall allow message length of at least 65,000 characters, with database storage capacity of up to 32,000 messages. Setup shall assign messages to access point **OR** zone **OR** sensor, **as directed**.
 - 5) Secondary messages shall be assignable by the operator for printing to provide further information and shall be editable by the operator.
 - 6) Allow 25 secondary messages with a field of four lines of 60 characters each.
 - 7) Store the most recent 1000 alarms for recall by the operator using the report generator.
 - b. Software Tamper:
 - 1) Annunciate a tamper alarm when unauthorized changes to system database files are attempted. Three consecutive unsuccessful attempts to log onto system shall generate a software tamper alarm.
 - 2) Annunciate a software tamper alarm when an operator or other individual makes three consecutive unsuccessful attempts to invoke functions beyond the authorization level.
 - 3) Maintain a transcript file of the last 5000 commands entered at each central station to serve as an audit trail. System shall not allow write access to system transcript files by any person, regardless of their authorization level.
 - 4) Allow only acknowledgment of software tamper alarms.
 - c. Read access to system transcript files shall be reserved for operators with the highest password authorization level available in system.
 - d. Animated Response Graphics: Highlight alarms with flashing icons on graphic maps; display and constantly update the current status of alarm inputs and outputs in real time through animated icons.
 - e. Multimedia Alarm Annunciation: WAV files to be associated with alarm events for audio annunciation or instructions.
 - f. Alarm Handling: Each input may be configured so that an alarm cannot be cleared unless it has returned to normal, with options of requiring the operator to enter a comment about disposition of alarm. Allow operator to silence alarm sound when alarm is acknowledged.
 - g. Alarm Automation Interface: High-level interface to central-station alarm automation software systems. Allows input alarms to be passed to and handled by automation systems in the same manner as burglar alarms, using a TIA 232-F ASCII interface.
 - h. CCTV Alarm Interface: Allow commands to be sent to CCTV systems during alarms (or input change of state) through serial ports.
 - i. Camera Control: Provides operator ability to select and control cameras from graphic maps.
15. Alarm Monitoring: Monitor sensors, controllers, and DTS circuits and notify operators of an alarm condition. Display higher-priority alarms first and, within alarm priorities, display the oldest unacknowledged alarm first. Operator acknowledgment of one alarm shall not be considered acknowledgment of other alarms nor shall it inhibit reporting of subsequent alarms.
- a. Displayed alarm data shall include type of alarm, location of alarm, and secondary alarm messages.
 - b. Printed alarm data shall include type of alarm, location of alarm, date and time (to nearest second) of occurrence, and operator responses.
 - c. Maps shall automatically display the alarm condition for each input assigned to that map if that option is selected for that input location.



- d. Alarms initiate a status of "pending" and require the following two handling steps by operators:
 - 1) First Operator Step: "Acknowledged." This action shall silence sounds associated with the alarm. The alarm remains in the system "Acknowledged" but "Un-Resolved."
 - 2) Second Operator Step: Operators enter the resolution or operator comment, giving the disposition of the alarm event. The alarm shall then clear.
 - e. Each workstation shall display the total pending alarms and total unresolved alarms.
 - f. Each alarm point shall be programmable to disallow the resolution of alarms until the alarm point has returned to its normal state.
 - g. Alarms shall transmit to the central station in real time except for allowing connection time for dial-up locations.
 - h. Alarms shall be displayed and managed from a minimum of four different windows.
 - 1) Input Status Window: Overlay status icon with a large red blinking icon. Selecting the icon will acknowledge the alarm.
 - 2) History Log Transaction Window: Display name, time, and date in red text. Selecting red text will acknowledge the alarm.
 - 3) Alarm Log Transaction Window: Display name, time, and date in red. Selecting red text will acknowledge the alarm.
 - 4) Graphic Map Display: Display a steady colored icon representing each alarm input location. Change icon to flashing red when the alarm occurs. Change icon from flashing red to steady red when the alarm is acknowledged.
 - i. Once an alarm is acknowledged, the operator shall be prompted to enter comments about the nature of the alarm and actions taken. Operator's comments may be manually entered or selected from a programmed predefined list, or a combination of both.
 - j. For locations where there are regular alarm occurrences, provide programmed comments. Selecting that comment shall clear the alarm.
 - k. The time and name of the operator who acknowledged and resolved the alarm shall be recorded in the database.
 - l. Identical alarms from the same alarm point shall be acknowledged at the same time the operator acknowledges the first alarm. Identical alarms shall be resolved when the first alarm is resolved.
 - m. Alarm functions shall have priority over downloading, retrieving, and updating database from workstations and controllers.
 - n. When a reader-controlled output (relay) is opened, the corresponding alarm point shall be automatically bypassed.
16. Monitor Display: Display text and graphic maps that include zone status integrated into the display. Colors are used for the various components and current data. Colors shall be uniform throughout the system.
- a. Color Code:
 - 1) FLASHING RED: Alerts operator that a zone has gone into an alarm or that primary power has failed.
 - 2) STEADY RED: Alerts operator that a zone is in alarm and alarm has been acknowledged.
 - 3) YELLOW: Advises operator that a zone is in access.
 - 4) GREEN: Indicates that a zone is secure and that power is on.
 - b. Graphics:
 - 1) Support 32,000 graphic display maps and allow import of maps from a minimum of 16 standard formats from another drawing or graphics program.
 - 2) Allow I/O to be placed on graphic maps by the drag-and-drop method.
 - 3) Operators shall be able to view the inputs, outputs, and the point's name by moving the mouse cursor over the point on the graphic map.
 - 4) Inputs or outputs may be placed on multiple graphic maps. The operator shall be able to toggle to view graphic maps associated with I/Os.



- 5) Each graphic map shall have a display-order sequence number associated with it to provide a predetermined order when toggled to different views.
 - 6) Camera icons shall have the ability to be placed on graphic maps that, when selected by an operator, will open a video window, display the camera associated with that icon, and provide pan-tilt-zoom control.
 - 7) Input, output, or camera placed on a map shall allow the ability to arm or bypass an input, open or secure an output, or control the pan-tilt-zoom function of the selected camera.
17. System test software enables operators to initiate a test of the entire system or of a particular portion of the system.
- a. Test Report: The results of each test shall be stored for future display or printout. The report shall document the operational status of system components.
18. Report-Generator Software: Include commands to generate reports for displaying, printing, and storing on disk and tape. Reports shall be stored by type, date, and time. Report printing shall be the lowest-priority activity. Report-generation mode shall be operator selectable but set up initially as periodic, automatic, or on request. Include time and date printed and the name of operator generating the report. Report formats may be configured by operators.
- a. Automatic Printing: Setup shall specify, modify, or inhibit the report to be generated; the time the initial report is to be generated; the time interval between reports; the end of the period; and the default printer.
 - b. Printing on Request: An operator may request a printout of any report.
 - c. Alarm Reports: Reporting shall be automatic as initially set up. Include alarms recorded by system over the selected time and information about the type of alarm such as door alarm, intrusion alarm, tamper alarm, etc, the type of sensor, the location, the time, and the action taken.
 - d. Access and Secure Reports: Document zones placed in access, the time placed in access, and the time placed in secure mode.
 - e. Custom Reports: Reports tailored to exact requirements of who, what, when, and where. As an option, custom report formats may be stored for future printing.
 - f. Automatic History Reports: Named, saved, and scheduled for automatic generation.
 - g. Cardholder Reports: Include data, or selected parts of the data, as well as the ability to be sorted by name, card number, imprinted number, or by any of the user-defined fields.
 - h. Cardholder by Reader Reports: Based on who has access to a specific reader or group of readers by selecting the readers from a list.
 - i. Cardholder by Access-Level Reports: Display everyone that has been assigned to the specified access level.
 - j. Who Is "In" (Muster) Report:
 - 1) Emergency Muster Report: One-click operation on toolbar launches report.
 - 2) Cardholder Report. Contain a count of persons who are "In" at a selected Location and a detailed listing of name, date, and time of last use, sorted by the last reader used or by the group assignment.
 - k. Panel Labels Reports: Printout of control-panel field documentation including the actual location of equipment, programming parameters, and wiring identification. Maintain system installation data within system database so that data are available on-site at all times.
 - l. Activity and Alarm On-Line Printing: Activity printers for use at workstations; prints all events, or alarms only.
 - m. History Reports: Custom reports that allow the operator to select any date, time, event type, device, output, input, operator, Location, name, or cardholder to be included or excluded from the report.
 - 1) Initially store history on the hard disk of the host PC.
 - 2) Permit viewing of the history on workstations or print history to any system printer.
 - 3) The report shall be definable by a range of dates and times with the ability to have a daily start and stop time over a given date range.
 - 4) Each report shall depict the date, time, event type, event description, and device; or I/O name, cardholder group assignment, and cardholder name or code number.



- 5) Each line of a printed report shall be numbered to ensure that the integrity of the report has not been compromised.
 - 6) Total number of lines of the report shall be given at the end of the report. If the report is run for a single event such as "Alarms," the total shall reflect how many alarms occurred during that period.
 - n. Reports shall have the following four options:
 - 1) View on screen.
 - 2) Print to system printer. Include automatic print spooling and "Print To" options if more than one printer is connected to the system.
 - 3) "Save to File" with full path statement.
 - 4) System shall have the ability to produce a report indicating status of system inputs and outputs or of inputs and outputs that are abnormal, out of time zone, manually overridden, not reporting, or in alarm.
 - o. Custom Code List Subroutine: Allow the access codes of system to be sorted and printed according to the following criteria:
 - 1) Active, inactive, or future activate or deactivate.
 - 2) Code number, name, or imprinted card number.
 - 3) Group, Location access levels.
 - 4) Start and stop code range.
 - 5) Codes that have not been used since a selectable number of days.
 - 6) In, out, or either status.
 - 7) Codes with trace designation.
 - p. The reports of system database shall allow options so that every data field may be printed.
 - q. The reports of system database shall be constructed so that the actual position of the printed data shall closely match the position of the data on the data-entry windows.
19. Anti-Passback:
- a. System shall have global and local anti-passback features, selectable by Location. System shall support hard and soft anti-passback.
 - b. Hard Anti-Passback: Once a credential holder is granted access through a reader with one type of designation (IN or OUT), the credential holder may not pass through that type of reader designation until the credential holder passes through a reader of opposite designation.
 - c. Soft Anti-Passback: Should a violation of the proper IN or OUT sequence occur, access shall be granted, but a unique alarm shall be transmitted to the control station, reporting the credential holder and the door involved in the violation. A separate report may be run on this event.
 - d. Timed Anti-Passback: A controller capability that prevents an access code from being used twice at the same device (door) within a user-defined amount of time.
 - e. Provide four separate zones per Location that can operate without requiring interaction with the host PC (done at controller). Each reader shall be assignable to one or all four anti-passback zones. In addition, each anti-passback reader can be further designated as "Hard," "Soft," or "Timed" in each of the four anti-passback zones. The four anti-passback zones shall operate independently.
 - f. The anti-passback schemes shall be definable for each individual door.
 - g. The Master Access Level shall override anti-passback.
 - h. System shall have the ability to forgive (or reset) an individual credential holder or the entire credential-holder population anti-passback status to a neutral status.
20. Visitor Assignment:
- a. Provide for and allow an operator to be restricted to only working with visitors. The visitor badging subsystem shall assign credentials and enroll visitors. Allow only those access levels that have been designated as approved for visitors.
 - b. Provide an automated log of visitor name, time and doors accessed, and name of person contacted.
 - c. Allow a visitor designation to be assigned to a credential holder.



- d. Security access system shall be able to restrict the access levels that may be assigned to credentials issued to visitors.
 - e. Allow operator to recall visitors' credential-holder file once a visitor is enrolled in the system.
 - f. The operator may designate any reader as one that deactivates the credential after use at that reader. The history log shall show the return of the credential.
 - g. System shall have the ability to use the visitor designation in searches and reports. Reports shall be able to print all or any visitor activity.
21. Time and Attendance:
- a. Time and attendance reporting shall be provided to match IN and OUT reads and display cumulative time in for each day and cumulative time in for length designated in the report.
 - b. Shall be provided to match IN and OUT reads and display cumulative time in for each day and cumulative time in for length designated in the report.
 - c. System software setup shall allow designation of selected access-control readers as time and attendance hardware to gather the clock-in and clock-out times of the users at these readers.
 - 1) Reports shall show in and out times for each day, total time in for each day, and a total time in for period specified by the user.
 - 2) Allow the operator to view and print the reports, or save the reports to a file.
 - 3) Alphabetically sort reports on the person's last name, by Location or location group. Include all credential holders or optionally select individual credential holders for the report.
22. Training Software: Enables operators to practice system operation, including alarm acknowledgment, alarm assessment, response force deployment, and response force communications. System shall continue normal operation during training exercises and shall terminate exercises when an alarm signal is received at the console.
23. Entry-Control Enrollment Software: Database management functions that allow operators to add, delete, and modify access data as needed.
- a. The enrollment station shall not have alarm response or acknowledgment functions.
 - b. Provide multiple, password-protected access levels. Database management and modification functions shall require a higher operator access level than personnel enrollment functions.
 - c. The program shall provide means to disable the enrollment station when it is unattended, to prevent unauthorized use.
 - d. The program shall provide a method to enter personnel identifying information into the entry-control database files through enrollment stations. In the case of personnel identity-verification subsystems, this shall include biometric data. Allow entry of personnel identifying information into the system database using menu selections and data fields. The data field names shall be customized during setup to suit user and site needs. Personnel identity-verification subsystems selected for use with the system shall fully support the enrollment function and shall be compatible with the entry-control database files.
 - e. Cardholder Data: Provide 99 user-defined fields. System shall have the ability to run searches and reports using any combination of these fields. Each user-defined field shall be configurable, using any combination of the following features:
 - 1) MASK: Determines a specific format with which data must comply.
 - 2) REQUIRED: Operator is required to enter data into field before saving.
 - 3) UNIQUE: Data entered must be unique.
 - 4) DEACTIVATE DATE: Data entered will be evaluated as an additional deactivate date for all cards assigned to this cardholder.
 - 5) NAME ID: Data entered will be considered a unique ID for the cardholder.
 - f. Personnel Search Engine: A report generator with capabilities such as search by last name, first name, group, or any predetermined user-defined data field; by codes not used in definable number of days; by skills; or by seven other methods.
 - g. Multiple Deactivate Dates for Cards: User-defined fields to be configured as additional stop dates to deactivate any cards assigned to the cardholder.



- h. Batch card printing.
- i. Default card data can be programmed to speed data entry for sites where most card data are similar.
- j. Enhanced ASCII File Import Utility: Allows the importing of cardholder data and images.
- k. Card Expire Function: Allows readers to be configured to deactivate cards when a card is used at selected devices.

D. System Database

1. Database and database management software shall define and modify each point in database using operator commands. Definition shall include parameters and constraints associated with each system device.
2. Database Operations:
 - a. System data management shall be in a hierarchical menu tree format, with navigation through expandable menu branches and manipulated with use of menus and icons in a main menu and system toolbar.
 - b. Navigational Aids:
 - 1) Toolbar icons for add, delete, copy, print, capture image, activate, deactivate, and muster report.
 - 2) Point and click feature to facilitate data manipulation.
 - 3) Next and previous command buttons visible when editing database fields to facilitate navigation from one record to the next.
 - 4) Copy command and copy tool in the toolbar to copy data from one record to create a new similar record.
 - c. Data entry shall be automatically checked for duplicate and illegal data and shall verify that data are in a valid format.
 - d. System shall generate a memo or note field for each item that is stored in database, allowing the storing of information about any defining characteristics of the item. Memo field is used for noting the purpose the item was entered for, reasons for changes that were made, and the like.
3. File Management:
 - a. File management shall include backup and restoration system, allowing selection of storage media, including 3.5-inch floppy disk, Zip and Jaz drives, and designated network resources.
 - b. Operations shall be both manual and automatic mode. The number of automatic sequential backups before the oldest backup becomes overwritten; FIFO mode shall be operator selectable.
 - c. Backup program shall provide manual operation from any PC on the LAN and shall operate while system remains operational.
4. Operator Passwords:
 - a. Software shall support up to 32,000 individual system operators, each with a unique password.
 - b. One to eight alphanumeric characters.
 - c. Allow passwords to be case sensitive.
 - d. Passwords shall not be displayed when entered.
 - e. Passwords shall have unique and customizable password profile, and allow several operators to share a password profile. Include the following features in the password profile:
 - 1) Allow for at least 32,000 operator password profiles.
 - 2) Predetermine the highest-level password profile for access to all functions and areas of program.
 - 3) Allow or disallow operator access to any program operation, including the functions of View, Add, Edit, and Delete.
 - 4) Restrict which doors an operator can assign access to.



- f. Operators shall use a user name and password to log on to system. This user name and password shall be used to access database areas and programs as determined by the associated profile.
- g. Make provision to allow the operator to log off without fully exiting program. User may be logged off but program will remain running while displaying the login window for the next operator.
5. Access Card/Code Operation and Management: Access authorization shall be by card, by a manually entered code (PIN), or by a combination of both (card plus PIN).
 - a. Access authorization shall verify the facility code first, the card or card-and-PIN validation second, and the access level (time of day, day of week, date), anti-passback status, and number of uses last.
 - b. Use data-entry windows to view, edit, and issue access levels. Access authorization entry management system shall maintain and coordinate all access levels to prevent duplication or the incorrect creation of levels.
 - c. Allow assignment of multiple cards/codes to a cardholder.
 - d. Allow assignment of up to four access levels for each Location to a cardholder. Each access level may contain any combination of doors.
 - e. Each door may be assigned four time zones.
 - f. Access codes may be up to 11 digits in length.
 - g. Software shall allow the grouping of locations so cardholder data can be shared by all locations in the group.
 - h. Visitor Access: Issue a visitor badge for data tracking or photo ID purposes without assigning that person a card or code.
 - i. Cardholder Tracing: Allow for selection of cardholder for tracing. Make a special audible and visual annunciation at control station when a selected card or code is used at a designated code reader. Annunciation shall include an automatic display of the cardholder image.
 - j. Allow each cardholder to be given either an unlimited number of uses or a number from 1 to 9998 that regulates the number of times the card can be used before it is automatically deactivated.
 - k. Provide for cards and codes to be activated and deactivated manually or automatically by date. Provide for multiple deactivate dates to be preprogrammed.
6. Security Access Integration:
 - a. Photo ID badging and photo verification shall use same database as the security access and may query data from cardholder, group, and other personal information to build a custom ID badge.
 - b. Automatic or manual image recall and manual access based on photo verification shall also be a means of access verification and entry.
 - c. System shall allow sorting of cardholders together by group or other characteristic for a fast and efficient method of reporting on, and enabling or disabling, cards or codes.
7. Key control and tracking shall be an integrated function of cardholder data.
 - a. Provide the ability to store information about which conventional metal keys are issued and to whom, along with key construction information.
 - b. Reports shall be designed to list everyone that has possession of a specified key.
8. Facility Codes: System shall accommodate up to 2048 facility codes per Location, with the option of allowing facility codes to work at all doors or only particular doors.
9. Operator Comments:
 - a. With the press of one appropriate button on toolbar, the user shall be permitted to make operator comments into history at anytime.
 - b. Automatic prompting of operator comment shall occur before the resolution of each alarm.
 - c. Operator comments shall be recorded by time, date, and operator number.
 - d. Comments shall be sorted and viewed through reports and history.
 - e. The operator may enter comments in two ways; either or both may be used:
 - 1) Manually entered through keyboard data entry (typed), up to 65,000 characters per each alarm.
 - 2) Predefined and stored in database for retrieval on request.



- f. System shall have a minimum of 999 predefined operator comments with up to 30 characters per comment.
10. Group:
 - a. Group names may be used to sort cardholders into groups that allow the operator to determine the tenant, vendor, contractor, department, division, or any other designation of a group to which the person belongs.
 - b. System software shall have the capacity to assign 1 of 32,000 group names to an access authorization.
 - c. Make provision in software to deactivate and reactivate all access authorizations assigned to a particular group.
 - d. Allow sorting of history reports and code list printouts by group name.
11. Time Zones:
 - a. Each zone consists of a start and stop time for 7 days of the week and three holiday schedules. A time zone is assigned to inputs, outputs, or access levels to determine when an input shall automatically arm or disarm, when an output automatically opens or secures, or when access authorization assigned to an access level will be denied or granted.
 - b. Up to four time zones may be assigned to inputs and outputs to allow up to four arm or disarm periods per day or four lock or unlock periods per day; up to three holiday override schedules may be assigned to a time zone.
 - c. Data-entry window shall display a dynamically linked bar graph showing active and inactive times for each day and holiday, as start and stop times are entered or edited.
 - d. System shall have the capacity for 2048 time zones for each Location.
12. Holidays:
 - a. Three different holiday schedules may be assigned to a time zone. Holiday schedule consists of date in format MM/DD/YEAR and a description. When the holiday date matches the current date of the time zone, the holiday schedule replaces the time zone schedule for that 24-hour period.
 - b. System shall have the capacity for 32,000 holidays.
 - c. Three separate holiday schedules may be applied to a time zone.
 - d. Holidays have an option to be designated as occurring on the designated date each year. These holidays remain in system and will not be purged.
 - e. Holidays not designated to occur each year shall be automatically purged from database after the date expires.
13. Access Levels:
 - a. System shall allow for the creation up to 32,000 access levels.
 - b. One level shall be predefined as the Master Access Level. The Master Access Level shall work at all doors at all times and override any anti-passback.
 - c. System shall allow for access to be restricted to any area by reader and by time. Access levels shall determine when and where an Identifier is authorized.
 - d. System shall be able to create multiple door and time zone combinations under same access level so that an Identifier may be valid during different time periods at different readers even if the readers are on the same Controller.
14. User-Defined Fields:
 - a. System shall provide a minimum of 99 user-defined fields, each with up to 50 characters, for specific information about each credential holder.
 - b. System shall accommodate a title for each field; field length shall be 20 characters.
 - c. A "Required" option may be applied to each user-defined field that, when selected, forces the operator to enter data in the user-defined field before the credential can be saved.
 - d. A "Unique" option may be applied to each user-defined field that, when selected, will not allow duplicate data from different credential holders to be entered.
 - e. Data format option may be assigned to each user-defined field that will require the data to be entered with certain character types in specific spots in the field entry window.
 - f. A user-defined field, if selected, will define the field as a deactivate date. The selection shall automatically cause the data to be formatted with the windows MM/DD/YEAR date format. The credential of the holder will be deactivated on that date.



- support at least 256 colors at a resolution of 1280 by 1024 at a minimum refresh rate of 70 Hz.
- i. Keyboard: With a minimum of 64 characters, standard ASCII character set based on ANSI INCITS 154.
 - j. Mouse: Standard, compatible with the installed software.
 - k. Special function keyboard attachments or special function keys to facilitate data input of the following operator tasks:
 - 1) Help.
 - 2) Alarm Acknowledge.
 - 3) Place Zone in Access.
 - 4) Place Zone in Secure.
 - 5) System Test.
 - 6) Print Reports.
 - 7) Change Operator.
 - l. Disk storage shall include the following, each with appropriate controller:
 - 1) Minimum 10 GB hard disk, maximum average access time of 10 ms.
 - 2) Floppy Disk Drive: High density, 3-1/2-inch (90-mm) size.
 - 3) PCMCIA slot with removable 500 MB media.
 - 4) 100 MB Iomega Zip drive.
 - 5) 250 MB Iomega Jaz drive.
 - m. Magnetic Tape System: 4-mm cartridge magnetic tape system with minimum 2 **OR 4 OR 12 OR 20, as directed**, GB formatted capacity per tape. Provide 10 tapes, each in a rigid cartridge with spring-loaded cover and operator-settable write-protect feature.
 - n. Modem: 56,600 bps, full duplex for asynchronous communications. With error detection, auto answer/autodial, and call-in-progress detection. Modem shall comply with requirements in ITU-T v.34, ITU-T v.42 for error correction, and ITU-T v.42 BIS for data compression standards; and shall be suitable for operating on unconditioned voice-grade telephone lines complying with 47 CFR 68.
 - o. Audible Alarm: Manufacturer's standard.
 - p. CD-ROM Drive:
 - 1) Nominal storage capacity of 650 MB.
 - 2) Data Transfer Rate: 1.2 Mbps.
 - 3) Average Access Time: 150 ms.
 - 4) Cache Memory: 256 KB.
 - 5) Data Throughput: 1 MB/second, minimum.
 - q. Dot Matrix Alarm Printer:
 - 1) Connected to the Central Station.
 - 2) Minimum of 96 characters, standard ASCII character set based on ANSI INCITS 154, and with graphics capability and programmable control of top-of-form.
 - 3) Prints in both red and black without ribbon change.
 - 4) Adjustable sprockets for paper width up to 11 inches.
 - 5) 80 columns per line, minimum speed of 200 characters per second.
 - 6) Character Spacing: Selectable at 10, 12, or 17 characters per inch.
 - 7) Paper: Sprocket-fed fan fold paper.
 - r. Report Printer:
 - 1) Connected to the Central Station and designated workstations.
 - 2) Laser printer with minimum resolution of 600 dpi.
 - 3) RAM: 2 MB, minimum.
 - 4) Printing Speed: Minimum 12 pages per minute.
 - 5) Paper Handling: Automatic sheet feeder with 250-sheet paper cassette and with automatic feed.
 - s. Interface: Bidirectional parallel and universal serial bus.
 - t. LAN Adapter Card: 10/100 Mbps internal network interface card.
2. Redundant Central Computer: One identical redundant central computer, connected in a hot standby, peer configuration. This computer shall automatically maintain its own copies of system



- software, application software, and data files. System transactions and other activities that alter system data files shall be updated to system files of redundant computer in near real-time. If central computer fails, redundant computer shall assume control immediately and automatically.
3. UPS: Self-contained; complying with requirements in Division 26 Section "Static Uninterruptible Power Supply".
 - a. Size: Provide a minimum of 6 hours of operation of the central-station equipment, including 2 hours of alarm printer operation.
 - b. Batteries: Sealed, valve regulated, recombinant, lead calcium.
 - c. Accessories:
 - 1) Transient voltage suppression.
 - 2) Input-harmonics reduction.
 - 3) Rectifier/charger.
 - 4) Battery disconnect device.
 - 5) Static bypass transfer switch.
 - 6) Internal maintenance bypass/isolation switch.
 - 7) External maintenance bypass/isolation switch.
 - 8) Output isolation transformer.
 - 9) Remote UPS monitoring.
 - 10) Battery monitoring.
 - 11) Remote battery monitoring.

G. Standard Workstation Hardware

1. Workstation shall consist of a standard unmodified PC, with accessories and peripherals that configure the workstation for a specific duty.
2. Workstation Computer: Standard unmodified PC of modular design. The CPU word size shall be 32 bytes or larger; the CPU operating speed shall be at least 66 MHz **OR GH, as directed**.
 - a. Memory: 512 MB of usable installed memory, expandable to a minimum of 8 GB without additional chassis or power supplies.
 - b. Power Supply: Minimum capacity of 250 W.
 - c. Real-Time Clock:
 - 1) Accuracy: Plus or minus 1 minute per month.
 - 2) Time Keeping Format: 24-hour time format including seconds, minutes, hours, date, day, and month; resettable by software.
 - 3) Provide automatic time correction once every 24 hours by synchronizing clock with the Central Station.
 - d. Serial Ports: Provide two TIA 232-F USB serial ports for general use, with additional ports as required. Data transmission rates shall be selectable under program control.
 - e. Parallel Port: An enhanced parallel port.
 - f. Sound Card: For playback and recording of digital WMP sound files that are associated with audible warning and alarm functions.
 - g. Color Monitor: Not less than 17 inches (430 mm), with a minimum resolution of 1280 by 1024 pixels, noninterlaced, and a maximum dot pitch of 0.28 mm. The video card shall support at least 256 colors at a resolution of 1280 by 1024 at a minimum refresh rate of 70 Hz.
 - h. Keyboard: With a minimum of 64 characters, standard ASCII character set based on ANSI INCITS 154.
 - i. Mouse: Standard, compatible with the installed software. Minimum resolution shall be 400 dpi.
 - j. Disk storage shall include the following, each with appropriate controller:
 - 1) Minimum 20 GB hard disk, maximum average access time of 10 ms.
 - 2) Floppy Disk Drive: High density, 3-1/2-inch (90-mm) size.
 - k. CD-ROM Drive:
 - 1) Nominal storage capacity of 700 MB.
 - 2) Data Transfer Rate: 3.6 Mbps.
 - 3) Average Access Time: 150 ms.
 - 4) Cache Memory: 512 KB.



- 5) Data Throughput: 3.6 MB/second, minimum.
 - 6) Read Speed: 48x.
 - 7) Write Speed: 32x.
 - I. DVD/DVD-RW Drive:
 - 1) Nominal Storage Capacity: 4.7 GB.
 - 2) Data Transfer Rate: 3.6 Mbps.
 - 3) Cache Memory: 512 KB.
 - 4) Read Speed: 24x.
 - 5) Write Speed: 6x.
 - m. Printer:
 - 1) Connected to the Central Station and designated workstations.
 - 2) Laser printer with minimum resolution of 600 dpi.
 - 3) RAM: 8 MB, minimum.
 - 4) Printing Speed: Minimum 12 pages per minute.
 - 5) Paper Handling: Automatic sheet feeder with 250-sheet paper cassette and with automatic feed.
 - n. Interface: Bidirectional parallel, and universal serial bus.
 - o. LAN Adapter Card: 10/100 Mbps internal network interface card.
 3. Redundant Workstation: One identical redundant workstation, connected in a hot standby, peer configuration. This workstation shall automatically maintain its own copies of system software, application software, and data files. System transactions and other activities that alter system data files shall be updated to system files of redundant workstation in near real time. If its associated workstation fails, redundant workstation shall assume control immediately and automatically.
 4. UPS: Self-contained, complying with requirements in Division 26 Section "Static Uninterruptible Power Supply".
 - a. Size: Provide a minimum of 6 hours of operation of the central-station equipment, including 2 hours of alarm printer operation.
 - b. Batteries: Sealed, valve regulated, recombinant, lead calcium.
 - c. Accessories:
 - 1) Transient voltage suppression.
 - 2) Input-harmonics reduction.
 - 3) Rectifier/charger.
 - 4) Battery disconnect device.
 - 5) Static bypass transfer switch.
 - 6) Internal maintenance bypass/isolation switch.
 - 7) External maintenance bypass/isolation switch.
 - 8) Output isolation transformer.
 - 9) Remote UPS monitoring.
 - 10) Battery monitoring.
 - 11) UPS operation monitoring.
 - 12) Abnormal operation. Visible and audible indication.
 - 13) Remote battery monitoring.
- H. Communications Workstation
1. Standard workstation, modified as follows:
 - a. Additional TIA 232-F serial ports. The CPU word size shall be 32 bytes or larger; the CPU operating speed shall be at least 66 MHz. Multiplexed serial ports shall be expandable with 8 character transmit and receive buffers for each port. Total buffer size shall be a minimum of 1 MB.
 - b. Redundant workstation is not required.
 - c. Printer is not required.
 - I. Fixed Map Display: A fixed map display shall show layout of the protected facilities. Zones corresponding to those monitored by system shall be highlighted on the display. Status of each zone



shall be displayed using LEDs as required within each designated zone. An LED test switch shall be provided on the map display.

J. Controllers

1. Controllers: Intelligent peripheral control unit, complying with UL 294, that stores time, date, valid codes, access levels, and similar data downloaded from the Central Station or workstation for controlling its operation.
2. Subject to compliance with requirements in this Article, manufacturers may use multipurpose Controllers.
3. Battery Backup: Sealed, lead acid; sized to provide run time during a power outage of 90 minutes, complying with UL 924.
4. Alarm Annunciation Controller:
 - a. The Controller shall automatically restore communication within 10 seconds after an interruption with the field device network with dc line supervision on each of its alarm inputs.
 - 1) Inputs: Monitor dry contacts for changes of state that reflect alarm conditions. Provides at least eight alarm inputs, which are suitable for wiring as normally open or normally closed contacts for alarm conditions.
 - 2) Alarm-Line Supervision:
 - a) Supervise the alarm lines by monitoring each circuit for changes or disturbances in the signal, and for conditions as described in UL 1076 for line security equipment **OR** by monitoring for abnormal open, grounded, or shorted conditions, **as directed**, using dc change measurements. System shall initiate an alarm in response to an abnormal current, which is a dc change of 5 **OR** 10, **as directed**, percent or more for longer than 500 ms.
 - b) Transmit alarm-line-supervision alarm to the Central Station during the next interrogation cycle after the abnormal current condition.
 - 3) Outputs: Managed by Central Station software.
 - b. Auxiliary Equipment Power: A GFI service outlet inside the Controller enclosure.
5. Entry-Control Controller:
 - a. Function: Provide local entry-control functions including one- and two-way communications with access-control devices such as card readers, keypads, biometric personal identity verification devices, door strikes, magnetic latches, gate and door operators, and exit push-buttons.
 - 1) Operate as a stand-alone portal Controller using the downloaded database during periods of communication loss between the Controller and the field-device network.
 - 2) Accept information generated by the entry-control devices; automatically process this information to determine valid identification of the individual present at the portal:
 - a) On authentication of the credentials or information presented, check privileges of the identified individual, allowing only those actions granted as privileges.
 - b) Privileges shall include, but not be limited to, time of day control, day of week control, group control, and visitor escort control.
 - 3) Maintain a date-, time-, and Location-stamped record of each transaction. A transaction is defined as any successful or unsuccessful attempt to gain access through a controlled portal by the presentation of credentials or other identifying information.
 - b. Inputs:
 - 1) Data from entry-control devices; use this input to change modes between access and secure.
 - 2) Database downloads and updates from the Central Station that include enrollment and privilege information.
 - c. Outputs:
 - 1) Indicate success or failure of attempts to use entry-control devices and make comparisons of presented information with stored identification information.
 - 2) Grant or deny entry by sending control signals to portal-control devices and mask intrusion alarm annunciation from sensors stimulated by authorized entries.



- 3) Maintain a date-, time-, and Location-stamped record of each transaction and transmit transaction records to the Central Station.
 - 4) Door Prop Alarm: If a portal is held open for longer than 20 seconds **OR** time listed in a schedule, **as directed**, alarm sounds.
- d. With power supplies sufficient to power at voltage and frequency required for field devices and portal-control devices.
- e. Data Line Problems: For periods of loss of communications with Central Station, or when data transmission is degraded and generating continuous checksum errors, the Controller shall continue to control entry by accepting identifying information, making authentication decisions, checking privileges, and controlling portal-control devices.
- 1) Store up to 1000 transactions during periods of communication loss between the Controller and access-control devices for subsequent upload to the Central Station on restoration of communication.
- f. Controller Power: NFPA 70, Class II power supply transformer, with 12- or 24-V ac secondary, backup battery and charger.
- 1) Backup Battery: Premium, valve-regulated, recombinant-sealed, lead-calcium battery; spill proof; with a full 1-year warranty and a pro rata 19-year warranty. With single-stage, constant-voltage-current, limited battery charger, comply with battery manufacturer's written instructions for battery terminal voltage and charging current recommendations for maximum battery life.
 - 2) Backup Battery: Valve-regulated, recombinant-sealed, lead-acid battery; spill proof. With single-stage, constant-voltage-current, limited battery charger, comply with battery manufacturer's written instructions for battery terminal voltage and charging current recommendations for maximum battery life.
 - 3) Backup Power Supply Capacity: 5 **OR** 90, **as directed**, minutes of battery supply. Submit battery and charger calculations.
 - 4) Power Monitoring: Provide manual dynamic battery load test, initiated and monitored at the control center; with automatic disconnection of the Controller when battery voltage drops below Controller limits. Report by using local Controller-mounted LEDs and by communicating status to Central Station. Indicate and report the following:
 - a) Trouble Alarm: Normal power off load assumed by battery.
 - b) Trouble Alarm: Low battery.
 - c) Alarm: Power off.
- K. Secondary Alarm Annunciator
1. Secondary Alarm Annunciation Site: A workstation with limited I/O capacity, consisting of a secondary alarm annunciation workstation to allow the operator to duplicate functions of the main operator interface, and to show system status changes **OR** to display alarms or system status changes only, **as directed**.
- L. Card Readers, Credential Cards, And Keypads
1. Card-Reader Power: Powered from its associated controller, including its standby power source, and shall not dissipate more than 5 W.
 2. Response Time: Card reader shall respond to passage requests by generating a signal that is sent to the controller. Response time shall be 800 ms or less, from the time the card reader finishes reading the credential card until a response signal is generated.
 3. Enclosure: Suitable for surface, semi-flush, pedestal, or weatherproof mounting. Mounting types shall additionally be suitable for installation in the following locations:
 - a. Indoors, controlled environment.
 - b. Indoors, uncontrolled environment.
 - c. Outdoors, with built-in heaters or other cold-weather equipment to extend the operating temperature range as needed for operation at the site.



4. Display: Digital visual indicator shall provide visible and audible status indications and user prompts. Indicate power on or off, whether user passage requests have been accepted or rejected, and whether the door is locked or unlocked.
5. Stripe Swipe Readers: Bidirectional, reading cards swiped in both directions, powered by the controller. Reader shall be set up for ABA Track.
 - a. ABA Track: Magnetic stripe that is encoded on track 2, at 75-bpi density in binary-coded decimal format; for example, 5-bit, 16-character set.
 - b. Readers for outdoors shall be in a polymeric plastic enclosure with all electronics potted in plastic. Rated for operation in ambient conditions of minus 40 to plus 160 deg F (minus 40 to plus 70 deg C) in a humidity range of 10 to 90 percent.
6. Wiegand Swipe Reader: Set up for 33 **OR** 26-bit data cards, **as directed**. Comply with SIA AC-01.
7. Wiegand Key-Insert Reader: Set up for 33 **OR** 26-bit data cards, **as directed**.
8. Bar-Code Reader: Set up for Code 39 **OR** 93 **OR** 128, **as directed**.
9. Insert Readers: Requiring the card to be inserted from the bottom **OR** side, **as directed**, powered by the controller.
10. Touch-Plate and Proximity Readers:
 - a. Active-detection proximity card readers shall provide power to compatible credential cards through magnetic induction, and shall receive and decode a unique identification code number transmitted from the credential card.
 - b. Passive-detection proximity card readers shall use a swept-frequency, RF field generator to read the resonant frequencies of tuned circuits laminated into compatible credential cards. The resonant frequencies read shall constitute a unique identification code number.
 - c. The card reader shall read proximity cards in a range from direct contact to at least 6 inches (150 mm) from the reader.
11. Keypads:
 - a. Entry-control keypads shall use a unique combination of alphanumeric and other symbols as an Identifier.
 - b. Keypads shall contain an integral alphanumeric/special symbols keyboard with symbols arranged in ascending ASCII-code ordinal sequence **OR** random scrambled order, **as directed**.
 - c. Communication protocol shall be compatible with the local processor.
12. Keypad Display:
 - a. Keypads shall include a digital visual indicator and shall provide visible **OR** visible and audible status indications and user prompts, **as directed**.
 - b. Display shall indicate power on or off and whether user passage requests have been accepted or rejected.
 - c. Design of the keypad display or keypad enclosure shall limit viewing angles of the keypad as follows:
 - 1) Maximum Horizontal Viewing Angle: Plus or minus 5 degrees or less off a vertical plane perpendicular to the plane of the face of the keypad display.
 - 2) Maximum Vertical Viewing Angle: Plus or minus 15 degrees or less off a horizontal plane perpendicular to the plane of the face of the keypad display.
13. Keypad Response Time:
 - a. The keypad shall respond to passage requests by generating a signal to the local processor. The response time shall be 800 ms or less from the time the last alphanumeric symbol is entered until a response signal is generated.
14. Keypad Power:
 - a. The keypad shall be powered from the source as shown and shall not dissipate more than 150 W.
15. Keypad Mounting Method:
 - a. Keypads shall be suitable for surface, semi-flush, pedestal, or weatherproof mounting as required.
16. Keypad Duress Codes:
 - a. Keypads shall provide a means for users to indicate a duress situation by entering a special code.



17. Keypad and Wiegand-Swipe-Reader Combination: Designed to require an entry on the keypad before presenting the credential card.
 - a. Keypad: Allow the entry of four numeric digits **OR** alphanumeric characters, **as directed**, that are associated with a specific credential. Keypads shall contain an integral alphanumeric/special symbol keyboard with symbols arranged in ascending ASCII-code ordinal sequence **OR** random scrambled order, **as directed**. Keypad display or enclosure shall limit viewing angles of the keypad as follows:
 - 1) Maximum Horizontal Viewing Angle: Plus or minus 5 degrees or less off a vertical plane perpendicular to the plane of the face of the keypad display.
 - 2) Maximum Vertical Viewing Angle: Plus or minus 15 degrees or less off a horizontal plane perpendicular to the plane of the face of the keypad display.
 - b. Wiegand Swipe Reader: Set up for 33 OR 26-bit data cards, **as directed**, to generate a unique card identification code. Comply with SIA AC-01.
 18. Communication Protocol: Compatible with local processor.
 19. Touch-Plate and Contactless Card Reader: The reader shall have "flash" download capability to accommodate card format changes. The card reader shall have capability of transmitting data to security control panel and shall comply with ISO/IEC 7816.
 20. Credential Card Modification: Entry-control cards shall be able to be modified by lamination direct print process during the enrollment process without reduction of readability. The design of the credential cards shall allow for the addition of at least one slot or hole to accommodate the attachment of a clip for affixing the credential card to the badge holder used at the site.
 21. Specify the standard card size of 2-1/8 by 3-3/8 inches (54 by 85 mm) unless a different size card is needed. If a nonstandard size card is specified, verify that the card size will work with the photo badging system and the card reader specified.
 22. Card Size and Dimensional Stability: Credential cards shall be **2-1/8 by 3-3/8 inches (54 by 86 mm)**. The credential card material shall be dimensionally stable so that an undamaged card with deformations resulting from normal use shall be readable by the card reader.
 23. Card Material: Abrasion resistant, nonflammable, nontoxic, and impervious to solar radiation and effects of ultraviolet light.
 24. Insert additional security enhancements in paragraph below if needed. Retain card lamination and assembly equipment if needed at the site.
 25. Card Construction:
 - a. Core and laminate or monolithic construction.
 - b. Lettering, logos, and other markings shall be hot stamped into the credential material or direct printed.
 - c. Incorporate holographic images **OR** phosphorous ink, **as directed**, as a security enhancement.
 - d. Furnish equipment for on-site assembly and lamination of credential cards.
- M. Biometric Identity Verification Equipment
1. Biometric identity verification templates shall be stored as part of system database files and used as a comparative base by the identity verification equipment to generate an appropriate signal to the associated Controller.
 2. Eye Retina Scanner: Designed to incorporate positive measures to establish that the eye retina being scanned by the device belongs to a living human being.
 - a. Scanner shall not require eye contact with the retina scan equipment. Scan initiation shall be manual.
 - b. The efficiency and accuracy of scanner shall not be affected by contact lenses.
 - c. Storage space of each eye template shall not exceed 512 8-bit bytes.
 - d. Light-emitting source used for retina scans may not use light levels exceeding 20 percent of the maximum safe level established in the American Conference of Governmental Industrial Hygienists limit values.
 - e. Template Update: Eye scanner shall not automatically update a user's template. Significant changes in an individual's eye shall require re-enrollment.



- f. Scan acceptance tolerance or template match criteria shall be under system manager/operator control. Eye scanner shall determine automatically when multiple attempts are needed to verify the eye being scanned, prompting automatically for additional attempts, up to a maximum of three. Three failed attempts shall generate an entry-control alarm.
 - g. Time of Verification: Eye scanner shall respond to passage requests by generating an entry request signal to the Controller. The verification time shall be 1.5 seconds or less from the moment eye scanner initiates the scan process until eye scanner generates a response signal.
 - h. Modes: Eye scanner shall provide an enrollment mode, a recognition mode, and a code/credential verification mode.
 - 1) In the enrollment mode, eye scanner shall create an eye template for new personnel and enter the template into system database file created for that person. Template information shall be compatible with system application software.
 - 2) In the recognition mode, eye scanner shall allow passage when the eye scan data from the verification attempt match an eye template stored in database files.
 - 3) In the code/credential verification mode, eye scanner shall allow passage when the eye scan data from the verification attempt match the eye scan template associated with the identification code entered into a keypad, or they match the eye scan template associated with credential card data read by a card reader.
 - i. Reports: Eye scanner shall create and store template match scores for all transactions involving eye retinal scans. Template match scores shall be stored in the matching personnel data file used for report generation.
 - j. Power: Scanner shall be powered from its associated Controller, requiring not more than 45 W.
 - k. Enclosure: Eye scanners shall be available with enclosures that are suitable for surface, semiflush, or pedestal mounting. Mounting types shall additionally be suitable for installation in the following locations:
 - 1) Indoors, controlled environment.
 - 2) Indoors, uncontrolled environment.
 - l. Display: LED or other type of visual indicator display shall provide visual and audible status indications and user prompts. Indicate power on/off, and whether user passage requests have been accepted or rejected.
3. Hand Geometry: Use unique human hand measurements to identify authorized, enrolled personnel. The design of this device shall incorporate positive measures to establish that the hand being measured by the device belongs to a living human being.
- a. The user's hand shall remain in full view of the user at all times. The scan process of the hand geometry device shall make three-dimensional measurements of the size and shape of the subject's hand. Scanning shall start automatically once the user's hand is properly positioned by the alignment system.
 - b. Hand geometry device shall be able to use either left or right hand for enrollment and verification.
 - c. Storage space of each eye template shall not exceed 50 8-bit bytes.
 - d. Template Update and Acceptance Tolerances: Hand geometry devices shall not automatically update a user's profile. Significant changes in an individual's hand geometry shall require re-enrollment. Hand geometry devices shall provide an adjustable acceptance tolerance or template match criteria under system manager/operator control. Hand geometry device shall determine when multiple attempts are needed for hand geometry verification and shall automatically prompt the user for additional attempts up to a maximum of three. Three failed attempts shall generate an entry-control alarm.
 - e. Average Verification Time: Hand geometry device shall respond to passage requests by generating an entry request signal to the Controller. The verification time shall be 1.5 seconds or less from the moment hand geometry device initiates the scan process until hand geometry device generates a response signal.
 - f. Modes: Hand geometry device shall provide an enrollment mode, a recognition mode, and a code/credential verification mode.



- 1) In the enrollment mode, hand geometry device shall create a hand template for new personnel and enter the template into system database file created for that person. Template information shall be compatible with system application software.
 - 2) In the recognition mode, hand geometry device shall allow passage when the hand scan data from the verification attempt match a hand geometry template stored in database files.
 - 3) In the code/credential verification mode, hand geometry device shall allow passage when the hand scan data from the verification attempt match the hand geometry template associated with the identification code entered into a keypad, or they match the hand geometry template associated with credential card data read by a card reader.
- g. Reports: Hand geometry device shall create and store template match scores for all transactions involving hand geometry scans. Template match scores shall be stored in the matching personnel data file used for report generation.
- h. Power: Hand geometry device shall be powered from its associated Controller, requiring not more than 45 W.
- i. Enclosure: Geometry readers shall be available with enclosures that are suitable for surface, semiflush, or pedestal mounting. Mounting types shall additionally be suitable for installation in the following locations:
- 1) Indoors, controlled environment.
 - 2) Indoors, uncontrolled environment.
 - 3) Outdoors.
- j. Display: LED or other type of visual indicator display shall provide visual and audible status indications and user prompts. Indicate power on/off, and whether user passage requests have been accepted or rejected.
4. Fingerprint Analysis Scanner: Use a unique human fingerprint pattern to identify authorized, enrolled personnel. The design of this device shall incorporate positive measures to establish that the hand or fingers being scanned by the device belong to a living human being.
- a. The user's hand shall remain in full view of the user at all times. The scan process of the fingerprint analysis scanner shall perform an optical or other type of scan of the enrollee's fingers. Scanning shall start automatically when the user's fingers are properly positioned.
 - b. Storage space for each fingerprint template shall not require more than 1250 8-bit bytes.
 - c. Template Update and Acceptance Tolerances: Fingerprint analysis scanners shall not automatically update a user's profile. Significant changes in an individual's fingerprints shall require re-enrollment. Fingerprint analysis scanners shall provide an adjustable acceptance tolerance or template match criteria under system manager/operator control. Fingerprint analysis scanner shall determine when multiple attempts are needed for fingerprint verification and shall automatically prompt the enrollee for additional attempts up to a maximum of three. Three failed attempts shall generate an entry-control alarm.
 - d. Average Verification Time: Fingerprint analysis scanner shall respond to passage requests by generating an entry request signal to the Controller. The verification time shall be 2 seconds or less from the moment fingerprint analysis scanner initiates the scan process until fingerprint analysis scanner generates a response signal.
 - e. Modes: Fingerprint analysis scanner shall provide an enrollment mode, a recognition mode, and a code/credential verification mode.
 - 1) In the enrollment mode, fingerprint analysis scanner shall create a fingerprint template for new personnel and enter the template into the system database file created for that person.
 - 2) In the recognition mode, fingerprint analysis scanner shall allow passage when the fingerprint data from the verification attempt match a fingerprint template stored in database files.
 - 3) In the code/credential verification mode, fingerprint analysis scanner shall allow passage when the fingerprint data from the verification attempt match the fingerprint template associated with the identification code entered into a keypad, or they match the fingerprint template associated with credential card data read by a card reader.



- f. Reports: Fingerprint analysis device shall create and store pattern match scores for all transactions involving fingerprint scans. Template match scores shall be stored in the matching personnel data file used for report generation.
 - g. Power: Fingerprint analysis scanner shall be powered from its associated Controller, requiring not more than 45 W.
 - h. Enclosure: Scanners shall be available with enclosures that are suitable for surface, semiflush, or pedestal mounting. Mounting types shall additionally be suitable for installation in the following locations:
 - 1) Indoors, controlled environment.
 - 2) Indoors, uncontrolled environment.
 - 3) Outdoors.
 - i. Display: LED or other type of visual indicator display shall provide visual and audible status indications and user prompts. Indicate power on/off, and whether user passage requests have been accepted or rejected.
5. Iris Scan Device: Use the unique patterns found in the iris of the human eye to identify authorized, enrolled personnel. The device shall use ambient light to capture an image of the iris of a person for identification. The resulting video image shall be compared against a stored template that was captured during the enrollment process. When the presented image is sufficiently similar to the stored image template, then the device shall authenticate the presenting individual as identified. The threshold of similarity shall be adjustable.
- a. Enrollees who wear contact lenses or eyeglasses shall not adversely affect the efficiency and accuracy of the device.
 - b. Iris scan device shall provide a means for enrollees to align their eye for identification that does not require facial contact with the device. A manual push-button shall be provided to initiate the scan process when the enrollee's eye is aligned in front of the device.
 - c. The device shall include adjustments to accommodate differences in enrollee height.
 - d. Template Update: Iris scanners shall not automatically update an enrollee's template. Significant changes in an individual's eye shall require re-enrollment.
 - e. Scan acceptance tolerance or template match criteria shall be under system manager/operator control. Iris scanner shall determine when multiple attempts are needed to verify the iris being scanned and shall automatically prompt the enrollee for additional attempts up to three. Three failed attempts shall generate an entry-control alarm.
 - f. Average Verification Time: Iris scanner shall respond to passage requests by generating an entry request signal to the Controller. The verification time shall be 1.5 seconds or less from the moment iris scanner initiates the scan process until iris scanner generates a response signal.
 - g. Modes: Iris scanner shall provide an enrollment mode, a recognition mode, and a code/credential verification mode.
 - 1) In the enrollment mode, iris scanner shall create an iris template for new personnel and enter the template into system database file created for that person. Template information shall be compatible with system application software.
 - 2) In the recognition mode, iris scanner shall allow passage when the iris scan data from the verification attempt match an iris template stored in database files.
 - 3) In the code/credential verification mode, iris scanner shall allow passage when the iris scan data from the verification attempt match the iris scan template associated with the identification code entered into a keypad, or they match the iris scan template associated with credential card data read by a card reader.
 - h. Reports: Iris imaging shall create and store template match scores for all transactions involving iris scans. Template match scores shall be stored in the matching personnel data file used for report generation.
 - i. Power: Iris scanner shall be powered from its associated Controller, requiring not more than 45 W.
 - j. Enclosure: Eye scanners shall be available with enclosures that are suitable for surface, semiflush, or pedestal mounting. Mounting types shall additionally be suitable for installation in the following locations:
 - 1) Indoors, controlled environment.



- 2) Indoors, uncontrolled environment.
- k. Display: LED or other type of visual indicator display shall provide visual and audible status indications and user prompts. Indicate power on/off, and whether user passage requests have been accepted or rejected.

N. Enrollment Center

1. Equipment for enrolling personnel into, and removing personnel from, system database, using a dedicated workstation PC **OR** central-station equipment, **as directed**.
 - a. Include equipment to enroll selected biometric credentials.
2. Enrollment equipment shall support encoding of credential cards including cryptographic and other internal security checks as required for system.
 - a. Allow only authorized entry-control enrollment personnel to access the enrollment equipment using passwords.
 - b. Include enrollment subsystem configuration controls and electronic diagnostic aids for subsystem setup and troubleshooting with the Central Station.
 - c. Enrollment station records printer shall meet requirements of the report printer.
3. Entry-Control Enrollment Software:
 - a. Shall include database management functions for the system, and shall allow an operator to change and modify the data entered in the system as needed.
 - b. Software shall not have alarm response or acknowledgment functions as a programmable function.
 - c. Multiple, password-protected access levels shall be provided at the enrollment station.
 - d. Database management and modification functions shall require a higher operator-access level than personnel enrollment functions.
 - e. Software shall provide a means for disabling the enrollment station when it is unattended, to prevent unauthorized use.
 - f. Software shall provide a method to enter personnel identifying information into the entry-control database files through enrollment stations to include a credential unit in use at the installation.
 - g. In the case of personnel identity-verification subsystems, this data shall include biometric data.
 - h. Software shall allow entry of this data into the system database files through the use of simple menu selections and data fields. The data field names shall be customized to suit user and site needs.
 - i. Personnel identity-verification subsystems selected for use with the system shall fully support the enrollment function and shall be compatible with the entry-control database files.
4. Accessories:
 - a. Steel desk-type console, swivel chair on casters, and equipment racks.
 - b. Console and Equipment Racks: Comply with EIA-310-D.
 - c. Equipment, with the exception of the printers, shall be rack mounted in the console and equipment racks.
 - d. Storage Cabinet: Locking cabinet approximately 72 inches (1830 mm) high, 36 inches (915 mm) wide, and 24 inches (610 mm) deep, with 3 adjustable shelves and 2 storage racks for storage of disks, tapes, printouts, printer paper, ribbons, manuals, and other documentation.
5. System Capacity: Number of badges shall be limited only by hard disk space. Badge templates and images shall be in color, supporting the maximum color capability of Microsoft Windows operating system.
6. Badge Configuration:
 - a. Software for badge template creation shall include a template consisting of background and predetermined locations of photographs, text objects and data fields for text, and bar-code and biometric information. Include automatic sizing of data fields placed on a badge to compensate for names, which may otherwise be too large to fit in the area designated.
 - b. Allow different badge templates to be used for each department, tenant, or visitor.



- c. As a setup option, templates shall be automatically selected for the badge, based on the group the credential holder is assigned to. Allow the operator to override the automatic template selection and use a template chosen by the operator for creating a badge.
 - d. Setup shall determine which graphics and credential holder information will be displayed and where on the card it will be placed. All data in the security access system such as name, code, group, access level, and any of the 99 user-defined fields shall be selectable, with the ability to place them anywhere on the card.
 - e. System shall include an importing, filing, and recall system of stored images and shapes that can be placed on the badge.
 - f. Allow multiple images on same badge, including, but not be limited to, bar codes, digital photos, and signatures.
 - g. Support transparent backgrounds so that image is only surrounded by the intended background, but not its immediate background.
7. Photo Imaging: Integral to security access.
- a. Import images from bitmap file formats, digital cameras, TWAIN cameras, or scanners. Allow image cropping and editing, WYSIWYG badge building application, and badge print preview and printing capabilities.
 - b. System shall support multiple images stored for each credential holder, including signatures, portrait views, and profile views.
8. Text Objects: Badge configuration shall provide for creation of custom text as an object, allowing font selection, typing, scaling, and formatting of the text object. Formatting options shall include changing font, font size, text flow, and text alignment; bending or curving the text object into a circle or semicircle; applying 3-D effects; and applying predefined effects such as tilt, extrusion, or beveling. Text shall be placed and optionally automatically centered within any region of the badge layout.
9. Badges and Credential Cards:
- a. Badges are credential cards that do not contain data to be read by card readers.
 - b. Credential cards shall store uniquely coded data used by card readers as an Identifier.
 - 1) Magnetic-Stripe Cards: Comply with ISO 7810, ISO 7811-1, ISO 7811-2, ISO 7811-3, and ISO 7811-6. Use single-layer magnetic tape material that is coated with a plastic slick protective coat and affixed to the back of the credential card near the top.
 - 2) Wiegand Wire Effect Cards: Ferromagnetic wires laminated into the credential card using binary digits specified for Wiegand readers to generate a unique credential card identification code.
 - 3) Proximity Cards **OR** Key Fobs, **as directed**: Use proximity detection without physical contact with the proximity reader for proper operation.
 - c. Allow entry-control card to be modified by lamination or direct print process during the enrollment process for use as a picture and identification badge without reduction of readability. The design shall allow for the addition of at least one slot or hole to accommodate the attachment of a clip for affixing the credential card to the type of badge holder used at the site.
 - 1) Card Size and Dimensional Stability: Standard size, 2-1/8 by 3-3/8 inches (54 by 85 mm); dimensionally stable so that an undamaged card with deformations resulting from normal use is readable by the card reader.
 - 2) Card Material: Abrasion resistant, nonflammable, and nontoxic; and impervious to solar radiation and effects of ultraviolet light.
 - 3) Card Construction: Core and laminate or monolithic construction. Lettering, logos, and other markings shall be hot stamped into the credential material or direct printed.
 - a) With holographic images **OR** phosphorous ink, **as directed**, as a security enhancement.
 - b) Furnish equipment for on-site assembly and lamination of credential cards.
 - 4) Card Durability and Maintainability: Designed and constructed to yield a useful lifetime of at least 5 years or 5000 insertions or swipes, whichever results in a longer



period of time. Allow credential cards to be cleaned by wiping with a sponge or cloth wetted with soap and water.

10. Card-Making Equipment: Consisting of a workstation, video camera, video-imaging equipment, and a printer.
 - a. Camera: NTSC color standard, RGB video output, 470 lines minimum horizontal resolution, and automatic white balance with full rated output under illumination of 0.5 fc (5 lx).
 - b. Video Imaging: Live-image capture software and hardware and a digital signature capture pad.
 - c. Standard workstation, modified as follows:
 - 1) Redundant workstation is not required.
 - 2) Printer is not required.
 - 3) UPS is not required.
 - 4) Sound card is not required.
 - d. Printer: Dye-sublimation resin thermal transfer, 300 dpi resolution, 16.7 million colors, accepting cards ranging in size from 2.1 by 3 inches to 2.6 by 3.7 inches (53 by 76 mm to 66 by 94 mm) and having card thickness ranging from 0.020 to 0.060 inch (0.5 to 1.5 mm). Printer shall have options for encoding magnetic stripe using tracks 1, 2, and 3. Throughput shall be not less than 60 seconds per card.

O. Push-Button Switches

1. Push-Button Switches: Momentary-contact back-lighted push buttons, with stainless-steel switch enclosures.
 - a. Electrical Ratings:
 - 1) Minimum continuous current rating of 10 A at 120 V ac or 5 A at 240-V ac.
 - 2) Contacts that will make 720 VA at 60 A and that will break at 720 VA at 10 A.
 - b. Enclosures: Flush or surface mounting. Push buttons shall be suitable for flush mounting in the switch enclosures.
 - c. Enclosures shall additionally be suitable for installation in the following locations:
 - 1) Indoors, controlled environment.
 - 2) Indoors, uncontrolled environment.
 - 3) Outdoors.
 - d. Power: Push-button switches shall be powered from their associated Controller, using dc control.

P. Door And Gate Hardware Interface

1. Exit Device with Alarm: Operation of the exit device shall generate an alarm and annunciate a local alarm. Exit device and alarm contacts are specified in Division 08 Section "Door Hardware".
2. Exit Alarm: Operation of a monitored door shall generate an alarm. Exit devices and alarm contacts are specified in Division 08 Section "Door Hardware".
3. Electric Door Strikes: Use end-of-line resistors to provide power line supervision. Signal switches shall transmit data to Controller to indicate when the bolt is not engaged and the strike mechanism is unlocked, and shall report a forced entry. Power and signal shall be from the Controller. Electric strikes are specified in Division 08 Section "Door Hardware".
4. Electromagnetic Locks: End-of-line resistors shall provide power line supervision. Lock status sensing signal shall positively indicate door is secure. Power and signal shall be from the Controller. Electromagnetic locks are specified in Division 08 Section "Door Hardware".
5. Vehicle Gate Operator: Interface electrical operation of gate with controls of this Section. Vehicle gate operators shall be connected, monitored, and controlled, by the security access Controllers. Vehicle gate and accessories are specified in Division 32 Section "Chain Link Fences And Gates".

Q. Field-Processing Software

1. Operating System:



- a. Local processors shall contain an operating system that controls and schedules that local processor's activities in real time.
 - b. Local processor shall maintain a point database in its memory that includes parameters, constraints, and the latest value or status of all points connected to that local processor.
 - c. Execution of local processor application programs shall utilize the data in memory resident files.
 - d. Operating system shall include a real-time clock function that maintains the seconds, minutes, hours, date, and month, including day of the week.
 - e. Local processor real-time clock shall be automatically synchronized with the central station at least once per day to plus or minus 10 seconds (the time synchronization shall be accomplished automatically, without operator action and without requiring system shutdown).
2. Startup Software:
- a. Causes automatic commencement of operation without human intervention, including startup of all connected I/O functions.
 - b. Local processor restart program based on detection of power failure at the local processor shall be included in the local processor software.
 - c. Initiates operation of self-test diagnostic routines.
 - d. Upon failure of the local processor, if the database and application software are no longer resident, the local processor shall not restart and systems shall remain in the failure mode indicated until the necessary repairs are made.
 - e. If the database and application programs are resident, the local processor shall immediately resume operation.
3. Operating Mode:
- a. Local processors shall control and monitor inputs and outputs as specified, independent of communications with the central station or designated workstations.
 - b. Alarms, status changes, and other data shall be transmitted to the central station or designated workstations when communications circuits are operable.
 - c. If communications are not available, each local processor shall function in a stand-alone mode and operational data, including the status and alarm data normally transmitted to the central station or designated workstations, shall be stored for later transmission to the central station or designated workstations.
 - d. Storage for the latest 4000 events shall be provided at local processors, as a minimum.
 - e. Local processors shall accept software downloaded from the central station.
 - f. Panel shall support flash ROM technology to accomplish firmware downloads from a central location.
4. Failure Mode: Upon failure for any reason, each local processor shall perform an orderly shutdown and force all local processor outputs to a predetermined (failure-mode) state, consistent with the failure modes shown and the associated control device.
5. Functions:
- a. Monitoring of inputs.
 - b. Control of outputs.
 - c. Reporting of alarms automatically to the central station.
 - d. Reporting of sensor and output status to central station upon request.
 - e. Maintenance of real time, automatically updated by the central station at least once a day.
 - f. Communication with the central station.
 - g. Execution of local processor resident programs.
 - h. Diagnostics.
 - i. Download and upload data to and from the central station.

R. Field-Processing Hardware

1. Alarm Annunciation Local Processor:
 - a. Respond to interrogations from the field device network, recognize and store alarm status inputs until they are transmitted to the central station, and change outputs based on commands received from the central station.



- b. Local processor shall also automatically restore communication within 10 seconds after an interruption with the field device network and provide dc line supervision on each of its alarm inputs.
 - c. Local processor inputs shall monitor dry contacts for changes of state that reflect alarm conditions.
 - d. Local processor shall have at least eight alarm inputs which allow wiring contacts as normally open or normally closed for alarm conditions; and shall provide line supervision for each input by monitoring each input for abnormal open, grounded, or shorted conditions using dc current change measurements.
 - e. Local processor shall report line supervision alarms to the central station.
 - f. Alarms shall be reported for any condition that remains abnormal at an input for longer than 500 milliseconds.
 - g. Alarm condition shall be transmitted to the central computer during the next interrogation cycle.
 - h. Local processor outputs shall reflect the state of commands issued by the central station.
 - i. Outputs shall be a form C contact and shall include normally open and normally closed contacts.
 - j. Local processor shall have at least four command outputs.
 - k. Local processor shall be able to communicate with the central station via RS-485 or TCP/IP as a minimum.
2. Processor Power Supply:
- a. Local processor and sensors shall be powered from an uninterruptible power source.
 - b. Uninterruptible power source shall provide eight hours of battery back-up power in the event of primary power failure and shall automatically fully recharge the batteries within 12 hours after primary power is restored.
 - c. If the facility is without an emergency generator, the uninterruptible power source shall provide 24 hours of battery backup power.
 - d. There shall be no equipment malfunctions or perturbations or loss of data during the switch from primary to battery power and vice versa.
 - e. Batteries shall be sealed, non-outgassing type.
 - f. Power supply shall be equipped with an indicator for ac input power and an indicator for dc output power.
 - g. Loss of primary power shall be reported to the central station as an alarm.
3. Auxiliary Equipment Power: A GFI service outlet shall be furnished inside the local processor's enclosure.
4. Entry-Control Local Processor:
- a. Entry-control local processor shall respond to interrogations from the field device network, recognize and store alarm status inputs until they are transmitted to the central station, and change outputs based on commands received from the central station.
 - b. Local processor shall also automatically restore communication within 10 seconds after an interruption with the field device network and provide dc line supervision on each of its alarm inputs.
 - c. Entry-control local processor shall provide local entry-control functions including communicating with field devices such as card readers, keypads, biometric personnel identity-verification devices, door strikes, magnetic latches, gate and door operators, and exit push buttons.
 - d. Processor shall also accept data from entry-control field devices as well as database downloads and updates from the central station that include enrollment and privilege information.
 - e. Processor shall send indications of successful or failed attempts to use entry-control field devices and shall make comparisons of presented information with stored identification information.
 - f. Processor shall grant or deny entry by sending control signals to portal-control devices and mask intrusion-alarm annunciation from sensors stimulated by authorized entries.



- g. Entry-control local processor shall use inputs from entry-control devices to change modes between access and secure.
- h. Local processor shall maintain a date-time- and location-stamped record of each transaction and transmit transaction records to the central station.
- i. Processor shall operate as a stand-alone portal controller using the downloaded database during periods of communication loss between the local processor and the central station.
- j. Processor shall store a minimum of 4000 transactions during periods of communication loss between the local processor and the central station for subsequent upload to the central station upon restoration of communication.
- k. Local processor inputs shall monitor dry contacts for changes of state that reflect alarm conditions.
- l. Local processor shall have at least eight alarm inputs which allow wiring contacts as normally open or normally closed for alarm conditions; and shall also provide line supervision for each input by monitoring each input for abnormal open, grounded, or shorted conditions using dc current change measurements.
- m. Local processor shall report line supervision alarms to the central station.
- n. Alarms shall be reported for any condition that remains abnormal at an input for longer than 500 ms.
- o. Alarm condition shall be transmitted to the central station during the next interrogation cycle.
- p. Entry-control local processor shall include the necessary software drivers to communicate with entry-control field devices. Information generated by the entry-control field devices shall be accepted by the local processor and automatically processed to determine valid identification of the individual present at the portal.
- q. Upon authentication of the credentials or information presented, the local processor shall automatically check privileges of the identified individual, allowing only those actions granted as privileges.
- r. Privileges shall include, but are not limited to, time of day control, day of week control, group control, and visitor escort control. The local processor shall maintain a date-time- and location-stamped record of each transaction.
- s. Transaction is defined as any successful or unsuccessful attempt to gain access through a controlled portal by the presentation of credentials or other identifying information.
- t. Local processor outputs shall reflect the state of commands issued by the central station.
- u. Outputs shall be a form C contact and shall include normally open and normally closed contacts.
- v. Local processor shall have at least four addressable outputs.
- w. The entry-control local processor shall also provide control outputs to portal-control devices.
- x. Local processor shall be able to communicate with the central station via RS-485 or TCP/IP as a minimum.
- y. The system manufacturer shall provide strategies for downloading database information for panel configurations and cardholder data to minimize the required download time when using IP connectivity.

S. Tia 232-F Ascii Interface Specifications

- 1. ASCII interface shall allow TIA 232-F connections to be made between the control station operating as the host PC and any equipment that will accept TIA 232-F ASCII command strings, such as CCTV switches, intercoms, and paging systems.
 - a. Alarm inputs in system shall allow for individual programming to output up to four unique ASCII character strings through two different COM ports on the host PC.
 - b. Inputs shall have the ability to be defined to transmit a unique ASCII string for alarm and one for restore through one COM port, and a unique ASCII string for a nonalarm, abnormal condition and one for a normal condition through the same or different COM port.
 - c. Predefined ASCII character strings shall have the ability to be up to 420 characters long with full use of all the ASCII control characters, such as return or line feed. Character



strings shall be defined in the system database and then assigned to the appropriate inputs.

- d. COM ports of the host PC used to interface with external equipment shall be defined in the setup portion of the software. COM port's baud rate, word length, stop bits, and parity shall be definable in the software to match that of the external equipment.
2. Pager-System Interface: Alarms shall be able to activate a pager system with customized message for each input alarm.
 - a. TIA 232-F output shall be capable of connection to a pager interface that can be used to call a paging system or service and send a signal to a portable pager. System shall allow an individual alphanumeric message per alarm input to be sent to the paging system. This interface shall support both numeric and alphanumeric pagers.
3. Alarm-System Interface:
 - a. TIA 232-F output shall be capable of transmitting alarms from other monitoring and alarm systems to central-station automation software.
 - b. Alternatively, alarms that are received by this access-control system are to be transferred to the alarm automation system as if they were sent through a digital alarm receiver.
 - 1) System shall be able to transmit an individual message from any alarm input to a burglar-alarm automation monitoring system.
 - 2) System shall be able to append to each message a predefined set of character strings as a prefix and a suffix.

T. Floor Select Elevator Control

1. Elevator access control shall be integral to security access.
 - a. System shall be capable of providing full elevator security and control through dedicated Controllers without relying on the control-station host PC for elevator control decisions.
 - b. Access-control system shall enable and disable car calls on each floor and floor select buttons in each elevator car, restricting passengers' access to the floors where they have been given access.
 - c. System setup shall, through programming, automatically secure and unsecure each floor select button of a car individually by time and day. Each floor select button within a car shall be separately controlled so that some floors may be secure while others remain unsecure.
 - d. When a floor select button is secure, it shall require the passenger to use his/her access code and have access to that floor before the floor select button will operate. The passenger's credential shall determine which car call and floor select buttons are to be enabled, restricting access to floors unless authorized by system's access code database. Floor select button shall be enabled only in the car where the credential holder is the passenger.
2. Security access system shall record which call button is pressed, along with credential and time information.
 - a. System Controller shall record elevator access data.
 - b. The Controller shall reset all additional call buttons that may have been enabled by the user's credential.
 - c. The floor select elevator control shall allow for manual override either individually by floor or by cab as a group from a workstation PC.

U. Real-Time Guard Tour

1. Guard tour module shall provide the ability to plan, track, and route tours. Module shall input an alarm during tour if guard fails to make a station. Tours can be programmed for sequential or random tour-station order.
 - a. Guard tour setup shall define specific routes or tours for the guard to take, with time restrictions in which to reach every predefined tour station.
 - b. Guard tour activity shall be automatically logged to the central-station PC's hard drive.
 - c. If the guard is early or late to a tour station, a unique alarm per station shall appear at the Central Station to indicate the time and station.



- d. Guard tour setup shall allow the tours to be executed sequentially or in a random order with an overall time limit set for the entire tour instead of individual times for each tour station.
 - e. Setup shall allow recording of predefined responses that will display for the operator at the control station should a "Failed to Check-in" alarm occur.
 2. Guard tour module shall allow proprietary direct-connected systems to use security access-control hardware to perform guard tour management in real time.
 3. A tour station is a physical location a guard shall reach and perform an action indicating that the guard has arrived. This action, performed at the tour station, shall be 1 of 13 different events with any combination of station types within the same tour. A tour station shall be one of the following event types:
 - a. Access Granted.
 - b. Access Denied Code.
 - c. Access Denied Card plus PIN.
 - d. Access Denied Time Zone.
 - e. Access Denied Level.
 - f. Access Denied Facility.
 - g. Access Denied Code Timer.
 - h. Access Denied Anti-Passback.
 - i. Access Granted Passback Violation.
 - j. Alarm.
 - k. Restored.
 - l. Input Normal.
 - m. Input Abnormal.
 4. Guard tour and other system features shall operate simultaneously with no interference.
 5. Guard Tour Module Capacity: 999 possible guard tour definitions with each tour having up to 99 tour stations. System shall allow all 999 tours to be running at same time.
- V. Video And Camera Control
1. Control station or designated workstation displays live video from a CCTV source.
 - a. Control Buttons: On the display window, with separate control buttons to represent Left, Right, Up, Down, Zoom In, Zoom Out, Scan, and a minimum of two custom command auxiliary controls.
 - b. Provide at least seven icons to represent different types of cameras, with ability to import custom icons. Provide option for display of icons on graphic maps to represent their physical location.
 - c. Provide the alarm-handling window with a command button that will display the camera associated with the alarm point.
 2. Display mouse-selectable icons representing each camera source, to select source to be displayed. For CCTV sources that are connected to a video switcher, control station shall automatically send control commands through a COM port to display the requested camera when the camera icon is selected.
 3. Allow cameras with preset positioning to be defined by displaying a different icon for each of the presets. Provide control with Next and Previous buttons to allow operator to cycle quickly through the preset positions.
- W. Cables
1. General Cable Requirements: Comply with requirements in Division 28 Section "Conductors And Cables For Electronic Safety And Security" and as recommended by system manufacturer for integration requirement.
 2. PVC-Jacketed, TIA 232-F Cables:
 - a. Two pairs, No. 22 AWG, stranded (7x30) tinned copper conductors, polypropylene insulation, and individual aluminum-foil/polyester-tape shielded pairs with 100 percent shield coverage; PVC jacket.
 - b. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.



- c. NFPA 70, Type CM.
 - d. Flame Resistance: UL 1581 vertical tray.
3. Plenum-Type, TIA 232-F Cables:
 - a. Two pairs, No. 22 AWG, stranded (7x30) tinned copper conductors, plastic insulation, and individual aluminum-foil/polyester-tape shielded pairs with 100 percent shield coverage; plastic jacket.
 - b. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
 - c. NFPA 70, Type CMP.
 - d. Flame Resistance: NFPA 262 flame test.
4. PVC-Jacketed, TIA 485-A Cables: Two pairs, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors, PVC insulation, unshielded, PVC jacket, and NFPA 70, Type CMG.
5. Plenum-Type, TIA 485-A Cables:
 - a. Two pairs, No. 22 AWG, stranded (7x30) tinned copper conductors, fluorinated-ethylene-propylene insulation, unshielded, and fluorinated-ethylene-propylene jacket.
 - b. NFPA 70, Type CMP.
 - c. Flame Resistance: NFPA 262 flame test.
6. Multiconductor, PVC Readers and Wiegand Keypads Cables:
 - a. No. 22 AWG, paired and twisted multiple conductors, stranded (7x30) tinned copper conductors, semirigid PVC insulation, overall aluminum foil-polyester tape shield with 100 percent shield coverage, plus tinned copper braid shield with 65 percent shield coverage, and PVC jacket.
 - b. NFPA 70, Type CMG.
 - c. Flame Resistance: UL 1581 Vertical Tray.
 - d. For TIA 232-F applications.
7. Paired PVC Readers and Wiegand Keypad Cables:
 - a. Three pairs, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors, polypropylene insulation, individual aluminum foil-polyester tape shielded pairs each with No. 22 AWG, stranded tinned copper drain wire, 100 percent shield coverage, and PVC jacket.
 - b. NFPA 70, Type CM.
 - c. Flame Resistance: UL 1581 Vertical Tray.
8. Paired PVC Readers and Wiegand Keypads Cable:
 - a. Three 3 pairs, twisted, No. 20 AWG, stranded (7x28) tinned copper conductors, polyethylene (polyolefin) insulation, individual aluminum foil-polyester tape shielded pairs each with No. 22 AWG, stranded (19x34) tinned copper drain wire, 100 percent shield coverage, and PVC jacket.
 - b. NFPA 70, Type CM.
 - c. Flame Resistance: UL 1581 Vertical Tray.
9. Paired, Plenum-Type, Reader and Wiegand Keypad Cable:
 - a. Three pairs, No. 22 AWG, stranded (7x30) tinned copper conductors, plastic insulation, individual aluminum foil-polypropylene tape shielded pairs each with No. 22 AWG, stranded tinned copper drain wire, 100 percent shield coverage, and fluorinated-ethylene-propylene jacket.
 - b. NFPA 70, Type CMP.
 - c. Flame Resistance: NFPA 262 Flame Test.
10. Multiconductor, Plenum-Type, Reader and Wiegand Keypad Cable:
 - a. Six conductors, No. 20 AWG, stranded (7x28) tinned copper conductors, fluorinated-ethylene-propylene insulation, overall aluminum foil-polyester tape shield with 100 percent shield coverage plus tinned copper braid shield with 85 percent shield coverage, and fluorinated-ethylene-propylene jacket.
 - b. NFPA 70, Type CMP.
 - c. Flame Resistance: NFPA 262 Flame Test.
11. Paired Lock Cable:



- a. One pair, twisted, No. 16 AWG, stranded (19x29) tinned copper conductors, PVC insulation, unshielded, and PVC jacket.
 - b. NFPA 70, Type CMG.
 - c. Flame Resistance: UL 1581 Vertical Tray.
12. Paired, Plenum-Type, Lock Cable:
- a. One pair, twisted, No. 16 AWG, stranded (19x29) tinned copper conductors, PVC insulation, unshielded, and PVC jacket.
 - b. NFPA 70, Type CMP.
 - c. Flame Resistance: NFPA 262 Flame Test.
13. Paired Lock Cable:
- a. One pair, twisted, No. 18 AWG, stranded (19x30) tinned copper conductors, PVC insulation, unshielded, and PVC jacket.
 - b. NFPA 70, Type CMG.
 - c. Flame Resistance: UL 1581 Vertical Tray.
14. Paired, Plenum-Type, Lock Cable:
- a. One pair, twisted, No. 18 AWG, stranded (19x30) tinned copper conductors, fluorinated-ethylene-propylene insulation, unshielded, and plastic jacket.
 - b. NFPA 70, Type CMP.
 - c. Flame Resistance: NFPA 262 Flame Test.
15. Paired Input Cable:
- a. One pair, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors, polypropylene insulation, overall aluminum foil-polyester tape shield with No. 22 AWG, stranded (7x30) tinned copper drain wire, 100 percent shield coverage, and PVC jacket.
 - b. NFPA 70, Type CMR.
 - c. Flame Resistance: UL 1666 Riser Flame Test.
16. Paired, Plenum-Type, Input Cable:
- a. One pair, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors, fluorinated-ethylene-propylene insulation, aluminum foil-polyester tape shield (foil side out), with No. 22 AWG drain wire, 100 percent shield coverage, and plastic jacket.
 - b. NFPA 70, Type CMP.
 - c. Flame Resistance: NFPA 262 Flame Test.
17. Paired AC Transformer Cable:
- a. One pair, twisted, No. 18 AWG, stranded (7x26) tinned copper conductors, PVC insulation, unshielded, and PVC jacket.
 - b. NFPA 70, Type CMG.
18. Paired, Plenum-Type, AC Transformer Cable:
- a. One pair, twisted, No. 18 AWG, stranded (19x30) tinned copper conductors, fluorinated-ethylene-propylene insulation, unshielded, and plastic jacket.
 - b. NFPA 70, Type CMP.
 - c. Flame Resistance: NFPA 262 Flame Test.
19. Elevator Travel Cable:
- a. Steel center core, with shielded, twisted pairs, No. 20 AWG conductor size.
 - b. Steel center support shall be preformed, flexible, low-torsion, zinc-coated, steel wire rope; insulated with 60 deg C flame-resistant PVC and covered with a nylon or cotton braid.
 - c. Shielded Pairs: Insulated copper conductors; color-coded, insulated with 60 deg C flame-resistant PVC; each pair shielded with bare copper braid for 85 percent coverage.
 - d. Electrical grade, dry jute filler
 - e. Helically wound synthetic fiber binder
 - f. Rayon or cotton braid applied with 95 percent coverage.
 - g. 60 deg C PVC jacket specifically compounded for flexibility and abrasion resistance and complying with UL VW-1 and CSA FT1 flame rated.
20. LAN Cabling:
- a. Comply with requirements in Division 28 Section "Conductors And Cables For Electronic Safety And Security".
 - b. NFPA 262.



- X. Transformers: NFPA 70, Class II control transformers, NRTL listed. Transformers for security access-control system shall not be shared with any other system.
- Y. Cable And Asset Management Software
1. Computer-based cable and asset management system, with fully integrated database and graphic capabilities, complying with requirements in TIA/EIA-606.
 - a. Document physical characteristics by recording the network, asset, user, TIA/EAI details, device configurations, and exact connections between equipment and cabling.
 - 1) Manage the physical layer of security system.
 - 2) List device configurations.
 - 3) List and display circuit connections.
 - 4) Record firestopping data.
 - 5) Record grounding and bonding connections and test data.
 - b. Information shall be presented in database view, schematic plans, or technical drawings.
 - 1) Microsoft Visio Technical Drawing shall be used as drawing and schematic plans software. Drawing symbols, system layout, and design shall comply with SIA/IAPSC AG-01.
 - c. System shall interface with the following testing and recording devices:
 - 1) Direct upload tests from circuit testing instrument into the PC.
 - 2) Direct download circuit labeling into labeling printer.
 2. Software shall be designed for Microsoft Windows of same version as security access system's Central Station and workstations and shall be installed on the designated PC, using a hard drive dedicated only to this management function. Hard-drive capacity shall be not less than 50 GB.

1.3 EXECUTION

- A. Examination
1. Examine pathway elements intended for cables. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation.
 2. Examine roughing-in for LAN and control cable conduit systems to PCs, controllers, card readers, and other cable-connected devices to verify actual locations of conduit and back boxes before device installation.
 3. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Preparation
1. Comply with recommendations in SIA CP-01.
 2. Comply with TIA/EIA 606-A, "Administration Standard for Commercial Telecommunications Infrastructure."
 3. Obtain detailed Project planning forms from manufacturer of access-control system; develop custom forms to suit Project. Fill in all data available from Project plans and specifications and publish as Project planning documents for review and approval.
 - a. Record setup data for control station and workstations.
 - b. For each Location, record setup of controller features and access requirements.
 - c. Propose start and stop times for time zones and holidays, and match up access levels for doors.
 - d. Set up groups, facility codes, linking, and list inputs and outputs for each controller.
 - e. Assign action message names and compose messages.
 - f. Set up alarms. Establish interlocks between alarms, intruder detection, and video surveillance features.
 - g. Prepare and install alarm graphic maps.
 - h. Develop user-defined fields.
 - i. Develop screen layout formats.
 - j. Propose setups for guard tours and key control.



- k. Discuss badge layout options; design badges.
 - l. Complete system diagnostics and operation verification.
 - m. Prepare a specific plan for system testing, startup, and demonstration.
 - n. Develop acceptance test concept and, on approval, develop specifics of the test.
4. Develop cable and asset-management system details; input data from construction documents. Include system schematics and Visio Technical Drawings in electronic format.
 5. In meetings with the Owner, present Project planning documents and review, adjust, and prepare final setup documents. Use final documents to set up system software.

C. Cabling

1. Comply with NECA 1, "Good Workmanship in Electrical Contracting."
2. Install cables and wiring according to requirements in Division 28 Section "Conductors And Cables For Electronic Safety And Security".
3. Wiring Method: Install wiring in raceway and cable tray except within consoles, cabinets, desks, and counters. Conceal raceway and wiring except in unfinished spaces.
4. Wiring Method: Install wiring in raceway and cable tray except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Use NRTL-listed plenum cable in environmental air spaces, including plenum ceilings. Conceal raceway and cables except in unfinished spaces.
5. Install LAN cables using techniques, practices, and methods that are consistent with Category 5E rating of components and fiber-optic rating of components, and that ensure Category 6 performance and fiber-optic performance of completed and linked signal paths, end to end.
6. Boxes and enclosures containing security system components or cabling, and which are easily accessible to employees or to the public, shall be provided with a lock. Boxes above ceiling level in occupied areas of the building shall not be considered to be accessible. Junction boxes and small device enclosures below ceiling level and easily accessible to employees or the public shall be covered with a suitable cover plate and secured with tamperproof screws.
7. Install end-of-line resistors at the field device location and not at the Controller or panel location.

D. Cable Application

1. Comply with TIA-569-B, "Commercial Building Standard for Telecommunications Pathways and Spaces."
2. Cable application requirements are minimum requirements and shall be exceeded if recommended or required by manufacturer of system hardware.
3. TIA 232-F Cabling: Install at a maximum distance of 50 feet (15 m).
4. TIA 485-A Cabling: Install at a maximum distance of 4000 feet (1220 m).
5. Card Readers and Keypads:
 - a. Install number of conductor pairs recommended by manufacturer for the functions specified.
 - b. Unless manufacturer recommends larger conductors, install No. 22 AWG wire if maximum distance from Controller to the reader is 250 feet (75 m), and install No. 20 AWG wire if maximum distance is 500 feet (150 m).
 - c. For greater distances, install "extender" or "repeater" modules recommended by manufacturer of the Controller.
 - d. Install minimum No. 18 AWG shielded cable to readers and keypads that draw 50 mA or more.
6. Install minimum No. 16 AWG cable from Controller to electrically powered locks. Do not exceed 250 feet (75 m) **OR** 500 feet (150 m), **as directed**.
7. Install minimum No. 18 AWG ac power wire from transformer to Controller, with a maximum distance of 25 feet (8 m).

E. Grounding

1. Comply with Division 26 Section "Grounding And Bonding For Electrical Systems".
2. Comply with IEEE 1100, "Recommended Practice for Power and Grounding Electronic Equipment."



3. Ground cable shields, drain conductors, and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
 4. Bond shields and drain conductors to ground at only one point in each circuit.
 5. Signal Ground:
 - a. Terminal: Locate in each equipment room and wiring closet; isolate from power system and equipment grounding.
 - b. Bus: Mount on wall of main equipment room with standoff insulators.
 - c. Backbone Cable: Extend from signal ground bus to signal ground terminal in each equipment room and wiring closet.
- F. Installation
1. Push Buttons: Where multiple push buttons are housed within a single switch enclosure, they shall be stacked vertically with each push-button switch labeled with 1/4-inch- (6.4-mm-) high text and symbols as required. Push-button switches shall be connected to the Controller associated with the portal to which they are applied, and shall operate the appropriate electric strike, electric bolt, or other facility release device.
 2. Install card readers, keypads, push buttons, and biometric readers.
- G. Identification
1. In addition to requirements in this Article, comply with applicable requirements in Division 26 Section "Identification For Electrical Systems" and with TIA/EIA-606.
 2. Using software specified in "Cable and Asset Management Software" Article, develop cable administration drawings for system identification, testing, and management. Use unique, alphanumeric designation for each cable, and label cable and jacks, connectors, and terminals to which it connects with the same designation. Use logical and systematic designations for facility's architectural arrangement.
 3. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
 - a. All wiring conductors connected to terminal strips shall be individually numbered, and each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with the name and number of the particular device as shown.
 - b. Each wire connected to building-mounted devices is not required to be numbered at the device if the color of the wire is consistent with the associated wire connected and numbered within the panel or cabinet.
 4. At completion, cable and asset management software shall reflect as-built conditions.
- H. System Software and Hardware
1. Develop, install, and test software and hardware, and perform database test for the complete and proper operation of systems involved. Assign software license to the Owner.
- I. Field Quality Control
1. Perform tests and inspections.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installation, including connections, and to assist testing.
 2. Testing and Inspections:
 - a. LAN Cable Procedures: Inspect for physical damage and test each conductor signal path for continuity and shorts. Use Class 2, bidirectional, Category 5 tester. Test for faulty connectors, splices, and terminations. Test according to TIA/EIA-568-B.1, "Commercial Building Telecommunications Cabling Standards - Part 1 General Requirements." Link performance for UTP cables must comply with minimum criteria in TIA/EIA-568-B.
 - b. Test each circuit and component of each system. Tests shall include, but are not limited to, measurements of power supply output under maximum load, signal loop resistance, and leakage to ground where applicable. System components with battery backup shall be operated on battery power for a period of not less than 10 percent of the calculated battery



- operating time. Provide special equipment and software if testing requires special or dedicated equipment.
- c. Operational Test: After installation of cables and connectors, demonstrate product capability and compliance with requirements. Test each signal path for end-to-end performance from each end of all pairs installed. Remove temporary connections when tests have been satisfactorily completed.
 3. Devices and circuits will be considered defective if they do not pass tests and inspections.
 4. Prepare test and inspection reports.
- J. Startup Service
1. Engage a factory-authorized service representative to supervise and assist with startup service.
 - a. Complete installation and startup checks according to approved procedures that were developed in "Preparation" Article and with manufacturer's written instructions.
 - b. Enroll and prepare badges and access cards for Owner's operators, management, and security personnel.
- K. Protection
1. Maintain strict security during the installation of equipment and software. Rooms housing the control station, and workstations that have been powered up shall be locked and secured, with an activated burglar alarm and access-control system reporting to a Central Station complying with UL 1610, "Central-Station Burglar-Alarm Units," during periods when a qualified operator in the employ of Contractor is not present.

END OF SECTION 28 13 33 16b



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Task	Specification	Specification Description
28 13 33 16	27 51 33 00	Educational Intercommunications and Program Systems
28 13 33 16	26 33 43 00b	Public Address and Mass Notification Systems



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SECTION 28 23 00 00 - VIDEO SURVEILLANCE

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for video surveillance. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes a video surveillance system consisting of cameras, digital video recorder, data transmission wiring, and a control station with its associated equipment.
2. Video surveillance system shall be integrated with monitoring and control system specified in Division 13 Section "Perimeter Security", "Intrusion Detection", "Security Access", and PLC Electronic Detention Monitoring and Control Systems", which specifies systems integration.

C. Definitions

1. AGC: Automatic gain control.
2. BNC: Bayonet Neill-Concelman - type of connector.
3. B/W: Black and white.
4. CCD: Charge-coupled device.
5. FTP: File transfer protocol.
6. IP: Internet protocol.
7. LAN: Local area network.
8. MPEG: Moving picture experts group.
9. NTSC: National Television System Committee.
10. PC: Personal computer.
11. PTZ: Pan-tilt-zoom.
12. RAID: Redundant array of independent disks.
13. TCP: Transmission control protocol - connects hosts on the Internet.
14. UPS: Uninterruptible power supply.
15. WAN: Wide area network.

D. Performance Requirements

1. Seismic Performance: Video surveillance system shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

E. Submittals

1. Product Data: For each type of product indicated. Include dimensions and data on features, performance, electrical characteristics, ratings, and finishes.
2. Shop Drawings: For video surveillance. Include plans, elevations, sections, details, and attachments to other work.
 - a. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - b. Functional Block Diagram: Show single-line interconnections between components for signal transmission and control. Show cable types and sizes.
 - c. Dimensioned plan and elevations of equipment racks, control panels, and consoles. Show access and workspace requirements.
 - d. UPS: Sizing calculations.
 - e. Wiring Diagrams: For power, signal, and control wiring.



3. Equipment List: Include every piece of equipment by model number, manufacturer, serial number, location, and date of original installation. Add pretesting record of each piece of equipment, listing name of person testing, date of test, set points of adjustments, name and description of the view of preset positions, description of alarms, and description of unit output responses to an alarm.
4. Seismic Qualification Certificates: For video surveillance, cameras, camera-supporting equipment, accessories, and components, from manufacturer.
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
 - d. Field quality-control reports.
 - e. Operation and Maintenance Data: For cameras, power supplies, infrared illuminators, monitors, videotape recorders, digital video recorders, video switches, and control-station components to include in emergency, operation, and maintenance manuals. Include the following:
 - 1) Lists of spare parts and replacement components recommended to be stored at the site for ready access.
5. Warranty: Sample of special warranty.

F. Quality Assurance

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with NECA 1.
3. Comply with NFPA 70.
4. Electronic data exchange between video surveillance system with an access-control system shall comply with SIA TVAC.

G. Project Conditions

1. Environmental Conditions: Capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
 - a. Control Station: Rated for continuous operation in ambient temperatures of 60 to 85 deg F (16 to 29 deg C) and a relative humidity of 20 to 80 percent, noncondensing.
 - b. Interior, Controlled Environment: System components, except central-station control unit, installed in air-conditioned **OR** temperature-controlled, **as directed**, interior environments shall be rated for continuous operation in ambient temperatures of 36 to 122 deg F (2 to 50 deg C) dry bulb and 20 to 90 percent relative humidity, noncondensing. Use NEMA 250, Type 1 enclosures.
 - c. Interior, Uncontrolled Environment: System components installed in non-air-conditioned **OR** non-temperature-controlled, **as directed**, interior environments shall be rated for continuous operation in ambient temperatures of 0 to 122 deg F (minus 18 to plus 50 deg C) dry bulb and 20 to 90 percent relative humidity, noncondensing. Use NEMA 250, Type 3R **OR** Type 4 **OR** Type 12 **OR** Type 12K, **as directed**, enclosures.
 - d. Exterior Environment: System components installed in locations exposed to weather shall be rated for continuous operation in ambient temperatures of minus 30 to plus 122 deg F (minus 34 to plus 50 deg C) dry bulb and 20 to 90 percent relative humidity, condensing. Rate for continuous operation when exposed to rain as specified in NEMA 250, winds up to 85 mph (137 km/h) and snow cover up to 24 inches (610 mm) thick, **as directed**. Use NEMA 250, Type 3 **OR** Type 3R **OR** Type 3S **OR** Type 4 **OR** Type 4X, **as directed**, enclosures.
 - e. Hazardous Environment: System components located in areas where fire or explosion hazards may exist because of flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers shall be rated, listed, and installed according to NFPA 70.



- f. Corrosive Environment: System components subject to corrosive fumes, vapors, and wind-driven salt spray in coastal zones. Use NEMA 250, Type 4X **OR** Type 6P, **as directed**, enclosures.
- g. Security Environment: Camera housing for use in high-risk areas where surveillance equipment may be subject to physical violence.

H. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of cameras, equipment related to camera operation, and control-station equipment that fail in materials or workmanship within specified warranty period.
 - a. Warranty Period: Three years from date of Final Completion.

1.2 PRODUCTS

A. System Requirements

1. Video-signal format shall comply with NTSC standard, composite interlaced video. Composite video-signal termination shall be 75 ohms.
2. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor's entry connection to components.
 - a. Minimum Protection for Power Connections 120 V and More: Auxiliary panel suppressors complying with requirements in Division 16 Section "Transient Voltage Suppression."
 - b. Minimum Protection for Communication, Signal, Control, and Low-Voltage Power Connections: Comply with requirements in Division 16 Section "Transient Voltage Suppression" as recommended by manufacturer for type of line being protected.
3. Tamper Protection: Tamper switches on enclosures, control units, pull boxes, junction boxes, cabinets, and other system components shall initiate a tamper-alarm signal when unit is opened or partially disassembled. Control-station, control-unit alarm display shall identify tamper alarms and indicate locations.

B. Standard Cameras

1. B/W Camera:
 - a. Comply with UL 639.
 - b. Pickup Device: CCD interline transfer, 252,000 512(H) by 492(V) pixels, **unless directed otherwise**.
 - c. Horizontal Resolution: 380 lines.
 - d. Signal-to-Noise Ratio: Not less than 46 dB.
 - e. With AGC, manually selectable on or off.
 - f. Sensitivity: Camera shall provide usable images in low-light conditions, delivering an image at a scene illumination, as directed by the Owner, with camera AGC off, **as directed**.
OR
Sensitivity: Camera shall deliver 1-V peak-to-peak video signal at the minimum specified light level. Illumination for the test shall be with lamps rated at approximately 2200-K color temperature, and with camera AGC off.
 - g. Manually selectable modes for backlight compensation or normal lighting.
 - h. Scanning Synchronization: Determined by external synch over the coaxial cable. Camera shall revert to internally generated synchronization on loss of external synch signal.
 - i. Motion Detector: Built-in digital.
2. Color Camera:
 - a. Comply with UL 639.
 - b. Pickup Device: CCD interline transfer, 380,000 771(H) by 492(V) pixels, **unless directed otherwise**.
 - c. Horizontal Resolution: 480 lines.
 - d. Signal-to-Noise Ratio: Not less than 50 dB, with camera AGC off.



- e. With AGC, manually selectable on or off.
 - f. Sensitivity: Camera shall provide usable images in low-light conditions, delivering an image at a scene illumination, as directed by the Owner, with camera AGC off, **as directed.**
OR
Sensitivity: Camera shall deliver 1-V peak-to-peak video signal at the minimum specified light level. Illumination for the test shall be with lamps rated at approximately 2200-K color temperature, and with camera AGC off.
 - g. Manually selectable modes for backlight compensation or normal lighting.
 - h. Scanning Synchronization: Determined by external synch over the coaxial cable. Camera shall revert to internally generated synchronization on loss of external synch signal.
 - i. White Balance: Auto-tracing white balance, with manually settable fixed balance option.
 - j. Motion Detector: Built-in digital.
3. Automatic Color Dome Camera: Assembled and tested as a manufactured unit, containing dome assembly, color camera, motorized pan and tilt, zoom lens, and receiver/driver.
- a. Comply with UL 639.
 - b. Pickup Device: CCD interline transfer, 380,000 768(H) by 494(V) pixels, **unless directed otherwise.**
 - c. Horizontal Resolution: 480 lines.
 - d. Signal-to-Noise Ratio: Not less than 50 dB, with camera AGC off.
 - e. With AGC, manually selectable on or off.
 - f. Sensitivity: Camera shall provide usable images in low-light conditions, delivering an image at a scene illumination, as directed by the Owner, with camera AGC off, **as directed.**
OR
Sensitivity: Camera shall deliver 1-V peak-to-peak video signal at the minimum specified light level. Illumination for the test shall be with lamps rated at approximately 2200-K color temperature, and with camera AGC off.
 - g. Manually selectable modes for backlight compensation or normal lighting.
 - h. Pan and Tilt: Direct-drive motor, 360-degree rotation angle, and 180-degree tilt angle. Pan-and-tilt speed shall be controlled by operator. Movement from preset positions shall be not less than 300 degrees per second.
 - i. Preset Positioning: Eight user-definable scenes, each allowing 16-character titles. Controls shall include the following:
 - 1) In "sequence mode," camera shall continuously sequence through preset positions, with dwell time and sequencing under operator control.
 - 2) Motion detection shall be available at each camera position.
 - 3) Up to four preset positions may be selected to be activated by an alarm. Each of the alarm positions may be programmed to output a response signal.
 - j. Scanning Synchronization: Determined by external synch over the coaxial cable. Camera shall revert to internally generated synchronization on loss of external synch signal.
 - k. White Balance: Auto-tracing white balance, with manually settable fixed balance option.
 - l. Motion Detector: Built-in digital.
 - m. Dome shall support multiplexed control communications using coaxial cable recommended by manufacturer.

C. Submersible Cameras

- 1. Camera: Color, designed for underwater monitoring and for inspecting pipes and storm drains. Attributes as follows:
 - a. Infrared LEDs to provide illumination in zero-light conditions.
 - b. 60-foot (18.3-m) factory-installed cable with BNC connector for video and a 2.1-mm jack for 12-V dc power supply.
 - c. An adjustable swivel mount and attachment base.
 - d. Pickup Device: CCD interline transfer, 290,000 500(H) by 580(V) pixels, **unless directed otherwise.**



- e. Horizontal Resolution: 380 lines.
- f. Signal-to-Noise Ratio: Not less than 50 dB.
- g. With AGC, from 4 to 39 dB.
- h. Sensitivity: Camera shall provide usable images in low-light conditions, delivering an image at a scene illumination of 0.1 lux at f/2.0.
- i. Scanning Synchronization: Internal.
- j. White Balance: Auto-tracing white balance, for colors ranging from 2800 to 8200 deg K.

D. Reinforced Dome Cameras

- 1. Camera: Designed for high-abuse locations, with a weathertight semirecessed **OR** surface, **as directed**, mounting, impact-resistance polycarbonate dome, and heavy-gage, 6061 T6 aluminum body.
 - a. Suitable for exterior environment, rated for continuous operation in ambient temperatures of minus 40 to plus 122 deg F (minus 40 to plus 50 deg C) dry bulb and up to 85 percent relative humidity.
 - b. Pickup Device: CCD interline transfer, 290,000 510(H) by 492(V) pixels, **unless directed otherwise**.
 - c. Horizontal Resolution: 350 lines.
 - d. Signal-to-Noise Ratio: Not less than 46 dB.
 - e. With AGC and automatic backlight compensation.
 - f. Sensitivity: Camera shall provide usable images in low-light conditions, delivering an image at a scene illumination of 6 lux at f/2.0.
 - g. Scanning Synchronization: Determined by external synch over the coaxial cable. Camera shall revert to internally generated synchronization on loss of external synch signal.
 - h. White Balance: Auto-tracing white balance.

E. Lenses

- 1. Description: Optical-quality coated lens, designed specifically for video-surveillance applications and matched to specified camera. Provide color-corrected lenses with color cameras.
 - a. Auto-Iris Lens: Electrically controlled iris with circuit set to maintain a constant video level in varying lighting conditions.
 - b. Fixed Lens: With calibrated focus ring.
 - c. Zoom Lens: Motorized, remote-controlled unit, rated as "quiet operating." Features include the following:
 - 1) Electrical Leads: Filtered to minimize video signal interference.
 - 2) Motor Speed: Variable.
 - 3) Lens shall be available with preset positioning capability to recall the position of specific scenes.

F. Power Supplies

- 1. Low-voltage power supplies matched for voltage and current requirements of cameras and accessories, and of type as recommended by manufacturer of camera, infrared illuminator, **as directed**, and lens.
 - a. Enclosure: NEMA 250, Type 1 **OR** Type 3 **OR** Type 4X, **as directed**.

G. Infrared Illuminators

- 1. Description: Lighting fixtures that emit light only in the infrared spectrum, suitable for use with cameras indicated, for nighttime surveillance, without emitting visible light.
 - a. Field-Selectable Beam Patterns: Narrow, medium, and wide.
 - b. Rated Lamp Life: More than 8000 hours.
 - c. Power Supply: 12-V ac/dc **OR** 120-V ac, **as directed**.
- 2. Area Coverage: Illumination to 150 feet (50 m) in a narrow beam pattern.
- 3. Exterior housings shall be suitable for same environmental conditions as the associated camera.

H. Camera-Supporting Equipment



1. Minimum Load Rating: Rated for load in excess of the total weight supported times a minimum safety factor of two.
 2. Pan Units: Motorized automatic-scanning units arranged to provide remote-controlled manual and automatic camera panning action, and equipped with matching mounting brackets.
 - a. Scanning Operation: Silent, smooth, and positive.
 - b. Stops: Adjustable without disassembly, to limit the scanning arc.
 3. Pan-and-Tilt Units: Motorized units arranged to provide remote-controlled aiming of cameras with smooth and silent operation, and equipped with matching mounting brackets.
 - a. Panning Rotation: 0 to 355 degrees, with adjustable stops.
 - b. Tilt Movement: 90 degrees, plus or minus 5 degrees, with adjustable stops.
 - c. Speed: 12 degrees per second in both horizontal and vertical planes.
 - d. Wiring: Factory prewired for camera and zoom lens functions and pan-and-tilt power and control.
 - e. Built-in encoders or potentiometers for position feedback, and thermostat-controlled heater, **as directed**.
 - f. Pan-and-tilt unit shall be available with preset positioning capability to recall the position of a specific scene.
 4. Mounting Brackets for Fixed Cameras: Type matched to items supported and mounting conditions. Include manual pan-and-tilt adjustment.
 5. Protective Housings for Fixed and Movable Cameras: Steel or 6061 T6 aluminum, **as directed**, enclosures with internal camera mounting and connecting provisions that are matched to camera/lens combination and mounting and installing arrangement of camera to be housed.
 - a. Tamper switch on access cover sounds an alarm signal when unit is opened or partially disassembled. Central-control unit shall identify tamper alarms and indicate location in alarm display. Tamper switches and central-control unit are specified in Division 13 Section "Intrusion Detection."
 - b. Camera Viewing Window: Polycarbonate **OR** Lexan, **as directed**, window, aligned with camera lens.
 - c. Duplex Receptacle: Internally mounted.
 - d. Alignment Provisions: Camera mounting shall provide for field aiming of camera and permit removal and reinstallation of camera lens without disturbing camera alignment.
 - e. Built-in, thermostat-activated heater and blower units. Units shall be automatically controlled so the environmental limits of the camera equipment are not exceeded.
 - f. Sun shield shall not interfere with normal airflow around the housing.
 - g. Mounting bracket and hardware for wall or ceiling mounting of the housing. Bracket shall be of same material as the housing; mounting hardware shall be stainless steel.
 - h. Finish: Housing and mounting bracket shall be factory finished using manufacturer's standard finishing process suitable for the environment.
 - i. Enclosure Rating: as directed by the Owner.
- I. Monitors
1. Monochrome:
 - a. Metal cabinet units designed for continuous operation.
 - b. Screen Size (Diagonal Dimension): as directed by the Owner.
 - c. Horizontal Resolution: 600 lines, minimum, at center.
 - d. Minimum Front Panel Devices and Controls: Power switch; power-on indicator; and brightness, horizontal-hold, vertical-hold, and contrast controls.
 - e. Mounting: Adjustable tilting and training.
 - f. Mounting: Single, 14-inch (356-mm) **OR** Dual, 9-inch (229-mm), **as directed**, vertical, EIA 19-inch (483-mm) electronic equipment rack or cabinet complying with CEA 310-E.
 - g. Electrical: 120-V ac, 60 Hz.
 2. Color:
 - a. Metal cabinet units designed for continuous operation.
 - b. Screen Size (Diagonal Dimension): as directed by the Owner.
 - c. Horizontal Resolution: 300 lines.



- d. Minimum Front Panel Devices and Controls: Power switch; power-on indicator; and brightness, contrast, color, and tint controls.
- e. Degaussing: Automatic.
- f. Mounting: Single, 14-inch (356-mm) **OR** Dual, 9-inch (229-mm), **as directed**, vertical, EIA 19-inch (483-mm) electronic equipment rack or cabinet complying with CEA 310-E.
- g. Electrical: 120-V ac, 60 Hz.

J. Videotape Recorders

- 1. Description: Industrial, time-lapse type recorder, designed for continuous operation. Tape format is 1/2 inch (13 mm) using industrial-grade, T-120 cassettes.
 - a. Horizontal Resolution: 400 lines, minimum.
 - b. Recording Heads: Rotary-scan type.
 - c. Integral Timer: Permits programming of recording operation for adjustable daily and weekly periods.
 - d. Time-Lapse Operating Modes: Multiple, covering 24 to 240 hours, minimum.
 - e. Other Operating Modes:
 - 1) Manual play and recording at two- and six-hour speeds.
 - 2) Forward and reverse high-speed search.
 - 3) Reverse, slow, and single-frame play.
 - f. Alarm Recording: Operating mode is automatically switched from time-lapse to two- or six-hour recording mode when an externally generated alarm signal is received.
 - g. Audio Recording: 70 to 7000 Hz. Phono and microphone input; phono output.
 - h. Time and Date Generator: Records time and date legend in corner of recorded scenes.
 - i. Tape Counter: Displays tape position.
 - j. Manual Recording Lock: Key or keypad operated. Prevents unauthorized tampering or control changes during preset operation.
 - k. Signal-to-Noise Ratio: 45 dB for video output in standard play mode.
 - l. Mounting: Standard 19-inch (483-mm) rack complying with CEA 310-E, or freestanding desktop.

K. Digital Video Recorders

- 1. Description: Digital, time-lapse type, full-frame and motion recorder, with removable hard drive.
 - a. Recording Time: 400 hours minimum.
 - b. Resolution: 720 by 480 lines, minimum.
 - c. Programming shall be from trackball and push buttons on face of the recorder, settings shall be displayed on any video monitor connected to the recorder. Programming shall include the following:
 - 1) Motion analysis graph.
 - 2) Password protection.
 - 3) Alarm and timer controls.
 - 4) Continuous recording option.
 - 5) Time-lapse operating modes.
 - 6) Search video by time, event, or motion.
 - d. Programming: SmartMedia card for software updating, image archiving, and image transfer to a PC.
 - e. Storage: 80-GB, **unless directed otherwise**, removable hard drive. Software shall permit hot-swapping drives.
 - f. Compression: MPEG-2.
 - g. Time and Date Generator: Records time (hr:min:sec) and date legend of each frame.
 - h. Audio Recording: 70 to 7000 Hz. Phono and microphone input; phono output.
 - i. Mounting: Standard 19-inch (483-mm) rack complying with CEA 310-E, or freestanding desktop.

L. Network Video Recorders

- 1. External storage or internal 250-1, 500-GB hard disk drive.
 - a. Video and audio recording over TCP/IP network.



- b. Video recording of MPEG-2 and MPEG-4 streams.
- c. Video recording up to 48 Mbps for internal storage and up to 100 Mbps for external storage.
- d. Duplex Operation: Simultaneous recording and playback.
- e. Continuous and alarm-based recording.
- f. Full-Featured Search Capabilities: Search based on camera, time, or date.
- g. Automatic data replenishment to ensure recording even if network is down.
- h. Digital certification by watermarking.
- i. Internal RAID storage or non-RAID storage of up to 1500 GB.
- j. Capable of adding external RAID storage up to 7000 GB for models with no internal storage.
- k. Full integration with LAN, Intranet, or Internet through standard Web browser or video management software.
- l. Integrated Web server FTP server functionality.
- m. Supports up to 16, 32, or 64 devices.

M. Digital Switchers

1. Quad Switch: For displaying images from four cameras on a single monitor. Provide color switcher if one or more cameras or monitors are in color.
 - a. Controls: Unit-mounted front panel.
 - b. Resolution: 720 by 480 lines, **unless directed otherwise**.
 - c. Modes: Auto, manual, and alarm. In manual mode, each channel can also be viewed in single display mode. In the event of an alarm, alarming channel shall automatically switch to full screen. If several alarms are activated, channels in alarm shall be in auto-switching mode.
 - d. Channel Loss Alarm: Audible buzzer; occurrence details shall be recorded.
 - e. Time: Indicate date and time.
 - f. Timing of Auto-Switcher: 1 to 30 seconds, selectable.
 - g. Mounting: Standard 19-inch (483-mm) rack complying with CEA 310-E, or freestanding desktop.
2. Manual Switch Bank: Low-loss, high-isolation, multiple-video switch to allow manual switching of multiple quad switches and cameras to a single output. Switches shall be illuminated.
3. Sequential Switchers: Automatically sequence outputs of multiple cameras to single monitor and videotape recorder.
 - a. Switching Time Interval: Continuously adjustable, 5 to 20 seconds minimum, with manual override.
 - b. Skip-Sequential-Hold Switch: One for each camera, with LED to indicate active camera.
 - c. Camera Identification Legend: Either on-screen message or label at skip-sequential switch.
 - d. Alarm Switching: In the event of an alarm, alarming channel shall automatically switch the monitor to full screen.
 - e. Mounting: Standard 19-inch (483-mm) rack complying with CEA 310-E.
4. PTZ Controls: Arranged for multiple-camera control, with switches to select camera to be controlled.
 - a. Pan-and-Tilt Control: Joystick type.
 - b. Zoom Control: Momentary-contact, "in-out" push button.
 - c. Automatic-Scan Control: A push button for each camera with pan capability that places camera in automatic-scanning mode.

N. IP Video Systems

1. Description:
 - a. System shall provide high-quality delivery and processing of IP-based video, audio, and control data using standard Ethernet-based networks.
 - b. System shall have seamless integration of all video surveillance and control functions.



- c. Graphical user interface software shall manage all IP-based video matrix switching and camera control functions, two-way audio communication, alarm monitoring and control, and recording and archive/retrieval management. IP system shall also be capable of integrating into larger system environments.
 - d. System design shall include all necessary compression software for high-performance, dual-stream, MPEG-2/MPEG-4 video. Unit shall provide connections for all video cameras, camera PTZ control data, bidirectional audio, discreet sensor inputs, and control system outputs.
 - e. All camera signals shall be compressed, encoded, and delivered onto the network for processing and control by the IP video-management software.
 - f. Camera system units shall be ruggedly built and designed for extreme adverse environments, complying with NEMA Type environmental standards.
 - g. Encoder/decoder combinations shall place video, audio, and data network stream that can be managed from multiple workstations on the user's LAN or WAN.
 - h. All system interconnect cables, workstation PCs, PTZ joysticks, and network intermediate devices shall be provided for full performance of specified system.
- O. Video Motion Sensors (Interior)
- 1. Device Performance: Detect changes in video signal within a user-defined protected zone. Video inputs shall be composite video as defined in SMPTE 170M. Provide an alarm output for each video input.
 - a. Detect movement within protected zone of intruders wearing clothing with a reflectivity that differs from that of background scene by a factor of two. Reject all other changes in video signal.
 - b. Modular design that allows for expansion or modification of number of inputs.
 - c. Controls:
 - 1) Size of detection zones.
 - 2) Sensitivity of detection of each protected zone.
 - d. Mounting: Standard 19-inch (483-mm) rack complying with CEA 310-E.
- P. Control Stations
- 1. Description: Heavy-duty, freestanding, modular, metal furniture units arranged to house electronic equipment. Coordinate component arrangement and wiring with components and wiring of other systems.
 - 2. Equipment Mounting: Standard 19-inch (483-mm) rack complying with CEA 310-E.
 - 3. Normal System Power Supply: 120 V, 60 Hz, through a locked disconnect device and an isolation transformer in central-station control unit. Central-station control unit shall supply power to all components connected to it unless otherwise indicated.
 - 4. Power Continuity for Control Station: Batteries in power supplies of central-station control units and individual system components shall maintain continuous system operation during outages of both normal and backup ac system supply.
 - a. Batteries: Rechargeable, valve-regulated, recombinant, sealed, lead-acid type with nominal 10-year life expectancy. Capacity adequate to operate portions of system served including audible trouble signal devices for up to four hours and audible and visual alarm devices under alarm conditions for an additional 10 minutes.
 - b. Battery Charger: Solid-state, fully automatic, variable-charging-rate type. Charger shall recharge fully discharged battery within 24 hours.
 - 5. Annunciation: Indicate change in system condition and switching of system or component to backup power.
- Q. Signal Transmission Components
- 1. Cable: Coaxial cable elements have 75-ohm nominal impedance. Comply with requirements in Division 16 Section "Conductors and Cables for Electronic Safety and Security."
 - 2. Video Surveillance Coaxial Cable Connectors: BNC type, 75 ohms. Comply with requirements in Division 16 Section "Conductors and Cables for Electronic Safety and Security."



1.3 EXECUTION

A. Examination

1. Examine pathway elements intended for cables. Check raceways and other elements for compliance with space allocations, installation tolerance, hazards to camera installation, and other conditions affecting installation.
2. Examine roughing-in for LAN, WAN, and IP network before device installation.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Wiring

1. Comply with requirements in Division 16 Section "Raceways and Boxes."

OR

Wiring Method: Install cables in raceways unless otherwise indicated.

- a. Except raceways are not required in accessible indoor ceiling spaces and attics.
- OR**
- Except raceways are not required in hollow gypsum board partitions.
 - b. Conceal raceways and wiring except in unfinished spaces.
2. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.
 3. Splices, Taps, and Terminations: For power and control wiring, use numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
 4. For LAN connection and fiber-optic and copper communication wiring, comply with Division 16 Sections "Communications Backbone Cabling" and "Communications Horizontal Cabling."
 5. Grounding: Provide independent-signal circuit grounding recommended in writing by manufacturer.

C. Video Surveillance System Installation

1. Install cameras and infrared illuminators level and plumb.
2. Install cameras with 84-inch- (2134-mm-) minimum clear space below cameras and their mountings. Change type of mounting to achieve required clearance.
3. Set pan unit and pan-and-tilt unit stops to suit final camera position and to obtain the field of view required for camera. Connect all controls and alarms, and adjust.
4. Install power supplies and other auxiliary components at control stations unless otherwise indicated.
5. Install tamper switches on components indicated to receive tamper switches, arranged to detect unauthorized entry into system-component enclosures and mounted in self-protected, inconspicuous positions.
6. Avoid ground loops by making ground connections only at the control station.
 - a. For 12- and 24-V dc cameras, connect the coaxial cable shields only at the monitor end.
7. Identify system components, wiring, cabling, and terminals according to Division 16 Section "Electrical Identification."

D. Field Quality Control

1. Perform tests and inspections.
2. Tests and Inspections:
 - a. Inspection: Verify that units and controls are properly installed, connected, and labeled, and that interconnecting wires and terminals are identified.
 - b. Pretesting: Align and adjust system and pretest components, wiring, and functions to verify that they comply with specified requirements. Conduct tests at varying lighting levels, including day and night scenes as applicable. Prepare video-surveillance equipment for acceptance and operational testing as follows:
 - 1) Prepare equipment list described in "Submittals" Article.



- 2) Verify operation of auto-iris lenses.
 - 3) Set back-focus of fixed focal length lenses. At focus set to infinity, simulate nighttime lighting conditions by using a dark glass filter of a density that produces a clear image. Adjust until image is in focus with and without the filter.
 - 4) Set back-focus of zoom lenses. At focus set to infinity, simulate nighttime lighting conditions by using a dark glass filter of a density that produces a clear image. Additionally, set zoom to full wide angle and aim camera at an object 50 to 75 feet (17 to 23 m) away. Adjust until image is in focus from full wide angle to full telephoto, with the filter in place.
 - 5) Set and name all preset positions; consult Owner's personnel.
 - 6) Set sensitivity of motion detection.
 - 7) Connect and verify responses to alarms.
 - 8) Verify operation of control-station equipment.
- c. Test Schedule: Schedule tests after pretesting has been successfully completed and system has been in normal functional operation for at least 14 days. Provide a minimum of 10 days' notice of test schedule.
 - d. Operational Tests: Perform operational system tests to verify that system complies with Specifications. Include all modes of system operation. Test equipment for proper operation in all functional modes.
3. Video surveillance system will be considered defective if it does not pass tests and inspections.
 4. Prepare test and inspection reports.

E. Adjusting

1. Occupancy Adjustments: When requested within 12 months of date of Final Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Tasks shall include, but are not limited to, the following:
 - a. Check cable connections.
 - b. Check proper operation of cameras and lenses. Verify operation of auto-iris lenses and adjust back-focus as needed.
 - c. Adjust all preset positions; consult Owner's personnel.
 - d. Recommend changes to cameras, lenses, and associated equipment to improve Owner's use of video surveillance system.
 - e. Provide a written report of adjustments and recommendations.

F. Cleaning

1. Clean installed items using methods and materials recommended in writing by manufacturer.
2. Clean video-surveillance-system components, including camera-housing windows, lenses, and monitor screens.

G. Demonstration

1. Train Owner's maintenance personnel to adjust, operate, and maintain video-surveillance equipment.

END OF SECTION 28 23 00 00



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Task	Specification	Specification Description
28 23 00 00	01 22 16 00	No Specification Required
28 23 00 00	28 13 33 16b	Security Access
28 26 13 00	28 13 33 16	Perimeter Security
28 26 13 00	28 13 33 16a	Intrusion Detection
28 26 13 00	28 13 33 16b	Security Access



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SECTION 28 31 00 00 - OIL/WATER SEPARATOR

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for oil/water separator. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Scope

1. The separator shall be designed for gravity separation of sand, grit, settleable solids, or semisolids, and free oils (hydrocarbons and other petroleum products) from wastewater. Separator shall be installed belowground with top access at or above grade level. The source of the influent to the separator shall be gravity flow from storm water runoff, hydrocarbon spills, and/or cleaning/maintenance operations.

C. Performance

1. Influent Characteristics

- a. Provide separator designed for intermittent and variable flows of water, oil, or any combination of non-emulsified oil-water mixtures. Minimum separator retention time shall be 10 minutes. Operating temperatures of the influent oil in water mixture shall range from 40 degrees F. to 80 degrees F. The specific gravity of the oils at operating temperatures shall range from 0.71 to 0.92. The specific gravity of the fresh water at operating temperatures shall range from 1.00 to 1.03.

2. Effluent Characteristics

- a. The free oil and grease concentration in the effluent from the separator shall not exceed 10 mg/l (10 PPM) to satisfy requirements of the NPDES stormwater discharge permit. To achieve this goal, it will be necessary to remove all free oil droplets equal to and greater than 20 microns.

D. Design Criteria

1. The separator shall be listed to Underwriters' Laboratories UL-SU2215. Construction and performance of the oil/water separators shall be in accordance with UL-SU2215. Provide certification documentation detailing criteria under which the system was tested. UL-SU2215 label shall be prominently displayed on manway covers.
2. Separator shall be designed in accordance with Stokes Law and the American Petroleum Institute Publication 421, "Monographs on Refinery Environmental Control - Management of Water Discharges; Design and Operation of Oil/Water Separators." Effective surface area calculations, signed and stamped by a Registered Professional Engineer shall be submitted to document specified effluent quality based on complete removal of the specified oil globule at design flow. A separator with lower effective surface area than required is not permissible.
3. Separator capacities, dimensions, construction, and thickness shall be in strict accordance with Underwriters' Laboratories, Subject UL-58 Standard for Safety, Steel Underground Tanks for Flammable and Combustible Liquids, September 30, 1997, Double Wall construction with 360 degree Steel Secondary Containment. The inner steel tank shall be completely contained within the outer steel tank, enclosing 100% of the tank volume. The tank shall have a double steel shell with a space between the layers. The space between the inner and outer steel walls shall be monitored with an approved electronic leak detection device through a pipe that extends vertically to the top of the tank from a small sump at the bottom. Tank construction using thin walled primary tank with external fiberglass jacket shall not be permissible.
4. Separator Corrosion Control System shall be in strict accordance with Underwriters' Laboratories Inc. Subject UL-1746 Standard for External Corrosion Protection Systems for Steel Underground Storage Tanks and the HighGuard® External Corrosion Protection Specifications.



5. Oil/water separator shall comply with National Fire Protection Association NFPA 30 Flammable and Combustible Liquids Code, 2003 Edition.
6. Separator vessel volume shall allow for a hydraulic retention time of ten (10) minutes to ensure laminar flow conditions which result in hydraulic uniformity and high effluent quality. Volume reduction will adversely affect separator performance by increasing horizontal velocity and turbulence, therefore a separator of smaller volume is not permissible.
7. Separator shall be the standard patented product of a steel tank manufacturer regularly engaged in the production of such equipment. Manufacturer shall have at least 20 years experience in manufacturing similar units for identical applications. No subcontracting of tank fabrication shall be permitted.
8. Separator shall be fabricated, inspected, and tested for leakage before shipment from the factory by manufacturer as a completely assembled vessel ready for installation.
9. Separator shall be cylindrical, horizontal, atmospheric-type steel vessel intended for the separation and storage of flammable and combustible liquids. The separator shall have the structural strength to withstand static and dynamic hydraulic loading while empty and during operating conditions. The Oil/Water Separator's dimensions and thickness shall be in strict compliance with Roark's Formulas for Stress and Strain as presented in UL 58, September 30, 1997. Calculations, signed and stamped by a Registered Professional Engineer shall be submitted to document structural strength under specified overbearing or external pressure. A separator with a reduced shell thickness is not permissible.
10. Separator shall have an oil storage capacity equal to about 43% of the total vessel volume and an emergency oil spill capacity equal to 80% of the total vessel volume.
11. To prevent extensive shutdown and maintenance, the separator design must allow solids to fall unhindered by turbulence, and oil droplets to rise without risk of re-emulsifying due to collisions with interfering solids. The use of plastic perforated tubes, spherical balls, or irregular shaped media will increase the facility's maintenance costs and shall not be permitted.
12. Separator shall consist of inlet and outlet connections, integral sand interceptor compartment, non-clogging flow distributor and energy dissipater device, stationary under flow baffle, presettling chamber for solids, sludge baffle, oil coalescing chamber with removable parallel flat/corrugated plate coalescer, with removable plates, and sectionalized removable polypropylene impingement coalescers to optimize separation of free oil from water, effluent downcomer positioned to prevent discharge of free oil that has been separated from the water, access ways for coalescers and each chamber, fittings for vent, oil pump-out, sampling, gauging, leak detection, and lifting lugs.

E. Submittals:

1. Shop Drawings: shop drawings for oil water separators shall show principal dimensions and location of all fittings.
2. Instructions: provide three complete sets of installation, operation, and maintenance instructions with separator.
3. Quality Control: Quality control, inspection procedures, and reports shall be considered part of the submittal package.

F. Warranty

1. The manufacturer shall warrant its products to be free from defects in material and workmanship for a period of one year from the date of shipment. The warranty shall be limited to repair or replacement of the defective part(s).
2. The manufacturer's warranty shall be standard limited warranty in effect at time of purchase.

1.2 PRODUCTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Highland Tank, One Highland Road, Box 338, Stoystown, PA 15563, Phone 814-893-5701, FAX 893-6126, E-mail ows.info@highlandtank.com, Website <http://www.highlandtank.com>

**B. Product**

1. Provide and install Highland Tank Model HTC Series "G" UL-SU2215 approved Belowground Double Wall Parallel Flat/Corrugated Plate Gravity Displacement Oil/Water Separator with Integral Sand Interceptor Compartment. Separator shall be furnished with oil level alarm and leak detection systems. Oil/Water Separator shall be of capacity to comply with Spill Prevention Control and Countermeasures (SPCC) plan requirements at the facility. The sizing of this oil/water separator is consistent with industry protocols for complying with the minimum federal spill and discharge regulations therefore a separator of smaller volume is not permissible.
2. Separator shall be furnished with a Corella™ inclined parallel flat/corrugated plate coalescer to simultaneously separate free oil droplets and settleable or suspended solids particles from water without clogging of the coalescer.

C. Description

1. Separator shall be standard prefabricated inclined parallel flat/corrugated plate, gravity displacement type unit.
2. Separator shall be cylindrical with capacities, dimensions, construction, and thickness in strict accordance with Underwriters' Laboratories Subject 58, Double Wall construction using flat-flanged heads. Separator shall comply with National Fire Protection Association NFPA 30 Flammable and Combustible Liquids Code, 2003 Edition.
3. The separator shall be a pre-packaged, pre-engineered, ready to install unit consisting of:
 - a. An influent connection, flanged. An internal influent nozzle at the inlet end of the separator. Nozzle discharge to be located at the furthest diagonal point from the effluent discharge opening.
 - b. An integral sand interceptor compartment containing one (1) manhole, UL approved, complete with extension, cover, gasket, and bolts. A heavy-duty bulkhead shall retain sand, grit, settleable solids or semisolids and prevent them from entering the separation chamber. Bulkhead shall have a transfer pipe.
 - c. A velocity head diffusion baffle at the inlet to:
 - 1) reduce horizontal velocity and flow turbulence.
 - 2) distribute the flow equally over the separator's cross-sectional area.
 - 3) direct the flow in a serpentine path in order to enhance hydraulic characteristics and fully utilize all separator volume.
 - 4) completely isolate all inlet turbulence from the separation chamber.
 - d. A sediment chamber to disperse flow and collect oily solids and sediments.
 - e. A sludge baffle to retain settleable solids and sediment and prevent them from entering the separation chamber.
 - f. An Oil/Water Separation Chamber containing a removable Corella™ inclined parallel flat/corrugated plate coalescer. The coalescer shall have individual removable plates, sloped towards the sediment chamber. Each coalescing plate shall be flat on the top and corrugated on the bottom. The flat top plate shall resist clogging and clotting with solids. The corrugations of each of the plate bottoms shall be shaped and positioned to enhance collisions between the rising oil droplets and coalesce between them thereby improving separator efficiency. The coalescer shall:
 - 1) effect separation of oil and solids from all strata of the wastewater stream.
 - 2) shorten the vertical distance that an oil globule or solid particle has to rise or sink, respectively, for effective removal. Minimum plate gap to be 3/4".
 - 3) enhance coalescence and agglomeration by causing the smaller globules and particles (those possessing smaller rising/settling rates) to coalesce and collect on the plates thereby forming larger globules and particles that separate rapidly in water.
 - 4) direct the flow paths of the separated oil to the surface of the separator and separated solids to the bottom of the separator.
 - 5) allow solids to fall unhindered by turbulence, and oil droplets to rise without risk of re-emulsifying due to collisions with interfering solids.
 - g. The Oil/Water Separation Chamber shall also contain a sectionalized removable "Petro-Screen"™ polypropylene impingement coalescer designed to intercept oil globules of less



than 20 microns in diameter. Heavy, one-piece impingement coalescers are not permissible.

- h. An internal effluent downcomer at the outlet end of the separator, to allow for discharge from the bottom of the separation chamber only.
- i. An effluent connection, flanged.
- j. Fittings for vent, interface/level sensor, leak detection, waste oil pump-out, sampling, and gauge.
- k. Two (2) manholes, UL approved, complete with extension, cover, gasket, and bolts. One manway shall be placed between the inlet and the parallel flat/corrugated plate coalescer to facilitate access into sediment chamber for solids removal. One manway shall be placed between the parallel flat/corrugated plate coalescer and outlet to facilitate access into the oil water separation chamber for oil removal.
- l. Lifting lugs at balancing points for handling and installation.
- m. Identification plates: Plates shall be affixed in prominent location and be durable and legible throughout equipment life.
- n. HighGuard® Corrosion Protection System consisting of:
 - 1) Isolation Spool Pieces
 - 2) Dielectric Isolation Gaskets and Bushings
 - 3) External surfaces commercial grit blast, coated 75 mils DFT Self-Reinforcing Polyurethane.
- o. Internal surfaces commercial grit blast and coated with 10 mils DFT heavy duty Polyurethane.

D. Accessories

- 1. Separator shall be supplied with an audible and visual alarm system that indicates hi oil level (visual only) and hi hi oil level (audible and visual) of oil storage in the oil/water separator and an audible and visual leak detection alarm system that indicates hydrocarbon and/or water in the interstice. A silence control shall be provided for the audible alarms. Level sensor(s) shall be intrinsically safe. Level sensor floats shall be made of stainless steel. The control panel shall contain both level sensor and detection control. The control panel shall be NEMA 4. Power to the control panel shall be as directed by the Owner.
- 2. Separator shall be supplied with Polyester Hold-down straps.
- 3. Separator shall be supplied with prefabricated Concrete Deadman Anchors.
- 4. Separator shall be supplied with cylindrical and/or rectangular steel Grade Level Manways designed to AASHTO H20 requirements.

1.3 EXECUTION

A. Installation

- 1. Installation shall be in strict compliance with manufacturer's instructions and shall comply with all applicable local, state, and federal requirements.

END OF SECTION 28 31 00 00



SECTION 28 31 23 00 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for digital, addressable fire alarm system. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Fire-alarm control unit.
 - b. Manual fire-alarm boxes.
 - c. System smoke detectors.
 - d. Nonsystem smoke detectors.
 - e. Heat detectors.
 - f. Notification appliances.
 - g. Firefighters' two-way telephone communication service.
 - h. Magnetic door holders.
 - i. Remote annunciator.
 - j. Addressable interface device.
 - k. Digital alarm communicator transmitter.
 - l. Radio alarm transmitter.
 - m. System printer.

C. Definitions

1. LED: Light-emitting diode.
2. NICET: National Institute for Certification in Engineering Technologies.

D. System Description

1. Noncoded, UL-certified **OR** FMG-placarded, **as directed**, addressable system, with multiplexed signal transmission, dedicated to fire-alarm service only.
2. Noncoded addressable system, with automatic sensitivity control of certain smoke detectors and multiplexed signal transmission, dedicated to fire-alarm service only.

E. Performance Requirements

1. Seismic Performance: Fire-alarm control unit and raceways shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event," **as directed**.

F. Submittals

1. General Submittal Requirements:
 - a. Submittals shall be approved by authorities having jurisdiction prior to submitting them to the Owner.
 - b. Shop Drawings shall be prepared by persons with the following qualifications:
 - 1) Trained and certified by manufacturer in fire-alarm system design.
 - 2) NICET-certified fire-alarm technician, Level III **OR** Level IV, **as directed**, minimum.
 - 3) Licensed or certified by authorities having jurisdiction.
2. Product Data: For each type of product indicated.
3. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.



- a. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
- b. Include voltage drop calculations for notification appliance circuits.
- c. Include battery-size calculations.
- d. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
- e. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
- f. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
- g. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.
4. Delegated-Design Submittal: For smoke and heat detectors indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - a. Drawings showing the location of each smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the detector.
 - b. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72.
5. Qualification Data: For qualified Installer.
6. Seismic Qualification Certificates: For fire-alarm control unit, accessories, and components, from manufacturer.
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
7. Field quality-control reports.
8. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. Deliver copies to authorities having jurisdiction and include the following:
 - a. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 - b. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
 - c. Record copy of site-specific software.
 - d. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:
 - 1) Frequency of testing of installed components.
 - 2) Frequency of inspection of installed components.
 - 3) Requirements and recommendations related to results of maintenance.
 - 4) Manufacturer's user training manuals.
 - e. Manufacturer's required maintenance related to system warranty requirements.
 - f. Abbreviated operating instructions for mounting at fire-alarm control unit.
 - g. Copy of NFPA 25.
9. Software and Firmware Operational Documentation:
 - a. Software operating and upgrade manuals.
 - b. Program Software Backup: On magnetic media or compact disk, complete with data files.
 - c. Device address list.
 - d. Printout of software application and graphic screens.



G. Quality Assurance

1. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
2. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level II **OR** Level III **OR** Level IV, **as directed**, technician.
3. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer. Components shall be compatible with, and operate as, an extension of existing system.
4. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
5. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL.
6. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.
7. NFPA Certification: Obtain certification according to NFPA 72 in the form of a placard by an FMG-approved alarm company.
8. NFPA Certification: Obtain certification according to NFPA 72 by agency having jurisdiction.

H. Project Conditions

1. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by the Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:
 - a. Notify the Owner no fewer than two days in advance of proposed interruption of fire-alarm service.
 - b. Do not proceed with interruption of fire-alarm service without the Owner written permission.

I. Sequencing And Scheduling

1. Existing Fire-Alarm Equipment: Maintain existing equipment fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service and label existing fire-alarm equipment "NOT IN SERVICE" until removed from the building.
2. Equipment Removal: After acceptance of new fire-alarm system, remove existing disconnected fire-alarm equipment and wiring.

J. Software Service Agreement

1. Comply with UL 864.
2. Technical Support: Beginning with Final Completion, provide software support for two years.
3. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Final Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
 - a. Provide 30 days' notice to the Owner to allow scheduling and access to system and to allow the Owner to upgrade computer equipment if necessary.

1.2 PRODUCTS

A. Systems Operational Description

1. Fire-alarm signal initiation shall be by one or more of the following devices and systems, **as directed**:
 - a. Manual stations.
 - b. Heat detectors.
 - c. Flame detectors.
 - d. Smoke detectors.
 - e. Duct smoke detectors.
 - f. Verified automatic alarm operation of smoke detectors.
 - g. Automatic sprinkler system water flow.
 - h. Heat detectors in elevator shaft and pit.



- i. Fire-extinguishing system operation.
- j. Fire standpipe system.
2. Fire-alarm signal shall initiate the following actions:
 - a. Continuously operate alarm notification appliances.
 - b. Identify alarm at fire-alarm control unit and remote annunciators, **as directed**.
 - c. Transmit an alarm signal to the remote alarm receiving station.
 - d. Unlock electric door locks in designated egress paths.
 - e. Release fire and smoke doors held open by magnetic door holders.
 - f. Activate voice/alarm communication system.
 - g. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
 - h. Activate smoke-control system (smoke management) at firefighter smoke-control system panel.
 - i. Activate stairwell and elevator-shaft pressurization systems.
 - j. Close smoke dampers in air ducts of designated air-conditioning duct systems.
 - k. Recall elevators to primary or alternate recall floors.
 - l. Activate emergency lighting control.
 - m. Activate emergency shutoffs for gas and fuel supplies.
 - n. Record events in the system memory.
 - o. Record events by the system printer.
3. Supervisory signal initiation shall be by one or more of the following devices and actions:
 - a. Valve supervisory switch.
 - b. Low-air-pressure switch of a dry-pipe sprinkler system.
 - c. Elevator shunt-trip supervision.
4. System trouble signal initiation shall be by one or more of the following devices and actions:
 - a. Open circuits, shorts, and grounds in designated circuits.
 - b. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
 - c. Loss of primary power at fire-alarm control unit.
 - d. Ground or a single break in fire-alarm control unit internal circuits.
 - e. Abnormal ac voltage at fire-alarm control unit.
 - f. Break in standby battery circuitry.
 - g. Failure of battery charging.
 - h. Abnormal position of any switch at fire-alarm control unit or annunciator.
 - i. Fire-pump power failure, including a dead-phase or phase-reversal condition.
 - j. Low-air-pressure switch operation on a dry-pipe or preaction sprinkler system.
5. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators, **as directed**. Record the event on system printer.

B. Fire-Alarm Control Unit

1. General Requirements for Fire-Alarm Control Unit:
 - a. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL.
 - 1) System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
 - 2) Include a real-time clock for time annotation of events on the event recorder and printer.
 - b. Addressable initiation devices that communicate device identity and status.
 - 1) Smoke sensors shall additionally communicate sensitivity setting and allow for adjustment of sensitivity at fire-alarm control unit, **as directed**.
 - 2) Temperature sensors shall additionally test for and communicate the sensitivity range of the device.
 - c. Addressable control circuits for operation of mechanical equipment.



2. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
 - a. Annunciator and Display: Liquid-crystal type, 1 **OR** 2 **OR** 3, **as directed**, line(s) of 40 **OR** 80, **as directed**, characters, minimum.
 - b. Keypad: Arranged to permit entry and execution of programming, display, and control commands and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters, **as directed**.
3. Circuits:
 - a. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class A.
 - 1) Initiating Device Circuits: Style D **OR** Style E, **as directed**.
 - 2) Notification Appliance Circuits: Style Z.
 - 3) Signaling Line Circuits: Style 2 **OR** Style 5 **OR** Style 6 **OR** Style 7, **as directed**.
 - 4) Install no more than 50 addressable devices on each signaling line circuit.
 - b. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class B.
 - 1) Initiating Device Circuits: Style A **OR** Style B **OR** Style C, **as directed**.
 - 2) Notification Appliance Circuits: Style W **OR** Style X **OR** Style Y, **as directed**.
 - 3) Signaling Line Circuits: Style 0.5 **OR** Style 1 **OR** Style 3 **OR** Style 3.5 **OR** Style 4 **OR** Style 4.5, **as directed**.
 - 4) Install no more than 50 addressable devices on each signaling line circuit.
 - c. Serial Interfaces: Two RS-232 ports for printers.
4. Stairwell Pressurization: Provide an output signal using an addressable relay to start the stairwell pressurization system. Signal shall remain on until alarm conditions are cleared and fire-alarm system is reset. Signal shall not stop in response to alarm acknowledge or signal silence commands.
 - a. Pressurization starts when any alarm is received at fire-alarm control unit.
 - b. Alarm signals from smoke detectors at pressurization air supplies have a higher priority than other alarm signals that start the system.
5. Smoke-Alarm Verification:
 - a. Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.
 - b. Activate an NRTL-listed and -approved "alarm-verification" sequence at fire-alarm control unit and detector.
 - c. Record events by the system printer.
 - d. Sound general alarm if the alarm is verified.
 - e. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.
6. Notification Appliance Circuit: Operation shall sound in a <Insert pattern>.
7. Elevator Recall:
 - a. Smoke detectors at the following locations shall initiate automatic elevator recall. Alarm-initiating devices, except those listed, shall not start elevator recall, **as directed**.
 - 1) Elevator lobby detectors except the lobby detector on the designated floor.
 - 2) Smoke detector in elevator machine room.
 - 3) Smoke detectors in elevator hoistway.
 - b. Elevator lobby detectors located on the designated recall floors shall be programmed to move the cars to the alternate recall floor.
 - c. Water-flow alarm connected to sprinkler in an elevator shaft and elevator machine room shall shut down elevators associated with the location without time delay.
 - 1) Water-flow switch associated with the sprinkler in the elevator pit may have a delay to allow elevators to move to the designated floor.
8. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke barrier walls shall be **OR** not be, **as directed**, connected to fire-alarm system.
9. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-



adjustment schedule changes in system memory, and print out the final adjusted values on system printer.

10. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.
11. Voice/Alarm Signaling Service: Central emergency communication system with redundant microphones, preamplifiers, amplifiers, and tone generators provided in a separate cabinet located in the fire command center **OR** as a special module that is part of fire-alarm control unit, **as directed**.
 - a. Indicated number of alarm channels for automatic, simultaneous transmission of different announcements to different zones or for manual transmission of announcements by use of the central-control microphone. Amplifiers shall comply with UL 1711 and be listed by an NRTL.
 - 1) Allow the application of and evacuation signal to indicated number of zones and, at same time, allow voice paging to the other zones selectively or in any combination.
 - 2) Programmable tone and message sequence selection.
 - 3) Standard digitally recorded messages for "Evacuation" and "All Clear."
 - 4) Generate tones to be sequenced with audio messages of type recommended by NFPA 72 and that are compatible with tone patterns of notification appliance circuits of fire-alarm control unit.
 - b. Status Annunciator: Indicate the status of various voice/alarm speaker zones and the status of firefighters' two-way telephone communication zones.
 - c. Preamplifiers, amplifiers, and tone generators shall automatically transfer to backup units, on primary equipment failure.
12. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also print system reset event, including same information for device, location, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.
13. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory signals **OR** supervisory and digital alarm communicator transmitters **OR** digital alarm radio transmitters, **as directed**, shall be powered by 24-V dc source.
 - a. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.
14. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
 - a. Batteries: Sealed lead calcium **OR** Sealed, valve-regulated, recombinant lead acid **OR** Vented, wet-cell pocket, plate nickel cadmium, **as directed**.
15. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

C. Manual Fire-Alarm Boxes

1. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
 - a. Single-action mechanism, breaking-glass or plastic-rod **OR** pull-lever, **as directed**, type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
 - b. Double-action mechanism requiring two actions to initiate an alarm, breaking-glass or plastic-rod **OR** pull-lever, **as directed**, type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.



- c. Station Reset: Key- or wrench-operated switch.
 - d. Indoor Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.
 - e. Weatherproof Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.
- D. System Smoke Detectors
- 1. General Requirements for System Smoke Detectors:
 - a. Comply with UL 268; operating at 24-V dc, nominal.
 - b. Detectors shall be four **OR** two, **as directed**, -wire type.
 - c. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
 - d. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
 - e. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
 - f. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status, **as directed**.
 - g. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.
 - 1) Rate-of-rise temperature characteristic shall be selectable at fire-alarm control unit for 15 or 20 deg F (8 or 11 deg C) per minute.
 - 2) Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F (57 or 68 deg C).
 - 3) Provide multiple levels of detection sensitivity for each sensor.
 - 2. Photoelectric Smoke Detectors:
 - a. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
 - b. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - 1) Primary status.
 - 2) Device type.
 - 3) Present average value.
 - 4) Present sensitivity selected.
 - 5) Sensor range (normal, dirty, etc.).
 - 3. Ionization Smoke Detector:
 - a. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
 - b. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - 1) Primary status.
 - 2) Device type.
 - 3) Present average value.
 - 4) Present sensitivity selected.
 - 5) Sensor range (normal, dirty, etc.).
 - 4. Duct Smoke Detectors: Photoelectric type complying with UL 268A.
 - a. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
 - b. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - 1) Primary status.
 - 2) Device type.
 - 3) Present average value.



- 4) Present sensitivity selected.
 - 5) Sensor range (normal, dirty, etc.).
 - c. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.
 - d. Each sensor shall have multiple levels of detection sensitivity.
 - e. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
 - f. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.
- E. Nonsystem Smoke Detectors
1. Single-Station Smoke Detectors:
 - a. Comply with UL 217; suitable for NFPA 101, residential occupancies; operating at 120-V ac with 9-V dc battery as the secondary power source. Provide with "low" or "missing" battery chirping-sound device, **as directed**.
 - b. Auxiliary Relays: One Form C rated at 0.5 A **OR** Form A and one Form C, both rated at 0.5 A, **as directed**.
 - c. Audible Notification Appliance: Piezoelectric sounder rated at 90 dBA at 10 feet (3 m) according to UL 464.
 - d. Visible Notification Appliance: 177-cd strobe.
 - e. Heat sensor, 135 deg F (57 deg C) combination rate-of-rise, **as directed**, and fixed temperature.
 - f. Test Switch: Push to test; simulates smoke at rated obscuration.
 - g. Tandem Connection: Allow tandem connection of number of indicated detectors; alarm on one detector shall actuate notification on all connected detectors.
 - h. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
 - i. Self-Restoring: Detectors shall not require resetting or readjustment after actuation to restore them to normal operation.
 - j. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status, **as directed**.
 2. Single-Station Duct Smoke Detectors:
 - a. Comply with UL 268A; operating at 120-V ac.
 - b. Sensor: LED or infrared light source with matching silicon-cell receiver.
 - 1) Detector Sensitivity: Smoke obscuration between 2.5 and 3.5 percent/foot (0.008 and 0.011 percent/mm) when tested according to UL 268A.
 - c. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. The fixed base shall be designed for mounting directly to air duct. Provide terminals in the fixed base for connection to building wiring.
 - 1) Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.
 - d. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
 - e. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.
- F. Heat Detectors
1. General Requirements for Heat Detectors: Comply with UL 521.
 2. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F (57 deg C) or a rate of rise that exceeds 15 deg F (8 deg C) per minute unless otherwise indicated.
 - a. Mounting: Adapter plate for outlet box mounting **OR** Twist-lock base interchangeable with smoke-detector bases, **as directed**.
 - b. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.



3. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190 deg F (88 deg C).
 - a. Mounting: Adapter plate for outlet box mounting **OR** Twist-lock base interchangeable with smoke-detector bases, **as directed**.
 - b. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
4. Continuous Linear Heat-Detector System:
 - a. Detector Cable: Rated detection temperature 155 deg F (68 deg C). NRTL listed for "regular" service and a standard environment. Cable includes two steel actuator wires twisted together with spring pressure, wrapped with protective tape, and finished with PVC outer sheath. Each actuator wire is insulated with heat-sensitive material that reacts with heat to allow the cable twist pressure to short-circuit wires at the location of elevated temperature.
 - b. Control Unit: Two-zone or multizone unit as indicated. Provide same system power supply, supervision, and alarm features as specified for fire-alarm control unit.
 - c. Signals to Fire-Alarm Control Unit: Any type of local system trouble shall be reported to fire-alarm control unit as a composite "trouble" signal. Alarms on each detection zone shall be individually reported to central fire-alarm control unit as separately identified zones.
 - d. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

G. Notification Appliances

1. General Requirements for Notification Appliances: Individually addressed, connected to a signaling line circuit, equipped for mounting as indicated and with screw terminals for system connections.
2. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections.
 - a. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.
3. Chimes, Low-Level Output: Vibrating type, 75-dBA minimum rated output.
4. Chimes, High-Level Output: Vibrating type, 81-dBA minimum rated output.
5. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet (3 m) from the horn, using the coded signal prescribed in UL 464 test protocol.
6. Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.
 - a. Rated Light Output:
 - 1) 15 **OR** 30 **OR** 75 **OR** 110 **OR** 177, **as directed**, cd.
OR
15/30/75/110 cd, selectable in the field.
 - b. Mounting: Wall mounted unless otherwise indicated.
 - c. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
 - d. Flashing shall be in a temporal pattern, synchronized with other units.
 - e. Strobe Leads: Factory connected to screw terminals.
 - f. Mounting Faceplate: Factory finished, red **OR** white, **as directed**.
7. Voice/Tone Notification Appliances:
 - a. Appliances shall comply with UL 1480 and shall be listed and labeled by an NRTL.
 - b. High-Range Units: Rated 2 to 15 W.
 - c. Low-Range Units: Rated 1 to 2 W.
 - d. Mounting: Flush **OR** Semirecessed **OR** Surface mounted and bidirectional, **as directed**.



- e. Matching Transformers: Tap range matched to acoustical environment of speaker location.
- H. Firefighters' Two-Way Telephone Communication Service
- 1. Dedicated, two-way, supervised, telephone voice communication links between fire-alarm control unit, the fire command center, **as directed**, and remote firefighters' telephone stations. Supervised telephone lines shall be connected to talk circuits by controls in a control module. Provide the following:
 - a. Common-talk type for firefighter use only.
 - b. Selective-talk type for use by firefighters and fire wardens.
 - c. Controls to disconnect phones from talk circuits if too many phones are in use simultaneously.
 - d. Audible Pulse and Tone Generator, and High-Intensity Lamp: When a remote telephone is activated, it causes audible signal to sound and high-intensity lamp to flash.
 - e. Selector panel controls shall provide for simultaneous operation of up to six telephones in selected zones. Indicate ground faults and open or shorted telephone lines on the panel front by individual LEDs.
 - f. Display: Graphic **OR** Liquid-crystal digital, **as directed**, to indicate location of caller.
 - g. Remote Telephone Cabinet: Flush- or surface-mounted cabinet as indicated, factory-standard red finish, with handset.
 - 1) Install one-piece handset to cabinet with vandal-resistant armored cord. Silk-screened or engraved label on cabinet door, designating "Fire Warden Phone" **OR** "Fire Emergency Phone", **as directed**.
 - 2) With "break-glass" type door access lock.
 - h. Remote Telephone Jack Stations: Single-gang, stainless-steel-plate mounted plug, engraved "Fire Warden Phone" **OR** "Fire Emergency Phone", **as directed**.
 - i. Handsets: **<Insert number>** push-to-talk-type sets with noise-canceling microphone, **as directed**, stored in a cabinet adjacent to fire-alarm control unit **OR** in the fire command center, **as directed**.
- I. Magnetic Door Holders
- 1. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.
 - a. Electromagnet: Requires no more than 3 W to develop 25-lbf (111-N) holding force.
 - b. Wall-Mounted Units: Flush mounted unless otherwise indicated.
 - c. Rating: 24-V ac or dc.
 - d. Rating: 120-V ac.
 - 2. Material and Finish: Match door hardware.
- J. Remote Annunciator
- 1. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.
 - a. Mounting: Flush **OR** Surface, **as directed**, cabinet, NEMA 250, Type 1.
 - 2. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.
- K. Addressable Interface Device
- 1. Description: Microelectronic monitor module, NRTL listed for use in providing a system address for alarm-initiating devices for wired applications with normally open contacts.
 - 2. Integral Relay: Capable of providing a direct signal to elevator controller to initiate elevator recall **OR** to circuit-breaker shunt trip for power shutdown, **as directed**.
- L. Digital Alarm Communicator Transmitter



1. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.
2. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture one **OR** two, **as directed**, telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either, **as directed**, line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.
3. Local functions and display at the digital alarm communicator transmitter shall include the following:
 - a. Verification that both telephone lines are available.
 - b. Programming device.
 - c. LED display.
 - d. Manual test report function and manual transmission clear indication.
 - e. Communications failure with the central station or fire-alarm control unit.
4. Digital data transmission shall include the following:
 - a. Address of the alarm-initiating device.
 - b. Address **OR** Zone, **as directed**, of the supervisory signal.
 - c. Address **OR** Zone, **as directed**, of the trouble-initiating device.
 - d. Loss of ac supply or loss of power.
 - e. Low battery.
 - f. Abnormal test signal.
 - g. Communication bus failure.
5. Secondary Power: Integral rechargeable battery and automatic charger.
6. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

M. Radio Alarm Transmitter

1. Transmitter shall comply with NFPA 1221 and shall be listed and labeled by an NRTL.
2. Comply with 47 CFR 90.
3. Description: Manufacturer's standard commercial product; factory assembled, wired, tested, and ready for installation and operation.
 - a. Packaging: A single, modular, NEMA 250, Type 1 metal enclosure with a tamper-resistant flush tumbler lock.
 - b. Signal Transmission Mode and Frequency: VHF or UHF 2-W power output, coordinated with operating characteristics of the established remote alarm receiving station designated by the Owner.
 - c. Normal Power Input: 120-V ac.
 - d. Secondary Power: Integral-sealed, rechargeable, 12-V battery and charger. Comply with NFPA 72 requirements for battery capacity; submit calculations.
 - e. Antenna: Omnidirectional, coaxial half-wave, dipole type with driving point impedance matched to transmitter and antenna cable output impedance. Wind-load strength of antenna and mounting hardware and supports shall withstand 100 mph (160 km/h), **as directed**, with a gust factor of 1.3 without failure.
 - f. Antenna Cable: Coaxial cable with impedance matched to the transmitter output impedance.
 - g. Antenna-Cable Connectors: Weatherproof.
 - h. Alarm Interface Devices: Circuit boards, modules, and other auxiliary devices, integral to the transmitter, matching fire-alarm and other system outputs to message-generating inputs of the transmitter that produce required message transmissions.
4. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit or from its own internal sensors or controls and shall automatically transmit signal along with a unique code that identifies the transmitting station to the remote alarm receiving station. Transmitted messages shall correspond to standard designations for fire-



reporting system to which the signal is being transmitted and shall include separately designated messages in response to the following events or conditions:

- a. Transmitter Low-Battery Condition: Sent when battery voltage is below 85 percent of rated value.
- b. System Test Message: Initiated manually by a test switch within the transmitter cabinet, or automatically at an optionally preselected time, once every 24 hours, with transmission time controlled by a programmed timing device integral to transmitter controls.
- c. Transmitter Trouble Message: Actuated by failure, in excess of one-minute duration, of the transmitter normal power source, derangement of the wiring of the transmitter, or any alarm input interface circuit or device connected to it.
- d. Local Fire-Alarm-System Trouble Message: Initiated by events or conditions that cause a trouble signal to be indicated on the building system.
- e. Local Fire-Alarm-System Alarm Message: Actuated when the building system goes into an alarm state. Identifies device that initiated the alarm.
- f. Local Fire-Alarm-System Supervisory-Alarm Message: Actuated when the building alarm system indicates a supervisory alarm, **as directed**.

N. System Printer

1. Printer shall be listed and labeled by an NRTL as an integral part of fire-alarm system.

O. Device Guards

1. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.
 - a. Factory fabricated and furnished by manufacturer of device.
 - b. Finish: Paint of color to match the protected device.

1.3 EXECUTION

A. Equipment Installation

1. Comply with NFPA 72 for installation of fire-alarm equipment.
2. Equipment Mounting: Install fire-alarm control unit on concrete base with tops of cabinets not more than 72 inches (1830 mm) above the finished floor. Comply with requirements for concrete base specified in Division 03 Section "Cast-in-place Concrete".
 - a. Install seismic bracing. Comply with requirements in Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
 - b. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - c. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - d. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - e. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Equipment Mounting: Install fire-alarm control unit on finished floor with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.
 - a. Comply with requirements for seismic-restraint devices specified in Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
4. Install wall-mounted equipment, with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.
 - a. Comply with requirements for seismic-restraint devices specified in Division 26 Section "Vibration And Seismic Controls For Electrical Systems".
5. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.
 - a. Connect new equipment to existing control panel in existing part of the building.
 - b. Connect new equipment to existing monitoring equipment at the supervising station.



- c. Expand, modify, and supplement existing control **OR** monitoring, **as directed**, equipment as necessary to extend existing control **OR** monitoring, **as directed**, functions to the new points. New components shall be capable of merging with existing configuration without degrading the performance of either system.
 6. Smoke- or Heat-Detector Spacing:
 - a. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
 - b. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
 - c. Smooth ceiling spacing shall not exceed 30 feet (9 m)
 - d. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix A or Appendix B in NFPA 72.
 - e. HVAC: Locate detectors not closer than 3 feet (1 m) **OR** 5 feet (1.5 m), **as directed**, from air-supply diffuser or return-air opening.
 - f. Lighting Fixtures: Locate detectors not closer than 12 inches (300 mm) from any part of a lighting fixture.
 7. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.
 8. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.
 9. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.
 10. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.
 11. Audible Alarm-Indicating Devices: Install not less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.
 12. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches (150 mm) below the ceiling.
 13. Device Location-Indicating Lights: Locate in public space near the device they monitor.
 14. Fire-Alarm Control Unit: Surface mounted, with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.
 15. Annunciator: Install with top of panel not more than 72 inches (1830 mm) above the finished floor.
 16. Antenna for Radio Alarm Transmitter: Mount to building structure where indicated. Use mounting arrangement and substrate connection that will resist 100-mph (160-km/h), **as directed**, wind load with a gust factor of 1.3 without damage.
- B. Connections
1. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Division 08 Section "Door Hardware". Connect hardware and devices to fire-alarm system.
 - a. Verify that hardware and devices are NRTL listed for use with fire-alarm system in this Section before making connections.
 2. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet (1 m) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
 - a. Alarm-initiating connection to smoke-control system (smoke management) at firefighter smoke-control system panel.
 - b. Alarm-initiating connection to stairwell and elevator-shaft pressurization systems.
 - c. Smoke dampers in air ducts of designated air-conditioning duct systems.
 - d. Alarm-initiating connection to elevator recall system and components.
 - e. Alarm-initiating connection to activate emergency lighting control.
 - f. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.



- g. Supervisory connections at valve supervisory switches.
 - h. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
 - i. Supervisory connections at elevator shunt trip breaker.
 - j. Supervisory connections at fire-pump power failure including a dead-phase or phase-reversal condition.
 - k. Supervisory connections at fire-pump engine control panel.
- C. Identification
- 1. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification For Electrical Systems".
 - 2. Install framed instructions in a location visible from fire-alarm control unit.
- D. Grounding
- 1. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.
- E. Field Quality Control
- 1. Field tests shall be witnessed by authorities having jurisdiction.
 - 2. Tests and Inspections:
 - a. Visual Inspection: Conduct visual inspection prior to testing.
 - 1) Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
 - 2) Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
 - b. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 - c. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
 - d. Test audible appliances for the private operating mode according to manufacturer's written instructions.
 - e. Test visible appliances for the public operating mode according to manufacturer's written instructions.
 - f. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 - 3. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
 - 4. Fire-alarm system will be considered defective if it does not pass tests and inspections.
 - 5. Prepare test and inspection reports.
 - 6. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.
 - 7. Annual Test and Inspection: One year after date of Final Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

END OF SECTION 28 31 23 00



SECTION 28 31 23 00a - ZONED (DC LOOP) FIRE-ALARM SYSTEM

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for zoned (DC loop) fire alarm system. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Fire-alarm control unit.
 - b. Manual fire-alarm boxes.
 - c. System smoke detectors.
 - d. Nonsystem smoke detectors.
 - e. Heat detectors.
 - f. Notification appliances.
 - g. Magnetic door holders.
 - h. Remote annunciator.
 - i. Digital alarm communicator transmitter.
 - j. Radio alarm transmitter.

C. Definitions

1. LED: Light-emitting diode.
2. NICET: National Institute for Certification in Engineering Technologies.

D. System Description

1. Noncoded system, dedicated to fire-alarm service only.

E. Submittals

1. General Submittal Requirements:
 - a. Submittals shall be approved by authorities having jurisdiction prior to submitting them to the Owner.
 - b. Shop Drawings shall be prepared by persons with the following qualifications:
 - 1) Trained and certified by manufacturer in fire-alarm system design.
 - 2) NICET-certified fire-alarm technician, Level III **OR** Level IV, **as directed**, minimum.
 - 3) Licensed or certified by authorities having jurisdiction.
2. Product Data: For each type of product indicated.
3. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.
 - a. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
 - b. Include voltage drop calculations for notification appliance circuits.
 - c. Include battery size calculations.
 - d. Include performance parameters and installation details for each detector, verifying that each detector is listed for the complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
 - e. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.



- f. Include floor plans to indicate final outlet locations showing zone designation of each device. Show size and route of cable and conduits.
 4. Delegated-Design Submittal: For smoke and heat detectors indicated to comply with performance requirements and design criteria, including analysis data, signed and sealed by the qualified professional engineer responsible for their preparation.
 - a. Drawings showing the location of each smoke and heat detector, the ratings of each, and installation details as needed to comply with the listing conditions of the detector.
 - b. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72.
 5. Qualification Data: For qualified Installer.
 6. Field quality-control reports.
 7. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. Deliver copies to authorities having jurisdiction, **as directed**, and include the following:
 - a. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 - b. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
 - c. Record copy of site-specific software.
 - d. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:
 - 1) Frequency of testing of installed components.
 - 2) Frequency of inspection of installed components.
 - 3) Requirements and recommendations related to results of maintenance.
 - 4) Manufacturer's user training manuals.
 - e. Manufacturer's required maintenance related to system warranty requirements.
 - f. Abbreviated operating instructions for mounting at fire-alarm control unit.
 - g. Copy of NFPA 25.
- F. Quality Assurance
1. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
 2. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level II **OR** Level III **OR** Level IV, **as directed**, technician.
 3. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer. Components shall be compatible with, and operate as, an extension of existing system.
 4. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- G. Project Conditions
1. Interruption of Existing Fire-alarm Service: Do not interrupt fire-alarm service to facilities occupied by the Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:
 - a. Notify the Owner no fewer than two days in advance of proposed interruption of fire-alarm service.
 - b. Do not proceed with interruption of fire-alarm service without the Owner 's written permission.
- H. Sequencing And Scheduling
1. Existing Fire-Alarm Equipment: Maintain existing equipment fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service and label existing fire-alarm equipment "NOT IN SERVICE" until removed from the building.



2. Equipment Removal: After acceptance of new fire-alarm system, remove existing disconnected fire-alarm equipment and wiring.

1.2 PRODUCTS

A. Systems Operational Description

1. Fire-alarm signal initiation shall be by one or more of the following devices and systems, **as directed**:
 - a. Manual stations.
 - b. Heat detectors.
 - c. Smoke detectors.
 - d. Duct smoke detectors.
 - e. Automatic sprinkler system water flow.
 - f. Fire-extinguishing system operation.
 - g. Fire standpipe system.
2. Fire-alarm signal shall initiate the following actions:
 - a. Continuously operate alarm notification appliances.
 - b. Identify alarm zone at fire-alarm control unit and remote annunciators, **as directed**.
 - c. Transmit an alarm signal to the remote alarm receiving station.
3. Supervisory signal initiation shall be by one or more of the following devices and systems:
 - a. Valve supervisory switch.
4. System trouble signal initiation shall be by one or more of the following devices and actions:
 - a. Open circuits, shorts, and grounds in designated circuits.
 - b. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
 - c. Loss of primary power at fire-alarm control unit.
 - d. Ground or a single break in fire-alarm control unit internal circuits.
 - e. Abnormal ac voltage at fire-alarm control unit.
 - f. Break in standby battery circuitry.
 - g. Failure of battery charging.
 - h. Abnormal position of any switch at fire-alarm control unit or annunciator, **as directed**.
5. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators, **as directed**.

B. Fire-Alarm Control Unit

1. General Requirements for Fire-Alarm Control Unit:
 - a. Modular, power-limited design with electronic modules, UL 864 listed.
 - 1) Include a real-time clock for time annotation of events.
2. Alphanumeric Display and System Controls: Display alarm, supervisory, and component status messages and the programming and control menu.
 - a. Annunciator and Display: Liquid-crystal type, one line of 40 **OR** 80, **as directed**, characters, minimum.
3. Circuits:
 - a. No Fewer Than Five Initiating Device Circuits:
 - 1) Four circuits, NFPA 72, Class B.
 - 2) One circuit(s), NFPA 72, Class A, Style 6
 - b. No Fewer Than Two Notification Appliance Circuits: NFPA 72, Class B, Style Y.
4. Notification Appliance Circuit: Operation shall sound in a **<Insert pattern>**.
5. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke barrier walls shall be **OR** not be, **as directed**, connected to fire-alarm system.
6. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.
7. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory signals **OR**



supervisory and digital alarm communicator transmitters **OR** digital alarm radio transmitters, **as directed**, shall be powered by the 24-V dc source.

- a. Alarm current draw of the entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.
8. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
 - a. Batteries: Sealed lead calcium **OR** Sealed, valve-regulated, recombinant lead acid **OR** Vented, wet-cell pocket, plate nickel cadmium, **as directed**.
9. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

C. Manual Fire-Alarm Boxes

1. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
 - a. Single-action mechanism, breaking-glass or plastic-rod **OR** pull-lever, **as directed**, type.
 - b. Double-action mechanism requiring two actions to initiate an alarm, breaking-glass or plastic-rod **OR** pull-lever, **as directed**, type.
 - c. Station Reset: Key- or wrench-operated switch.
 - d. Indoor Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.
 - e. Weatherproof Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.

D. System Smoke Detectors

1. General Requirements for System Smoke Detectors:
 - a. Operating at 24-V dc, nominal.
 - b. Detectors shall be four **OR** two, **as directed**, -wire type.
 - c. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
 - d. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
 - e. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status, **as directed**.
 - f. Provide multiple levels of detection sensitivity for each sensor, with alarm-verification feature, **as directed**.
2. Photoelectric Smoke Detectors: Comply with UL 268.
3. Ionization Smoke Detector: Comply with UL 268.
4. Duct Smoke Detectors: Photoelectric type complying with UL 268A.
 - a. Remote indication and test, **as directed**, station. Operating key switch initiates an alarm test, **as directed**.
 - b. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.
 - c. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
 - d. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

E. Nonsystem Smoke Detectors

1. Single-Station Smoke Detectors:



- a. Comply with UL 217; suitable for NFPA 101, residential occupancies; operating at 120-V ac with 9-V dc battery as the secondary power source. Provide with "low" or "missing" battery chirping-sound device, **as directed**.
 - b. Auxiliary Relays: One Form C rated at 0.5 A **OR** Form A and one Form C, both rated at 0.5 A, **as directed**.
 - c. Audible Notification Appliance: Piezoelectric sounder rated at 90 dBA at 10 feet (3 m) according to UL 464.
 - d. Visible Notification Appliance: 177-cd strobe.
 - e. Heat sensor, 135 deg F (57 deg C) combination rate-of-rise and fixed temperature, **as directed**.
 - f. Test Switch: Push-to-test; simulates smoke at rated obscuration.
 - g. Tandem Connection: Allow tandem connection of number of indicated detectors; alarm on one detector shall actuate notification on all connected detectors.
 - h. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
 - i. Self-Restoring: Detectors shall not require resetting or readjustment after actuation to restore them to normal operation.
 - j. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status, **as directed**.
2. Single-Station Duct Smoke Detectors:
 - a. Comply with UL 268A; operating at 120-V ac.
 - b. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. The fixed base shall be designed for mounting directly to air duct. Provide terminals in the fixed base for connection to building wiring.
 - 1) Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.
 - c. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
 - d. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.
- F. Heat Detectors
1. General Requirements for Heat Detectors: Comply with UL 521.
 2. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F (57 deg C) or a rate of rise that exceeds 15 deg F (8 deg C) per minute unless otherwise indicated.
 - a. Mounting: Adapter plate for outlet box mounting **OR** Twist-lock base interchangeable with smoke-detector bases, **as directed**.
 3. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190 deg F (88 deg C).
 - a. Mounting: Adapter plate for outlet box mounting **OR** Twist-lock base interchangeable with smoke-detector bases, **as directed**.
- G. Notification Appliances
1. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections.
 - a. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.
 2. Chimes, High-Level Output: Vibrating type, 81-dBA minimum rated output.
 3. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet (3 m) from the horn, using the coded signal prescribed in UL 464 test protocol.



4. Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.
 - a. Rated Light Output:
 - 1) Indicated on Drawings.
 - 2) **15 OR 30 OR 75 OR 110 OR 177, as directed, cd.**
OR
15/30/75/110 cd, selectable in the field.
 - b. Mounting: Indicated on Drawings **OR** Wall mounted, **as directed**.
 - c. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
 - d. Flashing shall be in a temporal pattern, synchronized with other units.
 - e. Strobe Leads: Factory connected to screw terminals.
 - f. Mounting Faceplate: Factory finished, red **OR** white, **as directed**.

- H. Magnetic Door Holders
 1. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.
 - a. Electromagnet: Requires no more than 3 W to develop 25-lbf (111-N) holding force.
 - b. Wall-Mounted Units: Flush mounted unless otherwise indicated.
 - c. Rating: 24-V ac or dc.
 - d. Rating: 120-V ac.
 2. Material and Finish: Match door hardware.

- I. Remote Annunciator
 1. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.
 - a. Mounting: Flush **OR** Surface, **as directed**, cabinet, NEMA 250, Type 1.
 2. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

- J. Digital Alarm Communicator Transmitter
 1. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.
 2. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture one **OR** two, **as directed**, telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either, **as directed**, line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.
 3. Local functions and display at the digital alarm communicator transmitter shall include the following:
 - a. Verification that both telephone lines are available.
 - b. Programming device.
 - c. LED display.
 - d. Manual test report function and manual transmission clear indication.
 - e. Communications failure with the central station or fire-alarm control unit.
 4. Digital data transmission shall include the following:
 - a. Zone of the alarm initiating device.
 - b. Zone of the supervisory signal.
 - c. Zone of the trouble initiating device.



- d. Loss of ac supply or loss of power.
 - e. Low battery.
 - f. Abnormal test signal.
 - g. Communication bus failure.
 5. Secondary Power: Integral rechargeable battery and automatic charger.
 6. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.
- K. Radio Alarm Transmitter
1. Transmitter shall comply with NFPA 1221 and shall be listed and labeled by an NRTL.
 2. Comply with 47 CFR 90.
 3. Description: Manufacturer's standard commercial product; factory assembled, wired, tested, and ready for installation and operation.
 - a. Packaging: A single, modular, NEMA 250, Type 1 metal enclosure with a tamper-resistant flush tumbler lock.
 - b. Signal Transmission Mode and Frequency: VHF or UHF 2-W power output, coordinated with operating characteristics of the established remote alarm receiving station designated by the Owner.
 - c. Normal Power Input: 120-V ac.
 - d. Secondary Power: Integral-sealed, rechargeable, 12-V battery and charger. Comply with NFPA 72 requirements for battery capacity; submit calculations.
 - e. Antenna: Omnidirectional, coaxial half-wave, dipole type with driving point impedance matched to transmitter and antenna cable output impedance. Wind-load strength of antenna and mounting hardware and supports shall withstand 100 mph (160 km/h) with a gust factor of 1.3 without failure.
 - f. Antenna Cable: Coaxial cable with impedance matched to the transmitter output impedance.
 - g. Antenna-Cable Connectors: Weatherproof.
 - h. Alarm Interface Devices: Circuit boards, modules, and other auxiliary devices, integral to the transmitter, matching fire-alarm and other system outputs to message-generating inputs of the transmitter that produce required message transmissions.
 4. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit or from its own internal sensors or controls and shall automatically transmit signal along with a unique code that identifies the transmitting station to the remote alarm receiving station. Transmitted messages shall correspond to standard designations for fire-reporting system to which the signal is being transmitted and shall include separately designated messages in response to the following events or conditions:
 - a. Transmitter Low-Battery Condition: Sent when battery voltage is below 85 percent of rated value.
 - b. System Test Message: Initiated manually by a test switch within the transmitter cabinet, or automatically at an optionally preselected time, once every 24 hours, with transmission time controlled by a programmed timing device integral to transmitter controls.
 - c. Transmitter Trouble Message: Actuated by failure, in excess of one-minute duration, of the transmitter normal power source, derangement of the wiring of the transmitter, or any alarm input interface circuit or device connected to it.
 - d. Local Fire-Alarm-System Trouble Message: Initiated by events or conditions that cause a trouble signal to be indicated on the building system.
 - e. Local Fire-Alarm-System Alarm Message: Actuated when the building system goes into an alarm state. Identifies device that initiated the alarm.
 - f. Local Fire-Alarm-System Supervisory-Alarm Message: Actuated when the building alarm system indicates a supervisory alarm, **as directed**.
- L. Device Guards
1. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.
 - a. Factory fabricated and furnished by manufacturer of the device.
 - b. Finish: Paint of color to match the protected device.



1.3 EXECUTION

A. Equipment Installation

1. Comply with NFPA 72 for installation of fire-alarm equipment.
2. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.
 - a. Connect new equipment to the existing control panel in the existing part of the building.
 - b. Connect new equipment to the existing monitoring equipment at the supervising station.
 - c. Expand, modify, and supplement the existing control **OR** monitoring, **as directed**, equipment as necessary to extend the existing control **OR** monitoring, **as directed**, functions to the new points. New components shall be capable of merging with the existing configuration without degrading the performance of either system.
3. Smoke- or Heat-Detector Spacing:
 - a. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
 - b. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
 - c. Smooth ceiling spacing shall not exceed 30 feet (9 m), **as directed**.
 - d. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix A or Appendix B, **as directed**, in NFPA 72.
 - e. HVAC: Locate detectors not closer than 3 feet (1 m) **OR** 5 feet (1.5 m), **as directed**, from air-supply diffuser or return-air opening.
 - f. Lighting Fixtures: Locate detectors not closer than 12 inches (300 mm) from any part of a lighting fixture.
4. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.
5. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.
6. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.
7. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.
8. Audible Alarm-Indicating Devices: Install not less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.
9. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches (150 mm) below the ceiling.
10. Device Location-Indicating Lights: Locate in public space near the device they monitor.
11. Fire-Alarm Control Unit: Surface mounting, with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.
12. Annunciator: Install with top of panel not more than 72 inches (1830 mm) above the finished floor.
13. Antenna for Radio Alarm Transmitter: Mount to building structure where indicated. Use mounting arrangement and substrate connection that will resist 100-mph (160-km/h), **as directed**, wind load with a gust factor of 1.3 without damage.

B. Connections

1. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Division 08 Section "Door Hardware". Connect hardware and devices to fire-alarm system.
 - a. Verify that hardware and devices are NRTL listed for use with fire-alarm system in this Section before making connections.



2. Connect supervised interface devices to the following devices and systems. Install the interface device less than 3 feet (1 m) from the device controlled.
 - a. Smoke dampers in air ducts of designated air-conditioning duct systems.
 - b. Supervisory connections at valve supervisory switches.
 - c. Supervisory connections at fire-pump power failure including a dead-phase or phase-reversal condition.
 - d. Supervisory connections at fire-pump engine control panel.
- C. Identification
 1. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification For Electrical Systems".
 2. Install framed instructions in a location visible from fire-alarm control unit.
- D. Grounding
 1. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.
- E. Field Quality Control
 1. Field tests shall be witnessed by authorities having jurisdiction.
 2. Tests and Inspections:
 - a. Visual Inspection: Conduct the visual inspection prior to testing.
 - 1) Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
 - 2) Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
 - b. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing, and Maintenance" Chapter in NFPA 72.
 - c. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
 - d. Test visible appliances for the public operating mode according to manufacturer's written instructions.
 - e. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 3. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
 4. Fire-alarm system will be considered defective if it does not pass tests and inspections.
 5. Prepare test and inspection reports.
 6. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.
 7. Annual Test and Inspection: One year after date of Final Completion, test fire-alarm system complying with the visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

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SECTION 31 05 13 00 - EARTHWORK

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for earthwork. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Preparing subgrades for slabs-on-grade, walks, pavements, turf and grasses, and plants.
 - b. Excavating and backfilling for buildings and structures.
 - c. Drainage course for concrete slabs-on-grade.
 - d. Subbase course for concrete walks and pavements.
 - e. Subbase course and base course for asphalt paving.
 - f. Subsurface drainage backfill for walls and trenches.
 - g. Excavating and backfilling trenches for utilities and pits for buried utility structures.
 - h. Excavating well hole to accommodate elevator-cylinder assembly.

C. Definitions

1. Backfill: Soil material or controlled low-strength material used to fill an excavation.
 - a. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
 - b. Final Backfill: Backfill placed over initial backfill to fill a trench.
2. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.
3. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.
4. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
5. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
6. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
 - a. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by the Owner. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
 - b. Bulk Excavation: Excavation more than 10 feet (3 m) in width and more than 30 feet (9 m) in length.
 - c. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by the Owner. Unauthorized excavation, as well as remedial work directed by the Owner, shall be without additional compensation.
7. Fill: Soil materials used to raise existing grades.
8. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. (0.76 cu. m) for bulk excavation or 3/4 cu. yd. (0.57 cu. m) for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:
 - a. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch- (1065-mm-) wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp (103-kW) flywheel power with bucket-curling force of not less than 28,700 lbf (128 kN) and stick-crowd force of not less than 18,400 lbf (82 kN) with extra-long reach boom; measured according to SAE J-1179.



- b. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 230-hp (172-kW) flywheel power and developing a minimum of 47,992-lbf (213.3-kN) breakout force with a general-purpose bare bucket; measured according to SAE J-732.
- 9. If Standard Penetration Values are used to Define Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. (0.57 cu. m) or more in volume that exceed a standard penetration resistance of 100 blows/2 inches (97 blows/50 mm) when tested by a geotechnical testing agency, according to ASTM D 1586.
- 10. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- 11. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
- 12. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
- 13. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

D. Submittals

- 1. Product Data: For each type of the following manufactured products required:
 - a. Geotextiles.
 - b. Controlled low-strength material, including design mixture.
 - c. Geofoam.
 - d. Warning tapes.
- 2. Samples: For the following products, in sizes indicated below:
 - a. Geotextile: 12 by 12 inches (300 by 300 mm).
 - b. Warning Tape: 12 inches (300 mm) long; of each color.
- 3. Qualification Data: For qualified testing agency.
- 4. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:
 - a. Classification according to ASTM D 2487.
 - b. Laboratory compaction curve according to ASTM D 698 **OR** ASTM D 1557, **as directed**.
- 5. Blasting plan approved by authorities having jurisdiction.
- 6. Seismic survey report from seismic survey agency.
- 7. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by earth moving operations. Submit before earth moving begins.

E. Quality Assurance

- 1. Blasting:
 - a. Blasting will not be allowed.

OR

Comply with applicable requirements in NFPA 495, "Explosive Materials Code," and prepare a blasting plan reporting the following:

 - 1) Types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
 - 2) Seismographic monitoring during blasting operations.
- 2. Seismic Survey Agency: An independent testing agency, acceptable to authorities having jurisdiction, experienced in seismic surveys and blasting procedures to perform the following services:
 - a. Report types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.



- b. Seismographic monitoring during blasting operations.
3. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.
4. Pre-excavation Conference: Conduct conference at Project site.

F. Project Conditions

1. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.
 - a. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from the Owner and authorities having jurisdiction.
 - b. Provide alternate routes around closed or obstructed traffic ways if required by the Owner or authorities having jurisdiction.
2. Improvements on Adjoining Property: Authority for performing earth moving indicated on property adjoining the Owner's property will be obtained by the Owner before award of Contract.
3. Do not proceed with work on adjoining property until directed by the Owner.
4. Utility Locator Service: Notify utility locator service **OR** "Miss Utility" **OR** "Call Before You Dig" **OR** "Dig Safe System" **OR** "One Call", **as directed**, for area where Project is located before beginning earth moving operations.
5. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures, specified in Division 01 Section(s) "Temporary Facilities And Controls" **OR** Division 31 Section(s) "Site Clearing", **as directed**, are in place.
6. Do not commence earth moving operations until plant-protection measures specified in Division 01 Section "Temporary Tree And Plant Protection" are in place.
7. The following practices are prohibited within protection zones:
 - a. Storage of construction materials, debris, or excavated material.
 - b. Parking vehicles or equipment.
 - c. Foot traffic.
 - d. Erection of sheds or structures.
 - e. Impoundment of water.
 - f. Excavation or other digging unless otherwise indicated.
 - g. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
8. Do not direct vehicle or equipment exhaust towards protection zones.
9. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

1.2 PRODUCTS

A. Soil Materials

1. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
2. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487 **OR** Groups A-1, A-2-4, A-2-5, and A-3 according to AASHTO M 145, **as directed**, or a combination of these groups; free of rock or gravel larger than 3 inches (75 mm) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
3. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487 **OR** Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7 according to AASHTO M 145, **as directed**, or a combination of these groups.
 - a. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
4. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.
5. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.



6. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.
7. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.
8. Drainage Course: Narrowly graded mixture of washed, **as directed**, crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.
9. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch (25-mm) sieve and 0 to 5 percent passing a No. 4 (4.75-mm) sieve.
10. Sand: ASTM C 33; fine aggregate.
11. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

B. Geotextiles

1. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
 - a. Survivability: Class 2; AASHTO M 288.
 - b. Apparent Opening Size: No. 40 (0.425-mm) **OR** No. 60 (0.250-mm) **OR** No. 70 (0.212-mm), **as directed**, sieve, maximum; ASTM D 4751.
 - c. Permittivity: 0.5 **OR** 0.2 **OR** 0.1, **as directed**, per second, minimum; ASTM D 4491.
 - d. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.
2. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
 - a. Survivability: Class 2; AASHTO M 288.
 - b. Apparent Opening Size: No. 60 (0.250-mm) sieve, maximum; ASTM D 4751.
 - c. Permittivity: 0.02 per second, minimum; ASTM D 4491.
 - d. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

C. Controlled Low-Strength Material

1. Controlled Low-Strength Material: Self-compacting, low-density, **as directed**, flowable concrete material produced from the following:
 - a. Portland Cement: ASTM C 150, Type I **OR** Type II **OR** Type III, **as directed**.
 - b. Fly Ash: ASTM C 618, Class C or F.
 - c. Normal-Weight Aggregate: ASTM C 33, 3/4-inch (19-mm) **OR** 3/8-inch (10-mm), **as directed**, nominal maximum aggregate size.
 - d. Foaming Agent (if low-density, controlled low-strength material is required): ASTM C 869.
 - e. Water: ASTM C 94/C 94M.
 - f. Air-Entraining Admixture (not required for low-density, controlled low-strength material using foaming agent): ASTM C 260.
2. Produce low-density, controlled low-strength material with the following physical properties:
 - a. As-Cast Unit Weight: 30 to 36 lb/cu. ft. (480 to 576 kg/cu. m) **OR** 36 to 42 lb/cu. ft. (576 to 675 kg/cu. m), **as directed**, at point of placement, when tested according to ASTM C 138/C 138M.
 - b. Compressive Strength: 80 psi (550 kPa) **OR** 140 psi (965 kPa), **as directed**, when tested according to ASTM C 495.

OR

Produce conventional-weight, controlled low-strength material with 80-psi (550-kPa) **OR** 140-psi (965-kPa), **as directed**, compressive strength when tested according to ASTM C 495.

D. Geofoam



1. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, 1.55-lb/cu. ft. (25-kg/cu. m) density, 25-psi (173-kPa) compressive strength **OR** Type X, 1.30-lb/cu. ft. (21-kg/cu. m) density, 15-psi (104-kPa) compressive strength **OR** Type VI, 1.80-lb/cu. ft. (29-kg/cu. m) density, 40-psi (276-kPa) compressive strength **OR** Type VII, 2.20-lb/cu. ft. (35-kg/cu. m) density, 60-psi (414-kPa) compressive strength **OR** Type V, 3.00-lb/cu. ft. (48-kg/cu. m) density, 100-psi (690-kPa) compressive strength, **as directed**.
2. Molded-Polystyrene Board Insulation: ASTM C 578, Type I, 0.90-lb/cu. ft. (15-kg/cu. m) density, 10-psi (69-kPa) compressive strength **OR** Type VIII, 1.15-lb/cu. ft. (18-kg/cu. m) density, 13-psi (90-kPa) compressive strength **OR** Type II, 1.35-lb/cu. ft. (22-kg/cu. m) density, 15-psi (104-kPa) compressive strength, **as directed**.
 - a. Manufacture molded polystyrene with an inorganic mineral registered with the EPA and suitable for application as a termite deterrent.
3. Rigid Cellular Polystyrene Geofoam: ASTM D 6817, Type EPS 19, 1.15-lb/cu. ft. (18.4-kg/cu. m) density, 5.8-psi (40-kPa) compressive strength at 1 percent deformation; 16-psi (110-kPa) compressive strength at 10 percent deformation **OR** Type EPS 39, 2.40-lb/cu. ft. (38.4-kg/cu. m) density, 15-psi (103-kPa) compressive strength at 1 percent deformation; 40-psi (276-kPa) compressive strength at 10 percent deformation, **as directed**.
4. Connectors: Geofoam manufacturer's multibarbed, galvanized-steel sheet connectors **OR** Deformed steel reinforcing bars, 3/4 inch (19 mm) in diameter, **as directed**.

E. Accessories

1. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility; colored as follows:
 - a. Red: Electric.
 - b. Yellow: Gas, oil, steam, and dangerous materials.
 - c. Orange: Telephone and other communications.
 - d. Blue: Water systems.
 - e. Green: Sewer systems.**OR**

Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored as follows:

 - f. Red: Electric.
 - g. Yellow: Gas, oil, steam, and dangerous materials.
 - h. Orange: Telephone and other communications.
 - i. Blue: Water systems.
 - j. Green: Sewer systems.

1.3 EXECUTION

A. Preparation

1. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.
2. Protect and maintain erosion and sedimentation controls during earth moving operations.
3. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

B. Dewatering

1. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.



2. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
 - a. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

C. Explosives

1. Explosives: Do not use explosives.

OR

Explosives: Obtain written permission from authorities having jurisdiction before bringing explosives to Project site or using explosives on Project site.

- a. Perform blasting without damaging adjacent structures, property, or site improvements.
- b. Perform blasting without weakening the bearing capacity of rock subgrade and with the least-practicable disturbance to rock to remain.

D. Excavation, General

1. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
 - a. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
 - b. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
 - 1) 24 inches (600 mm) outside of concrete forms other than at footings.
 - 2) 12 inches (300 mm) outside of concrete forms at footings.
 - 3) 6 inches (150 mm) outside of minimum required dimensions of concrete cast against grade.
 - 4) Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
 - 5) 6 inches (150 mm) beneath bottom of concrete slabs-on-grade.
 - 6) 6 inches (150 mm) beneath pipe in trenches, and the greater of 24 inches (600 mm) wider than pipe or 42 inches (1065 mm) wide.
2. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by the Owner. The Contract Sum will be adjusted for rock excavation according to unit prices included in the Contract Documents. Changes in the Contract Time may be authorized for rock excavation.
 - a. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.
 - 1) Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.
 - b. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction without exceeding the following dimensions:
 - 1) 24 inches (600 mm) outside of concrete forms other than at footings.
 - 2) 12 inches (300 mm) outside of concrete forms at footings.
 - 3) 6 inches (150 mm) outside of minimum required dimensions of concrete cast against grade.
 - 4) Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
 - 5) 6 inches (150 mm) beneath bottom of concrete slabs-on-grade.
 - 6) 6 inches (150 mm) beneath pipe in trenches, and the greater of 24 inches (600 mm) wider than pipe or 42 inches (1065 mm) wide.



E. Excavation For Structures

1. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
 - a. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
 - b. Pile Foundations: Stop excavations 6 to 12 inches (150 to 300 mm) above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
 - c. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch (25 mm). Do not disturb bottom of excavations intended as bearing surfaces.
2. Excavations at Edges of Tree- and Plant-Protection Zones:
 - a. Excavate by hand to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
 - b. Cut and protect roots according to requirements in Division 01 Section "Temporary Tree And Plant Protection".

F. Excavation For Walks And Pavements

1. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

G. Excavation For Utility Trenches

1. Excavate trenches to indicated gradients, lines, depths, and elevations.
 - a. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
2. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit unless otherwise indicated.
 - a. Clearance: 12 inches (300 mm) each side of pipe or conduit **OR** As indicated, **as directed**.
3. Trench Bottoms (if a bedding course is not required under pipe and conduit): Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
 - a. For pipes and conduit less than 6 inches (150 mm) in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
 - b. For pipes and conduit 6 inches (150 mm) or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
 - c. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.
 - d. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.
4. Trench Bottoms (if a bedding course is required under pipe and conduit): Excavate trenches 4 inches (100 mm) deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.
 - a. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.
5. Trenches in Tree- and Plant-Protection Zones:
 - a. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.



- b. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
 - c. Cut and protect roots according to requirements in Division 01 Section "Temporary Tree And Plant Protection".

- H. Excavation For Elevator Cylinder
 - 1. Drill well hole plumb in elevator pit to accommodate installation of elevator-cylinder assembly. Coordinate with applicable requirements for diameter and tolerances in Division 14 Section(s) "Hydraulic Elevators" OR "Hydraulic Freight Elevators", **as directed**.
 - 2. Provide well casing as necessary to retain walls of well hole.

- I. Subgrade Inspection
 - 1. Notify the Owner when excavations have reached required subgrade.
 - 2. If the Owner determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
 - 3. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes) to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
 - a. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph (5 km/h).
 - b. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by the Owner, and replace with compacted backfill or fill as directed.
 - 4. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
 - 5. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by the Owner, without additional compensation.

- J. Unauthorized Excavation
 - 1. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi (17.2 MPa), may be used when approved by the Owner.
 - a. Fill unauthorized excavations under other construction, pipe, or conduit as directed by the Owner.

- K. Storage Of Soil Materials
 - 1. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - a. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

- L. Backfill
 - 1. Place and compact backfill in excavations promptly, but not before completing the following:
 - a. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
 - b. Surveying locations of underground utilities for Record Documents.
 - c. Testing and inspecting underground utilities.
 - d. Removing concrete formwork.
 - e. Removing trash and debris.
 - f. Removing temporary shoring and bracing, and sheeting.
 - g. Installing permanent or temporary horizontal bracing on horizontally supported walls.
 - 2. Place backfill on subgrades free of mud, frost, snow, or ice.

- M. Utility Trench Backfill
 - 1. Place backfill on subgrades free of mud, frost, snow, or ice.



2. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
3. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches (450 mm) of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Division 03 Section "Cast-in-place Concrete".
4. Trenches under Roadways: Provide 4-inch- (100-mm-) thick, concrete-base slab support for piping or conduit less than 30 inches (750 mm) below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches (100 mm) of concrete before backfilling or placing roadway subbase course. Concrete is specified in Division 03 Section "Cast-in-place Concrete".
5. Backfill voids with satisfactory soil while removing shoring and bracing.
6. If soil material is required as initial backfill, place and compact initial backfill of subbase material **OR** satisfactory soil, **as directed**, free of particles larger than 1 inch (25 mm) in any dimension, to a height of 12 inches (300 mm) over the pipe or conduit.
 - a. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
7. Controlled Low-Strength Material: If controlled low-strength material is permitted or required as initial backfill, place initial backfill of controlled low-strength material to a height of 12 inches (300 mm) over the pipe or conduit. Coordinate backfilling with utilities testing.
8. If satisfactory soil material is required as final backfill, place and compact final backfill of satisfactory soil to final subgrade elevation.
9. Controlled Low-Strength Material: If controlled low-strength material is permitted or required as final backfill, place final backfill of controlled low-strength material to final subgrade elevation.
10. Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

N. Soil Fill

1. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
2. Place and compact fill material in layers to required elevations as follows:
 - a. Under grass and planted areas, use satisfactory soil material.
 - b. Under walks and pavements, use satisfactory soil material.
 - c. Under steps and ramps, use engineered fill.
 - d. Under building slabs, use engineered fill.
 - e. Under footings and foundations, use engineered fill.
3. Place soil fill on subgrades free of mud, frost, snow, or ice.

O. Geofoam Fill

1. Place a leveling course of sand, 2 inches (50 mm) thick, over subgrade. Finish leveling course to a tolerance of 1/2 inch (13 mm) when tested with a 10-foot (3-m) straightedge.
 - a. Place leveling course on subgrades free of mud, frost, snow, or ice.
 - b. Install geofoam blocks in layers with abutting edges and ends and with the long dimension of each block at right angles to blocks in each subsequent layer. Offset joints of blocks in successive layers.
 - c. Install geofoam connectors at each layer of geofoam to resist horizontal displacement according to geofoam manufacturer's written instructions.
2. Cover geofoam with subdrainage **OR** separation, **as directed**, geotextile before placing overlying soil materials.

P. Soil Moisture Control

1. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
 - a. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.



- b. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

Q. Compaction Of Soil Backfills And Fills

1. Place backfill and fill soil materials in layers not more than 8 inches (200 mm) in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.
2. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
3. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698 **OR** ASTM D 1557, **as directed**:
 - a. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches (300 mm) of existing subgrade and each layer of backfill or fill soil material at 95 percent.
 - b. Under walkways, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 92 percent.
 - c. Under turf or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 85 percent.
 - d. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.

R. Grading

1. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 - a. Provide a smooth transition between adjacent existing grades and new grades.
 - b. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
2. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 - a. Turf or Unpaved Areas: Plus or minus 1 inch (25 mm).
 - b. Walks: Plus or minus 1 inch (25 mm).
 - c. Pavements: Plus or minus 1/2 inch (13 mm).
3. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch (13 mm) when tested with a 10-foot (3-m) straightedge.

S. Subsurface Drainage

1. Subdrainage Pipe: Specified in Division 33 Section "Storm Utility Drainage Piping".
2. Subsurface Drain: If nonwoven geotextile is used in subsurface drainage applications, place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch (150-mm) course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches (300 mm) of filter material, placed in compacted layers 6 inches (150 mm) thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches (150 mm).
 - a. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698 **OR** with a minimum of two passes of a plate-type vibratory compactor, **as directed**.
3. Drainage Backfill: If using free-draining granular backfill against walls, place and compact filter material over subsurface drain, in width indicated, to within 12 inches (300 mm) of final subgrade, in compacted layers 6 inches (150 mm) thick. Overlay drainage backfill with one layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches (150 mm).
 - a. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698 **OR** with a minimum of two passes of a plate-type vibratory compactor, **as directed**.



- b. Place and compact impervious fill over drainage backfill in 6-inch- (150-mm-) thick compacted layers to final subgrade.
- T. Subbase And Base Courses Under Pavements And Walks
1. Place subbase course and base course, **as directed**, on subgrades free of mud, frost, snow, or ice.
 2. On prepared subgrade, place subbase course and base course, **as directed**, under pavements and walks as follows:
 - a. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
 - b. Place base course material over subbase course under hot-mix asphalt pavement.
 - c. Shape subbase course and base course, **as directed**, to required crown elevations and cross-slope grades.
 - d. Place subbase course and base course, **as directed**, 6 inches (150 mm) or less in compacted thickness in a single layer.
 - e. Place subbase course and base course, **as directed**, that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
 - f. Compact subbase course and base course, **as directed**, at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698 **OR** ASTM D 1557, **as directed**.
 3. Pavement Shoulders: Place shoulders along edges of subbase course and base course, **as directed**, to prevent lateral movement. Construct shoulders, at least 12 inches (300 mm) wide, of satisfactory soil materials and compact simultaneously with each subbase and base, **as directed**, layer to not less than 95 percent of maximum dry unit weight according to ASTM D 698 **OR** ASTM D 1557, **as directed**.
- U. Drainage Course Under Concrete Slabs-On-Grade
1. Place drainage course on subgrades free of mud, frost, snow, or ice.
 2. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
 - a. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
 - b. Place drainage course 6 inches (150 mm) or less in compacted thickness in a single layer.
 - c. Place drainage course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
 - d. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.
- V. Field Quality Control
1. Special Inspections: If special inspections are required by code, engage a qualified special inspector to perform the following special inspections:
 - a. Determine prior to placement of fill that site has been prepared in compliance with requirements.
 - b. Determine that fill material and maximum lift thickness comply with requirements.
 - c. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.
 2. Testing Agency: Engage a qualified geotechnical engineering testing agency to perform tests and inspections.
 3. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
 4. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing



subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by the Owner.

5. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
 - a. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. (186 sq. m) or less of paved area or building slab, but in no case fewer than three tests.
 - b. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet (30 m) or less of wall length, but no fewer than two tests.
 - c. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet (46 m) or less of trench length, but no fewer than two tests.
6. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

W. Protection

1. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
2. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
 - a. Scarify or remove and replace soil material to depth as directed by the Owner; reshape and recompact.
3. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 - a. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

X. Disposal Of Surplus And Waste Materials

1. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off the Owner's property.
OR
 Transport surplus satisfactory soil to designated storage areas on the Owner's property. Stockpile or spread soil as directed by the Owner.
 - a. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off the Owner's property.

END OF SECTION 31 05 13 00



SECTION 31 05 13 00a - SUBDRAINAGE

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for subdrainage. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Perforated-wall pipe and fittings.
 - b. Drainage conduits.
 - c. Drainage panels.
 - d. Geotextile filter fabrics.

C. Submittals

1. Drainage conduits, including rated capacities.
2. Drainage panels, including rated capacities.
3. Geotextile filter fabrics.

1.2 PRODUCTS

A. Perforated-Wall Pipes And Fittings

1. Perforated PE Pipe and Fittings:
 - a. NPS 6 (DN 150) and Smaller: ASTM F 405 or AASHTO M 252, Type CP; corrugated, for coupled joints.
 - b. NPS 8 (DN 200) and Larger: ASTM F 667; AASHTO M 252, Type CP; or AASHTO M 294, Type CP; corrugated; for coupled joints.
 - c. Couplings: Manufacturer's standard, band type.
2. Perforated PVC Sewer Pipe and Fittings: ASTM D 2729, bell-and-spigot ends, for loose joints.
3. Perforated Clay Pipe and Fittings: ASTM C 700, Standard- and Extra-Strength classes, unglazed, socket-and-spigot ends, for gasketed joints.
 - a. Gaskets: ASTM C 425, rubber.
4. Perforated Concrete Pipe and Fittings: ASTM C 444 (ASTM C 444M), Type 1, and applicable requirements in ASTM C 14 (ASTM C 14M), Class 2, socket-and-spigot ends for gasketed joints.
 - a. Gaskets: ASTM C 443 (ASTM C 443M), rubber.

B. Drainage Conduits

1. Molded-Sheet Drainage Conduits: Prefabricated geocomposite with cusped, molded-plastic drainage core wrapped in geotextile filter fabric.
 - a. Nominal Size: 12 inches (305 mm) high by approximately 1 inch (25 mm) thick.
 - 1) Minimum In-Plane Flow: 30 gpm (114 L/min.) at hydraulic gradient of 1.0 when tested according to ASTM D 4716.
 - b. Nominal Size: 18 inches (457 mm) high by approximately 1 inch (25 mm) thick.
 - 1) Minimum In-Plane Flow: 45 gpm (170 L/min.) at hydraulic gradient of 1.0 when tested according to ASTM D 4716.
 - c. Filter Fabric: PP geotextile.
 - d. Fittings: HDPE with combination NPS 4 and NPS 6 (DN 100 and DN 150) outlet connection.



2. Multipipe Drainage Conduits: Prefabricated geocomposite with interconnected, corrugated, perforated-pipe core molded from HDPE complying with ASTM D 1248 and wrapped in geotextile filter fabric.
 - a. Nominal Size: 6 inches (152 mm) high by approximately 1-1/4 inches (31 mm) thick.
 - 1) Minimum In-Plane Flow: 15 gpm (57 L/min.) at hydraulic gradient of 1.0 when tested according to ASTM D 4716.
 - b. Nominal Size: 12 inches (305 mm) high by approximately 1-1/4 inches (31 mm) thick.
 - 1) Minimum In-Plane Flow: 30 gpm (114 L/min.) at hydraulic gradient of 1.0 when tested according to ASTM D 4716.
 - c. Nominal Size: 18 inches (457 mm) high by approximately 1-1/4 inches (31 mm) thick.
 - 1) Minimum In-Plane Flow: 45 gpm (170 L/min.) at hydraulic gradient of 1.0 when tested according to ASTM D 4716.
 - d. Filter Fabric: Nonwoven, needle-punched geotextile.
 - e. Fittings: HDPE with combination NPS 4 and NPS 6 (DN 100 and DN 150) outlet connection.
 - f. Couplings: HDPE.
3. Single-Pipe Drainage Conduits: Prefabricated geocomposite with perforated corrugated core molded from HDPE complying with ASTM D 3350 and wrapped in geotextile filter fabric.
 - a. Nominal Size: 12 inches (305 mm) high by approximately 1 inch (25 mm) thick.
 - 1) Minimum In-Plane Flow: 30 gpm (114 L/min.) at hydraulic gradient of 1.0 when tested according to ASTM D 4716.
 - b. Nominal Size: 18 inches (457 mm) high by approximately 1 inch (25 mm) thick.
 - 1) Minimum In-Plane Flow: 45 gpm (170 L/min.) at hydraulic gradient of 1.0 when tested according to ASTM D 4716.
 - c. Filter Fabric: Nonwoven, PP geotextile.
 - d. Fittings: HDPE with combination NPS 4 and NPS 6 (DN 100 and DN 150) outlet connection.
 - e. Couplings: Corrugated HDPE band.
4. Mesh Fabric Drainage Conduits: Prefabricated geocomposite with plastic-filament drainage core wrapped in geotextile filter fabric. Include fittings for bends and connection to drainage piping.
 - a. Nominal Size: 6 inches (2-mm) high by approximately 0.9 inch (23 mm) thick.
 - 1) Minimum In-Plane Flow: 2.4 gpm (9.1 L/min.) at hydraulic gradient of 1.0 when tested according to ASTM D 4716.
 - b. Filter Fabric: Nonwoven geotextile made of PP or polyester fibers or combination of both. Flow rates range from 120 to 200 gpm/sq. ft. (81 to 136 L/s per sq. m) when tested according to ASTM D 4491.
5. Ring Fabric Drainage Conduits: Drainage conduit with HDPE-rings-in-grid-pattern drainage core, for field-applied geotextile filter fabric. Include fittings for bends and connection to drainage piping.
 - a. Nominal Size: 18 inches (0.5 m) high by 1 inch (25 mm) thick.
 - 1) Minimum In-Plane Flow: 82 gpm (310 L/min.) at hydraulic gradient of 1.0 when tested according to ASTM D 4716.
 - b. Nominal Size: 36 inches (1 m) high by 1 inch (25 mm) thick.
 - 1) Minimum In-Plane Flow: 164 gpm (621 L/min.) at hydraulic gradient of 1.0 when tested according to ASTM D 4716.
 - c. Filter Fabric: Specified in Part 1.2 "Geotextile Filter Fabrics" Article.

C. Drainage Panels

1. Molded-Sheet Drainage Panels: Prefabricated geocomposite, 36 to 60 inches (915 to 1525 mm) wide with drainage core faced with geotextile filter fabric.
 - a. Drainage Core: Three-dimensional, nonbiodegradable, molded PP.
 - 1) Minimum Compressive Strength: 10,000 lbf/sq. ft. (479 kPa) **OR** 15,000 lbf/sq. ft. (718 kPa) **OR** 18,000 lbf/sq. ft. (862 kPa) **OR** 21,000 lbf/sq. ft. (1005 kPa), **as directed**, when tested according to ASTM D 1621.



- 2) Minimum In-Plane Flow Rate: 2.8 gpm/ft. (35 L/min. per m) **OR** 7 gpm/ft. (87 L/min. per m) **OR** 15 gpm/ft. (188 L/min. per m), **as directed**, of unit width at hydraulic gradient of 1.0 and compressive stress of 25 psig (172 kPa) when tested according to ASTM D 4716.
- b. Filter Fabric: Nonwoven needle-punched geotextile, manufactured for subsurface drainage, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with the following properties determined according to AASHTO M 288:
 - 1) Survivability: Class 1 **OR** 2 **OR** 3, **as directed**.
 - 2) Apparent Opening Size: No. 40 (0.425-mm) **OR** No. 60 (0.25-mm) **OR** No. 70 (0.212-mm), **as directed**, sieve, maximum.
 - 3) Permittivity: 0.5 **OR** 0.2 **OR** 0.1, **as directed**, per second, minimum.
- c. Filter Fabric: Woven geotextile fabric, manufactured for subsurface drainage, made from polyolefins or polyesters; with elongation less than 50 percent; complying with the following properties determined according to AASHTO M 288:
 - 1) Survivability: Class 1 **OR** 2 **OR** 3, **as directed**.
 - 2) Apparent Opening Size: No. 40 (0.425-mm) **OR** No. 60 (0.25-mm) **OR** No. 70 (0.212-mm) **OR** No. 30 (0.6-mm), **as directed**, sieve, maximum.
 - 3) Permittivity: 0.5 **OR** 0.2 **OR** 0.1 **OR** 0.02, **as directed**, per second, minimum.
- d. Film Backing: Polymeric film bonded to drainage core surface.
2. Mesh Fabric Drainage Panels: Prefabricated geocomposite with drainage core faced with geotextile filter fabric.
 - a. Drainage Core: Open-construction, resilient, approximately 0.4-inch- (10.2-mm-) thick, plastic-filament mesh.
 - 1) Minimum In-Plane Flow Rate: 2.4 gpm/ft. (30 L/min. per m) of unit width at hydraulic gradient of 1.0 and normal pressure of 25 psig (172 kPa) when tested according to ASTM D 4716.
 - b. Filter Fabric: Nonwoven geotextile of PP or polyester fibers or combination of both. Flow rates range from 120 to 200 gpm/sq. ft. (81 to 136 L/s per sq. m) when tested according to ASTM D 4491.
3. Net Fabric Drainage Panels: Prefabricated geocomposite with drainage core faced with geotextile filter fabric.
 - a. Drainage Core: 3-dimensional, PE nonwoven-strand geonet, approximately 0.25-inch- (6-mm-) thick.
 - 1) Minimum In-Plane Flow Rate: 2.4 gpm/ft. (30 L/min. per m) **OR** 5 gpm/ft. (62 L/min. per m), **as directed**, of unit width at hydraulic gradient of 1.0 and normal pressure of 25 psig (172 kPa) when tested according to ASTM D 4716.
 - b. Filter Fabric: Nonwoven geotextile of PP or polyester fibers or combination of both. Flow rates range from 120 to 200 gpm/sq. ft. (81 to 136 L/s per sq. m) when tested according to ASTM D 4491.
4. Ring Fabric Drainage Panels: Drainage-core panel for field application of geotextile filter fabric.
 - a. Drainage Core: 3-dimensional, HDPE rings in grid pattern, approximately 1 inch (25 mm) thick.
 - 1) Minimum In-Plane Flow Rate: 40 gpm/ft. (500 L/min. per m) of unit width at hydraulic gradient of 1.0 and normal pressure of 25 psig (172 kPa) when tested according to ASTM D 4716.
5. Fabric-Covered Insulated Drainage Panels: Extruded PS board insulation complying with ASTM C 578; fabricated with shiplap **OR** tongue-and-groove, **as directed**, edges and with one side having grooved drainage channels; unfaced **OR** ; faced with geotextile filter fabric, **as directed**.
 - a. Type IV, 1.6-lb/cu. ft. (26-kg/cu. m) minimum density and 25-psig (172-kPa) minimum compressive strength.
 - b. Type VI, 1.8-lb/cu. ft. (29-kg/cu. m) minimum density and 40-psig (276-kPa) minimum compressive strength.
 - c. Minimum In-Plane Flow Rate: 9 gpm/ft. (112 L/min. per m) of unit width when tested according to ASTM D 4716.



- d. Filter Fabric: Nonwoven geotextile of PP or polyester fibers or combination of both. Flow rates range from 120 to 200 gpm/sq. ft. (81 to 136 L/s per sq. m) when tested according to ASTM D 4491.
6. Noncovered Insulated Drainage Panels: Extruded PS board insulation complying with ASTM C 578; fabricated with rabbeted edges and with one side having ribbed drainage channels.
 - a. Type VI, 1.8-lb/cu. ft. (29-kg/cu. m) minimum density and 40-psig (276-kPa) minimum compressive strength.
 - b. Type VII, 2.2-lb/cu. ft. (35-kg/cu. m) minimum density and 60-psig (414-kPa) minimum compressive strength.
 - c. Minimum In-Plane Flow Rate: 9 gpm/ft. (112 L/min. per m) of unit width when tested according to ASTM D 4716.
7. Expanded PS Insulated Drainage Panels: PS bead board insulation; panels are 4 inches (102 mm) thick by 48 inches (1220 mm) wide and faced with geotextile filter fabric.
 - a. Density: 2 lb/cu. ft. (32 kg/cu. m).
 - b. Compressive Strength: 800 lbf/sq. ft. (38 kPa).
 - c. Minimum In-Plane Flow Rate: 3 gpm/ft. (37 L/min. per m) of unit width when tested according to ASTM D 4716.
 - d. Filter Fabric: Nonwoven geotextile of PP or polyester fibers or combination of both. Flow rates range from 120 to 200 gpm/sq. ft. (81 to 136 L/s per sq. m) when tested according to ASTM D 4491.

D. Soil Materials

1. Soil materials are specified in Division 31 Section "Earth Moving".

E. Waterproofing Felts

1. Material: Comply with ASTM D 226, Type I, asphalt **OR** ASTM D 227, coal-tar, **as directed**, -saturated organic felt.

F. Geotextile Filter Fabrics

1. Description: Fabric of PP or polyester fibers or combination of both, with flow rate range from 110 to 330 gpm/sq. ft. (4480 to 13 440 L/min. per sq. m) when tested according to ASTM D 4491.
 - a. Structure Type: Nonwoven, needle-punched continuous filament.
 - 1) Survivability: AASHTO **M 288 Class 2**.
 - 2) Style(s): Flat **OR** sock, **as directed**.

1.3 EXECUTION

A. Earthwork

1. Excavating, trenching, and backfilling are specified in Division 31 Section "Earth Moving".

B. Foundation Drainage Installation

1. Place impervious fill material on subgrade adjacent to bottom of footing after concrete footing forms have been removed. Place and compact impervious fill to dimensions indicated, but not less than 6 inches (150 mm) deep and 12 inches (300 mm) wide.
2. Lay flat-style geotextile filter fabric in trench and overlap trench sides.
3. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches (100 mm).
4. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive or tape.
5. Install drainage piping as indicated in Article 1.3 "Piping Installation" for foundation subdrainage.
6. Add drainage course to width of at least 6 inches (150 mm) on side away from wall and to top of pipe to perform tests.
7. After satisfactory testing, cover drainage piping to width of at least 6 inches (150 mm) on side away from footing and above top of pipe to within 12 inches (300 mm) of finish grade.



8. Install drainage course and wrap top of drainage course with flat-style geotextile filter fabric.
9. Place layer of flat-style geotextile filter fabric **OR** waterproofing felt, **as directed**, over top of drainage course, overlapping edges at least 4 inches (100 mm).
10. Install drainage panels on foundation walls as follows:
 - a. Coordinate placement with other drainage materials.
 - b. Lay perforated drainage pipe at base of footing. Install as indicated in Article 1.3 "Piping Installation."
 - c. Separate 4 inches (100 mm) of fabric at beginning of roll and cut away 4 inches (100 mm) of core. Wrap fabric around end of remaining core.
 - d. Attach panels to wall beginning at subdrainage pipe. Place and secure molded-sheet drainage panels, with geotextile facing away from wall.
11. Place backfill material over compacted drainage course. Place material in loose-depth layers not exceeding 6 inches (150 mm). Thoroughly compact each layer. Final backfill to finish elevations and slope away from building.

C. Underslab Drainage Installation

1. Excavate for underslab drainage system after subgrade material has been compacted but before drainage course has been placed. Include horizontal distance of at least 6 inches (150 mm) between drainage pipe and trench walls. Grade bottom of trench excavations to required slope, and compact to firm, solid bed for drainage system.
2. Lay flat-style geotextile filter fabric in trench and overlap trench sides.
3. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches (100 mm).
4. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive or tape.
5. Install drainage piping as indicated in Part 1.3 "Piping Installation" Article for underslab subdrainage.
6. Add drainage course to width of at least 6 inches (150 mm) on side away from wall and to top of pipe to perform tests.
7. After satisfactory testing, cover drainage piping with drainage course to elevation of bottom of slab, and compact and wrap top of drainage course with flat-style geotextile filter fabric.
8. Install horizontal drainage panels as follows:
 - a. Coordinate placement with other drainage materials.
 - b. Lay perforated drainage pipe at inside edge of footings.
 - c. Place drainage panel over drainage pipe with core side up. Peel back fabric and wrap fabric around pipe. Locate top of core at bottom elevation of floor slab.
 - d. Butt additional panels against other installed panels. If panels have plastic flanges, overlap installed panel with flange.

D. Retaining-Wall Drainage Installation

1. Lay flat-style geotextile filter fabric in trench and overlap trench sides.
2. Place supporting layer of drainage course over compacted subgrade to compacted depth of not less than 4 inches (100 mm).
3. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive or tape.
4. Install drainage piping as indicated in Article 1.3 "Piping Installation" for retaining-wall subdrainage.
5. Add drainage course to width of at least 6 inches (150 mm) on side away from wall and to top of pipe to perform tests.
6. After satisfactory testing, cover drainage piping to width of at least 6 inches (150 mm) on side away from footing and above top of pipe to within 12 inches (300 mm) of finish grade.
7. Place drainage course in layers not exceeding 3 inches (75 mm) in loose depth; compact each layer placed and wrap top of drainage course with flat-style geotextile filter fabric.
8. Place layer of flat-style geotextile filter fabric **OR** waterproofing felt, **as directed**, over top of drainage course, overlapping edges at least 4 inches (100 mm).
9. Install drainage panels on walls as follows:



- a. Coordinate placement with other drainage materials.
 - b. Lay perforated drainage pipe at base of footing as described elsewhere in this Specification. Do not install aggregate.
 - c. If weep holes are used instead of drainage pipe, cut 1/2-inch- (13-mm-) diameter holes on core side at weep-hole locations. Do not cut fabric.
 - d. Mark horizontal chalk line on wall at a point 6 inches (150 mm) less than panel width above footing bottom. Before marking wall, subtract footing width.
 - e. Separate 4 inches (100 mm) of fabric at beginning of roll and cut away 4 inches (100 mm) of core. Wrap fabric around end of remaining core.
 - f. Attach panel to wall at horizontal mark and at beginning of wall corner. Place core side of panel against wall. Use concrete nails with washers through product. Place nails from 2 to 6 inches (50 to 150 mm) below top of panel, approximately 48 inches (1200 mm) apart. Construction adhesives, metal stick pins, or double-sided tape may be used instead of nails. Do not penetrate waterproofing. Before using adhesives, discuss with waterproofing manufacturer.
 - g. If another panel is required on same row, cut away 4 inches (100 mm) of installed panel core and wrap fabric over new panel.
 - h. If additional rows of panel are required, overlap lower panel with 4 inches (100 mm) of fabric.
 - i. Cut panel as necessary to keep top 12 inches (300 mm) below finish grade.
 - j. For inside corners, bend panel. For outside corners, cut core to provide 3 inches (75 mm) for overlap.
10. Fill to Grade: Place satisfactory soil fill material over compacted drainage course . Place material in loose-depth layers not exceeding 6 inches (150 mm). Thoroughly compact each layer. Fill to finish grade.

E. Landscaping Drainage Installation

1. Provide trench width to allow installation of drainage conduit. Grade bottom of trench excavations to required slope, and compact to firm, solid bed for drainage system.
2. Lay flat-style geotextile filter fabric in trench and overlap trench sides.
3. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches (100 mm).
4. Install drainage conduits as indicated in Article 1.3 "Piping Installation" for landscaping subdrainage with horizontal distance of at least 6 inches (150 mm) between conduit and trench walls. Wrap drainage conduits without integral geotextile filter fabric with flat-style geotextile filter fabric before installation. Connect fabric sections with adhesive or tape.
5. Add drainage course to top of drainage conduits.
6. After satisfactory testing, cover drainage conduit to within 12 inches (300 mm) of finish grade.
7. Install drainage course and wrap top of drainage course with flat-style geotextile filter fabric.
8. Place layer of flat-style geotextile filter fabric **OR** waterproofing felt, **as directed**, over top of drainage course, overlapping edges at least 4 inches (100 mm).
9. Fill to Grade: Place satisfactory soil fill material over drainage course. Place material in loose-depth layers not exceeding 6 inches (150 mm). Thoroughly compact each layer. Fill to finish grade.

F. Piping Installation

1. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing in filtering material. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.
 - a. Foundation Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of 0.5 percent and with a minimum cover of 36 inches (915 mm), unless otherwise indicated.
 - b. Underslab Subdrainage: Install piping level.
 - c. Plaza Deck Subdrainage: Install piping level.



- d. Retaining-Wall Subdrainage: When water discharges at end of wall into stormwater piping system, install piping level and with a minimum cover of 36 inches (915 mm), unless otherwise indicated.
 - e. Landscaping Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of 0.5 percent and with a minimum cover of 36 inches (915 mm), unless otherwise indicated.
 - f. Lay perforated pipe with perforations down.
 - g. Excavate recesses in trench bottom for bell ends of pipe. Lay pipe with bells facing upslope and with spigot end entered fully into adjacent bell.
2. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.
 3. Install thermoplastic piping according to ASTM D 2321.
- G. Pipe Joint Construction
1. Join perforated PE pipe and fittings with couplings according to ASTM D 3212 with loose banded, coupled, or push-on joints.
 2. Join perforated PVC sewer pipe and fittings according to ASTM D 3212 with loose bell-and-spigot, push-on joints.
 3. Special Pipe Couplings: Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and fit materials and dimensions of both pipes.
- 1.4 Backwater Valve Installation
1. Comply with requirements for backwater valves specified in Division 2 Section "Storm Drainage."
 2. Install horizontal backwater valves in header piping downstream from perforated subdrainage piping.
 3. Install horizontal backwater valves in piping in manholes or pits where indicated.
- B. Cleanout Installation
1. Comply with requirements for cleanouts specified in Division 2 Section "Storm Drainage."
 2. Cleanouts for Foundation, Retaining-Wall, and Landscaping Subdrainage:
 - a. Install cleanouts from piping to grade. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.
 - b. In vehicular-traffic areas, use NPS 4 (DN 100) cast-iron soil pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, 18 by 18 by 12 inches (450 by 450 by 300 mm) in depth. Set top of cleanout flush with grade. Cast-iron pipe may also be used for cleanouts in nonvehicular-traffic areas.
 - c. In nonvehicular-traffic areas, use NPS 4 (DN 100) cast-iron **OR** PVC, **as directed**, pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, 12 by 12 by 4 inches (300 by 300 by 100 mm) in depth. Set top of cleanout plug 1 inch (25 mm) above grade.
 3. Cleanouts for Underslab Subdrainage:
 - a. Install cleanouts and riser extensions from piping to top of slab. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.
 - b. Use NPS 4 (DN 100) cast-iron soil pipe and fittings for piping branch fittings and riser extensions to cleanout flush with top of slab.
- C. Connections
1. Comply with requirements for piping specified in Division 2 Section "Storm Drainage." Drawings indicate general arrangement of piping, fittings, and specialties.
 2. Connect low elevations of subdrainage system to building's solid-wall-piping storm drainage system.



3. Where required, connect low elevations of foundation **OR** Underslab, **as directed**, subdrainage to stormwater sump pumps.

D. Identification

1. Arrange for installation of green warning tapes directly over piping. Comply with requirements for underground warning tapes specified in specified in Division 31 Section "Earth Moving".
 - a. Install PE warning tape or detectable warning tape over ferrous piping.
 - b. Install detectable warning tape over nonferrous piping and over edges of underground structures.

E. Field Quality Control

1. Tests and Inspections:
 - a. After installing drainage course to top of piping, test drain piping with water to ensure free flow before backfilling.
 - b. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.
2. Drain piping will be considered defective if it does not pass tests and inspections.
3. Prepare test and inspection reports.

F. Cleaning

1. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

END OF SECTION 31 05 13 00a



Task	Specification	Specification Description
31 05 16 00	31 05 13 00	Earthwork
31 05 16 00	31 05 13 00a	Subdrainage



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SECTION 31 11 00 00 - SITE CLEARING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for site clearing. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Protecting existing vegetation to remain.
 - b. Removing existing vegetation.
 - c. Clearing and grubbing.
 - d. Stripping and stockpiling topsoil.
 - e. Removing above- and below-grade site improvements.
 - f. Disconnecting, capping or sealing, and removing site utilities **OR** abandoning site utilities in place, **as directed**.
 - g. Temporary erosion- and sedimentation-control measures.

C. Definitions

1. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
OR
Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.
2. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow.
OR
Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches (50 mm) in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.
3. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.
OR
Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and indicated on Drawings **OR** defined by a circle concentric with each tree with a radius 1.5 times the diameter of the drip line unless otherwise indicated, **as directed**.
4. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

D. Material Ownership

1. Except for stripped topsoil and other materials indicated to be stockpiled or otherwise remain the Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

E. Submittals

1. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.
 - a. Use sufficiently detailed photographs or videotape.



- b. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.
2. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

F. Quality Assurance

1. Preinstallation Conference: Conduct conference at Project site.

G. Project Conditions

1. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
 - a. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from the Owner and authorities having jurisdiction.
 - b. Provide alternate routes around closed or obstructed traffic ways if required by the Owner or authorities having jurisdiction.
2. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining the Owner's property will be obtained by the Owner before award of Contract.
 - a. Do not proceed with work on adjoining property until directed by the Owner.
3. Salvable Improvements: Carefully remove items indicated to be salvaged and store on the Owner's premises where indicated.
4. Utility Locator Service: Notify utility locator service **OR** Miss Utility **OR** Call Before You Dig **OR** Dig Safe System **OR** One Call, **as directed**, for area where Project is located before site clearing.
5. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant-protection measures are in place.
6. The following practices are prohibited within protection zones:
 - a. Storage of construction materials, debris, or excavated material.
 - b. Parking vehicles or equipment.
 - c. Foot traffic.
 - d. Erection of sheds or structures.
 - e. Impoundment of water.
 - f. Excavation or other digging unless otherwise indicated.
 - g. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
7. Do not direct vehicle or equipment exhaust towards protection zones.
8. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.
9. Soil Stripping, Handling, and Stockpiling: Perform only when the topsoil is dry or slightly moist.

1.2 PRODUCTS

A. Materials

1. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Division 31 Section "Earth Moving".
 - a. If soil backfill is required in below-grade areas after site clearing, obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.
2. Antirust Coating: Fast-curing, lead- and chromate-free, self-curing, universal modified-alkyd primer complying with MPI #79, Alkyd Anticorrosive Metal Primer **OR** SSPC-Paint 20 or SSPC-Paint 29 zinc-rich coating, **as directed**.
 - a. Use coating with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1.3 EXECUTION

A. Preparation



1. Protect and maintain benchmarks and survey control points from disturbance during construction.
 2. Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated. Flag **OR** Wrap a 1-inch (25-mm) blue vinyl tie tape flag around, **as directed**, each tree trunk at 54 inches (1372 mm) above the ground.
 3. Protect existing site improvements to remain from damage during construction.
 - a. Restore damaged improvements to their original condition, as acceptable to the Owner.
- B. Temporary Erosion And Sedimentation Control
1. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.
 2. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
 3. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
 4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
- C. Tree And Plant Protection
1. General: Protect trees and plants remaining on-site according to requirements in Division 01 Section "Temporary Tree And Plant Protection".
 2. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by the Owner.
- D. Existing Utilities
1. the Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.
OR
Verify that utilities have been disconnected and capped before proceeding with site clearing.
 2. Locate, identify, disconnect, and seal or cap utilities indicated to be removed.
 - a. Arrange with utility companies to shut off indicated utilities.
OR
the Owner will arrange to shut off indicated utilities when requested by Contractor.
 3. Locate, identify, and disconnect utilities indicated to be abandoned in place.
 4. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by the Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - a. Notify the Owner not less than two days in advance of proposed utility interruptions.
 - b. Do not proceed with utility interruptions without the Owner's written permission.
 5. Excavate for and remove underground utilities indicated to be removed.
OR
Removal of underground utilities is included in Division 21 OR Division 22 OR Division 23 OR Division 26 OR Division 28.
- E. Clearing And Grubbing
1. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
 - a. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
 - b. Grind down stumps and remove roots, obstructions, and debris to a depth of 18 inches (450 mm) below exposed subgrade.
 - c. Use only hand methods for grubbing within protection zones.
 - d. Chip removed tree branches and stockpile in areas approved by the Owner **OR** dispose of off-site, **as directed**.
 2. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.



- a. Place fill material in horizontal layers not exceeding a loose depth of 8 inches (200 mm), and compact each layer to a density equal to adjacent original ground.

F. Topsoil Stripping

1. Remove sod and grass before stripping topsoil.
2. Strip topsoil to depth indicated on Drawings **OR** to depth of 6 inches (150 mm), **as directed**, in a manner to prevent intermingling with underlying subsoil or other waste materials.
 - a. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects more than 2 inches (50 mm) in diameter; trash, debris, weeds, roots, and other waste materials.
3. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.
 - a. Limit height of topsoil stockpiles to 72 inches (1800 mm).
 - b. Do not stockpile topsoil within protection zones.
 - c. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
 - d. Stockpile surplus topsoil to allow for respreading deeper topsoil.

G. Site Improvements

1. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.
2. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
 - a. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
 - b. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

H. Disposal Of Surplus And Waste Materials

1. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off the Owner's property.
2. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 31 11 00 00



SECTION 31 13 13 00 - TREE PROTECTION AND TRIMMING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for tree protection and trimming. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.

C. Definitions

1. Caliper: Diameter of a trunk measured by a diameter tape or the average of the smallest and largest diameters at 6 inches (150 mm) above the ground for trees up to, and including, 4-inch (100-mm) size; and 12 inches (300 mm) above the ground for trees larger than 4-inch (100-mm) size.
2. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.
3. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and indicated on Drawings **OR** defined by a circle concentric with each tree with a radius 1.5 times the diameter of the drip line unless otherwise indicated, **as directed**.
4. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

D. Submittals

1. Product Data: For each type of product indicated.
2. Tree Pruning Schedule: Written schedule detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.
3. Qualification Data: For qualified arborist and tree service firm.
4. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.
5. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.
6. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.
 - a. Use sufficiently detailed photographs or videotape.
 - b. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

E. Quality Assurance

1. Arborist Qualifications: Certified Arborist as certified by ISA **OR** Certified Arborist-Municipal Specialist as certified by ISA **OR** Licensed arborist in jurisdiction where Project is located **OR** Current member of ASCA **OR** Registered Consulting Arborist as designated by ASCA, **as directed**.
2. Tree Service Firm Qualifications: An experienced tree service firm that has successfully completed temporary tree and plant protection work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work.
3. Preinstallation Conference: Conduct conference at Project site.

F. Project Conditions



1. The following practices are prohibited within protection zones:
 - a. Storage of construction materials, debris, or excavated material.
 - b. Parking vehicles or equipment.
 - c. Foot traffic.
 - d. Erection of sheds or structures.
 - e. Impoundment of water.
 - f. Excavation or other digging unless otherwise indicated.
 - g. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
2. Do not direct vehicle or equipment exhaust toward protection zones.
3. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

1.2 PRODUCTS

A. Materials

1. Topsoil: Natural or cultivated top layer of the soil profile or manufactured topsoil; containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 1 inch (25 mm) in diameter; and free of weeds, roots, and toxic and other nonsoil materials.
 - a. Obtain topsoil only from well-drained sites where topsoil is 4 inches (100 mm) deep or more; do not obtain from bogs or marshes.

OR

Topsoil: Stockpiled topsoil from location shown on Drawings **OR** Imported or manufactured topsoil complying with ASTM D 5268, **as directed**.
2. Organic Mulch: Free from deleterious materials and suitable as a top dressing for trees and shrubs, consisting of one of the following:
 - a. Type: Shredded hardwood **OR** Ground or shredded bark **OR** Wood and bark chips, **as directed**.
 - b. Size Range: 3 inches (76 mm) maximum, 1/2 inch (13 mm) minimum.
3. Protection-Zone Fencing: Fencing fixed in position and meeting one of the following requirements, **as directed**. Previously used materials may be used when approved by the Owner.
 - a. Chain-Link Protection-Zone Fencing: Galvanized-steel **OR** Polymer-coated steel **OR** Polymer-coated galvanized-steel, **as directed**, fencing fabricated from minimum 2-inch (50-mm) opening, 0.148-inch- (3.76-mm-) diameter wire chain-link fabric; with pipe posts, minimum 2-3/8-inch- (60-mm-) OD line posts, and 2-7/8-inch- (73-mm-) OD corner and pull posts; with 1-5/8-inch- (42-mm-) OD top rails **OR** with 0.177-inch- (4.5-mm-) diameter top tension wire, **as directed**, and 0.177-inch- (4.5-mm-) diameter bottom tension wire; with tie wires, hog ring ties, and other accessories for a complete fence system.
 - 1) Height: 4 feet (1.2 m) **OR** 6 feet (1.8 m) **OR** 8 feet (2.4 m), **as directed**.
 - 2) Polymer-Coating Color (if polymer coating is required): Dark green **OR** Olive green **OR** Brown **OR** Black, **as directed**.
 - b. Plywood Protection-Zone Fencing: Plywood framed with four 2-by-4-inch (50-by-100-mm) rails, with 4-by-4-inch (100-by-100-mm) preservative-treated wood posts spaced not more than 8 feet (2.4 m) apart.
 - 1) Height: 4 feet (1.2 m) **OR** 6 feet (1.8 m), **as directed**.
 - 2) Plywood and Lumber: Comply with requirements in Division 06 Section "Rough Carpentry" **OR** Division 06 Section "Miscellaneous Rough Carpentry", **as directed**.
 - c. Wood Protection-Zone Fencing: Constructed of two 2-by-4-inch (50-by-100-mm) horizontal rails, with 4-by-4-inch (100-by-100-mm) preservative-treated wood posts spaced not more than 8 feet (2.4 m) apart, and lower rail set halfway between top rail and ground.
 - 1) Height: 4 feet (1.2 m).



- 2) Lumber: Comply with requirements in Division 06 Section "Rough Carpentry" **OR** Division 06 Section "Miscellaneous Rough Carpentry", **as directed**.
- d. Plastic Protection-Zone Fencing: Plastic construction fencing constructed of high-density extruded and stretched polyethylene fabric with 2-inch (50-mm) maximum opening in pattern and weighing a minimum of 0.4 lb/ft. (0.6 kg/m); remaining flexible from minus 60 to plus 200 deg F (minus 16 to plus 93 deg C); inert to most chemicals and acids; minimum tensile yield strength of 2000 psi (13.8 MPa) and ultimate tensile strength of 2680 psi (18.5 MPa); secured with plastic bands or galvanized-steel or stainless-steel wire ties; and supported by tubular or T-shape galvanized-steel posts spaced not more than 8 feet (2.4 m) apart.
 - 1) Height: 4 feet (1.2 m).
 - 2) Color: High-visibility orange, nonfading.
- e. Gates: Single **OR** Double, **as directed**, swing access gates matching material and appearance of fencing, to allow for maintenance activities within protection zones; leaf width 24 inches (610 mm) **OR** 36 inches (914 mm) **OR** As indicated, **as directed**.
4. Protection-Zone Signage: Shop-fabricated, rigid plastic or metal sheet with attachment holes prepunched and reinforced; legibly printed with nonfading lettering and as follows:
 - a. Size and Text: As shown on Drawings.
 - b. Lettering: 3-inch- (75-mm-) high minimum, white **OR** black, **as directed**, characters on white **OR** red, **as directed**, background.

1.3 EXECUTION

A. Examination

1. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
2. For the record, prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

B. Preparation

1. Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated. Flag **OR** Tie a 1-inch (25-mm) blue-vinyl tape around, **as directed**, each tree trunk at 54 inches (1372 mm) above the ground.
2. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.
3. Tree-Protection Zones: Mulch areas inside tree-protection zones and other areas indicated.
 - a. Apply 4-inch (100-mm) **OR** 6-inch (150-mm), **as directed**, average thickness of organic mulch. Do not place mulch within 6 inches (150 mm) of tree trunks.

C. Tree- And Plant-Protection Zones

1. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people and animals from easily entering protected area except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.
 - a. Chain-Link Fencing: Install to comply with ASTM F 567 and with manufacturer's written instructions.
 - b. Posts: Set or drive posts into ground one-third the total height of the fence without concrete footings. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to the Owner.
 - c. Access Gates: Install where indicated; adjust to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption,



or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

2. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations in a manner approved by the Owner. Install one sign spaced approximately every 20 feet (6 m) **OR** 35 feet (10.5 m) **OR** 50 feet (15 m), **as directed**, on protection-zone fencing, but no fewer than four signs with each facing a different direction.
3. Maintain protection zones free of weeds and trash.
4. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by the Owner.
5. Maintain protection-zone fencing and signage in good condition as acceptable to the Owner and remove when construction operations are complete and equipment has been removed from the site.
 - a. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
 - b. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

D. Excavation

1. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Division 31 Section "Earth Moving".
2. Trenching near Trees: Where utility trenches are required within protection zones, hand excavate under or around tree roots or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning.
3. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches (75 mm) back from new construction and as required for root pruning.
4. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

E. Root Pruning

1. Prune roots that are affected by temporary and permanent construction. Prune roots as follows:
 - a. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
 - b. Cut Ends: Do not paint cut root ends **OR** Coat cut ends of roots more than 1-1/2 inches (38 mm) in diameter with an emulsified asphalt or other coating formulated for use on damaged plant tissues and that is acceptable to arborist, **as directed**.
 - c. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
 - d. Cover exposed roots with burlap and water regularly.
 - e. Backfill as soon as possible according to requirements in Division 31 Section "Earth Moving".
2. Root Pruning at Edge of Protection Zone: Prune roots 12 inches (300 mm) outside **OR** 12 inches (300 mm) inside **OR** 6 inches (150 mm) outside **OR** 6 inches (150 mm) inside **OR** flush with the edge, **as directed**, of the protection zone, by cleanly cutting all roots to the depth of the required excavation.
3. Root Pruning within Protection Zone: Clear and excavate by hand to the depth of the required excavation to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.



- F. Crown Pruning
1. Prune branches that are affected by temporary and permanent construction. Prune branches as follows:
 - a. Prune trees to remain to compensate for root loss caused by damaging or cutting root system. Provide subsequent maintenance during Contract period as recommended by arborist.
 - b. Pruning Standards: Prune trees according to ANSI A300 (Part 1) and the following:
 - 1) Type of Pruning: Cleaning **OR** Thinning **OR** Raising **OR** Reduction, **as directed**.
 - 2) Specialty Pruning: Restoration **OR** Vista **OR** Palm **OR** Utility, **as directed**.
 - c. Cut branches with sharp pruning instruments; do not break or chop.
 - d. Do not apply pruning paint to wounds.
 2. Chip removed branches and spread over areas identified by the Owner **OR** stockpile in areas approved by the Owner **OR** dispose of off-site, **as directed**.
- G. Regrading
1. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.
OR
Lowering Grade within Protection Zone: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by arborist unless otherwise indicated.
 - a. Root Pruning: Prune tree roots exposed by lowering the grade. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots as required for root pruning.
 2. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.
OR
Minor Fill within Protection Zone: Where existing grade is 2 inches (50 mm) or less below elevation of finish grade, fill with topsoil. Place topsoil in a single uncompacted layer and hand grade to required finish elevations.
- H. Field Quality Control
1. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.
- I. Repair And Replacement
1. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by the Owner.
 - a. Submit details of proposed root cutting and tree and shrub repairs.
 - b. Have arborist perform the root cutting, branch pruning, and damage repair of trees and shrubs.
 - c. Treat damaged trunks, limbs, and roots according to arborist's written instructions.
 - d. Perform repairs within 24 hours.
 - e. Replace vegetation that cannot be repaired and restored to full-growth status, as determined by the Owner.
 2. Trees: Remove and replace trees indicated to remain that are more than 25 **OR** 66, **as directed**, percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that the Owner determines are incapable of restoring to normal growth pattern.
 - a. Provide new trees of same size and species as those being replaced for each tree that measures 6 inches (150 mm) **OR** 4 inches (100 mm), **as directed**, or smaller in caliper size.
OR
Provide one **OR** two, **as directed**, new tree(s) of 6-inch (150-mm) **OR** 4-inch (100-mm), **as directed**, caliper size for each tree being replaced that measures more than 6 inches (150 mm) **OR** 4 inches (100 mm), **as directed**, in caliper size.
 - 1) Species: Species selected by the Owner.



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- b. Plant and maintain new trees as specified in Division 32 Section "Plants".
 - 3. Soil Aeration: Where directed by the Owner, aerate surface soil compacted during construction. Aerate 10 feet (3 m) beyond drip line and no closer than 36 inches (900 mm) to tree trunk. Drill 2-inch- (50-mm-) diameter holes a minimum of 12 inches (300 mm) deep at 24 inches (600 mm) o.c. Backfill holes with an equal mix of augered soil and sand.
- J. Disposal Of Surplus And Waste Materials
- 1. Disposal: Remove excess excavated material, displaced trees, trash and debris, and legally dispose of them off Owner's property.

END OF SECTION 31 13 13 00



Task	Specification	Specification Description
31 13 13 00	31 11 00 00	Site Clearing
31 13 16 00	31 11 00 00	Site Clearing
31 13 16 00	31 13 13 00	Tree Protection And Trimming



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SECTION 31 23 16 13 - EXCAVATION SUPPORT AND PROTECTION

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for excavation support and protection. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Performance Requirements

1. Design, **as directed**, furnish, install, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting soil and hydrostatic pressure and superimposed and construction loads.
 - a. Delegated Design: Design excavation support and protection system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
 - b. Prevent surface water from entering excavations by grading, dikes, or other means.
 - c. Install excavation support and protection systems without damaging existing buildings, structures, and site improvements adjacent to excavation.
 - d. Monitor vibrations, settlements, and movements.

C. Submittals

1. Shop Drawings: For excavation support and protection system.
2. Delegated-Design Submittal: For excavation support and protection system indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Quality Assurance

1. Preinstallation Conference: Conduct conference at Project site.

E. Project Conditions

1. Interruption of Existing Utilities: Do not interrupt any utility serving facilities occupied by the Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:
 - a. Notify the Owner no fewer than two days in advance of proposed interruption of utility.
 - b. Do not proceed with interruption of utility without the Owner's written permission.
2. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.
 - a. During installation of excavation support and protection systems, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations and positions for comparison with original elevations and positions. Promptly notify the Owner if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.

1.2 PRODUCTS

A. Materials

1. General: Provide materials that are either new or in serviceable condition.
2. Structural Steel: ASTM A 36/A 36M, ASTM A 690/A 690M, or ASTM A 992/A 992M.
3. Steel Sheet Piling: ASTM A 328/A 328M, ASTM A 572/A 572M, or ASTM A 690/A 690M; with continuous interlocks.



- a. Corners: Site-fabricated mechanical interlock **OR** Roll-formed corner shape with continuous interlock, **as directed**.
4. Wood Lagging: Lumber, mixed hardwood, nominal rough thickness of size and strength required for application, **OR** 3 inches (75 mm) **OR** 4 inches (100 mm), **as directed**.
5. Shotcrete: Comply with Division 03 Section "Shotcrete" for shotcrete materials and mixes, reinforcement, and shotcrete application.
6. Cast-in-Place Concrete: ACI 301, of compressive strength required for application.
7. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
8. Tiebacks: Steel bars, ASTM A 722/A 722M.
9. Tiebacks: Steel strand, ASTM A 416/A 416M.

1.3 EXECUTION

A. Preparation

1. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.
 - a. Shore, support, and protect utilities encountered.
2. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
 - a. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from the Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
3. Locate excavation support and protection systems clear of permanent construction so that forming and finishing of concrete surfaces are not impeded.
4. Monitor excavation support and protection systems daily during excavation progress and for as long as excavation remains open. Promptly correct bulges, breakage, or other evidence of movement to ensure that excavation support and protection systems remain stable.
5. Promptly repair damages to adjacent facilities caused by installing excavation support and protection systems.

B. Soldier Piles And Lagging

1. Install steel soldier piles before starting excavation. Extend soldier piles below excavation grade level to depths adequate to prevent lateral movement. Space soldier piles at regular intervals not to exceed allowable flexural strength of wood lagging. Accurately align exposed faces of flanges to vary not more than 2 inches (50 mm) from a horizontal line and not more than 1:120 out of vertical alignment.
2. Install wood lagging within flanges of soldier piles as excavation proceeds. Trim excavation as required to install lagging. Fill voids behind lagging with soil, and compact.
3. Install wales horizontally at locations indicated on Drawings and secure to soldier piles.

C. Sheet Piling

1. Before starting excavation, install one-piece sheet piling lengths and tightly interlock to form a continuous barrier. Accurately place the piling, using templates and guide frames unless otherwise recommended in writing by the sheet piling manufacturer. Limit vertical offset of adjacent sheet piling to 60 inches (1500 mm). Accurately align exposed faces of sheet piling to vary not more than 2 inches (50 mm) from a horizontal line and not more than 1:120 out of vertical alignment. Cut tops of sheet piling to uniform elevation at top of excavation.

D. Tiebacks

1. Tiebacks: Drill, install, grout, and tension tiebacks. Test load-carrying capacity of each tieback and replace and retest deficient tiebacks.
 - a. Test loading shall be observed by a qualified professional engineer responsible for design of excavation support and protection system.



- b. Maintain tiebacks in place until permanent construction is able to withstand lateral soil and hydrostatic pressures.

E. Bracing

- 1. Bracing: Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move brace, install new bracing before removing original brace.
 - a. Do not place bracing where it will be cast into or included in permanent concrete work unless otherwise approved by the Owner.
 - b. Install internal bracing, if required, to prevent spreading or distortion of braced frames.
 - c. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

F. Removal And Repairs

- 1. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and bear soil and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils or damaging structures, pavements, facilities, and utilities.
 - a. Remove excavation support and protection systems to a minimum depth of 48 inches (1200 mm) below overlaying construction and abandon remainder.
 - b. Fill voids immediately with approved backfill compacted to density specified in Division 31 Section "Earth Moving".
 - c. Repair or replace, as approved by the Owner, adjacent work damaged or displaced by removing excavation support and protection systems.
- 2. Leave excavation support and protection systems permanently in place.

END OF SECTION 31 23 16 13



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Task	Specification	Specification Description
31 23 16 13	31 05 13 00	Earthwork
31 23 16 33	31 05 13 00	Earthwork
31 23 16 36	31 23 16 13	Excavation Support And Protection
31 23 16 36	31 05 13 00	Earthwork
31 23 16 43	31 23 16 13	Excavation Support And Protection
31 23 16 43	31 05 13 00	Earthwork
31 23 23 23	31 05 13 00	Earthwork
31 23 23 33	31 23 16 13	Excavation Support And Protection
31 23 23 33	31 05 13 00	Earthwork



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SECTION 31 24 13 00 - EMBANKMENT

1.1 GENERAL

A. Description Of Work

1. This specification covers the reuse of suitable excavated material or furnishing material at the Contractor's expense to construct embankments where and as required by the Owner.

B. Submittals

1. Preconstruction Submittals
 - a. Construction equipment list.
 - b. Contractor shall record Existing Conditions prior to starting work in accordance with the paragraph entitled, "Existing Conditions," of this section.
 - c. Location of Utilities
 - d. Location of Tests
 - e. Location of Inspection
 - f. Location of Approved Utilities
 - g. A protection plan verifying the Existing Utilities left in place.
2. Test Reports for Soil Test within three working days of test date. Soil test shall comply with paragraph entitled, "Quality Control Testing During Construction."
3. Certificates of compliance for Proposed Soil Materials shall be submitted in accordance with paragraph entitled, "Tests for Proposed Soil Materials."

C. Definitions

1. Soil Materials
 - a. Cohesionless soil materials include gravels, gravel-sand mixtures, sands, and gravelly sands. Moisture-density relations of compacted cohesionless soils when plotted on graphs will show straight lines or reverse-shaped moisture-density curves.
 - b. Cohesive soil materials include clayey and silty gravels, sand-clay mixtures, gravel-silt mixtures, clayey and silty sands, sand-silt mixtures, clays, silts, and very fine sands. Moisture density relations of compacted cohesive soils when plotted on graphs will show normal moisture-density curves.
2. Subgrade shall mean the top surface of a backfill or fill or the uppermost surface of an excavation, graded to conform to the required subgrade elevation and compacted to densities indicated.
3. Degree of compaction required is expressed as a percentage of the maximum density obtained by the test procedure in AASHTO T 180, Method B or D.
4. Classified Excavation: Separate consideration will be given to the nature of the materials excavated, in accordance with the following designations and classifications.
 - a. Rock excavation shall include blasting, excavating, grading, and disposing of material classified as rock and shall include the satisfactory removal and disposition of boulders 1/2-cu yd (0.4 cu m) or more in volume; solid rock; rock material in ledges, bedded deposits, and unstratified masses which cannot be removed without systematic drilling and blasting; and conglomerate deposits that are so firmly cemented as to possess the characteristics of solid rock that is impossible to remove without systematic drilling and blasting. The removal of any concrete or masonry structures, except pavements, exceeding 1/2-cu yd (0.4 cu m) in volume that may be encountered in the work shall be included in this classification.
 - b. Common excavation shall include the satisfactory removal and disposition of materials not classified as rock excavation.
5. Unclassified Excavation: No consideration will be given to the nature of the materials, and all excavation will be designated as unclassified excavation.

D. Sampling And Testing



1. Soil Test and Inspection Service: Soil survey for satisfactory soil materials and samples of soil materials shall be furnished by the Contractor. A certified soil testing service approved by the Owner shall be provided by the Contractor. Testing shall include soil survey for satisfactory soil materials, sampling and testing soil materials proposed for use in the work, and field-testing facilities for quality control during construction period.
2. Tests for Proposed Soil Materials: Soil materials proposed for use in the work shall be tested. The materials shall be approved by the Owner prior to start of work as follows:

<u>MATERIAL</u>	<u>REQUIREMENT</u>	<u>TEST METHOD</u>	<u>NUMBER OF TESTS</u>
Satisfactory soil materials	Sampling	AASHTO T 2	One for each source of materials to determine conformance to definition of satisfactory soil materials; additional tests whenever there is any apparent change
	Preparation of samples	AASHTO T 87	
	Sieve analysis of fine and coarse aggregate	ASTM C 136	
	Mechanical analysis of soils	ASTM D 422	
	Liquid limit of Soils	ASTM D 4318	
	Plastic limit and plasticity index of soils	ASTM D 4318	
	Moisture-density relations of soil	AASHTO T 180, Method B or D	



- 3. Quality Control Testing During Construction: Soil Test on materials shall be performed during construction as follows:

<u>MATERIAL</u>	<u>REQUIREMENT</u>	<u>TEST METHOD</u>	<u>MATERIAL TESTED AND NUMBER OF TESTS</u>
Soil material-in-place after compaction	Density of soil-in-place	ASTM D 1556 Sand Cone Method or ASTM D 2922 Nuclear Method	At least three daily for each subgrade soil material, and for each layer of soil material; additional tests whenever there is any change in moisture

- 4. Field Testing Facilities at Subbase Mixing Plant: Field-testing facilities for the purpose of testing subbase course material at the mixing plant shall be provided by the Contractor's soil-testing service.
- 5. Reports: No soil material shall be used until soil test reports have been reviewed and approved.
- 6. Evaluation of Test Results
 - a. Soil materials of any classification shall not have a moisture content at the time of compaction that would be classified as unsatisfactory soil materials in the paragraph entitled, "Definitions."
 - b. Results of density of soil-in-place tests shall be considered satisfactory if the average of any group of four consecutive density tests which may be selected is in each instance equal to or greater than the specified density, and if no density test has a value more than 2 percentage points below the specified density.

E. Use Of Explosives:

- 1. Explosives shall not be used or brought to the project site without prior written approval. Such approval shall not be construed as relieving the Contractor of responsibility for injury to persons or for damage to property due to blasting operations. Blasting shall be performed by skilled personnel in accordance with governing authorities and as approved. Minimum safety requirements for blasting shall be in accordance with OSHA Regulations 29 CFR 1926, Subpart U.
- OR**
- The use of explosives will not be permitted.

F. Protection Of Persons And Property

- 1. Excavations shall be barricaded and posted with warning signs for the safety of persons. Warning lights shall be provided during hours of darkness.
- 2. Structures, utilities, sidewalks, pavements, and other facilities immediately adjacent to excavations shall be protected against damage including settlement, lateral movement, undermining, and washout.
- 3. Topsoil removal operations shall be conducted to ensure safety of persons and to prevent damage to existing structures and utilities, construction in progress, trees and vegetation to remain standing, and other property.

G. Construction Equipment List: Construction Equipment List for all major equipment to be used in this section shall be submitted to the Owner prior to start of work.

H. Existing Conditions

- 1. Records of Existing Conditions shall be submitted by the Contractor prior to the start of work. The Contractor shall verify the existing conditions are correct as shown on the plans and described in the specifications. the Owner shall be notified immediately if any discrepancies are found.



2. Records of underground utilities, Location of Utilities, Location of Inspection, Location of Tests, and Location of Approved Utilities shall be submitted to the Owner prior to start of work.

1.2 PRODUCTS

A. Materials

1. Satisfactory Materials shall mean AASHTO M 145 (ASTM D 3282), Soil Classification Groups A-1, A-2-4, A-2-5, and A-3.
2. Unsatisfactory Materials shall mean AASHTO M 145, Soil Classification Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7, peat and other highly organic soils, and soil materials of any classification that have a moisture content, at the time of compaction, beyond the range of 1 percentage point below and 3 percentage points above the optimum moisture content of the soil material as determined by moisture-density relations test.
3. Topsoil shall be any soil removed from the project site which consists of clay or sandy loam. The topsoil shall be reasonably free from subsoil, clay lumps, brush, objectionable weeds, and other litter, and shall be free from stones, stumps, roots, and other objectionable material larger than 2 in. (50 mm) in any dimension.
4. Compost shall be yard trimmings or yard waste compost processed and graded according to state and local regulations.
5. Topsoil Blend: Where insufficient topsoil is removed from the project site for later reuse, the topsoil removed shall be stockpiled and blended with compost at the site to achieve the required volume.

1.3 EXECUTION

A. Blasting:

1. Where explosives are used in rock excavation, the charges shall be so proportioned and placed that they will not loosen the rock outside the excavation lines indicated, or as specified. Contractor shall remove, at no additional cost, any material outside the authorized cross section that may be shattered or loosened by blasting.

OR

Blasting is not required or permitted.

- ### B. Conservation Of Topsoil:
- Topsoil shall be stripped to a depth of not less than 4 in. (100 mm); when stored it shall be kept separate from other excavated materials, free of roots, stones, and other undesirable materials. Where indicated, topsoil shall be removed without contamination with subsoil and spread on areas already graded and prepared for topsoil, or when so specified, topsoil shall be transported and deposited in stockpiles convenient to areas that are to receive application of the topsoil later or at locations indicated or specified by the Owner. Topsoil blend shall be used on all embankments when there is not enough topsoil available.

C. Excavation

1. Excavations specified shall be done on either a classified or unclassified basis as directed by the Owner.
2. Contractor shall perform excavation of every type of material encountered by cutting accurately to the cross sections to the lines, grades, and elevations indicated. Grading shall be in conformity with the typical sections indicated and the tolerances specified in paragraph entitled, "Finishing."
3. Satisfactory excavated materials shall be transported to and placed in fill or embankment areas within the limits of the work. Unsatisfactory materials encountered within the limits of the work shall be excavated below grade and replaced with satisfactory materials as directed. Surplus satisfactory excavated material not required for fill or embankment shall be disposed in areas approved for surplus materials storage or designated waste areas. Unsatisfactory excavated material shall be disposed in designated waste or spoil areas. During construction, excavation



- and filling shall be performed in a manner and sequence that will provide proper drainage at all times. Material required for fill or embankment in excess of that produced by excavation within the grading limits shall be excavated from the borrow areas indicated or from other approved areas selected by the Owner.
4. Excavation of Ditches, Gutters, and Channels: Care shall be taken not to excavate ditches and gutters below grades shown. Excessive open-ditch or gutter excavation shall be backfilled with suitable materials to grades indicated at no additional cost. Materials excavated shall be disposed as indicated, except that in no case shall material be deposited less than 3 ft. (1 m) from the edge of a ditch. Contractor shall maintain excavations free from debris until final acceptance of the work.
 5. Excavation for Drainage Structures
 - a. Dimensions and elevations of footings and foundation excavations indicated are only approximate and may be changed if necessary to ensure adequate foundation support. Trenches and foundation pits shall be of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations. Rock or other hard foundation material shall be cleaned of loose debris and cut to a firm surface, either level, stepped, or serrated. Loose disintegrated rock and thin strata shall be removed. When concrete or masonry is to be placed in an excavated area, special care shall be taken not to disturb the bottom of the excavation. Excavation to the final grade level shall not be made until just before concrete or masonry is to be placed.
 - b. Where pile foundations are to be used, the excavation of each pit shall be stopped at an elevation 1 ft. (300 mm) above the base of the footing, as specified, before piles are driven. After pile driving has been completed, loose and displaced material shall be removed and excavation completed, leaving a smooth, solid, undisturbed surface to receive concrete or masonry.
 6. Protection or Removal of Utility Lines: Existing Utilities that are indicated to be retained, or the locations of which have been ascertained from the Owner utility drawings, as well as utility lines encountered during excavation, shall be protected from damage during excavation and backfilling. However, reliance on the information obtained from the Owner drawings does not absolve the Contractor of responsibility for damages, so careful hand methods shall be used to verify the location of underground utilities. Damage shall be reported immediately and satisfactorily repaired by the Contractor at no additional cost. The Contractor shall provide sketches of existing conditions if there are variances, as well as any modifications, on "as-built" drawings. When utility lines that are to be removed are encountered within the area of operations, the Contractor shall give notice in ample time for the necessary measures to be taken to prevent interruption of service.
- D. Classification Of Excavation: Excavations specified shall be done on either a classified or unclassified basis as provided for under the item designations of the Contract.
- E. Utilization Of Excavation Materials: Unsatisfactory materials removed from excavations shall be disposed in designated areas. Satisfactory material removed from excavations shall be used, insofar as practicable, in the construction of fills, embankments, subgrades, shoulders, bedding; as backfill; and for similar purposes. No satisfactory excavated material shall be wasted without specific written authorization. Satisfactory material authorized to be wasted shall be disposed in designated areas approved for surplus material storage or designated waste areas as directed. Coarse rock from excavations shall be stockpiled and used for constructing slopes of embankments adjacent to streams, for constructing slopes or sides and bottoms of channels, and for protecting against erosion. Hand placing of coarse rock from excavations will not be required. Excavated material shall not be disposed in a manner as to obstruct the flow of any stream, endanger a partly finished structure, impair the efficiency or appearance of any structure, or be detrimental to the completed work in any way.
- F. Selection Of Borrow Material: Borrow material shall be selected to meet the requirements and conditions of the particular fill or embankment for which it is to be used. Borrow material shall be obtained from the borrow areas indicated on the plans or from other approved sources, either private or within the limits of the project site, selected by the Contractor. Unless otherwise provided in the



contract, the Contractor shall obtain from the Owner the right to procure material, pay all royalties and other charges involved, and bear all expense of developing the sources, including rights-of-way for hauling. Borrow material from approved sources on the Owner-controlled land may be obtained without payment of royalties. Unless specifically provided, no borrow shall be obtained within the limits of the project site without prior written approval. Necessary clearing, grubbing, and satisfactory drainage of borrow pits and the disposal of debris shall be considered related operations to the borrow excavation and shall be performed by the Contractor at no additional cost to the Owner.

- G. **Opening And Drainage Of Excavation And Borrow Pits:** The Contractor shall give notice sufficiently in advance of the opening of any excavation or borrow pit to permit elevations and measurements of the undisturbed ground surface to be taken. Unless otherwise permitted, borrow pits and other excavation areas shall be excavated in such manner as will afford adequate drainage. Overburden and other spoil material shall be transported to designated spoil areas or otherwise disposed as directed. Borrow pits shall be neatly trimmed and left in such shape as will facilitate accurate measurements after the excavation is completed.
- H. **Grading Areas:** When so provided and indicated, work under contract will be divided into grading areas, within which satisfactory excavated material shall be placed in embankments, fills, and required backfills. Contractor shall not haul satisfactory material excavated in one grading area to another grading area, except when so directed in writing.
- I. **Preparation Of Ground Surface For Embankments**
1. Ground surface on which fill is to be placed shall be stripped of live, dead, or decayed vegetation, rubbish, debris, and other unsatisfactory material; shall be plowed, disked, or otherwise broken up; pulverized; moistened or aerated as necessary; mixed; and compacted to at least 90 percent maximum density for cohesive materials or 100 percent maximum density for cohesionless materials.
 2. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, or other approved equipment. The prepared ground surface shall be scarified and moistened or aerated just prior to placement of embankment materials to ensure adequate bond between embankment material and the prepared ground surface.
- J. **Embankments**
1. **Earth Embankments**
 - a. Earth embankments shall be constructed from satisfactory materials free of organic or frozen material and rocks with maximum dimensions not greater than 3 in. (75 mm). The material shall be placed in successive horizontal layers of loose material not more than 6 in. (150 mm) in depth. Each layer shall be spread uniformly on a prepared surface, i.e., a soil surface that has been moistened or aerated and scarified plowed, disked, or otherwise broken up in such a manner that the fill will bond with the surface on which it is placed, mixed, and compacted to at least 90 percent maximum density for borrow materials or 100 percent maximum density for excavated materials. Compaction requirements for the upper portion of earth embankments forming subgrade for pavements shall be identical to those requirements specified in paragraph entitled, "Subgrade Preparation."
 - b. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, or other approved equipment.
 2. **Rock Embankments**
 - a. Rock embankments shall be constructed from material essentially classified as rock excavation, placed in successive horizontal layers of loose material not more than 8 to 10 in. (200 to 250 mm) in depth. Pieces of rock larger than 8 to 10 in. (200 to 250 mm) in greatest dimension shall not be used.
 - b. Each layer of material shall be spread uniformly and shall be completely saturated and compacted to density as directed by the Owner.



- c. Each layer of material shall be spread uniformly and shall be completely saturated and compacted until the interstices are filled with well-compacted materials and the entire layer is a dense, compacted mass.
 - d. Each successive layer of material shall adequately bond to the material on which it is placed.
 - e. Compaction shall be accomplished with vibratory compactors with a minimum static weight of 20,000 lbs. (90 kN), heavy rubber-tired rollers weighing not less than 25,000 lbs. (110 kN) or steel-wheeled rollers with a loaded weight of not less than 4,000 lb/ft (58,400 N/m) of drum length.
 - f. Rock shall not be used above a point 6 in. (150 mm) below the surface of an embankment that is to be paved.
- K. Subgrade Preparation
1. Construction
 - a. Subgrade shall be shaped to line, grade, and cross section and compacted as specified. This operation shall include plowing, disking, and any moistening or aerating required to obtain proper compaction. Soft or otherwise unsatisfactory material shall be removed and replaced with satisfactory excavated material or other approved material as directed. Rock encountered in the cut sections shall be excavated to a depth of 6 in. (150 mm) below finished grade for the subgrade. Low areas resulting from removal of unsatisfactory material or excavation of rock shall be brought up to required grade with satisfactory materials, and the entire subgrade shall be shaped to line, grade, and cross section and compacted as specified.
 - b. After rolling, the surface of the subgrade for roadways and/or airfields shall indicate a deviation not greater than 3/8 in. (10 mm) when tested with a 10-ft (3.0 m) straightedge applied both parallel with, and at right angles to, the centerline of the area.
 - c. Elevation of the finished subgrade shall vary not more than 1/4-in. (6 mm) from the established grade and approved cross section.
 2. Compaction: Compaction for pavements and shoulders shall be accomplished with approved equipment until the layer is compacted to the full depth to at least 95 percent maximum density.
- L. Shoulder Construction: Shoulders shall be constructed of satisfactory excavated or borrow materials or as otherwise indicated on the plans. Shoulders shall be constructed as soon as possible after adjacent paving is complete, but in the case of rigid pavements, shoulders shall not be constructed until permission has been obtained. The entire shoulder area shall be compacted to at least the percentage of maximum density as specified for specific ranges of depth below the surface of the shoulder. Compaction shall be accomplished with approved equipment. Shoulder construction shall be done in proper sequence in such a manner that adjacent ditches will be drained effectively and no damage of any kind is done to the adjacent, completed pavement. The completed shoulders shall be true to alignment and grade and shaped to drain in conformity with the cross section indicated.
- M. Finishing: Surface of excavations, embankments, and subgrades shall be finished to a reasonably smooth and compact surface substantially in accordance with the lines, grades, and cross sections or elevations indicated. Degree of finish for graded areas shall be within 1/10 ft (30 mm) of the grades and elevations indicated, except that the degree of finish for subgrades shall be as specified. Gutters and ditches shall be finished as indicated. Surface of areas to be turfed shall be finished to a smoothness suitable for the application of turfing materials.
- N. Subgrade And Embankment Protection: During construction, embankments and excavations shall be kept shaped and drained. Ditches and drains along subgrade shall be maintained in such a manner as to drain effectively at all times. Finished subgrade shall not be disturbed by traffic or other operations and shall be protected and maintained by the Contractor in a satisfactory condition until ballast, subbase, base, or pavement is placed. Storage or stockpiling materials on finished subgrade will not be permitted. Subbase, base course, ballast, or pavement shall not be laid until the subgrade has been checked and approved, and in no case shall subbase, base, surfacing, pavement, or ballast be placed on a muddy, spongy, or frozen subgrade.



END OF SECTION 31 24 13 00



SECTION 31 24 13 00a - LEVEE CLOSURE

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing of labor and materials for providing levee closures.

1.2 PRODUCTS - (Not Used)

1.3 EXECUTION

A. If there is deemed, by the Owner, to be considerable risk of flooding involved with removing drainage structures and gates in the existing Levee System, the Contractor shall perform the work of this contract as follows:

1. Only one drainage structure/flap gate will be allowed to be disrupted at one time. All proposed work at each drainage structure shall be completed before proceeding to the next structure.
2. The Contractor shall have all materials required for each structure installation secured on site, before beginning construction on that structure.
3. The Contractor shall have all necessary materials on site to temporarily plug existing and/or proposed piping through the levee.
4. Weather and river flow conditions shall be monitored at all times by the Contractor while each drainage structure is open to flow. The Contractor shall construct an adequate closure in a timely fashion to plug the drainage structure preventing flow through the levee.

END OF SECTION 31 24 13 00a



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Task	Specification	Specification Description
31 24 13 00	31 05 13 00	Earthwork



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SECTION 31 25 14 13 - GEOSYNTHETIC FABRIC

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing of labor, material and equipment for the installation of geosynthetic fabric.

1.2 PRODUCTS

A. Materials

1. Erosion Control Fabric - Photo and biodegradable plastic Curlex Blanket as manufactured by American Excelsior Co. or approved equal.
2. Drainage/Leach Bed - Non-woven polypropylene/polyethylene fabric, Mirafi 140N or approved equal.
3. Road Base and Structure Reinforcement - Woven polypropylene fabric, Mirafi 600X or approved equal.
4. Sediment and Job Site erosion control - woven polypropylene fabric - Envirofence by Mirafi or approved equal.

1.3 EXECUTION

- #### A.
- For sediment and job site erosion control fabric, the Contractor shall provide and install silt fence as detailed on the Storm Water Management and Erosion Control Plan. It shall be the Contractor's option to provide fabricated reinforced silt fence or prefabricated units, unless otherwise noted. In all installations, the bottom flap of filter cloth shall be firmly embedded into undisturbed or stabilized grade. Embedment shall resist pullout and prevent flow under the installation.

END OF SECTION 31 25 14 13



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Task	Specification	Specification Description
31 25 14 13	01 56 26 00	Sediment Removal
31 25 14 13	01 56 26 00a	Erosion Control
31 25 14 16	01 56 26 00	Sediment Removal
31 25 14 16	31 25 14 13	Geosynthetic Fabric
31 25 14 16	01 56 26 00a	Erosion Control



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SECTION 31 25 14 23 - UNIT PAVERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for unit pavers. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Brick pavers set in aggregate, bituminous or mortar setting beds.
 - b. Concrete pavers set in aggregate, bituminous or mortar setting beds.
 - c. Asphalt-block pavers set in bituminous setting beds.
 - d. Stone pavers set in aggregate or mortar setting beds.
 - e. Plastic or Steel or Aluminum edge restraints.
 - f. Cast-in-place concrete edge restraints.
 - g. Precast concrete curbs.
 - h. Stone curbs.

C. Preconstruction Testing

1. Preconstruction Adhesion and Compatibility Testing: Submit to latex-additive manufacturer, for testing as indicated below, samples of paving materials that will contact or affect mortar and grout that contain latex additives.
 - a. Use manufacturer's standard test methods to determine whether mortar and grout materials will obtain optimum adhesion with, and will be nonstaining to, installed pavers and other materials constituting paver installation.

D. Action Submittals

1. Product Data: For materials other than water and aggregates.
2. Product Data: For the following:
 - a. Pavers.
 - b. Bituminous setting materials.
 - c. Mortar and grout materials.
 - d. Edge restraints.
 - e. Precast concrete curbs.
 - f. Stone curbs.
3. LEED Submittals:
 - a. Product Certificates for Credit MR 5: For products and materials required to comply with requirements for regional materials, certificates indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating distance to Project, cost for each regional material, and fraction by weight that is considered regional.
4. Adhesion and Compatibility Test Reports: From latex-additive manufacturer for mortar and grout containing latex additives.
5. Sieve Analyses: For aggregate setting-bed materials, according to ASTM C 136.
6. Samples for Initial Selection: For the following:
 - a. Each type of unit paver indicated.
 - b. Joint materials involving color selection.
 - c. Exposed edge restraints involving color selection.
 - d. Precast concrete curbs.
 - e. Granite for stone curbs.
7. Samples for Verification:



- a. Full-size units of each type of unit paver indicated. Assemble no fewer than five Samples of each type of unit on suitable backing and grout joints.]
- b. Joint materials.
- c. Exposed edge restraints.
- d. Precast concrete curbs.
- e. Stone curbs.

E. Quality Assurance

1. Source Limitations: Obtain each type of unit paver, joint material, and setting material from single source with resources to provide materials and products of consistent quality in appearance and physical properties.
2. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - a. Approved mockups may become part of the completed Work if undisturbed at time of Final Completion.
3. Preinstallation Conference: Conduct conference at Project site.

F. Delivery, Storage, And Handling

1. Store pavers on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied.
2. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
3. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
4. Store liquids in tightly closed containers protected from freezing.
5. Store asphalt cement and other bituminous materials in tightly closed containers.

G. Project Conditions

1. Cold-Weather Protection: Do not use frozen materials or build on frozen subgrade or setting beds.
2. Weather Limitations for Bituminous Setting Bed:
 - a. Install bituminous setting bed only when ambient temperature is above 40 deg F (4 deg C) and when base is dry.
 - b. Apply asphalt adhesive only when ambient temperature is above 50 deg F (10 deg C) and when temperature has not been below 35 deg F (2 deg C) for 12 hours immediately before application. Do not apply when setting bed is wet or contains excess moisture.
3. Weather Limitations for Mortar and rout:
 - a. Cold-Weather Requirements: Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
 - b. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602. Provide artificial shade and windbreaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg F (38 deg C) and higher.
 - 1) When ambient temperature exceeds 100 deg F (38 deg C), or when wind velocity exceeds 8 mph (13 km/h) and ambient temperature exceeds 90 deg F (32 deg C), set pavers within 1 minute of spreading setting-bed mortar.

1.2 PRODUCTS

A. Brick Pavers

1. Regional Materials: Provide brick pavers that have been manufactured within 500 miles (800 km) of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.



2. Brick Pavers: Light-traffic paving brick; ASTM C 902; Class SX for exposure to freezing weather **OR** Class MX for exterior uses that do not expose brick to freezing, **as directed**, Type I for locations exposed to extensive abrasion, such as sidewalks and driveways in public spaces **OR** Type II for locations exposed to intermediate abrasion, such as heavily traveled residential walkways and driveways **OR** Type III for locations exposed to low abrasion, such as floors and patios exposed in single-family homes, **as directed**. Application PS normal tolerance for installation with grouted joints **OR** Application PX close tolerance for ungrouted joints **OR** Application PA non-uniform sized for decorative effect, **as directed**. Provide brick without frogs or cores in surfaces exposed to view in the completed Work.
 - a. Thickness: 1-1/4 inches (32 mm) **OR** 1-1/2 inches (38 mm) **OR** 1-5/8 inches (41 mm) **OR** 2-1/4 inches (57 mm) **OR** 2-5/8 inches (67 mm), **as directed**.
 - b. Face Size: 3-3/4 by 7-1/2 inches (95 by 190 mm) **OR** 3-5/8 by 7-5/8 inches (92 by 194 mm) **OR** 3-5/8 by 11-5/8 inches (92 by 295 mm) **OR** 7-5/8 by 7-5/8 inches (194 by 194 mm) **OR** 4 by 8 inches (102 by 203 mm) **OR** 4 by 12 inches (102 by 305 mm) **OR** 8 by 8 inches (203 by 203 mm), **as directed**.
 - c. Color: As selected from manufacturer's full range.
 3. Brick Pavers: Heavy vehicular paving brick; ASTM C 1272, Type F, Application PX **OR** Type R, Application PS **OR** Type R, Application PX **OR** Type R, Application PA, **as directed**. Provide brick without frogs or cores in surfaces exposed to view in the completed Work.
 - a. Type R is for units set in a mortar setting bed or a bituminous setting bed supported by an adequate base. Type F is for units set in a sand setting bed with sand between the pavers. Application PS is for general use; Application PX is for pavers with close dimensional tolerances. Application PX must be selected if specifying Type F
 - b. Thickness: 2-1/4 inches (57 mm) **OR** 2-5/8 inches (67 mm), **as directed**.
 - c. Face Size: 3-3/4 by 7-1/2 inches (95 by 190 mm) **OR** 3-5/8 by 7-5/8 inches (92 by 194 mm) **OR** 3-5/8 by 11-5/8 inches (92 by 295 mm) **OR** 7-5/8 by 7-5/8 inches (194 by 194 mm) **OR** 4 by 8 inches (102 by 203 mm) **OR** 4 by 12 inches (102 by 305 mm) **OR** 8 by 8 inches (203 by 203 mm), **as directed**.
 - d. Color: As selected from manufacturer's full range.
 4. Efflorescence: Brick shall be rated "not effloresced" when tested according to ASTM C 67.
 5. Temporary Protective Coating: Precoat exposed surfaces of brick pavers with a continuous film of a temporary protective coating that is compatible with brick, mortar, and grout products and can be removed without damaging grout or brick. Do not coat unexposed brick surfaces; handle brick to prevent coated surfaces from contacting backs or edges of other units. If, despite these precautions, coating does contact bonding surfaces of brick, remove coating from bonding surfaces before setting brick.
- B. Concrete Pavers
1. Concrete Pavers: Solid interlocking paving units complying with ASTM C 936 and resistant to freezing and thawing when tested according to ASTM C 67, made from normal-weight aggregates.
 - a. Thickness: 2-3/8 inches (60 mm) **OR** 3-1/8 inches (80 mm), **as directed**.
 - b. Face Size and Shape: 3-7/8 inches (98 mm) square **OR** 4-7/16 inches (113 mm) **OR** 8-7/8 inches (225 mm) **OR** 9 inches (229 mm) square, **as directed**.
 - c. Face Size and Shape: 3-7/8-by-7-7/8 inch (98-by-200 mm) **OR** 4-by-8-inch (102-by-203-mm) **OR** 4-7/16-by-8-7/8 inch (113-by-225-mm), **as directed**, rectangle.
 - d. Face Size and Shape: 5-1/2-inch (140-mm) octagon with attached 3-1/2-inch (89-mm) square **OR** 4-1/2-by-9 inch (114-by-229 mm) rectangle with saw-tooth edges **OR** 4-3/4-inch (121-mm) rectangular and trapezoidal units arranged in semicircular courses to produce fan-shaped pattern, **as directed**.
 - e. Color: As selected from manufacturer's full range.
 2. Concrete Pavers: Solid paving units, made from normal-weight concrete with a compressive strength not less than 5000 psi (34 MPa) **OR** 6000 psi (41 MPa), **as directed**, water absorption not more than 5 percent according to ASTM C 140, and no breakage and not more than 1 percent mass loss when tested for freeze-thaw resistance according to ASTM C 67.



- a. Thickness: 1-5/8 inches (41 mm) **OR** 1-3/4 inches (45 mm) **OR** 2 inches (51 mm) **OR** 2-3/8 inches (60 mm), **as directed**.
 - b. Face Size and Shape: 8-7/8 inches (225 mm) square **OR** 9 inches (229 mm) square **OR** 12 inches (305 mm) square **OR** 18 inches (457 mm) square **OR** 24 inches (610 mm) square, **as directed**.
 - c. Face Size and Shape: 9-by-18 inch (229-by-457 mm) **OR** 12-by-24 inch (305-by-610 mm), **as directed**, rectangle.
 - d. Face Size and Shape: As indicated.
 - e. Color: As selected from manufacturer's full range.
3. Concrete Pavers: Solid paving units complying with ASTM C 1491, made from lightweight concrete.
- a. Thickness: 1-5/8 inches (41 mm) **OR** 1-3/4 inches (45 mm) **OR** 2 inches (51 mm), **as directed**.
 - b. Face Size and Shape: 9 inches (229 mm) square **OR** 12 inches (305 mm) square **OR** 18 inches (457 mm) square, **as directed**.
 - c. Color: As selected from manufacturer's full range.
- C. Asphalt-Block Pavers
1. Asphalt-Block Pavers: Solid units made from asphalt cement complying with ASTM D 312, Type III; inorganic stone dust or cement filler; and coarse aggregate, consisting of clean, hard, unweathered stone crushed into angular particles varying in size up to 3/8 inch (9.5 mm).
 - a. Thickness: 1-1/4 inches (32 mm) **OR** 2 inches (51 mm) **OR** 3 inches (76 mm), **as directed**.
 - b. Face Size: 4 by 6 inches (102 by 152 mm) **OR** 6 by 6 inches (152 by 152 mm) **OR** 8 by 8 inches (203 by 203 mm) **OR** 5 by 12 inches (127 by 305 mm) **OR** 6 by 12 inches (152 by 305 mm) **OR** 8-inch- (203-mm-) wide hexagon, **as directed**.
 - c. Finish: Natural, smooth **OR** Ground **OR** Ground and sandblasted, **as directed**.
 - d. Color: As selected from manufacturer's full range.
- D. Stone Pavers
1. Granite Pavers: Rectangular paving slabs made from granite complying with ASTM C 615
 - a. Color and Grain: Light gray **OR** Dark gray **OR** Buff **OR** White **OR** Black **OR** Pink, **as directed**, with medium **OR** fine, **as directed**, grain.
 - b. Finish: Honed **OR** Thermal, **as directed**.
 - c. Match Architect's samples for color, finish, and other stone characteristics relating to aesthetic effects.
 - d. Thickness: Not less than 3/4 inch (20 mm) **OR** 30 mm **OR** 1-1/4 inches (32 mm) **OR** 1-5/8 inches (40 mm), **as directed**, unless otherwise indicated.
 - e. Face Size: 9 inches (229 mm) square **OR** 12 inches (305 mm) square **OR** 18 inches (457 mm) square **OR** 9 by 18 inches (229 by 457 mm), **as directed**.
 2. Limestone Pavers: Rectangular paving slabs made from limestone complying with ASTM C 568.
 - a. Classification: II Medium-Density **OR** III High-Density, **as directed**.
 - b. Stone Abrasion Resistance: Minimum value of 10, based on testing according to ASTM C 241 or ASTM C 1353.
 - c. Finish: Smooth **OR** Chat sawed **OR** Shot sawed, **as directed**.
 - d. Match Architect's samples for color, finish, and other stone characteristics relating to aesthetic effects.
 - e. Thickness: Not less than 1 inch (25 mm) **OR** 1-1/4 inches (32 mm) **OR** 1-5/8 inches (40 mm) **OR** 2 inches (50 mm), **as directed**, unless otherwise indicated.
 - f. Face Size: 9 inches (229 mm) square **OR** 12 inches (305 mm) square **OR** 18 inches (457 mm) square **OR** 9 by 18 inches (229 by 457 mm), **as directed**.
 3. Marble Pavers: Rectangular paving slabs made from marble complying with ASTM C 503.
 - a. Stone Abrasion Resistance: Minimum value of 10, based on testing according to ASTM C 241 or ASTM C 1353.
 - b. Description: Uniform, fine- to medium-grained, white stone with only slight veining.



- c. Finish: Honed **OR as directed.**
 - d. Match samples for color, finish, and other stone characteristics relating to aesthetic effects.
 - e. Thickness: Not less than 3/4 inch (20 mm) **OR** 30 mm **OR** 1-1/4 inches (32 mm), **as directed.**
 - f. Face Size: 9 inches (229 mm) square **OR** 12 inches (305 mm) square **OR** 18 inches (457 mm) square **OR** 9 by 18 inches (229 by 457 mm) **as directed.**
 4. Quartz-Based Stone Pavers: Rectangular paving slabs **OR** Random polygonal flagstones made from quartz-based stone complying with ASTM C 616, Classification I Sandstone **OR** II Quartzitic Sandstone **OR** III Quartzite, **as directed.**
 - a. Stone Abrasion Resistance: Minimum value of 10, based on testing according to ASTM C 241 or ASTM C 1353.
 - b. Finish: Sand rubbed **OR** Natural cleft **OR** Thermal, **as directed.**
 - c. Match samples for color, finish, and other stone characteristics relating to aesthetic effects.
 - d. Thickness: Not less than 1 inch (25 mm) **OR** 1-1/4 inches (32 mm) **OR** 1-1/2 inches (38 mm) **OR** 1-5/8 inches (40 mm) **OR** 2 inches (50 mm), **as directed.**
 - e. Face Size: 9 inches (229 mm) square **OR** 12 inches (305 mm) square **OR** 18 inches (457 mm) square **OR** 9 by 18 inches (229 by 457 mm), **as directed.**
 5. Slate Pavers: Rectangular paving slabs **OR** Random polygonal flagstones made from slate complying with ASTM C 629, Classification I Exterior, with a fine, even grain and unfading color, from clear, sound stock.
 - a. Color: Black **OR** Blue-black **OR** Gray **OR** Blue-gray **OR** Green **OR** Purple **OR** Mottled purple and green **OR** Red, **as directed.**
 - b. Stone Abrasion Resistance: Minimum value of 8, based on testing according to ASTM C 241 or ASTM C 1353.
 - c. Finish: Honed **OR** Sand rubbed **OR** Natural cleft, **as directed.**
 - d. Match samples for color, finish, and other stone characteristics relating to aesthetic effects.
 - e. Thickness: Not less than 1/2 inch (13 mm) **OR** 3/4 inch (20 mm) **OR** 1 inch (25 mm), **as directed.**
 - f. Face Size: 9 inches (229 mm) square **OR** 12 inches (305 mm) square **OR** 18 inches (457 mm) square **OR** 9 by 18 inches (229 by 457 mm), **as directed.**
 6. Travertine Pavers: Rectangular paving slabs made from travertine complying with ASTM C 1527, Classification I Exterior.
 - a. Stone Abrasion Resistance: Minimum value of 10, based on testing according to ASTM C 241 or ASTM C 1353.
 - b. Cut: Vein cut.
 - c. Filling: Fill pores on faces of stone with cementitious filler of color as selected by the Owner.
 - d. Finish: Honed **OR as directed.**
 - e. Match samples for color, finish, and other stone characteristics relating to aesthetic effects.
 - f. Thickness: Not less than 3/4 inch (20 mm) **OR** 30 mm **OR** 1-1/4 inches (32 mm), **as directed.**
 - g. Face Size: 9 inches (229 mm) square **OR** 12 inches (305 mm) square **OR** 18 inches (457 mm) square **OR** 9 by 18 inches (229 by 457 mm), **as directed.**
 7. Rough-Stone Pavers: Rectangular tumbled paving stones, with split or thermal-finished faces and edges, made from granite complying with ASTM C 615.
 - a. Granite Color and Grain: Light gray **OR** Dark gray **OR** Buff **OR** White **OR** Black **OR** Pink, **as directed**, with medium **OR** fine, **as directed**, grain.
 - b. Thickness: 1-1/4 inches (32 mm) **OR** 2 inches (51 mm) **OR** 3 inches (76 mm) **OR** 4 inches (102 mm) **OR** 4 inches (102 mm), plus or minus 1/2 inch (13 mm), **as directed.**
 - c. Face Size: 4 by 4 inches (100 by 100 mm), plus or minus 1/2 inch (13 mm) **OR** 3 to 5 inches (75 to 125 mm) by 8 to 12 inches (200 to 300 mm), **as directed.**
- E. Curbs And Edge Restraints
1. Plastic Edge Restraints: Manufacturer's standard triangular PVC extrusions 1-3/4 inches (45 mm) high by 3-1/2 inches (89 mm) wide **OR** 3-1/8 inches (79 mm) high by 9-1/2 inches (241 mm) wide, **as directed**, designed to serve as edge restraints for unit pavers; rigid type for straight



edges and flexible type for curved edges, with pipe connectors and 3/8-inch (9.5-mm) diameter by 12-inch- (300-mm-) long steel spikes.

2. Steel Edge Restraints: Manufacturer's standard painted steel edging 3/16 inch (4.8 mm) thick by 4 inches (100 mm) high **OR** 1/4 inch (6.4 mm) thick by 5 inches (125 mm) high, **as directed** with loops pressed from or welded to face to receive stakes at 36 inches (900 mm) o.c., and steel stakes 15 inches (380 mm) long for each loop.
 - a. Color: As selected from manufacturer's full range.
3. Aluminum Edge Restraints: Manufacturer's standard straight, 1/8-inch- (3.2-mm-) thick by 4-inch- (100-mm-) high **OR** straight, 3/16-inch- (4.8-mm-) thick by 4-inch- (100-mm-) high **OR** L-shaped, 1/8-inch- (3.2-mm-) thick by 1-3/8-inch- (35-mm-) high **OR** L-shaped, 3/16-inch- (4.8-mm-) thick by 2-1/4-inch- (57-mm-) high, **as directed** extruded-aluminum edging with loops pressed from face to receive stakes at 12 inches (300 mm) o.c., and aluminum stakes 12 inches (300 mm) long for each loop.
4. Job-Built Concrete Edge Restraints: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mixed concrete with minimum 28-day compressive strength of 3000 psi (20 MPa).
5. Precast Concrete Curbs: Made from normal-weight concrete with a compressive strength not less than 5000 psi (34 MPa) **OR** 6000 psi (41 MPa), **as directed** and water absorption not more than 5 percent, in shapes and sizes indicated.
6. Stone Curbs: Granite curbing, with face battered 1 inch per foot (1:12), produced in random lengths not less than 36 inches (900 mm) from granite complying with ASTM C 615.
 - a. Granite Color and Grain: Light gray **OR** Dark gray **OR** Buff **OR** White **OR** Black **OR** Pink, **as directed** with fine **OR** medium **OR** coarse grain, **as directed**.
 - b. Top Width: 4 inches (102 mm) **OR** 5 inches (127 mm) **OR** 6 inches (152 mm), **as directed**.
 - c. Face Height: 4 inches (102 mm) **OR** 6 inches (152 mm) **OR** 8 inches (203 mm), **as directed**.
 - d. Total Height: 12 inches (305 mm) **OR** 16 inches (406 mm) **OR** 18 inches (457 mm), **as directed**.
 - e. Top Finish: Sawed **OR** Thermal **OR** Bush hammered, **as directed**.
 - f. Face Finish: Split **OR** Sawed **OR** Thermal **OR** Bush hammered, **as directed**.

F. Accessories

1. Cork Joint Filler: Preformed strips complying with ASTM D 1752, Type II.
2. Compressible Foam Filler: Preformed strips complying with ASTM D 1056, Grade 2A1.

G. Aggregate Setting-Bed Materials

1. Graded Aggregate for Sub-base: Sound, crushed stone or gravel complying with ASTM D 448 for Size No. 57 **OR** ASTM D 2940, sub-base material **OR** requirements in Division 31 Section "Earth Moving" for sub-base material, **as directed**.
2. Graded Aggregate for Base: Sound, crushed stone or gravel complying with ASTM D 448 for Size No. 8 **OR** ASTM D 2940, base material **OR** requirements in Division 31 Section "Earth Moving" for base course, **as directed**.
3. Sand for Leveling Course: Sound, sharp, washed, natural sand or crushed stone complying with gradation requirements in ASTM C 33 for fine aggregate.
4. Stone Screenings for Leveling Course: Sound stone screenings complying with ASTM D 448 for Size No. 10.
5. Sand for Joints: Fine, sharp, washed, natural sand or crushed stone with 100 percent passing No. 16 (1.18-mm) sieve and no more than 10 percent passing No. 200 (0.075-mm) sieve.
 - a. Provide sand of color needed to produce required joint color.
6. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications; made from polyolefins or polyesters, with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
 - a. Survivability: Class 2, AASHTO M 288.
 - b. Apparent Opening Size: No. 60 (0.250-mm) sieve, maximum; ASTM D 4751.



- c. Permittivity: 0.02 per second, minimum; ASTM D 4491.
 - d. UV Stability: 50 percent after 500 hours' exposure, ASTM D 4355.
 7. Drainage Geotextile: Nonwoven needle-punched geotextile made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
 - a. Survivability: Class 2, AASHTO M 288.
 - b. Apparent Opening Size: No. 40 (0.425-mm) sieve, maximum; ASTM D 4751.
 - c. Permittivity: 0.5 per second, minimum; ASTM D 4491.
 - d. UV Stability: 50 percent after 500 hours' exposure, ASTM D 4355.
 8. Herbicide: Commercial chemical for weed control, registered with the EPA. Provide in granular, liquid, or wettable powder form.
- H. Bituminous Setting-Bed Materials
1. Primer for Base: ASTM D 2028, cutback asphalt, grade as recommended by unit paver manufacturer.
 2. Fine Aggregate for Setting Bed: ASTM D 1073, No. 2 or No. 3.
 3. Asphalt Cement: ASTM D 3381, Viscosity Grade AC-10 or Grade AC-20.
 4. Neoprene-Modified Asphalt Adhesive: Paving manufacturer's standard adhesive consisting of oxidized asphalt combined with 2 percent neoprene and 10 percent long-fibered mineral fibers containing no asbestos.
 5. Sand for Joints: Fine, sharp, washed, natural sand or crushed stone with 100 percent passing No. 16 (1.18-mm) sieve and no more than 10 percent passing No. 200 (0.075-mm) sieve.
 - a. Provide sand of color needed to produce required joint color.
- I. Mortar Setting-Bed Materials
1. Portland Cement: ASTM C 150, Type I or II.
 2. Hydrated Lime: ASTM C 207, Type S.
 3. Sand: ASTM C 144.
 4. Latex Additive: Manufacturer's standard, acrylic resin or styrene-butadiene-rubber water emulsion, **as directed** serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed, and not containing a retarder.
 5. Thinset Mortar: Latex-modified portland cement mortar complying with ANSI A118.4.
 - a. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
 - b. Provide prepackaged, dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive at Project site, as directed.
 6. Water: Potable.
 7. Reinforcing Wire Fabric: Galvanized, welded wire fabric, 2-by-2-inch (51-by-51-mm) by 0.062-inch- (1.57-mm-) diameter wire; comply with ASTM A 185/A 185M and ASTM A 82/A 82M except for minimum wire size.
- J. Grout Materials
1. Sand-Portland Cement Grout: ANSI A108.10, composed of white or gray cement, unfading mineral pigments and white or colored sand as required to produce required color.
 - a. Colored Mortar Pigments for Grout: Natural and synthetic iron and chromium oxides, compounded for use in mortar and grout mixes. Use only pigments that have proved, through testing and experience, to be satisfactory for use in portland cement grout.
 2. Standard Cement Grout: ANSI A118.6, sanded.
 3. Polymer-Modified Grout: ANSI A118.7, sanded grout; in color indicated.
 - a. Polymer Type: Ethylene-vinyl acetate or acrylic additive in dry, redispersible form; prepackaged with other dry ingredients.
 - b. Polymer Type: Acrylic resin or styrene-butadiene rubber in liquid-latex form for addition to prepackaged dry-grout mix.
 4. Grout Colors: As selected from manufacturer's full range.
 5. Water: Potable.



- K. Bituminous Setting-Bed Mix
1. Mix bituminous setting-bed materials at an asphalt plant in approximate proportion, by weight, of 7 percent asphalt cement to 93 percent fine aggregate, unless otherwise indicated. Heat mixture to 300 deg F (149 deg C).
- L. Mortar And Grout Mixes
1. General: Comply with referenced standards and with manufacturers' written instructions. Discard mortars and grout if they have reached their initial set before being used.
 2. Mortar-Bed Bond Coat: Mix neat cement or cement and sand with latex additive **OR** water, **as directed**, to a creamy consistency.
 3. Portland Cement-Lime Setting-Bed Mortar: Type M complying with ASTM C 270, Proportion Specification.
 4. Latex-Modified, Portland Cement Setting-Bed Mortar: Proportion and mix portland cement, sand, and latex additive for setting bed to comply with written instructions of latex-additive manufacturer and as necessary to produce stiff mixture with a moist surface when bed is ready to receive pavers.
 5. Latex-Modified, Portland Cement Slurry Bond Coat: Proportion and mix portland cement, aggregate, and liquid latex for bond coat to comply with written instructions of liquid-latex manufacturer.
 6. Thinset Mortar Bond Coat: Proportion and mix thinset mortar ingredients according to manufacturer's written instructions.
 7. Job-Mixed Portland Cement Grout: Proportion and mix job-mixed portland cement and aggregate grout to match setting-bed mortar except omit hydrated lime and use enough water to produce a pourable mixture.
 - a. Pigmented Grout: Select and proportion pigments with other ingredients to produce color required. Do not exceed pigment-to-cement ratio of 1:10, by weight.
 - b. Colored-Aggregate Grout: Produce color required by combining colored sand with portland cement of selected color.
 8. Package Grout Mix: Proportion and mix grout ingredients according to grout manufacturer's written instructions.

1.3 EXECUTION

- A. Examination
1. Examine areas indicated to receive paving, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
 2. Where pavers are to be installed over waterproofing, examine waterproofing installation, with waterproofing Installer present, for protection from paving operations, including areas where waterproofing system is turned up or flashed against vertical surfaces.
 3. Proceed with installation only after unsatisfactory conditions have been corrected and waterproofing protection is in place.
- B. Preparation
1. Remove substances from concrete substrates that could impair mortar bond, including curing and sealing compounds, form oil, and laitance.
 2. Sweep concrete substrates to remove dirt, dust, debris, and loose particles.
 3. Proof-roll prepared subgrade according to requirements in Division 31 Section "Earth Moving" to identify soft pockets and areas of excess yielding. Proceed with unit paver installation only after deficient subgrades have been corrected and are ready to receive subbase and base course for unit pavers.
- C. Installation, General
1. Do not use unit pavers with chips, cracks, voids, discolorations, or other defects that might be visible or cause staining in finished work.



2. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.
3. Cut unit pavers with motor-driven masonry saw equipment to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible.
 - a. For concrete pavers, a block splitter may be used.
4. Handle protective-coated brick pavers to prevent coated surfaces from contacting backs or edges of other units. If, despite these precautions, coating does contact bonding surfaces of brick, remove coating from bonding surfaces before setting brick.
5. Joint Pattern: Running bond **OR** Herringbone **OR** Basket weave **OR** Match and continue existing unit paver joint pattern, **as directed**.
6. Pavers over Waterproofing: Exercise care in placing pavers and setting materials over waterproofing so protection materials are not displaced and waterproofing is not punctured or otherwise damaged. Carefully replace protection materials that become displaced and arrange for repair of damaged waterproofing before covering with paving.
 - a. Provide joint filler at waterproofing that is turned up on vertical surfaces, unless otherwise indicated; where unfilled joints are indicated, provide temporary filler or protection until paver installation is complete.
7. Tolerances: For smooth pavers where slopes to drains are critical. Do not exceed 1/32-inch (0.8-mm) unit-to-unit offset from flush (lippage) nor 1/8 inch in 10 feet (3 mm in 3 m) from level, or indicated slope, for finished surface of paving.

OR

Tolerances: For smooth, flat pavers. Do not exceed 1/16-inch (1.6-mm) unit-to-unit offset from flush (lippage) nor 1/8 inch in 24 inches (3 mm in 600 mm) and 1/4 inch in 10 feet (6 mm in 3 m) from level, or indicated slope, for finished surface of paving.
8. Expansion and Control Joints: Provide for sealant-filled joints at locations and of widths indicated. Provide compressible foam filler as backing for sealant-filled joints unless otherwise indicated; where unfilled joints are indicated, provide temporary filler until paver installation is complete. Install joint filler before setting pavers. Sealant materials and installation are specified in Division 07 Section "Joint Sealants".

OR

Expansion and Control Joints: Provide cork joint filler at locations and of widths indicated. Install joint filler before setting pavers. Make top of joint filler flush with top of pavers.
9. Provide edge restraints as indicated. Install edge restraints before placing unit pavers.
 - a. Install edge restraints to comply with manufacturer's written instructions. Install stakes at intervals required to hold edge restraints in place during and after unit paver installation.
 - b. For metal edge restraints with top edge exposed, drive stakes at least 1 inch (25 mm) below top edge.
 - c. Install job-built concrete edge restraints to comply with requirements in Division 03 Section "Cast-in-place Concrete".
 - d. Where pavers set in mortar bed are indicated as edge restraints for pavers set in aggregate setting bed, install pavers set in mortar and allow mortar to cure before placing aggregate setting bed and remainder of pavers. Cut off mortar bed at a steep angle so it will not interfere with aggregate setting bed.
 - e. Where pavers embedded in concrete are indicated as edge restraints for pavers set in aggregate setting bed, install pavers embedded in concrete and allow concrete to cure before placing aggregate setting bed and remainder of pavers. Hold top of concrete below aggregate setting bed.
10. Provide steps made of pavers as indicated. Install paver steps before installing adjacent pavers.
 - a. Where pavers set in mortar bed are indicated for steps constructed adjacent to pavers set in aggregate setting bed, install steps and allow mortar to cure before placing aggregate setting bed and remainder of pavers. Cut off mortar bed at a steep angle so it will not interfere with aggregate setting bed.

D. Aggregate Setting-Bed Applications

1. Compact soil subgrade uniformly to at least 95 percent of ASTM D 698 **OR** ASTM D 1557, **as directed**, laboratory density.



2. Proof-roll prepared subgrade to identify soft pockets and areas of excess yielding. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined, and replace with compacted backfill or fill as directed.
3. Place separation geotextile over prepared subgrade, overlapping ends and edges at least 12 inches (300 mm).
4. Place aggregate subbase and base **OR** base, **as directed**.
 - a. For light-traffic compact by tamping with plate vibrator, and screed to depth indicated.
 - b. For heavy duty compact to 100 percent of ASTM D 1557 maximum laboratory density, and screed to depth indicated.
5. Place drainage geotextile over compacted base course, overlapping ends and edges at least 12 inches (300 mm).
6. Place leveling course and screed to a thickness of 1 to 1-1/2 inches (25 to 38 mm), taking care that moisture content remains constant and density is loose and constant until pavers are set and compacted.
7. Treat leveling course with herbicide to inhibit growth of grass and weeds.
8. Set pavers with a minimum joint width of 1/16 inch (1.5 mm) and a maximum of 1/8 inch (3 mm), being careful not to disturb leveling base. If pavers have spacer bars, place pavers hand tight against spacer bars. Use string lines to keep straight lines. Fill gaps between units that exceed 3/8 inch (10 mm) with pieces cut to fit from full-size unit pavers.
 - a. When installation is performed with mechanical equipment, use only unit pavers with spacer bars on sides of each unit.
9. Vibrate pavers into leveling course with a low-amplitude plate vibrator capable of a 3500- to 5000-lbf (16- to 22-kN) compaction force at 80 to 90 Hz. Use vibrator with neoprene mat on face of plate or other means as needed to prevent cracking and chipping of pavers. Perform at least three passes across paving with vibrator.
 - a. Compact pavers when there is sufficient surface to accommodate operation of vibrator, leaving at least 36 inches (900 mm) of uncompacted pavers adjacent to temporary edges.
 - b. Before ending each day's work, compact installed concrete pavers except for 36-inch (900 mm) width of uncompacted pavers adjacent to temporary edges (laying faces).
 - c. As work progresses to perimeter of installation, compact installed pavers that are adjacent to permanent edges unless they are within 36 inches (90 mm) of laying face.
 - d. Before ending each day's work and when rain interrupts work, cover pavers that have not been compacted and cover leveling course on which pavers have not been placed with nonstaining plastic sheets to protect them from rain.
10. Spread dry sand and fill joints immediately after vibrating pavers into leveling course. Vibrate pavers and add sand until joints are completely filled, then remove excess sand. Leave a slight surplus of sand on the surface for joint filling.
11. Do not allow traffic on installed pavers until sand has been vibrated into joints.
12. Repeat joint-filling process 30 days later.

E. Bituminous Setting-Bed Applications

1. Apply primer to concrete slab or binder course immediately before placing setting bed.
2. Prepare for setting-bed placement by locating 3/4-inch- (19-mm-) deep control bars approximately 11 feet (3.3 m) apart, to serve as guides for striking board. Adjust bars for accurate setting of paving units to finished grades indicated.
3. Place bituminous setting bed between control bars. Spread mix at a minimum temperature of 250 deg F (121 deg C). Strike setting bed smooth, firm, even, and not less than 3/4 inch (19 mm) thick. Add fresh bituminous material to low, porous spots after each pass of striking board. Carefully fill depressions that remain after removing depth-control bars.
 - a. Roll setting bed with power roller to a nominal depth of 3/4 inch (19 mm). Adjust thickness as necessary to allow accurate setting of unit pavers to finished grades indicated. Complete rolling before mix temperature cools to 185 deg F (85 deg C).
4. Apply neoprene-modified asphalt adhesive to cold setting bed by squeegeeing or troweling to a uniform thickness of 1/16 inch (1.6 mm). Proceed with setting of paving units only after adhesive is tacky and surface is dry to touch.



5. Place pavers carefully by hand in straight courses, maintaining accurate alignment and uniform top surface. Protect newly laid pavers with plywood panels on which workers can stand. Advance protective panels as work progresses, but maintain protection in areas subject to continued movement of materials and equipment to avoid creating depressions or disrupting alignment of pavers. If additional leveling of paving is required, and before treating joints, roll paving with power roller after sufficient heat has built up in the surface from several days of hot weather.
6. Joint Treatment: Place unit pavers with hand-tight joints. Fill joints by sweeping sand over paved surface until joints are filled. Remove excess sand after joints are filled.

F. Mortar Setting-Bed Applications

1. Saturate concrete sub-base with clean water several hours before placing setting bed. Remove surface water about one hour before placing setting bed.
2. Apply mortar-bed bond coat over surface of concrete sub-base about 15 minutes before placing setting bed. Limit area of bond coat to avoid its drying out before placing setting bed. Do not exceed 1/16-inch (1.6-mm) thickness for bond coat.
3. Apply mortar bed over bond coat immediately after applying bond coat. Spread and screed to subgrade elevations required for accurate setting of pavers to finished grades indicated.
4. Place reinforcing wire over concrete sub-base, lapped at joints by at least one full mesh and supported so mesh becomes embedded in the middle of setting bed. Hold edges back from vertical surfaces approximately 1/2 inch (13 mm).
5. Place mortar bed with reinforcing wire fully embedded in middle of setting bed. Spread and screed setting bed to uniform thickness at subgrade elevations required for accurate setting of pavers to finished grades indicated.
6. Mix and place only that amount of mortar that can be covered with pavers before initial set. Cut back and discard setting-bed material that has reached initial set before placing pavers.
7. Wet brick pavers before laying if the initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.
8. Place pavers before initial set of cement occurs. Immediately before placing pavers, apply uniform 1/16-inch- (1.5-mm-) thick, slurry bond coat to bed or to back of each paver.
9. Tamp or beat pavers with a wooden block or rubber mallet to obtain full contact with setting bed and to bring finished surfaces within indicated tolerances. Set each paver in a single operation before initial set of mortar; do not return to areas already set or disturb pavers for purposes of realigning finished surfaces or adjusting joints.
10. Spaced Joint Widths: Provide 3/8-inch (10-mm) **OR** 1/2-inch (13-mm) **OR** 3/4-inch (19-mm), **as directed**, nominal joint width with variations not exceeding plus or minus 1/16 inch (1.5 mm) **OR** 1/8 inch (3 mm) **OR** 3/16 inch (4.5 mm), **as directed**.
11. Grouted Joints: Grout paver joints complying with ANSI A108.10.
12. Grout joints as soon as possible after initial set of setting bed.
 - a. Force grout into joints, taking care not to smear grout on adjoining surfaces.
 - b. Clean pavers as grouting progresses by dry brushing or rubbing with dry burlap to remove smears before tooling joints.
 - c. Tool exposed joints slightly concave when thumbprint hard.
 - d. If tooling squeezes grout from joints, remove excess grout and smears by dry brushing or rubbing with dry burlap and tool joints again to produce a uniform appearance.
13. Cure grout by maintaining in a damp condition for seven days, unless otherwise recommended by grout or liquid-latex manufacturer.

G. Repairing, Pointing, And Cleaning

1. Remove and replace unit pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.
2. Pointing: During tooling of joints, enlarge voids or holes and completely fill with grout. Point joints at sealant joints to provide a neat, uniform appearance, properly prepared for sealant application.



-
3. Cleaning: Remove excess grout from exposed paver surfaces; wash and scrub clean.
 - a. Remove temporary protective coating as recommended by coating manufacturer and as acceptable to paver and grout manufacturers.
 - b. Do not allow protective coating to enter floor drains. Trap, collect, and remove coating material.

END OF SECTION 31 25 14 23



Task	Specification	Specification Description
31 25 14 23	01 56 26 00	Sediment Removal
31 25 14 23	31 25 14 13	Geosynthetic Fabric
31 25 14 23	01 56 26 00a	Erosion Control



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SECTION 31 25 14 26 - SILT FENCES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing of labor, material and equipment for the installation of silt fencing.

1.2 PRODUCTS

A. Materials

1. Fabricated Units
 - a. Posts: 36" long, 2" hardwood or "T" or "U" type steel.
 - b. Fence: Woven wire, 14-1/2 ga. 6-inch max. mesh opening.
 - c. Filter Cloth: MIRAFL 100X or approved equal.
2. Prefabricated Units
 - a. Envirofence by MIRAFL or approved equal.

1.3 EXECUTION

- A. The Contractor shall provide and install silt fences as directed by the Owner. It shall be the Contractor's option to provide fabricated reinforced silt fence or prefabricated units, unless otherwise directed. In all installations, the bottom flap of filter cloth shall be firmly embedded into undisturbed or stabilized grade. Embedment shall resist pullout and prevent flow under the installation.

END OF SECTION 31 25 14 26



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Task	Specification	Specification Description
31 25 14 26	01 56 26 00	Sediment Removal
31 25 14 26	01 56 26 00a	Erosion Control



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SECTION 31 31 19 13 - SOIL STERILIZATION

1.1 GENERAL

A. Description Of Work

1. This specification covers soil sterilization. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations.

1.2 PRODUCTS

- A. Weed Eradication and Soil Fumigation: Products approved by the Environmental Protection Agency.
- B. Liquid and Dry Herbicides:
 1. Bare Ground Herbicides: Bromacil powder mixture or an ammonium sulfamate spray.
 2. Wetting Agents: As required.
- C. Equipment: Equipment shall be appropriate to the application and approved before use by the Owner.

1.3 EXECUTION

- A. Soil: After the subgrade has been prepared, all areas to be surfaced shall be treated with a weed eradicator and soil fumigant only in the designated areas.
- B. Wetting Agents may be used as an additive to improve the performance of weed and brush herbicides.

END OF SECTION 31 31 19 13



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SECTION 31 32 13 16 - SOIL STABILIZATION-LIME**1.1 GENERAL****A. Description Of Work**

1. This specification covers furnishing of materials and the preparation and production of a stabilized subgrade by the addition of hydrated lime to the native material.

1.2 PRODUCTS**A. Hydrated lime material requirements shall be as follows:**

1. Available Lime Index as Calcium Hydroxide: 90 percent minimum.
2. Residue retained on No. 30 Sieve: 1 percent maximum.
3. Residue retained on No. 200 Sieve: 20 percent maximum.

1.3 EXECUTION:

- A. Preparation: Scarify the subgrade to the depth required and pulverize the material until it is substantially free of lumps greater than three inches in diameter.
- B. Installation: Lime shall be applied to the pulverized material as a slurry, unless otherwise directed. Water shall be added as needed to provide a moisture content of not less than 20 percent. Surface-applied lime slurry shall be plowed and/or disked into the soil as necessary. The resulting mixture shall be aged for not less than 48 hours before compaction.

END OF SECTION 31 32 13 16



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SECTION 31 32 13 19 - SOIL STABILIZATION-VIBROFLOTATION

1.1 GENERAL

- A. This specification covers soil stabilization of sandy subsurfaces by the method of vibroflotation.

1.2 PRODUCTS - (Not Used)

1.3 EXECUTION

- A. The vibroflotation process shall be applied only to areas of clean, granular soils, with not over 20 percent silt or 10 percent clay. Vibrators shall be water-jetted into the soil mass to the depth required. The vibrator shall be withdrawn in 1 foot increments as the saturated soil compacts laterally and at a rate of approximately 1 ft/min to a minimum relative density of 70 percent. As the surface crater forms, sand or crushed rock shall be added and compacted to the appropriate line and grade. The horizontal distance between successive treatments shall not exceed 5 feet, or as directed.

END OF SECTION 31 32 13 19



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Task	Specification	Specification Description
31 32 13 19	31 32 13 16	Soil Stabilization-Lime
31 32 13 29	31 32 13 16	Soil Stabilization-Lime
31 32 19 13	31 32 13 16	Soil Stabilization-Lime
31 32 19 13	31 25 14 13	Geosynthetic Fabric



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SECTION 31 32 19 16 - SEWAGE TREATMENT LAGOONS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for the repair and maintenance of sewage treatment lagoons. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: For each type of product indicated.

1.2 PRODUCTS**A. Materials**

1. Concrete Block shall comply with ASTM C 129.
2. Concrete Grout shall comply with Fed. Spec. MMM-A-001993.
3. Riprap Stone shall comply with AREA-01.
4. Concrete Repair Material shall comply with Fed. Spec. MMM-A-001993.
5. Sand shall comply with ASTM C 33.
6. Portland Cement shall comply with ASTM C 150, Type V.
7. Rubble shall consist of broken concrete or broken stone.

1.3 EXECUTION

- A. Algae Removal shall be by mechanical or manual methods and shall include, but not be limited to, skimming, pumping through a screen, raking, or draining and cleaning the lagoon.
- B. Slope and Dike Reconstruction shall be made to re-establish the original design configuration and grades. Place riprap, where required, so that its angle of repose is not exceeded.
- C. Liner Reconstruction and Repair shall be made with materials compatible with the existing liner and compatible with the wastewater and sludge to be contained therein.
- D. Repairs to Elastomeric Membrane Liners shall be made with like material and shall overlap all cuts, tears, fractures or other defects a minimum of 4 inches. Cut repair pieces square or rectangular. The method of bonding the new material to existing material shall be similar to the original joint banding method, except when the original joints have failed. In this case, the material supplier shall demonstrate that an alternate jointing system shall be satisfactory to the Owner. Replace earth or sand cover removed during repair or replacement of plastic liner to the same thickness as the original installation.
- E. Repairs to Non-Elastomeric Membrane Liners shall be made by cutting out defective areas back to sound liner material and replacing with similar material. Joints shall be watertight.

END OF SECTION 31 32 19 16



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SECTION 31 32 19 16a - POND RESERVOIR LINERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for pond and reservoir liners. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes geomembrane liners and floating covers for ponds and reservoirs.

C. Definitions

1. Plastics Terminology: See ASTM D 1600 for definitions of abbreviated terms for plastics not otherwise defined in this Section.
2. CSPE: Chlorosulfonated polyethylene.
3. EIA: Ethylene interpolymer alloy.
4. EPDM: Ethylene-propylene-diene terpolymer.
5. PE: Polyethylene.
6. PP: Polypropylene.

D. Performance Requirements

1. Provide geomembrane liners and floating covers, **as directed**, that prevent the passage of water and gas, **as directed**.

E. Submittals

1. Product Data: For each type of product indicated. Include the following:
 - a. Sheets for geomembrane liners and floating covers.
 - b. Seaming adhesives, solvents, and extrusions.
 - c. Penetration assemblies.
 - d. Accessories for floating covers.
2. Shop Drawings: Show fabrication and installation details for geomembrane liners. Show panel layout, seams, penetrations, perimeter anchorage, floating cover, and methods of attachment and sealing to other construction. Differentiate between factory and field seams and joints.
3. Samples: For the following products, in sizes indicated:
 - a. Geomembrane Panels: For each type, not less than one 12-inch (300-mm) seam length for factory-bonded sheets and one 12-inch (300-mm) seam length for field-bonded sheets.
4. Qualification Data: For qualified Installer **OR** testing agency, **as directed**.
5. Product Certificates: For each type of geomembrane liner and floating cover, from manufacturer.
6. Product Test Reports: For each geomembrane sheet, based on evaluation of comprehensive tests performed by a qualified testing agency.
7. Source quality-control reports.
8. Field quality-control reports.
9. Maintenance Data: For geomembrane liner and floating cover to include in maintenance manuals.
10. Warranty: Special warranty specified in this Section.

F. Quality Assurance

1. Installer Qualifications: Fabricator of products **OR** An employer of workers trained and approved by manufacturer, **as directed**.
2. Source Limitations: Obtain geomembrane liner and floating cover, accessories, and required seaming materials, solvents, and adhesives from single source.
3. Preinstallation Conference: Conduct conference at Project site.



- a. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
- b. Review structural load limitations.
- c. Review limitations on equipment and Installer's personnel.
- d. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
- e. Review required testing, inspecting, and certifying procedures.
- f. Review existing and forecasted weather conditions and procedures for unfavorable conditions.

G. Project Conditions

1. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit placement and seaming of geomembrane liners and floating covers to be performed according to manufacturers' written instructions and warranty requirements.

H. Warranty

1. Special Warranty: Specified form in which geomembrane manufacturer, geomembrane liner and floating cover fabricator, and geomembrane liner and floating cover Installer agree to repair or replace geomembrane liner and floating cover that fail(s) in materials or workmanship or that deteriorate(s) under conditions of normal weather within specified warranty period. Warranty does not include deterioration or failure of geomembrane liner and floating cover due to exposure to harmful chemicals, gases or vapors, abnormal and severe weather phenomena, fire, earthquakes, floods, vandalism, or abuse by persons, animals, or equipment.
 - a. Failures include, but are not limited to, the following:
 - 1) Leaks in geomembrane liner and floating cover.
 - 2) Defects in seams.
 - 3) Cracks and holes in floating cover.
 - b. Warranty Period: One **OR** Five **OR** 10, **as directed**, year(s) from date of Final Completion.

1.2 PRODUCTS

A. CSPE Sheet Materials

1. CSPE Sheet: Formulated from CSPE for use in hydraulic structures and formed into uniform, flexible sheets.
 - a. Reinforcing Scrim: One-ply polyester fabric totally encapsulated between two sheets.
 - 1) Construction: 6 x 6 - 1000 d **OR** 8 x 8 - 250 d **OR** 10 x 10 - 1000 d, **as directed**.
 - b. Nominal Thickness: 45-mil- (1.14-mm-) thick sheet per ASTM D 5199 or ASTM D 751, Optical Method.
 - c. Nominal Thickness over Scrim: 11-mil- (0.28-mm-) thick sheet per ASTM D 5199 or ASTM D 751, Optical Method.
 - d. Breaking Strength: Not less than 200 lbf (0.89 kN) minimum average per ASTM D 751, Procedure A.
 - e. Tear Strength, Initial: Not less than 70 lbf (0.31 kN) minimum average per ASTM D 5884 or ASTM D 751, Procedure B.
 - f. Tear Strength, after Aging: Not less than 35 lbf (0.16 kN) minimum average per ASTM D 5884 or ASTM D 751, Procedure B.
 - g. Puncture Resistance: Not less than 200 lbf (0.89 kN) minimum average per ASTM D 4833.
 - h. Hydrostatic Resistance: Not less than 250-psi (1725-kPa) minimum average resistance per ASTM D 5514, Procedure A or ASTM D 751, Method A, Procedure 1.
 - i. Dimensional Stability, Reinforced Sheet: Not more than plus or minus 2 percent per ASTM D 1204.
 - j. Low-Temperature Flexibility: Pass, 1/8-inch (3-mm) mandrel, four hours at minus 40 deg F (minus 40 deg C), and per ASTM D 2136.



- k. UV-Light Resistance: Pass, 4000 hours at 176 deg F (80 deg C), per ASTM G 155.
- l. Ply Adhesion: Not less than 7 lbf/in. (1.2 kN/m) **OR** 10 lbf/in. (1.75 kN/m), **as directed**, of seam width, or film tearing bond, according to ASTM D 413, Machine Method.
- m. Water Absorption (for low-water-absorption CSPE): Not more than 2 percent at 70 deg F (21 deg C) and not more than 30 percent at 158 deg F (70 deg C) for 30 days each per ASTM D 471, 30-mil- (0.76-mm-) thick sheet.

B. EIA Sheet Materials

- 1. EIA Sheet: Formulated from EIA for use in hydraulic structures and formed into uniform, flexible sheets.
 - a. Reinforcing Scrim: One-ply polyester fabric totally encapsulated between two sheets.
 - 1) Construction: 6 x 6 - 1000 d **OR** 8 x 8 - 500 d **OR** 10 x 10 - 1000 d **OR** 10 x 11 - 2520 d x 2000 d, **as directed**.
 - b. Nominal Thickness: 36-mil- (0.91-mm-) thick sheet per ASTM D 1593 or ASTM D 751, Optical Method.
 - c. Tensile Strength: Not less than 400 lbf (1.8 kN) minimum average per ASTM D 751, Procedure A.
 - d. Tear Strength: Not less than 35 lbf (0.16 kN) minimum average per ASTM D 5884 or ASTM D 751, Procedure B.
 - e. Puncture Resistance: Not less than 150 lbf (0.67 kN) minimum average per ASTM D 4833.
 - f. Hydrostatic Resistance: Not less than 100-psi (690-kPa) minimum average resistance per ASTM D 751, Procedure A.
 - g. Dimensional Stability, Reinforced Sheet: Not more than plus or minus 2 percent per ASTM D 1204.
 - h. Low-Temperature Flexibility: Pass, 1/8-inch (3-mm) mandrel, four hours at minus 30 deg F (minus 34 deg C), and per ASTM D 2136.
 - i. UV-Light Resistance: Pass, 4000 hours at 176 deg F (80 deg C), per ASTM G 155.
 - j. Ply Adhesion: Not less than 7 lbf/in. (1.2 kN/m) **OR** 10 lbf/in. (1.75 kN/m), **as directed**, of seam width, or film tearing bond, according to ASTM D 413, Machine Method.

C. EPDM Sheet Materials

- 1. EPDM Sheet: Formulated from EPDM, compounded for use in hydraulic structures and formed into uniform, flexible sheets.
 - a. Reinforcing Scrim: One-ply polyester fabric totally encapsulated between two sheets.
 - 1) Construction: 9 x 9 - 1000 d **OR** 10 x 10 - 1000 d, **as directed**.
 - b. Nominal Thickness: 45-mil- (1.14-mm-) thick sheet per ASTM D 5199 or ASTM D 751, Optical Method.
 - c. Breaking Strength: Not less than 190 lbf (0.85 kN) minimum average per ASTM D 882, ASTM D 7004, or ASTM D 751, Procedure A.
 - d. Tear Resistance: Not less than 130 lb (0.58 kN) minimum average per ASTM D 1004.
 - e. Puncture Strength: Not less than 60 lbf (0.27 kN) minimum average per ASTM D 4833.

D. PE Sheet Materials

- 1. PE Sheet: Formulated from virgin PE, compounded for use in hydraulic structures, and formed into uniform sheets.
 - a. Sheet Texture: One side smooth; other side smooth **OR** textured, **as directed**.
 - b. Nominal Density: Low density, 0.910 to 0.925 g/cu. cm **OR** Linear low density, 0.919 to 0.925 g/cu. cm **OR** Medium density, 0.926 to 0.939 g/cu. cm **OR** High density, 0.940 to 0.959 g/cu. Cm, **as directed**, per ASTM D 1505.
 - c. Nominal Thickness: 60-mil- (1.5-mm-) thick sheet per ASTM D 5199 **OR** ASTM D 5994, **as directed**.
 - d. Melt Flow Index: Not more than 0.035 oz./10 minutes (1.0 g/10 minutes) per ASTM D 1238, Condition 190/2.16.
 - e. Carbon Black Content: 2 to 3 percent per ASTM D 1603 or ASTM D 4218.
 - f. Carbon Black Dispersion: Per ASTM D 5596, Category 1 and 2.



- g. Oxidation Induction Time: Not less than 100 minutes per ASTM D 3895.
 - h. Tensile Properties: Not less than indicated for each direction, per ASTM D 638, Type IV or ASTM D 6693, Type IV.
 - 1) Strength at Yield: Not less than 126 lbf/in. (22 kN/m) and 2100 psi (14.5 MPa) minimum average.
 - 2) Strength at Break: Not less than 228 lbf/in. (40 kN/m) and 3800 psi (26.2 MPa) minimum average.
 - 3) Elongation at Yield: Not less than 12 percent minimum average.
 - 4) Elongation at Break: Not less than 700 percent minimum average.
 - i. Tear Resistance: Not less than 39 lbf (0.18 kN) minimum average per ASTM D 1004.
 - j. Puncture Resistance: Not less than 108 lbf (0.48 kN) minimum average per ASTM D 4833.
 - k. Dimensional Stability, Reinforced Sheet: Not more than plus or minus 2 percent per ASTM D 1204.
 - l. Low-Temperature Brittleness: Four hours at minus 76 deg F (minus 60 deg C) per ASTM D 746.
 - m. Environmental Stress Cracking Resistance: Not less than 1500 hours per ASTM D 1693, Condition B.
- E. PP Sheet Materials
- 1. PP Sheet: Formulated from virgin PP, compounded for use in hydraulic structures, and formed into uniform, flexible sheets.
 - a. Reinforcing Scrim: One-ply polyester fabric totally encapsulated between two sheets.
 - 1) Construction: 9 x 9 - 1000 d **OR** 10 x 10 - 1000 d, **as directed**.
 - b. Sheet Texture: One side smooth; other side smooth **OR** textured, **as directed**.
 - c. Nominal Thickness: 45-mil- (1.14-mm-) thick sheet per ASTM D 5199 or ASTM D 751, Optical Method **OR** ASTM D 5994, **as directed**.
 - d. Tensile Strength: Not less than 250 lbf (1.1 kN) minimum average per ASTM D 412, ASTM D 7003, ASTM D 6693, or ASTM D 751, Procedure A.
 - e. Tear Resistance: Not less than 55 lbf (0.24 kN) minimum average per ASTM D 1004, ASTM D 5884, ASTM D 7003, or ASTM D 751, Procedure B.
 - f. Puncture Resistance: Not less than 200 lbf (0.88 kN) minimum average per ASTM D 4833 or ASTM D 7003.
 - g. Low-Temperature Flexibility: Pass, 1/8-inch (3-mm) mandrel, four hours at minus 40 deg F (minus 40 deg C), and per ASTM D 2136.
 - h. Hydrostatic Resistance: Not less than 250-psi (1725-kPa) minimum average resistance per ASTM D 5514, Procedure A or ASTM D 751, Method A, Procedure 1.
 - i. Dimensional Stability, Reinforced Sheet: Not more than plus or minus 1 percent per ASTM D 1204.
 - j. Ply Adhesion: Not less than 20 lbf/in. (3.5 kN/m) of seam width, or film tearing bond, according to ASTM D 413, Machine Method.
- F. PVC Sheet Materials
- 1. PVC Sheet: Formulated from virgin PVC with plasticizers and other modifiers, compounded for use in hydraulic structures, and formed into uniform, flexible sheets with material properties complying with ASTM D 7176 **OR** PGI 1104, "Specification for PVC Geomembranes", **as directed**, for nominal thickness indicated.
 - a. Nominal Thickness: 10 mils (0.25 mm) **OR** 20 mils (0.51 mm) **OR** 30 mils (0.76 mm) **OR** 40 mils (1.02 mm) **OR** 50 mils (1.3 mm) **OR** 60 mils (1.5 mm), **as directed**.
 - b. Sheet Texture: One side smooth; other side smooth **OR** matte **OR** faille textured, **as directed**.
- G. Floating Cover Accessories
- 1. Screened Scupper Hoses: Manufacturer's standard.



2. Flotation Blocks: Closed-cell polyethylene foam blocks approximately 4 by 12 inches (102 by 300 mm), 2.2 lb/cu. ft. (35.2 kg/cu. m).
3. Access Hatch: Manufacturer's standard, in size indicated.

H. Miscellaneous Materials

1. Adhesives: Provide types of adhesive primers, compounds, solvents, and tapes recommended in writing by geomembrane liner manufacturer for bonding to structures (if required), for sealing of seams in geomembrane liner, and for sealing penetrations through geomembrane liner.
2. Penetration Assemblies: Provide manufacturer's standard factory-fabricated assemblies for sealing penetrations. Include joint sealant recommended in writing by geomembrane liner manufacturer and compatible with geomembrane liner, containment conditions, and materials.
3. Battens: Long-length strips of material indicated, size as shown on Drawings. Fabricate battens with sharp projections removed and edges eased and then predrilled or punched for anchors. Provide anchors, or other type of attachment, of type and spacing recommended in writing by geomembrane liner manufacturer for attaching geomembrane liner system to substrate and as indicated.
 - a. Batten Material: Liner manufacturer's standard system.
OR
Batten Material: Aluminum; with stainless-steel anchors, complete with gasket and sealant compatible with geomembrane liner, containment conditions, and materials.
OR
Batten Material: Stainless steel; with stainless-steel anchors, complete with gasket and sealant compatible with geomembrane liner, containment conditions, and materials.
OR
Batten Material: Plastic compatible with geomembrane liner, cast in place or fastened with stainless-steel anchors, designed to continuously seal geomembrane liner to batten.
4. Sand: ASTM C 33; fine aggregate, natural or manufactured sand.

I. Fabrication

1. Fabricate geomembrane liner and floating cover, **as directed**, panels from sheets in sizes as large as possible with factory-sealed seams, consistent with limitations of weight and installation procedures. Minimize field seaming.
2. Fabricate flotation blocks, wrap in geomembrane, and attach to underside of floating cover according to manufacturer's written instructions.
3. Fabricate ballast tubes of sand-filled geomembrane and attach to top surface of floating cover according to manufacturer's written instructions.
4. Install built-in accessories, hatches, access panels, vents, and walkways on geomembrane floating cover.

J. Source Quality Control

1. Testing Agency: Engage a qualified testing agency to evaluate geomembrane seams.
2. Destructive Testing: Test for bonded seam strength and peel adhesion every 3000 feet (915 m) or once per panel, whichever is more frequent.
3. CSPE Liner and Floating Cover: Test and inspect factory seams, according to ASTM D 4545, for peel adhesion not less than 10 lbf/in. (1.75 kN/m) of seam width and for bonded seam strength not less than 180 lbf/in. (32 kN/m) of seam width for seams constructed from two scrim-reinforced sheets, each with nominal sheet thickness of not less than 45 mils (1.14 mm).
4. EIA Liner and Floating Cover: Test and inspect factory seams, according to ASTM D 4545, for peel adhesion not less than 10 lbf/in. (1.75 kN/m) of seam width and for bonded seam strength not less than 270 lbf/in. (48 kN/m) of seam width for seams constructed from two scrim-reinforced sheets, each with nominal sheet thickness of not less than 36 mils (0.91 mm).
5. EPDM Liner: Test and inspect factory seams, according to ASTM D 4545, for peel adhesion not less than 10 lbf/in. (1.75 kN/m) of seam width and for bonded seam strength not less than 160 lbf/in. (28 kN/m) of seam width for seams constructed from two scrim-reinforced sheets, each with nominal sheet thickness of not less than 45 mils (1.14 mm).



6. PE Liner: Test and inspect factory seams, according to ASTM D 4545, for peel adhesion and for bonded seam strength indicated.
 - a. Peel Adhesion/Extrusion: Film tear bond and not less than 78 lbf/in. (13.7 kN/m) of extrusion-bonded seam width.
OR
Peel Adhesion/Fusion: Film tear bond and not less than 90 lbf/in. (15.8 kN/m) of fused seam width.
 - b. Bonded Seam Strength: Not less than 120 lbf/in. (21 kN/m) of seam width for seams constructed from two scrim-reinforced sheets, each with nominal sheet thickness of not less than 45 mils (1.14 mm).
7. PP Liner and Floating Cover: Test and inspect factory seams, according to ASTM D 4545, for peel adhesion not less than 20 lbf/in. (3.5 kN/m) of seam width and for bonded seam strength not less than 200 lbf/in. (35 kN/m) of seam width for seams constructed from two scrim-reinforced sheets, each with nominal sheet thickness of not less than 45 mils (1.14 mm).
8. PVC Liner and Floating Cover: Test and inspect factory seams, according to ASTM D 4545, for peel adhesion not less than 10 lbf/in. (1.75 kN/m) of seam width and for bonded seam strength not less than that indicated below for seams constructed from two sheets of minimum nominal thickness indicated for each:
 - a. Bonded Seam Strength for 10-mil- (0.25-mm-) Thick Sheets: 20 lbf/in. (3.5 kN/m) of seam width.
 - b. Bonded Seam Strength for 20-mil- (0.51-mm-) Thick Sheets: 38.5 lbf/in. (6.7 kN/m) of seam width.
 - c. Bonded Seam Strength for 30-mil- (0.76-mm-) Thick Sheets: 58.4 lbf/in. (10.2 kN/m) of seam width.
 - d. Bonded Seam Strength for 40-mil- (1.02-mm-) Thick Sheets: 77.6 lbf/in. (13.6 kN/m) of seam width.
 - e. Bonded Seam Strength for 50-mil- (1.3-mm-) Thick Sheets: 96 lbf/in. (16.8 kN/m) of seam width.
 - f. Bonded Seam Strength for 60-mil- (1.5-mm-) Thick Sheets: 116 lbf/in. (20.3 kN/m) of seam width.

1.3 EXECUTION

A. Examination

1. Examine substrates, with Installer present, for compliance with requirements for soil compaction and grading; for subgrade free from angular rocks, rubble, roots, vegetation, debris, voids, protrusions, and ground water; and for other conditions affecting performance of geomembrane liner.
2. Examine anchor trench excavation **OR** concrete perimeter, **as directed**, where geomembrane liner and floating cover, **as directed**, will be secured, for substrate conditions indicated above and for correct location and configuration.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Preparation

1. Provide temporary ballast, until edges are permanently secured, that does not damage geomembrane liner or substrate, to prevent uplift of geomembrane liner in areas with prevailing winds.
2. Prepare surfaces of construction penetrating through geomembrane liner according to geomembrane liner manufacturer's written instructions.
3. Remove curing compounds and coatings from concrete surfaces to be sealed to geomembrane liner.

C. Installation



1. General: Place geomembrane liner over prepared surfaces to ensure minimum handling. Install according to Shop Drawings and in compliance with geomembrane liner manufacturer's written instructions. Begin placing geomembrane liner at Project's upwind direction and proceed downwind. Install geomembrane liner in a relaxed condition, free from stress and with minimum wrinkles, and in full contact with subgrade. Do not bridge over voids or low areas in the subgrade. Fit closely and seal around inlets, outlets, and other projections through geomembrane liner. Permanently secure edges.
 2. Field Seams: Comply with geomembrane liner and floating cover manufacturer's written instructions. Form seams by lapping edges of panels 2 to 4 inches (50 to 102 mm) unless instructions require a larger overlap. Wipe contact surfaces clean and free of dirt, dust, moisture, and other foreign materials. Use solvent-cleaning methods and grind geomembrane seam surfaces if recommended by geomembrane liner manufacturer. Proceed with seaming at required temperatures for materials and ambient conditions. Continuously bond sheet to sheet to construct single or double seams of width recommended for method of seaming used. Seal or fuse free seam edges. Inspect seams and reseal voids.
 - a. Adhesive Bonding: Apply bonding cement to both contact surfaces in seam area and press together immediately, or use other seaming methods as instructed by geomembrane liner manufacturer. Roll to press surfaces together, to distribute adhesive to leading edges of panels, and to remove wrinkles and fishmouths. Remove excess adhesive.
OR
Thermal Bonding: Use thermal-welding technique recommended by geomembrane liner manufacturer. Apply pressure to smoothly bond surfaces together. Examine for and patch wrinkles and fishmouths.
 3. Installation in Anchor Trench: Install geomembrane liner and floating cover in trench according to manufacturer's written instructions. Backfill and compact to lock liner into trench.
 4. Attachment to Concrete: Use manufacturer's standard system to suit Project conditions. Support adhesive and geomembrane on minimum 8-inch- (200-mm-) wide concrete substrate unless otherwise indicated.
 - a. Install batten strips over geomembrane liner and floating cover as shown on Drawings.
 - b. Install antichafing strips of geomembrane sheet between geomembrane liner and floating cover according to manufacturer's written instructions.
 - c. Install floating cover with perimeter fold.
 5. Floating Cover Flotation Control: Connect drainage hoses in perimeter fold, sumps, or scuppers to pump or gravity drain system.
 6. Liner Repairs: Repair tears, punctures, and other imperfections in geomembrane liner field and seams using patches of geomembrane liner material, liner-to-liner bonding materials, and bonding methods according to geomembrane liner manufacturer's written instructions. Apply bonding solvent or weld to contact surfaces of both patch and geomembrane liner, and press together immediately. Roll to remove wrinkles.
- D. Field Quality Control
1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
 2. Nondestructive Testing: Visually inspect seams and patches. Comply with ASTM D 4437 for Air Lance Test, Vacuum Box Testing, or Ultrasonic (High Frequency) Pulse Echo Testing or with GRI Test Method GM6, as applicable to geomembrane liner and floating cover and seam construction. Record locations of failed seams and patches. Individually number and date occurrences and details of leak and remedial action. Repair leaking seams and patches.
 3. Prepare test and inspection reports.
- E. Disinfection
1. Disinfect the complete installation according to procedures in AWWA C652.
- F. Protection
1. Protect installed geomembrane liner and floating cover according to manufacturer's written instructions. Repair or replace areas of geomembrane liner damaged by scuffing, punctures, traffic, rough subgrade, or other unacceptable conditions.



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2. Before initial filling of pond or placement of earth cover, inspect seams and patched areas to ensure tight, continuously bonded installation. Repair damaged geomembrane and seams and reinspect repaired work.

END OF SECTION 31 32 19 16a



Task	Specification	Specification Description
31 32 19 16	22 05 23 00	Piped Utilities Basic Materials And Methods
31 32 19 16	31 32 13 16	Soil Stabilization-Lime
31 32 19 16	31 25 14 13	Geosynthetic Fabric



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SECTION 31 36 13 00 - WIRE MESH GABIONS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of wire mesh gabions. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

- #### B. Description:
- Gabion units shall consist of compartmented rectangular basket containers filled with stone. The required sizes of the gabion units are Length times Width times Depth. Twisted or welded wire mesh shall be used. Baskets shall be fabricated from galvanized steel wire formed into a nonraveling mesh.

C. Submittals

1. Samples: Stone fill material submitted for approval prior to delivery.

1.2 PRODUCTS

- #### A. Steel Twisted Wire Mesh Gabions:
- Gabion basket units shall be of nonraveling construction and fabricated from a double twisted hexagonal wire mesh. The size of mesh openings shall be approximately 3-1/4 in. by 4-1/2 in. (80 by 115 mm). The gabion mesh wires shall be wrapped around the selvage wire no less than 1 1/2 times and shall interconnect with adjacent mesh wires. All steel wire used shall be galvanized prior to fabrication into mesh. All gabion diaphragm and frame wire shall equal or exceed ASTM A 641, and possess soft tensile strength of 60,000 psi (415 Mpa) with a tolerance of minus 2,000 psi (14 Mpa). The galvanized wire shall have a Finish 5, Class 3, zinc coating, as indicated in ASTM A 641. The weight of coating shall be determined by ASTM A 90. The grade of zinc used for coating shall be High Grade or Special High Grade as prescribed in ASTM B 6, Table 1. The uniformity of coating shall equal or exceed four 1-minute dips by the Preece Test, as determined by ASTM A 239.
- #### B. Steel Welded Wire Mesh Gabions:
- Gabion basket units shall be of nonraveling construction and fabricated from a welded square wire mesh. The size of mesh openings shall be approximately 3 in. by 3 in. (75 by 75 mm). The welded joints of the wire mesh shall conform to ASTM A 185 except that the weld shears shall be at least 600 lbs (2700 N). All gabion diaphragm and frame wire shall equal or exceed ASTM A 641, and possess soft tensile strength of 60,000 psi (415 Mpa) with a tolerance of minus 2,000 psi (14 Mpa). The galvanized wire shall have a Finish 5 Class 3 zinc coating, indicated in ASTM A 641. The weight of coating shall be determined by ASTM A 90. The grade of zinc used for coating shall be High Grade or Special High Grade as prescribed in ASTM B 6, Table 1. The uniformity of coating shall equal or exceed four 1-minute dips by the Preece Test, as determined by ASTM A 239.
- #### C. Mesh wire shall be minimum 0.120-in. (3.05 mm) diameter after coating with 0.85 oz/sq ft (240 g/sq m) zinc coating.
- #### D. Selvage wire shall be minimum 0.150-in. (3.80 mm) diameter after coating with 0.85 oz/sq ft (240 g/sq m) zinc coating.
- #### E. Wire used for lacing or as internal connecting wire within basket cells shall be minimum 0.087-in. (2.21 mm) diameter after coating with 0.70 oz/sq ft (220 g/sq m) zinc coating and may have soft tensile strength designation.
- #### F. Stone Fill



1. **Quality:** Stone shall be durable and of suitable quality to ensure permanence in the structure and climate in which it is to be used. It shall be free of cracks, seams, and other defects that would tend to increase unduly its deterioration from natural causes or reduce its size to that which could not be retained in the gabion baskets. The inclusion of more than 5% by weight of dirt, sand, clay, and rock fines will not be permitted. The sources from which the Contractor proposes to obtain the material shall be selected well in advance of the time when the material will be required in the work. Suitable samples of stone fill material shall be collected in the presence of the Owner's representative and submitted to the Owner for approval prior to delivery of any such material to the site of the work. Unless otherwise specified, all test samples shall be obtained by the Contractor and delivered at its expense to the Owner. Suitable tests and/or service records will be used to determine the acceptability of the stone. In the event suitable test reports and service records are not available, the material shall be subjected to such tests as are necessary to determine its acceptability for use in the work. Tests to which the material may be subjected include petrographic analysis, specific gravity, absorption, wetting and drying, freezing and thawing, and such other tests as may be considered necessary to demonstrate to the satisfaction of the Owner that the materials are acceptable for use in the work.
2. **Gradation:** Stone fill used in the gabions shall be a well-graded mixture with sizes ranging between 4 in. and 8 in. (100 and 200 mm), based on US Standard square mesh sieves. No stone shall have a minimum dimension less than 4 in. (100 mm) and a maximum dimension greater than 12 in. (300 mm) in any direction. The ratio of the maximum dimension to the minimum dimension shall not be greater than two. If the height of the gabion basket is 12 in. (300 mm) or less, stone shall have no dimensions greater than 8 in. (200 mm) in any direction.
3. **Filter Material:** The material shall be composed of tough durable particles, reasonably free from thin, flat, and elongated pieces, and contain no organic matter or soft friable particles in quantities considered objectionable by the Owner. Filter material shall consist of sand and gravel or crushed stone, well graded between the prescribed limits listed below, and conform to the requirements of paragraph STONE FILL, subparagraph QUALITY as to quality.

1.3 EXECUTION:

- A. **Foundation Preparation:** No foundation preparation work shall take place on frozen or snow-covered ground. After excavation or stripping to the extent indicated on the drawings or as directed by the Owner, all remaining loose or otherwise unsuitable materials shall be removed. All depressions shall be carefully backfilled to grade. If pervious materials are encountered in the foundation depressions, the areas shall be backfilled with free-draining materials. Otherwise, the depressions shall be backfilled with suitable materials from adjacent required excavation, or other approved source, and compacted to a density at least equal to that of the adjacent foundation. Any buried debris protruding from the foundation that will impede the proper installation and final appearance of the gabion layer shall also be removed, and the voids carefully backfilled and compacted as specified above. Immediately prior to placing the material, the prepared foundation surface shall be inspected by the Owner, and no material shall be placed thereon until that area has been approved.
- B. **Filter Placement:** Filter material shall be spread uniformly on the prepared foundation surface in a manner satisfactory to the Owner, and to the slopes, lines, and grades as indicated on the drawings or as directed. Placing of filter material by methods which will tend to segregate particle sizes will not be permitted. Any damage to the foundation surface during filter placement shall be repaired before proceeding with the work. Compaction of the filter materials will not be required, but it shall be finished to present a reasonably even surface free from mounds or windrows.
- C. **Fabrication:** Gabions shall be fabricated in such a manner that the sides, ends, lid, and diaphragms can be assembled at the construction site into rectangular baskets of the sizes specified and shown on the drawings. Gabions shall be of single unit construction, i.e., the base, lid, ends, and sides shall be either woven into a single unit, or one edge of these members connected to the base section of the gabion in such a manner that the minimum strengths of the wire mesh and connections as stated in paragraph



MATERIALS are met. Where the length of the gabion exceeds one and one-half its horizontal width, the gabion shall be equally divided by diaphragms of the same mesh and gage as the body of the gabions, into cells whose length does not exceed the horizontal width. The gabion shall be furnished with the necessary diaphragms secured in proper position on the base in such a manner that no additional tying at this juncture will be necessary. For twisted wire gabions, all perimeter edges of the mesh forming the gabion shall be securely selvaged. In addition, the selvaged edges shall be so wrapped and reinforced with the mesh ends that the selvaige wire will not be deformed locally about the lacing wire or wire fasteners when baskets are filled or during lid closing. Lacing wire, connecting wire, and/or wire fasteners shall be supplied in sufficient quantity for securely fastening all diaphragms and edges of the gabion.

- D. Assembly And Installation: For gabion units in excess of 4 ft. (1.3 m) in thickness, and placed in horizontal or near horizontal position to resist high velocity flow, or as part of a stilling basin feature, a minimum of two uniformly spaced vertical connecting wires per cell linking the foundation mesh to basket lid mesh should be specified. Empty gabion units shall be assembled individually and placed on the approved surface with the sides, ends, and diaphragms erected in such a manner to ensure the correct position of all creases and that the tops of all sides are level. Filling of gabion units in one place and then transporting them to their final position in the work will not be permitted. The front row of gabion units shall be placed first and successively constructed toward the top of the slope or the back of the structure. All gabion units shall be properly staggered horizontally and vertically. Finished gabion structure shall have no gaps along the perimeter of the contact surfaces between adjoining gabion basket units. All adjoining empty gabion units shall be connected by lacing wire/or wire fasteners along the perimeter of their contact surfaces in order to obtain a monolithic structure. Lacing of adjoining basket units shall be accomplished by continuous stitching with alternating single and double loops at intervals of not more than 5 in. (125 mm), and a half hitch shall be included at every double loop. All lacing wire terminals shall be securely fastened. Wire fasteners may be used in lieu of lacing wire for forming individual baskets and joining empty baskets together prior to stone filling. All joining shall be made through selvaige-to-selvaige or selvaige-to-edge wire connection; mesh-to-mesh or selvaige-to-mesh wire connection is prohibited except in the case where baskets are offset or stacked and selvaige-to-mesh or mesh-to-mesh wire connection would be necessary. Wire fasteners shall not be used to tie or join stone-filled baskets, unless approved by the Owner. As a minimum, a fastener shall be installed at each mesh opening at the location where mesh wire meets selvaige or edge wire. The initial line of basket units shall be placed on the prepared filter layer surface and partially filled to provide anchorage against deformation and displacement during filling operations. After adjoining empty basket units are set to line and grade and common sides with adjacent units thoroughly laced or fastened, they shall be placed in tension and stretched to remove any kinks from the mesh and to a uniform alignment. The stretching of empty basket units shall be accomplished in such a manner as to prevent any possible unraveling. Stone filling operations shall carefully proceed with placement by hand or machine so as not to damage galvanized wire coating, to assure a minimum of voids between the stones, and the maintenance of alignment throughout the filling process. Undue deformation and bulging of the mesh shall be corrected prior to further stone filling. To avoid localized deformation, the basket units in any row are to be filled in stages consisting of maximum 12-in. (300 mm) courses, and at no time shall any cell be filled to a depth exceeding 1 ft. (300 mm) more than the adjoining cell. The maximum height from which the stone may be dropped into the basket units shall be 36 in. (1 m). For gabion units in excess of 2 ft. (0.67 m) in height, two uniformly spaced internal connecting wires shall be placed between each stone layer in all front and side gabion units, connecting the back and the front faces of the compartments. Connecting wires or alternatively the preformed stiffeners shall be looped around two twisted wire mesh openings or a welded wire joint at each basket face and the wire terminals shall be securely twisted to prevent their loosening. For twisted wire gabions, the internal connecting wires or preformed stiffeners are installed. For welded wire gabion units, preformed stiffeners are installed across the corners of gabion panels. Along all exposed faces, the outer layer of stone shall be carefully placed and arranged by hand to ensure a neat and compact appearance. The last layer of stone shall be uniformly overfilled 1 to 2 in. (25 to 50 mm) to compensate for the future settlement in rock but still allow for the proper closing of the lid and to provide an even surface that is uniform in appearance. Final adjustments for compaction and surface tolerance shall be done by hand. Lids shall be stretched tight over the stone fill using only an approved lid closing tool, until the lid meets the perimeter edges of



the front and end panels. Using crowbars or other single point leverage bars for lid closing shall be prohibited. The lid shall then be tightly tied with lacing wire, or with wire fasteners if approved by the Owner, along all edges, ends, and internal cell diaphragms by continuous stitching with alternating single and double loops at intervals of not more than 5 in. (125 mm), and a half hitch shall be included at every double loop. Special attention shall be given to see that all projections or wire ends are turned into the baskets. The Contractor shall have the option of providing gabion baskets with separate roll-out lids for the slope baskets. Roll-out lids shall be fabricated of the same material as the basket units and shall be furnished in widths as required for the contract work. as directed by the Owner, or where a complete gabion unit cannot be installed because of space limitations, the basket unit shall be cut, folded, and wired together to suit existing site conditions. The mesh must be cleanly cut and the surplus mesh cut out completely, or folded back and neatly wired to an adjacent gabion face. The assembling, installation, filling, lid closing, and lacing of the reshaped gabion units shall be carried out as specified above.

END OF SECTION 31 36 13 00



SECTION 31 37 00 00 - RIPRAP**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of riprap. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Demolition and removal of materials shall be as required to support the work.

1.2 PRODUCTS

- A. Riprap: Stone used for dumped riprap shall be hard, durable, angular in shape, resistant to weathering and to water action, and free from overburden, spoil, shale, and organic material. Neither width nor thickness of a single stone should be less than one third its length. Rounded stone, boulders, shale, and stone with shale seams will not be acceptable. The minimum density of the riprap material shall be 162 pounds per cubic foot. Each load of riprap shall be reasonably well graded. Sand and rock dust exceeding 5 percent by weight of each load shall not be permitted.
- B. Riprap Bedding: The riprap bedding blanket shall consist of well graded gravel, crushed rock, sand, or a combination thereof with a maximum size of 6 inches. All material comprising the riprap bedding blanket shall be composed of tough, durable particles, reasonably free from thin, flat, and elongated pieces, and shall contain no organic matter nor soft, friable particles in excess quantities.

1.3 EXECUTION

- A. Preparation: Prepare earth slopes by grading and compacting.
- B. Installation:
 1. Riprap Bedding Blanket Layers shall be placed on the prepared slope or area to develop the full thickness. Each layer shall be placed in one operation, using methods that will not cause segregation of particle sizes within the bedding. The surface of the finished layer should be reasonably even and free from mounds or windows.
 2. Stone for Riprap shall be placed on the prepared slope or area in a manner that will product a reasonably well-graded mass of stone with the minimum practicable percentage of voids. Riprap shall be placed to its full course in one operation and in such a manner as to avoid displacing the underlying material. The larger stones shall be well distributed and the entire mass of stone shall be well-graded. The result shall be a compact, uniform riprap layer.

END OF SECTION 31 37 00 00



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Task	Specification	Specification Description
31 37 00 00	31 32 19 16	Sewage Treatment Lagoons
31 41 16 13	31 23 16 13	Excavation Support And Protection
31 45 13 00	31 32 13 19	Soil Stabilization-Vibroflotation



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SECTION 31 62 13 19 - CONCRETE-FILLED STEEL PILES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for concrete-filled steel piles. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes concrete-filled steel shell and pipe piles.

C. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: For composite piles. Show fabrication and installation details for piles, including splices and tip details.
 - a. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
 - b. Indicate locations, sizes, type, and arrangement of reinforcement.
 - c. Include arrangement of static pile reaction frame, test and anchor piles, equipment, and instrumentation. Submit structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
3. Welding certificates.
4. Design Mixes: For each concrete mix. Include revised mix proportions when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
5. Material Certificates: For steel shell piles and accessories, steel pipe piles and accessories, steel reinforcement and concrete admixtures, from manufacturer.
6. Material Test Reports: For concrete materials.
7. Pile-Driving Equipment Data: Include type, make, and rated energy range; weight of striking part of hammer; weight of drive cap; and, type, size, and properties of hammer cushion.
 - a. Include mandrel type and details.
8. Static Pile Test Reports: Submit within three days of completing each test.
9. Pile-Driving Records: Submit within three days of driving each pile.
10. Field quality-control reports.
11. Preconstruction Photographs: Photographs or video of existing conditions of adjacent construction. Submit before the Work begins.

D. Quality Assurance

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
2. Comply with requirements in ACI 301, "Specifications for Structural Concrete."
3. Welding Qualifications: Qualify procedures and personnel according to the following:
 - a. AWS D1.1/D1.1M, "Structural Welding Code - Steel"
 - b. AWS D1.3, "Structural Welding Code - Sheet Steel."
4. Preinstallation Conference: Conduct conference at Project site.

E. Delivery, Storage, And Handling

1. Deliver piles to Project site in such quantities and at such times to ensure continuity of installation. Handle and store piles at Project site to prevent physical damage.
 - a. Painted Piles: Protect finish and touch up damage before driving piles.

F. Project Conditions



1. Protect structures, underground utilities, and other construction from damage caused by pile driving.
2. Preconstruction Photographs: Inventory and record the condition of adjacent structures, underground utilities, and other construction. Provide photographs **OR** video, **as directed**, of conditions that might be misconstrued as damage caused by pile driving.

1.2 PRODUCTS

A. Steel Shell Piles

1. Fluted Pile Shells: Manufacturer's standard, vertically fluted pile shells; cold formed from steel sheet; 50,000-psi (345-MPa) minimum yield strength after forming. Fabricate watertight, uniformly tapered sections with forged-steel conical nose welded to tip.
 - a. Constant Diameter Extensions: Fabricate with splice overlap capable of telescoping into tapered section.
 - b. Taper: 0.14 inch in 12 inches (1:86) **OR** 0.25 inch in 12 inches (1:48) **OR** 0.40 inch in 12 inches (1:30), **as directed**.
 - c. Thickness: 0.150 inch (3.80 mm) **OR** 0.179 inch (4.55 mm) **OR** 0.209 inch (5.31 mm) **OR** 0.239 inch (6.07 mm), **as directed**.
2. Helically Corrugated Pile Shells: Manufacturer's standard, helically corrugated, uniform-diameter, steel sheet shell piles; of sufficient strength and thickness to remain watertight and resist distortion and buckling due to soil pressure, internal mandrel operation, or re-driving. Fabricate in one-piece lengths with 3/16-inch- (4.76-mm-) thick, minimum steel-plate boot continuously welded to tip and as follows:
 - a. Nominal Diameter: 8-5/8 inches (219 mm) **OR** 10-5/8 inches (270 mm) **OR** 11-1/8 inches (283 mm) **OR** 12-1/4 inches (311 mm) **OR** 14 inches (350 mm) **OR** 16-1/8 inches (410 mm), **as directed**.
 - b. Thickness: 0.048 inch (1.21 mm), minimum **OR** 0.060 inch (1.52 mm), minimum **OR** 0.075 inch (1.90 mm), minimum **OR** 0.105 inch (2.66 mm), **as directed**.

B. Steel Pipe Piles

1. Steel Pipe: ASTM A 252, Grade 2 **OR** Grade 3, **as directed**; seamless or welded.

C. Steel Reinforcement

1. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420); deformed.
2. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M.
3. Galvanized Reinforcing Bars: ASTM A 767/A 767M, Class II zinc coated, hot-dip galvanized after fabrication and bending, as follows:
 - a. Steel Reinforcement: ASTM A 615/A 615M, Grade 60 (Grade 420) **OR** ASTM A 706/A 706M, **as directed**; deformed.
4. Epoxy-Coated Reinforcing Bars: ASTM A 775/A 775M or ASTM A 934/A 934M, as follows:
 - a. Steel Reinforcement: ASTM A 615/A 615M, Grade 60 (Grade 420) **OR** ASTM A 706/A 706M, **as directed**; deformed.
5. Plain Steel Wire: ASTM A 82/A 82M, as drawn **OR** galvanized, **as directed**.
6. Deformed-Steel Wire: ASTM A 496/A 496M.
7. Epoxy-Coated-Steel Wire: ASTM A 884/A 884M, Class A coated, plain **OR** deformed, **as directed**.

D. Concrete Materials

1. Portland Cement: ASTM C 150, Type I or II.
 - a. Fly Ash: ASTM C 618, Class C or F.
 - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
2. Blended Hydraulic Cement: ASTM C 595, Type IS, portland blast-furnace slag **OR** Type IP, portland-pozzolan **OR** Type I (PM), pozzolan-modified portland **OR** Type I (SM), slag-modified Portland, **as directed**, cement.



3. Normal-Weight Aggregates: ASTM C 33, Class 4S **OR** Class 4M **OR** Class 1N, **as directed**, uniformly graded, 3/4-inch (19-mm) maximum aggregate size. Provide aggregates from a single source.
 4. Water: Potable, complying with ASTM C 94/C 94M requirements.
 5. Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent chloride ions by mass of cementitious material.
 - a. Air-Entraining Admixture: ASTM C 260.
 - b. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - c. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - d. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - e. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - f. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 - g. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
- E. Pile Accessories
1. Driving Points: Manufacturer's standard 60-degree conical driving point, with integral reinforcing ribs, to provide full bearing of pipe pile tip. Fabricate from steel castings as follows:
 2. Inside Cutting Shoes: Manufacturer's standard, inside-flanged, open-ended cutting shoe, to provide full bearing of pipe pile tip. Fabricate from steel castings as follows:
 3. Outside Cutting Shoes: Manufacturer's standard, outside-flanged, open-ended cutting shoe, to provide full bearing of pipe pile tip. Fabricate from steel castings as follows:
 - a. Carbon-Steel Castings: ASTM A 27/A 27M, Grade 65-35 (Grade 450-240), heat treated **OR** Grade N1, **as directed**.
 - b. High-Strength Steel Castings: ASTM A 148/A 148M, Grade 80-40 (Grade 550-275) **OR** Grade 90-60 (Grade 620-415), **as directed**.
 4. Splice Coupling: Manufacturer's standard splice coupling, rolled from ASTM A 36/A 36M, carbon-steel bar or cast from heat-treated carbon steel, ASTM A 27/A 27M, Grade 65-35 (Grade 450-240), with interior stop and internally tapered for friction fit driving.
- F. Paint
1. Paint: SSPC-Paint 16; self-priming, two-component, coal-tar epoxy polyamide, black **OR** red **OR** manufacturer's standard color, **as directed**.
- G. Concrete Mixes
1. Prepare concrete design mixes according to ACI 301, determined by either laboratory trial batch or field test data basis.
 - a. Use a qualified testing agency for preparing and reporting proposed mix designs determined by laboratory trial batch.
 2. Proportion mixes according to ACI 301 to provide normal-weight concrete suitable for piles with the following properties:
 - a. Compressive Strength (28 Days): 5000 psi (34.5 MPa) **OR** 4000 psi (27.6 MPa) **OR** 3000 psi (20.7 MPa), **as directed**.
 - b. Maximum Water-Cementitious Material Ratio at Point of Placement: 0.45 **OR** 0.50, **as directed**.
 - c. Slump Limit: 5 inches (127 mm) **OR** 8 inches (203 mm), **as directed**, plus or minus 1 inch (25 mm).
 3. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content of 6.0 percent, plus or minus 1.5 **OR** 2.5 to 4.5, **as directed**, percent.
 4. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 limits as if concrete were exposed to deicing chemicals.
 5. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 **OR** 0.30, **as directed**, percent by weight of cement.
 6. Concrete-mix design adjustments may be considered if characteristics of materials, Project conditions, weather, test results, or other circumstances warrant. Resubmit and obtain approval from the Owner of proposed changes to concrete-mix proportions.



H. Fabrication

1. Fabricate and assemble piles in shop to greatest extent possible.
2. Fabricate full-length piles to eliminate splicing during driving.

OR

Fabricate full-length piles by splicing pile lengths together. Maintain axial alignment of pile lengths. Maintain structural properties of pile across splice.

- a. Splice Coupling: Fit splice coupling into position and weld to adjoining steel pipe pile sections according to manufacturer's written instructions and AWS D1.1/D1.1M for procedures, appearance and quality of welds, and methods used in correcting welding work.
 - b. Welded Splices: Accurately mill meeting ends of steel pipe piles and bevel for welding. Continuously weld pile according to AWS D1.1/D1.1M for procedures, appearance and quality of welds, and methods used in correcting welding work.
 - c. Welded Splices: Continuously weld steel shell pile according to manufacturer's written instructions and AWS D1.1/D1.1M and AWS D1.3, **as directed**, for procedures, appearance and quality of welds, and methods used in correcting welding work.
 - d. Splice piles during fabrication or field installation.
3. Fit and weld driving points to tip of pile according to manufacturer's written instructions and AWS D1.1/D1.1M for procedures, appearance and quality of welds, and methods used in correcting welding work.

OR

Fit and weld cutting shoes to tip of pile according to manufacturer's written instructions and AWS D1.1/D1.1M for procedures, appearance and quality of welds, and methods used in correcting welding work.

4. Pile-Length Markings: Mark each pile with horizontal lines at 12-inch (305-mm) intervals; label the distance from pile tip at 60-inch (1.52-m) intervals. Maintain markings on piles until driven.

I. Shop Painting, **as directed**

1. General: Shop paint steel pile surfaces, except for surfaces to be encased in concrete, as follows:
 - a. Extend painting to a depth of 60 inches (1.52 m) below finished grade **OR** low-tide level, **as directed**, to top of exposed pile.
2. Surface Preparation: Clean surfaces to be painted. Remove loose rust and loose mill scale, and remove spatter, slag, or flux deposits. Prepare surfaces according to SSPC-SP 10/NACE No. 2, "Near-White Blast Cleaning."
3. Painting: Immediately after surface preparation, apply coat of paint according to manufacturer's written instructions to provide a dry film thickness of not less than 8 mils (0.2 mm).
 - a. Apply second coat to provide a dry film thickness of not less than 8 mils (0.2 mm), resulting in a two-coat paint system thickness of not less than 16 mils (0.4 mm).
 - b. Apply second and third coats with each coat having a dry film thickness of not less than 8 mils (0.2 mm), resulting in a three-coat paint system thickness of not less than 24 mils (0.6 mm).
 - c. Mark pile lengths after shop painting.

J. Concrete Mixing

1. Ready-Mixed Concrete: Comply with ASTM C 94/C 94M.
 - a. Do not add water to concrete mix after mixing.
 - b. Maintain concrete temperature to not exceed 90 deg F (32 deg C).

1.3 EXECUTION

A. Examination



1. Site Conditions: Do not start pile-driving operations until earthwork fills have been completed or excavations have reached an elevation of 6 to 12 inches (152 to 305 mm) above bottom of footing or pile cap.
- B. Driving Equipment
1. Pile Hammer: Air-, steam-, hydraulic-, or diesel-powered type capable of consistently delivering adequate peak-force duration and magnitude to develop the ultimate capacity required for type and size of pile driven and character of subsurface material anticipated.
 2. Hammer Cushions and Driving Caps: Between hammer and top of pile, provide hammer cushion and steel driving cap as recommended by hammer manufacturer and as required to drive pile without damage.
 3. Leads: Use fixed, semifixed, or hanging-type pile-driver leads that will hold full length of pile firmly in position and in axial alignment with hammer.
 4. Mandrel: Expandable mandrel, capable of distributing driving energy throughout length of steel shell pile.
- C. Static Pile Tests, **as directed**
1. General: Static pile tests will be used to verify driving criteria and pile lengths and to confirm allowable load of piles.
 - a. Furnish test piles 60 inches (1.52 m) longer than production piles.
 - b. Determination of actual length of piles will be based on results of static pile tests.
 2. Pile Tests: Arrange and perform the following pile tests:
 - a. Axial Compressive Static Load Test: ASTM D 1143.
 - b. Axial Tension Static Load Test: ASTM D 3689.
 - c. Lateral Load Test: ASTM D 3966.
 3. Equip each test pile with two telltale rods, according to ASTM D 1143, for measuring deformation during load test.
 4. Provide pile reaction frame, anchor piles, equipment, and instrumentation with sufficient reaction capacity to perform tests. Notify the Owner at least 48 hours in advance of performing tests. On completion of testing, remove testing structure, anchor piles, equipment, and instrumentation.
 - a. Allow a minimum of seven days to elapse after driving test piles before starting pile testing.
 - b. Number of Test Piles: One pile **OR** As indicated, **as directed**.
 5. Driving Test Piles: Drive test piles at locations indicated to the minimum penetration or driving resistance indicated. Use test piles identical to those required for Project and drive with appropriate pile-driving equipment operating at rated driving energy to be used in driving permanent piles.
 - a. Pile Design Load: As indicated **OR as directed**.
 6. Approval Criteria: Allowable load shall be the load acting on the test pile when the lesser of, **as directed**, the following criteria are met, divided by a factor of safety of 2:
 - a. Net settlement, after deducting rebound, of not more than 0.01 inch/ton (0.25 mm/907 kg) of test load.
 - b. Total settlement exceeds the pile elastic compression by 0.15 inch (4 mm), plus 1.0 percent of the tip diagonal dimension.
 - c. A plunging failure or sharp break in the load settlement curve.
 7. Test Pile-Driving Records: Prepare driving records for each test pile, compiled and attested to by a qualified professional engineer, **as directed**. Include same data as required for driving records of permanent piles.
 8. Test piles that comply with requirements, including location tolerances, may be used on Project.
- D. Steel Reinforcement
1. Comply with recommendations in CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
 2. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy bond with concrete.
 3. Fabricate and install reinforcement cages symmetrically about axis of pile shell **OR** pipe, **as directed**, in a single unit.



4. Accurately position, support, and secure reinforcement against displacement during concreting. Maintain minimum cover on reinforcement.
5. Protect exposed ends of extended reinforcement, dowels, or anchor bolts from mechanical damage and exposure to weather.

E. Concrete Placement

1. Do not place concrete until other piles within a radius of 20 feet (6 m) have been driven and approved.
2. Inspection: Before placing concrete, allow testing and inspecting agency to visually inspect and verify that each pile shell **OR** pipe, **as directed**, is clean, watertight, plumb, and free of distortion or other defects.
3. Place concrete in a continuous operation and without segregation immediately after cleaning out pile shell **OR** pipe, **as directed**.
4. Place concrete by means of bottom discharge bucket, flexible drop chute, steep-sided funnel hopper, or tremie or pump concrete into place.
5. Place concrete in a dry pile shell **OR** pipe, **as directed**, unless placement underwater is approved by the Owner.
 - a. Place concrete underwater by tremie method or pumping. Control placement operations to ensure tremie is embedded no less than 60 inches (1.52 m) into concrete, and flow of tremied concrete is continuous from bottom to top of pile shell **OR** pipe, **as directed**.
 - b. Other methods of depositing concrete may be used if approved by the Owner.
6. Consolidate final 10 feet (3 m) of concrete during placement to ensure that concrete is thoroughly worked around steel reinforcement and into corners.
7. Screed concrete level at cutoff elevation and apply a scoured, rough finish.

F. Driving Piles

1. General: Continuously drive piles to elevations or penetration resistance indicated or established by static load testing of piles, **as directed**. Establish and maintain axial alignment of leads and piles before and during driving.
2. Predrilling, **as directed**: Provide pre-excavated holes where indicated, to depths indicated. Drill holes with a diameter less than the largest cross-section dimension of pile.
 - a. Firmly seat pile in predrilled hole by driving with reduced energy before starting final driving.
3. Heaved Piles: Redrive heaved piles to tip elevation at least as deep as original tip elevation with a driving resistance at least as great as original driving resistance.
4. Pile Splices: Splice piles during installation and align pile segments concentrically.
5. Driving Tolerances: Drive piles without exceeding the following tolerances, measured at pile heads:
 - a. Location: 4 inches (102 mm) from location indicated after initial driving, and 6 inches (152 mm) after pile driving is completed.
 - b. Plumb: Maintain 1 inch (25 mm) in 4 feet (1.2 m) from vertical, or a maximum of 4 inches (102 mm), measured when pile is aboveground in leads.
 - c. Batter Angle: Maximum 1 inch (25 mm) in 4 feet (1.2 m) from required angle, measured when pile is aboveground in leads.
6. Excavation: Clean out steel pipe pile by removing soil and debris from inside pile before placing steel reinforcement or concrete.
7. Withdraw damaged or defective piles and piles that exceed driving tolerances and install new piles within driving tolerances.
 - a. Fill holes left by withdrawn piles using cohesionless soil material such as gravel, broken stone, and gravel-sand mixtures. Place and compact in lifts not exceeding 72 inches (1.83 m).
OR
Fill holes left by withdrawn piles as directed by the Owner.

OR



- Abandon and cut off rejected piles as directed by the Owner. Leave rejected piles in place and install new piles in locations as directed by the Owner.
8. Cutting Off: Cut off tops of driven piles square with pile axis and at elevations indicated.
 9. Pile-Driving Records: Maintain accurate driving records for each pile, compiled and attested to by a qualified professional engineer, **as directed**. Include the following data:
 - a. Project name and number.
 - b. Name of Contractor.
 - c. Pile location in pile group and designation of pile group.
 - d. Sequence of driving in pile group.
 - e. Pile dimensions.
 - f. Ground elevation.
 - g. Elevation of tips after driving.
 - h. Final tip and cutoff elevations of piles after driving pile group.
 - i. Records of re-driving.
 - j. Elevation of splices.
 - k. Type, make, model, and rated energy of hammer.
 - l. Weight and stroke of hammer.
 - m. Type of pile-driving cap used.
 - n. Cushion material and thickness.
 - o. Actual stroke and blow rate of hammer.
 - p. Pile-driving start and finish times, and total driving time.
 - q. Time, pile-tip elevation, and reason for interruptions.
 - r. Number of blows for every 12 inches (305 mm) of penetration, and number of blows per 1 inch (25 mm) for the last 6 inches (152 mm) of driving.
 - s. Pile deviations from location and plumb.
 - t. Preboring, jetting, or special procedures used.
 - u. Unusual occurrences during pile driving.
- G. Field Quality Control
1. Special Inspections: Engage a qualified special inspector to perform the following special inspections:
 - a. Pile foundations.
 2. Testing Agency: Engage a qualified independent testing agency to perform tests and inspections.
 3. Tests and Inspections:
 - a. Dynamic Pile Testing: High-strain dynamic monitoring shall be performed and reported according to ASTM D 4945 during initial driving and during restriking on 5 single piles **OR** 3 percent of piles, **as directed**.
 - b. Low-strain integrity measurement shall be performed and reported for each pile.
 - c. Weld Testing: In addition to visual inspection, welds shall be tested and inspected according to AWS D1.1/D1.1M and the inspection procedures listed in subparagraphs below, at testing agency's option. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
 - 1) Liquid Penetrant Inspection: ASTM E 165.
 - 2) Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - 3) Radiographic Inspection: ASTM E 94; minimum quality level "2-2T."
 - 4) Ultrasonic Inspection: ASTM E 164.
 - d. Concrete: Sampling and testing of concrete for quality control shall include the following:
 - 1) Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94/C 94M.
 - a) Slump: ASTM C 143/C 143M; one test at point of placement for each compressive-strength test, but no fewer than one test for each concrete load.
 - b) Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (5 deg C) and below or when 80 deg F (27 deg C) and above, and one test for each set of compressive-strength specimens.



- c) Compression Test Specimens: ASTM C 31/C 31M; one set of four standard cylinders for each compressive-strength test unless otherwise indicated. Mold and store cylinders for laboratory-cured test specimens unless field-cured test specimens are required.
 - d) Compressive-Strength Tests: ASTM C 39/C 39M; one set for each truck load. One specimen shall be tested at seven days, two specimens shall be tested at 28 days, and one specimen shall be retained in reserve for later testing if required.
- 2) When frequency of testing will provide fewer than five strength tests for a given class of concrete, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 - 3) When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing in-place concrete.
 - 4) Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi (3.45 MPa).
 - 5) Test results shall be reported in writing to the Owner, concrete manufacturer, and Contractor within 24 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, concrete type and class, location of concrete batch in piles, design compressive strength at 28 days, concrete-mix proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
 - 6) Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as sole basis for acceptance or rejection.
 - 7) Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate concrete strengths or other requirements have not been met.

H. Touchup Painting, **as directed**

1. Clean field welds, splices, and abraded painted areas and field-apply paint according to SSPC-PA 1. Use same paint and apply same number of coats as specified for shop painting.
 - a. Apply touchup paint before driving piles to surfaces that will be immersed or inaccessible after driving.

I. Disposal

1. Remove withdrawn piles and cutoff sections of piles from site and legally dispose of them off Owner's property.

END OF SECTION 31 62 13 19



SECTION 31 62 13 23 - PRESTRESSED CONCRETE PILES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for relief wells. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Shop Drawings: Submit shop drawings.
2. Statements
 - a. Before installation, all well screen shall be approved.
 - b. The filter pack material and its gradation shall be approved before it is placed.
 - c. Submit the cement grout mixture proportion to be used in plugging abandoned wells.
3. Reports: Submit sampling and testing reports for each relief well, logs of the borings, well screen and riser pipe, backfill material, and pump tests. Register each well with the state as required by the state in which the well is installed.

- #### C. Regulatory Requirements: The state statutory and regulatory requirements form a part of this specification.

1.2 PRODUCTS

- #### A. Well Screen: The Contractor may, at its option, furnish and install well screen of any of the alternate types specified. The clear inside diameter of the screen shall be as directed by the Owner. Screen openings shall be uniform in size and pattern, and shall be spaced approximately equally around the circumference of the pipe.

1. PVC Pipe Screen: Pipe, fittings, and screen shall be of the size and types specified. Pipe, fittings, and screen shall conform to ASTM D 1784, ASTM D 1785, ASTM D 2466, or ASTM D 2467. All joints in the PVC pipe shall include couplings and shall be glued with a solvent cement conforming to ASTM D 2564. The PVC pipe strength properties shall be equivalent to PVC 1120 Schedule 40 **OR** 80, **as directed**, unthreaded plastic pipe.
 - a. Couplings: Couplings shall be bonded socket **OR** threaded, **OR** certilock, **as directed**, type. Fittings shall be produced of the same material and equal quality as specified for plastic pipe screen. Socket type fitting connections of pipe sections shall be bonded with solvent cement. The determination of the proportions and preparation of adhesives, the method of application, and the procedure used for making and curing the connections shall be the responsibility of the Contractor. The system for making joints at the relief well site shall provide a curing period adequate to develop the ultimate strength of the solvent cement. Self-tapping screws or other devices for holding pipe in the couplings during the setting period may be utilized as long as the screws do not penetrate the inside of the pipe. In no case shall a newly-made joint in the casing be stressed, lowered into the relief well, or be submerged in water prior to complete curing of the solvent cement adhesive.
 - b. Perforations: The PVC well screen shall be mill slot **OR** continuous wire wrapped rod base **OR** continuous wire wrapped rod base on perforated pipe **OR** continuous wire wrapped on perforated pipe screen **OR** similar to that manufactured by Johnson Well Equipment, Inc., Pensacola, FL, telephone (904) 453-3131, **as directed**. All well screen shall have smooth, sharp-edged openings free of burns, chipped edges, or broken areas on the interior and exterior surfaces of the pipe. The slots or groups of slots shall be distributed in a uniform pattern around the periphery of the pipe and shall be oriented with the length of the slot parallel to, normal to, or diagonal with the axis of the pipe.



2. **Fiberglass Pipe Screen:** Fiberglass pipe screen and fittings shall be manufactured from thermosetting epoxy resins and glass fiber by either a centrifugal casting process or by a filament winding process. Glass fiber used shall be continuous filament, electrical glass with a finish compatible with epoxy resins. Each glass fiber or filament shall be thoroughly impregnated with epoxy resin. Fiberglass pipe wall thickness, strength and durability requirements shall be equivalent to the Fiberglass/Epoxy pipe produced by Fiberglass Resources Corporation of Farmingdale, New York or Burgess Well Company, Inc., Minden, Nebraska, telephone (308) 832-1642. All fiberglass pipe and fittings shall be round and straight, of uniform quality and workmanship, and free from all defects including indentation, delamination, bends, cracks, blisters, porosity, dry spots, resin segregation and resin-starved areas. The inside of the pipe and fittings shall be smooth and uniform. The impregnation of the glass fiber with resin shall be such that when the pipe is cut or slotted, no fraying or looseness of glass fiber occurs.
 - a. **Couplings:** Couplings for fiberglass pipe sections shall be socket threaded or mechanical key-type couplings. The couplings shall be manufactured of the same materials used for the fiberglass pipe specified herein and may be either cast integrally with the pipe sections or as separate components for attachment to the pipe in the manufacturers plant. Key-type couplings shall consist of male and female halves designed for joining and locking together by means of a key strip inserted in grooves in the coupling halves. The minimum wall thickness remaining at any grooved section shall not be less than the minimum thickness specified for pipe. Key strips and locking strips shall be of fiberglass, plastic or other non-corrosive material capable of withstanding shearing and bearing stresses equivalent to the design load for the coupling. Socket type fitting connections of the pipe sections shall be bonded with epoxy adhesive. The epoxy materials and bonding agents shall be as recommended by the pipe manufacturer. Self-tapping screws or other devices for holding adhesive-joined pipe in the couplings during the curing period may be utilized. In no case shall a newly-made joint in the casing pipe be lowered into the relief well, or be submerged in water prior to complete curing of the adhesive.
 - b. **Perforations:** All fiberglass well screen shall be mill slot **OR** continuous wire wrapped rod base, **as directed**. All relief well screen shall have smooth, sharp-edged openings free of burrs, chipped edges, or broken areas on the interior and exterior surfaces of the pipe. The slots or groups of slots shall be distributed in a uniform pattern around the periphery of the pipe and shall be oriented with the length of the slot parallel to, normal to, or diagonal with the axis of the pipe.
3. **Steel Pipe Screen:** Steel well screen shall consist of perforated or slotted sections of steel pipe conforming to the requirements of ASTM A 53.
 - a. **Couplings:** Couplings for steel pipe screen shall be welded joints or threaded couplings. Welding shall be performed in accordance with requirements in ASME B31.9. Couplings shall meet the material requirements specified for steel pipe screen, except perforations shall be omitted. All threaded pipe and fittings shall be threaded in accordance with ASME B1.20.1. All threaded pipe sections may be field connected. Couplings shall be given the same protection against corrosion as specified for the well screen pipe. Protective coatings damaged while making couplings shall have the areas recoated.
 - b. **Perforations:** All steel pipe to be used as relief well screen shall be provided with perforations which shall consist of either machine-cut slots; drilled or punched openings. The slots or groups of slots shall be distributed in a uniform pattern around the periphery of the pipe and shall be oriented with the length of the slot parallel to, normal to, or diagonal with the axis of the pipe. The pattern of the openings shall be uniformly spaced around the periphery of the pipe.
4. **Stainless Steel Well Screen:** The perforated well screen and fittings shall be fabricated entirely from stainless steel conforming to ASTM A 312/A 312M, Type 304, 304-L, 316 or 316-L. The well screen shall be of stainless steel with a keystone wire-wrapped continuous slot strainer equivalent to that manufactured by Howard Smith Screen Company, Houston, TX, telephone (713) 869-5771 or Johnson Screens, St. Paul, MN 55164, telephone (612) 636-3900.
 - a. **Couplings:** Couplings for the stainless steel well screen shall consist of the same material as the well screen and shall be threaded, flanged, and/or fitted with a welding ring. The



couplings shall conform in design to the couplings recommended by the manufacturer of the well screen.

- b. Tailpipe for Well Screen: The tailpipe for each well screen shall be made of the same material and at least the same minimum thickness as the riser pipe and shall include a bottom plug.
- B. Riser Pipe: The relief well riser pipe material and method of manufacture shall conform to the requirements specified in paragraph WELL SCREEN, except that the screen perforations or opening shall be omitted. The relief well riser pipe diameter and discharge details shall be as directed. Couplings to the well screen and between riser pipe sections shall be as specified in paragraph COUPLING.
- C. Filter Pack: Material for the filter pack around the riser pipes and screens shall be a washed grave, **OR** washed sand **OR** dry processed sand, **as directed**, composed of hard, tough, and durable particles free from adherent coating. The filter pack shall not be crushed stone. The filter pack material shall contain no detrimental quantities of organic matter nor soft, friable, thin, or elongated particles in accordance with the quality requirements in ASTM C 33, Table 1 and Table 3, Class 5S, and in ASTM E 11, Table 1.
- D. Outlet For Relief Well: Check Valve.
1. The check valve shall be a one piece reinforced all rubber (neoprene) check valve with an integral elastomer flange similar and equal to the Red Valve Series 35, manufactured by Red Valve Company, Inc., 700 North Bell Ave., Pittsburgh, PA 15106, telephone (412) 279-0044. The backup ring for the check valve shall be stainless steel. Stainless steel bolts, washers, and nuts shall be used to fasten the valves onto the flanged end of the pipes. The check valve shall be installed with the flared end duck bill in a vertical position.
OR
Fabricate check valves of brass **OR** stainless steel **OR** aluminum, **as directed**, plate, threaded fasteners and rods. Fabricate sealing disc of silicone sponge rubber free of porous areas, foreign materials, and visible defects.
 2. Workmanship and metalwork fabrication of check valves shall be as directed. Install check valves accurately vertically and adjust to the required elevation.
- E. Concrete: Concrete shall conform to the requirements specified in Division 03 Section "Cast-in-place Concrete".

1.3 EXECUTION

- A. Drilling: Wells may be drilled by the reverse rotary circulation method or other method approved, which will ensure proper placement of the well screen, riser pipe, and filter pack. Methods which involve radical displacement of the formation, or which may reduce the yield of the well, will not be permitted. Excavated material shall be disposed of as directed.
1. Reverse Circulation Method: If the reverse circulation method is used for drilling wells, all of the drilling fluid shall be removed from the filter pack and the natural pervious formation. If in the opinion of the Owner the walls of the hole above the top of the filter pack require support during development operations, a temporary casing similar to that specified in paragraph TEMPORARY CASING shall be placed so as to extend from the ground surface to at least 3 ft (1 m) below the top of the filter pack. The diameter of the hole shall be such as will permit the placement of the minimum thickness of filter pack as specified in paragraph FILTER PACK PLACEMENT. The drilling fluid shall be a suspension of fine grained soil or shall be a commercial product of a recognized manufacturer, shall be approved by the Owner, and shall have the characteristic of being readily removable from the filter pack and the walls of the formation by development as specified in paragraph DEVELOPMENT. The use of bentonite will not be permitted.
 2. Temporary Casing: Temporary well casing of either iron or steel of sufficient length to case to the bottom of all borings shall be available at the construction site. the Owner will direct the use of a temporary casing to the bottom of the boring during drilling and placement of screen, riser, and



filter pack when it believes it is necessary to provide adequate support to the sides of the hole. When the walls of the boring will require support only during development operations a temporary casing will be required to extend only to a depth 3 ft (3 m) below the top of the filter pack. The temporary casing, shall have sufficient thickness to retain its shape and maintain a true section throughout its depth, and may be in sections of any convenient length. The temporary casing shall be such as to permit its removal without disturbing the filter pack, riser, or well screen. The setting of temporary casing shall be such that no cavity will be created outside of it at any point along its length. In the event the temporary casing should become unduly distorted or bent it shall be discarded and a new casing shall be used during installation of any additional relief wells.

B. Installation Of Riser Pipe And Screen

1. **Assembly:** All riser pipe and screen shall be in good condition before installation and all couplings and other accessory parts shall be securely fastened in place. The successive lengths of pipe shall be arranged to provide accurate placement of the screen sections in the bore hole. The riser-pipe shall be provided with an approved cap and a flanged top section, the top of which shall be set at the elevation directed. Centralizers shall be attached to the assembled riser pipe and screen in such numbers and of a type that they will satisfactorily center the riser pipe and screen in the well and will hold it securely in position while the filter pack material is being placed.
2. **Joints:** Sections of relief well pipe shall be joined together as specified in paragraph COUPLINGS. Joints shall be designed and constructed to have the strength of the pipe and where possible a strength capable to support the weight of the relief well stem as it is lowered into the hole. When not practicable to construct joints that will support the weight of the relief well stem, the stem shall be supported at the lower end by any approved means that will assure that the joints do not open while being lowered into place in the well.
3. **Installation:** The assembled riser pipe and screen shall be placed in the bore hole in such manner as to avoid jarring impacts and to ensure that the assembly is centered and not damaged or disconnected. The screen shall be suspended in the hole and not resting on the bottom of the hole. After the screen and riser pipe have been placed, a filter pack shall be constructed around the screen section as specified in paragraph FILTER PACK PLACEMENT and the well developed as specified in paragraph DEVELOPMENT. The top of the riser pipe shall be held at the designated elevation during placement of the filter pack.
4. **Check for Plumbness and Alignment:** The well shall be constructed and all casing set round, plumb, and true. The Contractor shall perform the following tests after the installation of the well but prior to backfilling, and before its acceptance. Additional tests may be made during the performance of the work at the option of the Contractor. Should the Contractor fail to correct, at no additional cost to the Owner, any faulty alignment or plumbness disclosed as a result of these tests, the Owner may refuse to accept the well. the Owner may waive the requirements for plumbness if in its judgement the Contractor has exercised all possible care in constructing the well and the defect is due to circumstances beyond its control or if the utility of the completed well is not materially affected or if the cost of necessary remedial measures will be excessive. In no event will the provisions with respect to alignment be waived.
 - a. **Plumbness:** Plumbness shall be tested by use of a plumb line. The plummet shall be suspended from a small diameter wire rope and its point of suspension shall be in the exact center of the plummet. The plummet shall be sufficiently heavy to stretch the wire rope taut. The wire rope shall pass over a guide sheave which shall be positioned above the top of the well and adjusted horizontally so that the plummet hangs in the center of the well. Displacement of the wire rope during the plumbness check shall be measured by means of a transparent plastic sheet on which a number of concentric circles shall be scribed or drawn, and which is centered on the top of the well. The exact center of these circles shall be marked, and then a slot, slightly larger than the plumb line and extending from this center to the edge, shall be cut in the plastic sheet. As the plummet is lowered, any out-of-plumb condition of the well will be indicated by the wire rope tending to drift away from the center, and the plastic sheet shall be rotated until the slot is oriented in the direction of this drift, while at all times maintaining the center of the concentric circles coincident with the center of the well. Measurement of the amount of drift shall be made



- along the edge of the slot for each increment by which the plummet is lowered into the well. Drift at any depth shall be determined by multiplying the measured plumb line displacement by the total length of the plumb line and dividing the result by the fixed distance between the guide sheave and the top of the well. If desired, alignment may be calculated from the plumbness data in lieu of the alignment check described in paragraph ALIGNMENT. Should the well vary from the vertical in excess of allowable, the plumbness of the well shall be corrected by the Contractor at no additional cost to the Owner.
- b. Alignment: Alignment shall be tested by lowering into the well a section of cylinder or a dummy of the same length. The outside diameter of cylinder shall be smaller than the inside diameter of the well. Should the cylinder fail to move freely throughout the length of the well, the alignment of the well shall be corrected by the Contractor at no additional expense to the Owner.
- C. Filter Pack Placement: After the well screen and riser pipe have been installed, the filter pack material shall be placed by tremie, when using a well graded material, in an approved manner such that segregation will not occur. When using a uniform graded filter material, the material may be poured around the well screen at a rate that will prevent bridging of the material. The material shall be placed around all sides of the screen to assure that the screen is not pushed against the side of the bore hole causing the screen to come in contact with foundation material or prevent the proper thickness of filter from being placed uniformly around the screen. The filter pack shall be placed at a constant rate from the start of placement until it has reached the elevation directed. If a tremie is required, a double string of tremie pipe shall be used. The pipes shall be placed on opposite sides of the screen and/or casing, that is, 180 degrees apart, and shall be guided in such a manner that they will remain in this position throughout the placing process. The tremie pipes shall be set in place, filled completely with filter pack prior to being lifted off the bottom of the hole. The filter pack in the tremie pipe shall be kept above the water surface in the well throughout the placing process. In no case shall the gradation of the filter pack fall outside of the range specified in paragraph FILTER PACK.
- D. Development
1. General: Following placement of filter pack materials, the Contractor shall develop the relief well by jetting, surging, intermittent pumping, or other approved methods as may be necessary to give the maximum yield of water. At the time of development of any relief well, the well shall be free of drawdown or surcharge effects due to pump testing, developing or drilling at another location. The Contractor shall be responsible for maintaining at the relief well the needed access and work area and clearance in the relief well necessary to accomplish development. The Contractor shall furnish, install, or construct the necessary discharge line and troughs to conduct and dispose of the discharge a sufficient distance from the work areas to prevent damage. Development shall be conducted to achieve a stable well of maximum efficiency and shall be continued until a satisfactory sand test, as specified in paragraph SAND TEST, is obtained. As development proceeds, filter pack material shall be added to the annular space around the screen to maintain the top elevation of the filter pack to the specified elevation. The Contractor shall provide an open tube or other approved means for accurately determining the water level in the well under all conditions. If at any time during the development process it becomes apparent in the opinion of the Owner that the well may be damaged, development operations shall be immediately terminated. the Owner may require a change in method if the method selected does not accomplish the desired results. the Owner may order that wells which continue to produce excessive amounts of fines after development for 6 hours be abandoned, plugged, and backfilled, and may require the Contractor to construct new wells nearby. All materials pulled into the well by the development process shall be removed prior to performing the pumping test.
- a. Jetting: Jetting should be performed using either a single or double ring jet. The jetting tool shall be constructed of high-strength material and conservatively designed and proportioned so that it will withstand high pressures. The jetting tool shall have two hydraulically balanced nozzles spaced 180 degrees **OR** four diameter holes spaced 90 degrees, **as directed**, apart and which shall exert the jetting force horizontally through the screen slots. The rings shall be constructed such that the tips of the jets shall be within 1/2 in. (13 mm) from the inner surface of the well screen. The pump used in conjunction with



the jetting tool shall be capable of providing a minimum jetting fluid exit velocity of 150 feet per second (45 meters per second). Prior to commencing jetting, and following each jetting cycle, all sand and/or other materials shall be removed from inside the screen. All wells shall be pumped during the jetting cycle to remove incoming sand and other material. Such pumping shall be at a rate not less than 115 percent of the rate at which fluid is introduced through the jetting tool. This will allow a flow of material into the well as it is being developed. Water used for development shall be free of sand. the Owner may require other means of developing the well such as intermittent pumping method, variation of the intermittent pumping method, or surge block if it appears that the development of the well is not producing the desired results.

- b. Intermittent Pumping: Intermittent pumping shall be performed by pumping the well at a capacity sufficient to produce a rapid drawdown, stopping the pump (backflow through pump will not be permitted) to permit the water surface to rise to its former elevation, and repeating this procedure. Cycle time for this procedure will vary as directed but will not be more than 3 cycles per minute. A deep well turbine pump, or electric submersible pump with check valve, shall be used with any attachment necessary to accomplish rapid starting and stopping for intermittent pumping. The intake shall be set below the maximum expected drawdown in the well. Prior to commencing intermittent pumping, and periodically during development by this method, all sand and/or other materials shall be removed from inside the screen. The amount of drawdown may be decreased if, in the opinion of the Owner, the efficiency of the well might otherwise be impaired.
 - c. Surging: Surging of the well shall require use of a circular block which is smaller in diameter than the inside diameter of the relief well and is constructed of a material which will not damage the screen if the block comes in contact with the screen, and a bailer or pump to remove materials drawn into the well. The surging shall be continued for a period of approximately one hour or until little or no additional material from the foundation or filter pack can be pulled through the screen. The surge block shall be moved by a steady motion up and down the full length of the well screen. Prior to commencing surging, and periodically during development by this method, all sand and/or other materials shall be removed from inside the screen. All materials pulled into the well by the surging process shall be removed by the Contractor.
- E. Backfilling: After the well has been developed, additional filter pack shall be added if necessary to meet the requirements of paragraph FILTER PACK PLACEMENT. Then the annular space above the filter pack, shall be backfilled by first placing a layer of concrete sand on the filter pack and then filling the remainder of the space up to the finished ground surface **OR** well pit, **as directed**, with grout or concrete. The concrete backfill shall be placed to a depth at least equal to the existing impervious blanket. For PVC riser pipe, after the well has been developed, additional filter pack shall be added if necessary for it to meet the requirements of paragraph FILTER PACK PLACEMENT. Then the remaining annular space above the filter pack shall be backfilled by first placing a layer of concrete sand on the filter pack and then filling the remainder of the space up to the finished ground surface **OR** well pit, **as directed**, with bentonite. The temporary casing, if used, shall be withdrawn in increments as the backfill is placed. The Contractor shall fill with impervious material to original grade all pits such as those incidental to the reverse rotary circulation method of drilling.
- F. Plugging Of Abandoned Wells: The Contractor has the option of attempting to remove the well screen. If the well screen can be removed, the Contractor will grout the bore hole starting from the bottom of the hole. The grouting shall start at the elevation of the bottom of the tailpipe of the well. If the well screen can not be removed or breaks off during the removal attempt, the Contractor shall still be responsible for grouting the well from the bottom of the tailpipe to within 3 ft (1 m) of ground surface. Either of the above abandonment procedures may require the Contractor to redrill the hole so that the bore hole can be grouted. The well shall be grouted from the bottom of the tailpipe. After the grout has setup the riser pipe shall be cutoff. Then the hole shall be backfilled. The cement grout mixture proportion to be used shall be submitted for approval.



G. Tests

1. Pump Test: Upon completion but before acceptance, each well shall be subjected to a pump test of which a sand test will form a part. The Contractor shall provide a deep well turbine pump, capable of producing the specified drawdowns over periods of time sufficient to satisfactorily perform the pump test specified herein. The intake shall be set below the maximum expected drawdown in the well. The amount of sand shall be measured after each test. The pump shall be complete with either gasoline, diesel, or electric motor of adequate size. In case an electric motor is used, the Contractor shall provide, without additional cost to the Owner, the electric power and the necessary wiring. The Contractor shall provide an open tube or other approved means for accurately determining the water level in the well. The Contractor shall furnish and install an orifice meter of approved design or other approved equipment for the purpose of measuring the discharge from the well during the pumping test. The Contractor shall furnish, install, or construct the necessary pipe discharge line, troughs, or ditches necessary to dispose of the pumping test discharge a sufficient distance from the work area to prevent damage. The tests will be conducted under the direction of the Owner and may be made as soon as each well is completed. Test data will be recorded by the Owner. The Contractor shall test each well by pumping continuously for a minimum of 6 hours. Prior to starting the pump test all material shall be removed from the bottom of the well. If the test is interrupted, other than by order of the Owner, prior to the completion of the specified period of continuous operation, the test shall be re-run. In addition to the required pumping test, the Owner may direct the Contractor to perform additional pump tests. Such additional testing shall conform in general to the requirements specified herein except that the duration of the tests and the approximate draw-down will be determined by the Owner. In the event that sand or other material collects in the well as a result of the pump test, accurate measurements shall be taken as to the quantity of material in the well and all such material shall be removed by the Contractor. Upon completion of the pump test, the Contractor shall remove all equipment, discharge lines, electrical lines, lumber, and debris, and shall backfill any excavated areas with impervious material.
2. Sand Test: As part of each Pump Test or at the end of each intermittent pumping a determination of the amount of sand (filter pack and/or foundation material) a well is producing shall be performed. Prior to starting the sand test all material shall be removed from the bottom of the tailpipe. After the pump is at the desired pumping rate the flow from the discharge shall be diverted into a container that will collect all the sand being carried by the water **OR** through a Rossum Sand Tester, **as directed**. Upon completion of the test the amount of sand in the tailpipe shall be determined to verify that no material is being deposited in the bottom of the well.
3. Filter Pack Sampling and Testing: The Contractor shall verify that all materials conform to the specifications before delivery to the project. The particle size distribution of the filter pack shall be sampled and tested by the Contractor in accordance with ASTM C 136 and ASTM D 75. Within 48 hours before being placed in the relief well to be back-filled, the filter pack shall be sampled from the material stockpiled at the project site. There shall be at least one particle size distribution test on the filter pack for each well. A pump test shall be performed in accordance with technical provisions herein specified.
4. Reports: Reports shall include, for each relief well, logs of the boring, elevations of the well screen, top of riser pipe, bottom of the tailpipe, filter pack gradation, quantity of filter pack added during development, pump test, sand test, and report of backfilling. The log of backfill material shall include the filter pack particle size distribution test data, and notes concerning installation and development of the relief well. The pump test log shall include the duration of the test and the draw-down response data with time in the pumped well, in adjacent wells, and in nearby piezometers. The relief well log and the pump test log shall be submitted to the Owner. The Contractor shall also submit a report of the well installation to the appropriate public agency and in the form required by state statutory and/or regulatory requirements specified in paragraph REGULATORY REQUIREMENTS.

END OF SECTION 31 62 13 23



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SECTION 31 62 16 16 - STEEL H PILES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for steel H piles. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes steel H piles.

C. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: For steel piles. Show fabrication and installation details for piles, including details of driving points, splices, and pile caps.
 - a. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
 - b. Include arrangement of static pile reaction frame, test and anchor piles, equipment, and instrumentation. Submit structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
3. Welding certificates.
4. Mill Test Reports: For steel H piles, steel castings, and steel plate, signed by manufacturer.
5. Pile-Driving Equipment Data: Include type, make, and rated energy range; weight of striking part of hammer; weight of drive cap; and, type, size, and properties of hammer cushion.
6. Static Pile Test Reports: Submit within three days of completing each test.
7. Pile-Driving Records: Submit within three days of driving each pile.
8. Field quality-control reports.
9. Preconstruction Photographs: Photographs or video of existing conditions of adjacent construction. Submit before the Work begins.

D. Quality Assurance

1. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
2. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
3. Preinstallation Conference: Conduct conference at Project site.

E. Delivery, Storage, And Handling

1. Deliver piles to Project site in such quantities and at such times to ensure continuity of installation. Handle and store piles at Project site to prevent buckling or physical damage.
 - a. Painted Piles: Protect finish and touch up paint damage before driving piles.

F. Project Conditions

1. Protect structures, underground utilities, and other construction from damage caused by pile driving.
2. Preconstruction Photographs: Inventory and record the condition of adjacent structures, underground utilities, and other construction. Provide photographs **OR** video, **as directed**, of conditions that might be misconstrued as damage caused by pile driving.

1.2 PRODUCTS

A. Steel H Piles



1. High-Strength, Low-Alloy, Columbium-Vanadium Structural Steel: ASTM A 572/A 572M, Grade 50 (Grade 345) **OR** Grade 60 (Grade 415), **as directed**.
 2. High-Strength, Low-Alloy, Nickel, Copper, Phosphorous Steel H Piles: ASTM A 690/A 690M.
 3. High-Strength, Low-Alloy, Structural Steel: ASTM A 588/A 588M.
- B. Pile Accessories
1. Driving Points: Manufacturer's standard one-piece driving point, fabricated from steel castings as follows to provide full bearing of web and flange of pile tip:
 - a. Carbon-Steel Castings: ASTM A 27/A 27M, Grade 65-35 (Grade 450-240), heat treated **OR** Grade N1, **as directed**.
 - b. High-Strength Steel Castings: ASTM A 148/A 148M, Grade 80-40 (Grade 550-275) **OR** Grade 90-60 (Grade 620-415), **as directed**.
 2. Splice Unit: Manufacturer's standard splice unit, fabricated from two connected steel plates, of same material as H pile or material of equal strength, shaped to encase web and part of each flange.
- C. Paint
1. Paint, **as directed**: SSPC-Paint 16; self-priming, two-component, coal-tar epoxy polyamide, black **OR** red **OR** manufacturer's standard color, **as directed**.
- D. Fabrication
1. Fabricate and assemble piles in shop to greatest extent possible.
 2. Pile-Length Markings: Mark each pile with horizontal lines at 12-inch (305-mm) intervals; label the distance from pile tip at 60-inch (1.52-m) intervals. Maintain markings on piles until driven.
 3. Fabricate full-length piles to eliminate splicing during driving, with ends square.
OR
Fabricate full-length piles by splicing lengths of H pile together. Accurately mill meeting ends of piles and bevel for welding. Maintain axial alignment of pile lengths. Maintain structural properties of pile across splice.
 4. Splice Units: Notch web of pile, fit splice unit into position, and weld according to manufacturer's written instructions and AWS D1.1/D1.1M for procedures, appearance and quality of welds, and methods used in correcting welding work.
OR
Continuously Welded Splices: Splice piles by continuously welding according to AWS D1.1/D1.1M for procedures, appearance and quality of welds, and methods used in correcting welding work.
 - a. Splice piles during fabrication or field installation, **as directed**.
 5. Fit and weld driving points to tip of pile according to manufacturer's written instructions and AWS D1.1/D1.1M for procedures, appearance and quality of welds, and methods used in correcting welding work.
- E. Shop Painting, **as directed**
1. General: Shop paint steel pile surfaces, except for surfaces to be encased in concrete, as follows:
 - a. Extend painting to a depth of 60 inches (1.52 m) below finished grade **OR** low-tide level, **as directed**, to top of exposed pile.
 2. Surface Preparation: Clean surfaces to be painted. Remove loose rust and loose mill scale, spatter, slag, and flux deposits. Prepare surfaces according to SSPC-SP 10/NACE No. 2, "Near-White Blast Cleaning."
 3. Painting: Immediately after surface preparation, apply coat of paint according to manufacturer's written instructions to provide a dry film thickness of not less than 8 mils (0.2 mm).
 - a. Apply second coat to provide a dry film thickness of not less than 8 mils (0.2 mm), resulting in a two-coat paint system thickness of not less than 16 mils (0.4 mm).



- b. Apply second and third coats with each coat having a dry film thickness of not less than 8 mils (0.2 mm), resulting in a three-coat paint system thickness of not less than 24 mils (0.6 mm).
- c. Mark pile lengths after shop painting.

1.3 EXECUTION

A. Examination

1. Site Conditions: Do not start pile-driving operations until earthwork fills have been completed or excavations have reached an elevation of 6 to 12 inches (152 to 305 mm) above bottom of footing or pile cap.

B. Driving Equipment

1. Pile Hammer: Air-, steam-, hydraulic-, or diesel-powered type capable of consistently delivering adequate peak-force duration and magnitude to develop the ultimate capacity required for type and size of pile driven and character of subsurface material anticipated.
2. Hammer Cushions and Driving Caps: Between hammer and top of pile, provide hammer cushion and steel driving cap as recommended by hammer manufacturer and as required to drive pile without damage.
3. Leads: Use fixed, semifixed, or hanging-type pile-driver leads that will hold full length of pile firmly in position and in axial alignment with hammer.

C. Static Pile Tests, **as directed**

1. General: Static pile tests will be used to verify driving criteria and pile lengths and to confirm allowable load of piles.
 - a. Furnish test piles 60 inches (1.52 m) longer than production piles.
 - b. Determination of actual length of piles will be based on results of static pile tests.
2. Pile Tests: Arrange and perform the following pile tests:
 - a. Axial Compressive Static Load Test: ASTM D 1143.
 - b. Axial Tension Static Load Test: ASTM D 3689.
 - c. Lateral Load Test: ASTM D 3966.
3. Equip each test pile with two telltale rods, according to ASTM D 1143, for measuring deformation during load test.
4. Provide pile reaction frame, anchor piles, equipment, and instrumentation with sufficient reaction capacity to perform tests. Notify the Owner at least 48 hours in advance of performing tests. On completion of testing, remove testing structure, anchor piles, equipment, and instrumentation.
 - a. Allow a minimum of seven days to elapse after driving test piles before starting pile testing.
 - b. Number of Test Piles: One pile **OR** As indicated, **as directed**.
5. Driving Test Piles: Drive test piles at locations indicated to the minimum penetration or driving resistance indicated. Use test piles identical to those required for Project and drive with appropriate pile-driving equipment operating at rated driving energy to be used in driving permanent piles.
6. Approval Criteria: Allowable load shall be the load acting on the test pile when the lesser of, **as directed**, the following criteria are met, divided by a factor of safety of 2:
 - a. Net settlement, after deducting rebound, of not more than 0.01 inch/ton (0.25 mm/907 kg) of test load.
 - b. Total settlement exceeds the pile elastic compression by 0.15 inch (4 mm), plus 1.0 percent of the tip diagonal dimension.
 - c. A plunging failure or sharp break in the load settlement curve.
7. Test Pile-Driving Records: Prepare driving records for each test pile, compiled and attested to by a qualified professional engineer, **as directed**. Include same data as required for driving records of permanent piles.
8. Test piles that comply with requirements, including location tolerances, may be used on Project.

D. Driving Piles



1. General: Continuously drive piles to elevations or penetration resistance indicated or established by static load testing of piles, **as directed**. Establish and maintain axial alignment of leads and piles before and during driving.
2. Predrilling, **as directed**: Provide pre-excavated holes where indicated, to depths indicated. Drill holes with a diameter less than the largest cross-section dimension of pile.
 - a. Firmly seat pile in predrilled hole by driving with reduced energy before starting final driving.
3. Heaved Piles: Redrive heaved piles to tip elevation at least as deep as original tip elevation with a driving resistance at least as great as original driving resistance.
4. Driving Tolerances: Drive piles without exceeding the following tolerances, measured at pile heads:
 - a. Location: 4 inches (102 mm) from location indicated after initial driving, and 6 inches (152 mm) after pile driving is completed.
 - b. Plumb: Maintain 1 inch (25 mm) in 4 feet (1.2 m) from vertical, or a maximum of 4 inches (102 mm), measured when pile is aboveground in leads.
 - c. Batter Angle: Maximum 1 inch (25 mm) in 4 feet (1.2 m) from required angle, measured when pile is aboveground in leads.
5. Withdraw damaged or defective piles and piles that exceed driving tolerances and install new piles within driving tolerances.
 - a. Fill holes left by withdrawn piles using cohesionless soil material such as gravel, broken stone, and gravel-sand mixtures. Place and compact in lifts not exceeding 72 inches (1.83 m).

OR

Fill holes left by withdrawn piles as directed by the Owner.

OR

Abandon and cut off rejected piles as directed by the Owner. Leave rejected piles in place and install new piles in locations as directed by the Owner.
6. Cutting Off: Cut off tops of driven piles square with pile axis and at elevations indicated.
7. Pile-Driving Records: Maintain accurate driving records for each pile, compiled and attested to by a qualified professional engineer, **as directed**. Include the following data:
 - a. Project name and number.
 - b. Name of Contractor.
 - c. Pile location in pile group and designation of pile group.
 - d. Sequence of driving in pile group.
 - e. Pile dimensions.
 - f. Ground elevation.
 - g. Elevation of tips after driving.
 - h. Final tip and cutoff elevations of piles after driving pile group.
 - i. Records of re-driving.
 - j. Elevation of splices.
 - k. Type, make, model, and rated energy of hammer.
 - l. Weight and stroke of hammer.
 - m. Type of pile-driving cap used.
 - n. Cushion material and thickness.
 - o. Actual stroke and blow rate of hammer.
 - p. Pile-driving start and finish times, and total driving time.
 - q. Time, pile-tip elevation, and reason for interruptions.
 - r. Number of blows for every 12 inches (305 mm) of penetration, and number of blows per 1 inch (25 mm) for the last 6 inches (152 mm) of driving.
 - s. Pile deviations from location and plumb.
 - t. Preboring, jetting, or special procedures used.
 - u. Unusual occurrences during pile driving.

E. Field Quality Control



1. Special Inspections: Engage a qualified special inspector to perform the following special inspections:
 - a. Pile foundations.
 2. Testing Agency: Engage a qualified independent testing agency to perform tests and inspections.
 3. Tests and Inspections:
 - a. Dynamic Pile Testing: High-strain dynamic monitoring shall be performed and reported according to ASTM D 4945 during initial driving and during restriking on five single piles **OR** 3 percent of piles, **as directed**.
 - b. Weld Testing: In addition to visual inspection, welds shall be tested and inspected according to AWS D1.1/D1.1M and inspection procedures listed below, at testing agency's option. Correct deficiencies in Work that test reports and inspections indicate do not comply with the Contract Documents.
 - 1) Liquid Penetrant Inspection: ASTM E 165.
 - 2) Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - 3) Radiographic Inspection: ASTM E 94, minimum quality level "2-2T."
 - 4) Ultrasonic Inspection: ASTM E 164.
- F. Touchup Painting, **as directed**
1. Clean field welds, splices, and abraded painted areas and field-apply paint according to SSPC-PA 1. Use same paint and apply same number of coats as specified for shop painting.
 - a. Apply touchup paint before driving piles to surfaces that will be immersed or inaccessible after driving.
- G. Disposal
1. Remove withdrawn piles and cutoff sections of piles from site and legally dispose of them off Owner's property.

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Task	Specification	Specification Description
31 62 16 19	31 62 13 19	Concrete-Filled Steel Piles



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SECTION 31 62 19 00 - TIMBER PILES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for timber piles. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes round timber piles.

C. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: For timber piles. Show fabrication and installation details for piles, including details of driving shoes, tips or boots, and pile butt protection.
 - a. Include arrangement of static pile reaction frame, test and anchor piles, equipment, and instrumentation. Submit structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
3. Round timber pile treatment data as follows, including chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material:
 - a. For each type of preservative-treated timber product include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.
 - b. For waterborne-treated products include statement that moisture content of treated materials was reduced to levels indicated before shipment to Project site.
4. Pile-Driving Equipment Data: Include type, make, and rated energy range; weight of striking part of hammer; weight of drive cap; and, type, size, and properties of hammer cushion.
5. Static Pile Test Reports: Submit within three days of completing each test.
6. Pile-Driving Records: Submit within three days of driving each pile.
7. Field quality-control reports.
8. Warranty of chemical treatment manufacturer for each type of treatment.
9. Preconstruction Photographs: Photographs or video of existing conditions of adjacent construction. Submit before the Work begins.

D. Quality Assurance

1. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
2. Preinstallation Conference: Conduct conference at Project site.

E. Delivery, Storage, And Handling

1. Deliver piles to Project site in such quantities and at such times to ensure continuity of installation. Handle and store piles at Project site to prevent breaks, cuts, abrasions, or other physical damage and as required by AWPA M4.
 - a. Do not drill holes or drive spikes or nails into pile below cutoff elevation.

F. Project Conditions

1. Protect structures, underground utilities, and other construction from damage caused by pile driving.
2. Preconstruction Photographs: Inventory and record the condition of adjacent structures, underground utilities, and other construction. Provide photographs **OR** video, **as directed**, of conditions that might be misconstrued as damage caused by pile driving.



1.2 PRODUCTS

A. Timber Piles

1. Round Timber Piles: ASTM D 25, unused, clean peeled, one piece from butt to tip; of the following species and size basis:
 - a. Species: Coastal Douglas fir **OR** Southern yellow pine, **as directed**.
 - b. Size Basis: Butt circumference **OR** Class A **OR** Class B **OR** Tip circumference **OR** 8-inch (203-mm) tip and natural taper, **as directed**.
2. Pressure-treat round timber piles according to AWPA C3 and, **as directed**, AWPA C18 **OR** AWPA C14, **as directed**, as follows:
 - a. Service Condition: Land and freshwater **OR** Foundation **OR** Saltwater **OR** Marine piles - dual treatment, **as directed**.
 - b. Treatment: Waterborne preservative **OR** Creosote or creosote solution **OR** Oil-borne preservative **OR** Waterborne preservative, severe marine borer hazard **OR** Dual treatment consisting of waterborne preservative, followed by creosote or creosote solution, **as directed**.

B. Pile Accessories

1. Driving Shoes: Fabricate from ASTM A 1011/A 1011M, hot-rolled carbon-steel strip to suit pile-tip diameter, of the following type and thickness, and secure to pile tip so as to not affect pile alignment during driving:
 - a. Type: Flat boot **OR** Arrow point, **as directed**.
 - b. Thickness: 3/16 inch (4.8 mm) **OR** 1/4 inch (6 mm), **as directed**.

C. Fabrication

1. Pile Tips: Cut and shape pile tips to accept driving shoes. Fit and fasten driving shoes to pile tips according to manufacturer's written instructions.
2. Pile Butt: Trim pile butt and cut perpendicular to longitudinal axis of pile. Chamfer and shape butt to fit tightly to driving cap of hammer.
3. Field-Applied Wood Preservative: Treat field cuts, holes, and other penetrations according to AWPA M4.
 - a. Coal-tar roofing cement for treating drilled holes or sealing cutoffs shall be free of asbestos.
4. Pile Splices: Splices will not be permitted.
5. Pile-Length Markings: Mark each pile with horizontal lines at 12-inch (305-mm) intervals; label the distance from pile tip at 60-inch (1.52-m) intervals. Maintain markings on piles until driven.

1.3 EXECUTION

A. Examination

1. Site Conditions: Do not start pile-driving operations until earthwork fills have been completed or excavations have reached an elevation of 6 to 12 inches (152 to 305 mm) above bottom of footing or pile cap.

B. Driving Equipment

1. Pile Hammer: Air-, steam-, hydraulic-, or diesel-powered type capable of consistently delivering adequate peak-force duration and magnitude to develop the ultimate capacity required for type and size of pile driven and character of subsurface material anticipated.
2. Hammer Cushions and Driving Caps: Between hammer and top of pile, provide hammer cushion and steel driving cap as recommended by hammer manufacturer and as required to drive pile without damage.
3. Leads: Use fixed, semifixed, or hanging-type pile-driver leads that will hold full length of pile firmly in position and in axial alignment with hammer.



C. Static Pile Tests, **as directed**

1. General: Static pile tests will be used to verify driving criteria and pile lengths and to confirm allowable load of piles.
 - a. Furnish test piles 60 inches (1.52 m) longer than production piles.
 - b. Determination of actual length of piles will be based on results of static pile tests.
2. Pile Tests: Arrange and perform the following pile tests:
 - a. Axial Compressive Static Load Test: ASTM D 1143.
 - b. Axial Tension Static Load Test: ASTM D 3689.
 - c. Lateral Load Test: ASTM D 3966.
3. Equip each test pile with two telltale rods, according to ASTM D 1143, for measuring deformation during load test.
4. Provide pile reaction frame, anchor piles, equipment, and instrumentation with sufficient reaction capacity to perform tests. Notify the Owner at least 48 hours in advance of performing tests. On completion of testing, remove testing structure, anchor piles, equipment, and instrumentation.
 - a. Allow a minimum of seven days to elapse after driving test piles before starting pile testing.
 - b. Number of Test Piles: One pile **OR** As indicated, **as directed**.
5. Driving Test Piles: Drive test piles at locations indicated to the minimum penetration or driving resistance indicated. Use test piles identical to those required for Project and drive with appropriate pile-driving equipment operating at rated driving energy to be used in driving permanent piles.
6. Approval Criteria: Allowable load shall be the load acting on the test pile when the lesser of, **as directed**, the following criteria are met, divided by a factor of safety of 2:
 - a. Net settlement, after deducting rebound, of not more than 0.01 inch/ton (0.25 mm/907 kg) of test load.
 - b. Total settlement exceeds the pile elastic compression by 0.15 inch (4 mm), plus 1.0 percent of the tip diagonal dimension.
 - c. A plunging failure or sharp break in the load settlement curve.
7. Test Pile-Driving Records: Prepare driving records for each test pile, compiled and attested to by a qualified professional engineer, **as directed**. Include same data as required for driving records of permanent piles.
8. Test piles that comply with requirements, including location tolerances, may be used on Project.

D. Driving Piles

1. General: Continuously drive piles to elevations or penetration resistance indicated or established by static load testing of piles, **as directed**. Establish and maintain axial alignment of leads and piles before and during driving.
2. Spudding: Drive spud piles through overlying highly resistant strata or obstructions and withdraw for reuse.
3. Predrilling, **as directed**: Provide pre-excavated holes where indicated, to depths indicated. Drill holes with a diameter less than the largest cross-section dimension of pile.
 - a. Firmly seat pile in predrilled hole by driving with reduced energy before starting final driving.
4. Heaved Piles: Redrive heaved piles to tip elevation at least as deep as original tip elevation with a driving resistance at least as great as original driving resistance.
5. Driving Tolerances: Drive piles without exceeding the following tolerances, measured at pile heads:
 - a. Location: 4 inches (102 mm) from location indicated after initial driving, and 6 inches (152 mm) after pile driving is completed.
 - b. Plumb: Maintain 1 inch (25 mm) in 4 feet (1.2 m) from vertical, or a maximum of 4 inches (102 mm), measured when pile is aboveground in leads.
 - c. Batter Angle: Maximum 1 inch (25 mm) in 4 feet (1.2 m) from required angle, measured when pile is aboveground in leads.
6. Withdraw damaged or defective piles and piles that exceed driving tolerances and install new piles within driving tolerances.



- a. Fill holes left by withdrawn piles using cohesionless soil material such as gravel, broken stone, and gravel-sand mixtures. Place and compact in lifts not exceeding 72 inches (1.83 m).

OR

Fill holes left by withdrawn piles as directed by the Owner.

OR

Abandon and cut off rejected piles as directed by the Owner. Leave rejected piles in place and install new piles in locations as directed by the Owner.

- 7. Cutting Off: Cut off butts of driven piles square with pile axis and at elevations indicated.
 - a. Cover cut-off piling surfaces with caps overlapping pile end by minimum 2 inches (51 mm) **OR** minimum three coats of preservative treatment, **as directed**, according to AWPMA M4.
- 8. Pile-Driving Records: Maintain accurate driving records for each pile, compiled and attested to by a qualified professional engineer, **as directed**. Include the following data:
 - a. Project name and number.
 - b. Name of Contractor.
 - c. Pile species.
 - d. Pile location in pile group and designation of pile group.
 - e. Sequence of driving in pile group.
 - f. Pile dimensions.
 - g. Ground elevation.
 - h. Elevation of tips after driving.
 - i. Final tip and cutoff elevations of piles after driving pile group.
 - j. Records of re-driving.
 - k. Elevation of splices.
 - l. Type, make, model, and rated energy of hammer.
 - m. Weight and stroke of hammer.
 - n. Type of pile-driving cap used.
 - o. Cushion material and thickness.
 - p. Actual stroke and blow rate of hammer.
 - q. Pile-driving start and finish times, and total driving time.
 - r. Time, pile-tip elevation, and reason for interruptions.
 - s. Number of blows for every 12 inches (305 mm) of penetration, and number of blows per 1 inch (25 mm) for the last 6 inches (152 mm) of driving.
 - t. Pile deviations from location and plumb.
 - u. Preboring, jetting, or special procedures used.
 - v. Unusual occurrences during pile driving.

E. Field Quality Control

- 1. Special Inspections: Engage a qualified special inspector to perform the following special inspections:
 - a. Pile foundations.
- 2. Testing Agency: Engage a qualified independent testing agency to perform tests and inspections.
- 3. Tests and Inspections:
 - a. Dynamic Pile Testing: High-strain dynamic monitoring shall be performed and reported according to ASTM D 4945 during initial driving and during restriking on five single piles **OR** 3 percent of piles, **as directed**.

F. Disposal

- 1. Remove withdrawn piles and cutoff sections of piles from site and legally dispose of them off Owner's property.

END OF SECTION 31 62 19 00



Task	Specification	Specification Description
31 62 23 13	31 62 13 19	Concrete-Filled Steel Piles



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SECTION 31 64 13 00 - DRILLED PIERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for drilled piers. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Dry-installed drilled piers.
 - b. Slurry displacement-installed drilled piers.

C. Submittals

1. Product Data: For each type of product indicated.
2. Design Mixtures: For each concrete mixture.
3. Shop Drawings: For concrete reinforcement.
4. Welding certificates.
5. Material certificates **OR** test reports, **as directed**.

D. Quality Assurance

1. Welding Qualifications: Qualify procedures and personnel according to the following:
 - a. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - b. AWS D1.4, "Structural Welding Code - Reinforcing Steel."
2. Drilled-Pier Standard: Comply with ACI 336.1 unless modified in this Section.
3. Preinstallation Conference: Conduct conference at Project site.

E. Project Conditions

1. Existing Utilities: Locate existing underground utilities before excavating drilled piers. If utilities are to remain in place, provide protection from damage during drilled-pier operations.
 - a. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, adapt drilling procedure if necessary to prevent damage to utilities. Cooperate with the Owner and utility companies in keeping services and facilities in operation without interruption. Repair damaged utilities to satisfaction of utility the Owner.
2. Interruption of Existing Utilities: Do not interrupt any utility to facilities occupied by the Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:
 - a. Notify the Owner no fewer than two days in advance of proposed interruption of utility.
 - b. Do not proceed with interruption of utility without the Owner's written permission.
3. Survey Work: Engage a qualified land surveyor or professional engineer to perform surveys, layouts, and measurements for drilled piers. Before excavating, lay out each drilled pier to lines and levels required. Record actual measurements of each drilled pier's location, shaft diameter, bottom and top elevations, deviations from specified tolerances, and other specified data.
 - a. Record and maintain information pertinent to each drilled pier and cooperate with the Owner's testing and inspecting agency to provide data for required reports.

1.2 PRODUCTS

A. Steel Reinforcement

1. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
2. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.



3. Galvanized Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420) **OR** ASTM A 706/A 706M, **as directed**, deformed bars, ASTM A 767/A 767M, Class I **OR** Class II, **as directed**, zinc coated after fabrication and bending.
4. Epoxy-Coated Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420) **OR** ASTM A 706/A 706M, **as directed**, deformed bars, ASTM A 775/A 775M or ASTM A 934/A 934M, epoxy coated, with less than 2 percent damaged coating in each 12-inch (300-mm) bar length.
5. Plain-Steel Wire: ASTM A 82, as drawn **OR** galvanized, **as directed**.
6. Deformed-Steel Wire: ASTM A 496.
7. Epoxy-Coated Wire: ASTM A 884/A 884M, Class A, Type 1 coated, as-drawn, plain **OR** deformed, **as directed**, steel wire, with less than 2 percent damaged coating in each 12-inch (300-mm) wire length.
8. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain. Cut bars true to length with ends square and free of burrs.

B. Concrete Materials

1. Cementitious Material: Use the following cementitious materials, of same type, brand, and source, throughout Project:
 - a. Portland Cement: ASTM C 150, Type I **OR** Type II **OR** Type I/II **OR** Type III **OR** Type V, **as directed**. Supplement with the following, **as directed**:
 - 1) Fly Ash: ASTM C 618, Class C **OR** Class F, **as directed**.
 - 2) Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
 - b. Blended Hydraulic Cement: ASTM C 595, Type IS, portland blast-furnace slag **OR** Type IP, portland-pozzolan **OR** Type I (PM), pozzolan-modified portland **OR** Type I (SM), slag-modified Portland, **as directed**, cement.
2. Normal-Weight Aggregate: ASTM C 33, graded, 3/4-inch- (19-mm-) nominal maximum coarse-aggregate size.
 - a. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
3. Water: ASTM C 94/C 94M and potable.
4. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - a. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - b. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - c. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 - d. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
5. Sand-Cement Grout: Portland cement, ASTM C 150, Type II; clean natural sand, ASTM C 404; and water to result in grout with a minimum 28-day compressive strength of 1000 psi (6.9 MPa), of consistency required for application.

C. Steel Casings

1. Steel Pipe Casings: ASTM A 283/A 283M, Grade C, or ASTM A 36/A 36M, carbon-steel plate, with joints full-penetration welded according to AWS D1.1/D1.1M.
2. Corrugated-Steel Pipe Casings: ASTM A 929/A 929M, steel sheet, zinc coated.
3. Liners: Comply with ACI 336.1.

D. Slurry

1. Slurry: Pulverized bentonite, pulverized attapulgite, or polymers mixed with water to form stable colloidal suspension; complying with ACI 336.1 for density, viscosity, sand content, and pH.

E. Concrete Mixtures

1. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
2. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 limits as if concrete were exposed to deicing chemicals.



3. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 **OR** 0.30, **as directed**, percent by weight of cement.
4. Proportion normal-weight concrete mixture as follows:
 - a. Compressive Strength (28 Days): 6000 psi (41.4 MPa) **OR** 5000 psi (34.5 MPa) **OR** 4500 psi (31 MPa) **OR** 4000 psi (27.6 MPa) **OR** 3500 psi (24.1 MPa) **OR** 3000 psi (20.7 MPa), **as directed**.
 - b. Maximum Water-Cementitious Materials Ratio: 0.50 **OR** 0.45 **OR** 0.40, **as directed**.
 - c. Minimum Slump: Capable of maintaining the following slump until completion of placement:
 - 1) 4 inches (100 mm) for dry, uncased, or permanent-cased drilling method.
 - 2) 6 inches (150 mm) for temporary-casing drilling method.
 - 3) 7 inches (175 mm) for slurry displacement method.
 - d. Air Content: Do not air entrain concrete.

F. Fabricating Reinforcement

1. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

G. Concrete Mixing

1. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
 - a. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

1.3 EXECUTION

A. Preparation

1. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, vibration, and other hazards created by drilled-pier operations.

B. Excavation

1. Unclassified Excavation: Excavate to bearing elevations regardless of character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions.
 - a. Obstructions: Unclassified excavation may include removal of unanticipated boulders, concrete, masonry, or other subsurface obstructions. No changes in the Contract Sum or the Contract Time will be authorized for removal of obstructions.
2. Classified Excavation: Excavation is classified as standard excavation, special excavation, and obstruction removal and includes excavation to bearing elevations as follows:
 - a. Standard excavation includes excavation accomplished with conventional augers fitted with soil or rock teeth, drilling buckets, or underreaming tools attached to drilling equipment of size, power, torque, and downthrust necessary for the Work.
 - b. Special excavation includes excavation that requires special equipment or procedures above or below indicated depth of drilled piers where drilled-pier excavation equipment used in standard excavation, operating at maximum power, torque, and downthrust, cannot advance the shaft.
 - 1) Special excavation requires use of special rock augers, core barrels, air tools, blasting, or other methods of hand excavation.
 - 2) Earth seams, rock fragments, and voids included in rock excavation area will be considered rock for full volume of shaft from initial contact with rock.
 - c. Obstructions: Payment for removing unanticipated boulders, concrete, masonry, or other subsurface obstructions that cannot be removed by conventional augers fitted with soil or rock teeth, drilling buckets, or underreaming tools attached to drilling equipment of size, power, torque, and downthrust necessary for the Work will be according to Contract provisions for changes in the Work.



3. Prevent surface water from entering excavated shafts. Conduct water to site drainage facilities.
4. Excavate shafts for drilled piers to indicated elevations. Remove loose material from bottom of excavation.
 - a. Excavate bottom of drilled piers to level plane within 1:12 tolerance.
 - b. Remove water from excavated shafts before concreting.
 - c. Excavate rock sockets of dimensions indicated.
 - d. Cut series of grooves about perimeter of shaft to height from bottom of shaft, vertical spacing, and dimensions indicated.
5. Notify and allow testing and inspecting agency to test and inspect bottom of excavation. If unsuitable bearing stratum is encountered, make adjustments to drilled piers as determined by the Owner.
 - a. Do not excavate shafts deeper than elevations indicated unless approved by the Owner.
 - b. Payment for additional authorized excavation will be according to Contract provisions for changes in the Work.
6. End-Bearing Drilled Piers: If further exploration below bearing elevation is required for end-bearing piers or if soft soils are suspected, probe with auger to a depth below bearing elevation, equal to diameter of the bearing area of drilled pier. Determine whether voids, clay seams, or solution channels exist.
 - a. Fill augur-probe holes with grout.
7. End-Bearing Drilled Piers: If drilled piers bear on clay or hardpan, probe with auger to a depth of 96 inches (2450 mm) below bottom elevation of shaft, and visually inspect and classify soil. Verify continuity and thickness of stratum.
8. Excavate shafts for closely spaced drilled piers and for drilled piers occurring in fragile or sand strata only after adjacent drilled piers are filled with concrete and allowed to set.
9. Slurry Displacement Method: Stabilize excavation with slurry maintained a minimum of 60 inches (1500 mm) above ground-water level and above unstable soil strata to prevent caving or sloughing of shaft. Maintain slurry properties before concreting.
 - a. Excavate and complete concreting of drilled pier on same day if possible, or redrill, clean, and test slurry in excavation before concreting.
 - b. Clean bottom of each shaft before concreting.
10. Temporary Casings: Install watertight steel casings of sufficient length and thickness to prevent water seepage into shaft; to withstand compressive, displacement, and withdrawal stresses; and to maintain stability of shaft walls.
 - a. Remove temporary casings, maintained in plumb position, during concrete placement and before initial set of concrete, or leave temporary casings in place, **as directed**.
11. Bells: Excavate bells for drilled piers to shape, base thickness, and slope angle indicated. Excavate bottom of bells to level plane and remove loose material before placing concrete.
 - a. Shore bells in unstable soil conditions to prevent cave-in during excavation, inspection, and concreting.
12. Tolerances: Construct drilled piers to remain within ACI 336.1 tolerances.
 - a. If location or out-of-plumb tolerances are exceeded, provide corrective construction. Submit design and construction proposals to the Owner for review before proceeding.

C. Permanent Steel Casings

1. Install steel casings of minimum wall thickness indicated and of diameter not less than diameter of drilled pier.
 - a. Install casings as excavation proceeds, to maintain sidewall stability.
 - b. Fabricate bottom edge of lowest casing section with cutting shoe capable of penetrating rock and achieving water seal.
 - c. Connect casing sections by continuous penetration welds to form watertight, continuous casing.
 - d. Remove and replace or repair casings that have been damaged during installation and that could impair strength or efficiency of drilled pier.
 - e. Fill annular void between casing and shaft wall with grout.



2. Corrugated-Steel Casings: Provide corrugated-steel casings formed from zinc-coated steel sheet.
 - a. Corrugated casings may be delivered in sections or panels of convenient length and field connected according to manufacturer's written instructions.
- D. Steel Reinforcement
 1. Comply with recommendations in CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
 2. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy bond with concrete.
 3. Fabricate and install reinforcing cages symmetrically about axis of shafts in a single unit.
 4. Accurately position, support, and secure reinforcement against displacement during concreting. Maintain minimum cover over reinforcement.
 5. Use templates to set anchor bolts, leveling plates, and other accessories furnished in work of other Sections. Provide blocking and holding devices to maintain required position during final concrete placement.
 6. Protect exposed ends of extended reinforcement, dowels, or anchor bolts from mechanical damage and exposure to weather.
- E. Concrete Placement
 1. Place concrete in continuous operation and without segregation immediately after inspection and approval of shaft by the Owner's independent testing and inspecting agency.
 - a. Construct a construction joint if concrete placement is delayed more than one hour. Level top surface of concrete and insert joint dowel bars, **as directed**. Before placing remainder of concrete, clean surface laitance, roughen, and slush concrete with commercial bonding agent or with sand-cement grout mixed at ratio of 1:1.
 2. Dry Method: Place concrete to fall vertically down the center of drilled pier without striking sides of shaft or steel reinforcement.
 - a. Where concrete cannot be directed down shaft without striking reinforcement, place concrete with chutes, tremies, or pumps.
 - b. Vibrate top 60 inches (1500 mm) of concrete.
 3. Slurry Displacement Method: Place concrete in slurry-filled shafts by tremie methods or pumping. Control placement operations to ensure that tremie or pump pipe is embedded no fewer than 60 inches (1500 mm) into concrete and that flow of concrete is continuous from bottom to top of drilled pier.
 4. Coordinate withdrawal of temporary casings with concrete placement to maintain at least a 60-inch (1500-mm) head of concrete above bottom of casing.
 - a. Vibrate top 60 inches (1500 mm) of concrete after withdrawal of temporary casing.
 5. Screed concrete at cutoff elevation level and apply scoured, rough finish. Where cutoff elevation is above the ground elevation, form top section above grade and extend shaft to required elevation.
 6. Protect concrete work, according to ACI 301, from frost, freezing, or low temperatures that could cause physical damage or reduced strength.
 - a. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - b. Do not use calcium chloride, salt, or other mineral-containing antifreeze agents or chemical accelerators.
 7. If hot-weather conditions exist that would seriously impair quality and strength of concrete, place concrete according to ACI 301 to maintain delivered temperature of concrete at no more than 90 deg F (32 deg C).
 - a. Place concrete immediately on delivery. Keep exposed concrete surfaces and formed shaft extensions moist by fog sprays, wet burlap, or other effective means for a minimum of seven days.
- F. Field Quality Control



1. Special Inspections: Engage a qualified special inspector to perform the following special inspections:
 - a. Drilled piers.
 - b. Excavation.
 - c. Concrete.
 - d. Steel reinforcement welding.
2. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
3. Drilled-Pier Tests and Inspections: For each drilled pier, before concrete placement.
 - a. Soil Testing: Bottom elevations, bearing capacities, and lengths of drilled piers indicated have been estimated from available soil data. Actual elevations and drilled-pier lengths and bearing capacities will be determined by testing and inspecting agency. Final evaluations and approval of data will be determined by the Owner.
 - 1) Bearing Stratum Tests: Testing agency will take undisturbed hardpan **OR** rock, **as directed**, core samples from drilled-pier bottoms and test each sample for compression, moisture content, and density, and will report results and evaluations.
4. Concrete Tests and Inspections: ASTM C 172 except modified for slump to comply with ASTM C 94/C 94M.
 - a. Slump: ASTM C 143/C 143M; one test at point of placement for each compressive-strength test but no fewer than one test for each concrete load.
 - b. Concrete Temperature: ASTM C 1064/C 1064M; 1 test hourly when air temperature is 40 deg F (4.4 deg C) and below and 80 deg F (27 deg C) and above, and 1 test for each set of compressive-strength specimens.
 - c. Compression Test Specimens: ASTM C 31/C 31M; one set of four standard cylinders for each compressive-strength test unless otherwise indicated. Mold and store cylinders for laboratory-cured test specimens unless field-cured test specimens are required.
 - d. Compressive-Strength Tests: ASTM C 39; one set for each drilled pier but not more than one set for each truck load. One specimen will be tested at 7 days, 2 specimens will be tested at 28 days, and 1 specimen will be retained in reserve for later testing if required.
 - e. If frequency of testing will provide fewer than five strength tests for a given class of concrete, testing will be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 - f. If strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
 - g. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
 - h. Report test results in writing to the Owner, concrete manufacturer, and Contractor within 48 hours of testing. List Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests in reports of compressive-strength tests.
 - i. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by the Owner but will not be used as sole basis for approval or rejection of concrete.
 - j. Additional Tests: Testing and inspecting agency will make additional tests of concrete if test results indicate that slump, compressive strengths, or other requirements have not been met, as directed by the Owner.
 - 1) Continuous coring of drilled piers may be required, at Contractor's expense, if temporary casings have not been withdrawn within specified time limits or if observations of placement operations indicate deficient concrete quality, presence of voids, segregation, or other possible defects.



- k. Perform additional testing and inspecting, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.
- l. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
5. An excavation, concrete, or a drilled pier will be considered defective if it does not pass tests and inspections.
6. Prepare test and inspection reports for each drilled pier as follows:
 - a. Actual top and bottom elevations.
 - b. Actual drilled-pier diameter at top, bottom, and bell.
 - c. Top of rock elevation.
 - d. Description of soil materials.
 - e. Description, location, and dimensions of obstructions.
 - f. Final top centerline location and deviations from requirements.
 - g. Variation of shaft from plumb.
 - h. Shaft excavating method.
 - i. Design and tested bearing capacity of bottom.
 - j. Depth of rock socket.
 - k. Levelness of bottom and adequacy of cleanout.
 - l. Properties of slurry and slurry test results at time of slurry placement and at time of concrete placement.
 - m. Ground-water conditions and water-infiltration rate, depth, and pumping.
 - n. Description, purpose, length, wall thickness, diameter, tip, and top and bottom elevations of temporary or permanent casings. Include anchorage and sealing methods used and condition and weather tightness of splices if any.
 - o. Description of soil or water movement, sidewall stability, loss of ground, and means of control.
 - p. Bell dimensions and variations from original design.
 - q. Date and time of starting and completing excavation.
 - r. Inspection report.
 - s. Condition of reinforcing steel and splices.
 - t. Position of reinforcing steel.
 - u. Concrete placing method, including elevation of consolidation and delays.
 - v. Elevation of concrete during removal of casings.
 - w. Locations of construction joints.
 - x. Concrete volume.
 - y. Concrete testing results.
 - z. Remarks, unusual conditions encountered, and deviations from requirements.
- G. Disposal Of Surplus And Waste Materials
 1. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off the Owner's property.

END OF SECTION 31 64 13 00



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SECTION 31 66 13 00 - RESISTANCE PIER SYSTEMS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of 2-Piece Resistance Piers. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Scope of Work: The work includes, but is not limited, to the following:

1. All soil excavation;
2. Preparation of the footing and stem wall or foundation grade beam;
3. Installation of the Pier Bracket including concrete anchors;
4. Mounting of the Drive Stand Assembly and the installation of steel Pier Sections to designed specifications;
5. Installation of the Top Pier Platform and Two Piece Lift Head Assembly;
6. Lifting of the structure with hydraulic rams and the restoration of the structure to a permanent elevation;
7. Replacement of the soil and general site clean-up.

1.2 PRODUCTS

A. Pier Bracket

1. Standard 2-Piece Pier Bracket (2-7/8" Diameter Pier Pipe): The Pier Bracket shall be a welded assembly of 5/8 and 1/2 inch thick flame cut steel plates conforming to ASTM A36, A568 and A569. The Pier Bracket shall provide 69 square inches of bearing surface against the bottom of the footing and a minimum of 48 square inches against the vertical face of the foundation. The Pier Bracket shall have guides for the top pier platform, two 9/16 inch diameter bracket mounting holes, two 11/16 inch diameter pier pin holes and four 1-1/32 inch diameter alignment and equipment mounting holes.
2. Standard 2-Piece Pier Bracket (3-1/2" & 4" Diameter Pier Pipe): The Pier Bracket for the 3-1/2 inch or 4-inch diameter pier shall be a welded assembly of 5/8 and 1/2 inch thick flame cut steel plates conforming to ASTM A36, A568 and A569. The Pier Bracket shall provide 74 square inches of bearing surface against the bottom of the footing and a minimum of 59 square inches against the vertical face of the foundation. The Pier Bracket shall have guides for the Top Pier Platform, two 9/16 inch diameter bracket mounting holes, two 11/16 inch diameter pier pin holes and six 1-1/32 inch diameter alignment and equipment mounting holes.
3. Heavy Duty 2-Piece Pier Bracket (4-1/2" Diameter Pier Pipe): The Pier Bracket shall be a welded assembly of 5/8 and 1/2 inch thick flame cut steel plates conforming to ASTM A36, A568 and A569. The Pier Bracket shall provide 74 square inches of bearing surface against the bottom of the footing and a minimum of 128 square inches against the vertical face of the foundation. The Pier Bracket shall have guides for the Top Pier Platform, four 9/16 inch diameter bracket mounting holes, two 7/8 inch diameter pier pin holes and six 1-1/32 inch diameter alignment and equipment mounting holes.
4. Flat Plate 2-Piece Pier Bracket (2-7/8", 3-1/2" & 4" Diameter Pier Pipe): The Pier Bracket shall be a welded assembly of 5/8 and 1/2-inch thick flame cut steel plates conforming to ASTM A36, A568 and A569. The Pier Bracket shall provide 320 square inches of surface contact against a vertical face of the stem wall or column. The Pier Bracket shall have guides for the Top Pier Platform, four 1 inch and four 1-1/8 inch diameter bracket mounting holes, four 11/16 inch diameter pier pin holes and six 1-1/32 inch diameter alignment and equipment mounting holes.
5. Curved Plate 2-Piece Pier Bracket (2-7/8", 3-1/2" & 4" Diameter Pier Pipe): The Curved Plate series of Pier Brackets shall be constructed as specified in Paragraph A.1 above with the



exception that the plate that mounts against the circular column shall be rolled to conform to the diameter of the column.

B. Anchor Bolts

1. Standard Pier Anchor Bolts: Each Pier Bracket requires two 1/2 inch diameter by 5-1/2 inch long (minimum) steel concrete expansion bolts (Four required for the 4-1/2" Diameter Heavy Duty 2-Piece Pier), cadmium plated with an ultimate pull out capacity of 6,300 pounds, working load 2,400 pounds. Bolts are required for mounting only. The Anchor Bolts shall be supplied with a flat washer and nut.
2. Plate Pier Anchor Bolts: Each Pier Bracket requires two 1/2 inch diameter by 5-1/2 inch long (minimum), four 3/4 inch diameter by 7-1/2 inch long (minimum) and four 3/4 inch diameter (minimum) by 10 inch long (minimum) steel concrete expansion bolts, cadmium plated with an ultimate pull out capacity of 7,250 pounds (minimum) to achieve maximum capacity. (Lighter bolt design may be used with lighter load applications.) The Anchor Bolts shall be supplied with a flat washer and nut.

C. Grout (Optional)

1. Pressure Bearing Grout: Quick setting premixed mortar with a 4,500 psi (minimum), three day strength. Master Builder's 713 Non-Shrink Grout or equivalent.
2. Flowable Pipe Grout: Quick setting, neat cement flowable grout with a 4,000 psi (minimum), three day strength.
3. Flowable Grout Fill: The grout slurry shall consist of sand, soil or other suitable void fill material mixed with any recognized lubricant such as 12 per cent cement (2-1/2 sack mix), bentonite or other lubricant to promote proper flow characteristics.

D. Drive Stand Assembly: The Drive Stand Assembly shall be a welded steel frame with a double acting hydraulic actuator capable of pressing the 42 inch long steel Pier Sections through the soil to a load bearing strata. The Drive Stand Assembly shall be temporarily attached to the Pier Bracket by means of one inch diameter by 2-3/4 inch long high strength locking pins.

E. Pier Section

1. Pier Section (2-7/8" Diameter x 0.165" Wall Thickness): Each Pier Section shall be fabricated from a 2-7/8 inch outside diameter by 42-inch long mill rolled, induction heat treated steel section with a 0.165 inch wall thickness. Yield strength shall be 50,000 psi and tensile strength shall be 55,000 psi. The initial section shall have a 3-1/2 inch outside diameter collar welded to the lead end of the pipe to assist in reducing wall friction during driving of the pier to capacity. The Pier Sections that follow shall each have a Coupling welded to one end. Steel in this section shall conform to ASTM A513.
2. Standard Pier Section (3-1/2" Diameter x 0.160" Wall Thickness): Each Pier Section shall be fabricated from a 3-1/2 inch outside diameter by 42-inch long mill rolled galvanized steel section with a 0.160 inch wall thickness. Yield strength shall be 50,000 psi and tensile strength shall be 55,000 psi. A triple coat corrosion protection of zinc chromate and clear polymer coating shall be provided. The initial section shall have a 4 inch outside diameter collar welded to the lead end of the pipe to assist in reducing wall friction during driving of the pier to capacity. The Pier Sections that follow shall each have a Coupling welded to one end. Steel in this section shall conform to ASTM A53, A513, A588, and B6.
3. Pier Section (4" Diameter x 0.219" Wall Thickness): Each Pier Section shall be fabricated from a 4 inch outside diameter by 42-inch long mill rolled steel section with a 0.219 inch wall thickness. Yield strength shall be 50,000 psi and tensile strength shall be 55,000 psi. The initial section shall have a 4-1/2 inch outside diameter collar welded to the lead end of the pipe to assist in reducing wall friction during driving of the pier to capacity. The Pier Sections that follow shall each have a Coupling welded to one end. Steel in this section shall conform to ASTM A513.
4. Heavy Duty Pier Section (4-1/2" Diameter x 0.238" Wall Thickness): Each Pier Section shall be fabricated from a 4-1/2 inch diameter, 0.238 wall thick pipe. Yield strength shall be 50,000 psi and tensile strength shall be 55,000 psi. The initial section shall have a 5 inch outside diameter



collar welded to the lead end of the pipe to assist in reducing wall friction during driving of the pier to capacity. The Pier Sections that follow shall each have a Coupling welded to one end. Steel in this section shall conform to ASTM A513.

- F. Coupling: The Pier Coupling shall be a 6-inch long tubular steel section of suitable diameter to fit inside the Pier Section. The Coupling shall be inserted and attached 3 inches inside one end of each Pier Section that follows the initial Pier Section. The remaining 3 inches of the Coupling shall extend beyond the Pier Section. All components shall conform to ASTM A513. On the 3-1/2" Pier Pipe, the Coupling shall be attached by an embossed mechanical connection. On all other Pier Pipe sizes, the Coupling shall be attached by plug welding the Coupling to the Pier Pipe.
- G. Modified Sleeve Pier Section (Modified Pier Only): The Modified Sleeve Pier Section shall be fabricated from a 3-1/2 inch diameter, 0.216 inch thick wall or 4 inch diameter, 0.219 inch thick wall mill rolled steel pipe, by 42 inches long. The yield strength shall be 50,000 psi. The Pipe Sleeve shall be mounted over the last Pier Section and shall be used to increase the moment transfer capacity from the Top Pier Platform to the Pier Section. Steel in this section shall conform to ASTM A36.
- H. Pier Sleeving (Optional): Pier Sleeving shall be used to stiffen the segmented joints through areas of weak soils. Depending upon the product, the sleeve sections shall be fabricated from 3 inch diameter, schedule 40 pipe, or 4 inch diameter, 0.219 inch thick wall mill rolled steel pipe, or 4-1/2 inch diameter, 0.238 thick wall mill rolled steel pipe by 42 inches long. The Sleeving shall be driven over the Pier Sections in the area of weak soils. The Sleeving shall be installed in a manner that staggers the joints in the Pier with the joints in the Sleeving. Steel in this section shall conform to one or more of ASTM A53, A513, A588, B6.
- I. Top Pier Platform
1. Top Pier Platform For Standard, Modified And Plate Piers: The Standard Pier Platform shall be a welded assembly consisting of an 18 inch long steel tube of suitable size to fit over the Pier Section that shall form the cap cylinder. The cap cylinder shall have two 10 inch long by 5/8 inch thick steel plates welded as vertical stabilizers to the sides of the steel cap cylinder. The top of the Top Pier Platform shall be a 1 inch thick steel plate welded to the top of the cap cylinder. All steel elements shall conform to ASTM A36.
 2. Top Pier Platform For 4-1/2" Diameter Piers: A 4 inch outside diameter by 20 inch long steel pipe shall be welded to the inside of a 4-1/2 outside diameter by 10 inch long steel pipe to form the cap cylinder. The cap cylinder shall have two 9-1/2 inch long by 5/8 inch thick steel plates welded as vertical stabilizers to the sides of the steel cap cylinder. At the top of the Top Pier Platform shall be a 1 inch thick steel plate welded to the top of the cap cylinder. All steel elements shall conform to ASTM A36.
- J. High Strength Pier Pins
1. High Strength Pier Pins For Standard, Modified And Plate Piers: Two 5/8 inch diameter by three inch long high strength, heat treated cadmium plated Pier Pins are required per pier. The Pier Pins shall be capable of providing 55,000 pounds of ultimate shear resistance capacity in double shear configuration. Pier Pins shall be 10B21 Boron Steel and heat treated to RC36 +/- . Pins shall conform to ASTM A490.
 2. High Strength Pier Pins For 4-1/2" Diameter Piers: Two 3/4 inch diameter by 3-1/4 inch long high strength cadmium plated Pier Pins are required per pier. The Pier Pins are capable of providing a minimum 30,000 pounds of shear capacity at each point of shear. Pier Pins shall be equivalent to Grade 8.
- K. Lift Shims: The Lift Shims shall be 5/8 inch by 1-1/2 inch and either 7 gauge or 16 gauge cadmium plated hot rolled steel. Lift Shims shall be used as required. The steel shall conform to ASTM A36.
- L. Two Piece Lift Head Assembly: The Two Piece Lift Head shall be a welded assembly that consists of 5/8 inch thick and 1 inch thick steel plates and is capable of providing a minimum of 45,000 pounds resistance capacity. The Two Piece Lift Head Assembly shall be temporarily attached to the Pier



Bracket by means of one inch diameter by 2-3/4 inch long high strength locking pins that are inserted through matching 1-1/32 inch diameter holes.

- M. Lateral Support Device: The Lateral Support Device is a specialized tool used to provide a horizontal force to the bottom of the Pier Bracket during Pier Section installation. The Lateral Support Device shall help counteract the torque developed between the structure and the Pier Bracket during Pier Section installation. The Lateral Support Device is a welded assembly of steel plate and tubing that has an adjustable length by means of a hand actuated thread and by a steel pin inserted through adjustment holes in the Lateral Support Device.
- N. Helical Outrigger Assembly (Optional): The Helical Outrigger Assembly shall provide supplemental drive resistance when installing the Pier Sections. This optional assembly is for use on light structures with low structural integrity. It is also used to push the Pier Section through weak or unsuitable strata and to develop a higher factor of safety. The Helical Outrigger Assembly shall consist of Helical Anchors, Helical Extension Sections, Connector Pins and Extension Rods.
- O. Weldments: All welded connections shall conform to the requirements of the American Welding Society, "Structural Welding Code AWS D1.1", and applicable revisions.

1.3 EXECUTION

- A. Exposure Of Footing Or Grade Beam: An area shall be excavated immediately adjacent to the building foundation to expose the footing, bottom of the grade beam, stem wall or column to a width of at least 36 inches and at least 15 inches beneath the proposed elevation of the base of the Pier Bracket. A chipping hammer shall be used to smooth and prepare the foundation for mounting of the Pier Bracket. The vertical and bottom face of the footing, if applicable, shall, to the extent possible, be smooth and at right angles to each other. The spread footing, if present, shall be notched to allow the Pier Bracket to mount directly under the bearing load of the stem wall, or shall be core drilled to allow the Pier Pipe from the Plate Pier to be installed. DO NOT cut any reinforcing steel in the footing element without approval by the engineer. The surfaces shall be smooth, free of all dirt, debris, and loose concrete so as to provide firm bearing surfaces for the Pier Bracket.
- B. Installation Of The Pier Bracket
 - 1. Installation Of The Standard & Heavy Duty Two Piece Pier Bracket
 - a. The Pier Bracket shall be temporarily mounted to the Drive Stand Assembly using one inch diameter locking pins and retaining clips. This assembly shall be lowered into the excavation adjacent to the foundation. The Pier Bracket shall then be seated flush against the footing using a hydraulic actuator or ram. The Pier Bracket shall be then fastened to the footing with two expansion Anchor Bolts. If the Pier Bracket does not have continuous bearing support on either the vertical or horizontal face, then Pressure Bearing Grout shall be used to provide proper bearing prior to driving the pier. Care should be exercised to insure that the Drive Stand Assembly frame is aligned plumb prior to driving each Pier Section. A carpenter's level may be used to verify the vertical alignment.
 - b. Install a Lateral Support Device between the bottom front side of the Pier Bracket and the vertical wall of the excavation opposite the pier. During installation of the Pier Sections, maintain support against the Pier Bracket with the Lateral Support Device. If required, install the optional Helical Outrigger Assembly to provide Supplemental Drive Resistance at this time.
 - 2. Installation Of The Two-Piece Plate Pier Bracket: A bolt template shall be used to properly locate and align the Pier Bracket at the location directed by the designer or directly over the cored hole in the footing element, if present. Once the anchor bolt holes are located, the 8 bolts shall be installed to the vertical face. The Plate Pier Bracket shall be installed with the nuts and washers provided with the anchor bolts. The longer bolts mount to the lower holes. Follow manufacturer's recommendations for bolt installation and maintain maximum embedment of the bolts. If the Pier



Bracket does not have continuous bearing support on the vertical face, then Pressure Bearing Grout shall be used to provide proper bearing prior to driving the pier. Care should be exercised to insure that the Pier Bracket is aligned plumb. A carpenter's level may be used to verify the vertical alignment.

C. Driving And Testing Pier Sections

1. Driving Of Pier Sections: All Pier Sections shall be continuously driven by use of the Drive Stand Assembly. The initial Pier Section shall have the friction reduction collar on the bottom end. Additional Pier Sections shall be added as the pier driving operation continues. Driving of the Pier Sections will continue until rock or an equal bearing strata is reached.
2. Load Testing Pier Section
 - a. Using The Double Acting Hydraulic Actuator: The pier shall be driven using the Drive Stand Assembly and the double acting hydraulic actuator until the maximum operating pressure of the hydraulic cylinder is reached or until lift of the structure is achieved, whichever occurs first. If the maximum hydraulic cylinder operating pressure is reached without lifting the structure, load test the Pier Section per Paragraph b following.
 - b. Using A Hydraulic Ram: Load testing the Pier to a force greater than the capacity of the hydraulic cylinder shall be achieved by removing the double acting hydraulic actuator from the Drive Stand Assembly and replacing it with the Supplemental Block. Install a 25 or 50 ton hydraulic ram, depending upon test force required, between the last Pier Section and the Supplemental Block. The hydraulic ram shall be actuated with a hand pump until bearing strata is verified as defined by a maximum installation force of:
 - 45,000 lbs. for 2-7/8" Dia. x 0.165" 2-Piece Pier & Plate Pier,
 - 52,500 lbs. for 2-7/8" Dia. x 0.165" 2-Piece Modified Pier & Modified Plate Pier,
 - 65,000 lbs. for 3-1/2" Dia. x 0.160" 2-Piece Pier & Plate Pier,
 - 67,500 lbs. for 3-1/2" Dia. x 0.160" 2-Piece Modified Pier & Modified Plate Pier,
 - 71,250 lbs. for 4" Dia. x 0.219" 2-Piece Pier & Plate Pier
 - 75,000 lbs. for 4" Dia. x 0.219" 2-Piece Modified Pier & Modified Plate Pier
 - 82,500 lbs. for 4-1/2" Dia. Heavy Duty 2-Piece Pier;or until lift of the structure is achieved, whichever is less.
3. Drive Equipment Removal: The Drive Stand Assembly shall be then removed from the Pier Bracket by removing the one inch diameter locking pins. The optional Helical Outrigger Assembly shall be removed at this time. (NOTE: If the 3-1/2" Diameter Modified Pier is being installed, or if the Pier is to be sleeved; perform the operations in Paragraph 4. following, before removing the Drive Stand Assembly.)
4. Cutting Final Pier Section: It is likely that the final installed Pier Section will have to be removed from the hole and cut to a length suitable to provide space for installing the Top Pier Platform. Mark and cut the Pier Section to the proper length using a metal cutting saw capable of a smooth cut at 90 degrees to the length of the Pier Section. After cutting to length, the final Pier Section is replaced.

- D. Driving Of Pipe Sleeve (Optional): Once the capacity of the pier is achieved, the Drive Stand Assembly shall be used to push the Modified Sleeving Pier Section or plain Pier Sleeving over the last Pier Section or sections. **Do not exceed the manufacturer's rated operating capacity for the hydraulic cylinder.** The joints between the Pier Sleeves shall be staggered with the Couplings on the Pier Sections. Once the Pipe Sleeve(s) are installed, the Drive Stand Assembly shall be removed from the Pier Bracket by removing the one inch diameter locking pins.

- E. Installing Pipe Grout (Optional): Once the pier is installed to load bearing stratum and cut to the proper elevation, a neat cement flowable grout may be installed to the pier pipe. The grout will increase the moment of inertia (stiffness) and corrosion resistance of the pier. The grout shall be introduced to the bottom of the pier by means of a tube inserted into the pier pipe. As the grout is pumped into the pier pipe the tube shall be removed as the elevation of the grout increases. The process shall be executed carefully so that air is not entrained into the grout.



- F. Installation Of The Top Pier Platform: The Top Pier Platform shall be installed over the last installed Pier Section. Align the vertical stabilizers within the channels on the legs of the Pier Bracket and tap the Top Pier Platform until it contacts the top of the final Pier Section. A small port shall be provided between the cap cylinder and the platform to verify contact.
- G. Installation Of The Two Piece Lift Head Assembly: The Two Piece Lift Head Assembly shall be temporarily attached to the Pier Bracket by aligning the holes in each assembly. The one inch diameter locking pins and clips are used to align and hold the two pieces together.
- H. Lifting And Holding: The lifting and holding operation is designed to raise the structure and to restore it to as close to the original elevation as the construction will allow. Normally this lift and hold operation is accomplished with several Pier placements simultaneously. Install one 25 or 30 ton hydraulic ram as required between the Two Piece Lift Head Assembly and the Top Pier Platform on each pier. Install 3-1/2 inch square pier shims or equal to reduce excess space between the ram and the Two Piece Lift Head Assembly. The rams shall be actuated simultaneously to raise the structure. Lifting shall continue until the structure is restored to its approximate original elevation or to design specifications. Once restored, install the cadmium plated Lift Shims above the vertical stabilizer plates of the Top Pier Platform. The 7 gauge shims shall always be used for this operation. The 16 gauge shims shall only be used for fine adjustments between the stack of shims and the bottom of the pier pin holes in the Pier Bracket. Install two High Strength Pier Pins into the holes in the Pier Bracket by tapping the High Strength Pier Pins into place. There must be a snug fit of the High Strength Pier Pins and the Lift Shims. The load is transferred to the Pier System by removing the pressure from the hydraulic rams. Remove the ram and then remove the one inch locking pins along with the Two Piece Lift Head Assembly from the Pier Bracket.
- I. Documentation: The installer shall carefully monitor the driving force applied to the Pier Sections as the pier is installed. It is recommended that the driving force be recorded at 3-1/2 foot unless directed otherwise by the Engineer. The form of the data may be as directed by the customer or the Engineer. The Lifting Force, Lift, and Pier Depth shall also be recorded and presented in a tabular form. In addition, the installer shall know and have the desired terminal pressure that will create the desired driving force approved by the Engineer prior to beginning the pier installation.
- J. Void Filling (Optional - Depends upon soil characteristics, structure, and amount of lift): After raising operations are complete, voids created between the foundation and underlying soil shall be filled using a low pressure injection of grout slurry. Injection shall be through holes through the foundation. The contractor shall inject the grout in such a manner as to completely fill the void without trapping pockets of air. When the operation is complete, the contractor shall repair the injection holes by filling the holes with high strength non-shrinking grout and finishing to reasonably match the existing surface textures and elevations.
- K. Clean Up: Once all of the equipment has been removed, the area shall be backfilled using the previously excavated soil. The backfill shall be made by placing no more than 8 inches of loose material in a lift and compacting that soil prior to placement of the next 8-inch lift. Sufficient lifts shall be used to restore the ground to its original elevation and density. Slope the soil contour for drainage away from the foundation.

END OF SECTION 31 66 13 00



SECTION 32 01 11 53 - TRAFFIC COATINGS

1.1 GENERAL

A. Description Of Work:

1. This specification covers the furnishing and installation of materials for traffic coating. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes traffic coatings for the following applications:
 - a. Interior and exterior pedestrian traffic.
 - b. Vehicular traffic.
 - c. Pavement markings.

C. Submittals

1. Product Data: For each product indicated.
2. Shop Drawings: Show extent of each traffic coating. Include details for treating substrate joints and cracks, flashings, deck penetrations, and other termination conditions.
3. Samples: For each type of finish indicated.
4. Material test reports.
5. Material certificates.
6. Qualification data.
7. Maintenance data.
8. Warranty.
9. LEED Submittal:
 - a. Product Data for Credit EQ 4.2: For interior field-applied traffic coatings and pavement marking paints, including printed statement of VOC content.

D. Quality Assurance

1. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of traffic coatings required for this Project.
2. Fire-Test-Response Characteristics: Provide traffic coating materials with the fire-test-response characteristics as determined by testing identical products per test method below for deck type and slopes indicated by an independent testing and inspecting agency that is acceptable to authorities having jurisdiction.
 - a. Class A **OR B OR C, as directed**, roof covering per ASTM E 108 or UL 790.
3. Preinstallation Conference: Conduct conference at Project site.

E. Delivery, Storage, And Handling

1. Deliver materials in original packages and containers with seals unbroken and bearing manufacturer's labels showing the following information:
 - a. Manufacturer's brand name.
 - b. Type of material.
 - c. Directions for storage.
 - d. Date of manufacture and shelf life.
 - e. Lot or batch number.
 - f. Mixing and application instructions.
 - g. Color.
2. Store materials in a clean, dry location protected from exposure to direct sunlight. In storage areas, maintain environmental conditions within range recommended in writing by manufacturer.

F. Project Conditions



1. Environmental Limitations: Apply traffic coatings within the range of ambient and substrate temperatures recommended in writing by manufacturer. Do not apply traffic coatings to damp or wet substrates, when temperatures are below 40 deg F (5 deg C), when relative humidity exceeds 85 percent, or when temperatures are less than 5 deg F (3 deg C) above dew point.
 - a. Do not apply traffic coatings in snow, rain, fog, or mist, or when such weather conditions are imminent during the application and curing period. Apply only when frost-free conditions occur throughout the depth of substrate.
2. Do not install traffic coating until items that will penetrate membrane have been installed.

G. Warranty

1. Special Warranty: Manufacturer's standard form in which traffic coating manufacturer agrees to repair or replace traffic coatings that deteriorate during the specified warranty period. Warranty does not include deterioration or failure of traffic coating due to unusual weather phenomena, failure of prepared and treated substrate, formation of new substrate cracks exceeding 1/16 inch (1.6 mm) in width, fire, vandalism, or abuse by snowplow, maintenance equipment, and truck traffic.
 - a. Deterioration of traffic coatings includes the following:
 - 1) Adhesive or cohesive failures.
 - 2) Abrasion or tearing failures.
 - 3) Surface crazing or spalling.
 - 4) Intrusion of water, oils, gasoline, grease, salt, deicer chemicals, or acids into deck substrate.
 - b. Warranty Period: Five years from date of Final Completion.

1.2 PRODUCTS

A. Materials

1. Traffic Coatings: Complying with ASTM C 957.
2. Material Compatibility: Provide primers; base, intermediate, and topcoats; and miscellaneous materials that are compatible with one another and with substrate under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
3. VOC Content: Provide traffic coatings and pavement marking paints, for use inside the weatherproofing system, with VOC content of 150 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Traffic Coating

1. Primer: Manufacturer's standard factory-formulated primer recommended for substrate and conditions indicated.
 - a. Material: Epoxy **OR** Urethane, **as directed**.
2. Preparatory and Base Coats: Single- or multicomponent, aromatic liquid urethane elastomer.
3. Intermediate Coat: Single- or multicomponent, aromatic liquid urethane elastomer **OR** Single- or multicomponent, aliphatic liquid urethane elastomer **OR** Liquid epoxy, **as directed**.
4. Topcoat: Single- or multicomponent, aromatic liquid urethane elastomer **OR** Single- or multicomponent, aliphatic liquid urethane elastomer **OR** Single- or multicomponent, aromatic liquid urethane elastomer with UV inhibitors **OR** Liquid epoxy, **as directed**.
 - a. Color: As selected by the Owner from manufacturer's full range.
5. Aggregate: Uniformly graded, washed silicon carbide sand **OR** Uniformly graded, washed silica sand **OR** Uniformly graded, washed flint shot silica **OR** Walnut shell granules **OR** Aluminum-oxide grit, **as directed**, of particle sizes, shape, and minimum hardness recommended in writing by traffic coating manufacturer.
 - a. Spreading Rate: As recommended by manufacturer for substrate and service conditions indicated, but not less than the following:
 - 1) Intermediate Coat: 8 to 10 lb/100 sq. ft. (3.6 to 4.5 kg/10 sq. m) **OR** To refusal, **as directed**.



- 2) Topcoat: 8 to 10 lb/100 sq. ft. (3.6 to 4.5 kg/10 sq. m) **OR** As required to achieve slip-resistant finish, **as directed**.

C. Miscellaneous Materials

1. Joint Sealants: As specified in Division 07 Section "Joint Sealants".
2. Sheet Flashing: Nonstaining.
 - a. Minimum Thickness: 60 mils (1.5 mm) **OR** 50 mils (1.3 mm), **as directed**.
 - b. Material: Sheet material recommended in writing by traffic coating manufacturer **OR** Uncured neoprene sheet **OR** Cured neoprene sheet, **as directed**.
3. Adhesive: Contact adhesive recommended in writing by traffic coating manufacturer.
4. Reinforcing Strip: Fiberglass mesh recommended in writing by traffic coating manufacturer.

D. Pavement Markings

1. Pavement-Marking Paint: Alkyd-resin ready mixed, complying with AASHTO M 248, Type S **OR** N **OR** F, **as directed**.
 - a. Color: White **OR** Yellow **OR** As indicated, **as directed**.
 - 1) Use blue for spaces accessible to people with disabilities.
2. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, with drying time of less than three **OR** 45, **as directed**, minutes.
 - a. Color: White **OR** Yellow **OR** As indicated, **as directed**.
 - 1) Use blue for spaces accessible to people with disabilities.
3. Glass Beads: AASHTO M 247, Type 1.

1.3 EXECUTION

A. Examination

1. Examine substrates, with Installer present, for compliance with requirements and for other conditions affecting performance of traffic coatings.
 - a. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance.
 - b. Verify compatibility with and suitability of substrates.
 - c. Begin coating application only after minimum concrete curing and drying period recommended by traffic coating manufacturer has passed, after unsatisfactory conditions have been corrected, and after surfaces are dry.
 - d. Verify that substrates are visibly dry and free of moisture.
 - 1) Test for moisture vapor transmission by plastic sheet method according to ASTM D 4263.
 - 2) Test for moisture content by measuring with an electronic moisture meter **OR** method recommended in writing by manufacturer, **as directed**.
 - e. Application of coating indicates acceptance of surfaces and conditions.

B. Preparation

1. Clean and prepare substrates according to ASTM C 1127 and manufacturer's written recommendations to produce clean, dust-free, dry substrate for traffic coating application.
2. Mask adjoining surfaces not receiving traffic coatings, deck drains, and other deck substrate penetrations to prevent spillage, leaking, and migration of coatings.
3. Concrete Substrates: Mechanically abrade concrete surfaces to a uniform profile according to ASTM D 4259. Do not acid etch.
 - a. Remove grease, oil, paints, and other penetrating contaminants from concrete.
 - b. Remove concrete fins, ridges, and other projections.
 - c. Remove laitance, glaze, efflorescence, curing compounds, concrete hardeners, form-release agents, and other incompatible materials that might affect coating adhesion.
 - d. Remove remaining loose material to provide a sound surface, and clean surfaces according to ASTM D 4258.



- C. Terminations And Penetrations
1. Prepare vertical and horizontal surfaces at terminations and penetrations through traffic coatings and at expansion joints, drains, and sleeves according to ASTM C 1127 and manufacturer's written recommendations.
 2. Provide sealant cants at penetrations and at reinforced and nonreinforced, deck-to-wall butt joints.
 3. Terminate edges of deck-to-deck expansion joints with preparatory base-coat strip.
 4. Install sheet flashings at deck-to-wall expansion and dynamic joints, and bond to deck and wall substrates according to manufacturer's written recommendations.
- D. Joint And Crack Treatment
1. Prepare, treat, rout, and fill joints and cracks in substrates according to ASTM C 1127 and manufacturer's written recommendations. Before coating surfaces, remove dust and dirt from joints and cracks according to ASTM D 4258.
 - a. Comply with recommendations in ASTM C 1193 for joint-sealant installation.
- E. Traffic Coating Application
1. Apply traffic coating material according to ASTM C 1127 and manufacturer's written recommendations.
 - a. Start traffic coating application in presence of manufacturer's technical representative.
 - b. Verify that wet film thickness of each component coat complies with requirements every 100 sq. ft. (9 sq. m).
 2. Apply traffic coatings to prepared wall terminations and vertical surfaces to height indicated, and omit aggregate on vertical surfaces.
 3. Cure traffic coatings according to manufacturer's written recommendations. Prevent contamination and damage during application and curing stages.
- F. Pavement Markings
1. Do not apply traffic paint for striping and other markings until traffic coating has cured according to manufacturer's written recommendations.
 2. Apply traffic paint for striping and other markings with mechanical equipment to produce uniform straight edges. Apply at manufacturer's recommended rates for a 15-mil- (0.38-mm-) minimum wet film thickness.
 3. Spread glass beads uniformly into wet traffic paint at a rate of 6 lb/gal. (0.72 kg/L).
- G. Field Quality Control
1. Testing: Engage a qualified testing agency to perform the following field tests and inspections and prepare test reports:
 - a. Samples of material delivered to Project site shall be taken, identified, sealed, and certified in presence of the Owner and Contractor.
 - b. Testing agency shall perform tests for characteristics specified, using applicable referenced testing procedures.
 - c. Testing agency shall verify thickness of coatings during traffic coating application.
 - d. If test results show traffic coating materials do not comply with requirements, remove noncomplying materials, prepare surfaces, and reapply traffic coatings.
 2. Flood Testing: Flood test each deck area for leaks, according to recommendations in ASTM D 5957, after traffic coating has completely cured. Install temporary containment assemblies, plug or dam drains, and flood with potable water.
 - a. Flood to an average depth of 2-1/2 inches (65 mm) with a minimum depth of 1 inch (25 mm) and not exceeding a depth of 4 inches (100 mm).
 - b. Flood each area for 24 **OR** 48 **OR** 72, **as directed**, hours.
 - c. After flood testing, repair leaks, repeat flood tests, and make further repairs until traffic coating installation is watertight.
 - d. Engage an independent testing agency to observe flood testing and examine underside of decks and terminations for evidence of leaks during flood testing.



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3. Final Traffic Coating Inspection: Arrange for traffic coating manufacturer's technical personnel to inspect membrane installation on completion.
 - a. Notify the Owner 48 hours in advance of date and time of inspection.
 4. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- H. Protecting And Cleaning
1. Protect traffic coatings from damage and wear during remainder of construction period.
 2. Clean spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 32 01 11 53



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SECTION 32 01 16 71 - GRINDING/GROOVING PAVEMENT**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of grinding/grooving pavement. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: For each type of product indicated.

1.2 PRODUCTS - Not Used**1.3 EXECUTION****A. Grinding:** This covers grinding asphalt concrete or portland cement concrete pavement and roadway surfaces of structures as shown on the plans and as specified in these specifications and the special provisions

1. Grinding shall be performed with abrasive grinding equipment utilizing diamond cutting blades.
2. Existing portland cement concrete pavement not constructed as part of the project shall be ground as follows:
 - a. Grinding shall be performed so that the pavement surface on both sides of all transverse joints and cracks has essentially the same depth of texture and does not vary from a true plane enough to permit a 1.9 mm thick shim 75 mm wide to pass under a one-meter straightedge adjacent to either side of the joint or crack when the straightedge is laid on the pavement parallel to centerline with its midpoint at the joint or crack. After grinding has been completed, the pavement shall conform to the straightedge and profile requirements specified in paving specification, paragraph "Final Finishing," except that pavement on tangent alignment and on horizontal curves of any radius shall have a profile index of 19 mm or less per 0.1-km.
 - b. Abnormally depressed areas due to subsidence or other localized causes will be excluded from testing with the profilograph and 3.6-m±0.06-m straightedge. The accumulated total of the excluded areas shall not exceed 5 percent of the total area to be ground. Profilograph testing shall end 8 m prior to excluded areas and shall resume 8 m following the excluded areas.
3. Existing asphalt concrete pavement not constructed as part of the project shall be ground so that the finished surface shall not vary from a true plane enough to permit a 3-mm thick shim 75 mm wide to pass under a straightedge 3.6 m±0.06-m long when the straightedge is laid on the finished surface parallel with the centerline. The transverse slope of the finished surface shall be uniform to a degree such that a 6 mm thick shim 75 mm wide will not pass under a straightedge 3.6 m±0.06-m long when the straightedge is laid on the finished surface in a direction transverse to the centerline and extending from edge to edge of a 3.6-m traffic lane.
4. Ground areas on structures, approach slabs and the adjacent 15 m of approach pavement shall conform to the provisions for smoothness and concrete cover over reinforcing steel.
5. Ground surfaces shall not be smooth or polished and, except as otherwise specified, shall have a coefficient of friction of not less than 0.30.
6. Residue from grinding operations shall be picked up by means of a vacuum attachment to the grinding machine and shall not be allowed to flow across the pavement nor be left on the surface of the pavement. Residue from grinding portland cement concrete pavement shall be disposed of



as directed. Residue from grinding asphalt concrete shall be disposed of outside the highway right of way.

7. At the option of the Contractor, the residue from grinding portland cement concrete pavement may be disposed of as directed by the authorities having jurisdiction over the site. A copy of the approval shall be delivered to the Engineer before disposing of residue at the site.
8. The noise level created by the combined grinding operation shall not exceed 86 dBA at a distance of 15 m at right angles to the direction of travel.

B. Grooving: This work shall consist of grooving the surface of asphalt concrete or Portland cement concrete pavement and bridge decks as shown on the plans and as specified in these specifications and the special provisions

1. Grooved areas shall begin and end at lines normal to the pavement center line and shall be centered within the lane width. If new concrete pavement is grooved, the grooving in any lane shall cover the full lane width.
2. Grooving blades shall be 2.41 mm \pm 0.13-mm wide and shall be spaced 19 mm on centers. The grooves shall be cut not less than 3 mm nor more than 7 mm deep. The grooves on bridge decks shall be cut not less than 3 mm nor more than 5 mm deep. Grooves over inductive loop detectors shall be cut not less than 2 mm nor more than 3 mm deep.
3. At the beginning of each work shift, all grooving machines shall be equipped with a full complement of grooving blades that are capable of cutting grooves of the specified width, depth and spacing.
4. If during the course of work a single grooving blade on any individual grooving machine becomes incapable of cutting a groove, work will be permitted to continue for the remainder of the work shift, and the Contractor will not be required to otherwise cut the groove omitted because of the failed blade. Should 2 or more grooving blades on any individual grooving machine become incapable of cutting grooves the Contractor shall either:
 - a. Discontinue work with the affected grooving machine within 15 m of the location where more than one blade became incapable, in which event the Contractor will not be required to otherwise cut the grooves omitted because of the failed blades; **OR**
Continue work with the affected grooving machine for the remainder of the work shift and by other means cut all grooves omitted, including grooves omitted because a single blade was incapable, by the affected grooving machine within that work shift. The omitted grooves shall be cut before any of the grooving work performed during the time the grooves were omitted will be accepted.
5. The actual grooved area of any selected 0.6-m by 30 m longitudinal area of pavement specified to be grooved shall be not less than 95 percent of the selected area. Grooves which are omitted as permitted for blades which become incapable will be measured as being actually grooved. No area will be measured until omitted grooves, which are required to be cut before the area is accepted, have been cut. Except as provided for omitted grooves due to an incapable blade, any area within the selected area not grooved shall be due only to irregularities in the pavement surface and for no other reason.
6. Residue from grooving operations shall be picked up by means of a vacuum attachment to the grooving machine and shall not be allowed to flow across the pavement nor be left on the surface of the pavement. Residue from grooving portland cement concrete pavement shall be disposed of as directed. Residue from grooving asphalt concrete shall be disposed of outside the highway right of way.
7. At the option of the Contractor, the residue from grooving portland cement concrete pavement may be disposed as directed by the authorities having jurisdiction over the site. A copy of the approval shall be delivered to the Engineer before disposing of residue at the site.
8. The noise level created by the combined grooving operation shall not exceed 86 dBA at a distance of 15 m at right angles to the direction of travel.

C. Highway or Street Grooving: AASHTO recommends the following groove specifications: 2.4 mm wide; depth of 3.2 to 4.8 mm, and a center-to-center spacing of 19.1 mm (0.75 inches) (7). The center 10-foot portion of a 12-foot lane is typically grooved, leaving a 1-foot strip ungrooved at the edge of each lane.



- D. Boat Ramp Grooving: Grooves shall be non-skid V-grooves spaced 2 inches on center, 1/2-inch radius, 1/2-inch deep.
- E. Runway Grooving
1. General
 - a. The grooving dimensions shall be as follows:
 - 1) Depth - One-quarter (1/4) inch \pm one sixteenth (1/16) inch
 - 2) Width - One-quarter (1/4) inch \pm one sixteenth (1/16) inch
 - 3) Center to center - One and one-half (1 1/2) inch \pm one eighth (1/8) inch
 - b. Grooving shall not begin until new pavement has properly cooled/cured and permission is given.
 - c. In no case shall final painted pavement markings be applied prior to grooving.
 2. The pavement must be grooved by approved diamond bladed saw-cutting equipment. Variations in the grooving contour will not be permitted without approval. All reasonable precautions shall be taken to avoid breaking or chipping the pavement surfaces between grooves. Excessive spalling of the grooved edges will not be permitted.
 3. The Contractor shall groove bituminous concrete and portland cement concrete pavements according to the following specifications (from FAA Advisory Circular 150/5320-12B, Section IV):
 - a. The depth of 90 percent or more of the groove shall not be less than 1/4 inch.
 - b. The grooves shall be continuous for the entire runway length and transverse (perpendicular) to the direction of aircraft landing and takeoff operations.
 - c. The grooves shall be continued to the end of the runway where the concrete meets the asphalt.
 - d. The grooves shall not vary more than 3 inches in alignment for 75 feet, allowing for realignment every 500 feet.
 - e. Grooves shall not be closer than 3 inches or more than 9 inches from transverse joints in concrete pavements.
 - f. Grooving through longitudinal or diagonal saw kerfs where lighting cables are installed shall be avoided. Grooves may be continued through longitudinal construction joints.
 - g. Grooves shall be sawed no closer than 6 inches and no more than 18 inches from in-pavement light fixtures.
 4. Cleanup is extremely important and should be continuous throughout the grooving operations. Accumulation of debris resulting from the grooving operations shall be cleaned from the grooves and removed from the pavement by air jets, high pressure water streams, or other approved methods, after each grooving operation at hourly intervals. The Contractor shall provide water for cleanup operations. The waste material shall not be flushed into the storm or sanitary sewer system. The waste material shall not be allowed to drain onto the shoulders or left on the runway surface in order to prevent foreign object damage.

END OF SECTION 32 01 16 71



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SECTION 32 01 16 72 - ASPHALT PAVING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for asphalt paving. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Cold milling of existing hot-mix asphalt pavement.
 - b. Hot-mix asphalt patching.
 - c. Hot-mix asphalt paving.
 - d. Hot-mix asphalt paving overlay.
 - e. Asphalt surface treatments.
 - f. Pavement-marking paint.
 - g. Traffic-calming devices.
 - h. Imprinted asphalt.

C. Definition

1. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.

D. Submittals

1. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.
 - a. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
 - b. Job-Mix Designs: For each job mix proposed for the Work.
2. Material Certificates: For each paving material, from manufacturer.

E. Quality Assurance

1. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by authorities having jurisdiction or the DOT of state in which Project is located.
2. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of State or local DOT for asphalt paving work.
 - a. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.
3. Preinstallation Conference: Conduct conference at Project site.

F. Delivery, Storage, And Handling

1. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.
2. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

G. Project Conditions

1. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:
 - a. Prime Coat: Minimum surface temperature of 60 deg F (15.6 deg C).
 - b. Tack Coat: Minimum surface temperature of 60 deg F (15.6 deg C).



- c. Slurry Coat: Comply with weather limitations in ASTM D 3910.
 - d. Asphalt Base Course: Minimum surface temperature of 40 deg F (4.4 deg C) and rising at time of placement.
 - e. Asphalt Surface Course: Minimum surface temperature of 60 deg F (15.6 deg C) at time of placement.
2. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F (4.4 deg C) for oil-based materials **OR** 55 deg F (12.8 deg C) for water-based materials, **as directed**, and not exceeding 95 deg F (35 deg C).
 3. Imprinted Asphalt Paving: Proceed with coating imprinted pavement only when air temperature is at least 50 deg F (10 deg C) and rising and will not drop below 50 deg F (10 deg C) within 8 hours of coating application. Proceed only if no precipitation is expected within two hours after applying the final layer of coating.

1.2 PRODUCTS

A. Aggregates

1. General: Use materials and gradations that have performed satisfactorily in previous installations.
2. Coarse Aggregate: ASTM D 692, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.
3. Fine Aggregate: ASTM D 1073 or AASHTO M 29, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.
 - a. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.
4. Mineral Filler: ASTM D 242 or AASHTO M 17, rock or slag dust, hydraulic cement, or other inert material.

B. Asphalt Materials

1. Asphalt Binder: AASHTO M 320 or AASHTO MP 1a, PG 64-22 **OR** PG 58-28 **OR** PG 70-22, **as directed**.
2. Asphalt Cement: ASTM D 3381 for viscosity-graded material **OR** ASTM D 946 for penetration-graded material, **as directed**.
3. Prime Coat:
 - a. ASTM D 2027, medium-curing cutback asphalt, MC-30 or MC-70 **OR** MC-250, **as directed**.
OR
Asphalt emulsion prime coat complying with State or local DOT requirements.
4. Tack Coat: ASTM D 977 or AASHTO M 140 emulsified asphalt, or ASTM D 2397 or AASHTO M 208 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.
5. Fog Seal: ASTM D 977 or AASHTO M 140 emulsified asphalt, or ASTM D 2397 or AASHTO M 208 cationic emulsified asphalt, slow setting, factory diluted in water, of suitable grade and consistency for application.
6. Water: Potable.
7. Undersealing Asphalt: ASTM D 3141, pumping consistency.

C. Auxiliary Materials

1. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.
2. Sand: ASTM D 1073 or AASHTO M 29, Grade Nos. 2 or 3.
3. Paving Geotextile: AASHTO M 288, nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications.



4. Joint Sealant: ASTM D 6690 or AASHTO M 324, Type I **OR** Type II or III **OR** Type IV, **as directed**, hot-applied, single-component, polymer-modified bituminous sealant.
 5. Pavement-Marking Paint: Color shall be White **OR** Yellow **OR** Blue, **as directed**.
 - a. Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248, Type N **OR** Type F **OR** Type S, **as directed**; colors complying with FS TT-P-1952.
OR
MPI #32 Alkyd Traffic Marking Paint.
OR
Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, Type II, with drying time of less than three **OR** 45, **as directed**, minutes.
OR
MPI #97 Latex Traffic Marking Paint.
 6. Glass Beads: AASHTO M 247, Type 1.
 7. Wheel Stops:
 - a. Precast, air-entrained concrete, 2500-psi (17.2-MPa) minimum compressive strength, 4-1/2 inches (115 mm) high by 9 inches (225 mm) wide by 72 inches (1800 mm) long. Provide chamfered corners, drainage slots on underside, and holes for anchoring to substrate.
OR
Solid, integrally colored, 96 percent recycled HDPE or commingled postconsumer and postindustrial recycled plastic; UV stabilized; 4 inches (100 mm) high by 6 inches (150 mm) wide by 72 inches (1800 mm) long. Provide chamfered corners, drainage slots on underside, and holes for anchoring to substrate.
 - b. Dowels: Galvanized steel, 3/4-inch (19-mm) diameter, 10-inch (254-mm) minimum length.
 - c. Adhesive: As recommended by wheel-stop manufacturer for application to asphalt pavement.
- D. Preformed Traffic-Calming Devices
1. Speed Bumps **OR** Humps **OR** Cushions, **as directed**: Solid, integrally colored, 100 percent postconsumer or commingled postconsumer and postindustrial recycled rubber **OR** plastic, **as directed**; UV stabilized. Provide holes for anchoring to substrate.
 - a. Size: Modular bumps 2 inches (51 mm) high by 10 inches (254 mm) wide by 72 inches (1800 mm) long, with overall length as dimensioned on Drawings.
 - b. Size: Modular assemblies 3 inches (76 mm) high by 12 feet (3.7 m) in overall width **OR** 4 inches (102 mm) high by 14 feet (4.3 m) in overall width, **as directed**, with overall length as dimensioned on Drawings.
 - c. Mounting Hardware: Galvanized-steel spike, 1/2-inch (13-mm) diameter, 10-inch (254-mm) minimum length **OR** lag screw, shield, and washers; 1/2-inch (13-mm) diameter, 8-inch (203-mm) minimum length **OR** hardware as standard with device manufacturer, **as directed**.
 - d. Adhesive: As recommended by device manufacturer.
- E. Imprinted Asphalt Materials
1. Templates: Imprinted-asphalt manufacturer's standard flexible templates for imprinting pattern into hot asphalt paving.
 - a. Pattern: Running bond brick **OR** Cobblestone **OR** Custom pattern indicated on Drawings, **as directed**.
 2. Coating System: Imprinted-asphalt manufacturer's standard system formulated for exterior application on asphalt paving surfaces.
 - a. Base Coating: Portland cement and epoxy-modified acrylic polymer blended with sand and aggregate, formulated for exterior application on asphalt paving surfaces.
 - b. Top Coating: Epoxy-modified acrylic polymer blended with sand and aggregate, formulated for exterior application on asphalt paving surfaces.
 - c. Colorant: UV-stable pigment blend, added to each coating layer.
 - d. Color: White **OR** Yellow, **as directed**.



3. Precut Marking Material: Imprinted-asphalt manufacturer's standard, reflectorized, thermoplastic, 90-mil (2.3-mm) minimum thickness, formulated for exterior application on asphalt paving surfaces, and matching the imprinted pattern of templates.

F. Mixes

1. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction; designed according to procedures in AI MS-2, "Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types"; and complying with the following requirements:
 - a. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
 - b. Base Course: In accordance with state or local DOT specifications.
 - c. Surface Course: In accordance with state or local DOT specifications.
2. Hot-Mix Asphalt Based on ASTM D 3515 Requirements: Dense, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction and designed according to procedures in AI MS-2, "Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types."
 - a. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
 - b. Provide mixes complying with composition, grading, and tolerance requirements in ASTM D 3515 for the following nominal, maximum aggregate sizes:
 - 1) Base Course: 1 inch (25 mm).
 - 2) Surface Course: 1/2 inch (13 mm).
3. Emulsified-Asphalt Slurry: ASTM D 3910, Type 1 **OR** Type 2 **OR** Type 3, **as directed**.

1.3 EXECUTION

A. Examination

1. Verify that subgrade is dry and in suitable condition to begin paving.
2. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
 - a. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph (5 km/h).
 - b. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes).
 - c. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by the Owner, and replace with compacted backfill or fill as directed.
3. Proceed with paving only after unsatisfactory conditions have been corrected.
4. Verify that utilities, traffic loop detectors, and other items requiring a cut and installation beneath the asphalt surface have been completed and that asphalt surface has been repaired flush with adjacent asphalt prior to beginning installation of imprinted asphalt.

B. Cold Milling

1. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.
 - a. Mill to a depth of 1-1/2 inches (38 mm) **OR** 2 inches (50 mm) **OR** 3 inches (75 mm), **as directed**.
 - b. Mill to a uniform finished surface free of excessive gouges, grooves, and ridges.
 - c. Control rate of milling to prevent tearing of existing asphalt course.
 - d. Repair or replace curbs, manholes, and other construction damaged during cold milling.
 - e. Excavate and trim unbound-aggregate base course, if encountered, and keep material separate from milled hot-mix asphalt.
 - f. Transport milled hot-mix asphalt to asphalt recycling facility.
 - g. Keep milled pavement surface free of loose material and dust.



C. Patching

1. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches (300 mm) into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompress existing unbound-aggregate base course to form new subgrade.
2. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseat concrete pieces firmly.
 - a. Pump hot undersealing asphalt under rocking slab until slab is stabilized or, if necessary, crack slab into pieces and roll to reseat pieces firmly.
 - b. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompress existing unbound-aggregate base course to form new subgrade.
3. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m).
 - a. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 - b. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
4. Patching:
 - a. Fill excavated pavements with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.
OR
Partially fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

D. Repairs

1. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch (25 mm) in existing pavements.
 - a. Install leveling wedges in compacted lifts not exceeding 3 inches (75 mm) thick.
2. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/4 inch (6 mm).
 - a. Clean cracks and joints in existing hot-mix asphalt pavement.
 - b. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch (6 mm) wide. Fill flush with surface of existing pavement and remove excess.
 - c. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch (6 mm) wide. Fill flush with surface of existing pavement and remove excess.

E. Surface Preparation

1. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
2. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.
 - a. Mix herbicide with prime coat if formulated by manufacturer for that purpose.
3. Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd. (0.7 to 2.3 L/sq. m). Apply enough material to penetrate and seal but not flood surface. Allow prime coat to cure.
 - a. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
 - b. Protect primed substrate from damage until ready to receive paving.
4. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m).
 - a. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.



- b. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

F. Paving Geotextile Installation

1. Apply tack coat **OR** asphalt binder **OR** asphalt cement, **as directed**, uniformly to existing pavement surfaces at a rate of 0.20 to 0.30 gal./sq. yd. (0.8 to 1.2 L/sq. m).
2. Place paving geotextile promptly according to manufacturer's written instructions. Broom or roll geotextile smooth and free of wrinkles and folds. Overlap longitudinal joints 4 inches (100 mm) and transverse joints 6 inches (150 mm).
 - a. Protect paving geotextile from traffic and other damage and place hot-mix asphalt paving overlay the same day.

G. Hot-Mix Asphalt Placing

1. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
 - a. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
 - b. Place hot-mix asphalt surface course in single lift.
 - c. Spread mix at minimum temperature of 250 deg F (121 deg C).
 - d. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
 - e. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
2. Place paving in consecutive strips not less than 10 feet (3 m) wide unless infill edge strips of a lesser width are required.
 - a. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.
3. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

H. Joints

1. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.
 - a. Clean contact surfaces and apply tack coat to joints.
 - b. Offset longitudinal joints, in successive courses, a minimum of 6 inches (150 mm).
 - c. Offset transverse joints, in successive courses, a minimum of 24 inches (600 mm).
 - d. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations" **OR** as shown on Drawings, **as directed**.
 - e. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
 - f. Compact asphalt at joints to a density within 2 percent of specified course density.

I. Compaction

1. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.
 - a. Complete compaction before mix temperature cools to 185 deg F (85 deg C).
2. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.



3. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
 - a. Average Density:
 - 1) 96 percent of reference laboratory density according to ASTM D 6927 or AASHTO T 245, but not less than 94 percent nor greater than 100 percent.
OR
92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.
 4. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
 5. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
 6. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.
 7. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
 8. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.
- J. Asphalt Curbs
1. Construct hot-mix asphalt curbs over compacted pavement surfaces. Apply a light tack coat unless pavement surface is still tacky and free from dust. Spread mix at minimum temperature of 250 deg F (121 deg C).
 - a. Asphalt Mix: Same as pavement surface-course mix.
 2. Place hot-mix asphalt to curb cross section indicated or, if not indicated, to local standard shapes, by machine or by hand in wood or metal forms. Tamp hand-placed materials and screed to smooth finish. Remove forms after hot-mix asphalt has cooled.
- K. Asphalt Traffic-Calming Devices
1. Construct hot-mix asphalt speed bumps, humps, cushions, and tables over compacted pavement surfaces. Apply a tack coat unless pavement surface is still tacky and free from dust. Spread mix at minimum temperature of 250 deg F (121 deg C).
 - a. Tack Coat Application: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m).
 - b. Asphalt Mix: Same as pavement surface-course mix.
 - c. Before installation, mill pavement that will be in contact with bottom of traffic-calming device. Mill to a depth of 1 inch (25 mm) from top of pavement to a clean, rough profile.
 2. Place hot-mix asphalt to cross section indicated, by machine or by hand in wood or metal forms. Tamp hand-placed materials and screed to smooth finish. Remove forms after hot-mix asphalt has cooled.
- L. Installation Tolerances
1. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
 - a. Base Course: Plus or minus 1/2 inch (13 mm).
 - b. Surface Course: Plus 1/4 inch (6 mm), no minus.
 2. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot (3-m) straightedge applied transversely or longitudinally to paved areas:
 - a. Base Course: 1/4 inch (6 mm).
 - b. Surface Course: 1/8 inch (3 mm).
 - c. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch (6 mm).



3. Traffic-Calming Devices: Compact and form asphalt to produce the contour indicated and within a tolerance of plus or minus 1/8 inch (3 mm) of height indicated above pavement surface.

M. Surface Treatments

1. Fog Seals: Apply fog seal at a rate of 0.10 to 0.15 gal./sq. yd. (0.45 to 0.7 L/sq. m) to existing asphalt pavement and allow to cure. With fine sand, lightly dust areas receiving excess fog seal.
2. Slurry Seals: Apply slurry coat in a uniform thickness according to ASTM D 3910 and allow to cure.
 - a. Roll slurry seal to remove ridges and provide a uniform, smooth surface.

N. Pavement Marking

1. Do not apply pavement-marking paint until layout, colors, and placement have been verified with the Owner.
2. Allow paving to age for 30 **OR** 90, **as directed**, days before starting pavement marking.
3. Sweep and clean surface to eliminate loose material and dust.
4. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils (0.4 mm).
 - a. Broadcast glass beads uniformly into wet pavement markings at a rate of 6 lb/gal. (0.72 kg/L).

O. Wheel Stops

1. Install wheel stops in bed of adhesive as recommended by manufacturer.
2. Securely attach wheel stops to pavement with not less than two galvanized-steel dowels embedded at one-quarter to one-third points. Securely install dowels into pavement and bond to wheel stop. Recess head of dowel beneath top of wheel stop.

P. Preformed Traffic-Calming Devices

1. Install preformed speed bumps **OR** humps **OR** cushions, **as directed**, in bed of adhesive as recommended by manufacturer for heavy traffic.
2. Securely attach preformed speed bumps **OR** humps **OR** cushions, **as directed**, to pavement with hardware spaced as recommended by manufacturer for heavy traffic. Recess head of hardware beneath top surface.

Q. Imprinting Asphalt

1. General: Imprint asphalt according to manufacturer's written instructions, using manufacturer's recommended equipment.
2. Freshly Laid Asphalt: Immediately after asphalt has been laid and compacted but still plastic, begin the surface imprinting process.
 - a. Monitor asphalt surface temperature in compliance with manufacturer's written recommendations to ensure required temperature to perform surface imprinting.
 - b. Reheat asphalt if surface temperature drops below that required.
3. Reheating Asphalt: Soften asphalt pavement surface by heating to a depth of at least 1/2 inch (13 mm) without burning asphalt.
 - a. Heat to a temperature of 300 to 325 deg F (149 to 163 deg C) immediately before applying templates.
 - b. Regularly monitor the pavement temperature to prevent overheating.
 - c. Direct flame heaters are not permitted.
 - d. If pavement is overheated and begins to emit black smoke, remove damaged pavement by milling down 1 inch (25 mm) and replace removed pavement with new, compacted surface course prior to resuming imprinting work.
4. Surface Imprinting: Apply and imprint templates to a minimum depth of 1/4 inch (6 mm) **OR** as required to embed precut marking material flush or barely beneath pavement surface, **as directed**.



5. Coating Application: After imprinted surface has cooled, apply two layers of base coating followed by two layers of top coating **OR** four layers of top coating, **as directed**. Do not allow traffic until coating has completely dried and cured.
6. Precut Marking Material Application: Position precut marking material aligned with imprinted pattern and slowly heat to a temperature no higher than 325 deg F (163 deg C) until marking material begins to liquefy and flow. Do not allow traffic until installed marking material has cooled to ambient temperature.

R. Field Quality Control

1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
2. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.
3. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
4. Traffic-Calming Devices: Finished height of asphalt speed bumps, humps, cushions, and tables above pavement will be measured for compliance with tolerances.
5. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979 or AASHTO T 168.
 - a. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
 - b. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
 - 1) One core sample will be taken for every 1000 sq. yd. (836 sq. m) or less of installed pavement, with no fewer than 3 cores taken.
 - 2) Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.
6. Replace and compact hot-mix asphalt where core tests were taken.
7. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

S. Disposal

1. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.
 - a. Do not allow milled materials to accumulate on-site.

END OF SECTION 32 01 16 72



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**SECTION 32 01 16 72a - BITUMINOUS REJUVENATION****1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of bituminous rejuvenation of airfield pavements, roads, streets, parking areas, and other general applications by the use of a chemical rejuvenator. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: For each type of product indicated.

1.2 PRODUCTS

- A. Rejuvenator:** The asphalt rejuvenating agent shall be composed of a petroleum resin-oil base uniformly emulsified with water and shall conform to the following physical and chemical requirements:

B. Property Test Method Requirement

Viscosity, S.F. at 77 F, sec.	ASTM D 244	15-40
Residue, % (1)	ASTM D 244 (Mod.)	60-65(min.)
Sieve Test, %	ASTM D 244 (Mod.)	0.10 (max.)
Viscosity @ 140 F, centistokes (2)	ASTM D 2170	80-500
Flash Point, Cleveland Open Cup(COC), °F (3)	ASTM D 92	350 (min.)

(1) ASTM D 244 Modified Evaporation Test for percent residue is made by heating 50 gm samples to 300°F until foaming ceases; then cool immediately and calculate results.

(2) Viscosity on residue obtained from evaporation test.

(3) Flash point on residue from evaporation test.

- C. Aggregate:** Gradation of mineral aggregate shall meet the following requirements:

Sieve Percent by Designation	Weight Passing
No. 16	100
No. 30	40-75
No. 50	4-12
No. 100	0-5

1.3 EXECUTION

- A. Bituminous Storage Tanks** shall be capable of heating the bituminous material under effective and positive control at all times to the required temperature.
- B. Bituminous Distributor** shall be designed and equipped to spray the bituminous material in a uniform double to triple lap at the temperature recommended by the manufacturer, at variable widths, and at readily determined and controlled rates from 0.04 to 0.2 gallons per square yard, plus or minus 5 percent.
- C. Brooms and Blowers** shall be of the power type.
- D. Preparation of Surface:** Immediately before applying the rejuvenator, all loose material, dirt, clay, or other objectionable material shall be removed from the surface to be treated.



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- E. Application of Rejuvenator: The rejuvenator shall be uniformly applied over the surface at the approved rate with an allowable variation of plus or minus 20 percent. Materials shall be applied at the temperature recommended by the manufacturer.
 - F. Excess Rejuvenator Material: Approved mineral aggregate shall be provided by the Contractor and shall be spread in sufficient quantity to effectively blot up any excess rejuvenator material remaining on the treated pavement surface after 24 hours.
 - G. Insufficient Rejuvenator Material: When it is determined by the Owner that the actual application rate of the rejuvenator is more than 20 percent below the approved application rate, subsequent application(s) shall be made within 24 hours to ensure adequate penetration into the pavement surface.

END OF SECTION 32 01 16 72a



SECTION 32 01 16 72b - COLD MIX RECYCLING

1.1 GENERAL

A. Description Of Work

- 1. This specification covers the furnishing and installation of cold mix recycling of existing paving and the addition of new materials. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

- 1. Product Data: For each type of product indicated.

1.2 PRODUCTS

A. Aggregates:

- 1. General: Aggregates shall consist of material obtained from milling, or removing and crushing the existing in situ material, and/or new aggregate material as needed.
- 2. Aggregate Quality and Gradation: Aggregate for bituminous mixture shall be of such size that the material can be spread with a paver to the desired thickness and compacted to meet the specified smoothness, grade, and density requirements. New aggregates shall be approved and be equal to or better than the reclaimed aggregate in quality. Maximum size of new aggregate shall not exceed one-half of the layer thickness and in no case shall the maximum aggregate size exceed 1 inch.

- B. Bituminous Materials: Bituminous materials, if required, shall be an emulsified asphalt conforming to ASTM D 977 or ASTM D 2397, grade as required.

- C. Job-Mix Formula: The Job-Mix Formula (JMF) for the recycled mixture will be furnished by the Contractor to the Owner. The formula will indicate a definite percentage of water and asphalt to be added to the mixture. The JMF will be allowed an asphalt content tolerance of 0.3 percent. The asphalt content may be adjusted by the Owner to improve paving mixture, without adjustment in contract unit price. When asphalt is added, the optimum asphalt content will be selected to provide the following properties when samples are compacted at 250 F with 75 blows of standard Marshall hammer on each side of the specimen.

Property Requirement	
Stability minimum, pounds	1,800
Flow maximum, 1/100-inch units	16
Voids in total mix, percent	3-5
Voids filled with bitumen, percent	70-80

The water content will be selected to provide maximum density when samples are prepared at the optimum asphalt content and compacted with 75 blows of Marshall hammer at ambient temperature. When no asphalt binder is added to the mixture, the water content will be selected by the Owner to provide maximum density.

1.3 EXECUTION

- A. Preparation of Bituminous Mixtures: The required amount of bituminous material for each batch, or calibrated amount of continuous mixing, shall be introduced into the mixer. Aggregates, asphalt emulsion, and water shall be mixed for 35 seconds or longer, as necessary, to thoroughly coat all



particles with bituminous material. When longer mixing time is necessary, additional mixing time shall be determined by the Owner.

- B. Conditioning of Existing Surface: Ruts or soft yielding spots that appear in the existing pavement areas and deviations of surface from requirements specified shall be corrected. An asphalt tack coat shall be applied to all contact surfaces in advance of the recycled overlayment. The asphalt tack shall be placed at an asphalt residue coverage rate of 0.05 gal/sq. yd.
- C. Placing:
 - 1. Layer Thickness and Curing: Each layer of compacted mixture shall be no more than 2-1/2 inches in thickness; each layer of bituminous mixture shall be allowed to cure for at least 5 days before placing a succeeding layer.
 - 2. Compaction of Mixture: Bituminous mixtures shall be rolled until all roller marks are eliminated and a density of at least 86 percent of the theoretical maximum density has been obtained when tested in accordance with MIL-STD-620, Method 101 or ASTM D 2041. When bituminous material is not added to the cold recycled mixture, the material shall be compacted to 100 percent of density determined by MIL-STD-621, Method 100, compaction effort designation CE-55.
 - 3. Joints: Longitudinal joints shall be offset at least 1 foot from existing joints. Transverse joints shall be offset at least 2 feet from existing transverse joints.
 - 4. Surface Smoothness: After final rolling, the pavement surface shall not vary in excess of 1/8 inch from a straightedge laid on the surface.

END OF SECTION 32 01 16 72b



SECTION 32 01 16 72c - CENTRAL PLANT HOT-MIX RECYCLING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of central plant hot-mix recycling of existing asphalt concrete intermediate and wearing courses for airfields, heliports, and heavy-duty pavements. The specification also includes the addition of new materials, as required to meet project requirements. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: For each type of product indicated.

1.2 PRODUCTS

A. Aggregates:

1. General: Aggregates shall consist of material obtained from milling, or removing and crushing the existing in-situ material, and/or new aggregate material as needed.
2. Aggregate Quality and Gradation: Aggregate for the bituminous mixture shall be such size that the material can be spread with a paver to the desired thickness and compacted to meet the specified smoothness, grade, and density requirements. New aggregates shall be approved and shall be equal to or better than the reclaimed aggregate in quality. Maximum size of new aggregate shall not exceed one-half of the layer thickness, and in no case shall the maximum aggregate size exceed one inch. Aggregate gradations shall be as prescribed by local usage, with the approval of the Owner. In order to meet pollution requirements and ensure the recycled mixture is satisfactory, the amount of reclaimed asphalt pavement shall not exceed 60 percent for drum mixers or 50 percent for batch plants.

B. Mineral Filler shall conform to ASTM D 242.

C. Bituminous Materials:

1. New Asphalt Cement: The appropriate types and grades of bituminous materials for the anticipated use and climactic environment shall be used. Requirements of ASTM D 946 shall be used to specify penetration-graded asphalt cement, or ASTM D 3381 for viscosity-graded asphalt cement.
2. Recycled Asphalt Cement: The penetration of asphalt cement recovered from the recycled mixture shall be in accordance with ASTM D 1856 and shall have a penetration between 50 and 70 percent of that specified for the particular region for new asphalt cement, measured in accordance with ASTM D 5.

D. Job-Mix Formula (JMF): The JMF for the recycled mixture will be furnished by the Contractor to the Owner. The formula will indicate the percentage of reclaimed asphalt pavement, the percentage of bitumen, and the temperature of the completed mixture when discharged from the mixer. The requirements for stability, flow, and voids are shown in the following tables for nonabsorptive and absorptive mixtures, respectively.

1. Nonabsorptive-Aggregate Mixture

	Wearing Property Course	Intermediate Course
Stability minimum, lbs	1,800	1,800
Flow maximum, 1/100-inch units	16	16



	Voids total mix, percent	3-5	5-7
	Voids filled with bitumen, percent	70-80	50-70
2.	Absorptive-Aggregate Mixture		
		Wearing	Intermediate
		Property Course	Course
	Stability minimum, lbs.	1,800	1,800
	Flow maximum, 1/100-inch units	16	16
	Voids total mix, percent	2-4	4-6
	Voids filled with bitumen, percent	75-80	55-75

When the water-absorption value of the entire blend of aggregate does not exceed 2.5 percent, the aggregate is designated as nonabsorptive. When the water-absorption value exceeds 2.5 percent as determined by ASTM C 127 and ASTM C 128, the aggregate is designated as absorptive.

1.3 EXECUTION

- A. Preparation of Bituminous Mixtures: Aggregates, reclaimed asphalt pavement, mineral filler, bitumen, and recycling agent shall be conveyed into the mixer in proportionate quantities required to meet the JMF. Particles larger than 2 inches shall be removed from the reclaimed asphalt pavement prior to being added to the mixer. Mixing time shall be as required to obtain a uniform coating of the aggregate with the bituminous material. Temperature of bitumen at time of mixing will be as required to meet project requirements. Temperature of aggregate and mineral filler in the mixer shall not exceed 325 F when bitumen is added.
- B. Surface Preparation of Underlying Course: Prior to placing of intermediate or wearing course, the underlying course shall be cleaned of all foreign or objectionable matter. The surface of previously constructed base course shall be sprayed with a prime coat at an asphalt residue coverage rate of 0.25 gal/sq. yd. Contact surfaces of previously constructed pavement, curbs, manholes, and other structures shall be sprayed with a thin tack coat at an asphalt residue coverage rate of 0.05 gal/sq. yd.
- C. Placing:
 - 1. Layer Thickness and Curing: A required uncompacted thickness of intermediate course, 7 inches or less, may be spread and compacted in one layer. Where the required thickness of base is more than 7 inches, the mixture shall be spread and compacted in two or more layers. Each layer of compacted mixture for the surface course shall be no more than 2-1/2 inches in thickness. Each layer of bituminous mixture shall be allowed to cure for at least 5 days before placing a succeeding layer.
 - 2. Compaction of Mixture: Rolling shall begin as soon after placing as the mixture will bear roller without undue displacement. After the Contractor is assured of meeting crown, grade, and smoothness requirements, rolling shall be continued until a mat density of 98 to 100.0 percent and a joint density of 96.5 to 100.0 percent of density is obtained. Places inaccessible to rollers shall be thoroughly compacted with hot hand tampers.
 - 3. Joints: Longitudinal joints shall be offset at least 1 foot from existing joints. Transverse joints shall be offset at least 2 feet from existing transverse joints.
 - 4. Surface Smoothness: After final rolling, the pavement surface shall not vary in excess of 1/8 inch from a straightedge laid on the surface.

END OF SECTION 32 01 16 72c



SECTION 32 01 17 61 - CRACK SEALING OF BITUMINOUS PAVEMENTS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for crack sealing of bituminous pavements. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. **Manufacturer's Recommendations:** Where installation procedures, or any part thereof, are required to be in accordance with the manufacturer's recommendations, printed copies of these recommendations shall be submitted to the Owner. Installation of the material will not be allowed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.
2. **Schedules/Construction Equipment List:** List of proposed equipment to be used in performance of construction work including descriptive data shall be submitted to the Owner.
3. **Samples:** Samples of the materials (sealant, primer if required, and backup material), in sufficient quantity for testing and approval shall be submitted to the Owner. No material will be allowed to be used until it has been approved.

- C. **Safety:** Joint sealant shall not be placed within 25 feet of any liquid oxygen (LOX) equipment, LOX storage, or LOX piping. Joints in this area shall be thoroughly cleaned and left unsealed.

- D. **Test Requirements:** The joint sealant and backup or separating material shall be tested for conformance with the referenced applicable material specification. Testing of the materials shall be performed in an approved independent laboratory and certified copies of the test reports shall be submitted and approved prior to the use of the materials at the job site. Samples will be retained by the Owner for possible future testing should the materials appear defective during or after application. Conformance with the requirements of the laboratory tests specified will not constitute final acceptance of the materials. Final acceptance will be based on the performance of the in-place materials.

- E. **Equipment:** Machines, tools, and equipment used in the performance of the work required by this section shall be approved before the work is started and shall be maintained in satisfactory condition at all times.

1.2 PRODUCTS**A. Materials**

1. **Liquid Asphalt:** ASTM D 2027, Grade MC-250.
2. **Emulsified Asphalt:** ASTM D 977, Grade AS-2.
3. **Sealing Compound:** ASTM D 3405.
4. **Backer Rod:** ASTM D 5249.
5. **Fine Aggregate:** Natural sand or crusher dust having a maximum size of not more than 1/8 inch and be free of clay or organic-matter.

1.3 EXECUTION**A. Preparation:**

1. All cracks to be sealed shall be cleaned of dirt and debris, and moisture shall be removed.



2. Crack Cleaning Equipment shall consist of a portable air compressor with hose and nozzles for directing air directly into cracks and stiff bristle brooms.
3. Heating Equipment for Liquid Asphalt shall be mobile and shall be equipped with an agitating device for stirring material during heating, a thermometer, regulating equipment for heat control, and a gravity-type draw-off valve.
4. Heating Equipment for Sealing Compound: Unless otherwise required by the manufacturer's recommendations, the equipment shall be mobile and shall consist of double-boiler, agitator-type kettles with oil medium in the outer space for heat transfer. The applicator unit shall be so designed that the sealant will circulate through the delivery hose and return to the inner kettle when not sealing cracks.
5. Application Equipment shall have a spout or nozzle of such size that the sealing material will be placed in the cracks without entrapping air in cracks or spreading material on adjacent pavement surface.

B. Installation:

1. Backer Rod: Install backer in accordance with manufacturer's instructions where required under sealing compound.
2. Sealing Compound: All cracks 1/8 inch wide and wider shall be sealed. The application temperature for sealing compound shall comply with ASTM C 1193. Cracks 1/2 inch wide and wider shall be filled with a slurry of fine sand and an emulsified asphalt or liquid asphalt. After the slurry has cured, cracks shall be sealed with liquid asphalt or emulsified asphalt and lightly sanded.
3. Liquid and Emulsified Asphalt Sealer: The temperature shall be varied so that it flows freely into cracks and completely fills cracks without entrapping air. Cracks shall be free of moisture before filling and shall be filled slightly above the pavement surface. When excess sealer has been removed, the sealer shall be covered with fine sand.
4. Traffic Control: Traffic will not be permitted over sealed cracks until the sealer has cooled so that it is not picked up by vehicle tires. The Contractor will be responsible for all barricades and flagmen necessary to control traffic.

END OF SECTION 32 01 17 61



SECTION 32 01 17 61a - SPRAY APPLICATIONS, SEAL COATS, AND SURFACE TREATMENTS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for the spray applications, seal coats, and surface treatments of asphalt concrete pavements. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: For each type of product indicated.

1.2 PRODUCTS

- A. Bituminous Material: Bituminous material shall be liquid asphalt complying with ASTM D 2028, Grade RC-250, or tar complying with ASTM D 490, Grade RT-6.

- B. Aggregate: Aggregates shall consist of crushed stone, crushed gravel, or crushed slag. The moisture content of the aggregate shall be such that the aggregate will be readily coated with the bituminous material. Aggregate gradations shall be in compliance with ASTM C 136.

C. Construction Equipment

1. Bituminous Distributor shall be designed and equipped to distribute the bituminous material uniformly at even heat on variable widths of surface at readily determined and controlled rates and pressures recommended by the manufacturer and with an allowable variation from any specified rate not exceeding 5 percent.
2. Single-Pass Surface Treatment Machine shall be capable of distributing the bituminous material and aggregates uniformly in controlled amounts in a single-pass operation over the surface to be sealed.
3. Heating Equipment for Storage Tanks shall consist of steam coils, hot oil coils, or electrical coils. If steam or hot oil coils are used, the coils must be so designed and maintained that the bituminous material cannot become contaminated.
4. Power Rollers shall be the self-propelled tandem and three-wheel type rollers, weighing not less than 5 tons and shall be suitable for rolling bituminous pavements.
5. Self-Propelled Pneumatic-Tired rollers shall have a total compacting width of not less than 60 inches. The gross weight shall be adjustable within the ranges of 200 to 350 lb/in. of compacting width.
6. Spreading Equipment: Aggregate spreading equipment shall be adjustable and capable of spreading aggregate at controlled amounts per square yard.
7. Drags: Broom drags shall consist of brooms mounted on a frame, designed to spread fine aggregate uniformly over the surface of a bituminous pavement. Towing equipment shall have pneumatic tires.
8. Brooms and Blowers shall be of the power type and shall be suitable for cleaning surfaces of bituminous pavements.

1.3 EXECUTION**A. Installation**

1. Spreading Aggregate: Application of seal aggregate shall immediately follow the application of bituminous material, and in no case shall the time to application exceed 15 minutes.



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2. Brooming and Rolling: Begin the rolling operations immediately following the application of cover aggregate. Rolling shall be accomplished with pneumatic-tired rollers; steel-wheeled rollers shall be used in a supplementary capacity only. All surplus aggregate shall be swept off the surface and removed not less than 26 hours or more than four days after rolling is completed.

END OF SECTION 32 01 17 61a



Task	Specification	Specification Description
32 01 17 61	32 01 16 72	Asphalt Paving
32 01 17 63	32 01 16 72	Asphalt Paving
32 01 26 71	32 01 16 71	Grinding/Grooving Pavement
32 01 90 13	31 13 13 00	Tree Protection And Trimming
32 01 90 19	01 22 16 00	No Specification Required
32 01 90 23	31 13 13 00	Tree Protection And Trimming
32 01 90 26	31 13 13 00	Tree Protection And Trimming
32 01 90 36	31 13 13 00	Tree Protection And Trimming
32 01 90 36	31 31 19 13	Soil Sterilization
32 01 90 39	31 13 13 00	Tree Protection And Trimming
32 01 90 43	31 13 13 00	Tree Protection And Trimming
32 01 90 46	31 13 13 00	Tree Protection And Trimming
32 01 90 53	31 13 13 00	Tree Protection And Trimming



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SECTION 32 11 16 16 - CRUSHED STONE PAVING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of crushed stone paving. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

1.2 PRODUCTS

A. Aggregates: Aggregates shall consist of crushed stone or slag, crushed gravel, angular sand, or other approved materials. Aggregates shall be durable, sound, and free from foreign material.

1. Coarse Aggregates, consisting of angular fragments of uniform density and quality, shall have a percentage of wear not to exceed 50 percent after 500 revolutions when tested in accordance with ASTM C131. The amount of flat and elongated particles (length to width greater than 3 to 1) shall not exceed 30 percent.
2. Crushed Gravel shall be manufactured from gravel particles with the following gradation:

100% passing	2" sieve
25 - 60% passing	1/4" sieve
5 - 40% passing	#40 sieve
0 - 10%	#200 sieve
3. Crushed Stone shall contain at least 50 percent by weight of crushed pieces having two or more freshly fractured faces for each range of sizes.
4. Slag shall be an air-cooled blast-furnace product having a dry weight of not less than 65 pcf.

B. Binder Material shall consist of screenings, angular sand, or other finely divided mineral matter processed or naturally combined with the coarse aggregate.

1.3 EXECUTION

A. Installation:

1. Mixing and Placing: Materials shall be mixed in such a manner as to obtain a uniform stabilized-aggregate material and a uniform optimum water content for compaction. Mixing and placing procedures shall produce true grades, minimize segregation and degradation, optimize water content, and ensure a satisfactory base course.
2. Compaction: Each layer of stabilized-aggregate paving shall be compacted. Water content shall be maintained at optimum. Areas inaccessible to the rollers shall be compacted, with mechanical tampers and shall be shaped and finished by hand methods.
3. Layer Thickness: No layer shall be in excess of 8 inches nor less than 3 inches in compacted thickness.
4. Proof Rolling: Materials in paving or underlying materials that produce unsatisfactory results by rolling shall be removed and replaced with satisfactory materials and recompact.
5. Edges of Paving: Approved materials shall be placed along edges of stabilized-aggregate paving course in such quantities as will compact to thickness of the course being constructed, allowing at least a 1-foot width of the shoulder to be rolled and compacted simultaneously with rolling and compacting of each layer of the paving course.
6. Finishing: Finished surface shall be of uniform grade and texture.
7. Thickness Control: Compacted thickness of the stabilized paving course shall be within 1/2 inch of the thickness required.



END OF SECTION 32 11 16 16



SECTION 32 11 16 16a - CRUSHED STONE

1.1 GENERAL

A. Description Of Work

1. The work under this section consists of furnishing, placing and compacting crushed stone where called for and as detailed, in conformance with lines, grades and typical as follows or as directed by the Owner.

1.2 PRODUCTS

A. Materials

1. Material shall consist of clean, coating free, durable, sharp angled fragments of crushed stone, crushed ledge rock, or blends thereof that conform to the specific requirements of the following table. Shale will not be acceptable.
2. Crushed Stone used in Absorption Beds shall be washed and free of fines.
3. Gradation: Crushed stone sizes shall meet the gradation requirements of Table 1-1.

TABLE 1-1 (1)GRADATION OF CRUSHED STONE

Size Designation	4"	3"	2-1/2"	2"	1-1/2"	1"	1/2"	1/4"	1/8"	No.80 Sieve
Screening (2)							100	90-100		
1B								100	90-100	0-15
1A							100	90-100	0-15	
1 st							100	0-15		
1						100	90-100	0-15		
2					100	90-100	0-15			
3A				100	90-100	0-15				
3			100	90-100	5-70	0-15				
4A		100	90-100		0-20					
4	100	90-100		0-15						
5	90-100	0-15								

- a. Percentage by weight passing the following square openings.
- b. Screenings shall include all of the fine material passing a 1/4-inch screen.
4. All crushing plants shall be fitted with tailing chutes so that no aggregate will reach the bins other than that which passes through the proper screens

- B. Soundness: Material furnished under this item shall be substantially free of shale or other soft, poor durability particles. A visual inspection of particle composition by the Owner will generally be the basis



for acceptance. Where the State elects to test for this requirement, a Magnesium Sulfate Soundness Loss exceeding 35 percent will be cause for rejection.

- C. Contamination: Contamination of the crushed stone with any deleterious material, such as silt, clay, mud, ice, snow or organic materials, through any cause whatsoever, shall be corrected by the Contractor by excavation and replacement of the material in the affected areas.
- D. Sampling: Samples and certified gradations shall be furnished by the Contractor to the Owner and approval of these samples must be received prior to delivery or placement of the material.

1.3 EXECUTION

- A. Compaction: All material shall be placed in uniform horizontal layers not exceeding 6-inches thickness before compaction. All portions of each layer shall be mechanically compacted to the satisfaction of the Owner. Compaction equipment shall be approved by the Owner.

END OF SECTION 32 11 16 16a

**SECTION 32 11 16 16b - SELECT GRAVEL**

1.1 GENERAL

A. Description Of Work

1. The work under this section consists of furnishing, placing and compacting select gravel where called for and as detailed, in conformance with lines, grades and typical sections as provided or directed by the Owner.

1.2 PRODUCTS

A. Materials

1. Material shall consist of clean, durable gravel or crushed stone free from coating.
2. Select Gravel used for stone paving shall be manufactured from crushed stone and contain no gravel.
3. Gradation of gravel or stone shall be as follows with percent passing calculated by weight:

Select Gravel	
<u>Sieve</u>	<u>Percent Passing</u>
2"	100
1/4"	30 - 65
No. 40	5 - 40
No. 200	0 - 10

1.3 EXECUTION

- A. Soundness: Materials furnished under this item shall be substantially free of shale, organic or other soft, poor durability particles. A visual inspection of particle composition by the Owner will generally be the basis for acceptance. Where the Owner elects to test for this requirement, a Magnesium Sulfate Soundness Loss exceeding 35 percent will be cause for rejection.
- B. Contamination: Contamination of the Select Gravel with any deleterious material, such as silt, clay, mud, ice, snow or organic material, through any cause whatsoever, shall be corrected by the Contractor by excavation and replacement of the material in the affected area.
- C. Sampling: Samples and certified gradations shall be furnished by the Contractor to the Owner and approval of these samples must be received prior to delivery or placement of the material.
- D. Compaction:
 1. All material shall be placed in uniform horizontal layers not exceeding 6-inches thickness before compaction. All portions of each layer shall be mechanically compacted to the percentage of the Standard Proctor Maximum Density (AASHTO T-99) as follows, unless noted otherwise. Compaction equipment approval shall be made by the Owner.
 2. Density determination.
 - a. Structures (entire area within 10 feet outside perimeter) 95%
 - b. Building Slabs and Steps: 95%
 - c. Lawn or Unpaved Areas: 90%
 - d. Pavements and Walkways: 95%
 - e. Pipes and Tunnels: 95%
 - f. Pipe Bedding: 100%



END OF SECTION 32 11 16 16b



Task	Specification	Specification Description
32 11 23 16	32 11 16 16	Crushed Stone Paving
32 11 23 16	32 11 16 16a	Crushed Stone
32 11 23 16	32 11 16 16b	Select Gravel



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SECTION 32 12 13 13 - BITUMINOUS PAVING-REPAIR AND RESURFACING**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials repair and resurfacing of bituminous pavements. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Reports: Copies of test results, within 24 hours after completion of tests.
2. Waybills and Delivery Tickets: Copies of waybills or delivery tickets, during the progress of the work.

1.2 PRODUCTS:**A. Asphaltic Concrete:**

1. Hot-Mixed, Hot-Mixed Asphaltic Concrete and Emulsified asphalt shall comply with requirements of ASTM D 3515.
2. Plant-Mixed, Stockpiled Asphalt Cold Mixes shall comply with the requirements of Asphalt Institute Specification PM-2.

B. Bituminous Prime: Bituminous primer shall comply with ASTM D 2027.**C. Base Course: Base course material shall comply with State highway department specification for dense-graded, high-quality material.****D. Bituminous Tack Coat: Bituminous tack coat shall comply with ASTM D 2027.****1.3 EXECUTION:****A. Preparation of Areas for Patching:**

1. Pot Holes: Trim the perimeter of each hole to a vertical face with a carborundum blade in a square or rectangular pattern at least 18 inches from ragged edge. Remove material to a depth that provides a uniform well-compacted bottom surface. Remove all loose material resulting from trimming or otherwise existing in the hole. If subbase is disturbed, reestablish in a like manner to adjacent substrate. Areas to be repaired shall be dry before repair is started.
2. Alligator-Cracked and Rutted Areas: The pavement shall be sawed or cut with pavement breakers to a smooth vertical face 18 inches outside of the alligator-cracked area. Unsatisfactory material shall be removed in a manner not to disturb the sides of the excavated area.
3. Slippage Areas: Saw a rectangular area around the slippage area that overlaps into the well-bonded material by at least 18 inches. The depth of the saw cut shall be equal to the thickness of the layer of material that is slipping. The surface where slipping is occurring shall be broomed clean and all loose material removed.

B. Installation:

1. Application Temperatures: Application temperatures for all asphalt material shall comply with provisions of the Asphalt Institute Publications and the applicable ASTM Standards.



2. Base Course: Place base course material in layers not exceeding a compacted thickness of 6 inches. After placing, compact each layer by mechanical compactors to a density of not less than the density of the corresponding layer of the adjacent pavement structure.
3. Prime Coat: Prime base course with MC-70 liquid asphalt at a rate of 0.20 to 0.30 gallon per sq. yd. Bolt excess prime with sand before the surfacing material is applied.
4. Tack Coat: Give the edges of existing asphaltic concrete or surfaces of Portland cement concrete and asphaltic concrete a tack coat of MC-70 liquid asphalt at a rate of 0.05 to 0.15 gallon per sq. yd. Allow the material to cure before placing the surfacing material.
5. Hot-Mixed Asphaltic Concrete: Place the material in layers not exceeding 2-1/2 inches in thickness and compact to a density equal to the density of the adjacent asphaltic concrete.
6. Stockpiled Cold Mixes: The compacted thickness of each layer of material shall not exceed 2 inches. Before compaction, the material shall be allowed to aerate, if necessary, until the proper amount of cohesion has developed to obtain adequate compaction. When more than one layer is used, each layer shall be thoroughly cured before the succeeding layer is placed.

END OF SECTION 32 12 13 13

**SECTION 32 12 13 13a - ASPHALTIC CONCRETE OVERLAYS**

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of asphaltic concrete overlays. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: For each type of product indicated.

1.2 PRODUCTS

- A. Asphalt Cement: The asphalt cement shall comply with ASTM D 946 penetration grade 85-100 requirements and shall show a negative spot test when tested in compliance with AASHTO T 102.

- B. Mineral Aggregates: Shall comply with ASTM D 3515 for 3/4-inch maximum aggregate mix.

- C. Test Properties: The bituminous mixture shall meet the following requirements when tested in compliance with MIL-STD 620.

Stability minimum, lb	500
Flow maximum, 1/100-in. units	20
Voids total mix, %	3-5
Voids filled with bitumen, %	75-85

1.3 EXECUTION

- A. Preparation of Existing Surface: The Contractor shall raise and reset all structures such as manhole frames, valve boxes, drainage structures, etc., to meet the required grade. An asphalt tack coat shall be applied to all contact surfaces in advance of the asphalt concrete overlay placement. The asphalt tack shall be placed at an asphalt residue coverage rate of 0.05 gal/sq yd.

B. Installation:

1. Joints: Longitudinal joints of the overlay shall be offset at least 1 foot from existing joints. Transverse joints shall be offset at least 2 feet from existing transverse joints.
2. All Asphalt Concrete Mixture and Pavement that are contaminated, damaged, or defective shall be removed and replaced by the Contractor. Skin patching of rolled pavement will not be permitted.
3. Compaction of Mixture: The asphalt concrete mixture shall be rolled until a density of not less than 95 percent and not more than 100 percent of laboratory compacted specimen is obtained.
4. Surface Smoothness: After final rolling, the pavement surface shall not vary in excess of 1/8 inch from a 10-foot straightedge laid on the surface.

END OF SECTION 32 12 13 13a



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Task	Specification	Specification Description
32 12 13 13	32 01 16 72	Asphalt Paving
32 12 13 19	32 01 16 72	Asphalt Paving
32 12 13 19	32 12 13 13	Bituminous Paving-Repair And Resurfacing
32 12 13 19	32 12 13 13a	Asphaltic Concrete Overlays



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SECTION 32 12 16 13 - PAVEMENT JOINT SEALANTS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for pavement joint sealants. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Cold-applied joint sealants.
 - b. Cold-applied, jet-fuel-resistant joint sealants.
 - c. Hot-applied joint sealants.
 - d. Hot-applied, jet-fuel-resistant joint sealants.

C. Preconstruction Testing

1. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, eight, Samples of materials that will contact or affect joint sealants. Use ASTM C 1087 **OR** manufacturer's standard test method, **as directed**, to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

D. Submittals

1. Product Data: For each joint-sealant product indicated.
2. Samples: For each kind and color of joint sealant required.
3. Pavement-Joint-Sealant Schedule: Include the following information:
 - a. Joint-sealant application, joint location, and designation.
 - b. Joint-sealant manufacturer and product name.
 - c. Joint-sealant formulation.
 - d. Joint-sealant color.
4. Product certificates.
5. Product test reports.
6. Preconstruction compatibility and adhesion test reports.

E. Quality Assurance

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021.
2. Preinstallation Conference: Conduct conference at Project site.

F. Project Conditions

1. Do not proceed with installation of joint sealants under the following conditions:
 - a. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (5 deg C).
 - b. When joint substrates are wet.
 - c. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 - d. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.



1.2 PRODUCTS

A. Materials

1. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.
2. Colors of Exposed Joint Sealants: As selected from manufacturer's full range.

B. Cold-Applied Joint Sealants

1. Single-Component, Nonsag, Silicone Joint Sealant for Concrete: ASTM D 5893, Type NS.
2. Single-Component, Self-Leveling, Silicone Joint Sealant for Concrete: ASTM D 5893, Type SL.
3. Multicomponent, Pourable, Traffic-Grade, Urethane Joint Sealant for Concrete: ASTM C 920, Type M, Grade P, Class 25, for Use T.

C. Cold-Applied, Jet-Fuel-Resistant Joint Sealants

1. Jet-Fuel-Resistant, Single-Component, Pourable, Traffic-Grade, Modified-Urethane Joint Sealant for Concrete: ASTM C 920, Type S, Grade P, Class 25, for Use T.
2. Jet-Fuel-Resistant, Multicomponent, Pourable, Traffic-Grade, Modified-Urethane Joint Sealant for Concrete: ASTM C 920, Type M, Grade P, Class 12-1/2, for Use T.
3. Jet-Fuel-Resistant, Multicomponent, Pourable, Traffic-Grade, Modified-Urethane Joint Sealant for Concrete: ASTM C 920, Type M, Grade P, Class 25, for Use T.

D. Hot-Applied Joint Sealants

1. Hot-Applied, Single-Component Joint Sealant for Concrete: ASTM D 3406.
2. Hot-Applied, Single-Component Joint Sealant for Concrete and Asphalt: ASTM D 6690, Types I, II, and III.

E. Hot-Applied, Jet-Fuel-Resistant Joint Sealants

1. Hot-Applied, Jet-Fuel-Resistant, Single-Component Joint Sealant for Concrete: ASTM D 7116, Type I.
2. Hot-Applied, Jet-Fuel-Resistant, Single-Component Joint Sealant for Concrete and Tar Concrete: Single-component formulation complying with ASTM D 3581.

F. Joint-Sealant Backer Materials

1. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.
2. For use in joints such as contraction joints cut partially through paving material:
 - a. Round Backer Rods for Cold- and Hot-Applied Joint Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.
 - b. Round Backer Rods for Cold-Applied Joint Sealants: ASTM D 5249, Type 3, of diameter and density required to control joint-sealant depth and prevent bottom-side adhesion of sealant.
3. For use in joints such as expansion joints extending through the full depth of the pavement:
 - a. Backer Strips for Cold- and Hot-Applied Joint Sealants: ASTM D 5249; Type 2; of thickness and width required to control joint-sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

G. Primers

1. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.



1.3 EXECUTION

A. Installation Of Joint Sealants

1. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.
2. Cleaning of Joints: Clean out joints immediately before installing joint sealants.
3. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
4. Install joint-sealant backings of kind indicated to support joint sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - a. Do not leave gaps between ends of joint-sealant backings.
 - b. Do not stretch, twist, puncture, or tear joint-sealant backings.
 - c. Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.
5. Install joint sealants using proven techniques that comply with the following and at the same time backings are installed:
 - a. Place joint sealants so they directly contact and fully wet joint substrates.
 - b. Completely fill recesses in each joint configuration.
 - c. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
6. Tooling of Nonsag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint:
 - a. Remove excess joint sealant from surfaces adjacent to joints.
 - b. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.
7. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.

B. Cleaning

1. Clean off excess joint sealant or sealant smears adjacent to joints as the Work progresses, by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

C. Protection

1. Protect joint sealants, during and after curing period, from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Final Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations in repaired areas are indistinguishable from the original work.

END OF SECTION 32 12 16 13



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Task	Specification	Specification Description
32 12 16 13	32 01 16 72	Asphalt Paving
32 12 16 13	32 12 13 13	Bituminous Paving-Repair And Resurfacing
32 12 16 13	32 12 13 13a	Asphaltic Concrete Overlays
32 12 16 19	32 12 13 13	Bituminous Paving-Repair And Resurfacing
32 12 16 19	32 12 13 13a	Asphaltic Concrete Overlays
32 12 16 39	31 32 13 16	Soil Stabilization-Lime
32 12 16 39	31 25 14 13	Geosynthetic Fabric
32 12 16 43	32 01 16 72	Asphalt Paving
32 12 16 43	32 01 17 61	Crack Sealing Of Bituminous Pavements
32 12 16 43	32 01 17 61a	Spray Applications, Seal Coats, And Surface Treatments
32 12 33 00	32 01 16 72	Asphalt Paving
32 12 33 00	32 12 13 13	Bituminous Paving-Repair And Resurfacing
32 12 33 00	32 12 13 13a	Asphaltic Concrete Overlays
32 12 36 00	32 01 16 72	Asphalt Paving
32 12 36 00	32 01 17 61	Crack Sealing Of Bituminous Pavements
32 12 36 00	32 01 17 61a	Spray Applications, Seal Coats, And Surface Treatments



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SECTION 32 13 13 33 - DECORATIVE CEMENT CONCRETE PAVEMENT

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for decorative cement concrete pavement. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section includes colored, stamped, stenciled, and stained concrete paving.

C. Definitions

1. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

D. Submittals

1. Product Data: For each type of product indicated.
2. LEED Submittals:
 - a. Product Data for Credit MR 4.1 and Credit MR 4.2, **as directed**: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.
 - b. Design Mixtures for Credit ID 1.1: For each concrete mixture containing fly ash as a replacement for portland cement or other portland cement replacements. For each design mixture submitted, include an equivalent concrete mixture that does not contain portland cement replacements, to determine amount of portland cement replaced.
3. Samples: For each type of exposed color, pattern, or texture indicated.
4. Other Action Submittals:
 - a. Design Mixtures: For each decorative concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
5. Qualification Data: For qualified Installer, ready-mix concrete manufacturer, and testing agency.
6. Material Certificates: For the following, from manufacturer:
 - a. Cementitious materials.
 - b. Steel reinforcement and reinforcement accessories.
 - c. Fiber reinforcement.
 - d. Admixtures.
 - e. Curing compounds.
 - f. Applied finish materials.
 - g. Bonding agent or epoxy adhesive.
 - h. Joint fillers.
7. Material Test Reports: For each of the following:
 - a. Aggregates. Include service-record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.
8. Field quality-control reports.

E. Quality Assurance

1. Installer Qualifications: An employer of workers trained and approved by manufacturer of decorative concrete paving systems.
2. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.



- a. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").
3. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
 - a. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
4. Source Limitations: Obtain decorative concrete paving products and each type or class of cementitious material of the same brand from same manufacturer's plant, and obtain each aggregate from single source.
5. Concrete Testing Service: Engage a qualified testing agency to perform material evaluation tests and to design concrete mixtures.
6. ACI Publications: Comply with ACI 301 (ACI 301M) unless otherwise indicated.
7. Preinstallation Conference: Conduct conference at Project site.

F. Project Conditions

1. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

1.2 PRODUCTS

A. Forms

1. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.
 - a. Use flexible or uniformly curved forms for curves of a radius of 100 feet (30.5 m) or less. Do not use notched and bent forms.
2. Forms for Textured Finish Concrete: Units of face design, size, arrangement, and configuration indicated. Provide solid backing and form supports to ensure stability of textured form liners.
3. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

B. Steel Reinforcement

1. Recycled Content: Provide steel reinforcement with an average recycled content of steel so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
2. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, fabricated from as-drawn steel wire into flat sheets.
3. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420); deformed.
4. Steel Bar Mats: ASTM A 184/A 184M; with ASTM A 615/A 615M, Grade 60 (Grade 420), deformed bars; assembled with clips.
5. Plain-Steel Wire: ASTM A 82/A 82M, as drawn.
6. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420) plain-steel bars. Cut bars true to length with ends square and free of burrs.
7. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:
 - a. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.

C. Concrete Materials

1. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:



- a. Portland Cement: ASTM C 150, gray **OR** white, **as directed**, portland cement Type I **OR** Type II **OR** Type I/II **OR** Type III **OR** Type V, **as directed**. Supplement with the following, **as directed**:
 - 1) Fly Ash: ASTM C 618, Class C or F.
 - 2) Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
 - b. Blended Hydraulic Cement: ASTM C 595, Type IS, portland blast-furnace slag **OR** Type IP, portland-pozzolan, **as directed**, cement.
 2. Normal-Weight Aggregates: ASTM C 33, Class 4S **OR** Class 4M **OR** Class 1N, **as directed**, uniformly graded. Provide aggregates from a single source with documented service-record data of at least 10 years' satisfactory service in similar paving applications and service conditions using similar aggregates and cementitious materials, **as directed**.
 - a. Maximum Aggregate Size: 1-1/2 inches (38 mm) **OR** 1 inch (25 mm) **OR** 3/4 inch (19 mm), **as directed**, nominal.
 - b. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
 3. Water: Potable and complying with ASTM C 94/C 94M.
 4. Air-Entraining Admixture: ASTM C 260.
 5. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
 - a. Water-Reducing Admixture: ASTM C 494/C 494M, Type A, colored, **as directed**.
 - b. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D, colored, **as directed**.
 - c. Water-Reducing and Accelerating Admixture: ASTM C 494/C 494M, Type E.
 6. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, **as directed**, nonfading, and resistant to lime and other alkalis.
- D. Fiber Reinforcement
1. Synthetic Fiber: Monofilament or fibrillated polypropylene fibers engineered and designed for use in decorative concrete paving, complying with ASTM C 1116/C 1116M, Type III, 1/2 to 1-1/2 inches (13 to 38 mm) long.
- E. Surface Coloring Materials
1. Pigmented Mineral Dry-Shake Hardener: Factory-packaged, dry combination of portland cement, graded quartz aggregate, color pigments, and plasticizing admixture. Use color pigments that are finely ground, nonfading mineral oxides interground with cement.
 2. Pigmented Powder Release Agent: Factory-packaged, dry combination of surface-conditioning and dispersing agents interground with color pigments that facilitates release of stamp mats. Use color pigments that are finely ground, nonfading mineral oxides interground with cement.
 3. Liquid Release Agent: Manufacturer's standard, clear, evaporating formulation that facilitates release of stamp mats and texture rollers.
- F. Stamping Devices
1. Stamp Mats: Semirigid polyurethane mats with projecting textured and ridged underside capable of imprinting texture and joint patterns on plastic concrete.
 2. Stamp Tools: Open-grid, aluminum or rigid-plastic stamp tool capable of imprinting joint patterns on plastic concrete.
 3. Rollers: Manually controlled, water-filled aluminum rollers with projecting ridges on drum capable of imprinting texture and joint patterns on plastic concrete.
 4. Texture Rollers: Manually controlled, abrasion-resistant polyurethane rollers capable of imprinting texture on plastic concrete.
- G. Stencil Materials
1. Stencils: Manufacturer's standard, moisture-resistant paper or reusable plastic stencils, designed for use on plastic concrete.



- H. Stain Materials
1. Reactive Stain: Acidic-based stain with wetting agents and high-grade, UV-stable metallic salts that react with calcium hydroxide in cured concrete to produce permanent, variegated, or translucent color effects.
 2. Penetrating Stain: Water-based, acrylic latex, penetrating stain with colorfast pigments.
- I. Curing And Sealing Materials
1. Curing Paper: Nonstaining, waterproof paper, consisting of two layers of kraft paper cemented together and reinforced with fiber, and complying with ASTM C 171.
 2. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.
 3. Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type I, Class B, manufactured for colored concrete.
 - a. For integrally colored concrete, curing compound shall be pigmented type approved by coloring admixture manufacturer.
 - b. For concrete indicated to be sealed, curing compound shall be compatible with sealer.
 4. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type I, Class A, manufactured for use with colored concrete.
 5. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type I, Class A, manufactured for use with colored concrete.
 6. Clear Acrylic Sealer: Manufacturer's standard, waterborne, nonyellowing and UV-resistant, membrane-forming, medium-gloss, acrylic copolymer emulsion solution, manufactured for colored concrete, containing not less than 15 percent solids by volume.
 7. Slip-Resistance-Enhancing Additive: Manufacturer's standard finely graded aggregate or polymer additive, designed to be added to clear acrylic sealer to enhance slip resistance of sealed paving surface.
- J. Related Materials
1. Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork in preformed strips.
 2. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
 3. Epoxy Bonding Adhesive: ASTM C 881/C 881M, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements, and of the following types:
 - a. Types I and II, non-load bearing **OR** Types IV and V, load bearing, **as directed**, for bonding hardened or freshly mixed concrete to hardened concrete.
 4. Polyethylene Film: ASTM D 4397, 1 mil (0.025 mm) thick, clear.
- K. Concrete Mixtures
1. Prepare design mixtures, proportioned according to ACI 301 (ACI 301M), for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.
 - a. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
 2. Proportion mixtures to provide normal-weight concrete with the following properties:
 - a. Compressive Strength (28 Days): 4500 psi (31 MPa) **OR** 4000 psi (27.6 MPa) **OR** 3500 psi (24.1 MPa) **OR** 3000 psi (20.7 MPa), **as directed**.
 - b. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.45 **OR** 0.50, **as directed**.
 - c. Slump Limit: 4 inches (100 mm) **OR** 5 inches (125 mm), **as directed**, plus or minus 1 inch (25 mm).
 3. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
 - a. Air Content: 5-1/2 **OR** 4-1/2 **OR** 2-1/2, **as directed**, percent plus or minus 1.5 percent for 1-1/2-inch (38-mm) nominal maximum aggregate size.



- b. Air Content: 6 **OR** 4-1/2 **OR** 3, **as directed**, percent plus or minus 1.5 percent for 1-inch (25-mm) nominal maximum aggregate size.
- c. Air Content: 6 **OR** 5 **OR** 3-1/2, **as directed**, percent plus or minus 1.5 percent for 3/4-inch (19-mm) nominal maximum aggregate size.
4. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 **OR** 0.30, **as directed**, percent by weight of cement.
5. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
 - a. Use water-reducing admixture **OR** water-reducing and retarding admixture **OR** water-reducing and accelerating admixture, **as directed**, in concrete as required for placement and workability.
 - b. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
6. Cementitious Materials: Limit percentage by weight of cementitious materials other than portland cement according to ACI 301 (ACI 301M) requirements for concrete exposed to deicing chemicals **OR** as follows, **as directed**:
 - a. Fly Ash or Pozzolan: 25 percent.
 - b. Ground Granulated Blast-Furnace Slag: 50 percent.
 - c. Combined Fly Ash or Pozzolan, and Ground Granulated Blast-Furnace Slag: 50 percent, with fly ash or pozzolan not exceeding 25 percent.
7. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd. (0.60 kg/cu. m).
8. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

L. Concrete Mixing

1. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, **as directed**. Furnish batch certificates for each batch discharged and used in the Work.
 - a. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.
2. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
 - a. For concrete batches of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
 - b. For concrete batches larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
 - c. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

1.3 EXECUTION

A. Examination

1. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.
2. Proof-roll prepared subbase surface below decorative concrete paving to identify soft pockets and areas of excess yielding.
 - a. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph (5 km/h).
 - b. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes).
 - c. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch (13 mm) according to requirements in Division 31 Section "Earth Moving".



3. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Preparation
1. Remove loose material from compacted subbase surface immediately before placing concrete.
 2. Protect adjacent construction from discoloration and spillage during application of color hardeners, release agents, stains, curing compounds, and sealers.
- C. Edge Forms And Screed Construction
1. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
 2. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.
- D. Steel Reinforcement
1. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
 2. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
 3. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
 4. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
 5. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch (50-mm) overlap to adjacent mats.
- E. Joints
1. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.
 - a. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.
 2. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.
 - a. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
 - b. Butt Joints: Use bonding agent **OR** epoxy bonding adhesive, **as directed**, at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 - c. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
 - d. Dowelled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.
 3. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
 - a. Locate expansion joints at intervals of 50 feet (15.25 m) unless otherwise indicated.
 - b. Extend joint fillers full width and depth of joint.
 - c. Terminate joint filler not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished surface if joint sealant is indicated.
 - d. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
 - e. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.



- f. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
4. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows, to match jointing of existing adjacent decorative concrete paving, **as directed**:
 - a. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch (6-mm) **OR** 3/8-inch (10-mm), **as directed**, radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate grooving-tool marks on concrete surfaces.
 - 1) Tolerance: Ensure that grooved joints are within 3 inches (75 mm) either way from centers of dowels.
 - b. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
 - 1) Tolerance: Ensure that sawed joints are within 3 inches (75 mm) in both directions from center of dowels.
 - c. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.
5. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch (6-mm) **OR** 3/8-inch (10-mm), **as directed**, radius. Repeat tooling of edges after applying surface finishes. Eliminate edging tool marks on concrete surfaces.

F. Concrete Placement

1. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.
2. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.
3. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
4. Comply with ACI 301 (ACI 301M) requirements for measuring, mixing, transporting, and placing concrete.
5. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.
6. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
7. Consolidate concrete according to ACI 301 (ACI 301M) by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
 - a. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.
8. Screed paving surface with a straightedge and strike off.
9. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.
10. Cold-Weather Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:
 - a. When air temperature has fallen to or is expected to fall below 40 deg F (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture



- temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
- b. Do not use frozen materials or materials containing ice or snow.
 - c. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.
11. Hot-Weather Placement: Comply with ACI 301 (ACI 301M) and as follows when hot-weather conditions exist:
- a. Cool ingredients before mixing to maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - b. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
 - c. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.
- G. Float Finishing
1. General: Do not add water to concrete surfaces during finishing operations.
 2. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
- H. Integrally Colored Concrete Finish
1. Integrally Colored Concrete Finish: After final floating, apply the following finish:
 - a. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
 - b. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.
 - c. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch (1.6 to 3 mm) deep with a stiff-bristled broom, perpendicular to line of traffic.
- I. Stenciling
1. Cut stencils to slab width and lay on wet concrete. Overlap "mortar joint" on trailing edge of each section of stencil onto leading "mortar joint" of previous section.
 2. Trim stencils to fit slab and adjacent patterns.
 3. Slightly embed stencil into concrete by rolling with stencil roller.
 4. Apply pigmented mineral dry-shake hardener materials to concrete surfaces according to manufacturer's written instructions.
 5. Stencil Rolling:
 - a. Apply pigmented powder release agent **OR** liquid release agent, **as directed**, according to manufacturer's written instructions prior to applying texture roller to surface of concrete.
 - b. Perform rolling operation to produce required texture on concrete surface.
 6. Remove stencils when concrete has sufficiently cured to bear weight. Do not leave stencils in concrete overnight.
 7. Remove debris with mechanical blower prior to application of curing compound. If release agent is applied, delay removal of debris for 24 hours, then flood area with low-pressure water hose, wetting release agent, and follow by cleaning surface with pressure washer.
- J. Pigmented Mineral Dry-Shake Hardener
1. Pigmented Mineral Dry-Shake Hardener Finish: After initial floating, apply dry-shake materials to paving surfaces according to manufacturer's written instructions and as follows:



- a. Uniformly apply dry-shake hardener at a rate of 100 lb/100 sq. ft. (49 kg/10 sq. m) unless greater amount is recommended by manufacturer to match paving color required.
- b. Uniformly distribute approximately two-thirds of dry-shake hardener over the concrete surface with mechanical spreader; allow hardener to absorb moisture and embed it by power floating. Follow power floating with a second application of pigmented mineral dry-shake hardener, uniformly distributing remainder of material at right angles to first application to ensure uniform color, and embed hardener by final power floating.
- c. After final power floating, apply the following finish:
 - 1) Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
 - 2) Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.
 - 3) Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch (1.6 to 3 mm) deep with a stiff-bristled broom, perpendicular to line of traffic.
2. Pigmented Powder Release Agent: Uniformly distribute onto dry-shake-hardened and still-plastic concrete at a rate of 3 to 4 lb/100 sq. ft. (1.5 to 2 kg/10 sq. m).
3. Liquid Release Agent: Uniformly mist surface of dry-shake-hardened and still-plastic concrete at a rate of 5 gal/1000 sq. ft. (0.2 L/sq. m).

K. Stamping

1. Mat Stamping: After floating and while concrete is plastic, apply mat-stamped finish.
 - a. Pigmented Powder Release Agent: Uniformly distribute onto concrete at a rate of 3 to 4 lb/100 sq. ft. (1.5 to 2 kg/10 sq. m).
 - b. Liquid Release Agent: Apply liquid release agent to the concrete surface and the stamp mat. Uniformly mist surface of concrete at a rate of 5 gal/1000 sq. ft. (0.2 L/sq. m).
 - c. After application of release agent, accurately align and place stamp mats in sequence.
 - d. Uniformly load mats and press into concrete to produce required imprint pattern and depth of imprint on concrete surface. Gently remove stamp mats. Hand stamp edges and surfaces unable to be imprinted by stamp mats.
 - e. Remove residual release agent according to manufacturer's written instructions, but no fewer than three days after stamping concrete. High-pressure-wash surface and joint patterns, taking care not to damage stamped concrete. Control, collect, and legally dispose of runoff.
2. Tool Stamping: After floating and while concrete is plastic, apply tool-stamped finish.
 - a. Cover surface with polyethylene film, stretch taut to remove wrinkles, lap sides and ends 3 inches (75 mm), and secure to edge forms. Lightly broom surface to remove air bubbles.
 - b. Accurately align and place stamp tools in sequence and tamp into concrete to produce required imprint pattern and depth of imprint on concrete surface. Gently remove stamp tools. Hand stamp edges and surfaces unable to be imprinted by stamp tools.
 - c. Carefully remove polyethylene film immediately after tool stamping.
3. Roller Stamping: After floating and while concrete is plastic, apply roller-stamped finish.
 - a. Cover surface with polyethylene film, stretch taut to remove wrinkles, lap sides and ends 3 inches (75 mm), and secure to edge forms. Lightly broom surface to remove air bubbles.
 - b. Accurately align roller and perform rolling operation to produce required imprint pattern and depth of imprint on concrete surface. Hand stamp surfaces inaccessible to roller.
 - c. Carefully remove polyethylene film immediately after roller stamping.

L. Concrete Protection And Curing

1. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
2. Comply with ACI 306.1 for cold-weather protection.
3. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during



- finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.
4. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
 5. Curing Compound: Apply curing compound immediately after final finishing. Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas that have been subjected to heavy rainfall within three hours after application. Maintain continuity of coating, and repair damage during curing period.
 - a. Cure integrally colored concrete with a pigmented, **as directed**, curing compound.
 - b. Cure concrete finished with pigmented mineral dry-shake hardener with a pigmented, **as directed**, curing compound.
 6. Curing and Sealing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.
 7. Curing Paper: Cure with unwrinkled curing paper in pieces large enough to cover the entire width and edges of slab. Do not lap sheets. Fold curing paper down over paving edges and secure with continuous banks of earth to prevent displacement or billowing due to wind. Immediately repair holes or tears in paper.

M. Staining

1. Newly placed concrete paving shall be at least 14 **OR** 30, **as directed**, days old before staining.
2. Prepare surfaces according to manufacturer's written instructions and as follows:
 - a. Clean concrete thoroughly by scraping, applying solvents or stripping agents, sweeping and pressure washing, or scrubbing with a rotary floor machine and detergents recommended by stain manufacturer. Rinse until water is clear and allow surface to dry.
 - 1) Do not use acidic solutions to clean surfaces.
 - b. Test surfaces with droplets of water. If water beads and does not penetrate surface, or penetrates only in some areas, profile surfaces by acid etching, grinding, sanding, or abrasive blasting. Retest and continue profiling surface until water droplets immediately darken and uniformly penetrate concrete surfaces.
 - c. Apply acidic solution to dampened concrete surfaces, scrubbing with uncolored, acid-resistant nylon-bristle brushes until bubbling stops and concrete surface has texture of 120-grit sandpaper. Do not allow solution to dry on concrete surfaces. Rinse until water is clear. Control, collect, and legally dispose of runoff.
 - d. Neutralize concrete surfaces and rinse until water is clear. Test surface for residue with clean white cloth. Test surface according to ASTM F 710 to ensure pH is between 7 and 8.
3. Scoring: Score decorative jointing in paving surfaces 1/16 inch (1.6 mm) deep with diamond blades to match pattern indicated. Rinse until water is clear. Score after **OR** before, **as directed**, staining.
 - a. Joint Width: 3/8 inch (10 mm).
4. Allow paving surface to dry before applying stain. Verify readiness of paving to receive stain according to ASTM D 4263 by tightly taping 18-by-18-inch (450-by-450-mm), 4-mil- (0.1-mm-) thick polyethylene sheet to a representative area of paving surface. Apply stain only if no evidence of moisture has accumulated under sheet after 16 hours.
5. Reactive Stain: Apply reactive stain to paving surfaces according to manufacturer's written instructions and as follows:
 - a. Apply stain by uncolored bristle brush, roller, or high-volume, low-pressure sprayer and immediately scrub into concrete surface with uncolored, acid-resistant nylon-bristle brushes in continuous, circular motion. Do not spread stain after fizzing stops. Allow to dry four hours and repeat application of stain in sufficient quantity to obtain color consistent with approved mockup.
 - b. Remove stain residue after four hours by wet scrubbing with commercial-grade detergent recommended by stain manufacturer. Rinse until water is clear. Control, collect, and legally dispose of runoff.



6. Penetrating Stain: Apply penetrating stain to paving surfaces according to manufacturer's written instructions and as follows:
 - a. Apply first coat of stain to dry, clean surfaces by airless sprayer or by high-volume, low-pressure sprayer.
 - b. Allow to dry four hours and repeat application of stain in sufficient quantity to obtain color consistent with approved mockup.
 - c. Rinse until water is clear. Control, collect, and legally dispose of runoff.

N. Sealer

1. Clear Acrylic Sealer: Apply uniformly in two coats in continuous operations according to manufacturer's written instructions. Allow first coat to dry before applying second coat, at 90 degrees to the direction of the first coat using same application methods and rates.
 - a. Begin sealing dry surface no sooner than 14 days after concrete placement.
 - b. Allow stained concrete surfaces to dry before applying sealer.
 - c. Thoroughly mix slip-resistance-enhancing additive into sealer before applying sealer according to manufacturer's written instructions. Stir sealer occasionally during application to maintain even distribution of additive.

O. Paving Tolerances

1. Comply with tolerances in ACI 117 and as follows:
 - a. Elevation: 3/4 inch (19 mm).
 - b. Thickness: Plus 3/8 inch (10 mm), minus 1/4 inch (6 mm).
 - c. Surface: Gap below 10-foot- (3-m-) long, unleveled straightedge not to exceed 1/2 inch (13 mm).
 - d. Lateral Alignment and Spacing of Dowels: 1 inch (25 mm).
 - e. Vertical Alignment of Dowels: 1/4 inch (6 mm).
 - f. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches (6 mm per 300 mm) of dowel.
 - g. Joint Spacing: 3 inches (75 mm).
 - h. Contraction Joint Depth: Plus 1/4 inch (6 mm), no minus.
 - i. Joint Width: Plus 1/8 inch (3 mm), no minus.

P. Field Quality Control

1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
2. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 - a. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. (76 cu. m) OR 5000 sq. ft. (465 sq. m), **as directed**, or fraction thereof of each concrete mixture placed each day.
 - 1) When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 - b. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 - c. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - d. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when it is 80 deg F (27 deg C) and above, and one test for each composite sample.
 - e. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
 - f. Compressive-Strength Tests: ASTM C 39/C 39M; test one specimen at seven days and two specimens at 28 days.
 - 1) A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.



3. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
4. Test results shall be reported in writing to the Owner, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
5. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by the Owner but will not be used as sole basis for approval or rejection of concrete.
6. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by the Owner.
7. Decorative concrete paving will be considered defective if it does not pass tests and inspections.
8. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
9. Prepare test and inspection reports.

Q. Repairs And Protection

1. Remove and replace decorative concrete paving that is broken or damaged or does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by the Owner.
2. Detailing: Grind concrete "squeeze" left from tool placement. Color ground areas with slurry of color hardener mixed with water and bonding agent. Remove excess release agent with high-velocity blower.
3. Protect decorative concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
4. Maintain decorative concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Final Completion inspections.

END OF SECTION 32 13 13 33



Task	Specification	Specification Description
32 13 13 33	03 31 13 00	Cement Concrete Pavement
32 13 13 33	03 31 13 00a	Roller Compacted Concrete Pavement
32 13 13 33	03 31 13 00c	Steel Reinforced Portland Cement Concrete Overlays
32 13 13 33	03 31 13 00d	Fiber Reinforced Portland Cement Concrete Overlays
32 13 73 13	32 01 16 72	Asphalt Paving
32 13 73 13	32 01 17 61	Crack Sealing Of Bituminous Pavements
32 13 73 13	32 01 17 61a	Spray Applications, Seal Coats, And Surface Treatments
32 13 73 16	32 01 16 72	Asphalt Paving
32 13 73 16	32 01 17 61	Crack Sealing Of Bituminous Pavements
32 13 73 16	32 01 17 61a	Spray Applications, Seal Coats, And Surface Treatments
32 13 73 19	32 01 16 72	Asphalt Paving
32 13 73 19	32 01 17 61a	Spray Applications, Seal Coats, And Surface Treatments



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SECTION 32 14 09 00 - EXTERIOR PLANTS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for exterior plants. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Plants.
 - b. Planting soils.
 - c. Tree stabilization.
 - d. Landscape edgings.
 - e. Tree grates.

C. Definitions

1. Backfill: The earth used to replace or the act of replacing earth in an excavation.
2. Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown, with ball size not less than sizes indicated **OR** diameter and depth recommended by ANSI Z60.1 for type and size of plant required, **as directed**; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1.
3. Balled and Potted Stock: Plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than sizes indicated **OR** diameter and depth recommended by ANSI Z60.1 for type and size of plant required, **as directed**.
4. Bare-Root Stock: Plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than minimum root spread according to ANSI Z60.1 for type and size of plant required.
5. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.
6. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.
7. Fabric Bag-Grown Stock: Healthy, vigorous, well-rooted plants established and grown in-ground in a porous fabric bag with well-established root system reaching sides of fabric bag. Fabric bag size is not less than diameter, depth, and volume required by ANSI Z60.1 for type and size of plant.
8. Finish Grade: Elevation of finished surface of planting soil.
9. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
10. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
11. Pests: Living organisms that occur where they are not desired, or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
12. Planting Area: Areas to be planted.



13. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
14. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.
15. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.
16. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.
17. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.
18. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
19. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

D. Submittals

1. Product Data: For each type of product indicated, including soils.
2. Samples of mineral mulch.
3. Product certificates.
4. Maintenance Instructions: Recommended procedures to be established by the Owner for maintenance of plants during a calendar year.

E. Quality Assurance

1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
 - a. Pesticide Applicator: State licensed, commercial.
2. Soil Analysis: For each unamended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory.
 - a. The soil-testing laboratory shall oversee soil sampling.
 - b. Report suitability of tested soil for plant growth.
 - 1) State recommendations for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
 - 2) Report presence of problem salts, minerals, or heavy metals; if present, provide additional recommendations for corrective action.
3. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.
4. Preinstallation Conference: Conduct conference at Project site.

F. Delivery, Storage, And Handling

1. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws if applicable.
2. Bulk Materials:
 - a. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
 - b. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
 - c. Accompany each delivery of bulk fertilizers, lime, and soil amendments with appropriate certificates.
3. Deliver bare-root stock plants freshly dug. Immediately after digging up bare-root stock, pack root system in wet straw, hay, or other suitable material to keep root system moist until planting.



4. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.
5. Handle planting stock by root ball.
6. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F (16 to 18 deg C) until planting.
7. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.
 - a. Heel-in bare-root stock. Soak roots that are in dry condition in water for two hours. Reject dried-out plants.
 - b. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
 - c. Do not remove container-grown stock from containers before time of planting.
 - d. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly-wet condition.

G. Warranty

1. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.
 - a. Failures include, but are not limited to, the following:
 - 1) Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by the Owner, or incidents that are beyond Contractor's control.
 - 2) Structural failures including plantings falling or blowing over.
 - 3) Faulty performance of tree stabilization, edgings, or tree grates.
 - 4) Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - b. Warranty Periods from Date of Planting Completion **OR** Final Completion, **as directed**:
 - 1) Trees, Shrubs, Vines, and Ornamental Grasses: 12 months.
 - 2) Ground Covers, Biennials, Perennials, and Other Plants: 12 **OR** Nine **OR** Six **OR** Three, **as directed**, months.
 - 3) Annuals: Three **OR** Two, **as directed**, months.

H. Maintenance Service

1. Initial Maintenance Service: Provide maintenance by skilled employees of landscape Installer. Maintain as required in Part 1.3. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established but for not less than maintenance period below.
 - a. Maintenance Period for Trees and Shrubs: 12 **OR** Six **OR** Three, **as directed**, months from date of planting completion **OR** Final Completion, **as directed**.
 - b. Maintenance Period for Ground Cover and Other Plants: Six **OR** Three, **as directed**, months from date of planting completion **OR** Final Completion, **as directed**.
2. Continuing Maintenance Proposal: From Installer to the Owner, in the form of a standard yearly (or other period) maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

1.2 PRODUCTS

A. Plant Material



1. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant Schedule or Plant Legend shown on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.
 - a. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 3/4 inch (19 mm) in diameter; or with stem girdling roots will be rejected.
 - b. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.
2. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which shall begin at root flare according to ANSI Z60.1. Root flare shall be visible before planting.
3. Annuals and Biennials: Provide healthy, disease-free plants of species and variety shown or listed, with well-established root systems reaching to sides of the container to maintain a firm ball, but not with excessive root growth encircling the container. Provide only plants that are acclimated to outdoor conditions before delivery and that are in bud but not yet in bloom.

B. Inorganic Soil Amendments

1. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:
 - a. Class: T, with a minimum of 99 percent passing through No. 8 (2.36-mm) sieve and a minimum of 75 percent passing through No. 60 (0.25-mm) sieve.
OR
Class: O, with a minimum of 95 percent passing through No. 8 (2.36-mm) sieve and a minimum of 55 percent passing through No. 60 (0.25-mm) sieve.
 - b. Provide lime in form of ground dolomitic limestone **OR** calcitic limestone **OR** mollusk shells, **as directed**.
2. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent sulfur, with a minimum of 99 percent passing through No. 6 (3.35-mm) sieve and a maximum of 10 percent passing through No. 40 (0.425-mm) sieve.
3. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.
4. Aluminum Sulfate: Commercial grade, unadulterated.
5. Perlite: Horticultural perlite, soil amendment grade.
6. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50 (0.30-mm) sieve.
7. Sand: Clean, washed, natural or manufactured, and free of toxic materials.
8. Diatomaceous Earth: Calcined, 90 percent silica, with approximately 140 percent water absorption capacity by weight.
OR
Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

C. Organic Soil Amendments

1. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch (25-mm) **OR** 3/4-inch (19-mm) **OR** 1/2-inch (13-mm), **as directed**, sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
 - a. Organic Matter Content: 50 to 60 percent of dry weight.
 - b. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.
2. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or granular texture, with a pH range of 3.4 to 4.8.



3. Muck Peat: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture, with a pH range of 6 to 7.5, and having a water-absorbing capacity of 1100 to 2000 percent.
4. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.
 - a. In lieu of decomposed wood derivatives, mix partially decomposed wood derivatives with ammonium nitrate at a minimum rate of 0.15 lb/cu. ft. (2.4 kg/cu. m) of loose sawdust or ground bark, or with ammonium sulfate at a minimum rate of 0.25 lb/cu. ft. (4 kg/cu. m) of loose sawdust or ground bark.
5. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, debris, and material harmful to plant growth.

D. Fertilizers

1. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 1 **OR** 4, **as directed**, percent nitrogen and 10 **OR** 20, **as directed**, percent phosphoric acid.
2. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.
3. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
 - a. Composition: 1 lb/1000 sq. ft. (0.45 kg/92.9 sq. m) of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
 - b. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.
4. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
 - a. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.
 - b. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.
5. Planting Tablets: Tightly compressed chip type, long-lasting, slow-release, commercial-grade planting fertilizer in tablet form. Tablets shall break down with soil bacteria, converting nutrients into a form that can be absorbed by plant roots.
 - a. Size: 5-gram **OR** 10-gram **OR** 21-gram, **as directed**, tablets.
 - b. Nutrient Composition: 20 percent nitrogen, 10 percent phosphorous, and 5 percent potassium, by weight plus micronutrients.
6. Chelated Iron: Commercial-grade FeEDDHA for dicots and woody plants, and commercial-grade FeDTPA for ornamental grasses and monocots.

E. Planting Soils

1. Planting Soil: ASTM D 5268 topsoil, with pH range of 5.5 to 7, a minimum of 2 percent organic material content **OR** Existing, native surface topsoil formed under natural conditions with the duff layer retained during excavation process **OR** Existing, in-place surface soil **OR** Imported topsoil or manufactured topsoil from off-site sources; do not obtain from agricultural land, bogs or marshes, **as directed**. Verify suitability of soil to produce viable planting soil. Clean soil of roots, plants, sod, stones, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth. Mix soil with the following soil amendments and fertilizers in the following quantities to produce planting soil:
 - a. Ratio of Loose Compost to Topsoil by Volume: 1:4 **OR** 1:3 **OR** 1:2, **as directed**.
 - b. Ratio of Loose Sphagnum **OR** Muck, **as directed**, Peat to Topsoil by Volume: as directed by the Owner.
 - c. Ratio of Loose Wood Derivatives to Topsoil by Volume: as directed by the Owner.
 - d. Weight of Lime per 1000 Sq. Ft. (92.9 Sq. m): as directed by the Owner.



- e. Weight of Sulfur **OR** Iron Sulfate **OR** Aluminum Sulfate, **as directed**, per 1000 Sq. Ft. (92.9 Sq. m): as directed by the Owner.
 - f. Weight of Agricultural Gypsum per 1000 Sq. Ft. (92.9 Sq. m): as directed by the Owner.
 - g. Volume of Sand Plus 10 Percent Diatomaceous Earth **OR** Zeolites, **as directed**, per 1000 Sq. Ft. (92.9 Sq. m): as directed by the Owner.
 - h. Weight of Bonemeal per 1000 Sq. Ft. (92.9 Sq. m): as directed by the Owner.
 - i. Weight of Superphosphate per 1000 Sq. Ft. (92.9 Sq. m): as directed by the Owner.
 - j. Weight of Commercial Fertilizer per 1000 Sq. Ft. (92.9 Sq. m): as directed by the Owner.
 - k. Weight of Slow-Release Fertilizer per 1000 Sq. Ft. (92.9 Sq. m): as directed by the Owner.
- F. Mulches
- 1. Organic Mulch: Shredded hardwood **OR** Ground or shredded bark **OR** Wood and bark chips **OR** Pine straw **OR** Salt hay or threshed straw **OR** Pine needles **OR** Peanut, pecan, and cocoa-bean shells, **as directed**.
 - 2. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch (25-mm) sieve; soluble salt content of 2 to 5 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings.
 - 3. Mineral Mulch: Rounded riverbed gravel or smooth-faced stone **OR** Crushed stone or gravel **OR** Marble chips **OR** Granite chips, **as directed**.
 - a. Size Range: 1-1/2 inches (38 mm) maximum, 3/4 inch (19 mm) minimum **OR** 3/4 inch (19 mm) maximum, 1/4 inch (6.4 mm) minimum, **as directed**.
 - b. Color: Uniform tan-beige color range acceptable to the Owner **OR** Readily available natural gravel color range, **as directed**.
- G. Weed-Control Barriers
- 1. Nonwoven Geotextile Filter Fabric: Polypropylene or polyester fabric, 3 oz./sq. yd. (101g/sq. m) minimum, composed of fibers formed into a stable network so that fibers retain their relative position. Fabric shall be inert to biological degradation and resist naturally-encountered chemicals, alkalis, and acids.
 - 2. Composite Fabric: Woven, needle-punched polypropylene substrate bonded to a nonwoven polypropylene fabric, 4.8 oz./sq. yd. (162 g/sq. m).
- H. Pesticides
- 1. General: Pesticide registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.
 - 2. Pre-Emergent Herbicide (Selective and Non-Selective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.
 - 3. Post-Emergent Herbicide (Selective and Non-Selective): Effective for controlling weed growth that has already germinated.
- I. Tree Stabilization Materials
- 1. Stakes and Guys:
 - a. Upright and Guy Stakes: Rough-sawn, sound, new hardwood **OR** softwood with specified wood pressure-preservative treatment, **as directed**, free of knots, holes, cross grain, and other defects, 2-by-2-inch nominal (38-by-38-mm actual) by length indicated, pointed at one end.
 - b. Wood Deadmen: Timbers measuring 8 inches (200 mm) in diameter and 48 inches (1200 mm) long, treated with specified wood pressure-preservative treatment.
 - c. Flexible Ties: Wide rubber or elastic bands or straps of length required to reach stakes or turnbuckles **OR** compression springs, **as directed**.
 - d. Guys and Tie Wires: ASTM A 641/A 641M, Class 1, galvanized-steel wire, two-strand, twisted, 0.106 inch (2.7 mm) in diameter.



- e. Tree-Tie Webbing: UV-resistant polypropylene or nylon webbing with brass grommets.
 - f. Guy Cables: Five-strand, 3/16-inch- (4.8-mm-) diameter, galvanized-steel cable, with zinc-coated turnbuckles **OR** compression springs, **as directed**, a minimum of 3 inches (75 mm) long, with two 3/8-inch (10-mm) galvanized eyebolts.
 - g. Flags: Standard surveyor's plastic flagging tape, white, 6 inches (150 mm) long.
 - h. Proprietary Staking-and-Guying Devices: Proprietary stake and adjustable tie systems to secure each new planting by plant stem; sized as indicated and per manufacturer's written recommendations.
2. Root-Ball Stabilization Materials:
 - a. Upright Stakes and Horizontal Hold-Down: Rough-sawn, sound, new hardwood or softwood, free of knots, holes, cross grain, and other defects, 2-by-2-inch nominal (38-by-38-mm actual) by length indicated; stakes pointed at one end.
 - b. Wood Screws: ASME B18.6.1.
 - c. Proprietary Root-Ball Stabilization Devices: Proprietary at- or below-grade stabilization systems to secure each new planting by root ball; sized per manufacturer's written recommendations unless otherwise indicated.
 3. Palm Bracing: Battens or blocks, struts, straps, and protective padding as indicated.
 - a. Battens or Blocks and Struts: Rough-sawn, sound, new hardwood or softwood, free of knots, holes, cross grain, and other defects, 2-by-4-inch nominal (38-by-89-mm actual) by lengths indicated.
 - b. Straps: Adjustable steel or plastic package banding straps.
 - c. Padding: Burlap.
 - d. Proprietary Palm-Bracing Devices: Proprietary systems to secure each new planting by trunk; sized per manufacturer's written recommendations unless otherwise indicated.
- J. Landscape Edgings
1. Wood Edging: Of sizes shown on Drawings, and wood stakes as follows:
 - a. Species: Western red cedar, all heart **OR** Southern pine with specified wood pressure-preservative treatment, **as directed**.
 - b. Stakes: Same species as edging, 1-by-2-inch nominal (19-by-38-mm actual) by 18 inches (450 mm) long, with galvanized nails for anchoring edging.
 2. Steel Edging: Standard commercial-steel edging, rolled edge, fabricated in sections of standard lengths, with loops stamped from or welded to face of sections to receive stakes.
 - a. Edging Size: 3/16 inch (4.8 mm) wide by 4 inches (100 mm) deep **OR** 1/4 inch (6.4 mm) wide by 5 inches (125 mm) deep **OR** 1/4 inch (6.4 mm) wide by 4 inches (100 mm) deep **OR** 1/8 inch (3.2 mm) wide by 4 inches (100 mm) deep **OR** 1/8 inch (3.2 mm) wide by 6 inches (150 mm) deep **OR** 0.1 inch (2.5 mm) wide by 4 inches (100 mm) deep, **as directed**.
 - b. Stakes: Tapered steel, a minimum of 12 inches (300 mm) **OR** 15 inches (380 mm), **as directed**, long.
 - c. Accessories: Standard tapered ends, corners, and splicers.
 - d. Finish: Standard paint **OR** Zinc coated **OR** Unfinished, **as directed**.
 - e. Paint Color: Black **OR** Green **OR** Brown, **as directed**.
 3. Aluminum Edging: Standard-profile extruded-aluminum edging, ASTM B 221 (ASTM B 221M), Alloy 6063-T6, fabricated in standard lengths with interlocking sections with loops stamped from face of sections to receive stakes.
 - a. Edging Size: 3/16 inch (4.8 mm) wide by 5-1/2 inches (140 mm) deep **OR** 3/16 inch (4.8 mm) wide by 4 inches (100 mm) deep **OR** 1/8 inch (3.2 mm) wide by 5-1/2 inches (140 mm) deep **OR** 1/8 inch (3.2 mm) wide by 4 inches (100 mm) deep, **as directed**.
 - b. Stakes: Aluminum, ASTM B 221 (ASTM B 221M), Alloy 6061-T6, approximately 1-1/2 inches (38 mm) wide by 12 inches (300 mm) long.
 - c. Finish: Manufacturer's standard paint **OR** Powder-coat paint **OR** Mill (natural aluminum) **OR** Black anodized, **as directed**.
 - d. Paint Color: Black **OR** Green **OR** Brown, **as directed**.



4. Plastic Edging: Standard black polyethylene or vinyl edging, V-lipped bottom **OR** horizontally grooved, **as directed**, extruded in standard lengths, with 9-inch (225-mm) steel angle **OR** plastic, **as directed**, stakes.
 - a. Edging Size: 0.1 inch (2.5 mm) wide by 5 inches (125 mm) deep **OR** 0.07 inch (1.8 mm) wide by 5 inches (125 mm) deep, **as directed**.
 - b. Top Profile: Straight, with top 2 inches (50 mm) being 1/4 inch (6.4 mm) thick.
 - c. Top Profile: Round top, 1/2 inch (13 mm) **OR** 1 inch (25 mm), **as directed**, in diameter.
 - d. Accessories: Manufacturer's standard alignment clips or plugs.

K. Tree Grates

1. Tree Grates and Frames: ASTM A 48/A 48M, Class 35 (Class 250) or better, gray-iron castings of shape, pattern, and size indicated.
OR
Tree Grates and Frames: ASTM A 48/A 48M, Class 35 (Class 250) or better, gray-iron castings and ASTM A 36/A 36M steel-angle frames of shape, pattern, and size indicated; steel frames hot-dip galvanized.
2. Shape and Size: As indicated **OR** Round, 36 inches (914 mm) in diameter **OR** Round, 72 inches (1828 mm) in diameter **OR** 48 inches (1219 mm) square **OR** 60 inches (1524 mm) square **OR** Rectangular, 36 by 60 inches (914 by 1524 mm) **OR** Rectangular, 48 by 72 inches (1219 by 1828 mm), **as directed**.
3. Finish: As fabricated **OR** Powder-coat finish, **as directed**.
 - a. Color: Low-gloss black **OR** dark brown **OR** dark green **OR** dark gray, **as directed**.

L. Miscellaneous Products

1. Wood Pressure-Preservative Treatment: AWPAC2, with waterborne preservative for soil and freshwater use, acceptable to authorities having jurisdiction, and containing no arsenic; including ammoniacal copper arsenate, ammoniacal copper zinc arsenate, and chromated copper arsenate.
2. Root Barrier: Black, molded, modular panels manufactured with 50 percent recycled polyethylene plastic with ultraviolet inhibitors, 85 mils (2.2 mm) thick, with vertical root deflecting ribs protruding 3/4 inch (19 mm) out from panel, and each panel 18 inches (457 mm) **OR** 24 inches (610 mm), **as directed**, wide.
3. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.
4. Burlap: Non-synthetic, biodegradable.
5. Planter Drainage Gravel: Washed, sound crushed stone or gravel complying with ASTM D 448 for Size No. 8.
6. Planter Filter Fabric: Woven **OR** Nonwoven, **as directed**, geotextile manufactured for separation applications and made of polypropylene, polyolefin, or polyester fibers or combination of them.
7. Mycorrhizal Fungi: Dry, granular inoculant containing at least 5300 spores per lb (0.45 kg) of vesicular-arbuscular mycorrhizal fungi and 95 million spores per lb (0.45 kg) of ectomycorrhizal fungi, 33 percent hydrogel, and a maximum of 5.5 percent inert material.

1.3 EXECUTION

A. Preparation

1. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.
2. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
3. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Architect's acceptance of layout before excavating or planting. Make minor adjustments as required.



4. Lay out plants at locations directed by Architect. Stake locations of individual trees and shrubs and outline areas for multiple plantings.
 5. Apply antidesiccant to trees and shrubs using power spray to provide an adequate film over trunks (before wrapping), branches, stems, twigs, and foliage to protect during digging, handling, and transportation.
 - a. If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.
 6. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.
- B. Planting Area Establishment
1. Loosen subgrade of planting areas to a minimum depth of 4 inches (100 mm) **OR** 6 inches (150 mm) **OR** 8 inches (200 mm) **OR** 12 inches (300 mm), **as directed**. Remove stones larger than 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off the Owner's property.
 - a. Apply superphosphate fertilizer directly to subgrade before loosening.
 - b. Thoroughly blend planting soil off-site before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil.
 - 1) Delay mixing fertilizer with planting soil if planting will not proceed within a few days.
 - 2) Mix lime with dry soil before mixing fertilizer.
 - c. Spread planting soil to a depth of 4 inches (100 mm) **OR** 6 inches (150 mm) **OR** 8 inches (200 mm) **OR** 12 inches (300 mm), **as directed**, but not less than required to meet finish grades after natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
 - 1) Spread approximately one-half the thickness of planting soil over loosened subgrade. Mix thoroughly into top 2 inches (50 mm) **OR** 4 inches (100 mm), **as directed**, of subgrade. Spread remainder of planting soil.
 2. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.
 3. Before planting, obtain the Owner's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.
 4. Application of Mycorrhizal Fungi: At time directed by the Owner, broadcast dry product uniformly over prepared soil at application rate indicated on Drawings.
- C. Excavation For Trees And Shrubs
1. Planting Pits and Trenches: Excavate circular planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are not acceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.
 - a. Excavate approximately three times as wide as ball diameter for balled and burlapped **OR** balled and potted **OR** container-grown **OR** fabric bag-grown, **as directed**, stock.
 - b. Excavate at least 12 inches (300 mm) wider than root spread and deep enough to accommodate vertical roots for bare-root stock.
 - c. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
 - d. If area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.
 - e. Maintain required angles of repose of adjacent materials as shown on the Drawings. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
 - f. Maintain supervision of excavations during working hours.
 - g. Keep excavations covered or otherwise protected overnight **OR** after working hours **OR** when unattended by Installer's personnel, **as directed**.



- h. If drain tile is shown on Drawings or required under planting areas, excavate to top of porous backfill over tile.
 2. Subsoil and topsoil removed from excavations may **OR** may not, **as directed**, be used as planting soil.
 3. Obstructions: Notify the Owner if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.
 - a. Hardpan Layer: Drill 6-inch- (150-mm-) diameter holes, 24 inches (600 mm) apart, into free-draining strata or to a depth of 10 feet (3 m), whichever is less, and backfill with free-draining material.
 4. Drainage: Notify the Owner if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.
 5. Fill excavations with water and allow to percolate away before positioning trees and shrubs.
- D. Tree, Shrub, And Vine Planting
1. Before planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.
 2. Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.
 3. Set balled and burlapped stock plumb and in center of planting pit or trench with root flare 1 inch (25 mm) above **OR** 2 inches (50 mm) above, **as directed**, adjacent finish grades.
 - a. Use planting soil for backfill.
 - b. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
 - c. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
 - d. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil-testing laboratory. Place tablets beside the root ball about 1 inch (25 mm) from root tips; do not place tablets in bottom of the hole.
 - e. Continue backfilling process. Water again after placing and tamping final layer of soil.
 4. Set balled and potted **OR** container-grown, **as directed**, stock plumb and in center of planting pit or trench with root flare 1 inch (25 mm) above **OR** 2 inches (50 mm) above, **as directed**, adjacent finish grades.
 - a. Use planting soil for backfill.
 - b. Carefully remove root ball from container without damaging root ball or plant.
 - c. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
 - d. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil-testing laboratory. Place tablets beside the root ball about 1 inch (25 mm) from root tips; do not place tablets in bottom of the hole.
 - e. Continue backfilling process. Water again after placing and tamping final layer of soil.
 5. Set fabric bag-grown stock plumb and in center of planting pit or trench with root flare 1 inch (25 mm) above **OR** 2 inches (50 mm) above, **as directed**, adjacent finish grades.
 - a. Use planting soil for backfill.
 - b. Carefully remove root ball from fabric bag without damaging root ball or plant. Do not use planting stock if root ball is cracked or broken before or during planting operation.
 - c. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.



- d. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil-testing laboratory. Place tablets beside the root ball about 1 inch (25 mm) from root tips; do not place tablets in bottom of the hole.
 - e. Continue backfilling process. Water again after placing and tamping final layer of soil.
 - f. Set and support bare-root stock in center of planting pit or trench with root flare 1 inch (25 mm) above **OR** 2 inches (50 mm) above, **as directed**, adjacent finish grade.
6. Use planting soil for backfill.
 - a. Spread roots without tangling or turning toward surface, and carefully work backfill around roots by hand. Puddle with water until backfill layers are completely saturated. Plumb before backfilling, and maintain plumb while working backfill around roots and placing layers above roots.
 - b. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil-testing laboratory. Place tablets beside soil-covered roots about 1 inch (25 mm) from root tips; do not place tablets in bottom of the hole or touching the roots.
 - c. Continue backfilling process. Water again after placing and tamping final layer of soil.
 7. When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.
- E. Mechanized Tree Spade Planting
1. Trees shall **OR** may, **as directed**, be planted with an approved mechanized tree spade at the designated locations. Do not use tree spade to move trees larger than the maximum size allowed for a similar field-grown, balled-and-burlapped root-ball diameter according to ANSI Z60.1, or larger than the manufacturer's maximum size recommendation for the tree spade being used, whichever is smaller.
 2. When extracting the tree, center the trunk within the tree spade and move tree with a solid ball of earth.
 3. Cut exposed roots cleanly during transplanting operations.
 4. Use the same tree spade to excavate the planting hole as was used to extract and transport the tree.
 5. Plant trees as shown on Drawings, following procedures in "Tree, Shrub, and Vine Planting" Article.
 6. Where possible, orient the tree in the same direction as in its original location.
- F. Tree, Shrub, And Vine Pruning
1. Remove only dead, dying, or broken branches. Do not prune for shape.
 2. Prune, thin, and shape trees, shrubs, and vines as directed by Architect.
 3. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Architect, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.
 4. Do not apply pruning paint to wounds.
- G. Tree Stabilization
1. Install trunk stabilization as follows unless otherwise indicated:
 - a. Upright Staking and Tying: Stake trees of 2- through 5-inch (50- through 125-mm) caliper. Stake trees of less than 2-inch (50-mm) caliper only as required to prevent wind tip out. Use a minimum of two stakes of length required to penetrate at least 18 inches (450 mm) below bottom of backfilled excavation and to extend to the dimension shown on Drawings **OR** at least 72 inches (1830 mm) **OR** one-third of trunk height, **as directed**, above grade. Set vertical stakes and space to avoid penetrating root balls or root masses.
 - b. Use two stakes for trees up to 12 feet (3.6 m) high and 2-1/2 inches (63 mm) or less in caliper; three stakes for trees less than 14 feet (4.2 m) high and up to 4 inches (100 mm) in caliper. Space stakes equally around trees.



- c. Support trees with bands of flexible ties at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.
OR
 Support trees with two strands of tie wire, connected to the brass grommets of tree-tie webbing at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.
2. Staking and Guying: Stake and guy trees more than 14 feet (4.2 m) in height and more than 3 inches (75 mm) in caliper unless otherwise indicated. Securely attach no fewer than three guys to stakes 30 inches (760 mm) long, driven to grade.
- a. Site-Fabricated Staking-and-Guying Method:
- 1) For trees more than 6 inches (150 mm) in caliper, anchor guys to wood deadmen buried at least 36 inches (900 mm) below grade. Provide turnbuckle **OR** compression spring, **as directed**, for each guy wire and tighten securely.
 - 2) Support trees with bands of flexible ties at contact points with tree trunk and reaching to turnbuckle **OR** compression spring, **as directed**. Allow enough slack to avoid rigid restraint of tree.
 - 3) Support trees with strands of cable or multiple strands of tie wire, connected to the brass grommets of tree-tie webbing at contact points with tree trunk and reaching to turnbuckle **OR** compression spring, **as directed**. Allow enough slack to avoid rigid restraint of tree.
 - 4) Attach flags to each guy wire, 30 inches (760 mm) above finish grade.
OR
 Paint turnbuckles **OR** compression springs, **as directed**, with luminescent white paint.
- b. Proprietary Staking and Guying Device: Install staking and guying system sized and positioned as recommended by manufacturer unless otherwise indicated and according to manufacturer's written instructions.
3. Root-Ball Stabilization: Install at- or below-grade stabilization system to secure each new planting by the root ball unless otherwise indicated.
- a. Wood Hold-Down Method: Place vertical stakes against side of root ball and drive them into subsoil; place horizontal wood hold-down stake across top of root ball and screw at each end to one of the vertical stakes.
- 1) Install stakes of length required to penetrate at least to the dimension shown on Drawings **OR** 18 inches (450 mm), **as directed**, below bottom of backfilled excavation. Saw stakes off at horizontal stake.
 - 2) Install screws through horizontal hold-down and penetrating at least 1 inch (25 mm) into stakes. Predrill holes if necessary to prevent splitting wood.
 - 3) Install second set of stakes on other side of root trunk for larger trees as indicated.
- b. Proprietary Root-Ball Stabilization Device: Install root-ball stabilization system sized and positioned as recommended by manufacturer unless otherwise indicated and according to manufacturer's written instructions.
4. Palm Bracing: Install bracing system at three or more places equally spaced around perimeter of trunk to secure each palm until established unless otherwise indicated.
- a. Site-Fabricated Palm-Bracing Method:
- 1) Place battens over padding and secure battens in place around trunk perimeter with at least two straps, tightened to prevent displacement. Ensure that straps do not contact trunk.
 - 2) Place diagonal braces and cut to length. Secure upper ends of diagonal braces with galvanized nails into battens or into nail-attached blocks on battens. Do not drive nails, screws, or other securing devices into palm trunk; do not penetrate palm trunk in any fashion. Secure lower ends of diagonal braces with stakes driven into ground to prevent outward slippage of braces.
- b. Proprietary Palm-Bracing Device: Install palm-bracing system sized and positioned as recommended by manufacturer unless otherwise indicated and according to manufacturer's written instructions.



H. Root-Barrier Installation

1. Install root barrier where trees are planted within 60 inches (1500 mm) **OR** 48 inches (1200 mm), **as directed**, of paving or other hardscape elements, such as walls, curbs, and walkways unless otherwise shown on Drawings.
2. Align root barrier vertically **OR** with bottom edge angled at 20 degrees away from the paving or other hardscape element, **as directed**, and run it linearly along and adjacent to the paving or other hardscape elements to be protected from invasive roots.
3. Install root barrier continuously for a distance of 60 inches (1500 mm) in each direction from the tree trunk, for a total distance of 10 feet (3 m) per tree. If trees are spaced closer, use a single continuous piece of root barrier.
 - a. Position top of root barrier flush with finish grade **OR** 1/2 inch (13 mm) above finish grade **OR** per manufacturer's recommendations, **as directed**.
 - b. Overlap root barrier a minimum of 12 inches (300 mm) at joints.
 - c. Do not distort or bend root barrier during construction activities.
 - d. Do not install root barrier surrounding the root ball of tree.

I. Planting In Planters

1. Place a layer of drainage gravel at least 4 inches (100 mm) thick in bottom of planter. Cover bottom with filter fabric and wrap filter fabric 4 inches (100 mm) **OR** 6 inches (150 mm), **as directed**, up on all sides. Duct tape along the entire top edge of the filter fabric, to secure the filter fabric against the sides during the soil-filling process.
2. Fill planter with lightweight on-structure planting soil. Place soil in lightly compacted layers to an elevation of 1-1/2 inches (38 mm) below top of planter, allowing natural settlement.

J. Ground Cover And Plant Planting

1. Set out and space ground cover and plants other than trees, shrubs, and vines 9 inches (225 mm) apart **OR** 12 inches (300 mm) apart **OR** 18 inches (450 mm) apart **OR** 24 inches (600 mm) apart **OR** as indicated, **as directed**, in even rows with triangular spacing.
2. Use planting soil for backfill.
3. Dig holes large enough to allow spreading of roots.
4. For rooted cutting plants supplied in flats, plant each in a manner that will minimally disturb the root system but to a depth not less than two nodes.
5. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.
6. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.
7. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

K. Planting Area Mulching

1. Install weed-control barriers before mulching according to manufacturer's written instructions. Completely cover area to be mulched, overlapping edges a minimum of 6 inches (150 mm) **OR** 12 inches (300mm), **as directed**, and secure seams with galvanized pins.
2. Mulch backfilled surfaces of planting areas and other areas indicated.
 - a. Trees and Tree-like Shrubs in Turf Areas: Apply organic **OR** mineral, **as directed**, mulch ring of 2-inch (50-mm) **OR** 3-inch (75-mm), **as directed**, average thickness, with 12-inch (300-mm) **OR** 24-inch (600-mm) **OR** 36-inch (900-mm), **as directed**, radius around trunks or stems. Do not place mulch within 3 inches (75 mm) **OR** 6 inches (150 mm), **as directed**, of trunks or stems.
 - b. Organic Mulch in Planting Areas: Apply 2-inch (50-mm) **OR** 3-inch (75-mm), **as directed**, average thickness of organic mulch extending 12 inches (300 mm) beyond edge of individual planting pit or trench and over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 3 inches (75 mm) **OR** 6 inches (150 mm), **as directed**, of trunks or stems.
 - c. Mineral Mulch in Planting Areas: Apply 2-inch (50-mm) **OR** 3-inch (75-mm), **as directed**, average thickness of mineral mulch extending 12 inches (300 mm) beyond edge of individual planting pit or trench and over whole surface of planting area, and finish level



with adjacent finish grades. Do not place mulch within 3 inches (75 mm) **OR** 6 inches (150 mm), **as directed**, of trunks or stems.

L. Edging Installation

1. Wood Edging: Install edging where indicated. Mitre cut joints and connections at a 45 degree angle. Fasten each cut joint or connection with two galvanized nails. Anchor with wood stakes spaced up to 36 inches (900 mm) apart, driven at least 1 inch (25 mm) below top elevation of edging. Use two galvanized nails per stake to fasten edging, of length as needed to penetrate both edging and stake and provide 1/2-inch (13-mm) clinch at point. Pre-drill stakes if needed to avoid splitting. Replace stakes that crack or split during installation process.
2. Steel Edging: Install steel edging where indicated according to manufacturer's written instructions. Anchor with steel stakes spaced approximately 30 inches (760 mm) apart, driven below top elevation of edging.
3. Aluminum Edging: Install aluminum edging where indicated according to manufacturer's written instructions. Anchor with aluminum stakes spaced approximately 36 inches (900 mm) **OR** 48 inches (1200 mm), **as directed**, apart, driven below top elevation of edging.
4. Plastic Edging: Install plastic edging where indicated according to manufacturer's written instructions. Anchor with steel stakes spaced approximately 36 inches (900 mm) **OR** 48 inches (1200 mm), **as directed**, apart, driven through upper base grooves or V-lip of edging.
5. Shovel-Cut Edging: Separate mulched areas from turf areas, curbs, and paving with a 45-degree, 4- to 6-inch- (100- to 150-mm-) deep, shovel-cut edge as shown on Drawings.

M. Tree Grate Installation

1. Tree Grates: Set grate segments flush with adjoining surfaces as shown on Drawings. Shim from supporting substrate with soil-resistant plastic. Maintain a 3-inch- (75-mm-) minimum growth radius around base of tree; break away units of casting, if necessary, according to manufacturer's written instructions.

N. Plant Maintenance

1. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings. Spray or treat as required to keep trees and shrubs free of insects and disease.
2. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.
3. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

O. Pesticide Application

1. Apply pesticides and other chemical products and biological control agents in accordance with authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with the Owner's operations and others in proximity to the Work. Notify the Owner before each application is performed.
2. Pre-Emergent Herbicides (Selective and Non-Selective): Apply to tree, shrub, and ground-cover areas in accordance with manufacturer's written recommendations. Do not apply to seeded areas.
3. Post-Emergent Herbicides (Selective and Non-Selective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations.

P. Cleanup And Protection

1. During planting, keep adjacent paving and construction clean and work area in an orderly condition.



2. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.
3. After installation and before Final Completion, remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.

Q. Disposal

1. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off the Owner's property.

END OF SECTION 32 14 09 00



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SECTION 32 14 11 00 - ASPHALT CONCRETE SIDEWALKS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of asphalt concrete sidewalks. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: For each type of product indicated.

1.2 PRODUCTS**A. Asphaltic Concrete:**

1. Hot-Mixed, Hot-Laid Bituminous Paving Mixtures: ASTM D 3515.
2. Plant-Mixed, Stockpiled Asphalt Cold Mixes: Asphalt Institute Manual MS-14.

B. Bituminous Prime: ASTM D 2027, Grades MC-30 or MC-70; ASTM D 2028, Grade RC-70; or ASTM D 2026, Grade SC-70.**C. Base Course: ASTM D 2940.****D. Bituminous Tack Coat: ASTM D 977, Grades RS-1, MS-1 or SS-1h; ASTM D 2027, Grade MC-30; ASTM D 2028, Grade RC-70; ASTM D 2026, Grade SC-70; or ASTM D 2397, Grades CRS-1 or CSS-1.****E. Seal Coat: ASTM D 2027, Grade HC-250 or MC-800; or D 2028, Grade RC-250 or RC-800.****F. Slurry Coat Mixture shall be comprised of 70 percent sand or fine aggregate, 10 percent water, and 20 percent liquid or emulsified asphalt.**

1. Fine Aggregate: ASTM D 1073, Grade 2.
2. Emulsified Asphalt: ASTM D 977, Grades SS-1 or SS-1h.

1.3 EXECUTION**A. Application Temperatures: Application temperatures for all asphalt materials shall comply with provisions of the Asphalt Institute publications and the applicable ASTM standards.****B. Subgrade: Construct the subgrade for walkway replacement true to grade and compact as required.****C. Base Course**

1. Placing: Spread the base course material evenly upon the prepared subgrade, in a layer of such depth that when compacted the layer will be uniform and of the thickness required.
2. Compaction: Immediately following the spreading of the material, compact the base course with equipment to a density as required.

D. Surface Course

1. Placing: Apply prime coat, and allow it to cure. The placing of the mixture shall be continuous. Paint all contact surfaces of previously constructed sidewalk with a tack coat of rapid-setting liquid asphalt just before the fresh mixture is placed.



2. Forms: Set forms with the upper edge true to line and hold grade rigidly in place by stakes placed on the outside of the forms and set flush with the top edge of the forms.
3. Compaction: Immediately following the placement of the asphalt concrete mixture, compact the surface course with equipment to a density as required.
4. Backfilling: After removing the forms and debris, backfill the exposed or excavated area adjoining the sidewalk with granular material, grade, and compact to conform to the surrounding area.

E. Patching

1. For Repair Operations Involving Raveling, Heaving, Spalling, and Alligating: Cut asphalt concrete paving back to solid material, making cut area rectangular with vertical sides. Remove deteriorated pavement including base material if required. Replace base course, compact, and tack coat the base material and the vertical surfaces of cut area. Fill area with new asphalt concrete and compact level with existing walkway. Dust patched area with sand or mineral dust.
2. Pothole Repair: Cut rectangular hole around pothole back to solid pavement leaving straight, vertical edges. Remove loose material and water to firm base. Fill holes and compact to within 3 inches of the surface in layers not exceeding 6 inches with either base material or asphalt mixture. Apply tack coat to base material and vertical edges. On the surface layer, fill with asphalt mixture and mound to such height that when compacted the mix will be level with surrounding walkway surface. Dust patched area with sand or mineral dust.
3. Low Spot or Depression Repair: Determine limits of depression with straightedge, and mark outline with crayon. Apply tack coat, 0.05 to 0.15 gallon per square yard, to the cleaned area, and allow to cure. Spread area with asphalt concrete mix and feather edge by raking and manipulation of the material. Roll and compact area to surrounding walkway level. Recheck with straightedge. Apply a sand seal to the patched area to prevent entrance of water.
4. Polished Aggregate Repair: Clean and dry area thoroughly. Apply tack coat at a rate of 0.05 to 0.15 gallon per square yard; overlay area with new asphalt concrete mix to a minimum 1-1/2 inch thickness and feather to adjoining walkway surfaces. Roll with pneumatic or steel rollers.
5. Damaged Edging Repair: Remove damaged or deteriorated edging materials and replace.
6. Prime Coat: Prime new base course with MC-70 liquid asphalt at a rate of 0.20 to 0.30 gallon per square yard. Take care to apply to more asphalt than will penetrate into the base course during curing. Blot excess prime with sand before the surfacing material is applied.
7. Tack Coat: Surfaces and cut edges of existing asphalt concrete shall be given a tack coat of MC-70 liquid asphalt at a rate of 0.05 to 0.15 gallon per square yard. After application of the tack coat, allow time for the material to cure before surfacing and patching material is placed.
8. Seal Coat Spray Application: Walkway surfaces that are to be sealed shall receive a liquid asphalt coat applied at a rate of 0.15 to 0.20 gallon per square yard, along with a fine aggregate at a rate of 15 to 20 pounds per square yard.

- F. Crack Repair: Fill cracks after drying with liquid asphalt, sand asphalt emulsion water mixture, or slurry seal. After thorough cleaning, work the mixture into cracks by broom or squeegee. Cracks 1/8 to 1/2 inch width shall be slurry sealed and filled with liquid asphalt. Dust repaired cracks with fine aggregate or mineral dust to prevent cracking. Final thickness of the slurry seal shall be 1/8 inch minimum.

END OF SECTION 32 14 11 00



SECTION 32 14 11 00a - MISCELLANEOUS SIDEWALKS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of miscellaneous sidewalks. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: For each type of product indicated.

1.2 PRODUCTS**A. Aggregate shall comply with the following:**

1. Surface Course Aggregates shall be well-graded, crushed stone, 3/4- to 1-1/4 inch size, consisting of clean, sound, durable particles.
2. Masonry Grout Aggregate: ASTM C 404, Size 2.

B. Base Course: Base course material shall be a granular dense-graded, high-quality compactable material.**C. Ready-Mixed Concrete:** Ready-mixed concrete shall comply with ASTM C 94. The concrete shall attain a minimum compressive strength of 3,000 psi at 28 days.**D. Portland Cement Concrete:** Cement shall comply with ASTM C 150.**E. Joint Filler:** Masonry joint filler shall be Portland cement concrete mix with cement complying with ASTM C 150.**F. Masonry Units:** Color and texture shall match the existing as nearly as is practicable.**G. Wood and Preservatives:** Footboards and supports shall be 1-1/2 inch thick Number 1 dense Douglas fir or yellow pine lumber, pressure-treated with chromated copper arsenate (CCA) preservative complying with applicable ASTM Standards. Retention shall be a minimum of 0.25 pounds per cubic foot.**1.3 EXECUTION****A. Base Course Repair:** Remove material in soft spots to such depth required to provide a firm foundation for surface materials and fill with granular material of a quality that will compact when moistened. Roll or tamp this material to obtain the proper density.**B. Surface Repair**

1. Aggregate Walkways: Spread the surface material evenly on the base course in a layer of such depth that when compacted, the layer will be uniform with a minimum thickness of 4 inches.
2. Joint Filling: Completely remove and clean the joint of all loose joint material, dirt, clay, or other foreign matter. Fill the joint flush with concrete to provide a uniform surface.
3. Wood Walkways: Secure wood members with galvanized nails, screws, bolts, or other approved fasteners to ensure tight joints.



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4. Masonry Walkways: New or salvaged masonry units will be placed on a 3/4-inch mortar setting bed with mortar joints matching the existing walkway. Place the setting bed on a fresh 3-inch thick Portland cement concrete slab.

END OF SECTION 32 14 11 00a



SECTION 32 14 11 00b - PRECAST SIDEWALKS AND PAVERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of precast sidewalks and pavers. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: For each type of product indicated.
 - a. For stone varieties proposed for use on Project, include data on physical properties specified or required by referenced ASTM standards.
2. Stone Samples: For each color, grade, finish, and variety of stone required.

1.2 PRODUCTS

- A. Precast Concrete Patio Blocks: ASTM C 936. Natural or colored, minimum 2 inches thick.

- B. Exposed Aggregate or Granite: ASTM C 615 and National Building Granite Quarries Association, Inc.

1. Exposed Limestone: Limestone (Oolitic), ASTM C 568, Category II.
2. Exposed White Tumblestone Aggregate: As required to meet project requirements.

C. Stone Pavers

1. Bluestone Flagging Paver: Irregular cut, 1 inch thick.
2. White Marble, Crushed Stone: ASTM C 503 and Marble Institute of America (MIA), 3 inches thick.
3. Bluestone, Crushed Stone: 3 inches thick.
4. Natural Cleft Slate: ASTM C 629, 3/4-inch irregular cut, 1/2-inch random rectangular cut, or 1/4-inch random rectangular butted joints.

- D. Granite Blocks: Blocks shall be 3 to 5 inches thick and comply with requirements of ASTM C 615 and National Building Granite Quarries Association, Inc. Sizes shall be 3-1/2 inches square; 4 to 12 inches by 3 to 5 inches; and 6 to 15 inches by 3 to 6 inches.

E. Mortar and Grout

1. Portland Cement: ASTM C 150 and the staining requirements of ASTM C 91.
2. Masonry Cement: ASTM C 91, non-staining.
3. Hydrated Lime: ASTM C 207, Type S.
4. Sand: ASTM C 144.
 - a. White Pointing Mortar: Natural white sand or ground white stone.
 - b. Colored Pointing Mortar: Marble, granite, or sound stone.

1.3 EXECUTION

A. Preparation

1. Clean stone or concrete block with clear water.
2. Ferrous Metal: Apply a heavy coat of bituminous paint on metal surfaces in contact with block.

B. Installation

1. Expansion Joints: Install continuous strips of preformed joint filler.



2. Clean sub-base and saturate with clean water.
3. Slush Coat: Apply 1/16-in. thick slush coat of cement grout over concrete sub-base about 15 minutes prior to placing setting bed.
4. Setting Bed: Mix one 94-lb. bag of cement to 3 cu. ft. of sand. Use only enough water to produce a moist surface when setting bed is ready for setting of stone. Spread and screed to a uniform thickness.
5. Set stone or concrete block before initial set of cement bed occurs. Wet stone or block thoroughly before setting. Apply a thin layer of neat cement paste 1/32-in. to 1/16-in. thick to setting bed, or bottom of stone or block.
6. Grout joints as soon as possible after initial set of setting bed and tool slightly concave. Use grout mix of one bag Portland cement to 2 cu. ft. sand. Cure grout by maintaining in a moist condition for 7 days. Do not permit traffic on surface during setting of units or for at least 24 hours after final grouting of joints.

END OF SECTION 32 14 11 00b



Task	Specification	Specification Description
32 14 11 00	31 25 14 23	Unit Pavers
32 14 16 00	32 14 11 00	Asphalt Concrete Sidewalks
32 14 16 00	32 14 11 00a	Miscellaneous Sidewalks
32 14 16 00	32 14 11 00b	Precast Sidewalks And Pavers
32 14 16 00	31 25 14 23	Unit Pavers



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SECTION 32 14 43 00 - POROUS UNIT PAVING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for porous unit paving. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Porous paving consisting of concrete pavers set in aggregate setting beds.
 - b. Edge restraints.
 - c. Cast-in-place concrete edge restraints.
 - d. Precast concrete curbs.
 - e. Granite curbs.

C. Submittals

1. Product Data: For materials other than aggregates.
2. Sieve Analyses: For aggregate materials, according to ASTM C 136.
3. Samples:
 - a. Full-size units of each type of unit paver indicated.
 - b. Exposed edge restraints.
 - c. Precast concrete curbs.
 - d. Granite curbs.
 - e. Aggregate fill.
4. Material Certificates: For unit pavers. Include statements of material properties indicating compliance with requirements, including compliance with standards. Provide for each type and size of unit.

D. Quality Assurance

1. Preinstallation Conference: Conduct conference at Project site.

E. Delivery, Storage, And Handling

1. Store pavers on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied.
2. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

1.2 PRODUCTS

A. Concrete Unit Pavers

1. Concrete Grid Pavers: Grid paving units complying with ASTM C 1319, made from normal-weight aggregates.
2. Solid Concrete Pavers for Porous Paving: Solid interlocking paving units of shapes that provide openings between units, complying with ASTM C 936, resistant to freezing and thawing when tested according to ASTM C 67, **as directed**, and made from normal-weight aggregates.
 - a. Thickness: 2-3/8 inches (60 mm) **OR** 3-1/8 inches (80 mm) **OR** 3-1/2 inches (90 mm) **OR** 4 inches (100 mm), **as directed**.
 - b. Face Size and Shape: As indicated.
 - c. Color: As indicated by manufacturer's designations **OR** Match the Owner's sample **OR** As selected by the Owner from manufacturer's full range, **as directed**.



B. Accessories

1. Plastic Edge Restraints: Triangular PVC extrusions, 1-3/4 inches (45 mm) high by 3-1/2 inches (90mm) wide **OR** 3-1/8 inches (80 mm) high by 9-1/2 inches (240 mm) wide, **as directed**, designed to serve as edge restraints for unit pavers; rigid type for straight edges and flexible type for curved edges, with pipe connectors and 3/8-inch- (9.5-mm-) diameter by 12-inch- (300-mm-) long steel spikes.
2. Steel Edge Restraints: Painted steel edging, 3/16 inch (4.8 mm) thick by 4 inches (100 mm) high **OR** 1/4 inch (6.4 mm) thick by 5 inches (125 mm) high, **as directed**, with loops pressed from or welded to face to receive stakes at 36 inches (900 mm) o.c., and with steel stakes 15 inches (380 mm) long for each loop.
 - a. Color: As indicated by manufacturer's designations **OR** Match the Owner's sample **OR** As selected by the Owner from manufacturer's full range, **as directed**.
3. Aluminum Edge Restraints: Straight, 1/8-inch- (3.2-mm-) thick by 4-inch- (100-mm-) high **OR** Straight, 3/16-inch- (4.8-mm-) thick by 4-inch- (100-mm-) high **OR** L-shaped, 1/8-inch- (3.2-mm-) thick by 1-3/8-inch- (35-mm-) high **OR** L-shaped, 3/16-inch- (4.8-mm-) thick by 2-1/4-inch- (57-mm-) high, **as directed**, extruded-aluminum edging, with loops pressed from face to receive stakes at 12 inches (300 mm) o.c., and with aluminum stakes 12 inches (300 mm) long for each loop.
4. Precast Concrete Curbs: Made from normal-weight concrete with a compressive strength not less than 5000 psi (35 MPa) **OR** 6000 psi (41 MPa), **as directed**, and water absorption not more than 5 percent, in shapes and sizes indicated.
 - a. Color and Texture: As indicated by manufacturer's designations **OR** Match the Owner's sample **OR** As selected by the Owner from manufacturer's full range, **as directed**.
5. Granite Curbs: Granite curbing, with face battered 1 inch per foot (1:12), produced in random lengths not less than 36 inches (900 mm) from granite complying with ASTM C 615.
 - a. Granite Color and Grain: Light gray **OR** Dark gray **OR** Buff **OR** White **OR** Black **OR** Pink, **as directed**, with fine **OR** medium **OR** coarse, **as directed**, grain.
 - b. Top Width: 4 inches (100 mm) **OR** 5 inches (125 mm) **OR** 6 inches (150 mm), **as directed**.
 - c. Face Height: 4 inches (100 mm) **OR** 6 inches (150 mm) **OR** 8 inches (200 mm), **as directed**.
 - d. Total Height: 12 inches (300 mm) **OR** 16 inches (400 mm) **OR** 18 inches (450 mm), **as directed**.
 - e. Top Finish: Sawed **OR** Thermal **OR** Bushhammered, **as directed**.
 - f. Face Finish: Split **OR** Sawed **OR** Thermal **OR** Bushhammered, **as directed**.

C. Aggregate Setting-Bed Materials

1. Graded Aggregate for Subbase: Sound crushed stone or gravel complying with ASTM D 448 for Size No. 57 **OR** ASTM D 448 for Size No. 5 **OR** ASTM D 2940, subbase material **OR** requirements in Division 31 Section "Earth Moving" for subbase material, **as directed**.
2. Graded Aggregate for Base Course: Sound crushed stone or gravel complying with ASTM D 448 for Size No. 8 **OR** ASTM D 448 for Size No. 57 **OR** ASTM D 2940, base-course material **OR** requirements in Division 31 Section "Earth Moving" for base-course material, **as directed**.
3. Sand for Leveling Course: Sound, sharp, washed, natural sand or crushed stone complying with gradation requirements in ASTM C 33 for fine aggregate.
4. Soil Mix for Leveling Course: Sound, sharp, washed, natural sand or crushed stone complying with gradation requirements in ASTM C 33 for fine aggregate blended with planting soil mix complying with requirements in Division 32 Section(s) "Turf And Grasses" **OR** "Plants", **as directed**. Use blend consisting of 1/2 sand and 1/2 soil mix **OR** 2/3 sand and 1/3 soil mix, **as directed**.
5. Graded Aggregate for Leveling Course: Sound crushed stone or gravel complying with ASTM D 448 for Size No. 8 **OR** 9, **as directed**.
6. Soil for Porous Paver Fill: Planting soil mix complying with requirements in Division 32 Section(s) "Turf And Grasses" **OR** "Plants", **as directed**.



7. Graded Aggregate for Porous Paver Fill: Sound crushed stone or gravel complying with ASTM D 448 for Size No. 8 **OR** 9, **as directed**.
 - a. Provide stone of color indicated **OR** to match the Owner's sample, **as directed**.
8. Grass Seed: Comply with requirements in Division 32 Section "Turf And Grasses".
9. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications; made from polyolefins or polyesters, with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
 - a. Survivability: Class 2; AASHTO M 288.
 - b. Apparent Opening Size: No. 60 (0.250-mm) sieve, maximum; ASTM D 4751.
 - c. Permittivity: 0.02 per second, minimum; ASTM D 4491.
 - d. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.
10. Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
 - a. Survivability: Class 2; AASHTO M 288.
 - b. Apparent Opening Size: No. 40 (0.425-mm) sieve, maximum; ASTM D 4751.
 - c. Permittivity: 0.5 per second, minimum; ASTM D 4491.
 - d. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

1.3 EXECUTION

A. Preparation

1. Proof-roll prepared subgrade according to requirements in Division 31 Section "Earth Moving" to identify soft pockets and areas of excess yielding. Proceed with porous paver installation only after deficient subgrades have been corrected and are ready to receive subbase and base **OR** base, **as directed**, course for porous paving.

B. Installation, General

1. Do not use unit pavers with chips, cracks, voids, discolorations, and other defects that might be structurally unsound or visible in finished work.
2. Cut unit pavers with motor-driven masonry saw equipment or a block splitter, **as directed**, to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.
3. Tolerances:
 - a. Variation in Plane between Adjacent Units (Lipping): Do not exceed 1/16-inch (1.5-mm) unit-to-unit offset from flush.
 - b. Variation from Level or Indicated Slope: Do not exceed 1/8 inch in 24 inches (3 mm in 600 mm) and 1/4 inch in 10 feet (6 mm in 3 m) or a maximum of 1/2 inch (13 mm).
4. Provide edge restraints as indicated. Install edge restraints before placing unit pavers.
 - a. Install edge restraints to comply with manufacturer's written instructions. Install stakes at intervals required to hold edge restraints in place during and after porous paver installation.
 - b. For metal edge restraints with top edge exposed, drive stakes at least 1 inch (25 mm) below top edge.
 - c. Install job-built concrete edge restraints to comply with requirements in Division 32 Section "Concrete Paving".
5. Provide curbs as indicated. Install curbs before placing unit pavers.
 - a. Install precast concrete **OR** granite, **as directed**, curbs on a bedding of compacted base-course material over compacted subgrade. Install curbs before placing base course for pavers. Set curbs at elevations indicated, accurately aligned, and place and compact base-course material behind curbs as indicated.
 - b. Install precast concrete curbs on aggregate base course after placing and compacting base course for pavers. Set curbs with top edge 1 inch (25 mm) below top of pavers. Anchor curbs with metal stakes driven through holes in curbs into base-course material.



- c. Install precast concrete curbs on aggregate-base course after placing and compacting base course for pavers. Set curbs with top surface 1/2 inch (13 mm) **OR** 2 inches (50 mm) **OR** 4 inches (100 mm), **as directed**, above top of pavers. Anchor curbs with metal stakes driven behind curbs into base-course material.

C. Setting-Bed Installation

1. Compact soil subgrade uniformly to at least 95 percent of ASTM D 698 **OR** ASTM D 1557, **as directed**, laboratory density.
2. Proof-roll prepared subgrade to identify soft pockets and areas of excess yielding. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by the Owner, and replace with compacted backfill or fill as directed.
3. Place separation **OR** drainage, **as directed**, geotextile over prepared subgrade, overlapping ends and edges at least 12 inches (300 mm).
4. For light-traffic uses, place aggregate subbase **OR** subbase and base, **as directed**, compact by tamping with plate vibrator, and screed to depth indicated.
5. For heavy-duty applications, place aggregate subbase **OR** subbase and base, **as directed**, compact to 100 percent of ASTM D 1557 maximum laboratory density, and screed to depth indicated.
6. Place drainage geotextile over compacted subbase, overlapping ends and edges at least 12 inches (300 mm).
7. Place drainage geotextile over compacted base course, overlapping ends and edges at least 12 inches (300 mm).
8. Place leveling course and screed to a thickness of 1 to 1-1/2 inches (25 to 38 mm) **OR** 2 to 2-1/2 inches (50 to 64 mm) **OR** 3 inches (76 mm), **as directed**, taking care that moisture content remains constant and density is loose and constant until pavers are set and compacted.

D. Paver Installation

1. Set unit pavers on leveling course, being careful not to disturb leveling base. If pavers have lugs or spacer bars to control spacing, place pavers hand tight against lugs or spacer bars. If pavers do not have lugs or spacer bars, place pavers with a 1/16-inch- (1.6-mm-) minimum and 1/8-inch- (3.2-mm-) maximum joint width. Use string lines to keep straight lines. Fill gaps between units that exceed 3/8 inch (10 mm) with pieces cut to fit from full-size pavers.
 - a. When installation is performed with mechanical equipment, use only unit pavers with lugs or spacer bars on sides of each unit.
2. Compact pavers into leveling course with a low-amplitude plate vibrator capable of a 3500- to 5000-lbf (16- to 22-kN) compaction force at 80 to 90 Hz. Use vibrator with neoprene mat on face of plate or other means as needed to prevent cracking and chipping of pavers. Perform at least three passes across paving with vibrator.
 - a. Compact pavers when there is sufficient surface to accommodate operation of vibrator, leaving at least 36 inches (900 mm) of uncompacted pavers adjacent to temporary edges.
 - b. Before ending each day's work, compact installed concrete pavers except for 36-inch (900 mm) width of uncompacted pavers adjacent to temporary edges (laying faces).
 - c. As work progresses to perimeter of installation, compact installed pavers that are adjacent to permanent edges unless they are within 36 inches (90 mm) of laying face.
 - d. Before ending each day's work and when rain interrupts work, cover pavers that have not been compacted and leveling course on which pavers have not been placed with nonstaining plastic sheets to protect them from rain.
3. Place soil fill as follows, immediately after vibrating pavers into leveling course. Spread and screed soil fill level with tops of pavers. Vibrate pavers and add soil fill until porous paving is filled to about 3/4 inch (19 mm) from top surface; remove excess soil fill if any.
 - a. Before ending each day's work, place soil fill in installed porous paving except for 42-inch (1067-mm) width of unfilled paving adjacent to temporary edges (laying faces).
 - b. As work progresses to perimeter of installation, place soil fill in installed paving that is adjacent to permanent edges unless it is within 42 inches (1067 mm) of laying face.



- c. Before ending each day's work and when rain interrupts work, cover paving that has not been filled with nonstaining plastic sheets to protect it from rain.
 4. After filling pavers with soil, sow seed to comply with requirements in Division 32 Section "Turf And Grasses". except sow seed at half the rate specified for seeding lawns. Sweep seed from surfaces of pavers into voids and water with fine spray.
 - a. Within 24 hours after sowing seed, spread an additional 3/16 inch (4.8 mm) of soil fill over seed and soak with water.
 5. Place graded aggregate fill immediately after vibrating pavers into leveling course. Spread and screed aggregate fill level with tops of pavers.
 - a. Before ending each day's work, place aggregate fill in installed porous paving except for 42-inch (1067-mm) width of unfilled paving adjacent to temporary edges (laying faces).
 - b. As work progresses to perimeter of installation, place aggregate fill in installed paving that is adjacent to permanent edges unless it is within 42 inches (1067 mm) of laying face.
 - c. Before ending each day's work and when rain interrupts work, cover paving that has not been filled with nonstaining plastic sheets to protect it from rain.
 6. Remove and replace pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.
- E. Maintenance And Protection
 1. Water newly planted grass and keep moist until grass is established. Maintain grass that is planted in paving to comply with requirements in Division 32 Section "Turf And Grasses".
 2. Erect barricades and warning signs as required to protect newly planted areas from traffic. Maintain barricades for 60 days after planting.

END OF SECTION 32 14 43 00



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Task	Specification	Specification Description
32 14 43 00	03 31 13 00	Cement Concrete Pavement
32 14 43 00	10 14 00 00	Vitrified Brick Pavement Replacement
32 15 40 00	32 11 16 16	Crushed Stone Paving
32 15 40 00	32 11 16 16a	Crushed Stone
32 15 40 00	32 11 16 16b	Select Gravel



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SECTION 32 16 13 13 - STEEL CURBS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of steel curbs. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: For each type of product indicated.

1.2 PRODUCTS

- #### A. Standard Steel Curb Sections: Noncorrosive steel sections as required to match existing.

- #### B. Coating: Steel curb sections shall be zinc coated.

C. Joint Materials

1. Expansion Joint Fillers: ASTM D 1751 or ASTM D 1752.
2. Joint Sealers: ASTM D 1850.

- #### D. Concrete: Concrete shall have a minimum compressive strength of 3,000 psi. The maximum size of aggregate shall be 1-1/2 inches. Concrete shall have a slump of not more than 3 inches and an air content by volume of concrete of 3 to 6 percent.

1.3 EXECUTION

- #### A. Preparation: The subgrade shall be constructed to grade and cross section. The subgrade shall be of materials equal in bearing quality to the subgrade under the adjacent pavement and shall be compacted. The subgrade shall be maintained in a smooth, compacted condition, in conformity with the required section and established grade until the concrete is placed. The subgrade shall be in a moist condition when concrete is placed.

B. Installation

1. Steel Curb Setting: Steel curbs shall be carefully set to alignment and grade and to conform to the dimensions of the curb.
2. Concrete Placement And Finishing: Concrete shall be placed in layers not to exceed 6 inches. Concrete shall be thoroughly consolidated. Floated surfaces shall then be brushed with longitudinal strokes. The top surface of the entrance shall be finished to grade with a wood float. Expansion joints and contraction joints shall be constructed at right angles to the line of curb. Contraction joints shall be constructed by means of 1/8-inch thick separators, of a section conforming to the cross section of the curb and gutter. Contraction joints shall match joints in abutting Portland cement concrete pavement. At other pavements, construction joints shall be placed at not less than 5 feet nor greater than 15 feet apart. Expansion joints shall be formed by means of preformed expansion joint filler material cut and shaped to the cross section of curb. Expansion joints shall be provided in curb at the end of all returns. Expansion joints shall match expansion joints of abutting Portland cement concrete pavement. At other pavements, expansion joints at least 1/2 inch in width shall be provided at intervals not exceeding 45 feet. Exposed concrete surfaces shall be cured for not less than 7 days.



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3. Backfilling: After curing, debris shall be removed and the area adjoining the concrete shall be backfilled, graded, and compacted.
 4. Sealing Joints: Expansion joints and the top 1-inch depth of contraction joints shall be sealed with joint sealer. The joint opening shall be thoroughly cleaned before the sealing material is placed. Excess material on exposed surfaces of the concrete shall be removed immediately and exposed concrete surfaces cleaned.

END OF SECTION 32 16 13 13



Task	Specification	Specification Description
32 16 13 13	03 31 13 00	Cement Concrete Pavement
32 16 13 14	03 31 13 00	Cement Concrete Pavement
32 16 13 14	32 16 13 13	Steel Curbs
32 16 13 16	03 31 13 00	Cement Concrete Pavement
32 16 13 16	32 16 13 13	Steel Curbs
32 16 13 19	03 31 13 00	Cement Concrete Pavement
32 16 13 23	03 31 13 00	Cement Concrete Pavement
32 16 13 23	32 16 13 13	Steel Curbs
32 16 13 33	03 31 13 00	Cement Concrete Pavement
32 16 13 33	32 16 13 13	Steel Curbs
32 16 13 43	32 14 43 00	Porous Unit Paving
32 16 23 00	32 14 11 00	Asphalt Concrete Sidewalks
32 16 23 00	32 14 11 00a	Miscellaneous Sidewalks
32 16 23 00	32 14 11 00b	Precast Sidewalks And Pavers
32 16 23 00	31 25 14 23	Unit Pavers
32 16 43 00	32 01 16 72	Asphalt Paving
32 17 13 19	11 12 16 00	Parking Control Equipment
32 17 13 23	11 12 16 00	Parking Control Equipment
32 17 13 23	11 12 16 00a	Prefabricated Control Booths
32 17 13 26	11 12 16 00	Parking Control Equipment
32 17 13 26	11 12 16 00a	Prefabricated Control Booths
32 17 16 00	32 01 16 72	Asphalt Paving
32 17 23 13	32 01 16 72	Asphalt Paving
32 17 23 13	03 31 13 00	Cement Concrete Pavement
32 17 23 13	32 01 11 53	Traffic Coatings
32 17 23 23	32 01 16 72	Asphalt Paving
32 17 23 23	03 31 13 00	Cement Concrete Pavement
32 17 23 23	32 01 11 53	Traffic Coatings
32 17 23 26	32 01 16 72	Asphalt Paving
32 17 23 26	03 31 13 00	Cement Concrete Pavement
32 17 23 33	32 01 16 72	Asphalt Paving
32 17 23 33	03 31 13 00	Cement Concrete Pavement
32 17 23 33	32 01 11 53	Traffic Coatings



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SECTION 32 18 23 29 - COLORED ATHLETIC WEARING SURFACE

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of colored athletic wearing surface on asphaltic concrete base. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

- B. Submittals: Submit product data and manufacturer's application instruction.

1.2 PRODUCTS

- A. Manufacturer: Athletic wearing surface shall be the "Plexipave" system by California Products Corporation, 169 Waverly Street, Cambridge Ma. 02139 or approved equal.
- B. Plexipave Court Patch Binder prepared as per manufacturers recommendations.
- C. California Acrylic Resurfacer prepared as per manufacturers recommendations.
- D. Fortified Plexipave Job Mix prepared as per manufacturers recommendations.
- E. Plexipave Color Base as required to meet project requirements.
- F. Plexichrome Color as required to meet project requirements.

1.3 EXECUTION:

- A. Personnel used to install athletic wearing surface must have a minimum of three years experience and at least three jobs with similar square footage of placement.
- B. When required, asphaltic concrete base shall be placed to conform to manufacturer's planarity requirements.
- C. Protect adjacent surfaces not to receive coating during application.
- D. All finished surfaces must have a uniform appearance and be free of ridges and tool marks and shall not vary more than 1/8" in 10 feet measured in any direction.

END OF SECTION 32 18 23 29



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SECTION 32 18 23 29a - SYNTHETIC TURF

1.1 GENERAL

A. Description Of Work

1. This section covers the furnishing and/or installation of: synthetic turf with covers for cut-outs; paint lines and markings for football, soccer and baseball fields; the painting of a logo at midfield; line painter equipment, portable blower for ground clean-up, turf vacuum cleaner, and pylon markers. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals:

1. Turf covers for baseball infield cutouts.
2. Painting template for a logo.
3. Layouts for lines and markings of game fields.
4. Maintenance Manual: 2 copies, providing a full description of materials to be used for maintaining Synthetic Turf System.
5. Manufacturer's literature for line painter equipment, turf vacuum cleaner, and portable blowers.
6. Warranties: For synthetic turf, for line painter equipment, for turf vacuum cleaner, and for portable blowers.
7. Synthetic turf: Sample, technical data and manufacturer's directions for installation and maintenance.
8. Line Paint: Manufacturer's literature and application directions.

C. Warranties: The warranty submitted shall have the following characteristics:

1. Shall provide full coverage for eight (8) years, from date of first use.
2. Shall warrant materials and workmanship.
3. Shall warrant that the materials installed meet or exceed the product specifications.
4. Shall have a provision to either: (a) make repairs or (b) replace such portions of the installed materials that are no longer serviceable, to maintain a serviceable and playable surface, and make good without cost or expense to the Owner.
5. Shall state all limitations and exclusions.
6. Shall be a warranty from a single source covering workmanship and all self-manufactured or procured materials.
7. Warranty shall be for full value, not prorated.

1.2 PRODUCTS

A. Synthetic Turf

1. Synthetic turf shall be Astro Turf-8, by Astro Turf Industries, Inc., 809 Kenner Street, Dalton, Georgia 30720, or approved equivalent.
2. Turf fabric: Knitted of nylon 6.6 ribbon with a polyester filament backing yarns and weighing approximately 63 ounces per square yard.
3. Pile material: 500 denier, textured nylon, 6.6 ribbon with a 1/2-inch pile height to give the appearance of mown grass; weight 50 ounces per square yard; pigmented green and stabilized for outdoor exposure.
4. Backing Yarns: High strength polyester fiber yarns, heat set for maximum dimensional stability.

B. Underpad

1. Underpad: 5/8-inch thick, energy-absorbing, made of closed cell foam, reinforced with carbon black, and perforated for drainage.
2. Pad density: 7.5 pounds per cubic foot.
3. Compression module: 25%, 8 pounds per square inch.



4. Perforations: 3/8-inch holes, 3 on center in a staggered pattern, factory perforated.
- C. Adhesives for bonding the synthetic turf to the pad shall be weather-resistant to withstand the climate of the site and shall be compatible with the materials of the turf and pad.
 - D. All butt seams of the turf surface shall be sewn and glued.
 - E. Paint shall be Sherwin-Williams "Watch-Guard System Metalex" semi-gloss enamel, or approved equivalent.
 - F. Line painter shall be Model 98-331, as manufactured by Binks Co., or approved equivalent, with 5 gallon pressure-tested tank, adjustable line marker, quick disconnect for ease of cleaning, 12" front pneumatic wheels, 5HP 4-cycle air-cooled gasoline engine, air-actuated spray gun, dual cylinder compressor.
 - G. Turf vacuum cleaner shall be Model BT-80-VIC, manufactured by the Billy Goat Industries, Inc., Lees Summit, MO, or approved equivalent. Vacuum shall be 8 HP Push-gasoline Big Wheel model complete with 5" intake hose kit (Part No. 800521) exhaust hose kit (Part No. 800077), and caster assembly (Part No. 800065).
 - H. Portable Blower for Ground Cleanup
 1. Windmill "Fast-Blo", Model No. 22B hand-held gas power blower as supplied by A.M. Leonard Inc., Piqua, Ohio, or approved equivalent.
 2. Variable speed control, 2-cycle gas engine type, weighing 10 pounds.
 - I. Football Pylons: Model No. "WP-12"
 1. "Ethafoam", water and mildew resistant, size 4" x 4" x18", of standard bright color.
 2. Weighted: Springs back upon impact.
 3. Provide two (2) sets of twelve (12) pylons for a total of 24, for football field.
 - J. Soccer Flags
 1. Soccer Flags: Model "WSF" as manufactured by Marty Gilman, Inc., Gilman, CT. 06336, or approved equivalent.
 2. Provide two (2) sets of four (4) flags for a total of eight, for soccer field.
 - K. Baseball Infield Conversion System
 1. Submit Shop Drawings indicating method of detailing conversion panels for approval.
 2. Panels shall be removable in conversion area.
 3. Cut panels from same synthetic turf material as football field, to match.
 4. Provide spacers and pad wedges.
- 1.3 EXECUTION
- A. Before any synthetic turf is installed, the Contractor shall inspect the asphaltic concrete base and, when satisfied with its condition, shall notify the Owner in writing of acceptance of the base.
 - B. A manufacturer's representative shall be present at the job site when the synthetic turf is installed. Turf shall be laid in strict accordance with the manufacturer's instructions by workmen who are skilled in this type of work.
 - C. Turf material shall be protected before, during and after installation.
 - D. Installed work and materials of other trades shall be protected.



- E. Assurance
1. Qualified bidders must have successfully installed at least five (5) other outdoor installations of synthetic stadium surface within the last three (3) years of a type described herein.
 2. The field installation shall be made under the direct, active, personal supervision of technical representatives of the synthetic turf manufacturer. All key positions shall be manned by experienced employees of the installer.
 3. The synthetic turf contractor shall keep a full-time superintendent on the project during the installation of the synthetic turf.
 4. The synthetic turf system supplied shall be of previous acceptance at all levels of competition, including University and Professional.
- F. Underpad Installation
1. At "float drain" system: strip glue underpad at all joints.
 2. At "vertical drain" system: provide intermittent gluing at a spread rate of 150-160 sq. ft./gal.
 3. Sew Pad joints, using thread and stitching recommended by the synthetic turf manufacturer.
 4. Lay out work so that seams of the underpad are offset from the seams of turf, but not less than 12".
- G. Turf Installation
1. The synthetic turf shall be bonded to the pad with no wrinkles, ripples or bubbles. Slits in the fabric to relieve such defects are not permitted. Joints in the turf shall be offset from joints of the pad by not less than 12".
 2. Side seams in the fabric shall be at 15'-0" intervals, at 5-yard lines for the football field. There shall be no cross or head seams.
 3. Sew seams with high strength polyester fiber cord and lay with a bed of adhesive. Seams shall be flat, tight and permanent, with no separation or fraying.
 4. Covers for the baseball infield cut-outs shall be flush and tight. Install covers and check for proper fittings.
 5. Insert edges of turf in trench drain receptor at perimeter of field for "float drain" systems; terminated edges at concrete curb and wood nailer at "vertical drain" systems.
 6. Provide covering caps for football and soccer goal posts and markers within the playing fields.
 7. At completion, remove all excess materials and all debris resulting from operations of Work in this Section. Leave entire Work in neat, clean condition.
- H. Painting
1. Lines and markings for game fields shall be painted in accordance with the approved Shop Drawings.
 2. Any logo shall be painted at midfield in accordance with the approved Shop Drawings.
- I. Maintenance
1. Manual shall describe the materials, devices and procedures to be followed for use and maintenance of the synthetic turf system, including the cleaning, paint application and removal, and conversion techniques. Include any precautions required by the warranty.
 2. Training: Give demonstrations and training sessions, devoting a sufficient amount of time to thoroughly instruct the Owner's personnel in operation and maintenance (for cleaning, conversion of baseball-to-football, and line striping) of the synthetic turf system and equipment.
- J. Acceptance
1. Before the acceptance of the work, should any imperfect areas or spots develop in the surface, such areas shall be removed and replaced with new materials.
 2. All such repair work shall be done at no additional cost to the Owner.
- K. At the completion of the Work, remove all material scraps, debris, and equipment from the site and leave the synthetic turf area ready for use.



END OF SECTION 32 18 23 29a



SECTION 32 18 23 29b - TRACK, COURT, AND PLAYGROUND MARKINGS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing of materials and the installation of track, court, and playground markings. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Submit product data and manufacturer's recommendations for each marking to be furnished.
2. Submit sample of each marking to be furnished.
3. Submit "Line Layout Drawing" prior to installation of marking and upon completion of markings, submit three (3) certified line layout drawings indicating all lines and colors.

C. Quality Assurance: Personnel shall have a minimum of three years marking experience.

D. Delivery, Storage and Handling: Deliver paint to site in original sealed containers or drums, with labels legible, intact and unbroken. Comply with all health and fire regulations.

E. Environmental Requirements: Do not install markings on wet or frozen surfaces. Comply with manufacturer's instructions for temperature requirements.

1.2 PRODUCTS

A. Manufacturers

1. Line Paint for Resilient Surface: Aliphatic polyurethane paint, such as Hi-Build Aliphatic Polyurethane paint by Sherwin-Williams, or approved equivalent.
2. Line Paint for Asphaltic Concrete Pavement: Latex traffic marking paint, such as Setfast Latex Traffic Marking paint by Sherwin-Williams, or approved equivalent.
3. Line Paint for Athletic Wearing Surface (Plexipave): 100% acrylic latex paint, such as Plexicolor by California Products, or approved equivalent.

1.3 EXECUTION

A. Application

1. Line Painting

- a. Accurately measure and layout line markings.
- b. Apply paint with mechanical equipment.
- c. Paint lines as specified below under "Track Marking".
- d. Provide uniform straight edges.
- e. Apply not less than two coats in accordance with manufacturer's recommended rates.
- f. Lines shall be 2 in. (50 mm) wide unless otherwise specified.

2. Track Marking

- a. Employ a licensed land surveyor to accurately measure and lay out line markings in accordance with National Federation of State High School Athletic Association Regulations or other Standards set forth by the Owner.
- b. Events:
 - 1) 100 meter dash
 - 2) 200 meter dash
 - 3) 400 meter dash



- 4) 800 meter run
 - 5) 1600 meter run
 - 6) 3200 meter run
 - 7) One mile run
 - 8) 4 x 100 meter relay
 - 9) 4 x 200 meter relay
 - 10) 4 x 400 meter relay
 - 11) 4 x 800 meter relay
 - 12) 110 meter high hurdles
 - 13) 300 meter intermediate hurdles
 - 14) Girls 100 meter hurdles
 - 15) Girls 300 meter hurdles
 - c. Hurdle location markers: yellow hash marks.
 - d. Lane lines: white (min. 42 in. (105 cm) apart).
 - e. Exchange zones:
 - 1) 4 x100 m green
 - 2) 4 x 200 m blue
 - 3) 4 x 400 m yellow
 - 4) 12 in. (305 mm) across entire lane width.
 - f. Lane numbers: Stenciled in three locations from inside to outside. Numbers shall be 24 in. (60 cm) high and white in color.
 - g. Finish line to be located near bleachers.
 - h. All starts and finishes to be white.
- B. Cleaning: Upon completion of work, remove containers and debris and leave site in clean orderly condition acceptable to the Owner.
- C. Protection
1. Erect temporary barriers to protect paint during drying period.
 2. Protect markings from damage until completion of project.

END OF SECTION 32 18 23 29b



Task	Specification	Specification Description
32 18 23 29	11 68 23 13	Playing Fields



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SECTION 32 18 23 33 - SYNTHETIC RUNNING TRACK SURFACE

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of synthetic running track surface. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals: Submit the following:

1. Sample of the actual sport surface in the standard color(s) selected.
2. Technical data sheets of the product.
3. Adhesive product data sheets and manufacturer's certificate indicating approval for the proposed application.
4. Line paint data sheets and the manufacturer's certificate indicating approval for the proposed application.
5. Submit 3 copies of the maintenance instruction.

C. Delivery and Storage: Deliver and store the material in the original packaging with the labels intact in a controlled environment of a minimum temperature of 55°F (13°C) and under 50% relative humidity. Protect work until accepted by the Owner.

D. Warranty: Provide manufacturer's standard warranty.

1.2 PRODUCTS

A. Acrylic Color Coating System

1. Manufacturer: Copeland Coating Company or approved equivalent.
2. System shall consist of stone base, asphalt binder/top, cushion made of granulated rubber particles suspended in acrylic emulsions (**as directed**), acrylic filler coat(s), acrylic finish coat, and acrylic line paint.
3. Design and construction shall be by materials manufacturer.

B. Polyurethane

1. Manufacturer: Conica Sports Surfaces or approved equivalent.
2. Impermeable, full polyurethane, 3 layer athletic track system. In-situ applied with a granular colored EPDM finish. IAAF certified as required.

C. Rubber Granule Surface

1. Manufacturer: Atlas Track & Tennis or approved equivalent.
2. Rubber granules applied "dry" to the surface and adhered by spray application of a resin binder. This process is repeated until the specified thickness is achieved, allowing sufficient curing time between each application. The process is then finished with a structural spray coating of highly pigmented polyurethane coating.

D. Prefabricated Rubber Surface

1. Manufacturer: Mondo USA, or approved equivalent.
2. Prefabricated rubber sport surface to be 6 mm (1/4") **OR** 8mm (5/16") **OR** 10mm (3/8") **OR** 12mm (1/2") **OR** 14mm (9/16"), **as directed**, thickness, with a non-slip, non-reflecting, highly spike resistant top surface. Provided in manufacturer's standard colors.
3. Prefabricated rubber surface to be sheet goods, double durometer or homogenous vulcanized and calandered, with a particular closed cell structure, based on special isoprenic rubbers, mineral fillers, vulcanizing and stabilizing agents and color pigments, highly resistant to UV rays



and atmospherical agents, with system of differentiated elasticity between top surface and base, supplied in rolls of suitable size and thickness. Surface shall have a special texture including adhesive and striping

4. Prefabricated rubber sport surface to be manufactured in two layers, which are vulcanized together. The shore hardness of the lower layer to be less than the upper layer, shore hardness of the respected layers to be recommended by the manufacturer and within the limits hereinafter specified. Field laminated triple durometer are unacceptable.
5. Adhesive: Rubber sport surface adhesive to be two part polyurethane adhesive suitable for adherence of a sheet good to asphalt, concrete or urethane substrate. Adhesive to be supplied or approved/recommended by sport surface manufacturer.

E. Patching Compound: Patching compound to be supplied or approved/recommended by sport surface manufacturer.

F. Line marking: Line marking paint to be supplied by sport surface manufacturer.

1.3 EXECUTION

A. Installation

1. Install sport flooring in accordance with manufacturer's printed instructions.
2. Prefabricated sport flooring shall be unrolled and allowed to relax.
3. Cut and adjust prefabricated sport flooring prior to adhesion.
4. Mix adhesive in accordance with manufacturer's instructions.
5. Hold all seams in place with suitable weights for a minimum of 12 hours.
6. Lines to be painted as per manufacturer's recommendations.
7. Surface to be protected before, during and after installation until project's acceptance by the the Owner or his agent.

END OF SECTION 32 18 23 33



Task	Specification	Specification Description
32 18 23 33	32 18 23 29	Colored Athletic Wearing Surface
32 18 23 33	32 18 23 29a	Synthetic Turf
32 18 23 33	32 18 23 29b	Track, Court, And Playground Markings
32 18 23 39	32 18 23 29	Colored Athletic Wearing Surface
32 18 23 39	32 18 23 29a	Synthetic Turf
32 18 23 39	32 18 23 29b	Track, Court, And Playground Markings
32 18 23 39	32 18 23 33	Synthetic Running Track Surface
32 18 23 53	32 18 23 29b	Track, Court, And Playground Markings
32 18 23 53	11 68 23 13	Playing Fields
32 18 23 56	32 18 23 29	Colored Athletic Wearing Surface
32 18 23 56	32 18 23 29a	Synthetic Turf
32 18 23 56	32 18 23 29b	Track, Court, And Playground Markings
32 18 23 56	11 68 23 13	Playing Fields
32 18 23 61	32 18 23 29	Colored Athletic Wearing Surface
32 18 23 61	32 18 23 29a	Synthetic Turf
32 18 23 61	32 18 23 29b	Track, Court, And Playground Markings



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SECTION 32 31 11 00 - CHAIN-LINK FENCES AND GATES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for chain-link fences and gates. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Chain-link fences.
 - b. Gates: Manually and Motor operated, horizontal slide and swing.

C. Performance Requirements

1. Delegated Design: Design chain-link fences and gates, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2. Structural Performance: Chain-link fence and gate framework shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to ASCE/SEI 7:
 - a. Minimum Post Size and Maximum Spacing: Determine according to CLFMI WLG 2445, based on mesh size and pattern specified and on the following:
 - 1) Wind Loads: **<Insert loads required for Project location>**.
 - 2) Exposure Category: **B OR C OR D, as directed**.
 - 3) Fence Height: 10 feet (3 m).
 - 4) Material Group: **IA, ASTM F 1043, Schedule 40 steel pipe OR IC, electric-resistance-welded round steel pipe, as directed**.
3. Lightning Protection System: Maximum grounding-resistance value of 25 ohms under normal dry conditions.

D. Submittals

1. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for chain-link fences and gates.
 - a. Fence and gate posts, rails, and fittings.
 - b. Chain-link fabric, reinforcements, and attachments.
 - c. Accessories: Privacy slats **OR** Barbed wire **OR** Barbed tape, **as directed**.
 - d. Gates and hardware.
 - e. Gate operators, including operating instructions.
 - f. Motors: Show nameplate data, ratings, characteristics, and mounting arrangements.
2. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Show accessories, hardware, gate operation, and operational clearances.
 - a. Gate Operator: Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
 - b. Wiring Diagrams: For power, signal, and control wiring.
3. Samples: Prepared on Samples of size indicated below:
 - a. Polymer-Coated Components: In 6-inch (150-mm) lengths for components and on full-sized units for accessories.
4. Delegated-Design Submittal: For chain-link fences and gate framework indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.



5. Qualification Data: For qualified professional engineer **OR** testing agency **OR** factory-authorized service representative, **as directed**.
6. Product Certificates: For each type of chain-link fence, operator, and gate, from manufacturer.
7. Product Test Reports: For framing strength according to ASTM F 1043.
8. Field quality-control reports.
9. Operation and Maintenance Data: For the following to include in emergency, operation, and maintenance manuals:
 - a. Polymer finishes.
 - b. Gate hardware.
 - c. Gate operator.
10. Warranty: Sample of special warranty.

E. Quality Assurance

1. Testing Agency Qualifications: For testing fence grounding. Member company of NETA or an NRTL.
 - a. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. Emergency Access Requirements: Comply with requirements of authorities having jurisdiction for gates with automatic gate operators serving as a required means of access.
4. Preinstallation Conference: Conduct conference at Project site.

F. Project Conditions

1. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

G. Warranty

1. Special Warranty: Manufacturer's standard form in which manufacturer **OR** Installer, **as directed**, agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.
 - a. Failures include, but are not limited to, the following:
 - 1) Faulty operation of gate operators and controls.
 - 2) Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - b. Warranty Period: Five **OR** 15, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Chain-Link Fence Fabric

1. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist. Comply with CLFMI Product Manual and with requirements indicated below:
 - a. Fabric Height: As indicated on Drawings **OR** As directed.
 - b. Steel Wire Fabric: Wire with a diameter of 0.192 inch (4.88 mm) **OR** 0.148 inch (3.76 mm) **OR** 0.120 inch (3.05 mm) **OR** 0.113 inch (2.87 mm), **as directed**.
 - 1) Mesh Size: 2-1/8 inches (54 mm) **OR** 2 inches (50 mm) **OR** 1-3/4 inches (44 mm) **OR** 1 inch (25 mm), **as directed**.
 - 2) Aluminum-Coated Fabric: ASTM A 491, Type I, 0.40 oz./sq. ft. (122 g/sq. m) **OR** 0.35 oz./sq. ft. (107 g/sq. m) **OR** 0.30 oz./sq. ft. (92 g/sq. m), **as directed**.
 - 3) Zinc-Coated Fabric: ASTM A 392, Type II, Class 1, 1.2 oz./sq. ft. (366 g/sq. m) **OR** Class 2, 2.0 oz./sq. ft. (610 g/sq. m), **as directed**, with zinc coating applied before **OR** after, **as directed**, weaving.



- 4) Zn-5-Al-MM Aluminum-Mischmetal-Coated Fabric: ASTM F 1345, Type III, Class 1, 0.60 oz./sq. ft. (183 g/sq. m) **OR** Class 2, 1.0 oz./sq. ft. (305 g/sq. m), **as directed**.
- 5) Polymer-Coated Fabric: ASTM F 668, Class 1 **OR** Class 2a **OR** Class 2b, **as directed**, over aluminum **OR** zinc **OR** Zn-5-Al-MM-alloy, **as directed**, -coated steel wire.
 - a) Color: Dark green **OR** Olive green **OR** Brown **OR** Black **OR** As selected from manufacturer's full range, **as directed**, complying with ASTM F 934.
- 6) Coat selvage ends of fabric that is metallic coated before the weaving process with manufacturer's standard clear protective coating.
- c. Aluminum Wire Fabric: ASTM F 1183, with mill **OR** caustic-cleaned or etched, **as directed**, finish, and wire diameter of 0.148 inch (3.76 mm) **OR** 0.192 inch (4.88 mm), **as directed**.
 - 1) Mesh Size: 2 inches (50 mm) **OR** 1 inch (25 mm), **as directed**.
- d. Selvage: Knuckled at both selvages **OR** Twisted top and knuckled bottom, **as directed**.

B. Fence Framing

1. Posts and Rails: Comply with ASTM F 1043 for framing, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 or ASTM F 1083, **as directed**, based on the following:
 - a. Fence Height: 72 inches (1830 mm) **OR** 96 inches (2440 mm) **OR** As indicated on Drawings, **as directed**.
 - b. Light Industrial Strength: Material Group IC-L, round steel pipe, electric-resistance-welded pipe **OR** Group II-L, roll-formed steel C-section shapes **OR** Group III-L, hot-rolled H-beam shapes **OR** Group IV, Alternative Design, **as directed**.
 - 1) Line Post: 1.9 inches (48 mm) in diameter **OR** 2.375 inches (60 mm) in diameter **OR** 2.875 inches (73 mm) in diameter **OR** 2.25 by 1.7 inches (57 by 43 mm), **as directed**.
 - 2) End, Corner and Pull Post: 2.375 inches (60 mm) **OR** 2.875 inches (73 mm) **OR** 4.0 inches (102 mm) **OR** 2.25 by 1.7 inches (57 by 43 mm), **as directed**.
 - c. Heavy Industrial Strength: Material Group IA, round steel pipe, Schedule 40 **OR** Group IC, round steel pipe, electric-resistance-welded pipe **OR** Group II, roll-formed steel C-section shapes **OR** Group III, hot-rolled H-beam shapes **OR** Group IV, Alternative Design, **as directed**.
 - 1) Line Post: 1.9 inches (48 mm) in diameter **OR** 2.375 inches (60 mm) in diameter **OR** 2.875 inches (73 mm) in diameter **OR** 4.0 inches (102 mm) in diameter **OR** 6.625 inches (168 mm) in diameter **OR** 1.875 by 1.63 inches (48 by 41 mm) **OR** 2.25 by 1.70 inches (67 by 43 mm) **OR** 3.25 by 2.50 inches (83 by 64 mm), **as directed**.
 - 2) End, Corner and Pull Post: 2.375 inches (60 mm) in diameter **OR** 2.875 inches (73 mm) in diameter **OR** 4.0 inches (102 mm) in diameter **OR** 6.625 inches (168 mm) in diameter **OR** 2.25 by 1.70 inches (67 by 43 mm) **OR** 3.25 by 2.50 inches (83 by 64 mm) **OR** 3.5 by 1.5 inches (89 by 38 mm), **as directed**.
 - d. Horizontal Framework Members: Intermediate, top and bottom rails, **as directed**, complying with ASTM F 1043.
 - 1) Top Rail: 1.66 inches (42 mm) in diameter **OR** 1.25 by 1.63 inches (32 by 41 mm), **as directed**.
 - e. Brace Rails: Comply with ASTM F 1043.
 - f. Metallic Coating for Steel Framing:
 - 1) Type A, consisting of not less than minimum 2.0-oz./sq. ft. (0.61-kg/sq. m) average zinc coating per ASTM A 123/A 123M or 4.0-oz./sq. ft. (1.22-kg/sq. m) zinc coating per ASTM A 653/A 653M.
 - 2) Type B, zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. (0.27 kg/sq. m) of zinc after welding, a chromate conversion coating, and a clear, verifiable polymer film.
 - 3) External, Type B, zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. (0.27 kg/sq. m) of zinc after welding, a chromate conversion coating, and a clear,



verifiable polymer film. Internal, Type D, consisting of 81 percent, not less than 0.3-mil- (0.0076-mm-) thick, zinc-pigmented coating.

- 4) Type C, Zn-5-Al-MM alloy, consisting of not less than 1.8-oz./sq. ft. (0.55-kg/sq. m) coating.
- 5) Coatings: Any coating above.
- g. Polymer coating over metallic coating.
 - 1) Color: Match chain-link fabric **OR** Dark green **OR** Olive green **OR** Brown **OR** Black **OR** As selected from manufacturer's full range, **as directed**, complying with ASTM F 934.

C. Tension Wire

1. Metallic-Coated Steel Wire: 0.177-inch- (4.5-mm-) diameter, marcelled tension wire complying with ASTM A 817 and ASTM A 824, with the following metallic coating:
 - a. Type I, aluminum coated (aluminized).
 - b. Type II, zinc coated (galvanized) by hot-dip **OR** electrolytic, **as directed**, process, with the following minimum coating weight:
 - 1) Class 3: Not less than 0.8 oz./sq. ft. (244 g/sq. m) of uncoated wire surface.
 - 2) Class 4: Not less than 1.2 oz./sq. ft. (366 g/sq. m) of uncoated wire surface.
 - 3) Class 5: Not less than 2 oz./sq. ft. (610 g/sq. m) of uncoated wire surface.
 - 4) Matching chain-link fabric coating weight.
 - c. Type III, Zn-5-Al-MM alloy with the following minimum coating weight:
 - 1) Class 60: Not less than 0.6 oz./sq. ft. (183 g/sq. m) of uncoated wire surface.
 - 2) Class 100: Not less than 1 oz./sq. ft. (305 g/sq. m) of uncoated wire surface.
 - 3) Matching chain-link fabric coating weight.
2. Polymer-Coated Steel Wire: 0.177-inch- (4.5-mm-) **OR** 0.148-inch- (3.8-mm-), **as directed**, diameter, tension wire complying with ASTM F 1664, Class 1 **OR** Class 2a **OR** Class 2b, **as directed**, over aluminum **OR** zinc **OR** Zn-5-Al-MM-alloy, **as directed**, -coated steel wire.
 - a. Color: Match chain-link fabric **OR** Dark green **OR** Olive green **OR** Brown **OR** Black **OR** As selected from manufacturer's full range, **as directed**, complying with ASTM F 934.
3. Aluminum Wire: 0.192-inch- (4.88-mm-) diameter tension wire, mill finished, complying with ASTM B 211 (ASTM B211M), Alloy 6061-T94 with 50,000-psi (344-MPa) minimum tensile strength.

D. Swing Gates

1. General: Comply with ASTM F 900 for gate posts and single **OR** double, **as directed**, swing gate types. Provide automated vehicular gates that comply with ASTM F 2200, **as directed**.
 - a. Gate Leaf Width: 36 inches (914 mm) **OR** As indicated, **as directed**.
 - b. Gate Fabric Height: 72 inches (1830 mm) or less **OR** More than 72 inches (1830 mm) **OR** As indicated, **as directed**.
2. Pipe and Tubing:
 - a. Zinc-Coated Steel: Comply with ASTM F 1043 and ASTM F 1083; protective coating and finish to match fence framing **OR** manufacturer's standard protective coating and finish, **as directed**.
 - b. Aluminum: Comply with ASTM B 429/B 429M; mill **OR** manufacturer's standard, **as directed**, finish.
 - c. Gate Posts: Round tubular steel **OR** Rectangular tubular steel **OR** Round tubular aluminum **OR** Rectangular tubular aluminum, **as directed**.
 - d. Gate Frames and Bracing: Round tubular steel **OR** Rectangular tubular steel **OR** Round tubular aluminum **OR** Rectangular tubular aluminum, **as directed**.
3. Frame Corner Construction: Welded **OR** Assembled with corner fittings, **as directed**.
4. Extended Gate Posts and Frame Members: Extend gate posts and frame end members above top of chain-link fabric at both ends of gate frame 12 inches (300 mm) **OR** as indicated, **as directed**, to attach barbed wire **OR** tape, **as directed**, assemblies.
5. Hardware:



- a. Hinges: 180-degree inward **OR** 180-degree outward **OR** 360-degree inward and outward, **as directed**, swing.
 - b. Latches permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate, **as directed**.
 - c. Padlock and Chain: Owner furnished.
 - d. Lock: Manufacturer's standard internal device furnished in lieu of gate latch, **as directed**.
 - e. Closer: Manufacturer's standard, **as directed**.
- E. Horizontal-Slide Gates
1. General: Comply with ASTM F 1184 for gate posts and single **OR** double, **as directed**, sliding gate types. Provide automated vehicular gates that comply with ASTM F 2200, **as directed**.
 - a. Classification: Type I Overhead Slide (opening widths to 40 feet (12.2 m) with an overhead clearance of up to 22 feet (6.7 m)).
 - 1) Gate Leaf Width: As indicated **OR** As directed.
 - 2) Gate Fabric Height: 72 inches (1830 mm) or less **OR** More than 72 inches (1830 mm) **OR** As indicated, **as directed**.
 - b. Classification: Type II Cantilever Slide (opening widths to 30 feet (9.1 m) and heights to 8 feet (2.44 m))
 - 1) Class 1 with external **OR** Class 2 with internal, **as directed**, roller assemblies.
 - 2) Gate Frame Width and Height: 48 inches (1200 mm) wide or less by 72 inches (1830 mm) high or less **OR** More than 48 inches (1200 mm) wide by any height **OR** As indicated, **as directed**.
 2. Pipe and Tubing:
 - a. Zinc-Coated Steel: Protective coating and finish to match fence framing **OR** Manufacturer's standard protective coating and finish, **as directed**.
 - b. Aluminum: Comply with ASTM B 429/B 429M; mill **OR** manufacturer's standard, **as directed**, finish.
 - c. Gate Posts: Comply with ASTM F 1184. Provide round tubular steel **OR** rectangular tubular steel **OR** round tubular aluminum **OR** rectangular tubular aluminum, **as directed**, posts.
 - d. Gate Frames and Bracing: Round tubular steel **OR** Rectangular tubular steel **OR** Round tubular aluminum **OR** Rectangular tubular aluminum, **as directed**.
 3. Frame Corner Construction: Welded **OR** Assembled with corner fittings, **as directed**.
 4. Extended Gate Posts and Frame Members: Extend gate posts and frame end members above top of chain-link fabric at both ends of gate frame 12 inches (300 mm) **OR** as indicated, **as directed**, as required to attach barbed wire **OR** tape, **as directed**, assemblies.
 5. Overhead Track Assembly: Manufacturer's standard track, with overhead framing supports, bracing, and accessories, engineered to support size, weight, width, operation, and design of gate and roller assemblies.
 6. Hardware:
 - a. Latches permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate, **as directed**.
 - b. Padlock and Chain: Owner furnished.
 - c. Lock: Manufacturer's standard internal device furnished in lieu of gate latch, **as directed**.
 - d. Hangers, roller assemblies, and stops fabricated from galvanized steel **OR** galvanized malleable iron **OR** mill-finished Grade 319 aluminum-alloy casting with stainless-steel fasteners, **as directed**.
- F. Fittings
1. General: Comply with ASTM F 626.
 2. Post Caps: Provide for each post.
 - a. Provide line post caps with loop to receive tension wire or top rail.
 3. Rail and Brace Ends: For each gate, corner, pull, and end post.
 4. Rail Fittings: Provide the following:
 - a. Top Rail Sleeves: Pressed-steel or round-steel tubing **OR** Aluminum Alloy 6063, **as directed**, not less than 6 inches (152 mm) long.



- b. Rail Clamps: Line and corner boulevard clamps for connecting intermediate, and bottom, **as directed**, rails in the fence line-to-line posts.
5. Tension and Brace Bands: Pressed steel **OR** Aluminum Alloy 6063, **as directed**.
6. Tension Bars: Steel **OR** Aluminum **OR** Fiberglass, **as directed**, length not less than 2 inches (50 mm) shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.
7. Truss Rod Assemblies: Steel, hot-dip galvanized after threading **OR** Mill-finished aluminum, **as directed**, rod and turnbuckle or other means of adjustment.
8. Barbed Wire Arms: Pressed steel or cast iron **OR** Aluminum, **as directed**, with clips, slots, or other means for attaching strands of barbed wire, and means for attaching to posts **OR** integral with post cap, **as directed**; for each post unless otherwise indicated, and as follows:
- Provide line posts with arms that accommodate top rail or tension wire.
 - Provide corner arms at fence corner posts, unless extended posts are indicated.
 - Type I, single slanted arm.
 - Type II, single vertical arm.
 - Type III, V-shaped arm.
 - Type IV, A-shaped arm.
9. Tie Wires, Clips, and Fasteners: According to ASTM F 626.
- Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, complying with the following:
 - Hot-Dip Galvanized Steel: 0.106-inch- (2.69-mm-) **OR** 0.148-inch- (3.76-mm-), **as directed**, diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric, **as directed**.
 - Aluminum: ASTM B 211 (ASTM B 211M); Alloy 1350-H19; 0.148-inch- (3.76-mm-) **OR** 0.192-inch- (4.88-mm-), **as directed**, diameter, mill-finished wire.
10. Finish:
- Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz. /sq. ft. (366 g /sq. m) zinc.
 - Polymer coating over metallic coating.
 - Aluminum: Mill finish.
- G. Privacy Slats
- Material: PVC, UV-light stabilized, flame resistant, four ply, **as directed**, not less than 0.006 inch (0.15 mm) **OR** 0.023 inch (0.58 mm), **as directed**, thick; attached to not less than 0.0475-inch- (1.21-mm-) diameter, twisted galvanized wire; hedge-type lattice, **as directed**; sized to fit mesh specified for direction indicated.
OR
 Material: Polyethylene tubular slats, not less than 0.023 inch (0.58 mm) thick, manufactured for chain-link fences from virgin polyethylene containing UV inhibitor, sized to fit mesh specified for direction indicated; with vandal-resistant fasteners and lock strips **OR** fins for increased privacy factor, **as directed**.
OR
 Material: Fiber-glass-reinforced plastic, UV-light stabilized, not less than 0.06 inch (1.5 mm) thick, sized to fit mesh specified for direction indicated; with vandal-resistant fasteners and lock strips, **as directed**.
OR
 Material: Aluminum, not less than 0.01 inch (0.25 mm) thick, sized to fit mesh specified for direction indicated.
OR
 Material: Redwood, 5/16 inch (7.9 mm) thick, sized to fit mesh specified for direction indicated.
 - Color: As indicated by manufacturer's designations **OR** As selected from manufacturer's full range **OR** As indicated on Drawings, **as directed**.
- H. Barbed Wire



1. Steel Barbed Wire: Comply with ASTM A 121, for two-strand barbed wire, 0.099-inch- (2.51-mm-) diameter line wire with 0.080-inch- (2.03-mm-) diameter, four-point round barbs spaced not more than 5 inches (127 mm) o.c.
 - a. Aluminum Coating: Type A.
 - b. Zinc Coating: Type Z, Class 3.
 2. Polymer-Coated, Galvanized-Steel Barbed Wire: Comply with ASTM F 1665 two-strand barbed wire, 0.080-inch- (2.03-mm-) diameter line wire with 0.080-inch- (2.03-mm-) diameter, four-point round aluminum alloy **OR** galvanized-steel, **as directed**, barbs spaced not more than 5 inches (127 mm) o.c.:
 - a. Polymer Coating: Class 1 **OR** Class 2a **OR** Class 2b, **as directed**, over aluminum **OR** zinc **OR** Zn-5-Al-MM-alloy, **as directed**, -coated steel wire.
 - 1) Color: Match chain-link fabric **OR** Dark green **OR** Olive green **OR** Brown **OR** Black **OR** As selected from manufacturer's full range, **as directed**, complying with ASTM F 934.
- I. Barbed Tape
1. Wire-Reinforced Tape: ASTM F 1910; with four-point, needle-sharp barbs permanently cold clenched around a core wire.
 - a. Core Wire: High-tensile-strength, zinc-coated steel **OR** stainless steel, **as directed**.
 2. Clips: Stainless steel, 0.065 inch (1.7 mm) thick by 0.375 inch (9.5 mm) wide, capable of withstanding a minimum 150-lbf (667-N) pull load to limit extension of coil, resulting in a concertina pattern when deployed.
 3. Tie Wires: Stainless steel, 0.065 inch (1.7 mm) in diameter.
 4. Fabrication: Continuous coils of barbed tape as defined in ASTM F 1379 for the following characteristics:
 - a. Configuration: Single **OR** Double, **as directed**, coil.
 - b. Style: Helical **OR** Concertina, **as directed**, pattern.
 - c. Coil Diameter(s): 18 inches (457 mm) **OR** 24 inches (610 mm) **OR** 24-inch (610-mm) inner coil and 30-inch (762-mm) outer coil **OR** As indicated on Drawings, **as directed**.
 - d. Coil Loop Spacing(s): 12 inches (300 mm) **OR** Manufacturer's standard **OR** As indicated on Drawings, **as directed**.
 - e. Barb Length Classification: Long, 1.2-inch (30.5-mm) **OR** Medium, 0.4-inch (10.2-mm) **OR** Short, 0.1875-inch (4.76-mm), **as directed**, barb.
 - f. Barb Spacing: 4 inches (102 mm) o.c.
 - g. Barb Set: Straight **OR** Offset **OR** Manufacturer's standard, **as directed**.
- J. Gate Operators
1. General: Provide factory-assembled automatic operating system designed for gate size, type, weight, and operation frequency. Provide operation control system with characteristics suitable for Project conditions, with remote-control stations, safety devices, and weatherproof enclosures; coordinate electrical requirements with building electrical system.
 - a. Provide operator designed so motor may be removed without disturbing limit-switch adjustment and without affecting auxiliary emergency operator.
 - b. Provide operator with UL approval **OR** -approved components, **as directed**.
 - c. Provide electronic components with built-in troubleshooting diagnostic feature.
 - d. Provide unit designed and wired for both right-hand/left-hand opening, permitting universal installation.
 2. Comply with NFPA 70.
 3. UL Standard: Fabricate and label gate operators to comply with UL 325.
 4. Motor Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, within installed environment, with indicated operating sequence, and without exceeding nameplate rating or considering service factor. Comply with NEMA MG 1 and the following:
 - a. Voltage: 12-V dc **OR** 120 V **OR** 208-220 V **OR** NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected, **as directed**.
 - b. Horsepower: 1/4 **OR** 1/3 **OR** 3/4, **as directed**.
 - c. Enclosure: Open dripproof **OR** Totally enclosed **OR** Manufacturer's standard, **as directed**.



- d. Duty: Continuous duty at ambient temperature of 105 deg F (40 deg C) and at altitude of 3300 feet (1005 m) above sea level.
 - e. Service Factor: 1.15 for open dripproof motors; 1.0 for totally enclosed motors.
 - f. Phase: One **OR** Polyphase, **as directed**.
5. Gate Operators: Gate **OR** Equipment base/pad **OR** Pedestal post **OR** In ground, **as directed**, mounted and as follows:
- a. Hydraulic Swing **OR** Slide, **as directed**, Gate Operators:
 - 1) Duty: Light **OR** Medium **OR** Heavy, **as directed**, duty, residential **OR** commercial/industrial, **as directed**.
 - 2) Gate Speed: Minimum 45 feet (13.7 m) **OR** 60 feet (18.2 m), **as directed**, per minute.
 - 3) Maximum Gate Weight: 300 lb (137 kg).
 - 4) Frequency of Use: 10 cycles per hour **OR** 25 cycles per hour **OR** Continuous duty, **as directed**.
 - 5) Locking: Hydraulic in both directions.
 - 6) Heater: Manufacturer's standard track and roller heater with thermostatic control.
 - 7) Operating Type: Crank arm **OR** Wheel and rail drive **OR** Roller chain, **as directed**, with manual release, **as directed**.
 - b. Mechanical Swing **OR** Slide, **as directed**, Gate Operators:
 - 1) Duty: Light **OR** Medium **OR** Heavy, **as directed**, duty, residential **OR** commercial/industrial, **as directed**.
 - 2) Gate Speed: Minimum 45 feet (13.7 m) per minute **OR** 60 feet (18.2 m) per minute **OR** variable speed, **as directed**.
 - 3) Maximum Gate Weight: 600 lb (272 kg) **OR** 800 lb (363 kg), **as directed**.
 - 4) Frequency of Use: 10 cycles per hour **OR** 25 cycles per hour **OR** 60 cycles per hour **OR** Continuous duty, **as directed**.
 - 5) Operating Type: Crank arm **OR** Wheel and rail drive **OR** Roller chain, **as directed**, with manual release, **as directed**.
 - 6) Drive Type: Enclosed worm gear **OR** worm gear and chain-and-sprocket, **as directed**, reducers, roller-chain drive. **OR**
Drive Type: V-belt and worm gear **OR** chain-and-sprocket, **as directed**, reducers, roller-chain drive.
6. Remote Controls: Electric controls separated from gate and motor and drive mechanism, with NEMA ICS 6, Type 1 **OR** NEMA ICS 6, Type 4, **as directed**, enclosure for surface **OR** recessed or flush **OR** equipment base/pad **OR** pedestal, **as directed**, mounting and with space for additional optional equipment. Provide the following remote-control device(s):
- a. Control Station: Keyed, two **OR** three, **as directed**, -position switch, located remotely from gate. Provide two keys per station. **OR**
Control Station: Momentary-contact, single **OR** three, **as directed**, -button-operated; located remotely from gate. Key switch to lock out open and close buttons, **as directed**.
 - 1) Function: Open, stop, **as directed**, and close.
 - b. Card Reader: Functions only when authorized card is presented. Programmable, magnetic multiple **OR** single, **as directed**, -code system, permitting four different access time periods, **as directed**; face-lighted unit fully visible at night, **as directed**.
 - 1) Reader Type: Touch plate **OR** Swipe **OR** Insertion **OR** Proximity, **as directed**.
 - 2) Features: Timed anti-passback **OR** Limited-time usage **OR** Capable of monitoring and auditing gate activity, **as directed**.
 - c. Digital Keypad Entry Unit: Multiple-code capability **OR** Multiple-programmable, code capability, **as directed**, of not less than five **OR** 500 **OR** 2500, **as directed**, possible individual codes, consisting of one- to seven **OR** four **OR** five, **as directed**, -digit codes, and permitting four different access time periods, **as directed**.
 - 1) Features: Timed anti-passback **OR** Limited-time usage **OR** Capable of monitoring and auditing gate activity, **as directed**.



- 2) Face-lighted unit with metal-keyed **OR** keyless-membrane, **as directed**, keypad fully visible at night.
 - d. Radio Control: Digital system consisting of code-compatible universal receiver for each gate, located where indicated, with remote antenna with coaxial cable and mounting brackets designed to operate gates. Provide one **OR** two, **as directed**, programmable transmitter(s) with multiple-code capability permitting validating or voiding of not less than 1000 **OR** 10,000, **as directed**, codes per channel configured for the following functions:
 - 1) Transmitters: Single **OR** Three, **as directed**, button operated, with open **OR** open and close, **as directed**, function.
 - 2) Channel Settings: Two **OR** Three **OR** Four, **as directed**, independent channel settings controlling separate receivers for operating more than one gate from each transmitter.
 - e. Telephone Entry System: Hands-free voice-communication system for connection to building telephone system with digital-entry code activation of gate operator and auxiliary keypad entry, **as directed**.
 - 1) Residential System: Designed to be wired to same line with telephone.
OR
Multiunit System: Designed to be wired to a dedicated telephone line, with capacity to access 20 **OR** 100, **as directed**, telephones and with electronic directory, **as directed**.
 - f. Vehicle Loop Detector: System including automatic closing timer with adjustable time delay before closing, timer cut-off switch, **as directed**, and loop detector designed to open and close gate **OR** hold gate open until traffic clears **OR** reverse gate, **as directed**. Provide electronic detector with adjustable detection patterns, adjustable sensitivity and frequency settings, and panel indicator light designed to detect presence or transit of a vehicle over an embedded loop of wire and to emit a signal activating the gate operator. Provide number of loops consisting of multiple strands of wire, number of turns, loop size, and method of placement at location shown on Drawings, as recommended in writing by detection system manufacturer for function indicated.
 - 1) Loop: Wire, in size indicated for field assembly, for pave-over **OR** saw-cut with epoxy-grouted, **as directed**, installation.
OR
Loop: Factory preformed in size indicated; style for pave-over **OR** saw-cut with epoxy-grouted, **as directed**, installation.
 - g. Vehicle Presence Detector: System including automatic closing timer with adjustable time delay before closing, timer cut-off switch, **as directed**, and presence detector designed to open and close gate **OR** hold gate open until traffic clears **OR** reverse gate, **as directed**. Provide retroreflective **OR** emitter/receiver, **as directed**, detector with adjustable detection zone pattern and sensitivity, designed to detect the presence or transit of a vehicle in gate pathway when infrared beam in zone pattern is interrupted, and to emit a signal activating the gate operator.
7. Obstruction Detection Devices: Provide each motorized gate with automatic safety sensor(s). Activation of sensor(s) causes operator to immediately function as follows:
- a. Action: Reverse gate in both opening and closing cycles and hold until clear of obstruction **OR** Stop gate in opening cycle and reverse gate in closing cycle and hold until clear of obstruction, **as directed**.
 - b. Internal Sensor: Built-in torque or current monitor senses gate is obstructed.
 - c. Sensor Edge: Contact-pressure-sensitive safety edge, profile, and sensitivity designed for type of gate and component indicated, in locations as follows. Connect to control circuit using take-up cable reel **OR** self-coiling cable **OR** gate edge transmitter and operator receiver system, **as directed**.
 - 1) Along entire gate leaf leading edge (for swing gates and slide gates).
 - 2) Along entire gate leaf trailing edge (for slide gates).
 - 3) Across entire gate leaf bottom edge (for vehicular swing and slide gates complying with UL 325 or to suit Project; consider retaining for pedestrian gates).



- 4) Along entire length of gate posts (for slide gates; revise for sensor edge at pinch point post of swing gates).
 - 5) Along entire length of gate guide posts (for Type II Cantilever Slide, Class 1 gates).
 - 6) Where indicated on Drawings.
 - d. Photoelectric/Infrared Sensor System: Designed to detect an obstruction in gate's path when infrared beam in the zone pattern is interrupted.
 8. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop gate at fully retracted and fully extended positions.
 - a. Type: Integral fail-safe release, allowing gate to be pushed open without mechanical devices, keys, cranks, or special knowledge **OR** Mechanical device, key, or crank-activated release, **as directed**.
 9. Operating Features:
 - a. Digital Microprocessor Control: Electronic programmable means for setting, changing, and adjusting control features with capability for monitoring and auditing gate activity, **as directed**. Provide unit that is isolated from voltage spikes and surges.
 - b. System Integration: With controlling circuit board capable of accepting any type of input from external devices.
 - c. Master/Slave Capability: Control stations designed and wired for gate pair operation.
 - d. Automatic Closing Timer: With adjustable time delay before closing and timer cut-off switch, **as directed**.
 - e. Open Override Circuit: Designed to override closing commands.
 - f. Reversal Time Delay: Designed to protect gate system from shock load on reversal in both directions.
 - g. Maximum Run Timer: Designed to prevent damage to gate system by shutting down system if normal time to open gate is exceeded.
 - h. Clock Timer: 24-hour **OR** Seven-day, **as directed**, programmable for regular events.
 10. Accessories:
 - a. Warning Module: Audio **OR** Visual, **as directed**, constant **OR** strobe, **as directed**, light alarm sounding three to five seconds in advance of gate operation and continuing until gate stops moving; compliant with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.
 - b. Battery Backup System: Battery-powered drive and access-control system, independent of primary drive system.
 - 1) Fail Safe: Gate opens and remains open until power is restored.
 - 2) Fail Secure: Gate cycles on battery power, then fail safe when battery is discharged.
 - c. External electric-powered solenoid **OR** magnetic, **as directed**, lock with delay timer allowing time for lock to release before gate operates.
 - d. Fire **OR** Postal, **as directed**, box.
 - e. Fire strobe **OR** siren, **as directed**, alarm.
 - f. Intercom System: <Insert requirements>.
 - g. Instructional, Safety, and Warning Labels and Signs: According to UL 325 **OR** Manufacturer's standard for components and features specified **OR** As indicated on Drawings, **as directed**.
 - h. Equipment Bases/Pads: Cast-in-place or precast concrete, depth not less than 12 inches (300 mm), dimensioned and reinforced according to gate-operator component manufacturer's written instructions and as indicated on Drawings.
- K. Grout And Anchoring Cement
1. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout, recommended in writing by manufacturer, for exterior applications.
 2. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to



erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended in writing by manufacturer, for exterior applications.

- L. Fence Grounding
 - 1. Conductors: Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.
 - a. Material above Finished Grade: Copper **OR** Aluminum, **as directed**.
 - b. Material on or below Finished Grade: Copper.
 - c. Bonding Jumpers: Braided copper tape, 1 inch (25 mm) wide, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.
 - 2. Connectors and Grounding Rods: Comply with UL 467.
 - a. Connectors for Below-Grade Use: Exothermic welded type.
 - b. Grounding Rods: Copper-clad steel, 5/8 by 96 inches (16 by 2440 mm).

1.3 EXECUTION

- A. Examination
 - 1. Examine areas and conditions, with Installer present, for compliance with requirements for a verified survey of property lines and legal boundaries, **as directed**, site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.
 - a. Do not begin installation before final grading is completed unless otherwise permitted by the Owner.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Preparation
 - 1. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet (152.5 m) or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.
- C. Installation, General
 - 1. Install chain-link fencing to comply with ASTM F 567 and more stringent requirements indicated.
 - a. Install fencing on established boundary lines inside property line.
- D. Chain-Link Fence Installation
 - 1. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.
 - 2. Post Setting: Set posts in concrete **OR** with mechanical anchors **OR** by mechanically driving into soil, **as directed**, at indicated spacing into firm, undisturbed soil.
 - a. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
 - b. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
 - 1) Exposed Concrete: Extend 2 inches (50 mm) above grade; shape and smooth to shed water.
 - 2) Concealed Concrete: Top 2 inches (50 mm) below grade as indicated on Drawings to allow covering with surface material.
 - 3) Posts Set into Concrete in Sleeves: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout **OR** anchoring cement, **as directed**, mixed and placed to comply with anchoring material manufacturer's written instructions, and finished sloped to drain water away from post.
 - 4) Posts Set into Voids in Concrete: Form or core drill holes not less than 5 inches (125 mm) deep and 3/4 inch (20 mm) larger than OD of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with



- nonshrink, nonmetallic grout **OR** anchoring cement, **as directed**, mixed and placed to comply with anchoring material manufacturer's written instructions, and finished sloped to drain water away from post.
- c. Mechanically Driven Posts: Drive into soil to depth of 30 inches (762 mm) **OR** 36 inches (914 mm), **as directed**. Protect post top to prevent distortion.
 3. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more **OR** 30 degrees or more **OR** as indicated on Drawings, **as directed**.
 4. Line Posts: Space line posts uniformly at 96 inches (2440 mm) **OR** 10 feet (3 m), **as directed**, o.c.
 5. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.
 - a. Locate horizontal braces at midheight of fabric 72 inches (1830 mm) or higher, on fences with top rail and at two-third fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.
 6. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch- (3.05-mm-) diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches (610 mm) o.c. Install tension wire in locations indicated before stretching fabric. Provide horizontal tension wire at the following locations:
 - a. Extended along top **OR** bottom **OR** top and bottom, **as directed**, of fence fabric. Install top tension wire through post cap loops. Install bottom tension wire within 6 inches (152 mm) of bottom of fabric and tie to each post with not less than same diameter and type of wire.
 - b. Extended along top of barbed wire arms **OR** extended posts, **as directed**, and top of fence fabric for supporting barbed tape.
 - c. As indicated.
 7. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.
 8. Intermediate and Bottom Rails: Install and secure to posts with fittings.
 9. Chain-Link Fabric: Apply fabric to outside **OR** inside, **as directed**, of enclosing framework. Leave 1 inch (25.4 mm) **OR** 2 inches (50 mm), **as directed**, between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.
 10. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches (380 mm) o.c.
 11. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric per ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.
 - a. Maximum Spacing: Tie fabric to line posts at 12 inches (300 mm) o.c. and to braces at 24 inches (610 mm) o.c.
 12. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts, **as directed**.
 13. Privacy Slats: Install slats in direction indicated, securely locked in place.
 - a. Vertically **OR** Horizontally, **as directed**, for privacy factor of 70 to 75.
OR
Diagonally, for privacy factor of 80 to 85.
OR
Direction and privacy factor, **as directed**, as indicated.



14. Barbed Wire: Install barbed wire uniformly spaced, angled toward security side of fence **OR** as indicated on Drawings, **as directed**. Pull wire taut, install securely to extension arms, and secure to end post or terminal arms.
 15. Barbed Tape: Comply with ASTM F 1911. Install barbed tape uniformly in configurations indicated and fasten securely to prevent movement or displacement.
- E. Gate Installation
1. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.
- F. Gate Operator Installation
1. General: Install gate operators according to manufacturer's written instructions, aligned and true to fence line and grade.
 2. Excavation for Support Posts **OR** Pedestals **OR** Equipment Bases/Pads, **as directed**: Hand-excavate holes for bases/pads, in firm, undisturbed soil to dimensions and depths and at locations as required by gate-operator component manufacturer's written instructions and as indicated.
 3. Vehicle Loop Detector System: Cut grooves in pavement and bury **OR** Bury, **as directed**, and seal wire loop according to manufacturer's written instructions. Connect to equipment operated by detector.
 4. Comply with NFPA 70 and manufacturer's written instructions for grounding of electric-powered motors, controls, and other devices.
- G. Grounding And Bonding
1. Fence Grounding: Install at maximum intervals of 1500 feet (450 m), **as directed**, except as follows:
 - a. Fences within 100 Feet (30 m) of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet (225 m), **as directed**.
 - 1) Gates and Other Fence Openings: Ground fence on each side of opening.
 - a) Bond metal gates to gate posts.
 - b) Bond across openings, with and without gates, except openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches (460 mm) below finished grade.
 2. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a maximum distance of 150 feet (45 m) on each side of crossing.
 3. Fences Enclosing Electrical Power Distribution Equipment: Ground as required by IEEE C2 unless otherwise indicated.
 4. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches (150 mm) below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at the grounding location, including the following:
 - a. Make grounding connections to each barbed wire strand with wire-to-wire connectors designed for this purpose.
 - b. Make grounding connections to each barbed tape coil with connectors designed for this purpose.
 5. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.
 6. Connections: Make connections to minimize possibility of galvanic action or electrolysis. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
 - a. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
 - b. Make connections with clean, bare metal at points of contact.
 - c. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.



- d. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
 - e. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
7. Bonding to Lightning Protection System: If fence terminates at lightning-protected building or structure, ground the fence and bond the fence grounding conductor to lightning protection down conductor or lightning protection grounding conductor complying with NFPA 780.
- H. Field Quality Control
1. Grounding-Resistance Testing: Engage a qualified testing agency to perform tests and inspections.
 - a. Grounding-Resistance Tests: Subject completed grounding system to a megger test at each grounding location. Measure grounding resistance no fewer than two full days after last trace of precipitation, without soil having been moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural grounding resistance. Perform tests by two-point method according to IEEE 81.
 - b. Excessive Grounding Resistance: If resistance to grounding exceeds specified value, notify the Owner promptly. Include recommendations for reducing grounding resistance and a proposal to accomplish recommended work.
 - c. Report: Prepare test reports certified by a testing agency of grounding resistance at each test location. Include observations of weather and other phenomena that may affect test results.
- I. Adjusting
1. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
 2. Automatic Gate Operator: Energize circuits to electrical equipment and devices. Adjust operators, controls, safety devices, alarms, **as directed**, and limit switches.
 - a. Hydraulic Operator: Purge operating system, adjust pressure and fluid levels, and check for leaks.
 - b. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - c. Test and adjust controls, alarms, **as directed**, and safeties. Replace damaged and malfunctioning controls and equipment.
 3. Lubricate hardware, gate operator, **as directed**, and other moving parts.
- J. Demonstration
1. Train the Owner's personnel to adjust, operate, and maintain chain-link fences and gates.

END OF SECTION 32 31 11 00

**SECTION 32 31 13 00 - HIGH-SECURITY CHAIN-LINK FENCES AND GATES**

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for high-security chain-link fences and gates. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. High-security chain-link fences.
 - b. Gates: Motor operated, horizontal slide and swing.

C. Performance Requirements

1. Delegated-Design Submittal: For chain-link fences and gate framework indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
2. Structural Performance: Chain-link fences and gate framework shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to ASCE/SEI 7:
 - a. Minimum Post Size: Determine according to ASTM F 1043 for framework up to 12 feet (3.66 m) high, and post spacing not to exceed 10 feet (3 m) for Material Group IA, ASTM F 1043, Schedule 40 steel pipe **OR** Group IC, electric-resistance-welded round steel pipe, **as directed**.
OR
Minimum Post Size and Maximum Spacing: Provide line posts of size and in spacing indicated, but not less than sizes and spacings determined according to ASTM F 1916, including Appendix **OR** CLFMI WLG 2445, **as directed**, based on mesh size and pattern specified and the following:
 - 1) Wind Loads: Determine design wind loads applicable to Project from basic wind speed and exposure category according to CLFMI WLG 2445.
 - 2) Exposure Category: B **OR** C **OR** D, **as directed**.
 - 3) Fence Height: 10 feet (3 m).
 - 4) Material Group: IA, ASTM F 1043, Schedule 40 steel pipe **OR** IC, electric-resistance-welded round steel pipe, **as directed**.
 - b. Fabric Tension: Provide fences in which fabric deflections do not exceed those indicated in Table X1.1 of ASTM F 1916 when tested by applying a 30-lbf (133-N) force at midpoint between rails and horizontally between posts for every eighth lower panel along the fence line.
 - c. Fence Post Rigidity: Provide fences in which post deflections do not exceed 3/4 inch (19 mm) when tested according to ASTM F 1916 by applying a 50-lbf (222-N) force at midheight of every eighth post along the fence line.
3. Lightning Protection System: Maximum grounding-resistance value of 25 ohms under normal dry conditions.

D. Submittals

1. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for chain-link fences and gates, **as directed**.
 - a. Fence and gate posts, rails, and fittings.
 - b. Chain-link fabric, reinforcements, and attachments.
 - c. Accessories: Barbed wire **OR** Barbed tape, **as directed**.



- d. Gates and hardware.
 - e. Gate Operator: Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
 - f. Wiring Diagrams: For power, signal, and control wiring.
 2. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Show accessories, hardware, gate operation, and operational clearances.
 - a. Gate Operator: Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
 - b. Wiring Diagrams: For power, signal, and control wiring.
 3. Samples: Prepared on Samples of size indicated below:
 - a. Polymer-Coated Components: In 6-inch (150-mm) lengths for components and on full-sized units for accessories.
 4. Delegated-Design Submittal: For chain-link fences and gate framework indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 5. Qualification Data: For qualified professional engineer **OR** testing agency **OR** factory-authorized service representative, **as directed**.
 6. Product Certificates: For each type of chain-link fence, operator, **as directed**, and gate, from manufacturer.
 7. Product Test Reports: For framing strength according to ASTM F 1043.
 8. Field quality-control reports.
 9. Soil sterilization certificate of treatment stating materials and quantities used, and date of application.
 10. Operation and Maintenance Data: For the following to include in emergency, operation, and maintenance manuals:
 - a. Polymer finishes.
 - b. Gate hardware.
 - c. Gate operator.
 11. Warranty: Sample of special warranty.
- E. Quality Assurance
1. Testing Agency Qualifications: For testing fence grounding. Member company of NETA or an NRTL.
 - a. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
 2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 3. Emergency Access Requirements: Comply with requirements of authorities having jurisdiction for automatic gate operators serving as a required means of access.
 4. Preinstallation Conference: Conduct conference at Project site.
- F. Project Conditions
1. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.
- G. Warranty
1. Special Warranty: Manufacturer's standard form in which manufacturer **OR** Installer, **as directed**, agrees to repair or replace components of high-security chain-link fences and gates that fail in materials or workmanship within specified warranty period.
 - a. Failures include, but are not limited to, the following:
 - 1) Deflection of fence fabric beyond design limits.



- 2) Deterioration of metals, metal finishes, and other materials beyond normal weathering.
- 3) Faulty operation of gate operators and controls.
- b. Warranty Period: Five **OR** 15, **as directed**, years from date of Final Completion.

1.2 PRODUCTS

A. Chain-Link Fence Fabric

1. Chain-Link Fence Fabric: Provide fabric in one **OR** two, **as directed**,-piece heights measured between top and bottom of outer edge of selvage. Comply with CLFMI Product Manual and with requirements indicated below:
 - a. Fabric Height: As indicated on Drawings **OR** As directed.
 - 1) Steel Wire Fabric: Wire with a diameter of 0.192 inch (4.88 mm) **OR** 0.148 inch (3.76 mm) **OR** 0.120 inch (3.05 mm) **OR** 0.113 inch (2.87 mm), **as directed**.
 - a) Mesh Size: 2 inches (51 mm) **OR** 1 inch (25.4 mm) **OR** 3/8 inch (9.5 mm), **as directed**.
 - b. Fabric Heights and Overlap: As indicated on Drawings **OR** As directed.
 - 1) Steel Wire Lower Fabric: Wire with a diameter of 0.192 inch (4.88 mm) **OR** 0.148 inch (3.76 mm) **OR** 0.120 inch (3.05 mm) **OR** 0.113 inch (2.87 mm), **as directed**.
 - a) Mesh Size: 2 inches (51 mm) **OR** 1 inch (25.4 mm) **OR** 3/8 inch (9.5 mm), **as directed**.
 - 2) Steel Wire Upper Fabric: Wire with a diameter of 0.120 inch (3.05 mm).
 - a) Mesh Size: 3/8 inch (9.5 mm).
 - c. Aluminum-Coated Fabric: ASTM A 491, Type I, 0.40 oz./sq. ft. (122 g/sq. m) **OR** 0.35 oz./sq. ft. (107 g/sq. m) **OR** 0.30 oz./sq. ft. (92 g/sq. m), **as directed**.
 - d. Zinc-Coated Fabric: ASTM A 392, Type II, Class 1, 1.2 oz./sq. ft. (366 g/sq. m) **OR** Class 2, 2.0 oz./sq. ft. (610 g/sq. m), **as directed**, with zinc coating applied before **OR** after, **as directed**, weaving.
 - e. Zn-5-Al-MM Aluminum-Mischmetal-Coated Fabric: ASTM F 1345, Type III, Class 2, 1.0 oz./sq. ft. (305 g/sq. m).
 - f. Polymer-Coated Fabric: ASTM F 668, Class 2b over aluminum **OR** zinc **OR** Zn-5-Al-MM-alloy, **as directed**, -coated steel wire.
 - 1) Color: Dark green **OR** Olive green **OR** Brown **OR** Black **OR** As selected by the Owner from manufacturer's full range, **as directed**, complying with ASTM F 934.
 - g. Coat selvage ends of fabric that is metallic coated before the weaving process with manufacturer's standard clear protective coating.
 - h. Selvage: Twisted and barbed top and bottom.

B. Security Fence Framing

1. Posts and Rails: Comply with ASTM F 1043 for framing, including rails, braces, and line; terminal; and corner posts.
 - a. Fence Height: 96 inches (2440 mm) **OR** 12 feet (3.66 m) **OR** As indicated on Drawings, **as directed**.
 - b. Heavy **OR** Light, **as directed**, Industrial Strength: Material Group IA, round steel pipe, Schedule 40 **OR** Group IC, round steel pipe, electric resistance-welded pipe, **as directed**.
 - 1) Line Post: 2.375 inches (60 mm) in diameter **OR** 2.875 inches (73 mm) in diameter **OR** 4 inches (100-mm) in diameter **OR** 6.625 inches (168 mm) in diameter **OR** 8.625 inches (168 mm) in diameter **OR** 2.25 by 1.70 inches (67 by 43 mm) **OR** 3.25 by 2.50 inches (83 by 64 mm), **as directed**.
 - 2) End, Corner, and Pull Post: 2.875 inches (73 mm) in diameter **OR** 4.0 inches (102 mm) in diameter **OR** 6.625 inches (168 mm) in diameter **OR** 8.625 inches (168 mm) in diameter, **as directed**.
 - c. Rail Members: Intermediate, top, and brace, **as directed**, rails complying with ASTM F 1043 for Heavy Industrial.
 - d. Metallic Coating for Steel Framing:



- 1) Type A, consisting of not less than minimum 2.0-oz./sq. ft. (0.61-kg/sq. m) average zinc coating per ASTM A 123/A 123M or 4.0-oz./sq. ft. (1.22-kg/sq. m) zinc coating per ASTM A 653/A 653M.
- 2) Type B, zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. (0.27 kg/sq. m) of zinc after welding, a chromate conversion coating, and a clear, verifiable polymer film.
- 3) External, Type B, zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. (0.27 kg/sq. m) of zinc after welding, a chromate conversion coating, and a clear, verifiable polymer film. Internal, Type D, consisting of 81 percent, not less than 0.3-mil- (0.0076-mm-) thick, zinc-pigmented coating.
- 4) Type C, Zn-5-Al-MM alloy, consisting of not less than 1.8-oz./sq. ft. (0.55-kg/sq. m) coating.
- 5) Coatings: Any coating above.
- e. Polymer coating over metallic coating.
 - 1) Color: Match chain-link fabric **OR** Dark green **OR** Olive green **OR** Brown **OR** Black **OR** As selected from manufacturer's full range, **as directed**, complying with ASTM F 934.

C. Tension Wire

1. Metallic-Coated Steel Wire: 0.177-inch- (4.5-mm-) diameter, marcelled tension wire complying with ASTM A 817 and ASTM A 824, with the following metallic coating:
 - a. Type I, aluminum coated (aluminized).
 - b. Type II, zinc coated (galvanized) by hot-dip **OR** electrolytic, **as directed**, process, with Class 5 minimum coating weight of not less than 2.0 oz./sq. ft. (610 g/sq. m) of uncoated wire surface.
2. Polymer-Coated Steel Wire: 0.177-inch- (4.5-mm-) diameter, tension wire complying with ASTM F 1664, Class 1 **OR** Class 2a **OR** Class 2b, **as directed**, over aluminum **OR** zinc **OR** Zn-5-Al-MM-alloy, **as directed**, -coated steel wire.
 - a. Color: Match chain-link fabric **OR** Dark green **OR** Olive green **OR** Brown **OR** Black **OR** As selected from manufacturer's full range, **as directed**, complying with ASTM F 934.

D. Swing Gates

1. General: Comply with ASTM F 900 for gate posts and single **OR** double, **as directed**, swing gate types. Provide automated vehicular gates that comply with ASTM F 2200, **as directed**.
 - a. Gate Leaf Width: 36 inches (914 mm) **OR** As indicated, **as directed**.
 - b. Gate Fabric Height: 72 inches (1830 mm) or less **OR** More than 72 inches (1830 mm) **OR** As indicated, **as directed**.
2. Pipe and Tubing:
 - a. Zinc-Coated Steel: Comply with ASTM F 1043 and ASTM F 1083; protective coating and finish to match fence framing **OR** manufacturer's standard protective coating and finish, **as directed**.
 - b. Aluminum: Comply with ASTM B 429/B 429M; mill **OR** manufacturer's standard, **as directed**, finish.
 - c. Gate Post Size and Weight: Not less than required by ASTM F 900 **OR** ASTM F 1916, **as directed**.
 - d. Gate Posts: Round tubular steel **OR** Rectangular tubular steel **OR** Round tubular aluminum **OR** Rectangular tubular aluminum, **as directed**.
 - e. Gate Frames and Bracing: Round tubular steel **OR** Rectangular tubular steel **OR** Round tubular aluminum **OR** Rectangular tubular aluminum, **as directed**.
3. Frame Corner Construction: Welded **OR** Assembled with corner fittings, **as directed**, and 3/8-inch- (9.5-mm-) diameter, adjustable truss rods for panels 5 feet (1.52 m) or wider.
4. Extended Gate Posts and Frame Members: Extend above top of chain-link fabric at both ends of gate frame 12 inches (300 mm) **OR** as indicated, **as directed**, as required to attach barbed wire **OR** tape, **as directed**, assemblies.
5. Provide separate isolated gate frame according to ASTM F 1916 and as indicated.



- a. Separation between Hinge and Latch Post and Fence Termination Post: 2 inches (51 mm) minimum, 2-1/2 inches (63.5 mm) maximum.
6. Hardware: Comply with ASTM F 1916.
 - a. Hinges: 180-degree inward **OR** 180-degree outward **OR** 360-degree inward and outward, **as directed**, swing.
 - b. Latches permitting operation from one side **OR** both sides, **as directed**, of gate with provision for padlocking accessible from both sides of gate, **as directed**.
 - c. Padlock and Chain: the Owner furnished.
 - d. Lock: Manufacturer's standard, **as directed**, internal device furnished in lieu of gate latch, **as directed**.
 - e. Closer: Manufacturer's standard, **as directed**.
 - f. For gates 14 feet (4.27 m) and higher, add locking device to transom.
- E. Horizontal-Slide Gates
 1. General: Comply with ASTM F 1184 for gate posts and single **OR** double, **as directed**, sliding gate types. Provide automated vehicular gates that comply with ASTM F 2200, **as directed**.
 - a. Classification: Type I Overhead Slide.
 - 1) Gate Leaf Width: As indicated.
 - 2) Gate Fabric Height: 72 inches (1830 mm) or less **OR** More than 72 inches (1830 mm) **OR** As indicated, **as directed**.
 - b. Classification: Type II Cantilever Slide, Class 1 with external **OR** Class 2 with internal, **as directed**, roller assemblies.
 - 1) Gate Frame Width and Height: 48 inches (1200 mm) wide or less by 72 inches (1830 mm) high or less **OR** More than 48 inches (1200 mm) wide by any height **OR** As indicated, **as directed**.
 2. Pipe and Tubing:
 - a. Zinc-Coated Steel: Protective coating and finish to match fence framing **OR** Manufacturer's standard protective coating and finish, **as directed**.
 - b. Aluminum: Comply with ASTM B 429/B 429M; mill **OR** manufacturer's standard, **as directed**, finish.
 - c. Gate Post Size and Weight: Not less than required by ASTM F 1184 **OR** ASTM F 1916, **as directed**.
 - d. Gate Frames and Bracing: Round tubular steel **OR** Rectangular tubular steel **OR** Round tubular aluminum **OR** Rectangular tubular aluminum, **as directed**.
 3. Frame Corner Construction: Welded **OR** Assembled with corner fittings, **as directed**, and 3/8-inch- (9.5-mm-) diameter, adjustable truss rods for panels 5 feet (1.52 m) or wider.
 4. Extended Gate Posts and Frame Members: Extend above top of chain-link fabric at both ends of gate frame 12 inches (300 mm) **OR** as indicated, **as directed**, as required to attach barbed wire **OR** tape, **as directed**, assemblies.
 5. Overhead Track Assembly: Manufacturer's standard track, with overhead framing supports, bracing, and accessories, engineered to support size, weight, width, operation, and design of gate and roller assemblies.
 6. Hardware:
 - a. Latches permitting operation from one side **OR** both sides, **as directed**, of gate with provision for padlocking accessible from both sides of gate, **as directed**.
 - b. Padlock and Chain: the Owner furnished.
 - c. Lock: Manufacturer's standard, **as directed**, internal device furnished in lieu of gate latch, **as directed**.
 - d. Hangers, roller assemblies, and stops fabricated from galvanized steel **OR** galvanized malleable iron **OR** mill-finished Grade 319 aluminum-alloy casting with stainless-steel fasteners, **as directed**.
- F. Fittings
 1. General: Comply with ASTM F 626.
 2. Post Caps: Provide for each post.
 - a. Provide line post caps with loop to receive tension wire or top rail.



3. Rail and Brace Ends: For each gate, corner, pull, and end post.
 4. Rail Fittings: Provide the following:
 - a. Top-Rail Sleeves: Pressed steel or round steel tubing not less than 6 inches (152 mm) long.
 - b. Rail Clamps: Line and corner boulevard clamps for connecting intermediate and bottom, **as directed**, rails in the fence line to line posts.
 5. Tension and Brace Bands, Tension Bars, and Truss Rod Assemblies: Comply with ASTM F 2611.
 6. Barbed Wire Arms: Pressed steel or cast iron **OR** Aluminum, **as directed**, with clips, slots, or other means for attaching strands of barbed wire, and means for attaching to posts **OR** integral with post cap, **as directed**; for each post unless otherwise indicated, and as follows:
 - a. Provide line posts with arms that accommodate top rail or tension wire.
 - b. Provide corner arms at fence corner posts, unless extended posts are indicated.
 - c. Type I, single slanted arm.
 - d. Type II, single vertical arm.
 - e. Type III, V-shaped arm.
 - f. Type IV, A-shaped arm.
 - g. Bolts or rivets for connection to post.
 7. Tie Wires, Clips, and Fasteners: Comply with ASTM F 626 and ASTM F 1916.
 - a. High-Security Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, complying with the following:
 - 1) Metallic-Coated Steel: 0.148-inch- (3.76-mm-) **OR** 0.192-inch- (4.88-mm-), **as directed**, diameter wire; zinc **OR** aluminum, **as directed**, coating.
 - 2) Stainless steel.
 8. Power-Driven Fabric Fasteners: Comply with ASTM F 1916.
 9. Finish:
 - a. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz. /sq. ft. (366 g/sq. m) of zinc.
 - 1) Polymer coating over metallic coating.
 - b. Aluminum: Mill finish.
- G. Barbed Wire
1. Steel Barbed Wire: Comply with ASTM A 121, High Security Grade, for two-strand barbed wire; 0.099-inch- (2.51-mm-) diameter line wire with 0.080-inch- (2.03-mm-) diameter, four-point round barbs spaced not more than 3 inches (76 mm) o.c.
 - a. Aluminum Coating: Type A.
 2. Polymer-Coated, Galvanized-Steel Barbed Wire: Comply with ASTM F 1665, Type II, for two-strand barbed wire; 0.080-inch- (2.03-mm-) diameter line wire with 0.080-inch- (2.03-mm-) diameter, four-point round aluminum-alloy **OR** galvanized-steel, **as directed**, barbs spaced not more than 3 inches (76 mm) o.c.
 - a. Polymer Coating: Class 1 **OR** Class 2a **OR** Class 2b, **as directed**, over aluminum **OR** zinc **OR** Zn-5-Al-MM-alloy, **as directed**, -coated steel wire.
 - 1) Color: Match chain-link fabric **OR** Dark green **OR** Olive green **OR** Brown **OR** Black **OR** As selected from manufacturer's full range, **as directed**, complying with ASTM F 934.
- H. Barbed Tape
1. Wire-Reinforced Tape: ASTM F 1910; with four-point, needle-sharp barbs permanently cold clenched around a core wire.
 - a. Core Wire: High-tensile-strength, zinc-coated steel or stainless steel.
 2. Clips: Stainless steel, 0.065 inch (1.65 mm) thick by 0.375 inch (9.5 mm) wide; capable of withstanding a minimum 150-lbf (667-N) pull load to limit extension of coil, resulting in a concertina pattern when deployed.
 3. Tie Wires: Stainless steel, 0.065 inch (1.65 mm) in diameter.



4. Fabrication: Continuous coils of barbed tape as defined in ASTM F 1379 for the following characteristics:
 - a. Configuration: Single **OR** Double, **as directed**, coil.
 - b. Style: Helical **OR** Concertina, **as directed**, pattern.
 - c. Coil Diameter(s): 18 inches (457 mm) **OR** 24 inches (610 mm) **OR** 24-inch (610-mm) inner coil and 30-inch (762-mm) outer coil **OR** As indicated on Drawings, **as directed**.
 - d. Coil Loop Spacing(s): 12 inches (305 mm) **OR** Manufacturer's standard **OR** As indicated on Drawings, **as directed**.
 - e. Barb Length Classification: Long, 1.2-inch (30.5-mm) **OR** Medium, 0.4-inch (10.2-mm) **OR** Short, 0.1875-inch (4.76-mm), **as directed**, barb.
 - f. Barb Spacing: 4 inches (102 mm) o.c.
 - g. Barb Set: Straight **OR** Offset **OR** Manufacturer's standard, **as directed**.
 5. Ground Barrier Stakes: 3/8-inch- (9.5-mm-) diameter galvanized reinforcing bar, 18 inches (457 mm) long with 180-degree end hook 3-1/2 inches (89 mm) long.
- I. Gate Operators
1. General: Provide factory-assembled automatic operating system designed for gate size, type, weight, and operation frequency. Provide operation control system with characteristics suitable for Project conditions, with remote-control stations, safety devices, and weatherproof enclosures; coordinate electrical requirements with building electrical system.
 - a. Provide operator designed so motor may be removed without disturbing limit-switch adjustment and without affecting auxiliary emergency operator.
 - b. Provide operator with UL approval **OR** UL-approved components, **as directed**.
 - c. Provide electronic components with built-in troubleshooting diagnostic feature.
 - d. Provide unit designed and wired for both right-hand/left-hand opening, permitting universal installation.
 2. Comply with NFPA 70.
 3. UL Standard: Manufacturer and label gate operators to comply with UL 325.
 4. Motor Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, within installed environment, with indicated operating sequence, and without exceeding nameplate rating or considering service factor. Comply with NEMA MG 1 and the following:
 - a. Voltage: 12-V dc **OR** 120 V **OR** 208-220 V **OR** NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected, **as directed**.
 - b. Horsepower: 1/4 **OR** 1/3 **OR** 3/4, **as directed**.
 - c. Enclosure: Open dripproof **OR** Totally enclosed **OR** Manufacturer's standard, **as directed**.
 - d. Duty: Continuous duty at ambient temperature of 105 deg F (40 deg C) and at altitude of 3300 feet (1005 m) above sea level.
 - e. Service Factor: 1.15 for open dripproof motors; 1.0 for totally enclosed motors.
 - f. Phase: One **OR** Polyphase, **as directed**.
 5. Gate Operators: Gate **OR** Equipment base/pad **OR** Pedestal post **OR** In ground, **as directed**, mounted and as follows:
 - a. Hydraulic Swing **OR** Slide, **as directed**, Gate Operators:
 - 1) Duty: Medium **OR** Heavy, **as directed**.
 - 2) Gate Speed: Minimum 45 feet (13.7 m) **OR** 60 feet (18.2 m), **as directed**, per minute.
 - 3) Maximum Gate Weight: 800 lb (363 kg).
 - 4) Frequency of Use: 10 cycles per hour **OR** 25 cycles per hour **OR** Continuous duty, **as directed**.
 - 5) Operating Type: Wheel and rail drive with manual release, **as directed**.
 - 6) Hydraulic Fluid: Of viscosity required for gate operation at ambient temperature range for Project.
 - 7) Locking: Hydraulic in both directions.
 - 8) Heater: Manufacturer's standard track and roller heater with thermostatic control.
 - b. Mechanical Swing **OR** Slide, **as directed**, Gate Operators:
 - 1) Duty: Medium **OR** Heavy **OR** Maximum security, **as directed**.



- 2) Gate Speed: Minimum 45 feet (13.7 m) per minute **OR** 60 feet (18.2 m) per minute **OR** variable speed, **as directed**.
 - 3) Maximum Gate Weight: 800 lb (363 kg) **OR** 3000 lb (1360 kg), **as directed**.
 - 4) Frequency of Use: 10 cycles per hour **OR** 25 cycles per hour **OR** 60 cycles per hour **OR** Continuous duty, **as directed**.
 - 5) Operating Type: Crank arm **OR** Enclosed **OR** Wheel and rail drive **OR** Roller chain, **as directed**, with manual release, **as directed**.
 - 6) Drive Type: Enclosed worm gear and chain-and-sprocket, **as directed**, reducers, roller-chain drive.
OR
Drive Type: V-belt and worm gear **OR** chain-and-sprocket, **as directed**, reducers, roller-chain drive.
6. Remote Controls: Electric controls separated from gate and motor and drive mechanism, with NEMA ICS 6, Type 1 **OR** NEMA ICS 6, Type 4, **as directed**, enclosure for surface **OR** recessed or flush **OR** equipment base/pad **OR** pedestal, **as directed**, mounting and with space for additional optional equipment. Provide the following remote-control device(s):
- a. Control Station: Keyed, two **OR** three, **as directed**, -position switch, located remotely from gate. Provide two keys per station.
OR
Control Station: Momentary contact, single **OR** three, **as directed**, -button operated, located remotely from gate. Key switch to lock out open and close buttons, **as directed**.
 - 1) Function: Open, stop, **as directed**, and close.
 - b. Card Reader: Functions only when authorized card is presented. Programmable, magnetic multiple **OR** single, **as directed**, -code system, permitting four different access time periods, **as directed**; face-lighted unit fully visible at night, **as directed**.
 - 1) Reader Type: Touch plate **OR** Swipe **OR** Insertion **OR** Proximity, **as directed**.
 - 2) Features: Timed anti-passback **OR** Limited-time usage **OR** Capable of monitoring and auditing gate activity, **as directed**.
 - c. Digital Keypad Entry Unit: Multiple-code capability **OR** Multiple-programmable code capability, **as directed**, of not less than five **OR** 500 **OR** 2500, **as directed**, possible individual codes, consisting of one- to seven **OR** four **OR** five, **as directed**, -digit codes and permitting four different access time periods, **as directed**.
 - 1) Features: Timed anti-passback **OR** Limited-time usage **OR** Capable of monitoring and auditing gate activity, **as directed**.
 - 2) Face-lighted unit with metal-keyed **OR** keyless-membrane, **as directed**, keypad fully visible at night.
 - d. Radio Control: Digital system consisting of code-compatible universal receiver for each gate, located where indicated, with remote antenna with coaxial cable and mounting brackets designed to operate gates. Provide one **OR** two, **as directed**, programmable transmitter(s) with multiple-code capability permitting validating or voiding of not less than 1000 **OR** 10,000, **as directed**, codes per channel configured for the following functions:
 - 1) Transmitters: Single **OR** Three, **as directed**, -button operated, with open **OR** open and close, **as directed**, function.
 - 2) Channel Settings: Two **OR** Three **OR** Four, **as directed**, independent channel settings controlling separate receivers for operating more than one gate from each transmitter.
 - e. Telephone Entry System: Hands-free voice-communication system for connection to building telephone system with digital-entry code activation of gate operator and auxiliary keypad entry, **as directed**.
 - 1) System: Designed to be wired to same line with telephone.
OR
Multiunit System: Designed to be wired to a dedicated telephone line, with capacity to access 20 **OR** 100, **as directed**, telephones and with electronic directory, **as directed**.



- f. Vehicle Loop Detector: System including automatic closing timer with adjustable time delay before closing, timer cut-off switch, **as directed**, and loop detector designed to open and close gate **OR** hold gate open until traffic clears **OR** reverse gate, **as directed**. Provide electronic detector with adjustable detection patterns, adjustable sensitivity and frequency settings, and panel indicator light designed to detect presence or transit of a vehicle over an embedded loop of wire and to emit a signal activating the gate operator. Provide number of loops consisting of multiple strands of wire, number of turns, loop size, and method of placement at location shown on Drawings, as recommended in writing by detection system manufacturer for function indicated.
- 1) Loop: Wire, in size indicated for field assembly, for pave-over **OR** saw-cut with epoxy-grouted, **as directed**, installation.
OR
Loop: Factory preformed in size indicated; style for pave-over **OR** saw-cut with epoxy-grouted, **as directed**, installation.
- g. Vehicle Presence Detector: System including automatic closing timer with adjustable time delay before closing, timer cut-off switch, **as directed**, and presence detector designed to open and close gate **OR** hold gate open until traffic clears **OR** reverse gate, **as directed**. Provide retroreflective **OR** emitter/receiver, **as directed**, detector with adjustable detection zone pattern and sensitivity, designed to detect presence or transit of a vehicle in gate pathway when an infrared beam in zone pattern is interrupted, and to emit a signal activating the gate operator.
7. Obstruction Detection Devices: Provide each motorized gate with automatic safety sensor(s). Activation of sensor(s) causes operator to immediately function as follows:
- a. Action: Reverse gate in both opening and closing cycles and hold until clear of obstruction **OR** Stop gate in opening cycle and reverse gate in closing cycle and hold until clear of obstruction, **as directed**.
 - b. Internal Sensor: Built-in torque or current monitor senses gate is obstructed.
 - c. Sensor Edge: Contact-pressure-sensitive safety edge, profile, and sensitivity designed for type of gate and component indicated, in locations as follows. Connect to control circuit using take-up cable reel **OR** self-coiling cable **OR** gate edge transmitter and operator receiver system, **as directed**.
 - 1) Along entire gate leaf leading edge (for swing gates and slide gates).
 - 2) Along entire gate leaf trailing edge (for slide gates).
 - 3) Across entire gate leaf bottom edge (for vehicular swing and slide gates complying with UL 325 or to suit Project; consider retaining for pedestrian gates).
 - 4) Along entire length of gate posts (for slide gates; revise for sensor edge at pinch point post of swing gates).
 - 5) Along entire length of gate guide posts (for Type II Cantilever Slide, Class 1 gates).
 - 6) Where indicated on Drawings.
 - d. Photoelectric/Infrared Sensor: System designed to detect an obstruction in gate's path when infrared beam in the zone pattern is interrupted.
8. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop gate at fully retracted and fully extended positions.
9. Emergency Release Mechanism: Quick-disconnect release of operator drive system of the following type of mechanism, permitting manual operation if operator fails. Design system so control circuit power is disconnected during manual operation.
- a. Type: Integral fail-safe release, allowing gate to be pushed open without mechanical devices, keys, cranks, or special knowledge **OR** Mechanical device, key, or crank-activated release, **as directed**.
10. Operating Features:
- a. Digital Microprocessor Control: Electronic programmable means for setting, changing, and adjusting control features with capability of monitoring and auditing gate activity, **as directed**. Provide unit that is isolated from voltage spikes and surges.
 - b. System Integration: With controlling circuit board capable of accepting any type of input from external devices.
 - c. Master/Slave Capability: Control stations designed and wired for gate pair operation.



- d. Automatic Closing Timer: With adjustable time delay before closing and timer cut-off switch, **as directed**.
 - e. Open Override Circuit: Designed to override closing commands.
 - f. Reversal Time Delay: Designed to protect gate system from shock load on reversal in both directions.
 - g. Maximum Run Timer: Designed to prevent damage to gate system by shutting down system if normal time to open gate is exceeded.
 - h. Clock Timer: 24-hour **OR** Seven-day, **as directed**, programmable for regular events.
11. Accessories:
- a. Warning Module: Audio **OR** Visual, **as directed**, constant **OR** strobe, **as directed**, -light alarm sounding three to five seconds in advance of gate operation and continuing until gate stops moving; compliant with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.
 - b. Battery Backup System: Battery-powered drive and access-control system, independent of primary drive system.
 - 1) Fail Safe: Gate opens and remains open until power is restored.
 - 2) Fail Secure: Gate cycles on battery power, then fail safe when battery is discharged.
 - c. External electric-powered solenoid **OR** magnetic, **as directed**, lock with delay timer allowing time for lock to release before gate operates.
 - d. Fire **OR** Postal, **as directed**, box.
 - e. Fire strobe **OR** siren, **as directed**, sensor.
 - f. Intercom System: As required to meet Project requirements.
 - g. Instructional, Safety, and Warning Labels and Signs: According to UL 325 **OR** Manufacturer's standard for components and features specified **OR** As indicated on Drawings, **as directed**.
 - h. Equipment Bases/Pads: Precast concrete, depth not less than 12 inches (305 mm), dimensioned and reinforced according to gate operator component manufacturer's written instructions and as indicated on Drawings.
- J. Grout And Anchoring Cement
- 1. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout, recommended in writing by manufacturer, for exterior applications.
 - 2. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended in writing by manufacturer for exterior applications.
- K. Fence Grounding
- 1. Conductors: Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.
 - a. Material above Finished Grade: Copper **OR** Aluminum, **as directed**.
 - b. Material on or below Finished Grade: Copper.
 - c. Bonding Jumpers: Braided copper tape, 1 inch (25.4 mm) wide, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.
 - 2. Connectors and Grounding Rods: Listed in UL 467.
 - a. Connectors for Below-Grade Use: Exothermic welded type.
 - b. Grounding Rods: Copper-clad steel, 5/8 by 96 inches (16 by 2440 mm).
- L. Soil Sterilization
- 1. Soil Sterilant: Type approved by authorities having jurisdiction.
 - 2. Polyethylene Sheeting: 6 mils (0.15 mm) thick, black, and serving as soil separation fabric.
 - 3. Stone Ground Cover: 3/4- to 2-inch (19- to 51-mm) crushed stone or washed gravel.



1.3 EXECUTION

A. Examination

1. Examine areas and conditions, with Installer present, for compliance with requirements for a verified survey of property lines and legal boundaries, **as directed**, site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.
 - a. Do not begin installation before final grading is completed unless otherwise permitted by the Owner.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Preparation

1. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet (152 m) or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

C. Installation, General

1. Install chain-link fencing to comply with ASTM F 567 **OR** ASTM F 1916, **as directed**, and more stringent requirements specified.
 - a. Install fencing on established boundary lines inside property line.

D. Chain-Link Fence Installation

1. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.
2. Post Setting: Set posts in concrete **OR** with mechanical anchors **OR** by mechanically driving into soil, **as directed**, at indicated spacing into firm, undisturbed soil.
 - a. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
 - b. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
 - 1) Exposed Concrete: Extend 2 inches (51 mm) above grade or to same elevation as concrete grade beam, **as directed**; shape and smooth to shed water.
 - 2) Concealed Concrete: Top 2 inches (51 mm) below grade as indicated on Drawings to allow covering with surface material.
 - 3) Posts Set into Concrete in Sleeves: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout **OR** anchoring cement, **as directed**, mixed and placed to comply with anchoring material manufacturer's written instructions, and finished sloped to drain water away from post.
 - 4) Posts Set into Voids in Concrete: Form or core drill holes not less than 5 inches (127 mm) deep and 3/4 inch (19 mm) larger than OD of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout **OR** anchoring cement, **as directed**, mixed and placed to comply with anchoring material manufacturer's written instructions, and finished sloped to drain water away from post.
3. Terminal Posts: Locate and install terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more, at any abrupt change in grade, and at intervals not greater than 500 feet (152 m). For runs exceeding 500 feet (152 m), space pull posts an equal distance between corner or end posts.
4. Line Posts: Space line posts uniformly at 96 inches (2440 mm) **OR** 10 feet (3 m), **as directed**, o.c.
5. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.



- a. Locate horizontal braces at midheight of fabric 72 inches (1830 mm) or higher, on fences with top rail and at two-third fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.
6. Barbed Wire Arms: Bolt or rivet to top of post. Angle single arms away from approach side of fence.
7. Tension Wire: Install according to ASTM F 567 and ASTM F 1916, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch- (3.05-mm-) diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches (610 mm) o.c. Install tension wire in locations indicated before stretching fabric. Provide horizontal tension wire at the following locations:
 - a. Extended along top and bottom, **as directed**, of fence fabric. Install top tension wire through post cap loops. Install bottom tension wire within 6 inches (152 mm) of bottom of fabric and tie to each post with not less than same diameter and type of wire.
 - b. Extended along top of barbed wire arms **OR** extended posts, **as directed**, and top of fence fabric for supporting barbed tape.
 - c. As indicated.
8. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended by fencing manufacturer.
9. Bottom Rails: Install and secure to posts with fittings; anchor rail at midspan to concrete footing **OR** continuous grade beam, **as directed**.
10. Chain-Link Fabric: Apply fabric on the approach side of fence, inside of enclosing framework. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.
 - a. Leave 1-1/2 inches (38 mm) **OR** 2 inches (51 mm), **as directed**, between finish grade or surface and bottom selvage unless otherwise indicated.
 - b. Where indicated, bury an 18-inch- (457-mm-) wide, polymer-coated fabric 12 inches (305 mm) into trench; overlap above-grade fabric 6 inches (152 mm) and secure to bottom rail with tie wires. Backfill and compact trench.
 - c. Overlapping Fabric: At or between post or rail according to ASTM F 1916, with wire ties or steel strap method.
11. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches (381 mm) o.c.
12. Tie Wires: Power-fastened or manually fastened ties configured to wrap a full 360 degrees around rail or post and a minimum of one complete diamond of fabric. Twist ends one and one-half machine twists or three full manual twists, and cut off protruding ends to preclude untwisting by hand.
 - a. Maximum Spacing: Tie fabric to line posts at 12 inches (305 mm) o.c. and to braces at 24 inches (610 mm) o.c.
13. Power-Driven Fasteners: Fasten 0.192- or 0.148-inch (4.87- or 3.76-mm) wire fabric with 2- or 1-inch (51- or 25.4-mm) mesh size.
 - a. Fasten fabric to line posts 12 inches (305 mm) o.c. and to braces 24 inches (610 mm) o.c.
14. Fasteners: Install nuts for tension bands and carriage bolts on the side of fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts, **as directed**.
15. Barbed Wire: Install barbed wire uniformly spaced as indicated on Drawings **OR** as directed. Pull wire taut, install securely to extension arms, and secure to end post or terminal arms.
16. Barbed Tape: Comply with ASTM F 1911. Install barbed tape uniformly in configurations indicated and fasten securely to prevent movement or displacement.
17. Ground Barrier Stakes: Stake coils at 10 feet (3 m) o.c., driven to full depth.

E. Gate Installation

1. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-



resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

F. Gate Operator Installation

1. General: Install gate operators according to manufacturer's written instructions, aligned and true to fence line and grade.
2. Excavation for Support Posts **OR** Pedestals **OR** Equipment Bases/Pads, **as directed**: Hand-excavate holes for bases/pads, in firm, undisturbed soil to dimensions and depths and at locations as required by gate operator component manufacturer's written instructions and as indicated.
3. Vehicle Loop Detector System: Cut grooves in pavement and bury **OR** Bury, **as directed**, and seal wire loop according to manufacturer's written instructions. Connect to equipment operated by detector.
4. Comply with NFPA 70 and manufacturer's written instructions for grounding of electric-powered motors, controls, and other devices.

G. Grounding And Bonding

1. Fence Grounding: Install at maximum intervals of 100 feet (30 m) except as follows:
 - a. Gates and Other Fence Openings: Ground fence on each side of opening.
 - 1) Bond metal gates to gate posts.
 - 2) Bond across openings, with and without gates, except openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches (457 mm) below finished grade.
2. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a maximum distance of 150 feet (45 m) on each side of crossing.
3. Fences Enclosing Electrical Power Distribution Equipment: Ground as required by IEEE C2 unless otherwise indicated.
4. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches (152 mm) below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location, including the following:
 - a. Make grounding connections to each barbed wire strand with wire-to-wire connectors designed for this purpose.
 - b. Make grounding connections to each barbed tape coil with connectors designed for this purpose.
5. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.
6. Connections: Make connections to minimize possibility of galvanic action or electrolysis. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
 - a. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
 - b. Make connections with clean, bare metal at points of contact.
 - c. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
 - d. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
 - e. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
7. Bonding to Lightning Protection System: If fence terminates at lightning-protected building or structure, ground the fence and bond the fence grounding conductor to lightning protection down conductor or lightning protection grounding conductor complying with NFPA 780.

H. Soil Sterilization

1. General: Comply with ASTM F 1916.
2. Apply sterilant after completing grounding and other below-grade electrical work along fence line and within zone between double-row chain-link fence installation.



3. Install soil separation fabric continuously between double-row chain-link fence installation, overlapping punctures and joints 6 inches (152 mm).
4. Lay continuous 3-inch- (75-mm-) deep bed of crushed stone or washed gravel over soil separation fabric.
5. Extend soil sterilization 4 feet (1.2 m) **OR** 6 feet (1.8 m), **as directed**, beyond outside and inside of fence.

I. Field Quality Control

1. Fabric Testing: Test fabric tension according to ASTM F 1916.
2. Fence Post Rigidity Testing: Test line posts for rigidity according to ASTM F 1916.
3. Grounding-Resistance Testing: Engage a qualified testing agency to perform tests and inspections.
 - a. Grounding-Resistance Tests: Subject completed grounding system to a megger test at each grounding location. Measure grounding resistance no fewer than two full days after last trace of precipitation, without soil having been moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural grounding resistance. Perform tests by two-point method according to IEEE 81.
 - b. Excessive Grounding Resistance: If resistance to grounding exceeds specified value, notify the Owner promptly. Include recommendations for reducing grounding resistance and a proposal to accomplish recommended work.
 - c. Report: Prepare test reports, certified by testing agency, of grounding resistance at each test location. Include observations of weather and other phenomena that may affect test results.

J. Adjusting

1. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
2. Automatic Gate Operator: Energize circuits to electrical equipment and devices. Adjust operators, controls, safety devices, alarms, **as directed**, and limit switches.
 - a. Hydraulic Operator: Purge operating system, adjust pressure and fluid levels, and check for leaks.
 - b. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - c. Test and adjust controls, alarms, **as directed**, and safeties. Replace damaged and malfunctioning controls and equipment.
3. Lubricate hardware, gate operator, **as directed**, and other moving parts.

K. Demonstration

1. Train the Owner's personnel to adjust, operate, and maintain high-security chain-link fences and gates.

END OF SECTION 32 31 13 00



Task	Specification	Specification Description
32 31 13 00	01 22 16 00	No Specification Required
32 31 13 00	31 13 13 00	Tree Protection And Trimming
32 31 13 00	32 31 11 00	Chain-Link Fences And Gates



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SECTION 32 31 19 00 - ORNAMENTAL METAL FENCES AND GATES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of ornamental metal fences and gates. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Decorative metallic-coated steel tubular picket fences.
 - b. Decorative metallic-coated steel wire fences.
 - c. Decorative metallic-coated steel security fences.
 - d. Decorative steel fences.
 - e. Decorative aluminum fences.
 - f. Swing gates.
 - g. Horizontal-slide gates.
 - h. Gate operators, including controls.

C. Performance Requirements

1. Lightning-Protection System: Maximum grounding-resistance value of 25 ohms under normal dry conditions.

D. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: For gates. Include plans, elevations, sections, details, and attachments to other work.
 - a. Wiring Diagrams: For power, signal, and control wiring.
3. Samples: For each fence material and for each color specified.
 - a. Provide Samples 12 inches (300 mm) in length for linear materials.
 - b. Provide Samples 12 inches (300 mm) square for wire mesh, bar grating, and sheet or plate materials.
4. Welding certificates.
5. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for decorative metallic-coated steel tubular picket fences, including finish, indicating compliance with referenced standard and other specified requirements.
6. Maintenance Data: For gate operators to include in maintenance manuals.

E. Quality Assurance

1. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel **OR** AWS D1.2/D1.2M, "Structural Welding Code - Aluminum", **as directed**.
2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. UL Standard: Provide gate operators that comply with UL 325.
4. Emergency Access Requirements: Comply with requirements of authorities having jurisdiction for automatic gate operators on gates that must provide emergency access.
5. Preinstallation Conference: Conduct conference at Project site.



1.2 PRODUCTS

A. Aluminum

1. Aluminum, General: Provide alloys and tempers with not less than the strength and durability properties of alloy and temper designated in paragraphs below for each aluminum form required.
2. Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T5.
3. Tubing: ASTM B 429, Alloy 6063-T6.
4. Plate and Sheet: ASTM B 209 (ASTM B 209M), Alloy 6061-T6.
5. Die and Hand Forgings: ASTM B 247 (ASTM B 247M), Alloy 6061-T6.
6. Castings: ASTM B 26/B 26M, Alloy A356.0-T6.

B. Steel And Iron

1. Plates, Shapes, and Bars: ASTM A 36/A 36M.
2. Bars (Pickets): Hot-rolled, carbon steel complying with ASTM A 29/A 29M, Grade 1010.
3. Tubing: ASTM A 500, cold formed steel tubing.
4. Bar Grating: NAAMM MBG 531.
 - a. Bars: Hot-rolled steel strip, ASTM A 1011/A 1011M, Commercial Steel, Type B.
 - b. Wire Rods: ASTM A 510 (ASTM A 510M).
5. Uncoated Steel Sheet: Hot-rolled steel sheet, ASTM A 1011/A 1011M, Structural Steel, Grade 45 (Grade 310) or cold-rolled steel sheet, ASTM A 1008/A 1008M, Structural Steel, Grade 50 (Grade 340).
6. Galvanized-Steel Sheet: ASTM A 653/A 653M, structural quality, Grade 50 (Grade 340), with G90 (Z275) **OR** G60 (Z180), **as directed**, coating.
7. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, structural quality, Grade 50 (Grade 340), with AZ60 (AZM180) coating.
8. Castings: Either gray or malleable iron unless otherwise indicated.
 - a. Gray Iron: ASTM A 48/A 48M, Class 30.
 - b. Malleable Iron: ASTM A 47/A 47M.

C. Coating Materials

1. Shop Primers for Steel: Provide primers that comply with Division 09 Section(s) "Exterior Painting" OR "High-performance Coatings", **as directed**.
2. Epoxy Zinc-Rich Primer for Steel: Complying with MPI #20 and compatible with coating specified to be applied over it.
 - a. Use primer with a VOC content of 420 g/L **OR** 400 g/L **OR** 340 g/L, **as directed**, or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Epoxy Primer for Galvanized Steel: Complying with MPI #101 and compatible with coating specified to be applied over it.
 - a. Use primer with a VOC content of 420 g/L **OR** 400 g/L **OR** 300 g/L, **as directed**, or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
4. Epoxy Intermediate Coat: Complying with MPI #77 and compatible with primer and topcoat.
 - a. Use product with a VOC content of 420 g/L **OR** 400 g/L **OR** 250 g/L, **as directed**, or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
5. Polyurethane Topcoat: Complying with MPI #72 and compatible with undercoat.
 - a. Use product with a VOC content of 420 g/L **OR** 400 g/L **OR** 250 g/L, **as directed**, or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Miscellaneous Materials

1. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
 - a. For aluminum, provide type and alloy as recommended by producer of metal to be welded and as required for strength and compatibility in fabricated items.
2. Concrete: Normal-weight, air-entrained, ready-mix concrete complying with requirements in Division 03 Section "Miscellaneous Cast-in-place Applications) Concrete" with a minimum 28-day compressive strength of 3000 psi (20 MPa), 3-inch (75-mm) slump, and 1-inch (25-mm)



- maximum aggregate size or dry, packaged, normal-weight concrete mix complying with ASTM C 387 mixed with potable water according to manufacturer's written instructions.
3. Nonshrink Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107 and specifically recommended by manufacturer for exterior applications.
- E. Grounding Materials
1. Grounding Conductors: Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.
 - a. Material above Finished Grade: Copper **OR** Aluminum, **as directed**.
 - b. Material on or below Finished Grade: Copper.
 - c. Bonding Jumpers: Braided copper tape, 1 inch (25 mm) wide, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.
 2. Grounding Connectors and Grounding Rods: Comply with UL 467.
 - a. Connectors for Below-Grade Use: Exothermic-welded type.
 - b. Grounding Rods: Copper-clad steel.
 - 1) Size: 5/8 by 96 inches (16 by 2440 mm).
- F. Decorative Metallic-Coated Steel Tubular Picket Fences
1. Decorative Metallic-Coated Steel Tubular Picket Fences: Comply with ASTM F 2408, for residential **OR** light industrial (commercial) **OR** industrial, **as directed**, application (class) unless otherwise indicated.
 2. Metallic-Coated Steel Sheet: Galvanized-steel sheet or aluminum-zinc alloy-coated steel sheet.
 3. Interior surface of tubes formed from uncoated steel sheet shall be hot-dip zinc coated same as exterior or coated with zinc-rich thermosetting coating to comply with ASTM F 2408.
 4. Posts:
 - a. End and Corner Posts: Square tubes 2-1/2 by 2-1/2 inches (64 by 64 mm) **OR** 3 by 3 inches (76 by 76 mm), **as directed**, formed from 0.108-inch (2.74-mm) nominal-thickness, metallic-coated steel sheet or formed from 0.105-inch (2.66-mm) nominal-thickness steel sheet and hot-dip galvanized after fabrication.
 - b. Swing Gate Posts:
 - 1) Square tubes 3 by 3 inches (76 by 76 mm) formed from 0.108-inch (2.74-mm) nominal-thickness, metallic-coated steel sheet or formed from 0.105-inch (2.66-mm) nominal-thickness steel sheet and hot-dip galvanized after fabrication.
OR
Square steel tubing 3 by 3 inches (76 by 76 mm) **OR** 4 by 4 inches (102 by 102 mm), **as directed**, with 3/16-inch (4.76-mm) wall thickness, hot-dip galvanized.
 - c. Horizontal-Slide Gate Post, Openings up to 12 Feet (3.7 m): Square steel tubing 3 by 3 inches (76 by 76 mm) **OR** 4 by 4 inches (102 by 102 mm), **as directed**, with 3/16-inch (4.76-mm) wall thickness, hot-dip galvanized.
 - d. Horizontal-Slide Gate Post, Openings Wider Than 12 Feet (3.7 m): Square steel tubing 4 by 4 inches (102 by 102 mm) with 3/16-inch (4.76-mm) wall thickness, hot-dip galvanized.
 - e. Guide Posts for Class 1 Horizontal-Slide Gates:
 - 1) Square tubes 3 by 3 inches (76 by 76 mm) formed from 0.108-inch (2.74-mm) nominal-thickness, metallic-coated steel sheet or formed from 0.105-inch (2.66-mm) nominal-thickness steel sheet and hot-dip galvanized after fabrication; installed adjacent to gate post to permit gate to slide in space between.
OR
Square steel tubing 3 by 3 inches (76 by 76 mm) **OR** 4 by 4 inches (102 by 102 mm), **as directed**, with 3/16-inch (4.76-mm) wall thickness, hot-dip galvanized; installed adjacent to gate post to permit gate to slide in space between.
 5. Post Caps: Formed from steel sheet and hot-dip galvanized after forming **OR** UV-resistant plastic **OR** Aluminum castings **OR** Aluminum castings with round ball finials, **as directed**.
 6. Rails: Square tubes **OR** Double-wall channels, **as directed**.
 - a. Size: 1-1/2 by 1-1/2 inches (38 by 38 mm) **OR** 1-3/4 by 1-3/4 inches (45 by 45 mm), **as directed**.



- b. Metal and Thickness: 0.079-inch (2.01-mm) nominal-thickness, metallic-coated steel sheet or 0.075-inch (1.90-mm) nominal-thickness, uncoated steel sheet, hot-dip galvanized after fabrication.
- 7. Pickets: Square tubes.
 - a. Terminate tops of pickets at top rail for flush top appearance **OR** Extend pickets beyond top rail as indicated and terminate with UV-resistant plastic caps **OR** Extend pickets beyond top rail as indicated and terminate with galvanized-steel caps **OR** Extend pickets beyond top rail as indicated and press flat and trim to produce spear point shape, **as directed**.
 - b. Picket Spacing: 6 inches (152.4 mm) **OR** 4 inches (101.6 mm) **OR** 1-3/4 inches (44 mm), **as directed**, clear, maximum.
- 8. Fasteners: Manufacturer's standard concealed fastening system.
- 9. Fasteners: Manufacturer's standard tamperproof, **as directed**, corrosion-resistant, color-coated fasteners matching fence components, with resilient polymer washers, **as directed**.
- 10. Galvanizing: For components indicated to be galvanized and for which galvanized coating is not specified in ASTM F 2408, hot-dip galvanize to comply with ASTM A 123/A 123M. For hardware items, hot-dip galvanize to comply with ASTM A 153/A 153M.
- 11. Finish: Organic coating complying with requirements in ASTM F 2408 **OR** Powder coating, **as directed**.

G. Decorative Metallic-Coated Steel Wire Fences

- 1. Metallic-Coated Steel Wire: Welded-wire fence fabric, hot-dip galvanized after fabrication. Weight of zinc coating shall be not less than 1.0 oz./sq. ft. (305 g/sq. m).
 - a. Spacing of Vertical Wires: 1-3/4 inches (44 mm) **OR** 2 inches (51 mm) **OR** 3-1/2 inches (89 mm) **OR** 4 inches (102 mm) **OR** As indicated, **as directed**.
 - b. Vertical Wire Size: 0.187 inch (4.76 mm) **OR** 0.192 inch (4.88 mm) **OR** 0.225 inch (5.72 mm) **OR** 0.25 inch (6.35 mm) **OR** 0.262 inch (6.67 mm), **as directed**.
 - c. Spacing of Horizontal Wires: 1-3/4 inches (44 mm) **OR** 2 inches (51 mm) **OR** 4 inches (102 mm) **OR** 8 inches (203 mm) **OR** As indicated, **as directed**.
 - d. Horizontal Wire Size: 0.187 inch (4.76 mm) **OR** 0.192 inch (4.88 mm) **OR** 0.225 inch (5.72 mm) **OR** 0.25 inch (6.35 mm) **OR** 0.312 inch (7.94 mm), **as directed**.
- 2. Metallic-Coated Steel Sheet: Galvanized-steel sheet or aluminum-zinc alloy-coated steel sheet.
- 3. Interior surface of tubes formed from uncoated steel sheet shall be hot-dip zinc coated same as exterior or coated with zinc-rich thermosetting coating to comply with ASTM F 2408.
- 4. Posts:
 - a. Line Posts: Square tubes 2 by 2 inches (50 by 50 mm) **OR** 2-1/2 by 2-1/2 inches (64 by 64 mm) **OR** 3 by 3 inches (76 by 76 mm), **as directed**, formed from 0.064-inch (1.63-mm) **OR** 0.079-inch (2.01-mm) **OR** 0.108-inch (2.74-mm), **as directed**, nominal-thickness, metallic-coated steel sheet or formed from 0.060-inch (1.52-mm) **OR** 0.075-inch (1.90-mm) **OR** 0.105-inch (2.66-mm), **as directed**, nominal-thickness steel sheet and hot-dip galvanized after fabrication.
 - b. End and Corner Posts: Square tubes 2-1/2 by 2-1/2 inches (64 by 64 mm) **OR** 3 by 3 inches (76 by 76 mm), **as directed**, formed from 0.108-inch (2.74-mm) nominal-thickness, metallic-coated steel sheet or formed from 0.105-inch (2.66-mm) nominal-thickness steel sheet and hot-dip galvanized after fabrication.
 - c. Swing Gate Posts:
 - 1) Square tubes 3 by 3 inches (76 by 76 mm) formed from 0.108-inch (2.74-mm) nominal-thickness, metallic-coated steel sheet or formed from 0.105-inch (2.66-mm) nominal-thickness steel sheet and hot-dip galvanized after fabrication.
OR
Square steel tubing 3 by 3 inches (76 by 76 mm) **OR** 4 by 4 inches (102 by 102 mm), **as directed**, with 3/16-inch (4.76-mm) wall thickness, hot-dip galvanized.
 - d. Horizontal-Slide Gate Post, Openings up to 12 Feet (3.7 m): Square steel tubing 3 by 3 inches (76 by 76 mm) **OR** 4 by 4 inches (102 by 102 mm), **as directed**, with 3/16-inch (4.76-mm) wall thickness, hot-dip galvanized.



- e. Horizontal-Slide Gate Post, Openings Wider Than 12 Feet (3.7 m): Square steel tubing 4 by 4 inches (102 by 102 mm) with 3/16-inch (4.76-mm) wall thickness, hot-dip galvanized.
 - f. Guide Posts for Class 1 Horizontal-Slide Gates:
 - 1) Square tubes 3 by 3 inches (76 by 76 mm) formed from 0.108-inch (2.74-mm) nominal-thickness, metallic-coated steel sheet or formed from 0.105-inch (2.66-mm) nominal-thickness steel sheet and hot-dip galvanized after fabrication; installed adjacent to gate post to permit gate to slide in space between.
OR
Square steel tubing 3 by 3 inches (76 by 76 mm) **OR** 4 by 4 inches (102 by 102 mm), **as directed**, with 3/16-inch (4.76-mm) wall thickness, hot-dip galvanized; installed adjacent to gate post to permit gate to slide in space between.
 5. Post Caps: Formed from steel sheet and hot-dip galvanized after forming **OR** UV-resistant plastic **OR** Aluminum castings **OR** Aluminum castings with round ball finials, **as directed**.
 6. Rails: Square tubes.
 - a. Size: 1-3/16 by 1-1/2 inches (30 by 38 mm) **OR** 1-3/8 by 1-1/2 inches (35 by 38 mm) **OR** 1-1/2 by 1-1/2 inches (38 by 38 mm), **as directed**.
 - b. Metal and Thickness: 0.064-inch (1.63-mm) **OR** 0.079-inch (2.01-mm), **as directed**, nominal-thickness, metallic-coated steel sheet or 0.060-inch (1.52-mm) **OR** 0.075-inch (1.90-mm), **as directed**, nominal-thickness, uncoated steel sheet, hot-dip galvanized after fabrication.
 7. Fasteners: Manufacturer's standard tamperproof, **as directed**, corrosion-resistant, color-coated fasteners matching fence components with resilient polymer washers or clips, **as directed**.
 8. Galvanizing: For components indicated to be galvanized and for which galvanized coating is not specified, hot-dip galvanize to comply with ASTM A 123/A 123M. For hardware items, hot-dip galvanize to comply with ASTM A 153/A 153M.
 9. Finish: Organic coating complying with requirements in ASTM F 2408 **OR** Powder coating, **as directed**.
- H. Decorative Metallic-Coated Steel Security Fences
1. Posts: 1-3/4-by-4-inch (45-by-102-mm) double-thickness, I-shaped sections.
 - a. Metal and Thickness: 0.108-inch (2.74-mm) nominal-thickness, metallic-coated steel sheet or 0.105-inch (2.66-mm) nominal-thickness, uncoated steel sheet, hot-dip galvanized after fabrication.
 2. Post Caps: Aluminum castings.
 3. Rails: 2-by-2-1/2-inch (50-by-64-mm) pentagon-shaped box channel designed to shed water and to enclose wire rope reinforcement.
 - a. Metal and Thickness: 0.108-inch (2.74-mm) nominal-thickness, metallic-coated steel sheet or 0.105-inch (2.66-mm) nominal-thickness, uncoated steel sheet, hot-dip galvanized after fabrication.
 - b. Wire Rope Reinforcement: 3/4-inch (19-mm) zinc-coated steel wire rope.
 4. Pickets: 3/4-by-2-3/4-inch (19-by-70-mm) M-shaped pales.
 - a. Metal and Thickness: 0.079-inch (2.01-mm) nominal-thickness, metallic-coated steel sheet or 0.075-inch (1.90-mm) nominal-thickness, uncoated steel sheet, hot-dip galvanized after fabrication.
 - b. Extend pickets beyond top rail as indicated and terminate with rounded edge **OR** cut and split to form three points, **as directed**.
 - c. Picket Spacing: 6 inches (152.4 mm) o.c.
 5. Fasteners: Stainless-steel carriage bolts with tamperproof nuts.
 6. Galvanizing: For components indicated to be galvanized, hot-dip galvanize to comply with ASTM A 123/A 123M unless otherwise indicated. For hardware items, hot-dip galvanize to comply with ASTM A 153/A 153M.
 7. Finish: Powder coating.
- I. Decorative Steel Fences
1. Decorative Steel Fences: Fences made from steel tubing bars, **as directed**, and shapes, hot-dip galvanized, **as directed**.



2. Posts: Square steel tubing.
 - a. Line Posts: 2 by 2 inches (50 by 50 mm) **OR** 2-1/2 by 2-1/2 inches (64 by 64 mm) **OR** 3 by 3 inches (76 by 76 mm), **as directed**, with 1/8-inch (3.2-mm) **OR** 3/16-inch (4.76-mm), **as directed**, wall thickness.
 - b. End and Corner Posts: 2-1/2 by 2-1/2 inches (64 by 64 mm) **OR** 3 by 3 inches (76 by 76 mm) **OR** 4 by 4 inches (102 by 102 mm), **as directed**, with 1/8-inch (3.2-mm) **OR** 3/16-inch (4.76-mm), **as directed**, wall thickness.
 - c. Swing Gate Posts: 3 by 3 inches (76 by 76 mm) **OR** 4 by 4 inches (102 by 102 mm), **as directed**, with 3/16-inch (4.76-mm) wall thickness.
 - d. Horizontal-Slide Gate Post, Openings up to 12 Feet (3.7 m): 3 by 3 inches (76 by 76 mm) **OR** 4 by 4 inches (102 by 102 mm), **as directed**, with 3/16-inch (4.76-mm) wall thickness.
 - e. Horizontal-Slide Gate Post, Openings Wider Than 12 Feet (3.7 m): 4 by 4 inches (102 by 102 mm) with 3/16-inch (4.76-mm) wall thickness.
 - f. Guide Posts for Class 1 Horizontal-Slide Gates: 3 by 3 inches (76 by 76 mm) **OR** 4 by 4 inches (102 by 102 mm), **as directed**, with 3/16-inch (4.76-mm) wall thickness; installed adjacent to gate post to permit gate to slide in space between.
3. Post Caps: Formed from steel sheet **OR** Formed from steel sheet and hot-dip galvanized after forming **OR** Aluminum castings **OR** Aluminum castings with round ball finials, **as directed**.
4. Rails:
 - a. Steel Tube Rails: Square steel tubing 2 by 2 inches (50 by 50 mm) **OR** 2-1/2 by 2-1/2 inches (64 by 64 mm), **as directed**, with 1/8-inch (3.2-mm) wall thickness.
 - b. Steel Channel Rails: Steel channels 2 by 1 inch (50 by 25 mm) **OR** 1-1/2 by 3/4 inch (38 by 19 mm) **OR** 1-1/2 by 1/2 inch (38 by 13 mm), **as directed**.
5. Pickets: 1/2-inch- (13-mm-) square steel bars **OR** 3/4-inch- (19-mm-) square steel bars **OR** Decorative steel bars of pattern and size indicated **OR** 5/8 inch (16 mm) square by 0.065-inch (1.65-mm) steel tubes **OR** 5/8 inch (16 mm) square by 0.083-inch (2.11-mm) steel tubes **OR** 3/4 inch (19 mm) square by 0.065-inch (1.65-mm) steel tubes **OR** 3/4 inch (19 mm) square by 0.083-inch (2.11-mm) steel tubes **OR** 1 inch (25 mm) square by 0.065-inch (1.65-mm) steel tubes **OR** 1 inch (25 mm) square by 0.083-inch (2.11-mm) steel tubes, **as directed**.
 - a. Terminate tops of pickets at top rail for flush top appearance **OR** Extend pickets beyond top rail as indicated and mill ends to pyramid shaped points **OR** Extend pickets beyond top rail as indicated and press flat and trim to produce spear point shape **OR** Extend pickets beyond top rail as indicated and cap with metal spear point finial **OR** Extend pickets beyond top rail as indicated and cap with metal tripoint finial, **as directed**.
 - b. Picket Spacing: 6 inches (152.4 mm) **OR** 4 inches (101.6 mm) **OR** 1-3/4 inches (44 mm), **as directed**, clear, maximum.
 - c. Treillage: Provide iron castings of pattern indicated between each pair of pickets.
6. Infill: Forge-welded steel bar grating.
 - a. Perimeter Bars: Steel flat bars 1 by 1/8 inch (25 by 3.2 mm).
 - b. Vertical Main Bars: Steel flat bars 1 by 1/8 inch (25 by 3.2 mm) **OR** 1-3/16 by 5/32 inch (30 by 4 mm), **as directed**.
 - c. Vertical Main Bar Spacing: 1-21/32 inches (42 mm) **OR** 1-7/8 inches (48 mm) **OR** 2-7/16 inches (62 mm), **as directed**, o.c.
 - d. Horizontal Cross Rods: 3/16-inch- (4.8-mm-) **OR** 1/4-inch- (6.4-mm-), **as directed**, diameter, steel rods.
 - e. Horizontal Cross Rod Spacing: 1-3/4 inches (45 mm) **OR** 2-19/32 inches (66 mm) **OR** 5-3/16 inches (132 mm), **as directed**, o.c.
7. Infill: Custom design as indicated on Drawings.
 - a. Bars: 1/2-inch- (12.7 -mm-) square steel bars **OR** 3/4-inch- (19-mm-) square steel bars **OR** 1/2-inch- (12.7 -mm-) diameter, round steel bars **OR** 3/4-inch- (19-mm-) diameter, round steel bars **OR** 1-by-1/8-inch (25-by-3.2-mm) steel flat bars **OR** 1-by-1/4-inch (25-by-6.4-mm) steel flat bars **OR** 1-by-1/2-inch (25-by-12.7 -mm) steel flat bars, **as directed**, unless otherwise indicated.



- b. Square Tubes: Square steel tubing 2 by 2 inches (50 by 50 mm) **OR** 2-1/2 by 2-1/2 inches (64 by 64 mm), **as directed**, with 1/8-inch (3.2-mm) wall thickness unless otherwise indicated.
 - c. Round Tubes: 1-inch- (25-mm-) **OR** 1-1/2-inch- (38-mm-) **OR** 2-inch- (50-mm-) **OR** 2-1/2-inch- (64-mm-), **as directed**, diameter, round steel tubing with 1/8-inch (3.2-mm) wall thickness unless otherwise indicated.
 - d. Steel Plate: 1/8 inch (3.2 mm) **OR** 3/16 inch (4.8 mm) **OR** 1/4 inch (6.4 mm), **as directed**, thick unless otherwise indicated.
 - e. Perforated Metal Sheet: Uncoated steel sheet, perforated as indicated, 0.060-inch (1.52-mm) **OR** 0.075-inch (1.90-mm) **OR** 0.105-inch (2.66-mm), **as directed**, nominal thickness.
 8. Fasteners: Stainless-steel carriage bolts and tamperproof, **as directed**, nuts.
 9. Fabrication:
 - a. Assemble fences into sections by welding pickets to rails.
 - 1) Fabricate sections with clips welded to rails for fastening to posts in field.
 - 2) Drill posts and clips for fasteners before finishing to maximum extent possible.
 - b. Fabricate bar grating infill into sections of size indicated.
 - 1) Fabricate rails with clips welded to rails for fastening to posts in field.
 - 2) Drill posts, clips, **as directed**, and bar grating for fasteners before finishing to maximum extent possible.
 10. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes okay **OR** Finish #3 - partially dressed weld with splatter removed **OR** Finish #4 - good-quality, uniform undressed weld with minimal splatter, **as directed**.
 11. Galvanizing: For items other than hardware that are indicated to be galvanized, hot-dip galvanize to comply with ASTM A 123/A 123M. For hardware items, hot-dip galvanize to comply with ASTM A 153/A 153M.
 - a. Hot-dip galvanize posts and rails, **as directed**.
 - b. Hot-dip galvanize rail and picket assemblies after fabrication.
 - c. Hot-dip galvanize bar grating infill after fabrication.
 - d. Hot-dip galvanize custom-design rail and infill assemblies after fabrication.
 12. Finish for Bar Grating Infill: Powder coating.
 13. Finish for Steel Items Other than Bar Grating Infill: Primed **OR** Shop painted **OR** High-performance coating, **as directed**.
 14. Finish for Metallic-Coated Steel Items Other than Bar Grating Infill: High-performance coating **OR** Galvanized finish, **as directed**.
- J. Decorative Aluminum Fences
1. Decorative Aluminum Fences: Fences made from aluminum extrusions.
 2. Posts: Square extruded tubes.
 - a. Line Posts: 2 by 2 inches (50 by 50 mm) **OR** 2-1/2 by 2-1/2 inches (64 by 64 mm) **OR** 3 by 3 inches (76 by 76 mm), **as directed**, with 0.062-inch (1.57-mm) **OR** 0.080-inch (2.03-mm) **OR** 0.093-inch (2.36-mm) **OR** 0.100-inch (2.54-mm) **OR** 0.125-inch (3.18-mm), **as directed**, wall thickness.
 - b. End and Corner Posts: 2 by 2 inches (50 by 50 mm) **OR** 2-1/2 by 2-1/2 inches (64 by 64 mm) **OR** 3 by 3 inches (76 by 76 mm), **as directed**, with 0.062-inch (1.57-mm) **OR** 0.080-inch (2.03-mm) **OR** 0.093-inch (2.36-mm) **OR** 0.100-inch (2.54-mm) **OR** 0.125-inch (3.18-mm), **as directed**, wall thickness.
 - c. Swing Gate Posts: 2-1/2 by 2-1/2 inches (64 by 64 mm) **OR** 3 by 3 inches (76 by 76 mm) **OR** 4 by 4 inches (102 by 102 mm), **as directed**, with 0.125-inch (3.18-mm) **OR** 0.250-inch (6.35-mm), **as directed**, wall thickness.
 - d. Horizontal-Slide Gate Post, Openings up to 12 Feet (3.7 m): 2-1/2 by 2-1/2 inches (64 by 64 mm) **OR** 3 by 3 inches (76 by 76 mm) **OR** 4 by 4 inches (102 by 102 mm), **as directed**, with 0.125-inch (3.18-mm) **OR** 0.250-inch (6.35-mm), **as directed**, wall thickness.
 - e. Horizontal-Slide Gate Post, Openings Wider Than 12 Feet (3.7 m): 3 by 3 inches (76 by 76 mm) **OR** 4 by 4 inches (102 by 102 mm) **OR** 6 by 6 inches (152 by 152 mm), **as directed**, with 0.125-inch (3.18-mm) **OR** 0.250-inch (6.35-mm), **as directed**, wall thickness.



- f. Guide Posts for Class 1 Horizontal-Slide Gates: 2 by 2 inches (50 by 50 mm) **OR** 2-1/2 by 2-1/2 inches (64 by 64 mm) **OR** 3 by 3 inches (76 by 76 mm), **as directed**, with 0.062-inch (1.57-mm) **OR** 0.093-inch (2.36-mm) **OR** 0.125-inch (3.18-mm), **as directed**, wall thickness; installed adjacent to gate post to permit gate to slide in space between.
 3. Post Caps: Aluminum castings that cover entire top of posts **OR** project at least 1/4 inch (6 mm) beyond posts, **as directed**, with round ball finial, **as directed**.
 4. Rails: Extruded-aluminum channels, 1-1/2 by 1-1/2 inches (38 by 38 mm), with 0.100-inch- (2.54-mm-) thick sidewalls and 0.070-inch- (1.78-mm-) thick top **OR** 1 by 1-1/2 inches (25 by 38 mm), with 0.082-inch- (2.08-mm-) thick sidewalls and 0.055-inch- (1.40-mm-) thick top **OR** 1-1/4 by 1-1/4 inches (32 by 32 mm), with 0.078-inch- (1.98-mm-) thick sidewalls and 0.062-inch- (1.57-mm-) thick top **OR** 1 by 1 inch (25 by 25 mm), with 0.080-inch- (2.03-mm-) thick sidewalls and 0.055-inch- (1.40-mm-) thick top **OR** 1 by 1 inch (25 by 25 mm), with 0.078-inch- (1.98-mm-) thick sidewalls and 0.062-inch- (1.57-mm-) thick top, **as directed**.
 5. Pickets: Extruded-aluminum tubes, 1 inch (25 mm) square, with 0.062-inch (1.57-mm) wall thickness **OR** 1 inch (25 mm) square, with 0.060-inch (1.52-mm) wall thickness **OR** 3/4 inch (19 mm) square, with 0.050-inch (1.27-mm) wall thickness **OR** 1 by 5/8 inch (25 by 16 mm), with 0.050-inch (1.27-mm) wall thickness **OR** 5/8 inch (16 mm) square, with 0.050-inch (1.27-mm) wall thickness, **as directed**.
 - a. Terminate tops of pickets at top rail for flush top appearance **OR** Extend pickets beyond top rail as indicated and terminate with UV-resistant plastic caps **OR** Extend pickets beyond top rail as indicated and terminate with cast-aluminum caps **OR** Extend pickets beyond top rail as indicated and press flat and trim to produce spear point shape **OR** Extend pickets beyond top rail as indicated and terminate with cast-aluminum spear point finial **OR** Extend pickets beyond top rail as indicated and terminate with cast-aluminum tripoint finial, **as directed**.
 - b. Picket Spacing: 6 inches (152.4 mm) **OR** 4 inches (101.6 mm) **OR** 1-3/4 inches (44 mm), **as directed**, clear, maximum.
 6. Fasteners:
 - a. Manufacturer's standard concealed fastening system. **OR** Manufacturer's standard tamperproof, **as directed**, corrosion-resistant, color-coated fasteners matching fence components with resilient polymer washers, **as directed**.
 7. Fabrication: Assemble fences into sections by welding **OR** fastening, **as directed**, pickets to rails.
 - a. Fabricate sections with clips welded to rails for fastening to posts in field.
 - b. Drill clips for fasteners before finishing.
 8. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes okay **OR** Finish #3 - partially dressed weld with splatter removed **OR** Finish #4 - good-quality, uniform undressed weld with minimal splatter, **as directed**.
 9. Finish: Baked enamel or powder coating.
- K. Swing Gates
1. Gate Configuration: Single leaf **OR** Double leaf, **unless directed otherwise**.
 2. Gate Frame Height: 72 inches (1830 mm), **unless directed otherwise**.
 3. Gate Opening Width: 36 inches (914 mm), **unless directed otherwise**.
 4. Galvanized-Steel Frames and Bracing: Fabricate members from square tubes 1-1/2 by 1-1/2 inches (38 by 38 mm) **OR** 1-3/4 by 1-3/4 inches (45 by 45 mm) **OR** 2 by 2 inches (50 by 50 mm) **OR** 2-1/2 by 2-1/2 inches (64 by 64 mm), **as directed**, formed from 0.108-inch (2.74-mm) nominal-thickness, metallic-coated steel sheet or formed from 0.105-inch (2.66-mm) nominal-thickness steel sheet and hot-dip galvanized after fabrication.
 5. Steel Frames and Bracing: Fabricate members from square steel tubing 1-1/2 by 1-1/2 inches (38 by 38 mm) **OR** 2 by 2 inches (50 by 50 mm) **OR** 2-1/2 by 2-1/2 inches (64 by 64 mm), **as directed**, with 1/8-inch (3.2-mm) wall thickness. Hot-dip galvanize frames after fabrication, **as directed**.



6. Aluminum Frames and Bracing: Fabricate members from square extruded-aluminum tubes 1-1/2 by 1-1/2 inches (38 by 38 mm) **OR** 2 by 2 inches (50 by 50 mm) **OR** 2-1/2 by 2-1/2 inches (64 by 64 mm), **as directed**, with 0.100-inch (2.54-mm) **OR** 0.125-inch (3.18-mm) **OR** 0.140-inch (3.56-mm) **OR** 0.154-inch (3.91-mm), **as directed**, wall thickness.
7. Frame Corner Construction: Welded or assembled with corner fittings and 5/16-inch- (7.9-mm-) diameter, adjustable truss rods for panels 5 feet (1.52 m) wide or wider.
8. Additional Rails: Provide as indicated, complying with requirements for fence rails.
9. Infill: Comply with requirements for adjacent fence.
10. Picket Size, Configuration, and Spacing: Comply with requirements for adjacent fence.
 - a. Treillage: Provide iron castings of pattern indicated between each pair of pickets. Finish as specified for adjacent fence **OR** gates, **as directed**.
11. Hardware: Latches permitting operation from both sides of gate, hinges, and keepers for each gate leaf more than 5 feet (1.52 m) wide. Provide center gate stops and cane bolts for pairs of gates. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate, **as directed**.
12. Spring Hinges: BHMA A156.17, Grade 1, suitable for exterior use.
 - a. Function: 320 - Gate spring pivot hinge. Adjustable tension **OR** 321 - Gate spring pivot hinge. Fixed tension, **as directed**.
 - b. Material: Malleable iron.
13. Hinges: BHMA A156.1, Grade 1, suitable for exterior use.
 - a. Function: 39 - Full surface, triple weight, antifriction bearing.
 - b. Material: Wrought steel, forged steel, cast steel, or malleable iron.
14. Rim Locks: BHMA A156.5, Grade 1, suitable for exterior use.
 - a. Function: 621 - Latchbolt by key from outside and by turn from inside. Latchbolt is held retracted by device from inside **OR** 622 - Deadbolt by key from outside and by turn from inside **OR** 629 - Deadlocking latchbolt by key from outside and by turn from inside **OR** 626 - Interlocking deadbolt operated by key from either side **OR** 627 - Interlocking deadbolt operated by key from outside and by turn from inside, **as directed**.
 - b. Material: Cast, forged, or extruded brass or bronze.
 - c. Mounting Plate: Configuration necessary for mounting locks. Fabricate from 1/8-inch- (3.2-mm-) thick, steel **OR** aluminum, **as directed**, plate.
15. Mortise Locks: BHMA A156.13, Grade 1, suitable for exterior use.
 - a. Function: F06 - Holdback lock **OR** F07 - Storeroom or closet lock **OR** F09 - Apartment, exit, or public toilet lock **OR** F16 - Double-cylinder dead lock **OR** F17 - Dead lock, **as directed**.
 - b. Material: Brass or bronze.
 - c. Levers: Cast, forged, or extruded brass or bronze.
 - d. Mounting Box: Configuration necessary to enclose locks. Fabricate from 1/8-inch- (3.2-mm-) thick, steel **OR** aluminum, **as directed**, plate.
16. Electric Strikes: BHMA A156.31, Grade 1, of configuration required for use with lock specified, fail safe **OR** fail secure, **as directed**, and suitable for exterior use.
 - a. Mounting Plate: Configuration necessary for mounting electric strikes. Fabricate from 1/8-inch- (3.2-mm-) thick, steel **OR** aluminum, **as directed**, plate.
 - b. Mounting: Mortise into post.
17. Exit Hardware: BHMA A156.3, Grade 1, Type 1 (rim exit device), with push pad actuating bar, suitable for exterior use.
 - a. Function: 01 - Exit only, no trim or blank escutcheon **OR** 04 - Entrance by trim when latch bolt is released by key or set in a retracted position by key **OR** 08 - Entrance by lever. Key locks or unlocks lever **OR** 09 - Entrance by lever only when released by key. Key removable only when locked, **as directed**.
 - b. Mounting Channel: Bent-plate channel formed from 1/8-inch- (3.2-mm-) thick, steel **OR** aluminum, **as directed**, plate. Channel spans gate frame. Exit device is mounted on channel web, recessed between flanges, with flanges extending 1/8 inch (3.2 mm) beyond push pad surface.
18. Cane Bolts: Provide for inactive leaf of pairs of gates. Fabricated from 1/2-inch- (12.7 -mm-) **OR** 3/4-inch- (19-mm-), **as directed**, diameter, round steel bars, hot-dip galvanized after fabrication.



Finish to match gates. Provide galvanized-steel pipe strikes to receive cane bolts in closed position **OR** both open and closed positions, **as directed**.

19. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes okay **OR** Finish #3 - partially dressed weld with splatter removed **OR** Finish #4 - good-quality, uniform undressed weld with minimal splatter, **as directed**.
20. Galvanizing: For items other than hardware that are indicated to be galvanized, hot-dip galvanize to comply with ASTM A 123/A 123M unless otherwise indicated. For hardware items, hot-dip galvanize to comply with ASTM A 153/A 153M.
21. Metallic-Coated Steel Finish: High-performance coating **OR** Galvanized finish, **as directed**.
22. Steel Finish: Primed **OR** Shop painted **OR** High-performance coating, **as directed**.
23. Aluminum Finish: Baked enamel or powder coating.

L. Horizontal-Slide Gates

1. Gate Configuration: Single leaf **OR** Double leaf **OR** As indicated, **as directed**.
 - a. Type:
 - 1) Overhead slide.

OR

Cantilever slide, with external **OR** internal, **as directed**, roller assemblies.
2. Gate Frame Height: 72 inches (1830 mm), **unless directed otherwise**.
3. Gate Opening Width: 36 inches (914 mm), **unless directed otherwise**.
4. Galvanized-Steel Frames and Bracing: Fabricate members from square tubing.
 - a. Frame Members: Square tubes 1-1/2 by 1-1/2 inches (38 by 38 mm) **OR** 1-3/4 by 1-3/4 inches (45 by 45 mm) **OR** 2 by 2 inches (50 by 50 mm) **OR** 2-1/2 by 2-1/2 inches (64 by 64 mm), **as directed**, formed from 0.108-inch (2.74-mm) nominal-thickness, metallic-coated steel sheet or formed from 0.105-inch (2.66-mm) nominal-thickness steel sheet and hot-dip galvanized after fabrication.
 - b. Bracing Members: Square tubes 1-1/2 by 1-1/2 inches (38 by 38 mm) **OR** 1-3/4 by 1-3/4 inches (45 by 45 mm) **OR** 2 by 2 inches (50 by 50 mm) **OR** 2-1/2 by 2-1/2 inches (64 by 64 mm), **as directed**, formed from 0.108-inch (2.74-mm) nominal-thickness, metallic-coated steel sheet or formed from 0.105-inch (2.66-mm) nominal-thickness steel sheet and hot-dip galvanized after fabrication.
5. Steel Frames and Bracing: Fabricate members from square tubing. Hot-dip galvanize frames after fabrication, **as directed**.
 - a. Frame Members: Steel tubing 1-1/2 by 1-1/2 inches (38 by 38 mm) **OR** 2 by 2 inches (50 by 50 mm) **OR** 2-1/2 by 2-1/2 inches (64 by 64 mm), **as directed**, with 1/8-inch (3.2-mm) wall thickness.
 - b. Bracing Members: Steel tubing 1-1/2 by 1-1/2 inches (38 by 38 mm) **OR** 2 by 2 inches (50 by 50 mm) **OR** 2-1/2 by 2-1/2 inches (64 by 64 mm), **as directed**, with 1/8-inch (3.2-mm) wall thickness.
6. Aluminum Frames and Bracing: Fabricate members from square tubing.
 - a. Frame Members: Extruded-aluminum tubes 1-1/2 by 1-1/2 inches (38 by 38 mm) **OR** 2 by 2 inches (50 by 50 mm) **OR** 2-1/2 by 2-1/2 inches (64 by 64 mm), **as directed**, with 0.100-inch (2.54-mm) **OR** 0.125-inch (3.18-mm) **OR** 0.140-inch (3.56-mm) **OR** 0.154-inch (3.91-mm), **as directed**, wall thickness.
 - b. Bracing Members: Extruded-aluminum tubes 1-1/2 by 1-1/2 inches (38 by 38 mm) **OR** 2 by 2 inches (50 by 50 mm) **OR** 2-1/2 by 2-1/2 inches (64 by 64 mm), **as directed**, with 0.100-inch (2.54-mm) **OR** 0.125-inch (3.18-mm) **OR** 0.140-inch (3.56-mm) **OR** 0.154-inch (3.91-mm), **as directed**, wall thickness.
7. Frame Corner Construction:
 - a. Welded frame with panels assembled with bolted or riveted corner fittings and 5/16-inch- (7.9-mm-) diameter, adjustable truss rods for panels 5 feet (1.52 m) wide or wider.
 - b. Overhead Slide Gates: Welded or assembled with corner fittings including 5/16-inch- (7.9-mm-) diameter, adjustable truss rods for panels 5 feet (1.52 m) wide or wider.
8. Additional Rails: Provide as indicated, complying with requirements for fence rails.
9. Infill: Comply with requirements for adjacent fence.



10. Picket Size, Configuration, and Spacing: Comply with requirements for adjacent fence.
 - a. Treillage: Provide iron castings of pattern indicated between each pair of pickets. Finish as specified for adjacent fence **OR** gates, **as directed**.
11. Overhead Track Assembly: Manufacturer's standard track, with overhead framing supports, bracing, and accessories, engineered to support size, weight, width, operation, and design of gate and roller assemblies.
12. Hardware: Latches permitting operation from both sides of gate, locking devices, hangers, roller assemblies, and stops fabricated from galvanized steel **OR** galvanized malleable iron **OR** mill-finished, Grade 319 aluminum-alloy casting with stainless-steel fasteners, **as directed**. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate, **as directed**.
13. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes okay **OR** Finish #3 - partially dressed weld with splatter removed **OR** Finish #4 - good-quality, uniform undressed weld with minimal splatter, **as directed**.
14. Galvanizing: For items other than hardware that are indicated to be galvanized, hot-dip galvanize to comply with ASTM A 123/A 123M unless otherwise indicated. For hardware items, hot-dip galvanize to comply with ASTM A 153/A 153M.
15. Metallic-Coated Steel Finish: High-performance coating **OR** Galvanized finish, **as directed**.
16. Steel Finish: Primed **OR** Shop painted **OR** High-performance coating, **as directed**.
17. Aluminum Finish: Baked enamel or powder coating.

M. Gate Operators

1. General: Provide factory-assembled automatic operating system designed for gate size, type, weight, and operation frequency. Provide operation control system with characteristics suitable for Project conditions, with remote-control stations, safety devices, and weatherproof enclosures; coordinate electrical requirements with building electrical system.
 - a. Provide operator designed so motor may be removed without disturbing limit-switch adjustment and without affecting auxiliary emergency operator.
 - b. Provide operator with UL approval **OR** UL-approved components, **as directed**.
 - c. Provide electronic components with built-in troubleshooting diagnostic feature.
 - d. Provide unit designed and wired for both right-hand/left-hand opening, permitting universal installation.
 - e. Provide controllers, electrical devices, and wiring that comply with requirements specified in Division 22.
2. Motors: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 11 Section "Common Motor Requirements For Equipment".
 - a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - b. Horsepower: Not less than 1/4 **OR** 1/3 **OR** 1/2 **OR** 3/4, **as directed**.
 - c. Enclosure: Open dripproof **OR** Totally enclosed **OR** Manufacturer's standard, **as directed**.
 - d. Duty: Continuous duty at ambient temperature of 105 deg F (40 deg C) and at altitude of 3300 feet (1005 m) above sea level.
 - e. Service Factor: 1.15 for open dripproof motors; 1.0 for totally enclosed motors.
 - f. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 22.
3. Gate Operators: Gate **OR** Concrete base **OR** Post **OR** In-ground, **as directed**, mounted and as follows:
 - a. Hydraulic Swing **OR** Slide, **as directed**, Gate Operators:
 - 1) Duty: Light **OR** Medium **OR** Heavy, **as directed**, duty, residential **OR** commercial/industrial, **as directed**.
 - 2) Gate Speed: Minimum 45 feet (13.7 m) **OR** 60 feet (18.2 m), **as directed**, per minute.
 - 3) Maximum Gate Weight: Not to exceed operator manufacturer's recommendations.
 - 4) Frequency of Use: 10 cycles per hour **OR** 25 cycles per hour **OR** Continuous duty, **as directed**.



- 5) Locking: Hydraulic in both directions.
- 6) Heater: Manufacturer's standard track and roller heater with thermostatic control, as directed.
- 7) Operating Type: Crank arm **OR** Wheel and rail drive **OR** Roller chain, **as directed**, with manual release, **as directed**.
- b. Mechanical Swing **OR** Slide, **as directed**, Gate Operators:
 - 1) Duty: Light **OR** Medium **OR** Heavy, **as directed**, duty, residential **OR** commercial/industrial, **as directed**.
 - 2) Gate Speed: Minimum 45 feet (13.7 m) per minute **OR** 60 feet (18.2 m) per minute **OR** variable speed, **as directed**.
 - 3) Maximum Gate Weight: 600 lb (272 kg) **OR** 800 lb (363 kg), **as directed**.
 - 4) Frequency of Use: 10 cycles per hour **OR** 25 cycles per hour **OR** 60 cycles per hour **OR** Continuous duty, **as directed**.
 - 5) Operating Type: Crank arm **OR** Wheel and rail drive **OR** Roller chain, **as directed**, with manual release, **as directed**.
 - 6) Drive Type:
 - a) Enclosed worm gear and chain-and-sprocket, **as directed**, reducers, roller-chain drive.
OR
V-belt and worm gear **OR** chain-and-sprocket, **as directed**, reducers, roller-chain drive.
4. Remote Controls: Electric controls separated from gate and motor and drive mechanism, with NEMA ICS 6, Type 1 **OR** NEMA ICS 6, Type 4, **as directed**, enclosure for surface **OR** recessed or flush, **as directed**, concrete base **OR** pedestal, **as directed**, mounting, and with space for additional optional equipment. Provide the following remote-control device(s):
 - a. Control Station:
 - 1) Keyed, two-position **OR** three-position, **as directed**, switch with open, stop, **as directed**, and close function; located remotely from gate. Provide two keys per station.
OR
Momentary-contact, single-button-operated **OR** three-button-operated, **as directed**, with open, stop, **as directed**, and close function; located remotely from gate. Key switch to lock out open and close buttons, **as directed**.
 - b. Card Reader: Functions only when authorized card is presented. Programmable, multiple-code **OR** single-code, **as directed**, system, permitting four different access time periods, **as directed**, face-lighted unit fully visible at night, **as directed**.
 - 1) Reader Type: Touch plate **OR** Swipe **OR** Insertion **OR** Proximity, **as directed**.
 - 2) Features: Timed antipassback **OR** Limited-time usage **OR** Capable of monitoring and auditing gate activity, **as directed**.
 - c. Digital Keypad Entry Unit: Multiple-programmable **OR** Multiple-code, **as directed**, capability of not less than 5 **OR** 500 **OR** 2500, **as directed**, possible individual codes, consisting of 1- to 7 **OR** 4 **OR** 5, **as directed**,-digit codes, and permitting 4 different access time periods, **as directed**.
 - 1) Features: Timed antipassback **OR** Limited-time usage **OR** Capable of monitoring and auditing gate activity, **as directed**.
 - 2) Face-lighted unit with metal-keyed **OR** keyless-membrane, **as directed**, keypad fully visible at night.
 - d. Radio Control: Digital system consisting of code-compatible universal receiver for each gate, located where indicated, with remote antenna with coaxial cable and mounting brackets designed to operate gates. Provide 1 **OR** 2, **as directed**, programmable transmitter(s) with multiple-code capability permitting validating or voiding of not less than 1000 **OR** 10,000, **as directed**, codes per channel configured for the following functions:
 - 1) Transmitters: Single **OR** Three, **as directed**,-button operated, with open and close, **as directed**, function.



- 2) Channel Settings: Two **OR** Three **OR** Four, **as directed**, independent channel settings controlling separate receivers for operating more than one gate from each transmitter.
 - e. Telephone Entry System: Hands-free, voice-communication system for connection to building telephone system with digital-entry code activation of gate operator and auxiliary keypad entry, **as directed**.
 - 1) Residential System: Designed to be wired to same line with telephone.
 - 2) Multiunit System: Designed to be wired to a dedicated telephone line, with capacity to access 20 **OR** 100, **as directed**, telephones, and with electronic directory, **as directed**.
 - f. Vehicle Loop Detector: System including automatic closing timer with adjustable time delay before closing, timer cutoff switch, **as directed**, and loop detector designed to open and close gate **OR** hold gate open until traffic clears **OR** reverse gate, **as directed**. Provide electronic detector with adjustable detection patterns, adjustable sensitivity and frequency settings, and panel indicator light designed to detect presence or transit of a vehicle over an embedded loop of wire and to emit a signal activating the gate operator. Provide number of loops consisting of multiple strands of wire, number of turns, loop size, and method of placement at location shown on Drawings, as recommended in writing by detection system manufacturer for function indicated.
 - 1) Loop:
 - a) Wire, in size indicated for field assembly, for pave-over **OR** saw cut with epoxy-grouted, **as directed**, installation.
OR
Loop: Factory preformed in size indicated; style for pave-over **OR** saw cut with epoxy-grouted, **as directed**, installation.
 - g. Vehicle Presence Detector: System including automatic closing timer with adjustable time delay before closing, timer cutoff switch, **as directed**, and presence detector designed to open and close gate **OR** hold gate open until traffic clears **OR** reverse gate, **as directed**. Provide retroreflective **OR** emitter/receiver, **as directed**, detector with adjustable detection zone pattern and sensitivity, designed to detect the presence or transit of a vehicle in gate pathway when infrared beam in zone pattern is interrupted, and to emit a signal activating the gate operator.
5. Obstruction Detection Devices: Provide each motorized gate with automatic safety sensor(s). Activation of sensor(s) causes operator to immediately function as follows:
 - a. Action:
 - 1) Reverse gate in both opening and closing cycles and hold until clear of obstruction.
OR
Stop gate in opening cycle and reverse gate in closing cycle and hold until clear of obstruction.
 - b. Internal Sensor: Built-in torque or current monitor senses gate is obstructed.
 - c. Sensor Edge: Contact-pressure-sensitive safety edge, profile, and sensitivity designed for type of gate and component indicated, in locations as follows. Connect to control circuit using take-up cable reel **OR** self-coiling cable **OR** gate edge transmitter and operator receiver system, **as directed**.
 - 1) Along entire gate leaf leading edge **OR** Along entire gate leaf trailing edge **OR** Across entire gate leaf bottom edge **OR** Along entire length of gate posts **OR** Along entire length of gate guide posts **OR** Where indicated on Drawings, **as directed**.
 - d. Photoelectric/Infrared Sensor System: Designed to detect an obstruction in gate's path when infrared beam in the zone pattern is interrupted.
 6. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop gate at fully retracted and fully extended positions.
 7. Emergency Release Mechanism: Quick-disconnect release of operator drive system of the following type of mechanism, permitting manual operation if operator fails. Design system so control-circuit power is disconnected during manual operation.
 - a. Type:



- 1) Integral fail-safe release, allowing gate to be pushed open without mechanical devices, keys, cranks, or special knowledge.

OR

Mechanical device, key, or crank-activated release.

8. Operating Features:

- a. Digital Microprocessor Control: Electronic programmable means for setting, changing, and adjusting control features with capability for monitoring and auditing gate activity, **as directed**. Provide unit that is isolated from voltage spikes and surges.
- b. System Integration: With controlling circuit board capable of accepting any type of input from external devices.
- c. Master/Slave Capability: Control stations designed and wired for gate pair operation.
- d. Automatic Closing Timer: With adjustable time delay before closing and timer cutoff switch, **as directed**.
- e. Open Override Circuit: Designed to override closing commands.
- f. Reversal Time Delay: Designed to protect gate system from shock load on reversal in both directions.
- g. Maximum Run Timer: Designed to prevent damage to gate system by shutting down system if normal time to open gate is exceeded.
- h. Clock Timer: 24-hour **OR** Seven-day, **as directed**, programmable for regular events.

9. Accessories:

- a. Warning Module: Audio **OR** Visual, **as directed**, ADA/ABA-compliant, constant-light **OR** strobe-light, **as directed**, alarm sounding three to five seconds in advance of gate operation and continuing until gate stops moving.
- b. Battery Backup System: Battery-powered drive and access-control system, independent of primary drive system:
 - 1) Fail Safe: Gate opens and remains open until power is restored.
 - 2) Fail Secure: Gate cycles on battery power, then fail safe when battery is discharged.
- c. External electric-powered solenoid **OR** magnetic, **as directed**, lock with delay timer allowing time for lock to release before gate operates.
- d. Fire **OR** Postal, **as directed**, box.
- e. Fire strobe **OR** siren, **as directed**, alarm.
- f. Intercom System: as directed by the Owner.
- g. Instructional, Safety, and Warning Labels and Signs: According to UL 325 **OR** Manufacturer's standard for components and features specified **OR** As indicated on Drawings, **as directed**.

N. Aluminum Finishes

1. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 2 mils (0.05 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - a. Color and Gloss: As selected from manufacturer's full range.

O. Steel Finishes

1. Surface Preparation: Clean surfaces according to SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning" **OR** SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning", **as directed**.
 - a. After cleaning, apply a conversion coating suited to the organic coating to be applied over it.
2. Powder Coating: Immediately after cleaning, apply 2-coat finish consisting of epoxy primer and TGIC polyester topcoat, with a minimum total dry film thickness of not less than 8 mils (0.20 mm). Comply with coating manufacturer's written instructions.
 - a. Color and Gloss: As selected from manufacturer's full range.
3. Primer Application: Apply zinc-rich epoxy primer immediately after cleaning, to provide a minimum dry film thickness of 2 mils (0.05 mm) per applied coat, to surfaces that will be exposed after assembly and installation, and to concealed surfaces.



4. Shop-Painted Finish: Comply with Division 09 Section(s) "Exterior Painting" OR "High-performance Coatings", **as directed**.
5. High-Performance Coating: Apply epoxy intermediate and polyurethane topcoats to prime-coated surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Apply at spreading rates recommended by coating manufacturer.
 - a. Match approved Samples for color, texture, and coverage. Remove and refinish, or recoat work that does not comply with specified requirements.

P. Metallic-Coated Steel Finishes

1. Galvanized Finish: Clean welds, mechanical connections, and abraded areas and repair galvanizing to comply with ASTM A 780.
2. Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a zinc-phosphate, **as directed**, conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas and repair galvanizing to comply with ASTM A 780.
3. Powder Coating: Immediately after cleaning and pretreating, apply TGIC polyester powder-coat finish, with a minimum dry film thickness of 2 mils (0.05 mm).
 - a. Color and Gloss: As selected from manufacturer's full range.
4. Powder Coating: Immediately after cleaning and pretreating, apply 2-coat finish consisting of zinc-rich, **as directed**, epoxy prime coat and TGIC polyester topcoat, with a minimum dry film thickness of 2 mils (0.05 mm) for topcoat. Comply with coating manufacturer's written instructions to achieve a minimum total dry film thickness of 4 mils (0.10 mm).
 - a. Color and Gloss: As selected from manufacturer's full range.
 - b. Comply with surface finish testing requirements in ASTM F 2408 except change corrosion-resistance requirement to 3000 hours without failure, **as directed**.
5. High-Performance Coating: Apply epoxy primer, epoxy intermediate coat, and polyurethane topcoat to prepared surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Apply at spreading rates recommended by coating manufacturer.
 - a. Match approved Samples for color, texture, and coverage. Remove and refinish, or recoat work that does not comply with specified requirements.

1.3 EXECUTION

A. Examination

1. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, construction layout, and other conditions affecting performance of the Work.
2. Do not begin installation before final grading is completed unless otherwise permitted by the Owner.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Preparation

1. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet (152.5 m) or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

C. Decorative Fence Installation

1. Install fences according to manufacturer's written instructions.
OR
Install fences by setting posts as indicated and fastening rails and infill panels to posts. Peen threads of bolts after assembly to prevent removal, **as directed**.



2. Post Excavation: Drill or hand-excavate holes for posts in firm, undisturbed soil. Excavate holes to a diameter of not less than 4 times post size and a depth of not less than 24 inches (600 mm) plus 3 inches (75 mm) for each foot (300 mm) or fraction of a foot (300 mm) that fence height exceeds 4 feet (1200 mm).
 3. Post Setting: Set posts in concrete **OR** with mechanical anchors **OR** by mechanically driving into soil, **as directed**, at indicated spacing into firm, undisturbed soil.
 - a. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
 - b. Concrete Fill: Place concrete around posts and sleeves, **as directed**, and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
 - 1) Exposed Concrete: Extend 2 inches (50 mm) above grade. Finish and slope top surface to drain water away from post.
 - 2) Concealed Concrete: Top 2 inches (50 mm) below grade as indicated on Drawings to allow covering with surface material. Slope top surface of concrete to drain water away from post.
 - c. Posts Set in Concrete: Extend post to within 6 inches (150 mm) of specified excavation depth, but not closer than 3 inches (75 mm) to bottom of concrete.
 - d. Posts Set into Concrete in Sleeves: Use galvanized-steel pipe sleeves with inside diameter at least 3/4 inch (20 mm) larger than outside diagonal dimension of post, preset and anchored into concrete for installing posts.
 - 1) Extend posts at least 5 inches (125 mm) into sleeve.
 - 2) After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink grout, mixed and placed to comply with grout manufacturer's written instructions; shape and smooth to shed water. Finish and slope top surface of grout to drain water away from post.
 - e. Posts Set into Voids in Concrete: Form or core drill holes not less than 3/4 inch (20 mm) larger than outside diagonal dimension of post.
 - 1) Extend posts at least 5 inches (125 mm) into concrete.
 - 2) Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink grout, mixed and placed to comply with grout manufacturer's written instructions. Finish and slope top surface of grout to drain water away from post.
 - f. Mechanically Driven Posts: Drive into soil to depth of 30 inches (762 mm) **OR** 36 inches (914 mm), **as directed**. Protect post top to prevent distortion.
 - g. Space posts uniformly at 6 feet (1.83 m) **OR** 8 feet (2.44 m), **as directed**, o.c.
- D. Gate Installation
1. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.
- E. Gate Operator Installation
1. General: Install gate operators according to manufacturer's written instructions, aligned and true to fence line and grade.
 2. Excavation for Support Posts **OR** Pedestals **OR** Concrete Bases, **as directed**: Hand-excavate holes for bases, in firm, undisturbed soil to dimensions and depths and at locations as required by gate operator component manufacturer's written instructions and as indicated.
 3. Concrete Bases: Cast-in-place or precast concrete, depth not less than 12 inches (300 mm) **OR** 6 to 12 inches (150 to 300 mm) below frost line, **as directed**, dimensioned and reinforced according to gate operator component manufacturer's written instructions and as indicated on Drawings.
 4. Vehicle Loop Detector System: Cut grooves in pavement, **as directed**, and bury and seal wire loop according to manufacturer's written instructions. Connect to equipment operated by detector.



5. Comply with NFPA 70 and manufacturer's written instructions for grounding of electric-powered motors, controls, and other devices.

F. Grounding And Bonding

1. Fence Grounding: Install at maximum intervals of 1500 feet (450 m) except as follows:
 - a. Fences within 100 Feet (30 m) of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet (225 m).
 - 1) Gates and Other Fence Openings: Ground fence on each side of opening.
 - a) Bond metal gates to gate posts.
 - b) Bond across openings, with and without gates, except openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches (460 mm) below finished grade.
 2. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a maximum distance of 150 feet (45 m) on each side of crossing.
 3. Fences Enclosing Electrical Power Distribution Equipment: Ground as required by IEEE C2 unless otherwise indicated.
 4. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches (150 mm) below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at the grounding location.
 5. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.
 6. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
 - a. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
 - b. Make connections with clean, bare metal at points of contact.
 - c. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
 - d. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
 - e. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
 7. Bonding to Lightning-Protection System: If fence terminates at lightning-protected building or structure, ground the fence and bond the fence grounding conductor to lightning-protection down conductor or lightning-protection grounding conductor, complying with NFPA 780.

G. Field Quality Control

1. Grounding-Resistance Testing: Engage a qualified testing agency to perform tests and inspections.
 - a. Grounding-Resistance Tests: Subject completed grounding system to a megger test at each grounding location. Measure grounding resistance not less than two full days after last trace of precipitation, without soil having been moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural grounding resistance. Perform tests by two-point method according to IEEE 81.
 - b. Excessive Grounding Resistance: If resistance to grounding exceeds specified value, notify the Owner promptly. Include recommendations for reducing grounding resistance and a proposal to accomplish recommended work.
 - c. Report: Prepare test reports certified by a testing agency of grounding resistance at each test location. Include observations of weather and other phenomena that may affect test results.

H. Adjusting

1. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire



operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

2. Automatic Gate Operators: Energize circuits to electrical equipment and devices. Adjust operators, controls, safety devices, alarms, **as directed**, and limit switches.
 - a. Hydraulic Operators: Purge Operating System, Adjust Pressure And Fluid Levels, And Check For Leaks.
 - b. Operational Test: After Electrical Circuitry Has Been Energized, Start Units To Confirm Proper Motor Rotation And Unit Operation.
 - c. Test And Adjust Controls, Alarms, **as directed**, And Safeties. Replace Damaged And Malfunctioning Controls And Equipment.
 3. Lubricate hardware, gate operators, **as directed**, and other moving parts.
- I. Demonstration
1. Train Owner's personnel to adjust, operate, and maintain gates.

END OF SECTION 32 31 19 00



Task	Specification	Specification Description
32 31 19 00	01 22 16 00	No Specification Required
32 31 19 00	32 31 13 00	High-Security Chain-Link Fences And Gates



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SECTION 32 31 29 00 - PERMANENT WOOD FENCING**1.1 GENERAL****A. Description Of Work**

1. The specification covers the furnishing and installation of materials for repair and maintenance of permanent wood fencing. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

- B. Submittals: Shop drawings shall be submitted for approval.

1.2 PRODUCTS**A. Pickets:**

1. Size: Wood For picket shall match the existing fencing in material, configuration, dimensions, texture, and finishes,
2. Attachment: Hot-dipped galvanized nails complying with Fed. Spec. FF-N-105 shall be used to fasten pickets to rails.

B. Framework:

1. Line Posts: 4 x 4 of required length to match existing post height and extend into the ground as required to ensure rigid installation.
2. Terminal and Corner Posts: 4 x 4 of required length.
3. Gate Posts: 4 x 6 and of the length required for firm embedment to resist gate action.
4. Top Rail: 2 x 4 of length required to span between posts.
5. Where bracing is required, it shall match top and bottom rails in dimension and finish.
6. Metal Posts and Rails: Solid mild steel galvanized in compliance with ASTM A 123 of the length and style required to match existing.

C. Gates:

1. Frame: 2 x 4 members with attached pickets. Configuration of gate shall match that of existing gates.
2. Bracing: Single 2 x 4 running diagonally across the gate to opposite corners of the frame.
3. Hardware: Hinges, latches, and other hardware shall be hot dipped galvanized and of configurations to match existing hardware. Bolts and nuts shall comply with ASTM A 307 and galvanized in compliance with ASTM A 153.

- D. Finish: All wood fence members shall be given a pressure preservative treatment in a closed retort. The treatment shall comply with Fed. Spec. TT-W-571. Wood cut or sawed after treatment shall have the cut surfaces well brush-coated with the preservative used in the treatment. Paint to match existing after treatment and installation.

1.3 EXECUTION

- A. Posts: Hold in line in a true vertical position by temporary bracing until backfilling is completed. Compact by hand tamping or other suitable methods to a density comparable to that of adjacent ground. Posts of fencing that are higher than four feet and exposed to strong winds and posts at all gates shall be of heavy construction and shall be embedded in concrete.

32 - Exterior Improvements



-
- B. Rails: Install at the height and in the manner required to match existing fencing, and secure to post with fasteners similar to existing.
 - C. Pickets: Space, attach, and position to match existing pattern and attachment methods.
 - D. Accessories: Install to match existing conditions.

END OF SECTION 32 31 29 00



Task	Specification	Specification Description
32 31 29 00	01 22 16 00	No Specification Required



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SECTION 32 32 13 00 - SEGMENTAL RETAINING WALLS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for segmental retaining walls. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes single- and multiple- depth segmental retaining walls with and without soil reinforcement.

C. Performance Requirements

1. Basis of Design: Design of segmental retaining walls is based on products indicated. If comparable products of other manufacturers are proposed, provide engineering design for proposed products, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2. Delegated Design: Design segmental retaining walls, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
3. Structural Performance: Engineering design shall be based on the following loads and be according to NCMA's "Design Manual for Segmental Retaining Walls."
4. Gravity loads due to soil pressures resulting from grades and sloped backfill indicated.
 - a. Superimposed loads (surcharge) indicated on Drawings.
5. Seismic Performance: Engineering design shall be based on the following loads and factors and be according to NCMA's "Segmental Retaining Walls - Seismic Design Manual."
 - a. Gravity loads due to soil pressures resulting from grades and sloped backfill indicated.
 - b. Superimposed loads (surcharge) indicated on Drawings.
 - c. Horizontal Peak Ground Acceleration (A) for Project: **As directed.**

D. Preconstruction Testing

1. Preconstruction Testing Service: Engage a qualified testing agency to perform the following preconstruction testing:
 - a. Test soil reinforcement and backfill materials for pullout resistance according to ASTM D 6706.
 - b. Test soil reinforcement and backfill materials for coefficient of friction according to ASTM D 5321.

E. Submittals

1. Product Data: For each type of product indicated.
2. Samples: For each color and texture of concrete unit required. Submit full-size units **OR** sections of units not less than 3 inches (75 mm) square, **as directed.**
 - a. Include one full-size unit for each type of concrete unit required.
3. Delegated-Design Submittal: For segmental retaining walls indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - a. Compliance Review: Qualified professional engineer responsible for segmental retaining wall design shall review and approve submittals and source and field quality-control reports for compliance of materials and construction with design.
4. Product Certificates: For segmental retaining wall units and soil reinforcement, from manufacturer.



- a. Include test data for shear strength between segmental retaining wall units according to ASTM D 6916.
- b. Include test data for connection strength between segmental retaining wall units and soil reinforcement according to ASTM D 6638.
5. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for segmental retaining wall units and soil reinforcement.
 - a. Include test data for freeze-thaw durability of segmental retaining wall units.
 - b. Include test data for shear strength between segmental retaining wall units according to ASTM D 6916.
 - c. Include test data for connection strength between segmental retaining wall units and soil reinforcement according to ASTM D 6638.

F. Quality Assurance

1. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
2. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects.
 - a. Build mockup of segmental retaining wall as shown on Drawings **OR** approximately 72 inches (1800 mm) long by not less than 36 inches (900 mm) high above finished grade at front of wall, **as directed**.
 - 1) Include typical soil reinforcement.
 - 2) Include typical base and cap or finished top construction.
 - 3) Include backfill to typical finished grades at both sides of wall.
 - 4) Include typical end construction at one end of mockup.
 - 5) Include 36-inch (900-mm) return at 1 end of mockup, with typical corner construction.
 - b. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
3. Preinstallation Conference: Conduct conference at Project site.
 - a. Review methods and procedures related to segmental retaining walls including, but not limited to, the following:
 - 1) Structural load limitations.
 - 2) Construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3) Field quality-control procedures.

G. Delivery, Storage, And Handling

1. Store and handle concrete units and accessories to prevent deterioration or damage due to contaminants, breaking, chipping, or other causes.
2. Store geosynthetics in manufacturer's original packaging with labels intact. Store and handle geosynthetics to prevent deterioration or damage due to sunlight, chemicals, flames, temperatures above 160 deg F (71 deg C) or below 32 deg F (0 deg C), and other conditions that might damage them. Verify identification of geosynthetics before using and examine them for defects as material is placed.

1.2 PRODUCTS

A. Segmental Retaining Wall Units

1. Concrete Units: ASTM C 1372, Normal Weight, except that maximum water absorption shall not exceed 7 percent by weight and units shall not differ in height more than plus or minus 1/16 inch (1.6 mm) from specified dimension.
 - a. Provide units that comply with requirements for freeze-thaw durability.
 - b. Provide units that interlock with courses above and below by means of integral lugs or lips, pins, clips, or hollow cores filled with drainage fill.
2. Color: As selected from manufacturer's full range.



3. Shape and Texture: Provide units of basic shape and dimensions indicated with machine-split textured **OR** smooth, **as directed**, exposed faces.
 4. Shape and Texture: Provide units matching basic shape, dimensions, and face texture indicated by referencing manufacturer's pattern designation.
 5. Shape and Texture: Provide units of any basic shape and dimensions that will produce segmental retaining walls of dimensions and profiles indicated without interfering with other elements of the Work and with machine-split textured, flat exposed face **OR** shaped exposed face with deeply beveled vertical edges, **as directed**.
 6. Batter: Provide units that offset from course below to provide at least 1:24 **OR** 1:16 **OR** 1:14 **OR** 1:8 **OR** 1:5, **as directed**, batter.
 7. Cap Units: Provide cap units of shape indicated **OR** same shape as other units, **as directed**, with smooth, as-cast top surfaces without holes or lugs.
 8. Special Units: Provide corner units, end units, and other shapes as needed to produce segmental retaining walls of dimensions and profiles indicated and to provide texture on exposed surfaces matching face **OR** as indicated, **as directed**.
- B. Installation Materials
1. Pins: Product supplied by segmental retaining wall unit manufacturer for use with units provided, made from nondegrading polymer reinforced with glass fibers.
 2. Clips: Product supplied by segmental retaining wall unit manufacturer for use with units provided, made from nondegrading polymer reinforced with glass fibers.
 3. Cap Adhesive: Product supplied or recommended by segmental retaining wall unit manufacturer for adhering cap units to units below.
 4. Leveling Base: Comply with requirements in Division 31 Section "Earth Moving" for base material **OR** Division 33 Section "Subdrainage" for drainage fill, **as directed**.
 - a. Leveling Course: Lean concrete with a compressive strength of not more than 500 psi (3.4 MPa).
 5. Drainage Fill: Comply with requirements in Division 33 Section "Subdrainage".
 6. Reinforced-Soil Fill: ASTM D 2487; GW, GP, SW, SP, and SM soil classification groups or a combination of these groups; free of debris, waste, frozen materials, vegetation, and other deleterious matter; meeting the following gradation according to ASTM C 136: 20 to 100 percent passing No. 4 (4.75-mm) sieve, 0 to 60 percent passing No. 40 (0.425-mm) sieve, 0 to 35 percent passing No. 200 (0.075-mm) sieve, and with fine fraction having a plasticity index of less than 20.
 7. Nonreinforced-Soil Fill: Comply with requirements in Division 31 Section "Earth Moving" for satisfactory soils.
 8. Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent.
 - a. Apparent Opening Size: No. 70 to 100 (0.212- to 0.150-mm) sieve, maximum; ASTM D 4751.
 - b. Minimum Grab Tensile Strength: 110 lb (49.9 kg); ASTM D 4632.
 - c. Minimum Weight: 4 oz./sq. yd. (132 g/sq. m).
 9. Subdrainage Pipe and Filter Fabric: Comply with requirements in Division 33 Section "Subdrainage".
 - a. Product Type: Knitted or woven geogrid made from polyester yarns with a protective coating **OR** Molded geogrid made from high-density polyethylene **OR** Woven geotextile made from polyamides, polyesters, or polyolefins, **as directed**.
- C. Source Quality Control
1. Direct manufacturer to test and inspect each roll of soil reinforcement at the factory for minimum average roll values for geosynthetic index property tests, including the following:
 - a. Weight.
 - b. Roll size.
 - c. Grab or single-rib strength.
 - d. Aperture opening.
 - e. Rib or yarn size.



1.3 EXECUTION

A. Examination

1. Examine areas and conditions, with Installer present, for compliance with requirements for excavation tolerances, condition of subgrades, and other conditions affecting performance of segmental retaining walls.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Retaining Wall Installation

1. General: Place units according to NCMA's "Segmental Retaining Wall Installation Guide" and segmental retaining wall unit manufacturer's written instructions.
 - a. Lay units in running bond **OR** bond pattern indicated, **as directed**.
 - b. Form corners and ends by using special units **OR** cutting units with motor-driven saw **OR** splitting units with mason's hammer and chisel, **as directed**.
2. Leveling Base: Place and compact base material to thickness indicated and with not less than 95 percent maximum dry unit weight according to ASTM D 698.
 - a. Leveling Course: At Contractor's option, unreinforced lean concrete may be substituted for upper 1 to 2 inches (25 to 50 mm) of base **OR** Place unreinforced lean concrete over leveling base 1 to 2 inches (25 to 50 mm) thick, **as directed**. Compact and screed concrete to a smooth, level surface.
3. First Course: Place first course of segmental retaining wall units for full length of wall. Place units in firm contact with each other, properly aligned and level.
 - a. Tamp units into leveling base as necessary to bring tops of units into a level plane.
4. Subsequent Courses: Remove excess fill and debris from tops of units in course below. Place units in firm contact, properly aligned, and directly on course below.
 - a. For units with lugs designed to fit into holes in adjacent units, lay units so lugs are accurately aligned with holes, and bedding surfaces are firmly seated on beds of units below.
 - b. For units with lips at front of units, slide units as far forward as possible for firm contact with lips of units below.
 - c. For units with lips at bottom rear of units, slide units as far forward as possible for firm contact of lips with units below.
 - d. For units with pins, install pins and align units.
 - e. For units with clips, install clips and align units.
5. Cap Units: Place cap units and secure with cap adhesive.

C. Fill Placement

1. General: Comply with requirements in Division 31 Section "Earth Moving", NCMA's "Segmental Retaining Wall Installation Guide," and segmental retaining wall unit manufacturer's written instructions.
2. Fill voids between and within units with drainage fill. Place fill as each course of units is laid.
3. Place, spread, and compact drainage fill and soil fill in uniform lifts for full width and length of embankment as wall is laid. Place and compact fills without disturbing alignment of units. Where both sides of wall are indicated to be filled, place fills on both sides at same time. Begin at wall and place and spread fills toward embankment.
 - a. Use only hand-operated compaction equipment within 48 inches (1200 mm) of wall, or one-half of height above bottom of wall, whichever is greater.
 - b. Compact reinforced-soil fill to not less than 95 percent maximum dry unit weight according to ASTM D 698.
 - 1) In areas where only hand-operated compaction equipment is allowed, compact fills to not less than 90 percent maximum dry unit weight according to ASTM D 698.
 - 2) In areas where fill height exceeds 15 feet (4.5 m), compact reinforced-soil fill that will be more than 15 feet (4.5 m) below finished grade to not less than 98 percent maximum dry unit weight according to ASTM D 698.



- 3) In areas where fill height exceeds 30 feet (9 m), compact reinforced-soil fill that will be more than 30 feet (9 m) below finished grade to not less than 100 percent maximum dry unit weight according to ASTM D 698.
 - c. Compact nonreinforced-soil fill to comply with Division 31 Section "Earth Moving".
 4. Place drainage geotextile against back of wall and place layer of drainage fill at least 12 inches (300 mm) **OR** 6 inches (150 mm), **as directed**, wide behind drainage geotextile to within 12 inches (300 mm) of finished grade. Place another layer of drainage geotextile between drainage fill and soil fill.
 5. Place a layer of drainage fill at least 12 inches (300 mm) **OR** 6 inches (150 mm), **as directed**, wide behind wall to within 12 inches (300 mm) of finished grade. Place a layer of drainage geotextile between drainage fill and soil fill.
 6. Wrap subdrainage pipe with filter fabric and place in drainage fill as indicated, sloped not less than 0.5 percent to drain.
 7. Place impervious fill over top edge of drainage fill layer.
 8. Slope grade at top of wall away from wall unless otherwise indicated. Slope grade at base of wall away from wall. Provide uniform slopes that will prevent ponding.
 9. Place soil reinforcement in horizontal joints of retaining wall where indicated and according to soil-reinforcement manufacturer's written instructions. Embed reinforcement a minimum of 8 inches (200 mm) into retaining wall and stretch tight over compacted backfill. Anchor soil reinforcement before placing fill.
 - a. Place additional soil reinforcement at corners and curved walls to provide continuous reinforcement.
 - b. Place geosynthetics with seams, if any, oriented perpendicular to segmental retaining walls.
 - c. Do not dump fill material directly from trucks onto geosynthetics.
 - d. Place at least 6 inches (150 mm) of fill over reinforcement before compacting with tracked vehicles or 4 inches (100 mm) before compacting with rubber-tired vehicles.
 - e. Do not turn vehicles on fill until first layer of fill is compacted and second layer is placed over each soil-reinforcement layer.
- D. Construction Tolerances
1. Variation from Level: For bed-joint lines along walls, do not exceed 1-1/4 inches in 10 feet (32 mm in 3 m), 3 inches (75 mm) maximum.
 2. Variation from Indicated Batter: For slope of wall face, do not vary from indicated slope by more than 1-1/4 inches in 10 feet (32 mm in 3 m).
 3. Variation from Indicated Wall Line: For walls indicated as straight, do not vary from straight line by more than 1-1/4 inches in 10 feet (32 mm in 3 m).
- E. Field Quality Control
1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
 2. Comply with requirements in Division 31 Section "Earth Moving" for field quality control.
 - a. In each compacted backfill layer, perform at least 1 field in-place compaction test for each 150 feet (45 m) or less of segmental retaining wall length.
 - b. In each compacted backfill layer, perform at least 1 field in-place compaction test for each 24 inches (600 mm) of fill depth and each 50 feet (15 m) or less of segmental retaining wall length.
- F. Adjusting
1. Remove and replace segmental retaining wall construction of the following descriptions:
 - a. Broken, chipped, stained, or otherwise damaged units. Units may be repaired if the Owner approves methods and results.
 - b. Segmental retaining walls that do not match approved Samples.
 - c. Segmental retaining walls that do not comply with other requirements indicated.
 2. Replace units so segmental retaining wall matches approved Samples and mockups, complies with other requirements, and shows no evidence of replacement.



END OF SECTION 32 32 13 00



Task	Specification	Specification Description
32 32 16 00	03 48 29 00	Plant-Precast Structural Concrete
32 32 23 13	32 32 13 00	Segmental Retaining Walls
32 32 26 00	32 32 13 00	Segmental Retaining Walls
32 32 29 00	32 32 13 00	Segmental Retaining Walls
32 32 53 00	32 32 13 00	Segmental Retaining Walls



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SECTION 32 33 23 00 - SITE FURNISHINGS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for site furnishings. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Seating.
 - b. Tables.
 - c. Bicycle racks.
 - d. Bicycle lockers.
 - e. Trash receptacles.
 - f. Ash receptacles.
 - g. Planters.
 - h. Bollards.

C. Submittals

1. Product Data: For each type of product indicated.
2. Samples: For each type of exposed finish required.
3. Product Schedule: For site furnishings. Use same designations indicated on Drawings.
4. Material Certificates: For site furnishings, signed by manufacturers.
 - a. Wood Preservative Treatment: Include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.
 - b. Sustainably Harvested Wood: Include certification by manufacturer and from sources that participate in sustained yield programs.
 - c. Recycled plastic.
5. Maintenance Data: For site furnishings to include in maintenance manuals.

1.2 PRODUCTS

A. Materials

1. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated; free of surface blemishes and complying with the following:
 - a. Rolled or Cold-Finished Bars, Rods, and Wire: ASTM B 211 (ASTM B 211M).
 - b. Extruded Bars, Rods, Wire, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
 - c. Structural Pipe and Tube: ASTM B 429.
 - d. Sheet and Plate: ASTM B 209 (ASTM B 209M).
 - e. Castings: ASTM B 26/B 26M.
2. Steel and Iron: Free of surface blemishes and complying with the following:
 - a. Plates, Shapes, and Bars: ASTM A 36/A 36M.
 - b. Steel Pipe: Standard-weight steel pipe complying with ASTM A 53, or electric-resistance-welded pipe complying with ASTM A 135.
 - c. Tubing: Cold-formed steel tubing complying with ASTM A 500.
 - d. Mechanical Tubing: Cold-rolled, electric-resistance-welded carbon or alloy steel tubing complying with ASTM A 513, or steel tubing fabricated from steel complying with ASTM A 1011/A 1011M and complying with dimensional tolerances in ASTM A 500; zinc coated internally and externally.



- e. Sheet: Commercial steel sheet complying with ASTM A 1011/A 1011M.
- f. Perforated Metal: From steel sheet not less than 0.0747-inch (1.9-mm) **OR** 0.0897-inch (2.3-mm) **OR** 0.1196-inch (3.0-mm), **as directed**, nominal thickness; manufacturer's standard perforation pattern.
- g. Expanded Metal: Carbon-steel sheets, deburred after expansion, and complying with ASTM F 1267.
- h. Malleable-Iron Castings: ASTM A 47/A 47M, grade as recommended by fabricator for type of use intended.
- i. Gray-Iron Castings: ASTM A 48/A 48M, Class 200.
- 3. Stainless Steel: Free of surface blemishes and complying with the following:
 - a. Sheet, Strip, Plate, and Flat Bars: ASTM A 666.
 - b. Pipe: Schedule 40 steel pipe complying with ASTM A 312/A 312M.
 - c. Tubing: ASTM A 554.
- 4. Wood: Surfaced smooth on four sides with eased edges; kiln dried, free of knots, solid stock of species indicated.
 - a. Wood Species: Manufacturer's standard.
 - 1) Douglas Fir: Clear Grade, vertical grain.
 - 2) Pine: Southern pine; No. 2 or better; preservative treated, kiln dried after treatment.
 - 3) Eastern White **OR** Red **OR** Yellow **OR** Cedar, **as directed**: Select Grade or better.
 - 4) Redwood: Clear all heart **OR** Construction heart or better, **as directed**, free-of-heart center.
 - 5) Teak (*Tectona Grandis*): Clear Grade. Provide wood obtained from sources that participate in a well-managed forest and chain-of-custody program certified by an independent agency accredited by FSC.
 - 6) Finish: Manufacturer's standard stain and transparent sealer **OR** transparent wood preservative treatment and sealer, **as directed**.
- 5. Fiberglass: Multiple laminations of glass-fiber-reinforced polyester resin with UV-light stable, colorfast, nonfading, weather- and stain-resistant, colored polyester gel coat, and manufacturer's standard finish.
- 6. Plastic: Color impregnated, color and UV-light stabilized, and mold resistant.
 - a. Polyethylene: Fabricated from virgin plastic HDPE resin.
 - b. Recycled Polyethylene: Fabricated from not less than 96 percent recycled, purified, fractional-melt plastic resin with not less than 90 percent recycled postconsumer waste by weight HDPE.
- 7. Anchors, Fasteners, Fittings, and Hardware: Stainless steel **OR** Brass **OR** Galvanized steel **OR** Zinc-plated steel **OR** Manufacturer's standard, corrosion-resistant-coated or noncorrodible materials, **as directed**; commercial quality, tamperproof, vandal and theft resistant **OR** concealed, recessed, and capped or plugged, **as directed**.
 - a. Angle Anchors: For inconspicuously bolting legs of site furnishings to on **OR** below, **as directed** -grade substrate; one per leg **OR** extent as indicated, **as directed**.
 - b. Antitheft Hold-Down Brackets: For securing site furnishings to substrate; two per unit **OR** extent as indicated on Drawings, **as directed**.
- 8. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107; recommended in writing by manufacturer, for exterior applications.
- 9. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound; resistant to erosion from water exposure without needing protection by a sealer or waterproof coating; recommended in writing by manufacturer, for exterior applications.
- 10. Galvanizing: Where indicated for steel and iron components, provide the following protective zinc coating applied to components after fabrication:
 - a. Zinc-Coated Tubing: External, zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. (0.27 kg/sq. m) of zinc after welding, a chromate conversion coating, and a clear,



- polymer film. Internal, same as external or consisting of 81 percent zinc pigmented coating, not less than 0.3 mil (0.0076 mm) thick.
- b. Hot-Dip Galvanizing: According to ASTM A 123/A 123M, ASTM A 153/A 153M, or ASTM A 924/A 924M.
- B. Seating And Tables
1. Frame: Cast aluminum **OR** Cast iron **OR** Steel **OR** Stainless steel **OR** Wrought iron **OR** Cedar **OR** Teak, **as directed**.
 2. Seat **OR** Seat and Back, **as directed**:
 - a. Material:
 - 1) Aluminum Sheet: Perforated **OR** Expanded, **as directed**, metal.
 - 2) Steel **OR** Painted Steel, **as directed**: Perforated metal **OR** Expanded metal **OR** Evenly spaced, parallel flat straps or bars **OR** Evenly woven, flat straps or bars **OR** Edge framed, evenly spaced, parallel rods or rolled bars, **as directed**.
 - 3) Stainless Steel: Perforated metal **OR** Expanded metal **OR** Evenly spaced, parallel flat straps or bars **OR** Evenly woven, flat straps or bars **OR** Edge framed, evenly spaced, parallel rods or rolled bars, **as directed**.
 - 4) Wood: Douglas fir **OR** Pine **OR** Cedar **OR** Redwood **OR** Teak, **as directed**; formed into evenly spaced parallel slats **OR** planks, **as directed**.
 - 5) Recycled **OR** Plastic **OR** fiberglass, **as directed**, Planks: Evenly spaced, parallel.
 - 6) Recycled **OR** Plastic **OR** Fiberglass, **as directed**, Sheet: Solid **OR** Perforated, **as directed**.
 - b. Seat Height: As indicated.
 - c. Seat Surface Shape: Flat **OR** Contoured or dished, **as directed**.
 - d. Overall Height: As indicated.
 - e. Overall Width: As indicated.
 - f. Overall Depth: As indicated.
 - g. Arms: None **OR** One, as indicated **OR** Two, one at each end **OR** Three, one at each end and in center, **as directed**.
 - 1) Arm Material: Match frame **OR** seat, **as directed**.
 - h. Seating Configuration: Multiple units as indicated.
 - 1) Straight **OR** Angled **OR** Curved, **as directed**, shape.
 - 2) Closed hexagon **OR** circle **OR** shape indicated, **as directed**, around a tree trunk **OR** planter **OR** light post, **as directed**.
 3. Table Top:
 - a. Material:
 - 1) Aluminum Sheet: Perforated **OR** Expanded, **as directed**, metal.
 - 2) Steel **OR** Painted Steel, **as directed**: Perforated metal **OR** Expanded metal **OR** Evenly spaced, parallel flat straps or bars **OR** Evenly woven, flat straps or bars **OR** Edge framed, evenly spaced, parallel rods or rolled bars, **as directed**.
 - 3) Stainless Steel: Perforated metal **OR** Expanded metal **OR** Evenly spaced, parallel flat straps or bars **OR** Evenly woven, flat straps or bars **OR** Edge framed, evenly spaced, parallel rods or rolled bars, **as directed**.
 - 4) Wood: Douglas fir **OR** Pine **OR** Cedar **OR** Redwood **OR** Teak, **as directed**; formed into evenly spaced parallel slats **OR** planks, **as directed**.
 - 5) Recycled **OR** Plastic **OR** Fiberglass, **as directed**, Planks: Evenly spaced, parallel.
 - 6) Recycled **OR** Plastic **OR** Fiberglass, **as directed**, Sheet: Solid **OR** Perforated, **as directed**.
 - b. Surface Shape: Round **OR** Hexagon **OR** Shape indicated, **as directed**.
 - c. Feature: Center umbrella hole.
 4. Aluminum Finish: Mill finish **OR** Color coated, **as directed**.
 - a. Color: As selected from manufacturer's full range.
 5. Steel Finish: Galvanized and color **OR** PVC-color, **as directed**, coated.
 - a. Color: As selected from manufacturer's full range.
 6. Stainless-Steel Finish: Dull Satin No. 6.



7. Wood Finish: Unfinished **OR** Factory-applied transparent finish **OR** Factory-applied stain and transparent finish **OR** Factory-applied opaque finish **OR** Manufacturer's standard finish, **as directed**.
 - a. Stain: Manufacturer's standard.
8. Fiberglass **OR** HDPE, **as directed**, Color: As selected from manufacturer's full range.
9. Graphics: Surface-applied **OR** Engraved **OR** Attached brass plaque with engraved, **as directed**, copy, content, and style per manufacturer's standard **OR** as indicated on Drawings, **as directed**.

C. Bicycle Racks

1. Bicycle Rack Construction:
 - a. Frame: Aluminum **OR** Steel **OR** Galvanized steel **OR** Stainless steel **OR** Steel and redwood **OR** Steel and pine, **as directed**.
 - 1) Pipe **OR** Tubing, **as directed**, OD: Not less than 1-5/8 inches (41 mm) **OR** 2-3/8 inches (60 mm) **OR** 2-7/8 inches (73 mm) **OR** 4-1/2 inches (115 mm), **as directed**.
 - 2) Locking Bars: Solid round bar, not less than 3/4 inch (19 mm) **OR** 1 inch (25 mm), **as directed**, in diameter.
 - b. Style: Single-side parking **OR** Double-side parking **OR** Bollard **OR** As indicated, **as directed**.
 - 1) Capacity: Designed to accommodate no fewer than two **OR** three **OR** four, **as directed**, bicycles.
 - c. Security: Designed to lock wheel and frame.
 - d. Accessories: Base covers for each pipe and tubing anchored end **OR** Wheel stops, **as directed**.
 - e. Installation Method: Freestanding **OR** Surface flange anchored at finished grade to substrate indicated **OR** Surface flange anchored below finished grade to substrate indicated **OR** Cast in concrete **OR** Bolted to cast-in anchor bolts **OR** Wall mounted **OR** As indicated, **as directed**.
2. Aluminum Finish: Mill finish **OR** Color coated, **as directed**.
 - a. Color: As selected from manufacturer's full range.
3. Steel Finish: Galvanized **OR** Color coated, **as directed**.
 - a. Color: As selected from manufacturer's full range.
4. Stainless-Steel Finish: Directional Satin No. 4.
5. Wood Finish: Unfinished **OR** Manufacturer's standard finish, **as directed**.

D. Bicycle Lockers

1. Bicycle Locker Construction:
 - a. Locker: Molded one-piece fiberglass **OR** Sheet steel, 0.053 inch (1.4 mm) thick, **OR** Sheet steel, 0.053 inch (1.4 mm) thick, with perforated metal sides, **as directed**, with welded tubular steel frame.
 - b. Door: Molded one-piece fiberglass **OR** Sheet steel, 0.053 inch (1.4 mm) thick, **as directed**, with tubular steel frame **OR** Match locker, **as directed**.
 - c. View Window **OR** Grille, **as directed**: Lexan, 12 inches (305 mm) square **OR** Perforated metal, **as directed**.
 - d. Lock: Manufacturer's standard **OR** Key lock with internal locking bar **OR** Coin/token lock, **as directed**.
 - 1) Provide four keys.
 - e. Overall Height: As indicated.
 - f. Overall Width: As indicated.
 - g. Overall Depth: As indicated.
 - h. Capacity: Designed to accommodate one **OR** two, **as directed**, bicycle(s).
 - i. Installation Method: Locker anchored at finished grade to substrate indicated **OR** Locker anchored below finished grade to substrate indicated **OR** As indicated, **as directed**.
 - j. Locker Configuration: Multiple **OR** Four, **as directed**, units as indicated, in straight row **OR** curved shape **OR** shape indicated, **as directed**.
2. Steel Finish: Color coated.



- a. Color: As selected from manufacturer's full range.
 3. Fiberglass Color: As selected from manufacturer's full range.
- E. Trash And Ash Receptacles
1. Aluminum Facing Surrounds: Aluminum sheet **OR** Perforated aluminum sheet **OR** Grid in tubular frame **OR** Evenly patterned, parallel flat aluminum straps, bars, or tubular shapes **OR** Match benches, **as directed**.
 2. Steel Facing Surrounds: Steel sheet **OR** Perforated-steel sheet **OR** Evenly patterned, parallel flat steel straps, bars, or tubular shapes **OR** Evenly patterned, parallel round steel rods, bars, or tubular shapes **OR** Grid in tubular frame **OR** Match benches, **as directed**.
 3. Stainless-Steel Facing Surrounds: Steel sheet **OR** Perforated-steel sheet **OR** Evenly patterned, parallel flat steel straps, bars, or tubular shapes **OR** Evenly patterned, parallel round steel rods, bars, or tubular shapes **OR** Grid in tubular frame **OR** Match benches, **as directed**.
 4. Wood Facing Surrounds: Evenly spaced, Douglas fir slats **OR** Evenly spaced pine slats **OR** Evenly spaced cedar slats **OR** Redwood panels **OR** Evenly spaced redwood slats **OR** Teak panels **OR** Evenly spaced teak slats **OR** Match benches, **as directed**.
 5. Fiberglass Facing Surrounds: Molded fiberglass shape.
 6. Plastic Facing Surrounds: Molded HDPE shape **OR** Evenly spaced HDPE slats **OR** Evenly spaced, recycled HDPE slats **OR** Match benches, **as directed**.
 7. Support Frames: Steel **OR** Galvanized steel, **as directed**; welded.
 8. Trash and Ash Receptacles:
 - a. Receptacle Shape and Form: Round cylinder **OR** Round cylinder with tapered funnel top **OR** Round, tapered column **OR** Square column **OR** Rectangular column **OR** As indicated, **as directed**; with opening for depositing trash in lid or top **OR** side of lid or top **OR** receptacle side, **as directed**.
 - b. Ash Receptacle Function: Uncovered receptacle with sand pan **OR** Uncovered receptacle with bowl and funnel **OR** Covered receptacle with sand pan **OR** Covered receptacle with bowl and screen **OR** Covered receptacle with slots **OR** Uncovered receptacle with sand pan attaching to side of trash receptacle, **as directed**, for depositing cigarette butts; fire-proof design; bowl and pan removable for cleaning.
 - c. Lids and Tops: Matching facing panels **OR** Aluminum **OR** Steel **OR** HDPE **OR** Recycled HDPE, **as directed**, secured by cable or chain, hinged, swiveled, or permanently secured.
 - 1) Description: Flat rim ring lid with center opening **OR** Dome top **OR** Arched top **OR** Elevated flat or shallow dome rain-cap lid **OR** Combination ash sand pan and rim lid **OR** Combination ash sand pan and dome top **OR** Combination ash sand pan and elevated flat or shallow dome rain-cap lid, **as directed**.
 - 2) Opening for depositing trash covered by self-closing, spring-loaded-hinged, push-in **OR** rotating, **as directed**, weather flap.
 - d. Inner Container: Aluminum **OR** Galvanized steel sheet **OR** Perforated-metal **OR** Fiberglass **OR** Rigid plastic, **as directed**, container with drain holes **OR** lift-out handles, **as directed**; designed to be removable and reusable.
 - e. Disposable Liners: Provide receptacle designed to accommodate disposable liners.
 - f. Capacity: Not less than 22 gal. (83 L) **OR** 28 gal. (106 L) **OR** 30 gal. (114 L) **OR** 32 gal. (121 L) **OR** 40 gal. (151 L) **OR** 55 gal. (208 L), **as directed**.
 - g. Service Access: Removable lid or top **OR** Fixed lid or top, side access, **as directed**; inner container and disposable liner lift or slide out for emptying; lockable with padlock hasps **OR** keyed lock with two keys per receptacle **OR** self-latching hinge, **as directed**.
 - h. Post Mount: Color-coated steel pipe; color to match receptacle **OR** Galvanized steel pipe **OR** Wood, **as directed**; for mounting one **OR** two **OR** three, **as directed**, receptacle(s).
 - i. Ash Receptacle Accessories: Sand sifter **OR** Butt stub-out, **as directed**.
 9. Aluminum Finish: Mill finish **OR** Color coated, **as directed**.
 - a. Color: As selected from manufacturer's full range.
 10. Steel Finish: Galvanized and color **OR** PVC-color, **as directed**, coated.
 - a. Color: As selected from manufacturer's full range.
 11. Stainless-Steel Finish: Dull Satin No. 6.



12. Wood Finish: Unfinished **OR** Factory-applied transparent finish **OR** Factory-applied stain and transparent finish **OR** Factory-applied opaque finish **OR** Manufacturer's standard finish, **as directed**.
 - a. Stain: Manufacturer's standard.
13. Fiberglass **OR** HDPE, **as directed**, Color: As selected from manufacturer's full range.
14. Graphics: Surface-applied **OR** Engraved **OR** Attached brass plaque with engraved, **as directed**, copy, content, and style per manufacturer's standard **OR** as indicated on Drawings, **as directed**.
 - a. Copy: Litter **OR** Trash **OR** Waste **OR** Recycle, **as directed**.

F. Planters

1. Aluminum Facing Surrounds: Aluminum sheet **OR** Perforated aluminum sheet **OR** Grid in tubular frame **OR** Evenly patterned, parallel flat aluminum, **as directed**, straps, bars, or tubular shapes **OR** Match benches, **as directed**.
2. Steel Facing Surrounds: Steel sheet **OR** Perforated-steel sheet **OR** Evenly patterned, parallel flat steel straps, bars, or tubular shapes **OR** Evenly patterned, parallel round steel rods, bars, or tubular shapes **OR** Grid in tubular frame **OR** Match benches, **as directed**.
3. Stainless-Steel Facing Surrounds: Steel sheet **OR** Perforated-steel sheet **OR** Evenly patterned, parallel flat steel straps, bars, or tubular shapes **OR** Evenly patterned, parallel round steel rods, bars, or tubular shapes **OR** Grid in tubular frame **OR** Match benches, **as directed**.
4. Wood Facing Surrounds: Evenly spaced, Douglas fir slats **OR** Evenly spaced pine slats **OR** Evenly spaced cedar slats **OR** Redwood panels **OR** Evenly spaced redwood slats **OR** Teak panels **OR** Evenly spaced teak slats **OR** Match benches, **as directed**.
5. Fiberglass Facing Surrounds: Molded fiberglass shape.
6. Plastic Facing Surrounds: Molded HDPE shape **OR** Evenly spaced HDPE slats **OR** Evenly spaced, recycled HDPE slats **OR** Match benches, **as directed**.
7. Support Frames: Steel **OR** Galvanized steel, **as directed**; welded.
8. Planter Shape and Form: Round cylinder **OR** Round cylinder with tapered funnel top **OR** Round, tapered column **OR** Square column **OR** Rectangular column **OR** As indicated, **as directed**.
9. Style: To match benches **OR** As indicated by manufacturer's designation, **as directed**.
10. Inner Container: Aluminum **OR** Galvanized steel sheet **OR** Fiberglass **OR** Rigid plastic, **as directed**, container with drain holes.
11. Capacity: Not less than 22 gal. (83 L) **OR** 28 gal. (106 L) **OR** 30 gal. (114 L) **OR** 32 gal. (121 L) **OR** 40 gal. (151 L) **OR** 55 gal. (208 L), **as directed**.
12. Installation Method: Freestanding **OR** Freestanding with weighted base **OR** Anchored to substrate indicated on Drawings **OR** Wall mounted **OR** Post mounted **OR** Mounted on elevated leg angles anchored at finished grade to substrate indicated on Drawings **OR** Mounted on elevated leg angles anchored below finished grade to substrate indicated on Drawings **OR** As indicated on Drawings, **as directed**.
 - a. Post Mount: Color-coated steel pipe; color to match receptacle **OR** Galvanized steel pipe **OR** Wood, **as directed**; for mounting one **OR** two **OR** three, **as directed**, planter(s).
13. Aluminum Finish: Color coated.
 - a. Color: As selected from manufacturer's full range.
14. Steel Finish: Galvanized and color **OR** PVC-color, **as directed**, coated.
 - a. Color: As selected from manufacturer's full range.
15. Stainless-Steel Finish: Dull Satin No. 6.
16. Wood Finish: Unfinished **OR** Factory-applied transparent finish **OR** Factory-applied stained and transparent finish, **as directed**.
17. Fiberglass **OR** HDPE, **as directed**, Color: As selected from manufacturer's full range.
 - a. Finish: Smooth **OR** Textured, **as directed**.

G. Bollards

1. Bollard Construction:
 - a. Pipe **OR** Tubing **OR** Cast, **as directed** OD: Not less than 4-1/2 inches (115 mm), fluted, **as directed**.
 - 1) Steel: Schedule 40 **OR** 80, **as directed**, pipe.



- 2) Aluminum: Extruded pipe and tubes **OR** Castings, **as directed**.
 - 3) Stainless Steel: Tubes **OR** Pipe, **as directed**.
 - 4) Cast Iron: Tapered **OR** As indicated, **as directed**.
 - b. Round **OR** Square, **as directed**, Wood: Cedar, 8 inches (203 mm) square **OR** 10 inches (254 mm) in diameter, **as directed**.
 - c. Style: Manufacturer's standard **OR** Chamfered top **OR** Dome top **OR** Ornamental cap **OR** As indicated, **as directed**.
 - d. Accessories: Eye bolts.
 - e. Installation Method: Surface flange anchored at finished grade to substrate indicated **OR** Surface flange anchored below finished grade to substrate indicated **OR** Cast in concrete **OR** Bolted to cast-in anchor bolts **OR** As indicated, **as directed**.
 2. Aluminum Finish: Mill finish **OR** Color coated, **as directed**.
 - a. Color: As selected from manufacturer's full range.
 3. Steel Finish: Galvanized **OR** Color coated, **as directed**.
 - a. Color: As selected from manufacturer's full range.
 4. Cast-Iron Finish: Manufacturer's standard **OR** Galvanized **OR** Color coated, **as directed**.
 - a. Color: As selected from manufacturer's full range.
 5. Stainless-Steel Finish: Directional Satin No. 4.
 6. Wood Finish: Unfinished **OR** Manufacturer's standard finish, **as directed**.
- H. Fabrication
1. Metal Components: Form to required shapes and sizes with true, consistent curves, lines, and angles. Separate metals from dissimilar materials to prevent electrolytic action.
 2. Welded Connections: Weld connections continuously. Weld solid members with full-length, full-penetration welds and hollow members with full-circumference welds. At exposed connections, finish surfaces smooth and blended so no roughness or unevenness shows after finishing and welded surface matches contours of adjoining surfaces.
 3. Pipes and Tubes: Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.
 4. Preservative-Treated Wood Components: Complete fabrication of treated items before treatment if possible. If cut after treatment, apply field treatment complying with AWPA M4 to cut surfaces.
 5. Exposed Surfaces: Polished, sanded, or otherwise finished; all surfaces smooth, free of burrs, barbs, splinters, and sharpness; all edges and ends rolled, rounded, or capped.
 6. Factory Assembly: Assemble components in the factory to greatest extent possible to minimize field assembly. Clearly mark units for assembly in the field.
- I. Finishes, General
1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 2. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- J. Aluminum Finishes
1. Baked-Enamel, Powder-Coat Finish: Manufacturer's standard, baked, polyester, powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.
- K. Steel And Galvanized Steel Finishes
1. Baked-Enamel, Powder-Coat Finish: Manufacturer's standard, baked, polyester, powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.



2. PVC Finish: Manufacturer's standard, UV-light stabilized, mold-resistant, slip-resistant, matte-textured, dipped or sprayed-on, PVC-plastisol finish, with flame retardant added; complying with coating manufacturer's written instructions for pretreatment, application, and minimum dry film thickness.

L. Iron Finishes

1. Baked-Enamel, Powder-Coat Finish: Manufacturer's standard, baked, polyester, powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.

M. Stainless-Steel Finishes

1. Remove tool and die marks and stretch lines or blend into finish.
2. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

1.3 EXECUTION

A. Installation, General

1. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.
2. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.
3. Install site furnishings level, plumb, true, and securely anchored **OR** positioned, **as directed**, at locations indicated on Drawings.
4. Post Setting: Set cast-in support posts in concrete footing with smooth top, shaped to shed water. Protect portion of posts above footing from concrete splatter. Verify that posts are set plumb or at correct angle and are aligned and at correct height and spacing. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.
5. Posts Set into Voids in Concrete: Form or core-drill holes for installing posts in concrete to depth recommended in writing by manufacturer of site furnishings and 3/4 inch (19 mm) larger than OD of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions, with top smoothed and shaped to shed water.
6. Pipe Sleeves: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions, with top smoothed and shaped to shed water.

B. Cleaning

1. After completing site furnishing installation, inspect components. Remove spots, dirt, and debris. Repair damaged finishes to match original finish or replace component.

END OF SECTION 32 33 23 00

**SECTION 32 33 23 00a - MISCELLANEOUS SITE AND STREET FURNISHINGS****1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of miscellaneous site and street furnishings. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Shop Drawings: Fabrication and installation drawings for each type of product indicated.
2. Product Data: For each type of product indicated.

C. Qualification Of Welders

1. Qualify welders in accordance with AWS D1.1 using procedures, materials, and equipment of the type required for the work.

D. Delivery, Storage, And Protection

1. Protect from corrosion, staining, and other types of damage. Store items in an enclosed area free from contact with soil and weather. Remove and replace damaged items with new items.

1.2 PRODUCTS**A. Precast Benches**

1. Design precast benches in accordance with manufacturer's standards, size as indicated. Finish and color as indicated selected from manufacturer's standards.
2. Glass Fiber Reinforced Concrete (GFRC) Benches
 - a. Provide glass fiber reinforced concrete (GFRC) benches at locations as directed. Comply with PCI MNL-128 recommended practice for glass fiber reinforced concrete, including Appendix G, Polymer Modified Glass Fiber Reinforced Concrete Panels.
 - b. Design precast benches to sustain a live load of not less than 200 pounds per square foot (10 kPa), constructed of minimum 3000 psi concrete with ASTM C 150 cement, white or grey color consistent with final finish, using alkali resistant (AR) glass fibers produced specifically for use in glass fiber reinforced concrete, minimum three percent glass fiber content. Aggregate shall be clear silica sand aggregate; washed, dried and free from deleterious materials. Provide type with successful history of uses in GFRC fabrication standard with the manufacturer. Provide manufacturer's standard acrylic thermoplastic copolymer admixture.
 - c. Provide factory finished units standard with the manufacturer; texture and color as selected.
3. Precast Concrete/Cast Stone Benches
 - a. Provide reinforced precast concrete benches consisting of a mixture of cement, aggregates and mineral colors suitable for exterior use, located as directed.
 - b. Design benches to sustain a live load of not less than 200 pounds per square foot (10 kPa).
 - 1) Portland cement: ASTM C150 Type I, II, or III.
 - 2) Aggregate: ASTM C33, maximum size 3/4 inch (19 mm).
 - 3) Reinforcing steel: ASTM A615/A615M
 - 4) Galvanized wire mesh: ASTM A185
 - 5) Integral color: ASTM C979, pure mineral oxide, limeproof and non-fading.
 - 6) Provide minimum 5000 psi (35 MPa) 28 day compressive strength concrete, maximum five percent absorption.



- 7) Admixture: ASTM C260 for air-entraining.
- B. Precast Concrete Bicycle Rack
1. Provide one-piece precast concrete bicycle rack base with embedded galvanized metal hitching loops. Design bicycle rack with wheel notches for bike support and wheel locking device.
- C. Precast Concrete Bollards
1. Provide reinforced concrete bollards 12 inch (300 mm) **OR** 18 inch (450 mm), **as directed**, square **OR** round, **as directed**, height as indicated, suitable for ground mount installation. Provide exposed aggregate or sandblast finish as indicated; manufacturer's standard clear acrylic sealer.
 - a. Portland cement: ASTM C150, Type I II or III.
 - b. Aggregate: ASTM C33, maximum size 3/4 inch (19 mm).
 - c. Reinforcing steel: ASTM A615/A615M.
 - d. Integral color: ASTM C979, pure mineral oxide, limeproof and non-fading.
 - e. Concrete strength: 5000 psi (35 MPa), 28 day minimum compressive strength.
 - f. Admixture: ASTM C260 for air-entraining.
- D. Planters, Receptacles, Ash Receptacles
1. Provide for waste receptacles spun aluminum **OR** reinforced fiberglass, **as directed**, flat **OR** domed, **as directed**, tops and removable semi-rigid plastic liner insert. Provide top-mounted ash trays for ash receptacles.
 2. Glass Fiber Reinforced Concrete (GFRC) Precast:
 - a. Provide glass fiber reinforced concrete (GFRC) precast planters/waste receptacles/ash receptacles at locations as directed. Comply with PCI MNL-117 and PCI MNL-128.
 - b. Materials: Provide manufacturer's standard shell thickness of 3/8 to 5/8 inch (9 to 16 mm).
 - 1) Cement: ASTM C150, use only one brand and type of cement throughout the Project.
 - 2) Glass Fibers: Alkali resistant (AR) glass fibers produced specifically for use in glass fiber reinforced concrete. Glass content of GFRC unit to be a minimum of three percent.
 - 3) Aggregates: clear silica sand; washed, dried, and free from deleterious materials; provide type with successful history of use in GFRC and as standard with the manufacturer.
 - 4) Compressive Strength: Minimum 3000 psi (20/25 MPa) 28 day strength.
 - 5) Density: Approximately 120 pcf (1921 kg/cu. m).
 - 6) Polymer Admixture: Manufacturer's standard acrylic thermoplastic copolymer.
 - c. Finishes: Provide factory finished units with manufacturer's standard texture or sandblasted finish as selected.
 - 1) Cement: White or grey as consistent with final finish.
 3. Precast Concrete/Cast Stone Planters
 - a. Provide reinforced precast concrete planters/waste receptacles/ash receptacles consisting of a mixture of cement, aggregates, and mineral colors suitable for exterior use as located on the drawings. Provide manufacturer's standard exposed aggregate or sandblast finish (with clear acrylic coating) as selected.
 - 1) Portland Cement: ASTM C150, gray, Type I.
 - 2) Aggregate: ASTM C33, crushed limestone and sand.
 - 3) Galvanized Steel Mesh: ASTM A185.
 - 4) Integral Color: ASTM C979, pure mineral oxide, limeproof and non-fading.
 - 5) Concrete Strength: 4000 psi (30 MPa) minimum compressive strength at 28 days.
 - 6) Admixture: ASTM C260 for air-entraining.
 4. Wood Planters
 - a. Provide manufacturer's standard wood planter/waste receptacle/ash receptacles fabricated of 3/4 inch (19 mm) thick tongue and grooved wood slats permanently bonded with



- fiberglass interior shell. Provide wood top trim for square planters and fiberglass top trim for round planters.
- 1) Wood Species: As directed.
 - 2) Fiberglass: Molded with multiple laminations of glass fiber impregnated with polyester isophthalic thermosetting resins with a finish of 12-15 mil (0.30-0.38 mm) color impregnated polyester gel coat.
 - 3) Metal Frame: Black color-coated steel frame.
5. Wood Planters with Metal Frames
- a. Provide manufacturer's standard wood planter/waste receptacle/ash receptacle with galvanized steel welded frames, and nominal 2 inch (50 mm) tongue and grooved, beveled or square cut wood staves. Attach wood staves to metal frame from inside with steel plated screws.
 - 1) Wood species: Kiln dried, maximum 19 percent moisture content, species as directed.
 - 2) Metal frame: Reinforced with steel bars as per manufacture's standard construction, black color factory finish coated.
 - 3) Bottom: 1/4 inch (6.25 mm) exterior grade redwood with drain holes.
 - 4) Liners: Removable galvanized steel or manufacturer's standard.
 - 5) Tops: Hinged top opening, spun aluminum open top with molded rim, ash top.
6. Fiberglass Planters/Waste Receptacles/Ash Receptacles
- a. Provide reinforced fiberglass planters/waste receptacles/ash receptacles molded with multiple laminations of glass fiber impregnated with polyester isophthalic thermosetting resins; with 12-15 mil (0.30-0.38 mm) color impregnated polyester gel coat finish; minimum thickness of 1/4 inch (6.25 mm); color as selected.
 - b. Receptacles:
 - 1) Shall be manufactured by Maglin,
 - 2) Color: Malaga Green
- E. Shelters
1. AISC S342L; AISC S335. Provide prefabricated shelter systems to meet design conditions indicated. Shelter design shall conform to all applicable State and Local Building Codes and shall meet manufacturer's standards of construction and materials. Shelter systems shall be preglazed, pre-drilled and pre-cut, shipped with all hardware and accessories necessary for complete field assembly.
 2. Framing Systems: Framing system; columns, rafters, ridge, purlins and other structural framing members shall be aluminum/steel/wood as indicated. Manufacturer shall provide shop drawings and calculations prepared by a structural engineer.
 - a. Extruded aluminum alloy tubing shall conform to ASTM B429 6063-T5 or 3003-H14, anodized or powder coat finish, color as directed. Framing sizes and configurations shall be as required for size of structure indicated meeting manufacturer's standards and applicable building codes.
 - b. Structural steel shall conform to ASTM A36/A36M or ASTM A500, 36,000 psi (248 MPa) yield strength and 58,000 psi (400 MPa) tensile strength, factory finished with rust inhibited primer and powder coat conforming to ASTM D3451. Framing sizes and configurations shall be as required for size of structure indicated meeting manufacturer's standard and applicable building codes.
 - c. Wood framing system shall consist of surfaced four sides (S4S), #2 grade southern yellow pine solid timber columns with eased edges, pressure treated CCA (Copper Chrome Arsinat) 0.6 PCF (9.6 kg/cu.m) against decay, fungi and insect infestation, surfaced four sides (S4S), #1 grade, southern pine, glue-laminated columns manufactured in accordance with ANSI/AITC A190.1 and AITC certified glue-laminated structural grade southern yellow pine beams, rafters and purlins, factory sealed and individually wrapped for protection during shipment. Factory stain all wood members prior to shipment.
 3. Roof Panels/Decking: Provide manufacturer's standard molded acrylic translucent roof panel, OR standing seam metal roof panel, OR wood decking, OR V-beam aluminum roof panels, OR



FRP roof panels, as indicated. Materials shall be factory finished and shipped with all necessary fasteners and accessories as required for complete site assembly.

4. Glazing: Factory installed in separate structural window frames, gasketed and glazed as per manufacturer's standard, interchangeable, glazing system. Provide 1/4 inch (6.25 mm) acrylic sheet, OR tempered glass, OR polycarbonate plastic sheet OR mar-resistant polycarbonate plastic sheet, clear OR color.

F. Tables

1. Precast Concrete Tables: Provide reinforced precast concrete tables with smooth tops; minimum 4500 psi (35 MPa) concrete, 28 day minimum compressive strength, consisting of a mixture of cement, aggregates, and mineral colors suitable for exterior use as located on the drawings. Provide manufacturer's standard exposed aggregate or sandblast finish with clear acrylic coating.
 - a. Portland cement: ASTM C150, gray, Type I.
 - b. Aggregate: ASTM C33, washed limestone and sand.
 - c. Galvanized wire mesh: 14 gage (1.9 mm), 2 by two inch (50 by 50 mm).
 - d. Welded wire fabric: ASTM A185.
 - e. Reinforcing steel: ASTM A615/A615M.
 - f. Integral color: ASTM C979, pure mineral oxide, limeproof and non-fading.
 - g. Admixture: ASTM C260 for air-entraining..
2. Fiberglass Tables: Provide reinforced fiberglass table tops molded with multiple laminations of glass fiber impregnated with polyester isophthalic thermosetting resins, minimum thickness of 1/4 inch (6.25 mm) with 12-15 mil (0.30-0.38 mm) thickness color impregnated polyester gel coat, color as selected.
 - a. Steel pedestal base: ASTM A53 Schedule 40 steel pipe.
 - b. Mounting: Type as indicated.
 - c. Metal finish: Powder coating conforming to ASTM D3451 testing.
3. Perforated Steel Tables: Provide 14 gage (1.9 mm) **OR** 16 gage (1.6 mm), **as directed**, perforated steel sheet table tops with solid metal edges as per manufacturer's standard. Weld tops to base as required for frame support.
 - a. Steel pedestal base: ASTM A53 Schedule 40 steel pipe, 2 3/8 inch (60 mm) O.D.
 - b. Mounting: Type as indicated.
 - c. Hardware: Zinc or cadmium plated nuts, bolts, screws, and lock washers.
 - d. Metal finish: Powder coating conforming to ASTM D3451 testing.
4. Wood Seats and Tables
 - a. Provide manufacturer's standard wood seats and tables, minimum 1-5/8 inches (40 mm) thick with rounded edges, with wood or metal bases as indicated. Provide fasteners and accessories required for on site assembly. Kiln dry and pressure treat wood components to manufacturer's standard, maximum 19 percent moisture content. Pre-treat metal components and provide manufacturer's standard primer and powder coat finish complying with ASTM D3451, color as selected.
 - 1) Design wood tables to sustain a live load of not less than 200 pounds per square foot (10 kPa).
 - 2) Provide kiln dried, surfaced four sides (S4S), clear all sides wood slats of species and sizes indicated.
 - a) Species: As directed.
 - b) Nominal wood slat sizes: As directed.
 - b. Support Base: Provide wood or metal support bases as per manufacturer's standard.
 - 1) Wood: Match in species, grade, grain, color and finish of the wood slats.
 - 2) Steel: ASTM A653/A653M.
 - 3) Cast grey iron: ASTM A 48/A48M, Class 30 or recycled cast grey iron ASTM A48/A48M, Class 25.
 - 4) Cast aluminum: ASTM B26/B26M or ASTM B108 as applicable.
 - 5) Design bases to support the loads imposed in the design of the tables.

G. Grates



1. Provide cast aluminum **OR** cast iron **OR** cast bronze **OR** punched steel **OR** stainless steel, **as directed**, tree grates in round **OR** square, **as directed**, model of sizes indicated on the drawings. Furnish complete with angle steel frames with finish to match tree grates.

H. Fabrication Finishes

1. Galvanizing: Hot-dip galvanize items specified to be zinc-coated, after fabrication where practicable. Galvanizing: ASTM A123/A123M, ASTM A153/A153M or ASTM A653/A653M, as applicable.
2. Galvanize: Anchor bolts, grating fasteners, washers, and parts or devices necessary for proper installation, unless indicated otherwise.
3. Repair of Zinc-Coated Surfaces: Repair damaged surfaces with galvanizing repair method and paint conforming to ASTM A780 or by the application of stick or thick paste material specifically designed for repair of galvanizing, as approved. Clean areas to be repaired and remove the slag from the welds. Heat surfaces to which stick or paste material is applied, with a torch to a temperature sufficient to melt the metallics in stick or paste; spread the molten material uniformly over surfaces to be coated and wipe the excess material off.
4. Pretreatment, Priming and Painting: Apply pretreatment, primer, and paint in accordance with manufacturer's printed instructions. On surfaces concealed in the finished construction or not accessible for finish painting, apply an additional prime coat to a minimum dry film thickness of 1.0 mil (0.03 mm). Tint additional prime coat with a small amount of tinting pigment.
5. Nonferrous Metal Surfaces: Protect by plating, anodic, or organic coatings.
6. Aluminum Surfaces
 - a. Surface Condition: Before finishes are applied, remove roll marks, scratches, rolled-in scratches, kinks, stains, pits, orange peel, die marks, structural streaks, and other defects which will affect uniform appearance of finished surfaces.

1.3 EXECUTION

A. Installation

1. Install items at locations indicated, according to manufacturer's instructions. Items listed below require additional procedures.
 - a. Assembly and Erection of Components: Items shall be shipped knocked-down (KD) ready for site assembly. Packaged components shall be complete including all accessories and hardware. Follow manufacturer's instructions for assembly and erection. Provide mounting bolts or hardware for mounting items to substrate.

B. Anchorage, Fastenings, And Connections

1. Provide anchorage where necessary for fastening furniture or furnishings securely in place. Include for anchorage not otherwise specified or indicated slotted inserts, expansion shields, and powder-driven fasteners, when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; through bolts, lag bolts, and screws for wood. Do not use wood plugs in any material. Provide non-ferrous attachments for non-ferrous metal. Make exposed fastenings of compatible materials, generally matching in color and finish, to which fastenings are applied. Conceal fastenings where practicable.

C. Built-In-Work

1. Form for anchorage metal work built-in with concrete or masonry, or provide with suitable anchoring devices as indicated or as required. Furnish metal work in ample time for securing in place as the work progresses.

D. Welding

1. Perform welding, welding inspection, and corrective welding, in accordance with AWS D1.1. Use continuous welds on all exposed connections. Grind visible welds smooth in the finished installation.



E. Finishes: Dissimilar Materials

1. Where dissimilar metals are in contact, protect surfaces with a coat conforming to FS TT-P-664 to prevent galvanic or corrosive action. Where aluminum is in contact with concrete, mortar, masonry, wood, or absorptive materials subject to wetting, protect with ASTM D1187, asphalt-base emulsion.

F. Bollards

1. Install in pipe sleeves embedded in concrete and filled with non-shrink grout or quick setting anchoring cement.

G. Shelters

1. Secure to the adjacent construction with the clip angles attached to the concrete. Secure to concrete with not less than two 1/2 inch (12 mm) diameter expansion bolts.
 - a. Glazing: Factory install windows into separate structural frame. Miter corners and connect internally by extruded aluminum corner keys or screw bosses with tamper-proof stainless steel screws. Provide continuous gasketing around windows set to metal frames. Provide 1/2 to 3/4 inch (13 to 19 mm) deep pocket for polycarbonate glazing. Fully gasket and frame in independent interchangeable factory assembled units. Affix to shelter frame with 3/16 inch (5 mm) shallow head aluminum rivets at approximately 13 1/4 inches (331 mm) on centers for full 360 degrees (6.28 rad), rivet from inside of shelter.
 - b. Roof: Provide manufacturer's standard roof system including fascia **OR** gutter, **as directed**, assembly, ensuring a weather-tight seal and installation.

END OF SECTION 32 33 23 00a



Task	Specification	Specification Description
32 33 23 00	01 22 16 00	No Specification Required
32 33 33 00	32 33 23 00	Site Furnishings
32 33 33 00	32 33 23 00a	Miscellaneous Site and Street Furnishings
32 33 43 13	32 33 23 00	Site Furnishings
32 33 43 53	32 33 23 00a	Miscellaneous Site and Street Furnishings
32 33 53 00	01 22 16 00	No Specification Required
32 39 16 00	32 33 23 00a	Miscellaneous Site and Street Furnishings



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SECTION 32 82 00 00 - IRRIGATION SYSTEMS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for irrigation systems. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Piping.
 - b. Encasement for piping.
 - c. Manual valves.
 - d. Pressure-reducing valves.
 - e. Automatic control valves.
 - f. Automatic drain valves.
 - g. Transition fittings.
 - h. Dielectric fittings.
 - i. Miscellaneous piping specialties.
 - j. Sprinklers.
 - k. Quick couplers.
 - l. Drip irrigation specialties.
 - m. Controllers.
 - n. Boxes for automatic control valves.

C. Definitions

1. Circuit Piping: Downstream from control valves to sprinklers, specialties, and drain valves. Piping is under pressure during flow.
2. Drain Piping: Downstream from circuit-piping drain valves. Piping is not under pressure.
3. Main Piping: Downstream from point of connection to water distribution piping to, and including, control valves. Piping is under water-distribution-system pressure.
4. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

D. Performance Requirements

1. Irrigation zone control shall be automatic operation with controller and automatic control **OR** manual operation with manual, **as directed**, valves.
2. Location of Sprinklers and Specialties: Design location is approximate. Make minor adjustments necessary to avoid plantings and obstructions such as signs and light standards. Maintain 100 percent irrigation coverage of areas indicated.
3. Delegated Design: Design 100 percent coverage irrigation system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
 - a. Available land records indicate the following soil conditions:
 - 1) Type: Coarse **OR** Medium **OR** Fine, **as directed**.
 - 2) Texture:
 - a) Sand: as directed by the Owner.
 - b) Silt: as directed by the Owner .
 - c) Clay: as directed by the Owner.
 - 3) Particle Size:
 - a) Sand: as directed by the Owner.
 - b) Silt: as directed by the Owner.



- c) Clay: as directed by the Owner.
 - 4) Structure: Single grained **OR** Granular **OR** Platy **OR** Blocky, **as directed**.
 - 5) Density: as directed by the Owner.
 - 6) Moisture Content: as directed by the Owner.
 - 7) Infiltration Rate: as directed by the Owner.
4. Minimum Working Pressures: The following are minimum pressure requirements for piping, valves, and specialties unless otherwise indicated:
- a. Irrigation Main Piping: 200 psig (1380 kPa).
 - b. Circuit Piping: 150 psig (1035 kPa).

E. Submittals

- 1. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- 2. Wiring Diagrams: For power, signal, and control wiring.
- 3. Delegated-Design Submittal: For irrigation systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- 4. Zoning Chart: Show each irrigation zone and its control valve.
- 5. Controller Timing Schedule: Indicate timing settings for each automatic controller zone.
- 6. Field quality-control reports.
- 7. Operation and maintenance data.

F. Quality Assurance

- 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Delivery, Storage, And Handling

- 1. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
- 2. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

H. Project Conditions

- 1. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by the Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
 - a. Notify the Owner no fewer than two days in advance of proposed interruption of water service.
 - b. Do not proceed with interruption of water service without the Owner's written permission.

1.2 PRODUCTS

A. Pipes, Tubes, And Fittings

- 1. Comply with requirements in the piping schedule for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.
- 2. Galvanized-Steel Pipe: ASTM A 53/A 53M, Standard Weight, Type E, Grade B.
 - a. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106/A 106M, Standard Weight, seamless-steel pipe with threaded ends.
 - b. Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
 - c. Malleable-Iron Unions: ASME B16.39, Class 150, hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface, and female threaded ends.
 - d. Cast-Iron Flanges: ASME B16.1, Class 125.
- 3. Ductile-Iron Pipe with Mechanical Joints: AWWA C151, with mechanical-joint bell and spigot ends.



- a. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - 1) Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
 4. Ductile-Iron Pipe with Push-on Joint: AWWA C151, with push-on-joint bell and spigot ends.
 - a. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - 1) Gaskets: AWWA C111, rubber.
 5. Soft Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B), water tube, annealed temper.
 - a. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper solder-joint fittings. Furnish wrought-copper fittings if indicated.
 - b. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end.
 - c. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.
 6. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B), and ASTM B 88, Type M (ASTM B 88M, Type C), water tube, drawn temper.
 - a. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper solder-joint fittings. Furnish wrought-copper fittings if indicated.
 - b. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end.
 - c. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.
 7. PE Pipe with Controlled ID: ASTM F 771, PE 3408 compound; SIDR 11.5 and SIDR 15.
 - a. Insert Fittings for PE Pipe: ASTM D 2609, nylon or propylene plastic with barbed ends. Include bands or other fasteners.
 8. PE Pipe with Controlled OD: ASTM F 771, PE 3408 compound, SDR 11.
 - a. PE Butt, Heat-Fusion Fittings: ASTM D 3261.
 - b. PE Socket-Type Fittings: ASTM D 2683.
 9. PE Pressure Pipe: AWWA C906, with DR of 7.3, 9, or 9.3 and PE compound number required to give pressure rating not less than 160 psig (1100 kPa) **OR** 200 psig (1380 kPa), **as directed**.
 - a. PE Butt, Heat-Fusion Fittings: ASTM D 3261.
 - b. PE Socket-Type Fittings: ASTM D 2683.
 10. PVC Pipe: ASTM D 1785, PVC 1120 compound, Schedule 40 **OR** Schedule 80, **as directed**.
 - a. PVC Socket Fittings: ASTM D 2466, Schedule 40 **OR** Schedule 80, **as directed**.
 - b. PVC Threaded Fittings: ASTM D 2464, Schedule 80.
 - c. PVC Socket Unions: Construction similar to MSS SP-107, except both headpiece and tailpiece shall be PVC with socket ends.
 11. PVC Pipe, Pressure Rated: ASTM D 2241, PVC 1120 compound, SDR 21 and SDR 26.
 - a. PVC Socket Fittings: ASTM D 2467, Schedule 80.
 - b. PVC Socket Unions: Construction similar to MSS SP-107, except both headpiece and tailpiece shall be PVC with socket or threaded ends.
- B. Piping Joining Materials
1. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick unless otherwise indicated; full-face or ring type unless otherwise indicated.
 2. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
 3. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.
 4. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
 5. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 6. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.
- C. Encasement For Piping
1. Standard: ASTM A 674 or AWWA C105.



2. Form: Sheet **OR** Tube, **as directed**.
3. Material: LLDPE film of 0.008-inch (0.20-mm) **OR** LLDPE film of 0.008-inch (0.20-mm) minimum thickness or high-density, cross-laminated PE film of 0.004-inch (0.10-mm) **OR** High-density, cross-laminated PE film of 0.004-inch (0.10-mm), **as directed**, minimum thickness.
4. Color: Black **OR** Natural, **as directed**.

D. Manual Valves

1. Curb Valves:
 - a. Description:
 - 1) Standard: AWWA C800.
 - 2) NPS 1 (DN 25) and Smaller Pressure Rating: 100 psig (690 kPa) minimum **OR** 150 psig (1035 kPa), **as directed**.
 - 3) NPS 1-1/4 to NPS 2 (DN 32 to DN 50) Pressure Rating: 80 psig (550 kPa) minimum **OR** 150 psig (1035 kPa), **as directed**.
 - 4) Body Material: Brass or bronze with ball or ground-key plug.
 - 5) End Connections: Matching piping.
 - 6) Stem: With wide-tee head.
 2. Curb-Valve Casing:
 - a. Standard: Similar to AWWA M44 for cast-iron valve casings.
 - b. Top Section: Telescoping, of length required for depth of burial of curb valve.
 - c. Barrel: Approximately 3-inch (75-mm) diameter.
 - d. Plug: With lettering "WATER."
 - e. Bottom Section: With base of size to fit over valve.
 - f. Base Support: Concrete collar **OR** wood frame, **as directed**.
 3. Shutoff Rods for Curb-Valve Casings: Furnish one **OR** two, **as directed**, steel, tee-handle shutoff rod(s) with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve for Project.
 4. Brass Ball Valves:
 - a. Description:
 - 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Two piece.
 - 5) Body Material: Forged brass.
 - 6) Ends: Threaded or solder joint if indicated.
 - 7) Seats: PTFE or TFE.
 - 8) Stem: Brass.
 - 9) Ball: Chrome-plated brass.
 - 10) Port: Full **OR** regular, but not reduced, **as directed**.
 5. Bronze Ball Valves:
 - a. Description:
 - 1) Standard: MSS SP-110.
 - 2) SWP Rating: 150 psig (1035 kPa).
 - 3) CWP Rating: 600 psig (4140 kPa).
 - 4) Body Design: Two piece.
 - 5) Body Material: Bronze.
 - 6) Ends: Threaded or solder joint if indicated.
 - 7) Seats: PTFE or TFE.
 - 8) Stem: Bronze.
 - 9) Ball: Chrome-plated brass.
 - 10) Port: Full **OR** regular, but not reduced, **as directed**.
 6. Iron Ball Valves:
 - a. Description:
 - 1) Standard: MSS SP-72.
 - 2) CWP Rating: 200 psig (1380 kPa).



- 3) Body Design: Split body.
 - 4) Body Material: ASTM A 126, gray iron.
 - 5) Ends: Flanged.
 - 6) Seats: PTFE or TFE.
 - 7) Stem: Stainless steel.
 - 8) Ball: Stainless steel.
 - 9) Port: Full.
7. Plastic Ball Valves:
 - a. Description:
 - 1) Standard: MSS SP-122.
 - 2) Pressure Rating: 125 psig (860 kPa) minimum **OR** 150 psig (1035 kPa), **as directed**.
 - 3) Body Material: PVC.
 - 4) Type: Union.
 - 5) End Connections: Socket or threaded.
 - 6) Port: Full.
 8. Bronze Gate Valves:
 - a. Description:
 - 1) Standard: MSS SP-80, Type 2.
 - 2) Class: 125.
 - 3) CWP Rating: 200 psig (1380 kPa).
 - 4) Body Material: ASTM B 62 bronze with integral seat and screw-in bonnet.
 - 5) Ends: Threaded or solder joint.
 - 6) Stem: Bronze, nonrising.
 - 7) Disc: Solid wedge; bronze.
 - 8) Packing: Asbestos free.
 - 9) Handwheel: Malleable iron, bronze, or aluminum.
 9. Iron Gate Valves, Resilient Seated:
 - a. Description:
 - 1) Standard: AWWA C509.
 - 2) Pressure Rating: 200 psig (1380 kPa) **OR** 250 psig (1725 kPa), **as directed**, minimum.
 - 3) Body Material: Ductile or gray iron with bronze trim.
 - 4) End Connections: Mechanical joint or push-on joint.
 - 5) Interior Coating: Comply with AWWA C550.
 - 6) Body Design: Nonrising stem.
 - 7) Operator: Stem nut.
 - 8) Disc: Solid wedge with resilient coating.
 10. Iron Gate Valve Casings:
 - a. Standard: AWWA M44 for cast-iron valve casings.
 - b. Top Section: Adjustable extension of length required for depth of burial of valve.
 - c. Barrel: Approximately 5-inch (125-mm) diameter.
 - d. Plug: With lettering "WATER."
 - e. Bottom Section: With base of size to fit over valve.
 - f. Base Support: Concrete collar **OR** wood frame, **as directed**.
 11. Operating Wrenches for Iron Gate Valve Casings: Furnish one **OR** two, **as directed**, steel, tee-handle operating wrench(es) with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut for Project.
 12. Iron Gate Valves, NRS:
 - a. Description:
 - 1) Standard: MSS SP-70, Type I.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM A 126, gray iron with bolted bonnet.
 - 4) Ends: Flanged.
 - 5) Trim: All bronze.
 - 6) Disc: Solid wedge.



- 7) Packing and Gasket: Asbestos free.
13. Iron Gate Valves, OS&Y:
 - a. Description:
 - 1) Standard: MSS SP-70, Type I.
 - 2) CWP Rating: 200 psig (1380 kPa).
 - 3) Body Material: ASTM A 126, gray iron with bolted bonnet.
 - 4) Ends: Flanged.
 - 5) Trim: All bronze.
 - 6) Disc: Solid wedge.
 - 7) Packing and Gasket: Asbestos free.
- E. Pressure-Reducing Valves
 1. Water Regulators:
 - a. Description:
 - 1) Standard: ASSE 1003.
 - 2) Body Material: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3 (DN 65 and DN 80).
 - 3) Pressure Rating: Initial pressure of 150 psig (1035 kPa).
 - 4) End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 and NPS 3 (DN 65 and DN 80).
 2. Water Control Valves:
 - a. Description: Pilot-operation, diaphragm-type, single-seated main water control valve. Include small pilot control valve, restrictor device, specialty fittings, and sensor piping.
 - 1) Main Valve Body: Cast- or ductile-iron body with AWWA C550 or FDA-approved, interior epoxy coating; or stainless-steel body.
 - 2) Pattern: Angle-valve **OR** Globe-valve, **as directed**, design.
 - 3) Trim: Stainless steel.
 - 4) Pressure Rating: Initial pressure of 150 psig (1035 kPa) minimum.
 - 5) End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
- F. Automatic Control Valves
 1. Bronze, Automatic Control Valves:
 - a. Description: Cast-bronze body, normally closed, diaphragm type with manual-flow adjustment, and operated by 24-V ac solenoid.
 2. Plastic, Automatic Control Valves:
 - a. Description: Molded-plastic body, normally closed, diaphragm type with manual-flow adjustment, and operated by 24-V ac solenoid.
- G. Automatic Drain Valves
 1. Description: Spring-loaded-ball type of corrosion-resistant construction and designed to open for drainage if line pressure drops below 2-1/2 to 3 psig (17 to 20 kPa).
- H. Transition Fittings
 1. General Requirements: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
 2. Transition Couplings:
 - a. Description: AWWA C219, metal sleeve-type coupling for underground pressure piping.
 3. Plastic-to-Metal Transition Fittings:
 - a. Description: PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-socket or threaded end.
 4. Plastic-to-Metal Transition Unions:



- a. Description: MSS SP-107, PVC four-part union. Include one brass or stainless-steel threaded end, one solvent-cement-joint or threaded plastic end, rubber O-ring, and union nut.
- I. Dielectric Fittings
1. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.
 2. Dielectric Unions:
 - a. Description: Factory-fabricated union, NPS 2 (DN 50) and smaller.
 - 1) Pressure Rating: 150 psig (1035 kPa) minimum **OR** 250 psig (1725 kPa), **as directed**, at 180 deg F (82 deg C).
 - 2) End Connections: Solder-joint copper alloy and threaded ferrous; threaded ferrous.
 3. Dielectric Flanges:
 - a. Description: Factory-fabricated, bolted, companion-flange assembly, NPS 2-1/2 to NPS 4 (DN 65 to DN 100) and larger.
 - 1) Pressure Rating: 150 psig (1035 kPa) minimum **OR** 175 psig (1200 kPa) minimum **OR** 300 psig (2070 kPa), **as directed**.
 - 2) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
 4. Dielectric-Flange Kits:
 - a. Description: Nonconducting materials for field assembly of companion flanges, NPS 2-1/2 (DN 65) and larger.
 - 1) Pressure Rating: 150 psig (1035 kPa) minimum.
 - 2) Gasket: Neoprene or phenolic.
 - 3) Bolt Sleeves: Phenolic or polyethylene.
 - 4) Washers: Phenolic with steel backing washers.
 5. Dielectric Couplings:
 - a. Description: Galvanized-steel coupling.
 - 1) Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C).
 - 2) End Connections: Female threaded.
 - 3) Lining: Inert and noncorrosive, thermoplastic lining.
 6. Dielectric Nipples:
 - a. Description: Electroplated steel nipple complying with ASTM F 1545.
 - 1) Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C).
 - 2) End Connections: Male threaded or grooved.
 - 3) Lining: Inert and noncorrosive, propylene.
- J. Miscellaneous Piping Specialties
1. Water Hammer Arresters: ASSE 1010 or PDI WH 201, with bellows or piston-type pressurized cushioning chamber and in sizes complying with PDI WH 201, Sizes A to F.
 2. Pressure Gages: ASME B40.1. Include 4-1/2-inch- (115-mm-) diameter dial, dial range of two times system operating pressure, and bottom outlet.
- K. Sprinklers
1. General Requirements: Designed for uniform coverage over entire spray area indicated at available water pressure.
 2. Metal, Exposed, Impact-Drive Rotary Sprinklers:
 - a. Description:
 - 1) Construction: Brass and other corrosion-resistant metals.
 - 2) Mounting: Aboveground, exposed on riser.
 3. Plastic, Exposed, Impact-Drive Rotary Sprinklers:
 - a. Description:
 - 1) Construction: ABS and corrosion-resistant metals.
 - 2) Mounting: Aboveground, exposed on riser.
 4. Plastic, Pop-up, Gear-Drive Rotary Sprinklers:



- a. Description:
 - 1) Body Material: ABS.
 - 2) Nozzle: ABS **OR** Brass, **as directed**.
 - 3) Retraction Spring: Stainless steel.
 - 4) Internal Parts: Corrosion resistant.
5. Metal, Pop-up, Impact-Drive Rotary Sprinklers:
 - a. Description:
 - 1) Case: Brass.
 - 2) Body Material: Brass.
 - 3) Pop-up Height: Approximately 3 inches (75 mm).
 - 4) Sprinkler Construction: Brass and other corrosion-resistant metals.
6. Plastic, Pop-up, Impact-Drive Rotary Sprinklers:
 - a. Description:
 - 1) Case: ABS.
 - 2) Pop-up Height: Approximately 3 inches (75 mm).
 - 3) Sprinkler Construction: ABS and other corrosion-resistant metals.
7. Metal, Surface Spray Sprinklers:
 - a. Description:
 - 1) Body Material and Flange: Brass.
 - 2) Nozzle: Brass.
 - 3) Pattern: Fixed, with flow adjustment.
8. Plastic, Surface Spray Sprinklers:
 - a. Description:
 - 1) Body Material and Flange: ABS.
 - 2) Pattern: Fixed, with flow adjustment.
9. Metal, Surface, Pop-up Spray Sprinklers:
 - a. Description:
 - 1) Body Material and Flange: Brass.
 - 2) Nozzle: Brass.
 - 3) Pattern: Fixed, with flow adjustment.
10. Plastic, Surface, Pop-up Spray Sprinklers:
 - a. Description:
 - 1) Body Material and Flange: ABS.
 - 2) Pattern: Fixed, with flow adjustment.
11. Plastic, Pop-up Spray Sprinklers:
 - a. Description:
 - 1) Body Material: ABS.
 - 2) Nozzle: ABS **OR** Brass, **as directed**.
 - 3) Retraction Spring: Stainless steel.
 - 4) Internal Parts: Corrosion resistant.
 - 5) Pattern: Fixed, with flow adjustment.
12. Metal Shrub Sprinklers:
 - a. Description:
 - 1) Body Material: Brass.
 - 2) Nozzle: Brass.
 - 3) Pattern: Fixed, with flow adjustment.
13. Plastic Shrub Sprinklers:
 - a. Description:
 - 1) Body Material: ABS or other plastic.
 - 2) Pattern: Fixed, with flow adjustment.

L. Quick Couplers

1. Description: Factory-fabricated, bronze or brass, two-piece assembly. Include coupler water-seal valve; removable upper body with spring-loaded or weighted, rubber-covered cap; hose swivel with ASME B1.20.7, 3/4-11.5NH threads for garden hose on outlet; and operating key.



- a. Locking-Top Option: Vandal-resistant locking feature. Include one **OR** two, **as directed**, matching key(s).

M. Drip Irrigation Specialties

1. Freestanding Emitters: Device to deliver water at approximately 20 psig (138 kPa).
 - a. Body Material: PE or vinyl, with flow control.
 - b. Riser to Emitter: PE or PVC flexible tubing.
2. Manifold Emitter Systems: Manifold with tubing and emitters.
 - a. Manifold: With multiple outlets to deliver water to emitters.
 - 1) Body Material: Plastic.
 - 2) Outlet Caps: Plastic, for outlets without installed tubing.
 - 3) Operation: Automatic pressure compensating.
 - b. Tubing: PE or PVC; 1/8-inch (3-mm) minimum ID.
 - c. Emitter: Device to deliver water at approximately 20 psig (138 kPa).
 - 1) Body Material: PE or vinyl, with flow control.
3. Multiple-Outlet Emitter Systems: Emitter with tubing and button-type outlets.
 - a. Emitter: With multiple outlets to deliver water to remote outlets.
 - 1) Body Material: Plastic, with flow control.
 - 2) Outlet Caps: Plastic, for outlets without installed tubing.
 - 3) Operation: Automatic pressure compensating.
 - 4) Emitters: Devices to deliver water at approximately 20 psig (138 kPa).
 - b. Tubing: PE or PVC; 1/8-inch (3-mm) minimum ID.
4. Drip Tubes with Direct-Attached Emitters:
 - a. Tubing: Flexible PE or PVC with plugged end.
 - b. Emitters: Devices to deliver water at approximately 20 psig (138 kPa).
 - 1) Body Material: PE or vinyl, with flow control.
 - 2) Mounting: Inserted into tubing at set intervals.
5. Drip Tubes with Remote Discharge:
 - a. Tubing: Flexible PE or PVC with plugged end.
 - b. Emitters: Devices to deliver water at approximately 20 psig (138 kPa).
 - 1) Body Material: PE or vinyl, with flow control.
 - 2) Mounting: Inserted into tubing at set intervals.
6. Off-Ground Supports: Plastic stakes.
7. Application Pressure Regulators: Brass or plastic housing, NPS 3/4 (DN 20), with corrosion-resistant internal parts; capable of controlling outlet pressure to approximately 20 psig (138 kPa).
8. Filter Units: Brass or plastic housing, with corrosion-resistant internal parts; of size and capacity required for devices downstream from unit.
9. Air Relief Valves: Brass or plastic housing, with corrosion-resistant internal parts.
10. Vacuum Relief Valves: Brass or plastic housing, with corrosion-resistant internal parts.

N. Controllers

1. Description:
 - a. Controller Stations for Automatic Control Valves: Each station is variable from approximately 5 to 60 minutes. Include switch for manual or automatic operation of each station.
 - b. Exterior Control Enclosures: NEMA 250, Type 4, weatherproof, with locking cover and two matching keys; include provision for grounding.
 - 1) Body Material: Enameled-steel sheet metal **OR** Stainless-steel sheet metal **OR** Molded plastic, **as directed**.
 - 2) Mounting: Freestanding type for concrete base **OR** Surface type for wall, **as directed**.
 - c. Interior Control Enclosures: NEMA 250, Type 12, dripproof, with locking cover and two matching keys.
 - 1) Body Material: Enameled-steel sheet metal **OR** Stainless-steel sheet metal **OR** Molded plastic, **as directed**.



- 2) Mounting: Freestanding type for concrete base **OR** Surface type for wall, **as directed**.
- d. Control Transformer: 24-V secondary, with primary fuse.
- e. Timing Device: Adjustable, 24-hour, 14-day clock, with automatic operations to skip operation any day in timer period, to operate every other day, or to operate two or more times daily.
 - 1) Manual or Semiautomatic Operation: Allows this mode without disturbing preset automatic operation.
 - 2) Nickel-Cadmium Battery and Trickle Charger: Automatically powers timing device during power outages.
 - 3) Surge Protection: Metal-oxide-varistor type on each station and primary power.
- f. Moisture Sensor: Adjustable from one to seven days, to shut off water flow during rain.
- g. Wiring: UL 493, Type UF multiconductor, with solid-copper conductors; insulated cable; suitable for direct burial.
 - 1) Feeder-Circuit Cables: No. 12 AWG minimum, between building and controllers.
 - 2) Low-Voltage, Branch-Circuit Cables: No. 14 AWG minimum, between controllers and automatic control valves; color-coded different from feeder-circuit-cable jacket color; with jackets of different colors for multiple-cable installation in same trench.
 - 3) Splicing Materials: Manufacturer's packaged kit consisting of insulating, spring-type connector or crimped joint and epoxy resin moisture seal; suitable for direct burial.
- h. Concrete Base: Reinforced precast concrete not less than 36 by 24 by 4 inches (900 by 600 by 100 mm) thick, and 6 inches (150 mm) greater in each direction than overall dimensions of controller. Include opening for wiring.

O. Boxes For Automatic Control Valves

1. Plastic Boxes:
 - a. Description: Box and cover, with open bottom and openings for piping; designed for installing flush with grade.
 - 1) Size: As required for valves and service.
 - 2) Shape: Round **OR** Square **OR** Rectangular, **as directed**.
 - 3) Sidewall Material: PE **OR** PE, ABS, or FRP, **as directed**.
 - 4) Cover Material: PE **OR** PE, ABS, or FRP, **as directed**.
 - a) Lettering: "VALVE BOX" **OR** "IRRIGATION," **as directed**.
2. Polymer-Concrete Boxes:
 - a. Description: Box and cover, with open bottom and openings for piping; designed for installing flush with grade.
 - 1) Size: As required for valves and service.
 - 2) Shape: Round **OR** Square **OR** Rectangular, **as directed**.
 - 3) Sidewall Material: Polymer concrete with lateral and vertical sidewall design loading of 5000 lb (2268 kg) **OR** 10,000 lb (4536 kg) **OR** 15,000 lb (6800 kg), **as directed**, minimum over 10 by 10 inches (254 by 254 mm) square.
 - 4) Cover Material: Polymer concrete **OR** Reinforced polymer concrete, **as directed**, with cover design loading of 5000 lb (2268 kg) **OR** 10,000 lb (4536 kg) **OR** 15,000 lb (6800 kg), **as directed**, minimum over 10 by 10 inches (254 by 254 mm) square.
 - a) Lettering: "VALVE BOX" **OR** "IRRIGATION," **as directed**.
3. Drainage Backfill: Cleaned gravel or crushed stone, graded from 3/4 inch (19 mm) minimum to 3 inches (75 mm) maximum.

1.3 EXECUTION

A. Earthwork

1. Excavating, trenching, and backfilling are specified in Division 31 Section "Earth Moving".
2. Install warning tape directly above pressure piping, 12 inches (300 mm) below finished grades, except 6 inches (150 mm) below subgrade under pavement and slabs.



3. Drain Pockets: Excavate to sizes indicated. Backfill with cleaned gravel or crushed stone, graded from 3/4 to 3 inches (19 to 75 mm), to 12 inches (300 mm) below grade. Cover gravel or crushed stone with sheet of asphalt-saturated felt and backfill remainder with excavated material.
4. Provide minimum cover over top of underground piping according to the following:
 - a. Irrigation Main Piping: Minimum depth of 36 inches (900 mm) below finished grade, or not less than 18 inches (450 mm) below average local frost depth, whichever is deeper.
 - b. Circuit Piping: 12 inches (300 mm).
 - c. Drain Piping: 12 inches (300 mm)
 - d. Sleeves: 24 inches (600 mm).

B. Piping Installation

1. Location and Arrangement: Drawings indicate location and arrangement of piping systems. Install piping as indicated unless deviations are approved on Coordination Drawings.
2. Install piping at minimum uniform slope of 0.5 percent down toward drain valves.
3. Install piping free of sags and bends.
4. Install groups of pipes parallel to each other, spaced to permit valve servicing.
5. Install fittings for changes in direction and branch connections.
6. Install unions adjacent to valves and to final connections to other components with NPS 2 (DN 50) or smaller pipe connection.
7. Install flanges adjacent to valves and to final connections to other components with NPS 2-1/2 (DN 65) or larger pipe connection.
8. Install underground thermoplastic piping according to ASTM D 2774 and ASTM F 690.
9. Install expansion loops in control-valve boxes for plastic piping.
10. Lay piping on solid subbase, uniformly sloped without humps or depressions.
11. Install ductile-iron piping according to AWWA C600.
12. Install PVC piping in dry weather when temperature is above 40 deg F (5 deg C). Allow joints to cure at least 24 hours at temperatures above 40 deg F (5 deg C) before testing.
13. Install water regulators with shutoff valve and strainer on inlet and pressure gage on outlet. Install shutoff valve on outlet. Install aboveground or in control-valve boxes.
14. Water Hammer Arresters: Install between connection to building main and circuit valves aboveground or in control-valve boxes.
15. Install piping in sleeves under parking lots, roadways, and sidewalks.
16. Install sleeves made of Schedule 40 **OR** Schedule 80, **as directed**, PVC pipe and socket fittings, and solvent-cemented joints.
17. Install transition fittings for plastic-to-metal pipe connections according to the following:
 - a. Underground Piping:
 - 1) NPS 1-1/2 (DN 40) and Smaller: Plastic-to-metal transition fittings.
 - 2) NPS 2 (DN 50) and Larger: AWWA transition couplings.
 - b. Aboveground Piping:
 - 1) NPS 2 (DN 50) and Smaller: Plastic-to-metal transition fittings **OR** unions, **as directed**.
 - 2) NPS 2 (DN 50) and Larger: Use dielectric flange kits with one plastic flange.
18. Install dielectric fittings for dissimilar-metal pipe connections according to the following:
 - a. Underground Piping:
 - 1) NPS 2 (DN 50) and Smaller: Dielectric coupling or dielectric nipple.
 - 2) NPS 2-1/2 (DN 65) and Larger: Prohibited except in control-valve box.
 - b. Aboveground Piping:
 - 1) NPS 2 (DN 50) and Smaller: Dielectric union.
 - 2) NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Dielectric flange.
 - 3) NPS 5 (DN 125) and Larger: Dielectric flange kit.
 - c. Piping in Control-Valve Boxes:
 - 1) NPS 2 (DN 50) and Smaller: Dielectric union.
 - 2) NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Dielectric flange.
 - 3) NPS 5 (DN 125) and Larger: Dielectric flange kit.

C. Joint Construction



1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
 2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
 3. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
 4. Flanged Joints: Select rubber gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
 5. Ductile-Iron Piping Gasketed Joints: Comply with AWWA C600 and AWWA M41.
 6. Copper-Tubing Brazed Joints: Construct joints according to CDA's "Copper Tube Handbook," using copper-phosphorus brazing filler metal.
 7. Copper-Tubing Soldered Joints: Apply ASTM B 813 water-flushable flux to tube end unless otherwise indicated. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy (0.20 percent maximum lead content) complying with ASTM B 32.
 8. PE Piping Fastener Joints: Join with insert fittings and bands or fasteners according to piping manufacturer's written instructions.
 9. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 - a. Plain-End PE Pipe and Fittings: Use butt fusion.
 - b. Plain-End PE Pipe and Socket Fittings: Use socket fusion.
 10. PVC Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - b. PVC Pressure Piping: Join schedule number, ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 - c. PVC Nonpressure Piping: Join according to ASTM D 2855.
- D. Valve Installation
1. Underground Curb Valves: Install in curb-valve casings with tops flush with grade.
 2. Underground Iron Gate Valves, Resilient Seat: Comply with AWWA C600 and AWWA M44. Install in valve casing with top flush with grade.
 - a. Install valves and PVC pipe with restrained, gasketed joints.
 3. Aboveground Valves: Install as components of connected piping system.
 4. Pressure-Reducing Valves: Install in boxes for automatic control valves or aboveground between shutoff valves. Install full-size valved bypass, **as directed**.
 5. Throttling Valves: Install in underground piping in boxes for automatic control valves.
 6. Drain Valves: Install in underground piping in boxes for automatic control valves.
- E. Sprinkler Installation
1. Install sprinklers after hydrostatic test is completed.
 2. Install sprinklers at manufacturer's recommended heights.
 3. Locate part-circle sprinklers to maintain a minimum distance of 4 inches (100 mm) from walls and 2 inches (50 mm) from other boundaries unless otherwise indicated.
- F. Drip Irrigation Specialty Installation
1. Install freestanding emitters on pipe riser to mounting height indicated.
 2. Install manifold emitter systems with tubing to emitters. Plug unused manifold outlets. Install emitters on off-ground supports at height indicated.



3. Install multiple-outlet emitter systems with tubing to outlets. Plug unused emitter outlets. Install outlets on off-ground supports at height indicated.
 4. Install drip tubes with direct-attached emitters on ground.
 5. Install drip tubes with remote-discharge on ground with outlets on off-ground supports at height indicated.
 6. Install off-ground supports of length required for indicated mounted height of device.
 7. Install application pressure regulators and filter units in piping near device being protected, and aboveground **OR** in control-valve boxes, **as directed**.
 8. Install air relief valves and vacuum relief valves in piping, and aboveground **OR** in control-valve boxes, **as directed**.
- G. Automatic Irrigation-Control System Installation
1. Equipment Mounting: Install interior controllers on floor **OR** concrete bases **OR** wall, **as directed**.
 - a. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - b. Install anchor bolts to elevations required for proper attachment to supported equipment.
 2. Equipment Mounting: Install exterior freestanding controllers on precast concrete bases.
 - a. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - b. Install anchor bolts to elevations required for proper attachment to supported equipment.
 3. Install control cable in same trench as irrigation piping and at least 2 inches (51 mm) below or beside piping. Provide conductors of size not smaller than recommended by controller manufacturer. Install cable in separate sleeve under paved areas.
- H. Connections
1. Comply with requirements for piping specified in Division 22 Section "Facility Water Distribution Piping" for water supply from exterior water service piping, water meters, protective enclosures, and backflow preventers. Drawings indicate general arrangement of piping, fittings, and specialties.
 2. Install piping adjacent to equipment, valves, and devices to allow service and maintenance.
 3. Connect wiring between controllers and automatic control valves.
- I. Identification
1. Identify system components. Comply with requirements for identification specified in Division 22 Section "Identification For Plumbing Piping And Equipment".
 2. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplates and signs on each automatic controller.
 - a. Text: In addition to identifying unit, distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.
 3. Warning Tapes: Arrange for installation of continuous, underground, detectable warning tapes over underground piping during backfilling of trenches. See Division 31 Section "Earth Moving" for warning tapes.
- J. Field Quality Control
1. Perform tests and inspections.
 2. Tests and Inspections:
 - a. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - b. Operational Test: After electrical circuitry has been energized, operate controllers and automatic control valves to confirm proper system operation.
 - c. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 3. Any irrigation product will be considered defective if it does not pass tests and inspections.
 4. Prepare test and inspection reports.



- K. Adjusting
1. Adjust settings of controllers.
 2. Adjust automatic control valves to provide flow rate at rated operating pressure required for each sprinkler circuit.
 3. Adjust sprinklers and devices, except those intended to be mounted aboveground, so they will be flush with, or not more than 1/2 inch (13 mm) above, finish grade.
- L. Cleaning
1. Flush dirt and debris from piping before installing sprinklers and other devices.
- M. Piping Schedule
1. Install components having pressure rating equal to or greater than system operating pressure.
 2. Piping in control-valve boxes and aboveground may be joined with flanges or unions instead of joints indicated.
 3. Aboveground irrigation main piping, NPS 4 (DN 100) and smaller, shall be one of the following:
 - a. Galvanized-steel pipe and galvanized-steel pipe nipples; galvanized, gray-iron threaded fittings; and threaded joints.
 - b. Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube, wrought- or cast-copper fittings, and brazed **OR** soldered, **as directed**, joints.
 - c. Schedule 40 **OR** Schedule 80, **as directed**, PVC pipe; socket-type PVC fittings; and solvent-cemented joints.
 - d. Schedule 80, PVC pipe; Schedule 80, threaded PVC fittings; and threaded joints.
 4. Aboveground irrigation main piping, NPS 5 (DN 125) and larger, shall be one of the following:
 - a. Galvanized-steel pipe and galvanized-steel pipe nipples; galvanized, gray-iron threaded fittings; and threaded joints.
 - b. Schedule 40 **OR** Schedule 80, **as directed**, PVC pipe and socket fittings; and solvent-cemented joints.
 - c. Schedule 80, PVC pipe; Schedule 80, threaded PVC fittings; and threaded joints.
 5. Underground irrigation main piping, NPS 4 (DN 100) and smaller, shall be one of the following:
 - a. NPS 3 and NPS 4 (DN 80 and DN 100) ductile-iron, mechanical-joint pipe; ductile-iron, mechanical-joint fittings, glands, bolts, and nuts; and gasketed joints.
 - b. NPS 3 and NPS 4 (DN 80 and DN 100) ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings and gaskets; and gasketed joints.
 - c. Type L (Type B) soft copper tube, wrought-copper fittings, and brazed joints.
 - d. NPS 4 (DN 100) PE pressure pipe; PE butt, heat-fusion or socket-type fittings; and heat-fusion joints.
 - e. Schedule 40 **OR** Schedule 80, **as directed**, PVC pipe and socket fittings, and solvent-cemented joints.
 - f. Schedule 80, PVC pipe; Schedule 80, threaded PVC fittings; and threaded joints.
 - g. SDR 21, PVC, pressure-rated pipe; Schedule 80, PVC socket fittings; and solvent-cemented joints.
 6. Underground irrigation main piping, NPS 5 (DN 125) and larger, shall be one of the following:
 - a. NPS 6 (DN 150) and larger ductile-iron, mechanical-joint pipe; ductile-iron, mechanical-joint fittings, glands, bolts, and nuts; and gasketed joints.
 - b. NPS 6 (DN 150) and larger ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings and gaskets; and gasketed joints.
 - c. PE pressure pipe; PE butt, heat-fusion fittings; and heat-fusion joints.
 - d. Schedule 40 **OR** Schedule 80, **as directed**, PVC pipe and socket fittings; and solvent-cemented joints.
 - e. SDR 21, PVC, pressure-rated pipe; Schedule 80, PVC socket fittings; and solvent-cemented joints.
 7. Circuit piping, NPS 2 (DN 50) and smaller, shall be one of the following:
 - a. SDR 7 **OR** SDR 9, **as directed**, PE, controlled ID pipe; insert fittings for PE pipe; and fastener joints.



- b. DR 9 **OR** DR 11, **as directed**, PE, controlled OD pipe; PE butt, heat-fusion, or PE socket-type fittings; and heat-fusion joints.
 - c. Schedule 40, PVC pipe and socket fittings; and solvent-cemented joints.
 - d. SDR 26, PVC, pressure-rated pipe; Schedule 40, PVC socket fittings; and solvent-cemented joints.
8. Circuit piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100), shall be one of the following:
- a. SIDR 7 **OR** SIDR 9, **as directed**, PE, controlled ID pipe; insert fittings for PE pipe; and banded or fastener joints.
 - b. DR 9 **OR** DR 11, **as directed**, PE, controlled OD pipe; PE socket or butt-fusion fittings; and heat-fusion joints. NPS 3 (DN 80) pipe and fittings if NPS 2-1/2 (DN 65) pipe and fittings are not available.
 - c. Schedule 40, PVC pipe and socket fittings; and solvent-cemented joints.
 - d. SDR 26, PVC, pressure-rated pipe; Schedule 40, PVC socket fittings; and solvent-cemented joints.
9. Underground Branches and Offsets at Sprinklers and Devices: Schedule 80, PVC pipe; threaded PVC fittings; and threaded joints.
- a. Option: Plastic swing-joint assemblies, with offsets for flexible joints, manufactured for this application.
10. Risers to Aboveground Sprinklers and Specialties: Type L (Type B) **OR** Type M (Type C), **as directed**, hard copper tube, wrought-copper fittings, and brazed **OR** soldered, **as directed**, joints.
11. Risers to Aboveground Sprinklers and Specialties: Schedule 80, PVC pipe and socket fittings; and solvent-cemented joints.
12. Drain piping shall be one of the following:
- a. SIDR 9, 11.5, or 15, PE, controlled ID pipe; insert fittings for PE pipe; and banded or fastener joints.
 - b. Schedule 40, PVC pipe and socket fittings; and solvent-cemented joints.
 - c. SDR 21, 26, or 32.5, PVC, pressure-rated pipe; Schedule 40, PVC socket fittings; and solvent-cemented joints.
- N. Valve Schedule
1. Underground, Shutoff-Duty Valves: Use the following:
 - a. NPS 2 (DN 50) and Smaller: Curb valve, curb-valve casing, and shutoff rod.
 - b. NPS 3 (DN 80) and Larger: Iron gate valve, resilient seated; iron gate valve casing; and operating wrench(es).
 2. Aboveground, Shutoff-Duty Valves:
 - a. NPS 2 (DN 50) and Smaller: Brass **OR** Bronze **OR** Plastic, **as directed**, ball valve.
 - b. NPS 2 (DN 50) and Smaller: Bronze gate valve.
 - c. NPS 2-1/2 (DN 65) and Larger: Iron ball valve.
 - d. NPS 2-1/2 (DN 65) and Larger: Iron gate valve, NRS **OR** OS&Y, **as directed**.
 3. Throttling-Duty Valves:
 - a. NPS 2 (DN 50) and Smaller: Bronze **OR** Plastic, **as directed**, automatic control valve.
 - b. NPS 2 (DN 50) and Smaller: Brass **OR** Bronze **OR** Plastic, **as directed**, ball valve.
 - c. NPS 2-1/2 and NPS 3 (DN 65 and DN 80): Bronze **OR** Plastic, **as directed**, automatic control valve.
 - d. NPS 2-1/2 and NPS 3 (DN 65 and DN 80): Iron ball valve.
 4. Drain Valves:
 - a. NPS 1/2 and NPS 3/4 (DN 15 and DN 20): Automatic drain valve.
 - b. NPS 1/2 and NPS 3/4 (DN 15 and DN 20): Brass **OR** Bronze **OR** Plastic, **as directed**, ball valve.
 - c. NPS 1/2 and NPS 3/4 (DN 15 and DN 20): Bronze gate valve.
 - d. NPS 1 to NPS 2 (DN 25 to DN 50): Brass **OR** Bronze **OR** Plastic, **as directed**, ball valve.
 - e. NPS 1 to NPS 2 (DN 25 to DN 50): Bronze gate valve.

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Task	Specification	Specification Description
32 84 00 00	07 21 13 13a	Modified Bitumous Protected Membrane Roofing
32 84 13 00	32 82 00 00	Irrigation Systems
32 84 13 00	07 21 13 13a	Modified Bitumous Protected Membrane Roofing
32 84 23 00	01 22 16 00	No Specification Required
32 84 23 00	32 82 00 00	Irrigation Systems
32 84 23 00	07 21 13 13a	Modified Bitumous Protected Membrane Roofing
32 84 23 00	07 63 00 00	Common Work Results for Fire Suppression
32 84 23 00	07 63 00 00a	Common Work Results for Plumbing
32 84 23 00	07 63 00 00b	Common Work Results for HVAC



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SECTION 32 91 13 16 - TREE RELOCATION

1.1 GENERAL

A. Description Of Work

1. This specification covers labor, materials, necessary equipment and services to complete the tree relocation work. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.
2. Before tree excavation, pruning, removal, or relocation of existing trees, contractor shall notify:
 - a. the Owner of schedule of operation.
 - b. Appropriate utility companies and the Owner for flagging and coordination of service disconnection as necessary to complete work.
 - c. Coordinate work with other trades.

B. Definitions

1. Toxic Substances: Do not deliver any toxic substance or item as defined by the state, to the site without furnishing to the Owner a Material Safety Data Sheet (MSDS). Provide current MSDS information with each initial shipment.
 - a. The MSDS shall contain the following information:
 - 1) The chemical name and the common name of the toxic substance.
 - 2) The hazards or other risks in the use of the toxic substance, including:
 - a) The potential for fire, explosion, corrosivity and reactivity.
 - b) The known acute and chronic health effects of risks from exposure, including the medical conditions which are generally recognized as being aggravated by exposure to the toxic substance.
 - c) The primary routes of entry and symptoms of overexposure.
 - 3) The proper precautions, handling practices, necessary personal protective equipment, any other safety precautions in the use of or exposure to the toxic substance including appropriate emergency treatment in case of overexposure.
 - 4) The emergency procedure for spills, fire disposal, and first aid.
 - 5) A description in lay terms of the known specific potential health risks posed by the toxic substance intended to alert any person reading this information.
 - 6) The year and month, if available, that the information was compiled and the name, address, and emergency telephone number of the manufacturer responsible for preparing the information.

C. Description

1. Protect existing trees to remain during construction phases. Provide tree protection barriers for those existing trees adjacent to tree transplantation operations. Any trees scarred or destroyed, designated to remain, will be replaced at the Contractor's expense, with similar species, size, and quality.
2. Remove other vegetation as necessary and as required to meet project requirements to accommodate new plantings. Prepare areas to be planted according to Division 32 Section "Plants".
3. Resulting tree pits of relocated material shall be backfilled with clean fill and brought back flush with surrounding grade, unless the pits are to be immediately replanted. Stabilize grade if required. Correct problems caused by erosion, wind, etc., in the reclaimed area. Pits to be quickly replanted shall be surrounded by safety barricades to prevent accidental falls into pits.
 - a. In areas where new plant material will replace relocated plant material, appropriate planting soil mix shall be used as backfill.

D. Submittals



1. Submit a list of equipment, procedure, and labor force anticipated for use for tree relocation for approval by the Owner.
2. Submit a schedule by day indicating units to be dug and relocated. Note materials requiring root pruning, and that the relocation schedule is to begin at the end of the specified root pruning period.
3. Obtain permits required by authority having jurisdiction.
4. Submit written certification that trees indicated to remain have been protected during the course of construction according to recognized standards of the industry. Certify that where damage did occur:
 - a. Trees were promptly and properly treated.
 - b. Indicate which damaged trees (if any) are incapable of retaining full growth potential and are recommended to be replaced.
5. Submit for approval, proposed methods, and schedule for effecting tree and plant protection.

E. Quality Assurance

1. Unless otherwise specified, tree transplanting shall comply with NAA Ref.1.
2. Comply with NAA standards for pruning and remove branches from trees to remain to clear new construction.
3. Recommend procedures to compensate for loss of roots (if any) and perform initial pruning of branches and stimulation of root growth where removed to accommodate new construction.
4. Perform tree repair work for damage incurred by new construction.
5. Provide routine progress evaluation reports on relocated trees until the end of the maintenance period.
6. Evaluate existing trees and verify trees are free of disease and ready to survive relocation from the site to their new location on-site or off-site.

F. Delivery, Storage, and Handling

1. Properly handle trees and palms during moving so trunks will not be scarred or damaged and to avoid broken limbs. Broken limbs not causing the tree to be rejected shall be repaired as follows:
 - a. Properly prune dead, dying, or damaged branches with clean, sharp equipment.
 - b. Remove injured bark and wood of a tree would with a clean, sharp knife to a point where healthy bark and wood make contact at their margins.
 - c. Inspect and treat wound for insect and disease.
 - d. Seal wounds with bituminous base wound paint for all oak limbs greater than 3 inch diameter.
2. Transport trees on vehicles of adequate size to prevent overcrowding, broken limbs, foliage damage, or root ball damage.
3. Keep root balls moist during relocation.
4. Protect tree crowns with shade cloth to prevent desiccation and wind burn. Crowns shall be periodically sprayed with water to help ensure against desiccation.
5. Handle plant material only in ways and means accepted by the landscaping industry and accepted by the Owner.
6. Plant material shall be planted the same day it is dug. Coordinate preparation of planting pits or beds to ensure this schedule.

G. Warranty

1. Relocated plant material does not fall under the standard 12 month guarantee.
2. For relocated trees or palms that die, replace their canopy area with new trees as specified.
 - a. Canopy spread for all palms and trees shall be listed on proposal when submitted for relocation work.
 - b. Replacements (mitigation plantings) shall be provided at no additional cost to the Owner.
 - c. Submit the attached form to the Owner for review and approval.
 - d. Proposed replacement canopy tree species shall be the Owner accepted trees and palms.
3. Repair damage to other plants and lawn or construction work within the relocation area during tree transplantation at no cost to the Owner. This includes, but is not limited to, damage to curbs,



walks, roads, fences, site furnishings, etc. Replacing and replanting of damaged trees or shrubs shall be according to Division 32 Section "Plants" Replacing and replanting of damaged turf shall be according to Division 32 Section "Turf And Grasses".

H. Maintenance

1. Maintain relocated plant materials immediately after each item is planted and continued until the 90 day watering period is completed, upon which time the Owner will take over maintenance of materials following procedures and recommendations of contractor and specifications.
2. During the maintenance period, maintain relocated plant materials.

1.2 PRODUCT

A. Materials

1. Bone meal shall be readily available steamed bone meal, useable as a natural organic nitrogen fertilizer.
2. Peat moss, topsoil, planting soil, mulch, staking, and guying shall be as specified in Division 32 Section "Plants".

1.3 EXECUTION

A. Transplantation

1. Transplanting shall consist of on-site or off-site transplanting of existing trees or palms from proposed construction areas to permanent positions.
2. Digging, Wrapping, and Handling: Plants shall be dug and prepared for moving in a manner that will not cause damage to branches, shape, root system, and development.
3. Balled and Burlapped Plants:
 - a. Balls shall be firmly wrapped with burlap or accepted cloth substitute.
 - b. No balled plant will be acceptable if the ball is cracked and broken or if the stem or trunk is loose in the ball, either before or during transplanting.
 - c. Balled plants shall be lifted and handled from the bottom of the ball.
 - d. Protect ball and deliver to the site, plant immediately, and water thoroughly.
 - e. Ball sizes shall be as recommended in ANSI Z 60.1.

B. Planting

1. Relocated Material
 - a. Relocated trees/palms shall be planted according to procedures described for new material, Division 32 Section "Plants". Verify final grades have been established before planting operations. Ensure proposed planting pits drain by test-filling with water before transplantation.
 - b. Continue watering and caring for relocated material as specified.
 - c. Mulch tree pit areas to reduce weeds, discourage foot traffic, conserve moisture, and minimize temperature fluctuations.
 - d. Brace trunk and leave in place for approximately one year until trees are wind firm.
 - e. Wrap trunks and structural branches of thin-barked trees to protect against sun scald and dehydration. Retain through at least one growing season, and through cold season.
 - f. Feed with a diluted solution of N-P-K in solution form with a soil needle, providing water, air, and nutrients.
 - g. Where foliage is retarded, spray with one of the soluble types of foliage feeders.
 - h. At time of planting, fill air pockets and keep roots, especially feeder roots, moist, live, and healthy. Use soil needles for watering new transplants. Direct fine spray at foliage to help harden-off new leaves.

- C. Staking And Guying: Stake and guy designated material according to procedures described for new plant materials, Division 32 Section "Plants".



D. Watering

1. Following transplantation, water trees daily for the first two weeks, every other day for the next three weeks, and every third day for the balance of the three month watering/maintenance period. Such watering shall thoroughly saturate the root ball to its full depth.
2. Following relocation, trees designated for transplanting shall be watered as specified in this section. Such watering shall thoroughly saturate the root ball to its full depth.
3. Provide manual watering of relocated plant materials for 90 days. If used, after watering period, Contractor shall be responsible for the complete removal of all temporary watering systems.

E. Tagging: Trees within the designated areas for relocation shall be clearly marked by means of yellow plastic surveyor's ribbons and coordinated with, inspected, and accepted by the Owner before root pruning and digging.

F. Root Preparation

1. Trees to be relocated shall be root pruned at least 45 days before digging with clean, sharp equipment.
 - a. Maintain root pruned materials by watering, weeding, mowing, spraying, fertilizing, and other horticulture practices.
 - b. After root pruning, backfill with good rooting medium, fertilize with organic fertilizer to promote root growth.
 - c. Mulch to reduce weeds, discourage foot traffic, conserve moisture, and minimize temperature fluctuation.
2. Root Ball Size Chart: Root ball sizes shall be according to minimum standards set forth in Grades and Standards for Nursery Plants Part II, Palms and Trees, local state Department of Agriculture.
 - a. Trees-Minimum Ball Sizes:

Caliper	Minimum Ball Diameter
3-1/2" to 4"	28"
4" to 4-1/2"	30"
4-1/2" to 5"	32"
5" to 5-1/2"	34"
Larger sizes increase proportionally.	

b. Minimum Ball Depth:

Ball Diameter	Depth
Less than 20"	Not less than 75 percent of diameter.
20" to 30"	Not less than 65 percent of diameter.
30" to 48"	Not less than 60 percent of diameter.

G. Crown Preparation

1. Shade and Flowering Trees
 - a. Shade Trees: Selectively prune and thin crown to remove approximately one third of the branches. Preserve the basic shape and form of the tree, eliminate cross-branching and dead or diseased branches.
 - b. Hand strip selected species of all leaves following pruning and before moving.
2. Palms: Follow standard procedure for transplantation of palms.

H. Hand Digging: Burlapping is required. Trees that are burlapped for relocation shall comply and be handled in same manner as new plant material specified in Section "Exterior Plants."



-
- I. Special Conditions
 - 1. Multi-Trunk Trees: Relocate multi-trunk tree as one unit. Measure unit by taking the aggregate total of all DBH measurements.
 - 2. Multi-Trunk Palms: Relocate multi-trunk palms as one unit. Unit shall be measured as follows:
 - a. 50 percent of the value in dollars of the largest trunk in the grouping times the number of trunks in the clump.
 - 3. On-site relocation
 - a. On-site relocation shall include root pruning, canopy pruning, on-site transportation, hauling and dumping of debris, and 90-day maintenance.
 - b. If the tree or palm should die within the 90-day maintenance period, remove the tree, replace the material, and restore the site at no additional cost to the Owner.
 - J. Cleaning
 - 1. Cleaning up the Site
 - a. Upon completion of the work, thoroughly clean up the project site.
 - b. In addition to removing equipment, unused materials, deleterious material, and surplus excavated material, the Contractor shall fine grade all disturbed areas and the areas adjacent to the transplanted material to provide a neat and uniform site.
 - c. All damaged or altered existing structures, as a result of the landscape work, shall be corrected.

END OF SECTION 32 91 13 16



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Task	Specification	Specification Description
32 91 13 26	32 91 13 16	Tree Relocation



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SECTION 32 91 13 33 - LAWNS AND GRASSES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for lawns and grasses. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Seeding.
 - b. Hydroseeding.
 - c. Sodding.
 - d. Plugging.
 - e. Sprigging.
 - f. Meadow grasses and wildflowers.
 - g. Turf renovation.
 - h. Erosion-control material(s).
 - i. Grass paving.

C. Definitions

1. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.
2. Finish Grade: Elevation of finished surface of planting soil.
3. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
4. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
5. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
6. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
7. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill before planting soil is placed.
8. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
9. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.

D. Submittals

1. Product Data: For each type of product indicated.
2. Certification of Grass Seed.
 - a. Certification of each seed mixture for turfgrass sod **OR** plugs, **as directed**.
3. Product Certificates: For soil amendments and fertilizers, from manufacturer.
4. Maintenance Instructions: Recommended procedures to be established by the Owner for maintenance of turf and meadows during a calendar year. Submit before expiration of required initial maintenance periods.



E. Quality Assurance

1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
 - a. Pesticide Applicator: State licensed, commercial.
2. Soil Analysis: For each unamended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory.
 - a. The soil-testing laboratory shall oversee soil sampling.
 - b. Report suitability of tested soil for turf growth.
 - 1) State recommendations for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
 - 2) Report presence of problem salts, minerals, or heavy metals; if present, provide additional recommendations for corrective action.

F. Delivery, Storage, And Handling

1. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable.
2. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod in time for planting within 24 hours of harvesting. Protect sod from breakage and drying.
3. Bulk Materials:
 - a. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
 - b. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
 - c. Accompany each delivery of bulk fertilizers, lime, and soil amendments with appropriate certificates.

G. Maintenance Service

1. Initial Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 1.3. Begin maintenance immediately after each area is planted and continue until acceptable turf is established but for not less than the following periods:
 - a. Seeded Turf: 60 days from date of planting completion **OR** Final Completion, **as directed**.
 - 1) When initial maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue maintenance during next planting season.
 - b. Sodded Turf: 30 days from date of planting completion **OR** Final Completion, **as directed**.
 - c. Plugged Turf: 30 days from date of planting completion **OR** Final Completion, **as directed**.
 - d. Sprigged Turf: 30 days from date of planting completion **OR** Final Completion, **as directed**.
2. Initial Meadow Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 1.3. Begin maintenance immediately after each area is planted and continue until acceptable meadow is established, but for not less than 40 days from date of planting completion **OR** Final Completion, **as directed**.
3. Continuing Maintenance Proposal: From Installer to the Owner, in the form of a standard yearly (or other period) maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.



1.2 PRODUCTS

A. Seed

1. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.
2. Seed Species: If grass seed is required to be certified by the State Department of Agriculture, State-certified seed of grass species as follows:
OR
Seed Species: If grass seed is not required to be certified by the State Department of Agriculture, seed of grass species as follows, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 0.5 percent weed seed:
 - a. Warm-season grass
 - 1) Full Sun: Bermudagrass (*Cynodon dactylon*).
 - b. Cool-season grass
 - 1) Full Sun: Kentucky bluegrass (*Poa pratensis*), a minimum of three cultivars.
 - 2) Sun and Partial Shade: Proportioned by weight as follows:
 - a) 50 percent Kentucky bluegrass (*Poa pratensis*).
 - b) 30 percent chewings red fescue (*Festuca rubra* variety).
 - c) 10 percent perennial ryegrass (*Lolium perenne*).
 - d) 10 percent redtop (*Agrostis alba*).
 - 3) Shade: Proportioned by weight as follows:
 - a) 50 percent chewings red fescue (*Festuca rubra* variety).
 - b) 35 percent rough bluegrass (*Poa trivialis*).
 - c) 15 percent redtop (*Agrostis alba*).
3. Grass Seed Mix: Proprietary seed mix as directed by the Owner.

B. Turfgrass Sod

1. Turfgrass Sod: Certified **OR** Approved **OR** Number 1 Quality/Premium, including limitations on thatch, weeds, diseases, nematodes, and insects, **as directed**, complying with "Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted.
2. Turfgrass Species (warm-season grass): Bermudagrass (*Cynodon dactylon*) **OR** Carpetgrass (*Axonopus affinis*) **OR** Centipedegrass (*Eremochloa ophiuroides*) **OR** St. Augustinegrass (*Stenotaphrum secundatum*) **OR** Zoysiagrass (*Zoysia japonica*) **OR** Zoysiagrass (*Zoysia matrella*), **as directed**.
3. Turfgrass Species (cool-season grass): Sod of grass species as follows, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 0.5 percent weed seed:
 - a. Full Sun: Kentucky bluegrass (*Poa pratensis*), a minimum of three cultivars.
 - b. Sun and Partial Shade: Proportioned by weight as follows:
 - 1) 50 percent Kentucky bluegrass (*Poa pratensis*).
 - 2) 30 percent chewings red fescue (*Festuca rubra* variety).
 - 3) 10 percent perennial ryegrass (*Lolium perenne*).
 - 4) 10 percent redtop (*Agrostis alba*).
 - c. Shade: Proportioned by weight as follows:
 - 1) 50 percent chewings red fescue (*Festuca rubra* variety).
 - 2) 35 percent rough bluegrass (*Poa trivialis*).
 - 3) 15 percent redtop (*Agrostis alba*).

C. Plugs

1. Plugs: Turfgrass sod, certified **OR** approved **OR** Number 1 Quality/Premium, including limitations on thatch, weeds, diseases, nematodes, and insects, **as directed**, complying with "Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture, cut into square or round plugs, strongly rooted,



and capable of vigorous growth and development when planted; of the following turfgrass species and plug size:

- a. Turfgrass Species (warm-season grass): Bermudagrass (*Cynodon dactylon*) **OR** Carpetgrass (*Axonopus affinis*) **OR** Centipedegrass (*Eremochloa ophiuroides*) **OR** St. Augustinegrass (*Stenotaphrum secundatum*) **OR** Zoysiagrass (*Zoysia japonica*) **OR** Zoysiagrass (*Zoysia matrella*), **as directed**.
- b. Plug Size: 2 inches (50 mm) **OR** 3 inches (75 mm) **OR** 4 inches (100 mm), **as directed**.

D. Sprigs

1. Sod Sprigs: Healthy living stems, rhizomes, or stolons with a minimum of two nodes and attached roots free of soil, of the following turfgrass species:
 - a. Turfgrass Species (warm-season grass): Bermudagrass (*Cynodon dactylon*) **OR** Carpetgrass (*Axonopus affinis*) **OR** Centipedegrass (*Eremochloa ophiuroides*) **OR** St. Augustinegrass (*Stenotaphrum secundatum*) **OR** Zoysiagrass (*Zoysia japonica*) **OR** Zoysiagrass (*Zoysia matrella*), **as directed**.
 - b. Turfgrass Species (cool-season grass): Creeping bentgrass (*Agrostis palustris*).

E. Meadow Grasses And Wildflowers

1. Wildflower Seed: Fresh, clean, and dry new seed, of mixed species as directed.
2. Native Grass Seed: Fresh, clean, and dry new seed, of mixed species as directed.
3. Wildflower and Native Grass Seed: Fresh, clean, and dry new seed, of mixed species as directed.
4. Seed Carrier: Inert material, sharp clean sand or perlite, mixed with seed at a ratio of not less than two parts seed carrier to one part seed.

F. Inorganic Soil Amendments

1. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:
 - a. Class T, with a minimum of 99 percent passing through No. 8 (2.36-mm) sieve and a minimum of 75 percent passing through No. 60 (0.25-mm) sieve.
OR
Class O, with a minimum of 95 percent passing through No. 8 (2.36-mm) sieve and a minimum of 55 percent passing through No. 60 (0.25-mm) sieve.
 - b. Provide lime in form of ground dolomitic limestone **OR** calcitic limestone **OR** mollusk shells, **as directed**.
2. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, and with a minimum of 99 percent passing through No. 6 (3.35-mm) sieve and a maximum of 10 percent passing through No. 40 (0.425-mm) sieve.
3. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.
4. Aluminum Sulfate: Commercial grade, unadulterated.
5. Perlite: Horticultural perlite, soil amendment grade.
6. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50 (0.30-mm) sieve.
7. Sand: Clean, washed, natural or manufactured, and free of toxic materials.
8. Diatomaceous Earth: Calcined, 90 percent silica, with approximately 140 percent water absorption capacity by weight.
OR
Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

G. Organic Soil Amendments

1. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch (25-mm) **OR** 3/4-inch (19-mm) **OR** 1/2-inch (12.5-mm), **as directed**, sieve; soluble salt content of 5 to 10



decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

- a. Organic Matter Content: 50 to 60 percent of dry weight.
- b. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.
2. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or of granular texture, with a pH range of 3.4 to 4.8.
3. Muck Peat: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture, with a pH range of 6 to 7.5, and having a water-absorbing capacity of 1100 to 2000 percent.
4. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.
 - a. In lieu of decomposed wood derivatives, mix partially decomposed wood derivatives with ammonium nitrate at a minimum rate of 0.15 lb/cu. ft. (2.4 kg/cu. m) of loose sawdust or ground bark, or with ammonium sulfate at a minimum rate of 0.25 lb/cu. ft. (4 kg/cu. m) of loose sawdust or ground bark.
5. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

H. Fertilizers

1. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 1 **OR** 4, **as directed**, percent nitrogen and 10 **OR** 20, **as directed**, percent phosphoric acid.
2. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.
3. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
 - a. Composition: 1 lb/1000 sq. ft. (0.45 kg/92.9 sq. m) of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
 - b. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.
4. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
 - a. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.
OR
Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

I. Planting Soils

1. Planting Soil: ASTM D 5268 topsoil, with pH range of 5.5 to 7, a minimum of 2 percent organic material content **OR** Existing, native surface topsoil formed under natural conditions with the duff layer retained during excavation process **OR** Existing, in-place surface soil **OR** Imported topsoil or manufactured topsoil from off-site sources; do not obtain from agricultural land, bogs or marshes, **as directed**. Verify suitability of soil to produce viable planting soil. Clean soil of roots, plants, sod, stones, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth. Mix soil with the following soil amendments and fertilizers in the following quantities to produce planting soil:
 - a. Ratio of Loose Compost to Topsoil by Volume: 1:4 **OR** 1:3 **OR** 1:2, **as directed**.
 - b. Ratio of Loose Sphagnum **OR** Muck, **as directed**, Peat to Topsoil by Volume: as directed by the Owner .
 - c. Ratio of Loose Wood Derivatives to Topsoil by Volume: as directed by the Owner.
 - d. Weight of Lime per 1000 Sq. Ft. (92.9 Sq. m): as directed by the Owner.



- e. Weight of Sulfur **OR** Iron Sulfate **OR** Aluminum Sulfate, **as directed**, per 1000 Sq. Ft. (92.9 Sq. m): as directed by the Owner.
- f. Weight of Agricultural Gypsum per 1000 Sq. Ft. (92.9 Sq. m): as directed by the Owner.
- g. Volume of Sand Plus 10 Percent Diatomaceous Earth **OR** Zeolites, **as directed**, per 1000 Sq. Ft. (92.9 Sq. m): as directed by the Owner.
- h. Weight of Bonemeal per 1000 Sq. Ft. (92.9 Sq. m): as directed by the Owner.
- i. Weight of Superphosphate per 1000 Sq. Ft. (92.9 Sq. m): as directed by the Owner.
- j. Weight of Commercial Fertilizer per 1000 Sq. Ft. (92.9 Sq. m): as directed by the Owner.
- k. Weight of Slow-Release Fertilizer per 1000 Sq. Ft. (92.9 Sq. m): as directed by the Owner.

J. Mulches

1. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.
2. Sphagnum Peat Mulch: Partially decomposed sphagnum peat moss, finely divided or of granular texture, and with a pH range of 3.4 to 4.8.
3. Muck Peat Mulch: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture, with a pH range of 6 to 7.5, and having a water-absorbing capacity of 1100 to 2000 percent.
4. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch (25-mm) sieve; soluble salt content of 2 to 5 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
 - a. Organic Matter Content: 50 to 60 percent of dry weight.
 - b. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.
5. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic and free of plant-growth or germination inhibitors; with a maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.
6. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.
7. Asphalt Emulsion: ASTM D 977, Grade SS-1; nontoxic and free of plant-growth or germination inhibitors.

K. Pesticides

1. General: Pesticide, registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.
2. Pre-Emergent Herbicide (Selective and Non-Selective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.
3. Post-Emergent Herbicide (Selective and Non-Selective): Effective for controlling weed growth that has already germinated.

L. Erosion-Control Materials

1. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches (150 mm) long.
2. Erosion-Control Fiber Mesh: Biodegradable burlap or spun-coir mesh, a minimum of 0.92 lb/sq. yd. (0.5 kg/sq. m), with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches (150 mm) long.
3. Erosion-Control Mats: Cellular, non-biodegradable slope-stabilization mats designed to isolate and contain small areas of soil over steeply sloped surface, of 3-inch (75-mm) **OR** 4-inch (100-mm) **OR** 6-inch (150-mm), **as directed**, nominal mat thickness. Include manufacturer's recommended anchorage system for slope conditions.



M. Grass-Paving Materials

1. Grass Paving: Cellular, non-biodegradable plastic mats, designed to contain small areas of soil and enhance the ability of turf to support vehicular and pedestrian traffic, of 1-inch (25-mm) **OR** 1-3/4-inch (45-mm) **OR** 2-inch (50-mm) **OR** manufacturer's standard, **as directed**, nominal mat thickness. Include manufacturer's recommended anchorage system for slope conditions.
2. Base Course: Sound crushed stone or gravel complying with ASTM D 448 for Size No. 8 **OR** Division 31 Section "Earth Moving" for base-course material, **as directed**.
3. Sand: Sound, sharp, washed, natural sand or crushed stone complying with gradation requirements in ASTM C 33 for fine aggregate.
4. Proprietary Growing Mix: As submitted and acceptable to the Owner.
5. Sandy Loam Soil Mix: Sound, sharp, washed, natural sand or crushed stone complying with gradation requirements in ASTM C 33 for fine aggregate blended with planting soil as specified. Use blend consisting of 1/2 sand and 1/2 planting soil **OR** 2/3 sand and 1/3 planting soil, **as directed**.
6. Soil for Paving Fill: Planting soil as specified.

1.3 EXECUTION

A. Preparation

1. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
 - a. Protect adjacent and adjoining areas from hydroseeding and hydromulching overspray.
 - b. Protect grade stakes set by others until directed to remove them.
2. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

B. Turf Area Preparation

1. Limit turf subgrade preparation to areas to be planted.
2. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 4 inches (100 mm) **OR** 6 inches (150 mm) **OR** 8 inches (200 mm), **as directed**. Remove stones larger than 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off the Owner's property.
 - a. Apply superphosphate fertilizer directly to subgrade before loosening.
 - b. Thoroughly blend planting soil off-site before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil.
 - 1) Delay mixing fertilizer with planting soil if planting will not proceed within a few days.
 - 2) Mix lime with dry soil before mixing fertilizer.
 - c. Spread planting soil to a depth of 4 inches (100 mm) **OR** 6 inches (150 mm) **OR** 8 inches (200 mm), **as directed**, but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
 - 1) Spread approximately 1/2 the thickness of planting soil over loosened subgrade. Mix thoroughly into top 2 inches (50 mm) **OR** 4 inches (100 mm), **as directed**, of subgrade. Spread remainder of planting soil.
 - 2) Reduce elevation of planting soil to allow for soil thickness of sod.
3. Unchanged Subgrades: If turf is to be planted in areas unaltered or undisturbed by excavating, grading, or surface-soil stripping operations, prepare surface soil as follows:
 - a. Remove existing grass, vegetation, and turf. Do not mix into surface soil.
 - b. Loosen surface soil to a depth of at least 6 inches (150 mm) **OR** 8 inches (200 mm), **as directed**. Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top 4 inches (100 mm) **OR** 6 inches (150 mm), **as directed**, of soil. Till soil to a homogeneous mixture of fine texture.
 - 1) Apply superphosphate fertilizer directly to surface soil before loosening.
 - c. Remove stones larger than 1 inch (25 mm) **OR** 1-1/2 inches (38 mm) **OR** 2 inches (50 mm), **as directed**, in any dimension and sticks, roots, trash, and other extraneous matter.



- d. Legally dispose of waste material, including grass, vegetation, and turf, off the Owner's property.
 4. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch (13 mm) of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.
 5. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
 6. Before planting, obtain the Owner's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.
- C. Preparation For Erosion-Control Materials
1. Prepare area as specified in "Turf Area Preparation" Article.
 2. For erosion-control mats, install planting soil in two lifts, with second lift equal to thickness of erosion-control mats. Install erosion-control mat and fasten as recommended by material manufacturer.
 3. Fill cells of erosion-control mat with planting soil and compact before planting.
 4. For erosion-control blanket or mesh, install from top of slope, working downward, and as recommended by material manufacturer for site conditions. Fasten as recommended by material manufacturer.
 5. Moisten prepared area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- D. Preparation For Grass-Paving Materials
1. Reduce subgrade elevation soil to allow for thickness of grass-paving system. Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade so that installed paving is within plus or minus 1/2 inch (13 mm) of finish elevation. Roll and rake, remove ridges, and fill depressions.
 2. Install base course **OR** sand course **OR** base course and sand course, **as directed**, and sandy loam soil mix **OR** proprietary growing mix **OR** soil for paving fill, **as directed**, as recommended by paving-material manufacturer for site conditions; comply with details shown on Drawings. Compact according to paving-material manufacturer's written instructions.
 3. Install paving mat and fasten according to paving-material manufacturer's written instructions.
 4. Before planting, fill cells of paving mat with planting soil **OR** sandy loam soil mix **OR** proprietary growing mix **OR** sand half full, **as directed**, and compact according to manufacturer's written instructions.
 5. Moisten prepared area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- E. Seeding
1. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph (8 km/h). Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
 - a. Do not use wet seed or seed that is moldy or otherwise damaged.
 - b. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.
 2. Sow seed at a total rate of 2 lb/1000 sq. ft. (0.9 kg/92.9 sq. m) **OR** 3 to 4 lb/1000 sq. ft. (1.4 to 1.8 kg/92.9 sq. m) **OR** 5 to 8 lb/1000 sq. ft. (2.3 to 3.6 kg/92.9 sq. m), **as directed**.
 3. Rake seed lightly into top 1/8 inch (3 mm) of soil, roll lightly, and water with fine spray.
 4. Protect seeded areas with slopes exceeding 1:4 with erosion-control blankets and 1:6 with erosion-control fiber mesh installed and stapled according to manufacturer's written instructions.
 5. Protect seeded areas with erosion-control mats where shown on Drawings; install and anchor according to manufacturer's written instructions.
 6. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre (42 kg/92.9 sq. m) to form a continuous blanket 1-1/2 inches (38 mm) in loose thickness over seeded areas. Spread by hand, blower, or other suitable equipment.



- a. Anchor straw mulch by crimping into soil with suitable mechanical equipment.
 - b. Bond straw mulch by spraying with asphalt emulsion at a rate of 10 to 13 gal./1000 sq. ft. (38 to 49 L/92.9 sq. m). Take precautions to prevent damage or staining of structures or other plantings adjacent to mulched areas. Immediately clean damaged or stained areas.
7. Protect seeded areas from hot, dry weather or drying winds by applying compost mulch **OR** peat mulch **OR** planting soil, **as directed**, within 24 hours after completing seeding operations. Soak areas, scatter mulch uniformly to a thickness of 3/16 inch (4.8 mm), and roll surface smooth.
- F. Hydroseeding
1. Hydroseeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.
 - a. Mix slurry with nonasphaltic **OR** asphalt-emulsion **OR** fiber-mulch manufacturer's recommended, **as directed**, tackifier.
 - b. Apply slurry uniformly to all areas to be seeded in a one-step process. Apply slurry at a rate so that mulch component is deposited at not less than 1500-lb/acre (15.6-kg/92.9 sq. m) dry weight, and seed component is deposited at not less than the specified seed-sowing rate.

OR

Apply slurry uniformly to all areas to be seeded in a two-step process. Apply first slurry coat at a rate so that mulch component is deposited at not less than 500-lb/acre (5.2-kg/92.9 sq. m) dry weight, and seed component is deposited at not less than the specified seed-sowing rate. Apply slurry cover coat of fiber mulch (hydromulching) at a rate of 1000 lb/acre (10.4 kg/92.9 sq. m).
- G. Sodding
1. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.
 2. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.
 - a. Lay sod across angle of slopes exceeding 1:3.
 - b. Anchor sod on slopes exceeding 1:6 with wood pegs or steel staples spaced as recommended by sod manufacturer but not less than 2 anchors per sod strip to prevent slippage.
 3. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches (38 mm) below sod.
- H. Plugging
1. Plant plugs in holes or furrows, spaced 12 inches (300 mm) **OR** 18 inches (450 mm), **as directed**, apart in both directions. On slopes, contour furrows to near level.
- I. Sprigging
1. Plant freshly shredded sod sprigs in furrows 1 to 1-1/2 inches (25 to 38 mm) **OR** 1-1/2 to 2 inches (38 to 50 mm) **OR** 2-1/2 to 3 inches (64 to 75 mm), **as directed**, deep. Place individual sprigs with roots and portions of stem in moistened soil, 6 inches (150 mm) **OR** 12 inches (300 mm), **as directed**, apart in rows 10 inches (250 mm) **OR** 18 inches (450 mm), **as directed**, apart, and fill furrows without covering growing tips. Lightly roll and firm soil around sprigs after planting.
 2. Broadcast sprigs uniformly over prepared surface at a rate of 10 cu. ft./1000 sq. ft. (0.28 cu. m/92.9 sq. m) and mechanically force sprigs into lightly moistened soil.
 - a. Spread a 1/4-inch- (6-mm-) thick layer of compost mulch **OR** peat mulch **OR** planting soil, **as directed**, on sprigs.
 - b. Lightly roll and firm soil around sprigs after planting.



- c. Water sprigs immediately after planting and keep moist by frequent watering until well rooted.

J. Turf Renovation

1. Renovate existing turf.
2. Renovate existing turf damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles.
 - a. Reestablish turf where settlement or washouts occur or where minor regrading is required.
 - b. Install new planting soil as required.
3. Remove sod and vegetation from diseased or unsatisfactory turf areas; do not bury in soil.
4. Remove topsoil containing foreign materials such as oil drippings, fuel spills, stones, gravel, and other construction materials resulting from Contractor's operations, and replace with new planting soil.
5. Mow, dethatch, core aerate, and rake existing turf.
6. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.
7. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off the Owner's property.
8. Till stripped, bare, and compacted areas thoroughly to a soil depth of 6 inches (150 mm).
9. Apply soil amendments and initial fertilizers required for establishing new turf and mix thoroughly into top 4 inches (100 mm) of existing soil. Install new planting soil to fill low spots and meet finish grades.
10. Apply seed and protect with straw mulch **OR** sod, **as directed**, as required for new turf.
11. Water newly planted areas and keep moist until new turf is established.

K. Turf Maintenance

1. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.
 - a. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
 - b. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
 - c. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.
2. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches (100 mm).
 - a. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
 - b. Water turf with fine spray at a minimum rate of 1 inch (25 mm) per week unless rainfall precipitation is adequate.
3. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:
 - a. Mow bentgrass to a height of 1/2 inch (13 mm) or less.
 - b. Mow bermudagrass to a height of 1/2 to 1 inch (13 to 25 mm).
 - c. Mow carpetgrass, centipedegrass, perennial ryegrass, and zoysiagrass to a height of 1 to 2 inches (25 to 50 mm).
 - d. Mow Kentucky bluegrass, buffalograss, annual ryegrass, and chewings red fescue to a height of 1-1/2 to 2 inches (38 to 50 mm).



- e. Mow bahiagrass, turf-type tall fescue, and St. Augustinegrass to a height of 2 to 3 inches (50 to 75 mm).
4. Turf Postfertilization: Apply fertilizer after initial mowing and when grass is dry.
 - a. Use fertilizer that will provide actual nitrogen of at least 1 lb/1000 sq. ft. (0.45 kg/92.9 sq. m) to turf area.
- L. Satisfactory Turf
 1. Turf installations shall meet the following criteria as determined by Architect:
 - a. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. (0.92 sq. m) and bare spots not exceeding 5 by 5 inches (125 by 125 mm).
 - b. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.
 - c. Satisfactory Plugged Turf: At end of maintenance period, the required number of plugs has been established as well-rooted, viable patches of grass, and areas between plugs are free of weeds and other undesirable vegetation.
 - d. Satisfactory Sprigged Turf: At end of maintenance period, the required number of sprigs has been established as well-rooted, viable plants, and areas between sprigs are free of weeds and other undesirable vegetation.
 2. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.
- M. Meadow
 1. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph (8 km/h). Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
 - a. Do not use wet seed or seed that is moldy or otherwise damaged.
 2. Sow seed at a total rate of 4 oz./1000 sq. ft. (113 g/92.9 sq. m) **OR** 5 oz./1000 sq. ft. (142 g/92.9 sq. m) **OR** 6 oz./1000 sq. ft. (170 g/92.9 sq. m), **as directed**.
 3. Brush seed into top 1/16 inch (1.6 mm) of soil, roll lightly, and water with fine spray.
 4. Protect seeded areas from hot, dry weather or drying winds by applying peat or compost mulch within 24 hours after completing seeding operations. Soak areas, scatter mulch uniformly to a thickness of 3/16 inch (4.8 mm), and roll surface smooth.
 5. Water newly planted areas and keep moist until meadow is established.
- N. Meadow Maintenance
 1. Maintain and establish meadow by watering, weeding, mowing, trimming, replanting, and performing other operations as required to establish a healthy, viable meadow. Roll, regrade, and replant bare or eroded areas and remulch. Provide materials and installation the same as those used in the original installation.
 - a. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and meadow damaged or lost in areas of subsidence.
 - b. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
 - c. Apply treatments as required to keep meadow and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.
 2. Watering: Install and maintain temporary piping, hoses, and meadow-watering equipment to convey water from sources and to keep meadow uniformly moist.
 - a. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
 - b. Water meadow with fine spray at a minimum rate of 1/2 inch (13 mm) per week for four **OR** six **OR** eight, **as directed**, weeks after planting unless rainfall precipitation is adequate.



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- O. Pesticide Application
 - 1. Apply pesticides and other chemical products and biological control agents in accordance with requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with the Owner's operations and others in proximity to the Work. Notify the Owner before each application is performed.
 - 2. Post-Emergent Herbicides (Selective and Non-Selective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations.

 - P. Cleanup And Protection
 - 1. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
 - 2. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.
 - 3. Remove nondegradable erosion-control measures after grass establishment period.

END OF SECTION 32 91 13 33



Task	Specification	Specification Description
32 91 13 33	31 13 13 00	Tree Protection And Trimming
32 91 13 33	31 05 13 00	Earthwork
32 91 13 33	31 24 13 00	Embankment
32 91 13 36	32 91 13 16	Tree Relocation
32 91 13 36	32 91 13 33	Lawns And Grasses



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SECTION 32 91 19 13 - CONCRETE REVETMENT

1.1 GENERAL

A. Description Of Work

- 1. This specification covers installation of a concrete revetment. Work includes but is not limited to furnishing all labor, materials, equipment and supervision necessary to construct concrete revetment as follows or as directed by the Owner.

1.2 PRODUCTS

A. The Concrete Revetment shall be an articulating cellular concrete block system, as manufactured by American Excelsior Company, or approved equal, (800-713-8245), is a block structure installed over a geotextile fabric as described herein. The cellular blocks are made of Portland Cement Concrete cast into "lock" blocks and "key" blocks to provide a three directional interlock to resist lateral movement. The articulating cellular concrete block system is a "flexible" concrete revetment which allows the blocks to traverse changes in terrain without disruption of the placement pattern and interlock feature.

- 1. The minimum concrete strength shall be 3,000 psi. Nominal block thickness shall be either 4 inches, 6 inches or 8 inches, as required to meet project requirements. Block weights, per pair of "key" and "lock" blocks, shall be approximately 50, 70 and 90 pounds for #4010-4 inch, #4015-6 inch and #4020-8 inch thick blocks, respectively. Each pair of "key" and "lock" blocks shall cover approximately 1.54 square feet, including uncovered openings between the blocks. The system shall provide approximately 80 percent coverage of the area with blocks, leaving approximately 20 percent, but not less than 16 percent, uncovered area at the ground surface.

B. Filter fabric shall be Tri-Lock Fabric #792 as supplied by American Excelsior Company, or approved equal, (800) 713-8245; roll values:

<u>Property</u>	<u>Specification</u>	<u>Test Method</u>
Weight	7.4 oz/sy	ASTM D3776
Thickness	25 mils	ASTM D1777
Permeability	0.5 cm/sec	ASTM D4491
Abrasion Resistance	Warp: 58 percent	ASTM N3884
(% strength retained)	Fill: 81 percent	
Tensile Grab Strength	350 lbs. x 395 lbs	ASTM D4632
Grab Elongation	24% x 24%	ASTM D4632
Burst Strength	780 psi	ASTM D3786
Trapezoid Tear	120 lbs x 110 lbs.	ASTM D4533
Puncture Strength	165 lbs.	ASTM D4833
Apparent Opening Size	40-70	ASTM D-4751
UV Resistance @ 500 hours	90 percent	ASTM D-4355

C. Tri-Lock block size selection shall be determined from documented hydraulic characteristics, derived from test procedures outlined in: "Hydraulic Stability of Articulating Concrete block Revetment Systems During Overtopping Flow." Report No. FHWA-RD-89-199, and "Minimizing Embankment Damage During Overtopping Flow." Report No. FHWA-RD-88-181.

D. Backfill: Topsoil and seeding shall be as per Division 31 Section(s) "Earth Moving" AND Division 32 Section(s) "Turf And Grasses".

1.3 EXECUTION



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- A. Excavation shall be made so that the placement of the geotextile and concrete blocks shall be in conformity with the lines and grades shown on the plans or as required to meet project requirements. The area for placement shall be free from obstructions such as tree roots, projecting stones or other foreign matter and graded smooth. Voids or soft areas shall be filled with suitable materials and compacted to non-movement. Place the geotextile on the prepared subgrade. Lock the edges into a key trench as required to meet project requirements. The concrete blocks shall be assembled overlaying a geotextile in a manner that allows maximum flexibility but discourages vertical movement of any single component. Fill open areas of the blocks with concrete at the interface to concrete structure. After placement, the open areas of the block system shall be backfilled with topsoil to the top of the blocks. The backfilling shall be completed within 14 days of placement of the geotextile.

END OF SECTION 32 91 19 13



SECTION 32 91 19 13a - SEPTIC TANK SYSTEMS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for septic tank systems. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Septic tanks.
 - b. Distribution boxes.
 - c. Pipe and fittings.
 - d. Absorption systems

C. Submittals

1. Product Data: For each type of product indicated.
 - a. Include construction details, material descriptions, dimensions of individual components, and profiles.
 - b. Include manhole openings, covers, and pipe connections.
2. Shop Drawings: For [trench absorption systems] [bed absorption systems].
 - a. Include manhole openings, covers, pipe connections, and accessories.
 - b. Include piping with sizes and invert elevations.
 - c. Include underground structures.
 - d. Include other utilities.

1.2 PRODUCTS

A. Septic Tanks

1. Precast Concrete Septic Tanks: ASTM C 1227, single-chamber **OR** two-chamber, **as directed**, precast, reinforced-concrete tank with internal baffle, **as directed**, and covers.
 - a. Design: For A-8 (H10-44) **OR** A-12 (HS15-44) **OR** A-16 (HS20-44), **as directed**, traffic loading according to ASTM C 890.
 - b. Manholes: 20-inch- (508-mm-) **OR** 22-inch- (559-mm-) **OR** 24-inch- (610-mm-), **as directed**, minimum diameter opening with reinforced-concrete risers to grade and access lid with steel lift rings. Include manhole in center of each septic tank compartment top.
 - c. Filter Access: Reinforced-concrete access hole, large enough to remove filter, over filter position.
 - d. Inlet and Outlet Access: 12-inch- (300-mm-) minimum diameter, reinforced-concrete access lids with steel lift rings. Include access centered over inlet and outlet.
 - e. Resilient Connectors: ASTM C 923 (ASTM C 923M), of size required for piping, fitted into inlet and outlet openings.
2. Fiberglass Septic Tanks: UL 1316, single-chamber, FRP construction; fabricated for septic tank application with at least one access riser and manhole.
 - a. Manholes: 22-inch- (559-mm-) **OR** 24-inch- (610-mm-), **as directed**, minimum diameter opening with FRP access risers to grade and cover.
 - b. Filter Access: Include access hole, large enough to remove filter, over filter position.
 - c. Resilient Connectors: ASTM C 923 (ASTM C 923M) or other watertight seal, of size required for piping, fitted into inlet and outlet openings.
3. Polyethylene Septic Tanks: Single-chamber, molded, HDPE or PE construction; fabricated for septic tank application, with baffle, **as directed**, and at least one access riser and manhole.



4. Polyethylene Septic Tanks: Two-chamber, molded, HDPE or PE construction; fabricated for septic tank application, with access risers and manholes.
 - a. Manholes: 18-inch- (457-mm-) **OR** 20-inch- (508-mm-) **OR** 22-inch- (559-mm-), **as directed**, minimum diameter opening with HDPE or PE access risers to grade and cover.
 - b. Filter Access: Include access hole, large enough to remove filter, over filter position.
 - c. Resilient Connectors: ASTM C 923 (ASTM C 923M) or other watertight seal, of size required for piping, fitted into inlet and outlet openings.
- B. Filters
1. Description: Removable, septic-tank-outlet filter that restricts discharge solids to 1/8 inch (3.2 mm).
 - a. Housing: HDPE or PVC.
 - b. Outlet Size: NPS 4 (DN 100) **OR** NPS 6 (DN 150), **as directed**.
- C. Dosing Tanks
1. Dosing Tanks: Comply with ASTM C 913 for precast, reinforced-concrete tank and cover; designed for structural loading according to ASTM C 890.
 - a. Design: For effluent pump, **OR** automatic siphon, **as directed**, installation and A-8 (H10-44) **OR** A-12 (HS15-44) **OR** A-16 (HS20-44), **as directed**, traffic loading according to ASTM C 890.
 - b. Manholes: 20-inch- (508-mm-) **OR** 22-inch- (559-mm-) **OR** 24-inch- (610-mm-), **as directed**, minimum diameter opening with reinforced-concrete risers to grade and access lid with steel lift rings. Include manhole in center of each septic tank compartment top.
 - c. Resilient Connectors: ASTM C 923 (ASTM C 923M), of size required for piping, fitted into inlet and outlet openings.
- D. Automatic Siphons
1. Description: Manufactured siphon assembly of molded-HDPE trap, pipe, and bell, with PVC vent piping and stainless-steel bolts.
- E. Distribution Boxes
1. Description: Precast concrete, single-chamber box and cover.
 - a. Design: Made according to ASTM C 913, and for A-8 (H10-44) **OR** A-12 (HS15-44) **OR** A-16 (HS20-44), **as directed**, traffic loading according to ASTM C 890. Include baffle opposite inlet.
 - b. Manholes: 20-inch- (508-mm-) **OR** 22-inch- (559-mm-) **OR** 24-inch- (610-mm-), **as directed**, minimum diameter opening with reinforced-concrete risers to grade and cover with steel lift rings in center of distribution box cover.
 - c. Pipe Connections: ASTM C 923 (ASTM C 923M) resilient connectors, of size required for piping, fitted into inlet and outlet openings. Include watertight plugs in outlets not required.
 2. Description: Molded-HDPE or -PE, single-chamber box and cover.
 - a. Manholes: 18-inch- (457-mm-) **OR** 20-inch- (508-mm-) **OR** 22-inch- (559-mm-), **as directed**, minimum diameter opening with HDPE or PE access risers to grade and cover. Access for PE distribution boxes may be a removable plastic cover and is usually small. **OR** Manufacturer's standard cover or other access opening of size that permits access to distribution-box inlet and outlets.
 - b. Pipe Connections: With seal that prevents leakage. Include watertight plugs in outlets not required.
- F. Leaching Pipes And Fittings
1. Pipe: PE, complying with ASTM F 810, perforated.
 - a. Fittings: ASTM D 2729 PVC for loose joints; ASTM D 3034, PVC for gasketed joints; or ASTM D 2751, ABS for gasketed joints.



2. Tube and Fittings: PE, complying with ASTM F 405, perforated corrugated tube with solid-wall fittings.
 - a. Couplings: PE band, matching tube and fitting dimensions.
 3. Pipe and Fittings: PVC, complying with ASTM D 2729, perforated, for solvent-cement joints.
 - a. Solvent Cement: ASTM D 2564. Include primer according to ASTM F 656
 4. Drainage Tile: Clay drain tile, complying with ASTM C 4, Standard class, drain tile with regular and smooth ends, for open joints.
- G. Nonpressure-Type Pipe Couplings
1. Description: Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - a. Sleeve Materials:
 - 1) For Concrete Pipes: ASTM C 443 (ASTM C 443M), rubber.
 - 2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - 3) For Vitrified-Clay Pipes: ASTM C 425, rubber.
 - 4) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
- H. Leaching Chambers
1. Description: Arched, molded-PE structures with solid top, perforated sides, open ends, and open bottom.
 - a. End Pieces: Solid and solid with pipe opening types.
 - b. Effluent Distribution Piping: PE or PVC pipe, with holes or slots along pipe, attached to underside of top of chambers.
- I. Trench **OR** Bed, **as directed**, Absorption-System Materials
1. Filtering Material: ASTM D 448, Size No. 24, 3/4 to 2-1/2 inches (19 to 63 mm), washed, crushed stone or gravel; or broken, hard-burned clay brick.
 2. Filter Mat: Geotextile woven or spun filter fabric, in 1 or more layers, for minimum total unit weight of 3 oz./sq. yd. (101 g/sq. m) **OR** Untreated building paper or similar porous material, **as directed**.
 3. Cover for Distribution Pipe: Geotextile woven filter fabric, in 1 or more layers, for minimum total unit weight of 3 oz./sq. yd. (101 g/sq. m).
 4. Fill Material: Soil removed from trench.
- J. Mound Absorption-System Materials
1. Sand Filtering Material: 25 percent or more of very coarse, coarse, or medium sand or combination; maximum of 50 percent fine or very fine sand or combination; and silt and clay combination not to exceed 25 percent. If clay exceeds 60 percent in combination with silt, mixture cannot exceed 15 percent of sand filtering material.
 2. Aggregate Filtering Material: Coarse, 1/2 to 2-1/2 inches (13 to 63 mm).
 3. Cap: Clay, silt, or combination of clay and silt.
 4. Topsoil: Good quality, free of stones, metal, and glass.
 5. Vegetation Cover: Grass compatible with adjacent ground cover. No shrubs or trees.
 6. Filter Mat: Geotextile woven or spun filter fabric, in 1 or more layers, for minimum total unit weight of 3 oz./sq. yd. (101 g/sq. m) **OR** Untreated building paper or similar porous material, **as directed**.
 7. Cover for Distribution Pipe: Geotextile woven filter fabric, in 1 or more layers, for minimum total unit weight of 3 oz./sq. yd. (101 g/sq. m).
- K. Chamber Absorption-System Materials
1. Chamber: Arched, molded-PE structures with solid top, perforated sides, open ends, and open bottom.
 2. End Pieces: Blank without opening for distribution pipe at end of last chamber in row, and with opening for distribution pipe where pipe penetrates chamber.



3. Retain first paragraph below to run piping through chambers to improve distribution.
4. Effluent Distribution Piping: PE or PVC pipe, with holes or slots along pipe, attached to underside of top of chambers.

L. Seepage Pit Absorption-System Materials

1. Constructed-in-Place-Type Seepage Pit: Include the following materials.
 - a. Pit Lining: ASTM C 62, Type SW, clay bricks; ASTM C 55, concrete bricks; ASTM C 90, hollow, concrete masonry units; or precast concrete rings with notches or weep holes.
 - b. Filtering Material: ASTM D 448, Size No. 24, 3/4 to 2-1/2 inches (19 to 63 mm), washed, crushed stone or gravel; or broken, hard-burned clay brick.
 - c. Cover: Precast concrete slab; designed for A-8 (H10-44) **OR** A-12 (HS15-44) **OR** A-16 (HS20-44), **as directed**, traffic loading according to ASTM C 890 and made according to ASTM C 913. Include slab dimensions that will extend minimum of 12 inches (300 mm) beyond edge of excavation. Cast cover with opening for manhole in center.
 - d. Manholes: 20-inch- (508-mm-) **OR** 22-inch- (559-mm-) **OR** 24-inch- (610-mm-), **as directed**, minimum diameter opening with reinforced-concrete risers to grade and access lid with steel lift rings.

1.3 EXECUTION

A. Earthwork

1. Excavating, trenching, and backfilling for piping and seepage pits are specified in Division 31 Section "Earth Moving".
 - a. Stockpile topsoil for reuse in finish grading without intermixing with other excavated material. Stockpile materials away from edge of excavation and do not store within drip line of remaining trees.
 - b. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
2. Excavating and Backfilling for Septic and Dosing Tanks:
 - a. Excavate sufficient width and length for tanks to depth determined by tank inlet elevation. Provide level bottom.
 - b. Backfill with excavated soil, mounding soil above original grade without compacting.
3. Excavating and Backfilling for Trench **OR** Bed, **as directed**, Absorption Fields:
 - a. Excavate for trench absorption fields 30 inches (760 mm) wide and 24 inches (600 mm) deep, minimum.
 - b. Backfill trench absorption fields with excavated soil, mounding soil above original grade without compacting.
 - c. Excavate for bed absorption fields of width indicated and 24 inches (600 mm) deep, minimum.
 - d. Backfill bed absorption fields with excavated soil, mounding soil above original grade without compacting.

B. Excavating and Backfilling for Chamber Absorption Systems:

1. Excavate for trench-type chamber absorption systems **30 inches (762 mm)** wide and **24 inches (610 mm)** deep, minimum.
2. Excavate for bed-type chamber absorption systems of width indicated and **24 inches (610 mm)** deep, minimum.
3. Backfill chamber absorption systems with excavated soil, mounding soil above original grade without compacting.

C. Excavating and Backfilling for Seepage-Pit Absorption Systems:

1. Excavate sufficient hole diameter for pits to depth determined by tank inlet and bottom elevations. Provide level bottom.
2. Backfill with excavated soil, mounding soil above original grade without compacting.



- D. Septic Tank Installation
1. Install precast concrete septic tanks level according to ASTM C 891.
 2. Install septic tanks level.
 3. Connect septic tank to concrete ballast pad.
 4. Install filter in septic tank outlet. Secure filter to septic tank wall. Make direct connections to distribution piping.
 5. Install insulation on exterior sides and top of septic tank.
 6. Fill septic tank with water.
- E. Dosing Tank Installation
1. Install dosing tanks level and according to ASTM C 891.
 2. Install automatic siphons embedded in precast concrete dosing tank. Make direct connections to distribution piping.
 3. Set submersible effluent pumps on dosing tank floor. Make direct connections to distribution piping.
 4. Fill dosing tanks with water.
- F. Distribution Box Installation
1. Install precast concrete distribution boxes according to ASTM C 891 and at invert elevations indicated. Set level and plumb.
 2. Install PE distribution boxes at invert elevations indicated and according to manufacturer's written instructions. Set level and plumb.
- G. Piping Installation
1. Install leaching piping according to the following:
 - a. Use perforated pipe and fittings for trench **OR** bed **OR** mound, **as directed**, absorption fields with perforations at bottom.
 - b. PE Tube and Fittings: ASTM F 481.
 - c. PVC Sewer Pipe and Fittings: ASTM F 481.
- H. Pipe Joint Construction
1. Basic piping joint construction is specified in Division 33 Section "Common Work Results For Utilities". Where specific joint construction is not indicated, follow piping manufacturer's written instructions.
 2. Join distribution piping with or according to the following:
 - a. Install leaching pipe and fittings for trench **OR** bed **OR** mound, as directed, absorption fields with closed joints, unless otherwise indicated.
 - b. PE Tube and Fittings: With PE band couplings.
 - c. PVC Sewer Pipe and Fittings: With solvent-cemented joints according to ASTM F 402 and ASTM D 2321.
 3. Join dissimilar pipe materials according to ASTM D 5926, with couplings and gaskets compatible with pipe materials being joined.
- I. Cleanout Installation
1. Install cleanouts according to the following:
 - a. Inlet and Outlet of Septic Tanks: Cast-iron cleanouts.
 - b. Inlet and Outlet of Dosing Tanks: Cast-iron cleanouts.
 - c. Inlet and Outlet of Distribution Boxes: Cast-iron **OR** PVC cleanouts.
 - d. At Each Change in Direction of Sewer Piping: Cast-iron **OR** PVC cleanouts.
 - e. At Ends of Each Row and at Each Change in Direction of Distribution Piping: Cast-iron **OR** PVC cleanouts.
 2. Cast-Iron Cleanouts: Install with PVC fitting riser from distribution and leaching piping to cast-iron cleanout housing at grade. Use NPS 4 (DN 100) PVC sewer pipe and fittings with solvent-cemented joints for risers. Attach riser to cleanout housing with rubber gasket or coupling.



3. PVC Cleanouts: Install with PVC riser from distribution and leaching piping to PVC cleanout at grade. Use NPS 4 (DN 100) PVC sewer pipe and fittings with solvent-cemented joints for risers and cleanout fitting.
4. Cleanout Support: Set cleanouts in concrete blocks 18 by 18 by 12 inches (457 by 457 by 305 mm) deep, unless location is in concrete pavement. Formwork, reinforcement, and concrete are specified in Division 03 Section "Cast-in-place Concrete".
5. Set top of cleanout 1 inch (25 mm) **OR** 2 inches (50 mm), **as directed**, above surrounding rough grade, or set flush with grade if installed in pavement.

J. Trench **OR** Bed **OR** Absorption-Field, **as directed**, Installation

1. Filtering Material: Place supporting layer of filtering material over the compacted trench **OR** bed, **as directed**, base to a compacted depth not less than 6 inches (150 mm) below bottom of pipe.
2. Refer to Part 1.3 "Piping Installation" and "Pipe Joint Construction" articles for specific piping material installation.
3. Install distribution piping at minimum slope of 1 percent and maximum slope of 2 percent.
4. Install leaching piping solidly bedded in filtering material, with full bearing for each pipe section throughout its length. Maintain pipe alignment with no slope.
 - a. Install perforated pipe with perforations down and joints tightly closed. Install collars and couplings as required.
 - b. Install open-joint pipe with 1/2-inch (13-mm) space, maximum, between ends, unless otherwise indicated. Cover top two-thirds of joint opening with joint cover, and tie with corrosion-resistant wire. Commercial joint-cover assemblies may be provided.
 - c. Install elbow fittings with tight joints.
 - d. Place additional filtering material around sides to a minimum compacted depth of 8 inches (200 mm) above the top of leaching piping.
5. Install filter mat over filter material before backfilling.
6. Install leaching chambers with no slope in bottom of trench **OR** bed, **as directed**.
 - a. Install leaching chamber distribution piping with tight joints throughout chambers.
7. Backfill according to Part 1.3 "Earthwork" Article.

K. Mound Absorption-Field Installation

1. Plow top 6 inches (150 mm) of surface.
2. Place layers of sand, aggregate, **as directed**, cap, and topsoil above plowed area. Provide grass topping to match adjacent vegetation. Provide side slope not steeper than 3:1. Tie slope toe smoothly into existing grade.
3. Refer to Part 1.3 "Piping Installation" and "Pipe Joint Construction" articles for specific piping material installation.
4. Provide solid vent pipe with vent cap extending 12 inches (300 mm) above top of mounds.
5. Install distribution piping with no slope for pressurized effluent system.
6. Install distribution piping at a minimum slope of 1 percent and a maximum slope of 2 percent for gravity effluent system.
7. Install leaching piping solidly bedded in filtering material, with full bearing for each pipe section throughout its length. Maintain pipe alignment with no slope.
 - a. Install perforated pipe with perforations down and joints tightly closed. Install collars and couplings as required.
 - b. Install open-joint pipe with 1/2-inch (13-mm) space, maximum, between ends, unless otherwise indicated. Cover top two-thirds of joint opening with joint cover, and tie with corrosion-resistant wire. Commercial joint-cover assemblies may be provided.
 - c. Install elbow fittings with tight joints.
8. Install leaching chambers with no slope above plowed area.
 - a. Install leaching chamber distribution piping with tight joints throughout chambers.
9. Provide adequate grading around mound absorption field to prevent storm runoff from washing away a portion of mound absorption field and to prevent exposing pipes.

L. Seepage Pit Installation



1. Excavate hole to minimum diameter of 6 inches (150 mm) greater than outside of pit lining.
2. Do not extend pit depth into ground-water table.
3. Install constructed-in-place seepage pits according to the following procedure if no requirements of authorities having jurisdiction apply:
 - a. Install brick pit lining material dry and laid flat with staggered joints for seepage.
 - b. Install block pit lining material dry with staggered joints and a minimum of 20 percent of blocks on side for seepage. Install precast concrete rings with notches or weep holes for seepage.
 - c. Extend pit lining material so top of manhole will be approximately 8 inches (200 mm) below finished grade.
 - d. Backfill bottom of inside of pit with filtering material at least 12 inches (300 mm) above bottom of lining material.
 - e. Extend effluent inlet pipe 12 inches (300 mm) into seepage pit and terminate into side of tee fitting.
 - f. Backfill around outside of pit lining with filtering material to top of lining.
 - g. Install manhole risers from top of pit to grade. Support cover on undisturbed soil. Do not support cover on pit lining.

M. Identification

1. Identification materials and their installation are specified in Division 31 Section "Earth Moving". Arrange for installation of green warning tape directly over piping (including absorption-field piping), at outside edges of underground structures, and at outside edges of absorption fields.
2. Use detectable warning tape over piping, over edges of underground structures, and over edges of absorption fields.

N. Field Quality Control

1. System Tests: Perform testing of completed septic tank system piping and structures according to authorities having jurisdiction.
2. Additional Tests: Fill underground structures with water and let stand overnight. If water level recedes, locate and repair leaks and retest. Repeat tests and repairs until no leaks exist.

O. Cleaning

1. Clear interior of piping and structures of dirt and other superfluous material as work progresses.
2. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of workday or when work stops.

END OF SECTION 32 91 19 13a



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Task	Specification	Specification Description
32 91 19 13	02 41 13 13	Portland Cement Concrete Removal
32 91 19 13	31 11 00 00	Site Clearing
32 91 19 13	31 13 13 00	Tree Protection And Trimming
32 91 19 13	31 05 13 00	Earthwork
32 91 19 13	31 24 13 00	Embankment
32 91 19 13	32 91 13 33	Lawns And Grasses
32 91 19 16	02 41 13 13	Portland Cement Concrete Removal
32 91 19 16	31 11 00 00	Site Clearing
32 91 19 16	31 13 13 00	Tree Protection And Trimming
32 91 19 16	31 05 13 00	Earthwork
32 91 19 16	31 24 13 00	Embankment
32 91 19 16	32 91 19 13	Concrete Revetment
32 91 19 16	32 91 19 13a	Septic Tank Systems
32 91 19 16	32 91 13 33	Lawns And Grasses
32 92 16 00	32 91 13 33	Lawns And Grasses
32 92 19 13	32 91 13 33	Lawns And Grasses
32 92 19 19	32 91 13 33	Lawns And Grasses
32 92 23 00	32 91 13 33	Lawns And Grasses
32 93 13 00	32 14 09 00	Exterior Plants
32 93 23 00	32 14 09 00	Exterior Plants
32 93 33 00	31 11 00 00	Site Clearing
32 93 33 00	32 14 09 00	Exterior Plants
32 93 43 00	32 14 09 00	Exterior Plants
32 93 53 00	31 13 13 00	Tree Protection And Trimming
32 93 53 00	32 91 13 16	Tree Relocation
32 93 53 00	32 14 09 00	Exterior Plants
32 94 13 00	32 14 09 00	Exterior Plants
32 94 16 00	32 14 09 00	Exterior Plants
32 94 43 00	01 22 16 00	No Specification Required
32 94 43 00	32 33 23 00a	Miscellaneous Site and Street Furnishings
32 94 49 00	01 22 16 00	No Specification Required
32 94 49 00	32 14 09 00	Exterior Plants
32 96 33 00	32 91 13 16	Tree Relocation
32 96 43 00	32 91 13 16	Tree Relocation



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Task	Specification	Specification Description
33 01 30 16	01 22 16 00	No Specification Required



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SECTION 33 01 30 41 - SEWER LINE CLEANING

1.1 GENERAL

A. Description Of Work

1. This specification covers sewer line cleaning. Cleaning procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

- #### B. Submittals: Submit product data and manufacturer's instruction.

1.2 PRODUCTS

- #### A. All materials shall be clean, free of defects, corrosion, and damage. All items shall be of proper type, size, design, and characteristics for the use intended. Unless otherwise specified, all items shall be factory-made.

- #### B. Portable Cleaning Equipment: Equipment used in the cleaning of sewer lines shall be as required to complete the work for the size, length, and conditions of the sewer. Portable and mobile equipment shall comply with Water Pollution Control Federation Manual No. 7.

- #### C. Chemicals shall be of the strength required to perform the work. The chemicals shall not be damaging to pipe materials, manholes, pumping equipment, nor treatment process and shall not be contaminated by foreign substances.

1.3 EXECUTION

A. Preparation

1. Protection required to prevent damage to adjacent materials, equipment, fixtures, and finishes shall be provided. Necessary protective clothing and accessories for personnel working with chemicals shall be provided.
2. Ventilation of Sewers: Contractor shall provide proper ventilation for personnel working in the sewer.
3. Alternate Sewage Discharge: Contractor shall provide an alternate routing of sewage discharge to a downstream manhole.
4. Traffic: Contractor shall provide all traffic signs required to safely direct traffic at and around work areas.

B. Installation

1. Direction of Work: Sewer line cleaning work, with the exception of hydraulic scouring, shall proceed in the downstream direction. Cleaning by hydraulic scouring shall proceed in the upstream direction.
2. Testing: Upon completion of cleaning operation, test sewer lines for proper operation and observe for a period of 24 hours. Clean out all stoppages and the retest the line for proper operation.

END OF SECTION 33 01 30 41



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SECTION 33 01 30 42 - REPAIR AND MAINTENANCE OF IMHOFF TANKS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for repair and maintenance of sewage treatment plant Imhoff tanks. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: For each type of product indicated.

1.2 PRODUCTS**A. Coatings:**

1. Epoxy-Filler Compound for concrete surfaces shall comply with Fed. Spec. MMM-A-001993.
2. Coal-Tar Epoxy shall comply with SSPC-PAINT 16.
3. Epoxy Paint shall comply with Mil. Spec. MIL-P-24441.
4. Red-Lead Base Paint shall comply with Fed. Spec. TT-P-86, Type I.
5. Aluminum Finish Paint shall comply with Fed. Spec. TT-P-38.

- B. Steel Tank Repair Material** for minor leaks shall be a two-component epoxy sealing compound. For badly corroded areas, a steel plate of the same composition and thickness as the original tank shall be used.

- C. Pipe and Fittings** for replacement shall be equivalent to the existing pipe and fittings.

1.3 EXECUTION

- A. Preparation:** Drain the contents of the tank and dispose of the sludge and sewage.

B. Leak Repair:

1. Concrete Tanks: Repair concrete tank leaks by cleaning and chipping or sandblasting the area of the leak and applying two-component epoxy concrete sealant.
2. Steel Tanks: Repair steel tank leaks by cleaning, scraping, chipping, or sandblasting the area of the leak and applying epoxy steel sealant. Repair badly corroded areas of steel tanks by cutting out the corroded area and welding a section of new steel plate in place. Welding shall be in compliance with AWS D1.1.

- C. Pipe and Fittings:** Replace pipe and fittings as required.

D. Cleaning and Coatings:

1. Interior Concrete Surfaces of the tank shall be cleaned with high pressure water or steam to remove dirt and residue, allowed to dry, and brush sandblasted.
2. Holes and Voids in the concrete surfaces left from the blast cleaning shall be filled by means of troweling and squeeze application of epoxy filler. Two coats of coal-tar epoxy shall be applied to the surface after the epoxy has cured.
3. Submerged Ferrous Metal Surfaces such as piping and equipment that are exposed to the sewage shall be sandblasted and coated with two coats of coal-tar epoxy.



4. Exterior Concrete Surfaces of the tank shall be cleaned by means of brush sandblast. The surfaces shall be blown down with air to remove the blasting residue and dust, and two coats of epoxy-polyamide paint shall be applied.
5. Ferrous Metal Surfaces that are not submerged shall be cleaned by means of sandblasting. Coat surfaces with one coat of red-lead base paint. After the base paint has dried sufficiently, apply two coats of aluminum finish paint.

END OF SECTION 33 01 30 42



Task	Specification	Specification Description
33 01 30 42	22 05 23 00	Piped Utilities Basic Materials And Methods
33 01 30 42	33 01 30 41	Sewer Line Cleaning



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SECTION 33 01 30 73 - REPAIR AND MAINTENANCE OF SIPHON TANK AND SIPHONS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of materials for the repair and maintenance of sewage treatment plant dosing siphon tanks. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: For each type of product indicated.

1.2 PRODUCTS

- A. Tank Repair Material shall be epoxy type grout complying with Fed. Spec. MMM-A-001993.

B. Concrete Coatings:

1. Outside and Above Grade shall be epoxy type in compliance with Mil. Spec. MIL-P-24441.
2. Inside and Below Grade shall be coal-tar epoxy type in compliance with SSPC-PAINT 16.

- C. Steel Repair Material shall be steel plate or epoxy cement and fiberglass cloth.

- D. Corroded or Defective Siphons: Replace those parts corroded or defective with new parts compatible with the unit, as recommended by the manufacturer.

E. Steel Coatings:

1. Red-Lead Base Coat shall comply with Fed. Spec. TT-P-86, Type I.
2. Aluminum Paint shall comply with Fed. Spec. TT-P-38.

1.3 EXECUTION

- A. Corroded or Broken Pipe and Fittings: Replace as required.

- B. Minor Leaks: Repair minor leaks in the tank using material and surface preparation and application methods recommended by the material manufacturer.

- C. Spalled Areas: Repair as required.

D. Cleaning and Coating:

1. Interior Concrete Surfaces of the tank shall be cleaned with high pressure water or steam to remove all dirt and residue, allowed to dry, and brush sandblasted in compliance with SSPC-SP 7.
2. The Exterior Concrete Surfaces of the tank shall be cleaned by means of brush sandblasting in compliance with SSPC-SP 7. The surfaces shall be blown down with air to remove the blasting residue and dust, and two coats of epoxy-polyamide paint shall be applied.
3. Holes and Voids in the concrete surfaces left from the blast cleaning shall be filled by means of troweling and squeeze application of an epoxy filler. The surfacing material shall be allowed to cure overnight, and then two coats of coal-tar epoxy complying with SSPC-PAINT 16 shall be applied.



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4. Submerged Ferrous Metal Surfaces that are exposed to the sewage shall be sandblasted in compliance with SSPC-SP 10 and coated with two coats of coal-tar epoxy.
 5. Ferrous Metal Surfaces that are not submerged shall be cleaned by means of sandblasting in compliance with SSPC-SP 6. Surfaces inaccessible to sandblasting shall be power tool cleaned in compliance with SSPC-SP 3. Surfaces shall be coated with one coat of red-lead base paint. After the base paint has dried sufficiently, two coats of aluminum finish paint shall be applied.

END OF SECTION 33 01 30 73



SECTION 33 01 30 73a - UNDERGROUND DUCTS AND UTILITY STRUCTURES

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for underground ducts and utility structures. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Conduit, ducts, and duct accessories for direct-buried and concrete-encased duct banks, and in single duct runs\.
 - b. Handholes and pull boxes.
 - c. Manholes.

C. Definition

1. RNC: Rigid nonmetallic conduit.

D. Submittals

1. Product Data: For the following:
 - a. Duct-bank materials, including separators and miscellaneous components.
 - b. Ducts and conduits and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
 - c. Accessories for manholes, handholes, pull boxes, and other utility structures.
 - d. Warning tape.
 - e. Warning planks.
2. Shop Drawings for Precast or Factory-Fabricated Underground Utility Structures: Include plans, elevations, sections, details, attachments to other work, and accessories, including the following:
 - a. Duct entry provisions, including locations and duct sizes.
 - b. Reinforcement details.
 - c. Frame and cover design and manhole frame support rings.
 - d. Ladder **OR** Step, **as directed**, details.
 - e. Grounding details.
 - f. Dimensioned locations of cable rack inserts, pulling-in and lifting irons, and sumps.
 - g. Joint details.
3. Shop Drawings for Factory-Fabricated Handholes and Pull Boxes Other Than Precast Concrete: Include dimensioned plans, sections, and elevations, and fabrication and installation details, including the following:
 - a. Duct entry provisions, including locations and duct sizes.
 - b. Cover design.
 - c. Grounding details.
 - d. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
4. Duct-Bank Coordination Drawings: Show duct profiles and coordination with other utilities and underground structures.
 - a. Include plans and sections, drawn to scale, and show bends and locations of expansion fittings.
 - b. Drawings shall be signed and sealed by a qualified professional engineer.
5. Product Certificates: For concrete and steel used in precast concrete manholes and handholes, as required by ASTM C 858.
6. Qualification Data: For qualified professional engineer and testing agency.
7. Source quality-control reports
8. Field quality-control test reports.



- E. Quality Assurance
 - 1. Comply with IEEE C2.
 - 2. Comply with NFPA 70.

- F. Delivery, Storage, And Handling
 - 1. Deliver ducts to Project site with ends capped. Store nonmetallic ducts with supports to prevent bending, warping, and deforming.
 - 2. Store precast concrete and other factory-fabricated underground utility structures at Project site as recommended by manufacturer to prevent physical damage. Arrange so identification markings are visible.
 - 3. Lift and support precast concrete units only at designated lifting or supporting points.

- G. Project Conditions
 - 1. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by the Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
 - a. Notify the Owner no fewer than two days in advance of proposed interruption of electrical service.
 - b. Do not proceed with interruption of electrical service without the Owner's written permission.

1.2 PRODUCTS

- A. Conduit
 - 1. Rigid Steel Conduit: Galvanized. Comply with ANSI C80.1.
 - 2. RNC: NEMA TC 2, Type EPC-40-PVC and Type EPC-80-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

- B. Nonmetallic Ducts And Duct Accessories
 - 1. Underground Plastic Utilities Duct: NEMA TC 6 & 8, Type EB-20-PVC, ASTM F 512, UL 651A, with matching fittings by the same manufacturer as the duct, complying with NEMA TC 9.
 - 2. Underground Plastic Utilities Duct: NEMA TC 6 & 8, Type DB-60-PVC and Type DB-120-PVC, ASTM F 512, with matching fittings by the same manufacturer as the duct, complying with NEMA TC 9.
 - 3. Duct Accessories:
 - a. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and sizes of ducts with which used, and selected to provide minimum duct spacings indicated while supporting ducts during concreting or backfilling.
 - b. Warning Tape: Underground-line warning tape specified in Division 26 Section "Identification For Electrical Systems".
 - c. Concrete Warning Planks: Nominal 12 by 24 by 3 inches (300 by 600 by 76 mm) in size, manufactured from 6000-psi (41-MPa) concrete.
 - 1) Color: Red dye added to concrete during batching.
 - 2) Mark each plank with "ELECTRIC" in 2-inch- (50-mm-) high, 3/8-inch- (10-mm-) deep letters.

- C. Precast Concrete Handholes And Pull Boxes
 - 1. Comply with ASTM C 858 for design and manufacturing processes.
 - 2. Ferrous metal hardware shall be hot-dip galvanized in accordance with ASTM A153 (ASTM A153M) and ASTM A123 (ASTM A123M).
 - 3. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover shall form top of enclosure and shall have load rating consistent with that of handhole or pull box.



- a. Frame and Cover: Weatherproof cast-iron frame, with cast-iron cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
- b. Frame and Cover: Weatherproof steel frame, with steel cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
- c. Frame and Cover: Weatherproof steel frame, with hinged steel access door assembly with tamper-resistant, captive, cover-securing bolts.
 - 1) Cover Hinges: Concealed, with hold-open ratchet assembly.
 - 2) Cover Handle: Recessed.
- d. Frame and Cover: Weatherproof aluminum frame with hinged aluminum access door assembly with tamper-resistant, captive, cover-securing stainless-steel bolts.
 - 1) Cover Hinges: Concealed, with hold-open ratchet assembly.
 - 2) Cover Handle: Recessed.
- e. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
- f. Cover Legend: Molded lettering, "ELECTRIC" **OR** "TELEPHONE" **OR** As indicated for each service, **as directed**.
- g. Configuration: Units shall be designed for flush burial and have open **OR** closed **OR** integral closed, **as directed**, bottom, unless otherwise indicated.
- h. Extensions and Slabs: Designed to mate with bottom of enclosure. Same material as enclosure.
 - 1) Extension shall provide increased depth of 12 inches (300 mm).
 - 2) Slab: Same dimensions as bottom of enclosure, and arranged to provide closure.
- i. Windows: Precast openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks plus an additional 12 inches (300 mm) vertically and horizontally to accommodate alignment variations.
 - 1) Windows shall be located no less than 6 inches (150 mm) from interior surfaces of walls, floors, or frames and covers of handholes, but close enough to corners to facilitate racking of cables on walls.
 - 2) Window opening shall have cast-in-place, welded wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct banks.
 - 3) Window openings shall be framed with at least two additional No. 4 steel reinforcing bars in concrete around each opening.
- j. Duct Entrances in Handhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.
 - 1) Type and size shall match fittings to duct or conduit to be terminated.
 - 2) Fittings shall align with elevations of approaching ducts and be located near interior corners of handholes to facilitate racking of cable.
- k. Handholes 12 inches wide by 24 inches long (300 mm wide by 600 mm long) and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

D. Handholes and Pull Boxes Other Than Precast Concrete

1. Description: Comply with SCTE 77.
 - a. Color: Gray **OR** Green, **as directed**.
 - b. Configuration: Units shall be designed for flush burial and have open **OR** closed **OR** integral closed, **as directed**, bottom, unless otherwise indicated.
 - c. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
 - d. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 - e. Cover Legend: Molded lettering, "ELECTRIC" **OR** "TELEPHONE" **OR** As indicated for each service, **as directed**.
 - f. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.
 - g. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
 - h. Handholes 12 inches wide by 24 inches long (300 mm wide by 600 mm long) and larger shall have factory-installed inserts for cable racks and pulling-in irons.



2. Polymer Concrete Handholes and Pull Boxes with Polymer Concrete Cover: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two.
3. Fiberglass Handholes and Pull Boxes with Polymer Concrete Frame and Cover: Sheet-molded, fiberglass-reinforced, polyester resin enclosure joined to polymer concrete top ring or frame.
4. Fiberglass Handholes and Pull Boxes: Molded of fiberglass-reinforced polyester resin, with covers of polymer concrete **OR** reinforced concrete **OR** cast iron **OR** hot-dip galvanized-steel diamond plate **OR** fiberglass, **as directed**.
5. High-Density Plastic Pull Boxes: Injection molded of high-density polyethylene or copolymer-polypropylene. Cover shall be polymer concrete **OR** hot-dip galvanized-steel diamond plate **OR** plastic, **as directed**.

E. Precast Manholes

1. Comply with ASTM C 858, with structural design loading as specified in Para. 1.3 "Underground Enclosure Application" Article and with interlocking mating sections, complete with accessories, hardware, and features.
 - a. Windows: Precast openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks plus an additional 12 inches (300 mm) vertically and horizontally to accommodate alignment variations.
 - 1) Windows shall be located no less than 6 inches (150 mm) from interior surfaces of walls, floors, or roofs of manholes, but close enough to corners to facilitate racking of cables on walls.
 - 2) Window opening shall have cast-in-place, welded wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct banks.
 - 3) Window openings shall be framed with at least two additional No. 4 steel reinforcing bars in concrete around each opening.
 - b. Duct Entrances in Manhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.
 - 1) Type and size shall match fittings to duct or conduit to be terminated.
 - 2) Fittings shall align with elevations of approaching ducts and be located near interior corners of manholes to facilitate racking of cable.
2. Concrete Knockout Panels: 1-1/2 to 2 inches (38 to 50 mm) thick, for future conduit entrance and sleeve for ground rod.
3. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.

F. Cast-In-Place Manholes

1. Description: Underground utility structures, constructed in place, complete with accessories, hardware, and features. Include concrete knockout panels for conduit entrance and sleeve for ground rod.
2. Materials: Comply with ASTM C 858 and with Division 03 Section "Cast-in-place Concrete".
 - a. Concrete shall have a minimum compressive strength of 3000 psi (20 MPa).
3. Structural Design Loading: As specified in "Underground Enclosure Application" Article.

G. Utility Structure Accessories

1. Ferrous metal hardware, where indicated, shall be hot-dip galvanized complying with ASTM A 153 (A 153M) and A 123 (A 123M).
2. Manhole Frames, Covers, and Chimney Components: Comply with structural design loading specified for manhole.
 - a. Frame and Cover: Weatherproof, gray cast iron complying with ASTM A 48/A 48M, Class 30B **OR** cast aluminum, **as directed**, with milled cover-to-frame bearing surfaces; diameter, 26 inches (660 mm) **OR** 29 inches (737 mm), **as directed**.
 - 1) Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.



- 2) Special Covers: Recess in face of cover designed to accept finish material in paved areas.
- b. Cover Legend: Cast in. Selected to suit system.
 - 1) Legend: "ELECTRIC-LV" for duct systems with power wires and cables for systems operating at 600 V and less.
 - 2) Legend: "ELECTRIC-HV" for duct systems with medium-voltage cables.
 - 3) Legend: "SIGNAL" for communications, data, and telephone duct systems.
- c. Manhole Chimney Components: Precast concrete rings with dimensions matched to those of roof opening.
 - 1) Mortar for Chimney Ring and Frame and Cover Joints: Comply with ASTM C 270, Type M, except for quantities less than 2.0 cu. ft. (60 L) where packaged mix complying with ASTM C 387, Type M, may be used.
3. Manhole Sump Frame and Grate: ASTM A 48/A 48M, Class 30B, gray cast iron.
4. Pulling Eyes in Concrete Walls: Eyebolt with reinforcing-bar fastening insert, 2-inch- (50-mm-) diameter eye, and 1-by-4-inch (25-by-100-mm) bolt.
 - a. Working Load Embedded in 6-Inch (150-mm), 4000-psi (27.6-MPa) Concrete: 13,000-lbf (58-kN) minimum tension.
5. Pulling Eyes in Nonconcrete Walls: Eyebolt with reinforced fastening, 1-1/4-inch- (32-mm-) diameter eye, rated 2500-lbf (11-kN) minimum tension.
6. Pulling-In and Lifting Irons in Concrete Floors: 7/8-inch- (22-mm-) diameter, hot-dip galvanized, bent steel rod; stress relieved after forming; and fastened to reinforcing rod. Exposed triangular opening.
 - a. Ultimate Yield Strength: 40,000-lbf (180-kN) shear and 60,000-lbf (270-kN) tension.
7. Bolting Inserts for Concrete Utility Structure Cable Racks and Other Attachments: Flared, threaded inserts of noncorrosive, chemical-resistant, nonconductive thermoplastic material; 1/2-inch (13-mm) ID by 2-3/4 inches (69 mm) deep, flared to 1-1/4 inches (32 mm) minimum at base.
 - a. Tested Ultimate Pullout Strength: 12,000 lbf (53 kN) minimum.
8. Expansion Anchors for Installation after Concrete Is Cast: Zinc-plated, carbon-steel-wedge type with stainless-steel expander clip with 1/2-inch (13-mm) bolt, 5300-lbf (24-kN) rated pullout strength, and minimum 6800-lbf (30-kN) rated shear strength.
9. Cable Rack Assembly: Steel, hot-rolled **OR** hot-dip, **as directed**, galvanized, except insulators.
 - a. Stanchions: T-section or channel; 2-1/4-inch (57-mm) nominal size; punched with 14 holes on 1-1/2-inch (38-mm) centers for cable-arm attachment.
 - b. Arms: 1-1/2 inches (38 mm) wide, lengths ranging from 3 inches (75 mm) with 450-lb (204-kg) minimum capacity to 18 inches (460 mm) with 250-lb (114-kg) minimum capacity. Arms shall have slots along full length for cable ties and be arranged for secure mounting in horizontal position at any vertical location on stanchions.
 - c. Insulators: High-glaze, wet-process porcelain arranged for mounting on cable arms.
10. Cable Rack Assembly: Nonmetallic. Components fabricated from nonconductive, fiberglass-reinforced polymer.
 - a. Stanchions: Nominal 36 inches (900 mm) high by 4 inches (100 mm) wide, with minimum of 9 holes for arm attachment.
 - b. Arms: Arranged for secure, drop-in attachment in horizontal position at any location on cable stanchions, and capable of being locked in position. Arms shall be available in lengths ranging from 3 inches (75 mm) with 450-lb (204-kg) minimum capacity to 20 inches (508 mm) with 250-lb (114-kg) minimum capacity. Top of arm shall be nominally 4 inches (100 mm) wide, and arm shall have slots along full length for cable ties.
11. Duct-Sealing Compound: Nonhardening, safe for contact with human skin, not deleterious to cable insulation, and workable at temperatures as low as 35 deg F (2 deg C). Capable of withstanding temperature of 300 deg F (150 deg C) without slump and adhering to clean surfaces of plastic ducts, metallic conduits, conduit coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals.
12. Fixed Manhole Ladders: Arranged for attachment to roof or wall **OR** and floor, **as directed**, of manhole. Ladder and mounting brackets and braces shall be fabricated from nonconductive, structural-grade, fiberglass-reinforced resin **OR** hot-dip galvanized steel, **as directed**.



13. Portable Manhole Ladders: UL-listed, heavy-duty wood **OR** fiberglass, **as directed**, specifically designed for portable use for access to electrical manholes. Minimum length equal to distance from deepest manhole floor to grade plus 36 inches (900 mm). One required.
14. Cover Hooks: Heavy duty, designed for lifts 60 lbf (270 N) and greater **OR** Light duty, designed for lifts less than 60 lbf (270 N), **as directed**. Two required.

H. Source Quality Control

1. Test and inspect precast concrete utility structures according to ASTM C 1037.
2. Nonconcrete Handhole and Pull-Box Prototype Test: Test prototypes of manholes and pull boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
 - a. Engage a qualified testing agency to evaluate nonconcrete handholes and pull boxes.
 - b. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

1.3 EXECUTION

A. Corrosion Protection

1. Aluminum shall not be installed in contact with earth or concrete.

B. Underground Duct Application

1. Ducts for Electrical Cables Over 600 V: RNC, NEMA Type EPC-80 **OR** EPC-40 **OR** EB-20, **as directed**, -PVC, in concrete-encased duct bank, unless otherwise indicated.
2. Ducts for Electrical Feeders 600 V and Less: RNC, NEMA Type EPC-80 **OR** EPC-40 **OR** EB-20, **as directed**, -PVC, in concrete-encased duct bank, unless otherwise indicated.
3. Ducts for Electrical Feeders 600 V and Less: RNC, NEMA Type EPC-80 **OR** EPC-40 **as directed**, -PVC, in direct-buried duct bank, unless otherwise indicated.
4. Ducts for Electrical Branch Circuits: RNC, NEMA Type EPC-80 **OR** EPC-40, **as directed**, -PVC, in direct-buried duct bank, unless otherwise indicated.
5. Underground Ducts for Telephone, Communications, or Data Utility Service Cables: RNC, NEMA Type EPC-40 **OR** EB-20, **as directed**, -PVC, in concrete-encased duct bank, unless otherwise indicated.
6. Underground Ducts for Telephone, Communications, or Data Utility Service Cables: RNC, NEMA Type EPC-40-PVC **OR** Underground plastic utilities duct, NEMA Type DB-60-PVC **OR** Underground plastic utilities duct, NEMA Type DB-120-PVC, **as directed**, installed in direct-buried **OR** concrete-encased, **as directed**, duct bank, unless otherwise indicated.
7. Underground Ducts for Telephone, Communications, or Data Circuits: RNC, NEMA Type EPC-40 **OR** DB-60 **OR** DB-120, **as directed**, -PVC, in direct-buried duct bank, unless otherwise indicated.
8. Underground Ducts for Telephone, Communications, or Data Circuits: RNC, NEMA Type EB-20-PVC, in concrete-encased duct bank, unless otherwise indicated.
9. Underground Ducts Crossing Paved Paths **OR** Walks and Driveways **OR** Roadways and Railroads, **as directed**: RNC, NEMA Type EPC-40-PVC, encased in reinforced concrete.

C. Underground Enclosure Application

1. Handholes and Pull Boxes for 600 V and Less, Including Telephone, Communications, and Data Wiring:
 - a. Units in Roadways and Other Deliberate Traffic Paths: Precast concrete, AASHTO HB 17, H-10 **OR** H-20, **as directed**, structural load rating.
 - b. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Precast concrete, AASHTO HB 17, H-20 **OR** Polymer concrete, SCTE 77, Tier 15 **OR** Fiberglass enclosures with polymer concrete frame and cover, SCTE 77, Tier 15 **OR** Fiberglass-reinforced polyester resin, SCTE 77, Tier 15 **OR** High-density plastic, SCTE 77, Tier 15, **as directed**, structural load rating.



- c. Units in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Precast concrete, AASHTO HB 17, H-10 **OR** Polymer concrete units, SCTE 77, Tier 8 **OR** Heavy-duty fiberglass units with polymer concrete frame and cover, SCTE 77, Tier 8 **OR** High-density plastic, SCTE 77, Tier 8, **as directed**, structural load rating.
 - d. Units Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin **OR** High-density plastic, **as directed**, structurally tested according to SCTE 77 with 3000-lbf (13 345-N) vertical loading.
 2. Manholes: Precast or cast-in-place concrete.
 - a. Units Located in Roadways and Other Deliberate Traffic Paths by Heavy or Medium Vehicles: H-20 structural load rating according to AASHTO HB 17.
 - b. Units Not Located in Deliberate Traffic Paths by Heavy or Medium Vehicles: H-10 load rating according to AASHTO HB 17.
- D. Earthwork
1. Excavation and Backfill: Comply with Division 31 Section "Earth Moving", but do not use heavy-duty, hydraulic-operated, compaction equipment.
 2. Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated. Replace removed sod immediately after backfilling is completed.
 3. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Division 32 Section(s) "Turf And Grasses" AND "Plants".
 4. Cut and patch existing pavement in the path of underground ducts and utility structures according to Division 01 Section "Cutting And Patching".
- E. Duct Installation
1. Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope ducts from a high point in runs between two manholes to drain in both directions.
 2. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches (1220 mm) **OR** 12.5 feet (4 m) **OR** 25 feet (7.5 m), **as directed**, both horizontally and vertically, at other locations, unless otherwise indicated.
 3. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.
 4. Duct Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches (250 mm) o.c. for 5-inch (125-mm) ducts, and vary proportionately for other duct sizes.
 - a. Begin change from regular spacing to end-bell spacing 10 feet (3 m) from the end bell without reducing duct line slope and without forming a trap in the line.
 - b. Direct-Buried Duct Banks: Install an expansion and deflection fitting in each conduit in the area of disturbed earth adjacent to manhole or handhole.
 - c. Grout end bells into structure walls from both sides to provide watertight entrances.
 5. Building Wall Penetrations: Make a transition from underground duct to rigid steel conduit at least 10 feet (3 m) outside the building wall without reducing duct line slope away from the building, and without forming a trap in the line. Use fittings manufactured for duct-to-conduit transition. Install conduit penetrations of building walls as specified in Division 26 Section "Common Work Results For Electrical".
 6. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig (1.03-MPa) hydrostatic pressure.
 7. Pulling Cord: Install 100-lbf- (445-N-) test nylon cord in ducts, including spares.
 8. Concrete-Encased Ducts: Support ducts on duct separators.
 - a. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, with not less than 4 **OR** 5, **as directed**, spacers per 20 feet (6 m) of duct. Secure



- separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately 6 inches (150 mm) between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
- b. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.
 - 1) Start at one end and finish at the other, allowing for expansion and contraction of ducts as their temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written recommendations, or use other specific measures to prevent expansion-contraction damage.
 - 2) If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch (19-mm) reinforcing rod dowels extending 18 inches (450 mm) into concrete on both sides of joint near corners of envelope.
 - c. Pouring Concrete: Spade concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Use a plank to direct concrete down sides of bank assembly to trench bottom. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.
 - d. Reinforcement: Reinforce concrete-encased duct banks where they cross disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
 - e. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
 - f. Minimum Space between Ducts: 3 inches (75 mm) between ducts and exterior envelope wall, 2 inches (50 mm) between ducts for like services, and 4 inches (100 mm) between power and signal ducts.
 - g. Depth: Install top of duct bank at least 24 inches (600 mm) below finished grade in areas not subject to deliberate traffic, and at least 30 inches (750 mm) below finished grade in deliberate traffic paths for vehicles, unless otherwise indicated.
 - h. Stub-Ups:
 - 1) Use manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Extend concrete encasement throughout the length of the elbow.
OR
Use manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
 - a) Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete.
 - b) Stub-Ups to Equipment: For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of base. Install insulated grounding bushings on terminations at equipment.
 - i. Warning Tape: Bury warning tape approximately 12 inches (300 mm) above all concrete-encased ducts and duct banks. Align tape parallel to and within 3 inches (75 mm) of the centerline of duct bank. Provide an additional warning tape for each 12-inch (300-mm) increment of duct-bank width over a nominal 18 inches (450 mm). Space additional tapes 12 inches (300 mm) apart, horizontally.
9. Direct-Buried Duct Banks:
- a. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
 - b. Space separators close enough to prevent sagging and deforming of ducts, with not less than 4 **OR** 5, **as directed**, spacers per 20 feet (6 m) of duct. Secure separators to earth and to ducts to prevent displacement during backfill and yet permit linear duct movement



due to expansion and contraction as temperature changes. Stagger spacers approximately 6 inches (150 mm) between tiers.

- c. Excavate trench bottom to provide firm and uniform support for duct bank. Prepare trench bottoms as specified in Division 31 Section "Earth Moving" for pipes less than 6 inches (150 mm) in nominal diameter.
- d. Install backfill as specified in Division 31 Section "Earth Moving".
- e. After installing first tier of ducts, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand-place backfill to 4 inches (100 mm) over ducts and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving".
- f. Install ducts with a minimum of 3 inches (75 mm) between ducts for like services and 6 inches (150 mm) between power and signal ducts.
- g. Depth: Install top of duct bank at least 36 inches (900 mm) below finished grade, unless otherwise indicated.
- h. Set elevation of bottom of duct bank below the frost line.
- i. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.

OR

Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.

- 1) Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete.
 - 2) For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
- j. Warning Planks: Bury warning planks approximately 12 inches (300 mm) above direct-buried ducts and duct banks, placing them 24 inches (600 mm) o.c. Align planks along the width and along the centerline of duct bank. Provide an additional plank for each 12-inch (300-mm) increment of duct-bank width over a nominal 18 inches (450 mm). Space additional planks 12 inches (300 mm) apart, horizontally.

F. Installation Of Concrete Manholes, Handholes, And Pull Boxes

1. Cast-in-Place Manhole Installation:
 - a. Finish interior surfaces with a smooth-troweled finish.
 - b. Windows for Future Duct Connections: Form and pour concrete knockout panels 1-1/2 to 2 inches (38 to 50 mm) thick, arranged as indicated.
 - c. Cast-in-place concrete, formwork, and reinforcement are specified in Division 03 Section "Cast-in-place Concrete".
2. Precast Concrete Handhole and Manhole Installation:
 - a. Comply with ASTM C 891, unless otherwise indicated.
 - b. Install units level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances.
 - c. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch (25-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.
3. Elevations:
 - a. Manhole Roof: Install with rooftop at least 15 inches (380 mm) below finished grade.
 - b. Manhole Frame: In paved areas and trafficways, set frames flush with finished grade. Set other manhole frames 1 inch (25 mm) above finished grade.
 - c. Install handholes with bottom below the frost line, below grade.



- d. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade. Set covers of other handholes 1 inch (25 mm) above finished grade.
 - e. Where indicated, cast handhole cover frame integrally with handhole structure.
 4. Drainage: Install drains in bottom of manholes where indicated. Coordinate with drainage provisions indicated.
 5. Manhole Access: Circular opening in manhole roof; sized to match cover size.
 - a. Manholes with Fixed Ladders: Offset access opening from manhole centerlines to align with ladder.
 - b. Install chimney, constructed of precast concrete collars and rings to support frame and cover and to connect cover with manhole roof opening. Provide moisture-tight masonry joints and waterproof grouting for cast-iron frame to chimney.
 6. Waterproofing: Apply waterproofing to exterior surfaces of manholes and handholes after concrete has cured at least three days. Waterproofing materials and installation are specified in Division 07 Section(s) "Elastomeric Sheet Waterproofing" OR "Thermoplastic Sheet Waterproofing", **as directed**. After ducts have been connected and grouted, and before backfilling, waterproof joints and connections and touch up abrasions and scars. Waterproof exterior of manhole chimneys after mortar has cured at least three days.
 7. Dampproofing: Apply dampproofing to exterior surfaces of manholes and handholes after concrete has cured at least three days. Dampproofing materials and installation are specified in Division 07 Section "Bituminous Dampproofing". After ducts have been connected and grouted, and before backfilling, dampproof joints and connections and touch up abrasions and scars. Dampproof exterior of manhole chimneys after mortar has cured at least three days.
 8. Hardware: Install removable hardware, including pulling eyes, cable stanchions, and cable arms, and insulators, as required for installation and support of cables and conductors and as indicated.
 9. Fixed Manhole Ladders: Arrange to provide for safe entry with maximum clearance from cables and other items in manholes.
 10. Field-Installed Bolting Anchors in Manholes and Concrete Handholes: Do not drill deeper than 3-7/8 inches (98 mm) for manholes and 2 inches (50 mm) for handholes, for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.
 11. Warning Sign: Install "Confined Space Hazard" warning sign on the inside surface of each manhole cover.
- G. Installation Of Handholes And Pull Boxes Other Than Precast Concrete
1. Install handholes and pull boxes level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of ducts, and seal joint between box and extension as recommended by the manufacturer.
 2. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.7-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.
 3. Elevation: In paved areas and trafficways, set so cover surface will be flush with finished grade. Set covers of other handholes 1 inch (25 mm) above finished grade.
 4. Install handholes and pull boxes with bottom below the frost line, below grade.
 5. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.
 6. Field-cut openings for ducts and conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.
 7. For enclosures installed in asphalt paving and subject to occasional, nondeliberate, heavy-vehicle loading, form and pour a concrete ring encircling, and in contact with, enclosure and with top surface screeded to top of box cover frame. Bottom of ring shall rest on compacted earth.
 - a. Concrete: 3000 psi (20 kPa), 28-day strength, complying with Division 03 Section "Cast-in-place Concrete", with a troweled finish.



b. Dimensions: 10 inches wide by 12 inches deep (250 mm wide by 300 mm deep).

H. Grounding

1. Ground underground ducts and utility structures according to Division 26 Section "Grounding And Bonding For Electrical Systems".

I. Field Quality Control

1. Perform the following tests and inspections:

a. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.

b. Pull aluminum or wood test mandrel through duct to prove joint integrity and test for out-of-round duct. Provide mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.

c. Test manhole and handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Division 26 Section "Grounding And Bonding For Electrical Systems".

2. Correct deficiencies and retest as specified above to demonstrate compliance.

3. Prepare test and inspection reports.

J. Cleaning

1. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

2. Clean internal surfaces of manholes, including sump. Remove foreign material.

END OF SECTION 33 01 30 73a



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Task	Specification	Specification Description
33 01 30 73	01 22 16 00	No Specification Required
33 01 30 73	22 05 23 00	Piped Utilities Basic Materials And Methods
33 01 30 73	22 05 76 00	Sanitary Sewerage
33 01 30 73	33 01 30 42	Repair And Maintenance Of Imhoff Tanks
33 01 30 73	33 41 13 00	Storm Drainage
33 01 30 73	31 32 19 16	Sewage Treatment Lagoons
33 05 16 13	33 01 30 73a	Underground Ducts And Utility Structures
33 11 00 00	21 05 19 00	Water Distribution
33 11 13 13	22 05 23 00	Piped Utilities Basic Materials And Methods
33 11 13 13	31 62 13 19	Concrete-Filled Steel Piles
33 11 13 13	21 05 19 00	Water Distribution
33 11 13 13	22 05 76 00	Sanitary Sewerage
33 11 13 13	33 41 13 00	Storm Drainage



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SECTION 33 11 13 23 - SAND DRAINS**1.1 GENERAL****A. Description Of Work**

1. This specification covers the furnishing and installation of sand drains. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: For each type of product indicated.

1.2 PRODUCTS

- A. Galvanized Perforated Corrugated Metal Pipe: AASHTO M36.

- B. Perforated Polyvinyl Chloride (PVC) Plastic Pipe: ASTM D 1784.

- C. Aggregate shall be sand, gravel, crushed rock, or chat that is clean, sound, and of a good quality. Gradation shall conform to the following table:

Retained on the 1-inch sieve	0%
Retained on the 3/8-inch sieve	0-15%
Retained on the No. 8 sieve	40-60%
Retained on the No. 30 sieve	70-95%
Retained on the No. 100 sieve	98-100%

1.3 EXECUTION

- A. Pipe Bedding: Aggregate shall be placed in uniform layers on level excavation.

- B. Perforated Pipe shall be installed with securely aligned joints to lines and grades, which will allow proper drainage.

- C. Perforated Pipe shall be embedded with a minimum coverage of two feet of aggregate or as directed.

END OF SECTION 33 11 13 23



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SECTION 33 11 13 23a - HYDRONIC DISTRIBUTION

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for hydronic distribution. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes underground piping outside the building for distribution of heating hot and chilled water.

C. Performance Requirements

1. Provide components and installation capable of producing hydronic piping systems with the following minimum working-pressure ratings:
 - a. Hot-Water Piping: 100 psig (690 kPa) **OR** 150 psig (1035 kPa), **as directed**.
 - b. Chilled-Water Piping: 100 psig (690 kPa) **OR** 150 psig (1035 kPa), **as directed**.
 - c. Condenser-Water Piping: 100 psig (690 kPa) **OR** 150 psig (1035 kPa), **as directed**.

D. Submittals

1. Product Data
2. Shop Drawings
3. Welding certificates.
4. Source quality-control test reports.
5. Field quality-control test reports.

E. Quality Assurance

1. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.
2. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.

F. Project Conditions

1. Existing Utilities: Do not interrupt utilities serving facilities occupied by the Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - a. Notify the Owner no fewer than two days in advance of proposed utility interruptions.
 - b. Do not proceed with utility interruptions without the Owner's written permission.

1.2 PRODUCTS

A. Piping Materials

1. Refer to Part 1.3 "Piping Application" Article for applications of pipes, tubes, fittings, and joining methods.
2. Refer to Division 33 Section "Common Work Results For Utilities" for commonly used joining materials.

B. Steel Pipes And Fittings

1. Steel Pipe: ASTM A 53/A 53M, Type E, Grade B, Standard Weight; with plain ends.
2. Nipples: ASTM A 733, Standard Weight, seamless, carbon-steel pipe complying with ASTM A 53/A 53M.



3. Malleable-Iron, Threaded Fittings: ASME B16.3, Classes 150 **OR** 300, **as directed**, with threads according to ASME B1.20.1.
4. Cast-Iron, Threaded Fittings: ASME B16.4, Classes 125 **OR** 250, **as directed**, standard pattern, with threads according to ASME B1.20.1.
5. Steel Welding Fittings: ASME B16.9 **OR** ASTM A 234/A 234M, **as directed**, seamless or welded.
6. Ductile-Iron, Grooved-End Fittings: ASTM A 536, ductile-iron casting with dimensions matching piping.
7. Steel-Pipe, Keyed Couplings: AWWA C606 for steel-pipe dimensions. Include ferrous housing sections, gasket suitable for hot water, and bolts and nuts.

C. Conduit Piping

1. Description: Factory-fabricated and -assembled, airtight and watertight, drainable, pressure-tested piping with conduit, inner pipe supports, and insulated carrier piping. Fabricate so insulation can be dried in place by forcing dry air through conduit.
2. Carrier Pipe: Steel pipe complying with ASTM A 53/A 53M, Type E, Grade B with beveled **OR** socket, **as directed**, ends for welded joints.
3. Carrier Pipe Insulation:
 - a. Mineral-Wool Pipe Insulation: ASTM C 547, Type I, molded.
 - 1) Apparent Thermal Conductivity (k-Value): 0.31 at 200 deg F (0.044 at 93 deg C) mean temperature.
 - 2) Density: Maximum 10 lb/cu. ft. (160 kg/cu. m) average.
 - 3) Compressive Strength: 10 psig (69 kPa) minimum at 5 percent deformation.
 - 4) Bands: ASTM A 666, Type 304, stainless steel, 3/4 inch (19 mm) wide, 0.020 inch (0.5 mm) thick.
 - b. Calcium Silicate Pipe Insulation: ASTM C 533, Type I; preformed, incombustible, inorganic, with non-asbestos fibrous reinforcement.
 - 1) Thermal Conductivity (k-Value): 0.60 at 500 deg F (0.087 at 260 deg C).
 - 2) Dry Density: 15 lb/cu. ft. (240 kg/cu. m) maximum.
 - 3) Compressive Strength: 60 psig (414 kPa) minimum at 5 percent deformation.
 - 4) Bands: ASTM A 666, Type 304, stainless steel, 3/4 inch (19 mm) wide, 0.020 inch (0.5 mm) thick.
 - c. Polyisocyanurate Foam Pipe Insulation: ASTM C 591, preformed, rigid, cellular.
 - 1) Thermal Conductivity (k-Value): 0.14 at 75 deg F (0.020 at 24 deg C).
 - 2) Service Temperature: Minus 250 to plus 400 deg F (Minus 156 to plus 204 deg C).
 - 3) Moisture Absorption: ASTM D 2842, maximum 0.054 percent by volume.
 - 4) Minimum 90 percent closed cell.
 - 5) Dry Density: 2 lb/cu. ft. (32 kg/cu. m) maximum.
 - 6) Compressive Strength: 35 psig (242 kPa) minimum at 5 percent deformation.
 - 7) Water-Vapor Transmission: 1.26 perm inches (1.83 ng/Pa x s x m) according to ASTM E 96.
 - d. Polyurethane Foam Pipe Insulation: ASTM C 591, preformed, rigid, cellular.
 - 1) Thermal Conductivity (k-Value): 0.13 at 75 deg F (0.019 at 24 deg C).
 - 2) Service Temperature: Minus 250 to plus 200 deg F (Minus 156 to plus 93 deg C).
 - 3) Moisture Absorption: ASTM D 2842, maximum 0.054 percent by volume.
 - 4) Minimum 90 percent closed cell.
 - 5) Dry Density: 2 lb/cu. ft. (32 kg/cu. m) maximum.
 - 6) Compressive Strength: 35 psig (242 kPa) minimum at 5 percent deformation.
 - 7) Water-Vapor Transmission: 1.26 perm inches (1.83 ng/Pa x s x m) according to ASTM E 96.
4. Minimum Clearance:
 - a. Between Carrier Pipe Insulation and Conduit: 1 inch (25 mm).
 - b. Between Insulation of Multiple Carrier Pipes: 3/16 inch (4.75 mm).
 - c. Between Bottom of Carrier Pipe Insulation and Conduit: 1 inch (25 mm).
 - d. Between Bottom of Bare, Carrier Pipe and Casing: 1-3/8 inches (35 mm).



5. Conduit: Spiral wound, steel. Finish conduit with 2 coats of fusion-bonded epoxy, minimum 20 mils (0.50 mm) thick. Cover with polyurethane foam insulation with a high-density polyethylene jacket; thickness indicated in Part 1.3 "Piping Application" Article, **as directed**.
OR
Conduit: Spiral wound, bare steel. Cover with polyurethane foam insulation with a high-density polyethylene jacket; thickness indicated in Part 1.3 "Piping Application" Article.
6. Carrier Piping Supports within Conduit: Corrugated galvanized steel with a maximum spacing of 10 feet (3 m).
7. Fittings: Factory-fabricated and -insulated elbows and tees. Elbows may be bent pipe equal to carrier pipe. Tees shall be factory fabricated and insulated, and shall be compatible with the carrier pipe.
8. Expansion Offsets and Loops: Size casing to contain piping expansion.
9. Conduit accessories include the following:
 - a. Water Shed: Terminal end protector for carrier pipes entering building through floor, 3 inches (75 mm) deep and 2 inches (50 mm) larger than casing; terminate casing 20 inches (500 mm) above the floor level.
 - b. Guides and Anchors: Steel plate welded to carrier pipes and to casing, complete with vent and drainage openings inside casing.
 - c. End Seals: Steel plate welded to carrier pipes and to casing, complete with drain and vent openings on vertical centerline.
 - d. Gland Seals: Packed stuffing box and gland follower mounted on steel plate, welded to end of casing, permitting axial movement of carrier piping, with drain and vent connections on vertical centerline.
 - e. Joint Kit: Half-shell, pourable or split insulation and shrink-wrap sleeve.
10. Source Quality Control: Factory test the conduit to 15 psig (105 kPa) for a minimum of 2 minutes with no change in pressure. Factory test the carrier pipe to 150 percent of the operating pressure of system. Furnish test certificates.

D. Cased Piping

1. Description: Factory-fabricated piping with carrier pipe, insulation, and casing.
2. Carrier Pipe: Steel pipe complying with ASTM A 53/A 53M, Type E, Grade B with beveled **OR** socket, **as directed**, ends for welded joints.
3. Carrier Pipe Insulation:
 - a. Polyurethane Foam Pipe Insulation: ASTM C 591, preformed, rigid, cellular.
 - 1) Thermal Conductivity (k-Value): 0.13 at 75 deg F (0.019 at 24 deg C).
 - 2) Service Temperature: Minus 250 to plus 200 deg F (Minus 156 to plus 93 deg C).
 - 3) Moisture Absorption: ASTM D 2842, maximum 0.054 percent by volume.
 - 4) Minimum 90 percent closed cell.
 - 5) Dry Density: 2 lb/cu. ft. (32 kg/cu. m) maximum.
 - 6) Compressive Strength: 35 psig (242 kPa) minimum at 5 percent deformation.
 - 7) Water-Vapor Transmission: 1.26 perm inches (1.83 ng/Pa x s x m) according to ASTM E 96.
4. Casing: High-density polyethylene **OR** Filament-wound, fiberglass-reinforced polyester resin **OR** PVC, **as directed**.
5. Casing accessories include the following:
 - a. Joint Kit: Half-shell, pourable or split insulation, casing sleeve, and shrink-wrap sleeve.
 - b. Expansion Blanket: Elastomeric foam, formed to fit over piping.
 - c. End Seals: Shrink wrap the casing material to seal watertight around casing and carrier pipe.
6. Source Quality Control: Factory test the carrier pipe to 150 percent of the operating pressure of system. Furnish test certificates.

E. Loose-Fill Insulation

1. Granular, Loose-Fill Insulation: Inorganic, nontoxic, nonflammable, sodium potassium aluminum silicate with calcium carbonate filler. Include chemical treatment that renders insulation hydrophobic.



- a. Thermal Conductivity (k-Value): 0.60 at 175 deg F (0.087 at 79 deg C) and 0.65 at 300 deg F (0.094 at 149 deg C).
 - b. Application Temperature Range: 35 to 800 deg F (2 to 426 deg C).
 - c. Dry Density: 40 to 42 lb/cu. ft. (640 to 672 kg/cu. m).
 - d. Strength: 12,000 lb/sq. ft. (58 600 kg/sq. m).
2. Powder, Loose-Fill Insulation: Inert, nontoxic, nonflammable, calcium carbonate particles. Include chemical treatment that renders insulation hydrophobic.
- a. Thermal Conductivity (k-Value): ASTM C 177, 0.58 at 100 deg F (0.084 at 37 deg C) and 0.68 at 300 deg F (0.098 at 149 deg C).
 - b. Application Temperature Range: Minus 273 to plus 480 deg F (Minus 169 to plus 250 deg C).
 - c. Dry Density: Approximately 60 lb/cu. ft. (960 kg/cu. m).
 - d. Strength: 12,000 lb/sq. ft. (58 600 kg/sq. m).

1.3 EXECUTION

- A. Earthwork: Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.
- B. Piping Application
1. Hot-Water Piping: Schedule 40 **OR** Schedule 80, **as directed**, steel pipe with cast-iron, threaded fittings and threaded **OR** steel fittings and welded **OR** ductile-iron, grooved-end fittings and mechanical, **as directed**, joints; granular **OR** powder, loose-fill insulation.
OR
 Hot-Water Piping: Conduit piping with mineral-wool **OR** calcium silicate **OR** polyisocyanurate **OR** polyurethane, **as directed**, carrier-pipe insulation and with coated **OR** coated and insulated, **as directed**, conduit.
 - a. Insulation Thickness: 1 inch (25 mm) **OR** 2 inches (50 mm), **as directed**.**OR**
 Hot-Water Piping: Cased piping with polyurethane carrier-pipe insulation.
 2. Chilled-Water Piping: Schedule 40 **OR** Schedule 80, **as directed**, steel pipe with cast-iron, threaded fittings and threaded **OR** steel welding fittings and welded **OR** ductile-iron, grooved-end fittings and mechanical, **as directed**, joints; granular **OR** powder, **as directed**, loose-fill insulation.
OR
 Chilled-Water Piping: Conduit piping with mineral-wool **OR** calcium silicate **OR** polyisocyanurate **OR** polyurethane, **as directed**, carrier-pipe insulation and with coated **OR** coated and insulated, **as directed**, conduit.
 - a. Insulation Thickness: 1 inch (25 mm) **OR** 2 inches (50 mm), **as directed**.**OR**
 Chilled-Water Piping: Cased piping with polyurethane carrier-pipe insulation.
 3. Condenser-Water Piping: Schedule 40 **OR** Schedule 80, **as directed**, steel pipe with cast-iron, threaded fittings and threaded **OR** steel welding fittings and welded **OR** ductile-iron, grooved-end fittings and mechanical, **as directed**, joints; granular **OR** powder, **as directed**, loose-fill insulation.
OR
 Condenser-Water Piping: Conduit piping with mineral-wool **OR** calcium silicate **OR** polyisocyanurate **OR** polyurethane, **as directed**, carrier-pipe insulation and with coated **OR** coated and insulated, **as directed**, conduit.
 - a. Insulation Thickness: 1 inch (25 mm) **OR** 2 inches (50 mm), **as directed**.**OR**
 Condenser-Water Piping: Cased piping with polyurethane carrier-pipe insulation.
- C. Piping Installation



1. General Locations and Arrangements: Drawings indicate general location and arrangement of piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, unless deviations to layout are approved.
2. Remove any standing water in the bottom of trench.
3. Bed the pipe on a minimum 6-inch (150-mm) layer of granular fill material with a minimum 6-inch (150-mm) clearance between the pipes.
4. Do not insulate piping or backfill piping trench until field quality-control testing has been completed and results approved.
5. Install piping at uniform grade of 0.2 percent upward in direction of flow or as indicated.
6. Install components with pressure rating equal to or greater than system operating pressure.
7. Install piping free of sags and bends.
8. Install fittings for changes in direction and branch connections.
9. Refer to Division 23 Section "Common Work Results For Hvac" for sleeves and mechanical sleeve seals through exterior building walls.
10. Secure anchors with concrete thrust blocks. Concrete is specified in Division 03 Section "Cast-in-place Concrete".
11. Connect to hydronic piping where it passes through the building wall. Hydronic piping inside the building is specified in Division 23 Section "Hydronic Piping".

D. Loose-Fill Insulation Installation

1. Do not disturb the bottom of trench, or compact and stabilize it to ensure proper support.
2. Remove any standing water in the bottom of trench.
3. Form insulation trench by excavation or by installing drywall side forms to establish required height and width of the insulation.
4. Support piping with proper pitch, separation, and clearance to backfill or side forms using temporary supporting devices that can be removed after back filling with insulation.
5. Place insulation and backfill after field quality-control testing has been completed and results approved.
6. Apply bitumastic coating to carbon-steel anchors and guides. Pour concrete thrust blocks and anchors. Refer to Division 03 Section "Cast-in-place Concrete" for concrete and reinforcement.
7. Wrap piping at expansion loops and offsets with mineral-wool insulation of thickness appropriate for calculated expansion amount.
8. Pour loose-fill insulation to required dimension agitating insulation to eliminate voids around piping.
9. Remove temporary hangers and supports.
10. Cover loose-fill insulation with polyethylene sheet a minimum of 4 mils (0.10 mm) thick, and empty loose-fill insulation bags on top.
11. Manually backfill 6 inches (150 mm) of clean backfill. If mechanical compaction is required, manually backfill to 12 inches (300 mm) before using mechanical-compaction equipment.

E. Joint Construction

1. Refer to Division 33 Section "Common Work Results For Utilities" for basic piping joint construction.
2. Keyed-Coupling Joints: Cut- or roll-groove pipes. Assemble joints with keyed couplings, gaskets, lubricant, and bolts.
3. Conduit and Cased Piping Joints: Assemble sections and finish joints with pourable or split insulation, exterior jacket sleeve, and apply shrink-wrap seals as required by manufacturer's written installation instructions.

F. Identification: Install continuous plastic underground warning tapes during back filling of trenches for underground hydronic distribution piping. Locate 6 to 8 inches (150 to 200 mm) below finished grade, directly over piping. Refer to Division 31 Section "Earth Moving" for warning-tape materials and devices and their installation.

G. Field Quality Control



1. Prepare hydronic piping for testing according to ASME B31.9 and as follows:
 - a. Leave joints, including welds, uninsulated and exposed for examination during test.
 - b. Isolate equipment. Do not subject equipment to test pressure.
 - c. Install relief valve set at pressure no more than one-third higher than test pressure.
 - d. Fill system with water. Where there is risk of freezing, air or a safe, compatible liquid may be used.
 - e. Use vents installed at high points to release trapped air while filling system.
2. Test hydronic piping as follows:
 - a. Subject hydronic piping to hydrostatic test pressure that is not less than 1.5 times the design pressure.
 - b. After hydrostatic test pressure has been applied for 10 minutes, examine joints for leakage. Remake leaking joints using new materials and repeat hydrostatic test until no leaks exist.
3. Test conduit as follows:
 - a. Seal vents and drains and subject conduit to 15 psig (105 kPa) for 4 hours with no loss of pressure. Repair leaks and retest as required.
4. Prepare a written report of testing.

END OF SECTION 33 11 13 23a



Task	Specification	Specification Description
33 11 13 23	01 22 16 00	No Specification Required
33 11 13 23	22 05 23 00	Piped Utilities Basic Materials And Methods
33 11 13 23	21 05 19 00	Water Distribution
33 11 13 23	23 11 23 00a	Monitoring Wells
33 11 13 23	22 11 23 39	Water Supply Wells
33 11 13 23	22 05 76 00	Sanitary Sewerage
33 11 13 23	32 91 19 13a	Septic Tank Systems
33 11 13 23	31 05 13 00a	Subdrainage
33 11 13 23	33 41 13 00	Storm Drainage
33 11 13 36	22 05 23 00	Piped Utilities Basic Materials And Methods
33 11 13 36	22 11 23 39	Water Supply Wells
33 11 13 36	33 11 13 23a	Hydronic Distribution
33 11 13 36	23 05 29 00	Steam Distribution
33 11 13 39	22 05 23 00	Piped Utilities Basic Materials And Methods
33 11 13 39	21 05 19 00	Water Distribution
33 11 13 43	22 05 76 00	Sanitary Sewerage
33 11 13 53	01 22 16 00	No Specification Required
33 11 13 53	07 63 00 00	Common Work Results for Fire Suppression
33 11 13 53	07 63 00 00a	Common Work Results for Plumbing
33 11 13 53	07 63 00 00b	Common Work Results for HVAC
33 11 13 53	22 11 16 00	Domestic Water Piping
33 11 13 53	22 11 16 00a	Sanitary Waste And Vent Piping
33 11 13 53	22 11 16 00b	Storm Drainage Piping
33 11 13 53	22 11 16 00c	Hydronic Piping
33 11 13 53	22 11 16 00d	Steam And Condensate Piping
33 11 13 53	22 11 16 00e	Refrigerant Piping
33 11 13 53	22 11 16 00f	General-Service Compressed-Air Piping
33 12 00 00	21 05 19 00	Water Distribution
33 12 13 23	01 22 16 00	No Specification Required
33 12 13 23	22 05 23 00	Piped Utilities Basic Materials And Methods
33 12 13 23	21 05 19 00	Water Distribution
33 12 16 00	01 22 16 00	No Specification Required
33 12 16 00	22 05 23 00	Piped Utilities Basic Materials And Methods
33 12 16 00	21 05 19 00	Water Distribution
33 12 19 00	22 05 23 00	Piped Utilities Basic Materials And Methods
33 12 19 00	21 05 19 00	Water Distribution
33 12 33 00	01 22 16 00	No Specification Required
33 12 33 00	21 05 19 00	Water Distribution
33 12 33 00	21 05 19 00a	Meters and Gages for Plumbing Piping
33 12 33 00	21 05 19 00b	Meters and Gages for HVAC Piping
33 13 00 00	22 05 23 00	Piped Utilities Basic Materials And Methods
33 13 00 00	33 01 30 42	Repair And Maintenance Of Imhoff Tanks
33 13 00 00	33 01 30 41	Sewer Line Cleaning
33 21 13 00	22 05 23 00	Piped Utilities Basic Materials And Methods
33 21 13 00	22 11 23 39	Water Supply Wells
33 26 00 00	22 05 23 00	Piped Utilities Basic Materials And Methods
33 26 00 00	33 11 13 23	Sand Drains
33 26 00 00	23 11 23 00	Relief Wells
33 31 00 00	22 05 23 00	Piped Utilities Basic Materials And Methods
33 31 00 00	33 11 13 23	Sand Drains
33 31 00 00	21 05 19 00	Water Distribution
33 31 00 00	23 11 23 00a	Monitoring Wells
33 31 00 00	22 11 23 39	Water Supply Wells
33 31 00 00	22 05 76 00	Sanitary Sewerage
33 31 00 00	32 91 19 13a	Septic Tank Systems



33 31 00 00	33 11 13 23a	Hydronic Distribution
33 31 00 00	31 05 13 00a	Subdrainage
33 31 00 00	33 41 13 00	Storm Drainage
33 32 16 13	01 22 16 00	No Specification Required
33 39 13 00	01 22 16 00	No Specification Required
33 39 13 00	22 05 23 00	Piped Utilities Basic Materials And Methods
33 39 13 00	22 05 76 00	Sanitary Sewerage
33 39 13 00	33 01 30 73a	Underground Ducts And Utility Structures
33 39 13 00	33 41 13 00	Storm Drainage
33 39 13 00	31 32 19 16	Sewage Treatment Lagoons



SECTION 33 41 13 00 - STORM DRAINAGE

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for storm drainage. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Pipe and fittings.
 - b. Nonpressure transition couplings.
 - c. Pressure pipe couplings.
 - d. Expansion joints and deflection fittings.
 - e. Backwater valves.
 - f. Cleanouts.
 - g. Drains.
 - h. Encasement for piping.
 - i. Manholes.
 - j. Channel drainage systems.
 - k. Catch basins.
 - l. Stormwater inlets.
 - m. Stormwater detention structures.
 - n. Pipe outlets.
 - o. Dry wells.
 - p. Stormwater disposal systems.

C. Definitions

1. FRP: Fiberglass-reinforced plastic.

D. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings:
 - a. Manholes: Include plans, elevations, sections, details, frames, and covers.
 - b. Catch basins, stormwater inlets, and dry wells. Include plans, elevations, sections, details, frames, covers, and grates.
 - c. Stormwater Detention Structures: Include plans, elevations, sections, details, frames, covers, design calculations, and concrete design-mix reports.
3. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from storm drainage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.
4. Profile Drawings: Show system piping in elevation. Draw profiles at horizontal scale of not less than 1 inch equals 50 feet (1:500) and vertical scale of not less than 1 inch equals 5 feet (1:50). Indicate manholes and piping. Show types, sizes, materials, and elevations of other utilities crossing system piping.
5. Product Certificates: For each type of cast-iron soil pipe and fitting, from manufacturer.
6. Field quality-control reports.

E. Delivery, Storage, And Handling

1. Do not store plastic manholes, pipe, and fittings in direct sunlight.
2. Protect pipe, pipe fittings, and seals from dirt and damage.
3. Handle manholes according to manufacturer's written rigging instructions.



4. Handle catch basins and stormwater inlets according to manufacturer's written rigging instructions.

F. Project Conditions

1. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by the Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - a. Notify the Owner no fewer than two days in advance of proposed interruption of service.
 - b. Do not proceed with interruption of service without the Owner written permission.

1.2 PRODUCTS

A. Hub-And-Spigot, Cast-Iron Soil Pipe And Fittings

1. Pipe and Fittings: ASTM A 74, Service class **OR** Extra-Heavy class, **as directed**.
2. Gaskets: ASTM C 564, rubber.
3. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

B. Hubless Cast-Iron Soil Pipe And Fittings

1. Pipe and Fittings: ASTM A 888 or CISPI 301.
2. CISPI-Trademarked, Shielded Couplings:
 - a. Description: ASTM C 1277 and CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
3. Heavy-Duty, Shielded Couplings:
 - a. Description: ASTM C 1277 and ASTM C 1540, with stainless-steel shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
4. Cast-Iron, Shielded Couplings:
 - a. Description: ASTM C 1277 and ASTM A 48/A 48M, two-piece, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve with integral, center pipe stop.

C. Ductile-Iron, Culvert Pipe And Fittings

1. Pipe: ASTM A 716, for push-on joints.
2. Standard Fittings: AWWA C110, ductile or gray iron, for push-on joints.
3. Compact Fittings: AWWA C153, for push-on joints.
4. Gaskets: AWWA C111, rubber.

D. Ductile-Iron, Pressure Pipe And Fittings

1. Push-on-Joint Piping:
 - a. Pipe: AWWA C151, for push-on joints.
 - b. Standard Fittings: AWWA C110, ductile or gray iron, for push-on joints.
 - c. Compact Fittings: AWWA C153, for push-on joints.
 - d. Gaskets: AWWA C111, rubber, of shape matching pipe and fittings.
2. Mechanical-Joint Piping:
 - a. Pipe: AWWA C151, with bolt holes in bell.
 - b. Standard Fittings: AWWA C110, ductile or gray iron, with bolt holes in bell.
 - c. Compact Fittings: AWWA C153, with bolt holes in bells.
 - d. Glands: Cast or ductile iron, with bolt holes and high-strength, cast-iron or high-strength, low-alloy steel bolts and nuts.
 - e. Gaskets: AWWA C111, rubber, of shape matching pipe, fittings, and glands.

E. Steel Pipe And Fittings



1. Corrugated-Steel Pipe and Fittings: ASTM A 760/A 760M, Type I with fittings of similar form and construction as pipe.
 - a. Special-Joint Bands: Corrugated steel with O-ring seals.
 - b. Standard-Joint Bands: Corrugated steel.
 - c. Coating: Aluminum **OR** Zinc, **as directed**.

- F. Aluminum Pipe And Fittings
 1. Corrugated Aluminum Pipe and Fittings: ASTM B 745/B 745M, Type I with fittings of similar form and construction as pipe.
 - a. Special-Joint Bands: Corrugated steel with O-ring seals.
 - b. Standard-Joint Bands: Corrugated steel.

- G. ABS Pipe And Fittings
 1. ABS Sewer Pipe and Fittings: ASTM D 2751, with bell-and-spigot ends for gasketed joints.
 - a. NPS 3 to NPS 6 (DN 80 to DN 150): SDR 35.
 - b. NPS 8 to NPS 12 (DN 200 to DN 300): SDR 42.
 2. Gaskets: ASTM F 477, elastomeric seals.

- H. PE Pipe And Fittings
 1. Corrugated PE Drainage Pipe and Fittings NPS 3 to NPS 10 (DN 80 to DN 250): AASHTO M 252M, Type S, with smooth waterway for coupling joints.
 - a. Silttight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with tube and fittings.
 - b. Soiltight Couplings: AASHTO M 252M, corrugated, matching tube and fittings.
 2. Corrugated PE Pipe and Fittings NPS 12 to NPS 60 (DN 300 to DN 1500): AASHTO M 294M, Type S, with smooth waterway for coupling joints.
 - a. Silttight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with pipe and fittings.
 - b. Soiltight Couplings: AASHTO M 294M, corrugated, matching pipe and fittings.

- I. PVC Pipe And Fittings
 1. PVC Cellular-Core Piping:
 - a. PVC Cellular-Core Pipe and Fittings: ASTM F 891, Sewer and Drain Series, PS 50 minimum stiffness, PVC cellular-core pipe with plain ends for solvent-cemented joints.
 - b. Fittings: ASTM D 3034, SDR 35, PVC socket-type fittings.
 2. PVC Corrugated Sewer Piping:
 - a. Pipe: ASTM F 949, PVC, corrugated pipe with bell-and-spigot ends for gasketed joints.
 - b. Fittings: ASTM F 949, PVC molded or fabricated, socket type.
 - c. Gaskets: ASTM F 477, elastomeric seals.
 3. PVC Profile Sewer Piping:
 - a. Pipe: ASTM F 794, PVC profile, gravity sewer pipe with bell-and-spigot ends for gasketed joints.
 - b. Fittings: ASTM D 3034, PVC with bell ends.
 - c. Gaskets: ASTM F 477, elastomeric seals.
 4. PVC Type PSM Sewer Piping:
 - a. Pipe: ASTM D 3034, SDR 35, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
 - b. Fittings: ASTM D 3034, PVC with bell ends.
 - c. Gaskets: ASTM F 477, elastomeric seals.
 5. PVC Gravity Sewer Piping:
 - a. Pipe and Fittings: ASTM F 679, T-1 **OR** T-2, **as directed**, wall thickness, PVC gravity sewer pipe with bell-and-spigot ends and with integral ASTM F 477, elastomeric seals for gasketed joints.
 6. PVC Pressure Piping:
 - a. Pipe: AWWA C900, Class 100 **OR** Class 150 **OR** Class 200, **as directed**, PVC pipe with bell-and-spigot ends for gasketed joints.



- b. Fittings: AWWA C900, Class 100 **OR** Class 150 **OR** Class 200, **as directed**, PVC pipe with bell ends
- c. Gaskets: ASTM F 477, elastomeric seals.
- 7. PVC Water-Service Piping:
 - a. Pipe: ASTM D 1785, Schedule 40 **OR** Schedule 80, **as directed**, PVC, with plain ends for solvent-cemented joints.
 - b. Fittings: ASTM D 2466, Schedule 40 **OR** ASTM D 2467, Schedule 80, **as directed**, PVC, socket type.
- J. Fiberglass Pipe And Fittings
 - 1. Fiberglass Sewer Pipe: ASTM D 3262, RTRP for gasketed joints fabricated with Type 2, polyester **OR** Type 4, epoxy, **as directed**, resin.
 - a. Liner: Reinforced thermoset **OR** Nonreinforced thermoset **OR** Thermoplastic **OR** No liner, **as directed**.
 - b. Grade: Reinforced, surface layer matching pipe resin **OR** Nonreinforced, surface layer matching pipe resin **OR** No surface layer, **as directed**.
 - c. Stiffness: 9 psig (62 kPa) **OR** 18 psig (124 kPa) **OR** 36 psig (248 kPa) **OR** 72 psig (496 kPa), **as directed**.
 - 2. Fiberglass Nonpressure Fittings: ASTM D 3840, RTRF for gasketed joints.
 - a. Laminating Resin: Type 1, polyester **OR** Type 2, epoxy, **as directed**, resin.
 - b. Reinforcement: Grade with finish compatible with resin.
 - 3. Gaskets: ASTM F 477, elastomeric seals.
- K. Concrete Pipe And Fittings
 - 1. Nonreinforced-Concrete Sewer Pipe and Fittings: ASTM C 14 (ASTM C 14M), Class 1 **OR** Class 2 **OR** Class 3, **as directed**, with bell-and-spigot **OR** tongue-and-groove, **as directed** ends and gasketed joints with ASTM C 443 (ASTM C 443M), rubber gaskets **OR** sealant joints with ASTM C 990 (ASTM C 990M), bitumen or butyl-rubber sealant, **as directed**.
 - 2. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76 (ASTM C 76M).
 - a. Bell-and-spigot **OR** Tongue-and-groove, **as directed**, ends and gasketed joints with ASTM C 443 (ASTM C 443M), rubber gaskets **OR** sealant joints with ASTM C 990 (ASTM C 990M), bitumen or butyl-rubber sealant, **as directed**.
 - b. Class I, Wall A **OR** Wall B, **as directed**.
 - c. Class II, Wall A **OR** Wall B **OR** Wall C, **as directed**.
 - d. Class III, Wall A **OR** Wall B **OR** Wall C, **as directed**.
 - e. Class IV, Wall A **OR** Wall B **OR** Wall C, **as directed**.
 - f. Class V, Wall B **OR** Wall C, **as directed**.
- L. Nonpressure Transition Couplings
 - 1. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - 2. Sleeve Materials:
 - a. For Concrete Pipes: ASTM C 443 (ASTM C 443M), rubber.
 - b. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
 - c. For Fiberglass Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - d. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - e. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
 - 3. Unshielded, Flexible Couplings:
 - a. Description: Elastomeric sleeve, with stainless-steel shear ring, **as directed**, and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - 4. Shielded, Flexible Couplings:



- a. Description: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
5. Ring-Type, Flexible Couplings:
 - a. Description: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.
- M. Pressure Pipe Couplings
 1. Description: AWWA C219, tubular-sleeve coupling, with center sleeve, gaskets, end rings, and bolt fasteners.
 2. Metal, bolted, sleeve-type, reducing or transition coupling, for joining underground pressure piping. Include 150-psig (1035-kPa) **OR** 200-psig (1380-kPa), **as directed**, minimum pressure rating and ends sized to fit adjoining pipes.
 3. Center-Sleeve Material: Manufacturer's standard **OR** Carbon steel **OR** Stainless steel **OR** Ductile iron **OR** Malleable iron, **as directed**.
 4. Gasket Material: Natural or synthetic rubber.
 5. Metal Component Finish: Corrosion-resistant coating or material.
- N. Expansion Joints And Deflection Fittings
 1. Ductile-Iron Flexible Expansion Joints:
 - a. Description: Compound fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include two gasketed ball-joint sections and one or more gasketed sleeve sections, rated for 250-psig (1725-kPa) minimum working pressure and for offset and expansion indicated.
 2. Ductile-Iron Expansion Joints:
 - a. Description: Three-piece assembly of telescoping sleeve with gaskets and restrained-type, ductile-iron or steel with protective coating, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Include rating for 250-psig (1725-kPa) minimum working pressure and for expansion indicated.
 3. Ductile-Iron Deflection Fittings:
 - a. Description: Compound-coupling fitting, with ball joint, flexing section, gaskets, and restrained-joint ends, complying with AWWA C110 or AWWA C153. Include rating for 250-psig (1725-kPa) minimum working pressure and for up to 15 degrees of deflection.
- O. Backwater Valves
 1. Cast-Iron Backwater Valves:
 - a. Description: ASME A112.14.1, gray-iron body and bolted cover, with bronze seat.
 - b. Horizontal type; with swing check valve and hub-and-spigot ends.
 - c. Combination horizontal and manual gate-valve type; with swing check valve, integral gate valve, and hub-and-spigot ends.
 - d. Terminal type; with bronze seat, swing check valve, and hub inlet.
 2. Plastic Backwater Valves:
 - a. Description: Horizontal type; with PVC body, PVC removable cover, and PVC swing check valve.
- P. Cleanouts
 1. Cast-Iron Cleanouts:
 - a. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
 - b. Top-Loading Classification(s): Light Duty **OR** Medium Duty **OR** Heavy Duty **OR** Extra-Heavy Duty, **as directed**.
 - c. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.
 2. Plastic Cleanouts:



- a. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

Q. Drains

1. Cast-Iron Area Drains:
 - a. Description: ASME A112.6.3 gray-iron round body with anchor flange and round secured **OR** non-secured, **as directed**, grate. Include bottom outlet with inside calk or spigot connection, of sizes indicated.
 - b. Top-Loading Classification(s): Medium Duty **OR** Heavy Duty, **as directed**.
2. Cast-Iron Trench Drains:
 - a. Description: ASME A112.6.3, 6-inch- (150-mm-) wide top surface, rectangular body with anchor flange or other anchoring device, and rectangular secured **OR** non-secured, **as directed**, grate. Include units of total length indicated and quantity of bottom outlets with inside calk or spigot connections, of sizes indicated.
 - b. Top-Loading Classification(s): Medium Duty **OR** Heavy Duty **OR** Extra-Heavy Duty **OR** Medium and Heavy Duty **OR** Medium and Extra-Heavy Duty **OR** Heavy and Extra-Heavy Duty **OR** Medium, Heavy, and Extra-Heavy Duty, **as directed**.
3. Steel Trench Drains:
 - a. Description: Factory fabricated from ASTM A 242/A 242M, welded steel plate, to form rectangular body with uniform bottom downward slope of 2 percent toward outlet, anchor flange, and grate. Include units of total length indicated, bottom outlet of size indicated, outlet strainer, acid-resistant enamel coating on inside and outside surfaces, and grate with openings of total free area at least two times cross-sectional area of outlet.
 - b. Plate Thicknesses: 1/8 inch (3.2 mm) **OR** 1/4 inch (6.4 mm), **as directed**.
 - c. Overall Widths: 7-1/2 inches (190 mm) **OR** 12-1/3 inches (313 mm), **as directed**.
 - 1) Grate Openings: 1/4 inch (6.4 mm) circular **OR** 3/8 inch (9.5 mm) circular **OR** 3/8-by-3-inch (9.5-by-76-mm) slots, **as directed**.

R. Encasement For Piping

1. Standard: ASTM A 674 or AWWA C105.
2. Material: Linear low-density polyethylene film of 0.008-inch (0.20-mm) **OR** high-density, cross-laminated polyethylene film of 0.004-inch (0.10-mm), **as directed**, minimum thickness.
3. Form: Sheet **OR** Tube, **as directed**.
4. Color: Black **OR** Natural, **as directed**.

S. Manholes

1. Standard Precast Concrete Manholes:
 - a. Description: ASTM C 478 (ASTM C 478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints.
 - b. Diameter: 48 inches (1200 mm) minimum unless otherwise indicated.
 - c. Ballast: Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.
 - d. Base Section: 6-inch (150-mm) minimum thickness for floor slab and 4-inch (102-mm) minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
 - e. Riser Sections: 4-inch (102-mm) minimum thickness, and lengths to provide depth indicated.
 - f. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated, and top of cone of size that matches grade rings.
 - g. Joint Sealant: ASTM C 990 (ASTM C 990M), bitumen or butyl rubber.
 - h. Resilient Pipe Connectors: ASTM C 923 (ASTM C 923M), cast or fitted into manhole walls, for each pipe connection.
 - i. Steps: Individual FRP steps or FRP ladder **OR** Individual FRP steps; FRP ladder; or ASTM A 615/A 615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D 4101, PP **OR** ASTM A 615/A 615M, deformed, 1/2-inch (13-mm) steel reinforcing



- rods encased in ASTM D 4101, PP, **as directed**, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches (1500 mm).
- j. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
- OR**
- Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.
2. Designed Precast Concrete Manholes:
- a. Description: ASTM C 913; designed according to ASTM C 890 for A-16 (AASHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for sealant joints.
- b. Ballast: Increase thickness of one or more precast concrete sections or add concrete to manhole as required to prevent flotation.
- c. Joint Sealant: ASTM C 990 (ASTM C 990M), bitumen or butyl rubber.
- d. Resilient Pipe Connectors: ASTM C 923 (ASTM C 923M), cast or fitted into manhole walls, for each pipe connection.
- e. Steps: Individual FRP steps or FRP ladder **OR** Individual FRP steps; FRP ladder; or ASTM A 615/A 615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D 4101, PP **OR** ASTM A 615/A 615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D 4101, PP, **as directed**, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches (1500 mm).
- f. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
- OR**
- Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, to match diameter of manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope.
3. Fiberglass Manholes:
- a. Description: ASTM D 3753.
- b. Diameter: 48 inches (1200 mm) minimum unless otherwise indicated.
- c. Ballast: Increase thickness of concrete base as required to prevent flotation.
- d. Base Section: Concrete, 6-inch (150-mm) minimum thickness.
- e. Resilient Pipe Connectors (if required): ASTM C 923 (ASTM C 923M), cast or fitted into manhole walls, for each pipe connection.
- f. Steps: Individual FRP steps or FRP ladder, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches (1500 mm).
- g. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
- OR**
- Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.
4. Manhole Frames and Covers:



- a. Description: Ferrous; 24-inch (610-mm) ID by 7- to 9-inch (175- to 225-mm) riser with 4-inch- (102-mm-) minimum width flange and 26-inch- (660-mm-) diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."
- b. Material: ASTM A 536, Grade 60-40-18 ductile **OR** ASTM A 48/A 48M, Class 35 gray, **as directed**, iron unless otherwise indicated.

T. Concrete

1. General: Cast-in-place concrete according to ACI 318, ACI 350/350R (ACI 350M/350RM), and the following:
 - a. Cement: ASTM C 150, Type II.
 - b. Fine Aggregate: ASTM C 33, sand.
 - c. Coarse Aggregate: ASTM C 33, crushed gravel.
 - d. Water: Potable.
2. Portland Cement Design Mix: 4000 psi (27.6 MPa) minimum, with 0.45 maximum water/cementitious materials ratio.
 - a. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
 - b. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.
3. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi (27.6 MPa) minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.
 - a. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
 - 1) Invert Slope: **1 OR 2, as directed**, percent through manhole.
 - b. Benches: Concrete, sloped to drain into channel.
 - 1) Slope: **4 OR 8, as directed**, percent.
4. Ballast and Pipe Supports: Portland cement design mix, 3000 psi (20.7 MPa) minimum, with 0.58 maximum water/cementitious materials ratio.
 - a. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
 - b. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

U. Polymer-Concrete, Channel Drainage Systems

1. General Requirements for Polymer-Concrete, Channel Drainage Systems: Modular system of precast, polymer-concrete channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling. Include quantity of units required to form total lengths indicated.
2. Sloped-Invert, Polymer-Concrete Systems:
 - a. Channel Sections:
 - 1) Interlocking-joint, precast, modular units with end caps.
 - 2) 4-inch (102-mm) inside width and deep, rounded bottom, with built-in invert slope of 0.6 percent and with outlets in quantities, sizes, and locations indicated.
 - 3) Extension sections necessary for required depth.
 - 4) Frame: Include gray-iron or steel frame for grate.
 - b. Grates:
 - 1) Manufacturer's designation "Heavy **OR** "Medium, **as directed**, Duty," with slots or perforations that fit recesses in channels.
 - 2) Material: Fiberglass **OR** Galvanized steel **OR** Gray iron **OR** Stainless steel, **as directed**.
 - c. Covers: Solid gray iron if indicated.
 - d. Locking Mechanism: Manufacturer's standard device for securing grates to channel sections.
3. Narrow-Width, Level-Invert, Polymer-Concrete Systems:
 - a. Channel Sections:
 - 1) Interlocking-joint, precast, modular units with end caps.



- 2) 5-inch (127-mm) inside width and 9-3/4-inch- (248-mm-) deep, rounded bottom, with level invert and with NPS 4 (DN 100) outlets in quantities, sizes, and locations indicated.
 - b. Grates:
 - 1) Slots or perforations that fit recesses in channels.
 - 2) Material: Fiberglass **OR** Galvanized steel **OR** Gray iron **OR** Stainless steel, **as directed**.
 - c. Covers: Solid gray iron if indicated.
 - d. Locking Mechanism: Manufacturer's standard device for securing grates to channel sections.
 4. Wide-Width, Level-Invert, Polymer-Concrete Systems:
 - a. Channel Sections:
 - 1) Interlocking-joint, precast, modular units with end caps.
 - 2) 8-inch (203-mm) inside width and 13-3/4-inch- (350-mm-) deep, rounded bottom, with level invert and with outlets in quantities, sizes, and locations indicated.
 - b. Grates:
 - 1) Slots or other openings that fit recesses in channels.
 - 2) Material: Fiberglass **OR** Gray iron, **as directed**.
 - c. Covers: Solid gray iron if indicated.
 - d. Locking Mechanism: Manufacturer's standard device for securing grates to channel sections.
 5. Drainage Specialties: Precast, polymer-concrete units.
 - a. Large Catch Basins:
 - 1) 24-by-12-inch (610-by-305-mm) polymer-concrete body, with outlets in quantities and sizes indicated.
 - 2) Gray-iron slotted grate.
 - 3) Frame: Include gray-iron or steel frame for grate.
 - b. Small Catch Basins:
 - 1) 19- to 24-inch by approximately 6-inch (483- to 610-mm by approximately 150-mm) polymer-concrete body, with outlets in quantities and sizes indicated.
 - 2) Gray-iron slotted grate.
 - 3) Frame: Include gray-iron or steel frame for grate.
 - c. Oil Interceptors:
 - 1) Polymer-concrete body with interior baffle and four steel support channels and two 1/4-inch- (6.4-mm-) thick, steel-plate covers.
 - 2) Steel-plate covers.
 - 3) Capacity: 140 gal. (530 L) **OR** 200 gal. (757 L) **OR** 260 gal. (984 L), **as directed**.
 - 4) Inlet and Outlet: NPS 4 (DN 100) **OR** NPS 6 (DN 150), **as directed**.
 - d. Sediment Interceptors:
 - 1) 27-inch- (686-mm-) square, polymer-concrete body, with outlets in quantities and sizes indicated.
 - 2) 24-inch- (610-mm-) square, gray-iron frame and slotted grate.
 6. Supports, Anchors, and Setting Devices: Manufacturer's standard unless otherwise indicated.
 7. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

V. Plastic, Channel Drainage Systems

1. General Requirements for Plastic, Channel Drainage Systems:
 - a. Modular system of plastic channel sections, grates, and appurtenances.
 - b. Designed so grates fit into frames without rocking or rattling.
 - c. Number of units required to form total lengths indicated.
2. Fiberglass Systems:
 - a. Channel Sections:
 - 1) Interlocking-joint, fiberglass modular units, with built-in invert slope of approximately 1 percent and with end caps.
 - 2) Rounded or inclined inside bottom surface, with outlets in quantities, sizes, and locations indicated.



- 3) Width: 6 inches (150 mm) **OR** 6 or 8 inches (150 or 203 mm) **OR** 8 inches (203 mm), **as directed**.
- b. Factory- or field-attached frames that fit channel sections and grates.
 - 1) Material: Galvanized steel **OR** Stainless steel **OR** Manufacturer's standard metal, **as directed**.
- c. Grates with slots or perforations that fit frames.
 - 1) Material: Fiberglass **OR** Galvanized steel **OR** Gray iron **OR** Stainless steel, **as directed**.
- d. Covers: Solid gray iron if indicated.
- e. Drainage Specialties:
 - 1) Large Catch Basins: 24-inch- (610-mm-) square plastic body, with outlets in quantities and sizes indicated. Include gray-iron frame and slotted grate.
 - 2) Small Catch Basins: 12-by-24-inch (305-by-610-mm) plastic body, with outlets in quantities and sizes indicated. Include gray-iron frame and slotted grate.
3. PE Systems:
 - a. Channel Sections: Interlocking-joint, PE modular units, 4 inches (102 mm) wide, with end caps. Include rounded bottom, with level invert and with outlets in quantities, sizes, and locations indicated.
 - b. Grates: PE, ladder shaped; with stainless-steel screws.
 - c. Color: Gray unless otherwise indicated.
 - d. Drainage Specialties: Include the following PE components:
 - 1) Drains: 4-inch- (102-mm-) diameter, round, slotted top; with NPS 4 (DN 100) bottom outlet.
OR
Drains: 8-inch- (203-mm-) diameter, round, slotted top; with NPS 6 (DN 150) bottom outlet.
OR
Drains: 4-inch- (102-mm-) square, slotted top; with NPS 3 (DN 80) bottom outlet.
OR
Drains: 8-inch- (203-mm-) square, slotted top; with NPS 6 (DN 150) bottom outlet.
OR
Catch Basins: 12-inch- (305-mm-) square plastic body, with outlets in quantities and sizes indicated. Include PE slotted grate 11-3/4 inches (298 mm) square by 1-1/8 inches (28.6 mm) thick.
4. Supports, Anchors, and Setting Devices: Manufacturer's standard unless otherwise indicated.
5. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

W. Catch Basins

1. Standard Precast Concrete Catch Basins:
 - a. Description: ASTM C 478 (ASTM C 478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints.
 - b. Base Section: 6-inch (150-mm) minimum thickness for floor slab and 4-inch (102-mm) minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
 - c. Riser Sections: 4-inch (102-mm) minimum thickness, 48-inch (1200-mm) diameter, and lengths to provide depth indicated.
 - d. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
 - e. Joint Sealant: ASTM C 990 (ASTM C 990M), bitumen or butyl rubber.
 - f. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
OR
Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch (150- to 225-mm) total thickness, that match 24-inch- (610-mm-) diameter frame and grate.



- c. Steps: Individual FRP steps or FRP ladder **OR** Individual FRP steps; FRP ladder; or ASTM A 615/A 615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D 4101, PP **OR** ASTM A 615/A 615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D 4101, PP, **as directed**, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of structure to finished grade is less than 60 inches (1500 mm).
2. Manhole Frames and Covers: ASTM A 536, Grade 60-40-18, ductile-iron castings designed for heavy-duty service. Include 24-inch (610-mm) ID by 7- to 9-inch (175- to 225-mm) riser with 4-inch (102-mm) minimum width flange, and 26-inch- (660-mm-) diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."

Z. Pipe Outlets

1. Head Walls: Cast-in-place reinforced concrete, with apron and tapered sides.
2. Riprap Basins: Broken, irregularly sized and shaped, graded stone according to NSSGA's "Quarried Stone for Erosion and Sediment Control."
 - a. Average Size: NSSGA No. R-3, screen opening 2 inches (51 mm).
 - b. Average Size: NSSGA No. R-4, screen opening 3 inches (76 mm).
 - c. Average Size: NSSGA No. R-5, screen opening 5 inches (127 mm).
3. Filter Stone: According to NSSGA's "Quarried Stone for Erosion and Sediment Control," No. FS-2, No. 4 screen opening, average-size graded stone.
4. Energy Dissipaters: According to NSSGA's "Quarried Stone for Erosion and Sediment Control," No. A-1, 3-ton (2721-kg) average weight armor stone, unless otherwise indicated.

AA. Dry Wells

1. Description: ASTM C 913, precast, reinforced, perforated concrete rings. Include the following:
 - a. Floor: Cast-in-place concrete.
 - b. Cover: Liff-off-type concrete cover with cast-in lift rings.
 - c. Wall Thickness: 4 inches (102 mm) minimum with 1-inch (25-mm) diameter or 1-by-3-inch- (25-by-76-mm-) maximum slotted perforations arranged in rows parallel to axis of ring.
 - 1) Total Free Area of Perforations: Approximately 15 percent of ring interior surface.
 - 2) Ring Construction: Designed to be self-aligning.
 - d. Filtering Material: ASTM D 448, Size No. 24, 3/4- to 2-1/2-inch (19- to 63-mm) washed, crushed stone or gravel.

OR

Description: Manufactured PE side panels and top cover that assemble into 50-gal. (190-L) storage capacity units.

- a. Side Panels: With knockout ports for piping and seepage holes.
- b. Top Cover: With knockout port for drain.
- c. Filter Fabric: As recommended by unit manufacturer.
- d. Filtering Material: ASTM D 448, Size No. 24, 3/4- to 2-1/2-inch (19- to 63-mm) washed, crushed stone or gravel.

OR

Description: Constructed-in-place aggregate type. Include the following:

- a. Lining: Clay or concrete bricks.

OR

Lining: Concrete blocks or precast concrete rings with notches or weep holes.
- b. Filtering Material: ASTM D 448, Size No. 24, 3/4- to 2-1/2-inch (19- to 63-mm) washed, crushed stone or gravel.
- c. Cover: Precast, reinforced-concrete slab, designed for structural loading according to ASTM C 890 and made according to ASTM C 913. Include slab dimensions that will extend 12 inches (300 mm) minimum beyond edge of excavation, with bituminous coating over entire surface. Cast cover with opening for manhole in center.
- d. Manhole: 24-inch- (610-mm-) diameter, reinforced-concrete access lid with steel lift rings. Include bituminous coating over entire surface.

**BB. Stormwater Disposal Systems****1. Chamber Systems:**

- a. Storage and Leaching Chambers: Molded PE with perforated sides and open bottom. Include number of chambers, distribution piping, end plates, and other standard components as required for system total capacity.
- b. Filtering Material: ASTM D 448, Size No. 24, 3/4- to 2-1/2-inch (19- to 63-mm) washed, crushed stone or gravel.
- c. Filter Mat: Geotextile woven or spun filter fabric, in one or more layers, for minimum total unit weight of 4 oz./sq. yd. (135 g/sq. m).

OR

Pipe Systems: Perforated manifold, header, and lateral piping complying with AASHTO M 252M for NPS 10 (DN 250) and smaller, AASHTO M 294M for NPS 12 to NPS 60 (DN 300 to DN 1500). Include proprietary fittings, couplings, seals, and filter fabric.

1.3 EXECUTION**1.4 EARTHWORK**

A. Excavation, trenching, and backfilling are specified in Division 31 Section "Earth Moving".

B. Piping Installation

1. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
2. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
3. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
4. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
5. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.
6. Install gravity-flow, nonpressure drainage piping according to the following:
 - a. Install piping pitched down in direction of flow.
 - b. Install piping NPS 6 (DN 150) and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.
 - c. Install piping with 36-inch (915-mm) **OR** 48-inch (1220-mm) **OR** 60-inch (1520-mm) **OR** 72-inch (1830-mm), **as directed**, minimum cover.
 - d. Install hub-and-spigot, cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
 - e. Install hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
 - f. Install ductile-iron piping and special fittings according to AWWA C600 or AWWA M41.
 - g. Install corrugated steel piping according to ASTM A 798/A 798M.
 - h. Install corrugated aluminum piping according to ASTM B 788/B 788M.
 - i. Install ABS sewer piping according to ASTM D 2321 and ASTM F 1668.
 - j. Install PE corrugated sewer piping according to ASTM D 2321.
 - k. Install PVC cellular-core piping according to ASTM D 2321 and ASTM F 1668.
 - l. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
 - m. Install PVC profile gravity sewer piping according to ASTM D 2321 and ASTM F 1668.



- n. Install PVC water-service piping according to ASTM D 2321 and ASTM F 1668.
- o. Install fiberglass sewer piping according to ASTM D 3839 and ASTM F 1668.
- p. Install nonreinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."
- q. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."
- 7. Install force-main pressure piping according to the following:
 - a. Install piping with restrained joints at tee fittings and at horizontal and vertical changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.
 - b. Install piping with 36-inch (915-mm) **OR** 48-inch (1220-mm) **OR** 60-inch (1520-mm) **OR** 72-inch (1830-mm), **as directed**, minimum cover.
 - c. Install **ductile**-iron pressure piping according to AWWA C600 or AWWA M41.
 - d. Install ductile-iron special fittings according to AWWA C600.
 - e. Install PVC pressure piping according to AWWA M23, or ASTM D 2774 and ASTM F 1668.
 - f. Install PVC water-service piping according to ASTM D 2774 and ASTM F 1668.
- 8. Install corrosion-protection piping encasement over the following underground metal piping according to ASTM A 674 or AWWA C105:
 - a. Hub-and-spigot, cast-iron soil pipe and fittings.
 - b. Hubless cast-iron soil pipe and fittings.
 - c. Ductile-iron pipe and fittings.
 - d. Expansion joints and deflection fittings.

C. Pipe Joint Construction

- 1. Join gravity-flow, nonpressure drainage piping according to the following:
 - a. Join hub-and-spigot, cast-iron soil piping with gasketed joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
 - b. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
 - c. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
 - d. Join ductile-iron culvert piping according to AWWA C600 for push-on joints.
 - e. Join ductile-iron piping and special fittings according to AWWA C600 or AWWA M41.
 - f. Join corrugated steel sewer piping according to ASTM A 798/A 798M.
 - g. Join corrugated aluminum sewer piping according to ASTM B 788/B 788M.
 - h. Join ABS sewer piping according to ASTM D 2321 and ASTM D 2751 for elastomeric-seal joints.
 - i. Join corrugated PE piping according to ASTM D 3212 for push-on joints.
 - j. Join PVC cellular-core piping according to ASTM D 2321 and ASTM F 891 for solvent-cemented joints.
 - k. Join PVC corrugated sewer piping according to ASTM D 2321 for elastomeric-seal joints.
 - l. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasketed joints.
 - m. Join PVC profile gravity sewer piping according to ASTM D 2321 for elastomeric-seal joints or ASTM F 794 for gasketed joints.
 - n. Join fiberglass sewer piping according to ASTM D 3839 for elastomeric-seal joints.
 - o. Join nonreinforced-concrete sewer piping according to ASTM C 14 (ASTM C 14M) and ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.
 - p. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.
 - q. Join dissimilar pipe materials with nonpressure-type flexible couplings.
- 2. Join force-main pressure piping according to the following:
 - a. Join ductile-iron pressure piping according to AWWA C600 or AWWA M41 for push-on joints.



- b. Join ductile-iron special fittings according to AWWA C600 or AWWA M41 for push-on joints.
 - c. Join PVC pressure piping according to AWWA M23 for gasketed joints.
 - d. Join PVC water-service piping according to ASTM D 2855 for solvent-cemented joints.
 - e. Join dissimilar pipe materials with pressure-type couplings.
- D. Backwater Valve Installation
1. Install horizontal-type backwater valves in piping where indicated.
 2. Install combination horizontal and manual gate-valve type in piping and in manholes where indicated.
 3. Install terminal-type backwater valves on end of piping and in manholes where indicated.
- E. Cleanout Installation
1. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
 - a. Use Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
 - b. Use Medium-Duty, top-loading classification cleanouts in paved foot-traffic areas.
 - c. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
 - d. Use Extra-Heavy-Duty, top-loading classification cleanouts in roads.
 - e. Set cleanout frames and covers in earth in cast-in-place concrete block, 18 by 18 by 12 inches (450 by 450 by 300 mm) deep. Set with tops 1 inch (25 mm) above surrounding earth grade.
 - f. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.
- F. Drain Installation
1. Install type of drains in locations indicated.
 - a. Use Light-Duty, top-loading classification drains in earth or unpaved foot-traffic areas.
 - b. Use Medium-Duty, top-loading classification drains in paved foot-traffic areas.
 - c. Use Heavy-Duty, top-loading classification drains in vehicle-traffic service areas.
 - d. Use Extra-Heavy-Duty, top-loading classification drains in roads.
 2. Embed drains in 4-inch (102-mm) minimum concrete around bottom and sides.
 3. Fasten grates to drains if indicated.
 4. Set drain frames and covers with tops flush with pavement surface.
 5. Assemble trench sections with flanged joints.
 6. Embed trench sections in 4-inch (102-mm) minimum concrete around bottom and sides.
- G. Manhole Installation
1. General: Install manholes, complete with appurtenances and accessories indicated.
 2. Install precast concrete manhole sections with sealants according to ASTM C 891.
 3. Where specific manhole construction is not indicated, follow manhole manufacturer's written instructions.
 4. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches (76 mm) above finished surface elsewhere unless otherwise indicated.
- H. Catch Basin Installation
1. Construct catch basins to sizes and shapes indicated.
 2. Set frames and grates to elevations indicated.
- I. Stormwater Inlet And Outlet Installation
1. Construct inlet head walls, aprons, and sides of reinforced concrete, as indicated.
 2. Construct riprap of broken stone, as indicated.
 3. Install outlets that spill onto grade, anchored with concrete, where indicated.
 4. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.
 5. Construct energy dissipaters at outlets, as indicated.

**J. Dry Well Installation**

1. Excavate hole to diameter of at least 6 inches (150 mm) greater than outside of dry well. Do not extend excavation into ground-water table.
2. Install precast, concrete-ring dry wells according to the following:
 - a. Assemble rings to depth indicated.
 - b. Extend rings to height where top of cover will be approximately 8 inches (203 mm) below finished grade.
 - c. Backfill bottom of inside of rings with filtering material to level at least 12 inches (300 mm) above bottom.
 - d. Extend effluent inlet pipe 12 inches (300 mm) into rings and terminate into side of tee fitting.
 - e. Backfill around outside of rings with filtering material to top level of rings.
 - f. Install cover over top of rings.
3. Install manufactured, PE dry wells according to manufacturer's written instructions and the following:
 - a. Assemble and install panels and cover.
 - b. Backfill bottom of inside of unit with filtering material to level at least 12 inches (300 mm) above bottom.
 - c. Extend effluent inlet pipe 12 inches (300 mm) into unit and terminate into side of tee fitting.
 - d. Install filter fabric around outside of unit.
 - e. Install filtering material around outside of unit.
4. Install constructed-in-place dry wells according to the following:
 - a. Install brick lining material dry and laid flat, with staggered joints for seepage. Build to diameter and depth indicated.
 - b. Install block lining material dry, with staggered joints and 20 percent minimum of blocks on side for seepage. Install precast concrete rings with notches or weep holes for seepage. Build to diameter and depth indicated.
 - c. Extend lining material to height where top of manhole will be approximately 8 inches (203 mm) below finished grade.
 - d. Backfill bottom of inside of lining with filtering material to level at least 12 inches (300 mm) above bottom.
 - e. Extend effluent inlet pipe 12 inches (300 mm) into lining and terminate into side of tee fitting.
 - f. Backfill around outside of lining with filtering material to top level of lining.
 - g. Install manhole over top of dry well. Support cover on undisturbed soil. Do not support cover on lining.

K. Concrete Placement

1. Place cast-in-place concrete according to ACI 318.

L. Channel Drainage System Installation

1. Install with top surfaces of components, except piping, flush with finished surface.
2. Assemble channel sections to form slope down toward drain outlets. Use sealants, adhesives, fasteners, and other materials recommended by system manufacturer.
3. Embed channel sections and drainage specialties in 4-inch (102-mm) minimum concrete around bottom and sides.
4. Fasten grates to channel sections if indicated.
5. Assemble channel sections with flanged or interlocking joints.
6. Embed channel sections in 4-inch (102-mm) minimum concrete around bottom and sides.

M. Stormwater Disposal System Installation

1. Chamber Systems: Excavate trenches of width and depth, and install system and backfill according to chamber manufacturer's written instructions. Include storage and leaching chambers, filtering material, and filter mat.

OR



Piping Systems: Excavate trenches of width and depth, and install piping system, filter fabric, and backfill, according to piping manufacturer's written instructions.

N. Connections

1. Connect nonpressure, gravity-flow drainage piping in building's storm building drains specified in Division 22 Section "Facility Storm Drainage Piping".
2. Connect force-main piping to building's storm drainage force mains specified in Division 22 Section "Facility Storm Drainage Piping". Terminate piping where indicated.
3. Make connections to existing piping and underground manholes.
 - a. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch (150-mm) overlap, with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).
 - b. Make branch connections from side into existing piping, NPS 4 to NPS 20 (DN 100 to DN 500). Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).
 - c. Make branch connections from side into existing piping, NPS 21 (DN 525) or larger, or to underground manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches (76 mm) of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe, manhole, or structure wall, encase entering connection in 6 inches (150 mm) of concrete for minimum length of 12 inches (300 mm) to provide additional support of collar from connection to undisturbed ground.
 - 1) Use concrete that will attain a minimum 28-day compressive strength of 3000 psi (20.7 MPa) unless otherwise indicated.
 - 2) Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
 - d. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.
4. Connect to sediment interceptors specified in Division 22 Section "Sanitary Waste Interceptors".
5. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
 - a. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.
 - 1) Unshielded **OR** Shielded, **as directed**, flexible couplings for same or minor difference OD pipes.
 - 2) Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
 - 3) Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.
 - b. Use pressure-type pipe couplings for force-main joints.

O. Closing Abandoned Storm Drainage Systems

1. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:
 - a. Close open ends of piping with at least 8-inch- (203-mm-) thick, brick masonry bulkheads.
 - b. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.
2. Abandoned Manholes and Structures: Excavate around manholes and structures as required and use one procedure below:
 - a. Remove manhole or structure and close open ends of remaining piping.



- b. Remove top of manhole or structure down to at least 36 inches (915 mm) below final grade. Fill to within 12 inches (300 mm) of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.
3. Backfill to grade according to Division 31 Section "Earth Moving".

P. Identification

1. Materials and their installation are specified in Division 31 Section "Earth Moving". Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.
 - a. Use warning tape **OR** detectable warning tape, **as directed**, over ferrous piping.
 - b. Use detectable warning tape over nonferrous piping and over edges of underground structures.

Q. Field Quality Control

1. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (610 mm) of backfill is in place, and again at completion of Project.
 - a. Submit separate reports for each system inspection.
 - b. Defects requiring correction include the following:
 - 1) Alignment: Less than full diameter of inside of pipe is visible between structures.
 - 2) Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - 3) Damage: Crushed, broken, cracked, or otherwise damaged piping.
 - 4) Infiltration: Water leakage into piping.
 - 5) Exfiltration: Water leakage from or around piping.
 - c. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
 - d. Reinspect and repeat procedure until results are satisfactory.
2. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
 - a. Do not enclose, cover, or put into service before inspection and approval.
 - b. Test completed piping systems according to requirements of authorities having jurisdiction.
 - c. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
 - d. Submit separate report for each test.
 - e. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
 - 1) Exception: Piping with soiltight joints unless required by authorities having jurisdiction.
 - 2) Option: Test plastic piping according to ASTM F 1417.
 - 3) Option: Test concrete piping according to ASTM C 924 (ASTM C 924M).
 - f. Force-Main Storm Drainage Piping: Perform hydrostatic test after thrust blocks, supports, and anchors have hardened. Test at pressure not less than 1-1/2 times the maximum system operating pressure, but not less than 150 psig (1035 kPa).
 - 1) Ductile-Iron Piping: Test according to AWWA C600, "Hydraulic Testing" Section.
 - 2) PVC Piping: Test according to AWWA M23, "Testing and Maintenance" Chapter.
3. Leaks and loss in test pressure constitute defects that must be repaired.
4. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

R. Cleaning

1. Clean interior of piping of dirt and superfluous materials. Flush with potable water **OR** Flush with water, **as directed**.



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Task	Specification	Specification Description
33 41 13 00	22 05 76 00	Sanitary Sewerage
33 41 13 00	22 11 16 00b	Storm Drainage Piping
33 41 13 00	22 05 76 00a	Storm Drainage Piping Specialties



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SECTION 33 42 16 13 - CULVERTS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for culverts. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: For each type of product indicated.

C. Delivery, Storage, And Handling

1. Delivery and Storage: Materials delivered to site shall be inspected for damage, unloaded, and stored with a minimum of handling. Materials shall not be stored directly on the ground. The inside of pipes and fittings shall be kept free of dirt and debris. Before, during, and after installation, plastic pipe and fittings shall be protected from any environment that would result in damage or deterioration to the material. The Contractor shall have a copy of the manufacturer's instructions available at the construction site at all times and shall follow these instructions unless directed otherwise by the the Owner. Solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install plastic pipe shall be stored in accordance with the manufacturer's recommendations and shall be discarded if the storage period exceeds the recommended shelf life. Solvents in use shall be discarded when the recommended pot life is exceeded.
2. Handling: Materials shall be handled in a manner that ensures delivery to the trench in sound, undamaged condition. Pipe shall be carried to the trench, not dragged.

1.2 PRODUCTS

A. Pipe For Culverts

1. Pipe for culverts and storm drains shall be of the sizes indicated and shall conform to the requirements specified.
2. Concrete Pipe
 - a. ASTM C76/ASTM C76M, Class I **OR II OR III OR IV OR V, as directed**, or ASTM C655 D-Load. Note: D-load is defined as the minimum required three-edge test load on a pipe to produce a 0.01 inch crack and/or ultimate failure in pounds per linear foot per foot (no metric definition) of inside diameter.
 - b. Reinforced Arch Culvert and Storm Drainpipe: ASTM C506/ASTM C506M, Class A-II **OR A-III OR A-IV, as directed**.
 - c. Reinforced Elliptical Culvert and Storm Drainpipe: ASTM C507/ASTM C507M. Horizontal elliptical pipe shall be Class HE-A **OR HE-I OR HE-II OR HE-III OR HE-IV, as directed**. Vertical elliptical pipe shall be Class VE-II **OR VE-III OR VE-IV OR VE-V OR VE-VI, as directed**.
 - d. Nonreinforced Pipe: ASTM C14/ASTM C14M, Class 1 **OR 2 OR 3, as directed**.
 - 1) Cast-In-Place Nonreinforced Conduit: ACI 346, except that testing shall be the responsibility of and at the expense of the Contractor. In the case of other conflicts between ACI 346 and project specifications, requirements of ACI 346 shall govern.
NOTE: This type conduit should not be used beneath structures, for drain crossings, adjacent to paved areas, or under high fills.
3. Clay Pipe: Standard or extra strength, as indicated, conforming to ASTM C700.
NOTE: "Bell-and-spigot piping only" in areas where corrosion problems may be anticipated with the stainless steel parts of the couplings used for plain-end piping.



4. Corrugated Steel Pipe
 - a. ASTM A760/A760M, zinc or aluminum (Type 2) coated pipe of either:
 - 1) Type I **OR** II, **as directed**, pipe with annular **OR** helical, **as directed**, 2-2/3 by 1/2 inch (68 by 13 mm) corrugations.
 - 2) Type IR **OR** IIR, **as directed**, pipe with helical 3/4 by 3/4 by 7-1/2 inch (19 by 19 by 190 mm) corrugations.
 - b. Fully Bituminous Coated
 - 1) AASHTO M190 Type A and ASTM A760/A 760M zinc or aluminum (Type 2) coated pipe of either:
 - a) Type I **OR** II, **as directed**, pipe with annular **OR** helical, **as directed**, 2-2/3 by 1/2 inch (68 by 13 mm) corrugations.
 - b) Type IR **OR** IIR, **as directed**, pipe with helical 3/4 by 3/4 by 7-1/2 inch (19 by 19 by 190 mm) corrugations.
 - c. Half Bituminous Coated, Part Paved: AASHTO M190 Type B and ASTM A760/A 760M zinc or aluminum (Type 2) coated Type I **OR** II, **as directed**, pipe with annular **OR** helical, **as directed**, 2-2/3 by 1/2 inch (68 by 13 mm) corrugations.
 - d. Fully Bituminous Coated, Part Paved: AASHTO M190 Type C and ASTM A760/A 760M zinc or aluminum (Type 2) coated Type I **OR** II, **as directed**, pipe with annular **OR** helical, **as directed**, 2-2/3 by 1/2 inch (68 by 13 mm) corrugations.
 - e. Fully Bituminous Coated, Fully Paved: AASHTO M190 Type D and ASTM A760/A 760M zinc or aluminum (Type 2) coated Type I **OR** II, **as directed**, pipe with annular **OR** helical, **as directed**, 2-2/3 by 1/2 inch (68 by 13 mm) corrugations.
 - f. Concrete-Lined: ASTM A760/A760M zinc coated Type I corrugated steel pipe with annular **OR** helical, **as directed**, 2-2/3 by 1/2 inch (68 by 13 mm) corrugations and a concrete lining in accordance with ASTM A849.
 - g. Polymer Precoated: ASTM A 762/A 762M corrugated steel pipe fabricated from ASTM A742/A742M Grade 250/250 10/10 polymer precoated sheet of either:
 - 1) Type I **OR** II, **as directed**, pipe with annular **OR** helical, **as directed**, 2-2/3 by 1/2 inch (68 by 13 mm) corrugations.
 - 2) Type IR **OR** IIR, **as directed**, pipe with helical 3/4 by 3/4 by 7-1/2 inch (19 by 19 by 190 mm) corrugations.
 - h. Polymer Precoated, Part Paved: ASTM A762/A762M Type I **OR** II, **as directed**, corrugated steel pipe and AASHTO M190 Type B (modified) paved invert only, fabricated from ASTM A742/A742M Grade 250/250 10/10 polymer precoated sheet with annular **OR** helical, **as directed**, 2-2/3 by 1/2 inch (68 by 13 mm) corrugations.
 - i. Polymer Precoated, Fully Paved: ASTM A762/A762M Type I **OR** II, **as directed**, corrugated steel pipe and AASHTO M190 Type D (modified), fully paved only, fabricated from ASTM A 742/A 742M Grade 250/250 10/10 polymer precoated sheet with annular **OR** helical, **as directed**, 2-2/3 by 1/2 inch (68 by 13 mm) corrugations.
 5. Corrugated Aluminum Alloy Pipe: ASTM B745/B745M corrugated aluminum alloy pipe of either:
 - 1) Type I **OR** II, **as directed**, pipe with annular **OR** helical, **as directed**, corrugations.
 - 2) Type IA **OR** IR **OR** IIA **OR** IIR, **as directed**, pipe with helical corrugations.
 - b. Aluminum Fully Bituminous Coated: Bituminous coating shall conform to ASTM A849. Piping shall conform to AASHTO M190 Type A and ASTM B745/B745M corrugated aluminum alloy pipe of either:
 - 1) Type I **OR** II, **as directed**, pipe with annular **OR** helical, **as directed**, corrugations.
 - 2) Type IA **OR** IR **OR** IIA **OR** IIR, **as directed**, pipe with helical corrugations.
 - c. Aluminum Fully Bituminous Coated, Part Paved: Bituminous coating shall conform to ASTM A849. Piping shall conform to AASHTO M190 Type C and ASTM B 745/B 745M corrugated aluminum alloy pipe of either:
 - 1) Type I **OR** II, **as directed**, pipe with annular **OR** helical, **as directed**, corrugations.
 - 2) Type IR **OR** IIR, **as directed**, pipe with helical corrugations.
 6. Structural Plate, Steel Pipe, Pipe Arches and Arches



- a. Assembled with galvanized steel nuts and bolts, from galvanized corrugated steel plates conforming to AASHTO M167. Pipe coating, when required, shall conform to the requirements of AASHTO M190 Type A **OR** AASHTO M243, **as directed**.
- b. Thickness of plates shall be as indicated.
- 7. Structural Plate, Aluminum Pipe, Pipe Arches and Arches
 - a. Assembled with either aluminum alloy, aluminum coated steel, stainless steel or zinc coated steel nuts and bolts. Nuts and bolts, and aluminum alloy plates shall conform to AASHTO M219. Pipe coating, when required, shall conform to the requirements of AASHTO M190, Type A **OR** AASHTO M 243, **as directed**.
 - b. Thickness of plates shall be as indicated.
- 8. Ductile Iron Culvert Pipe: ASTM A716.
- 9. Cast-Iron Soil Piping: Cast-Iron Soil Pipe shall conform to ASTM A74, service-weight; gaskets shall be compression-type rubber conforming to ASTM C564.
- 10. PVC Pipe
 - a. The pipe manufacturer's resin certification, indicating the cell classification of PVC used to manufacture the pipe, shall be submitted prior to installation of the pipe.
 - b. Type PSM PVC Pipe: ASTM D3034, Type PSM, maximum SDR 35, produced from PVC certified by the compounder as meeting the requirements of ASTM D1784, minimum cell class 12454-B.
 - c. Profile PVC Pipe: ASTM F794, Series 46, produced from PVC certified by the compounder as meeting the requirements of ASTM D1784, minimum cell class 12454-B.
 - d. Smooth Wall PVC Pipe: ASTM F679 produced from PVC certified by the compounder as meeting the requirements of ASTM D1784, minimum cell class 12454-B.
 - e. Corrugated PVC Pipe: ASTM F949 produced from PVC certified by the compounder as meeting the requirements of ASTM D 1784, minimum cell class 12454-B.
- 11. PE Pipe
 - a. The pipe manufacturer's resin certification indicating the cell classification of PE used to manufacture the pipe shall be submitted prior to installation of the pipe. The minimum cell classification for polyethylene plastic shall apply to each of the seven primary properties of the cell classification limits in accordance with ASTM D3350.
 - b. Smooth Wall PE Pipe: ASTM F714, maximum DR of 21 for pipes 3 to 24 inches (80 to 600 mm) in diameter and maximum DR of 26 for pipes 26 to 48 inches (650 to 1200 mm) in diameter. Pipe shall be produced from PE certified by the resin producer as meeting the requirements of ASTM D3350, minimum cell class 335434C.
 - c. Corrugated PE Pipe: AASHTO M294, Type S or D, for pipes 12 to 48 inches (300 to 1200 mm) and AASHTO MP 7, Type S or D, for pipes 54 to 60 inches (1350 to 1500 mm) produced from PE certified by the resin producer as meeting the requirements of ASTM D3350, minimum cell class in accordance with AASHTO M294. Pipe walls shall have the following properties:
 NOTE: Corrugated PE pipe culverts and storm drains shall not be installed beneath airfield pavements, Class A, B, or C roads, or road pavements with a design index of 6 or greater. Type S pipe has a full circular cross-section, with an outer corrugated pipe wall and a smooth inner liner. Type C pipe has a full circular cross-section, with a corrugated surface both inside and outside. Corrugations may be either annular or helical.

Nominal Size (in.)	Minimum Wall Area (square in/ft)	Minimum Moment of Inertia of Wall Section (in to the 4th/in)
12	1.50	0.024
15	1.91	0.053
18	2.34	0.062
24	3.14	0.116
30	3.92	0.163
36	4.50	0.222
42	4.69	0.543



48	5.15	0.543
54	5.67	0.800
60	6.45	0.800
		Minimum Moment of Inertia of Wall Section (mm to the 4th/mm)
Nominal Size (mm)	Minimum Wall Area (square mm/m)	
300	3200	390
375	4000	870
450	4900	1020
600	6600	1900
750	8300	2670
900	9500	3640
1050	9900	8900
1200	10900	8900
1350	12000	13110
1500	13650	13110

- d. Profile Wall PE Pipe: ASTM F894, RSC 160, produced from PE certified by the resin producer as meeting the requirements of ASTM D3350, minimum cell class 334433C. Pipe walls shall have the following properties:

Nominal Size (in.)	Minimum Wall Area (square in/ft)	Minimum Moment Of Inertia of Wall Section (in to the 4th/in)	
		Cell Class 334433C	Cell Class 335434C
18	2.96	0.052	0.038
21	4.15	0.070	0.051
24	4.66	0.081	0.059
27	5.91	0.125	0.091
30	5.91	0.125	0.091
33	6.99	0.161	0.132
36	8.08	0.202	0.165
42	7.81	0.277	0.227
48	8.82	0.338	0.277
		Minimum Moment Of Inertia of Wall Section (mm to the 4th/mm)	
Nominal Size (mm)	Minimum Wall Area (square mm/m)	Cell Class 334433C	Cell Class 335434C
450	6300	850	620
525	8800	1150	840
600	9900	1330	970
675	12500	2050	1490
750	12500	2050	1490



825	14800	2640	2160
900	17100	3310	2700
1050	16500	4540	3720
1200	18700	5540	4540

B. Drainage Structures

1. Flared End Sections: Sections shall be of a standard design fabricated from zinc coated steel sheets meeting requirements of ASTM A929/A929M.
2. Precast Reinforced Concrete Box: Four-sided box section with open ends to be monolithically cast of reinforced concrete, smooth inside surfaces. Each box section shall be manufactured with chamfered inside corners. Design and manufacture shall conform to ASTM C890.
 - a. Design References: ACI 318.
 - 1) Boxes subjected to highway loadings shall conform to requirements of AASHTO M259 or M273, as applicable, and ASTM C789, C850, C1433, and PS62.
 - 2) Boxes subjected to aircraft loadings shall conform to requirements of FAA specifications.
 - 3) Boxes subjected to railway loadings shall conform to requirements of AREMA specifications.
 - b. Concrete: 5,000 psi @ 30 days, unless otherwise directed.
 - c. Entrained Air: 5 to 9 percent.
 - d. Steel Reinforcing: ASTM A185, A615, A616, Grade 60, 60 ksi.
 - e. Design Loading: AASHTO HS-20-44 or HS-25-44 with 30 percent impact and equivalent soil pressure of 130 psf. Floation forces not accounted for.
 - f. Joints: Each section shall have a male and female end with no less than 1-1/2-inch of concrete overlap and shall include a 1-inch square neoprene gasket, cemented to male surface of section during manufacture.
 - g. End Sections: As required for the individual installation, provide:
 - 1) Doweled end for 1-inch diameter x 12-inch deep steel dowels, keyway slot.
 - 2) Keyway slot, a shear connection between the precast and field cast sections.
 - 3) Plain end, for use where wing and end walls act independently of precast box.
 - h. Lifting Pins: Each section shall be equipped with 4 OSHA approved lifting pins.
 - i. For multi-cell installations, fill 1-inch spacing between cells with granular material to assume proper load distribution.
3. Three-Sided Structures for Culverts or Short Span Bridge System
 - a. Structures shall conform to requirements of ASTM C1504 and ACI 318. For structures subjected to roadway loadings, conform to requirements of AASHTO specifications.

C. Miscellaneous Materials

1. Concrete
 - a. Unless otherwise specified, concrete and reinforced concrete shall conform to the requirements concrete under Division 03 Section "Cast-in-place Concrete". The concrete mixture shall have air content by volume of concrete, based on measurements made immediately after discharge from the mixer, of 5 to 7 percent when maximum size of coarse aggregate exceeds 1-1/2 inches (37.5 mm).
 - b. Air content shall be determined in accordance with ASTM C231. The concrete covering over steel reinforcing shall not be less than 1 inch (25 mm) thick for covers and not less than 1-1/2 inches (40 mm) thick for walls and flooring. Concrete covering deposited directly against the ground shall have a thickness of at least 3 inches (75 mm) between steel and ground.
 - c. Expansion-joint filler material shall conform to ASTM D1751, or ASTM D1752, or shall be resin-impregnated fiberboard conforming to the physical requirements of ASTM D1752.
2. Mortar: Mortar for pipe joints, connections to other drainage structures, and brick or block construction shall conform to ASTM C270, Type M, except that the maximum placement time shall be 1 hour. The quantity of water in the mixture shall be sufficient to produce a stiff workable mortar. Water shall be clean and free of harmful acids, alkalis, and organic impurities. The mortar shall be used within 30 minutes after the ingredients are mixed with water. The inside of



- the joint shall be wiped clean and finished smooth. The mortar head on the outside shall be protected from air and sun with a proper covering until satisfactorily cured.
3. Precast Concrete Segmental Blocks: Precast concrete segmental block shall conform to ASTM C139, not more than 8 inches (200 mm) thick, not less than 8 inches (200 mm) long, and of such shape that joints can be sealed effectively and bonded with cement mortar.
 4. Brick
 - a. Brick shall conform to ASTM C62, Grade SW; ASTM C55, Grade S-I or S-II; or ASTM C32, Grade MS. Mortar for jointing and plastering shall consist of one part portland cement and two parts fine sand. Lime may be added to the mortar in a quantity not more than 25 percent of the volume of cement.
 - b. The joints shall be filled completely and shall be smooth and free from surplus mortar on the inside of the structure. Brick structures shall be plastered with 1/2 inch (10 mm) of mortar over the entire outside surface of the walls. For square or rectangular structures, brick shall be laid in stretcher courses with a header course every sixth course. For round structures, brick shall be laid radially with every sixth course a stretcher course.
 5. Precast Reinforced Concrete Manholes
 - a. Precast reinforced concrete manholes shall conform to ASTM C478/ASTM C478M.
 - b. Joints between precast concrete risers and tops shall be full-bedded in cement mortar and shall be smoothed to a uniform surface on both interior and exterior of the structure **OR** made with flexible watertight, rubber-type gaskets meeting the requirements of paragraph JOINTS, **as directed**.
 6. Prefabricated Corrugated Metal Manholes
 - a. Manholes shall be of the type and design recommended by the manufacturer.
 - b. Manholes shall be complete with frames and cover, or frames and gratings.
 7. Frame and Cover for Gratings
 - a. Frame and cover for gratings shall be cast gray iron, ASTM A48/A48M,
 - b. Class 35B; cast ductile iron, ASTM A536, Grade 65-45-12; or cast aluminum, ASTM B26M/B26, Alloy 356.OT6. Weight, shape, size, and waterway openings for grates and curb inlets shall be as indicated on the plans.
 8. Joints
 - a. Flexible Watertight Joints
 - 1) Materials: Flexible watertight joints shall be made with plastic or rubber-type gaskets for concrete pipe and with factory-fabricated resilient materials for clay pipe. The design of joints and the physical requirements for plastic gaskets shall conform to AASHTO M198, and rubber-type gaskets shall conform to ASTM C443/ASTM C443M. Factory-fabricated resilient joint materials shall conform to ASTM C425. Gaskets shall have not more than one factory-fabricated splice, except that two factory-fabricated splices of the rubber-type gasket are permitted if the nominal diameter of the pipe being gasketed exceeds 54 inches (1.35 m).
 - 2) Test Requirements: Watertight joints shall be tested and shall meet test requirements of paragraph HYDROSTATIC TEST ON WATERTIGHT JOINTS. Rubber gaskets shall comply with the oil resistant gasket requirements of ASTM C443/ASTM C443M. Certified copies of test results shall be delivered to the the Owner before gaskets or jointing materials are installed. Alternate types of watertight joint may be furnished, if specifically approved.
 - b. External Sealing Bands: Requirements for external sealing bands shall conform to ASTM C877/ASTM C877M.
 - c. Flexible Watertight, Gasketed Joints
 - 1) Gaskets: When infiltration or exfiltration is a concern for pipe lines, the couplings may be required to have gaskets. The closed-cell expanded rubber gaskets shall be a continuous band approximately 7 inches (178 mm) wide and approximately 3/8 inch (10 mm) thick, meeting the requirements of ASTM D1056, Type 2 A1 **OR** B3, **as directed**, and shall have a quality retention rating of not less than 70 percent when tested for weather resistance by ozone chamber exposure, Method B of ASTM D1171. Rubber O-ring gaskets shall be 13/16 inch (21 mm) in diameter for pipe



diameters of 36 inches (914 mm) or smaller and 7/8 inch (22 mm) in diameter for larger pipe having 1/2 inch (13 mm) deep end corrugation. Rubber O-ring gaskets shall be 1-3/8 inches (35 mm) in diameter for pipe having 1 inch (25 mm) deep end corrugations. O-rings shall meet the requirements of AASHTO M198 or ASTM C443/ASTM C443M. Flexible plastic gaskets shall conform to requirements of AASHTO M198, Type B.

- 2) Connecting Bands: Connecting bands shall be of the type, size and sheet thickness of band, and the size of angles, bolts, rods and lugs as indicated or where not indicated as specified in the applicable standards or specifications for the pipe. Exterior rivet heads in the longitudinal seam under the connecting band shall be countersunk or the rivets shall be omitted and the seam welded. Watertight joints shall be tested and shall meet the test requirements of paragraph HYDROSTATIC TEST ON WATERTIGHT JOINTS.

- d. PVC Plastic Pipes: Joints shall be solvent cement or elastomeric gasket type in accordance with the specification for the pipe and as recommended by the pipe manufacturer.
- e. Smooth Wall PE Plastic Pipe: Pipe shall be joined using butt fusion method as recommended by the pipe manufacturer.
- f. Corrugated PE Plastic Pipe: Water tight joints shall be made using a PVC or PE coupling and rubber gaskets as recommended by the pipe manufacturer. Rubber gaskets shall conform to ASTM F477. Soil tight joints shall conform to the requirements in AASHTO HB-17, Division II, Section 26.4.2.4.(e) for soil tightness and shall be as recommended by the pipe manufacturer.
- g. Profile Wall PE Plastic Pipe: Joints shall be gasketed or thermal weld type with integral bell in accordance with ASTM F894.
- h. Ductile Iron Pipe: Couplings and fittings shall be as recommended by the pipe manufacturer.

D. Steel Ladder

1. Steel ladder shall be provided where the depth of the manhole exceeds 12 feet (3.66 m). These ladders shall be not less than 16 inches (406 mm) in width, with 3/4 inch (19 mm) diameter rungs spaced 12 inches (305 mm) apart. The two stringers shall be a minimum 3/8 inch (10 mm) thick and 2-1/2 inches (63 mm) wide. Ladders and inserts shall be galvanized after fabrication in conformance with ASTM A123/A123M.

E. Resilient Connectors

1. Flexible, watertight connectors used for connecting pipe to manholes and inlets shall conform to ASTM C923/ASTM C923M.

F. Hydrostatic Test On Watertight Joints

1. Concrete, Clay, PVC and PE Pipe: A hydrostatic test shall be made on the watertight joint types as proposed. Only one sample joint of each type needs testing; however, if the sample joint fails because of faulty design or workmanship, an additional sample joint may be tested. During the test period, gaskets or other jointing material shall be protected from extreme temperatures which might adversely affect the performance of such materials. Performance requirements for joints in reinforced and nonreinforced concrete pipe shall conform to AASHTO M198 or ASTM C443M ASTM C443. Test requirements for joints in clay pipe shall conform to ASTM C425. Test requirements for joints in PVC and PE plastic pipe shall conform to ASTM D3212.
2. Corrugated Steel and Aluminum Pipe: A hydrostatic test shall be made on the watertight joint system or coupling band type proposed. The moment strength required of the joint is expressed as 15 percent of the calculated moment capacity of the pipe on a transverse section remote from the joint by the AASHTO HB-17 (Division II, Section 26). The pipe shall be supported for the hydrostatic test with the joint located at the point which develops 15 percent of the moment capacity of the pipe based on the allowable span in meters feet for the pipe flowing full or 40,000 foot-pounds (54,233 Newton meters), whichever is less. Performance requirements shall be met



at an internal hydrostatic pressure of 10 psi (69 kPa) for a 10 minute period for both annular corrugated metal pipe and helical corrugated metal pipe with factory reformed ends.

- G. Erosion Control Riprap
 1. Provide nonerrodible rock not exceeding 15 inches (375 mm) in its greatest dimension and choked with sufficient small rocks to provide a dense mass with a minimum thickness of 8 inches (200 mm) or as indicated.

1.3 EXECUTION

- A. Excavation for Pipe Culverts and Drainage Structures
 1. Excavation of trenches, and for appurtenances and backfilling for culverts and storm drains, shall be in accordance with the applicable portions of Division 31 Section "Earth Moving" and the requirements specified below.
 2. Trenching: The width of trenches at any point below the top of the pipe shall be not greater than the outside diameter of the pipe plus 12-inches (300 mm) each side of pipe to permit satisfactory jointing and thorough tamping of the bedding material under and around the pipe. Sheet piling and bracing, where required, shall be placed within the trench width as specified. Contractor shall not overexcavate. Where trench widths are exceeded, redesign with a resultant increase in cost of stronger pipe or special installation procedures will be necessary. Cost of this redesign and increased cost of pipe or installation shall be borne by the Contractor without additional cost to the Owner.
 3. Removal of Rock: Rock in either ledge or boulder formation shall be replaced with suitable materials to provide a compacted earth cushion having a thickness between unremoved rock and the pipe of at least 8 inches (200 mm) or 1/2 inch (13 mm) for each meter foot of fill over the top of the pipe, whichever is greater, but not more than three-fourths the nominal diameter of the pipe. Where bell-and-spigot pipe is used, the cushion shall be maintained under the bell as well as under the straight portion of the pipe. Rock excavation shall be as specified and defined in Division 31 Section "Earth Moving".
 4. Removal of Unstable Material: Where wet or otherwise unstable soil incapable of properly supporting the pipe, as determined by the the Owner, is unexpectedly encountered in the bottom of a trench, such material shall be removed to the depth required and replaced to the proper grade with select granular material, compacted as provided in paragraph BACKFILLING. When removal of unstable material is due to the fault or neglect of the Contractor while performing shoring and sheet piling, water removal, or other specified requirements, such removal and replacement shall be performed at no additional cost to the Owner.
- B. Bedding
 1. The bedding surface for the pipe shall provide a firm foundation of uniform density throughout the entire length of the pipe.
 2. Concrete Pipe Requirements: When no bedding class is specified or detailed on the drawings, concrete pipe shall be bedded in a soil foundation accurately shaped and rounded to conform to the lowest one-fourth of the outside portion of circular pipe or to the lower curved portion of pipe arch for the entire length of the pipe or pipe arch. When necessary, the bedding shall be tamped. Bell holes and depressions for joints shall be not more than the length, depth, and width required for properly making the particular type of joint.
 3. Clay Pipe Requirements: Bedding for clay pipe shall be as specified by ASTM C12.
 4. Corrugated Metal Pipe: Bedding for corrugated metal pipe and pipe arch shall be in accordance with ASTM A798/A798M. It is not required to shape the bedding to the pipe geometry. However, for pipe arches, the Contractor shall either shape the bedding to the relatively flat bottom arc or fine grade the foundation to a shallow v-shape. Bedding for corrugated structural plate pipe shall meet requirements of ASTM A807/A807M.
 5. Ductile Iron and Cast-Iron Pipe: Bedding for ductile iron and cast-iron pipe shall be as shown on the drawings.



- 6. Plastic Pipe: Bedding for PVC and PE pipe shall meet the requirements of ASTM D2321. Bedding, haunching, and initial backfill shall be either Class IB or II material.

C. Placing Pipe

- 1. Each pipe shall be thoroughly examined before being laid; defective or damaged pipe shall not be used. Plastic pipe shall be protected from exposure to direct sunlight prior to laying, if necessary to maintain adequate pipe stiffness and meet installation deflection requirements. Pipelines shall be laid to the grades and alignment indicated. Proper facilities shall be provided for lowering sections of pipe into trenches. Lifting lugs in vertically elongated metal pipe shall be placed in the same vertical plane as the major axis of the pipe. Pipe shall not be laid in water, and pipe shall not be laid when trench conditions or weather are unsuitable for such work. Diversion of drainage or dewatering of trenches during construction shall be provided as necessary. Deflection of installed flexible pipe shall not exceed the following limits:

TYPE OF PIPE	MAXIMUM ALLOWABLE DEFLECTION (%)
Corrugated Steel and Aluminum Alloy	5
Concrete-Lined Corrugated Steel	3
Ductile Iron Culvert	3
Plastic	7.5

Not less than 30 days after the completion of backfilling, the Owner may perform a deflection test on the entire length of installed flexible pipe using a mandrel or other suitable device. Installed flexible pipe showing deflections greater than those indicated above shall be retested by a run from the opposite direction. If the retest also fails, the suspect pipe shall be replaced.

- 2. Concrete, Clay, PVC, Ribbed PVC, Ductile Iron and Cast-Iron Pipe: Laying shall proceed upgrade with spigot ends of bell-and-spigot pipe and tongue ends of tongue-and-groove pipe pointing in the direction of the flow.
- 3. Elliptical and Elliptical Reinforced Concrete Pipe: The manufacturer's reference lines, designating the top of the pipe, shall be within 5 degrees of a vertical plane through the longitudinal axis of the pipe, during placement. Damage to or misalignment of the pipe shall be prevented in all backfilling operations.
- 4. Corrugated PE Pipe: Laying shall be with the separate sections joined firmly on a bed shaped to line and grade and shall follow manufacturer's recommendations.
- 5. Corrugated Metal Pipe and Pipe Arch: Laying shall be with the separate sections joined firmly together, with the outside laps of circumferential joints pointing upstream, and with longitudinal laps on the sides. Part paved pipe shall be installed so that the centerline of bituminous pavement in the pipe, indicated by suitable markings on the top at each end of the pipe sections, coincides with the specified alignment of pipe. Fully paved steel pipe or pipe arch shall have a painted or otherwise applied label inside the pipe or pipe arch indicating sheet thickness of pipe or pipe arch. Any unprotected metal in the joints shall be coated with bituminous material as specified in AASHTO M190 or AASHTO M243. Interior coating shall be protected against damage from insertion or removal of struts or tie wires. Lifting lugs shall be used to facilitate moving pipe without damage to exterior or interior coatings. During transportation and installation, pipe or pipe arch and coupling bands shall be handled with care to preclude damage to the coating, paving or lining. Damaged coatings, pavings and linings shall be repaired in accordance with the manufacturer's recommendations prior to placing backfill. Pipe on which coating, paving or lining has been damaged to such an extent that satisfactory field repairs cannot be made shall be removed and replaced. Vertical elongation, where indicated, shall be accomplished by factory elongation. Suitable markings or properly placed lifting lugs shall be provided to ensure placement of factory elongated pipe in a vertical plane.
- 6. Structural-Plate Steel: Structural plate shall be installed in accordance with ASTM A807/A807M. Structural plate shall be assembled in accordance with instructions furnished by the manufacturer. Instructions shall show the position of each plate and the order of assembly. Bolts shall be tightened progressively and uniformly, starting at one end of the structure after all plates are in place. The operation shall be repeated to ensure that all bolts are tightened to meet the torque requirements of 200 foot-pounds (270 Newton meters) plus or minus 50 foot-pounds (68 Newton meters). Any power wrenches used shall be checked by the use of hand torque



wrenches or long-handled socket or structural wrenches for amount of torque produced. Power wrenches shall be checked and adjusted frequently as needed, according to type or condition, to ensure proper adjustment to supply the required torque.

7. **Structural-Plate Aluminum:** Structural plate shall be assembled in accordance with instructions furnished by the manufacturer. Instructions shall show the position of each plate and the order of assembly. Bolts shall be tightened progressively and uniformly, starting at one end of the structure after all plates are in place. The operation shall be repeated to ensure that all bolts are torqued to a minimum of 100 foot-pounds (136 Newton meters) on aluminum alloy bolts and a minimum of 150 foot-pounds (203 Newton meters) on galvanized steel bolts. Any power wrenches used shall be checked by the use of hand torque wrenches or long-handled socket or structural wrenches for the amount of torque produced. Power wrenches shall be checked and adjusted as frequently as needed, according to type or condition, to ensure that they are in proper adjustment to supply the required torque.
8. **Multiple Culverts:** Where multiple lines of pipe are installed, adjacent sides of pipe shall be at least half the nominal pipe diameter or 1 meter 3 feet apart, whichever is less.
9. **Jacking Pipe Through Fills:** Methods of operation and installation for jacking pipe through fills shall conform to requirements specified in Volume 1, Chapter 1, Part 4 of AREMA Manual.

D. Jointing

1. Concrete and Clay Pipe

- a. **Cement-Mortar Bell-and-Spigot Joint:** The first pipe shall be bedded to the established gradeline, with the bell end placed upstream. The interior surface of the bell shall be thoroughly cleaned with a wet brush and the lower portion of the bell filled with mortar as required to bring inner surfaces of abutting pipes flush and even. The spigot end of each subsequent pipe shall be cleaned with a wet brush and uniformly matched into a bell so that sections are closely fitted. After each section is laid, the remainder of the joint shall be filled with mortar, and a bead shall be formed around the outside of the joint with sufficient additional mortar. If mortar is not sufficiently stiff to prevent appreciable slump before setting, the outside of the joint shall be wrapped or bandaged with cheesecloth to hold mortar in place.
- b. **Cement-Mortar Oakum Joint for Bell-and-Spigot Pipe:** A closely twisted gasket shall be made of jute or oakum of the diameter required to support the spigot end of the pipe at the proper grade and to make the joint concentric. Joint packing shall be in one piece of sufficient length to pass around the pipe and lap at top. This gasket shall be thoroughly saturated with neat cement grout. The bell of the pipe shall be thoroughly cleaned with a wet brush, and the gasket shall be laid in the bell for the lower third of the circumference and covered with mortar. The spigot of the pipe shall be thoroughly cleaned with a wet brush, inserted in the bell, and carefully driven home. A small amount of mortar shall be inserted in the annular space for the upper two-thirds of the circumference. The gasket shall be lapped at the top of the pipe and driven home in the annular space with a caulking tool. The remainder of the annular space shall be filled completely with mortar and beveled at an angle of approximately 45 degrees with the outside of the bell. If mortar is not sufficiently stiff to prevent appreciable slump before setting, the outside of the joint thus made shall be wrapped with cheesecloth. Placing of this type of joint shall be kept at least five joints behind laying operations.
- c. **Cement-Mortar Diaper Joint for Bell-and-Spigot Pipe:** The pipe shall be centered so that the annular space is uniform. The annular space shall be caulked with jute or oakum. Before caulking, the inside of the bell and the outside of the spigot shall be cleaned.
 - 1) **Diaper Bands:** Diaper bands shall consist of heavy cloth fabric to hold grout in place at joints and shall be cut in lengths that extend one-eighth of the circumference of pipe above the spring line on one side of the pipe and up to the spring line on the other side of the pipe. Longitudinal edges of fabric bands shall be rolled and stitched around two pieces of wire. Width of fabric bands shall be such that after fabric has been securely stitched around both edges on wires, the wires will be uniformly spaced not less than 200 mm 8 inches apart. Wires shall be cut into



- lengths to pass around pipe with sufficient extra length for the ends to be twisted at top of pipe to hold the band securely in place; bands shall be accurately centered around lower portion of joint.
- 2) Grout: Grout shall be poured between band and pipe from the high side of band only, until grout rises to the top of band at the spring line of pipe, or as nearly so as possible, on the opposite side of pipe, to ensure a thorough sealing of joint around the portion of pipe covered by the band. Silt, slush, water, or polluted mortar grout forced up on the lower side shall be forced out by pouring, and removed.
 - 3) Remainder of Joint: The remaining unfilled upper portion of the joint shall be filled with mortar and a bead formed around the outside of this upper portion of the joint with a sufficient amount of additional mortar. The diaper shall be left in place. Placing of this type of joint shall be kept at least five joints behind actual laying of pipe. No backfilling around joints shall be done until joints have been fully inspected and approved.
- d. Cement-Mortar Tongue-and-Groove Joint: The first pipe shall be bedded carefully to the established gradeline with the groove upstream. A shallow excavation shall be made underneath the pipe at the joint and filled with mortar to provide a bed for the pipe. The grooved end of the first pipe shall be thoroughly cleaned with a wet brush, and a layer of soft mortar applied to the lower half of the groove. The tongue of the second pipe shall be cleaned with a wet brush; while in horizontal position, a layer of soft mortar shall be applied to the upper half of the tongue. The tongue end of the second pipe shall be inserted in the grooved end of the first pipe until mortar is squeezed out on interior and exterior surfaces. Sufficient mortar shall be used to fill the joint completely and to form a bead on the outside.
 - e. Cement-Mortar Diaper Joint for Tongue-and-Groove Pipe: The joint shall be of the type described for cement-mortar tongue-and-groove joint in this paragraph, except that the shallow excavation directly beneath the joint shall not be filled with mortar until after a gauze or cheesecloth band dipped in cement mortar has been wrapped around the outside of the joint. The cement-mortar bead at the joint shall be at least 1/2 inch (15 mm), thick and the width of the diaper band shall be at least 8 inches (200 mm). The diaper shall be left in place. Placing of this type of joint shall be kept at least five joints behind the actual laying of the pipe. Backfilling around the joints shall not be done until the joints have been fully inspected and approved.
 - f. Plastic Sealing Compound Joints for Tongue-and-Grooved Pipe: Sealing compounds shall follow the recommendation of the particular manufacturer in regard to special installation requirements. Surfaces to receive lubricants, primers, or adhesives shall be dry and clean. Sealing compounds shall be affixed to the pipe not more than 3 hours prior to installation of the pipe, and shall be protected from the sun, blowing dust, and other deleterious agents at all times. Sealing compounds shall be inspected before installation of the pipe, and any loose or improperly affixed sealing compound shall be removed and replaced. The pipe shall be aligned with the previously installed pipe, and the joint pulled together. If, while making the joint with mastic-type sealant, a slight protrusion of the material is not visible along the entire inner and outer circumference of the joint when the joint is pulled up, the pipe shall be removed and the joint remade. After the joint is made, all inner protrusions shall be cut off flush with the inner surface of the pipe. If nonmastic-type sealant material is used, the "Squeeze-Out" requirement above will be waived.
 - g. Flexible Watertight Joints: Gaskets and jointing materials shall be as recommended by the particular manufacturer in regard to use of lubricants, cements, adhesives, and other special installation requirements. Surfaces to receive lubricants, cements, or adhesives shall be clean and dry. Gaskets and jointing materials shall be affixed to the pipe not more than 24 hours prior to the installation of the pipe, and shall be protected from the sun, blowing dust, and other deleterious agents at all times. Gaskets and jointing materials shall be inspected before installing the pipe; any loose or improperly affixed gaskets and jointing materials shall be removed and replaced. The pipe shall be aligned with the previously installed pipe, and the joint pushed home. If, while the joint is being made the gasket becomes visibly dislocated the pipe shall be removed and the joint remade.



- h. External Sealing Band Joint for Noncircular Pipe: Surfaces to receive sealing bands shall be dry and clean. Bands shall be installed in accordance with manufacturer's recommendations.
- 2. Corrugated Metal Pipe
 - a. Field Joints: Transverse field joints shall be designed so that the successive connection of pipe sections will form a continuous line free of appreciable irregularities in the flow line. In addition, the joints shall meet the general performance requirements described in ASTM A798/A798M. Suitable transverse field joints which satisfy the requirements for one or more of the joint performance categories can be obtained with the following types of connecting bands furnished with suitable band-end fastening devices: corrugated bands, bands with projections, flat bands, and bands of special design that engage factory reformed ends of corrugated pipe. The space between the pipe and connecting bands shall be kept free from dirt and grit so that corrugations fit snugly. The connecting band, while being tightened, shall be tapped with a soft-head mallet of wood, rubber or plastic, to take up slack and ensure a tight joint. The annular space between abutting sections of part paved, and fully paved pipe and pipe arch, in sizes 30 inches (750 mm) or larger, shall be filled with a bituminous material after jointing. Field joints for each type of corrugated metal pipe shall maintain pipe alignment during construction and prevent infiltration of fill material during the life of the installations. The type, size, and sheet thickness of the band and the size of angles or lugs and bolts shall be as indicated or where not indicated, shall be as specified in the applicable standards or specifications for the pipe.
 - b. Flexible Watertight, Gasketed Joints: Installation shall be as recommended by the gasket manufacturer for use of lubricants and cements and other special installation requirements. The gasket shall be placed over one end of a section of pipe for half the width of the gasket. The other half shall be doubled over the end of the same pipe. When the adjoining section of pipe is in place, the doubled-over half of the gasket shall then be rolled over the adjoining section. Any unevenness in overlap shall be corrected so that the gasket covers the end of pipe sections equally. Connecting bands shall be centered over adjoining sections of pipe, and rods or bolts placed in position and nuts tightened. Band Tightening: The band shall be tightened evenly, even tension being kept on the rods or bolts, and the gasket; the gasket shall seat properly in the corrugations. Watertight joints shall remain uncovered for a period of time designated, and before being covered, tightness of the nuts shall be measured with a torque wrench. If the nut has tended to loosen its grip on the bolts or rods, the nut shall be retightened with a torque wrench and remain uncovered until a tight, permanent joint is assured.

E. Concrete Placement

- 1. Place cast-in-place concrete according to ACI 318/318R.

F. Drainage Structures

- 1. Manholes and Inlets: Construction shall be of reinforced concrete, plain concrete, brick, precast reinforced concrete, precast concrete segmental blocks, prefabricated corrugated metal, or bituminous coated corrugated metal; complete with frames and covers or gratings; and with fixed galvanized steel ladders where indicated. Pipe studs and junction chambers of prefabricated corrugated metal manholes shall be fully bituminous-coated and paved when the connecting branch lines are so treated. Pipe connections to concrete manholes and inlets shall be made with flexible, watertight connectors.
- 2. Walls and Headwalls: Construction shall be as indicated.

G. Steel Ladder Installation

- 1. Ladder shall be adequately anchored to the wall by means of steel inserts spaced not more than 6 feet (1.83 m) vertically, and shall be installed to provide at least 6 inches (152 mm) of space between the wall and the rungs. The wall along the line of the ladder shall be vertical for its entire length.



H. Backfilling

1. **Backfilling Pipe in Trenches:** After the pipe has been properly bedded, selected material from excavation or borrow, at a moisture content that will facilitate compaction, shall be placed along both sides of pipe in layers not exceeding 6 inches (150 mm) in compacted depth. The backfill shall be brought up evenly on both sides of pipe for the full length of pipe. The fill shall be thoroughly compacted under the haunches of the pipe. Each layer shall be thoroughly compacted with mechanical tampers or rammers. This method of filling and compacting shall continue until the fill has reached an elevation of at least 12 inches (300 mm) above the top of the pipe. The remainder of the trench shall be backfilled and compacted by spreading and rolling or compacted by mechanical rammers or tampers in layers not exceeding 8 inches (200 mm). Tests for density shall be made as necessary to ensure conformance to the compaction requirements specified below. Where it is necessary, in the opinion of the the Owner, that sheeting or portions of bracing used be left in place, the contract will be adjusted accordingly. Untreated sheeting shall not be left in place beneath structures or pavements.
2. **Backfilling Pipe in Fill Sections:** For pipe placed in fill sections, backfill material and the placement and compaction procedures shall be as specified below. The fill material shall be uniformly spread in layers longitudinally on both sides of the pipe, not exceeding 6 inches (150 mm) in compacted depth, and shall be compacted by rolling parallel with pipe or by mechanical tamping or ramming. Prior to commencing normal filling operations, the crown width of the fill at a height of 12 inches (300 mm) above the top of the pipe shall extend a distance of not less than twice the outside pipe diameter on each side of the pipe or 12 feet (4 m), whichever is less. After the backfill has reached at least 12 inches (300 mm) above the top of the pipe, the remainder of the fill shall be placed and thoroughly compacted in layers not exceeding 8 inches (200 mm).
3. **Movement of Construction Machinery:** When compacting by rolling or operating heavy equipment parallel with the pipe, displacement of or injury to the pipe shall be avoided. Movement of construction machinery over a culvert or storm drain at any stage of construction shall be at the Contractor's risk. Any damaged pipe shall be repaired or replaced.
4. **Compaction**
 - a. **General Requirements:** Cohesionless materials include gravels, gravel-sand mixtures, sands, and gravelly sands. Cohesive materials include clayey and silty gravels, gravel-silt mixtures, clayey and silty sands, sand-clay mixtures, clays, silts, and very fine sands. When results of compaction tests for moisture-density relations are recorded on graphs, cohesionless soils will show straight lines or reverse-shaped moisture-density curves, and cohesive soils will show normal moisture-density curves.
 - b. **Minimum Density:** Backfill over and around the pipe and backfill around and adjacent to drainage structures shall be compacted at the approved moisture content to the following applicable minimum density, which will be determined as specified below.
 - 1) Under airfield and heliport pavements, paved roads, streets, parking areas, and similar-use pavements including adjacent shoulder areas, the density shall be not less than 90 percent of maximum density for cohesive material and 95 percent of maximum density for cohesionless material, up to the elevation where requirements for pavement subgrade materials and compaction shall control.
 - 2) Under unpaved or turfed traffic areas, density shall not be less than 90 percent of maximum density for cohesive material and 95 percent of maximum density for cohesionless material.
 - 3) Under nontraffic areas, density shall be not less than that of the surrounding material.
5. **Determination of Density:** Testing shall be the responsibility of the Contractor and performed at no additional cost to the Owner. Testing shall be performed by an approved commercial testing laboratory or by the Contractor subject to approval. Tests shall be performed in sufficient number to ensure that specified density is being obtained. Laboratory tests for moisture-density relations shall be made in accordance with ASTM D1557 except that mechanical tampers may be used provided the results are correlated with those obtained with the specified hand tamper. Field density tests shall be determined in accordance with ASTM D2167 or ASTM D2922. When ASTM D2922 is used, the calibration curves shall be checked and adjusted, if necessary, using the sand cone method as described in paragraph Calibration of the referenced publications.



ASTM D2922 results in a wet unit weight of soil and when using this method ASTM D3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall be checked along with density calibration checks as described in ASTM D3017 or ASTM D2922. Test results shall be furnished to the Owner. The calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed.

I. Pipeline Testing

1. Leakage Tests: Lines shall be tested for leakage by low pressure air or water testing or exfiltration tests, as appropriate. Low pressure air testing for vitrified clay pipes shall conform to ASTM C828. Low pressure air testing for concrete pipes shall conform to ASTM C924/ASTM C924M. Low pressure air testing for plastic pipe shall conform to ASTM F1417. Low pressure air testing procedures for other pipe materials shall use the pressures and testing times prescribed in ASTM C828 or ASTM C924/ASTM C924M, after consultation with the pipe manufacturer. Testing of individual joints for leakage by low pressure air or water shall conform to ASTM C1103/ASTM C1103M. Prior to exfiltration tests, the trench shall be backfilled up to at least the lower half of the pipe. If required, sufficient additional backfill shall be placed to prevent pipe movement during testing, leaving the joints uncovered to permit inspection. Visible leaks encountered shall be corrected regardless of leakage test results. When the water table is 600 mm 2 feet or more above the top of the pipe at the upper end of the pipeline section to be tested, infiltration shall be measured using a suitable weir or other device acceptable to the Owner. An exfiltration test shall be made by filling the line to be tested with water so that a head of at least 2 feet (600 mm) is provided above both the water table and the top of the pipe at the upper end of the pipeline to be tested. The filled line shall be allowed to stand until the pipe has reached its maximum absorption, but not less than 4 hours. After absorption, the head shall be reestablished. The amount of water required to maintain this water level during a 2-hour test period shall be measured. Leakage as measured by the exfiltration test shall not exceed 250 gallons per inch in diameter per mile (60 liters per mm in diameter per kilometer) of pipeline per day **OR** 0.2 gallons per inch in diameter per 100 feet (9 mL per mm in diameter per 100 meters), **as directed**, of pipeline per hour. When leakage exceeds the maximum amount specified, satisfactory correction shall be made and retesting accomplished.
2. Deflection Testing: Perform a deflection test on entire length of installed plastic pipeline on completion of work adjacent to and over the pipeline, including leakage tests, backfilling, placement of fill, grading, paving, concreting, and any other superimposed loads. Deflection of pipe in the installed pipeline under external loads shall not exceed 4.5 percent of the average inside diameter of pipe. Determine whether the allowable deflection has been exceeded by use of a pull-through device or a deflection measuring device.
 - a. Pull-through device: This device shall be a spherical, spheroidal, or elliptical ball, a cylinder, or circular sections fused to a common shaft. Circular sections shall be so spaced on the shaft that distance from external faces of front and back sections will equal or exceed diameter of the circular section. Pull-through device may also be of a design promulgated by the Uni-Bell Plastic Pipe Association, provided that the device meets the applicable requirements specified in this paragraph, including those for diameter of the device. Ball, cylinder, or circular sections shall conform to the following:
 - 1) A diameter, or minor diameter as applicable, of 95 percent of the average inside diameter of the pipe; tolerance of plus 0.5 percent will be permitted.
 - 2) A homogeneous material throughout, with a density greater than 1.0 as related to water at 39.2 degrees F (4 degrees C), and a surface Brinell hardness of not less than 150.
 - 3) Center bored and through bolted with a 1/4 inch (6 mm) minimum diameter steel shaft having a yield strength of not less than 70,000 psi (483 MPa), with eyes or loops at each end for attaching pulling cables.
 - 4) Each eye or loop shall be suitably backed with a flange or heavy washer such that a pull exerted on opposite end of shaft will produce compression throughout remote end.



- b. Deflection measuring device: Sensitive to 1.0 percent of the diameter of the pipe being tested and accurate to 1.0 percent of the indicated dimension. Deflection measuring device shall be approved by the the Owner prior to use.
- c. Pull-through device: Pass the pull-through device through each run of pipe, either by pulling it through or flushing it through with water. If the device fails to pass freely through a pipe run, replace pipe which has the excessive deflection and completely retest in same manner and under same conditions as specified.
- d. Deflection measuring device procedure: Measure deflections through each run of installed pipe. If deflection readings in excess of 4.5 percent of average inside diameter of pipe are obtained, retest pipe by a run from the opposite direction. If retest continues to show a deflection in excess of 4.5 percent of average inside diameter of pipe, remove pipe which has excessive deflection, replace with new pipe, and completely retest in same manner and under same conditions.
- e. Warranty period test: Pipe found to have a deflection of greater than 5 percent of average inside diameter when deflection test is performed just prior to end of one-year warranty period shall be replaced with new pipe and tested as specified for leakage and deflection.

J. Field Painting

- 1. After installation, clean cast-iron frames, covers, gratings, and steps not buried in masonry or concrete to bare metal of mortar, rust, grease, dirt, and other deleterious materials and apply a coat of bituminous paint **OR** After installation, clean steel covers and steel or concrete frames not buried in masonry or concrete to bare metal of mortar, dirt, grease, and other deleterious materials. Apply a coat of primer and apply a top coat as specified in Division 09 Section "Exterior Painting", **as directed**. Do not paint surfaces subject to abrasion.

END OF SECTION 33 42 16 13



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Task	Specification	Specification Description
33 42 16 13	01 22 16 00	No Specification Required
33 42 16 13	22 05 23 00	Piped Utilities Basic Materials And Methods
33 42 16 13	22 05 76 00	Sanitary Sewerage
33 42 16 13	33 41 13 00	Storm Drainage
33 44 13 13	22 05 23 00	Piped Utilities Basic Materials And Methods
33 44 13 13	33 41 13 00	Storm Drainage
33 44 13 13	31 32 19 16	Sewage Treatment Lagoons
33 44 16 00	22 05 23 00	Piped Utilities Basic Materials And Methods
33 44 16 00	33 41 13 00	Storm Drainage
33 44 16 00	31 32 19 16	Sewage Treatment Lagoons
33 44 19 19	22 13 19 26	Interceptors
33 44 19 19	28 31 00 00	Oil/Water Separator
33 46 16 00	01 22 16 00	No Specification Required
33 46 16 00	22 05 23 00	Piped Utilities Basic Materials And Methods
33 46 16 00	22 05 76 00	Sanitary Sewerage
33 46 16 00	32 91 19 13a	Septic Tank Systems
33 46 16 00	31 05 13 00a	Subdrainage
33 46 16 00	33 41 13 00	Storm Drainage
33 46 23 00	22 05 23 00	Piped Utilities Basic Materials And Methods
33 46 23 00	31 05 13 00a	Subdrainage
33 51 13 00	01 22 16 00	No Specification Required
33 51 13 00	22 05 23 00	Piped Utilities Basic Materials And Methods
33 51 13 00	07 63 00 00	Common Work Results for Fire Suppression
33 51 13 00	07 63 00 00a	Common Work Results for Plumbing
33 51 13 00	07 63 00 00b	Common Work Results for HVAC
33 51 13 00	23 11 23 00b	Facility Natural-Gas Piping
33 51 13 00	23 11 23 00c	Facility Liquefied-Petroleum Gas Piping
33 61 13 00	33 11 13 23a	Hydronic Distribution



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SECTION 34 71 13 13 - BEAM-TYPE GUARDRAIL

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for beam-type guardrail. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: For each type of product indicated.
2. Shop drawings shall be submitted for approval.

1.2 PRODUCTS

A. Rail Elements, End Sections, and Fasteners

1. ARTBA technical bulletin No. 268-B.
2. Provide galvanized steel W-beam in accordance with AASHTO M-180, class A, type 1.
3. Shop curve rail elements when required radius of installation on horizontal curve is 150 ft (46 m) or less. Provide W-beam rail (ARTBA RE-3) with a flared end section (ARTBA RE-5), rounded end section (ARTBA RE-6) at each end of installations.
4. Provide standard back-up plates behind rail elements at all intermediate, non-splice posts when steel posts and blocks are used.
5. Galvanize the rail sections, including end sections, in accordance with ASTM A 525, coating G-210.

B. Posts

1. Wood: Provide wood posts with blocks, size as required by State DOT. Rough sawn or S4S timber of Douglas Fir or any other locally approved species that is either No. 1 grade or Select Structural grade when graded in accordance with the requirements for Timber and Posts as set forth in WWPA-01 may be used. Give all wood posts and blocks a preservative treatment in accordance with the requirements of AASHTO M-133. Cut to length and bore posts and blocks for bolt holes before treatment.
2. Steel: Provide steel posts with blocks. Fabricate posts and blocks from W6X9 structural steel shapes complying with the requirements of ASTM A 36. Fabricate in the shop, grind smooth all corners and edges, galvanize posts and blocks after fabrication in accordance with ASTM A 123.

C. Bolts, Nuts, and Washers

1. Provide galvanized bolts, nuts, and washers that meet common ARTBA standards, designed to develop the required joint strength. Provide bolts with rounded heads to provide minimum obstruction.
2. Provide galvanized steel bolts conforming to the requirements of ASTM A 307, nuts conforming to the requirements of ASTM A 563, Grade A or better and galvanized steel washers, all galvanized in accordance with the requirements of ASTM A 153. Provide high strength bolts conforming to the requirements of ASTM A 325 where needed.

D. Reflectors: Provide guardrail reflectors as indicated. Place the galvanized steel tabs with reflective sheeting at every post except no reflectors are to be placed along the guardrail end flares.

E. Breakaway Cable Terminal (BCT) Assemblies: Provide BCT assemblies in accordance with the ARTBA details and standards referenced on the details.



- F. Concrete and Reinforcement for the Post Footings: In accordance with applicable sections of Division 03 Section "Cast-in-place Concrete".

1.3 EXECUTION

- A. Guardrail: Erect steel beam-type guardrail in locations and to lines and grades as directed and in accordance with details indicated.
- B. Erection
 1. Firmly set posts spaced at 6 ft. 3 in. (1.9 m) centers to the required depth. Set posts by placing in hand or mechanically dug holes or by driving, with or without pilot holes. Backfill gaps around posts with approved material that is moistened and thoroughly compacted. Repair damaged roadway surfacing where pavement is disturbed.
 2. Position the top of W-beam rail at 27 in. (0.69 m) above the finished roadway surface. Align rail both vertically and horizontally within 1/4-in. (6 mm) from the theoretical alignments. Lap the rail sections at posts, in the direction of traffic in the adjacent lane, and lap end sections on the face of the rail.
 3. Exercise care to avoid damage to treated wood and galvanized steel parts. Repair or replace damaged parts at the Contractor's expense. Securely tighten all bolts in the finished guardrail. Toenail the wood blocks to wood posts with two 16 penny galvanized nails, one on each side of the top of the block.

END OF SECTION 34 71 13 13



SECTION 34 71 13 16 - ACTIVE VEHICLE BARRIERS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for active vehicle barriers. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Shop Drawings: Installation, Equipment, and Electrical Work
 - a. Detail drawings containing complete wiring and schematic diagrams, and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including foundation and clearances for maintenance and operation. For Federal work, detail drawings shall include a copy of the Department of State certificate of barrier performance.
2. Product Data:
 - a. Vehicle Barriers: A complete list of equipment, materials, including industrial standards used and how they apply to the applicable component and manufacturer's descriptive data and technical literature, catalog cuts, and installation instructions. Information necessary to document a minimum 1-year successful field operation performance history for each type of vehicle barrier installed.
 - b. Spare Parts: Spare parts data for each different item of material and equipment used, after approval of the detail drawings. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.
3. Test Reports
 - a. Field Testing: Test reports in booklet form showing all field tests, including component adjustments and demonstration of compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall indicate the final position of controls.
4. Operation and Maintenance Data
 - a. Vehicle Barriers: Operating and Maintenance Instructions
 - 1) Six copies of operation and maintenance manuals, a minimum of 2 weeks prior to field training. One complete set prior to performance testing and the remainder upon acceptance. Manuals shall be approved prior to acceptance. Operation manuals shall outline the step-by-step procedures required for system startup, operation, and shutdown. The manuals shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Maintenance manuals shall include routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guide. The manuals shall include piping layout, equipment layout, and simplified wiring and control diagrams of the system as installed. The manuals shall also include synthetic biodegradable hydraulic oil types to be used for ambient temperature ranges of minus 30 degrees F (minus 34 degrees C) to 150 degrees F (plus 66 degrees C) to cover winter operation, summer operation, and ambient temperature ranges in between.

C. General Requirements

1. Performance levels shall be based on the following:
 - a. The Department of State (DOS) publication SD-SDT-02.01 Specification for Vehicle Crash Testing of Perimeter Barriers and Gates (April 1985) in which:
 - 1) Impact Conditions:



Condition Designation	Vehicle Weight	Impact Speed	Kinetic Energy
K4	15,000 lb (6,800 kg)	30 mph (48 km/h)	450,000 ft-lb (610 kJ)
K8	15,000 lb (6,800 kg)	40 mph (65 km/h)	800,000 ft-lb (1084 kJ)
K12	15,000 lb (6,800 kg)	50 mph (80 km/h)	1,250,000 ft-lb (1695 kJ)

2) Performance Levels:

- a) L 3.0 Vehicle and cargo are to be stopped although vehicle partial penetration and/or barrier deflection of up to 3 feet (1 m) permitted.
- b) L 2.0 Vehicle and cargo are to be stopped although vehicle partial penetration and/or barrier deflection of up to 20 feet (6 m) is permitted.
- c) L 1.0 Vehicle is disabled and does not travel more than 50 feet (15 m) after impact.

2. Vehicle Barriers furnished shall in all respects be identical to the unit tested and certified except for the width of the vehicle barrier, which is as indicated and except for bollards which have a diameter based on a required crash rating. Crash test shall be performed and data compiled by an approved independent testing agency. Test vehicle shall not vault or penetrate the barrier during the test. The design and structural materials of the vehicle barrier furnished shall be the same as those used in the crash tested barrier.

D. Nameplates

1. Nameplate data shall be permanently attached to each vehicle barrier. The data shall be legibly marked on corrosion-resistant metal plates and shall consist of at least the following:
 - a. Manufacturer's name.
 - b. Model number.
 - c. Serial number.
 - d. Date of manufacture.

E. Delivery And Storage

1. Components placed in storage shall be protected from the weather, humidity, and temperature variation, dirt and dust, or other contaminants. Structural materials shall be stored on sleepers or pallets and shall be protected from rust and objectionable materials such as dirt, grease, or oil.

F. Spare Parts

1. A manufacturer's standard recommended spare parts package, with current unit prices and source of supply complete with detailed manuals on parts replacement, shall be provided with each barrier to facilitate 1 year of normal operation. Particular consideration shall be given to system components which are not readily available from local or commercial sources and which are critical to the operation of the system.

G. Manufacturer's Services

1. Services of a manufacturer's representative who is experienced in the installation, adjustment, and operation of the equipment supplied shall be available. The representative shall supervise the installation, adjustment, and testing of the equipment.

1.2 PRODUCT

- A. Retractable Barriers: When in the raised position, the total retractable barrier heights shall be no less than 28 inches (711 mm) above the roadway surface and shall be 144 inches (3.66 m) wide. When in the lowered position, the retractable barrier shall extend no more than 5/8 inch (16 mm) above the roadway surface. Retractable barriers in the lowered position shall be capable of supporting a 32,000 pound (142 kN) axle load or a 16,000 (71 kN) wheel load. Design for this load shall be in accordance with AASHTO HB-17.

1. Powered Retractable Barrier: The retractable barrier shall be capable of 300 complete up/down cycles per hour. The retractable barrier motion shall be instantly reversible and shall be capable



of raising the barrier from the lowered position to the raised position within 8 seconds during normal use, and within 2 seconds during an emergency. Also, the barrier shall be capable of being lowered from the raised position to the lowered position in not more than 3 seconds. Retractable barrier shall withstand a K4 **OR** K8 **OR** K12, **as directed**, impact condition with Performance Level of L1.0 **OR** L2.0 **OR** L3.0, **as directed**.

- a. Failure Modes of Operation: The system shall be designed to remain in the last commanded position in the event of hydraulic, electrical, or mechanical failure. A manual pump, or other system, shall be included for operation of hydraulic barriers without power.
 - b. Electric Motors: Unless otherwise indicated, electric motors shall have drip-proof **OR** totally enclosed **OR** totally enclosed fan cooled, **as directed**, enclosures. All couplings, motor shafts, gears, and other moving parts shall be fully guarded in accordance with 29 CFR 1910 Subpart O. Guards shall be removable without disassembling the guarded unit. For multiple barriers operated from a single hydraulic unit it is highly recommended that the electric motor be 3-phase.
 - c. System: The system shall be designed to maintain the barriers in the raised position, without inspection, for periods of time of up to 1 week. If a hydraulic system is used, it shall be equipped with pressure relief valves to prevent overpressure. The system shall not require continuous running of the motor to stay in the raised position, excluding the use of manual pinning to do so.
 - d. Hydraulic Power Unit: The hydraulic power unit shall contain synthetic biodegradable hydraulic fluid which maintains its viscosity operating range, even at constant heaviest use rate, for an ambient temperature range of 20 to 150 degrees F (minus 7 to plus 66 degrees C). A hydraulic fluid heater shall be provided so that the viscosity remains within its operating range if ambient temperatures below 20 degrees F (minus 7 degrees C) are expected. Buried hydraulic lines for the connection of the hydraulic power unit to the barrier shall be flexible or carbon steel pipe, or a combination of flexible and carbon steel pipe. Flexible and rigid hydraulic line working pressures shall exceed the maximum system relief pressure. PVC pipe and fittings for burial of hydraulic lines shall be in accordance with ASTM D 3034 Type PS 46 with minimum pipe stiffness of 46.
 - 1) Flexible hydraulic lines shall be in accordance with SAE J517.
 - 2) Rigid hydraulic lines shall be seamless carbon steel pipe in accordance with ASTM A 106.
 - e. Hydraulic Power Unit Enclosure: A NEMA Type 3R enclosure as specified in NEMA 250 shall be provided to enclose the hydraulic power unit. The enclosure shall be designed for easy removal of the hydraulic power unit and other accessories without complete removal of the enclosure. An access door with hinges and an inside and outside operable/lockable (exterior) door latch shall be provided. Equipment within the enclosure shall be placed and configured so that all periodic maintenance can be performed through the access door without removal of the equipment. The enclosure shall be equipped with weatherproof louver vents appropriately sized and located to dissipate internal heat generation.
2. Manual Retractable Barriers: The manual barrier shall be capable of being raised and lowered by manual means such as levers or hydraulics requiring a maximum 60 pounds (267 N) of force. The manual mechanism shall contain a locking pin which accepts a padlock for securing the barrier when it is in the "UP" position. Retractable barrier shall withstand a K4 **OR** K8 **OR** K12, **as directed**, impact condition with Performance Level of L1.0 **OR** L2.0 **OR** L3.0, **as directed**. Barrier should be capable of being locked in the down position.
- B. Retractable Bollards: The total bollard height when in the raised position shall be no less than 30 inches (750 mm) above the roadway surface and shall have an outside diameter of no less than 8 inches (200 mm). A bollard system shall consist of a minimum of 3 bollards spaced no more than 36 inches (915 mm) from centerline to centerline of bollards across a 10 foot (3.0 m) roadway. Bollards in the lowered position shall be capable of supporting a 16,000 pound (71 kN) wheel load each. Design for this load shall be in accordance with AASHTO HB-17. Retractable bollards shall withstand a K4 **OR** K8 **OR** K12, **as directed**, Impact Condition with Performance Level of L1.0 **OR** L2.0 **OR** L3.0, **as directed**.



1. Powered Retractable Bollards: The retractable bollard shall be capable of 300 complete up/down cycles per hour. Bollards shall be capable of being raised or lowered within a 3 to 15-second range during normal use and within 2.5 seconds for emergency operations.
 - a. Failure Modes of Operation: The system shall be designed to prevent lowering of the barrier in the event of hydraulic, electrical, or mechanical failure. A manual pump, or other system, shall be included for operation of hydraulic and/or mechanical barriers without power.
 - b. Electric Motors: Unless otherwise indicated, electric motors shall have drip-proof **OR** totally enclosed, **as directed**, enclosures. For multiple barriers being operated from a hydraulic power unit it is highly recommended that the electric motor be 3-phase.
 - c. System: The system shall be designed to maintain the barriers in the raised position, without inspection, for period of time of up to 1 week. If a hydraulic system is used, it shall be equipped with pressure relief valves to prevent overpressure.
 - d. Hydraulic Power Unit: The hydraulic power unit shall contain synthetic biodegradable hydraulic fluid which maintains its viscosity operating range, even at constant heaviest use rate, for an ambient temperature range of 20 to 150 degrees F (minus 7 to plus 66 degrees C). A hydraulic fluid heater shall be provided so that the viscosity remains within its operating range, if ambient temperatures below 20 degrees F (minus 7 degrees C) are expected. Buried hydraulic lines for the connection of the hydraulic power unit to the barrier shall be flexible or carbon steel pipe, or a combination of flexible and carbon steel pipe. Flexible and rigid hydraulic line working pressures shall exceed the maximum system relief pressure. PVC pipe and fittings for burial of hydraulic lines shall be in accordance with ASTM D 3034 Type PS 46 with minimum pipe stiffness of 46.
 - 1) Flexible hydraulic lines shall be in accordance with SAE J517.
 - 2) Rigid hydraulic lines shall be seamless carbon steel pipe in accordance with ASTM A 106.
 - e. Hydraulic Power Unit Enclosure: A NEMA Type 3R enclosure as specified in NEMA 250 shall be provided to enclose the hydraulic power unit. The enclosure shall be designed for easy removal of the hydraulic power unit and other accessories without complete removal of the enclosure. An access door with hinges and an inside and outside operable/lockable (exterior) door latch shall be provided. Equipment within the enclosure shall be placed and configured so that all periodic maintenance can be performed through the access door without removal of the equipment. The enclosure shall be equipped with weatherproof louver vents appropriately sized and located to dissipate internal heat generation.
 2. Manual Retractable Bollards: Manual bollards shall be capable of being raised and lowered utilizing a recessed handle on the top surface of the bollard or a manual hydraulic pump, either requiring a maximum 60 pounds (267 N) of force. A mechanism, that is lockable, shall be provided to secure the bollard in either the full "UP" or full "DOWN" position.
- C. Crash Gate: The crash gate shall consist of steel buttresses anchored into the ground and an above grade assembly consisting of a heavy steel structure or a combination of heavy steel and structural aluminum capable of being opened and closed. The height of the gate shall be a minimum of 84 inches (2.1 m) from the road surface to the top of the gate frame. The length shall close and protect a minimum 120 inch (3.0 m) clear opening. The maximum clear opening between the gate frame and end posts, between the bottom of the gate and finished grade, and between any grill work shall be 3 inches (75 mm).
1. Powered Crash Gate: The gate movement shall be controlled by an electro-mechanical gate operator **OR** a hydraulic gate operator, **as directed**, consisting of an operator unit with required control circuits and operator station. The control and operating voltage shall be 24 vac (nominal) or, as an option 24 vdc. A remote control master station shall be capable of driving the gate at minimum 48 fpm (14.6 m per minute) for a slide gate or 6 degrees per second for a swing gate. Unless otherwise indicated, motors shall have drip-proof **OR** totally enclosed, **as directed**, enclosures. Crash gate shall withstand a 15,000 pound (6804 kg) vehicle at impact speed of 30 **OR** 40 **OR** 50, **as directed**, mph (48 **OR** 64 **OR** 80, **as directed**, km/hour), with maximum barrier deflection or vehicle penetration of 3 feet (1 m).



- a. Failure Mode of Operation: The system shall be designed to prevent opening of the crash gate in the event of electrical or mechanical failure. A disconnect system for the gate drive shall be provided to allow manual operation of the barrier in the event of a power outage.
 - b. Hydraulic Power Unit: The hydraulic power unit shall contain synthetic biodegradable hydraulic fluid which maintains its viscosity within its operating range, even at constant heaviest use rate, for an ambient temperature range of 20 to 150 degrees F (minus 7 to plus 66 degrees C). A hydraulic fluid heater shall be provided so that the viscosity remains within its operating range if ambient temperatures below 20 degrees F (minus 7 degrees C) are expected. Buried hydraulic lines for the connection of the hydraulic power unit to the barrier shall be flexible or carbon steel pipe, or a combination of flexible and carbon steel. Flexible and rigid hydraulic line working pressures shall exceed the maximum system relief pressure. PVC pipe and fittings for burial of hydraulic lines shall be in accordance with ASTM D 3034 Type PS 46 with minimum pipe stiffness of 46.
 - 1) Flexible hydraulic lines shall be in accordance with SAE J517.
 - 2) Rigid hydraulic lines shall be seamless carbon steel pipe in accordance with ASTM A 106.
 - c. Hydraulic Power Unit Enclosure: A NEMA Type 3R enclosure as specified in NEMA 250 shall be provided to enclose the hydraulic power unit. The enclosure shall be designed for easy removal of the hydraulic power unit and other accessories without complete removal of the enclosure. An access door with hinges and an inside and outside operable/lockable (exterior) door latch shall be provided. Equipment within the enclosure shall be placed and configured so that all periodic maintenance can be performed through the access door without removal of the equipment. The enclosure shall be equipped with weatherproof louver vents appropriately sized and located to dissipate internal heat generation.
2. Manual Crash Gate: The manual crash gate shall be capable of being hinged from either side. Hinge points of both buttresses shall each contain a locking pin with padlock acceptance for securing the crash gate in the closed position. The crash gate shall withstand a 10,000 pound (4535 kg) vehicle at impact speed of 50 mph (80 km/hour), with maximum gate deflection or vehicle penetration of 10 feet (3 m) 15,000 pound (6804 kg) vehicle traveling at impact speed of 30 **OR** 40 **OR** 50, **as directed**, mph (48 **OR** 64 **OR** 80, **as directed**, km/hour), with a maximum gate deflection or vehicle penetration of up to 3 feet (1 m).
- D. Crash Beam: The crash beam shall be an above-grade assembly that, in the "DOWN" position, shall present a visible obstacle to approaching vehicles. The height of the barrier shall be a minimum of 30 inches (750 mm) as measured from the roadway surface to the centerline of the crash beam. The crash beam shall be capable of blocking a minimum road width of 120 inches (3.0 m). The crash beam end shall contain a locking pin with padlock acceptance for securing the crash beam when it is in the "DOWN" position. Crash beam shall withstand a 15,000 pound (6804 kg) vehicle traveling at 30 **OR** 40 **OR** 50, **as directed**, mph (48 **OR** 64 **OR** 80, **as directed**, km/hour), with maximum vehicle penetration of 20 feet (6 m) 10,000 pound (4535 kg) vehicle at impact speed of 15 mph (24 km/hour), with a maximum vehicle penetration of 10 feet (3 m).
1. Powered Crash Beam: The crash beam shall be operated by means of a hydraulic power system. The crash beam shall be capable of being raised or lowered within an 8 to 15 second time range.
 - a. Failure Mode of Operation: A disconnect system for the crash beam shall be provided to allow manual operation of the barrier in the event of an electrical or mechanical failure.
 - b. Hydraulic Power Unit: The hydraulic power unit shall contain synthetic biodegradable hydraulic fluid which maintains its viscosity operating range, even at constant heaviest use rate, for an ambient temperature range of 20 to 150 degrees F (minus 7 to plus 66 degrees C). A hydraulic fluid heater shall be provided so that the viscosity remains within its operating range if ambient temperatures below 20 degrees F (minus 7 degrees C) are expected. Buried hydraulic lines for the connection of the hydraulic power unit to the barrier shall be flexible or carbon steel pipe or a combination of flexible and carbon steel pipe. Flexible and rigid hydraulic line working pressures shall exceed the maximum system relief pressure. PVC pipe and fittings for burial of hydraulic lines shall be in accordance with ASTM D 3034 Type PS 46 with minimum pipe stiffness of 46.



- 1) Flexible hydraulic lines shall be in accordance with SAE J517.
 - 2) Rigid hydraulic lines shall be seamless carbon steel pipe in accordance with ASTM A 106.
- c. Hydraulic Power Unit Enclosure: A NEMA Type 3R enclosure as specified in NEMA 250 shall be provided to enclose the hydraulic power unit. The enclosure shall be designed for easy removal of the hydraulic power unit components and other accessories without complete removal of the enclosure. An access door with hinges and an inside and outside operable/lockable exterior door latch shall be provided. Equipment within the enclosure shall be placed and configured so that all periodic maintenance can be performed through the access door without removal of the equipment. The enclosure shall be equipped with weatherproof louver vents appropriately sized and located to dissipate internal heat generation.
2. Manual Crash Beam: The crash beam shall be manually raised and lowered with the aid of a counterbalanced end requiring approximately 60 pounds (267 N) of force.
- E. Portable Retractable Barrier: The portable retractable barrier shall be transportable and capable of manual and/or electro-mechanical operation. When in the raised position, the total barrier heights shall be no less than 28 inches (711 mm) above the roadway surface and shall be up to 144 inches (3.66 m wide). The barrier shall be equipped with entrance/exit ramps when the barrier extends more than 5/8 inch (16 mm) above the roadway surface. Retractable barriers in the lowered position shall be capable of supporting a 32,000 pound (142 kN) axle load or a 16,000 (71 kN) pound wheel load. Design for this load shall be in accordance with AASHTO HB-17.
1. Powered Portable Retractable Barrier: The portable retractable barrier shall be capable of 300 complete up/down cycles per hour. The retractable barrier motion shall be instantly reversible and shall be capable of raising the barrier from the lowered position to the raised position within 8 seconds during normal use, and within 2 seconds during an emergency. Also, the barrier shall be capable of being closed from the raised position to the lowered position in not more than 3 seconds. Retractable barrier shall withstand a K4 **OR** K8 **OR** K12, **as directed**, impact condition with Performance Level of L1.0 **OR** L2.0 **OR** L3.0, **as directed**. Portable retractable barrier, when impacted by a 15,000 pound (6,800 kg) vehicle at impact speed of 50 mph (80 km/hour) shall disable the vehicle and allow it to travel no more than 50 feet (15.2 m) after impact. Portable power assisted retractable barriers shall be equipped with on and off ramps for smooth transition between surfaces when the barrier extends more than 5/8 inch (16 mm) above the roadway surface.
 - a. Failure Modes of Operation: The system shall be designed to prevent lowering of the barrier in the event of hydraulic, electric, or mechanical failure. A manual pump shall be included for operation of hydraulic and/or mechanical barriers without power.
 - b. Electric Motors: Unless otherwise indicated, electric motors shall have drip-proof **OR** totally enclosed, **as directed**, enclosures.
 - c. System: The system shall be designed to maintain the barriers in the raised position, without inspection, for periods of time of up to 1 week. If a hydraulic system is used, it shall be equipped with pressure relief valves to prevent overpressure.
 - d. Hydraulic Power Unit: The hydraulic power unit shall contain synthetic biodegradable hydraulic fluid which maintains its viscosity operating range, even at constant heaviest use rate, for an ambient temperature range of 20 to 150 degrees F (minus 7 to plus 66 degrees C). A hydraulic fluid heater shall be provided so that the viscosity remains within its operating range if ambient temperatures below 20 degrees F (minus 7 degrees C) are expected. Flexible hydraulic lines shall be used for the connection of the hydraulic power unit to the barrier. Flexible hydraulic line working pressures shall exceed the maximum system relief pressure; flexible hydraulic lines shall be in accordance with SAE J517.
 2. Manual Retractable Portable Barriers: The manual barrier shall be capable of being raised and lowered by manual means such as levers or hydraulics requiring a maximum 60 pounds (267 N) of force. The manual mechanism shall contain a locking pin which accepts a padlock for securing the barrier when it is in the "UP" position and shall also be capable of being locked in the



"DOWN" position. Retractable barrier shall withstand a K4 **OR** K8 **OR** K12, **as directed**, impact condition with Performance Level of L1.0 **OR** L2.0 **OR** L3.0, **as directed**

- F. Portable Crash Beam: The portable crash beam shall be an above-grade assembly that, in the "DOWN" position, shall present a visible obstacle to approaching vehicles. The height of the barrier shall be a minimum of 30 inches (750 mm) as measured from the roadway surface to the centerline of the crash beam. The crash beam shall be capable of blocking a minimum road width of 120 inches (3.0 m). The crash beam end shall contain a locking pin with padlock acceptance for securing the crash beam when it is in the "DOWN" position. Crash beam shall withstand a 15,000 pound (6804 kg) vehicle traveling at 30 mph (48 km/hour), with maximum vehicle penetration and/or barrier deflection of 20 feet (6 m).
1. Powered Portable Crash Beam: The portable crash beam shall be operated by means of a hydraulic power system. The crash beam shall be capable of being raised or lowered within an 8 to 15 second time range.
 - a. Failure Mode of Operation: A disconnect system for the portable crash beam shall be provided to allow manual operation of the barrier in the event of an electrical or mechanical failure.
 - b. Hydraulic Power Unit: The hydraulic power unit shall contain synthetic biodegradable hydraulic fluid which maintains its viscosity operating range, even at constant heaviest use rate, for an ambient temperature range of 20 to 150 degrees F (minus 7 to plus 66 degrees C). A hydraulic fluid heater shall be provided so that the viscosity remains within its operating range if ambient temperatures below 20 degrees F (minus 7 degrees C) are expected. Flexible hydraulic lines shall be used for the connection of the hydraulic power unit to the barrier. Flexible hydraulic line working pressures shall exceed the maximum system relief pressure; flexible hydraulic lines shall be in accordance with SAE J517.
 - c. Hydraulic Power Unit Enclosure: A weather resistant enclosure shall be provided to enclose the hydraulic power unit. The enclosure shall be designed for easy removal of the hydraulic power unit components and other accessories without complete removal of the enclosure. An access door with hinges and an inside and outside operable lockable (exterior) door latch shall be provided. Equipment within the enclosure shall be placed and configured so that all periodic maintenance can be performed through the access door without removal of the equipment. The enclosure shall be equipped with weatherproof louver vents appropriately sized and located to dissipate internal heat generation.
 2. Manual Portable Crash Beam: The crash beam shall be manually operated by means of a counter balanced system requiring approximately 60 pounds (267 N) of force.
- G. Electrical Work: Motors, manual or automatic motor control equipment except where installed in motor control centers and protective or signal devices required for the operation specified herein shall be provided in accordance with Division 22. All field wiring for loop detectors, communication lines, and power circuits shall have surge protection. Any wiring required for the operation specified herein, but not shown on the electrical plans, shall be provided under this section in accordance with Division 22.
- H. Control Panel: A control panel and control circuit shall be provided to interface between all barrier control stations and the power unit. A control panel shall be provided for the inbound lanes and a separate one for the outbound lanes where the barriers are located. The control station is defined as the main control panel and the remote control panel as shown. The control circuit shall contain all relays, timers, and other devices or an industrial programmable controller programmed as necessary for the barrier operation. The control panel shall allow direct interface with auxiliary equipment such as card readers, remote switches, loop detectors, infrared sensors, and sliding **OR** swinging, **as directed**, gate limit switches. Loop controllers shall not cause an automatic barrier raise following power loss or restoration. The enclosure shall be as indicated on the drawings. All device interconnect lines shall be run to terminal strips.
1. Voltage: The control circuit shall operate from a 120 volt 60 **OR** 50, **as directed**, Hz supply. The control circuit voltage shall be 12 **OR** 24, **as directed**, ac **OR** dc, **as directed**, for all external control panels.



2. Main Control Panel: A main control panel shall be supplied to control barrier function. This panel shall have a key-lockable main switch with main power "ON" and panel "ON" lights. Buttons to raise and lower each barrier **OR** set of barriers, **as directed**, shall be provided. Barrier "UP" and "DOWN" indicator lights shall be included for each barrier **OR** set of barriers, **as directed**. An emergency fast operate circuit (EFO) shall be operated from a push button larger than the normal controls and have a flip safety cover installed over the push button or toggle switch. The EFO shall also be furnished with an EFO-active light and reset button. The main control panel shall have a key lockable switch to arm or disable the remote control panel. An indicator light shall show if the remote control panel is enabled.
3. Remote Control Panel: A remote control panel, one panel for the inbound lane(s) and a separate panel for the outbound lane(s), shall have a panel "ON" light that is lit when enabled by a key lockable switch on the main control panel. Buttons to raise and lower each barrier shall be provided. Barrier "UP" and "DOWN" indicator lights shall be included for each barrier. The EFO shall be operated from a push button larger than the normal controls and have a flip safety cover installed over the push button or toggle switch. Activation of either EFO will operate all barriers. The EFO shall be interconnected with an EFO-active light. When the remote control panel EFO is pushed, operation of the barrier will not be possible from this panel until reset at the main control panel.

I. Miscellaneous Equipment

1. Safety Equipment

- a. Barrier Systems Sensors: The sensors shall be compatible with the barrier controller and shall function as part of a complete barrier control system. The barrier system sensors shall consist of the following:
 - 1) Suppression Loops - Two inductive loops whose outputs shall be used to prevent barriers raising when a vehicle is within a prescribed distance of the barrier. The output of the loops shall override all barrier rise signals until one second after a vehicle clears the suppression loop.
 - 2) Speed Loops - Two inductive loops whose output shall be used to signal the barrier controller of a vehicle approaching at a speed greater than the posted speed (25 mph (11.2 m/sec) or less (recommended)). The speed loops shall cause the barrier control panel to annunciate a warning sound alerting the guard to make a decision as to whether the barrier should be raised or not.
 - 3) Wrong Way Loops - Two inductive loops whose output shall be used to signal the barrier control panel to enunciate a warning sound if a vehicle is attempting to enter the facility through the exit lane. The warning sound will alert the guard to make a decision as to whether the barrier should be raised or not.
- b. Traffic Lights: Red/yellow 8 inch (200 mm) traffic lights shall be supplied for each entrance and exit to alert motorists of the barrier position. Traffic lights are not required for manual barriers. The yellow flashing light shall indicate that the barrier is fully open. All other positions shall cause the light to show red. Brackets shall be supplied to allow the light to be mounted a minimum 4.5 feet (1.4 m) above the roadway pavement on a 3.5 inch (90 mm) outside diameter metal post or mounted directly on the crash gate.
2. Warning Annunciator: Provide a warning annunciator built into the barrier control panel that produces a pulsing audible sound when the speed loop detects a vehicle entering the facility with excess speed. Provide a warning annunciator built into the barrier control panel that produces a continuous sound whenever a wrong way loop detects a vehicle entering from the exit. The warning annunciator shall sound until a warning annunciator silence reset button is pressed.
3. Heater: A waterproof barrier heater with a thermostat control and NEMA 4 junction box connection point shall be provided for de-icing and snow melting. The heater shall provide barrier operation to an ambient temperature of minus 40 degrees F (minus 40 degrees C). For retractable bollards, a 250-watt heater shall be provided for each bollard.
4. Signage: Signage shall read "Axle Weight Limit 9 Tons" and shall conform to FHWA SA-89-006 sign (R12.2).



5. Vertical Arm Gates (Traffic Arms): Vertical arm gates shall have an opening and closing time of less than or equal to 5 seconds. The gates shall be capable of 500 duty cycles per hour as a minimum. Gate shall operate the arm through 90 degrees. Gate operators shall be supplied with single phase 120 volt motors. Each entry lane shall be provided with a vertical arm gate. Each gate shall be capable of being operated from a remote open-close push button station in each guard booth and the gatehouse for the respective entry lane. Gates shall have a hand-crank, or other means, which will allow manual operation during power failures. Gate arms shall be constructed out of wood, steel, fiberglass, or aluminum, as specified by the manufacturer for the given lengths as shown on the drawings. Gate arms shall be covered with 16 inch (406 mm) wide reflectorized red and white sheeting. Each gate shall be furnished with a spare gate arm. Gate operator cabinets shall be constructed of galvanized steel, or aluminum and shall be painted manufacturers standard color as approved. Each gate operator shall be provided with an obstruction detector that will automatically reverse the gate motor when an obstruction is detected. The obstruction detector shall be any of the following 3 types: An electronic loop vehicle detector buried in the road, a photocell electric eye mounted on the gate operator, or a safety strip mounted on the lower edge of the arm. The detector system shall be automatically deactivated when the arm reaches the fully lowered position. Slab size and anchorage for gate operator shall be per manufacturer requirements.
 6. Vehicle Barrier Vertical Arm Gate (Traffic Arm): A traffic arm, as a separate piece of equipment, will be included with each non-portable active vehicle barrier as part of the barrier safety operating system. This traffic arm shall automatically deploy (close) when the emergency up button is activated and open when the vehicle barrier is reset. This traffic arm will not be equipped with an automatic obstruction detector.
- J. Finish: Surfaces shall be painted in accordance with requirements of Division 09 Section(s) "Exterior Painting" OR "Interior Painting", as applicable. The roadway plate shall have a nonskid surface painted white with reflective red 4 **OR** 6, **as directed**, inch (100 **OR** 150, **as directed**, mm) wide red reflective stripes 4 inches (100 mm) apart. The barrier front shall be painted white and have 4 **OR** 6, **as directed**, inch (100 **OR** 150, **as directed**, mm) wide reflective red stripes 4 inches (100 mm) apart. The diagonal striping should point down and outward from the center of the device. Bollards shall be painted white with 2 **OR** 3, **as directed**, inch (50 **OR** 75, **as directed**, mm) wide reflective red diagonal stripes. The barrier crash gate shall be painted as specified by purchaser and the crash beam shall be painted white with 3 inch (75 mm) wide reflective red diagonal stripes.
- K. Concrete: The concrete shall conform to Division 03 Section "Cast-in-place Concrete".
- L. Welding: Welding shall be in accordance with AWS D1.1/D1.1M.
- M. Pavement: After placement of the vehicle barrier, the pavement sections shall be replaced to match the section and depth of the surrounding pavement. Pavement shall be warped to match the elevations of existing pavement. Positive surface drainage, away from the vehicle barrier, shall be provided by pavement slope.
- ### 1.3 EXECUTION
- A. Installation: Installation shall be in accordance with manufacturer's instructions and in the presence of a representative of the manufacturer. Manufacturer's representative shall be experienced in the installation, adjustment, and operation of the equipment provided. The representative shall also be present during adjustment and testing of the equipment.
- B. Hydraulic Lines: Buried hydraulic lines shall be placed in polyvinyl chloride (PVC) sleeves. Positive drainage shall be provided from the hydraulic power unit to the barrier for drainage of condensation within the PVC sleeve.



- C. Pit Drainage: A drain connection and oil/water separator, **as directed**, shall be provided in each barrier that requires pit/vault type construction. Hookups between the storm drains shall be made. The self-priming sump pump shall have the capacity to remove minimum 150 gallons per minute (34 cubic meters per hour).
- D. Electrical: All control power wiring requiring compression terminals shall use ring-style terminals. Terminals and compression tools shall conform to UL 486A. Roundhead screws and lockwashers shall be used to provide vibration-resistant connections. Connections between any printed circuit cards and the chassis shall be made with screw connections or other locking means to prevent shock or vibration separation of the card from its chassis. The electrical power supply breaker for the hydraulic power unit shall be capable of being locked in the power on and power off positions.
- E. Field Testing: Upon completion of construction, a field test shall be performed for each vehicle barrier. The test shall include raising and lowering the barrier, both electrically and manually, through its complete range of operation. Each vehicle barrier shall then be continuously cycled for not less than 30 minutes to test for heat build-up in the hydraulic system. The Owner shall be notified at least 7 days prior to the beginning of the field test. The Contractor shall furnish all equipment and make all necessary corrections and adjustments prior to tests witnessed by the Owner. Any conditions that interfere with the proper operation of the barrier disclosed by the test shall be corrected at no additional cost to the Owner. Adjustments and repairs shall be done by the Contractor under the direction of the Owner. After adjustments are made to assure correct functioning of components, applicable tests shall be completed.
- F. Field Training: A field training course shall be provided for designated operating staff members. Training shall be provided for a total period of not less than 8 hours (for electrical/hydraulic operated units) or 1 hour (for manually operated units) of normal working time and shall start after the system is functionally complete but prior to final acceptance tests. Field training shall cover all of the items contained in the operating and maintenance instructions.

END OF SECTION 34 71 13 16



Task	Specification	Specification Description
34 71 13 16	34 71 13 13	Beam-Type Guardrail
34 71 13 26	01 22 16 00	No Specification Required
34 71 13 26	34 71 13 13	Beam-Type Guardrail
34 71 16 00	01 22 16 00	No Specification Required
34 71 16 00	34 71 13 16	Active Vehicle Barriers
34 71 16 00	34 71 13 13	Beam-Type Guardrail
34 71 19 16	11 12 16 00	Parking Control Equipment
34 71 19 16	11 12 16 00a	Prefabricated Control Booths



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Task	Specification	Specification Description
35 05 70 00	01 22 16 00	No Specification Required



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Task	Specification	Specification Description
40 05 23 43	22 05 23 00	Piped Utilities Basic Materials And Methods
40 05 23 43	23 11 23 00	Relief Wells
40 05 23 43	23 11 23 00a	Monitoring Wells
40 05 23 43	22 11 23 39	Water Supply Wells
40 05 23 43	22 05 76 00	Sanitary Sewerage
40 05 23 43	07 63 00 00	Common Work Results for Fire Suppression
40 05 23 43	07 63 00 00a	Common Work Results for Plumbing
40 05 23 43	07 63 00 00b	Common Work Results for HVAC



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SECTION 41 01 20 00 - MATERIAL HANDLING HOISTS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of material handling hoists. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: For each type of product indicated.

1.2 PRODUCTS

A. Electric Chain Hoists

1. Hoist motors shall be H4 duty classification. Class F insulation shall be used in hoist motor for 30 minute operation. Load chain shall be grade 80 alloy, case hardened and zinc plated sized for the intended load. Hoists shall employ AC motor brakes employing single or multiple all-steel disks. Controls shall be hand-held, low voltage electrical, with emergency shut off and enclosed in NEMA 3R rated weatherproof enclosure. Hoist shall include fail safe limit switches in the hoist enclosure. Hoist shall meet requirements of ANSI B30.16 standard. Load hook shall be heavy-duty drop forged with safety latch. Hoist shall have swivel top and bottom hooks.

B. Manual Chain Hoists

1. Load capacity of hoist shall be as specified. Load chain shall be grade 80 alloy, case hardened and zinc plated sized for the intended load. Load hook shall be heavy-duty drop forged with safety latch. Hoist mechanism shall be double pawl ratchet system with Weston type brake using a non-asbestos friction disk. Hoist shall have swivel top and bottom hooks. Hoist shall require between 50 and 80 pounds effort to move load.

C. Electric Wire Rope Hoists

1. Hoist motors shall be H4 duty classification. Class F insulation shall be used in hoist motor for 30 minute operation. Lift range shall be between 20 and 150 feet. Lifting cable shall be pre-formed wire rope, of hoisting service construction, made of extra improved steel (XIP) with an independent wire rope center. Load hook shall be heavy-duty drop forged with safety latch. Hoist shall have swivel top and bottom hooks. Controls shall be hand held, low voltage electrical, with emergency shut off and enclosed in NEMA 3R rated weatherproof enclosure. Hoist shall include fail-safe limit switches in the hoist enclosure. Hoist shall meet requirements of ANSI B30.16 standard.

1.3 EXECUTION

A. Installation

1. The Contractor shall complete the assembly of any equipment furnished partially assembled and place the items in position as directed. The hoists shall be assembled and securely bolted in position, hoisting chain or wire rope installed, and the hoist made ready for regular operation. The Contractor shall furnish all miscellaneous hardware items required to complete the installation of all equipment and components. Equipment shall be primed and finish painted with a suitable corrosion-resistant paint on all parts and components not made of corrosion-resistant materials or otherwise protected.



END OF SECTION 41 01 20 00



SECTION 41 22 23 13 - MONORAILS WITH ELECTRIC POWERED HOISTS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for monorails with electric powered hoists. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. System Description

1. Provide a monorail system with electric powered hoist(s) and plain type (hand operated) **OR** hand chain operated **OR** electric powered, **as directed**, trolley(s) complete, tested and ready for operation. Monorails, hoist(s), trolley(s), equipment, materials, installation, examination, inspection, and workmanship shall be in accordance with the applicable requirements of NFPA 70, ASME/ANSI B30.11, ASME/ANSI B30.16, ASME HST-1M, ANSI/ASME HST-4M, and MMA MH27.1, with modifications specified herein. Reference in these publications to the "authority having jurisdiction" shall be interpreted to mean the "the Owner."

C. Submittals

1. Shop Drawings: Monorail system
2. Product Data: Monorail track system including switches, suspension system and other components; Electric wire rope hoist; Electric chain hoist; Trolley; Pendant pushbutton station; Electrification.
3. Design Data: Load and sizing calculations.
4. Test Reports
5. Certificates
6. Operation and Maintenance Data

D. Delivery, Storage, and Handling

1. Delivery and Storage: Inspect materials delivered to site for damage; unload and store with minimum handling. Store materials on-site in enclosures or under protective coverings. Protect materials not suitable for outdoor storage to prevent damage during periods of inclement weather, including subfreezing temperatures, precipitation, and high winds. Store materials susceptible to deterioration by direct sunlight under cover and avoid damage due to high temperatures. Do not store materials directly on ground. When special precautions are required, prominently and legibly stencil instructions for such precautions on outside of equipment or its crating.
2. Handling: Handle materials in such a manner as to ensure delivery to final location in undamaged condition. Make repairs to damaged materials at no cost to the Owner.

E. Quality Assurance

1. Certificates: Overload Test Certificate: Submit a statement that the monorail system can be periodically load tested to 125 percent (plus 5 minus 0) of rated load.
2. Drawings: Monorail System: Show the general arrangement of all components, clearances and principal dimensions, assemblies of hoist, trolley, track, track suspension system, and electrical schematic drawings.
3. Design Data: Load and Sizing Calculations: Submit calculations verifying the sizing of any track, track suspension device and additional supports which are not the monorail system manufacturer's standard cataloged product.

1.2 PRODUCTS



- A. Overhead Monorail System: Provide overhead monorail system conforming to MMA MH27.1, Class C, for indoor **OR** outdoor, **as directed**, service, with an electric wire rope or chain hoist mounted on a movable trolley. Trolley shall be plain type (hand operated) **OR** hand chain operated **OR** motor operated, **as directed**. Monorail system shall operate on AC voltage as required to meet project requirements, 60 Hz, single **OR** three, **as directed**, phase power source.
1. Capacity: The monorail system shall have a minimum rated capacity as required to meet project requirements. Mark the hoist capacity in pounds (kg) on both sides of the hoist or load block.
 2. Speeds: The hoist shall have two operating speeds, **unless directed otherwise**, and shall be capable of hoisting and lowering the rated load at a high speed of 20 feet per minute (fpm) (100 mm/s). The trolley shall have two operating speeds, **unless directed otherwise**, and shall be capable of moving the rated load at a high speed of 50 fpm **OR** 100 fpm, **as directed**, (250 mm/s **OR** 500 mm/s, **as directed**,). Low speed(s) shall be one quarter to one third of high speed(s). Actual speed(s) shall be within plus or minus 15 percent of those specified.
 3. Material Limitations: Shafts, keys, couplings, sprockets, and chains shall be steel. All gears shall be steel except for worm gears, which shall be bronze or steel. Cast iron and aluminum used to support components of the hoist power transmission train shall be ductile.
 4. Safety: Comply with the mandatory and advisory safety requirements of ASME/ANSI B30.11, ASME/ANSI B30.16, and 29 CFR 1910.179.
- B. Monorail Track System: MMA MH27.1. Track beams shall be patented track sections fabricated by a manufacturer regularly engaged in production of this type of beam.
1. Track Suspension System: Monorail suspension shall be flexible **OR** rigid, **as directed**, type. Make bolted connections to supporting structure, excluding hanger rods, with ASTM A 325/A 325M bolts, ASTM A 563/A 563M nuts, and ASTM F 959/F 959M load indicator washers. ASTM A 325/A 325M bolts shall be fully pre-tensioned in accordance with AISC S329. Support monorail track system from the structural members shown. Provide additional supports as required to carry monorail track system loads to the structural members shown. Materials for additional supports shall conform to the material requirements contained in Division 05 Section "Structural Steel Framing".
- C. Electric Wire Rope Hoist: ANSI/ASME HST-4M, Class H3, except as modified herein. Hoist shall be double reeved, **unless directed otherwise**.
1. Hoisting Ropes: FS RR-W-410, improved or extra improved plow steel, regular lay, uncoated, 6 by 37 class construction, with an independent wire rope core. Provide proof of wire rope breaking strength test report.
 2. Sheaves: Sheaves shall be steel or ductile cast iron. Pitch diameter of running sheaves shall not be less than 16 times the rope diameter. Pitch diameter of non running sheaves shall not be less than 12 times the rope diameter.
 3. Drum: Drum shall be steel or ductile cast iron. Pitch diameter of the drum shall not be less than 18 times the rope diameter. Not less than two dead wraps of the hoisting rope shall remain on each anchorage when the hook is in its extreme low position.
- D. Electric Chain Hoist: ASME HST-1M, Class H3, except as modified herein. Provide load chain proof test.
- E. Trolley: Trolley shall meet all applicable requirements of MMA MH27.1, ASME HST-1M and ANSI/ASME HST-4M. Trolley shall have elastomeric bumpers to engage runway stops.
- F. Motors: NEMA MG 1. Hoist motor shall be single **OR** two, **as directed**, speed AC squirrel cage induction type. Trolley motor shall be single **OR** two, **as directed**, speed AC squirrel cage induction type. Motor insulation shall be Class B minimum. Provide totally enclosed non-ventilated (TENV) motor enclosures. Maximum motor speed shall not exceed 1800 RPM.



- G. Controls: Provide single **OR** two, **as directed**, speed magnetic control for the hoist. Provide single **OR** two, **as directed**, speed magnetic controls for the trolley. Provide reduced voltage starting, acceleration and deceleration for the trolley drive.
 - H. Limit Switches: Provide upper and lower limit switches which de-energize the hoist motor.
 - I. Brakes: Provide hoist with an electro-mechanical holding brake and a mechanical load brake, each capable of holding 130 percent of the rated hoist capacity. Hoist holding brake shall be capable of being released to test the load brake. Provide trolley with an electro-mechanical brake. Provide trolley brake with a minimum torque rating of 100 percent (for outdoor monorails) or 50 percent (for indoor monorails) of the drive motor rated torque. Trolley brake torque shall be adjustable down to 85 percent of its torque rating.
 - J. Load Block And Hook: Construct load blocks of steel. Provide forged steel, swivel type hook, with hook nut keyed to hook shank by means of a setscrew installed in a plane parallel to the longitudinal axis of the hook shank, or other similar easily removable securing device. Hook throat opening shall not be less than as required to meet project requirements. Provide hook with spring loaded steel safety latch for closing the hook throat opening. The hook and hook nut shall be unpainted. Permanently mark hook and hook nut with an identification number.
 - 1. Hook and Hook Nut Magnetic Particle Inspection: Magnetic particle inspect the hook and nut over the entire area in accordance with ASTM A 275/A 275M. Acceptance standard shall be no defects. A defect is defined as a linear indication that is greater than 1/8 inch (3 mm) long whose length is equal to or greater than three times it width.
 - K. Bearings: All bearings except those subject to a small rocker motion shall be anti-friction type. Bearings not considered lifetime lubricated by the manufacturer shall be provided with a means for lubrication.
 - L. Pendant Pushbutton Station: Hoist and trolley, **unless directed otherwise**, shall be controlled from a pendant pushbutton station. Arrange pushbuttons in accordance with ASME/ANSI B30.11 recommendations. Locate station 4 feet (1.2 m) above the finished floor
 - M. Electrification: Runway electrification shall be of the flat festooned type **OR** enclosed safety bar type, **as directed**, with four continuous copper conductors. Provide electrical work for the monorail system in accordance with NFPA 70.
 - N. Identification Plates: Provide identification plates of noncorrosive metal with clearly legible permanent lettering giving the manufacturer's name, model number, capacity in pounds, and other essential information or identification.
 - O. Painting System: Painting shall be manufacturers standard. Provide a primer and a finish coat. For outdoor monorail systems, blast clean all components prior to painting and prime with inorganic zinc type primer; finish coat shall be an epoxy formulated for marine environments. Paint coats shall be smooth and even, free of runs, sags, orange peel, or other defects.
- 1.3 EXECUTION:
- A. Erection And Installation: Erect and install the monorail system, complete in accordance with the approved submittals and in condition to perform the operational and acceptance tests.
 - B. Erection Services: Provide supervisory erection services from the monorail system manufacturer.
 - C. Field Quality Control
 - 1. Post-Erection Inspection: After erection, the Contractor and the the Owner shall jointly inspect the monorail and hoist systems and components to determine compliance with specifications and



- approved submittals. The Contractor shall notify the the Owner 3 days before the inspection. Provide a report of the inspection indicating the monorail system is considered ready for operational tests
2. **Operational Tests:** After erection and inspection, test the hoist, and trolley as specified herein. Test the systems in service to determine that each component of the system operates as specified, is properly installed and adjusted, and is free from defects in material, manufacturer, installation, and workmanship. Rectify all deficiencies disclosed by testing and retest the system or component to prove the monorail system is operational. The Contractor shall furnish loads for testing, operating personnel, instruments, and all other necessary apparatus. The the Owner will furnish loads for testing; the Contractor shall receive and transport the loads from a location not more than 100 miles (161 km) from the job site and shall return them to that location after the tests have been completed.
 3. **Test Data:** Record test data on appropriate test record forms suitable for retention for the life of the monorail system. Record operating and startup current measurements for electrical equipment (motors and coils) using appropriate instrumentation (i.e., clamp-on ammeters). Compare recorded values with design specifications or manufacturer's recommended values; abnormal differences (i.e., greater than 10 percent from manufacturer's or design values) shall be justified or appropriate adjustments performed. In addition, high temperatures or abnormal operation of any equipment or machinery shall be noted, investigated, and corrected. Record hoist and trolley speeds during each test cycle.
 4. **Hook Test:** Measure hook for hook throat spread before and after load test. Establish a throat dimension base measurement by installing two tram points and measuring the distance between these tram points (plus or minus 1/64 inch (0.4 mm)). Record this base dimension. Measure the distance between tram points before and after load test. An increase in the throat opening by more than 5 percent from the base measurement shall be cause for rejection.
 5. **No-Load Test**
 - a. **Hoist:** Raise the load hook the full operating lift distance and verify satisfactory operation of hoist, upper limit switch, lower limit switch, and the hoisting and lowering speeds. Operate the hoist at low and high speed in both directions.
 - b. **Trolley:** Operate trolley assembly the full length of the monorail in both directions. Operate trolley at low and high speed in each direction. Verify satisfactory operation and verify trolley speed. Operate all rail switches.
 6. **Load Test: 125 Percent (plus 5 percent minus 0) of rated capacity**
 - a. **Hoist Static Test:** Raise test load approximately one foot above the floor and hold for 10 minutes. Observe load lowering that may occur which will indicate malfunction of hoisting component or brake. Lower the test load to the floor until the hoist line is slack.
 - b. **Hoist Dynamic Test:** Raise the test load to approximately 5 feet (1.5 m) above the floor using both speed points in the process. Lower the load back to the floor using both speed points. Stop the test load at least once while lowering at high speed and observe proper brake operation. Wait 5 minutes, then repeat the above cycle.
 - c. **Load Brake Test:** Raise test load approximately 5 feet (1.5 m). With the hoist controller in the neutral position, release the holding brake. The load brake should hold the test load. Again with the holding brake in the released position, start the test load down at low speed and return the controller to off position as the test load lowers. The load brake should prevent the test load from accelerating. NOTE: It is not necessary for the load brake to halt the downward motion of the test load.
 - d. **Loss of Power Test:** Raise the test load approximately 3 feet (1 m) and while lowering test load at low speed, cut main power to hoist. Load should stop.
 - e. **Trolley Test:** With test load hoisted to a height of one foot (300 mm) above the floor, operate trolley the full distance of the monorail in both directions using both speed points in the process. Observe for any malfunctioning of the trolley assembly and monorail system. Operate all rail switches.
 - f. **Rated Load Speed Test:** With the hoist loaded to rated capacity, raise and lower the load verifying that the hoisting and lowering speeds are provided as specified. With the hoist loaded to rated capacity, operate trolley along the monorail beam verifying that the trolley



speed is provided as specified. Further, verify that the trolley stops in each direction within a distance (in feet) equal to 10 percent of rated capacity high speed (in feet per minute) when initially travelling at high speed and carrying the rated capacity load. Record voltage, amperage, hoisting and lowering speeds, trolley travel speed, and motor speed for each motor.

END OF SECTION 41 22 23 13



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SECTION 41 22 23 13a - MONORAILS WITH MANUAL HOIST

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for monorails with manual hoist. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Verification Of Dimensions:

1. The Contractor shall verify all building dimensions that relate to fabrication of the monorail system, and shall notify the Owner of any discrepancy before the order to the monorail manufacturer is finalized.

C. Submittals

1. Shop Drawings: Submit drawings showing the general arrangement of the track beam system, including curves and switches, clearances, principal dimensions, details of structural connections, and all component details. Manufacturer's catalog data will suffice for items of standard manufacturer.
2. Design Data: Structural design calculations.
3. Test Reports
 - a. Hook and hook nut magnetic-particle tests.
 - b. Monorail system load tests
4. Certificates: Manual hoist load chain
5. Operation and Maintenance Data
 - a. Track beam system
 - b. Hoist and trolley

D. Quality Assurance

1. Certifications: Submit factory certification of load chain rated capacity.
2. Design Data: Submit design calculations verifying the size of structural members, structural support fittings, rods, brackets, components, and lifting beams for the track beam system. The calculations shall include stress and loading diagrams. Submit calculations with monorail drawings.

1.2 PRODUCTS

A. Fabrication And Construction: Provide manual hoist and trolley, ANSI/ASME HST-2M, ANSI/ASME HST-3M, trolley suspension. Trolley and wheels shall be suitable for operation on the steel monorail track beam provided, and shall have not less than four wheels.

1. Capacity: The hoist shall have a minimum rated capacity as required to meet project requirements. The monorail system shall have a minimum rated capacity as required to meet project requirements.
2. Hook Lift: Shall be the manufacturer's standard. The hoist lift shall be at its highest point a minimum of 8 feet (2400 mm) above the finished floor and at its lowest point a minimum of 2 feet (600 mm) below the finished floor.
3. Hooks: Shall be of the safety type with hook nuts keyed to hook shanks by means of a setscrew installed in a plane parallel to the longitudinal axis of the hook shank, or by any other similar easily removable securing device. All hook components shall be magnetic-particle inspected over the entire area in accordance with ASTM A 275/A 275M. The acceptance standard shall be one of no defects. A defect is defined as a linear indication revealed by magnetic-particle



inspection that is greater than 1/8 inch (3 mm) long whose length is equal to or is greater than three times its width.

4. Trolley: Shall be designed to operate from track beam section. Where two or more hoists are located on the same monorail beam, the trolleys shall be equipped with rubber bumper devices designed to prevent contact of any part or parts of the hoists.
5. Load Chain: High strength steel links, flexible; minimum safety factor of 5 to 1 based on ratio of minimum chain breaking load to the calculated load on the chain when the hoist is assumed loaded to rated capacity. Certification from hoist manufacturer of provided chain's breaking strength shall be submitted to the Owner and approved prior to final acceptance of hoist. Do not paint or coat the load chain.
6. Load Hooks and Load Hook Components
 - a. Hook: Forged steel; complete with spring-loaded steel throat opening safety device. The hook shall be carried on suitably sealed or shielded anti-friction thrust bearings and shall swivel freely through 360 degrees rotation with full load without twisting chain.
 - 1) Disassembly. Hook and hook nut shall be capable of complete disassembly that enables access to all surfaces of the hook, including shank and hook nut for inspection purposes. Provision shall be made for the hook nut, or other hook-to-block fastener, to be keyed to hook shank by means of a set screw or similar, easily removable, securing device.
 - 2) Hook Non-Destructive Test. Each hook, including shank and hook nut, shall be inspected over the entire surface areas by magnetic particle inspection. If hook nut is not used, any device that functions the same as the hook nut shall be inspected by magnetic particle inspection.
 - a) Procedure: Magnetic particle inspection shall be conducted in accordance with ASTM A 275/A 275M. This inspection shall be conducted at the factory of the hook manufacturer or hoist manufacturer. Alternately, a recognized independent testing lab may conduct the inspections if equipped and competent to perform such a service, and if approved by the the Owner.
 - b) Acceptance Criteria: Defects found on the hook or hook nut shall result in rejection of defective items for use on furnished hoist. For this inspection, a defect is defined as a linear or non-linear indication for which the largest dimension is greater than 1/8 inch (3 mm). Weld repairs for defects on hook or hook nut will not be permitted.
 - c) Test Report: A test report of the magnetic particle inspection of each hook and hook nut provided shall be submitted to and approved by the the Owner prior to final acceptance of hoist installation. Test reports shall be certified by the testing organization.

B. Monorail Track Beam System: Comply with MMA MH27.1 except as modified and supplemented herein.

1. Patented Track: Provide specially designed trackage, e.g., patented track beam, curves, and switches constructed from welded steel components. The lower flange of the track section shall have flat wheel treads; minimum lower flange width of 3.25 inches (80 mm); chemical composition of 0.45 to 0.60 percent carbon content, 0.60 to 1.1 percent manganese content; and wheel treads shall be hardened to a minimum Brinell Hardness Number of 225. Upper flange and web of the track section shall be steel, continuously welded together or provided as one monolithic piece.
2. Track Suspension: Provide means of suspending the monorail track system, including curves and switches from the structural supports. The suspension system shall be the sole responsibility of the track supplier; however, design shall be subject to the requirements specified herein.
 - a. Cataloged Products: If possible, provide track manufacturer's standard cataloged devices for connection of the track to the indicated supporting structures. If track manufacturer's cataloged devices are not provided for this suspension system, complete shop drawings and calculations for the custom suspension device shall be submitted for review and approval by the the Owner. Track suspension devices which are not the track



- manufacturer's cataloged products shall meet the additional requirements specified in Division 05 Section "Metal Fabrications".
- b. Design: The suspension system shall be designed and constructed to ensure no impairment of the strength of track or the structural support. A hanger or suspension shall be located at each rack splice joint. Provide bracing to hold track sections in rigid alignment at all joints.
 - c. Suspension of Curves and Switches: Provide steel framing (structural supports), in addition to that indicated, as required by monorail curve and switch manufacturer to support curves and switches. The additional steel framing shall be the sole responsibility of the monorail supplier. Submit shop drawings and framing design calculations to the the Owner for approval.
 - d. Sway Bracing: Where the track is suspended from hanger rods, track shall be braced laterally and longitudinally to prevent sway.
 - e. Lock Nuts: Where the track is suspended from hanger rods, lock nuts or other means shall be provided to prevent the nuts from backing off the rods.
 - f. Multiple Suspension Devices: Where more than one suspension device attached to the track at a single point, the suspension devices shall be provided so that the loads shall be induced in each in proportion to the device's size.
3. Identification Plates: Provide identification plates of noncorrosive metal. Information and data on the plates shall include, in clearly legible permanent lettering, the manufacturer's name, model number, capacity rating, and other essential information. In addition, the monorail track beam system shall be furnished with identification plates showing the capacity of the system, which shall be legible from the floor and from either side of the monorail track beam.
- C. Painting Of System: Provide manufacturer's standard painting or shop painting of components specified in this section; comply with the requirements specified in Division 07. Do not paint, coat, or galvanize load chain, load, hook nut, or load chain sheave.

1.3 EXECUTION

- A. Erection And Installation: The Contractor shall erect and install the hoist trolley and monorail system in accordance with manufacturers written instructions, MMA MH27.1, and the contract drawings. The monorail supplier shall provide supervisory erection services. Welding new sections of monorail track to existing shall conform to AWS D1.1.
- B. Field Inspection And Tests
1. Pre-Erection Inspection: Before erection, the Contractor and the manufacturer's representative shall jointly inspect the monorail and hoist systems and components at the job site to determine compliance with specifications and manufacturer's data and shop drawings as approved. The Contractor shall notify the the Owner 3 days before the inspection.
 2. Operational Inspection and Load Tests: Upon completion, and before final acceptance, the hoist, trolley, and monorail shall be given the rated load test specified in ASME/ANSI B30.11, carrying 125 percent (plus 5 percent, minus 0 percent) of the rated capacity, and with the units spaced to obtain maximum possible loads in the monorail track beam systems. Hoists shall hold a static, as well as control a dynamic, 125 percent rated load. The systems shall be thoroughly tested in service to determine that each component of the system operates as specified, is properly installed and adjusted, and is free from defects in material, manufacture, installation, and workmanship. The Contractor shall furnish test loads, operating personnel, instruments, and all other necessary apparatus at no additional cost to the Owner. The test and final adjustments of the equipment will be under the supervision of the Owner. The Contractor shall rectify any deficiencies found and completely retest work affected by such deficiencies.

END OF SECTION 41 22 23 13a



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Task	Specification	Specification Description
41 22 23 13	41 01 20 00	Material Handling Hoists



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43 - Process Gas and Liquid Handling, Purification, and Storage Equipment

Task	Specification	Specification Description
43 23 78 31	22 05 23 00	Piped Utilities Basic Materials And Methods
43 24 41 23	22 05 23 00	Piped Utilities Basic Materials And Methods
43 41 31 00	01 22 16 00	No Specification Required



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02 86 00 00	02 41 16 13, 02 61 00 00, 02 61 13 00, 02 61 13 00a, 02 61 13 00b, 02 81 00 00
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CTC Information:

- ☑ This Construction Task Catalog® was developed and customized by The Gordian Group, Inc. specifically for **Los Angeles Community Development Commission**, priced locally using current labor, material and equipment costs, and published in January 2016.
- ☑ The Gordian Group, Inc. licenses the use of this CTC and other proprietary information and software for the sole purpose of providing Job Order Contracting services to **Los Angeles Community Development Commission**. Use of The Gordian Group's CTC and other proprietary information and software for any other purpose or any other entity is expressly prohibited without the express written consent of The Gordian Group, Inc.

MasterFormat™

- ☑ The tasks in this Construction Task Catalog are organized using CSI's *MasterFormat*.



The Unit Prices Include:

LABOR COSTS:

- ☑ Labor costs include unloading equipment, materials, and tools, and transporting the same up or down 2 1/2 stories and 125' to reach the project site; layout; measuring and cutting to fit; performing the task; disposal of excess material; and time for lunch and breaks.
- ☑ Labor costs include direct labor through the working foreperson level at straight-time prevailing wage rates including fringe benefits and an allowance for Social Security and Medicare taxes, worker's

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compensation, unemployment insurance and employee benefits.

- ☑ Labor costs are based on workers familiar with and skilled in the performance of the task following OSHA requirements.

EQUIPMENT COSTS:

- ☑ Equipment costs include all equipment required to accomplish the task. Mobilization is included for all equipment except large equipment (e.g. cranes, pile drivers, bulldozers, excavators, backhoes, bobcats etc.), which exclude mobilization.
- ☑ Equipment costs include all operating expenses such as fuel, electricity, lubricants, etc.

MATERIAL COSTS:

- ☑ Material costs include the cost of the material, delivery, and all incidentals and accessories integral to the installation.
- ☑ Material costs include manufacturer's and/or fabricator's shop drawings.
- ☑ Material costs for roofing, drywall, VCT, carpet, wall covering, ceiling tile, pipe, conduit, concrete, etc. include an allowance for waste. This list is not intended to be all inclusive, but descriptive of the types of construction materials that are typically sold in standard lengths, sizes and weights.

Complete and In-Place Construction:

- ☑ Unit prices are for complete and in-place construction and include all labor, equipment and material required to complete the task as described in the CTC.
- ☑ If the Contractor uses a crane or other lifting equipment (except a truck mounted boom lift or other equipment as part of the delivery process) to lift material onto a roof, even if that roof is less than

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- 2 ½ stories, the contractor will be paid for such crane or lifting equipment as a separate task.
- ☑ Unit prices for imported materials (e.g. aggregate, sand, soil, etc.) include delivery up to 15 miles from the closest approved source.
 - ☑ Unit prices include all fasteners such as anchor bolts, lag bolts, screws, adhesive, wedge anchors, expansion bolts, roofing clips (excluding hurricane clips) that are required. Fasteners listed separately in the CTC are for use with Owner furnished material and equipment or relocating or reinstalling existing material and equipment.
 - ☑ Unit prices exclude more substantial mounting material such as threaded rod or angle iron unless the task description states otherwise.
 - ☑ Unit prices for doors and windows, duct work, plumbing fixtures, seamless floors, countertops, flashing, pitch pockets, skylights, curbs, roofing, etc. include sealant and caulking.
 - ☑ Unit prices include testing, calibration, balancing and the like required to ensure proper installation, construction and performance (e.g. compaction test for backfill, balancing of heating ventilation and air conditioning, pneumatic or hydrostatic testing, soaping of joints, disinfection and flushing, others as required). Use of owner supplied materials, equipment or tying into existing equipment/piping may justify testing, balancing, etc.

Demolition:

- ☑ Unit prices for demolition include all labor, equipment and material required for the complete removal of the items; clean-up of the area; and transporting the demolished items up or down 2 ½ stories into a truck, dumpster, or to an owner designated area, located within 125' of the project site.
- ☑ Unit prices for demolition exclude costs for hauling (See 01741900), dump fees (See 01741900), dumpsters (See 01741900), and trash chutes (See 01741900).

- ☑ If the item being demolished is attached to another item being removed and can be removed as one item, then that item shall not be priced as a separate demolition task, unless the component alone must be demolished to accomplish the task (e.g. demolition of pipe includes pipe fittings unless the fitting must be demolished separately to accomplish the task; demolition of a wood door includes hinges, hardware, closures, kick plates, etc.).
- ☑ The description "replace" includes the demolition of the existing item and the installation of the new item.
- ☑ The descriptions "remove and relocate" or "remove and reinstall" includes the removal, cleaning of item and installation of the existing item in either the same location or another location.
- ☑ The description "reinstall" includes the cleaning and installation of the existing item.
- ☑ Salvageable materials remain the property of the Owner and shall be turned over as directed when specified in the Job Order.

The Adjustment Factors Include:

BUSINESS COSTS:

- ☑ Overhead costs, including, unless specifically excluded in the Contract Documents, but not limited to;
 - home office overhead
 - insurance, bonds, and indemnification
 - project meetings, training, management and supervision
 - mobilization and close-out for the contract and each Job Order and
 - project office staff and equipment.
- ☑ Profit.
- ☑ Subcontractor's overhead and profit.

- All taxes for which a waiver is not available including material sales tax and equipment rental.
- Employee or Subcontractor's wage rates that exceed the prevailing wage rates.
- Fringe benefits, payroll taxes, worker's compensation, insurance costs and any other payment mandated by law in connection with labor that exceeds the labor rate allowances.
- Cost of financing the work.
- Business risks such as the risk of a lower than expected volume of work, smaller than anticipated Job Orders, poor Subcontractor performance, and inflation or material cost fluctuations.

CONSTRUCTION RELATED COSTS:

- Services required to obtain filings and permits.
- Preparation and modification of proposals, sketches, drawings, submittals, as-built drawings, CADD drawings, microfilm, and other project records.
- Incidental engineering and architectural services.
- Office trailer and portable toilets for Contractor's use.
- Construction vehicles such as pick-up trucks, utility trucks, vans, flat bed trucks, tractors, trailers, etc.
- Storage devices or items such as gang boxes and containers for Contractor's tools, equipment and materials.
- Basic safety and warning signage, minor barricades (e.g., construction tape, etc.) and personnel safety equipment (e.g., hard hats, safety harnesses with lifeline or cabling, protective clothing, safety glasses, face shields, etc.).
- Meeting Owner security requirements.
- Excess waste including roofing, drywall, VCT, carpet, wall covering, ceiling tile, pipe, conduit, siding, concrete, etc. This list is not intended to be all inclusive, but descriptive of the types of construction materials that are typically sold in standard lengths, sizes and weights.

- Removing and returning Owner's furniture and furnishings (e.g. chairs, tables, pictures, etc. but excluding modular furniture, wall or ceiling attached or fastened devices or furnishings, safes or other furniture requiring disassembly).
- Sealing, windows, and openings with plastic to contain construction dust and debris within the work area.
- Daily clean-up.
- Final professional project clean-up.
- Costs resulting from inadequate supply of building materials, fuel, electricity, or skilled labor.
- Costs resulting from productivity loss.
- Working in extreme temperatures (below or above normal) or adverse conditions such as excessive rain, wind, sleet or snow.
- Differences in project size; complexity and location.
- All costs for other than discreet items of work specifically required to complete a particular Job Order.

PRICE VARIATIONS:

- Contractors may find differences in labor, equipment and material costs due to certain economic factors. Variations in labor cost can also result from labor efficiency, labor restrictions, working conditions and local work rules. Variations in material costs can also result from the quantity of material purchased, the existing relationship with suppliers, and because the materials have been discontinued or have become obsolete.
- While diligent effort is made to provide accurate and reliable up-to-date pricing, it is the responsibility of the Contractor to review and analyze the unit prices, and to calculate their Adjustment Factors accordingly, prior to bidding.

GENERAL COSTS:

- This list is not exhaustive and is intended to provide general examples of cost items to be included in the

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Contractor's Adjustment Factor as defined in the Contract.

- The only compensation to be paid to a Contractor for the unit price tasks will be:

Published Unit Price	X	Installation (or Demolition) Quantity	X	Appropriate Adjustment Factor
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- No additional payments of any kind whatsoever will be made. All costs not included in the unit prices must be part of the Adjustment Factors.

General Interpretations:

WORKING HEIGHT:

- Typical working height for work other than masonry is up to 14' above the finished floor or stationary working surface. The Contractor will not be paid for scaffolding, lifts, or similar equipment for work below 14'.
- Typical working height for masonry work is up to 4' above the finished floor or stationary working surface. The Contractor will not be paid for scaffolding, lifts, or similar equipment for masonry work below 4'.

FIELD ENGINEERING:

- Surveying tasks shall be used only when the Owner requests the Contractor to perform topographic surveys, property line surveys or to establish horizontal and vertical controls. If the Owner provides horizontal and vertical control points within or adjacent to the project site, any other surveying required to complete the work is considered construction staking or layout and the cost thereof is included in the appropriate task.

ASSEMBLIES:

- Assembly unit prices take precedence over individual component pricing.

TESTING:

- Contractor will be paid for testing existing material, as required by the technical specifications and as directed by the Owner (record tests) at the unit price for the appropriate task. The cost of process quality control testing routinely performed by the Contractor is included in the unit prices for the individual tasks.

MISCELLANEOUS:

- For the purpose of calculating the quantity of a task, quantities are calculated on a per project basis. The quantity so determined shall be used for the task and all appropriate modifiers, unless the task states otherwise.
- Whenever there are alternative tasks that may be selected to complete work the Contractor shall select the most practical and economical tasks available (e.g. rental of equipment by weeks or months rather than days or painting by roller or spray rather than brush).
- Restricted Working Space is defined as any area with less than 3' vertical or horizontal clearance and includes areas such as crawl spaces, ceiling plenums where the grid is not removed, narrow piping tunnels, and equipment rooms where the space to install the new work is congested as a result of equipment and piping placement that meet these dimensional restrictions. A Restricted Working Space modifier is available for certain mechanical piping and piping accessories tasks and for certain electrical conduit and conduit accessories tasks. Only those tasks with a modifier for Restricted Working Space are eligible for a price adjustment, and then only if the modifier applies to the contemplated tasks. A non pre-priced task will not be allowed because of Restricted Working Space for any CTC task.
- Confined Working Space is defined according to the OSHA definition 29 CFR 1926.21(b)(6)(i): "Any space having limited means of egress, which is subject to accumulation of toxic or flammable contaminants or has an oxygen deficient atmosphere, including, but not limited to, storage

tanks, process vessels, bins, boilers, ventilation and exhaust duct, sewers, underground vaults, tunnels, pipelines and open top spaces more than 4 feet in depth such as pits and tubs." The Contractor shall conform to all OSHA and Owner requirements for working in Confined Working Spaces. Required ventilation and air monitoring equipment tasks shall be priced from the CTC.

- ☑ Whenever a material, article or piece of equipment is identified in the CTC or in the specifications by reference to manufacturers' or vendors' names, trade names, catalogue numbers, or make, the identification is intended to establish a standard. Any material, article or equipment of another manufacturer or vendor which performs satisfactorily the duties imposed by the general design may be considered equally acceptable provided that, in the opinion of the Owner, the material, article or equipment so proposed is of equal quality, substance and function. The Contractor shall not provide, furnish or install any proposed material, article or equipment without the prior written approval of the Owner. The burden of proof and all costs related thereto concerning the "or equal" nature of the substitute item, whether approved or disapproved, shall be borne by the Contractor.

SPECIFICATIONS:

- ☑ Specifications for tasks shall be interpreted as follows: All labor, material, equipment, spare parts, services, and work required by a specification shall be considered part of the unit price, unless the task description or technical specifications state otherwise.

Useful Information:

UNIT OF MEASURE DEFINITIONS:

ACR – Acre, **BAG** – Bag, **BBL** – Barrel, **BCY** - Bank (In-place) Cubic Yards, **BF** - Board Foot, **BOX** - Box (each), **BTU** - British Thermal Unit, **C** - One Hundred, **CCF** - One Hundred Cubic Feet, **CCY** - Compacted

Cubic Yards, **CF** - Cubic Foot, **CFM** - Cubic Feet Per Minute, **CI** – Cubic Inch, **CLF** - One Hundred Linear Feet, **CSF** - One Hundred Square Feet, **CSY** - Hundred Square Yards, **CWT** - Hundred Weight, **CY** - Cubic Yard, **CYM** - Cubic Yard Mile, **DAY** – Day, **DRM** - Drum (each), **EA** – Each, **FLR** - Floor (Per Floor), **FT** – Foot, **GAL** – Gallon, **GSF** - Ground Square Foot, **HR** – Hour, **HWT** - Hundred Carton Weight, **HYR** – Half Year, **IN** – Inch, **JOB** – Job, **LAN** – Lane, **LB** – Pound, **LCY** - Loose (Excavated) Cubic Yards, **LF** - Linear Foot, **LFD** - Linear Feet Per Day, **LIT** – Liter, **LOT** – Lot, **MBF** - One Thousand Board Feet, **MBH** - One Thousand British Thermal Units, **MCF** – One Thousand Cubic Feet, **MF3** - One Thousand Cubic Feet Per Minute, **MGL** – One Thousand Gallons, **MI** – Mile, **MLF** - One Thousand Linear Feet, **MO** – Month, **MSF** - One Thousand Square Feet, **MSY** - One Thousand Square Yards, **MT** – Metric Ton, **MTK** – Metric Ton Kilometer, **M2** – Square Meter, **M3K** – Cubic Meter Kilometer, **NTE** – Note, **OPN** – Opening, **OUT** - Outlet or Output (each), **OZ** – Ounce, **PKG** – Package, **PNT** – Point, **PR** – Pair, **QT** – Quart, **ROL** - Roll (each), **ROM** – Room, **ROW** – Row, **RSR** - Riser (Per Rise), **SEA** – Seat, **SET** – Set, **SF** - Square Foot, **SHT** – Sheet, **SI** - Square Inch, **STP** - Stop (each), **SQ** - Square or One Hundred Square Feet, **SY** - Square Yard, **SYI** – Inches per Square Yard, **TNM** - Tons per Mile, **TON** – Ton, **TRK** – Truck Load, **UI** - United Inch, **UNT** – Unit, **VLF** - Vertical Linear Foot, **WK** – Week, **YD** – Yard, **YR** – Year

MATERIAL WEIGHTS:

EARTHEN MATERIAL

- ☑ The following engineering values for establishing shrink/swell factors shall be used unless otherwise directed by the Owner.

Material	Material Weight (Lbs Per CY)		
	In-place (Bank)	Loose (Excavated Materials)	Compacted
Earth, Common (Average)	3170	2536	3520
Sand	2880	2590	3240

Using The Construction Task Catalog®

Earth, Rock Mix. (75% E/ 25% R)	3380	2370	3720
Earth, Rock Mix. (50% E/50% R)	3750	2710	4000
Earth, Rock Mix. (25% E/ 75% R)	4120	3140	3680
Gravel (Average)	3280	2730	3570
Limestone	4380	2690	3220
Riprap Rock (Average)	4500	2610	3150
Granite	4540	2640	3170
Basalt	4950	3020	3640
Clay	3220	2150	3570
Gneiss	4550	2720	3180

1 Mile = 5280 Feet = 1.6093 Kilometers

1 Pound = 0.4536 Kilograms

1 Square Foot = 144 Square Inches = .0929 Square Meters

1 Square Meter = 1.1960 Square Yards = 10.7639 Square Feet

1 Square Yard = 9 Square Feet = 0.8361 Square Meters

1 Ton = 2000 Pounds = 907.185 Kilograms

1 Yard = 3 Feet = 0.9144 Meters

BULK FACTORS FOR DEMOLITION:

The following bulk factors shall be used to calculate the volume of demolished material to be transported from the project site.

- **Asphalt** = 1.25
- **Concrete** = 1.40

CONVERSIONS:

1 Acre = 43,560 Square Feet = 4046.8 Square Meters

1 Board Foot = 12" x 12" x 1" = 144 Cubic Inches

1 Centimeter = 0.3937 Inches = 0.0328 Feet

1 Cubic Foot = 0.03704 Cubic Yards = 0.02832 Cubic Meters

1 Cubic Meter = 1.3080 Cubic Yards = 35.3147 Cubic Feet

1 Cubic Yard = 27 Cubic Feet = 0.7646 Cubic Meters

1 Foot = 12 Inches = 0.3048 Meters

1 Inch = 2.54 Centimeters = 0.0254 Meters

1 Kilogram = 2.2046 Pounds

1 Kilometer = 0.6214 Miles = 3280 Feet

1 Meter = 100 Centimeters = 3.2808 Feet

Sheet Metal Thickness (inches)				
Gage No.	Steel Sheet	Galvanized Steel Sheet	Stainless Steel Sheet	Aluminum Sheet
10	.135	.138	.141	
11	.120	.123	.125	
12	.105	.108	.109	
13	.090	.093	.094	.072
14	.075	.079	.078	.064
15	.067	.071	.070	.057
16	.060	.064	.063	.051
17	.054	.058	.056	.045
18	.048	.052	.050	.040
19	.042	.046	.044	.036
20	.036	.040	.038	.032
21	.033	.037	.034	.028
22	.030	.034	.031	.025
23	.027	.031	.028	.023
24	.024	.028	.025	.020
25	.021	.025	.022	.018
26	.018	.022	.019	.017

STANDARD GEOMETRY:

Circle

- Circumference = $2 \pi \text{ radius} = \pi \text{ diameter}$
- Area = $\pi \text{ radius}^2 = \pi (\text{diameter}^2 / 4)$

Cylinder

- Volume = $(\pi \text{ radius}^2) \text{ height}$
- Surface Area = $2 \pi \text{ radius}^2 + (2 \pi \text{ radius}) \text{ height}$

Sphere

- Volume = $(4 \pi \text{ radius}^3) / 3$
- Surface Area = $4 \pi \text{ radius}^2$

$\pi = 3.14159$

United Inch

- The industry standard for measuring windows is the United Inch or UI. The UI is determined by adding the width and the height in inches.

TRADEMARKS

- Gordian JOC Solution, JOC Complete Solution, JOC Complete Solution Plus, PROGEN, eGordian, ezIQC, Construction Task Catalog, Catalog of Construction Tasks, DMAP, The Standard for Job Order Contracting and 6 Phase Development and Implementation Process are either registered trademarks or trademarks of The Gordian Group, Inc. The names of actual companies and products mentioned herein may be the trademarks of their respective owners.

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MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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01 General Requirements

01 20 Price And Payment Procedures ⁽⁰¹⁾

01 22 Unit Prices ^(01 20)

01 22 16 Unit Price Payment ^(01 22)

01 22 16 00-0001 Reimbursable Fees ^(01 22 16)

Note: Reimbursable fees include but are not limited to permits, special inspections, special insurance, additional warranties, tolls, etc, which are not included in a task or an Adjustment Factor as explained in the Contract or The Construction Task Catalog®.

01 22 16 00-0002	EA	Reimbursable Fees.....	1.00
<p>Note: Reimbursable Fees will be paid to the contractor for eligible costs. The base cost of the Reimbursable Fee is \$1.00. Insert the appropriate quantity to adjust the base cost to the actual Reimbursable Fee (e.g. quantity of 125 = \$125.00 Reimbursable Fee). If there are multiple Reimbursable Fees, list each one separately and add a comment in the "note" block to identify the Reimbursable Fee (e.g. sidewalk closure, road cut, various permits, extended warrantee, expedited shipping costs, etc.). A copy of each receipt shall be submitted with the Price Proposal.</p>			

01 22 20 Wage Rates ^(01 22)

01 22 20 00-0001 Local Labor/Wage Rates ^(01 22 20)

Note: Welders receive the rate prescribed for the craft performing the operation to which the welding is incidental.

01 22 20 00-0002	HR	Asbestos Removal Worker.....	67.62
<p>Note: For tasks not included in the Construction Task Catalog® and as directed by owner only.</p>			
		<i>For Foreman, Add</i>	3.38
		<i>For Apprentice, Deduct</i>	-13.52
01 22 20 00-0003	HR	Insulator.....	68.29
<p>Note: For tasks not included in the Construction Task Catalog® and as directed by owner only.</p>			
		<i>For Foreman, Add</i>	3.41
		<i>For Apprentice, Deduct</i>	-13.66
01 22 20 00-0004	HR	Boilermaker.....	86.67
<p>Note: For tasks not included in the Construction Task Catalog® and as directed by owner only.</p>			
		<i>For Foreman, Add</i>	4.33
		<i>For Apprentice, Deduct</i>	-17.33
01 22 20 00-0005	HR	Brick Layer.....	66.89
<p>Note: For tasks not included in the Construction Task Catalog® and as directed by owner only.</p>			
		<i>For Foreman, Add</i>	3.34
		<i>For Apprentice, Deduct</i>	-13.38
01 22 20 00-0006	HR	Carpenter.....	71.24
<p>Note: For tasks not included in the Construction Task Catalog® and as directed by owner only.</p>			
		<i>For Foreman, Add</i>	3.56
		<i>For Apprentice, Deduct</i>	-14.25
01 22 20 00-0007	HR	Carpet, Linoleum.....	55.54
<p>Note: For tasks not included in the Construction Task Catalog® and as directed by owner only.</p>			
		<i>For Foreman, Add</i>	2.78
		<i>For Apprentice, Deduct</i>	-11.11
01 22 20 00-0008	HR	Cement Mason.....	66.57
<p>Note: For tasks not included in the Construction Task Catalog® and as directed by owner only.</p>			
		<i>For Foreman, Add</i>	3.33
		<i>For Apprentice, Deduct</i>	-13.31
01 22 20 00-0009	HR	Drywall Finisher.....	66.94
<p>Note: For tasks not included in the Construction Task Catalog® and as directed by owner only.</p>			
		<i>For Foreman, Add</i>	3.35
		<i>For Apprentice, Deduct</i>	-13.39
01 22 20 00-0010	HR	Electrician.....	80.15
<p>Note: For tasks not included in the Construction Task Catalog® and as directed by owner only.</p>			
		<i>For Foreman, Add</i>	4.01
		<i>For Apprentice, Deduct</i>	-16.03
01 22 20 00-0011	HR	Equipment Operator, Heavy (Crane).....	80.66
<p>Note: For tasks not included in the Construction Task Catalog® and as directed by owner only.</p>			
		<i>For Foreman, Add</i>	4.03
		<i>For Apprentice, Deduct</i>	-16.13
01 22 20 00-0012	HR	Equipment Operator, Medium (Bulldozer).....	80.29
<p>Note: For tasks not included in the Construction Task Catalog® and as directed by owner only.</p>			
		<i>For Foreman, Add</i>	4.01
		<i>For Apprentice, Deduct</i>	-16.06
01 22 20 00-0013	HR	Equipment Operator, Light (Backhoe, Bobcat).....	79.86
<p>Note: For tasks not included in the Construction Task Catalog® and as directed by owner only.</p>			
		<i>For Foreman, Add</i>	3.99
		<i>For Apprentice, Deduct</i>	-15.97
01 22 20 00-0014	HR	Glazier.....	75.81
<p>Note: For tasks not included in the Construction Task Catalog® and as directed by owner only.</p>			
		<i>For Foreman, Add</i>	3.79
		<i>For Apprentice, Deduct</i>	-15.16
01 22 20 00-0015	HR	Laborer.....	72.75
<p>Note: For tasks not included in the Construction Task Catalog® and as directed by owner only.</p>			
01 22 20 00-0016	HR	Lather.....	67.89
<p>Note: For tasks not included in the Construction Task Catalog® and as directed by owner only.</p>			
		<i>For Foreman, Add</i>	3.39
		<i>For Apprentice, Deduct</i>	-13.58

01	General Requirements
01 20	Price And Payment Procedures
01 22	Unit Prices



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
01 22 20 00-0017	HR		Marble Setter	66.89	
			Note: For tasks not included in the Construction Task Catalog® and as directed by owner only.		
			For Foreman, Add	3.34	
			For Apprentice, Deduct	-13.38	
01 22 20 00-0018	HR		Millwright.....	68.36	
			Note: For tasks not included in the Construction Task Catalog® and as directed by owner only.		
			For Foreman, Add	3.42	
			For Apprentice, Deduct	-13.67	
01 22 20 00-0019	HR		Mold Removal Worker	60.61	
			Note: For tasks not included in the Construction Task Catalog® and as directed by owner only.		
			For Foreman, Add	3.03	
			For Apprentice, Deduct	-12.12	
01 22 20 00-0020	HR		Painter, Ordinary.....	54.73	
			Note: For tasks not included in the Construction Task Catalog® and as directed by owner only.		
			For Foreman, Add	2.74	
			For Apprentice, Deduct	-10.95	
01 22 20 00-0021	HR		Painter, Structural Steel.....	69.72	
			Note: For tasks not included in the Construction Task Catalog® and as directed by owner only.		
			For Foreman, Add	3.49	
			For Apprentice, Deduct	-13.94	
01 22 20 00-0022	HR		Paperhanger	54.73	
			Note: For tasks not included in the Construction Task Catalog® and as directed by owner only.		
			For Foreman, Add	2.74	
			For Apprentice, Deduct	-10.95	
01 22 20 00-0023	HR		Pile Drivers	87.28	
			Note: For tasks not included in the Construction Task Catalog® and as directed by owner only.		
			For Foreman, Add	4.36	
			For Apprentice, Deduct	-17.46	
01 22 20 00-0024	HR		Plasterer	65.80	
			Note: For tasks not included in the Construction Task Catalog® and as directed by owner only.		
			For Foreman, Add	3.29	
			For Apprentice, Deduct	-13.16	
01 22 20 00-0025	HR		Plumber	79.20	
			Note: For tasks not included in the Construction Task Catalog® and as directed by owner only.		
			For Foreman, Add	3.96	
			For Apprentice, Deduct	-15.84	
01 22 20 00-0026	HR		Powderman.....	71.39	
			Note: For tasks not included in the Construction Task Catalog® and as directed by owner only.		
			For Foreman, Add	3.57	
			For Apprentice, Deduct	-14.28	
01 22 20 00-0027	HR		Rodman (Reinforcing)/Ornamental Steel Worker.....	80.86	
			Note: For tasks not included in the Construction Task Catalog® and as directed by owner only.		
			For Foreman, Add	4.04	
			For Apprentice, Deduct	-16.17	
01 22 20 00-0028	HR		Roofer, Composite	71.60	
			Note: For tasks not included in the Construction Task Catalog® and as directed by owner only.		
			For Foreman, Add	3.58	
			For Apprentice, Deduct	-14.32	
01 22 20 00-0029	HR		Roofer, Metal	90.08	
			Note: For tasks not included in the Construction Task Catalog® and as directed by owner only.		
01 22 20 00-0030	HR		Roofer, Tile/Slate.....	71.14	
			Note: For tasks not included in the Construction Task Catalog® and as directed by owner only.		
			For Foreman, Add	3.56	
			For Apprentice, Deduct	-14.23	
01 22 20 00-0031	HR		Sheet Metal Worker	79.85	
			Note: For tasks not included in the Construction Task Catalog® and as directed by owner only.		
			For Foreman, Add	3.99	
			For Apprentice, Deduct	-15.97	
01 22 20 00-0032	HR		Sprinkler Installer	76.45	
			Note: For tasks not included in the Construction Task Catalog® and as directed by owner only.		
			For Foreman, Add	3.82	
			For Apprentice, Deduct	-15.29	
01 22 20 00-0033	HR		Steam / Pipe Fitter	79.20	
			Note: For tasks not included in the Construction Task Catalog® and as directed by owner only.		
			For Foreman, Add	3.96	
			For Apprentice, Deduct	-15.84	
01 22 20 00-0034	HR		Stone Mason.....	66.89	
			Note: For tasks not included in the Construction Task Catalog® and as directed by owner only.		
			For Foreman, Add	3.34	
			For Apprentice, Deduct	-13.38	
01 22 20 00-0035	HR		Structural Steel Worker.....	85.42	
			Note: For tasks not included in the Construction Task Catalog® and as directed by owner only.		
			For Foreman, Add	4.27	
			For Apprentice, Deduct	-17.08	
01 22 20 00-0036	HR		Tile Layer.....	61.36	
			Note: For tasks not included in the Construction Task Catalog® and as directed by owner only.		
			For Foreman, Add	3.07	
			For Apprentice, Deduct	-12.27	
01 22 20 00-0037	HR		Terrazzo Worker	56.68	
			Note: For tasks not included in the Construction Task Catalog® and as directed by owner only.		
			For Foreman, Add	2.83	
			For Apprentice, Deduct	-11.34	
01 22 20 00-0038	HR		Truck Driver, Light.....	63.62	
			Note: For tasks not included in the Construction Task Catalog® and as directed by owner only.		
			For Foreman, Add	3.18	
			For Apprentice, Deduct	-12.72	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
01 22 20 00-0039 HR Truck Driver, Heavy.....	63.82	
Note: For tasks not included in the Construction Task Catalog® and as directed by owner only.		
<i>For Foreman, Add</i>		
<i>For Apprentice, Deduct</i>		
	3.19	
	-12.76	
01 22 20 00-0040 HR Class I Diver	163.33	
Note: For tasks not included in the Construction Task Catalog® and as directed by owner only.		
01 22 20 00-0041 HR Class III Diver Tender.....	87.68	
Note: For tasks not included in the Construction Task Catalog® and as directed by owner only.		
01 22 20 00-0042 HR D1 Certified Welder	91.76	
Note: For tasks not included in the Construction Task Catalog® and as directed by owner only.		
01 22 20 00-0043 Rates For Services <small>(01 22 20)</small>		
01 22 20 00-0044 HR Watchman/Guard, Unarmed	22.39	
01 22 20 00-0045 HR Watchman/Guard, Armed	32.43	
01 22 20 00-0046 HR OSHA Testing.....	71.25	
01 22 20 00-0047 HR Investigating Engineer Or Specialty Consultant.....	80.00	
Note: For special investigating requirements or services outside required architectural and engineering services.		
01 22 20 00-0048 HR Investigating Senior Engineer Or Specialty Consultant	125.00	
Note: For special investigating requirements or services outside required architectural and engineering services.		
01 22 20 00-0049 HR Industrial Hygienist	48.56	
01 22 20 00-0050 HR On-Site Certified Materials Testing Technician.....	57.00	
01 22 20 00-0051 HR Certified Industrial Hygienist	64.73	
01 22 20 00-0052 MI Mileage For Professional Services (Engineering, Surveying, Etcetera).....	0.56	
Note: For use only when the Owner directs the contractor to use personnel whose base of operations is more than 100 miles from the site. Quantity shall be miles that exceed 100.		
01 22 20 00-0053 HR Fire Safety Technician	54.93	
01 22 20 00-0054 Rates For Traffic Control <small>(01 22 20)</small>		
01 22 20 00-0055 HR Flagperson For Traffic Control.....	62.61	
01 22 23 Equipment Usage <small>(01 22)</small>		
Note: Includes fuel costs unless otherwise stated. These tasks shall be used for owned, leased or rented equipment. See CSI section 01 71 13 00-0000 for equipment delivery, pickup, mobilization and demobilization.		
01 22 23 00-0001 Aerial Equipment <small>(01 22 23)</small>		
01 22 23 00-0002 Manlifts <small>(01 22 23 00-0001)</small>		
Note: Excludes operator, delivery, set-up, and removal.		
01 22 23 00-0003 Telescoping Boom Manlifts <small>(01 22 23 00-0002)</small>		
01 22 23 00-0004 Engine Powered, Telescoping Boom Manlifts <small>(01 22 23 00-0003)</small>		
Note: Diesel or dual fuel (gasoline or liquid propane gas). Two- or four-wheel drive. For use on unpaved or paved surfaces.		
01 22 23 00-0005 DAY 40' Engine Powered, Telescoping Boom Manlift.....	422.25	
01 22 23 00-0006 WK 40' Engine Powered, Telescoping Boom Manlift.....	1,062.44	
01 22 23 00-0007 MO 40' Engine Powered, Telescoping Boom Manlift.....	2,383.68	
01 22 23 00-0008 DAY 60' Engine Powered, Telescoping Boom Manlift.....	619.76	
01 22 23 00-0009 WK 60' Engine Powered, Telescoping Boom Manlift.....	1,477.88	
01 22 23 00-0010 MO 60' Engine Powered, Telescoping Boom Manlift.....	3,234.99	
01 22 23 00-0011 DAY 80' Engine Powered, Telescoping Boom Manlift.....	1,205.46	
01 22 23 00-0012 WK 80' Engine Powered, Telescoping Boom Manlift.....	2,921.70	
01 22 23 00-0013 MO 80' Engine Powered, Telescoping Boom Manlift.....	6,129.45	
01 22 23 00-0014 DAY 110' Engine Powered, Telescoping Boom Manlift.....	1,716.25	
01 22 23 00-0015 WK 110' Engine Powered, Telescoping Boom Manlift.....	4,132.61	
01 22 23 00-0016 MO 110' Engine Powered, Telescoping Boom Manlift.....	10,297.48	
01 22 23 00-0017 DAY 120' Engine Powered, Telescoping Boom Manlift.....	2,090.82	
01 22 23 00-0018 WK 120' Engine Powered, Telescoping Boom Manlift.....	5,332.62	
01 22 23 00-0019 MO 120' Engine Powered, Telescoping Boom Manlift.....	12,122.69	
01 22 23 00-0020 Articulating (Up/Over) Boom Manlifts <small>(01 22 23 00-0002)</small>		
01 22 23 00-0021 Engine Powered, Articulating (Up/Over) Boom Manlifts <small>(01 22 23 00-0020)</small>		
Note: Diesel or dual fuel (gasoline or liquid propane gas). Two- or four-wheel drive. For use on unpaved or paved surfaces.		
01 22 23 00-0022 DAY 34' Engine Powered, Articulating (Up/Over) Boom Manlift.....	331.16	
01 22 23 00-0023 WK 34' Engine Powered, Articulating (Up/Over) Boom Manlift.....	830.90	
01 22 23 00-0024 MO 34' Engine Powered, Articulating (Up/Over) Boom Manlift.....	1,998.97	
01 22 23 00-0025 DAY 45' Engine Powered, Articulating (Up/Over) Boom Manlift.....	421.47	
01 22 23 00-0026 WK 45' Engine Powered, Articulating (Up/Over) Boom Manlift.....	921.21	
01 22 23 00-0027 MO 45' Engine Powered, Articulating (Up/Over) Boom Manlift.....	2,286.78	
01 22 23 00-0028 DAY 60' Engine Powered, Articulating (Up/Over) Boom Manlift.....	541.89	
01 22 23 00-0029 WK 60' Engine Powered, Articulating (Up/Over) Boom Manlift.....	1,252.37	
01 22 23 00-0030 MO 60' Engine Powered, Articulating (Up/Over) Boom Manlift.....	2,799.76	
01 22 23 00-0031 DAY 80' Engine Powered, Articulating (Up/Over) Boom Manlift.....	945.30	
01 22 23 00-0032 WK 80' Engine Powered, Articulating (Up/Over) Boom Manlift.....	2,227.77	
01 22 23 00-0033 MO 80' Engine Powered, Articulating (Up/Over) Boom Manlift.....	5,417.70	
01 22 23 00-0034 DAY 125' Engine Powered, Articulating (Up/Over) Boom Manlift.....	1,836.40	
01 22 23 00-0035 WK 125' Engine Powered, Articulating (Up/Over) Boom Manlift.....	4,335.12	
01 22 23 00-0036 MO 125' Engine Powered, Articulating (Up/Over) Boom Manlift.....	10,596.96	



MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

01 22 23 00-0037		Electric, Articulating (Up/Over) Boom Manlifts (01 22 23 00-0020)	
Note: For use on paved surfaces.			
01 22 23 00-0038	DAY	30' Electric, Articulating (Up/Over) Boom Manlift	331.16
01 22 23 00-0039	WK	30' Electric, Articulating (Up/Over) Boom Manlift	830.90
01 22 23 00-0040	MO	30' Electric, Articulating (Up/Over) Boom Manlift	1,998.97
01 22 23 00-0041	DAY	35' Electric, Articulating (Up/Over) Boom Manlift	331.16
01 22 23 00-0042	WK	35' Electric, Articulating (Up/Over) Boom Manlift	830.90
01 22 23 00-0043	MO	35' Electric, Articulating (Up/Over) Boom Manlift	1,998.97
01 22 23 00-0044	DAY	40' Electric, Articulating (Up/Over) Boom Manlift	409.43
01 22 23 00-0045	WK	40' Electric, Articulating (Up/Over) Boom Manlift	885.09
01 22 23 00-0046	MO	40' Electric, Articulating (Up/Over) Boom Manlift	2,197.66
01 22 23 00-0047	DAY	45' Electric, Articulating (Up/Over) Boom Manlift	409.43
01 22 23 00-0048	WK	45' Electric, Articulating (Up/Over) Boom Manlift	885.09
01 22 23 00-0049	MO	45' Electric, Articulating (Up/Over) Boom Manlift	2,197.66
01 22 23 00-0050		Platform Lifts (01 22 23 00-0001)	
Note: Excludes operator, delivery, set-up, and removal.			
01 22 23 00-0051		Electric, Scissor Platform Lifts (01 22 23 00-0050)	
Note: For use on paved surfaces.			
01 22 23 00-0052	DAY	17' Electric, Scissor Platform Lift	154.68
01 22 23 00-0053	WK	17' Electric, Scissor Platform Lift	309.36
01 22 23 00-0054	MO	17' Electric, Scissor Platform Lift	632.79
01 22 23 00-0055	DAY	20' Electric, Scissor Platform Lift	168.74
01 22 23 00-0056	WK	20' Electric, Scissor Platform Lift	337.49
01 22 23 00-0057	MO	20' Electric, Scissor Platform Lift	674.98
01 22 23 00-0058	DAY	25' Electric, Scissor Platform Lift	217.96
01 22 23 00-0059	WK	25' Electric, Scissor Platform Lift	435.92
01 22 23 00-0060	MO	25' Electric, Scissor Platform Lift	935.12
01 22 23 00-0061	DAY	30' Electric, Scissor Platform Lift	281.24
01 22 23 00-0062	WK	30' Electric, Scissor Platform Lift	555.45
01 22 23 00-0063	MO	30' Electric, Scissor Platform Lift	1,230.42
01 22 23 00-0064	DAY	33' Electric, Scissor Platform Lift	302.33
01 22 23 00-0065	WK	33' Electric, Scissor Platform Lift	590.60
01 22 23 00-0066	MO	33' Electric, Scissor Platform Lift	1,335.89
01 22 23 00-0067	DAY	40' Electric, Scissor Platform Lift	393.74
01 22 23 00-0068	WK	40' Electric, Scissor Platform Lift	977.31
01 22 23 00-0069	MO	40' Electric, Scissor Platform Lift	2,721.00
01 22 23 00-0070		Engine Powered, Scissor Platform Lifts (01 22 23 00-0050)	
Note: Diesel or dual fuel (gasoline or liquid propane gas). Two- or four-wheel drive. For use on unpaved or paved surfaces.			
01 22 23 00-0071	DAY	25' Engine Powered, Scissor Platform Lift	316.40
01 22 23 00-0072	WK	25' Engine Powered, Scissor Platform Lift	618.73
01 22 23 00-0073	MO	25' Engine Powered, Scissor Platform Lift	1,511.66
01 22 23 00-0074	DAY	33' Engine Powered, Scissor Platform Lift	323.43
01 22 23 00-0075	WK	33' Engine Powered, Scissor Platform Lift	738.26
01 22 23 00-0076	MO	33' Engine Powered, Scissor Platform Lift	1,617.13
01 22 23 00-0077	DAY	40' Engine Powered, Scissor Platform Lift	358.58
01 22 23 00-0078	WK	40' Engine Powered, Scissor Platform Lift	822.63
01 22 23 00-0079	MO	40' Engine Powered, Scissor Platform Lift	1,828.06
01 22 23 00-0080	DAY	43' Engine Powered, Scissor Platform Lift	379.67
01 22 23 00-0081	WK	43' Engine Powered, Scissor Platform Lift	885.91
01 22 23 00-0082	MO	43' Engine Powered, Scissor Platform Lift	2,179.61
01 22 23 00-0083	DAY	50' Engine Powered, Scissor Platform Lift	710.13
01 22 23 00-0084	WK	50' Engine Powered, Scissor Platform Lift	1,560.88
01 22 23 00-0085	MO	50' Engine Powered, Scissor Platform Lift	3,838.93
01 22 23 00-0086		Personnel Lifts (01 22 23 00-0001)	
Note: Includes delivery to job site and pick-up when complete. Excludes operator. For use on paved surfaces.			
01 22 23 00-0087	DAY	24', Push-Type, Electric Single Man Personnel Lift	119.25
01 22 23 00-0088	WK	24', Push-Type, Electric Single Man Personnel Lift	337.88
01 22 23 00-0089	MO	24', Push-Type, Electric Single Man Personnel Lift	682.38
01 22 23 00-0090	DAY	30', Push-Type, Electric Single Man Personnel Lift	165.62
01 22 23 00-0091	WK	30', Push-Type, Electric Single Man Personnel Lift	351.12
01 22 23 00-0092	MO	30', Push-Type, Electric Single Man Personnel Lift	689.00
01 22 23 00-0093	DAY	36', Push-Type, Electric Single Man Personnel Lift	278.25
01 22 23 00-0094	WK	36', Push-Type, Electric Single Man Personnel Lift	675.75
01 22 23 00-0095	MO	36', Push-Type, Electric Single Man Personnel Lift	1,974.25
01 22 23 00-0096	DAY	40', Push-Type, Electric Single Man Personnel Lift	298.12
01 22 23 00-0097	WK	40', Push-Type, Electric Single Man Personnel Lift	742.00
01 22 23 00-0098	MO	40', Push-Type, Electric Single Man Personnel Lift	2,232.62
01 22 23 00-0099	DAY	15', Self-Propelled, Electric Single Man Personnel Lift	159.00
01 22 23 00-0100	WK	15', Self-Propelled, Electric Single Man Personnel Lift	318.00
01 22 23 00-0101	MO	15', Self-Propelled, Electric Single Man Personnel Lift	636.00
01 22 23 00-0102	DAY	20', Self-Propelled, Electric Single Man Personnel Lift	159.00
01 22 23 00-0103	WK	20', Self-Propelled, Electric Single Man Personnel Lift	318.00



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
01 22 23 00-0104 MO 20', Self-Propelled, Electric Single Man Personnel Lift.....	661.18	
01 22 23 00-0105 Bucket Trucks (01 22 23 00-0001) Note: Includes full-time operator, delivery, and removal.		
01 22 23 00-0106 DAY 48' Bucket Truck With Full-Time Operator.....	930.59	
For Equipment Without Operator, Deduct	-510.59	
01 22 23 00-0107 WK 48' Bucket Truck With Full-Time Operator.....	4,052.94	
For Equipment Without Operator, Deduct	-2,552.94	
01 22 23 00-0108 MO 48' Bucket Truck With Full-Time Operator.....	15,304.05	
For Equipment Without Operator, Deduct	-11,004.05	
01 22 23 00-0109 Air Equipment (01 22 23)		
01 22 23 00-0110 Air Compressors (01 22 23 00-0109) Note: Includes delivery, set-up, and removal. Excludes operator.		
01 22 23 00-0111 DAY 100 CFM Diesel Powered Portable Air Compressor.....	148.10	
01 22 23 00-0112 WK 100 CFM Diesel Powered Portable Air Compressor.....	444.31	
01 22 23 00-0113 MO 100 CFM Diesel Powered Portable Air Compressor.....	1,234.19	
01 22 23 00-0114 DAY 130 CFM Diesel Powered Portable Air Compressor.....	177.72	
01 22 23 00-0115 WK 130 CFM Diesel Powered Portable Air Compressor.....	523.30	
01 22 23 00-0116 MO 130 CFM Diesel Powered Portable Air Compressor.....	1,481.02	
01 22 23 00-0117 DAY 185 CFM Diesel Powered Portable Air Compressor.....	236.96	
01 22 23 00-0118 WK 185 CFM Diesel Powered Portable Air Compressor.....	533.17	
01 22 23 00-0119 MO 185 CFM Diesel Powered Portable Air Compressor.....	1,174.95	
01 22 23 00-0120 DAY 375 CFM Diesel Powered Portable Air Compressor.....	335.70	
01 22 23 00-0121 WK 375 CFM Diesel Powered Portable Air Compressor.....	849.12	
01 22 23 00-0122 MO 375 CFM Diesel Powered Portable Air Compressor.....	2,024.07	
01 22 23 00-0123 DAY 600 CFM Diesel Powered Portable Air Compressor.....	746.44	
01 22 23 00-0124 WK 600 CFM Diesel Powered Portable Air Compressor.....	1,796.98	
01 22 23 00-0125 MO 600 CFM Diesel Powered Portable Air Compressor.....	4,478.62	
01 22 23 00-0126 DAY 750 CFM Diesel Powered Portable Air Compressor.....	898.49	
01 22 23 00-0127 WK 750 CFM Diesel Powered Portable Air Compressor.....	2,211.66	
01 22 23 00-0128 MO 750 CFM Diesel Powered Portable Air Compressor.....	5,430.42	
01 22 23 00-0129 DAY 825 CFM Diesel Powered Portable Air Compressor.....	898.49	
01 22 23 00-0130 WK 825 CFM Diesel Powered Portable Air Compressor.....	2,211.66	
01 22 23 00-0131 MO 825 CFM Diesel Powered Portable Air Compressor.....	5,430.42	
01 22 23 00-0132 DAY 1,300 CFM Diesel Powered Portable Air Compressor.....	1,046.59	
01 22 23 00-0133 WK 1,300 CFM Diesel Powered Portable Air Compressor.....	2,345.94	
01 22 23 00-0134 MO 1,300 CFM Diesel Powered Portable Air Compressor.....	6,255.85	
01 22 23 00-0135 DAY 1,600 CFM Diesel Powered Portable Air Compressor.....	1,303.30	
01 22 23 00-0136 WK 1,600 CFM Diesel Powered Portable Air Compressor.....	2,932.43	
01 22 23 00-0137 MO 1,600 CFM Diesel Powered Portable Air Compressor.....	7,819.81	
01 22 23 00-0138 Negative Air Machines (01 22 23 00-0109) Note: Includes delivery to job site and pick-up when complete. Excludes operator.		
01 22 23 00-0139 DAY Up To 2,000 CFM Portable Negative Air Machine With Pre-Filter And HEPA Filter.....	56.00	
01 22 23 00-0140 WK Up To 2,000 CFM Portable Negative Air Machine With Pre-Filter And HEPA Filter.....	230.00	
01 22 23 00-0141 MO Up To 2,000 CFM Portable Negative Air Machine With Pre-Filter And HEPA Filter.....	695.00	
01 22 23 00-0142 EA Replacement HEPA Filter, 99.99% Efficient @ 0.3 Micron For Negative Air Machine.....	200.35	
Note: Required if over 800 hours operation.		
01 22 23 00-0143 LF Discharge Flexible Duct For Negative Air Machine.....	1.29	
01 22 23 00-0144 Portable Air Scrubbers (01 22 23 00-0109) Note: Includes delivery to job site and pick-up when complete. Excludes operator.		
01 22 23 00-0145 DAY 200 to 1,000 CFM Portable Air Scrubber.....	83.00	
01 22 23 00-0146 WK 200 to 1,000 CFM Portable Air Scrubber.....	345.00	
01 22 23 00-0147 MO 200 to 1,000 CFM Portable Air Scrubber.....	955.00	
01 22 23 00-0148 DAY >1,000 to 2,000 CFM Portable Air Scrubber.....	105.00	
01 22 23 00-0149 WK >1,000 to 2,000 CFM Portable Air Scrubber.....	435.00	
01 22 23 00-0150 MO >1,000 to 2,000 CFM Portable Air Scrubber.....	1,275.00	
01 22 23 00-0151 Compaction And Paving Equipment (01 22 23)		
01 22 23 00-0152 Steel Plates (01 22 23 00-0151) Note: 3 day minimum.		
01 22 23 00-0153 DAY 1" x 4' x 8' Steel Plate.....	18.75	
01 22 23 00-0154 WK 1" x 4' x 8' Steel Plate.....	44.27	
01 22 23 00-0155 MO 1" x 4' x 8' Steel Plate.....	58.26	
01 22 23 00-0156 DAY 1" x 4' x 10' Steel Plate.....	25.00	
01 22 23 00-0157 WK 1" x 4' x 10' Steel Plate.....	56.25	
01 22 23 00-0158 MO 1" x 4' x 10' Steel Plate.....	68.75	
01 22 23 00-0159 DAY 1" x 5' x 10' Steel Plate.....	26.04	
01 22 23 00-0160 WK 1" x 5' x 10' Steel Plate.....	58.85	
01 22 23 00-0161 MO 1" x 5' x 10' Steel Plate.....	156.24	
01 22 23 00-0162 DAY 1" x 6' x 8' Steel Plate.....	16.67	
01 22 23 00-0163 WK 1" x 6' x 8' Steel Plate.....	37.50	
01 22 23 00-0164 MO 1" x 6' x 8' Steel Plate.....	99.99	

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MINOR
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TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

01 22 23 00-0165	DAY	1" x 6' x 10' Steel Plate	31.25	
01 22 23 00-0166	WK	1" x 6' x 10' Steel Plate	41.14	
01 22 23 00-0167	MO	1" x 6' x 10' Steel Plate	109.89	
01 22 23 00-0168	DAY	1" x 6' x 12' Steel Plate	43.75	
01 22 23 00-0169	WK	1" x 6' x 12' Steel Plate	55.99	
01 22 23 00-0170	MO	1" x 6' x 12' Steel Plate	151.55	
01 22 23 00-0171	DAY	1" x 8' x 10' Steel Plate	27.60	
01 22 23 00-0172	WK	1" x 8' x 10' Steel Plate	61.98	
01 22 23 00-0173	MO	1" x 8' x 10' Steel Plate	165.09	
01 22 23 00-0174	DAY	1" x 8' x 12' Steel Plate	50.00	
01 22 23 00-0175	WK	1" x 8' x 12' Steel Plate	61.98	
01 22 23 00-0176	MO	1" x 8' x 12' Steel Plate	299.98	
01 22 23 00-0177	DAY	1" x 8' x 16' Steel Plate	66.66	
01 22 23 00-0178	WK	1" x 8' x 16' Steel Plate	149.99	
01 22 23 00-0179	MO	1" x 8' x 16' Steel Plate	399.97	
01 22 23 00-0180	LF	Cold Mix For Temporary Ramp Base, 6" At Edge Of Trench Plate	1.72	0.90
01 22 23 00-0181	EA	Remove And Reset Trench Plate	23.45	

01 22 23 00-0182 Street Sweepers (01 22 23 00-0151)

Note: Includes full-time operator. Excludes delivery, set-up, and removal.

01 22 23 00-0183	DAY	8' Broom Sweeper With Full-Time Operator	902.23	
		<i>For Equipment Without Operator, Deduct</i>	-638.87	
01 22 23 00-0184	WK	8' Broom Sweeper With Full-Time Operator	3,908.35	
		<i>For Equipment Without Operator, Deduct</i>	-3,194.35	
01 22 23 00-0185	MO	8' Broom Sweeper With Full-Time Operator	16,033.66	
		<i>For Equipment Without Operator, Deduct</i>	-13,768.74	
01 22 23 00-0186	DAY	Self-Propelled Street Sweeper With Hopper And Full-Time Operator	1,090.18	
		Note: Truck with main and gutter brooms, elevator, debris hopper and water tank.		
		<i>For Equipment Without Operator, Deduct</i>	-638.87	
01 22 23 00-0187	WK	Self-Propelled Street Sweeper With Hopper And Full-Time Operator	5,254.74	
		Note: Truck with main and gutter brooms, elevator, debris hopper and water tank.		
		<i>For Equipment Without Operator, Deduct</i>	-3,194.35	
01 22 23 00-0188	MO	Self-Propelled Street Sweeper With Hopper And Full-Time Operator	21,593.73	
		Note: Truck with main and gutter brooms, elevator, debris hopper and water tank.		
		<i>For Equipment Without Operator, Deduct</i>	-13,768.74	

01 22 23 00-0189 Earthmoving Equipment (01 22 23)

01 22 23 00-0190 Skid-Steer Loaders (Bobcat) (01 22 23 00-0189)

Note: Includes full-time operator and combination bucket and dozer blade attachments. Add extra attachments where necessary. Excludes delivery, set-up, and removal.

01 22 23 00-0191	DAY	700 LB Capacity, 36" Wide, Skid-Steer Loader (Bobcat) With Full-Time Operator	851.75	
		<i>For Equipment Without Operator, Deduct</i>	-638.87	
01 22 23 00-0192	WK	700 LB Capacity, 36" Wide, Skid-Steer Loader (Bobcat) With Full-Time Operator	3,752.82	
		<i>For Equipment Without Operator, Deduct</i>	-3,194.35	
01 22 23 00-0193	MO	700 LB Capacity, 36" Wide, Skid-Steer Loader (Bobcat) With Full-Time Operator	15,113.70	
		<i>For Equipment Without Operator, Deduct</i>	-13,768.74	
01 22 23 00-0194	DAY	1,500 LB Capacity, 60" Wide, Skid-Steer Loader (Bobcat) With Full-Time Operator	907.86	
		<i>For Equipment Without Operator, Deduct</i>	-638.87	
01 22 23 00-0195	WK	1,500 LB Capacity, 60" Wide, Skid-Steer Loader (Bobcat) With Full-Time Operator	3,854.36	
		<i>For Equipment Without Operator, Deduct</i>	-3,194.35	
01 22 23 00-0196	MO	1,500 LB Capacity, 60" Wide, Skid-Steer Loader (Bobcat) With Full-Time Operator	15,336.37	
		<i>For Equipment Without Operator, Deduct</i>	-13,768.74	
01 22 23 00-0197	DAY	2,400 LB Capacity, 72" Wide, Skid-Steer Loader (Bobcat) With Full-Time Operator	923.89	
		<i>For Equipment Without Operator, Deduct</i>	-638.87	
01 22 23 00-0198	WK	2,400 LB Capacity, 72" Wide, Skid-Steer Loader (Bobcat) With Full-Time Operator	4,000.43	
		<i>For Equipment Without Operator, Deduct</i>	-3,194.35	
01 22 23 00-0199	MO	2,400 LB Capacity, 72" Wide, Skid-Steer Loader (Bobcat) With Full-Time Operator	15,723.83	
		<i>For Equipment Without Operator, Deduct</i>	-13,768.74	
01 22 23 00-0200	DAY	2,500 LB Capacity, 78" Wide, Tracked Skid-Steer Loader (Bobcat) With Full-Time Operator	986.24	
		<i>For Equipment Without Operator, Deduct</i>	-638.87	
01 22 23 00-0201	WK	2,500 LB Capacity, 78" Wide, Tracked Skid-Steer Loader (Bobcat) With Full-Time Operator	4,205.29	
		<i>For Equipment Without Operator, Deduct</i>	-3,194.35	
01 22 23 00-0202	MO	2,500 LB Capacity, 78" Wide, Tracked Skid-Steer Loader (Bobcat) With Full-Time Operator	16,400.76	
		<i>For Equipment Without Operator, Deduct</i>	-13,768.74	
01 22 23 00-0203	DAY	3,000 LB Capacity, 78" Wide, Tracked Skid-Steer Loader (Bobcat) With Full-Time Operator	1,093.13	
		<i>For Equipment Without Operator, Deduct</i>	-638.87	
01 22 23 00-0204	WK	3,000 LB Capacity, 78" Wide, Tracked Skid-Steer Loader (Bobcat) With Full-Time Operator	4,610.56	
		<i>For Equipment Without Operator, Deduct</i>	-3,194.35	
01 22 23 00-0205	MO	3,000 LB Capacity, 78" Wide, Tracked Skid-Steer Loader (Bobcat) With Full-Time Operator	17,398.34	
		<i>For Equipment Without Operator, Deduct</i>	-13,768.74	
01 22 23 00-0206	DAY	Hydraulic Hammer Attachment For Skid-Steer Loaders	178.14	
01 22 23 00-0207	WK	Hydraulic Hammer Attachment For Skid-Steer Loaders	592.32	
01 22 23 00-0208	MO	Hydraulic Hammer Attachment For Skid-Steer Loaders	1,576.54	
01 22 23 00-0209	DAY	Forklift Attachment For Skid-Steer Loaders	38.30	
01 22 23 00-0210	WK	Forklift Attachment For Skid-Steer Loaders	102.43	
01 22 23 00-0211	MO	Forklift Attachment For Skid-Steer Loaders	289.48	
01 22 23 00-0212	DAY	Backhoe Attachment For Skid-Steer Loaders	84.62	
01 22 23 00-0213	WK	Backhoe Attachment For Skid-Steer Loaders	203.08	
01 22 23 00-0214	MO	Backhoe Attachment For Skid-Steer Loaders	505.03	
01 22 23 00-0215	DAY	Broom Attachment For Skid-Steer Loaders	83.73	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
01 22 23 00-0216 WK Broom Attachment For Skid-Steer Loaders	227.13	
01 22 23 00-0217 MO Broom Attachment For Skid-Steer Loaders	601.22	
01 22 23 00-0218 DAY 9", 12", Or 16" Auger Attachment For Skid-Steer Loaders	56.11	
01 22 23 00-0219 WK 9", 12", Or 16" Auger Attachment For Skid-Steer Loaders	178.14	
01 22 23 00-0220 MO 9", 12", Or 16" Auger Attachment For Skid-Steer Loaders	423.08	
01 22 23 00-0221 Bulldozers <small>(01 22 23 00-0189)</small>		
Note: Includes full-time operator. Excludes delivery, set-up, and removal.		
01 22 23 00-0222 DAY 70 HP, D3 Bulldozer With Full-Time Operator	970.57	
For Equipment Without Operator, Deduct	-642.31	
01 22 23 00-0223 WK 70 HP, D3 Bulldozer With Full-Time Operator	4,506.01	
For Equipment Without Operator, Deduct	-3,211.57	
01 22 23 00-0224 MO 70 HP, D3 Bulldozer With Full-Time Operator	17,682.95	
For Equipment Without Operator, Deduct	-13,842.98	
01 22 23 00-0225 DAY 90 To 105 HP, D4 Or D5 Bulldozer With Full-Time Operator	1,125.40	
For Equipment Without Operator, Deduct	-642.31	
01 22 23 00-0226 WK 90 To 105 HP, D4 Or D5 Bulldozer With Full-Time Operator	5,131.55	
For Equipment Without Operator, Deduct	-3,211.57	
01 22 23 00-0227 MO 90 To 105 HP, D4 Or D5 Bulldozer With Full-Time Operator	19,602.94	
For Equipment Without Operator, Deduct	-13,842.98	
01 22 23 00-0228 DAY 140 HP, D6 Bulldozer With Full-Time Operator	1,565.14	
For Equipment Without Operator, Deduct	-642.31	
01 22 23 00-0229 WK 140 HP, D6 Bulldozer With Full-Time Operator	6,890.51	
For Equipment Without Operator, Deduct	-3,211.57	
01 22 23 00-0230 MO 140 HP, D6 Bulldozer With Full-Time Operator	24,867.41	
For Equipment Without Operator, Deduct	-13,842.98	
01 22 23 00-0231 DAY 200 HP, D7 Bulldozer With Full-Time Operator	1,955.33	
For Equipment Without Operator, Deduct	-642.31	
01 22 23 00-0232 WK 200 HP, D7 Bulldozer With Full-Time Operator	8,457.46	
For Equipment Without Operator, Deduct	-3,211.57	
01 22 23 00-0233 MO 200 HP, D7 Bulldozer With Full-Time Operator	29,574.47	
For Equipment Without Operator, Deduct	-13,842.98	
01 22 23 00-0234 DAY 335 HP, D8 Bulldozer With Full-Time Operator	2,419.84	
For Equipment Without Operator, Deduct	-642.31	
01 22 23 00-0235 WK 335 HP, D8 Bulldozer With Full-Time Operator	10,315.51	
For Equipment Without Operator, Deduct	-3,211.57	
01 22 23 00-0236 MO 335 HP, D8 Bulldozer With Full-Time Operator	35,148.62	
For Equipment Without Operator, Deduct	-13,842.98	
01 22 23 00-0237 DAY 460 HP, D9 Bulldozer With Full-Time Operator	2,679.97	
For Equipment Without Operator, Deduct	-642.31	
01 22 23 00-0238 WK 460 HP, D9 Bulldozer With Full-Time Operator	11,349.83	
For Equipment Without Operator, Deduct	-3,211.57	
01 22 23 00-0239 MO 460 HP, D9 Bulldozer With Full-Time Operator	38,245.37	
For Equipment Without Operator, Deduct	-13,842.98	
01 22 23 00-0240 Motor Scraper <small>(01 22 23 00-0189)</small>		
Note: Includes full-time operator. Excludes delivery, set-up, and removal.		
01 22 23 00-0241 DAY 11 CY Motor Scraper-Hauler With Full-Time Operator	1,767.82	
For Equipment Without Operator, Deduct	-642.31	
01 22 23 00-0242 WK 11 CY Motor Scraper-Hauler With Full-Time Operator	7,713.63	
For Equipment Without Operator, Deduct	-3,211.57	
01 22 23 00-0243 MO 11 CY Motor Scraper-Hauler With Full-Time Operator	27,333.73	
For Equipment Without Operator, Deduct	-13,842.98	
01 22 23 00-0244 DAY 18 CY Motor Scraper-Hauler With Full-Time Operator	2,222.65	
For Equipment Without Operator, Deduct	-642.31	
01 22 23 00-0245 WK 18 CY Motor Scraper-Hauler With Full-Time Operator	9,532.95	
For Equipment Without Operator, Deduct	-3,211.57	
01 22 23 00-0246 MO 18 CY Motor Scraper-Hauler With Full-Time Operator	32,807.12	
For Equipment Without Operator, Deduct	-13,842.98	
01 22 23 00-0247 DAY 24 CY Motor Scraper-Hauler With Full-Time Operator	2,662.07	
For Equipment Without Operator, Deduct	-642.31	
01 22 23 00-0248 WK 24 CY Motor Scraper-Hauler With Full-Time Operator	11,282.89	
For Equipment Without Operator, Deduct	-3,211.57	
01 22 23 00-0249 MO 24 CY Motor Scraper-Hauler With Full-Time Operator	38,049.24	
For Equipment Without Operator, Deduct	-13,842.98	
01 22 23 00-0250 Hydraulic Excavators <small>(01 22 23 00-0189)</small>		
Note: Includes full-time operator. Excludes delivery, set-up, and removal.		
01 22 23 00-0251 DAY 3/8 CY Hydraulic Excavator With Full-Time Operator	989.39	
For Equipment Without Operator, Deduct	-642.31	
01 22 23 00-0252 WK 3/8 CY Hydraulic Excavator With Full-Time Operator	4,439.22	
For Equipment Without Operator, Deduct	-3,211.57	
01 22 23 00-0253 MO 3/8 CY Hydraulic Excavator With Full-Time Operator	17,956.58	
For Equipment Without Operator, Deduct	-13,842.98	
01 22 23 00-0254 DAY 1/2 CY Hydraulic Excavator With Full-Time Operator	1,087.09	
For Equipment Without Operator, Deduct	-642.31	
01 22 23 00-0255 WK 1/2 CY Hydraulic Excavator With Full-Time Operator	4,869.87	
For Equipment Without Operator, Deduct	-3,211.57	
01 22 23 00-0256 MO 1/2 CY Hydraulic Excavator With Full-Time Operator	19,679.15	
For Equipment Without Operator, Deduct	-13,842.98	

01	General Requirements
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MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
01 22 23 00-0257	DAY		5/8 CY Hydraulic Excavator With Full-Time Operator	1,117.95	
			<i>For Equipment Without Operator, Deduct</i>	-642.31	
01 22 23 00-0258	WK		5/8 CY Hydraulic Excavator With Full-Time Operator	5,030.55	
			<i>For Equipment Without Operator, Deduct</i>	-3,211.57	
01 22 23 00-0259	MO		5/8 CY Hydraulic Excavator With Full-Time Operator	19,961.96	
			<i>For Equipment Without Operator, Deduct</i>	-13,842.98	
01 22 23 00-0260	DAY		3/4 CY Hydraulic Excavator With Full-Time Operator	1,150.08	
			<i>For Equipment Without Operator, Deduct</i>	-642.31	
01 22 23 00-0261	WK		3/4 CY Hydraulic Excavator With Full-Time Operator	5,178.39	
			<i>For Equipment Without Operator, Deduct</i>	-3,211.57	
01 22 23 00-0262	MO		3/4 CY Hydraulic Excavator With Full-Time Operator	20,244.77	
			<i>For Equipment Without Operator, Deduct</i>	-13,842.98	
01 22 23 00-0263	DAY		7/8 To 1 CY Hydraulic Excavator With Full-Time Operator	1,175.79	
			<i>For Equipment Without Operator, Deduct</i>	-642.31	
01 22 23 00-0264	WK		7/8 To 1 CY Hydraulic Excavator With Full-Time Operator	5,332.65	
			<i>For Equipment Without Operator, Deduct</i>	-3,211.57	
01 22 23 00-0265	MO		7/8 To 1 CY Hydraulic Excavator With Full-Time Operator	20,527.58	
			<i>For Equipment Without Operator, Deduct</i>	-13,842.98	
01 22 23 00-0266	DAY		1-1/8 To 1-1/4 CY Hydraulic Excavator With Full-Time Operator	1,522.88	
			<i>For Equipment Without Operator, Deduct</i>	-642.31	
01 22 23 00-0267	WK		1-1/8 To 1-1/4 CY Hydraulic Excavator With Full-Time Operator	6,714.56	
			<i>For Equipment Without Operator, Deduct</i>	-3,211.57	
01 22 23 00-0268	MO		1-1/8 To 1-1/4 CY Hydraulic Excavator With Full-Time Operator	24,351.94	
			<i>For Equipment Without Operator, Deduct</i>	-13,842.98	
01 22 23 00-0269	DAY		1-3/8 To 1-1/2 CY Hydraulic Excavator With Full-Time Operator	1,574.30	
			<i>For Equipment Without Operator, Deduct</i>	-642.31	
01 22 23 00-0270	WK		1-3/8 To 1-1/2 CY Hydraulic Excavator With Full-Time Operator	6,939.52	
			<i>For Equipment Without Operator, Deduct</i>	-3,211.57	
01 22 23 00-0271	MO		1-3/8 To 1-1/2 CY Hydraulic Excavator With Full-Time Operator	25,026.83	
			<i>For Equipment Without Operator, Deduct</i>	-13,842.98	
01 22 23 00-0272	DAY		1-5/8 To 1-7/8 CY Hydraulic Excavator With Full-Time Operator	1,670.71	
			<i>For Equipment Without Operator, Deduct</i>	-642.31	
01 22 23 00-0273	WK		1-5/8 To 1-7/8 CY Hydraulic Excavator With Full-Time Operator	7,325.17	
			<i>For Equipment Without Operator, Deduct</i>	-3,211.57	
01 22 23 00-0274	MO		1-5/8 To 1-7/8 CY Hydraulic Excavator With Full-Time Operator	26,183.78	
			<i>For Equipment Without Operator, Deduct</i>	-13,842.98	
01 22 23 00-0275	DAY		2 To 2-3/8 CY Hydraulic Excavator With Full-Time Operator	1,779.98	
			<i>For Equipment Without Operator, Deduct</i>	-642.31	
01 22 23 00-0276	WK		2 To 2-3/8 CY Hydraulic Excavator With Full-Time Operator	7,755.81	
			<i>For Equipment Without Operator, Deduct</i>	-3,211.57	
01 22 23 00-0277	MO		2 To 2-3/8 CY Hydraulic Excavator With Full-Time Operator	27,469.28	
			<i>For Equipment Without Operator, Deduct</i>	-13,842.98	
01 22 23 00-0278	DAY		2-1/2 To 2-7/8 CY Hydraulic Excavator With Full-Time Operator	1,812.11	
			<i>For Equipment Without Operator, Deduct</i>	-642.31	
01 22 23 00-0279	WK		2-1/2 To 2-7/8 CY Hydraulic Excavator With Full-Time Operator	7,884.36	
			<i>For Equipment Without Operator, Deduct</i>	-3,211.57	
01 22 23 00-0280	MO		2-1/2 To 2-7/8 CY Hydraulic Excavator With Full-Time Operator	27,854.93	
			<i>For Equipment Without Operator, Deduct</i>	-13,842.98	
01 22 23 00-0281	DAY		3 To 3-3/4 CY Hydraulic Excavator With Full-Time Operator	2,120.63	
			<i>For Equipment Without Operator, Deduct</i>	-642.31	
01 22 23 00-0282	WK		3 To 3-3/4 CY Hydraulic Excavator With Full-Time Operator	9,124.87	
			<i>For Equipment Without Operator, Deduct</i>	-3,211.57	
01 22 23 00-0283	MO		3 To 3-3/4 CY Hydraulic Excavator With Full-Time Operator	31,582.88	
			<i>For Equipment Without Operator, Deduct</i>	-13,842.98	
01 22 23 00-0284	DAY		4 To 5-3/4 CY Hydraulic Excavator With Full-Time Operator	2,564.13	
			<i>For Equipment Without Operator, Deduct</i>	-642.31	
01 22 23 00-0285	WK		4 To 5-3/4 CY Hydraulic Excavator With Full-Time Operator	10,886.01	
			<i>For Equipment Without Operator, Deduct</i>	-3,211.57	
01 22 23 00-0286	MO		4 To 5-3/4 CY Hydraulic Excavator With Full-Time Operator	36,853.43	
			<i>For Equipment Without Operator, Deduct</i>	-13,842.98	
01 22 23 00-0287	DAY		Thumbs Or Grapple Attachment For Hydraulic Excavators	89.98	
01 22 23 00-0288	WK		Thumbs Or Grapple Attachment For Hydraulic Excavators	347.08	
01 22 23 00-0289	MO		Thumbs Or Grapple Attachment For Hydraulic Excavators	1,028.40	
01 22 23 00-0290	DAY		1,000 Ft-Lb Hydraulic Hammer Attachment For Hydraulic Excavators	398.50	
01 22 23 00-0291	WK		1,000 Ft-Lb Hydraulic Hammer Attachment For Hydraulic Excavators	1,054.11	
01 22 23 00-0292	MO		1,000 Ft-Lb Hydraulic Hammer Attachment For Hydraulic Excavators	2,950.22	
01 22 23 00-0293	DAY		1,500 Ft-Lb Hydraulic Hammer Attachment For Hydraulic Excavators	617.04	
01 22 23 00-0294	WK		1,500 Ft-Lb Hydraulic Hammer Attachment For Hydraulic Excavators	1,574.74	
01 22 23 00-0295	MO		1,500 Ft-Lb Hydraulic Hammer Attachment For Hydraulic Excavators	4,094.32	
01 22 23 00-0296	DAY		3,000 Ft-Lb Hydraulic Hammer Attachment For Hydraulic Excavators	861.28	
01 22 23 00-0297	WK		3,000 Ft-Lb Hydraulic Hammer Attachment For Hydraulic Excavators	2,320.33	
01 22 23 00-0298	MO		3,000 Ft-Lb Hydraulic Hammer Attachment For Hydraulic Excavators	6,504.63	
01 22 23 00-0299	DAY		24" Compaction Wheel Attachment For Hydraulic Excavators	179.97	
01 22 23 00-0300	WK		24" Compaction Wheel Attachment For Hydraulic Excavators	719.88	
01 22 23 00-0301	MO		24" Compaction Wheel Attachment For Hydraulic Excavators	2,159.64	
01 22 23 00-0302	DAY		36" Compaction Wheel Attachment For Hydraulic Excavators	257.10	
01 22 23 00-0303	WK		36" Compaction Wheel Attachment For Hydraulic Excavators	1,028.40	
01 22 23 00-0304	MO		36" Compaction Wheel Attachment For Hydraulic Excavators	3,085.20	
01 22 23 00-0305	DAY		48" Compaction Wheel Attachment For Hydraulic Excavators	282.81	
01 22 23 00-0306	WK		48" Compaction Wheel Attachment For Hydraulic Excavators	1,118.38	
01 22 23 00-0307	MO		48" Compaction Wheel Attachment For Hydraulic Excavators	3,342.30	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
01 22 23 00-0308 Mini-Excavators <small>(01 22 23 00-0189)</small>		
Note: Includes full-time operator. Excludes delivery, set-up, and removal.		
01 22 23 00-0309 DAY 2,000 LB Mini-Excavator With Full-Time Operator (Bobcat 316)	912.27	
For Equipment Without Operator, Deduct	-642.31	
01 22 23 00-0310 WK 2,000 LB Mini-Excavator With Full-Time Operator (Bobcat 316)	3,976.44	
For Equipment Without Operator, Deduct	-3,211.57	
01 22 23 00-0311 MO 2,000 LB Mini-Excavator With Full-Time Operator (Bobcat 316)	15,526.98	
For Equipment Without Operator, Deduct	-13,842.98	
01 22 23 00-0312 DAY 3,500 LB Mini-Excavator With Full-Time Operator (Bobcat 322 Or 323)	918.69	
For Equipment Without Operator, Deduct	-642.31	
01 22 23 00-0313 WK 3,500 LB Mini-Excavator With Full-Time Operator (Bobcat 322 Or 323)	3,995.73	
For Equipment Without Operator, Deduct	-3,211.57	
01 22 23 00-0314 MO 3,500 LB Mini-Excavator With Full-Time Operator (Bobcat 322 Or 323)	15,931.92	
For Equipment Without Operator, Deduct	-13,842.98	
01 22 23 00-0315 DAY 6,000 LB Mini-Excavator With Full-Time Operator (Bobcat 325 Or 328)	950.83	
For Equipment Without Operator, Deduct	-642.31	
01 22 23 00-0316 WK 6,000 LB Mini-Excavator With Full-Time Operator (Bobcat 325 Or 328)	4,085.71	
For Equipment Without Operator, Deduct	-3,211.57	
01 22 23 00-0317 MO 6,000 LB Mini-Excavator With Full-Time Operator (Bobcat 325 Or 328)	15,989.76	
For Equipment Without Operator, Deduct	-13,842.98	
01 22 23 00-0318 DAY 7,500 LB Mini-Excavator With Full-Time Operator (Bobcat 329, 331 Or 334)	963.69	
For Equipment Without Operator, Deduct	-642.31	
01 22 23 00-0319 WK 7,500 LB Mini-Excavator With Full-Time Operator (Bobcat 329, 331 Or 334)	4,130.70	
For Equipment Without Operator, Deduct	-3,211.57	
01 22 23 00-0320 MO 7,500 LB Mini-Excavator With Full-Time Operator (Bobcat 329, 331 Or 334)	16,015.48	
For Equipment Without Operator, Deduct	-13,842.98	
01 22 23 00-0321 DAY 9,500 LB Mini-Excavator With Full-Time Operator (Bobcat 335)	1,040.81	
For Equipment Without Operator, Deduct	-642.31	
01 22 23 00-0322 WK 9,500 LB Mini-Excavator With Full-Time Operator (Bobcat 335)	4,194.98	
For Equipment Without Operator, Deduct	-3,211.57	
01 22 23 00-0323 MO 9,500 LB Mini-Excavator With Full-Time Operator (Bobcat 335)	16,761.06	
For Equipment Without Operator, Deduct	-13,842.98	
01 22 23 00-0324 DAY 11,000 LB Mini-Excavator With Full-Time Operator (Bobcat 337)	1,047.24	
For Equipment Without Operator, Deduct	-642.31	
01 22 23 00-0325 WK 11,000 LB Mini-Excavator With Full-Time Operator (Bobcat 337)	4,516.35	
For Equipment Without Operator, Deduct	-3,211.57	
01 22 23 00-0326 MO 11,000 LB Mini-Excavator With Full-Time Operator (Bobcat 337)	16,793.20	
For Equipment Without Operator, Deduct	-13,842.98	
01 22 23 00-0327 Road Graders <small>(01 22 23 00-0189)</small>		
Note: Includes full-time operator. Excludes delivery, set-up, and removal.		
01 22 23 00-0328 DAY 60 HP Road Grader With Full-Time Operator	1,279.69	
For Equipment Without Operator, Deduct	-642.31	
01 22 23 00-0329 WK 60 HP Road Grader With Full-Time Operator	4,935.76	
For Equipment Without Operator, Deduct	-3,211.57	
01 22 23 00-0330 MO 60 HP Road Grader With Full-Time Operator	18,999.22	
For Equipment Without Operator, Deduct	-13,842.98	
01 22 23 00-0331 DAY 80 HP Road Grader With Full-Time Operator	1,467.64	
For Equipment Without Operator, Deduct	-642.31	
01 22 23 00-0332 WK 80 HP Road Grader With Full-Time Operator	5,458.74	
For Equipment Without Operator, Deduct	-3,211.57	
01 22 23 00-0333 MO 80 HP Road Grader With Full-Time Operator	20,584.50	
For Equipment Without Operator, Deduct	-13,842.98	
01 22 23 00-0334 DAY 130 HP Road Grader With Full-Time Operator	1,598.23	
For Equipment Without Operator, Deduct	-642.31	
01 22 23 00-0335 WK 130 HP Road Grader With Full-Time Operator	6,040.77	
For Equipment Without Operator, Deduct	-3,211.57	
01 22 23 00-0336 MO 130 HP Road Grader With Full-Time Operator	22,322.88	
For Equipment Without Operator, Deduct	-13,842.98	
01 22 23 00-0337 Loader-Backhoes With Standard Bucket <small>(01 22 23 00-0189)</small>		
Note: Includes full-time operator. Excludes delivery, set-up, and removal.		
01 22 23 00-0338 DAY 1/2 To 5/8 CY, 65 HP, Loader-Backhoe With Standard Bucket And Full-Time Operator	1,150.12	
For Equipment Without Operator, Deduct	-642.31	
01 22 23 00-0339 WK 1/2 To 5/8 CY, 65 HP, Loader-Backhoe With Standard Bucket And Full-Time Operator	4,417.61	
For Equipment Without Operator, Deduct	-3,211.57	
01 22 23 00-0340 MO 1/2 To 5/8 CY, 65 HP, Loader-Backhoe With Standard Bucket And Full-Time Operator	16,681.26	
For Equipment Without Operator, Deduct	-13,842.98	
01 22 23 00-0341 DAY 1 CY, 24" Bucket, 14'-4" Deep, 75 HP, Loader-Backhoe With Full-Time Operator	1,204.53	
For Equipment Without Operator, Deduct	-642.31	
01 22 23 00-0342 WK 1 CY, 24" Bucket, 14'-4" Deep, 75 HP, Loader-Backhoe With Full-Time Operator	4,608.04	
For Equipment Without Operator, Deduct	-3,211.57	
01 22 23 00-0343 MO 1 CY, 24" Bucket, 14'-4" Deep, 75 HP, Loader-Backhoe With Full-Time Operator	17,841.97	
For Equipment Without Operator, Deduct	-13,842.98	
01 22 23 00-0344 DAY 1-1/2 CY, 24" Bucket, 16'-6" Deep, 90 HP, Loader-Backhoe With Full-Time Operator	1,288.41	
For Equipment Without Operator, Deduct	-642.31	
01 22 23 00-0345 WK 1-1/2 CY, 24" Bucket, 16'-6" Deep, 90 HP, Loader-Backhoe With Full-Time Operator	4,816.61	
For Equipment Without Operator, Deduct	-3,211.57	
01 22 23 00-0346 MO 1-1/2 CY, 24" Bucket, 16'-6" Deep, 90 HP, Loader-Backhoe With Full-Time Operator	18,440.46	
For Equipment Without Operator, Deduct	-13,842.98	
01 22 23 00-0347 DAY 1-3/4 CY, 30" Bucket, 18'-0" Deep, 112 HP, Loader-Backhoe With Full-Time Operator	1,662.46	
For Equipment Without Operator, Deduct	-642.31	

01	General Requirements
01 20	Price And Payment Procedures
01 22	Unit Prices



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
01 22 23 00-0348	WK		1-3/4 CY, 30" Bucket, 18'-0" Deep, 112 HP, Loader-Backhoe With Full-Time Operator.....	5,931.97	
			<i>For Equipment Without Operator, Deduct</i>	-3,211.57	
01 22 23 00-0349	MO		1-3/4 CY, 30" Bucket, 18'-0" Deep, 112 HP, Loader-Backhoe With Full-Time Operator.....	21,632.39	
			<i>For Equipment Without Operator, Deduct</i>	-13,842.98	
01 22 23 00-0350			Heavy Duty Construction Loaders <small>(01 22 23 00-0189)</small>		
			Note: Includes full-time operator. Excludes delivery, set-up, and removal.		
01 22 23 00-0351	DAY		2-1/2 CY, 119 HP, Heavy Duty Construction Loader With Full-Time Operator.....	1,094.06	
			<i>For Equipment Without Operator, Deduct</i>	-642.31	
01 22 23 00-0352	WK		2-1/2 CY, 119 HP, Heavy Duty Construction Loader With Full-Time Operator.....	4,997.72	
			<i>For Equipment Without Operator, Deduct</i>	-3,211.57	
01 22 23 00-0353	MO		2-1/2 CY, 119 HP, Heavy Duty Construction Loader With Full-Time Operator.....	19,194.48	
			<i>For Equipment Without Operator, Deduct</i>	-13,842.98	
01 22 23 00-0354	DAY		3 CY, 135 HP, Heavy Duty Construction Loader With Full-Time Operator.....	1,469.36	
			<i>For Equipment Without Operator, Deduct</i>	-642.31	
01 22 23 00-0355	WK		3 CY, 135 HP, Heavy Duty Construction Loader With Full-Time Operator.....	5,407.77	
			<i>For Equipment Without Operator, Deduct</i>	-3,211.57	
01 22 23 00-0356	MO		3 CY, 135 HP, Heavy Duty Construction Loader With Full-Time Operator.....	19,402.98	
			<i>For Equipment Without Operator, Deduct</i>	-13,842.98	
01 22 23 00-0357	DAY		3-1/2 CY, 198 HP, Heavy Duty Construction Loader With Full-Time Operator.....	1,552.76	
			<i>For Equipment Without Operator, Deduct</i>	-642.31	
01 22 23 00-0358	WK		3-1/2 CY, 198 HP, Heavy Duty Construction Loader With Full-Time Operator.....	5,630.17	
			<i>For Equipment Without Operator, Deduct</i>	-3,211.57	
01 22 23 00-0359	MO		3-1/2 CY, 198 HP, Heavy Duty Construction Loader With Full-Time Operator.....	19,958.98	
			<i>For Equipment Without Operator, Deduct</i>	-13,842.98	
01 22 23 00-0360	DAY		4-1/2 CY, 215 HP, Heavy Duty Construction Loader With Full-Time Operator.....	1,782.11	
			<i>For Equipment Without Operator, Deduct</i>	-642.31	
01 22 23 00-0361	WK		4-1/2 CY, 215 HP, Heavy Duty Construction Loader With Full-Time Operator.....	10,856.57	
			<i>For Equipment Without Operator, Deduct</i>	-3,211.57	
01 22 23 00-0362	MO		4-1/2 CY, 215 HP, Heavy Duty Construction Loader With Full-Time Operator.....	21,487.98	
			<i>For Equipment Without Operator, Deduct</i>	-13,842.98	
01 22 23 00-0363	DAY		7-1/3 CY, 330 HP, Heavy Duty Construction Loader With Full-Time Operator.....	2,372.86	
			<i>For Equipment Without Operator, Deduct</i>	-642.31	
01 22 23 00-0364	WK		7-1/3 CY, 330 HP, Heavy Duty Construction Loader With Full-Time Operator.....	10,119.87	
			<i>For Equipment Without Operator, Deduct</i>	-3,211.57	
01 22 23 00-0365	MO		7-1/3 CY, 330 HP, Heavy Duty Construction Loader With Full-Time Operator.....	34,553.98	
			<i>For Equipment Without Operator, Deduct</i>	-13,842.98	
01 22 23 00-0366	DAY		13-1/2 CY, 690 HP, Heavy Duty Construction Loader With Full-Time Operator.....	6,264.79	
			<i>For Equipment Without Operator, Deduct</i>	-642.31	
01 22 23 00-0367	WK		13-1/2 CY, 690 HP, Heavy Duty Construction Loader With Full-Time Operator.....	21,469.03	
			<i>For Equipment Without Operator, Deduct</i>	-3,211.57	
01 22 23 00-0368	MO		13-1/2 CY, 690 HP, Heavy Duty Construction Loader With Full-Time Operator.....	63,599.49	
			<i>For Equipment Without Operator, Deduct</i>	-13,842.98	
01 22 23 00-0369			Shoring <small>(01 22 23 00-0189)</small>		
			Note: Includes delivery to job site and pick-up when complete.		
01 22 23 00-0370			Aluminum Hydraulic Shoring <small>(01 22 23 00-0369)</small>		
			Note: Includes delivery to job site and pick-up when complete. Excludes sheeting.		
01 22 23 00-0371	WK		2' Rails, 1 Cylinder, Aluminum Hydraulic Shoring.....	30.17	
			Note: Up to 88" spread width.		
01 22 23 00-0372	MO		2' Rails, 1 Cylinder, Aluminum Hydraulic Shoring.....	88.99	
			Note: Up to 88" spread width.		
01 22 23 00-0373	WK		Up To 12' Rails, 2 Cylinders, Aluminum Hydraulic Shoring.....	40.47	
			Note: Up to 88" spread width.		
01 22 23 00-0374	MO		Up To 12' Rails, 2 Cylinders, Aluminum Hydraulic Shoring.....	119.38	
			Note: Up to 88" spread width.		
01 22 23 00-0375	WK		Up To 16' Rails, 3 Cylinders, Aluminum Hydraulic Shoring.....	75.05	
			Note: Up to 88" spread width.		
01 22 23 00-0376	MO		Up To 16' Rails, 3 Cylinders, Aluminum Hydraulic Shoring.....	221.40	
			Note: Up to 88" spread width.		
01 22 23 00-0377	EA		Set-up And Remove Aluminum Hydraulic Shores, 1 Cylinder.....	22.84	
01 22 23 00-0378	EA		Set-up And Remove Aluminum Hydraulic Shores, 2 Cylinders.....	36.54	
01 22 23 00-0379	EA		Set-up And Remove Aluminum Hydraulic Shores, 3 Cylinders.....	60.89	
01 22 23 00-0380			Trench Boxes/Trench Shields <small>(01 22 23 00-0189)</small>		
			Note: Trenching tasks include moving the trench box in excavation as trenching proceeds. Includes delivery to job site and pick-up when complete. For stackable units, combine multiple units for depth required.		
01 22 23 00-0381	WK		4' x 6' Trench Box With Up To 48" Spreaders.....	162.38	
01 22 23 00-0382	MO		4' x 6' Trench Box With Up To 48" Spreaders.....	487.13	
01 22 23 00-0383	WK		6' x 6' Trench Box With Up To 48" Spreaders.....	183.33	
01 22 23 00-0384	MO		6' x 6' Trench Box With Up To 48" Spreaders.....	549.99	
01 22 23 00-0385	WK		8' x 6' Trench Box With Up To 48" Spreaders.....	193.81	
01 22 23 00-0386	MO		8' x 6' Trench Box With Up To 48" Spreaders.....	581.42	
01 22 23 00-0387	WK		4' x 8' Trench Box With Up To 48" Spreaders.....	178.09	
01 22 23 00-0388	MO		4' x 8' Trench Box With Up To 48" Spreaders.....	534.28	
01 22 23 00-0389	WK		6' x 8' Trench Box With Up To 48" Spreaders.....	209.52	
01 22 23 00-0390	MO		6' x 8' Trench Box With Up To 48" Spreaders.....	628.56	
01 22 23 00-0391	WK		8' x 8' Trench Box With Up To 48" Spreaders.....	235.71	
01 22 23 00-0392	MO		8' x 8' Trench Box With Up To 48" Spreaders.....	707.13	
01 22 23 00-0393	WK		4' x 10' Trench Box With Up To 48" Spreaders.....	199.04	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
01 22 23 00-0394 MO 4' x 10' Trench Box With Up To 48" Spreaders.....	597.13	
01 22 23 00-0395 WK 6' x 10' Trench Box With Up To 48" Spreaders.....	235.71	
01 22 23 00-0396 MO 6' x 10' Trench Box With Up To 48" Spreaders.....	707.13	
01 22 23 00-0397 WK 8' x 10' Trench Box With Up To 48" Spreaders.....	288.09	
01 22 23 00-0398 MO 8' x 10' Trench Box With Up To 48" Spreaders.....	859.03	
01 22 23 00-0399 WK 4' x 12' Trench Box With Up To 48" Spreaders.....	235.71	
01 22 23 00-0400 MO 4' x 12' Trench Box With Up To 48" Spreaders.....	707.13	
01 22 23 00-0401 WK 6' x 12' Trench Box With Up To 48" Spreaders.....	288.09	
01 22 23 00-0402 MO 6' x 12' Trench Box With Up To 48" Spreaders.....	864.27	
01 22 23 00-0403 WK 8' x 12' Trench Box With Up To 48" Spreaders.....	366.66	
01 22 23 00-0404 MO 8' x 12' Trench Box With Up To 48" Spreaders.....	1,099.98	
01 22 23 00-0405 WK 4' x 14' Trench Box With Up To 48" Spreaders.....	261.90	
01 22 23 00-0406 MO 4' x 14' Trench Box With Up To 48" Spreaders.....	785.70	
01 22 23 00-0407 WK 6' x 14' Trench Box With Up To 48" Spreaders.....	340.47	
01 22 23 00-0408 MO 6' x 14' Trench Box With Up To 48" Spreaders.....	1,021.41	
01 22 23 00-0409 WK 8' x 14' Trench Box With Up To 48" Spreaders.....	419.04	
01 22 23 00-0410 MO 8' x 14' Trench Box With Up To 48" Spreaders.....	1,257.12	
01 22 23 00-0411 WK 4' x 16' Trench Box With Up To 48" Spreaders.....	288.09	
01 22 23 00-0412 MO 4' x 16' Trench Box With Up To 48" Spreaders.....	864.27	
01 22 23 00-0413 WK 6' x 16' Trench Box With Up To 48" Spreaders.....	392.85	
01 22 23 00-0414 MO 6' x 16' Trench Box With Up To 48" Spreaders.....	1,178.55	
01 22 23 00-0415 WK 8' x 16' Trench Box With Up To 48" Spreaders.....	471.42	
01 22 23 00-0416 MO 8' x 16' Trench Box With Up To 48" Spreaders.....	1,414.26	
01 22 23 00-0417 WK 4' x 20' Trench Box With Up To 48" Spreaders.....	340.47	
01 22 23 00-0418 MO 4' x 20' Trench Box With Up To 48" Spreaders.....	1,021.41	
01 22 23 00-0419 WK 6' x 20' Trench Box With Up To 48" Spreaders.....	471.42	
01 22 23 00-0420 MO 6' x 20' Trench Box With Up To 48" Spreaders.....	1,414.26	
01 22 23 00-0421 WK 8' x 20' Trench Box With Up To 48" Spreaders.....	549.99	
01 22 23 00-0422 MO 8' x 20' Trench Box With Up To 48" Spreaders.....	1,649.97	
01 22 23 00-0423 WK 4' x 24' Trench Box With Up To 48" Spreaders.....	471.42	
01 22 23 00-0424 MO 4' x 24' Trench Box With Up To 48" Spreaders.....	1,414.26	
01 22 23 00-0425 WK 6' x 24' Trench Box With Up To 48" Spreaders.....	576.18	
01 22 23 00-0426 MO 6' x 24' Trench Box With Up To 48" Spreaders.....	1,728.54	
01 22 23 00-0427 WK 8' x 24' Trench Box With Up To 48" Spreaders.....	628.56	
01 22 23 00-0428 MO 8' x 24' Trench Box With Up To 48" Spreaders.....	1,885.68	
01 22 23 00-0429 WK For Spreaders >48" To 84", Add.....	15.71	
01 22 23 00-0430 MO For Spreaders >48" To 84", Add.....	47.14	
01 22 23 00-0431 WK For Spreaders >84" To 120", Add.....	94.28	
01 22 23 00-0432 MO For Spreaders >84" To 120", Add.....	282.85	
01 22 23 00-0433 WK For Spreaders >120", Add.....	199.04	
01 22 23 00-0434 MO For Spreaders >120", Add.....	597.13	
01 22 23 00-0435 WK 8' x 4' Manhole Box.....	247.50	
01 22 23 00-0436 MO 8' x 4' Manhole Box.....	742.49	
01 22 23 00-0437 WK 8' x 8' Manhole Box.....	353.57	
01 22 23 00-0438 MO 8' x 8' Manhole Box.....	1,060.70	

01 22 23 00-0439

Trenchers (01 22 23 00-0189)

Note: Includes full-time operator. Excludes delivery, set-up, and removal.

01 22 23 00-0440 DAY 4' Maximum Trench Depth, Ride-On Trencher With Full-Time Operator.....	974.04	
<i>For Equipment Without Operator, Deduct</i>	<i>-642.31</i>	
01 22 23 00-0441 WK 4' Maximum Trench Depth, Ride-On Trencher With Full-Time Operator.....	4,341.52	
<i>For Equipment Without Operator, Deduct</i>	<i>-3,211.57</i>	
01 22 23 00-0442 MO 4' Maximum Trench Depth, Ride-On Trencher With Full-Time Operator.....	16,952.93	
<i>For Equipment Without Operator, Deduct</i>	<i>-13,842.98</i>	
01 22 23 00-0443 DAY 5' Maximum Trench Depth, Ride-On Trencher With Full-Time Operator.....	1,533.83	
<i>For Equipment Without Operator, Deduct</i>	<i>-642.31</i>	
01 22 23 00-0444 WK 5' Maximum Trench Depth, Ride-On Trencher With Full-Time Operator.....	6,228.22	
<i>For Equipment Without Operator, Deduct</i>	<i>-3,211.57</i>	
01 22 23 00-0445 MO 5' Maximum Trench Depth, Ride-On Trencher With Full-Time Operator.....	22,136.18	
<i>For Equipment Without Operator, Deduct</i>	<i>-13,842.98</i>	

01 22 23 00-0446

Heavy Equipment Mats (01 22 23 00-0189)

Note: Rental price per mat. Excludes mobilization and demobilization. See CSI section 01 71 13 00-0001 for equipment delivery, pickup, mobilization and demobilization.

01 22 23 00-0447 Day 14' Width x 8' Length, 6" Thick, 3-Ply Laminated Heavy Equipment Mat.....	20.00	
01 22 23 00-0448 WK 14' Width x 8' Length, 6" Thick, 3-Ply Laminated Heavy Equipment Mat.....	47.62	
01 22 23 00-0449 MO 14' Width x 8' Length, 6" Thick, 3-Ply Laminated Heavy Equipment Mat.....	100.00	
01 22 23 00-0450 Day 16' Width x 8' Length, 6" Thick, 3-Ply Laminated Heavy Equipment Mat.....	21.00	
01 22 23 00-0451 WK 16' Width x 8' Length, 6" Thick, 3-Ply Laminated Heavy Equipment Mat.....	50.00	
01 22 23 00-0452 MO 16' Width x 8' Length, 6" Thick, 3-Ply Laminated Heavy Equipment Mat.....	105.00	
01 22 23 00-0453 Day 16' Width x 4' Length, 8" Thick Hardwood Timbers, Dragline/Excavator Mat.....	17.00	
01 22 23 00-0454 WK 16' Width x 4' Length, 8" Thick Hardwood Timbers, Dragline/Excavator Mat.....	40.00	
01 22 23 00-0455 MO 16' Width x 4' Length, 8" Thick Hardwood Timbers, Dragline/Excavator Mat.....	85.00	
01 22 23 00-0456 Day 18' Width x 4' Length, 8" Thick Hardwood Timbers, Dragline/Excavator Mat.....	19.00	
01 22 23 00-0457 WK 18' Width x 4' Length, 8" Thick Hardwood Timbers, Dragline/Excavator Mat.....	45.00	
01 22 23 00-0458 MO 18' Width x 4' Length, 8" Thick Hardwood Timbers, Dragline/Excavator Mat.....	95.00	
01 22 23 00-0459 Day 20' Width x 4' Length, 8" Thick Hardwood Timbers, Dragline/Excavator Mat.....	21.00	
01 22 23 00-0460 WK 20' Width x 4' Length, 8" Thick Hardwood Timbers, Dragline/Excavator Mat.....	50.00	
01 22 23 00-0461 MO 20' Width x 4' Length, 8" Thick Hardwood Timbers, Dragline/Excavator Mat.....	105.00	
01 22 23 00-0462 Day 24' Width x 4' Length, 8" Thick Hardwood Timbers, Dragline/Excavator Mat.....	23.00	



MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

01 22 23 00-0463	WK	24' Width x 4' Length, 8" Thick Hardwood Timbers, Dragline/Excavator Mat	54.76
01 22 23 00-0464	MO	24' Width x 4' Length, 8" Thick Hardwood Timbers, Dragline/Excavator Mat	115.00
01 22 23 00-0465	Day	12' Width x 4' Length, 12" Thick Hardwood Timbers, Crane Mat	18.00
01 22 23 00-0466	WK	12' Width x 4' Length, 12" Thick Hardwood Timbers, Crane Mat	50.00
01 22 23 00-0467	MO	12' Width x 4' Length, 12" Thick Hardwood Timbers, Crane Mat	90.00
01 22 23 00-0468	Day	16' Width x 4' Length, 12" Thick Hardwood Timbers, Crane Mat	21.00
01 22 23 00-0469	WK	16' Width x 4' Length, 12" Thick Hardwood Timbers, Crane Mat	50.00
01 22 23 00-0470	MO	16' Width x 4' Length, 12" Thick Hardwood Timbers, Crane Mat	105.00
01 22 23 00-0471	Day	20' Width x 4' Length, 12" Thick Hardwood Timbers, Crane Mat	25.00
01 22 23 00-0472	WK	20' Width x 4' Length, 12" Thick Hardwood Timbers, Crane Mat	55.00
01 22 23 00-0473	MO	20' Width x 4' Length, 12" Thick Hardwood Timbers, Crane Mat	125.00
01 22 23 00-0474	Day	24' Width x 4' Length, 12" Thick Hardwood Timbers, Crane Mat	27.00
01 22 23 00-0475	WK	24' Width x 4' Length, 12" Thick Hardwood Timbers, Crane Mat	64.29
01 22 23 00-0476	MO	24' Width x 4' Length, 12" Thick Hardwood Timbers, Crane Mat	135.00
01 22 23 00-0477	Day	28' Width x 4' Length, 12" Thick Hardwood Timbers, Crane Mat	29.00
01 22 23 00-0478	WK	28' Width x 4' Length, 12" Thick Hardwood Timbers, Crane Mat	69.05
01 22 23 00-0479	MO	28' Width x 4' Length, 12" Thick Hardwood Timbers, Crane Mat	145.00
01 22 23 00-0480	Day	30' Width x 4' Length, 12" Thick Hardwood Timbers, Crane Mat	30.00
01 22 23 00-0481	WK	30' Width x 4' Length, 12" Thick Hardwood Timbers, Crane Mat	71.43
01 22 23 00-0482	MO	30' Width x 4' Length, 12" Thick Hardwood Timbers, Crane Mat	150.00
01 22 23 00-0483	Day	14' Width x 8' Length, 2-3/4" Thick, Laminated Heavy Equipment Mat (Emtek™)	9.62
01 22 23 00-0484	WK	14' Width x 8' Length, 2-3/4" Thick, Laminated Heavy Equipment Mat (Emtek™)	24.05
01 22 23 00-0485	MO	14' Width x 8' Length, 2-3/4" Thick, Laminated Heavy Equipment Mat (Emtek™)	72.15
01 22 23 00-0486	Day	14' Width x 8' Length, 3-1/2" Thick, Laminated Heavy Equipment Mat (Emtek™)	11.50
01 22 23 00-0487	WK	14' Width x 8' Length, 3-1/2" Thick, Laminated Heavy Equipment Mat (Emtek™)	28.75
01 22 23 00-0488	MO	14' Width x 8' Length, 3-1/2" Thick, Laminated Heavy Equipment Mat (Emtek™)	86.25
01 22 23 00-0489	Day	16' Width x 8' Length, 3-1/2" Thick, Laminated Heavy Equipment Mat (Emtek™)	13.13
01 22 23 00-0490	WK	16' Width x 8' Length, 3-1/2" Thick, Laminated Heavy Equipment Mat (Emtek™)	32.83
01 22 23 00-0491	MO	16' Width x 8' Length, 3-1/2" Thick, Laminated Heavy Equipment Mat (Emtek™)	98.50
01 22 23 00-0492	Day	14' Width x 8' Length, 4-1/2" Thick, Laminated Heavy Equipment Mat (Emtek™)	14.00
01 22 23 00-0493	WK	14' Width x 8' Length, 4-1/2" Thick, Laminated Heavy Equipment Mat (Emtek™)	35.00
01 22 23 00-0494	MO	14' Width x 8' Length, 4-1/2" Thick, Laminated Heavy Equipment Mat (Emtek™)	105.00
01 22 23 00-0495	Day	16' Width x 8' Length, 4-1/2" Thick, Laminated Heavy Equipment Mat (Emtek™)	16.00
01 22 23 00-0496	WK	16' Width x 8' Length, 4-1/2" Thick, Laminated Heavy Equipment Mat (Emtek™)	40.00
01 22 23 00-0497	MO	16' Width x 8' Length, 4-1/2" Thick, Laminated Heavy Equipment Mat (Emtek™)	120.00
01 22 23 00-0498	Day	16' Width x 8' Length, 5-1/2" Thick, Laminated Heavy Equipment Mat (Emtek™)	18.39
01 22 23 00-0499	WK	16' Width x 8' Length, 5-1/2" Thick, Laminated Heavy Equipment Mat (Emtek™)	45.97
01 22 23 00-0500	MO	16' Width x 8' Length, 5-1/2" Thick, Laminated Heavy Equipment Mat (Emtek™)	137.90
01 22 23 00-0501	Day	24' Width x 4' Length, 6" Thick, Laminated Heavy Equipment Mat (Emtek™)	14.15
01 22 23 00-0502	WK	24' Width x 4' Length, 6" Thick, Laminated Heavy Equipment Mat (Emtek™)	35.37
01 22 23 00-0503	MO	24' Width x 4' Length, 6" Thick, Laminated Heavy Equipment Mat (Emtek™)	106.10
01 22 23 00-0504	Day	30' Width x 4' Length, 6-1/2" Thick, Laminated Heavy Equipment Mat (Emtek™)	19.15
01 22 23 00-0505	WK	30' Width x 4' Length, 6-1/2" Thick, Laminated Heavy Equipment Mat (Emtek™)	47.88
01 22 23 00-0506	MO	30' Width x 4' Length, 6-1/2" Thick, Laminated Heavy Equipment Mat (Emtek™)	143.65
01 22 23 00-0507	Day	24' Width x 4' Length, 7-1/2" Thick, Laminated Heavy Equipment Mat (Emtek™)	16.56
01 22 23 00-0508	WK	24' Width x 4' Length, 7-1/2" Thick, Laminated Heavy Equipment Mat (Emtek™)	41.40
01 22 23 00-0509	MO	24' Width x 4' Length, 7-1/2" Thick, Laminated Heavy Equipment Mat (Emtek™)	124.20
01 22 23 00-0510	Day	40' Width x 4' Length, 7-1/2" Thick, Laminated Heavy Equipment Mat (Emtek™)	27.62
01 22 23 00-0511	WK	40' Width x 4' Length, 7-1/2" Thick, Laminated Heavy Equipment Mat (Emtek™)	69.05
01 22 23 00-0512	MO	40' Width x 4' Length, 7-1/2" Thick, Laminated Heavy Equipment Mat (Emtek™)	207.14
01 22 23 00-0513	Day	40' Width x 4' Length, 8" Thick, Laminated Heavy Equipment Mat (Emtek™)	29.44
01 22 23 00-0514	WK	40' Width x 4' Length, 8" Thick, Laminated Heavy Equipment Mat (Emtek™)	73.60
01 22 23 00-0515	MO	40' Width x 4' Length, 8" Thick, Laminated Heavy Equipment Mat (Emtek™)	220.80

01 22 23 00-0516 Electrical Equipment (01 22 23)

01 22 23 00-0517 Tripod Mounted Floodlights (01 22 23 00-0516)

Note: Includes delivery to job site and pick-up when complete.

01 22 23 00-0518	DAY	500 Watt, 115 Volt, 2 Lamp, Portable Light Stand With Tripod	61.50
01 22 23 00-0519	WK	500 Watt, 115 Volt, 2 Lamp, Portable Light Stand With Tripod	145.50
01 22 23 00-0520	MO	500 Watt, 115 Volt, 2 Lamp, Portable Light Stand With Tripod	307.50
01 22 23 00-0521	DAY	1,000 Watt, 115 Volt, 2 Lamp, Portable Light Stand With Tripod	61.50
01 22 23 00-0522	WK	1,000 Watt, 115 Volt, 2 Lamp, Portable Light Stand With Tripod	180.00
01 22 23 00-0523	MO	1,000 Watt, 115 Volt, 2 Lamp, Portable Light Stand With Tripod	532.50
01 22 23 00-0524	DAY	2,000 Watt, 115 Volt, 2 Lamp, Portable Light Stand With Tripod	69.00
01 22 23 00-0525	WK	2,000 Watt, 115 Volt, 2 Lamp, Portable Light Stand With Tripod	187.50
01 22 23 00-0526	MO	2,000 Watt, 115 Volt, 2 Lamp, Portable Light Stand With Tripod	457.50

01 22 23 00-0527 Trailer Mounted Floodlights (01 22 23 00-0516)

Note: Includes delivery to job site and pick-up when complete. Excludes operator.

01 22 23 00-0528	DAY	4 x 1,000 Watt Floodlights, 30' Telescoping Tower, Diesel Power Trailer Mounted Light Tower	172.50
01 22 23 00-0529	WK	4 x 1,000 Watt Floodlights, 30' Telescoping Tower, Diesel Power Trailer Mounted Light Tower	382.50
01 22 23 00-0530	MO	4 x 1,000 Watt Floodlights, 30' Telescoping Tower, Diesel Power Trailer Mounted Light Tower	825.00

01 22 23 00-0531 Generator Sets (01 22 23 00-0516)

01 22 23 00-0532 Portable, Gas Or Diesel Powered Generator Sets (01 22 23 00-0531)

Note: With 24 hour day-tank. Includes delivery to job site and pick-up when complete. Excludes cables, operator and fuel costs. See CSI section 01 22 23 00-0615 for reimbursable fuel fees.



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
01 22 23 00-0533 DAY 3.6 KW, 8 HP Gas Powered Generator Set.....	50.59	
<i>For LP Or NG Gas, Add</i>	6.32	
01 22 23 00-0534 WK 3.6 KW, 8 HP Gas Powered Generator Set.....	182.34	
<i>For LP Or NG Gas, Add</i>	22.79	
01 22 23 00-0535 MO 3.6 KW, 8 HP Gas Powered Generator Set.....	505.85	
<i>For LP Or NG Gas, Add</i>	63.23	
01 22 23 00-0536 DAY 5 KW, 11 HP Gas Powered Generator Set.....	71.76	
<i>For LP Or NG Gas, Add</i>	8.97	
01 22 23 00-0537 WK 5 KW, 11 HP Gas Powered Generator Set.....	229.40	
<i>For LP Or NG Gas, Add</i>	28.68	
01 22 23 00-0538 MO 5 KW, 11 HP Gas Powered Generator Set.....	523.50	
<i>For LP Or NG Gas, Add</i>	65.44	
01 22 23 00-0539 DAY 6.5 KW, 13 HP Gas Powered Generator Set.....	91.76	
<i>For LP Or NG Gas, Add</i>	11.47	
01 22 23 00-0540 WK 6.5 KW, 13 HP Gas Powered Generator Set.....	247.04	
<i>For LP Or NG Gas, Add</i>	30.88	
01 22 23 00-0541 MO 6.5 KW, 13 HP Gas Powered Generator Set.....	682.31	
<i>For LP Or NG Gas, Add</i>	85.29	
01 22 23 00-0542 DAY 10 KW, 18 HP Gas Powered Generator Set.....	102.35	
<i>For LP Or NG Gas, Add</i>	12.79	
01 22 23 00-0543 WK 10 KW, 18 HP Gas Powered Generator Set.....	276.45	
<i>For LP Or NG Gas, Add</i>	34.56	
01 22 23 00-0544 MO 10 KW, 18 HP Gas Powered Generator Set.....	794.07	
<i>For LP Or NG Gas, Add</i>	99.26	
01 22 23 00-0545 Towable, Diesel Powered Generator Sets <small>(01 22 23 00-0531)</small>		
<small>Note: Includes 24 hour day-tank on sizes up to 180KW, 40 hour day-tank for sizes greater than 180KW To 300 KW and 1000 gallon for sizes greater than 300KW. Multi-voltage transformer unless stated otherwise, trailer mounted including sound attenuation and control panel. Excludes cables, operator and fuel costs. See CSI section 01 22 23 00-0615 for reimbursable fuel fees.</small>		
01 22 23 00-0546 DAY 20 KW, 60 Hertz Diesel Powered Generator Set.....	210.58	
<small>Note: Fuel consumption: 100% load - 1.7 gallons per hour, 75% load - 1.3 gallons per hour, 50% load - 1.0 gallons per hour.</small>		
01 22 23 00-0547 WK 20 KW, 60 Hertz Diesel Powered Generator Set.....	550.56	
<small>Note: Fuel consumption: 100% load - 1.7 gallons per hour, 75% load - 1.3 gallons per hour, 50% load - 1.0 gallons per hour.</small>		
01 22 23 00-0548 MO 20 KW, 60 Hertz Diesel Powered Generator Set.....	1,499.91	
<small>Note: Fuel consumption: 100% load - 1.7 gallons per hour, 75% load - 1.3 gallons per hour, 50% load - 1.0 gallons per hour.</small>		
01 22 23 00-0549 DAY 40.0 KW, 60 Hertz Diesel Powered Generator Set.....	276.34	
<small>Note: Fuel consumption: 100% load - 3.1 gallons per hour, 75% load - 2.3 gallons per hour, 50% load - 1.7 gallons per hour.</small>		
01 22 23 00-0550 WK 40.0 KW, 60 Hertz Diesel Powered Generator Set.....	622.43	
<small>Note: Fuel consumption: 100% load - 3.1 gallons per hour, 75% load - 2.3 gallons per hour, 50% load - 1.7 gallons per hour.</small>		
01 22 23 00-0551 MO 40.0 KW, 60 Hertz Diesel Powered Generator Set.....	1,658.06	
<small>Note: Fuel consumption: 100% load - 3.1 gallons per hour, 75% load - 2.3 gallons per hour, 50% load - 1.7 gallons per hour.</small>		
01 22 23 00-0552 DAY 70.0 KW, 60 Hertz Diesel Powered Generator Set.....	361.88	
<small>Note: Fuel consumption: 100% load - 6.25 gallons per hour, 75% load - 10.0 gallons per hour, 50% load - 3.8 gallons per hour.</small>		
01 22 23 00-0553 WK 70.0 KW, 60 Hertz Diesel Powered Generator Set.....	811.48	
<small>Note: Fuel consumption: 100% load - 6.25 gallons per hour, 75% load - 10.0 gallons per hour, 50% load - 3.8 gallons per hour.</small>		
01 22 23 00-0554 MO 70.0 KW, 60 Hertz Diesel Powered Generator Set.....	2,253.51	
<small>Note: Fuel consumption: 100% load - 6.25 gallons per hour, 75% load - 10.0 gallons per hour, 50% load - 3.8 gallons per hour.</small>		
01 22 23 00-0555 DAY 100.0 KW, 60 Hertz Diesel Powered Generator Set.....	455.09	
<small>Note: Fuel consumption: 100% load - 7.9 gallons per hour, 75% load - 5.9 gallons per hour, 50% load - 4.2 gallons per hour.</small>		
01 22 23 00-0556 WK 100.0 KW, 60 Hertz Diesel Powered Generator Set.....	1,003.39	
<small>Note: Fuel consumption: 100% load - 7.9 gallons per hour, 75% load - 5.9 gallons per hour, 50% load - 4.2 gallons per hour.</small>		
01 22 23 00-0557 MO 100.0 KW, 60 Hertz Diesel Powered Generator Set.....	2,856.64	
<small>Note: Fuel consumption: 100% load - 7.9 gallons per hour, 75% load - 5.9 gallons per hour, 50% load - 4.2 gallons per hour.</small>		
01 22 23 00-0558 DAY 120.0 KW, 60 Hertz Diesel Powered Generator Set.....	468.80	
<small>Note: Fuel consumption: 100% load - 10.7 gallons per hour, 75% load - 8.3 gallons per hour, 50% load - 6.5 gallons per hour.</small>		
01 22 23 00-0559 WK 120.0 KW, 60 Hertz Diesel Powered Generator Set.....	1,080.15	
<small>Note: Fuel consumption: 100% load - 10.7 gallons per hour, 75% load - 8.3 gallons per hour, 50% load - 6.5 gallons per hour.</small>		
01 22 23 00-0560 MO 120.0 KW, 60 Hertz Diesel Powered Generator Set.....	3,328.18	
<small>Note: Fuel consumption: 100% load - 10.7 gallons per hour, 75% load - 8.3 gallons per hour, 50% load - 6.5 gallons per hour.</small>		
01 22 23 00-0561 DAY 150.0 KW, 60 Hertz Diesel Powered Generator Set.....	482.50	
<small>Note: Fuel consumption: 100% load - 10.7 gallons per hour, 75% load - 8.3 gallons per hour, 50% load - 6.5 gallons per hour.</small>		
01 22 23 00-0562 WK 150.0 KW, 60 Hertz Diesel Powered Generator Set.....	1,151.43	
<small>Note: Fuel consumption: 100% load - 10.7 gallons per hour, 75% load - 8.3 gallons per hour, 50% load - 6.5 gallons per hour.</small>		
01 22 23 00-0563 MO 150.0 KW, 60 Hertz Diesel Powered Generator Set.....	3,799.72	
<small>Note: Fuel consumption: 100% load - 10.7 gallons per hour, 75% load - 8.3 gallons per hour, 50% load - 6.5 gallons per hour.</small>		

01	General Requirements
01 20	Price And Payment Procedures
01 22	Unit Prices



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
01 22 23 00-0564	DAY		175.0 KW, 60 Hertz Diesel Powered Generator Set..... Note: Fuel consumption: 100% load - 16.1 gallons per hour, 75% load - 12.3 gallons per hour, 50% load - 8.9 gallons per hour.	528.56	
01 22 23 00-0565	WK		175.0 KW, 60 Hertz Diesel Powered Generator Set..... Note: Fuel consumption: 100% load - 16.1 gallons per hour, 75% load - 12.3 gallons per hour, 50% load - 8.9 gallons per hour.	1,201.87	
01 22 23 00-0566	MO		175.0 KW, 60 Hertz Diesel Powered Generator Set..... Note: Fuel consumption: 100% load - 16.1 gallons per hour, 75% load - 12.3 gallons per hour, 50% load - 8.9 gallons per hour.	3,991.62	
01 22 23 00-0567	DAY		250.0 KW, 60 Hertz Diesel Powered Generator Set..... Note: Fuel consumption: 100% load - 19.4 gallons per hour, 75% load - 15.5 gallons per hour, 50% load - 11.6 gallons per hour.	657.96	
01 22 23 00-0568	WK		250.0 KW, 60 Hertz Diesel Powered Generator Set..... Note: Fuel consumption: 100% load - 19.4 gallons per hour, 75% load - 15.5 gallons per hour, 50% load - 11.6 gallons per hour.	1,683.28	
01 22 23 00-0569	MO		250.0 KW, 60 Hertz Diesel Powered Generator Set..... Note: Fuel consumption: 100% load - 19.4 gallons per hour, 75% load - 15.5 gallons per hour, 50% load - 11.6 gallons per hour.	4,441.23	
01 22 23 00-0570	DAY		300.0 KW, 60 Hertz Diesel Powered Generator Set..... Note: Fuel consumption: 100% load - 22.7 gallons per hour, 75% load - 17.6 gallons per hour, 50% load - 13.6 gallons per hour.	745.69	
01 22 23 00-0571	WK		300.0 KW, 60 Hertz Diesel Powered Generator Set..... Note: Fuel consumption: 100% load - 22.7 gallons per hour, 75% load - 17.6 gallons per hour, 50% load - 13.6 gallons per hour.	1,809.39	
01 22 23 00-0572	MO		300.0 KW, 60 Hertz Diesel Powered Generator Set..... Note: Fuel consumption: 100% load - 22.7 gallons per hour, 75% load - 17.6 gallons per hour, 50% load - 13.6 gallons per hour.	4,934.70	
01 22 23 00-0573	DAY		350.0 KW, 60 Hertz Diesel Powered Generator Set..... Note: Fuel consumption: 100% load - 29.1 gallons per hour, 75% load - 23.9 gallons per hour, 50% load - 18.3 gallons per hour.	1,052.74	
01 22 23 00-0574	WK		350.0 KW, 60 Hertz Diesel Powered Generator Set..... Note: Fuel consumption: 100% load - 29.1 gallons per hour, 75% load - 23.9 gallons per hour, 50% load - 18.3 gallons per hour.	2,368.66	
01 22 23 00-0575	MO		350.0 KW, 60 Hertz Diesel Powered Generator Set..... Note: Fuel consumption: 100% load - 29.1 gallons per hour, 75% load - 23.9 gallons per hour, 50% load - 18.3 gallons per hour.	6,316.42	
01 22 23 00-0576	DAY		400.0 KW, 60 Hertz Diesel Powered Generator Set..... Note: Fuel consumption: 100% load - 32.7 gallons per hour, 75% load - 26.4 gallons per hour, 50% load - 19.9 gallons per hour.	1,124.02	
01 22 23 00-0577	WK		400.0 KW, 60 Hertz Diesel Powered Generator Set..... Note: Fuel consumption: 100% load - 32.7 gallons per hour, 75% load - 26.4 gallons per hour, 50% load - 19.9 gallons per hour.	2,719.57	
01 22 23 00-0578	MO		400.0 KW, 60 Hertz Diesel Powered Generator Set..... Note: Fuel consumption: 100% load - 32.7 gallons per hour, 75% load - 26.4 gallons per hour, 50% load - 19.9 gallons per hour.	7,950.35	
01 22 23 00-0579	DAY		500.0 KW, 60 Hertz Diesel Powered Generator Set..... Note: Fuel consumption: 100% load - 37.4 gallons per hour, 75% load - 28.5 gallons per hour, 50% load - 23.7 gallons per hour.	1,254.51	
01 22 23 00-0580	WK		500.0 KW, 60 Hertz Diesel Powered Generator Set..... Note: Fuel consumption: 100% load - 37.4 gallons per hour, 75% load - 28.5 gallons per hour, 50% load - 23.7 gallons per hour.	2,851.16	
01 22 23 00-0581	MO		500.0 KW, 60 Hertz Diesel Powered Generator Set..... Note: Fuel consumption: 100% load - 37.4 gallons per hour, 75% load - 28.5 gallons per hour, 50% load - 23.7 gallons per hour.	8,553.48	
01 22 23 00-0582	DAY		750.0 KW, 60 Hertz Diesel Powered Generator Set..... Note: Fuel consumption: 100% load - 54.8 gallons per hour, 75% load - 40.9 gallons per hour, 50% load - 28.8 gallons per hour.	1,754.56	
01 22 23 00-0583	WK		750.0 KW, 60 Hertz Diesel Powered Generator Set..... Note: Fuel consumption: 100% load - 54.8 gallons per hour, 75% load - 40.9 gallons per hour, 50% load - 28.8 gallons per hour.	4,386.40	
01 22 23 00-0584	MO		750.0 KW, 60 Hertz Diesel Powered Generator Set..... Note: Fuel consumption: 100% load - 54.8 gallons per hour, 75% load - 40.9 gallons per hour, 50% load - 28.8 gallons per hour.	13,159.20	
01 22 23 00-0585	EA		Up To 300 KW Generator Set Delivery, Set-Up, Testing And Pick-up.....	761.30	
01 22 23 00-0586	EA		350 To 750 KW Generator Set Delivery, Set-Up, Testing And Pick-up.....	1,193.61	
01 22 23 00-0587			Cabling For Generator Sets (01 22 23 00-0531) Note: Includes delivery to job site and pick-up when complete.		
01 22 23 00-0588	DAY		#1 Banded Cable, 50' With Camlock Ends For Generator Set.....	24.13	
01 22 23 00-0589	WK		#1 Banded Cable, 50' With Camlock Ends For Generator Set.....	42.22	
01 22 23 00-0590	MO		#1 Banded Cable, 50' With Camlock Ends For Generator Set.....	126.66	
01 22 23 00-0591	DAY		50', 4/0 Cable With Camlock Ends For Generator Set.....	12.06	
01 22 23 00-0592	WK		50', 4/0 Cable With Camlock Ends For Generator Set.....	35.09	
01 22 23 00-0593	MO		50', 4/0 Cable With Camlock Ends For Generator Set.....	97.60	
01 22 23 00-0594			Resistive Loadbanks (01 22 23 00-0531) Note: Includes delivery to job site and pick-up when complete. See CSI section 01 22 23 00-0615 for reimbursable fuel fees.		
01 22 23 00-0595	DAY		100 KW A/C Resistive Loadbank.....	387.75	
01 22 23 00-0596	WK		100 KW A/C Resistive Loadbank.....	957.00	
01 22 23 00-0597	MO		100 KW A/C Resistive Loadbank.....	2,862.75	
01 22 23 00-0598	DAY		650 KW A/C Resistive Loadbank.....	653.40	
01 22 23 00-0599	WK		650 KW A/C Resistive Loadbank.....	1,747.35	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
01 22 23 00-0600 MO 650 KW A/C Resistive Loadbank.....	4,455.00	
01 22 23 00-0601 Sub-Distribution Panels (Spider Box) (01 22 23 00-0531)		
Note: Includes delivery to job site and pick-up when complete.		
01 22 23 00-0602 DAY Sub-Distribution Panel (Spider Box)	59.22	
01 22 23 00-0603 WK Sub-Distribution Panel (Spider Box)	153.52	
01 22 23 00-0604 MO Sub-Distribution Panel (Spider Box)	433.16	
01 22 23 00-0605 Portable Distribution Panels (01 22 23 00-0531)		
Note: Includes delivery to job site and pick-up when complete.		
01 22 23 00-0606 DAY 200 Amp Spider Box Feeder Panel	131.59	
01 22 23 00-0607 WK 200 Amp Spider Box Feeder Panel	356.40	
01 22 23 00-0608 MO 200 Amp Spider Box Feeder Panel	997.91	
01 22 23 00-0609 DAY 100 Amp Quad Box Panel	107.47	
01 22 23 00-0610 WK 100 Amp Quad Box Panel	279.63	
01 22 23 00-0611 MO 100 Amp Quad Box Panel	795.04	
01 22 23 00-0612 DAY 200 Amp Quad Box Panel	137.08	
01 22 23 00-0613 WK 200 Amp Quad Box Panel	345.43	
01 22 23 00-0614 MO 200 Amp Quad Box Panel	937.59	
01 22 23 00-0615 Fuel Reimbursement For Generators (01 22 23 00-0531)		
01 22 23 00-0616 EA Fuel Reimbursement For Generators	1.00	
Note: Purchases made by the contractor for fuel will be reimbursed to the Contractor at the actual cost of the purchase, without mark-up, for which a receipt or bill is received. The Adjustment Factor applied to Reimbursable Fees will be 1.0000. The base cost of the purchase is \$1.00, quantity will adjust cost to actual purchase cost; i.e., quantity of 125 = \$125.00 purchase. If there are multiple purchases, each one shall be listed separately with a comment in the "note" block to identify the purchase.		
01 22 23 00-0617 Space Heaters (01 22 23 00-0516)		
Note: Includes delivery to job site and pick-up when complete. Excludes operator.		
01 22 23 00-0618 DAY 150,000 BTU/Hour Space Heater	46.52	
01 22 23 00-0619 WK 150,000 BTU/Hour Space Heater	133.74	
01 22 23 00-0620 MO 150,000 BTU/Hour Space Heater	377.98	
01 22 23 00-0621 DAY 500,000 BTU/Hour Space Heater	98.86	
01 22 23 00-0622 WK 500,000 BTU/Hour Space Heater	244.23	
01 22 23 00-0623 MO 500,000 BTU/Hour Space Heater	617.55	
01 22 23 00-0624 General Equipment (01 22 23)		
01 22 23 00-0625 Jacks And Bracing (01 22 23 00-0624)		
Note: Includes delivery to job site and pick-up when complete.		
01 22 23 00-0626 Manual Hydraulic Jacks (01 22 23 00-0625)		
01 22 23 00-0627 DAY 12 Ton Manual Hydraulic Bottle Jack	14.19	
01 22 23 00-0628 WK 12 Ton Manual Hydraulic Bottle Jack	36.90	
01 22 23 00-0629 MO 12 Ton Manual Hydraulic Bottle Jack	65.28	
01 22 23 00-0630 DAY 20 Ton Manual Hydraulic Bottle Jack	28.38	
01 22 23 00-0631 WK 20 Ton Manual Hydraulic Bottle Jack	79.48	
01 22 23 00-0632 MO 20 Ton Manual Hydraulic Bottle Jack	156.11	
01 22 23 00-0633 DAY 50 Ton Manual Hydraulic Bottle Jack	44.00	
01 22 23 00-0634 WK 50 Ton Manual Hydraulic Bottle Jack	109.28	
01 22 23 00-0635 MO 50 Ton Manual Hydraulic Bottle Jack	184.50	
01 22 23 00-0636 DAY 100 Ton Manual Hydraulic Bottle Jack	116.37	
01 22 23 00-0637 WK 100 Ton Manual Hydraulic Bottle Jack	279.58	
01 22 23 00-0638 MO 100 Ton Manual Hydraulic Bottle Jack	465.50	
01 22 23 00-0639 Manual Screw Jacks (01 22 23 00-0625)		
01 22 23 00-0640 DAY 10 To 20 Ton Manual Screw Jack	13.67	
01 22 23 00-0641 WK 10 To 20 Ton Manual Screw Jack	36.81	
01 22 23 00-0642 MO 10 To 20 Ton Manual Screw Jack	102.01	
01 22 23 00-0643 Pressure Washers (01 22 23 00-0624)		
Note: Includes full-time operator, delivery, set-up, and removal.		
01 22 23 00-0644 DAY 2,000 PSI Pressure Washer With Full-Time Operator	649.29	
<i>For Equipment Without Operator, Deduct</i>		
	-582.01	
01 22 23 00-0645 WK 2,000 PSI Pressure Washer With Full-Time Operator	3,080.83	
<i>For Equipment Without Operator, Deduct</i>		
	-2,910.05	
01 22 23 00-0646 MO 2,000 PSI Pressure Washer With Full-Time Operator	12,978.01	
<i>For Equipment Without Operator, Deduct</i>		
	-12,543.31	
01 22 23 00-0647 DAY 2,500 PSI Pressure Washer With Full-Time Operator	649.29	
<i>For Equipment Without Operator, Deduct</i>		
	-582.01	
01 22 23 00-0648 WK 2,500 PSI Pressure Washer With Full-Time Operator	3,080.83	
<i>For Equipment Without Operator, Deduct</i>		
	-2,910.05	
01 22 23 00-0649 MO 2,500 PSI Pressure Washer With Full-Time Operator	12,978.01	
<i>For Equipment Without Operator, Deduct</i>		
	-12,543.31	

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01 22 23 00-0650	DAY		3,000 PSI Pressure Washer With Full-Time Operator	649.29	
			<i>For Equipment Without Operator, Deduct</i>	-582.01	
01 22 23 00-0651	WK		3,000 PSI Pressure Washer With Full-Time Operator	3,080.83	
			<i>For Equipment Without Operator, Deduct</i>	-2,910.05	
01 22 23 00-0652	MO		3,000 PSI Pressure Washer With Full-Time Operator	12,978.01	
			<i>For Equipment Without Operator, Deduct</i>	-12,543.31	
01 22 23 00-0653	DAY		3,500 PSI Pressure Washer With Full-Time Operator	654.46	
			<i>For Equipment Without Operator, Deduct</i>	-582.01	
01 22 23 00-0654	WK		3,500 PSI Pressure Washer With Full-Time Operator	3,096.35	
			<i>For Equipment Without Operator, Deduct</i>	-2,910.05	
01 22 23 00-0655	MO		3,500 PSI Pressure Washer With Full-Time Operator	13,019.41	
			<i>For Equipment Without Operator, Deduct</i>	-12,543.31	
01 22 23 00-0656	DAY		4,000 PSI Pressure Washer With Full-Time Operator	675.16	
			<i>For Equipment Without Operator, Deduct</i>	-582.01	
01 22 23 00-0657	WK		4,000 PSI Pressure Washer With Full-Time Operator	3,163.63	
			<i>For Equipment Without Operator, Deduct</i>	-2,910.05	
01 22 23 00-0658	MO		4,000 PSI Pressure Washer With Full-Time Operator	13,252.29	
			<i>For Equipment Without Operator, Deduct</i>	-12,543.31	
01 22 23 00-0659	DAY		5,000 PSI Pressure Washer With Full-Time Operator	685.51	
			<i>For Equipment Without Operator, Deduct</i>	-582.01	
01 22 23 00-0660	WK		5,000 PSI Pressure Washer With Full-Time Operator	3,189.50	
			<i>For Equipment Without Operator, Deduct</i>	-2,910.05	
01 22 23 00-0661	MO		5,000 PSI Pressure Washer With Full-Time Operator	13,329.91	
			<i>For Equipment Without Operator, Deduct</i>	-12,543.31	
01 22 23 00-0662			Confined Space Entry Equipment (01 22 23 00-0624)		
			Note: Includes delivery, set-up, and removal.		
01 22 23 00-0663	DAY		Ventilation Equipment For Confined Space	47.47	
			Note: Includes electric or gas blower and ventilation duct up to 25'.		
01 22 23 00-0664	WK		Ventilation Equipment For Confined Space	142.42	
			Note: Includes electric or gas blower and ventilation duct up to 25'.		
01 22 23 00-0665	MO		Ventilation Equipment For Confined Space	424.99	
			Note: Includes electric or gas blower and ventilation duct up to 25'.		
01 22 23 00-0666	DAY		Confined Space Air Monitor, Tripod, Harness, Cables, SCBAs And Complete Assembly	31.98	
01 22 23 00-0667	WK		Confined Space Air Monitor, Tripod, Harness, Cables, SCBAs And Complete Assembly	95.95	
01 22 23 00-0668	MO		Confined Space Air Monitor, Tripod, Harness, Cables, SCBAs And Complete Assembly	287.85	
01 22 23 00-0669	DAY		Confined Space Air Monitor Personnel	638.87	
			Note: Per person day.		
01 22 23 00-0670			Material Handling Equipment (01 22 23)		
01 22 23 00-0671			Cranes, Hydraulic Truck Mounted, Up To 110' (01 22 23 00-0670)		
			Note: Includes full-time operator. Excludes delivery, set-up, and removal		
01 22 23 00-0672	DAY		6 Ton Lift Hydraulic Crane With Full-Time Operator	1,076.25	
			<i>For Equipment Without Operator, Deduct</i>	-642.31	
01 22 23 00-0673	WK		6 Ton Lift Hydraulic Crane With Full-Time Operator	4,526.16	
			<i>For Equipment Without Operator, Deduct</i>	-3,211.57	
01 22 23 00-0674	MO		6 Ton Lift Hydraulic Crane With Full-Time Operator	17,799.51	
			<i>For Equipment Without Operator, Deduct</i>	-13,842.98	
01 22 23 00-0675	DAY		8 To 9 Ton Lift Hydraulic Crane With Full-Time Operator	1,191.12	
			<i>For Equipment Without Operator, Deduct</i>	-642.31	
01 22 23 00-0676	WK		8 To 9 Ton Lift Hydraulic Crane With Full-Time Operator	4,867.57	
			<i>For Equipment Without Operator, Deduct</i>	-3,211.57	
01 22 23 00-0677	MO		8 To 9 Ton Lift Hydraulic Crane With Full-Time Operator	18,820.55	
			<i>For Equipment Without Operator, Deduct</i>	-13,842.98	
01 22 23 00-0678	DAY		14 To 15 Ton Lift Hydraulic Crane With Full-Time Operator	1,305.99	
			<i>For Equipment Without Operator, Deduct</i>	-642.31	
01 22 23 00-0679	WK		14 To 15 Ton Lift Hydraulic Crane With Full-Time Operator	5,208.98	
			<i>For Equipment Without Operator, Deduct</i>	-3,211.57	
01 22 23 00-0680	MO		14 To 15 Ton Lift Hydraulic Crane With Full-Time Operator	19,841.59	
			<i>For Equipment Without Operator, Deduct</i>	-13,842.98	
01 22 23 00-0681	DAY		20 To 25 Ton Lift Hydraulic Crane With Full-Time Operator	1,459.14	
			<i>For Equipment Without Operator, Deduct</i>	-642.31	
01 22 23 00-0682	WK		20 To 25 Ton Lift Hydraulic Crane With Full-Time Operator	5,668.45	
			<i>For Equipment Without Operator, Deduct</i>	-3,211.57	
01 22 23 00-0683	MO		20 To 25 Ton Lift Hydraulic Crane With Full-Time Operator	21,213.61	
			<i>For Equipment Without Operator, Deduct</i>	-13,842.98	
01 22 23 00-0684	DAY		30 To 35 Ton Lift Hydraulic Crane With Full-Time Operator	1,599.53	
			<i>For Equipment Without Operator, Deduct</i>	-642.31	
01 22 23 00-0685	WK		30 To 35 Ton Lift Hydraulic Crane With Full-Time Operator	6,619.29	
			<i>For Equipment Without Operator, Deduct</i>	-3,211.57	
01 22 23 00-0686	MO		30 To 35 Ton Lift Hydraulic Crane With Full-Time Operator	24,063.59	
			<i>For Equipment Without Operator, Deduct</i>	-13,842.98	
01 22 23 00-0687	DAY		40 To 45 Ton Lift Hydraulic Crane With Full-Time Operator	1,931.37	
			<i>For Equipment Without Operator, Deduct</i>	-642.31	
01 22 23 00-0688	WK		40 To 45 Ton Lift Hydraulic Crane With Full-Time Operator	7,806.25	
			<i>For Equipment Without Operator, Deduct</i>	-3,211.57	
01 22 23 00-0689	MO		40 To 45 Ton Lift Hydraulic Crane With Full-Time Operator	27,627.02	
			<i>For Equipment Without Operator, Deduct</i>	-13,842.98	
01 22 23 00-0690	DAY		50 To 55 Ton Lift Hydraulic Crane With Full-Time Operator	2,141.96	
			<i>For Equipment Without Operator, Deduct</i>	-642.31	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
01 22 23 00-0691 WK 50 To 55 Ton Lift Hydraulic Crane With Full-Time Operator <i>For Equipment Without Operator, Deduct</i>	8,546.50 -3,211.57	
01 22 23 00-0692 MO 50 To 55 Ton Lift Hydraulic Crane With Full-Time Operator <i>For Equipment Without Operator, Deduct</i>	29,852.89 -13,842.98	
01 22 23 00-0693 DAY 60 To 65 Ton Lift Hydraulic Crane With Full-Time Operator <i>For Equipment Without Operator, Deduct</i>	2,307.88 -642.31	
01 22 23 00-0694 WK 60 To 65 Ton Lift Hydraulic Crane With Full-Time Operator <i>For Equipment Without Operator, Deduct</i>	9,146.37 -3,211.57	
01 22 23 00-0695 MO 60 To 65 Ton Lift Hydraulic Crane With Full-Time Operator <i>For Equipment Without Operator, Deduct</i>	31,649.92 -13,842.98	
01 22 23 00-0696 DAY 70 To 75 Ton Lift Hydraulic Crane With Full-Time Operator <i>For Equipment Without Operator, Deduct</i>	2,473.80 -642.31	
01 22 23 00-0697 WK 70 To 75 Ton Lift Hydraulic Crane With Full-Time Operator <i>For Equipment Without Operator, Deduct</i>	9,746.23 -3,211.57	
01 22 23 00-0698 MO 70 To 75 Ton Lift Hydraulic Crane With Full-Time Operator <i>For Equipment Without Operator, Deduct</i>	33,446.95 -13,842.98	
01 22 23 00-0699 DAY 90 Ton Lift Hydraulic Crane With Full-Time Operator <i>For Equipment Without Operator, Deduct</i>	2,582.29 -642.31	
01 22 23 00-0700 WK 90 Ton Lift Hydraulic Crane With Full-Time Operator <i>For Equipment Without Operator, Deduct</i>	10,116.35 -3,211.57	
01 22 23 00-0701 MO 90 Ton Lift Hydraulic Crane With Full-Time Operator <i>For Equipment Without Operator, Deduct</i>	34,570.09 -13,842.98	
01 22 23 00-0702 DAY 100 Ton Lift Hydraulic Crane With Full-Time Operator <i>For Equipment Without Operator, Deduct</i>	2,729.06 -642.31	
01 22 23 00-0703 WK 100 Ton Lift Hydraulic Crane With Full-Time Operator <i>For Equipment Without Operator, Deduct</i>	10,665.16 -3,211.57	
01 22 23 00-0704 MO 100 Ton Lift Hydraulic Crane With Full-Time Operator <i>For Equipment Without Operator, Deduct</i>	36,203.76 -13,842.98	
01 22 23 00-0705 Cranes, Mechanical, Cable Controlled Lattice Boom, Truck Mounted <small>(01 22 23 00-0670)</small>		
<i>Note: Includes full-time operator. Excludes delivery, set-up, and removal.</i>		
01 22 23 00-0706 DAY 75 To 80 Ton Lift Mechanical Crane With Full-Time Operator <i>For Equipment Without Operator, Deduct</i>	2,173.87 -642.31	
01 22 23 00-0707 WK 75 To 80 Ton Lift Mechanical Crane With Full-Time Operator <i>For Equipment Without Operator, Deduct</i>	8,674.13 -3,211.57	
01 22 23 00-0708 MO 75 To 80 Ton Lift Mechanical Crane With Full-Time Operator <i>For Equipment Without Operator, Deduct</i>	30,230.67 -13,842.98	
01 22 23 00-0709 DAY 100 To 110 Ton Lift Mechanical Crane With Full-Time Operator <i>For Equipment Without Operator, Deduct</i>	3,354.45 -642.31	
01 22 23 00-0710 WK 100 To 110 Ton Lift Mechanical Crane With Full-Time Operator <i>For Equipment Without Operator, Deduct</i>	10,639.64 -3,211.57	
01 22 23 00-0711 MO 100 To 110 Ton Lift Mechanical Crane With Full-Time Operator <i>For Equipment Without Operator, Deduct</i>	36,127.18 -13,842.98	
01 22 23 00-0712 DAY 125 Ton Lift Mechanical Crane With Full-Time Operator <i>For Equipment Without Operator, Deduct</i>	3,545.89 -642.31	
01 22 23 00-0713 WK 125 Ton Lift Mechanical Crane With Full-Time Operator <i>For Equipment Without Operator, Deduct</i>	12,037.18 -3,211.57	
01 22 23 00-0714 MO 125 Ton Lift Mechanical Crane With Full-Time Operator <i>For Equipment Without Operator, Deduct</i>	40,318.55 -13,842.98	
01 22 23 00-0715 DAY 150 Ton Lift Mechanical Crane With Full-Time Operator <i>For Equipment Without Operator, Deduct</i>	3,928.78 -642.31	
01 22 23 00-0716 WK 150 Ton Lift Mechanical Crane With Full-Time Operator <i>For Equipment Without Operator, Deduct</i>	13,434.73 -3,211.57	
01 22 23 00-0717 MO 150 Ton Lift Mechanical Crane With Full-Time Operator <i>For Equipment Without Operator, Deduct</i>	44,504.81 -13,842.98	
01 22 23 00-0718 DAY 250 Ton Lift Mechanical Crane With Full-Time Operator <i>For Equipment Without Operator, Deduct</i>	4,292.53 -642.31	
01 22 23 00-0719 WK 250 Ton Lift Mechanical Crane With Full-Time Operator <i>For Equipment Without Operator, Deduct</i>	16,229.83 -3,211.57	
01 22 23 00-0720 MO 250 Ton Lift Mechanical Crane With Full-Time Operator <i>For Equipment Without Operator, Deduct</i>	52,897.76 -13,842.98	
01 22 23 00-0721 DAY 300 Ton Lift Mechanical Crane With Full-Time Operator <i>For Equipment Without Operator, Deduct</i>	4,892.39 -642.31	
01 22 23 00-0722 WK 300 Ton Lift Mechanical Crane With Full-Time Operator <i>For Equipment Without Operator, Deduct</i>	18,380.40 -3,211.57	
01 22 23 00-0723 MO 300 Ton Lift Mechanical Crane With Full-Time Operator <i>For Equipment Without Operator, Deduct</i>	59,340.52 -13,842.98	
01 22 23 00-0724 DAY 500 Ton Lift Mechanical Crane With Full-Time Operator <i>For Equipment Without Operator, Deduct</i>	8,580.90 -642.31	
01 22 23 00-0725 WK 500 Ton Lift Mechanical Crane With Full-Time Operator <i>For Equipment Without Operator, Deduct</i>	31,526.29 -3,211.57	
01 22 23 00-0726 MO 500 Ton Lift Mechanical Crane With Full-Time Operator <i>For Equipment Without Operator, Deduct</i>	98,793.51 -13,842.98	
01 22 23 00-0727 Telescopic Boom, Hi-Reach, Rough Terrain Construction Forklifts <small>(01 22 23 00-0670)</small>		
<i>Note: Includes full-time operator. Excludes delivery, set-up, and removal.</i>		
01 22 23 00-0728 DAY 5,000 LB Telescopic Boom, Hi-Reach, Rough Terrain Construction Forklift With Full-Time Operator <i>For Equipment Without Operator, Deduct</i>	1,098.37 -638.87	
01 22 23 00-0729 WK 5,000 LB Telescopic Boom, Hi-Reach, Rough Terrain Construction Forklift With Full-Time Operator <i>For Equipment Without Operator, Deduct</i>	4,318.91 -3,194.35	
01 22 23 00-0730 MO 5,000 LB Telescopic Boom, Hi-Reach, Rough Terrain Construction Forklift With Full-Time Operator <i>For Equipment Without Operator, Deduct</i>	16,187.14 -13,768.74	

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01 22 23 00-0731 DAY 6,000 LB Telescopic Boom, Hi-Reach, Rough Terrain Construction Forklift With Full-Time Operator.....	1,146.73	
<i>For Equipment Without Operator, Deduct</i>	-638.87	
01 22 23 00-0732 WK 6,000 LB Telescopic Boom, Hi-Reach, Rough Terrain Construction Forklift With Full-Time Operator.....	4,427.73	
<i>For Equipment Without Operator, Deduct</i>	-3,194.35	
01 22 23 00-0733 MO 6,000 LB Telescopic Boom, Hi-Reach, Rough Terrain Construction Forklift With Full-Time Operator.....	16,428.98	
<i>For Equipment Without Operator, Deduct</i>	-13,768.74	
01 22 23 00-0734 DAY 8,000 LB Telescopic Boom, Hi-Reach, Rough Terrain Construction Forklift With Full-Time Operator.....	1,134.64	
<i>For Equipment Without Operator, Deduct</i>	-638.87	
01 22 23 00-0735 WK 8,000 LB Telescopic Boom, Hi-Reach, Rough Terrain Construction Forklift With Full-Time Operator.....	4,482.15	
<i>For Equipment Without Operator, Deduct</i>	-3,194.35	
01 22 23 00-0736 MO 8,000 LB Telescopic Boom, Hi-Reach, Rough Terrain Construction Forklift With Full-Time Operator.....	16,791.74	
<i>For Equipment Without Operator, Deduct</i>	-13,768.74	
01 22 23 00-0737 DAY 10,000 LB Telescopic Boom, Hi-Reach, Rough Terrain Construction Forklift With Full-Time Operator.....	1,273.70	
<i>For Equipment Without Operator, Deduct</i>	-638.87	
01 22 23 00-0738 WK 10,000 LB Telescopic Boom, Hi-Reach, Rough Terrain Construction Forklift With Full-Time Operator.....	4,844.91	
<i>For Equipment Without Operator, Deduct</i>	-3,194.35	
01 22 23 00-0739 MO 10,000 LB Telescopic Boom, Hi-Reach, Rough Terrain Construction Forklift With Full-Time Operator.....	17,638.18	
<i>For Equipment Without Operator, Deduct</i>	-13,768.74	
01 22 23 00-0740 Straight Mast, Rough Terrain Construction Forklifts <small>(01 22 23 00-0670)</small>		
Note: Includes full-time operator. Excludes delivery, set-up, and removal.		
01 22 23 00-0741 DAY 5,000 LB Straight Mast, Rough Terrain Construction Forklift With Full-Time Operator.....	937.54	
<i>For Equipment Without Operator, Deduct</i>	-638.87	
<i>For Propane Instead Of Gas Or Diesel, Add</i>	59.73	
01 22 23 00-0742 WK 5,000 LB Straight Mast, Rough Terrain Construction Forklift With Full-Time Operator.....	4,009.96	
<i>For Equipment Without Operator, Deduct</i>	-3,194.35	
<i>For Propane Instead Of Gas Or Diesel, Add</i>	163.12	
01 22 23 00-0743 MO 5,000 LB Straight Mast, Rough Terrain Construction Forklift With Full-Time Operator.....	15,635.44	
<i>For Equipment Without Operator, Deduct</i>	-13,768.74	
<i>For Propane Instead Of Gas Or Diesel, Add</i>	373.34	
01 22 23 00-0744 DAY 6,000 LB Straight Mast, Rough Terrain Construction Forklift With Full-Time Operator.....	953.26	
<i>For Equipment Without Operator, Deduct</i>	-638.87	
<i>For Propane Instead Of Gas Or Diesel, Add</i>	62.88	
01 22 23 00-0745 WK 6,000 LB Straight Mast, Rough Terrain Construction Forklift With Full-Time Operator.....	4,052.88	
<i>For Equipment Without Operator, Deduct</i>	-3,194.35	
<i>For Propane Instead Of Gas Or Diesel, Add</i>	171.71	
01 22 23 00-0746 MO 6,000 LB Straight Mast, Rough Terrain Construction Forklift With Full-Time Operator.....	15,733.69	
<i>For Equipment Without Operator, Deduct</i>	-13,768.74	
<i>For Propane Instead Of Gas Or Diesel, Add</i>	392.99	
01 22 23 00-0747 DAY 8,000 LB Straight Mast, Rough Terrain Construction Forklift With Full-Time Operator.....	1,037.91	
<i>For Equipment Without Operator, Deduct</i>	-638.87	
<i>For Propane Instead Of Gas Or Diesel, Add</i>	79.81	
01 22 23 00-0748 WK 8,000 LB Straight Mast, Rough Terrain Construction Forklift With Full-Time Operator.....	4,288.68	
<i>For Equipment Without Operator, Deduct</i>	-3,194.35	
<i>For Propane Instead Of Gas Or Diesel, Add</i>	218.87	
01 22 23 00-0749 MO 8,000 LB Straight Mast, Rough Terrain Construction Forklift With Full-Time Operator.....	16,277.83	
<i>For Equipment Without Operator, Deduct</i>	-13,768.74	
<i>For Propane Instead Of Gas Or Diesel, Add</i>	501.82	
01 22 23 00-0750 DAY 10,000 LB Straight Mast, Rough Terrain Construction Forklift With Full-Time Operator.....	1,084.52	
<i>For Equipment Without Operator, Deduct</i>	-638.87	
<i>For Propane Instead Of Gas Or Diesel, Add</i>	89.13	
01 22 23 00-0751 WK 10,000 LB Straight Mast, Rough Terrain Construction Forklift With Full-Time Operator.....	4,268.48	
<i>For Equipment Without Operator, Deduct</i>	-3,194.35	
<i>For Propane Instead Of Gas Or Diesel, Add</i>	214.83	
01 22 23 00-0752 MO 10,000 LB Straight Mast, Rough Terrain Construction Forklift With Full-Time Operator.....	16,442.64	
<i>For Equipment Without Operator, Deduct</i>	-13,768.74	
<i>For Propane Instead Of Gas Or Diesel, Add</i>	534.78	
01 22 23 00-0753 Straight Mast, Industrial Warehouse Forklifts <small>(01 22 23 00-0670)</small>		
Note: Includes full-time operator. Excludes delivery, set-up, and removal.		
01 22 23 00-0754 DAY 5,000 LB Straight Mast, Industrial Warehouse Forklift With Full-Time Operator.....	892.80	
<i>For Equipment Without Operator, Deduct</i>	-638.87	
<i>For Propane Instead Of Gas Or Diesel, Add</i>	50.79	
01 22 23 00-0755 WK 5,000 LB Straight Mast, Industrial Warehouse Forklift With Full-Time Operator.....	3,774.77	
<i>For Equipment Without Operator, Deduct</i>	-3,194.35	
<i>For Propane Instead Of Gas Or Diesel, Add</i>	116.08	
01 22 23 00-0756 MO 5,000 LB Straight Mast, Industrial Warehouse Forklift With Full-Time Operator.....	15,159.32	
<i>For Equipment Without Operator, Deduct</i>	-13,768.74	
<i>For Propane Instead Of Gas Or Diesel, Add</i>	278.12	
01 22 23 00-0757 DAY 6,000 LB Straight Mast, Industrial Warehouse Forklift With Full-Time Operator.....	898.85	
<i>For Equipment Without Operator, Deduct</i>	-638.87	
<i>For Propane Instead Of Gas Or Diesel, Add</i>	52.00	
01 22 23 00-0758 WK 6,000 LB Straight Mast, Industrial Warehouse Forklift With Full-Time Operator.....	3,792.90	
<i>For Equipment Without Operator, Deduct</i>	-3,194.35	
<i>For Propane Instead Of Gas Or Diesel, Add</i>	119.71	
01 22 23 00-0759 MO 6,000 LB Straight Mast, Industrial Warehouse Forklift With Full-Time Operator.....	15,201.64	
<i>For Equipment Without Operator, Deduct</i>	-13,768.74	
<i>For Propane Instead Of Gas Or Diesel, Add</i>	286.58	
01 22 23 00-0760 DAY 8,000 LB Straight Mast, Industrial Warehouse Forklift With Full-Time Operator.....	1,025.81	
<i>For Equipment Without Operator, Deduct</i>	-638.87	
<i>For Propane Instead Of Gas Or Diesel, Add</i>	77.39	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
01 22 23 00-0761 WK 8,000 LB Straight Mast, Industrial Warehouse Forklift With Full-Time Operator.....	4,071.02	
<i>For Equipment Without Operator, Deduct</i>	-3,194.35	
<i>For Propane Instead Of Gas Or Diesel, Add</i>	175.33	
01 22 23 00-0762 MO 8,000 LB Straight Mast, Industrial Warehouse Forklift With Full-Time Operator.....	15,884.84	
<i>For Equipment Without Operator, Deduct</i>	-13,768.74	
<i>For Propane Instead Of Gas Or Diesel, Add</i>	423.22	
01 22 23 00-0763 DAY 12,000 LB Straight Mast, Industrial Warehouse Forklift With Full-Time Operator.....	1,037.91	
<i>For Equipment Without Operator, Deduct</i>	-638.87	
<i>For Propane Instead Of Gas Or Diesel, Add</i>	79.81	
01 22 23 00-0764 WK 12,000 LB Straight Mast, Industrial Warehouse Forklift With Full-Time Operator.....	4,173.80	
<i>For Equipment Without Operator, Deduct</i>	-3,194.35	
<i>For Propane Instead Of Gas Or Diesel, Add</i>	195.89	
01 22 23 00-0765 MO 12,000 LB Straight Mast, Industrial Warehouse Forklift With Full-Time Operator.....	16,247.60	
<i>For Equipment Without Operator, Deduct</i>	-13,768.74	
<i>For Propane Instead Of Gas Or Diesel, Add</i>	495.77	
01 22 23 00-0766 DAY 15,000 LB Straight Mast, Industrial Warehouse Forklift With Full-Time Operator.....	1,146.73	
<i>For Equipment Without Operator, Deduct</i>	-638.87	
<i>For Propane Instead Of Gas Or Diesel, Add</i>	101.57	
01 22 23 00-0767 WK 15,000 LB Straight Mast, Industrial Warehouse Forklift With Full-Time Operator.....	4,349.14	
<i>For Equipment Without Operator, Deduct</i>	-3,194.35	
<i>For Propane Instead Of Gas Or Diesel, Add</i>	230.96	
01 22 23 00-0768 MO 15,000 LB Straight Mast, Industrial Warehouse Forklift With Full-Time Operator.....	16,549.90	
<i>For Equipment Without Operator, Deduct</i>	-13,768.74	
<i>For Propane Instead Of Gas Or Diesel, Add</i>	556.23	
01 22 23 00-0769 Chain Hoists <small>(01 22 23 00-0670)</small>		
<small>Note: Includes delivery to job site and pick-up when complete.</small>		
01 22 23 00-0770 DAY 1 Ton, 20' Lift, Manual Chain Hoist.....	14.19	
01 22 23 00-0771 WK 1 Ton, 20' Lift, Manual Chain Hoist.....	38.32	
01 22 23 00-0772 MO 1 Ton, 20' Lift, Manual Chain Hoist.....	96.51	
01 22 23 00-0773 DAY 3 Ton, 20' Lift, Manual Chain Hoist.....	31.22	
01 22 23 00-0774 WK 3 Ton, 20' Lift, Manual Chain Hoist.....	75.22	
01 22 23 00-0775 MO 3 Ton, 20' Lift, Manual Chain Hoist.....	187.33	
01 22 23 00-0776 DAY 5 Ton, 20' Lift, Manual Chain Hoist.....	45.41	
01 22 23 00-0777 WK 5 Ton, 20' Lift, Manual Chain Hoist.....	109.28	
01 22 23 00-0778 MO 5 Ton, 20' Lift, Manual Chain Hoist.....	272.49	
01 22 23 00-0779 DAY 2 Ton, 20' Lift, 2-Speed, 230/460 Volt, 60 Cycle, Electric Chain Hoist.....	90.83	
01 22 23 00-0780 WK 2 Ton, 20' Lift, 2-Speed, 230/460 Volt, 60 Cycle, Electric Chain Hoist.....	218.56	
01 22 23 00-0781 MO 2 Ton, 20' Lift, 2-Speed, 230/460 Volt, 60 Cycle, Electric Chain Hoist.....	544.97	
01 22 23 00-0782 DAY 3 Ton, 20' Lift, 2-Speed, 230/460 Volt, 60 Cycle, Electric Chain Hoist.....	102.18	
01 22 23 00-0783 WK 3 Ton, 20' Lift, 2-Speed, 230/460 Volt, 60 Cycle, Electric Chain Hoist.....	246.94	
01 22 23 00-0784 MO 3 Ton, 20' Lift, 2-Speed, 230/460 Volt, 60 Cycle, Electric Chain Hoist.....	613.09	
01 22 23 00-0785 DAY 5 Ton, 20' Lift, 2-Speed, 230/460 Volt, 60 Cycle, Electric Chain Hoist.....	127.73	
01 22 23 00-0786 WK 5 Ton, 20' Lift, 2-Speed, 230/460 Volt, 60 Cycle, Electric Chain Hoist.....	307.97	
01 22 23 00-0787 MO 5 Ton, 20' Lift, 2-Speed, 230/460 Volt, 60 Cycle, Electric Chain Hoist.....	766.37	
01 22 23 00-0788 Roof Swing Hoist, Hand Powered, 300# <small>(01 22 23 00-0670)</small>		
01 22 23 00-0789 DAY Roof Swing Hoist, Hand Powered, 300#.....	50.00	
01 22 23 00-0790 WK Roof Swing Hoist, Hand Powered, 300#.....	200.00	
01 22 23 00-0791 MO Roof Swing Hoist, Hand Powered, 300#.....	600.00	
01 22 23 00-0792 Pumping Equipment <small>(01 22 23)</small>		
01 22 23 00-0793 Gas Powered Portable Centrifugal Pumps <small>(01 22 23 00-0792)</small>		
<small>Note: Includes delivery, set-up, and removal. Excludes operator. See CSI section 01 22 23 00-0817 for larger diameter pumps.</small>		
01 22 23 00-0794 DAY 8,500 GPH, 2" Discharge, 108' Maximum Head, Gas Powered Portable Centrifugal Pump.....	55.90	
01 22 23 00-0795 WK 8,500 GPH, 2" Discharge, 108' Maximum Head, Gas Powered Portable Centrifugal Pump.....	125.78	
01 22 23 00-0796 MO 8,500 GPH, 2" Discharge, 108' Maximum Head, Gas Powered Portable Centrifugal Pump.....	335.42	
01 22 23 00-0797 DAY 16,500 GPH, 3" Discharge, 85' Maximum Head, Gas Powered Portable Centrifugal Pump.....	67.08	
01 22 23 00-0798 WK 16,500 GPH, 3" Discharge, 85' Maximum Head, Gas Powered Portable Centrifugal Pump.....	150.94	
01 22 23 00-0799 MO 16,500 GPH, 3" Discharge, 85' Maximum Head, Gas Powered Portable Centrifugal Pump.....	402.51	
01 22 23 00-0800 Gas Powered Portable Diaphragm Pumps <small>(01 22 23 00-0792)</small>		
<small>Note: Includes delivery, set-up, and removal. Excludes operator.</small>		
01 22 23 00-0801 DAY 3,000 GPH, 2" Discharge, 25' Maximum Head, Gas Powered Portable Diaphragm Pump.....	64.29	
01 22 23 00-0802 WK 3,000 GPH, 2" Discharge, 25' Maximum Head, Gas Powered Portable Diaphragm Pump.....	181.69	
01 22 23 00-0803 MO 3,000 GPH, 2" Discharge, 25' Maximum Head, Gas Powered Portable Diaphragm Pump.....	461.21	
01 22 23 00-0804 DAY 5,200 GPH, 3" Discharge, 25' Maximum Head, Gas Powered Portable Diaphragm Pump.....	78.27	
01 22 23 00-0805 WK 5,200 GPH, 3" Discharge, 25' Maximum Head, Gas Powered Portable Diaphragm Pump.....	209.64	
01 22 23 00-0806 MO 5,200 GPH, 3" Discharge, 25' Maximum Head, Gas Powered Portable Diaphragm Pump.....	593.98	
01 22 23 00-0807 Gas Powered Portable Trash Pumps <small>(01 22 23 00-0792)</small>		
<small>Note: Includes delivery, set-up, and removal. Excludes operator.</small>		
01 22 23 00-0808 DAY 12,000 GPH, 2" Discharge, 100' Maximum Head, Gas Powered Portable Trash Pump.....	81.06	
01 22 23 00-0809 WK 12,000 GPH, 2" Discharge, 100' Maximum Head, Gas Powered Portable Trash Pump.....	167.71	
01 22 23 00-0810 MO 12,000 GPH, 2" Discharge, 100' Maximum Head, Gas Powered Portable Trash Pump.....	503.14	
01 22 23 00-0811 DAY 25,000 GPH, 3" Discharge, 90' Maximum Head, Gas Powered Portable Trash Pump.....	81.06	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
01 22 23 00-0812	WK		25,000 GPH, 3" Discharge, 90' Maximum Head, Gas Powered Portable Trash Pump.....	216.63	
01 22 23 00-0813	MO		25,000 GPH, 3" Discharge, 90' Maximum Head, Gas Powered Portable Trash Pump.....	593.98	
01 22 23 00-0814	DAY		35,000 GPH, 4" Discharge, 106' Maximum Head, Gas Powered Portable Trash Pump.....	128.58	
01 22 23 00-0815	WK		35,000 GPH, 4" Discharge, 106' Maximum Head, Gas Powered Portable Trash Pump.....	363.38	
01 22 23 00-0816	MO		35,000 GPH, 4" Discharge, 106' Maximum Head, Gas Powered Portable Trash Pump.....	1,055.19	
01 22 23 00-0817			Diesel Powered Portable Trash Pumps (01 22 23 00-0792)		
			Note: Includes delivery, set-up, and removal. Excludes operator.		
01 22 23 00-0818	DAY		63,000 GPH, 4" Discharge, 153' Maximum Head, Diesel Powered Portable Trash Pump	251.57	
01 22 23 00-0819	WK		63,000 GPH, 4" Discharge, 153' Maximum Head, Diesel Powered Portable Trash Pump	684.82	
01 22 23 00-0820	MO		63,000 GPH, 4" Discharge, 153' Maximum Head, Diesel Powered Portable Trash Pump	2,983.88	
01 22 23 00-0821	DAY		156,000 GPH, 6" Discharge, 160' Maximum Head, Diesel Powered Portable Trash Pump	384.34	
01 22 23 00-0822	WK		156,000 GPH, 6" Discharge, 160' Maximum Head, Diesel Powered Portable Trash Pump	1,006.27	
01 22 23 00-0823	MO		156,000 GPH, 6" Discharge, 160' Maximum Head, Diesel Powered Portable Trash Pump	2,676.40	
01 22 23 00-0824	DAY		246,000 GPH, 10" Discharge, 160' Maximum Head, Diesel Powered Portable Trash Pump	522.70	
01 22 23 00-0825	WK		246,000 GPH, 10" Discharge, 160' Maximum Head, Diesel Powered Portable Trash Pump	1,399.00	
01 22 23 00-0826	MO		246,000 GPH, 10" Discharge, 160' Maximum Head, Diesel Powered Portable Trash Pump	3,742.77	
01 22 23 00-0827	DAY		379,000 GPH, 12" Discharge, 104' Maximum Head, Diesel Powered Portable Trash Pump	676.44	
01 22 23 00-0828	WK		379,000 GPH, 12" Discharge, 104' Maximum Head, Diesel Powered Portable Trash Pump	1,727.43	
01 22 23 00-0829	MO		379,000 GPH, 12" Discharge, 104' Maximum Head, Diesel Powered Portable Trash Pump	5,073.29	
01 22 23 00-0830			Diesel Powered Portable Silenced Environmental Trash Pumps (01 22 23 00-0792)		
			Note: Includes delivery, set-up, and removal. Excludes operator.		
01 22 23 00-0831	DAY		90,000 GPH, 4" Discharge, 330' Maximum Head, Diesel Powered Portable Silenced Environmental Trash Pump	359.18	
01 22 23 00-0832	WK		90,000 GPH, 4" Discharge, 330' Maximum Head, Diesel Powered Portable Silenced Environmental Trash Pump	817.60	
01 22 23 00-0833	MO		90,000 GPH, 4" Discharge, 330' Maximum Head, Diesel Powered Portable Silenced Environmental Trash Pump	2,549.22	
01 22 23 00-0834	DAY		136,800 GPH, 6" Discharge, 158' Maximum Head, Diesel Powered Portable Silenced Environmental Trash Pump	440.24	
01 22 23 00-0835	WK		136,800 GPH, 6" Discharge, 158' Maximum Head, Diesel Powered Portable Silenced Environmental Trash Pump	1,097.12	
01 22 23 00-0836	MO		136,800 GPH, 6" Discharge, 158' Maximum Head, Diesel Powered Portable Silenced Environmental Trash Pump	2,983.88	
01 22 23 00-0837	DAY		246,000 GPH, 10" Discharge, 158' Maximum Head, Diesel Powered Portable Silenced Environmental Trash Pump	531.09	
01 22 23 00-0838	WK		246,000 GPH, 10" Discharge, 158' Maximum Head, Diesel Powered Portable Silenced Environmental Trash Pump	1,570.90	
01 22 23 00-0839	MO		246,000 GPH, 10" Discharge, 158' Maximum Head, Diesel Powered Portable Silenced Environmental Trash Pump	4,381.48	
01 22 23 00-0840	DAY		510,000 GPH, 12" Discharge, 200' Maximum Head, Diesel Powered Portable Silenced Environmental Trash Pump	799.43	
01 22 23 00-0841	WK		510,000 GPH, 12" Discharge, 200' Maximum Head, Diesel Powered Portable Silenced Environmental Trash Pump	2,041.89	
01 22 23 00-0842	MO		510,000 GPH, 12" Discharge, 200' Maximum Head, Diesel Powered Portable Silenced Environmental Trash Pump	5,995.70	
01 22 23 00-0843			3 Phase Electric Submersible Pumps (01 22 23 00-0792)		
			Note: Includes delivery, set-up, and removal. Excludes operator.		
01 22 23 00-0844	DAY		24,000 GPH, 3" Discharge, 78' Maximum Head, 3 Phase Electric Submersible Pump	139.76	
01 22 23 00-0845	WK		24,000 GPH, 3" Discharge, 78' Maximum Head, 3 Phase Electric Submersible Pump	349.40	
01 22 23 00-0846	MO		24,000 GPH, 3" Discharge, 78' Maximum Head, 3 Phase Electric Submersible Pump	1,048.20	
01 22 23 00-0847	DAY		49,800 GPH, 4" Discharge, 98' Maximum Head, 3 Phase Electric Submersible Pump	184.48	
01 22 23 00-0848	WK		49,800 GPH, 4" Discharge, 98' Maximum Head, 3 Phase Electric Submersible Pump	461.21	
01 22 23 00-0849	MO		49,800 GPH, 4" Discharge, 98' Maximum Head, 3 Phase Electric Submersible Pump	1,383.62	
01 22 23 00-0850			Hydraulic Submersible Pumps (01 22 23 00-0792)		
			Note: Includes delivery, set-up, and removal. Excludes operator.		
01 22 23 00-0851	DAY		60,000 GPH, 4" Discharge, 115' Maximum Head, Hydraulic Submersible Pump	92.24	
01 22 23 00-0852	WK		60,000 GPH, 4" Discharge, 115' Maximum Head, Hydraulic Submersible Pump	247.38	
01 22 23 00-0853	MO		60,000 GPH, 4" Discharge, 115' Maximum Head, Hydraulic Submersible Pump	691.81	
01 22 23 00-0854	DAY		132,000 GPH, 6" Discharge, 90' Maximum Head, Hydraulic Submersible Pump	117.40	
01 22 23 00-0855	WK		132,000 GPH, 6" Discharge, 90' Maximum Head, Hydraulic Submersible Pump	301.88	
01 22 23 00-0856	MO		132,000 GPH, 6" Discharge, 90' Maximum Head, Hydraulic Submersible Pump	922.42	
01 22 23 00-0857			Suction Hose With Couplings (01 22 23 00-0792)		
			Note: Includes delivery, set-up, and removal.		
01 22 23 00-0858	DAY		1-1/2" Inside Diameter, 20' Length, Suction Hose With Couplings.....	9.64	
01 22 23 00-0859	WK		1-1/2" Inside Diameter, 20' Length, Suction Hose With Couplings.....	24.11	
01 22 23 00-0860	MO		1-1/2" Inside Diameter, 20' Length, Suction Hose With Couplings.....	59.47	
01 22 23 00-0861	DAY		2" Inside Diameter, 20' Length, Suction Hose With Couplings.....	11.25	
01 22 23 00-0862	WK		2" Inside Diameter, 20' Length, Suction Hose With Couplings.....	25.72	
01 22 23 00-0863	MO		2" Inside Diameter, 20' Length, Suction Hose With Couplings.....	62.68	
01 22 23 00-0864	DAY		3" Inside Diameter, 20' Length, Suction Hose With Couplings.....	24.11	
01 22 23 00-0865	WK		3" Inside Diameter, 20' Length, Suction Hose With Couplings.....	53.04	
01 22 23 00-0866	MO		3" Inside Diameter, 20' Length, Suction Hose With Couplings.....	143.04	
01 22 23 00-0867	DAY		4" Inside Diameter, 20' Length, Suction Hose With Couplings.....	30.54	
01 22 23 00-0868	WK		4" Inside Diameter, 20' Length, Suction Hose With Couplings.....	69.11	
01 22 23 00-0869	MO		4" Inside Diameter, 20' Length, Suction Hose With Couplings.....	184.83	
01 22 23 00-0870	DAY		6" Inside Diameter, 20' Length, Suction Hose With Couplings.....	40.18	
01 22 23 00-0871	WK		6" Inside Diameter, 20' Length, Suction Hose With Couplings.....	93.22	
01 22 23 00-0872	MO		6" Inside Diameter, 20' Length, Suction Hose With Couplings.....	210.55	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
01 22 23 00-0873				Discharge Hose With Couplings (01 22 23 00-0792) Note: Includes delivery, set-up, and removal.		
				01 22 23 00-0874 DAY 1-1/2" Inside Diameter, 50' Length, Discharge Hose With Couplings	13.98	
				01 22 23 00-0875 WK 1-1/2" Inside Diameter, 50' Length, Discharge Hose With Couplings	29.35	
				01 22 23 00-0876 MO 1-1/2" Inside Diameter, 50' Length, Discharge Hose With Couplings	62.89	
				01 22 23 00-0877 DAY 2" Inside Diameter, 50' Length, Discharge Hose With Couplings	22.36	
				01 22 23 00-0878 WK 2" Inside Diameter, 50' Length, Discharge Hose With Couplings	32.14	
				01 22 23 00-0879 MO 2" Inside Diameter, 50' Length, Discharge Hose With Couplings	67.08	
				01 22 23 00-0880 DAY 3" Inside Diameter, 50' Length, Discharge Hose With Couplings	22.36	
				01 22 23 00-0881 WK 3" Inside Diameter, 50' Length, Discharge Hose With Couplings	44.72	
				01 22 23 00-0882 MO 3" Inside Diameter, 50' Length, Discharge Hose With Couplings	88.05	
				01 22 23 00-0883 DAY 4" Inside Diameter, 50' Length, Discharge Hose With Couplings	30.75	
				01 22 23 00-0884 WK 4" Inside Diameter, 50' Length, Discharge Hose With Couplings	81.06	
				01 22 23 00-0885 MO 4" Inside Diameter, 50' Length, Discharge Hose With Couplings	163.52	
				01 22 23 00-0886 DAY 6" Inside Diameter, 50' Length, Discharge Hose With Couplings	61.49	
				01 22 23 00-0887 WK 6" Inside Diameter, 50' Length, Discharge Hose With Couplings	125.78	
				01 22 23 00-0888 MO 6" Inside Diameter, 50' Length, Discharge Hose With Couplings	265.54	
01 22 23 00-0889				Temporary Building Services (01 22 23)		
01 22 23 00-0890				Boilers (01 22 23 00-0889) Note: Excludes operator, delivery, set-up, and removal.		
01 22 23 00-0891				Electric Boilers (01 22 23 00-0890)		
				01 22 23 00-0892 MO 40 MBH, 12 KW Electric Boiler Rental	1,381.82	
				01 22 23 00-0893 MO 60 MBH, 20 KW Electric Boiler Rental	1,507.46	
				01 22 23 00-0894 MO 95 MBH, 30 KW Electric Boiler Rental	1,570.28	
				01 22 23 00-0895 MO 135 MBH, 40 KW Electric Boiler Rental	1,758.68	
				01 22 23 00-0896 MO 165 MBH, 50 KW Electric Boiler Rental	2,449.59	
				01 22 23 00-0897 MO 215 MBH, 60 KW Electric Boiler Rental	2,826.46	
				01 22 23 00-0898 MO 365 MBH, 100 KW Electric Boiler Rental	3,705.83	
				01 22 23 00-0899 MO 510 MBH, 150 KW Electric Boiler Rental	4,522.37	
01 22 23 00-0900				Oil/Gas Fired Boilers (01 22 23 00-0890)		
				01 22 23 00-0901 MO Up To 100 HP Gas/Oil Dual Fuel Boiler Rental	5,000.00	
				For >3 Months Rental, Deduct	-750.00	
				01 22 23 00-0902 MO >100 HP To 250 HP Gas/Oil Dual Fuel Boiler Rental	6,500.00	
				For >3 Months Rental, Deduct	-975.00	
				01 22 23 00-0903 MO >250 HP To 500 HP Gas/Oil Dual Fuel Boiler Rental	10,500.00	
				For >3 Months Rental, Deduct	-1,575.00	
				01 22 23 00-0904 MO >500 HP To 800 HP Gas/Oil Dual Fuel Boiler Rental	14,500.00	
				For >3 Months Rental, Deduct	-2,175.00	
01 22 23 00-0905				Oil Fired Boilers (01 22 23 00-0890)		
				01 22 23 00-0906 MO 250 HP Oil Fired Boiler Rental	3,880.85	
				01 22 23 00-0907 MO 350 HP Oil Fired Boiler Rental	5,174.47	
				01 22 23 00-0908 MO 500 HP Oil Fired Boiler Rental	6,468.09	
				01 22 23 00-0909 MO 600 HP Oil Fired Boiler Rental	7,114.89	
01 22 23 00-0910				Boilers Setup (01 22 23 00-0890)		
				01 22 23 00-0911 EA Setup Rental Boiler	3,873.02	
				Note: Includes delivery, setup, installation, startup, commissioning, decommissioning, and pickup. Excludes piping and electrical hookup. Excludes crane.		
01 22 23 00-0912				Chillers (01 22 23 00-0889) Note: Excludes operator, delivery, set-up, and removal.		
01 22 23 00-0913				Air Cooled Chillers (01 22 23 00-0912)		
				01 22 23 00-0914 MO 25 Ton Air Cooled Chiller Rental	2,357.06	
				For >3 To 6 Month Rental, Deduct	-353.56	
				For >6 Month Rental, Deduct	-589.27	
				01 22 23 00-0915 MO 40 Ton Air Cooled Chiller Rental	3,771.31	
				For >3 To 6 Month Rental, Deduct	-565.70	
				For >6 Month Rental, Deduct	-942.83	
				01 22 23 00-0916 MO 60 Ton Air Cooled Chiller Rental	4,612.73	
				For >3 To 6 Month Rental, Deduct	-691.91	
				For >6 Month Rental, Deduct	-1,153.18	
				01 22 23 00-0917 MO 80 Ton Air Cooled Chiller Rental	5,454.16	
				For >3 To 6 Month Rental, Deduct	-818.12	
				For >6 Month Rental, Deduct	-1,363.54	
				01 22 23 00-0918 MO 100 Ton Air Cooled Chiller Rental	6,295.59	
				For >3 To 6 Month Rental, Deduct	-944.34	
				For >6 Month Rental, Deduct	-1,573.90	
				01 22 23 00-0919 MO 125 Ton Air Cooled Chiller Rental	7,293.56	
				For >3 To 6 Month Rental, Deduct	-1,094.03	
				For >6 Month Rental, Deduct	-1,823.39	

01	General Requirements
01 20	Price And Payment Procedures
01 22	Unit Prices



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
01 22 23 00-0920	MO		155 Ton Air Cooled Chiller Rental.....	8,823.42	
			<i>For >3 To 6 Month Rental, Deduct</i>	-1,323.51	
			<i>For >6 Month Rental, Deduct</i>	-2,205.86	
01 22 23 00-0921	MO		170 Ton Air Cooled Chiller Rental.....	9,435.37	
			<i>For >3 To 6 Month Rental, Deduct</i>	-1,415.31	
			<i>For >6 Month Rental, Deduct</i>	-2,358.84	
01 22 23 00-0922	MO		200 Ton Air Cooled Chiller Rental.....	10,838.94	
			<i>For >3 To 6 Month Rental, Deduct</i>	-1,625.84	
			<i>For >6 Month Rental, Deduct</i>	-2,709.74	
01 22 23 00-0923	MO		250 Ton Air Cooled Chiller Rental.....	12,897.15	
			<i>For >3 To 6 Month Rental, Deduct</i>	-1,934.57	
			<i>For >6 Month Rental, Deduct</i>	-3,224.29	
01 22 23 00-0924	MO		300 Ton Air Cooled Chiller Rental.....	15,049.64	
			Note: Includes trailer.		
			<i>For >3 To 6 Month Rental, Deduct</i>	-2,257.45	
			<i>For >6 Month Rental, Deduct</i>	-3,762.41	
01 22 23 00-0925	MO		400 Ton Air Cooled Chiller Rental.....	19,852.72	
			Note: Includes trailer, pump and 200' of 6" hose.		
			<i>For >3 To 6 Month Rental, Deduct</i>	-2,977.91	
			<i>For >6 Month Rental, Deduct</i>	-4,963.18	
01 22 23 00-0926	MO		500 Ton Air Cooled Chiller Rental.....	24,573.96	
			Note: Includes trailer, pump and 200' of 6" hose.		
			<i>For >3 To 6 Month Rental, Deduct</i>	-3,686.09	
			<i>For >6 Month Rental, Deduct</i>	-6,143.49	
01 22 23 00-0927	EA		Setup Air Cooled Chiller Rental Unit.....	2,692.22	
			Note: Includes delivery, setup, installation, refrigerant charge, startup, commissioning, decommissioning, recovery of refrigerant and pickup. Excludes piping and electrical hookup. Excludes crane if off-loaded.		
01 22 23 00-0928			Chiller Rental Accessories <small>(01 22 23 00-0912)</small>		
01 22 23 00-0929	MO		4" x 25' Flexible Water Hose For Chiller Rental.....	42.00	
01 22 23 00-0930	MO		6" x 25' Flexible Water Hose For Chiller Rental.....	52.50	
01 22 23 00-0931			Emergency Cooler/Freezer <small>(01 22 23 00-0889)</small>		
			Note: Excludes utility connection, delivery, set-up, and removal. Cooler 115V or 230V, freezer 208/230V, combo 115V or 230V.		
01 22 23 00-0932	DAY		8 x 6 x 7 Emergency Cooler Rental.....	90.00	
01 22 23 00-0933	WK		8 x 6 x 7 Emergency Cooler Rental.....	480.00	
01 22 23 00-0934	DAY		10 x 7 x 7 Emergency Cooler Rental.....	180.00	
01 22 23 00-0935	WK		10 x 7 x 7 Emergency Cooler Rental.....	720.00	
01 22 23 00-0936	MO		10 x 7 x 7 Emergency Cooler Rental.....	1,800.00	
01 22 23 00-0937	DAY		10 x 7 x 7 Emergency Freezer Rental.....	210.00	
01 22 23 00-0938	WK		10 x 7 x 7 Emergency Freezer Rental.....	840.00	
01 22 23 00-0939	MO		10 x 7 x 7 Emergency Freezer Rental.....	2,160.00	
01 22 23 00-0940	DAY		6 x 8 x 7 Or 6 x 6 x 7, Emergency Combo Cooler/Freezer Rental.....	240.00	
01 22 23 00-0941	WK		6 x 8 x 7 Or 6 x 6 x 7, Emergency Combo Cooler/Freezer Rental.....	960.00	
01 22 23 00-0942	MO		6 x 8 x 7 Or 6 x 6 x 7, Emergency Combo Cooler/Freezer Rental.....	2,400.00	
01 22 23 00-0943			Portable Spot Cooling Units <small>(01 22 23 00-0889)</small>		
			Note: Includes delivery to job site, connection to existing system and pick-up when complete. Excludes operator.		
01 22 23 00-0944	DAY		1 Ton Portable Spot Cooling Unit.....	125.00	
01 22 23 00-0945	WK		1 Ton Portable Spot Cooling Unit.....	275.00	
01 22 23 00-0946	MO		1 Ton Portable Spot Cooling Unit.....	550.00	
01 22 23 00-0947	DAY		2 Ton Portable Spot Cooling Unit.....	200.00	
01 22 23 00-0948	WK		2 Ton Portable Spot Cooling Unit.....	400.00	
01 22 23 00-0949	MO		2 Ton Portable Spot Cooling Unit.....	900.00	
01 22 23 00-0950	DAY		3 Ton Portable Spot Cooling Unit.....	300.00	
01 22 23 00-0951	WK		3 Ton Portable Spot Cooling Unit.....	600.00	
01 22 23 00-0952	MO		3 Ton Portable Spot Cooling Unit.....	1,200.00	
01 22 23 00-0953	DAY		5 Ton Portable Spot Cooling Unit.....	350.00	
01 22 23 00-0954	WK		5 Ton Portable Spot Cooling Unit.....	700.00	
01 22 23 00-0955	MO		5 Ton Portable Spot Cooling Unit.....	1,600.00	
01 22 23 00-0956	DAY		10 Ton Portable Spot Cooling Unit.....	750.00	
01 22 23 00-0957	WK		10 Ton Portable Spot Cooling Unit.....	1,200.00	
01 22 23 00-0958	MO		10 Ton Portable Spot Cooling Unit.....	2,400.00	
01 22 23 00-0959	DAY		20 Ton Portable Spot Cooling Unit.....	1,000.00	
01 22 23 00-0960	WK		20 Ton Portable Spot Cooling Unit.....	1,750.00	
01 22 23 00-0961	MO		20 Ton Portable Spot Cooling Unit.....	3,750.00	
01 22 23 00-0962	DAY		25 Ton Portable Spot Cooling Unit.....	800.00	
01 22 23 00-0963	WK		25 Ton Portable Spot Cooling Unit.....	1,700.00	
01 22 23 00-0964	MO		25 Ton Portable Spot Cooling Unit.....	4,000.00	
01 22 23 00-0965			Fuel Oil Tank <small>(01 22 23 00-0889)</small>		
			Note: Includes delivery to job site, connection to existing system and pick-up when complete. Excludes Off-road fuel costs. See CSI section 01 22 23 00-0615 for reimbursable fuel fees.		
01 22 23 00-0966	MO		100 Gallon Portable Double Wall Fuel Oil Tank Rental.....	446.76	
01 22 23 00-0967	MO		275 Gallon Portable Double Wall Fuel Oil Tank Rental.....	694.95	
01 22 23 00-0968	MO		500 Gallon Portable Double Wall Fuel Oil Tank Rental.....	1,737.38	
01 22 23 00-0969	MO		1,000 Gallon Portable Double Wall Fuel Oil Tank Rental.....	2,895.64	
01 22 23 00-0970	MO		2,300 Gallon Portable Double Wall Fuel Oil Tank Rental.....	3,822.24	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
01 22 23 00-0971 MO 5,000 Gallon Portable Double Wall Fuel Oil Tank Rental	6,828.19	
01 22 23 00-0972 Truck And Trailer Equipment (01 22 23)		
01 22 23 00-0973 Trucks (01 22 23 00-0972)		
Note: Includes full-time driver, delivery, and removal.		
01 22 23 00-0974 Flat Bed Trucks (01 22 23 00-0973)		
Note: Includes hydraulic tilt bed.		
01 22 23 00-0975 DAY 1-1/2 Ton Capacity, 8' To 10' Bed, 4 x 2 Flat Bed Truck With Full-Time Truck Driver	709.47	
<i>For Equipment Without Operator, Deduct</i>		
	-510.59	
01 22 23 00-0976 WK 1-1/2 Ton Capacity, 8' To 10' Bed, 4 x 2 Flat Bed Truck With Full-Time Truck Driver	3,074.32	
<i>For Equipment Without Operator, Deduct</i>		
	-2,552.94	
01 22 23 00-0977 MO 1-1/2 Ton Capacity, 8' To 10' Bed, 4 x 2 Flat Bed Truck With Full-Time Truck Driver	12,320.93	
<i>For Equipment Without Operator, Deduct</i>		
	-11,004.05	
01 22 23 00-0978 DAY 3 Ton Capacity, 12' To 16' Bed, 4 x 2 Flat Bed Truck With Full-Time Truck Driver	795.47	
<i>For Equipment Without Operator, Deduct</i>		
	-510.59	
01 22 23 00-0979 WK 3 Ton Capacity, 12' To 16' Bed, 4 x 2 Flat Bed Truck With Full-Time Truck Driver	3,294.69	
<i>For Equipment Without Operator, Deduct</i>		
	-2,552.94	
01 22 23 00-0980 MO 3 Ton Capacity, 12' To 16' Bed, 4 x 2 Flat Bed Truck With Full-Time Truck Driver	12,885.30	
<i>For Equipment Without Operator, Deduct</i>		
	-11,004.05	
01 22 23 00-0981 DAY 6-1/2 Ton Capacity, 16' Bed, 4 x 2 Flat Bed Truck With Full-Time Truck Driver	857.17	
<i>For Equipment Without Operator, Deduct</i>		
	-510.59	
01 22 23 00-0982 WK 6-1/2 Ton Capacity, 16' Bed, 4 x 2 Flat Bed Truck With Full-Time Truck Driver	3,530.54	
<i>For Equipment Without Operator, Deduct</i>		
	-2,552.94	
01 22 23 00-0983 MO 6-1/2 Ton Capacity, 16' Bed, 4 x 2 Flat Bed Truck With Full-Time Truck Driver	13,782.95	
<i>For Equipment Without Operator, Deduct</i>		
	-11,004.07	
01 22 23 00-0984 Light Duty Trucks (01 22 23 00-0973)		
01 22 23 00-0985 DAY 1/2 To 3/4 Ton, 4 x 2 Light Duty Conventional Pickup Truck With Full-Time Truck Driver	761.66	
<i>For Equipment Without Operator, Deduct</i>		
	-510.59	
01 22 23 00-0986 WK 1/2 To 3/4 Ton, 4 x 2 Light Duty Conventional Pickup Truck With Full-Time Truck Driver	3,376.77	
<i>For Equipment Without Operator, Deduct</i>		
	-2,552.94	
01 22 23 00-0987 MO 1/2 To 3/4 Ton, 4 x 2 Light Duty Conventional Pickup Truck With Full-Time Truck Driver	12,730.17	
<i>For Equipment Without Operator, Deduct</i>		
	-11,004.05	
01 22 23 00-0988 DAY 3/4 Ton, 4 x 4 Crew Cab Pickup Truck With Full-Time Truck Driver	808.74	
<i>For Equipment Without Operator, Deduct</i>		
	-510.59	
01 22 23 00-0989 WK 3/4 Ton, 4 x 4 Crew Cab Pickup Truck With Full-Time Truck Driver	3,518.00	
<i>For Equipment Without Operator, Deduct</i>		
	-2,552.94	
01 22 23 00-0990 MO 3/4 Ton, 4 x 4 Crew Cab Pickup Truck With Full-Time Truck Driver	13,044.01	
<i>For Equipment Without Operator, Deduct</i>		
	-11,004.05	
01 22 23 00-0991 Rear Dump Trucks (01 22 23 00-0973)		
01 22 23 00-0992 DAY 4 CY Rear Dump Truck With Full-Time Truck Driver	888.82	
<i>For Equipment Without Operator, Deduct</i>		
	-510.59	
01 22 23 00-0993 WK 4 CY Rear Dump Truck With Full-Time Truck Driver	3,595.00	
<i>For Equipment Without Operator, Deduct</i>		
	-2,552.94	
01 22 23 00-0994 MO 4 CY Rear Dump Truck With Full-Time Truck Driver	13,705.70	
<i>For Equipment Without Operator, Deduct</i>		
	-11,004.05	
01 22 23 00-0995 DAY 6 CY Rear Dump Truck With Full-Time Truck Driver	942.85	
<i>For Equipment Without Operator, Deduct</i>		
	-510.59	
01 22 23 00-0996 WK 6 CY Rear Dump Truck With Full-Time Truck Driver	3,710.79	
<i>For Equipment Without Operator, Deduct</i>		
	-2,552.94	
01 22 23 00-0997 MO 6 CY Rear Dump Truck With Full-Time Truck Driver	13,782.89	
<i>For Equipment Without Operator, Deduct</i>		
	-11,004.05	
01 22 23 00-0998 DAY 13 CY Rear Dump Truck With Full-Time Truck Driver	1,583.53	
<i>For Equipment Without Operator, Deduct</i>		
	-510.59	
01 22 23 00-0999 WK 13 CY Rear Dump Truck With Full-Time Truck Driver	5,030.74	
<i>For Equipment Without Operator, Deduct</i>		
	-2,552.94	
01 22 23 00-1000 MO 13 CY Rear Dump Truck With Full-Time Truck Driver	17,488.01	
<i>For Equipment Without Operator, Deduct</i>		
	-11,004.05	
01 22 23 00-1001 DAY 18 CY Rear Dump Truck With Full-Time Truck Driver	1,690.83	
<i>For Equipment Without Operator, Deduct</i>		
	-510.59	
01 22 23 00-1002 WK 18 CY Rear Dump Truck With Full-Time Truck Driver	5,278.52	
<i>For Equipment Without Operator, Deduct</i>		
	-2,552.94	
01 22 23 00-1003 MO 18 CY Rear Dump Truck With Full-Time Truck Driver	18,136.41	
<i>For Equipment Without Operator, Deduct</i>		
	-11,004.05	
01 22 23 00-1004 Vacuum Trucks (01 22 23 00-0973)		
01 22 23 00-1005 DAY 5,000 Gallon Vacuum Truck With Full-Time Truck Driver	1,575.81	
<i>For Equipment Without Operator, Deduct</i>		
	-510.59	
01 22 23 00-1006 WK 5,000 Gallon Vacuum Truck With Full-Time Truck Driver	5,760.96	
<i>For Equipment Without Operator, Deduct</i>		
	-2,552.94	
01 22 23 00-1007 MO 5,000 Gallon Vacuum Truck With Full-Time Truck Driver	20,470.63	
<i>For Equipment Without Operator, Deduct</i>		
	-11,004.05	
01 22 23 00-1008 Water Trucks (01 22 23 00-0973)		
See CSI section 01 22 23 00-1016 for water trailer.		

01	General Requirements
01 20	Price And Payment Procedures
01 22	Unit Prices



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
01 22 23 00-1009	DAY		2,000 Gallon Water Truck With Full-Time Operator	1,031.11	
			<i>For Equipment Without Operator, Deduct</i>	-510.59	
			<i>For Each 1,000 Gallon Of Purchased Water, Add</i>	2.55	
01 22 23 00-1010	WK		2,000 Gallon Water Truck With Full-Time Operator	3,923.63	
			<i>For Equipment Without Operator, Deduct</i>	-2,552.94	
			<i>For Each 1,000 Gallon Of Purchased Water, Add</i>	2.55	
01 22 23 00-1011	MO		2,000 Gallon Water Truck With Full-Time Operator	14,242.81	
			<i>For Equipment Without Operator, Deduct</i>	-11,004.05	
			<i>For Each 1,000 Gallon Of Purchased Water, Add</i>	2.55	
01 22 23 00-1012	DAY		3,700 To 4,000 Gallon Water Truck With Full-Time Operator	1,285.58	
			<i>For Equipment Without Operator, Deduct</i>	-510.59	
			<i>For Each 1,000 Gallon Of Purchased Water, Add</i>	2.55	
01 22 23 00-1013	WK		3,700 To 4,000 Gallon Water Truck With Full-Time Operator	4,687.05	
			<i>For Equipment Without Operator, Deduct</i>	-2,552.94	
			<i>For Each 1,000 Gallon Of Purchased Water, Add</i>	2.55	
01 22 23 00-1014	MO		3,700 To 4,000 Gallon Water Truck With Full-Time Operator	16,209.20	
			<i>For Equipment Without Operator, Deduct</i>	-11,004.05	
			<i>For Each 1,000 Gallon Of Purchased Water, Add</i>	2.55	
01 22 23 00-1015			Trailers (01 22 23 00-0972) Note: Includes delivery to job site and pick-up when complete.		
01 22 23 00-1016			Water Trailers With Pump (01 22 23 00-1015)		
01 22 23 00-1017	DAY		500 To 600 Gallon Water Trailer With Pump	133.02	
01 22 23 00-1018	WK		500 To 600 Gallon Water Trailer With Pump	341.23	
01 22 23 00-1019	MO		500 To 600 Gallon Water Trailer With Pump	913.79	
01 30	Administrative Requirements (01)				
01 32	Construction Progress Documentation (01 30)				
01 32 33	Photographic Documentation (01 32)				
01 32 33 00-0001			Photography (01 32 33) Note: Excludes QC photographs. As requested by owner.		
01 32 33 00-0002	EA		3-1/2" x 5" Color Print Photograph	1.58	
01 32 33 00-0003	EA		4" x 6" Color Print Photograph	2.11	
01 32 33 00-0004	EA		5" x 7" Color Print Photograph	4.27	
01 32 33 00-0005	EA		8" x 10" Color Print Photograph	7.12	
01 40	Quality Requirements (01)				
01 45	Quality Control (01 40)				
01 45 23	Testing And Inspecting Services (01 45) Note: For application to existing materials/site conditions only. Includes acquisition and maintenance of sample (for laboratory tests) to include shipping as required, applicable equipment for field tests, and appropriate test reports.				
01 45 23 00-0001			Soils/Aggregate Testing (01 45 23)		
01 45 23 00-0002			Field Soils Tests (01 45 23 00-0001)		
01 45 23 00-0003	EA		Plasticity Index Soils Test, ASTM D-4318, Field Soils Test	171.15	
01 45 23 00-0004	EA		4" Compaction Curves Soils Test, ASTM D-1557, Field Soils Test	242.92	
01 45 23 00-0005	EA		6" Compaction Curves Soils Test, ASTM D-1557, Field Soils Test	276.05	
01 45 23 00-0006	EA		Resistance (R) Value Soils Test, CA 301, Field Soils Test.....	220.84	
01 45 23 00-0007	SET		Cement Treated Base Laboratory Design, Soil Cement, Field Soils Test.....	662.29	
01 45 23 00-0008	EA		Moisture Content, Field Soils Test	24.84	
01 45 23 00-0009	EA		UBC Or Swell Test, Field Soils Test	87.01	
01 45 23 00-0010	EA		Proctor Compaction 4" Standard Mold ASTM D698, Field Soils Test.....	165.57	
01 45 23 00-0011	EA		Proctor Compaction 6" Standard Mold, Field Soils Test	206.97	
01 45 23 00-0012	EA		Density And Classification Test, Field Soils Test	66.23	
01 45 23 00-0013	EA		Percolation Test, Field Soils Test.....	165.57	
01 45 23 00-0014	EA		Infiltration Test, Field Soils Test.....	331.14	
01 45 23 00-0015			Soil Borings Laboratory Tests (01 45 23 00-0001)		
01 45 23 00-0016	EA		Atterberg Limits - Liquid Limits (LL) And Plastic Limits (PL), T89, T90, ASTM D4318, Soil Borings Laboratory Test.....	76.00	
01 45 23 00-0017	EA		Shrinkage Limit, Soil Borings Laboratory Test	24.25	
01 45 23 00-0018	EA		Unconfined Compressive Strength of Cohesive Soils, Soil Borings Laboratory Test.....	58.46	
01 45 23 00-0019	EA		Consolidation, Soil Borings Laboratory Test	409.26	
01 45 23 00-0020	EA		Swell Test, Soil Borings Laboratory Test	80.84	
01 45 23 00-0021	EA		In Place Density, Soil Borings Laboratory Test.....	17.54	
01 45 23 00-0022	EA		Moisture Content, ASTM D2216, Soil Borings Laboratory Test	10.90	
01 45 23 00-0023	EA		Hydrometer Analysis, Soil Borings Laboratory Test.....	140.68	
01 45 23 00-0024	EA		Specific Gravity, ASTM D854, Soil Borings Laboratory Test	49.06	
01 45 23 00-0025	EA		Partial Sieve Analysis, Soil Borings Laboratory Test	9.70	
01 45 23 00-0026	EA		Laboratory Permeability, Soil Borings Laboratory Test.....	485.09	
01 45 23 00-0027	EA		Sieve Analysis, ASTM D422, Soil Borings Laboratory Test.....	98.12	
01 45 23 00-0028	EA		Sulfate Soundness, Soil Borings Laboratory Test.....	121.27	
01 45 23 00-0029	EA		Los Angeles Abrasion, Soil Borings Laboratory Test.....	282.77	



General Requirements	01	10
Quality Requirements	01 40	
Quality Control	01 45	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
01 45 23 00-0030 EA California Bearing Ratio, ASTM D1883	248.44	
01 45 23 00-0031 EA Compaction Test Subgrade, Soil Borings Laboratory Test	72.76	
01 45 23 00-0032 EA Compaction Test Base Course, Soil Borings Laboratory Test	61.56	
01 45 23 00-0033 EA In Place Density And Water Content Test By Nuclear Methods, ASTM D6938, Soil Borings Laboratory Test	239.27	
01 45 23 00-0034 EA Field Density Sand Cone, AASHTO T-191, ASTM D1556, Soil Borings Laboratory Test	37.19	
01 45 23 00-0035 Aggregate Testing <small>(01 45 23 00-0001)</small>		
01 45 23 00-0036 EA Coarse Aggregate Sieve Analysis Test, ASTM C-136, CA 202	55.21	
01 45 23 00-0037 EA Fine Aggregate Sieve Analysis Test, ASTM C-136, CA 202	99.38	
01 45 23 00-0038 EA Sieve Analysis, Pit Run, ASTM C136	107.62	
Note: Includes wash.		
01 45 23 00-0039 EA Specific Special Gravity, Course, ASTM C127	87.70	
Note: Includes absorption test.		
01 45 23 00-0040 EA Special Gravity, Fine, ASTM C127	78.65	
Note: Includes absorption test.		
01 45 23 00-0041 EA Aggregate Cleanness Value, ASTM C-128, CA 227	110.42	
01 45 23 00-0042 EA Sand Equivalent, Average of 3 Tests, ASTM D2419, CA 217	82.82	
01 45 23 00-0043 EA Fine Aggregate Durability Index, CA 229	88.34	
01 45 23 00-0044 EA Sodium And Magnesium Soundness, ASTM C88	231.80	
01 45 23 00-0045 EA Los Angeles Rattler, ASTM C-131, CA 211	176.67	
01 45 23 00-0046 EA Unit Weight Of Aggregates, ASTM C29	49.69	
01 45 23 00-0047 EA Organic Impurities In Sand, ASTM C40	49.67	
01 45 23 00-0048 EA Crushed Particle, ASTM California Test Method	49.67	
01 45 23 00-0049 EA Clay Lump And Friable Particles, ASTM C142	99.34	
01 45 23 00-0050 Permeability Tests <small>(01 45 23 00-0001)</small>		
01 45 23 00-0051 In-Place Tests <small>(01 45 23 00-0050)</small>		
01 45 23 00-0052 EA Double Ring Infiltrometer Test, ASTM D3385	876.98	
01 45 23 00-0053 EA Unconfined Compressive Strength (Pocket Penetrometer) Test	41.39	
01 45 23 00-0054 Lab Tests <small>(01 45 23 00-0050)</small>		
01 45 23 00-0055 EA Falling Head Rigid Wall Consolidometer Technique CAE	409.26	
01 45 23 00-0056 EA Falling Head Permeability Test EPA-9100	409.26	
01 45 23 00-0057 EA Constant Head Permeability Test For Granular Soils, ASTM D2432	233.86	
01 45 23 00-0058 Concrete/Cement/Asphalt Testing <small>(01 45 23)</small>		
01 45 23 00-0059 Concrete Testing <small>(01 45 23 00-0058)</small>		
01 45 23 00-0060 EA Prepare 6 x 12 Concrete Cylinder And Deliver To Lab	16.58	
01 45 23 00-0061 EA 6 x 12 Cylinder Concrete Compression Test, ASTM C-39 Or ASTM D1633	35.08	
01 45 23 00-0062 EA Concrete Cores Compression Test, ASTM C-42	71.77	
01 45 23 00-0063 EA 6 x 6 x 18 Concrete Flexural Test, ASTM C-78	104.90	
01 45 23 00-0064 EA Unit Weight Of Concrete Cylinder, ASTM C-567	38.65	
01 45 23 00-0065 EA Concrete Mix Design Review	209.80	
01 45 23 00-0066 EA Trial Concrete Batch Prepared In Laboratory	496.89	
01 45 23 00-0067 EA Concrete Shrinkage, ASTM C-157 Modified	386.47	
01 45 23 00-0068 EA 6 x 12 Concrete Cylinder Splitting Tensile Test, ASTM C-496	59.63	
01 45 23 00-0069 EA Concrete Slump Test, ASTM C143	27.60	
01 45 23 00-0070 EA Concrete Air Content Test, ASTM C138, ASTM C173, Or ASTM C231	27.60	
01 45 23 00-0071 Cement Testing <small>(01 45 23 00-0058)</small>		
01 45 23 00-0072 EA Cement Grab Sample (CCR Title 24)	27.60	
Note: Includes sealing and storing 1 year.		
01 45 23 00-0073 EA 2" x 2" x 2" Cube Compression Test, All Type Materials	44.17	
01 45 23 00-0074 Asphaltic Concrete Testing <small>(01 45 23 00-0058)</small>		
01 45 23 00-0075 EA Hveem Asphaltic Concrete Stability Test, CA 366	55.21	
01 45 23 00-0076 EA Marshall Asphaltic Concrete Stability Test (3 Specimens), ASTM D-6926/6927	143.55	
01 45 23 00-0077 EA Stability Tests, Premixed, ASTM D1559	55.21	
01 45 23 00-0078 EA Stability Tests, Lab. Mixed, ASTM D1559	143.55	
01 45 23 00-0079 EA Swell Test, CA 305	66.25	
Note: Includes compaction.		
01 45 23 00-0080 EA % Asphalt Extraction Test, ASTM D-2172 B	165.63	
01 45 23 00-0081 EA Maximum Theoretical Unit Weight, ASTM C2041	105.24	
01 45 23 00-0082 EA Unit Weight Sample Requiring Compaction, California Test Method 308	22.08	
01 45 23 00-0083 EA Asphalt Unit Weight On Core Test, CA 308C	22.08	
01 45 23 00-0084 HR Nuclear Field Density Testing, 4 Hour Minimum	113.73	
01 45 23 00-0085 EA Asphalt Film Stripping Test, CTM 302/AASHTO T182/ASTM D1664	74.51	
01 45 23 00-0086 EA Penetration, ASTM D5	79.76	
01 45 23 00-0087 Masonry/Concrete Block/Tile Testing <small>(01 45 23)</small>		
01 45 23 00-0088 Masonry Testing <small>(01 45 23 00-0087)</small>		

01	01	General Requirements
	01 40	Quality Requirements
	01 45	Quality Control



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
01 45 23 00-0089	EA		2" x 4" Cylinder Mortar Compression Test.....	36.44	
01 45 23 00-0090	EA		4" x 4" x 8" Grout Prisms Compression Test.....	36.44	
01 45 23 00-0091	EA		Masonry Cores Compression Test.....	71.77	
01 45 23 00-0092	EA		Composite Grouted Prism Compression Test.....	138.02	

01 45 23 00-0093 Concrete Block Testing (ASTM C140 Or CMA Per Specimen) (01 45 23 00-0087)

01 45 23 00-0094	EA		Up To 8" x 8" x 16" Concrete Block Compression Test, ASTM C-140.....	88.34	
01 45 23 00-0095	EA		Absorption Test, Moisture Content And Unit Weight.....	60.73	
01 45 23 00-0096	EA		Moisture Condition By Relative Humidity, ASTM C427, First Unit.....	231.80	
01 45 23 00-0097	EA		Moisture Condition By Relative Humidity, ASTM C427, Additional Unit.....	115.90	

01 50 Temporary Facilities And Controls (01)

Note: Tasks in this section shall be used as directed by owner.

01 51 Temporary Utilities (01 50)

01 51 13 Temporary Electricity (01 51)

01 51 13 00-0001 Cord Grip Plug (01 51 13)

Note: Includes installation, a maximum of 50' of cord and connection to source.

01 51 13 00-0002	EA		Temporary 2 - Pole Cord Grip Plug With Installation.....	112.36	49.30
01 51 13 00-0003	EA		Temporary 3 - Pole Cord Grip Plug With Installation.....	166.37	75.84
01 51 13 00-0004	EA		Temporary 4 - Pole Cord Grip Plug With Installation.....	214.00	98.45
01 51 13 00-0005	EA		Temporary 3 - Pole (30 A) Cord Grip Plug With Installation.....	163.04	75.84
01 51 13 00-0006	EA		Temporary 4 - Pole (30 A) Cord Grip Plug With Installation.....	208.70	98.45
01 51 13 00-0007	EA		Temporary 3 - Pole (50 A) Cord Grip Plug With Installation.....	179.63	75.84

01 51 26 Temporary Lighting (01 51)

01 51 26 00-0001 Temporary Devices (01 51 26)

Note: Includes removal after use.

01 51 26 00-0002	EA		Temporary Exit Light.....	124.51	36.77
01 51 26 00-0003	EA		Temporary Light Socket With Branch Wiring Connection And Lamp.....	16.97	7.65
01 51 26 00-0004	EA		Temporary 10 Light String With Cages.....	45.92	17.28
01 51 26 00-0005	EA		Temporary GFI Device With Enclosure And Branch Wiring.....	133.61	49.30
01 51 26 00-0006	EA		Temporary Trailer Socket With Branch Wiring.....	51.70	17.85
01 51 26 00-0007	EA		Temporary High Bay Light.....	172.64	72.39

01 52 Construction Facilities (01 50)

Note: Tasks in this section shall be used as directed by owner for owner's use.

01 52 13 Field Offices And Sheds (01 52)

01 52 13 00-0001 Field Offices (01 52 13)

Note: Excludes furniture, utility connections and service. Minimum 6 months rental.

01 52 13 00-0002	MO		8' x 24' Office, With Toilet.....	96.12	
			<i>For Each Delivery And Removal, Round Trip, Add</i>	679.17	
			<i>For Each Set-Up (Block And Level), Add</i>	122.57	
			<i>For Each Anchoring Into Dirt, Add</i>	74.99	
			<i>For Each Anchoring Into Asphalt Or Concrete, Add</i>	112.49	
			<i>For Office Trailer Without Toilet, Deduct</i>	-19.22	
01 52 13 00-0003	MO		8' x 32' Office, With Toilet.....	108.93	
			<i>For Each Delivery And Removal, Round Trip, Add</i>	679.17	
			<i>For Each Set-Up (Block And Level), Add</i>	122.57	
			<i>For Each Anchoring Into Dirt, Add</i>	74.99	
			<i>For Each Anchoring Into Asphalt Or Concrete, Add</i>	112.49	
			<i>For Office Trailer Without Toilet, Deduct</i>	-21.79	
01 52 13 00-0004	MO		10' x 36' Office, With Toilet.....	147.39	
			<i>For Each Delivery And Removal, Round Trip, Add</i>	1,126.00	
			<i>For Each Set-Up (Block And Level), Add</i>	199.98	
			<i>For Each Anchoring Into Dirt, Add</i>	74.99	
			<i>For Each Anchoring Into Asphalt Or Concrete, Add</i>	112.49	
			<i>For Office Trailer Without Toilet, Deduct</i>	-29.48	
01 52 13 00-0005	MO		10' x 40' Office, With Toilet.....	157.00	
			<i>For Each Delivery And Removal, Round Trip, Add</i>	1,126.00	
			<i>For Each Set-Up (Block And Level), Add</i>	199.98	
			<i>For Each Anchoring Into Dirt, Add</i>	74.99	
			<i>For Each Anchoring Into Asphalt Or Concrete, Add</i>	112.49	
			<i>For Office Trailer Without Toilet, Deduct</i>	-31.40	
01 52 13 00-0006	MO		10' x 44' Office, With Toilet.....	173.02	
			<i>For Each Delivery And Removal, Round Trip, Add</i>	1,126.00	
			<i>For Each Set-Up (Block And Level), Add</i>	199.98	
			<i>For Each Anchoring Into Dirt, Add</i>	74.99	
			<i>For Each Anchoring Into Asphalt Or Concrete, Add</i>	112.49	
01 52 13 00-0007	MO		10' x 50' Office, With Toilet.....	182.63	
			<i>For Each Delivery And Removal, Round Trip, Add</i>	1,126.00	
			<i>For Each Set-Up (Block And Level), Add</i>	199.98	
			<i>For Each Anchoring Into Dirt, Add</i>	74.99	
			<i>For Each Anchoring Into Asphalt Or Concrete, Add</i>	112.49	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
01 52 13 00-0008 MO 12' x 44' Office, With Toilet..... <i>For Each Delivery And Removal, Round Trip, Add</i> <i>For Each Set-Up (Block And Level), Add</i> <i>For Each Anchoring Into Dirt, Add</i> <i>For Each Anchoring Into Asphalt Or Concrete, Add</i>	195.23 1,126.00 199.98 74.99 112.49	
01 52 13 00-0009 MO 12' x 50' Office, With Toilet..... <i>For Each Delivery And Removal, Round Trip, Add</i> <i>For Each Set-Up (Block And Level), Add</i> <i>For Each Anchoring Into Dirt, Add</i> <i>For Each Anchoring Into Asphalt Or Concrete, Add</i>	214.67 1,126.00 199.98 74.99 112.49	
01 52 13 00-0010 MO 12' x 60' Office, With Toilet..... <i>For Each Delivery And Removal, Round Trip, Add</i> <i>For Each Set-Up (Block And Level), Add</i> <i>For Each Anchoring Into Dirt, Add</i> <i>For Each Anchoring Into Asphalt Or Concrete, Add</i>	233.90 1,126.00 199.98 74.99 112.49	
01 52 13 00-0011 MO 24' x 60' Office, With Toilet..... <i>For Each Delivery And Removal, Round Trip, Add</i> <i>For Each Set-Up (Block And Level), Add</i> <i>For Each Anchoring Into Dirt, Add</i> <i>For Each Anchoring Into Asphalt Or Concrete, Add</i>	512.64 2,144.76 322.55 74.99 112.49	
01 52 13 00-0012 MO 24' x 72' Office, With Toilet..... <i>For Each Delivery And Removal, Round Trip, Add</i> <i>For Each Set-Up (Block And Level), Add</i> <i>For Each Anchoring Into Dirt, Add</i> <i>For Each Anchoring Into Asphalt Or Concrete, Add</i>	615.17 2,144.76 322.55 74.99 112.49	
01 52 13 00-0013 MO 30' x 30' Office, With Toilet..... <i>For Each Delivery And Removal, Round Trip, Add</i> <i>For Each Set-Up (Block And Level), Add</i> <i>For Each Anchoring Into Dirt, Add</i> <i>For Each Anchoring Into Asphalt Or Concrete, Add</i>	292.37 2,144.76 322.55 74.99 112.49	
01 52 13 00-0014 Accessories For Field Office Trailers <small>(01 52 13)</small> Note: Costs includes installation or placement in trailer.		
01 52 13 00-0015 MO Desk For Field Office Trailer.....	28.48	
01 52 13 00-0016 MO Rolling Desk Chair For Field Office Trailer.....	17.80	
01 52 13 00-0017 MO File Cabinet For Field Office Trailer.....	21.36	
01 52 13 00-0018 MO Table For Field Office Trailer.....	14.24	
01 52 13 00-0019 MO Folding Chair For Field Office Trailer.....	6.75	
01 52 13 00-0020 EA Phone Hook-Up For Field Office Trailer.....	78.33	
01 52 13 00-0021 MO Local Phone Service Per Phone Line For Field Office Trailer.....	49.85	
01 52 13 00-0022 MO Security System With Monitoring For Field Office Trailer.....	80.00	
01 52 13 00-0023 LF Perimeter Trailer Skirting For Field Office Trailer.....	25.72	
01 52 13 00-0024 LF Insulated Perimeter Trailer Skirting For Field Office Trailer.....	46.77	
01 52 13 00-0025 MO Steps For Field Office Trailer.....	25.00	
01 52 13 00-0026 MO Fax Machine For Field Office Trailer.....	35.61	
01 52 13 00-0027 MO Copier For Field Office Trailer.....	56.97	
01 52 13 00-0028 Storage Containers <small>(01 52 13)</small>		
01 52 13 00-0029 MO 8' x 8' x 10' Storage Container..... <i>For Delivery And Pick-up Of Container, Add</i> <i>For >12 Months, Deduct</i>	74.96 716.00 -22.49	
01 52 13 00-0030 MO 8' x 8' x 20' Storage Container..... <i>For Delivery And Pick-up Of Container, Add</i> <i>For >12 Months, Deduct</i>	78.37 716.00 -23.51	
01 52 13 00-0031 MO 8' x 8' x 40' Storage Container..... <i>For Delivery And Pick-up Of Container, Add</i> <i>For >12 Months, Deduct</i>	92.68 716.00 -27.80	
01 52 19 Sanitary Facilities <small>(01 52)</small>		
01 52 19 00-0001 Portable Toilets <small>(01 52 19)</small> Note: Includes delivery, set-up, servicing once per week and removal.		
01 52 19 00-0002 WK Portable Toilets, Chemical..... <i>For Each Additional Servicing Per Unit Per Week, Add</i>	41.68 25.00	
01 52 19 00-0003 MO Portable Toilets, Chemical..... <i>For Each Additional Servicing Per Unit Per Week, Add</i>	125.05 25.00	
01 52 19 00-0004 WK ADA Portable Toilets, Chemical..... <i>For Each Additional Servicing Per Unit Per Week, Add</i>	49.72 25.00	
01 52 19 00-0005 MO ADA Portable Toilets, Chemical..... <i>For Each Additional Servicing Per Unit Per Week, Add</i>	145.90 25.00	
01 52 19 00-0006 WK Two Station Portable Handwash.....	27.29	
01 52 19 00-0007 MO Two Station Portable Handwash.....	82.79	
01 52 19 00-0008 MO Portable Toilets, Multi Trailer - 16'..... Note: Includes women's room (3 toilets, 2 sinks) and men's room (1 toilet, 1 urinal and 1 sink)	2,500.00	
01 52 19 00-0009 WK Service Trailer Restrooms, 3 Times Per Week.....	1,874.00	

01 54 Construction Aids (01 50)
01 54 23 Temporary Scaffolding And Platforms (01 54)

01	General Requirements
01 50	Temporary Facilities And Controls
01 54	Construction Aids



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
01 54 23 00-0001			Scaffolding ^(01 54 23) Note: Additional scaffolding rental for work above the normal working height of 14'.		
01 54 23 00-0002			Scaffolding Rental - Rental Only ^(01 54 23 00-0001) Note: Monthly rental of actual scaffolding volume rented. Scaffolding is complete with bracing, 2" thick x 12" wide scaffolding planks, scaffolding stairs (where necessary in lieu of planks), standard accessories, base leveling devices, mud sills, climbing ladders and landings, brackets, clamps and building ties, etc. See CSI section 01 54 23 00-0006 for scaffolding erection and dismantling.		
01 54 23 00-0003	CCF		Scaffolding With Bracing Accessories - Area Based On 5' Wide x 7' Long Sections (CCF / Month).....	20.84	
			For Up To 25, Add	8.34	
			For >25 To 50, Add	5.21	
			For >50 To 150, Add	2.08	
01 54 23 00-0004	CCF		Scaffolding With Bracing Accessories - Area Based On 4' Wide x 7' Long Sections (CCF / Month).....	23.44	
			For Up To 25, Add	9.38	
			For >25 To 50, Add	5.86	
			For >50 To 150, Add	2.34	
01 54 23 00-0005	CCF		Scaffolding With Bracing Accessories - Area Based On 3' Wide x 7' Long Sections (CCF / Month).....	31.26	
			For Up To 25, Add	12.50	
			For >25 To 50, Add	7.82	
			For >50 To 150, Add	3.13	
01 54 23 00-0006			Scaffolding Erection And Dismantling - Labor Only ^(01 54 23 00-0001) Note: Includes both initial erection and final dismantling Excludes lifting equipment. The unit of measure is the volume of scaffolding erected. See CSI section 01 54 23 00-0002 for scaffolding rental.		
01 54 23 00-0007	CCF		Up To 20' Height Scaffolding Initial Erection And Final Dismantling, Per CCF Of Scaffolding And Accessories	36.15	
01 54 23 00-0008	CCF		>20' To 40' Height Scaffolding Initial Erection And Final Dismantling, Per CCF Of Scaffolding And Accessories	45.20	
01 54 23 00-0009	CCF		>40' To 60' Height Scaffolding Initial Erection And Final Dismantling, Per CCF Of Scaffolding And Accessories	54.24	
01 54 23 00-0010	CCF		>60' To 80' Scaffolding Initial Erection And Final Dismantling, Per CCF Of Scaffolding And Accessories.....	59.67	
01 54 23 00-0011	CCF		>80' Height Scaffolding Initial Erection And Final Dismantling, Per CCF Of Scaffolding And Accessories.....	68.70	
01 54 23 00-0012			Rolling Scaffolding ^(01 54 23) Note: Includes moving and relocating scaffolding on site. Excludes initial erection and final dismantling of scaffold.		
01 54 23 00-0013	DAY		Rolling Scaffolding >14' To 20' Complete With Wheels, Railings, Etc., (5' Wide X 7' Long Section)	10.15	
01 54 23 00-0014	WK		Rolling Scaffolding >14' To 20' Complete With Wheels, Railings, Etc., (5' Wide X 7' Long Section)	40.69	
01 54 23 00-0015	MO		Rolling Scaffolding >14' To 20' Complete With Wheels, Railings, Etc., (5' Wide X 7' Long Section)	162.74	
01 54 23 00-0016	DAY		Rolling Scaffolding >20' To 40' Complete With Wheels, Railings, Etc., (5' Wide X 7' Long Section)	17.00	
01 54 23 00-0017	WK		Rolling Scaffolding >20' To 40' Complete With Wheels, Railings, Etc., (5' Wide X 7' Long Section)	68.08	
01 54 23 00-0018	MO		Rolling Scaffolding >20' To 40' Complete With Wheels, Railings, Etc., (5' Wide X 7' Long Section)	272.36	
01 54 23 00-0019	EA		Rolling Scaffolding Initial Erection And Final Dismantling For Each Scaffold, >14' To 20'	91.32	
01 54 23 00-0020	EA		Rolling Scaffolding Initial Erection And Final Dismantling For Each Scaffold, >20' To 40'	114.15	
01 54 26			Temporary Swing Staging ^(01 54) Note: Up to one month rental. Includes connection to existing electrical outlet on roof, all necessary safety equipment for personnel and anchoring to existing roof anchors. Excludes installing roof anchors.		
01 54 26 00-0001			Swing Stage ^(01 54 26) Note: Up to one month rental. Includes connection to existing electrical outlet on roof, all necessary safety equipment for personnel and anchoring to existing roof anchors. Excludes installing roof anchors.		
01 54 26 00-0002	MO		Swing Stage, Electric Operated.....	1,497.38	
01 54 26 00-0003	MO		Swing Stage, Manually Operated, With Ropes, Winch, Support Hooks, Etcetera	539.71	
01 54 26 00-0004	EA		Swing Stage Erection And Dismantling.....	421.82	
			Note: Includes both erection and dismantling of swing stage.		
01 54 26 00-0005	EA		Move Swing Stage To Different Roof At Same Site	199.46	
01 54 26 00-0006	EA		Move Swing Stage To Different Location At Same Roof.....	92.06	
01 54 29			Temporary Sidewalk Protection ^(01 54)		
01 54 29 00-0001			Sidewalk Bridge ^(01 54 29)		
01 54 29 00-0002			Installation of Sidewalk Bridge ^(01 54 29 00-0001)		
01 54 29 00-0003	LF		Installation of Heavy Duty Steel Post And Beam Sidewalk Bridge Assembly	61.47	
			Note: Includes spanning openings, planking and parapet, lighting, up to 8' wide, up to 8' high, 2 post system.		
			For 3 Post System, Add	6.00	
			For Each Additional Foot Over 8' Wide, Add	3.00	
			For Each Additional Foot Over 8' High, Add	2.00	
01 54 29 00-0004	LF		Installation of Netting for Sidewalk Bridge.....	2.95	
01 54 29 00-0005			Monthly Rental of Sidewalk Bridge ^(01 54 29 00-0001)		
01 54 29 00-0006	LF		Monthly Rental Of Up To 8' Wide And 8' High, 2 Post System, Heavy Duty Steel Post And Beam Sidewalk Bridge Assembly	5.34	
			Note: Includes spanning openings, planking and parapet, lighting and maintenance.		
			For 3 Post System, Add	0.80	
01 54 29 00-0007	LF		Monthly Rental Of Up To 8' Wide, 8' - 12' High, 2 Post System, Heavy Duty Steel Post And Beam Sidewalk Bridge Assembly.....	6.01	
			Note: Includes spanning openings, planking and parapet, lighting and maintenance.		
			For 3 Post System, Add	0.90	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
01 54 29 00-0008 LF Monthly Rental Of Up To 8' Wide, Over 12' High, 2 Post System, Heavy Duty Steel Post And Beam Sidewalk Bridge Assembly.....	6.67	
Note: Includes spanning openings, planking and parapet, lighting and maintenance.		
For 3 Post System, Add	1.00	
01 54 29 00-0009 LF Monthly Rental Of 8' - 12' Wide And 8' High, 2 Post System, Heavy Duty Steel Post And Beam Sidewalk Bridge Assembly.....	6.67	
Note: Includes spanning openings, planking and parapet, lighting and maintenance.		
For 3 Post System, Add	1.00	
01 54 29 00-0010 LF Monthly Rental Of 8' - 12' Wide, 8' - 12' High, 2 Post System, Heavy Duty Steel Post And Beam Sidewalk Bridge Assembly.....	7.34	
Note: Includes spanning openings, planking and parapet, lighting and maintenance.		
For 3 Post System, Add	1.10	
01 54 29 00-0011 LF Monthly Rental Of 8' - 12' Wide, Over 12' High, 2 Post System, Heavy Duty Steel Post And Beam Sidewalk Bridge Assembly.....	8.67	
Note: Includes spanning openings, planking and parapet, lighting and maintenance.		
For 3 Post System, Add	1.30	
01 54 29 00-0012 LF Monthly Rental Of Over 12' Wide And 8' High, 2 Post System, Heavy Duty Steel Post And Beam Sidewalk Bridge Assembly.....	8.01	
Note: Includes spanning openings, planking and parapet, lighting and maintenance.		
For 3 Post System, Add	1.20	
01 54 29 00-0013 LF Monthly Rental Of Over 12' Wide, 8' - 12' High, 2 Post System, Heavy Duty Steel Post And Beam Sidewalk Bridge Assembly.....	9.34	
Note: Includes spanning openings, planking and parapet, lighting and maintenance.		
For 3 Post System, Add	1.40	
01 54 29 00-0014 LF Monthly Rental Of Over 12' Wide, Over 12' High, 2 Post System, Heavy Duty Steel Post And Beam Sidewalk Bridge Assembly.....	10.01	
Note: Includes spanning openings, planking and parapet, lighting and maintenance.		
For 3 Post System, Add	1.50	
01 54 29 00-0015 LF Monthly Rental of Netting for Sidewalk Bridge.....	1.00	
01 54 29 00-0016 Removal of Sidewalk Bridge (01 54 29 00-0001)		
01 54 29 00-0017 LF Removal of Heavy Duty Steel Post And Beam Sidewalk Bridge Assembly.....	24.09	
Note: Includes spanning openings, planking and parapet, lighting, up to 8' wide, up to 8' high, 2 post system.		
For 3 Post System, Add	2.50	
For Each Additional Foot Over 8' Wide, Add	1.25	
For Each Additional Foot Over 8' High, Add	0.75	
01 54 29 00-0018 LF Removal of Netting for Sidewalk Bridge.....	1.48	
01 55 Vehicular Access And Parking (01 50)		
01 55 23 Temporary Roads (01 55)		
01 55 23 00-0001 Temporary Stabilized Construction Entrance (01 55 23)		
Note: As per Caltrans detail.		
01 55 23 00-0002 SF 3" To 4" Rock Temporary Stabilized Construction Entrance Assembly.....	2.99	
Note: Includes up to 12" excavation of pit, hauling and disposal of soil, filter fabric at base and sides, filled with rock, and compaction.		
01 55 23 00-0003 SF >4" To 6" Rock Temporary Stabilized Construction Entrance Assembly.....	4.27	
Note: Includes up to 12" excavation of pit, hauling and disposal of soil, filter fabric at base and sides, filled with rock, and compaction.		
01 55 23 00-0004 Rumble Trench Plate (01 55 23)		
01 55 23 00-0005 MO 8' x 10' Steel Rumble Trench Plate Rental.....	200.00	
01 55 23 00-0006 EA Place And Remove Rumble Plate.....	74.09	
Note: If lifting equipment is not available on site, See CSI section 01 22 23 00-0000 for rentals tasks, 01 71 13 00-0000 for mobilization tasks.		
01 55 23 00-0007 EA Relocate And Adjust Location Of Rumble Plate.....	18.52	
Note: If lifting equipment is not available on site, See CSI section 01 22 23 00-0000 for rentals tasks, 01 71 13 00-0000 for mobilization tasks.		
01 55 26 Traffic Control (01 55)		
01 55 26 00-0001 Removable Preformed Traffic Black Line Mask (01 55 26)		
Note: Includes installation and removal after use.		
01 55 26 00-0002 LF 6" Removable Traffic Black Line Mask.....	4.17	
01 55 26 00-0003 LF 8" Removable Traffic Black Line Mask.....	5.06	
01 55 26 00-0004 Temporary Preformed Traffic Line Tape (01 55 26)		
Note: Includes installation and removal after use.		
01 55 26 00-0005 LF 4" Reflective Removable Traffic Line Tape.....	3.21	
01 55 26 00-0006 LF 6" Reflective Removable Traffic Line Tape.....	4.22	
01 55 26 00-0007 LF 8" Reflective Removable Traffic Line Tape.....	5.17	
01 55 26 00-0008 Temporary Painted Traffic Lines (01 55 26)		
Note: Includes installation and removal after use.		
01 55 26 00-0009 LF 4" Temporary Painted Traffic Lines.....	2.78	
For Not Removed, Deduct	-2.34	

01	General Requirements
01 50	Temporary Facilities And Controls
01 55	Vehicular Access And Parking



MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

01 55 26 00-0010	LF	6" Temporary Painted Traffic Lines.....	3.72
		<i>For Not Removed, Deduct</i>	-3.19
01 55 26 00-0011	LF	8" Temporary Painted Traffic Lines.....	4.68
		<i>For Not Removed, Deduct</i>	-4.03

01 55 26 00-0012 Pedestrian Traffic Control (01 55 26)

01 55 26 00-0013	CLF	1", 4 Mil Polyethylene Printed Barricade Tape, Fluorescent Orange	10.95
01 55 26 00-0014	CLF	2", 4 Mil Polyethylene Printed Barricade Tape, Fluorescent Orange	14.85
01 55 26 00-0015	CLF	3/4", 4 Mil Polyethylene Printed Barricade Tape, Fluorescent Yellow	7.82
01 55 26 00-0016	CLF	2", 4 Mil Polyethylene Printed Barricade Tape, Fluorescent Yellow	9.83
01 55 26 00-0017	CLF	3", 4 Mil Polyethylene Printed Barricade Tape, Non Fluorescent.....	11.06
01 55 26 00-0018	CLF	6", 4 Mil Polyethylene Printed Barricade Tape, Non Fluorescent.....	16.05
01 55 26 00-0019	CLF	1" Exterior Vinyl Tape (Warning Tape).....	13.64
01 55 26 00-0020	CLF	2" Exterior Vinyl Tape (Warning Tape).....	19.95
01 55 26 00-0021	CLF	3" Exterior Vinyl Tape (Warning Tape).....	26.06
01 55 26 00-0022	CLF	4" Exterior Vinyl Tape (Warning Tape).....	30.55

01 55 26 00-0023 Traffic Protection (01 55 26)

01 55 26 00-0024 Portable Traffic Control Device Rental (01 55 26 00-0023)

Note: Excludes placing and removing devices.

01 55 26 00-0025	DAY	28" Cone With Reflective Collar	0.43
01 55 26 00-0026	WK	28" Cone With Reflective Collar.....	1.29
01 55 26 00-0027	MO	28" Cone With Reflective Collar.....	3.86
01 55 26 00-0028	DAY	Vertical Panel.....	1.30
01 55 26 00-0029	WK	Vertical Panel.....	3.89
01 55 26 00-0030	MO	Vertical Panel.....	11.67
01 55 26 00-0031	DAY	Channelizer Drum.....	1.41
01 55 26 00-0032	WK	Channelizer Drum.....	4.22
01 55 26 00-0033	MO	Channelizer Drum.....	12.67
01 55 26 00-0034	DAY	Stackable Channelizer Panel.....	0.67
01 55 26 00-0035	WK	Stackable Channelizer Panel.....	2.00
01 55 26 00-0036	MO	Stackable Channelizer Panel.....	5.99
01 55 26 00-0037	DAY	Type I Barricade, Up To 3' Wide With Reflective Rail Each Side.....	0.92
01 55 26 00-0038	WK	Type I Barricade, Up To 3' Wide With Reflective Rail Each Side.....	2.77
01 55 26 00-0039	MO	Type I Barricade, Up To 3' Wide With Reflective Rail Each Side.....	8.30
01 55 26 00-0040	DAY	Type II Barricade, Up To 3' Wide With Two Reflective Rails Each Side	2.04
01 55 26 00-0041	WK	Type II Barricade, Up To 3' Wide With Two Reflective Rails Each Side	6.13
01 55 26 00-0042	MO	Type II Barricade, Up To 3' Wide With Two Reflective Rails Each Side	18.39
01 55 26 00-0043	DAY	Type III Barricade, Up To 5' Wide With Three Reflective Rails	2.33
01 55 26 00-0044	WK	Type III Barricade, Up To 5' Wide With Three Reflective Rails	6.99
01 55 26 00-0045	MO	Type III Barricade, Up To 5' Wide With Three Reflective Rails	20.96
01 55 26 00-0046	DAY	Type III Barricade, >5' To 10' Wide With Three Reflective Rails.....	4.26
01 55 26 00-0047	WK	Type III Barricade, >5' To 10' Wide With Three Reflective Rails.....	12.78
01 55 26 00-0048	MO	Type III Barricade, >5' To 10' Wide With Three Reflective Rails.....	38.34
01 55 26 00-0049	DAY	Up To 10' Wide A Frame Barricade	2.34
01 55 26 00-0050	WK	Up To 10' Wide A Frame Barricade	7.01
01 55 26 00-0051	MO	Up To 10' Wide A Frame Barricade	21.03
01 55 26 00-0052	DAY	Type A Or C Flasher	0.48
01 55 26 00-0053	WK	Type A Or C Flasher	1.43
01 55 26 00-0054	MO	Type A Or C Flasher	4.29
01 55 26 00-0055	DAY	Type B Flasher (High Intensity).....	2.58
01 55 26 00-0056	WK	Type B Flasher (High Intensity).....	7.75
01 55 26 00-0057	MO	Type B Flasher (High Intensity).....	23.25

01 55 26 00-0058 Traffic Barriers Rental (01 55 26 00-0023)

Note: Excludes placing and removing devices.

01 55 26 00-0059	DAY	6' Long Portable Parking Curbs	1.11
01 55 26 00-0060	WK	6' Long Portable Parking Curbs	3.34
01 55 26 00-0061	MO	6' Long Portable Parking Curbs	10.02
01 55 26 00-0062	DAY	6' Long Portable Speed Bumps	3.29
01 55 26 00-0063	WK	6' Long Portable Speed Bumps	9.88
01 55 26 00-0064	MO	6' Long Portable Speed Bumps	29.64
01 55 26 00-0065	DAY	Up To 12.5' Concrete Traffic Barrier	7.91
01 55 26 00-0066	WK	Up To 12.5' Concrete Traffic Barrier	23.73
01 55 26 00-0067	MO	Up To 12.5' Concrete Traffic Barrier	71.20
01 55 26 00-0068	DAY	>12.5' To 20' Concrete Traffic Barrier	15.82
01 55 26 00-0069	WK	>12.5' To 20' Concrete Traffic Barrier	47.47
01 55 26 00-0070	MO	>12.5' To 20' Concrete Traffic Barrier	142.40
01 55 26 00-0071	DAY	6' x 32" Tall Plastic Water Barrier.....	9.45
01 55 26 00-0072	WK	6' x 32" Tall Plastic Water Barrier.....	28.34
01 55 26 00-0073	MO	6' x 32" Tall Plastic Water Barrier.....	85.03
01 55 26 00-0074	DAY	6' x 46" Tall Plastic Water Barrier.....	13.49
01 55 26 00-0075	WK	6' x 46" Tall Plastic Water Barrier.....	40.47
01 55 26 00-0076	MO	6' x 46" Tall Plastic Water Barrier.....	121.41
01 55 26 00-0077	DAY	Sand Filled Crash Attenuator Barrels.....	5.28
01 55 26 00-0078	WK	Sand Filled Crash Attenuator Barrels.....	15.84
01 55 26 00-0079	MO	Sand Filled Crash Attenuator Barrels.....	47.52



MINOR	CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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01 55 26 00-0080

Portable Signs And Message Displays Rental (01 55 26 00-0023)

Note: Excludes placing and removing devices.

01 55 26 00-0081	DAY	Mesh Or Vinyl Roll-up Sign With Stand	4.15
01 55 26 00-0082	WK	Mesh Or Vinyl Roll-up Sign With Stand	12.44
01 55 26 00-0083	MO	Mesh Or Vinyl Roll-up Sign With Stand	37.31
01 55 26 00-0084	DAY	Aluminum Sign And Post.....	2.35
01 55 26 00-0085	WK	Aluminum Sign And Post.....	7.04
01 55 26 00-0086	MO	Aluminum Sign And Post.....	21.14
01 55 26 00-0087	DAY	Aluminum Sign And A Frame Stand	3.13
01 55 26 00-0088	WK	Aluminum Sign And A Frame Stand	9.40
01 55 26 00-0089	MO	Aluminum Sign And A Frame Stand	28.21
01 55 26 00-0090	DAY	Trailer Mounted Arrow Board.....	55.79
01 55 26 00-0091	WK	Trailer Mounted Arrow Board.....	167.38
01 55 26 00-0092	MO	Trailer Mounted Arrow Board.....	502.14
01 55 26 00-0093	DAY	Trailer Mounted Message Board.....	192.00
01 55 26 00-0094	WK	Trailer Mounted Message Board.....	576.00
01 55 26 00-0095	MO	Trailer Mounted Message Board.....	1,728.00
01 55 26 00-0096	DAY	Trailer Mounted Traffic Signal.....	258.20
01 55 26 00-0097	WK	Trailer Mounted Traffic Signal.....	1,704.12
01 55 26 00-0098	MO	Trailer Mounted Traffic Signal.....	6,713.20

01 55 26 00-0099

Place And Remove Traffic Protection Using Truck (01 55 26 00-0023)

Note: Includes delivery and return up to 15 miles.

01 55 26 00-0100	EA	Place And Remove Up To 250 Cones Using Truck.....	3.65
01 55 26 00-0101	EA	Place And Remove >250 Cones Using Truck.....	2.93
01 55 26 00-0102	EA	Place And Remove Up To 250 Panels/Channelizers Using Truck.....	4.88
01 55 26 00-0103	EA	Place And Remove >250 Panels/Channelizers Using Truck.....	3.90
01 55 26 00-0104	EA	Place And Remove Up To 250 Barricades Using Truck.....	7.32
01 55 26 00-0105	EA	Place And Remove >250 Barricades Using Truck.....	5.85
01 55 26 00-0106	EA	Place And Remove Curbs/Speed Bumps Using Truck.....	7.32
01 55 26 00-0107	EA	Place And Remove Portable Sign And Stand Using Truck.....	4.39
01 55 26 00-0108	EA	Place And Remove Aluminum Sign And Post Using Truck	18.29
01 55 26 00-0109	EA	Place And Remove Trailer Mounted Boards Using Truck.....	54.87
01 55 26 00-0110	EA	Place And Remove Up To 12.5' Concrete Traffic Barrier.....	74.09
		Note: If lifting equipment is not available on site, See CSI section 01 22 23 00-0000 for rentals tasks, 01 71 13 00-0000 for mobilization tasks.	
		For 1 Barrier, Add	185.23
		For 2 Barriers, Add	66.68
		For 3 Barriers, Add	22.23
01 55 26 00-0111	EA	Place And Remove >12.5' Concrete Traffic Barrier	111.13
		Note: If lifting equipment is not available on site, See CSI section 01 22 23 00-0000 for rentals tasks, 01 71 13 00-0000 for mobilization tasks.	
		For 1 Barrier, Add	277.83
		For 2 Barriers, Add	100.02
		For 3 Barriers, Add	33.34
01 55 26 00-0112	EA	Place And Remove Plastic Water Barrier	38.56
		Note: Includes water. If lifting equipment is not available on site, See CSI section 01 22 23 00-0000 for Equipment Usage, 01 71 13 00-0000 for mobilization tasks.	
		For 1 Barrier, Add	92.63
		For 2 Barriers, Add	33.35
		For 3 Barriers, Add	11.12
01 55 26 00-0113	EA	Place And Remove Crash Attenuator Barrels.....	55.56
		Note: If lifting equipment is not available on site, See CSI section 01 22 23 00-0000 for rentals tasks, 01 71 13 00-0000 for mobilization tasks.	
		For 1 Barrier, Add	138.90
		For 2 Barriers, Add	50.00
		For 3 Barriers, Add	16.67

01 55 26 00-0114

Place And Remove Traffic Protection From Roadside (Daily) (01 55 26 00-0023)

01 55 26 00-0115	EA	Place And Remove Up To 250 Cones By Hand From Roadside.....	1.83
01 55 26 00-0116	EA	Place And Remove >250 Cones By Hand From Roadside.....	1.47
01 55 26 00-0117	EA	Place And Remove Up To 250 Panels/Channelizers By Hand From Roadside.....	2.44
01 55 26 00-0118	EA	Place And Remove >250 Panels/Channelizers By Hand From Roadside	1.95
01 55 26 00-0119	EA	Place And Remove Up To 250 Barricades By Hand From Roadside	3.65
01 55 26 00-0120	EA	Place And Remove >250 Barricades By Hand From Roadside.....	2.93
01 55 26 00-0121	EA	Place And Remove Portable Sign And Stand From Roadside.....	2.32
01 55 26 00-0122	EA	Place And Remove Trailer Mounted Boards From Roadside	27.43
01 55 26 00-0123	EA	Roadside Relocation Of Concrete Traffic Barrier	37.05
		Note: Excludes flatbed truck. If lifting equipment is not available on site, See CSI section 01 22 23 00-0000 for rental tasks, 01 71 13 00-0000 for mobilization.	

01 56 Temporary Barriers And Enclosures (01 50)

Note: Includes removal after use.

01 56 16 Temporary Dust Barriers (01 56)

01 56 16 00-0001 Temporary Stud Wall (01 56 16)

01	General Requirements
01 50	Temporary Facilities And Controls
01 56	Temporary Barriers And Enclosures



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
01 56 16 00-0002			Temporary Stud Wall With Drywall (01 56 16 00-0001) Note: Includes 2 x 4 wood studs installed 16" on center, drywall taped and finished, and removal after use. Excludes paint.		
01 56 16 00-0003			Temporary Stud Wall With Drywall (01 56 16 00-0002)		
01 56 16 00-0004	SF		3/8" Gypsum Board On One Side, Temporary Wood Stud Wall, 16" On Center.....	4.06	
			<i>For Metal Studs 24" On Center, Add</i>	0.24	
01 56 16 00-0005	SF		1/2" Gypsum Board On One Side, Temporary Wood Stud Wall, 16" On Center.....	4.06	
			<i>For Metal Studs 24" On Center, Add</i>	0.24	
01 56 16 00-0006	SF		5/8" Gypsum Board On One Side, Temporary Wood Stud Wall, 16" On Center.....	4.15	
			<i>For Metal Studs 24" On Center, Add</i>	0.24	
01 56 16 00-0007	SF		3/8" Gypsum Board On Both Sides, Temporary Wood Stud Wall, 16" On Center	5.65	
			<i>For Metal Studs 24" On Center, Add</i>	0.30	
01 56 16 00-0008	SF		1/2" Gypsum Board On Both Sides, Temporary Wood Stud Wall, 16" On Center	5.65	
			<i>For Metal Studs 24" On Center, Add</i>	0.30	
01 56 16 00-0009	SF		5/8" Gypsum Board On Both Sides, Temporary Wood Stud Wall, 16" On Center	5.82	
			<i>For Metal Studs 24" On Center, Add</i>	0.30	
01 56 16 00-0010			Temporary Stud Wall With Fire Rated Drywall (01 56 16 00-0002)		
01 56 16 00-0011	SF		1/2" Type C Fire Rated Gypsum Board On One Side, Temporary Wood Stud Wall, 16" On Center	4.16	
			<i>For Metal Studs 24" On Center, Add</i>	0.24	
01 56 16 00-0012	SF		5/8" Type C Fire Rated Gypsum Board On One Side, Temporary Wood Stud Wall, 16" On Center	4.18	
			<i>For Metal Studs 24" On Center, Add</i>	0.24	
01 56 16 00-0013	SF		5/8" Type X Fire Rated Gypsum Board On One Side, Temporary Wood Stud Wall, 16" On Center.....	4.14	
			<i>For Metal Studs 24" On Center, Add</i>	0.24	
01 56 16 00-0014	SF		3/4" Fire Rated (Sheetrock® Ultracode®) Gypsum Board On One Side, Temporary Wood Stud Wall, 16" On Center.....	4.76	
			<i>For Metal Studs 24" On Center, Add</i>	0.24	
01 56 16 00-0015	SF		1/2" Type C Fire Rated Gypsum Board On Both Sides, Temporary Wood Stud Wall, 16" On Center.....	5.84	
			<i>For Metal Studs 24" On Center, Add</i>	0.30	
01 56 16 00-0016	SF		5/8" Type C Fire Rated Gypsum Board On Both Sides, Temporary Wood Stud Wall, 16" On Center.....	5.89	
			<i>For Metal Studs 24" On Center, Add</i>	0.30	
01 56 16 00-0017	SF		5/8" Type X Fire Rated Gypsum Board On Both Sides, Temporary Wood Stud Wall, 16" On Center	5.80	
			<i>For Metal Studs 24" On Center, Add</i>	0.30	
01 56 16 00-0018	SF		3/4" Fire Rated (Sheetrock® Ultracode®) Gypsum Board On Both Sides, Temporary Wood Stud Wall, 16" On Center.....	7.05	
			<i>For Metal Studs 24" On Center, Add</i>	0.30	
01 56 16 00-0019			Temporary Stud Wall With Oriented Strand Board (OSB) (01 56 16 00-0001) Note: Includes 2 x 4 wood studs installed 16" on center, oriented strand board (OSB) wall sheathing, and removal after use. Excludes paint.		
01 56 16 00-0020	SF		7/16" Oriented Strand Board (OSB) Wall Sheathing On One Side, Temporary Wood Stud Wall, 16" On Center.....	3.95	
			<i>For Metal Studs 24" On Center, Add</i>	0.24	
01 56 16 00-0021	SF		1/2" Oriented Strand Board (OSB) Wall Sheathing On One Side, Temporary Wood Stud Wall, 16" On Center.....	3.98	
			<i>For Metal Studs 24" On Center, Add</i>	0.24	
01 56 16 00-0022	SF		5/8" Oriented Strand Board (OSB) Wall Sheathing On One Side, Temporary Wood Stud Wall, 16" On Center.....	4.09	
			<i>For Metal Studs 24" On Center, Add</i>	0.24	
01 56 16 00-0023	SF		3/4" Oriented Strand Board (OSB) Wall Sheathing On One Side, Temporary Wood Stud Wall, 16" On Center.....	4.14	
			<i>For Metal Studs 24" On Center, Add</i>	0.24	
01 56 16 00-0024	SF		7/16" Oriented Strand Board (OSB) Wall Sheathing On Both Sides, Temporary Wood Stud Wall, 16" On Center	5.42	
			<i>For Metal Studs 24" On Center, Add</i>	0.30	
01 56 16 00-0025	SF		1/2" Oriented Strand Board (OSB) Wall Sheathing On Both Sides, Temporary Wood Stud Wall, 16" On Center	5.49	
			<i>For Metal Studs 24" On Center, Add</i>	0.30	
01 56 16 00-0026	SF		5/8" Oriented Strand Board (OSB) Wall Sheathing On Both Sides, Temporary Wood Stud Wall, 16" On Center	5.70	
			<i>For Metal Studs 24" On Center, Add</i>	0.30	
01 56 16 00-0027	SF		3/4" Oriented Strand Board (OSB) Wall Sheathing On Both Sides, Temporary Wood Stud Wall, 16" On Center	5.81	
			<i>For Metal Studs 24" On Center, Add</i>	0.30	
01 56 16 00-0028			Temporary Stud Wall With BC Plywood (01 56 16 00-0001) Note: Includes 2 x 4 wood studs installed 16" on center, interior/exterior BC plywood wall sheathing, and removal after use. Excludes paint.		
01 56 16 00-0029	SF		3/8" BC Plywood Wall Sheathing On One Side, Temporary Wood Stud Wall, 16" On Center.....	4.19	
			<i>For Metal Studs 24" On Center, Add</i>	0.24	
01 56 16 00-0030	SF		1/2" BC Plywood Wall Sheathing On One Side, Temporary Wood Stud Wall, 16" On Center.....	4.32	
			<i>For Metal Studs 24" On Center, Add</i>	0.24	
01 56 16 00-0031	SF		5/8" BC Plywood Wall Sheathing On One Side, Temporary Wood Stud Wall, 16" On Center.....	4.46	
			<i>For Metal Studs 24" On Center, Add</i>	0.24	
01 56 16 00-0032	SF		3/4" BC Plywood Wall Sheathing On One Side, Temporary Wood Stud Wall, 16" On Center	4.57	
			<i>For Metal Studs 24" On Center, Add</i>	0.24	
01 56 16 00-0033	SF		3/8" BC Plywood Wall Sheathing On Both Sides, Temporary Wood Stud Wall, 16" On Center.....	5.91	
			<i>For Metal Studs 24" On Center, Add</i>	0.30	
01 56 16 00-0034	SF		1/2" BC Plywood Wall Sheathing On Both Sides, Temporary Wood Stud Wall, 16" On Center.....	6.17	
			<i>For Metal Studs 24" On Center, Add</i>	0.30	
01 56 16 00-0035	SF		5/8" BC Plywood Wall Sheathing On Both Sides, Temporary Wood Stud Wall, 16" On Center.....	6.45	
			<i>For Metal Studs 24" On Center, Add</i>	0.30	
01 56 16 00-0036	SF		3/4" BC Plywood Wall Sheathing On Both Sides, Temporary Wood Stud Wall, 16" On Center.....	6.67	
			<i>For Metal Studs 24" On Center, Add</i>	0.30	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
01 56 16 00-0037 Temporary Stud Wall With Plastic Sheeting <small>(01 56 16 00-0001)</small> Note: Includes 2 x 4 wood studs installed 16" on center, 6 Mil plastic sheeting, and removal after use. Excludes paint.		
01 56 16 00-0038 SF 6 Mil Plastic Sheeting On One Side, Temporary Wood Stud Wall, 16" On Center	2.31	
01 56 16 00-0039 Temporary Doors <small>(01 56 16 00-0001)</small>		
01 56 16 00-0040 EA Temporary Metal Door And Frame	382.43	
Note: Painted with panic hardware, lockset, threshold and smoke seals. Remove after use.		
01 56 16 00-0041 Temporary Floor Protection <small>(01 56 16)</small>		
01 56 16 00-0042 SF Masonite For Temporary Floor Protection	1.30	
01 56 16 00-0043 SF 1/2" Plywood For Temporary Floor Protection	1.35	
01 56 16 00-0044 SF 3/4" Plywood For Temporary Floor Protection	1.67	
01 56 26 Temporary Fencing <small>(01 56)</small>		
01 56 26 00-0001 Temporary Fencing <small>(01 56 26)</small> Note: Includes set-up and removal. Excludes auguring/drilling for posts.		
01 56 26 00-0002 Temporary Chain Link Fence <small>(01 56 26 00-0001)</small> Note: Includes set-up and removal. Excludes auguring/drilling for posts.		
01 56 26 00-0003 Temporary Chain Link Fence, Up To 6 Months <small>(01 56 26 00-0002)</small>		
01 56 26 00-0004 LF Temporary 4' High Chain Link Fence And Posts, Up To 6 Months	3.15	
For >100 To 250, Deduct	-0.16	
For >250 To 500, Deduct	-0.32	
For >500, Deduct	-0.47	
For Shade Cloth, Add	1.60	
01 56 26 00-0005 LF Temporary 6' High Chain Link Fence And Posts, Up To 6 Months	3.56	
For >100 To 250, Deduct	-0.18	
For >250 To 500, Deduct	-0.36	
For >500, Deduct	-0.53	
For Shade Cloth, Add	2.55	
01 56 26 00-0006 LF Temporary 8' High Chain Link Fence And Posts, Up To 6 Months	6.01	
For >100 To 250, Deduct	-0.30	
For >250 To 500, Deduct	-0.60	
For >500, Deduct	-0.90	
For Shade Cloth, Add	3.60	
01 56 26 00-0007 LF Temporary 10' High Chain Link Fence And Posts, Up To 6 Months	17.88	
For >100 To 250, Deduct	-0.89	
For >250 To 500, Deduct	-1.79	
For >500, Deduct	-2.68	
For Shade Cloth, Add	4.75	
01 56 26 00-0008 Temporary Chain Link Fence, >6 To 12 Months <small>(01 56 26 00-0002)</small>		
01 56 26 00-0009 LF Temporary 4' High Chain Link Fence And Posts, >6 To 12 Months	3.48	
For >100 To 250, Deduct	-0.17	
For >250 To 500, Deduct	-0.35	
For >500, Deduct	-0.52	
For Shade Cloth, Add	1.60	
01 56 26 00-0010 LF Temporary 6' High Chain Link Fence And Posts, >6 To 12 Months	3.91	
For >100 To 250, Deduct	-0.20	
For >250 To 500, Deduct	-0.39	
For >500, Deduct	-0.59	
For Shade Cloth, Add	2.55	
01 56 26 00-0011 LF Temporary 8' High Chain Link Fence And Posts, >6 To 12 Months	6.61	
For >100 To 250, Deduct	-0.33	
For >250 To 500, Deduct	-0.66	
For >500, Deduct	-0.99	
For Shade Cloth, Add	3.60	
01 56 26 00-0012 LF Temporary 10' High Chain Link Fence And Posts, >6 To 12 Months	19.66	
For >100 To 250, Deduct	-0.98	
For >250 To 500, Deduct	-1.97	
For >500, Deduct	-2.95	
For Shade Cloth, Add	4.75	
01 56 26 00-0013 Temporary Chain Link Fence, >12 To 18 Months <small>(01 56 26 00-0002)</small>		
01 56 26 00-0014 LF Temporary 4' High Chain Link Fence And Posts, >12 To 18 Months	3.83	
For >100 To 250, Deduct	-0.19	
For >250 To 500, Deduct	-0.38	
For >500, Deduct	-0.57	
For Shade Cloth, Add	1.60	
01 56 26 00-0015 LF Temporary 6' High Chain Link Fence And Posts, >12 To 18 Months	4.31	
For >100 To 250, Deduct	-0.22	
For >250 To 500, Deduct	-0.43	
For >500, Deduct	-0.65	
For Shade Cloth, Add	2.55	

01	General Requirements
01 50	Temporary Facilities And Controls
01 56	Temporary Barriers And Enclosures



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
01 56 26 00-0016 LF Temporary 8' High Chain Link Fence And Posts, >12 To 18 Months.....	7.28	
For >100 To 250, Deduct	-0.36	
For >250 To 500, Deduct	-0.73	
For >500, Deduct	-1.09	
For Shade Cloth, Add	3.60	
01 56 26 00-0017 LF Temporary 10' High Chain Link Fence And Posts, >12 To 18 Months.....	21.63	
For >100 To 250, Deduct	-1.08	
For >250 To 500, Deduct	-2.16	
For >500, Deduct	-3.24	
For Shade Cloth, Add	4.75	
01 56 26 00-0018 Temporary Chain Link Fence, >18 Months (01 56 26 00-0002)		
01 56 26 00-0019 LF Temporary 4' High Chain Link Fence And Posts, >18 Months.....	4.21	
For >100 To 250, Deduct	-0.21	
For >250 To 500, Deduct	-0.42	
For >500, Deduct	-0.63	
For Shade Cloth, Add	1.60	
01 56 26 00-0020 LF Temporary 6' High Chain Link Fence And Posts, >18 Months.....	4.72	
For >100 To 250, Deduct	-0.24	
For >250 To 500, Deduct	-0.47	
For >500, Deduct	-0.71	
For Shade Cloth, Add	2.55	
01 56 26 00-0021 LF Temporary 8' High Chain Link Fence And Posts, >18 Months.....	7.99	
For >100 To 250, Deduct	-0.40	
For >250 To 500, Deduct	-0.80	
For >500, Deduct	-1.20	
For Shade Cloth, Add	3.60	
01 56 26 00-0022 LF Temporary 10' High Chain Link Fence And Posts, >18 Months.....	23.78	
For >100 To 250, Deduct	-1.19	
For >250 To 500, Deduct	-2.38	
For >500, Deduct	-3.57	
For Shade Cloth, Add	4.75	
01 56 26 00-0023 Temporary Chain Link Fence Gates (01 56 26 00-0001)		
Note: Includes set-up and removal. Excludes auguring/drilling for posts.		
01 56 26 00-0024 Temporary Chain Link Fence Gates, Up To 6 Months (01 56 26 00-0023)		
01 56 26 00-0025 4' High, Temporary Chain Link Fence Gates, Up To 6 Months (01 56 26 00-0024)		
01 56 26 00-0026 EA 4' Wide, 4' High, Temporary Chain Link Fence Gate, Up To 6 Months.....	200.98	
For Shade Cloth, Add	15.01	
01 56 26 00-0027 EA 10' Wide, 4' High, Temporary Chain Link Fence Gate, Up To 6 Months.....	312.64	
For Shade Cloth, Add	37.52	
01 56 26 00-0028 EA 12' Wide, 4' High, Temporary Chain Link Fence Gate, Up To 6 Months.....	357.30	
For Shade Cloth, Add	45.02	
01 56 26 00-0029 EA 15' Wide, 4' High, Temporary Chain Link Fence Gate, Up To 6 Months.....	401.96	
For Shade Cloth, Add	56.28	
01 56 26 00-0030 EA 20' Wide, 4' High, Temporary Chain Link Fence Gate, Up To 6 Months.....	491.28	
For Shade Cloth, Add	75.03	
01 56 26 00-0031 EA 24' Wide, 4' High, Temporary Chain Link Fence Gate, Up To 6 Months.....	535.97	
For Shade Cloth, Add	90.04	
01 56 26 00-0032 6' High, Temporary Chain Link Fence Gates, Up To 6 Months (01 56 26 00-0024)		
01 56 26 00-0033 EA 4' Wide, 6' High, Temporary Chain Link Fence Gate, Up To 6 Months.....	210.12	
For Shade Cloth, Add	23.92	
01 56 26 00-0034 EA 10' Wide, 6' High, Temporary Chain Link Fence Gate, Up To 6 Months.....	326.84	
For Shade Cloth, Add	59.79	
01 56 26 00-0035 EA 12' Wide, 6' High, Temporary Chain Link Fence Gate, Up To 6 Months.....	373.53	
For Shade Cloth, Add	71.75	
01 56 26 00-0036 EA 15' Wide, 6' High, Temporary Chain Link Fence Gate, Up To 6 Months.....	420.25	
For Shade Cloth, Add	89.69	
01 56 26 00-0037 EA 20' Wide, 6' High, Temporary Chain Link Fence Gate, Up To 6 Months.....	513.62	
For Shade Cloth, Add	119.58	
01 56 26 00-0038 EA 24' Wide, 6' High, Temporary Chain Link Fence Gate, Up To 6 Months.....	560.31	
For Shade Cloth, Add	143.50	
01 56 26 00-0039 8' High, Temporary Chain Link Fence Gates, Up To 6 Months (01 56 26 00-0024)		
01 56 26 00-0040 EA 4' Wide, 8' High, Temporary Chain Link Fence Gate, Up To 6 Months.....	231.13	
For Shade Cloth, Add	33.77	
01 56 26 00-0041 EA 10' Wide, 8' High, Temporary Chain Link Fence Gate, Up To 6 Months.....	359.54	
For Shade Cloth, Add	84.41	
01 56 26 00-0042 EA 12' Wide, 8' High, Temporary Chain Link Fence Gate, Up To 6 Months.....	410.90	
For Shade Cloth, Add	101.30	
01 56 26 00-0043 EA 15' Wide, 8' High, Temporary Chain Link Fence Gate, Up To 6 Months.....	462.26	
For Shade Cloth, Add	126.62	
01 56 26 00-0044 EA 20' Wide, 8' High, Temporary Chain Link Fence Gate, Up To 6 Months.....	564.99	
For Shade Cloth, Add	168.83	
01 56 26 00-0045 EA 24' Wide, 8' High, Temporary Chain Link Fence Gate, Up To 6 Months.....	616.35	
For Shade Cloth, Add	202.59	



General Requirements			01
Temporary Facilities And Controls			01 50
Temporary Barriers And Enclosures			01 56

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
01 56 26 00-0046 10' High, Temporary Chain Link Fence Gates, Up To 6 Months <small>(01 56 26 00-0024)</small>		
01 56 26 00-0047 EA 4' Wide, 10' High, Temporary Chain Link Fence Gate, Up To 6 Months.....	288.91	
For Shade Cloth, Add	44.55	
01 56 26 00-0048 EA 10' Wide, 10' High, Temporary Chain Link Fence Gate, Up To 6 Months.....	449.42	
For Shade Cloth, Add	111.38	
01 56 26 00-0049 EA 12' Wide, 10' High, Temporary Chain Link Fence Gate, Up To 6 Months.....	513.62	
For Shade Cloth, Add	133.65	
01 56 26 00-0050 EA 15' Wide, 10' High, Temporary Chain Link Fence Gate, Up To 6 Months.....	577.83	
For Shade Cloth, Add	167.07	
01 56 26 00-0051 EA 20' Wide, 10' High, Temporary Chain Link Fence Gate, Up To 6 Months.....	706.23	
For Shade Cloth, Add	222.76	
01 56 26 00-0052 EA 24' Wide, 10' High, Temporary Chain Link Fence Gate, Up To 6 Months.....	770.43	
For Shade Cloth, Add	267.31	
01 56 26 00-0053 Temporary Chain Link Fence Gates, >6 To 12 Months <small>(01 56 26 00-0023)</small>		
01 56 26 00-0054 4' High, Temporary Chain Link Fence Gates, >6 To 12 Months <small>(01 56 26 00-0053)</small>		
01 56 26 00-0055 EA 4' Wide, 4' High, Temporary Chain Link Fence Gate, >6 To 12 Months.....	211.03	
For Shade Cloth, Add	15.01	
01 56 26 00-0056 EA 10' Wide, 4' High, Temporary Chain Link Fence Gate, >6 To 12 Months.....	328.27	
For Shade Cloth, Add	37.52	
01 56 26 00-0057 EA 12' Wide, 4' High, Temporary Chain Link Fence Gate, >6 To 12 Months.....	375.17	
For Shade Cloth, Add	45.02	
01 56 26 00-0058 EA 15' Wide, 4' High, Temporary Chain Link Fence Gate, >6 To 12 Months.....	422.06	
For Shade Cloth, Add	56.28	
01 56 26 00-0059 EA 20' Wide, 4' High, Temporary Chain Link Fence Gate, >6 To 12 Months.....	515.84	
For Shade Cloth, Add	75.03	
01 56 26 00-0060 EA 24' Wide, 4' High, Temporary Chain Link Fence Gate, >6 To 12 Months.....	562.76	
For Shade Cloth, Add	90.04	
01 56 26 00-0061 6' High, Temporary Chain Link Fence Gates, >6 To 12 Months <small>(01 56 26 00-0053)</small>		
01 56 26 00-0062 EA 4' Wide, 6' High, Temporary Chain Link Fence Gate, >6 To 12 Months.....	220.63	
For Shade Cloth, Add	23.92	
01 56 26 00-0063 EA 10' Wide, 6' High, Temporary Chain Link Fence Gate, >6 To 12 Months.....	343.19	
For Shade Cloth, Add	59.79	
01 56 26 00-0064 EA 12' Wide, 6' High, Temporary Chain Link Fence Gate, >6 To 12 Months.....	392.21	
For Shade Cloth, Add	71.75	
01 56 26 00-0065 EA 15' Wide, 6' High, Temporary Chain Link Fence Gate, >6 To 12 Months.....	441.26	
For Shade Cloth, Add	89.69	
01 56 26 00-0066 EA 20' Wide, 6' High, Temporary Chain Link Fence Gate, >6 To 12 Months.....	539.30	
For Shade Cloth, Add	119.58	
01 56 26 00-0067 EA 24' Wide, 6' High, Temporary Chain Link Fence Gate, >6 To 12 Months.....	588.33	
For Shade Cloth, Add	143.50	
01 56 26 00-0068 8' High, Temporary Chain Link Fence Gates, >6 To 12 Months <small>(01 56 26 00-0053)</small>		
01 56 26 00-0069 EA 4' Wide, 8' High, Temporary Chain Link Fence Gate, >6 To 12 Months.....	242.69	
For Shade Cloth, Add	33.77	
01 56 26 00-0070 EA 10' Wide, 8' High, Temporary Chain Link Fence Gate, >6 To 12 Months.....	377.51	
For Shade Cloth, Add	84.41	
01 56 26 00-0071 EA 12' Wide, 8' High, Temporary Chain Link Fence Gate, >6 To 12 Months.....	431.44	
For Shade Cloth, Add	101.30	
01 56 26 00-0072 EA 15' Wide, 8' High, Temporary Chain Link Fence Gate, >6 To 12 Months.....	485.37	
For Shade Cloth, Add	126.62	
01 56 26 00-0073 EA 20' Wide, 8' High, Temporary Chain Link Fence Gate, >6 To 12 Months.....	593.23	
For Shade Cloth, Add	168.83	
01 56 26 00-0074 EA 24' Wide, 8' High, Temporary Chain Link Fence Gate, >6 To 12 Months.....	647.16	
For Shade Cloth, Add	202.59	
01 56 26 00-0075 10' High, Temporary Chain Link Fence Gates, >6 To 12 Months <small>(01 56 26 00-0053)</small>		
01 56 26 00-0076 EA 4' Wide, 10' High, Temporary Chain Link Fence Gate, >6 To 12 Months.....	303.36	
For Shade Cloth, Add	44.55	
01 56 26 00-0077 EA 10' Wide, 10' High, Temporary Chain Link Fence Gate, >6 To 12 Months.....	471.89	
For Shade Cloth, Add	111.38	
01 56 26 00-0078 EA 12' Wide, 10' High, Temporary Chain Link Fence Gate, >6 To 12 Months.....	539.30	
For Shade Cloth, Add	133.65	
01 56 26 00-0079 EA 15' Wide, 10' High, Temporary Chain Link Fence Gate, >6 To 12 Months.....	606.72	
For Shade Cloth, Add	167.07	
01 56 26 00-0080 EA 20' Wide, 10' High, Temporary Chain Link Fence Gate, >6 To 12 Months.....	741.54	
For Shade Cloth, Add	222.76	
01 56 26 00-0081 EA 24' Wide, 10' High, Temporary Chain Link Fence Gate, >6 To 12 Months.....	808.96	
For Shade Cloth, Add	267.31	
01 56 26 00-0082 Temporary Chain Link Fence Gates, >12 To 18 Months <small>(01 56 26 00-0023)</small>		
01 56 26 00-0083 4' High, Temporary Chain Link Fence Gates, >12 To 18 Months <small>(01 56 26 00-0082)</small>		
01 56 26 00-0084 EA 4' Wide, 4' High, Temporary Chain Link Fence Gate, >12 To 18 Months.....	221.58	
For Shade Cloth, Add	15.01	

01	General Requirements
01 50	Temporary Facilities And Controls
01 56	Temporary Barriers And Enclosures



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
01 56 26 00-0085 EA 10' Wide, 4' High, Temporary Chain Link Fence Gate, >12 To 18 Months	344.69	
For Shade Cloth, Add	37.52	
01 56 26 00-0086 EA 12' Wide, 4' High, Temporary Chain Link Fence Gate, >12 To 18 Months	393.93	
For Shade Cloth, Add	45.02	
01 56 26 00-0087 EA 15' Wide, 4' High, Temporary Chain Link Fence Gate, >12 To 18 Months	443.16	
For Shade Cloth, Add	56.28	
01 56 26 00-0088 EA 20' Wide, 4' High, Temporary Chain Link Fence Gate, >12 To 18 Months	541.64	
For Shade Cloth, Add	75.03	
01 56 26 00-0089 EA 24' Wide, 4' High, Temporary Chain Link Fence Gate, >12 To 18 Months	590.90	
For Shade Cloth, Add	90.04	
01 56 26 00-0090 6' High, Temporary Chain Link Fence Gates, >12 To 18 Months (01 56 26 00-0082)		
01 56 26 00-0091 EA 4' Wide, 6' High, Temporary Chain Link Fence Gate, >12 To 18 Months	231.66	
For Shade Cloth, Add	23.92	
01 56 26 00-0092 EA 10' Wide, 6' High, Temporary Chain Link Fence Gate, >12 To 18 Months	360.35	
For Shade Cloth, Add	59.79	
01 56 26 00-0093 EA 12' Wide, 6' High, Temporary Chain Link Fence Gate, >12 To 18 Months	411.82	
For Shade Cloth, Add	71.75	
01 56 26 00-0094 EA 15' Wide, 6' High, Temporary Chain Link Fence Gate, >12 To 18 Months	463.32	
For Shade Cloth, Add	89.69	
01 56 26 00-0095 EA 20' Wide, 6' High, Temporary Chain Link Fence Gate, >12 To 18 Months	566.27	
For Shade Cloth, Add	119.58	
01 56 26 00-0096 EA 24' Wide, 6' High, Temporary Chain Link Fence Gate, >12 To 18 Months	617.74	
For Shade Cloth, Add	143.50	
01 56 26 00-0097 8' High, Temporary Chain Link Fence Gates, >12 To 18 Months (01 56 26 00-0082)		
01 56 26 00-0098 EA 4' Wide, 8' High, Temporary Chain Link Fence Gate, >12 To 18 Months	254.82	
For Shade Cloth, Add	33.77	
01 56 26 00-0099 EA 10' Wide, 8' High, Temporary Chain Link Fence Gate, >12 To 18 Months	396.39	
For Shade Cloth, Add	84.41	
01 56 26 00-0100 EA 12' Wide, 8' High, Temporary Chain Link Fence Gate, >12 To 18 Months	453.02	
For Shade Cloth, Add	101.30	
01 56 26 00-0101 EA 15' Wide, 8' High, Temporary Chain Link Fence Gate, >12 To 18 Months	509.64	
For Shade Cloth, Add	126.62	
01 56 26 00-0102 EA 20' Wide, 8' High, Temporary Chain Link Fence Gate, >12 To 18 Months	622.90	
For Shade Cloth, Add	168.83	
01 56 26 00-0103 EA 24' Wide, 8' High, Temporary Chain Link Fence Gate, >12 To 18 Months	679.52	
For Shade Cloth, Add	202.59	
01 56 26 00-0104 10' High, Temporary Chain Link Fence Gates, >12 To 18 Months (01 56 26 00-0082)		
01 56 26 00-0105 EA 4' Wide, 10' High, Temporary Chain Link Fence Gate, >12 To 18 Months	318.53	
For Shade Cloth, Add	44.55	
01 56 26 00-0106 EA 10' Wide, 10' High, Temporary Chain Link Fence Gate, >12 To 18 Months	495.49	
For Shade Cloth, Add	111.38	
01 56 26 00-0107 EA 12' Wide, 10' High, Temporary Chain Link Fence Gate, >12 To 18 Months	566.27	
For Shade Cloth, Add	133.65	
01 56 26 00-0108 EA 15' Wide, 10' High, Temporary Chain Link Fence Gate, >12 To 18 Months	637.05	
For Shade Cloth, Add	167.07	
01 56 26 00-0109 EA 20' Wide, 10' High, Temporary Chain Link Fence Gate, >12 To 18 Months	778.62	
For Shade Cloth, Add	222.76	
01 56 26 00-0110 EA 24' Wide, 10' High, Temporary Chain Link Fence Gate, >12 To 18 Months	849.40	
For Shade Cloth, Add	267.31	
01 56 26 00-0111 Temporary Chain Link Fence Gates, >18 Months (01 56 26 00-0023)		
01 56 26 00-0112 4' High, Temporary Chain Link Fence Gates, >18 Months (01 56 26 00-0111)		
01 56 26 00-0113 EA 4' Wide, 4' High, Temporary Chain Link Fence Gate, >18 Months	232.13	
For Shade Cloth, Add	15.01	
01 56 26 00-0114 EA 10' Wide, 4' High, Temporary Chain Link Fence Gate, >18 Months	361.10	
For Shade Cloth, Add	37.52	
01 56 26 00-0115 EA 12' Wide, 4' High, Temporary Chain Link Fence Gate, >18 Months	412.68	
For Shade Cloth, Add	45.02	
01 56 26 00-0116 EA 15' Wide, 4' High, Temporary Chain Link Fence Gate, >18 Months	464.27	
For Shade Cloth, Add	56.28	
01 56 26 00-0117 EA 20' Wide, 4' High, Temporary Chain Link Fence Gate, >18 Months	567.43	
For Shade Cloth, Add	75.03	
01 56 26 00-0118 EA 24' Wide, 4' High, Temporary Chain Link Fence Gate, >18 Months	619.04	
For Shade Cloth, Add	90.04	
01 56 26 00-0119 6' High, Temporary Chain Link Fence Gates, >18 Months (01 56 26 00-0111)		
01 56 26 00-0120 EA 4' Wide, 6' High, Temporary Chain Link Fence Gate, >18 Months	242.69	
For Shade Cloth, Add	23.92	
01 56 26 00-0121 EA 10' Wide, 6' High, Temporary Chain Link Fence Gate, >18 Months	377.50	
For Shade Cloth, Add	59.79	
01 56 26 00-0122 EA 12' Wide, 6' High, Temporary Chain Link Fence Gate, >18 Months	431.43	
For Shade Cloth, Add	71.75	
01 56 26 00-0123 EA 15' Wide, 6' High, Temporary Chain Link Fence Gate, >18 Months	485.38	
For Shade Cloth, Add	89.69	



General Requirements	01	10
Temporary Facilities And Controls	01 50	
Temporary Barriers And Enclosures	01 56	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
01 56 26 00-0124 EA 20' Wide, 6' High, Temporary Chain Link Fence Gate, >18 Months	593.23	
For Shade Cloth, Add	119.58	
01 56 26 00-0125 EA 24' Wide, 6' High, Temporary Chain Link Fence Gate, >18 Months	647.16	
For Shade Cloth, Add	143.50	
01 56 26 00-0126 8' High, Temporary Chain Link Fence Gates, >18 Months (01 56 26 00-0111)		
01 56 26 00-0127 EA 4' Wide, 8' High, Temporary Chain Link Fence Gate, >18 Months	266.96	
For Shade Cloth, Add	33.77	
01 56 26 00-0128 EA 10' Wide, 8' High, Temporary Chain Link Fence Gate, >18 Months	415.26	
For Shade Cloth, Add	84.41	
01 56 26 00-0129 EA 12' Wide, 8' High, Temporary Chain Link Fence Gate, >18 Months	474.59	
For Shade Cloth, Add	101.30	
01 56 26 00-0130 EA 15' Wide, 8' High, Temporary Chain Link Fence Gate, >18 Months	533.91	
For Shade Cloth, Add	126.62	
01 56 26 00-0131 EA 20' Wide, 8' High, Temporary Chain Link Fence Gate, >18 Months	652.56	
For Shade Cloth, Add	168.83	
01 56 26 00-0132 EA 24' Wide, 8' High, Temporary Chain Link Fence Gate, >18 Months	711.88	
For Shade Cloth, Add	202.59	
01 56 26 00-0133 10' High, Temporary Chain Link Fence Gates, >18 Months (01 56 26 00-0111)		
01 56 26 00-0134 EA 4' Wide, 10' High, Temporary Chain Link Fence Gate, >18 Months	333.69	
For Shade Cloth, Add	44.55	
01 56 26 00-0135 EA 10' Wide, 10' High, Temporary Chain Link Fence Gate, >18 Months	519.08	
For Shade Cloth, Add	111.38	
01 56 26 00-0136 EA 12' Wide, 10' High, Temporary Chain Link Fence Gate, >18 Months	593.23	
For Shade Cloth, Add	133.65	
01 56 26 00-0137 EA 15' Wide, 10' High, Temporary Chain Link Fence Gate, >18 Months	667.39	
For Shade Cloth, Add	167.07	
01 56 26 00-0138 EA 20' Wide, 10' High, Temporary Chain Link Fence Gate, >18 Months	815.70	
For Shade Cloth, Add	222.76	
01 56 26 00-0139 EA 24' Wide, 10' High, Temporary Chain Link Fence Gate, >18 Months	889.85	
For Shade Cloth, Add	267.31	
01 56 26 00-0140 Temporary Chain Link Fence Panels (Portable) (01 56 26 00-0001)		
Note: Includes set-up and removal. Excludes sandbags.		
01 56 26 00-0141 Temporary Chain Link Fence Panels (Portable), Up To 6 Months (01 56 26 00-0140)		
01 56 26 00-0142 LF Temporary 4' High Chain Link Fence Panels (Portable), Up To 6 Months.....	3.78	
For >100 To 250, Deduct	-0.19	
For >250 To 500, Deduct	-0.38	
For >500, Deduct	-0.57	
For Shade Cloth, Add	1.60	
01 56 26 00-0143 LF Temporary 6' High Chain Link Fence Panels (Portable), Up To 6 Months.....	4.23	
For >100 To 250, Deduct	-0.21	
For >250 To 500, Deduct	-0.42	
For >500, Deduct	-0.63	
For Shade Cloth, Add	2.55	
01 56 26 00-0144 LF Temporary 8' High Chain Link Fence Panels (Portable), Up To 6 Months.....	6.82	
For >100 To 250, Deduct	-0.34	
For >250 To 500, Deduct	-0.68	
For >500, Deduct	-1.02	
For Shade Cloth, Add	3.60	
01 56 26 00-0145 Temporary Chain Link Fence Panels (Portable), >6 To 12 Months (01 56 26 00-0140)		
01 56 26 00-0146 LF Temporary 4' High Chain Link Fence Panels (Portable), >6 To 12 Months.....	4.10	
For >100 To 250, Deduct	-0.21	
For >250 To 500, Deduct	-0.41	
For >500, Deduct	-0.62	
For Shade Cloth, Add	1.60	
01 56 26 00-0147 LF Temporary 6' High Chain Link Fence Panels (Portable), >6 To 12 Months.....	4.58	
For >100 To 250, Deduct	-0.23	
For >250 To 500, Deduct	-0.46	
For >500, Deduct	-0.69	
For Shade Cloth, Add	2.55	
01 56 26 00-0148 LF Temporary 8' High Chain Link Fence Panels (Portable), >6 To 12 Months.....	7.42	
For >100 To 250, Deduct	-0.37	
For >250 To 500, Deduct	-0.74	
For >500, Deduct	-1.11	
For Shade Cloth, Add	3.60	
01 56 26 00-0149 Temporary Chain Link Fence Panels (Portable), >12 To 18 Months (01 56 26 00-0140)		
01 56 26 00-0150 LF Temporary 4' High Chain Link Fence Panels (Portable), >12 To 18 Months.....	4.42	
For >100 To 250, Deduct	-0.22	
For >250 To 500, Deduct	-0.44	
For >500, Deduct	-0.66	
For Shade Cloth, Add	1.60	

01	General Requirements
01 50	Temporary Facilities And Controls
01 56	Temporary Barriers And Enclosures



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
	01 56 26 00-0151	LF	Temporary 6' High Chain Link Fence Panels (Portable), >12 To 18 Months	4.99	
			<i>For >100 To 250, Deduct</i>	-0.25	
			<i>For >250 To 500, Deduct</i>	-0.50	
			<i>For >500, Deduct</i>	-0.75	
			<i>For Shade Cloth, Add</i>	2.55	
	01 56 26 00-0152	LF	Temporary 8' High Chain Link Fence Panels (Portable), >12 To 18 Months	8.09	
			<i>For >100 To 250, Deduct</i>	-0.40	
			<i>For >250 To 500, Deduct</i>	-0.81	
			<i>For >500, Deduct</i>	-1.21	
			<i>For Shade Cloth, Add</i>	3.60	
01 56 26 00-0153	Temporary Chain Link Fence Panels (Portable), >18 Months <small>(01 56 26 00-0140)</small>				
	01 56 26 00-0154	LF	Temporary 4' High Chain Link Fence Panels (Portable), >18 Months	4.83	
			<i>For >100 To 250, Deduct</i>	-0.24	
			<i>For >250 To 500, Deduct</i>	-0.48	
			<i>For >500, Deduct</i>	-0.72	
			<i>For Shade Cloth, Add</i>	1.60	
	01 56 26 00-0155	LF	Temporary 6' High Chain Link Fence Panels (Portable), >18 Months	5.39	
			<i>For >100 To 250, Deduct</i>	-0.27	
			<i>For >250 To 500, Deduct</i>	-0.54	
			<i>For >500, Deduct</i>	-0.81	
			<i>For Shade Cloth, Add</i>	2.55	
	01 56 26 00-0156	LF	Temporary 8' High Chain Link Fence Panels (Portable), >18 Months	8.79	
			<i>For >100 To 250, Deduct</i>	-0.44	
			<i>For >250 To 500, Deduct</i>	-0.88	
			<i>For >500, Deduct</i>	-1.32	
			<i>For Shade Cloth, Add</i>	3.60	
01 56 26 00-0157	Temporary Chain Link Fence Panels (Portable) Sandbags <small>(01 56 26 00-0140)</small>				
	01 56 26 00-0158	BAG	Temporary Chain Link Fence Panels (Portable) Sandbag.....	5.95	
			Note: Includes placement and removal.		
01 56 26 00-0159	Relocate Chain Link Fence, Gates And Panels <small>(01 56 26 00-0001)</small>				
			Note: Excludes auguring/drilling for posts.		
01 56 26 00-0160	Relocate Temporary Chain Link Fence On Site <small>(01 56 26 00-0159)</small>				
	01 56 26 00-0161	LF	Relocate Temporary 4' High Chain Link Fence And Posts	2.39	
	01 56 26 00-0162	LF	Relocate Temporary 6' High Chain Link Fence And Posts	3.58	
	01 56 26 00-0163	LF	Relocate Temporary 8' High Chain Link Fence And Posts	5.18	
	01 56 26 00-0164	LF	Relocate Temporary 10' High Chain Link Fence And Posts	6.37	
01 56 26 00-0165	Relocate Temporary Chain Link Fence Panels On Site <small>(01 56 26 00-0159)</small>				
	01 56 26 00-0166	LF	Relocate Temporary 4' High Chain Link Fence Panel, Self Standing	0.73	
	01 56 26 00-0167	LF	Relocate Temporary 6' High Chain Link Fence Panel, Self Standing	0.87	
	01 56 26 00-0168	LF	Relocate Temporary 8' High Chain Link Fence Panel, Self Standing	0.98	
01 56 26 00-0169	Relocate Temporary Chain Link Gates On Site <small>(01 56 26 00-0159)</small>				
	01 56 26 00-0170	EA	Relocate Temporary 4' High Chain Link Vehicle Gate And Posts.....	94.98	
	01 56 26 00-0171	EA	Relocate Temporary 6' High Chain Link Vehicle Gate And Posts.....	109.59	
	01 56 26 00-0172	EA	Relocate Temporary 8' High Chain Link Vehicle Gate And Posts.....	135.16	
	01 56 26 00-0173	EA	Relocate Temporary 10' High Chain Link Vehicle Gate And Posts.....	146.12	
01 56 26 00-0174	Temporary Rail And Timber Structure <small>(01 56 26)</small>				
	01 56 26 00-0175	LF	4' High Temporary Rail And Timber Structure	140.53	
			Note: Includes steel posts, rails and plates, excavation, concrete, forming, finish, backfill and creosoted planking with 2" gaps		
	01 56 26 00-0176	LF	6' High Temporary Rail And Timber Structure	199.74	
			Note: Includes steel posts, rails and plates, excavation, concrete, forming, finish, backfill and creosoted planking with 2" gaps		
	01 56 26 00-0177	LF	8' High Temporary Rail And Timber Structure	258.94	
			Note: Includes steel posts, rails and plates, excavation, concrete, forming, finish, backfill and creosoted planking with 2" gaps		
	01 56 26 00-0178	LF	10' High Temporary Rail And Timber Structure	325.85	
			Note: Includes steel posts, rails and plates, excavation, concrete, forming, finish, backfill and creosoted planking with 2" gaps		
	01 56 26 00-0179	LF	12' High Temporary Rail And Timber Structure	377.75	
			Note: Includes steel posts, rails and plates, excavation, concrete, forming, finish, backfill and creosoted planking with 2" gaps		
	01 56 26 00-0180	LF	15' High Temporary Rail And Timber Structure	433.32	
			Note: Includes steel posts, rails and plates, excavation, concrete, forming, finish, backfill and creosoted planking with 2" gaps		
01 56 26 00-0181	Temporary Safety Fence <small>(01 56 26)</small>				
			Note: Includes removal after use.		
	01 56 26 00-0182	LF	Temporary Safety Fence, Plastic Mesh, 48" High With Posts At 8' On Center.....	2.47	



General Requirements	01	10
Temporary Facilities And Controls	01 50	
Temporary Barriers And Enclosures	01 56	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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01 56 29 Temporary Protective Walkways (01 56)

01 56 29 00-0001 Temporary Walkways And Railings (01 56 29)

01 56 29 00-0002	LF	Temporary Wooden Guardrail With Top-Rail With Two Side Rails On 36" High 2 x 4 Posts 18" On Center Attached To Walkway.....	8.40
Note: Excludes walkway.			
01 56 29 00-0003	SF	Temporary Walkway With 3/4" Plywood On 2 x 6 Stringers	4.26
01 56 29 00-0004	RSR	Temporary Stairs On 2 x 12 Stringers (Cost Per Riser).....	14.70

01 56 29 00-0005 Safety Nets (01 56 29)

01 56 29 00-0006	SF	Small Mesh Debris Netting	1.40
Note: Includes 3" molded plastic base plates, plastic cable ties, and 1/4", 7x9 aircraft cable tied off to structure, not including anchors.			

01 56 33 Temporary Security Barriers (01 56)

01 56 33 00-0001 Temporary Fiberglass Panels (01 56 33)

01 56 33 00-0002	SF	Prefabricated Fiberglass Panels.....	1.43
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01 56 33 00-0003 Temporary Safety Guardrail (01 56 33)

Note: Includes removal after use.			
01 56 33 00-0004	LF	42" High, Wood Temporary Safety Guardrail.....	21.01
Note: Includes 2" x 4" construction, top, middle and bottom horizontal rails, and post boots.			
For Attachment To A Concrete Substrate, Add			1.13

01 56 33 00-0005 Board-up Opening With Plywood (01 56 33)

Note: For use where directed by owner for boarding up door and window openings.			
01 56 33 00-0006	OPN	Remove Protective Barrier To Allow Work In Building, Reseal At End Of Day, Per Opening Per Day	10.96
01 56 33 00-0007	SF	Board-up Opening With 5/8" Thick Plywood, 2" x 4" Wood Stud Framing And Fasteners.....	5.57
01 56 33 00-0008	SF	Board-up Opening With 3/4" Thick Plywood, 2" x 4" Wood Stud Framing And Fasteners.....	6.45

01 56 33 00-0009 Street Barricade (01 56 33)

01 56 33 00-0010	LF	Temporary Street Barricade, Using 12" x 12" Beam As Base With 2" x 4" Top Warning Rail And Sides, Per Month.....	7.76
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01 56 39 Temporary Tree And Plant Protection (01 56)

01 56 39 00-0001 Temporary Tree Guards (01 56 39)

Note: Includes digging holes and removal.			
01 56 39 00-0002	EA	Up To 4' x 4' Temporary Tree Guard, 2" x 4" Wood Stud Framing Construction, 4 Uprights Set In Earth 2' Deep, With Double Rail.....	141.08
01 56 39 00-0003	EA	4' x 4' Temporary Tree Guard, 2" x 4" Wood Stud Framing Construction, 4 Uprights Set In Earth 2' Deep, With Double Rail	162.53
01 56 39 00-0004	EA	6' x 6' Temporary Tree Guard, 2" x 4" Wood Stud Framing Construction, 4 Uprights Set In Earth 2' Deep, With Double Rail	175.61

01 57 Temporary Controls (01 50)

01 57 13 Temporary Erosion And Sediment Control (01 57)

See CSI section 31 25 00 00-0000 for temporary erosion and sediment control.

01 57 23 Temporary Storm Water Pollution Control (01 57)

See CSI section 31 25 00 00-0000 for temporary storm water pollution control.

01 57 23 00-0001 Drain Guard (01 57 23)

Note: Includes removal after use.			
01 57 23 00-0002	EA	36" x 48" x 18" Non-Woven Polypropylene Trash and Debris Drain Guard (Ultra-Drain Guard® 9227).....	65.69
01 57 23 00-0003	EA	36" x 48" x 18" Non-Woven Polypropylene Oil and Sediment Drain Guard (Ultra-Drain Guard® 9217).....	64.66
Note: Up to 0.87 gallons oil, up to 40 lbs sediment.			
01 57 23 00-0004	EA	36" x 48" x 18" Non-Woven Polypropylene Oil and Sediment Drain Guard (Ultra-Drain Guard® 9219).....	79.15
Note: Up to 1.38 gallons oil, up to 40 lbs sediment.			
01 57 23 00-0005	EA	60" x 60" x 18" Non-Woven Polypropylene Oil and Sediment Drain Guard (Ultra-Drain Guard® 9356).....	78.11
Note: Up to 1.55 gallons oil, up to 40 lbs sediment.			
01 57 23 00-0006	EA	60" x 60" x 18" Non-Woven Polypropylene Oil and Sediment Drain Guard (Ultra-Drain Guard® 9358).....	93.64
Note: Up to 2.06 gallons oil, up to 40 lbs sediment.			

01 58 Project Identification (01 50)

Note: Includes removal after use.

01 58 13 Temporary Project Signage (01 58)

01 58 13 00-0001		Project Sign (01 58 13)
01 58 13 00-0002		MDO Plywood Signs (01 58 13 00-0001)
Note: Excludes posts.		

01	General Requirements
01 50	Temporary Facilities And Controls
01 58	Project Identification



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
01 58 13 00-0003			Reflectorized, MDO Plywood Signs (01 58 13 00-0002)		
01 58 13 00-0004			Engineer Grade, Reflectorized, MDO Plywood Signs (01 58 13 00-0003)		
01 58 13 00-0005	EA		Up To 8 SF, One Or Two Color Design, Engineer Grade, Reflectorized, MDO Plywood Sign For High-Intensity Grade, Add For Diamond Grade, Add	102.15 21.69 41.82	20.09
01 58 13 00-0006	EA		>8 To 16 SF, One Or Two Color Design, Engineer Grade, Reflectorized, MDO Plywood Sign For High-Intensity Grade, Add For Diamond Grade, Add	165.95 43.38 83.65	21.00
01 58 13 00-0007	EA		>16 To 24 SF, One Or Two Color Design, Engineer Grade, Reflectorized, MDO Plywood Sign For High-Intensity Grade, Add For Diamond Grade, Add	229.73 65.06 125.48	21.93
01 58 13 00-0008	EA		>24 To 32 SF, One Or Two Color Design, Engineer Grade, Reflectorized, MDO Plywood Sign For High-Intensity Grade, Add For Diamond Grade, Add	293.52 86.75 167.30	22.84
01 58 13 00-0009	SF		>32 SF, One Or Two Color Design, Engineer Grade, Reflectorized, MDO Plywood Sign For High-Intensity Grade, Add For Diamond Grade, Add	9.21 2.71 5.23	0.73
01 58 13 00-0010			Non-Reflectorized, MDO Plywood Signs (01 58 13 00-0002)		
01 58 13 00-0011			One Or Two Color Design, Non-Reflectorized, MDO Plywood Signs (01 58 13 00-0010)		
01 58 13 00-0012	EA		Up To 8 SF, One Or Two Color Design, Non Reflectorized, MDO Plywood Sign	124.26	20.09
01 58 13 00-0013	EA		>8 To 16 SF, One Or Two Color Design, Non Reflectorized, MDO Plywood Sign	146.15	21.00
01 58 13 00-0014	EA		>16 To 24 SF, One Or Two Color Design, Non Reflectorized, MDO Plywood Sign	179.97	21.93
01 58 13 00-0015	EA		>24 To 32 SF, One Or Two Color Design, Non Reflectorized, MDO Plywood Sign	211.95	22.84
01 58 13 00-0016	SF		>32 SF, One Or Two Color Design, Non Reflectorized, MDO Plywood Sign	6.66	0.73
01 58 13 00-0017			Full Color Design, Non-Reflectorized, MDO Plywood Signs (01 58 13 00-0010)		
01 58 13 00-0018	EA		Up To 8 SF, Full Color Design, Non Reflectorized, MDO Plywood Sign	126.62	20.09
01 58 13 00-0019	EA		>8 To 16 SF, Full Color Design, Non Reflectorized, MDO Plywood Sign	158.91	21.00
01 58 13 00-0020	EA		>16 To 24 SF, Full Color Design, Non Reflectorized, MDO Plywood Sign	192.94	21.93
01 58 13 00-0021	EA		>24 To 32 SF, Full Color Design, Non Reflectorized, MDO Plywood Sign	223.07	22.84
01 58 13 00-0022	SF		>32 SF, Full Color Design, Non Reflectorized, MDO Plywood Sign	7.00	0.73
01 58 13 00-0023			Fabricate And Install New Posts (01 58 13 00-0001) Note: Includes excavation, backfill and compaction. Excludes core drilling.		
01 58 13 00-0024	LF		Galvanized Metal Channel Sign Posts	10.25	
01 58 13 00-0025	LF		4" x 4" Pressure Treated Wood Sign Posts	7.74	
01 58 13 00-0026	LF		4" x 6" Pressure Treated Wood Sign Posts	9.19	
01 58 13 00-0027			Owner Supplied Signs (01 58 13 00-0001)		
01 58 13 00-0028	EA		Install And Remove Owner Supplied Project Sign	73.07	

01 60 Product Requirements (01)

01 66 Product Storage And Handling Requirements (01 60)

01 66 19 Material Handling (01 66)

Note: Not for use in conjunction with other tasks when the distance is less than 2 stories with attic (2-1/2 stories) or less than 125'.

01 66 19 00-0001 Material Handling Between Floors (01 66 19)

01 66 19 00-0002 CY Moving Material Via Stairs, Per CY Of Material Per Floor.....8.03
Note: Quantity equals material volume times number of floors traveled.

01 66 19 00-0003 CY Moving Material Via Elevator, Per CY Of Material4.82
Note: Quantity equals material volume. If more than one elevator is used, the quantity is factored by the number of transfers.

01 66 19 00-0004 Moving Furniture (01 66 19)

Note: To be used when contractor is required to move furniture. Not to be used when the amount of furniture is less than 55% of the total floor space. Moving of furniture which occupies less than 55% of the total floor space is considered as part of the coefficient adjustment factor.

01 66 19 00-0005 SF Remove, Transport, Return And Reinstall Office Furniture.....0.91
Note: Includes general, desks, tables, file cabinets (full), chairs, storage boxes, bookshelves, office equipment and computers (per SF of office area). Not to be used when amount of furniture is less than 55% of total floor space.

01 66 19 00-0006 Material Handling For Distances Greater Than 125' (01 66 19)

01 66 19 00-0007 CY Handling Material For Over 125' Per CY Of Material Per 125'3.80
Note: For delivery, demolition or miscellaneous moving required by owner.



General Requirements	01	10
Product Requirements	01 60	
Product Storage And Handling Requirements	01 66	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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01 66 19 00-0008	Rubbish Handling Between Floors <small>(01 66 19)</small> Note: Only use with selective demolition tasks to transfer demolished material more than 2-1/2 stories.	
01 66 19 00-0009	CY Rubbish Handling Via Stairs, Per CY Of Material Per Floor Note: Quantity equals material volume times bulk factor times number of floors traveled.	7.31
01 66 19 00-0010	CY Rubbish Handling Via Elevator, Per CY Of Material Note: Quantity equals material volume times bulk factor. If more than one elevator is used, the quantity is factored by the number of transfers.	4.38

01 70 Execution And Closeout Requirements (01)

01 71 Examination And Preparation (01 70)

01 71 13 Mobilization (01 71)

01 71 13 00-0001	Equipment Delivery, Pickup, Mobilization And Demobilization <small>(01 71 13)</small> Note: Excludes flagman for traffic control where necessary.	
01 71 13 00-0002	EA Equipment Delivery, Pickup, Mobilization And Demobilization Using A Rollback Flatbed Truck Note: Includes delivery of equipment, off loading on site, rigging, dismantling, loading and transporting away. For equipment such as trenchers, skid-steer loaders (bobcats), industrial warehouse forklifts, sweepers, scissor platform lifts, telescoping and articulating boom manlifts with up to 40' boom lengths, etc.	201.32
01 71 13 00-0003	EA Equipment Delivery, Pickup, Mobilization And Demobilization Using A Tractor Trailer With Up To 53' Bed..... Note: Includes delivery of equipment, off loading on site, rigging, dismantling, loading and transporting away. For equipment such as bulldozers, motor scrapers, hydraulic excavators, gradalls, road graders, loader-backhoes, heavy duty construction loaders, tractors, pavers, rollers, bridge finishers, straight mast construction forklifts, telescoping boom rough terrain construction forklifts, telescoping and articulating boom manlifts with >40' boom lengths, etc.	402.63

01 71 13 00-0004 Crane Delivery, Pickup, Mobilization And Demobilization (01 71 13)

Note: Includes delivery of equipment, off loading on site and rigging. Return includes dismantling, loading and transporting away. Excludes flagman for traffic control where necessary.		
01 71 13 00-0005	EA Up To 20 Ton Lift Move On/Off Cost, Truck Mounted Crane Note: Includes delivery and pickup. <i>For >30 To 60 Miles Radius, Add</i> <i>For >60 To 100 Miles Radius, Add</i>	260.40 65.10 104.16
01 71 13 00-0006	EA 20 To 30 Ton Lift Move On/Off Cost, Truck Mounted Crane..... Note: Includes delivery and pickup. <i>For >30 To 60 Miles Radius, Add</i> <i>For >60 To 100 Miles Radius, Add</i>	374.98 93.75 149.99
01 71 13 00-0007	EA 40 To 50 Ton Lift Move On/Off Cost, Truck Mounted Crane..... Note: Includes delivery and pickup. <i>For >30 To 60 Miles Radius, Add</i> <i>For >60 To 100 Miles Radius, Add</i>	499.97 124.99 199.99
01 71 13 00-0008	EA 70 To 100 Ton Lift Move On/Off Cost, Truck Mounted Crane Note: Includes delivery and pickup. <i>For >30 To 60 Miles Radius, Add</i> <i>For >60 To 100 Miles Radius, Add</i>	812.45 203.11 324.98
01 71 13 00-0009	EA 75 Ton Lift Move On/Off Cost, Mechanical Crane Note: Includes delivery and pickup. <i>For >30 To 60 Miles Radius, Add</i> <i>For >60 To 100 Miles Radius, Add</i>	641.63 160.41 256.65
01 71 13 00-0010	EA 100 Ton Lift Move On/Off Cost, Mechanical Crane Note: Includes delivery and pickup. <i>For >30 To 60 Miles Radius, Add</i> <i>For >60 To 100 Miles Radius, Add</i>	1,041.60 260.40 416.64
01 71 13 00-0011	EA 125 Ton Lift Move On/Off Cost, Mechanical Crane Note: Includes delivery and pickup. <i>For >30 To 60 Miles Radius, Add</i> <i>For >60 To 100 Miles Radius, Add</i>	1,291.58 322.90 516.63
01 71 13 00-0012	EA 150 Ton Lift Move On/Off Cost, Mechanical Crane Note: Includes delivery and pickup. <i>For >30 To 60 Miles Radius, Add</i> <i>For >60 To 100 Miles Radius, Add</i>	1,604.06 401.02 641.62
01 71 13 00-0013	EA 250 Ton Lift Move On/Off Cost, Mechanical Crane Note: Includes delivery and pickup. <i>For >30 To 60 Miles Radius, Add</i> <i>For >60 To 100 Miles Radius, Add</i>	2,916.48 729.12 1,166.59
01 71 13 00-0014	EA 300 Ton Lift Move On/Off Cost, Mechanical Crane Note: Includes delivery and pickup. <i>For >30 To 60 Miles Radius, Add</i> <i>For >60 To 100 Miles Radius, Add</i>	4,166.40 1,041.60 1,666.56
01 71 13 00-0015	EA 500 Ton Lift Move On/Off Cost, Mechanical Crane Note: Includes delivery and pickup. <i>For >30 To 60 Miles Radius, Add</i> <i>For >60 To 100 Miles Radius, Add</i>	6,249.60 1,562.40 2,499.84

01 71 23 Field Engineering (01 71)

01 71 23 16 Construction Surveying (01 71 23)

01	General Requirements
01 70	Execution And Closeout Requirements
01 71	Examination And Preparation



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
01 71 23 16-0001			Conventional Topographic Survey (01 71 23 16) Note: The professional services include AutoCAD drafting and certification. The survey includes location of structures, walks, drives, parking, significant vegetation, utilities, etc. The area within building footprint is not to be considered as part of the acreage.		
01 71 23 16-0002	ACR		Survey Clear Area With Few To No Obstacles	813.85	
01 71 23 16-0003	ACR		Survey Clear Area With Medium Height Vegetation, Few Trees (<5% Buildings)	2,369.39	
01 71 23 16-0004	ACR		Survey Clear Area With Few Structures, And/Or Wooded (5-25% Buildings).....	3,395.77	
01 71 23 16-0005	ACR		Survey Developed Areas With Several Structures (25-65% Buildings).....	5,159.94	
01 71 23 16-0006	ACR		Survey Highly Developed Areas, Sidewalks, Etcetera (>65% Buildings).....	6,480.32	
01 71 23 16-0007			Property Lines Survey (01 71 23 16) Note: Not to be added to tasks in the "Conventional Topographic Survey" section.		
01 71 23 16-0008	LF		Survey Property Lines On Cleared Land	1.96	
01 71 23 16-0009	LF		Survey Property Lines On Slightly Wooded Land	2.27	
01 71 23 16-0010	LF		Survey Property Lines On Wooded Land.....	2.66	
01 71 23 16-0011			Survey Monument (01 71 23 16)		
01 71 23 16-0012	EA		3' Precast Survey Monument.....	122.90	
			<i>For Owner Furnished Monument, Deduct</i>	-55.44	
01 71 23 16-0013	EA		Precast Survey Monument Box With Cast Iron Frame And Cover.....	170.93	
01 71 23 16-0014	EA		Riser Ring For Survey Monument.....	85.56	
01 71 23 16-0015	EA		Adjust Survey Monument Cover To Grade	55.44	
01 71 23 16-0016			Facade Surveying (01 71 23 16)		
01 71 23 16-0017	LF		Facade Survey And Reports (LF Of Facade x Number Of Floors).....	5.44	
01 71 36			Non-Destructive Concrete Examination (01 71)		
01 71 36 00-0001			X-Ray And Electromagnetic Survey (01 71 36) Note: To locate reinforcing bars, conduits, pipes, etc., prior to core drilling or cutting existing concrete, masonry or asphalt. Electromagnetic survey includes Subsurface Interface Radar (SIR) and/or Ground Penetrating Radar (GPR). Includes printed reports.		
01 71 36 00-0002			X-Ray Or Electromagnetic Survey Minimum Set-Up Charge (01 71 36 00-0001)		
01 71 36 00-0003	EA		X-Ray Or Electromagnetic Survey Minimum Set-Up Charge	580.34	
			Note: For projects where the total charges are less than the minimum set-up charge, use this task exclusively. This task should not be used in conjunction with any other tasks in this section.		
01 71 36 00-0004			X-Ray Survey (01 71 36 00-0001)		
01 71 36 00-0005	EA		X-Ray Survey Up To 2 SF Of Concrete, Masonry Or Asphalt.....	138.02	
			<i>For >8 To 25, Deduct</i>	-31.25	
01 71 36 00-0006			Electromagnetic (SIR/GPR) Survey (01 71 36 00-0001)		
01 71 36 00-0007	EA		Electromagnetic (SIR/GPR) Survey Up To 4 SF Of Concrete, Masonry Or Asphalt.....	276.05	
01 71 36 00-0008	EA		Electromagnetic (SIR/GPR) Survey >4 To 500 SF Of Concrete, Masonry Or Asphalt	552.10	
01 71 36 00-0009	SF		Electromagnetic (SIR/GPR) Survey >500 SF Of Concrete, Masonry Or Asphalt.....	1.10	
01 74			Cleaning And Waste Management (01 70)		
01 74 13			Progress Cleaning (01 74) Note: For use on existing areas other than where actual work is to be performed where ordered by the owner. Daily cleanup and final cleanup is included in the contractor's adjustment factor.		
01 74 13 00-0001			General (01 74 13)		
01 74 13 00-0002	CSF		Clean Miscellaneous Surfaces, Wipe Down With Mild Detergent.....	18.28	
01 74 13 00-0003	CY		Collect Existing Debris And Load Into Truck Or Dumpster	21.41	
			Note: Per CY of debris removed.		
01 74 16			Site Maintenance (01 74)		
01 74 16 00-0001			Parking Lot, Roads And Pathway Maintenance (01 74 16) Note: These tasks shall be used for maintenance of existing roads and walks only as requested by the owner. Do not use these tasks in conjunction with related installation/demolition tasks in the Construction Task Catalog®.		
01 74 16 00-0002			Parking Lot, Road, And Street Sweeping (01 74 16 00-0001)		
01 74 16 00-0003	MSF		Sweep Parking Lot, With Street Sweeper	15.90	
01 74 16 00-0004	MSF		Sweeper/Vacuum/Sprayer For Parking Lots, Streets And Roads.....	19.08	
01 74 16 00-0005	MSF		Sweep Runway, With Street Sweep	23.84	
01 74 19			Construction Waste Management And Disposal (01 74) Note: Tasks in this section shall be used as directed by owner.		
01 74 19 00-0001			Debris Chutes (01 74 19) Note: Includes hopper sections and entry sections. Used as required for buildings of all heights.		



General Requirements	01	10
Execution And Closeout Requirements	01 70	
Cleaning And Waste Management	01 74	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
01 74 19 00-0002 Steel Temporary Debris Chutes (01 74 19 00-0001)		
01 74 19 00-0003 LF 18" Diameter, Steel Temporary Debris Chute.....	22.55	
01 74 19 00-0004 LF 30" Diameter, Steel Temporary Debris Chute.....	33.96	
01 74 19 00-0005 Plastic Temporary Debris Chutes (01 74 19 00-0001)		
01 74 19 00-0006 LF 24" Diameter, Plastic Temporary Debris Chute	8.92	
For Steel Liner, Add	1.73	
01 74 19 00-0007 LF 30" Diameter, Plastic Temporary Debris Chute	10.22	
For Steel Liner, Add	1.98	
01 74 19 00-0008 LF 36" Diameter, Plastic Temporary Debris Chute	11.52	
For Steel Liner, Add	2.23	
01 74 19 00-0009 Wood Temporary Debris Chutes (01 74 19 00-0001)		
01 74 19 00-0010 LF 4' x 4', Wood Temporary Debris Chute.....	17.30	
Note: Includes fabrication and installation.		
01 74 19 00-0011 Construction Dumpsters Rental (01 74 19)		
Note: Includes delivery and pick-up of dumpster, hauling of debris, rental of dumpster and all applicable non-hazardous disposal fees. Cost of "each" is based on each pick-up. Unacceptable materials include: aerosol cans, all liquids, animals, antifreeze, appliances, asbestos, barrels, batteries, chemical products, computers, contaminated oils (mixed with solvents, gasoline, etc.), dirt, fluorescent tubes, hazardous waste, herbicides & pesticides, industrial waste, lubricating/hydraulic oil, mattresses, medical waste, microwaves, monitors, motor oil, oil filters, other flammable liquids, paint (except completely dried latex paint cans, no liquids), petroleum-contaminated soil/lead paint chips, propane tanks, radioactive material, railroad ties, solvents, televisions, tires, and transmission oil.		
01 74 19 00-0012 EA 6 CY Dumpster "Construction Debris"	262.50	
Note: Includes delivery of dumpster, rental cost, pick-up cost, hauling, and disposal fee. Non-hazardous material.		
01 74 19 00-0013 EA 10 CY Dumpster "Construction Debris"	339.98	
Note: Includes delivery of dumpster, rental cost, pick-up cost, hauling, and disposal fee. Non-hazardous material.		
01 74 19 00-0014 EA 15 CY Dumpster "Construction Debris"	374.99	
Note: Includes delivery of dumpster, rental cost, pick-up cost, hauling, and disposal fee. Non-hazardous material.		
01 74 19 00-0015 EA 20 CY Dumpster "Construction Debris"	385.00	
Note: Includes delivery of dumpster, rental cost, pick-up cost, hauling, and disposal fee. Non-hazardous material.		
01 74 19 00-0016 EA 30 CY Dumpster "Construction Debris"	450.00	
Note: Includes delivery of dumpster, rental cost, pick-up cost, hauling, and disposal fee. Non-hazardous material.		
01 74 19 00-0017 EA 40 CY Dumpster "Construction Debris"	525.00	
Note: Includes delivery of dumpster, rental cost, pick-up cost, hauling, and disposal fee. Non-hazardous material.		
01 74 19 00-0018 EA 10 CY Low-Boy Dumpster "Concrete Or Asphalt Only"	525.00	
Note: Includes delivery of dumpster, rental cost, pick-up cost, hauling, and disposal fee. Concrete or asphalt only.		
01 74 19 00-0019 Concrete Washout Service (01 74 19)		
01 74 19 00-0020 MO Rampless Concrete Washout Bin	331.33	
Note: Includes delivery.		
01 74 19 00-0021 MO Ramped Concrete Washout Bin	397.59	
Note: Includes delivery.		
01 74 19 00-0022 EA Interim Vacuum Service, Concrete Washout Bin.....	309.84	
Note: Includes vacuum and recycle excess clear liquid from the unfilled bin to allow additional space for washout material.		
01 74 19 00-0023 EA Vacuum, Pickup, Swap And Dump, Concrete Washout Bin	671.32	
Note: Includes vacuum the liquid from the full bin and pick up the bin, and recycle all material. An empty bin will be left at the site if the project is not completed.		
01 74 19 00-0024 Debris Processing Fee (01 74 19)		
01 74 19 00-0025 Recycler Fees (01 74 19 00-0024)		
Note: Does not apply with use of dumpsters. Excludes hauling.		
01 74 19 00-0026 CY Drop-Off Asphalt At Recycling Center	25.86	
01 74 19 00-0027 CY Drop-Off Concrete At Recycling Center.....	12.93	
01 74 19 00-0028 Landfill Dump Fees (01 74 19 00-0024)		
Note: Does not apply when material is transferred to owner's site or facility, or with use of dumpsters. Excludes hauling.		
01 74 19 00-0029 CY Traditional Building Construction Materials Landfill Dump Fee.....	17.21	
01 74 19 00-0030 CY Trees, Stumps And Brush, Landfill Dump Fee.....	20.71	
01 74 19 00-0031 CY Rubbish Landfill Dump Fee.....	16.89	
01 74 19 00-0032 CY Hazardous Materials And Rubbish (Paint Cans, Etcetera) Landfill Dump Fee	49.40	
01 74 19 00-0033 CY Excavated Dirt Landfill Dump Fee	16.57	
01 74 19 00-0034 Hauling (01 74 19)		
Note: Includes driver and equipment, ten (10) to fifteen (15) minutes load time, time for travel, dump time and return (roundtrip). The task quantity is the number of miles to the disposal site/transfer station (one way mileage) times the number of cubic yards being transported. For example, to haul 8 CY to a site 14 miles away, the quantity is calculated as follows: 14 miles x 8 CY = 112 CYM. Use both hauling tasks for distances greater than 15 miles. To haul 28 CY to a site 32 miles away, the quantity for the task to haul the first 15 miles is calculated: 15 miles x 28 CY = 420 CYM. The quantity for the additional hauling task over the first 15 miles is calculated: 32 total miles less 15 initial miles equals 17 miles x 28 CY = 476 CYM.		

01	General Requirements
01 70	Execution And Closeout Requirements
01 74	Cleaning And Waste Management



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
01 74 19 00-0035 CYM Hauling Up To 15 Miles.....	0.87	
01 74 19 00-0036 CYM Hauling, Miles Over Initial 15 Miles.....	0.65	
01 74 23 Final Cleaning (01 74)		
01 74 23 00-0001 Glass (01 74 23)		
01 74 23 00-0002 CSF Clean Existing Glass Surfaces.....	23.79	
01 95 Residential Construction (01)		
01 95 01 Residential - General Conditions (01 95)		
01 95 01 00-0001 Pre-Clean Interior Of Unit (01 95 01)		
Note: Remove all discarded debris from unit prior to commencement of work. Excludes disposal of waste.		
01 95 01 00-0002 EA Pre-Clean Unit - Efficiency Unit.....	511.35	
01 95 01 00-0003 EA Pre-Clean Unit - One Bedroom Unit.....	657.03	
01 95 01 00-0004 EA Pre-Clean Unit - Two Bedroom Unit.....	982.00	
01 95 01 00-0005 EA Pre-Clean Unit - Three Bedroom Unit.....	1,323.57	
01 95 01 00-0006 EA Pre-Clean Unit - Four Bedroom Unit.....	1,681.88	
01 95 01 00-0007 EA Pre-Clean Unit - Six Bedroom Unit.....	2,372.11	
01 95 01 00-0008 EA Pre-Clean Basement.....	1,461.21	
01 95 01 00-0009 EA Pre-Clean Unit - Five Bedroom Unit.....	2,029.46	
01 95 01 00-0010 Final Clean Interior Of Unit (01 95 01)		
Note: Final cleaning to make unit ready for tenant move-in. This is over and above the daily and final construction cleaning which is part of the Contractor's Adjustment Factor.		
01 95 01 00-0011 EA Final Clean Unit - Efficiency Unit.....	621.26	
01 95 01 00-0012 EA Final Clean Unit - One Bedroom Unit.....	801.11	
01 95 01 00-0013 EA Final Clean Unit - Two Bedroom Unit.....	1,170.85	
01 95 01 00-0014 EA Final Clean Unit - Three Bedroom Unit.....	1,522.10	
01 95 01 00-0015 EA Final Clean Unit - Four Bedroom Unit.....	1,985.35	
01 95 01 00-0016 EA Final Clean Unit - Five Bedroom Unit.....	2,341.69	
01 95 01 00-0017 EA Final Clean Unit - Six Bedroom Unit.....	2,701.95	
01 95 01 00-0018 EA Final Clean Unit - Basement.....	1,607.85	
01 95 01 00-0019 Clean HVAC (01 95 01)		
01 95 01 00-0020 EA Clean And Service Furnace.....	386.41	
01 95 01 00-0021 EA Clean Ductwork In Efficiency Unit.....	474.91	
01 95 01 00-0022 EA Clean Ductwork In 1 Bedroom Unit.....	567.60	
01 95 01 00-0023 EA Clean Ductwork In 2 Bedroom Unit.....	660.35	
01 95 01 00-0024 EA Clean Ductwork In 3 Bedroom Unit.....	754.13	
01 95 01 00-0025 EA Clean Ductwork In 4 Bedroom Unit.....	846.40	
01 95 01 00-0026 EA Clean Ductwork In 5 Bedroom Unit.....	952.30	
01 95 01 00-0027 EA Clean Ductwork In 6 Bedroom Unit.....	1,060.69	
01 95 01 00-0028 Relocation Costs (01 95 01)		
Note: Includes packing and relocating furniture to new location. Excludes moving truck.		
01 95 01 00-0029 EA Move Efficiency Bedroom, Same Floor.....	574.65	
01 95 01 00-0030 EA Move One Bedroom, Same Floor.....	770.30	
01 95 01 00-0031 EA Move Two Bedroom, Same Floor.....	1,221.45	
01 95 01 00-0032 EA Move Three Bedroom, Same Floor.....	1,598.80	
01 95 01 00-0033 EA Move Four Bedroom, Same Floor.....	1,975.54	
01 95 01 00-0034 EA Move Five Bedroom, Same Floor.....	2,286.05	
01 95 01 00-0035 EA Move Six Bedroom, Same Floor.....	2,665.77	
01 95 01 00-0036 EA Move Efficiency Bedroom, Different Floor.....	684.76	
01 95 01 00-0037 EA Move One Bedroom, Different Floor.....	916.09	
01 95 01 00-0038 EA Move Two Bedroom, Different Floor.....	1,516.38	
01 95 01 00-0039 EA Move Three Bedroom, Different Floor.....	1,963.44	
01 95 01 00-0040 EA Move Four Bedroom, Different Floor.....	2,429.45	
01 95 01 00-0041 EA Move Five Bedroom, Different Floor.....	2,800.31	
01 95 01 00-0042 EA Move Six Bedroom, Different Floor.....	3,180.80	
01 95 01 00-0043 EA Move Efficiency Bedroom, Different Building.....	1,088.39	
01 95 01 00-0044 EA Move One Bedroom, Different Building.....	1,353.72	
01 95 01 00-0045 EA Move Two Bedroom, Different Building.....	1,951.34	
01 95 01 00-0046 EA Move Three Bedroom, Different Building.....	2,554.65	
01 95 01 00-0047 EA Move Four Bedroom, Different Building.....	3,025.44	
01 95 01 00-0048 EA Move Five Bedroom, Different Building.....	3,386.72	
01 95 01 00-0049 EA Move Six Bedroom, Different Building.....	3,766.75	
01 95 01 00-0050 Testing (01 95 01)		
01 95 01 00-0051 EA Carbon Dioxide (CO2) Test For Sewer Vents.....	344.17	
01 95 01 00-0052 EA Carbon Monoxide (CO) Test On Furnace.....	489.16	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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01 95 06 Residential - Wood And Plastics (01 95 06)

01 95 06 00-0001	Wood Hand Rails <small>(01 95 06)</small>				
01 95 06 00-0002	EA	Brackets For Hand Rails.....	25.89		8.84
01 95 06 00-0003	LF	2-1/4" x 2-3/8" Oak Colonial Handrail	12.82		5.03
01 95 06 00-0004	LF	2-1/4" x 2-3/8" Hemlock Colonial Handrail.....	11.57		5.03
01 95 06 00-0005	LF	2-1/4" x 2-3/8" Poplar Colonial Handrail.....	12.73		5.03
01 95 06 00-0006	LF	1-5/8" x 1-1/16" Pine Oval Handrail	9.85		5.03
01 95 06 00-0007	LF	1-1/4" x 2-1/4" Pine Oval Handrail	9.89		5.03
01 95 06 00-0008	LF	2-1/4" x 1-5/16" Poplar Oval Handrail	10.30		5.03
01 95 06 00-0009	LF	1-3/4" x 1-5/8" Oak Oval Handrail	11.00		5.03
01 95 06 00-0010	LF	2-1/4" x 1-1/2" Oak Oval Handrail	11.12		5.03

01 95 06 00-0011	Wood Shelving <small>(01 95 06)</small>	Note: Wood shelving is clear or finger jointed pine, poplar, laminated particle board or MDF shelving. Includes brackets.			
01 95 06 00-0012	LF	12" Wide Wood Shelving For Closets.....	17.52		4.60
01 95 06 00-0013	LF	16" Wide Wood Shelving For Closets.....	26.29		6.97
01 95 06 00-0014	LF	20" Wide Wood Shelving For Closets.....	35.17		9.27

01 95 06 00-0015	Base Cabinets <small>(01 95 06)</small>	Note: Armstrong Extreme Branford Oak or Coronet Plantation Hardwood. Excludes tops.			
01 95 06 00-0016	Base Cabinets, Single Drawer And Single Door <small>(01 95 06 00-0015)</small>	Note: Use these cabinets for Universal Access (32-1/2" high with 8-1/2" kick) applications.			
01 95 06 00-0017	EA	Up To 15" Width, 34-1/2" High x 24" Deep Base 1 Drawer And 1 Door Cabinet	183.70		40.96
		Note: Prefinished with solid hardwood face frames, hardwood door frames and drawer fronts. Solid hardwood door panels. Excludes countertop.			
		<i>For 3 Drawer Unit, Add</i>	50.12		
		<i>For 4 Drawer Unit, Add</i>	62.65		
01 95 06 00-0018	EA	>15"-18" Width, 34-1/2" High x 24" Deep Base 1 Drawer And 1 Door Cabinet	202.34		50.31
		Note: Prefinished with solid hardwood face frames, hardwood door frames and drawer fronts. Solid hardwood door panels. Excludes countertop.			
		<i>For 3 Drawer Unit, Add</i>	52.28		
		<i>For 4 Drawer Unit, Add</i>	65.35		
01 95 06 00-0019	EA	>18"-21" Width, 34-1/2" High x 24" Deep Base 1 Drawer And 1 Door Cabinet	222.81		57.50
		Note: Prefinished with solid hardwood face frames, hardwood door frames and drawer fronts. Solid hardwood door panels. Excludes countertop.			
		<i>For 3 Drawer Unit, Add</i>	56.35		
		<i>For 4 Drawer Unit, Add</i>	70.44		
01 95 06 00-0020	EA	>21"-24" Width, 34-1/2" High x 24" Deep Base 1 Drawer And 1 Door Cabinet	241.18		66.85
		Note: Prefinished with solid hardwood face frames, hardwood door frames and drawer fronts. Solid hardwood door panels. Excludes countertop.			
		<i>For 3 Drawer Unit, Add</i>	58.38		
		<i>For 4 Drawer Unit, Add</i>	72.98		

01 95 06 00-0021	Base Cabinets, Double Drawer And Double Door <small>(01 95 06 00-0015)</small>	Note: Use these cabinets for Universal Access (32-1/2" high with 8-1/2" kick) applications.			
01 95 06 00-0022	EA	24"-27" Wide, 34-1/2" High x 24" Deep 2 Drawer And 2 Door Cabinet.....	293.45		54.98
		Note: Prefinished with solid hardwood face frames, hardwood door frames and drawer fronts. Solid hardwood door panels. Excludes countertop.			
		<i>For 3 Drawer Unit, Add</i>	18.35		
		<i>For Sink Base With Sink Front (No Drawer), Deduct</i>	-27.52		
01 95 06 00-0023	EA	>27"-30" Wide, 34-1/2" High x 24" Deep 2 Drawer And 2 Door Cabinet.....	307.40		58.94
		Note: Prefinished with solid hardwood face frames, hardwood door frames and drawer fronts. Solid hardwood door panels. Excludes countertop.			
		<i>For 3 Drawer Unit, Add</i>	18.95		
		<i>For Sink Base With Sink Front (No Drawer), Deduct</i>	-28.43		
01 95 06 00-0024	EA	>30"-33" Wide, 34-1/2" High x 24" Deep 2 Drawer And 2 Door Cabinet.....	317.90		60.37
		Note: Prefinished with solid hardwood face frames, hardwood door frames and drawer fronts. Solid hardwood door panels. Excludes countertop.			
		<i>For 3 Drawer Unit, Add</i>	19.72		
		<i>For Sink Base With Sink Front (No Drawer), Deduct</i>	-29.57		
01 95 06 00-0025	EA	>33"-36" Wide, 34-1/2" High x 24" Deep 2 Drawer And 2 Door Cabinet.....	327.46		61.81
		Note: Prefinished with solid hardwood face frames, hardwood door frames and drawer fronts. Solid hardwood door panels. Excludes countertop.			
		<i>For 3 Drawer Unit, Add</i>	20.38		
		<i>For Sink Base With Sink Front (No Drawer), Deduct</i>	-30.58		
01 95 06 00-0026	EA	>36"-42" Wide, 34-1/2" High x 24" Deep 2 Drawer And 2 Door Cabinet.....	358.51		66.85
		Note: Prefinished with solid hardwood face frames, hardwood door frames and drawer fronts. Solid hardwood door panels. Excludes countertop.			
		<i>For 3 Drawer Unit, Add</i>	22.48		
		<i>For Sink Base With Sink Front (No Drawer), Deduct</i>	-33.72		
01 95 06 00-0027	EA	>42"-48" Wide, 34-1/2" High x 24" Deep 2 Drawer And 2 Door Cabinet.....	391.35		75.47
		Note: Prefinished with solid hardwood face frames, hardwood door frames and drawer fronts. Solid hardwood door panels. Excludes countertop.			
		<i>For 3 Drawer Unit, Add</i>	24.04		
		<i>For Sink Base With Sink Front (No Drawer), Deduct</i>	-36.06		

01 95 06 00-0028	Vanity Bases <small>(01 95 06 00-0015)</small>				
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01 General Requirements**01 95 Residential Construction****01 95 06 Residential - Wood And Plastics**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
01 95 06 00-0029	EA		32-1/2" High x 21" Deep x 18" Wide Vanity Bases, 1 Door..... Note: Prefinished with solid hardwood face frames, hardwood door frames and drawer fronts. Solid hardwood door panels. Excludes countertop.	232.50	53.48
01 95 06 00-0030	EA		32-1/2" High x 21" Deep x 21" Wide Vanity Bases, 1 Door..... Note: Prefinished with solid hardwood face frames, hardwood door frames and drawer fronts. Solid hardwood door panels. Excludes countertop.	251.70	59.51
01 95 06 00-0031	EA		32-1/2" High x 21" Deep x 24" Wide Vanity Bases, 2 Door..... Note: Prefinished with solid hardwood face frames, hardwood door frames and drawer fronts. Solid hardwood door panels. Excludes countertop.	266.07	61.95
01 95 06 00-0032	EA		32-1/2" High x 21" Deep x 30" Wide Vanity Bases, 2 Door..... Note: Prefinished with solid hardwood face frames, hardwood door frames and drawer fronts. Solid hardwood door panels. Excludes countertop.	314.00	75.47
01 95 06 00-0033	EA		32-1/2" High x 21" Deep x 36" Wide Vanity Bases, 2 Door..... Note: Prefinished with solid hardwood face frames, hardwood door frames and drawer fronts. Solid hardwood door panels. Excludes countertop.	328.31	75.47
01 95 06 00-0034	EA		32-1/2" High x 21" Deep x 42" Wide Vanity Bases, 2 Door..... Note: Prefinished with solid hardwood face frames, hardwood door frames and drawer fronts. Solid hardwood door panels. Excludes countertop.	343.26	75.47
01 95 06 00-0035			Wall Cabinets (01 95 06) Note: Armstrong Extreme Branford Oak or Coronet Plantation Hardwood.		
01 95 06 00-0036			Wall Cabinets 36" High x 13" Deep (01 95 06 00-0035)		
01 95 06 00-0037			Single Door Type Units (01 95 06 00-0036)		
01 95 06 00-0038	EA		Up To 15" Wide, 36" High x 13" Deep Single Door Wall Cabinet..... Note: Prefinished with solid hardwood face frames, hardwood door frames. Solid hardwood door panels.	200.14	51.74
01 95 06 00-0039	EA		>15"-18" Wide, 36" High x 13" Deep Single Door Wall Cabinet..... Note: Prefinished with solid hardwood face frames, hardwood door frames. Solid hardwood door panels.	210.75	52.82
01 95 06 00-0040	EA		>18"-24" Wide, 36" High x 13" Deep Single Door Wall Cabinet..... Note: Prefinished with solid hardwood face frames, hardwood door frames. Solid hardwood door panels.	222.32	54.62
01 95 06 00-0041			Double Door Type Units (01 95 06 00-0036)		
01 95 06 00-0042	EA		Up To 27" Wide, 36" High x 13" Deep Double Door Wall Cabinet..... Note: Prefinished with solid hardwood face frames, hardwood door frames. Solid hardwood door panels.	267.11	60.37
01 95 06 00-0043	EA		>27"-30" Wide, 36" High x 13" Deep Double Door Wall Cabinet..... Note: Prefinished with solid hardwood face frames, hardwood door frames. Solid hardwood door panels.	288.66	66.12
01 95 06 00-0044	EA		>30"-36" Wide, 36" High x 13" Deep Double Door Wall Cabinet..... Note: Prefinished with solid hardwood face frames, hardwood door frames. Solid hardwood door panels.	310.76	67.56
01 95 06 00-0045	EA		>36"-42" Wide, 36" High x 13" Deep Double Door Wall Cabinet..... Note: Prefinished with solid hardwood face frames, hardwood door frames. Solid hardwood door panels.	338.98	70.08
01 95 06 00-0046	EA		>42"-48" Wide, 36" High x 13" Deep Double Door Wall Cabinet..... Note: Prefinished with solid hardwood face frames, hardwood door frames. Solid hardwood door panels.	353.86	73.31
01 95 06 00-0047			Wall Cabinets 30" High x 13" Deep (01 95 06 00-0035)		
01 95 06 00-0048			Single Door Type Units (01 95 06 00-0047)		
01 95 06 00-0049	EA		Up To 12" Wide, 30" High x 13" Deep Single Door Wall Cabinet..... Note: Prefinished with solid hardwood face frames, hardwood door frames. Solid hardwood door panels.	145.19	40.87
01 95 06 00-0050	EA		>12"-15" Wide, 30" High x 13" Deep Single Door Wall Cabinet..... Note: Prefinished with solid hardwood face frames, hardwood door frames. Solid hardwood door panels.	148.66	42.64
01 95 06 00-0051	EA		>15"-18" Wide, 30" High x 13" Deep Single Door Wall Cabinet..... Note: Prefinished with solid hardwood face frames, hardwood door frames. Solid hardwood door panels.	158.74	43.54
01 95 06 00-0052	EA		>18"-24" Wide, 30" High x 13" Deep Single Door Wall Cabinet..... Note: Prefinished with solid hardwood face frames, hardwood door frames. Solid hardwood door panels.	171.81	45.08
01 95 06 00-0053			Double Door Type Units (01 95 06 00-0047)		
01 95 06 00-0054	EA		Up To 27" Wide, 30" High x 13" Deep Double Door Wall Cabinet..... Note: Prefinished with solid hardwood face frames, hardwood door frames. Solid hardwood door panels.	190.18	46.04
01 95 06 00-0055	EA		>27"-30" Wide, 30" High x 13" Deep Double Door Wall Cabinet..... Note: Prefinished with solid hardwood face frames, hardwood door frames. Solid hardwood door panels.	200.84	47.18
01 95 06 00-0056	EA		>30"-36" Wide, 30" High x 13" Deep Double Door Wall Cabinet..... Note: Prefinished with solid hardwood face frames, hardwood door frames. Solid hardwood door panels.	217.23	48.32
01 95 06 00-0057	EA		>36"-42" Wide, 30" High x 13" Deep Double Door Wall Cabinet..... Note: Prefinished with solid hardwood face frames, hardwood door frames. Solid hardwood door panels.	234.56	49.45
01 95 06 00-0058	EA		>42"-48" Wide, 30" High x 13" Deep Double Door Wall Cabinet..... Note: Prefinished with solid hardwood face frames, hardwood door frames. Solid hardwood door panels.	244.19	50.02
01 95 06 00-0059			Wall Cabinets 24" High x 13" Deep (01 95 06 00-0035)		
01 95 06 00-0060			Double Door Type Units (01 95 06 00-0059)		
01 95 06 00-0061	EA		Up To 27" Wide, 24" High x 13" Deep Double Door Wall Cabinet..... Note: Prefinished with solid hardwood face frames, hardwood door frames. Solid hardwood door panels.	171.27	37.38
01 95 06 00-0062	EA		>27"-30" Wide, 24" High x 13" Deep Double Door Wall Cabinet..... Note: Prefinished with solid hardwood face frames, hardwood door frames. Solid hardwood door panels.	180.93	39.17
01 95 06 00-0063	EA		>30"-36" Wide, 24" High x 13" Deep Double Door Wall Cabinet..... Note: Prefinished with solid hardwood face frames, hardwood door frames. Solid hardwood door panels.	195.99	40.32
01 95 06 00-0064	EA		>36"-42" Wide, 24" High x 13" Deep Double Door Wall Cabinet..... Note: Prefinished with solid hardwood face frames, hardwood door frames. Solid hardwood door panels.	212.01	40.96



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
01 95 06 00-0065 Wall Cabinets 15" High x 13" Deep <small>(01 95 06 00-0035)</small>		
01 95 06 00-0066 Double Door Type Units <small>(01 95 06 00-0065)</small>		
01 95 06 00-0067 EA Up To 30" Wide, 15" High x 13" Deep Double Door Wall Cabinet.....	150.14	35.22
Note: Prefinished with solid hardwood face frames, hardwood door frames. Solid hardwood door panels.		
01 95 06 00-0068 EA >30"-36" Wide, 15" High x 13" Deep Double Door Wall Cabinet	165.78	40.32
Note: Prefinished with solid hardwood face frames, hardwood door frames. Solid hardwood door panels.		
01 95 06 00-0069 EA >36"-39" Wide, 15" High x 13" Deep Double Door Wall Cabinet.....	173.77	40.32
Note: Prefinished with solid hardwood face frames, hardwood door frames. Solid hardwood door panels.		
01 95 06 00-0070 Wall Cabinets 12" High x 13" Deep <small>(01 95 06 00-0035)</small>		
01 95 06 00-0071 EA Up To 30" Wide, 12" High x 13" Deep Double Door Wall Cabinet.....	150.46	22.13
Note: Prefinished with solid hardwood face frames, hardwood door frames. Solid hardwood door panels.		
01 95 06 00-0072 EA >30"-39" Wide, 12" High x 13" Deep Double Door Wall Cabinet	174.06	16.60
Note: Prefinished with solid hardwood face frames, hardwood door frames. Solid hardwood door panels.		
01 95 06 00-0073 Accessories <small>(01 95 06)</small>		
01 95 06 00-0074 EA Single Door Wall Corner Cabinet With Shelving.....	400.29	80.82
Note: Prefinished with solid hardwood face frames, hardwood door frames. Solid hardwood door panels.		
01 95 06 00-0075 EA Single Door Wall Lazy Susan With Cabinet Enclosure	453.72	80.82
Note: Prefinished with solid hardwood face frames, hardwood door frames. Solid hardwood door panels.		
01 95 06 00-0076 EA Base Corner Cabinet.....	365.80	32.32
Note: Prefinished with solid hardwood face frames, hardwood door frames. Solid hardwood door panels.		
Excludes countertop.		
01 95 06 00-0077 EA Broom/Utility Cabinet.....	478.50	46.19
Note: Prefinished with solid hardwood face frames, hardwood door frames. Solid hardwood door panels.		
01 95 06 00-0078 EA Base Range Cabinet.....	425.94	26.94
Note: Prefinished with solid hardwood face frames, hardwood door frames. Solid hardwood door panels.		
01 95 06 00-0079 EA Microwave Cabinet.....	180.16	21.55
Note: Prefinished with solid hardwood face frames, hardwood door frames. Solid hardwood door panels.		
01 95 06 00-0080 Cabinet Repairs <small>(01 95 06)</small>		
01 95 06 00-0081 EA Replace Cabinet Door.....	57.54	
Note: Includes all hardware.		
01 95 06 00-0082 EA Replace Cabinet Drawer.....	69.08	
Note: Includes all hardware.		
01 95 06 00-0083 PR Replace Drawer Guides.....	29.94	
01 95 06 00-0084 EA Replace Knob/Pull.....	19.21	
01 95 06 00-0085 PR Replace Hinges.....	14.86	
01 95 06 00-0086 Stair Parts <small>(01 95 06)</small>		
01 95 06 00-0087 LF Replace Pine Stair Treads.....	17.61	
01 95 06 00-0088 LF Replace Oak Stair Treads.....	25.66	
01 95 06 00-0089 LF Replace Pine Stair Risers.....	16.50	
01 95 06 00-0090 LF Replace Oak Stair Risers.....	21.10	
01 95 06 00-0091 EA Stairs Re-Anchor Bracket.....	47.98	
01 95 06 00-0092 Finish Carpentry <small>(01 95 06)</small>		
01 95 06 00-0093 LF 5/8" x 3-1/4" Primed Finger Joint Casing.....	4.05	1.28
01 95 06 00-0094 LF 1 1/16" x 2-1/4" Primed Finger Joint Casing.....	3.39	1.28
01 95 06 00-0095 LF 1 1/16" x 3-1/4" Pine Casing.....	3.50	1.28
01 95 07 Residential - Thermal And Moisture Protection <small>(01 95)</small>		
01 95 07 00-0001 Siding <small>(01 95 07)</small>		
See CSI section 06 65 00 00-0048 for PVC Trim, 07 46 33 00-0001 for vinyl siding.		
01 95 07 00-0002 Roofing <small>(01 95 07)</small>		
01 95 07 00-0003 Aluminum Drip Edge <small>(01 95 07 00-0002)</small>		
See CSI section 07 62 00 00-0044 for drip edge.		
01 95 07 00-0004 LF 0.031" Thick Vented Aluminum Drip Edge, 6-1/2" Shingle Underlay, Painted Finish.....	4.51	0.72
01 95 07 00-0005 Flashing <small>(01 95 07 00-0002)</small>		
01 95 07 00-0006 SF Aluminum Valley Flashing.....	19.85	2.01
01 95 07 00-0007 SF Aluminum Step Flashing.....	21.37	2.50
01 95 07 00-0008 SF Copper Step Flashing.....	14.55	3.54
01 95 07 00-0009 Roofing <small>(01 95 07 00-0002)</small>		
01 95 07 00-0010 SQ Solar Reflective Shingles, CertainTeed Landmark Colaris.....	342.66	115.24

01 General Requirements**01 95 Residential Construction****01 95 07 Residential - Thermal And Moisture Protection**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
01 95 07 00-0011 Hip And Ridge Vent <small>(01 95 07 00-0002)</small> See CSI section 07 31 13 00-0020 for hip and ridge vent.		
01 95 08 Residential - Doors And Windows <small>(01 95)</small> See CSI section 08 36 13 00-0101 for residential overhead doors, 08 53 00 00-0000 for vinyl windows.		
01 95 08 00-0001 Exterior Doors <small>(01 95 08)</small>		
01 95 08 00-0002 Steel Exterior Residential Door Slab <small>(01 95 08 00-0001)</small> Note: Primed galvanized steel skin with polystyrene core door.		
01 95 08 00-0003 EA 24 Gauge Flush Steel Exterior Residential Door Slab For 12" x 12" Vision Light, Add For 20 Minute Fire Rating, Add For 90 Minute Fire Rating, Add	184.52 74.12 1.09 9.81	37.73
01 95 08 00-0004 EA 24 Gauge Six Panel Steel Exterior Residential Door Slab For Fan Or Nine Lite, Add For 20 Minute Fire Rating, Add For 90 Minute Fire Rating, Add	193.40 60.36 1.18 10.61	37.73
01 95 08 00-0005 EA 22 Gauge Flush Steel Exterior Residential Door Slab For 12" x 12" Vision Light, Add For 20 Minute Fire Rating, Add For 90 Minute Fire Rating, Add	269.93 74.12 1.91 265.31	39.53
01 95 08 00-0006 EA 22 Gauge Six Panel Steel Exterior Residential Door Slab For Fan Or Nine Lite, Add For 20 Minute Fire Rating, Add For 90 Minute Fire Rating, Add	275.72 60.36 1.97 273.36	39.53
01 95 08 00-0007 Prehung Steel Exterior Residential Doors <small>(01 95 08 00-0001)</small> Note: Primed galvanized steel skin with polystyrene core door. Primed galvanized steel skin and wood frame.		
01 95 08 00-0008 EA 25 Gauge Flush Prehung (Or Slab Only) Steel Exterior Residential Doors For 12" x 12" Vision Light, Add For 20 Minute Fire Rating, Add For 90 Minute Fire Rating, Add	232.34 74.12 75.08 173.87	50.31
01 95 08 00-0009 EA 25 Gauge Six Panel Prehung (Or Slab Only) Steel Exterior Residential Doors For Fan Or Nine Lite, Add For 20 Minute Fire Rating, Add For 90 Minute Fire Rating, Add	244.83 60.36 82.20 190.36	50.31
01 95 08 00-0010 EA 24 Gauge Flush Prehung Steel Exterior Residential Doors For 12" x 12" Vision Light, Add For 20 Minute Fire Rating, Add For 90 Minute Fire Rating, Add	337.45 74.12 9.19 135.49	53.90
01 95 08 00-0011 EA 24 Gauge Six Panel Prehung Steel Exterior Residential Doors For Fan Or Nine Lite, Add For 20 Minute Fire Rating, Add For 90 Minute Fire Rating, Add	345.81 60.36 9.52 140.42	53.90
01 95 08 00-0012 EA 22 Gauge Flush Prehung Steel Exterior Residential Doors For 12" x 12" Vision Light, Add For 20 Minute Fire Rating, Add For 90 Minute Fire Rating, Add	403.12 74.12 11.53 282.37	57.50
01 95 08 00-0013 EA 22 Gauge Six Panel Prehung Steel Exterior Residential Doors For Fan Or Nine Lite, Add For 20 Minute Fire Rating, Add For 90 Minute Fire Rating, Add	414.99 60.36 12.00 294.00	57.50
01 95 08 00-0014 Fiberglass Exterior Residential Door Slab <small>(01 95 08 00-0001)</small>		
01 95 08 00-0015 EA Flush Fiberglass Exterior Residential Doors For 12" x 12" Vision Light, Add For 20 Minute Fire Rating, Add	225.33 74.12 1.50	37.73
01 95 08 00-0016 EA Six Panel Fiberglass Exterior Residential Doors For Fan Or Nine Lite, Add For 20 Minute Fire Rating, Add	225.41 60.36 64.47	37.73
01 95 08 00-0017 Prehung Fiberglass Exterior Residential Doors <small>(01 95 08 00-0001)</small>		
01 95 08 00-0018 EA Flush Prehung Fiberglass Exterior Residential Doors For Fan Or Nine Lite, Add For 20 Minute Fire Rating, Add	375.86 60.36 45.57	53.90
01 95 08 00-0019 EA Six Panel Prehung Fiberglass Exterior Residential Doors For Fan Or Nine Lite, Add For 20 Minute Fire Rating, Add	375.94 60.36 69.71	53.90
01 95 08 00-0020 Interior Doors <small>(01 95 08)</small>		
01 95 08 00-0021 Birch Faced Hollow Core Flush Door Slab <small>(01 95 08 00-0020)</small> Note: Includes preparing door for lockset and hinges.		
01 95 08 00-0022 EA 2'-4", 1-3/8" Unfinished, Birch Faced, Hollow Core, Flush Door Slab 01 95 08 00-0023 EA 2'-6", 1-3/8" Unfinished, Birch Faced, Hollow Core, Flush Door Slab 01 95 08 00-0024 EA 2'-8", 1-3/8" Unfinished, Birch Faced, Hollow Core, Flush Door Slab 01 95 08 00-0025 EA 3'-0", 1-3/8" Unfinished, Birch Faced, Hollow Core, Flush Door Slab	100.60 101.32 103.19 106.17	32.70 33.06 33.42 33.78



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
01 95 08 00-0026				Lauan Faced Hollow Core Flush Door Slab <small>(01 95 08 00-0020)</small> Note: Includes preparing door for lockset and hinges.		
	01 95 08 00-0027	EA		1'-6", 1-3/8" Unfinished, Lauan Faced, Hollow Core, Flush Door Slab	81.35	28.75
	01 95 08 00-0028	EA		2'-0", 1-3/8" Unfinished, Lauan Faced, Hollow Core, Flush Door Slab	88.54	32.34
	01 95 08 00-0029	EA		2'-4", 1-3/8" Unfinished, Lauan Faced, Hollow Core, Flush Door Slab	92.65	32.70
	01 95 08 00-0030	EA		2'-6", 1-3/8" Unfinished, Lauan Faced, Hollow Core, Flush Door Slab	94.51	33.06
	01 95 08 00-0031	EA		2'-8", 1-3/8" Unfinished, Lauan Faced, Hollow Core, Flush Door Slab	96.37	33.42
	01 95 08 00-0032	EA		3'-0", 1-3/8" Unfinished, Lauan Faced, Hollow Core, Flush Door Slab	98.22	33.78
01 95 08 00-0033				Lauan Faced Solid Core Flush Door Slab <small>(01 95 08 00-0020)</small> Note: Includes preparing door for lockset and hinges.		
	01 95 08 00-0034	EA		2'-8", 1-3/8" Unfinished, Lauan Faced, Solid Core, Flush Door Slab	121.35	33.42
	01 95 08 00-0035	EA		3'-0", 1-3/8" Unfinished, Lauan Faced, Solid Core, Flush Door Slab	124.34	33.78
01 95 08 00-0036				High Density Fiberboard Hollow Core Six Panel Door Slab <small>(01 95 08 00-0020)</small> Note: Includes preparing door for lockset and hinges.		
	01 95 08 00-0037	EA		2'-0", 1-3/8" Primed, High Density Fiberboard Hardboard, Hollow Core, Six Panel Door Slab	101.03	32.34
	01 95 08 00-0038	EA		2'-4", 1-3/8" Primed, High Density Fiberboard Hardboard, Hollow Core, Six Panel Door Slab	105.14	32.70
	01 95 08 00-0039	EA		2'-6", 1-3/8" Primed, High Density Fiberboard Hardboard, Hollow Core, Six Panel Door Slab	105.86	33.06
	01 95 08 00-0040	EA		2'-8", 1-3/8" Primed, High Density Fiberboard Hardboard, Hollow Core, Six Panel Door Slab	108.86	33.42
	01 95 08 00-0041	EA		3'-0", 1-3/8" Primed, High Density Fiberboard Hardboard, Hollow Core, Six Panel Door Slab	111.84	33.78
01 95 08 00-0042				Prehung Lauan Faced Hollow Core Flush Door Slab And Frame <small>(01 95 08 00-0020)</small> Note: Includes hinges.		
	01 95 08 00-0043	EA		2'-0", Prehung 1-3/8" Unfinished, Lauan Faced, Hollow Core, Flush Door And Frame	144.34	44.92
	01 95 08 00-0044	EA		2'-4", Prehung 1-3/8" Unfinished, Lauan Faced, Hollow Core, Flush Door And Frame	147.28	45.82
	01 95 08 00-0045	EA		2'-6", Prehung 1-3/8" Unfinished, Lauan Faced, Hollow Core, Flush Door And Frame	151.34	46.72
	01 95 08 00-0046	EA		2'-8", Prehung 1-3/8" Unfinished, Lauan Faced, Hollow Core, Flush Door And Frame	155.41	47.61
	01 95 08 00-0047	EA		3'-0", Prehung 1-3/8" Unfinished, Lauan Faced, Hollow Core, Flush Door And Frame	159.48	48.51
01 95 08 00-0048				Prehung High Density Fiberboard Hollow Core Six Panel Door And Frame <small>(01 95 08 00-0020)</small> Note: Includes hinges.		
	01 95 08 00-0049	EA		1'-6", Prehung 1-3/8" Primed, High Density Fiberboard Hardboard, Hollow Core, Six Panel Door And Frame	155.52	43.12
	01 95 08 00-0050	EA		2'-0", Prehung 1-3/8" Primed, High Density Fiberboard Hardboard, Hollow Core, Six Panel Door And Frame	161.38	44.92
	01 95 08 00-0051	EA		2'-4", Prehung 1-3/8" Primed, High Density Fiberboard Hardboard, Hollow Core, Six Panel Door And Frame	169.99	45.82
	01 95 08 00-0052	EA		2'-6", Prehung 1-3/8" Primed, High Density Fiberboard Hardboard, Hollow Core, Six Panel Door And Frame	172.91	46.72
	01 95 08 00-0053	EA		2'-8", Prehung 1-3/8" Primed, High Density Fiberboard Hardboard, Hollow Core, Six Panel Door And Frame	176.99	47.61
	01 95 08 00-0054	EA		3'-0", Prehung 1-3/8" Primed, High Density Fiberboard Hardboard, Hollow Core, Six Panel Door And Frame	181.06	48.51
01 95 08 00-0055				Bi-Fold And Bi-Pass Doors <small>(01 95 08)</small> See CSI section 08 13 76 00-0001 for bi-fold metal doors, 08 14 76 00-0001 for bi-fold wood doors.		
01 95 08 00-0056				Security Screens <small>(01 95 08)</small>		
	01 95 08 00-0057	EA		Heavy Duty Aluminum Security Screen Door, 0.028" Stainless Mesh, Hardware (Tapco Or Equal)	476.22	110.62
				<i>For Powder Coated Color, Add</i>	19.71	
	01 95 08 00-0058	EA		Heavy Duty Steel Security Screen Door, 0.028" Stainless Steel Mesh, Powder Coated Color And Hardware (Summitt Or Rusco Or Equal)	632.29	110.62
01 95 08 00-0059				Door Hardware <small>(01 95 08)</small> See CSI section 08 71 16 00-2365 for residential locks and latches, 08 71 16 00-2376 for deadbolts.		
	01 95 08 00-0060	PR		Exterior Residential Grade Door Hinges	40.33	7.25
	01 95 08 00-0061	PR		Interior Residential Grade Door Hinges	33.99	7.25
	01 95 08 00-0062	EA		4" Modern Surface Bolt, Bright Brass	27.48	7.98
	01 95 08 00-0063	EA		6" Modern Surface Bolt, Bright Brass	29.40	7.98
	01 95 08 00-0064	EA		4" Modern Surface Bolt, Satin Chrome	29.26	7.98
	01 95 08 00-0065	EA		6" Modern Surface Bolt, Satin Chrome	31.44	7.98
	01 95 08 00-0066	EA		Mortise Entry Lockset With Lever Handle, Schlage L9000-06A	394.78	18.13
	01 95 08 00-0067	EA		Interior Lockset With Knobs, Schlage Rhode Design "D" Series	280.44	33.66
	01 95 08 00-0068	EA		Interior Lockset With Knobs, Schlage Levon Design "A" Series	203.26	33.66
01 95 08 00-0069				Door Accessories <small>(01 95 08)</small>		
	01 95 08 00-0070	EA		Chain Door Guard	33.25	7.18
	01 95 08 00-0071	EA		Wall Mounted Door Bumper	16.95	3.59
	01 95 08 00-0072	OPN		Weatherstripping	49.53	6.28
	01 95 08 00-0073	EA		Aluminum Threshold	35.24	6.28
	01 95 08 00-0074	EA		Wood Threshold	37.49	6.28
01 95 08 00-0075				Window Repair <small>(01 95 08)</small> Note: Includes self adhering butyl rubber tape flashing at perimeter.		
	01 95 08 00-0076	EA		Replace Window Sash Locks	10.94	
	01 95 08 00-0077	EA		Replace Window Lifts/Handles	10.54	

01 General Requirements**01 95 Residential Construction****01 95 08 Residential - Doors And Windows**

MINOR		TOTAL DIRECT	DEMOLITION
CSI	UOM DESCRIPTION	UNIT COST	UNIT COST
01 95 08 00-0078	EA Remove And Replace Window Balance, Complete (Per Balance) Note: Includes bracket, guides and support hardware.	12.35	
01 95 08 00-0079	EA Replace Casement Window Fasteners.....	10.76	
01 95 08 00-0080	EA Replace Window Hooks.....	8.99	
01 95 08 00-0081	SF Replace Window Insect Screens - Fiberglass.....	3.22	
01 95 08 00-0082	SF Replace Window Insect Screens - Aluminum.....	3.23	
01 95 08 00-0083	Residential Window Barrier (01 95 08)		
01 95 08 00-0084	SF Inoperable/Fixed, 12 Mesh (0.028") Stainless Steel Wire Cloth Infill, Level 5, Steel Narrowline Security Screen (Kane SNR5Z).....	13.94	0.46
01 95 08 00-0085	SF Operable, 12 Mesh (0.028") Stainless Steel Wire Cloth Infill, Level 5, Steel Narrowline Security Screen (Kane SNR50).....	20.94	0.46
01 95 09 Residential - Finishes (01 95)			
01 95 09 00-0001	Flooring (01 95 09)		
01 95 09 00-0002	SF 0.08" Inlaid Sheet Vinyl Floor, Mannington Fine Fields #10146..... For >40 To 100, Add For >1,000, Deduct	4.67 1.02 -0.38	0.42
01 95 09 00-0003	Painting (01 95 09)		
01 95 09 00-0004	GSF One Coat Paint - Efficiency Unit.....	1.97	
01 95 09 00-0005	GSF One Coat Paint - One Bedroom Unit.....	1.95	
01 95 09 00-0006	GSF One Coat Paint - Two Bedroom Unit.....	1.92	
01 95 09 00-0007	GSF One Coat Paint - Three Bedroom Unit.....	1.88	
01 95 09 00-0008	GSF One Coat Paint - Four Bedroom Unit.....	1.84	
01 95 09 00-0009	GSF One Coat Paint - Five Bedroom Unit.....	1.81	
01 95 09 00-0010	GSF One Coat Paint - Six Bedroom Unit.....	1.78	
01 95 09 00-0011	GSF Two Coats Paint - Efficiency Unit.....	2.62	
01 95 09 00-0012	GSF Two Coats Paint - One Bedroom Unit.....	2.55	
01 95 09 00-0013	GSF Two Coats Paint - Two Bedroom Unit.....	2.52	
01 95 09 00-0014	GSF Two Coats Paint - Three Bedroom Unit.....	2.49	
01 95 09 00-0015	GSF Two Coats Paint - Four Bedroom Unit.....	2.46	
01 95 09 00-0016	GSF Two Coats Paint - Five Bedroom Unit.....	2.43	
01 95 09 00-0017	GSF Two Coats Paint - Six Bedroom Unit.....	2.40	
01 95 09 00-0018	GSF Paint Entire Unit Complete Including Doors..... Note: Includes doors, walls, moldings, kitchen, ceilings, etc. Includes preparation. Per SF of floor area. Combination semi-gloss and eggshell. Two coats paint or one coat primer and one coat paint. For Each Additional Coat, Add	3.94 1.41	
01 95 09 00-0019	GSF Paint Entire Unit Complete Excluding Doors..... Note: Includes walls, moldings, kitchen, ceilings, etc. Includes preparation. Per SF of floor area. Combination semi-gloss and eggshell. Two coats paint or one coat primer and one coat paint. For Each Additional Coat, Add	3.61 1.30	
01 95 09 00-0020	Residential Sound Improvement Program Assemblies (01 95 09) Note: Assemblies are inclusive of all Labor, Equipment, and Materials to Sound insulate residential units as per the LA County RSIP program specifications, scopes of work, and details. Required incidental engineering, load calculations, and permitting to complete these tasks are also inclusive of these assemblies. The County reserves the right to add or delete individual tasks from these assemblies as deemed necessary based on site specific conditions.		
01 95 09 00-0021	EA RSIP Single Family Residence up to 1,000 SF..... Note: (Up to 12 windows Included)	18,930.60	
01 95 09 00-0022	EA RSIP Single Family Residence up to 1,500 SF..... Note: (Up to 15 windows Included)	21,034.00	
01 95 09 00-0023	EA RSIP Single Family Residence up to 2,000 SF..... Note: (Up to 20 windows Included)	23,137.40	
01 95 09 00-0024	EA RSIP Single Family Residence up to 2,500 SF..... Note: (Up to 22 windows Included)	25,240.80	
01 95 09 00-0025	EA RSIP Single Family Residence over 2,500 SF..... Note: (Up to 25 windows Included)	27,344.20	
01 95 09 00-0026	EA RSIP Multi-Family Residence up to 2 Units..... Note: (Up to 20 windows Included)	25,766.65	
01 95 09 00-0027	EA RSIP Multi-Family Residence up to 3 Units..... Note: (Up to 22 windows Included)	27,344.20	
01 95 09 00-0028	EA RSIP Multi-Family Residence up to 4 Units..... Note: (Up to 25 windows Included)	31,288.08	
01 95 09 00-0029	EA RSIP Apartment studio/1 bedroom..... Note: (Up to 5 windows Included)	16,827.20	
01 95 09 00-0030	EA RSIP Apartment 2 bedroom..... Note: (Up to 8 windows Included)	18,930.60	
01 95 09 00-0031	EA RSIP Apartment 3+ bedroom..... Note: (Up to 12 windows Included)	21,034.00	
01 95 10 Residential - Specialties (01 95)			
01 95 10 00-0001	Toilet Accessories (01 95 10) See CSI section 10 28 16 13-0001 for residential toilet accessories.		



MINOR	CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
01 95 10 00-0002	Wire Shelving (01 95 10) Note: Includes brackets and hardware.		
01 95 10 00-0003	LF 12" Wire Shelving For Closets.....	18.27	5.82
01 95 10 00-0004	LF 16" Wire Shelving For Closets.....	19.93	5.82
01 95 10 00-0005	LF 20" Wire Shelving For Closets.....	21.60	5.82
01 95 11	Residential - Equipment (01 95)		
01 95 11 00-0001	Kitchen Equipment (01 95 11)		
01 95 11 00-0002	Refrigerators (01 95 11 00-0001)		
01 95 11 00-0003	EA 11.9 CF Top Freezer Refrigerator.....	753.23	36.54
01 95 11 00-0004	EA 15.5 CF Top Freezer Refrigerator.....	892.87	36.54
01 95 11 00-0005	EA 17.9 CF Top Freezer Refrigerator.....	844.07	36.54
01 95 11 00-0006	Ranges (01 95 11 00-0001)		
01 95 11 00-0007	EA 24" Electric Free Standing Range.....	587.85	73.07
01 95 11 00-0008	EA 30" Electric Free Standing Range.....	576.49	73.07
01 95 11 00-0009	EA 24" Gas Free Standing Range.....	690.04	73.07
01 95 11 00-0010	EA 30" Gas Free Standing Range.....	655.98	73.07
01 95 12	Residential - Furnishings (01 95)		
01 95 12 00-0001	Mini Blinds (01 95 12)		
01 95 12 00-0002	SF 1" Vinyl Mini Blinds.....	1.87	0.72
01 95 12 00-0003	SF 1" Aluminum Mini Blinds.....	4.01	1.08
01 95 13	Residential - Special Construction (01 95)		
01 95 13 00-0001	Residential Smoke Detector (01 95 13)		
01 95 13 00-0002	EA Photo Electric Smoke Detector 110-120 Volt, Wired; BRK 7010.....	80.15	30.21
01 95 22	Residential - Plumbing (01 95)		
01 95 22 00-0001	Plumbing (01 95 22)		
01 95 22 00-0002	Bathroom Toilets (01 95 22 00-0001) See CSI section 22 42 13 00-0001 for additional water closets.		
01 95 22 00-0003	EA 2 Piece Tank Type, Gravity Flush System, Floor Mounted, Floor Outlet, Elongated Vitreous China Water Closet (Kohler Wellworth® K-3978).....	351.52	129.91
	Note: Includes seat, wax ring, escutcheon, supply valve and line.		
01 95 22 00-0004	EA Water Closet, Kohler K-3423, White With K-9404 Trip Lever.....	343.17	129.91
	Note: Includes seat, wax ring, escutcheon, supply valve and line.		
01 95 22 00-0005	EA 2 Piece Tank Type, Gravity Flush System, Floor Mounted, Floor Outlet, Elongated Vitreous China Water Closet (Kohler Highline® K-3999).....	376.82	129.91
	Note: Includes seat, wax ring, escutcheon, supply valve and line.		
01 95 22 00-0006	EA Round Front Toilet Seat, White (Kohler K-4716-T).....	39.87	12.46
01 95 22 00-0007	Bathroom Lavatory Faucets (01 95 22 00-0001) See CSI section 22 42 39 00-0024 for additional lavatory faucets.		
01 95 22 00-0008	EA Lavatory Faucet, Polished Chrome (Kohler K-15240-4).....	104.47	28.75
01 95 22 00-0009	EA Faucet, Kohler (K-15182-P).....	130.35	23.95
01 95 22 00-0010	EA Lavatory Faucet (Delta 2522LF-MPU).....	107.36	28.75
01 95 22 00-0011	EA Lavatory Faucet, Single Handle, Polished Chrome, Moen CAL4621.....	138.95	28.75
01 95 22 00-0012	Bathroom Wall Hung Lavatory (01 95 22 00-0001) See CSI section 22 42 16 00-0002 for wall hung lavatories.		
01 95 22 00-0013	Bathroom Counter Top Lavatory (01 95 22 00-0001) See CSI section 22 42 16 00-0011 for additional countertop lavatories.		
01 95 22 00-0014	EA 20" x 18" Oval Vitreous China Single Hole Countertop Lavatory, Self Rimming (Kohler K-2196-1N).....	429.45	64.31
01 95 22 00-0015	Bathtubs (01 95 22 00-0001) See CSI section 22 42 19 00-0001 for additional tubs.		
01 95 22 00-0016	EA 5" Bathtub, American Standard Princeton Series.....	652.28	204.33
01 95 22 00-0017	EA 60" x 30" x 14" Bathtub, Kohler K-715 or K-716.....	699.59	204.33
01 95 22 00-0018	Bathroom Tub/Shower Faucets And Trim (01 95 22 00-0001)		
01 95 22 00-0019	EA Pressure Balancing Shower Valve (Kohler K-304-K).....	125.12	34.65
01 95 22 00-0020	EA Pressure Balancing Shower Valve (Symmons BP-46-2-X).....	135.88	34.65
01 95 22 00-0021	EA Pressure Balancing Shower Valve (Moen 62370).....	127.51	34.65
01 95 22 00-0022	EA Shower And Tub Control Set, Single Control With Balancing Valve (Moen L2353).....	154.41	34.65

01 General Requirements**01 95 Residential Construction****01 95 22 Residential - Plumbing**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
01 95 22 00-0023	EA		Shower And Tub Control Set, Single Control With Balancing Valve (Moen L2363).....	168.96	34.65
01 95 22 00-0024	EA		Shower And Tub Control Set, 2 Knobs With Balancing Valve (Pfister 07-312).....	124.47	34.65
01 95 22 00-0025	EA		Shower And Tub Control Set, 3 Knobs With Balancing Valve (Pfister 01-312).....	144.60	34.65
01 95 22 00-0026	EA		Single Control Trim Kit (Symmons BPM46-2-LR-TRM).....	103.27	34.65
01 95 22 00-0027	EA		Single Control Trim Kit (Symmons BP-46-2-STK-TRM).....	89.34	34.65
01 95 22 00-0028	EA		Brass Shower Head (EZ Flo 15013 Or 15015).....	35.14	7.98
01 95 22 00-0029	EA		Wall Mount, Hand Shower Unit With Hose (Alsons 62001 DS).....	165.64	19.96
01 95 22 00-0030	EA		Posi-Temp Single Handle Tub/Shower Chrome Shower Valve, Moen Chateau L2353.....	138.65	34.65
01 95 22 00-0031			Bathroom Fixture Components And/Or Trim Replacement (01 95 22 00-0001) See CSI section 22 01 40 00-0001 for fixture trim accessories.		
01 95 22 00-0032	EA		Elongated Toilet Seat, White (Kohler K-4712-T).....	44.73	12.46
01 95 22 00-0033	EA		Replace Vitreous China Toilet Tank And Lid.....	111.61	
01 95 22 00-0034	EA		Replace Ball Cock Assembly.....	51.27	
01 95 22 00-0035	EA		Replace Wax Ring Seal.....	7.57	
01 95 22 00-0036	EA		Aerator, 2.2 GPM, Polished Chrome Vandal Resistant Spray, Non Aerated (Kohler K-18034).....	18.71	3.99
01 95 22 00-0037	EA		Aerator, Polished Chrome Vandal Resistant, 2.2 GPM (Kohler K-18033).....	16.33	3.99
01 95 22 00-0038	EA		Aerator, NEOPERL 1.5 GPM, Chrome Plated.....	9.07	3.99
01 95 22 00-0039	EA		Aerator, NEOPERL 2.2 GPM, Chrome Plated.....	9.07	3.99
01 95 22 00-0040			Bathroom Culture Marble Lavatory Vanity Top (01 95 22 00-0001) Note: Includes splash. Single sink, center or offset. Bowl is either oval, shell shape or rectangular. See CSI section 22 42 16 00-0030 for vanity top.		
01 95 22 00-0041			Preassembled Vanities With Tops (01 95 22 00-0001)		
01 95 22 00-0042	EA		19" Preassembled Vanity With Top (Glacier Bay GB18P2COM-WH).....	205.82	61.95
01 95 22 00-0043	EA		24-1/2" Preassembled Vanity With Top (Glacier Bay GB24P2COM-WH).....	253.83	75.47
01 95 22 00-0044	EA		30-1/2" Preassembled Vanity With Top (Glacier Bay GB30P2COM-WH).....	303.02	79.06
01 95 22 00-0045			Kitchen Sinks (01 95 22 00-0001) Note: Includes strainer.		
01 95 22 00-0046	EA		25" x 22" x 6" Stainless Steel Kitchen Sink, Single Bowl, 22 Gauge (Elkay K125224).....	403.28	69.09
01 95 22 00-0047	EA		33" x 21" x 6-1/2" Stainless Steel Kitchen Sink, Double Bowl, 20 Gauge (Elkay D233213).....	462.60	78.65
01 95 22 00-0048	EA		33" x 21" x 10-1/8" Stainless Steel Kitchen Sink, Double Bowl, 18 Gauge (Elkay DLR33224).....	1,578.29	78.65
01 95 22 00-0049			Kitchen Faucets (01 95 22 00-0001)		
01 95 22 00-0050	EA		Kitchen Faucet, Polished Chrome (Kohler K-15251-B).....	110.91	39.92
01 95 22 00-0051	EA		Kitchen Faucet, Polished Chrome (Kohler K-15171-P).....	130.55	39.92
01 95 22 00-0052	EA		Kitchen Faucet, Polished Chrome (Delta 2100).....	108.64	39.92
01 95 22 00-0053	EA		Kitchen Faucet, Single-Handle, Polished Chrome, Moen CA8710.....	153.33	39.92
01 95 22 00-0054	EA		Kitchen Faucet, Single-Handle, Polished Chrome, Moen #7300.....	158.55	39.92
01 95 22 00-0055			Kitchen Countertops (01 95 22 00-0001) See CSI section 12 36 23 13-0001 for countertops.		
01 95 22 00-0056			Washer Box (01 95 22 00-0001)		
01 95 22 00-0057	EA		Washer Box With Supply Lines And Valve.....	154.35	59.90
01 95 22 00-0058			Water Heaters Parts And Accessories (01 95 22 00-0001)		
01 95 22 00-0059	EA		Replace Pressure And Temperature Valve.....	90.48	
01 95 22 00-0060	EA		Remove And Replace 9", 120 Volt, 1,500 Watt Screw-In Water Heater Element..... Note: Incoloy Nickel-base sheath elements.	80.09	
01 95 22 00-0061	EA		Remove And Replace 9", 208 Volt, 2,000 Watt Screw-In Water Heater Element..... Note: Incoloy Nickel-base sheath elements.	86.49	
01 95 22 00-0062	EA		Remove And Replace 16-1/2", 208 Volt, 3,000 Watt Screw-In Water Heater Element..... Note: Incoloy Nickel-base sheath elements.	118.68	
01 95 22 00-0063	EA		Remove And Replace 16-1/2", 208 Volt, 4,000 Watt Screw-In Water Heater Element..... Note: Incoloy Nickel-base sheath elements.	118.68	
01 95 22 00-0064	EA		Remove And Replace 16-1/2", 208 Volt, 4,500 Watt Screw-In Water Heater Element..... Note: Incoloy Nickel-base sheath elements.	119.08	
01 95 22 00-0065	EA		Remove And Replace 16-1/2", 208 Volt, 5,000 Watt Screw-In Water Heater Element..... Note: Incoloy Nickel-base sheath elements.	121.89	
01 95 22 00-0066	EA		Remove And Replace 16-1/2", 208 Volt, 6,000 Watt Screw-In Water Heater Element..... Note: Incoloy Nickel-base sheath elements.	119.75	
01 95 22 00-0067	EA		Remove And Replace 9-1/4", 240 Volt, 1,000 Watt Screw-In Water Heater Element..... Note: Incoloy Nickel-base sheath elements.	76.75	
01 95 22 00-0068	EA		Remove And Replace 9", 240 Volt, 1,000 Watt Screw-In Water Heater Element..... Note: Incoloy Nickel-base sheath elements.	82.62	
01 95 22 00-0069	EA		Remove And Replace 11-1/2", 240 Volt, 2,000 Watt Screw-In Water Heater Element..... Note: Incoloy Nickel-base sheath elements.	84.82	
01 95 22 00-0070	EA		Remove And Replace 11", 240 Volt, 2,500 Watt Screw-In Water Heater Element..... Note: Incoloy Nickel-base sheath elements.	84.69	
01 95 22 00-0071	EA		Remove And Replace 13-1/2", 240 Volt, 3,000 Watt Screw-In Water Heater Element..... Note: Incoloy Nickel-base sheath elements.	93.51	
01 95 22 00-0072	EA		Remove And Replace 13-3/4", 240 Volt, 3,500 Watt Screw-In Water Heater Element..... Note: Incoloy Nickel-base sheath elements.	93.91	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
01 95 22 00-0073 EA Remove And Replace 16", 240 Volt, 4,000 Watt Screw-In Water Heater Element..... Note: Incoloy Nickel-base sheath elements.	113.21	
01 95 22 00-0074 EA Remove And Replace 13-3/4", 240 Volt, 4,500 Watt Screw-In Water Heater Element..... Note: Incoloy Nickel-base sheath elements.	96.58	
01 95 22 00-0075 EA Remove And Replace 16", 240 Volt, 5,000 Watt Screw-In Water Heater Element..... Note: Incoloy Nickel-base sheath elements.	115.75	
01 95 22 00-0076 EA Remove And Replace 13-1/2", 240 Volt, 5,500 Watt Screw-In Water Heater Element..... Note: Incoloy Nickel-base sheath elements.	100.31	
01 95 22 00-0077 EA Remove And Replace 16-1/2", 240 Volt, 6,000 Watt Screw-In Water Heater Element..... Note: Incoloy Nickel-base sheath elements.	114.28	
01 95 22 00-0078 EA Remove And Replace 16-1/2", 277 Volt, 3,000 Watt Screw-In Water Heater Element..... Note: Incoloy Nickel-base sheath elements.	121.08	
01 95 22 00-0079 EA Remove And Replace 16-1/2", 277 Volt, 4,500 Watt Screw-In Water Heater Element..... Note: Incoloy Nickel-base sheath elements.	125.22	
01 95 22 00-0080 EA Remove And Replace 16", 480 Volt, 2,000 Watt Screw-In Water Heater Element..... Note: Incoloy Nickel-base sheath elements.	106.67	
01 95 22 00-0081 EA Remove And Replace 16-1/2", 480 Volt, 3,000 Watt Screw-In Water Heater Element..... Note: Incoloy Nickel-base sheath elements.	120.82	
01 95 22 00-0082 EA Remove And Replace 16-1/2", 480 Volt, 4,000 Watt Screw-In Water Heater Element..... Note: Incoloy Nickel-base sheath elements.	125.36	
01 95 22 00-0083 EA Remove And Replace 16-1/2", 480 Volt, 4,500 Watt Screw-In Water Heater Element..... Note: Incoloy Nickel-base sheath elements.	125.76	
01 95 22 00-0084 EA Remove And Replace 16-1/2", 480 Volt, 5,000 Watt Screw-In Water Heater Element..... Note: Incoloy Nickel-base sheath elements.	125.76	
01 95 22 00-0085 EA Remove And Replace 16-1/2", 480 Volt, 6,000 Watt Screw-In Water Heater Element..... Note: Incoloy Nickel-base sheath elements.	123.49	
01 95 22 00-0086 Domestic Water Heater <small>(01 95 22 00-0001)</small>		
01 95 22 00-0087 EA 40 Gallon, Gas Domestic Water Heater; Bradford White M-I-5036FBN	773.76	157.69
01 95 22 00-0088 EA 38 Gallon, Gas Domestic Water Heater; Rheem #563688	806.66	157.69
01 95 22 00-0089 EA 30" x 74" x 30" Galvanized Steel Water Heater Enclosure (Holdrite QS-E30)	185.05	157.69
01 95 22 00-0090 EA 1/2" x 1/2" Temperature And Pressure Relief Valve, Bronze Body, Threaded, Residential.....	45.87	20.36
01 95 22 00-0091 EA 3/4" x 3/4" Temperature And Pressure Relief Valve, Bronze Body, Threaded, Residential.....	54.61	24.43
01 95 23 Residential - HVAC <small>(01 95)</small>		
01 95 23 00-0001 HVAC <small>(01 95 23)</small>		
01 95 23 00-0002 Residential Furnaces <small>(01 95 23 00-0001)</small> Note: All units based on output.		
01 95 23 00-0003 EA 35 MBH Top Vent Natural Gas Furnace; Williams Monterey #3509622	864.90	64.86
01 95 23 00-0004 Air Handling Parts And Accessories <small>(01 95 23 00-0001)</small>		
01 95 23 00-0005 EA Replace Motor For Blower Assembly.....	142.52	
01 95 23 00-0006 EA Replace Blower Assembly	486.88	
01 95 23 00-0007 EA Replace Heater/Furnace Door	38.99	
01 95 23 00-0008 EA Up To 4" Diameter Roof Jack With Bird Screen And Back Draft Damper	76.44	28.98
01 95 23 00-0009 EA 6" Diameter Roof Jack With Bird Screen And Back Draft Damper.....	88.97	28.98
01 95 23 00-0010 Air Distribution <small>(01 95 23 00-0001)</small>		
01 95 23 00-0011 EA Replace Exhaust Fan	144.90	
01 95 23 00-0012 EA Replace R/A Grills	40.30	
01 95 23 00-0013 EA Replace Registers	24.81	
01 95 23 00-0014 Thermostat <small>(01 95 23 00-0001)</small>		
01 95 23 00-0015 EA Lightstat Thermostat, 24 Volt A.C. Heat Only Thermostat..... Note: With automatic setback.	210.47	26.16
01 95 23 00-0016 Thru Wall Air Conditioner <small>(01 95 23 00-0001)</small>		
01 95 23 00-0017 EA 14,800 BTU Packaged Terminal Air Conditioner with 14,000 Heat Pump BTU, R-410A Refrigerant, Electronic Touch Controls, LED Display and 4.5 Dehumidification Rate; GE #AZ61H15DAB	1,705.40	211.32
01 95 26 Residential - Electrical <small>(01 95)</small>		
01 95 26 00-0001 Wire <small>(01 95 26)</small>		
01 95 26 00-0002 LF 12 AWG, 2 Conductor, Solid, Romex Copper Wire	2.74	1.29
01 95 26 00-0003 LF 10 AWG, 2 Conductor, Solid, Romex Copper Wire	3.00	1.29
01 95 26 00-0004 Residential Lighting Fixtures <small>(01 95 26)</small> Note: Includes lamps.		
01 95 26 00-0005 Bedroom Fixtures <small>(01 95 26 00-0004)</small>		
01 95 26 00-0006 EA 11" Round, Close To Ceiling Fixture, Incandescent (Progress 3520-30)	81.24	26.78

01 General Requirements**01 95 Residential Construction****01 95 26 Residential - Electrical**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
	01 95 26 00-0007	EA	12" Round, Close To Ceiling Fixture, Compact Fluorescent, 2 - 13W Lamps (Sea Gull 5902-15)	106.87	26.78
	01 95 26 00-0008	EA	Globe, Close To Ceiling Fixture, Incandescent (Progress 3605-30)	53.98	26.78
	01 95 26 00-0009	EA	Globe, Close To Ceiling Fixture, Incandescent, With Pull Chain (Progress 3605-30SW)	61.74	26.78
	01 95 26 00-0010	EA	14" Round, Close To Ceiling Fixture, Compact Fluorescent (Progress 7378-30)	123.03	26.78
	01 95 26 00-0011	EA	12" Square Canopy, Incandescent (Progress 4962)	54.44	26.78
	01 95 26 00-0012	EA	12" Square Canopy, Incandescent (Progress 4961)	53.87	26.78
	01 95 26 00-0013	EA	Square Ceiling Fixture, Two Light Incandescent, Westinghouse #66201	54.47	26.78
	01 95 26 00-0014	EA	6" Opal Ball Ceiling Mount Fixture, One Light; Sunset #F2203-30	40.96	16.09
	01 95 26 00-0015	EA	Slim line - 11" Diameter- 3" Low Profile Steel Fixture With Acrylic Lens (White) 13 Watt	63.50	19.85
01 95 26 00-0016	Bathroom Fixtures (01 95 26 00-0004)				
	01 95 26 00-0017	EA	Wall Fixture, Incandescent (Sea Gull 4450)	61.34	26.78
	01 95 26 00-0018	EA	Wall Fixture, Incandescent (Westinghouse 66401)	49.44	26.78
	01 95 26 00-0019	EA	Wall Fixture, Incandescent, 2 Lamps (Westinghouse 66403)	53.00	26.78
	01 95 26 00-0020	EA	70 CFM Bathroom Fan With Light; Nutone 668RP	154.47	40.28
	01 95 26 00-0021	EA	1250W/120V Ceiling Bath Heater; Broan #154	105.44	26.78
01 95 26 00-0022	Kitchen And Hallway Fixtures (01 95 26 00-0004)				
	See CSI section 26 51 13 00-0491 for ceiling light fixtures.				
	01 95 26 00-0023	EA	Public Halls, 5" x 26" Vandal Resistant Fluorescent, 1 - 17 Watt, Luminaire VSL.1 17	305.36	26.78
	01 95 26 00-0024	EA	Public Halls, 9" x 26" Vandal Resistant Fluorescent, 2 - 17 Watt, Luminaire VSL.2 17	344.83	26.78
01 95 26 00-0025	Exterior Fixtures (01 95 26 00-0004)				
	01 95 26 00-0026	EA	Wall Lantern, Glass Globe, Incandescent (Progress Lighting P5602-31)	50.30	26.78
	01 95 26 00-0027	EA	Wall Lantern, Glass Lens, Incandescent (Lumapro 3RB20)	68.94	26.78
	01 95 26 00-0028	EA	Wall Lantern, Polycarbonate Lens, HPS (Lumapro 5MM60)	151.44	26.78
	01 95 26 00-0029	EA	13 Watt Porch Light, Glass Globe, Cooper FE13PCW	59.45	20.11
	01 95 26 00-0030	EA	Motion Sensor, Zenith SL-5105	74.16	20.11
	01 95 26 00-0031	EA	Exterior Porch Light, Incandescent, Rabb VAN1F-13	109.15	26.78
01 95 26 00-0032	Energy Efficient Lighting And Ballasts (01 95 26 00-0004)				
	Note: Listed manufacturers or equal.				
	01 95 26 00-0033	EA	Elec. LP Bal. And (1) 4' T8 Lamp - A; Advance VEL (or REL) -1P32-RH-TP	62.61	
	01 95 26 00-0034	EA	Retrofit LP Elec. Bal. And (2) 4' T8 Lamp - B; Advance VEL (or REL) -2P32-LW-RH-TP	64.29	
	01 95 26 00-0035	EA	Retrofit TW in 2; LP Elec. Bal. And (2) 4' T8 Lamp - BT; Advance VEL (or REL) - 4P32-LW-RH-TP	58.75	
	01 95 26 00-0036	EA	Retrofit LP Elec. Bal. And (4) 4' T8 Lamp - D; Advance VEL (or REL) - 4P32-LW-RH-TP	72.96	
	01 95 26 00-0037	EA	Retrofit 23W CF With Bal. - F3; Phillips LKGEB23100	45.51	
	01 95 26 00-0038	EA	Retrofit 13W CF With Bal. (3pc) And Reflect- F5; Lumatech 11324 Lamp PLQ13	57.68	
	01 95 26 00-0039	EA	8' To 4' Conversion Kit; LP Elec. Bal. (4) 4' T8 - JT; Advance VEL (or REL) - 4P32-LW-RH-TP	63.92	
	01 95 26 00-0040	EA	Retrofit - LP Elec. Bal.; (1) 2' T8 - KA	52.10	
	01 95 26 00-0041	EA	Retrofit - TW In 2; Elec. Bal.; (4) 2' T8 - KB; Howard EL/32IS	53.55	
	01 95 26 00-0042	EA	Retrofit - LP Elec. Bal.; (1) 3' T8 - LA; Advance VEL (Or REL) - 1P32-RH-TP	52.10	
	01 95 26 00-0043	EA	Retrofit - Elec. Bal. (2) 4' T8, (1) 2' x 4' Spec Refl - R	106.90	
	01 95 26 00-0044	EA	Retrofit - Elec. Bal. (2) 2' T8, (1) 2' x 2' - RU; Advance VEL (or REL) - 2P17-RH-TP	96.52	
01 95 26 00-0045	Wiring Devices (01 95 26)				
	01 95 26 00-0046	EA	Duplex Receptacle With Cover And Termination Note: Includes 20 LF of 3 conductor wire.	75.47	37.46
	01 95 26 00-0047	EA	Single Wall Switch With Cover And Termination Note: Includes 20 LF of 3 conductor wire.	75.56	36.74
	01 95 26 00-0048	EA	Double Wall Switch With Cover And Termination Note: Includes 20 LF of 3 conductor wire.	84.70	41.90
	01 95 26 00-0049	EA	Triple Wall Switch With Cover And Termination Note: Includes 20 LF of 3 conductor wire.	94.63	46.73
	01 95 26 00-0050	EA	Quad Wall Switch With Cover And Termination Note: Includes 20 LF of 3 conductor wire.	111.58	54.79
	01 95 26 00-0051	EA	GFIs, 15 Or 20 Amp New With Cover And Termination Note: Includes 20 LF of 3 conductor wire.	33.00	13.45
	01 95 26 00-0052	EA	Replace Existing Cover Plates	8.17	
	01 95 26 00-0053	EA	Telephone Jack With Cover And Termination	22.01	10.55
01 95 26 00-0054	Alarms (01 95 26)				
	01 95 26 00-0055	EA	Battery Operated Smoke Alarm (Kidde 0916E)	32.59	10.05
	01 95 26 00-0056	EA	AC Powered Wire-in Smoke Alarm (Kidde i12020)	50.42	20.11
	01 95 26 00-0057	EA	Battery Operated Carbon Monoxide and Smoke Alarm (Kidde 900-0102)	77.62	10.05
	01 95 26 00-0058	EA	AC Powered, Carbon Monoxide Alarm (Kidde 900-0107)	91.59	20.11
	01 95 26 00-0059	EA	AC Powered, Carbon Monoxide and Fire Alarm (Kidde 900-0114)	101.07	20.11
	01 95 26 00-0060	EA	AC Powered Wire-in Smoke Alarm, BRK 9120B	97.87	40.21
01 95 26 00-0061	Occupancy Sensor (01 95 26)				
	01 95 26 00-0062	EA	180 Degree Occupancy Sensor	103.00	40.21



General Requirements	01	01
Residential Construction	01 95	
Residential - Electrical	01 95 26	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
01 95 26 00-0063 Breakers ^(01 95 26) See CSI section 26 24 16 00-0390 for circuit breakers.		

END OF SECTION 01

01	01	General Requirements
	01 95	Residential Construction
	01 95 26	Residential - Electrical



MINOR	TOTAL DIRECT	DEMOLITION
CSI UOM DESCRIPTION	UNIT COST	UNIT COST

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MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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02 Existing Conditions

02 20 Assessment ⁽⁰²⁾

02 25 Existing Material Assessment ^(02 20)

02 25 16 Existing Concrete, Masonry Or Asphalt Assessment ^(02 25)

See CSI section 01 71 36 00-0000 for non-destructive concrete examination.

02 40 Demolition And Structure Moving ⁽⁰²⁾

02 41 Demolition ^(02 40)

02 41 13 Selective Site Demolition ^(02 41)

02 41 13 13 Paving Removal ^(02 41 13)

Note: Includes break-up of material, loading into truck or dumpster and clean-up. Salvage tasks include placement on pallets and storage on site.

02 41 13 13-0001 By Machine, Break-up And Leave In Place Bituminous And Concrete Paving ^(02 41 13 13)

Note: Includes slabs, pavements, sidewalks and base courses. Includes work around obstacles. These tasks are not to be used in conjunction with any other loading activities or other break-up tasks. Excludes saw cutting. See CSI section 02 41 13 13-0018 for breaking-up, removal and loading as a combined operation, 02 41 19 13-0049 for saw cutting.

02 41 13 13-0002	SY Up To 3" By Machine, Break-up And Leave In Place Bituminous Paving	5.09	
	For >500 To 1,000, Deduct	-0.51	
	For >1,000 To 2,500, Deduct	-0.92	
	For >2,500 To 5,000, Deduct	-1.32	
	For >5,000 To 10,000, Deduct	-1.73	
	For >10,000, Deduct	-2.14	
02 41 13 13-0003	SY >3" To 6" By Machine, Break-up And Leave In Place Bituminous Paving	7.63	
	For >500 To 1,000, Deduct	-0.76	
	For >1,000 To 2,500, Deduct	-1.37	
	For >2,500 To 5,000, Deduct	-1.98	
	For >5,000 To 10,000, Deduct	-2.59	
	For >10,000, Deduct	-3.20	
02 41 13 13-0004	SY >6" To 8" By Machine, Break-up And Leave In Place Bituminous Paving	10.18	
	For >500 To 1,000, Deduct	-1.02	
	For >1,000 To 2,500, Deduct	-1.83	
	For >2,500 To 5,000, Deduct	-2.65	
	For >5,000 To 10,000, Deduct	-3.46	
	For >10,000, Deduct	-4.28	
02 41 13 13-0005	SY Up To 3" By Machine, Break-up And Leave In Place Concrete Paving	9.20	
	For >500 To 1,000, Deduct	-0.92	
	For >1,000 To 2,500, Deduct	-1.66	
	For >2,500 To 5,000, Deduct	-2.39	
	For >5,000 To 10,000, Deduct	-3.13	
	For >10,000, Deduct	-3.86	
02 41 13 13-0006	SY >3" To 6" By Machine, Break-up And Leave In Place Concrete Paving	12.98	
	For >500 To 1,000, Deduct	-1.30	
	For >1,000 To 2,500, Deduct	-2.34	
	For >2,500 To 5,000, Deduct	-3.37	
	For >5,000 To 10,000, Deduct	-4.41	
	For >10,000, Deduct	-5.45	
02 41 13 13-0007	SY >6" To 9" By Machine, Break-up And Leave In Place Concrete Paving	18.39	
	For >500 To 1,000, Deduct	-1.84	
	For >1,000 To 2,500, Deduct	-3.31	
	For >2,500 To 5,000, Deduct	-4.78	
	For >5,000 To 10,000, Deduct	-6.25	
	For >10,000, Deduct	-7.72	
02 41 13 13-0008	SY >9" To 14" By Machine, Break-up And Leave In Place Concrete Paving	25.96	
	For >500 To 1,000, Deduct	-2.60	
	For >1,000 To 2,500, Deduct	-4.67	
	For >2,500 To 5,000, Deduct	-6.75	
	For >5,000 To 10,000, Deduct	-8.83	
	For >10,000, Deduct	-10.90	
02 41 13 13-0009	SY >14" To 19" By Machine, Break-up And Leave In Place Concrete Paving	33.95	
	For >500 To 1,000, Deduct	-3.40	
	For >1,000 To 2,500, Deduct	-6.11	
	For >2,500 To 5,000, Deduct	-8.83	
	For >5,000 To 10,000, Deduct	-11.54	
	For >10,000, Deduct	-14.26	
02 41 13 13-0010	SY >19" To 24" By Machine, Break-up And Leave In Place Concrete Paving	44.15	
	For >500 To 1,000, Deduct	-4.42	
	For >1,000 To 2,500, Deduct	-7.95	
	For >2,500 To 5,000, Deduct	-11.48	
	For >5,000 To 10,000, Deduct	-15.01	
	For >10,000, Deduct	-18.54	

02 Existing Conditions**02 40 Demolition And Structure Moving****02 41 Demolition**MINOR
CSI UOM DESCRIPTIONTOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

02 41 13 13-0011	By Hand, Break-up And Leave In Place Bituminous And Concrete Paving ^(02 41 13 13)	
	Note: Includes slabs, pavements, sidewalks and base courses. Includes work around obstacles with jackhammer and hand tools. For individual work areas up to 100 SF where conventional equipment access is limited or prohibited. Task is only to be used when requested by owner. These tasks are not to be used in conjunction with any other loading activities or other break-up tasks. Excludes saw cutting. See CSI section 02 41 13 13-0032 for breaking-up, removal and loading as a combined operation, 02 41 19 13-0049 for saw cutting.	
02 41 13 13-0012	SF Up To 3" By Hand, Break-up And Leave In Place Bituminous Paving	1.38
02 41 13 13-0013	SF >3" To 6" By Hand, Break-up And Leave In Place Bituminous Paving	1.76
02 41 13 13-0014	SF >6" To 8" By Hand, Break-up And Leave In Place Bituminous Paving	2.32
02 41 13 13-0015	SF Up To 3" By Hand, Break-up And Leave In Place Concrete Paving	1.74
02 41 13 13-0016	SF >3" To 6" By Hand, Break-up And Leave In Place Concrete Paving	2.20
02 41 13 13-0017	SF Break-Up >6" To 8" Concrete Paving By Hand With Material Left In Place After Break-up	2.90
02 41 13 13-0018	By Machine, Break-up And Remove Bituminous And Concrete Paving ^(02 41 13 13)	
	Note: Includes slabs, pavements, sidewalks and base courses. Includes work around obstacles, breaking into manageable sizes by machine and loading into truck, dumpster or moving material to stockpile. Excludes saw cutting. See CSI section 02 41 19 13-0049 for saw cutting.	
02 41 13 13-0019	SY Up To 3" By Machine, Break-up And Remove Bituminous Paving	10.27
	For Additional Cost Of Hand Held Equipment Usage (Around Existing Structures And Obstructions), Add	3.08
	Note: (Around Existing Structures And Obstructions), Add	
	For Elevated Slab, Add	5.14
	For >500 To 1,000, Deduct	-1.03
	For >1,000 To 2,500, Deduct	-1.85
	For >2,500 To 5,000, Deduct	-2.67
	For >5,000 To 10,000, Deduct	-3.49
	For >10,000, Deduct	-4.31
02 41 13 13-0020	SY >3" To 6" By Machine, Break-up And Remove Bituminous Paving	14.02
	For Additional Cost Of Hand Held Equipment Usage (Around Existing Structures And Obstructions), Add	4.21
	Note: (Around Existing Structures And Obstructions), Add	
	For Elevated Slab, Add	7.01
	For >500 To 1,000, Deduct	-1.40
	For >1,000 To 2,500, Deduct	-2.52
	For >2,500 To 5,000, Deduct	-3.65
	For >5,000 To 10,000, Deduct	-4.77
	For >10,000, Deduct	-5.89
02 41 13 13-0021	SY Up To 3" By Machine, Break-up And Remove Non Reinforced Concrete Paving	11.81
	For Additional Cost Of Hand Held Equipment Usage (Around Existing Structures And Obstructions), Add	3.54
	Note: (Around Existing Structures And Obstructions), Add	
	For Elevated Slab, Add	5.91
	For >500 To 1,000, Deduct	-1.18
	For >1,000 To 2,500, Deduct	-2.13
	For >2,500 To 5,000, Deduct	-3.07
	For >5,000 To 10,000, Deduct	-4.02
	For >10,000, Deduct	-4.96
02 41 13 13-0022	SY >3" To 6" By Machine, Break-up And Remove Non Reinforced Concrete Paving	15.45
	For Additional Cost Of Hand Held Equipment Usage (Around Existing Structures And Obstructions), Add	4.64
	Note: (Around Existing Structures And Obstructions), Add	
	For Elevated Slab, Add	7.73
	For >500 To 1,000, Deduct	-1.55
	For >1,000 To 2,500, Deduct	-2.78
	For >2,500 To 5,000, Deduct	-4.02
	For >5,000 To 10,000, Deduct	-5.25
	For >10,000, Deduct	-6.49
02 41 13 13-0023	SY Up To 3" By Machine, Break-up And Remove Welded Wire Reinforced Concrete Paving	15.68
	For Additional Cost Of Hand Held Equipment Usage (Around Existing Structures And Obstructions), Add	4.70
	Note: (Around Existing Structures And Obstructions), Add	
	For Elevated Slab, Add	7.84
	For >500 To 1,000, Deduct	-1.57
	For >1,000 To 2,500, Deduct	-2.82
	For >2,500 To 5,000, Deduct	-4.08
	For >5,000 To 10,000, Deduct	-5.33
	For >10,000, Deduct	-6.59
02 41 13 13-0024	SY >3" To 6" By Machine, Break-up And Remove Welded Wire Reinforced Concrete Paving	20.31
	For Additional Cost Of Hand Held Equipment Usage (Around Existing Structures And Obstructions), Add	6.09
	Note: (Around Existing Structures And Obstructions), Add	
	For Elevated Slab, Add	10.16
	For >500 To 1,000, Deduct	-2.03
	For >1,000 To 2,500, Deduct	-3.66
	For >2,500 To 5,000, Deduct	-5.28
	For >5,000 To 10,000, Deduct	-6.91
	For >10,000, Deduct	-8.53
02 41 13 13-0025	SY >6" To 9" By Machine, Break-up And Remove Welded Wire Reinforced Concrete Paving	33.66
	For Additional Cost Of Hand Held Equipment Usage (Around Existing Structures And Obstructions), Add	10.10
	Note: (Around Existing Structures And Obstructions), Add	
	For Elevated Slab, Add	16.83
	For >500 To 1,000, Deduct	-3.37
	For >1,000 To 2,500, Deduct	-6.06
	For >2,500 To 5,000, Deduct	-8.75
	For >5,000 To 10,000, Deduct	-11.44
	For >10,000, Deduct	-14.14



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
02 41 13 13-0026 SY Up To 3" By Machine, Break-up And Remove Rod Reinforced Concrete Paving.....	16.99	
<i>For Elevated Slab, Add</i>	8.50	
<i>For >500 To 1,000, Deduct</i>	-1.70	
<i>For >1,000 To 2,500, Deduct</i>	-3.06	
<i>For >2,500 To 5,000, Deduct</i>	-4.42	
<i>For >5,000 To 10,000, Deduct</i>	-5.78	
<i>For >10,000, Deduct</i>	-7.14	
02 41 13 13-0027 SY >3" To 6" By Machine, Break-up And Remove Rod Reinforced Concrete Paving.....	21.85	
<i>For Elevated Slab, Add</i>	10.93	
<i>For >500 To 1,000, Deduct</i>	-2.19	
<i>For >1,000 To 2,500, Deduct</i>	-3.93	
<i>For >2,500 To 5,000, Deduct</i>	-5.68	
<i>For >5,000 To 10,000, Deduct</i>	-7.43	
<i>For >10,000, Deduct</i>	-9.18	
02 41 13 13-0028 SY >6" To 9" By Machine, Break-up And Remove Rod Reinforced Concrete Paving.....	39.07	
<i>For Elevated Slab, Add</i>	19.54	
<i>For >500 To 1,000, Deduct</i>	-3.91	
<i>For >1,000 To 2,500, Deduct</i>	-7.03	
<i>For >2,500 To 5,000, Deduct</i>	-10.16	
<i>For >5,000 To 10,000, Deduct</i>	-13.28	
<i>For >10,000, Deduct</i>	-16.41	
02 41 13 13-0029 SY >9" To 14" By Machine, Break-up And Remove Rod Reinforced Concrete Paving.....	50.99	
<i>For Elevated Slab, Add</i>	25.50	
<i>For >500 To 1,000, Deduct</i>	-5.10	
<i>For >1,000 To 2,500, Deduct</i>	-9.18	
<i>For >2,500 To 5,000, Deduct</i>	-13.26	
<i>For >5,000 To 10,000, Deduct</i>	-17.34	
<i>For >10,000, Deduct</i>	-21.42	
02 41 13 13-0030 SY >14" To 19" By Machine, Break-up And Remove Rod Reinforced Concrete Paving.....	66.66	
<i>For Elevated Slab, Add</i>	33.33	
<i>For >500 To 1,000, Deduct</i>	-6.67	
<i>For >1,000 To 2,500, Deduct</i>	-12.00	
<i>For >2,500 To 5,000, Deduct</i>	-17.33	
<i>For >5,000 To 10,000, Deduct</i>	-22.66	
<i>For >10,000, Deduct</i>	-28.00	
02 41 13 13-0031 SY >19" To 24" By Machine, Break-up And Remove Rod Reinforced Concrete Paving.....	80.90	
<i>For Elevated Slab, Add</i>	40.45	
<i>For >500 To 1,000, Deduct</i>	-8.09	
<i>For >1,000 To 2,500, Deduct</i>	-14.56	
<i>For >2,500 To 5,000, Deduct</i>	-21.03	
<i>For >5,000 To 10,000, Deduct</i>	-27.51	
<i>For >10,000, Deduct</i>	-33.98	
02 41 13 13-0032 By Hand, Break-up And Remove Bituminous And Concrete Paving <small>(02 41 13 13)</small>		
<small>Note: Includes slabs, pavements, sidewalks and base courses. Includes work around obstacles. Work includes breaking into manageable size with jackhammer and hand tools, removal and loading onto a truck or dumpster. For individual work areas up to 100 SF where conventional equipment access is limited or prohibited. Task is only to be used when requested by owner. Excludes saw cutting. See CSI section 02 41 19 13-0049 for saw cutting.</small>		
02 41 13 13-0033 SF Up To 3" By Hand, Break-up And Remove Bituminous Paving	3.08	
02 41 13 13-0034 SF >3" To 6" By Hand, Break-up And Remove Bituminous Paving	4.06	
02 41 13 13-0035 SF >6" To 8" By Hand, Break-up And Remove Bituminous Paving	5.28	
02 41 13 13-0036 SF Up To 3" By Hand, Break-up And Remove Concrete Paving	3.86	
02 41 13 13-0037 SF >3" To 6" By Hand, Break-up And Remove Concrete Paving.....	5.33	
02 41 13 13-0038 SF >6" To 8" By Hand, Break-up And Remove Concrete Paving.....	6.83	
02 41 13 13-0039 Grind Concrete <small>(02 41 13 13)</small>		
02 41 13 13-0040 EA Grind Existing Sidewalks Up To 1/2" Depth To Remove Ridges (Tripping Hazard)	143.16	
<small>Note: For each location up to 5' wide, feather up to 12' each direction.</small>		
<i>For >1/2" To 1" Depth Of Grinding, Add</i>	21.47	
<i>For >1" To 1-1/2" Depth Of Grinding, Add</i>	35.79	
<i>For Up To 5, Add</i>	28.63	
<i>For >5 To 10, Add</i>	14.32	
<i>For >25 To 50, Deduct</i>	-14.32	
<i>For >50 To 250, Deduct</i>	-21.47	
<i>For >250, Deduct</i>	-28.63	
<i>For Sidewalks >5', Add</i>	14.32	
<i>For Up To 12" Additional Feathering Per Side, Add</i>	14.32	
02 41 16 Structure Demolition <small>(02 41)</small>		
02 41 16 13 Building Demolition <small>(02 41 16)</small>		
02 41 16 13-0001 Building Interior Demolition <small>(02 41 16 13)</small>		
<small>Note: Gutted and placed in truck or dumpsters. Based on overall floor area including space under demolished walls. Includes all soft stripping of materials (doors and frames, non-load bearing walls, carpet, moldings, drywall, tile, ceiling, ductwork, piping, light fixtures, etc.), accessible mechanical, electrical, plumbing, overhead sprinkler, fire protection and similar systems. Excludes lead, asbestos or other contaminants or load bearing walls, mechanical, plumbing or electrical equipment such as furnaces, water heaters, plumbing fixtures, sump pumps, switchgear or panelboards. Excludes hauling, dump fees, recycling charges, and/or salvage value.</small>		
02 41 16 13-0002 GSF Residential Building Interior Demolition, Gutting And Placing Into Dumpster Or Truck	6.07	
02 41 16 13-0003 GSF Up To 2,000 SF Commercial Building Interior Demolition, Gutting And Placing Into Dumpster Or Truck.....	9.18	
02 41 16 13-0004 GSF >2,000 To 10,000 SF Commercial Building Interior Demolition, Gutting And Placing Into Dumpster Or Truck	7.51	

02	Existing Conditions
02 40	Demolition And Structure Moving
02 41	Demolition



MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

02 41 16 13-0005	GSF	>10,000 SF Commercial Building Interior Demolition, Gutting And Placing Into Dumpster Or Truck.....	6.68
02 41 16 13-0006		Foundation Demolition (02 41 16 13)	
		Note: Excludes earthwork.	
02 41 16 13-0007		Concrete Foundation Demolition (02 41 16 13-0006)	
02 41 16 13-0008	CF	Non Reinforced Concrete Foundation Demolition.....	11.52
02 41 16 13-0009	SF	4" Thick Non Reinforced Concrete Foundation Wall Demolition.....	4.94
02 41 16 13-0010	SF	6" Thick Non Reinforced Concrete Foundation Wall Demolition.....	6.58
02 41 16 13-0011	SF	8" Thick Non Reinforced Concrete Foundation Wall Demolition.....	8.22
02 41 16 13-0012	SF	10" Thick Non Reinforced Concrete Foundation Wall Demolition.....	9.86
02 41 16 13-0013	SF	12" Thick Non Reinforced Concrete Foundation Wall Demolition.....	11.52
02 41 16 13-0014	SF	16" Thick Non Reinforced Concrete Foundation Wall Demolition.....	13.16
02 41 16 13-0015	CF	Reinforced Concrete Foundation Demolition.....	13.82
02 41 16 13-0016	SF	4" Thick Reinforced Concrete Foundation Wall Demolition.....	5.92
02 41 16 13-0017	SF	6" Thick Reinforced Concrete Foundation Wall Demolition.....	7.89
02 41 16 13-0018	SF	8" Thick Reinforced Concrete Foundation Wall Demolition.....	9.86
02 41 16 13-0019	SF	10" Thick Reinforced Concrete Foundation Wall Demolition.....	11.68
02 41 16 13-0020	SF	12" Thick Reinforced Concrete Foundation Wall Demolition.....	13.82
02 41 16 13-0021	SF	16" Thick Reinforced Concrete Foundation Wall Demolition.....	15.79
02 41 16 13-0022		Concrete Block Foundation Wall Demolition (02 41 16 13-0006)	
02 41 16 13-0023	SF	4" Thick Non Reinforced Concrete Block Foundation Wall Demolition.....	3.61
02 41 16 13-0024	SF	6" Thick Non Reinforced Concrete Block Foundation Wall Demolition.....	3.86
02 41 16 13-0025	SF	8" Thick Non Reinforced Concrete Block Foundation Wall Demolition.....	4.36
02 41 16 13-0026	SF	10" Thick Non Reinforced Concrete Block Foundation Wall Demolition.....	5.01
02 41 16 13-0027	SF	12" Thick Non Reinforced Concrete Block Foundation Wall Demolition.....	5.59
02 41 16 13-0028	SF	16" Thick Non Reinforced Concrete Block Foundation Wall Demolition.....	6.99
02 41 16 13-0029	SF	4" Thick Reinforced Concrete Block Foundation Wall Demolition.....	4.35
02 41 16 13-0030	SF	6" Thick Reinforced Concrete Block Foundation Wall Demolition.....	4.64
02 41 16 13-0031	SF	8" Thick Reinforced Concrete Block Foundation Wall Demolition.....	5.23
02 41 16 13-0032	SF	10" Thick Reinforced Concrete Block Foundation Wall Demolition.....	6.02
02 41 16 13-0033	SF	12" Thick Reinforced Concrete Block Foundation Wall Demolition.....	6.71
02 41 16 13-0034	SF	16" Thick Reinforced Concrete Block Foundation Wall Demolition.....	8.39
02 41 16 13-0035		Brick Foundation Wall Demolition (02 41 16 13-0006)	
02 41 16 13-0036	SF	4" Thick Brick Foundation Wall Demolition.....	3.61
02 41 16 13-0037	SF	6" Thick Brick Foundation Wall Demolition.....	3.86
02 41 16 13-0038	SF	8" Thick Brick Foundation Wall Demolition.....	4.36
02 41 16 13-0039	SF	10" Thick Brick Foundation Wall Demolition.....	5.01
02 41 16 13-0040	SF	12" Thick Brick Foundation Wall Demolition.....	5.59
02 41 16 13-0041	SF	16" Thick Brick Foundation Wall Demolition.....	6.99
02 41 16 13-0042		Stone Foundation Demolition (02 41 16 13-0006)	
02 41 16 13-0043	CF	Stone Footing Or Foundation Wall Demolition.....	11.52
02 41 16 13-0044		Other Foundation Demolition (02 41 16 13-0006)	
02 41 16 13-0045	CF	Concrete Footing For Fence, Gate Or Playground Equipment Post, Etc. Demolition.....	11.64
		Note: Includes excavation.	
02 41 19		Selective Demolition (02 41)	
02 41 19 13		Selective Building Demolition (02 41 19)	
02 41 19 13-0001		Exterior Masonry Removal (02 41 19 13)	
02 41 19 13-0002		Masonry Columns Removal (Interior And Exterior) (02 41 19 13-0001)	
02 41 19 13-0003	VLF	8" x 8" Masonry Column Removal.....	12.22
02 41 19 13-0004	VLF	10" x 10" Masonry Column Removal.....	19.10
02 41 19 13-0005	VLF	12" x 12" Masonry Column Removal.....	24.48
02 41 19 13-0006	VLF	14" x 14" Masonry Column Removal.....	30.64
02 41 19 13-0007	VLF	16" x 16" Masonry Column Removal.....	37.63
02 41 19 13-0008	CF	Masonry Column Removal, Per CF Of Masonry Removed; For Other Sizes Over 16" Square.....	21.14
02 41 19 13-0009		Masonry Chimney Removal (02 41 19 13-0001)	
02 41 19 13-0010	CF	Up To 3 CF/VLF Chimney Removal, Per CF Of Masonry Removed.....	24.80
02 41 19 13-0011	CF	>3 To 10 CF/VLF Chimney Removal, Per CF Of Masonry Removed.....	18.61
02 41 19 13-0012	CF	>10 To 20 CF/VLF Chimney Removal, Per CF Of Masonry Removed.....	14.25
02 41 19 13-0013	CF	>20 CF/VLF Chimney Removal, Per CF Of Masonry Removed.....	9.86



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
02 41 19 13-0014		
Remove And Reset Precast, Stone Or Masonry Coping <small>(02 41 19 13-0001)</small>		
<small>Note: Includes removing, cleaning, and resetting coping with new ties and mortar. Excludes finished edge saw cutting at the intersection between demolition and undisturbed areas. See CSI section 02 41 19 13-0049 for saw cutting.</small>		
02 41 19 13-0015 LF Up To 8" Wide, Remove And Reset Precast, Stone Or Masonry Coping	13.36	
02 41 19 13-0016 LF >8" To 12" Wide, Remove And Reset Precast, Stone Or Masonry Coping	20.33	
02 41 19 13-0017 LF >12" To 24" Wide, Remove And Reset Precast, Stone Or Masonry Coping	39.53	
02 41 19 13-0018		
Facade Removal <small>(02 41 19 13-0001)</small>		
<small>Note: Includes any saw cutting that may be required for size reduction into manageable pieces for handling and disposal. Excludes finished edge saw cutting at the intersection between demolition and undisturbed areas. See CSI section 02 41 19 13-0049 for saw cutting.</small>		
02 41 19 13-0019 SF Stone Or Brick Veneer Facade Removal	4.65	
<i>For Cleaning and Storage For Reuse, Add</i>	3.49	
02 41 19 13-0020		
Exterior Masonry Removal <small>(02 41 19 13-0001)</small>		
<small>Note: Includes any saw cutting that may be required for size reduction into manageable pieces for handling and disposal. Salvage modifier includes removing mortar, scraping, cleaning, placement on pallets and storage on site. Excludes finished edge saw cutting at the intersection between demolition and undisturbed areas. See CSI section 02 41 19 13-0049 for saw cutting.</small>		
02 41 19 13-0021 SF Demolish 4" Thick Non Reinforced Concrete Block Exterior Wall.....	4.10	
02 41 19 13-0022 SF Demolish 6" Thick Non Reinforced Concrete Block Exterior Wall.....	4.62	
02 41 19 13-0023 SF Demolish 8" Thick Non Reinforced Concrete Block Exterior Wall.....	5.58	
02 41 19 13-0024 SF Demolish 10" Thick Non Reinforced Concrete Block Exterior Wall.....	6.10	
02 41 19 13-0025 SF Demolish 12" Thick Non Reinforced Concrete Block Exterior Wall.....	6.70	
02 41 19 13-0026 SF Demolish 16" Thick Non Reinforced Concrete Block Exterior Wall.....	8.38	
02 41 19 13-0027 SF Demolish 4" Thick Reinforced Concrete Block Exterior Wall	4.84	
02 41 19 13-0028 SF Demolish 6" Thick Reinforced Concrete Block Exterior Wall	5.54	
02 41 19 13-0029 SF Demolish 8" Thick Reinforced Concrete Block Exterior Wall	6.70	
02 41 19 13-0030 SF Demolish 10" Thick Reinforced Concrete Block Exterior Wall	7.33	
02 41 19 13-0031 SF Demolish 12" Thick Reinforced Concrete Block Exterior Wall	8.04	
02 41 19 13-0032 SF Demolish 16" Thick Reinforced Concrete Block Exterior Wall	10.06	
02 41 19 13-0033 SF Demolish 4" Thick Brick Exterior Wall.....	4.10	
<i>For Cleaning and Storage For Reuse, Add</i>	3.08	
02 41 19 13-0034 SF Demolish 6" Thick Brick Exterior Wall.....	4.62	
<i>For Cleaning and Storage For Reuse, Add</i>	3.47	
02 41 19 13-0035 SF Demolish 8" Thick Brick Exterior Wall.....	5.58	
<i>For Cleaning and Storage For Reuse, Add</i>	4.19	
02 41 19 13-0036 SF Demolish 10" Thick Brick Exterior Wall.....	6.10	
<i>For Cleaning and Storage For Reuse, Add</i>	4.58	
02 41 19 13-0037 SF Demolish 12" Thick Brick Exterior Wall.....	6.70	
<i>For Cleaning and Storage For Reuse, Add</i>	5.03	
02 41 19 13-0038 SF Demolish 16" Thick Brick Exterior Wall.....	8.38	
<i>For Cleaning and Storage For Reuse, Add</i>	6.29	
02 41 19 13-0039 CF Exterior Brick, Concrete Block Or Composite Removal	11.92	
<i>For Cleaning and Storage For Reuse, Add</i>	8.94	
02 41 19 13-0040		
Exterior Concrete Wall Removal <small>(02 41 19 13)</small>		
02 41 19 13-0041 SF Demolish 4" Thick Reinforced Concrete Exterior Wall	5.12	
02 41 19 13-0042 SF Demolish 6" Thick Reinforced Concrete Exterior Wall	9.29	
02 41 19 13-0043 SF Demolish 8" Thick Reinforced Concrete Exterior Wall	11.68	
02 41 19 13-0044 SF Demolish 10" Thick Reinforced Concrete Exterior Wall	13.77	
02 41 19 13-0045 SF Demolish 12" Thick Reinforced Concrete Exterior Wall	16.28	
02 41 19 13-0046		
Roofing Removal <small>(02 41 19 13)</small>		
02 41 19 13-0047		
Clay Tile Roof Remove And Salvage For Re-use <small>(02 41 19 13-0046)</small>		
<small>Note: Includes removing mortar, scraping, cleaning, placement on pallets and storage on site.</small>		
02 41 19 13-0048 SQ Remove Clay Roof Tile, Salvage For Re-use	243.32	
02 41 19 13-0049		
Saw Cutting <small>(02 41 19 13)</small>		
<small>Note: Includes blade wear, water, taping off area, layout, clean-up and mist spray with wet vacuuming for dust control where necessary. For projects where the total saw cutting charge is less than the minimum charge, use task "Saw Cut Minimum Charge" exclusively. Task "Saw Cut Minimum Charge" should not be used in conjunction with any other tasks in this section.</small>		
02 41 19 13-0050 LF Saw Cut Bituminous Paving Up To 4" Depth	1.90	
<i>For Each Additional Pass (Depth To 3"), Add</i>	0.71	
<i>For >250, Deduct</i>	-0.17	
02 41 19 13-0051 LF Saw Cut Brick Masonry Up To 4" Depth	6.58	
<i>For Each Additional Pass (Depth To 3"), Add</i>	2.57	
<i>For >250, Deduct</i>	-0.64	
02 41 19 13-0052 LF Saw Cut Concrete Block Up To 4" Depth	5.99	
<i>For Each Additional Pass (Depth To 3"), Add</i>	2.33	
<i>For >250, Deduct</i>	-0.58	
02 41 19 13-0053 LF Saw Cut Concrete Slab Or Paving Up To 4" Depth	2.22	
<i>For Each Additional Pass (Depth To 3"), Add</i>	0.82	
<i>For >250, Deduct</i>	-0.20	

02	Existing Conditions
02 40	Demolition And Structure Moving
02 41	Demolition



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
02 41 19 13-0054	LF		Saw Cut Welded Wire Reinforced Concrete Slab Up To 4" Depth	2.88	
			<i>For Each Additional Pass (Depth To 3"), Add</i>	1.07	
			<i>For >250, Deduct</i>	-0.26	
02 41 19 13-0055	LF		Saw Cut Rod Reinforced Concrete Slab Up To 4" Depth	4.58	
			<i>For Each Additional Pass (Depth To 3"), Add</i>	1.74	
			<i>For >250, Deduct</i>	-0.43	
02 41 19 13-0056	LF		Saw Cut Plain Concrete Walls Up To 4" Depth.....	8.38	
			<i>For Each Additional Pass (Depth To 3"), Add</i>	3.28	
			<i>For >250, Deduct</i>	-0.81	
02 41 19 13-0057	LF		Saw Cut Rod Reinforced Concrete Walls Up To 4" Depth.....	11.25	
			<i>For Each Additional Pass (Depth To 3"), Add</i>	4.41	
			<i>For >250, Deduct</i>	-1.09	
02 41 19 13-0058	LF		Saw Cut In Streets, Concrete And Asphalt Up To 4" Depth.....	2.04	
			<i>For Each Additional Pass (Depth To 3"), Add</i>	0.75	
			<i>For >250, Deduct</i>	-0.18	
02 41 19 13-0059	LF		Saw Cut Igneous Stone Pavements Up To 4" Depth.....	6.03	
			<i>For Each Additional Pass (Depth To 3"), Add</i>	2.34	
			<i>For >250, Deduct</i>	-0.58	
02 41 19 13-0060	LF		Saw Cut Sedimentary Stone Pavements Up To 4" Depth.....	6.03	
			<i>For Each Additional Pass (Depth To 3"), Add</i>	2.34	
			<i>For >250, Deduct</i>	-0.58	
02 41 19 13-0061	LF		Saw Cut Metamorphic Stone Pavements Up To 4" Depth.....	6.03	
			<i>For Each Additional Pass (Depth To 3"), Add</i>	2.34	
			<i>For >250, Deduct</i>	-0.58	
02 41 19 13-0062	LF		Saw Cut Terrazzo Stone Pavements Up To 4" Depth.....	6.03	
			<i>For Each Additional Pass (Depth To 3"), Add</i>	2.34	
			<i>For >250, Deduct</i>	-0.58	
02 41 19 13-0063	EA		Saw Cut Minimum Charge.....	719.40	
			Note: For projects where the total saw cutting charge is less than the minimum charge, use this task exclusively.		
			This task should not be used in conjunction with any other tasks in this section.		
02 41 19 13-0064			Torch Cutting (02 41 19 13)		
			Note: Includes grinding edge		
02 41 19 13-0065	LF		Up To 1/2", Torch Cut Steel Plate.....	2.32	
02 41 19 13-0066	LF		>1/2" To 1" Thick, Torch Cut Steel Plate.....	4.64	
02 41 19 13-0067	LF		>1" To 1-1/2" Thick, Torch Cut Steel Plate	6.95	
02 41 19 13-0068	LF		>1-1/2" To 2" Thick, Torch Cut Steel Plate	9.28	
02 41 19 13-0069	LF		>2" To 2-1/2" Thick, Torch Cut Steel Plate	11.60	
02 41 19 13-0070	LF		>2-1/2" To 3" Thick, Torch Cut Steel Plate	13.93	
02 41 19 13-0071			Drilling (02 41 19 13)		
			Note: Includes drill bit wear, water, layout, set-up and clean-up.		
02 41 19 13-0072			Concrete Core Drilling (02 41 19 13-0071)		
02 41 19 13-0073			Up To 4" Thick Concrete Core Drilling (02 41 19 13-0072)		
02 41 19 13-0074	EA		Drill 1" Diameter Core In Up To 4" Concrete.....	34.41	
			<i>For Horizontal Cores, Add</i>	6.12	
			<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	12.25	
02 41 19 13-0075	EA		Drill 1-1/2" Diameter Core In Up To 4" Concrete.....	37.80	
			<i>For Horizontal Cores, Add</i>	6.80	
			<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	13.60	
02 41 19 13-0076	EA		Drill 2" Diameter Core In Up To 4" Concrete.....	41.59	
			<i>For Horizontal Cores, Add</i>	7.56	
			<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	15.12	
02 41 19 13-0077	EA		Drill 3" Diameter Core In Up To 4" Concrete.....	59.07	
			<i>For Horizontal Cores, Add</i>	10.80	
			<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	21.60	
02 41 19 13-0078	EA		Drill 4" Diameter Core In Up To 4" Concrete.....	79.20	
			<i>For Horizontal Cores, Add</i>	14.47	
			<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	28.94	
02 41 19 13-0079	EA		Drill 6" Diameter Core In Up To 4" Concrete.....	89.62	
			<i>For Horizontal Cores, Add</i>	16.20	
			<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	32.40	
02 41 19 13-0080	EA		Drill 8" Diameter Core In Up To 4" Concrete.....	141.41	
			<i>For Horizontal Cores, Add</i>	25.92	
			<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	51.84	
02 41 19 13-0081	EA		Drill 10" Diameter Core In Up To 4" Concrete.....	178.12	
			<i>For Horizontal Cores, Add</i>	32.40	
			<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	64.79	
02 41 19 13-0082	EA		Drill 12" Diameter Core In Up To 4" Concrete.....	208.32	
			<i>For Horizontal Cores, Add</i>	37.80	
			<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	75.60	
02 41 19 13-0083	EA		Drill 14" Diameter Core In Up To 4" Concrete.....	238.97	
			<i>For Horizontal Cores, Add</i>	43.19	
			<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	86.38	
02 41 19 13-0084	EA		Drill 18" Diameter Core In Up To 4" Concrete.....	272.50	
			<i>For Horizontal Cores, Add</i>	48.59	
			<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	97.18	
02 41 19 13-0085			>4" To 6" Thick Concrete Core Drilling (02 41 19 13-0072)		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
02 41 19 13-0086 EA Drill 1" Diameter Core In >4" To 6" Concrete.....	49.52	
<i>For Horizontal Cores, Add</i>	8.74	
<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	17.49	
02 41 19 13-0087 EA Drill 1-1/2" Diameter Core In >4" To 6" Concrete.....	54.38	
<i>For Horizontal Cores, Add</i>	9.72	
<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	19.43	
02 41 19 13-0088 EA Drill 2" Diameter Core In >4" To 6" Concrete.....	59.78	
<i>For Horizontal Cores, Add</i>	10.80	
<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	21.59	
02 41 19 13-0089 EA Drill 3" Diameter Core In >4" To 6" Concrete.....	72.75	
<i>For Horizontal Cores, Add</i>	12.96	
<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	25.92	
02 41 19 13-0090 EA Drill 4" Diameter Core In >4" To 6" Concrete.....	91.52	
<i>For Horizontal Cores, Add</i>	16.20	
<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	32.40	
02 41 19 13-0091 EA Drill 6" Diameter Core In >4" To 6" Concrete.....	121.09	
<i>For Horizontal Cores, Add</i>	21.60	
<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	43.20	
02 41 19 13-0092 EA Drill 8" Diameter Core In >4" To 6" Concrete.....	179.87	
<i>For Horizontal Cores, Add</i>	32.40	
<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	64.79	
02 41 19 13-0093 EA Drill 10" Diameter Core In >4" To 6" Concrete.....	213.12	
<i>For Horizontal Cores, Add</i>	37.80	
<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	75.60	
02 41 19 13-0094 EA Drill 12" Diameter Core In >4" To 6" Concrete.....	244.88	
<i>For Horizontal Cores, Add</i>	43.19	
<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	86.38	
02 41 19 13-0095 EA Drill 14" Diameter Core In >4" To 6" Concrete.....	278.09	
<i>For Horizontal Cores, Add</i>	48.59	
<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	97.18	
02 41 19 13-0096 EA Drill 18" Diameter Core In >4" To 6" Concrete.....	315.48	
<i>For Horizontal Cores, Add</i>	53.99	
<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	107.98	
02 41 19 13-0097 >6" To 8" Thick Concrete Core Drilling (02 41 19 13-0072)		
02 41 19 13-0098 EA Drill 1" Diameter Core In >6" To 8" Concrete.....	55.99	
<i>For Horizontal Cores, Add</i>	9.62	
<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	19.24	
02 41 19 13-0099 EA Drill 1-1/2" Diameter Core In >6" To 8" Concrete.....	61.34	
<i>For Horizontal Cores, Add</i>	10.69	
<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	21.38	
02 41 19 13-0100 EA Drill 2" Diameter Core In >6" To 8" Concrete.....	67.27	
<i>For Horizontal Cores, Add</i>	11.88	
<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	23.76	
02 41 19 13-0101 EA Drill 3" Diameter Core In >6" To 8" Concrete.....	81.02	
<i>For Horizontal Cores, Add</i>	14.04	
<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	28.08	
02 41 19 13-0102 EA Drill 4" Diameter Core In >6" To 8" Concrete.....	105.99	
<i>For Horizontal Cores, Add</i>	18.36	
<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	36.72	
02 41 19 13-0103 EA Drill 6" Diameter Core In >6" To 8" Concrete.....	147.16	
<i>For Horizontal Cores, Add</i>	25.92	
<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	51.84	
02 41 19 13-0104 EA Drill 8" Diameter Core In >6" To 8" Concrete.....	239.93	
<i>For Horizontal Cores, Add</i>	43.19	
<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	86.38	
02 41 19 13-0105 EA Drill 10" Diameter Core In >6" To 8" Concrete.....	275.05	
<i>For Horizontal Cores, Add</i>	48.59	
<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	97.18	
02 41 19 13-0106 EA Drill 12" Diameter Core In >6" To 8" Concrete.....	308.45	
<i>For Horizontal Cores, Add</i>	53.99	
<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	107.98	
02 41 19 13-0107 EA Drill 14" Diameter Core In >6" To 8" Concrete.....	344.18	
<i>For Horizontal Cores, Add</i>	59.38	
<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	118.76	
02 41 19 13-0108 EA Drill 18" Diameter Core In >6" To 8" Concrete.....	385.47	
<i>For Horizontal Cores, Add</i>	64.79	
<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	129.58	
02 41 19 13-0109 >8" To 10" Thick Concrete Core Drilling (02 41 19 13-0072)		
02 41 19 13-0110 EA Drill 1" Diameter Core In >8" To 10" Concrete.....	66.80	
<i>For Horizontal Cores, Add</i>	11.37	
<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	22.74	
02 41 19 13-0111 EA Drill 1-1/2" Diameter Core In >8" To 10" Concrete.....	73.12	
<i>For Horizontal Cores, Add</i>	12.63	
<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	25.27	
02 41 19 13-0112 EA Drill 2" Diameter Core In >8" To 10" Concrete.....	80.14	
<i>For Horizontal Cores, Add</i>	14.04	
<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	28.08	
02 41 19 13-0113 EA Drill 3" Diameter Core In >8" To 10" Concrete.....	94.70	
<i>For Horizontal Cores, Add</i>	16.20	
<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	32.40	

02 Existing Conditions**02 40 Demolition And Structure Moving****02 41 Demolition**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
02 41 19 13-0114 EA Drill 4" Diameter Core In >8" To 10" Concrete.....	109.67	
For Horizontal Cores, Add	18.36	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	36.72	
02 41 19 13-0115 EA Drill 6" Diameter Core In >8" To 10" Concrete.....	151.64	
For Horizontal Cores, Add	25.92	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	51.84	
02 41 19 13-0116 EA Drill 8" Diameter Core In >8" To 10" Concrete.....	246.00	
For Horizontal Cores, Add	43.19	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	86.38	
02 41 19 13-0117 EA Drill 10" Diameter Core In >8" To 10" Concrete.....	283.04	
For Horizontal Cores, Add	48.59	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	97.18	
02 41 19 13-0118 EA Drill 12" Diameter Core In >8" To 10" Concrete.....	317.99	
For Horizontal Cores, Add	53.98	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	107.96	
02 41 19 13-0119 EA Drill 14" Diameter Core In >8" To 10" Concrete.....	356.32	
For Horizontal Cores, Add	59.38	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	118.76	
02 41 19 13-0120 EA Drill 18" Diameter Core In >8" To 10" Concrete.....	401.37	
For Horizontal Cores, Add	64.78	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	129.55	
02 41 19 13-0121 >10" To 12" Thick Concrete Core Drilling (02 41 19 13-0072)		
02 41 19 13-0122 EA Drill 1" Diameter Core In >10" To 12" Concrete.....	73.26	
For Horizontal Cores, Add	12.25	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	24.49	
02 41 19 13-0123 EA Drill 1-1/2" Diameter Core In >10" To 12" Concrete.....	80.06	
For Horizontal Cores, Add	13.61	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	27.21	
02 41 19 13-0124 EA Drill 2" Diameter Core In >10" To 12" Concrete.....	87.62	
For Horizontal Cores, Add	15.12	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	30.24	
02 41 19 13-0125 EA Drill 3" Diameter Core In >10" To 12" Concrete.....	97.57	
For Horizontal Cores, Add	16.20	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	32.40	
02 41 19 13-0126 EA Drill 4" Diameter Core In >10" To 12" Concrete.....	129.54	
For Horizontal Cores, Add	21.60	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	43.20	
02 41 19 13-0127 EA Drill 6" Diameter Core In >10" To 12" Concrete.....	166.91	
For Horizontal Cores, Add	28.08	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	56.16	
02 41 19 13-0128 EA Drill 8" Diameter Core In >10" To 12" Concrete.....	262.87	
For Horizontal Cores, Add	45.35	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	90.70	
02 41 19 13-0129 EA Drill 10" Diameter Core In >10" To 12" Concrete.....	291.03	
For Horizontal Cores, Add	48.59	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	97.18	
02 41 19 13-0130 EA Drill 12" Diameter Core In >10" To 12" Concrete.....	338.46	
For Horizontal Cores, Add	56.16	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	112.31	
02 41 19 13-0131 >12" Thick Concrete Core Drilling (02 41 19 13-0072)		
02 41 19 13-0132 IN Drill 1" Diameter Core In >12" Concrete.....	8.49	
For Horizontal Cores, Add	1.50	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	3.00	
02 41 19 13-0133 IN Drill 1-1/2" Diameter Core In >12" Concrete.....	9.32	
For Horizontal Cores, Add	1.66	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	3.33	
02 41 19 13-0134 IN Drill 2" Diameter Core In >12" Concrete.....	10.25	
For Horizontal Cores, Add	1.85	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	3.70	
02 41 19 13-0135 IN Drill 3" Diameter Core In >12" Concrete.....	11.50	
For Horizontal Cores, Add	2.02	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	4.05	
02 41 19 13-0136 IN Drill 4" Diameter Core In >12" Concrete.....	15.29	
For Horizontal Cores, Add	2.70	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	5.40	
02 41 19 13-0137 IN Drill 6" Diameter Core In >12" Concrete.....	19.76	
For Horizontal Cores, Add	3.51	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	7.02	
02 41 19 13-0138 IN Drill 8" Diameter Core In >12" Concrete.....	31.38	
For Horizontal Cores, Add	5.67	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	11.35	
02 41 19 13-0139 IN Drill 10" Diameter Core In >12" Concrete.....	34.51	
For Horizontal Cores, Add	6.10	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	12.20	
02 41 19 13-0140 IN Drill 12" Diameter Core In >12" Concrete.....	39.93	
For Horizontal Cores, Add	7.02	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	14.05	
02 41 19 13-0141 Brick/Concrete Block Core Drilling (02 41 19 13-0071)		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
02 41 19 13-0142 Up To 4" Thick Brick/Concrete Block Core Drilling (02 41 19 13-0141)		
02 41 19 13-0143 EA Drill 1" Diameter Core In Up To 4" Brick/Concrete Block	28.28	
For Horizontal Cores, Add	4.90	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	9.80	
02 41 19 13-0144 EA Drill 1-1/2" Diameter Core In Up To 4" Brick/Concrete Block	30.99	
For Horizontal Cores, Add	5.44	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	10.88	
02 41 19 13-0145 EA Drill 2" Diameter Core In Up To 4" Brick/Concrete Block	34.03	
For Horizontal Cores, Add	6.05	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	12.10	
02 41 19 13-0146 EA Drill 3" Diameter Core In Up To 4" Brick/Concrete Block	48.28	
For Horizontal Cores, Add	8.64	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	17.28	
02 41 19 13-0147 EA Drill 4" Diameter Core In Up To 4" Brick/Concrete Block	64.73	
For Horizontal Cores, Add	11.58	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	23.15	
02 41 19 13-0148 EA Drill 6" Diameter Core In Up To 4" Brick/Concrete Block	73.42	
For Horizontal Cores, Add	12.96	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	25.92	
02 41 19 13-0149 EA Drill 8" Diameter Core In Up To 4" Brick/Concrete Block	115.50	
For Horizontal Cores, Add	20.74	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	41.47	
02 41 19 13-0150 EA Drill 10" Diameter Core In Up To 4" Brick/Concrete Block	145.72	
For Horizontal Cores, Add	25.92	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	51.83	
02 41 19 13-0151 EA Drill 12" Diameter Core In Up To 4" Brick/Concrete Block	170.51	
For Horizontal Cores, Add	30.24	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	60.47	
02 41 19 13-0152 EA Drill 14" Diameter Core In Up To 4" Brick/Concrete Block	195.77	
For Horizontal Cores, Add	34.55	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	69.10	
02 41 19 13-0153 EA Drill 18" Diameter Core In Up To 4" Brick/Concrete Block	223.91	
For Horizontal Cores, Add	38.87	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	77.74	
02 41 19 13-0154 >4" To 6" Thick Brick/Concrete Block Core Drilling (02 41 19 13-0141)		
02 41 19 13-0155 EA Drill 1" Diameter Core In >4" To 6" Brick/Concrete Block	40.78	
For Horizontal Cores, Add	7.00	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	13.99	
02 41 19 13-0156 EA Drill 1-1/2" Diameter Core In >4" To 6" Brick/Concrete Block	44.67	
For Horizontal Cores, Add	7.77	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	15.55	
02 41 19 13-0157 EA Drill 2" Diameter Core In >4" To 6" Brick/Concrete Block	48.99	
For Horizontal Cores, Add	8.64	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	17.28	
02 41 19 13-0158 EA Drill 3" Diameter Core In >4" To 6" Brick/Concrete Block	59.80	
For Horizontal Cores, Add	10.37	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	20.74	
02 41 19 13-0159 EA Drill 4" Diameter Core In >4" To 6" Brick/Concrete Block	75.32	
For Horizontal Cores, Add	12.96	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	25.92	
02 41 19 13-0160 EA Drill 6" Diameter Core In >4" To 6" Brick/Concrete Block	99.49	
For Horizontal Cores, Add	17.28	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	34.56	
02 41 19 13-0161 EA Drill 8" Diameter Core In >4" To 6" Brick/Concrete Block	147.47	
For Horizontal Cores, Add	25.92	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	51.83	
02 41 19 13-0162 EA Drill 10" Diameter Core In >4" To 6" Brick/Concrete Block	175.31	
For Horizontal Cores, Add	30.24	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	60.47	
02 41 19 13-0163 EA Drill 12" Diameter Core In >4" To 6" Brick/Concrete Block	201.68	
For Horizontal Cores, Add	34.55	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	69.10	
02 41 19 13-0164 EA Drill 14" Diameter Core In >4" To 6" Brick/Concrete Block	229.50	
For Horizontal Cores, Add	38.87	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	77.74	
02 41 19 13-0165 EA Drill 18" Diameter Core In >4" To 6" Brick/Concrete Block	261.50	
For Horizontal Cores, Add	43.19	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	86.39	
02 41 19 13-0166 >6" To 8" Thick Brick/Concrete Block Core Drilling (02 41 19 13-0141)		
02 41 19 13-0167 EA Drill 1" Diameter Core In >6" To 8" Brick/Concrete Block	46.37	
For Horizontal Cores, Add	7.70	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	15.40	
02 41 19 13-0168 EA Drill 1-1/2" Diameter Core In >6" To 8" Brick/Concrete Block	50.64	
For Horizontal Cores, Add	8.55	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	17.10	
02 41 19 13-0169 EA Drill 2" Diameter Core In >6" To 8" Brick/Concrete Block	55.40	
For Horizontal Cores, Add	9.50	
For Overhead Ceiling Cores (Where Not Accessible From Above), Add	19.01	

02	Existing Conditions
02 40	Demolition And Structure Moving
02 41	Demolition



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
02 41 19 13-0170	EA		Drill 3" Diameter Core In >6" To 8" Brick/Concrete Block	66.99	
			<i>For Horizontal Cores, Add</i>	11.23	
			<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	22.46	
02 41 19 13-0171	EA		Drill 4" Diameter Core In >6" To 8" Brick/Concrete Block	87.63	
			<i>For Horizontal Cores, Add</i>	14.69	
			<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	29.37	
02 41 19 13-0172	EA		Drill 6" Diameter Core In >6" To 8" Brick/Concrete Block	121.25	
			<i>For Horizontal Cores, Add</i>	20.74	
			<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	41.47	
02 41 19 13-0173	EA		Drill 8" Diameter Core In >6" To 8" Brick/Concrete Block	196.73	
			<i>For Horizontal Cores, Add</i>	34.55	
			<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	69.10	
02 41 19 13-0174	EA		Drill 10" Diameter Core In >6" To 8" Brick/Concrete Block	226.46	
			<i>For Horizontal Cores, Add</i>	38.87	
			<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	77.74	
02 41 19 13-0175	EA		Drill 12" Diameter Core In >6" To 8" Brick/Concrete Block	254.47	
			<i>For Horizontal Cores, Add</i>	43.19	
			<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	86.39	
02 41 19 13-0176	EA		Drill 14" Diameter Core In >6" To 8" Brick/Concrete Block	284.81	
			<i>For Horizontal Cores, Add</i>	47.50	
			<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	95.01	
02 41 19 13-0177	EA		Drill 18" Diameter Core In >6" To 8" Brick/Concrete Block	320.68	
			<i>For Horizontal Cores, Add</i>	51.83	
			<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	103.67	
02 41 19 13-0178			>8" To 10" Thick Brick/Concrete Block Core Drilling (02 41 19 13-0141)		
02 41 19 13-0179	EA		Drill 1" Diameter Core In >8" To 10" Brick/Concrete Block	55.43	
			<i>For Horizontal Cores, Add</i>	9.10	
			<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	18.19	
02 41 19 13-0180	EA		Drill 1-1/2" Diameter Core In >8" To 10" Brick/Concrete Block	60.49	
			<i>For Horizontal Cores, Add</i>	10.11	
			<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	20.22	
02 41 19 13-0181	EA		Drill 2" Diameter Core In >8" To 10" Brick/Concrete Block	66.10	
			<i>For Horizontal Cores, Add</i>	11.23	
			<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	22.46	
02 41 19 13-0182	EA		Drill 3" Diameter Core In >8" To 10" Brick/Concrete Block	78.50	
			<i>For Horizontal Cores, Add</i>	12.96	
			<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	25.92	
02 41 19 13-0183	EA		Drill 4" Diameter Core In >8" To 10" Brick/Concrete Block	91.31	
			<i>For Horizontal Cores, Add</i>	14.69	
			<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	29.37	
02 41 19 13-0184	EA		Drill 6" Diameter Core In >8" To 10" Brick/Concrete Block	125.73	
			<i>For Horizontal Cores, Add</i>	20.74	
			<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	41.47	
02 41 19 13-0185	EA		Drill 8" Diameter Core In >8" To 10" Brick/Concrete Block	202.80	
			<i>For Horizontal Cores, Add</i>	34.55	
			<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	69.10	
02 41 19 13-0186	EA		Drill 10" Diameter Core In >8" To 10" Brick/Concrete Block	234.45	
			<i>For Horizontal Cores, Add</i>	38.87	
			<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	77.74	
02 41 19 13-0187	EA		Drill 12" Diameter Core In >8" To 10" Brick/Concrete Block	264.01	
			<i>For Horizontal Cores, Add</i>	43.18	
			<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	86.37	
02 41 19 13-0188	EA		Drill 14" Diameter Core In >8" To 10" Brick/Concrete Block	296.95	
			<i>For Horizontal Cores, Add</i>	47.50	
			<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	95.01	
02 41 19 13-0189	EA		Drill 18" Diameter Core In >8" To 10" Brick/Concrete Block	336.60	
			<i>For Horizontal Cores, Add</i>	51.82	
			<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	103.64	
02 41 19 13-0190			>10" To 12" Thick Brick/Concrete Block Core Drilling (02 41 19 13-0141)		
02 41 19 13-0191	EA		Drill 1" Diameter Core In >10" To 12" Brick/Concrete Block	61.01	
			<i>For Horizontal Cores, Add</i>	9.80	
			<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	19.59	
02 41 19 13-0192	EA		Drill 1-1/2" Diameter Core In >10" To 12" Brick/Concrete Block	66.46	
			<i>For Horizontal Cores, Add</i>	10.89	
			<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	21.77	
02 41 19 13-0193	EA		Drill 2" Diameter Core In >10" To 12" Brick/Concrete Block	72.51	
			<i>For Horizontal Cores, Add</i>	12.10	
			<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	24.19	
02 41 19 13-0194	EA		Drill 3" Diameter Core In >10" To 12" Brick/Concrete Block	81.37	
			<i>For Horizontal Cores, Add</i>	12.96	
			<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	25.92	
02 41 19 13-0195	EA		Drill 4" Diameter Core In >10" To 12" Brick/Concrete Block	107.94	
			<i>For Horizontal Cores, Add</i>	17.28	
			<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	34.56	
02 41 19 13-0196	EA		Drill 6" Diameter Core In >10" To 12" Brick/Concrete Block	138.84	
			<i>For Horizontal Cores, Add</i>	22.46	
			<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	44.93	
02 41 19 13-0197	EA		Drill 8" Diameter Core In >10" To 12" Brick/Concrete Block	217.52	
			<i>For Horizontal Cores, Add</i>	36.28	
			<i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	72.56	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
02 41 19 13-0198 EA Drill 10" Diameter Core In >10" To 12" Brick/Concrete Block <i>For Horizontal Cores, Add</i> <i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	242.44 38.87 77.74	
02 41 19 13-0199 EA Drill 12" Diameter Core In >10" To 12" Brick/Concrete Block <i>For Horizontal Cores, Add</i> <i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	282.30 44.92 89.85	
02 41 19 13-0200 >12" Thick Brick/Concrete Block Core Drilling (02 41 19 13-0141)		
02 41 19 13-0201 IN Drill 1" Diameter Core In >12" Brick/Concrete Block <i>For Horizontal Cores, Add</i> <i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	6.99 1.20 2.40	
02 41 19 13-0202 IN Drill 1-1/2" Diameter Core In >12" Brick/Concrete Block <i>For Horizontal Cores, Add</i> <i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	7.65 1.33 2.66	
02 41 19 13-0203 IN Drill 2" Diameter Core In >12" Brick/Concrete Block <i>For Horizontal Cores, Add</i> <i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	8.39 1.48 2.96	
02 41 19 13-0204 IN Drill 3" Diameter Core In >12" Brick/Concrete Block <i>For Horizontal Cores, Add</i> <i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	9.47 1.62 3.24	
02 41 19 13-0205 IN Drill 4" Diameter Core In >12" Brick/Concrete Block <i>For Horizontal Cores, Add</i> <i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	12.59 2.16 4.32	
02 41 19 13-0206 IN Drill 6" Diameter Core In >12" Brick/Concrete Block <i>For Horizontal Cores, Add</i> <i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	16.25 2.81 5.62	
02 41 19 13-0207 IN Drill 8" Diameter Core In >12" Brick/Concrete Block <i>For Horizontal Cores, Add</i> <i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	25.70 4.54 9.08	
02 41 19 13-0208 IN Drill 10" Diameter Core In >12" Brick/Concrete Block <i>For Horizontal Cores, Add</i> <i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	28.41 4.88 9.76	
02 41 19 13-0209 IN Drill 12" Diameter Core In >12" Brick/Concrete Block <i>For Horizontal Cores, Add</i> <i>For Overhead Ceiling Cores (Where Not Accessible From Above), Add</i>	32.91 5.62 11.24	
02 41 19 13-0210 Asphalt Core Drilling (02 41 19 13-0071)		
02 41 19 13-0211 Up To 2" Thick Asphalt Core Drilling (02 41 19 13-0210)		
02 41 19 13-0212 EA Drill 2" Diameter Core In Up To 2" Asphalt 02 41 19 13-0213 EA Drill 3" Diameter Core In Up To 2" Asphalt 02 41 19 13-0214 EA Drill 4" Diameter Core In Up To 2" Asphalt 02 41 19 13-0215 EA Drill 6" Diameter Core In Up To 2" Asphalt 02 41 19 13-0216 EA Drill 8" Diameter Core In Up To 2" Asphalt 02 41 19 13-0217 EA Drill 10" Diameter Core In Up To 2" Asphalt 02 41 19 13-0218 EA Drill 12" Diameter Core In Up To 2" Asphalt	24.30 30.25 38.13 47.92 59.96 74.38 92.75	
02 41 19 13-0219 >2" To 3" Thick Asphalt Core Drilling (02 41 19 13-0210)		
02 41 19 13-0220 EA Drill 2" Diameter Core In >2" To 3" Asphalt 02 41 19 13-0221 EA Drill 3" Diameter Core In >2" To 3" Asphalt 02 41 19 13-0222 EA Drill 4" Diameter Core In >2" To 3" Asphalt 02 41 19 13-0223 EA Drill 6" Diameter Core In >2" To 3" Asphalt 02 41 19 13-0224 EA Drill 8" Diameter Core In >2" To 3" Asphalt 02 41 19 13-0225 EA Drill 10" Diameter Core In >2" To 3" Asphalt 02 41 19 13-0226 EA Drill 12" Diameter Core In >2" To 3" Asphalt	30.93 38.80 48.61 61.26 76.23 95.37 118.54	
02 41 19 13-0227 >3" To 4" Thick Asphalt Core Drilling (02 41 19 13-0210)		
02 41 19 13-0228 EA Drill 2" Diameter Core In >3" To 4" Asphalt 02 41 19 13-0229 EA Drill 3" Diameter Core In >3" To 4" Asphalt 02 41 19 13-0230 EA Drill 4" Diameter Core In >3" To 4" Asphalt 02 41 19 13-0231 EA Drill 6" Diameter Core In >3" To 4" Asphalt 02 41 19 13-0232 EA Drill 8" Diameter Core In >3" To 4" Asphalt 02 41 19 13-0233 EA Drill 10" Diameter Core In >3" To 4" Asphalt 02 41 19 13-0234 EA Drill 12" Diameter Core In >3" To 4" Asphalt	39.81 49.69 62.59 78.24 98.33 122.36 152.36	
02 41 19 13-0235 >4" To 6" Thick Asphalt Core Drilling (02 41 19 13-0210)		
02 41 19 13-0236 EA Drill 2" Diameter Core In >4" To 6" Asphalt 02 41 19 13-0237 EA Drill 3" Diameter Core In >4" To 6" Asphalt 02 41 19 13-0238 EA Drill 4" Diameter Core In >4" To 6" Asphalt 02 41 19 13-0239 EA Drill 6" Diameter Core In >4" To 6" Asphalt 02 41 19 13-0240 EA Drill 8" Diameter Core In >4" To 6" Asphalt 02 41 19 13-0241 EA Drill 10" Diameter Core In >4" To 6" Asphalt 02 41 19 13-0242 EA Drill 12" Diameter Core In >4" To 6" Asphalt	50.93 64.98 81.05 100.81 127.24 158.16 197.24	
02 41 19 13-0243 Manhole Core Drilling (02 41 19 13-0071)		
02 41 19 13-0244 EA Drill 4" Diameter Core In 6" Brick Manhole	169.09	

02	Existing Conditions
02 40	Demolition And Structure Moving
02 41	Demolition



MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

02 41 19 13-0245	EA	Drill 5" Diameter Core In 6" Brick Manhole	193.11
02 41 19 13-0246	EA	Drill 6" Diameter Core In 6" Brick Manhole	224.75
02 41 19 13-0247	EA	Drill 8" Diameter Core In 6" Brick Manhole	335.94
02 41 19 13-0248	EA	Drill 2" Diameter Core In 8" Concrete Manhole.....	225.05
02 41 19 13-0249	EA	Drill 3" Diameter Core In 8" Concrete Manhole.....	241.87
02 41 19 13-0250	EA	Drill 4" Diameter Core In 8" Concrete Manhole.....	268.34
02 41 19 13-0251	EA	Drill 5" Diameter Core In 8" Concrete Manhole.....	288.53
02 41 19 13-0252	EA	Drill 6" Diameter Core In 8" Concrete Manhole.....	341.02
02 41 19 13-0253	EA	Drill 8" Diameter Core In 8" Concrete Manhole.....	486.04
02 41 19 13-0254	EA	Drill 2" Diameter Core In Fiberglass Manhole.....	21.72
02 41 19 13-0255	EA	Drill 3" Diameter Core In Fiberglass Manhole.....	25.11
02 41 19 13-0256	EA	Drill 4" Diameter Core In Fiberglass Manhole.....	27.25
02 41 19 13-0257	EA	Drill 5" Diameter Core In Fiberglass Manhole.....	29.73
02 41 19 13-0258	EA	Drill 6" Diameter Core In Fiberglass Manhole.....	32.70
02 41 19 13-0259	EA	Drill 8" Diameter Core In Fiberglass Manhole.....	36.38
02 41 19 13-0260		Drilling In Concrete Per Inch Of Depth (02 41 19 13-0071)	
		Note: Includes layout.	
02 41 19 13-0261	IN	1/4" Diameter Drilling In Concrete Per Inch Of Depth.....	1.93
02 41 19 13-0262	IN	3/8" Diameter Drilling In Concrete Per Inch Of Depth.....	2.03
02 41 19 13-0263	IN	1/2" Diameter Drilling In Concrete Per Inch Of Depth.....	2.17
02 41 19 13-0264	IN	5/8" Diameter Drilling In Concrete Per Inch Of Depth.....	2.32
02 41 19 13-0265	IN	3/4" Diameter Drilling In Concrete Per Inch Of Depth.....	2.53
02 41 19 13-0266	IN	7/8" Diameter Drilling In Concrete Per Inch Of Depth.....	2.75
02 41 19 13-0267	IN	1" Diameter Drilling In Concrete Per Inch Of Depth.....	2.90
02 41 19 13-0268	IN	1-1/4" Diameter Drilling In Concrete Per Inch Of Depth.....	3.21
02 41 19 13-0269	IN	1-1/2" Diameter Drilling In Concrete Per Inch Of Depth.....	3.63
02 41 19 13-0270		Drilling In Brick/Concrete Block Per Inch Of Depth (02 41 19 13-0071)	
		Note: Includes layout.	
02 41 19 13-0271	IN	1/4" Diameter Drilling In Brick/Concrete Block Per Inch Of Depth.....	1.62
02 41 19 13-0272	IN	3/8" Diameter Drilling In Brick/Concrete Block Per Inch Of Depth.....	1.71
02 41 19 13-0273	IN	1/2" Diameter Drilling In Brick/Concrete Block Per Inch Of Depth.....	1.82
02 41 19 13-0274	IN	5/8" Diameter Drilling In Brick/Concrete Block Per Inch Of Depth.....	1.94
02 41 19 13-0275	IN	3/4" Diameter Drilling In Brick/Concrete Block Per Inch Of Depth.....	2.12
02 41 19 13-0276	IN	7/8" Diameter Drilling In Brick/Concrete Block Per Inch Of Depth.....	2.31
02 41 19 13-0277	IN	1" Diameter Drilling In Brick/Concrete Block Per Inch Of Depth.....	2.44
02 41 19 13-0278	IN	1-1/4" Diameter Drilling In Brick/Concrete Block Per Inch Of Depth.....	2.69
02 41 19 13-0279	IN	1-1/2" Diameter Drilling In Brick/Concrete Block Per Inch Of Depth.....	3.04
02 41 19 13-0280		Drilling In Wood Or Plastic Per Inch Of Depth (02 41 19 13-0071)	
		Note: Includes layout.	
02 41 19 13-0281	IN	1/4" Diameter Drilling In Wood Or Plastic Per Inch Of Depth.....	0.79
02 41 19 13-0282	IN	3/8" Diameter Drilling In Wood Or Plastic Per Inch Of Depth.....	0.83
02 41 19 13-0283	IN	1/2" Diameter Drilling In Wood Or Plastic Per Inch Of Depth.....	0.89
02 41 19 13-0284	IN	5/8" Diameter Drilling In Wood Or Plastic Per Inch Of Depth.....	0.95
02 41 19 13-0285	IN	3/4" Diameter Drilling In Wood Or Plastic Per Inch Of Depth.....	1.04
02 41 19 13-0286	IN	7/8" Diameter Drilling In Wood Or Plastic Per Inch Of Depth.....	1.13
02 41 19 13-0287	IN	1" Diameter Drilling In Wood Or Plastic Per Inch Of Depth.....	1.19
02 41 19 13-0288	IN	1-1/4" Diameter Drilling In Wood Or Plastic Per Inch Of Depth.....	1.31
02 41 19 13-0289	IN	1-1/2" Diameter Drilling In Wood Or Plastic Per Inch Of Depth.....	1.48
02 41 19 13-0290		Limestone Core Drilling (02 41 19 13-0071)	
02 41 19 13-0291		10" To 14" Thick Limestone Core Drilling (02 41 19 13-0290)	
02 41 19 13-0292	EA	Drill 1" Diameter Core In 10" To 14" Limestone.....	51.17
02 41 19 13-0293	EA	Drill 1-1/2" Diameter Core In 10" To 14" Limestone.....	61.92
02 41 19 13-0294	EA	Drill 2" Diameter Core In 10" To 14" Limestone.....	68.02
02 41 19 13-0295	EA	Drill 3" Diameter Core In 10" To 14" Limestone.....	80.28
02 41 19 13-0296	EA	Drill 4" Diameter Core In 10" To 14" Limestone.....	92.84
02 41 19 13-0297	EA	Drill 6" Diameter Core In 10" To 14" Limestone.....	128.54
02 41 19 13-0298	EA	Drill 8" Diameter Core In 10" To 14" Limestone.....	208.86
02 41 19 13-0299		15" To 18" Thick Limestone Core Drilling (02 41 19 13-0290)	
02 41 19 13-0300	EA	Drill 1" Diameter Core In 15" To 18" Limestone.....	56.82
02 41 19 13-0301	EA	Drill 1-1/2" Diameter Core In 15" To 18" Limestone.....	67.87
02 41 19 13-0302	EA	Drill 2" Diameter Core In 15" To 18" Limestone.....	74.32
02 41 19 13-0303	EA	Drill 3" Diameter Core In 15" To 18" Limestone.....	82.58
02 41 19 13-0304	EA	Drill 4" Diameter Core In 15" To 18" Limestone.....	109.66
02 41 19 13-0305	EA	Drill 6" Diameter Core In 15" To 18" Limestone.....	141.34
02 41 19 13-0306	EA	Drill 8" Diameter Core In 15" To 18" Limestone.....	223.03
02 41 19 13-0307		19" To 24" Thick Limestone Core Drilling (02 41 19 13-0290)	
02 41 19 13-0308	EA	Drill 1" Diameter Core In 19" To 24" Limestone.....	62.33
02 41 19 13-0309	EA	Drill 1-1/2" Diameter Core In 19" To 24" Limestone.....	73.67



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
02 41 19 13-0310 EA Drill 2" Diameter Core In 19" To 24" Limestone	80.38	
02 41 19 13-0311 EA Drill 3" Diameter Core In 19" To 24" Limestone	93.80	
02 41 19 13-0312 EA Drill 4" Diameter Core In 19" To 24" Limestone	130.73	
02 41 19 13-0313 EA Drill 6" Diameter Core In 19" To 24" Limestone	163.02	
02 41 19 13-0314 EA Drill 8" Diameter Core In 19" To 24" Limestone	241.36	
02 41 19 13-0315 Minimum Charge For Core Drilling (02 41 19 13-0071)		
02 41 19 13-0316 EA Core Drill Minimum Charge.....	583.53	
Note: For projects where the total core drilling charge is less than the minimum charge, use task "Minimum Charge For Core Drilling" exclusively. Task "Minimum Charge For Core Drilling" should not be used in conjunction with any other tasks in this section. Does not apply to sections "Drilling In Concrete Per Inch Of Depth" or "Drilling In Brick Or Block Per Inch Of Depth".		
02 41 19 13-0317 Cutouts (02 41 19 13)		
Note: Includes saw cutting and removal of material. Not to be used for openings greater than 24 SF.		
02 41 19 13-0318 Reinforced Concrete Slab On Grade Cutouts (02 41 19 13-0317)		
02 41 19 13-0319 SF 4" Thick Reinforced Concrete Slab On Grade Cutouts, <24 SF	40.80	
02 41 19 13-0320 SF 6" Thick Reinforced Concrete Slab On Grade Cutouts, <24 SF	43.28	
02 41 19 13-0321 SF 8" Thick Reinforced Concrete Slab On Grade Cutouts, <24 SF	45.75	
02 41 19 13-0322 SF 10" Thick Reinforced Concrete Slab On Grade Cutouts, <24 SF	48.22	
02 41 19 13-0323 SF 12" Thick Reinforced Concrete Slab On Grade Cutouts, <24 SF	49.45	
02 41 19 13-0324 Reinforced Concrete Elevated Slab Cutouts (02 41 19 13-0317)		
Note: Includes cutting and removing steel decking.		
02 41 19 13-0325 SF 4" Thick Reinforced Concrete Elevated Slab Cutouts, <24 SF	49.73	
02 41 19 13-0326 SF 6" Thick Reinforced Concrete Elevated Slab Cutouts, <24 SF	52.74	
02 41 19 13-0327 SF 8" Thick Reinforced Concrete Elevated Slab Cutouts, <24 SF	55.75	
02 41 19 13-0328 SF 10" Thick Reinforced Concrete Elevated Slab Cutouts, <24 SF	58.76	
02 41 19 13-0329 SF 12" Thick Reinforced Concrete Elevated Slab Cutouts, <24 SF	60.27	
02 41 19 13-0330 Reinforced Concrete Wall Cutouts (02 41 19 13-0317)		
02 41 19 13-0331 SF 4" Thick Reinforced Concrete Wall Cutouts, <24 SF	51.00	
02 41 19 13-0332 SF 6" Thick Reinforced Concrete Wall Cutouts, <24 SF	54.10	
02 41 19 13-0333 SF 8" Thick Reinforced Concrete Wall Cutouts, <24 SF	57.18	
02 41 19 13-0334 SF 10" Thick Reinforced Concrete Wall Cutouts, <24 SF	60.27	
02 41 19 13-0335 SF 12" Thick Reinforced Concrete Wall Cutouts, <24 SF	61.82	
02 41 19 13-0336 Brick Wall Cutouts (02 41 19 13-0317)		
Note: Excludes toothing.		
02 41 19 13-0337 SF 4" Thick Brick Wall Cutouts, <24 SF	15.45	
02 41 19 13-0338 SF 6" Thick Brick Wall Cutouts, <24 SF	25.50	
02 41 19 13-0339 SF 8" Thick Brick Wall Cutouts, <24 SF	35.51	
02 41 19 13-0340 SF 10" Thick Brick Wall Cutouts, <24 SF	43.28	
02 41 19 13-0341 SF 12" Thick Brick Wall Cutouts, <24 SF	51.77	
02 41 19 13-0342 SF 16" Thick Brick Wall Cutouts, <24 SF	61.04	
02 41 19 13-0343 Concrete Block Wall Cutouts (02 41 19 13-0317)		
Note: Excludes toothing.		
02 41 19 13-0344 SF 4" Thick Concrete Block Wall Cutouts, <24 SF	25.56	
02 41 19 13-0345 SF 6" Thick Concrete Block Wall Cutouts, <24 SF	27.07	
02 41 19 13-0346 SF 8" Thick Concrete Block Wall Cutouts, <24 SF	28.60	
02 41 19 13-0347 SF 10" Thick Concrete Block Wall Cutouts, <24 SF	30.13	
02 41 19 13-0348 SF 12" Thick Concrete Block Wall Cutouts, <24 SF	30.91	
02 41 19 13-0349 SF 16" Thick Concrete Block Wall Cutouts, <24 SF	32.46	
02 41 19 13-0350 Limestone Cutouts (02 41 19 13-0317)		
02 41 19 13-0351 SF 2" Thick Limestone Cutouts, <24 SF	43.28	
02 41 19 13-0352 SF 4" Thick Limestone Cutouts, <24 SF	52.55	
02 41 19 13-0353 SF 6" Thick Limestone Cutouts, <24 SF	55.63	
02 41 19 13-0354 SF 8" Thick Limestone Cutouts, <24 SF	58.73	
02 41 19 13-0355 SF 10" Thick Limestone Cutouts, <24 SF	61.82	
02 41 19 13-0356 SF 12" Thick Limestone Cutouts, <24 SF	64.91	
02 41 19 13-0357 Toothing Masonry Cutouts (02 41 19 13-0317)		
Note: For use where existing masonry must be removed in a toothing pattern along horizontal and vertical mortar joints. VLF measurement includes all horizontal cutting.		
02 41 19 13-0358 VLF Brick, Soft Old Mortar, Toothing Masonry Cutouts.....	15.45	
02 41 19 13-0359 VLF Brick, Hard Mortar, Toothing Masonry Cutouts.....	20.86	
02 41 19 13-0360 VLF Concrete Block, Soft Old Mortar, Toothing Masonry Cutouts	9.27	
02 41 19 13-0361 VLF Concrete Block, Hard Mortar, Toothing Masonry Cutouts	12.37	

02	Existing Conditions
02 40	Demolition And Structure Moving
02 41	Demolition



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
02 41 19 13-0362			Minimum Charge For Cutouts (02 41 19 13-0317) Note: For projects where the total cutouts charge is less than the minimum charge, use this task exclusively. This task should not be used in conjunction with any other tasks in this section.		
02 41 19 13-0363	EA		Cutouts Minimum Charge	309.09	
02 41 19 13-0364			Elevated Concrete Removal (02 41 19 13)		
02 41 19 13-0365	CF		Elevated Concrete Beam/Slab/Steps Removal, Reinforced	10.35	
02 41 19 16			Selective Interior Demolition (02 41 19) Note: Includes break-up of material, loading into truck or dumpster and clean-up. Salvage tasks include placement on pallets and storage on site.		
02 41 19 16-0001			Floor Removal (02 41 19 16)		
02 41 19 16-0002			Remove And Salvage For Re-Use (02 41 19 16-0001) Note: Includes removing mortar, scraping, cleaning, placement on pallets and storage on site.		
02 41 19 16-0003	SF		Remove Brick Flooring And Salvage	2.22	
02 41 19 16-0004	SF		Remove Ceramic/Quarry Tile Floor And Salvage	2.22	
02 41 19 16-0005	SF		Remove Terrazzo Flooring And Salvage	3.06	
02 41 19 16-0006	SF		Remove Wood Strip Flooring And Salvage	1.79	
02 41 19 16-0007	SF		Remove Wood Parquet Flooring And Salvage	0.94	
02 41 19 16-0008	SF		Remove Resilient/Linoleum Flooring And Salvage	0.68	
02 41 19 16-0009			Scarify Concrete (02 41 19 16-0001) Note: Up to 1/4" removal per pass.		
02 41 19 16-0010	SF		Scarify Concrete Floor	0.20	
02 41 19 16-0011	SF		Scarify Concrete Tread And Riser	1.70	
02 41 19 16-0012	SF		Scarify Concrete Wall	1.54	
02 41 19 16-0013			Fireproofing Removal (02 41 19 16)		
02 41 19 16-0014	SF		Remove Fireproofing From Concrete Or Steel	1.04	
02 41 19 16-0015			Demolish Ceiling (02 41 19 16)		
02 41 19 16-0016	SF		Demolish Drywall Ceiling	0.80	
02 41 19 16-0017	SF		Demolish Furred Plastered Ceiling	1.87	
02 41 19 16-0018	SF		Demolish Suspended Plastered Ceiling And Suspension System	1.43	
02 41 19 16-0019			Demolish Concrete Stair (02 41 19 16)		
02 41 19 16-0020	CF		Demolish Interior Reinforced Concrete Stairs	6.70	
02 41 19 16-0021	CF		Demolish Exterior Reinforced Concrete Stairs	5.34	
02 41 19 16-0022			Demolish Interior Partition/Wall (02 41 19 16) Note: Price includes knock down, loading, clean-up.		
02 41 19 16-0023			Demolish Masonry And Concrete Interior Partition/Walls (02 41 19 16-0022) Note: Includes saw cutting, knock down, loading and clean-up.		
02 41 19 16-0024			Demolish Concrete Block Interior Partition/Walls (02 41 19 16-0023)		
02 41 19 16-0025	SF		Demolish 4" Thick Non Reinforced Concrete Block Interior Partition/Wall	4.34	
02 41 19 16-0026	SF		Demolish 6" Thick Non Reinforced Concrete Block Interior Partition/Wall	4.64	
02 41 19 16-0027	SF		Demolish 8" Thick Non Reinforced Concrete Block Interior Partition/Wall	5.22	
02 41 19 16-0028	SF		Demolish 12" Thick Non Reinforced Concrete Block Interior Partition/Wall	6.70	
02 41 19 16-0029	SF		Demolish 16" Thick Non Reinforced Concrete Block Interior Partition/Wall	8.38	
02 41 19 16-0030	SF		Demolish 4" Thick Reinforced Concrete Block Interior Partition/Wall	5.21	
02 41 19 16-0031	SF		Demolish 6" Thick Reinforced Concrete Block Interior Partition/Wall	5.56	
02 41 19 16-0032	SF		Demolish 8" Thick Reinforced Concrete Block Interior Partition/Wall	6.28	
02 41 19 16-0033	SF		Demolish 12" Thick Reinforced Concrete Block Interior Partition/Wall	8.05	
02 41 19 16-0034	SF		Demolish 16" Thick Reinforced Concrete Block Interior Partition/Wall	10.07	
02 41 19 16-0035			Demolish Brick Interior Partition/Walls (02 41 19 16-0023)		
02 41 19 16-0036	SF		Demolish 4" Thick Brick Interior Partition/Wall	4.34	
02 41 19 16-0037	SF		Demolish 8" Thick Brick Interior Partition/Wall	5.22	
02 41 19 16-0038	SF		Demolish 12" Thick Brick Interior Partition/Wall	6.70	
02 41 19 16-0039	SF		Demolish 16" Thick Brick Interior Partition/Wall	8.38	
02 41 19 16-0040			Demolish Glass Block Interior Partition/Walls (02 41 19 16-0023)		
02 41 19 16-0041	SF		Demolish Glass Block Interior Partition/Walls	3.72	
02 41 19 16-0042			Demolish Concrete Interior Partition/Walls (02 41 19 16-0023) See CSI section 02 41 16 13-0006 for concrete foundation demolition.		
02 41 19 16-0043	SF		Demolish 6" Thick Non Reinforced Concrete Interior Partition/Wall	7.89	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
02 41 19 16-0044 SF Demolish 8" Thick Non Reinforced Concrete Interior Partition/Wall.....	9.86	
02 41 19 16-0045 SF Demolish 12" Thick Non Reinforced Concrete Interior Partition/Wall.....	13.81	
02 41 19 16-0046 SF Demolish 6" Thick Reinforced Concrete Interior Partition/Wall.....	9.47	
02 41 19 16-0047 SF Demolish 8" Thick Reinforced Concrete Interior Partition/Wall.....	11.92	
02 41 19 16-0048 SF Demolish 12" Thick Reinforced Concrete Interior Partition/Wall.....	16.58	
02 41 19 16-0049 Demolish Terra-Cotta Block Interior Partition/Walls (02 41 19 16-0023)		
02 41 19 16-0050 SF Demolish Up To 6" Thick Terra-Cotta Block Interior Partition/Wall Finished With Plaster.....	1.49	
02 41 19 16-0051 Demolish Stud Framed Interior Partition/Walls (02 41 19 16-0022)		
Note: Includes knock down, loading and clean-up. Includes demo of insulation if required.		
02 41 19 16-0052 SF Demolish Wood Or Metal Framed Interior Partition/Wall With Drywall 1 Side.....	2.64	
For Heights >14' To 20', Add	0.40	
For Heights >20', Add	0.53	
02 41 19 16-0053 SF Demolish Wood Or Metal Framed Interior Partition/Wall With Drywall 2 Sides.....	3.08	
For Heights >14' To 20', Add	0.46	
For Heights >20', Add	0.62	
02 41 19 16-0054 SF Demolish Wood Or Metal Framed Interior Partition/Wall With Plaster And Lath 1 Side.....	3.38	
For Heights >14' To 20', Add	0.51	
For Heights >20', Add	0.68	
02 41 19 16-0055 SF Demolish Wood Or Metal Framed Interior Partition/Wall With Plaster And Lath 2 Sides.....	4.70	
For Heights >14' To 20', Add	0.71	
For Heights >20', Add	0.94	
02 41 19 16-0056 SF Demolish Plaster And Lath From 1 Side Of An Interior Partition/Wall.....	1.39	
For Heights >14' To 20', Add	0.21	
For Heights >20', Add	0.28	
02 41 19 16-0057 SF Demolish Plaster And Lath From 2 Sides Of An Interior Partition/Wall.....	1.65	
For Heights >14' To 20', Add	0.25	
For Heights >20', Add	0.33	
02 50 Site Remediation (02)		
02 58 Snow Control (02 50)		
02 58 13 Snow Fencing (02 58)		
02 58 13 00-0001 Snow/Sand Fence On Steel Posts (02 58 13)		
02 58 13 00-0002 LF Steel Fence Post, 10' On Center With 4' Wood Snow/Sand Fence.....	5.42	1.76
02 60 Contaminated Site Material Removal (02)		
02 61 Removal And Disposal Of Contaminated Soils (02 60)		
02 61 13 Excavation And Handling Of Contaminated Material (02 61)		
See CSI section 31 23 16 00-0000 for excavation.		
02 61 13 00-0001 Excavate Petroleum Contaminated Soil (02 61 13)		
02 61 13 00-0002 CY Excavate Petroleum Contaminated Soil.....	9.94	
Note: Includes excavation, making a determination if the soil is reusable or contaminated, and stockpiling as per determination.		
02 61 13 00-0003 CY Load Excavated Petroleum Contaminated Soil.....	5.55	
02 61 13 00-0004 CY Disposal Fees Of Petroleum Contaminated Soil.....	79.14	
02 61 13 00-0005 Accessories For Contaminated Soil Stockpile (02 61 13)		
See CSI section 31 25 14 23-0001 for sand bags.		
02 61 13 00-0006 SF 30 Mil Base Liner.....	0.95	
Note: 9.93 SF of liner per 1 ton of petroleum contaminated soil.		
02 61 13 00-0007 SF 10 Mil Base Liner.....	0.69	
Note: 9.93 SF of liner per 1 ton of petroleum contaminated soil.		
02 65 Underground Storage Tank Removal (02 60)		
Note: Petroleum gasoline is classified as a hazardous material; fuel oil is considered a non-hazardous material. See CSI section 01 74 19 00-0034 for hauling, 31 20 00 00-0000 for non-contaminated soil excavation, 31 23 16 00-0000 for excavation, 31 41 00 00-0000 for shoring.		
02 65 00 00-0001 Monitoring, Sampling, Testing And Analysis (02 65)		
02 65 00 00-0002 Field Samples For Testing (02 65 00 00-0001)		
02 65 00 00-0003 EA Collection Of Sludge Sample.....	14.66	
02 65 00 00-0004 EA Collection Of Pumpable Liquids Sample.....	14.66	
02 65 00 00-0005 EA Collection Of Contaminated Soil Sample.....	14.66	
02 65 00 00-0006 Lab Tests For Underground Storage Tank Removal (02 65 00 00-0001)		
Note: Includes lab test fees, reports, shipping, handling, chain of custody documents and disposal of sample.		

02 Existing Conditions**02 60 Contaminated Site Material Removal****02 65 Underground Storage Tank Removal**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
02 65 00 00-0007 EA Lab Test - Benzene, Toluene, Ethylbenzene, Xylene 8020 Note: The cost is for the in-lab test for Benzene, Toluene, Ethylbenzene, And Xylene using procedure 8020 as detailed in EPA SW-846.	100.97	
02 65 00 00-0008 EA Lab Test - Flashpoint Note: The cost is for the in-lab test for the flashpoint using procedure 40CFR 261.21 as detailed in EPA SW-846.	39.27	
02 65 00 00-0009 EA Lab Test - TOX 9020 Note: The cost is for the in-lab test for total organic halides using procedure 9020 as detailed in EPA SW-846.	94.46	
02 65 00 00-0010 EA Lab Test - TPH 8015 Modified Note: The cost is for the in-lab test for total petroleum hydrocarbons by gas chromatography using procedure 8015 Mod. as detailed in EPA SW-846.	100.97	
02 65 00 00-0011 EA Lab Test - TRPH 418.1 Note: The cost is for the in-lab test for total recoverable petroleum hydrocarbons using procedure 418.1 as detailed in EPA SW-846.	78.53	
02 65 00 00-0012 EA Lab Test - VOC Note: The cost is for the in-lab test for volatile organics using procedure 8240 as detailed in EPA SW-846.	213.16	
02 65 00 00-0013 EA Lab Test - Semi-Volatile Organic Note: The cost is for the in-lab test for semi-volatile organics using procedure 8270 as detailed in EPA SW-846.	392.66	
02 65 00 00-0014 EA Lab Test - Oil And Grease 413.1 Note: The cost is for the in-lab test for oil and grease using procedure 413.1 as detailed in EPA SW-846.	47.23	
02 65 00 00-0015 EA Lab Test - TCLP (Extraction) - Metals..... Note: The cost is for the in-lab test for toxicity characteristics leaching procedures using procedure 1311 as detailed in EPA SW-846.	84.14	
02 65 00 00-0016 EA Lab Test - TCLP (Extraction) - Semi-Volatile Organic..... Note: The cost is for the in-lab test for toxicity characteristics leaching procedures using procedure 1311 as detailed in EPA SW-846.	112.19	
02 65 00 00-0017 EA Lab Test - Metals 6010 RCRA Note: The cost is for the in-lab test for metals using procedure 6010 RCRA as detailed in EPA SW-846.	125.65	
02 65 00 00-0018 EA Lab Test - Metals (Arsenic) 7060 Note: The cost is for the in-lab test for the metal arsenic using procedure 7060 as detailed in EPA SW-846.	16.83	
02 65 00 00-0019 EA Lab Test - Metals (Selenium) 7740 Note: The cost is for the in-lab test for the metal selenium (SE) using procedure 7740 as detailed in EPA SW-846.	16.83	
02 65 00 00-0020 EA Lab Test - Metals (Lead) 7421 Note: The cost is for the in-lab test for the metal lead using procedure 7421 as detailed in EPA SW-846.	16.83	
02 65 00 00-0021 EA Lab Test - Metals (Mercury) 7470 Note: The cost is for the in-lab test for the metal mercury using procedure 7470 as detailed in EPA SW-846.	31.41	
02 65 00 00-0022 EA Lab Test - PNA/PAH 8100 Note: The cost is for the in-lab test for polynuclear aromatic hydrocarbons using procedure 8100 as detailed in EPA SW-846.	179.50	
02 65 00 00-0023 EA Lab Test - Fuel Id ASTM D3328-78 Note: The cost is for the in-lab test to determine the constituents of fuel using the procedure as detailed in ASTM D3328-78.	64.94	
02 65 00 00-0024 EA Lab Test - pH.....	13.46	
02 65 00 00-0025 EA Lab Test - PCBs In Wastewater.....	168.28	
02 65 00 00-0026 EA Lab Test - Methyl Tertiary Butyl Ether (MTBE)	100.97	
02 65 00 00-0027 Tests, Surveys And Maintenance (02 65 00 00-0001)		
02 65 00 00-0028 EA Site Survey For AST/UST Location By Certified Tank Installer..... Note: Includes testing Pump output both tank and dispenser, Calibrate pump dispenser if needed, Check all sumps both tank and dispenser, check all fitting connections for leaks and check wiring connection for possible malfunction or safety hazard, check seals on caps for fill tube, check overflow performance for safety shutdown, check all hoses and pump handle, check break-away couplings, complete written report on all data found.	590.32	
02 65 00 00-0029 EA Check Cathodic Protection - Impressed Current Systems And Sacrificial Anode Systems Note: By Certified Technician. Write report of findings for action if needed	100.98	
02 65 00 00-0030 EA Check And Report On Monitor Probes..... Note: By Certified Technician	23.43	
02 65 00 00-0031 EA Tank Monitoring System: Check System Per Manufacturer's Specification By Certified Technician With Written Report..... Note: Including pass / fail; paper feed operational paper installed etc.; and status of inspection repairs needed etc.	165.65	
02 65 00 00-0032 EA Replace Anode On Impressed System	69.94	
02 65 00 00-0033 EA Replace Power Converter On Impressed System.....	101.16	
02 65 00 00-0034 EA Replace Monitor Probes	148.55	
02 65 00 00-0035 EA Ultrasonic Test.....	67.13	
02 65 00 00-0036 Tests And Sampling Labor Hours (02 65 00 00-0001)		
02 65 00 00-0037 HR Certified Tank Installer.....	64.70	
02 65 00 00-0038 HR Certified Geologist/Environmentalist.....	64.70	
02 65 00 00-0039 HR Hourly Office Work For Reports Required For EPA Note: Includes title searches, well survey data, site drawings, submitting preliminary work, etc. Hours not to be used in association with other tasks performed.	62.99	
02 65 00 00-0040 Remove Tank Contents (02 65)		
02 65 00 00-0041 Transfer Liquid (02 65 00 00-0040) Note: For use to transfer liquids from one tank to another.		
02 65 00 00-0042 GAL Transfer Reusable Liquid To Different Tank Note: Per gallon of material transferred.	0.52	
02 65 00 00-0043 Remove And Dispose Of Liquid From Tank (02 65 00 00-0040)		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
02 65 00 00-0044 GAL Remove and Dispose of Hazardous Liquids From Tank.....	1.45	
02 65 00 00-0045 GAL Remove And Dispose Of Non Hazardous Liquid From Tank.....	0.96	
02 65 00 00-0046 Remove And Dispose Of Solids Or Sludge (02 65 00 00-0040)		
Note: Includes scraping and solidifying agent.		
02 65 00 00-0047 GAL Remove And Dispose Of Hazardous Solids Or Sludge From Tank.....	5.38	
02 65 00 00-0048 GAL Remove And Dispose Of Non Hazardous Solids Or Sludge From Tank	1.29	
02 65 00 00-0049 Purge Vapors, Open And Clean Tank (02 65)		
02 65 00 00-0050 Purge Vapors (02 65 00 00-0049)		
02 65 00 00-0051 LB Purge Tank Using Dry Ice.....	2.63	
Note: Approximately 1.5 To 3.0 LBS of dry ice per 100 Gals of tank volume.		
02 65 00 00-0052 High Pressure Water Wash And Rinse Of Tank Interior (02 65 00 00-0049)		
02 65 00 00-0053 EA Up To 275 Gallon Tank, High Pressure Water Wash And Rinse Of Tank Interior	219.23	
02 65 00 00-0054 EA >275 To 550 Gallon Tank, High Pressure Water Wash And Rinse Of Tank Interior.....	281.87	
02 65 00 00-0055 EA >550 To 1,000 Gallon Tank, High Pressure Water Wash And Rinse Of Tank Interior.....	357.04	
02 65 00 00-0056 EA >1,000 To 2,000 Gallon Tank, High Pressure Water Wash And Rinse Of Tank Interior.....	463.52	
02 65 00 00-0057 EA >2,000 To 5,000 Gallon Tank, High Pressure Water Wash And Rinse Of Tank Interior.....	864.40	
02 65 00 00-0058 EA >5,000 To 6,000 Gallon Tank, High Pressure Water Wash And Rinse Of Tank Interior.....	1,039.79	
02 65 00 00-0059 EA >6,000 To 8,000 Gallon Tank, High Pressure Water Wash And Rinse Of Tank Interior.....	1,158.80	
02 65 00 00-0060 EA >8,000 To 10,000 Gallon Tank, High Pressure Water Wash And Rinse Of Tank Interior.....	1,390.56	
02 65 00 00-0061 EA >10,000 To 15,000 Gallon Tank, High Pressure Water Wash And Rinse Of Tank Interior.....	1,728.81	
02 65 00 00-0062 EA >15,000 To 20,000 Gallon Tank, High Pressure Water Wash And Rinse Of Tank Interior.....	2,079.58	
02 65 00 00-0063 EA >20,000 To 30,000 Gallon Tank, High Pressure Water Wash And Rinse Of Tank Interior.....	2,599.47	
02 65 00 00-0064 EA >30,000 To 40,000 Gallon Tank, High Pressure Water Wash And Rinse Of Tank Interior.....	3,249.65	
02 65 00 00-0065 EA >40,000 To 50,000 Gallon Tank, High Pressure Water Wash And Rinse Of Tank Interior.....	4,061.43	
02 65 00 00-0066 Scrape Clean Tank Exterior (02 65 00 00-0049)		
02 65 00 00-0067 EA Up To 275 Gallon Tank, Scrape Clean Tank Exterior.....	185.53	
02 65 00 00-0068 EA >275 To 550 Gallon Tank, Scrape Clean Tank Exterior	247.06	
02 65 00 00-0069 EA >550 To 1,000 Gallon Tank, Scrape Clean Tank Exterior	323.74	
02 65 00 00-0070 EA >1,000 To 2,000 Gallon Tank, Scrape Clean Tank Exterior	448.31	
02 65 00 00-0071 EA >2,000 To 5,000 Gallon Tank, Scrape Clean Tank Exterior	992.78	
02 65 00 00-0072 EA >5,000 To 6,000 Gallon Tank, Scrape Clean Tank Exterior	1,257.08	
02 65 00 00-0073 EA >6,000 To 8,000 Gallon Tank, Scrape Clean Tank Exterior	1,471.01	
02 65 00 00-0074 EA >8,000 To 10,000 Gallon Tank, Scrape Clean Tank Exterior	1,849.27	
02 65 00 00-0075 EA >10,000 To 15,000 Gallon Tank, Scrape Clean Tank Exterior	2,403.60	
02 65 00 00-0076 EA >15,000 To 20,000 Gallon Tank, Scrape Clean Tank Exterior	3,016.98	
02 65 00 00-0077 EA >20,000 To 30,000 Gallon Tank, Scrape Clean Tank Exterior	3,928.37	
02 65 00 00-0078 EA >30,000 To 40,000 Gallon Tank, Scrape Clean Tank Exterior	4,714.04	
02 65 00 00-0079 EA >40,000 To 50,000 Gallon Tank, Scrape Clean Tank Exterior	5,892.55	
02 65 00 00-0080 Tank And Piping Removal (02 65)		
Note: Excludes excavation.		
02 65 00 00-0081 Removal And Disposal Of Piping (02 65 00 00-0080)		
Note: Includes removal, inspection, loading, transporting pipe to disposal facility or transfer station within 15 miles and disposal fees.		
02 65 00 00-0082 LF Up To 4", Removal And Disposal Of Piping.....	14.37	
02 65 00 00-0083 LF >4" To 8", Removal And Disposal Of Piping.....	19.16	
02 65 00 00-0084 Cut Straps, Extract Tank From The Diggings And Block To Prevent Movement (02 65 00 00-0080)		
Note: Excludes excavation or backfill.		
02 65 00 00-0085 EA Up To 275 Gallon Tank, Cut Straps, Extract Tank From The Diggings And Block To Prevent Movement	526.07	
02 65 00 00-0086 EA >275 To 550 Gallon Tank, Cut Straps, Extract Tank From The Diggings And Block To Prevent Movement.....	638.79	
02 65 00 00-0087 EA >550 To 1,000 Gallon Tank, Cut Straps, Extract Tank From The Diggings And Block To Prevent Movement.....	751.53	
02 65 00 00-0088 EA >1,000 To 2,000 Gallon Tank, Cut Straps, Extract Tank From The Diggings And Block To Prevent Movement.....	939.40	
02 65 00 00-0089 EA >2,000 To 5,000 Gallon Tank, Cut Straps, Extract Tank From The Diggings And Block To Prevent Movement.....	1,315.16	
02 65 00 00-0090 EA >5,000 To 6,000 Gallon Tank, Cut Straps, Extract Tank From The Diggings And Block To Prevent Movement.....	1,653.34	
02 65 00 00-0091 EA >6,000 To 8,000 Gallon Tank, Cut Straps, Extract Tank From The Diggings And Block To Prevent Movement.....	1,878.80	
02 65 00 00-0092 EA >8,000 To 10,000 Gallon Tank, Cut Straps, Extract Tank From The Diggings And Block To Prevent Movement.....	2,254.56	
02 65 00 00-0093 EA >10,000 To 15,000 Gallon Tank, Cut Straps, Extract Tank From The Diggings And Block To Prevent Movement.....	3,006.08	
02 65 00 00-0094 EA >15,000 To 20,000 Gallon Tank, Cut Straps, Extract Tank From The Diggings And Block To Prevent Movement.....	3,603.63	
02 65 00 00-0095 EA >20,000 To 30,000 Gallon Tank, Cut Straps, Extract Tank From The Diggings And Block To Prevent Movement.....	4,222.71	
02 65 00 00-0096 EA >30,000 To 40,000 Gallon Tank, Cut Straps, Extract Tank From The Diggings And Block To Prevent Movement.....	4,940.20	
02 65 00 00-0097 EA >40,000 To 50,000 Gallon Tank, Cut Straps, Extract Tank From The Diggings And Block To Prevent Movement.....	6,175.25	
02 65 00 00-0098 Cut Tank Into Sections That Can Easily Be Transported And Disposed Of When Necessary (02 65 00 00-0080)		
Note: Includes 1 lengthwise at every 4' O.C. height wise.		
02 65 00 00-0099 EA >1,000 To 2,000 Gallon Tank, Cut Tank Into Sections That Can Easily Be Transported And Disposed Of	622.28	

02 Existing Conditions**02 60 Contaminated Site Material Removal****02 65 Underground Storage Tank Removal**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
02 65 00 00-0100 EA >2,000 To 5,000 Gallon Tank, Cut Tank Into Sections That Can Easily Be Transported And Disposed Of	1,160.46	
02 65 00 00-0101 EA >5,000 To 6,000 Gallon Tank, Cut Tank Into Sections That Can Easily Be Transported And Disposed Of	1,395.92	
02 65 00 00-0102 EA >6,000 To 8,000 Gallon Tank, Cut Tank Into Sections That Can Easily Be Transported And Disposed Of	1,555.68	
02 65 00 00-0103 EA >8,000 To 10,000 Gallon Tank, Cut Tank Into Sections That Can Easily Be Transported And Disposed Of	1,866.82	
02 65 00 00-0104 EA >10,000 To 15,000 Gallon Tank, Cut Tank Into Sections That Can Easily Be Transported And Disposed Of.....	2,320.91	
02 65 00 00-0105 EA >15,000 To 20,000 Gallon Tank, Cut Tank Into Sections That Can Easily Be Transported And Disposed Of.....	2,791.83	
02 65 00 00-0106 EA >20,000 To 30,000 Gallon Tank, Cut Tank Into Sections That Can Easily Be Transported And Disposed Of	3,489.78	
02 65 00 00-0107 EA >30,000 To 40,000 Gallon Tank, Cut Tank Into Sections That Can Easily Be Transported And Disposed Of	4,362.24	
02 65 00 00-0108 EA >40,000 To 50,000 Gallon Tank, Cut Tank Into Sections That Can Easily Be Transported And Disposed Of	5,452.78	
02 65 00 00-0109 Load, Transport, And Dispose Of Tank At Disposal Facility Or Transfer Station (02 65 00 00-0080)		
Note: Includes disposal fee.		
02 65 00 00-0110 EA Up To 275 Gallon Tank, Load, Transport, And Dispose Of Tank At Disposal Facility Or Transfer Station	143.28	
For Each Additional Mile >15 Miles, Add	3.58	
02 65 00 00-0111 EA >275 To 550 Gallon Tank, Load, Transport, And Dispose Of Tank At Disposal Facility Or Transfer Station.....	180.98	
For Each Additional Mile >15 Miles, Add	4.52	
02 65 00 00-0112 EA >550 To 1,000 Gallon Tank, Load, Transport, And Dispose Of Tank At Disposal Facility Or Transfer Station.....	271.47	
For Each Additional Mile >15 Miles, Add	6.79	
02 65 00 00-0113 EA >1,000 To 2,000 Gallon Tank, Load, Transport, And Dispose Of Tank At Disposal Facility Or Transfer Station.....	954.09	
For Each Additional Mile >15 Miles, Add	7.92	
02 65 00 00-0114 EA >2,000 To 5,000 Gallon Tank, Load, Transport, And Dispose Of Tank At Disposal Facility Or Transfer Station.....	1,684.06	
For Each Additional Mile >15 Miles, Add	13.95	
02 65 00 00-0115 EA >5,000 To 6,000 Gallon Tank, Load, Transport, And Dispose Of Tank At Disposal Facility Or Transfer Station.....	1,729.30	
For Each Additional Mile >15 Miles, Add	15.08	
02 65 00 00-0116 EA >6,000 To 8,000 Gallon Tank, Load, Transport, And Dispose Of Tank At Disposal Facility Or Transfer Station.....	1,804.72	
For Each Additional Mile >15 Miles, Add	16.97	
02 65 00 00-0117 EA >8,000 To 10,000 Gallon Tank, Load, Transport, And Dispose Of Tank At Disposal Facility Or Transfer Station.....	2,647.07	
For Each Additional Mile >15 Miles, Add	22.62	
02 65 00 00-0118 EA >10,000 To 15,000 Gallon Tank, Load, Transport, And Dispose Of Tank At Disposal Facility Or Transfer Station.....	3,588.17	
For Each Additional Mile >15 Miles, Add	33.93	
02 65 00 00-0119 EA >15,000 To 20,000 Gallon Tank, Load, Transport, And Dispose Of Tank At Disposal Facility Or Transfer Station.....	4,227.65	
For Each Additional Mile >15 Miles, Add	37.70	
02 65 00 00-0120 EA >20,000 To 30,000 Gallon Tank, Load, Transport, And Dispose Of Tank At Disposal Facility Or Transfer Station.....	5,251.64	
For Each Additional Mile >15 Miles, Add	45.24	
02 65 00 00-0121 EA >30,000 To 40,000 Gallon Tank, Load, Transport, And Dispose Of Tank At Disposal Facility Or Transfer Station.....	7,483.26	
For Each Additional Mile >15 Miles, Add	54.29	
02 65 00 00-0122 EA >40,000 To 50,000 Gallon Tank, Load, Transport, And Dispose Of Tank At Disposal Facility Or Transfer Station.....	9,083.78	
For Each Additional Mile >15 Miles, Add	62.44	
02 65 00 00-0123 Other Storage Tank Removals (02 65 00 00-0080)		
02 65 00 00-0124 GAL Remove Cement Lining	0.48	
02 65 00 00-0125 GAL Sandblast Tank In Prep For Lining Or Welding; Remove Sand, Vacuum Walls And Seams.....	0.17	
02 65 00 00-0126 GAL Install Epoxy For Interior Corrosion Protection	0.81	
02 65 00 00-0127 Tank Closure Report (02 65 00 00-0080)		
Note: Excludes soils tests. See CSI section 02 65 00 00-0006 for soil tests.		
02 65 00 00-0128 EA Prepare Tank Closure Report.....	1,475.82	
02 65 00 00-0129 Temporary Tanks (02 65)		
02 65 00 00-0130 Temporary Holding Tanks (02 65 00 00-0129)		
02 65 00 00-0131 Above Ground Temporary Holding Tanks, Monthly Rental (02 65 00 00-0130)		
02 65 00 00-0132 MO 550 Gallon, Stainless Steel, DOT Approved, Above Ground Temporary Holding Tanks, Monthly Rental	466.85	
02 65 00 00-0133 MO 630 Gallon, Polyethylene, DOT Approved, Above Ground Temporary Holding Tanks, Monthly Rental	466.85	
02 65 00 00-0134 MO 630 Gallon, Polyethylene, Stackable, Above Ground Temporary Holding Tanks, Monthly Rental	933.70	
02 65 00 00-0135 MO 4,000 Gallon, Polyethylene, Stackable, Above Ground Temporary Holding Tanks, Monthly Rental	700.28	
02 65 00 00-0136 MO 4,000 Gallon, Polyethylene, Trailer Mounted, Above Ground Temporary Holding Tanks, Monthly Rental	1,633.98	
02 65 00 00-0137 MO 6,000 Gallon, Polyethylene, Total Drain, Above Ground Temporary Holding Tanks, Monthly Rental.....	1,167.13	
02 65 00 00-0138 MO 21,000 Gallon (500 BBL), Steel, Open, Stationary, Above Ground Temporary Holding Tanks, Monthly Rental.....	1,966.66	
02 65 00 00-0139 MO 21,000 Gallon (500 BBL), Steel, Closed, Stationary, Above Ground Temporary Holding Tanks, Monthly Rental	2,356.87	
02 65 00 00-0140 MO 21,000 Gallon (500 BBL), Steel, Vapor Proof, Above Ground Temporary Holding Tanks, Monthly Rental	3,980.14	
02 65 00 00-0141 Secondary Containment Berm (02 65 00 00-0129)		
02 65 00 00-0142 MO Secondary Containment Berm Monthly Rental	1,011.51	
02 80 Facility Remediation (02)		
02 81 Transportation And Disposal Of Hazardous Materials (02 80)		
02 81 00 00-0001 Hazardous Material Disposal (02 81)		
02 81 00 00-0002 GAL Drain Hazardous (PCB) Oil Filled Equipment And Dispose In Approved Container	8.32	
Note: Includes handling of container and disposal at approved site.		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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02 81 00 00-0003	CF	Hazardous (PCB) Oil Filled Equipment Disposal At Approved Site.....	56.22
Note: Includes handling of equipment and disposal at approved site. Excludes draining of PCB contaminated oil prior to disposal.			

02 82 Asbestos Remediation (02 80)

Note: Tasks include materials, equipment (e.g. ladders, high volume vacuum with sound suppression system where required, etc.), mobilization, preparation, critical barriers (e.g. electrical outlets, registers, windows, etc.), signage, removal, clean-up, HEPA vacuuming, transportation for up to 25 miles, disposal, personnel health monitoring, negative air, fees, documentation and other associated costs necessary for the complete abatement and disposal of the ACM in accordance with EPA, OSHA, and local regulations. Where types of ACM are listed by quantity, the quantity of the entire project, not a particular work area, is to be used in determining which task applies. For certain types of work, there are tasks with a unit of measure of EA for a quantity of less than 10 LF or SF (10 LF to 20 LF for ACM pipe insulation), followed by a series of tasks for other quantities. For those tasks the contractor will be paid the first task with a unit of measure of EA, plus an additional task to arrive at the appropriate quantity for the project. See CSI section 01 74 19 00-0034 for hauling in excess of 25 miles to transfer or disposal site, 02 81 00 00-0000 for hauling in excess of 25 miles to transfer or disposal site, 02 89 00 00-0002 for solid isolation barriers, 02 89 00 00-0012 for plastic sheeting for containment construction, 02 89 00 00-0019 for decontamination chambers.

02 82 13 Asbestos Abatement (02 82)

02 82 13 00-0001 Air Monitoring And Bulk Sampling, Asbestos Testing (02 82 13)

Note: Testing tasks include packaging of sample for shipping, shipping to testing lab, chain of custody documentation, analysis of sample, lab report, and sample disposal. Polarizing Light Microscope (PLM), Phase Contrast Microscope (PCM), and Transmission Electron Microscope (TEM). Excludes sampling time.

02 82 13 00-0002	HR	Bulk Sampling Or Air Monitoring, Asbestos Testing	69.91
02 82 13 00-0003	EA	48 Hours Or Longer Turnaround, (Bulk Point Counting) PLM Test, Asbestos Testing	30.50
02 82 13 00-0004	EA	Next Day Turnaround, (Bulk Point Counting) PLM Test, Asbestos Testing	35.76
02 82 13 00-0005	EA	Same Day Turnaround, (Bulk Point Counting) PLM Test, Asbestos Testing	56.79
02 82 13 00-0006	EA	48 Hours Or Longer Turnaround, (Bulk) TEM Test, Asbestos Testing	97.81
02 82 13 00-0007	EA	Next Day Turnaround, (Bulk) TEM Test, Asbestos Testing	118.84
02 82 13 00-0008	EA	48 Hours Or Longer Turnaround, (Air) PCM Test, Asbestos Testing.....	24.19
02 82 13 00-0009	EA	Next Day Turnaround, (Air) PCM Test, Asbestos Testing	29.45
02 82 13 00-0010	EA	Same Day Turnaround, (Air) PCM Test, Asbestos Testing	39.96
02 82 13 00-0011	EA	48 Hours Or Longer Turnaround, (Air Point Counting) PLM Test	30.50
02 82 13 00-0012	EA	Next Day Turnaround, (Air Point Counting) PLM Test	35.76
02 82 13 00-0013	EA	Same Day Turnaround, (Air Point Counting) PLM Test.....	56.79
02 82 13 00-0014	EA	48 Hours Or Longer Turnaround, (Air) TEM Test, Asbestos Testing	97.81
02 82 13 00-0015	EA	Next Day Turnaround, (Air) TEM Test, Asbestos Testing.....	112.53
02 82 13 00-0016	EA	Same Day Turnaround, (Air) TEM Test, Asbestos Testing.....	156.70

02 82 16 Engineering Control of Asbestos Containing Materials (02 82)

02 82 16 00-0001 Asbestos Encapsulation (Lock-Down) (02 82 16)

02 82 16 00-0002	SF	Asbestos Encapsulant Spray Adhesive (Lock-Down), Per Coat.....	1.06
02 82 16 00-0003	SF	Asbestos Binding Compound Encapsulant/Sealant, Per Coat Required (Fiberlock® ABC® Asbestos Binding Compound).....	1.53
02 82 16 00-0004	SF	Asbestos Fiberspray Encapsulation (Fiberlock® ABC Fiberspray®)	1.46
02 82 16 00-0005	SF	Asbestos Acrylic Encasement/Encapsulation (Fiberlock® Lag-Kote®)	1.66
02 82 16 00-0006	SF	Water Activated Repair Cloth Encapsulant (Fiberlock® Lag-Kwik®).....	4.70
02 82 16 00-0007	SF	Water Activated Repair Cloth Encapsulant (Fiberlock® Lag-Kloth®)	5.25

02 82 33 Removal and Disposal of Asbestos Containing Materials (02 82)

02 82 33 00-0001 Pipe And Pipe Fittings Insulation, Asbestos Abatement And Disposal (02 82 33)

02 82 33 00-0002 Pipe Insulation, Asbestos Abatement And Disposal (02 82 33 00-0001)

Note: Diameter is outer size of insulation. Treat fittings as additional linear feet of insulation.

02 82 33 00-0003 Up To 6" Diameter Pipe Insulation, Asbestos Abatement And Disposal (02 82 33 00-0002)

See CSI section 02 82 33 00-0017 for projects with less than 10 LF.

02 82 33 00-0004	EA	10 To 20 LF, Up To 6" Diameter Pipe Insulation, Asbestos Abatement And Disposal.....	577.37
		<i>For Work In Restricted Working Space, Add</i>	<i>173.21</i>
02 82 33 00-0005	LF	>20 To 250 LF, Up To 6" Diameter Pipe Insulation, Asbestos Abatement And Disposal	29.52
		<i>For Work In Restricted Working Space, Add</i>	<i>8.86</i>
02 82 33 00-0006	LF	>250 To 500 LF, Up To 6" Diameter Pipe Insulation, Asbestos Abatement And Disposal	22.15
		<i>For Work In Restricted Working Space, Add</i>	<i>6.65</i>
02 82 33 00-0007	LF	>500 To 2,500 LF, Up To 6" Diameter Pipe Insulation, Asbestos Abatement And Disposal	16.61
		<i>For Work In Restricted Working Space, Add</i>	<i>4.98</i>
02 82 33 00-0008	LF	>2,500 To 10,000 LF, Up To 6" Diameter Pipe Insulation, Asbestos Abatement And Disposal	12.45
		<i>For Work In Restricted Working Space, Add</i>	<i>3.74</i>
02 82 33 00-0009	LF	>10,000 LF, Up To 6" Diameter Pipe Insulation, Asbestos Abatement And Disposal.....	10.83
		<i>For Work In Restricted Working Space, Add</i>	<i>3.25</i>

02 82 33 00-0010 >6" To 12" Diameter Pipe Insulation, Asbestos Abatement And Disposal (02 82 33 00-0002)

See CSI section 02 82 33 00-0017 for projects with less than 10 LF.

02 82 33 00-0011	EA	10 To 20 LF, >6" To 12" Diameter Pipe Insulation, Asbestos Abatement And Disposal.....	577.37
		<i>For Work In Restricted Working Space, Add</i>	<i>173.21</i>
02 82 33 00-0012	LF	>20 To 250 LF, >6" To 12" Diameter Pipe Insulation, Asbestos Abatement And Disposal.....	33.96
		<i>For Work In Restricted Working Space, Add</i>	<i>10.19</i>

02 Existing Conditions**02 80 Facility Remediation****02 82 Asbestos Remediation**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
02 82 33 00-0013 LF >250 To 500 LF, >6" To 12" Diameter Pipe Insulation, Asbestos Abatement And Disposal.....	25.46	
For Work In Restricted Working Space, Add	7.64	
02 82 33 00-0014 LF >500 To 2,500 LF, >6" To 12" Diameter Pipe Insulation, Asbestos Abatement And Disposal.....	19.10	
For Work In Restricted Working Space, Add	5.73	
02 82 33 00-0015 LF >2,500 To 10,000 LF, >6" To 12" Diameter Pipe Insulation, Asbestos Abatement And Disposal.....	14.32	
For Work In Restricted Working Space, Add	4.30	
02 82 33 00-0016 LF >10,000 LF, >6" To 12" Diameter Pipe Insulation, Asbestos Abatement And Disposal.....	12.45	
For Work In Restricted Working Space, Add	3.74	
02 82 33 00-0017 Glove Bag Method, Pipe Insulation, Asbestos Abatement And Disposal (02 82 33 00-0002)		
Note: Solid isolation barriers and plastic sheeting for containment construction (except on floor) are not required for glove bag projects unless required by local codes.		
02 82 33 00-0018 EA Glove Bag For First 3 LF Pipe Insulation, Asbestos Abatement And Disposal.....	629.20	
For Work In Restricted Working Space, Add	188.76	
02 82 33 00-0019 LF >3 To 20 LF Additional Glove Bag Work for Pipe Insulation.....	93.22	
For Work In Restricted Working Space, Add	27.97	
02 82 33 00-0020 LF >20 To 250 LF Additional Glove Bag Work for Pipe Insulation.....	36.19	
For Work In Restricted Working Space, Add	10.86	
02 82 33 00-0021 LF >250 To 500 LF Additional Glove Bag Work for Pipe Insulation.....	27.13	
For Work In Restricted Working Space, Add	8.14	
02 82 33 00-0022 LF >500 LF Additional Glove Bag Work for Pipe Insulation.....	20.35	
For Work In Restricted Working Space, Add	6.11	
02 82 33 00-0023 Thermal Insulation, Asbestos Abatement And Disposal (02 82 33)		
02 82 33 00-0024 Other Thermal Insulation, Up To 3" Thickness, Asbestos Abatement And Disposal (02 82 33 00-0023)		
Note: e.g., duct, boiler, tank, etc.		
02 82 33 00-0025 EA Up To 10 SF, Up To 3" Thickness Thermal Insulation, Asbestos Abatement And Disposal.....	577.37	
02 82 33 00-0026 SF >10 To 500 SF, Up To 3" Thickness Thermal Insulation, Asbestos Abatement And Disposal.....	29.52	
02 82 33 00-0027 SF >500 To 2,500 SF, Up To 3" Thickness Thermal Insulation, Asbestos Abatement And Disposal.....	23.26	
02 82 33 00-0028 SF >2,500 To 10,000 SF, Up To 3" Thickness Thermal Insulation, Asbestos Abatement And Disposal.....	17.44	
02 82 33 00-0029 SF >10,000 SF, Up To 3" Thickness Thermal Insulation, Asbestos Abatement And Disposal.....	13.08	
02 82 33 00-0030 Surfacing Material, Asbestos Abatement And Disposal (02 82 33)		
02 82 33 00-0031 Fireproofing For Small Areas, Asbestos Abatement And Disposal (02 82 33 00-0030)		
Note: For asbestos abatement for up to 1 SF sections to expose area for attachments. See CSI section 02 82 33 00-0033 for areas > 1 SF see CSI section.		
02 82 33 00-0032 EA Up To 1 SF, Fireproofing For Small Areas, Asbestos Abatement And Disposal.....	144.35	
Note: For asbestos abatement for up to 1 SF sections to expose steel area for welding attachments.		
02 82 33 00-0033 Fireproofing, Asbestos Abatement And Disposal (02 82 33 00-0030)		
Note: Exposed surface area, includes associated overspray.		
02 82 33 00-0034 EA Up To 10 SF, Fireproofing, Asbestos Abatement And Disposal.....	577.37	
02 82 33 00-0035 SF >10 To 500 SF, Fireproofing, Asbestos Abatement And Disposal.....	35.42	
02 82 33 00-0036 SF >500 To 2,500 SF, Fireproofing, Asbestos Abatement And Disposal.....	26.56	
02 82 33 00-0037 SF >2,500 To 10,000 SF, Fireproofing, Asbestos Abatement And Disposal.....	19.92	
02 82 33 00-0038 SF >10,000 SF, Fireproofing, Asbestos Abatement And Disposal.....	14.94	
02 82 33 00-0039 Acoustical Plaster, Asbestos Abatement And Disposal (02 82 33 00-0030)		
Note: Remove surface coat from brown coat or remove entire assembly, including lathe and finish materials.		
02 82 33 00-0040 EA Up To 10 SF, Acoustical Plaster, Asbestos Abatement And Disposal.....	577.37	
02 82 33 00-0041 SF >10 To 500 SF, Acoustical Plaster, Asbestos Abatement And Disposal.....	14.80	
02 82 33 00-0042 SF >500 To 2,500 SF, Acoustical Plaster, Asbestos Abatement And Disposal.....	11.19	
02 82 33 00-0043 SF >2,500 To 10,000 SF, Acoustical Plaster, Asbestos Abatement And Disposal.....	8.30	
02 82 33 00-0044 SF >10,000 SF, Acoustical Plaster, Asbestos Abatement And Disposal.....	6.14	
02 82 33 00-0045 Gypsum Wall Board, Asbestos Abatement And Disposal (02 82 33 00-0030)		
02 82 33 00-0046 EA Up To 10 SF, Gypsum Wall Board, Asbestos Abatement And Disposal.....	577.37	
02 82 33 00-0047 SF >10 To 500 SF, Gypsum Wall Board, Asbestos Abatement And Disposal.....	11.37	
02 82 33 00-0048 SF >500 To 2,500 SF, Gypsum Wall Board, Asbestos Abatement And Disposal.....	8.30	
02 82 33 00-0049 SF >2,500 To 10,000 SF, Gypsum Wall Board, Asbestos Abatement And Disposal.....	6.50	
02 82 33 00-0050 SF >10,000 To 50,000 SF, Gypsum Wall Board, Asbestos Abatement And Disposal.....	5.05	
02 82 33 00-0051 SF >50,000 SF, Gypsum Wall Board, Asbestos Abatement And Disposal.....	3.61	
02 82 33 00-0052 Gypsum Wall Board (Or Backer Board) With Ceramic Tile And Mastic, Asbestos Abatement And Disposal (02 82 33 00-0030)		
02 82 33 00-0053 EA Up To 10 SF, Gypsum Wall Board (Or Backer Board) With Ceramic Tile And Mastic, Asbestos Abatement And Disposal.....	577.37	
02 82 33 00-0054 SF >10 To 500 SF, Gypsum Wall Board (Or Backer Board) With Ceramic Tile And Mastic, Asbestos Abatement And Disposal.....	21.58	
02 82 33 00-0055 SF >500 To 2,500 SF, Gypsum Wall Board (Or Backer Board) With Ceramic Tile And Mastic, Asbestos Abatement And Disposal.....	15.81	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
				02 82 33 00-0056 SF >2,500 To 10,000 SF, Gypsum Wall Board (Or Backer Board) With Ceramic Tile And Mastic, Asbestos Abatement And Disposal.....	12.34	
				02 82 33 00-0057 SF >10,000 To 50,000 SF, Gypsum Wall Board (Or Backer Board) With Ceramic Tile And Mastic, Asbestos Abatement And Disposal.....	9.60	
				02 82 33 00-0058 SF >50,000 SF, Gypsum Wall Board (Or Backer Board) With Ceramic Tile And Mastic, Asbestos Abatement And Disposal.....	6.86	
				02 82 33 00-0059 Stucco, Asbestos Abatement And Disposal (02 82 33 00-0030)		
				02 82 33 00-0060 EA Up To 10 SF, Stucco, Asbestos Abatement And Disposal.....	577.37	
				02 82 33 00-0061 SF >10 To 500 SF, Stucco, Asbestos Abatement And Disposal.....	25.10	
				02 82 33 00-0062 SF >500 To 2,500 SF, Stucco, Asbestos Abatement And Disposal.....	18.82	
				02 82 33 00-0063 SF >2,500 To 10,000 SF, Stucco, Asbestos Abatement And Disposal.....	14.12	
				02 82 33 00-0064 SF >10,000 SF, Stucco, Asbestos Abatement And Disposal.....	10.59	
				02 82 33 00-0065 Spray On Acoustical Ceiling, Asbestos Abatement And Disposal (02 82 33 00-0030)		
				02 82 33 00-0066 EA Up To 10 SF, Spray On Acoustical Ceiling, Asbestos Abatement And Disposal.....	577.37	
				02 82 33 00-0067 SF >10 To 500 SF, Spray On Acoustical Ceiling, Asbestos Abatement And Disposal.....	9.62	
				02 82 33 00-0068 SF >500 To 2,500 SF, Spray On Acoustical Ceiling, Asbestos Abatement And Disposal.....	7.21	
				02 82 33 00-0069 SF >2,500 To 10,000 SF, Spray On Acoustical Ceiling, Asbestos Abatement And Disposal.....	5.41	
				02 82 33 00-0070 SF >10,000 SF, Spray On Acoustical Ceiling, Asbestos Abatement And Disposal.....	4.05	
				02 82 33 00-0071 Plywood, Asbestos Abatement And Disposal (02 82 33 00-0030)		
				02 82 33 00-0072 EA Up To 10 SF, Plywood, Asbestos Abatement And Disposal.....	577.37	
				02 82 33 00-0073 SF >10 To 500 SF, Plywood, Asbestos Abatement And Disposal.....	12.27	
				02 82 33 00-0074 SF >500 To 2,500 SF, Plywood, Asbestos Abatement And Disposal.....	5.90	
				02 82 33 00-0075 SF >2,500 To 10,000 SF, Plywood, Asbestos Abatement And Disposal.....	3.98	
				02 82 33 00-0076 SF >10,000 SF, Plywood, Asbestos Abatement And Disposal.....	3.39	
				02 82 33 00-0077 Flooring Material, Asbestos Abatement And Disposal (02 82 33)		
				02 82 33 00-0078 Floor Tile, Linoleum, Carpet Or Base, Asbestos Abatement And Disposal (02 82 33 00-0077)		
				02 82 33 00-0079 Floor Tile Or Linoleum, Asbestos Abatement And Disposal (02 82 33 00-0078) Note: Single layer or first of multiple layers. Excludes mastic.		
				02 82 33 00-0080 EA Up To 10 SF, Single Layer Or First Of Multiple Layers, Floor Tile Or Linoleum, Asbestos Abatement And Disposal.....	577.37	
				02 82 33 00-0081 SF >10 To 500 SF, Single Layer Or First Of Multiple Layers, Floor Tile Or Linoleum, Asbestos Abatement And Disposal.....	5.90	
				For Each Additional Layer, Add Disposal.....	1.48	
				02 82 33 00-0082 SF >500 To 2,500 SF, Single Layer Or First Of Multiple Layers, Floor Tile Or Linoleum, Asbestos Abatement And Disposal.....	4.80	
				For Each Additional Layer, Add Disposal.....	1.20	
				02 82 33 00-0083 SF >2,500 To 10,000 SF, Single Layer Or First Of Multiple Layers, Floor Tile Or Linoleum, Asbestos Abatement And Disposal.....	3.79	
				For Each Additional Layer, Add Disposal.....	0.95	
				02 82 33 00-0084 SF >10,000 SF, Single Layer Or First Of Multiple Layers, Floor Tile Or Linoleum, Asbestos Abatement And Disposal.....	2.56	
				For Each Additional Layer, Add Disposal.....	0.64	
				02 82 33 00-0085 Carpet, Asbestos Abatement And Disposal (02 82 33 00-0078)		
				02 82 33 00-0086 EA Up To 10 SF, Non-Friable Carpet, Asbestos Abatement And Disposal.....	577.37	
				02 82 33 00-0087 SF >10 To 500 SF, Non-Friable Carpet, Asbestos Abatement And Disposal.....	4.59	
				02 82 33 00-0088 SF >500 To 2,500 SF, Non-Friable Carpet, Asbestos Abatement And Disposal.....	3.68	
				02 82 33 00-0089 SF >2,500 To 10,000 SF, Non-Friable Carpet, Asbestos Abatement And Disposal.....	2.64	
				02 82 33 00-0090 SF >10,000 SF, Non-Friable Carpet, Asbestos Abatement And Disposal.....	1.96	
				02 82 33 00-0091 Wall Or Cove Base, Asbestos Abatement And Disposal (02 82 33 00-0078) Note: Up to 12'.		
				02 82 33 00-0092 EA Up To 10 LF, Wall Base And Mastic, Asbestos Abatement And Disposal.....	216.51	
				02 82 33 00-0093 LF >10 To 100 LF, Wall Base And Mastic, Asbestos Abatement And Disposal.....	3.85	
				02 82 33 00-0094 LF >100 To 500 LF, Wall Base And Mastic, Asbestos Abatement And Disposal.....	2.31	
				02 82 33 00-0095 LF >500 To 2,500 LF, Wall Base And Mastic, Asbestos Abatement And Disposal.....	1.45	
				02 82 33 00-0096 LF >2,500 LF, Wall Base And Mastic, Asbestos Abatement And Disposal.....	1.01	
				02 82 33 00-0097 Mastic, Asbestos Abatement And Disposal (02 82 33 00-0077) Note: Applies to single layer or bottom layer only of multiple layers. Non hydrocarbon with pine, citrus or no odor.		
				02 82 33 00-0098 EA Up To 10 SF, Mastic, Asbestos Abatement And Disposal.....	577.37	
				Note: Applies to bottom layer only if multiple layers.		
				02 82 33 00-0099 SF >10 To 500 SF, Mastic, Asbestos Abatement And Disposal.....	1.48	
				Note: Applies to bottom layer only if multiple layers.		
				02 82 33 00-0100 SF >500 To 2,500 SF, Mastic, Asbestos Abatement And Disposal.....	1.09	
				Note: Applies to bottom layer only if multiple layers.		
				02 82 33 00-0101 SF >2,500 To 10,000 SF, Mastic, Asbestos Abatement And Disposal.....	0.84	
				Note: Applies to bottom layer only if multiple layers.		
				02 82 33 00-0102 SF >10,000 SF, Mastic, Asbestos Abatement And Disposal.....	0.67	
				Note: Applies to bottom layer only if multiple layers.		

02 Existing Conditions**02 80 Facility Remediation****02 82 Asbestos Remediation**
 MINOR
 CSI UOM DESCRIPTION

 TOTAL DIRECT DEMOLITION
 UNIT COST UNIT COST

02 82 33 00-0103		Hardwood Flooring System With Asbestos Barrier Paper Backing, Asbestos Abatement And Disposal <small>(02 82 33 00-0077)</small>	
		Note: Includes finish wood, asbestos barrier paper, cleanup of sub-wood floor, fasteners, wood fillers and protection of clean crawl space from contamination.	
02 82 33 00-0104	EA	Up To 10 SF, Hardwood Flooring System With Asbestos Barrier Paper Backing, Asbestos Abatement And Disposal.....	577.37
02 82 33 00-0105	SF	>10 To 500 SF, Hardwood Flooring System With Asbestos Barrier Paper Backing, Asbestos Abatement And Disposal.....	6.82
02 82 33 00-0106	SF	>500 To 2,500 SF, Hardwood Flooring System With Asbestos Barrier Paper Backing, Asbestos Abatement And Disposal.....	4.98
02 82 33 00-0107	SF	>2,500 To 10,000 SF, Hardwood Flooring System With Asbestos Barrier Paper Backing, Asbestos Abatement And Disposal.....	3.90
02 82 33 00-0108	SF	>10,000 SF, Hardwood Flooring System With Asbestos Barrier Paper Backing, Asbestos Abatement And Disposal.....	3.04
02 82 33 00-0109		Roofing, Asbestos Abatement And Disposal <small>(02 82 33)</small>	
02 82 33 00-0110		Built-Up Tar And Felt Roofing, Asbestos Abatement And Disposal <small>(02 82 33 00-0109)</small>	
		Note: Includes paint, flashing, sheet metal, insulation, pitch pockets, board etc.	
02 82 33 00-0111		Up To 2" Average Thickness, Built-Up Tar And Felt Roofing, Asbestos Abatement And Disposal <small>(02 82 33 00-0110)</small>	
02 82 33 00-0112	EA	Up To 125 SF, Up To 2" Average Thickness, Built-Up Tar And Felt Roofing, Asbestos Abatement And Disposal.....	577.37
02 82 33 00-0113	SF	>125 To 1,000 SF, Up To 2" Average Thickness, Built-Up Tar And Felt Roofing, Asbestos Abatement And Disposal.....	4.61
02 82 33 00-0114	SF	>1,000 To 5,000 SF, Up To 2" Average Thickness, Built-Up Tar And Felt Roofing, Asbestos Abatement And Disposal.....	3.69
02 82 33 00-0115	SF	>5,000 To 10,000 SF, Up To 2" Average Thickness, Built-Up Tar And Felt Roofing, Asbestos Abatement And Disposal.....	2.95
02 82 33 00-0116	SF	>10,000 To 20,000 SF, Up To 2" Average Thickness, Built-Up Tar And Felt Roofing, Asbestos Abatement And Disposal.....	2.22
02 82 33 00-0117	SF	>20,000 SF, Up To 2" Average Thickness, Built-Up Tar And Felt Roofing, Asbestos Abatement And Disposal.....	1.66
02 82 33 00-0118		>2" To 5" Average Thickness, Built-Up Tar And Felt Roofing, Asbestos Abatement And Disposal <small>(02 82 33 00-0110)</small>	
02 82 33 00-0119	EA	Up To 110 SF, >2" To 5" Average Thickness, Built-Up Tar And Felt Roofing, Asbestos Abatement And Disposal.....	577.37
02 82 33 00-0120	SF	>110 To 1,000 SF, >2" To 5" Average Thickness, Built-Up Tar And Felt Roofing, Asbestos Abatement And Disposal.....	5.25
02 82 33 00-0121	SF	>1,000 To 5,000 SF, >2" To 5" Average Thickness, Built-Up Tar And Felt Roofing, Asbestos Abatement And Disposal.....	4.19
02 82 33 00-0122	SF	>5,000 To 10,000 SF, >2" To 5" Average Thickness, Built-Up Tar And Felt Roofing, Asbestos Abatement And Disposal.....	3.37
02 82 33 00-0123	SF	>10,000 To 20,000 SF, >2" To 5" Average Thickness, Built-Up Tar And Felt Roofing, Asbestos Abatement And Disposal.....	2.53
02 82 33 00-0124	SF	>20,000 SF, >2" To 5" Average Thickness, Built-Up Tar And Felt Roofing, Asbestos Abatement And Disposal.....	1.89
02 82 33 00-0125		>5" Average Thickness, Built-Up Tar And Felt Roofing, Asbestos Abatement And Disposal <small>(02 82 33 00-0110)</small>	
02 82 33 00-0126	EA	Up To 110 SF, >5" Average Thickness, Built-Up Tar And Felt Roofing, Asbestos Abatement And Disposal.....	577.37
02 82 33 00-0127	SF	>110 To 1,000 SF, >5" Average Thickness, Built-Up Tar And Felt Roofing, Asbestos Abatement And Disposal.....	5.83
02 82 33 00-0128	SF	>1,000 To 5,000 SF, >5" Average Thickness, Built-Up Tar And Felt Roofing, Asbestos Abatement And Disposal.....	4.64
02 82 33 00-0129	SF	>5,000 To 10,000 SF, >5" Average Thickness, Built-Up Tar And Felt Roofing, Asbestos Abatement And Disposal.....	3.75
02 82 33 00-0130	SF	>10,000 To 20,000 SF, >5" Average Thickness, Built-Up Tar And Felt Roofing, Asbestos Abatement And Disposal.....	2.81
02 82 33 00-0131	SF	>20,000 SF, >5" Average Thickness, Built-Up Tar And Felt Roofing, Asbestos Abatement And Disposal.....	2.10
02 82 33 00-0132		Shingles And Felt Roofing, Asbestos Abatement And Disposal <small>(02 82 33 00-0109)</small>	
02 82 33 00-0133		Shingles And Felt Roofing, Asbestos Abatement And Disposal <small>(02 82 33 00-0132)</small>	
02 82 33 00-0134	EA	Up To 125 SF, Shingles And Felt Roofing, Asbestos Abatement And Disposal..... Note: Single or first of multiple layers.	577.37
02 82 33 00-0135	SF	>125 To 1,000 SF, Shingles And Felt Roofing, Asbestos Abatement And Disposal..... Note: Single or first of multiple layers.	4.61
		<i>For Each Additional Layer, Add</i>	1.15
02 82 33 00-0136	SF	>1,000 To 5,000 SF, Shingles And Felt Roofing, Asbestos Abatement And Disposal..... Note: Single or first of multiple layers.	3.69
		<i>For Each Additional Layer, Add</i>	0.92
02 82 33 00-0137	SF	>5,000 To 10,000 SF, Shingles And Felt Roofing, Asbestos Abatement And Disposal..... Note: Single or first of multiple layers.	2.95
		<i>For Each Additional Layer, Add</i>	0.74
02 82 33 00-0138	SF	>10,000 To 20,000 SF, Shingles And Felt Roofing, Asbestos Abatement And Disposal..... Note: Single or first of multiple layers.	2.22
		<i>For Each Additional Layer, Add</i>	0.56
02 82 33 00-0139	SF	>20,000 SF, Shingles And Felt Roofing, Asbestos Abatement And Disposal..... Note: Single or first of multiple layers.	1.66
		<i>For Each Additional Layer, Add</i>	0.42



Existing Conditions	02	
Facility Remediation	02 80	02
Asbestos Remediation	02 82	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
02 82 33 00-0140 Roof Penetration Mastic, Asbestos Abatement And Disposal <small>(02 82 33 00-0109)</small>		
02 82 33 00-0141 EA Up To 10 SF, Roof Penetration Mastic, Asbestos Abatement And Disposal.....	144.35	
02 82 33 00-0142 SF >10 To 50 SF, Roof Penetration Mastic, Asbestos Abatement And Disposal.....	1.80	
02 82 33 00-0143 SF >50 To 100 SF, Roof Penetration Mastic, Asbestos Abatement And Disposal.....	1.48	
02 82 33 00-0144 SF >100 To 250 SF, Roof Penetration Mastic, Asbestos Abatement And Disposal.....	1.19	
02 82 33 00-0145 SF >250 SF, Roof Penetration Mastic, Asbestos Abatement And Disposal.....	0.86	
02 82 33 00-0146 Roof Curb Mastic, Asbestos Abatement And Disposal <small>(02 82 33 00-0109)</small>		
02 82 33 00-0147 EA Up To 10 SF, Roof Curb Mastic, Asbestos Abatement And Disposal.....	144.35	
02 82 33 00-0148 LF >10 To 20 LF, Roof Curb Mastic, Asbestos Abatement And Disposal.....	5.41	
02 82 33 00-0149 LF >20 To 50 LF, Roof Curb Mastic, Asbestos Abatement And Disposal.....	4.33	
02 82 33 00-0150 LF >50 To 150 LF, Roof Curb Mastic, Asbestos Abatement And Disposal.....	3.61	
02 82 33 00-0151 LF >150 LF, Roof Curb Mastic, Asbestos Abatement And Disposal.....	2.60	
02 82 33 00-0152 Asbestos-Cement Products, Asbestos Abatement And Disposal <small>(02 82 33)</small>		
02 82 33 00-0153 Interior Asbestos-Cement Board, Asbestos Abatement And Disposal <small>(02 82 33 00-0152)</small>		
Note: Includes detachment of mounted objects before removal.		
02 82 33 00-0154 EA Up To 10 SF, Interior Asbestos-Cement Board, Asbestos Abatement And Disposal.....	577.37	
Note: Includes detachment of mounted objects before removal.		
02 82 33 00-0155 SF >10 To 500 SF, Interior Asbestos-Cement Board, Asbestos Abatement And Disposal.....	5.90	
Note: Includes detachment of mounted objects before removal.		
02 82 33 00-0156 SF >500 To 2,500 SF, Interior Asbestos-Cement Board, Asbestos Abatement And Disposal.....	2.95	
Note: Includes detachment of mounted objects before removal.		
02 82 33 00-0157 SF >2,500 To 10,000 SF, Interior Asbestos-Cement Board, Asbestos Abatement And Disposal.....	2.36	
Note: Includes detachment of mounted objects before removal.		
02 82 33 00-0158 SF >10,000 SF, Interior Asbestos-Cement Board, Asbestos Abatement And Disposal.....	2.06	
Note: Includes detachment of mounted objects before removal.		
02 82 33 00-0159 Exterior Asbestos-Cement Board, Asbestos Abatement And Disposal <small>(02 82 33 00-0152)</small>		
02 82 33 00-0160 EA Up To 10 SF, Exterior Asbestos-Cement Board, Asbestos Abatement And Disposal.....	577.37	
02 82 33 00-0161 SF >10 To 500 SF, Exterior Asbestos-Cement Board, Asbestos Abatement And Disposal.....	5.12	
02 82 33 00-0162 SF >500 To 2,500 SF, Exterior Asbestos-Cement Board, Asbestos Abatement And Disposal.....	2.62	
02 82 33 00-0163 SF >2,500 To 10,000 SF, Exterior Asbestos-Cement Board, Asbestos Abatement And Disposal.....	2.10	
02 82 33 00-0164 SF >10,000 SF, Exterior Asbestos-Cement Board, Asbestos Abatement And Disposal.....	1.82	
02 82 33 00-0165 Up To 12" Diameter Asbestos-Cement Pipe, Asbestos Abatement And Disposal <small>(02 82 33 00-0152)</small>		
02 82 33 00-0166 EA Up To 10 LF, Up To 12" Diameter Asbestos-Cement Pipe, Asbestos Abatement And Disposal.....	577.37	
02 82 33 00-0167 LF >10 To 100 LF, Up To 12" Diameter Asbestos-Cement Pipe, Asbestos Abatement And Disposal.....	29.52	
02 82 33 00-0168 LF >100 To 250 LF, Up To 12" Diameter Asbestos-Cement Pipe, Asbestos Abatement And Disposal.....	22.15	
02 82 33 00-0169 LF >250 To 500 LF, Up To 12" Diameter Asbestos-Cement Pipe, Asbestos Abatement And Disposal.....	16.61	
02 82 33 00-0170 LF >500 To 2,500 LF, Up To 12" Diameter Asbestos-Cement Pipe, Asbestos Abatement And Disposal.....	12.45	
02 82 33 00-0171 LF >2,500 To 10,000 LF, Up To 12" Diameter Asbestos-Cement Pipe, Asbestos Abatement And Disposal.....	9.34	
02 82 33 00-0172 LF >10,000 LF, Up To 12" Diameter Asbestos-Cement Pipe, Asbestos Abatement And Disposal.....	9.12	
02 82 33 00-0173 Exterior Transite Siding, Asbestos Abatement And Disposal <small>(02 82 33 00-0152)</small>		
02 82 33 00-0174 EA Up To 125 SF, Exterior Transite Siding, Asbestos Abatement And Disposal.....	577.37	
Note: Single or first of multiple layers.		
02 82 33 00-0175 SF >125 To 1,000 SF, Exterior Transite Siding, Asbestos Abatement And Disposal.....	4.61	
Note: Single or first of multiple layers.		
02 82 33 00-0176 SF >1,000 To 5,000 SF, Exterior Transite Siding, Asbestos Abatement And Disposal.....	3.69	
Note: Single or first of multiple layers.		
02 82 33 00-0177 SF >5,000 To 10,000 SF, Exterior Transite Siding, Asbestos Abatement And Disposal.....	2.95	
Note: Single or first of multiple layers.		
02 82 33 00-0178 SF >10,000 To 20,000 SF, Exterior Transite Siding, Asbestos Abatement And Disposal.....	2.22	
Note: Single or first of multiple layers.		
02 82 33 00-0179 SF >20,000 SF, Exterior Transite Siding, Asbestos Abatement And Disposal.....	1.66	
Note: Single or first of multiple layers.		
02 82 33 00-0180 Asbestos Contaminated Debris, Asbestos Abatement And Disposal <small>(02 82 33)</small>		
02 82 33 00-0181 Asbestos Contaminated Debris, Asbestos Abatement And Disposal <small>(02 82 33 00-0180)</small>		
02 82 33 00-0182 EA Up To 10 CF, Asbestos Contaminated Debris, Asbestos Abatement And Disposal.....	577.37	
<i>For Work In Restricted Working Space, Add</i>		
	173.21	
02 82 33 00-0183 CF >10 To 100 CF, Asbestos Contaminated Debris, Asbestos Abatement And Disposal.....	57.41	
<i>For Work In Restricted Working Space, Add</i>		
	17.22	
02 82 33 00-0184 CF >100 To 250 CF, Asbestos Contaminated Debris, Asbestos Abatement And Disposal.....	38.28	
<i>For Work In Restricted Working Space, Add</i>		
	11.48	
02 82 33 00-0185 CF >250 To 500 CF, Asbestos Contaminated Debris, Asbestos Abatement And Disposal.....	28.75	
<i>For Work In Restricted Working Space, Add</i>		
	8.63	

02 Existing Conditions**02 80 Facility Remediation****02 82 Asbestos Remediation**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
02 82 33 00-0186	CF		>500 To 2,500 CF, Asbestos Contaminated Debris, Asbestos Abatement And Disposal.....	22.97	
			<i>For Work In Restricted Working Space, Add</i>	6.89	
02 82 33 00-0187	CF		>2,500 To 10,000 CF, Asbestos Contaminated Debris, Asbestos Abatement And Disposal.....	19.52	
			<i>For Work In Restricted Working Space, Add</i>	5.86	
02 82 33 00-0188	CF		>10,000 CF, Asbestos Contaminated Debris, Asbestos Abatement And Disposal.....	17.57	
			<i>For Work In Restricted Working Space, Add</i>	5.27	
02 82 33 00-0189			Asbestos Contaminated Soil, Asbestos Abatement And Disposal <small>(02 82 33 00-0180)</small>		
02 82 33 00-0190	EA		Up To 10 CF, Asbestos Contaminated Soil, Asbestos Abatement And Disposal	866.05	
			<i>For Work In Restricted Working Space, Add</i>	259.82	
02 82 33 00-0191	CF		>10 To 100 CF, Asbestos Contaminated Soil, Asbestos Abatement And Disposal	57.41	
			<i>For Work In Restricted Working Space, Add</i>	17.22	
02 82 33 00-0192	CF		>100 To 250 CF, Asbestos Contaminated Soil, Asbestos Abatement And Disposal	38.28	
			<i>For Work In Restricted Working Space, Add</i>	11.48	
02 82 33 00-0193	CF		>250 To 500 CF, Asbestos Contaminated Asbestos Abatement And Disposal	28.75	
02 82 33 00-0194	CF		>500 To 2,500 CF, Asbestos Contaminated Soil, Asbestos Abatement And Disposal	22.97	
			<i>For Work In Restricted Working Space, Add</i>	6.89	
02 82 33 00-0195	CF		>2,500 To 10,000 CF, Asbestos Contaminated Soil, Asbestos Abatement And Disposal	19.52	
			<i>For Work In Restricted Working Space, Add</i>	5.86	
02 82 33 00-0196	CF		>10,000 CF, Asbestos Contaminated Soil, Asbestos Abatement And Disposal	17.57	
			<i>For Work In Restricted Working Space, Add</i>	5.27	
02 82 33 00-0197			Asbestos Contaminated Light Fixture, Asbestos Abatement And Disposal <small>(02 82 33 00-0180)</small>		
02 82 33 00-0198	EA		Up To 4 EA, Asbestos Contaminated Light Fixture, Asbestos Abatement And Disposal	577.37	
02 82 33 00-0199	EA		>4 To 40 EA, Asbestos Contaminated Light Fixture, Asbestos Abatement And Disposal	51.67	
02 82 33 00-0200	EA		>40 To 60 EA, Asbestos Contaminated Light Fixture, Asbestos Abatement And Disposal	34.45	
02 82 33 00-0201	EA		>60 To 125 EA, Asbestos Contaminated Light Fixture, Asbestos Abatement And Disposal	25.88	
02 82 33 00-0202	EA		>125 To 625 EA, Asbestos Contaminated Light Fixture, Asbestos Abatement And Disposal	20.67	
02 82 33 00-0203	EA		>625 To 1,500 EA, Asbestos Contaminated Light Fixture, Asbestos Abatement And Disposal	17.57	
02 82 33 00-0204	EA		>1,500 EA, Asbestos Contaminated Light Fixture, Asbestos Abatement And Disposal	15.81	
02 82 33 00-0205			Other Asbestos Containing Materials, Asbestos Abatement And Disposal <small>(02 82 33 00-0205)</small>		
02 82 33 00-0206			30" To 36" Fire Door, Asbestos Abatement And Disposal <small>(02 82 33 00-0205)</small>		
02 82 33 00-0207	EA		Up To 5 EA, 30" To 36" Fire Door, Asbestos Abatement And Disposal	115.48	
02 82 33 00-0208	EA		>5 To 20 EA, 30" To 36" Fire Door, Asbestos Abatement And Disposal	44.28	
02 82 33 00-0209	EA		>20 EA, 30" To 36" Fire Door, Asbestos Abatement And Disposal	29.52	
02 82 33 00-0210			HVAC Duct Flexible Connector (Web Cloth), Asbestos Abatement And Disposal <small>(02 82 33 00-0205)</small>		
02 82 33 00-0211	EA		Up To 10 LF, HVAC Duct Flexible Connector (Web Cloth), Asbestos Abatement And Disposal	288.68	
02 82 33 00-0212	LF		>10 To 50 LF, HVAC Duct Flexible Connector (Web Cloth), Asbestos Abatement And Disposal	5.90	
02 82 33 00-0213	LF		>50 To 100 LF, HVAC Duct Flexible Connector (Web Cloth), Asbestos Abatement And Disposal	4.43	
02 82 33 00-0214	LF		>100 To 250 LF, HVAC Duct Flexible Connector (Web Cloth), Asbestos Abatement And Disposal	3.81	
02 82 33 00-0215	LF		>250 To 1,000 LF, HVAC Duct Flexible Connector (Web Cloth), Asbestos Abatement And Disposal	3.28	
02 82 33 00-0216	LF		>1,000 To 2,500 LF, HVAC Duct Flexible Connector (Web Cloth), Asbestos Abatement And Disposal	2.80	
02 82 33 00-0217	LF		>2,500 LF, HVAC Duct Flexible Connector (Web Cloth), Asbestos Abatement And Disposal	2.42	
02 82 33 00-0218			Grout, Asbestos Abatement And Disposal <small>(02 82 33 00-0205)</small>		
			Note: e.g. flue grout.		
02 82 33 00-0219	EA		Up To 10 LF, Grout, Asbestos Abatement And Disposal	216.51	
02 82 33 00-0220	LF		>10 To 50 LF, Grout, Asbestos Abatement And Disposal	11.37	
02 82 33 00-0221	LF		>50 To 100 LF, Grout, Asbestos Abatement And Disposal	7.82	
02 82 33 00-0222	LF		>100 To 250 LF, Grout, Asbestos Abatement And Disposal	6.70	
02 82 33 00-0223	LF		>250 To 1,000 LF, Grout, Asbestos Abatement And Disposal	5.75	
02 82 33 00-0224	LF		>1,000 To 2,500 LF, Grout, Asbestos Abatement And Disposal	4.96	
02 82 33 00-0225	LF		>2,500 LF, Grout, Asbestos Abatement And Disposal	4.25	
02 82 33 00-0226			Gaskets, Asbestos Abatement And Disposal <small>(02 82 33 00-0205)</small>		
			Note: e.g. rope, web cloth, flat.		
02 82 33 00-0227	EA		Up To 10 LF, Gaskets, Asbestos Abatement And Disposal	216.51	
02 82 33 00-0228	LF		>10 To 50 LF, Gaskets, Asbestos Abatement And Disposal	15.31	
02 82 33 00-0229	LF		>50 To 250 LF, Gaskets, Asbestos Abatement And Disposal	11.48	
02 82 33 00-0230	LF		>250 To 500 LF, Gaskets, Asbestos Abatement And Disposal	9.78	
02 82 33 00-0231	LF		>500 To 1,500 LF, Gaskets, Asbestos Abatement And Disposal	8.80	
02 82 33 00-0232	LF		>1,500 To 2,500 LF, Gaskets, Asbestos Abatement And Disposal	7.90	
02 82 33 00-0233	LF		>2,500 LF, Gaskets, Asbestos Abatement And Disposal	7.53	
02 82 33 00-0234			Ceiling Tile Including Glue Removal, Asbestos Abatement And Disposal <small>(02 82 33 00-0205)</small>		
			Note: e.g. grid, spline, or glued on; 12" x 12" to 2' x 4'.		
02 82 33 00-0235	EA		Up To 50 SF, Ceiling Tile Including Glue Removal, Asbestos Abatement And Disposal	577.37	
02 82 33 00-0236	SF		>50 To 1,000 SF, Ceiling Tile Including Glue Removal, Asbestos Abatement And Disposal	12.27	
02 82 33 00-0237	SF		>1,000 To 2,500 SF, Ceiling Tile Including Glue Removal, Asbestos Abatement And Disposal	5.90	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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02 82 33 00-0238	SF	>2,500 To 10,000 SF, Ceiling Tile Including Glue Removal, Asbestos Abatement And Disposal	3.98	
02 82 33 00-0239	SF	>10,000 SF, Ceiling Tile Including Glue Removal, Asbestos Abatement And Disposal	3.39	

02 82 33 00-0240 Nailed-On Ceiling Tile System With Asbestos Barrier Paper Backing, Asbestos Abatement And Disposal (02 82 33 00-0205)

Note: Includes ceiling tile, asbestos barrier paper, and furring strips.

02 82 33 00-0241	EA	Up To 50 SF, Nailed-On Ceiling Tile System With Asbestos Barrier Paper Backing, Asbestos Abatement And Disposal.....	577.37	
02 82 33 00-0242	SF	>50 To 1,000 SF, Nailed-On Ceiling Tile System With Asbestos Barrier Paper Backing, Asbestos Abatement And Disposal.....	12.27	
02 82 33 00-0243	SF	>1,000 To 2,500 SF, Nailed-On Ceiling Tile System With Asbestos Barrier Paper Backing, Asbestos Abatement And Disposal	5.90	
02 82 33 00-0244	SF	>2,500 To 10,000 SF, Nailed-On Ceiling Tile System With Asbestos Barrier Paper Backing, Asbestos Abatement And Disposal	3.98	
02 82 33 00-0245	SF	>10,000 SF, Nailed-On Ceiling Tile System With Asbestos Barrier Paper Backing, Asbestos Abatement And Disposal.....	3.39	

02 82 33 00-0246 Caulking, Asbestos Abatement And Disposal (02 82 33 00-0205)

02 82 33 00-0247 Non Friable Caulking, Asbestos Abatement And Disposal (02 82 33 00-0246)

02 82 33 00-0248	EA	Up To 10 LF, Non Friable Asbestos Or PCB Contaminated Caulking, Asbestos Abatement And Disposal	216.51	
02 82 33 00-0249	LF	>10 To 50 LF, Non Friable Asbestos Or PCB Contaminated Caulking, Asbestos Abatement And Disposal.....	8.51	
02 82 33 00-0250	LF	>50 To 100 LF, Non Friable Asbestos Or PCB Contaminated Caulking, Asbestos Abatement And Disposal.....	6.01	
02 82 33 00-0251	LF	>100 To 250 LF, Non Friable Asbestos Or PCB Contaminated Caulking, Asbestos Abatement And Disposal.....	4.46	
02 82 33 00-0252	LF	>250 To 1,000 LF, Non Friable Asbestos Or PCB Contaminated Caulking, Asbestos Abatement And Disposal.....	3.36	
02 82 33 00-0253	LF	>1,000 To 2,500 LF, Non Friable Asbestos Or PCB Contaminated Caulking, Asbestos Abatement And Disposal.....	2.65	
02 82 33 00-0254	LF	>2,500 LF, Non Friable Asbestos Or PCB Contaminated Caulking, Asbestos Abatement And Disposal.....	2.30	

02 83 Lead Remediation (02 80)

Note: Tasks include materials, equipment, mobilization, preparation, critical barriers (e.g. electrical outlets, registers, windows, etc.), signage, removal, clean-up, vacuuming, transportation for up to 25 miles, disposal, personnel health monitoring, negative air, documentation and other associated costs necessary for the complete removal and disposal of lead contaminated materials in accordance with EPA and local regulations. Where types of Lead are listed by quantity, the quantity of the entire project, not a particular work area, is to be used in determining which task applies. See CSI section 01 74 19 00-0034 for hauling in excess of 25 miles to transfer or disposal site, 02 89 00 00-0002 for solid isolation barriers, 02 89 00 00-0012 for plastic sheeting for containment construction, 02 89 00 00-0019 for decontamination chambers.

02 83 19 Lead-Based Paint Remediation (02 83)

02 83 19 13 Lead-Based Paint Abatement (02 83 19)

02 83 19 13-0001 Sampling And Testing (02 83 19 13)

Note: Includes taking sample, delivery to lab and lab fee.

02 83 19 13-0002	EA	X-Ray Fluorescence (XRF) Lead Testing Including Technician, 3 Readings Per Surface.....	36.25	
02 83 19 13-0003	EA	Toxicity Characteristic Leaching Procedure (TCLP) Lead Test (5 Day Turnaround) And Lab Fee.....	34.71	
02 83 19 13-0004	EA	Toxicity Characteristic Leaching Procedure (TCLP) Lead Test (48 Hour Turnaround) And Lab Fee	52.58	
02 83 19 13-0005	EA	Toxicity Characteristic Leaching Procedure (TCLP) Lead Test (24 Hour Turnaround) And Lab Fee	73.62	
02 83 19 13-0006	EA	Total Threshold Leaching Concentration (TTL) Lead Test (5 Day Turnaround) And Lab Fee	13.67	
02 83 19 13-0007	EA	Total Threshold Leaching Concentration (TTL) Lead Test (24 Hour Turnaround) And Lab Fee	21.03	
02 83 19 13-0008	EA	Total Threshold Leaching Concentration (TTL) Lead Test (8 Hour Turnaround) And Lab Fee	26.29	
02 83 19 13-0009	EA	Soluble Threshold Limit Concentration (STLC) Lead Test (5 Day Turnaround) And Lab Fee	34.71	
02 83 19 13-0010	EA	Soluble Threshold Limit Concentration (STLC) Lead Test (3 Day Turnaround) And Lab Fee	52.58	
02 83 19 13-0011	EA	Lead Wipe Samples (5 Day Turnaround) And Lab Fee	5.78	
02 83 19 13-0012	EA	Lead Wipe Samples (24 Hour Turnaround) And Lab Fee.....	7.89	
02 83 19 13-0013	EA	Lead Wipe Samples (8 Hour Turnaround) And Lab Fee.....	11.57	
02 83 19 13-0014	EA	Lead Air Samples (5 Day Turn -Around) And Lab Fee	5.78	
02 83 19 13-0015	EA	Lead Air Samples (24 Hour Turnaround) And Lab Fee	7.89	
02 83 19 13-0016	EA	Lead Air Samples (8 Hour Turnaround) And Lab Fee	11.57	
02 83 19 13-0017	EA	Lead Water Test (5 Day Turnaround) and Lab Fee.....	21.03	
02 83 19 13-0018	EA	Lead Water Test (24 Hour Turnaround) and Lab Fee.....	31.55	
02 83 19 13-0019	EA	Lead Water Test (8 Hour Turnaround) and Lab Fee.....	42.07	
02 83 19 13-0020	EA	Lead Paint Chip Test (5 Day Turnaround) and Lab Fee	21.75	
02 83 19 13-0021	EA	Lead Soil Test (5 Day Turnaround) and Lab Fee.....	43.50	
02 83 19 13-0022	EA	Sample Pickup, Per Trip	31.55	

02 83 19 13-0023 Chemical Stripping Of Lead Contaminated Material (02 83 19 13)

Note: Per 0.02" (20 mils) application. Manufacture recommended operating temperatures not to be below 50 degrees. Includes heat gun (where required) for follow up, waste handling, packing and all personnel blood work, lab test fees and monitoring. Industrial coatings often contain other hazardous ingredients in addition to or in place of lead. These might include, but are not be limited to, chromium, cadmium and mercury.

02 83 19 13-0024	SF	Balustrades, Simple, Chemical Stripping Of Lead Contaminated Material	23.95	
02 83 19 13-0025	SF	Balustrades, Ornate, Chemical Stripping Of Lead Contaminated Material	35.79	
02 83 19 13-0026	LF	Up To 6" Wide Baseboard, Chemical Stripping Of Lead Contaminated Material.....	10.19	
02 83 19 13-0027	LF	>6" To 12" Wide Baseboard, Chemical Stripping Of Lead Contaminated Material.....	21.16	
02 83 19 13-0028	SF	Brick, Concrete Block, Concrete, Chemical Stripping Of Lead Contaminated Material	6.62	
02 83 19 13-0029	SF	Cabinets, Ornate, Chemical Stripping Of Lead Contaminated Material	25.67	
02 83 19 13-0030	SF	Cabinets, Simple Design, Chemical Stripping Of Lead Contaminated Material.....	20.04	
02 83 19 13-0031	SF	Ceilings, All, Chemical Stripping Of Lead Contaminated Material	9.29	
02 83 19 13-0032	SF	Columns, Chemical Stripping Of Lead Contaminated Material.....	8.79	

02 Existing Conditions**02 80 Facility Remediation****02 83 Lead Remediation**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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02 83 19 13-0033	SF	Cornice, Simple, Chemical Stripping Of Lead Contaminated Material	10.89		
02 83 19 13-0034	SF	Cornice, Ornate, Chemical Stripping Of Lead Contaminated Material	31.85		
02 83 19 13-0035	SF	Doors, One Side Flush, Chemical Stripping Of Lead Contaminated Material	7.80		
02 83 19 13-0036	SF	Doors, One Panel, Chemical Stripping Of Lead Contaminated Material	8.15		
02 83 19 13-0037	SF	Doors, Four Panel, Chemical Stripping Of Lead Contaminated Material	14.36		
02 83 19 13-0038	EA	Electrical Devices, Chemical Stripping Of Lead Contaminated Material	105.69		
02 83 19 13-0039	LF	Trim Or Frames, One Side, Chemical Stripping Of Lead Contaminated Material	10.13		
02 83 19 13-0040	LF	Up To 2" Electrical Conduit, Chemical Stripping Of Lead Contaminated Material	4.38		
02 83 19 13-0041	SF	Fence, Picket, Chemical Stripping Of Lead Contaminated Material	21.50		
02 83 19 13-0042	SF	Floors, Wood, Chemical Stripping Of Lead Contaminated Material	5.38		
02 83 19 13-0043	SF	Grilles, Ornate, Chemical Stripping Of Lead Contaminated Material	25.67		
02 83 19 13-0044	SF	Grilles, Simple, Chemical Stripping Of Lead Contaminated Material	21.45		
02 83 19 13-0045	EA	Hinges, Chemical Stripping Of Lead Contaminated Material	13.04		
02 83 19 13-0046	EA	Up To 6" Diameter Hangers, Chemical Stripping Of Lead Contaminated Material	16.23		
02 83 19 13-0047	LF	Up To 4" Diameter Pipes (Brush), Chemical Stripping Of Lead Contaminated Material	7.23		
02 83 19 13-0048	LF	>4" To 8" Diameter Pipes (Brush), Chemical Stripping Of Lead Contaminated Material	12.99		
02 83 19 13-0049	LF	>8" To 12" Diameter Pipes (Brush), Chemical Stripping Of Lead Contaminated Material	17.90		
02 83 19 13-0050	LF	>12" To 16" Diameter Pipes (Brush), Chemical Stripping Of Lead Contaminated Material	32.30		
02 83 19 13-0051	SF	>16" Diameter Pipes (Brush), Chemical Stripping Of Lead Contaminated Material, SF Of Surface Area	9.72		
02 83 19 13-0052	EA	Up To 12 SF Radiators, Chemical Stripping Of Lead Contaminated Material	194.59		
02 83 19 13-0053	EA	Shutters Front And Back Louvered, Up To 6', Chemical Stripping Of Lead Contaminated Material	218.00		
02 83 19 13-0054	EA	Shutters Flat, Chemical Stripping Of Lead Contaminated Material	159.88		
02 83 19 13-0055	SF	Siding, Chemical Stripping Of Lead Contaminated Material	7.34		
02 83 19 13-0056	SF	Soffit, Chemical Stripping Of Lead Contaminated Material	16.13		
02 83 19 13-0057	SF	Steel, Flat Surfaces And Tanks Up To 12', Chemical Stripping Of Lead Contaminated Material	7.17		
02 83 19 13-0058	SF	Steel Beams, Chemical Stripping Of Lead Contaminated Material	8.19		
02 83 19 13-0059	SF	Trusses, Chemical Stripping Of Lead Contaminated Material	11.78		
02 83 19 13-0060	SF	Walls, Wood, Chemical Stripping Of Lead Contaminated Material	8.19		
02 83 19 13-0061	SF	Windows, One Side, 1/1 Light, Chemical Stripping Of Lead Contaminated Material	19.44		
02 83 19 13-0062	SF	Windows, One Side, 2/2 Light, Chemical Stripping Of Lead Contaminated Material	21.33		
02 83 19 13-0063	SF	Windows, One Side, 4/4 Light, Chemical Stripping Of Lead Contaminated Material	22.59		
02 83 19 13-0064	SF	Windows, One Side, 6/6 Light, Chemical Stripping Of Lead Contaminated Material	23.87		
02 83 19 13-0065	SF	Windows, One Side, 8/8 Light Chemical Stripping Of Lead Contaminated Material	25.14		
02 83 19 13-0066	SF	Windows, One Side, 10/10 Light, Chemical Stripping Of Lead Contaminated Material	26.46		
02 83 19 13-0067	SF	Windows, One Side, 12/12 light Chemical Stripping Of Lead Contaminated Material	27.70		
02 83 19 13-0068	SF	Windows, One Side, 14/14 Light, Chemical Stripping Of Lead Contaminated Material	28.33		
02 83 19 13-0069	SF	Windows, One Side, 16/16 Light Chemical Stripping Of Lead Contaminated Material	28.99		
02 83 19 13-0070	SF	Windows, One Side, 20/20 Light, Chemical Stripping Of Lead Contaminated Material	29.60		
02 83 19 13-0071	SF	Metal Stair, Chemical Stripping Of Lead Contaminated Material	38.80		
02 83 19 13-0072	SF	Metal Railing And Posts, Chemical Stripping Of Lead Contaminated Material	19.51		
Note: The unit of measure "SF" is measured for 'Length x Height'. Work includes both sides of railing.					
02 83 19 13-0073	LF	Ornate Railings, Chemical Stripping Of Lead Contaminated Material	6.56		

02 83 19 13-0074**Demolish Lead Contaminated Material** (02 83 19 13)

Note: Includes waste handling, packing, all personnel blood work, lab test fees and monitoring. Industrial coatings often contain other hazardous ingredients in addition to or in place of lead. These might include, but are not be limited to, chromium, cadmium and mercury.

02 83 19 13-0075	SF	Demolish Ceiling Including Suspension System, Plaster, Lath, Lead Contaminated Material	1.75		
02 83 19 13-0076	SF	Demolish Finished Plaster/Stucco, Leaving Wire Lath, Lead Contaminated Material	2.54		
02 83 19 13-0077	SF	Demolish Suspended Acoustical Ceiling System, Including Tile, Lead Contaminated Material	1.01		
02 83 19 13-0078	SF	Demolish Acoustical Ceiling Tile, Lead Contaminated Material	0.65		
02 83 19 13-0079	SF	Demolish Metal Pan Grid System, Lead Contaminated Material	1.01		
02 83 19 13-0080	SF	Demolish Gypsum Board, Lead Contaminated Material	0.82		
02 83 19 13-0081	EA	Demolish Up To 2' x 4' Light Fixtures, Lead Contaminated Material	48.68		
02 83 19 13-0082	EA	Demolish >2' x 4' Light Fixtures, Lead Contaminated Material	64.59		
02 83 19 13-0083	SF	Demolish Non Load Bearing Partitions, Plaster, Lath And Studs, Lead Contaminated Material	7.21		
02 83 19 13-0084	SF	Demolish Non Load Bearing Partitions, Gypsum Board And Studs, Lead Contaminated Material	4.04		
02 83 19 13-0085	SF	Remove Lead Paint On Brick Or Concrete Block, Lead Contaminated Material	4.44		
02 83 19 13-0086	IN	Drilling, Up To 1/2" Diameter In Lead Paint/Asbestos Material Per Inch Of Depth	3.43		
02 83 19 13-0087	IN	Drilling, >1/2" To 1" Diameter In Lead Paint/Asbestos Material Per Inch Of Depth	4.56		
02 83 19 13-0088	SF	Demolish Balustrades And Railings, Lead Contaminated Material	5.05		
02 83 19 13-0089	LF	Demolish Up To 6" Wide Baseboard, Lead Contaminated Material	1.32		
02 83 19 13-0090	LF	Demolish >6" To 12" Wide Baseboard, Lead Contaminated Material	1.64		
02 83 19 13-0091	LF	Demolish Base Shoe Molding, Lead Contaminated Material	1.07		
02 83 19 13-0092	SF	Demolish Brick, Lead Contaminated Material	3.04		
02 83 19 13-0093	SF	Demolish Concrete Block, Lead Contaminated Material	3.91		
02 83 19 13-0094	SF	Demolish Concrete, Lead Contaminated Material	10.05		
02 83 19 13-0095	LF	Demolish Cabinets, Lead Contaminated Material	23.39		
02 83 19 13-0096	SF	Demolish Ceilings, Gypsum Board, Lead Contaminated Material	1.33		
02 83 19 13-0097	SF	Demolish Up To 12" Diameter Columns, Lead Contaminated Material	12.96		
02 83 19 13-0098	SF	Demolish Cornice, Lead Contaminated Material	1.73		
02 83 19 13-0099	EA	Demolish Doors, Lead Contaminated Material	50.75		
02 83 19 13-0100	LF	Demolish Door And Window Trim Or Frames, Lead Contaminated Material	1.55		
02 83 19 13-0101	EA	Demolish Electrical Devices, Lead Contaminated Material	15.57		
02 83 19 13-0102	LF	Demolish Up To 1" Diameter Electrical Conduit, Lead Contaminated Material	2.00		
02 83 19 13-0103	LF	Demolish >1" To 2" Diameter Electrical Conduit, Lead Contaminated Material	3.32		
02 83 19 13-0104	SF	Demolish Fence, Picket, Lead Contaminated Material	1.92		
02 83 19 13-0105	SF	Demolish Wood Floors, Lead Contaminated Material	2.40		
02 83 19 13-0106	SF	Demolish Grilles, Lead Contaminated Material	2.82		
02 83 19 13-0107	EA	Demolish Hinges, Lead Contaminated Material	5.66		



MINOR		TOTAL DIRECT	DEMOLITION
CSI	UOM DESCRIPTION	UNIT COST	UNIT COST
02 83 19 13-0108	EA Demolish Up To 6" Diameter Hangers, Lead Contaminated Material	12.16	
02 83 19 13-0109	LF Demolish Up To 2" Diameter Pipes, Lead Contaminated Material	4.99	
02 83 19 13-0110	LF Demolish >2" To 4" Diameter Pipes, Lead Contaminated Material	7.27	
02 83 19 13-0111	LF Demolish >4" To 8" Diameter Pipes, Lead Contaminated Material	10.99	
02 83 19 13-0112	LF Demolish >8" To 12" Diameter Pipes, Lead Contaminated Material	20.28	
02 83 19 13-0113	EA Demolish Radiators, Lead Contaminated Material	87.59	
02 83 19 13-0114	EA Demolish Shutters And Louvered, Up To 6', Lead Contaminated Material	34.13	
02 83 19 13-0115	SF Demolish Siding, Lead Contaminated Material	1.36	
02 83 19 13-0116	SF Demolish Up To 12" Wide Soffit, Lead Contaminated Material	1.16	
02 83 19 13-0117	SF Demolish Steel, Flat Surfaces And Tanks Up To 12', Lead Contaminated Material	3.16	
02 83 19 13-0118	SF Demolish Steel Beams, Lead Contaminated Material	3.71	
02 83 19 13-0119	SF Demolish Trusses, Lead Contaminated Material	4.87	
02 83 19 13-0120	SF Demolish Walls, Wood, Lead Contaminated Material	3.61	
02 83 19 13-0121	SF Demolish Windows, Lead Contaminated Material	12.12	
02 83 19 13-0122	SF Demolish Metal Stair, Lead Contaminated Material	5.80	
02 83 19 13-0123	LF Demolish Metal Railing And Posts, Lead Contaminated Material	6.97	
02 83 19 13-0124	SF Demolish Plywood, Lead Contaminated Material	5.24	
02 83 19 13-0125	SF Demolish Planks (Various Sizes), Lead Contaminated Material	2.56	
02 83 19 13-0126	SF Demolish Ceramic Tile, Walls Or Floor, Lead Contaminated Material	2.95	
02 83 19 13-0127	EA Demolish Metal Brackets Or Other Small Metal Shapes, Lead Contaminated Material	15.98	
02 83 19 13-0128	SF Demolish Ceramic Tile Block, Lead Contaminated Material	3.48	
02 83 19 13-0129	LF Demolish Metal Hand Rails, Lead Contaminated Material	4.26	
02 83 19 13-0130	LF Demolish Metal Guard Rails, Lead Contaminated Material	9.60	
02 83 19 13-0131	LF Demolish Roof Metal Trim, Lead Contaminated Material	2.04	
02 83 19 13-0132	LF Demolish Rain Gutters, Lead Contaminated Material	2.24	
02 83 19 13-0133	LF Demolish Downspouts, Lead Contaminated Material	2.24	
02 83 19 13-0134	LF Demolish Roof Metal Flashing, Lead Contaminated Material	2.04	
02 83 19 13-0135	LF Demolish Fascia Board Up To 12", Lead Contaminated Material	5.11	
02 83 19 13-0136	Wet Sanding Of Lead Contaminated Material (02 83 19 13)		
02 83 19 13-0137	SF Wet Sand/Scrape Of Lead Contaminated Material For Prep Before New Paint	1.39	
02 83 19 13-0138	Lead Abatement Encapsulation (02 83 19 13)		
Note: Can also be used for asbestos contaminated encapsulation. Spray applied application unless task described otherwise.			
02 83 19 13-0139	SF Balustrades, Lead Abatement Encapsulation	4.45	
02 83 19 13-0140	LF Up To 6" Wide, Baseboard, Lead Abatement Encapsulation	5.09	
02 83 19 13-0141	LF >6" To 12" Wide, Baseboard, Lead Abatement Encapsulation	6.89	
02 83 19 13-0142	SF Brick, Concrete Block, Concrete, Lead Abatement Encapsulation	2.87	
02 83 19 13-0143	SF Ornate Cabinets, Lead Abatement Encapsulation	6.42	
02 83 19 13-0144	SF Simple Design Cabinets, Lead Abatement Encapsulation	5.23	
02 83 19 13-0145	SF Drywall Ceilings, Lead Abatement Encapsulation	1.81	
02 83 19 13-0146	SF Wood Ceilings, Lead Abatement Encapsulation	2.19	
02 83 19 13-0147	SF Acoustical And Popcorn Ceilings, Lead Abatement Encapsulation	2.04	
02 83 19 13-0148	SF Columns, Lead Abatement Encapsulation	3.46	
02 83 19 13-0149	SF Doors, Lead Abatement Encapsulation	7.54	
02 83 19 13-0150	LF Up To 2" Electrical Conduit, Lead Abatement Encapsulation	2.90	
02 83 19 13-0151	SF Picket Fence (Brush), Lead Abatement Encapsulation	2.08	
02 83 19 13-0152	SF Wood Floors (Roller), Lead Abatement Encapsulation	1.74	
02 83 19 13-0153	SF Grilles, Vents, Lead Abatement Encapsulation	4.79	
02 83 19 13-0154	LF Gutters And Downspouts, Lead Abatement Encapsulation	4.45	
02 83 19 13-0155	EA Hangers, Lead Abatement Encapsulation	37.65	
02 83 19 13-0156	LF Up To 4" Diameter Pipe (Brush), Lead Abatement Encapsulation	2.70	
02 83 19 13-0157	LF >4" To 8" Diameter Pipe (Brush), Lead Abatement Encapsulation	3.90	
02 83 19 13-0158	LF >8" To 12" Diameter Pipe (Brush), Lead Abatement Encapsulation	6.05	
02 83 19 13-0159	LF >12" To 16" Diameter Pipe (Brush), Lead Abatement Encapsulation	8.93	
02 83 19 13-0160	EA Radiators, Lead Abatement Encapsulation	161.85	
02 83 19 13-0161	EA Up To 6' Shutters, Lead Abatement Encapsulation	139.77	
02 83 19 13-0162	SF Siding, Lead Abatement Encapsulation	2.48	
02 83 19 13-0163	SF Up To 12" Soffit, Lead Abatement Encapsulation	3.46	
02 83 19 13-0164	SF Steel, Flat Surfaces And Tanks Up To 12', Lead Abatement Encapsulation	2.87	
02 83 19 13-0165	SF Steel Beams And Metal Decks, Lead Abatement Encapsulation	3.74	
02 83 19 13-0166	SF Trusses, Lead Abatement Encapsulation	3.74	
02 83 19 13-0167	SF Drywall Walls, Lead Abatement Encapsulation	1.61	
02 83 19 13-0168	SF Wood Walls, Lead Abatement Encapsulation	1.98	
02 83 19 13-0169	EA Double Hung Window, Lead Abatement Encapsulation	140.23	
02 83 19 13-0170	EA Colonial Window, Lead Abatement Encapsulation	164.82	
02 83 19 13-0171	LF Frames And Trim, Lead Abatement Encapsulation	2.53	
02 83 19 13-0172	LF Steel Lintels, Lead Abatement Encapsulation	2.91	
02 83 33	Removal and Disposal of Material Containing Lead (02 83)		
02 83 33 13	Lead-Based Paint Removal and Disposal (02 83 33)		
02 83 33 13-0001	Remove Loose Dirt And Debris Containing Lead (02 83 33 13)		
02 83 33 13-0002	SF HEPA Vacuum And Wet Clean Lead Contaminated Area With Mild Detergent	0.21	
02 83 33 13-0003	SF HEPA Vacuum And Wet Clean Lead Contaminated Area With Tri-Sodium Phosphate	0.25	
02 83 33 13-0004	SF HEPA Vacuum And Shampoo Lead Contaminated Carpeting	1.01	

02 Existing Conditions**02 80 Facility Remediation****02 83 Lead Remediation**MINOR
CSI UOM DESCRIPTIONTOTAL DIRECT DEMOLITION
UNIT COST UNIT COST**02 84 Polychlorinate Biphenyl Remediation (02 80)****02 84 16 Handling Of Lighting Ballasts and Lamps Containing PBCs and Mercury (02 84)**

02 84 16 00-0001	EA	Removal Of TSCA-Exempt PCB And Non-PCB Ballasts From Demolished Fixtures (02 84 16)	
		Note: Includes removal of TSCA-exempt PCB and Non-PCB ballast from demolished lighting fixture and placing ballast in an approved container for recycling.	
02 84 16 00-0002	EA	Remove TSCA-Exempt PCB And Non-PCB Ballast From A Demolished Fixture For Recycling.....	6.45
02 84 16 00-0003		Recycle TSCA-Exempt PCB And Non-PCB Ballasts (02 84 16)	
		Note: Non leaking ballasts. Includes containers, shipping costs and recycling fees. Excludes ballast removal.	
02 84 16 00-0004	EA	Recycle Non-PCB Ballast Removed From Up To 4' Length Fixtures.....	0.88
02 84 16 00-0005	EA	Recycle Non-PCB Ballast Removed From >4' To 8' Length Fixtures	1.32
02 84 16 00-0006	EA	Recycle TSCA-Exempt PCB Ballast Removed From Up To 4' Length Fixtures.....	4.09
02 84 16 00-0007	EA	Recycle TSCA-Exempt PCB Ballast Removed From >4' To 8' Length Fixtures	9.35
02 84 16 00-0008		Disposal Of Leaking PCB And Non-PCB Ballasts (02 84 16)	
		Note: Disposal at an EPA approved facility. Includes containers, shipping costs and disposal fees. Excludes ballast removal.	
02 84 16 00-0009	EA	Dispose Of Leaking Non-PCB Ballast Removed From Up To 4' Length Fixtures	2.19
02 84 16 00-0010	EA	Dispose Of Leaking Non-PCB Ballast Removed From >4' To 8' Length Fixtures	3.29
02 84 16 00-0011	EA	Dispose Of Leaking PCB Ballast Removed From Up To 4' Length Fixtures.....	6.14
02 84 16 00-0012	EA	Dispose Of Leaking PCB Ballast Removed From >4' To 8' Length Fixtures.....	14.03

02 85 Mold Remediation (02 80)

Note: All unit pricing in this section includes: materials, equipment, mobilization, preparation, removal, clean-up, vacuuming, transportation for up to 25 miles, disposal, monitoring (personnel and air), sampling/testing, fees, documentation and other associated costs necessary for the complete removal and disposal of mold in accordance with EPA, OSHA, IICRC standards and local regulations. Where types of Mold are listed by quantity, the quantity of the entire project, not a particular work area of building, is to be used in determining which task applies. See CSI section 01 74 19 00-0034 for hauling in excess of 25 miles to transfer or disposal site, 02 81 00 00-0000 for hauling in excess of 25 miles to transfer or disposal site, 02 89 00 00-0002 for solid isolation barriers, 02 89 00 00-0012 for plastic sheeting for containment construction, 02 89 00 00-0019 for decontamination chambers.

02 85 33 Removal and Disposal of Materials with Mold (02 85)

02 85 33 00-0001		Pipe And Pipe Fittings Insulation, Mold Abatement And Disposal (02 85 33)	
		Note: Treat fittings as additional lf of insulation.	
02 85 33 00-0002		Pipe Insulation, Mold Abatement And Disposal (02 85 33 00-0001)	
		Note: Diameter is outer size of insulation.	
02 85 33 00-0003		Up To 6" Diameter Pipe Insulation, Mold Abatement And Disposal (02 85 33 00-0002)	
		Note: Excludes encased fittings.	
02 85 33 00-0004	LF	Up To 25 LF, Up To 6" Diameter Pipe Insulation, Mold Abatement And Disposal	29.91
02 85 33 00-0005	LF	>25 To 250 LF, Up To 6" Diameter Pipe Insulation, Mold Abatement And Disposal.....	22.33
02 85 33 00-0006	LF	>250 To 500 LF, Up To 6" Diameter Pipe Insulation, Mold Abatement And Disposal.....	16.75
02 85 33 00-0007	LF	>500 To 2,500 LF, Up To 6" Diameter Pipe Insulation, Mold Abatement And Disposal.....	12.56
02 85 33 00-0008	LF	>2,500 To 10,000 LF, Up To 6" Diameter Pipe Insulation, Mold Abatement And Disposal.....	9.42
02 85 33 00-0009	LF	>10,000 LF, Up To 6" Diameter Pipe Insulation, Mold Abatement And Disposal.....	8.19
02 85 33 00-0010		>6" Diameter Pipe Insulation, Mold Abatement And Disposal (02 85 33 00-0002)	
02 85 33 00-0011	LF	Up To 25 LF, >6" Diameter Pipe Insulation, Mold Abatement And Disposal.....	34.40
02 85 33 00-0012	LF	>25 To 250 LF, >6" Diameter Pipe Insulation, Mold Abatement And Disposal	25.67
02 85 33 00-0013	LF	>250 To 500 LF, >6" Diameter Pipe Insulation, Mold Abatement And Disposal	19.25
02 85 33 00-0014	LF	>500 To 2,500 LF, >6" Diameter Pipe Insulation, Mold Abatement And Disposal	14.45
02 85 33 00-0015	LF	>2,500 To 10,000 LF, >6" Diameter Pipe Insulation, Mold Abatement And Disposal	10.83
02 85 33 00-0016	LF	>10,000 LF, >6" Diameter Pipe Insulation, Mold Abatement And Disposal	9.42
02 85 33 00-0017		Thermal Insulation, Mold Abatement And Disposal (02 85 33)	
02 85 33 00-0018		Other Thermal Insulation, Up To 3" Thick, Mold Abatement And Disposal (02 85 33 00-0017)	
02 85 33 00-0019	SF	Up To 50 SF, Up To 3" Thick Thermal Insulation, Mold Abatement And Disposal.....	18.05
02 85 33 00-0020	SF	>50 To 500 SF, Up To 3" Thick Thermal Insulation, Mold Abatement And Disposal	12.83
02 85 33 00-0021	SF	>500 To 2,500 SF, Up To 3" Thick Thermal Insulation, Mold Abatement And Disposal	9.62
02 85 33 00-0022	SF	>2,500 To 10,000 SF, Up To 3" Thick Thermal Insulation, Mold Abatement And Disposal	7.21
02 85 33 00-0023	SF	>10,000 SF, Up To 3" Thick Thermal Insulation, Mold Abatement And Disposal	5.53
02 85 33 00-0024		Surfacing Material, Mold Abatement And Disposal (02 85 33)	
		Note: e.g. fireproofing, acoustical plaster, etc.	
02 85 33 00-0025		Stucco, Mold Abatement And Disposal (02 85 33 00-0024)	
		Note: Remove surface coat from brown coat or remove entire assembly, including lath.	
02 85 33 00-0026	SF	Up To 100 SF, Stucco, Mold Abatement And Disposal.....	18.05
02 85 33 00-0027	SF	>100 To 500 SF, Stucco, Mold Abatement And Disposal	12.83



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
02 85 33 00-0028 SF >500 To 2,500 SF, Stucco, Mold Abatement And Disposal	9.62	
02 85 33 00-0029 SF >2,500 To 10,000 SF, Stucco, Mold Abatement And Disposal	7.21	
02 85 33 00-0030 SF >10,000 SF, Stucco, Mold Abatement And Disposal	5.42	
02 85 33 00-0031 Acoustical Plaster, Mold Abatement And Disposal (02 85 33 00-0024) Note: Remove surface coat from brown coat or remove entire assembly, including lath.		
02 85 33 00-0032 SF Up To 100 SF, Acoustical Plaster, Mold Abatement And Disposal	18.05	
02 85 33 00-0033 SF >100 To 500 SF, Acoustical Plaster, Mold Abatement And Disposal	12.83	
02 85 33 00-0034 SF >500 To 2,500 SF, Acoustical Plaster, Mold Abatement And Disposal	9.62	
02 85 33 00-0035 SF >2,500 To 10,000 SF, Acoustical Plaster, Mold Abatement And Disposal	7.21	
02 85 33 00-0036 SF >10,000 SF, Acoustical Plaster, Mold Abatement And Disposal	5.42	
02 85 33 00-0037 Gypsum Board, Mold Abatement And Disposal (02 85 33 00-0024)		
02 85 33 00-0038 SF Up To 100 SF, Gypsum Board, Mold Abatement And Disposal	5.77	
02 85 33 00-0039 SF >100 To 500 SF, Gypsum Board, Mold Abatement And Disposal	4.15	
02 85 33 00-0040 SF >500 To 2,500 SF, Gypsum Board, Mold Abatement And Disposal	3.25	
02 85 33 00-0041 SF >2,500 To 10,000 SF, Gypsum Board, Mold Abatement And Disposal	2.52	
02 85 33 00-0042 SF >10,000 SF, Gypsum Board, Mold Abatement And Disposal	1.80	
02 85 33 00-0043 Fireproofing, Mold Abatement And Disposal (02 85 33 00-0024) Note: Exposed surface area, includes associated overspray.		
02 85 33 00-0044 SF Up To 100 SF, Fireproofing, Mold Abatement And Disposal	18.05	
02 85 33 00-0045 SF >100 To 500 SF, Fireproofing, Mold Abatement And Disposal	17.68	
02 85 33 00-0046 SF >500 To 2,500 SF, Fireproofing, Mold Abatement And Disposal	13.28	
02 85 33 00-0047 SF >2,500 To 10,000 SF, Fireproofing, Mold Abatement And Disposal	9.96	
02 85 33 00-0048 SF >10,000 SF, Fireproofing, Mold Abatement And Disposal	7.47	
02 85 33 00-0049 Flooring, Mold Abatement And Disposal (02 85 33) Note: Includes cove base.		
02 85 33 00-0050 Floor Tile Or Linoleum, Mold Abatement And Disposal (02 85 33 00-0049)		
02 85 33 00-0051 Floor Tile Or Linoleum, Mold Abatement And Disposal (02 85 33 00-0050) Note: Single layer or first of multiple layers.		
02 85 33 00-0052 SF Up To 100 SF, Single Layer Or First Of Multiple Layers, Floor Tile Or Linoleum, Mold Abatement And Disposal	6.56	
For Each Additional Layer, Add	1.64	
02 85 33 00-0053 SF >100 To 500 SF, Single Layer Or First Of Multiple Layers, Floor Tile Or Linoleum, Mold Abatement And Disposal	4.12	
For Each Additional Layer, Add	1.03	
02 85 33 00-0054 SF >500 To 2,500 SF, Single Layer Or First Of Multiple Layers, Floor Tile Or Linoleum, Mold Abatement And Disposal	2.22	
For Each Additional Layer, Add	0.56	
02 85 33 00-0055 SF >2,500 To 10,000 SF, Single Layer Or First Of Multiple Layers, Floor Tile Or Linoleum, Mold Abatement And Disposal	1.20	
For Each Additional Layer, Add	0.30	
02 85 33 00-0056 SF >10,000 SF, Single Layer Or First Of Multiple Layers, Floor Tile Or Linoleum, Mold Abatement And Disposal	0.88	
For Each Additional Layer, Add	0.22	
02 85 33 00-0057 Carpet, Mold Abatement And Disposal (02 85 33 00-0049)		
02 85 33 00-0058 Carpet, Glue Down, Mold Abatement And Disposal (02 85 33 00-0057)		
02 85 33 00-0059 SF Up To 100 SF, Carpet, Glue Down, Mold Abatement And Disposal	5.25	
02 85 33 00-0060 SF >100 To 500 SF, Carpet, Glue Down, Mold Abatement And Disposal	3.40	
02 85 33 00-0061 SF >500 To 2,500 SF, Carpet, Glue Down, Mold Abatement And Disposal	2.07	
02 85 33 00-0062 SF >2,500 To 10,000 SF, Carpet, Glue Down, Mold Abatement And Disposal	1.31	
02 85 33 00-0063 SF >10,000 SF, Carpet, Glue Down, Mold Abatement And Disposal	0.96	
02 85 33 00-0064 Carpet, Padded With Tack Strips, Mold Abatement And Disposal (02 85 33 00-0057)		
02 85 33 00-0065 SF Up To 100 SF, Carpet And Pad, Mold Abatement And Disposal	5.77	
Note: Includes tack strips.		
02 85 33 00-0066 SF >100 To 500 SF, Carpet And Pad, Mold Abatement And Disposal	3.85	
Note: Includes tack strips.		
02 85 33 00-0067 SF >500 To 2,500 SF, Carpet And Pad, Mold Abatement And Disposal	2.75	
Note: Includes tack strips.		
02 85 33 00-0068 SF >2,500 To 10,000 SF, Carpet And Pad, Mold Abatement And Disposal	2.14	
Note: Includes tack strips.		
02 85 33 00-0069 SF >10,000 SF, Carpet And Pad, Mold Abatement And Disposal	1.61	
Note: Includes tack strips.		
02 85 33 00-0070 Subflooring, Mold Abatement And Disposal (02 85 33 00-0049)		
02 85 33 00-0071 SF Up To 100 SF, Subflooring, Mold Abatement And Disposal	7.64	
02 85 33 00-0072 SF >100 To 500 SF, Subflooring, Mold Abatement And Disposal	4.77	
02 85 33 00-0073 SF >500 To 2,500 SF, Subflooring, Mold Abatement And Disposal	2.98	
02 85 33 00-0074 SF >2,500 To 10,000 SF, Subflooring, Mold Abatement And Disposal	1.73	
02 85 33 00-0075 SF >10,000 SF, Subflooring, Mold Abatement And Disposal	1.03	

02 Existing Conditions**02 80 Facility Remediation****02 85 Mold Remediation**MINOR
CSI UOM DESCRIPTIONTOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

02 85 33 00-0076	Siding, Mold Abatement And Disposal (02 85 33)		
02 85 33 00-0077	Interior Paneling, Mold Abatement And Disposal (02 85 33 00-0076)		
	Note: Includes detachment of mounted objects before removal.		
02 85 33 00-0078	SF Up To 100 SF, Interior Paneling, Mold Abatement And Disposal	5.77	
	Note: Includes detachment of mounted objects before removal.		
02 85 33 00-0079	SF >100 To 500 SF, Interior Paneling, Mold Abatement And Disposal	4.11	
	Note: Includes detachment of mounted objects before removal.		
02 85 33 00-0080	SF >500 To 2,500 SF, Interior Paneling, Mold Abatement And Disposal	2.83	
	Note: Includes detachment of mounted objects before removal.		
02 85 33 00-0081	SF >2,500 To 10,000 SF, Interior Paneling, Mold Abatement And Disposal	1.57	
	Note: Includes detachment of mounted objects before removal.		
02 85 33 00-0082	SF >10,000 SF, Interior Paneling, Mold Abatement And Disposal	1.15	
	Note: Includes detachment of mounted objects before removal.		
02 85 33 00-0083	Exterior Siding, Mold Abatement And Disposal (02 85 33 00-0076)		
02 85 33 00-0084	SF Up To 100 SF, Exterior Siding Board, Mold Abatement And Disposal	8.02	
02 85 33 00-0085	SF >100 To 500 SF, Exterior Siding Board, Mold Abatement And Disposal	5.16	
02 85 33 00-0086	SF >500 To 2,500 SF, Exterior Siding Board, Mold Abatement And Disposal	3.52	
02 85 33 00-0087	SF >2,500 To 10,000 SF, Exterior Siding Board, Mold Abatement And Disposal	2.31	
02 85 33 00-0088	SF >10,000 SF, Exterior Siding Board, Mold Abatement And Disposal	2.07	
02 85 33 00-0089	Contaminated Debris, Mold Abatement And Disposal (02 85 33)		
02 85 33 00-0090	Contaminated Debris, Mold Abatement And Disposal (02 85 33 00-0089)		
02 85 33 00-0091	CF Up To 10 CF, Contaminated Debris, Mold Abatement And Disposal	33.28	
02 85 33 00-0092	CF >10 To 100 CF, Contaminated Debris, Mold Abatement And Disposal	19.96	
02 85 33 00-0093	CF >100 To 250 CF, Contaminated Debris, Mold Abatement And Disposal	13.32	
02 85 33 00-0094	CF >250 To 500 CF, Contaminated Debris, Mold Abatement And Disposal	9.98	
02 85 33 00-0095	CF >500 To 2,500 CF, Contaminated Debris, Mold Abatement And Disposal	7.99	
02 85 33 00-0096	CF >2,500 To 10,000 CF, Contaminated Debris, Mold Abatement And Disposal	4.37	
02 85 33 00-0097	CF >10,000 CF, Contaminated Debris, Mold Abatement And Disposal	3.92	
02 85 33 00-0098	Other Mold Containing Materials, Mold Abatement And Disposal (02 85 33)		
02 85 33 00-0099	Wood Studs, Mold Abatement And Disposal (02 85 33 00-0098)		
	Note: 2" x 4" or 2" x 6" exposed studs in walls. Excludes surfacing material.		
02 85 33 00-0100	LF Up To 100 LF, Wood Studs, Mold Abatement And Disposal	3.24	
02 85 33 00-0101	LF >100 To 500 LF, Wood Studs, Mold Abatement And Disposal	2.32	
02 85 33 00-0102	LF >500 To 2,500 LF, Wood Studs, Mold Abatement And Disposal	1.70	
02 85 33 00-0103	LF >2,500 To 10,000 LF, Wood Studs, Mold Abatement And Disposal	1.31	
02 85 33 00-0104	LF >10,000 LF, Wood Studs, Mold Abatement And Disposal	0.97	
02 85 33 00-0105	Ceiling Tile, Mold Abatement And Disposal (02 85 33 00-0098)		
	Note: e.g. grid, spline, or glued on; 12" x 12" to 2' x 4'.		
02 85 33 00-0106	SF Up To 200 SF, Ceiling Tile, Mold Abatement And Disposal	9.62	
02 85 33 00-0107	SF >200 To 1,000 SF, Ceiling Tile, Mold Abatement And Disposal	7.21	
02 85 33 00-0108	SF >1,000 To 2,500 SF, Ceiling Tile, Mold Abatement And Disposal	3.29	
02 85 33 00-0109	SF >2,500 To 10,000 SF, Ceiling Tile, Mold Abatement And Disposal	2.31	
02 85 33 00-0110	SF >10,000 SF, Ceiling Tile, Mold Abatement And Disposal	2.07	
02 85 33 00-0111	Caulking, Mold Abatement And Disposal (02 85 33 00-0098)		
02 85 33 00-0112	LF Up To 10 LF, Caulking, Mold Abatement And Disposal	3.40	
02 85 33 00-0113	LF >10 To 50 LF, Caulking, Mold Abatement And Disposal	2.89	
02 85 33 00-0114	LF >50 To 100 LF, Caulking, Mold Abatement And Disposal	2.07	
02 85 33 00-0115	LF >100 To 250 LF, Caulking, Mold Abatement And Disposal	1.56	
02 85 33 00-0116	LF >250 To 1,000 LF, Caulking, Mold Abatement And Disposal	1.15	
02 85 33 00-0117	LF >1,000 To 2,500 LF, Caulking, Mold Abatement And Disposal	0.93	
02 85 33 00-0118	LF >2,500 LF, Caulking, Mold Abatement And Disposal	0.80	
02 85 33 00-0119	Wipe Down Walls, Ceilings And Floors (02 85 33 00-0098)		
02 85 33 00-0120	CSF Wipe Down Floors With Mild Bleach Solution	16.04	
02 85 33 00-0121	CSF Wipe Down Walls With Mild Bleach Solution	18.87	
02 85 33 00-0122	CSF Wipe Down Ceilings With Mild Bleach Solution	21.47	
02 85 33 00-0123	CSF Wipe Down Countertops With Mild Bleach Solution	17.49	
02 85 33 00-0124	CSF Wipe Down Other Surfaces With Mild Bleach Solution	22.21	
02 85 33 00-0125	Cabinets (02 85 33 00-0098)		
02 85 33 00-0126	LF Up To 20 LF, Base Cabinet, Mold Abatement And Disposal	59.42	
02 85 33 00-0127	LF >20 LF, Base Cabinet, Mold Abatement And Disposal	41.94	
02 85 33 00-0128	LF Up To 20 LF, Wall Cabinet, Mold Abatement And Disposal	52.43	
02 85 33 00-0129	LF >20 LF, Wall Cabinet, Mold Abatement And Disposal	34.95	



MINOR	CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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02 86 Hazardous Waste Drum Handling (02 80)

02 86 00 00-0001 Hazardous Waste Packaging (02 86)

02 86 00 00-0002 Overpacks (02 86 00 00-0001)

02 86 00 00-0003 Steel Salvage Drums, 16 Gauge (02 86 00 00-0002)

02 86 00 00-0004	EA	110 Gallon, 30" Diameter X 41" High.....	192.76
02 86 00 00-0005	EA	85 Gallon, 26" Diameter X 38" High.....	109.73
02 86 00 00-0006	EA	83 Gallon, 26" Diameter X 36" High.....	105.90
02 86 00 00-0007	EA	55 Gallon, DOT 17C, 18" Diameter X 34" High.....	66.26
02 86 00 00-0008	EA	30 Gallon, DOT 17C, 18" Diameter X 28" High.....	52.19
02 86 00 00-0009	EA	22 Gallon, 16" Diameter X 25" High.....	35.17
02 86 00 00-0010	EA	15 Gallon, DOT 17C, 14" Diameter X 24" High.....	31.79
02 86 00 00-0011	EA	10 Gallon, 13.8" Diameter X 15" High.....	28.02

02 86 00 00-0012 Polyethylene Overpacks (02 86 00 00-0002)

02 86 00 00-0013	EA	95 Gallon, DOT E9618, Twist On Lid 31" Diameter X 41" High.....	217.74
02 86 00 00-0014	EA	20 Gallon, Labpack, Twist On Lid 21" Diameter X 7.5" High.....	40.24
02 86 00 00-0015	EA	85 Gallon, DOT E9775, Clamp Ring Lid, 27" Diameter X 41" High.....	197.02

02 86 00 00-0016 Composite Overpacks (02 86 00 00-0002)

02 86 00 00-0017	EA	55 Gal, DOT 17C, Steel Drum Nested With 2-20 Gallon Fiber Drums.....	106.92
02 86 00 00-0018	EA	55 Gal, DOT 17C, Steel Drum Nested With 4-10 Gallon Fiber Drums.....	146.72
02 86 00 00-0019	EA	85 Gal, 16 Gauge Salvage Drum Nested With 3-20 Gallon Fiber Drums.....	199.01

02 86 00 00-0020 DOT E-9168 Exempt Packaging (02 86 00 00-0002)

02 86 00 00-0021	EA	32 Oz Bottle, Carton, Insert, Can, Poly Bag And Tape -E9168.....	9.78
02 86 00 00-0022	EA	950 cc Bottle, Carton, Insert, Can, Poly Bag And Tape -E9168.....	10.32
02 86 00 00-0023	EA	500 cc Bottle, Carton, Insert, Can, Poly Bag And Tape -E9168.....	10.09
02 86 00 00-0024	EA	250 cc Bottle, Carton, Insert, Can, Poly Bag And Tape -E9168.....	5.00
02 86 00 00-0025	EA	Can, Carton, Insert, Tape - Corrosive And Flammable - UPS.....	5.73
02 86 00 00-0026	EA	16 Oz Bottle, Carton, Insert And Tape, Sludge/Viscous, UPS.....	3.93
02 86 00 00-0027	EA	32 Oz Bottle, Carton, Insert And Tape, Sludge/Viscous, UPS.....	5.11

02 86 00 00-0028 Steel Drums (02 86 00 00-0001)

02 86 00 00-0029 UN Rated Steel Drums (02 86 00 00-0028)

02 86 00 00-0030	EA	8 Gallon, 17C, Open.....	35.90
02 86 00 00-0031	EA	55 Gallon Stainless Steel DOT 5C Seamless Oh Drum 16-Gauge (25-49).....	923.11
02 86 00 00-0032	EA	UN 1A2/X 320/S 55 Gallon, Open, 16 Gauge, Steel Drum.....	65.74
02 86 00 00-0033	EA	55 Gallon Stainless Steel DOT 17E Ch 18-Gauge Drum (10-24).....	744.90
02 86 00 00-0034	EA	55 Gallon Reconditioned Steel 17h Drum (50+).....	35.12
02 86 00 00-0035	EA	55 Gallon Stainless Steel DOT 17E Ch 18-Gauge Drum (25-49).....	730.88
02 86 00 00-0036	EA	UN 1A2/X 320/S 55 Gallon, Closed, 16 Gauge, Steel Drum.....	62.13
02 86 00 00-0037	EA	55 Gallon Stainless Steel DOT 5C Seamless Oh Drum 16-Gauge (50+).....	875.05
02 86 00 00-0038	EA	55 Gallon Stainless Steel DOT 5C Ch Seamless Drum 16-Gauge (10-24).....	1,069.28
02 86 00 00-0039	EA	55 Gallon Stainless Steel DOT 5C Ch Seamless Drum 16-Gauge (25-49).....	1,049.26
02 86 00 00-0040	EA	55 Gallon Stainless Steel DOT 5C Oh 16-Gauge Drum (1-9).....	967.16
02 86 00 00-0041	EA	UN 1A2/Y 1.4/100 55 Gallon, Open, 16 Gauge, Steel Drum.....	50.38
02 86 00 00-0042	EA	55 Gallon Stainless Steel DOT 17E Ch 18-Gauge Drum (50+).....	658.79
02 86 00 00-0043	EA	55 Gallon Stainless Steel DOT 5C Oh 16-Gauge Drum (10-24).....	949.14
02 86 00 00-0044	EA	UN 1A2/Y 1.4/100 55 Gallon, Closed, 16 Gauge, Steel Drum.....	39.70
02 86 00 00-0045	EA	30 Gallon Stainless Steel DOT 5C Ch 16-Gauge Drum (1-9).....	620.75
02 86 00 00-0046	EA	55 Gallon Stainless Steel DOT 5C Ch Seamless Drum 16-Gauge (50+).....	945.14
02 86 00 00-0047	EA	UN 1A2/X 160/S 30 Gallon, Open, 18 Gauge, Steel Drum.....	46.02
02 86 00 00-0048	EA	55 Gallon Stainless Steel DOT 5C Ch 16-Gauge Drum (1-9).....	1,009.21
02 86 00 00-0049	EA	30 Gallon Stainless Steel DOT 5C Ch 16-Gauge Drum (10-24).....	596.72
02 86 00 00-0050	EA	55 Gallon Stainless Steel DOT 5C Oh 16-Gauge Drum (25-49).....	855.03
02 86 00 00-0051	EA	30 Gallon Stainless Steel DOT 5C Ch 16-Gauge Drum (25-49).....	570.69
02 86 00 00-0052	EA	55 Gallon Stainless Steel DOT 5C Ch 16-Gauge Drum (10-24).....	985.18
02 86 00 00-0053	EA	UN 1A2/Y 1.4/100 30 Gallon, Open, 18 Gauge, Steel Drum.....	39.12
02 86 00 00-0054	EA	55 Gallon Stainless Steel DOT 5C Oh 16-Gauge Drum (50+).....	810.97
02 86 00 00-0055	EA	55 Gallon Reconditioned Steel 17h Drum (1-9).....	51.51
02 86 00 00-0056	EA	30 Gallon Stainless Steel DOT 5C Ch 16-Gauge Drum (50+).....	550.66
02 86 00 00-0057	EA	55 Gallon Stainless Steel DOT 5C Ch 16-Gauge Drum (25-49).....	967.16
02 86 00 00-0058	EA	30 Gallon, 17E, Open.....	28.38
02 86 00 00-0059	EA	55 Gallon Reconditioned Steel 17h Drum (10-24).....	45.65
02 86 00 00-0060	EA	20 Gallon, 17C, Open.....	39.89
02 86 00 00-0061	EA	55 Gallon Stainless Steel DOT 5C Ch 16-Gauge Drum (50+).....	871.05
02 86 00 00-0062	EA	55 Gallon Stainless Steel DOT 5C Seamless Oh Drum 16-Gauge (1-9).....	1,043.25
02 86 00 00-0063	EA	55 Gallon Stainless Steel DOT 17E Ch 18-Gauge Drum (1-9).....	762.92
02 86 00 00-0064	EA	55 Gallon Reconditioned Steel 17h Drum (25-49).....	39.80
02 86 00 00-0065	EA	55 Gallon Stainless Steel DOT 5C Seamless Oh Drum 16-Gauge (10-24).....	1,023.23
02 86 00 00-0066	EA	20 Gallon, 17E, Open.....	26.85

02 Existing Conditions**02 80 Facility Remediation****02 86 Hazardous Waste Drum Handling**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
02 86 00 00-0067 Plastic Drums (02 86 00 00-0001)		
02 86 00 00-0068 Polyethylene Closed Head Drums (02 86 00 00-0067)		
Note: Closed head drums have standard NPS (National Pipe Standard) plug and drain vents. Primarily for liquids.		
02 86 00 00-0069 EA 55 Gallon Polyethylene Closed Head Drums.....	41.27	
02 86 00 00-0070 EA 35 Gallon Polyethylene Closed Head Drums.....	31.68	
02 86 00 00-0071 EA 30 Gallon Polyethylene Closed Head Drums.....	28.77	
02 86 00 00-0072 EA 20 Gallon Polyethylene Closed Head Drums.....	20.10	
02 86 00 00-0073 EA 15 Gallon Polyethylene Closed Head Drums.....	19.71	
02 86 00 00-0074 Polyethylene Open Head Drums (02 86 00 00-0067)		
Note: Open head drums are primarily used for solids and sludge.		
02 86 00 00-0075 EA 55 Gallon Polyethylene Open Head Drums.....	52.16	
02 86 00 00-0076 EA 35 Gallon Polyethylene Open Head Drums.....	38.35	
02 86 00 00-0077 EA 30 Gallon Polyethylene Open Head Drums.....	36.44	
02 86 00 00-0078 EA 20 Gallon Polyethylene Open Head Drums.....	26.85	
02 86 00 00-0079 EA 15 Gallon Polyethylene Open Head Drums.....	23.01	
02 86 00 00-0080 Fiber Drums (02 86 00 00-0001)		
02 86 00 00-0081 Steel Top/Fiber Bottom Drums, Hazardous (02 86 00 00-0080)		
Note: Waste fiber drums have tubular rubber gaskets and caulked bottom seams.		
02 86 00 00-0082 EA 30 Gallon Fiber Drum DOT-21C (1-9).....	31.60	
02 86 00 00-0083 EA 30 Gallon Fiber Drum DOT-21C (10-24).....	29.61	
02 86 00 00-0084 EA 30 Gallon Fiber Drum DOT-21C (25-49).....	27.00	
02 86 00 00-0085 EA 30 Gallon Fiber Drum DOT-21C (50+).....	26.69	
02 86 00 00-0086 EA 55 Gallon Fiber Drum DOT-21C (1-9).....	32.52	
02 86 00 00-0087 EA 55 Gallon Fiber Drum DOT-21C (10-24).....	30.68	
02 86 00 00-0088 EA 55 Gallon Fiber Drum DOT-21C (25-49).....	28.38	
02 86 00 00-0089 EA 55 Gallon Fiber Drum DOT-21C (50-99).....	27.46	
02 86 00 00-0090 EA 55 Gallon Fiber Drum DOT-21C (100+).....	23.78	
02 86 00 00-0091 EA 10 Gallon, 20" Diameter, DOT 21C-250 Polyethylene/Polyester Lined.....	20.25	
02 86 00 00-0092 EA 20 Gallon, 20" Diameter, DOT 21C-250 Polyethylene/Polyester Lined.....	22.09	
02 86 00 00-0093 EA 20 Gallon, 23" Diameter, DOT 21C-250 Polyethylene/Polyester Lined.....	25.77	
02 86 00 00-0094 Loading Hazardous Waste For Shipment (02 86 00 00-0001)		
02 86 00 00-0095 EA Load Drums On Disposal Truck.....	8.22	
02 86 00 00-0096 EA Load Liquid Or Sludge Into 5,000 Gallon Bulk Tank Truck.....	884.94	
02 86 00 00-0097 Transport Drums To Landfill (02 86 00 00-0001)		
Note: Includes transportation for up to 25 miles.		
02 86 00 00-0098 EA Transport Drum To Landfill.....	49.47	
Note: Includes transportation for up to 25 miles.		
02 87 Bio-Hazard Material Remediation (02 80)		
Note: Tasks includes materials, equipment, mobilization, preparation, critical barriers (e.g. electrical outlets, registers, windows, etc.), signage, removal, clean-up, vacuuming, disposal, personnel health monitoring, documentation and other associated costs necessary for the complete removal and disposal of the contaminated material in accordance with EPA and local regulations. The quantity of the entire project, not a particular work area, is to be used in determining which tasks apply. There is a task with a unit of measure of EA for a quantity of less than 10 SF, followed by a series of tasks for additional quantities. For those tasks the contractor will be paid the first task with a unit of measure of EA, plus each additional task in sequence to arrive at the total quantity for the entire project, not a particular work area.		
02 87 00 00-0001 Bird Waste Removal (02 87)		
Note: In addition to items listed the Bio-Hazard Material Remediation note above, tasks include wetting agents and disinfection of contaminated surfaces.		
02 87 00 00-0002 EA Up To 10 SF Bird Waste Removal, Up To 3" Thickness.....	577.37	
<i>For Work In Restricted Working Space, Add</i>		
	173.21	
02 87 00 00-0003 SF >10 To 500 SF Bird Waste Removal, Up To 3" Thickness.....	9.62	
<i>For Work In Restricted Working Space, Add</i>		
	2.89	
02 87 00 00-0004 SF >500 To 2,500 SF Bird Waste Removal, Up To 3" Thickness.....	8.75	
<i>For Work In Restricted Working Space, Add</i>		
	2.63	
02 87 00 00-0005 SF >2,500 To 10,000 SF Bird Waste Removal, Up To 3" Thickness.....	7.96	
<i>For Work In Restricted Working Space, Add</i>		
	2.39	
02 87 00 00-0006 SF >10,000 SF Bird Waste Removal, Up To 3" Thickness.....	7.23	
<i>For Work In Restricted Working Space, Add</i>		
	2.17	
02 89 Hazmat Ancillary Tasks And Support (02 80)		
02 89 00 00-0001 Barriers And Protection (02 89)		
Note: Includes removal and disposal after use.		
02 89 00 00-0002 Isolation Barriers (02 89 00 00-0001)		
Note: Use framing task with applicable barrier task. See CSI section 01 56 16 00-0001 for temporary stud walls.		
02 89 00 00-0003 SF 1/2" Plywood For Solid Isolation Barrier.....	2.39	
02 89 00 00-0004 SF 6 Mil Plastic Sheeting For Separation Barrier.....	0.33	
02 89 00 00-0005 SF 1/2" Drywall For Solid Isolation Barrier.....	1.16	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
02 89 00 00-0006 SF 5/8" Drywall For Solid Isolation Barrier	1.28	
02 89 00 00-0007 Cleaning Surfaces <small>(02 89 00 00-0001)</small>		
<small>Note: Other surfaces within contamination area but not contaminated by, or part of removal.</small>		
02 89 00 00-0008 SF Up To 100 SF, Clean Asbestos Surface	1.41	
02 89 00 00-0009 SF >100 To 500 SF, Clean Asbestos Surface	0.99	
02 89 00 00-0010 SF >500 To 1,000 SF, Clean Asbestos Surface	0.64	
02 89 00 00-0011 SF >1,000 SF, Clean Asbestos Surface	0.49	
02 89 00 00-0012 Hazmat Containment Construction <small>(02 89 00 00-0001)</small>		
02 89 00 00-0013 SF 6 Mil Plastic Sheeting, Applied To Floors, Hazmat Containment Construction	0.33	
02 89 00 00-0014 SF 6 Mil Plastic Sheeting, Applied To Walls, Hazmat Containment Construction	0.44	
02 89 00 00-0015 SF 6 Mil Plastic Sheeting, Applied To Ceilings, Hazmat Containment Construction	0.60	
02 89 00 00-0016 SF 6 Mil Plastic Anti Static And Fire And Flame Retardant Sheeting, Applied To Floors, Hazmat Containment Construction	0.41	
02 89 00 00-0017 SF 6 Mil Plastic Anti Static And Fire And Flame Retardant Sheeting, Applied To Walls, Hazmat Containment Construction	0.52	
02 89 00 00-0018 SF 6 Mil Plastic Anti Static And Fire And Flame Retardant Sheeting, Applied To Ceilings, Hazmat Containment Construction	0.68	
02 89 00 00-0019 Decontamination Chambers <small>(02 89)</small>		
<small>Note: Includes removal after use.</small>		
02 89 00 00-0020 EA Portable Personnel Decontamination Wash Facility (3 Stage)	543.08	
<small>Note: Includes connection to negative air system.</small>		
<i>For Dismantling And Relocation To A Different Area, Add</i>		320.07
02 89 00 00-0021 EA Portable Waste Decontamination Unit	338.89	
<small>Note: Includes connection to negative air system.</small>		
<i>For Dismantling And Relocation To A Different Area, Add</i>		227.39
02 90 Disaster Recovery <small>(02)</small>		
<small>Note: The tasks in this division are only to be used when specifically requested by the Owner and are not to be combined with tasks from other divisions of this or other Construction Task Catalogs® unless specifically requested by the Owner.</small>		
02 90 50 Cleaning And Emergency Clean-up <small>(02 90)</small>		
02 90 50 00-0001 Non-Mold Contaminated Wet Material Removal <small>(02 90 50)</small>		
<small>Note: For materials that do not require mold abatement.</small>		
02 90 50 00-0002 SY Wet Broadloom Carpet Removal	7.19	
02 90 50 00-0003 SY Wet Carpet Tile Removal	1.75	
02 90 50 00-0004 SF Wet Batt Insulation Removal	0.15	
02 90 50 00-0005 SF Wet Ceiling Tile Removal	0.18	
02 90 50 00-0006 SF Single Layer, Wet Gypsum Board Removal	0.17	
02 90 50 00-0007 SF Double Layer, Wet Gypsum Board Removal	0.27	
02 90 50 00-0008 Cleaning <small>(02 90 50)</small>		
<small>Note: Use "Light Clean" when soot or dust is barely evident. Use "Medium Clean" when paint color can be seen through the soot or dust. Use "Heavy Clean" when paint color cannot be seen. Includes all man power, equipment and expendables required</small>		
02 90 50 00-0009 Clean Furnishings <small>(02 90 50 00-0008)</small>		
02 90 50 00-0010 EA Office Equipment, Exterior Wipe	25.86	
<i>For Medium Clean, Add</i>		10.86
<i>For Heavy Clean, Add</i>		33.62
02 90 50 00-0011 SF Bookcase (Per SF Of Face Area), Light Clean	1.44	
<i>For Medium Clean, Add</i>		0.60
<i>For Heavy Clean, Add</i>		1.87
02 90 50 00-0012 LF Shelving, Light Clean	2.59	
<i>For Medium Clean, Add</i>		1.09
<i>For Heavy Clean, Add</i>		3.37
02 90 50 00-0013 EA Plastic Or Metal Chair, Light Clean	7.47	
<i>For Medium Clean, Add</i>		3.14
<i>For Heavy Clean, Add</i>		9.71
02 90 50 00-0014 EA Upholstered Chair, Light Clean	24.14	
<i>For Medium Clean, Add</i>		10.14
<i>For Heavy Clean, Add</i>		31.38
02 90 50 00-0015 EA Upholstered Sofa, Light Clean	148.86	
<i>For Medium Clean, Add</i>		62.52
<i>For Heavy Clean, Add</i>		193.52
02 90 50 00-0016 EA Desk, Light Clean	30.46	
<i>For Medium Clean, Add</i>		12.79
<i>For Heavy Clean, Add</i>		39.60
02 90 50 00-0017 EA Table, Light Clean	28.74	
<i>For Medium Clean, Add</i>		12.07
<i>For Heavy Clean, Add</i>		37.36
02 90 50 00-0018 EA Two Drawer File Cabinet, Light Clean	6.30	
<i>For Medium Clean, Add</i>		2.65
<i>For Heavy Clean, Add</i>		8.19

02 Existing Conditions**02 90 Disaster Recovery****02 90 50 Cleaning And Emergency Clean-up**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
02 90 50 00-0019	EA		Four Drawer File Cabinet, Light Clean.....	8.06	
			<i>For Medium Clean, Add</i>	3.39	
			<i>For Heavy Clean, Add</i>	10.48	
02 90 50 00-0020	LF		Base Cabinet, Exterior Wipe, Light Clean.....	6.61	
			<i>For Medium Clean, Add</i>	2.78	
			<i>For Heavy Clean, Add</i>	8.59	
02 90 50 00-0021	LF		Base Cabinet, Exterior And Interior Wipe, Light Clean	12.93	
			<i>For Medium Clean, Add</i>	5.43	
			<i>For Heavy Clean, Add</i>	16.81	
02 90 50 00-0022	LF		Wall Cabinet, Exterior Wipe, Light Clean.....	6.61	
			<i>For Medium Clean, Add</i>	2.78	
			<i>For Heavy Clean, Add</i>	8.59	
02 90 50 00-0023	LF		Wall Cabinet, Exterior And Interior Wipe, Light Clean.....	11.50	
			<i>For Medium Clean, Add</i>	4.83	
			<i>For Heavy Clean, Add</i>	14.95	
02 90 50 00-0024	EA		Picture Frame, Glass And Back, Light Clean.....	2.76	
			<i>For Medium Clean, Add</i>	1.16	
			<i>For Heavy Clean, Add</i>	3.59	
02 90 50 00-0025 Clean Hard Surfaces (02 90 50 00-0008)					
02 90 50 00-0026	LF		Wood, Vinyl Or Rubber Baseboard, Light Clean.....	0.38	
			<i>For Medium Clean, Add</i>	0.16	
			<i>For Heavy Clean, Add</i>	0.49	
02 90 50 00-0027	EA		Door And Hardware (Per Side), Light Clean.....	4.89	
			<i>For Medium Clean, Add</i>	2.05	
			<i>For Heavy Clean, Add</i>	6.36	
02 90 50 00-0028	EA		Detailed Door And Hardware (Per Side), Light Clean.....	5.55	
			<i>For Medium Clean, Add</i>	2.33	
			<i>For Heavy Clean, Add</i>	7.22	
02 90 50 00-0029	SF		Overhead Door, Light Clean	0.39	
			<i>For Medium Clean, Add</i>	0.16	
			<i>For Heavy Clean, Add</i>	0.51	
02 90 50 00-0030	SF		Mirror, Light Clean	0.29	
			<i>For Medium Clean, Add</i>	0.12	
			<i>For Heavy Clean, Add</i>	0.38	
02 90 50 00-0031	SF		Window, Light Clean.....	0.85	
			<i>For Medium Clean, Add</i>	0.36	
			<i>For Heavy Clean, Add</i>	1.11	
02 90 50 00-0032	LF		Handrail, Light Clean	0.75	
			<i>For Medium Clean, Add</i>	0.32	
			<i>For Heavy Clean, Add</i>	0.98	
02 90 50 00-0033	LF		Bumper Rail, Light Clean.....	0.40	
			<i>For Medium Clean, Add</i>	0.17	
			<i>For Heavy Clean, Add</i>	0.52	
02 90 50 00-0034	SF		Hard Floor, Light Clean.....	0.33	
			<i>For Medium Clean, Add</i>	0.14	
			<i>For Heavy Clean, Add</i>	0.43	
02 90 50 00-0035	SF		Carpet, Light Clean.....	0.34	
			<i>For Medium Clean, Add</i>	0.14	
			<i>For Heavy Clean, Add</i>	0.44	
02 90 50 00-0036	SF		Hard Ceiling, Light Clean.....	0.27	
			<i>For Medium Clean, Add</i>	0.11	
			<i>For Heavy Clean, Add</i>	0.35	
02 90 50 00-0037	SF		Suspended Ceiling, Tile And Grid, Light Clean.....	0.29	
			<i>For Medium Clean, Add</i>	0.12	
			<i>For Heavy Clean, Add</i>	0.38	
02 90 50 00-0038	SF		Ceramic Tile Wall, Light Clean.....	0.24	
			<i>For Medium Clean, Add</i>	0.10	
			<i>For Heavy Clean, Add</i>	0.31	
02 90 50 00-0039	SF		Wall, Light Clean.....	0.17	
			<i>For Medium Clean, Add</i>	0.07	
			<i>For Heavy Clean, Add</i>	0.22	
02 90 50 00-0040	SF		Masonry Wall, Light Clean.....	0.24	
			<i>For Medium Clean, Add</i>	0.10	
			<i>For Heavy Clean, Add</i>	0.31	
02 90 50 00-0041	EA		Up To 24 SF Area Rug, Off-Site Cleaning, Light Clean.....	60.62	
			Note: Includes removal from site, cleaning, and return.		
			<i>For Medium Clean, Add</i>	25.46	
			<i>For Heavy Clean, Add</i>	78.81	
02 90 50 00-0042	EA		>24 To 96 SF Area Rug, Off-Site Cleaning, Light Clean.....	75.76	
			Note: Includes removal from site, cleaning, and return.		
			<i>For Medium Clean, Add</i>	31.82	
			<i>For Heavy Clean, Add</i>	98.49	
02 90 50 00-0043	EA		>96 To 140 SF Area Rug, Off-Site Cleaning, Light Clean.....	90.92	
			Note: Includes removal from site, cleaning, and return.		
			<i>For Medium Clean, Add</i>	38.19	
			<i>For Heavy Clean, Add</i>	118.20	
02 90 50 00-0044	EA		>140 To 216 SF Area Rug, Off-Site Cleaning, Light Clean.....	106.07	
			<i>For Medium Clean, Add</i>	44.55	
			<i>For Heavy Clean, Add</i>	137.89	

02 90 50 00-0045 Clean Window Treatments (02 90 50 00-0008)



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
02 90 50 00-0046 SF Window Blind, Light Clean.....	0.66	
<i>For Medium Clean, Add</i>	0.28	
<i>For Heavy Clean, Add</i>	0.86	
02 90 50 00-0047 EA Up To 6' Long Drapery (Per Pleat), Light Clean	1.34	
<i>For Medium Clean, Add</i>	0.56	
<i>For Heavy Clean, Add</i>	1.74	
02 90 50 00-0048 EA Up To 6' Long Lined Drapery (Per Pleat), Light Clean.....	1.55	
<i>For Medium Clean, Add</i>	0.65	
<i>For Heavy Clean, Add</i>	2.02	
02 90 50 00-0049 EA >6' To 8' Drapery (Per Pleat), Light Clean	1.42	
<i>For Medium Clean, Add</i>	0.60	
<i>For Heavy Clean, Add</i>	1.85	
02 90 50 00-0050 EA >6' To 8' Lined Drapery (Per Pleat), Light Clean	1.63	
<i>For Medium Clean, Add</i>	0.68	
<i>For Heavy Clean, Add</i>	2.12	
02 90 50 00-0051 EA >8' To 10' Drapery (Per Pleat), Light Clean	1.73	
<i>For Medium Clean, Add</i>	0.73	
<i>For Heavy Clean, Add</i>	2.25	
02 90 50 00-0052 EA >8' To 10' Lined Drapery (Per Pleat), Light Clean.....	1.99	
<i>For Medium Clean, Add</i>	0.84	
<i>For Heavy Clean, Add</i>	2.59	
02 90 50 00-0053 Clean Appliances <small>(02 90 50 00-0008)</small>		
02 90 50 00-0054 EA Microwave Oven, Outside, Light Clean.....	11.91	
<i>For Medium Clean, Add</i>	5.00	
<i>For Heavy Clean, Add</i>	15.48	
02 90 50 00-0055 EA Refrigerator, Outside, Light Clean	28.06	
<i>For Medium Clean, Add</i>	11.79	
<i>For Heavy Clean, Add</i>	36.48	
02 90 50 00-0056 EA Range, Outside, Light Clean.....	24.25	
<i>For Medium Clean, Add</i>	10.19	
<i>For Heavy Clean, Add</i>	31.53	
02 90 50 00-0057 Clean Plumbing <small>(02 90 50 00-0008)</small>		
02 90 50 00-0058 EA Water Heater, Light Clean	17.24	
<i>For Medium Clean, Add</i>	7.24	
<i>For Heavy Clean, Add</i>	22.41	
02 90 50 00-0059 EA Plumbing Fixture, Light Clean.....	17.41	
<i>For Medium Clean, Add</i>	7.31	
<i>For Heavy Clean, Add</i>	22.63	
02 90 50 00-0060 EA Restroom Accessory, Light Clean.....	7.99	
<i>For Medium Clean, Add</i>	3.36	
<i>For Heavy Clean, Add</i>	10.39	
02 90 50 00-0061 Clean HVAC <small>(02 90 50 00-0008)</small>		
02 90 50 00-0062 LF Baseboard Heater, Light Clean.....	5.15	
<i>For Medium Clean, Add</i>	2.16	
<i>For Heavy Clean, Add</i>	6.70	
02 90 50 00-0063 LF Ductwork, Exterior Wipe, Light Clean	14.37	
<i>For Medium Clean, Add</i>	6.04	
<i>For Heavy Clean, Add</i>	18.68	
02 90 50 00-0064 EA Ductwork, Interior (Per Grille/Register), Light Clean	55.18	
<i>For Medium Clean, Add</i>	23.18	
<i>For Heavy Clean, Add</i>	71.73	
02 90 50 00-0065 EA Grille/Register, Light Clean.....	5.17	
<i>For Medium Clean, Add</i>	2.17	
<i>For Heavy Clean, Add</i>	6.72	
02 90 50 00-0066 EA Air Handling Unit, Exterior Wipe, Light Clean	35.83	
<i>For Medium Clean, Add</i>	15.05	
<i>For Heavy Clean, Add</i>	46.58	
02 90 50 00-0067 EA Furnace, Exterior Wipe, Light Clean	31.90	
<i>For Medium Clean, Add</i>	13.40	
<i>For Heavy Clean, Add</i>	41.47	
02 90 50 00-0068 Clean Electrical <small>(02 90 50 00-0008)</small>		
02 90 50 00-0069 EA Electric Fan, Light Clean.....	21.27	
<i>For Medium Clean, Add</i>	8.93	
<i>For Heavy Clean, Add</i>	27.65	
02 90 50 00-0070 EA Ceiling Fan, Light Clean	22.99	
<i>For Medium Clean, Add</i>	9.66	
<i>For Heavy Clean, Add</i>	29.89	
02 90 50 00-0071 EA Ceiling Fan And Light, Light Clean	29.89	
<i>For Medium Clean, Add</i>	12.55	
<i>For Heavy Clean, Add</i>	38.86	
02 90 50 00-0072 EA Ceiling Exhaust Fan, Light Clean.....	20.98	
<i>For Medium Clean, Add</i>	8.81	
<i>For Heavy Clean, Add</i>	27.27	
02 90 50 00-0073 EA 2' x 4' Light Fixture, Light Clean.....	13.79	
<i>For Medium Clean, Add</i>	5.79	
<i>For Heavy Clean, Add</i>	17.93	

02 Existing Conditions**02 90 Disaster Recovery****02 90 50 Cleaning And Emergency Clean-up**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
02 90 50 00-0074 EA Light Fixture, Light Clean..... <i>For Medium Clean, Add</i> <i>For Heavy Clean, Add</i>	6.32 2.65 8.22	
02 90 50 00-0075 EA Smoke Detector, Light Clean..... <i>For Medium Clean, Add</i> <i>For Heavy Clean, Add</i>	4.89 2.05 6.36	
02 90 50 00-0076 EA Thermostat, Light Clean..... <i>For Medium Clean, Add</i> <i>For Heavy Clean, Add</i>	1.72 0.72 2.24	
02 90 50 00-0077 Thermal Fog (02 90 50 00-0008)		
02 90 50 00-0078 CF Clean And Deodorize Building With Thermal Fog.....		0.02
02 90 50 00-0079 Contents Manipulation (02 90 50)		
02 90 50 00-0080 SF Cover Contents With Plastic.....	0.19	
02 90 50 00-0081 SF Floor Protection - Adhesive Film.....	0.24	
02 90 50 00-0082 SF Move Contents Out And Later Reset.....	0.46	
02 90 50 00-0083 MO 20' Long Job Site Storage Trailer.....	108.98	
02 90 50 00-0084 MO 40' Long Job Site Storage Trailer.....	144.53	
02 90 50 00-0085 EA Delivery Or Pickup Job Site Storage Trailer.....	133.69	
02 90 50 00-0086 Water Emergency Clean-up (02 90 50)		
02 90 50 00-0087 LF Detach Baseboard.....	0.62	
02 90 50 00-0088 LF Detach And Later Reset Baseboard.....	1.09	
02 90 50 00-0089 EA Block And Pad Furniture (Per Piece Of Furniture).....	4.01	
02 90 50 00-0090 SF Water Extraction From Floor.....	0.41	
02 90 50 00-0091 SF Gray Water Extraction From Floor.....	0.68	
02 90 50 00-0092 SF Black Water Extraction From Floor.....	1.06	
02 90 50 00-0093 SF Tear Out Wet Non Salvageable Carpet.....	0.34	
02 90 50 00-0094 SF Tear Out Wet Non Salvageable Carpet, Black Water.....	0.40	
02 90 50 00-0095 SF Tear Out Wet Non Salvageable Glue Down Carpet.....	0.59	
02 90 50 00-0096 SF Tear Out Wet Non Salvageable Glue Down Carpet, Black Water.....	0.87	
02 90 50 00-0097 SF Tear Out Vinyl Flooring.....	0.82	
02 90 50 00-0098 SF Tear Out Vinyl Flooring, Black Water.....	1.20	
02 90 50 00-0099 SF Tear Out Wood Flooring, Black Water.....	3.11	
02 90 50 00-0100 SF Tear Out Laminated Wood Flooring.....	1.53	
02 90 50 00-0101 SF Tear Out Laminated Wood Flooring, Black Water.....	2.24	
02 90 50 00-0102 SF Tear Out Wet Ceiling Tile.....	0.25	
02 90 50 00-0103 SF Tear Out Batt Insulation.....	0.25	
02 90 50 00-0104 SF Tear Out Wet Gypsum Board.....	0.33	
02 90 50 00-0105 SF Apply Antimicrobial Agent.....	0.19	
02 90 50 00-0106 SF HEPA Vacuuming.....	0.33	
02 90 50 00-0107 Emergency Clean-up Labor (02 90 50)		
Note: Used in the performance of time and material projects. Not to be used in conjunction with tasks in the Cleaning, Contents Manipulation, and Water Emergency Clean-up sections.		
02 90 50 00-0108 HR Cleaning And Emergency Clean Up - General Laborer (Unskilled).....	24.30	
02 90 50 00-0109 HR Cleaning And Emergency Clean Up - General Laborer (Skilled).....	32.40	
02 90 50 00-0110 HR Cleaning And Emergency Clean Up - Skilled Tradesman.....	59.40	
02 90 50 00-0111 HR Cleaning And Emergency Clean Up - Restoration Laborer.....	37.80	
02 90 50 00-0112 HR Cleaning And Emergency Clean Up - Restoration Technician.....	48.60	
02 90 50 00-0113 HR Cleaning And Emergency Clean Up - Restoration Supervisor.....	70.20	
02 90 50 00-0114 HR Cleaning And Emergency Clean Up - Restoration Project Manager.....	97.20	
02 90 50 00-0115 HR Cleaning And Emergency Clean Up - Assistant Project Manager.....	81.00	
02 90 50 00-0116 HR Cleaning And Emergency Clean Up - Project Manager.....	102.60	
02 90 50 00-0117 HR Cleaning And Emergency Clean Up - Project Director.....	156.60	
02 90 50 00-0118 HR Cleaning And Emergency Clean Up - Resource Coordinator.....	48.60	
02 90 50 00-0119 HR Cleaning And Emergency Clean Up - Project Accountant.....	81.00	
02 90 50 00-0120 HR Cleaning And Emergency Clean Up - Corrosion Technician.....	70.20	
02 90 50 00-0121 HR Cleaning And Emergency Clean Up - Sr. Corrosion Technician.....	81.00	
02 90 50 00-0122 HR Cleaning And Emergency Clean Up - Certified Mold Technician.....	71.28	
02 90 50 00-0123 HR Cleaning And Emergency Clean Up - Certified Mold Supervisor.....	81.00	
02 90 50 00-0124 HR Cleaning And Emergency Clean Up - Clerical.....	37.80	
02 90 50 00-0125 HR Cleaning And Emergency Clean Up - Biohazard Technician.....	81.00	
02 90 50 00-0126 HR Cleaning And Emergency Clean Up - Biohazard Supervisor.....	0.00	
02 90 50 00-0127 HR Cleaning And Emergency Clean Up - Health And Safety Officer.....	75.60	
02 90 50 00-0128 HR Cleaning And Emergency Clean Up - Resource And Logistics Coordinator.....	54.00	
02 90 50 00-0129 HR Cleaning And Emergency Clean Up - Restoration Consultant.....	156.60	
02 90 50 00-0130 Emergency Clean-up Equipment (02 90 50)		
Note: Used in the performance of time and material projects. Used in the performance of time and material projects. Not used in conjunction with tasks in the Cleaning, Contents Manipulation, and Water Emergency Clean-up sections.		
02 90 50 00-0131 General Emergency Clean-up Equipment (02 90 50 00-0130)		
02 90 50 00-0132 DAY Air Compressor.....	52.62	
02 90 50 00-0133 DAY Buffer - Floor.....	35.08	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
02 90 50 00-0134 DAY Carpet Cleaning Machine - Portable.....	87.70	
02 90 50 00-0135 DAY Chain Saw.....	40.93	
02 90 50 00-0136 EA Cleaning Kit With Mop, Broom And Bucket.....	52.62	
02 90 50 00-0137 DAY Cut Off Saw.....	66.24	
02 90 50 00-0138 DAY Dry Cleaning Unit - Portable.....	99.39	
02 90 50 00-0139 DAY Extension Cords - 220 Volt.....	29.23	
02 90 50 00-0140 DAY Extension Cords - 220 Volt Converter Box.....	17.54	
02 90 50 00-0141 DAY Demolition Cart, 7 Yard.....	52.62	
02 90 50 00-0142 EA Demolition Kit With Wheel Barrow, Shovel And Broom.....	87.70	
02 90 50 00-0143 DAY Dry-Ice Blasting System.....	409.26	
02 90 50 00-0144 DAY Fogger - Mist.....	29.23	
02 90 50 00-0145 DAY Fogger - Electric Thermal.....	42.09	
02 90 50 00-0146 DAY Fogger - Gas Power Thermal.....	105.24	
02 90 50 00-0147 JOB Gang Box, Demo/Framing (One Time Per Job).....	76.00	
02 90 50 00-0148 DAY Hand Trucks/Dollies.....	14.03	
02 90 50 00-0149 DAY Heat Gun - Shrinkwrap.....	46.77	
02 90 50 00-0150 DAY HEPA Negative Air Machine.....	146.16	
Note: Includes all filters.		
02 90 50 00-0151 DAY Ladder.....	19.88	
02 90 50 00-0152 DAY Lights - Demo, Drop, Stand, String.....	21.05	
02 90 50 00-0153 DAY Lights - Wobble.....	25.72	
02 90 50 00-0154 DAY Moisture Meter.....	29.23	
02 90 50 00-0155 DAY Nail Gun.....	52.62	
02 90 50 00-0156 DAY Ozone Generator.....	146.16	
02 90 50 00-0157 DAY PPE (Personal Protective Equipment) Mold Remediation Related.....	70.16	
02 90 50 00-0158 DAY Portable Generator, Up To 7,500 Watts.....	116.93	
02 90 50 00-0159 DAY Pressure Washer, Hot.....	175.40	
02 90 50 00-0160 DAY Pressure Washer, Cold.....	116.93	
02 90 50 00-0161 DAY Scaffolding - Per Section.....	76.00	
02 90 50 00-0162 DAY Small Tools - Tool Box.....	29.23	
02 90 50 00-0163 DAY Soda Blasting Equipment.....	263.09	
02 90 50 00-0164 DAY Sprayer - Hudson.....	9.35	
02 90 50 00-0165 DAY Sprayer - Industrial Airless.....	124.20	
02 90 50 00-0166 DAY Storage Space (Per SF Per Day).....	0.96	
02 90 50 00-0167 DAY Submersible Pump.....	29.23	
02 90 50 00-0168 DAY Trash Pump - 2" Gas Powered.....	146.16	
02 90 50 00-0169 DAY Vehicle, Pick-up, SUV, Car.....	87.70	
02 90 50 00-0170 DAY Vehicle, Van.....	146.16	
02 90 50 00-0171 DAY Vehicle, 16' Or 24' Box Truck (Inclusive Of Mileage).....	233.86	
02 90 50 00-0172 DAY Trailer - Refrigerated 40' Storage.....	146.16	
02 90 50 00-0173 DAY Trailer - Utility (Inclusive Of Mileage).....	116.93	
02 90 50 00-0174 DAY Truck Mount, Per Wand Extraction.....	228.01	
02 90 50 00-0175 DAY Vacuum - Backpack.....	29.23	
02 90 50 00-0176 DAY Vacuum - Shop Vacuum.....	29.23	
02 90 50 00-0177 DAY Vacuum - Commercial.....	87.70	
02 90 50 00-0178 DAY Vacuum - HEPA Industrial.....	99.39	
02 90 50 00-0179 DAY Vacuum - Upright.....	17.54	
02 90 50 00-0180 DAY Zip Walls (Per 2 Poles).....	29.23	
02 90 50 00-0181 DAY 2 Way Radio.....	23.39	
02 90 50 00-0182 Technical/Electronics Restoration Equipment (02 90 50 00-0130)		
02 90 50 00-0183 DAY Computer - Diagnostic.....	29.23	
02 90 50 00-0184 WK Computer - Diagnostic.....	80.39	
02 90 50 00-0185 MO Computer - Diagnostic.....	219.24	
02 90 50 00-0186 DAY Convection Oven - Large.....	192.93	
02 90 50 00-0187 WK Convection Oven - Large.....	530.57	
02 90 50 00-0188 MO Convection Oven - Large.....	1,447.01	
02 90 50 00-0189 DAY Convection Oven - Small.....	105.24	
02 90 50 00-0190 WK Convection Oven - Small.....	289.40	
02 90 50 00-0191 MO Convection Oven - Small.....	789.28	
02 90 50 00-0192 DAY Convection Oven - Vacuum.....	140.32	
02 90 50 00-0193 WK Convection Oven - Vacuum.....	385.87	
02 90 50 00-0194 MO Convection Oven - Vacuum.....	1,052.37	
02 90 50 00-0195 DAY Decontamination Booth.....	192.93	
02 90 50 00-0196 WK Decontamination Booth.....	530.57	
02 90 50 00-0197 MO Decontamination Booth.....	1,447.01	
02 90 50 00-0198 DAY DI Water System.....	52.62	
02 90 50 00-0199 WK DI Water System.....	144.70	
02 90 50 00-0200 MO DI Water System.....	394.64	
02 90 50 00-0201 DAY ESD Bench Workstation.....	23.39	
02 90 50 00-0202 WK ESD Bench Workstation.....	64.31	
02 90 50 00-0203 MO ESD Bench Workstation.....	175.40	
02 90 50 00-0204 DAY Heater/Enclosure Control System.....	17.54	
02 90 50 00-0205 WK Heater/Enclosure Control System.....	48.23	
02 90 50 00-0206 MO Heater/Enclosure Control System.....	131.55	
02 90 50 00-0207 DAY Hi-Tech Mobile Cart/Workstation.....	292.32	
02 90 50 00-0208 WK Hi-Tech Mobile Cart/Workstation.....	803.89	
02 90 50 00-0209 MO Hi-Tech Mobile Cart/Workstation.....	2,192.44	
02 90 50 00-0210 DAY Micro-Blaster/Dust Collector.....	263.09	
02 90 50 00-0211 WK Micro-Blaster/Dust Collector.....	723.50	

02 Existing Conditions**02 90 Disaster Recovery****02 90 50 Cleaning And Emergency Clean-up**

MINOR			TOTAL DIRECT	DEMOLITION
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST
02 90 50 00-0212	MO	Micro-Blaster/Dust Collector	1,973.19	
02 90 50 00-0213	DAY	Mobile Laboratory	730.81	
02 90 50 00-0214	WK	Mobile Laboratory	2,009.73	
02 90 50 00-0215	MO	Mobile Laboratory	5,481.09	
02 90 50 00-0216	DAY	Nitrogen Enclosure Cabinet	14.03	
02 90 50 00-0217	WK	Nitrogen Enclosure Cabinet	38.59	
02 90 50 00-0218	MO	Nitrogen Enclosure Cabinet	105.24	
02 90 50 00-0219	DAY	Odell Cleaning Station	409.26	
02 90 50 00-0220	WK	Odell Cleaning Station	1,125.45	
02 90 50 00-0221	MO	Odell Cleaning Station	3,069.41	
02 90 50 00-0222	DAY	Parts Washer	29.23	
02 90 50 00-0223	WK	Parts Washer	80.39	
02 90 50 00-0224	MO	Parts Washer	219.24	
02 90 50 00-0225	DAY	Ultrasonic Cleaning System	87.70	
02 90 50 00-0226	WK	Ultrasonic Cleaning System	241.17	
02 90 50 00-0227	MO	Ultrasonic Cleaning System	657.73	
02 90 50 00-0228	DAY	Vacuum - HEPA Technical	23.39	
02 90 50 00-0229	WK	Vacuum - HEPA Technical	64.31	
02 90 50 00-0230	MO	Vacuum - HEPA Technical	175.40	
02 90 50 00-0231 Drying/Dehumidification Equipment (02 90 50 00-0130)				
02 90 50 00-0232	DAY	Water Extraction Unit With Dual 3-Stage Vacuums, 202 CFM	146.16	
		Note: Includes 25' high Pressure solution hose and 25' Vacuum hose.		
02 90 50 00-0233	WK	Water Extraction Unit With Dual 3-Stage Vacuums, 202 CFM	401.95	
		Note: Includes 25' high Pressure solution hose and 25' Vacuum hose.		
02 90 50 00-0234	MO	Water Extraction Unit With Dual 3-Stage Vacuums, 202 CFM	1,096.22	
		Note: Includes 25' high Pressure solution hose and 25' Vacuum hose.		
02 90 50 00-0235	DAY	Centrifugal Air Mover, 2200 CFM.....	29.23	
02 90 50 00-0236	WK	Centrifugal Air Mover, 2200 CFM.....	80.39	
02 90 50 00-0237	MO	Centrifugal Air Mover, 2200 CFM.....	219.24	
02 90 50 00-0238	DAY	Axial Air Mover, 3000 CFM	76.00	
02 90 50 00-0239	WK	Axial Air Mover, 3000 CFM	209.01	
02 90 50 00-0240	MO	Axial Air Mover, 3000 CFM	570.03	
02 90 50 00-0241	DAY	Injectidry System.....	181.24	
02 90 50 00-0242	WK	Injectidry System.....	498.41	
02 90 50 00-0243	MO	Injectidry System.....	1,359.31	
02 90 50 00-0244	DAY	1200 Drizair Refrigerant Dehumidifier	122.78	
02 90 50 00-0245	WK	1200 Drizair Refrigerant Dehumidifier	337.64	
02 90 50 00-0246	MO	1200 Drizair Refrigerant Dehumidifier	920.82	
02 90 50 00-0247	DAY	2000 Drizair Refrigerant Dehumidifier	146.16	
02 90 50 00-0248	WK	2000 Drizair Refrigerant Dehumidifier	401.95	
02 90 50 00-0249	MO	2000 Drizair Refrigerant Dehumidifier	1,096.22	
02 90 50 00-0250	DAY	2400 Drizair Refrigerant Dehumidifier	169.55	
02 90 50 00-0251	WK	2400 Drizair Refrigerant Dehumidifier	466.26	
02 90 50 00-0252	MO	2400 Drizair Refrigerant Dehumidifier	1,271.61	
02 90 50 00-0253	DAY	Phoenix 200 Refrigerant Dehumidifier	169.55	
02 90 50 00-0254	WK	Phoenix 200 Refrigerant Dehumidifier	466.26	
02 90 50 00-0255	MO	Phoenix 200 Refrigerant Dehumidifier	1,271.61	
02 90 50 00-0256	DAY	Phoenix 300 Refrigerant Dehumidifier	181.24	
02 90 50 00-0257	WK	Phoenix 300 Refrigerant Dehumidifier	498.41	
02 90 50 00-0258	MO	Phoenix 300 Refrigerant Dehumidifier	1,359.31	
02 90 50 00-0259	DAY	D-500 Desiccant Dehumidifier	409.26	
02 90 50 00-0260	WK	D-500 Desiccant Dehumidifier	1,125.45	
02 90 50 00-0261	MO	D-500 Desiccant Dehumidifier	3,069.41	
02 90 50 00-0262	DAY	D-750 Desiccant Dehumidifier	701.58	
02 90 50 00-0263	WK	D-750 Desiccant Dehumidifier	1,929.34	
02 90 50 00-0264	MO	D-750 Desiccant Dehumidifier	5,261.85	
02 90 50 00-0265	DAY	D-1000 Desiccant Dehumidifier	789.28	
02 90 50 00-0266	WK	D-1000 Desiccant Dehumidifier	2,170.51	
02 90 50 00-0267	MO	D-1000 Desiccant Dehumidifier	5,919.58	
02 90 50 00-0268	DAY	D-1500 Desiccant Dehumidifier	876.98	
02 90 50 00-0269	WK	D-1500 Desiccant Dehumidifier	2,411.68	
02 90 50 00-0270	MO	D-1500 Desiccant Dehumidifier	6,577.31	
02 90 50 00-0271	DAY	D-2000 Desiccant Dehumidifier	935.44	
02 90 50 00-0272	WK	D-2000 Desiccant Dehumidifier	2,572.46	
02 90 50 00-0273	MO	D-2000 Desiccant Dehumidifier	7,015.80	
02 90 50 00-0274	DAY	D-2250 Desiccant Dehumidifier	993.90	
02 90 50 00-0275	WK	D-2250 Desiccant Dehumidifier	2,733.24	
02 90 50 00-0276	MO	D-2250 Desiccant Dehumidifier	7,454.29	
02 90 50 00-0277	DAY	D-3000 Desiccant Dehumidifier	1,128.37	
02 90 50 00-0278	WK	D-3000 Desiccant Dehumidifier	3,103.03	
02 90 50 00-0279	MO	D-3000 Desiccant Dehumidifier	8,462.81	
02 90 50 00-0280	DAY	D-4500 Desiccant Dehumidifier	1,403.16	
02 90 50 00-0281	WK	D-4500 Desiccant Dehumidifier	3,858.69	
02 90 50 00-0282	MO	D-4500 Desiccant Dehumidifier	10,523.70	
02 90 50 00-0283	DAY	D-5000 Desiccant Dehumidifier	1,578.56	
02 90 50 00-0284	WK	D-5000 Desiccant Dehumidifier	4,341.03	
02 90 50 00-0285	MO	D-5000 Desiccant Dehumidifier	11,839.16	
02 90 50 00-0286	DAY	D-9000 Desiccant Dehumidifier	2,163.20	
02 90 50 00-0287	WK	D-9000 Desiccant Dehumidifier	5,948.81	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
02 90 50 00-0288 MO D-9000 Desiccant Dehumidifier	16,224.04	
02 90 50 00-0289 DAY D-10500 Desiccant Dehumidifier	2,572.46	
02 90 50 00-0290 WK D-10500 Desiccant Dehumidifier	7,074.26	
02 90 50 00-0291 MO D-10500 Desiccant Dehumidifier	19,293.45	
02 90 50 00-0292 DAY DX Unit - Heating / Air Conditioning (3.5 Ton)	409.26	
02 90 50 00-0293 WK DX Unit - Heating / Air Conditioning (3.5 Ton)	1,125.45	
02 90 50 00-0294 MO DX Unit - Heating / Air Conditioning (3.5 Ton)	3,069.41	
02 90 50 00-0295 DAY DX Unit - Heating / Air Conditioning (5 Ton)	578.80	
02 90 50 00-0296 WK DX Unit - Heating / Air Conditioning (5 Ton)	1,591.71	
02 90 50 00-0297 MO DX Unit - Heating / Air Conditioning (5 Ton)	4,341.03	
02 90 50 00-0298 DAY DX Unit - Heating / Air Conditioning (10 Ton)	701.58	
02 90 50 00-0299 WK DX Unit - Heating / Air Conditioning (10 Ton)	1,929.34	
02 90 50 00-0300 MO DX Unit - Heating / Air Conditioning (10 Ton)	5,261.85	
02 90 50 00-0301 DAY DX Unit - Heating / Air Conditioning (25 Ton)	876.98	
02 90 50 00-0302 WK DX Unit - Heating / Air Conditioning (25 Ton)	2,411.68	
02 90 50 00-0303 MO DX Unit - Heating / Air Conditioning (25 Ton)	6,577.31	
02 90 50 00-0304 DAY DX Unit - Heating / Air Conditioning (50 Ton)	1,140.07	
02 90 50 00-0305 WK DX Unit - Heating / Air Conditioning (50 Ton)	3,135.19	
02 90 50 00-0306 MO DX Unit - Heating / Air Conditioning (50 Ton)	8,550.51	
02 90 50 00-0307 DAY DX Unit - Heating / Air Conditioning (80 Ton)	1,578.56	
02 90 50 00-0308 WK DX Unit - Heating / Air Conditioning (80 Ton)	4,341.03	
02 90 50 00-0309 MO DX Unit - Heating / Air Conditioning (80 Ton)	11,839.16	
02 90 50 00-0310 DAY Flex Duct - 25'	23.39	
02 90 50 00-0311 WK Flex Duct - 25'	64.31	
02 90 50 00-0312 MO Flex Duct - 25'	175.40	
02 90 50 00-0313 DAY Hygro Thermograph	29.23	
02 90 50 00-0314 WK Hygro Thermograph	80.39	
02 90 50 00-0315 MO Hygro Thermograph	219.24	
02 90 50 00-0316 DAY Dehumidification Trailer With 1,500 CFM Desiccant Unit	5,115.69	
Note: Includes 400 KW generator, 1500 CFM desiccant DH, 25 Ton DX unit, 1000 gallon fuel tank, and limited electrical distribution.		
02 90 50 00-0317 WK Dehumidification Trailer With 1,500 CFM Desiccant Unit	14,068.14	
Note: Includes 400 KW generator, 1500 CFM desiccant DH, 25 Ton DX unit, 1000 gallon fuel tank, and limited electrical distribution.		
02 90 50 00-0318 MO Dehumidification Trailer With 1,500 CFM Desiccant Unit	38,367.66	
Note: Includes 400 KW generator, 1500 CFM desiccant DH, 25 Ton DX unit, 1000 gallon fuel tank, and limited electrical distribution.		
02 90 50 00-0319 Power Equipment (02 90 50 00-0130)		
02 90 50 00-0320 WK Generator, Up to 65 KVA	3,040.18	
02 90 50 00-0321 WK Generator, Up to 125 KVA	3,390.97	
02 90 50 00-0322 WK Generator, Up to 250 KVA	4,443.34	
02 90 50 00-0323 WK Generator, Up to 375 KVA	5,378.78	
02 90 50 00-0324 WK Generator, Up to 440 KVA	6,781.94	
02 90 50 00-0325 WK Generator, Up to 625 KVA	8,652.82	
02 90 50 00-0326 WK Generator, Up to 800 KVA	14,733.18	
02 90 50 00-0327 WK Generator, Up to 1,000 KVA	19,176.52	
02 90 50 00-0328 WK Generator, Up to 1,500 KVA	23,853.72	
02 90 50 00-0329 EA Generator Cable/Pigtails (Per Section)	11.69	
02 90 50 00-0330 EA Sub-Distribution Panel (Spider Box)	76.00	
02 90 50 00-0331 EA Electrical Distribution Panel	233.86	
02 90 50 00-0332 EA Quad Box Strings (25' Sections)	29.23	
02 90 50 00-0333 EA 50' Power Cord For Spider Box	29.23	
02 90 50 00-0334 EA Pig Tails (Per Each)	2.92	
02 90 50 00-0335 Freight Charges (02 90 50 00-0130)		
02 90 50 00-0336 MI Freight Up To 1 Ton Pick Up Truck	1.46	
02 90 50 00-0337 MI Freight >1 Ton Pick Up Truck	2.63	
02 90 50 00-0338 MI Freight 16' Or 24' Box Truck	2.63	
02 90 50 00-0339 MI Freight Tractor Trailer	3.80	
02 90 50 00-0340 Emergency Clean-up Personal Protection Equipment (02 90 50)		
Note: Used in the performance of time and material projects. Used in the performance of time and material projects. Not used in conjunction with tasks in the Cleaning, Contents Manipulation, and Water Emergency Clean-up sections.		
02 90 50 00-0341 EA Tyvek Suit	8.77	
02 90 50 00-0342 EA Cartridge - Respirator	14.03	
02 90 50 00-0343 BOX Dust Mask	31.86	
02 90 50 00-0344 PR Gloves - Cotton	5.26	
02 90 50 00-0345 BOX Gloves - Latex	15.79	
02 90 50 00-0346 PR Gloves - Leather	8.77	
02 90 50 00-0347 EA Gloves - Rubber (Heavy Duty)	4.68	
02 90 50 00-0348 PR Polycarbonate Lens Safety Goggles	8.65	
02 90 50 00-0349 EA Respirator - With One Pair Cartridges	39.65	
02 90 50 00-0350 PR Safety Glasses	3.79	
02 90 50 00-0351 EA Safety Harness (Per Person/Day)	5.85	

02 Existing Conditions**02 90 Disaster Recovery****02 90 50 Cleaning And Emergency Clean-up**

MINOR

CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST**02 90 50 00-0352****Emergency Clean-up Expendables** (02 90 50)

Note: Used in the performance of time and material projects. Used in the performance of time and material projects. Not used in conjunction with tasks in the Cleaning, Contents Manipulation, and Water Emergency Clean-up sections.

02 90 50 00-0353**General Materials** (02 90 50 00-0352)

02 90 50 00-0354	GAL Adhesive Remover.....	87.70
02 90 50 00-0355	GAL Bio-HS	24.92
02 90 50 00-0356	GAL Biocide.....	31.79
02 90 50 00-0357	EA Box - Book.....	4.62
02 90 50 00-0358	EA Box - Large.....	7.60
02 90 50 00-0359	GAL Bleach.....	4.09
02 90 50 00-0360	EA Brush - Stainless - Small.....	5.59
02 90 50 00-0361	EA Buckets - 2 1/2 Gal.....	6.17
02 90 50 00-0362	EA Buckets - 5 Gallon.....	9.35
02 90 50 00-0363	GAL Carpet Defoamer.....	24.06
02 90 50 00-0364	GAL Carpet Pre-treat.....	23.12
02 90 50 00-0365	GAL Carpet Spotter.....	34.92
02 90 50 00-0366	GAL Carpet/Upholstery Cleaner.....	31.41
02 90 50 00-0367	ROL Carpet Masking/Shield.....	77.17
02 90 50 00-0368	EA Chem Sponge.....	3.45
02 90 50 00-0369	GAL Clear Seal.....	87.70
02 90 50 00-0370	GAL Coil Cleaner.....	28.06
02 90 50 00-0371	EA Comfort Masks, Per Box 50.....	34.67
02 90 50 00-0372	EA Coverall - Bio-Hazard.....	24.39
02 90 50 00-0373	EA Decon Chamber.....	239.71
02 90 50 00-0374	GAL Degreaser, All Purpose.....	32.74
02 90 50 00-0375	GAL De-Foamer Liquid.....	35.08
02 90 50 00-0376	EA Deodorization Membrane.....	83.79
02 90 50 00-0377	GAL Deodorizer, 9D9.....	90.33
02 90 50 00-0378	LB Deodorizing Gel.....	15.20
02 90 50 00-0379	GAL Deodorizing Liquid.....	44.43
02 90 50 00-0380	PAIL Deodorizing Block.....	52.62
02 90 50 00-0381	GAL Disinfectant/Antimicrobial.....	56.71
02 90 50 00-0382	GAL Disinfectant, BruClean.....	28.06
02 90 50 00-0383	GAL Dryclene.....	34.92
02 90 50 00-0384	GAL Duct Sealant Spray.....	52.62
02 90 50 00-0385	GAL Duct Sealant, Antifungal.....	76.00
02 90 50 00-0386	GAL Microbial Encapsulant (Fosters 20 - 40).....	108.16
02 90 50 00-0387	PR Ear Plugs.....	0.47
02 90 50 00-0388	GAL Encapsulant.....	107.42
02 90 50 00-0389	GAL Fiberlocke - Aftershock.....	95.40
02 90 50 00-0390	GAL Fiberlocke - IAQ 2500.....	90.25
02 90 50 00-0391	GAL Fiberlocke - IAS 6000.....	92.82
02 90 50 00-0392	ROL Filter Material.....	76.00
02 90 50 00-0393	EA Filter, Blue Paper Collection Bag.....	5.79
02 90 50 00-0394	EA Filter, CVAC For HEPA Vacuum.....	263.38
02 90 50 00-0395	EA Filter, Pre-Filter For Negative Air Machine.....	4.50
02 90 50 00-0396	EA Filter, Pleated For Negative Air Machine.....	7.02
02 90 50 00-0397	EA Filter, Charcoal For Negative Air Machine.....	34.96
02 90 50 00-0398	EA Filter, HEPA For Negative Air Machine.....	222.75
02 90 50 00-0399	EA Filter, Pleated For Dehumidifiers.....	8.77
02 90 50 00-0400	GAL Floor Stripper.....	16.37
02 90 50 00-0401	GAL Floor Wax.....	23.39
02 90 50 00-0402	GAL Fogger (Thermal).....	92.37
02 90 50 00-0403	BOX Furniture Blocks.....	116.93
02 90 50 00-0404	EA Furniture Polish, Per Can.....	12.86
02 90 50 00-0405	GAL Glass Cleaner.....	19.88
02 90 50 00-0406	PR Chemical Splash/Impact Resistant, Polycarbonate Lens Safety Goggles.....	14.27
02 90 50 00-0407	EA Goof Off Spray, 12 Oz.....	8.19
02 90 50 00-0408	EA Halogen Light Bulbs.....	16.70
02 90 50 00-0409	QT Hand Sanitizer.....	8.26
02 90 50 00-0410	EA Hard Hats.....	6.80
02 90 50 00-0411	BOX Hog Rings, Box Of 2,500.....	16.95
02 90 50 00-0412	GAL HVAC Coil Cleaner.....	38.59
02 90 50 00-0413	BOX Inventory Tag, Box Of 1,000.....	105.24
02 90 50 00-0414	EA Knives - Utility.....	12.86
02 90 50 00-0415	ROL Lay Flat Tubing, 13" (250' Roll).....	64.55
02 90 50 00-0416	ROL Lay Flat Tubing, 20" (250' Roll).....	98.22
02 90 50 00-0417	ROL Lay Flat Tubing, 29" (250' Roll).....	167.21
02 90 50 00-0418	ROL Lay Flat Tubing, 39" (250' Roll).....	273.62
02 90 50 00-0419	GAL Lemon Oil.....	46.77
02 90 50 00-0420	GAL LPS 1/Mecca Lube.....	42.49
02 90 50 00-0421	GAL LPS 2.....	44.97
02 90 50 00-0422	GAL LPS Contact Cleaner.....	44.76
02 90 50 00-0423	GAL Lubricant, Preserver (Light).....	38.59
02 90 50 00-0424	GAL Lubricant, Preserver (Heavy).....	23.39
02 90 50 00-0425	GAL Machinery Cleaning Solvent.....	52.62
02 90 50 00-0426	GAL Metal Polishing Paste.....	11.69
02 90 50 00-0427	GAL Microban.....	47.26
02 90 50 00-0428	GAL Milgo.....	58.01



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
02 90 50 00-0429 EA Mop Heads	6.84	
02 90 50 00-0430 EA Nylon Scouring Pads	1.29	
02 90 50 00-0431 GAL Odor Neutralizer	52.09	
02 90 50 00-0432 EA Packing Paper, 25 LB Bundle.....	30.99	
02 90 50 00-0433 EA Paint Brushes	5.85	
02 90 50 00-0434 ROL Paper, Corrugated/Craft	102.90	
02 90 50 00-0435 EA Putty Knives.....	5.30	
02 90 50 00-0436 ROL Red Resin Paper, 200' Roll.....	31.57	
02 90 50 00-0437 GAL Reodorant.....	99.39	
02 90 50 00-0438 EA Respirator - N95.....	4.64	
02 90 50 00-0439 EA Respirator - N95 w/valve.....	5.29	
02 90 50 00-0440 PR Respirator Cartridges - 3M.....	35.45	
02 90 50 00-0441 PR Respirator Cartridges -P100	35.45	
02 90 50 00-0442 EA Respirator Cleaning Wipes, Per Box 100	28.37	
02 90 50 00-0443 GAL Restoracide.....	46.62	
02 90 50 00-0444 GAL Rust Remover.....	81.85	
02 90 50 00-0445 EA Saltesmo Test Samples.....	7.60	
02 90 50 00-0446 EA Sand Bag, Excluding Sand	1.99	
02 90 50 00-0447 EA Scotch-Brite 7447, Per Box 50.....	37.97	
02 90 50 00-0448 EA Sm. Scrub Brushes.....	5.59	
02 90 50 00-0449 GAL Soot Sealant, Clear.....	45.60	
02 90 50 00-0450 GAL Soot Sealant, Pigmented.....	46.77	
02 90 50 00-0451 ROL Shrinkwrap Plastic.....	56.13	
02 90 50 00-0452 EA Sponges - Dry.....	2.48	
02 90 50 00-0453 EA Spray Adhesive, Per Can.....	5.26	
02 90 50 00-0454 EA Spray Bot./Trigger.....	4.51	
02 90 50 00-0455 GAL Stain Remover	28.06	
02 90 50 00-0456 GAL Stainless Steel Cleaner	43.26	
02 90 50 00-0457 EA Stainless Steel Polish, Per Can	15.20	
02 90 50 00-0458 LB Sweeping Compound	18.91	
02 90 50 00-0459 ROL Tape - Duct.....	7.89	
02 90 50 00-0460 ROL Tape - Environmental (Teal)	10.92	
02 90 50 00-0461 ROL Tape - HVAC (Aluminum)	25.72	
02 90 50 00-0462 ROL Tape - Blue Masking (Painters Tape)	10.97	
02 90 50 00-0463 ROL Tape - Poly Box	4.68	
02 90 50 00-0464 LB Terry Towels.....	6.02	
02 90 50 00-0465 GAL Thermal Fog	57.47	
02 90 50 00-0466 ROL Trash Bags - Lawn And Leaf	37.42	
02 90 50 00-0467 ROL Trash Bags - 6 Mil Heavy Duty (50 Count)	103.48	
02 90 50 00-0468 EA Trisodium Phosphate, 20 LB Pail.....	42.67	
02 90 50 00-0469 EA Vacuum Bags - Backpack.....	1.44	
02 90 50 00-0470 EA Vacuum Bags - Upright.....	1.92	
02 90 50 00-0471 GAL Vinyl And Leather Cleaner	93.54	
02 90 50 00-0472 ROL Visqueen 1 Mil	44.73	
02 90 50 00-0473 ROL Visqueen 4 Mil	91.79	
02 90 50 00-0474 ROL Visqueen 6 Mil	130.96	
02 90 50 00-0475 LB Wipes, Cotton Cloth.....	5.09	
02 90 50 00-0476 ROL 12" x 750', Wrap, Bubble / Anti-Static.....	73.67	
02 90 50 00-0477 EA Wyp-Alls, Case, 160 Wipes	38.59	
02 90 50 00-0478 EA Zip Wall Zippers.....	21.05	
02 90 50 00-0479	Technical/Electronics Restoration Materials	<small>(02 90 50 00-0352)</small>
02 90 50 00-0480 EA Brush - Brass.....	4.38	
02 90 50 00-0481 EA Brush - Natural Bristle 1"	1.40	
02 90 50 00-0482 EA Brush - Natural Bristle 1/2"	1.17	
02 90 50 00-0483 EA Brush - Natural Bristle 1/4"	0.99	
02 90 50 00-0484 EA Brush - Parts.....	6.08	
02 90 50 00-0485 EA Brush - Plastic.....	3.16	
02 90 50 00-0486 EA Brush - Wire Grout.....	5.85	
02 90 50 00-0487 EA Brushing Tool.....	14.62	
02 90 50 00-0488 EA Cleaning Swabs, Cotton	0.29	
02 90 50 00-0489 EA Cleaning Swabs, Foam Tip.....	0.35	
02 90 50 00-0490 EA Contact Restorer, Per Can.....	28.36	
02 90 50 00-0491 EA Contact Spray, Per Can.....	19.29	
02 90 50 00-0492 UNIT Corrosion Inhibitor Emitter - 1 CF	2.81	
02 90 50 00-0493 UNIT Corrosion Inhibitor Emitter - 5 CF	6.43	
02 90 50 00-0494 UNIT Corrosion Inhibitor Emitter - 10 CF	11.11	
02 90 50 00-0495 LB Cotton Cleaning Cloths.....	17.54	
02 90 50 00-0496 EA 12" x 17" Dust Cloths.....	0.26	
02 90 50 00-0497 EA 24" x 24" Dust Cloths.....	0.72	
02 90 50 00-0498 EA Deoxidizing Agent, Per Can.....	13.74	
02 90 50 00-0499 GAL Electronic Grade Detergent	21.05	
02 90 50 00-0500 SHT Inventory Labels	6.37	
02 90 50 00-0501 GAL Isopropyl Alcohol	29.23	
02 90 50 00-0502 EA Lubrication/Penetrating Oil, Per Can	6.43	
02 90 50 00-0503 GAL PC Board Detergent	80.10	
02 90 50 00-0504 GAL Rust Inhibitor, Regular Duty.....	31.57	
02 90 50 00-0505 GAL Rust Inhibitor - Moderate Duty.....	34.49	
02 90 50 00-0506 GAL Rust Inhibitor - Severe Duty.....	39.76	
02 90 50 00-0507 LB Wipes - Lint Free Cloths	8.19	

02 Existing Conditions**02 90 Disaster Recovery****02 90 50 Cleaning And Emergency Clean-up**

MINOR			TOTAL DIRECT	DEMOLITION
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST
02 90 50 00-0508	EA	Wire Marker Card.....	2.05	
02 90 50 00-0509	EA	Steel Wool, 16 Pad Sleeve.....	7.02	
02 90 50 00-0510		Board Up And Tarp Up (02 90 50)		
02 90 50 00-0511	SF	Polyethylene Tarp On Roof.....	0.20	
02 90 50 00-0512	SF	Temporary Plywood On Roof.....	1.24	
02 90 50 00-0513	SF	Temporary Plywood On Wall Or Windows.....	1.59	
02 90 50 00-0514		Minimum Charges (02 90 50)		
02 90 50 00-0515	EA	Minimum For Cleaning.....	99.39	
02 90 50 00-0516	EA	Minimum For Water Extraction.....	116.93	
02 90 50 00-0517	EA	Minimum For Carpet Cleaning.....	140.32	
02 90 50 00-0518		Document Restoration (02 90 50)		
02 90 50 00-0519	EA	Book Rebinding, Each.....	72.46	
02 90 50 00-0520	EA	Book Recasing, Each.....	36.22	
02 90 50 00-0521	EA	Boxes-MCS, 1.2 CF.....	7.25	
02 90 50 00-0522	EA	Boxes-MCS, 2.0 CF.....	9.39	
02 90 50 00-0523	EA	Boxes Bankers.....	11.58	
02 90 50 00-0524	EA	Boxes Standard Packout.....	4.33	
02 90 50 00-0525	EA	Boxes X Ray.....	7.25	
02 90 50 00-0526	EA	CD Scanning and Diagnostics, Each.....	7.25	
02 90 50 00-0527	EA	Cleaning Antique Books, Each.....	217.37	
02 90 50 00-0528	EA	Cleaning Catheter Roll, Per Roll.....	28.98	
02 90 50 00-0529	EA	Cleaning CD And DVD, Per Disc.....	2.91	
02 90 50 00-0530	EA	Cleaning Level 1 - Blue Prints, Each.....	2.91	
02 90 50 00-0531	CF	Cleaning Level 1 - Document Per CF.....	89.87	
02 90 50 00-0532	EA	Cleaning Level 1 - Linen, Each.....	2.91	
02 90 50 00-0533	EA	Cleaning Level 1 - Mylar, Each.....	2.91	
02 90 50 00-0534	EA	Cleaning Level 2 - Blue Print, Each.....	3.62	
02 90 50 00-0535	CF	Cleaning Level 2 - Document Per CF.....	134.77	
02 90 50 00-0536	EA	Cleaning Level 2 - Linen, Each.....	3.62	
02 90 50 00-0537	EA	Cleaning Level 2 - Mylar, Each.....	3.62	
02 90 50 00-0538	EA	Cleaning Level 3 - Blue Prints, Each.....	5.12	
02 90 50 00-0539	CF	Cleaning Level 3 - Document Per CF.....	179.73	
02 90 50 00-0540	EA	Cleaning Level 3 - Linen, Each.....	5.12	
02 90 50 00-0541	EA	Cleaning Level 3 - Mylar, Each.....	5.12	
02 90 50 00-0542	EA	Cleaning Level 4 - All Fire-Blue Print, Each.....	7.25	
02 90 50 00-0543	EA	Cleaning Level 4 - All Fire-Linen, Each.....	7.25	
02 90 50 00-0544	EA	Cleaning Level 4 - All Fire-Mylar, Each.....	7.25	
02 90 50 00-0545	CF	Cleaning Level 4 - Light Fire-Document Per CF.....	224.62	
02 90 50 00-0546	EA	Cleaning Level 5 - Severe Fire-Blue Print, Each.....	8.66	
02 90 50 00-0547	CF	Cleaning Level 5 - Severe Fire-Document Per CF.....	449.26	
02 90 50 00-0548	EA	Cleaning Level 5 - Severe Fire-Linen, Each.....	8.66	
02 90 50 00-0549	EA	Cleaning Level 5 - Severe Fire-Mylar, Each.....	8.66	
02 90 50 00-0550	EA	Cleaning Microfiche Sheets, Each.....	2.91	
02 90 50 00-0551	EA	Cleaning Microfiche Strips, Each.....	0.74	
02 90 50 00-0552	EA	Cleaning Microfilm Rolls (In House), Per Roll.....	72.46	
02 90 50 00-0553	EA	Cleaning Microfilm Rolls (Outside), Per Roll.....	101.45	
02 90 50 00-0554	EA	Cleaning Photographs Negatives, Per Negative.....	0.74	
02 90 50 00-0555	EA	Cleaning Photographs, Each.....	2.91	
02 90 50 00-0556	EA	Cleaning Record Albums, Each.....	2.91	
02 90 50 00-0557	EA	Cleaning VHS And Beta Tapes-In House, Each.....	7.25	
02 90 50 00-0558	EA	Cleaning VHS And Beta Tapes-Outside, Each.....	28.98	
02 90 50 00-0559	EA	Cleaning X Ray 1-1000, Per Film.....	4.33	
02 90 50 00-0560	EA	Cleaning X Ray 1K-5K, Per Film.....	3.62	
02 90 50 00-0561	EA	Cleaning X Ray 5K-Up, Per Film.....	2.91	
02 90 50 00-0562	EA	Copying Clean Water, Per Page.....	0.43	
02 90 50 00-0563	EA	Copying Greywater Fire, Per Page.....	0.78	
02 90 50 00-0564	EA	Deodorization, Vapor Tech, Per Cube.....	7.25	
02 90 50 00-0565	EA	Disinfectant-Fogging, Per Cube.....	10.16	
02 90 50 00-0566	EA	Document Disposal In House No Shredding.....	23.21	
02 90 50 00-0567	EA	Document Disposal In House With Shredding.....	39.97	
02 90 50 00-0568	EA	Drying-MCS Center 1-50 Cubes.....	130.42	
02 90 50 00-0569	EA	Drying-MCS Center 151-500 Cubes.....	101.45	
02 90 50 00-0570	EA	Drying-MCS Center 500 And Up.....	86.95	
02 90 50 00-0571	EA	Drying-MCS Center 51-150 Cubes.....	115.94	
02 90 50 00-0572	EA	Drying-Onsite 1-500 Cubes.....	217.37	
02 90 50 00-0573	EA	Drying-Onsite 501- Up Cube.....	133.35	
02 90 50 00-0574	EA	Drying Antique Books, Each.....	28.98	
02 90 50 00-0575	EA	Drying Blue Prints, Each.....	3.62	
02 90 50 00-0576	EA	DVD Scanning And Diagnostics, Each.....	7.25	
02 90 50 00-0577	EA	Freeze Drying (In House).....	101.45	
02 90 50 00-0578	EA	Freeze Drying (Outside).....	133.35	
02 90 50 00-0579	EA	Irradiation - Gamma 0-48 Cubes (minimum charge).....	1,546.98	
02 90 50 00-0580	EA	Irradiation - Gamma 49-Up Cube (per cube charge).....	32.23	
02 90 50 00-0581	EA	Linen Prints.....	7.25	
02 90 50 00-0582	EA	Minimal Drying Jobs.....	709.04	



Existing Conditions	02	02
Disaster Recovery	02 90	
Cleaning And Emergency Clean-up	02 90 50	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
02 90 50 00-0583 EA Monthly Storage.....	72.46	
02 90 50 00-0584 EA Mylar Prints.....	7.25	
02 90 50 00-0585 EA Ozoning, Per Cube	7.25	
02 90 50 00-0586 MO Stabilization Freezer Storage, Per Cube-Per Month	10.16	
02 90 50 00-0587 MO Stabilization Freezer Storage, Per Page-Per Month	0.07	
02 90 50 00-0588 EA Wood Pallets, Each	36.22	

END OF SECTION 02

02

02 Existing Conditions

02 90 Disaster Recovery

02 90 50 Cleaning And Emergency Clean-up



MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

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MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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03 Concrete

03 01 Maintenance Of Concrete ⁽⁰³⁾

03 01 30 Maintenance Of Cast-In-Place Concrete ^(03 01)

03 01 30 51 Cleaning Of Cast-In-Place Concrete ^(03 01 30)

03 01 30 51-0001	Abrasive Blasting ^(03 01 30 51)	
	Note: Includes containment and clean-up of all material.	
03 01 30 51-0002	SF Concrete Floors, Abrasive Shot Blasting	1.14
	Note: Includes steel ball media.	

03 01 30 71 Rehabilitation Of Cast-in-Place Concrete ^(03 01 30)

03 01 30 71-0001	Concrete Resurfacing/Repair ^(03 01 30 71)	
	See CSI section 09 91 43 00-0002 for surface preparation as required.	
03 01 30 71-0002	Concrete Repair ^(03 01 30 71-0001)	
03 01 30 71-0003	Decks Or Floors ^(03 01 30 71-0002)	
	Note: Includes bonding agent and sealant. Excludes saw cutting, sand blasting and forming.	
03 01 30 71-0004	SF 1/8" To 1/4", Cementitious Mortar Patch, Decks And Floors.....	4.66
03 01 30 71-0005	SF 1/8" To 1/4", Epoxy Cementitious Mortar Patch, Decks And Floors.....	14.35
03 01 30 71-0006	SF White Aluminum Oxide Grit (Non Slip Aggregate) Patch, Decks And Floors.....	0.41

03 01 30 71-0007	Verticals Or Overheads ^(03 01 30 71-0002)	
	Note: Includes bonding agent and sealant. Excludes saw cutting, sand blasting and forming.	
03 01 30 71-0008	SF 1/8" To 1/4" Cementitious Mortar Patch, Verticals And Overheads	7.00
03 01 30 71-0009	SF 1/8" To 1/4" Epoxy Cementitious Mortar Patch, Verticals And Overheads	19.89
03 01 30 71-0010	SF 1/8" To 1/4" Latex Cementitious Mortar Patch, Verticals And Overheads	22.32
03 01 30 71-0011	SF 1/8" To 1/4" Elastomeric Compound Patch, Verticals And Overheads	5.51
03 01 30 71-0012	SF 1/8" To 1/4" Copolymer Cementitious Compound Patch, Verticals And Overheads.....	9.60
	Note: Rapid Set - Wunderfixx	

03 01 30 71-0013	Bridge Deck Treatment ^(03 01 30 71-0002)	
03 01 30 71-0014	SF Sweep Bridge Deck	0.01
03 01 30 71-0015	SF Clean Bridge Deck.....	0.02
03 01 30 71-0016	SF Treat Bridge Deck With Methacrylate Resin Sealant.....	1.29

03 01 30 71-0017 Concrete Finishes ^(03 01 30 71-0001)

03 01 30 71-0018 Concrete Patching ^(03 01 30 71-0017)

03 01 30 71-0019 Walls ^(03 01 30 71-0018)

03 01 30 71-0020	BAG Sika Top 111 Plus.....	97.08
	Note: SikaTop 111 PLUS is a two-component, polymer-modified, portland-cement, fast-setting, screed mortar.	
	Yield: Approximately 0.5 cu. ft./unit. Approximately 0.75 cu. ft./unit (SikaTop 111 + 42 lbs. of 3/8" pea gravel).	
	For Up To 10, Add	31.83
	For >10 To 25, Add	19.10
	For >25 To 50, Add	12.73
	For >50 To 75, Add	6.37
03 01 30 71-0021	BAG Sika Grout 212, 50 LB Bag.....	39.21
	Note: SikaGrout 212 is a non-shrink, cementitious grout with a unique 2-stage shrinkage compensating mechanism. It is non-metallic and contains no chloride. Coverage: Approximately 0.44 cu. ft./bag at high flow.	
	For Up To 10, Add	5.68
	For >10 To 25, Add	3.41
	For >25 To 50, Add	2.27
	For >50 To 75, Add	1.14
03 01 30 71-0022	EA Sika Flex 1A, 10.3 Ounce Tube.....	26.55
	Note: Sikaflex-1a is a premium-grade, high-performance, moisture-cured, 1-component, polyurethane-based, non-sag elastomeric sealant. Coverage: 10.3 fl. oz. cartridge seals 12.4 lineal ft. of 1/2 x 1/4 in. joint. 20 fl. oz. uni-pac sausage seals 24 lineal ft. of 1/2 x 1/4 in. joint.	
03 01 30 71-0023	BAG Pea Gravel.....	18.71

03 01 30 71-0024 Crack Repair For Concrete ^(03 01 30 71-0001)

03 01 30 71-0025 Non Structural Crack Repair For Concrete ^(03 01 30 71-0024)

03 01 30 71-0026 Surface Applied, Non Structural Crack Repair For Concrete ^(03 01 30 71-0025)

	Note: Includes removing all debris and contaminants accessible within the crack using hand tools, water blasting, compressed air or vacuuming. Includes installing sealer with caulk gun, cartridge gun, squeeze bottle, etc. Excludes backer rod and sanding.	
03 01 30 71-0027	LF Up To 1/4" Wide, Latex Emulsion, Gravity Fed Non Structural Crack Repair For Concrete, Surface Applied With Squeeze Tube (Quikrete® Concrete Crack Seal).....	5.21
	For Walls Instead Of Floors, Add	0.51
	For V-Grooving Crack With Grinder, Add	4.21

03 Concrete**03 01 Maintenance Of Concrete****03 01 30 Maintenance Of Cast-In-Place Concrete**

MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
03 01 30 71-0028	LF	>1/4" To 1/2" Wide, Latex Emulsion, Gravity Fed Non Structural Crack Repair For Concrete, Surface Applied With Squeeze Tube (Quikrete® Concrete Crack Seal).....	6.78		
		<i>For Walls Instead Of Floors, Add</i>	0.66		
		<i>For V-Grooving Crack With Grinder, Add</i>	4.11		
03 01 30 71-0029	LF	Up To 1/4" Wide, Sanded Acrylic Latex, Gravity Fed Non Structural Crack Repair For Concrete, Surface Applied With Caulk Gun (Quikrete® Concrete Repair).....	5.28		
		<i>For Walls Instead Of Floors, Add</i>	0.51		
		<i>For V-Grooving Crack With Grinder, Add</i>	4.21		
03 01 30 71-0030	LF	>1/4" To 1/2" Wide, Sanded Acrylic Latex, Gravity Fed Non Structural Crack Repair For Concrete, Surface Applied With Caulk Gun (Quikrete® Concrete Repair).....	6.92		
		<i>For Walls Instead Of Floors, Add</i>	0.66		
		<i>For V-Grooving Crack With Grinder, Add</i>	4.11		
03 01 30 71-0031	LF	Up To 1/4" Wide, Self Leveling Polyurethane Sealant, Gravity Fed Non Structural Crack Repair For Concrete, Surface Applied With Cartridge Tool (Sikaflex® Self-Leveling Sealant).....	5.53		
		<i>For Walls Instead Of Floors, Add</i>	0.51		
		<i>For V-Grooving Crack With Grinder, Add</i>	4.21		
03 01 30 71-0032	LF	>1/4" To 1/2" Wide, Self Leveling Polyurethane Sealant, Gravity Fed Non Structural Crack Repair For Concrete, Surface Applied With Cartridge Tool (Sikaflex® Self-Leveling Sealant).....	7.43		
		<i>For Walls Instead Of Floors, Add</i>	0.66		
		<i>For V-Grooving Crack With Grinder, Add</i>	4.11		
03 01 30 71-0033	LF	Up To 1/4" Wide, Non-Sag Elastomeric Polyurethane Sealant, Gravity Fed Non Structural Crack Repair For Concrete, Surface Applied With Cartridge Tool (Sikaflex® Concrete Fix).....	5.72		
		<i>For Walls Instead Of Floors, Add</i>	0.51		
		<i>For V-Grooving Crack With Grinder, Add</i>	4.21		
03 01 30 71-0034	LF	>1/4" To 1/2" Wide, Non-Sag Elastomeric Polyurethane Sealant, Gravity Fed Non Structural Crack Repair For Concrete, Surface Applied With Cartridge Tool (Sikaflex® Concrete Fix).....	7.80		
		<i>For Walls Instead Of Floors, Add</i>	0.66		
		<i>For V-Grooving Crack With Grinder, Add</i>	4.11		
03 01 30 71-0035		Pressure Injected, Non Structural Crack Repair For Concrete <small>(03 01 30 71-0025)</small>			
		Note: Includes removing all debris and contaminants accessible within the crack using hand tools, water blasting, compressed air or vacuuming. Includes installing injection ports, sealing the crack opening (one side only), injecting the crack with polyurethane and restoring the sealed surface to flush conditions. Excludes disposal.			
03 01 30 71-0036	LF	Up To 1/4" Wide, Water Activated Polyurethane Foam Grout, Non Structural Crack Repair For Concrete, Installed With Automated Injection Equipment (SealBoss 1570).....	20.44		
		<i>For Walls Instead Of Floors, Add</i>	1.60		
		<i>For Cracks Accessible From Both Sides, Add</i>	4.15		
03 01 30 71-0037		Structural Crack Repair For Concrete <small>(03 01 30 71-0024)</small>			
03 01 30 71-0038		Surface Applied, Structural Crack Repair For Concrete <small>(03 01 30 71-0037)</small>			
		Note: Includes removing all debris and contaminants accessible within the crack using hand tools, water blasting, compressed air or vacuuming. Excludes disposal.			
03 01 30 71-0039	LF	Up To 1/4" Wide, Low Viscosity, High Strength Epoxy Resin, Gravity Fed Structural Crack Repair For Concrete, Surface Applied With Trowel (Sikadur® 35).....	5.76		
		<i>For Walls Instead Of Floors, Add</i>	0.51		
		<i>For V-Grooving Crack With Grinder, Add</i>	4.21		
03 01 30 71-0040	LF	>1/4" To 1/2" Wide, Low Viscosity, High Strength Epoxy Resin, Gravity Fed Structural Crack Repair For Concrete, Surface Applied With Trowel (Sikadur® 35).....	7.89		
		<i>For Walls Instead Of Floors, Add</i>	0.66		
		<i>For V-Grooving Crack With Grinder, Add</i>	4.11		
03 01 30 71-0041	LF	Up To 1/4" Wide, Moisture Tolerant, Low Viscosity, High Strength Epoxy Resin, Gravity Fed Structural Crack Repair For Concrete, Surface Applied With Trowel (Sikadur® 52).....	5.76		
		<i>For Walls Instead Of Floors, Add</i>	0.51		
		<i>For V-Grooving Crack With Grinder, Add</i>	4.21		
03 01 30 71-0042	LF	>1/4" To 1/2" Wide, Moisture Tolerant, Low Viscosity, High Strength Epoxy Resin, Gravity Fed Structural Crack Repair For Concrete, Surface Applied With Trowel (Sikadur® 52).....	7.87		
		<i>For Walls Instead Of Floors, Add</i>	0.66		
		<i>For V-Grooving Crack With Grinder, Add</i>	4.11		
03 01 30 71-0043	LF	Up To 1/4" Wide, Low Viscosity, High Strength Epoxy Resin, Gravity Fed Structural Crack Repair For Concrete, Surface Applied With Caulk Gun (Sikadur® Crack Fix).....	6.49		
		<i>For Walls Instead Of Floors, Add</i>	0.51		
		<i>For V-Grooving Crack With Grinder, Add</i>	4.21		
03 01 30 71-0044	LF	>1/4" To 1/2" Wide, Low Viscosity, High Strength Epoxy Resin, Gravity Fed Structural Crack Repair For Concrete, Surface Applied With Caulk Gun (Sikadur® Crack Fix).....	9.34		
		<i>For Walls Instead Of Floors, Add</i>	0.66		
		<i>For V-Grooving Crack With Grinder, Add</i>	4.11		
03 01 30 71-0045		Pressure Injected, Structural Crack Repair For Concrete <small>(03 01 30 71-0037)</small>			
		Note: Includes removing all debris and contaminants accessible within the crack using hand tools, water blasting, compressed air or vacuuming. Includes installing injection ports, sealing the crack opening (one side only), injecting the crack with epoxy and restoring the sealed surface to flush conditions. Excludes disposal.			
03 01 30 71-0046	LF	Up To 1/4" Wide, Low Viscosity, High Strength Epoxy Resin, Structural Crack Repair For Concrete, Installed With Automated Injection Equipment (Sikadur® 35).....	18.46		
		<i>For Walls Instead Of Floors, Add</i>	1.60		
		<i>For Cracks Accessible From Both Sides, Add</i>	4.15		
03 01 30 71-0047	LF	Up To 1/4" Wide, Moisture Tolerant, Low Viscosity, High Strength Epoxy Resin, Structural Crack Repair For Concrete, Installed With Automated Injection Equipment (Sikadur® 52).....	18.46		
		<i>For Walls Instead Of Floors, Add</i>	1.60		
		<i>For Cracks Accessible From Both Sides, Add</i>	4.15		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
03 01 30 71-0048 Carbon Fiber Strengthening System <small>(03 01 30 71-0001)</small> Note: Includes preparing surface, dust and debris removal by hand, clean and protect adjacent area, fill voids, primer, fabric substrate layers, final coat of epoxy and finish. Excludes disposal.		
03 01 30 71-0049 SF Carbon Fiber Strengthening System Beams, Per Layer	48.70	
03 01 30 71-0050 SF Carbon Fiber Strengthening System Columns, Per Layer	42.89	
03 01 30 71-0051 SF Carbon Fiber Strengthening System Slabs, Per Layer	37.82	
03 01 30 71-0052 Concrete Rehabilitation <small>(03 01 30 71)</small>		
03 01 30 71-0053 Corrosive Inhibitor <small>(03 01 30 71-0052)</small>		
03 01 30 71-0054 SF Corrosive Inhibitor.....	3.00	

03 05 Common Work Results For Concrete (03)

03 05 00 00-0001 Concrete Admixtures <small>(03 05)</small>		
03 05 00 00-0002 CY Low Range Water Reducing (LRWR), Type A Concrete Admixture	3.36	
03 05 00 00-0003 CY Set Retarding, Type B Concrete Admixture	2.32	
03 05 00 00-0004 CY 1% Calcium Chloride Accelerating, Type C Concrete Admixture.....	3.61	
03 05 00 00-0005 CY 2% Calcium Chloride Accelerating, Type C Concrete Admixture.....	7.23	
03 05 00 00-0006 CY 1% Non-Chloride Accelerating, Type C Concrete Admixture.....	6.46	
03 05 00 00-0007 CY 2% Non-Chloride Accelerating, Type C Concrete Admixture	12.91	
03 05 00 00-0008 CY Water Reducing and Retarding (Hydration Stabilizer), Type D Concrete Admixture	2.79	
03 05 00 00-0009 CY 1% Water Reducing and Accelerating (High Early Strength), Type E Concrete Admixture	3.87	
03 05 00 00-0010 CY 2% Water Reducing and Accelerating (High Early Strength), Type E Concrete Admixture	7.75	
03 05 00 00-0011 CY Mid Range Water Reducing (MRWR) Superplasticizer, Type A Or E Concrete Admixture	3.83	
03 05 00 00-0012 CY High Range Water Reducing (HRWR) Superplasticizer, Type F Concrete Admixture.....	6.20	
03 05 00 00-0013 CY 1-1/2 LB/CY Polyethylene, Polypropylene, Nylon, Synthetic Plastic Fibers, Concrete Admixture	8.26	
03 05 00 00-0014 CY 25 LB/CY Steel Fibers, Concrete Admixture.....	20.34	
03 05 00 00-0015 CY 10% Microsilica (Silica Fume), Concrete Admixture	61.25	
03 05 00 00-0016 CY Corrosion Inhibiting Concrete Admixture	15.49	
03 05 00 00-0017 CY Winter Service Or Heat, Concrete Add.....	3.61	
03 05 00 00-0018 CY Chilled Water, Concrete Add	3.61	
03 05 00 00-0019 CY Subtle Color (See Davis Colors Color Card), Concrete Admixture	20.91	
03 05 00 00-0020 CY Standard Color (See Davis Colors Color Card), Concrete Admixture.....	34.86	
03 05 00 00-0021 CY Premium Color (See Davis Colors Color Card), Concrete Admixture	66.93	
03 05 00 00-0022 CY Ultra Premium Color (See Davis Colors Color Card), Concrete Admixture	92.95	

03 10 Concrete Forming And Accessories (03)

03 11 Concrete Forming (03 10)

03 11 13 Structural Cast-In-Place Concrete Forming (03 11)

Note: Per square foot of formwork.

03 11 13 00-0001 Wood Formwork <small>(03 11 13)</small> Note: For job built wood and/or plywood form systems where metal framed formwork cannot be used. Includes erecting, stripping, stacking, plywood, framing lumber, oiling, studs/walers, strongbacks, deadmen, supporting braces, turnbuckles, ties, and clips.		
03 11 13 00-0002 Foundation Wood Formwork <small>(03 11 13 00-0001)</small> Note: For foundation work below or at grade.		
03 11 13 00-0003 SF Continuous Footings Foundation Wood Formwork.....	5.63	
For <1,000, Add	1.04	
For Foundations >8' Below Grade, Add	1.00	
For Curved Formwork, Add	2.00	
03 11 13 00-0004 SF Pile Cap, Pier Or Spread Footings Foundation Wood Formwork.....	6.69	
For <1,000, Add	1.25	
For Foundations >8' Below Grade, Add	1.21	
For Curved Formwork, Add	2.41	
03 11 13 00-0005 SF Mat Foundation Wood Formwork.....	7.67	
For <1,000, Add	1.46	
For Foundations >8' Below Grade, Add	1.42	
For Curved Formwork, Add	2.84	
03 11 13 00-0006 SF Grade Beams Or Duct Bank Foundation Wood Formwork	6.34	
For <1,000, Add	1.19	
For Foundations >8' Below Grade, Add	1.15	
For Curved Formwork, Add	2.31	
03 11 13 00-0007 SF Below Grade Walls Foundation Wood Formwork	9.03	
Note: Excludes footing		
For <1,000, Add	1.69	
For Foundations >8' Below Grade, Add	1.63	
For Curved Formwork, Add	3.26	

03 11 13 00-0008 **Slab Edge And Block-Out Wood Formwork** (03 11 13 00-0001)

03 Concrete**03 10 Concrete Forming And Accessories****03 11 Concrete Forming**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
03 11 13 00-0009	LF		Up To 6" High Slab Edge and Block-Out Wood Formwork	4.32	
			<i>For Foundations >8' Below Grade, Add</i>	0.80	
			<i>For Curved Formwork, Add</i>	1.59	
			<i>For <250, Add</i>	0.82	
03 11 13 00-0010	LF		>6" To 12" High Slab Edge and Block-Out Wood Formwork	6.22	
			<i>For Foundations >8' Below Grade, Add</i>	1.11	
			<i>For Curved Formwork, Add</i>	2.22	
			<i>For <250, Add</i>	1.16	
03 11 13 00-0011	SF		>12" High Slab Edge and Block-Out Wood Formwork	7.94	
			<i>For Foundations >8' Below Grade, Add</i>	1.44	
			<i>For Curved Formwork, Add</i>	2.87	
			<i>For <1,000, Add</i>	1.49	
03 11 13 00-0012			Column Wood Formwork (03 11 13 00-0001)		
03 11 13 00-0013	LF		Up To 8" Square Column Wood Formwork	33.60	
03 11 13 00-0014	LF		>8" To 12" Square Column Wood Formwork	48.97	
03 11 13 00-0015	LF		>12" To 18" Square Column Wood Formwork	61.30	
03 11 13 00-0016	LF		>18" To 24" Square Column Wood Formwork	87.54	
03 11 13 00-0017	LF		>24" To 36" Square Column Wood Formwork	125.48	
03 11 13 00-0018	LF		>36" To 48" Square Column Wood Formwork	165.42	
03 11 13 00-0019			Above Grade Wall Wood Formwork (03 11 13 00-0001)		
03 11 13 00-0020	SF		Up To 8' High Above Grade Wall Wood Formwork	10.08	
			<i>For Curved Formwork, Add</i>	3.68	
			<i>For <1,000, Add</i>	1.90	
03 11 13 00-0021	SF		>8' High Above Grade Wall Wood Formwork	11.94	
			<i>For Curved Formwork, Add</i>	4.37	
			<i>For <1,000, Add</i>	2.25	
03 11 13 00-0022			Elevated Beam Wood Formwork (03 11 13 00-0001)		
			Note: Includes adjustable shores and column supports and bracing lumber up to 14' for bottom of elevated beam.		
03 11 13 00-0023	SF		Bottom of Elevated Beam Wood Formwork	13.03	
			<i>For Curved Formwork, Add</i>	4.79	
			<i>For <1,000, Add</i>	2.46	
03 11 13 00-0024	SF		Vertical Sides of Elevated Beam Wood Formwork	8.34	
			<i>For Curved Formwork, Add</i>	3.06	
			<i>For <1,000, Add</i>	1.58	
03 11 13 00-0025			Elevated Slab Wood Formwork (03 11 13 00-0001)		
			Note: Includes adjustable shores and column supports and bracing lumber up to 14' for bottom of elevated slab.		
03 11 13 00-0026	SF		Elevated Slab Wood Formwork	7.73	
			<i>For <1,000, Add</i>	1.41	
03 11 13 00-0027			Metal Framed Formwork (03 11 13)		
			Note: For all metal framed and metal form systems. Includes erecting, stripping, stacking, oiling, studs/walers, strongbacks, deadmen, supporting braces, turnbuckles, ties, and clips.		
03 11 13 00-0028			Foundation Metal Framed Formwork (03 11 13 00-0027)		
			Note: For foundation work below or at grade.		
03 11 13 00-0029	SF		Continuous Footings Foundation Metal Framed Formwork	4.74	
			<i>For <1,000, Add</i>	0.90	
			<i>For Foundations >8' Below Grade, Add</i>	0.87	
			<i>For Curved Formwork, Add</i>	1.74	
03 11 13 00-0030	SF		Pile Cap, Pier Or Spread Footings Foundation Metal Framed Formwork	5.29	
			<i>For <1,000, Add</i>	1.01	
			<i>For Foundations >8' Below Grade, Add</i>	0.98	
			<i>For Curved Formwork, Add</i>	1.96	
03 11 13 00-0031	SF		Mat Foundation Metal Framed Formwork	5.87	
			<i>For <1,000, Add</i>	1.11	
			<i>For Foundations >8' Below Grade, Add</i>	1.08	
			<i>For Curved Formwork, Add</i>	2.15	
03 11 13 00-0032	SF		Grade Beams Or Duct Bank Foundation Metal Framed Formwork	4.94	
			<i>For <1,000, Add</i>	0.93	
			<i>For Foundations >8' Below Grade, Add</i>	0.90	
			<i>For Curved Formwork, Add</i>	1.81	
03 11 13 00-0033	SF		Below Grade Walls Foundation Metal Framed Formwork	7.63	
			Note: Excludes footing.		
			<i>For <1,000, Add</i>	1.46	
			<i>For Foundations >8' Below Grade, Add</i>	1.42	
			<i>For Curved Formwork, Add</i>	2.84	
03 11 13 00-0034			Slab Edge And Block-Out Metal Framed Formwork (03 11 13 00-0027)		
03 11 13 00-0035	LF		Up To 6" High Slab Edge and Block-Out Metal Framed Formwork	3.68	
			<i>For Foundations >8' Below Grade, Add</i>	0.72	
			<i>For Curved Formwork, Add</i>	1.45	
			<i>For <250, Add</i>	0.73	



Concrete	03	03	
Concrete Forming And Accessories			03 10
Concrete Forming			03 11

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
03 11 13 00-0036 LF >6" To 12" High Slab Edge and Block-Out Metal Framed Formwork..... <i>For Foundations >8' Below Grade, Add</i> <i>For Curved Formwork, Add</i> <i>For <250, Add</i>	4.59 0.90 1.80 0.91	
03 11 13 00-0037 SF >12" High Slab Edge and Block-Out Metal Framed Formwork..... <i>For Foundations >8' Below Grade, Add</i> <i>For Curved Formwork, Add</i> <i>For <1,000, Add</i>	5.08 0.99 1.99 1.00	
03 11 13 00-0038 Column Metal Framed Formwork (03 11 13 00-0027)		
03 11 13 00-0039 Square Columns (03 11 13 00-0038)		
03 11 13 00-0040 LF Up To 12" Square Column Metal Framed Formwork.....	29.52	
03 11 13 00-0041 LF >12" To 16" Square Column Metal Framed Formwork.....	35.53	
03 11 13 00-0042 LF >16" To 20" Square Column Metal Framed Formwork.....	41.55	
03 11 13 00-0043 LF >20" To 24" Square Column Metal Framed Formwork.....	49.73	
03 11 13 00-0044 LF >24" To 30" Square Column Metal Framed Formwork.....	59.82	
03 11 13 00-0045 LF >30" To 36" Square Column Metal Framed Formwork.....	71.71	
03 11 13 00-0046 LF >36" To 48" Square Column Metal Framed Formwork.....	91.92	
03 11 13 00-0047 LF >48" To 60" Square Column Metal Framed Formwork.....	113.17	
03 11 13 00-0048 Round Columns (03 11 13 00-0038)		
03 11 13 00-0049 LF Up To 12" Diameter Column Metal Formwork.....	25.17	
03 11 13 00-0050 LF >12" To 16" Diameter Column Metal Formwork.....	28.30	
03 11 13 00-0051 LF >16" To 20" Diameter Column Metal Formwork.....	32.79	
03 11 13 00-0052 LF >20" To 24" Diameter Column Metal Formwork.....	38.82	
03 11 13 00-0053 LF >24" To 30" Diameter Column Metal Formwork.....	46.22	
03 11 13 00-0054 LF >30" To 36" Diameter Column Metal Formwork.....	53.23	
03 11 13 00-0055 LF >36" To 48" Diameter Column Metal Formwork.....	67.53	
03 11 13 00-0056 LF >48" To 60" Diameter Column Metal Formwork.....	84.51	
03 11 13 00-0057 Above Grade Wall Metal Framed Formwork (03 11 13 00-0027)		
03 11 13 00-0058 SF Up to 8' High Above Grade Wall Metal Framed Formwork..... <i>For Curved Formwork, Add</i> <i>For <1,000, Add</i>	4.54 1.61 0.84	
03 11 13 00-0059 SF >8' High Above Grade Wall Metal Framed Formwork..... <i>For Curved Formwork, Add</i> <i>For <1,000, Add</i>	5.50 1.93 1.01	
03 11 13 00-0060 Elevated Beam Metal Framed Formwork (03 11 13 00-0027) Note: Includes adjustable shores and column supports and bracing lumber up to 14' for bottom of elevated beam.		
03 11 13 00-0061 SF Bottom of Elevated Beam Metal Framed Formwork..... <i>For Curved Formwork, Add</i> <i>For <1,000, Add</i>	4.51 1.50 0.80	
03 11 13 00-0062 SF Vertical Sides of Elevated Beam Metal Framed Formwork..... <i>For Curved Formwork, Add</i> <i>For <1,000, Add</i>	3.35 1.17 0.61	
03 11 13 00-0063 Elevated Slab Metal Framed Formwork (03 11 13 00-0027) Note: Includes adjustable shores and column supports and bracing lumber up to 14' for bottom of elevated slab.		
03 11 13 00-0064 SF Elevated Slab Metal Framed Formwork..... <i>For <1,000, Add</i>	5.99 0.95	
03 11 13 00-0065 Fiber Tube Formwork (03 11 13) Note: Includes all supporting braces, erecting, aligning, stripping, turnbuckles, ties and clips.		
03 11 13 00-0066 Round Column Fiber Tube Formwork (03 11 13 00-0065)		
03 11 13 00-0067 LF 8" Diameter Round Fiber Tube Formwork..... <i>For Plastic Lined, Add</i> <i>For Columns >12' In Length, Add</i>	14.70 0.82 1.47	
03 11 13 00-0068 LF 10" Diameter Round Fiber Tube Formwork..... <i>For Plastic Lined, Add</i> <i>For Columns >12' In Length, Add</i>	16.57 1.04 1.66	
03 11 13 00-0069 LF 12" Diameter Round Fiber Tube Formwork..... <i>For Plastic Lined, Add</i> <i>For Columns >12' In Length, Add</i>	18.90 1.20 1.89	
03 11 13 00-0070 LF 14" Diameter Round Fiber Tube Formwork..... <i>For Plastic Lined, Add</i> <i>For Columns >12' In Length, Add</i>	20.72 1.37 2.07	
03 11 13 00-0071 LF 16" Diameter Round Fiber Tube Formwork..... <i>For Plastic Lined, Add</i> <i>For Columns >12' In Length, Add</i>	21.87 1.55 2.19	
03 11 13 00-0072 LF 18" Diameter Round Fiber Tube Formwork..... <i>For Plastic Lined, Add</i> <i>For Columns >12' In Length, Add</i>	24.54 2.15 2.45	

03 Concrete**03 10 Concrete Forming And Accessories****03 11 Concrete Forming**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
03 11 13 00-0073	LF		20" Diameter Round Fiber Tube Formwork	27.09	
			<i>For Plastic Lined, Add</i>	2.72	
			<i>For Columns >12' In Length, Add</i>	2.71	
03 11 13 00-0074	LF		22" Diameter Round Fiber Tube Formwork	28.60	
			<i>For Plastic Lined, Add</i>	2.91	
			<i>For Columns >12' In Length, Add</i>	2.86	
03 11 13 00-0075	LF		24" Diameter Round Fiber Tube Formwork	30.12	
			<i>For Plastic Lined, Add</i>	3.09	
			<i>For Columns >12' In Length, Add</i>	3.01	
03 11 13 00-0076	LF		26" Diameter Round Fiber Tube Formwork	31.22	
			<i>For Plastic Lined, Add</i>	3.32	
			<i>For Columns >12' In Length, Add</i>	3.12	
03 11 13 00-0077	LF		28" Diameter Round Fiber Tube Formwork	32.42	
			<i>For Plastic Lined, Add</i>	3.57	
			<i>For Columns >12' In Length, Add</i>	3.24	
03 11 13 00-0078	LF		30" Diameter Round Fiber Tube Formwork	33.76	
			<i>For Plastic Lined, Add</i>	3.86	
			<i>For Columns >12' In Length, Add</i>	3.38	
03 11 13 00-0079	LF		36" Diameter Round Fiber Tube Formwork	38.37	
			<i>For Plastic Lined, Add</i>	4.85	
			<i>For Columns >12' In Length, Add</i>	3.84	
03 11 13 00-0080	LF		42" Diameter Round Fiber Tube Formwork	47.54	
			<i>For Plastic Lined, Add</i>	7.32	
			<i>For Columns >12' In Length, Add</i>	4.75	
03 11 13 00-0081	LF		48" Diameter Round Fiber Tube Formwork	56.69	
			<i>For Plastic Lined, Add</i>	9.79	
			<i>For Columns >12' In Length, Add</i>	5.67	
03 11 13 00-0082			Accessories For Formwork (03 11 13)		
03 11 13 00-0083			Keyway Forms, All Materials (03 11 13 00-0082)		
03 11 13 00-0084	LF		2" x 4" To 2" x 6" Keyway Forms for Concrete Formwork, All Materials.....	1.47	
03 11 13 00-0085			Chamfer Strips, All Materials (03 11 13 00-0082)		
03 11 13 00-0086	LF		1/2" Wide Chamfer Strips for Concrete Formwork, All Materials.....	1.54	
03 11 13 00-0087	LF		3/4" Wide Chamfer Strips for Concrete Formwork, All Materials.....	1.79	
03 11 13 00-0088	LF		1" Wide Chamfer Strips for Concrete Formwork, All Materials.....	2.07	
03 11 13 00-0089			Sleeves And Chases, Plastic Or Sheet Metal (03 11 13 00-0082)		
03 11 13 00-0090	EA		2" Diameter Sleeves Or Chases for Concrete Formwork, Plastic or Sheet Metal	8.44	
03 11 13 00-0091	EA		4" Diameter Sleeves Or Chases for Concrete Formwork, Plastic or Sheet Metal	10.13	
03 11 13 00-0092	EA		6" Diameter Sleeves Or Chases for Concrete Formwork, Plastic or Sheet Metal	12.23	
03 11 13 00-0093	EA		8" Diameter Sleeves Or Chases for Concrete Formwork, Plastic or Sheet Metal	13.72	
03 11 13 00-0094	EA		12" Diameter Sleeves Or Chases for Concrete Formwork, Plastic or Sheet Metal	17.63	
03 11 13 00-0095	EA		18" Diameter Sleeves Or Chases for Concrete Formwork, Plastic or Sheet Metal	37.23	
03 11 16			Architectural Cast-In-Place Concrete Forming (03 11)		
03 11 16 00-0001			Concrete Form Liners (03 11 16)		
03 11 16 00-0002	SF		Concrete Form Liner, Various Patterns And Textures, Add To Formwork.....	3.79	
03 11 23			Permanent Stair Forming (03 11)		
03 11 23 00-0001			Stairway Wood Formwork (03 11 23)		
03 11 23 00-0002	SF		Cast On Grade Stairway Wood Formwork	12.85	
			<i>For Curved Formwork, Add</i>	4.92	
			<i>For <1,000, Add</i>	2.50	
03 11 23 00-0003	SF		Elevated Stairway Wood Formwork	25.03	
			Note: Includes adjustable column supports and bracing lumber up to 14' for bottom of elevated stair.		
			<i>For Curved Formwork, Add</i>	9.48	
			<i>For <1,000, Add</i>	4.83	
03 11 23 00-0004			Stairway Metal Framed Formwork (03 11 23)		
03 11 23 00-0005	SF		Cast On Grade Stairway Metal Framed Formwork	10.23	
			<i>For Curved Formwork, Add</i>	3.95	
			<i>For <1,000, Add</i>	2.00	
03 11 23 00-0006	SF		Elevated Stairway Metal Framed Formwork	19.06	
			Note: Includes adjustable column supports and bracing lumber up to 14' for bottom of elevated stair.		
			<i>For Curved Formwork, Add</i>	7.34	
			<i>For <1,000, Add</i>	3.72	
03 15			Concrete Accessories (03 10)		
03 15 13			Waterstops (03 15)		
03 15 13 13			Non-Expanding Waterstops (03 15 13)		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
03 15 13 13-0001 Polyvinyl Chloride (PVC) Waterstops (03 15 13 13)		
03 15 13 13-0002 LF 3/16" Thick x 4" Wide Ribbed Polyvinyl Chloride (PVC) Waterstop.....	5.45	
03 15 13 13-0003 LF 3/16" Thick x 6" Wide Ribbed Polyvinyl Chloride (PVC) Waterstop.....	6.08	
03 15 13 13-0004 LF 3/16" Thick x 9" Wide Ribbed Polyvinyl Chloride (PVC) Waterstop With Center Bulb.....	7.19	
03 15 13 13-0005 LF 3/8" Thick x 9" Wide Ribbed Polyvinyl Chloride (PVC) Waterstop With Center Bulb.....	7.83	
03 15 13 13-0006 LF 1/2" Thick x 9" Wide Ribbed Polyvinyl Chloride (PVC) Waterstop.....	11.18	
03 15 13 13-0007 LF 3/16" Thick x 6" Wide Dumbbell Polyvinyl Chloride (PVC) Waterstop.....	5.69	
03 15 13 13-0008 LF 3/8" Thick x 6" Wide Dumbbell Polyvinyl Chloride (PVC) Waterstop.....	7.21	
03 15 13 13-0009 LF 3/8" Thick x 9" Wide Plain Polyvinyl Chloride (PVC) Waterstop.....	12.11	
03 15 13 13-0010 LF 3/8" Thick x 9" Wide Plain Polyvinyl Chloride (PVC) Waterstop With Center Bulb.....	9.81	
03 15 13 13-0011 Rubber Waterstops (03 15 13 13)		
03 15 13 13-0012 LF 3/8" Thick x 6" Wide Rubber Dumbbell Waterstop.....	6.91	
03 15 13 13-0013 LF 3/8" Thick x 9" Wide Rubber Dumbbell Waterstop.....	8.09	
03 15 13 13-0014 LF 1/4" Thick x 6" Wide Rubber Waterstop, With Center Bulb.....	7.66	
03 15 13 13-0015 LF 1/4" Thick x 9" Wide Rubber Waterstop, With Center Bulb.....	10.97	
03 15 13 13-0016 LF 3/8" Thick x 6" Wide Rubber Waterstop, With Center Bulb.....	8.61	
03 15 13 13-0017 LF 3/8" Thick x 9" Wide Rubber Waterstop, With Center Bulb.....	11.45	
03 15 13 16 Expanding Waterstops (03 15 13)		
03 15 13 16-0001 Bentonite Waterstops (03 15 13 16)		
03 15 13 16-0002 LF 3/4" x 3/8" Bentonite Waterstop.....	4.73	
03 15 13 16-0003 LF 1-1/4" x 1/2" Bentonite Waterstop.....	7.08	
03 15 13 16-0004 LF 1" x 3/4" Bentonite Waterstop.....	7.91	
03 15 13 16-0005 LF 1" x 1" Bentonite Waterstop.....	8.86	
03 15 16 Concrete Construction Joints (03 15)		
03 15 16 00-0001 Poured Expansion Joint (03 15 16)		
03 15 16 00-0002 LF 1/2" x 1" Plain Asphalt Expansion Joint, Poured.....	2.83	0.73
<i>For Installation In Walls, Add</i>	1.22	
03 15 16 00-0003 LF 1" x 2" Plain Asphalt Expansion Joint, Poured.....	6.15	0.73
<i>For Installation In Walls, Add</i>	1.37	
03 15 16 00-0004 LF 1/2" x 1" Liquid Neoprene Expansion Joint, Poured, Cold Applied.....	2.40	0.73
<i>For Installation In Walls, Add</i>	1.22	
03 15 16 00-0005 LF 1" x 2" Liquid Neoprene Expansion Joint, Poured, Cold Applied.....	4.98	0.73
<i>For Installation In Walls, Add</i>	1.37	
03 15 16 00-0006 LF 1/2" x 1" Polyurethane Expansion Joint, Poured, 2 Parts.....	3.29	0.73
<i>For Installation In Walls, Add</i>	1.37	
03 15 16 00-0007 LF 1" x 2" Polyurethane Expansion Joint, Poured, Poured, 2 Parts.....	5.87	0.73
<i>For Installation In Walls, Add</i>	2.23	
03 15 16 00-0008 LF 1/2" x 1" Rubberized Asphalt Expansion Joint, Poured, Hot Or Cold Applied.....	2.02	0.73
<i>For Installation In Walls, Add</i>	1.22	
03 15 16 00-0009 LF 1/2" x 1" Rubberized Asphalt Expansion Joint, Poured, Hot Applied Fuel Resistant.....	2.47	0.73
<i>For Installation In Walls, Add</i>	1.22	
03 15 16 00-0010 LF 1" x 2" Rubberized Asphalt Expansion Joint, Poured, Hot Applied Fuel Resistant.....	3.37	0.73
<i>For Installation In Walls, Add</i>	1.37	
03 15 16 00-0011 Premolded Expansion Joints (03 15 16)		
03 15 16 00-0012 Asphalt Saturated Fiber, Premolded Expansion Joints (03 15 16 00-0011)		
03 15 16 00-0013 LF 1/4" x 3" Asphalt Saturated Fiber, Premolded Expansion Joint.....	1.57	0.71
03 15 16 00-0014 LF 1/4" x 4" Asphalt Saturated Fiber, Premolded Expansion Joint.....	1.81	0.76
03 15 16 00-0015 LF 1/4" x 5" Asphalt Saturated Fiber, Premolded Expansion Joint.....	1.96	0.79
03 15 16 00-0016 LF 1/4" x 6" Asphalt Saturated Fiber, Premolded Expansion Joint.....	2.11	0.83
03 15 16 00-0017 LF 3/8" x 3" Asphalt Saturated Fiber, Premolded Expansion Joint.....	1.73	0.71
03 15 16 00-0018 LF 3/8" x 4" Asphalt Saturated Fiber, Premolded Expansion Joint.....	1.94	0.76
03 15 16 00-0019 LF 3/8" x 5" Asphalt Saturated Fiber, Premolded Expansion Joint.....	2.19	0.79
03 15 16 00-0020 LF 3/8" x 6" Asphalt Saturated Fiber, Premolded Expansion Joint.....	2.55	0.83
03 15 16 00-0021 LF 1/2" x 2" Asphalt Saturated Fiber, Premolded Expansion Joint.....	1.57	0.68
03 15 16 00-0022 LF 1/2" x 3" Asphalt Saturated Fiber, Premolded Expansion Joint.....	1.71	0.71
03 15 16 00-0023 LF 1/2" x 4" Asphalt Saturated Fiber, Premolded Expansion Joint.....	1.88	0.76
03 15 16 00-0024 LF 1/2" x 5" Asphalt Saturated Fiber, Premolded Expansion Joint.....	2.02	0.79
03 15 16 00-0025 LF 1/2" x 6" Asphalt Saturated Fiber, Premolded Expansion Joint.....	2.20	0.83
03 15 16 00-0026 LF 1/2" x 8" Asphalt Saturated Fiber, Premolded Expansion Joint.....	2.45	0.87
03 15 16 00-0027 LF 1/2" x 10" Asphalt Saturated Fiber, Premolded Expansion Joint.....	2.64	0.90
03 15 16 00-0028 LF 1/2" x 12" Asphalt Saturated Fiber, Premolded Expansion Joint.....	2.98	0.94
03 15 16 00-0029 LF 3/4" x 4" Asphalt Saturated Fiber, Premolded Expansion Joint.....	1.89	0.76
03 15 16 00-0030 LF 3/4" x 5" Asphalt Saturated Fiber, Premolded Expansion Joint.....	2.18	0.79
03 15 16 00-0031 LF 3/4" x 8" Asphalt Saturated Fiber, Premolded Expansion Joint.....	2.69	0.87
03 15 16 00-0032 SF 1" Asphalt Saturated Fiber, Premolded Expansion Joint.....	4.73	1.19
03 15 16 00-0033 Cork, Premolded Expansion Joints (03 15 16 00-0011)		
03 15 16 00-0034 LF 1/2" x 4" Cork, Premolded Expansion Joint.....	2.78	0.76
03 15 16 00-0035 LF 1/2" x 6" Cork, Premolded Expansion Joint.....	3.13	0.83

03 Concrete**03 10 Concrete Forming And Accessories****03 15 Concrete Accessories**

MINOR				TOTAL DIRECT	DEMOLITION
CSI	UOM	DESCRIPTION		UNIT COST	UNIT COST
03 15 16 00-0036	LF	1/2" x 8" Cork, Premolded Expansion Joint		3.40	0.87
03 15 16 00-0037	LF	1/2" x 10" Cork, Premolded Expansion Joint		4.84	0.90
03 15 16 00-0038	LF	1/2" x 12" Cork, Premolded Expansion Joint		5.15	0.94
03 15 16 00-0039	SF	1/2" Cork, Premolded Expansion Joint		5.67	1.19
03 15 16 00-0040	SF	3/4" Cork, Premolded Expansion Joint		6.61	1.19
03 15 16 00-0041	SF	1" Cork, Premolded Expansion Joint		7.04	1.19
03 15 16 00-0042		Flexible Polyethylene Foam, Premolded Expansion Joints (03 15 16 00-0011)			
03 15 16 00-0043	LF	1/4" x 4" Flexible Polyethylene Foam, Premolded Expansion Joint		1.71	0.76
03 15 16 00-0044	LF	1/4" x 5" Flexible Polyethylene Foam, Premolded Expansion Joint		1.78	0.79
03 15 16 00-0045	LF	1/4" x 6" Flexible Polyethylene Foam, Premolded Expansion Joint		1.88	0.83
03 15 16 00-0046	LF	1/4" x 8" Flexible Polyethylene Foam, Premolded Expansion Joint		2.20	0.87
03 15 16 00-0047	LF	1/2" x 4" Flexible Polyethylene Foam, Premolded Expansion Joint		1.76	0.76
03 15 16 00-0048	LF	1/2" x 5" Flexible Polyethylene Foam, Premolded Expansion Joint		1.84	0.79
03 15 16 00-0049	LF	1/2" x 6" Flexible Polyethylene Foam, Premolded Expansion Joint		1.91	0.83
03 15 16 00-0050	LF	1/2" x 8" Flexible Polyethylene Foam, Premolded Expansion Joint		2.11	0.87
03 15 16 00-0051		Zip Strip, Premolded Expansion Joints (03 15 16 00-0011)			
03 15 16 00-0052	LF	1" Zip Strip, Premolded Expansion Joint		1.73	0.76
03 15 16 00-0053	LF	1-1/2" Zip Strip, Premolded Expansion Joint		1.89	0.79
03 15 16 00-0054	LF	2" Zip Strip, Premolded Expansion Joint		2.11	0.87
03 15 16 00-0055		Sponge Rubber, Premolded Expansion Joints (03 15 16 00-0011)			
03 15 16 00-0056	LF	1/2" x 4" Sponge Rubber, Premolded Expansion Joint		3.48	0.71
03 15 16 00-0057	LF	1/2" x 6" Sponge Rubber, Premolded Expansion Joint		4.17	0.71
03 15 16 00-0058		Asphalt Felt Control Joints Or Bond Breaker (03 15 16)			
03 15 16 00-0059	SF	Asphalt Felt Control Joint, 30 LB Felt Bond Breaker		0.81	0.54
03 15 16 00-0060	SF	Asphalt Felt Control Joint, 15 LB Felt Bond Breaker		0.76	0.54
03 15 16 00-0061		Keyed Cold Expansion And Control Joints (03 15 16)			
03 15 16 00-0062		24 Gauge Galvanized Steel With Stakes (03 15 16 00-0061)			
03 15 16 00-0063	LF	24 Gauge Galvanized Steel Keyed Joint, 3-1/2" Cold Expansion Or Control Joint		4.11	
03 15 16 00-0064	LF	24 Gauge Galvanized Steel Keyed Joint, 4-1/2" Cold Expansion Or Control Joint		4.18	
03 15 16 00-0065	LF	24 Gauge Galvanized Steel Keyed Joint, 5-1/2" Cold Expansion Or Control Joint		4.33	
03 15 16 00-0066	LF	24 Gauge Galvanized Steel Keyed Joint, 7-1/2" Cold Expansion Or Control Joint		4.58	
03 15 16 00-0067	LF	24 Gauge Galvanized Steel Keyed Joint, 9-1/2" Cold Expansion Or Control Joint		5.73	
03 15 19		Cast-In Concrete Anchors (03 15)			
03 15 19 00-0001		Cast In Place Anchors (03 15 19) Note: For cast in place installations. Includes nut and washer.			
03 15 19 00-0002		J-Type Anchor Bolts (03 15 19 00-0001) See CSI section 03 11 13 00-0002 for template.			
03 15 19 00-0003		1/2" And 5/8" Diameter (03 15 19 00-0002)			
03 15 19 00-0004	EA	1/2" Diameter x 6" Length, Plain Steel, J-Type Cast In Place Anchor Bolt		5.51	
		For Galvanized, Add		0.72	
		For Stainless Steel, Add		5.01	
		For >10 To 50, Deduct		-0.20	
		For >50 To 100, Deduct		-0.44	
		For >100, Deduct		-0.89	
03 15 19 00-0005	EA	1/2" Diameter x 12" Length, Plain Steel, J-Type Cast In Place Anchor Bolt		6.22	
		For Galvanized, Add		0.91	
		For Stainless Steel, Add		6.37	
		For >10 To 50, Deduct		-0.22	
		For >50 To 100, Deduct		-0.49	
		For >100, Deduct		-0.97	
03 15 19 00-0006	EA	1/2" Diameter x 18" Length, Plain Steel, J-Type Cast In Place Anchor Bolt		7.28	
		For Galvanized, Add		1.26	
		For Stainless Steel, Add		8.79	
		For >10 To 50, Deduct		-0.24	
		For >50 To 100, Deduct		-0.54	
		For >100, Deduct		-1.08	
03 15 19 00-0007	EA	5/8" Diameter x 12" Length, Plain Steel, J-Type Cast In Place Anchor Bolt		8.05	
		For Galvanized, Add		1.64	
		For Stainless Steel, Add		11.48	
		For >10 To 50, Deduct		-0.24	
		For >50 To 100, Deduct		-0.56	
		For >100, Deduct		-1.12	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
03 15 19 00-0008	EA		5/8" Diameter x 18" Length, Plain Steel, J-Type Cast In Place Anchor Bolt .....9.58		
			<i>For Galvanized, Add</i>	2.19	
			<i>For Stainless Steel, Add</i>	15.33	
			<i>For >10 To 50, Deduct</i>	-0.26	
			<i>For >50 To 100, Deduct</i>	-0.63	
			<i>For >100, Deduct</i>	-1.26	
03 15 19 00-0009	EA		5/8" Diameter x 24" Length, Plain Steel, J-Type Cast In Place Anchor Bolt .....10.73		
			<i>For Galvanized, Add</i>	2.51	
			<i>For Stainless Steel, Add</i>	17.54	
			<i>For >10 To 50, Deduct</i>	-0.29	
			<i>For >50 To 100, Deduct</i>	-0.70	
			<i>For >100, Deduct</i>	-1.39	
03 15 19 00-0010			3/4" And 7/8" Diameter (03 15 19 00-0002)		
03 15 19 00-0011	EA		3/4" Diameter x 8" Length, Plain Steel, J-Type Cast In Place Anchor Bolt .....10.69		
			<i>For Galvanized, Add</i>	2.49	
			<i>For Stainless Steel, Add</i>	17.40	
			<i>For >10 To 50, Deduct</i>	-0.29	
			<i>For >50 To 100, Deduct</i>	-0.70	
			<i>For >100, Deduct</i>	-1.39	
03 15 19 00-0012	EA		3/4" Diameter x 12" Length, Plain Steel, J-Type Cast In Place Anchor Bolt .....12.15		
			<i>For Galvanized, Add</i>	2.90	
			<i>For Stainless Steel, Add</i>	20.27	
			<i>For >10 To 50, Deduct</i>	-0.32	
			<i>For >50 To 100, Deduct</i>	-0.78	
			<i>For >100, Deduct</i>	-1.56	
03 15 19 00-0013	EA		3/4" Diameter x 18" Length, Plain Steel, J-Type Cast In Place Anchor Bolt .....14.56		
			<i>For Galvanized, Add</i>	3.71	
			<i>For Stainless Steel, Add</i>	25.97	
			<i>For >10 To 50, Deduct</i>	-0.36	
			<i>For >50 To 100, Deduct</i>	-0.90	
			<i>For >100, Deduct</i>	-1.80	
03 15 19 00-0014	EA		3/4" Diameter x 24" Length, Plain Steel, J-Type Cast In Place Anchor Bolt .....17.36		
			<i>For Galvanized, Add</i>	4.68	
			<i>For Stainless Steel, Add</i>	32.73	
			<i>For >10 To 50, Deduct</i>	-0.40	
			<i>For >50 To 100, Deduct</i>	-1.03	
			<i>For >100, Deduct</i>	-2.07	
03 15 19 00-0015	EA		7/8" Diameter x 12" Length, Plain Steel, J-Type Cast In Place Anchor Bolt .....13.94		
			<i>For Galvanized, Add</i>	3.40	
			<i>For Stainless Steel, Add</i>	23.80	
			<i>For >10 To 50, Deduct</i>	-0.36	
			<i>For >50 To 100, Deduct</i>	-0.88	
			<i>For >100, Deduct</i>	-1.77	
03 15 19 00-0016	EA		7/8" Diameter x 18" Length, Plain Steel, J-Type Cast In Place Anchor Bolt .....16.31		
			<i>For Galvanized, Add</i>	4.07	
			<i>For Stainless Steel, Add</i>	28.49	
			<i>For >10 To 50, Deduct</i>	-0.41	
			<i>For >50 To 100, Deduct</i>	-1.02	
			<i>For >100, Deduct</i>	-2.04	
03 15 19 00-0017	EA		7/8" Diameter x 24" Length, Plain Steel, J-Type Cast In Place Anchor Bolt .....20.38		
			<i>For Galvanized, Add</i>	5.43	
			<i>For Stainless Steel, Add</i>	37.98	
			<i>For >10 To 50, Deduct</i>	-0.48	
			<i>For >50 To 100, Deduct</i>	-1.22	
			<i>For >100, Deduct</i>	-2.45	
03 15 19 00-0018			1" And 1-1/8" Diameter (03 15 19 00-0002)		
03 15 19 00-0019	EA		1" Diameter x 12" Length, Plain Steel, J-Type Cast In Place Anchor Bolt .....16.96		
			<i>For Galvanized, Add</i>	4.40	
			<i>For Stainless Steel, Add</i>	30.77	
			<i>For >10 To 50, Deduct</i>	-0.41	
			<i>For >50 To 100, Deduct</i>	-1.04	
			<i>For >100, Deduct</i>	-2.07	
03 15 19 00-0020	EA		1" Diameter x 18" Length, Plain Steel, J-Type Cast In Place Anchor Bolt .....20.11		
			<i>For Galvanized, Add</i>	5.29	
			<i>For Stainless Steel, Add</i>	37.03	
			<i>For >10 To 50, Deduct</i>	-0.48	
			<i>For >50 To 100, Deduct</i>	-1.22	
			<i>For >100, Deduct</i>	-2.44	
03 15 19 00-0021	EA		1" Diameter x 24" Length, Plain Steel, J-Type Cast In Place Anchor Bolt .....24.69		
			<i>For Galvanized, Add</i>	6.63	
			<i>For Stainless Steel, Add</i>	46.41	
			<i>For >10 To 50, Deduct</i>	-0.57	
			<i>For >50 To 100, Deduct</i>	-1.47	
			<i>For >100, Deduct</i>	-2.95	
03 15 19 00-0022	EA		1" Diameter x 36" Length, Plain Steel, J-Type Cast In Place Anchor Bolt .....30.50		
			<i>For Galvanized, Add</i>	8.10	
			<i>For Stainless Steel, Add</i>	56.70	
			<i>For >10 To 50, Deduct</i>	-0.72	
			<i>For >50 To 100, Deduct</i>	-1.84	
			<i>For >100, Deduct</i>	-3.67	

03 Concrete**03 10 Concrete Forming And Accessories****03 15 Concrete Accessories**

MINOR		TOTAL DIRECT	DEMOLITION
CSI	UOM DESCRIPTION	UNIT COST	UNIT COST
03 15 19 00-0023	EA 1-1/8" Diameter x 12" Length, Plain Steel, J-Type Cast In Place Anchor Bolt	19.96	
	For Galvanized, Add	5.50	
	For Stainless Steel, Add	38.47	
	For >10 To 50, Deduct	-0.45	
	For >50 To 100, Deduct	-1.17	
	For >100, Deduct	-2.34	
03 15 19 00-0024	EA 1-1/8" Diameter x 18" Length, Plain Steel, J-Type Cast In Place Anchor Bolt	23.68	
	For Galvanized, Add	6.61	
	For Stainless Steel, Add	46.27	
	For >10 To 50, Deduct	-0.52	
	For >50 To 100, Deduct	-1.38	
	For >100, Deduct	-2.75	
03 15 19 00-0025	EA 1-1/8" Diameter x 24" Length, Plain Steel, J-Type Cast In Place Anchor Bolt	29.13	
	For Galvanized, Add	8.29	
	For Stainless Steel, Add	58.03	
	For >10 To 50, Deduct	-0.63	
	For >50 To 100, Deduct	-1.67	
	For >100, Deduct	-3.34	
03 15 19 00-0026	EA 1-1/8" Diameter x 36" Length, Plain Steel, J-Type Cast In Place Anchor Bolt	35.95	
	For Galvanized, Add	10.13	
	For Stainless Steel, Add	70.88	
	For >10 To 50, Deduct	-0.79	
	For >50 To 100, Deduct	-2.08	
	For >100, Deduct	-4.15	
03 15 19 00-0027	1-1/4" And 1-1/2" Diameter <small>(03 15 19 00-0002)</small>		
03 15 19 00-0028	EA 1-1/4" Diameter x 12" Length, Plain Steel, J-Type Cast In Place Anchor Bolt	23.66	
	For Galvanized, Add	6.87	
	For Stainless Steel, Add	48.06	
	For >10 To 50, Deduct	-0.50	
	For >50 To 100, Deduct	-1.34	
	For >100, Deduct	-2.67	
03 15 19 00-0029	EA 1-1/4" Diameter x 18" Length, Plain Steel, J-Type Cast In Place Anchor Bolt	28.12	
	For Galvanized, Add	8.27	
	For Stainless Steel, Add	57.86	
	For >10 To 50, Deduct	-0.58	
	For >50 To 100, Deduct	-1.57	
	For >100, Deduct	-3.14	
03 15 19 00-0030	EA 1-1/4" Diameter x 24" Length, Plain Steel, J-Type Cast In Place Anchor Bolt	34.63	
	For Galvanized, Add	10.37	
	For Stainless Steel, Add	72.56	
	For >10 To 50, Deduct	-0.70	
	For >50 To 100, Deduct	-1.91	
	For >100, Deduct	-3.82	
03 15 19 00-0031	EA 1-1/4" Diameter x 36" Length, Plain Steel, J-Type Cast In Place Anchor Bolt	42.69	
	For Galvanized, Add	12.66	
	For Stainless Steel, Add	88.59	
	For >10 To 50, Deduct	-0.87	
	For >50 To 100, Deduct	-2.37	
	For >100, Deduct	-4.74	
03 15 19 00-0032	EA 1-1/2" Diameter x 12" Length, Plain Steel, J-Type Cast In Place Anchor Bolt	28.31	
	For Galvanized, Add	8.59	
	For Stainless Steel, Add	60.10	
	For >10 To 50, Deduct	-0.56	
	For >50 To 100, Deduct	-1.54	
	For >100, Deduct	-3.09	
03 15 19 00-0033	EA 1-1/2" Diameter x 18" Length, Plain Steel, J-Type Cast In Place Anchor Bolt	33.66	
	For Galvanized, Add	10.33	
	For Stainless Steel, Add	72.31	
	For >10 To 50, Deduct	-0.65	
	For >50 To 100, Deduct	-1.82	
	For >100, Deduct	-3.63	
03 15 19 00-0034	EA 1-1/2" Diameter x 24" Length, Plain Steel, J-Type Cast In Place Anchor Bolt	41.51	
	For Galvanized, Add	12.96	
	For Stainless Steel, Add	90.69	
	For >10 To 50, Deduct	-0.78	
	For >50 To 100, Deduct	-2.21	
	For >100, Deduct	-4.42	
03 15 19 00-0035	EA 1-1/2" Diameter x 36" Length, Plain Steel, J-Type Cast In Place Anchor Bolt	51.12	
	For Galvanized, Add	15.82	
	For Stainless Steel, Add	110.74	
	For >10 To 50, Deduct	-0.97	
	For >50 To 100, Deduct	-2.74	
	For >100, Deduct	-5.48	
03 15 19 00-0036	L-Type Anchor Bolts <small>(03 15 19 00-0001)</small>		
	See CSI section 03 11 13 00-0002 for template.		
03 15 19 00-0037	3/4" And 7/8" Diameter <small>(03 15 19 00-0036)</small>		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
03 15 19 00-0038 EA 3/4" Diameter x 12" Length, Plain Steel, L-Type Cast In Place Anchor Bolt	10.16	
For Galvanized, Add	1.90	
For Stainless Steel, Add	13.30	
For >10 To 50, Deduct	-0.32	
For >50 To 100, Deduct	-0.73	
For >100, Deduct	-1.46	
03 15 19 00-0039 EA 3/4" Diameter x 18" Length, Plain Steel, L-Type Cast In Place Anchor Bolt	11.83	
For Galvanized, Add	2.35	
For Stainless Steel, Add	16.42	
For >10 To 50, Deduct	-0.36	
For >50 To 100, Deduct	-0.83	
For >100, Deduct	-1.66	
03 15 19 00-0040 EA 3/4" Diameter x 24" Length, Plain Steel, L-Type Cast In Place Anchor Bolt	13.55	
For Galvanized, Add	2.69	
For Stainless Steel, Add	18.83	
For >10 To 50, Deduct	-0.41	
For >50 To 100, Deduct	-0.95	
For >100, Deduct	-1.90	
03 15 19 00-0041 EA 3/4" Diameter x 30" Length, Plain Steel, L-Type Cast In Place Anchor Bolt	15.12	
For Galvanized, Add	2.80	
For Stainless Steel, Add	19.57	
For >10 To 50, Deduct	-0.48	
For >50 To 100, Deduct	-1.09	
For >100, Deduct	-2.19	
03 15 19 00-0042 EA 3/4" Diameter x 36" Length, Plain Steel, L-Type Cast In Place Anchor Bolt	17.30	
For Galvanized, Add	2.94	
For Stainless Steel, Add	20.55	
For >10 To 50, Deduct	-0.57	
For >50 To 100, Deduct	-1.29	
For >100, Deduct	-2.58	
03 15 19 00-0043 EA 7/8" Diameter x 12" Length, Plain Steel, L-Type Cast In Place Anchor Bolt	11.85	
For Galvanized, Add	2.36	
For Stainless Steel, Add	16.49	
For >10 To 50, Deduct	-0.36	
For >50 To 100, Deduct	-0.83	
For >100, Deduct	-1.66	
03 15 19 00-0044 EA 7/8" Diameter x 18" Length, Plain Steel, L-Type Cast In Place Anchor Bolt	13.66	
For Galvanized, Add	2.75	
For Stainless Steel, Add	19.22	
For >10 To 50, Deduct	-0.41	
For >50 To 100, Deduct	-0.95	
For >100, Deduct	-1.91	
03 15 19 00-0045 EA 7/8" Diameter x 24" Length, Plain Steel, L-Type Cast In Place Anchor Bolt	15.82	
For Galvanized, Add	3.15	
For Stainless Steel, Add	22.02	
For >10 To 50, Deduct	-0.48	
For >50 To 100, Deduct	-1.11	
For >100, Deduct	-2.22	
03 15 19 00-0046 EA 7/8" Diameter x 30" Length, Plain Steel, L-Type Cast In Place Anchor Bolt	17.97	
For Galvanized, Add	3.27	
For Stainless Steel, Add	22.89	
For >10 To 50, Deduct	-0.57	
For >50 To 100, Deduct	-1.31	
For >100, Deduct	-2.61	
03 15 19 00-0047 EA 7/8" Diameter x 36" Length, Plain Steel, L-Type Cast In Place Anchor Bolt	21.17	
For Galvanized, Add	3.44	
For Stainless Steel, Add	24.05	
For >10 To 50, Deduct	-0.72	
For >50 To 100, Deduct	-1.60	
For >100, Deduct	-3.20	
03 15 19 00-0048 1" And 1-1/8" Diameter <small>(03 15 19 00-0038)</small>		
03 15 19 00-0049 EA 1" Diameter x 12" Length, Plain Steel, L-Type Cast In Place Anchor Bolt	14.21	
For Galvanized, Add	3.02	
For Stainless Steel, Add	21.14	
For >10 To 50, Deduct	-0.41	
For >50 To 100, Deduct	-0.97	
For >100, Deduct	-1.94	
03 15 19 00-0050 EA 1" Diameter x 18" Length, Plain Steel, L-Type Cast In Place Anchor Bolt	16.33	
For Galvanized, Add	3.40	
For Stainless Steel, Add	23.80	
For >10 To 50, Deduct	-0.48	
For >50 To 100, Deduct	-1.12	
For >100, Deduct	-2.25	
03 15 19 00-0051 EA 1" Diameter x 24" Length, Plain Steel, L-Type Cast In Place Anchor Bolt	19.03	
For Galvanized, Add	3.80	
For Stainless Steel, Add	26.60	
For >10 To 50, Deduct	-0.57	
For >50 To 100, Deduct	-1.33	
For >100, Deduct	-2.67	

03 Concrete**03 10 Concrete Forming And Accessories****03 15 Concrete Accessories**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
03 15 19 00-0052	EA		1" Diameter x 30" Length, Plain Steel, L-Type Cast In Place Anchor Bolt	20.39	
			<i>For Galvanized, Add</i>	3.98	
			<i>For Stainless Steel, Add</i>	27.86	
			<i>For >10 To 50, Deduct</i>	-0.62	
			<i>For >50 To 100, Deduct</i>	-1.44	
			<i>For >100, Deduct</i>	-2.88	
03 15 19 00-0053	EA		1" Diameter x 36" Length, Plain Steel, L-Type Cast In Place Anchor Bolt	22.63	
			<i>For Galvanized, Add</i>	4.17	
			<i>For Stainless Steel, Add</i>	29.16	
			<i>For >10 To 50, Deduct</i>	-0.72	
			<i>For >50 To 100, Deduct</i>	-1.64	
			<i>For >100, Deduct</i>	-3.28	
03 15 19 00-0054	EA		1" Diameter x 42" Length, Plain Steel, L-Type Cast In Place Anchor Bolt	25.54	
			<i>For Galvanized, Add</i>	4.83	
			<i>For Stainless Steel, Add</i>	33.81	
			<i>For >10 To 50, Deduct</i>	-0.79	
			<i>For >50 To 100, Deduct</i>	-1.83	
			<i>For >100, Deduct</i>	-3.66	
03 15 19 00-0055	EA		1" Diameter x 48" Length, Plain Steel, L-Type Cast In Place Anchor Bolt	30.36	
			<i>For Galvanized, Add</i>	5.65	
			<i>For Stainless Steel, Add</i>	39.55	
			<i>For >10 To 50, Deduct</i>	-0.95	
			<i>For >50 To 100, Deduct</i>	-2.19	
			<i>For >100, Deduct</i>	-4.38	
03 15 19 00-0056	EA		1-1/8" Diameter x 18" Length, Plain Steel, L-Type Cast In Place Anchor Bolt	17.48	
			<i>For Galvanized, Add</i>	3.98	
			<i>For Stainless Steel, Add</i>	27.83	
			<i>For >10 To 50, Deduct</i>	-0.48	
			<i>For >50 To 100, Deduct</i>	-1.15	
			<i>For >100, Deduct</i>	-2.30	
03 15 19 00-0057	EA		1-1/8" Diameter x 24" Length, Plain Steel, L-Type Cast In Place Anchor Bolt	20.33	
			<i>For Galvanized, Add</i>	4.45	
			<i>For Stainless Steel, Add</i>	31.15	
			<i>For >10 To 50, Deduct</i>	-0.57	
			<i>For >50 To 100, Deduct</i>	-1.37	
			<i>For >100, Deduct</i>	-2.73	
03 15 19 00-0058	EA		1-1/8" Diameter x 30" Length, Plain Steel, L-Type Cast In Place Anchor Bolt	21.74	
			<i>For Galvanized, Add</i>	4.66	
			<i>For Stainless Steel, Add</i>	32.59	
			<i>For >10 To 50, Deduct</i>	-0.62	
			<i>For >50 To 100, Deduct</i>	-1.48	
			<i>For >100, Deduct</i>	-2.95	

03 20 Concrete Reinforcing ⁽⁰³⁾

Note: Includes cutting or torching to size, bending where necessary and tie wires.

03 21 Reinforcement Bars ^(03 20)

Note: Includes cutting, bending, tie wire, tying, bar chairs and all non-mechanical splicing. The weights of reinforcing steel shall be used as follows: #2 - 0.167 Lbs./LF, #3 - 0.376 Lbs./LF, #4 - 0.668 Lbs./LF, #5 - 1.043 Lbs./LF, #6 - 1.502 Lbs./LF, #7 - 2.044 Lbs./LF, #8 - 2.670 Lbs./LF, #9 - 3.400 Lbs./LF, #10 - 4.303 Lbs./LF, #11 - 5.313 Lbs./LF, #14 - 7.650 Lbs./LF, #18 - 13.600 Lbs./LF.

03 21 11 Plain Steel Reinforcement Bars ^(03 21)**03 21 11 00-0001 Beams And Girders, Steel Reinforcement Bar** ^(03 21 11)

Note: ASTM A-615 Plain Steel and A-706 Low Alloy Steel.

03 21 11 00-0002	LF	#3, Grade 40, Beams And Girders, Steel Reinforcement Bar	0.49
03 21 11 00-0003	LF	#4, Grade 40, Beams And Girders, Steel Reinforcement Bar	0.81
03 21 11 00-0004	LF	#5, Grade 40, Beams And Girders, Steel Reinforcement Bar	1.21
03 21 11 00-0005	LF	#6, Grade 40, Beams And Girders, Steel Reinforcement Bar	1.64
03 21 11 00-0006	LF	#3, Grade 50, Beams And Girders, Steel Reinforcement Bar	0.50
03 21 11 00-0007	LF	#4, Grade 50, Beams And Girders, Steel Reinforcement Bar	0.82
03 21 11 00-0008	LF	#5, Grade 50, Beams And Girders, Steel Reinforcement Bar	1.23
03 21 11 00-0009	LF	#6, Grade 50, Beams And Girders, Steel Reinforcement Bar	1.68
03 21 11 00-0010	LF	#3, Grade 60, Beams And Girders, Steel Reinforcement Bar	0.51
03 21 11 00-0011	LF	#4, Grade 60, Beams And Girders, Steel Reinforcement Bar	0.85
03 21 11 00-0012	LF	#5, Grade 60, Beams And Girders, Steel Reinforcement Bar	1.27
03 21 11 00-0013	LF	#6, Grade 60, Beams And Girders, Steel Reinforcement Bar	1.73
03 21 11 00-0014	LF	#7, Grade 60, Beams And Girders, Steel Reinforcement Bar	2.24
03 21 11 00-0015	LF	#8, Grade 60, Beams And Girders, Steel Reinforcement Bar	2.77
03 21 11 00-0016	LF	#9, Grade 60, Beams And Girders, Steel Reinforcement Bar	3.37
03 21 11 00-0017	LF	#10, Grade 60, Beams And Girders, Steel Reinforcement Bar	4.10
03 21 11 00-0018	LF	#11, Grade 60, Beams And Girders, Steel Reinforcement Bar	4.84
03 21 11 00-0019	LF	#14, Grade 60, Beams And Girders, Steel Reinforcement Bar	6.66
03 21 11 00-0020	LF	#18, Grade 60, Beams And Girders, Steel Reinforcement Bar	11.28
03 21 11 00-0021	LF	#6, Grade 75, Beams And Girders, Steel Reinforcement Bar	1.78
03 21 11 00-0022	LF	#7, Grade 75, Beams And Girders, Steel Reinforcement Bar	2.31
03 21 11 00-0023	LF	#8, Grade 75, Beams And Girders, Steel Reinforcement Bar	2.86
03 21 11 00-0024	LF	#9, Grade 75, Beams And Girders, Steel Reinforcement Bar	3.49
03 21 11 00-0025	LF	#10, Grade 75, Beams And Girders, Steel Reinforcement Bar	4.24
03 21 11 00-0026	LF	#11, Grade 75, Beams And Girders, Steel Reinforcement Bar	5.02
03 21 11 00-0027	LF	#14, Grade 75, Beams And Girders, Steel Reinforcement Bar	6.91
03 21 11 00-0028	LF	#18, Grade 75, Beams And Girders, Steel Reinforcement Bar	11.74
03 21 11 00-0029	LF	#3, Grade 60, Beams And Girders, Low Alloy Steel Reinforcement Bar	0.52



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
03 21 11 00-0030	LF			#4, Grade 60, Beams And Girders, Low Alloy Steel Reinforcement Bar	0.86	
03 21 11 00-0031	LF			#5, Grade 60, Beams And Girders, Low Alloy Steel Reinforcement Bar	1.29	
03 21 11 00-0032	LF			#6, Grade 60, Beams And Girders, Low Alloy Steel Reinforcement Bar	1.76	
03 21 11 00-0033	LF			#7, Grade 60, Beams And Girders, Low Alloy Steel Reinforcement Bar	2.29	
03 21 11 00-0034	LF			#8, Grade 60, Beams And Girders, Low Alloy Steel Reinforcement Bar	2.83	
03 21 11 00-0035	LF			#9, Grade 60, Beams And Girders, Low Alloy Steel Reinforcement Bar	3.46	
03 21 11 00-0036	LF			#10, Grade 60, Beams And Girders, Low Alloy Steel Reinforcement Bar	4.21	
03 21 11 00-0037	LF			#11, Grade 60, Beams And Girders, Low Alloy Steel Reinforcement Bar	4.97	
03 21 11 00-0038	LF			#14, Grade 60, Beams And Girders, Low Alloy Steel Reinforcement Bar	6.85	
03 21 11 00-0039	LF			#18, Grade 60, Beams And Girders, Low Alloy Steel Reinforcement Bar	11.63	

03 21 11 00-0040 Columns, Steel Reinforcement Bar (03 21 11)

Note: ASTM A-615 Plain Steel and A-706 Low Alloy Steel.

03 21 11 00-0041	LF			#3, Grade 40, Columns, Steel Reinforcement Bar	0.51	
03 21 11 00-0042	LF			#4, Grade 40, Columns, Steel Reinforcement Bar	0.87	
03 21 11 00-0043	LF			#5, Grade 40, Columns, Steel Reinforcement Bar	1.28	
03 21 11 00-0044	LF			#6, Grade 40, Columns, Steel Reinforcement Bar	1.74	
03 21 11 00-0045	LF			#3, Grade 50, Columns, Steel Reinforcement Bar	0.52	
03 21 11 00-0046	LF			#4, Grade 50, Columns, Steel Reinforcement Bar	0.88	
03 21 11 00-0047	LF			#5, Grade 50, Columns, Steel Reinforcement Bar	1.30	
03 21 11 00-0048	LF			#6, Grade 50, Columns, Steel Reinforcement Bar	1.78	
03 21 11 00-0049	LF			#3, Grade 60, Columns, Steel Reinforcement Bar	0.53	
03 21 11 00-0050	LF			#4, Grade 60, Columns, Steel Reinforcement Bar	0.91	
03 21 11 00-0051	LF			#5, Grade 60, Columns, Steel Reinforcement Bar	1.34	
03 21 11 00-0052	LF			#6, Grade 60, Columns, Steel Reinforcement Bar	1.83	
03 21 11 00-0053	LF			#7, Grade 60, Columns, Steel Reinforcement Bar	2.36	
03 21 11 00-0054	LF			#8, Grade 60, Columns, Steel Reinforcement Bar	2.91	
03 21 11 00-0055	LF			#9, Grade 60, Columns, Steel Reinforcement Bar	3.53	
03 21 11 00-0056	LF			#10, Grade 60, Columns, Steel Reinforcement Bar	4.29	
03 21 11 00-0057	LF			#11, Grade 60, Columns, Steel Reinforcement Bar	5.05	
03 21 11 00-0058	LF			#14, Grade 60, Columns, Steel Reinforcement Bar	6.94	
03 21 11 00-0059	LF			#18, Grade 60, Columns, Steel Reinforcement Bar	11.71	
03 21 11 00-0060	LF			#6, Grade 75, Columns, Steel Reinforcement Bar	1.88	
03 21 11 00-0061	LF			#7, Grade 75, Columns, Steel Reinforcement Bar	2.43	
03 21 11 00-0062	LF			#8, Grade 75, Columns, Steel Reinforcement Bar	3.00	
03 21 11 00-0063	LF			#9, Grade 75, Columns, Steel Reinforcement Bar	3.65	
03 21 11 00-0064	LF			#10, Grade 75, Columns, Steel Reinforcement Bar	4.43	
03 21 11 00-0065	LF			#11, Grade 75, Columns, Steel Reinforcement Bar	5.23	
03 21 11 00-0066	LF			#14, Grade 75, Columns, Steel Reinforcement Bar	7.19	
03 21 11 00-0067	LF			#18, Grade 75, Columns, Steel Reinforcement Bar	12.17	
03 21 11 00-0068	LF			#3, Grade 60, Columns, Low Alloy Steel Reinforcement Bar	0.54	
03 21 11 00-0069	LF			#4, Grade 60, Columns, Low Alloy Steel Reinforcement Bar	0.92	
03 21 11 00-0070	LF			#5, Grade 60, Columns, Low Alloy Steel Reinforcement Bar	1.36	
03 21 11 00-0071	LF			#6, Grade 60, Columns, Low Alloy Steel Reinforcement Bar	1.86	
03 21 11 00-0072	LF			#7, Grade 60, Columns, Low Alloy Steel Reinforcement Bar	2.41	
03 21 11 00-0073	LF			#8, Grade 60, Columns, Low Alloy Steel Reinforcement Bar	2.97	
03 21 11 00-0074	LF			#9, Grade 60, Columns, Low Alloy Steel Reinforcement Bar	3.62	
03 21 11 00-0075	LF			#10, Grade 60, Columns, Low Alloy Steel Reinforcement Bar	4.40	
03 21 11 00-0076	LF			#11, Grade 60, Columns, Low Alloy Steel Reinforcement Bar	5.18	
03 21 11 00-0077	LF			#14, Grade 60, Columns, Low Alloy Steel Reinforcement Bar	7.13	
03 21 11 00-0078	LF			#18, Grade 60, Columns, Low Alloy Steel Reinforcement Bar	12.06	

03 21 11 00-0079 Footings, Steel Reinforcement Bar (03 21 11)

Note: ASTM A-615 Plain Steel and A-706 Low Alloy Steel.

03 21 11 00-0080	LF			#3, Grade 40, Footings, Steel Reinforcement Bar	0.44	
03 21 11 00-0081	LF			#4, Grade 40, Footings, Steel Reinforcement Bar	0.74	
03 21 11 00-0082	LF			#5, Grade 40, Footings, Steel Reinforcement Bar	1.10	
03 21 11 00-0083	LF			#6, Grade 40, Footings, Steel Reinforcement Bar	1.50	
03 21 11 00-0084	LF			#3, Grade 50, Footings, Steel Reinforcement Bar	0.45	
03 21 11 00-0085	LF			#4, Grade 50, Footings, Steel Reinforcement Bar	0.75	
03 21 11 00-0086	LF			#5, Grade 50, Footings, Steel Reinforcement Bar	1.12	
03 21 11 00-0087	LF			#6, Grade 50, Footings, Steel Reinforcement Bar	1.54	
03 21 11 00-0088	LF			#3, Grade 60, Footings, Steel Reinforcement Bar	0.46	
03 21 11 00-0089	LF			#4, Grade 60, Footings, Steel Reinforcement Bar	0.78	
03 21 11 00-0090	LF			#5, Grade 60, Footings, Steel Reinforcement Bar	1.16	
03 21 11 00-0091	LF			#6, Grade 60, Footings, Steel Reinforcement Bar	1.59	
03 21 11 00-0092	LF			#7, Grade 60, Footings, Steel Reinforcement Bar	2.05	
03 21 11 00-0093	LF			#8, Grade 60, Footings, Steel Reinforcement Bar	2.56	
03 21 11 00-0094	LF			#9, Grade 60, Footings, Steel Reinforcement Bar	3.12	
03 21 11 00-0095	LF			#10, Grade 60, Footings, Steel Reinforcement Bar	3.81	
03 21 11 00-0096	LF			#11, Grade 60, Footings, Steel Reinforcement Bar	4.52	
03 21 11 00-0097	LF			#14, Grade 60, Footings, Steel Reinforcement Bar	6.24	
03 21 11 00-0098	LF			#18, Grade 60, Footings, Steel Reinforcement Bar	10.61	
03 21 11 00-0099	LF			#6, Grade 75, Footings, Steel Reinforcement Bar	1.64	
03 21 11 00-0100	LF			#7, Grade 75, Footings, Steel Reinforcement Bar	2.12	
03 21 11 00-0101	LF			#8, Grade 75, Footings, Steel Reinforcement Bar	2.65	
03 21 11 00-0102	LF			#9, Grade 75, Footings, Steel Reinforcement Bar	3.24	
03 21 11 00-0103	LF			#10, Grade 75, Footings, Steel Reinforcement Bar	3.95	
03 21 11 00-0104	LF			#11, Grade 75, Footings, Steel Reinforcement Bar	4.70	



MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

03 21 11 00-0105	LF	#14, Grade 75, Footings, Steel Reinforcement Bar	6.49
03 21 11 00-0106	LF	#18, Grade 75, Footings, Steel Reinforcement Bar	11.07
03 21 11 00-0107	LF	#3, Grade 60, Footings, Low Alloy Steel Reinforcement Bar	0.47
03 21 11 00-0108	LF	#4, Grade 60, Footings, Low Alloy Steel Reinforcement Bar	0.79
03 21 11 00-0109	LF	#5, Grade 60, Footings, Low Alloy Steel Reinforcement Bar	1.18
03 21 11 00-0110	LF	#6, Grade 60, Footings, Low Alloy Steel Reinforcement Bar	1.62
03 21 11 00-0111	LF	#7, Grade 60, Footings, Low Alloy Steel Reinforcement Bar	2.10
03 21 11 00-0112	LF	#8, Grade 60, Footings, Low Alloy Steel Reinforcement Bar	2.62
03 21 11 00-0113	LF	#9, Grade 60, Footings, Low Alloy Steel Reinforcement Bar	3.21
03 21 11 00-0114	LF	#10, Grade 60, Footings, Low Alloy Steel Reinforcement Bar	3.92
03 21 11 00-0115	LF	#11, Grade 60, Footings, Low Alloy Steel Reinforcement Bar	4.65
03 21 11 00-0116	LF	#14, Grade 60, Footings, Low Alloy Steel Reinforcement Bar	6.43
03 21 11 00-0117	LF	#18, Grade 60, Footings, Low Alloy Steel Reinforcement Bar	10.96

03 21 11 00-0118 Slab On Grade, Steel Reinforcement Bar (0321 11)

Note: ASTM A-615 Plain Steel and A-706 Low Alloy Steel.

03 21 11 00-0119	LF	#3, Grade 40, Slab On Grade, Steel Reinforcement Bar	0.42
03 21 11 00-0120	LF	#4, Grade 40, Slab On Grade, Steel Reinforcement Bar	0.71
03 21 11 00-0121	LF	#5, Grade 40, Slab On Grade, Steel Reinforcement Bar	1.06
03 21 11 00-0122	LF	#6, Grade 40, Slab On Grade, Steel Reinforcement Bar	1.45
03 21 11 00-0123	LF	#3, Grade 50, Slab On Grade, Steel Reinforcement Bar	0.43
03 21 11 00-0124	LF	#4, Grade 50, Slab On Grade, Steel Reinforcement Bar	0.72
03 21 11 00-0125	LF	#5, Grade 50, Slab On Grade, Steel Reinforcement Bar	1.08
03 21 11 00-0126	LF	#6, Grade 50, Slab On Grade, Steel Reinforcement Bar	1.49
03 21 11 00-0127	LF	#3, Grade 60, Slab On Grade, Steel Reinforcement Bar	0.44
03 21 11 00-0128	LF	#4, Grade 60, Slab On Grade, Steel Reinforcement Bar	0.75
03 21 11 00-0129	LF	#5, Grade 60, Slab On Grade, Steel Reinforcement Bar	1.12
03 21 11 00-0130	LF	#6, Grade 60, Slab On Grade, Steel Reinforcement Bar	1.54
03 21 11 00-0131	LF	#7, Grade 60, Slab On Grade, Steel Reinforcement Bar	1.99
03 21 11 00-0132	LF	#8, Grade 60, Slab On Grade, Steel Reinforcement Bar	2.48
03 21 11 00-0133	LF	#9, Grade 60, Slab On Grade, Steel Reinforcement Bar	3.04
03 21 11 00-0134	LF	#10, Grade 60, Slab On Grade, Steel Reinforcement Bar	3.71
03 21 11 00-0135	LF	#11, Grade 60, Slab On Grade, Steel Reinforcement Bar	4.41
03 21 11 00-0136	LF	#14, Grade 60, Slab On Grade, Steel Reinforcement Bar	6.10
03 21 11 00-0137	LF	#18, Grade 60, Slab On Grade, Steel Reinforcement Bar	10.38
03 21 11 00-0138	LF	#6, Grade 75, Slab On Grade, Steel Reinforcement Bar	1.59
03 21 11 00-0139	LF	#7, Grade 75, Slab On Grade, Steel Reinforcement Bar	2.06
03 21 11 00-0140	LF	#8, Grade 75, Slab On Grade, Steel Reinforcement Bar	2.57
03 21 11 00-0141	LF	#9, Grade 75, Slab On Grade, Steel Reinforcement Bar	3.16
03 21 11 00-0142	LF	#10, Grade 75, Slab On Grade, Steel Reinforcement Bar	3.85
03 21 11 00-0143	LF	#11, Grade 75, Slab On Grade, Steel Reinforcement Bar	4.59
03 21 11 00-0144	LF	#14, Grade 75, Slab On Grade, Steel Reinforcement Bar	6.35
03 21 11 00-0145	LF	#18, Grade 75, Slab On Grade, Steel Reinforcement Bar	10.84
03 21 11 00-0146	LF	#3, Grade 60, Slab On Grade, Low Alloy Steel Reinforcement Bar	0.45
03 21 11 00-0147	LF	#4, Grade 60, Slab On Grade, Low Alloy Steel Reinforcement Bar	0.76
03 21 11 00-0148	LF	#5, Grade 60, Slab On Grade, Low Alloy Steel Reinforcement Bar	1.14
03 21 11 00-0149	LF	#6, Grade 60, Slab On Grade, Low Alloy Steel Reinforcement Bar	1.57
03 21 11 00-0150	LF	#7, Grade 60, Slab On Grade, Low Alloy Steel Reinforcement Bar	2.04
03 21 11 00-0151	LF	#8, Grade 60, Slab On Grade, Low Alloy Steel Reinforcement Bar	2.54
03 21 11 00-0152	LF	#9, Grade 60, Slab On Grade, Low Alloy Steel Reinforcement Bar	3.13
03 21 11 00-0153	LF	#10, Grade 60, Slab On Grade, Low Alloy Steel Reinforcement Bar	3.82
03 21 11 00-0154	LF	#11, Grade 60, Slab On Grade, Low Alloy Steel Reinforcement Bar	4.54
03 21 11 00-0155	LF	#14, Grade 60, Slab On Grade, Low Alloy Steel Reinforcement Bar	6.29
03 21 11 00-0156	LF	#18, Grade 60, Slab On Grade, Low Alloy Steel Reinforcement Bar	10.73

03 21 11 00-0157 Elevated Slabs, Steel Reinforcement Bar (0321 11)

Note: ASTM A-615 Plain Steel and A-706 Low Alloy Steel.

03 21 11 00-0158	LF	#3, Grade 40, Elevated Slabs, Steel Reinforcement Bar	0.39
03 21 11 00-0159	LF	#4, Grade 40, Elevated Slabs, Steel Reinforcement Bar	0.66
03 21 11 00-0160	LF	#5, Grade 40, Elevated Slabs, Steel Reinforcement Bar	0.99
03 21 11 00-0161	LF	#6, Grade 40, Elevated Slabs, Steel Reinforcement Bar	1.35
03 21 11 00-0162	LF	#3, Grade 50, Elevated Slabs, Steel Reinforcement Bar	0.40
03 21 11 00-0163	LF	#4, Grade 50, Elevated Slabs, Steel Reinforcement Bar	0.67
03 21 11 00-0164	LF	#5, Grade 50, Elevated Slabs, Steel Reinforcement Bar	1.01
03 21 11 00-0165	LF	#6, Grade 50, Elevated Slabs, Steel Reinforcement Bar	1.39
03 21 11 00-0166	LF	#3, Grade 60, Elevated Slabs, Steel Reinforcement Bar	0.41
03 21 11 00-0167	LF	#4, Grade 60, Elevated Slabs, Steel Reinforcement Bar	0.70
03 21 11 00-0168	LF	#5, Grade 60, Elevated Slabs, Steel Reinforcement Bar	1.05
03 21 11 00-0169	LF	#6, Grade 60, Elevated Slabs, Steel Reinforcement Bar	1.44
03 21 11 00-0170	LF	#7, Grade 60, Elevated Slabs, Steel Reinforcement Bar	1.87
03 21 11 00-0171	LF	#8, Grade 60, Elevated Slabs, Steel Reinforcement Bar	2.33
03 21 11 00-0172	LF	#9, Grade 60, Elevated Slabs, Steel Reinforcement Bar	2.87
03 21 11 00-0173	LF	#10, Grade 60, Elevated Slabs, Steel Reinforcement Bar	3.52
03 21 11 00-0174	LF	#11, Grade 60, Elevated Slabs, Steel Reinforcement Bar	4.20
03 21 11 00-0175	LF	#14, Grade 60, Elevated Slabs, Steel Reinforcement Bar	5.82
03 21 11 00-0176	LF	#18, Grade 60, Elevated Slabs, Steel Reinforcement Bar	9.95
03 21 11 00-0177	LF	#6, Grade 75, Elevated Slabs, Steel Reinforcement Bar	1.49
03 21 11 00-0178	LF	#7, Grade 75, Elevated Slabs, Steel Reinforcement Bar	1.94
03 21 11 00-0179	LF	#8, Grade 75, Elevated Slabs, Steel Reinforcement Bar	2.42



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
03 21 11 00-0180 LF #9, Grade 75, Elevated Slabs, Steel Reinforcement Bar	2.99	
03 21 11 00-0181 LF #10, Grade 75, Elevated Slabs, Steel Reinforcement Bar	3.66	
03 21 11 00-0182 LF #11, Grade 75, Elevated Slabs, Steel Reinforcement Bar	4.38	
03 21 11 00-0183 LF #14, Grade 75, Elevated Slabs, Steel Reinforcement Bar	6.07	
03 21 11 00-0184 LF #18, Grade 75, Elevated Slabs, Steel Reinforcement Bar	10.41	
03 21 11 00-0185 LF #3, Grade 60, Elevated Slabs, Low Alloy Steel Reinforcement Bar	0.42	
03 21 11 00-0186 LF #4, Grade 60, Elevated Slabs, Low Alloy Steel Reinforcement Bar	0.71	
03 21 11 00-0187 LF #5, Grade 60, Elevated Slabs, Low Alloy Steel Reinforcement Bar	1.07	
03 21 11 00-0188 LF #6, Grade 60, Elevated Slabs, Low Alloy Steel Reinforcement Bar	1.47	
03 21 11 00-0189 LF #7, Grade 60, Elevated Slabs, Low Alloy Steel Reinforcement Bar	1.92	
03 21 11 00-0190 LF #8, Grade 60, Elevated Slabs, Low Alloy Steel Reinforcement Bar	2.39	
03 21 11 00-0191 LF #9, Grade 60, Elevated Slabs, Low Alloy Steel Reinforcement Bar	2.96	
03 21 11 00-0192 LF #10, Grade 60, Elevated Slabs, Low Alloy Steel Reinforcement Bar	3.63	
03 21 11 00-0193 LF #11, Grade 60, Elevated Slabs, Low Alloy Steel Reinforcement Bar	4.33	
03 21 11 00-0194 LF #14, Grade 60, Elevated Slabs, Low Alloy Steel Reinforcement Bar	6.01	
03 21 11 00-0195 LF #18, Grade 60, Elevated Slabs, Low Alloy Steel Reinforcement Bar	10.30	

03 21 11 00-0196 Walls, Steel Reinforcement Bar ^(03 21 11)

Note: ASTM A-615 Plain Steel and A-706 Low Alloy Steel.

03 21 11 00-0197 LF #3, Grade 40, Walls, Steel Reinforcement Bar	0.37	
03 21 11 00-0198 LF #4, Grade 40, Walls, Steel Reinforcement Bar	0.63	
03 21 11 00-0199 LF #5, Grade 40, Walls, Steel Reinforcement Bar	0.95	
03 21 11 00-0200 LF #6, Grade 40, Walls, Steel Reinforcement Bar	1.30	
03 21 11 00-0201 LF #3, Grade 50, Walls, Steel Reinforcement Bar	0.38	
03 21 11 00-0202 LF #4, Grade 50, Walls, Steel Reinforcement Bar	0.64	
03 21 11 00-0203 LF #5, Grade 50, Walls, Steel Reinforcement Bar	0.97	
03 21 11 00-0204 LF #6, Grade 50, Walls, Steel Reinforcement Bar	1.34	
03 21 11 00-0205 LF #3, Grade 60, Walls, Steel Reinforcement Bar	0.39	
03 21 11 00-0206 LF #4, Grade 60, Walls, Steel Reinforcement Bar	0.67	
03 21 11 00-0207 LF #5, Grade 60, Walls, Steel Reinforcement Bar	1.01	
03 21 11 00-0208 LF #6, Grade 60, Walls, Steel Reinforcement Bar	1.39	
03 21 11 00-0209 LF #7, Grade 60, Walls, Steel Reinforcement Bar	1.81	
03 21 11 00-0210 LF #8, Grade 60, Walls, Steel Reinforcement Bar	2.27	
03 21 11 00-0211 LF #9, Grade 60, Walls, Steel Reinforcement Bar	2.79	
03 21 11 00-0212 LF #10, Grade 60, Walls, Steel Reinforcement Bar	3.43	
03 21 11 00-0213 LF #11, Grade 60, Walls, Steel Reinforcement Bar	4.09	
03 21 11 00-0214 LF #14, Grade 60, Walls, Steel Reinforcement Bar	5.68	
03 21 11 00-0215 LF #18, Grade 60, Walls, Steel Reinforcement Bar	9.73	
03 21 11 00-0216 LF #6, Grade 75, Walls, Steel Reinforcement Bar	1.44	
03 21 11 00-0217 LF #7, Grade 75, Walls, Steel Reinforcement Bar	1.88	
03 21 11 00-0218 LF #8, Grade 75, Walls, Steel Reinforcement Bar	2.36	
03 21 11 00-0219 LF #9, Grade 75, Walls, Steel Reinforcement Bar	2.91	
03 21 11 00-0220 LF #10, Grade 75, Walls, Steel Reinforcement Bar	3.57	
03 21 11 00-0221 LF #11, Grade 75, Walls, Steel Reinforcement Bar	4.27	
03 21 11 00-0222 LF #14, Grade 75, Walls, Steel Reinforcement Bar	5.93	
03 21 11 00-0223 LF #18, Grade 75, Walls, Steel Reinforcement Bar	10.19	
03 21 11 00-0224 LF #3, Grade 60, Walls, Low Alloy Steel Reinforcement Bar	0.40	
03 21 11 00-0225 LF #4, Grade 60, Walls, Low Alloy Steel Reinforcement Bar	0.68	
03 21 11 00-0226 LF #5, Grade 60, Walls, Low Alloy Steel Reinforcement Bar	1.03	
03 21 11 00-0227 LF #6, Grade 60, Walls, Low Alloy Steel Reinforcement Bar	1.42	
03 21 11 00-0228 LF #7, Grade 60, Walls, Low Alloy Steel Reinforcement Bar	1.86	
03 21 11 00-0229 LF #8, Grade 60, Walls, Low Alloy Steel Reinforcement Bar	2.33	
03 21 11 00-0230 LF #9, Grade 60, Walls, Low Alloy Steel Reinforcement Bar	2.88	
03 21 11 00-0231 LF #10, Grade 60, Walls, Low Alloy Steel Reinforcement Bar	3.54	
03 21 11 00-0232 LF #11, Grade 60, Walls, Low Alloy Steel Reinforcement Bar	4.22	
03 21 11 00-0233 LF #14, Grade 60, Walls, Low Alloy Steel Reinforcement Bar	5.87	
03 21 11 00-0234 LF #18, Grade 60, Walls, Low Alloy Steel Reinforcement Bar	10.08	

03 21 11 00-0235 Deformed Straight Dowels ^(03 21 11)

03 21 11 00-0236 EA 3/8" Diameter x 24" Long, Deformed Straight Dowel	1.84	
For Drilling Hole Into Concrete, Horizontal, Add Per Inch Of Depth	1.72	
For Drilling Hole Into Concrete, Vertical, Add Per Inch Of Depth	1.66	
For Drilling Hole Into Concrete, Inverted Overhead, Add Per Inch Of Depth	1.97	
For Up To 12" Length, Deduct	-0.23	
For >12" To <24" Length, Deduct	-0.12	
03 21 11 00-0237 EA 1/2" Diameter x 24" Long, Deformed Straight Dowel	2.20	
For Drilling Hole Into Concrete, Horizontal, Add Per Inch Of Depth	1.95	
For Drilling Hole Into Concrete, Vertical, Add Per Inch Of Depth	1.88	
For Drilling Hole Into Concrete, Inverted Overhead, Add Per Inch Of Depth	2.24	
For Up To 12" Length, Deduct	-0.30	
For >12" To <24" Length, Deduct	-0.15	
03 21 11 00-0238 EA 5/8" Diameter x 24" Long, Deformed Straight Dowel	2.71	
For Drilling Hole Into Concrete, Horizontal, Add Per Inch Of Depth	2.04	
For Drilling Hole Into Concrete, Vertical, Add Per Inch Of Depth	1.97	
For Drilling Hole Into Concrete, Inverted Overhead, Add Per Inch Of Depth	2.35	
For Up To 12" Length, Deduct	-0.48	
For >12" To <24" Length, Deduct	-0.24	

03	Concrete
03 20	Concrete Reinforcing
03 21	Reinforcement Bars



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
03 21 11 00-0239	EA		3/4" Diameter x 24" Long, Deformed Straight Dowel	3.34	
			For Drilling Hole Into Concrete, Horizontal, Add Per Inch Of Depth	2.16	
			For Drilling Hole Into Concrete, Vertical, Add Per Inch Of Depth	2.08	
			For Drilling Hole Into Concrete, Inverted Overhead, Add Per Inch Of Depth	2.48	
			For Up To 12" Length, Deduct	-0.70	
			For >12" To <24" Length, Deduct	-0.35	
03 21 11 00-0240	EA		7/8" Diameter x 24" Long, Deformed Straight Dowel	3.97	
			For Drilling Hole Into Concrete, Horizontal, Add Per Inch Of Depth	2.10	
			For Drilling Hole Into Concrete, Vertical, Add Per Inch Of Depth	2.02	
			For Drilling Hole Into Concrete, Inverted Overhead, Add Per Inch Of Depth	2.41	
			For Up To 12" Length, Deduct	-0.97	
			For >12" To <24" Length, Deduct	-0.48	
03 21 11 00-0241	EA		1" Diameter x 24" Long, Deformed Straight Dowel	5.01	
			For Drilling Hole Into Concrete, Horizontal, Add Per Inch Of Depth	2.56	
			For Drilling Hole Into Concrete, Vertical, Add Per Inch Of Depth	2.47	
			For Drilling Hole Into Concrete, Inverted Overhead, Add Per Inch Of Depth	2.95	
			For Up To 12" Length, Deduct	-1.24	
			For >12" To <24" Length, Deduct	-0.62	
03 21 11 00-0242	EA		1-1/8" Diameter x 24" Long, Deformed Straight Dowel	5.94	
			For Drilling Hole Into Concrete, Horizontal, Add Per Inch Of Depth	2.82	
			For Drilling Hole Into Concrete, Vertical, Add Per Inch Of Depth	2.72	
			For Drilling Hole Into Concrete, Inverted Overhead, Add Per Inch Of Depth	3.25	
			For Up To 12" Length, Deduct	-1.53	
			For >12" To <24" Length, Deduct	-0.77	
03 21 11 00-0243	EA		1-1/4" Diameter x 24" Long, Deformed Straight Dowel	7.30	
			For Drilling Hole Into Concrete, Horizontal, Add Per Inch Of Depth	3.07	
			For Drilling Hole Into Concrete, Vertical, Add Per Inch Of Depth	2.96	
			For Drilling Hole Into Concrete, Inverted Overhead, Add Per Inch Of Depth	3.53	
			For Up To 12" Length, Deduct	-2.00	
			For >12" To <24" Length, Deduct	-1.00	
03 21 11 00-0244	EA		1-3/8" Diameter x 24" Long, Deformed Straight Dowel	8.69	
			For Drilling Hole Into Concrete, Horizontal, Add Per Inch Of Depth	3.34	
			For Drilling Hole Into Concrete, Vertical, Add Per Inch Of Depth	3.22	
			For Drilling Hole Into Concrete, Inverted Overhead, Add Per Inch Of Depth	3.85	
			For Up To 12" Length, Deduct	-2.47	
			For >12" To <24" Length, Deduct	-1.24	
03 21 11 00-0245			Spirals, Reinforcing Steel <small>(03 21 11)</small>		
03 21 11 00-0246	TON		Up To 15" Diameter, Grade 60, Spirals, Reinforcing Steel	3,492.91	
			For Grade 75, Add	161.98	
03 21 11 00-0247	TON		>15" To 24" Diameter, Grade 60, Spirals, Reinforcing Steel	3,460.91	
			For Grade 75, Add	161.98	
03 21 11 00-0248	TON		>24" To 36" Diameter, Grade 60, Spirals, Reinforcing Steel	3,460.91	
			For Grade 75, Add	161.98	
03 21 11 00-0249	TON		>36" To 48" Diameter, Grade 60, Spirals, Reinforcing Steel	3,396.59	
			For Grade 75, Add	161.98	
03 21 11 00-0250	TON		>48" To 64" Diameter, Grade 60, Spirals, Reinforcing Steel	3,342.63	
			For Grade 75, Add	161.98	
03 21 11 00-0251	TON		>64" To 84" Diameter, Grade 60, Spirals, Reinforcing Steel	3,342.36	
			For Grade 75, Add	165.96	
03 21 11 00-0252	TON		>84" To 96" Diameter, Grade 60, Spirals, Reinforcing Steel	3,297.18	
			For Grade 75, Add	165.96	
03 21 11 00-0253			Dowel Or Hairpin, Drilled And Epoxy Into Concrete <small>(03 21 11)</small>		
03 21 11 00-0254	EA		Dowels Or Hairpin, 1/2" x 30" Length, Drilled And Epoxy In Concrete, 6" Embedment	16.91	
03 21 11 00-0255	EA		Dowels Or Hairpin, 1/2" x 36" Length, Drilled And Epoxy In Concrete, >6" To 12" Embedment	17.65	
03 21 11 00-0256			Accessories For Reinforcing Steel <small>(03 21 11)</small>		
03 21 11 00-0257			Reinforcing Steel Weld Splice <small>(03 21 11 00-0256)</small>		
03 21 11 00-0258	EA		Up To #6 Reinforcing Steel Weld Splice	32.08	
03 21 11 00-0259	EA		>#6 Reinforcing Steel Weld Splice	46.42	
03 21 11 00-0260			Reinforcing Steel Sleeve And Wedge Splice Joint <small>(03 21 11 00-0256)</small>		
03 21 11 00-0261	EA		Up To #4 Reinforcing Steel, Sleeve And Wedge Splice Joint	23.65	
03 21 11 00-0262	EA		#5 Reinforcing Steel, Sleeve And Wedge Splice Joint	34.29	
03 21 11 00-0263	EA		#6 Reinforcing Steel, Sleeve And Wedge Splice Joint	49.21	
03 21 13			Galvanized Reinforcement Steel Bars <small>(03 21)</small>		
03 21 13 00-0001			Beams And Girders, Galvanized Steel Reinforcement Bar <small>(03 21 13)</small>		
			Note: ASTM A-767 Hot Dipped Galvanized Steel.		
03 21 13 00-0002	LF		#3, Grade 40, Beams And Girders, Galvanized Steel Reinforcement Bar	0.57	
03 21 13 00-0003	LF		#4, Grade 40, Beams And Girders, Galvanized Steel Reinforcement Bar	0.96	
03 21 13 00-0004	LF		#5, Grade 40, Beams And Girders, Galvanized Steel Reinforcement Bar	1.45	
03 21 13 00-0005	LF		#6, Grade 40, Beams And Girders, Galvanized Steel Reinforcement Bar	1.99	
03 21 13 00-0006	LF		#3, Grade 50, Beams And Girders, Galvanized Steel Reinforcement Bar	0.58	
03 21 13 00-0007	LF		#4, Grade 50, Beams And Girders, Galvanized Steel Reinforcement Bar	0.98	
03 21 13 00-0008	LF		#5, Grade 50, Beams And Girders, Galvanized Steel Reinforcement Bar	1.47	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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03 21 13 00-009	LF	#6, Grade 50, Beams And Girders, Galvanized Steel Reinforcement Bar	2.02	
03 21 13 00-010	LF	#3, Grade 60, Beams And Girders, Galvanized Steel Reinforcement Bar	.....	0.60	
03 21 13 00-0011	LF	#4, Grade 60, Beams And Girders, Galvanized Steel Reinforcement Bar	.....	1.00	
03 21 13 00-0012	LF	#5, Grade 60, Beams And Girders, Galvanized Steel Reinforcement Bar	.....	1.50	
03 21 13 00-0013	LF	#6, Grade 60, Beams And Girders, Galvanized Steel Reinforcement Bar	.....	2.07	
03 21 13 00-0014	LF	#7, Grade 60, Beams And Girders, Galvanized Steel Reinforcement Bar	.....	2.71	
03 21 13 00-0015	LF	#8, Grade 60, Beams And Girders, Galvanized Steel Reinforcement Bar	.....	3.38	
03 21 13 00-0016	LF	#9, Grade 60, Beams And Girders, Galvanized Steel Reinforcement Bar	.....	4.15	
03 21 13 00-0017	LF	#10, Grade 60, Beams And Girders, Galvanized Steel Reinforcement Bar	.....	5.08	
03 21 13 00-0018	LF	#11, Grade 60, Beams And Girders, Galvanized Steel Reinforcement Bar	.....	6.06	
03 21 13 00-0019	LF	#14, Grade 60, Beams And Girders, Galvanized Steel Reinforcement Bar	.....	8.41	
03 21 13 00-0020	LF	#18, Grade 60, Beams And Girders, Galvanized Steel Reinforcement Bar	.....	14.40	
03 21 13 00-0021	LF	#6, Grade 75, Beams And Girders, Galvanized Steel Reinforcement Bar	.....	2.12	
03 21 13 00-0022	LF	#7, Grade 75, Beams And Girders, Galvanized Steel Reinforcement Bar	.....	2.78	
03 21 13 00-0023	LF	#8, Grade 75, Beams And Girders, Galvanized Steel Reinforcement Bar	.....	3.47	
03 21 13 00-0024	LF	#9, Grade 75, Beams And Girders, Galvanized Steel Reinforcement Bar	.....	4.27	
03 21 13 00-0025	LF	#10, Grade 75, Beams And Girders, Galvanized Steel Reinforcement Bar	.....	5.23	
03 21 13 00-0026	LF	#11, Grade 75, Beams And Girders, Galvanized Steel Reinforcement Bar	.....	6.23	
03 21 13 00-0027	LF	#14, Grade 75, Beams And Girders, Galvanized Steel Reinforcement Bar	.....	8.66	
03 21 13 00-0028	LF	#18, Grade 75, Beams And Girders, Galvanized Steel Reinforcement Bar	.....	14.86	

03 21 13 00-0029 Columns, Galvanized Steel Reinforcement Bar (03 21 13)

Note: ASTM A-767 Hot Dipped Galvanized Steel.

03 21 13 00-0030	LF	#3, Grade 40, Columns, Galvanized Steel Reinforcement Bar	.....	0.59	
03 21 13 00-0031	LF	#4, Grade 40, Columns, Galvanized Steel Reinforcement Bar	.....	1.02	
03 21 13 00-0032	LF	#5, Grade 40, Columns, Galvanized Steel Reinforcement Bar	.....	1.52	
03 21 13 00-0033	LF	#6, Grade 40, Columns, Galvanized Steel Reinforcement Bar	.....	2.09	
03 21 13 00-0034	LF	#3, Grade 50, Columns, Galvanized Steel Reinforcement Bar	.....	0.60	
03 21 13 00-0035	LF	#4, Grade 50, Columns, Galvanized Steel Reinforcement Bar	.....	1.04	
03 21 13 00-0036	LF	#5, Grade 50, Columns, Galvanized Steel Reinforcement Bar	.....	1.54	
03 21 13 00-0037	LF	#6, Grade 50, Columns, Galvanized Steel Reinforcement Bar	.....	2.12	
03 21 13 00-0038	LF	#3, Grade 60, Columns, Galvanized Steel Reinforcement Bar	.....	0.62	
03 21 13 00-0039	LF	#4, Grade 60, Columns, Galvanized Steel Reinforcement Bar	.....	1.06	
03 21 13 00-0040	LF	#5, Grade 60, Columns, Galvanized Steel Reinforcement Bar	.....	1.57	
03 21 13 00-0041	LF	#6, Grade 60, Columns, Galvanized Steel Reinforcement Bar	.....	2.17	
03 21 13 00-0042	LF	#7, Grade 60, Columns, Galvanized Steel Reinforcement Bar	.....	2.83	
03 21 13 00-0043	LF	#8, Grade 60, Columns, Galvanized Steel Reinforcement Bar	.....	3.52	
03 21 13 00-0044	LF	#9, Grade 60, Columns, Galvanized Steel Reinforcement Bar	.....	4.31	
03 21 13 00-0045	LF	#10, Grade 60, Columns, Galvanized Steel Reinforcement Bar	.....	5.27	
03 21 13 00-0046	LF	#11, Grade 60, Columns, Galvanized Steel Reinforcement Bar	.....	6.27	
03 21 13 00-0047	LF	#14, Grade 60, Columns, Galvanized Steel Reinforcement Bar	.....	8.69	
03 21 13 00-0048	LF	#18, Grade 60, Columns, Galvanized Steel Reinforcement Bar	.....	14.83	
03 21 13 00-0049	LF	#6, Grade 75, Columns, Galvanized Steel Reinforcement Bar	.....	2.22	
03 21 13 00-0050	LF	#7, Grade 75, Columns, Galvanized Steel Reinforcement Bar	.....	2.90	
03 21 13 00-0051	LF	#8, Grade 75, Columns, Galvanized Steel Reinforcement Bar	.....	3.61	
03 21 13 00-0052	LF	#9, Grade 75, Columns, Galvanized Steel Reinforcement Bar	.....	4.43	
03 21 13 00-0053	LF	#10, Grade 75, Columns, Galvanized Steel Reinforcement Bar	.....	5.42	
03 21 13 00-0054	LF	#11, Grade 75, Columns, Galvanized Steel Reinforcement Bar	.....	6.44	
03 21 13 00-0055	LF	#14, Grade 75, Columns, Galvanized Steel Reinforcement Bar	.....	8.94	
03 21 13 00-0056	LF	#18, Grade 75, Columns, Galvanized Steel Reinforcement Bar	.....	15.29	

03 21 13 00-0057 Footings, Galvanized Steel Reinforcement Bar (03 21 13)

Note: ASTM A-767 Hot Dipped Galvanized Steel.

03 21 13 00-0058	LF	#3, Grade 40, Footings, Galvanized Steel Reinforcement Bar	.....	0.52	
03 21 13 00-0059	LF	#4, Grade 40, Footings, Galvanized Steel Reinforcement Bar	.....	0.89	
03 21 13 00-0060	LF	#5, Grade 40, Footings, Galvanized Steel Reinforcement Bar	.....	1.34	
03 21 13 00-0061	LF	#6, Grade 40, Footings, Galvanized Steel Reinforcement Bar	.....	1.85	
03 21 13 00-0062	LF	#3, Grade 50, Footings, Galvanized Steel Reinforcement Bar	.....	0.53	
03 21 13 00-0063	LF	#4, Grade 50, Footings, Galvanized Steel Reinforcement Bar	.....	0.91	
03 21 13 00-0064	LF	#5, Grade 50, Footings, Galvanized Steel Reinforcement Bar	.....	1.36	
03 21 13 00-0065	LF	#6, Grade 50, Footings, Galvanized Steel Reinforcement Bar	.....	1.88	
03 21 13 00-0066	LF	#3, Grade 60, Footings, Galvanized Steel Reinforcement Bar	.....	0.55	
03 21 13 00-0067	LF	#4, Grade 60, Footings, Galvanized Steel Reinforcement Bar	.....	0.93	
03 21 13 00-0068	LF	#5, Grade 60, Footings, Galvanized Steel Reinforcement Bar	.....	1.39	
03 21 13 00-0069	LF	#6, Grade 60, Footings, Galvanized Steel Reinforcement Bar	.....	1.93	
03 21 13 00-0070	LF	#7, Grade 60, Footings, Galvanized Steel Reinforcement Bar	.....	2.52	
03 21 13 00-0071	LF	#8, Grade 60, Footings, Galvanized Steel Reinforcement Bar	.....	3.17	
03 21 13 00-0072	LF	#9, Grade 60, Footings, Galvanized Steel Reinforcement Bar	.....	3.90	
03 21 13 00-0073	LF	#10, Grade 60, Footings, Galvanized Steel Reinforcement Bar	.....	4.79	
03 21 13 00-0074	LF	#11, Grade 60, Footings, Galvanized Steel Reinforcement Bar	.....	5.74	
03 21 13 00-0075	LF	#14, Grade 60, Footings, Galvanized Steel Reinforcement Bar	.....	7.99	
03 21 13 00-0076	LF	#18, Grade 60, Footings, Galvanized Steel Reinforcement Bar	.....	13.73	
03 21 13 00-0077	LF	#6, Grade 75, Footings, Galvanized Steel Reinforcement Bar	.....	1.98	
03 21 13 00-0078	LF	#7, Grade 75, Footings, Galvanized Steel Reinforcement Bar	.....	2.59	
03 21 13 00-0079	LF	#8, Grade 75, Footings, Galvanized Steel Reinforcement Bar	.....	3.26	
03 21 13 00-0080	LF	#9, Grade 75, Footings, Galvanized Steel Reinforcement Bar	.....	4.02	
03 21 13 00-0081	LF	#10, Grade 75, Footings, Galvanized Steel Reinforcement Bar	.....	4.94	
03 21 13 00-0082	LF	#11, Grade 75, Footings, Galvanized Steel Reinforcement Bar	.....	5.91	
03 21 13 00-0083	LF	#14, Grade 75, Footings, Galvanized Steel Reinforcement Bar	.....	8.24	



MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

03 21 13 00-0084	LF	#18, Grade 75, Footings, Galvanized Steel Reinforcement Bar	14.19
03 21 13 00-0085 Slab On Grade, Galvanized Steel Reinforcement Bar (03 21 13)			
Note: ASTM A-767 Hot Dipped Galvanized Steel.			
03 21 13 00-0086	LF	#3, Grade 40, Slab On Grade, Galvanized Steel Reinforcement Bar	0.50
03 21 13 00-0087	LF	#4, Grade 40, Slab On Grade, Galvanized Steel Reinforcement Bar	0.86
03 21 13 00-0088	LF	#5, Grade 40, Slab On Grade, Galvanized Steel Reinforcement Bar	1.30
03 21 13 00-0089	LF	#6, Grade 40, Slab On Grade, Galvanized Steel Reinforcement Bar	1.80
03 21 13 00-0090	LF	#3, Grade 50, Slab On Grade, Galvanized Steel Reinforcement Bar	0.51
03 21 13 00-0091	LF	#4, Grade 50, Slab On Grade, Galvanized Steel Reinforcement Bar	0.88
03 21 13 00-0092	LF	#5, Grade 50, Slab On Grade, Galvanized Steel Reinforcement Bar	1.32
03 21 13 00-0093	LF	#6, Grade 50, Slab On Grade, Galvanized Steel Reinforcement Bar	1.83
03 21 13 00-0094	LF	#3, Grade 60, Slab On Grade, Galvanized Steel Reinforcement Bar	0.53
03 21 13 00-0095	LF	#4, Grade 60, Slab On Grade, Galvanized Steel Reinforcement Bar	0.90
03 21 13 00-0096	LF	#5, Grade 60, Slab On Grade, Galvanized Steel Reinforcement Bar	1.35
03 21 13 00-0097	LF	#6, Grade 60, Slab On Grade, Galvanized Steel Reinforcement Bar	1.88
03 21 13 00-0098	LF	#7, Grade 60, Slab On Grade, Galvanized Steel Reinforcement Bar	2.46
03 21 13 00-0099	LF	#8, Grade 60, Slab On Grade, Galvanized Steel Reinforcement Bar	3.09
03 21 13 00-0100	LF	#9, Grade 60, Slab On Grade, Galvanized Steel Reinforcement Bar	3.82
03 21 13 00-0101	LF	#10, Grade 60, Slab On Grade, Galvanized Steel Reinforcement Bar	4.69
03 21 13 00-0102	LF	#11, Grade 60, Slab On Grade, Galvanized Steel Reinforcement Bar	5.63
03 21 13 00-0103	LF	#14, Grade 60, Slab On Grade, Galvanized Steel Reinforcement Bar	7.85
03 21 13 00-0104	LF	#18, Grade 60, Slab On Grade, Galvanized Steel Reinforcement Bar	13.50
03 21 13 00-0105	LF	#6, Grade 75, Slab On Grade, Galvanized Steel Reinforcement Bar	1.93
03 21 13 00-0106	LF	#7, Grade 75, Slab On Grade, Galvanized Steel Reinforcement Bar	2.53
03 21 13 00-0107	LF	#8, Grade 75, Slab On Grade, Galvanized Steel Reinforcement Bar	3.18
03 21 13 00-0108	LF	#9, Grade 75, Slab On Grade, Galvanized Steel Reinforcement Bar	3.94
03 21 13 00-0109	LF	#10, Grade 75, Slab On Grade, Galvanized Steel Reinforcement Bar	4.84
03 21 13 00-0110	LF	#11, Grade 75, Slab On Grade, Galvanized Steel Reinforcement Bar	5.80
03 21 13 00-0111	LF	#14, Grade 75, Slab On Grade, Galvanized Steel Reinforcement Bar	8.10
03 21 13 00-0112	LF	#18, Grade 75, Slab On Grade, Galvanized Steel Reinforcement Bar	13.96
03 21 13 00-0113 Elevated Slabs, Galvanized Steel Reinforcement Bar (03 21 13)			
Note: ASTM A-767 Hot Dipped Galvanized Steel.			
03 21 13 00-0114	LF	#3, Grade 40, Elevated Slabs, Galvanized Steel Reinforcement Bar	0.47
03 21 13 00-0115	LF	#4, Grade 40, Elevated Slabs, Galvanized Steel Reinforcement Bar	0.81
03 21 13 00-0116	LF	#5, Grade 40, Elevated Slabs, Galvanized Steel Reinforcement Bar	1.23
03 21 13 00-0117	LF	#6, Grade 40, Elevated Slabs, Galvanized Steel Reinforcement Bar	1.70
03 21 13 00-0118	LF	#3, Grade 50, Elevated Slabs, Galvanized Steel Reinforcement Bar	0.48
03 21 13 00-0119	LF	#4, Grade 50, Elevated Slabs, Galvanized Steel Reinforcement Bar	0.83
03 21 13 00-0120	LF	#5, Grade 50, Elevated Slabs, Galvanized Steel Reinforcement Bar	1.25
03 21 13 00-0121	LF	#6, Grade 50, Elevated Slabs, Galvanized Steel Reinforcement Bar	1.73
03 21 13 00-0122	LF	#3, Grade 60, Elevated Slabs, Galvanized Steel Reinforcement Bar	0.50
03 21 13 00-0123	LF	#4, Grade 60, Elevated Slabs, Galvanized Steel Reinforcement Bar	0.85
03 21 13 00-0124	LF	#5, Grade 60, Elevated Slabs, Galvanized Steel Reinforcement Bar	1.28
03 21 13 00-0125	LF	#6, Grade 60, Elevated Slabs, Galvanized Steel Reinforcement Bar	1.78
03 21 13 00-0126	LF	#7, Grade 60, Elevated Slabs, Galvanized Steel Reinforcement Bar	2.34
03 21 13 00-0127	LF	#8, Grade 60, Elevated Slabs, Galvanized Steel Reinforcement Bar	2.94
03 21 13 00-0128	LF	#9, Grade 60, Elevated Slabs, Galvanized Steel Reinforcement Bar	3.65
03 21 13 00-0129	LF	#10, Grade 60, Elevated Slabs, Galvanized Steel Reinforcement Bar	4.50
03 21 13 00-0130	LF	#11, Grade 60, Elevated Slabs, Galvanized Steel Reinforcement Bar	5.42
03 21 13 00-0131	LF	#14, Grade 60, Elevated Slabs, Galvanized Steel Reinforcement Bar	7.57
03 21 13 00-0132	LF	#18, Grade 60, Elevated Slabs, Galvanized Steel Reinforcement Bar	13.07
03 21 13 00-0133	LF	#6, Grade 75, Elevated Slabs, Galvanized Steel Reinforcement Bar	1.83
03 21 13 00-0134	LF	#7, Grade 75, Elevated Slabs, Galvanized Steel Reinforcement Bar	2.41
03 21 13 00-0135	LF	#8, Grade 75, Elevated Slabs, Galvanized Steel Reinforcement Bar	3.03
03 21 13 00-0136	LF	#9, Grade 75, Elevated Slabs, Galvanized Steel Reinforcement Bar	3.77
03 21 13 00-0137	LF	#10, Grade 75, Elevated Slabs, Galvanized Steel Reinforcement Bar	4.65
03 21 13 00-0138	LF	#11, Grade 75, Elevated Slabs, Galvanized Steel Reinforcement Bar	5.59
03 21 13 00-0139	LF	#14, Grade 75, Elevated Slabs, Galvanized Steel Reinforcement Bar	7.82
03 21 13 00-0140	LF	#18, Grade 75, Elevated Slabs, Galvanized Steel Reinforcement Bar	13.53
03 21 13 00-0141 Walls, Galvanized Steel Reinforcement Bar (03 21 13)			
Note: ASTM A-767 Hot Dipped Galvanized Steel.			
03 21 13 00-0142	LF	#3, Grade 40, Walls, Galvanized Steel Reinforcement Bar	0.45
03 21 13 00-0143	LF	#4, Grade 40, Walls, Galvanized Steel Reinforcement Bar	0.78
03 21 13 00-0144	LF	#5, Grade 40, Walls, Galvanized Steel Reinforcement Bar	1.19
03 21 13 00-0145	LF	#6, Grade 40, Walls, Galvanized Steel Reinforcement Bar	1.65
03 21 13 00-0146	LF	#3, Grade 50, Walls, Galvanized Steel Reinforcement Bar	0.46
03 21 13 00-0147	LF	#4, Grade 50, Walls, Galvanized Steel Reinforcement Bar	0.80
03 21 13 00-0148	LF	#5, Grade 50, Walls, Galvanized Steel Reinforcement Bar	1.21
03 21 13 00-0149	LF	#6, Grade 50, Walls, Galvanized Steel Reinforcement Bar	1.68
03 21 13 00-0150	LF	#3, Grade 60, Walls, Galvanized Steel Reinforcement Bar	0.48
03 21 13 00-0151	LF	#4, Grade 60, Walls, Galvanized Steel Reinforcement Bar	0.82
03 21 13 00-0152	LF	#5, Grade 60, Walls, Galvanized Steel Reinforcement Bar	1.24
03 21 13 00-0153	LF	#6, Grade 60, Walls, Galvanized Steel Reinforcement Bar	1.73
03 21 13 00-0154	LF	#7, Grade 60, Walls, Galvanized Steel Reinforcement Bar	2.28
03 21 13 00-0155	LF	#8, Grade 60, Walls, Galvanized Steel Reinforcement Bar	2.88



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
03 21 13 00-0156	LF		#9, Grade 60, Walls, Galvanized Steel Reinforcement Bar	3.57	
03 21 13 00-0157	LF		#10, Grade 60, Walls, Galvanized Steel Reinforcement Bar	4.41	
03 21 13 00-0158	LF		#11, Grade 60, Walls, Galvanized Steel Reinforcement Bar	5.31	
03 21 13 00-0159	LF		#14, Grade 60, Walls, Galvanized Steel Reinforcement Bar	7.43	
03 21 13 00-0160	LF		#18, Grade 60, Walls, Galvanized Steel Reinforcement Bar	12.85	
03 21 13 00-0161	LF		#6, Grade 75, Walls, Galvanized Steel Reinforcement Bar	1.78	
03 21 13 00-0162	LF		#7, Grade 75, Walls, Galvanized Steel Reinforcement Bar	2.35	
03 21 13 00-0163	LF		#8, Grade 75, Walls, Galvanized Steel Reinforcement Bar	2.97	
03 21 13 00-0164	LF		#9, Grade 75, Walls, Galvanized Steel Reinforcement Bar	3.69	
03 21 13 00-0165	LF		#10, Grade 75, Walls, Galvanized Steel Reinforcement Bar	4.56	
03 21 13 00-0166	LF		#11, Grade 75, Walls, Galvanized Steel Reinforcement Bar	5.48	
03 21 13 00-0167	LF		#14, Grade 75, Walls, Galvanized Steel Reinforcement Bar	7.68	
03 21 13 00-0168	LF		#18, Grade 75, Walls, Galvanized Steel Reinforcement Bar	13.31	

03 21 16 Epoxy-Coated Reinforcement Steel Bars (03 21)

03 21 16 00-0001 Beams And Girders, Epoxy Coated Steel Reinforcement Bar (03 21 16)

Note: ASTM A-775 Epoxy Coated Steel.

03 21 16 00-0002	LF		#3, Grade 40, Beams And Girders, Epoxy Coated Steel Reinforcement Bar	0.57	
03 21 16 00-0003	LF		#4, Grade 40, Beams And Girders, Epoxy Coated Steel Reinforcement Bar	0.95	
03 21 16 00-0004	LF		#5, Grade 40, Beams And Girders, Epoxy Coated Steel Reinforcement Bar	1.42	
03 21 16 00-0005	LF		#6, Grade 40, Beams And Girders, Epoxy Coated Steel Reinforcement Bar	1.95	
03 21 16 00-0006	LF		#3, Grade 50, Beams And Girders, Epoxy Coated Steel Reinforcement Bar	0.57	
03 21 16 00-0007	LF		#4, Grade 50, Beams And Girders, Epoxy Coated Steel Reinforcement Bar	0.96	
03 21 16 00-0008	LF		#5, Grade 50, Beams And Girders, Epoxy Coated Steel Reinforcement Bar	1.44	
03 21 16 00-0009	LF		#6, Grade 50, Beams And Girders, Epoxy Coated Steel Reinforcement Bar	1.98	
03 21 16 00-0010	LF		#3, Grade 60, Beams And Girders, Epoxy Coated Steel Reinforcement Bar	0.59	
03 21 16 00-0011	LF		#4, Grade 60, Beams And Girders, Epoxy Coated Steel Reinforcement Bar	0.98	
03 21 16 00-0012	LF		#5, Grade 60, Beams And Girders, Epoxy Coated Steel Reinforcement Bar	1.48	
03 21 16 00-0013	LF		#6, Grade 60, Beams And Girders, Epoxy Coated Steel Reinforcement Bar	2.03	
03 21 16 00-0014	LF		#7, Grade 60, Beams And Girders, Epoxy Coated Steel Reinforcement Bar	2.66	
03 21 16 00-0015	LF		#8, Grade 60, Beams And Girders, Epoxy Coated Steel Reinforcement Bar	3.31	
03 21 16 00-0016	LF		#9, Grade 60, Beams And Girders, Epoxy Coated Steel Reinforcement Bar	4.07	
03 21 16 00-0017	LF		#10, Grade 60, Beams And Girders, Epoxy Coated Steel Reinforcement Bar	4.98	
03 21 16 00-0018	LF		#11, Grade 60, Beams And Girders, Epoxy Coated Steel Reinforcement Bar	5.92	
03 21 16 00-0019	LF		#14, Grade 60, Beams And Girders, Epoxy Coated Steel Reinforcement Bar	8.22	
03 21 16 00-0020	LF		#18, Grade 60, Beams And Girders, Epoxy Coated Steel Reinforcement Bar	14.06	
03 21 16 00-0021	LF		#6, Grade 75, Beams And Girders, Epoxy Coated Steel Reinforcement Bar	2.08	
03 21 16 00-0022	LF		#7, Grade 75, Beams And Girders, Epoxy Coated Steel Reinforcement Bar	2.73	
03 21 16 00-0023	LF		#8, Grade 75, Beams And Girders, Epoxy Coated Steel Reinforcement Bar	3.40	
03 21 16 00-0024	LF		#9, Grade 75, Beams And Girders, Epoxy Coated Steel Reinforcement Bar	4.18	
03 21 16 00-0025	LF		#10, Grade 75, Beams And Girders, Epoxy Coated Steel Reinforcement Bar	5.12	
03 21 16 00-0026	LF		#11, Grade 75, Beams And Girders, Epoxy Coated Steel Reinforcement Bar	6.10	
03 21 16 00-0027	LF		#14, Grade 75, Beams And Girders, Epoxy Coated Steel Reinforcement Bar	8.47	
03 21 16 00-0028	LF		#18, Grade 75, Beams And Girders, Epoxy Coated Steel Reinforcement Bar	14.52	

03 21 16 00-0029 Columns, Epoxy Coated Steel Reinforcement Bar (03 21 16)

Note: ASTM A-775 Epoxy Coated Steel.

03 21 16 00-0030	LF		#3, Grade 40, Columns, Epoxy Coated Steel Reinforcement Bar	0.59	
03 21 16 00-0031	LF		#4, Grade 40, Columns, Epoxy Coated Steel Reinforcement Bar	1.01	
03 21 16 00-0032	LF		#5, Grade 40, Columns, Epoxy Coated Steel Reinforcement Bar	1.49	
03 21 16 00-0033	LF		#6, Grade 40, Columns, Epoxy Coated Steel Reinforcement Bar	2.05	
03 21 16 00-0034	LF		#3, Grade 50, Columns, Epoxy Coated Steel Reinforcement Bar	0.59	
03 21 16 00-0035	LF		#4, Grade 50, Columns, Epoxy Coated Steel Reinforcement Bar	1.02	
03 21 16 00-0036	LF		#5, Grade 50, Columns, Epoxy Coated Steel Reinforcement Bar	1.51	
03 21 16 00-0037	LF		#6, Grade 50, Columns, Epoxy Coated Steel Reinforcement Bar	2.08	
03 21 16 00-0038	LF		#3, Grade 60, Columns, Epoxy Coated Steel Reinforcement Bar	0.61	
03 21 16 00-0039	LF		#4, Grade 60, Columns, Epoxy Coated Steel Reinforcement Bar	1.04	
03 21 16 00-0040	LF		#5, Grade 60, Columns, Epoxy Coated Steel Reinforcement Bar	1.55	
03 21 16 00-0041	LF		#6, Grade 60, Columns, Epoxy Coated Steel Reinforcement Bar	2.13	
03 21 16 00-0042	LF		#7, Grade 60, Columns, Epoxy Coated Steel Reinforcement Bar	2.78	
03 21 16 00-0043	LF		#8, Grade 60, Columns, Epoxy Coated Steel Reinforcement Bar	3.45	
03 21 16 00-0044	LF		#9, Grade 60, Columns, Epoxy Coated Steel Reinforcement Bar	4.23	
03 21 16 00-0045	LF		#10, Grade 60, Columns, Epoxy Coated Steel Reinforcement Bar	5.17	
03 21 16 00-0046	LF		#11, Grade 60, Columns, Epoxy Coated Steel Reinforcement Bar	6.13	
03 21 16 00-0047	LF		#14, Grade 60, Columns, Epoxy Coated Steel Reinforcement Bar	8.50	
03 21 16 00-0048	LF		#18, Grade 60, Columns, Epoxy Coated Steel Reinforcement Bar	14.49	
03 21 16 00-0049	LF		#6, Grade 75, Columns, Epoxy Coated Steel Reinforcement Bar	2.18	
03 21 16 00-0050	LF		#7, Grade 75, Columns, Epoxy Coated Steel Reinforcement Bar	2.85	
03 21 16 00-0051	LF		#8, Grade 75, Columns, Epoxy Coated Steel Reinforcement Bar	3.54	
03 21 16 00-0052	LF		#9, Grade 75, Columns, Epoxy Coated Steel Reinforcement Bar	4.34	
03 21 16 00-0053	LF		#10, Grade 75, Columns, Epoxy Coated Steel Reinforcement Bar	5.31	
03 21 16 00-0054	LF		#11, Grade 75, Columns, Epoxy Coated Steel Reinforcement Bar	6.31	
03 21 16 00-0055	LF		#14, Grade 75, Columns, Epoxy Coated Steel Reinforcement Bar	8.75	
03 21 16 00-0056	LF		#18, Grade 75, Columns, Epoxy Coated Steel Reinforcement Bar	14.95	

03 21 16 00-0057 Footings, Epoxy Coated Steel Reinforcement Bar (03 21 16)

Note: ASTM A-775 Epoxy Coated Steel.

03 21 16 00-0058	LF		#3, Grade 40, Footings, Epoxy Coated Steel Reinforcement Bar	0.52	
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MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

03 21 16 00-0059	LF	#4, Grade 40, Footings, Epoxy Coated Steel Reinforcement Bar	0.88
03 21 16 00-0060	LF	#5, Grade 40, Footings, Epoxy Coated Steel Reinforcement Bar	1.31
03 21 16 00-0061	LF	#6, Grade 40, Footings, Epoxy Coated Steel Reinforcement Bar	1.81
03 21 16 00-0062	LF	#3, Grade 50, Footings, Epoxy Coated Steel Reinforcement Bar	0.52
03 21 16 00-0063	LF	#4, Grade 50, Footings, Epoxy Coated Steel Reinforcement Bar	0.89
03 21 16 00-0064	LF	#5, Grade 50, Footings, Epoxy Coated Steel Reinforcement Bar	1.33
03 21 16 00-0065	LF	#6, Grade 50, Footings, Epoxy Coated Steel Reinforcement Bar	1.84
03 21 16 00-0066	LF	#3, Grade 60, Footings, Epoxy Coated Steel Reinforcement Bar	0.54
03 21 16 00-0067	LF	#4, Grade 60, Footings, Epoxy Coated Steel Reinforcement Bar	0.91
03 21 16 00-0068	LF	#5, Grade 60, Footings, Epoxy Coated Steel Reinforcement Bar	1.37
03 21 16 00-0069	LF	#6, Grade 60, Footings, Epoxy Coated Steel Reinforcement Bar	1.89
03 21 16 00-0070	LF	#7, Grade 60, Footings, Epoxy Coated Steel Reinforcement Bar	2.47
03 21 16 00-0071	LF	#8, Grade 60, Footings, Epoxy Coated Steel Reinforcement Bar	3.10
03 21 16 00-0072	LF	#9, Grade 60, Footings, Epoxy Coated Steel Reinforcement Bar	3.82
03 21 16 00-0073	LF	#10, Grade 60, Footings, Epoxy Coated Steel Reinforcement Bar	4.69
03 21 16 00-0074	LF	#11, Grade 60, Footings, Epoxy Coated Steel Reinforcement Bar	5.60
03 21 16 00-0075	LF	#14, Grade 60, Footings, Epoxy Coated Steel Reinforcement Bar	7.80
03 21 16 00-0076	LF	#18, Grade 60, Footings, Epoxy Coated Steel Reinforcement Bar	13.39
03 21 16 00-0077	LF	#6, Grade 75, Footings, Epoxy Coated Steel Reinforcement Bar	1.94
03 21 16 00-0078	LF	#7, Grade 75, Footings, Epoxy Coated Steel Reinforcement Bar	2.54
03 21 16 00-0079	LF	#8, Grade 75, Footings, Epoxy Coated Steel Reinforcement Bar	3.19
03 21 16 00-0080	LF	#9, Grade 75, Footings, Epoxy Coated Steel Reinforcement Bar	3.93
03 21 16 00-0081	LF	#10, Grade 75, Footings, Epoxy Coated Steel Reinforcement Bar	4.83
03 21 16 00-0082	LF	#11, Grade 75, Footings, Epoxy Coated Steel Reinforcement Bar	5.78
03 21 16 00-0083	LF	#14, Grade 75, Footings, Epoxy Coated Steel Reinforcement Bar	8.05
03 21 16 00-0084	LF	#18, Grade 75, Footings, Epoxy Coated Steel Reinforcement Bar	13.85

03 21 16 00-0085 Slab On Grade, Epoxy Coated Steel Reinforcement Bar (03 21 16)

Note: ASTM A-775 Epoxy Coated Steel.

03 21 16 00-0086	LF	#3, Grade 40, Slab On Grade, Epoxy Coated Steel Reinforcement Bar	0.50
03 21 16 00-0087	LF	#4, Grade 40, Slab On Grade, Epoxy Coated Steel Reinforcement Bar	0.85
03 21 16 00-0088	LF	#5, Grade 40, Slab On Grade, Epoxy Coated Steel Reinforcement Bar	1.27
03 21 16 00-0089	LF	#6, Grade 40, Slab On Grade, Epoxy Coated Steel Reinforcement Bar	1.76
03 21 16 00-0090	LF	#3, Grade 50, Slab On Grade, Epoxy Coated Steel Reinforcement Bar	0.50
03 21 16 00-0091	LF	#4, Grade 50, Slab On Grade, Epoxy Coated Steel Reinforcement Bar	0.86
03 21 16 00-0092	LF	#5, Grade 50, Slab On Grade, Epoxy Coated Steel Reinforcement Bar	1.29
03 21 16 00-0093	LF	#6, Grade 50, Slab On Grade, Epoxy Coated Steel Reinforcement Bar	1.79
03 21 16 00-0094	LF	#3, Grade 60, Slab On Grade, Epoxy Coated Steel Reinforcement Bar	0.52
03 21 16 00-0095	LF	#4, Grade 60, Slab On Grade, Epoxy Coated Steel Reinforcement Bar	0.88
03 21 16 00-0096	LF	#5, Grade 60, Slab On Grade, Epoxy Coated Steel Reinforcement Bar	1.33
03 21 16 00-0097	LF	#6, Grade 60, Slab On Grade, Epoxy Coated Steel Reinforcement Bar	1.84
03 21 16 00-0098	LF	#7, Grade 60, Slab On Grade, Epoxy Coated Steel Reinforcement Bar	2.41
03 21 16 00-0099	LF	#8, Grade 60, Slab On Grade, Epoxy Coated Steel Reinforcement Bar	3.02
03 21 16 00-0100	LF	#9, Grade 60, Slab On Grade, Epoxy Coated Steel Reinforcement Bar	3.74
03 21 16 00-0101	LF	#10, Grade 60, Slab On Grade, Epoxy Coated Steel Reinforcement Bar	4.59
03 21 16 00-0102	LF	#11, Grade 60, Slab On Grade, Epoxy Coated Steel Reinforcement Bar	5.49
03 21 16 00-0103	LF	#14, Grade 60, Slab On Grade, Epoxy Coated Steel Reinforcement Bar	7.66
03 21 16 00-0104	LF	#18, Grade 60, Slab On Grade, Epoxy Coated Steel Reinforcement Bar	13.16
03 21 16 00-0105	LF	#6, Grade 75, Slab On Grade, Epoxy Coated Steel Reinforcement Bar	1.89
03 21 16 00-0106	LF	#7, Grade 75, Slab On Grade, Epoxy Coated Steel Reinforcement Bar	2.48
03 21 16 00-0107	LF	#8, Grade 75, Slab On Grade, Epoxy Coated Steel Reinforcement Bar	3.11
03 21 16 00-0108	LF	#9, Grade 75, Slab On Grade, Epoxy Coated Steel Reinforcement Bar	3.85
03 21 16 00-0109	LF	#10, Grade 75, Slab On Grade, Epoxy Coated Steel Reinforcement Bar	4.73
03 21 16 00-0110	LF	#11, Grade 75, Slab On Grade, Epoxy Coated Steel Reinforcement Bar	5.67
03 21 16 00-0111	LF	#14, Grade 75, Slab On Grade, Epoxy Coated Steel Reinforcement Bar	7.91
03 21 16 00-0112	LF	#18, Grade 75, Slab On Grade, Epoxy Coated Steel Reinforcement Bar	13.62

03 21 16 00-0113 Elevated Slabs, Epoxy Coated Steel Reinforcement Bar (03 21 16)

Note: ASTM A-775 Epoxy Coated Steel.

03 21 16 00-0114	LF	#3, Grade 40, Elevated Slabs, Epoxy Coated Steel Reinforcement Bar	0.47
03 21 16 00-0115	LF	#4, Grade 40, Elevated Slabs, Epoxy Coated Steel Reinforcement Bar	0.80
03 21 16 00-0116	LF	#5, Grade 40, Elevated Slabs, Epoxy Coated Steel Reinforcement Bar	1.20
03 21 16 00-0117	LF	#6, Grade 40, Elevated Slabs, Epoxy Coated Steel Reinforcement Bar	1.66
03 21 16 00-0118	LF	#3, Grade 50, Elevated Slabs, Epoxy Coated Steel Reinforcement Bar	0.47
03 21 16 00-0119	LF	#4, Grade 50, Elevated Slabs, Epoxy Coated Steel Reinforcement Bar	0.81
03 21 16 00-0120	LF	#5, Grade 50, Elevated Slabs, Epoxy Coated Steel Reinforcement Bar	1.22
03 21 16 00-0121	LF	#6, Grade 50, Elevated Slabs, Epoxy Coated Steel Reinforcement Bar	1.69
03 21 16 00-0122	LF	#3, Grade 60, Elevated Slabs, Epoxy Coated Steel Reinforcement Bar	0.49
03 21 16 00-0123	LF	#4, Grade 60, Elevated Slabs, Epoxy Coated Steel Reinforcement Bar	0.83
03 21 16 00-0124	LF	#5, Grade 60, Elevated Slabs, Epoxy Coated Steel Reinforcement Bar	1.26
03 21 16 00-0125	LF	#6, Grade 60, Elevated Slabs, Epoxy Coated Steel Reinforcement Bar	1.74
03 21 16 00-0126	LF	#7, Grade 60, Elevated Slabs, Epoxy Coated Steel Reinforcement Bar	2.29
03 21 16 00-0127	LF	#8, Grade 60, Elevated Slabs, Epoxy Coated Steel Reinforcement Bar	2.87
03 21 16 00-0128	LF	#9, Grade 60, Elevated Slabs, Epoxy Coated Steel Reinforcement Bar	3.57
03 21 16 00-0129	LF	#10, Grade 60, Elevated Slabs, Epoxy Coated Steel Reinforcement Bar	4.40
03 21 16 00-0130	LF	#11, Grade 60, Elevated Slabs, Epoxy Coated Steel Reinforcement Bar	5.28
03 21 16 00-0131	LF	#14, Grade 60, Elevated Slabs, Epoxy Coated Steel Reinforcement Bar	7.38
03 21 16 00-0132	LF	#18, Grade 60, Elevated Slabs, Epoxy Coated Steel Reinforcement Bar	12.73
03 21 16 00-0133	LF	#6, Grade 75, Elevated Slabs, Epoxy Coated Steel Reinforcement Bar	1.79



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
03 21 16 00-0134 LF #7, Grade 75, Elevated Slabs, Epoxy Coated Steel Reinforcement Bar.....	2.36	
03 21 16 00-0135 LF #8, Grade 75, Elevated Slabs, Epoxy Coated Steel Reinforcement Bar.....	2.96	
03 21 16 00-0136 LF #9, Grade 75, Elevated Slabs, Epoxy Coated Steel Reinforcement Bar.....	3.68	
03 21 16 00-0137 LF #10, Grade 75, Elevated Slabs, Epoxy Coated Steel Reinforcement Bar.....	4.54	
03 21 16 00-0138 LF #11, Grade 75, Elevated Slabs, Epoxy Coated Steel Reinforcement Bar.....	5.46	
03 21 16 00-0139 LF #14, Grade 75, Elevated Slabs, Epoxy Coated Steel Reinforcement Bar.....	7.63	
03 21 16 00-0140 LF #18, Grade 75, Elevated Slabs, Epoxy Coated Steel Reinforcement Bar.....	13.19	
03 21 16 00-0141 Walls, Epoxy Coated Steel Reinforcement Bar (03 21 16)		
Note: ASTM A-775 Epoxy Coated Steel.		
03 21 16 00-0142 LF #3, Grade 40, Walls, Epoxy Coated Steel Reinforcement Bar.....	0.45	
03 21 16 00-0143 LF #4, Grade 40, Walls, Epoxy Coated Steel Reinforcement Bar.....	0.77	
03 21 16 00-0144 LF #5, Grade 40, Walls, Epoxy Coated Steel Reinforcement Bar.....	1.16	
03 21 16 00-0145 LF #6, Grade 40, Walls, Epoxy Coated Steel Reinforcement Bar.....	1.61	
03 21 16 00-0146 LF #3, Grade 50, Walls, Epoxy Coated Steel Reinforcement Bar.....	0.45	
03 21 16 00-0147 LF #4, Grade 50, Walls, Epoxy Coated Steel Reinforcement Bar.....	0.78	
03 21 16 00-0148 LF #5, Grade 50, Walls, Epoxy Coated Steel Reinforcement Bar.....	1.18	
03 21 16 00-0149 LF #6, Grade 50, Walls, Epoxy Coated Steel Reinforcement Bar.....	1.64	
03 21 16 00-0150 LF #3, Grade 60, Walls, Epoxy Coated Steel Reinforcement Bar.....	0.47	
03 21 16 00-0151 LF #4, Grade 60, Walls, Epoxy Coated Steel Reinforcement Bar.....	0.80	
03 21 16 00-0152 LF #5, Grade 60, Walls, Epoxy Coated Steel Reinforcement Bar.....	1.22	
03 21 16 00-0153 LF #6, Grade 60, Walls, Epoxy Coated Steel Reinforcement Bar.....	1.69	
03 21 16 00-0154 LF #7, Grade 60, Walls, Epoxy Coated Steel Reinforcement Bar.....	2.23	
03 21 16 00-0155 LF #8, Grade 60, Walls, Epoxy Coated Steel Reinforcement Bar.....	2.81	
03 21 16 00-0156 LF #9, Grade 60, Walls, Epoxy Coated Steel Reinforcement Bar.....	3.49	
03 21 16 00-0157 LF #10, Grade 60, Walls, Epoxy Coated Steel Reinforcement Bar.....	4.31	
03 21 16 00-0158 LF #11, Grade 60, Walls, Epoxy Coated Steel Reinforcement Bar.....	5.17	
03 21 16 00-0159 LF #14, Grade 60, Walls, Epoxy Coated Steel Reinforcement Bar.....	7.24	
03 21 16 00-0160 LF #18, Grade 60, Walls, Epoxy Coated Steel Reinforcement Bar.....	12.51	
03 21 16 00-0161 LF #6, Grade 75, Walls, Epoxy Coated Steel Reinforcement Bar.....	1.74	
03 21 16 00-0162 LF #7, Grade 75, Walls, Epoxy Coated Steel Reinforcement Bar.....	2.30	
03 21 16 00-0163 LF #8, Grade 75, Walls, Epoxy Coated Steel Reinforcement Bar.....	2.90	
03 21 16 00-0164 LF #9, Grade 75, Walls, Epoxy Coated Steel Reinforcement Bar.....	3.60	
03 21 16 00-0165 LF #10, Grade 75, Walls, Epoxy Coated Steel Reinforcement Bar.....	4.45	
03 21 16 00-0166 LF #11, Grade 75, Walls, Epoxy Coated Steel Reinforcement Bar.....	5.35	
03 21 16 00-0167 LF #14, Grade 75, Walls, Epoxy Coated Steel Reinforcement Bar.....	7.49	
03 21 16 00-0168 LF #18, Grade 75, Walls, Epoxy Coated Steel Reinforcement Bar.....	12.97	
03 21 16 00-0169 Epoxy Coated Deformed Straight Dowels (03 21 16)		
03 21 16 00-0170 EA 3/8" Diameter x 24" Long, Epoxy Coated Deformed Straight Dowel.....	2.18	
<i>For Drilling Hole Into Concrete, Horizontal, Add Per Inch Of Depth</i>	1.86	
<i>For Drilling Hole Into Concrete, Vertical, Add Per Inch Of Depth</i>	1.79	
<i>For Drilling Hole Into Concrete, Inverted Overhead, Add Per Inch Of Depth</i>	2.14	
<i>For Up To 12" Length, Deduct</i>	-0.32	
<i>For >12" To <24" Length, Deduct</i>	-0.16	
03 21 16 00-0171 EA 1/2" Diameter x 24" Long, Epoxy Coated Deformed Straight Dowel.....	2.67	
<i>For Drilling Hole Into Concrete, Horizontal, Add Per Inch Of Depth</i>	1.95	
<i>For Drilling Hole Into Concrete, Vertical, Add Per Inch Of Depth</i>	1.88	
<i>For Drilling Hole Into Concrete, Inverted Overhead, Add Per Inch Of Depth</i>	2.24	
<i>For Up To 12" Length, Deduct</i>	-0.49	
<i>For >12" To <24" Length, Deduct</i>	-0.25	
03 21 16 00-0172 EA 5/8" Diameter x 24" Long, Epoxy Coated Deformed Straight Dowel.....	3.34	
<i>For Drilling Hole Into Concrete, Horizontal, Add Per Inch Of Depth</i>	2.04	
<i>For Drilling Hole Into Concrete, Vertical, Add Per Inch Of Depth</i>	1.97	
<i>For Drilling Hole Into Concrete, Inverted Overhead, Add Per Inch Of Depth</i>	2.35	
<i>For Up To 12" Length, Deduct</i>	-0.73	
<i>For >12" To <24" Length, Deduct</i>	-0.37	
03 21 16 00-0173 EA 3/4" Diameter x 24" Long, Epoxy Coated Deformed Straight Dowel.....	4.03	
<i>For Drilling Hole Into Concrete, Horizontal, Add Per Inch Of Depth</i>	2.16	
<i>For Drilling Hole Into Concrete, Vertical, Add Per Inch Of Depth</i>	2.08	
<i>For Drilling Hole Into Concrete, Inverted Overhead, Add Per Inch Of Depth</i>	2.48	
<i>For Up To 12" Length, Deduct</i>	-0.97	
<i>For >12" To <24" Length, Deduct</i>	-0.49	
03 21 16 00-0174 EA 7/8" Diameter x 24" Long, Epoxy Coated Deformed Straight Dowel.....	5.05	
<i>For Drilling Hole Into Concrete, Horizontal, Add Per Inch Of Depth</i>	2.34	
<i>For Drilling Hole Into Concrete, Vertical, Add Per Inch Of Depth</i>	2.26	
<i>For Drilling Hole Into Concrete, Inverted Overhead, Add Per Inch Of Depth</i>	2.69	
<i>For Up To 12" Length, Deduct</i>	-1.32	
<i>For >12" To <24" Length, Deduct</i>	-0.66	
03 21 16 00-0175 EA 1" Diameter x 24" Long, Epoxy Coated Deformed Straight Dowel.....	5.99	
<i>For Drilling Hole Into Concrete, Horizontal, Add Per Inch Of Depth</i>	2.56	
<i>For Drilling Hole Into Concrete, Vertical, Add Per Inch Of Depth</i>	2.47	
<i>For Drilling Hole Into Concrete, Inverted Overhead, Add Per Inch Of Depth</i>	2.95	
<i>For Up To 12" Length, Deduct</i>	-1.63	
<i>For >12" To <24" Length, Deduct</i>	-0.82	
03 21 16 00-0176 EA 1-1/8" Diameter x 24" Long, Epoxy Coated Deformed Straight Dowel.....	7.16	
<i>For Drilling Hole Into Concrete, Horizontal, Add Per Inch Of Depth</i>	2.97	
<i>For Drilling Hole Into Concrete, Vertical, Add Per Inch Of Depth</i>	2.86	
<i>For Drilling Hole Into Concrete, Inverted Overhead, Add Per Inch Of Depth</i>	3.41	
<i>For Up To 12" Length, Deduct</i>	-1.98	
<i>For >12" To <24" Length, Deduct</i>	-0.99	

03	Concrete
03 20	Concrete Reinforcing
03 21	Reinforcement Bars



MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

03 21 16 00-0177	EA 1-1/4" Diameter x 24" Long, Epoxy Coated Deformed Straight Dowel.....	8.59
	<i>For Drilling Hole Into Concrete, Horizontal, Add Per Inch Of Depth</i>	3.47
	<i>For Drilling Hole Into Concrete, Vertical, Add Per Inch Of Depth</i>	3.34
	<i>For Drilling Hole Into Concrete, Inverted Overhead, Add Per Inch Of Depth</i>	4.00
	<i>For Up To 12" Length, Deduct</i>	-2.39
	<i>For >12" To <24" Length, Deduct</i>	-1.20

03 30 Cast-In-Place Concrete ⁽⁰³⁾

See CSI section 01 74 19 00-0034 for hauling over 15 miles.

03 31 Structural Concrete ^(03 30)

03 31 13 Heavyweight Structural Concrete ^(03 31)

Note: Includes delivery and placement of material. See CSI section 02 41 00 00-0000 for demolition, 03 05 00 00-0001 for admixtures, 03 11 00 00-0000 for forming, 03 20 00 00-0000 for reinforcing, 03 35 00 00-0000 for finishing, 03 39 00 00-0000 for curing.

03 31 13 00-0001 Concrete Assemblies ^(03 31 13)

03 31 13 00-0002 3,000 PSI Slab On Grade Concrete Slabs Assemblies ^(03 31 13 00-0001)

Note: Includes forms, welded wire reinforcement (where necessary), #3-#6 reinforcing rods at 12" on center with chairs (where necessary), vapor barrier, concrete, curing, latex or hot asphalt expansion joints, control joints, screed, float, and finish for pedestrian slabs. Excludes excavation, base, earthwork, and expansion joints along existing. See CSI section 03 05 00 00-0001 for color additive alternative, 03 31 13 00-0088 for concrete pumping equipment.

03 31 13 00-0003	SF 4" 3,000 PSI Slab On Grade Concrete Slabs Assembly	5.83
	<i>For 2,000 PSI Concrete, Deduct</i>	-0.14
	<i>For 2,500 PSI Concrete, Deduct</i>	-0.07
	<i>For 3,500 PSI Concrete, Add</i>	0.05
	<i>For 4,000 PSI Concrete, Add</i>	0.17
	<i>For Reinforcing Rods Are At 18" On Center, Deduct</i>	-0.13
	<i>For Reinforcing Rods Are At 24" On Center, Deduct</i>	-0.40
	<i>For Up To 500, Add</i>	2.43
	<i>For >500 To 1,000, Add</i>	1.66
	<i>For >1,000 To 2,000, Add</i>	0.90
	<i>For >2,000 To 5,000, Add</i>	0.45
	<i>For >10,000 To 20,000, Deduct</i>	-0.13
	<i>For >20,000 To 35,000, Deduct</i>	-0.28
	<i>For >35,000 To 50,000, Deduct</i>	-0.43
	<i>For >50,000 To 70,000, Deduct</i>	-0.57
	<i>For >70,000, Deduct</i>	-0.72
03 31 13 00-0004	SF 5" 3,000 PSI Slab On Grade Concrete Slabs Assembly	6.34
	<i>For 2,000 PSI Concrete, Deduct</i>	-0.16
	<i>For 2,500 PSI Concrete, Deduct</i>	-0.08
	<i>For 3,500 PSI Concrete, Add</i>	0.06
	<i>For 4,000 PSI Concrete, Add</i>	0.19
	<i>For Reinforcing Rods Are At 18" On Center, Deduct</i>	-0.13
	<i>For Reinforcing Rods Are At 24" On Center, Deduct</i>	-0.40
	<i>For Up To 500, Add</i>	2.59
	<i>For >500 To 1,000, Add</i>	1.78
	<i>For >1,000 To 2,000, Add</i>	0.96
	<i>For >2,000 To 5,000, Add</i>	0.48
	<i>For >10,000 To 20,000, Deduct</i>	-0.15
	<i>For >20,000 To 35,000, Deduct</i>	-0.31
	<i>For >35,000 To 50,000, Deduct</i>	-0.47
	<i>For >50,000 To 70,000, Deduct</i>	-0.63
	<i>For >70,000, Deduct</i>	-0.79
03 31 13 00-0005	SF 6" 3,000 PSI Slab On Grade Concrete Slabs Assembly	7.07
	<i>For 2,000 PSI Concrete, Deduct</i>	-0.19
	<i>For 2,500 PSI Concrete, Deduct</i>	-0.10
	<i>For 3,500 PSI Concrete, Add</i>	0.07
	<i>For 4,000 PSI Concrete, Add</i>	0.22
	<i>For Reinforcing Rods Are At 18" On Center, Deduct</i>	-0.13
	<i>For Reinforcing Rods Are At 24" On Center, Deduct</i>	-0.40
	<i>For Up To 500, Add</i>	2.82
	<i>For >500 To 1,000, Add</i>	1.94
	<i>For >1,000 To 2,000, Add</i>	1.06
	<i>For >2,000 To 5,000, Add</i>	0.53
	<i>For >10,000 To 20,000, Deduct</i>	-0.18
	<i>For >20,000 To 35,000, Deduct</i>	-0.35
	<i>For >35,000 To 50,000, Deduct</i>	-0.53
	<i>For >50,000 To 70,000, Deduct</i>	-0.71
	<i>For >70,000, Deduct</i>	-0.88



Concrete	03	03
Cast-In-Place Concrete	03 30	
Structural Concrete	03 31	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
03 31 13 00-0006 SF 7" 3,000 PSI Slab On Grade Concrete Slabs Assembly	7.75	
For 2,000 PSI Concrete, Deduct	-0.22	
For 2,500 PSI Concrete, Deduct	-0.11	
For 3,500 PSI Concrete, Add	0.08	
For 4,000 PSI Concrete, Add	0.26	
For Reinforcing Rods Are At 18" On Center, Deduct	-0.13	
For Reinforcing Rods Are At 24" On Center, Deduct	-0.40	
For Up To 500, Add	3.01	
For >500 To 1,000, Add	2.08	
For >1,000 To 2,000, Add	1.14	
For >2,000 To 5,000, Add	0.57	
For >10,000 To 20,000, Deduct	-0.20	
For >20,000 To 35,000, Deduct	-0.40	
For >35,000 To 50,000, Deduct	-0.59	
For >50,000 To 70,000, Deduct	-0.79	
For >70,000, Deduct	-0.98	
03 31 13 00-0007 SF 8" 3,000 PSI Slab On Grade Concrete Slabs Assembly	8.34	
For 2,000 PSI Concrete, Deduct	-0.24	
For 2,500 PSI Concrete, Deduct	-0.12	
For 3,500 PSI Concrete, Add	0.09	
For 4,000 PSI Concrete, Add	0.29	
For Reinforcing Rods Are At 18" On Center, Deduct	-0.13	
For Reinforcing Rods Are At 24" On Center, Deduct	-0.40	
For Up To 500, Add	3.19	
For >500 To 1,000, Add	2.20	
For >1,000 To 2,000, Add	1.22	
For >2,000 To 5,000, Add	0.61	
For >10,000 To 20,000, Deduct	-0.23	
For >20,000 To 35,000, Deduct	-0.44	
For >35,000 To 50,000, Deduct	-0.64	
For >50,000 To 70,000, Deduct	-0.85	
For >70,000, Deduct	-1.06	
03 31 13 00-0008 SF 10" 3,000 PSI Slab On Grade Concrete Slabs Assembly	9.82	
For 2,000 PSI Concrete, Deduct	-0.31	
For 2,500 PSI Concrete, Deduct	-0.15	
For 3,500 PSI Concrete, Add	0.11	
For 4,000 PSI Concrete, Add	0.36	
For Reinforcing Rods Are At 18" On Center, Deduct	-0.13	
For Reinforcing Rods Are At 24" On Center, Deduct	-0.40	
For Up To 500, Add	3.60	
For >500 To 1,000, Add	2.50	
For >1,000 To 2,000, Add	1.39	
For >2,000 To 5,000, Add	0.70	
For >10,000 To 20,000, Deduct	-0.29	
For >20,000 To 35,000, Deduct	-0.53	
For >35,000 To 50,000, Deduct	-0.78	
For >50,000 To 70,000, Deduct	-1.02	
For >70,000, Deduct	-1.27	
03 31 13 00-0009 SF 12" 3,000 PSI Slab On Grade Concrete Slabs Assembly	10.99	
For 2,000 PSI Concrete, Deduct	-0.36	
For 2,500 PSI Concrete, Deduct	-0.18	
For 3,500 PSI Concrete, Add	0.13	
For 4,000 PSI Concrete, Add	0.42	
For Reinforcing Rods Are At 18" On Center, Deduct	-0.13	
For Reinforcing Rods Are At 24" On Center, Deduct	-0.40	
For Up To 500, Add	3.96	
For >500 To 1,000, Add	2.75	
For >1,000 To 2,000, Add	1.54	
For >2,000 To 5,000, Add	0.77	
For >10,000 To 20,000, Deduct	-0.33	
For >20,000 To 35,000, Deduct	-0.60	
For >35,000 To 50,000, Deduct	-0.88	
For >50,000 To 70,000, Deduct	-1.15	
For >70,000, Deduct	-1.43	
 03 31 13 00-0010 Concrete Delivery And Placement <small>(03 31 13)</small>		
Note: Includes cleaning out equipment and standard concrete placement tests.		
 03 31 13 00-0011 Place Concrete By Method Indicated <small>(03 31 13 00-0010)</small>		
Note: Tasks for concrete placement "By Concrete Pump" exclude the pumping equipment. See CSI section 03 31 13 00-0088 for concrete pumping equipment.		
 03 31 13 00-0012 Place Concrete Pile Caps <small>(03 31 13 00-0011)</small>		

03	Concrete
03 30	Cast-In-Place Concrete
03 31	Structural Concrete



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
03 31	13 00-0013	CY	Crane And Bucket, Place 3,000 PSI Concrete Pile Caps	207.45	
			For 2,000 PSI Concrete, Deduct	-5.95	
			For 2,500 PSI Concrete, Deduct	-2.98	
			For 3,500 PSI Concrete, Add	5.51	
			For 3,750 PSI Concrete, Add	7.50	
			For 4,000 PSI Concrete, Add	9.48	
			For 4,500 PSI Concrete, Add	11.03	
			For 5,000 PSI Concrete, Add	12.57	
			For 6,000 PSI Concrete, Add	29.77	
			For White Cement Concrete, Add	13.23	
			For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	14.33	
			For High Early Strength, Type 3 ASTM C150, Add	11.03	
			For Lightweight Aggregate, ASTM C330, Add	33.08	
			For Up To 20, Add	38.88	
			For >20 To 50, Add	14.58	
			For >100 To 200, Deduct	-4.15	
			For >200 To 400, Deduct	-8.30	
			For >400, Deduct	-12.45	
03 31	13 00-0014	CY	Direct Chute, Place 3,000 PSI Concrete Pile Caps.....	156.06	
			For 2,000 PSI Concrete, Deduct	-5.95	
			For 2,500 PSI Concrete, Deduct	-2.98	
			For 3,500 PSI Concrete, Add	5.51	
			For 3,750 PSI Concrete, Add	7.50	
			For 4,000 PSI Concrete, Add	9.48	
			For 4,500 PSI Concrete, Add	11.03	
			For 5,000 PSI Concrete, Add	12.57	
			For 6,000 PSI Concrete, Add	29.77	
			For White Cement Concrete, Add	13.23	
			For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	14.33	
			For High Early Strength, Type 3 ASTM C150, Add	11.03	
			For Lightweight Aggregate, ASTM C330, Add	33.08	
			For Up To 20, Add	18.32	
			For >20 To 50, Add	6.87	
			For >100 To 200, Deduct	-3.12	
			For >200 To 400, Deduct	-6.24	
			For >400, Deduct	-9.36	
03 31	13 00-0015	CY	Concrete Pump, Place 3,000 PSI Concrete Pile Caps.....	163.06	
			Note: Excludes pumping equipment.		
			For 2,000 PSI Concrete, Deduct	-6.45	
			For 2,500 PSI Concrete, Deduct	-3.22	
			For 3,500 PSI Concrete, Add	5.97	
			For 3,750 PSI Concrete, Add	8.12	
			For 4,000 PSI Concrete, Add	10.27	
			For 4,500 PSI Concrete, Add	11.94	
			For 5,000 PSI Concrete, Add	13.62	
			For 6,000 PSI Concrete, Add	32.25	
			For White Cement Concrete, Add	14.33	
			For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	15.53	
			For High Early Strength, Type 3 ASTM C150, Add	11.94	
			For Lightweight Aggregate, ASTM C330, Add	35.83	
			For Up To 20, Add	17.45	
			For >20 To 50, Add	6.54	
			For >100 To 200, Deduct	-3.26	
			For >200 To 400, Deduct	-6.52	
			For >400, Deduct	-9.78	
03 31	13 00-0016		Place Concrete Continuous Footings <small>(03 31 13 00-0011)</small>		
03 31	13 00-0017	CY	Crane And Bucket, Place 3,000 PSI Concrete Continuous Footings.....	196.65	
			For 2,000 PSI Concrete, Deduct	-5.95	
			For 2,500 PSI Concrete, Deduct	-2.98	
			For 3,500 PSI Concrete, Add	5.51	
			For 3,750 PSI Concrete, Add	7.50	
			For 4,000 PSI Concrete, Add	9.48	
			For 4,500 PSI Concrete, Add	11.03	
			For 5,000 PSI Concrete, Add	12.57	
			For 6,000 PSI Concrete, Add	29.77	
			For White Cement Concrete, Add	13.23	
			For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	14.33	
			For High Early Strength, Type 3 ASTM C150, Add	11.03	
			For Lightweight Aggregate, ASTM C330, Add	33.08	
			For Up To 20, Add	34.56	
			For >20 To 50, Add	12.96	
			For >100 To 200, Deduct	-3.93	
			For >200 To 400, Deduct	-7.87	
			For >400, Deduct	-11.80	



Concrete	03	03
Cast-In-Place Concrete	03 30	
Structural Concrete	03 31	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
03 31 13 00-0018 CY Direct Chute, Place 3,000 PSI Concrete Continuous Footings.....	150.96	
For 2,000 PSI Concrete, Deduct	-5.95	
For 2,500 PSI Concrete, Deduct	-2.98	
For 3,500 PSI Concrete, Add	5.51	
For 3,750 PSI Concrete, Add	7.50	
For 4,000 PSI Concrete, Add	9.48	
For 4,500 PSI Concrete, Add	11.02	
For 5,000 PSI Concrete, Add	12.57	
For 6,000 PSI Concrete, Add	29.76	
For White Cement Concrete, Add	13.23	
For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	14.33	
For High Early Strength, Type 3 ASTM C150, Add	11.02	
For Lightweight Aggregate, ASTM C330, Add	33.07	
For Up To 20, Add	16.29	
For >20 To 50, Add	6.11	
For >100 To 200, Deduct	-3.02	
For >200 To 400, Deduct	-6.04	
For >400, Deduct	-9.06	
03 31 13 00-0019 CY Concrete Pump, Place 3,000 PSI Concrete Continuous Footings.....	158.21	
Note: Excludes pumping equipment.		
For 2,000 PSI Concrete, Deduct	-6.45	
For 2,500 PSI Concrete, Deduct	-3.22	
For 3,500 PSI Concrete, Add	5.97	
For 3,750 PSI Concrete, Add	8.12	
For 4,000 PSI Concrete, Add	10.27	
For 4,500 PSI Concrete, Add	11.94	
For 5,000 PSI Concrete, Add	13.62	
For 6,000 PSI Concrete, Add	32.25	
For White Cement Concrete, Add	14.33	
For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	15.53	
For High Early Strength, Type 3 ASTM C150, Add	11.94	
For Lightweight Aggregate, ASTM C330, Add	35.83	
For Up To 20, Add	15.51	
For >20 To 50, Add	5.82	
For >100 To 200, Deduct	-3.16	
For >200 To 400, Deduct	-6.33	
For >400, Deduct	-9.49	
03 31 13 00-0020 Place Concrete Spread Footings (03 31 13 00-0011)		
03 31 13 00-0021 CY Crane And Bucket, Place 3,000 PSI Concrete Spread Footings	256.04	
For 2,000 PSI Concrete, Deduct	-5.95	
For 2,500 PSI Concrete, Deduct	-2.98	
For 3,500 PSI Concrete, Add	5.51	
For 3,750 PSI Concrete, Add	7.50	
For 4,000 PSI Concrete, Add	9.48	
For 4,500 PSI Concrete, Add	11.02	
For 5,000 PSI Concrete, Add	12.57	
For 6,000 PSI Concrete, Add	29.76	
For White Cement Concrete, Add	13.23	
For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	14.33	
For High Early Strength, Type 3 ASTM C150, Add	11.02	
For Lightweight Aggregate, ASTM C330, Add	33.07	
For Up To 20, Add	58.32	
For >20 To 50, Add	21.87	
For >100 To 200, Deduct	-5.12	
For >200 To 400, Deduct	-10.24	
For >400, Deduct	-15.36	
03 31 13 00-0022 CY Direct Chute, Place 3,000 PSI Concrete Spread Footings	178.95	
For 2,000 PSI Concrete, Deduct	-5.95	
For 2,500 PSI Concrete, Deduct	-2.98	
For 3,500 PSI Concrete, Add	5.51	
For 3,750 PSI Concrete, Add	7.50	
For 4,000 PSI Concrete, Add	9.48	
For 4,500 PSI Concrete, Add	11.02	
For 5,000 PSI Concrete, Add	12.57	
For 6,000 PSI Concrete, Add	29.76	
For White Cement Concrete, Add	13.23	
For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	14.33	
For High Early Strength, Type 3 ASTM C150, Add	11.02	
For Lightweight Aggregate, ASTM C330, Add	33.07	
For Up To 20, Add	27.48	
For >20 To 50, Add	10.31	
For >100 To 200, Deduct	-3.58	
For >200 To 400, Deduct	-7.16	
For >400, Deduct	-10.74	

03	Concrete
03 30	Cast-In-Place Concrete
03 31	Structural Concrete



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
	03 31 13 00-0023	CY	Concrete Pump, Place 3,000 PSI Concrete Spread Footings..... Note: Excludes pumping equipment.	184.87	
			<i>For 2,000 PSI Concrete, Deduct</i>	-6.45	
			<i>For 2,500 PSI Concrete, Deduct</i>	-3.22	
			<i>For 3,500 PSI Concrete, Add</i>	5.97	
			<i>For 3,750 PSI Concrete, Add</i>	8.12	
			<i>For 4,000 PSI Concrete, Add</i>	10.27	
			<i>For 4,500 PSI Concrete, Add</i>	11.94	
			<i>For 5,000 PSI Concrete, Add</i>	13.62	
			<i>For 6,000 PSI Concrete, Add</i>	32.25	
			<i>For White Cement Concrete, Add</i>	14.33	
			<i>For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add</i>	15.53	
			<i>For High Early Strength, Type 3 ASTM C150, Add</i>	11.94	
			<i>For Lightweight Aggregate, ASTM C330, Add</i>	35.83	
			<i>For Up To 20, Add</i>	26.18	
			<i>For >20 To 50, Add</i>	9.82	
			<i>For >100 To 200, Deduct</i>	-3.70	
			<i>For >200 To 400, Deduct</i>	-7.39	
			<i>For >400, Deduct</i>	-11.09	
	03 31 13 00-0024		Place Concrete Mat Foundation (03 31 13 00-0011)		
	03 31 13 00-0025	CY	Crane And Bucket, Place 3,000 PSI Concrete Mat Foundation.....	136.15	
			<i>For 2,000 PSI Concrete, Deduct</i>	-5.95	
			<i>For 2,500 PSI Concrete, Deduct</i>	-2.98	
			<i>For 3,500 PSI Concrete, Add</i>	5.51	
			<i>For 3,750 PSI Concrete, Add</i>	7.50	
			<i>For 4,000 PSI Concrete, Add</i>	9.48	
			<i>For 4,500 PSI Concrete, Add</i>	11.02	
			<i>For 5,000 PSI Concrete, Add</i>	12.57	
			<i>For 6,000 PSI Concrete, Add</i>	29.76	
			<i>For White Cement Concrete, Add</i>	13.23	
			<i>For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add</i>	14.33	
			<i>For High Early Strength, Type 3 ASTM C150, Add</i>	11.02	
			<i>For Lightweight Aggregate, ASTM C330, Add</i>	33.07	
			<i>For Up To 20, Add</i>	10.36	
			<i>For >20 To 50, Add</i>	3.89	
			<i>For >100 To 200, Deduct</i>	-2.72	
			<i>For >200 To 400, Deduct</i>	-5.45	
			<i>For >400, Deduct</i>	-8.17	
	03 31 13 00-0026	CY	Direct Chute, Place 3,000 PSI Concrete Mat Foundation.....	122.46	
			<i>For 2,000 PSI Concrete, Deduct</i>	-5.95	
			<i>For 2,500 PSI Concrete, Deduct</i>	-2.98	
			<i>For 3,500 PSI Concrete, Add</i>	5.51	
			<i>For 3,750 PSI Concrete, Add</i>	7.50	
			<i>For 4,000 PSI Concrete, Add</i>	9.48	
			<i>For 4,500 PSI Concrete, Add</i>	11.02	
			<i>For 5,000 PSI Concrete, Add</i>	12.57	
			<i>For 6,000 PSI Concrete, Add</i>	29.76	
			<i>For White Cement Concrete, Add</i>	13.23	
			<i>For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add</i>	14.33	
			<i>For High Early Strength, Type 3 ASTM C150, Add</i>	11.02	
			<i>For Lightweight Aggregate, ASTM C330, Add</i>	33.07	
			<i>For Up To 20, Add</i>	4.89	
			<i>For >20 To 50, Add</i>	1.83	
			<i>For >100 To 200, Deduct</i>	-2.45	
			<i>For >200 To 400, Deduct</i>	-4.90	
			<i>For >400, Deduct</i>	-7.35	
	03 31 13 00-0027	CY	Concrete Pump, Place 3,000 PSI Concrete Mat Foundation..... Note: Excludes pumping equipment.	129.61	
			<i>For 2,000 PSI Concrete, Deduct</i>	-6.45	
			<i>For 2,500 PSI Concrete, Deduct</i>	-3.22	
			<i>For 3,500 PSI Concrete, Add</i>	5.97	
			<i>For 3,750 PSI Concrete, Add</i>	8.12	
			<i>For 4,000 PSI Concrete, Add</i>	10.27	
			<i>For 4,500 PSI Concrete, Add</i>	11.94	
			<i>For 5,000 PSI Concrete, Add</i>	13.62	
			<i>For 6,000 PSI Concrete, Add</i>	32.25	
			<i>For White Cement Concrete, Add</i>	14.33	
			<i>For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add</i>	15.53	
			<i>For High Early Strength, Type 3 ASTM C150, Add</i>	11.94	
			<i>For Lightweight Aggregate, ASTM C330, Add</i>	35.83	
			<i>For Up To 20, Add</i>	4.07	
			<i>For >20 To 50, Add</i>	1.53	
			<i>For >100 To 200, Deduct</i>	-2.59	
			<i>For >200 To 400, Deduct</i>	-5.18	
			<i>For >400, Deduct</i>	-7.78	
	03 31 13 00-0028		Place Concrete Grade Beams (03 31 13 00-0011)		



Concrete	03	03
Cast-In-Place Concrete	03 30	
Structural Concrete	03 31	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
03 31 13 00-0029 CY Crane And Bucket, Place 3,000 PSI Concrete Grade Beams.....	179.36	
For 2,000 PSI Concrete, Deduct	-5.95	
For 2,500 PSI Concrete, Deduct	-2.98	
For 3,500 PSI Concrete, Add	5.51	
For 3,750 PSI Concrete, Add	7.50	
For 4,000 PSI Concrete, Add	9.48	
For 4,500 PSI Concrete, Add	11.03	
For 5,000 PSI Concrete, Add	12.57	
For 6,000 PSI Concrete, Add	29.77	
For White Cement Concrete, Add	13.23	
For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	14.33	
For High Early Strength, Type 3 ASTM C150, Add	11.03	
For Lightweight Aggregate, ASTM C330, Add	33.08	
For Up To 20, Add	27.64	
For >20 To 50, Add	10.37	
For >100 To 200, Deduct	-3.59	
For >200 To 400, Deduct	-7.17	
For >400, Deduct	-10.76	
03 31 13 00-0030 CY Direct Chute, Place 3,000 PSI Concrete Grade Beams.....	142.81	
For 2,000 PSI Concrete, Deduct	-5.95	
For 2,500 PSI Concrete, Deduct	-2.98	
For 3,500 PSI Concrete, Add	5.51	
For 3,750 PSI Concrete, Add	7.50	
For 4,000 PSI Concrete, Add	9.48	
For 4,500 PSI Concrete, Add	11.02	
For 5,000 PSI Concrete, Add	12.57	
For 6,000 PSI Concrete, Add	29.76	
For White Cement Concrete, Add	13.23	
For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	14.33	
For High Early Strength, Type 3 ASTM C150, Add	11.02	
For Lightweight Aggregate, ASTM C330, Add	33.07	
For Up To 20, Add	13.03	
For >20 To 50, Add	4.89	
For >100 To 200, Deduct	-2.86	
For >200 To 400, Deduct	-5.71	
For >400, Deduct	-8.57	
03 31 13 00-0031 CY Concrete Pump, Place 3,000 PSI Concrete Grade Beams.....	150.45	
Note: Excludes pumping equipment.		
For 2,000 PSI Concrete, Deduct	-6.45	
For 2,500 PSI Concrete, Deduct	-3.22	
For 3,500 PSI Concrete, Add	5.97	
For 3,750 PSI Concrete, Add	8.12	
For 4,000 PSI Concrete, Add	10.27	
For 4,500 PSI Concrete, Add	11.94	
For 5,000 PSI Concrete, Add	13.62	
For 6,000 PSI Concrete, Add	32.25	
For White Cement Concrete, Add	14.33	
For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	15.53	
For High Early Strength, Type 3 ASTM C150, Add	11.94	
For Lightweight Aggregate, ASTM C330, Add	35.83	
For Up To 20, Add	12.41	
For >20 To 50, Add	4.65	
For >100 To 200, Deduct	-3.01	
For >200 To 400, Deduct	-6.02	
For >400, Deduct	-9.03	
03 31 13 00-0032 Place Concrete Slab On Grade (03 31 13 00-0011)		
03 31 13 00-0033 CY Up To 6", By Crane And Bucket, Place 3,000 PSI Concrete Slab On Grade.....	180.98	
For 2,000 PSI Concrete, Deduct	-5.95	
For 2,500 PSI Concrete, Deduct	-2.98	
For 3,500 PSI Concrete, Add	5.51	
For 3,750 PSI Concrete, Add	7.50	
For 4,000 PSI Concrete, Add	9.48	
For 4,500 PSI Concrete, Add	11.02	
For 5,000 PSI Concrete, Add	12.57	
For 6,000 PSI Concrete, Add	29.76	
For White Cement Concrete, Add	13.23	
For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	14.33	
For High Early Strength, Type 3 ASTM C150, Add	11.02	
For Lightweight Aggregate, ASTM C330, Add	33.07	
For Up To 20, Add	28.30	
For >20 To 50, Add	10.61	
For >100 To 200, Deduct	-3.62	
For >200 To 400, Deduct	-7.24	
For >400, Deduct	-10.86	

03	Concrete
03 30	Cast-In-Place Concrete
03 31	Structural Concrete



MINOR

CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

03 31 13 00-0034	CY >6", By Crane And Bucket, Place 3,000 PSI Concrete Slab On Grade	163.92
	For 2,000 PSI Concrete, Deduct	-5.95
	For 2,500 PSI Concrete, Deduct	-2.98
	For 3,500 PSI Concrete, Add	5.51
	For 3,750 PSI Concrete, Add	7.50
	For 4,000 PSI Concrete, Add	9.48
	For 4,500 PSI Concrete, Add	11.02
	For 5,000 PSI Concrete, Add	12.57
	For 6,000 PSI Concrete, Add	29.76
	For White Cement Concrete, Add	13.23
	For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	14.33
	For High Early Strength, Type 3 ASTM C150, Add	11.02
	For Lightweight Aggregate, ASTM C330, Add	33.07
	For Up To 20, Add	21.47
	For >20 To 50, Add	8.05
	For >100 To 200, Deduct	-3.28
	For >200 To 400, Deduct	-6.56
	For >400, Deduct	-9.84
03 31 13 00-0035	CY Up To 6", By Direct Chute, Place 3,000 PSI Concrete Slab On Grade	143.58
	For 2,000 PSI Concrete, Deduct	-5.95
	For 2,500 PSI Concrete, Deduct	-2.98
	For 3,500 PSI Concrete, Add	5.51
	For 3,750 PSI Concrete, Add	7.50
	For 4,000 PSI Concrete, Add	9.48
	For 4,500 PSI Concrete, Add	11.02
	For 5,000 PSI Concrete, Add	12.57
	For 6,000 PSI Concrete, Add	29.76
	For White Cement Concrete, Add	13.23
	For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	14.33
	For High Early Strength, Type 3 ASTM C150, Add	11.02
	For Lightweight Aggregate, ASTM C330, Add	33.07
	For Up To 20, Add	13.34
	For >20 To 50, Add	5.00
	For >100 To 200, Deduct	-2.87
	For >200 To 400, Deduct	-5.74
	For >400, Deduct	-8.61
03 31 13 00-0036	CY >6", By Direct Chute, Place 3,000 PSI Concrete Slab On Grade	135.53
	For 2,000 PSI Concrete, Deduct	-5.95
	For 2,500 PSI Concrete, Deduct	-2.98
	For 3,500 PSI Concrete, Add	5.51
	For 3,750 PSI Concrete, Add	7.50
	For 4,000 PSI Concrete, Add	9.48
	For 4,500 PSI Concrete, Add	11.02
	For 5,000 PSI Concrete, Add	12.57
	For 6,000 PSI Concrete, Add	29.76
	For White Cement Concrete, Add	13.23
	For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	14.33
	For High Early Strength, Type 3 ASTM C150, Add	11.02
	For Lightweight Aggregate, ASTM C330, Add	33.07
	For Up To 20, Add	10.12
	For >20 To 50, Add	3.79
	For >100 To 200, Deduct	-2.71
	For >200 To 400, Deduct	-5.42
	For >400, Deduct	-8.13
03 31 13 00-0037	CY Up To 6", By Concrete Pump, Place 3,000 PSI Concrete Slab On Grade	147.21
	Note: Excludes pumping equipment.	
	For 2,000 PSI Concrete, Deduct	-6.45
	For 2,500 PSI Concrete, Deduct	-3.22
	For 3,500 PSI Concrete, Add	5.97
	For 3,750 PSI Concrete, Add	8.12
	For 4,000 PSI Concrete, Add	10.27
	For 4,500 PSI Concrete, Add	11.94
	For 5,000 PSI Concrete, Add	13.62
	For 6,000 PSI Concrete, Add	32.25
	For White Cement Concrete, Add	14.33
	For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	15.53
	For High Early Strength, Type 3 ASTM C150, Add	11.94
	For Lightweight Aggregate, ASTM C330, Add	35.83
	For Up To 20, Add	11.11
	For >20 To 50, Add	4.17
	For >100 To 200, Deduct	-2.94
	For >200 To 400, Deduct	-5.89
	For >400, Deduct	-8.83



Concrete	03	03
Cast-In-Place Concrete	03 30	
Structural Concrete	03 31	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
03 31 13 00-0038 CY >6", By Concrete Pump, Place 3,000 PSI Concrete Slab On Grade 140.51 Note: Excludes pumping equipment.		
For 2,000 PSI Concrete, Deduct	-6.45	
For 2,500 PSI Concrete, Deduct	-3.22	
For 3,500 PSI Concrete, Add	5.97	
For 3,750 PSI Concrete, Add	8.12	
For 4,000 PSI Concrete, Add	10.27	
For 4,500 PSI Concrete, Add	11.94	
For 5,000 PSI Concrete, Add	13.62	
For 6,000 PSI Concrete, Add	32.25	
For White Cement Concrete, Add	14.33	
For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	15.53	
For High Early Strength, Type 3 ASTM C150, Add	11.94	
For Lightweight Aggregate, ASTM C330, Add	35.83	
For Up To 20, Add	8.43	
For >20 To 50, Add	3.16	
For >100 To 200, Deduct	-2.81	
For >200 To 400, Deduct	-5.62	
For >400, Deduct	-8.43	
03 31 13 00-0039 Place Concrete Duct Bank <small>(03 31 13 00-0011)</small>		
03 31 13 00-0040 CY Direct Chute, Place 3,000 PSI Concrete Duct Bank 137.83		
For 2,000 PSI Concrete, Deduct	-5.95	
For 2,500 PSI Concrete, Deduct	-2.98	
For 3,500 PSI Concrete, Add	5.51	
For 3,750 PSI Concrete, Add	7.50	
For 4,000 PSI Concrete, Add	9.48	
For 4,500 PSI Concrete, Add	11.02	
For 5,000 PSI Concrete, Add	12.57	
For 6,000 PSI Concrete, Add	29.76	
For White Cement Concrete, Add	13.23	
For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	14.33	
For High Early Strength, Type 3 ASTM C150, Add	11.02	
For Lightweight Aggregate, ASTM C330, Add	33.07	
For Up To 20, Add	11.04	
For >20 To 50, Add	4.14	
For >100 To 200, Deduct	-2.76	
For >200 To 400, Deduct	-5.51	
For >400, Deduct	-8.27	
03 31 13 00-0041 Place Concrete Stairs <small>(03 31 13 00-0011)</small>		
03 31 13 00-0042 CY Crane And Bucket, Place 3,000 PSI On Grade Concrete Stairs 428.53		
For 2,000 PSI Concrete, Deduct	-5.95	
For 2,500 PSI Concrete, Deduct	-2.98	
For 3,500 PSI Concrete, Add	5.51	
For 3,750 PSI Concrete, Add	7.50	
For 4,000 PSI Concrete, Add	9.48	
For 4,500 PSI Concrete, Add	11.03	
For 5,000 PSI Concrete, Add	12.57	
For 6,000 PSI Concrete, Add	29.77	
For White Cement Concrete, Add	13.23	
For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	14.33	
For High Early Strength, Type 3 ASTM C150, Add	11.03	
For Lightweight Aggregate, ASTM C330, Add	33.08	
For Up To 20, Add	127.31	
For >20 To 50, Add	47.74	
For >100 To 200, Deduct	-8.57	
For >200 To 400, Deduct	-17.14	
For >400, Deduct	-25.71	
03 31 13 00-0043 CY Direct Chute, Place 3,000 PSI On Grade Concrete Stairs 260.26		
For 2,000 PSI Concrete, Deduct	-5.95	
For 2,500 PSI Concrete, Deduct	-2.98	
For 3,500 PSI Concrete, Add	5.51	
For 3,750 PSI Concrete, Add	7.50	
For 4,000 PSI Concrete, Add	9.48	
For 4,500 PSI Concrete, Add	11.02	
For 5,000 PSI Concrete, Add	12.57	
For 6,000 PSI Concrete, Add	29.76	
For White Cement Concrete, Add	13.23	
For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	14.33	
For High Early Strength, Type 3 ASTM C150, Add	11.02	
For Lightweight Aggregate, ASTM C330, Add	33.07	
For Up To 20, Add	60.01	
For >20 To 50, Add	22.50	
For >100 To 200, Deduct	-5.21	
For >200 To 400, Deduct	-10.41	
For >400, Deduct	-15.62	

03	Concrete
03 30	Cast-In-Place Concrete
03 31	Structural Concrete



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
	03 31 13 00-0044	CY	Concrete Pump, Place 3,000 PSI On Grade Concrete Stairs Note: Excludes pumping equipment.	244.47	
			<i>For 2,000 PSI Concrete, Deduct</i>	-6.45	
			<i>For 2,500 PSI Concrete, Deduct</i>	-3.22	
			<i>For 3,500 PSI Concrete, Add</i>	5.97	
			<i>For 3,750 PSI Concrete, Add</i>	8.12	
			<i>For 4,000 PSI Concrete, Add</i>	10.27	
			<i>For 4,500 PSI Concrete, Add</i>	11.94	
			<i>For 5,000 PSI Concrete, Add</i>	13.62	
			<i>For 6,000 PSI Concrete, Add</i>	32.25	
			<i>For White Cement Concrete, Add</i>	14.33	
			<i>For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add</i>	15.53	
			<i>For High Early Strength, Type 3 ASTM C150, Add</i>	11.94	
			<i>For Lightweight Aggregate, ASTM C330, Add</i>	35.83	
			<i>For Up To 20, Add</i>	50.02	
			<i>For >20 To 50, Add</i>	18.76	
			<i>For >100 To 200, Deduct</i>	-4.89	
			<i>For >200 To 400, Deduct</i>	-9.78	
			<i>For >400, Deduct</i>	-14.67	
	03 31 13 00-0045		Place Concrete Thrust Blocks And Backfill (03 31 13 00-0011)		
	03 31 13 00-0046	CY	Direct Chute, Place 3,000 PSI Concrete Thrust Blocks <i>For 2,000 PSI Concrete, Deduct</i>	183.54	-5.95
			<i>For 2,500 PSI Concrete, Deduct</i>	-2.98	
			<i>For 3,500 PSI Concrete, Add</i>	5.51	
			<i>For 3,750 PSI Concrete, Add</i>	7.50	
			<i>For 4,000 PSI Concrete, Add</i>	9.48	
			<i>For 4,500 PSI Concrete, Add</i>	11.03	
			<i>For 5,000 PSI Concrete, Add</i>	12.57	
			<i>For 6,000 PSI Concrete, Add</i>	29.77	
			<i>For White Cement Concrete, Add</i>	13.23	
			<i>For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add</i>	14.33	
			<i>For High Early Strength, Type 3 ASTM C150, Add</i>	11.03	
			<i>For Lightweight Aggregate, ASTM C330, Add</i>	33.08	
			<i>For Up To 20, Add</i>	29.32	
			<i>For >20 To 50, Add</i>	10.99	
			<i>For >100 To 200, Deduct</i>	-3.67	
			<i>For >200 To 400, Deduct</i>	-7.34	
			<i>For >400, Deduct</i>	-11.01	
	03 31 13 00-0047		Place Concrete Slurry (03 31 13 00-0011) Note: 2 bag cement per CY.		
	03 31 13 00-0048	CY	Direct Chute, Place 1,200 PSI Concrete Slurry	169.76	
	03 31 13 00-0049	CY	Concrete Pump, Place 1,200 PSI Concrete Slurry..... Note: Excludes pumping equipment.	157.52	
	03 31 13 00-0050		Hand Mix And Place Concrete (03 31 13 00-0011)		
	03 31 13 00-0051	CF	Hand Mix And Place Concrete Note: For use where conventional equipment access is limited or when directed by the owner.	26.46	
			<i>For 2,000 PSI Concrete, Deduct</i>	-0.25	
			<i>For 2,500 PSI Concrete, Deduct</i>	-0.13	
			<i>For 3,500 PSI Concrete, Add</i>	0.24	
			<i>For 3,750 PSI Concrete, Add</i>	0.32	
			<i>For 4,000 PSI Concrete, Add</i>	0.41	
			<i>For 4,500 PSI Concrete, Add</i>	0.47	
			<i>For 5,000 PSI Concrete, Add</i>	0.54	
			<i>For 6,000 PSI Concrete, Add</i>	1.27	
			<i>For White Cement Concrete, Add</i>	0.57	
			<i>For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add</i>	0.61	
			<i>For High Early Strength, Type 3 ASTM C150, Add</i>	0.47	
			<i>For Lightweight Aggregate, ASTM C330, Add</i>	1.41	
	03 31 13 00-0052		Place Concrete Superstructure By Method Indicated (03 31 13 00-0010) See CSI section 03 31 13 00-0088 for concrete pump truck.		
	03 31 13 00-0053		Place Elevated Concrete Beams (03 31 13 00-0052)		



Concrete	03	03
Cast-In-Place Concrete	03 30	
Structural Concrete	03 31	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
03 31 13 00-0054 CY Crane And Bucket, Place 3,000 PSI Elevated Concrete Beams.....	283.03	
For 2,000 PSI Concrete, Deduct	-5.95	
For 2,500 PSI Concrete, Deduct	-2.98	
For 3,500 PSI Concrete, Add	5.51	
For 3,750 PSI Concrete, Add	7.50	
For 4,000 PSI Concrete, Add	9.48	
For 4,500 PSI Concrete, Add	11.02	
For 5,000 PSI Concrete, Add	12.57	
For 6,000 PSI Concrete, Add	29.76	
For White Cement Concrete, Add	13.23	
For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	14.33	
For High Early Strength, Type 3 ASTM C150, Add	11.02	
For Lightweight Aggregate, ASTM C330, Add	33.07	
For Up To 20, Add	69.12	
For >20 To 50, Add	25.92	
For >100 To 200, Deduct	-5.66	
For >200 To 400, Deduct	-11.32	
For >400, Deduct	-16.98	
03 31 13 00-0055 CY Concrete Pump, Place 3,000 PSI Elevated Concrete Beams.....	196.98	
Note: Excludes pumping equipment.		
For 2,000 PSI Concrete, Deduct	-6.45	
For 2,500 PSI Concrete, Deduct	-3.22	
For 3,500 PSI Concrete, Add	5.97	
For 3,750 PSI Concrete, Add	8.12	
For 4,000 PSI Concrete, Add	10.27	
For 4,500 PSI Concrete, Add	11.94	
For 5,000 PSI Concrete, Add	13.62	
For 6,000 PSI Concrete, Add	32.25	
For White Cement Concrete, Add	14.33	
For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	15.53	
For High Early Strength, Type 3 ASTM C150, Add	11.94	
For Lightweight Aggregate, ASTM C330, Add	35.83	
For Up To 20, Add	31.02	
For >20 To 50, Add	11.63	
For >100 To 200, Deduct	-3.94	
For >200 To 400, Deduct	-7.88	
For >400, Deduct	-11.82	
03 31 13 00-0056 Place Elevated Concrete Slab (03 31 13 00-0052)		
03 31 13 00-0057 CY Up To 6", By Crane And Bucket, Place 3,000 PSI Elevated Concrete Slab	191.59	
For 2,000 PSI Concrete, Deduct	-5.95	
For 2,500 PSI Concrete, Deduct	-2.98	
For 3,500 PSI Concrete, Add	5.51	
For 3,750 PSI Concrete, Add	7.50	
For 4,000 PSI Concrete, Add	9.48	
For 4,500 PSI Concrete, Add	11.02	
For 5,000 PSI Concrete, Add	12.57	
For 6,000 PSI Concrete, Add	29.76	
For White Cement Concrete, Add	13.23	
For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	14.33	
For High Early Strength, Type 3 ASTM C150, Add	11.02	
For Lightweight Aggregate, ASTM C330, Add	33.07	
For Up To 20, Add	32.54	
For >20 To 50, Add	12.20	
For >100 To 200, Deduct	-3.83	
For >200 To 400, Deduct	-7.66	
For >400, Deduct	-11.50	
03 31 13 00-0058 CY >6", By Crane And Bucket, Place 3,000 PSI Elevated Concrete Slab	171.96	
For 2,000 PSI Concrete, Deduct	-5.95	
For 2,500 PSI Concrete, Deduct	-2.98	
For 3,500 PSI Concrete, Add	5.51	
For 3,750 PSI Concrete, Add	7.50	
For 4,000 PSI Concrete, Add	9.48	
For 4,500 PSI Concrete, Add	11.02	
For 5,000 PSI Concrete, Add	12.57	
For 6,000 PSI Concrete, Add	29.76	
For White Cement Concrete, Add	13.23	
For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	14.33	
For High Early Strength, Type 3 ASTM C150, Add	11.02	
For Lightweight Aggregate, ASTM C330, Add	33.07	
For Up To 20, Add	24.69	
For >20 To 50, Add	9.26	
For >100 To 200, Deduct	-3.44	
For >200 To 400, Deduct	-6.88	
For >400, Deduct	-10.32	

03	Concrete
03 30	Cast-In-Place Concrete
03 31	Structural Concrete



MINOR

CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

03 31 13 00-0059	CY	Up To 6", By Concrete Pump, Place 3,000 PSI Elevated Concrete Slab.....	155.94	
		Note: Excludes pumping equipment.		
		For 2,000 PSI Concrete, Deduct	-6.45	
		For 2,500 PSI Concrete, Deduct	-3.22	
		For 3,500 PSI Concrete, Add	5.97	
		For 3,750 PSI Concrete, Add	8.12	
		For 4,000 PSI Concrete, Add	10.27	
		For 4,500 PSI Concrete, Add	11.94	
		For 5,000 PSI Concrete, Add	13.62	
		For 6,000 PSI Concrete, Add	32.25	
		For White Cement Concrete, Add	14.33	
		For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	15.53	
		For High Early Strength, Type 3 ASTM C150, Add	11.94	
		For Lightweight Aggregate, ASTM C330, Add	35.83	
		For Up To 20, Add	14.60	
		For >20 To 50, Add	5.48	
		For >100 To 200, Deduct	-3.12	
		For >200 To 400, Deduct	-6.24	
		For >400, Deduct	-9.36	
03 31 13 00-0060	CY	>6", By Concrete Pump, Place 3,000 PSI Elevated Concrete Slab	147.13	
		Note: Excludes pumping equipment.		
		For 2,000 PSI Concrete, Deduct	-6.45	
		For 2,500 PSI Concrete, Deduct	-3.22	
		For 3,500 PSI Concrete, Add	5.97	
		For 3,750 PSI Concrete, Add	8.12	
		For 4,000 PSI Concrete, Add	10.27	
		For 4,500 PSI Concrete, Add	11.94	
		For 5,000 PSI Concrete, Add	13.62	
		For 6,000 PSI Concrete, Add	32.25	
		For White Cement Concrete, Add	14.33	
		For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	15.53	
		For High Early Strength, Type 3 ASTM C150, Add	11.94	
		For Lightweight Aggregate, ASTM C330, Add	35.83	
		For Up To 20, Add	11.08	
		For >20 To 50, Add	4.16	
		For >100 To 200, Deduct	-2.94	
		For >200 To 400, Deduct	-5.89	
		For >400, Deduct	-8.83	
03 31 13 00-0061		Place Concrete Columns (03 31 13 00-0062)		
03 31 13 00-0062	CY	12" Square Or Round, By Crane And Bucket, Place 3,000 PSI Concrete Columns	296.86	
		For 2,000 PSI Concrete, Deduct	-5.95	
		For 2,500 PSI Concrete, Deduct	-2.98	
		For 3,500 PSI Concrete, Add	5.51	
		For 3,750 PSI Concrete, Add	7.50	
		For 4,000 PSI Concrete, Add	9.48	
		For 4,500 PSI Concrete, Add	11.03	
		For 5,000 PSI Concrete, Add	12.57	
		For 6,000 PSI Concrete, Add	29.77	
		For White Cement Concrete, Add	13.23	
		For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	14.33	
		For High Early Strength, Type 3 ASTM C150, Add	11.03	
		For Lightweight Aggregate, ASTM C330, Add	33.08	
		For Up To 20, Add	74.64	
		For >20 To 50, Add	27.99	
		For >100 To 200, Deduct	-5.94	
		For >200 To 400, Deduct	-11.87	
		For >400, Deduct	-17.81	
03 31 13 00-0063	CY	18" Square Or Round, By Crane And Bucket, Place 3,000 PSI Concrete Columns	245.88	
		For 2,000 PSI Concrete, Deduct	-5.95	
		For 2,500 PSI Concrete, Deduct	-2.98	
		For 3,500 PSI Concrete, Add	5.51	
		For 3,750 PSI Concrete, Add	7.50	
		For 4,000 PSI Concrete, Add	9.48	
		For 4,500 PSI Concrete, Add	11.02	
		For 5,000 PSI Concrete, Add	12.57	
		For 6,000 PSI Concrete, Add	29.76	
		For White Cement Concrete, Add	13.23	
		For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	14.33	
		For High Early Strength, Type 3 ASTM C150, Add	11.02	
		For Lightweight Aggregate, ASTM C330, Add	33.07	
		For Up To 20, Add	54.26	
		For >20 To 50, Add	20.35	
		For >100 To 200, Deduct	-4.92	
		For >200 To 400, Deduct	-9.84	
		For >400, Deduct	-14.75	



Concrete	03	03
Cast-In-Place Concrete	03 30	
Structural Concrete	03 31	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
03 31 13 00-0064 CY 24" Square Or Round, By Crane And Bucket, Place 3,000 PSI Concrete Columns	209.42	
For 2,000 PSI Concrete, Deduct	-5.95	
For 2,500 PSI Concrete, Deduct	-2.98	
For 3,500 PSI Concrete, Add	5.51	
For 3,750 PSI Concrete, Add	7.50	
For 4,000 PSI Concrete, Add	9.48	
For 4,500 PSI Concrete, Add	11.02	
For 5,000 PSI Concrete, Add	12.57	
For 6,000 PSI Concrete, Add	29.76	
For White Cement Concrete, Add	13.23	
For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	14.33	
For High Early Strength, Type 3 ASTM C150, Add	11.02	
For Lightweight Aggregate, ASTM C330, Add	33.07	
For Up To 20, Add	39.67	
For >20 To 50, Add	14.88	
For >100 To 200, Deduct	-4.19	
For >200 To 400, Deduct	-8.38	
For >400, Deduct	-12.57	
03 31 13 00-0065 CY 36" Square Or Round, By Crane And Bucket, Place 3,000 PSI Concrete Columns	193.19	
For 2,000 PSI Concrete, Deduct	-5.95	
For 2,500 PSI Concrete, Deduct	-2.98	
For 3,500 PSI Concrete, Add	5.51	
For 3,750 PSI Concrete, Add	7.50	
For 4,000 PSI Concrete, Add	9.48	
For 4,500 PSI Concrete, Add	11.03	
For 5,000 PSI Concrete, Add	12.57	
For 6,000 PSI Concrete, Add	29.77	
For White Cement Concrete, Add	13.23	
For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	14.33	
For High Early Strength, Type 3 ASTM C150, Add	11.03	
For Lightweight Aggregate, ASTM C330, Add	33.08	
For Up To 20, Add	33.18	
For >20 To 50, Add	12.44	
For >100 To 200, Deduct	-3.86	
For >200 To 400, Deduct	-7.73	
For >400, Deduct	-11.59	
03 31 13 00-0066 CY 12" Square Or Round, By Concrete Pump, Place 3,000 PSI Concrete Columns	203.20	
Note: Excludes pumping equipment.		
For 2,000 PSI Concrete, Deduct	-6.45	
For 2,500 PSI Concrete, Deduct	-3.22	
For 3,500 PSI Concrete, Add	5.97	
For 3,750 PSI Concrete, Add	8.12	
For 4,000 PSI Concrete, Add	10.27	
For 4,500 PSI Concrete, Add	11.94	
For 5,000 PSI Concrete, Add	13.62	
For 6,000 PSI Concrete, Add	32.25	
For White Cement Concrete, Add	14.33	
For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	15.53	
For High Early Strength, Type 3 ASTM C150, Add	11.94	
For Lightweight Aggregate, ASTM C330, Add	35.83	
For Up To 20, Add	33.51	
For >20 To 50, Add	12.57	
For >100 To 200, Deduct	-4.06	
For >200 To 400, Deduct	-8.13	
For >400, Deduct	-12.19	
03 31 13 00-0067 CY 18" Square Or Round, By Concrete Pump, Place 3,000 PSI Concrete Columns	180.32	
Note: Excludes pumping equipment.		
For 2,000 PSI Concrete, Deduct	-6.45	
For 2,500 PSI Concrete, Deduct	-3.22	
For 3,500 PSI Concrete, Add	5.97	
For 3,750 PSI Concrete, Add	8.12	
For 4,000 PSI Concrete, Add	10.27	
For 4,500 PSI Concrete, Add	11.94	
For 5,000 PSI Concrete, Add	13.62	
For 6,000 PSI Concrete, Add	32.25	
For White Cement Concrete, Add	14.33	
For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	15.53	
For High Early Strength, Type 3 ASTM C150, Add	11.94	
For Lightweight Aggregate, ASTM C330, Add	35.83	
For Up To 20, Add	24.36	
For >20 To 50, Add	9.13	
For >100 To 200, Deduct	-3.61	
For >200 To 400, Deduct	-7.21	
For >400, Deduct	-10.82	

03	Concrete
03 30	Cast-In-Place Concrete
03 31	Structural Concrete



MINOR

CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

03 31 13 00-0068	CY	24" Square Or Round, By Concrete Pump, Place 3,000 PSI Concrete Columns	163.94	
		Note: Excludes pumping equipment.		
		For 2,000 PSI Concrete, Deduct	-6.45	
		For 2,500 PSI Concrete, Deduct	-3.22	
		For 3,500 PSI Concrete, Add	5.97	
		For 3,750 PSI Concrete, Add	8.12	
		For 4,000 PSI Concrete, Add	10.27	
		For 4,500 PSI Concrete, Add	11.94	
		For 5,000 PSI Concrete, Add	13.62	
		For 6,000 PSI Concrete, Add	32.25	
		For White Cement Concrete, Add	14.33	
		For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	15.53	
		For High Early Strength, Type 3 ASTM C150, Add	11.94	
		For Lightweight Aggregate, ASTM C330, Add	35.83	
		For Up To 20, Add	17.80	
		For >20 To 50, Add	6.68	
		For >100 To 200, Deduct	-3.28	
		For >200 To 400, Deduct	-6.56	
		For >400, Deduct	-9.84	
03 31 13 00-0069	CY	36" Square Or Round, By Concrete Pump, Place 3,000 PSI Concrete Columns	156.66	
		Note: Excludes pumping equipment.		
		For 2,000 PSI Concrete, Deduct	-6.45	
		For 2,500 PSI Concrete, Deduct	-3.22	
		For 3,500 PSI Concrete, Add	5.97	
		For 3,750 PSI Concrete, Add	8.12	
		For 4,000 PSI Concrete, Add	10.27	
		For 4,500 PSI Concrete, Add	11.94	
		For 5,000 PSI Concrete, Add	13.62	
		For 6,000 PSI Concrete, Add	32.25	
		For White Cement Concrete, Add	14.33	
		For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	15.53	
		For High Early Strength, Type 3 ASTM C150, Add	11.94	
		For Lightweight Aggregate, ASTM C330, Add	35.83	
		For Up To 20, Add	14.89	
		For >20 To 50, Add	5.58	
		For >100 To 200, Deduct	-3.13	
		For >200 To 400, Deduct	-6.27	
		For >400, Deduct	-9.40	
03 31 13 00-0070		Place Concrete Walls <small>(03 31 13 00-0052)</small>		
03 31 13 00-0071	CY	8" Thick, By Crane And Bucket, Place 3,000 PSI Concrete Walls	285.19	
		For 2,000 PSI Concrete, Deduct	-5.95	
		For 2,500 PSI Concrete, Deduct	-2.98	
		For 3,500 PSI Concrete, Add	5.51	
		For 3,750 PSI Concrete, Add	7.50	
		For 4,000 PSI Concrete, Add	9.48	
		For 4,500 PSI Concrete, Add	11.02	
		For 5,000 PSI Concrete, Add	12.57	
		For 6,000 PSI Concrete, Add	29.76	
		For White Cement Concrete, Add	13.23	
		For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	14.33	
		For High Early Strength, Type 3 ASTM C150, Add	11.02	
		For Lightweight Aggregate, ASTM C330, Add	33.07	
		For Up To 20, Add	69.98	
		For >20 To 50, Add	26.24	
		For >100 To 200, Deduct	-5.70	
		For >200 To 400, Deduct	-11.41	
		For >400, Deduct	-17.11	
03 31 13 00-0072	CY	12" Thick, By Crane And Bucket, Place 3,000 PSI Concrete Walls	270.68	
		For 2,000 PSI Concrete, Deduct	-5.95	
		For 2,500 PSI Concrete, Deduct	-2.98	
		For 3,500 PSI Concrete, Add	5.51	
		For 3,750 PSI Concrete, Add	7.50	
		For 4,000 PSI Concrete, Add	9.48	
		For 4,500 PSI Concrete, Add	11.02	
		For 5,000 PSI Concrete, Add	12.57	
		For 6,000 PSI Concrete, Add	29.76	
		For White Cement Concrete, Add	13.23	
		For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	14.33	
		For High Early Strength, Type 3 ASTM C150, Add	11.02	
		For Lightweight Aggregate, ASTM C330, Add	33.07	
		For Up To 20, Add	64.18	
		For >20 To 50, Add	24.07	
		For >100 To 200, Deduct	-5.41	
		For >200 To 400, Deduct	-10.83	
		For >400, Deduct	-16.24	



Concrete	03	03
Cast-In-Place Concrete	03 30	
Structural Concrete	03 31	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
03 31 13 00-0073 CY 15" Thick, By Crane And Bucket, Place 3,000 PSI Concrete Walls.....	232.71	
For 2,000 PSI Concrete, Deduct	-5.95	
For 2,500 PSI Concrete, Deduct	-2.98	
For 3,500 PSI Concrete, Add	5.51	
For 3,750 PSI Concrete, Add	7.50	
For 4,000 PSI Concrete, Add	9.48	
For 4,500 PSI Concrete, Add	11.02	
For 5,000 PSI Concrete, Add	12.57	
For 6,000 PSI Concrete, Add	29.76	
For White Cement Concrete, Add	13.23	
For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	14.33	
For High Early Strength, Type 3 ASTM C150, Add	11.02	
For Lightweight Aggregate, ASTM C330, Add	33.07	
For Up To 20, Add	48.99	
For >20 To 50, Add	18.37	
For >100 To 200, Deduct	-4.65	
For >200 To 400, Deduct	-9.31	
For >400, Deduct	-13.96	
03 31 13 00-0074 CY 8" Thick, By Direct Chute, Place 3,000 PSI Concrete Walls.....	192.69	
For 2,000 PSI Concrete, Deduct	-5.95	
For 2,500 PSI Concrete, Deduct	-2.98	
For 3,500 PSI Concrete, Add	5.51	
For 3,750 PSI Concrete, Add	7.50	
For 4,000 PSI Concrete, Add	9.48	
For 4,500 PSI Concrete, Add	11.02	
For 5,000 PSI Concrete, Add	12.57	
For 6,000 PSI Concrete, Add	29.76	
For White Cement Concrete, Add	13.23	
For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	14.33	
For High Early Strength, Type 3 ASTM C150, Add	11.02	
For Lightweight Aggregate, ASTM C330, Add	33.07	
For Up To 20, Add	32.98	
For >20 To 50, Add	12.37	
For >100 To 200, Deduct	-3.85	
For >200 To 400, Deduct	-7.71	
For >400, Deduct	-11.56	
03 31 13 00-0075 CY 12" Thick, By Direct Chute, Place 3,000 PSI Concrete Walls.....	176.20	
For 2,000 PSI Concrete, Deduct	-5.95	
For 2,500 PSI Concrete, Deduct	-2.98	
For 3,500 PSI Concrete, Add	5.51	
For 3,750 PSI Concrete, Add	7.50	
For 4,000 PSI Concrete, Add	9.48	
For 4,500 PSI Concrete, Add	11.02	
For 5,000 PSI Concrete, Add	12.57	
For 6,000 PSI Concrete, Add	29.76	
For White Cement Concrete, Add	13.23	
For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	14.33	
For High Early Strength, Type 3 ASTM C150, Add	11.02	
For Lightweight Aggregate, ASTM C330, Add	33.07	
For Up To 20, Add	26.38	
For >20 To 50, Add	9.89	
For >100 To 200, Deduct	-3.52	
For >200 To 400, Deduct	-7.05	
For >400, Deduct	-10.57	
03 31 13 00-0076 CY 15" Thick, By Direct Chute, Place 3,000 PSI Concrete Walls.....	167.96	
For 2,000 PSI Concrete, Deduct	-5.95	
For 2,500 PSI Concrete, Deduct	-2.98	
For 3,500 PSI Concrete, Add	5.51	
For 3,750 PSI Concrete, Add	7.50	
For 4,000 PSI Concrete, Add	9.48	
For 4,500 PSI Concrete, Add	11.02	
For 5,000 PSI Concrete, Add	12.57	
For 6,000 PSI Concrete, Add	29.76	
For White Cement Concrete, Add	13.23	
For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	14.33	
For High Early Strength, Type 3 ASTM C150, Add	11.02	
For Lightweight Aggregate, ASTM C330, Add	33.07	
For Up To 20, Add	23.09	
For >20 To 50, Add	8.66	
For >100 To 200, Deduct	-3.36	
For >200 To 400, Deduct	-6.72	
For >400, Deduct	-10.08	

03	Concrete
03 30	Cast-In-Place Concrete
03 31	Structural Concrete



MINOR

CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

03 31 13 00-0077	CY	8" Thick, By Concrete Pump, Place 3,000 PSI Concrete Walls	197.95
		Note: Excludes pumping equipment.	
		For 2,000 PSI Concrete, Deduct	-6.45
		For 2,500 PSI Concrete, Deduct	-3.22
		For 3,500 PSI Concrete, Add	5.97
		For 3,750 PSI Concrete, Add	8.12
		For 4,000 PSI Concrete, Add	10.27
		For 4,500 PSI Concrete, Add	11.94
		For 5,000 PSI Concrete, Add	13.62
		For 6,000 PSI Concrete, Add	32.25
		For White Cement Concrete, Add	14.33
		For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	15.53
		For High Early Strength, Type 3 ASTM C150, Add	11.94
		For Lightweight Aggregate, ASTM C330, Add	35.83
		For Up To 20, Add	31.41
		For >20 To 50, Add	11.78
		For >100 To 200, Deduct	-3.96
		For >200 To 400, Deduct	-7.92
		For >400, Deduct	-11.88
03 31 13 00-0078	CY	12" Thick, By Concrete Pump, Place 3,000 PSI Concrete Walls	182.24
		Note: Excludes pumping equipment.	
		For 2,000 PSI Concrete, Deduct	-6.45
		For 2,500 PSI Concrete, Deduct	-3.22
		For 3,500 PSI Concrete, Add	5.97
		For 3,750 PSI Concrete, Add	8.12
		For 4,000 PSI Concrete, Add	10.27
		For 4,500 PSI Concrete, Add	11.94
		For 5,000 PSI Concrete, Add	13.62
		For 6,000 PSI Concrete, Add	32.25
		For White Cement Concrete, Add	14.33
		For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	15.53
		For High Early Strength, Type 3 ASTM C150, Add	11.94
		For Lightweight Aggregate, ASTM C330, Add	35.83
		For Up To 20, Add	25.12
		For >20 To 50, Add	9.42
		For >100 To 200, Deduct	-3.64
		For >200 To 400, Deduct	-7.29
		For >400, Deduct	-10.93
03 31 13 00-0079	CY	15" Thick, By Concrete Pump, Place 3,000 PSI Concrete Walls	174.40
		Note: Excludes pumping equipment.	
		For 2,000 PSI Concrete, Deduct	-6.45
		For 2,500 PSI Concrete, Deduct	-3.22
		For 3,500 PSI Concrete, Add	5.97
		For 3,750 PSI Concrete, Add	8.12
		For 4,000 PSI Concrete, Add	10.27
		For 4,500 PSI Concrete, Add	11.94
		For 5,000 PSI Concrete, Add	13.62
		For 6,000 PSI Concrete, Add	32.25
		For White Cement Concrete, Add	14.33
		For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	15.53
		For High Early Strength, Type 3 ASTM C150, Add	11.94
		For Lightweight Aggregate, ASTM C330, Add	35.83
		For Up To 20, Add	21.99
		For >20 To 50, Add	8.25
		For >100 To 200, Deduct	-3.49
		For >200 To 400, Deduct	-6.98
		For >400, Deduct	-10.46
03 31 13 00-0080		Place Elevated Concrete Stairs (03 31 13 00-0052)	
03 31 13 00-0081	CY	Crane And Bucket, Place 3,000 PSI Elevated Concrete Stairs.....	463.93
		For 2,000 PSI Concrete, Deduct	-5.95
		For 2,500 PSI Concrete, Deduct	-2.98
		For 3,500 PSI Concrete, Add	5.51
		For 3,750 PSI Concrete, Add	7.50
		For 4,000 PSI Concrete, Add	9.48
		For 4,500 PSI Concrete, Add	11.02
		For 5,000 PSI Concrete, Add	12.57
		For 6,000 PSI Concrete, Add	29.76
		For White Cement Concrete, Add	13.23
		For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	14.33
		For High Early Strength, Type 3 ASTM C150, Add	11.02
		For Lightweight Aggregate, ASTM C330, Add	33.07
		For Up To 20, Add	141.48
		For >20 To 50, Add	53.05
		For >100 To 200, Deduct	-9.28
		For >200 To 400, Deduct	-18.56
		For >400, Deduct	-27.84



Concrete	03	03
Cast-In-Place Concrete	03 30	
Structural Concrete	03 31	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
03 31 13 00-0082 CY Direct Chute, Place 3,000 PSI Elevated Concrete Stairs.....	276.93	
For 2,000 PSI Concrete, Deduct	-5.95	
For 2,500 PSI Concrete, Deduct	-2.98	
For 3,500 PSI Concrete, Add	5.51	
For 3,750 PSI Concrete, Add	7.50	
For 4,000 PSI Concrete, Add	9.48	
For 4,500 PSI Concrete, Add	11.03	
For 5,000 PSI Concrete, Add	12.57	
For 6,000 PSI Concrete, Add	29.77	
For White Cement Concrete, Add	13.23	
For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	14.33	
For High Early Strength, Type 3 ASTM C150, Add	11.03	
For Lightweight Aggregate, ASTM C330, Add	33.08	
For Up To 20, Add	66.67	
For >20 To 50, Add	25.00	
For >100 To 200, Deduct	-5.54	
For >200 To 400, Deduct	-11.08	
For >400, Deduct	-16.62	
03 31 13 00-0083 CY Concrete Pump, Place 3,000 PSI Elevated Concrete Stairs.....	258.34	
Note: Excludes pumping equipment.		
For 2,000 PSI Concrete, Deduct	-6.45	
For 2,500 PSI Concrete, Deduct	-3.22	
For 3,500 PSI Concrete, Add	5.97	
For 3,750 PSI Concrete, Add	8.12	
For 4,000 PSI Concrete, Add	10.27	
For 4,500 PSI Concrete, Add	11.94	
For 5,000 PSI Concrete, Add	13.62	
For 6,000 PSI Concrete, Add	32.25	
For White Cement Concrete, Add	14.33	
For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	15.53	
For High Early Strength, Type 3 ASTM C150, Add	11.94	
For Lightweight Aggregate, ASTM C330, Add	35.83	
For Up To 20, Add	55.56	
For >20 To 50, Add	20.84	
For >100 To 200, Deduct	-5.17	
For >200 To 400, Deduct	-10.33	
For >400, Deduct	-15.50	
03 31 13 00-0084 Place Concrete Coping (03 31 13 00-0082)		
03 31 13 00-0085 CY Crane And Bucket, Place 3,000 PSI Concrete Coping	476.16	
For 2,000 PSI Concrete, Deduct	-5.95	
For 2,500 PSI Concrete, Deduct	-2.98	
For 3,500 PSI Concrete, Add	5.51	
For 3,750 PSI Concrete, Add	7.50	
For 4,000 PSI Concrete, Add	9.48	
For 4,500 PSI Concrete, Add	11.03	
For 5,000 PSI Concrete, Add	12.57	
For 6,000 PSI Concrete, Add	29.77	
For White Cement Concrete, Add	13.23	
For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	14.33	
For High Early Strength, Type 3 ASTM C150, Add	11.03	
For Lightweight Aggregate, ASTM C330, Add	33.08	
For Up To 20, Add	146.36	
For >20 To 50, Add	54.89	
For >100 To 200, Deduct	-9.52	
For >200 To 400, Deduct	-19.05	
For >400, Deduct	-28.57	
03 31 13 00-0086 CY Direct Chute, Place 3,000 PSI Concrete Coping	275.82	
For 2,000 PSI Concrete, Deduct	-5.95	
For 2,500 PSI Concrete, Deduct	-2.98	
For 3,500 PSI Concrete, Add	5.51	
For 3,750 PSI Concrete, Add	7.50	
For 4,000 PSI Concrete, Add	9.48	
For 4,500 PSI Concrete, Add	11.03	
For 5,000 PSI Concrete, Add	12.57	
For 6,000 PSI Concrete, Add	29.77	
For White Cement Concrete, Add	13.23	
For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	14.33	
For High Early Strength, Type 3 ASTM C150, Add	11.03	
For Lightweight Aggregate, ASTM C330, Add	33.08	
For Up To 20, Add	66.23	
For >20 To 50, Add	24.84	
For >100 To 200, Deduct	-5.52	
For >200 To 400, Deduct	-11.03	
For >400, Deduct	-16.55	

03	Concrete
03 30	Cast-In-Place Concrete
03 31	Structural Concrete



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
03 31 13 00-0087	CY		Concrete Pump, Place 3,000 PSI Concrete Coping.....	370.21	
			Note: Excludes pumping equipment.		
			For 2,000 PSI Concrete, Deduct	-6.45	
			For 2,500 PSI Concrete, Deduct	-3.22	
			For 3,500 PSI Concrete, Add	5.97	
			For 3,750 PSI Concrete, Add	8.12	
			For 4,000 PSI Concrete, Add	10.27	
			For 4,500 PSI Concrete, Add	11.94	
			For 5,000 PSI Concrete, Add	13.62	
			For 6,000 PSI Concrete, Add	32.25	
			For White Cement Concrete, Add	14.33	
			For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	15.53	
			For High Early Strength, Type 3 ASTM C150, Add	11.94	
			For Lightweight Aggregate, ASTM C330, Add	35.83	
			For Up To 20, Add	100.31	
			For >20 To 50, Add	37.62	
			For >100 To 200, Deduct	-7.40	
			For >200 To 400, Deduct	-14.81	
			For >400, Deduct	-22.21	
03 31 13 00-0088			Concrete Pumping With Boom Truck <small>(03 31 13 00-0010)</small>		
			Note: Includes truck rental, operator, and local travel delivery. For delivery/set-up of equipment add one hour, for clean-up of equipment add one hour. Use four hours as the minimum cost including set-up and clean-up. Excludes concrete, use "Concrete Pump" concrete tasks from appropriate section to place into pump hopper and place concrete. Sizes are measured at a 30 degree vertical reach.		
03 31 13 00-0089	HR		55' To 60' Boom Truck For Concrete Placement (95 CY Per Hour Rating)	153.48	
03 31 13 00-0090	HR		70' To 80' Boom Truck For Concrete Placement (117 CY Per Hour Rating)	167.66	
03 31 13 00-0091	HR		90' To 100' Boom Truck For Concrete Placement (117 CY Per Hour Rating)	202.43	
03 31 13 00-0092	HR		105' To 115' Boom Truck For Concrete Placement (117 CY Per Hour Rating)	236.05	
03 31 13 00-0093	HR		120' To 130' Boom Truck For Concrete Placement (170 CY Per Hour Rating)	285.57	
03 31 13 00-0094	HR		135' To 140' Boom Truck For Concrete Placement (170 CY Per Hour Rating)	257.84	
03 31 13 00-0095	HR		148' To 155' Boom Truck For Concrete Placement (170 CY Per Hour Rating)	373.50	
03 31 13 00-0096	HR		170' To 175' Boom Truck For Concrete Placement (182 CY Per Hour Rating)	456.02	
03 31 13 00-0097	HR		35 CY/HR, 66 HP Trailer Mounted Concrete Pump	124.25	
			Note: Includes hoses		
03 31 13 00-0098			Concrete Carts <small>(03 31 13 00-0010)</small>		
			Note: Used to place concrete were necessary.		
03 31 13 00-0099	CY		50' Haul, Non Motorized, Concrete Buggy	20.46	
03 31 13 00-0100	CY		150' Haul, Non Motorized, Concrete Buggy	27.39	
03 31 13 00-0101	CY		250' Haul, Non Motorized, Concrete Buggy	36.53	
03 31 13 00-0102	CY		50' Haul, Motorized, Concrete Buggy	9.73	
03 31 13 00-0103	CY		150' Haul, Motorized, Concrete Buggy.....	13.04	
03 31 13 00-0104	CY		250' Haul, Motorized, Concrete Buggy.....	17.39	
03 31 13 00-0105			Delivery Fee For Small Purchases <small>(03 31 13)</small>		
03 31 13 00-0106	CY		Delivery Fee For Concrete Purchases Per CY For Each CY Less Than 9 CY	16.56	
			Note: The task quantity is 9 minus the number of CY's delivered. For example, the delivery fee for 2CY's is: (9-2) = 7.		
03 31 13 00-0107			Equipment Pads <small>(03 31 13)</small>		
03 31 13 00-0108			Small Concrete Equipment Housekeeping Pad Assemblies <small>(03 31 13 00-0107)</small>		
			Note: Includes forms, hand mix concrete, finish, curing and reinforcing. For up to 50 SF per pad and up to 5 pads per project.		
03 31 13 00-0109	SF		4" Equipment Pad With Welded Wire Reinforcement	13.48	
03 31 13 00-0110	SF		4" Equipment Pad With Rebar	16.60	
03 31 13 00-0111	SF		6" Equipment Pad With Rebar	20.92	
03 31 13 00-0112	SF		8" Equipment Pad With Rebar	26.33	
03 35			Concrete Finishing <small>(03 30)</small>		
03 35 16			Heavy-Duty Concrete Floor Finishing <small>(03 35)</small>		
03 35 16 00-0001			Floor Finishes <small>(03 35 16)</small>		
			Note: Task is for final finish type and includes all required prior finishes.		
03 35 16 00-0002	SF		Concrete Floor Finishes, Screed.....	0.74	
			For Up To 50 SF, Add	2.96	
			For >50 To 250, Add	0.74	
			For >2,500 To 7,500, Deduct	-0.07	
			For >7,500 To 10,000 SF, Deduct	-0.15	
			For >10,000 SF, Deduct	-0.19	
03 35 16 00-0003	SF		Concrete Floor Finishes, Darby	0.89	
			For Up To 50 SF, Add	3.56	
			For >50 To 250, Add	0.89	
			For >2,500 To 7,500, Deduct	-0.09	
			For >7,500 To 10,000 SF, Deduct	-0.18	
			For >10,000 SF, Deduct	-0.22	



Concrete	03	03
Cast-In-Place Concrete	03 30	
Concrete Finishing	03 35	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
03 35 16 00-0004 SF Concrete Floor Finishes, Broom	0.98	
For Up To 50 SF, Add	3.92	
For >50 To 250, Add	0.98	
For >2,500 To 7,500, Deduct	-0.10	
For >7,500 To 10,000 SF, Deduct	-0.20	
For >10,000 SF, Deduct	-0.25	
03 35 16 00-0005 SF Concrete Floor Finishes, Final Float	1.14	
For Up To 50 SF, Add	4.56	
For >50 To 250, Add	1.14	
For >2,500 To 7,500, Deduct	-0.11	
For >7,500 To 10,000 SF, Deduct	-0.23	
For >10,000 SF, Deduct	-0.29	
03 35 16 00-0006 SF Concrete Floor Finishes, Steel Trowel	1.29	
For Up To 50 SF, Add	5.16	
For >50 To 250, Add	1.29	
For >2,500 To 7,500, Deduct	-0.13	
For >7,500 To 10,000 SF, Deduct	-0.26	
For >10,000 SF, Deduct	-0.32	
03 35 16 00-0007 SF Concrete Floor Finishes, Machine	1.14	
For Up To 50 SF, Add	4.56	
For >50 To 250, Add	1.14	
For >2,500 To 7,500, Deduct	-0.11	
For >7,500 To 10,000 SF, Deduct	-0.23	
For >10,000 SF, Deduct	-0.29	
03 35 23 Exposed Aggregate Concrete Finishing (03 35)		
03 35 23 00-0001 Exposed Aggregate Concrete Finish (03 35 23)		
03 35 23 00-0002 SF Exposed Aggregate Concrete Floor Finish	2.49	
03 35 23 00-0003 Sand Blast Concrete Finish (03 35 23)		
03 35 23 00-0004 SF Up To 1/4" Aggregate Reveal, Sand Blast Concrete Finish	3.04	
03 35 23 00-0005 SF >1/4" To 1/2" Aggregate Reveal, Sand Blast Concrete Finish	6.06	
03 35 26 Grooved Concrete Surface Finishing (03 35)		
03 35 26 00-0001 Ramp, Grooved Concrete Surface Finishing (03 35 26)		
03 35 26 00-0002 SF Ramp, Grooved Concrete Surface Finishing	3.12	
03 35 29 Tooled Concrete Finishing (03 35)		
03 35 29 00-0001 Solid Board Concrete Finish (03 35 29)		
03 35 29 00-0002 SF Solid Board Concrete, Non Uniform Finish, 1 Use, Add To Formwork	10.88	
03 35 33 Stamped Concrete Finishing (03 35)		
03 35 33 00-0001 Stamped Finishes (03 35 33)		
03 35 33 00-0002 SF Up To 2,500 SF Stamped Finish	2.92	
03 35 33 00-0003 SF >2,500 To 10,000 SF Stamped Finish	2.64	
03 35 33 00-0004 SF >10,000 SF Stamped Finish	2.52	
03 35 39 Rusticated Concrete Finish (03 35)		
03 35 39 00-0001 Rusticated Concrete Finish (03 35 39)		
03 35 39 00-0002 SF Rusticated Concrete Finish, Beveled Edge, 1 Use, Add To Formwork	5.00	
03 35 39 00-0003 SF Rusticated Concrete Finish, Square Edge, 1 Use, Add To Formwork	6.56	
03 35 43 Polished Concrete Finishing (03 35)		
03 35 43 00-0001 Concrete Floor Polishing System (03 35 43)		
Note: The floor polishing system below may consist of one or multiple applications of each task/step below depending on existing conditions and desired results.		
03 35 43 00-0002 SF Mechanically Grind Concrete Floor With 40 Grit Metal Bonded Diamond Wheels	1.04	
For Up To 500, Add	2.02	
For >500 To 1,000, Add	1.87	
For >1,000 To 2,500, Add	1.24	
For >2,500 To 4,000, Add	0.64	
For >8,000 To 15,000, Deduct	-0.25	
For >15,000 To 25,000, Deduct	-0.32	
For >25,000, Deduct	-0.45	

03	Concrete
03 30	Cast-In-Place Concrete
03 35	Concrete Finishing



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
03 35 43 00-0003	SF		Mechanically Grind Concrete Floor With 80 Grit Metal Bonded Diamond Wheels.....	1.04	
			For Up To 500, Add	2.02	
			For >500 To 1,000, Add	1.87	
			For >1,000 To 2,500, Add	1.24	
			For >2,500 To 4,000, Add	0.64	
			For >8,000 To 15,000, Deduct	-0.25	
			For >15,000 To 25,000, Deduct	-0.32	
			For >25,000, Deduct	-0.45	
03 35 43 00-0004	SF		Mechanically Grind Concrete Floor With 100 Grit Resin Bonded Diamond Wheels	0.63	
			For Up To 500, Add	1.22	
			For >500 To 1,000, Add	1.13	
			For >1,000 To 2,500, Add	0.75	
			For >2,500 To 4,000, Add	0.39	
			For >8,000 To 15,000, Deduct	-0.15	
			For >15,000 To 25,000, Deduct	-0.19	
			For >25,000, Deduct	-0.27	
03 35 43 00-0005	SF		Mechanically Grind Concrete Floor With 150 Grit Metal Bonded Diamond Wheels.....	0.91	
			For Up To 500, Add	1.77	
			For >500 To 1,000, Add	1.64	
			For >1,000 To 2,500, Add	1.08	
			For >2,500 To 4,000, Add	0.56	
			For >8,000 To 15,000, Deduct	-0.22	
			For >15,000 To 25,000, Deduct	-0.28	
			For >25,000, Deduct	-0.39	
03 35 43 00-0006	SF		Mechanically Grind Concrete Floor With 200 Grit Resin Bonded Diamond Wheels	0.63	
			For Up To 500, Add	1.22	
			For >500 To 1,000, Add	1.13	
			For >1,000 To 2,500, Add	0.75	
			For >2,500 To 4,000, Add	0.39	
			For >8,000 To 15,000, Deduct	-0.15	
			For >15,000 To 25,000, Deduct	-0.19	
			For >25,000, Deduct	-0.27	
03 35 43 00-0007	SF		Mechanically Grind Concrete Floor With 400 Grit Resin Bonded Diamond Wheels	0.63	
			For Up To 500, Add	1.22	
			For >500 To 1,000, Add	1.13	
			For >1,000 To 2,500, Add	0.75	
			For >2,500 To 4,000, Add	0.39	
			For >8,000 To 15,000, Deduct	-0.15	
			For >15,000 To 25,000, Deduct	-0.19	
			For >25,000, Deduct	-0.27	
03 35 43 00-0008	SF		Mechanically Grind Concrete Floor With 800 Grit Resin Bonded Diamond Wheels	0.63	
			For Up To 500, Add	1.22	
			For >500 To 1,000, Add	1.13	
			For >1,000 To 2,500, Add	0.75	
			For >2,500 To 4,000, Add	0.39	
			For >8,000 To 15,000, Deduct	-0.15	
			For >15,000 To 25,000, Deduct	-0.19	
			For >25,000, Deduct	-0.27	
03 35 43 00-0009	SF		Mechanically Grind Concrete Floor With 1,500 Grit Resin Bonded Diamond Wheels	0.63	
			For Up To 500, Add	1.22	
			For >500 To 1,000, Add	1.13	
			For >1,000 To 2,500, Add	0.75	
			For >2,500 To 4,000, Add	0.39	
			For >8,000 To 15,000, Deduct	-0.15	
			For >15,000 To 25,000, Deduct	-0.19	
			For >25,000, Deduct	-0.27	
03 35 43 00-0010	SF		High Speed Burnish Concrete Floor With Diamond Pads.....	0.16	
			For Up To 500, Add	0.31	
			For >500 To 1,000, Add	0.29	
			For >1,000 To 2,500, Add	0.19	
			For >2,500 To 4,000, Add	0.10	
			For >8,000 To 15,000, Deduct	-0.04	
			For >15,000 To 25,000, Deduct	-0.05	
			For >25,000, Deduct	-0.07	
03 35 43 00-0011	SF		Apply 1 Coat Of Concrete Densifier.....	0.21	
			For Up To 500, Add	0.41	
			For >500 To 1,000, Add	0.38	
			For >1,000 To 2,500, Add	0.25	
			For >2,500 To 4,000, Add	0.13	
			For >8,000 To 15,000, Deduct	-0.05	
			For >15,000 To 25,000, Deduct	-0.06	
			For >25,000, Deduct	-0.09	
03 35 43 00-0012	SF		Apply 2 Coats Of Concrete Densifier With Stain Protector	0.21	
			For Up To 500, Add	0.41	
			For >500 To 1,000, Add	0.38	
			For >1,000 To 2,500, Add	0.25	
			For >2,500 To 4,000, Add	0.13	
			For >8,000 To 15,000, Deduct	-0.05	
			For >15,000 To 25,000, Deduct	-0.06	
			For >25,000, Deduct	-0.09	



Concrete	03	03
Cast-In-Place Concrete	03 30	
Concrete Finishing	03 35	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
03 35 43 00-0013 SF Concrete Floor Polishing Final Clean Up.....	0.11	
For Up To 500, Add	0.21	
For >500 To 1,000, Add	0.20	
For >1,000 To 2,500, Add	0.13	
For >2,500 To 4,000, Add	0.07	
For >4,000 To 15,000, Deduct	-0.03	
For >15,000 To 25,000, Deduct	-0.03	
For >25,000, Deduct	-0.05	
03 35 63 Slip-Resistant Floor Finishing (03 35)		
03 35 63 00-0001 Slip-Resistant Floor Finishing (03 35 63)		
03 35 63 00-0002 SF Aluminum Oxide Abrasive Floor Finish, 0.25 LB/SF.....	0.88	
For Up To 50 SF, Add	2.84	
For >50 To 250, Add	0.71	
For >2,500 To 7,500, Deduct	-0.07	
For >7,500 To 10,000 SF, Deduct	-0.14	
For >10,000 SF, Deduct	-0.18	
03 35 63 00-0003 SF Silicone Carbide Abrasive Floor Finish 0.25 LB/SF.....	0.96	
For Up To 50 SF, Add	2.84	
For >50 To 250, Add	0.71	
For >2,500 To 7,500, Deduct	-0.07	
For >7,500 To 10,000 SF, Deduct	-0.14	
For >10,000 SF, Deduct	-0.18	
03 35 66 Acid Etch Floor Finishing (03 35)		
03 35 66 00-0001 Acid Etch Floor (03 35 66)		
03 35 66 00-0002 SF Concrete Floor Finishes, Etch With Acid And Rinse.....	0.69	
For Up To 50 SF, Add	1.36	
For >50 To 250, Add	0.34	
For >2,500 To 7,500, Deduct	-0.03	
For >7,500 To 10,000 SF, Deduct	-0.07	
For >10,000 SF, Deduct	-0.09	
03 35 83 Wall Finishes (03 35)		
03 35 83 00-0001 Wall Finishes (03 35 83)		
03 35 83 00-0002 SF Wall Finishes, Burlap Rub With Grout.....	1.29	
For Up To 50 SF, Add	4.92	
For >50 To 250, Add	1.23	
For >2,500 To 7,500, Deduct	-0.12	
For >7,500 To 10,000 SF, Deduct	-0.25	
For >10,000 SF, Deduct	-0.31	
03 35 83 00-0003 SF Wall Finishes, 1/16" Float Finish.....	1.96	
For Up To 50 SF, Add	7.44	
For >50 To 250, Add	1.86	
For >2,500 To 7,500, Deduct	-0.19	
For >7,500 To 10,000 SF, Deduct	-0.37	
For >10,000 SF, Deduct	-0.47	
03 35 83 00-0004 SF Wall Finishes, Etch With Acid And Rinse.....	0.76	
For Up To 50 SF, Add	1.64	
For >50 To 250, Add	0.41	
For >2,500 To 7,500, Deduct	-0.04	
For >7,500 To 10,000 SF, Deduct	-0.08	
For >10,000 SF, Deduct	-0.10	
03 35 83 00-0005 SF Wall Finishes, Bush Hammer Green Concrete.....	3.96	
For Up To 50 SF, Add	15.72	
For >50 To 250, Add	3.93	
For >2,500 To 7,500, Deduct	-0.39	
For >7,500 To 10,000 SF, Deduct	-0.79	
For >10,000 SF, Deduct	-0.98	
03 35 83 00-0006 SF Wall Finishes, Bush Hammer Cured Concrete.....	6.14	
For Up To 50 SF, Add	24.32	
For >50 To 250, Add	6.08	
For >2,500 To 7,500, Deduct	-0.61	
For >7,500 To 10,000 SF, Deduct	-1.22	
For >10,000 SF, Deduct	-1.52	
03 35 83 00-0007 SF Wall Finishes, Break Ties And Patch.....	0.75	
For Up To 50 SF, Add	2.68	
For >50 To 250, Add	0.67	
For >2,500 To 7,500, Deduct	-0.07	
For >7,500 To 10,000 SF, Deduct	-0.13	
For >10,000 SF, Deduct	-0.17	
03 35 83 00-0008 SF Wall Finishes, Carborundum Dry Rub.....	2.56	
For Up To 50 SF, Add	9.92	
For >50 To 250, Add	2.48	
For >2,500 To 7,500, Deduct	-0.25	
For >7,500 To 10,000 SF, Deduct	-0.50	
For >10,000 SF, Deduct	-0.62	

03	Concrete
03 30	Cast-In-Place Concrete
03 35	Concrete Finishing



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
	03 35 83 00-0009	SF	Wall Finishes, Carborundum Wet Rub.....	3.90	
			<i>For Up To 50 SF, Add</i>	15.28	
			<i>For >50 To 250, Add</i>	3.82	
			<i>For >2,500 To 7,500, Deduct</i>	-0.38	
			<i>For >7,500 To 10,000 SF, Deduct</i>	-0.76	
			<i>For >10,000 SF, Deduct</i>	-0.96	
	03 35 83 00-0010	SF	Wall Finishes, Mechanical Concrete Sand Blasting, Heavy Penetration, Walls, Various Finish Textures	8.66	
			<i>For Up To 50 SF, Add</i>	32.24	
			<i>For >50 To 250, Add</i>	8.06	
			<i>For >2,500 To 7,500, Deduct</i>	-0.81	
			<i>For >7,500 To 10,000 SF, Deduct</i>	-1.61	
			<i>For >10,000 SF, Deduct</i>	-2.02	
	03 35 83 00-0011	SF	Wall Finishes, Light Sand Blast.....	1.93	
			Note: Not for use as sand blasting for existing material		
			<i>For Up To 50 SF, Add</i>	7.40	
			<i>For >50 To 250, Add</i>	1.85	
			<i>For >2,500 To 7,500, Deduct</i>	-0.19	
			<i>For >7,500 To 10,000 SF, Deduct</i>	-0.37	
			<i>For >10,000 SF, Deduct</i>	-0.46	

03 37 Specialty Placed Concrete (03 30)

Note: Includes gun finish. Not to be used for pumping concrete tasks. See CSI section 03 35 00 00-0000 for finishing.

03 37 13 Shotcrete (03 37)

03 37 13 00-0001 Fiber Reinforced, Structural Repair (03 37 13)

03 37 13 00-0002	SF	1" Thick Shotcrete, Fiber Reinforced	3.66
		<i>For Up To 25 SF, Add</i>	0.60
		<i>For >25 To 50 SF, Add</i>	0.34
		<i>For >50 To 150, Add</i>	0.12
03 37 13 00-0003	SF	2" Thick Shotcrete, Fiber Reinforced	6.72
		<i>For Up To 25 SF, Add</i>	1.05
		<i>For >25 To 50 SF, Add</i>	0.59
		<i>For >50 To 150, Add</i>	0.19
03 37 13 00-0004	SF	3" Thick Shotcrete, Fiber Reinforced	10.02
		<i>For Up To 25 SF, Add</i>	1.56
		<i>For >25 To 50 SF, Add</i>	0.87
		<i>For >50 To 150, Add</i>	0.28
03 37 13 00-0005	SF	4" Thick Shotcrete, Fiber Reinforced	13.29
		<i>For Up To 25 SF, Add</i>	2.07
		<i>For >25 To 50 SF, Add</i>	1.16
		<i>For >50 To 150, Add</i>	0.37
03 37 13 00-0006	SF	6" Thick Shotcrete, Fiber Reinforced	19.09
		<i>For Up To 25 SF, Add</i>	3.02
		<i>For >25 To 50 SF, Add</i>	1.69
		<i>For >50 To 150, Add</i>	0.55

03 37 13 00-0007 Gunite (Dry Mix Shotcrete), Sprayed (03 37 13)

03 37 13 00-0008	SF	1" Thick Gunite	3.59
		<i>For Radius Or Irregular Surface, Add</i>	0.86
		<i>For Up To 25 SF, Add</i>	0.68
		<i>For >25 To 50, Add</i>	0.39
		<i>For >50 To 150 SF, Add</i>	0.16
03 37 13 00-0009	SF	2" Thick Gunite	7.16
		<i>For Radius Or Irregular Surface, Add</i>	1.71
		<i>For Up To 25 SF, Add</i>	1.36
		<i>For >25 To 50, Add</i>	0.79
		<i>For >50 To 150 SF, Add</i>	0.32
03 37 13 00-0010	SF	3" Thick Gunite	10.78
		<i>For Radius Or Irregular Surface, Add</i>	2.58
		<i>For Up To 25 SF, Add</i>	2.05
		<i>For >25 To 50, Add</i>	1.19
		<i>For >50 To 150 SF, Add</i>	0.48
03 37 13 00-0011	SF	4" Thick Gunite	14.31
		<i>For Radius Or Irregular Surface, Add</i>	3.42
		<i>For Up To 25 SF, Add</i>	2.71
		<i>For >25 To 50, Add</i>	1.57
		<i>For >50 To 150 SF, Add</i>	0.64

03 39 Concrete Curing (03 30)

03 39 13 Water Concrete Curing (03 39)

03 39 13 00-0001 Water Concrete Curing (03 39 13)

03 39 13 00-0002	GAL	Water Based Curing, Sealing, Hardening And Dustproofing Compound	18.70
		Note: Coverage rates: rough finish = 300 SF/GAL, broom finish = 300 to 400 SF/GAL, steel troweled = 500 to 600 SF/GAL, and vertical surface = 400 - 500 SF/GAL.	

03 39 23 Membrane Concrete Curing (03 39)

03 39 23 23 Sheet Membrane Concrete Curing (03 39 23)



Concrete	03	03
Cast-In-Place Concrete	03 30	
Concrete Curing	03 39	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
03 39 23 23-0001 Concrete Curing Materials And Compounds <small>(03 39 23 23)</small>		
03 39 23 23-0002 CSF 7.5 Oz Burlap, Concrete Curing Blanket.....	31.20	
03 39 23 23-0003 CSF 9 Oz Burlap, Concrete Curing Blanket.....	31.41	
03 39 23 23-0004 CSF 12 Oz Burlap, Concrete Curing Blanket.....	33.12	
03 39 23 23-0005 CSF 2 Ply Reinforced, Concrete Curing Waterproof Paper	29.44	
03 39 23 23-0006 CSF Curing Paper.....	9.32	
03 39 33 Concrete Surface Treatments <small>(03 39)</small>		
03 39 33 00-0001 Concrete Surface Treatments <small>(03 39 33)</small>		
03 39 33 00-0002 GAL Acrylic Latex Bonding Agent, 250 SF Per Gallon.....	104.03	
03 39 33 00-0003 GAL Epoxy Resin Bonding Agent, 80 SF Per Gallon.....	173.14	
03 39 33 00-0004 SF Clear Acrylic Sealer, Hardener And Dustproofer	0.24	
Note: 300 SF/GAL.		
03 39 33 00-0005 SF Colored Acrylic Sealer, Hardener And Dustproofer	0.25	
Note: 300 SF/GAL.		
03 39 33 00-0006 GAL Clear Acrylic Sealer, Hardener And Dustproofer, 300 SF Per Gallon.....	70.28	
03 39 33 00-0007 GAL Colored Acrylic Sealer, Hardener And Dustproofer, 300 SF Per Gallon.....	72.92	
03 39 33 00-0008 Shake On Floor Hardeners <small>(03 39 33)</small>		
03 39 33 00-0009 SF 0.3 LB/SF, Metallic, Shake On Floor Hardener.....	0.90	
03 39 33 00-0010 SF 0.65 LB/SF, Metallic, Shake On Floor Hardener.....	1.36	
03 39 33 00-0011 SF 0.3 LB/SF, Non Metallic, Shake On Floor Hardener	0.85	
03 39 33 00-0012 SF 0.65 LB/SF, Non Metallic, Shake On Floor Hardener	1.01	
03 40 Precast Concrete <small>(03)</small>		
Note: Precast concrete material prices are based on a precast operation producing large quantities of precast products. Material prices include the concrete panel, delivery to construction site and overhead/mobilization charges for the precast plant.		
03 41 Precast Structural Concrete <small>(03 40)</small>		
03 41 33 Precast Structural Pretensioned Concrete <small>(03 41)</small>		
03 41 33 00-0001 Slabs, Roof And Floor Members <small>(03 41 33)</small>		
03 41 33 00-0002 SF 4" Thick Precast Prestressed Slab, 12-16' Span Roof/Floor.....	6.51	1.74
03 41 33 00-0003 SF 6" Thick Precast Prestressed Slab, 16-25' Span Roof/Floor.....	7.85	1.74
03 41 33 00-0004 SF 8" Thick Precast Prestressed Slab, 25-32' Span Roof/Floor.....	9.19	1.82
03 41 33 00-0005 SF 10" Thick Precast Prestressed Slab, 32-40' Span Roof/Floor.....	10.53	1.91
03 41 33 00-0006 Tee Members <small>(03 41 33)</small>		
03 41 33 00-0007 Multiple Tee, Roof And Floor <small>(03 41 33 00-0006)</small>		
03 41 33 00-0008 SF Prestressed Multiple Tee, Roof And Floor Members	13.39	2.26
03 41 33 00-0009 Double Tee Wall Member <small>(03 41 33 00-0006)</small>		
03 41 33 00-0010 SF Prestressed Double Tee Wall Members Precast Concrete, <40' Span.....	21.27	6.17
03 41 33 00-0011 Single Tee, Short Span, Roof Members <small>(03 41 33 00-0006)</small>		
03 41 33 00-0012 SF Prestressed Single Tee, Short Span Roof Precast Concrete Members, <40' Span.....	16.58	3.74
03 41 33 00-0013 Single Tee, Long Span, Roof Members <small>(03 41 33 00-0006)</small>		
03 41 33 00-0014 SF Prestressed Single Tee, Long Span Roof Precast Concrete Members, <40' Span.....	18.96	3.21
03 41 33 00-0015 Prestressed Concrete Items <small>(03 41 33)</small>		
03 41 33 00-0016 Prestressed Quad Tee <small>(03 41 33 00-0015)</small>		
03 41 33 00-0017 SF Tees, Prestressed Quad Tee, Short Spans, Roof.....	9.00	0.70
03 41 33 00-0018 SF Tees, Prestressed Quad Tee, Short Spans, Floor	9.37	0.70
03 41 33 00-0019 Prestressed Double Tee <small>(03 41 33 00-0015)</small>		
03 41 33 00-0020 SF Tees, Double Tee, Floor Members , 60' Span	14.52	0.61
03 41 33 00-0021 SF Tees, Double Tee, Floor Members , 80' Span	19.86	0.61
03 41 33 00-0022 SF Tees, Double Tee, Roof Members, 30' Span.....	10.39	1.05
03 41 33 00-0023 SF Tees, Double Tee, Roof Members, 50' Span.....	15.44	0.70
03 41 33 00-0024 SF Tees, Double Tee, Wall Members, Up To 55' High.....	11.47	1.39
03 41 33 00-0025 Prestressed Single Tee <small>(03 41 33 00-0015)</small>		
03 41 33 00-0026 SF Tees, Single Tee Roof Members, 40' Span	17.87	1.56
03 41 33 00-0027 SF Tees, Single Tee Roof Members, 80' Span	20.02	0.96

03	Concrete
03 40	Precast Concrete
03 41	Precast Structural Concrete



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
03 41 33 00-0028 SF Tees, Single Tee Roof Members, 100' Span	26.17	0.87
03 41 33 00-0029 SF Tees, Single Tee Roof Members, 120' Span	27.53	0.87
03 41 33 00-0030 Prestressed Double Tee Floor Members (03 41 33 00-0015)		
03 41 33 00-0031 EA Tees, Double Tees, Floor Members, Lightweight, 20" X 8' Wide, 45'	4,496.91	250.43
03 41 33 00-0032 EA Tees, Double Tees, Floor Members, Lightweight, 24" X 8' Wide, 50'	4,900.82	278.26
03 41 33 00-0033 EA Tees, Double Tees, Floor Members, Lightweight, 32" X 10' Wide, 60'	8,082.13	313.05
03 41 33 00-0034 EA Tees, Double Tees, Floor Members, Standard Weight, 12" X 8' Wide, 25'	1,859.72	227.74
03 41 33 00-0035 EA Tees, Double Tees, Floor Members, Standard Weight, 16" X 8' Wide, 25'	2,404.99	250.43
03 41 33 00-0036 EA Tees, Double Tees, Floor Members, Standard Weight, 18" X 8' Wide, 35'	3,020.26	250.43
03 41 33 00-0037 EA Tees, Double Tees, Floor Members, Standard Weight, 20" X 8' Wide, 45'	3,362.64	278.26
03 41 33 00-0038 EA Tees, Double Tees, Floor Members, Standard Weight, 24" X 8' Wide, 50'	4,267.45	313.05
03 41 33 00-0039 EA Tees, Double Tees, Floor Members, Standard Weight, 32" X 10' Wide, 60'	7,522.98	357.91
03 41 33 00-0040 Prestressed Double Tee Roof Members (03 41 33 00-0015)		
03 41 33 00-0041 EA Tees, Double Tees, Roof Members, Lightweight, 20" X 8' Wide, 45'	3,574.00	250.43
03 41 33 00-0042 EA Tees, Double Tees, Roof Members, Lightweight, 24" X 8' Wide, 50'	4,654.71	278.26
03 41 33 00-0043 EA Tees, Double Tees, Roof Members, Lightweight, 32" X 10' Wide, 60'	7,528.39	313.05
03 41 33 00-0044 EA Tees, Double Tees, Roof Members, Standard Weight, 12" X 8' Wide, 30'	2,438.08	227.74
03 41 33 00-0045 EA Tees, Double Tees, Roof Members, Standard Weight, 16" X 8' Wide, 30'	2,577.27	250.43
03 41 33 00-0046 EA Tees, Double Tees, Roof Members, Standard Weight, 18" X 8' Wide, 30'	2,835.68	250.43
03 41 33 00-0047 EA Tees, Double Tees, Roof Members, Standard Weight, 20" X 8' Wide, 40'	2,931.96	278.26
03 41 33 00-0048 EA Tees, Double Tees, Roof Members, Standard Weight, 24" X 8' Wide, 50'	3,836.76	313.05
03 41 33 00-0049 EA Tees, Double Tees, Roof Members, Standard Weight, 32" X 10' Wide, 60'	6,477.02	357.91
03 41 33 00-0050 Plant Produced Pretensioned Prestressed Concrete Hollow Core Slab (03 41 33)		
03 41 33 00-0051 SF Hollow Core Slab, 4" Slab, 12' - 16' Spans, Plant Produced Pretensioned Prestressed Concrete	9.43	
03 41 33 00-0052 SF Hollow Core Slab, 6" Slab, 16' - 25' Spans, Plant Produced Pretensioned Prestressed Concrete	9.84	
03 41 33 00-0053 SF Hollow Core Slab, 8" Slab, 25' - 30' Spans, Plant Produced Pretensioned Prestressed Concrete	10.43	
03 41 33 00-0054 SF Hollow Core Slab, 10" Slab, 30' - 35' Spans, Plant Produced Pretensioned Prestressed Concrete	10.91	
03 41 33 00-0055 SF Hollow Core Slab, 12" Slab, 35' - 40' Spans, Plant Produced Pretensioned Prestressed Concrete	11.82	
03 41 33 00-0056 Double And Single Tees (03 41 33)		
03 41 33 00-0057 Double And Single Tees With 16" Roof And Floor Loading (03 41 33 00-0056)		
03 41 33 00-0058 SF Double Tee With 16" Roof Loading, 30' Span, Pretensioned Prestressed Concrete	11.60	
03 41 33 00-0059 SF Double Tee With 16" Roof Loading, 40' Span, Pretensioned Prestressed Concrete	11.29	
03 41 33 00-0060 SF Double Tee With 16" Roof Loading, 45' Span, Pretensioned Prestressed Concrete	10.65	
03 41 33 00-0061 SF Double Tee With 16" Floor Loading, 30' Span, Pretensioned Prestressed Concrete	11.60	
03 41 33 00-0062 SF Double Tee With 16" Floor Loading, 40' Span, Pretensioned Prestressed Concrete	11.51	
03 41 33 00-0063 SF Single Tee With 16" Roof Loading, 30' Span, Pretensioned Prestressed Concrete	17.36	
03 41 33 00-0064 SF Single Tee With 16" Roof Loading, 40' Span, Pretensioned Prestressed Concrete	16.94	
03 41 33 00-0065 SF Single Tee With 16" Roof Loading, 45' Span, Pretensioned Prestressed Concrete	15.86	
03 41 33 00-0066 SF Single Tee With 16" Floor Loading, 30' Span, Pretensioned Prestressed Concrete	17.36	
03 41 33 00-0067 SF Single Tee With 16" Floor Loading, 40' Span, Pretensioned Prestressed Concrete	16.27	
03 41 33 00-0068 Double And Single Tees With 24" Roof And Floor Loading (03 41 33 00-0056)		
03 41 33 00-0069 SF Double Tee With 24" Roof Loading, 30' Span, Pretensioned Prestressed Concrete	11.93	
03 41 33 00-0070 SF Double Tee With 24" Roof Loading, 40' Span, Pretensioned Prestressed Concrete	11.62	
03 41 33 00-0071 SF Double Tee With 24" Roof Loading, 45' Span, Pretensioned Prestressed Concrete	11.21	
03 41 33 00-0072 SF Double Tee With 24" Floor Loading, 30' Span, Pretensioned Prestressed Concrete	11.93	
03 41 33 00-0073 SF Double Tee With 24" Floor Loading, 40' Span, Pretensioned Prestressed Concrete	11.51	
03 41 33 00-0074 SF Single Tee With 24" Roof Loading, 30' Span, Pretensioned Prestressed Concrete	17.80	
03 41 33 00-0075 SF Single Tee With 24" Roof Loading, 40' Span, Pretensioned Prestressed Concrete	17.38	
03 41 33 00-0076 SF Single Tee With 24" Roof Loading, 45' Span, Pretensioned Prestressed Concrete	16.75	
03 41 33 00-0077 SF Single Tee With 24" Floor Loading, 30' Span, Pretensioned Prestressed Concrete	17.80	
03 41 33 00-0078 SF Single Tee With 24" Floor Loading, 40' Span, Pretensioned Prestressed Concrete	17.27	
03 41 33 00-0079 Double And Single Tees With 32" Roof And Floor Loading (03 41 33 00-0056)		
03 41 33 00-0080 SF Double Tee With 32" Roof Load, 50' Span, Pretensioned Prestressed Concrete	12.63	
03 41 33 00-0081 SF Double Tee With 32" Roof Load, 60' Span, Pretensioned Prestressed Concrete	12.20	
03 41 33 00-0082 SF Double Tee With 32" Roof Load, 70' Span, Pretensioned Prestressed Concrete	11.77	
03 41 33 00-0083 SF Single Tee With 32" Roof Load, 50' Span, Pretensioned Prestressed Concrete	18.94	
03 41 33 00-0084 SF Single Tee With 32" Roof Load, 60' Span, Pretensioned Prestressed Concrete	18.29	
03 41 33 00-0085 SF Single Tee With 32" Roof Load, 70' Span, Pretensioned Prestressed Concrete	17.53	
03 41 40 Precast Items (03 40)		
03 41 40 00-0001 Precast Items (03 41 40)		
03 41 40 00-0002 Precast Bumper Curbs (03 41 40 00-0001)		



Concrete	03	CS
Precast Concrete	03 40	
Precast Items	03 41 40	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
03 41 40 00-0003	EA		6" x 10" x 7' Precast Bumper Curbs..... <i>For 3500 PSI Concrete, Add</i> <i>For 4000 PSI Concrete, Add</i> <i>For 4500 PSI Concrete, Add</i> <i>For 5000 PSI (350 Kg/Cm2) Concrete, Add</i>	53.22 0.89 1.31 1.76 2.63	10.86
03 48 Precast Concrete Specialties (03 40)					
03 48 16 Precast Concrete Splash Blocks (03 48)					
03 48 16 00-0001			Precast Concrete Splash Blocks (03 48 16)		
03 48 16 00-0002	EA		Precast Concrete Splash Blocks, Standard Size	16.24	3.29
03 48 24 Precast Minaret Segments (03 48)					
03 48 24 00-0001			Installation Costs Using A 50 Ton Hydraulic Crane (03 48 24) <i>Note: Includes handling, hoisting into place, alignment, bracing and permanent connections.</i>		
03 48 24 00-0002			L - Shaped Segments (03 48 24 00-0001)		
03 48 24 00-0003	EA		Install Minaret, L-Shape Segment, 0-1 Ton/Each 100' Maximum Radius With 50 Ton Crane	270.36	216.30
03 48 24 00-0004	EA		Install Minaret, L-Shape Segment, 1-3 Ton/Each 65' Maximum Radius With 50 Ton Crane	302.97	242.39
03 48 24 00-0005	EA		Install Minaret, L-Shape Segment, 3-5 Ton/Each 50' Maximum Radius With 50 Ton Crane	342.57	274.05
03 48 24 00-0006	EA		Install Minaret, L-Shape Segment, 5-7 Ton/Each 40' Maximum Radius With 50 Ton Crane	365.40	292.32
03 48 24 00-0007			O - Shaped Segments (03 48 24 00-0001)		
03 48 24 00-0008	EA		Install Minaret, O-Shape Segment, 0-1 Ton/Each 100' Maximum Radius With 50 Ton Crane	285.75	228.64
03 48 24 00-0009	EA		Install Minaret, O-Shape Segment, 1-3 Ton/Each 65' Maximum Radius With 50 Ton Crane	320.70	256.52
03 48 24 00-0010	EA		Install Minaret, O-Shape Segment, 3-5 Ton/Each 50' Maximum Radius With 50 Ton Crane	363.20	290.53
03 48 24 00-0011	EA		Install Minaret, O-Shape Segment, 5-7 Ton/Each 40' Maximum Radius With 50 Ton Crane	388.97	311.16
03 48 24 00-0012			Platform Segment (03 48 24 00-0001)		
03 48 24 00-0013	EA		Install Minaret, Platform Segments, 0-1 Ton/Each 100' Maximum Radius With 50 Ton Crane	548.11	438.53
03 48 24 00-0014	EA		Install Minaret, Platform Segments, 1-3 Ton/Each 65' Maximum Radius With 50 Ton Crane	662.55	530.00
03 48 24 00-0015	EA		Install Minaret, Platform Segments, 3-5 Ton/Each 50' Maximum Radius With 50 Ton Crane	735.27	588.22
03 48 24 00-0016	EA		Install Minaret, Platform Segments, 5-7 Ton/Each 40' Maximum Radius With 50 Ton Crane	825.91	660.75
03 48 24 00-0017			Cap Segment (03 48 24 00-0001)		
03 48 24 00-0018	EA		Install Minaret, Cap Segments, 0-1 Ton/Each 100' Maximum Radius With 50 Ton Crane	299.96	239.94
03 48 24 00-0019	EA		Install Minaret, Cap Segments, 1-3 Ton/Each 65' Maximum Radius With 50 Ton Crane	334.95	267.92
03 48 24 00-0020	EA		Install Minaret, Cap Segments, 3-5 Ton/Each 50' Maximum Radius With 50 Ton Crane	381.59	305.23
03 48 24 00-0021	EA		Install Minaret, Cap Segments, 5-7 Ton/Each 40' Maximum Radius With 50 Ton Crane	407.37	325.86
03 48 24 00-0022			Installation Costs Using A 90 Ton Crawler Crane (03 48 24) <i>Note: Includes handling, hoisting into place, alignment, bracing and permanent connections. Excludes grouting and caulking of joints.</i>		
03 48 24 00-0023			L - Shaped Segments (03 48 24 00-0022)		
03 48 24 00-0024	EA		Install Minaret, L-Shaped Segments, 0-1 Ton/Each 180' Maximum Radius With 90 Ton Crane	275.06	220.06
03 48 24 00-0025	EA		Install Minaret, L-Shaped Segments, 1-3 Ton/Each 135' Maximum Radius With 90 Ton Crane	308.24	246.61
03 48 24 00-0026	EA		Install Minaret, L-Shaped Segments, 3-5 Ton/Each 100' Maximum Radius With 90 Ton Crane	348.53	278.81
03 48 24 00-0027	EA		Install Minaret, L-Shaped Segments, 5-7 Ton/Each 79' Maximum Radius With 90 Ton Crane	371.76	297.40
03 48 24 00-0028			O - Shaped Segment (03 48 24 00-0022)		
03 48 24 00-0029	EA		Install Minaret, O-Shaped Segments, 0-1 Ton/Each 180' Maximum Radius With 90 Ton Crane	290.71	232.61
03 48 24 00-0030	EA		Install Minaret, O-Shaped Segments, 1-3 Ton/Each 135' Maximum Radius With 90 Ton Crane	326.28	260.98
03 48 24 00-0031	EA		Install Minaret, O-Shaped Segments, 3-5 Ton/Each 100' Maximum Radius With 90 Ton Crane	369.52	295.58
03 48 24 00-0032	EA		Install Minaret, O-Shaped Segments, 5-7 Ton/Each 79' Maximum Radius With 90 Ton Crane	395.74	316.57
03 48 24 00-0033			Platform Segment (03 48 24 00-0022)		
03 48 24 00-0034	EA		Install Minaret, Platform Segment, 0-1 Ton/Each 180' Maximum Radius With 90 Ton Crane	444.49	355.58
03 48 24 00-0035	EA		Install Minaret, Platform Segment, 1-3 Ton/Each 135' Maximum Radius With 90 Ton Crane	538.07	430.43
03 48 24 00-0036	EA		Install Minaret, Platform Segment, 3-5 Ton/Each 100' Maximum Radius With 90 Ton Crane	595.53	476.44
03 48 24 00-0037	EA		Install Minaret, Platform Segment, 5-7 Ton/Each 79' Maximum Radius With 90 Ton Crane	674.07	539.22
03 48 24 00-0038			Cap Segment (03 48 24 00-0022)		
03 48 24 00-0039	EA		Install Minaret, Cap Segment, 0-1 Ton/Each 180' Maximum Radius With 90 Ton Crane	305.18	244.12
03 48 24 00-0040	EA		Install Minaret, Cap Segment, 1-3 Ton/Each 135' Maximum Radius With 90 Ton Crane	340.78	272.57
03 48 24 00-0041	EA		Install Minaret, Cap Segment, 3-5 Ton/Each 100' Maximum Radius With 90 Ton Crane	388.23	310.54
03 48 24 00-0042	EA		Install Minaret, Cap Segment, 5-7 Ton/Each 79' Maximum Radius With 90 Ton Crane	414.46	331.53

03 Concrete**03 40 Precast Concrete****03 48 Precast Concrete Specialties**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
03 48 24 00-0043			Material Costs <small>(03 48 24)</small> Note: Includes 3000 PSI concrete, imbedded items, formwork and precast concrete operations.		
03 48 24 00-0044	CY		Precast Concrete Minaret, L-Shaped Segments Including Post Tension Cost, 3,000 PSI Concrete	2,953.23	
03 48 24 00-0045	CY		Precast Concrete Minaret, O-Shaped Segments Including Post Tension Cost, 3,000 PSI Concrete	2,953.23	
03 48 24 00-0046	CY		Precast Concrete Minaret, Platform Segments Including Post Tension Cost, 3,000 PSI Concrete	2,953.23	
03 48 24 00-0047	CY		Precast Concrete Minaret, Cap Segments Including Post Tension Cost, 3,000 PSI Concrete	2,953.23	
03 48 29			Precast Accessories <small>(03 48)</small> Note: Includes installation labor, material and equipment.		
03 48 29 00-0001			Bearing Pads For Precast Members <small>(03 48 29)</small>		
03 48 29 00-0002			Continuous 2" Wide Strips <small>(03 48 29 00-0001)</small>		
03 48 29 00-0003	LF		Bearing Pads, Continuous 2" Wide x 1/8" Thick Strips	1.21	
			Note: For precast members		
03 48 29 00-0004	LF		Bearing Pads, Continuous 2" Wide x 1/4" Thick Strips	1.75	
			Note: For precast members.		
03 48 29 00-0005	LF		Bearing Pads, Continuous 2" Wide x 1/2" Thick Strips	2.92	
			Note: For precast members		
03 48 29 00-0006	LF		Bearing Pads, Continuous 2" Wide x 3/4" Thick Strips	4.10	
			Note: For precast members		
03 48 29 00-0007	LF		Bearing Pads, Continuous 2" Wide x 1" Thick Strips	5.34	
			Note: For precast members		
03 48 29 00-0008	LF		Bearing Pads, Continuous 2" Wide x 1-1/2" Thick Strips	7.69	
			Note: For precast members		
03 48 29 00-0009			Bearing Pad Pipe Supports <small>(03 48 29)</small>		
03 48 29 00-0010	LF		8" Diameter Precast Balustrade, Decorative Shapes	65.05	
03 48 29 00-0011	LF		Precast Rail Cap, <1 SF Cross Section	41.80	
03 48 29 00-0012	LF		4" x 4" Precast Pipe Support	7.24	
03 48 49			Precast Landings <small>(03 48)</small>		
03 48 49 00-0001	SF		3" Thick Precast Landing	39.09	
03 48 49 00-0002	SF		4" Thick Precast Landing	45.13	
03 48 49 00-0003	SF		5" Thick Precast Landing	51.85	
03 48 49 00-0004	SF		6" Thick Precast Landing	59.94	
03 50			Cast Decks And Underlayment <small>(03)</small>		
03 51			Cast Roof Decks <small>(03 50)</small>		
03 51 13			Cementitious Wood Fiber Decks <small>(03 51)</small>		
03 51 13 00-0001			Cement Fiber Tongue And Groove Planks <small>(03 51 13)</small>		
03 51 13 00-0002	SF		1" Thick Cementitious Fiber Tongue And Groove Planks, Cement Wood Fiber System	2.42	
03 51 13 00-0003	SF		1-1/2" Thick Cementitious Fiber Tongue And Groove Planks, Cement Wood Fiber System	2.52	
03 51 13 00-0004	SF		2" Thick Cementitious Fiber Tongue And Groove Planks, Cement Wood Fiber System	2.64	
03 51 13 00-0005	SF		2-1/2" Thick Cementitious Fiber Tongue And Groove Planks, Cement Wood Fiber System	2.99	
03 51 13 00-0006	SF		3" Thick Cementitious Fiber Tongue And Groove Planks, Cement Wood Fiber System	3.38	
03 51 13 00-0007	SF		3-1/2" Thick Cementitious Fiber Tongue And Groove Planks, Cement Wood Fiber System	3.83	
03 51 13 00-0008	SF		4" Thick Cementitious Fiber Tongue And Groove Planks, Cement Wood Fiber System	4.38	
03 51 13 00-0009			Bulb Tees, Sub-Purlins And Grout <small>(03 51 13)</small>		
03 51 13 00-0010	SF		6' Span Bulb Tee, Sub-Purlins, Grout, Cement Wood Fiber System	1.05	
03 51 13 00-0011	SF		8' Span Bulb Tee, Sub-Purlins, Grout, Cement Wood Fiber System	1.60	
03 51 16			Gypsum Concrete Roof Decks <small>(03 51)</small>		
03 51 16 00-0001			Class A Gypsum Fill Concrete Deck <small>(03 51 16)</small>		
03 51 16 00-0002	SF		2" Thick Precast Gypsum Fill Concrete Deck, Class A	3.77	0.44
03 51 16 00-0003	SF		2-1/2" Thick Precast Gypsum Fill Concrete Deck, Class A	4.61	0.51
03 51 16 00-0004	SF		3" Thick Precast Gypsum Fill Concrete Deck, Class A	5.49	0.59
03 51 16 00-0005	SF		3-1/2" Thick Precast Gypsum Fill Concrete Deck, Class A	6.36	0.66
03 51 16 00-0006	SF		4" Thick Precast Gypsum Fill Concrete Deck, Class A	7.26	0.74
03 51 16 00-0007			Formboard For Lightweight Deck <small>(03 51 16)</small>		
03 51 16 00-0008	SF		Gypsum Deck Formboard, 1/2" Drywall For Lightweight Deck	1.68	
03 51 16 00-0009	SF		Gypsum Deck Formboard, 1" Mineral Fiber Board For Lightweight Deck	2.26	
03 51 16 00-0010	SF		Gypsum Deck Formboard, 1-1/2" Mineral Fiber Board For Lightweight Deck	4.71	
03 51 16 00-0011	SF		Gypsum Deck Formboard, 1" Cementitious Fiber Board For Lightweight Deck	1.87	0.43
03 51 16 00-0012	SF		Gypsum Deck Formboard, 1-1/2" Cementitious Fiber Board For Lightweight Deck	2.27	0.43
03 51 16 00-0013	SF		Gypsum Deck Formboard, 1" Glass Fiber Board For Lightweight Deck	2.54	0.43
03 51 16 00-0014	SF		Gypsum Deck Formboard, 1-1/2" Glass Fiber Board For Lightweight Deck	3.14	0.43



Concrete	03	CS
Cast Decks And Underlayment	03 50	
Cast Roof Decks	03 51	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
03 51 16 00-0015 Board Deck Supports For Formboard <small>(03 51 16)</small>		
03 51 16 00-0016 SF Gypsum Deck Formboard Supports, 5' Bulb Tee 40 LB/SF, Span	0.74	0.17
03 51 16 00-0017 SF Gypsum Deck Formboard Supports, 8' Bulb Tee 40 LB/SF Span	1.24	0.26
03 51 16 00-0018 Gypsum Plank <small>(03 51 16)</small>		
03 51 16 00-0019 SF Insulating Concrete Gypsum Plank, 2" Thick Roof Deck	2.72	
03 51 16 00-0020 SF Insulating Concrete Gypsum Plank, 3" Thick Roof Deck	3.55	
03 52 Lightweight Concrete Roof Insulation <small>(03 50)</small>		
03 52 16 Lightweight Insulating Concrete <small>(03 52)</small>		
<small>Note: Add costs for forming to all tasks below. See CSI section 03 11 00 00-0000 for forming.</small>		
03 52 16 00-0001 Poured Deck <small>(03 52 16)</small>		
03 52 16 00-0002 Perlite Or Vermiculite <small>(03 52 16 00-0001)</small>		
03 52 16 00-0003 CY Insulating Roof Deck, Perlite, 1:6 Mix Field Mix, Also Vermiculite	217.35	
<i>For Smooth Trowel Finish, Add</i>	41.30	
03 52 16 00-0004 Lightweight Insulating Concrete Deck, Ready Mix 1 To 6 Mix <small>(03 52 16 00-0001)</small>		
03 52 16 00-0005 SF 2" Insulating Roof Deck, Ready Mix, 1:6 Mix	2.21	
<i>For Smooth Trowel Finish, Add</i>	0.30	
03 52 16 00-0006 SF 3" Insulating Roof Deck, Ready Mix, 1:6 Mix	3.15	
<i>For Smooth Trowel Finish, Add</i>	0.36	
03 52 16 00-0007 Galvanized Mesh Reinforcing <small>(03 52 16 00-0001)</small>		
03 52 16 00-0008 SF Welded Wire Fabric, 2" Hexagonal Mesh (Keydeck #2160-2-1619)	1.45	
03 52 16 00-0009 Lightweight Concrete Plank <small>(03 52 16)</small>		
03 52 16 00-0010 SF 2" Thick Insulating Lightweight Concrete Plank Roof Deck	4.25	
<i>For >4 To 12 Pitch, Add</i>	0.31	
<i>For >6 To 12 Pitch, Add</i>	1.85	
03 52 16 00-0011 SF 2-1/2" Thick Insulating Lightweight Concrete Plank Roof Deck	4.93	
<i>For >4 To 12 Pitch, Add</i>	0.34	
<i>For >6 To 12 Pitch, Add</i>	2.03	
03 52 16 00-0012 SF 3" Thick Insulating Lightweight Concrete Plank Roof Deck	5.67	
<i>For >4 To 12 Pitch, Add</i>	0.37	
<i>For >6 To 12 Pitch, Add</i>	2.19	
03 52 16 00-0013 SF 3-1/2" Thick Insulating Lightweight Concrete Plank Roof Deck	5.95	
<i>For >4 To 12 Pitch, Add</i>	0.40	
<i>For >6 To 12 Pitch, Add</i>	2.37	
03 52 16 00-0014 SF 4" Thick Insulating Lightweight Concrete Plank Roof Deck	6.17	
<i>For >4 To 12 Pitch, Add</i>	0.41	
<i>For >6 To 12 Pitch, Add</i>	2.46	
03 52 16 00-0015 Lightweight Channel Slab <small>(03 52 16)</small>		
03 52 16 00-0016 SF 2-3/4" Thick Lightweight Channel Slab, Straight Insulating Concrete Roof Deck	4.74	
03 52 16 00-0017 SF 3-1/2" Thick Lightweight Channel Slab, Straight Insulating Concrete Roof Deck	5.05	
03 52 16 00-0018 SF 3-3/4" Thick Lightweight Channel Slab, Straight Insulating Concrete Roof Deck	5.16	
03 52 16 00-0019 SF 4-3/4" Thick Lightweight Channel Slab, Straight Insulating Concrete Roof Deck	5.33	
03 52 16 00-0020 SF 2-3/4" Thick Lightweight Channel Slab, Chopped Insulating Concrete Roof Deck	6.87	
03 52 16 00-0021 SF 3-1/2" Thick Lightweight Channel Slab, Chopped Insulating Concrete Roof Deck	6.94	
03 52 16 00-0022 SF 3-3/4" Thick Lightweight Channel Slab, Chopped Insulating Concrete Roof Deck	7.06	
03 52 16 00-0023 SF 4-3/4" Thick Lightweight Channel Slab, Chopped Insulating Concrete Roof Deck	7.18	
03 53 Concrete Topping <small>(03 50)</small>		
<small>Note: Installed over new or existing concrete.</small>		
03 53 00 00-0001 Integral Topping Including Hard Trowel Finish <small>(03 53)</small>		
<small>Note: Using 1:1:2 mix.</small>		
03 53 00 00-0002 SF 3/16" Thick Hard Trowel Integral Concrete Topping, 1:1:2 Mix	1.94	
03 53 00 00-0003 SF 1/2" Thick Hard Trowel Integral Concrete Topping, 1:1:2 Mix	2.17	
03 53 00 00-0004 SF 3/4" Thick Hard Trowel Integral Concrete Topping, 1:1:2 Mix	2.52	
03 53 00 00-0005 SF 1" Thick Hard Trowel Integral Concrete Topping, 1:1:2 Mix	2.97	
03 53 00 00-0006 SF 2" Thick Hard Trowel Integral Concrete Topping, 1:1:2 Mix	4.15	
03 53 00 00-0007 SF 2-1/2" Thick Hard Trowel Integral Concrete Topping, 1:1:2 Mix	3.48	
03 53 00 00-0008 SF 3" Thick Hard Trowel Integral Concrete Topping, 1:1:2 Mix	3.88	
03 53 00 00-0009 Granolithic Topping Laid After <small>(03 53)</small>		
<small>Note: Using 1:1:1-1/2 mix.</small>		
03 53 00 00-0010 SF 1/2" Thick Concrete Topping, Granolithic Laid After Finish, 1:1:1-1/2 Mix	3.27	

03 Concrete**03 50 Cast Decks And Underlayment**

03 53 Concrete Topping



MINOR			TOTAL DIRECT	DEMOLITION
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST
03 53 00 00-0011	SF	1" Thick Concrete Topping, Granolithic Laid After Finish, 1:1:1-1/2 Mix	3.51	
03 53 00 00-0012	SF	2" Thick Concrete Topping, Granolithic Laid After Finish, 1:1:1-1/2 Mix	4.36	
03 54		Cast Underlayment <small>(03 50)</small>		
Note: Includes primer. Excludes sandblasting existing smooth finished concrete surface (where necessary).				
03 54 16		Hydraulic Cement Underlayment <small>(03 54)</small>		
03 54 16 00-0001		Self Leveling Cementitious Underlayment For Floors <small>(03 54 16)</small>		
Note: Includes primer.				
03 54 16 00-0002	SF	1/8" Thick Self Leveling Cementitious Underlayment For Floors Including Surface Preparation	1.58	
03 54 16 00-0003	SF	1/4" Thick Self Leveling Cementitious Underlayment For Floors Including Surface Preparation	2.36	
03 54 16 00-0004	SF	1/2" Thick Self Leveling Cementitious Underlayment For Floors Including Surface Preparation	3.93	
03 54 16 00-0005	SF	3/4" Thick Self Leveling Cementitious Underlayment For Floors Including Surface Preparation	5.49	
03 54 16 00-0006	SF	1" Thick Self Leveling Cementitious Underlayment For Floors Including Surface Preparation	7.05	
03 54 16 00-0007	SF	1-1/4" Thick Self Leveling Cementitious Underlayment For Floors Including Surface Preparation	9.13	
03 54 16 00-0008	SF	1-1/2" Thick Self Leveling Cementitious Underlayment For Floors Including Surface Preparation	10.18	
03 54 16 00-0009	SF	1-3/4" Thick Self Leveling Cementitious Underlayment For Floors Including Surface Preparation	13.31	
03 60		Grouting <small>(03)</small>		
03 61		Cementitious Grouting <small>(03 60)</small>		
Note: 1 part cement to 3 parts sand by volume.				
03 61 16		Cementitious Flowable Grout <small>(03 61)</small>		
03 61 16 00-0001		Flowable Grout <small>(03 61 16)</small>		
03 61 16 00-0002	CY	Cementitious Flowable Grout.....	315.09	
03 62		Non-Shrink Grouting <small>(03 60)</small>		
03 62 13		Non-Metallic Non-Shrink Grouting <small>(03 62)</small>		
03 62 13 00-0001		Fluid Type, Non-Metallic Non-Shrink Grouting <small>(03 62 13)</small>		
03 62 13 00-0002	SF	1" Deep, Fluid Type, Non-Metallic Non-Shrink Grout For Grouting Bases.....	18.58	
03 62 13 00-0003	SF	2" Deep, Fluid Type, Non-Metallic Non-Shrink Grout For Grouting Bases.....	27.13	
03 62 13 00-0004		Non-Metallic Non-Shrink Grouting <small>(03 62 13)</small>		
03 62 13 00-0005	SF	1" Deep, Non-Metallic Non-Shrink Grout For Grouting Bases	28.30	
03 62 13 00-0006	SF	2" Deep, Non-Metallic Non-Shrink Grout For Grouting Bases	44.88	
03 62 13 00-0007		Non-Metallic Non-Shrink Grouting For Joints <small>(03 62 13)</small>		
03 62 13 00-0008		1/2" Joint Thickness, Non-Metallic Non-Shrink Grout For Joints <small>(03 62 13 00-0007)</small>		
03 62 13 00-0009	LF	4" Deep x 1/2" Thick, Non-Metallic Non-Shrink Grout For Joints	1.55	
03 62 13 00-0010	LF	6" Deep x 1/2" Thick, Non-Metallic Non-Shrink Grout For Joints	2.02	
03 62 13 00-0011	LF	8" Deep x 1/2" Thick, Non-Metallic Non-Shrink Grout For Joints	2.68	
03 62 13 00-0012		1" Joint Thickness, Non-Metallic Non-Shrink Grout For Joints <small>(03 62 13 00-0007)</small>		
03 62 13 00-0013	LF	4" Deep x 1" Thick, Non-Metallic Non-Shrink Grout For Joints	2.27	
03 62 13 00-0014	LF	6" Deep x 1" Thick, Non-Metallic Non-Shrink Grout For Joints	3.00	
03 62 13 00-0015	LF	8" Deep x 1" Thick, Non-Metallic Non-Shrink Grout For Joints	3.99	
03 62 16		Metallic Non-Shrink Grouting <small>(03 62)</small>		
03 62 16 00-0001		Metallic Non-Shrink Grouting <small>(03 62 16)</small>		
03 62 16 00-0002	SF	1" Deep, Metallic Non-Shrink Grout For Grouting Bases	24.32	
03 62 16 00-0003	SF	2" Deep, Metallic Non-Shrink Grout For Grouting Bases	37.16	
03 62 16 00-0004		Metallic Non-Shrink Grouting For Joints <small>(03 62 16)</small>		
03 62 16 00-0005		1/2" Joint Thickness, Metallic Non-Shrink Grout For Joints <small>(03 62 16 00-0004)</small>		
03 62 16 00-0006	LF	4" Deep x 1/2" Thick, Metallic Non-Shrink Grout For Joints.....	1.30	
03 62 16 00-0007	LF	6" Deep x 1/2" Thick, Metallic Non-Shrink Grout For Joints.....	1.65	
03 62 16 00-0008	LF	8" Deep x 1/2" Thick, Metallic Non-Shrink Grout For Joints.....	2.20	
03 62 16 00-0009		1" Joint Thickness, Metallic Non-Shrink Grout For Joints <small>(03 62 16 00-0004)</small>		
03 62 16 00-0010	LF	4" Deep x 1" Thick, Metallic Non-Shrink Grout For Joints.....	1.79	
03 62 16 00-0011	LF	6" Deep x 1" Thick, Metallic Non-Shrink Grout For Joints.....	2.24	
03 62 16 00-0012	LF	8" Deep x 1" Thick, Metallic Non-Shrink Grout For Joints.....	3.01	



Concrete	03	03
Grouting	03 60	
Epoxy Grouting	03 63	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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03 63 Epoxy Grouting (03 60)

03 63 00 00-0001 Spray On Concrete Epoxy Grout (03 63)

Note: (Sika 224) per thickness per coat.

03 63 00 00-0002	SF	1/2" Thick Coat Spray On Concrete Epoxy Grout.....	4.15
		<i>For Color, Add</i>	1.10
03 63 00 00-0003	SF	3/4" Thick Coat Spray On Concrete Epoxy Grout.....	5.67
		<i>For Color, Add</i>	1.65
03 63 00 00-0004	SF	1" Thick Coat Spray On Concrete Epoxy Grout.....	7.28
		<i>For Color, Add</i>	2.20

03 64 Injection Grouting (03 60)

Note: By volume of void filled. Includes injection ports.

03 64 23 Epoxy Injection Grouting (03 64)

03 64 23 00-0001 Epoxy Injection Grouting (03 64 23)

03 64 23 00-0002	CF	Pressure Injected Epoxy Grout.....	791.81
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03 64 26 Cementitious Injection Grouting (03 64)

03 64 26 00-0001 Cementitious Injection Grouting (03 64 26)

03 64 26 00-0002	CF	Pressure Injected Cementitious Grout.....	63.29
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03 80 Concrete Cutting And Boring (03)

03 81 Concrete Cutting (03 80)

03 81 13 Flat Concrete Sawing (03 81)

See CSI section 02 41 19 13-0049 for saw cutting.

03 81 16 Track Mounted Concrete Wall Sawing (03 81)

See CSI section 02 41 19 13-0049 for saw cutting.

03 82 Concrete Boring (03 80)

03 82 13 Concrete Core Drilling (03 82)

See CSI section 02 41 19 13-0071 for core drilling.

END OF SECTION 03

03	03	Concrete
	03 80	Concrete Cutting And Boring
	03 82	Concrete Boring



MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

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MINOR	CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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04 Masonry

04 01 Maintenance Of Masonry ⁽⁰⁴⁾

04 01 20 Maintenance Of Unit Masonry ^(04 01)

Note: For use on existing brick. Includes clean-up of debris. Excludes disposal.

04 01 20 41 Unit Masonry Stabilization ^(04 01 20)

04 01 20 41-0001	Masonry Repair (Helifix®) ^(04 01 20 41)		
04 01 20 41-0002	GROUTED TIES FOR STABILIZING SOLID MASONRY (HELIFIX® CEMTIE) ^(04 01 20 41-0001)		
	Note: Austenitic stainless steel. For stabilizing solid masonry. Includes drilling, cementitious grout and patching surface.		
04 01 20 41-0003	304 STAINLESS STEEL HELICAL PIN, GROUTED TIES FOR STABILIZING SOLID MASONRY (HELIFIX® CEMTIE) ^(04 01 20 41-0002)		
04 01 20 41-0004	EA 8mm Diameter, 350mm Length, 304 Stainless Steel Helical Pin, GROUTED TIE FOR STABILIZING SOLID MASONRY (HELIFIX® CEMTIE)	20.38	
	For Up To 10, Add	6.70	
	For >10 To 50, Add	3.35	
04 01 20 41-0005	EA 8mm Diameter, 600mm Length, 304 Stainless Steel Helical Pin, GROUTED TIE FOR STABILIZING SOLID MASONRY (HELIFIX® CEMTIE)	31.18	
	For Up To 10, Add	6.70	
	For >10 To 50, Add	3.35	
04 01 20 41-0006	EA 8mm Diameter, 900mm Length, 304 Stainless Steel Helical Pin, GROUTED TIE FOR STABILIZING SOLID MASONRY (HELIFIX® CEMTIE)	42.91	
	For Up To 10, Add	6.70	
	For >10 To 50, Add	3.35	
04 01 20 41-0007	316 STAINLESS STEEL HELICAL PIN, GROUTED TIES FOR STABILIZING SOLID MASONRY (HELIFIX® CEMTIE) ^(04 01 20 41-0002)		
04 01 20 41-0008	EA 8mm Diameter, 350mm Length, 316 Stainless Steel Helical Pin, GROUTED TIE FOR STABILIZING SOLID MASONRY (HELIFIX® CEMTIE)	22.72	
	For Up To 10, Add	6.70	
	For >10 To 50, Add	3.35	
04 01 20 41-0009	EA 8mm Diameter, 600mm Length, 316 Stainless Steel Helical Pin, GROUTED TIE FOR STABILIZING SOLID MASONRY (HELIFIX® CEMTIE)	35.34	
	For Up To 10, Add	6.70	
	For >10 To 50, Add	3.35	
04 01 20 41-0010	EA 8mm Diameter, 900mm Length, 316 Stainless Steel Helical Pin, GROUTED TIE FOR STABILIZING SOLID MASONRY (HELIFIX® CEMTIE)	49.15	
	For Up To 10, Add	6.70	
	For >10 To 50, Add	3.35	
04 01 20 41-0011	TIES FOR STITCHING MASONRY CRACKS (HELIFIX® HELIBAR) ^(04 01 20 41-0001)		
	Note: Austenitic stainless steel. For stabilizing cracked masonry. Includes removing horizontal mortar and re-pointing mortar bed. Includes cementitious grout. Excludes repairing vertical crack.		
04 01 20 41-0012	304 STAINLESS STEEL HELICAL PIN, TIES FOR STITCHING MASONRY CRACKS (HELIFIX® HELIBAR) ^(04 01 20 41-0011)		
04 01 20 41-0013	EA 4.5mm Diameter, 1m Length, 304 Stainless Steel Helical Pin, Tie For Stitching Masonry Cracks (Helifix® Helibar)	49.06	
	For Up To 10, Add	26.79	
	For >10 To 50, Add	13.40	
04 01 20 41-0014	EA 4.5mm Diameter, 1.2m Length, 304 Stainless Steel Helical Pin, Tie For Stitching Masonry Cracks (Helifix® Helibar)	55.19	
	For Up To 10, Add	26.79	
	For >10 To 50, Add	13.40	
04 01 20 41-0015	EA 4.5mm Diameter, 7m Length, 304 Stainless Steel Helical Pin, Tie For Stitching Masonry Cracks (Helifix® Helibar)	197.59	
	For Up To 10, Add	26.79	
	For >10 To 50, Add	13.40	
04 01 20 41-0016	EA 6mm Diameter, 1m Length, 304 Stainless Steel Helical Pin, Tie For Stitching Masonry Cracks (Helifix® Helibar)	49.06	
	For Up To 10, Add	26.79	
	For >10 To 50, Add	13.40	
04 01 20 41-0017	EA 6mm Diameter, 1.2m Length, 304 Stainless Steel Helical Pin, Tie For Stitching Masonry Cracks (Helifix® Helibar)	55.19	
	For Up To 10, Add	26.79	
	For >10 To 50, Add	13.40	
04 01 20 41-0018	EA 6mm Diameter, 1.5m Length, 304 Stainless Steel Helical Pin, Tie For Stitching Masonry Cracks (Helifix® Helibar)	62.18	
	For Up To 10, Add	26.79	
	For >10 To 50, Add	13.40	
04 01 20 41-0019	EA 6mm Diameter, 2m Length, 304 Stainless Steel Helical Pin, Tie For Stitching Masonry Cracks (Helifix® Helibar)	75.30	
	For Up To 10, Add	26.79	
	For >10 To 50, Add	13.40	
04 01 20 41-0020	EA 6mm Diameter, 7m Length, 304 Stainless Steel Helical Pin, Tie For Stitching Masonry Cracks (Helifix® Helibar)	197.59	
	For Up To 10, Add	26.79	
	For >10 To 50, Add	13.40	

04 Masonry**04 01 Maintenance Of Masonry****04 01 20 Maintenance Of Unit Masonry**MINOR
CSI UOM DESCRIPTIONTOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

04 01 20 41-0021	316 Stainless Steel Helical Pin, Ties For Stitching Masonry Cracks (Helifix® Helibar) <small>(04 01 20 41-0011)</small>	
04 01 20 41-0022	EA 4.5mm Diameter, 1m Length, 316 Stainless Steel Helical Pin, Tie For Stitching Masonry Cracks (Helifix® Helibar)	52.40
	For Up To 10, Add	26.79
	For >10 To 50, Add	13.40
04 01 20 41-0023	EA 4.5mm Diameter, 1.2m Length, 316 Stainless Steel Helical Pin, Tie For Stitching Masonry Cracks (Helifix® Helibar)	59.65
	For Up To 10, Add	26.79
	For >10 To 50, Add	13.40
04 01 20 41-0024	EA 4.5mm Diameter, 7m Length, 316 Stainless Steel Helical Pin, Tie For Stitching Masonry Cracks (Helifix® Helibar)	225.43
	For Up To 10, Add	26.79
	For >10 To 50, Add	13.40
04 01 20 41-0025	EA 6mm Diameter, 1m Length, 316 Stainless Steel Helical Pin, Tie For Stitching Masonry Cracks (Helifix® Helibar)	52.40
	For Up To 10, Add	26.79
	For >10 To 50, Add	13.40
04 01 20 41-0026	EA 6mm Diameter, 1.2m Length, 316 Stainless Steel Helical Pin, Tie For Stitching Masonry Cracks (Helifix® Helibar)	59.65
	For Up To 10, Add	26.79
	For >10 To 50, Add	13.40
04 01 20 41-0027	EA 6mm Diameter, 1.5m Length, 316 Stainless Steel Helical Pin, Tie For Stitching Masonry Cracks (Helifix® Helibar)	67.74
	For Up To 10, Add	26.79
	For >10 To 50, Add	13.40
04 01 20 41-0028	EA 6mm Diameter, 2m Length, 316 Stainless Steel Helical Pin, Tie For Stitching Masonry Cracks (Helifix® Helibar)	83.10
	For Up To 10, Add	26.79
	For >10 To 50, Add	13.40
04 01 20 41-0029	EA 6mm Diameter, 7m Length, 316 Stainless Steel Helical Pin, Tie For Stitching Masonry Cracks (Helifix® Helibar)	225.43
	For Up To 10, Add	26.79
	For >10 To 50, Add	13.40
04 01 20 41-0030	Mechanical Repair Anchors (Helifix® TorkFix) <small>(04 01 20 41-0001)</small>	
	Note: Austenitic stainless steel. For stabilizing masonry veneer walls to inner wythes of brick, concrete block, wood studs or steel studs. Includes drilling and patching surface.	
04 01 20 41-0031	304 Stainless Steel, Mechanical Repair Anchors (Helifix® TorkFix) <small>(04 01 20 41-0030)</small>	
04 01 20 41-0032	EA 4-1/2" Length, Brick To Brick/Concrete Block, 304 Stainless Steel, Mechanical Repair Anchor (Helifix® TorkFix)	9.90
	For Up To 10, Add	4.02
	For >10 To 50, Add	2.01
04 01 20 41-0033	EA 5-1/2" Length, Brick To Brick/Concrete Block, 304 Stainless Steel, Mechanical Repair Anchor (Helifix® TorkFix)	11.00
	For Up To 10, Add	4.02
	For >10 To 50, Add	2.01
04 01 20 41-0034	EA 6-1/2" Length, Brick To Brick/Concrete Block, 304 Stainless Steel, Mechanical Repair Anchor (Helifix® TorkFix)	12.10
	For Up To 10, Add	4.02
	For >10 To 50, Add	2.01
04 01 20 41-0035	EA 7-1/2" Length, Brick To Brick/Concrete Block, 304 Stainless Steel, Mechanical Repair Anchor (Helifix® TorkFix)	13.20
	For Up To 10, Add	4.02
	For >10 To 50, Add	2.01
04 01 20 41-0036	EA 8-1/2" Length, Brick To Brick/Concrete Block, 304 Stainless Steel, Mechanical Repair Anchor (Helifix® TorkFix)	14.30
	For Up To 10, Add	4.02
	For >10 To 50, Add	2.01
04 01 20 41-0037	EA 9-1/2" Length, Brick To Brick/Concrete Block, 304 Stainless Steel, Mechanical Repair Anchor (Helifix® TorkFix)	15.40
	For Up To 10, Add	4.02
	For >10 To 50, Add	2.01
04 01 20 41-0038	EA 4-1/2" Length, Brick To Wood Frame/Steel Stud, 304 Stainless Steel, Mechanical Repair Anchor (Helifix® TorkFix)	9.90
	For Up To 10, Add	4.02
	For >10 To 50, Add	2.01
04 01 20 41-0039	EA 5-1/2" Length, Brick To Wood Frame/Steel Stud, 304 Stainless Steel, Mechanical Repair Anchor (Helifix® TorkFix)	11.00
	For Up To 10, Add	4.02
	For >10 To 50, Add	2.01
04 01 20 41-0040	EA 6-1/2" Length, Brick To Wood Frame/Steel Stud, 304 Stainless Steel, Mechanical Repair Anchor (Helifix® TorkFix)	12.10
	For Up To 10, Add	4.02
	For >10 To 50, Add	2.01
04 01 20 41-0041	EA 7-1/2" Length, Brick To Wood Frame/Steel Stud, 304 Stainless Steel, Mechanical Repair Anchor (Helifix® TorkFix)	13.20
	For Up To 10, Add	4.02
	For >10 To 50, Add	2.01
04 01 20 41-0042	EA 8-1/2" Length, Brick To Wood Frame/Steel Stud, 304 Stainless Steel, Mechanical Repair Anchor (Helifix® TorkFix)	14.30
	For Up To 10, Add	4.02
	For >10 To 50, Add	2.01
04 01 20 41-0043	EA 10-1/2" Length, Brick To Wood Frame/Steel Stud, 304 Stainless Steel, Mechanical Repair Anchor (Helifix® TorkFix)	16.50
	For Up To 10, Add	4.02
	For >10 To 50, Add	2.01
04 01 20 41-0044	EA 4-1/2" Length, 304 Stainless Steel, Veneer Panel Anchor (Helifix® TorkFix)	9.90
	For Up To 10, Add	4.02
	For >10 To 50, Add	2.01
04 01 20 41-0045	EA 6-1/2" Length, 304 Stainless Steel, Veneer Panel Anchor (Helifix® TorkFix)	12.10
	For Up To 10, Add	4.02
	For >10 To 50, Add	2.01
04 01 20 41-0046	EA 8" Length, 304 Stainless Steel, Veneer Panel Anchor (Helifix® TorkFix)	13.75
	For Up To 10, Add	4.02
	For >10 To 50, Add	2.01



	MINOR	CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
04 01 20 41-0047		316 Stainless Steel, Mechanical Repair Anchors (Helifix® TorkFix) <small>(04 01 20 41-0030)</small>		
	EA	4-1/2" Length, Brick To Brick/Concrete Block, 316 Stainless Steel, Mechanical Repair Anchor (Helifix® TorkFix).....	9.90	
		<i>For Up To 10, Add</i>	4.02	
		<i>For >10 To 50, Add</i>	2.01	
	EA	5-1/2" Length, Brick To Brick/Concrete Block, 316 Stainless Steel, Mechanical Repair Anchor (Helifix® TorkFix).....	11.00	
		<i>For Up To 10, Add</i>	4.02	
		<i>For >10 To 50, Add</i>	2.01	
	EA	6-1/2" Length, Brick To Brick/Concrete Block, 316 Stainless Steel, Mechanical Repair Anchor (Helifix® TorkFix).....	12.10	
		<i>For Up To 10, Add</i>	4.02	
		<i>For >10 To 50, Add</i>	2.01	
	EA	7-1/2" Length, Brick To Brick/Concrete Block, 316 Stainless Steel, Mechanical Repair Anchor (Helifix® TorkFix).....	13.20	
		<i>For Up To 10, Add</i>	4.02	
		<i>For >10 To 50, Add</i>	2.01	
	EA	8-1/2" Length, Brick To Brick/Concrete Block, 316 Stainless Steel, Mechanical Repair Anchor (Helifix® TorkFix).....	14.30	
		<i>For Up To 10, Add</i>	4.02	
		<i>For >10 To 50, Add</i>	2.01	
	EA	9-1/2" Length, Brick To Brick/Concrete Block, 316 Stainless Steel, Mechanical Repair Anchor (Helifix® TorkFix).....	15.40	
		<i>For Up To 10, Add</i>	4.02	
		<i>For >10 To 50, Add</i>	2.01	
	EA	4-1/2" Length, Brick To Wood Frame/Steel Stud, 316 Stainless Steel, Mechanical Repair Anchor (Helifix® TorkFix).....	9.90	
		<i>For Up To 10, Add</i>	4.02	
		<i>For >10 To 50, Add</i>	2.01	
	EA	5-1/2" Length, Brick To Wood Frame/Steel Stud, 316 Stainless Steel, Mechanical Repair Anchor (Helifix® TorkFix).....	11.00	
		<i>For Up To 10, Add</i>	4.02	
		<i>For >10 To 50, Add</i>	2.01	
	EA	6-1/2" Length, Brick To Wood Frame/Steel Stud, 316 Stainless Steel, Mechanical Repair Anchor (Helifix® TorkFix).....	12.10	
		<i>For Up To 10, Add</i>	4.02	
		<i>For >10 To 50, Add</i>	2.01	
	EA	7-1/2" Length, Brick To Wood Frame/Steel Stud, 316 Stainless Steel, Mechanical Repair Anchor (Helifix® TorkFix).....	13.20	
		<i>For Up To 10, Add</i>	4.02	
		<i>For >10 To 50, Add</i>	2.01	
	EA	8-1/2" Length, Brick To Wood Frame/Steel Stud, 316 Stainless Steel, Mechanical Repair Anchor (Helifix® TorkFix).....	14.30	
		<i>For Up To 10, Add</i>	4.02	
		<i>For >10 To 50, Add</i>	2.01	
	EA	10-1/2" Length, Brick To Wood Frame/Steel Stud, 316 Stainless Steel, Mechanical Repair Anchor (Helifix® TorkFix).....	16.50	
		<i>For Up To 10, Add</i>	4.02	
		<i>For >10 To 50, Add</i>	2.01	
	EA	4-1/2" Length, 316 Stainless Steel, Veneer Panel Anchor (Helifix® TorkFix).....	9.90	
		<i>For Up To 10, Add</i>	4.02	
		<i>For >10 To 50, Add</i>	2.01	
	EA	6-1/2" Length, 316 Stainless Steel, Veneer Panel Anchor (Helifix® TorkFix).....	12.10	
		<i>For Up To 10, Add</i>	4.02	
		<i>For >10 To 50, Add</i>	2.01	
	EA	8" Length, 316 Stainless Steel, Veneer Panel Anchor (Helifix® TorkFix).....	13.75	
		<i>For Up To 10, Add</i>	4.02	
		<i>For >10 To 50, Add</i>	2.01	
04 01 20 41-0063		Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®) <small>(04 01 20 41-0001)</small>		
		<small>Note: Austenitic stainless steel. For pinning stucco, terracotta, granite, marble, etc., to concrete block, brick or solid concrete. Includes drilling and patching surface.</small>		
04 01 20 41-0064		304 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®) <small>(04 01 20 41-0063)</small>		
	EA	8mm Diameter, 115mm Length, 304 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	7.31	
		<i>For Up To 10, Add</i>	4.02	
		<i>For >10 To 50, Add</i>	2.01	
		<i>For Metal Stud Clip, Add</i>	2.25	
	EA	8mm Diameter, 155mm Length, 304 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	7.71	
		<i>For Up To 10, Add</i>	4.02	
		<i>For >10 To 50, Add</i>	2.01	
		<i>For Metal Stud Clip, Add</i>	2.25	
	EA	8mm Diameter, 170mm Length, 304 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	7.78	
		<i>For Up To 10, Add</i>	4.02	
		<i>For >10 To 50, Add</i>	2.01	
		<i>For Metal Stud Clip, Add</i>	2.25	
	EA	8mm Diameter, 195mm Length, 304 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	7.95	
		<i>For Up To 10, Add</i>	4.02	
		<i>For >10 To 50, Add</i>	2.01	
		<i>For Metal Stud Clip, Add</i>	2.25	

04 Masonry**04 01 Maintenance Of Masonry****04 01 20 Maintenance Of Unit Masonry**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
04 01 20 41-0069	EA		8mm Diameter, 220mm Length, 304 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	8.24	
			<i>For Up To 10, Add</i>	4.02	
			<i>For >10 To 50, Add</i>	2.01	
			<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0070	EA		8mm Diameter, 245mm Length, 304 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	8.48	
			<i>For Up To 10, Add</i>	4.02	
			<i>For >10 To 50, Add</i>	2.01	
			<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0071	EA		8mm Diameter, 270mm Length, 304 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	8.60	
			<i>For Up To 10, Add</i>	4.02	
			<i>For >10 To 50, Add</i>	2.01	
			<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0072	EA		8mm Diameter, 295mm Length, 304 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	8.75	
			<i>For Up To 10, Add</i>	4.02	
			<i>For >10 To 50, Add</i>	2.01	
			<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0073	EA		8mm Diameter, 325mm Length, 304 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	9.46	
			<i>For Up To 10, Add</i>	4.02	
			<i>For >10 To 50, Add</i>	2.01	
			<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0074	EA		8mm Diameter, 350mm Length, 304 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	9.56	
			<i>For Up To 10, Add</i>	4.02	
			<i>For >10 To 50, Add</i>	2.01	
			<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0075	EA		8mm Diameter, 400mm Length, 304 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	10.40	
			<i>For Up To 10, Add</i>	4.02	
			<i>For >10 To 50, Add</i>	2.01	
			<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0076	EA		8mm Diameter, 450mm Length, 304 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	11.12	
			<i>For Up To 10, Add</i>	4.02	
			<i>For >10 To 50, Add</i>	2.01	
			<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0077	EA		8mm Diameter, 500mm Length, 304 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	11.73	
			<i>For Up To 10, Add</i>	4.02	
			<i>For >10 To 50, Add</i>	2.01	
			<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0078	EA		8mm Diameter, 550mm Length, 304 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	13.89	
			<i>For Up To 10, Add</i>	4.02	
			<i>For >10 To 50, Add</i>	2.01	
			<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0079	EA		8mm Diameter, 600mm Length, 304 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	15.81	
			<i>For Up To 10, Add</i>	4.02	
			<i>For >10 To 50, Add</i>	2.01	
			<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0080	EA		8mm Diameter, 700mm Length, 304 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	18.36	
			<i>For Up To 10, Add</i>	4.02	
			<i>For >10 To 50, Add</i>	2.01	
			<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0081	EA		10mm Diameter, 125mm Length, 304 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	7.45	
			<i>For Up To 10, Add</i>	4.02	
			<i>For >10 To 50, Add</i>	2.01	
			<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0082	EA		10mm Diameter, 155mm Length, 304 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	7.87	
			<i>For Up To 10, Add</i>	4.02	
			<i>For >10 To 50, Add</i>	2.01	
			<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0083	EA		10mm Diameter, 170mm Length, 304 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	8.26	
			<i>For Up To 10, Add</i>	4.02	
			<i>For >10 To 50, Add</i>	2.01	
			<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0084	EA		10mm Diameter, 195mm Length, 304 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	8.60	
			<i>For Up To 10, Add</i>	4.02	
			<i>For >10 To 50, Add</i>	2.01	
			<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0085	EA		10mm Diameter, 220mm Length, 304 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	8.82	
			<i>For Up To 10, Add</i>	4.02	
			<i>For >10 To 50, Add</i>	2.01	
			<i>For Metal Stud Clip, Add</i>	2.25	



MINOR	TOTAL DIRECT	DEMOLITION
CSI UOM DESCRIPTION	UNIT COST	UNIT COST
04 01 20 41-0086 EA 10mm Diameter, 245mm Length, 304 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	8.97	
<i>For Up To 10, Add</i>	4.02	
<i>For >10 To 50, Add</i>	2.01	
<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0087 EA 10mm Diameter, 270mm Length, 304 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	9.23	
<i>For Up To 10, Add</i>	4.02	
<i>For >10 To 50, Add</i>	2.01	
<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0088 EA 10mm Diameter, 300mm Length, 304 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	9.34	
<i>For Up To 10, Add</i>	4.02	
<i>For >10 To 50, Add</i>	2.01	
<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0089 EA 10mm Diameter, 350mm Length, 304 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	9.83	
<i>For Up To 10, Add</i>	4.02	
<i>For >10 To 50, Add</i>	2.01	
<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0090 EA 10mm Diameter, 400mm Length, 304 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	10.54	
<i>For Up To 10, Add</i>	4.02	
<i>For >10 To 50, Add</i>	2.01	
<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0091 EA 10mm Diameter, 450mm Length, 304 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	11.14	
<i>For Up To 10, Add</i>	4.02	
<i>For >10 To 50, Add</i>	2.01	
<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0092 EA 10mm Diameter, 500mm Length, 304 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	11.89	
<i>For Up To 10, Add</i>	4.02	
<i>For >10 To 50, Add</i>	2.01	
<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0093 EA 10mm Diameter, 550mm Length, 304 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	15.93	
<i>For Up To 10, Add</i>	4.02	
<i>For >10 To 50, Add</i>	2.01	
<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0094 EA 10mm Diameter, 600mm Length, 304 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	18.20	
<i>For Up To 10, Add</i>	4.02	
<i>For >10 To 50, Add</i>	2.01	
<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0095 EA 10mm Diameter, 700mm Length, 304 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	21.72	
<i>For Up To 10, Add</i>	4.02	
<i>For >10 To 50, Add</i>	2.01	
<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0096 EA 8mm Tapered To 6.5mm Diameter, 155mm Length, 304 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix® Asymmetric)	8.37	
<i>For Up To 10, Add</i>	4.02	
<i>For >10 To 50, Add</i>	2.01	
<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0097 EA 8mm Tapered To 6.5mm Diameter, 170mm Length, 304 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix® Asymmetric)	8.63	
<i>For Up To 10, Add</i>	4.02	
<i>For >10 To 50, Add</i>	2.01	
<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0098 EA 8mm Tapered To 6.5mm Diameter, 185mm Length, 304 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix® Asymmetric)	8.79	
<i>For Up To 10, Add</i>	4.02	
<i>For >10 To 50, Add</i>	2.01	
<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0099 EA 8mm Tapered To 6.5mm Diameter, 195mm Length, 304 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix® Asymmetric)	8.91	
<i>For Up To 10, Add</i>	4.02	
<i>For >10 To 50, Add</i>	2.01	
<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0100 EA 8mm Tapered To 6.5mm Diameter, 220mm Length, 304 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix® Asymmetric)	9.26	
<i>For Up To 10, Add</i>	4.02	
<i>For >10 To 50, Add</i>	2.01	
<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0101 EA 8mm Tapered To 6.5mm Diameter, 245mm Length, 304 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix® Asymmetric)	9.82	
<i>For Up To 10, Add</i>	4.02	
<i>For >10 To 50, Add</i>	2.01	
<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0102 EA 8mm Tapered To 6.5mm Diameter, 270mm Length, 304 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix® Asymmetric)	10.03	
<i>For Up To 10, Add</i>	4.02	
<i>For >10 To 50, Add</i>	2.01	
<i>For Metal Stud Clip, Add</i>	2.25	

04 Masonry**04 01 Maintenance Of Masonry****04 01 20 Maintenance Of Unit Masonry**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
04 01 20 41-0103	EA		8mm Tapered To 6.5mm Diameter, 295mm Length, 304 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix® Asymmetric)	10.59	
			<i>For Up To 10, Add</i>	4.02	
			<i>For >10 To 50, Add</i>	2.01	
			<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0104	EA		10mm Tapered To 8mm Diameter, 155mm Length, 304 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix® Asymmetric)	9.03	
			<i>For Up To 10, Add</i>	4.02	
			<i>For >10 To 50, Add</i>	2.01	
			<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0105	EA		10mm Tapered To 8mm Diameter, 170mm Length, 304 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix® Asymmetric)	9.51	
			<i>For Up To 10, Add</i>	4.02	
			<i>For >10 To 50, Add</i>	2.01	
			<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0106	EA		10mm Tapered To 8mm Diameter, 195mm Length, 304 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix® Asymmetric)	9.85	
			<i>For Up To 10, Add</i>	4.02	
			<i>For >10 To 50, Add</i>	2.01	
			<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0107	EA		10mm Tapered To 8mm Diameter, 220mm Length, 304 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix® Asymmetric)	10.07	
			<i>For Up To 10, Add</i>	4.02	
			<i>For >10 To 50, Add</i>	2.01	
			<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0108	EA		10mm Tapered To 8mm Diameter, 245mm Length, 304 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix® Asymmetric)	10.23	
			<i>For Up To 10, Add</i>	4.02	
			<i>For >10 To 50, Add</i>	2.01	
			<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0109	EA		10mm Tapered To 8mm Diameter, 300mm Length, 304 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix® Asymmetric)	10.59	
			<i>For Up To 10, Add</i>	4.02	
			<i>For >10 To 50, Add</i>	2.01	
			<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0110	EA		304 Stainless Steel, Seismic Connector (Helifix® DryFix®)	3.97	
			Note: For installation over the DryFix® helical pin. Excludes removal of grout from the horizontal mortar joint and installation of Helibar or 9 gauge continuous wire.		
			<i>For Up To 10, Add</i>	2.01	
			<i>For >10 To 50, Add</i>	1.01	
04 01 20 41-0111			316 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®) <small>(04 01 20 41-0063)</small>		
04 01 20 41-0112	EA		8mm Diameter, 115mm Length, 316 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®)	7.94	
			<i>For Up To 10, Add</i>	4.02	
			<i>For >10 To 50, Add</i>	2.01	
			<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0113	EA		8mm Diameter, 155mm Length, 316 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®)	8.43	
			<i>For Up To 10, Add</i>	4.02	
			<i>For >10 To 50, Add</i>	2.01	
			<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0114	EA		8mm Diameter, 170mm Length, 316 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®)	8.53	
			<i>For Up To 10, Add</i>	4.02	
			<i>For >10 To 50, Add</i>	2.01	
			<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0115	EA		8mm Diameter, 195mm Length, 316 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®)	8.73	
			<i>For Up To 10, Add</i>	4.02	
			<i>For >10 To 50, Add</i>	2.01	
			<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0116	EA		8mm Diameter, 220mm Length, 316 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®)	9.09	
			<i>For Up To 10, Add</i>	4.02	
			<i>For >10 To 50, Add</i>	2.01	
			<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0117	EA		8mm Diameter, 245mm Length, 316 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®)	9.39	
			<i>For Up To 10, Add</i>	4.02	
			<i>For >10 To 50, Add</i>	2.01	
			<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0118	EA		8mm Diameter, 270mm Length, 316 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®)	9.54	
			<i>For Up To 10, Add</i>	4.02	
			<i>For >10 To 50, Add</i>	2.01	
			<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0119	EA		8mm Diameter, 295mm Length, 316 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®)	9.74	
			<i>For Up To 10, Add</i>	4.02	
			<i>For >10 To 50, Add</i>	2.01	
			<i>For Metal Stud Clip, Add</i>	2.25	



MINOR	TOTAL DIRECT	DEMOLITION
CSI UOM DESCRIPTION	UNIT COST	UNIT COST
04 01 20 41-0120 EA 8mm Diameter, 325mm Length, 316 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	10.47	
<i>For Up To 10, Add</i>	4.02	
<i>For >10 To 50, Add</i>	2.01	
<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0121 EA 8mm Diameter, 350mm Length, 316 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	10.60	
<i>For Up To 10, Add</i>	4.02	
<i>For >10 To 50, Add</i>	2.01	
<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0122 EA 8mm Diameter, 400mm Length, 316 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	11.66	
<i>For Up To 10, Add</i>	4.02	
<i>For >10 To 50, Add</i>	2.01	
<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0123 EA 8mm Diameter, 450mm Length, 316 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	12.55	
<i>For Up To 10, Add</i>	4.02	
<i>For >10 To 50, Add</i>	2.01	
<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0124 EA 8mm Diameter, 500mm Length, 316 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	13.32	
<i>For Up To 10, Add</i>	4.02	
<i>For >10 To 50, Add</i>	2.01	
<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0125 EA 8mm Diameter, 550mm Length, 316 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	16.01	
<i>For Up To 10, Add</i>	4.02	
<i>For >10 To 50, Add</i>	2.01	
<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0126 EA 8mm Diameter, 600mm Length, 316 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	18.20	
<i>For Up To 10, Add</i>	4.02	
<i>For >10 To 50, Add</i>	2.01	
<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0127 EA 8mm Diameter, 700mm Length, 316 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	21.39	
<i>For Up To 10, Add</i>	4.02	
<i>For >10 To 50, Add</i>	2.01	
<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0128 EA 10mm Diameter, 125mm Length, 316 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	8.19	
<i>For Up To 10, Add</i>	4.02	
<i>For >10 To 50, Add</i>	2.01	
<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0129 EA 10mm Diameter, 155mm Length, 316 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	8.68	
<i>For Up To 10, Add</i>	4.02	
<i>For >10 To 50, Add</i>	2.01	
<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0130 EA 10mm Diameter, 170mm Length, 316 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	9.16	
<i>For Up To 10, Add</i>	4.02	
<i>For >10 To 50, Add</i>	2.01	
<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0131 EA 10mm Diameter, 195mm Length, 316 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	9.59	
<i>For Up To 10, Add</i>	4.02	
<i>For >10 To 50, Add</i>	2.01	
<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0132 EA 10mm Diameter, 220mm Length, 316 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	9.87	
<i>For Up To 10, Add</i>	4.02	
<i>For >10 To 50, Add</i>	2.01	
<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0133 EA 10mm Diameter, 245mm Length, 316 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	10.05	
<i>For Up To 10, Add</i>	4.02	
<i>For >10 To 50, Add</i>	2.01	
<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0134 EA 10mm Diameter, 270mm Length, 316 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	10.37	
<i>For Up To 10, Add</i>	4.02	
<i>For >10 To 50, Add</i>	2.01	
<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0135 EA 10mm Diameter, 300mm Length, 316 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	10.50	
<i>For Up To 10, Add</i>	4.02	
<i>For >10 To 50, Add</i>	2.01	
<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0136 EA 10mm Diameter, 350mm Length, 316 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	11.09	
<i>For Up To 10, Add</i>	4.02	
<i>For >10 To 50, Add</i>	2.01	
<i>For Metal Stud Clip, Add</i>	2.25	

04 Masonry**04 01 Maintenance Of Masonry****04 01 20 Maintenance Of Unit Masonry**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
04 01 20 41-0137	EA		10mm Diameter, 400mm Length, 316 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	11.89	
			<i>For Up To 10, Add</i>	4.02	
			<i>For >10 To 50, Add</i>	2.01	
			<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0138	EA		10mm Diameter, 450mm Length, 316 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	12.62	
			<i>For Up To 10, Add</i>	4.02	
			<i>For >10 To 50, Add</i>	2.01	
			<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0139	EA		10mm Diameter, 500mm Length, 316 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	13.56	
			<i>For Up To 10, Add</i>	4.02	
			<i>For >10 To 50, Add</i>	2.01	
			<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0140	EA		10mm Diameter, 550mm Length, 316 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	18.62	
			<i>For Up To 10, Add</i>	4.02	
			<i>For >10 To 50, Add</i>	2.01	
			<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0141	EA		10mm Diameter, 600mm Length, 316 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	21.04	
			<i>For Up To 10, Add</i>	4.02	
			<i>For >10 To 50, Add</i>	2.01	
			<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0142	EA		10mm Diameter, 700mm Length, 316 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix®).....	25.44	
			<i>For Up To 10, Add</i>	4.02	
			<i>For >10 To 50, Add</i>	2.01	
			<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0143	EA		8mm Tapered To 6.5mm Diameter, 155mm Length, 316 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix® Asymmetric).....	9.37	
			<i>For Up To 10, Add</i>	4.02	
			<i>For >10 To 50, Add</i>	2.01	
			<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0144	EA		8mm Tapered To 6.5mm Diameter, 170mm Length, 316 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix® Asymmetric).....	9.65	
			<i>For Up To 10, Add</i>	4.02	
			<i>For >10 To 50, Add</i>	2.01	
			<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0145	EA		8mm Tapered To 6.5mm Diameter, 185mm Length, 316 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix® Asymmetric).....	9.85	
			<i>For Up To 10, Add</i>	4.02	
			<i>For >10 To 50, Add</i>	2.01	
			<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0146	EA		8mm Tapered To 6.5mm Diameter, 195mm Length, 316 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix® Asymmetric).....	10.00	
			<i>For Up To 10, Add</i>	4.02	
			<i>For >10 To 50, Add</i>	2.01	
			<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0147	EA		8mm Tapered To 6.5mm Diameter, 220mm Length, 316 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix® Asymmetric).....	10.44	
			<i>For Up To 10, Add</i>	4.02	
			<i>For >10 To 50, Add</i>	2.01	
			<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0148	EA		8mm Tapered To 6.5mm Diameter, 245mm Length, 316 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix® Asymmetric).....	11.14	
			<i>For Up To 10, Add</i>	4.02	
			<i>For >10 To 50, Add</i>	2.01	
			<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0149	EA		8mm Tapered To 6.5mm Diameter, 270mm Length, 316 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix® Asymmetric).....	11.37	
			<i>For Up To 10, Add</i>	4.02	
			<i>For >10 To 50, Add</i>	2.01	
			<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0150	EA		8mm Tapered To 6.5mm Diameter, 295mm Length, 316 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix® Asymmetric).....	12.06	
			<i>For Up To 10, Add</i>	4.02	
			<i>For >10 To 50, Add</i>	2.01	
			<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0151	EA		10mm Tapered To 8mm Diameter, 155mm Length, 316 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix® Asymmetric).....	10.08	
			<i>For Up To 10, Add</i>	4.02	
			<i>For >10 To 50, Add</i>	2.01	
			<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0152	EA		10mm Tapered To 8mm Diameter, 170mm Length, 316 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix® Asymmetric).....	10.69	
			<i>For Up To 10, Add</i>	4.02	
			<i>For >10 To 50, Add</i>	2.01	
			<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0153	EA		10mm Tapered To 8mm Diameter, 195mm Length, 316 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix® Asymmetric).....	11.12	
			<i>For Up To 10, Add</i>	4.02	
			<i>For >10 To 50, Add</i>	2.01	
			<i>For Metal Stud Clip, Add</i>	2.25	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
04 01 20 41-0154 EA 10mm Tapered To 8mm Diameter, 220mm Length, 316 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix® Asymmetric)	11.39	
<i>For Up To 10, Add</i>	4.02	
<i>For >10 To 50, Add</i>	2.01	
<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0155 EA 10mm Tapered To 8mm Diameter, 245mm Length, 316 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix® Asymmetric)	11.58	
<i>For Up To 10, Add</i>	4.02	
<i>For >10 To 50, Add</i>	2.01	
<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0156 EA 10mm Tapered To 8mm Diameter, 300mm Length, 316 Stainless Steel Helical Pin, Dry Mechanical Pinning And Remedial Tying System (Helifix® DryFix® Asymmetric)	12.03	
<i>For Up To 10, Add</i>	4.02	
<i>For >10 To 50, Add</i>	2.01	
<i>For Metal Stud Clip, Add</i>	2.25	
04 01 20 41-0157 EA 316 Stainless Steel, Seismic Connector (Helifix® DryFix®)	4.46	
Note: For installation over the DryFix® helical pin. Excludes removal of grout from the horizontal mortar joint and installation of Helibar or 9 gauge continuous wire.		
<i>For Up To 10, Add</i>	2.01	
<i>For >10 To 50, Add</i>	1.01	
04 01 20 41-0158 Concrete Patching Pins (Helifix® PatchPin) (04 01 20 41-0001)		
Note: Austenitic stainless steel. For patching reinforced concrete. Includes drilling. Excludes patching mortar.		
04 01 20 41-0159 304 Stainless Steel Helical Pin, Concrete Patching Pins (Helifix® PatchPin)		
(04 01 20 41-0158)		
04 01 20 41-0160 EA 8mm Diameter, 70mm Length, 304 Stainless Steel Helical Pin, Concrete Patching Pin (Helifix® PatchPin)	5.78	
<i>For Up To 10, Add</i>	4.02	
<i>For >10 To 50, Add</i>	2.01	
04 01 20 41-0161 EA 8mm Diameter, 102mm Length, 304 Stainless Steel Helical Pin, Concrete Patching Pin (Helifix® PatchPin)	5.83	
<i>For Up To 10, Add</i>	4.02	
<i>For >10 To 50, Add</i>	2.01	
04 01 20 41-0162 316 Stainless Steel Helical Pin, Concrete Patching Pins (Helifix® PatchPin)		
(04 01 20 41-0158)		
04 01 20 41-0163 EA 8mm Diameter, 70mm Length, 316 Stainless Steel Helical Pin, Concrete Patching Pin (Helifix® PatchPin)	6.12	
<i>For Up To 10, Add</i>	4.02	
<i>For >10 To 50, Add</i>	2.01	
04 01 20 41-0164 EA 8mm Diameter, 102mm Length, 316 Stainless Steel Helical Pin, Concrete Patching Pin (Helifix® PatchPin)	6.20	
<i>For Up To 10, Add</i>	4.02	
<i>For >10 To 50, Add</i>	2.01	
04 01 20 41-0165 Movement Joint Ties (Helifix® Movement Joint Tie) (04 01 20 41-0001)		
Note: Austenitic stainless steel. For creating movement joints in existing walls. Includes removing horizontal mortar and re-pointing mortar bed. Includes cementitious grout.		
04 01 20 41-0166 304 Stainless Steel Helical Pin, Movement Joint Ties (Helifix® Movement Joint Tie) (04 01 20 41-0165)		
04 01 20 41-0167 EA 6mm Diameter, 400mm Length, 304 Stainless Steel Helical Pin, Movement Joint Tie With De-Bond Sleeve (Helifix® Movement Joint Tie)	36.80	
<i>For Up To 10, Add</i>	26.79	
<i>For >10 To 50, Add</i>	13.40	
04 01 20 41-0168 316 Stainless Steel Helical Pin, Movement Joint Ties (Helifix® Movement Joint Tie) (04 01 20 41-0165)		
04 01 20 41-0169 EA 6mm Diameter, 400mm Length, 316 Stainless Steel Helical Pin, Movement Joint Tie With De-Bond Sleeve (Helifix® Movement Joint Tie)	38.34	
<i>For Up To 10, Add</i>	26.79	
<i>For >10 To 50, Add</i>	13.40	
04 01 20 51 Unit Masonry Maintenance (04 01 20)		
04 01 20 51-0001 Grind Unit Masonry (04 01 20 51)		
04 01 20 51-0002 SF Grind Smooth Masonry Wall	2.76	
04 01 20 52 Unit Masonry Cleaning (04 01 20)		
04 01 20 52-0001 Cleaning And Repointing Masonry (04 01 20 52)		
Note: Includes mortar for pointing. Excludes removing mortar.		
04 01 20 52-0002 SF Clean And Repoint Brick Masonry	1.60	
04 01 20 52-0003 SF Clean And Repoint Concrete Block Masonry	1.06	
04 01 20 52-0004 SF Clean And Repoint Brick On Historic Buildings	2.08	
04 01 20 91 Unit Masonry Restoration (04 01 20)		
See CSI section 03 01 30 71-0052 for crack repair.		

04 Masonry**04 01 Maintenance Of Masonry****04 01 20 Maintenance Of Unit Masonry**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
04 01 20 91-0001 Cut And Repoint Masonry <small>(04 01 20 91)</small> Note: Remove existing mortar to 3/4" depth. Repoint with pointing mortar. Includes pointing mortar, cutting, rinsing and cleaning joint.		
04 01 20 91-0002 SF Cut And Repoint Brick, Hard Intact Mortar, Running Bond	9.11	
For Common Bond, Add	0.25	
For Flemish Bond, Add	0.88	
For English Bond, Add	1.44	
For Oversized Or Larger Than Standard, Deduct	-1.37	
For >250 To 1,000, Deduct	-0.31	
For >1,000, Deduct	-0.77	
04 01 20 91-0003 SF Cut And Repoint Brick, Soft, Loose Or Crumbling Mortar, Running Bond	6.92	
For Common Bond, Add	0.17	
For Flemish Bond, Add	0.60	
For English Bond, Add	0.98	
For Oversized Or Larger Than Standard, Deduct	-1.04	
For >250 To 1,000, Deduct	-0.21	
For >1,000, Deduct	-0.56	
04 01 20 91-0004 SF Cut And Repoint Concrete Block, Hard Intact Mortar, Running Bond	5.71	
For Common Bond, Add	0.13	
For Oversized Or Larger Than Standard, Deduct	-0.86	
For >250 To 1,000, Deduct	-0.16	
For >1,000, Deduct	-0.45	
04 01 20 91-0005 SF Cut And Repoint Concrete Block, Soft, Loose Or Crumbling Mortar, Running Bond	4.41	
For Common Bond, Add	0.09	
For Oversized Or Larger Than Standard, Deduct	-0.66	
For >250 To 1,000, Deduct	-0.11	
For >1,000, Deduct	-0.33	
04 01 20 91-0006 LF Cut And Repoint Brick/Block, Irregular Shapes And Other Than Complete SF Area	2.03	
04 01 20 91-0007 Cut And Caulk Masonry <small>(04 01 20 91)</small> Note: Remove existing mortar to 1/2" depth. Replace with caulk. Includes caulk, cutting, rinsing and cleaning joint.		
04 01 20 91-0008 LF Cut And Caulk Masonry, Butyl Caulks	4.04	
For Vertical Expansion Joint Material, Add	0.21	
For 3/4" Deep Cut, Add	1.21	
04 01 20 91-0009 LF Cut And Caulk Masonry, Polysulfide Or Acrylic Caulks	4.98	
For Vertical Expansion Joint Material, Add	0.22	
For 3/4" Deep Cut, Add	1.49	
04 01 20 91-0010 LF Cut And Caulk Masonry, Silicone Caulks	5.92	
For Vertical Expansion Joint Material, Add	0.26	
For 3/4" Deep Cut, Add	1.78	
04 01 20 91-0011 Repair Masonry <small>(04 01 20 91)</small> Note: Includes mortar for repair.		
04 01 20 91-0012 SF Patch And Repair Terra Cotta Walls Or Coping, Including Replacement Of Damaged Material	12.66	
04 01 20 91-0013 SF Patch And Repair Terra Cotta Floors, Including Replacement Of Damaged Material	11.70	
04 01 20 91-0014 LF Chip And Repair With Masonry Patch, Cracks Up To 1/4"	3.06	
04 01 20 91-0015 SF Patching Over Masonry Surface With Elastomeric Paint Using A Trowel 6" Blade	5.15	
04 01 20 91-0016 LF Pressure Grout Block/Brick Using LA City RGA Rule Of General Application 1-91 (Portland Cement Base)	262.98	
04 01 20 91-0017 LF Pressure Grout Block/Brick Master Builders RHEOCEM 900 (Portland Cement Base)	75.03	
04 01 20 91-0018 LF Up To 1/4" Wide, Water Activated Polyurethane Foam Grout, Non Structural Crack Repair For Masonry, Installed With Automated Injection Equipment (SealBoss 1570)	24.43	
For Cracks Accessible From Both Sides, Add	4.94	
04 01 20 91-0019 LF Up To 1/4" Wide, Moisture Tolerant, Low Viscosity, High Strength Epoxy Resin, Structural Crack Repair For Masonry, Installed With Automated Injection Equipment (Sikadur® 52)	22.45	
For Cracks Accessible From Both Sides, Add	4.94	
04 01 20 91-0020 LF Up To 1/4" Wide, Moisture Tolerant, Low Viscosity, High Strength Epoxy Resin, Gravity Fed Structural Crack Repair For Masonry, Surface Applied Trowel (Sikadur® 52)	6.50	
For V-Grooving Crack With Grinder, Add	4.82	
04 01 20 91-0021 LF >1/4" To 1/2" Wide, Moisture Tolerant, Low Viscosity, High Strength Epoxy Resin, Gravity Fed Structural Crack Repair For Masonry, Surface Applied With Trowel (Sikadur® 52)	8.60	
For V-Grooving Crack With Grinder, Add	4.57	
04 01 40 Maintenance of Stone Assemblies <small>(04 01)</small>		
04 01 40 52 Stone Cleaning <small>(04 01 40)</small>		
04 01 40 52-0001 Cleaning And Pointing Stone <small>(04 01 40 52)</small>		
04 01 40 52-0002 SF Clean And Repoint Limestone On Historic Buildings	1.75	
04 01 40 52-0003 SF Clean And Repoint Marble, Tile, Stone Or Granite	1.52	
04 01 40 91 Stone Restoration <small>(04 01 40)</small>		
04 01 40 91-0001 Cut And Repoint <small>(04 01 40 91)</small>		
04 01 40 91-0002 LF Cut And Repoint Stone Work	4.00	
04 01 40 91-0003 Repair <small>(04 01 40 91)</small>		
04 01 40 91-0004 SF Repair Field Stone Walls, Including Remove Damaged Stones And Reset	29.00	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
04 01 40 91-0005 SF Repair Molded Stone.....	2.69	
04 01 40 91-0006 Clean And Patch Existing Stonework (04 01 40 91) Note: Excludes cutting, drilling or anchor bolts if required.		
04 01 40 91-0007 SF Clean And Patch Existing Stonework.....	3.16	
04 01 40 91-0008 Removal Of Deteriorated Stone (04 01 40 91) Note: Includes cutting of stone for removal.		
04 01 40 91-0009 SF Removal Of Deteriorated Stone..... Note: Does not include material for stone replacement	6.22	
04 01 50 Maintenance of Refractory Masonry (04 01)		
04 01 50 52 Refractory Cleaning (04 01 50)		
04 01 50 52-0001 Chimney Cleaning (04 01 50 52)		
04 01 50 52-0002 LF Up To 2 SF Cross Section Chimney Cleaning.....	5.85	
04 01 50 52-0003 LF >2 To 4 SF Cross Section Chimney Cleaning.....	11.69	
04 01 50 52-0004 LF >4 SF Cross Section Chimney Cleaning.....	17.53	
04 05 Common Work Results For Masonry (04)		
04 05 13 Masonry Mortaring (04 05)		
04 05 13 26 Engineered Masonry Mortaring (04 05 13) Note: Mortar, sand and standard supplements are included in the cost of brick, block, stone, simulated or synthetic masonry units.		
04 05 13 26-0001 Masonry Cement Mortar (04 05 13 26) Note: Ratio is bag material to sand.		
04 05 13 26-0002 CF Type M Masonry Cement 1:1:6 Mix.....	4.54	
04 05 13 26-0003 CF Type N Masonry Cement 1:3 Mix.....	4.19	
04 05 13 26-0004 CF Type O Masonry Cement 1:3 Mix.....	4.30	
04 05 13 26-0005 CF Type PM Masonry Cement 1:1:6 Mix, 2,500 PSI.....	4.70	
04 05 13 26-0006 CF Type S Masonry Cement 1/2:1:4 Mix.....	4.96	
04 05 13 26-0007 Mortar Admixture (04 05 13 26)		
04 05 13 26-0008 CF Water - Repellent Stearate - Cost Based On CF Of Mortar.....	0.27	
04 05 13 26-0009 CF Pozzolanic Plasticizers - Cost Based On CF Of Mortar.....	0.05	
04 05 13 26-0010 Color Admixtures For Mortar (04 05 13 26) Note: Costs are based on CF of mortar.		
04 05 13 26-0011 CF Buff Colored Admixture.....	1.72	
04 05 13 26-0012 CF Brown Colored Admixture.....	1.95	
04 05 13 26-0013 CF Black Colored Admixture.....	2.41	
04 05 13 26-0014 CF Red Colored Admixture.....	5.28	
04 05 13 26-0015 Portland Cement (04 05 13 26)		
04 05 13 26-0016 CF Normal Portland Cement (Type I).....	9.16	
04 05 13 26-0017 CF Modified Portland Cement (Type II).....	4.57	
04 05 13 26-0018 CF High Early Strength (Type III).....	4.85	
04 05 13 26-0019 CF White Non Staining Portland Cement (Type I).....	10.15	
04 05 16 Masonry Grouting (04 05)		
04 05 16 26 Engineered Masonry Grouting (04 05 16) Note: Does not include reinforcement.		
04 05 16 26-0001 Bond Beams And Lintels, Concrete Fill (04 05 16 26) Note: Excludes block.		
04 05 16 26-0002 LF Grout Beams And Lintels - 6" Block Concrete Fill Only, 0.1125 CF/LF, 8" Deep.....	3.06	
04 05 16 26-0003 LF Grout Beams And Lintels - 8" Block Concrete Fill Only, 0.20 CF/LF, 8" Deep.....	3.33	
04 05 16 26-0004 LF Grout Beams And Lintels - 10" Block Concrete Fill Only, 0.25 CF/LF, 8" Deep.....	3.72	
04 05 16 26-0005 LF Grout Beams And Lintels, 12" Block Concrete Fill Only, 0.30 CF/LF, 8" Deep.....	4.14	
04 05 16 26-0006 Concrete Block Cores, Solid Filled (04 05 16 26) Note: Per SF of face area filled.		
04 05 16 26-0007 SF Grout Concrete Block Cores- 4" Block Concrete Fill Block Solid (0.067 CF/SF).....	2.41	
04 05 16 26-0008 SF Grout Concrete Block Cores- 6" Block Concrete Fill Block Solid (0.175 CF/SF).....	3.47	
04 05 16 26-0009 SF Grout Concrete Block Cores- 8" Block Concrete Fill Block Solid (0.258 CF/SF).....	4.96	
04 05 16 26-0010 SF Grout Concrete Block Cores- 10" Block Concrete Fill Block Solid (0.34 CF/SF).....	6.08	
04 05 16 26-0011 SF Grout Concrete Block Cores- 12" Block Concrete Fill Block Solid (0.422 CF/SF).....	7.17	

04 Masonry**04 05 Common Work Results For Masonry****04 05 16 Masonry Grouting**

MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
04 05 16 26-0012		Cavity Walls <small>(04 05 16 26)</small> Note: Per SF of face area filled.			
04 05 16 26-0013	SF	Grout Cavity Walls - 2" Space Concrete Fill (0.167 CF/SF)	2.81		
04 05 16 26-0014	SF	Grout Cavity Walls - 3" Space Concrete Fill (0.250 CF/SF)	3.95		
04 05 16 26-0015	SF	Grout Cavity Walls - 4" Space Concrete Fill (0.333 CF/SF)	4.97		
04 05 16 26-0016	SF	Grout Cavity Walls - 6" Space Concrete Fill (0.500 CF/SF)	6.72		
04 05 16 26-0017		Grouting Frames <small>(04 05 16 26)</small>			
04 05 16 26-0018	LF	Grout Door Frames - Grout Fill	4.42		
04 05 16 26-0019	LF	Grout Window Frames - Grout Fill	3.79		
04 05 16 26-0020		Sand Filled Walls <small>(04 05 16 26)</small>			
04 05 16 26-0021		Cavity Walls Sand Fill Concrete Block <small>(04 05 16 26-0020)</small> Note: Per SF of face area filled.			
04 05 16 26-0022	SF	Sand Fill Cavity Walls - 2" Space (0.167 CF/SF)	2.69		
04 05 16 26-0023	SF	Sand Fill Cavity Walls - 3" Space (0.250 CF/SF)	3.75		
04 05 16 26-0024	SF	Sand Fill Cavity Walls - 4" Space (0.333 CF/SF)	4.66		
04 05 16 26-0025	SF	Sand Fill Cavity Walls - 6" Space (0.500 CF/SF)	6.34		
04 05 19		Masonry Anchorage And Reinforcing <small>(04 05)</small>			
04 05 19 13		Continuous Joint Reinforcing <small>(04 05 19)</small> Note: Includes cutting and bending.			
04 05 19 13-0001		Continuous Joint Reinforcing <small>(04 05 19 13)</small>			
04 05 19 13-0002		Ladder-Type, Masonry Wall Reinforcement <small>(04 05 19 13-0001)</small>			
04 05 19 13-0003		Ladder-Type, Masonry Wall Reinforcement <small>(04 05 19 13-0002)</small>			
04 05 19 13-0004		9 Gauge Side Rods, 9 Gauge Cross Rods, Ladder-Type, Masonry Wall Reinforcement <small>(04 05 19 13-0003)</small>			
04 05 19 13-0005	CLF	#4 (For 4" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Ladder-Type, Masonry Wall Reinforcement	33.11		
		For Class 1 Mill Galvanized, Add	1.37		
		For Class 2 Mill Galvanized, Add	2.06		
		For Hot-Dipped Galvanized, Add	3.43		
		For Stainless Steel, Add	13.72		
		For Cavity Drip, Add	0.50		
		For 3-Wire, Add	8.75		
		For Double Side Rods, Add	17.50		
04 05 19 13-0006	CLF	#6 (For 6" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Ladder-Type, Masonry Wall Reinforcement	35.24		
		For Class 1 Mill Galvanized, Add	1.44		
		For Class 2 Mill Galvanized, Add	2.16		
		For Hot-Dipped Galvanized, Add	3.60		
		For Stainless Steel, Add	14.40		
		For Cavity Drip, Add	0.50		
		For 3-Wire, Add	8.75		
		For Double Side Rods, Add	17.50		
04 05 19 13-0007	CLF	#8 (For 8" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Ladder-Type, Masonry Wall Reinforcement	38.19		
		For Class 1 Mill Galvanized, Add	1.52		
		For Class 2 Mill Galvanized, Add	2.28		
		For Hot-Dipped Galvanized, Add	3.80		
		For Stainless Steel, Add	15.18		
		For Cavity Drip, Add	0.50		
		For 3-Wire, Add	8.75		
		For Double Side Rods, Add	17.50		
04 05 19 13-0008	CLF	#10 (For 10" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Ladder-Type, Masonry Wall Reinforcement	41.68		
		For Class 1 Mill Galvanized, Add	1.61		
		For Class 2 Mill Galvanized, Add	2.41		
		For Hot-Dipped Galvanized, Add	4.02		
		For Stainless Steel, Add	16.06		
		For Cavity Drip, Add	0.50		
		For 3-Wire, Add	8.75		
		For Double Side Rods, Add	17.50		
04 05 19 13-0009	CLF	#12 (For 12" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Ladder-Type, Masonry Wall Reinforcement	45.86		
		For Class 1 Mill Galvanized, Add	1.69		
		For Class 2 Mill Galvanized, Add	2.54		
		For Hot-Dipped Galvanized, Add	4.23		
		For Stainless Steel, Add	16.92		
		For Cavity Drip, Add	0.50		
		For 3-Wire, Add	8.75		
		For Double Side Rods, Add	17.50		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
04 05 19 13-0010 CLF #13 (For 13" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Ladder-Type, Masonry Wall Reinforcement	49.05	
<i>For Class 1 Mill Galvanized, Add</i>	1.73	
<i>For Class 2 Mill Galvanized, Add</i>	2.60	
<i>For Hot-Dipped Galvanized, Add</i>	4.34	
<i>For Stainless Steel, Add</i>	17.34	
<i>For Cavity Drip, Add</i>	0.50	
<i>For 3-Wire, Add</i>	8.75	
<i>For Double Side Rods, Add</i>	17.50	
04 05 19 13-0011 CLF #14 (For 14" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Ladder-Type, Masonry Wall Reinforcement	51.31	
<i>For Class 1 Mill Galvanized, Add</i>	1.78	
<i>For Class 2 Mill Galvanized, Add</i>	2.67	
<i>For Hot-Dipped Galvanized, Add</i>	4.46	
<i>For Stainless Steel, Add</i>	17.82	
<i>For Cavity Drip, Add</i>	0.50	
<i>For 3-Wire, Add</i>	8.75	
<i>For Double Side Rods, Add</i>	17.50	
04 05 19 13-0012 CLF #16 (For 16" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Ladder-Type, Masonry Wall Reinforcement	57.35	
<i>For Class 1 Mill Galvanized, Add</i>	2.45	
<i>For Class 2 Mill Galvanized, Add</i>	3.68	
<i>For Hot-Dipped Galvanized, Add</i>	6.13	
<i>For Stainless Steel, Add</i>	24.50	
<i>For Cavity Drip, Add</i>	0.50	
<i>For 3-Wire, Add</i>	8.75	
<i>For Double Side Rods, Add</i>	17.50	
04 05 19 13-0013 CLF #18 (For 18" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Ladder-Type, Masonry Wall Reinforcement	66.73	
<i>For Class 1 Mill Galvanized, Add</i>	3.79	
<i>For Class 2 Mill Galvanized, Add</i>	5.68	
<i>For Hot-Dipped Galvanized, Add</i>	9.47	
<i>For Stainless Steel, Add</i>	37.88	
<i>For Cavity Drip, Add</i>	0.50	
<i>For 3-Wire, Add</i>	8.75	
<i>For Double Side Rods, Add</i>	17.50	
04 05 19 13-0014 3/16" Side Rods, 9 Gauge Cross Rods, Ladder-Type, Masonry Wall Reinforcement <small>(04 05 19 13-0003)</small>		
04 05 19 13-0015 CLF #4 (For 4" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Ladder-Type, Masonry Wall Reinforcement	36.92	
<i>For Class 1 Mill Galvanized, Add</i>	2.13	
<i>For Class 2 Mill Galvanized, Add</i>	3.20	
<i>For Hot-Dipped Galvanized, Add</i>	5.33	
<i>For Stainless Steel, Add</i>	21.32	
<i>For Cavity Drip, Add</i>	0.50	
<i>For 3-Wire, Add</i>	8.75	
<i>For Double Side Rods, Add</i>	17.50	
04 05 19 13-0016 CLF #6 (For 6" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Ladder-Type, Masonry Wall Reinforcement	39.09	
<i>For Class 1 Mill Galvanized, Add</i>	2.21	
<i>For Class 2 Mill Galvanized, Add</i>	3.32	
<i>For Hot-Dipped Galvanized, Add</i>	5.53	
<i>For Stainless Steel, Add</i>	22.10	
<i>For Cavity Drip, Add</i>	0.50	
<i>For 3-Wire, Add</i>	8.75	
<i>For Double Side Rods, Add</i>	17.50	
04 05 19 13-0017 CLF #8 (For 8" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Ladder-Type, Masonry Wall Reinforcement	42.08	
<i>For Class 1 Mill Galvanized, Add</i>	2.30	
<i>For Class 2 Mill Galvanized, Add</i>	3.44	
<i>For Hot-Dipped Galvanized, Add</i>	5.74	
<i>For Stainless Steel, Add</i>	22.96	
<i>For Cavity Drip, Add</i>	0.50	
<i>For 3-Wire, Add</i>	8.75	
<i>For Double Side Rods, Add</i>	17.50	
04 05 19 13-0018 CLF #10 (For 10" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Ladder-Type, Masonry Wall Reinforcement	45.53	
<i>For Class 1 Mill Galvanized, Add</i>	2.38	
<i>For Class 2 Mill Galvanized, Add</i>	3.56	
<i>For Hot-Dipped Galvanized, Add</i>	5.94	
<i>For Stainless Steel, Add</i>	23.76	
<i>For Cavity Drip, Add</i>	0.50	
<i>For 3-Wire, Add</i>	8.75	
<i>For Double Side Rods, Add</i>	17.50	
04 05 19 13-0019 CLF #12 (For 12" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Ladder-Type, Masonry Wall Reinforcement	49.70	
<i>For Class 1 Mill Galvanized, Add</i>	2.46	
<i>For Class 2 Mill Galvanized, Add</i>	3.69	
<i>For Hot-Dipped Galvanized, Add</i>	6.15	
<i>For Stainless Steel, Add</i>	24.60	
<i>For Cavity Drip, Add</i>	0.50	
<i>For 3-Wire, Add</i>	8.75	
<i>For Double Side Rods, Add</i>	17.50	

04 Masonry**04 05 Common Work Results For Masonry****04 05 19 Masonry Anchorage And Reinforcing**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
04 05 19 13-0020	CLF	#13 (For 13" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Ladder-Type, Masonry Wall Reinforcement		52.90	
		<i>For Class 1 Mill Galvanized, Add</i>		2.51	
		<i>For Class 2 Mill Galvanized, Add</i>		3.76	
		<i>For Hot-Dipped Galvanized, Add</i>		6.27	
		<i>For Stainless Steel, Add</i>		25.06	
		<i>For Cavity Drip, Add</i>		0.50	
		<i>For 3-Wire, Add</i>		8.75	
		<i>For Double Side Rods, Add</i>		17.50	
04 05 19 13-0021	CLF	#14 (For 14" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Ladder-Type, Masonry Wall Reinforcement		55.14	
		<i>For Class 1 Mill Galvanized, Add</i>		2.55	
		<i>For Class 2 Mill Galvanized, Add</i>		3.82	
		<i>For Hot-Dipped Galvanized, Add</i>		6.37	
		<i>For Stainless Steel, Add</i>		25.48	
		<i>For Cavity Drip, Add</i>		0.50	
		<i>For 3-Wire, Add</i>		8.75	
		<i>For Double Side Rods, Add</i>		17.50	
04 05 19 13-0022	CLF	#16 (For 16" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Ladder-Type, Masonry Wall Reinforcement		62.40	
		<i>For Class 1 Mill Galvanized, Add</i>		3.46	
		<i>For Class 2 Mill Galvanized, Add</i>		5.19	
		<i>For Hot-Dipped Galvanized, Add</i>		8.66	
		<i>For Stainless Steel, Add</i>		34.62	
		<i>For Cavity Drip, Add</i>		0.50	
		<i>For 3-Wire, Add</i>		8.75	
		<i>For Double Side Rods, Add</i>		17.50	
04 05 19 13-0023	CLF	#18 (For 18" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Ladder-Type, Masonry Wall Reinforcement		75.40	
		<i>For Class 1 Mill Galvanized, Add</i>		5.52	
		<i>For Class 2 Mill Galvanized, Add</i>		8.29	
		<i>For Hot-Dipped Galvanized, Add</i>		13.81	
		<i>For Stainless Steel, Add</i>		55.24	
		<i>For Cavity Drip, Add</i>		0.50	
		<i>For 3-Wire, Add</i>		8.75	
		<i>For Double Side Rods, Add</i>		17.50	
04 05 19 13-0024		3/16" Side Rods, 3/16" Cross Rods, Ladder-Type, Masonry Wall Reinforcement			
		<small>(04 05 19 13-0003)</small>			
04 05 19 13-0025	CLF	#4 (For 4" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Ladder-Type, Masonry Wall Reinforcement		40.59	
		<i>For Class 1 Mill Galvanized, Add</i>		2.87	
		<i>For Class 2 Mill Galvanized, Add</i>		4.30	
		<i>For Hot-Dipped Galvanized, Add</i>		7.17	
		<i>For Stainless Steel, Add</i>		28.68	
		<i>For Cavity Drip, Add</i>		0.50	
		<i>For 3-Wire, Add</i>		8.75	
		<i>For Double Side Rods, Add</i>		17.50	
04 05 19 13-0026	CLF	#6 (For 6" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Ladder-Type, Masonry Wall Reinforcement		43.40	
		<i>For Class 1 Mill Galvanized, Add</i>		3.03	
		<i>For Class 2 Mill Galvanized, Add</i>		4.54	
		<i>For Hot-Dipped Galvanized, Add</i>		7.57	
		<i>For Stainless Steel, Add</i>		30.26	
		<i>For Cavity Drip, Add</i>		0.50	
		<i>For 3-Wire, Add</i>		8.75	
		<i>For Double Side Rods, Add</i>		17.50	
04 05 19 13-0027	CLF	#8 (For 8" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Ladder-Type, Masonry Wall Reinforcement		46.21	
		<i>For Class 1 Mill Galvanized, Add</i>		3.18	
		<i>For Class 2 Mill Galvanized, Add</i>		4.78	
		<i>For Hot-Dipped Galvanized, Add</i>		7.96	
		<i>For Stainless Steel, Add</i>		31.84	
		<i>For Cavity Drip, Add</i>		0.50	
		<i>For 3-Wire, Add</i>		8.75	
		<i>For Double Side Rods, Add</i>		17.50	
04 05 19 13-0028	CLF	#10 (For 10" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Ladder-Type, Masonry Wall Reinforcement		50.51	
		<i>For Class 1 Mill Galvanized, Add</i>		3.37	
		<i>For Class 2 Mill Galvanized, Add</i>		5.06	
		<i>For Hot-Dipped Galvanized, Add</i>		8.43	
		<i>For Stainless Steel, Add</i>		33.72	
		<i>For Cavity Drip, Add</i>		0.50	
		<i>For 3-Wire, Add</i>		8.75	
		<i>For Double Side Rods, Add</i>		17.50	
04 05 19 13-0029	CLF	#12 (For 12" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Ladder-Type, Masonry Wall Reinforcement		54.82	
		<i>For Class 1 Mill Galvanized, Add</i>		3.56	
		<i>For Class 2 Mill Galvanized, Add</i>		5.34	
		<i>For Hot-Dipped Galvanized, Add</i>		8.90	
		<i>For Stainless Steel, Add</i>		35.60	
		<i>For Cavity Drip, Add</i>		0.50	
		<i>For 3-Wire, Add</i>		8.75	
		<i>For Double Side Rods, Add</i>		17.50	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
04 05 19 13-0030 CLF #13 (For 13" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Ladder-Type, Masonry Wall Reinforcement	58.68	
<i>For Class 1 Mill Galvanized, Add</i>	3.66	
<i>For Class 2 Mill Galvanized, Add</i>	5.49	
<i>For Hot-Dipped Galvanized, Add</i>	9.15	
<i>For Stainless Steel, Add</i>	36.60	
<i>For Cavity Drip, Add</i>	0.50	
<i>For 3-Wire, Add</i>	8.75	
<i>For Double Side Rods, Add</i>	17.50	
04 05 19 13-0031 CLF #14 (For 14" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Ladder-Type, Masonry Wall Reinforcement	60.80	
<i>For Class 1 Mill Galvanized, Add</i>	3.75	
<i>For Class 2 Mill Galvanized, Add</i>	5.62	
<i>For Hot-Dipped Galvanized, Add</i>	9.37	
<i>For Stainless Steel, Add</i>	37.46	
<i>For Cavity Drip, Add</i>	0.50	
<i>For 3-Wire, Add</i>	8.75	
<i>For Double Side Rods, Add</i>	17.50	
04 05 19 13-0032 CLF #16 (For 16" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Ladder-Type, Masonry Wall Reinforcement	64.69	
<i>For Class 1 Mill Galvanized, Add</i>	3.92	
<i>For Class 2 Mill Galvanized, Add</i>	5.88	
<i>For Hot-Dipped Galvanized, Add</i>	9.80	
<i>For Stainless Steel, Add</i>	39.18	
<i>For Cavity Drip, Add</i>	0.50	
<i>For 3-Wire, Add</i>	8.75	
<i>For Double Side Rods, Add</i>	17.50	
04 05 19 13-0033 CLF #18 (For 18" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Ladder-Type, Masonry Wall Reinforcement	80.34	
<i>For Class 1 Mill Galvanized, Add</i>	6.51	
<i>For Class 2 Mill Galvanized, Add</i>	9.77	
<i>For Hot-Dipped Galvanized, Add</i>	16.28	
<i>For Stainless Steel, Add</i>	65.10	
<i>For Cavity Drip, Add</i>	0.50	
<i>For 3-Wire, Add</i>	8.75	
<i>For Double Side Rods, Add</i>	17.50	
04 05 19 13-0034 Ladder-Type With Tabs, Masonry Wall Reinforcement <small>(04 05 19 13-0002)</small>		
04 05 19 13-0035 9 Gauge Side Rods, 9 Gauge Cross Rods, Ladder-Type With Tabs, Masonry Wall Reinforcement <small>(04 05 19 13-0034)</small>		
04 05 19 13-0036 CLF #8 (For 8" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Ladder-Type With Tabs, Masonry Wall Reinforcement	45.73	
<i>For Class 1 Mill Galvanized, Add</i>	2.33	
<i>For Class 2 Mill Galvanized, Add</i>	3.50	
<i>For Hot-Dipped Galvanized, Add</i>	5.83	
<i>For Stainless Steel, Add</i>	23.32	
<i>For Cavity Drip, Add</i>	0.50	
04 05 19 13-0037 CLF #10 (For 10" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Ladder-Type With Tabs, Masonry Wall Reinforcement.....	50.59	
<i>For Class 1 Mill Galvanized, Add</i>	2.55	
<i>For Class 2 Mill Galvanized, Add</i>	3.82	
<i>For Hot-Dipped Galvanized, Add</i>	6.37	
<i>For Stainless Steel, Add</i>	25.46	
<i>For Cavity Drip, Add</i>	0.50	
04 05 19 13-0038 CLF #12 (For 12" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Ladder-Type With Tabs, Masonry Wall Reinforcement.....	55.32	
<i>For Class 1 Mill Galvanized, Add</i>	2.73	
<i>For Class 2 Mill Galvanized, Add</i>	4.10	
<i>For Hot-Dipped Galvanized, Add</i>	6.84	
<i>For Stainless Steel, Add</i>	27.34	
<i>For Cavity Drip, Add</i>	0.50	
04 05 19 13-0039 CLF #13 (For 13" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Ladder-Type With Tabs, Masonry Wall Reinforcement.....	59.66	
<i>For Class 1 Mill Galvanized, Add</i>	2.84	
<i>For Class 2 Mill Galvanized, Add</i>	4.27	
<i>For Hot-Dipped Galvanized, Add</i>	7.11	
<i>For Stainless Steel, Add</i>	28.44	
<i>For Cavity Drip, Add</i>	0.50	
04 05 19 13-0040 CLF #14 (For 14" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Ladder-Type With Tabs, Masonry Wall Reinforcement.....	62.05	
<i>For Class 1 Mill Galvanized, Add</i>	2.94	
<i>For Class 2 Mill Galvanized, Add</i>	4.42	
<i>For Hot-Dipped Galvanized, Add</i>	7.36	
<i>For Stainless Steel, Add</i>	29.44	
<i>For Cavity Drip, Add</i>	0.50	
04 05 19 13-0041 CLF #16 (For 16" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Ladder-Type With Tabs, Masonry Wall Reinforcement.....	66.57	
<i>For Class 1 Mill Galvanized, Add</i>	3.17	
<i>For Class 2 Mill Galvanized, Add</i>	4.75	
<i>For Hot-Dipped Galvanized, Add</i>	7.92	
<i>For Stainless Steel, Add</i>	31.68	
<i>For Cavity Drip, Add</i>	0.50	

04 Masonry**04 05 Common Work Results For Masonry****04 05 19 Masonry Anchorage And Reinforcing**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
04 05 19 13-0042	CLF		#18 (For 18" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Ladder-Type With Tabs, Masonry Wall Reinforcement.....	70.54	
			<i>For Class 1 Mill Galvanized, Add</i>	3.35	
			<i>For Class 2 Mill Galvanized, Add</i>	5.03	
			<i>For Hot-Dipped Galvanized, Add</i>	8.39	
			<i>For Stainless Steel, Add</i>	33.54	
			<i>For Cavity Drip, Add</i>	0.50	
04 05 19 13-0043			3/16" Side Rods, 9 Gauge Cross Rods, Ladder-Type With Tabs, Masonry Wall Reinforcement		
			<small>(04 05 19 13-0034)</small>		
04 05 19 13-0044	CLF		#8 (For 8" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Ladder-Type With Tabs, Masonry Wall Reinforcement	50.46	
			<i>For Class 1 Mill Galvanized, Add</i>	3.28	
			<i>For Class 2 Mill Galvanized, Add</i>	4.92	
			<i>For Hot-Dipped Galvanized, Add</i>	8.20	
			<i>For Stainless Steel, Add</i>	32.78	
			<i>For Cavity Drip, Add</i>	0.50	
04 05 19 13-0045	CLF		#10 (For 10" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Ladder-Type With Tabs, Masonry Wall Reinforcement	55.33	
			<i>For Class 1 Mill Galvanized, Add</i>	3.49	
			<i>For Class 2 Mill Galvanized, Add</i>	5.24	
			<i>For Hot-Dipped Galvanized, Add</i>	8.74	
			<i>For Stainless Steel, Add</i>	34.94	
			<i>For Cavity Drip, Add</i>	0.50	
04 05 19 13-0046	CLF		#12 (For 12" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Ladder-Type With Tabs, Masonry Wall Reinforcement	60.01	
			<i>For Class 1 Mill Galvanized, Add</i>	3.67	
			<i>For Class 2 Mill Galvanized, Add</i>	5.51	
			<i>For Hot-Dipped Galvanized, Add</i>	9.18	
			<i>For Stainless Steel, Add</i>	36.72	
			<i>For Cavity Drip, Add</i>	0.50	
04 05 19 13-0047	CLF		#13 (For 13" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Ladder-Type With Tabs, Masonry Wall Reinforcement	64.40	
			<i>For Class 1 Mill Galvanized, Add</i>	3.79	
			<i>For Class 2 Mill Galvanized, Add</i>	5.69	
			<i>For Hot-Dipped Galvanized, Add</i>	9.48	
			<i>For Stainless Steel, Add</i>	37.92	
			<i>For Cavity Drip, Add</i>	0.50	
04 05 19 13-0048	CLF		#14 (For 14" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Ladder-Type With Tabs, Masonry Wall Reinforcement	66.79	
			<i>For Class 1 Mill Galvanized, Add</i>	3.89	
			<i>For Class 2 Mill Galvanized, Add</i>	5.84	
			<i>For Hot-Dipped Galvanized, Add</i>	9.73	
			<i>For Stainless Steel, Add</i>	38.92	
			<i>For Cavity Drip, Add</i>	0.50	
04 05 19 13-0049	CLF		#16 (For 16" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Ladder-Type With Tabs, Masonry Wall Reinforcement	71.31	
			<i>For Class 1 Mill Galvanized, Add</i>	4.12	
			<i>For Class 2 Mill Galvanized, Add</i>	6.17	
			<i>For Hot-Dipped Galvanized, Add</i>	10.29	
			<i>For Stainless Steel, Add</i>	41.16	
			<i>For Cavity Drip, Add</i>	0.50	
04 05 19 13-0050	CLF		#18 (For 18" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Ladder-Type With Tabs, Masonry Wall Reinforcement	75.34	
			<i>For Class 1 Mill Galvanized, Add</i>	4.31	
			<i>For Class 2 Mill Galvanized, Add</i>	6.47	
			<i>For Hot-Dipped Galvanized, Add</i>	10.79	
			<i>For Stainless Steel, Add</i>	43.14	
			<i>For Cavity Drip, Add</i>	0.50	
04 05 19 13-0051			3/16" Side Rods, 3/16" Cross Rods, Ladder-Type With Tabs, Masonry Wall Reinforcement		
			<small>(04 05 19 13-0034)</small>		
04 05 19 13-0052	CLF		#8 (For 8" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Ladder-Type With Tabs, Masonry Wall Reinforcement	52.76	
			<i>For Class 1 Mill Galvanized, Add</i>	3.74	
			<i>For Class 2 Mill Galvanized, Add</i>	5.61	
			<i>For Hot-Dipped Galvanized, Add</i>	9.35	
			<i>For Stainless Steel, Add</i>	37.38	
			<i>For Cavity Drip, Add</i>	0.50	
04 05 19 13-0053	CLF		#10 (For 10" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Ladder-Type With Tabs, Masonry Wall Reinforcement	58.18	
			<i>For Class 1 Mill Galvanized, Add</i>	4.06	
			<i>For Class 2 Mill Galvanized, Add</i>	6.10	
			<i>For Hot-Dipped Galvanized, Add</i>	10.16	
			<i>For Stainless Steel, Add</i>	40.64	
			<i>For Cavity Drip, Add</i>	0.50	
04 05 19 13-0054	CLF		#12 (For 12" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Ladder-Type With Tabs, Masonry Wall Reinforcement	63.56	
			<i>For Class 1 Mill Galvanized, Add</i>	4.38	
			<i>For Class 2 Mill Galvanized, Add</i>	6.57	
			<i>For Hot-Dipped Galvanized, Add</i>	10.96	
			<i>For Stainless Steel, Add</i>	43.82	
			<i>For Cavity Drip, Add</i>	0.50	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
04 05 19 13-0055 CLF #13 (For 13" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Ladder-Type With Tabs, Masonry Wall Reinforcement	68.20	
<i>For Class 1 Mill Galvanized, Add</i>	4.55	
<i>For Class 2 Mill Galvanized, Add</i>	6.83	
<i>For Hot-Dipped Galvanized, Add</i>	11.38	
<i>For Stainless Steel, Add</i>	45.52	
<i>For Cavity Drip, Add</i>	0.50	
04 05 19 13-0056 CLF #14 (For 14" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Ladder-Type With Tabs, Masonry Wall Reinforcement	70.87	
<i>For Class 1 Mill Galvanized, Add</i>	4.71	
<i>For Class 2 Mill Galvanized, Add</i>	7.06	
<i>For Hot-Dipped Galvanized, Add</i>	11.77	
<i>For Stainless Steel, Add</i>	47.08	
<i>For Cavity Drip, Add</i>	0.50	
04 05 19 13-0057 CLF #16 (For 16" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Ladder-Type With Tabs, Masonry Wall Reinforcement	75.93	
<i>For Class 1 Mill Galvanized, Add</i>	5.04	
<i>For Class 2 Mill Galvanized, Add</i>	7.56	
<i>For Hot-Dipped Galvanized, Add</i>	12.60	
<i>For Stainless Steel, Add</i>	50.40	
<i>For Cavity Drip, Add</i>	0.50	
04 05 19 13-0058 CLF #18 (For 18" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Ladder-Type With Tabs, Masonry Wall Reinforcement	80.60	
<i>For Class 1 Mill Galvanized, Add</i>	5.37	
<i>For Class 2 Mill Galvanized, Add</i>	8.05	
<i>For Hot-Dipped Galvanized, Add</i>	13.42	
<i>For Stainless Steel, Add</i>	53.66	
<i>For Cavity Drip, Add</i>	0.50	
04 05 19 13-0059 Ladder-Type With Adjustable Tabs For Composite Walls, Masonry Wall Reinforcement <small>(04 05 19 13-0002)</small>		
04 05 19 13-0060 9 Gauge Side Rods, 9 Gauge Cross Rods, Ladder-Type With Adjustable Tabs For Composite Walls, Masonry Wall Reinforcement <small>(04 05 19 13-0059)</small>		
04 05 19 13-0061 CLF #8 (For 4" + 4" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Ladder-Type With Adjustable Tabs For Composite Walls, Masonry Wall Reinforcement	58.47	
<i>For Class 1 Mill Galvanized, Add</i>	4.88	
<i>For Class 2 Mill Galvanized, Add</i>	7.32	
<i>For Hot-Dipped Galvanized, Add</i>	12.20	
<i>For Stainless Steel, Add</i>	48.80	
04 05 19 13-0062 CLF #10 (For 6" + 4" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Ladder-Type With Adjustable Tabs For Composite Walls, Masonry Wall Reinforcement	63.01	
<i>For Class 1 Mill Galvanized, Add</i>	5.03	
<i>For Class 2 Mill Galvanized, Add</i>	7.55	
<i>For Hot-Dipped Galvanized, Add</i>	12.58	
<i>For Stainless Steel, Add</i>	50.30	
04 05 19 13-0063 CLF #12 (For 8" + 4" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Ladder-Type With Adjustable Tabs For Composite Walls, Masonry Wall Reinforcement	67.55	
<i>For Class 1 Mill Galvanized, Add</i>	5.18	
<i>For Class 2 Mill Galvanized, Add</i>	7.77	
<i>For Hot-Dipped Galvanized, Add</i>	12.95	
<i>For Stainless Steel, Add</i>	51.80	
04 05 19 13-0064 CLF #14 (For 10" + 4" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Ladder-Type With Adjustable Tabs For Composite Walls, Masonry Wall Reinforcement.....	74.07	
<i>For Class 1 Mill Galvanized, Add</i>	5.35	
<i>For Class 2 Mill Galvanized, Add</i>	8.02	
<i>For Hot-Dipped Galvanized, Add</i>	13.37	
<i>For Stainless Steel, Add</i>	53.48	
04 05 19 13-0065 CLF #16 (For 12" + 4" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Ladder-Type With Adjustable Tabs For Composite Walls, Masonry Wall Reinforcement.....	78.31	
<i>For Class 1 Mill Galvanized, Add</i>	5.52	
<i>For Class 2 Mill Galvanized, Add</i>	8.27	
<i>For Hot-Dipped Galvanized, Add</i>	13.79	
<i>For Stainless Steel, Add</i>	55.16	
04 05 19 13-0066 CLF #18 (For 14" + 4" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Ladder-Type With Adjustable Tabs For Composite Walls, Masonry Wall Reinforcement.....	82.63	
<i>For Class 1 Mill Galvanized, Add</i>	5.77	
<i>For Class 2 Mill Galvanized, Add</i>	8.66	
<i>For Hot-Dipped Galvanized, Add</i>	14.43	
<i>For Stainless Steel, Add</i>	57.72	
04 05 19 13-0067 3/16" Side Rods, 9 Gauge Cross Rods, Ladder-Type With Adjustable Tabs For Composite Walls, Masonry Wall Reinforcement <small>(04 05 19 13-0059)</small>		
04 05 19 13-0068 CLF #8 (For 4" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Ladder-Type With Adjustable Tabs For Composite Walls, Masonry Wall Reinforcement	65.90	
<i>For Class 1 Mill Galvanized, Add</i>	6.37	
<i>For Class 2 Mill Galvanized, Add</i>	9.55	
<i>For Hot-Dipped Galvanized, Add</i>	15.92	
<i>For Stainless Steel, Add</i>	63.66	

04 Masonry**04 05 Common Work Results For Masonry****04 05 19 Masonry Anchorage And Reinforcing**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
04 05 19 13-0069	CLF	#10	(For 6" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Ladder-Type With Adjustable Tabs For Composite Walls, Masonry Wall Reinforcement.....	70.44	
			<i>For Class 1 Mill Galvanized, Add</i>	6.52	
			<i>For Class 2 Mill Galvanized, Add</i>	9.77	
			<i>For Hot-Dipped Galvanized, Add</i>	16.29	
			<i>For Stainless Steel, Add</i>	65.16	
04 05 19 13-0070	CLF	#12	(For 8" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Ladder-Type With Adjustable Tabs For Composite Walls, Masonry Wall Reinforcement.....	75.08	
			<i>For Class 1 Mill Galvanized, Add</i>	6.69	
			<i>For Class 2 Mill Galvanized, Add</i>	10.03	
			<i>For Hot-Dipped Galvanized, Add</i>	16.72	
			<i>For Stainless Steel, Add</i>	66.86	
04 05 19 13-0071	CLF	#14	(For 10" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Ladder-Type With Adjustable Tabs For Composite Walls, Masonry Wall Reinforcement.....	81.51	
			<i>For Class 1 Mill Galvanized, Add</i>	6.84	
			<i>For Class 2 Mill Galvanized, Add</i>	10.25	
			<i>For Hot-Dipped Galvanized, Add</i>	17.09	
			<i>For Stainless Steel, Add</i>	68.36	
04 05 19 13-0072	CLF	#16	(For 12" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Ladder-Type With Adjustable Tabs For Composite Walls, Masonry Wall Reinforcement.....	85.76	
			<i>For Class 1 Mill Galvanized, Add</i>	7.01	
			<i>For Class 2 Mill Galvanized, Add</i>	10.51	
			<i>For Hot-Dipped Galvanized, Add</i>	17.52	
			<i>For Stainless Steel, Add</i>	70.06	
04 05 19 13-0073	CLF	#18	(For 14" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Ladder-Type With Adjustable Tabs For Composite Walls, Masonry Wall Reinforcement.....	89.65	
			<i>For Class 1 Mill Galvanized, Add</i>	7.18	
			<i>For Class 2 Mill Galvanized, Add</i>	10.76	
			<i>For Hot-Dipped Galvanized, Add</i>	17.94	
			<i>For Stainless Steel, Add</i>	71.76	
04 05 19 13-0074			3/16" Side Rods, 3/16" Cross Rods, Ladder-Type With Adjustable Tabs For Composite Walls, Masonry Wall Reinforcement <small>(04 05 19 13-0059)</small>		
04 05 19 13-0075	CLF	#8	(For 4" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Ladder-Type With Adjustable Tabs For Composite Walls, Masonry Wall Reinforcement.....	66.44	
			<i>For Class 1 Mill Galvanized, Add</i>	6.47	
			<i>For Class 2 Mill Galvanized, Add</i>	9.71	
			<i>For Hot-Dipped Galvanized, Add</i>	16.19	
			<i>For Stainless Steel, Add</i>	64.74	
04 05 19 13-0076	CLF	#10	(For 6" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Ladder-Type With Adjustable Tabs For Composite Walls, Masonry Wall Reinforcement.....	71.40	
			<i>For Class 1 Mill Galvanized, Add</i>	6.71	
			<i>For Class 2 Mill Galvanized, Add</i>	10.06	
			<i>For Hot-Dipped Galvanized, Add</i>	16.77	
			<i>For Stainless Steel, Add</i>	67.08	
04 05 19 13-0077	CLF	#12	(For 8" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Ladder-Type With Adjustable Tabs For Composite Walls, Masonry Wall Reinforcement.....	76.34	
			<i>For Class 1 Mill Galvanized, Add</i>	6.94	
			<i>For Class 2 Mill Galvanized, Add</i>	10.41	
			<i>For Hot-Dipped Galvanized, Add</i>	17.35	
			<i>For Stainless Steel, Add</i>	69.38	
04 05 19 13-0078	CLF	#14	(For 10" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Ladder-Type With Adjustable Tabs For Composite Walls, Masonry Wall Reinforcement.....	83.42	
			<i>For Class 1 Mill Galvanized, Add</i>	7.22	
			<i>For Class 2 Mill Galvanized, Add</i>	10.83	
			<i>For Hot-Dipped Galvanized, Add</i>	18.05	
			<i>For Stainless Steel, Add</i>	72.18	
04 05 19 13-0079	CLF	#16	(For 12" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Ladder-Type With Adjustable Tabs For Composite Walls, Masonry Wall Reinforcement.....	88.20	
			<i>For Class 1 Mill Galvanized, Add</i>	7.49	
			<i>For Class 2 Mill Galvanized, Add</i>	11.24	
			<i>For Hot-Dipped Galvanized, Add</i>	18.74	
			<i>For Stainless Steel, Add</i>	74.94	
04 05 19 13-0080	CLF	#18	(For 14" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Ladder-Type With Adjustable Tabs For Composite Walls, Masonry Wall Reinforcement.....	92.62	
			<i>For Class 1 Mill Galvanized, Add</i>	7.77	
			<i>For Class 2 Mill Galvanized, Add</i>	11.66	
			<i>For Hot-Dipped Galvanized, Add</i>	19.43	
			<i>For Stainless Steel, Add</i>	77.70	
04 05 19 13-0081			Ladder-Type With Adjustable Tabs For Cavity Walls, Masonry Wall Reinforcement <small>(04 05 19 13-0002)</small>		
04 05 19 13-0082			9 Gauge Side Rods, 9 Gauge Cross Rods, Ladder-Type With Adjustable Tabs For Cavity Walls, Masonry Wall Reinforcement <small>(04 05 19 13-0081)</small>		
04 05 19 13-0083	CLF	#10	(For 4" + 2" + 4" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Ladder-Type With Adjustable Tabs For Cavity Walls, Masonry Wall Reinforcement.....	63.65	
			<i>For Class 1 Mill Galvanized, Add</i>	5.16	
			<i>For Class 2 Mill Galvanized, Add</i>	7.74	
			<i>For Hot-Dipped Galvanized, Add</i>	12.90	
			<i>For Stainless Steel, Add</i>	51.58	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
04 05 19 13-0084 CLF #12 (For 6" + 2" + 4" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Ladder-Type With Adjustable Tabs For Cavity Walls, Masonry Wall Reinforcement.....	68.17	
<i>For Class 1 Mill Galvanized, Add</i>	5.30	
<i>For Class 2 Mill Galvanized, Add</i>	7.96	
<i>For Hot-Dipped Galvanized, Add</i>	13.26	
<i>For Stainless Steel, Add</i>	53.04	
04 05 19 13-0085 CLF #14 (For 8" + 2" + 4" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Ladder-Type With Adjustable Tabs For Cavity Walls, Masonry Wall Reinforcement.....	74.59	
<i>For Class 1 Mill Galvanized, Add</i>	5.45	
<i>For Class 2 Mill Galvanized, Add</i>	8.18	
<i>For Hot-Dipped Galvanized, Add</i>	13.63	
<i>For Stainless Steel, Add</i>	54.52	
04 05 19 13-0086 CLF #16 (For 10" + 2" + 4" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Ladder-Type With Adjustable Tabs For Cavity Walls, Masonry Wall Reinforcement.....	78.86	
<i>For Class 1 Mill Galvanized, Add</i>	5.63	
<i>For Class 2 Mill Galvanized, Add</i>	8.44	
<i>For Hot-Dipped Galvanized, Add</i>	14.07	
<i>For Stainless Steel, Add</i>	56.26	
04 05 19 13-0087 CLF #18 (For 12" + 2" + 4" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Ladder-Type With Adjustable Tabs For Cavity Walls, Masonry Wall Reinforcement.....	82.74	
<i>For Class 1 Mill Galvanized, Add</i>	5.79	
<i>For Class 2 Mill Galvanized, Add</i>	8.69	
<i>For Hot-Dipped Galvanized, Add</i>	14.49	
<i>For Stainless Steel, Add</i>	57.94	
04 05 19 13-0088 CLF #20 (For 14" + 2" + 4" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Ladder-Type With Adjustable Tabs For Cavity Walls, Masonry Wall Reinforcement.....	86.53	
<i>For Class 1 Mill Galvanized, Add</i>	6.13	
<i>For Class 2 Mill Galvanized, Add</i>	9.20	
<i>For Hot-Dipped Galvanized, Add</i>	15.33	
<i>For Stainless Steel, Add</i>	61.32	
04 05 19 13-0089 3/16" Side Rods, 9 Gauge Cross Rods, Ladder-Type With Adjustable Tabs For Cavity Walls, Masonry Wall Reinforcement (04 05 19 13-0081)		
04 05 19 13-0090 CLF #10 (For 4" + 2" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Ladder-Type With Adjustable Tabs For Cavity Walls, Masonry Wall Reinforcement.....	71.08	
<i>For Class 1 Mill Galvanized, Add</i>	6.64	
<i>For Class 2 Mill Galvanized, Add</i>	9.97	
<i>For Hot-Dipped Galvanized, Add</i>	16.61	
<i>For Stainless Steel, Add</i>	66.44	
04 05 19 13-0091 CLF #12 (For 6" + 2" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Ladder-Type With Adjustable Tabs For Cavity Walls, Masonry Wall Reinforcement.....	75.62	
<i>For Class 1 Mill Galvanized, Add</i>	6.79	
<i>For Class 2 Mill Galvanized, Add</i>	10.19	
<i>For Hot-Dipped Galvanized, Add</i>	16.99	
<i>For Stainless Steel, Add</i>	67.94	
04 05 19 13-0092 CLF #14 (For 8" + 2" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Ladder-Type With Adjustable Tabs For Cavity Walls, Masonry Wall Reinforcement.....	82.14	
<i>For Class 1 Mill Galvanized, Add</i>	6.96	
<i>For Class 2 Mill Galvanized, Add</i>	10.44	
<i>For Hot-Dipped Galvanized, Add</i>	17.41	
<i>For Stainless Steel, Add</i>	69.62	
04 05 19 13-0093 CLF #16 (For 10" + 2" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Ladder-Type With Adjustable Tabs For Cavity Walls, Masonry Wall Reinforcement.....	86.28	
<i>For Class 1 Mill Galvanized, Add</i>	7.11	
<i>For Class 2 Mill Galvanized, Add</i>	10.67	
<i>For Hot-Dipped Galvanized, Add</i>	17.78	
<i>For Stainless Steel, Add</i>	71.10	
04 05 19 13-0094 CLF #18 (For 12" + 2" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Ladder-Type With Adjustable Tabs For Cavity Walls, Masonry Wall Reinforcement.....	90.17	
<i>For Class 1 Mill Galvanized, Add</i>	7.28	
<i>For Class 2 Mill Galvanized, Add</i>	10.92	
<i>For Hot-Dipped Galvanized, Add</i>	18.20	
<i>For Stainless Steel, Add</i>	72.80	
04 05 19 13-0095 CLF #20 (For 14" + 2" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Ladder-Type With Adjustable Tabs For Cavity Walls, Masonry Wall Reinforcement.....	94.06	
<i>For Class 1 Mill Galvanized, Add</i>	7.64	
<i>For Class 2 Mill Galvanized, Add</i>	11.46	
<i>For Hot-Dipped Galvanized, Add</i>	19.10	
<i>For Stainless Steel, Add</i>	76.38	
04 05 19 13-0096 3/16" Side Rods, 3/16" Cross Rods, Ladder-Type With Adjustable Tabs For Cavity Walls, Masonry Wall Reinforcement (04 05 19 13-0081)		
04 05 19 13-0097 CLF #10 (For 4" + 2" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Ladder-Type With Adjustable Tabs For Cavity Walls, Masonry Wall Reinforcement.....	71.61	
<i>For Class 1 Mill Galvanized, Add</i>	6.75	
<i>For Class 2 Mill Galvanized, Add</i>	10.13	
<i>For Hot-Dipped Galvanized, Add</i>	16.88	
<i>For Stainless Steel, Add</i>	67.50	

04 Masonry**04 05 Common Work Results For Masonry****04 05 19 Masonry Anchorage And Reinforcing**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
04 05 19 13-0098	CLF	#12	(For 6" + 2" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Ladder-Type With Adjustable Tabs For Cavity Walls, Masonry Wall Reinforcement.....	76.56	
			<i>For Class 1 Mill Galvanized, Add</i>	6.98	
			<i>For Class 2 Mill Galvanized, Add</i>	10.47	
			<i>For Hot-Dipped Galvanized, Add</i>	17.46	
			<i>For Stainless Steel, Add</i>	69.82	
04 05 19 13-0099	CLF	#14	(For 8" + 2" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Ladder-Type With Adjustable Tabs For Cavity Walls, Masonry Wall Reinforcement.....	83.42	
			<i>For Class 1 Mill Galvanized, Add</i>	7.22	
			<i>For Class 2 Mill Galvanized, Add</i>	10.83	
			<i>For Hot-Dipped Galvanized, Add</i>	18.05	
			<i>For Stainless Steel, Add</i>	72.18	
04 05 19 13-0100	CLF	#16	(For 10" + 2" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Ladder-Type With Adjustable Tabs For Cavity Walls, Masonry Wall Reinforcement.....	88.20	
			<i>For Class 1 Mill Galvanized, Add</i>	7.49	
			<i>For Class 2 Mill Galvanized, Add</i>	11.24	
			<i>For Hot-Dipped Galvanized, Add</i>	18.74	
			<i>For Stainless Steel, Add</i>	74.94	
04 05 19 13-0101	CLF	#18	(For 12" + 2" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Ladder-Type With Adjustable Tabs For Cavity Walls, Masonry Wall Reinforcement.....	92.62	
			<i>For Class 1 Mill Galvanized, Add</i>	7.77	
			<i>For Class 2 Mill Galvanized, Add</i>	11.66	
			<i>For Hot-Dipped Galvanized, Add</i>	19.43	
			<i>For Stainless Steel, Add</i>	77.70	
04 05 19 13-0102	CLF	#20	(For 14" + 2" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Ladder-Type With Adjustable Tabs For Cavity Walls, Masonry Wall Reinforcement.....	96.69	
			<i>For Class 1 Mill Galvanized, Add</i>	8.16	
			<i>For Class 2 Mill Galvanized, Add</i>	12.25	
			<i>For Hot-Dipped Galvanized, Add</i>	20.41	
			<i>For Stainless Steel, Add</i>	81.64	
04 05 19 13-0103			Ladder-Type With Hook And Eye Ties For Composite Walls, Masonry Wall Reinforcement <small>(04 05 19 13-0002)</small>		
04 05 19 13-0104			9 Gauge Side Rods, 9 Gauge Cross Rods, Ladder-Type With Hook And Eye Ties For Composite Walls, Masonry Wall Reinforcement <small>(04 05 19 13-0103)</small>		
04 05 19 13-0105	CLF	#8	(For 4" + 4" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Ladder-Type With Hook And Eye Ties For Composite Walls, Masonry Wall Reinforcement.....	61.20	
			<i>For Class 1 Mill Galvanized, Add</i>	4.67	
			<i>For Class 2 Mill Galvanized, Add</i>	7.00	
			<i>For Hot-Dipped Galvanized, Add</i>	11.67	
			<i>For Stainless Steel, Add</i>	46.68	
			<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0106	CLF	#10	(For 6" + 4" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Ladder-Type With Hook And Eye Ties For Composite Walls, Masonry Wall Reinforcement.....	65.60	
			<i>For Class 1 Mill Galvanized, Add</i>	4.79	
			<i>For Class 2 Mill Galvanized, Add</i>	7.19	
			<i>For Hot-Dipped Galvanized, Add</i>	11.98	
			<i>For Stainless Steel, Add</i>	47.90	
			<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0107	CLF	#12	(For 8" + 4" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Ladder-Type With Hook And Eye Ties For Composite Walls, Masonry Wall Reinforcement.....	71.93	
			<i>For Class 1 Mill Galvanized, Add</i>	4.92	
			<i>For Class 2 Mill Galvanized, Add</i>	7.38	
			<i>For Hot-Dipped Galvanized, Add</i>	12.30	
			<i>For Stainless Steel, Add</i>	49.20	
			<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0108	CLF	#14	(For 10" + 4" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Ladder-Type With Hook And Eye Ties For Composite Walls, Masonry Wall Reinforcement.....	76.02	
			<i>For Class 1 Mill Galvanized, Add</i>	5.06	
			<i>For Class 2 Mill Galvanized, Add</i>	7.59	
			<i>For Hot-Dipped Galvanized, Add</i>	12.65	
			<i>For Stainless Steel, Add</i>	50.58	
			<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0109	CLF	#16	(For 12" + 4" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Ladder-Type With Hook And Eye Ties For Composite Walls, Masonry Wall Reinforcement.....	79.79	
			<i>For Class 1 Mill Galvanized, Add</i>	5.20	
			<i>For Class 2 Mill Galvanized, Add</i>	7.81	
			<i>For Hot-Dipped Galvanized, Add</i>	13.01	
			<i>For Stainless Steel, Add</i>	52.04	
			<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0110	CLF	#18	(For 14" + 4" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Ladder-Type With Hook And Eye Ties For Composite Walls, Masonry Wall Reinforcement.....	82.54	
			<i>For Class 1 Mill Galvanized, Add</i>	5.33	
			<i>For Class 2 Mill Galvanized, Add</i>	8.00	
			<i>For Hot-Dipped Galvanized, Add</i>	13.34	
			<i>For Stainless Steel, Add</i>	53.34	
			<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0111			3/16" Side Rods, 9 Gauge Cross Rods, Ladder-Type With Hook And Eye Ties For Composite Walls, Masonry Wall Reinforcement <small>(04 05 19 13-0103)</small>		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
04 05 19 13-0112 CLF #8 (For 4" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Ladder-Type With Hook And Eye Ties For Composite Walls, Masonry Wall Reinforcement.....	68.17	
<i>For Class 1 Mill Galvanized, Add</i>	6.06	
<i>For Class 2 Mill Galvanized, Add</i>	9.09	
<i>For Hot-Dipped Galvanized, Add</i>	15.16	
<i>For Stainless Steel, Add</i>	60.62	
<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0113 CLF #10 (For 6" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Ladder-Type With Hook And Eye Ties For Composite Walls, Masonry Wall Reinforcement.....	72.44	
<i>For Class 1 Mill Galvanized, Add</i>	6.16	
<i>For Class 2 Mill Galvanized, Add</i>	9.24	
<i>For Hot-Dipped Galvanized, Add</i>	15.40	
<i>For Stainless Steel, Add</i>	61.58	
<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0114 CLF #12 (For 8" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Ladder-Type With Hook And Eye Ties For Composite Walls, Masonry Wall Reinforcement.....	78.79	
<i>For Class 1 Mill Galvanized, Add</i>	6.29	
<i>For Class 2 Mill Galvanized, Add</i>	9.44	
<i>For Hot-Dipped Galvanized, Add</i>	15.73	
<i>For Stainless Steel, Add</i>	62.92	
<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0115 CLF #14 (For 10" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Ladder-Type With Hook And Eye Ties For Composite Walls, Masonry Wall Reinforcement.....	82.84	
<i>For Class 1 Mill Galvanized, Add</i>	6.42	
<i>For Class 2 Mill Galvanized, Add</i>	9.63	
<i>For Hot-Dipped Galvanized, Add</i>	16.06	
<i>For Stainless Steel, Add</i>	64.22	
<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0116 CLF #16 (For 12" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Ladder-Type With Hook And Eye Ties For Composite Walls, Masonry Wall Reinforcement.....	86.53	
<i>For Class 1 Mill Galvanized, Add</i>	6.55	
<i>For Class 2 Mill Galvanized, Add</i>	9.83	
<i>For Hot-Dipped Galvanized, Add</i>	16.38	
<i>For Stainless Steel, Add</i>	65.52	
<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0117 CLF #18 (For 14" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Ladder-Type With Hook And Eye Ties For Composite Walls, Masonry Wall Reinforcement.....	90.04	
<i>For Class 1 Mill Galvanized, Add</i>	6.83	
<i>For Class 2 Mill Galvanized, Add</i>	10.25	
<i>For Hot-Dipped Galvanized, Add</i>	17.09	
<i>For Stainless Steel, Add</i>	68.34	
<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0118 3/16" Side Rods, 3/16" Cross Rods, Ladder-Type With Hook And Eye Ties For Composite Walls, Masonry Wall Reinforcement (04 05 19 13-0103)		
04 05 19 13-0119 CLF #8 (For 4" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Ladder-Type With Hook And Eye Ties For Composite Walls, Masonry Wall Reinforcement	68.69	
<i>For Class 1 Mill Galvanized, Add</i>	6.17	
<i>For Class 2 Mill Galvanized, Add</i>	9.25	
<i>For Hot-Dipped Galvanized, Add</i>	15.42	
<i>For Stainless Steel, Add</i>	61.66	
<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0120 CLF #10 (For 6" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Ladder-Type With Hook And Eye Ties For Composite Walls, Masonry Wall Reinforcement.....	73.59	
<i>For Class 1 Mill Galvanized, Add</i>	6.39	
<i>For Class 2 Mill Galvanized, Add</i>	9.58	
<i>For Hot-Dipped Galvanized, Add</i>	15.97	
<i>For Stainless Steel, Add</i>	63.88	
<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0121 CLF #12 (For 8" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Ladder-Type With Hook And Eye Ties For Composite Walls, Masonry Wall Reinforcement.....	80.37	
<i>For Class 1 Mill Galvanized, Add</i>	6.61	
<i>For Class 2 Mill Galvanized, Add</i>	9.91	
<i>For Hot-Dipped Galvanized, Add</i>	16.52	
<i>For Stainless Steel, Add</i>	66.08	
<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0122 CLF #14 (For 10" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Ladder-Type With Hook And Eye Ties For Composite Walls, Masonry Wall Reinforcement.....	85.10	
<i>For Class 1 Mill Galvanized, Add</i>	6.87	
<i>For Class 2 Mill Galvanized, Add</i>	10.31	
<i>For Hot-Dipped Galvanized, Add</i>	17.19	
<i>For Stainless Steel, Add</i>	68.74	
<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0123 CLF #16 (For 12" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Ladder-Type With Hook And Eye Ties For Composite Walls, Masonry Wall Reinforcement.....	89.46	
<i>For Class 1 Mill Galvanized, Add</i>	7.14	
<i>For Class 2 Mill Galvanized, Add</i>	10.71	
<i>For Hot-Dipped Galvanized, Add</i>	17.85	
<i>For Stainless Steel, Add</i>	71.38	
<i>For Seismic Hook And Eye, Add</i>	27.50	

04 Masonry**04 05 Common Work Results For Masonry****04 05 19 Masonry Anchorage And Reinforcing**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
04 05 19 13-0124	CLF		#18 (For 14" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Ladder-Type With Hook And Eye Ties For Composite Walls, Masonry Wall Reinforcement.....	92.87	
			<i>For Class 1 Mill Galvanized, Add</i>	7.40	
			<i>For Class 2 Mill Galvanized, Add</i>	11.10	
			<i>For Hot-Dipped Galvanized, Add</i>	18.50	
			<i>For Stainless Steel, Add</i>	74.00	
			<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0125			Ladder-Type With Hook And Eye Ties For Cavity Walls, Masonry Wall Reinforcement <small>(04 05 19 13-0002)</small>		
04 05 19 13-0126			9 Gauge Side Rods, 9 Gauge Cross Rods, Ladder-Type With Hook And Eye Ties For Cavity Walls, Masonry Wall Reinforcement <small>(04 05 19 13-0125)</small>		
04 05 19 13-0127	CLF		#10 (For 4" + 2" + 4" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Ladder-Type With Hook And Eye Ties For Cavity Walls, Masonry Wall Reinforcement	66.38	
			<i>For Class 1 Mill Galvanized, Add</i>	4.95	
			<i>For Class 2 Mill Galvanized, Add</i>	7.42	
			<i>For Hot-Dipped Galvanized, Add</i>	12.37	
			<i>For Stainless Steel, Add</i>	49.46	
			<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0128	CLF		#12 (For 6" + 2" + 4" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Ladder-Type With Hook And Eye Ties For Cavity Walls, Masonry Wall Reinforcement	72.66	
			<i>For Class 1 Mill Galvanized, Add</i>	5.07	
			<i>For Class 2 Mill Galvanized, Add</i>	7.60	
			<i>For Hot-Dipped Galvanized, Add</i>	12.67	
			<i>For Stainless Steel, Add</i>	50.66	
			<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0129	CLF		#14 (For 8" + 2" + 4" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Ladder-Type With Hook And Eye Ties For Cavity Walls, Masonry Wall Reinforcement	76.65	
			<i>For Class 1 Mill Galvanized, Add</i>	5.18	
			<i>For Class 2 Mill Galvanized, Add</i>	7.78	
			<i>For Hot-Dipped Galvanized, Add</i>	12.96	
			<i>For Stainless Steel, Add</i>	51.84	
			<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0130	CLF		#16 (For 10" + 2" + 4" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Ladder-Type With Hook And Eye Ties For Cavity Walls, Masonry Wall Reinforcement	80.46	
			<i>For Class 1 Mill Galvanized, Add</i>	5.34	
			<i>For Class 2 Mill Galvanized, Add</i>	8.01	
			<i>For Hot-Dipped Galvanized, Add</i>	13.35	
			<i>For Stainless Steel, Add</i>	53.38	
			<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0131	CLF		#18 (For 12" + 2" + 4" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Ladder-Type With Hook And Eye Ties For Cavity Walls, Masonry Wall Reinforcement	83.25	
			<i>For Class 1 Mill Galvanized, Add</i>	5.48	
			<i>For Class 2 Mill Galvanized, Add</i>	8.21	
			<i>For Hot-Dipped Galvanized, Add</i>	13.69	
			<i>For Stainless Steel, Add</i>	54.76	
			<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0132			3/16" Side Rods, 9 Gauge Cross Rods, Ladder-Type With Hook And Eye Ties For Cavity Walls, Masonry Wall Reinforcement <small>(04 05 19 13-0125)</small>		
04 05 19 13-0133	CLF		#10 (For 4" + 2" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Ladder-Type With Hook And Eye Ties For Cavity Walls, Masonry Wall Reinforcement.....	73.10	
			<i>For Class 1 Mill Galvanized, Add</i>	6.29	
			<i>For Class 2 Mill Galvanized, Add</i>	9.44	
			<i>For Hot-Dipped Galvanized, Add</i>	15.73	
			<i>For Stainless Steel, Add</i>	62.90	
			<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0134	CLF		#12 (For 6" + 2" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Ladder-Type With Hook And Eye Ties For Cavity Walls, Masonry Wall Reinforcement.....	79.43	
			<i>For Class 1 Mill Galvanized, Add</i>	6.42	
			<i>For Class 2 Mill Galvanized, Add</i>	9.63	
			<i>For Hot-Dipped Galvanized, Add</i>	16.05	
			<i>For Stainless Steel, Add</i>	64.20	
			<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0135	CLF		#14 (For 8" + 2" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Ladder-Type With Hook And Eye Ties For Cavity Walls, Masonry Wall Reinforcement.....	83.52	
			<i>For Class 1 Mill Galvanized, Add</i>	6.56	
			<i>For Class 2 Mill Galvanized, Add</i>	9.84	
			<i>For Hot-Dipped Galvanized, Add</i>	16.40	
			<i>For Stainless Steel, Add</i>	65.58	
			<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0136	CLF		#16 (For 10" + 2" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Ladder-Type With Hook And Eye Ties For Cavity Walls, Masonry Wall Reinforcement	87.12	
			<i>For Class 1 Mill Galvanized, Add</i>	6.67	
			<i>For Class 2 Mill Galvanized, Add</i>	10.01	
			<i>For Hot-Dipped Galvanized, Add</i>	16.68	
			<i>For Stainless Steel, Add</i>	66.70	
			<i>For Seismic Hook And Eye, Add</i>	27.50	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
04 05 19 13-0137 CLF #18 (For 12" + 2" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Ladder-Type With Hook And Eye Ties For Cavity Walls, Masonry Wall Reinforcement.....	89.97	
<i>For Class 1 Mill Galvanized, Add</i>	6.82	
<i>For Class 2 Mill Galvanized, Add</i>	10.23	
<i>For Hot-Dipped Galvanized, Add</i>	17.05	
<i>For Stainless Steel, Add</i>	68.20	
<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0138 3/16" Side Rods, 3/16" Cross Rods, Ladder-Type With Hook And Eye Ties For Cavity Walls, Masonry Wall Reinforcement <small>(04 05 19 13-0125)</small>		
04 05 19 13-0139 CLF #10 (For 4" + 2" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Ladder-Type With Hook And Eye Ties For Cavity Walls, Masonry Wall Reinforcement.....	73.79	
<i>For Class 1 Mill Galvanized, Add</i>	6.43	
<i>For Class 2 Mill Galvanized, Add</i>	9.64	
<i>For Hot-Dipped Galvanized, Add</i>	16.07	
<i>For Stainless Steel, Add</i>	64.28	
<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0140 CLF #12 (For 6" + 2" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Ladder-Type With Hook And Eye Ties For Cavity Walls, Masonry Wall Reinforcement.....	80.58	
<i>For Class 1 Mill Galvanized, Add</i>	6.65	
<i>For Class 2 Mill Galvanized, Add</i>	9.98	
<i>For Hot-Dipped Galvanized, Add</i>	16.63	
<i>For Stainless Steel, Add</i>	66.50	
<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0141 CLF #14 (For 8" + 2" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Ladder-Type With Hook And Eye Ties For Cavity Walls, Masonry Wall Reinforcement.....	85.10	
<i>For Class 1 Mill Galvanized, Add</i>	6.87	
<i>For Class 2 Mill Galvanized, Add</i>	10.31	
<i>For Hot-Dipped Galvanized, Add</i>	17.19	
<i>For Stainless Steel, Add</i>	68.74	
<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0142 CLF #16 (For 10" + 2" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Ladder-Type With Hook And Eye Ties For Cavity Walls, Masonry Wall Reinforcement.....	89.46	
<i>For Class 1 Mill Galvanized, Add</i>	7.14	
<i>For Class 2 Mill Galvanized, Add</i>	10.71	
<i>For Hot-Dipped Galvanized, Add</i>	17.85	
<i>For Stainless Steel, Add</i>	71.38	
<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0143 CLF #18 (For 12" + 2" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Ladder-Type With Hook And Eye Ties For Cavity Walls, Masonry Wall Reinforcement.....	92.87	
<i>For Class 1 Mill Galvanized, Add</i>	7.40	
<i>For Class 2 Mill Galvanized, Add</i>	11.10	
<i>For Hot-Dipped Galvanized, Add</i>	18.50	
<i>For Stainless Steel, Add</i>	74.00	
<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0144 Truss-Type, Masonry Wall Reinforcement <small>(04 05 19 13-0001)</small>		
04 05 19 13-0145 Truss-Type, Masonry Wall Reinforcement <small>(04 05 19 13-0144)</small>		
04 05 19 13-0146 9 Gauge Side Rods, 9 Gauge Cross Rods, Truss-Type, Masonry Wall Reinforcement <small>(04 05 19 13-0145)</small>		
04 05 19 13-0147 CLF #4 (For 4" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Truss-Type, Masonry Wall Reinforcement.....	35.97	
<i>For Class 1 Mill Galvanized, Add</i>	1.94	
<i>For Class 2 Mill Galvanized, Add</i>	2.92	
<i>For Hot-Dipped Galvanized, Add</i>	4.86	
<i>For Stainless Steel, Add</i>	19.44	
<i>For Cavity Drip, Add</i>	0.50	
<i>For 3-Wire, Add</i>	8.75	
<i>For Double Side Rods, Add</i>	17.50	
04 05 19 13-0148 CLF #6 (For 6" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Truss-Type, Masonry Wall Reinforcement.....	37.87	
<i>For Class 1 Mill Galvanized, Add</i>	1.97	
<i>For Class 2 Mill Galvanized, Add</i>	2.95	
<i>For Hot-Dipped Galvanized, Add</i>	4.92	
<i>For Stainless Steel, Add</i>	19.66	
<i>For Cavity Drip, Add</i>	0.50	
<i>For 3-Wire, Add</i>	8.75	
<i>For Double Side Rods, Add</i>	17.50	
04 05 19 13-0149 CLF #8 (For 8" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Truss-Type, Masonry Wall Reinforcement.....	40.82	
<i>For Class 1 Mill Galvanized, Add</i>	2.04	
<i>For Class 2 Mill Galvanized, Add</i>	3.07	
<i>For Hot-Dipped Galvanized, Add</i>	5.11	
<i>For Stainless Steel, Add</i>	20.44	
<i>For Cavity Drip, Add</i>	0.50	
<i>For 3-Wire, Add</i>	8.75	
<i>For Double Side Rods, Add</i>	17.50	

04 Masonry**04 05 Common Work Results For Masonry****04 05 19 Masonry Anchorage And Reinforcing**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
04 05 19 13-0150	CLF	#10	(For 10" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Truss-Type, Masonry Wall Reinforcement	44.37	
			<i>For Class 1 Mill Galvanized, Add</i>	2.14	
			<i>For Class 2 Mill Galvanized, Add</i>	3.22	
			<i>For Hot-Dipped Galvanized, Add</i>	5.36	
			<i>For Stainless Steel, Add</i>	21.44	
			<i>For Cavity Drip, Add</i>	0.50	
			<i>For 3-Wire, Add</i>	8.75	
			<i>For Double Side Rods, Add</i>	17.50	
04 05 19 13-0151	CLF	#12	(For 12" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Truss-Type, Masonry Wall Reinforcement	48.69	
			<i>For Class 1 Mill Galvanized, Add</i>	2.26	
			<i>For Class 2 Mill Galvanized, Add</i>	3.39	
			<i>For Hot-Dipped Galvanized, Add</i>	5.65	
			<i>For Stainless Steel, Add</i>	22.58	
			<i>For Cavity Drip, Add</i>	0.50	
			<i>For 3-Wire, Add</i>	8.75	
			<i>For Double Side Rods, Add</i>	17.50	
04 05 19 13-0152	CLF	#13	(For 13" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Truss-Type, Masonry Wall Reinforcement	51.97	
			<i>For Class 1 Mill Galvanized, Add</i>	2.32	
			<i>For Class 2 Mill Galvanized, Add</i>	3.48	
			<i>For Hot-Dipped Galvanized, Add</i>	5.80	
			<i>For Stainless Steel, Add</i>	23.18	
			<i>For Cavity Drip, Add</i>	0.50	
			<i>For 3-Wire, Add</i>	8.75	
			<i>For Double Side Rods, Add</i>	17.50	
04 05 19 13-0153	CLF	#14	(For 14" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Truss-Type, Masonry Wall Reinforcement	54.10	
			<i>For Class 1 Mill Galvanized, Add</i>	2.41	
			<i>For Class 2 Mill Galvanized, Add</i>	3.61	
			<i>For Hot-Dipped Galvanized, Add</i>	6.02	
			<i>For Stainless Steel, Add</i>	24.06	
			<i>For Cavity Drip, Add</i>	0.50	
			<i>For 3-Wire, Add</i>	8.75	
			<i>For Double Side Rods, Add</i>	17.50	
04 05 19 13-0154	CLF	#16	(For 16" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Truss-Type, Masonry Wall Reinforcement	61.99	
			<i>For Class 1 Mill Galvanized, Add</i>	3.38	
			<i>For Class 2 Mill Galvanized, Add</i>	5.07	
			<i>For Hot-Dipped Galvanized, Add</i>	8.45	
			<i>For Stainless Steel, Add</i>	33.80	
			<i>For Cavity Drip, Add</i>	0.50	
			<i>For 3-Wire, Add</i>	8.75	
			<i>For Double Side Rods, Add</i>	17.50	
04 05 19 13-0155	CLF	#18	(For 18" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Truss-Type, Masonry Wall Reinforcement	65.65	
			<i>For Class 1 Mill Galvanized, Add</i>	3.57	
			<i>For Class 2 Mill Galvanized, Add</i>	5.36	
			<i>For Hot-Dipped Galvanized, Add</i>	8.94	
			<i>For Stainless Steel, Add</i>	35.74	
			<i>For Cavity Drip, Add</i>	0.50	
			<i>For 3-Wire, Add</i>	8.75	
			<i>For Double Side Rods, Add</i>	17.50	
04 05 19 13-0156	CLF	#20	(For 20" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Truss-Type, Masonry Wall Reinforcement	82.07	
			<i>For Class 1 Mill Galvanized, Add</i>	6.18	
			<i>For Class 2 Mill Galvanized, Add</i>	9.27	
			<i>For Hot-Dipped Galvanized, Add</i>	15.46	
			<i>For Stainless Steel, Add</i>	61.82	
			<i>For Cavity Drip, Add</i>	0.50	
			<i>For 3-Wire, Add</i>	8.75	
			<i>For Double Side Rods, Add</i>	17.50	
04 05 19 13-0157			3/16" Side Rods, 9 Gauge Cross Rods, Truss-Type, Masonry Wall Reinforcement <small>(04 05 19 13-0145)</small>		
04 05 19 13-0158	CLF	#4	(For 4" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Truss-Type, Masonry Wall Reinforcement	39.74	
			<i>For Class 1 Mill Galvanized, Add</i>	2.70	
			<i>For Class 2 Mill Galvanized, Add</i>	4.04	
			<i>For Hot-Dipped Galvanized, Add</i>	6.74	
			<i>For Stainless Steel, Add</i>	26.96	
			<i>For Cavity Drip, Add</i>	0.50	
			<i>For 3-Wire, Add</i>	8.75	
			<i>For Double Side Rods, Add</i>	17.50	
04 05 19 13-0159	CLF	#6	(For 6" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Truss-Type, Masonry Wall Reinforcement	41.71	
			<i>For Class 1 Mill Galvanized, Add</i>	2.73	
			<i>For Class 2 Mill Galvanized, Add</i>	4.10	
			<i>For Hot-Dipped Galvanized, Add</i>	6.84	
			<i>For Stainless Steel, Add</i>	27.34	
			<i>For Cavity Drip, Add</i>	0.50	
			<i>For 3-Wire, Add</i>	8.75	
			<i>For Double Side Rods, Add</i>	17.50	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
04 05 19 13-0160 CLF #8 (For 8" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Truss-Type, Masonry Wall Reinforcement	44.66	
<i>For Class 1 Mill Galvanized, Add</i>	2.81	
<i>For Class 2 Mill Galvanized, Add</i>	4.22	
<i>For Hot-Dipped Galvanized, Add</i>	7.03	
<i>For Stainless Steel, Add</i>	28.12	
<i>For Cavity Drip, Add</i>	0.50	
<i>For 3-Wire, Add</i>	8.75	
<i>For Double Side Rods, Add</i>	17.50	
04 05 19 13-0161 CLF #10 (For 10" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Truss-Type, Masonry Wall Reinforcement	48.20	
<i>For Class 1 Mill Galvanized, Add</i>	2.91	
<i>For Class 2 Mill Galvanized, Add</i>	4.37	
<i>For Hot-Dipped Galvanized, Add</i>	7.28	
<i>For Stainless Steel, Add</i>	29.10	
<i>For Cavity Drip, Add</i>	0.50	
<i>For 3-Wire, Add</i>	8.75	
<i>For Double Side Rods, Add</i>	17.50	
04 05 19 13-0162 CLF #12 (For 12" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Truss-Type, Masonry Wall Reinforcement	52.47	
<i>For Class 1 Mill Galvanized, Add</i>	3.01	
<i>For Class 2 Mill Galvanized, Add</i>	4.52	
<i>For Hot-Dipped Galvanized, Add</i>	7.54	
<i>For Stainless Steel, Add</i>	30.14	
<i>For Cavity Drip, Add</i>	0.50	
<i>For 3-Wire, Add</i>	8.75	
<i>For Double Side Rods, Add</i>	17.50	
04 05 19 13-0163 CLF #13 (For 13" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Truss-Type, Masonry Wall Reinforcement	55.79	
<i>For Class 1 Mill Galvanized, Add</i>	3.08	
<i>For Class 2 Mill Galvanized, Add</i>	4.63	
<i>For Hot-Dipped Galvanized, Add</i>	7.71	
<i>For Stainless Steel, Add</i>	30.84	
<i>For Cavity Drip, Add</i>	0.50	
<i>For 3-Wire, Add</i>	8.75	
<i>For Double Side Rods, Add</i>	17.50	
04 05 19 13-0164 CLF #14 (For 14" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Truss-Type, Masonry Wall Reinforcement	57.87	
<i>For Class 1 Mill Galvanized, Add</i>	3.16	
<i>For Class 2 Mill Galvanized, Add</i>	4.74	
<i>For Hot-Dipped Galvanized, Add</i>	7.90	
<i>For Stainless Steel, Add</i>	31.60	
<i>For Cavity Drip, Add</i>	0.50	
<i>For 3-Wire, Add</i>	8.75	
<i>For Double Side Rods, Add</i>	17.50	
04 05 19 13-0165 CLF #16 (For 16" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Truss-Type, Masonry Wall Reinforcement	67.06	
<i>For Class 1 Mill Galvanized, Add</i>	4.39	
<i>For Class 2 Mill Galvanized, Add</i>	6.59	
<i>For Hot-Dipped Galvanized, Add</i>	10.99	
<i>For Stainless Steel, Add</i>	43.94	
<i>For Cavity Drip, Add</i>	0.50	
<i>For 3-Wire, Add</i>	8.75	
<i>For Double Side Rods, Add</i>	17.50	
04 05 19 13-0166 CLF #18 (For 18" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Truss-Type, Masonry Wall Reinforcement	70.71	
<i>For Class 1 Mill Galvanized, Add</i>	4.59	
<i>For Class 2 Mill Galvanized, Add</i>	6.88	
<i>For Hot-Dipped Galvanized, Add</i>	11.47	
<i>For Stainless Steel, Add</i>	45.86	
<i>For Cavity Drip, Add</i>	0.50	
<i>For 3-Wire, Add</i>	8.75	
<i>For Double Side Rods, Add</i>	17.50	
04 05 19 13-0167 CLF #20 (For 20" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Truss-Type, Masonry Wall Reinforcement	91.10	
<i>For Class 1 Mill Galvanized, Add</i>	8.66	
<i>For Class 2 Mill Galvanized, Add</i>	13.00	
<i>For Hot-Dipped Galvanized, Add</i>	21.66	
<i>For Stainless Steel, Add</i>	86.64	
<i>For Cavity Drip, Add</i>	0.50	
<i>For 3-Wire, Add</i>	8.75	
<i>For Double Side Rods, Add</i>	17.50	
04 05 19 13-0168 3/16" Side Rods, 3/16" Cross Rods, Truss-Type, Masonry Wall Reinforcement		
<small>(04 05 19 13-0145)</small>		
04 05 19 13-0169 CLF #4 (For 4" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Truss-Type, Masonry Wall Reinforcement	45.49	
<i>For Class 1 Mill Galvanized, Add</i>	3.85	
<i>For Class 2 Mill Galvanized, Add</i>	5.77	
<i>For Hot-Dipped Galvanized, Add</i>	9.62	
<i>For Stainless Steel, Add</i>	38.48	
<i>For Cavity Drip, Add</i>	0.50	
<i>For 3-Wire, Add</i>	8.75	
<i>For Double Side Rods, Add</i>	17.50	

04 Masonry**04 05 Common Work Results For Masonry****04 05 19 Masonry Anchorage And Reinforcing**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
04 05 19 13-0170 CLF #6 (For 6" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Truss-Type, Masonry Wall Reinforcement	47.75	
For Class 1 Mill Galvanized, Add	3.90	
For Class 2 Mill Galvanized, Add	5.84	
For Hot-Dipped Galvanized, Add	9.74	
For Stainless Steel, Add	38.96	
For Cavity Drip, Add	0.50	
For 3-Wire, Add	8.75	
For Double Side Rods, Add	17.50	
04 05 19 13-0171 CLF #8 (For 8" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Truss-Type, Masonry Wall Reinforcement	50.48	
For Class 1 Mill Galvanized, Add	4.04	
For Class 2 Mill Galvanized, Add	6.06	
For Hot-Dipped Galvanized, Add	10.10	
For Stainless Steel, Add	40.38	
For Cavity Drip, Add	0.50	
For 3-Wire, Add	8.75	
For Double Side Rods, Add	17.50	
04 05 19 13-0172 CLF #10 (For 10" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Truss-Type, Masonry Wall Reinforcement	54.82	
For Class 1 Mill Galvanized, Add	4.23	
For Class 2 Mill Galvanized, Add	6.35	
For Hot-Dipped Galvanized, Add	10.59	
For Stainless Steel, Add	42.34	
For Cavity Drip, Add	0.50	
For 3-Wire, Add	8.75	
For Double Side Rods, Add	17.50	
04 05 19 13-0173 CLF #12 (For 12" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Truss-Type, Masonry Wall Reinforcement	59.41	
For Class 1 Mill Galvanized, Add	4.48	
For Class 2 Mill Galvanized, Add	6.72	
For Hot-Dipped Galvanized, Add	11.20	
For Stainless Steel, Add	44.78	
For Cavity Drip, Add	0.50	
For 3-Wire, Add	8.75	
For Double Side Rods, Add	17.50	
04 05 19 13-0174 CLF #13 (For 13" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Truss-Type, Masonry Wall Reinforcement	63.32	
For Class 1 Mill Galvanized, Add	4.59	
For Class 2 Mill Galvanized, Add	6.88	
For Hot-Dipped Galvanized, Add	11.47	
For Stainless Steel, Add	45.88	
For Cavity Drip, Add	0.50	
For 3-Wire, Add	8.75	
For Double Side Rods, Add	17.50	
04 05 19 13-0175 CLF #14 (For 14" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Truss-Type, Masonry Wall Reinforcement	65.84	
For Class 1 Mill Galvanized, Add	4.75	
For Class 2 Mill Galvanized, Add	7.13	
For Hot-Dipped Galvanized, Add	11.89	
For Stainless Steel, Add	47.54	
For Cavity Drip, Add	0.50	
For 3-Wire, Add	8.75	
For Double Side Rods, Add	17.50	
04 05 19 13-0176 CLF #16 (For 16" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Truss-Type, Masonry Wall Reinforcement	78.47	
For Class 1 Mill Galvanized, Add	6.67	
For Class 2 Mill Galvanized, Add	10.01	
For Hot-Dipped Galvanized, Add	16.69	
For Stainless Steel, Add	66.74	
For Cavity Drip, Add	0.50	
For 3-Wire, Add	8.75	
For Double Side Rods, Add	17.50	
04 05 19 13-0177 CLF #18 (For 18" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Truss-Type, Masonry Wall Reinforcement	83.05	
For Class 1 Mill Galvanized, Add	7.05	
For Class 2 Mill Galvanized, Add	10.58	
For Hot-Dipped Galvanized, Add	17.63	
For Stainless Steel, Add	70.52	
For Cavity Drip, Add	0.50	
For 3-Wire, Add	8.75	
For Double Side Rods, Add	17.50	
04 05 19 13-0178 CLF #20 (For 20" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Truss-Type, Masonry Wall Reinforcement	112.12	
For Class 1 Mill Galvanized, Add	12.19	
For Class 2 Mill Galvanized, Add	18.29	
For Hot-Dipped Galvanized, Add	30.48	
For Stainless Steel, Add	121.92	
For Cavity Drip, Add	0.50	
For 3-Wire, Add	8.75	
For Double Side Rods, Add	17.50	

04 05 19 13-0179 Truss-Type With Tabs, Masonry Wall Reinforcement (04 05 19 13-0144)

04 05 19 13-0180 9 Gauge Side Rods, 9 Gauge Cross Rods, Truss-Type With Tabs, Masonry Wall Reinforcement (04 05 19 13-0179)



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
04 05 19 13-0181 CLF #8 (For 8" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Truss-Type With Tabs, Masonry		
Wall Reinforcement	49.31	
<i>For Class 1 Mill Galvanized, Add</i>	3.05	
<i>For Class 2 Mill Galvanized, Add</i>	4.57	
<i>For Hot-Dipped Galvanized, Add</i>	7.62	
<i>For Stainless Steel, Add</i>	30.48	
<i>For Cavity Drip, Add</i>	0.50	
04 05 19 13-0182 CLF #10 (For 10" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Truss-Type With Tabs, Masonry		
Wall Reinforcement	53.83	
<i>For Class 1 Mill Galvanized, Add</i>	3.19	
<i>For Class 2 Mill Galvanized, Add</i>	4.79	
<i>For Hot-Dipped Galvanized, Add</i>	7.99	
<i>For Stainless Steel, Add</i>	31.94	
<i>For Cavity Drip, Add</i>	0.50	
04 05 19 13-0183 CLF #12 (For 12" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Truss-Type With Tabs, Masonry		
Wall Reinforcement	58.55	
<i>For Class 1 Mill Galvanized, Add</i>	3.38	
<i>For Class 2 Mill Galvanized, Add</i>	5.07	
<i>For Hot-Dipped Galvanized, Add</i>	8.45	
<i>For Stainless Steel, Add</i>	33.80	
<i>For Cavity Drip, Add</i>	0.50	
04 05 19 13-0184 CLF #13 (For 13" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Truss-Type With Tabs, Masonry		
Wall Reinforcement	62.99	
<i>For Class 1 Mill Galvanized, Add</i>	3.51	
<i>For Class 2 Mill Galvanized, Add</i>	5.27	
<i>For Hot-Dipped Galvanized, Add</i>	8.78	
<i>For Stainless Steel, Add</i>	35.10	
<i>For Cavity Drip, Add</i>	0.50	
04 05 19 13-0185 CLF #14 (For 14" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Truss-Type With Tabs, Masonry		
Wall Reinforcement	65.41	
<i>For Class 1 Mill Galvanized, Add</i>	3.62	
<i>For Class 2 Mill Galvanized, Add</i>	5.42	
<i>For Hot-Dipped Galvanized, Add</i>	9.04	
<i>For Stainless Steel, Add</i>	36.16	
<i>For Cavity Drip, Add</i>	0.50	
04 05 19 13-0186 CLF #16 (For 16" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Truss-Type With Tabs, Masonry		
Wall Reinforcement	70.10	
<i>For Class 1 Mill Galvanized, Add</i>	3.87	
<i>For Class 2 Mill Galvanized, Add</i>	5.81	
<i>For Hot-Dipped Galvanized, Add</i>	9.69	
<i>For Stainless Steel, Add</i>	38.74	
<i>For Cavity Drip, Add</i>	0.50	
04 05 19 13-0187 CLF #18 (For 18" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Truss-Type With Tabs, Masonry		
Wall Reinforcement	74.43	
<i>For Class 1 Mill Galvanized, Add</i>	4.13	
<i>For Class 2 Mill Galvanized, Add</i>	6.20	
<i>For Hot-Dipped Galvanized, Add</i>	10.33	
<i>For Stainless Steel, Add</i>	41.32	
<i>For Cavity Drip, Add</i>	0.50	
04 05 19 13-0188 3/16" Side Rods, 9 Gauge Cross Rods, Truss-Type With Tabs, Masonry		
Wall Reinforcement <small>(04 05 19 13-0179)</small>		
04 05 19 13-0189 CLF #8 (For 8" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Truss-Type With Tabs, Masonry Wall		
Reinforcement	54.05	
<i>For Class 1 Mill Galvanized, Add</i>	4.00	
<i>For Class 2 Mill Galvanized, Add</i>	5.99	
<i>For Hot-Dipped Galvanized, Add</i>	9.99	
<i>For Stainless Steel, Add</i>	39.96	
<i>For Cavity Drip, Add</i>	0.50	
04 05 19 13-0190 CLF #10 (For 10" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Truss-Type With Tabs, Masonry		
Wall Reinforcement	58.59	
<i>For Class 1 Mill Galvanized, Add</i>	4.15	
<i>For Class 2 Mill Galvanized, Add</i>	6.22	
<i>For Hot-Dipped Galvanized, Add</i>	10.37	
<i>For Stainless Steel, Add</i>	41.46	
<i>For Cavity Drip, Add</i>	0.50	
04 05 19 13-0191 CLF #12 (For 12" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Truss-Type With Tabs, Masonry		
Wall Reinforcement	63.29	
<i>For Class 1 Mill Galvanized, Add</i>	4.33	
<i>For Class 2 Mill Galvanized, Add</i>	6.49	
<i>For Hot-Dipped Galvanized, Add</i>	10.82	
<i>For Stainless Steel, Add</i>	43.28	
<i>For Cavity Drip, Add</i>	0.50	
04 05 19 13-0192 CLF #13 (For 13" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Truss-Type With Tabs, Masonry		
Wall Reinforcement	67.73	
<i>For Class 1 Mill Galvanized, Add</i>	4.46	
<i>For Class 2 Mill Galvanized, Add</i>	6.69	
<i>For Hot-Dipped Galvanized, Add</i>	11.15	
<i>For Stainless Steel, Add</i>	44.58	
<i>For Cavity Drip, Add</i>	0.50	

04 Masonry**04 05 Common Work Results For Masonry****04 05 19 Masonry Anchorage And Reinforcing**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
04 05 19 13-0193	CLF	#14	(For 14" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Truss-Type With Tabs, Masonry Wall Reinforcement	70.13	
			<i>For Class 1 Mill Galvanized, Add</i>	4.56	
			<i>For Class 2 Mill Galvanized, Add</i>	6.84	
			<i>For Hot-Dipped Galvanized, Add</i>	11.40	
			<i>For Stainless Steel, Add</i>	45.60	
			<i>For Cavity Drip, Add</i>	0.50	
04 05 19 13-0194	CLF	#16	(For 16" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Truss-Type With Tabs, Masonry Wall Reinforcement	74.83	
			<i>For Class 1 Mill Galvanized, Add</i>	4.82	
			<i>For Class 2 Mill Galvanized, Add</i>	7.23	
			<i>For Hot-Dipped Galvanized, Add</i>	12.05	
			<i>For Stainless Steel, Add</i>	48.20	
			<i>For Cavity Drip, Add</i>	0.50	
04 05 19 13-0195	CLF	#18	(For 18" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Truss-Type With Tabs, Masonry Wall Reinforcement	79.18	
			<i>For Class 1 Mill Galvanized, Add</i>	5.08	
			<i>For Class 2 Mill Galvanized, Add</i>	7.62	
			<i>For Hot-Dipped Galvanized, Add</i>	12.71	
			<i>For Stainless Steel, Add</i>	50.82	
			<i>For Cavity Drip, Add</i>	0.50	
04 05 19 13-0196			3/16" Side Rods, 3/16" Cross Rods, Truss-Type With Tabs, Masonry Wall Reinforcement <small>(04 05 19 13-0179)</small>		
04 05 19 13-0197	CLF	#8	(For 8" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Truss-Type With Tabs, Masonry Wall Reinforcement	58.45	
			<i>For Class 1 Mill Galvanized, Add</i>	4.88	
			<i>For Class 2 Mill Galvanized, Add</i>	7.31	
			<i>For Hot-Dipped Galvanized, Add</i>	12.19	
			<i>For Stainless Steel, Add</i>	48.76	
			<i>For Cavity Drip, Add</i>	0.50	
04 05 19 13-0198	CLF	#10	(For 10" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Truss-Type With Tabs, Masonry Wall Reinforcement	63.40	
			<i>For Class 1 Mill Galvanized, Add</i>	5.11	
			<i>For Class 2 Mill Galvanized, Add</i>	7.66	
			<i>For Hot-Dipped Galvanized, Add</i>	12.77	
			<i>For Stainless Steel, Add</i>	51.08	
			<i>For Cavity Drip, Add</i>	0.50	
04 05 19 13-0199	CLF	#12	(For 12" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Truss-Type With Tabs, Masonry Wall Reinforcement	68.77	
			<i>For Class 1 Mill Galvanized, Add</i>	5.42	
			<i>For Class 2 Mill Galvanized, Add</i>	8.14	
			<i>For Hot-Dipped Galvanized, Add</i>	13.56	
			<i>For Stainless Steel, Add</i>	54.24	
			<i>For Cavity Drip, Add</i>	0.50	
04 05 19 13-0200	CLF	#13	(For 13" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Truss-Type With Tabs, Masonry Wall Reinforcement	73.42	
			<i>For Class 1 Mill Galvanized, Add</i>	5.60	
			<i>For Class 2 Mill Galvanized, Add</i>	8.39	
			<i>For Hot-Dipped Galvanized, Add</i>	13.99	
			<i>For Stainless Steel, Add</i>	55.96	
			<i>For Cavity Drip, Add</i>	0.50	
04 05 19 13-0201	CLF	#14	(For 14" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Truss-Type With Tabs, Masonry Wall Reinforcement	76.17	
			<i>For Class 1 Mill Galvanized, Add</i>	5.77	
			<i>For Class 2 Mill Galvanized, Add</i>	8.65	
			<i>For Hot-Dipped Galvanized, Add</i>	14.42	
			<i>For Stainless Steel, Add</i>	57.68	
			<i>For Cavity Drip, Add</i>	0.50	
04 05 19 13-0202	CLF	#16	(For 16" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Truss-Type With Tabs, Masonry Wall Reinforcement	81.52	
			<i>For Class 1 Mill Galvanized, Add</i>	6.16	
			<i>For Class 2 Mill Galvanized, Add</i>	9.24	
			<i>For Hot-Dipped Galvanized, Add</i>	15.40	
			<i>For Stainless Steel, Add</i>	61.58	
			<i>For Cavity Drip, Add</i>	0.50	
04 05 19 13-0203	CLF	#18	(For 18" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Truss-Type With Tabs, Masonry Wall Reinforcement	86.16	
			<i>For Class 1 Mill Galvanized, Add</i>	6.48	
			<i>For Class 2 Mill Galvanized, Add</i>	9.72	
			<i>For Hot-Dipped Galvanized, Add</i>	16.20	
			<i>For Stainless Steel, Add</i>	64.78	
			<i>For Cavity Drip, Add</i>	0.50	
04 05 19 13-0204			Truss-Type With Adjustable Tabs For Composite Walls, Masonry Wall Reinforcement <small>(04 05 19 13-0144)</small>		
04 05 19 13-0205			9 Gauge Side Rods, 9 Gauge Cross Rods, Truss-Type With Adjustable Tabs For Composite Walls, Masonry Wall Reinforcement <small>(04 05 19 13-0204)</small>		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
04 05 19 13-0206 CLF #8 (For 4" + 4" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Truss-Type With Adjustable Tabs For Composite Walls, Masonry Wall Reinforcement	64.10	
<i>For Class 1 Mill Galvanized, Add</i>	6.01	
<i>For Class 2 Mill Galvanized, Add</i>	9.01	
<i>For Hot-Dipped Galvanized, Add</i>	15.02	
<i>For Stainless Steel, Add</i>	60.06	
04 05 19 13-0207 CLF #10 (For 6" + 4" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Truss-Type With Adjustable Tabs For Composite Walls, Masonry Wall Reinforcement	68.10	
<i>For Class 1 Mill Galvanized, Add</i>	6.05	
<i>For Class 2 Mill Galvanized, Add</i>	9.07	
<i>For Hot-Dipped Galvanized, Add</i>	15.12	
<i>For Stainless Steel, Add</i>	60.48	
04 05 19 13-0208 CLF #12 (For 8" + 4" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Truss-Type With Adjustable Tabs For Composite Walls, Masonry Wall Reinforcement	72.63	
<i>For Class 1 Mill Galvanized, Add</i>	6.20	
<i>For Class 2 Mill Galvanized, Add</i>	9.29	
<i>For Hot-Dipped Galvanized, Add</i>	15.49	
<i>For Stainless Steel, Add</i>	61.96	
04 05 19 13-0209 CLF #14 (For 10" + 4" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Truss-Type With Adjustable Tabs For Composite Walls, Masonry Wall Reinforcement	79.28	
<i>For Class 1 Mill Galvanized, Add</i>	6.39	
<i>For Class 2 Mill Galvanized, Add</i>	9.59	
<i>For Hot-Dipped Galvanized, Add</i>	15.98	
<i>For Stainless Steel, Add</i>	63.90	
04 05 19 13-0210 CLF #16 (For 12" + 4" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Truss-Type With Adjustable Tabs For Composite Walls, Masonry Wall Reinforcement	83.84	
<i>For Class 1 Mill Galvanized, Add</i>	6.62	
<i>For Class 2 Mill Galvanized, Add</i>	9.93	
<i>For Hot-Dipped Galvanized, Add</i>	16.56	
<i>For Stainless Steel, Add</i>	66.22	
04 05 19 13-0211 CLF #18 (For 14" + 4" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Truss-Type With Adjustable Tabs For Composite Walls, Masonry Wall Reinforcement	88.28	
<i>For Class 1 Mill Galvanized, Add</i>	6.90	
<i>For Class 2 Mill Galvanized, Add</i>	10.35	
<i>For Hot-Dipped Galvanized, Add</i>	17.26	
<i>For Stainless Steel, Add</i>	69.02	
04 05 19 13-0212 3/16" Side Rods, 9 Gauge Cross Rods, Truss-Type With Adjustable Tabs For Composite Walls, Masonry Wall Reinforcement <small>(04 05 19 13-0204)</small>		
04 05 19 13-0213 CLF #8 (For 4" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Truss-Type With Adjustable Tabs For Composite Walls, Masonry Wall Reinforcement	71.44	
<i>For Class 1 Mill Galvanized, Add</i>	7.47	
<i>For Class 2 Mill Galvanized, Add</i>	11.21	
<i>For Hot-Dipped Galvanized, Add</i>	18.69	
<i>For Stainless Steel, Add</i>	74.74	
04 05 19 13-0214 CLF #10 (For 6" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Truss-Type With Adjustable Tabs For Composite Walls, Masonry Wall Reinforcement	75.54	
<i>For Class 1 Mill Galvanized, Add</i>	7.54	
<i>For Class 2 Mill Galvanized, Add</i>	11.30	
<i>For Hot-Dipped Galvanized, Add</i>	18.84	
<i>For Stainless Steel, Add</i>	75.36	
04 05 19 13-0215 CLF #12 (For 8" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Truss-Type With Adjustable Tabs For Composite Walls, Masonry Wall Reinforcement	80.07	
<i>For Class 1 Mill Galvanized, Add</i>	7.68	
<i>For Class 2 Mill Galvanized, Add</i>	11.53	
<i>For Hot-Dipped Galvanized, Add</i>	19.21	
<i>For Stainless Steel, Add</i>	76.84	
04 05 19 13-0216 CLF #14 (For 10" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Truss-Type With Adjustable Tabs For Composite Walls, Masonry Wall Reinforcement	86.71	
<i>For Class 1 Mill Galvanized, Add</i>	7.88	
<i>For Class 2 Mill Galvanized, Add</i>	11.81	
<i>For Hot-Dipped Galvanized, Add</i>	19.69	
<i>For Stainless Steel, Add</i>	78.76	
04 05 19 13-0217 CLF #16 (For 12" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Truss-Type With Adjustable Tabs For Composite Walls, Masonry Wall Reinforcement	91.17	
<i>For Class 1 Mill Galvanized, Add</i>	8.09	
<i>For Class 2 Mill Galvanized, Add</i>	12.13	
<i>For Hot-Dipped Galvanized, Add</i>	20.22	
<i>For Stainless Steel, Add</i>	80.88	
04 05 19 13-0218 CLF #18 (For 14" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Truss-Type With Adjustable Tabs For Composite Walls, Masonry Wall Reinforcement	95.28	
<i>For Class 1 Mill Galvanized, Add</i>	8.30	
<i>For Class 2 Mill Galvanized, Add</i>	12.45	
<i>For Hot-Dipped Galvanized, Add</i>	20.76	
<i>For Stainless Steel, Add</i>	83.02	
04 05 19 13-0219 3/16" Side Rods, 3/16" Cross Rods, Truss-Type With Adjustable Tabs For Composite Walls, Masonry Wall Reinforcement <small>(04 05 19 13-0204)</small>		

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MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
04 05 19 13-0220	CLF	#8	(For 4" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Truss-Type With Adjustable Tabs For Composite Walls, Masonry Wall Reinforcement.....	75.46	
			<i>For Class 1 Mill Galvanized, Add</i>	8.28	
			<i>For Class 2 Mill Galvanized, Add</i>	12.42	
			<i>For Hot-Dipped Galvanized, Add</i>	20.70	
			<i>For Stainless Steel, Add</i>	82.78	
04 05 19 13-0221	CLF	#10	(For 6" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Truss-Type With Adjustable Tabs For Composite Walls, Masonry Wall Reinforcement.....	79.57	
			<i>For Class 1 Mill Galvanized, Add</i>	8.34	
			<i>For Class 2 Mill Galvanized, Add</i>	12.51	
			<i>For Hot-Dipped Galvanized, Add</i>	20.86	
			<i>For Stainless Steel, Add</i>	83.42	
04 05 19 13-0222	CLF	#12	(For 8" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Truss-Type With Adjustable Tabs For Composite Walls, Masonry Wall Reinforcement.....	84.51	
			<i>For Class 1 Mill Galvanized, Add</i>	8.57	
			<i>For Class 2 Mill Galvanized, Add</i>	12.86	
			<i>For Hot-Dipped Galvanized, Add</i>	21.43	
			<i>For Stainless Steel, Add</i>	85.72	
04 05 19 13-0223	CLF	#14	(For 10" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Truss-Type With Adjustable Tabs For Composite Walls, Masonry Wall Reinforcement.....	91.70	
			<i>For Class 1 Mill Galvanized, Add</i>	8.87	
			<i>For Class 2 Mill Galvanized, Add</i>	13.31	
			<i>For Hot-Dipped Galvanized, Add</i>	22.19	
			<i>For Stainless Steel, Add</i>	88.74	
04 05 19 13-0224	CLF	#16	(For 12" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Truss-Type With Adjustable Tabs For Composite Walls, Masonry Wall Reinforcement.....	97.01	
			<i>For Class 1 Mill Galvanized, Add</i>	9.26	
			<i>For Class 2 Mill Galvanized, Add</i>	13.88	
			<i>For Hot-Dipped Galvanized, Add</i>	23.14	
			<i>For Stainless Steel, Add</i>	92.56	
04 05 19 13-0225	CLF	#18	(For 14" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Truss-Type With Adjustable Tabs For Composite Walls, Masonry Wall Reinforcement.....	102.17	
			<i>For Class 1 Mill Galvanized, Add</i>	9.68	
			<i>For Class 2 Mill Galvanized, Add</i>	14.52	
			<i>For Hot-Dipped Galvanized, Add</i>	24.20	
			<i>For Stainless Steel, Add</i>	96.80	
04 05 19 13-0226			Truss-Type With Adjustable Tabs For Cavity Walls, Masonry Wall Reinforcement <small>(04 05 19 13-0144)</small>		
04 05 19 13-0227			9 Gauge Side Rods, 9 Gauge Cross Rods, Truss-Type With Adjustable Tabs For Cavity Walls, Masonry Wall Reinforcement <small>(04 05 19 13-0226)</small>		
04 05 19 13-0228	CLF	#10	(For 4" + 2" + 4" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Truss-Type With Adjustable Tabs For Cavity Walls, Masonry Wall Reinforcement.....	69.29	
			<i>For Class 1 Mill Galvanized, Add</i>	6.29	
			<i>For Class 2 Mill Galvanized, Add</i>	9.43	
			<i>For Hot-Dipped Galvanized, Add</i>	15.72	
			<i>For Stainless Steel, Add</i>	62.86	
04 05 19 13-0229	CLF	#12	(For 6" + 2" + 4" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Truss-Type With Adjustable Tabs For Cavity Walls, Masonry Wall Reinforcement.....	73.30	
			<i>For Class 1 Mill Galvanized, Add</i>	6.33	
			<i>For Class 2 Mill Galvanized, Add</i>	9.50	
			<i>For Hot-Dipped Galvanized, Add</i>	15.83	
			<i>For Stainless Steel, Add</i>	63.30	
04 05 19 13-0230	CLF	#14	(For 8" + 2" + 4" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Truss-Type With Adjustable Tabs For Cavity Walls, Masonry Wall Reinforcement.....	79.69	
			<i>For Class 1 Mill Galvanized, Add</i>	6.47	
			<i>For Class 2 Mill Galvanized, Add</i>	9.71	
			<i>For Hot-Dipped Galvanized, Add</i>	16.18	
			<i>For Stainless Steel, Add</i>	64.72	
04 05 19 13-0231	CLF	#16	(For 10" + 2" + 4" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Truss-Type With Adjustable Tabs For Cavity Walls, Masonry Wall Reinforcement.....	84.06	
			<i>For Class 1 Mill Galvanized, Add</i>	6.67	
			<i>For Class 2 Mill Galvanized, Add</i>	10.00	
			<i>For Hot-Dipped Galvanized, Add</i>	16.67	
			<i>For Stainless Steel, Add</i>	66.66	
04 05 19 13-0232	CLF	#18	(For 12" + 2" + 4" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Truss-Type With Adjustable Tabs For Cavity Walls, Masonry Wall Reinforcement.....	88.27	
			<i>For Class 1 Mill Galvanized, Add</i>	6.90	
			<i>For Class 2 Mill Galvanized, Add</i>	10.35	
			<i>For Hot-Dipped Galvanized, Add</i>	17.25	
			<i>For Stainless Steel, Add</i>	69.00	
04 05 19 13-0233	CLF	#20	(For 14" + 2" + 4" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Truss-Type With Adjustable Tabs For Cavity Walls, Masonry Wall Reinforcement.....	91.57	
			<i>For Class 1 Mill Galvanized, Add</i>	7.14	
			<i>For Class 2 Mill Galvanized, Add</i>	10.71	
			<i>For Hot-Dipped Galvanized, Add</i>	17.85	
			<i>For Stainless Steel, Add</i>	71.40	
04 05 19 13-0234			3/16" Side Rods, 9 Gauge Cross Rods, Truss-Type With Adjustable Tabs For Cavity Walls, Masonry Wall Reinforcement <small>(04 05 19 13-0226)</small>		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
04 05 19 13-0235 CLF #10 (For 4" + 2" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Truss-Type With Adjustable Tabs For Cavity Walls, Masonry Wall Reinforcement.....	76.60	
<i>For Class 1 Mill Galvanized, Add</i>	7.75	
<i>For Class 2 Mill Galvanized, Add</i>	11.62	
<i>For Hot-Dipped Galvanized, Add</i>	19.37	
<i>For Stainless Steel, Add</i>	77.48	
04 05 19 13-0236 CLF #12 (For 6" + 2" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Truss-Type With Adjustable Tabs For Cavity Walls, Masonry Wall Reinforcement.....	80.71	
<i>For Class 1 Mill Galvanized, Add</i>	7.81	
<i>For Class 2 Mill Galvanized, Add</i>	11.72	
<i>For Hot-Dipped Galvanized, Add</i>	19.53	
<i>For Stainless Steel, Add</i>	78.12	
04 05 19 13-0237 CLF #14 (For 8" + 2" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Truss-Type With Adjustable Tabs For Cavity Walls, Masonry Wall Reinforcement.....	87.13	
<i>For Class 1 Mill Galvanized, Add</i>	7.96	
<i>For Class 2 Mill Galvanized, Add</i>	11.94	
<i>For Hot-Dipped Galvanized, Add</i>	19.90	
<i>For Stainless Steel, Add</i>	79.60	
04 05 19 13-0238 CLF #16 (For 10" + 2" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Truss-Type With Adjustable Tabs For Cavity Walls, Masonry Wall Reinforcement.....	91.49	
<i>For Class 1 Mill Galvanized, Add</i>	8.15	
<i>For Class 2 Mill Galvanized, Add</i>	12.23	
<i>For Hot-Dipped Galvanized, Add</i>	20.38	
<i>For Stainless Steel, Add</i>	81.52	
04 05 19 13-0239 CLF #18 (For 12" + 2" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Truss-Type With Adjustable Tabs For Cavity Walls, Masonry Wall Reinforcement.....	95.59	
<i>For Class 1 Mill Galvanized, Add</i>	8.36	
<i>For Class 2 Mill Galvanized, Add</i>	12.55	
<i>For Hot-Dipped Galvanized, Add</i>	20.91	
<i>For Stainless Steel, Add</i>	83.64	
04 05 19 13-0240 CLF #20 (For 14" + 2" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Truss-Type With Adjustable Tabs For Cavity Walls, Masonry Wall Reinforcement.....	98.95	
<i>For Class 1 Mill Galvanized, Add</i>	8.62	
<i>For Class 2 Mill Galvanized, Add</i>	12.92	
<i>For Hot-Dipped Galvanized, Add</i>	21.54	
<i>For Stainless Steel, Add</i>	86.16	
04 05 19 13-0241 3/16" Side Rods, 3/16" Cross Rods, Truss-Type With Adjustable Tabs For Cavity Walls, Masonry Wall Reinforcement <small>(04 05 19 13-0226)</small>		
04 05 19 13-0242 CLF #10 (For 4" + 2" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Truss-Type With Adjustable Tabs For Cavity Walls, Masonry Wall Reinforcement.....	80.64	
<i>For Class 1 Mill Galvanized, Add</i>	8.56	
<i>For Class 2 Mill Galvanized, Add</i>	12.83	
<i>For Hot-Dipped Galvanized, Add</i>	21.39	
<i>For Stainless Steel, Add</i>	85.56	
04 05 19 13-0243 CLF #12 (For 6" + 2" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Truss-Type With Adjustable Tabs For Cavity Walls, Masonry Wall Reinforcement.....	84.73	
<i>For Class 1 Mill Galvanized, Add</i>	8.62	
<i>For Class 2 Mill Galvanized, Add</i>	12.92	
<i>For Hot-Dipped Galvanized, Add</i>	21.54	
<i>For Stainless Steel, Add</i>	86.16	
04 05 19 13-0244 CLF #14 (For 8" + 2" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Truss-Type With Adjustable Tabs For Cavity Walls, Masonry Wall Reinforcement.....	91.59	
<i>For Class 1 Mill Galvanized, Add</i>	8.85	
<i>For Class 2 Mill Galvanized, Add</i>	13.28	
<i>For Hot-Dipped Galvanized, Add</i>	22.13	
<i>For Stainless Steel, Add</i>	88.52	
04 05 19 13-0245 CLF #16 (For 10" + 2" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Truss-Type With Adjustable Tabs For Cavity Walls, Masonry Wall Reinforcement.....	96.49	
<i>For Class 1 Mill Galvanized, Add</i>	9.15	
<i>For Class 2 Mill Galvanized, Add</i>	13.73	
<i>For Hot-Dipped Galvanized, Add</i>	22.88	
<i>For Stainless Steel, Add</i>	91.52	
04 05 19 13-0246 CLF #18 (For 12" + 2" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Truss-Type With Adjustable Tabs For Cavity Walls, Masonry Wall Reinforcement.....	101.43	
<i>For Class 1 Mill Galvanized, Add</i>	9.53	
<i>For Class 2 Mill Galvanized, Add</i>	14.30	
<i>For Hot-Dipped Galvanized, Add</i>	23.83	
<i>For Stainless Steel, Add</i>	95.32	
04 05 19 13-0247 CLF #20 (For 14" + 2" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Truss-Type With Adjustable Tabs For Cavity Walls, Masonry Wall Reinforcement.....	104.98	
<i>For Class 1 Mill Galvanized, Add</i>	9.82	
<i>For Class 2 Mill Galvanized, Add</i>	14.73	
<i>For Hot-Dipped Galvanized, Add</i>	24.56	
<i>For Stainless Steel, Add</i>	98.22	
04 05 19 13-0248 Truss-Type With Hook And Eye Ties For Composite Walls, Masonry Wall Reinforcement <small>(04 05 19 13-0144)</small>		
04 05 19 13-0249 9 Gauge Side Rods, 9 Gauge Cross Rods, Truss-Type With Hook And Eye Ties For Composite Walls, Masonry Wall Reinforcement <small>(04 05 19 13-0248)</small>		

04 Masonry**04 05 Common Work Results For Masonry****04 05 19 Masonry Anchorage And Reinforcing**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
04 05 19 13-0250	CLF	#8 (For 4" + 4" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Truss-Type With Hook And Eye Ties For Composite Walls, Masonry Wall Reinforcement.....		66.46	
		<i>For Class 1 Mill Galvanized, Add</i>		5.72	
		<i>For Class 2 Mill Galvanized, Add</i>		8.58	
		<i>For Hot-Dipped Galvanized, Add</i>		14.30	
		<i>For Stainless Steel, Add</i>		57.20	
		<i>For Seismic Hook And Eye, Add</i>		27.50	
04 05 19 13-0251	CLF	#10 (For 6" + 4" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Truss-Type With Hook And Eye Ties For Composite Walls, Masonry Wall Reinforcement.....		70.45	
		<i>For Class 1 Mill Galvanized, Add</i>		5.76	
		<i>For Class 2 Mill Galvanized, Add</i>		8.64	
		<i>For Hot-Dipped Galvanized, Add</i>		14.40	
		<i>For Stainless Steel, Add</i>		57.60	
		<i>For Seismic Hook And Eye, Add</i>		27.50	
04 05 19 13-0252	CLF	#12 (For 8" + 4" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Truss-Type With Hook And Eye Ties For Composite Walls, Masonry Wall Reinforcement.....		76.75	
		<i>For Class 1 Mill Galvanized, Add</i>		5.88	
		<i>For Class 2 Mill Galvanized, Add</i>		8.83	
		<i>For Hot-Dipped Galvanized, Add</i>		14.71	
		<i>For Stainless Steel, Add</i>		58.84	
		<i>For Seismic Hook And Eye, Add</i>		27.50	
04 05 19 13-0253	CLF	#14 (For 10" + 4" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Truss-Type With Hook And Eye Ties For Composite Walls, Masonry Wall Reinforcement.....		81.04	
		<i>For Class 1 Mill Galvanized, Add</i>		6.06	
		<i>For Class 2 Mill Galvanized, Add</i>		9.09	
		<i>For Hot-Dipped Galvanized, Add</i>		15.16	
		<i>For Stainless Steel, Add</i>		60.62	
		<i>For Seismic Hook And Eye, Add</i>		27.50	
04 05 19 13-0254	CLF	#16 (For 12" + 4" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Truss-Type With Hook And Eye Ties For Composite Walls, Masonry Wall Reinforcement.....		85.01	
		<i>For Class 1 Mill Galvanized, Add</i>		6.25	
		<i>For Class 2 Mill Galvanized, Add</i>		9.37	
		<i>For Hot-Dipped Galvanized, Add</i>		15.62	
		<i>For Stainless Steel, Add</i>		62.48	
		<i>For Seismic Hook And Eye, Add</i>		27.50	
04 05 19 13-0255	CLF	#18 (For 14" + 4" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Truss-Type With Hook And Eye Ties For Composite Walls, Masonry Wall Reinforcement.....		88.24	
		<i>For Class 1 Mill Galvanized, Add</i>		6.47	
		<i>For Class 2 Mill Galvanized, Add</i>		9.71	
		<i>For Hot-Dipped Galvanized, Add</i>		16.19	
		<i>For Stainless Steel, Add</i>		64.74	
		<i>For Seismic Hook And Eye, Add</i>		27.50	
04 05 19 13-0256		3/16" Side Rods, 9 Gauge Cross Rods, Truss-Type With Hook And Eye Ties For Composite Walls, Masonry Wall Reinforcement <small>(04 05 19 13-0248)</small>			
04 05 19 13-0257	CLF	#8 (For 4" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Truss-Type With Hook And Eye Ties For Composite Walls, Masonry Wall Reinforcement.....		73.20	
		<i>For Class 1 Mill Galvanized, Add</i>		7.07	
		<i>For Class 2 Mill Galvanized, Add</i>		10.60	
		<i>For Hot-Dipped Galvanized, Add</i>		17.67	
		<i>For Stainless Steel, Add</i>		70.68	
		<i>For Seismic Hook And Eye, Add</i>		27.50	
04 05 19 13-0258	CLF	#10 (For 6" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Truss-Type With Hook And Eye Ties For Composite Walls, Masonry Wall Reinforcement.....		77.27	
		<i>For Class 1 Mill Galvanized, Add</i>		7.12	
		<i>For Class 2 Mill Galvanized, Add</i>		10.69	
		<i>For Hot-Dipped Galvanized, Add</i>		17.81	
		<i>For Stainless Steel, Add</i>		71.24	
		<i>For Seismic Hook And Eye, Add</i>		27.50	
04 05 19 13-0259	CLF	#12 (For 8" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Truss-Type With Hook And Eye Ties For Composite Walls, Masonry Wall Reinforcement.....		83.51	
		<i>For Class 1 Mill Galvanized, Add</i>		7.24	
		<i>For Class 2 Mill Galvanized, Add</i>		10.85	
		<i>For Hot-Dipped Galvanized, Add</i>		18.09	
		<i>For Stainless Steel, Add</i>		72.36	
		<i>For Seismic Hook And Eye, Add</i>		27.50	
04 05 19 13-0260	CLF	#14 (For 10" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Truss-Type With Hook And Eye Ties For Composite Walls, Masonry Wall Reinforcement.....		87.76	
		<i>For Class 1 Mill Galvanized, Add</i>		7.41	
		<i>For Class 2 Mill Galvanized, Add</i>		11.11	
		<i>For Hot-Dipped Galvanized, Add</i>		18.52	
		<i>For Stainless Steel, Add</i>		74.06	
		<i>For Seismic Hook And Eye, Add</i>		27.50	
04 05 19 13-0261	CLF	#16 (For 12" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Truss-Type With Hook And Eye Ties For Composite Walls, Masonry Wall Reinforcement.....		91.72	
		<i>For Class 1 Mill Galvanized, Add</i>		7.59	
		<i>For Class 2 Mill Galvanized, Add</i>		11.39	
		<i>For Hot-Dipped Galvanized, Add</i>		18.98	
		<i>For Stainless Steel, Add</i>		75.90	
		<i>For Seismic Hook And Eye, Add</i>		27.50	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
04 05 19 13-0262 CLF #18 (For 14" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Truss-Type With Hook And Eye Ties For Composite Walls, Masonry Wall Reinforcement.....	94.83	
<i>For Class 1 Mill Galvanized, Add</i>	7.79	
<i>For Class 2 Mill Galvanized, Add</i>	11.69	
<i>For Hot-Dipped Galvanized, Add</i>	19.48	
<i>For Stainless Steel, Add</i>	77.92	
<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0263 3/16" Side Rods, 3/16" Cross Rods, Truss-Type With Hook And Eye Ties For Composite Walls, Masonry Wall Reinforcement <small>(04 05 19 13-0248)</small>		
04 05 19 13-0264 CLF #8 (For 4" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Truss-Type With Hook And Eye Ties For Composite Walls, Masonry Wall Reinforcement	77.28	
<i>For Class 1 Mill Galvanized, Add</i>	7.88	
<i>For Class 2 Mill Galvanized, Add</i>	11.83	
<i>For Hot-Dipped Galvanized, Add</i>	19.71	
<i>For Stainless Steel, Add</i>	78.84	
<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0265 CLF #10 (For 6" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Truss-Type With Hook And Eye Ties For Composite Walls, Masonry Wall Reinforcement	81.37	
<i>For Class 1 Mill Galvanized, Add</i>	7.94	
<i>For Class 2 Mill Galvanized, Add</i>	11.92	
<i>For Hot-Dipped Galvanized, Add</i>	19.86	
<i>For Stainless Steel, Add</i>	79.44	
<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0266 CLF #12 (For 8" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Truss-Type With Hook And Eye Ties For Composite Walls, Masonry Wall Reinforcement	88.15	
<i>For Class 1 Mill Galvanized, Add</i>	8.16	
<i>For Class 2 Mill Galvanized, Add</i>	12.25	
<i>For Hot-Dipped Galvanized, Add</i>	20.41	
<i>For Stainless Steel, Add</i>	81.64	
<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0267 CLF #14 (For 10" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Truss-Type With Hook And Eye Ties For Composite Walls, Masonry Wall Reinforcement.....	92.99	
<i>For Class 1 Mill Galvanized, Add</i>	8.45	
<i>For Class 2 Mill Galvanized, Add</i>	12.68	
<i>For Hot-Dipped Galvanized, Add</i>	21.13	
<i>For Stainless Steel, Add</i>	84.52	
<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0268 CLF #16 (For 12" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Truss-Type With Hook And Eye Ties For Composite Walls, Masonry Wall Reinforcement.....	97.85	
<i>For Class 1 Mill Galvanized, Add</i>	8.82	
<i>For Class 2 Mill Galvanized, Add</i>	13.22	
<i>For Hot-Dipped Galvanized, Add</i>	22.04	
<i>For Stainless Steel, Add</i>	88.16	
<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0269 CLF #18 (For 14" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Truss-Type With Hook And Eye Ties For Composite Walls, Masonry Wall Reinforcement.....	101.97	
<i>For Class 1 Mill Galvanized, Add</i>	9.22	
<i>For Class 2 Mill Galvanized, Add</i>	13.83	
<i>For Hot-Dipped Galvanized, Add</i>	23.05	
<i>For Stainless Steel, Add</i>	92.20	
<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0270 Truss-Type With Hook And Eye Ties For Cavity Walls, Masonry Wall Reinforcement <small>(04 05 19 13-0144)</small>		
04 05 19 13-0271 9 Gauge Side Rods, 9 Gauge Cross Rods, Truss-Type With Hook And Eye Ties For Cavity Walls, Masonry Wall <small>(04 05 19 13-0270)</small>		
04 05 19 13-0272 CLF #10 (For 4" + 2" + 4" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Truss-Type With Hook And Eye Ties For Cavity Walls, Masonry Wall Reinforcement	71.60	
<i>For Class 1 Mill Galvanized, Add</i>	5.99	
<i>For Class 2 Mill Galvanized, Add</i>	8.99	
<i>For Hot-Dipped Galvanized, Add</i>	14.98	
<i>For Stainless Steel, Add</i>	59.90	
<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0273 CLF #12 (For 6" + 2" + 4" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Truss-Type With Hook And Eye Ties For Cavity Walls, Masonry Wall Reinforcement	77.49	
<i>For Class 1 Mill Galvanized, Add</i>	6.03	
<i>For Class 2 Mill Galvanized, Add</i>	9.05	
<i>For Hot-Dipped Galvanized, Add</i>	15.08	
<i>For Stainless Steel, Add</i>	60.32	
<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0274 CLF #14 (For 8" + 2" + 4" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Truss-Type With Hook And Eye Ties For Cavity Walls, Masonry Wall Reinforcement	81.55	
<i>For Class 1 Mill Galvanized, Add</i>	6.16	
<i>For Class 2 Mill Galvanized, Add</i>	9.25	
<i>For Hot-Dipped Galvanized, Add</i>	15.41	
<i>For Stainless Steel, Add</i>	61.64	
<i>For Seismic Hook And Eye, Add</i>	27.50	

04 Masonry**04 05 Common Work Results For Masonry****04 05 19 Masonry Anchorage And Reinforcing**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
04 05 19 13-0275	CLF	#16	(For 10" + 2" + 4" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Truss-Type With Hook And Eye Ties For Cavity Walls, Masonry Wall Reinforcement	85.53	
			<i>For Class 1 Mill Galvanized, Add</i>	6.35	
			<i>For Class 2 Mill Galvanized, Add</i>	9.53	
			<i>For Hot-Dipped Galvanized, Add</i>	15.88	
			<i>For Stainless Steel, Add</i>	63.52	
			<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0276	CLF	#18	(For 12" + 2" + 4" Walls), Mill Galvanized, 9 Gauge Side Rods, 9 Gauge Cross Rods, Truss-Type With Hook And Eye Ties For Cavity Walls, Masonry Wall Reinforcement	88.72	
			<i>For Class 1 Mill Galvanized, Add</i>	6.57	
			<i>For Class 2 Mill Galvanized, Add</i>	9.86	
			<i>For Hot-Dipped Galvanized, Add</i>	16.43	
			<i>For Stainless Steel, Add</i>	65.70	
			<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0277			3/16" Side Rods, 9 Gauge Cross Rods, Truss-Type With Hook And Eye Ties For Cavity Walls, Masonry Wall Reinforcement <small>(04 05 19 13-0270)</small>		
04 05 19 13-0278	CLF	#10	(For 4" + 2" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Truss-Type With Hook And Eye Ties For Cavity Walls, Masonry Wall Reinforcement	78.86	
			<i>For Class 1 Mill Galvanized, Add</i>	7.44	
			<i>For Class 2 Mill Galvanized, Add</i>	11.16	
			<i>For Hot-Dipped Galvanized, Add</i>	18.61	
			<i>For Stainless Steel, Add</i>	74.42	
			<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0279	CLF	#12	(For 6" + 2" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Truss-Type With Hook And Eye Ties For Cavity Walls, Masonry Wall Reinforcement	84.77	
			<i>For Class 1 Mill Galvanized, Add</i>	7.49	
			<i>For Class 2 Mill Galvanized, Add</i>	11.23	
			<i>For Hot-Dipped Galvanized, Add</i>	18.72	
			<i>For Stainless Steel, Add</i>	74.88	
			<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0280	CLF	#14	(For 8" + 2" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Truss-Type With Hook And Eye Ties For Cavity Walls, Masonry Wall Reinforcement	88.81	
			<i>For Class 1 Mill Galvanized, Add</i>	7.62	
			<i>For Class 2 Mill Galvanized, Add</i>	11.42	
			<i>For Hot-Dipped Galvanized, Add</i>	19.04	
			<i>For Stainless Steel, Add</i>	76.16	
			<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0281	CLF	#16	(For 10" + 2" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Truss-Type With Hook And Eye Ties For Cavity Walls, Masonry Wall Reinforcement	92.71	
			<i>For Class 1 Mill Galvanized, Add</i>	7.79	
			<i>For Class 2 Mill Galvanized, Add</i>	11.68	
			<i>For Hot-Dipped Galvanized, Add</i>	19.47	
			<i>For Stainless Steel, Add</i>	77.88	
			<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0282	CLF	#18	(For 12" + 2" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 9 Gauge Cross Rods, Truss-Type With Hook And Eye Ties For Cavity Walls, Masonry Wall Reinforcement	95.70	
			<i>For Class 1 Mill Galvanized, Add</i>	7.97	
			<i>For Class 2 Mill Galvanized, Add</i>	11.95	
			<i>For Hot-Dipped Galvanized, Add</i>	19.92	
			<i>For Stainless Steel, Add</i>	79.66	
			<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0283			3/16" Side Rods, 3/16" Cross Rods, Truss-Type With Hook And Eye Ties For Cavity Walls, Masonry Wall Reinforcement <small>(04 05 19 13-0270)</small>		
04 05 19 13-0284	CLF	#10	(For 4" + 2" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Truss-Type With Hook And Eye Ties For Cavity Walls, Masonry Wall Reinforcement	82.39	
			<i>For Class 1 Mill Galvanized, Add</i>	8.15	
			<i>For Class 2 Mill Galvanized, Add</i>	12.22	
			<i>For Hot-Dipped Galvanized, Add</i>	20.37	
			<i>For Stainless Steel, Add</i>	81.48	
			<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0285	CLF	#12	(For 6" + 2" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Truss-Type With Hook And Eye Ties For Cavity Walls, Masonry Wall Reinforcement	88.36	
			<i>For Class 1 Mill Galvanized, Add</i>	8.21	
			<i>For Class 2 Mill Galvanized, Add</i>	12.31	
			<i>For Hot-Dipped Galvanized, Add</i>	20.52	
			<i>For Stainless Steel, Add</i>	82.06	
			<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0286	CLF	#14	(For 8" + 2" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Truss-Type With Hook And Eye Ties For Cavity Walls, Masonry Wall Reinforcement	92.88	
			<i>For Class 1 Mill Galvanized, Add</i>	8.43	
			<i>For Class 2 Mill Galvanized, Add</i>	12.65	
			<i>For Hot-Dipped Galvanized, Add</i>	21.08	
			<i>For Stainless Steel, Add</i>	84.30	
			<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 13-0287	CLF	#16	(For 10" + 2" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Truss-Type With Hook And Eye Ties For Cavity Walls, Masonry Wall Reinforcement	97.35	
			<i>For Class 1 Mill Galvanized, Add</i>	8.72	
			<i>For Class 2 Mill Galvanized, Add</i>	13.07	
			<i>For Hot-Dipped Galvanized, Add</i>	21.79	
			<i>For Stainless Steel, Add</i>	87.16	
			<i>For Seismic Hook And Eye, Add</i>	27.50	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
	04 05 19 13-0288	CLF		#18 (For 12" + 2" + 4" Walls), Mill Galvanized, 3/16" Side Rods, 3/16" Cross Rods, Truss-Type With Hook And Eye Ties For Cavity Walls, Masonry Wall Reinforcement.....	101.26	
				<i>For Class 1 Mill Galvanized, Add</i>	9.08	
				<i>For Class 2 Mill Galvanized, Add</i>	13.62	
				<i>For Hot-Dipped Galvanized, Add</i>	22.70	
				<i>For Stainless Steel, Add</i>	90.78	
				<i>For Seismic Hook And Eye, Add</i>	27.50	
04 05 19 16 Masonry Anchors (04 05 19)						
04 05 19 16-0001 Rectangular, Wire Masonry Wall Ties (04 05 19 16)						
04 05 19 16-0002 Hot-Dipped Galvanized, Rectangular, Wire Masonry Wall Ties (04 05 19 16-0001)						
	04 05 19 16-0003	EA		2" Width x 4" Length, 3/16" Diameter, Hot-Dipped Galvanized, Rectangular, Wire Masonry Wall Tie.....	0.83	
	04 05 19 16-0004	EA		2" Width x 6" Length, 3/16" Diameter, Hot-Dipped Galvanized, Rectangular, Wire Masonry Wall Tie.....	0.87	
	04 05 19 16-0005	EA		2" Width x 8" Length, 3/16" Diameter, Hot-Dipped Galvanized, Rectangular, Wire Masonry Wall Tie.....	0.91	
	04 05 19 16-0006	EA		2" Width x 10" Length, 3/16" Diameter, Hot-Dipped Galvanized, Rectangular, Wire Masonry Wall Tie.....	0.96	
	04 05 19 16-0007	EA		2" Width x 12" Length, 3/16" Diameter, Hot-Dipped Galvanized, Rectangular, Wire Masonry Wall Tie.....	1.01	
	04 05 19 16-0008	EA		4" Width x 6" Length, 3/16" Diameter, Hot-Dipped Galvanized, Rectangular, Wire Masonry Wall Tie.....	0.91	
	04 05 19 16-0009	EA		4" Width x 8" Length, 3/16" Diameter, Hot-Dipped Galvanized, Rectangular, Wire Masonry Wall Tie.....	0.96	
	04 05 19 16-0010	EA		4" Width x 10" Length, 3/16" Diameter, Hot-Dipped Galvanized, Rectangular, Wire Masonry Wall Tie.....	1.01	
	04 05 19 16-0011	EA		4" Width x 12" Length, 3/16" Diameter, Hot-Dipped Galvanized, Rectangular, Wire Masonry Wall Tie.....	1.06	
04 05 19 16-0012 Mill Galvanized, Rectangular, Wire Masonry Wall Ties (04 05 19 16-0001)						
	04 05 19 16-0013	EA		2" Width x 4" Length, 3/16" Diameter, Mill Galvanized, Rectangular, Wire Masonry Wall Tie.....	0.75	
	04 05 19 16-0014	EA		2" Width x 6" Length, 3/16" Diameter, Mill Galvanized, Rectangular, Wire Masonry Wall Tie.....	0.77	
	04 05 19 16-0015	EA		2" Width x 8" Length, 3/16" Diameter, Mill Galvanized, Rectangular, Wire Masonry Wall Tie.....	0.79	
	04 05 19 16-0016	EA		2" Width x 10" Length, 3/16" Diameter, Mill Galvanized, Rectangular, Wire Masonry Wall Tie.....	0.82	
	04 05 19 16-0017	EA		2" Width x 12" Length, 3/16" Diameter, Mill Galvanized, Rectangular, Wire Masonry Wall Tie.....	0.84	
	04 05 19 16-0018	EA		4" Width x 6" Length, 3/16" Diameter, Mill Galvanized, Rectangular, Wire Masonry Wall Tie.....	0.79	
	04 05 19 16-0019	EA		4" Width x 8" Length, 3/16" Diameter, Mill Galvanized, Rectangular, Wire Masonry Wall Tie.....	0.82	
	04 05 19 16-0020	EA		4" Width x 10" Length, 3/16" Diameter, Mill Galvanized, Rectangular, Wire Masonry Wall Tie.....	0.84	
	04 05 19 16-0021	EA		4" Width x 12" Length, 3/16" Diameter, Mill Galvanized, Rectangular, Wire Masonry Wall Tie.....	0.87	
04 05 19 16-0022 Z-Type, Wire Masonry Wall Ties (04 05 19 16)						
04 05 19 16-0023 Hot-Dipped Galvanized, Z-Type, Wire Masonry Wall Ties (04 05 19 16-0022)						
	04 05 19 16-0024	EA		6" Length, 2" Bends, 3/16" Diameter, Hot-Dipped Galvanized, Z-Type, Wire Masonry Wall Tie.....	0.76	
	04 05 19 16-0025	EA		8" Length, 2" Bends, 3/16" Diameter, Hot-Dipped Galvanized, Z-Type, Wire Masonry Wall Tie.....	0.78	
	04 05 19 16-0026	EA		10" Length, 2" Bends, 3/16" Diameter, Hot-Dipped Galvanized, Z-Type, Wire Masonry Wall Tie.....	0.85	
	04 05 19 16-0027	EA		12" Length, 2" Bends, 3/16" Diameter, Hot-Dipped Galvanized, Z-Type, Wire Masonry Wall Tie.....	0.89	
	04 05 19 16-0028	EA		6" Length, 2" Bends, 1/4" Diameter, Hot-Dipped Galvanized, Z-Type, Wire Masonry Wall Tie.....	0.90	
	04 05 19 16-0029	EA		8" Length, 2" Bends, 1/4" Diameter, Hot-Dipped Galvanized, Z-Type, Wire Masonry Wall Tie.....	0.94	
	04 05 19 16-0030	EA		10" Length, 2" Bends, 1/4" Diameter, Hot-Dipped Galvanized, Z-Type, Wire Masonry Wall Tie.....	1.00	
	04 05 19 16-0031	EA		12" Length, 2" Bends, 1/4" Diameter, Hot-Dipped Galvanized, Z-Type, Wire Masonry Wall Tie.....	1.04	
04 05 19 16-0032 Mill Galvanized, Z-Type, Wire Masonry Wall Ties (04 05 19 16-0022)						
	04 05 19 16-0033	EA		6" Length, 2" Bends, 3/16" Diameter, Mill Galvanized, Z-Type, Wire Masonry Wall Tie.....	0.70	
	04 05 19 16-0034	EA		8" Length, 2" Bends, 3/16" Diameter, Mill Galvanized, Z-Type, Wire Masonry Wall Tie.....	0.71	
	04 05 19 16-0035	EA		10" Length, 2" Bends, 3/16" Diameter, Mill Galvanized, Z-Type, Wire Masonry Wall Tie.....	0.77	
	04 05 19 16-0036	EA		12" Length, 2" Bends, 3/16" Diameter, Mill Galvanized, Z-Type, Wire Masonry Wall Tie.....	0.78	
	04 05 19 16-0037	EA		6" Length, 2" Bends, 1/4" Diameter, Mill Galvanized, Z-Type, Wire Masonry Wall Tie.....	0.79	
	04 05 19 16-0038	EA		8" Length, 2" Bends, 1/4" Diameter, Mill Galvanized, Z-Type, Wire Masonry Wall Tie.....	0.82	
	04 05 19 16-0039	EA		10" Length, 2" Bends, 1/4" Diameter, Mill Galvanized, Z-Type, Wire Masonry Wall Tie.....	0.84	
	04 05 19 16-0040	EA		12" Length, 2" Bends, 1/4" Diameter, Mill Galvanized, Z-Type, Wire Masonry Wall Tie.....	0.88	
04 05 19 16-0041 Wire Beam Ties (04 05 19 16)						
04 05 19 16-0042 Hot-Dipped Galvanized, Wire Beam Ties (04 05 19 16-0041)						
	04 05 19 16-0043	EA		2" Width x 12" Length, 3/16" Diameter, Hot-Dipped Galvanized, Wire Beam Tie.....	0.96	
	04 05 19 16-0044	EA		4" Width x 12" Length, 3/16" Diameter, Hot-Dipped Galvanized, Wire Beam Tie.....	0.98	
	04 05 19 16-0045	EA		6" Width x 12" Length, 3/16" Diameter, Hot-Dipped Galvanized, Wire Beam Tie.....	0.99	
	04 05 19 16-0046	EA		8" Width x 12" Length, 3/16" Diameter, Hot-Dipped Galvanized, Wire Beam Tie.....	1.01	
	04 05 19 16-0047	EA		10" Width x 12" Length, 3/16" Diameter, Hot-Dipped Galvanized, Wire Beam Tie.....	1.04	
04 05 19 16-0048 Mill Galvanized, Wire Beam Ties (04 05 19 16-0041)						
	04 05 19 16-0049	EA		2" Width x 12" Length, 3/16" Diameter, Mill Galvanized, Wire Beam Tie.....	1.11	
	04 05 19 16-0050	EA		4" Width x 12" Length, 3/16" Diameter, Mill Galvanized, Wire Beam Tie.....	1.15	
	04 05 19 16-0051	EA		6" Width x 12" Length, 3/16" Diameter, Mill Galvanized, Wire Beam Tie.....	1.19	
	04 05 19 16-0052	EA		8" Width x 12" Length, 3/16" Diameter, Mill Galvanized, Wire Beam Tie.....	1.22	
	04 05 19 16-0053	EA		10" Width x 12" Length, 3/16" Diameter, Mill Galvanized, Wire Beam Tie.....	1.25	
04 05 19 16-0054 Adjustable Double Pintle, Wire Masonry Wall Ties (04 05 19 16)						



MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

04 05 19 16-0055	Hot-Dipped Galvanized, Adjustable Double Pintle, Wire Masonry Wall Ties <small>(04 05 19 16-0054)</small>	
04 05 19 16-0056	EA 6" Total Length, 3/16" Diameter, Hot-Dipped Galvanized, Adjustable Double Pintle, Wire Masonry Wall Tie	1.04
04 05 19 16-0057	EA 7" Total Length, 3/16" Diameter, Hot-Dipped Galvanized, Adjustable Double Pintle, Wire Masonry Wall Tie	1.08
04 05 19 16-0058	EA 8" Total Length, 3/16" Diameter, Hot-Dipped Galvanized, Adjustable Double Pintle, Wire Masonry Wall Tie	1.10
04 05 19 16-0059	EA 9" Total Length, 3/16" Diameter, Hot-Dipped Galvanized, Adjustable Double Pintle, Wire Masonry Wall Tie	1.13
04 05 19 16-0060	EA 10" Total Length, 3/16" Diameter, Hot-Dipped Galvanized, Adjustable Double Pintle, Wire Masonry Wall Tie	1.14
04 05 19 16-0061	Mill Galvanized, Adjustable Double Pintle, Wire Masonry Wall Ties <small>(04 05 19 16-0054)</small>	
04 05 19 16-0062	EA 6" Total Length, 3/16" Diameter, Mill Galvanized, Adjustable Double Pintle, Wire Masonry Wall Tie	0.91
04 05 19 16-0063	EA 7" Total Length, 3/16" Diameter, Mill Galvanized, Adjustable Double Pintle, Wire Masonry Wall Tie	0.94
04 05 19 16-0064	EA 8" Total Length, 3/16" Diameter, Mill Galvanized, Adjustable Double Pintle, Wire Masonry Wall Tie	0.94
04 05 19 16-0065	EA 9" Total Length, 3/16" Diameter, Mill Galvanized, Adjustable Double Pintle, Wire Masonry Wall Tie	0.97
04 05 19 16-0066	EA 10" Total Length, 3/16" Diameter, Mill Galvanized, Adjustable Double Pintle, Wire Masonry Wall Tie	0.97
04 05 19 16-0067	Corrugated Buck (Brick) Anchors <small>(04 05 19 16)</small>	
04 05 19 16-0068	Hot-Dipped Galvanized, Corrugated Buck (Brick) Anchors <small>(04 05 19 16-0067)</small>	
04 05 19 16-0069	EA 3-1/2" Length, 1-1/4" Width, 16 Gauge, Hot-Dipped Galvanized, Corrugated Buck (Brick) Anchor	1.23
04 05 19 16-0070	EA 4-1/2" Length, 1-1/4" Width, 16 Gauge, Hot-Dipped Galvanized, Corrugated Buck (Brick) Anchor	1.27
04 05 19 16-0071	EA 5-1/2" Length, 1-1/4" Width, 16 Gauge, Hot-Dipped Galvanized, Corrugated Buck (Brick) Anchor	1.32
04 05 19 16-0072	EA 6-1/2" Length, 1-1/4" Width, 16 Gauge, Hot-Dipped Galvanized, Corrugated Buck (Brick) Anchor	1.36
04 05 19 16-0073	EA 7-1/2" Length, 1-1/4" Width, 16 Gauge, Hot-Dipped Galvanized, Corrugated Buck (Brick) Anchor	1.40
04 05 19 16-0074	EA 3-1/2" Length, 1-1/4" Width, 14 Gauge, Hot-Dipped Galvanized, Corrugated Buck (Brick) Anchor	1.27
04 05 19 16-0075	EA 4-1/2" Length, 1-1/4" Width, 14 Gauge, Hot-Dipped Galvanized, Corrugated Buck (Brick) Anchor	1.31
04 05 19 16-0076	EA 5-1/2" Length, 1-1/4" Width, 14 Gauge, Hot-Dipped Galvanized, Corrugated Buck (Brick) Anchor	1.36
04 05 19 16-0077	EA 6-1/2" Length, 1-1/4" Width, 14 Gauge, Hot-Dipped Galvanized, Corrugated Buck (Brick) Anchor	1.40
04 05 19 16-0078	EA 7-1/2" Length, 1-1/4" Width, 14 Gauge, Hot-Dipped Galvanized, Corrugated Buck (Brick) Anchor	1.45
04 05 19 16-0079	Mill Galvanized, Corrugated Buck (Brick) Anchors <small>(04 05 19 16-0067)</small>	
04 05 19 16-0080	EA 3-1/2" Length, 1-1/4" Width, 16 Gauge, Mill Galvanized, Corrugated Buck (Brick) Anchor	1.09
04 05 19 16-0081	EA 4-1/2" Length, 1-1/4" Width, 16 Gauge, Mill Galvanized, Corrugated Buck (Brick) Anchor	1.12
04 05 19 16-0082	EA 5-1/2" Length, 1-1/4" Width, 16 Gauge, Mill Galvanized, Corrugated Buck (Brick) Anchor	1.15
04 05 19 16-0083	EA 6-1/2" Length, 1-1/4" Width, 16 Gauge, Mill Galvanized, Corrugated Buck (Brick) Anchor	1.18
04 05 19 16-0084	EA 7-1/2" Length, 1-1/4" Width, 16 Gauge, Mill Galvanized, Corrugated Buck (Brick) Anchor	1.21
04 05 19 16-0085	EA 3-1/2" Length, 1-1/4" Width, 14 Gauge, Mill Galvanized, Corrugated Buck (Brick) Anchor	1.11
04 05 19 16-0086	EA 4-1/2" Length, 1-1/4" Width, 14 Gauge, Mill Galvanized, Corrugated Buck (Brick) Anchor	1.15
04 05 19 16-0087	EA 5-1/2" Length, 1-1/4" Width, 14 Gauge, Mill Galvanized, Corrugated Buck (Brick) Anchor	1.18
04 05 19 16-0088	EA 6-1/2" Length, 1-1/4" Width, 14 Gauge, Mill Galvanized, Corrugated Buck (Brick) Anchor	1.21
04 05 19 16-0089	EA 7-1/2" Length, 1-1/4" Width, 14 Gauge, Mill Galvanized, Corrugated Buck (Brick) Anchor	1.24
04 05 19 16-0090	Corrugated Wall Ties <small>(04 05 19 16)</small>	
04 05 19 16-0091	Hot-Dipped Galvanized, Corrugated Wall Ties <small>(04 05 19 16-0090)</small>	
04 05 19 16-0092	EA 7/8" Width, 7" Length, 28 Gauge, Hot-Dipped Galvanized, Corrugated Wall Tie	0.70
04 05 19 16-0093	EA 7/8" Width, 7" Length, 26 Gauge, Hot-Dipped Galvanized, Corrugated Wall Tie	0.73
04 05 19 16-0094	EA 7/8" Width, 7" Length, 24 Gauge, Hot-Dipped Galvanized, Corrugated Wall Tie	0.75
04 05 19 16-0095	EA 7/8" Width, 7" Length, 22 Gauge, Hot-Dipped Galvanized, Corrugated Wall Tie	0.76
04 05 19 16-0096	EA 7/8" Width, 7" Length, 16 Gauge, Hot-Dipped Galvanized, Corrugated Wall Tie	0.87
04 05 19 16-0097	Mill Galvanized, Corrugated Wall Ties <small>(04 05 19 16-0090)</small>	
04 05 19 16-0098	EA 7/8" Width, 7" Length, 26 Gauge, Mill Galvanized, Corrugated Wall Tie	0.71
04 05 19 16-0099	EA 7/8" Width, 7" Length, 24 Gauge, Mill Galvanized, Corrugated Wall Tie	0.72
04 05 19 16-0100	EA 7/8" Width, 7" Length, 22 Gauge, Mill Galvanized, Corrugated Wall Tie	0.73
04 05 19 16-0101	EA 7/8" Width, 7" Length, 16 Gauge, Mill Galvanized, Corrugated Wall Tie	0.82
04 05 19 16-0102	Stainless Steel, Corrugated Wall Ties <small>(04 05 19 16-0090)</small>	
04 05 19 16-0103	EA 7/8" Width, 7" Length, 28 Gauge, Stainless Steel, Corrugated Wall Tie	1.04
04 05 19 16-0104	EA 7/8" Width, 7" Length, 26 Gauge, Stainless Steel, Corrugated Wall Tie	1.09
04 05 19 16-0105	EA 7/8" Width, 7" Length, 24 Gauge, Stainless Steel, Corrugated Wall Tie	1.15
04 05 19 16-0106	EA 7/8" Width, 7" Length, 22 Gauge, Stainless Steel, Corrugated Wall Tie	1.20
04 05 19 16-0107	EA 7/8" Width, 7" Length, 16 Gauge, Stainless Steel, Corrugated Wall Tie	1.49
04 05 19 16-0108	Wire Mesh Wall Ties <small>(04 05 19 16)</small>	
	Note: 1/2" square mesh.	
04 05 19 16-0109	EA 3" Width, 8" Length, 16 Gauge, Hot-Dipped Galvanized, Wire Mesh Wall Tie	1.32
04 05 19 16-0110	EA 3" Width, 12" Length, 16 Gauge, Hot-Dipped Galvanized, Wire Mesh Wall Tie	1.57
04 05 19 16-0111	EA 6" Width, 8" Length, 16 Gauge, Hot-Dipped Galvanized, Wire Mesh Wall Tie	1.86
04 05 19 16-0112	EA 6" Width, 12" Length, 16 Gauge, Hot-Dipped Galvanized, Wire Mesh Wall Tie	2.32
04 05 19 16-0113	EA 10" Width, 8" Length, 16 Gauge, Hot-Dipped Galvanized, Wire Mesh Wall Tie	2.22
04 05 19 16-0114	EA 10" Width, 12" Length, 16 Gauge, Hot-Dipped Galvanized, Wire Mesh Wall Tie	2.66



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
04 05 19 16-0115				Triangle Brick Ties <small>(04 05 19 16)</small>		
04 05 19 16-0116				Hot-Dipped Galvanized, Triangle Brick Ties <small>(04 05 19 16-0115)</small>		
04 05 19 16-0117	EA			3" Length, 3/16" Diameter, Hot-Dipped Galvanized, Triangle Brick Tie	1.18	
04 05 19 16-0118	EA			3-1/2" Length, 3/16" Diameter, Hot-Dipped Galvanized, Triangle Brick Tie	1.20	
04 05 19 16-0119	EA			4" Length, 3/16" Diameter, Hot-Dipped Galvanized, Triangle Brick Tie	1.21	
04 05 19 16-0120	EA			4-1/2" Length, 3/16" Diameter, Hot-Dipped Galvanized, Triangle Brick Tie	1.26	
04 05 19 16-0121	EA			5" Length, 3/16" Diameter, Hot-Dipped Galvanized, Triangle Brick Tie	1.28	
04 05 19 16-0122	EA			6" Length, 3/16" Diameter, Hot-Dipped Galvanized, Triangle Brick Tie	1.36	
04 05 19 16-0123	EA			7" Length, 3/16" Diameter, Hot-Dipped Galvanized, Triangle Brick Tie	1.39	
04 05 19 16-0124	EA			9" Length, 3/16" Diameter, Hot-Dipped Galvanized, Triangle Brick Tie	1.48	
04 05 19 16-0125	EA			3" Length, 1/4" Diameter, Hot-Dipped Galvanized, Triangle Brick Tie	1.36	
04 05 19 16-0126	EA			3-1/2" Length, 1/4" Diameter, Hot-Dipped Galvanized, Triangle Brick Tie	1.38	
04 05 19 16-0127	EA			4" Length, 1/4" Diameter, Hot-Dipped Galvanized, Triangle Brick Tie	1.39	
04 05 19 16-0128	EA			4-1/2" Length, 1/4" Diameter, Hot-Dipped Galvanized, Triangle Brick Tie	1.43	
04 05 19 16-0129	EA			5" Length, 1/4" Diameter, Hot-Dipped Galvanized, Triangle Brick Tie	1.45	
04 05 19 16-0130	EA			6" Length, 1/4" Diameter, Hot-Dipped Galvanized, Triangle Brick Tie	1.52	
04 05 19 16-0131	EA			7" Length, 1/4" Diameter, Hot-Dipped Galvanized, Triangle Brick Tie	1.55	
04 05 19 16-0132	EA			9" Length, 1/4" Diameter, Hot-Dipped Galvanized, Triangle Brick Tie	1.64	
04 05 19 16-0133				Mill Galvanized, Triangle Brick Ties <small>(04 05 19 16-0115)</small>		
04 05 19 16-0134	EA			3" Length, 3/16" Diameter, Mill Galvanized, Triangle Brick Tie	1.09	
04 05 19 16-0135	EA			3-1/2" Length, 3/16" Diameter, Mill Galvanized, Triangle Brick Tie	1.09	
04 05 19 16-0136	EA			4" Length, 3/16" Diameter, Mill Galvanized, Triangle Brick Tie	1.10	
04 05 19 16-0137	EA			4-1/2" Length, 3/16" Diameter, Mill Galvanized, Triangle Brick Tie	1.14	
04 05 19 16-0138	EA			5" Length, 3/16" Diameter, Mill Galvanized, Triangle Brick Tie	1.14	
04 05 19 16-0139	EA			6" Length, 3/16" Diameter, Mill Galvanized, Triangle Brick Tie	1.20	
04 05 19 16-0140	EA			7" Length, 3/16" Diameter, Mill Galvanized, Triangle Brick Tie	1.21	
04 05 19 16-0141	EA			9" Length, 3/16" Diameter, Mill Galvanized, Triangle Brick Tie	1.24	
04 05 19 16-0142	EA			3" Length, 1/4" Diameter, Mill Galvanized, Triangle Brick Tie	1.20	
04 05 19 16-0143	EA			3-1/2" Length, 1/4" Diameter, Mill Galvanized, Triangle Brick Tie	1.21	
04 05 19 16-0144	EA			4" Length, 1/4" Diameter, Mill Galvanized, Triangle Brick Tie	1.22	
04 05 19 16-0145	EA			4-1/2" Length, 1/4" Diameter, Mill Galvanized, Triangle Brick Tie	1.26	
04 05 19 16-0146	EA			5" Length, 1/4" Diameter, Mill Galvanized, Triangle Brick Tie	1.27	
04 05 19 16-0147	EA			6" Length, 1/4" Diameter, Mill Galvanized, Triangle Brick Tie	1.33	
04 05 19 16-0148	EA			7" Length, 1/4" Diameter, Mill Galvanized, Triangle Brick Tie	1.35	
04 05 19 16-0149	EA			9" Length, 1/4" Diameter, Mill Galvanized, Triangle Brick Tie	1.40	
04 05 19 16-0150				Seismic Veneer Anchors <small>(04 05 19 16)</small>		
04 05 19 16-0151	EA			3-1/2" Length, 1-1/4" Width, Stainless Steel, Seismic Notch Veneer Anchor	5.15	
				Note: For horizontal wire attachment. Excludes wire.		
04 05 19 16-0152				Slip-Set, Joint Stabilization Anchors <small>(04 05 19 16)</small>		
				Note: For restraining lateral movement at control joints. Field bendable.		
04 05 19 16-0153	EA			9-5/8" Length, 1-5/8" Width, Mill Galvanized, Slip-Set, Joint Stabilization Anchor	3.34	
04 05 19 16-0154	EA			9-5/8" Length, 1-5/8" Width, Hot-Dipped Galvanized, Slip-Set, Joint Stabilization Anchor	3.61	
04 05 19 16-0155	EA			9-5/8" Length, 1-5/8" Width, Stainless Steel, Slip-Set, Joint Stabilization Anchor	5.15	
04 05 19 16-0156				Strap Partition Top Anchors <small>(04 05 19 16)</small>		
04 05 19 16-0157	EA			12 Gauge Strap, 3/8" Rod, Hot-Dipped Galvanized, Partition Top Anchor	1.99	
04 05 19 16-0158	EA			12 Gauge Strap, 3/8" Rod, Stainless Steel, Partition Top Anchor	5.44	
04 05 19 16-0159				Rigid Partition Anchors <small>(04 05 19 16)</small>		
04 05 19 16-0160				Hot-Dipped Galvanized, Rigid Partition Anchors <small>(04 05 19 16-0159)</small>		
04 05 19 16-0161	EA			1" Width, 8" Length, 1/8" Thick, Hot-Dipped Galvanized, U Or Z Style, Rigid Partition Anchor	1.61	
04 05 19 16-0162	EA			1-1/4" Width, 8" Length, 1/8" Thick, Hot-Dipped Galvanized, U Or Z Style, Rigid Partition Anchor	1.73	
04 05 19 16-0163	EA			1-1/2" Width, 8" Length, 1/8" Thick, Hot-Dipped Galvanized, U Or Z Style, Rigid Partition Anchor	1.87	
04 05 19 16-0164	EA			1-3/4" Width, 8" Length, 1/8" Thick, Hot-Dipped Galvanized, U Or Z Style, Rigid Partition Anchor	2.00	
04 05 19 16-0165	EA			2" Width, 8" Length, 1/8" Thick, Hot-Dipped Galvanized, U Or Z Style, Rigid Partition Anchor	2.13	
04 05 19 16-0166	EA			2-1/4" Width, 8" Length, 1/8" Thick, Hot-Dipped Galvanized, U Or Z Style, Rigid Partition Anchor	2.26	
04 05 19 16-0167	EA			1" Width, 8" Length, 1/4" Thick, Hot-Dipped Galvanized, U Or Z Style, Rigid Partition Anchor	2.13	
04 05 19 16-0168	EA			1-1/4" Width, 8" Length, 1/4" Thick, Hot-Dipped Galvanized, U Or Z Style, Rigid Partition Anchor	2.54	
04 05 19 16-0169	EA			1-1/2" Width, 8" Length, 1/4" Thick, Hot-Dipped Galvanized, U Or Z Style, Rigid Partition Anchor	2.95	
04 05 19 16-0170	EA			1-3/4" Width, 8" Length, 1/4" Thick, Hot-Dipped Galvanized, U Or Z Style, Rigid Partition Anchor	3.37	
04 05 19 16-0171	EA			2" Width, 8" Length, 1/4" Thick, Hot-Dipped Galvanized, U Or Z Style, Rigid Partition Anchor	3.78	
04 05 19 16-0172	EA			2-1/4" Width, 8" Length, 1/4" Thick, Hot-Dipped Galvanized, U Or Z Style, Rigid Partition Anchor	4.19	
04 05 19 16-0173				Mill Galvanized, Rigid Partition Anchors <small>(04 05 19 16-0159)</small>		
04 05 19 16-0174	EA			1" Width, 8" Length, 1/8" Thick, Mill Galvanized, U Or Z Style, Rigid Partition Anchor	1.50	
04 05 19 16-0175	EA			1-1/4" Width, 8" Length, 1/8" Thick, Mill Galvanized, U Or Z Style, Rigid Partition Anchor	1.60	
04 05 19 16-0176	EA			1-1/2" Width, 8" Length, 1/8" Thick, Mill Galvanized, U Or Z Style, Rigid Partition Anchor	1.70	
04 05 19 16-0177	EA			1-3/4" Width, 8" Length, 1/8" Thick, Mill Galvanized, U Or Z Style, Rigid Partition Anchor	1.80	
04 05 19 16-0178	EA			2" Width, 8" Length, 1/8" Thick, Mill Galvanized, U Or Z Style, Rigid Partition Anchor	1.90	

04 Masonry**04 05 Common Work Results For Masonry****04 05 19 Masonry Anchorage And Reinforcing**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
04 05 19 16-0179	EA		2-1/4" Width, 8" Length, 1/8" Thick, Mill Galvanized, U Or Z Style, Rigid Partition Anchor.....	2.00	
04 05 19 16-0180			Screw-On Masonry Veneer Anchor Plates (04 05 19 16)		
04 05 19 16-0181	EA		12 Gauge, Hot-Dipped Galvanized, Screw-On Masonry Veneer Anchor Plate.....	1.05	
04 05 19 16-0182	EA		14 Gauge, Hot-Dipped Galvanized, Screw-On Masonry Veneer Anchor Plate.....	1.09	
04 05 19 16-0183			Wire Column Ties (04 05 19 16)		
04 05 19 16-0184			Hot-Dipped Galvanized, Wire Column Ties (04 05 19 16-0183)		
04 05 19 16-0185	EA		3" Length, 3/16" Diameter, Hot-Dipped Galvanized, Wire Column Tie	1.22	
04 05 19 16-0186	EA		5" Length, 3/16" Diameter, Hot-Dipped Galvanized, Wire Column Tie	1.29	
04 05 19 16-0187	EA		7" Length, 3/16" Diameter, Hot-Dipped Galvanized, Wire Column Tie	1.34	
04 05 19 16-0188	EA		9" Length, 3/16" Diameter, Hot-Dipped Galvanized, Wire Column Tie	1.41	
04 05 19 16-0189	EA		10" Length, 3/16" Diameter, Hot-Dipped Galvanized, Wire Column Tie	1.28	
04 05 19 16-0190	EA		12" Length, 3/16" Diameter, Hot-Dipped Galvanized, Wire Column Tie	1.34	
04 05 19 16-0191	EA		14" Length, 3/16" Diameter, Hot-Dipped Galvanized, Wire Column Tie	1.39	
04 05 19 16-0192	EA		16" Length, 3/16" Diameter, Hot-Dipped Galvanized, Wire Column Tie	1.43	
04 05 19 16-0193	EA		3" Length, 1/4" Diameter, Hot-Dipped Galvanized, Wire Column Tie	1.59	
04 05 19 16-0194	EA		5" Length, 1/4" Diameter, Hot-Dipped Galvanized, Wire Column Tie	1.71	
04 05 19 16-0195	EA		7" Length, 1/4" Diameter, Hot-Dipped Galvanized, Wire Column Tie	1.78	
04 05 19 16-0196	EA		9" Length, 1/4" Diameter, Hot-Dipped Galvanized, Wire Column Tie	1.89	
04 05 19 16-0197	EA		10" Length, 1/4" Diameter, Hot-Dipped Galvanized, Wire Column Tie	1.71	
04 05 19 16-0198	EA		12" Length, 1/4" Diameter, Hot-Dipped Galvanized, Wire Column Tie	1.78	
04 05 19 16-0199	EA		14" Length, 1/4" Diameter, Hot-Dipped Galvanized, Wire Column Tie	1.85	
04 05 19 16-0200	EA		16" Length, 1/4" Diameter, Hot-Dipped Galvanized, Wire Column Tie	1.93	
04 05 19 16-0201			Mill Galvanized, Wire Column Ties (04 05 19 16-0183)		
04 05 19 16-0202	EA		3" Length, 3/16" Diameter, Mill Galvanized, Wire Column Tie	1.10	
04 05 19 16-0203	EA		5" Length, 3/16" Diameter, Mill Galvanized, Wire Column Tie	1.15	
04 05 19 16-0204	EA		7" Length, 3/16" Diameter, Mill Galvanized, Wire Column Tie	1.17	
04 05 19 16-0205	EA		9" Length, 3/16" Diameter, Mill Galvanized, Wire Column Tie	1.22	
04 05 19 16-0206	EA		10" Length, 3/16" Diameter, Mill Galvanized, Wire Column Tie	1.12	
04 05 19 16-0207	EA		12" Length, 3/16" Diameter, Mill Galvanized, Wire Column Tie	1.16	
04 05 19 16-0208	EA		14" Length, 3/16" Diameter, Mill Galvanized, Wire Column Tie	1.19	
04 05 19 16-0209	EA		16" Length, 3/16" Diameter, Mill Galvanized, Wire Column Tie	1.22	
04 05 19 16-0210	EA		3" Length, 1/4" Diameter, Mill Galvanized, Wire Column Tie	1.37	
04 05 19 16-0211	EA		5" Length, 1/4" Diameter, Mill Galvanized, Wire Column Tie	1.45	
04 05 19 16-0212	EA		7" Length, 1/4" Diameter, Mill Galvanized, Wire Column Tie	1.48	
04 05 19 16-0213	EA		9" Length, 1/4" Diameter, Mill Galvanized, Wire Column Tie	1.56	
04 05 19 16-0214	EA		10" Length, 1/4" Diameter, Mill Galvanized, Wire Column Tie	1.34	
04 05 19 16-0215	EA		12" Length, 1/4" Diameter, Mill Galvanized, Wire Column Tie	1.46	
04 05 19 16-0216	EA		14" Length, 1/4" Diameter, Mill Galvanized, Wire Column Tie	1.52	
04 05 19 16-0217	EA		16" Length, 1/4" Diameter, Mill Galvanized, Wire Column Tie	1.56	
04 05 19 16-0218			Dovetail Anchors, Slots And Ties (04 05 19 16)		
04 05 19 16-0219			Dovetail Anchor Slots (04 05 19 16-0218)		
04 05 19 16-0220			Hot-Dipped Galvanized, Dovetail Anchor Slot (04 05 19 16-0219)		
04 05 19 16-0221	LF		24 Gauge, Hot-Dipped Galvanized, Dovetail Anchor Slot.....	2.47	
04 05 19 16-0222	LF		22 Gauge, Hot-Dipped Galvanized, Dovetail Anchor Slot.....	2.67	
04 05 19 16-0223	LF		20 Gauge, Hot-Dipped Galvanized, Dovetail Anchor Slot.....	2.78	
04 05 19 16-0224	LF		18 Gauge, Hot-Dipped Galvanized, Dovetail Anchor Slot.....	2.84	
04 05 19 16-0225	LF		16 Gauge, Hot-Dipped Galvanized, Dovetail Anchor Slot.....	2.98	
04 05 19 16-0226			Mill Galvanized, Dovetail Anchor Slot (04 05 19 16-0219)		
04 05 19 16-0227	LF		24 Gauge, Mill Galvanized, Dovetail Anchor Slot.....	2.06	
04 05 19 16-0228	LF		22 Gauge, Mill Galvanized, Dovetail Anchor Slot.....	2.32	
04 05 19 16-0229	LF		20 Gauge, Mill Galvanized, Dovetail Anchor Slot.....	2.38	
04 05 19 16-0230	LF		18 Gauge, Mill Galvanized, Dovetail Anchor Slot.....	2.47	
04 05 19 16-0231	LF		16 Gauge, Mill Galvanized, Dovetail Anchor Slot.....	2.52	
04 05 19 16-0232			304 Stainless Steel, Dovetail Anchor Slot (04 05 19 16-0219)		
04 05 19 16-0233	LF		24 Gauge, 304 Stainless Steel, Dovetail Anchor Slot.....	2.89	
04 05 19 16-0234	LF		22 Gauge, 304 Stainless Steel, Dovetail Anchor Slot.....	3.27	
04 05 19 16-0235	LF		20 Gauge, 304 Stainless Steel, Dovetail Anchor Slot.....	3.40	
04 05 19 16-0236	LF		18 Gauge, 304 Stainless Steel, Dovetail Anchor Slot.....	3.83	
04 05 19 16-0237	LF		16 Gauge, 304 Stainless Steel, Dovetail Anchor Slot.....	4.25	
04 05 19 16-0238			316 Stainless Steel, Dovetail Anchor Slot (04 05 19 16-0219)		
04 05 19 16-0239	LF		24 Gauge, 316 Stainless Steel, Dovetail Anchor Slot.....	3.19	
04 05 19 16-0240	LF		22 Gauge, 316 Stainless Steel, Dovetail Anchor Slot.....	3.48	
04 05 19 16-0241	LF		20 Gauge, 316 Stainless Steel, Dovetail Anchor Slot.....	3.77	
04 05 19 16-0242	LF		18 Gauge, 316 Stainless Steel, Dovetail Anchor Slot.....	4.14	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
				04 05 19 16-0243 LF 16 Gauge, 316 Stainless Steel, Dovetail Anchor Slot.....	4.36	
04 05 19 16-0244				Dovetail Corrugated Brick Ties <small>(04 05 19 16-0218)</small>		
04 05 19 16-0245				Hot-Dipped Galvanized, Dovetail Corrugated Brick Tie <small>(04 05 19 16-0244)</small>		
				04 05 19 16-0246 EA 3-1/2" Length, 1" Width, 16 Gauge, Hot-Dipped Galvanized, Dovetail Corrugated Brick Tie.....	0.88	
				04 05 19 16-0247 EA 5-1/2" Length, 1" Width, 16 Gauge, Hot-Dipped Galvanized, Dovetail Corrugated Brick Tie.....	0.94	
				04 05 19 16-0248 EA 7-1/2" Length, 1" Width, 16 Gauge, Hot-Dipped Galvanized, Dovetail Corrugated Brick Tie.....	1.01	
				04 05 19 16-0249 EA 3-1/2" Length, 1" Width, 14 Gauge, Hot-Dipped Galvanized, Dovetail Corrugated Brick Tie.....	0.89	
				04 05 19 16-0250 EA 5-1/2" Length, 1" Width, 14 Gauge, Hot-Dipped Galvanized, Dovetail Corrugated Brick Tie.....	1.02	
				04 05 19 16-0251 EA 7-1/2" Length, 1" Width, 14 Gauge, Hot-Dipped Galvanized, Dovetail Corrugated Brick Tie.....	1.11	
				04 05 19 16-0252 EA 3-1/2" Length, 1" Width, 12 Gauge, Hot-Dipped Galvanized, Dovetail Corrugated Brick Tie.....	0.93	
				04 05 19 16-0253 EA 5-1/2" Length, 1" Width, 12 Gauge, Hot-Dipped Galvanized, Dovetail Corrugated Brick Tie.....	1.01	
				04 05 19 16-0254 EA 7-1/2" Length, 1" Width, 12 Gauge, Hot-Dipped Galvanized, Dovetail Corrugated Brick Tie.....	1.09	
04 05 19 16-0255				Mill Galvanized, Dovetail Corrugated Brick Tie <small>(04 05 19 16-0244)</small>		
				04 05 19 16-0256 EA 3-1/2" Length, 1" Width, 16 Gauge, Mill Galvanized, Dovetail Corrugated Brick Tie.....	0.82	
				04 05 19 16-0257 EA 5-1/2" Length, 1" Width, 16 Gauge, Mill Galvanized, Dovetail Corrugated Brick Tie.....	0.86	
				04 05 19 16-0258 EA 7-1/2" Length, 1" Width, 16 Gauge, Mill Galvanized, Dovetail Corrugated Brick Tie.....	0.90	
				04 05 19 16-0259 EA 3-1/2" Length, 1" Width, 14 Gauge, Mill Galvanized, Dovetail Corrugated Brick Tie.....	0.85	
				04 05 19 16-0260 EA 5-1/2" Length, 1" Width, 14 Gauge, Mill Galvanized, Dovetail Corrugated Brick Tie.....	0.93	
				04 05 19 16-0261 EA 7-1/2" Length, 1" Width, 14 Gauge, Mill Galvanized, Dovetail Corrugated Brick Tie.....	1.00	
				04 05 19 16-0262 EA 3-1/2" Length, 1" Width, 12 Gauge, Mill Galvanized, Dovetail Corrugated Brick Tie.....	0.86	
				04 05 19 16-0263 EA 5-1/2" Length, 1" Width, 12 Gauge, Mill Galvanized, Dovetail Corrugated Brick Tie.....	0.96	
				04 05 19 16-0264 EA 7-1/2" Length, 1" Width, 12 Gauge, Mill Galvanized, Dovetail Corrugated Brick Tie.....	1.03	
04 05 19 16-0265				Dovetail Stone Anchors <small>(04 05 19 16-0218)</small>		
04 05 19 16-0266				Hot-Dipped Galvanized, Dovetail Stone Anchors <small>(04 05 19 16-0265)</small>		
				04 05 19 16-0267 EA 3-1/2" Length, 1" Width, 16 Gauge, Hot-Dipped Galvanized, Dovetail Stone Anchor.....	1.02	
				04 05 19 16-0268 EA 5-1/2" Length, 1" Width, 16 Gauge, Hot-Dipped Galvanized, Dovetail Stone Anchor.....	1.08	
				04 05 19 16-0269 EA 7-1/2" Length, 1" Width, 16 Gauge, Hot-Dipped Galvanized, Dovetail Stone Anchor.....	1.15	
04 05 19 16-0270				Dovetail Partition Top Anchors <small>(04 05 19 16-0218)</small>		
				04 05 19 16-0271 EA 3/8" Rod, Hot-Dipped Galvanized, Dovetail Partition Top Anchor.....	2.09	
				04 05 19 16-0272 EA 3/8" Rod, Stainless Steel, Dovetail Partition Top Anchor.....	5.82	
04 05 19 16-0273				Dovetail Flexible Triangle Brick Ties <small>(04 05 19 16-0218)</small>		
04 05 19 16-0274				Hot-Dipped Galvanized, Dovetail Flexible Triangle Brick Ties <small>(04 05 19 16-0273)</small>		
				04 05 19 16-0275 EA 3" Length, 3/16" Diameter, Hot-Dipped Galvanized, Dovetail Flexible Triangle Brick Tie.....	1.48	
				04 05 19 16-0276 EA 5" Length, 3/16" Diameter, Hot-Dipped Galvanized, Dovetail Flexible Triangle Brick Tie.....	1.57	
				04 05 19 16-0277 EA 7" Length, 3/16" Diameter, Hot-Dipped Galvanized, Dovetail Flexible Triangle Brick Tie.....	1.63	
				04 05 19 16-0278 EA 9" Length, 3/16" Diameter, Hot-Dipped Galvanized, Dovetail Flexible Triangle Brick Tie.....	1.69	
04 05 19 16-0279				Mill Galvanized, Dovetail Flexible Triangle Brick Ties <small>(04 05 19 16-0273)</small>		
				04 05 19 16-0280 EA 3" Length, 3/16" Diameter, Mill Galvanized, Dovetail Flexible Triangle Brick Tie.....	1.36	
				04 05 19 16-0281 EA 5" Length, 3/16" Diameter, Mill Galvanized, Dovetail Flexible Triangle Brick Tie.....	1.37	
				04 05 19 16-0282 EA 7" Length, 3/16" Diameter, Mill Galvanized, Dovetail Flexible Triangle Brick Tie.....	1.40	
				04 05 19 16-0283 EA 9" Length, 3/16" Diameter, Mill Galvanized, Dovetail Flexible Triangle Brick Tie.....	1.50	
04 05 19 26				Masonry Reinforcing Bars <small>(04 05 19)</small>		
				Note: Includes cutting and bending.		
04 05 19 26-0001				Plain Steel Masonry Reinforcement Bar <small>(04 05 19 26)</small>		
				04 05 19 26-0002 LF #3, Grade 40, Horizontal Placed, Steel Masonry Reinforcement Bar.....	0.71	
				04 05 19 26-0003 LF #4, Grade 40, Horizontal Placed, Steel Masonry Reinforcement Bar.....	1.15	
				04 05 19 26-0004 LF #5, Grade 40, Horizontal Placed, Steel Masonry Reinforcement Bar.....	1.61	
				04 05 19 26-0005 LF #6, Grade 40, Horizontal Placed, Steel Masonry Reinforcement Bar.....	2.09	
				04 05 19 26-0006 LF #3, Grade 50, Horizontal Placed, Steel Masonry Reinforcement Bar.....	0.72	
				04 05 19 26-0007 LF #4, Grade 50, Horizontal Placed, Steel Masonry Reinforcement Bar.....	1.16	
				04 05 19 26-0008 LF #5, Grade 50, Horizontal Placed, Steel Masonry Reinforcement Bar.....	1.63	
				04 05 19 26-0009 LF #6, Grade 50, Horizontal Placed, Steel Masonry Reinforcement Bar.....	2.13	
				04 05 19 26-0010 LF #3, Grade 40, Vertical Placed, Steel Masonry Reinforcement Bar.....	0.85	
				04 05 19 26-0011 LF #4, Grade 40, Vertical Placed, Steel Masonry Reinforcement Bar.....	1.36	
				04 05 19 26-0012 LF #5, Grade 40, Vertical Placed, Steel Masonry Reinforcement Bar.....	1.91	
				04 05 19 26-0013 LF #6, Grade 40, Vertical Placed, Steel Masonry Reinforcement Bar.....	2.45	
				04 05 19 26-0014 LF #3, Grade 50, Vertical Placed, Steel Masonry Reinforcement Bar.....	0.86	
				04 05 19 26-0015 LF #4, Grade 50, Vertical Placed, Steel Masonry Reinforcement Bar.....	1.37	
				04 05 19 26-0016 LF #5, Grade 50, Vertical Placed, Steel Masonry Reinforcement Bar.....	1.93	
				04 05 19 26-0017 LF #6, Grade 50, Vertical Placed, Steel Masonry Reinforcement Bar.....	2.49	
04 05 19 26-0018				Galvanized Steel Masonry Reinforcement Bar <small>(04 05 19 26)</small>		

04 Masonry
04 05 Common Work Results For Masonry
04 05 19 Masonry Anchorage And Reinforcing



MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

04 05 19 26-0019	LF	#3, Grade 40, Horizontal Placed, Galvanized Steel Masonry Reinforcement Bar.....	0.79	
04 05 19 26-0020	LF	#4, Grade 40, Horizontal Placed, Galvanized Steel Masonry Reinforcement Bar.....	1.30	
04 05 19 26-0021	LF	#5, Grade 40, Horizontal Placed, Galvanized Steel Masonry Reinforcement Bar.....	1.85	
04 05 19 26-0022	LF	#6, Grade 40, Horizontal Placed, Galvanized Steel Masonry Reinforcement Bar.....	2.44	
04 05 19 26-0023	LF	#3, Grade 50, Horizontal Placed, Galvanized Steel Masonry Reinforcement Bar.....	0.80	
04 05 19 26-0024	LF	#4, Grade 50, Horizontal Placed, Galvanized Steel Masonry Reinforcement Bar.....	1.32	
04 05 19 26-0025	LF	#5, Grade 50, Horizontal Placed, Galvanized Steel Masonry Reinforcement Bar.....	1.87	
04 05 19 26-0026	LF	#6, Grade 50, Horizontal Placed, Galvanized Steel Masonry Reinforcement Bar.....	2.47	
04 05 19 26-0027	LF	#3, Grade 40, Vertical Placed, Galvanized Steel Masonry Reinforcement Bar.....	0.93	
04 05 19 26-0028	LF	#4, Grade 40, Vertical Placed, Galvanized Steel Masonry Reinforcement Bar.....	1.51	
04 05 19 26-0029	LF	#5, Grade 40, Vertical Placed, Galvanized Steel Masonry Reinforcement Bar.....	2.15	
04 05 19 26-0030	LF	#6, Grade 40, Vertical Placed, Galvanized Steel Masonry Reinforcement Bar.....	2.80	
04 05 19 26-0031	LF	#3, Grade 50, Vertical Placed, Galvanized Steel Masonry Reinforcement Bar.....	0.94	
04 05 19 26-0032	LF	#4, Grade 50, Vertical Placed, Galvanized Steel Masonry Reinforcement Bar.....	1.53	
04 05 19 26-0033	LF	#5, Grade 50, Vertical Placed, Galvanized Steel Masonry Reinforcement Bar.....	2.17	
04 05 19 26-0034	LF	#6, Grade 50, Vertical Placed, Galvanized Steel Masonry Reinforcement Bar.....	2.83	

04 05 19 26-0035 Epoxy-Coated Masonry Reinforcement Bar (04 05 19 26)

04 05 19 26-0036	LF	#3, Grade 40, Horizontal Placed, Epoxy-Coated Masonry Reinforcement Bar.....	0.79	
04 05 19 26-0037	LF	#4, Grade 40, Horizontal Placed, Epoxy-Coated Masonry Reinforcement Bar.....	1.29	
04 05 19 26-0038	LF	#5, Grade 40, Horizontal Placed, Epoxy-Coated Masonry Reinforcement Bar.....	1.82	
04 05 19 26-0039	LF	#6, Grade 40, Horizontal Placed, Epoxy-Coated Masonry Reinforcement Bar.....	2.40	
04 05 19 26-0040	LF	#3, Grade 50, Horizontal Placed, Epoxy-Coated Masonry Reinforcement Bar.....	0.79	
04 05 19 26-0041	LF	#4, Grade 50, Horizontal Placed, Epoxy-Coated Masonry Reinforcement Bar.....	1.30	
04 05 19 26-0042	LF	#5, Grade 50, Horizontal Placed, Epoxy-Coated Masonry Reinforcement Bar.....	1.84	
04 05 19 26-0043	LF	#6, Grade 50, Horizontal Placed, Epoxy-Coated Masonry Reinforcement Bar.....	2.43	
04 05 19 26-0044	LF	#3, Grade 40, Vertical Placed, Epoxy-Coated Masonry Reinforcement Bar.....	0.93	
04 05 19 26-0045	LF	#4, Grade 40, Vertical Placed, Epoxy-Coated Masonry Reinforcement Bar.....	1.50	
04 05 19 26-0046	LF	#5, Grade 40, Vertical Placed, Epoxy-Coated Masonry Reinforcement Bar.....	2.12	
04 05 19 26-0047	LF	#6, Grade 40, Vertical Placed, Epoxy-Coated Masonry Reinforcement Bar.....	2.76	
04 05 19 26-0048	LF	#3, Grade 50, Vertical Placed, Epoxy-Coated Masonry Reinforcement Bar.....	0.93	
04 05 19 26-0049	LF	#4, Grade 50, Vertical Placed, Epoxy-Coated Masonry Reinforcement Bar.....	1.51	
04 05 19 26-0050	LF	#5, Grade 50, Vertical Placed, Epoxy-Coated Masonry Reinforcement Bar.....	2.14	
04 05 19 26-0051	LF	#6, Grade 50, Vertical Placed, Epoxy-Coated Masonry Reinforcement Bar.....	2.79	

04 05 23 Masonry Accessories (04 05)

04 05 23 13 Masonry Control And Expansion Joints (04 05 23)

04 05 23 13-0001 Masonry Control Joints (04 05 23 13)

04 05 23 13-0002 Rubber, Masonry Control Joints (04 05 23 13-0001)

04 05 23 13-0003	LF	1-5/8" Width, T-Style, Rubber, Masonry Control Joint.....	3.48	0.67
04 05 23 13-0004	LF	2-5/8" Width, Rubber, Masonry Control Joint.....	3.40	0.67
04 05 23 13-0005	LF	6-7/8" Width, Rubber, Masonry Control Joint.....	6.86	0.67

04 05 23 13-0006 Polyvinyl Chloride (PVC), Masonry Control Joints (04 05 23 13-0001)

04 05 23 13-0007	LF	1-5/8" Width, T-Style, Polyvinyl Chloride (PVC), Masonry Control Joint.....	2.31	0.67
04 05 23 13-0008	LF	2-5/8" Width, Polyvinyl Chloride (PVC), Masonry Control Joint.....	2.38	0.67
04 05 23 13-0009	LF	4-7/8" Width, Polyvinyl Chloride (PVC), Masonry Control Joint.....	3.00	0.67
04 05 23 13-0010	LF	6-7/8" Width, Polyvinyl Chloride (PVC), Masonry Control Joint.....	3.35	0.67
04 05 23 13-0011	LF	11-1/8" Width, Polyvinyl Chloride (PVC), Masonry Control Joint.....	3.20	0.67

04 05 23 16 Masonry Embedded Flashing (04 05 23)

04 05 23 16-0001 Lead Coated Copper Through Wall Flashing (04 05 23 16)

04 05 23 16-0002 Mastic Backed 2 Sides, Lead Coated Copper Through Wall Flashing (04 05 23 16-0001)

04 05 23 16-0003	SF	2 Ounce, Mastic Backed 2 Sides, Lead Coated Copper Through Wall Flashing.....	4.75	1.21
04 05 23 16-0004	SF	3 Ounce, Mastic Backed 2 Sides, Lead Coated Copper Through Wall Flashing.....	5.16	1.21
04 05 23 16-0005	SF	5 Ounce, Mastic Backed 2 Sides, Lead Coated Copper Through Wall Flashing.....	6.30	1.21
04 05 23 16-0006	SF	7 Ounce, Mastic Backed 2 Sides, Lead Coated Copper Through Wall Flashing.....	7.31	1.21

04 05 23 16-0007 Fabric Backed 2 Sides, Lead Coated Copper Through Wall Flashing (04 05 23 16-0001)

04 05 23 16-0008	SF	2 Ounce, Fabric Backed 2 Sides, Lead Coated Copper Through Wall Flashing.....	5.15	1.21
04 05 23 16-0009	SF	3 Ounce, Fabric Backed 2 Sides, Lead Coated Copper Through Wall Flashing.....	5.52	1.21
04 05 23 16-0010	SF	5 Ounce, Fabric Backed 2 Sides, Lead Coated Copper Through Wall Flashing.....	6.83	1.21
04 05 23 16-0011	SF	7 Ounce, Fabric Backed 2 Sides, Lead Coated Copper Through Wall Flashing.....	8.05	1.21

04 05 23 16-0012 Paper Backed 2 Sides, Lead Coated Copper Through Wall Flashing (04 05 23 16-0001)

04 05 23 16-0013	SF	2 Ounce, Paper Backed 2 Sides, Lead Coated Copper Through Wall Flashing.....	4.84	1.21
04 05 23 16-0014	SF	3 Ounce, Paper Backed 2 Sides, Lead Coated Copper Through Wall Flashing.....	5.35	1.21
04 05 23 16-0015	SF	5 Ounce, Paper Backed 2 Sides, Lead Coated Copper Through Wall Flashing.....	6.09	1.21
04 05 23 16-0016	SF	7 Ounce, Paper Backed 2 Sides, Lead Coated Copper Through Wall Flashing.....	7.64	1.21



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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04 05 23 16-0017			Stainless Steel Through Wall Flashing (04 05 23 16)		
04 05 23 16-0018			Paper Backed 2 Sides, Stainless Steel Through Wall Flashing (04 05 23 16-0017)		
04 05 23 16-0019	SF		0.005" Thick Paper Backed 2 Sides, Stainless Steel Through Wall Flashing	5.29	1.13
04 05 23 16-0020			Polyvinyl Chloride (PVC) Through Wall Flashing (04 05 23 16)		
04 05 23 16-0021	SF		0.010" Thick Black Polyvinyl Chloride (PVC) Through Wall Flashing	2.67	1.16
04 05 23 16-0022	SF		0.020" Thick Black Polyvinyl Chloride (PVC) Through Wall Flashing	2.77	1.16
04 05 23 16-0023	SF		0.030" Thick Black Polyvinyl Chloride (PVC) Through Wall Flashing	2.88	1.16
04 05 23 16-0024	SF		0.056" Thick Black Polyvinyl Chloride (PVC) Through Wall Flashing	3.25	1.16
04 05 23 16-0025			Copper Through Wall Flashing (04 05 23 16)		
04 05 23 16-0026			2 Sides Coated With Asphalt, Thru-Wall Copper Flashing (04 05 23 16-0025)		
04 05 23 16-0027	SF		2 Ounce, 2 Sides Coated With Asphalt, Thru-Wall Copper Flashing	4.13	1.13
04 05 23 16-0028	SF		3 Ounce, 2 Sides Coated With Asphalt, Thru-Wall Copper Flashing	4.43	1.13
04 05 23 16-0029	SF		5 Ounce, 2 Sides Coated With Asphalt, Thru-Wall Copper Flashing	5.27	1.13
04 05 23 16-0030	SF		7 Ounce, 2 Sides Coated With Asphalt, Thru-Wall Copper Flashing	6.01	1.13
04 05 23 16-0031	SF		10 Ounce, 2 Sides Coated With Asphalt, Thru-Wall Copper Flashing	6.32	1.13
04 05 23 16-0032			2 Sides Glass Fabric And Asphalt, Thru-Wall Copper Flashing (04 05 23 16-0025)		
04 05 23 16-0033	SF		2 Ounce, 2 Sides Glass Fabric And Asphalt, Thru-Wall Copper Flashing	4.43	1.13
04 05 23 16-0034	SF		3 Ounce, 2 Sides Glass Fabric And Asphalt, Thru-Wall Copper Flashing	4.69	1.13
04 05 23 16-0035	SF		5 Ounce, 2 Sides Glass Fabric And Asphalt, Thru-Wall Copper Flashing	5.66	1.13
04 05 23 16-0036	SF		7 Ounce, 2 Sides Glass Fabric And Asphalt, Thru-Wall Copper Flashing	6.55	1.13
04 05 23 16-0037	SF		10 Ounce, 2 Sides Glass Fabric And Asphalt, Thru-Wall Copper Flashing	7.07	1.13
04 05 23 16-0038			1 Side Kraft Paper And Asphalt, Thru-Wall Copper Flashing (04 05 23 16-0025)		
04 05 23 16-0039	SF		2 Ounce, 1 Side Kraft Paper And Asphalt, Thru-Wall Copper Flashing	4.16	1.13
04 05 23 16-0040	SF		3 Ounce, 1 Side Kraft Paper And Asphalt, Thru-Wall Copper Flashing	4.47	1.13
04 05 23 16-0041	SF		5 Ounce, 1 Side Kraft Paper And Asphalt, Thru-Wall Copper Flashing	5.30	1.13
04 05 23 16-0042	SF		7 Ounce, 1 Side Kraft Paper And Asphalt, Thru-Wall Copper Flashing	6.04	1.13
04 05 23 16-0043	SF		10 Ounce, 1 Side Kraft Paper And Asphalt, Thru-Wall Copper Flashing	6.35	1.13
04 05 23 16-0044			2 Sides Kraft Paper And Asphalt, Thru-Wall Copper Flashing (04 05 23 16-0025)		
04 05 23 16-0045	SF		2 Ounce, 2 Sides Kraft Paper And Asphalt, Thru-Wall Copper Flashing	4.20	1.13
04 05 23 16-0046	SF		3 Ounce, 2 Sides Kraft Paper And Asphalt, Thru-Wall Copper Flashing	4.57	1.13
04 05 23 16-0047	SF		5 Ounce, 2 Sides Kraft Paper And Asphalt, Thru-Wall Copper Flashing	5.12	1.13
04 05 23 16-0048	SF		7 Ounce, 2 Sides Kraft Paper And Asphalt, Thru-Wall Copper Flashing	6.25	1.13
04 05 23 16-0049	SF		10 Ounce, 2 Sides Kraft Paper And Asphalt, Thru-Wall Copper Flashing	6.12	1.13
04 05 23 16-0050			2 Sides Kraft Paper Reinforced With Glass Fabric And Asphalt, Thru-Wall Copper Flashing (04 05 23 16-0025)		
04 05 23 16-0051	SF		3 Ounce, 2 Sides Kraft Paper Reinforced With Glass Fabric And Asphalt, Thru-Wall Copper Flashing	5.44	1.13
04 05 23 16-0052	SF		5 Ounce, 2 Sides Kraft Paper Reinforced With Glass Fabric And Asphalt, Thru-Wall Copper Flashing	6.56	1.13
04 05 23 16-0053			2 Sides Glass Fabric, Thru-Wall Copper Flashing (04 05 23 16-0025) Note: Glass fabric is bonded to both sides with a non-asphaltic adhesive.		
04 05 23 16-0054	SF		3 Ounce, 2 Sides Glass Fabric, Thru-Wall Copper Flashing	4.79	1.13
04 05 23 16-0055	SF		5 Ounce, 2 Sides Glass Fabric, Thru-Wall Copper Flashing	5.79	1.13
04 05 23 19			Masonry Cavity Drainage, Weepholes, And Vents (04 05 23)		
04 05 23 19-0001			Brick Vents, 4" Deep, With Insect Screen (04 05 23 19) Note: 0.100" nominal wall thickness, three mortar ribs on top and bottom of frame.		
04 05 23 19-0002	EA		8-1/8" x 2-3/8" Aluminum Brick Vent	44.29	
04 05 23 19-0003	EA		8-1/8" x 4-3/4" Aluminum Brick Vent	54.87	
04 05 23 19-0004	EA		8-1/8" x 7-3/4" Aluminum Brick Vent	69.08	
04 05 23 19-0005	EA		12" x 2-3/8" Aluminum Brick Vent	53.93	
04 05 23 19-0006	EA		12" x 4-3/4" Aluminum Brick Vent	66.54	
04 05 23 19-0007	EA		12" x 7-3/4" Aluminum Brick Vent	84.01	
04 05 23 19-0008	EA		16-1/2" x 2-3/8" Aluminum Brick Vent	63.58	
04 05 23 19-0009	EA		16-1/2" x 4-3/4" Aluminum Brick Vent	85.89	
04 05 23 19-0010	EA		16-1/2" x 7-3/4" Aluminum Brick Vent	104.68	
04 05 23 19-0011	EA		24" x 2-3/8" Aluminum Brick Vent	85.85	
04 05 23 19-0012	EA		24" x 4-3/4" Aluminum Brick Vent	111.69	
04 05 23 19-0013	EA		24" x 7-3/4" Aluminum Brick Vent	137.07	

04 05 26 Masonry Scaffolding (04 05)

04 Masonry**04 05 Common Work Results For Masonry****04 05 26 Masonry Scaffolding**

MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

Note: Costs based on one use per month. For use with unit masonry construction only. Height shown in tasks is for height of work. Includes assembly and disassembly of scaffolding.

04 05 26 00-0001	Scaffolding Rental <small>(04 05 26)</small>	
	Note: Total square foot of area is determined by the square foot of wall area at which scaffolding is required, above the established 4' working height limit. Scaffolding is complete with bracing, 2" thick x 12" wide scaffolding planks, scaffolding stairs (where necessary in lieu of planks), standard accessories, base leveling devices, mud sills, climbing ladders and landings, brackets, clamps and building ties, etc.	
04 05 26 00-0002	CSF Exterior Building Scaffolding, 1 To 5 Story, Tubular Steel, Based On 1 Use/Month	331.13
	For Each Additional Month Of Rental, Add	96.81
	For Additional Erection And Dismantling Of Scaffolding, Add	234.32
04 05 26 00-0003	CSF Exterior Building Scaffolding, 6 To 12 Story, Tubular Steel, Based On 1 Use/Month	390.26
	For Each Additional Month Of Rental, Add	88.45
	For Additional Erection And Dismantling Of Scaffolding, Add	301.81
04 05 26 00-0004	CSF Interior Scaffolding Wall, Up To 16' Tubular Steel, Based On 1 Use/Month	266.69
	For Each Additional Month Of Rental, Add	93.13
	For Additional Erection And Dismantling Of Scaffolding, Add	173.56
04 05 26 00-0005	CSF Interior Scaffolding Wall, 16' - 30' Tubular Steel, Based On 1 Use/Month	304.70
	For Each Additional Month Of Rental, Add	94.97
	For Additional Erection And Dismantling Of Scaffolding, Add	209.73

04 20 Unit Masonry (04)

Note: Includes pointing and cleaning of new brick and mortar. Includes cutting of new bricks/blocks to size.

04 21 Clay Unit Masonry (04 20)**04 21 13 Brick Masonry** (04 21)

Note: Includes brick and mortar. See CSI section 04 05 19 13-0000 for reinforcing, 04 05 19 16-0000 for masonry anchors, 04 05 26 00-0000 for scaffolding.

04 21 13 00-0001 Standard Size Brick With Running Bond (04 21 13)

Note: Standard size brick, 2-2/3" x 4" x 8".

04 21 13 00-0002 Red Face Brick (04 21 13 00-0001)

04 21 13 00-0003	SF Standard Size Red Face Brick - Veneer (6.4/SF With Running Bond)	15.88
	For Full Header Every 6th Course, Add	0.54
	For English, Full Header Every Second Course, Add	1.08
	For Flemish, Alternate Header Every Course, Add	2.15
	For Curved Wall Application, Add	2.71
	For Interior Veneer Construction, Add	2.03
	For Stacked Bond, Add	1.47
	For Battered Walls (Variable Depth Surface Placement), Add	3.38
	For Corbels, Add	10.15
	For Colored Mortar, Add	0.24
	For Basket Weave Or Soldier Bond Pattern, Add	1.47
	For Herringbone Pattern, Add	2.26
	For Severe Weather (SW) Brick, Add	0.35
	For Close Tolerance (FBX), Add	1.53
	For Small Area Replacements (Individual Areas) <10 SF, Add	20.41
	For Columns Where The Shortest Distance From Corner To Corner Is <3', Add	13.65
04 21 13 00-0004	SF Standard Size Red Face Brick - Cavity Wall (6.4/SF With Running Bond)	18.50
	For Full Header Every 6th Course, Add	0.65
	For English, Full Header Every Second Course, Add	1.29
	For Flemish, Alternate Header Every Course, Add	2.54
	For Curved Wall Application, Add	3.23
	For Interior Veneer Construction, Add	2.42
	For Stacked Bond, Add	1.73
	For Battered Walls (Variable Depth Surface Placement), Add	4.04
	For Corbels, Add	12.11
	For Colored Mortar, Add	0.24
	For Basket Weave Or Soldier Bond Pattern, Add	1.73
	For Herringbone Pattern, Add	2.66
	For Severe Weather (SW) Brick, Add	0.35
	For Close Tolerance (FBX), Add	1.79
	For Small Area Replacements (Individual Areas) <10 SF, Add	24.34
	For Columns Where The Shortest Distance From Corner To Corner Is <3', Add	16.27
04 21 13 00-0005	SF Standard Size Red Face Brick - 9" Solid Wall (12.7/SF With Running Bond)	26.18
	For Full Header Every 6th Course, Add	0.86
	For English, Full Header Every Second Course, Add	1.72
	For Flemish, Alternate Header Every Course, Add	3.46
	For Curved Wall Application, Add	4.31
	For Interior Veneer Construction, Add	3.23
	For Stacked Bond, Add	2.39
	For Battered Walls (Variable Depth Surface Placement), Add	5.38
	For Corbels, Add	16.15
	For Colored Mortar, Add	0.47
	For Basket Weave Or Soldier Bond Pattern, Add	2.39
	For Herringbone Pattern, Add	3.69
	For Severe Weather (SW) Brick, Add	0.70
	For Close Tolerance (FBX), Add	2.50
	For Small Area Replacements (Individual Areas) <10 SF, Add	32.53
	For Columns Where The Shortest Distance From Corner To Corner Is <3', Add	21.76

04 21 13 00-0006 Common Brick (04 21 13 00-0001)



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
04 21 13 00-0007 SF Select Common Brick For Veneer (6.4/SF).....	15.15	
For Full Header Every 6th Course, Add	0.51	
For English, Full Header Every Second Course, Add	1.02	
For Flemish, Alternate Header Every Course, Add	2.04	
For Curved Wall Application, Add	2.56	
For Interior Veneer Construction, Add	1.92	
For Stacked Bond, Add	1.40	
For Battered Walls (Variable Depth Surface Placement), Add	3.20	
For Corbels, Add	9.60	
For Colored Mortar, Add	0.24	
For Basket Weave Or Soldier Bond Pattern, Add	1.40	
For Herringbone Pattern, Add	2.16	
For Severe Weather (SW) Brick, Add	0.35	
For Close Tolerance (FBX), Add	1.46	
For Small Area Replacements (Individual Areas) <10 SF, Add	19.32	
For Columns Where The Shortest Distance From Corner to Corner Is <3', Add	12.92	
04 21 13 00-0008 SF Common Brick - 4" Back-up (6.4/SF).....	13.50	
For Full Header Every 6th Course, Add	0.46	
For English, Full Header Every Second Course, Add	0.91	
For Flemish, Alternate Header Every Course, Add	1.82	
For Curved Wall Application, Add	2.28	
For Interior Veneer Construction, Add	1.71	
For Stacked Bond, Add	1.25	
For Battered Walls (Variable Depth Surface Placement), Add	2.85	
For Corbels, Add	8.55	
For Colored Mortar, Add	0.21	
For Basket Weave Or Soldier Bond Pattern, Add	1.25	
For Herringbone Pattern, Add	1.92	
For Severe Weather (SW) Brick, Add	0.32	
For Close Tolerance (FBX), Add	1.30	
For Small Area Replacements (Individual Areas) <10 SF, Add	17.21	
For Columns Where The Shortest Distance From Corner to Corner Is <3', Add	11.51	
04 21 13 00-0009 SF Common Brick - 8" Back-up (12.7/SF).....	23.90	
For Full Header Every 6th Course, Add	0.79	
For English, Full Header Every Second Course, Add	1.58	
For Flemish, Alternate Header Every Course, Add	3.17	
For Curved Wall Application, Add	3.95	
For Interior Veneer Construction, Add	2.96	
For Stacked Bond, Add	2.18	
For Battered Walls (Variable Depth Surface Placement), Add	4.94	
For Corbels, Add	14.81	
For Colored Mortar, Add	0.42	
For Basket Weave Or Soldier Bond Pattern, Add	2.18	
For Herringbone Pattern, Add	3.38	
For Severe Weather (SW) Brick, Add	0.62	
For Close Tolerance (FBX), Add	2.29	
For Small Area Replacements (Individual Areas) <10 SF, Add	29.82	
For Columns Where The Shortest Distance From Corner to Corner Is <3', Add	19.95	
04 21 13 00-0010 SF Common Brick - 12" Solid (19/SF).....	33.86	
For Full Header Every 6th Course, Add	1.11	
For English, Full Header Every Second Course, Add	2.21	
For Flemish, Alternate Header Every Course, Add	4.46	
For Curved Wall Application, Add	5.53	
For Interior Veneer Construction, Add	4.14	
For Stacked Bond, Add	3.07	
For Battered Walls (Variable Depth Surface Placement), Add	6.91	
For Corbels, Add	20.72	
For Colored Mortar, Add	0.62	
For Basket Weave Or Soldier Bond Pattern, Add	3.07	
For Herringbone Pattern, Add	4.77	
For Severe Weather (SW) Brick, Add	0.93	
For Close Tolerance (FBX), Add	3.23	
For Small Area Replacements (Individual Areas) <10 SF, Add	41.76	
For Columns Where The Shortest Distance From Corner to Corner Is <3', Add	27.94	
04 21 13 00-0011 SF Common Brick - 16" Solid (25.4/SF).....	42.84	
For Full Header Every 6th Course, Add	1.38	
For English, Full Header Every Second Course, Add	2.76	
For Flemish, Alternate Header Every Course, Add	5.60	
For Curved Wall Application, Add	6.91	
For Interior Veneer Construction, Add	5.18	
For Stacked Bond, Add	3.87	
For Battered Walls (Variable Depth Surface Placement), Add	8.64	
For Corbels, Add	25.91	
For Colored Mortar, Add	0.83	
For Basket Weave Or Soldier Bond Pattern, Add	3.87	
For Herringbone Pattern, Add	6.01	
For Severe Weather (SW) Brick, Add	1.24	
For Close Tolerance (FBX), Add	4.08	
For Small Area Replacements (Individual Areas) <10 SF, Add	52.24	
For Columns Where The Shortest Distance From Corner to Corner Is <3', Add	34.96	

04	Masonry
04 20	Unit Masonry
04 21	Clay Unit Masonry



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
	04 21 13 00-0012	SF	Common Brick As 4" Wall Face Brick (6.4/SF)	15.15	
			For Full Header Every 6th Course, Add	0.51	
			For English, Full Header Every Second Course, Add	1.02	
			For Flemish, Alternate Header Every Course, Add	2.04	
			For Curved Wall Application, Add	2.56	
			For Interior Veneer Construction, Add	1.92	
			For Stacked Bond, Add	1.40	
			For Battered Walls (Variable Depth Surface Placement), Add	3.20	
			For Corbels, Add	9.60	
			For Colored Mortar, Add	0.24	
			For Basket Weave Or Soldier Bond Pattern, Add	1.40	
			For Herringbone Pattern, Add	2.16	
			For Severe Weather (SW) Brick, Add	0.35	
			For Close Tolerance (FBX), Add	1.46	
			For Small Area Replacements (Individual Areas) <10 SF, Add	19.32	
			For Columns Where The Shortest Distance From Corner to Corner Is <3', Add	12.92	
	04 21 13 00-0013		Glazed Brick (04 21 13 00-0001)		
	04 21 13 00-0014	SF	Glazed Brick Veneer (7.4/SF)	25.42	
			For Full Header Every 6th Course, Add	0.61	
			For English, Full Header Every Second Course, Add	1.22	
			For Flemish, Alternate Header Every Course, Add	2.80	
			For Curved Wall Application, Add	3.06	
			For Interior Veneer Construction, Add	2.30	
			For Stacked Bond, Add	2.04	
			For Battered Walls (Variable Depth Surface Placement), Add	3.83	
			For Corbels, Add	11.48	
			For Colored Mortar, Add	1.01	
			For Basket Weave Or Soldier Bond Pattern, Add	2.04	
			For Herringbone Pattern, Add	3.31	
			For Severe Weather (SW) Brick, Add	1.52	
			For Close Tolerance (FBX), Add	2.29	
			For Small Area Replacements (Individual Areas) <10 SF, Add	23.46	
			For Columns Where The Shortest Distance From Corner to Corner Is <3', Add	15.81	
	04 21 13 00-0015		Buff Or Gray Face Brick (04 21 13 00-0001)		
	04 21 13 00-0016	SF	Buff (Gray) Face Brick - Veneer (6.4/SF)	16.36	
			For Full Header Every 6th Course, Add	0.54	
			For English, Full Header Every Second Course, Add	1.08	
			For Flemish, Alternate Header Every Course, Add	2.17	
			For Curved Wall Application, Add	2.71	
			For Interior Veneer Construction, Add	2.03	
			For Stacked Bond, Add	1.49	
			For Battered Walls (Variable Depth Surface Placement), Add	3.38	
			For Corbels, Add	10.15	
			For Colored Mortar, Add	0.28	
			For Basket Weave Or Soldier Bond Pattern, Add	1.49	
			For Herringbone Pattern, Add	2.31	
			For Severe Weather (SW) Brick, Add	0.42	
			For Close Tolerance (FBX), Add	1.57	
			For Small Area Replacements (Individual Areas) <10 SF, Add	20.44	
			For Columns Where The Shortest Distance From Corner to Corner Is <3', Add	13.67	
	04 21 13 00-0017	SF	Buff (Gray) Face Brick - Cavity Wall (6.4/SF)	16.36	
			For Full Header Every 6th Course, Add	0.54	
			For English, Full Header Every Second Course, Add	1.08	
			For Flemish, Alternate Header Every Course, Add	2.17	
			For Curved Wall Application, Add	2.71	
			For Interior Veneer Construction, Add	2.03	
			For Stacked Bond, Add	1.49	
			For Battered Walls (Variable Depth Surface Placement), Add	3.38	
			For Corbels, Add	10.15	
			For Colored Mortar, Add	0.28	
			For Basket Weave Or Soldier Bond Pattern, Add	1.49	
			For Herringbone Pattern, Add	2.31	
			For Severe Weather (SW) Brick, Add	0.42	
			For Close Tolerance (FBX), Add	1.57	
			For Small Area Replacements (Individual Areas) <10 SF, Add	20.44	
			For Columns Where The Shortest Distance From Corner to Corner Is <3', Add	13.67	
	04 21 13 00-0018		Jumbo Or Oversized Face Brick (04 21 13)		
			Note: Jumbo utility: 4" x 4" x 12", 6" jumbo: 6" x 4" x 12", 8" jumbo: 8" x 4" x 12".		
	04 21 13 00-0019		Jumbo Or Oversize Brick Red Face Running Bond (04 21 13 00-0018)		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
04 21 13 00-0020 SF Jumbo Red Face Brick - 4" Veneer (3.0/SF With Running Bond).....	11.65	
For Full Header Every 6th Course, Add	0.37	
For English, Full Header Every Second Course, Add	0.74	
For Flemish, Alternate Header Every Course, Add	1.50	
For Curved Wall Application, Add	1.84	
For Interior Veneer Construction, Add	1.38	
For Stacked Bond, Add	1.04	
For Battered Walls (Variable Depth Surface Placement), Add	2.31	
For Corbels, Add	6.92	
For Colored Mortar, Add	0.24	
For Basket Weave Or Soldier Bond Pattern, Add	1.04	
For Herringbone Pattern, Add	1.63	
For Severe Weather (SW) Brick, Add	0.36	
For Close Tolerance (FBX), Add	1.10	
For Small Area Replacements (Individual Areas) <10 SF, Add	13.95	
For Columns Where The Shortest Distance From Corner to Corner Is <3', Add	9.34	
04 21 13 00-0021 SF Jumbo Red Face Brick - Cavity Wall (3.0/SF With Running Bond).....	13.19	
For Full Header Every 6th Course, Add	0.43	
For English, Full Header Every Second Course, Add	0.86	
For Flemish, Alternate Header Every Course, Add	1.74	
For Curved Wall Application, Add	2.15	
For Interior Veneer Construction, Add	1.61	
For Stacked Bond, Add	1.20	
For Battered Walls (Variable Depth Surface Placement), Add	2.69	
For Corbels, Add	8.07	
For Colored Mortar, Add	0.24	
For Basket Weave Or Soldier Bond Pattern, Add	1.20	
For Herringbone Pattern, Add	1.86	
For Severe Weather (SW) Brick, Add	0.36	
For Close Tolerance (FBX), Add	1.26	
For Small Area Replacements (Individual Areas) <10 SF, Add	16.26	
For Columns Where The Shortest Distance From Corner to Corner Is <3', Add	10.88	
04 21 13 00-0022 SF Jumbo Red Face Brick - 4" Back-up (3.0/SF With Running Bond).....	10.87	
For Full Header Every 6th Course, Add	0.36	
For English, Full Header Every Second Course, Add	0.73	
For Flemish, Alternate Header Every Course, Add	1.45	
For Curved Wall Application, Add	1.82	
For Interior Veneer Construction, Add	1.36	
For Stacked Bond, Add	1.00	
For Battered Walls (Variable Depth Surface Placement), Add	2.27	
For Corbels, Add	6.81	
For Colored Mortar, Add	0.18	
For Basket Weave Or Soldier Bond Pattern, Add	1.00	
For Herringbone Pattern, Add	1.54	
For Severe Weather (SW) Brick, Add	0.27	
For Close Tolerance (FBX), Add	1.04	
For Small Area Replacements (Individual Areas) <10 SF, Add	13.71	
For Columns Where The Shortest Distance From Corner to Corner Is <3', Add	9.17	
04 21 13 00-0023 SF Jumbo Red Face Brick - 8" Back-up (6.0/SF With Running Bond).....	17.41	
For Full Header Every 6th Course, Add	0.55	
For English, Full Header Every Second Course, Add	1.11	
For Flemish, Alternate Header Every Course, Add	2.25	
For Curved Wall Application, Add	2.76	
For Interior Veneer Construction, Add	2.07	
For Stacked Bond, Add	1.56	
For Battered Walls (Variable Depth Surface Placement), Add	3.46	
For Corbels, Add	10.37	
For Colored Mortar, Add	0.36	
For Basket Weave Or Soldier Bond Pattern, Add	1.56	
For Herringbone Pattern, Add	2.43	
For Severe Weather (SW) Brick, Add	0.54	
For Close Tolerance (FBX), Add	1.65	
For Small Area Replacements (Individual Areas) <10 SF, Add	20.91	
For Columns Where The Shortest Distance From Corner to Corner Is <3', Add	14.00	
04 21 13 00-0024 SF Jumbo Red Face Brick - 12" Solid (9.0/SF With Running Bond).....	26.48	
For Full Header Every 6th Course, Add	0.77	
For English, Full Header Every Second Course, Add	1.54	
For Flemish, Alternate Header Every Course, Add	3.24	
For Curved Wall Application, Add	3.84	
For Interior Veneer Construction, Add	2.88	
For Stacked Bond, Add	2.28	
For Battered Walls (Variable Depth Surface Placement), Add	4.80	
For Corbels, Add	14.39	
For Colored Mortar, Add	0.73	
For Basket Weave Or Soldier Bond Pattern, Add	2.28	
For Herringbone Pattern, Add	3.61	
For Severe Weather (SW) Brick, Add	1.09	
For Close Tolerance (FBX), Add	2.47	
For Small Area Replacements (Individual Areas) <10 SF, Add	29.15	
For Columns Where The Shortest Distance From Corner to Corner Is <3', Add	19.55	

04	Masonry
04 20	Unit Masonry
04 21	Clay Unit Masonry



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
04 21 13 00-0025	SF		Jumbo Red Face Brick - 16" Solid (12.0/SF With Running Bond).....	33.34	
			For Full Header Every 6th Course, Add	0.94	
			For English, Full Header Every Second Course, Add	1.89	
			For Flemish, Alternate Header Every Course, Add	4.03	
			For Curved Wall Application, Add	4.72	
			For Interior Veneer Construction, Add	3.54	
			For Stacked Bond, Add	2.85	
			For Battered Walls (Variable Depth Surface Placement), Add	5.91	
			For Corbels, Add	17.72	
			For Colored Mortar, Add	0.97	
			For Basket Weave Or Soldier Bond Pattern, Add	2.85	
			For Herringbone Pattern, Add	4.52	
			For Severe Weather (SW) Brick, Add	1.46	
			For Close Tolerance (FBX), Add	3.09	
			For Small Area Replacements (Individual Areas) <10 SF, Add	35.92	
			For Columns Where The Shortest Distance From Corner to Corner Is <3', Add	24.11	
04 21 13 00-0026			Other Brick Shapes (04 21 13)		
04 21 13 00-0027			Norman Face Brick (04 21 13 00-0026) Note: 2-2/3" x 4" x 12".		
04 21 13 00-0028			Norman Brick, Red Face Running Bond (04 21 13 00-0027)		
04 21 13 00-0029	SF		Red Face Norman Brick - Veneer (4.5/SF With Running Bond)	16.27	
			For Buff Or Gray Face, Add	0.51	
			For Marble Chip, Add	0.67	
			For Full Header Every 6th Course, Add	0.53	
			For English, Full Header Every Second Course, Add	1.06	
			For Flemish, Alternate Header Every Course, Add	2.13	
			For Curved Wall Application, Add	2.64	
			For Interior Veneer Construction, Add	1.98	
			For Stacked Bond, Add	1.47	
			For Battered Walls (Variable Depth Surface Placement), Add	3.30	
			For Corbels, Add	9.91	
			For Colored Mortar, Add	0.31	
			For Basket Weave Or Soldier Bond Pattern, Add	1.47	
			For Herringbone Pattern, Add	2.29	
			For Severe Weather (SW) Brick, Add	0.46	
			For Close Tolerance (FBX), Add	1.55	
			For Small Area Replacements (Individual Areas) <10 SF, Add	19.97	
			For Columns Where The Shortest Distance From Corner to Corner Is <3', Add	13.36	
04 21 13 00-0030	SF		Red Face Norman Brick - Cavity Wall (4.5/SF With Running Bond)	18.44	
			For Buff Or Gray Face, Add	0.51	
			For Marble Chip, Add	0.67	
			For Full Header Every 6th Course, Add	0.62	
			For English, Full Header Every Second Course, Add	1.23	
			For Flemish, Alternate Header Every Course, Add	2.46	
			For Curved Wall Application, Add	3.08	
			For Interior Veneer Construction, Add	2.31	
			For Stacked Bond, Add	1.69	
			For Battered Walls (Variable Depth Surface Placement), Add	3.85	
			For Corbels, Add	11.54	
			For Colored Mortar, Add	0.31	
			For Basket Weave Or Soldier Bond Pattern, Add	1.69	
			For Herringbone Pattern, Add	2.61	
			For Severe Weather (SW) Brick, Add	0.46	
			For Close Tolerance (FBX), Add	1.77	
			For Small Area Replacements (Individual Areas) <10 SF, Add	23.22	
			For Columns Where The Shortest Distance From Corner to Corner Is <3', Add	15.53	
04 21 13 00-0031			Engineer Brick (04 21 13 00-0026) Note: 3-1/5" x 4" x 8".		
04 21 13 00-0032			Engineer Brick, Red Face Running Bond (04 21 13 00-0031)		
04 21 13 00-0033	SF		Engineer Brick - Veneer (5.06/SF With Running Bond)	16.13	
			For Full Header Every 6th Course, Add	0.53	
			For English, Full Header Every Second Course, Add	1.06	
			For Flemish, Alternate Header Every Course, Add	2.13	
			For Curved Wall Application, Add	2.64	
			For Interior Veneer Construction, Add	1.98	
			For Stacked Bond, Add	1.47	
			For Battered Walls (Variable Depth Surface Placement), Add	3.30	
			For Corbels, Add	9.91	
			For Colored Mortar, Add	0.29	
			For Basket Weave Or Soldier Bond Pattern, Add	1.47	
			For Herringbone Pattern, Add	2.27	
			For Severe Weather (SW) Brick, Add	0.44	
			For Close Tolerance (FBX), Add	1.54	
			For Small Area Replacements (Individual Areas) <10 SF, Add	19.96	
			For Columns Where The Shortest Distance From Corner to Corner Is <3', Add	13.36	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
	04 21	13 00-0034	SF	Engineer Brick - Cavity Wall (5.06/SF With Running Bond).....	18.30	
				<i>For Full Header Every 6th Course, Add</i>	0.62	
				<i>For English, Full Header Every Second Course, Add</i>	1.23	
				<i>For Flemish, Alternate Header Every Course, Add</i>	2.45	
				<i>For Curved Wall Application, Add</i>	3.08	
				<i>For Interior Veneer Construction, Add</i>	2.31	
				<i>For Stacked Bond, Add</i>	1.68	
				<i>For Battered Walls (Variable Depth Surface Placement), Add</i>	3.85	
				<i>For Corbels, Add</i>	11.54	
				<i>For Colored Mortar, Add</i>	0.29	
				<i>For Basket Weave Or Soldier Bond Pattern, Add</i>	1.68	
				<i>For Herringbone Pattern, Add</i>	2.60	
				<i>For Severe Weather (SW) Brick, Add</i>	0.44	
				<i>For Close Tolerance (FBX), Add</i>	1.76	
				<i>For Small Area Replacements (Individual Areas) <10 SF, Add</i>	23.22	
				<i>For Columns Where The Shortest Distance From Corner to Corner Is <3', Add</i>	15.53	
	04 21	13 00-0035		Roman Brick <small>(04 21 13 00-0026)</small>		
				Note: 2" x 4" x 12" or Baby Roman 2" x 4" x 8".		
	04 21	13 00-0036		Roman Brick, Red Face Running Bond <small>(04 21 13 00-0035)</small>		
	04 21	13 00-0037	SF	Roman Brick - Veneer (5.23/SF With Running Bond).....	16.91	
				<i>For Full Header Every 6th Course, Add</i>	0.53	
				<i>For English, Full Header Every Second Course, Add</i>	1.06	
				<i>For Flemish, Alternate Header Every Course, Add</i>	2.17	
				<i>For Curved Wall Application, Add</i>	2.64	
				<i>For Interior Veneer Construction, Add</i>	1.98	
				<i>For Stacked Bond, Add</i>	1.51	
				<i>For Battered Walls (Variable Depth Surface Placement), Add</i>	3.30	
				<i>For Corbels, Add</i>	9.91	
				<i>For Colored Mortar, Add</i>	0.37	
				<i>For Basket Weave Or Soldier Bond Pattern, Add</i>	1.51	
				<i>For Herringbone Pattern, Add</i>	2.35	
				<i>For Severe Weather (SW) Brick, Add</i>	0.56	
				<i>For Close Tolerance (FBX), Add</i>	1.60	
				<i>For Small Area Replacements (Individual Areas) <10 SF, Add</i>	20.00	
				<i>For Columns Where The Shortest Distance From Corner to Corner Is <3', Add</i>	13.40	
	04 21	13 00-0038	SF	Roman Brick - Cavity Wall (5.23/SF With Running Bond).....	19.08	
				<i>For Full Header Every 6th Course, Add</i>	0.62	
				<i>For English, Full Header Every Second Course, Add</i>	1.23	
				<i>For Flemish, Alternate Header Every Course, Add</i>	2.49	
				<i>For Curved Wall Application, Add</i>	3.08	
				<i>For Interior Veneer Construction, Add</i>	2.31	
				<i>For Stacked Bond, Add</i>	1.72	
				<i>For Battered Walls (Variable Depth Surface Placement), Add</i>	3.85	
				<i>For Corbels, Add</i>	11.54	
				<i>For Colored Mortar, Add</i>	0.37	
				<i>For Basket Weave Or Soldier Bond Pattern, Add</i>	1.72	
				<i>For Herringbone Pattern, Add</i>	2.68	
				<i>For Severe Weather (SW) Brick, Add</i>	0.56	
				<i>For Close Tolerance (FBX), Add</i>	1.82	
				<i>For Small Area Replacements (Individual Areas) <10 SF, Add</i>	23.26	
				<i>For Columns Where The Shortest Distance From Corner to Corner Is <3', Add</i>	15.57	
	04 21	13 00-0039	SF	Baby Roman Brick - Veneer (7.76/SF With Running Bond).....	17.59	
				<i>For Full Header Every 6th Course, Add</i>	0.53	
				<i>For English, Full Header Every Second Course, Add</i>	1.06	
				<i>For Flemish, Alternate Header Every Course, Add</i>	2.20	
				<i>For Curved Wall Application, Add</i>	2.64	
				<i>For Interior Veneer Construction, Add</i>	1.98	
				<i>For Stacked Bond, Add</i>	1.54	
				<i>For Battered Walls (Variable Depth Surface Placement), Add</i>	3.30	
				<i>For Corbels, Add</i>	9.91	
				<i>For Colored Mortar, Add</i>	0.44	
				<i>For Basket Weave Or Soldier Bond Pattern, Add</i>	1.54	
				<i>For Herringbone Pattern, Add</i>	2.42	
				<i>For Severe Weather (SW) Brick, Add</i>	0.66	
				<i>For Close Tolerance (FBX), Add</i>	1.65	
				<i>For Small Area Replacements (Individual Areas) <10 SF, Add</i>	20.03	
				<i>For Columns Where The Shortest Distance From Corner to Corner Is <3', Add</i>	13.43	
	04 21	13 00-0040	SF	Baby Roman Brick - Cavity Wall (7.76/SF With Running Bond).....	19.76	
				<i>For Full Header Every 6th Course, Add</i>	0.62	
				<i>For English, Full Header Every Second Course, Add</i>	1.23	
				<i>For Flemish, Alternate Header Every Course, Add</i>	2.53	
				<i>For Curved Wall Application, Add</i>	3.08	
				<i>For Interior Veneer Construction, Add</i>	2.31	
				<i>For Stacked Bond, Add</i>	1.76	
				<i>For Battered Walls (Variable Depth Surface Placement), Add</i>	3.85	
				<i>For Corbels, Add</i>	11.54	
				<i>For Colored Mortar, Add</i>	0.44	
				<i>For Basket Weave Or Soldier Bond Pattern, Add</i>	1.76	
				<i>For Herringbone Pattern, Add</i>	2.75	
				<i>For Severe Weather (SW) Brick, Add</i>	0.66	
				<i>For Close Tolerance (FBX), Add</i>	1.87	
				<i>For Small Area Replacements (Individual Areas) <10 SF, Add</i>	23.29	
				<i>For Columns Where The Shortest Distance From Corner to Corner Is <3', Add</i>	15.60	

04	Masonry
04 20	Unit Masonry
04 21	Clay Unit Masonry



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
04 21 13 00-0041			Norwegian Brick <small>(0421 13 00-0026)</small> Note: 3-1/5" x 4" x 12" or 6" Norwegian 3-1/5" x 6" x 12".		
04 21 13 00-0042			Norwegian Brick, Red Face Running Bond <small>(0421 13 00-0041)</small>		
04 21 13 00-0043	SF		Norwegian Brick - Veneer (3.41/SF With Running Bond)	15.67	
			For Full Header Every 6th Course, Add	0.53	
			For English, Full Header Every Second Course, Add	1.06	
			For Flemish, Alternate Header Every Course, Add	2.10	
			For Curved Wall Application, Add	2.64	
			For Interior Veneer Construction, Add	1.98	
			For Stacked Bond, Add	1.44	
			For Battered Walls (Variable Depth Surface Placement), Add	3.30	
			For Corbels, Add	9.91	
			For Colored Mortar, Add	0.25	
			For Basket Weave Or Soldier Bond Pattern, Add	1.44	
			For Herringbone Pattern, Add	2.23	
			For Severe Weather (SW) Brick, Add	0.37	
			For Close Tolerance (FBX), Add	1.51	
			For Small Area Replacements (Individual Areas) <10 SF, Add	19.94	
			For Columns Where The Shortest Distance From Corner to Corner Is <3', Add	13.33	
04 21 13 00-0044	SF		Norwegian Brick - Cavity Wall (3.41/SF With Running Bond)	17.84	
			For Full Header Every 6th Course, Add	0.62	
			For English, Full Header Every Second Course, Add	1.23	
			For Flemish, Alternate Header Every Course, Add	2.43	
			For Curved Wall Application, Add	3.08	
			For Interior Veneer Construction, Add	2.31	
			For Stacked Bond, Add	1.66	
			For Battered Walls (Variable Depth Surface Placement), Add	3.85	
			For Corbels, Add	11.54	
			For Colored Mortar, Add	0.25	
			For Basket Weave Or Soldier Bond Pattern, Add	1.66	
			For Herringbone Pattern, Add	2.55	
			For Severe Weather (SW) Brick, Add	0.37	
			For Close Tolerance (FBX), Add	1.72	
			For Small Area Replacements (Individual Areas) <10 SF, Add	23.19	
			For Columns Where The Shortest Distance From Corner to Corner Is <3', Add	15.50	
04 21 13 00-0045	SF		6" Norwegian Brick - Veneer (3.41/SF With Running Bond)	16.85	
			For Full Header Every 6th Course, Add	0.53	
			For English, Full Header Every Second Course, Add	1.06	
			For Flemish, Alternate Header Every Course, Add	2.16	
			For Curved Wall Application, Add	2.64	
			For Interior Veneer Construction, Add	1.98	
			For Stacked Bond, Add	1.50	
			For Battered Walls (Variable Depth Surface Placement), Add	3.30	
			For Corbels, Add	9.91	
			For Colored Mortar, Add	0.36	
			For Basket Weave Or Soldier Bond Pattern, Add	1.50	
			For Herringbone Pattern, Add	2.35	
			For Severe Weather (SW) Brick, Add	0.55	
			For Close Tolerance (FBX), Add	1.59	
			For Small Area Replacements (Individual Areas) <10 SF, Add	20.00	
			For Columns Where The Shortest Distance From Corner to Corner Is <3', Add	13.39	
04 21 13 00-0046	SF		6" Norwegian Brick - Cavity Wall (3.41/SF With Running Bond)	19.02	
			For Full Header Every 6th Course, Add	0.62	
			For English, Full Header Every Second Course, Add	1.23	
			For Flemish, Alternate Header Every Course, Add	2.49	
			For Curved Wall Application, Add	3.08	
			For Interior Veneer Construction, Add	2.31	
			For Stacked Bond, Add	1.72	
			For Battered Walls (Variable Depth Surface Placement), Add	3.85	
			For Corbels, Add	11.54	
			For Colored Mortar, Add	0.36	
			For Basket Weave Or Soldier Bond Pattern, Add	1.72	
			For Herringbone Pattern, Add	2.67	
			For Severe Weather (SW) Brick, Add	0.55	
			For Close Tolerance (FBX), Add	1.81	
			For Small Area Replacements (Individual Areas) <10 SF, Add	23.25	
			For Columns Where The Shortest Distance From Corner to Corner Is <3', Add	15.56	
04 21 13 00-0047			Double Face Brick <small>(0421 13 00-0026)</small> Note: 5-1/3" x 4" x 8".		
04 21 13 00-0048			Double Face Brick, Red Face Running Bond <small>(0421 13 00-0047)</small>		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
04 21 13 00-0049 SF Double Face Brick - Veneer (3.13/SF With Running Bond)	15.17	
For Full Header Every 6th Course, Add	0.53	
For English, Full Header Every Second Course, Add	1.06	
For Flemish, Alternate Header Every Course, Add	2.08	
For Curved Wall Application, Add	2.64	
For Interior Veneer Construction, Add	1.98	
For Stacked Bond, Add	1.42	
For Battered Walls (Variable Depth Surface Placement), Add	3.30	
For Corbels, Add	9.91	
For Colored Mortar, Add	0.20	
For Basket Weave Or Soldier Bond Pattern, Add	1.42	
For Herringbone Pattern, Add	2.18	
For Severe Weather (SW) Brick, Add	0.29	
For Close Tolerance (FBX), Add	1.47	
For Small Area Replacements (Individual Areas) <10 SF, Add	19.91	
For Columns Where The Shortest Distance From Corner to Corner Is <3', Add	13.31	
04 21 13 00-0050 SF Double Face Brick - Cavity Wall (3.13/SF With Running Bond)	17.34	
For Full Header Every 6th Course, Add	0.62	
For English, Full Header Every Second Course, Add	1.23	
For Flemish, Alternate Header Every Course, Add	2.41	
For Curved Wall Application, Add	3.08	
For Interior Veneer Construction, Add	2.31	
For Stacked Bond, Add	1.64	
For Battered Walls (Variable Depth Surface Placement), Add	3.85	
For Corbels, Add	11.54	
For Colored Mortar, Add	0.20	
For Basket Weave Or Soldier Bond Pattern, Add	1.64	
For Herringbone Pattern, Add	2.50	
For Severe Weather (SW) Brick, Add	0.29	
For Close Tolerance (FBX), Add	1.69	
For Small Area Replacements (Individual Areas) <10 SF, Add	23.17	
For Columns Where The Shortest Distance From Corner to Corner Is <3', Add	15.48	
04 21 13 00-0051 Triple Face Brick <small>(04 21 13 00-0026)</small>		
Note: 5-1/3" x 4" x 12".		
04 21 13 00-0052 Triple Face Brick, Red Face Running Bond <small>(04 21 13 00-0051)</small>		
04 21 13 00-0053 SF Triple Face Brick - Veneer (2.11/SF With Running Bond)	14.85	
For Full Header Every 6th Course, Add	0.53	
For English, Full Header Every Second Course, Add	1.06	
For Flemish, Alternate Header Every Course, Add	2.06	
For Curved Wall Application, Add	2.64	
For Interior Veneer Construction, Add	1.98	
For Stacked Bond, Add	1.40	
For Battered Walls (Variable Depth Surface Placement), Add	3.30	
For Corbels, Add	9.91	
For Colored Mortar, Add	0.16	
For Basket Weave Or Soldier Bond Pattern, Add	1.40	
For Herringbone Pattern, Add	2.15	
For Severe Weather (SW) Brick, Add	0.25	
For Close Tolerance (FBX), Add	1.44	
For Small Area Replacements (Individual Areas) <10 SF, Add	19.90	
For Columns Where The Shortest Distance From Corner to Corner Is <3', Add	13.29	
04 21 13 00-0054 SF Triple Face Brick - Cavity Wall (2.11/SF With Running Bond)	17.02	
For Full Header Every 6th Course, Add	0.62	
For English, Full Header Every Second Course, Add	1.23	
For Flemish, Alternate Header Every Course, Add	2.39	
For Curved Wall Application, Add	3.08	
For Interior Veneer Construction, Add	2.31	
For Stacked Bond, Add	1.62	
For Battered Walls (Variable Depth Surface Placement), Add	3.85	
For Corbels, Add	11.54	
For Colored Mortar, Add	0.16	
For Basket Weave Or Soldier Bond Pattern, Add	1.62	
For Herringbone Pattern, Add	2.47	
For Severe Weather (SW) Brick, Add	0.25	
For Close Tolerance (FBX), Add	1.66	
For Small Area Replacements (Individual Areas) <10 SF, Add	23.15	
For Columns Where The Shortest Distance From Corner to Corner Is <3', Add	15.46	
04 21 13 00-0055 SCR Face Brick <small>(04 21 13 00-0026)</small>		
Note: 2-2/3" x 6" x 12".		
04 21 13 00-0056 SCR Face Brick, Red Face Running Bond <small>(04 21 13 00-0055)</small>		

04	Masonry
04 20	Unit Masonry
04 21	Clay Unit Masonry



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
04 21 13 00-0057	SF		SCR Face Brick - Veneer (4.03/SF With Running Bond)	17.45	
			For Full Header Every 6th Course, Add	0.53	
			For English, Full Header Every Second Course, Add	1.06	
			For Flemish, Alternate Header Every Course, Add	2.19	
			For Curved Wall Application, Add	2.64	
			For Interior Veneer Construction, Add	1.98	
			For Stacked Bond, Add	1.53	
			For Battered Walls (Variable Depth Surface Placement), Add	3.30	
			For Corbels, Add	9.91	
			For Colored Mortar, Add	0.42	
			For Basket Weave Or Soldier Bond Pattern, Add	1.53	
			For Herringbone Pattern, Add	2.41	
			For Severe Weather (SW) Brick, Add	0.64	
			For Close Tolerance (FBX), Add	1.64	
			For Small Area Replacements (Individual Areas) <10 SF, Add	20.03	
			For Columns Where The Shortest Distance From Corner to Corner Is <3', Add	13.42	
04 21 13 00-0058	SF		SCR Face Brick - Cavity Wall (4.03/SF With Running Bond)	19.62	
			For Full Header Every 6th Course, Add	0.62	
			For English, Full Header Every Second Course, Add	1.23	
			For Flemish, Alternate Header Every Course, Add	2.52	
			For Curved Wall Application, Add	3.08	
			For Interior Veneer Construction, Add	2.31	
			For Stacked Bond, Add	1.75	
			For Battered Walls (Variable Depth Surface Placement), Add	3.85	
			For Corbels, Add	11.54	
			For Colored Mortar, Add	0.42	
			For Basket Weave Or Soldier Bond Pattern, Add	1.75	
			For Herringbone Pattern, Add	2.73	
			For Severe Weather (SW) Brick, Add	0.64	
			For Close Tolerance (FBX), Add	1.86	
			For Small Area Replacements (Individual Areas) <10 SF, Add	23.28	
			For Columns Where The Shortest Distance From Corner to Corner Is <3', Add	15.59	
04 21 13 00-0059			Fire Brick <small>(04 21 13 00-0026)</small>		
			Note: 3-1/5" x 4" x 12" or 6" Norwegian 3-1/5" x 6" x 12".		
04 21 13 00-0060			Fire Brick, Red Face Running Bond <small>(04 21 13 00-0059)</small>		
04 21 13 00-0061	SF		Fire Brick - Veneer (With Running Bond)	17.56	
			For Full Header Every 6th Course, Add	0.53	
			For English, Full Header Every Second Course, Add	1.06	
			For Flemish, Alternate Header Every Course, Add	2.20	
			For Curved Wall Application, Add	2.64	
			For Interior Veneer Construction, Add	1.98	
			For Stacked Bond, Add	1.54	
			For Battered Walls (Variable Depth Surface Placement), Add	3.30	
			For Corbels, Add	9.91	
			For Colored Mortar, Add	0.44	
			For Basket Weave Or Soldier Bond Pattern, Add	1.54	
			For Herringbone Pattern, Add	2.42	
			For Severe Weather (SW) Brick, Add	0.65	
			For Close Tolerance (FBX), Add	1.65	
			For Small Area Replacements (Individual Areas) <10 SF, Add	20.03	
			For Columns Where The Shortest Distance From Corner to Corner Is <3', Add	13.43	
04 21 13 00-0062	SF		Fire Brick - Cavity Wall (With Running Bond)	19.73	
			For Full Header Every 6th Course, Add	0.62	
			For English, Full Header Every Second Course, Add	1.23	
			For Flemish, Alternate Header Every Course, Add	2.52	
			For Curved Wall Application, Add	3.08	
			For Interior Veneer Construction, Add	2.31	
			For Stacked Bond, Add	1.76	
			For Battered Walls (Variable Depth Surface Placement), Add	3.85	
			For Corbels, Add	11.54	
			For Colored Mortar, Add	0.44	
			For Basket Weave Or Soldier Bond Pattern, Add	1.76	
			For Herringbone Pattern, Add	2.74	
			For Severe Weather (SW) Brick, Add	0.65	
			For Close Tolerance (FBX), Add	1.86	
			For Small Area Replacements (Individual Areas) <10 SF, Add	23.29	
			For Columns Where The Shortest Distance From Corner to Corner Is <3', Add	15.60	
04 21 13 00-0063			Window Sill <small>(04 21 13)</small>		
04 21 13 00-0064	LF		Window Sill, Face Brick On Edge	17.69	
04 21 19			Clay Tile Masonry <small>(04 21)</small>		
04 21 19 00-0001			Scored Face, Hollow, Clay Backing Tile <small>(04 21 19)</small>		
04 21 19 00-0002			Load Bearing, Scored Face, Hollow, Clay Backing Tile <small>(04 21 19 00-0001)</small>		
04 21 19 00-0003	SF		4" Thick Load Bearing, Scored Face, Hollow, Clay Backing Tile	13.71	
			For Smooth Face, One Side, Add	0.77	
			For Smooth Face, Two Sides, Add	1.26	
04 21 19 00-0004	SF		6" Thick Load Bearing, Scored Face, Hollow, Clay Backing Tile	14.82	
			For Smooth Face, One Side, Add	0.85	
			For Smooth Face, Two Sides, Add	1.40	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
04 21 19 00-0005 SF 8" Thick Load Bearing, Scored Face, Hollow, Clay Backing Tile <i>For Smooth Face, One Side, Add</i>	16.43 0.97	
	<i>For Smooth Face, Two Sides, Add</i>	
04 21 19 00-0006 SF 10" Thick Load Bearing, Scored Face, Hollow, Clay Backing Tile <i>For Smooth Face, One Side, Add</i>	21.61 1.45	
	<i>For Smooth Face, Two Sides, Add</i>	
04 21 19 00-0007 SF 12" Thick Load Bearing, Scored Face, Hollow, Clay Backing Tile <i>For Smooth Face, One Side, Add</i>	27.70 1.99	
	<i>For Smooth Face, Two Sides, Add</i>	
04 21 19 00-0008 Non-Load Bearing, Scored Face, Hollow, Clay Backing Tile (04 21 19 00-0001)		
04 21 19 00-0009 SF 3" Thick Non Load Bearing, Scored Face, Hollow, Clay Backing Tile..... <i>For Smooth Face, One Side, Add</i>	11.64 0.63	
	<i>For Smooth Face, Two Sides, Add</i>	
04 21 19 00-0010 SF 4" Thick Non Load Bearing, Scored Face, Hollow, Clay Backing Tile..... <i>For Smooth Face, One Side, Add</i>	13.56 0.79	
	<i>For Smooth Face, Two Sides, Add</i>	
04 21 19 00-0011 SF 6" Thick Non Load Bearing, Scored Face, Hollow, Clay Backing Tile..... <i>For Smooth Face, One Side, Add</i>	13.97 0.81	
	<i>For Smooth Face, Two Sides, Add</i>	
04 21 19 00-0012 SF 8" Thick Non Load Bearing, Scored Face, Hollow, Clay Backing Tile..... <i>For Smooth Face, One Side, Add</i>	20.13 1.38	
	<i>For Smooth Face, Two Sides, Add</i>	
04 21 19 00-0013 SF 12" Thick Non Load Bearing, Scored Face, Hollow, Clay Backing Tile..... <i>For Smooth Face, One Side, Add</i>	26.72 1.96	
	<i>For Smooth Face, Two Sides, Add</i>	
04 21 26 Glazed Structural Clay Tile Masonry (04 21)		
Note: Includes tile and mortar in all colors.		
04 21 26 00-0001 6T Series Structural Glazed Clay Tile (04 21 26)		
04 21 26 00-0002 Glazed On One Side 6T Series Structural Glazed Clay Tile (04 21 26 00-0001)		
04 21 26 00-0003 SF 2" Thick 1 Sided 6T Series Structural Glazed Clay Tile, 5-1/3" x 12"..... <i>For Stacked Bond, Add</i>	24.58 1.45	
04 21 26 00-0004 SF 4" Thick 1 Sided 6T Series Structural Glazed Clay Tile, 5-1/3" x 12"..... <i>For Stacked Bond, Add</i>	28.51 1.45	
	<i>For 1 Hour Fire Rating, Add</i>	
04 21 26 00-0005 SF 6" Thick 1 Sided 6T Series Structural Glazed Clay Tile, 5-1/3" x 12"..... <i>For Stacked Bond, Add</i>	35.07 1.51	
	<i>For 2 Hour Fire Rating, Add</i>	
04 21 26 00-0006 Special Shapes 6T Series Structural Glazed Clay Tile (04 21 26 00-0001)		
04 21 26 00-0007 LF Bullnose, Jamb Or Sill Shapes 6T Series Structural Glazed Clay Tile..... <i>For Stacked Bond, Add</i>	24.99 1.71	
04 21 26 00-0008 LF 2" Or 4" Cove Base 6T Series Structural Glazed Clay Tile..... <i>For Stacked Bond, Add</i>	30.24 1.71	
04 21 26 00-0009 8W Series Structural Glazed Clay Tile (04 21 26)		
04 21 26 00-0010 Glazed On One Side 8W Series Structural Glazed Clay Tile (04 21 26 00-0009)		
04 21 26 00-0011 SF 2" Thick 1 Sided 8W Series Structural Glazed Clay Tile, 8" x 16"..... <i>For Stacked Bond, Add</i>	20.41 0.92	
04 21 26 00-0012 SF 4" Thick 1 Sided 8W Series Structural Glazed Clay Tile, 8" x 16"..... <i>For Stacked Bond, Add</i>	25.63 0.99	
	<i>For 1 Hour Fire Rating, Add</i>	
04 21 26 00-0013 SF 6" Thick 1 Sided 8W Series Structural Glazed Clay Tile, 8" x 16"..... <i>For Stacked Bond, Add</i>	35.03 1.05	
	<i>For 2 Hour Fire Rating, Add</i>	
04 21 26 00-0014 Special Shapes 8W Series Structural Glazed Clay Tile (04 21 26 00-0009)		
04 21 26 00-0015 LF Bullnose, Jamb Or Sill Shapes 8W Series Structural Glazed Clay Tile <i>For Stacked Bond, Add</i>	27.72 1.19	
04 21 26 00-0016 LF 2" Or 4" Cove Base 8W Series Structural Glazed Clay Tile..... <i>For Stacked Bond, Add</i>	27.77 1.19	
04 21 26 00-0017 4W Series Structural Glazed Clay Tile (04 21 26)		
04 21 26 00-0018 Glazed On One Side 4W Series Structural Glazed Clay Tile (04 21 26 00-0017)		
04 21 26 00-0019 SF 2" Thick 1 Sided 4W Series Structural Glazed Tile, 8" x 8"..... <i>For Stacked Bond, Add</i>	26.05 1.45	
04 21 26 00-0020 SF 4" Thick 1 Sided 4W Series Structural Glazed Tile, 8" x 8"..... <i>For Stacked Bond, Add</i>	28.27 1.45	
	<i>For 1 Hour Fire Rating, Add</i>	
04 21 26 00-0021 SF 6" Thick 1 Sided 4W Series Structural Glazed Tile, 8" x 8"..... <i>For Stacked Bond, Add</i>	35.81 1.51	
	<i>For 2 Hour Fire Rating, Add</i>	

04	Masonry
04 20	Unit Masonry
04 21	Clay Unit Masonry



MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

04 21 26 00-0022	Special Shapes 4W Series Structural Glazed Clay Tile (04 21 26 00-0017)		
04 21 26 00-0023	LF Bullnose, Jamb Or Sill Shapes 4W Series Structural Glazed Clay Tile.....	25.32	
	<i>For Stacked Bond, Add</i>	1.71	
04 21 26 00-0024	LF 2" Or 4" Cove Base 4W Series Structural Glazed Clay Tile.....	30.08	
	<i>For Stacked Bond, Add</i>	1.71	
04 21 26 00-0025	6T Series Sound Absorbing Structural Glazed Tile (04 21 26)		
04 21 26 00-0026	SF 4" Thick, 6T Sound Absorbing Structural Glazed Tile	33.98	
04 21 26 00-0027	SF 6" Thick, 6T Sound Absorbing Structural Glazed Tile	37.11	
04 21 26 00-0028	SF 8" Thick, 6T Sound Absorbing Structural Glazed Tile	43.20	
04 21 26 00-0029	8T Series Sound Absorbing Structural Glazed Tile (04 21 26)		
04 21 26 00-0030	SF 4" Thick, 8T Sound Absorbing Structural Glazed Tile	45.44	
04 21 26 00-0031	SF 6" Thick, 8T Sound Absorbing Structural Glazed Tile	52.39	
04 21 26 00-0032	SF 8" Thick, 8T Acoustical Glazed Tile	61.44	
04 21 29	Terra Cotta Masonry (04 21)		
04 21 29 00-0001	Coping (04 21 29)		
	Note: Includes caulk and ties. Excludes drilling into existing materials or other anchoring bolts.		
04 21 29 00-0002	CF Thick Terra Cotta Coping (Veneer).....	124.77	28.06
	<i>For Smooth Tile Instead Of Scored, Add</i>	11.39	
	<i>For Reinforcing With Steel Rods, Add</i>	12.57	
04 21 29 00-0003	Partition Or Back Up (Scored) (04 21 29)		
04 21 29 00-0004	Non-load Bearing, 12" x 12" (04 21 29 00-0003)		
04 21 29 00-0005	SF 3" Thick Terra Cotta, Non Load Bearing 12" x 12" Scored Face, Back-Up Partitions	14.15	
	<i>For Smooth Tile Instead Of Scored, Add</i>	1.64	
	<i>For Reinforcing With Steel Rods, Add</i>	1.62	
04 21 29 00-0006	SF 4" Thick Terra Cotta, Non Load Bearing 12" x 12" Scored Face, Back-Up Partitions	15.08	
	<i>For Smooth Tile Instead Of Scored, Add</i>	1.72	
	<i>For Reinforcing With Steel Rods, Add</i>	1.71	
04 21 29 00-0007	SF 6" Thick Terra Cotta, Non Load Bearing 12" x 12" Scored Face, Back-Up Partitions	19.18	
	<i>For Smooth Tile Instead Of Scored, Add</i>	2.35	
	<i>For Reinforcing With Steel Rods, Add</i>	2.26	
04 21 29 00-0008	SF 8" Thick Terra Cotta, Non Load Bearing 12" x 12" Scored Face, Back-Up Partitions	23.31	
	<i>For Smooth Tile Instead Of Scored, Add</i>	2.95	
	<i>For Reinforcing With Steel Rods, Add</i>	2.81	
04 21 29 00-0009	Load Bearing, 12" x 12" (04 21 29 00-0003)		
04 21 29 00-0010	In Walls (04 21 29 00-0009)		
04 21 29 00-0011	SF 4" Thick Terra Cotta, Walls 12" x 12" Load Bearing Scored Face	15.92	
	<i>For Smooth Tile Instead Of Scored, Add</i>	1.87	
	<i>For Reinforcing With Steel Rods, Add</i>	1.84	
04 21 29 00-0012	SF 6" Thick Terra Cotta, Walls 12" x 12" Load Bearing Scored Face	21.09	
	<i>For Smooth Tile Instead Of Scored, Add</i>	2.69	
	<i>For Reinforcing With Steel Rods, Add</i>	2.55	
04 21 29 00-0013	SF 8" Thick Terra Cotta, Walls 12" x 12" Load Bearing Scored Face	25.17	
	<i>For Smooth Tile Instead Of Scored, Add</i>	3.29	
	<i>For Reinforcing With Steel Rods, Add</i>	3.08	
04 21 29 00-0014	SF 10" Thick Terra Cotta, Walls 12" x 12" Load Bearing Scored Face.....	26.58	
	<i>For Smooth Tile Instead Of Scored, Add</i>	3.36	
	<i>For Reinforcing With Steel Rods, Add</i>	3.20	
04 21 29 00-0015	SF 12" Thick Terra Cotta, Walls 12" x 12" Load Bearing Scored Face.....	31.85	
	<i>For Smooth Tile Instead Of Scored, Add</i>	4.08	
	<i>For Reinforcing With Steel Rods, Add</i>	3.86	
04 21 29 00-0016	In Floors (04 21 29 00-0009)		
04 21 29 00-0017	SF 4" Thick Terra Cotta, Floors 12" x 12" Load Bearing Scored Face	14.08	
	<i>For Smooth Tile Instead Of Scored, Add</i>	1.87	
	<i>For Reinforcing With Steel Rods, Add</i>	1.74	
04 21 29 00-0018	SF 6" Thick Terra Cotta, Floors 12" x 12" Load Bearing Scored Face	19.04	
	<i>For Smooth Tile Instead Of Scored, Add</i>	2.69	
	<i>For Reinforcing With Steel Rods, Add</i>	2.45	
04 21 29 00-0019	SF 8" Thick Terra Cotta, Floors 12" x 12" Load Bearing Scored Face	23.06	
	<i>For Smooth Tile Instead Of Scored, Add</i>	3.29	
	<i>For Reinforcing With Steel Rods, Add</i>	2.98	
04 21 29 00-0020	SF 10" Thick Terra Cotta, Floors 12" x 12" Load Bearing Scored Face	24.21	
	<i>For Smooth Tile Instead Of Scored, Add</i>	3.36	
	<i>For Reinforcing With Steel Rods, Add</i>	3.08	
04 21 29 00-0021	SF 12" Thick Terra Cotta, Floors 12" x 12" Load Bearing Scored Face	28.78	
	<i>For Smooth Tile Instead Of Scored, Add</i>	4.08	
	<i>For Reinforcing With Steel Rods, Add</i>	3.70	



MINOR	CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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04 22 Concrete Unit Masonry (04 20)

Note: Includes block and mortar. Excludes horizontal and vertical reinforcing. See CSI section 04 05 19 13-0000 for joint reinforcing.

04 22 23 Architectural Concrete Unit Masonry (04 22)

04 22 23 13 Exposed Aggregate Concrete Unit Masonry (04 22 23)

04 22 23 13-0001 Back-Up Concrete Blocks (04 22 23 13)

04 22 23 13-0002 Back-Up Concrete Blocks (04 22 23 13-0001)

04 22 23 13-0003	SF 8" x 16" x 2", Solid, Back-Up Concrete Block	7.68	
	For Special Color, Add	0.85	
	For Stacked Bond, Add	1.73	
	For Scored Block, Add	0.20	
	For Curved Wall Application, Add	1.33	
	For Small Area Replacements (Individual Areas) <10 SF, Add	10.07	
04 22 23 13-0004	SF 8" x 16" x 4", Regular, Back-Up Concrete Block	7.87	
	For Special Color, Add	0.73	
	For Stacked Bond, Add	1.82	
	For Scored Block, Add	0.18	
	For Curved Wall Application, Add	1.40	
	For Small Area Replacements (Individual Areas) <10 SF, Add	10.55	
04 22 23 13-0005	SF 8" x 16" x 6", Regular, Back-Up Concrete Block	8.90	
	For Special Color, Add	0.92	
	For Stacked Bond, Add	2.03	
	For Scored Block, Add	0.22	
	For Curved Wall Application, Add	1.56	
	For Small Area Replacements (Individual Areas) <10 SF, Add	11.77	
04 22 23 13-0006	SF 8" x 16" x 8", Regular, Back-Up Concrete Block	9.54	
	For Special Color, Add	1.07	
	For Stacked Bond, Add	2.15	
	For Scored Block, Add	0.26	
	For Curved Wall Application, Add	1.65	
	For Small Area Replacements (Individual Areas) <10 SF, Add	12.47	
04 22 23 13-0007	SF 8" x 16" x 10", Regular, Back-Up Concrete Block	10.22	
	For Special Color, Add	1.43	
	For Stacked Bond, Add	2.21	
	For Scored Block, Add	0.34	
	For Curved Wall Application, Add	1.70	
	For Small Area Replacements (Individual Areas) <10 SF, Add	12.88	
04 22 23 13-0008	SF 8" x 16" x 12", Regular, Back-Up Concrete Block	12.32	
	For Special Color, Add	1.49	
	For Stacked Bond, Add	2.74	
	For Scored Block, Add	0.36	
	For Curved Wall Application, Add	2.11	
	For Small Area Replacements (Individual Areas) <10 SF, Add	15.93	

04 22 23 13-0009 Foundation Wall Concrete Blocks (04 22 23 13)

04 22 23 13-0010 Foundation Wall Concrete Blocks (04 22 23 13-0009)

04 22 23 13-0011	SF 8" x 16" x 6", Regular, Foundation Wall Concrete Block	8.02	
	For Special Color, Add	0.92	
	For Stacked Bond, Add	1.80	
	For Scored Block, Add	0.22	
	For Curved Wall Application, Add	1.38	
	For Small Area Replacements (Individual Areas) <10 SF, Add	10.45	
04 22 23 13-0012	SF 8" x 16" x 8", Regular, Foundation Wall Concrete Block	8.66	
	For Special Color, Add	1.07	
	For Stacked Bond, Add	1.92	
	For Scored Block, Add	0.26	
	For Curved Wall Application, Add	1.47	
	For Small Area Replacements (Individual Areas) <10 SF, Add	11.15	
04 22 23 13-0013	SF 8" x 16" x 10", Regular, Foundation Wall Concrete Block	9.85	
	For Special Color, Add	1.43	
	For Stacked Bond, Add	2.11	
	For Scored Block, Add	0.34	
	For Curved Wall Application, Add	1.63	
	For Small Area Replacements (Individual Areas) <10 SF, Add	12.32	
04 22 23 13-0014	SF 8" x 16" x 12", Regular, Foundation Wall Concrete Block	12.32	
	For Special Color, Add	1.49	
	For Stacked Bond, Add	2.74	
	For Scored Block, Add	0.36	
	For Curved Wall Application, Add	2.11	
	For Small Area Replacements (Individual Areas) <10 SF, Add	15.93	
04 22 23 13-0015	SF 8" x 16" x 6", Solid, Foundation Wall Concrete Block	8.56	
	For Special Color, Add	1.23	
	For Stacked Bond, Add	1.84	
	For Scored Block, Add	0.30	
	For Curved Wall Application, Add	1.42	
	For Small Area Replacements (Individual Areas) <10 SF, Add	10.73	

04	Masonry
04 20	Unit Masonry
04 22	Concrete Unit Masonry



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
04 22 23 13-0016	SF		8" x 16" x 8", Solid, Foundation Wall Concrete Block.....	9.43	
			<i>For Special Color, Add</i>	1.45	
			<i>For Stacked Bond, Add</i>	2.00	
			<i>For Scored Block, Add</i>	0.35	
			<i>For Curved Wall Application, Add</i>	1.54	
			<i>For Small Area Replacements (Individual Areas) <10 SF, Add</i>	11.65	
04 22 23 13-0017	SF		8" x 16" x 10", Solid, Foundation Wall Concrete Block.....	10.65	
			<i>For Special Color, Add</i>	1.78	
			<i>For Stacked Bond, Add</i>	2.21	
			<i>For Scored Block, Add</i>	0.43	
			<i>For Curved Wall Application, Add</i>	1.70	
			<i>For Small Area Replacements (Individual Areas) <10 SF, Add</i>	12.91	
04 22 23 13-0018	SF		8" x 16" x 12", Solid, Foundation Wall Concrete Block.....	13.39	
			<i>For Special Color, Add</i>	1.93	
			<i>For Stacked Bond, Add</i>	2.88	
			<i>For Scored Block, Add</i>	0.46	
			<i>For Curved Wall Application, Add</i>	2.21	
			<i>For Small Area Replacements (Individual Areas) <10 SF, Add</i>	16.78	
04 22 23 13-0019			Partition Concrete Blocks (04 22 23 13)		
04 22 23 13-0020			Lightweight, Regular, Partition Concrete Blocks (04 22 23 13-0019)		
04 22 23 13-0021	SF		8" x 16" x 4", Lightweight, Regular, Partition Concrete Block.....	7.93	
			<i>For Special Color, Add</i>	0.78	
			<i>For Stacked Bond, Add</i>	1.82	
			<i>For Scored Block, Add</i>	0.19	
			<i>For Curved Wall Application, Add</i>	1.40	
			<i>For Small Area Replacements (Individual Areas) <10 SF, Add</i>	10.56	
04 22 23 13-0022	SF		8" x 16" x 6", Lightweight, Regular, Partition Concrete Block.....	8.78	
			<i>For Special Color, Add</i>	1.00	
			<i>For Stacked Bond, Add</i>	1.97	
			<i>For Scored Block, Add</i>	0.24	
			<i>For Curved Wall Application, Add</i>	1.52	
			<i>For Small Area Replacements (Individual Areas) <10 SF, Add</i>	11.46	
04 22 23 13-0023	SF		8" x 16" x 8", Lightweight, Regular, Partition Concrete Block.....	9.48	
			<i>For Special Color, Add</i>	1.12	
			<i>For Stacked Bond, Add</i>	2.11	
			<i>For Scored Block, Add</i>	0.27	
			<i>For Curved Wall Application, Add</i>	1.63	
			<i>For Small Area Replacements (Individual Areas) <10 SF, Add</i>	12.30	
04 22 23 13-0024	SF		8" x 16" x 10", Lightweight, Regular, Partition Concrete Block.....	10.29	
			<i>For Special Color, Add</i>	1.49	
			<i>For Stacked Bond, Add</i>	2.21	
			<i>For Scored Block, Add</i>	0.36	
			<i>For Curved Wall Application, Add</i>	1.70	
			<i>For Small Area Replacements (Individual Areas) <10 SF, Add</i>	12.88	
04 22 23 13-0025	SF		8" x 16" x 12", Lightweight, Regular, Partition Concrete Block.....	12.46	
			<i>For Special Color, Add</i>	1.60	
			<i>For Stacked Bond, Add</i>	2.74	
			<i>For Scored Block, Add</i>	0.39	
			<i>For Curved Wall Application, Add</i>	2.11	
			<i>For Small Area Replacements (Individual Areas) <10 SF, Add</i>	15.94	
04 22 23 13-0026			Lightweight, Solid, Partition Concrete Blocks (04 22 23 13-0019)		
04 22 23 13-0027	SF		8" x 16" x 4", Lightweight, Solid, Partition Concrete Block.....	8.43	
			<i>For Special Color, Add</i>	1.05	
			<i>For Stacked Bond, Add</i>	1.86	
			<i>For Scored Block, Add</i>	0.25	
			<i>For Curved Wall Application, Add</i>	1.43	
			<i>For Small Area Replacements (Individual Areas) <10 SF, Add</i>	10.85	
04 22 23 13-0028	SF		8" x 16" x 6", Lightweight, Solid, Partition Concrete Block.....	9.26	
			<i>For Special Color, Add</i>	1.13	
			<i>For Stacked Bond, Add</i>	2.05	
			<i>For Scored Block, Add</i>	0.27	
			<i>For Curved Wall Application, Add</i>	1.58	
			<i>For Small Area Replacements (Individual Areas) <10 SF, Add</i>	11.95	
04 22 23 13-0029	SF		8" x 16" x 8", Lightweight, Solid, Partition Concrete Block.....	9.78	
			<i>For Special Color, Add</i>	1.17	
			<i>For Stacked Bond, Add</i>	2.18	
			<i>For Scored Block, Add</i>	0.28	
			<i>For Curved Wall Application, Add</i>	1.67	
			<i>For Small Area Replacements (Individual Areas) <10 SF, Add</i>	12.66	
04 22 23 13-0030	SF		8" x 16" x 10", Lightweight, Solid, Partition Concrete Block.....	10.71	
			<i>For Special Color, Add</i>	1.61	
			<i>For Stacked Bond, Add</i>	2.28	
			<i>For Scored Block, Add</i>	0.39	
			<i>For Curved Wall Application, Add</i>	1.75	
			<i>For Small Area Replacements (Individual Areas) <10 SF, Add</i>	13.30	
04 22 23 13-0031	SF		8" x 16" x 12", Lightweight, Solid, Partition Concrete Block.....	12.96	
			<i>For Special Color, Add</i>	1.73	
			<i>For Stacked Bond, Add</i>	2.83	
			<i>For Scored Block, Add</i>	0.42	
			<i>For Curved Wall Application, Add</i>	2.18	
			<i>For Small Area Replacements (Individual Areas) <10 SF, Add</i>	16.48	



Masonry	04	04
Unit Masonry	04 20	
Concrete Unit Masonry	04 22	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
04 22 23 13-0032 Normal Weight, Regular, Partition Concrete Blocks <small>(04 22 23 13-0019)</small>		
04 22 23 13-0033 SF 8" x 16" x 4", Normal Weight, Regular, Partition Concrete Block.....	8.11	
For Special Color, Add	0.78	
For Stacked Bond, Add	1.86	
For Scored Block, Add	0.19	
For 4" High (Half Height) Block, Add	1.10	
For Curved Wall Application, Add	1.43	
For Small Area Replacements (Individual Areas) <10 SF, Add	10.83	
04 22 23 13-0034 SF 8" x 16" x 6", Normal Weight, Regular, Partition Concrete Block.....	8.98	
For Special Color, Add	0.90	
For Stacked Bond, Add	2.05	
For Scored Block, Add	0.22	
For 4" High (Half Height) Block, Add	1.23	
For Curved Wall Application, Add	1.58	
For Small Area Replacements (Individual Areas) <10 SF, Add	11.93	
04 22 23 13-0035 SF 8" x 16" x 8", Normal Weight, Regular, Partition Concrete Block.....	9.61	
For Special Color, Add	1.03	
For Stacked Bond, Add	2.18	
For Scored Block, Add	0.25	
For 4" High (Half Height) Block, Add	1.35	
For Curved Wall Application, Add	1.67	
For Small Area Replacements (Individual Areas) <10 SF, Add	12.65	
04 22 23 13-0036 SF 8" x 16" x 10", Normal Weight, Regular, Partition Concrete Block.....	11.16	
For Special Color, Add	1.98	
For Stacked Bond, Add	2.28	
For Scored Block, Add	0.48	
For 4" High (Half Height) Block, Add	1.86	
For Curved Wall Application, Add	1.75	
For Small Area Replacements (Individual Areas) <10 SF, Add	13.33	
04 22 23 13-0037 SF 8" x 16" x 12", Normal Weight, Regular, Partition Concrete Block.....	13.35	
For Special Color, Add	2.05	
For Stacked Bond, Add	2.83	
For Scored Block, Add	0.49	
For 4" High (Half Height) Block, Add	2.10	
For Curved Wall Application, Add	2.18	
For Small Area Replacements (Individual Areas) <10 SF, Add	16.51	
04 22 23 13-0038 Normal Weight, Solid, Partition Concrete Blocks <small>(04 22 23 13-0019)</small>		
04 22 23 13-0039 SF 8" x 16" x 4", Normal Weight, Solid, Partition Concrete Block.....	8.57	
For Special Color, Add	1.00	
For Stacked Bond, Add	1.92	
For Scored Block, Add	0.24	
For 4" High (Half Height) Block, Add	1.23	
For Curved Wall Application, Add	1.47	
For Small Area Replacements (Individual Areas) <10 SF, Add	11.15	
04 22 23 13-0040 SF 8" x 16" x 6", Normal Weight, Solid, Partition Concrete Block.....	9.24	
For Special Color, Add	0.92	
For Stacked Bond, Add	2.11	
For Scored Block, Add	0.22	
For 4" High (Half Height) Block, Add	1.27	
For Curved Wall Application, Add	1.63	
For Small Area Replacements (Individual Areas) <10 SF, Add	12.28	
04 22 23 13-0041 SF 8" x 16" x 8", Normal Weight, Solid, Partition Concrete Block.....	9.92	
For Special Color, Add	1.07	
For Stacked Bond, Add	2.24	
For Scored Block, Add	0.26	
For 4" High (Half Height) Block, Add	1.39	
For Curved Wall Application, Add	1.73	
For Small Area Replacements (Individual Areas) <10 SF, Add	13.04	
04 22 23 13-0042 SF 8" x 16" x 10", Normal Weight, Solid, Partition Concrete Block.....	10.78	
For Special Color, Add	1.43	
For Stacked Bond, Add	2.36	
For Scored Block, Add	0.34	
For 4" High (Half Height) Block, Add	1.61	
For Curved Wall Application, Add	1.81	
For Small Area Replacements (Individual Areas) <10 SF, Add	13.72	
04 22 23 13-0043 SF 8" x 16" x 12", Normal Weight, Solid, Partition Concrete Block.....	13.05	
For Special Color, Add	1.49	
For Stacked Bond, Add	2.93	
For Scored Block, Add	0.36	
For 4" High (Half Height) Block, Add	1.86	
For Curved Wall Application, Add	2.25	
For Small Area Replacements (Individual Areas) <10 SF, Add	17.02	
04 22 23 13-0044 High Strength Concrete Blocks <small>(04 22 23 13)</small>		
04 22 23 13-0045 3,500 PSI, High Strength Concrete Blocks <small>(04 22 23 13-0044)</small>		
04 22 23 13-0046 SF 8" x 16" x 2", 3,500 PSI, High Strength Concrete Block.....	7.78	
For Special Color, Add	0.80	
For Stacked Bond, Add	1.77	
For Scored Block, Add	0.19	
For Curved Wall Application, Add	1.36	

04	Masonry
04 20	Unit Masonry
04 22	Concrete Unit Masonry



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
04 22 23 13-0047	SF		8" x 16" x 4", 3,500 PSI, High Strength Concrete Block.....	8.06	
			<i>For Special Color, Add</i>	0.74	
			<i>For Stacked Bond, Add</i>	1.86	
			<i>For Scored Block, Add</i>	0.18	
			<i>For Curved Wall Application, Add</i>	1.43	
04 22 23 13-0048	SF		8" x 16" x 6", 3,500 PSI, High Strength Concrete Block.....	9.05	
			<i>For Special Color, Add</i>	0.95	
			<i>For Stacked Bond, Add</i>	2.05	
			<i>For Scored Block, Add</i>	0.23	
			<i>For Curved Wall Application, Add</i>	1.58	
04 22 23 13-0049	SF		8" x 16" x 8", 3,500 PSI, High Strength Concrete Block.....	9.74	
			<i>For Special Color, Add</i>	1.14	
			<i>For Stacked Bond, Add</i>	2.18	
			<i>For Scored Block, Add</i>	0.27	
			<i>For Curved Wall Application, Add</i>	1.67	
04 22 23 13-0050	SF		8" x 16" x 10", 3,500 PSI, High Strength Concrete Block.....	10.81	
			<i>For Special Color, Add</i>	1.58	
			<i>For Stacked Bond, Add</i>	2.32	
			<i>For Scored Block, Add</i>	0.38	
			<i>For Curved Wall Application, Add</i>	1.78	
04 22 23 13-0051	SF		8" x 16" x 12", 3,500 PSI, High Strength Concrete Block.....	12.88	
			<i>For Special Color, Add</i>	1.66	
			<i>For Stacked Bond, Add</i>	2.83	
			<i>For Scored Block, Add</i>	0.40	
			<i>For Curved Wall Application, Add</i>	2.18	
04 22 23 13-0052			Solar Screen Concrete Blocks (04 22 23 13)		
04 22 23 13-0053			Solar Screen Concrete Blocks (04 22 23 13-0052)		
04 22 23 13-0054	SF		6" x 6" x 4" Solar Screen Concrete Block.....	10.61	
			<i>For Special Color, Add</i>	1.86	
			<i>For Stacked Bond, Add</i>	2.18	
			<i>For Scored Block, Add</i>	0.45	
			<i>For Curved Wall Application, Add</i>	1.67	
04 22 23 13-0055	SF		8" x 8" x 4" Solar Screen Concrete Block.....	11.45	
			<i>For Special Color, Add</i>	1.88	
			<i>For Stacked Bond, Add</i>	2.39	
			<i>For Scored Block, Add</i>	0.45	
			<i>For Curved Wall Application, Add</i>	1.84	
04 22 23 13-0056	SF		12" x 12" x 4" Solar Screen Concrete Block.....	13.13	
			<i>For Special Color, Add</i>	2.37	
			<i>For Stacked Bond, Add</i>	2.67	
			<i>For Scored Block, Add</i>	0.57	
			<i>For Curved Wall Application, Add</i>	2.05	
04 22 23 13-0057	SF		8" x 16" x 8" Solar Screen Concrete Block.....	18.67	
			<i>For Special Color, Add</i>	2.91	
			<i>For Stacked Bond, Add</i>	3.94	
			<i>For Scored Block, Add</i>	0.70	
			<i>For Curved Wall Application, Add</i>	3.03	
04 22 23 13-0058			Bond Beam Or Lintel Concrete Blocks (04 22 23 13)		
04 22 23 13-0059			Bond Beam Or Lintel Concrete Blocks (04 22 23 13-0058)		
			Note: Excludes concrete fill and reinforcing. See CSI section 04 05 16 26-0000 for concrete fill.		
04 22 23 13-0060	LF		8" x 16" x 6" Regular Weight, Bond Beam Or Lintel Concrete Block.....	9.16	
			<i>For Special Color, Add</i>	1.05	
			<i>For Stacked Bond, Add</i>	2.05	
			<i>For Grout And Fill With 2 #5 Rebar, Add</i>	5.21	
			<i>For Scored Block, Add</i>	0.25	
			<i>For Curved Wall Application, Add</i>	1.58	
04 22 23 13-0061	LF		8" x 16" x 8" Regular Weight, Bond Beam Or Lintel Concrete Block.....	9.94	
			<i>For Special Color, Add</i>	1.30	
			<i>For Stacked Bond, Add</i>	2.18	
			<i>For Grout And Fill With 2 #5 Rebar, Add</i>	5.76	
			<i>For Scored Block, Add</i>	0.31	
			<i>For Curved Wall Application, Add</i>	1.67	
04 22 23 13-0062	LF		8" x 16" x 12" Regular Weight, Bond Beam Or Lintel Concrete Block.....	12.56	
			<i>For Special Color, Add</i>	1.39	
			<i>For Stacked Bond, Add</i>	2.83	
			<i>For Grout And Fill With 2 #5 Rebar, Add</i>	7.12	
			<i>For Scored Block, Add</i>	0.34	
			<i>For Curved Wall Application, Add</i>	2.18	
04 22 23 13-0063	LF		8" x 16" x 6" Lightweight, Bond Beam Or Lintel Concrete Block.....	9.05	
			<i>For Special Color, Add</i>	1.22	
			<i>For Stacked Bond, Add</i>	1.97	
			<i>For Grout And Fill With 2 #5 Rebar, Add</i>	5.26	
			<i>For Scored Block, Add</i>	0.29	
			<i>For Curved Wall Application, Add</i>	1.52	
04 22 23 13-0064	LF		8" x 16" x 8" Lightweight, Bond Beam Or Lintel Concrete Block.....	9.91	
			<i>For Special Color, Add</i>	1.48	
			<i>For Stacked Bond, Add</i>	2.11	
			<i>For Grout And Fill With 2 #5 Rebar, Add</i>	5.85	
			<i>For Scored Block, Add</i>	0.36	
			<i>For Curved Wall Application, Add</i>	1.63	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
04 22 23 13-0065 LF 8" x 16" x 12" Lightweight, Bond Beam Or Lintel Concrete Block.....	12.42	
<i>For Special Color, Add</i>	1.57	
<i>For Stacked Bond, Add</i>	2.74	
<i>For Grout And Fill With 2 #5 Rebar, Add</i>	7.16	
<i>For Scored Block, Add</i>	0.38	
<i>For Curved Wall Application, Add</i>	2.11	
04 22 23 23 Prefaced Concrete Unit Masonry (04 22 23)		
04 22 23 23-0001 Ground Face Concrete Blocks (04 22 23 23)		
04 22 23 23-0002 SF 8" x 16" x 4" Ground Face Concrete Block	10.28	
<i>For Special Color, Add</i>	1.25	
<i>For Stacked Bond, Add</i>	2.28	
<i>For Scored Block, Add</i>	0.30	
<i>For Curved Wall Application, Add</i>	1.75	
<i>For Small Area Replacements (Individual Areas) <10 SF, Add</i>	13.27	
04 22 23 23-0003 SF 8" x 16" x 6" Ground Face Concrete Block	11.59	
<i>For Special Color, Add</i>	1.43	
<i>For Stacked Bond, Add</i>	2.57	
<i>For Scored Block, Add</i>	0.34	
<i>For Curved Wall Application, Add</i>	1.97	
<i>For Small Area Replacements (Individual Areas) <10 SF, Add</i>	14.93	
04 22 23 23-0004 SF 8" x 16" x 8" Ground Face Concrete Block	12.46	
<i>For Special Color, Add</i>	1.68	
<i>For Stacked Bond, Add</i>	2.71	
<i>For Scored Block, Add</i>	0.41	
<i>For Curved Wall Application, Add</i>	2.09	
<i>For Small Area Replacements (Individual Areas) <10 SF, Add</i>	15.80	
04 22 23 23-0005 SF 8" x 16" x 10" Ground Face Concrete Block	13.29	
<i>For Special Color, Add</i>	1.86	
<i>For Stacked Bond, Add</i>	2.87	
<i>For Scored Block, Add</i>	0.45	
<i>For Curved Wall Application, Add</i>	2.21	
<i>For Small Area Replacements (Individual Areas) <10 SF, Add</i>	16.74	
04 22 23 23-0006 SF 8" x 16" x 12" Ground Face Concrete Block	16.05	
<i>For Special Color, Add</i>	2.03	
<i>For Stacked Bond, Add</i>	3.54	
<i>For Scored Block, Add</i>	0.49	
<i>For Curved Wall Application, Add</i>	2.72	
<i>For Small Area Replacements (Individual Areas) <10 SF, Add</i>	20.58	
04 22 23 26 Sound-Absorbing Concrete Unit Masonry (04 22 23)		
04 22 23 26-0001 Acoustical Slotted Concrete Block (04 22 23 26)		
04 22 23 26-0002 SF 4" Thick, .45 - .55 NRC, Slotted, Acoustical Concrete Block	12.94	
<i>For Special Color, Add</i>	0.38	
<i>For Stacked Bond, Add</i>	0.88	
04 22 23 26-0003 SF 6" Thick, .45 - .55 NRC, Slotted, Acoustical Concrete Block	14.42	
<i>For Special Color, Add</i>	0.44	
<i>For Stacked Bond, Add</i>	0.95	
04 22 23 26-0004 SF 8" Thick, .50 - .60 NRC, Slotted, Acoustical Concrete Block	16.45	
<i>For Special Color, Add</i>	0.54	
<i>For Stacked Bond, Add</i>	1.04	
04 22 23 26-0005 SF 4" Thick, .65 - .75 NRC, Slotted With Filled Cavities, Acoustical Concrete Block	16.73	
<i>For Special Color, Add</i>	0.72	
<i>For Stacked Bond, Add</i>	0.88	
04 22 23 26-0006 SF 8" Thick, .50 - .60 NRC, Slotted With Filled Cavities, Acoustical Concrete Block	17.17	
<i>For Special Color, Add</i>	0.61	
<i>For Stacked Bond, Add</i>	1.04	
04 22 23 26-0007 SF 8" Thick, .60 - .75 NRC, Slotted With Filled Cavities, Acoustical Concrete Block	18.12	
<i>For Special Color, Add</i>	0.69	
<i>For Stacked Bond, Add</i>	1.04	
04 22 23 29 Split-Face Concrete Unit Masonry (04 22 23)		
04 22 23 29-0001 Modified Face Concrete Blocks (04 22 23 29)		
04 22 23 29-0002 Plain Or Scored Split Faced Concrete Blocks (04 22 23 29-0001)		
04 22 23 29-0003 SF 8" x 16" x 4" Plain Or Scored Split Face Concrete Block	10.46	
<i>For Special Color, Add</i>	1.40	
<i>For Stacked Bond, Add</i>	2.28	
<i>For Curved Wall Application, Add</i>	1.75	
<i>For Small Area Replacements (Individual Areas) <10 SF, Add</i>	13.28	
04 22 23 29-0004 SF 8" x 16" x 6" Plain Or Scored Split Face Concrete Block	11.80	
<i>For Special Color, Add</i>	1.60	
<i>For Stacked Bond, Add</i>	2.57	
<i>For Curved Wall Application, Add</i>	1.97	
<i>For Small Area Replacements (Individual Areas) <10 SF, Add</i>	14.95	
04 22 23 29-0005 SF 8" x 16" x 8" Plain Or Scored Split Face Concrete Block	12.70	
<i>For Special Color, Add</i>	1.88	
<i>For Stacked Bond, Add</i>	2.71	
<i>For Curved Wall Application, Add</i>	2.09	
<i>For Small Area Replacements (Individual Areas) <10 SF, Add</i>	15.82	

04	Masonry
04 20	Unit Masonry
04 22	Concrete Unit Masonry



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
04 22 23 29-0006	SF		8" x 16" x 10" Plain Or Scored Split Face Concrete Block	13.58	
			<i>For Special Color, Add</i>	2.10	
			<i>For Stacked Bond, Add</i>	2.87	
			<i>For Curved Wall Application, Add</i>	2.21	
			<i>For Small Area Replacements (Individual Areas) <10 SF, Add</i>	16.76	
04 22 23 29-0007	SF		8" x 16" x 12" Plain Or Scored Split Face Concrete Block	16.04	
			<i>For Special Color, Add</i>	2.03	
			<i>For Stacked Bond, Add</i>	3.54	
			<i>For Curved Wall Application, Add</i>	2.72	
			<i>For Small Area Replacements (Individual Areas) <10 SF, Add</i>	20.58	
04 22 23 29-0008			Plain Or Scored Split Faced Bond Beam Or Lintel Concrete Blocks (04 22 23 29-0001)		
04 22 23 29-0009	SF		8" x 16" x 4" Plain Or Scored Split Face Bond Beam Or Lintel Concrete Blocks	10.88	
			<i>For Special Color, Add</i>	1.75	
			<i>For Stacked Bond, Add</i>	2.28	
			<i>For Grout And Fill With 2 #5 Rebar, Add</i>	6.50	
			<i>For Curved Wall Application, Add</i>	1.75	
			<i>For Small Area Replacements (Individual Areas) <10 SF, Add</i>	13.31	
04 22 23 29-0010	SF		8" x 16" x 6" Plain Or Scored Split Face Bond Beam Or Lintel Concrete Blocks	12.28	
			<i>For Special Color, Add</i>	2.00	
			<i>For Stacked Bond, Add</i>	2.57	
			<i>For Grout And Fill With 2 #5 Rebar, Add</i>	7.35	
			<i>For Curved Wall Application, Add</i>	1.97	
			<i>For Small Area Replacements (Individual Areas) <10 SF, Add</i>	14.99	
04 22 23 29-0011	SF		8" x 16" x 8" Plain Or Scored Split Face Bond Beam Or Lintel Concrete Blocks	13.27	
			<i>For Special Color, Add</i>	2.36	
			<i>For Stacked Bond, Add</i>	2.71	
			<i>For Grout And Fill With 2 #5 Rebar, Add</i>	8.06	
			<i>For Curved Wall Application, Add</i>	2.09	
			<i>For Small Area Replacements (Individual Areas) <10 SF, Add</i>	15.86	
04 22 23 29-0012	SF		8" x 16" x 10" Plain Or Scored Split Face Bond Beam Or Lintel Concrete Blocks	14.21	
			<i>For Special Color, Add</i>	2.62	
			<i>For Stacked Bond, Add</i>	2.87	
			<i>For Grout And Fill With 2 #5 Rebar, Add</i>	8.69	
			<i>For Curved Wall Application, Add</i>	2.21	
			<i>For Small Area Replacements (Individual Areas) <10 SF, Add</i>	16.81	
04 22 23 29-0013	SF		8" x 16" x 12" Plain Or Scored Split Face Bond Beam Or Lintel Concrete Blocks	16.65	
			<i>For Special Color, Add</i>	2.53	
			<i>For Stacked Bond, Add</i>	3.54	
			<i>For Grout And Fill With 2 #5 Rebar, Add</i>	9.85	
			<i>For Curved Wall Application, Add</i>	2.72	
			<i>For Small Area Replacements (Individual Areas) <10 SF, Add</i>	20.63	
04 22 23 29-0014			Profile Units, Split Rib Concrete Block (04 22 23 29)		
04 22 23 29-0015			1" Deep Ribs, Profile Units, Split Rib Concrete Block (04 22 23 29-0014)		
04 22 23 29-0016	SF		8" x 16" x 4", 1" Deep Ribs, Profile Units, Split Rib Concrete Block	10.32	
			<i>For Special Color, Add</i>	1.29	
			<i>For Stacked Bond, Add</i>	2.28	
			<i>For Scored Block, Add</i>	0.31	
			<i>For Curved Wall Application, Add</i>	1.75	
			<i>For Small Area Replacements (Individual Areas) <10 SF, Add</i>	13.27	
04 22 23 29-0017	SF		8" x 16" x 6", 1" Deep Ribs, Profile Units, Split Rib Concrete Block	12.11	
			<i>For Special Color, Add</i>	1.86	
			<i>For Stacked Bond, Add</i>	2.57	
			<i>For Scored Block, Add</i>	0.45	
			<i>For Curved Wall Application, Add</i>	1.97	
			<i>For Small Area Replacements (Individual Areas) <10 SF, Add</i>	14.97	
04 22 23 29-0018	SF		8" x 16" x 8", 1" Deep Ribs, Profile Units, Split Rib Concrete Block	12.87	
			<i>For Special Color, Add</i>	2.03	
			<i>For Stacked Bond, Add</i>	2.71	
			<i>For Scored Block, Add</i>	0.49	
			<i>For Curved Wall Application, Add</i>	2.09	
			<i>For Small Area Replacements (Individual Areas) <10 SF, Add</i>	15.83	
04 22 23 29-0019	SF		8" x 16" x 10", 1" Deep Ribs, Profile Units, Split Rib Concrete Block	13.71	
			<i>For Special Color, Add</i>	2.21	
			<i>For Stacked Bond, Add</i>	2.87	
			<i>For Scored Block, Add</i>	0.53	
			<i>For Curved Wall Application, Add</i>	2.21	
			<i>For Small Area Replacements (Individual Areas) <10 SF, Add</i>	16.77	
04 22 23 29-0020	SF		8" x 16" x 12", 1" Deep Ribs, Profile Units, Split Rib Concrete Block	16.51	
			<i>For Special Color, Add</i>	2.42	
			<i>For Stacked Bond, Add</i>	3.54	
			<i>For Scored Block, Add</i>	0.58	
			<i>For Curved Wall Application, Add</i>	2.72	
			<i>For Small Area Replacements (Individual Areas) <10 SF, Add</i>	20.62	
04 22 23 31			Glazed Concrete Masonry Unit (04 22 23)		
			Note: Includes concrete block and mortar.		
04 22 23 31-0001			One Glazed Face Concrete Blocks (04 22 23 31)		
04 22 23 31-0002			One Glazed Face Concrete Blocks (04 22 23 31-0001)		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
04 22 23 31-0003 SF 4" Thick, One Glazed Face Concrete Block..... <i>For Special Shapes, Add</i>	15.97 7.47	
04 22 23 31-0004 SF 6" Thick, One Glazed Face Concrete Block..... <i>For Special Shapes, Add</i>	17.18 7.82	
04 22 23 31-0005 SF 8" Thick, One Glazed Face Concrete Block..... <i>For Special Shapes, Add</i>	18.19 8.32	
04 22 23 31-0006 SF 10" Thick, One Glazed Face Concrete Block..... <i>For Special Shapes, Add</i>	19.26 8.83	
04 22 23 31-0007 SF 12" Thick, One Glazed Face Concrete Block..... <i>For Special Shapes, Add</i>	22.06 9.26	
04 22 23 31-0008 Two Glazed Faces Concrete Blocks (04 22 23 31)		
04 22 23 31-0009 Two Glazed Faces Concrete Blocks (04 22 23 31-0008)		
04 22 23 31-0010 SF 4" Thick, Two Glazed Faces Concrete Block..... <i>For Special Shapes, Add</i>	20.79 11.09	
04 22 23 31-0011 SF 6" Thick, Two Glazed Faces Concrete Block..... <i>For Special Shapes, Add</i>	21.89 11.46	
04 22 23 31-0012 SF 8" Thick, Two Glazed Faces Concrete Block..... <i>For Special Shapes, Add</i>	23.48 11.96	
04 22 23 31-0013 Glazed Cove Base Concrete Blocks (04 22 23 31)		
04 22 23 31-0014 LF 2" Thick, Glazed Cove Base Concrete Block..... <i>For Special Shapes, Add</i>	17.74 6.69	
04 22 23 31-0015 LF 4" Thick, Glazed Cove Base Concrete Block..... <i>For Special Shapes, Add</i>	18.85 6.83	
04 22 23 31-0016 LF 6" Thick, Glazed Cove Base Concrete Block..... <i>For Special Shapes, Add</i>	20.28 7.12	
04 22 23 31-0017 LF 8" Thick, Glazed Cove Base Concrete Block..... <i>For Special Shapes, Add</i>	21.64 7.47	
04 22 23 31-0018 Glazed Corner, Bullnose Or Square Concrete Blocks (04 22 23 31)		
04 22 23 31-0019 EA 2" Thick, Glazed Corner, Bullnose Or Square Concrete Block..... <i>For Special Shapes, Add</i>	21.59 12.82	
04 22 23 31-0020 EA 4" Thick, Glazed Corner, Bullnose Or Square Concrete Block..... <i>For Special Shapes, Add</i>	25.02 15.32	
04 22 23 31-0021 EA 6" Thick, Glazed Corner, Bullnose Or Square Concrete Block..... <i>For Special Shapes, Add</i>	26.80 16.17	
04 22 23 31-0022 EA 8" Thick, Glazed Corner, Bullnose Or Square Concrete Block..... <i>For Special Shapes, Add</i>	28.08 17.03	
04 22 23 31-0023 EA 10" Thick, Glazed Corner, Bullnose Or Square Concrete Block..... <i>For Special Shapes, Add</i>	41.44 29.92	
04 22 23 31-0024 EA 12" Thick, Glazed Corner, Bullnose Or Square Concrete Block..... <i>For Special Shapes, Add</i>	47.64 33.44	
04 23 Glass Unit Masonry (04 20)		
04 23 13 Vertical Glass Unit Masonry (04 23)		
Note: Includes 1/4" mortar joints and caulking. Excludes joint reinforcement and anchors.		
04 23 13 00-0001 Glass Block Unit Masonry (04 23 13)		
04 23 13 00-0002 SF 6" x 6" x 4" Plain Glass Block..... <i>For Solar Reflective (Suntrol) Blocks, Add</i> <i>For Essex (Horizontal Striated) Blocks, Add</i> <i>For Sculptured Or Patterned Blocks, Add</i> <i>For Colored Glass, Add</i> <i>For Thinline Block, Deduct</i> <i>For >1,000 To 5,000, Deduct</i> <i>For >5,000, Deduct</i>	38.62 5.69 3.25 5.69 16.25 -4.06 -3.04 -4.96	
04 23 13 00-0003 SF 8" x 8" x 4" Plain Glass Block..... <i>For Solar Reflective (Suntrol) Blocks, Add</i> <i>For Essex (Horizontal Striated) Blocks, Add</i> <i>For Sculptured Or Patterned Blocks, Add</i> <i>For Colored Glass, Add</i> <i>For Thinline Block, Deduct</i> <i>For >1,000 To 5,000, Deduct</i> <i>For >5,000, Deduct</i>	27.96 4.03 2.30 4.03 11.51 -2.88 -2.21 -3.61	
04 23 13 00-0004 SF 12" x 12" x 4" Plain Glass Block..... <i>For Solar Reflective (Suntrol) Blocks, Add</i> <i>For Essex (Horizontal Striated) Blocks, Add</i> <i>For Sculptured Or Patterned Blocks, Add</i> <i>For Colored Glass, Add</i> <i>For Thinline Block, Deduct</i> <i>For >1,000 To 5,000, Deduct</i> <i>For >5,000, Deduct</i>	29.83 5.15 2.94 5.15 14.70 -3.68 -2.24 -3.73	
04 23 13 00-0005 Solid Glass Block (Vistabrik®) (04 23 13)		
04 23 13 00-0006 SF 3" x 8" x 3" Solid Glass Block (Vistabrik®).....	295.25	
04 23 13 00-0007 SF 4" x 8" x 3" Solid Glass Block (Vistabrik®).....	226.05	

04	04	Masonry
	04 20	Unit Masonry
	04 23	Glass Unit Masonry



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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04 23 13 00-0008	SF		6" x 8" x 3" Solid Glass Block (Vistabrik®).....	157.69	
04 23 13 00-0009	SF		8" x 8" x 3" Solid Glass Block (Vistabrik®).....	110.83	

04 26 Single-Wythe Unit Masonry (04 20)

04 26 13 Masonry Veneer (04 26)

04 26 13 00-0001			Brick Veneer And Accessories <small>(04 26 13)</small>		
04 26 13 00-0002			Brick Stretchers <small>(04 26 13 00-0001)</small>		
04 26 13 00-0003	SF		1/2" x 2-1/4" x 7-5/8" Brick Veneer, Stretcher, Smooth Finish	10.87	0.93
			<i>For Sand Finish, Deduct</i>	-0.81	
			<i>For Wire Cut Finish, Add</i>	0.72	
04 26 13 00-0004	SF		1/2" x 3-5/8" x 7-5/8" Brick Veneer, Stretcher, Smooth Finish	11.10	1.05
			<i>For Sand Finish, Deduct</i>	-0.81	
			<i>For Wire Cut Finish, Add</i>	0.72	
04 26 13 00-0005	SF		1/2" x 3-5/8" x 11-5/8" Brick Veneer, Stretcher, Smooth Finish	11.40	1.21
			<i>For Sand Finish, Deduct</i>	-0.81	
			<i>For Wire Cut Finish, Add</i>	0.72	
04 26 13 00-0006			Brick Corners <small>(04 26 13 00-0001)</small>		
04 26 13 00-0007	LF		1/2" x 2-1/4" x 7-5/8" Brick Veneer, Smooth Finish, Corner	15.83	2.79
04 26 13 00-0008	LF		1/2" x 3-5/8" x 7-5/8" Brick Veneer, Smooth Finish, Corner	14.12	2.79
04 26 13 00-0009			Brick Caps And Sills <small>(04 26 13 00-0001)</small>		
04 26 13 00-0010	LF		1" x 3 7/8" Brick Veneer, Smooth, Rolok Sill With Bracket.....	13.56	3.39
04 26 13 00-0011	EA		3-5/8" x 2-1/4" x 7-5/8" Brick Veneer Edge Cap.....	7.34	1.40
04 26 13 00-0012	EA		3-5/8" x 2-1/4" x 7-5/8" Brick Veneer Corner Edge Cap, L or R.....	11.82	1.40
04 26 13 00-0013			Brick Veneer Accessories <small>(04 26 13 00-0001)</small>		
04 26 13 00-0014	LF		2-7/8" Brick Veneer, Starter Angle	3.46	0.54
04 26 13 00-0015	LF		3-5/8" Brick Veneer, Top Side Angle	3.63	0.54

04 40 Stone Assemblies (04)

Note: Includes pointing and cleaning of new stone and mortar. All stone prices include material and mortar.

04 41 Dry-Placed Stone (04 40)

04 41 00 00-0001			Ashlar Veneer, Random Size, Square Cut Rough Stone <small>(04 41)</small>		
04 41 00 00-0002	SF		4" Thick Ashlar Veneer, Random Size, Square Cut Rough Stone	25.80	5.17
04 41 00 00-0003	SF		6" Thick Ashlar Veneer, Random Size, Square Cut Rough Stone	26.47	5.17

04 42 Exterior Stone Cladding (04 40)

04 42 43 Stone Panels For Curtain Walls (04 42)

04 42 43 00-0001			Marble Facing Panels <small>(04 42 43)</small>		
			Note: 3' x 1.5'		
04 42 43 00-0002	SF		3/4" Thick Marble Facing Panels	54.80	11.74
04 42 43 00-0003	SF		7/8" Thick Marble Facing Panels	58.12	11.89
04 42 43 00-0004	SF		1-1/2" Thick Marble Facing Panels	67.83	12.12
04 42 43 00-0005	SF		2" Thick Marble Facing Panels	74.92	12.50
04 42 43 00-0006	SF		2-1/4" Thick Marble Facing Panels	79.87	13.25
04 42 43 00-0007	CF		Marble Face Panel.....	342.46	43.18
04 42 43 00-0008			Smooth Limestone Panels <small>(04 42 43)</small>		
			Note: Up to 12' x 5' panels.		
04 42 43 00-0009	SF		1-1/2" Thick Smooth Limestone Panels	44.74	23.56
04 42 43 00-0010	SF		2" Thick Smooth Limestone Panels	47.61	24.70
04 42 43 00-0011	SF		3" Thick Smooth Limestone Panels	50.66	25.83
04 42 43 00-0012	SF		4" Thick Smooth Limestone Panels	59.52	28.40
04 42 43 00-0013			Sandstone Panels <small>(04 42 43)</small>		
04 42 43 00-0014	SF		2-1/2" Thick Sandstone Panels.....	52.54	24.70
04 42 43 00-0015	SF		4" Thick Sandstone Panels.....	57.00	28.40
04 42 43 00-0016	SF		Split Face Sandstone Panels, Random Sizes.....	51.13	28.40

04 43 Stone Masonry (04 40)

04 43 00 00-0001			Marble <small>(04 43)</small>		
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MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
04 43 00 00-0002 Marble Base <small>(04 43 00 00-0001)</small> Note: 1" thick.		
04 43 00 00-0003 LF 4" High Marble Base	78.12	48.16
04 43 00 00-0004 LF 6" High Marble Base	89.16	52.46
04 43 00 00-0005 Marble Columns <small>(04 43 00 00-0001)</small>		
04 43 00 00-0006 CF Plain Faced Solid Marble Columns	230.12	43.18
04 43 00 00-0007 CF Fluted, Carved Solid Marble Columns	395.18	43.18
04 43 00 00-0008 Marble Flooring <small>(04 43 00 00-0001)</small>		
04 43 00 00-0009 SF 3/8" Uniform Color Marble Flooring	22.52	11.03
04 43 00 00-0010 SF 1/2" Uniform Color Marble Flooring	24.35	11.03
04 43 00 00-0011 SF 1/2" Travertine Marble Flooring	29.36	12.60
04 43 00 00-0012 Marble Items <small>(04 43 00 00-0001)</small>		
04 43 00 00-0013 LF 12" Marble Stair Treads	62.53	17.24
04 43 00 00-0014 LF 6" Wide Marble Stair Risers	47.45	13.82
04 43 00 00-0015 LF 6" Wide x 2" Thick Marble Window Sills	28.02	10.31
04 43 00 00-0016 LF 5" Wide x 7/8" Thick Marble Window Stool, Polished	56.31	12.66
04 43 00 00-0017 SF 7/8" Thick, Non Skid, Marble Patio Blocks	29.76	15.98
04 43 00 00-0018 Limestone <small>(04 43)</small>		
04 43 00 00-0019 Ashlar Veneer Limestone <small>(04 43 00 00-0018)</small>		
04 43 00 00-0020 SF 4" Ashlar Veneer Limestone, Random Sizes	49.33	17.24
04 43 00 00-0021 SF 6" To 8" Thick, Pitched Face Ashlar Veneer Limestone, Random Sizes	76.24	23.68
<i>For High Lime Historic Mortar, Add</i>	<i>0.04</i>	
04 43 00 00-0022 Limestone Coping <small>(04 43 00 00-0018)</small> Note: Measured from the highest point. Includes drilling into existing materials, caulk and ties.		
04 43 00 00-0023 SF 2-1/2" Thick Limestone Coping	23.43	6.06
04 43 00 00-0024 SF 3" Thick Limestone Coping	26.46	6.44
04 43 00 00-0025 SF 3-1/2" Thick Limestone Coping	29.47	6.82
04 43 00 00-0026 SF 4" Thick Limestone Coping	31.73	7.04
04 43 00 00-0027 SF 5" Thick Limestone Coping	37.02	7.20
04 43 00 00-0028 SF 6" Thick Limestone Coping	55.62	7.58
04 43 00 00-0029 CF >6" Thick Limestone Coping	91.62	15.66
04 43 00 00-0030 Limestone Stair Treads <small>(04 43 00 00-0018)</small>		
04 43 00 00-0031 SF 2" Thick Limestone Treads	27.10	5.68
04 43 00 00-0032 SF 2-1/2" Thick Limestone Treads	28.93	6.06
04 43 00 00-0033 SF 3" Thick Limestone Treads	32.59	6.44
04 43 00 00-0034 SF 3-1/2" Thick Limestone Treads	35.50	6.82
04 43 00 00-0035 SF 4" Thick Limestone Treads	38.41	6.82
04 43 00 00-0036 SF 5" Thick Limestone Treads	42.71	7.20
04 43 00 00-0037 SF 6" Thick Limestone Tread, Smooth Finish	61.17	7.58
04 43 00 00-0038 Limestone Items <small>(04 43 00 00-0018)</small>		
04 43 00 00-0039 CF Sawn Edge Limestone Block, Sill, Lintel, Jamb And Other Trim	148.31	58.73
04 43 00 00-0040 Granite <small>(04 43)</small>		
04 43 00 00-0041 Polished Granite Veneer Facing Panels <small>(04 43 00 00-0040)</small> Note: Excludes structural support steel.		
04 43 00 00-0042 SF 7/8" Thick Black Polished Granite Veneer Facing Panels	69.73	23.71
04 43 00 00-0043 SF 7/8" Thick Gray Polished Granite Veneer Facing Panels	63.69	23.71
04 43 00 00-0044 Granite Stair Treads <small>(04 43 00 00-0040)</small>		
04 43 00 00-0045 SF 2" Thick Granite Stair Tread	40.72	5.68
04 43 00 00-0046 Slate <small>(04 43)</small>		
04 43 00 00-0047 Slate Panels Or Sills <small>(04 43 00 00-0046)</small>		
04 43 00 00-0048 SF 1" Thick Slate Panels	46.49	23.71
04 43 00 00-0049 SF 2" Thick Slate Panels	56.13	23.71
04 43 00 00-0050 Slate Sills Or Stools <small>(04 43 00 00-0046)</small>		
04 43 00 00-0051 LF 6" Wide, 1" Thick Slate Sills Or Stools With Sand Finish	21.72	10.38
04 43 00 00-0052 LF 10" Wide, 1" Thick Slate Sills Or Stools With Sand Finish	27.85	10.38

04	Masonry
04 40	Stone Assemblies
04 43	Stone Masonry



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
	04 43 00 00-0053	LF	6" Wide, 2" Thick Slate Sills Or Stools With Sand Finish.....	26.98	10.38
	04 43 00 00-0054	LF	10" Wide, 2" Thick Slate Sills Or Stools With Sand Finish.....	40.14	10.38
	04 43 00 00-0055		Slate Stair Treads (04 43 00 00-0046)		
	04 43 00 00-0056	SF	2" Thick Slate Stair Tread.....	33.07	5.68
04 70			Manufactured Masonry (04)		
	04 72		Cast Stone Masonry (04 70)		
	04 72 00 00-0001		Precast Concrete Lintels (04 72)		
	04 72 00 00-0002		Solid Precast Concrete Lintels (04 72 00 00-0001)		
	04 72 00 00-0003	LF	4" x 8", Solid Precast Concrete Lintel.....	10.65	
	04 72 00 00-0004	LF	6" x 8", Solid Precast Concrete Lintel.....	13.23	
	04 72 00 00-0005	LF	8" x 8", Solid Precast Concrete Lintel.....	16.11	
	04 72 00 00-0006		U Shaped Precast Concrete Lintels (04 72 00 00-0001)		
			Note: Excludes concrete fill and field added reinforcing. See CSI section 04 05 16 26-0001 for concrete fill.		
	04 72 00 00-0007	LF	6" x 8", U Shaped Precast Concrete Lintel.....	11.40	
	04 72 00 00-0008	LF	8" x 8", U Shaped Precast Concrete Lintel.....	13.63	
	04 72 00 00-0009	LF	12" x 8", U Shaped Precast Concrete Lintel.....	21.44	
	04 72 00 00-0010		Precast Concrete Coping (04 72)		
			Note: Includes caulk and ties. Excludes drilling into existing materials or other anchoring bolts. See CSI section 04 21 29 00-0001 for terra cotta coping.		
	04 72 00 00-0011		Precast Concrete Coping (04 72 00 00-0010)		
			Note: Measured at highest point.		
	04 72 00 00-0012	SF	2" Thick Precast Concrete Coping.....	30.70	8.48
	04 72 00 00-0013	SF	2-1/2" Thick Precast Concrete Coping.....	33.71	9.13
	04 72 00 00-0014	SF	3" Thick Precast Concrete Coping.....	38.47	9.78
	04 72 00 00-0015	SF	3-1/2" Thick Precast Concrete Coping.....	40.80	10.44
	04 72 00 00-0016	SF	4" Thick Precast Concrete Coping.....	43.15	11.09
	04 72 00 00-0017	SF	5" Thick Precast Concrete Coping.....	50.37	11.74
	04 72 00 00-0018	SF	6" Thick Precast Concrete Coping.....	56.54	12.40
	04 72 00 00-0019		Precast Concrete Window Sills (04 72)		
			Note: Includes caulk and ties.		
	04 72 00 00-0020		Precast Concrete Window Sills (04 72 00 00-0019)		
	04 72 00 00-0021	LF	6" Wide Precast Concrete Window Sill.....	22.02	6.53
	04 72 00 00-0022	LF	10" Wide Precast Concrete Window Sill.....	30.92	6.53
	04 72 00 00-0023	LF	14" Wide Precast Concrete Window Sill.....	35.60	6.53
	04 72 00 00-0024		Cast Stone Veneer (04 72)		
	04 72 00 00-0025	SF	1" Thick Cast Stone Veneer.....	43.56	12.78

END OF SECTION 04



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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05 Metals

05 05 Common Work Results For Metals ⁽⁰⁵⁾

05 05 19 Post-Installed Concrete Anchors ^(05 05)

See CSI section 03 15 19 00-0000 for cast-in concrete anchors.

05 05 19 00-0001 Concrete And Masonry Anchors ^(05 05 19)

05 05 19 00-0002 Expansion Anchors ^(05 05 19 00-0001)

Note: Includes drilling.

05 05 19 00-0003 Wedge Expansion Bolt Anchors ^(05 05 19 00-0002)

05 05 19 00-0004 Zinc Plated Steel, Wedge Anchor Expansion Bolt ^(05 05 19 00-0003)

Note: Includes nut and washer.

05 05 19 00-0005	EA 1/4" Diameter x 1-3/4" Length, Zinc Plated Steel, Wedge Anchor Expansion Bolt	7.53	
	For >10 To 50, Deduct	-0.36	
	For >50 To 100, Deduct	-0.72	
	For >100, Deduct	-1.44	
05 05 19 00-0006	EA 1/4" Diameter x 2-1/4" Length, Zinc Plated Steel, Wedge Anchor Expansion Bolt	7.60	
	For >10 To 50, Deduct	-0.36	
	For >50 To 100, Deduct	-0.72	
	For >100, Deduct	-1.45	
05 05 19 00-0007	EA 1/4" Diameter x 3-1/4" Length, Zinc Plated Steel, Wedge Anchor Expansion Bolt	7.84	
	For >10 To 50, Deduct	-0.36	
	For >50 To 100, Deduct	-0.74	
	For >100, Deduct	-1.49	
05 05 19 00-0008	EA 3/8" Diameter x 2-1/4" Length, Zinc Plated Steel, Wedge Anchor Expansion Bolt	9.24	
	For >10 To 50, Deduct	-0.43	
	For >50 To 100, Deduct	-0.88	
	For >100, Deduct	-1.76	
05 05 19 00-0009	EA 3/8" Diameter x 2-3/4" Length, Zinc Plated Steel, Wedge Anchor Expansion Bolt	9.29	
	For >10 To 50, Deduct	-0.43	
	For >50 To 100, Deduct	-0.88	
	For >100, Deduct	-1.76	
05 05 19 00-0010	EA 3/8" Diameter x 3" Length, Zinc Plated Steel, Wedge Anchor Expansion Bolt.....	9.31	
	For >10 To 50, Deduct	-0.43	
	For >50 To 100, Deduct	-0.88	
	For >100, Deduct	-1.76	
05 05 19 00-0011	EA 3/8" Diameter x 5" Length, Zinc Plated Steel, Wedge Anchor Expansion Bolt.....	9.51	
	For >10 To 50, Deduct	-0.43	
	For >50 To 100, Deduct	-0.89	
	For >100, Deduct	-1.77	
05 05 19 00-0012	EA 1/2" Diameter x 2-3/4" Length, Zinc Plated Steel, Wedge Anchor Expansion Bolt	13.38	
	For >10 To 50, Deduct	-0.61	
	For >50 To 100, Deduct	-1.25	
	For >100, Deduct	-2.51	
05 05 19 00-0013	EA 1/2" Diameter x 3-3/4" Length, Zinc Plated Steel, Wedge Anchor Expansion Bolt	13.42	
	For >10 To 50, Deduct	-0.61	
	For >50 To 100, Deduct	-1.26	
	For >100, Deduct	-2.51	
05 05 19 00-0014	EA 1/2" Diameter x 4-1/4" Length, Zinc Plated Steel, Wedge Anchor Expansion Bolt	13.50	
	For >10 To 50, Deduct	-0.61	
	For >50 To 100, Deduct	-1.26	
	For >100, Deduct	-2.52	
05 05 19 00-0015	EA 1/2" Diameter x 5-1/2" Length, Zinc Plated Steel, Wedge Anchor Expansion Bolt	13.72	
	For >10 To 50, Deduct	-0.61	
	For >50 To 100, Deduct	-1.26	
	For >100, Deduct	-2.53	
05 05 19 00-0016	EA 1/2" Diameter x 7" Length, Zinc Plated Steel, Wedge Anchor Expansion Bolt.....	14.02	
	For >10 To 50, Deduct	-0.61	
	For >50 To 100, Deduct	-1.27	
	For >100, Deduct	-2.54	
05 05 19 00-0017	EA 5/8" Diameter x 3-1/2" Length, Zinc Plated Steel, Wedge Anchor Expansion Bolt	17.39	
	For >10 To 50, Deduct	-0.76	
	For >50 To 100, Deduct	-1.57	
	For >100, Deduct	-3.14	
05 05 19 00-0018	EA 5/8" Diameter x 4-1/4" Length, Zinc Plated Steel, Wedge Anchor Expansion Bolt	17.45	
	For >10 To 50, Deduct	-0.76	
	For >50 To 100, Deduct	-1.57	
	For >100, Deduct	-3.15	
05 05 19 00-0019	EA 5/8" Diameter x 5" Length, Zinc Plated Steel, Wedge Anchor Expansion Bolt.....	17.59	
	For >10 To 50, Deduct	-0.76	
	For >50 To 100, Deduct	-1.58	
	For >100, Deduct	-3.15	
05 05 19 00-0020	EA 5/8" Diameter x 6" Length, Zinc Plated Steel, Wedge Anchor Expansion Bolt.....	17.86	
	For >10 To 50, Deduct	-0.76	
	For >50 To 100, Deduct	-1.58	
	For >100, Deduct	-3.17	
05 05 19 00-0021	EA 5/8" Diameter x 7" Length, Zinc Plated Steel, Wedge Anchor Expansion Bolt.....	18.13	
	For >10 To 50, Deduct	-0.76	
	For >50 To 100, Deduct	-1.59	
	For >100, Deduct	-3.18	

05 Metals**05 05 Common Work Results For Metals****05 05 19 Post-Installed Concrete Anchors**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 19 00-0022	EA		5/8" Diameter x 8-1/2" Length, Zinc Plated Steel, Wedge Anchor Expansion Bolt.....	20.26	
			<i>For >10 To 50, Deduct</i>	-0.76	
			<i>For >50 To 100, Deduct</i>	-1.64	
			<i>For >100, Deduct</i>	-3.29	
05 05 19 00-0023	EA		5/8" Diameter x 10" Length, Zinc Plated Steel, Wedge Anchor Expansion Bolt.....	22.09	
			<i>For >10 To 50, Deduct</i>	-0.76	
			<i>For >50 To 100, Deduct</i>	-1.69	
			<i>For >100, Deduct</i>	-3.38	
05 05 19 00-0024	EA		3/4" Diameter x 4-1/4" Length, Zinc Plated Steel, Wedge Anchor Expansion Bolt.....	20.98	
			<i>For >10 To 50, Deduct</i>	-0.90	
			<i>For >50 To 100, Deduct</i>	-1.88	
			<i>For >100, Deduct</i>	-3.75	
05 05 19 00-0025	EA		3/4" Diameter x 4-3/4" Length, Zinc Plated Steel, Wedge Anchor Expansion Bolt.....	21.04	
			<i>For >10 To 50, Deduct</i>	-0.90	
			<i>For >50 To 100, Deduct</i>	-1.88	
			<i>For >100, Deduct</i>	-3.76	
05 05 19 00-0026	EA		3/4" Diameter x 5-1/2" Length, Zinc Plated Steel, Wedge Anchor Expansion Bolt.....	21.37	
			<i>For >10 To 50, Deduct</i>	-0.90	
			<i>For >50 To 100, Deduct</i>	-1.89	
			<i>For >100, Deduct</i>	-3.77	
05 05 19 00-0027	EA		3/4" Diameter x 6-1/4" Length, Zinc Plated Steel, Wedge Anchor Expansion Bolt.....	21.76	
			<i>For >10 To 50, Deduct</i>	-0.90	
			<i>For >50 To 100, Deduct</i>	-1.90	
			<i>For >100, Deduct</i>	-3.79	
05 05 19 00-0028	EA		3/4" Diameter x 7" Length, Zinc Plated Steel, Wedge Anchor Expansion Bolt.....	22.21	
			<i>For >10 To 50, Deduct</i>	-0.90	
			<i>For >50 To 100, Deduct</i>	-1.91	
			<i>For >100, Deduct</i>	-3.82	
05 05 19 00-0029	EA		3/4" Diameter x 8-1/2" Length, Zinc Plated Steel, Wedge Anchor Expansion Bolt.....	23.91	
			<i>For >10 To 50, Deduct</i>	-0.90	
			<i>For >50 To 100, Deduct</i>	-1.95	
			<i>For >100, Deduct</i>	-3.90	
05 05 19 00-0030	EA		3/4" Diameter x 10" Length, Zinc Plated Steel, Wedge Anchor Expansion Bolt.....	26.18	
			<i>For >10 To 50, Deduct</i>	-0.90	
			<i>For >50 To 100, Deduct</i>	-2.01	
			<i>For >100, Deduct</i>	-4.01	
05 05 19 00-0031	EA		3/4" Diameter x 12" Length, Zinc Plated Steel, Wedge Anchor Expansion Bolt.....	28.74	
			<i>For >10 To 50, Deduct</i>	-0.90	
			<i>For >50 To 100, Deduct</i>	-2.07	
			<i>For >100, Deduct</i>	-4.14	
05 05 19 00-0032	EA		7/8" Diameter x 6" Length, Zinc Plated Steel, Wedge Anchor Expansion Bolt.....	28.01	
			<i>For >10 To 50, Deduct</i>	-0.98	
			<i>For >50 To 100, Deduct</i>	-2.17	
			<i>For >100, Deduct</i>	-4.33	
05 05 19 00-0033	EA		7/8" Diameter x 8" Length, Zinc Plated Steel, Wedge Anchor Expansion Bolt.....	29.35	
			<i>For >10 To 50, Deduct</i>	-0.98	
			<i>For >50 To 100, Deduct</i>	-2.20	
			<i>For >100, Deduct</i>	-4.40	
05 05 19 00-0034	EA		7/8" Diameter x 10" Length, Zinc Plated Steel, Wedge Anchor Expansion Bolt.....	31.14	
			<i>For >10 To 50, Deduct</i>	-0.98	
			<i>For >50 To 100, Deduct</i>	-2.25	
			<i>For >100, Deduct</i>	-4.49	
05 05 19 00-0035	EA		1" Diameter x 6" Length, Zinc Plated Steel, Wedge Anchor Expansion Bolt.....	34.71	
			<i>For >10 To 50, Deduct</i>	-1.27	
			<i>For >50 To 100, Deduct</i>	-2.77	
			<i>For >100, Deduct</i>	-5.53	
05 05 19 00-0036	EA		1" Diameter x 9" Length, Zinc Plated Steel, Wedge Anchor Expansion Bolt.....	37.25	
			<i>For >10 To 50, Deduct</i>	-1.27	
			<i>For >50 To 100, Deduct</i>	-2.83	
			<i>For >100, Deduct</i>	-5.66	
05 05 19 00-0037	EA		1" Diameter x 12" Length, Zinc Plated Steel, Wedge Anchor Expansion Bolt.....	39.76	
			<i>For >10 To 50, Deduct</i>	-1.27	
			<i>For >50 To 100, Deduct</i>	-2.89	
			<i>For >100, Deduct</i>	-5.79	
05 05 19 00-0038	EA		1-1/4" Diameter x 9" Length, Zinc Plated Steel, Wedge Anchor Expansion Bolt.....	45.20	
			<i>For >10 To 50, Deduct</i>	-1.62	
			<i>For >50 To 100, Deduct</i>	-3.56	
			<i>For >100, Deduct</i>	-7.12	
05 05 19 00-0039	EA		1-1/4" Diameter x 12" Length, Zinc Plated Steel, Wedge Anchor Expansion Bolt.....	47.01	
			<i>For >10 To 50, Deduct</i>	-1.62	
			<i>For >50 To 100, Deduct</i>	-3.61	
			<i>For >100, Deduct</i>	-7.21	
05 05 19 00-0040			304/18-8 Stainless Steel, Wedge Anchor Expansion Bolt <small>(05 05 19 00-0003)</small>		
			Note: Includes nut and washer.		
05 05 19 00-0041	EA		1/4" Diameter x 1-3/4" Length, 304/18-8 Stainless Steel, Wedge Anchor Expansion Bolt.....	8.04	
			<i>For >10 To 50, Deduct</i>	-0.36	
			<i>For >50 To 100, Deduct</i>	-0.73	
			<i>For >100, Deduct</i>	-1.47	
05 05 19 00-0042	EA		1/4" Diameter x 2-1/4" Length, 304/18-8 Stainless Steel, Wedge Anchor Expansion Bolt.....	8.26	
			<i>For >10 To 50, Deduct</i>	-0.36	
			<i>For >50 To 100, Deduct</i>	-0.74	
			<i>For >100, Deduct</i>	-1.48	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 19 00-0043 EA 1/4" Diameter x 3-1/4" Length, 304/18-8 Stainless Steel, Wedge Anchor Expansion Bolt.....	8.58	
<i>For >10 To 50, Deduct</i>	-0.36	
<i>For >50 To 100, Deduct</i>	-0.76	
<i>For >100, Deduct</i>	-1.52	
05 05 19 00-0044 EA 3/8" Diameter x 2-1/4" Length, 304/18-8 Stainless Steel, Wedge Anchor Expansion Bolt.....	10.21	
<i>For >10 To 50, Deduct</i>	-0.43	
<i>For >50 To 100, Deduct</i>	-0.90	
<i>For >100, Deduct</i>	-1.81	
05 05 19 00-0045 EA 3/8" Diameter x 2-3/4" Length, 304/18-8 Stainless Steel, Wedge Anchor Expansion Bolt.....	10.39	
<i>For >10 To 50, Deduct</i>	-0.43	
<i>For >50 To 100, Deduct</i>	-0.91	
<i>For >100, Deduct</i>	-1.81	
05 05 19 00-0046 EA 3/8" Diameter x 3" Length, 304/18-8 Stainless Steel, Wedge Anchor Expansion Bolt.....	10.53	
<i>For >10 To 50, Deduct</i>	-0.43	
<i>For >50 To 100, Deduct</i>	-0.91	
<i>For >100, Deduct</i>	-1.82	
05 05 19 00-0047 EA 3/8" Diameter x 5" Length, 304/18-8 Stainless Steel, Wedge Anchor Expansion Bolt.....	11.55	
<i>For >10 To 50, Deduct</i>	-0.43	
<i>For >50 To 100, Deduct</i>	-0.94	
<i>For >100, Deduct</i>	-1.87	
05 05 19 00-0048 EA 1/2" Diameter x 2-3/4" Length, 304/18-8 Stainless Steel, Wedge Anchor Expansion Bolt.....	15.57	
<i>For >10 To 50, Deduct</i>	-0.61	
<i>For >50 To 100, Deduct</i>	-1.31	
<i>For >100, Deduct</i>	-2.62	
05 05 19 00-0049 EA 1/2" Diameter x 3-3/4" Length, 304/18-8 Stainless Steel, Wedge Anchor Expansion Bolt.....	15.92	
<i>For >10 To 50, Deduct</i>	-0.61	
<i>For >50 To 100, Deduct</i>	-1.32	
<i>For >100, Deduct</i>	-2.64	
05 05 19 00-0050 EA 1/2" Diameter x 4-1/4" Length, 304/18-8 Stainless Steel, Wedge Anchor Expansion Bolt.....	16.13	
<i>For >10 To 50, Deduct</i>	-0.61	
<i>For >50 To 100, Deduct</i>	-1.32	
<i>For >100, Deduct</i>	-2.65	
05 05 19 00-0051 EA 1/2" Diameter x 5-1/2" Length, 304/18-8 Stainless Steel, Wedge Anchor Expansion Bolt.....	17.05	
<i>For >10 To 50, Deduct</i>	-0.61	
<i>For >50 To 100, Deduct</i>	-1.35	
<i>For >100, Deduct</i>	-2.69	
05 05 19 00-0052 EA 1/2" Diameter x 7" Length, 304/18-8 Stainless Steel, Wedge Anchor Expansion Bolt.....	18.45	
<i>For >10 To 50, Deduct</i>	-0.61	
<i>For >50 To 100, Deduct</i>	-1.38	
<i>For >100, Deduct</i>	-2.76	
05 05 19 00-0053 EA 5/8" Diameter x 3-1/2" Length, 304/18-8 Stainless Steel, Wedge Anchor Expansion Bolt.....	21.84	
<i>For >10 To 50, Deduct</i>	-0.76	
<i>For >50 To 100, Deduct</i>	-1.68	
<i>For >100, Deduct</i>	-3.36	
05 05 19 00-0054 EA 5/8" Diameter x 5" Length, 304/18-8 Stainless Steel, Wedge Anchor Expansion Bolt.....	22.75	
<i>For >10 To 50, Deduct</i>	-0.76	
<i>For >50 To 100, Deduct</i>	-1.71	
<i>For >100, Deduct</i>	-3.41	
05 05 19 00-0055 EA 5/8" Diameter x 6" Length, 304/18-8 Stainless Steel, Wedge Anchor Expansion Bolt.....	23.73	
<i>For >10 To 50, Deduct</i>	-0.76	
<i>For >50 To 100, Deduct</i>	-1.73	
<i>For >100, Deduct</i>	-3.46	
05 05 19 00-0056 EA 5/8" Diameter x 7" Length, 304/18-8 Stainless Steel, Wedge Anchor Expansion Bolt.....	25.03	
<i>For >10 To 50, Deduct</i>	-0.76	
<i>For >50 To 100, Deduct</i>	-1.76	
<i>For >100, Deduct</i>	-3.52	
05 05 19 00-0057 EA 5/8" Diameter x 8-1/2" Length, 304/18-8 Stainless Steel, Wedge Anchor Expansion Bolt.....	30.77	
<i>For >10 To 50, Deduct</i>	-0.76	
<i>For >50 To 100, Deduct</i>	-1.91	
<i>For >100, Deduct</i>	-3.81	
05 05 19 00-0058 EA 3/4" Diameter x 4-1/4" Length, 304/18-8 Stainless Steel, Wedge Anchor Expansion Bolt.....	26.06	
<i>For >10 To 50, Deduct</i>	-0.90	
<i>For >50 To 100, Deduct</i>	-2.00	
<i>For >100, Deduct</i>	-4.01	
05 05 19 00-0059 EA 3/4" Diameter x 4-3/4" Length, 304/18-8 Stainless Steel, Wedge Anchor Expansion Bolt.....	27.91	
<i>For >10 To 50, Deduct</i>	-0.90	
<i>For >50 To 100, Deduct</i>	-2.05	
<i>For >100, Deduct</i>	-4.10	
05 05 19 00-0060 EA 3/4" Diameter x 5-1/2" Length, 304/18-8 Stainless Steel, Wedge Anchor Expansion Bolt.....	29.48	
<i>For >10 To 50, Deduct</i>	-0.90	
<i>For >50 To 100, Deduct</i>	-2.09	
<i>For >100, Deduct</i>	-4.18	
05 05 19 00-0061 EA 3/4" Diameter x 6-1/4" Length, 304/18-8 Stainless Steel, Wedge Anchor Expansion Bolt.....	29.68	
<i>For >10 To 50, Deduct</i>	-0.90	
<i>For >50 To 100, Deduct</i>	-2.09	
<i>For >100, Deduct</i>	-4.19	
05 05 19 00-0062 EA 3/4" Diameter x 7" Length, 304/18-8 Stainless Steel, Wedge Anchor Expansion Bolt.....	31.15	
<i>For >10 To 50, Deduct</i>	-0.90	
<i>For >50 To 100, Deduct</i>	-2.13	
<i>For >100, Deduct</i>	-4.26	
05 05 19 00-0063 EA 3/4" Diameter x 8-1/2" Length, 304/18-8 Stainless Steel, Wedge Anchor Expansion Bolt.....	34.99	
<i>For >10 To 50, Deduct</i>	-0.90	
<i>For >50 To 100, Deduct</i>	-2.23	
<i>For >100, Deduct</i>	-4.45	

05 Metals**05 05 Common Work Results For Metals****05 05 19 Post-Installed Concrete Anchors**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 19 00-0064	EA		3/4" Diameter x 10" Length, 304/18-8 Stainless Steel, Wedge Anchor Expansion Bolt.....	40.41	
			<i>For >10 To 50, Deduct</i>	-0.90	
			<i>For >50 To 100, Deduct</i>	-2.36	
			<i>For >100, Deduct</i>	-4.73	
05 05 19 00-0065	EA		7/8" Diameter x 8" Length, 304/18-8 Stainless Steel, Wedge Anchor Expansion Bolt.....	40.94	
			<i>For >10 To 50, Deduct</i>	-0.98	
			<i>For >50 To 100, Deduct</i>	-2.49	
			<i>For >100, Deduct</i>	-4.98	
05 05 19 00-0066	EA		1" Diameter x 6" Length, 304/18-8 Stainless Steel, Wedge Anchor Expansion Bolt.....	58.84	
			<i>For >10 To 50, Deduct</i>	-1.27	
			<i>For >50 To 100, Deduct</i>	-3.37	
			<i>For >100, Deduct</i>	-6.74	
05 05 19 00-0067	EA		1" Diameter x 9" Length, 304/18-8 Stainless Steel, Wedge Anchor Expansion Bolt.....	66.86	
			<i>For >10 To 50, Deduct</i>	-1.27	
			<i>For >50 To 100, Deduct</i>	-3.57	
			<i>For >100, Deduct</i>	-7.14	
05 05 19 00-0068			316 Stainless Steel, Wedge Anchor Expansion Bolt <small>(05 05 19 00-0003)</small>		
			Note: Includes nut and washer.		
05 05 19 00-0069	EA		1/4" Diameter x 2-1/4" Length, 316 Stainless Steel, Wedge Anchor Expansion Bolt.....	8.22	
			<i>For >10 To 50, Deduct</i>	-0.36	
			<i>For >50 To 100, Deduct</i>	-0.74	
			<i>For >100, Deduct</i>	-1.48	
05 05 19 00-0070	EA		1/4" Diameter x 3-1/4" Length, 316 Stainless Steel, Wedge Anchor Expansion Bolt.....	8.66	
			<i>For >10 To 50, Deduct</i>	-0.36	
			<i>For >50 To 100, Deduct</i>	-0.76	
			<i>For >100, Deduct</i>	-1.53	
05 05 19 00-0071	EA		3/8" Diameter x 2-1/4" Length, 316 Stainless Steel, Wedge Anchor Expansion Bolt.....	10.81	
			<i>For >10 To 50, Deduct</i>	-0.43	
			<i>For >50 To 100, Deduct</i>	-0.92	
			<i>For >100, Deduct</i>	-1.84	
05 05 19 00-0072	EA		3/8" Diameter x 2-3/4" Length, 316 Stainless Steel, Wedge Anchor Expansion Bolt.....	11.13	
			<i>For >10 To 50, Deduct</i>	-0.43	
			<i>For >50 To 100, Deduct</i>	-0.93	
			<i>For >100, Deduct</i>	-1.85	
05 05 19 00-0073	EA		3/8" Diameter x 3" Length, 316 Stainless Steel, Wedge Anchor Expansion Bolt.....	11.22	
			<i>For >10 To 50, Deduct</i>	-0.43	
			<i>For >50 To 100, Deduct</i>	-0.93	
			<i>For >100, Deduct</i>	-1.86	
05 05 19 00-0074	EA		3/8" Diameter x 5" Length, 316 Stainless Steel, Wedge Anchor Expansion Bolt.....	12.75	
			<i>For >10 To 50, Deduct</i>	-0.43	
			<i>For >50 To 100, Deduct</i>	-0.97	
			<i>For >100, Deduct</i>	-1.93	
05 05 19 00-0075	EA		1/2" Diameter x 2-3/4" Length, 316 Stainless Steel, Wedge Anchor Expansion Bolt.....	17.04	
			<i>For >10 To 50, Deduct</i>	-0.61	
			<i>For >50 To 100, Deduct</i>	-1.35	
			<i>For >100, Deduct</i>	-2.69	
05 05 19 00-0076	EA		1/2" Diameter x 3-3/4" Length, 316 Stainless Steel, Wedge Anchor Expansion Bolt.....	17.93	
			<i>For >10 To 50, Deduct</i>	-0.61	
			<i>For >50 To 100, Deduct</i>	-1.37	
			<i>For >100, Deduct</i>	-2.74	
05 05 19 00-0077	EA		1/2" Diameter x 4-1/4" Length, 316 Stainless Steel, Wedge Anchor Expansion Bolt.....	19.55	
			<i>For >10 To 50, Deduct</i>	-0.61	
			<i>For >50 To 100, Deduct</i>	-1.41	
			<i>For >100, Deduct</i>	-2.82	
05 05 19 00-0078	EA		1/2" Diameter x 5-1/2" Length, 316 Stainless Steel, Wedge Anchor Expansion Bolt.....	19.96	
			<i>For >10 To 50, Deduct</i>	-0.61	
			<i>For >50 To 100, Deduct</i>	-1.42	
			<i>For >100, Deduct</i>	-2.84	
05 05 19 00-0079	EA		5/8" Diameter x 5" Length, 316 Stainless Steel, Wedge Anchor Expansion Bolt.....	26.81	
			<i>For >10 To 50, Deduct</i>	-0.76	
			<i>For >50 To 100, Deduct</i>	-1.81	
			<i>For >100, Deduct</i>	-3.61	
05 05 19 00-0080	EA		5/8" Diameter x 7" Length, 316 Stainless Steel, Wedge Anchor Expansion Bolt.....	27.29	
			<i>For >10 To 50, Deduct</i>	-0.76	
			<i>For >50 To 100, Deduct</i>	-1.82	
			<i>For >100, Deduct</i>	-3.64	
05 05 19 00-0081	EA		3/4" Diameter x 4-3/4" Length, 316 Stainless Steel, Wedge Anchor Expansion Bolt.....	33.01	
			<i>For >10 To 50, Deduct</i>	-0.90	
			<i>For >50 To 100, Deduct</i>	-2.18	
			<i>For >100, Deduct</i>	-4.36	
05 05 19 00-0082	EA		3/4" Diameter x 5-1/2" Length, 316 Stainless Steel, Wedge Anchor Expansion Bolt.....	35.03	
			<i>For >10 To 50, Deduct</i>	-0.90	
			<i>For >50 To 100, Deduct</i>	-2.23	
			<i>For >100, Deduct</i>	-4.46	
05 05 19 00-0083			Hot Dipped Galvanized Steel, Wedge Anchor Expansion Bolt <small>(05 05 19 00-0003)</small>		
			Note: Includes nut and washer.		
05 05 19 00-0084	EA		1/2" Diameter x 2-3/4" Length, Hot Dipped Galvanized Steel, Wedge Anchor Expansion Bolt.....	15.11	
			<i>For >10 To 50, Deduct</i>	-0.61	
			<i>For >50 To 100, Deduct</i>	-1.30	
			<i>For >100, Deduct</i>	-2.60	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 19 00-0085 EA 1/2" Diameter x 4-1/4" Length, Hot Dipped Galvanized Steel, Wedge Anchor Expansion Bolt.....	15.86	
For >10 To 50, Deduct	-0.61	
For >50 To 100, Deduct	-1.32	
For >100, Deduct	-2.63	
05 05 19 00-0086 EA 1/2" Diameter x 5-1/2" Length, Hot Dipped Galvanized Steel, Wedge Anchor Expansion Bolt.....	16.61	
For >10 To 50, Deduct	-0.61	
For >50 To 100, Deduct	-1.34	
For >100, Deduct	-2.67	
05 05 19 00-0087 EA 1/2" Diameter x 7" Length, Hot Dipped Galvanized Steel, Wedge Anchor Expansion Bolt.....	16.99	
For >10 To 50, Deduct	-0.61	
For >50 To 100, Deduct	-1.35	
For >100, Deduct	-2.69	
05 05 19 00-0088 EA 5/8" Diameter x 3-1/2" Length, Hot Dipped Galvanized Steel, Wedge Anchor Expansion Bolt.....	20.54	
For >10 To 50, Deduct	-0.76	
For >50 To 100, Deduct	-1.65	
For >100, Deduct	-3.30	
05 05 19 00-0089 EA 5/8" Diameter x 6" Length, Hot Dipped Galvanized Steel, Wedge Anchor Expansion Bolt.....	19.64	
For >10 To 50, Deduct	-0.76	
For >50 To 100, Deduct	-1.63	
For >100, Deduct	-3.25	
05 05 19 00-0090 EA 3/4" Diameter x 4-3/4" Length, Hot Dipped Galvanized Steel, Wedge Anchor Expansion Bolt.....	26.42	
For >10 To 50, Deduct	-0.90	
For >50 To 100, Deduct	-2.01	
For >100, Deduct	-4.03	
05 05 19 00-0091 EA 3/4" Diameter x 5-1/2" Length, Hot Dipped Galvanized Steel, Wedge Anchor Expansion Bolt.....	27.25	
For >10 To 50, Deduct	-0.90	
For >50 To 100, Deduct	-2.03	
For >100, Deduct	-4.07	
05 05 19 00-0092 EA 3/4" Diameter x 8-1/2" Length, Hot Dipped Galvanized Steel, Wedge Anchor Expansion Bolt.....	31.30	
For >10 To 50, Deduct	-0.90	
For >50 To 100, Deduct	-2.13	
For >100, Deduct	-4.27	
05 05 19 00-0093 EA 1" Diameter x 6" Length, Hot Dipped Galvanized Steel, Wedge Anchor Expansion Bolt.....	33.95	
For >10 To 50, Deduct	-1.27	
For >50 To 100, Deduct	-2.75	
For >100, Deduct	-5.50	
05 05 19 00-0094 EA 1" Diameter x 9" Length, Hot Dipped Galvanized Steel, Wedge Anchor Expansion Bolt.....	36.28	
For >10 To 50, Deduct	-1.27	
For >50 To 100, Deduct	-2.81	
For >100, Deduct	-5.61	
05 05 19 00-0095 EA 1" Diameter x 12" Length, Hot Dipped Galvanized Steel, Wedge Anchor Expansion Bolt.....	38.60	
For >10 To 50, Deduct	-1.27	
For >50 To 100, Deduct	-2.86	
For >100, Deduct	-5.73	
05 05 19 00-0096 Concrete Sleeve Anchors <small>(05 05 19 00-0002)</small>		
05 05 19 00-0097 Zinc Plated Steel, Concrete Sleeve Anchors <small>(05 05 19 00-0096)</small>		
Note: Includes nut and washer.		
05 05 19 00-0098 EA 1/4" Diameter x 5/8" Length, Zinc Plated Steel, Concrete Sleeve Anchor	7.57	
For >10 To 50, Deduct	-0.36	
For >50 To 100, Deduct	-0.73	
For >100, Deduct	-1.47	
05 05 19 00-0099 EA 1/4" Diameter x 1-3/8" Length, Zinc Plated Steel, Concrete Sleeve Anchor	8.66	
For >10 To 50, Deduct	-0.36	
For >50 To 100, Deduct	-0.74	
For >100, Deduct	-1.47	
05 05 19 00-0100 EA 1/4" Diameter x 2-1/4" Length, Zinc Plated Steel, Concrete Sleeve Anchor	7.78	
For >10 To 50, Deduct	-0.36	
For >50 To 100, Deduct	-0.74	
For >100, Deduct	-1.48	
05 05 19 00-0101 EA 5/16" Diameter x 1-1/2" Length, Zinc Plated Steel, Concrete Sleeve Anchor	7.98	
For >10 To 50, Deduct	-0.38	
For >50 To 100, Deduct	-0.77	
For >100, Deduct	-1.54	
05 05 19 00-0102 EA 5/16" Diameter x 2-1/2" Length, Zinc Plated Steel, Concrete Sleeve Anchor	8.07	
For >10 To 50, Deduct	-0.38	
For >50 To 100, Deduct	-0.77	
For >100, Deduct	-1.55	
05 05 19 00-0103 EA 3/8" Diameter x 1-7/8" Length, Zinc Plated Steel, Concrete Sleeve Anchor	9.04	
For >10 To 50, Deduct	-0.43	
For >50 To 100, Deduct	-0.87	
For >100, Deduct	-1.75	
05 05 19 00-0104 EA 3/8" Diameter x 3" Length, Zinc Plated Steel, Concrete Sleeve Anchor	9.20	
For >10 To 50, Deduct	-0.43	
For >50 To 100, Deduct	-0.88	
For >100, Deduct	-1.75	
05 05 19 00-0105 EA 3/8" Diameter x 4" Length, Zinc Plated Steel, Concrete Sleeve Anchor	9.35	
For >10 To 50, Deduct	-0.43	
For >50 To 100, Deduct	-0.88	
For >100, Deduct	-1.76	
05 05 19 00-0106 EA 1/2" Diameter x 2-1/4" Length, Zinc Plated Steel, Concrete Sleeve Anchor	13.02	
For >10 To 50, Deduct	-0.61	
For >50 To 100, Deduct	-1.25	
For >100, Deduct	-2.49	

05 Metals**05 05 Common Work Results For Metals****05 05 19 Post-Installed Concrete Anchors**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 19 00-0107	EA		1/2" Diameter x 3" Length, Zinc Plated Steel, Concrete Sleeve Anchor	13.22	
			<i>For >10 To 50, Deduct</i>	-0.61	
			<i>For >50 To 100, Deduct</i>	-1.25	
			<i>For >100, Deduct</i>	-2.50	
05 05 19 00-0108	EA		1/2" Diameter x 4" Length, Zinc Plated Steel, Concrete Sleeve Anchor	13.40	
			<i>For >10 To 50, Deduct</i>	-0.61	
			<i>For >50 To 100, Deduct</i>	-1.25	
			<i>For >100, Deduct</i>	-2.51	
05 05 19 00-0109	EA		1/2" Diameter x 6" Length, Zinc Plated Steel, Concrete Sleeve Anchor	13.61	
			<i>For >10 To 50, Deduct</i>	-0.61	
			<i>For >50 To 100, Deduct</i>	-1.26	
			<i>For >100, Deduct</i>	-2.52	
05 05 19 00-0110	EA		5/8" Diameter x 2-1/4" Length, Zinc Plated Steel, Concrete Sleeve Anchor	16.33	
			<i>For >10 To 50, Deduct</i>	-0.76	
			<i>For >50 To 100, Deduct</i>	-1.54	
			<i>For >100, Deduct</i>	-3.09	
05 05 19 00-0111	EA		5/8" Diameter x 3" Length, Zinc Plated Steel, Concrete Sleeve Anchor	16.64	
			<i>For >10 To 50, Deduct</i>	-0.76	
			<i>For >50 To 100, Deduct</i>	-1.55	
			<i>For >100, Deduct</i>	-3.10	
05 05 19 00-0112	EA		5/8" Diameter x 4-1/4" Length, Zinc Plated Steel, Concrete Sleeve Anchor	16.87	
			<i>For >10 To 50, Deduct</i>	-0.76	
			<i>For >50 To 100, Deduct</i>	-1.56	
			<i>For >100, Deduct</i>	-3.12	
05 05 19 00-0113	EA		5/8" Diameter x 6" Length, Zinc Plated Steel, Concrete Sleeve Anchor	17.54	
			<i>For >10 To 50, Deduct</i>	-0.76	
			<i>For >50 To 100, Deduct</i>	-1.57	
			<i>For >100, Deduct</i>	-3.15	
05 05 19 00-0114	EA		3/4" Diameter x 2-1/2" Length, Zinc Plated Steel, Concrete Sleeve Anchor	19.99	
			<i>For >10 To 50, Deduct</i>	-0.90	
			<i>For >50 To 100, Deduct</i>	-1.85	
			<i>For >100, Deduct</i>	-3.70	
05 05 19 00-0115	EA		3/4" Diameter x 4-1/4" Length, Zinc Plated Steel, Concrete Sleeve Anchor	20.57	
			<i>For >10 To 50, Deduct</i>	-0.90	
			<i>For >50 To 100, Deduct</i>	-1.87	
			<i>For >100, Deduct</i>	-3.73	
05 05 19 00-0116	EA		3/4" Diameter x 5-1/2" Length, Zinc Plated Steel, Concrete Sleeve Anchor	21.09	
			<i>For >10 To 50, Deduct</i>	-0.90	
			<i>For >50 To 100, Deduct</i>	-1.88	
			<i>For >100, Deduct</i>	-3.76	
05 05 19 00-0117	EA		3/4" Diameter x 6-1/4" Length, Zinc Plated Steel, Concrete Sleeve Anchor	21.92	
			<i>For >10 To 50, Deduct</i>	-0.90	
			<i>For >50 To 100, Deduct</i>	-1.90	
			<i>For >100, Deduct</i>	-3.80	
05 05 19 00-0118			304/18-8 Stainless Steel, Concrete Sleeve Anchors <small>(05 05 19 00-0096)</small>		
			Note: Includes nut and washer.		
05 05 19 00-0119	EA		1/4" Diameter x 1-3/8" Length, 304/18-8 Stainless Steel, Concrete Sleeve Anchor.....	8.41	
			<i>For >10 To 50, Deduct</i>	-0.36	
			<i>For >50 To 100, Deduct</i>	-0.75	
			<i>For >100, Deduct</i>	-1.51	
05 05 19 00-0120	EA		3/8" Diameter x 1-7/8" Length, 304/18-8 Stainless Steel, Concrete Sleeve Anchor.....	10.80	
			<i>For >10 To 50, Deduct</i>	-0.43	
			<i>For >50 To 100, Deduct</i>	-0.92	
			<i>For >100, Deduct</i>	-1.83	
05 05 19 00-0121	EA		3/8" Diameter x 3" Length, 304/18-8 Stainless Steel, Concrete Sleeve Anchor.....	11.66	
			<i>For >10 To 50, Deduct</i>	-0.43	
			<i>For >50 To 100, Deduct</i>	-0.94	
			<i>For >100, Deduct</i>	-1.88	
05 05 19 00-0122	EA		1/2" Diameter x 2-1/4" Length, 304/18-8 Stainless Steel, Concrete Sleeve Anchor.....	15.95	
			<i>For >10 To 50, Deduct</i>	-0.61	
			<i>For >50 To 100, Deduct</i>	-1.32	
			<i>For >100, Deduct</i>	-2.64	
05 05 19 00-0123	EA		1/2" Diameter x 4" Length, 304/18-8 Stainless Steel, Concrete Sleeve Anchor.....	17.50	
			<i>For >10 To 50, Deduct</i>	-0.61	
			<i>For >50 To 100, Deduct</i>	-1.36	
			<i>For >100, Deduct</i>	-2.71	
05 05 19 00-0124	EA		5/8" Diameter x 4-1/4" Length, 304/18-8 Stainless Steel, Concrete Sleeve Anchor.....	23.59	
			<i>For >10 To 50, Deduct</i>	-0.76	
			<i>For >50 To 100, Deduct</i>	-1.73	
			<i>For >100, Deduct</i>	-3.45	
05 05 19 00-0125			Concrete Strike Anchors <small>(05 05 19 00-0002)</small>		
			Note: Includes nut and washer.		
05 05 19 00-0126	EA		1/4" Diameter x 1-3/4" Length, Zinc Plated Steel, Concrete Strike Anchor	8.04	
			<i>For >10 To 50, Deduct</i>	-0.36	
			<i>For >50 To 100, Deduct</i>	-0.74	
			<i>For >100, Deduct</i>	-1.49	
05 05 19 00-0127	EA		1/4" Diameter x 2-3/8" Length, Zinc Plated Steel, Concrete Strike Anchor	8.20	
			<i>For >10 To 50, Deduct</i>	-0.36	
			<i>For >50 To 100, Deduct</i>	-0.75	
			<i>For >100, Deduct</i>	-1.50	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 19 00-0128 EA 5/16" Diameter x 2-3/4" Length, Zinc Plated Steel, Concrete Strike Anchor	8.57	
<i>For >10 To 50, Deduct</i>	-0.38	
<i>For >50 To 100, Deduct</i>	-0.79	
<i>For >100, Deduct</i>	-1.57	
05 05 19 00-0129 EA 5/16" Diameter x 4" Length, Zinc Plated Steel, Concrete Strike Anchor	9.24	
<i>For >10 To 50, Deduct</i>	-0.38	
<i>For >50 To 100, Deduct</i>	-0.80	
<i>For >100, Deduct</i>	-1.61	
05 05 19 00-0130 EA 3/8" Diameter x 2-3/8" Length, Zinc Plated Steel, Concrete Strike Anchor	9.77	
<i>For >10 To 50, Deduct</i>	-0.43	
<i>For >50 To 100, Deduct</i>	-0.89	
<i>For >100, Deduct</i>	-1.78	
05 05 19 00-0131 EA 3/8" Diameter x 3-1/2" Length, Zinc Plated Steel, Concrete Strike Anchor	10.28	
<i>For >10 To 50, Deduct</i>	-0.43	
<i>For >50 To 100, Deduct</i>	-0.90	
<i>For >100, Deduct</i>	-1.81	
05 05 19 00-0132 EA 3/8" Diameter x 5" Length, Zinc Plated Steel, Concrete Strike Anchor	10.67	
<i>For >10 To 50, Deduct</i>	-0.43	
<i>For >50 To 100, Deduct</i>	-0.91	
<i>For >100, Deduct</i>	-1.83	
05 05 19 00-0133 EA 1/2" Diameter x 2-3/4" Length, Zinc Plated Steel, Concrete Strike Anchor	14.28	
<i>For >10 To 50, Deduct</i>	-0.61	
<i>For >50 To 100, Deduct</i>	-1.28	
<i>For >100, Deduct</i>	-2.55	
05 05 19 00-0134 EA 1/2" Diameter x 3-1/2" Length, Zinc Plated Steel, Concrete Strike Anchor	14.58	
<i>For >10 To 50, Deduct</i>	-0.61	
<i>For >50 To 100, Deduct</i>	-1.28	
<i>For >100, Deduct</i>	-2.57	
05 05 19 00-0135 EA 1/2" Diameter x 4-3/4" Length, Zinc Plated Steel, Concrete Strike Anchor	15.47	
<i>For >10 To 50, Deduct</i>	-0.61	
<i>For >50 To 100, Deduct</i>	-1.31	
<i>For >100, Deduct</i>	-2.61	
05 05 19 00-0136 EA 1/2" Diameter x 6" Length, Zinc Plated Steel, Concrete Strike Anchor	16.62	
<i>For >10 To 50, Deduct</i>	-0.61	
<i>For >50 To 100, Deduct</i>	-1.34	
<i>For >100, Deduct</i>	-2.67	
05 05 19 00-0137 EA 5/8" Diameter x 4" Length, Zinc Plated Steel, Concrete Strike Anchor	18.99	
<i>For >10 To 50, Deduct</i>	-0.76	
<i>For >50 To 100, Deduct</i>	-1.61	
<i>For >100, Deduct</i>	-3.22	
05 05 19 00-0138 EA 5/8" Diameter x 4-3/4" Length, Zinc Plated Steel, Concrete Strike Anchor	20.05	
<i>For >10 To 50, Deduct</i>	-0.76	
<i>For >50 To 100, Deduct</i>	-1.64	
<i>For >100, Deduct</i>	-3.28	
05 05 19 00-0139 EA 5/8" Diameter x 6" Length, Zinc Plated Steel, Concrete Strike Anchor	20.99	
<i>For >10 To 50, Deduct</i>	-0.76	
<i>For >50 To 100, Deduct</i>	-1.66	
<i>For >100, Deduct</i>	-3.32	
05 05 19 00-0140 EA 3/4" Diameter x 5" Length, Zinc Plated Steel, Concrete Strike Anchor	24.42	
<i>For >10 To 50, Deduct</i>	-0.90	
<i>For >50 To 100, Deduct</i>	-1.96	
<i>For >100, Deduct</i>	-3.93	
05 05 19 00-0141 EA 3/4" Diameter x 6" Length, Zinc Plated Steel, Concrete Strike Anchor	25.41	
<i>For >10 To 50, Deduct</i>	-0.90	
<i>For >50 To 100, Deduct</i>	-1.99	
<i>For >100, Deduct</i>	-3.98	
 05 05 19 00-0142 Multi-Set Drop-In Anchors <small>(05 05 19 00-0002)</small>		
05 05 19 00-0143 Zinc Plated Steel, Multi-Set Drop-In Anchors <small>(05 05 19 00-0142)</small>		
Note: Excludes bolt, nut and washer.		
05 05 19 00-0144 EA 1/4" Bolt Diameter, Zinc Plated Steel, Multi-Set Drop-In Anchor	10.52	
<i>For >10 To 50, Deduct</i>	-0.51	
<i>For >50 To 100, Deduct</i>	-1.02	
<i>For >100, Deduct</i>	-2.04	
05 05 19 00-0145 EA 3/8" Bolt Diameter, Zinc Plated Steel, Multi-Set Drop-In Anchor	12.86	
<i>For >10 To 50, Deduct</i>	-0.62	
<i>For >50 To 100, Deduct</i>	-1.24	
<i>For >100, Deduct</i>	-2.49	
05 05 19 00-0146 EA 1/2" Bolt Diameter, Zinc Plated Steel, Multi-Set Drop-In Anchor	15.69	
<i>For >10 To 50, Deduct</i>	-0.73	
<i>For >50 To 100, Deduct</i>	-1.48	
<i>For >100, Deduct</i>	-2.96	
05 05 19 00-0147 EA 5/8" Bolt Diameter, Zinc Plated Steel, Multi-Set Drop-In Anchor	17.81	
<i>For >10 To 50, Deduct</i>	-0.80	
<i>For >50 To 100, Deduct</i>	-1.64	
<i>For >100, Deduct</i>	-3.28	
05 05 19 00-0148 EA 3/4" Bolt Diameter, Zinc Plated Steel, Multi-Set Drop-In Anchor	21.35	
<i>For >10 To 50, Deduct</i>	-0.91	
<i>For >50 To 100, Deduct</i>	-1.89	
<i>For >100, Deduct</i>	-3.79	
 05 05 19 00-0149 304/18-8 Stainless Steel, Multi-Set Drop-In Anchors <small>(05 05 19 00-0142)</small>		
Note: Excludes bolt, nut and washer.		

05 Metals**05 05 Common Work Results For Metals****05 05 19 Post-Installed Concrete Anchors**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 19 00-0150	EA		1/4" Bolt Diameter, 304/18-8 Stainless Steel, Multi-Set Drop-In Anchor.....	12.28	
			<i>For >10 To 50, Deduct</i>	-0.51	
			<i>For >50 To 100, Deduct</i>	-1.06	
			<i>For >100, Deduct</i>	-2.13	
05 05 19 00-0151	EA		3/8" Bolt Diameter, 304/18-8 Stainless Steel, Multi-Set Drop-In Anchor.....	16.22	
			<i>For >10 To 50, Deduct</i>	-0.62	
			<i>For >50 To 100, Deduct</i>	-1.33	
			<i>For >100, Deduct</i>	-2.66	
05 05 19 00-0152	EA		1/2" Bolt Diameter, 304/18-8 Stainless Steel, Multi-Set Drop-In Anchor.....	20.06	
			<i>For >10 To 50, Deduct</i>	-0.73	
			<i>For >50 To 100, Deduct</i>	-1.59	
			<i>For >100, Deduct</i>	-3.18	
05 05 19 00-0153	EA		5/8" Bolt Diameter, 304/18-8 Stainless Steel, Multi-Set Drop-In Anchor.....	24.84	
			<i>For >10 To 50, Deduct</i>	-0.80	
			<i>For >50 To 100, Deduct</i>	-1.82	
			<i>For >100, Deduct</i>	-3.63	
05 05 19 00-0154	EA		3/4" Bolt Diameter, 304/18-8 Stainless Steel, Multi-Set Drop-In Anchor.....	33.44	
			<i>For >10 To 50, Deduct</i>	-0.91	
			<i>For >50 To 100, Deduct</i>	-2.20	
			<i>For >100, Deduct</i>	-4.39	
05 05 19 00-0155			Single Bolt Expansion Anchors (05 05 19 00-0002)		
			Note: Excludes bolt, nut and washer.		
05 05 19 00-0156	EA		1/4" Bolt Diameter, Zinc Plated Steel, Single Bolt Expansion Anchor.....	7.71	
			<i>For >10 To 50, Deduct</i>	-0.36	
			<i>For >50 To 100, Deduct</i>	-0.74	
			<i>For >100, Deduct</i>	-1.47	
05 05 19 00-0157	EA		5/16" Bolt Diameter, Zinc Plated Steel, Single Bolt Expansion Anchor.....	8.25	
			<i>For >10 To 50, Deduct</i>	-0.38	
			<i>For >50 To 100, Deduct</i>	-0.78	
			<i>For >100, Deduct</i>	-1.56	
05 05 19 00-0158	EA		3/8" Bolt Diameter, Zinc Plated Steel, Single Bolt Expansion Anchor.....	9.32	
			<i>For >10 To 50, Deduct</i>	-0.43	
			<i>For >50 To 100, Deduct</i>	-0.88	
			<i>For >100, Deduct</i>	-1.76	
05 05 19 00-0159	EA		1/2" Bolt Diameter, Zinc Plated Steel, Single Bolt Expansion Anchor.....	13.61	
			<i>For >10 To 50, Deduct</i>	-0.61	
			<i>For >50 To 100, Deduct</i>	-1.26	
			<i>For >100, Deduct</i>	-2.52	
05 05 19 00-0160	EA		5/8" Bolt Diameter, Zinc Plated Steel, Single Bolt Expansion Anchor.....	18.86	
			<i>For >10 To 50, Deduct</i>	-0.76	
			<i>For >50 To 100, Deduct</i>	-1.61	
			<i>For >100, Deduct</i>	-3.22	
05 05 19 00-0161	EA		3/4" Bolt Diameter, Zinc Plated Steel, Single Bolt Expansion Anchor.....	22.75	
			<i>For >10 To 50, Deduct</i>	-0.90	
			<i>For >50 To 100, Deduct</i>	-1.92	
			<i>For >100, Deduct</i>	-3.84	
05 05 19 00-0162			Concrete Lag Shield Anchors (05 05 19 00-0002)		
			Note: Excludes lag bolt and washer.		
05 05 19 00-0163	EA		1/4" Bolt Diameter, Zinc Plated Steel, Concrete Lag Shield Anchor.....	7.75	
			<i>For >10 To 50, Deduct</i>	-0.36	
			<i>For >50 To 100, Deduct</i>	-0.74	
			<i>For >100, Deduct</i>	-1.48	
05 05 19 00-0164	EA		5/16" Bolt Diameter, Zinc Plated Steel, Concrete Lag Shield Anchor.....	9.23	
			<i>For >10 To 50, Deduct</i>	-0.43	
			<i>For >50 To 100, Deduct</i>	-0.88	
			<i>For >100, Deduct</i>	-1.75	
05 05 19 00-0165	EA		3/8" Bolt Diameter, Zinc Plated Steel, Concrete Lag Shield Anchor.....	9.63	
			<i>For >10 To 50, Deduct</i>	-0.43	
			<i>For >50 To 100, Deduct</i>	-0.89	
			<i>For >100, Deduct</i>	-1.77	
05 05 19 00-0166	EA		1/2" Bolt Diameter, Zinc Plated Steel, Concrete Lag Shield Anchor.....	13.59	
			<i>For >10 To 50, Deduct</i>	-0.61	
			<i>For >50 To 100, Deduct</i>	-1.26	
			<i>For >100, Deduct</i>	-2.52	
05 05 19 00-0167	EA		5/8" Bolt Diameter, Zinc Plated Steel, Concrete Lag Shield Anchor.....	18.23	
			<i>For >10 To 50, Deduct</i>	-0.76	
			<i>For >50 To 100, Deduct</i>	-1.59	
			<i>For >100, Deduct</i>	-3.18	
05 05 19 00-0168	EA		3/4" Bolt Diameter, Zinc Plated Steel, Concrete Lag Shield Anchor.....	20.46	
			<i>For >10 To 50, Deduct</i>	-0.90	
			<i>For >50 To 100, Deduct</i>	-1.86	
			<i>For >100, Deduct</i>	-3.73	
05 05 19 00-0169			Chemical And Adhesive Anchors (05 05 19 00-0001)		
05 05 19 00-0170			Chemically Adhered Anchor Rods (05 05 19 00-0169)		
			Note: Includes drilling hole, injected adhesive or pre-placed adhesive cartridge, nut and washer. Zinc coated carbon steel.		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 19 00-0171 EA 1/4" x 1-9/16" Long Chemically Adhered Anchor Rod	9.86	
<i>For >10 To 50, Deduct</i>	-0.40	
<i>For >50 To 100, Deduct</i>	-0.85	
<i>For >100, Deduct</i>	-1.69	
05 05 19 00-0172 EA 5/16" x 2-3/8" Long Chemically Adhered Anchor Rod	11.44	
<i>For >10 To 50, Deduct</i>	-0.44	
<i>For >50 To 100, Deduct</i>	-0.94	
<i>For >100, Deduct</i>	-1.88	
05 05 19 00-0173 EA 3/8" x 2-3/4" Long Chemically Adhered Anchor Rod	14.21	
<i>For >10 To 50, Deduct</i>	-0.54	
<i>For >50 To 100, Deduct</i>	-1.17	
<i>For >100, Deduct</i>	-2.34	
05 05 19 00-0174 EA 1/2" x 3-11/16" Long Chemically Adhered Anchor Rod	16.65	
<i>For >10 To 50, Deduct</i>	-0.61	
<i>For >50 To 100, Deduct</i>	-1.34	
<i>For >100, Deduct</i>	-2.67	
05 05 19 00-0175 EA 1/2" x 5-1/2" Long Chemically Adhered Anchor Rod	17.65	
<i>For >10 To 50, Deduct</i>	-0.61	
<i>For >50 To 100, Deduct</i>	-1.36	
<i>For >100, Deduct</i>	-2.72	
05 05 19 00-0176 EA 5/8" x 7" Long Chemically Adhered Anchor Rod.....	21.84	
<i>For >10 To 50, Deduct</i>	-0.76	
<i>For >50 To 100, Deduct</i>	-1.68	
<i>For >100, Deduct</i>	-3.36	
05 05 19 00-0177 EA 3/4" x 9-1/2" Long Chemically Adhered Anchor Rod	28.40	
<i>For >10 To 50, Deduct</i>	-0.90	
<i>For >50 To 100, Deduct</i>	-2.06	
<i>For >100, Deduct</i>	-4.12	
05 05 19 00-0178 EA 7/8" x 10" Long Chemically Adhered Anchor Rod.....	33.68	
<i>For >10 To 50, Deduct</i>	-0.98	
<i>For >50 To 100, Deduct</i>	-2.31	
<i>For >100, Deduct</i>	-4.61	
05 05 19 00-0179 EA 1" x 11-3/4" Long Chemically Adhered Anchor Rod	46.05	
<i>For >10 To 50, Deduct</i>	-1.27	
<i>For >50 To 100, Deduct</i>	-3.05	
<i>For >100, Deduct</i>	-6.10	
05 05 19 00-0180 EA 1-1/4" x 14" Long Chemically Adhered Anchor Rod	66.17	
<i>For >10 To 50, Deduct</i>	-1.60	
<i>For >50 To 100, Deduct</i>	-4.05	
<i>For >100, Deduct</i>	-8.10	
05 05 19 00-0181 Chemical Adhesives For Bolts, Dowels Or Threaded Rod <small>(05 05 19 00-0169)</small>		
<small>Note: Injected or drop in cartridge. Sizes listed are for the diameter of the bolt, dowel or rod to be anchored. Includes drilling. Excludes bolt, dowel or rod.</small>		
05 05 19 00-0182 EA 1/4" Chemical Adhesive For Bolt Or Threaded Rod	8.21	
<i>For >10 To 50, Deduct</i>	-0.40	
<i>For >50 To 100, Deduct</i>	-0.80	
<i>For >100, Deduct</i>	-1.61	
05 05 19 00-0183 EA 5/16" Chemical Adhesive For Bolt, Dowel Or Threaded Rod.....	8.99	
<i>For >10 To 50, Deduct</i>	-0.44	
<i>For >50 To 100, Deduct</i>	-0.88	
<i>For >100, Deduct</i>	-1.75	
05 05 19 00-0184 EA 3/8" Chemical Adhesive For Bolt, Dowel Or Threaded Rod.....	11.27	
<i>For >10 To 50, Deduct</i>	-0.54	
<i>For >50 To 100, Deduct</i>	-1.10	
<i>For >100, Deduct</i>	-2.20	
05 05 19 00-0185 EA 1/2" Chemical Adhesive For Bolt, Dowel Or Threaded Rod.....	12.81	
<i>For >10 To 50, Deduct</i>	-0.61	
<i>For >50 To 100, Deduct</i>	-1.24	
<i>For >100, Deduct</i>	-2.48	
05 05 19 00-0186 EA 5/8" Chemical Adhesive For Bolt, Dowel Or Threaded Rod.....	16.48	
<i>For >10 To 50, Deduct</i>	-0.76	
<i>For >50 To 100, Deduct</i>	-1.55	
<i>For >100, Deduct</i>	-3.10	
05 05 19 00-0187 EA 3/4" Chemical Adhesive For Bolt, Dowel Or Threaded Rod.....	20.36	
<i>For >10 To 50, Deduct</i>	-0.90	
<i>For >50 To 100, Deduct</i>	-1.86	
<i>For >100, Deduct</i>	-3.72	
05 05 19 00-0188 EA 7/8" Chemical Adhesive For Bolt, Dowel Or Threaded Rod.....	22.61	
<i>For >10 To 50, Deduct</i>	-0.98	
<i>For >50 To 100, Deduct</i>	-2.03	
<i>For >100, Deduct</i>	-4.06	
05 05 19 00-0189 EA 1" Chemical Adhesive For Bolt, Dowel Or Threaded Rod.....	29.97	
<i>For >10 To 50, Deduct</i>	-1.27	
<i>For >50 To 100, Deduct</i>	-2.65	
<i>For >100, Deduct</i>	-5.30	
05 05 19 00-0190 EA 1-1/8" Chemical Adhesive For Bolt, Dowel Or Threaded Rod	34.34	
<i>For >10 To 50, Deduct</i>	-1.43	
<i>For >50 To 100, Deduct</i>	-3.00	
<i>For >100, Deduct</i>	-6.01	
05 05 19 00-0191 EA 1-1/4" Chemical Adhesive For Bolt, Dowel Or Threaded Rod	39.37	
<i>For >10 To 50, Deduct</i>	-1.60	
<i>For >50 To 100, Deduct</i>	-3.38	
<i>For >100, Deduct</i>	-6.76	

05 Metals**05 05 Common Work Results For Metals****05 05 19 Post-Installed Concrete Anchors**

MINOR		TOTAL DIRECT	DEMOLITION
CSI	UOM DESCRIPTION	UNIT COST	UNIT COST
05 05 19 00-0192	EA 1-3/8" Chemical Adhesive For Bolt, Dowel Or Threaded Rod.....	42.68	
	<i>For >10 To 50, Deduct</i>	-1.67	
	<i>For >50 To 100, Deduct</i>	-3.57	
	<i>For >100, Deduct</i>	-7.14	
05 05 19 00-0193	EA 1-1/2" Chemical Adhesive For Bolt, Dowel Or Threaded Rod.....	47.22	
	<i>For >10 To 50, Deduct</i>	-1.74	
	<i>For >50 To 100, Deduct</i>	-3.79	
	<i>For >100, Deduct</i>	-7.58	
05 05 19 00-0194	EA 1-3/4" Chemical Adhesive For Bolt, Dowel Or Threaded Rod.....	56.34	
	<i>For >10 To 50, Deduct</i>	-1.89	
	<i>For >50 To 100, Deduct</i>	-4.24	
	<i>For >100, Deduct</i>	-8.48	
05 05 19 00-0195	EA 2" Chemical Adhesive For Bolt, Dowel Or Threaded Rod.....	76.40	
	<i>For >10 To 50, Deduct</i>	-1.96	
	<i>For >50 To 100, Deduct</i>	-4.85	
	<i>For >100, Deduct</i>	-9.70	
05 05 19 00-0196	Grout Concrete Anchor Bolt Or Threaded Rod (05 05 19 00-0169)		
05 05 19 00-0197	EA Grout Concrete Anchor Bolt or Threaded Rod.....	3.44	
	<i>For >10 To 50, Deduct</i>	-0.17	
	<i>For >50 To 100, Deduct</i>	-0.34	
	<i>For >100, Deduct</i>	-0.67	
05 05 19 00-0198	Other Concrete And Masonry Anchors (05 05 19 00-0001)		
05 05 19 00-0199	Tapcon Masonry Screws (05 05 19 00-0198) Note: Includes drilling. Countersunk or hex head.		
05 05 19 00-0200	EA 3/16" x 1-1/4" Tapcon Masonry Screw.....	7.44	
	<i>For >10 To 50, Deduct</i>	-0.36	
	<i>For >50 To 100, Deduct</i>	-0.73	
	<i>For >100, Deduct</i>	-1.46	
05 05 19 00-0201	EA 3/16" x 2-1/4" Tapcon Masonry Screw.....	7.49	
	<i>For >10 To 50, Deduct</i>	-0.36	
	<i>For >50 To 100, Deduct</i>	-0.73	
	<i>For >100, Deduct</i>	-1.46	
05 05 19 00-0202	EA 3/16" x 3-1/4" Tapcon Masonry Screw.....	7.59	
	<i>For >10 To 50, Deduct</i>	-0.36	
	<i>For >50 To 100, Deduct</i>	-0.73	
	<i>For >100, Deduct</i>	-1.47	
05 05 19 00-0203	EA 1/4" x 1-1/4" Tapcon Masonry Screw.....	7.49	
	<i>For >10 To 50, Deduct</i>	-0.36	
	<i>For >50 To 100, Deduct</i>	-0.73	
	<i>For >100, Deduct</i>	-1.46	
05 05 19 00-0204	EA 1/4" x 2-1/4" Tapcon Masonry Screw.....	7.55	
	<i>For >10 To 50, Deduct</i>	-0.36	
	<i>For >50 To 100, Deduct</i>	-0.73	
	<i>For >100, Deduct</i>	-1.47	
05 05 19 00-0205	EA 1/4" x 3-1/4" Tapcon Masonry Screw.....	7.68	
	<i>For >10 To 50, Deduct</i>	-0.36	
	<i>For >50 To 100, Deduct</i>	-0.74	
	<i>For >100, Deduct</i>	-1.47	
05 05 19 00-0206	Large Diameter, Self-Threading Concrete Fasteners (05 05 19 00-0198) Note: Includes drilling. Zinc plated.		
05 05 19 00-0207	EA 3/8" x 1-3/4", Large Diameter, Self-Threading Concrete Fastener.....	7.92	
	<i>For >10 To 50, Deduct</i>	-0.36	
	<i>For >50 To 100, Deduct</i>	-0.74	
	<i>For >100, Deduct</i>	-1.48	
05 05 19 00-0208	EA 3/8" x 2-1/2", Large Diameter, Self-Threading Concrete Fastener.....	8.16	
	<i>For >10 To 50, Deduct</i>	-0.36	
	<i>For >50 To 100, Deduct</i>	-0.75	
	<i>For >100, Deduct</i>	-1.50	
05 05 19 00-0209	EA 3/8" x 3", Large Diameter, Self-Threading Concrete Fastener.....	8.23	
	<i>For >10 To 50, Deduct</i>	-0.36	
	<i>For >50 To 100, Deduct</i>	-0.75	
	<i>For >100, Deduct</i>	-1.50	
05 05 19 00-0210	EA 3/8" x 4", Large Diameter, Self-Threading Concrete Fastener.....	8.34	
	<i>For >10 To 50, Deduct</i>	-0.36	
	<i>For >50 To 100, Deduct</i>	-0.75	
	<i>For >100, Deduct</i>	-1.50	
05 05 19 00-0211	EA 3/8" x 5", Large Diameter, Self-Threading Concrete Fastener.....	8.44	
	<i>For >10 To 50, Deduct</i>	-0.36	
	<i>For >50 To 100, Deduct</i>	-0.75	
	<i>For >100, Deduct</i>	-1.51	
05 05 19 00-0212	EA 1/2" x 3", Large Diameter, Self-Threading Concrete Fastener.....	8.65	
	<i>For >10 To 50, Deduct</i>	-0.36	
	<i>For >50 To 100, Deduct</i>	-0.76	
	<i>For >100, Deduct</i>	-1.52	
05 05 19 00-0213	EA 1/2" x 4", Large Diameter, Self-Threading Concrete Fastener.....	8.91	
	<i>For >10 To 50, Deduct</i>	-0.36	
	<i>For >50 To 100, Deduct</i>	-0.77	
	<i>For >100, Deduct</i>	-1.53	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 19 00-0214 EA 1/2" x 5", Large Diameter, Self-Threading Concrete Fastener.....	9.15	
<i>For >10 To 50, Deduct</i>	-0.36	
<i>For >50 To 100, Deduct</i>	-0.77	
<i>For >100, Deduct</i>	-1.55	
05 05 19 00-0215 EA 1/2" x 6", Large Diameter, Self-Threading Concrete Fastener.....	9.81	
<i>For >10 To 50, Deduct</i>	-0.36	
<i>For >50 To 100, Deduct</i>	-0.79	
<i>For >100, Deduct</i>	-1.58	
05 05 19 00-0216 EA 5/8" x 3", Large Diameter, Self-Threading Concrete Fastener.....	9.89	
<i>For >10 To 50, Deduct</i>	-0.36	
<i>For >50 To 100, Deduct</i>	-0.79	
<i>For >100, Deduct</i>	-1.58	
05 05 19 00-0217 EA 5/8" x 4", Large Diameter, Self-Threading Concrete Fastener.....	10.30	
<i>For >10 To 50, Deduct</i>	-0.36	
<i>For >50 To 100, Deduct</i>	-0.80	
<i>For >100, Deduct</i>	-1.60	
05 05 19 00-0218 EA 5/8" x 5", Large Diameter, Self-Threading Concrete Fastener.....	10.72	
<i>For >10 To 50, Deduct</i>	-0.36	
<i>For >50 To 100, Deduct</i>	-0.81	
<i>For >100, Deduct</i>	-1.62	
05 05 19 00-0219 EA 5/8" x 6", Large Diameter, Self-Threading Concrete Fastener.....	10.99	
<i>For >10 To 50, Deduct</i>	-0.36	
<i>For >50 To 100, Deduct</i>	-0.82	
<i>For >100, Deduct</i>	-1.64	
05 05 19 00-0220 EA 3/4" x 4-1/2", Large Diameter, Self-Threading Concrete Fastener.....	10.87	
<i>For >10 To 50, Deduct</i>	-0.36	
<i>For >50 To 100, Deduct</i>	-0.82	
<i>For >100, Deduct</i>	-1.63	
05 05 19 00-0221 EA 3/4" x 5-1/2", Large Diameter, Self-Threading Concrete Fastener.....	11.25	
<i>For >10 To 50, Deduct</i>	-0.36	
<i>For >50 To 100, Deduct</i>	-0.83	
<i>For >100, Deduct</i>	-1.65	
05 05 19 00-0222 EA 3/4" x 6-1/4", Large Diameter, Self-Threading Concrete Fastener.....	12.16	
<i>For >10 To 50, Deduct</i>	-0.36	
<i>For >50 To 100, Deduct</i>	-0.85	
<i>For >100, Deduct</i>	-1.70	
05 05 19 00-0223 Pin Bolt Drives <small>(05 05 19 00-0198)</small>		
Note: Includes drilling. Zinc plated.		
05 05 19 00-0224 EA 1/4" x 1" Pin Bolt Drive.....	4.63	
<i>For >10 To 50, Deduct</i>	-0.22	
<i>For >50 To 100, Deduct</i>	-0.44	
<i>For >100, Deduct</i>	-0.88	
05 05 19 00-0225 EA 1/4" x 1-1/4" Pin Bolt Drive.....	4.63	
<i>For >10 To 50, Deduct</i>	-0.22	
<i>For >50 To 100, Deduct</i>	-0.44	
<i>For >100, Deduct</i>	-0.88	
05 05 19 00-0226 EA 1/4" x 1-1/2" Pin Bolt Drive.....	4.67	
<i>For >10 To 50, Deduct</i>	-0.22	
<i>For >50 To 100, Deduct</i>	-0.44	
<i>For >100, Deduct</i>	-0.89	
05 05 19 00-0227 EA 1/4" x 2" Pin Bolt Drive.....	4.68	
<i>For >10 To 50, Deduct</i>	-0.22	
<i>For >50 To 100, Deduct</i>	-0.44	
<i>For >100, Deduct</i>	-0.89	
05 05 19 00-0228 Powder Actuated, Shot-In Place Anchors With Exposed Thread <small>(05 05 19 00-0198)</small>		
05 05 19 00-0229 EA 1/4" Diameter Threaded Stud Powder Actuated Anchor.....	10.50	
<i>For >10 To 50, Deduct</i>	-0.51	
<i>For >50 To 100, Deduct</i>	-1.02	
<i>For >100, Deduct</i>	-2.05	
05 05 19 00-0230 EA 3/8" Diameter Threaded Stud Powder Actuated Anchor.....	12.93	
<i>For >10 To 50, Deduct</i>	-0.62	
<i>For >50 To 100, Deduct</i>	-1.25	
<i>For >100, Deduct</i>	-2.49	
05 05 23 Metal Fastenings <small>(05 05)</small>		
05 05 23 00-0001 Hex Bolts <small>(05 05 23)</small>		
Note: For owner furnished materials or where requested by the owner. Excludes drilling through wood, steel, concrete, brick or block. See CSI section 02 41 19 13-0260 for drilling into concrete, 02 41 19 13-0270 for drilling into brick or block, 02 41 19 13-0280 for drilling into wood or plastic, 05 05 23 00-1567 for drilling through steel.		
05 05 23 00-0002 A307B Heavy Hex Bolts <small>(05 05 23 00-0001)</small>		
Note: Includes A307B heavy hex nut and two structural washers.		
05 05 23 00-0003 Plain Finish A307B Heavy Hex Bolts <small>(05 05 23 00-0002)</small>		
05 05 23 00-0004 EA 1/2" Diameter x 1-1/2" Long, Plain Finish A307B Heavy Hex Bolt.....	10.43	1.08
<i>For >10 To 50, Deduct</i>	-0.45	
<i>For >50 To 100, Deduct</i>	-0.94	
<i>For >100, Deduct</i>	-1.87	

05 Metals**05 05 Common Work Results For Metals****05 05 23 Metal Fastenings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-0005	EA		1/2" Diameter x 3" Long, Plain Finish A307B Heavy Hex Bolt	11.25	1.08
			<i>For >10 To 50, Deduct</i>	-0.45	
			<i>For >50 To 100, Deduct</i>	-0.96	
			<i>For >100, Deduct</i>	-1.92	
05 05 23 00-0006	EA		5/8" Diameter x 2" Long, Plain Finish A307B Heavy Hex Bolt	11.27	1.08
			<i>For >10 To 50, Deduct</i>	-0.45	
			<i>For >50 To 100, Deduct</i>	-0.96	
			<i>For >100, Deduct</i>	-1.92	
05 05 23 00-0007	EA		5/8" Diameter x 4" Long, Plain Finish A307B Heavy Hex Bolt	13.30	1.24
			<i>For >10 To 50, Deduct</i>	-0.52	
			<i>For >50 To 100, Deduct</i>	-1.11	
			<i>For >100, Deduct</i>	-2.21	
05 05 23 00-0008	EA		3/4" Diameter x 2" Long, Plain Finish A307B Heavy Hex Bolt	12.64	1.08
			<i>For >10 To 50, Deduct</i>	-0.45	
			<i>For >50 To 100, Deduct</i>	-0.99	
			<i>For >100, Deduct</i>	-1.99	
05 05 23 00-0009	EA		3/4" Diameter x 4" Long, Plain Finish A307B Heavy Hex Bolt	15.00	1.24
			<i>For >10 To 50, Deduct</i>	-0.51	
			<i>For >50 To 100, Deduct</i>	-1.15	
			<i>For >100, Deduct</i>	-2.29	
05 05 23 00-0010	EA		3/4" Diameter x 6" Long, Plain Finish A307B Heavy Hex Bolt	18.34	1.29
			<i>For >10 To 50, Deduct</i>	-0.54	
			<i>For >50 To 100, Deduct</i>	-1.27	
			<i>For >100, Deduct</i>	-2.53	
05 05 23 00-0011	EA		3/4" Diameter x 8" Long, Plain Finish A307B Heavy Hex Bolt	19.63	1.36
			<i>For >10 To 50, Deduct</i>	-0.57	
			<i>For >50 To 100, Deduct</i>	-1.34	
			<i>For >100, Deduct</i>	-2.68	
05 05 23 00-0012	EA		7/8" Diameter x 2" Long, Plain Finish A307B Heavy Hex Bolt	14.86	1.17
			<i>For >10 To 50, Deduct</i>	-0.49	
			<i>For >50 To 100, Deduct</i>	-1.11	
			<i>For >100, Deduct</i>	-2.21	
05 05 23 00-0013	EA		7/8" Diameter x 4" Long, Plain Finish A307B Heavy Hex Bolt	17.62	1.29
			<i>For >10 To 50, Deduct</i>	-0.54	
			<i>For >50 To 100, Deduct</i>	-1.25	
			<i>For >100, Deduct</i>	-2.49	
05 05 23 00-0014	EA		1" Diameter x 4" Long, Plain Finish A307B Heavy Hex Bolt	20.36	1.36
			<i>For >10 To 50, Deduct</i>	-0.57	
			<i>For >50 To 100, Deduct</i>	-1.36	
			<i>For >100, Deduct</i>	-2.71	
05 05 23 00-0015	EA		1" Diameter x 6" Long, Plain Finish A307B Heavy Hex Bolt	27.88	1.43
			<i>For >10 To 50, Deduct</i>	-0.59	
			<i>For >50 To 100, Deduct</i>	-1.59	
			<i>For >100, Deduct</i>	-3.18	
05 05 23 00-0016	EA		1-1/4" Diameter x 4" Long, Plain Finish A307B Heavy Hex Bolt	32.51	1.61
			<i>For >10 To 50, Deduct</i>	-0.67	
			<i>For >50 To 100, Deduct</i>	-1.82	
			<i>For >100, Deduct</i>	-3.64	
05 05 23 00-0017	EA		1-1/4" Diameter x 6" Long, Plain Finish A307B Heavy Hex Bolt	36.38	1.72
			<i>For >10 To 50, Deduct</i>	-0.72	
			<i>For >50 To 100, Deduct</i>	-1.99	
			<i>For >100, Deduct</i>	-3.98	
05 05 23 00-0018			Galvanized A307B Heavy Hex Bolts <small>(05 05 23 00-0002)</small>		
05 05 23 00-0019	EA		1/2" Diameter x 1-1/2" Long, Galvanized A307B Heavy Hex Bolt	10.84	1.08
			<i>For >10 To 50, Deduct</i>	-0.45	
			<i>For >50 To 100, Deduct</i>	-0.95	
			<i>For >100, Deduct</i>	-1.90	
05 05 23 00-0020	EA		1/2" Diameter x 3" Long, Galvanized A307B Heavy Hex Bolt	11.52	1.08
			<i>For >10 To 50, Deduct</i>	-0.45	
			<i>For >50 To 100, Deduct</i>	-0.96	
			<i>For >100, Deduct</i>	-1.93	
05 05 23 00-0021	EA		5/8" Diameter x 2" Long, Galvanized A307B Heavy Hex Bolt	12.26	1.08
			<i>For >10 To 50, Deduct</i>	-0.45	
			<i>For >50 To 100, Deduct</i>	-0.98	
			<i>For >100, Deduct</i>	-1.97	
05 05 23 00-0022	EA		5/8" Diameter x 4" Long, Galvanized A307B Heavy Hex Bolt	14.29	1.24
			<i>For >10 To 50, Deduct</i>	-0.52	
			<i>For >50 To 100, Deduct</i>	-1.13	
			<i>For >100, Deduct</i>	-2.26	
05 05 23 00-0023	EA		3/4" Diameter x 2" Long, Galvanized A307B Heavy Hex Bolt	13.76	1.08
			<i>For >10 To 50, Deduct</i>	-0.45	
			<i>For >50 To 100, Deduct</i>	-1.02	
			<i>For >100, Deduct</i>	-2.04	
05 05 23 00-0024	EA		3/4" Diameter x 4" Long, Galvanized A307B Heavy Hex Bolt	17.07	1.24
			<i>For >10 To 50, Deduct</i>	-0.51	
			<i>For >50 To 100, Deduct</i>	-1.20	
			<i>For >100, Deduct</i>	-2.40	
05 05 23 00-0025	EA		3/4" Diameter x 6" Long, Galvanized A307B Heavy Hex Bolt	21.92	1.29
			<i>For >10 To 50, Deduct</i>	-0.54	
			<i>For >50 To 100, Deduct</i>	-1.36	
			<i>For >100, Deduct</i>	-2.71	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-0026 EA 3/4" Diameter x 8" Long, Galvanized A307B Heavy Hex Bolt.....	25.41	1.36
<i>For >10 To 50, Deduct</i>	-0.57	
<i>For >50 To 100, Deduct</i>	-1.48	
<i>For >100, Deduct</i>	-2.97	
05 05 23 00-0027 EA 7/8" Diameter x 2" Long, Galvanized A307B Heavy Hex Bolt.....	17.80	1.17
<i>For >10 To 50, Deduct</i>	-0.49	
<i>For >50 To 100, Deduct</i>	-1.18	
<i>For >100, Deduct</i>	-2.36	
05 05 23 00-0028 EA 7/8" Diameter x 4" Long, Galvanized A307B Heavy Hex Bolt.....	20.93	1.29
<i>For >10 To 50, Deduct</i>	-0.54	
<i>For >50 To 100, Deduct</i>	-1.33	
<i>For >100, Deduct</i>	-2.66	
05 05 23 00-0029 EA 1" Diameter x 4" Long, Galvanized A307B Heavy Hex Bolt.....	24.63	1.36
<i>For >10 To 50, Deduct</i>	-0.57	
<i>For >50 To 100, Deduct</i>	-1.46	
<i>For >100, Deduct</i>	-2.93	
05 05 23 00-0030 EA 1" Diameter x 6" Long, Galvanized A307B Heavy Hex Bolt.....	35.63	1.43
<i>For >10 To 50, Deduct</i>	-0.59	
<i>For >50 To 100, Deduct</i>	-1.78	
<i>For >100, Deduct</i>	-3.57	
05 05 23 00-0031 EA 1-1/4" Diameter x 4" Long, Galvanized A307B Heavy Hex Bolt.....	35.98	1.61
<i>For >10 To 50, Deduct</i>	-0.67	
<i>For >50 To 100, Deduct</i>	-1.91	
<i>For >100, Deduct</i>	-3.81	
05 05 23 00-0032 EA 1-1/4" Diameter x 6" Long, Galvanized A307B Heavy Hex Bolt.....	44.40	1.72
<i>For >10 To 50, Deduct</i>	-0.72	
<i>For >50 To 100, Deduct</i>	-2.19	
<i>For >100, Deduct</i>	-4.38	
05 05 23 00-0033 A325 High Strength Structural Bolts <small>(05 05 23 00-0001)</small>		
05 05 23 00-0034 Plain Finish A325 High Strength Structural Bolts <small>(05 05 23 00-0033)</small>		
Note: Includes A325 heavy hex nut and structural washer.		
05 05 23 00-0035 EA 1/2" Diameter x 1-1/2" Long, Plain Finish A325 High Strength Structural Bolt.....	10.24	1.08
<i>For >10 To 50, Deduct</i>	-0.45	
<i>For >50 To 100, Deduct</i>	-0.93	
<i>For >100, Deduct</i>	-1.87	
05 05 23 00-0036 EA 1/2" Diameter x 3" Long, Plain Finish A325 High Strength Structural Bolt.....	10.42	1.08
<i>For >10 To 50, Deduct</i>	-0.45	
<i>For >50 To 100, Deduct</i>	-0.94	
<i>For >100, Deduct</i>	-1.87	
05 05 23 00-0037 EA 5/8" Diameter x 2" Long, Plain Finish A325 High Strength Structural Bolt.....	11.00	1.08
<i>For >10 To 50, Deduct</i>	-0.45	
<i>For >50 To 100, Deduct</i>	-0.95	
<i>For >100, Deduct</i>	-1.90	
05 05 23 00-0038 EA 5/8" Diameter x 4" Long, Plain Finish A325 High Strength Structural Bolt.....	13.32	1.24
<i>For >10 To 50, Deduct</i>	-0.52	
<i>For >50 To 100, Deduct</i>	-1.11	
<i>For >100, Deduct</i>	-2.21	
05 05 23 00-0039 EA 5/8" Diameter x 6" Long, Plain Finish A325 High Strength Structural Bolt.....	15.15	1.29
<i>For >10 To 50, Deduct</i>	-0.54	
<i>For >50 To 100, Deduct</i>	-1.19	
<i>For >100, Deduct</i>	-2.37	
05 05 23 00-0040 EA 3/4" Diameter x 2" Long, Plain Finish A325 High Strength Structural Bolt.....	11.80	1.08
<i>For >10 To 50, Deduct</i>	-0.45	
<i>For >50 To 100, Deduct</i>	-0.97	
<i>For >100, Deduct</i>	-1.94	
05 05 23 00-0041 EA 3/4" Diameter x 4" Long, Plain Finish A325 High Strength Structural Bolt.....	14.17	1.24
<i>For >10 To 50, Deduct</i>	-0.51	
<i>For >50 To 100, Deduct</i>	-1.13	
<i>For >100, Deduct</i>	-2.25	
05 05 23 00-0042 EA 3/4" Diameter x 6" Long, Plain Finish A325 High Strength Structural Bolt.....	15.91	1.29
<i>For >10 To 50, Deduct</i>	-0.54	
<i>For >50 To 100, Deduct</i>	-1.20	
<i>For >100, Deduct</i>	-2.41	
05 05 23 00-0043 EA 3/4" Diameter x 8" Long, Plain Finish A325 High Strength Structural Bolt.....	19.12	1.36
<i>For >10 To 50, Deduct</i>	-0.57	
<i>For >50 To 100, Deduct</i>	-1.33	
<i>For >100, Deduct</i>	-2.65	
05 05 23 00-0044 EA 7/8" Diameter x 2" Long, Plain Finish A325 High Strength Structural Bolt.....	13.54	1.17
<i>For >10 To 50, Deduct</i>	-0.49	
<i>For >50 To 100, Deduct</i>	-1.07	
<i>For >100, Deduct</i>	-2.14	
05 05 23 00-0045 EA 7/8" Diameter x 4" Long, Plain Finish A325 High Strength Structural Bolt.....	16.22	1.29
<i>For >10 To 50, Deduct</i>	-0.54	
<i>For >50 To 100, Deduct</i>	-1.21	
<i>For >100, Deduct</i>	-2.42	
05 05 23 00-0046 EA 7/8" Diameter x 6" Long, Plain Finish A325 High Strength Structural Bolt.....	18.29	1.36
<i>For >10 To 50, Deduct</i>	-0.57	
<i>For >50 To 100, Deduct</i>	-1.31	
<i>For >100, Deduct</i>	-2.61	
05 05 23 00-0047 EA 7/8" Diameter x 8" Long, Plain Finish A325 High Strength Structural Bolt.....	19.74	1.43
<i>For >10 To 50, Deduct</i>	-0.59	
<i>For >50 To 100, Deduct</i>	-1.39	
<i>For >100, Deduct</i>	-2.77	

05 Metals**05 05 Common Work Results For Metals****05 05 23 Metal Fastenings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-0048	EA		1" Diameter x 2" Long, Plain Finish A325 High Strength Structural Bolt.....	14.82	1.22
			<i>For >10 To 50, Deduct</i>	-0.51	
			<i>For >50 To 100, Deduct</i>	-1.13	
			<i>For >100, Deduct</i>	-2.27	
05 05 23 00-0049	EA		1" Diameter x 4" Long, Plain Finish A325 High Strength Structural Bolt.....	17.61	1.36
			<i>For >10 To 50, Deduct</i>	-0.57	
			<i>For >50 To 100, Deduct</i>	-1.29	
			<i>For >100, Deduct</i>	-2.58	
05 05 23 00-0050	EA		1" Diameter x 6" Long, Plain Finish A325 High Strength Structural Bolt.....	20.12	1.43
			<i>For >10 To 50, Deduct</i>	-0.59	
			<i>For >50 To 100, Deduct</i>	-1.39	
			<i>For >100, Deduct</i>	-2.79	
05 05 23 00-0051	EA		1" Diameter x 8" Long, Plain Finish A325 High Strength Structural Bolt.....	25.18	1.52
			<i>For >10 To 50, Deduct</i>	-0.63	
			<i>For >50 To 100, Deduct</i>	-1.58	
			<i>For >100, Deduct</i>	-3.16	
05 05 23 00-0052	EA		1-1/4" Diameter x 3" Long, Plain Finish A325 High Strength Structural Bolt.....	24.17	1.52
			<i>For >10 To 50, Deduct</i>	-0.63	
			<i>For >50 To 100, Deduct</i>	-1.55	
			<i>For >100, Deduct</i>	-3.11	
05 05 23 00-0053	EA		1-1/4" Diameter x 4" Long, Plain Finish A325 High Strength Structural Bolt.....	27.19	1.61
			<i>For >10 To 50, Deduct</i>	-0.67	
			<i>For >50 To 100, Deduct</i>	-1.69	
			<i>For >100, Deduct</i>	-3.37	
05 05 23 00-0054	EA		1-1/4" Diameter x 6" Long, Plain Finish A325 High Strength Structural Bolt.....	31.58	1.72
			<i>For >10 To 50, Deduct</i>	-0.72	
			<i>For >50 To 100, Deduct</i>	-1.87	
			<i>For >100, Deduct</i>	-3.74	
05 05 23 00-0055	EA		1-1/4" Diameter x 8" Long, Plain Finish A325 High Strength Structural Bolt.....	36.73	1.84
			<i>For >10 To 50, Deduct</i>	-0.77	
			<i>For >50 To 100, Deduct</i>	-2.07	
			<i>For >100, Deduct</i>	-4.14	
05 05 23 00-0056			Galvanized A325 High Strength Structural Bolts (05 05 23 00-0033)		
			Note: Includes A325 heavy hex nut and structural washer.		
05 05 23 00-0057	EA		1/2" Diameter x 1-1/2" Long, Galvanized A325 High Strength Structural Bolt.....	10.61	1.08
			<i>For >10 To 50, Deduct</i>	-0.45	
			<i>For >50 To 100, Deduct</i>	-0.94	
			<i>For >100, Deduct</i>	-1.88	
05 05 23 00-0058	EA		1/2" Diameter x 3" Long, Galvanized A325 High Strength Structural Bolt.....	10.73	1.08
			<i>For >10 To 50, Deduct</i>	-0.45	
			<i>For >50 To 100, Deduct</i>	-0.94	
			<i>For >100, Deduct</i>	-1.89	
05 05 23 00-0059	EA		5/8" Diameter x 2" Long, Galvanized A325 High Strength Structural Bolt.....	11.76	1.08
			<i>For >10 To 50, Deduct</i>	-0.45	
			<i>For >50 To 100, Deduct</i>	-0.97	
			<i>For >100, Deduct</i>	-1.94	
05 05 23 00-0060	EA		5/8" Diameter x 4" Long, Galvanized A325 High Strength Structural Bolt.....	13.86	1.24
			<i>For >10 To 50, Deduct</i>	-0.52	
			<i>For >50 To 100, Deduct</i>	-1.12	
			<i>For >100, Deduct</i>	-2.24	
05 05 23 00-0061	EA		5/8" Diameter x 6" Long, Galvanized A325 High Strength Structural Bolt.....	14.63	1.29
			<i>For >10 To 50, Deduct</i>	-0.54	
			<i>For >50 To 100, Deduct</i>	-1.17	
			<i>For >100, Deduct</i>	-2.35	
05 05 23 00-0062	EA		3/4" Diameter x 2" Long, Galvanized A325 High Strength Structural Bolt.....	12.15	1.08
			<i>For >10 To 50, Deduct</i>	-0.45	
			<i>For >50 To 100, Deduct</i>	-0.98	
			<i>For >100, Deduct</i>	-1.96	
05 05 23 00-0063	EA		3/4" Diameter x 4" Long, Galvanized A325 High Strength Structural Bolt.....	14.61	1.24
			<i>For >10 To 50, Deduct</i>	-0.51	
			<i>For >50 To 100, Deduct</i>	-1.14	
			<i>For >100, Deduct</i>	-2.27	
05 05 23 00-0064	EA		3/4" Diameter x 6" Long, Galvanized A325 High Strength Structural Bolt.....	16.59	1.29
			<i>For >10 To 50, Deduct</i>	-0.54	
			<i>For >50 To 100, Deduct</i>	-1.22	
			<i>For >100, Deduct</i>	-2.44	
05 05 23 00-0065	EA		3/4" Diameter x 8" Long, Galvanized A325 High Strength Structural Bolt.....	20.74	1.36
			<i>For >10 To 50, Deduct</i>	-0.57	
			<i>For >50 To 100, Deduct</i>	-1.37	
			<i>For >100, Deduct</i>	-2.73	
05 05 23 00-0066	EA		7/8" Diameter x 2" Long, Galvanized A325 High Strength Structural Bolt.....	15.64	1.17
			<i>For >10 To 50, Deduct</i>	-0.49	
			<i>For >50 To 100, Deduct</i>	-1.12	
			<i>For >100, Deduct</i>	-2.25	
05 05 23 00-0067	EA		7/8" Diameter x 4" Long, Galvanized A325 High Strength Structural Bolt.....	17.46	1.29
			<i>For >10 To 50, Deduct</i>	-0.54	
			<i>For >50 To 100, Deduct</i>	-1.24	
			<i>For >100, Deduct</i>	-2.48	
05 05 23 00-0068	EA		7/8" Diameter x 6" Long, Galvanized A325 High Strength Structural Bolt.....	19.79	1.36
			<i>For >10 To 50, Deduct</i>	-0.57	
			<i>For >50 To 100, Deduct</i>	-1.34	
			<i>For >100, Deduct</i>	-2.69	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-0069 EA 7/8" Diameter x 8" Long, Galvanized A325 High Strength Structural Bolt.....	24.25	1.43
<i>For >10 To 50, Deduct</i>	-0.59	
<i>For >50 To 100, Deduct</i>	-1.50	
<i>For >100, Deduct</i>	-3.00	
05 05 23 00-0070 EA 1" Diameter x 2" Long, Galvanized A325 High Strength Structural Bolt	16.45	1.22
<i>For >10 To 50, Deduct</i>	-0.51	
<i>For >50 To 100, Deduct</i>	-1.17	
<i>For >100, Deduct</i>	-2.35	
05 05 23 00-0071 EA 1" Diameter x 4" Long, Galvanized A325 High Strength Structural Bolt	21.35	1.36
<i>For >10 To 50, Deduct</i>	-0.57	
<i>For >50 To 100, Deduct</i>	-1.38	
<i>For >100, Deduct</i>	-2.76	
05 05 23 00-0072 EA 1" Diameter x 6" Long, Galvanized A325 High Strength Structural Bolt	23.25	1.43
<i>For >10 To 50, Deduct</i>	-0.59	
<i>For >50 To 100, Deduct</i>	-1.47	
<i>For >100, Deduct</i>	-2.95	
05 05 23 00-0073 EA 1" Diameter x 8" Long, Galvanized A325 High Strength Structural Bolt	29.04	1.52
<i>For >10 To 50, Deduct</i>	-0.63	
<i>For >50 To 100, Deduct</i>	-1.68	
<i>For >100, Deduct</i>	-3.35	
05 05 23 00-0074 EA 1-1/4" Diameter x 3" Long, Galvanized A325 High Strength Structural Bolt	28.88	1.52
<i>For >10 To 50, Deduct</i>	-0.63	
<i>For >50 To 100, Deduct</i>	-1.67	
<i>For >100, Deduct</i>	-3.34	
05 05 23 00-0075 EA 1-1/4" Diameter x 4" Long, Galvanized A325 High Strength Structural Bolt	30.79	1.61
<i>For >10 To 50, Deduct</i>	-0.67	
<i>For >50 To 100, Deduct</i>	-1.78	
<i>For >100, Deduct</i>	-3.55	
05 05 23 00-0076 EA 1-1/4" Diameter x 6" Long, Galvanized A325 High Strength Structural Bolt	35.71	1.72
<i>For >10 To 50, Deduct</i>	-0.72	
<i>For >50 To 100, Deduct</i>	-1.97	
<i>For >100, Deduct</i>	-3.94	
05 05 23 00-0077 EA 1-1/4" Diameter x 8" Long, Galvanized A325 High Strength Structural Bolt	41.04	1.84
<i>For >10 To 50, Deduct</i>	-0.77	
<i>For >50 To 100, Deduct</i>	-2.18	
<i>For >100, Deduct</i>	-4.35	
05 05 23 00-0078 A490 High Strength Structural Bolts <small>(05 05 23 00-0001)</small>		
Note: Includes A490 heavy hex nut and two structural washers.		
05 05 23 00-0079 Plain Finish A490 High Strength Structural Bolts <small>(05 05 23 00-0078)</small>		
05 05 23 00-0080 EA 5/8" Diameter x 2" Long, Plain Finish A490 High Strength Structural Bolt.....	11.29	1.08
<i>For >10 To 50, Deduct</i>	-0.45	
<i>For >50 To 100, Deduct</i>	-0.96	
<i>For >100, Deduct</i>	-1.92	
05 05 23 00-0081 EA 5/8" Diameter x 4" Long, Plain Finish A490 High Strength Structural Bolt.....	15.28	1.24
<i>For >10 To 50, Deduct</i>	-0.52	
<i>For >50 To 100, Deduct</i>	-1.15	
<i>For >100, Deduct</i>	-2.31	
05 05 23 00-0082 EA 5/8" Diameter x 6" Long, Plain Finish A490 High Strength Structural Bolt.....	16.28	1.29
<i>For >10 To 50, Deduct</i>	-0.54	
<i>For >50 To 100, Deduct</i>	-1.21	
<i>For >100, Deduct</i>	-2.43	
05 05 23 00-0083 EA 3/4" Diameter x 2" Long, Plain Finish A490 High Strength Structural Bolt.....	12.40	1.08
<i>For >10 To 50, Deduct</i>	-0.45	
<i>For >50 To 100, Deduct</i>	-0.99	
<i>For >100, Deduct</i>	-1.97	
05 05 23 00-0084 EA 3/4" Diameter x 4" Long, Plain Finish A490 High Strength Structural Bolt.....	14.84	1.24
<i>For >10 To 50, Deduct</i>	-0.51	
<i>For >50 To 100, Deduct</i>	-1.14	
<i>For >100, Deduct</i>	-2.29	
05 05 23 00-0085 EA 3/4" Diameter x 6" Long, Plain Finish A490 High Strength Structural Bolt.....	16.99	1.29
<i>For >10 To 50, Deduct</i>	-0.54	
<i>For >50 To 100, Deduct</i>	-1.23	
<i>For >100, Deduct</i>	-2.46	
05 05 23 00-0086 EA 3/4" Diameter x 8" Long, Plain Finish A490 High Strength Structural Bolt.....	21.23	1.36
<i>For >10 To 50, Deduct</i>	-0.57	
<i>For >50 To 100, Deduct</i>	-1.38	
<i>For >100, Deduct</i>	-2.76	
05 05 23 00-0087 EA 7/8" Diameter x 2" Long, Plain Finish A490 High Strength Structural Bolt.....	14.22	1.17
<i>For >10 To 50, Deduct</i>	-0.49	
<i>For >50 To 100, Deduct</i>	-1.09	
<i>For >100, Deduct</i>	-2.18	
05 05 23 00-0088 EA 7/8" Diameter x 4" Long, Plain Finish A490 High Strength Structural Bolt.....	16.43	1.29
<i>For >10 To 50, Deduct</i>	-0.54	
<i>For >50 To 100, Deduct</i>	-1.22	
<i>For >100, Deduct</i>	-2.43	
05 05 23 00-0089 EA 7/8" Diameter x 6" Long, Plain Finish A490 High Strength Structural Bolt.....	22.70	1.36
<i>For >10 To 50, Deduct</i>	-0.57	
<i>For >50 To 100, Deduct</i>	-1.42	
<i>For >100, Deduct</i>	-2.83	
05 05 23 00-0090 EA 1" Diameter x 2" Long, Plain Finish A490 High Strength Structural Bolt.....	16.41	1.22
<i>For >10 To 50, Deduct</i>	-0.51	
<i>For >50 To 100, Deduct</i>	-1.17	
<i>For >100, Deduct</i>	-2.35	

05 Metals**05 05 Common Work Results For Metals****05 05 23 Metal Fastenings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-0091	EA		1" Diameter x 4" Long, Plain Finish A490 High Strength Structural Bolt.....	19.40	1.36
			<i>For >10 To 50, Deduct</i>	-0.57	
			<i>For >50 To 100, Deduct</i>	-1.33	
			<i>For >100, Deduct</i>	-2.67	
05 05 23 00-0092	EA		1" Diameter x 6" Long, Plain Finish A490 High Strength Structural Bolt.....	22.05	1.43
			<i>For >10 To 50, Deduct</i>	-0.59	
			<i>For >50 To 100, Deduct</i>	-1.44	
			<i>For >100, Deduct</i>	-2.89	
05 05 23 00-0093	EA		1-1/4" Diameter x 3" Long, Plain Finish A490 High Strength Structural Bolt.....	27.02	1.52
			<i>For >10 To 50, Deduct</i>	-0.63	
			<i>For >50 To 100, Deduct</i>	-1.63	
			<i>For >100, Deduct</i>	-3.25	
05 05 23 00-0094	EA		1-1/4" Diameter x 4" Long, Plain Finish A490 High Strength Structural Bolt.....	33.99	1.61
			<i>For >10 To 50, Deduct</i>	-0.67	
			<i>For >50 To 100, Deduct</i>	-1.86	
			<i>For >100, Deduct</i>	-3.71	
05 05 23 00-0095	EA		1-1/4" Diameter x 6" Long, Plain Finish A490 High Strength Structural Bolt.....	35.82	1.72
			<i>For >10 To 50, Deduct</i>	-0.72	
			<i>For >50 To 100, Deduct</i>	-1.97	
			<i>For >100, Deduct</i>	-3.95	
05 05 23 00-0096	EA		1-1/4" Diameter x 8" Long, Plain Finish A490 High Strength Structural Bolt.....	37.46	1.84
			<i>For >10 To 50, Deduct</i>	-0.77	
			<i>For >50 To 100, Deduct</i>	-2.09	
			<i>For >100, Deduct</i>	-4.17	
05 05 23 00-0097			Hex Head Bolts <small>(05 05 23 00-0001)</small>		
05 05 23 00-0098			Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolts <small>(05 05 23 00-0097)</small>		
05 05 23 00-0099			1/4" Diameter, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolts <small>(05 05 23 00-0099)</small>		
05 05 23 00-0100	EA		1/4" Diameter x 1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	4.58	
			<i>For >100 To 250, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-1.13	
			<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0101	EA		1/4" Diameter x 1" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	4.60	
			<i>For >100 To 250, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-1.13	
			<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0102	EA		1/4" Diameter x 1-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	4.64	
			<i>For >100 To 250, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-1.13	
			<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0103	EA		1/4" Diameter x 2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	4.67	
			<i>For >100 To 250, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-1.13	
			<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0104	EA		1/4" Diameter x 2-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	4.83	
			<i>For >100 To 250, Deduct</i>	-0.93	
			<i>For >250 To 500, Deduct</i>	-1.16	
			<i>For >500, Deduct</i>	-1.40	
05 05 23 00-0105	EA		1/4" Diameter x 3" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	4.84	
			<i>For >100 To 250, Deduct</i>	-0.93	
			<i>For >250 To 500, Deduct</i>	-1.16	
			<i>For >500, Deduct</i>	-1.40	
05 05 23 00-0106	EA		1/4" Diameter x 3-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	4.91	
			<i>For >100 To 250, Deduct</i>	-0.93	
			<i>For >250 To 500, Deduct</i>	-1.16	
			<i>For >500, Deduct</i>	-1.40	
05 05 23 00-0107	EA		1/4" Diameter x 4" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.05	
			<i>For >100 To 250, Deduct</i>	-0.96	
			<i>For >250 To 500, Deduct</i>	-1.20	
			<i>For >500, Deduct</i>	-1.43	
05 05 23 00-0108	EA		1/4" Diameter x 4-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.07	
			<i>For >100 To 250, Deduct</i>	-0.96	
			<i>For >250 To 500, Deduct</i>	-1.20	
			<i>For >500, Deduct</i>	-1.43	
05 05 23 00-0109	EA		1/4" Diameter x 5" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.18	
			<i>For >100 To 250, Deduct</i>	-0.96	
			<i>For >250 To 500, Deduct</i>	-1.20	
			<i>For >500, Deduct</i>	-1.43	
05 05 23 00-0110	EA		1/4" Diameter x 5-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.39	
			<i>For >100 To 250, Deduct</i>	-0.98	
			<i>For >250 To 500, Deduct</i>	-1.23	
			<i>For >500, Deduct</i>	-1.47	
05 05 23 00-0111	EA		1/4" Diameter x 6" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.47	
			<i>For >100 To 250, Deduct</i>	-0.98	
			<i>For >250 To 500, Deduct</i>	-1.23	
			<i>For >500, Deduct</i>	-1.47	
05 05 23 00-0112	EA		1/4" Diameter x 6-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.59	
			<i>For >100 To 250, Deduct</i>	-0.98	
			<i>For >250 To 500, Deduct</i>	-1.23	
			<i>For >500, Deduct</i>	-1.47	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-0113 EA 1/4" Diameter x 7" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.97	
<i>For >100 To 250, Deduct</i>	-1.01	
<i>For >250 To 500, Deduct</i>	-1.26	
<i>For >500, Deduct</i>	-1.52	
05 05 23 00-0114 EA 1/4" Diameter x 7-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.14	
<i>For >100 To 250, Deduct</i>	-1.01	
<i>For >250 To 500, Deduct</i>	-1.26	
<i>For >500, Deduct</i>	-1.52	
05 05 23 00-0115 EA 1/4" Diameter x 8" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.18	
<i>For >100 To 250, Deduct</i>	-1.01	
<i>For >250 To 500, Deduct</i>	-1.26	
<i>For >500, Deduct</i>	-1.52	
05 05 23 00-0116 5/16" Diameter, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolts <small>(05 05 23 00-0098)</small>		
05 05 23 00-0117 EA 5/16" Diameter x 1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	4.62	
<i>For >100 To 250, Deduct</i>	-0.90	
<i>For >250 To 500, Deduct</i>	-1.13	
<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0118 EA 5/16" Diameter x 1" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	4.64	
<i>For >100 To 250, Deduct</i>	-0.90	
<i>For >250 To 500, Deduct</i>	-1.13	
<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0119 EA 5/16" Diameter x 1-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	4.68	
<i>For >100 To 250, Deduct</i>	-0.90	
<i>For >250 To 500, Deduct</i>	-1.13	
<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0120 EA 5/16" Diameter x 2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	4.71	
<i>For >100 To 250, Deduct</i>	-0.90	
<i>For >250 To 500, Deduct</i>	-1.13	
<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0121 EA 5/16" Diameter x 2-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	4.88	
<i>For >100 To 250, Deduct</i>	-0.93	
<i>For >250 To 500, Deduct</i>	-1.16	
<i>For >500, Deduct</i>	-1.40	
05 05 23 00-0122 EA 5/16" Diameter x 3" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	4.95	
<i>For >100 To 250, Deduct</i>	-0.93	
<i>For >250 To 500, Deduct</i>	-1.16	
<i>For >500, Deduct</i>	-1.40	
05 05 23 00-0123 EA 5/16" Diameter x 3-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	4.98	
<i>For >100 To 250, Deduct</i>	-0.93	
<i>For >250 To 500, Deduct</i>	-1.16	
<i>For >500, Deduct</i>	-1.40	
05 05 23 00-0124 EA 5/16" Diameter x 4" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.18	
<i>For >100 To 250, Deduct</i>	-0.96	
<i>For >250 To 500, Deduct</i>	-1.20	
<i>For >500, Deduct</i>	-1.43	
05 05 23 00-0125 EA 5/16" Diameter x 4-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.28	
<i>For >100 To 250, Deduct</i>	-0.96	
<i>For >250 To 500, Deduct</i>	-1.20	
<i>For >500, Deduct</i>	-1.43	
05 05 23 00-0126 EA 5/16" Diameter x 5" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.32	
<i>For >100 To 250, Deduct</i>	-0.96	
<i>For >250 To 500, Deduct</i>	-1.20	
<i>For >500, Deduct</i>	-1.43	
05 05 23 00-0127 EA 5/16" Diameter x 5-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.48	
<i>For >100 To 250, Deduct</i>	-0.98	
<i>For >250 To 500, Deduct</i>	-1.23	
<i>For >500, Deduct</i>	-1.47	
05 05 23 00-0128 EA 5/16" Diameter x 6" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.52	
<i>For >100 To 250, Deduct</i>	-0.98	
<i>For >250 To 500, Deduct</i>	-1.23	
<i>For >500, Deduct</i>	-1.47	
05 05 23 00-0129 EA 5/16" Diameter x 6-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.91	
<i>For >100 To 250, Deduct</i>	-0.98	
<i>For >250 To 500, Deduct</i>	-1.23	
<i>For >500, Deduct</i>	-1.47	
05 05 23 00-0130 EA 5/16" Diameter x 7" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.25	
<i>For >100 To 250, Deduct</i>	-1.01	
<i>For >250 To 500, Deduct</i>	-1.26	
<i>For >500, Deduct</i>	-1.52	
05 05 23 00-0131 EA 5/16" Diameter x 7-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.42	
<i>For >100 To 250, Deduct</i>	-1.01	
<i>For >250 To 500, Deduct</i>	-1.26	
<i>For >500, Deduct</i>	-1.52	
05 05 23 00-0132 EA 5/16" Diameter x 8" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.58	
<i>For >100 To 250, Deduct</i>	-1.01	
<i>For >250 To 500, Deduct</i>	-1.26	
<i>For >500, Deduct</i>	-1.52	
05 05 23 00-0133 3/8" Diameter, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolts <small>(05 05 23 00-0098)</small>		

05 Metals**05 05 Common Work Results For Metals****05 05 23 Metal Fastenings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-0134	EA		3/8" Diameter x 1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	4.67	
			<i>For >100 To 250, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-1.13	
			<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0135	EA		3/8" Diameter x 1" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	4.69	
			<i>For >100 To 250, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-1.13	
			<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0136	EA		3/8" Diameter x 1-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	4.74	
			<i>For >100 To 250, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-1.13	
			<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0137	EA		3/8" Diameter x 2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	4.79	
			<i>For >100 To 250, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-1.13	
			<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0138	EA		3/8" Diameter x 2-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	4.97	
			<i>For >100 To 250, Deduct</i>	-0.93	
			<i>For >250 To 500, Deduct</i>	-1.16	
			<i>For >500, Deduct</i>	-1.40	
05 05 23 00-0139	EA		3/8" Diameter x 3" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.06	
			<i>For >100 To 250, Deduct</i>	-0.93	
			<i>For >250 To 500, Deduct</i>	-1.16	
			<i>For >500, Deduct</i>	-1.40	
05 05 23 00-0140	EA		3/8" Diameter x 3-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.15	
			<i>For >100 To 250, Deduct</i>	-0.93	
			<i>For >250 To 500, Deduct</i>	-1.16	
			<i>For >500, Deduct</i>	-1.40	
05 05 23 00-0141	EA		3/8" Diameter x 4" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.37	
			<i>For >100 To 250, Deduct</i>	-0.96	
			<i>For >250 To 500, Deduct</i>	-1.20	
			<i>For >500, Deduct</i>	-1.43	
05 05 23 00-0142	EA		3/8" Diameter x 4-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.49	
			<i>For >100 To 250, Deduct</i>	-0.96	
			<i>For >250 To 500, Deduct</i>	-1.20	
			<i>For >500, Deduct</i>	-1.43	
05 05 23 00-0143	EA		3/8" Diameter x 5" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.55	
			<i>For >100 To 250, Deduct</i>	-0.96	
			<i>For >250 To 500, Deduct</i>	-1.20	
			<i>For >500, Deduct</i>	-1.43	
05 05 23 00-0144	EA		3/8" Diameter x 5-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.80	
			<i>For >100 To 250, Deduct</i>	-0.98	
			<i>For >250 To 500, Deduct</i>	-1.23	
			<i>For >500, Deduct</i>	-1.47	
05 05 23 00-0145	EA		3/8" Diameter x 6" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.87	
			<i>For >100 To 250, Deduct</i>	-0.98	
			<i>For >250 To 500, Deduct</i>	-1.23	
			<i>For >500, Deduct</i>	-1.47	
05 05 23 00-0146	EA		3/8" Diameter x 6-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.91	
			<i>For >100 To 250, Deduct</i>	-0.98	
			<i>For >250 To 500, Deduct</i>	-1.23	
			<i>For >500, Deduct</i>	-1.47	
05 05 23 00-0147	EA		3/8" Diameter x 7" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.09	
			<i>For >100 To 250, Deduct</i>	-1.01	
			<i>For >250 To 500, Deduct</i>	-1.26	
			<i>For >500, Deduct</i>	-1.52	
05 05 23 00-0148	EA		3/8" Diameter x 7-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.16	
			<i>For >100 To 250, Deduct</i>	-1.01	
			<i>For >250 To 500, Deduct</i>	-1.26	
			<i>For >500, Deduct</i>	-1.52	
05 05 23 00-0149	EA		3/8" Diameter x 8" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.27	
			<i>For >100 To 250, Deduct</i>	-1.01	
			<i>For >250 To 500, Deduct</i>	-1.26	
			<i>For >500, Deduct</i>	-1.52	
05 05 23 00-0150			7/16" Diameter, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolts <small>(05 05 23 00-0098)</small>		
05 05 23 00-0151	EA		7/16" Diameter x 1" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.55	
			<i>For >100 To 250, Deduct</i>	-1.04	
			<i>For >250 To 500, Deduct</i>	-1.30	
			<i>For >500, Deduct</i>	-1.55	
05 05 23 00-0152	EA		7/16" Diameter x 1-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.63	
			<i>For >100 To 250, Deduct</i>	-1.04	
			<i>For >250 To 500, Deduct</i>	-1.30	
			<i>For >500, Deduct</i>	-1.55	
05 05 23 00-0153	EA		7/16" Diameter x 2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.64	
			<i>For >100 To 250, Deduct</i>	-1.04	
			<i>For >250 To 500, Deduct</i>	-1.30	
			<i>For >500, Deduct</i>	-1.55	
05 05 23 00-0154	EA		7/16" Diameter x 2-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.86	
			<i>For >100 To 250, Deduct</i>	-1.06	
			<i>For >250 To 500, Deduct</i>	-1.33	
			<i>For >500, Deduct</i>	-1.59	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-0155 EA 7/16" Diameter x 3" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.97	
<i>For >100 To 250, Deduct</i>	-1.06	
<i>For >250 To 500, Deduct</i>	-1.33	
<i>For >500, Deduct</i>	-1.59	
05 05 23 00-0156 EA 7/16" Diameter x 3-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.06	
<i>For >100 To 250, Deduct</i>	-1.06	
<i>For >250 To 500, Deduct</i>	-1.33	
<i>For >500, Deduct</i>	-1.59	
05 05 23 00-0157 EA 7/16" Diameter x 4" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.43	
<i>For >100 To 250, Deduct</i>	-1.09	
<i>For >250 To 500, Deduct</i>	-1.36	
<i>For >500, Deduct</i>	-1.63	
05 05 23 00-0158 EA 7/16" Diameter x 4-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.49	
<i>For >100 To 250, Deduct</i>	-1.09	
<i>For >250 To 500, Deduct</i>	-1.36	
<i>For >500, Deduct</i>	-1.63	
05 05 23 00-0159 EA 7/16" Diameter x 5" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.63	
<i>For >100 To 250, Deduct</i>	-1.09	
<i>For >250 To 500, Deduct</i>	-1.36	
<i>For >500, Deduct</i>	-1.63	
05 05 23 00-0160 EA 7/16" Diameter x 5-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.98	
<i>For >100 To 250, Deduct</i>	-1.11	
<i>For >250 To 500, Deduct</i>	-1.39	
<i>For >500, Deduct</i>	-1.67	
05 05 23 00-0161 EA 7/16" Diameter x 6" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	7.04	
<i>For >100 To 250, Deduct</i>	-1.11	
<i>For >250 To 500, Deduct</i>	-1.39	
<i>For >500, Deduct</i>	-1.67	
05 05 23 00-0162 EA 7/16" Diameter x 6-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	7.21	
<i>For >100 To 250, Deduct</i>	-1.11	
<i>For >250 To 500, Deduct</i>	-1.39	
<i>For >500, Deduct</i>	-1.67	
05 05 23 00-0163 EA 7/16" Diameter x 7" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	7.41	
<i>For >100 To 250, Deduct</i>	-1.14	
<i>For >250 To 500, Deduct</i>	-1.42	
<i>For >500, Deduct</i>	-1.71	
05 05 23 00-0164 EA 7/16" Diameter x 7-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	7.57	
<i>For >100 To 250, Deduct</i>	-1.14	
<i>For >250 To 500, Deduct</i>	-1.42	
<i>For >500, Deduct</i>	-1.71	
05 05 23 00-0165 EA 7/16" Diameter x 8" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	7.87	
<i>For >100 To 250, Deduct</i>	-1.14	
<i>For >250 To 500, Deduct</i>	-1.42	
<i>For >500, Deduct</i>	-1.71	
05 05 23 00-0166 1/2" Diameter, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolts <small>(05 05 23 00-0098)</small>		
05 05 23 00-0167 EA 1/2" Diameter x 1" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.49	
<i>For >100 To 250, Deduct</i>	-1.04	
<i>For >250 To 500, Deduct</i>	-1.30	
<i>For >500, Deduct</i>	-1.55	
05 05 23 00-0168 EA 1/2" Diameter x 1-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.58	
<i>For >100 To 250, Deduct</i>	-1.04	
<i>For >250 To 500, Deduct</i>	-1.30	
<i>For >500, Deduct</i>	-1.55	
05 05 23 00-0169 EA 1/2" Diameter x 2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.67	
<i>For >100 To 250, Deduct</i>	-1.04	
<i>For >250 To 500, Deduct</i>	-1.30	
<i>For >500, Deduct</i>	-1.55	
05 05 23 00-0170 EA 1/2" Diameter x 2-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.89	
<i>For >100 To 250, Deduct</i>	-1.06	
<i>For >250 To 500, Deduct</i>	-1.33	
<i>For >500, Deduct</i>	-1.59	
05 05 23 00-0171 EA 1/2" Diameter x 3" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.98	
<i>For >100 To 250, Deduct</i>	-1.06	
<i>For >250 To 500, Deduct</i>	-1.33	
<i>For >500, Deduct</i>	-1.59	
05 05 23 00-0172 EA 1/2" Diameter x 3-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.07	
<i>For >100 To 250, Deduct</i>	-1.06	
<i>For >250 To 500, Deduct</i>	-1.33	
<i>For >500, Deduct</i>	-1.59	
05 05 23 00-0173 EA 1/2" Diameter x 4" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.32	
<i>For >100 To 250, Deduct</i>	-1.09	
<i>For >250 To 500, Deduct</i>	-1.36	
<i>For >500, Deduct</i>	-1.63	
05 05 23 00-0174 EA 1/2" Diameter x 4-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.43	
<i>For >100 To 250, Deduct</i>	-1.09	
<i>For >250 To 500, Deduct</i>	-1.36	
<i>For >500, Deduct</i>	-1.63	
05 05 23 00-0175 EA 1/2" Diameter x 5" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.61	
<i>For >100 To 250, Deduct</i>	-1.09	
<i>For >250 To 500, Deduct</i>	-1.36	
<i>For >500, Deduct</i>	-1.63	

05 Metals**05 05 Common Work Results For Metals****05 05 23 Metal Fastenings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-0176	EA		1/2" Diameter x 5-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.77	
			<i>For >100 To 250, Deduct</i>	-1.11	
			<i>For >250 To 500, Deduct</i>	-1.39	
			<i>For >500, Deduct</i>	-1.67	
05 05 23 00-0177	EA		1/2" Diameter x 6" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.79	
			<i>For >100 To 250, Deduct</i>	-1.11	
			<i>For >250 To 500, Deduct</i>	-1.39	
			<i>For >500, Deduct</i>	-1.67	
05 05 23 00-0178	EA		1/2" Diameter x 6-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.95	
			<i>For >100 To 250, Deduct</i>	-1.11	
			<i>For >250 To 500, Deduct</i>	-1.39	
			<i>For >500, Deduct</i>	-1.67	
05 05 23 00-0179	EA		1/2" Diameter x 7" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	7.22	
			<i>For >100 To 250, Deduct</i>	-1.14	
			<i>For >250 To 500, Deduct</i>	-1.42	
			<i>For >500, Deduct</i>	-1.71	
05 05 23 00-0180	EA		1/2" Diameter x 7-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	7.32	
			<i>For >100 To 250, Deduct</i>	-1.14	
			<i>For >250 To 500, Deduct</i>	-1.42	
			<i>For >500, Deduct</i>	-1.71	
05 05 23 00-0181	EA		1/2" Diameter x 8" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	7.59	
			<i>For >100 To 250, Deduct</i>	-1.14	
			<i>For >250 To 500, Deduct</i>	-1.42	
			<i>For >500, Deduct</i>	-1.71	
05 05 23 00-0182	EA		1/2" Diameter x 8-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	7.85	
			<i>For >100 To 250, Deduct</i>	-1.16	
			<i>For >250 To 500, Deduct</i>	-1.46	
			<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0183	EA		1/2" Diameter x 9" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	7.95	
			<i>For >100 To 250, Deduct</i>	-1.16	
			<i>For >250 To 500, Deduct</i>	-1.46	
			<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0184	EA		1/2" Diameter x 9-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	8.33	
			<i>For >100 To 250, Deduct</i>	-1.16	
			<i>For >250 To 500, Deduct</i>	-1.46	
			<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0185	EA		1/2" Diameter x 10" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	8.44	
			<i>For >100 To 250, Deduct</i>	-1.16	
			<i>For >250 To 500, Deduct</i>	-1.46	
			<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0186			9/16" Diameter, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolts <small>(05 05 23 00-0098)</small>		
05 05 23 00-0187	EA		9/16" Diameter x 1" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.58	
			<i>For >100 To 250, Deduct</i>	-1.04	
			<i>For >250 To 500, Deduct</i>	-1.30	
			<i>For >500, Deduct</i>	-1.55	
05 05 23 00-0188	EA		9/16" Diameter x 1-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.70	
			<i>For >100 To 250, Deduct</i>	-1.04	
			<i>For >250 To 500, Deduct</i>	-1.30	
			<i>For >500, Deduct</i>	-1.55	
05 05 23 00-0189	EA		9/16" Diameter x 2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.73	
			<i>For >100 To 250, Deduct</i>	-1.04	
			<i>For >250 To 500, Deduct</i>	-1.30	
			<i>For >500, Deduct</i>	-1.55	
05 05 23 00-0190	EA		9/16" Diameter x 2-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.25	
			<i>For >100 To 250, Deduct</i>	-1.06	
			<i>For >250 To 500, Deduct</i>	-1.33	
			<i>For >500, Deduct</i>	-1.59	
05 05 23 00-0191	EA		9/16" Diameter x 3" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.41	
			<i>For >100 To 250, Deduct</i>	-1.06	
			<i>For >250 To 500, Deduct</i>	-1.33	
			<i>For >500, Deduct</i>	-1.59	
05 05 23 00-0192	EA		9/16" Diameter x 3-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.46	
			<i>For >100 To 250, Deduct</i>	-1.06	
			<i>For >250 To 500, Deduct</i>	-1.33	
			<i>For >500, Deduct</i>	-1.59	
05 05 23 00-0193	EA		9/16" Diameter x 4" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.61	
			<i>For >100 To 250, Deduct</i>	-1.09	
			<i>For >250 To 500, Deduct</i>	-1.36	
			<i>For >500, Deduct</i>	-1.63	
05 05 23 00-0194	EA		9/16" Diameter x 4-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.65	
			<i>For >100 To 250, Deduct</i>	-1.09	
			<i>For >250 To 500, Deduct</i>	-1.36	
			<i>For >500, Deduct</i>	-1.63	
05 05 23 00-0195	EA		9/16" Diameter x 5" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.79	
			<i>For >100 To 250, Deduct</i>	-1.09	
			<i>For >250 To 500, Deduct</i>	-1.36	
			<i>For >500, Deduct</i>	-1.63	
05 05 23 00-0196	EA		9/16" Diameter x 5-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.95	
			<i>For >100 To 250, Deduct</i>	-1.11	
			<i>For >250 To 500, Deduct</i>	-1.39	
			<i>For >500, Deduct</i>	-1.67	



MINOR	TOTAL DIRECT	DEMOLITION
CSI UOM DESCRIPTION	UNIT COST	UNIT COST
05 05 23 00-0197 EA 9/16" Diameter x 6" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.98	
<i>For >100 To 250, Deduct</i>	-1.11	
<i>For >250 To 500, Deduct</i>	-1.39	
<i>For >500, Deduct</i>	-1.67	
05 05 23 00-0198 EA 9/16" Diameter x 6-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	7.10	
<i>For >100 To 250, Deduct</i>	-1.11	
<i>For >250 To 500, Deduct</i>	-1.39	
<i>For >500, Deduct</i>	-1.67	
05 05 23 00-0199 EA 9/16" Diameter x 7" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	7.36	
<i>For >100 To 250, Deduct</i>	-1.14	
<i>For >250 To 500, Deduct</i>	-1.42	
<i>For >500, Deduct</i>	-1.71	
05 05 23 00-0200 EA 9/16" Diameter x 7-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	7.51	
<i>For >100 To 250, Deduct</i>	-1.14	
<i>For >250 To 500, Deduct</i>	-1.42	
<i>For >500, Deduct</i>	-1.71	
05 05 23 00-0201 EA 9/16" Diameter x 8" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	7.65	
<i>For >100 To 250, Deduct</i>	-1.14	
<i>For >250 To 500, Deduct</i>	-1.42	
<i>For >500, Deduct</i>	-1.71	
05 05 23 00-0202 EA 9/16" Diameter x 8-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	7.90	
<i>For >100 To 250, Deduct</i>	-1.16	
<i>For >250 To 500, Deduct</i>	-1.46	
<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0203 EA 9/16" Diameter x 9" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	8.07	
<i>For >100 To 250, Deduct</i>	-1.16	
<i>For >250 To 500, Deduct</i>	-1.46	
<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0204 EA 9/16" Diameter x 9-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	8.18	
<i>For >100 To 250, Deduct</i>	-1.16	
<i>For >250 To 500, Deduct</i>	-1.46	
<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0205 EA 9/16" Diameter x 10" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	8.36	
<i>For >100 To 250, Deduct</i>	-1.16	
<i>For >250 To 500, Deduct</i>	-1.46	
<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0206 5/8" Diameter, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolts <small>(05 05 23 00-0098)</small>		
05 05 23 00-0207 EA 5/8" Diameter x 1" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.49	
<i>For >100 To 250, Deduct</i>	-1.16	
<i>For >250 To 500, Deduct</i>	-1.46	
<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0208 EA 5/8" Diameter x 1-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.57	
<i>For >100 To 250, Deduct</i>	-1.16	
<i>For >250 To 500, Deduct</i>	-1.46	
<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0209 EA 5/8" Diameter x 2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.68	
<i>For >100 To 250, Deduct</i>	-1.16	
<i>For >250 To 500, Deduct</i>	-1.46	
<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0210 EA 5/8" Diameter x 2-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.95	
<i>For >100 To 250, Deduct</i>	-1.19	
<i>For >250 To 500, Deduct</i>	-1.49	
<i>For >500, Deduct</i>	-1.79	
05 05 23 00-0211 EA 5/8" Diameter x 3" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	7.11	
<i>For >100 To 250, Deduct</i>	-1.19	
<i>For >250 To 500, Deduct</i>	-1.49	
<i>For >500, Deduct</i>	-1.79	
05 05 23 00-0212 EA 5/8" Diameter x 3-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	7.30	
<i>For >100 To 250, Deduct</i>	-1.19	
<i>For >250 To 500, Deduct</i>	-1.49	
<i>For >500, Deduct</i>	-1.79	
05 05 23 00-0213 EA 5/8" Diameter x 4" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	7.68	
<i>For >100 To 250, Deduct</i>	-1.22	
<i>For >250 To 500, Deduct</i>	-1.52	
<i>For >500, Deduct</i>	-1.82	
05 05 23 00-0214 EA 5/8" Diameter x 4-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	7.98	
<i>For >100 To 250, Deduct</i>	-1.22	
<i>For >250 To 500, Deduct</i>	-1.52	
<i>For >500, Deduct</i>	-1.82	
05 05 23 00-0215 EA 5/8" Diameter x 5" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	8.21	
<i>For >100 To 250, Deduct</i>	-1.22	
<i>For >250 To 500, Deduct</i>	-1.52	
<i>For >500, Deduct</i>	-1.82	
05 05 23 00-0216 EA 5/8" Diameter x 5-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	8.43	
<i>For >100 To 250, Deduct</i>	-1.24	
<i>For >250 To 500, Deduct</i>	-1.55	
<i>For >500, Deduct</i>	-1.86	
05 05 23 00-0217 EA 5/8" Diameter x 6" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	8.46	
<i>For >100 To 250, Deduct</i>	-1.24	
<i>For >250 To 500, Deduct</i>	-1.55	
<i>For >500, Deduct</i>	-1.86	

05 Metals**05 05 Common Work Results For Metals****05 05 23 Metal Fastenings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-0218	EA		5/8" Diameter x 6-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	8.86	
			<i>For >100 To 250, Deduct</i>	-1.24	
			<i>For >250 To 500, Deduct</i>	-1.55	
			<i>For >500, Deduct</i>	-1.86	
05 05 23 00-0219	EA		5/8" Diameter x 7" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	9.21	
			<i>For >100 To 250, Deduct</i>	-1.27	
			<i>For >250 To 500, Deduct</i>	-1.58	
			<i>For >500, Deduct</i>	-1.90	
05 05 23 00-0220	EA		5/8" Diameter x 7-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	9.53	
			<i>For >100 To 250, Deduct</i>	-1.27	
			<i>For >250 To 500, Deduct</i>	-1.58	
			<i>For >500, Deduct</i>	-1.90	
05 05 23 00-0221	EA		5/8" Diameter x 8" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	9.89	
			<i>For >100 To 250, Deduct</i>	-1.27	
			<i>For >250 To 500, Deduct</i>	-1.58	
			<i>For >500, Deduct</i>	-1.90	
05 05 23 00-0222	EA		5/8" Diameter x 8-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	10.42	
			<i>For >100 To 250, Deduct</i>	-1.29	
			<i>For >250 To 500, Deduct</i>	-1.62	
			<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0223	EA		5/8" Diameter x 9" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	10.78	
			<i>For >100 To 250, Deduct</i>	-1.29	
			<i>For >250 To 500, Deduct</i>	-1.62	
			<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0224	EA		5/8" Diameter x 9-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	11.15	
			<i>For >100 To 250, Deduct</i>	-1.29	
			<i>For >250 To 500, Deduct</i>	-1.62	
			<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0225	EA		5/8" Diameter x 10" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	11.43	
			<i>For >100 To 250, Deduct</i>	-1.29	
			<i>For >250 To 500, Deduct</i>	-1.62	
			<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0226			3/4" Diameter, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolts <small>(05 05 23 00-0098)</small>		
05 05 23 00-0227	EA		3/4" Diameter x 1" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.76	
			<i>For >100 To 250, Deduct</i>	-1.16	
			<i>For >250 To 500, Deduct</i>	-1.46	
			<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0228	EA		3/4" Diameter x 1-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.92	
			<i>For >100 To 250, Deduct</i>	-1.16	
			<i>For >250 To 500, Deduct</i>	-1.46	
			<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0229	EA		3/4" Diameter x 2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	7.07	
			<i>For >100 To 250, Deduct</i>	-1.16	
			<i>For >250 To 500, Deduct</i>	-1.46	
			<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0230	EA		3/4" Diameter x 2-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	7.39	
			<i>For >100 To 250, Deduct</i>	-1.19	
			<i>For >250 To 500, Deduct</i>	-1.49	
			<i>For >500, Deduct</i>	-1.79	
05 05 23 00-0231	EA		3/4" Diameter x 3" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	7.62	
			<i>For >100 To 250, Deduct</i>	-1.19	
			<i>For >250 To 500, Deduct</i>	-1.49	
			<i>For >500, Deduct</i>	-1.79	
05 05 23 00-0232	EA		3/4" Diameter x 3-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	7.83	
			<i>For >100 To 250, Deduct</i>	-1.19	
			<i>For >250 To 500, Deduct</i>	-1.49	
			<i>For >500, Deduct</i>	-1.79	
05 05 23 00-0233	EA		3/4" Diameter x 4" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	8.18	
			<i>For >100 To 250, Deduct</i>	-1.22	
			<i>For >250 To 500, Deduct</i>	-1.52	
			<i>For >500, Deduct</i>	-1.82	
05 05 23 00-0234	EA		3/4" Diameter x 4-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	8.46	
			<i>For >100 To 250, Deduct</i>	-1.22	
			<i>For >250 To 500, Deduct</i>	-1.52	
			<i>For >500, Deduct</i>	-1.82	
05 05 23 00-0235	EA		3/4" Diameter x 5" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	8.69	
			<i>For >100 To 250, Deduct</i>	-1.22	
			<i>For >250 To 500, Deduct</i>	-1.52	
			<i>For >500, Deduct</i>	-1.82	
05 05 23 00-0236	EA		3/4" Diameter x 5-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	9.28	
			<i>For >100 To 250, Deduct</i>	-1.24	
			<i>For >250 To 500, Deduct</i>	-1.55	
			<i>For >500, Deduct</i>	-1.86	
05 05 23 00-0237	EA		3/4" Diameter x 6" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	9.46	
			<i>For >100 To 250, Deduct</i>	-1.24	
			<i>For >250 To 500, Deduct</i>	-1.55	
			<i>For >500, Deduct</i>	-1.86	
05 05 23 00-0238	EA		3/4" Diameter x 6-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	9.82	
			<i>For >100 To 250, Deduct</i>	-1.24	
			<i>For >250 To 500, Deduct</i>	-1.55	
			<i>For >500, Deduct</i>	-1.86	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-0239 EA 3/4" Diameter x 7" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	9.97	
<i>For >100 To 250, Deduct</i>	-1.27	
<i>For >250 To 500, Deduct</i>	-1.58	
<i>For >500, Deduct</i>	-1.90	
05 05 23 00-0240 EA 3/4" Diameter x 7-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	10.79	
<i>For >100 To 250, Deduct</i>	-1.27	
<i>For >250 To 500, Deduct</i>	-1.58	
<i>For >500, Deduct</i>	-1.90	
05 05 23 00-0241 EA 3/4" Diameter x 8" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	11.17	
<i>For >100 To 250, Deduct</i>	-1.27	
<i>For >250 To 500, Deduct</i>	-1.58	
<i>For >500, Deduct</i>	-1.90	
05 05 23 00-0242 EA 3/4" Diameter x 8-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	11.81	
<i>For >100 To 250, Deduct</i>	-1.29	
<i>For >250 To 500, Deduct</i>	-1.62	
<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0243 EA 3/4" Diameter x 9" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	12.19	
<i>For >100 To 250, Deduct</i>	-1.29	
<i>For >250 To 500, Deduct</i>	-1.62	
<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0244 EA 3/4" Diameter x 9-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	12.70	
<i>For >100 To 250, Deduct</i>	-1.29	
<i>For >250 To 500, Deduct</i>	-1.62	
<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0245 EA 3/4" Diameter x 10" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	13.20	
<i>For >100 To 250, Deduct</i>	-1.29	
<i>For >250 To 500, Deduct</i>	-1.62	
<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0246 7/8" Diameter, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolts <small>(05 05 23 00-0098)</small>		
05 05 23 00-0247 EA 7/8" Diameter x 1" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	8.26	
<i>For >100 To 250, Deduct</i>	-1.29	
<i>For >250 To 500, Deduct</i>	-1.62	
<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0248 EA 7/8" Diameter x 1-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	8.40	
<i>For >100 To 250, Deduct</i>	-1.29	
<i>For >250 To 500, Deduct</i>	-1.62	
<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0249 EA 7/8" Diameter x 2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	8.46	
<i>For >100 To 250, Deduct</i>	-1.29	
<i>For >250 To 500, Deduct</i>	-1.62	
<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0250 EA 7/8" Diameter x 2-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	8.79	
<i>For >100 To 250, Deduct</i>	-1.32	
<i>For >250 To 500, Deduct</i>	-1.65	
<i>For >500, Deduct</i>	-1.98	
05 05 23 00-0251 EA 7/8" Diameter x 3" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	9.16	
<i>For >100 To 250, Deduct</i>	-1.32	
<i>For >250 To 500, Deduct</i>	-1.65	
<i>For >500, Deduct</i>	-1.98	
05 05 23 00-0252 EA 7/8" Diameter x 3-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	9.60	
<i>For >100 To 250, Deduct</i>	-1.32	
<i>For >250 To 500, Deduct</i>	-1.65	
<i>For >500, Deduct</i>	-1.98	
05 05 23 00-0253 EA 7/8" Diameter x 4" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	10.10	
<i>For >100 To 250, Deduct</i>	-1.35	
<i>For >250 To 500, Deduct</i>	-1.68	
<i>For >500, Deduct</i>	-2.02	
05 05 23 00-0254 EA 7/8" Diameter x 4-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	10.73	
<i>For >100 To 250, Deduct</i>	-1.35	
<i>For >250 To 500, Deduct</i>	-1.68	
<i>For >500, Deduct</i>	-2.02	
05 05 23 00-0255 EA 7/8" Diameter x 5" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	11.09	
<i>For >100 To 250, Deduct</i>	-1.35	
<i>For >250 To 500, Deduct</i>	-1.68	
<i>For >500, Deduct</i>	-2.02	
05 05 23 00-0256 EA 7/8" Diameter x 5-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	11.50	
<i>For >100 To 250, Deduct</i>	-1.37	
<i>For >250 To 500, Deduct</i>	-1.72	
<i>For >500, Deduct</i>	-2.06	
05 05 23 00-0257 EA 7/8" Diameter x 6" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	11.70	
<i>For >100 To 250, Deduct</i>	-1.37	
<i>For >250 To 500, Deduct</i>	-1.72	
<i>For >500, Deduct</i>	-2.06	
05 05 23 00-0258 EA 7/8" Diameter x 6-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	12.21	
<i>For >100 To 250, Deduct</i>	-1.37	
<i>For >250 To 500, Deduct</i>	-1.72	
<i>For >500, Deduct</i>	-2.06	
05 05 23 00-0259 EA 7/8" Diameter x 7" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	12.83	
<i>For >100 To 250, Deduct</i>	-1.40	
<i>For >250 To 500, Deduct</i>	-1.75	
<i>For >500, Deduct</i>	-2.09	

05 Metals**05 05 Common Work Results For Metals****05 05 23 Metal Fastenings**

MINOR		TOTAL DIRECT	DEMOLITION
CSI	UOM DESCRIPTION	UNIT COST	UNIT COST
05 05 23 00-0260	EA 7/8" Diameter x 7-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	13.34	
	<i>For >100 To 250, Deduct</i>	-1.40	
	<i>For >250 To 500, Deduct</i>	-1.75	
	<i>For >500, Deduct</i>	-2.09	
05 05 23 00-0261	EA 7/8" Diameter x 8" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	13.84	
	<i>For >100 To 250, Deduct</i>	-1.40	
	<i>For >250 To 500, Deduct</i>	-1.75	
	<i>For >500, Deduct</i>	-2.09	
05 05 23 00-0262	EA 7/8" Diameter x 8-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	14.45	
	<i>For >100 To 250, Deduct</i>	-1.42	
	<i>For >250 To 500, Deduct</i>	-1.78	
	<i>For >500, Deduct</i>	-2.13	
05 05 23 00-0263	EA 7/8" Diameter x 9" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	14.98	
	<i>For >100 To 250, Deduct</i>	-1.42	
	<i>For >250 To 500, Deduct</i>	-1.78	
	<i>For >500, Deduct</i>	-2.13	
05 05 23 00-0264	EA 7/8" Diameter x 9-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	15.47	
	<i>For >100 To 250, Deduct</i>	-1.42	
	<i>For >250 To 500, Deduct</i>	-1.78	
	<i>For >500, Deduct</i>	-2.13	
05 05 23 00-0265	EA 7/8" Diameter x 10" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	15.99	
	<i>For >100 To 250, Deduct</i>	-1.42	
	<i>For >250 To 500, Deduct</i>	-1.78	
	<i>For >500, Deduct</i>	-2.13	
05 05 23 00-0266	1" Diameter, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolts <small>(05 05 23 00-0098)</small>	8.88	
05 05 23 00-0267	EA 1" Diameter x 1-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	8.88	
	<i>For >100 To 250, Deduct</i>	-1.29	
	<i>For >250 To 500, Deduct</i>	-1.62	
	<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0268	EA 1" Diameter x 2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	9.80	
	<i>For >100 To 250, Deduct</i>	-1.29	
	<i>For >250 To 500, Deduct</i>	-1.62	
	<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0269	EA 1" Diameter x 2-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	10.52	
	<i>For >100 To 250, Deduct</i>	-1.32	
	<i>For >250 To 500, Deduct</i>	-1.65	
	<i>For >500, Deduct</i>	-1.98	
05 05 23 00-0270	EA 1" Diameter x 3" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	11.24	
	<i>For >100 To 250, Deduct</i>	-1.32	
	<i>For >250 To 500, Deduct</i>	-1.65	
	<i>For >500, Deduct</i>	-1.98	
05 05 23 00-0271	EA 1" Diameter x 3-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	11.90	
	<i>For >100 To 250, Deduct</i>	-1.32	
	<i>For >250 To 500, Deduct</i>	-1.65	
	<i>For >500, Deduct</i>	-1.98	
05 05 23 00-0272	EA 1" Diameter x 4" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	12.71	
	<i>For >100 To 250, Deduct</i>	-1.35	
	<i>For >250 To 500, Deduct</i>	-1.68	
	<i>For >500, Deduct</i>	-2.02	
05 05 23 00-0273	EA 1" Diameter x 4-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	13.35	
	<i>For >100 To 250, Deduct</i>	-1.35	
	<i>For >250 To 500, Deduct</i>	-1.68	
	<i>For >500, Deduct</i>	-2.02	
05 05 23 00-0274	EA 1" Diameter x 5" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	14.01	
	<i>For >100 To 250, Deduct</i>	-1.35	
	<i>For >250 To 500, Deduct</i>	-1.68	
	<i>For >500, Deduct</i>	-2.02	
05 05 23 00-0275	EA 1" Diameter x 5-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	14.47	
	<i>For >100 To 250, Deduct</i>	-1.37	
	<i>For >250 To 500, Deduct</i>	-1.72	
	<i>For >500, Deduct</i>	-2.06	
05 05 23 00-0276	EA 1" Diameter x 6" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	14.79	
	<i>For >100 To 250, Deduct</i>	-1.37	
	<i>For >250 To 500, Deduct</i>	-1.72	
	<i>For >500, Deduct</i>	-2.06	
05 05 23 00-0277	EA 1" Diameter x 6-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	15.34	
	<i>For >100 To 250, Deduct</i>	-1.37	
	<i>For >250 To 500, Deduct</i>	-1.72	
	<i>For >500, Deduct</i>	-2.06	
05 05 23 00-0278	EA 1" Diameter x 7" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	16.02	
	<i>For >100 To 250, Deduct</i>	-1.40	
	<i>For >250 To 500, Deduct</i>	-1.75	
	<i>For >500, Deduct</i>	-2.09	
05 05 23 00-0279	EA 1" Diameter x 7-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	16.56	
	<i>For >100 To 250, Deduct</i>	-1.40	
	<i>For >250 To 500, Deduct</i>	-1.75	
	<i>For >500, Deduct</i>	-2.09	
05 05 23 00-0280	EA 1" Diameter x 8" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	17.14	
	<i>For >100 To 250, Deduct</i>	-1.40	
	<i>For >250 To 500, Deduct</i>	-1.75	
	<i>For >500, Deduct</i>	-2.09	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-0281 EA 1" Diameter x 8-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	17.72	
<i>For >100 To 250, Deduct</i>	-1.42	
<i>For >250 To 500, Deduct</i>	-1.78	
<i>For >500, Deduct</i>	-2.13	
05 05 23 00-0282 EA 1" Diameter x 9" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	18.37	
<i>For >100 To 250, Deduct</i>	-1.42	
<i>For >250 To 500, Deduct</i>	-1.78	
<i>For >500, Deduct</i>	-2.13	
05 05 23 00-0283 EA 1" Diameter x 9-1/2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	18.94	
<i>For >100 To 250, Deduct</i>	-1.42	
<i>For >250 To 500, Deduct</i>	-1.78	
<i>For >500, Deduct</i>	-2.13	
05 05 23 00-0284 EA 1" Diameter x 10" Length, Zinc Plated Steel, Low Carbon/Grade 2, Hex Head Bolt.....	19.51	
<i>For >100 To 250, Deduct</i>	-1.42	
<i>For >250 To 500, Deduct</i>	-1.78	
<i>For >500, Deduct</i>	-2.13	
05 05 23 00-0285 Zinc Plated Steel, Grade 5, Hex Head Bolts <small>(05 05 23 00-0087)</small>		
05 05 23 00-0286 1/4" Diameter, Zinc Plated Steel, Grade 5, Hex Head Bolts <small>(05 05 23 00-0285)</small>		
05 05 23 00-0287 EA 1/4" Diameter x 1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	4.62	
<i>For >100 To 250, Deduct</i>	-0.90	
<i>For >250 To 500, Deduct</i>	-1.13	
<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0288 EA 1/4" Diameter x 1" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	4.64	
<i>For >100 To 250, Deduct</i>	-0.90	
<i>For >250 To 500, Deduct</i>	-1.13	
<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0289 EA 1/4" Diameter x 1-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	4.67	
<i>For >100 To 250, Deduct</i>	-0.90	
<i>For >250 To 500, Deduct</i>	-1.13	
<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0290 EA 1/4" Diameter x 2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	4.72	
<i>For >100 To 250, Deduct</i>	-0.90	
<i>For >250 To 500, Deduct</i>	-1.13	
<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0291 EA 1/4" Diameter x 2-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	4.90	
<i>For >100 To 250, Deduct</i>	-0.93	
<i>For >250 To 500, Deduct</i>	-1.16	
<i>For >500, Deduct</i>	-1.40	
05 05 23 00-0292 EA 1/4" Diameter x 3" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	4.98	
<i>For >100 To 250, Deduct</i>	-0.93	
<i>For >250 To 500, Deduct</i>	-1.16	
<i>For >500, Deduct</i>	-1.40	
05 05 23 00-0293 EA 1/4" Diameter x 3-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	5.08	
<i>For >100 To 250, Deduct</i>	-0.93	
<i>For >250 To 500, Deduct</i>	-1.16	
<i>For >500, Deduct</i>	-1.40	
05 05 23 00-0294 EA 1/4" Diameter x 4" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	5.28	
<i>For >100 To 250, Deduct</i>	-0.96	
<i>For >250 To 500, Deduct</i>	-1.20	
<i>For >500, Deduct</i>	-1.43	
05 05 23 00-0295 EA 1/4" Diameter x 4-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	5.40	
<i>For >100 To 250, Deduct</i>	-0.96	
<i>For >250 To 500, Deduct</i>	-1.20	
<i>For >500, Deduct</i>	-1.43	
05 05 23 00-0296 EA 1/4" Diameter x 5" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	5.48	
<i>For >100 To 250, Deduct</i>	-0.96	
<i>For >250 To 500, Deduct</i>	-1.20	
<i>For >500, Deduct</i>	-1.43	
05 05 23 00-0297 EA 1/4" Diameter x 5-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	5.69	
<i>For >100 To 250, Deduct</i>	-0.98	
<i>For >250 To 500, Deduct</i>	-1.23	
<i>For >500, Deduct</i>	-1.47	
05 05 23 00-0298 EA 1/4" Diameter x 6" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	5.77	
<i>For >100 To 250, Deduct</i>	-0.98	
<i>For >250 To 500, Deduct</i>	-1.23	
<i>For >500, Deduct</i>	-1.47	
05 05 23 00-0299 EA 1/4" Diameter x 6-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	5.84	
<i>For >100 To 250, Deduct</i>	-0.98	
<i>For >250 To 500, Deduct</i>	-1.23	
<i>For >500, Deduct</i>	-1.47	
05 05 23 00-0300 EA 1/4" Diameter x 7" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	6.08	
<i>For >100 To 250, Deduct</i>	-1.01	
<i>For >250 To 500, Deduct</i>	-1.26	
<i>For >500, Deduct</i>	-1.52	
05 05 23 00-0301 EA 1/4" Diameter x 7-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	6.18	
<i>For >100 To 250, Deduct</i>	-1.01	
<i>For >250 To 500, Deduct</i>	-1.26	
<i>For >500, Deduct</i>	-1.52	
05 05 23 00-0302 EA 1/4" Diameter x 8" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	6.29	
<i>For >100 To 250, Deduct</i>	-1.01	
<i>For >250 To 500, Deduct</i>	-1.26	
<i>For >500, Deduct</i>	-1.52	

05 Metals**05 05 Common Work Results For Metals****05 05 23 Metal Fastenings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-0303			5/16" Diameter, Zinc Plated Steel, Grade 5, Hex Head Bolts <small>(05 05 23 00-0285)</small>		
05 05 23 00-0304	EA		5/16" Diameter x 1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	4.67	
			<i>For >100 To 250, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-1.13	
			<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0305	EA		5/16" Diameter x 1" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	4.69	
			<i>For >100 To 250, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-1.13	
			<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0306	EA		5/16" Diameter x 1-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	4.73	
			<i>For >100 To 250, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-1.13	
			<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0307	EA		5/16" Diameter x 2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	4.79	
			<i>For >100 To 250, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-1.13	
			<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0308	EA		5/16" Diameter x 2-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	4.97	
			<i>For >100 To 250, Deduct</i>	-0.93	
			<i>For >250 To 500, Deduct</i>	-1.16	
			<i>For >500, Deduct</i>	-1.40	
05 05 23 00-0309	EA		5/16" Diameter x 3" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	5.06	
			<i>For >100 To 250, Deduct</i>	-0.93	
			<i>For >250 To 500, Deduct</i>	-1.16	
			<i>For >500, Deduct</i>	-1.40	
05 05 23 00-0310	EA		5/16" Diameter x 3-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	5.20	
			<i>For >100 To 250, Deduct</i>	-0.93	
			<i>For >250 To 500, Deduct</i>	-1.16	
			<i>For >500, Deduct</i>	-1.40	
05 05 23 00-0311	EA		5/16" Diameter x 4" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	5.41	
			<i>For >100 To 250, Deduct</i>	-0.96	
			<i>For >250 To 500, Deduct</i>	-1.20	
			<i>For >500, Deduct</i>	-1.43	
05 05 23 00-0312	EA		5/16" Diameter x 4-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	5.52	
			<i>For >100 To 250, Deduct</i>	-0.96	
			<i>For >250 To 500, Deduct</i>	-1.20	
			<i>For >500, Deduct</i>	-1.43	
05 05 23 00-0313	EA		5/16" Diameter x 5" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	5.63	
			<i>For >100 To 250, Deduct</i>	-0.96	
			<i>For >250 To 500, Deduct</i>	-1.20	
			<i>For >500, Deduct</i>	-1.43	
05 05 23 00-0314	EA		5/16" Diameter x 5-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	5.97	
			<i>For >100 To 250, Deduct</i>	-0.98	
			<i>For >250 To 500, Deduct</i>	-1.23	
			<i>For >500, Deduct</i>	-1.47	
05 05 23 00-0315	EA		5/16" Diameter x 6" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	6.01	
			<i>For >100 To 250, Deduct</i>	-0.98	
			<i>For >250 To 500, Deduct</i>	-1.23	
			<i>For >500, Deduct</i>	-1.47	
05 05 23 00-0316	EA		5/16" Diameter x 6-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	6.15	
			<i>For >100 To 250, Deduct</i>	-0.98	
			<i>For >250 To 500, Deduct</i>	-1.23	
			<i>For >500, Deduct</i>	-1.47	
05 05 23 00-0317	EA		5/16" Diameter x 7" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	6.47	
			<i>For >100 To 250, Deduct</i>	-1.01	
			<i>For >250 To 500, Deduct</i>	-1.26	
			<i>For >500, Deduct</i>	-1.52	
05 05 23 00-0318	EA		5/16" Diameter x 7-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	6.67	
			<i>For >100 To 250, Deduct</i>	-1.01	
			<i>For >250 To 500, Deduct</i>	-1.26	
			<i>For >500, Deduct</i>	-1.52	
05 05 23 00-0319	EA		5/16" Diameter x 8" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	6.86	
			<i>For >100 To 250, Deduct</i>	-1.01	
			<i>For >250 To 500, Deduct</i>	-1.26	
			<i>For >500, Deduct</i>	-1.52	
05 05 23 00-0320			3/8" Diameter, Zinc Plated Steel, Grade 5, Hex Head Bolts <small>(05 05 23 00-0285)</small>		
05 05 23 00-0321	EA		3/8" Diameter x 1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	4.70	
			<i>For >100 To 250, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-1.13	
			<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0322	EA		3/8" Diameter x 1" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	4.72	
			<i>For >100 To 250, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-1.13	
			<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0323	EA		3/8" Diameter x 1-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	4.79	
			<i>For >100 To 250, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-1.13	
			<i>For >500, Deduct</i>	-1.36	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-0324 EA 3/8" Diameter x 2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	4.86	
<i>For >100 To 250, Deduct</i>	-0.90	
<i>For >250 To 500, Deduct</i>	-1.13	
<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0325 EA 3/8" Diameter x 2-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	5.06	
<i>For >100 To 250, Deduct</i>	-0.93	
<i>For >250 To 500, Deduct</i>	-1.16	
<i>For >500, Deduct</i>	-1.40	
05 05 23 00-0326 EA 3/8" Diameter x 3" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	5.14	
<i>For >100 To 250, Deduct</i>	-0.93	
<i>For >250 To 500, Deduct</i>	-1.16	
<i>For >500, Deduct</i>	-1.40	
05 05 23 00-0327 EA 3/8" Diameter x 3-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	5.27	
<i>For >100 To 250, Deduct</i>	-0.93	
<i>For >250 To 500, Deduct</i>	-1.16	
<i>For >500, Deduct</i>	-1.40	
05 05 23 00-0328 EA 3/8" Diameter x 4" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	5.54	
<i>For >100 To 250, Deduct</i>	-0.96	
<i>For >250 To 500, Deduct</i>	-1.20	
<i>For >500, Deduct</i>	-1.43	
05 05 23 00-0329 EA 3/8" Diameter x 4-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	5.84	
<i>For >100 To 250, Deduct</i>	-0.96	
<i>For >250 To 500, Deduct</i>	-1.20	
<i>For >500, Deduct</i>	-1.43	
05 05 23 00-0330 EA 3/8" Diameter x 5" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	5.97	
<i>For >100 To 250, Deduct</i>	-0.96	
<i>For >250 To 500, Deduct</i>	-1.20	
<i>For >500, Deduct</i>	-1.43	
05 05 23 00-0331 EA 3/8" Diameter x 5-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	6.28	
<i>For >100 To 250, Deduct</i>	-0.98	
<i>For >250 To 500, Deduct</i>	-1.23	
<i>For >500, Deduct</i>	-1.47	
05 05 23 00-0332 EA 3/8" Diameter x 6" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	6.41	
<i>For >100 To 250, Deduct</i>	-0.98	
<i>For >250 To 500, Deduct</i>	-1.23	
<i>For >500, Deduct</i>	-1.47	
05 05 23 00-0333 EA 3/8" Diameter x 6-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	6.63	
<i>For >100 To 250, Deduct</i>	-0.98	
<i>For >250 To 500, Deduct</i>	-1.23	
<i>For >500, Deduct</i>	-1.47	
05 05 23 00-0334 EA 3/8" Diameter x 7" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	6.94	
<i>For >100 To 250, Deduct</i>	-1.01	
<i>For >250 To 500, Deduct</i>	-1.26	
<i>For >500, Deduct</i>	-1.52	
05 05 23 00-0335 EA 3/8" Diameter x 7-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	7.24	
<i>For >100 To 250, Deduct</i>	-1.01	
<i>For >250 To 500, Deduct</i>	-1.26	
<i>For >500, Deduct</i>	-1.52	
05 05 23 00-0336 EA 3/8" Diameter x 8" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	7.48	
<i>For >100 To 250, Deduct</i>	-1.01	
<i>For >250 To 500, Deduct</i>	-1.26	
<i>For >500, Deduct</i>	-1.52	
05 05 23 00-0337 7/16" Diameter, Zinc Plated Steel, Grade 5, Hex Head Bolts <small>(05 05 23 00-0285)</small>		
05 05 23 00-0338 EA 7/16" Diameter x 1" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	5.50	
<i>For >100 To 250, Deduct</i>	-1.04	
<i>For >250 To 500, Deduct</i>	-1.30	
<i>For >500, Deduct</i>	-1.55	
05 05 23 00-0339 EA 7/16" Diameter x 1-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	5.56	
<i>For >100 To 250, Deduct</i>	-1.04	
<i>For >250 To 500, Deduct</i>	-1.30	
<i>For >500, Deduct</i>	-1.55	
05 05 23 00-0340 EA 7/16" Diameter x 2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	5.71	
<i>For >100 To 250, Deduct</i>	-1.04	
<i>For >250 To 500, Deduct</i>	-1.30	
<i>For >500, Deduct</i>	-1.55	
05 05 23 00-0341 EA 7/16" Diameter x 2-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	5.95	
<i>For >100 To 250, Deduct</i>	-1.06	
<i>For >250 To 500, Deduct</i>	-1.33	
<i>For >500, Deduct</i>	-1.59	
05 05 23 00-0342 EA 7/16" Diameter x 3" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	6.06	
<i>For >100 To 250, Deduct</i>	-1.06	
<i>For >250 To 500, Deduct</i>	-1.33	
<i>For >500, Deduct</i>	-1.59	
05 05 23 00-0343 EA 7/16" Diameter x 3-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	6.17	
<i>For >100 To 250, Deduct</i>	-1.06	
<i>For >250 To 500, Deduct</i>	-1.33	
<i>For >500, Deduct</i>	-1.59	
05 05 23 00-0344 EA 7/16" Diameter x 4" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	6.43	
<i>For >100 To 250, Deduct</i>	-1.09	
<i>For >250 To 500, Deduct</i>	-1.36	
<i>For >500, Deduct</i>	-1.63	

05 Metals**05 05 Common Work Results For Metals****05 05 23 Metal Fastenings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-0345	EA		7/16" Diameter x 4-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	7.03	
			<i>For >100 To 250, Deduct</i>	-1.09	
			<i>For >250 To 500, Deduct</i>	-1.36	
			<i>For >500, Deduct</i>	-1.63	
05 05 23 00-0346	EA		7/16" Diameter x 5" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	7.29	
			<i>For >100 To 250, Deduct</i>	-1.09	
			<i>For >250 To 500, Deduct</i>	-1.36	
			<i>For >500, Deduct</i>	-1.63	
05 05 23 00-0347	EA		7/16" Diameter x 5-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	7.50	
			<i>For >100 To 250, Deduct</i>	-1.11	
			<i>For >250 To 500, Deduct</i>	-1.39	
			<i>For >500, Deduct</i>	-1.67	
05 05 23 00-0348	EA		7/16" Diameter x 6" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	7.62	
			<i>For >100 To 250, Deduct</i>	-1.11	
			<i>For >250 To 500, Deduct</i>	-1.39	
			<i>For >500, Deduct</i>	-1.67	
05 05 23 00-0349	EA		7/16" Diameter x 6-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	7.75	
			<i>For >100 To 250, Deduct</i>	-1.11	
			<i>For >250 To 500, Deduct</i>	-1.39	
			<i>For >500, Deduct</i>	-1.67	
05 05 23 00-0350	EA		7/16" Diameter x 7" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	8.05	
			<i>For >100 To 250, Deduct</i>	-1.14	
			<i>For >250 To 500, Deduct</i>	-1.42	
			<i>For >500, Deduct</i>	-1.71	
05 05 23 00-0351	EA		7/16" Diameter x 7-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	8.23	
			<i>For >100 To 250, Deduct</i>	-1.14	
			<i>For >250 To 500, Deduct</i>	-1.42	
			<i>For >500, Deduct</i>	-1.71	
05 05 23 00-0352	EA		7/16" Diameter x 8" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	8.40	
			<i>For >100 To 250, Deduct</i>	-1.14	
			<i>For >250 To 500, Deduct</i>	-1.42	
			<i>For >500, Deduct</i>	-1.71	
05 05 23 00-0353			1/2" Diameter, Zinc Plated Steel, Grade 5, Hex Head Bolts <small>(05 05 23 00-0285)</small>		
05 05 23 00-0354	EA		1/2" Diameter x 1" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	5.58	
			<i>For >100 To 250, Deduct</i>	-1.04	
			<i>For >250 To 500, Deduct</i>	-1.30	
			<i>For >500, Deduct</i>	-1.55	
05 05 23 00-0355	EA		1/2" Diameter x 1-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	5.66	
			<i>For >100 To 250, Deduct</i>	-1.04	
			<i>For >250 To 500, Deduct</i>	-1.30	
			<i>For >500, Deduct</i>	-1.55	
05 05 23 00-0356	EA		1/2" Diameter x 2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	5.75	
			<i>For >100 To 250, Deduct</i>	-1.04	
			<i>For >250 To 500, Deduct</i>	-1.30	
			<i>For >500, Deduct</i>	-1.55	
05 05 23 00-0357	EA		1/2" Diameter x 2-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	6.01	
			<i>For >100 To 250, Deduct</i>	-1.06	
			<i>For >250 To 500, Deduct</i>	-1.33	
			<i>For >500, Deduct</i>	-1.59	
05 05 23 00-0358	EA		1/2" Diameter x 3" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	6.15	
			<i>For >100 To 250, Deduct</i>	-1.06	
			<i>For >250 To 500, Deduct</i>	-1.33	
			<i>For >500, Deduct</i>	-1.59	
05 05 23 00-0359	EA		1/2" Diameter x 3-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	6.29	
			<i>For >100 To 250, Deduct</i>	-1.06	
			<i>For >250 To 500, Deduct</i>	-1.33	
			<i>For >500, Deduct</i>	-1.59	
05 05 23 00-0360	EA		1/2" Diameter x 4" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	6.55	
			<i>For >100 To 250, Deduct</i>	-1.09	
			<i>For >250 To 500, Deduct</i>	-1.36	
			<i>For >500, Deduct</i>	-1.63	
05 05 23 00-0361	EA		1/2" Diameter x 4-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	7.01	
			<i>For >100 To 250, Deduct</i>	-1.09	
			<i>For >250 To 500, Deduct</i>	-1.36	
			<i>For >500, Deduct</i>	-1.63	
05 05 23 00-0362	EA		1/2" Diameter x 5" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	7.04	
			<i>For >100 To 250, Deduct</i>	-1.09	
			<i>For >250 To 500, Deduct</i>	-1.36	
			<i>For >500, Deduct</i>	-1.63	
05 05 23 00-0363	EA		1/2" Diameter x 5-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	7.49	
			<i>For >100 To 250, Deduct</i>	-1.11	
			<i>For >250 To 500, Deduct</i>	-1.39	
			<i>For >500, Deduct</i>	-1.67	
05 05 23 00-0364	EA		1/2" Diameter x 6" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	7.67	
			<i>For >100 To 250, Deduct</i>	-1.11	
			<i>For >250 To 500, Deduct</i>	-1.39	
			<i>For >500, Deduct</i>	-1.67	
05 05 23 00-0365	EA		1/2" Diameter x 6-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	8.13	
			<i>For >100 To 250, Deduct</i>	-1.11	
			<i>For >250 To 500, Deduct</i>	-1.39	
			<i>For >500, Deduct</i>	-1.67	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-0366 EA 1/2" Diameter x 7" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	8.68	
<i>For >100 To 250, Deduct</i>	-1.14	
<i>For >250 To 500, Deduct</i>	-1.42	
<i>For >500, Deduct</i>	-1.71	
05 05 23 00-0367 EA 1/2" Diameter x 7-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	8.95	
<i>For >100 To 250, Deduct</i>	-1.14	
<i>For >250 To 500, Deduct</i>	-1.42	
<i>For >500, Deduct</i>	-1.71	
05 05 23 00-0368 EA 1/2" Diameter x 8" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	9.04	
<i>For >100 To 250, Deduct</i>	-1.14	
<i>For >250 To 500, Deduct</i>	-1.42	
<i>For >500, Deduct</i>	-1.71	
05 05 23 00-0369 EA 1/2" Diameter x 8-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	9.65	
<i>For >100 To 250, Deduct</i>	-1.16	
<i>For >250 To 500, Deduct</i>	-1.46	
<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0370 EA 1/2" Diameter x 9" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	10.11	
<i>For >100 To 250, Deduct</i>	-1.16	
<i>For >250 To 500, Deduct</i>	-1.46	
<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0371 EA 1/2" Diameter x 9-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	10.76	
<i>For >100 To 250, Deduct</i>	-1.16	
<i>For >250 To 500, Deduct</i>	-1.46	
<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0372 EA 1/2" Diameter x 10" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	11.00	
<i>For >100 To 250, Deduct</i>	-1.16	
<i>For >250 To 500, Deduct</i>	-1.46	
<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0373 9/16" Diameter, Zinc Plated Steel, Grade 5, Hex Head Bolts <small>(05 05 23 00-0285)</small>		
05 05 23 00-0374 EA 9/16" Diameter x 1" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	5.83	
<i>For >100 To 250, Deduct</i>	-1.04	
<i>For >250 To 500, Deduct</i>	-1.30	
<i>For >500, Deduct</i>	-1.55	
05 05 23 00-0375 EA 9/16" Diameter x 1-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	5.98	
<i>For >100 To 250, Deduct</i>	-1.04	
<i>For >250 To 500, Deduct</i>	-1.30	
<i>For >500, Deduct</i>	-1.55	
05 05 23 00-0376 EA 9/16" Diameter x 2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	6.12	
<i>For >100 To 250, Deduct</i>	-1.04	
<i>For >250 To 500, Deduct</i>	-1.30	
<i>For >500, Deduct</i>	-1.55	
05 05 23 00-0377 EA 9/16" Diameter x 2-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	6.39	
<i>For >100 To 250, Deduct</i>	-1.06	
<i>For >250 To 500, Deduct</i>	-1.33	
<i>For >500, Deduct</i>	-1.59	
05 05 23 00-0378 EA 9/16" Diameter x 3" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	6.58	
<i>For >100 To 250, Deduct</i>	-1.06	
<i>For >250 To 500, Deduct</i>	-1.33	
<i>For >500, Deduct</i>	-1.59	
05 05 23 00-0379 EA 9/16" Diameter x 3-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	6.78	
<i>For >100 To 250, Deduct</i>	-1.06	
<i>For >250 To 500, Deduct</i>	-1.33	
<i>For >500, Deduct</i>	-1.59	
05 05 23 00-0380 EA 9/16" Diameter x 4" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	7.15	
<i>For >100 To 250, Deduct</i>	-1.09	
<i>For >250 To 500, Deduct</i>	-1.36	
<i>For >500, Deduct</i>	-1.63	
05 05 23 00-0381 EA 9/16" Diameter x 4-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	7.97	
<i>For >100 To 250, Deduct</i>	-1.09	
<i>For >250 To 500, Deduct</i>	-1.36	
<i>For >500, Deduct</i>	-1.63	
05 05 23 00-0382 EA 9/16" Diameter x 5" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	8.17	
<i>For >100 To 250, Deduct</i>	-1.09	
<i>For >250 To 500, Deduct</i>	-1.36	
<i>For >500, Deduct</i>	-1.63	
05 05 23 00-0383 EA 9/16" Diameter x 5-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	8.54	
<i>For >100 To 250, Deduct</i>	-1.11	
<i>For >250 To 500, Deduct</i>	-1.39	
<i>For >500, Deduct</i>	-1.67	
05 05 23 00-0384 EA 9/16" Diameter x 6" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	8.76	
<i>For >100 To 250, Deduct</i>	-1.11	
<i>For >250 To 500, Deduct</i>	-1.39	
<i>For >500, Deduct</i>	-1.67	
05 05 23 00-0385 EA 9/16" Diameter x 6-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	9.51	
<i>For >100 To 250, Deduct</i>	-1.11	
<i>For >250 To 500, Deduct</i>	-1.39	
<i>For >500, Deduct</i>	-1.67	
05 05 23 00-0386 EA 9/16" Diameter x 7" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	10.57	
<i>For >100 To 250, Deduct</i>	-1.14	
<i>For >250 To 500, Deduct</i>	-1.42	
<i>For >500, Deduct</i>	-1.71	

05 Metals**05 05 Common Work Results For Metals****05 05 23 Metal Fastenings**

MINOR		TOTAL DIRECT	DEMOLITION
CSI	UOM DESCRIPTION	UNIT COST	UNIT COST
05 05 23 00-0387	EA 9/16" Diameter x 7-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	10.87	
	<i>For >100 To 250, Deduct</i>	-1.14	
	<i>For >250 To 500, Deduct</i>	-1.42	
	<i>For >500, Deduct</i>	-1.71	
05 05 23 00-0388	EA 9/16" Diameter x 8" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	11.39	
	<i>For >100 To 250, Deduct</i>	-1.14	
	<i>For >250 To 500, Deduct</i>	-1.42	
	<i>For >500, Deduct</i>	-1.71	
05 05 23 00-0389	EA 9/16" Diameter x 8-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	12.01	
	<i>For >100 To 250, Deduct</i>	-1.16	
	<i>For >250 To 500, Deduct</i>	-1.46	
	<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0390	EA 9/16" Diameter x 9" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	12.20	
	<i>For >100 To 250, Deduct</i>	-1.16	
	<i>For >250 To 500, Deduct</i>	-1.46	
	<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0391	EA 9/16" Diameter x 9-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	12.38	
	<i>For >100 To 250, Deduct</i>	-1.16	
	<i>For >250 To 500, Deduct</i>	-1.46	
	<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0392	EA 9/16" Diameter x 10" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	12.85	
	<i>For >100 To 250, Deduct</i>	-1.16	
	<i>For >250 To 500, Deduct</i>	-1.46	
	<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0393	5/8" Diameter, Zinc Plated Steel, Grade 5, Hex Head Bolts <small>(05 05 23 00-0285)</small>		
05 05 23 00-0394	EA 5/8" Diameter x 1" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	6.63	
	<i>For >100 To 250, Deduct</i>	-1.16	
	<i>For >250 To 500, Deduct</i>	-1.46	
	<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0395	EA 5/8" Diameter x 1-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	6.68	
	<i>For >100 To 250, Deduct</i>	-1.16	
	<i>For >250 To 500, Deduct</i>	-1.46	
	<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0396	EA 5/8" Diameter x 2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	6.73	
	<i>For >100 To 250, Deduct</i>	-1.16	
	<i>For >250 To 500, Deduct</i>	-1.46	
	<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0397	EA 5/8" Diameter x 2-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	7.00	
	<i>For >100 To 250, Deduct</i>	-1.19	
	<i>For >250 To 500, Deduct</i>	-1.49	
	<i>For >500, Deduct</i>	-1.79	
05 05 23 00-0398	EA 5/8" Diameter x 3" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	7.25	
	<i>For >100 To 250, Deduct</i>	-1.19	
	<i>For >250 To 500, Deduct</i>	-1.49	
	<i>For >500, Deduct</i>	-1.79	
05 05 23 00-0399	EA 5/8" Diameter x 3-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	7.47	
	<i>For >100 To 250, Deduct</i>	-1.19	
	<i>For >250 To 500, Deduct</i>	-1.49	
	<i>For >500, Deduct</i>	-1.79	
05 05 23 00-0400	EA 5/8" Diameter x 4" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	7.84	
	<i>For >100 To 250, Deduct</i>	-1.22	
	<i>For >250 To 500, Deduct</i>	-1.52	
	<i>For >500, Deduct</i>	-1.82	
05 05 23 00-0401	EA 5/8" Diameter x 4-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	8.27	
	<i>For >100 To 250, Deduct</i>	-1.22	
	<i>For >250 To 500, Deduct</i>	-1.52	
	<i>For >500, Deduct</i>	-1.82	
05 05 23 00-0402	EA 5/8" Diameter x 5" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	8.50	
	<i>For >100 To 250, Deduct</i>	-1.22	
	<i>For >250 To 500, Deduct</i>	-1.52	
	<i>For >500, Deduct</i>	-1.82	
05 05 23 00-0403	EA 5/8" Diameter x 5-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	8.74	
	<i>For >100 To 250, Deduct</i>	-1.24	
	<i>For >250 To 500, Deduct</i>	-1.55	
	<i>For >500, Deduct</i>	-1.86	
05 05 23 00-0404	EA 5/8" Diameter x 6" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	9.12	
	<i>For >100 To 250, Deduct</i>	-1.24	
	<i>For >250 To 500, Deduct</i>	-1.55	
	<i>For >500, Deduct</i>	-1.86	
05 05 23 00-0405	EA 5/8" Diameter x 6-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	9.71	
	<i>For >100 To 250, Deduct</i>	-1.24	
	<i>For >250 To 500, Deduct</i>	-1.55	
	<i>For >500, Deduct</i>	-1.86	
05 05 23 00-0406	EA 5/8" Diameter x 7" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	10.38	
	<i>For >100 To 250, Deduct</i>	-1.27	
	<i>For >250 To 500, Deduct</i>	-1.58	
	<i>For >500, Deduct</i>	-1.90	
05 05 23 00-0407	EA 5/8" Diameter x 7-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	10.87	
	<i>For >100 To 250, Deduct</i>	-1.27	
	<i>For >250 To 500, Deduct</i>	-1.58	
	<i>For >500, Deduct</i>	-1.90	



MINOR	TOTAL DIRECT	DEMOLITION
CSI UOM DESCRIPTION	UNIT COST	UNIT COST
05 05 23 00-0408 EA 5/8" Diameter x 8" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	10.94	
<i>For >100 To 250, Deduct</i>	-1.27	
<i>For >250 To 500, Deduct</i>	-1.58	
<i>For >500, Deduct</i>	-1.90	
05 05 23 00-0409 EA 5/8" Diameter x 8-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	11.96	
<i>For >100 To 250, Deduct</i>	-1.29	
<i>For >250 To 500, Deduct</i>	-1.62	
<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0410 EA 5/8" Diameter x 9" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	12.62	
<i>For >100 To 250, Deduct</i>	-1.29	
<i>For >250 To 500, Deduct</i>	-1.62	
<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0411 EA 5/8" Diameter x 9-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	13.58	
<i>For >100 To 250, Deduct</i>	-1.29	
<i>For >250 To 500, Deduct</i>	-1.62	
<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0412 EA 5/8" Diameter x 10" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	13.92	
<i>For >100 To 250, Deduct</i>	-1.29	
<i>For >250 To 500, Deduct</i>	-1.62	
<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0413 3/4" Diameter, Zinc Plated Steel, Grade 5, Hex Head Bolts (05 05 23 00-0285)		
05 05 23 00-0414 EA 3/4" Diameter x 1" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	7.18	
<i>For >100 To 250, Deduct</i>	-1.16	
<i>For >250 To 500, Deduct</i>	-1.46	
<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0415 EA 3/4" Diameter x 1-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	7.28	
<i>For >100 To 250, Deduct</i>	-1.16	
<i>For >250 To 500, Deduct</i>	-1.46	
<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0416 EA 3/4" Diameter x 2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	7.34	
<i>For >100 To 250, Deduct</i>	-1.16	
<i>For >250 To 500, Deduct</i>	-1.46	
<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0417 EA 3/4" Diameter x 2-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	7.67	
<i>For >100 To 250, Deduct</i>	-1.19	
<i>For >250 To 500, Deduct</i>	-1.49	
<i>For >500, Deduct</i>	-1.79	
05 05 23 00-0418 EA 3/4" Diameter x 3" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	7.92	
<i>For >100 To 250, Deduct</i>	-1.19	
<i>For >250 To 500, Deduct</i>	-1.49	
<i>For >500, Deduct</i>	-1.79	
05 05 23 00-0419 EA 3/4" Diameter x 3-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	8.30	
<i>For >100 To 250, Deduct</i>	-1.19	
<i>For >250 To 500, Deduct</i>	-1.49	
<i>For >500, Deduct</i>	-1.79	
05 05 23 00-0420 EA 3/4" Diameter x 4" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	8.68	
<i>For >100 To 250, Deduct</i>	-1.22	
<i>For >250 To 500, Deduct</i>	-1.52	
<i>For >500, Deduct</i>	-1.82	
05 05 23 00-0421 EA 3/4" Diameter x 4-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	8.92	
<i>For >100 To 250, Deduct</i>	-1.22	
<i>For >250 To 500, Deduct</i>	-1.52	
<i>For >500, Deduct</i>	-1.82	
05 05 23 00-0422 EA 3/4" Diameter x 5" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	9.43	
<i>For >100 To 250, Deduct</i>	-1.22	
<i>For >250 To 500, Deduct</i>	-1.52	
<i>For >500, Deduct</i>	-1.82	
05 05 23 00-0423 EA 3/4" Diameter x 5-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	9.78	
<i>For >100 To 250, Deduct</i>	-1.24	
<i>For >250 To 500, Deduct</i>	-1.55	
<i>For >500, Deduct</i>	-1.86	
05 05 23 00-0424 EA 3/4" Diameter x 6" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	10.20	
<i>For >100 To 250, Deduct</i>	-1.24	
<i>For >250 To 500, Deduct</i>	-1.55	
<i>For >500, Deduct</i>	-1.86	
05 05 23 00-0425 EA 3/4" Diameter x 6-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	10.72	
<i>For >100 To 250, Deduct</i>	-1.24	
<i>For >250 To 500, Deduct</i>	-1.55	
<i>For >500, Deduct</i>	-1.86	
05 05 23 00-0426 EA 3/4" Diameter x 7" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	11.57	
<i>For >100 To 250, Deduct</i>	-1.27	
<i>For >250 To 500, Deduct</i>	-1.58	
<i>For >500, Deduct</i>	-1.90	
05 05 23 00-0427 EA 3/4" Diameter x 7-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	12.11	
<i>For >100 To 250, Deduct</i>	-1.27	
<i>For >250 To 500, Deduct</i>	-1.58	
<i>For >500, Deduct</i>	-1.90	
05 05 23 00-0428 EA 3/4" Diameter x 8" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	12.41	
<i>For >100 To 250, Deduct</i>	-1.27	
<i>For >250 To 500, Deduct</i>	-1.58	
<i>For >500, Deduct</i>	-1.90	

05 Metals**05 05 Common Work Results For Metals****05 05 23 Metal Fastenings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-0429	EA		3/4" Diameter x 8-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	13.33	
			<i>For >100 To 250, Deduct</i>	-1.29	
			<i>For >250 To 500, Deduct</i>	-1.62	
			<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0430	EA		3/4" Diameter x 9" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	13.60	
			<i>For >100 To 250, Deduct</i>	-1.29	
			<i>For >250 To 500, Deduct</i>	-1.62	
			<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0431	EA		3/4" Diameter x 9-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	14.48	
			<i>For >100 To 250, Deduct</i>	-1.29	
			<i>For >250 To 500, Deduct</i>	-1.62	
			<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0432	EA		3/4" Diameter x 10" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	14.70	
			<i>For >100 To 250, Deduct</i>	-1.29	
			<i>For >250 To 500, Deduct</i>	-1.62	
			<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0433			7/8" Diameter, Zinc Plated Steel, Grade 5, Hex Head Bolts (05 05 23 00-0285)		
05 05 23 00-0434	EA		7/8" Diameter x 1" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	8.52	
			<i>For >100 To 250, Deduct</i>	-1.29	
			<i>For >250 To 500, Deduct</i>	-1.62	
			<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0435	EA		7/8" Diameter x 1-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	8.64	
			<i>For >100 To 250, Deduct</i>	-1.29	
			<i>For >250 To 500, Deduct</i>	-1.62	
			<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0436	EA		7/8" Diameter x 2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	8.81	
			<i>For >100 To 250, Deduct</i>	-1.29	
			<i>For >250 To 500, Deduct</i>	-1.62	
			<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0437	EA		7/8" Diameter x 2-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	9.11	
			<i>For >100 To 250, Deduct</i>	-1.32	
			<i>For >250 To 500, Deduct</i>	-1.65	
			<i>For >500, Deduct</i>	-1.98	
05 05 23 00-0438	EA		7/8" Diameter x 3" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	9.61	
			<i>For >100 To 250, Deduct</i>	-1.32	
			<i>For >250 To 500, Deduct</i>	-1.65	
			<i>For >500, Deduct</i>	-1.98	
05 05 23 00-0439	EA		7/8" Diameter x 3-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	9.94	
			<i>For >100 To 250, Deduct</i>	-1.32	
			<i>For >250 To 500, Deduct</i>	-1.65	
			<i>For >500, Deduct</i>	-1.98	
05 05 23 00-0440	EA		7/8" Diameter x 4" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	10.31	
			<i>For >100 To 250, Deduct</i>	-1.35	
			<i>For >250 To 500, Deduct</i>	-1.68	
			<i>For >500, Deduct</i>	-2.02	
05 05 23 00-0441	EA		7/8" Diameter x 4-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	10.90	
			<i>For >100 To 250, Deduct</i>	-1.35	
			<i>For >250 To 500, Deduct</i>	-1.68	
			<i>For >500, Deduct</i>	-2.02	
05 05 23 00-0442	EA		7/8" Diameter x 5" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	11.34	
			<i>For >100 To 250, Deduct</i>	-1.35	
			<i>For >250 To 500, Deduct</i>	-1.68	
			<i>For >500, Deduct</i>	-2.02	
05 05 23 00-0443	EA		7/8" Diameter x 5-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	11.68	
			<i>For >100 To 250, Deduct</i>	-1.37	
			<i>For >250 To 500, Deduct</i>	-1.72	
			<i>For >500, Deduct</i>	-2.06	
05 05 23 00-0444	EA		7/8" Diameter x 6" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	12.05	
			<i>For >100 To 250, Deduct</i>	-1.37	
			<i>For >250 To 500, Deduct</i>	-1.72	
			<i>For >500, Deduct</i>	-2.06	
05 05 23 00-0445	EA		7/8" Diameter x 6-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	13.62	
			<i>For >100 To 250, Deduct</i>	-1.37	
			<i>For >250 To 500, Deduct</i>	-1.72	
			<i>For >500, Deduct</i>	-2.06	
05 05 23 00-0446	EA		7/8" Diameter x 7" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	14.31	
			<i>For >100 To 250, Deduct</i>	-1.40	
			<i>For >250 To 500, Deduct</i>	-1.75	
			<i>For >500, Deduct</i>	-2.09	
05 05 23 00-0447	EA		7/8" Diameter x 7-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	15.00	
			<i>For >100 To 250, Deduct</i>	-1.40	
			<i>For >250 To 500, Deduct</i>	-1.75	
			<i>For >500, Deduct</i>	-2.09	
05 05 23 00-0448	EA		7/8" Diameter x 8" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	15.04	
			<i>For >100 To 250, Deduct</i>	-1.40	
			<i>For >250 To 500, Deduct</i>	-1.75	
			<i>For >500, Deduct</i>	-2.09	
05 05 23 00-0449	EA		7/8" Diameter x 8-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	16.17	
			<i>For >100 To 250, Deduct</i>	-1.42	
			<i>For >250 To 500, Deduct</i>	-1.78	
			<i>For >500, Deduct</i>	-2.13	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-0450 EA 7/8" Diameter x 9" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	16.85	
<i>For >100 To 250, Deduct</i>	-1.42	
<i>For >250 To 500, Deduct</i>	-1.78	
<i>For >500, Deduct</i>	-2.13	
05 05 23 00-0451 EA 7/8" Diameter x 9-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	17.42	
<i>For >100 To 250, Deduct</i>	-1.42	
<i>For >250 To 500, Deduct</i>	-1.78	
<i>For >500, Deduct</i>	-2.13	
05 05 23 00-0452 EA 7/8" Diameter x 10" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	18.00	
<i>For >100 To 250, Deduct</i>	-1.42	
<i>For >250 To 500, Deduct</i>	-1.78	
<i>For >500, Deduct</i>	-2.13	
05 05 23 00-0453 1" Diameter, Zinc Plated Steel, Grade 5, Hex Head Bolts <small>(05 05 23 00-0285)</small>		
05 05 23 00-0454 EA 1" Diameter x 1-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	9.62	
<i>For >100 To 250, Deduct</i>	-1.29	
<i>For >250 To 500, Deduct</i>	-1.62	
<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0455 EA 1" Diameter x 2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	9.66	
<i>For >100 To 250, Deduct</i>	-1.29	
<i>For >250 To 500, Deduct</i>	-1.62	
<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0456 EA 1" Diameter x 2-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	10.17	
<i>For >100 To 250, Deduct</i>	-1.32	
<i>For >250 To 500, Deduct</i>	-1.65	
<i>For >500, Deduct</i>	-1.98	
05 05 23 00-0457 EA 1" Diameter x 3" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	10.65	
<i>For >100 To 250, Deduct</i>	-1.32	
<i>For >250 To 500, Deduct</i>	-1.65	
<i>For >500, Deduct</i>	-1.98	
05 05 23 00-0458 EA 1" Diameter x 3-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	11.00	
<i>For >100 To 250, Deduct</i>	-1.32	
<i>For >250 To 500, Deduct</i>	-1.65	
<i>For >500, Deduct</i>	-1.98	
05 05 23 00-0459 EA 1" Diameter x 4" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	11.58	
<i>For >100 To 250, Deduct</i>	-1.35	
<i>For >250 To 500, Deduct</i>	-1.68	
<i>For >500, Deduct</i>	-2.02	
05 05 23 00-0460 EA 1" Diameter x 4-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	12.15	
<i>For >100 To 250, Deduct</i>	-1.35	
<i>For >250 To 500, Deduct</i>	-1.68	
<i>For >500, Deduct</i>	-2.02	
05 05 23 00-0461 EA 1" Diameter x 5" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	12.96	
<i>For >100 To 250, Deduct</i>	-1.35	
<i>For >250 To 500, Deduct</i>	-1.68	
<i>For >500, Deduct</i>	-2.02	
05 05 23 00-0462 EA 1" Diameter x 5-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	13.68	
<i>For >100 To 250, Deduct</i>	-1.37	
<i>For >250 To 500, Deduct</i>	-1.72	
<i>For >500, Deduct</i>	-2.06	
05 05 23 00-0463 EA 1" Diameter x 6" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	13.85	
<i>For >100 To 250, Deduct</i>	-1.37	
<i>For >250 To 500, Deduct</i>	-1.72	
<i>For >500, Deduct</i>	-2.06	
05 05 23 00-0464 EA 1" Diameter x 6-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	14.99	
<i>For >100 To 250, Deduct</i>	-1.37	
<i>For >250 To 500, Deduct</i>	-1.72	
<i>For >500, Deduct</i>	-2.06	
05 05 23 00-0465 EA 1" Diameter x 7" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	15.84	
<i>For >100 To 250, Deduct</i>	-1.40	
<i>For >250 To 500, Deduct</i>	-1.75	
<i>For >500, Deduct</i>	-2.09	
05 05 23 00-0466 EA 1" Diameter x 7-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	17.06	
<i>For >100 To 250, Deduct</i>	-1.40	
<i>For >250 To 500, Deduct</i>	-1.75	
<i>For >500, Deduct</i>	-2.09	
05 05 23 00-0467 EA 1" Diameter x 8" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	17.40	
<i>For >100 To 250, Deduct</i>	-1.40	
<i>For >250 To 500, Deduct</i>	-1.75	
<i>For >500, Deduct</i>	-2.09	
05 05 23 00-0468 EA 1" Diameter x 8-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	21.43	
<i>For >100 To 250, Deduct</i>	-1.42	
<i>For >250 To 500, Deduct</i>	-1.78	
<i>For >500, Deduct</i>	-2.13	
05 05 23 00-0469 EA 1" Diameter x 9" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	21.73	
<i>For >100 To 250, Deduct</i>	-1.42	
<i>For >250 To 500, Deduct</i>	-1.78	
<i>For >500, Deduct</i>	-2.13	
05 05 23 00-0470 EA 1" Diameter x 9-1/2" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt.....	22.57	
<i>For >100 To 250, Deduct</i>	-1.42	
<i>For >250 To 500, Deduct</i>	-1.78	
<i>For >500, Deduct</i>	-2.13	

05 Metals**05 05 Common Work Results For Metals****05 05 23 Metal Fastenings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-0471	EA		1" Diameter x 10" Length, Zinc Plated Steel, Grade 5, Hex Head Bolt	23.14	
			<i>For >100 To 250, Deduct</i>	-1.42	
			<i>For >250 To 500, Deduct</i>	-1.78	
			<i>For >500, Deduct</i>	-2.13	
05 05 23 00-0472			Zinc Plated Steel, Grade 8, Hex Head Bolts <small>(05 05 23 00-0097)</small>		
05 05 23 00-0473			1/4" Diameter, Zinc Plated Steel, Grade 8, Hex Head Bolts <small>(05 05 23 00-0472)</small>		
05 05 23 00-0474	EA		1/4" Diameter x 1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	4.63	
			<i>For >100 To 250, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-1.13	
			<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0475	EA		1/4" Diameter x 1" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	4.69	
			<i>For >100 To 250, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-1.13	
			<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0476	EA		1/4" Diameter x 1-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	4.72	
			<i>For >100 To 250, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-1.13	
			<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0477	EA		1/4" Diameter x 2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	4.78	
			<i>For >100 To 250, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-1.13	
			<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0478	EA		1/4" Diameter x 2-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	4.95	
			<i>For >100 To 250, Deduct</i>	-0.93	
			<i>For >250 To 500, Deduct</i>	-1.16	
			<i>For >500, Deduct</i>	-1.40	
05 05 23 00-0479	EA		1/4" Diameter x 3" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	5.02	
			<i>For >100 To 250, Deduct</i>	-0.93	
			<i>For >250 To 500, Deduct</i>	-1.16	
			<i>For >500, Deduct</i>	-1.40	
05 05 23 00-0480	EA		1/4" Diameter x 3-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	5.08	
			<i>For >100 To 250, Deduct</i>	-0.93	
			<i>For >250 To 500, Deduct</i>	-1.16	
			<i>For >500, Deduct</i>	-1.40	
05 05 23 00-0481	EA		1/4" Diameter x 4" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	5.22	
			<i>For >100 To 250, Deduct</i>	-0.96	
			<i>For >250 To 500, Deduct</i>	-1.20	
			<i>For >500, Deduct</i>	-1.43	
05 05 23 00-0482	EA		1/4" Diameter x 4-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	5.41	
			<i>For >100 To 250, Deduct</i>	-0.96	
			<i>For >250 To 500, Deduct</i>	-1.20	
			<i>For >500, Deduct</i>	-1.43	
05 05 23 00-0483	EA		1/4" Diameter x 5" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	5.58	
			<i>For >100 To 250, Deduct</i>	-0.96	
			<i>For >250 To 500, Deduct</i>	-1.20	
			<i>For >500, Deduct</i>	-1.43	
05 05 23 00-0484	EA		1/4" Diameter x 5-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	5.80	
			<i>For >100 To 250, Deduct</i>	-0.98	
			<i>For >250 To 500, Deduct</i>	-1.23	
			<i>For >500, Deduct</i>	-1.47	
05 05 23 00-0485	EA		1/4" Diameter x 6" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	5.90	
			<i>For >100 To 250, Deduct</i>	-0.98	
			<i>For >250 To 500, Deduct</i>	-1.23	
			<i>For >500, Deduct</i>	-1.47	
05 05 23 00-0486	EA		1/4" Diameter x 6-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	6.02	
			<i>For >100 To 250, Deduct</i>	-0.98	
			<i>For >250 To 500, Deduct</i>	-1.23	
			<i>For >500, Deduct</i>	-1.47	
05 05 23 00-0487	EA		1/4" Diameter x 7" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	6.24	
			<i>For >100 To 250, Deduct</i>	-1.01	
			<i>For >250 To 500, Deduct</i>	-1.26	
			<i>For >500, Deduct</i>	-1.52	
05 05 23 00-0488	EA		1/4" Diameter x 7-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	6.47	
			<i>For >100 To 250, Deduct</i>	-1.01	
			<i>For >250 To 500, Deduct</i>	-1.26	
			<i>For >500, Deduct</i>	-1.52	
05 05 23 00-0489	EA		1/4" Diameter x 8" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	6.58	
			<i>For >100 To 250, Deduct</i>	-1.01	
			<i>For >250 To 500, Deduct</i>	-1.26	
			<i>For >500, Deduct</i>	-1.52	
05 05 23 00-0490			5/16" Diameter, Zinc Plated Steel, Grade 8, Hex Head Bolts <small>(05 05 23 00-0472)</small>		
05 05 23 00-0491	EA		5/16" Diameter x 1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	4.68	
			<i>For >100 To 250, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-1.13	
			<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0492	EA		5/16" Diameter x 1" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	4.71	
			<i>For >100 To 250, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-1.13	
			<i>For >500, Deduct</i>	-1.36	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-0493 EA 5/16" Diameter x 1-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt	4.83	
<i>For >100 To 250, Deduct</i>	-0.90	
<i>For >250 To 500, Deduct</i>	-1.13	
<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0494 EA 5/16" Diameter x 2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	4.85	
<i>For >100 To 250, Deduct</i>	-0.90	
<i>For >250 To 500, Deduct</i>	-1.13	
<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0495 EA 5/16" Diameter x 2-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt	5.04	
<i>For >100 To 250, Deduct</i>	-0.93	
<i>For >250 To 500, Deduct</i>	-1.16	
<i>For >500, Deduct</i>	-1.40	
05 05 23 00-0496 EA 5/16" Diameter x 3" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	5.21	
<i>For >100 To 250, Deduct</i>	-0.93	
<i>For >250 To 500, Deduct</i>	-1.16	
<i>For >500, Deduct</i>	-1.40	
05 05 23 00-0497 EA 5/16" Diameter x 3-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt	5.26	
<i>For >100 To 250, Deduct</i>	-0.93	
<i>For >250 To 500, Deduct</i>	-1.16	
<i>For >500, Deduct</i>	-1.40	
05 05 23 00-0498 EA 5/16" Diameter x 4" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	5.48	
<i>For >100 To 250, Deduct</i>	-0.96	
<i>For >250 To 500, Deduct</i>	-1.20	
<i>For >500, Deduct</i>	-1.43	
05 05 23 00-0499 EA 5/16" Diameter x 4-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt	5.59	
<i>For >100 To 250, Deduct</i>	-0.96	
<i>For >250 To 500, Deduct</i>	-1.20	
<i>For >500, Deduct</i>	-1.43	
05 05 23 00-0500 EA 5/16" Diameter x 5" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	5.83	
<i>For >100 To 250, Deduct</i>	-0.96	
<i>For >250 To 500, Deduct</i>	-1.20	
<i>For >500, Deduct</i>	-1.43	
05 05 23 00-0501 EA 5/16" Diameter x 5-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt	6.10	
<i>For >100 To 250, Deduct</i>	-0.98	
<i>For >250 To 500, Deduct</i>	-1.23	
<i>For >500, Deduct</i>	-1.47	
05 05 23 00-0502 EA 5/16" Diameter x 6" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	6.19	
<i>For >100 To 250, Deduct</i>	-0.98	
<i>For >250 To 500, Deduct</i>	-1.23	
<i>For >500, Deduct</i>	-1.47	
05 05 23 00-0503 EA 5/16" Diameter x 6-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt	6.33	
<i>For >100 To 250, Deduct</i>	-0.98	
<i>For >250 To 500, Deduct</i>	-1.23	
<i>For >500, Deduct</i>	-1.47	
05 05 23 00-0504 EA 5/16" Diameter x 7" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	6.57	
<i>For >100 To 250, Deduct</i>	-1.01	
<i>For >250 To 500, Deduct</i>	-1.26	
<i>For >500, Deduct</i>	-1.52	
05 05 23 00-0505 EA 5/16" Diameter x 7-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt	6.68	
<i>For >100 To 250, Deduct</i>	-1.01	
<i>For >250 To 500, Deduct</i>	-1.26	
<i>For >500, Deduct</i>	-1.52	
05 05 23 00-0506 EA 5/16" Diameter x 8" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	6.88	
<i>For >100 To 250, Deduct</i>	-1.01	
<i>For >250 To 500, Deduct</i>	-1.26	
<i>For >500, Deduct</i>	-1.52	
05 05 23 00-0507 3/8" Diameter, Zinc Plated Steel, Grade 8, Hex Head Bolts (05 05 23 00-0472)		
05 05 23 00-0508 EA 3/8" Diameter x 1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	4.80	
<i>For >100 To 250, Deduct</i>	-0.90	
<i>For >250 To 500, Deduct</i>	-1.13	
<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0509 EA 3/8" Diameter x 1" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	4.81	
<i>For >100 To 250, Deduct</i>	-0.90	
<i>For >250 To 500, Deduct</i>	-1.13	
<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0510 EA 3/8" Diameter x 1-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt	4.82	
<i>For >100 To 250, Deduct</i>	-0.90	
<i>For >250 To 500, Deduct</i>	-1.13	
<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0511 EA 3/8" Diameter x 2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	4.95	
<i>For >100 To 250, Deduct</i>	-0.90	
<i>For >250 To 500, Deduct</i>	-1.13	
<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0512 EA 3/8" Diameter x 2-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt	5.16	
<i>For >100 To 250, Deduct</i>	-0.93	
<i>For >250 To 500, Deduct</i>	-1.16	
<i>For >500, Deduct</i>	-1.40	
05 05 23 00-0513 EA 3/8" Diameter x 3" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	5.29	
<i>For >100 To 250, Deduct</i>	-0.93	
<i>For >250 To 500, Deduct</i>	-1.16	
<i>For >500, Deduct</i>	-1.40	

05 Metals**05 05 Common Work Results For Metals****05 05 23 Metal Fastenings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-0514	EA		3/8" Diameter x 3-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	5.41	
			<i>For >100 To 250, Deduct</i>	-0.93	
			<i>For >250 To 500, Deduct</i>	-1.16	
			<i>For >500, Deduct</i>	-1.40	
05 05 23 00-0515	EA		3/8" Diameter x 4" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	5.91	
			<i>For >100 To 250, Deduct</i>	-0.96	
			<i>For >250 To 500, Deduct</i>	-1.20	
			<i>For >500, Deduct</i>	-1.43	
05 05 23 00-0516	EA		3/8" Diameter x 4-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	6.06	
			<i>For >100 To 250, Deduct</i>	-0.96	
			<i>For >250 To 500, Deduct</i>	-1.20	
			<i>For >500, Deduct</i>	-1.43	
05 05 23 00-0517	EA		3/8" Diameter x 5" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	6.09	
			<i>For >100 To 250, Deduct</i>	-0.96	
			<i>For >250 To 500, Deduct</i>	-1.20	
			<i>For >500, Deduct</i>	-1.43	
05 05 23 00-0518	EA		3/8" Diameter x 5-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	6.28	
			<i>For >100 To 250, Deduct</i>	-0.98	
			<i>For >250 To 500, Deduct</i>	-1.23	
			<i>For >500, Deduct</i>	-1.47	
05 05 23 00-0519	EA		3/8" Diameter x 6" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	6.45	
			<i>For >100 To 250, Deduct</i>	-0.98	
			<i>For >250 To 500, Deduct</i>	-1.23	
			<i>For >500, Deduct</i>	-1.47	
05 05 23 00-0520	EA		3/8" Diameter x 6-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	7.18	
			<i>For >100 To 250, Deduct</i>	-0.98	
			<i>For >250 To 500, Deduct</i>	-1.23	
			<i>For >500, Deduct</i>	-1.47	
05 05 23 00-0521	EA		3/8" Diameter x 7" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	7.49	
			<i>For >100 To 250, Deduct</i>	-1.01	
			<i>For >250 To 500, Deduct</i>	-1.26	
			<i>For >500, Deduct</i>	-1.52	
05 05 23 00-0522	EA		3/8" Diameter x 7-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	7.83	
			<i>For >100 To 250, Deduct</i>	-1.01	
			<i>For >250 To 500, Deduct</i>	-1.26	
			<i>For >500, Deduct</i>	-1.52	
05 05 23 00-0523	EA		3/8" Diameter x 8" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	8.60	
			<i>For >100 To 250, Deduct</i>	-1.01	
			<i>For >250 To 500, Deduct</i>	-1.26	
			<i>For >500, Deduct</i>	-1.52	
05 05 23 00-0524			7/16" Diameter, Zinc Plated Steel, Grade 8, Hex Head Bolts <small>(05 05 23 00-0472)</small>		
05 05 23 00-0525	EA		7/16" Diameter x 1" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	5.59	
			<i>For >100 To 250, Deduct</i>	-1.04	
			<i>For >250 To 500, Deduct</i>	-1.30	
			<i>For >500, Deduct</i>	-1.55	
05 05 23 00-0526	EA		7/16" Diameter x 1-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	5.61	
			<i>For >100 To 250, Deduct</i>	-1.04	
			<i>For >250 To 500, Deduct</i>	-1.30	
			<i>For >500, Deduct</i>	-1.55	
05 05 23 00-0527	EA		7/16" Diameter x 2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	5.81	
			<i>For >100 To 250, Deduct</i>	-1.04	
			<i>For >250 To 500, Deduct</i>	-1.30	
			<i>For >500, Deduct</i>	-1.55	
05 05 23 00-0528	EA		7/16" Diameter x 2-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	5.95	
			<i>For >100 To 250, Deduct</i>	-1.06	
			<i>For >250 To 500, Deduct</i>	-1.33	
			<i>For >500, Deduct</i>	-1.59	
05 05 23 00-0529	EA		7/16" Diameter x 3" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	6.18	
			<i>For >100 To 250, Deduct</i>	-1.06	
			<i>For >250 To 500, Deduct</i>	-1.33	
			<i>For >500, Deduct</i>	-1.59	
05 05 23 00-0530	EA		7/16" Diameter x 3-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	6.31	
			<i>For >100 To 250, Deduct</i>	-1.06	
			<i>For >250 To 500, Deduct</i>	-1.33	
			<i>For >500, Deduct</i>	-1.59	
05 05 23 00-0531	EA		7/16" Diameter x 4" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	6.47	
			<i>For >100 To 250, Deduct</i>	-1.09	
			<i>For >250 To 500, Deduct</i>	-1.36	
			<i>For >500, Deduct</i>	-1.63	
05 05 23 00-0532	EA		7/16" Diameter x 4-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	6.98	
			<i>For >100 To 250, Deduct</i>	-1.09	
			<i>For >250 To 500, Deduct</i>	-1.36	
			<i>For >500, Deduct</i>	-1.63	
05 05 23 00-0533	EA		7/16" Diameter x 5" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	7.39	
			<i>For >100 To 250, Deduct</i>	-1.09	
			<i>For >250 To 500, Deduct</i>	-1.36	
			<i>For >500, Deduct</i>	-1.63	
05 05 23 00-0534	EA		7/16" Diameter x 5-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	7.79	
			<i>For >100 To 250, Deduct</i>	-1.11	
			<i>For >250 To 500, Deduct</i>	-1.39	
			<i>For >500, Deduct</i>	-1.67	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-0535 EA 7/16" Diameter x 6" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	7.93	
<i>For >100 To 250, Deduct</i>	-1.11	
<i>For >250 To 500, Deduct</i>	-1.39	
<i>For >500, Deduct</i>	-1.67	
05 05 23 00-0536 EA 7/16" Diameter x 6-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt	8.14	
<i>For >100 To 250, Deduct</i>	-1.11	
<i>For >250 To 500, Deduct</i>	-1.39	
<i>For >500, Deduct</i>	-1.67	
05 05 23 00-0537 EA 7/16" Diameter x 7" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	8.59	
<i>For >100 To 250, Deduct</i>	-1.14	
<i>For >250 To 500, Deduct</i>	-1.42	
<i>For >500, Deduct</i>	-1.71	
05 05 23 00-0538 EA 7/16" Diameter x 7-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt	9.27	
<i>For >100 To 250, Deduct</i>	-1.14	
<i>For >250 To 500, Deduct</i>	-1.42	
<i>For >500, Deduct</i>	-1.71	
05 05 23 00-0539 EA 7/16" Diameter x 8" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	9.32	
<i>For >100 To 250, Deduct</i>	-1.14	
<i>For >250 To 500, Deduct</i>	-1.42	
<i>For >500, Deduct</i>	-1.71	
05 05 23 00-0540 1/2" Diameter, Zinc Plated Steel, Grade 8, Hex Head Bolts (05 05 23 00-0472)		
05 05 23 00-0541 EA 1/2" Diameter x 1" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	5.72	
<i>For >100 To 250, Deduct</i>	-1.04	
<i>For >250 To 500, Deduct</i>	-1.30	
<i>For >500, Deduct</i>	-1.55	
05 05 23 00-0542 EA 1/2" Diameter x 1-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt	5.87	
<i>For >100 To 250, Deduct</i>	-1.04	
<i>For >250 To 500, Deduct</i>	-1.30	
<i>For >500, Deduct</i>	-1.55	
05 05 23 00-0543 EA 1/2" Diameter x 2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	5.97	
<i>For >100 To 250, Deduct</i>	-1.04	
<i>For >250 To 500, Deduct</i>	-1.30	
<i>For >500, Deduct</i>	-1.55	
05 05 23 00-0544 EA 1/2" Diameter x 2-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt	6.18	
<i>For >100 To 250, Deduct</i>	-1.06	
<i>For >250 To 500, Deduct</i>	-1.33	
<i>For >500, Deduct</i>	-1.59	
05 05 23 00-0545 EA 1/2" Diameter x 3" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	6.35	
<i>For >100 To 250, Deduct</i>	-1.06	
<i>For >250 To 500, Deduct</i>	-1.33	
<i>For >500, Deduct</i>	-1.59	
05 05 23 00-0546 EA 1/2" Diameter x 3-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt	6.72	
<i>For >100 To 250, Deduct</i>	-1.06	
<i>For >250 To 500, Deduct</i>	-1.33	
<i>For >500, Deduct</i>	-1.59	
05 05 23 00-0547 EA 1/2" Diameter x 4" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	7.12	
<i>For >100 To 250, Deduct</i>	-1.09	
<i>For >250 To 500, Deduct</i>	-1.36	
<i>For >500, Deduct</i>	-1.63	
05 05 23 00-0548 EA 1/2" Diameter x 4-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt	7.33	
<i>For >100 To 250, Deduct</i>	-1.09	
<i>For >250 To 500, Deduct</i>	-1.36	
<i>For >500, Deduct</i>	-1.63	
05 05 23 00-0549 EA 1/2" Diameter x 5" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	7.49	
<i>For >100 To 250, Deduct</i>	-1.09	
<i>For >250 To 500, Deduct</i>	-1.36	
<i>For >500, Deduct</i>	-1.63	
05 05 23 00-0550 EA 1/2" Diameter x 5-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt	7.89	
<i>For >100 To 250, Deduct</i>	-1.11	
<i>For >250 To 500, Deduct</i>	-1.39	
<i>For >500, Deduct</i>	-1.67	
05 05 23 00-0551 EA 1/2" Diameter x 6" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	8.36	
<i>For >100 To 250, Deduct</i>	-1.11	
<i>For >250 To 500, Deduct</i>	-1.39	
<i>For >500, Deduct</i>	-1.67	
05 05 23 00-0552 EA 1/2" Diameter x 6-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt	8.80	
<i>For >100 To 250, Deduct</i>	-1.11	
<i>For >250 To 500, Deduct</i>	-1.39	
<i>For >500, Deduct</i>	-1.67	
05 05 23 00-0553 EA 1/2" Diameter x 7" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	9.31	
<i>For >100 To 250, Deduct</i>	-1.14	
<i>For >250 To 500, Deduct</i>	-1.42	
<i>For >500, Deduct</i>	-1.71	
05 05 23 00-0554 EA 1/2" Diameter x 7-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt	9.50	
<i>For >100 To 250, Deduct</i>	-1.14	
<i>For >250 To 500, Deduct</i>	-1.42	
<i>For >500, Deduct</i>	-1.71	
05 05 23 00-0555 EA 1/2" Diameter x 8" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	10.04	
<i>For >100 To 250, Deduct</i>	-1.14	
<i>For >250 To 500, Deduct</i>	-1.42	
<i>For >500, Deduct</i>	-1.71	

05 Metals**05 05 Common Work Results For Metals****05 05 23 Metal Fastenings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-0556	EA		1/2" Diameter x 8-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	11.07	
			<i>For >100 To 250, Deduct</i>	-1.16	
			<i>For >250 To 500, Deduct</i>	-1.46	
			<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0557	EA		1/2" Diameter x 9" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	11.46	
			<i>For >100 To 250, Deduct</i>	-1.16	
			<i>For >250 To 500, Deduct</i>	-1.46	
			<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0558	EA		1/2" Diameter x 9-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	11.66	
			<i>For >100 To 250, Deduct</i>	-1.16	
			<i>For >250 To 500, Deduct</i>	-1.46	
			<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0559	EA		1/2" Diameter x 10" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	12.63	
			<i>For >100 To 250, Deduct</i>	-1.16	
			<i>For >250 To 500, Deduct</i>	-1.46	
			<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0560			9/16" Diameter, Zinc Plated Steel, Grade 8, Hex Head Bolts (05 05 23 00-0472)		
05 05 23 00-0561	EA		9/16" Diameter x 1" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	5.86	
			<i>For >100 To 250, Deduct</i>	-1.04	
			<i>For >250 To 500, Deduct</i>	-1.30	
			<i>For >500, Deduct</i>	-1.55	
05 05 23 00-0562	EA		9/16" Diameter x 1-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	5.95	
			<i>For >100 To 250, Deduct</i>	-1.04	
			<i>For >250 To 500, Deduct</i>	-1.30	
			<i>For >500, Deduct</i>	-1.55	
05 05 23 00-0563	EA		9/16" Diameter x 2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	6.16	
			<i>For >100 To 250, Deduct</i>	-1.04	
			<i>For >250 To 500, Deduct</i>	-1.30	
			<i>For >500, Deduct</i>	-1.55	
05 05 23 00-0564	EA		9/16" Diameter x 2-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	6.59	
			<i>For >100 To 250, Deduct</i>	-1.06	
			<i>For >250 To 500, Deduct</i>	-1.33	
			<i>For >500, Deduct</i>	-1.59	
05 05 23 00-0565	EA		9/16" Diameter x 3" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	6.66	
			<i>For >100 To 250, Deduct</i>	-1.06	
			<i>For >250 To 500, Deduct</i>	-1.33	
			<i>For >500, Deduct</i>	-1.59	
05 05 23 00-0566	EA		9/16" Diameter x 3-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	6.97	
			<i>For >100 To 250, Deduct</i>	-1.06	
			<i>For >250 To 500, Deduct</i>	-1.33	
			<i>For >500, Deduct</i>	-1.59	
05 05 23 00-0567	EA		9/16" Diameter x 4" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	7.31	
			<i>For >100 To 250, Deduct</i>	-1.09	
			<i>For >250 To 500, Deduct</i>	-1.36	
			<i>For >500, Deduct</i>	-1.63	
05 05 23 00-0568	EA		9/16" Diameter x 4-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	8.31	
			<i>For >100 To 250, Deduct</i>	-1.09	
			<i>For >250 To 500, Deduct</i>	-1.36	
			<i>For >500, Deduct</i>	-1.63	
05 05 23 00-0569	EA		9/16" Diameter x 5" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	8.51	
			<i>For >100 To 250, Deduct</i>	-1.09	
			<i>For >250 To 500, Deduct</i>	-1.36	
			<i>For >500, Deduct</i>	-1.63	
05 05 23 00-0570	EA		9/16" Diameter x 5-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	8.79	
			<i>For >100 To 250, Deduct</i>	-1.11	
			<i>For >250 To 500, Deduct</i>	-1.39	
			<i>For >500, Deduct</i>	-1.67	
05 05 23 00-0571	EA		9/16" Diameter x 6" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	9.23	
			<i>For >100 To 250, Deduct</i>	-1.11	
			<i>For >250 To 500, Deduct</i>	-1.39	
			<i>For >500, Deduct</i>	-1.67	
05 05 23 00-0572	EA		9/16" Diameter x 6-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	10.87	
			<i>For >100 To 250, Deduct</i>	-1.11	
			<i>For >250 To 500, Deduct</i>	-1.39	
			<i>For >500, Deduct</i>	-1.67	
05 05 23 00-0573	EA		9/16" Diameter x 7" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	12.93	
			<i>For >100 To 250, Deduct</i>	-1.14	
			<i>For >250 To 500, Deduct</i>	-1.42	
			<i>For >500, Deduct</i>	-1.71	
05 05 23 00-0574	EA		9/16" Diameter x 7-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	15.31	
			<i>For >100 To 250, Deduct</i>	-1.14	
			<i>For >250 To 500, Deduct</i>	-1.42	
			<i>For >500, Deduct</i>	-1.71	
05 05 23 00-0575	EA		9/16" Diameter x 8" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	17.89	
			<i>For >100 To 250, Deduct</i>	-1.14	
			<i>For >250 To 500, Deduct</i>	-1.42	
			<i>For >500, Deduct</i>	-1.71	
05 05 23 00-0576			5/8" Diameter, Zinc Plated Steel, Grade 8, Hex Head Bolts (05 05 23 00-0472)		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-0577 EA 5/8" Diameter x 1" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	6.82	
<i>For >100 To 250, Deduct</i>	-1.16	
<i>For >250 To 500, Deduct</i>	-1.46	
<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0578 EA 5/8" Diameter x 1-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt	6.92	
<i>For >100 To 250, Deduct</i>	-1.16	
<i>For >250 To 500, Deduct</i>	-1.46	
<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0579 EA 5/8" Diameter x 2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	7.15	
<i>For >100 To 250, Deduct</i>	-1.16	
<i>For >250 To 500, Deduct</i>	-1.46	
<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0580 EA 5/8" Diameter x 2-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt	7.61	
<i>For >100 To 250, Deduct</i>	-1.19	
<i>For >250 To 500, Deduct</i>	-1.49	
<i>For >500, Deduct</i>	-1.79	
05 05 23 00-0581 EA 5/8" Diameter x 3" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	7.89	
<i>For >100 To 250, Deduct</i>	-1.19	
<i>For >250 To 500, Deduct</i>	-1.49	
<i>For >500, Deduct</i>	-1.79	
05 05 23 00-0582 EA 5/8" Diameter x 3-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt	8.04	
<i>For >100 To 250, Deduct</i>	-1.19	
<i>For >250 To 500, Deduct</i>	-1.49	
<i>For >500, Deduct</i>	-1.79	
05 05 23 00-0583 EA 5/8" Diameter x 4" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	8.28	
<i>For >100 To 250, Deduct</i>	-1.22	
<i>For >250 To 500, Deduct</i>	-1.52	
<i>For >500, Deduct</i>	-1.82	
05 05 23 00-0584 EA 5/8" Diameter x 4-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt	8.77	
<i>For >100 To 250, Deduct</i>	-1.22	
<i>For >250 To 500, Deduct</i>	-1.52	
<i>For >500, Deduct</i>	-1.82	
05 05 23 00-0585 EA 5/8" Diameter x 5" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	8.99	
<i>For >100 To 250, Deduct</i>	-1.22	
<i>For >250 To 500, Deduct</i>	-1.52	
<i>For >500, Deduct</i>	-1.82	
05 05 23 00-0586 EA 5/8" Diameter x 5-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt	9.34	
<i>For >100 To 250, Deduct</i>	-1.24	
<i>For >250 To 500, Deduct</i>	-1.55	
<i>For >500, Deduct</i>	-1.86	
05 05 23 00-0587 EA 5/8" Diameter x 6" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	9.58	
<i>For >100 To 250, Deduct</i>	-1.24	
<i>For >250 To 500, Deduct</i>	-1.55	
<i>For >500, Deduct</i>	-1.86	
05 05 23 00-0588 EA 5/8" Diameter x 6-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt	10.06	
<i>For >100 To 250, Deduct</i>	-1.24	
<i>For >250 To 500, Deduct</i>	-1.55	
<i>For >500, Deduct</i>	-1.86	
05 05 23 00-0589 EA 5/8" Diameter x 7" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	11.35	
<i>For >100 To 250, Deduct</i>	-1.27	
<i>For >250 To 500, Deduct</i>	-1.58	
<i>For >500, Deduct</i>	-1.90	
05 05 23 00-0590 EA 5/8" Diameter x 7-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt	11.90	
<i>For >100 To 250, Deduct</i>	-1.27	
<i>For >250 To 500, Deduct</i>	-1.58	
<i>For >500, Deduct</i>	-1.90	
05 05 23 00-0591 EA 5/8" Diameter x 8" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	12.13	
<i>For >100 To 250, Deduct</i>	-1.27	
<i>For >250 To 500, Deduct</i>	-1.58	
<i>For >500, Deduct</i>	-1.90	
05 05 23 00-0592 EA 5/8" Diameter x 8-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt	13.25	
<i>For >100 To 250, Deduct</i>	-1.29	
<i>For >250 To 500, Deduct</i>	-1.62	
<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0593 EA 5/8" Diameter x 9" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	14.34	
<i>For >100 To 250, Deduct</i>	-1.29	
<i>For >250 To 500, Deduct</i>	-1.62	
<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0594 EA 5/8" Diameter x 9-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt	14.42	
<i>For >100 To 250, Deduct</i>	-1.29	
<i>For >250 To 500, Deduct</i>	-1.62	
<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0595 EA 5/8" Diameter x 10" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	15.43	
<i>For >100 To 250, Deduct</i>	-1.29	
<i>For >250 To 500, Deduct</i>	-1.62	
<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0596 3/4" Diameter, Zinc Plated Steel, Grade 8, Hex Head Bolts (05 05 23 00-0472)		
05 05 23 00-0597 EA 3/4" Diameter x 1" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	7.34	
<i>For >100 To 250, Deduct</i>	-1.16	
<i>For >250 To 500, Deduct</i>	-1.46	
<i>For >500, Deduct</i>	-1.75	

05 Metals**05 05 Common Work Results For Metals****05 05 23 Metal Fastenings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-0598	EA		3/4" Diameter x 1-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	7.44	
			<i>For >100 To 250, Deduct</i>	-1.16	
			<i>For >250 To 500, Deduct</i>	-1.46	
			<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0599	EA		3/4" Diameter x 2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	7.51	
			<i>For >100 To 250, Deduct</i>	-1.16	
			<i>For >250 To 500, Deduct</i>	-1.46	
			<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0600	EA		3/4" Diameter x 2-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	7.78	
			<i>For >100 To 250, Deduct</i>	-1.19	
			<i>For >250 To 500, Deduct</i>	-1.49	
			<i>For >500, Deduct</i>	-1.79	
05 05 23 00-0601	EA		3/4" Diameter x 3" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	7.98	
			<i>For >100 To 250, Deduct</i>	-1.19	
			<i>For >250 To 500, Deduct</i>	-1.49	
			<i>For >500, Deduct</i>	-1.79	
05 05 23 00-0602	EA		3/4" Diameter x 3-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	8.57	
			<i>For >100 To 250, Deduct</i>	-1.19	
			<i>For >250 To 500, Deduct</i>	-1.49	
			<i>For >500, Deduct</i>	-1.79	
05 05 23 00-0603	EA		3/4" Diameter x 4" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	8.95	
			<i>For >100 To 250, Deduct</i>	-1.22	
			<i>For >250 To 500, Deduct</i>	-1.52	
			<i>For >500, Deduct</i>	-1.82	
05 05 23 00-0604	EA		3/4" Diameter x 4-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	9.00	
			<i>For >100 To 250, Deduct</i>	-1.22	
			<i>For >250 To 500, Deduct</i>	-1.52	
			<i>For >500, Deduct</i>	-1.82	
05 05 23 00-0605	EA		3/4" Diameter x 5" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	9.81	
			<i>For >100 To 250, Deduct</i>	-1.22	
			<i>For >250 To 500, Deduct</i>	-1.52	
			<i>For >500, Deduct</i>	-1.82	
05 05 23 00-0606	EA		3/4" Diameter x 5-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	10.22	
			<i>For >100 To 250, Deduct</i>	-1.24	
			<i>For >250 To 500, Deduct</i>	-1.55	
			<i>For >500, Deduct</i>	-1.86	
05 05 23 00-0607	EA		3/4" Diameter x 6" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	10.64	
			<i>For >100 To 250, Deduct</i>	-1.24	
			<i>For >250 To 500, Deduct</i>	-1.55	
			<i>For >500, Deduct</i>	-1.86	
05 05 23 00-0608	EA		3/4" Diameter x 6-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	11.43	
			<i>For >100 To 250, Deduct</i>	-1.24	
			<i>For >250 To 500, Deduct</i>	-1.55	
			<i>For >500, Deduct</i>	-1.86	
05 05 23 00-0609	EA		3/4" Diameter x 7" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	12.52	
			<i>For >100 To 250, Deduct</i>	-1.27	
			<i>For >250 To 500, Deduct</i>	-1.58	
			<i>For >500, Deduct</i>	-1.90	
05 05 23 00-0610	EA		3/4" Diameter x 7-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	12.94	
			<i>For >100 To 250, Deduct</i>	-1.27	
			<i>For >250 To 500, Deduct</i>	-1.58	
			<i>For >500, Deduct</i>	-1.90	
05 05 23 00-0611	EA		3/4" Diameter x 8" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	13.15	
			<i>For >100 To 250, Deduct</i>	-1.27	
			<i>For >250 To 500, Deduct</i>	-1.58	
			<i>For >500, Deduct</i>	-1.90	
05 05 23 00-0612	EA		3/4" Diameter x 8-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	14.32	
			<i>For >100 To 250, Deduct</i>	-1.29	
			<i>For >250 To 500, Deduct</i>	-1.62	
			<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0613	EA		3/4" Diameter x 9" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	15.08	
			<i>For >100 To 250, Deduct</i>	-1.29	
			<i>For >250 To 500, Deduct</i>	-1.62	
			<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0614	EA		3/4" Diameter x 9-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	15.63	
			<i>For >100 To 250, Deduct</i>	-1.29	
			<i>For >250 To 500, Deduct</i>	-1.62	
			<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0615	EA		3/4" Diameter x 10" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	15.84	
			<i>For >100 To 250, Deduct</i>	-1.29	
			<i>For >250 To 500, Deduct</i>	-1.62	
			<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0616			7/8" Diameter, Zinc Plated Steel, Grade 8, Hex Head Bolts (05 05 23 00-0472)		
05 05 23 00-0617	EA		7/8" Diameter x 1-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	9.41	
			<i>For >100 To 250, Deduct</i>	-1.29	
			<i>For >250 To 500, Deduct</i>	-1.62	
			<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0618	EA		7/8" Diameter x 2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	9.67	
			<i>For >100 To 250, Deduct</i>	-1.29	
			<i>For >250 To 500, Deduct</i>	-1.62	
			<i>For >500, Deduct</i>	-1.94	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-0619 EA 7/8" Diameter x 2-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt	10.19	
<i>For >100 To 250, Deduct</i>	-1.32	
<i>For >250 To 500, Deduct</i>	-1.65	
<i>For >500, Deduct</i>	-1.98	
05 05 23 00-0620 EA 7/8" Diameter x 3" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	10.97	
<i>For >100 To 250, Deduct</i>	-1.32	
<i>For >250 To 500, Deduct</i>	-1.65	
<i>For >500, Deduct</i>	-1.98	
05 05 23 00-0621 EA 7/8" Diameter x 3-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt	11.06	
<i>For >100 To 250, Deduct</i>	-1.32	
<i>For >250 To 500, Deduct</i>	-1.65	
<i>For >500, Deduct</i>	-1.98	
05 05 23 00-0622 EA 7/8" Diameter x 4" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	11.36	
<i>For >100 To 250, Deduct</i>	-1.35	
<i>For >250 To 500, Deduct</i>	-1.68	
<i>For >500, Deduct</i>	-2.02	
05 05 23 00-0623 EA 7/8" Diameter x 4-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt	13.24	
<i>For >100 To 250, Deduct</i>	-1.35	
<i>For >250 To 500, Deduct</i>	-1.68	
<i>For >500, Deduct</i>	-2.02	
05 05 23 00-0624 EA 7/8" Diameter x 5" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	13.72	
<i>For >100 To 250, Deduct</i>	-1.35	
<i>For >250 To 500, Deduct</i>	-1.68	
<i>For >500, Deduct</i>	-2.02	
05 05 23 00-0625 EA 7/8" Diameter x 5-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt	14.97	
<i>For >100 To 250, Deduct</i>	-1.37	
<i>For >250 To 500, Deduct</i>	-1.72	
<i>For >500, Deduct</i>	-2.06	
05 05 23 00-0626 EA 7/8" Diameter x 6" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	15.67	
<i>For >100 To 250, Deduct</i>	-1.37	
<i>For >250 To 500, Deduct</i>	-1.72	
<i>For >500, Deduct</i>	-2.06	
05 05 23 00-0627 EA 7/8" Diameter x 6-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt	17.50	
<i>For >100 To 250, Deduct</i>	-1.37	
<i>For >250 To 500, Deduct</i>	-1.72	
<i>For >500, Deduct</i>	-2.06	
05 05 23 00-0628 EA 7/8" Diameter x 7" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	18.22	
<i>For >100 To 250, Deduct</i>	-1.40	
<i>For >250 To 500, Deduct</i>	-1.75	
<i>For >500, Deduct</i>	-2.09	
05 05 23 00-0629 EA 7/8" Diameter x 7-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt	20.10	
<i>For >100 To 250, Deduct</i>	-1.40	
<i>For >250 To 500, Deduct</i>	-1.75	
<i>For >500, Deduct</i>	-2.09	
05 05 23 00-0630 EA 7/8" Diameter x 8" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	20.86	
<i>For >100 To 250, Deduct</i>	-1.40	
<i>For >250 To 500, Deduct</i>	-1.75	
<i>For >500, Deduct</i>	-2.09	
05 05 23 00-0631 EA 7/8" Diameter x 8-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt	21.59	
<i>For >100 To 250, Deduct</i>	-1.42	
<i>For >250 To 500, Deduct</i>	-1.78	
<i>For >500, Deduct</i>	-2.13	
05 05 23 00-0632 EA 7/8" Diameter x 9" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	21.81	
<i>For >100 To 250, Deduct</i>	-1.42	
<i>For >250 To 500, Deduct</i>	-1.78	
<i>For >500, Deduct</i>	-2.13	
05 05 23 00-0633 EA 7/8" Diameter x 9-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt	22.00	
<i>For >100 To 250, Deduct</i>	-1.42	
<i>For >250 To 500, Deduct</i>	-1.78	
<i>For >500, Deduct</i>	-2.13	
05 05 23 00-0634 EA 7/8" Diameter x 10" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	22.45	
<i>For >100 To 250, Deduct</i>	-1.42	
<i>For >250 To 500, Deduct</i>	-1.78	
<i>For >500, Deduct</i>	-2.13	
05 05 23 00-0635 1" Diameter, Zinc Plated Steel, Grade 8, Hex Head Bolts <small>(05 05 23 00-0472)</small>		
05 05 23 00-0636 EA 1" Diameter x 1-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt	10.15	
<i>For >100 To 250, Deduct</i>	-1.29	
<i>For >250 To 500, Deduct</i>	-1.62	
<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0637 EA 1" Diameter x 2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	10.80	
<i>For >100 To 250, Deduct</i>	-1.29	
<i>For >250 To 500, Deduct</i>	-1.62	
<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0638 EA 1" Diameter x 2-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt	11.23	
<i>For >100 To 250, Deduct</i>	-1.32	
<i>For >250 To 500, Deduct</i>	-1.65	
<i>For >500, Deduct</i>	-1.98	
05 05 23 00-0639 EA 1" Diameter x 3" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	11.72	
<i>For >100 To 250, Deduct</i>	-1.32	
<i>For >250 To 500, Deduct</i>	-1.65	
<i>For >500, Deduct</i>	-1.98	

05 Metals**05 05 Common Work Results For Metals****05 05 23 Metal Fastenings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-0640	EA		1" Diameter x 3-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	12.63	
			<i>For >100 To 250, Deduct</i>	-1.32	
			<i>For >250 To 500, Deduct</i>	-1.65	
			<i>For >500, Deduct</i>	-1.98	
05 05 23 00-0641	EA		1" Diameter x 4" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	13.00	
			<i>For >100 To 250, Deduct</i>	-1.35	
			<i>For >250 To 500, Deduct</i>	-1.68	
			<i>For >500, Deduct</i>	-2.02	
05 05 23 00-0642	EA		1" Diameter x 4-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	13.79	
			<i>For >100 To 250, Deduct</i>	-1.35	
			<i>For >250 To 500, Deduct</i>	-1.68	
			<i>For >500, Deduct</i>	-2.02	
05 05 23 00-0643	EA		1" Diameter x 5" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	14.84	
			<i>For >100 To 250, Deduct</i>	-1.35	
			<i>For >250 To 500, Deduct</i>	-1.68	
			<i>For >500, Deduct</i>	-2.02	
05 05 23 00-0644	EA		1" Diameter x 5-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	15.46	
			<i>For >100 To 250, Deduct</i>	-1.37	
			<i>For >250 To 500, Deduct</i>	-1.72	
			<i>For >500, Deduct</i>	-2.06	
05 05 23 00-0645	EA		1" Diameter x 6" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	15.90	
			<i>For >100 To 250, Deduct</i>	-1.37	
			<i>For >250 To 500, Deduct</i>	-1.72	
			<i>For >500, Deduct</i>	-2.06	
05 05 23 00-0646	EA		1" Diameter x 6-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	18.10	
			<i>For >100 To 250, Deduct</i>	-1.37	
			<i>For >250 To 500, Deduct</i>	-1.72	
			<i>For >500, Deduct</i>	-2.06	
05 05 23 00-0647	EA		1" Diameter x 7" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	18.56	
			<i>For >100 To 250, Deduct</i>	-1.40	
			<i>For >250 To 500, Deduct</i>	-1.75	
			<i>For >500, Deduct</i>	-2.09	
05 05 23 00-0648	EA		1" Diameter x 7-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	21.04	
			<i>For >100 To 250, Deduct</i>	-1.40	
			<i>For >250 To 500, Deduct</i>	-1.75	
			<i>For >500, Deduct</i>	-2.09	
05 05 23 00-0649	EA		1" Diameter x 8" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	21.47	
			<i>For >100 To 250, Deduct</i>	-1.40	
			<i>For >250 To 500, Deduct</i>	-1.75	
			<i>For >500, Deduct</i>	-2.09	
05 05 23 00-0650	EA		1" Diameter x 8-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	22.92	
			<i>For >100 To 250, Deduct</i>	-1.42	
			<i>For >250 To 500, Deduct</i>	-1.78	
			<i>For >500, Deduct</i>	-2.13	
05 05 23 00-0651	EA		1" Diameter x 9" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	23.64	
			<i>For >100 To 250, Deduct</i>	-1.42	
			<i>For >250 To 500, Deduct</i>	-1.78	
			<i>For >500, Deduct</i>	-2.13	
05 05 23 00-0652	EA		1" Diameter x 9-1/2" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	25.53	
			<i>For >100 To 250, Deduct</i>	-1.42	
			<i>For >250 To 500, Deduct</i>	-1.78	
			<i>For >500, Deduct</i>	-2.13	
05 05 23 00-0653	EA		1" Diameter x 10" Length, Yellow Zinc Plated Steel, Grade 8, Hex Head Bolt.....	26.69	
			<i>For >100 To 250, Deduct</i>	-1.42	
			<i>For >250 To 500, Deduct</i>	-1.78	
			<i>For >500, Deduct</i>	-2.13	
05 05 23 00-0654			Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolts <small>(05 05 23 00-0097)</small>		
05 05 23 00-0655			1/4" Diameter, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolts <small>(05 05 23 00-0654)</small>		
05 05 23 00-0656	EA		1/4" Diameter x 1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	4.71	
			<i>For >100 To 250, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-1.13	
			<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0657	EA		1/4" Diameter x 1" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	4.72	
			<i>For >100 To 250, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-1.13	
			<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0658	EA		1/4" Diameter x 1-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	4.73	
			<i>For >100 To 250, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-1.13	
			<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0659	EA		1/4" Diameter x 2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	4.86	
			<i>For >100 To 250, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-1.13	
			<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0660	EA		1/4" Diameter x 2-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.06	
			<i>For >100 To 250, Deduct</i>	-0.93	
			<i>For >250 To 500, Deduct</i>	-1.16	
			<i>For >500, Deduct</i>	-1.40	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-0661 EA 1/4" Diameter x 3" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.14	
<i>For >100 To 250, Deduct</i>	-0.93	
<i>For >250 To 500, Deduct</i>	-1.16	
<i>For >500, Deduct</i>	-1.40	
05 05 23 00-0662 EA 1/4" Diameter x 3-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.17	
<i>For >100 To 250, Deduct</i>	-0.93	
<i>For >250 To 500, Deduct</i>	-1.16	
<i>For >500, Deduct</i>	-1.40	
05 05 23 00-0663 EA 1/4" Diameter x 4" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.31	
<i>For >100 To 250, Deduct</i>	-0.96	
<i>For >250 To 500, Deduct</i>	-1.20	
<i>For >500, Deduct</i>	-1.43	
05 05 23 00-0664 EA 1/4" Diameter x 4-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.40	
<i>For >100 To 250, Deduct</i>	-0.96	
<i>For >250 To 500, Deduct</i>	-1.20	
<i>For >500, Deduct</i>	-1.43	
05 05 23 00-0665 EA 1/4" Diameter x 5" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.43	
<i>For >100 To 250, Deduct</i>	-0.96	
<i>For >250 To 500, Deduct</i>	-1.20	
<i>For >500, Deduct</i>	-1.43	
05 05 23 00-0666 EA 1/4" Diameter x 5-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.62	
<i>For >100 To 250, Deduct</i>	-0.98	
<i>For >250 To 500, Deduct</i>	-1.23	
<i>For >500, Deduct</i>	-1.47	
05 05 23 00-0667 EA 1/4" Diameter x 6" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.71	
<i>For >100 To 250, Deduct</i>	-0.98	
<i>For >250 To 500, Deduct</i>	-1.23	
<i>For >500, Deduct</i>	-1.47	
05 05 23 00-0668 EA 1/4" Diameter x 6-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.73	
<i>For >100 To 250, Deduct</i>	-0.98	
<i>For >250 To 500, Deduct</i>	-1.23	
<i>For >500, Deduct</i>	-1.47	
05 05 23 00-0669 EA 1/4" Diameter x 7" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.95	
<i>For >100 To 250, Deduct</i>	-1.01	
<i>For >250 To 500, Deduct</i>	-1.26	
<i>For >500, Deduct</i>	-1.52	
05 05 23 00-0670 EA 1/4" Diameter x 7-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.17	
<i>For >100 To 250, Deduct</i>	-1.01	
<i>For >250 To 500, Deduct</i>	-1.26	
<i>For >500, Deduct</i>	-1.52	
05 05 23 00-0671 EA 1/4" Diameter x 8" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.46	
<i>For >100 To 250, Deduct</i>	-1.01	
<i>For >250 To 500, Deduct</i>	-1.26	
<i>For >500, Deduct</i>	-1.52	
05 05 23 00-0672 5/16" Diameter, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolts <small>(05 05 23 00-0654)</small>		
05 05 23 00-0673 EA 5/16" Diameter x 1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	4.65	
<i>For >100 To 250, Deduct</i>	-0.90	
<i>For >250 To 500, Deduct</i>	-1.13	
<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0674 EA 5/16" Diameter x 1" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	4.91	
<i>For >100 To 250, Deduct</i>	-0.90	
<i>For >250 To 500, Deduct</i>	-1.13	
<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0675 EA 5/16" Diameter x 1-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	4.93	
<i>For >100 To 250, Deduct</i>	-0.90	
<i>For >250 To 500, Deduct</i>	-1.13	
<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0676 EA 5/16" Diameter x 2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	4.94	
<i>For >100 To 250, Deduct</i>	-0.90	
<i>For >250 To 500, Deduct</i>	-1.13	
<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0677 EA 5/16" Diameter x 2-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.19	
<i>For >100 To 250, Deduct</i>	-0.93	
<i>For >250 To 500, Deduct</i>	-1.16	
<i>For >500, Deduct</i>	-1.40	
05 05 23 00-0678 EA 5/16" Diameter x 3" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.43	
<i>For >100 To 250, Deduct</i>	-0.93	
<i>For >250 To 500, Deduct</i>	-1.16	
<i>For >500, Deduct</i>	-1.40	
05 05 23 00-0679 EA 5/16" Diameter x 3-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.47	
<i>For >100 To 250, Deduct</i>	-0.93	
<i>For >250 To 500, Deduct</i>	-1.16	
<i>For >500, Deduct</i>	-1.40	
05 05 23 00-0680 EA 5/16" Diameter x 4" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.67	
<i>For >100 To 250, Deduct</i>	-0.96	
<i>For >250 To 500, Deduct</i>	-1.20	
<i>For >500, Deduct</i>	-1.43	
05 05 23 00-0681 EA 5/16" Diameter x 4-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.70	
<i>For >100 To 250, Deduct</i>	-0.96	
<i>For >250 To 500, Deduct</i>	-1.20	
<i>For >500, Deduct</i>	-1.43	

05 Metals**05 05 Common Work Results For Metals****05 05 23 Metal Fastenings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-0682	EA		5/16" Diameter x 5" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.89	
			<i>For >100 To 250, Deduct</i>	-0.96	
			<i>For >250 To 500, Deduct</i>	-1.20	
			<i>For >500, Deduct</i>	-1.43	
05 05 23 00-0683	EA		5/16" Diameter x 5-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.07	
			<i>For >100 To 250, Deduct</i>	-0.98	
			<i>For >250 To 500, Deduct</i>	-1.23	
			<i>For >500, Deduct</i>	-1.47	
05 05 23 00-0684	EA		5/16" Diameter x 6" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.15	
			<i>For >100 To 250, Deduct</i>	-0.98	
			<i>For >250 To 500, Deduct</i>	-1.23	
			<i>For >500, Deduct</i>	-1.47	
05 05 23 00-0685	EA		5/16" Diameter x 6-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.33	
			<i>For >100 To 250, Deduct</i>	-0.98	
			<i>For >250 To 500, Deduct</i>	-1.23	
			<i>For >500, Deduct</i>	-1.47	
05 05 23 00-0686	EA		5/16" Diameter x 7" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.85	
			<i>For >100 To 250, Deduct</i>	-1.01	
			<i>For >250 To 500, Deduct</i>	-1.26	
			<i>For >500, Deduct</i>	-1.52	
05 05 23 00-0687	EA		5/16" Diameter x 7-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	7.15	
			<i>For >100 To 250, Deduct</i>	-1.01	
			<i>For >250 To 500, Deduct</i>	-1.26	
			<i>For >500, Deduct</i>	-1.52	
05 05 23 00-0688	EA		5/16" Diameter x 8" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	7.43	
			<i>For >100 To 250, Deduct</i>	-1.01	
			<i>For >250 To 500, Deduct</i>	-1.26	
			<i>For >500, Deduct</i>	-1.52	
05 05 23 00-0689 3/8" Diameter, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolts					
<small>(05 05 23 00-0654)</small>					
05 05 23 00-0690	EA		3/8" Diameter x 1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	4.73	
			<i>For >100 To 250, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-1.13	
			<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0691	EA		3/8" Diameter x 1" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	4.79	
			<i>For >100 To 250, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-1.13	
			<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0692	EA		3/8" Diameter x 1-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	4.85	
			<i>For >100 To 250, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-1.13	
			<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0693	EA		3/8" Diameter x 2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.01	
			<i>For >100 To 250, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-1.13	
			<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0694	EA		3/8" Diameter x 2-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.21	
			<i>For >100 To 250, Deduct</i>	-0.93	
			<i>For >250 To 500, Deduct</i>	-1.16	
			<i>For >500, Deduct</i>	-1.40	
05 05 23 00-0695	EA		3/8" Diameter x 3" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.34	
			<i>For >100 To 250, Deduct</i>	-0.93	
			<i>For >250 To 500, Deduct</i>	-1.16	
			<i>For >500, Deduct</i>	-1.40	
05 05 23 00-0696	EA		3/8" Diameter x 3-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.43	
			<i>For >100 To 250, Deduct</i>	-0.93	
			<i>For >250 To 500, Deduct</i>	-1.16	
			<i>For >500, Deduct</i>	-1.40	
05 05 23 00-0697	EA		3/8" Diameter x 4" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.69	
			<i>For >100 To 250, Deduct</i>	-0.96	
			<i>For >250 To 500, Deduct</i>	-1.20	
			<i>For >500, Deduct</i>	-1.43	
05 05 23 00-0698	EA		3/8" Diameter x 4-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.76	
			<i>For >100 To 250, Deduct</i>	-0.96	
			<i>For >250 To 500, Deduct</i>	-1.20	
			<i>For >500, Deduct</i>	-1.43	
05 05 23 00-0699	EA		3/8" Diameter x 5" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.91	
			<i>For >100 To 250, Deduct</i>	-0.96	
			<i>For >250 To 500, Deduct</i>	-1.20	
			<i>For >500, Deduct</i>	-1.43	
05 05 23 00-0700	EA		3/8" Diameter x 5-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.11	
			<i>For >100 To 250, Deduct</i>	-0.98	
			<i>For >250 To 500, Deduct</i>	-1.23	
			<i>For >500, Deduct</i>	-1.47	
05 05 23 00-0701	EA		3/8" Diameter x 6" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.33	
			<i>For >100 To 250, Deduct</i>	-0.98	
			<i>For >250 To 500, Deduct</i>	-1.23	
			<i>For >500, Deduct</i>	-1.47	
05 05 23 00-0702	EA		3/8" Diameter x 6-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.37	
			<i>For >100 To 250, Deduct</i>	-0.98	
			<i>For >250 To 500, Deduct</i>	-1.23	
			<i>For >500, Deduct</i>	-1.47	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-0703 EA 3/8" Diameter x 7" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.52	
<i>For >100 To 250, Deduct</i>	-1.01	
<i>For >250 To 500, Deduct</i>	-1.26	
<i>For >500, Deduct</i>	-1.52	
05 05 23 00-0704 EA 3/8" Diameter x 7-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.54	
<i>For >100 To 250, Deduct</i>	-1.01	
<i>For >250 To 500, Deduct</i>	-1.26	
<i>For >500, Deduct</i>	-1.52	
05 05 23 00-0705 EA 3/8" Diameter x 8" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.80	
<i>For >100 To 250, Deduct</i>	-1.01	
<i>For >250 To 500, Deduct</i>	-1.26	
<i>For >500, Deduct</i>	-1.52	
05 05 23 00-0706 7/16" Diameter, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolts		
<small>(05 05 23 00-0654)</small>		
05 05 23 00-0707 EA 7/16" Diameter x 1" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.78	
<i>For >100 To 250, Deduct</i>	-1.04	
<i>For >250 To 500, Deduct</i>	-1.30	
<i>For >500, Deduct</i>	-1.55	
05 05 23 00-0708 EA 7/16" Diameter x 1-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.06	
<i>For >100 To 250, Deduct</i>	-1.04	
<i>For >250 To 500, Deduct</i>	-1.30	
<i>For >500, Deduct</i>	-1.55	
05 05 23 00-0709 EA 7/16" Diameter x 2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.28	
<i>For >100 To 250, Deduct</i>	-1.04	
<i>For >250 To 500, Deduct</i>	-1.30	
<i>For >500, Deduct</i>	-1.55	
05 05 23 00-0710 EA 7/16" Diameter x 2-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.76	
<i>For >100 To 250, Deduct</i>	-1.06	
<i>For >250 To 500, Deduct</i>	-1.33	
<i>For >500, Deduct</i>	-1.59	
05 05 23 00-0711 EA 7/16" Diameter x 3" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.78	
<i>For >100 To 250, Deduct</i>	-1.06	
<i>For >250 To 500, Deduct</i>	-1.33	
<i>For >500, Deduct</i>	-1.59	
05 05 23 00-0712 EA 7/16" Diameter x 3-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.80	
<i>For >100 To 250, Deduct</i>	-1.06	
<i>For >250 To 500, Deduct</i>	-1.33	
<i>For >500, Deduct</i>	-1.59	
05 05 23 00-0713 EA 7/16" Diameter x 4" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	7.11	
<i>For >100 To 250, Deduct</i>	-1.09	
<i>For >250 To 500, Deduct</i>	-1.36	
<i>For >500, Deduct</i>	-1.63	
05 05 23 00-0714 EA 7/16" Diameter x 4-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	7.31	
<i>For >100 To 250, Deduct</i>	-1.09	
<i>For >250 To 500, Deduct</i>	-1.36	
<i>For >500, Deduct</i>	-1.63	
05 05 23 00-0715 EA 7/16" Diameter x 5" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	7.49	
<i>For >100 To 250, Deduct</i>	-1.09	
<i>For >250 To 500, Deduct</i>	-1.36	
<i>For >500, Deduct</i>	-1.63	
05 05 23 00-0716 EA 7/16" Diameter x 5-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	7.82	
<i>For >100 To 250, Deduct</i>	-1.11	
<i>For >250 To 500, Deduct</i>	-1.39	
<i>For >500, Deduct</i>	-1.67	
05 05 23 00-0717 EA 7/16" Diameter x 6" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	8.04	
<i>For >100 To 250, Deduct</i>	-1.11	
<i>For >250 To 500, Deduct</i>	-1.39	
<i>For >500, Deduct</i>	-1.67	
05 05 23 00-0718 1/2" Diameter, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolts		
<small>(05 05 23 00-0654)</small>		
05 05 23 00-0719 EA 1/2" Diameter x 1" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.65	
<i>For >100 To 250, Deduct</i>	-1.04	
<i>For >250 To 500, Deduct</i>	-1.30	
<i>For >500, Deduct</i>	-1.55	
05 05 23 00-0720 EA 1/2" Diameter x 1-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.74	
<i>For >100 To 250, Deduct</i>	-1.04	
<i>For >250 To 500, Deduct</i>	-1.30	
<i>For >500, Deduct</i>	-1.55	
05 05 23 00-0721 EA 1/2" Diameter x 2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	5.93	
<i>For >100 To 250, Deduct</i>	-1.04	
<i>For >250 To 500, Deduct</i>	-1.30	
<i>For >500, Deduct</i>	-1.55	
05 05 23 00-0722 EA 1/2" Diameter x 2-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.26	
<i>For >100 To 250, Deduct</i>	-1.06	
<i>For >250 To 500, Deduct</i>	-1.33	
<i>For >500, Deduct</i>	-1.59	
05 05 23 00-0723 EA 1/2" Diameter x 3" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.40	
<i>For >100 To 250, Deduct</i>	-1.06	
<i>For >250 To 500, Deduct</i>	-1.33	
<i>For >500, Deduct</i>	-1.59	

05 Metals**05 05 Common Work Results For Metals****05 05 23 Metal Fastenings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-0724	EA		1/2" Diameter x 3-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.66	
			<i>For >100 To 250, Deduct</i>	-1.06	
			<i>For >250 To 500, Deduct</i>	-1.33	
			<i>For >500, Deduct</i>	-1.59	
05 05 23 00-0725	EA		1/2" Diameter x 4" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.84	
			<i>For >100 To 250, Deduct</i>	-1.09	
			<i>For >250 To 500, Deduct</i>	-1.36	
			<i>For >500, Deduct</i>	-1.63	
05 05 23 00-0726	EA		1/2" Diameter x 4-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.94	
			<i>For >100 To 250, Deduct</i>	-1.09	
			<i>For >250 To 500, Deduct</i>	-1.36	
			<i>For >500, Deduct</i>	-1.63	
05 05 23 00-0727	EA		1/2" Diameter x 5" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	7.15	
			<i>For >100 To 250, Deduct</i>	-1.09	
			<i>For >250 To 500, Deduct</i>	-1.36	
			<i>For >500, Deduct</i>	-1.63	
05 05 23 00-0728	EA		1/2" Diameter x 5-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	7.38	
			<i>For >100 To 250, Deduct</i>	-1.11	
			<i>For >250 To 500, Deduct</i>	-1.39	
			<i>For >500, Deduct</i>	-1.67	
05 05 23 00-0729	EA		1/2" Diameter x 6" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	7.61	
			<i>For >100 To 250, Deduct</i>	-1.11	
			<i>For >250 To 500, Deduct</i>	-1.39	
			<i>For >500, Deduct</i>	-1.67	
05 05 23 00-0730	EA		1/2" Diameter x 6-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	7.63	
			<i>For >100 To 250, Deduct</i>	-1.11	
			<i>For >250 To 500, Deduct</i>	-1.39	
			<i>For >500, Deduct</i>	-1.67	
05 05 23 00-0731	EA		1/2" Diameter x 7" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	7.81	
			<i>For >100 To 250, Deduct</i>	-1.14	
			<i>For >250 To 500, Deduct</i>	-1.42	
			<i>For >500, Deduct</i>	-1.71	
05 05 23 00-0732	EA		1/2" Diameter x 7-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	7.87	
			<i>For >100 To 250, Deduct</i>	-1.14	
			<i>For >250 To 500, Deduct</i>	-1.42	
			<i>For >500, Deduct</i>	-1.71	
05 05 23 00-0733	EA		1/2" Diameter x 8" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	8.05	
			<i>For >100 To 250, Deduct</i>	-1.14	
			<i>For >250 To 500, Deduct</i>	-1.42	
			<i>For >500, Deduct</i>	-1.71	
05 05 23 00-0734	EA		1/2" Diameter x 8-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	9.02	
			<i>For >100 To 250, Deduct</i>	-1.16	
			<i>For >250 To 500, Deduct</i>	-1.46	
			<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0735	EA		1/2" Diameter x 9" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	9.16	
			<i>For >100 To 250, Deduct</i>	-1.16	
			<i>For >250 To 500, Deduct</i>	-1.46	
			<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0736	EA		1/2" Diameter x 9-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	9.19	
			<i>For >100 To 250, Deduct</i>	-1.16	
			<i>For >250 To 500, Deduct</i>	-1.46	
			<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0737	EA		1/2" Diameter x 10" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	9.27	
			<i>For >100 To 250, Deduct</i>	-1.16	
			<i>For >250 To 500, Deduct</i>	-1.46	
			<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0738			5/8" Diameter, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolts <small>(05 05 23 00-0654)</small>		
05 05 23 00-0739	EA		5/8" Diameter x 1" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.62	
			<i>For >100 To 250, Deduct</i>	-1.16	
			<i>For >250 To 500, Deduct</i>	-1.46	
			<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0740	EA		5/8" Diameter x 1-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.76	
			<i>For >100 To 250, Deduct</i>	-1.16	
			<i>For >250 To 500, Deduct</i>	-1.46	
			<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0741	EA		5/8" Diameter x 2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	6.86	
			<i>For >100 To 250, Deduct</i>	-1.16	
			<i>For >250 To 500, Deduct</i>	-1.46	
			<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0742	EA		5/8" Diameter x 2-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	7.15	
			<i>For >100 To 250, Deduct</i>	-1.19	
			<i>For >250 To 500, Deduct</i>	-1.49	
			<i>For >500, Deduct</i>	-1.79	
05 05 23 00-0743	EA		5/8" Diameter x 3" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	7.36	
			<i>For >100 To 250, Deduct</i>	-1.19	
			<i>For >250 To 500, Deduct</i>	-1.49	
			<i>For >500, Deduct</i>	-1.79	
05 05 23 00-0744	EA		5/8" Diameter x 3-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	7.83	
			<i>For >100 To 250, Deduct</i>	-1.19	
			<i>For >250 To 500, Deduct</i>	-1.49	
			<i>For >500, Deduct</i>	-1.79	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-0745 EA 5/8" Diameter x 4" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	8.03	
<i>For >100 To 250, Deduct</i>	-1.22	
<i>For >250 To 500, Deduct</i>	-1.52	
<i>For >500, Deduct</i>	-1.82	
05 05 23 00-0746 EA 5/8" Diameter x 4-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	8.11	
<i>For >100 To 250, Deduct</i>	-1.22	
<i>For >250 To 500, Deduct</i>	-1.52	
<i>For >500, Deduct</i>	-1.82	
05 05 23 00-0747 EA 5/8" Diameter x 5" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	8.26	
<i>For >100 To 250, Deduct</i>	-1.22	
<i>For >250 To 500, Deduct</i>	-1.52	
<i>For >500, Deduct</i>	-1.82	
05 05 23 00-0748 EA 5/8" Diameter x 5-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	8.56	
<i>For >100 To 250, Deduct</i>	-1.24	
<i>For >250 To 500, Deduct</i>	-1.55	
<i>For >500, Deduct</i>	-1.86	
05 05 23 00-0749 EA 5/8" Diameter x 6" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	8.73	
<i>For >100 To 250, Deduct</i>	-1.24	
<i>For >250 To 500, Deduct</i>	-1.55	
<i>For >500, Deduct</i>	-1.86	
05 05 23 00-0750 EA 5/8" Diameter x 6-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	9.21	
<i>For >100 To 250, Deduct</i>	-1.24	
<i>For >250 To 500, Deduct</i>	-1.55	
<i>For >500, Deduct</i>	-1.86	
05 05 23 00-0751 EA 5/8" Diameter x 7" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	9.37	
<i>For >100 To 250, Deduct</i>	-1.27	
<i>For >250 To 500, Deduct</i>	-1.58	
<i>For >500, Deduct</i>	-1.90	
05 05 23 00-0752 EA 5/8" Diameter x 7-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	10.21	
<i>For >100 To 250, Deduct</i>	-1.27	
<i>For >250 To 500, Deduct</i>	-1.58	
<i>For >500, Deduct</i>	-1.90	
05 05 23 00-0753 EA 5/8" Diameter x 8" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	10.45	
<i>For >100 To 250, Deduct</i>	-1.27	
<i>For >250 To 500, Deduct</i>	-1.58	
<i>For >500, Deduct</i>	-1.90	
05 05 23 00-0754 EA 5/8" Diameter x 8-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	10.94	
<i>For >100 To 250, Deduct</i>	-1.29	
<i>For >250 To 500, Deduct</i>	-1.62	
<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0755 EA 5/8" Diameter x 9" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	11.34	
<i>For >100 To 250, Deduct</i>	-1.29	
<i>For >250 To 500, Deduct</i>	-1.62	
<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0756 EA 5/8" Diameter x 9-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	12.24	
<i>For >100 To 250, Deduct</i>	-1.29	
<i>For >250 To 500, Deduct</i>	-1.62	
<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0757 EA 5/8" Diameter x 10" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	12.31	
<i>For >100 To 250, Deduct</i>	-1.29	
<i>For >250 To 500, Deduct</i>	-1.62	
<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0758 3/4" Diameter, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolts <small>(05 05 23 00-0654)</small>		
05 05 23 00-0759 EA 3/4" Diameter x 1" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	7.30	
<i>For >100 To 250, Deduct</i>	-1.16	
<i>For >250 To 500, Deduct</i>	-1.46	
<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0760 EA 3/4" Diameter x 1-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	7.34	
<i>For >100 To 250, Deduct</i>	-1.16	
<i>For >250 To 500, Deduct</i>	-1.46	
<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0761 EA 3/4" Diameter x 2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	7.51	
<i>For >100 To 250, Deduct</i>	-1.16	
<i>For >250 To 500, Deduct</i>	-1.46	
<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0762 EA 3/4" Diameter x 2-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	8.03	
<i>For >100 To 250, Deduct</i>	-1.19	
<i>For >250 To 500, Deduct</i>	-1.49	
<i>For >500, Deduct</i>	-1.79	
05 05 23 00-0763 EA 3/4" Diameter x 3" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	8.68	
<i>For >100 To 250, Deduct</i>	-1.19	
<i>For >250 To 500, Deduct</i>	-1.49	
<i>For >500, Deduct</i>	-1.79	
05 05 23 00-0764 EA 3/4" Diameter x 3-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	9.10	
<i>For >100 To 250, Deduct</i>	-1.19	
<i>For >250 To 500, Deduct</i>	-1.49	
<i>For >500, Deduct</i>	-1.79	
05 05 23 00-0765 EA 3/4" Diameter x 4" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	9.46	
<i>For >100 To 250, Deduct</i>	-1.22	
<i>For >250 To 500, Deduct</i>	-1.52	
<i>For >500, Deduct</i>	-1.82	

05 Metals**05 05 Common Work Results For Metals****05 05 23 Metal Fastenings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-0766	EA		3/4" Diameter x 4-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	9.49	
			<i>For >100 To 250, Deduct</i>	-1.22	
			<i>For >250 To 500, Deduct</i>	-1.52	
			<i>For >500, Deduct</i>	-1.82	
05 05 23 00-0767	EA		3/4" Diameter x 5" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	9.58	
			<i>For >100 To 250, Deduct</i>	-1.22	
			<i>For >250 To 500, Deduct</i>	-1.52	
			<i>For >500, Deduct</i>	-1.82	
05 05 23 00-0768	EA		3/4" Diameter x 5-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	9.76	
			<i>For >100 To 250, Deduct</i>	-1.24	
			<i>For >250 To 500, Deduct</i>	-1.55	
			<i>For >500, Deduct</i>	-1.86	
05 05 23 00-0769	EA		3/4" Diameter x 6" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	10.32	
			<i>For >100 To 250, Deduct</i>	-1.24	
			<i>For >250 To 500, Deduct</i>	-1.55	
			<i>For >500, Deduct</i>	-1.86	
05 05 23 00-0770	EA		3/4" Diameter x 6-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	10.55	
			<i>For >100 To 250, Deduct</i>	-1.24	
			<i>For >250 To 500, Deduct</i>	-1.55	
			<i>For >500, Deduct</i>	-1.86	
05 05 23 00-0771	EA		3/4" Diameter x 7" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	11.13	
			<i>For >100 To 250, Deduct</i>	-1.27	
			<i>For >250 To 500, Deduct</i>	-1.58	
			<i>For >500, Deduct</i>	-1.90	
05 05 23 00-0772	EA		3/4" Diameter x 7-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	11.21	
			<i>For >100 To 250, Deduct</i>	-1.27	
			<i>For >250 To 500, Deduct</i>	-1.58	
			<i>For >500, Deduct</i>	-1.90	
05 05 23 00-0773	EA		3/4" Diameter x 8" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	11.43	
			<i>For >100 To 250, Deduct</i>	-1.27	
			<i>For >250 To 500, Deduct</i>	-1.58	
			<i>For >500, Deduct</i>	-1.90	
05 05 23 00-0774	EA		3/4" Diameter x 8-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	11.90	
			<i>For >100 To 250, Deduct</i>	-1.29	
			<i>For >250 To 500, Deduct</i>	-1.62	
			<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0775	EA		3/4" Diameter x 9" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	12.14	
			<i>For >100 To 250, Deduct</i>	-1.29	
			<i>For >250 To 500, Deduct</i>	-1.62	
			<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0776	EA		3/4" Diameter x 9-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	12.27	
			<i>For >100 To 250, Deduct</i>	-1.29	
			<i>For >250 To 500, Deduct</i>	-1.62	
			<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0777	EA		3/4" Diameter x 10" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	12.34	
			<i>For >100 To 250, Deduct</i>	-1.29	
			<i>For >250 To 500, Deduct</i>	-1.62	
			<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0778			7/8" Diameter, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolts <small>(05 05 23 00-0654)</small>		
05 05 23 00-0779	EA		7/8" Diameter x 1-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	9.30	
			<i>For >100 To 250, Deduct</i>	-1.29	
			<i>For >250 To 500, Deduct</i>	-1.62	
			<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0780	EA		7/8" Diameter x 2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	9.57	
			<i>For >100 To 250, Deduct</i>	-1.29	
			<i>For >250 To 500, Deduct</i>	-1.62	
			<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0781	EA		7/8" Diameter x 2-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	9.86	
			<i>For >100 To 250, Deduct</i>	-1.32	
			<i>For >250 To 500, Deduct</i>	-1.65	
			<i>For >500, Deduct</i>	-1.98	
05 05 23 00-0782	EA		7/8" Diameter x 3" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	11.26	
			<i>For >100 To 250, Deduct</i>	-1.32	
			<i>For >250 To 500, Deduct</i>	-1.65	
			<i>For >500, Deduct</i>	-1.98	
05 05 23 00-0783	EA		7/8" Diameter x 3-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	11.48	
			<i>For >100 To 250, Deduct</i>	-1.32	
			<i>For >250 To 500, Deduct</i>	-1.65	
			<i>For >500, Deduct</i>	-1.98	
05 05 23 00-0784	EA		7/8" Diameter x 4" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	11.87	
			<i>For >100 To 250, Deduct</i>	-1.35	
			<i>For >250 To 500, Deduct</i>	-1.68	
			<i>For >500, Deduct</i>	-2.02	
05 05 23 00-0785	EA		7/8" Diameter x 4-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	12.17	
			<i>For >100 To 250, Deduct</i>	-1.35	
			<i>For >250 To 500, Deduct</i>	-1.68	
			<i>For >500, Deduct</i>	-2.02	
05 05 23 00-0786	EA		7/8" Diameter x 5" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	12.54	
			<i>For >100 To 250, Deduct</i>	-1.35	
			<i>For >250 To 500, Deduct</i>	-1.68	
			<i>For >500, Deduct</i>	-2.02	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-0787 EA 7/8" Diameter x 5-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	12.94	
<i>For >100 To 250, Deduct</i>	-1.37	
<i>For >250 To 500, Deduct</i>	-1.72	
<i>For >500, Deduct</i>	-2.06	
05 05 23 00-0788 EA 7/8" Diameter x 6" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	13.23	
<i>For >100 To 250, Deduct</i>	-1.37	
<i>For >250 To 500, Deduct</i>	-1.72	
<i>For >500, Deduct</i>	-2.06	
05 05 23 00-0789 EA 7/8" Diameter x 6-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	15.54	
<i>For >100 To 250, Deduct</i>	-1.37	
<i>For >250 To 500, Deduct</i>	-1.72	
<i>For >500, Deduct</i>	-2.06	
05 05 23 00-0790 EA 7/8" Diameter x 7" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	15.99	
<i>For >100 To 250, Deduct</i>	-1.40	
<i>For >250 To 500, Deduct</i>	-1.75	
<i>For >500, Deduct</i>	-2.09	
05 05 23 00-0791 EA 7/8" Diameter x 7-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	16.53	
<i>For >100 To 250, Deduct</i>	-1.40	
<i>For >250 To 500, Deduct</i>	-1.75	
<i>For >500, Deduct</i>	-2.09	
05 05 23 00-0792 EA 7/8" Diameter x 8" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	16.66	
<i>For >100 To 250, Deduct</i>	-1.40	
<i>For >250 To 500, Deduct</i>	-1.75	
<i>For >500, Deduct</i>	-2.09	
05 05 23 00-0793 EA 7/8" Diameter x 8-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	16.93	
<i>For >100 To 250, Deduct</i>	-1.42	
<i>For >250 To 500, Deduct</i>	-1.78	
<i>For >500, Deduct</i>	-2.13	
05 05 23 00-0794 EA 7/8" Diameter x 9" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	17.23	
<i>For >100 To 250, Deduct</i>	-1.42	
<i>For >250 To 500, Deduct</i>	-1.78	
<i>For >500, Deduct</i>	-2.13	
05 05 23 00-0795 EA 7/8" Diameter x 9-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	17.61	
<i>For >100 To 250, Deduct</i>	-1.42	
<i>For >250 To 500, Deduct</i>	-1.78	
<i>For >500, Deduct</i>	-2.13	
05 05 23 00-0796 EA 7/8" Diameter x 10" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	17.96	
<i>For >100 To 250, Deduct</i>	-1.42	
<i>For >250 To 500, Deduct</i>	-1.78	
<i>For >500, Deduct</i>	-2.13	
05 05 23 00-0797 1" Diameter, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolts <small>(05 05 23 00-0854)</small>		
05 05 23 00-0798 EA 1" Diameter x 2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	11.18	
<i>For >100 To 250, Deduct</i>	-1.29	
<i>For >250 To 500, Deduct</i>	-1.62	
<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0799 EA 1" Diameter x 2-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	11.41	
<i>For >100 To 250, Deduct</i>	-1.32	
<i>For >250 To 500, Deduct</i>	-1.65	
<i>For >500, Deduct</i>	-1.98	
05 05 23 00-0800 EA 1" Diameter x 3" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	11.91	
<i>For >100 To 250, Deduct</i>	-1.32	
<i>For >250 To 500, Deduct</i>	-1.65	
<i>For >500, Deduct</i>	-1.98	
05 05 23 00-0801 EA 1" Diameter x 3-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	12.31	
<i>For >100 To 250, Deduct</i>	-1.32	
<i>For >250 To 500, Deduct</i>	-1.65	
<i>For >500, Deduct</i>	-1.98	
05 05 23 00-0802 EA 1" Diameter x 4" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	13.35	
<i>For >100 To 250, Deduct</i>	-1.35	
<i>For >250 To 500, Deduct</i>	-1.68	
<i>For >500, Deduct</i>	-2.02	
05 05 23 00-0803 EA 1" Diameter x 4-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	13.55	
<i>For >100 To 250, Deduct</i>	-1.35	
<i>For >250 To 500, Deduct</i>	-1.68	
<i>For >500, Deduct</i>	-2.02	
05 05 23 00-0804 EA 1" Diameter x 5" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	14.13	
<i>For >100 To 250, Deduct</i>	-1.35	
<i>For >250 To 500, Deduct</i>	-1.68	
<i>For >500, Deduct</i>	-2.02	
05 05 23 00-0805 EA 1" Diameter x 5-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	14.32	
<i>For >100 To 250, Deduct</i>	-1.37	
<i>For >250 To 500, Deduct</i>	-1.72	
<i>For >500, Deduct</i>	-2.06	
05 05 23 00-0806 EA 1" Diameter x 6" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	14.54	
<i>For >100 To 250, Deduct</i>	-1.37	
<i>For >250 To 500, Deduct</i>	-1.72	
<i>For >500, Deduct</i>	-2.06	
05 05 23 00-0807 EA 1" Diameter x 6-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt.....	16.53	
<i>For >100 To 250, Deduct</i>	-1.37	
<i>For >250 To 500, Deduct</i>	-1.72	
<i>For >500, Deduct</i>	-2.06	

05 Metals**05 05 Common Work Results For Metals****05 05 23 Metal Fastenings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-0808	EA		1" Diameter x 7" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt	17.02	
			<i>For >100 To 250, Deduct</i>	-1.40	
			<i>For >250 To 500, Deduct</i>	-1.75	
			<i>For >500, Deduct</i>	-2.09	
05 05 23 00-0809	EA		1" Diameter x 7-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt	17.86	
			<i>For >100 To 250, Deduct</i>	-1.40	
			<i>For >250 To 500, Deduct</i>	-1.75	
			<i>For >500, Deduct</i>	-2.09	
05 05 23 00-0810	EA		1" Diameter x 8" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt	18.68	
			<i>For >100 To 250, Deduct</i>	-1.40	
			<i>For >250 To 500, Deduct</i>	-1.75	
			<i>For >500, Deduct</i>	-2.09	
05 05 23 00-0811	EA		1" Diameter x 8-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt	19.06	
			<i>For >100 To 250, Deduct</i>	-1.42	
			<i>For >250 To 500, Deduct</i>	-1.78	
			<i>For >500, Deduct</i>	-2.13	
05 05 23 00-0812	EA		1" Diameter x 9" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt	19.73	
			<i>For >100 To 250, Deduct</i>	-1.42	
			<i>For >250 To 500, Deduct</i>	-1.78	
			<i>For >500, Deduct</i>	-2.13	
05 05 23 00-0813	EA		1" Diameter x 9-1/2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt	20.23	
			<i>For >100 To 250, Deduct</i>	-1.42	
			<i>For >250 To 500, Deduct</i>	-1.78	
			<i>For >500, Deduct</i>	-2.13	
05 05 23 00-0814	EA		1" Diameter x 10" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Hex Head Bolt	20.99	
			<i>For >100 To 250, Deduct</i>	-1.42	
			<i>For >250 To 500, Deduct</i>	-1.78	
			<i>For >500, Deduct</i>	-2.13	
05 05 23 00-0815			304/18-8 Stainless Steel, Hex Head Bolts <small>(05 05 23 00-0097)</small>		
05 05 23 00-0816			1/4" Diameter, 304/18-8 Stainless Steel, Hex Head Bolts <small>(05 05 23 00-0815)</small>		
05 05 23 00-0817	EA		1/4" Diameter x 1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	4.66	
			<i>For >100 To 250, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-1.13	
			<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0818	EA		1/4" Diameter x 1" Length, 304/18-8 Stainless Steel, Hex Head Bolt	4.71	
			<i>For >100 To 250, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-1.13	
			<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0819	EA		1/4" Diameter x 1-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	4.78	
			<i>For >100 To 250, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-1.13	
			<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0820	EA		1/4" Diameter x 2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	4.85	
			<i>For >100 To 250, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-1.13	
			<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0821	EA		1/4" Diameter x 2-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	5.06	
			<i>For >100 To 250, Deduct</i>	-0.93	
			<i>For >250 To 500, Deduct</i>	-1.16	
			<i>For >500, Deduct</i>	-1.40	
05 05 23 00-0822	EA		1/4" Diameter x 3" Length, 304/18-8 Stainless Steel, Hex Head Bolt	5.17	
			<i>For >100 To 250, Deduct</i>	-0.93	
			<i>For >250 To 500, Deduct</i>	-1.16	
			<i>For >500, Deduct</i>	-1.40	
05 05 23 00-0823	EA		1/4" Diameter x 3-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	5.30	
			<i>For >100 To 250, Deduct</i>	-0.93	
			<i>For >250 To 500, Deduct</i>	-1.16	
			<i>For >500, Deduct</i>	-1.40	
05 05 23 00-0824	EA		1/4" Diameter x 4" Length, 304/18-8 Stainless Steel, Hex Head Bolt	5.52	
			<i>For >100 To 250, Deduct</i>	-0.96	
			<i>For >250 To 500, Deduct</i>	-1.20	
			<i>For >500, Deduct</i>	-1.43	
05 05 23 00-0825	EA		1/4" Diameter x 4-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	5.68	
			<i>For >100 To 250, Deduct</i>	-0.96	
			<i>For >250 To 500, Deduct</i>	-1.20	
			<i>For >500, Deduct</i>	-1.43	
05 05 23 00-0826	EA		1/4" Diameter x 5" Length, 304/18-8 Stainless Steel, Hex Head Bolt	5.82	
			<i>For >100 To 250, Deduct</i>	-0.96	
			<i>For >250 To 500, Deduct</i>	-1.20	
			<i>For >500, Deduct</i>	-1.43	
05 05 23 00-0827	EA		1/4" Diameter x 5-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	6.07	
			<i>For >100 To 250, Deduct</i>	-0.98	
			<i>For >250 To 500, Deduct</i>	-1.23	
			<i>For >500, Deduct</i>	-1.47	
05 05 23 00-0828	EA		1/4" Diameter x 6" Length, 304/18-8 Stainless Steel, Hex Head Bolt	6.31	
			<i>For >100 To 250, Deduct</i>	-0.98	
			<i>For >250 To 500, Deduct</i>	-1.23	
			<i>For >500, Deduct</i>	-1.47	
05 05 23 00-0829	EA		1/4" Diameter x 6-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	9.19	
			<i>For >100 To 250, Deduct</i>	-0.98	
			<i>For >250 To 500, Deduct</i>	-1.23	
			<i>For >500, Deduct</i>	-1.47	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-0830 EA 1/4" Diameter x 7" Length, 304/18-8 Stainless Steel, Hex Head Bolt	10.73	
<i>For >100 To 250, Deduct</i>	-1.01	
<i>For >250 To 500, Deduct</i>	-1.26	
<i>For >500, Deduct</i>	-1.52	
05 05 23 00-0831 EA 1/4" Diameter x 7-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	10.86	
<i>For >100 To 250, Deduct</i>	-1.01	
<i>For >250 To 500, Deduct</i>	-1.26	
<i>For >500, Deduct</i>	-1.52	
05 05 23 00-0832 EA 1/4" Diameter x 8" Length, 304/18-8 Stainless Steel, Hex Head Bolt	11.19	
<i>For >100 To 250, Deduct</i>	-1.01	
<i>For >250 To 500, Deduct</i>	-1.26	
<i>For >500, Deduct</i>	-1.52	
05 05 23 00-0833 5/16" Diameter, 304/18-8 Stainless Steel, Hex Head Bolts <small>(05 05 23 00-0815)</small>		
05 05 23 00-0834 EA 5/16" Diameter x 1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	4.76	
<i>For >100 To 250, Deduct</i>	-0.90	
<i>For >250 To 500, Deduct</i>	-1.13	
<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0835 EA 5/16" Diameter x 1" Length, 304/18-8 Stainless Steel, Hex Head Bolt	4.81	
<i>For >100 To 250, Deduct</i>	-0.90	
<i>For >250 To 500, Deduct</i>	-1.13	
<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0836 EA 5/16" Diameter x 1-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	4.91	
<i>For >100 To 250, Deduct</i>	-0.90	
<i>For >250 To 500, Deduct</i>	-1.13	
<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0837 EA 5/16" Diameter x 2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	4.99	
<i>For >100 To 250, Deduct</i>	-0.90	
<i>For >250 To 500, Deduct</i>	-1.13	
<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0838 EA 5/16" Diameter x 2-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	5.27	
<i>For >100 To 250, Deduct</i>	-0.93	
<i>For >250 To 500, Deduct</i>	-1.16	
<i>For >500, Deduct</i>	-1.40	
05 05 23 00-0839 EA 5/16" Diameter x 3" Length, 304/18-8 Stainless Steel, Hex Head Bolt	5.33	
<i>For >100 To 250, Deduct</i>	-0.93	
<i>For >250 To 500, Deduct</i>	-1.16	
<i>For >500, Deduct</i>	-1.40	
05 05 23 00-0840 EA 5/16" Diameter x 3-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	5.59	
<i>For >100 To 250, Deduct</i>	-0.93	
<i>For >250 To 500, Deduct</i>	-1.16	
<i>For >500, Deduct</i>	-1.40	
05 05 23 00-0841 EA 5/16" Diameter x 4" Length, 304/18-8 Stainless Steel, Hex Head Bolt	5.91	
<i>For >100 To 250, Deduct</i>	-0.96	
<i>For >250 To 500, Deduct</i>	-1.20	
<i>For >500, Deduct</i>	-1.43	
05 05 23 00-0842 EA 5/16" Diameter x 4-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	6.21	
<i>For >100 To 250, Deduct</i>	-0.96	
<i>For >250 To 500, Deduct</i>	-1.20	
<i>For >500, Deduct</i>	-1.43	
05 05 23 00-0843 EA 5/16" Diameter x 5" Length, 304/18-8 Stainless Steel, Hex Head Bolt	6.36	
<i>For >100 To 250, Deduct</i>	-0.96	
<i>For >250 To 500, Deduct</i>	-1.20	
<i>For >500, Deduct</i>	-1.43	
05 05 23 00-0844 EA 5/16" Diameter x 5-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	6.95	
<i>For >100 To 250, Deduct</i>	-0.98	
<i>For >250 To 500, Deduct</i>	-1.23	
<i>For >500, Deduct</i>	-1.47	
05 05 23 00-0845 EA 5/16" Diameter x 6" Length, 304/18-8 Stainless Steel, Hex Head Bolt	7.70	
<i>For >100 To 250, Deduct</i>	-0.98	
<i>For >250 To 500, Deduct</i>	-1.23	
<i>For >500, Deduct</i>	-1.47	
05 05 23 00-0846 EA 5/16" Diameter x 6-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	9.41	
<i>For >100 To 250, Deduct</i>	-0.98	
<i>For >250 To 500, Deduct</i>	-1.23	
<i>For >500, Deduct</i>	-1.47	
05 05 23 00-0847 EA 5/16" Diameter x 7" Length, 304/18-8 Stainless Steel, Hex Head Bolt	12.32	
<i>For >100 To 250, Deduct</i>	-1.01	
<i>For >250 To 500, Deduct</i>	-1.26	
<i>For >500, Deduct</i>	-1.52	
05 05 23 00-0848 3/8" Diameter, 304/18-8 Stainless Steel, Hex Head Bolts <small>(05 05 23 00-0815)</small>		
05 05 23 00-0849 EA 3/8" Diameter x 1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	4.89	
<i>For >100 To 250, Deduct</i>	-0.90	
<i>For >250 To 500, Deduct</i>	-1.13	
<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0850 EA 3/8" Diameter x 1" Length, 304/18-8 Stainless Steel, Hex Head Bolt	4.95	
<i>For >100 To 250, Deduct</i>	-0.90	
<i>For >250 To 500, Deduct</i>	-1.13	
<i>For >500, Deduct</i>	-1.36	

05 Metals**05 05 Common Work Results For Metals****05 05 23 Metal Fastenings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-0851	EA		3/8" Diameter x 1-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	5.11	
			<i>For >100 To 250, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-1.13	
			<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0852	EA		3/8" Diameter x 2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	5.32	
			<i>For >100 To 250, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-1.13	
			<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0853	EA		3/8" Diameter x 2-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	5.55	
			<i>For >100 To 250, Deduct</i>	-0.93	
			<i>For >250 To 500, Deduct</i>	-1.16	
			<i>For >500, Deduct</i>	-1.40	
05 05 23 00-0854	EA		3/8" Diameter x 3" Length, 304/18-8 Stainless Steel, Hex Head Bolt	5.71	
			<i>For >100 To 250, Deduct</i>	-0.93	
			<i>For >250 To 500, Deduct</i>	-1.16	
			<i>For >500, Deduct</i>	-1.40	
05 05 23 00-0855	EA		3/8" Diameter x 3-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	5.93	
			<i>For >100 To 250, Deduct</i>	-0.93	
			<i>For >250 To 500, Deduct</i>	-1.16	
			<i>For >500, Deduct</i>	-1.40	
05 05 23 00-0856	EA		3/8" Diameter x 4" Length, 304/18-8 Stainless Steel, Hex Head Bolt	6.26	
			<i>For >100 To 250, Deduct</i>	-0.96	
			<i>For >250 To 500, Deduct</i>	-1.20	
			<i>For >500, Deduct</i>	-1.43	
05 05 23 00-0857	EA		3/8" Diameter x 4-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	6.51	
			<i>For >100 To 250, Deduct</i>	-0.96	
			<i>For >250 To 500, Deduct</i>	-1.20	
			<i>For >500, Deduct</i>	-1.43	
05 05 23 00-0858	EA		3/8" Diameter x 5" Length, 304/18-8 Stainless Steel, Hex Head Bolt	7.08	
			<i>For >100 To 250, Deduct</i>	-0.96	
			<i>For >250 To 500, Deduct</i>	-1.20	
			<i>For >500, Deduct</i>	-1.43	
05 05 23 00-0859	EA		3/8" Diameter x 5-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	7.27	
			<i>For >100 To 250, Deduct</i>	-0.98	
			<i>For >250 To 500, Deduct</i>	-1.23	
			<i>For >500, Deduct</i>	-1.47	
05 05 23 00-0860	EA		3/8" Diameter x 6" Length, 304/18-8 Stainless Steel, Hex Head Bolt	7.74	
			<i>For >100 To 250, Deduct</i>	-0.98	
			<i>For >250 To 500, Deduct</i>	-1.23	
			<i>For >500, Deduct</i>	-1.47	
05 05 23 00-0861	EA		3/8" Diameter x 6-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	8.73	
			<i>For >100 To 250, Deduct</i>	-0.98	
			<i>For >250 To 500, Deduct</i>	-1.23	
			<i>For >500, Deduct</i>	-1.47	
05 05 23 00-0862	EA		3/8" Diameter x 7" Length, 304/18-8 Stainless Steel, Hex Head Bolt	9.10	
			<i>For >100 To 250, Deduct</i>	-1.01	
			<i>For >250 To 500, Deduct</i>	-1.26	
			<i>For >500, Deduct</i>	-1.52	
05 05 23 00-0863	EA		3/8" Diameter x 7-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	9.24	
			<i>For >100 To 250, Deduct</i>	-1.01	
			<i>For >250 To 500, Deduct</i>	-1.26	
			<i>For >500, Deduct</i>	-1.52	
05 05 23 00-0864	EA		3/8" Diameter x 8" Length, 304/18-8 Stainless Steel, Hex Head Bolt	10.23	
			<i>For >100 To 250, Deduct</i>	-1.01	
			<i>For >250 To 500, Deduct</i>	-1.26	
			<i>For >500, Deduct</i>	-1.52	
05 05 23 00-0865			7/16" Diameter, 304/18-8 Stainless Steel, Hex Head Bolts <small>(05 05 23 00-0815)</small>		
05 05 23 00-0866	EA		7/16" Diameter x 1" Length, 304/18-8 Stainless Steel, Hex Head Bolt	6.07	
			<i>For >100 To 250, Deduct</i>	-1.04	
			<i>For >250 To 500, Deduct</i>	-1.30	
			<i>For >500, Deduct</i>	-1.55	
05 05 23 00-0867	EA		7/16" Diameter x 1-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	6.14	
			<i>For >100 To 250, Deduct</i>	-1.04	
			<i>For >250 To 500, Deduct</i>	-1.30	
			<i>For >500, Deduct</i>	-1.55	
05 05 23 00-0868	EA		7/16" Diameter x 2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	6.40	
			<i>For >100 To 250, Deduct</i>	-1.04	
			<i>For >250 To 500, Deduct</i>	-1.30	
			<i>For >500, Deduct</i>	-1.55	
05 05 23 00-0869	EA		7/16" Diameter x 2-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	6.68	
			<i>For >100 To 250, Deduct</i>	-1.06	
			<i>For >250 To 500, Deduct</i>	-1.33	
			<i>For >500, Deduct</i>	-1.59	
05 05 23 00-0870	EA		7/16" Diameter x 3" Length, 304/18-8 Stainless Steel, Hex Head Bolt	7.00	
			<i>For >100 To 250, Deduct</i>	-1.06	
			<i>For >250 To 500, Deduct</i>	-1.33	
			<i>For >500, Deduct</i>	-1.59	
05 05 23 00-0871	EA		7/16" Diameter x 3-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	7.52	
			<i>For >100 To 250, Deduct</i>	-1.06	
			<i>For >250 To 500, Deduct</i>	-1.33	
			<i>For >500, Deduct</i>	-1.59	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-0872 EA 7/16" Diameter x 4" Length, 304/18-8 Stainless Steel, Hex Head Bolt	7.89	
<i>For >100 To 250, Deduct</i>	-1.09	
<i>For >250 To 500, Deduct</i>	-1.36	
<i>For >500, Deduct</i>	-1.63	
05 05 23 00-0873 EA 7/16" Diameter x 4-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	8.51	
<i>For >100 To 250, Deduct</i>	-1.09	
<i>For >250 To 500, Deduct</i>	-1.36	
<i>For >500, Deduct</i>	-1.63	
05 05 23 00-0874 EA 7/16" Diameter x 5" Length, 304/18-8 Stainless Steel, Hex Head Bolt	8.77	
<i>For >100 To 250, Deduct</i>	-1.09	
<i>For >250 To 500, Deduct</i>	-1.36	
<i>For >500, Deduct</i>	-1.63	
05 05 23 00-0875 EA 7/16" Diameter x 5-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	9.74	
<i>For >100 To 250, Deduct</i>	-1.11	
<i>For >250 To 500, Deduct</i>	-1.39	
<i>For >500, Deduct</i>	-1.67	
05 05 23 00-0876 EA 7/16" Diameter x 6" Length, 304/18-8 Stainless Steel, Hex Head Bolt	10.68	
<i>For >100 To 250, Deduct</i>	-1.11	
<i>For >250 To 500, Deduct</i>	-1.39	
<i>For >500, Deduct</i>	-1.67	
05 05 23 00-0877 EA 7/16" Diameter x 6-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	10.81	
<i>For >100 To 250, Deduct</i>	-1.11	
<i>For >250 To 500, Deduct</i>	-1.39	
<i>For >500, Deduct</i>	-1.67	
05 05 23 00-0878 EA 7/16" Diameter x 7" Length, 304/18-8 Stainless Steel, Hex Head Bolt	11.05	
<i>For >100 To 250, Deduct</i>	-1.14	
<i>For >250 To 500, Deduct</i>	-1.42	
<i>For >500, Deduct</i>	-1.71	
05 05 23 00-0879 1/2" Diameter, 304/18-8 Stainless Steel, Hex Head Bolts <small>(05 05 23 00-0815)</small>	6.06	
05 05 23 00-0880 EA 1/2" Diameter x 1" Length, 304/18-8 Stainless Steel, Hex Head Bolt	6.06	
<i>For >100 To 250, Deduct</i>	-1.04	
<i>For >250 To 500, Deduct</i>	-1.30	
<i>For >500, Deduct</i>	-1.55	
05 05 23 00-0881 EA 1/2" Diameter x 1-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	6.14	
<i>For >100 To 250, Deduct</i>	-1.04	
<i>For >250 To 500, Deduct</i>	-1.30	
<i>For >500, Deduct</i>	-1.55	
05 05 23 00-0882 EA 1/2" Diameter x 2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	6.55	
<i>For >100 To 250, Deduct</i>	-1.04	
<i>For >250 To 500, Deduct</i>	-1.30	
<i>For >500, Deduct</i>	-1.55	
05 05 23 00-0883 EA 1/2" Diameter x 2-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	6.84	
<i>For >100 To 250, Deduct</i>	-1.06	
<i>For >250 To 500, Deduct</i>	-1.33	
<i>For >500, Deduct</i>	-1.59	
05 05 23 00-0884 EA 1/2" Diameter x 3" Length, 304/18-8 Stainless Steel, Hex Head Bolt	7.21	
<i>For >100 To 250, Deduct</i>	-1.06	
<i>For >250 To 500, Deduct</i>	-1.33	
<i>For >500, Deduct</i>	-1.59	
05 05 23 00-0885 EA 1/2" Diameter x 3-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	7.42	
<i>For >100 To 250, Deduct</i>	-1.06	
<i>For >250 To 500, Deduct</i>	-1.33	
<i>For >500, Deduct</i>	-1.59	
05 05 23 00-0886 EA 1/2" Diameter x 4" Length, 304/18-8 Stainless Steel, Hex Head Bolt	7.79	
<i>For >100 To 250, Deduct</i>	-1.09	
<i>For >250 To 500, Deduct</i>	-1.36	
<i>For >500, Deduct</i>	-1.63	
05 05 23 00-0887 EA 1/2" Diameter x 4-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	7.97	
<i>For >100 To 250, Deduct</i>	-1.09	
<i>For >250 To 500, Deduct</i>	-1.36	
<i>For >500, Deduct</i>	-1.63	
05 05 23 00-0888 EA 1/2" Diameter x 5" Length, 304/18-8 Stainless Steel, Hex Head Bolt	8.95	
<i>For >100 To 250, Deduct</i>	-1.09	
<i>For >250 To 500, Deduct</i>	-1.36	
<i>For >500, Deduct</i>	-1.63	
05 05 23 00-0889 EA 1/2" Diameter x 5-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	9.36	
<i>For >100 To 250, Deduct</i>	-1.11	
<i>For >250 To 500, Deduct</i>	-1.39	
<i>For >500, Deduct</i>	-1.67	
05 05 23 00-0890 EA 1/2" Diameter x 6" Length, 304/18-8 Stainless Steel, Hex Head Bolt	9.80	
<i>For >100 To 250, Deduct</i>	-1.11	
<i>For >250 To 500, Deduct</i>	-1.39	
<i>For >500, Deduct</i>	-1.67	
05 05 23 00-0891 EA 1/2" Diameter x 6-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	10.30	
<i>For >100 To 250, Deduct</i>	-1.11	
<i>For >250 To 500, Deduct</i>	-1.39	
<i>For >500, Deduct</i>	-1.67	
05 05 23 00-0892 EA 1/2" Diameter x 7" Length, 304/18-8 Stainless Steel, Hex Head Bolt	11.17	
<i>For >100 To 250, Deduct</i>	-1.14	
<i>For >250 To 500, Deduct</i>	-1.42	
<i>For >500, Deduct</i>	-1.71	

05 Metals**05 05 Common Work Results For Metals****05 05 23 Metal Fastenings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-0893	EA		1/2" Diameter x 7-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	11.47	
			<i>For >100 To 250, Deduct</i>	-1.14	
			<i>For >250 To 500, Deduct</i>	-1.42	
			<i>For >500, Deduct</i>	-1.71	
05 05 23 00-0894	EA		1/2" Diameter x 8" Length, 304/18-8 Stainless Steel, Hex Head Bolt	11.95	
			<i>For >100 To 250, Deduct</i>	-1.14	
			<i>For >250 To 500, Deduct</i>	-1.42	
			<i>For >500, Deduct</i>	-1.71	
05 05 23 00-0895	EA		1/2" Diameter x 8-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	14.38	
			<i>For >100 To 250, Deduct</i>	-1.16	
			<i>For >250 To 500, Deduct</i>	-1.46	
			<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0896	EA		1/2" Diameter x 9" Length, 304/18-8 Stainless Steel, Hex Head Bolt	14.57	
			<i>For >100 To 250, Deduct</i>	-1.16	
			<i>For >250 To 500, Deduct</i>	-1.46	
			<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0897	EA		1/2" Diameter x 9-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	15.88	
			<i>For >100 To 250, Deduct</i>	-1.16	
			<i>For >250 To 500, Deduct</i>	-1.46	
			<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0898	EA		1/2" Diameter x 10" Length, 304/18-8 Stainless Steel, Hex Head Bolt	17.18	
			<i>For >100 To 250, Deduct</i>	-1.16	
			<i>For >250 To 500, Deduct</i>	-1.46	
			<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0899			9/16" Diameter, 304/18-8 Stainless Steel, Hex Head Bolts <small>(05 05 23 00-0815)</small>		
05 05 23 00-0900	EA		9/16" Diameter x 1" Length, 304/18-8 Stainless Steel, Hex Head Bolt	8.22	
			<i>For >100 To 250, Deduct</i>	-1.04	
			<i>For >250 To 500, Deduct</i>	-1.30	
			<i>For >500, Deduct</i>	-1.55	
05 05 23 00-0901	EA		9/16" Diameter x 1-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	9.08	
			<i>For >100 To 250, Deduct</i>	-1.04	
			<i>For >250 To 500, Deduct</i>	-1.30	
			<i>For >500, Deduct</i>	-1.55	
05 05 23 00-0902	EA		9/16" Diameter x 2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	10.58	
			<i>For >100 To 250, Deduct</i>	-1.04	
			<i>For >250 To 500, Deduct</i>	-1.30	
			<i>For >500, Deduct</i>	-1.55	
05 05 23 00-0903	EA		9/16" Diameter x 2-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	11.00	
			<i>For >100 To 250, Deduct</i>	-1.06	
			<i>For >250 To 500, Deduct</i>	-1.33	
			<i>For >500, Deduct</i>	-1.59	
05 05 23 00-0904	EA		9/16" Diameter x 3" Length, 304/18-8 Stainless Steel, Hex Head Bolt	11.53	
			<i>For >100 To 250, Deduct</i>	-1.06	
			<i>For >250 To 500, Deduct</i>	-1.33	
			<i>For >500, Deduct</i>	-1.59	
05 05 23 00-0905	EA		9/16" Diameter x 3-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	12.46	
			<i>For >100 To 250, Deduct</i>	-1.06	
			<i>For >250 To 500, Deduct</i>	-1.33	
			<i>For >500, Deduct</i>	-1.59	
05 05 23 00-0906	EA		9/16" Diameter x 4" Length, 304/18-8 Stainless Steel, Hex Head Bolt	13.96	
			<i>For >100 To 250, Deduct</i>	-1.09	
			<i>For >250 To 500, Deduct</i>	-1.36	
			<i>For >500, Deduct</i>	-1.63	
05 05 23 00-0907	EA		9/16" Diameter x 4-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	14.17	
			<i>For >100 To 250, Deduct</i>	-1.09	
			<i>For >250 To 500, Deduct</i>	-1.36	
			<i>For >500, Deduct</i>	-1.63	
05 05 23 00-0908	EA		9/16" Diameter x 5" Length, 304/18-8 Stainless Steel, Hex Head Bolt	16.13	
			<i>For >100 To 250, Deduct</i>	-1.09	
			<i>For >250 To 500, Deduct</i>	-1.36	
			<i>For >500, Deduct</i>	-1.63	
05 05 23 00-0909	EA		9/16" Diameter x 5-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	17.18	
			<i>For >100 To 250, Deduct</i>	-1.11	
			<i>For >250 To 500, Deduct</i>	-1.39	
			<i>For >500, Deduct</i>	-1.67	
05 05 23 00-0910	EA		9/16" Diameter x 6" Length, 304/18-8 Stainless Steel, Hex Head Bolt	18.24	
			<i>For >100 To 250, Deduct</i>	-1.11	
			<i>For >250 To 500, Deduct</i>	-1.39	
			<i>For >500, Deduct</i>	-1.67	
05 05 23 00-0911			5/8" Diameter, 304/18-8 Stainless Steel, Hex Head Bolts <small>(05 05 23 00-0815)</small>		
05 05 23 00-0912	EA		5/8" Diameter x 1" Length, 304/18-8 Stainless Steel, Hex Head Bolt	7.43	
			<i>For >100 To 250, Deduct</i>	-1.16	
			<i>For >250 To 500, Deduct</i>	-1.46	
			<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0913	EA		5/8" Diameter x 1-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	7.63	
			<i>For >100 To 250, Deduct</i>	-1.16	
			<i>For >250 To 500, Deduct</i>	-1.46	
			<i>For >500, Deduct</i>	-1.75	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-0914 EA 5/8" Diameter x 2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	8.44	
<i>For >100 To 250, Deduct</i>	-1.16	
<i>For >250 To 500, Deduct</i>	-1.46	
<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0915 EA 5/8" Diameter x 2-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	8.71	
<i>For >100 To 250, Deduct</i>	-1.19	
<i>For >250 To 500, Deduct</i>	-1.49	
<i>For >500, Deduct</i>	-1.79	
05 05 23 00-0916 EA 5/8" Diameter x 3" Length, 304/18-8 Stainless Steel, Hex Head Bolt	9.10	
<i>For >100 To 250, Deduct</i>	-1.19	
<i>For >250 To 500, Deduct</i>	-1.49	
<i>For >500, Deduct</i>	-1.79	
05 05 23 00-0917 EA 5/8" Diameter x 3-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	9.65	
<i>For >100 To 250, Deduct</i>	-1.19	
<i>For >250 To 500, Deduct</i>	-1.49	
<i>For >500, Deduct</i>	-1.79	
05 05 23 00-0918 EA 5/8" Diameter x 4" Length, 304/18-8 Stainless Steel, Hex Head Bolt	10.48	
<i>For >100 To 250, Deduct</i>	-1.22	
<i>For >250 To 500, Deduct</i>	-1.52	
<i>For >500, Deduct</i>	-1.82	
05 05 23 00-0919 EA 5/8" Diameter x 4-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	10.49	
<i>For >100 To 250, Deduct</i>	-1.22	
<i>For >250 To 500, Deduct</i>	-1.52	
<i>For >500, Deduct</i>	-1.82	
05 05 23 00-0920 EA 5/8" Diameter x 5" Length, 304/18-8 Stainless Steel, Hex Head Bolt	11.11	
<i>For >100 To 250, Deduct</i>	-1.22	
<i>For >250 To 500, Deduct</i>	-1.52	
<i>For >500, Deduct</i>	-1.82	
05 05 23 00-0921 EA 5/8" Diameter x 5-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	11.58	
<i>For >100 To 250, Deduct</i>	-1.24	
<i>For >250 To 500, Deduct</i>	-1.55	
<i>For >500, Deduct</i>	-1.86	
05 05 23 00-0922 EA 5/8" Diameter x 6" Length, 304/18-8 Stainless Steel, Hex Head Bolt	12.15	
<i>For >100 To 250, Deduct</i>	-1.24	
<i>For >250 To 500, Deduct</i>	-1.55	
<i>For >500, Deduct</i>	-1.86	
05 05 23 00-0923 EA 5/8" Diameter x 6-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	14.20	
<i>For >100 To 250, Deduct</i>	-1.24	
<i>For >250 To 500, Deduct</i>	-1.55	
<i>For >500, Deduct</i>	-1.86	
05 05 23 00-0924 EA 5/8" Diameter x 7" Length, 304/18-8 Stainless Steel, Hex Head Bolt	15.46	
<i>For >100 To 250, Deduct</i>	-1.27	
<i>For >250 To 500, Deduct</i>	-1.58	
<i>For >500, Deduct</i>	-1.90	
05 05 23 00-0925 EA 5/8" Diameter x 7-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	16.39	
<i>For >100 To 250, Deduct</i>	-1.27	
<i>For >250 To 500, Deduct</i>	-1.58	
<i>For >500, Deduct</i>	-1.90	
05 05 23 00-0926 EA 5/8" Diameter x 8" Length, 304/18-8 Stainless Steel, Hex Head Bolt	16.81	
<i>For >100 To 250, Deduct</i>	-1.27	
<i>For >250 To 500, Deduct</i>	-1.58	
<i>For >500, Deduct</i>	-1.90	
05 05 23 00-0927 EA 5/8" Diameter x 8-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	18.66	
<i>For >100 To 250, Deduct</i>	-1.29	
<i>For >250 To 500, Deduct</i>	-1.62	
<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0928 EA 5/8" Diameter x 9" Length, 304/18-8 Stainless Steel, Hex Head Bolt	19.20	
<i>For >100 To 250, Deduct</i>	-1.29	
<i>For >250 To 500, Deduct</i>	-1.62	
<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0929 EA 5/8" Diameter x 9-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	21.65	
<i>For >100 To 250, Deduct</i>	-1.29	
<i>For >250 To 500, Deduct</i>	-1.62	
<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0930 EA 5/8" Diameter x 10" Length, 304/18-8 Stainless Steel, Hex Head Bolt	22.65	
<i>For >100 To 250, Deduct</i>	-1.29	
<i>For >250 To 500, Deduct</i>	-1.62	
<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0931 3/4" Diameter, 304/18-8 Stainless Steel, Hex Head Bolts <small>(05 05 23 00-0815)</small>		
05 05 23 00-0932 EA 3/4" Diameter x 1" Length, 304/18-8 Stainless Steel, Hex Head Bolt	8.32	
<i>For >100 To 250, Deduct</i>	-1.16	
<i>For >250 To 500, Deduct</i>	-1.46	
<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0933 EA 3/4" Diameter x 1-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	8.71	
<i>For >100 To 250, Deduct</i>	-1.16	
<i>For >250 To 500, Deduct</i>	-1.46	
<i>For >500, Deduct</i>	-1.75	
05 05 23 00-0934 EA 3/4" Diameter x 2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	9.21	
<i>For >100 To 250, Deduct</i>	-1.16	
<i>For >250 To 500, Deduct</i>	-1.46	
<i>For >500, Deduct</i>	-1.75	

05 Metals**05 05 Common Work Results For Metals****05 05 23 Metal Fastenings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-0935	EA		3/4" Diameter x 2-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	9.89	
			<i>For >100 To 250, Deduct</i>	-1.19	
			<i>For >250 To 500, Deduct</i>	-1.49	
			<i>For >500, Deduct</i>	-1.79	
05 05 23 00-0936	EA		3/4" Diameter x 3" Length, 304/18-8 Stainless Steel, Hex Head Bolt	10.44	
			<i>For >100 To 250, Deduct</i>	-1.19	
			<i>For >250 To 500, Deduct</i>	-1.49	
			<i>For >500, Deduct</i>	-1.79	
05 05 23 00-0937	EA		3/4" Diameter x 3-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	11.38	
			<i>For >100 To 250, Deduct</i>	-1.19	
			<i>For >250 To 500, Deduct</i>	-1.49	
			<i>For >500, Deduct</i>	-1.79	
05 05 23 00-0938	EA		3/4" Diameter x 4" Length, 304/18-8 Stainless Steel, Hex Head Bolt	12.06	
			<i>For >100 To 250, Deduct</i>	-1.22	
			<i>For >250 To 500, Deduct</i>	-1.52	
			<i>For >500, Deduct</i>	-1.82	
05 05 23 00-0939	EA		3/4" Diameter x 4-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	12.94	
			<i>For >100 To 250, Deduct</i>	-1.22	
			<i>For >250 To 500, Deduct</i>	-1.52	
			<i>For >500, Deduct</i>	-1.82	
05 05 23 00-0940	EA		3/4" Diameter x 5" Length, 304/18-8 Stainless Steel, Hex Head Bolt	13.63	
			<i>For >100 To 250, Deduct</i>	-1.22	
			<i>For >250 To 500, Deduct</i>	-1.52	
			<i>For >500, Deduct</i>	-1.82	
05 05 23 00-0941	EA		3/4" Diameter x 5-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	14.47	
			<i>For >100 To 250, Deduct</i>	-1.24	
			<i>For >250 To 500, Deduct</i>	-1.55	
			<i>For >500, Deduct</i>	-1.86	
05 05 23 00-0942	EA		3/4" Diameter x 6" Length, 304/18-8 Stainless Steel, Hex Head Bolt	15.28	
			<i>For >100 To 250, Deduct</i>	-1.24	
			<i>For >250 To 500, Deduct</i>	-1.55	
			<i>For >500, Deduct</i>	-1.86	
05 05 23 00-0943	EA		3/4" Diameter x 6-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	16.80	
			<i>For >100 To 250, Deduct</i>	-1.24	
			<i>For >250 To 500, Deduct</i>	-1.55	
			<i>For >500, Deduct</i>	-1.86	
05 05 23 00-0944	EA		3/4" Diameter x 7" Length, 304/18-8 Stainless Steel, Hex Head Bolt	20.98	
			<i>For >100 To 250, Deduct</i>	-1.27	
			<i>For >250 To 500, Deduct</i>	-1.58	
			<i>For >500, Deduct</i>	-1.90	
05 05 23 00-0945	EA		3/4" Diameter x 7-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	22.27	
			<i>For >100 To 250, Deduct</i>	-1.27	
			<i>For >250 To 500, Deduct</i>	-1.58	
			<i>For >500, Deduct</i>	-1.90	
05 05 23 00-0946	EA		3/4" Diameter x 8" Length, 304/18-8 Stainless Steel, Hex Head Bolt	25.03	
			<i>For >100 To 250, Deduct</i>	-1.27	
			<i>For >250 To 500, Deduct</i>	-1.58	
			<i>For >500, Deduct</i>	-1.90	
05 05 23 00-0947	EA		3/4" Diameter x 8-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	25.28	
			<i>For >100 To 250, Deduct</i>	-1.29	
			<i>For >250 To 500, Deduct</i>	-1.62	
			<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0948	EA		3/4" Diameter x 9" Length, 304/18-8 Stainless Steel, Hex Head Bolt	25.72	
			<i>For >100 To 250, Deduct</i>	-1.29	
			<i>For >250 To 500, Deduct</i>	-1.62	
			<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0949	EA		3/4" Diameter x 9-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	26.90	
			<i>For >100 To 250, Deduct</i>	-1.29	
			<i>For >250 To 500, Deduct</i>	-1.62	
			<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0950	EA		3/4" Diameter x 10" Length, 304/18-8 Stainless Steel, Hex Head Bolt	27.80	
			<i>For >100 To 250, Deduct</i>	-1.29	
			<i>For >250 To 500, Deduct</i>	-1.62	
			<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0951			7/8" Diameter, 304/18-8 Stainless Steel, Hex Head Bolts <small>(05 05 23 00-0815)</small>		
05 05 23 00-0952	EA		7/8" Diameter x 1-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	11.36	
			<i>For >100 To 250, Deduct</i>	-1.29	
			<i>For >250 To 500, Deduct</i>	-1.62	
			<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0953	EA		7/8" Diameter x 2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	12.32	
			<i>For >100 To 250, Deduct</i>	-1.29	
			<i>For >250 To 500, Deduct</i>	-1.62	
			<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0954	EA		7/8" Diameter x 2-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	13.18	
			<i>For >100 To 250, Deduct</i>	-1.32	
			<i>For >250 To 500, Deduct</i>	-1.65	
			<i>For >500, Deduct</i>	-1.98	
05 05 23 00-0955	EA		7/8" Diameter x 3" Length, 304/18-8 Stainless Steel, Hex Head Bolt	14.15	
			<i>For >100 To 250, Deduct</i>	-1.32	
			<i>For >250 To 500, Deduct</i>	-1.65	
			<i>For >500, Deduct</i>	-1.98	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-0956 EA 7/8" Diameter x 3-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt.....	14.47	
<i>For >100 To 250, Deduct</i>	-1.32	
<i>For >250 To 500, Deduct</i>	-1.65	
<i>For >500, Deduct</i>	-1.98	
05 05 23 00-0957 EA 7/8" Diameter x 4" Length, 304/18-8 Stainless Steel, Hex Head Bolt.....	15.39	
<i>For >100 To 250, Deduct</i>	-1.35	
<i>For >250 To 500, Deduct</i>	-1.68	
<i>For >500, Deduct</i>	-2.02	
05 05 23 00-0958 EA 7/8" Diameter x 4-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt.....	15.70	
<i>For >100 To 250, Deduct</i>	-1.35	
<i>For >250 To 500, Deduct</i>	-1.68	
<i>For >500, Deduct</i>	-2.02	
05 05 23 00-0959 EA 7/8" Diameter x 5" Length, 304/18-8 Stainless Steel, Hex Head Bolt.....	17.81	
<i>For >100 To 250, Deduct</i>	-1.35	
<i>For >250 To 500, Deduct</i>	-1.68	
<i>For >500, Deduct</i>	-2.02	
05 05 23 00-0960 EA 7/8" Diameter x 5-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt.....	18.25	
<i>For >100 To 250, Deduct</i>	-1.37	
<i>For >250 To 500, Deduct</i>	-1.72	
<i>For >500, Deduct</i>	-2.06	
05 05 23 00-0961 EA 7/8" Diameter x 6" Length, 304/18-8 Stainless Steel, Hex Head Bolt.....	19.06	
<i>For >100 To 250, Deduct</i>	-1.37	
<i>For >250 To 500, Deduct</i>	-1.72	
<i>For >500, Deduct</i>	-2.06	
05 05 23 00-0962 EA 7/8" Diameter x 6-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt.....	23.52	
<i>For >100 To 250, Deduct</i>	-1.37	
<i>For >250 To 500, Deduct</i>	-1.72	
<i>For >500, Deduct</i>	-2.06	
05 05 23 00-0963 EA 7/8" Diameter x 7" Length, 304/18-8 Stainless Steel, Hex Head Bolt.....	25.36	
<i>For >100 To 250, Deduct</i>	-1.40	
<i>For >250 To 500, Deduct</i>	-1.75	
<i>For >500, Deduct</i>	-2.09	
05 05 23 00-0964 EA 7/8" Diameter x 7-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt.....	27.36	
<i>For >100 To 250, Deduct</i>	-1.40	
<i>For >250 To 500, Deduct</i>	-1.75	
<i>For >500, Deduct</i>	-2.09	
05 05 23 00-0965 EA 7/8" Diameter x 8" Length, 304/18-8 Stainless Steel, Hex Head Bolt.....	28.97	
<i>For >100 To 250, Deduct</i>	-1.40	
<i>For >250 To 500, Deduct</i>	-1.75	
<i>For >500, Deduct</i>	-2.09	
05 05 23 00-0966 EA 7/8" Diameter x 8-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt.....	34.00	
<i>For >100 To 250, Deduct</i>	-1.42	
<i>For >250 To 500, Deduct</i>	-1.78	
<i>For >500, Deduct</i>	-2.13	
05 05 23 00-0967 EA 7/8" Diameter x 9" Length, 304/18-8 Stainless Steel, Hex Head Bolt.....	37.92	
<i>For >100 To 250, Deduct</i>	-1.42	
<i>For >250 To 500, Deduct</i>	-1.78	
<i>For >500, Deduct</i>	-2.13	
05 05 23 00-0968 EA 7/8" Diameter x 9-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt.....	39.73	
<i>For >100 To 250, Deduct</i>	-1.42	
<i>For >250 To 500, Deduct</i>	-1.78	
<i>For >500, Deduct</i>	-2.13	
05 05 23 00-0969 EA 7/8" Diameter x 10" Length, 304/18-8 Stainless Steel, Hex Head Bolt.....	41.54	
<i>For >100 To 250, Deduct</i>	-1.42	
<i>For >250 To 500, Deduct</i>	-1.78	
<i>For >500, Deduct</i>	-2.13	
05 05 23 00-0970 1" Diameter, 304/18-8 Stainless Steel, Hex Head Bolts <small>(05 05 23 00-0815)</small>		
05 05 23 00-0971 EA 1" Diameter x 1-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt.....	13.68	
<i>For >100 To 250, Deduct</i>	-1.29	
<i>For >250 To 500, Deduct</i>	-1.62	
<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0972 EA 1" Diameter x 2" Length, 304/18-8 Stainless Steel, Hex Head Bolt.....	14.37	
<i>For >100 To 250, Deduct</i>	-1.29	
<i>For >250 To 500, Deduct</i>	-1.62	
<i>For >500, Deduct</i>	-1.94	
05 05 23 00-0973 EA 1" Diameter x 2-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt.....	15.55	
<i>For >100 To 250, Deduct</i>	-1.32	
<i>For >250 To 500, Deduct</i>	-1.65	
<i>For >500, Deduct</i>	-1.98	
05 05 23 00-0974 EA 1" Diameter x 3" Length, 304/18-8 Stainless Steel, Hex Head Bolt.....	16.42	
<i>For >100 To 250, Deduct</i>	-1.32	
<i>For >250 To 500, Deduct</i>	-1.65	
<i>For >500, Deduct</i>	-1.98	
05 05 23 00-0975 EA 1" Diameter x 3-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt.....	17.86	
<i>For >100 To 250, Deduct</i>	-1.32	
<i>For >250 To 500, Deduct</i>	-1.65	
<i>For >500, Deduct</i>	-1.98	
05 05 23 00-0976 EA 1" Diameter x 4" Length, 304/18-8 Stainless Steel, Hex Head Bolt.....	19.61	
<i>For >100 To 250, Deduct</i>	-1.35	
<i>For >250 To 500, Deduct</i>	-1.68	
<i>For >500, Deduct</i>	-2.02	

05 Metals**05 05 Common Work Results For Metals****05 05 23 Metal Fastenings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-0977	EA		1" Diameter x 4-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	20.62	
			<i>For >100 To 250, Deduct</i>	-1.35	
			<i>For >250 To 500, Deduct</i>	-1.68	
			<i>For >500, Deduct</i>	-2.02	
05 05 23 00-0978	EA		1" Diameter x 5" Length, 304/18-8 Stainless Steel, Hex Head Bolt	22.11	
			<i>For >100 To 250, Deduct</i>	-1.35	
			<i>For >250 To 500, Deduct</i>	-1.68	
			<i>For >500, Deduct</i>	-2.02	
05 05 23 00-0979	EA		1" Diameter x 5-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	23.63	
			<i>For >100 To 250, Deduct</i>	-1.37	
			<i>For >250 To 500, Deduct</i>	-1.72	
			<i>For >500, Deduct</i>	-2.06	
05 05 23 00-0980	EA		1" Diameter x 6" Length, 304/18-8 Stainless Steel, Hex Head Bolt	23.71	
			<i>For >100 To 250, Deduct</i>	-1.37	
			<i>For >250 To 500, Deduct</i>	-1.72	
			<i>For >500, Deduct</i>	-2.06	
05 05 23 00-0981	EA		1" Diameter x 6-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	27.70	
			<i>For >100 To 250, Deduct</i>	-1.37	
			<i>For >250 To 500, Deduct</i>	-1.72	
			<i>For >500, Deduct</i>	-2.06	
05 05 23 00-0982	EA		1" Diameter x 7" Length, 304/18-8 Stainless Steel, Hex Head Bolt	32.86	
			<i>For >100 To 250, Deduct</i>	-1.40	
			<i>For >250 To 500, Deduct</i>	-1.75	
			<i>For >500, Deduct</i>	-2.09	
05 05 23 00-0983	EA		1" Diameter x 7-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	33.60	
			<i>For >100 To 250, Deduct</i>	-1.40	
			<i>For >250 To 500, Deduct</i>	-1.75	
			<i>For >500, Deduct</i>	-2.09	
05 05 23 00-0984	EA		1" Diameter x 8" Length, 304/18-8 Stainless Steel, Hex Head Bolt	34.36	
			<i>For >100 To 250, Deduct</i>	-1.40	
			<i>For >250 To 500, Deduct</i>	-1.75	
			<i>For >500, Deduct</i>	-2.09	
05 05 23 00-0985	EA		1" Diameter x 8-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	35.99	
			<i>For >100 To 250, Deduct</i>	-1.42	
			<i>For >250 To 500, Deduct</i>	-1.78	
			<i>For >500, Deduct</i>	-2.13	
05 05 23 00-0986	EA		1" Diameter x 9" Length, 304/18-8 Stainless Steel, Hex Head Bolt	38.29	
			<i>For >100 To 250, Deduct</i>	-1.42	
			<i>For >250 To 500, Deduct</i>	-1.78	
			<i>For >500, Deduct</i>	-2.13	
05 05 23 00-0987	EA		1" Diameter x 9-1/2" Length, 304/18-8 Stainless Steel, Hex Head Bolt	48.73	
			<i>For >100 To 250, Deduct</i>	-1.42	
			<i>For >250 To 500, Deduct</i>	-1.78	
			<i>For >500, Deduct</i>	-2.13	
05 05 23 00-0988	EA		1" Diameter x 10" Length, 304/18-8 Stainless Steel, Hex Head Bolt	60.91	
			<i>For >100 To 250, Deduct</i>	-1.42	
			<i>For >250 To 500, Deduct</i>	-1.78	
			<i>For >500, Deduct</i>	-2.13	
05 05 23 00-0989			316 Stainless Steel, Hex Head Bolts <small>(05 05 23 00-0997)</small>		
05 05 23 00-0990			1/4" Diameter, 316 Stainless Steel, Hex Head Bolts <small>(05 05 23 00-0989)</small>		
05 05 23 00-0991	EA		1/4" Diameter x 1/2" Length, 316 Stainless Steel, Hex Head Bolt	4.76	
			<i>For >100 To 250, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-1.13	
			<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0992	EA		1/4" Diameter x 1" Length, 316 Stainless Steel, Hex Head Bolt	4.87	
			<i>For >100 To 250, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-1.13	
			<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0993	EA		1/4" Diameter x 1-1/2" Length, 316 Stainless Steel, Hex Head Bolt	4.95	
			<i>For >100 To 250, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-1.13	
			<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0994	EA		1/4" Diameter x 2" Length, 316 Stainless Steel, Hex Head Bolt	5.01	
			<i>For >100 To 250, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-1.13	
			<i>For >500, Deduct</i>	-1.36	
05 05 23 00-0995	EA		1/4" Diameter x 2-1/2" Length, 316 Stainless Steel, Hex Head Bolt	5.29	
			<i>For >100 To 250, Deduct</i>	-0.93	
			<i>For >250 To 500, Deduct</i>	-1.16	
			<i>For >500, Deduct</i>	-1.40	
05 05 23 00-0996	EA		1/4" Diameter x 3" Length, 316 Stainless Steel, Hex Head Bolt	5.44	
			<i>For >100 To 250, Deduct</i>	-0.93	
			<i>For >250 To 500, Deduct</i>	-1.16	
			<i>For >500, Deduct</i>	-1.40	
05 05 23 00-0997	EA		1/4" Diameter x 3-1/2" Length, 316 Stainless Steel, Hex Head Bolt	5.58	
			<i>For >100 To 250, Deduct</i>	-0.93	
			<i>For >250 To 500, Deduct</i>	-1.16	
			<i>For >500, Deduct</i>	-1.40	
05 05 23 00-0998	EA		1/4" Diameter x 4" Length, 316 Stainless Steel, Hex Head Bolt	5.82	
			<i>For >100 To 250, Deduct</i>	-0.96	
			<i>For >250 To 500, Deduct</i>	-1.20	
			<i>For >500, Deduct</i>	-1.43	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-0999 EA 1/4" Diameter x 4-1/2" Length, 316 Stainless Steel, Hex Head Bolt	5.94	
<i>For >100 To 250, Deduct</i>	-0.96	
<i>For >250 To 500, Deduct</i>	-1.20	
<i>For >500, Deduct</i>	-1.43	
05 05 23 00-1000 EA 1/4" Diameter x 5" Length, 316 Stainless Steel, Hex Head Bolt	6.00	
<i>For >100 To 250, Deduct</i>	-0.96	
<i>For >250 To 500, Deduct</i>	-1.20	
<i>For >500, Deduct</i>	-1.43	
05 05 23 00-1001 EA 1/4" Diameter x 5-1/2" Length, 316 Stainless Steel, Hex Head Bolt	6.49	
<i>For >100 To 250, Deduct</i>	-0.98	
<i>For >250 To 500, Deduct</i>	-1.23	
<i>For >500, Deduct</i>	-1.47	
05 05 23 00-1002 EA 1/4" Diameter x 6" Length, 316 Stainless Steel, Hex Head Bolt	6.59	
<i>For >100 To 250, Deduct</i>	-0.98	
<i>For >250 To 500, Deduct</i>	-1.23	
<i>For >500, Deduct</i>	-1.47	
05 05 23 00-1003 EA 1/4" Diameter x 6-1/2" Length, 316 Stainless Steel, Hex Head Bolt	10.25	
<i>For >100 To 250, Deduct</i>	-0.98	
<i>For >250 To 500, Deduct</i>	-1.23	
<i>For >500, Deduct</i>	-1.47	
05 05 23 00-1004 EA 1/4" Diameter x 7" Length, 316 Stainless Steel, Hex Head Bolt	14.82	
<i>For >100 To 250, Deduct</i>	-1.01	
<i>For >250 To 500, Deduct</i>	-1.26	
<i>For >500, Deduct</i>	-1.52	
05 05 23 00-1005 EA 1/4" Diameter x 7-1/2" Length, 316 Stainless Steel, Hex Head Bolt	24.59	
<i>For >100 To 250, Deduct</i>	-1.01	
<i>For >250 To 500, Deduct</i>	-1.26	
<i>For >500, Deduct</i>	-1.52	
05 05 23 00-1006 EA 1/4" Diameter x 8" Length, 316 Stainless Steel, Hex Head Bolt	26.81	
<i>For >100 To 250, Deduct</i>	-1.01	
<i>For >250 To 500, Deduct</i>	-1.26	
<i>For >500, Deduct</i>	-1.52	
05 05 23 00-1007 5/16" Diameter, 316 Stainless Steel, Hex Head Bolts (05 05 23 00-0999)		
05 05 23 00-1008 EA 5/16" Diameter x 1/2" Length, 316 Stainless Steel, Hex Head Bolt	4.91	
<i>For >100 To 250, Deduct</i>	-0.90	
<i>For >250 To 500, Deduct</i>	-1.13	
<i>For >500, Deduct</i>	-1.36	
05 05 23 00-1009 EA 5/16" Diameter x 1" Length, 316 Stainless Steel, Hex Head Bolt	5.04	
<i>For >100 To 250, Deduct</i>	-0.90	
<i>For >250 To 500, Deduct</i>	-1.13	
<i>For >500, Deduct</i>	-1.36	
05 05 23 00-1010 EA 5/16" Diameter x 1-1/2" Length, 316 Stainless Steel, Hex Head Bolt	5.25	
<i>For >100 To 250, Deduct</i>	-0.90	
<i>For >250 To 500, Deduct</i>	-1.13	
<i>For >500, Deduct</i>	-1.36	
05 05 23 00-1011 EA 5/16" Diameter x 2" Length, 316 Stainless Steel, Hex Head Bolt	5.40	
<i>For >100 To 250, Deduct</i>	-0.90	
<i>For >250 To 500, Deduct</i>	-1.13	
<i>For >500, Deduct</i>	-1.36	
05 05 23 00-1012 EA 5/16" Diameter x 2-1/2" Length, 316 Stainless Steel, Hex Head Bolt	5.60	
<i>For >100 To 250, Deduct</i>	-0.93	
<i>For >250 To 500, Deduct</i>	-1.16	
<i>For >500, Deduct</i>	-1.40	
05 05 23 00-1013 EA 5/16" Diameter x 3" Length, 316 Stainless Steel, Hex Head Bolt	5.93	
<i>For >100 To 250, Deduct</i>	-0.93	
<i>For >250 To 500, Deduct</i>	-1.16	
<i>For >500, Deduct</i>	-1.40	
05 05 23 00-1014 EA 5/16" Diameter x 3-1/2" Length, 316 Stainless Steel, Hex Head Bolt	6.15	
<i>For >100 To 250, Deduct</i>	-0.93	
<i>For >250 To 500, Deduct</i>	-1.16	
<i>For >500, Deduct</i>	-1.40	
05 05 23 00-1015 EA 5/16" Diameter x 4" Length, 316 Stainless Steel, Hex Head Bolt	6.38	
<i>For >100 To 250, Deduct</i>	-0.96	
<i>For >250 To 500, Deduct</i>	-1.20	
<i>For >500, Deduct</i>	-1.43	
05 05 23 00-1016 EA 5/16" Diameter x 4-1/2" Length, 316 Stainless Steel, Hex Head Bolt	6.86	
<i>For >100 To 250, Deduct</i>	-0.96	
<i>For >250 To 500, Deduct</i>	-1.20	
<i>For >500, Deduct</i>	-1.43	
05 05 23 00-1017 EA 5/16" Diameter x 5" Length, 316 Stainless Steel, Hex Head Bolt	6.96	
<i>For >100 To 250, Deduct</i>	-0.96	
<i>For >250 To 500, Deduct</i>	-1.20	
<i>For >500, Deduct</i>	-1.43	
05 05 23 00-1018 EA 5/16" Diameter x 5-1/2" Length, 316 Stainless Steel, Hex Head Bolt	7.42	
<i>For >100 To 250, Deduct</i>	-0.98	
<i>For >250 To 500, Deduct</i>	-1.23	
<i>For >500, Deduct</i>	-1.47	
05 05 23 00-1019 EA 5/16" Diameter x 6" Length, 316 Stainless Steel, Hex Head Bolt	7.80	
<i>For >100 To 250, Deduct</i>	-0.98	
<i>For >250 To 500, Deduct</i>	-1.23	
<i>For >500, Deduct</i>	-1.47	

05 Metals**05 05 Common Work Results For Metals****05 05 23 Metal Fastenings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-1020	EA		5/16" Diameter x 6-1/2" Length, 316 Stainless Steel, Hex Head Bolt	10.91	
			<i>For >100 To 250, Deduct</i>	-0.98	
			<i>For >250 To 500, Deduct</i>	-1.23	
			<i>For >500, Deduct</i>	-1.47	
05 05 23 00-1021	EA		5/16" Diameter x 7" Length, 316 Stainless Steel, Hex Head Bolt.....	15.47	
			<i>For >100 To 250, Deduct</i>	-1.01	
			<i>For >250 To 500, Deduct</i>	-1.26	
			<i>For >500, Deduct</i>	-1.52	
05 05 23 00-1022			3/8" Diameter, 316 Stainless Steel, Hex Head Bolts <small>(05 05 23 00-0989)</small>		
05 05 23 00-1023	EA		3/8" Diameter x 1/2" Length, 316 Stainless Steel, Hex Head Bolt.....	5.24	
			<i>For >100 To 250, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-1.13	
			<i>For >500, Deduct</i>	-1.36	
05 05 23 00-1024	EA		3/8" Diameter x 1" Length, 316 Stainless Steel, Hex Head Bolt.....	5.29	
			<i>For >100 To 250, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-1.13	
			<i>For >500, Deduct</i>	-1.36	
05 05 23 00-1025	EA		3/8" Diameter x 1-1/2" Length, 316 Stainless Steel, Hex Head Bolt	5.49	
			<i>For >100 To 250, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-1.13	
			<i>For >500, Deduct</i>	-1.36	
05 05 23 00-1026	EA		3/8" Diameter x 2" Length, 316 Stainless Steel, Hex Head Bolt.....	5.95	
			<i>For >100 To 250, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-1.13	
			<i>For >500, Deduct</i>	-1.36	
05 05 23 00-1027	EA		3/8" Diameter x 2-1/2" Length, 316 Stainless Steel, Hex Head Bolt	6.25	
			<i>For >100 To 250, Deduct</i>	-0.93	
			<i>For >250 To 500, Deduct</i>	-1.16	
			<i>For >500, Deduct</i>	-1.40	
05 05 23 00-1028	EA		3/8" Diameter x 3" Length, 316 Stainless Steel, Hex Head Bolt.....	6.33	
			<i>For >100 To 250, Deduct</i>	-0.93	
			<i>For >250 To 500, Deduct</i>	-1.16	
			<i>For >500, Deduct</i>	-1.40	
05 05 23 00-1029	EA		3/8" Diameter x 3-1/2" Length, 316 Stainless Steel, Hex Head Bolt	6.73	
			<i>For >100 To 250, Deduct</i>	-0.93	
			<i>For >250 To 500, Deduct</i>	-1.16	
			<i>For >500, Deduct</i>	-1.40	
05 05 23 00-1030	EA		3/8" Diameter x 4" Length, 316 Stainless Steel, Hex Head Bolt.....	6.92	
			<i>For >100 To 250, Deduct</i>	-0.96	
			<i>For >250 To 500, Deduct</i>	-1.20	
			<i>For >500, Deduct</i>	-1.43	
05 05 23 00-1031	EA		3/8" Diameter x 4-1/2" Length, 316 Stainless Steel, Hex Head Bolt	7.18	
			<i>For >100 To 250, Deduct</i>	-0.96	
			<i>For >250 To 500, Deduct</i>	-1.20	
			<i>For >500, Deduct</i>	-1.43	
05 05 23 00-1032	EA		3/8" Diameter x 5" Length, 316 Stainless Steel, Hex Head Bolt.....	7.35	
			<i>For >100 To 250, Deduct</i>	-0.96	
			<i>For >250 To 500, Deduct</i>	-1.20	
			<i>For >500, Deduct</i>	-1.43	
05 05 23 00-1033	EA		3/8" Diameter x 5-1/2" Length, 316 Stainless Steel, Hex Head Bolt	8.05	
			<i>For >100 To 250, Deduct</i>	-0.98	
			<i>For >250 To 500, Deduct</i>	-1.23	
			<i>For >500, Deduct</i>	-1.47	
05 05 23 00-1034	EA		3/8" Diameter x 6" Length, 316 Stainless Steel, Hex Head Bolt.....	8.73	
			<i>For >100 To 250, Deduct</i>	-0.98	
			<i>For >250 To 500, Deduct</i>	-1.23	
			<i>For >500, Deduct</i>	-1.47	
05 05 23 00-1035	EA		3/8" Diameter x 6-1/2" Length, 316 Stainless Steel, Hex Head Bolt	8.76	
			<i>For >100 To 250, Deduct</i>	-0.98	
			<i>For >250 To 500, Deduct</i>	-1.23	
			<i>For >500, Deduct</i>	-1.47	
05 05 23 00-1036	EA		3/8" Diameter x 7" Length, 316 Stainless Steel, Hex Head Bolt.....	10.63	
			<i>For >100 To 250, Deduct</i>	-1.01	
			<i>For >250 To 500, Deduct</i>	-1.26	
			<i>For >500, Deduct</i>	-1.52	
05 05 23 00-1037	EA		3/8" Diameter x 7-1/2" Length, 316 Stainless Steel, Hex Head Bolt	13.45	
			<i>For >100 To 250, Deduct</i>	-1.01	
			<i>For >250 To 500, Deduct</i>	-1.26	
			<i>For >500, Deduct</i>	-1.52	
05 05 23 00-1038	EA		3/8" Diameter x 8" Length, 316 Stainless Steel, Hex Head Bolt.....	16.49	
			<i>For >100 To 250, Deduct</i>	-1.01	
			<i>For >250 To 500, Deduct</i>	-1.26	
			<i>For >500, Deduct</i>	-1.52	
05 05 23 00-1039			7/16" Diameter, 316 Stainless Steel, Hex Head Bolts <small>(05 05 23 00-0989)</small>		
05 05 23 00-1040	EA		7/16" Diameter x 1" Length, 316 Stainless Steel, Hex Head Bolt.....	6.68	
			<i>For >100 To 250, Deduct</i>	-1.04	
			<i>For >250 To 500, Deduct</i>	-1.30	
			<i>For >500, Deduct</i>	-1.55	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-1041 EA 7/16" Diameter x 1-1/2" Length, 316 Stainless Steel, Hex Head Bolt	6.97	
<i>For >100 To 250, Deduct</i>	-1.04	
<i>For >250 To 500, Deduct</i>	-1.30	
<i>For >500, Deduct</i>	-1.55	
05 05 23 00-1042 EA 7/16" Diameter x 2" Length, 316 Stainless Steel, Hex Head Bolt	7.52	
<i>For >100 To 250, Deduct</i>	-1.04	
<i>For >250 To 500, Deduct</i>	-1.30	
<i>For >500, Deduct</i>	-1.55	
05 05 23 00-1043 EA 7/16" Diameter x 2-1/2" Length, 316 Stainless Steel, Hex Head Bolt	8.11	
<i>For >100 To 250, Deduct</i>	-1.06	
<i>For >250 To 500, Deduct</i>	-1.33	
<i>For >500, Deduct</i>	-1.59	
05 05 23 00-1044 EA 7/16" Diameter x 3" Length, 316 Stainless Steel, Hex Head Bolt	8.64	
<i>For >100 To 250, Deduct</i>	-1.06	
<i>For >250 To 500, Deduct</i>	-1.33	
<i>For >500, Deduct</i>	-1.59	
05 05 23 00-1045 EA 7/16" Diameter x 3-1/2" Length, 316 Stainless Steel, Hex Head Bolt	9.50	
<i>For >100 To 250, Deduct</i>	-1.06	
<i>For >250 To 500, Deduct</i>	-1.33	
<i>For >500, Deduct</i>	-1.59	
05 05 23 00-1046 EA 7/16" Diameter x 4" Length, 316 Stainless Steel, Hex Head Bolt	10.45	
<i>For >100 To 250, Deduct</i>	-1.09	
<i>For >250 To 500, Deduct</i>	-1.36	
<i>For >500, Deduct</i>	-1.63	
05 05 23 00-1047 EA 7/16" Diameter x 4-1/2" Length, 316 Stainless Steel, Hex Head Bolt	10.61	
<i>For >100 To 250, Deduct</i>	-1.09	
<i>For >250 To 500, Deduct</i>	-1.36	
<i>For >500, Deduct</i>	-1.63	
05 05 23 00-1048 EA 7/16" Diameter x 5" Length, 316 Stainless Steel, Hex Head Bolt	10.92	
<i>For >100 To 250, Deduct</i>	-1.09	
<i>For >250 To 500, Deduct</i>	-1.36	
<i>For >500, Deduct</i>	-1.63	
05 05 23 00-1049 EA 7/16" Diameter x 5-1/2" Length, 316 Stainless Steel, Hex Head Bolt	11.26	
<i>For >100 To 250, Deduct</i>	-1.11	
<i>For >250 To 500, Deduct</i>	-1.39	
<i>For >500, Deduct</i>	-1.67	
05 05 23 00-1050 EA 7/16" Diameter x 6" Length, 316 Stainless Steel, Hex Head Bolt	11.48	
<i>For >100 To 250, Deduct</i>	-1.11	
<i>For >250 To 500, Deduct</i>	-1.39	
<i>For >500, Deduct</i>	-1.67	
05 05 23 00-1051 EA 7/16" Diameter x 6-1/2" Length, 316 Stainless Steel, Hex Head Bolt	11.71	
<i>For >100 To 250, Deduct</i>	-1.11	
<i>For >250 To 500, Deduct</i>	-1.39	
<i>For >500, Deduct</i>	-1.67	
05 05 23 00-1052 EA 7/16" Diameter x 7" Length, 316 Stainless Steel, Hex Head Bolt	12.02	
<i>For >100 To 250, Deduct</i>	-1.14	
<i>For >250 To 500, Deduct</i>	-1.42	
<i>For >500, Deduct</i>	-1.71	
05 05 23 00-1053 1/2" Diameter, 316 Stainless Steel, Hex Head Bolts (05 05 23 00-0989)	6.66	
05 05 23 00-1054 EA 1/2" Diameter x 1" Length, 316 Stainless Steel, Hex Head Bolt	6.66	
<i>For >100 To 250, Deduct</i>	-1.04	
<i>For >250 To 500, Deduct</i>	-1.30	
<i>For >500, Deduct</i>	-1.55	
05 05 23 00-1055 EA 1/2" Diameter x 1-1/2" Length, 316 Stainless Steel, Hex Head Bolt	6.98	
<i>For >100 To 250, Deduct</i>	-1.04	
<i>For >250 To 500, Deduct</i>	-1.30	
<i>For >500, Deduct</i>	-1.55	
05 05 23 00-1056 EA 1/2" Diameter x 2" Length, 316 Stainless Steel, Hex Head Bolt	7.42	
<i>For >100 To 250, Deduct</i>	-1.04	
<i>For >250 To 500, Deduct</i>	-1.30	
<i>For >500, Deduct</i>	-1.55	
05 05 23 00-1057 EA 1/2" Diameter x 2-1/2" Length, 316 Stainless Steel, Hex Head Bolt	8.07	
<i>For >100 To 250, Deduct</i>	-1.06	
<i>For >250 To 500, Deduct</i>	-1.33	
<i>For >500, Deduct</i>	-1.59	
05 05 23 00-1058 EA 1/2" Diameter x 3" Length, 316 Stainless Steel, Hex Head Bolt	8.56	
<i>For >100 To 250, Deduct</i>	-1.06	
<i>For >250 To 500, Deduct</i>	-1.33	
<i>For >500, Deduct</i>	-1.59	
05 05 23 00-1059 EA 1/2" Diameter x 3-1/2" Length, 316 Stainless Steel, Hex Head Bolt	8.68	
<i>For >100 To 250, Deduct</i>	-1.06	
<i>For >250 To 500, Deduct</i>	-1.33	
<i>For >500, Deduct</i>	-1.59	
05 05 23 00-1060 EA 1/2" Diameter x 4" Length, 316 Stainless Steel, Hex Head Bolt	9.01	
<i>For >100 To 250, Deduct</i>	-1.09	
<i>For >250 To 500, Deduct</i>	-1.36	
<i>For >500, Deduct</i>	-1.63	
05 05 23 00-1061 EA 1/2" Diameter x 4-1/2" Length, 316 Stainless Steel, Hex Head Bolt	9.95	
<i>For >100 To 250, Deduct</i>	-1.09	
<i>For >250 To 500, Deduct</i>	-1.36	
<i>For >500, Deduct</i>	-1.63	

05 Metals**05 05 Common Work Results For Metals****05 05 23 Metal Fastenings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-1062	EA		1/2" Diameter x 5" Length, 316 Stainless Steel, Hex Head Bolt.....	11.85	
			<i>For >100 To 250, Deduct</i>	-1.09	
			<i>For >250 To 500, Deduct</i>	-1.36	
			<i>For >500, Deduct</i>	-1.63	
05 05 23 00-1063	EA		1/2" Diameter x 5-1/2" Length, 316 Stainless Steel, Hex Head Bolt	12.12	
			<i>For >100 To 250, Deduct</i>	-1.11	
			<i>For >250 To 500, Deduct</i>	-1.39	
			<i>For >500, Deduct</i>	-1.67	
05 05 23 00-1064	EA		1/2" Diameter x 6" Length, 316 Stainless Steel, Hex Head Bolt.....	12.42	
			<i>For >100 To 250, Deduct</i>	-1.11	
			<i>For >250 To 500, Deduct</i>	-1.39	
			<i>For >500, Deduct</i>	-1.67	
05 05 23 00-1065	EA		1/2" Diameter x 6-1/2" Length, 316 Stainless Steel, Hex Head Bolt	14.78	
			<i>For >100 To 250, Deduct</i>	-1.11	
			<i>For >250 To 500, Deduct</i>	-1.39	
			<i>For >500, Deduct</i>	-1.67	
05 05 23 00-1066	EA		1/2" Diameter x 7" Length, 316 Stainless Steel, Hex Head Bolt.....	16.48	
			<i>For >100 To 250, Deduct</i>	-1.14	
			<i>For >250 To 500, Deduct</i>	-1.42	
			<i>For >500, Deduct</i>	-1.71	
05 05 23 00-1067	EA		1/2" Diameter x 7-1/2" Length, 316 Stainless Steel, Hex Head Bolt	17.50	
			<i>For >100 To 250, Deduct</i>	-1.14	
			<i>For >250 To 500, Deduct</i>	-1.42	
			<i>For >500, Deduct</i>	-1.71	
05 05 23 00-1068	EA		1/2" Diameter x 8" Length, 316 Stainless Steel, Hex Head Bolt.....	19.19	
			<i>For >100 To 250, Deduct</i>	-1.14	
			<i>For >250 To 500, Deduct</i>	-1.42	
			<i>For >500, Deduct</i>	-1.71	
05 05 23 00-1069	EA		1/2" Diameter x 8-1/2" Length, 316 Stainless Steel, Hex Head Bolt	23.78	
			<i>For >100 To 250, Deduct</i>	-1.16	
			<i>For >250 To 500, Deduct</i>	-1.46	
			<i>For >500, Deduct</i>	-1.75	
05 05 23 00-1070	EA		1/2" Diameter x 9" Length, 316 Stainless Steel, Hex Head Bolt.....	26.66	
			<i>For >100 To 250, Deduct</i>	-1.16	
			<i>For >250 To 500, Deduct</i>	-1.46	
			<i>For >500, Deduct</i>	-1.75	
05 05 23 00-1071	EA		1/2" Diameter x 9-1/2" Length, 316 Stainless Steel, Hex Head Bolt	27.14	
			<i>For >100 To 250, Deduct</i>	-1.16	
			<i>For >250 To 500, Deduct</i>	-1.46	
			<i>For >500, Deduct</i>	-1.75	
05 05 23 00-1072	EA		1/2" Diameter x 10" Length, 316 Stainless Steel, Hex Head Bolt.....	27.87	
			<i>For >100 To 250, Deduct</i>	-1.16	
			<i>For >250 To 500, Deduct</i>	-1.46	
			<i>For >500, Deduct</i>	-1.75	
05 05 23 00-1073			9/16" Diameter, 316 Stainless Steel, Hex Head Bolts <small>(05 05 23 00-0989)</small>		
05 05 23 00-1074	EA		9/16" Diameter x 1" Length, 316 Stainless Steel, Hex Head Bolt.....	14.56	
			<i>For >100 To 250, Deduct</i>	-1.04	
			<i>For >250 To 500, Deduct</i>	-1.30	
			<i>For >500, Deduct</i>	-1.55	
05 05 23 00-1075	EA		9/16" Diameter x 1-1/2" Length, 316 Stainless Steel, Hex Head Bolt	15.59	
			<i>For >100 To 250, Deduct</i>	-1.04	
			<i>For >250 To 500, Deduct</i>	-1.30	
			<i>For >500, Deduct</i>	-1.55	
05 05 23 00-1076	EA		9/16" Diameter x 2" Length, 316 Stainless Steel, Hex Head Bolt.....	19.06	
			<i>For >100 To 250, Deduct</i>	-1.04	
			<i>For >250 To 500, Deduct</i>	-1.30	
			<i>For >500, Deduct</i>	-1.55	
05 05 23 00-1077	EA		9/16" Diameter x 2-1/2" Length, 316 Stainless Steel, Hex Head Bolt	21.12	
			<i>For >100 To 250, Deduct</i>	-1.06	
			<i>For >250 To 500, Deduct</i>	-1.33	
			<i>For >500, Deduct</i>	-1.59	
05 05 23 00-1078	EA		9/16" Diameter x 3" Length, 316 Stainless Steel, Hex Head Bolt.....	23.16	
			<i>For >100 To 250, Deduct</i>	-1.06	
			<i>For >250 To 500, Deduct</i>	-1.33	
			<i>For >500, Deduct</i>	-1.59	
05 05 23 00-1079	EA		9/16" Diameter x 3-1/2" Length, 316 Stainless Steel, Hex Head Bolt	25.21	
			<i>For >100 To 250, Deduct</i>	-1.06	
			<i>For >250 To 500, Deduct</i>	-1.33	
			<i>For >500, Deduct</i>	-1.59	
05 05 23 00-1080	EA		9/16" Diameter x 4" Length, 316 Stainless Steel, Hex Head Bolt.....	26.62	
			<i>For >100 To 250, Deduct</i>	-1.09	
			<i>For >250 To 500, Deduct</i>	-1.36	
			<i>For >500, Deduct</i>	-1.63	
05 05 23 00-1081	EA		9/16" Diameter x 4-1/2" Length, 316 Stainless Steel, Hex Head Bolt	28.31	
			<i>For >100 To 250, Deduct</i>	-1.09	
			<i>For >250 To 500, Deduct</i>	-1.36	
			<i>For >500, Deduct</i>	-1.63	
05 05 23 00-1082	EA		9/16" Diameter x 5" Length, 316 Stainless Steel, Hex Head Bolt.....	29.81	
			<i>For >100 To 250, Deduct</i>	-1.09	
			<i>For >250 To 500, Deduct</i>	-1.36	
			<i>For >500, Deduct</i>	-1.63	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-1083 EA 9/16" Diameter x 5-1/2" Length, 316 Stainless Steel, Hex Head Bolt	30.38	
<i>For >100 To 250, Deduct</i>	-1.11	
<i>For >250 To 500, Deduct</i>	-1.39	
<i>For >500, Deduct</i>	-1.67	
05 05 23 00-1084 EA 9/16" Diameter x 6" Length, 316 Stainless Steel, Hex Head Bolt	31.70	
<i>For >100 To 250, Deduct</i>	-1.11	
<i>For >250 To 500, Deduct</i>	-1.39	
<i>For >500, Deduct</i>	-1.67	
05 05 23 00-1085 5/8" Diameter, 316 Stainless Steel, Hex Head Bolts (05 05 23 00-0989)		
05 05 23 00-1086 EA 5/8" Diameter x 1" Length, 316 Stainless Steel, Hex Head Bolt	8.91	
<i>For >100 To 250, Deduct</i>	-1.16	
<i>For >250 To 500, Deduct</i>	-1.46	
<i>For >500, Deduct</i>	-1.75	
05 05 23 00-1087 EA 5/8" Diameter x 1-1/2" Length, 316 Stainless Steel, Hex Head Bolt	9.00	
<i>For >100 To 250, Deduct</i>	-1.16	
<i>For >250 To 500, Deduct</i>	-1.46	
<i>For >500, Deduct</i>	-1.75	
05 05 23 00-1088 EA 5/8" Diameter x 2" Length, 316 Stainless Steel, Hex Head Bolt	9.03	
<i>For >100 To 250, Deduct</i>	-1.16	
<i>For >250 To 500, Deduct</i>	-1.46	
<i>For >500, Deduct</i>	-1.75	
05 05 23 00-1089 EA 5/8" Diameter x 2-1/2" Length, 316 Stainless Steel, Hex Head Bolt	9.75	
<i>For >100 To 250, Deduct</i>	-1.19	
<i>For >250 To 500, Deduct</i>	-1.49	
<i>For >500, Deduct</i>	-1.79	
05 05 23 00-1090 EA 5/8" Diameter x 3" Length, 316 Stainless Steel, Hex Head Bolt	10.36	
<i>For >100 To 250, Deduct</i>	-1.19	
<i>For >250 To 500, Deduct</i>	-1.49	
<i>For >500, Deduct</i>	-1.79	
05 05 23 00-1091 EA 5/8" Diameter x 3-1/2" Length, 316 Stainless Steel, Hex Head Bolt	12.29	
<i>For >100 To 250, Deduct</i>	-1.19	
<i>For >250 To 500, Deduct</i>	-1.49	
<i>For >500, Deduct</i>	-1.79	
05 05 23 00-1092 EA 5/8" Diameter x 4" Length, 316 Stainless Steel, Hex Head Bolt	12.82	
<i>For >100 To 250, Deduct</i>	-1.22	
<i>For >250 To 500, Deduct</i>	-1.52	
<i>For >500, Deduct</i>	-1.82	
05 05 23 00-1093 EA 5/8" Diameter x 4-1/2" Length, 316 Stainless Steel, Hex Head Bolt	14.51	
<i>For >100 To 250, Deduct</i>	-1.22	
<i>For >250 To 500, Deduct</i>	-1.52	
<i>For >500, Deduct</i>	-1.82	
05 05 23 00-1094 EA 5/8" Diameter x 5" Length, 316 Stainless Steel, Hex Head Bolt	15.10	
<i>For >100 To 250, Deduct</i>	-1.22	
<i>For >250 To 500, Deduct</i>	-1.52	
<i>For >500, Deduct</i>	-1.82	
05 05 23 00-1095 EA 5/8" Diameter x 5-1/2" Length, 316 Stainless Steel, Hex Head Bolt	16.32	
<i>For >100 To 250, Deduct</i>	-1.24	
<i>For >250 To 500, Deduct</i>	-1.55	
<i>For >500, Deduct</i>	-1.86	
05 05 23 00-1096 EA 5/8" Diameter x 6" Length, 316 Stainless Steel, Hex Head Bolt	16.80	
<i>For >100 To 250, Deduct</i>	-1.24	
<i>For >250 To 500, Deduct</i>	-1.55	
<i>For >500, Deduct</i>	-1.86	
05 05 23 00-1097 EA 5/8" Diameter x 6-1/2" Length, 316 Stainless Steel, Hex Head Bolt	19.76	
<i>For >100 To 250, Deduct</i>	-1.24	
<i>For >250 To 500, Deduct</i>	-1.55	
<i>For >500, Deduct</i>	-1.86	
05 05 23 00-1098 EA 5/8" Diameter x 7" Length, 316 Stainless Steel, Hex Head Bolt	20.95	
<i>For >100 To 250, Deduct</i>	-1.27	
<i>For >250 To 500, Deduct</i>	-1.58	
<i>For >500, Deduct</i>	-1.90	
05 05 23 00-1099 EA 5/8" Diameter x 7-1/2" Length, 316 Stainless Steel, Hex Head Bolt	21.33	
<i>For >100 To 250, Deduct</i>	-1.27	
<i>For >250 To 500, Deduct</i>	-1.58	
<i>For >500, Deduct</i>	-1.90	
05 05 23 00-1100 EA 5/8" Diameter x 8" Length, 316 Stainless Steel, Hex Head Bolt	22.71	
<i>For >100 To 250, Deduct</i>	-1.27	
<i>For >250 To 500, Deduct</i>	-1.58	
<i>For >500, Deduct</i>	-1.90	
05 05 23 00-1101 EA 5/8" Diameter x 8-1/2" Length, 316 Stainless Steel, Hex Head Bolt	24.08	
<i>For >100 To 250, Deduct</i>	-1.29	
<i>For >250 To 500, Deduct</i>	-1.62	
<i>For >500, Deduct</i>	-1.94	
05 05 23 00-1102 EA 5/8" Diameter x 9" Length, 316 Stainless Steel, Hex Head Bolt	25.26	
<i>For >100 To 250, Deduct</i>	-1.29	
<i>For >250 To 500, Deduct</i>	-1.62	
<i>For >500, Deduct</i>	-1.94	
05 05 23 00-1103 EA 5/8" Diameter x 9-1/2" Length, 316 Stainless Steel, Hex Head Bolt	30.84	
<i>For >100 To 250, Deduct</i>	-1.29	
<i>For >250 To 500, Deduct</i>	-1.62	
<i>For >500, Deduct</i>	-1.94	

05 Metals**05 05 Common Work Results For Metals****05 05 23 Metal Fastenings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-1104	EA		5/8" Diameter x 10" Length, 316 Stainless Steel, Hex Head Bolt.....	36.80	
			<i>For >100 To 250, Deduct</i>	-1.29	
			<i>For >250 To 500, Deduct</i>	-1.62	
			<i>For >500, Deduct</i>	-1.94	
05 05 23 00-1105			3/4" Diameter, 316 Stainless Steel, Hex Head Bolts (05 05 23 00-0989)		
05 05 23 00-1106	EA		3/4" Diameter x 1" Length, 316 Stainless Steel, Hex Head Bolt.....	11.26	
			<i>For >100 To 250, Deduct</i>	-1.16	
			<i>For >250 To 500, Deduct</i>	-1.46	
			<i>For >500, Deduct</i>	-1.75	
05 05 23 00-1107	EA		3/4" Diameter x 1-1/2" Length, 316 Stainless Steel, Hex Head Bolt	11.47	
			<i>For >100 To 250, Deduct</i>	-1.16	
			<i>For >250 To 500, Deduct</i>	-1.46	
			<i>For >500, Deduct</i>	-1.75	
05 05 23 00-1108	EA		3/4" Diameter x 2" Length, 316 Stainless Steel, Hex Head Bolt.....	12.27	
			<i>For >100 To 250, Deduct</i>	-1.16	
			<i>For >250 To 500, Deduct</i>	-1.46	
			<i>For >500, Deduct</i>	-1.75	
05 05 23 00-1109	EA		3/4" Diameter x 2-1/2" Length, 316 Stainless Steel, Hex Head Bolt	13.11	
			<i>For >100 To 250, Deduct</i>	-1.19	
			<i>For >250 To 500, Deduct</i>	-1.49	
			<i>For >500, Deduct</i>	-1.79	
05 05 23 00-1110	EA		3/4" Diameter x 3" Length, 316 Stainless Steel, Hex Head Bolt.....	14.61	
			<i>For >100 To 250, Deduct</i>	-1.19	
			<i>For >250 To 500, Deduct</i>	-1.49	
			<i>For >500, Deduct</i>	-1.79	
05 05 23 00-1111	EA		3/4" Diameter x 3-1/2" Length, 316 Stainless Steel, Hex Head Bolt	15.47	
			<i>For >100 To 250, Deduct</i>	-1.19	
			<i>For >250 To 500, Deduct</i>	-1.49	
			<i>For >500, Deduct</i>	-1.79	
05 05 23 00-1112	EA		3/4" Diameter x 4" Length, 316 Stainless Steel, Hex Head Bolt.....	17.46	
			<i>For >100 To 250, Deduct</i>	-1.22	
			<i>For >250 To 500, Deduct</i>	-1.52	
			<i>For >500, Deduct</i>	-1.82	
05 05 23 00-1113	EA		3/4" Diameter x 4-1/2" Length, 316 Stainless Steel, Hex Head Bolt	18.22	
			<i>For >100 To 250, Deduct</i>	-1.22	
			<i>For >250 To 500, Deduct</i>	-1.52	
			<i>For >500, Deduct</i>	-1.82	
05 05 23 00-1114	EA		3/4" Diameter x 5" Length, 316 Stainless Steel, Hex Head Bolt.....	18.64	
			<i>For >100 To 250, Deduct</i>	-1.22	
			<i>For >250 To 500, Deduct</i>	-1.52	
			<i>For >500, Deduct</i>	-1.82	
05 05 23 00-1115	EA		3/4" Diameter x 5-1/2" Length, 316 Stainless Steel, Hex Head Bolt	19.32	
			<i>For >100 To 250, Deduct</i>	-1.24	
			<i>For >250 To 500, Deduct</i>	-1.55	
			<i>For >500, Deduct</i>	-1.86	
05 05 23 00-1116	EA		3/4" Diameter x 6" Length, 316 Stainless Steel, Hex Head Bolt.....	20.28	
			<i>For >100 To 250, Deduct</i>	-1.24	
			<i>For >250 To 500, Deduct</i>	-1.55	
			<i>For >500, Deduct</i>	-1.86	
05 05 23 00-1117	EA		3/4" Diameter x 6-1/2" Length, 316 Stainless Steel, Hex Head Bolt	23.24	
			<i>For >100 To 250, Deduct</i>	-1.24	
			<i>For >250 To 500, Deduct</i>	-1.55	
			<i>For >500, Deduct</i>	-1.86	
05 05 23 00-1118	EA		3/4" Diameter x 7" Length, 316 Stainless Steel, Hex Head Bolt.....	27.65	
			<i>For >100 To 250, Deduct</i>	-1.27	
			<i>For >250 To 500, Deduct</i>	-1.58	
			<i>For >500, Deduct</i>	-1.90	
05 05 23 00-1119	EA		3/4" Diameter x 7-1/2" Length, 316 Stainless Steel, Hex Head Bolt	30.97	
			<i>For >100 To 250, Deduct</i>	-1.27	
			<i>For >250 To 500, Deduct</i>	-1.58	
			<i>For >500, Deduct</i>	-1.90	
05 05 23 00-1120	EA		3/4" Diameter x 8" Length, 316 Stainless Steel, Hex Head Bolt.....	31.48	
			<i>For >100 To 250, Deduct</i>	-1.27	
			<i>For >250 To 500, Deduct</i>	-1.58	
			<i>For >500, Deduct</i>	-1.90	
05 05 23 00-1121	EA		3/4" Diameter x 8-1/2" Length, 316 Stainless Steel, Hex Head Bolt	33.61	
			<i>For >100 To 250, Deduct</i>	-1.29	
			<i>For >250 To 500, Deduct</i>	-1.62	
			<i>For >500, Deduct</i>	-1.94	
05 05 23 00-1122	EA		3/4" Diameter x 9" Length, 316 Stainless Steel, Hex Head Bolt.....	38.66	
			<i>For >100 To 250, Deduct</i>	-1.29	
			<i>For >250 To 500, Deduct</i>	-1.62	
			<i>For >500, Deduct</i>	-1.94	
05 05 23 00-1123	EA		3/4" Diameter x 9-1/2" Length, 316 Stainless Steel, Hex Head Bolt	39.08	
			<i>For >100 To 250, Deduct</i>	-1.29	
			<i>For >250 To 500, Deduct</i>	-1.62	
			<i>For >500, Deduct</i>	-1.94	
05 05 23 00-1124	EA		3/4" Diameter x 10" Length, 316 Stainless Steel, Hex Head Bolt.....	40.15	
			<i>For >100 To 250, Deduct</i>	-1.29	
			<i>For >250 To 500, Deduct</i>	-1.62	
			<i>For >500, Deduct</i>	-1.94	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-1125 7/8" Diameter, 316 Stainless Steel, Hex Head Bolts <small>(05 05 23 00-0989)</small>		
05 05 23 00-1126 EA 7/8" Diameter x 1-1/2" Length, 316 Stainless Steel, Hex Head Bolt	12.66	
For >100 To 250, Deduct	-1.29	
For >250 To 500, Deduct	-1.62	
For >500, Deduct	-1.94	
05 05 23 00-1127 EA 7/8" Diameter x 2" Length, 316 Stainless Steel, Hex Head Bolt	14.05	
For >100 To 250, Deduct	-1.29	
For >250 To 500, Deduct	-1.62	
For >500, Deduct	-1.94	
05 05 23 00-1128 EA 7/8" Diameter x 2-1/2" Length, 316 Stainless Steel, Hex Head Bolt	14.95	
For >100 To 250, Deduct	-1.32	
For >250 To 500, Deduct	-1.65	
For >500, Deduct	-1.98	
05 05 23 00-1129 EA 7/8" Diameter x 3" Length, 316 Stainless Steel, Hex Head Bolt	16.89	
For >100 To 250, Deduct	-1.32	
For >250 To 500, Deduct	-1.65	
For >500, Deduct	-1.98	
05 05 23 00-1130 EA 7/8" Diameter x 3-1/2" Length, 316 Stainless Steel, Hex Head Bolt	17.76	
For >100 To 250, Deduct	-1.32	
For >250 To 500, Deduct	-1.65	
For >500, Deduct	-1.98	
05 05 23 00-1131 EA 7/8" Diameter x 4" Length, 316 Stainless Steel, Hex Head Bolt	18.65	
For >100 To 250, Deduct	-1.35	
For >250 To 500, Deduct	-1.68	
For >500, Deduct	-2.02	
05 05 23 00-1132 EA 7/8" Diameter x 4-1/2" Length, 316 Stainless Steel, Hex Head Bolt	19.83	
For >100 To 250, Deduct	-1.35	
For >250 To 500, Deduct	-1.68	
For >500, Deduct	-2.02	
05 05 23 00-1133 EA 7/8" Diameter x 5" Length, 316 Stainless Steel, Hex Head Bolt	22.48	
For >100 To 250, Deduct	-1.35	
For >250 To 500, Deduct	-1.68	
For >500, Deduct	-2.02	
05 05 23 00-1134 EA 7/8" Diameter x 5-1/2" Length, 316 Stainless Steel, Hex Head Bolt	22.68	
For >100 To 250, Deduct	-1.37	
For >250 To 500, Deduct	-1.72	
For >500, Deduct	-2.06	
05 05 23 00-1135 EA 7/8" Diameter x 6" Length, 316 Stainless Steel, Hex Head Bolt	23.56	
For >100 To 250, Deduct	-1.37	
For >250 To 500, Deduct	-1.72	
For >500, Deduct	-2.06	
05 05 23 00-1136 EA 7/8" Diameter x 6-1/2" Length, 316 Stainless Steel, Hex Head Bolt	30.96	
For >100 To 250, Deduct	-1.37	
For >250 To 500, Deduct	-1.72	
For >500, Deduct	-2.06	
05 05 23 00-1137 EA 7/8" Diameter x 7" Length, 316 Stainless Steel, Hex Head Bolt	34.36	
For >100 To 250, Deduct	-1.40	
For >250 To 500, Deduct	-1.75	
For >500, Deduct	-2.09	
05 05 23 00-1138 EA 7/8" Diameter x 7-1/2" Length, 316 Stainless Steel, Hex Head Bolt	37.87	
For >100 To 250, Deduct	-1.40	
For >250 To 500, Deduct	-1.75	
For >500, Deduct	-2.09	
05 05 23 00-1139 EA 7/8" Diameter x 8" Length, 316 Stainless Steel, Hex Head Bolt	39.60	
For >100 To 250, Deduct	-1.40	
For >250 To 500, Deduct	-1.75	
For >500, Deduct	-2.09	
05 05 23 00-1140 EA 7/8" Diameter x 8-1/2" Length, 316 Stainless Steel, Hex Head Bolt	41.99	
For >100 To 250, Deduct	-1.42	
For >250 To 500, Deduct	-1.78	
For >500, Deduct	-2.13	
05 05 23 00-1141 EA 7/8" Diameter x 9" Length, 316 Stainless Steel, Hex Head Bolt	43.49	
For >100 To 250, Deduct	-1.42	
For >250 To 500, Deduct	-1.78	
For >500, Deduct	-2.13	
05 05 23 00-1142 EA 7/8" Diameter x 9-1/2" Length, 316 Stainless Steel, Hex Head Bolt	44.99	
For >100 To 250, Deduct	-1.42	
For >250 To 500, Deduct	-1.78	
For >500, Deduct	-2.13	
05 05 23 00-1143 EA 7/8" Diameter x 10" Length, 316 Stainless Steel, Hex Head Bolt	46.67	
For >100 To 250, Deduct	-1.42	
For >250 To 500, Deduct	-1.78	
For >500, Deduct	-2.13	
05 05 23 00-1144 1" Diameter, 316 Stainless Steel, Hex Head Bolts <small>(05 05 23 00-0989)</small>		
05 05 23 00-1145 EA 1" Diameter x 2" Length, 316 Stainless Steel, Hex Head Bolt	15.72	
For >100 To 250, Deduct	-1.29	
For >250 To 500, Deduct	-1.62	
For >500, Deduct	-1.94	
05 05 23 00-1146 EA 1" Diameter x 2-1/2" Length, 316 Stainless Steel, Hex Head Bolt	17.99	
For >100 To 250, Deduct	-1.32	
For >250 To 500, Deduct	-1.65	
For >500, Deduct	-1.98	

05 Metals**05 05 Common Work Results For Metals****05 05 23 Metal Fastenings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-1147	EA		1" Diameter x 3" Length, 316 Stainless Steel, Hex Head Bolt.....	19.42	
			<i>For >100 To 250, Deduct</i>	-1.32	
			<i>For >250 To 500, Deduct</i>	-1.65	
			<i>For >500, Deduct</i>	-1.98	
05 05 23 00-1148	EA		1" Diameter x 3-1/2" Length, 316 Stainless Steel, Hex Head Bolt	21.71	
			<i>For >100 To 250, Deduct</i>	-1.32	
			<i>For >250 To 500, Deduct</i>	-1.65	
			<i>For >500, Deduct</i>	-1.98	
05 05 23 00-1149	EA		1" Diameter x 4" Length, 316 Stainless Steel, Hex Head Bolt.....	22.66	
			<i>For >100 To 250, Deduct</i>	-1.35	
			<i>For >250 To 500, Deduct</i>	-1.68	
			<i>For >500, Deduct</i>	-2.02	
05 05 23 00-1150	EA		1" Diameter x 4-1/2" Length, 316 Stainless Steel, Hex Head Bolt	24.21	
			<i>For >100 To 250, Deduct</i>	-1.35	
			<i>For >250 To 500, Deduct</i>	-1.68	
			<i>For >500, Deduct</i>	-2.02	
05 05 23 00-1151	EA		1" Diameter x 5" Length, 316 Stainless Steel, Hex Head Bolt.....	25.78	
			<i>For >100 To 250, Deduct</i>	-1.35	
			<i>For >250 To 500, Deduct</i>	-1.68	
			<i>For >500, Deduct</i>	-2.02	
05 05 23 00-1152	EA		1" Diameter x 5-1/2" Length, 316 Stainless Steel, Hex Head Bolt	27.48	
			<i>For >100 To 250, Deduct</i>	-1.37	
			<i>For >250 To 500, Deduct</i>	-1.72	
			<i>For >500, Deduct</i>	-2.06	
05 05 23 00-1153	EA		1" Diameter x 6" Length, 316 Stainless Steel, Hex Head Bolt.....	31.54	
			<i>For >100 To 250, Deduct</i>	-1.37	
			<i>For >250 To 500, Deduct</i>	-1.72	
			<i>For >500, Deduct</i>	-2.06	
05 05 23 00-1154	EA		1" Diameter x 6-1/2" Length, 316 Stainless Steel, Hex Head Bolt	35.52	
			<i>For >100 To 250, Deduct</i>	-1.37	
			<i>For >250 To 500, Deduct</i>	-1.72	
			<i>For >500, Deduct</i>	-2.06	
05 05 23 00-1155	EA		1" Diameter x 7" Length, 316 Stainless Steel, Hex Head Bolt.....	41.10	
			<i>For >100 To 250, Deduct</i>	-1.40	
			<i>For >250 To 500, Deduct</i>	-1.75	
			<i>For >500, Deduct</i>	-2.09	
05 05 23 00-1156	EA		1" Diameter x 7-1/2" Length, 316 Stainless Steel, Hex Head Bolt	45.70	
			<i>For >100 To 250, Deduct</i>	-1.40	
			<i>For >250 To 500, Deduct</i>	-1.75	
			<i>For >500, Deduct</i>	-2.09	
05 05 23 00-1157	EA		1" Diameter x 8" Length, 316 Stainless Steel, Hex Head Bolt.....	46.36	
			<i>For >100 To 250, Deduct</i>	-1.40	
			<i>For >250 To 500, Deduct</i>	-1.75	
			<i>For >500, Deduct</i>	-2.09	
05 05 23 00-1158	EA		1" Diameter x 8-1/2" Length, 316 Stainless Steel, Hex Head Bolt	47.99	
			<i>For >100 To 250, Deduct</i>	-1.42	
			<i>For >250 To 500, Deduct</i>	-1.78	
			<i>For >500, Deduct</i>	-2.13	
05 05 23 00-1159	EA		1" Diameter x 9" Length, 316 Stainless Steel, Hex Head Bolt.....	48.61	
			<i>For >100 To 250, Deduct</i>	-1.42	
			<i>For >250 To 500, Deduct</i>	-1.78	
			<i>For >500, Deduct</i>	-2.13	
05 05 23 00-1160	EA		1" Diameter x 9-1/2" Length, 316 Stainless Steel, Hex Head Bolt	56.23	
			<i>For >100 To 250, Deduct</i>	-1.42	
			<i>For >250 To 500, Deduct</i>	-1.78	
			<i>For >500, Deduct</i>	-2.13	
05 05 23 00-1161	EA		1" Diameter x 10" Length, 316 Stainless Steel, Hex Head Bolt.....	63.59	
			<i>For >100 To 250, Deduct</i>	-1.42	
			<i>For >250 To 500, Deduct</i>	-1.78	
			<i>For >500, Deduct</i>	-2.13	
05 05 23 00-1162			Screws <small>(05 05 23)</small>		
05 05 23 00-1163			Teks® 5 Self Drilling Screws <small>(05 05 23 00-1162)</small>		
			Note: Screws include Climaseal® finish, self-drill point and tapping threads.		
05 05 23 00-1164	EA		12-24 x 1-1/4", Hex Washer Head, Teks® 5 Self Drilling Screw	2.42	
			<i>For >10 To 50, Deduct</i>	-0.11	
			<i>For >50 To 100, Deduct</i>	-0.22	
			<i>For >100, Deduct</i>	-0.45	
05 05 23 00-1165	EA		12-24 x 1-1/2", Hex Washer Head, Teks® 5 Self Drilling Screw	2.51	
			<i>For >10 To 50, Deduct</i>	-0.11	
			<i>For >50 To 100, Deduct</i>	-0.22	
			<i>For >100, Deduct</i>	-0.45	
05 05 23 00-1166	EA		12-24 x 2", Hex Washer Head, Teks® 5 Self Drilling Screw	2.79	
			<i>For >10 To 50, Deduct</i>	-0.12	
			<i>For >50 To 100, Deduct</i>	-0.24	
			<i>For >100, Deduct</i>	-0.48	
05 05 23 00-1167	EA		1/4"-28 x 3", Hex Washer Head, Teks® 5 Self Drilling Screw.....	3.80	
			<i>For >10 To 50, Deduct</i>	-0.14	
			<i>For >50 To 100, Deduct</i>	-0.31	
			<i>For >100, Deduct</i>	-0.62	
05 05 23 00-1168	EA		1/4"-28 x 4", Hex Washer Head, Teks® 5 Self Drilling Screw.....	4.05	
			<i>For >10 To 50, Deduct</i>	-0.15	
			<i>For >50 To 100, Deduct</i>	-0.33	
			<i>For >100, Deduct</i>	-0.66	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-1169 EA 1/4"-28 x 6", Hex Washer Head, Teks® 5 Self Drilling Screw.....	4.94	
<i>For >10 To 50, Deduct</i>	-0.16	
<i>For >50 To 100, Deduct</i>	-0.36	
<i>For >100, Deduct</i>	-0.72	
05 05 23 00-1170 EA 1/4"-28 x 8", Hex Washer Head, Teks® 5 Self Drilling Screw.....	5.50	
<i>For >10 To 50, Deduct</i>	-0.17	
<i>For >50 To 100, Deduct</i>	-0.39	
<i>For >100, Deduct</i>	-0.77	
05 05 23 00-1171 Security Screws <small>(05 05 23 00-1162)</small>		
05 05 23 00-1172 304/18-8 Stainless Steel, Security Screws <small>(05 05 23 00-1171)</small>		
Note: Includes "security" style drive in machine or sheet metal screw threads.		
05 05 23 00-1173 EA #4 Diameter x 1/2" Length, 304/18-8 Stainless Steel, Security Screws.....	1.89	
<i>For >10 To 50, Deduct</i>	-0.09	
<i>For >50 To 100, Deduct</i>	-0.18	
<i>For >100, Deduct</i>	-0.37	
05 05 23 00-1174 EA #6 Diameter x 1/2" Length, 304/18-8 Stainless Steel, Security Screw.....	2.11	
<i>For >10 To 50, Deduct</i>	-0.09	
<i>For >50 To 100, Deduct</i>	-0.19	
<i>For >100, Deduct</i>	-0.38	
05 05 23 00-1175 EA #6 Diameter x 1" Length, 304/18-8 Stainless Steel, Security Screw.....	2.29	
<i>For >10 To 50, Deduct</i>	-0.09	
<i>For >50 To 100, Deduct</i>	-0.19	
<i>For >100, Deduct</i>	-0.39	
05 05 23 00-1176 EA #6 Diameter x 1-1/2" Length, 304/18-8 Stainless Steel, Security Screw.....	2.35	
<i>For >10 To 50, Deduct</i>	-0.09	
<i>For >50 To 100, Deduct</i>	-0.19	
<i>For >100, Deduct</i>	-0.39	
05 05 23 00-1177 EA #6 Diameter x 2" Length, 304/18-8 Stainless Steel, Security Screw.....	2.47	
<i>For >10 To 50, Deduct</i>	-0.09	
<i>For >50 To 100, Deduct</i>	-0.20	
<i>For >100, Deduct</i>	-0.40	
05 05 23 00-1178 EA #8 Diameter x 1/2" Length, 304/18-8 Stainless Steel, Security Screw.....	2.15	
<i>For >10 To 50, Deduct</i>	-0.09	
<i>For >50 To 100, Deduct</i>	-0.19	
<i>For >100, Deduct</i>	-0.38	
05 05 23 00-1179 EA #8 Diameter x 1" Length, 304/18-8 Stainless Steel, Security Screw.....	2.24	
<i>For >10 To 50, Deduct</i>	-0.09	
<i>For >50 To 100, Deduct</i>	-0.19	
<i>For >100, Deduct</i>	-0.38	
05 05 23 00-1180 EA #8 Diameter x 1-1/2" Length, 304/18-8 Stainless Steel, Security Screw.....	2.43	
<i>For >10 To 50, Deduct</i>	-0.09	
<i>For >50 To 100, Deduct</i>	-0.20	
<i>For >100, Deduct</i>	-0.39	
05 05 23 00-1181 EA #8 Diameter x 2" Length, 304/18-8 Stainless Steel, Security Screw.....	2.48	
<i>For >10 To 50, Deduct</i>	-0.09	
<i>For >50 To 100, Deduct</i>	-0.20	
<i>For >100, Deduct</i>	-0.40	
05 05 23 00-1182 EA #10 Diameter x 1/2" Length, 304/18-8 Stainless Steel, Security Screw.....	2.21	
<i>For >10 To 50, Deduct</i>	-0.09	
<i>For >50 To 100, Deduct</i>	-0.19	
<i>For >100, Deduct</i>	-0.38	
05 05 23 00-1183 EA #10 Diameter x 1" Length, 304/18-8 Stainless Steel, Security Screw.....	2.23	
<i>For >10 To 50, Deduct</i>	-0.09	
<i>For >50 To 100, Deduct</i>	-0.19	
<i>For >100, Deduct</i>	-0.38	
05 05 23 00-1184 EA #10 Diameter x 1-1/2" Length, 304/18-8 Stainless Steel, Security Screw.....	2.31	
<i>For >10 To 50, Deduct</i>	-0.09	
<i>For >50 To 100, Deduct</i>	-0.19	
<i>For >100, Deduct</i>	-0.39	
05 05 23 00-1185 EA #10 Diameter x 2" Length, 304/18-8 Stainless Steel, Security Screw.....	2.56	
<i>For >10 To 50, Deduct</i>	-0.09	
<i>For >50 To 100, Deduct</i>	-0.20	
<i>For >100, Deduct</i>	-0.40	
05 05 23 00-1186 EA 1/4" Diameter x 1/2" Length, 304/18-8 Stainless Steel, Security Screw.....	2.35	
<i>For >10 To 50, Deduct</i>	-0.09	
<i>For >50 To 100, Deduct</i>	-0.19	
<i>For >100, Deduct</i>	-0.39	
05 05 23 00-1187 EA 1/4" Diameter x 1" Length, 304/18-8 Stainless Steel, Security Screw.....	2.41	
<i>For >10 To 50, Deduct</i>	-0.09	
<i>For >50 To 100, Deduct</i>	-0.20	
<i>For >100, Deduct</i>	-0.39	
05 05 23 00-1188 EA 1/4" Diameter x 1-1/2" Length, 304/18-8 Stainless Steel, Security Screw.....	2.65	
<i>For >10 To 50, Deduct</i>	-0.09	
<i>For >50 To 100, Deduct</i>	-0.20	
<i>For >100, Deduct</i>	-0.40	
05 05 23 00-1189 EA 1/4" Diameter x 2" Length, 304/18-8 Stainless Steel, Security Screw.....	3.03	
<i>For >10 To 50, Deduct</i>	-0.09	
<i>For >50 To 100, Deduct</i>	-0.21	
<i>For >100, Deduct</i>	-0.42	

05 05 23 00-1190

Threaded Rod (05 05 23)

Note: Fully threaded. See CSI section 05 05 19 00-0169 for anchoring adhesive, 05 05 23 00-1283 for nuts and

05 Metals**05 05 Common Work Results For Metals****05 05 23 Metal Fastenings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
			washers.		
05 05 23 00-1191			Plain Finish Steel, Low Carbon Threaded Rod <small>(05 05 23 00-1190)</small>		
05 05 23 00-1192	LF		1/4" Diameter, Plain Finish Steel, Low Carbon Threaded Rod	1.59	0.43
			<i>For Left Hand Threaded Rod, Add</i>	0.07	
05 05 23 00-1193	LF		5/16" Diameter, Plain Finish Steel, Low Carbon Threaded Rod	2.05	0.47
			<i>For Left Hand Threaded Rod, Add</i>	0.11	
05 05 23 00-1194	LF		3/8" Diameter, Plain Finish Steel, Low Carbon Threaded Rod	2.37	0.54
			<i>For Left Hand Threaded Rod, Add</i>	0.13	
05 05 23 00-1195	LF		7/16" Diameter, Plain Finish Steel, Low Carbon Threaded Rod	3.12	0.55
			<i>For Left Hand Threaded Rod, Add</i>	0.20	
05 05 23 00-1196	LF		1/2" Diameter, Plain Finish Steel, Low Carbon Threaded Rod	3.20	0.57
			<i>For Left Hand Threaded Rod, Add</i>	0.21	
05 05 23 00-1197	LF		9/16" Diameter, Plain Finish Steel, Low Carbon Threaded Rod	3.91	0.58
			<i>For Left Hand Threaded Rod, Add</i>	0.27	
05 05 23 00-1198	LF		5/8" Diameter, Plain Finish Steel, Low Carbon Threaded Rod	4.37	0.59
			<i>For Left Hand Threaded Rod, Add</i>	0.32	
05 05 23 00-1199	LF		3/4" Diameter, Plain Finish Steel, Low Carbon Threaded Rod	7.00	0.61
			<i>For Left Hand Threaded Rod, Add</i>	0.58	
05 05 23 00-1200	LF		7/8" Diameter, Plain Finish Steel, Low Carbon Threaded Rod	7.62	0.63
			<i>For Left Hand Threaded Rod, Add</i>	0.64	
05 05 23 00-1201	LF		1" Diameter, Plain Finish Steel, Low Carbon Threaded Rod	10.36	0.71
			<i>For Left Hand Threaded Rod, Add</i>	0.89	
05 05 23 00-1202	LF		1-1/8" Diameter, Plain Finish Steel, Low Carbon Threaded Rod	12.84	0.80
			<i>For Left Hand Threaded Rod, Add</i>	1.13	
05 05 23 00-1203	LF		1-1/4" Diameter, Plain Finish Steel, Low Carbon Threaded Rod	16.96	0.87
			<i>For Left Hand Threaded Rod, Add</i>	1.52	
05 05 23 00-1204	LF		1-3/8" Diameter, Plain Finish Steel, Low Carbon Threaded Rod	21.02	0.94
			<i>For Left Hand Threaded Rod, Add</i>	1.92	
05 05 23 00-1205	LF		1-1/2" Diameter, Plain Finish Steel, Low Carbon Threaded Rod	25.07	0.98
			<i>For Left Hand Threaded Rod, Add</i>	2.31	
05 05 23 00-1206	LF		1-3/4" Diameter, Plain Finish Steel, Low Carbon Threaded Rod	30.68	1.03
			<i>For Left Hand Threaded Rod, Add</i>	2.86	
05 05 23 00-1207	LF		2" Diameter, Plain Finish Steel, Low Carbon Threaded Rod	39.08	1.08
			<i>For Left Hand Threaded Rod, Add</i>	3.69	
05 05 23 00-1208			Zinc Plated Steel, Low Carbon Threaded Rod <small>(05 05 23 00-1190)</small>		
05 05 23 00-1209	LF		1/4" Diameter, Zinc Plated Steel, Low Carbon Threaded Rod	1.61	0.43
			<i>For Left Hand Threaded Rod, Add</i>	0.07	
05 05 23 00-1210	LF		5/16" Diameter, Zinc Plated Steel, Low Carbon Threaded Rod	2.29	0.47
			<i>For Left Hand Threaded Rod, Add</i>	0.13	
05 05 23 00-1211	LF		3/8" Diameter, Zinc Plated Steel, Low Carbon Threaded Rod	2.55	0.54
			<i>For Left Hand Threaded Rod, Add</i>	0.15	
05 05 23 00-1212	LF		7/16" Diameter, Zinc Plated Steel, Low Carbon Threaded Rod	3.57	0.55
			<i>For Left Hand Threaded Rod, Add</i>	0.25	
05 05 23 00-1213	LF		1/2" Diameter, Zinc Plated Steel, Low Carbon Threaded Rod	3.84	0.57
			<i>For Left Hand Threaded Rod, Add</i>	0.27	
05 05 23 00-1214	LF		9/16" Diameter, Zinc Plated Steel, Low Carbon Threaded Rod	4.95	0.58
			<i>For Left Hand Threaded Rod, Add</i>	0.38	
05 05 23 00-1215	LF		5/8" Diameter, Zinc Plated Steel, Low Carbon Threaded Rod	5.24	0.59
			<i>For Left Hand Threaded Rod, Add</i>	0.41	
05 05 23 00-1216	LF		3/4" Diameter, Zinc Plated Steel, Low Carbon Threaded Rod	7.75	0.61
			<i>For Left Hand Threaded Rod, Add</i>	0.65	
05 05 23 00-1217	LF		7/8" Diameter, Zinc Plated Steel, Low Carbon Threaded Rod	9.96	0.63
			<i>For Left Hand Threaded Rod, Add</i>	0.87	
05 05 23 00-1218	LF		1" Diameter, Zinc Plated Steel, Low Carbon Threaded Rod	13.31	0.71
			<i>For Left Hand Threaded Rod, Add</i>	1.19	
05 05 23 00-1219	LF		1-1/8" Diameter, Zinc Plated Steel, Low Carbon Threaded Rod	17.11	0.80
			<i>For Left Hand Threaded Rod, Add</i>	1.55	
05 05 23 00-1220	LF		1-1/4" Diameter, Zinc Plated Steel, Low Carbon Threaded Rod	20.40	0.87
			<i>For Left Hand Threaded Rod, Add</i>	1.86	
05 05 23 00-1221	LF		1-3/8" Diameter, Zinc Plated Steel, Low Carbon Threaded Rod	23.15	0.94
			<i>For Left Hand Threaded Rod, Add</i>	2.13	
05 05 23 00-1222	LF		1-1/2" Diameter, Zinc Plated Steel, Low Carbon Threaded Rod	29.06	0.98
			<i>For Left Hand Threaded Rod, Add</i>	2.71	
05 05 23 00-1223	LF		1-3/4" Diameter, Zinc Plated Steel, Low Carbon Threaded Rod	35.93	1.03
			<i>For Left Hand Threaded Rod, Add</i>	3.39	
05 05 23 00-1224	LF		2" Diameter, Zinc Plated Steel, Low Carbon Threaded Rod	52.23	1.08
			<i>For Left Hand Threaded Rod, Add</i>	5.01	
05 05 23 00-1225			Hot Dipped Galvanized Steel, Low Carbon Threaded Rod <small>(05 05 23 00-1190)</small>		
05 05 23 00-1226	LF		3/8" Diameter, Hot Dipped Galvanized Steel, Low Carbon Threaded Rod	4.04	0.54
			<i>For Left Hand Threaded Rod, Add</i>	0.30	
05 05 23 00-1227	LF		1/2" Diameter, Hot Dipped Galvanized Steel, Low Carbon Threaded Rod	5.58	0.57
			<i>For Left Hand Threaded Rod, Add</i>	0.44	
05 05 23 00-1228	LF		5/8" Diameter, Hot Dipped Galvanized Steel, Low Carbon Threaded Rod	7.44	0.59
			<i>For Left Hand Threaded Rod, Add</i>	0.63	
05 05 23 00-1229	LF		3/4" Diameter, Hot Dipped Galvanized Steel, Low Carbon Threaded Rod	10.12	0.61
			<i>For Left Hand Threaded Rod, Add</i>	0.89	
05 05 23 00-1230	LF		7/8" Diameter, Hot Dipped Galvanized Steel, Low Carbon Threaded Rod	13.92	0.63
			<i>For Left Hand Threaded Rod, Add</i>	1.27	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-1231 LF 1" Diameter, Hot Dipped Galvanized Steel, Low Carbon Threaded Rod..... <i>For Left Hand Threaded Rod, Add</i>	17.91 1.65	0.71
05 05 23 00-1232 LF 1-1/8" Diameter, Hot Dipped Galvanized Steel, Low Carbon Threaded Rod..... <i>For Left Hand Threaded Rod, Add</i>	23.48 2.19	0.80
05 05 23 00-1233 LF 1-1/4" Diameter, Hot Dipped Galvanized Steel, Low Carbon Threaded Rod..... <i>For Left Hand Threaded Rod, Add</i>	30.81 2.90	0.87
05 05 23 00-1234 LF 1-3/8" Diameter, Hot Dipped Galvanized Steel, Low Carbon Threaded Rod..... <i>For Left Hand Threaded Rod, Add</i>	34.41 3.25	0.94
05 05 23 00-1235 LF 1-1/2" Diameter, Hot Dipped Galvanized Steel, Low Carbon Threaded Rod..... <i>For Left Hand Threaded Rod, Add</i>	40.89 3.89	0.98
05 05 23 00-1236 LF 1-3/4" Diameter, Hot Dipped Galvanized Steel, Low Carbon Threaded Rod..... <i>For Left Hand Threaded Rod, Add</i>	49.62 4.76	1.03
05 05 23 00-1237 LF 2" Diameter, Hot Dipped Galvanized Steel, Low Carbon Threaded Rod..... <i>For Left Hand Threaded Rod, Add</i>	86.28 8.41	1.08
05 05 23 00-1238 304/18-8 Stainless Steel Threaded Rod (05 05 23 00-1190)		
05 05 23 00-1239 LF 1/4" Diameter, 304/18-8 Stainless Steel Threaded Rod <i>For Left Hand Threaded Rod, Add</i>	2.00 0.11	0.43
05 05 23 00-1240 LF 5/16" Diameter, 304/18-8 Stainless Steel Threaded Rod <i>For Left Hand Threaded Rod, Add</i>	2.89 0.19	0.47
05 05 23 00-1241 LF 3/8" Diameter, 304/18-8 Stainless Steel Threaded Rod <i>For Left Hand Threaded Rod, Add</i>	3.66 0.26	0.54
05 05 23 00-1242 LF 7/16" Diameter, 304/18-8 Stainless Steel Threaded Rod <i>For Left Hand Threaded Rod, Add</i>	4.95 0.38	0.55
05 05 23 00-1243 LF 1/2" Diameter, 304/18-8 Stainless Steel Threaded Rod <i>For Left Hand Threaded Rod, Add</i>	5.89 0.47	0.57
05 05 23 00-1244 LF 9/16" Diameter, 304/18-8 Stainless Steel Threaded Rod <i>For Left Hand Threaded Rod, Add</i>	8.30 0.71	0.58
05 05 23 00-1245 LF 5/8" Diameter, 304/18-8 Stainless Steel Threaded Rod <i>For Left Hand Threaded Rod, Add</i>	8.65 0.75	0.59
05 05 23 00-1246 LF 3/4" Diameter, 304/18-8 Stainless Steel Threaded Rod <i>For Left Hand Threaded Rod, Add</i>	11.96 1.07	0.61
05 05 23 00-1247 LF 7/8" Diameter, 304/18-8 Stainless Steel Threaded Rod <i>For Left Hand Threaded Rod, Add</i>	16.32 1.51	0.63
05 05 23 00-1248 LF 1" Diameter, 304/18-8 Stainless Steel Threaded Rod <i>For Left Hand Threaded Rod, Add</i>	20.87 1.94	0.71
05 05 23 00-1249 LF 1-1/4" Diameter, 304/18-8 Stainless Steel Threaded Rod..... <i>For Left Hand Threaded Rod, Add</i>	43.74 4.20	0.87
05 05 23 00-1250 LF 1-1/2" Diameter, 304/18-8 Stainless Steel Threaded Rod..... <i>For Left Hand Threaded Rod, Add</i>	66.34 6.44	0.98
05 05 23 00-1251 LF 1-3/4" Diameter, 304/18-8 Stainless Steel Threaded Rod..... <i>For Left Hand Threaded Rod, Add</i>	68.26 6.62	1.03
05 05 23 00-1252 LF 2" Diameter, 304/18-8 Stainless Steel Threaded Rod <i>For Left Hand Threaded Rod, Add</i>	94.21 9.21	1.08
05 05 23 00-1253 316 Stainless Steel Threaded Rod (05 05 23 00-1190)		
05 05 23 00-1254 LF 1/4" Diameter, 316 Stainless Steel Threaded Rod <i>For Left Hand Threaded Rod, Add</i>	2.77 0.19	0.43
05 05 23 00-1255 LF 5/16" Diameter, 316 Stainless Steel Threaded Rod <i>For Left Hand Threaded Rod, Add</i>	4.30 0.34	0.47
05 05 23 00-1256 LF 3/8" Diameter, 316 Stainless Steel Threaded Rod <i>For Left Hand Threaded Rod, Add</i>	5.64 0.46	0.54
05 05 23 00-1257 LF 7/16" Diameter, 316 Stainless Steel Threaded Rod <i>For Left Hand Threaded Rod, Add</i>	8.61 0.75	0.55
05 05 23 00-1258 LF 1/2" Diameter, 316 Stainless Steel Threaded Rod <i>For Left Hand Threaded Rod, Add</i>	9.13 0.80	0.57
05 05 23 00-1259 LF 9/16" Diameter, 316 Stainless Steel Threaded Rod <i>For Left Hand Threaded Rod, Add</i>	11.86 1.07	0.58
05 05 23 00-1260 LF 5/8" Diameter, 316 Stainless Steel Threaded Rod <i>For Left Hand Threaded Rod, Add</i>	12.74 1.16	0.59
05 05 23 00-1261 LF 3/4" Diameter, 316 Stainless Steel Threaded Rod <i>For Left Hand Threaded Rod, Add</i>	18.39 1.72	0.61
05 05 23 00-1262 LF 7/8" Diameter, 316 Stainless Steel Threaded Rod <i>For Left Hand Threaded Rod, Add</i>	25.05 2.38	0.63
05 05 23 00-1263 LF 1" Diameter, 316 Stainless Steel Threaded Rod <i>For Left Hand Threaded Rod, Add</i>	31.64 3.02	0.71
05 05 23 00-1264 LF 1-1/4" Diameter, 316 Stainless Steel Threaded Rod <i>For Left Hand Threaded Rod, Add</i>	66.37 6.46	0.87
05 05 23 00-1265 LF 1-1/2" Diameter, 316 Stainless Steel Threaded Rod <i>For Left Hand Threaded Rod, Add</i>	86.86 8.49	0.98
05 05 23 00-1266 Plain Finish Steel, B-7 Alloy Threaded Rod (05 05 23 00-1190)		
05 05 23 00-1267 LF 1/4" Diameter, Plain Finish Steel, B-7 Alloy Threaded Rod <i>For Zinc Plating, Add</i>	2.62 0.88	0.43
05 05 23 00-1268 LF 5/16" Diameter, Plain Finish Steel, B-7 Alloy Threaded Rod..... <i>For Zinc Plating, Add</i>	3.94 1.50	0.47
05 05 23 00-1269 LF 3/8" Diameter, Plain Finish Steel, B-7 Alloy Threaded Rod <i>For Zinc Plating, Add</i>	4.15 1.54	0.54
05 05 23 00-1270 LF 7/16" Diameter, Plain Finish Steel, B-7 Alloy Threaded Rod <i>For Zinc Plating, Add</i>	4.51 1.70	0.55

05 Metals**05 05 Common Work Results For Metals****05 05 23 Metal Fastenings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-1271	LF		1/2" Diameter, Plain Finish Steel, B-7 Alloy Threaded Rod	4.96	0.57
			<i>For Zinc Plating, Add</i>	1.91	
05 05 23 00-1272	LF		9/16" Diameter, Plain Finish Steel, B-7 Alloy Threaded Rod	6.13	0.58
			<i>For Zinc Plating, Add</i>	2.48	
05 05 23 00-1273	LF		5/8" Diameter, Plain Finish Steel, B-7 Alloy Threaded Rod	6.33	0.59
			<i>For Zinc Plating, Add</i>	2.57	
05 05 23 00-1274	LF		3/4" Diameter, Plain Finish Steel, B-7 Alloy Threaded Rod	8.32	0.61
			<i>For Zinc Plating, Add</i>	3.55	
05 05 23 00-1275	LF		7/8" Diameter, Plain Finish Steel, B-7 Alloy Threaded Rod	9.94	0.63
			<i>For Zinc Plating, Add</i>	4.34	
05 05 23 00-1276	LF		1" Diameter, Plain Finish Steel, B-7 Alloy Threaded Rod	12.85	0.71
			<i>For Zinc Plating, Add</i>	5.71	
05 05 23 00-1277	LF		1-1/8" Diameter, Plain Finish Steel, B-7 Alloy Threaded Rod	16.66	0.80
			<i>For Zinc Plating, Add</i>	7.54	
05 05 23 00-1278	LF		1-1/4" Diameter, Plain Finish Steel, B-7 Alloy Threaded Rod	18.55	0.87
			<i>For Zinc Plating, Add</i>	8.38	
05 05 23 00-1279	LF		1-3/8" Diameter, Plain Finish Steel, B-7 Alloy Threaded Rod	21.37	0.94
			<i>For Zinc Plating, Add</i>	9.75	
05 05 23 00-1280	LF		1-1/2" Diameter, Plain Finish Steel, B-7 Alloy Threaded Rod	25.91	0.98
			<i>For Zinc Plating, Add</i>	11.98	
05 05 23 00-1281	LF		1-3/4" Diameter, Plain Finish Steel, B-7 Alloy Threaded Rod	26.80	1.03
			<i>For Zinc Plating, Add</i>	12.38	
05 05 23 00-1282	LF		2" Diameter, Plain Finish Steel, B-7 Alloy Threaded Rod	35.85	1.08
			<i>For Zinc Plating, Add</i>	16.85	

05 05 23 00-1283 Nuts And Washers (05 05 23)**05 05 23 00-1284 Hex Nuts (05 05 23 00-1283)****05 05 23 00-1285 Zinc Plated Steel, Low Carbon/Grade 2 Hex Nuts (05 05 23 00-1284)**

05 05 23 00-1286	EA		1/4" Diameter, Zinc Plated Steel, Low Carbon/Grade 2 Hex Nut	0.40	0.18
05 05 23 00-1287	EA		5/16" Diameter, Zinc Plated Steel, Low Carbon/Grade 2 Hex Nut	0.44	0.18
05 05 23 00-1288	EA		3/8" Diameter, Zinc Plated Steel, Low Carbon/Grade 2 Hex Nut	0.47	0.18
05 05 23 00-1289	EA		7/16" Diameter, Zinc Plated Steel, Low Carbon/Grade 2 Hex Nut	0.54	0.18
05 05 23 00-1290	EA		1/2" Diameter, Zinc Plated Steel, Low Carbon/Grade 2 Hex Nut	0.59	0.18
05 05 23 00-1291	EA		9/16" Diameter, Zinc Plated Steel, Low Carbon/Grade 2 Hex Nut	0.77	0.18
05 05 23 00-1292	EA		5/8" Diameter, Zinc Plated Steel, Low Carbon/Grade 2 Hex Nut	0.80	0.18
05 05 23 00-1293	EA		3/4" Diameter, Zinc Plated Steel, Low Carbon/Grade 2 Hex Nut	0.94	0.36
05 05 23 00-1294	EA		7/8" Diameter, Zinc Plated Steel, Low Carbon/Grade 2 Hex Nut	1.34	0.36
05 05 23 00-1295	EA		1" Diameter, Zinc Plated Steel, Low Carbon/Grade 2 Hex Nut	1.71	0.36
05 05 23 00-1296	EA		1-1/8" Diameter, Zinc Plated Steel, Low Carbon/Grade 2 Hex Nut	2.78	0.36
05 05 23 00-1297	EA		1-1/4" Diameter, Zinc Plated Steel, Low Carbon/Grade 2 Hex Nut	3.40	0.36
05 05 23 00-1298	EA		1-3/8" Diameter, Zinc Plated Steel, Low Carbon/Grade 2 Hex Nut	4.98	0.36
05 05 23 00-1299	EA		1-1/2" Diameter, Zinc Plated Steel, Low Carbon/Grade 2 Hex Nut	5.76	0.54
05 05 23 00-1300	EA		1-3/4" Diameter, Zinc Plated Steel, Low Carbon/Grade 2 Hex Nut	8.42	0.54
05 05 23 00-1301	EA		2" Diameter, Zinc Plated Steel, Low Carbon/Grade 2 Hex Nut	12.14	0.54

05 05 23 00-1302 Zinc Plated Steel, Grade 5 Hex Nuts (05 05 23 00-1284)

05 05 23 00-1303	EA		1/4" Diameter, Zinc Plated Steel, Grade 5 Hex Nut	0.41	0.18
05 05 23 00-1304	EA		5/16" Diameter, Zinc Plated Steel, Grade 5 Hex Nut	0.45	0.18
05 05 23 00-1305	EA		3/8" Diameter, Zinc Plated Steel, Grade 5 Hex Nut	0.49	0.18
05 05 23 00-1306	EA		7/16" Diameter, Zinc Plated Steel, Grade 5 Hex Nut	0.56	0.18
05 05 23 00-1307	EA		1/2" Diameter, Zinc Plated Steel, Grade 5 Hex Nut	0.66	0.18
05 05 23 00-1308	EA		9/16" Diameter, Zinc Plated Steel, Grade 5 Hex Nut	0.79	0.18
05 05 23 00-1309	EA		5/8" Diameter, Zinc Plated Steel, Grade 5 Hex Nut	0.81	0.18
05 05 23 00-1310	EA		3/4" Diameter, Zinc Plated Steel, Grade 5 Hex Nut	1.06	0.36
05 05 23 00-1311	EA		7/8" Diameter, Zinc Plated Steel, Grade 5 Hex Nut	1.46	0.36
05 05 23 00-1312	EA		1" Diameter, Zinc Plated Steel, Grade 5 Hex Nut	2.06	0.36
05 05 23 00-1313	EA		1-1/8" Diameter, Zinc Plated Steel, Grade 5 Hex Nut	3.13	0.36
05 05 23 00-1314	EA		1-1/4" Diameter, Zinc Plated Steel, Grade 5 Hex Nut	4.42	0.36
05 05 23 00-1315	EA		1-3/8" Diameter, Zinc Plated Steel, Grade 5 Hex Nut	6.47	0.36
05 05 23 00-1316	EA		1-1/2" Diameter, Zinc Plated Steel, Grade 5 Hex Nut	7.14	0.54
05 05 23 00-1317	EA		1-3/4" Diameter, Zinc Plated Steel, Grade 5 Hex Nut	12.82	0.54
05 05 23 00-1318	EA		2" Diameter, Zinc Plated Steel, Grade 5 Hex Nut	18.35	0.54

05 05 23 00-1319 Zinc Plated Steel, Grade 8 Hex Nuts (05 05 23 00-1284)

05 05 23 00-1320	EA		1/4" Diameter, Zinc Plated Steel, Grade 8 Hex Nut	0.42	0.18
05 05 23 00-1321	EA		5/16" Diameter, Zinc Plated Steel, Grade 8 Hex Nut	0.48	0.18
05 05 23 00-1322	EA		3/8" Diameter, Zinc Plated Steel, Grade 8 Hex Nut	0.52	0.18
05 05 23 00-1323	EA		7/16" Diameter, Zinc Plated Steel, Grade 8 Hex Nut	0.63	0.18
05 05 23 00-1324	EA		1/2" Diameter, Zinc Plated Steel, Grade 8 Hex Nut	0.76	0.18
05 05 23 00-1325	EA		9/16" Diameter, Zinc Plated Steel, Grade 8 Hex Nut	0.91	0.18
05 05 23 00-1326	EA		5/8" Diameter, Zinc Plated Steel, Grade 8 Hex Nut	1.03	0.18
05 05 23 00-1327	EA		3/4" Diameter, Zinc Plated Steel, Grade 8 Hex Nut	1.27	0.36
05 05 23 00-1328	EA		7/8" Diameter, Zinc Plated Steel, Grade 8 Hex Nut	1.88	0.36
05 05 23 00-1329	EA		1" Diameter, Zinc Plated Steel, Grade 8 Hex Nut	2.49	0.36
05 05 23 00-1330	EA		1-1/8" Diameter, Zinc Plated Steel, Grade 8 Hex Nut	3.89	0.36
05 05 23 00-1331	EA		1-1/4" Diameter, Zinc Plated Steel, Grade 8 Hex Nut	4.86	0.36
05 05 23 00-1332	EA		1-3/8" Diameter, Zinc Plated Steel, Grade 8 Hex Nut	7.97	0.36



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-1333 EA 1-1/2" Diameter, Zinc Plated Steel, Grade 8 Hex Nut	8.46	0.54
05 05 23 00-1334 EA 1-3/4" Diameter, Zinc Plated Steel, Grade 8 Hex Nut	12.86	0.54
05 05 23 00-1335 EA 2" Diameter, Zinc Plated Steel, Grade 8 Hex Nut	18.15	0.54
05 05 23 00-1336 Hot Dipped Galvanized Steel, Low Carbon/Grade 2 Hex Nuts <small>(05 05 23 00-1284)</small>		
05 05 23 00-1337 EA 1/4" Diameter, Hot Dipped Galvanized Steel, Low Carbon/Grade 2 Hex Nut	0.42	0.18
05 05 23 00-1338 EA 5/16" Diameter, Hot Dipped Galvanized Steel, Low Carbon/Grade 2 Hex Nut	0.47	0.18
05 05 23 00-1339 EA 3/8" Diameter, Hot Dipped Galvanized Steel, Low Carbon/Grade 2 Hex Nut	0.51	0.18
05 05 23 00-1340 EA 7/16" Diameter, Hot Dipped Galvanized Steel, Low Carbon/Grade 2 Hex Nut	0.62	0.18
05 05 23 00-1341 EA 1/2" Diameter, Hot Dipped Galvanized Steel, Low Carbon/Grade 2 Hex Nut	0.72	0.18
05 05 23 00-1342 EA 9/16" Diameter, Hot Dipped Galvanized Steel, Low Carbon/Grade 2 Hex Nut	0.80	0.18
05 05 23 00-1343 EA 5/8" Diameter, Hot Dipped Galvanized Steel, Low Carbon/Grade 2 Hex Nut	0.88	0.18
05 05 23 00-1344 EA 3/4" Diameter, Hot Dipped Galvanized Steel, Low Carbon/Grade 2 Hex Nut	1.16	0.36
05 05 23 00-1345 EA 7/8" Diameter, Hot Dipped Galvanized Steel, Low Carbon/Grade 2 Hex Nut	1.66	0.36
05 05 23 00-1346 EA 1" Diameter, Hot Dipped Galvanized Steel, Low Carbon/Grade 2 Hex Nut	2.29	0.36
05 05 23 00-1347 EA 1-1/8" Diameter, Hot Dipped Galvanized Steel, Low Carbon/Grade 2 Hex Nut	3.76	0.36
05 05 23 00-1348 EA 1-1/4" Diameter, Hot Dipped Galvanized Steel, Low Carbon/Grade 2 Hex Nut	4.83	0.36
05 05 23 00-1349 EA 1-3/8" Diameter, Hot Dipped Galvanized Steel, Low Carbon/Grade 2 Hex Nut	7.15	0.36
05 05 23 00-1350 EA 1-1/2" Diameter, Hot Dipped Galvanized Steel, Low Carbon/Grade 2 Hex Nut	8.33	0.54
05 05 23 00-1351 EA 1-3/4" Diameter, Hot Dipped Galvanized Steel, Low Carbon/Grade 2 Hex Nut	14.47	0.54
05 05 23 00-1352 EA 2" Diameter, Hot Dipped Galvanized Steel, Low Carbon/Grade 2 Hex Nut	24.98	0.54
05 05 23 00-1353 304 Stainless Steel Hex Nuts <small>(05 05 23 00-1284)</small>		
05 05 23 00-1354 EA 1/4" Diameter, 304 Stainless Steel Hex Nut	0.45	0.18
05 05 23 00-1355 EA 5/16" Diameter, 304 Stainless Steel Hex Nut	0.53	0.18
05 05 23 00-1356 EA 3/8" Diameter, 304 Stainless Steel Hex Nut	0.59	0.18
05 05 23 00-1357 EA 7/16" Diameter, 304 Stainless Steel Hex Nut	0.83	0.18
05 05 23 00-1358 EA 1/2" Diameter, 304 Stainless Steel Hex Nut	0.91	0.18
05 05 23 00-1359 EA 9/16" Diameter, 304 Stainless Steel Hex Nut	1.34	0.18
05 05 23 00-1360 EA 5/8" Diameter, 304 Stainless Steel Hex Nut	1.48	0.18
05 05 23 00-1361 EA 3/4" Diameter, 304 Stainless Steel Hex Nut	1.70	0.36
05 05 23 00-1362 EA 7/8" Diameter, 304 Stainless Steel Hex Nut	2.72	0.36
05 05 23 00-1363 EA 1" Diameter, 304 Stainless Steel Hex Nut	4.14	0.36
05 05 23 00-1364 EA 1-1/4" Diameter, 304 Stainless Steel Hex Nut	9.84	0.36
05 05 23 00-1365 EA 1-1/2" Diameter, 304 Stainless Steel Hex Nut	18.80	0.54
05 05 23 00-1366 EA 1-3/4" Diameter, 304 Stainless Steel Hex Nut	32.95	0.54
05 05 23 00-1367 EA 2" Diameter, 304 Stainless Steel Hex Nut	46.90	0.54
05 05 23 00-1368 316 Stainless Steel Hex Nuts <small>(05 05 23 00-1284)</small>		
05 05 23 00-1369 EA 1/4" Diameter, 316 Stainless Steel Hex Nut	0.52	0.18
05 05 23 00-1370 EA 5/16" Diameter, 316 Stainless Steel Hex Nut	0.58	0.18
05 05 23 00-1371 EA 3/8" Diameter, 316 Stainless Steel Hex Nut	0.69	0.18
05 05 23 00-1372 EA 7/16" Diameter, 316 Stainless Steel Hex Nut	1.07	0.18
05 05 23 00-1373 EA 1/2" Diameter, 316 Stainless Steel Hex Nut	1.16	0.18
05 05 23 00-1374 EA 9/16" Diameter, 316 Stainless Steel Hex Nut	1.55	0.18
05 05 23 00-1375 EA 5/8" Diameter, 316 Stainless Steel Hex Nut	1.74	0.18
05 05 23 00-1376 EA 3/4" Diameter, 316 Stainless Steel Hex Nut	2.40	0.36
05 05 23 00-1377 EA 7/8" Diameter, 316 Stainless Steel Hex Nut	3.29	0.36
05 05 23 00-1378 EA 1" Diameter, 316 Stainless Steel Hex Nut	5.05	0.36
05 05 23 00-1379 EA 1-1/4" Diameter, 316 Stainless Steel Hex Nut	15.19	0.36
05 05 23 00-1380 EA 1-1/2" Diameter, 316 Stainless Steel Hex Nut	24.50	0.54
05 05 23 00-1381 EA 1-3/4" Diameter, 316 Stainless Steel Hex Nut	41.26	0.54
05 05 23 00-1382 EA 2" Diameter, 316 Stainless Steel Hex Nut	76.57	0.54
05 05 23 00-1383 Flat Washers <small>(05 05 23 00-1283)</small>		
05 05 23 00-1384 Zinc Plated Steel, Low Carbon Flat Washers <small>(05 05 23 00-1383)</small>		
05 05 23 00-1385 EA 1/4" Inside Diameter, Zinc Plated Steel, Low Carbon Flat Washer	0.03	
05 05 23 00-1386 EA 5/16" Inside Diameter, Zinc Plated Steel, Low Carbon Flat Washer	0.04	
05 05 23 00-1387 EA 3/8" Inside Diameter, Zinc Plated Steel, Low Carbon Flat Washer	0.08	
05 05 23 00-1388 EA 7/16" Inside Diameter, Zinc Plated Steel, Low Carbon Flat Washer	0.12	
05 05 23 00-1389 EA 1/2" Inside Diameter, Zinc Plated Steel, Low Carbon Flat Washer	0.17	
05 05 23 00-1390 EA 9/16" Inside Diameter, Zinc Plated Steel, Low Carbon Flat Washer	0.19	
05 05 23 00-1391 EA 5/8" Inside Diameter, Zinc Plated Steel, Low Carbon Flat Washer	0.33	
05 05 23 00-1392 EA 3/4" Inside Diameter, Zinc Plated Steel, Low Carbon Flat Washer	0.47	
05 05 23 00-1393 EA 7/8" Inside Diameter, Zinc Plated Steel, Low Carbon Flat Washer	0.56	
05 05 23 00-1394 EA 1" Inside Diameter, Zinc Plated Steel, Low Carbon Flat Washer	0.68	
05 05 23 00-1395 EA 1-1/8" Inside Diameter, Zinc Plated Steel, Low Carbon Flat Washer	0.77	
05 05 23 00-1396 EA 1-1/4" Inside Diameter, Zinc Plated Steel, Low Carbon Flat Washer	0.92	
05 05 23 00-1397 EA 1-3/8" Inside Diameter, Zinc Plated Steel, Low Carbon Flat Washer	1.45	
05 05 23 00-1398 EA 1-1/2" Inside Diameter, Zinc Plated Steel, Low Carbon Flat Washer	1.48	
05 05 23 00-1399 EA 1-3/4" Inside Diameter, Zinc Plated Steel, Low Carbon Flat Washer	2.20	
05 05 23 00-1400 EA 2" Inside Diameter, Zinc Plated Steel, Low Carbon Flat Washer	2.73	
05 05 23 00-1401 Zinc Plated Steel, Hardened Flat Washers <small>(05 05 23 00-1383)</small>		

05 Metals**05 05 Common Work Results For Metals****05 05 23 Metal Fastenings**

MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

05 05 23 00-1402	EA	1/4" Inside Diameter, Zinc Plated Steel, Hardened Flat Washer.....	0.10	
05 05 23 00-1403	EA	5/16" Inside Diameter, Zinc Plated Steel, Hardened Flat Washer.....	0.14	
05 05 23 00-1404	EA	3/8" Inside Diameter, Zinc Plated Steel, Hardened Flat Washer.....	0.16	
05 05 23 00-1405	EA	7/16" Inside Diameter, Zinc Plated Steel, Hardened Flat Washer.....	0.21	
05 05 23 00-1406	EA	1/2" Inside Diameter, Zinc Plated Steel, Hardened Flat Washer.....	0.29	
05 05 23 00-1407	EA	9/16" Inside Diameter, Zinc Plated Steel, Hardened Flat Washer.....	0.47	
05 05 23 00-1408	EA	5/8" Inside Diameter, Zinc Plated Steel, Hardened Flat Washer.....	0.67	
05 05 23 00-1409	EA	3/4" Inside Diameter, Zinc Plated Steel, Hardened Flat Washer.....	0.94	
05 05 23 00-1410	EA	7/8" Inside Diameter, Zinc Plated Steel, Hardened Flat Washer.....	1.58	
05 05 23 00-1411	EA	1" Inside Diameter, Zinc Plated Steel, Hardened Flat Washer.....	1.75	
05 05 23 00-1412	EA	1-1/8" Inside Diameter, Zinc Plated Steel, Hardened Flat Washer.....	2.54	
05 05 23 00-1413	EA	1-1/4" Inside Diameter, Zinc Plated Steel, Hardened Flat Washer.....	2.78	
05 05 23 00-1414	EA	1-3/8" Inside Diameter, Zinc Plated Steel, Hardened Flat Washer.....	3.66	
05 05 23 00-1415	EA	1-1/2" Inside Diameter, Zinc Plated Steel, Hardened Flat Washer.....	4.18	
05 05 23 00-1416	EA	1-3/4" Inside Diameter, Zinc Plated Steel, Hardened Flat Washer.....	5.62	
05 05 23 00-1417	EA	2" Inside Diameter, Zinc Plated Steel, Hardened Flat Washer.....	6.75	

05 05 23 00-1418 Hot Dipped Galvanized Steel Flat Washers (05 05 23 00-1383)

05 05 23 00-1419	EA	1/4" Inside Diameter, Hot Dipped Galvanized Steel Flat Washer.....	0.07	
05 05 23 00-1420	EA	5/16" Inside Diameter, Hot Dipped Galvanized Steel Flat Washer.....	0.09	
05 05 23 00-1421	EA	3/8" Inside Diameter, Hot Dipped Galvanized Steel Flat Washer.....	0.11	
05 05 23 00-1422	EA	7/16" Inside Diameter, Hot Dipped Galvanized Steel Flat Washer.....	0.20	
05 05 23 00-1423	EA	1/2" Inside Diameter, Hot Dipped Galvanized Steel Flat Washer.....	0.25	
05 05 23 00-1424	EA	9/16" Inside Diameter, Hot Dipped Galvanized Steel Flat Washer.....	0.41	
05 05 23 00-1425	EA	5/8" Inside Diameter, Hot Dipped Galvanized Steel Flat Washer.....	0.46	
05 05 23 00-1426	EA	3/4" Inside Diameter, Hot Dipped Galvanized Steel Flat Washer.....	0.70	
05 05 23 00-1427	EA	7/8" Inside Diameter, Hot Dipped Galvanized Steel Flat Washer.....	0.98	
05 05 23 00-1428	EA	1" Inside Diameter, Hot Dipped Galvanized Steel Flat Washer.....	1.08	
05 05 23 00-1429	EA	1-1/8" Inside Diameter, Hot Dipped Galvanized Steel Flat Washer.....	1.65	
05 05 23 00-1430	EA	1-1/4" Inside Diameter, Hot Dipped Galvanized Steel Flat Washer.....	1.84	
05 05 23 00-1431	EA	1-3/8" Inside Diameter, Hot Dipped Galvanized Steel Flat Washer.....	2.62	
05 05 23 00-1432	EA	1-1/2" Inside Diameter, Hot Dipped Galvanized Steel Flat Washer.....	2.84	
05 05 23 00-1433	EA	1-3/4" Inside Diameter, Hot Dipped Galvanized Steel Flat Washer.....	4.12	

05 05 23 00-1434 304/18-8 Stainless Steel Flat Washers (05 05 23 00-1383)

05 05 23 00-1435	EA	1/4" Inside Diameter, 304/18-8 Stainless Steel Flat Washer.....	0.07	
05 05 23 00-1436	EA	5/16" Inside Diameter, 304/18-8 Stainless Steel Flat Washer.....	0.09	
05 05 23 00-1437	EA	3/8" Inside Diameter, 304/18-8 Stainless Steel Flat Washer.....	0.13	
05 05 23 00-1438	EA	7/16" Inside Diameter, 304/18-8 Stainless Steel Flat Washer.....	0.25	
05 05 23 00-1439	EA	1/2" Inside Diameter, 304/18-8 Stainless Steel Flat Washer.....	0.45	
05 05 23 00-1440	EA	9/16" Inside Diameter, 304/18-8 Stainless Steel Flat Washer.....	0.56	
05 05 23 00-1441	EA	5/8" Inside Diameter, 304/18-8 Stainless Steel Flat Washer.....	0.82	
05 05 23 00-1442	EA	3/4" Inside Diameter, 304/18-8 Stainless Steel Flat Washer.....	0.84	
05 05 23 00-1443	EA	7/8" Inside Diameter, 304/18-8 Stainless Steel Flat Washer.....	1.77	
05 05 23 00-1444	EA	1" Inside Diameter, 304/18-8 Stainless Steel Flat Washer.....	2.24	
05 05 23 00-1445	EA	1-1/8" Inside Diameter, 304/18-8 Stainless Steel Flat Washer.....	2.61	
05 05 23 00-1446	EA	1-1/4" Inside Diameter, 304/18-8 Stainless Steel Flat Washer.....	2.81	
05 05 23 00-1447	EA	1-3/8" Inside Diameter, 304/18-8 Stainless Steel Flat Washer.....	2.97	
05 05 23 00-1448	EA	1-1/2" Inside Diameter, 304/18-8 Stainless Steel Flat Washer.....	3.62	
05 05 23 00-1449	EA	1-3/4" Inside Diameter, 304/18-8 Stainless Steel Flat Washer.....	4.50	
05 05 23 00-1450	EA	2" Inside Diameter, 304/18-8 Stainless Steel Flat Washer.....	8.84	

05 05 23 00-1451 316 Stainless Steel Flat Washers (05 05 23 00-1383)

05 05 23 00-1452	EA	1/4" Inside Diameter, 316 Stainless Steel Flat Washer.....	0.14	
05 05 23 00-1453	EA	5/16" Inside Diameter, 316 Stainless Steel Flat Washer.....	0.15	
05 05 23 00-1454	EA	3/8" Inside Diameter, 316 Stainless Steel Flat Washer.....	0.27	
05 05 23 00-1455	EA	7/16" Inside Diameter, 316 Stainless Steel Flat Washer.....	0.32	
05 05 23 00-1456	EA	1/2" Inside Diameter, 316 Stainless Steel Flat Washer.....	0.58	
05 05 23 00-1457	EA	9/16" Inside Diameter, 316 Stainless Steel Flat Washer.....	1.05	
05 05 23 00-1458	EA	5/8" Inside Diameter, 316 Stainless Steel Flat Washer.....	1.24	
05 05 23 00-1459	EA	3/4" Inside Diameter, 316 Stainless Steel Flat Washer.....	1.56	
05 05 23 00-1460	EA	7/8" Inside Diameter, 316 Stainless Steel Flat Washer.....	2.42	
05 05 23 00-1461	EA	1" Inside Diameter, 316 Stainless Steel Flat Washer.....	2.70	
05 05 23 00-1462	EA	1-1/8" Inside Diameter, 316 Stainless Steel Flat Washer.....	3.08	
05 05 23 00-1463	EA	1-1/4" Inside Diameter, 316 Stainless Steel Flat Washer.....	3.79	
05 05 23 00-1464	EA	1-3/8" Inside Diameter, 316 Stainless Steel Flat Washer.....	4.00	
05 05 23 00-1465	EA	1-1/2" Inside Diameter, 316 Stainless Steel Flat Washer.....	4.10	
05 05 23 00-1466	EA	1-3/4" Inside Diameter, 316 Stainless Steel Flat Washer.....	6.00	

05 05 23 00-1467 Lock Washers (05 05 23 00-1283)**05 05 23 00-1468 Zinc Plated Steel, Low Carbon Lock Washers (05 05 23 00-1467)**

05 05 23 00-1469	EA	1/4" Inside Diameter, Zinc Plated Steel, Low Carbon Lock Washer.....	0.01	
05 05 23 00-1470	EA	5/16" Inside Diameter, Zinc Plated Steel, Low Carbon Lock Washer.....	0.02	
05 05 23 00-1471	EA	3/8" Inside Diameter, Zinc Plated Steel, Low Carbon Lock Washer.....	0.03	
05 05 23 00-1472	EA	7/16" Inside Diameter, Zinc Plated Steel, Low Carbon Lock Washer.....	0.05	
05 05 23 00-1473	EA	1/2" Inside Diameter, Zinc Plated Steel, Low Carbon Lock Washer.....	0.07	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-1474 EA 9/16" Inside Diameter, Zinc Plated Steel, Low Carbon Lock Washer	0.11	
05 05 23 00-1475 EA 5/8" Inside Diameter, Zinc Plated Steel, Low Carbon Lock Washer	0.12	
05 05 23 00-1476 EA 3/4" Inside Diameter, Zinc Plated Steel, Low Carbon Lock Washer	0.19	
05 05 23 00-1477 EA 7/8" Inside Diameter, Zinc Plated Steel, Low Carbon Lock Washer	0.31	
05 05 23 00-1478 EA 1" Inside Diameter, Zinc Plated Steel, Low Carbon Lock Washer	0.56	
05 05 23 00-1479 EA 1-1/8" Inside Diameter, Zinc Plated Steel, Low Carbon Lock Washer	0.82	
05 05 23 00-1480 EA 1-1/4" Inside Diameter, Zinc Plated Steel, Low Carbon Lock Washer	1.25	
05 05 23 00-1481 EA 1-3/8" Inside Diameter, Zinc Plated Steel, Low Carbon Lock Washer	1.98	
05 05 23 00-1482 EA 1-1/2" Inside Diameter, Zinc Plated Steel, Low Carbon Lock Washer	2.33	
05 05 23 00-1483 EA 1-3/4" Inside Diameter, Zinc Plated Steel, Low Carbon Lock Washer	4.16	
05 05 23 00-1484 EA 2" Inside Diameter, Zinc Plated Steel, Low Carbon Lock Washer	4.69	
05 05 23 00-1485 Hot Dipped Galvanized Steel Lock Washers <small>(05 05 23 00-1467)</small>		
05 05 23 00-1486 EA 1/4" Inside Diameter, Hot Dipped Galvanized Steel Lock Washer	0.05	
05 05 23 00-1487 EA 5/16" Inside Diameter, Hot Dipped Galvanized Steel Lock Washer	0.06	
05 05 23 00-1488 EA 3/8" Inside Diameter, Hot Dipped Galvanized Steel Lock Washer	0.08	
05 05 23 00-1489 EA 7/16" Inside Diameter, Hot Dipped Galvanized Steel Lock Washer	0.09	
05 05 23 00-1490 EA 1/2" Inside Diameter, Hot Dipped Galvanized Steel Lock Washer	0.14	
05 05 23 00-1491 EA 9/16" Inside Diameter, Hot Dipped Galvanized Steel Lock Washer	0.18	
05 05 23 00-1492 EA 5/8" Inside Diameter, Hot Dipped Galvanized Steel Lock Washer	0.21	
05 05 23 00-1493 EA 3/4" Inside Diameter, Hot Dipped Galvanized Steel Lock Washer	0.36	
05 05 23 00-1494 EA 7/8" Inside Diameter, Hot Dipped Galvanized Steel Lock Washer	0.52	
05 05 23 00-1495 EA 1" Inside Diameter, Hot Dipped Galvanized Steel Lock Washer	0.82	
05 05 23 00-1496 EA 1-1/8" Inside Diameter, Hot Dipped Galvanized Steel Lock Washer	1.48	
05 05 23 00-1497 EA 1-1/4" Inside Diameter, Hot Dipped Galvanized Steel Lock Washer	1.76	
05 05 23 00-1498 EA 1-3/8" Inside Diameter, Hot Dipped Galvanized Steel Lock Washer	2.54	
05 05 23 00-1499 EA 1-1/2" Inside Diameter, Hot Dipped Galvanized Steel Lock Washer	2.91	
05 05 23 00-1500 EA 1-3/4" Inside Diameter, Hot Dipped Galvanized Steel Lock Washer	3.94	
05 05 23 00-1501 EA 2" Inside Diameter, Hot Dipped Galvanized Steel Lock Washer	5.36	
05 05 23 00-1502 304/18-8 Stainless Steel Lock Washers <small>(05 05 23 00-1467)</small>		
05 05 23 00-1503 EA 1/4" Inside Diameter, 304/18-8 Stainless Steel Lock Washer	0.06	
05 05 23 00-1504 EA 5/16" Inside Diameter, 304/18-8 Stainless Steel Lock Washer	0.08	
05 05 23 00-1505 EA 3/8" Inside Diameter, 304/18-8 Stainless Steel Lock Washer	0.12	
05 05 23 00-1506 EA 7/16" Inside Diameter, 304/18-8 Stainless Steel Lock Washer	0.22	
05 05 23 00-1507 EA 1/2" Inside Diameter, 304/18-8 Stainless Steel Lock Washer	0.24	
05 05 23 00-1508 EA 9/16" Inside Diameter, 304/18-8 Stainless Steel Lock Washer	0.58	
05 05 23 00-1509 EA 5/8" Inside Diameter, 304/18-8 Stainless Steel Lock Washer	0.68	
05 05 23 00-1510 EA 3/4" Inside Diameter, 304/18-8 Stainless Steel Lock Washer	0.80	
05 05 23 00-1511 EA 7/8" Inside Diameter, 304/18-8 Stainless Steel Lock Washer	1.44	
05 05 23 00-1512 EA 1" Inside Diameter, 304/18-8 Stainless Steel Lock Washer	2.03	
05 05 23 00-1513 EA 1-1/8" Inside Diameter, 304/18-8 Stainless Steel Lock Washer	3.55	
05 05 23 00-1514 EA 1-1/4" Inside Diameter, 304/18-8 Stainless Steel Lock Washer	4.72	
05 05 23 00-1515 EA 1-3/8" Inside Diameter, 304/18-8 Stainless Steel Lock Washer	6.00	
05 05 23 00-1516 EA 1-1/2" Inside Diameter, 304/18-8 Stainless Steel Lock Washer	7.20	
05 05 23 00-1517 316 Stainless Steel Lock Washers <small>(05 05 23 00-1467)</small>		
05 05 23 00-1518 EA 1/4" Inside Diameter, 316 Stainless Steel Lock Washer	0.07	
05 05 23 00-1519 EA 5/16" Inside Diameter, 316 Stainless Steel Lock Washer	0.16	
05 05 23 00-1520 EA 3/8" Inside Diameter, 316 Stainless Steel Lock Washer	0.18	
05 05 23 00-1521 EA 7/16" Inside Diameter, 316 Stainless Steel Lock Washer	0.31	
05 05 23 00-1522 EA 1/2" Inside Diameter, 316 Stainless Steel Lock Washer	0.34	
05 05 23 00-1523 EA 9/16" Inside Diameter, 316 Stainless Steel Lock Washer	0.62	
05 05 23 00-1524 EA 5/8" Inside Diameter, 316 Stainless Steel Lock Washer	0.68	
05 05 23 00-1525 EA 3/4" Inside Diameter, 316 Stainless Steel Lock Washer	1.17	
05 05 23 00-1526 EA 7/8" Inside Diameter, 316 Stainless Steel Lock Washer	1.94	
05 05 23 00-1527 EA 1" Inside Diameter, 316 Stainless Steel Lock Washer	2.63	
05 05 23 00-1528 EA 1-1/8" Inside Diameter, 316 Stainless Steel Lock Washer	3.68	
05 05 23 00-1529 EA 1-1/4" Inside Diameter, 316 Stainless Steel Lock Washer	5.66	
05 05 23 00-1530 EA 1-3/8" Inside Diameter, 316 Stainless Steel Lock Washer	10.12	
05 05 23 00-1531 EA 1-1/2" Inside Diameter, 316 Stainless Steel Lock Washer	11.24	
05 05 23 00-1532 Load Indicating Washers <small>(05 05 23 00-1283)</small>		
05 05 23 00-1533 A325, Direct Tension Indicator, Load Indicating Washers (ASTM F959) <small>(05 05 23 00-1532)</small>		
05 05 23 00-1534 Plain Finish, A325, Direct Tension Indicator, Load Indicating Washers (ASTM F959) <small>(05 05 23 00-1533)</small>		
05 05 23 00-1535 EA 1/2", Plain Finish, A325, Direct Tension Indicator, Load Indicating Washer (ASTM F959)	1.36	
05 05 23 00-1536 EA 5/8", Plain Finish, A325, Direct Tension Indicator, Load Indicating Washer (ASTM F959)	1.54	
05 05 23 00-1537 EA 3/4", Plain Finish, A325, Direct Tension Indicator, Load Indicating Washer (ASTM F959)	1.66	
05 05 23 00-1538 EA 7/8", Plain Finish, A325, Direct Tension Indicator, Load Indicating Washer (ASTM F959)	1.88	
05 05 23 00-1539 EA 1", Plain Finish, A325, Direct Tension Indicator, Load Indicating Washer (ASTM F959)	2.27	
05 05 23 00-1540 EA 1-1/8", Plain Finish, A325, Direct Tension Indicator, Load Indicating Washer (ASTM F959)	3.78	
05 05 23 00-1541 EA 1-1/4", Plain Finish, A325, Direct Tension Indicator, Load Indicating Washer (ASTM F959)	4.88	
05 05 23 00-1542 EA 1-3/8", Plain Finish, A325, Direct Tension Indicator, Load Indicating Washer (ASTM F959)	6.23	

05 Metals**05 05 Common Work Results For Metals****05 05 23 Metal Fastenings**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-1543 EA 1-1/2", Plain Finish, A325, Direct Tension Indicator, Load Indicating Washer (ASTM F959).....	6.86	
05 05 23 00-1544 Galvanized, A325, Direct Tension Indicator, Load Indicating Washers (ASTM F959) <small>(05 05 23 00-1533)</small>		
05 05 23 00-1545 EA 1/2", Galvanized, A325, Direct Tension Indicator, Load Indicating Washer (ASTM F959).....	1.72	
05 05 23 00-1546 EA 5/8", Galvanized, A325, Direct Tension Indicator, Load Indicating Washer (ASTM F959).....	1.91	
05 05 23 00-1547 EA 3/4", Galvanized, A325, Direct Tension Indicator, Load Indicating Washer (ASTM F959).....	1.86	
05 05 23 00-1548 EA 7/8", Galvanized, A325, Direct Tension Indicator, Load Indicating Washer (ASTM F959).....	2.27	
05 05 23 00-1549 EA 1", Galvanized, A325, Direct Tension Indicator, Load Indicating Washer (ASTM F959).....	2.69	
05 05 23 00-1550 EA 1-1/8", Galvanized, A325, Direct Tension Indicator, Load Indicating Washer (ASTM F959).....	4.06	
05 05 23 00-1551 EA 1-1/4", Galvanized, A325, Direct Tension Indicator, Load Indicating Washer (ASTM F959).....	5.11	
05 05 23 00-1552 EA 1-3/8", Galvanized, A325, Direct Tension Indicator, Load Indicating Washer (ASTM F959).....	7.27	
05 05 23 00-1553 EA 1-1/2", Galvanized, A325, Direct Tension Indicator, Load Indicating Washer (ASTM F959).....	8.00	
05 05 23 00-1554 Beveled Washers <small>(05 05 23 00-1283)</small>		
05 05 23 00-1555 Plain Finish, Square Beveled Structural Washers (ASTM F436) <small>(05 05 23 00-1554)</small>		
05 05 23 00-1556 EA 1/2", Plain Finish, Square Beveled Structural Washer (ASTM F436).....	2.24	
05 05 23 00-1557 EA 5/8", Plain Finish, Square Beveled Structural Washer (ASTM F436).....	2.29	
05 05 23 00-1558 EA 3/4", Plain Finish, Square Beveled Structural Washer (ASTM F436).....	2.34	
05 05 23 00-1559 EA 7/8", Plain Finish, Square Beveled Structural Washer (ASTM F436).....	2.84	
05 05 23 00-1560 EA 1", Plain Finish, Square Beveled Structural Washer (ASTM F436).....	2.99	
05 05 23 00-1561 Galvanized, Square Beveled Structural Washers (ASTM F436) <small>(05 05 23 00-1554)</small>		
05 05 23 00-1562 EA 1/2", Galvanized, Square Beveled Structural Washer (ASTM F436).....	3.22	
05 05 23 00-1563 EA 5/8", Galvanized, Square Beveled Structural Washer (ASTM F436).....	3.37	
05 05 23 00-1564 EA 3/4", Galvanized, Square Beveled Structural Washer (ASTM F436).....	3.37	
05 05 23 00-1565 EA 7/8", Galvanized, Square Beveled Structural Washer (ASTM F436).....	3.56	
05 05 23 00-1566 EA 1", Galvanized, Square Beveled Structural Washer (ASTM F436).....	3.79	
05 05 23 00-1567 Drilling In Steel Plates <small>(05 05 23)</small>		
05 05 23 00-1568 EA Up To 1/2" Diameter Drill Through Up To 1/4" Steel Plate.....	15.71	
For Aluminum, Deduct	-1.57	
For Stainless Steel, Add	1.96	
05 05 23 00-1569 EA >1/2" To 7/8" Diameter Drill Through Up To 1/4" Steel Plate.....	18.48	
For Aluminum, Deduct	-1.85	
For Stainless Steel, Add	2.31	
05 05 23 00-1570 EA >7/8" To 1-1/2" Diameter Drill Through Up To 1/4" Steel Plate.....	22.18	
For Aluminum, Deduct	-2.22	
For Stainless Steel, Add	2.77	
05 05 23 00-1571 EA >1-1/2" To 4" Diameter Drill Through Up To 1/4" Steel Plate.....	25.87	
For Aluminum, Deduct	-2.59	
For Stainless Steel, Add	3.23	
05 05 23 00-1572 EA >4" To 10" Diameter Drill Through Up To 1/4" Steel Plate.....	34.65	
For Aluminum, Deduct	-3.47	
For Stainless Steel, Add	4.33	
05 05 23 00-1573 EA Up To 1/2" Diameter Drill Through >1/4" To 1/2" Steel Plate.....	18.48	
For Aluminum, Deduct	-1.85	
For Stainless Steel, Add	2.31	
05 05 23 00-1574 EA >1/2" To 7/8" Diameter Drill Through >1/4" To 1/2" Steel Plate.....	23.10	
For Aluminum, Deduct	-2.31	
For Stainless Steel, Add	2.89	
05 05 23 00-1575 EA >7/8" To 1-1/2" Diameter Drill Through >1/4" To 1/2" Steel Plate.....	27.73	
For Aluminum, Deduct	-2.77	
For Stainless Steel, Add	3.47	
05 05 23 00-1576 EA >1-1/2" To 4" Diameter Drill Through >1/4" To 1/2" Steel Plate.....	34.65	
For Aluminum, Deduct	-3.47	
For Stainless Steel, Add	4.33	
05 05 23 00-1577 EA Up To 1/2" Diameter Drill Through >1/2" To 1" Steel Plate.....	23.10	
For Aluminum, Deduct	-2.31	
For Stainless Steel, Add	2.89	
05 05 23 00-1578 EA >1/2" To 7/8" Diameter Drill Through >1/2" To 1" Steel Plate.....	30.50	
For Aluminum, Deduct	-3.05	
For Stainless Steel, Add	3.81	
05 05 23 00-1579 EA >7/8" To 1-1/2" Diameter Drill Through >1/2" To 1" Steel Plate.....	36.96	
05 05 23 00-1580 Welded Stud Anchors <small>(05 05 23)</small>		
05 05 23 00-1581 EA 1/4" Diameter x 1-1/8" Long, Welded Stud Concrete Anchors.....	2.21	
05 05 23 00-1582 EA 1/4" Diameter x 2-11/16" Long, Welded Stud Concrete Anchors.....	2.24	
05 05 23 00-1583 EA 1/4" Diameter x 3-1/8" Long, Welded Stud Concrete Anchors.....	2.25	
05 05 23 00-1584 EA 1/4" Diameter x 4-1/8" Long, Welded Stud Concrete Anchors.....	2.26	
05 05 23 00-1585 EA 3/8" Diameter x 1-3/8" Long, Welded Stud Concrete Anchors.....	2.30	
05 05 23 00-1586 EA 3/8" Diameter x 1-5/8" Long, Welded Stud Concrete Anchors.....	2.37	
05 05 23 00-1587 EA 3/8" Diameter x 2-1/8" Long, Welded Stud Concrete Anchors.....	2.43	
05 05 23 00-1588 EA 3/8" Diameter x 2-5/8" Long, Welded Stud Concrete Anchors.....	2.47	
05 05 23 00-1589 EA 3/8" Diameter x 3-1/8" Long, Welded Stud Concrete Anchors.....	2.50	
05 05 23 00-1590 EA 3/8" Diameter x 4-1/8" Long, Welded Stud Concrete Anchors.....	2.64	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 05 23 00-1591	EA			3/8" Diameter x 5-1/8" Long, Welded Stud Concrete Anchors.....	2.75	
05 05 23 00-1592	EA			3/8" Diameter x 6-1/8" Long, Welded Stud Concrete Anchors.....	2.84	
05 05 23 00-1593	EA			1/2" Diameter x 1-1/2" Long, Welded Stud Concrete Anchors.....	2.69	
05 05 23 00-1594	EA			1/2" Diameter x 1-5/8" Long, Welded Stud Concrete Anchors.....	2.70	
05 05 23 00-1595	EA			1/2" Diameter x 2-1/8" Long, Welded Stud Concrete Anchors.....	2.81	
05 05 23 00-1596	EA			1/2" Diameter x 2-5/8" Long, Welded Stud Concrete Anchors.....	2.90	
05 05 23 00-1597	EA			1/2" Diameter x 3-1/8" Long, Welded Stud Concrete Anchors.....	3.02	
05 05 23 00-1598	EA			1/2" Diameter x 4-1/8" Long, Welded Stud Concrete Anchors.....	3.21	
05 05 23 00-1599	EA			1/2" Diameter x 5-5/16" Long, Welded Stud Concrete Anchors.....	3.33	
05 05 23 00-1600	EA			1/2" Diameter x 6-1/8" Long, Welded Stud Concrete Anchors.....	3.66	
05 05 23 00-1601	EA			1/2" Diameter x 8-1/8" Long, Welded Stud Concrete Anchors.....	4.28	
05 05 23 00-1602	EA			5/8" Diameter x 2-11/16" Long, Welded Stud Concrete Anchors.....	3.51	
05 05 23 00-1603	EA			5/8" Diameter x 3-3/16" Long, Welded Stud Concrete Anchors.....	3.66	
05 05 23 00-1604	EA			5/8" Diameter x 3-11/16" Long, Welded Stud Concrete Anchors.....	3.79	
05 05 23 00-1605	EA			5/8" Diameter x 4-3/16" Long, Welded Stud Concrete Anchors.....	3.92	
05 05 23 00-1606	EA			5/8" Diameter x 4-11/16" Long, Welded Stud Concrete Anchors.....	4.02	
05 05 23 00-1607	EA			5/8" Diameter x 5-3/16" Long, Welded Stud Concrete Anchors.....	4.12	
05 05 23 00-1608	EA			5/8" Diameter x 6-3/16" Long, Welded Stud Concrete Anchors.....	4.25	
05 05 23 00-1609	EA			5/8" Diameter x 6-9/16" Long, Welded Stud Concrete Anchors.....	4.78	
05 05 23 00-1610	EA			5/8" Diameter x 8-3/16" Long, Welded Stud Concrete Anchors.....	5.52	

05 05 23 00-1611 Welded Shear Stud Connector (05 05 23)

05 05 23 00-1612 3/4" Diameter Welded Shear Stud Connector (05 05 23 00-1611)

05 05 23 00-1613	EA			3/4" Diameter x 3-3/8" Long, Welded Shear Stud Connector.....	4.32	
05 05 23 00-1614	EA			3/4" Diameter x 3-3/8" Long, Welded Shear Stud Connector.....	4.43	
05 05 23 00-1615	EA			3/4" Diameter x 3-7/8" Long, Welded Shear Stud Connector.....	4.46	
05 05 23 00-1616	EA			3/4" Diameter x 4-3/16" Long, Welded Shear Stud Connector.....	4.47	
05 05 23 00-1617	EA			3/4" Diameter x 4-3/8" Long, Welded Shear Stud Connector.....	4.60	
05 05 23 00-1618	EA			3/4" Diameter x 4-11/16" Long, Welded Shear Stud Connector.....	4.83	
05 05 23 00-1619	EA			3/4" Diameter x 4-7/8" Long, Welded Shear Stud Connector.....	7.09	
05 05 23 00-1620	EA			3/4" Diameter x 5-3/16" Long, Welded Shear Stud Connector.....	5.11	
05 05 23 00-1621	EA			3/4" Diameter x 5-3/8" Long, Welded Shear Stud Connector.....	5.52	
05 05 23 00-1622	EA			3/4" Diameter x 6-3/16" Long, Welded Shear Stud Connector.....	7.94	
05 05 23 00-1623	EA			3/4" Diameter x 7-3/16" Long, Welded Shear Stud Connector.....	8.07	
05 05 23 00-1624	EA			3/4" Diameter x 8-3/16" Long, Welded Shear Stud Connector.....	8.52	
05 05 23 00-1625	EA			3/4" Diameter x 10-3/16" Long, Welded Shear Stud Connector.....	10.41	

05 05 23 00-1626 7/8" Diameter Welded Shear Stud Connector (05 05 23 00-1611)

05 05 23 00-1627	EA			7/8" Diameter x 3-3/16" Long, Welded Shear Stud Connector.....	4.88	
05 05 23 00-1628	EA			7/8" Diameter x 3-11/16" Long, Welded Shear Stud Connector.....	5.06	
05 05 23 00-1629	EA			7/8" Diameter x 4-3/16" Long, Welded Shear Stud Connector.....	5.24	
05 05 23 00-1630	EA			7/8" Diameter x 5-3/16" Long, Welded Shear Stud Connector.....	5.76	
05 05 23 00-1631	EA			7/8" Diameter x 6-3/16" Long, Welded Shear Stud Connector.....	8.22	
05 05 23 00-1632	EA			7/8" Diameter x 7-3/16" Long, Welded Shear Stud Connector.....	8.76	
05 05 23 00-1633	EA			7/8" Diameter x 8-3/16" Long, Welded Shear Stud Connector.....	9.30	
05 05 23 00-1634	EA			7/8" Diameter x 10-3/16" Long, Welded Shear Stud Connector.....	10.82	

05 05 23 00-1635 1" Diameter Welded Shear Stud Connector (05 05 23 00-1611)

05 05 23 00-1636	EA			1" Diameter x 3-1/4" Long, Welded Shear Stud Connector.....	6.06	
05 05 23 00-1637	EA			1" Diameter x 4-1/4" Long, Welded Shear Stud Connector.....	6.61	
05 05 23 00-1638	EA			1" Diameter x 5-1/4" Long, Welded Shear Stud Connector.....	7.43	
05 05 23 00-1639	EA			1" Diameter x 6-1/4" Long, Welded Shear Stud Connector.....	10.26	
05 05 23 00-1640	EA			1" Diameter x 7-1/4" Long, Welded Shear Stud Connector.....	11.12	
05 05 23 00-1641	EA			1" Diameter x 8-1/4" Long, Welded Shear Stud Connector.....	11.98	

05 10 Structural Metal Framing (05)

05 12 Structural Steel Framing (05 10)

05 12 23 Structural Steel For Buildings (05 12)

Note: Prices are based on ASTM A992/A36 steel with bolted standard beam connections and shop primed with red primer paint. Stock sections only. Includes shop fabrication into sub-assemblies and delivery to site, all connecting bolts, connecting welds, and crane for erection. Excludes moment connection welding. See CSI section 05 12 23 00-0075 for field fabrication of additional structural metal connections, 05 12 23 00-0090 for moment connection welding.

05 12 23 00-0001 Rolled Steel Members (05 12 23)

05 12 23 00-0002 Beams, Girders And Columns (05 12 23 00-0001)

Note: For one and two story I beams and W shapes and HP shapes.

05 12 23 00-0003	TON	Up To 30 LB/LF Beams, Girders And Columns.....	6,071.92	963.70
		For ASTM A242 Type 2 High Strength Steel, Add	326.26	
		For Hot Dip Galvanizing, Add	1,141.90	
05 12 23 00-0004	TON	>30-65 LB/LF Beams, Girders And Columns.....	4,011.60	622.97
		For ASTM A242 Type 2 High Strength Steel, Add	267.76	
		For Hot Dip Galvanizing, Add	937.17	

05	Metals
05 10	Structural Metal Framing
05 12	Structural Steel Framing



MINOR	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 12 23 00-0005	Shapes <small>(05 12 23 00-0001)</small>		
05 12 23 00-0006	Rolled C, MC Steel Channels <small>(05 12 23 00-0005)</small>		
05 12 23 00-0007	TON Up To 10 LB/LF Rolled C, MC Steel Channels <i>For ASTM A242 Type 2 High Strength Steel, Add</i> <i>For Hot Dip Galvanizing, Add</i>	9,908.53 464.05 1,624.18	2,453.18
05 12 23 00-0008	TON >10-20 LB/LF Rolled C, MC Steel Channels..... <i>For ASTM A242 Type 2 High Strength Steel, Add</i> <i>For Hot Dip Galvanizing, Add</i>	7,549.86 444.49 1,555.72	1,869.10
05 12 23 00-0009	Double L Shape Steel Angles <small>(05 12 23 00-0005)</small>		
05 12 23 00-0010	TON Up To 20 LB/LF Double L Shape Steel Angles..... <i>For ASTM A242 Type 2 High Strength Steel, Add</i> <i>For Hot Dip Galvanizing, Add</i>	8,155.51 453.38 1,586.84	1,421.44
05 12 23 00-0011	Combination Section Shapes <small>(05 12 23 00-0001)</small>		
05 12 23 00-0012	Combination Section, W Shapes And Angles <small>(05 12 23 00-0011)</small>		
05 12 23 00-0013	TON Up To 30 LB/LF Combination Section - W Shapes And Angles..... <i>For ASTM A242 Type 2 High Strength Steel, Add</i> <i>For Hot Dip Galvanizing, Add</i>	6,983.13 399.15 1,397.04	1,051.36
05 12 23 00-0014	TON >30-65 LB/LF Combination Section - W Shapes And Angles <i>For ASTM A242 Type 2 High Strength Steel, Add</i> <i>For Hot Dip Galvanizing, Add</i>	4,776.13 328.92 1,151.24	622.97
05 12 23 00-0015	TON >100-300 LB/LF Combination Section - W Shapes And Angles <i>For ASTM A242 Type 2 High Strength Steel, Add</i> <i>For Hot Dip Galvanizing, Add</i>	2,932.69 218.69 765.42	186.54
05 12 23 00-0016	Combination Section, Channels And Angles <small>(05 12 23 00-0011)</small>		
05 12 23 00-0017	TON Up To 30 LB/LF Combination Section - Channels And Angles..... <i>For ASTM A242 Type 2 High Strength Steel, Add</i> <i>For Hot Dip Galvanizing, Add</i>	7,327.61 426.71 1,493.49	1,051.36
05 12 23 00-0018	Standard Weight Pipe <small>(05 12 23 00-0001)</small>		
05 12 23 00-0019	TON 1/2" To 5" Diameter Standard Weight Pipe..... <i>For ASTM A242 Type 2 High Strength Steel, Add</i> <i>For Hot Dip Galvanizing, Add</i>	4,065.15 277.36 970.77	560.72
05 12 23 00-0020	TON >5" To 12" Diameter Standard Weight Pipe..... <i>For ASTM A242 Type 2 High Strength Steel, Add</i> <i>For Hot Dip Galvanizing, Add</i>	4,370.25 289.81 1,014.33	700.91
05 12 23 00-0021	Structural Steel Shapes <small>(05 12 23)</small>		
05 12 23 00-0022	Steel Rods <small>(05 12 23 00-0021)</small>		
05 12 23 00-0023	TON 1/2" To 5" Diameter Extra Strong Steel, Solid..... <i>For ASTM A242 Type 2 High Strength Steel, Add</i> <i>For Hot Dip Galvanizing, Add</i>	4,334.35 309.37 1,082.78	438.12
05 12 23 00-0024	Column Base Plates <small>(05 12 23 00-0021)</small>		
05 12 23 00-0025	LB Column Base Plates, Up To 150 LB / Each, A36 Miscellaneous Steel Items <i>For ASTM A242 Type 2 High Strength Steel, Add</i> <i>For Hot Dip Galvanizing, Add</i>	2.30 0.13 0.47	0.60
05 12 23 00-0026	Double Extra Strong Pipes <small>(05 12 23 00-0021)</small>		
05 12 23 00-0027	TON 2" To 5" Diameter Double Extra Strong Pipe <i>For ASTM A242 Type 2 High Strength Steel, Add</i> <i>For Hot Dip Galvanizing, Add</i>	5,277.14 353.82 1,238.36	801.00
05 12 23 00-0028	TON >5" To 8" Diameter Double Extra Strong Pipe <i>For ASTM A242 Type 2 High Strength Steel, Add</i> <i>For Hot Dip Galvanizing, Add</i>	4,660.54 336.04 1,176.13	431.30
05 12 23 00-0029	Structural Pipes <small>(05 12 23 00-0021)</small>		
05 12 23 00-0030	TON 3" To 5" Outside Diameter Structural Pipe, Extra Heavy A36 Miscellaneous Steel Items..... <i>For ASTM A242 Type 2 High Strength Steel, Add</i> <i>For Hot Dip Galvanizing, Add</i>	3,680.86 248.92 871.21	370.08
05 12 23 00-0031	TON >5" To 12" Outside Diameter Structural Pipe, Extra Heavy A36 Miscellaneous Steel Items..... <i>For ASTM A242 Type 2 High Strength Steel, Add</i> <i>For Hot Dip Galvanizing, Add</i>	4,053.06 248.92 871.21	426.81
05 12 23 00-0032	Structural Tubing <small>(05 12 23 00-0021)</small>		
05 12 23 00-0033	Rectangle Structural Tubing <small>(05 12 23 00-0032)</small>		



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 12 23 00-0034	TON	3" x 2"	Weight Range 5-7 LB/LF Structural Tubing - Rectangle..... <i>For ASTM A242 Type 2 High Strength Steel, Add</i> <i>For Hot Dip Galvanizing, Add</i>	5,954.90 444.49 1,555.72	373.82
05 12 23 00-0035	TON	4" x 3", 2"	Weight Range 6-13 LB/LF Structural Tubing - Rectangle <i>For ASTM A242 Type 2 High Strength Steel, Add</i> <i>For Hot Dip Galvanizing, Add</i>	6,016.25 444.49 1,555.72	431.30
05 12 23 00-0036	TON	5" x 4", 2"	Weight Range 8-20 LB/LF Structural Tubing - Rectangle <i>For ASTM A242 Type 2 High Strength Steel, Add</i> <i>For Hot Dip Galvanizing, Add</i>	5,276.71 382.26 1,337.92	467.27
05 12 23 00-0037	TON	6" x 4", 3", 2"	Weight Range 9-29 LB/LF Structural Tubing - Rectangle <i>For ASTM A242 Type 2 High Strength Steel, Add</i> <i>For Hot Dip Galvanizing, Add</i>	5,043.04 355.59 1,244.58	560.72
05 12 23 00-0038 Square Structural Tubing <small>(05 12 23 00-0032)</small>					
05 12 23 00-0039	TON	2" x 2"	Weight Range 4-6 LB/LF Structural Tubing - Square <i>For ASTM A242 Type 2 High Strength Steel, Add</i> <i>For Hot Dip Galvanizing, Add</i>	5,929.98 444.49 1,555.72	350.45
05 12 23 00-0040	TON	2.5" x 2.5"	Weight Range 5-8 LB/LF Structural Tubing - Square <i>For ASTM A242 Type 2 High Strength Steel, Add</i> <i>For Hot Dip Galvanizing, Add</i>	5,954.90 444.49 1,555.72	373.82
05 12 23 00-0041	TON	3" x 3"	Weight Range 6-11 LB/LF Structural Tubing - Square <i>For ASTM A242 Type 2 High Strength Steel, Add</i> <i>For Hot Dip Galvanizing, Add</i>	5,387.84 391.15 1,369.04	467.27
05 12 23 00-0042	TON	3.5" x 3.5"	Weight Range 8-13 LB/LF Structural Tubing - Square <i>For ASTM A242 Type 2 High Strength Steel, Add</i> <i>For Hot Dip Galvanizing, Add</i>	5,376.40 382.26 1,337.92	560.72
05 12 23 00-0043	TON	4" x 4"	Weight Range 10-22 LB/LF Structural Tubing - Square <i>For ASTM A242 Type 2 High Strength Steel, Add</i> <i>For Hot Dip Galvanizing, Add</i>	4,392.48 291.59 1,020.56	700.91
05 12 23 00-0044	TON	5" x 5"	Weight Range 12-30 LB/LF Structural Tubing - Square <i>For ASTM A242 Type 2 High Strength Steel, Add</i> <i>For Hot Dip Galvanizing, Add</i>	4,499.28 291.59 1,020.56	801.00
05 12 23 00-0045	TON	6" x 6"	Weight Range 15-35 LB/LF Structural Tubing - Square <i>For ASTM A242 Type 2 High Strength Steel, Add</i> <i>For Hot Dip Galvanizing, Add</i>	4,841.06 291.59 1,020.56	1,121.46
05 12 23 00-0046 Structural Shapes <small>(05 12 23 00-0021)</small>					
05 12 23 00-0047	TON	Structural Shapes, Steel Angle A36 Structural Steel, Purlins And Girts (Up To 20 LB/LF)..... <i>For ASTM A242 Type 2 High Strength Steel, Add</i> <i>For Hot Dip Galvanizing, Add</i> <i>For >20 To 50 LB/LF, Deduct</i> <i>For >50 To 75 LB/LF, Deduct</i> <i>For >75 To 100 LB/LF, Deduct</i>	7,153.82 299.06 1,046.71 -886.16 -1,414.63 -1,943.10	2,151.80	
05 12 23 00-0048	TON	Structural Shapes, Steel Plate A36 Structural Steel Note: Up to 21.5 LB per SF <i>For ASTM A242 Type 2 High Strength Steel, Add</i> <i>For Hot Dip Galvanizing, Add</i> <i>For >21.5 To 50 LB/LF, Deduct</i>	4,700.60 284.48 995.69 -527.29	860.72	
05 12 23 00-0049	LB	Structural Shapes, Primed Pipe Supports (Up To 20 LB/LF).....	2.70	0.19	
05 12 23 00-0050	LB	Structural Shapes, Galvanized Pipe Supports.....	3.26	0.19	
05 12 23 00-0051 Built-Up Trusses <small>(05 12 23 00-0021)</small>					
05 12 23 00-0052	TON	Up To 50 LF Span Average Weight 100 LB/LF Trusses, Built-up.....	4,821.77	280.36	
05 12 23 00-0053	TON	>50-100 LF Span Average Weight 120 LB/LF Trusses, Built-up.....	4,733.30	155.70	
05 12 23 00-0054	TON	>100-200 LF Span Average Weight 150 LB/LF Trusses, Built-up.....	4,199.51	82.43	
05 12 23 00-0055	TON	>200 LF Span Average Weight 180 LB/LF Trusses, Built-up.....	4,083.51	77.94	
05 12 23 00-0056 Masonry Plates, Filler Plates, Sole Plates And Anchor Straps <small>(05 12 23 00-0021)</small>					
Note: Includes shop fabrication, welds, drilling and shop primer.					
05 12 23 00-0057	SF	1/4" Masonry Plates, Filler Plates, Sole Plates And Anchor Straps.....	17.83	6.20	
05 12 23 00-0058	SF	3/8" Masonry Plates, Filler Plates, Sole Plates And Anchor Straps.....	26.75	9.27	
05 12 23 00-0059	SF	1/2" Masonry Plates, Filler Plates, Sole Plates And Anchor Straps.....	35.67	12.36	
05 12 23 00-0060	SF	5/8" Masonry Plates, Filler Plates, Sole Plates And Anchor Straps.....	44.59	15.44	
05 12 23 00-0061	SF	3/4" Masonry Plates, Filler Plates, Sole Plates And Anchor Straps.....	53.51	18.45	
05 12 23 00-0062	SF	7/8" Masonry Plates, Filler Plates, Sole Plates And Anchor Straps.....	62.43	21.62	
05 12 23 00-0063	SF	1" Masonry Plates, Filler Plates, Sole Plates And Anchor Straps.....	71.34	24.71	
05 12 23 00-0064	SF	1-1/8" Masonry Plates, Filler Plates, Sole Plates And Anchor Straps.....	80.26	27.80	
05 12 23 00-0065	SF	1-1/4" Masonry Plates, Filler Plates, Sole Plates And Anchor Straps.....	89.18	30.89	
05 12 23 00-0066	SF	1-3/8" Masonry Plates, Filler Plates, Sole Plates And Anchor Straps.....	98.10	33.98	
05 12 23 00-0067	SF	1-1/2" Masonry Plates, Filler Plates, Sole Plates And Anchor Straps.....	107.02	37.07	
05 12 23 00-0068	SF	1-5/8" Masonry Plates, Filler Plates, Sole Plates And Anchor Straps.....	115.94	40.16	
05 12 23 00-0069	SF	1-3/4" Masonry Plates, Filler Plates, Sole Plates And Anchor Straps.....	124.86	43.24	
05 12 23 00-0070	SF	1-7/8" Masonry Plates, Filler Plates, Sole Plates And Anchor Straps.....	133.78	46.33	
05 12 23 00-0071	SF	2" Masonry Plates, Filler Plates, Sole Plates And Anchor Straps.....	142.70	49.42	
05 12 23 00-0072	Accessories For Steel <small>(05 12 23)</small>				
05 12 23 00-0073	Field Painting For Touch-Up Of Shop Prime Coat <small>(05 12 23 00-0072)</small>				

05 Metals**05 10 Structural Metal Framing****05 12 Structural Steel Framing**

MINOR

CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

05 12 23 00-0074	SF	Touch Up Paint - Type 1 Red Oxide Field Painting Prime Coat.....	0.80
05 12 23 00-0075		Connection And Stiffener Plates <small>(05 12 23 00-0072)</small>	
		Note: For field fabrication of additional structural metal connections.	
05 12 23 00-0076	TON	1/8" Plate Weight 6.16 LB/SF Connection And Stiffener Plates.....	10,265.87
05 12 23 00-0077	TON	3/16" Plate Weight 8.71 LB/SF Connection And Stiffener Plates.....	8,758.79
05 12 23 00-0078	TON	1/4" Plate Weight 11.26 LB/SF Connection And Stiffener Plates.....	6,773.35
05 12 23 00-0079	TON	5/16" Plate Weight 13.81 LB/SF Connection And Stiffener Plates.....	6,773.35
05 12 23 00-0080	TON	3/8" Plate Weight 16.37 LB/SF Connection And Stiffener Plates.....	6,773.35
05 12 23 00-0081	TON	1/2" Plate Weight 21.47 LB/SF Connection And Stiffener Plates.....	6,773.35
05 12 23 00-0082	TON	9/16" Plate Weight 24.02 LB/SF Connection And Stiffener Plates.....	6,773.35
05 12 23 00-0083	TON	5/8" Plate Weight 26.58 LB/SF Connection And Stiffener Plates.....	6,773.35
05 12 23 00-0084	TON	3/4" Plate Weight 31.68 LB/SF Connection And Stiffener Plates.....	6,350.02
05 12 23 00-0085	TON	7/8" Plate Weight 36.78 LB/SF Connection And Stiffener Plates.....	6,350.02
05 12 23 00-0086	TON	1" Plate Weight 41.89 LB/SF Connection And Stiffener Plates.....	6,350.02
05 12 23 00-0087		Spot Welding <small>(05 12 23 00-0072)</small>	
05 12 23 00-0088	EA	Up To 15 Spot Weldings, Welds Up To 1" Length Each.....	9.53
		<i>For Aluminum Welding, Add</i>	1.45
		<i>For Stainless Steel Welding, Add</i>	2.41
05 12 23 00-0089	EA	>15 Spot Weldings, Welds Up To 1" Length Each.....	7.68
		<i>For Aluminum Welding, Add</i>	1.33
		<i>For Stainless Steel Welding, Add</i>	2.15
05 12 23 00-0090		Field Welding (Seam And Stitch Welding) <small>(05 12 23 00-0072)</small>	
05 12 23 00-0091		Vertical Fillet Welds <small>(05 12 23 00-0090)</small>	
		Note: For existing steel and moment connections. Includes tack welds for proper alignment until the final welds are made.	
05 12 23 00-0092	LF	3/16" Vertical Fillet Weld.....	10.02
		<i>For Aluminum Welding, Add</i>	1.65
		<i>For Stainless Steel Welding, Add</i>	2.69
		<i>For Up To 25, Add</i>	3.44
		<i>For >25 To 50, Add</i>	2.46
05 12 23 00-0093	LF	1/4" Vertical Fillet Weld.....	15.04
		<i>For Aluminum Welding, Add</i>	2.48
		<i>For Stainless Steel Welding, Add</i>	4.05
		<i>For Up To 25, Add</i>	5.17
		<i>For >25 To 50, Add</i>	3.68
05 12 23 00-0094	LF	5/16" Vertical Fillet Weld.....	20.05
		<i>For Aluminum Welding, Add</i>	3.32
		<i>For Stainless Steel Welding, Add</i>	5.40
		<i>For Up To 25, Add</i>	6.89
		<i>For >25 To 50, Add</i>	4.91
05 12 23 00-0095	LF	3/8" Vertical Fillet Weld.....	25.07
		<i>For Aluminum Welding, Add</i>	4.14
		<i>For Stainless Steel Welding, Add</i>	6.75
		<i>For Up To 25, Add</i>	8.61
		<i>For >25 To 50, Add</i>	6.14
05 12 23 00-0096	LF	7/16" Vertical Fillet Weld.....	29.82
		<i>For Aluminum Welding, Add</i>	4.77
		<i>For Stainless Steel Welding, Add</i>	7.83
		<i>For Up To 25, Add</i>	10.31
		<i>For >25 To 50, Add</i>	7.36
05 12 23 00-0097	LF	1/2" Vertical Fillet Weld.....	34.72
		<i>For Aluminum Welding, Add</i>	5.74
		<i>For Stainless Steel Welding, Add</i>	9.35
		<i>For Up To 25, Add</i>	11.93
		<i>For >25 To 50, Add</i>	8.50
05 12 23 00-0098	LF	9/16" Vertical Fillet Weld.....	40.78
		<i>For Aluminum Welding, Add</i>	6.60
		<i>For Stainless Steel Welding, Add</i>	10.80
		<i>For Up To 25, Add</i>	14.07
		<i>For >25 To 50, Add</i>	10.04
05 12 23 00-0099	LF	5/8" Vertical Fillet Weld.....	44.92
		<i>For Aluminum Welding, Add</i>	7.30
		<i>For Stainless Steel Welding, Add</i>	11.94
		<i>For Up To 25, Add</i>	15.49
		<i>For >25 To 50, Add</i>	11.04
05 12 23 00-0100	LF	3/4" Vertical Fillet Weld.....	61.70
		<i>For Aluminum Welding, Add</i>	10.23
		<i>For Stainless Steel Welding, Add</i>	16.64
		<i>For Up To 25, Add</i>	21.19
		<i>For >25 To 50, Add</i>	15.10
05 12 23 00-0101		Horizontal Or Flat Fillet Welds <small>(05 12 23 00-0090)</small>	
		Note: For existing steel and moment connections. Includes tack welds for proper alignment until the final welds are made.	



Metals	05	05
Structural Metal Framing	05 10	
Structural Steel Framing	05 12	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 12 23 00-0102 LF 1/8" Horizontal Or Flat Fillet Weld.....	5.69	
<i>For Aluminum Welding, Add</i>	0.97	
<i>For Stainless Steel Welding, Add</i>	1.57	
<i>For Up To 25, Add</i>	1.94	
<i>For >25 To 50, Add</i>	1.38	
05 12 23 00-0103 LF 3/16" Horizontal Or Flat Fillet Weld.....	7.60	
<i>For Aluminum Welding, Add</i>	1.30	
<i>For Stainless Steel Welding, Add</i>	2.10	
<i>For Up To 25, Add</i>	2.59	
<i>For >25 To 50, Add</i>	1.85	
05 12 23 00-0104 LF 1/4" Horizontal Or Flat Fillet Weld.....	11.39	
<i>For Aluminum Welding, Add</i>	1.95	
<i>For Stainless Steel Welding, Add</i>	3.15	
<i>For Up To 25, Add</i>	3.89	
<i>For >25 To 50, Add</i>	2.77	
05 12 23 00-0105 LF 5/16" Horizontal Or Flat Fillet Weld.....	15.20	
<i>For Aluminum Welding, Add</i>	2.60	
<i>For Stainless Steel Welding, Add</i>	4.21	
<i>For Up To 25, Add</i>	5.19	
<i>For >25 To 50, Add</i>	3.69	
05 12 23 00-0106 LF 3/8" Horizontal Or Flat Fillet Weld.....	18.99	
<i>For Aluminum Welding, Add</i>	3.24	
<i>For Stainless Steel Welding, Add</i>	5.24	
<i>For Up To 25, Add</i>	6.48	
<i>For >25 To 50, Add</i>	4.62	
05 12 23 00-0107 LF 7/16" Horizontal Or Flat Fillet Weld.....	21.96	
<i>For Aluminum Welding, Add</i>	3.61	
<i>For Stainless Steel Welding, Add</i>	5.89	
<i>For Up To 25, Add</i>	7.55	
<i>For >25 To 50, Add</i>	5.38	
05 12 23 00-0108 LF 1/2" Horizontal Or Flat Fillet Weld.....	26.80	
<i>For Aluminum Welding, Add</i>	4.58	
<i>For Stainless Steel Welding, Add</i>	7.40	
<i>For Up To 25, Add</i>	9.15	
<i>For >25 To 50, Add</i>	6.51	
05 12 23 00-0109 LF 9/16" Horizontal Or Flat Fillet Weld.....	30.17	
<i>For Aluminum Welding, Add</i>	5.04	
<i>For Stainless Steel Welding, Add</i>	8.18	
<i>For Up To 25, Add</i>	10.35	
<i>For >25 To 50, Add</i>	7.37	
05 12 23 00-0110 LF 5/8" Horizontal Or Flat Fillet Weld.....	36.22	
<i>For Aluminum Welding, Add</i>	6.09	
<i>For Stainless Steel Welding, Add</i>	9.88	
<i>For Up To 25, Add</i>	12.40	
<i>For >25 To 50, Add</i>	8.84	
05 12 23 00-0111 LF 3/4" Horizontal Or Flat Fillet Weld.....	45.68	
<i>For Aluminum Welding, Add</i>	7.87	
<i>For Stainless Steel Welding, Add</i>	12.70	
<i>For Up To 25, Add</i>	15.56	
<i>For >25 To 50, Add</i>	11.08	
05 12 23 00-0112 LF 7/8" Horizontal Or Flat Fillet Weld.....	69.13	
<i>For Aluminum Welding, Add</i>	11.38	
<i>For Stainless Steel Welding, Add</i>	18.54	
<i>For Up To 25, Add</i>	23.78	
<i>For >25 To 50, Add</i>	16.95	
05 12 23 00-0113 LF 1" Horizontal Or Flat Fillet Weld.....	91.13	
<i>For Aluminum Welding, Add</i>	15.57	
<i>For Stainless Steel Welding, Add</i>	25.16	
<i>For Up To 25, Add</i>	31.10	
<i>For >25 To 50, Add</i>	22.15	
05 12 23 00-0114 Cold Galvanizing <small>(05 12 23 00-0072)</small>		
05 12 23 00-0115 SF Brush Applied Cold Galvanizing	1.34	
05 12 23 00-0116 Metal Grinding <small>(05 12 23 00-0072)</small>		
Note: For use to prepare existing metal for welding by removing of rust or scale and smoothing surface after torch cutting.		
05 12 23 00-0117 SI Metal Grinding Up To 1/32" Thickness To Be Removed.....	0.69	
Note: Includes rust or scale removal on metal and smoothing surface.		
05 12 23 00-0119 Lightweight Framing Steel Shapes <small>(05 12 23)</small>		
05 12 23 00-0120 Angle Iron - L <small>(05 12 23 00-0119)</small>		
05 12 23 00-0121 1/8" Thick <small>(05 12 23 00-0120)</small>		

05 Metals

05 10 Structural Metal Framing

05 12 Structural Steel Framing



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 12 23 00-0122	LF		1/2" x 1/2" x 1/8" Angle Iron	2.08	1.36
			<i>For >100 To 250, Deduct</i>	-0.14	
			<i>For >250 To 500, Deduct</i>	-0.19	
			<i>For >500 To 1,000, Deduct</i>	-0.29	
			<i>For >1,000, Deduct</i>	-0.38	
			<i>For 316 Stainless Steel, Add</i>	0.86	
			<i>For Aluminum, Add</i>	0.05	
			<i>For Galvanized Steel, Add</i>	0.17	
			<i>For 304 Stainless Steel, Add</i>	0.77	
			<i>For High Strength Steel (HSS), Add</i>	0.42	
05 12 23 00-0123	LF		3/4" x 1/2" x 1/8" Angle Iron	2.39	1.54
			<i>For >100 To 250, Deduct</i>	-0.15	
			<i>For >250 To 500, Deduct</i>	-0.21	
			<i>For >500 To 1,000, Deduct</i>	-0.32	
			<i>For >1,000, Deduct</i>	-0.44	
			<i>For 316 Stainless Steel, Add</i>	1.09	
			<i>For Aluminum, Add</i>	0.06	
			<i>For Galvanized Steel, Add</i>	0.21	
			<i>For 304 Stainless Steel, Add</i>	0.97	
			<i>For High Strength Steel (HSS), Add</i>	0.48	
05 12 23 00-0124	LF		3/4" x 3/4" x 1/8" Angle Iron	2.67	1.69
			<i>For >100 To 250, Deduct</i>	-0.17	
			<i>For >250 To 500, Deduct</i>	-0.24	
			<i>For >500 To 1,000, Deduct</i>	-0.36	
			<i>For >1,000, Deduct</i>	-0.48	
			<i>For 316 Stainless Steel, Add</i>	1.34	
			<i>For Aluminum, Add</i>	0.08	
			<i>For Galvanized Steel, Add</i>	0.26	
			<i>For 304 Stainless Steel, Add</i>	1.20	
			<i>For High Strength Steel (HSS), Add</i>	0.53	
05 12 23 00-0125	LF		1" x 3/4" x 1/8" Angle Iron	3.01	1.88
			<i>For >100 To 250, Deduct</i>	-0.19	
			<i>For >250 To 500, Deduct</i>	-0.26	
			<i>For >500 To 1,000, Deduct</i>	-0.40	
			<i>For >1,000, Deduct</i>	-0.54	
			<i>For 316 Stainless Steel, Add</i>	1.57	
			<i>For Aluminum, Add</i>	0.09	
			<i>For Galvanized Steel, Add</i>	0.30	
			<i>For 304 Stainless Steel, Add</i>	1.40	
			<i>For High Strength Steel (HSS), Add</i>	0.60	
05 12 23 00-0126	LF		1" x 1" x 1/8" Angle Iron	3.28	2.03
			<i>For >100 To 250, Deduct</i>	-0.20	
			<i>For >250 To 500, Deduct</i>	-0.29	
			<i>For >500 To 1,000, Deduct</i>	-0.44	
			<i>For >1,000, Deduct</i>	-0.58	
			<i>For 316 Stainless Steel, Add</i>	1.82	
			<i>For Aluminum, Add</i>	0.10	
			<i>For Galvanized Steel, Add</i>	0.35	
			<i>For 304 Stainless Steel, Add</i>	1.62	
			<i>For High Strength Steel (HSS), Add</i>	0.66	
05 12 23 00-0127	LF		1-1/4" x 1-1/4" x 1/8" Angle Iron	3.91	2.40
			<i>For >100 To 250, Deduct</i>	-0.24	
			<i>For >250 To 500, Deduct</i>	-0.34	
			<i>For >500 To 1,000, Deduct</i>	-0.51	
			<i>For >1,000, Deduct</i>	-0.69	
			<i>For 316 Stainless Steel, Add</i>	2.30	
			<i>For Aluminum, Add</i>	0.13	
			<i>For Galvanized Steel, Add</i>	0.45	
			<i>For 304 Stainless Steel, Add</i>	2.05	
			<i>For High Strength Steel (HSS), Add</i>	0.78	
05 12 23 00-0128	LF		1-1/2" x 1" x 1/8" Angle Iron	3.91	2.40
			<i>For >100 To 250, Deduct</i>	-0.24	
			<i>For >250 To 500, Deduct</i>	-0.34	
			<i>For >500 To 1,000, Deduct</i>	-0.51	
			<i>For >1,000, Deduct</i>	-0.69	
			<i>For 316 Stainless Steel, Add</i>	2.30	
			<i>For Aluminum, Add</i>	0.13	
			<i>For Galvanized Steel, Add</i>	0.45	
			<i>For 304 Stainless Steel, Add</i>	2.05	
			<i>For High Strength Steel (HSS), Add</i>	0.78	
05 12 23 00-0129	LF		1-1/2" x 1-1/2" x 1/8" Angle Iron	4.69	2.87
			<i>For >100 To 250, Deduct</i>	-0.29	
			<i>For >250 To 500, Deduct</i>	-0.40	
			<i>For >500 To 1,000, Deduct</i>	-0.62	
			<i>For >1,000, Deduct</i>	-0.83	
			<i>For 316 Stainless Steel, Add</i>	2.78	
			<i>For Aluminum, Add</i>	0.16	
			<i>For Galvanized Steel, Add</i>	0.54	
			<i>For 304 Stainless Steel, Add</i>	2.48	
			<i>For High Strength Steel (HSS), Add</i>	0.94	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 12 23 00-0130 LF 2" x 2" x 1/8" Angle Iron.....	6.37	3.90
For >100 To 250, Deduct	-0.39	
For >250 To 500, Deduct	-0.55	
For >500 To 1,000, Deduct	-0.84	
For >1,000, Deduct	-1.13	
For 316 Stainless Steel, Add	3.78	
For Aluminum, Add	0.21	
For Galvanized Steel, Add	0.73	
For 304 Stainless Steel, Add	3.36	
For High Strength Steel (HSS), Add	1.27	
05 12 23 00-0131 3/16" Thick <small>(05 12 23 00-0120)</small>		
05 12 23 00-0132 LF 1-1/4" x 1-1/4" x 3/16" Angle Iron.....	4.42	2.53
For >100 To 250, Deduct	-0.25	
For >250 To 500, Deduct	-0.36	
For >500 To 1,000, Deduct	-0.56	
For >1,000, Deduct	-0.75	
For 316 Stainless Steel, Add	3.36	
For Aluminum, Add	0.19	
For Galvanized Steel, Add	0.65	
For 304 Stainless Steel, Add	2.99	
For High Strength Steel (HSS), Add	0.88	
05 12 23 00-0133 LF 1-1/2" x 1" x 3/16" Angle Iron.....	4.42	2.53
For >100 To 250, Deduct	-0.25	
For >250 To 500, Deduct	-0.36	
For >500 To 1,000, Deduct	-0.56	
For >1,000, Deduct	-0.75	
For 316 Stainless Steel, Add	3.36	
For Aluminum, Add	0.19	
For Galvanized Steel, Add	0.65	
For 304 Stainless Steel, Add	2.99	
For High Strength Steel (HSS), Add	0.88	
05 12 23 00-0134 LF 1-1/2" x 1-1/2" x 3/16" Angle Iron.....	4.89	2.71
For >100 To 250, Deduct	-0.27	
For >250 To 500, Deduct	-0.39	
For >500 To 1,000, Deduct	-0.61	
For >1,000, Deduct	-0.82	
For 316 Stainless Steel, Add	4.10	
For Aluminum, Add	0.23	
For Galvanized Steel, Add	0.79	
For 304 Stainless Steel, Add	3.65	
For High Strength Steel (HSS), Add	0.98	
05 12 23 00-0135 LF 2" x 2" x 3/16" Angle Iron.....	5.61	2.91
For >100 To 250, Deduct	-0.29	
For >250 To 500, Deduct	-0.43	
For >500 To 1,000, Deduct	-0.67	
For >1,000, Deduct	-0.90	
For 316 Stainless Steel, Add	5.57	
For Aluminum, Add	0.31	
For Galvanized Steel, Add	1.08	
For 304 Stainless Steel, Add	4.96	
For High Strength Steel (HSS), Add	1.12	
05 12 23 00-0136 LF 2-1/2" x 2" x 3/16" Angle Iron.....	6.11	3.11
For >100 To 250, Deduct	-0.31	
For >250 To 500, Deduct	-0.46	
For >500 To 1,000, Deduct	-0.72	
For >1,000, Deduct	-0.98	
For 316 Stainless Steel, Add	6.27	
For Aluminum, Add	0.35	
For Galvanized Steel, Add	1.22	
For 304 Stainless Steel, Add	5.59	
For High Strength Steel (HSS), Add	1.22	
05 12 23 00-0137 LF 2-1/2" x 2-1/2" x 3/16" Angle Iron.....	6.65	3.33
For >100 To 250, Deduct	-0.33	
For >250 To 500, Deduct	-0.50	
For >500 To 1,000, Deduct	-0.78	
For >1,000, Deduct	-1.06	
For 316 Stainless Steel, Add	7.04	
For Aluminum, Add	0.40	
For Galvanized Steel, Add	1.36	
For 304 Stainless Steel, Add	6.27	
For High Strength Steel (HSS), Add	1.33	
05 12 23 00-0138 LF 3" x 2" x 3/16" Angle Iron.....	6.64	3.33
For >100 To 250, Deduct	-0.33	
For >250 To 500, Deduct	-0.50	
For >500 To 1,000, Deduct	-0.78	
For >1,000, Deduct	-1.05	
For 316 Stainless Steel, Add	7.01	
For Aluminum, Add	0.39	
For Galvanized Steel, Add	1.36	
For 304 Stainless Steel, Add	6.24	
For High Strength Steel (HSS), Add	1.33	

05 Metals**05 10 Structural Metal Framing****05 12 Structural Steel Framing**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 12 23 00-0139	LF		3" x 2-1/2" x 3/16" Angle Iron.....	7.33	3.68
			<i>For >100 To 250, Deduct</i>	-0.37	
			<i>For >250 To 500, Deduct</i>	-0.55	
			<i>For >500 To 1,000, Deduct</i>	-0.86	
			<i>For >1,000, Deduct</i>	-1.16	
			<i>For 316 Stainless Steel, Add</i>	7.74	
			<i>For Aluminum, Add</i>	0.44	
			<i>For Galvanized Steel, Add</i>	1.50	
			<i>For 304 Stainless Steel, Add</i>	6.90	
			<i>For High Strength Steel (HSS), Add</i>	1.47	
05 12 23 00-0140	LF		3" x 3" x 3/16" Angle Iron.....	8.02	4.03
			<i>For >100 To 250, Deduct</i>	-0.40	
			<i>For >250 To 500, Deduct</i>	-0.60	
			<i>For >500 To 1,000, Deduct</i>	-0.94	
			<i>For >1,000, Deduct</i>	-1.27	
			<i>For 316 Stainless Steel, Add</i>	8.48	
			<i>For Aluminum, Add</i>	0.48	
			<i>For Galvanized Steel, Add</i>	1.64	
			<i>For 304 Stainless Steel, Add</i>	7.55	
			<i>For High Strength Steel (HSS), Add</i>	1.60	
05 12 23 00-0141			1/4" Thick (05 12 23 00-0120)		
05 12 23 00-0142	LF		1-1/2" x 1" x 1/4" Angle Iron.....	4.91	2.68
			<i>For >100 To 250, Deduct</i>	-0.27	
			<i>For >250 To 500, Deduct</i>	-0.39	
			<i>For >500 To 1,000, Deduct</i>	-0.60	
			<i>For >1,000, Deduct</i>	-0.81	
			<i>For 316 Stainless Steel, Add</i>	4.32	
			<i>For Aluminum, Add</i>	0.24	
			<i>For Galvanized Steel, Add</i>	0.84	
			<i>For 304 Stainless Steel, Add</i>	3.85	
			<i>For High Strength Steel (HSS), Add</i>	0.98	
05 12 23 00-0143	LF		1-1/2" x 1-1/2" x 1/4" Angle Iron.....	5.46	2.86
			<i>For >100 To 250, Deduct</i>	-0.29	
			<i>For >250 To 500, Deduct</i>	-0.42	
			<i>For >500 To 1,000, Deduct</i>	-0.65	
			<i>For >1,000, Deduct</i>	-0.89	
			<i>For 316 Stainless Steel, Add</i>	5.28	
			<i>For Aluminum, Add</i>	0.30	
			<i>For Galvanized Steel, Add</i>	1.02	
			<i>For 304 Stainless Steel, Add</i>	4.70	
			<i>For High Strength Steel (HSS), Add</i>	1.09	
05 12 23 00-0144	LF		2" x 2" x 1/4" Angle Iron.....	6.34	3.05
			<i>For >100 To 250, Deduct</i>	-0.31	
			<i>For >250 To 500, Deduct</i>	-0.46	
			<i>For >500 To 1,000, Deduct</i>	-0.72	
			<i>For >1,000, Deduct</i>	-0.98	
			<i>For 316 Stainless Steel, Add</i>	7.26	
			<i>For Aluminum, Add</i>	0.41	
			<i>For Galvanized Steel, Add</i>	1.41	
			<i>For 304 Stainless Steel, Add</i>	6.47	
			<i>For High Strength Steel (HSS), Add</i>	1.27	
05 12 23 00-0145	LF		2-1/2" x 2" x 1/4" Angle Iron.....	7.09	3.38
			<i>For >100 To 250, Deduct</i>	-0.34	
			<i>For >250 To 500, Deduct</i>	-0.52	
			<i>For >500 To 1,000, Deduct</i>	-0.81	
			<i>For >1,000, Deduct</i>	-1.10	
			<i>For 316 Stainless Steel, Add</i>	8.26	
			<i>For Aluminum, Add</i>	0.46	
			<i>For Galvanized Steel, Add</i>	1.60	
			<i>For 304 Stainless Steel, Add</i>	7.35	
			<i>For High Strength Steel (HSS), Add</i>	1.42	
05 12 23 00-0146	LF		2-1/2" x 2-1/2" x 1/4" Angle Iron.....	7.86	3.70
			<i>For >100 To 250, Deduct</i>	-0.37	
			<i>For >250 To 500, Deduct</i>	-0.57	
			<i>For >500 To 1,000, Deduct</i>	-0.89	
			<i>For >1,000, Deduct</i>	-1.21	
			<i>For 316 Stainless Steel, Add</i>	9.34	
			<i>For Aluminum, Add</i>	0.53	
			<i>For Galvanized Steel, Add</i>	1.81	
			<i>For 304 Stainless Steel, Add</i>	8.32	
			<i>For High Strength Steel (HSS), Add</i>	1.57	
05 12 23 00-0147	LF		3" x 2" x 1/4" Angle Iron.....	7.86	3.70
			<i>For >100 To 250, Deduct</i>	-0.37	
			<i>For >250 To 500, Deduct</i>	-0.57	
			<i>For >500 To 1,000, Deduct</i>	-0.89	
			<i>For >1,000, Deduct</i>	-1.21	
			<i>For 316 Stainless Steel, Add</i>	9.34	
			<i>For Aluminum, Add</i>	0.53	
			<i>For Galvanized Steel, Add</i>	1.81	
			<i>For 304 Stainless Steel, Add</i>	8.32	
			<i>For High Strength Steel (HSS), Add</i>	1.57	



Metals	05	05
Structural Metal Framing	05 10	
Structural Steel Framing	05 12	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 12 23 00-0148	LF		3" x 2-1/2" x 1/4" Angle Iron.....	8.70	4.12
			<i>For >100 To 250, Deduct</i>	-0.41	
			<i>For >250 To 500, Deduct</i>	-0.63	
			<i>For >500 To 1,000, Deduct</i>	-0.98	
			<i>For >1,000, Deduct</i>	-1.34	
			<i>For 316 Stainless Steel, Add</i>	10.27	
			<i>For Aluminum, Add</i>	0.58	
			<i>For Galvanized Steel, Add</i>	1.99	
			<i>For 304 Stainless Steel, Add</i>	9.15	
			<i>For High Strength Steel (HSS), Add</i>	1.74	
05 12 23 00-0149	LF		3" x 3" x 1/4" Angle Iron.....	9.52	4.52
			<i>For >100 To 250, Deduct</i>	-0.45	
			<i>For >250 To 500, Deduct</i>	-0.69	
			<i>For >500 To 1,000, Deduct</i>	-1.08	
			<i>For >1,000, Deduct</i>	-1.47	
			<i>For 316 Stainless Steel, Add</i>	11.17	
			<i>For Aluminum, Add</i>	0.63	
			<i>For Galvanized Steel, Add</i>	2.16	
			<i>For 304 Stainless Steel, Add</i>	9.95	
			<i>For High Strength Steel (HSS), Add</i>	1.90	
05 12 23 00-0150	LF		3-1/2" x 3" x 1/4" Angle Iron.....	10.32	4.86
			<i>For >100 To 250, Deduct</i>	-0.49	
			<i>For >250 To 500, Deduct</i>	-0.74	
			<i>For >500 To 1,000, Deduct</i>	-1.16	
			<i>For >1,000, Deduct</i>	-1.58	
			<i>For 316 Stainless Steel, Add</i>	12.29	
			<i>For Aluminum, Add</i>	0.69	
			<i>For Galvanized Steel, Add</i>	2.38	
			<i>For 304 Stainless Steel, Add</i>	10.94	
			<i>For High Strength Steel (HSS), Add</i>	2.06	
05 12 23 00-0151	LF		3-1/2" x 3-1/2" x 1/4" Angle Iron.....	10.90	0.50
			<i>For >100 To 250, Deduct</i>	-0.51	
			<i>For >250 To 500, Deduct</i>	-0.78	
			<i>For >500 To 1,000, Deduct</i>	-1.22	
			<i>For >1,000, Deduct</i>	-1.66	
			<i>For 316 Stainless Steel, Add</i>	13.25	
			<i>For Aluminum, Add</i>	0.75	
			<i>For Galvanized Steel, Add</i>	2.57	
			<i>For 304 Stainless Steel, Add</i>	11.80	
			<i>For High Strength Steel (HSS), Add</i>	2.18	
05 12 23 00-0152	LF		4" x 3" x 1/4" Angle Iron.....	10.90	5.07
			<i>For >100 To 250, Deduct</i>	-0.51	
			<i>For >250 To 500, Deduct</i>	-0.78	
			<i>For >500 To 1,000, Deduct</i>	-1.22	
			<i>For >1,000, Deduct</i>	-1.66	
			<i>For 316 Stainless Steel, Add</i>	13.25	
			<i>For Aluminum, Add</i>	0.75	
			<i>For Galvanized Steel, Add</i>	2.57	
			<i>For 304 Stainless Steel, Add</i>	11.80	
			<i>For High Strength Steel (HSS), Add</i>	2.18	
05 12 23 00-0153	LF		4" x 3-1/2" x 1/4" Angle Iron.....	11.46	5.28
			<i>For >100 To 250, Deduct</i>	-0.53	
			<i>For >250 To 500, Deduct</i>	-0.82	
			<i>For >500 To 1,000, Deduct</i>	-1.28	
			<i>For >1,000, Deduct</i>	-1.74	
			<i>For 316 Stainless Steel, Add</i>	14.11	
			<i>For Aluminum, Add</i>	0.79	
			<i>For Galvanized Steel, Add</i>	2.73	
			<i>For 304 Stainless Steel, Add</i>	12.57	
			<i>For High Strength Steel (HSS), Add</i>	2.29	
05 12 23 00-0154	LF		4" x 4" x 1/4" Angle Iron.....	12.06	5.52
			<i>For >100 To 250, Deduct</i>	-0.55	
			<i>For >250 To 500, Deduct</i>	-0.85	
			<i>For >500 To 1,000, Deduct</i>	-1.34	
			<i>For >1,000, Deduct</i>	-1.82	
			<i>For 316 Stainless Steel, Add</i>	15.07	
			<i>For Aluminum, Add</i>	0.85	
			<i>For Galvanized Steel, Add</i>	2.92	
			<i>For 304 Stainless Steel, Add</i>	13.42	
			<i>For High Strength Steel (HSS), Add</i>	2.41	
05 12 23 00-0155	LF		5" x 3" x 1/4" Angle Iron.....	12.06	5.52
			<i>For >100 To 250, Deduct</i>	-0.55	
			<i>For >250 To 500, Deduct</i>	-0.85	
			<i>For >500 To 1,000, Deduct</i>	-1.34	
			<i>For >1,000, Deduct</i>	-1.82	
			<i>For 316 Stainless Steel, Add</i>	15.07	
			<i>For Aluminum, Add</i>	0.85	
			<i>For Galvanized Steel, Add</i>	2.92	
			<i>For 304 Stainless Steel, Add</i>	13.42	
			<i>For High Strength Steel (HSS), Add</i>	2.41	

05 Metals**05 10 Structural Metal Framing****05 12 Structural Steel Framing**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 12 23 00-0156	LF		5" x 3-1/2" x 1/4" Angle Iron	12.73	5.81
			<i>For >100 To 250, Deduct</i>	-0.58	
			<i>For >250 To 500, Deduct</i>	-0.90	
			<i>For >500 To 1,000, Deduct</i>	-1.41	
			<i>For >1,000, Deduct</i>	-1.92	
			<i>For 316 Stainless Steel, Add</i>	15.94	
			<i>For Aluminum, Add</i>	0.90	
			<i>For Galvanized Steel, Add</i>	3.09	
			<i>For 304 Stainless Steel, Add</i>	14.19	
			<i>For High Strength Steel (HSS), Add</i>	2.55	
05 12 23 00-0157			5/16" Thick <small>(05 12 23 00-0120)</small>		
05 12 23 00-0158	LF		2-1/2" x 2" x 5/16" Angle Iron	8.44	3.93
			<i>For >100 To 250, Deduct</i>	-0.39	
			<i>For >250 To 500, Deduct</i>	-0.60	
			<i>For >500 To 1,000, Deduct</i>	-0.95	
			<i>For >1,000, Deduct</i>	-1.29	
			<i>For 316 Stainless Steel, Add</i>	10.27	
			<i>For Aluminum, Add</i>	0.58	
			<i>For Galvanized Steel, Add</i>	1.99	
			<i>For 304 Stainless Steel, Add</i>	9.15	
			<i>For High Strength Steel (HSS), Add</i>	1.69	
05 12 23 00-0159	LF		2-1/2" x 2-1/2" x 5/16" Angle Iron	9.13	4.17
			<i>For >100 To 250, Deduct</i>	-0.42	
			<i>For >250 To 500, Deduct</i>	-0.65	
			<i>For >500 To 1,000, Deduct</i>	-1.01	
			<i>For >1,000, Deduct</i>	-1.38	
			<i>For 316 Stainless Steel, Add</i>	11.42	
			<i>For Aluminum, Add</i>	0.64	
			<i>For Galvanized Steel, Add</i>	2.21	
			<i>For 304 Stainless Steel, Add</i>	10.17	
			<i>For High Strength Steel (HSS), Add</i>	1.83	
05 12 23 00-0160	LF		3" x 2" x 5/16" Angle Iron	9.13	4.17
			<i>For >100 To 250, Deduct</i>	-0.42	
			<i>For >250 To 500, Deduct</i>	-0.65	
			<i>For >500 To 1,000, Deduct</i>	-1.01	
			<i>For >1,000, Deduct</i>	-1.38	
			<i>For 316 Stainless Steel, Add</i>	11.42	
			<i>For Aluminum, Add</i>	0.64	
			<i>For Galvanized Steel, Add</i>	2.21	
			<i>For 304 Stainless Steel, Add</i>	10.17	
			<i>For High Strength Steel (HSS), Add</i>	1.83	
05 12 23 00-0161	LF		3" x 2-1/2" x 5/16" Angle Iron	10.09	4.57
			<i>For >100 To 250, Deduct</i>	-0.46	
			<i>For >250 To 500, Deduct</i>	-0.71	
			<i>For >500 To 1,000, Deduct</i>	-1.11	
			<i>For >1,000, Deduct</i>	-1.52	
			<i>For 316 Stainless Steel, Add</i>	12.80	
			<i>For Aluminum, Add</i>	0.72	
			<i>For Galvanized Steel, Add</i>	2.48	
			<i>For 304 Stainless Steel, Add</i>	11.40	
			<i>For High Strength Steel (HSS), Add</i>	2.02	
05 12 23 00-0162	LF		3" x 3" x 5/16" Angle Iron	10.96	4.96
			<i>For >100 To 250, Deduct</i>	-0.50	
			<i>For >250 To 500, Deduct</i>	-0.77	
			<i>For >500 To 1,000, Deduct</i>	-1.21	
			<i>For >1,000, Deduct</i>	-1.65	
			<i>For 316 Stainless Steel, Add</i>	13.92	
			<i>For Aluminum, Add</i>	0.78	
			<i>For Galvanized Steel, Add</i>	2.70	
			<i>For 304 Stainless Steel, Add</i>	12.40	
			<i>For High Strength Steel (HSS), Add</i>	2.19	
05 12 23 00-0163	LF		3-1/2" x 3" x 5/16" Angle Iron	11.66	5.21
			<i>For >100 To 250, Deduct</i>	-0.52	
			<i>For >250 To 500, Deduct</i>	-0.81	
			<i>For >500 To 1,000, Deduct</i>	-1.28	
			<i>For >1,000, Deduct</i>	-1.74	
			<i>For 316 Stainless Steel, Add</i>	15.07	
			<i>For Aluminum, Add</i>	0.85	
			<i>For Galvanized Steel, Add</i>	2.92	
			<i>For 304 Stainless Steel, Add</i>	13.42	
			<i>For High Strength Steel (HSS), Add</i>	2.33	
05 12 23 00-0164	LF		3-1/2" x 3-1/2" x 5/16" Angle Iron	12.42	5.48
			<i>For >100 To 250, Deduct</i>	-0.55	
			<i>For >250 To 500, Deduct</i>	-0.86	
			<i>For >500 To 1,000, Deduct</i>	-1.35	
			<i>For >1,000, Deduct</i>	-1.84	
			<i>For 316 Stainless Steel, Add</i>	16.38	
			<i>For Aluminum, Add</i>	0.92	
			<i>For Galvanized Steel, Add</i>	3.17	
			<i>For 304 Stainless Steel, Add</i>	14.59	
			<i>For High Strength Steel (HSS), Add</i>	2.48	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 12 23 00-0165 LF 4" x 3" x 5/16" Angle Iron.....	12.42	5.48
For >100 To 250, Deduct	-0.55	
For >250 To 500, Deduct	-0.86	
For >500 To 1,000, Deduct	-1.35	
For >1,000, Deduct	-1.84	
For 316 Stainless Steel, Add	16.38	
For Aluminum, Add	0.92	
For Galvanized Steel, Add	3.17	
For 304 Stainless Steel, Add	14.59	
For High Strength Steel (HSS), Add	2.48	
05 12 23 00-0166 LF 4" x 3-1/2" x 5/16" Angle Iron.....	13.19	5.79
For >100 To 250, Deduct	-0.58	
For >250 To 500, Deduct	-0.91	
For >500 To 1,000, Deduct	-1.43	
For >1,000, Deduct	-1.95	
For 316 Stainless Steel, Add	17.54	
For Aluminum, Add	0.99	
For Galvanized Steel, Add	3.40	
For 304 Stainless Steel, Add	15.62	
For High Strength Steel (HSS), Add	2.64	
05 12 23 00-0167 LF 4" x 4" x 5/16" Angle Iron.....	13.90	6.04
For >100 To 250, Deduct	-0.60	
For >250 To 500, Deduct	-0.95	
For >500 To 1,000, Deduct	-1.50	
For >1,000, Deduct	-2.05	
For 316 Stainless Steel, Add	18.72	
For Aluminum, Add	1.05	
For Galvanized Steel, Add	3.63	
For 304 Stainless Steel, Add	16.67	
For High Strength Steel (HSS), Add	2.78	
05 12 23 00-0168 LF 5" x 3" x 5/16" Angle Iron.....	13.90	6.04
For >100 To 250, Deduct	-0.60	
For >250 To 500, Deduct	-0.95	
For >500 To 1,000, Deduct	-1.50	
For >1,000, Deduct	-2.05	
For 316 Stainless Steel, Add	18.72	
For Aluminum, Add	1.05	
For Galvanized Steel, Add	3.63	
For 304 Stainless Steel, Add	16.67	
For High Strength Steel (HSS), Add	2.78	
05 12 23 00-0169 LF 5" x 3-1/2" x 5/16" Angle Iron.....	14.58	6.29
For >100 To 250, Deduct	-0.63	
For >250 To 500, Deduct	-0.99	
For >500 To 1,000, Deduct	-1.57	
For >1,000, Deduct	-2.14	
For 316 Stainless Steel, Add	19.81	
For Aluminum, Add	1.11	
For Galvanized Steel, Add	3.84	
For 304 Stainless Steel, Add	17.64	
For High Strength Steel (HSS), Add	2.92	
05 12 23 00-0170 LF 5" x 5" x 5/16" Angle Iron.....	16.10	6.56
For >100 To 250, Deduct	-0.66	
For >250 To 500, Deduct	-1.06	
For >500 To 1,000, Deduct	-1.68	
For >1,000, Deduct	-2.30	
For 316 Stainless Steel, Add	23.52	
For Aluminum, Add	1.32	
For Galvanized Steel, Add	4.56	
For 304 Stainless Steel, Add	20.95	
For High Strength Steel (HSS), Add	3.22	
05 12 23 00-0171 LF 6" x 3-1/2" x 5/16" Angle Iron.....	16.08	6.83
For >100 To 250, Deduct	-0.68	
For >250 To 500, Deduct	-1.09	
For >500 To 1,000, Deduct	-1.72	
For >1,000, Deduct	-2.34	
For 316 Stainless Steel, Add	22.30	
For Aluminum, Add	1.25	
For Galvanized Steel, Add	4.32	
For 304 Stainless Steel, Add	19.86	
For High Strength Steel (HSS), Add	3.22	
05 12 23 00-0172 3/8" Thick <small>(05 12 23 00-0120)</small>		
05 12 23 00-0173 LF 3" x 2" x 3/8" Angle Iron.....	10.01	4.36
For >100 To 250, Deduct	-0.44	
For >250 To 500, Deduct	-0.69	
For >500 To 1,000, Deduct	-1.08	
For >1,000, Deduct	-1.48	
For 316 Stainless Steel, Add	13.44	
For Aluminum, Add	0.76	
For Galvanized Steel, Add	2.60	
For 304 Stainless Steel, Add	11.97	
For High Strength Steel (HSS), Add	2.00	

05 Metals

05 10 Structural Metal Framing

05 12 Structural Steel Framing



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 12 23 00-0174	LF		3" x 2-1/2" x 3/8" Angle Iron	11.00	4.72
			For >100 To 250, Deduct	-0.47	
			For >250 To 500, Deduct	-0.75	
			For >500 To 1,000, Deduct	-1.18	
			For >1,000, Deduct	-1.61	
			For 316 Stainless Steel, Add	15.07	
			For Aluminum, Add	0.85	
			For Galvanized Steel, Add	2.92	
			For 304 Stainless Steel, Add	13.42	
			For High Strength Steel (HSS), Add	2.20	
05 12 23 00-0175	LF		3" x 3" x 3/8" Angle Iron	11.89	5.08
			For >100 To 250, Deduct	-0.51	
			For >250 To 500, Deduct	-0.81	
			For >500 To 1,000, Deduct	-1.27	
			For >1,000, Deduct	-1.74	
			For 316 Stainless Steel, Add	16.38	
			For Aluminum, Add	0.92	
			For Galvanized Steel, Add	3.17	
			For 304 Stainless Steel, Add	14.59	
			For High Strength Steel (HSS), Add	2.38	
05 12 23 00-0176	LF		3-1/2" x 3" x 3/8" Angle Iron	12.60	5.22
			For >100 To 250, Deduct	-0.52	
			For >250 To 500, Deduct	-0.84	
			For >500 To 1,000, Deduct	-1.33	
			For >1,000, Deduct	-1.82	
			For 316 Stainless Steel, Add	18.05	
			For Aluminum, Add	1.02	
			For Galvanized Steel, Add	3.50	
			For 304 Stainless Steel, Add	16.07	
			For High Strength Steel (HSS), Add	2.52	
05 12 23 00-0177	LF		3-1/2" x 3-1/2" x 3/8" Angle Iron	13.40	5.51
			For >100 To 250, Deduct	-0.55	
			For >250 To 500, Deduct	-0.89	
			For >500 To 1,000, Deduct	-1.41	
			For >1,000, Deduct	-1.92	
			For 316 Stainless Steel, Add	19.36	
			For Aluminum, Add	1.09	
			For Galvanized Steel, Add	3.75	
			For 304 Stainless Steel, Add	17.24	
			For High Strength Steel (HSS), Add	2.68	
05 12 23 00-0178	LF		4" x 3" x 3/8" Angle Iron	13.40	5.51
			For >100 To 250, Deduct	-0.55	
			For >250 To 500, Deduct	-0.89	
			For >500 To 1,000, Deduct	-1.41	
			For >1,000, Deduct	-1.92	
			For 316 Stainless Steel, Add	19.36	
			For Aluminum, Add	1.09	
			For Galvanized Steel, Add	3.75	
			For 304 Stainless Steel, Add	17.24	
			For High Strength Steel (HSS), Add	2.68	
05 12 23 00-0179	LF		4" x 3-1/2" x 3/8" Angle Iron	14.48	6.00
			For >100 To 250, Deduct	-0.60	
			For >250 To 500, Deduct	-0.96	
			For >500 To 1,000, Deduct	-1.52	
			For >1,000, Deduct	-2.09	
			For 316 Stainless Steel, Add	20.74	
			For Aluminum, Add	1.17	
			For Galvanized Steel, Add	4.02	
			For 304 Stainless Steel, Add	18.47	
			For High Strength Steel (HSS), Add	2.90	
05 12 23 00-0180	LF		4" x 4" x 3/8" Angle Iron	15.20	6.18
			For >100 To 250, Deduct	-0.62	
			For >250 To 500, Deduct	-1.00	
			For >500 To 1,000, Deduct	-1.58	
			For >1,000, Deduct	-2.17	
			For 316 Stainless Steel, Add	22.30	
			For Aluminum, Add	1.25	
			For Galvanized Steel, Add	4.32	
			For 304 Stainless Steel, Add	19.86	
			For High Strength Steel (HSS), Add	3.04	
05 12 23 00-0181	LF		5" x 3" x 3/8" Angle Iron	15.54	6.42
			For >100 To 250, Deduct	-0.64	
			For >250 To 500, Deduct	-1.03	
			For >500 To 1,000, Deduct	-1.63	
			For >1,000, Deduct	-2.24	
			For 316 Stainless Steel, Add	22.30	
			For Aluminum, Add	1.25	
			For Galvanized Steel, Add	4.32	
			For 304 Stainless Steel, Add	19.86	
			For High Strength Steel (HSS), Add	3.11	



Metals	05	05
Structural Metal Framing	05 10	
Structural Steel Framing	05 12	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 12 23 00-0182	LF		5" x 3-1/2" x 3/8" Angle Iron.....	16.63	6.92
			<i>For >100 To 250, Deduct</i>	-0.69	
			<i>For >250 To 500, Deduct</i>	-1.11	
			<i>For >500 To 1,000, Deduct</i>	-1.75	
			<i>For >1,000, Deduct</i>	-2.40	
			<i>For 316 Stainless Steel, Add</i>	23.68	
			<i>For Aluminum, Add</i>	1.33	
			<i>For Galvanized Steel, Add</i>	4.59	
			<i>For 304 Stainless Steel, Add</i>	21.09	
			<i>For High Strength Steel (HSS), Add</i>	3.33	
05 12 23 00-0183	LF		5" x 5" x 3/8" Angle Iron.....	19.54	8.06
			<i>For >100 To 250, Deduct</i>	-0.81	
			<i>For >250 To 500, Deduct</i>	-1.30	
			<i>For >500 To 1,000, Deduct</i>	-2.05	
			<i>For >1,000, Deduct</i>	-2.81	
			<i>For 316 Stainless Steel, Add</i>	28.10	
			<i>For Aluminum, Add</i>	1.58	
			<i>For Galvanized Steel, Add</i>	5.44	
			<i>For 304 Stainless Steel, Add</i>	25.02	
			<i>For High Strength Steel (HSS), Add</i>	3.91	
05 12 23 00-0184	LF		6" x 3-1/2" x 3/8" Angle Iron.....	18.32	7.50
			<i>For >100 To 250, Deduct</i>	-0.75	
			<i>For >250 To 500, Deduct</i>	-1.21	
			<i>For >500 To 1,000, Deduct</i>	-1.92	
			<i>For >1,000, Deduct</i>	-2.62	
			<i>For 316 Stainless Steel, Add</i>	26.66	
			<i>For Aluminum, Add</i>	1.50	
			<i>For Galvanized Steel, Add</i>	5.16	
			<i>For 304 Stainless Steel, Add</i>	23.74	
			<i>For High Strength Steel (HSS), Add</i>	3.66	
05 12 23 00-0185	LF		6" x 4" x 3/8" Angle Iron.....	19.54	8.06
			<i>For >100 To 250, Deduct</i>	-0.81	
			<i>For >250 To 500, Deduct</i>	-1.30	
			<i>For >500 To 1,000, Deduct</i>	-2.05	
			<i>For >1,000, Deduct</i>	-2.81	
			<i>For 316 Stainless Steel, Add</i>	28.10	
			<i>For Aluminum, Add</i>	1.58	
			<i>For Galvanized Steel, Add</i>	5.44	
			<i>For 304 Stainless Steel, Add</i>	25.02	
			<i>For High Strength Steel (HSS), Add</i>	3.91	
05 12 23 00-0186	LF		6" x 6" x 3/8" Angle Iron.....	23.53	9.68
			<i>For >100 To 250, Deduct</i>	-0.97	
			<i>For >250 To 500, Deduct</i>	-1.56	
			<i>For >500 To 1,000, Deduct</i>	-2.47	
			<i>For >1,000, Deduct</i>	-3.38	
			<i>For 316 Stainless Steel, Add</i>	34.02	
			<i>For Aluminum, Add</i>	1.91	
			<i>For Galvanized Steel, Add</i>	6.59	
			<i>For 304 Stainless Steel, Add</i>	30.30	
			<i>For High Strength Steel (HSS), Add</i>	4.71	
05 12 23 00-0187	LF		7" x 4" x 3/8" Angle Iron.....	21.54	8.88
			<i>For >100 To 250, Deduct</i>	-0.89	
			<i>For >250 To 500, Deduct</i>	-1.43	
			<i>For >500 To 1,000, Deduct</i>	-2.26	
			<i>For >1,000, Deduct</i>	-3.10	
			<i>For 316 Stainless Steel, Add</i>	31.04	
			<i>For Aluminum, Add</i>	1.75	
			<i>For Galvanized Steel, Add</i>	6.01	
			<i>For 304 Stainless Steel, Add</i>	27.65	
			<i>For High Strength Steel (HSS), Add</i>	4.31	
05 12 23 00-0188			1/2" Thick <small>(05 12 23 00-0120)</small>		
05 12 23 00-0189	LF		3" x 3" x 1/2" Angle Iron.....	13.63	5.19
			<i>For >100 To 250, Deduct</i>	-0.52	
			<i>For >250 To 500, Deduct</i>	-0.86	
			<i>For >500 To 1,000, Deduct</i>	-1.37	
			<i>For >1,000, Deduct</i>	-1.89	
			<i>For 316 Stainless Steel, Add</i>	21.47	
			<i>For Aluminum, Add</i>	1.21	
			<i>For Galvanized Steel, Add</i>	4.16	
			<i>For 304 Stainless Steel, Add</i>	19.12	
			<i>For High Strength Steel (HSS), Add</i>	2.73	
05 12 23 00-0190	LF		4" x 3" x 1/2" Angle Iron.....	16.10	6.13
			<i>For >100 To 250, Deduct</i>	-0.61	
			<i>For >250 To 500, Deduct</i>	-1.02	
			<i>For >500 To 1,000, Deduct</i>	-1.62	
			<i>For >1,000, Deduct</i>	-2.23	
			<i>For 316 Stainless Steel, Add</i>	25.34	
			<i>For Aluminum, Add</i>	1.43	
			<i>For Galvanized Steel, Add</i>	4.91	
			<i>For 304 Stainless Steel, Add</i>	22.57	
			<i>For High Strength Steel (HSS), Add</i>	3.22	

05 Metals**05 10 Structural Metal Framing****05 12 Structural Steel Framing**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 12 23 00-0191	LF		4" x 3-1/2" x 1/2" Angle Iron	17.26	6.57
			<i>For >100 To 250, Deduct</i>	-0.66	
			<i>For >250 To 500, Deduct</i>	-1.09	
			<i>For >500 To 1,000, Deduct</i>	-1.74	
			<i>For >1,000, Deduct</i>	-2.39	
			<i>For 316 Stainless Steel, Add</i>	27.17	
			<i>For Aluminum, Add</i>	1.53	
			<i>For Galvanized Steel, Add</i>	5.26	
			<i>For 304 Stainless Steel, Add</i>	24.20	
			<i>For High Strength Steel (HSS), Add</i>	3.45	
05 12 23 00-0192	LF		4" x 4" x 1/2" Angle Iron	18.56	7.08
			<i>For >100 To 250, Deduct</i>	-0.71	
			<i>For >250 To 500, Deduct</i>	-1.17	
			<i>For >500 To 1,000, Deduct</i>	-1.87	
			<i>For >1,000, Deduct</i>	-2.57	
			<i>For 316 Stainless Steel, Add</i>	29.22	
			<i>For Aluminum, Add</i>	1.64	
			<i>For Galvanized Steel, Add</i>	5.66	
			<i>For 304 Stainless Steel, Add</i>	26.02	
			<i>For High Strength Steel (HSS), Add</i>	3.71	
05 12 23 00-0193	LF		5" x 3" x 1/2" Angle Iron	18.56	7.08
			<i>For >100 To 250, Deduct</i>	-0.71	
			<i>For >250 To 500, Deduct</i>	-1.17	
			<i>For >500 To 1,000, Deduct</i>	-1.87	
			<i>For >1,000, Deduct</i>	-2.57	
			<i>For 316 Stainless Steel, Add</i>	29.22	
			<i>For Aluminum, Add</i>	1.64	
			<i>For Galvanized Steel, Add</i>	5.66	
			<i>For 304 Stainless Steel, Add</i>	26.02	
			<i>For High Strength Steel (HSS), Add</i>	3.71	
05 12 23 00-0194	LF		5" x 3-1/2" x 1/2" Angle Iron	19.71	7.52
			<i>For >100 To 250, Deduct</i>	-0.75	
			<i>For >250 To 500, Deduct</i>	-1.24	
			<i>For >500 To 1,000, Deduct</i>	-1.99	
			<i>For >1,000, Deduct</i>	-2.73	
			<i>For 316 Stainless Steel, Add</i>	31.04	
			<i>For Aluminum, Add</i>	1.75	
			<i>For Galvanized Steel, Add</i>	6.01	
			<i>For 304 Stainless Steel, Add</i>	27.65	
			<i>For High Strength Steel (HSS), Add</i>	3.94	
05 12 23 00-0195	LF		5" x 5" x 1/2" Angle Iron	23.50	8.95
			<i>For >100 To 250, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-1.48	
			<i>For >500 To 1,000, Deduct</i>	-2.37	
			<i>For >1,000, Deduct</i>	-3.26	
			<i>For 316 Stainless Steel, Add</i>	36.99	
			<i>For Aluminum, Add</i>	2.08	
			<i>For Galvanized Steel, Add</i>	7.17	
			<i>For 304 Stainless Steel, Add</i>	32.95	
			<i>For High Strength Steel (HSS), Add</i>	4.70	
05 12 23 00-0196	LF		6" x 4" x 1/2" Angle Iron	23.50	8.95
			<i>For >100 To 250, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-1.48	
			<i>For >500 To 1,000, Deduct</i>	-2.37	
			<i>For >1,000, Deduct</i>	-3.26	
			<i>For 316 Stainless Steel, Add</i>	36.99	
			<i>For Aluminum, Add</i>	2.08	
			<i>For Galvanized Steel, Add</i>	7.17	
			<i>For 304 Stainless Steel, Add</i>	32.95	
			<i>For High Strength Steel (HSS), Add</i>	4.70	
05 12 23 00-0197	LF		6" x 6" x 1/2" Angle Iron	28.42	10.83
			<i>For >100 To 250, Deduct</i>	-1.08	
			<i>For >250 To 500, Deduct</i>	-1.79	
			<i>For >500 To 1,000, Deduct</i>	-2.87	
			<i>For >1,000, Deduct</i>	-3.94	
			<i>For 316 Stainless Steel, Add</i>	44.74	
			<i>For Aluminum, Add</i>	2.52	
			<i>For Galvanized Steel, Add</i>	8.67	
			<i>For 304 Stainless Steel, Add</i>	39.84	
			<i>For High Strength Steel (HSS), Add</i>	5.68	
05 12 23 00-0198	LF		7" x 4" x 1/2" Angle Iron	25.96	9.89
			<i>For >100 To 250, Deduct</i>	-0.99	
			<i>For >250 To 500, Deduct</i>	-1.64	
			<i>For >500 To 1,000, Deduct</i>	-2.62	
			<i>For >1,000, Deduct</i>	-3.60	
			<i>For 316 Stainless Steel, Add</i>	40.86	
			<i>For Aluminum, Add</i>	2.30	
			<i>For Galvanized Steel, Add</i>	7.92	
			<i>For 304 Stainless Steel, Add</i>	36.39	
			<i>For High Strength Steel (HSS), Add</i>	5.19	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 12 23 00-0199	LF		8" x 4" x 1/2" Angle Iron <i>For >100 To 250, Deduct</i> <i>For >250 To 500, Deduct</i> <i>For >500 To 1,000, Deduct</i> <i>For >1,000, Deduct</i> <i>For 316 Stainless Steel, Add</i> <i>For Aluminum, Add</i> <i>For Galvanized Steel, Add</i> <i>For 304 Stainless Steel, Add</i> <i>For High Strength Steel (HSS), Add</i>	28.42 -1.08 -1.79 -2.87 -3.94 44.74 2.52 8.67 39.84 5.68	10.83
05 12 23 00-0200	LF		8" x 6" x 1/2" Angle Iron <i>For >100 To 250, Deduct</i> <i>For >250 To 500, Deduct</i> <i>For >500 To 1,000, Deduct</i> <i>For >1,000, Deduct</i> <i>For 316 Stainless Steel, Add</i> <i>For Aluminum, Add</i> <i>For Galvanized Steel, Add</i> <i>For 304 Stainless Steel, Add</i> <i>For High Strength Steel (HSS), Add</i>	33.36 -1.27 -2.11 -3.36 -4.62 52.51 2.95 10.17 46.77 6.67	12.71
05 12 23 00-0201	LF		8" x 8" x 1/2" Angle Iron <i>For >100 To 250, Deduct</i> <i>For >250 To 500, Deduct</i> <i>For >500 To 1,000, Deduct</i> <i>For >1,000, Deduct</i> <i>For 316 Stainless Steel, Add</i> <i>For Aluminum, Add</i> <i>For Galvanized Steel, Add</i> <i>For 304 Stainless Steel, Add</i> <i>For High Strength Steel (HSS), Add</i>	38.29 -1.46 -2.42 -3.86 -5.30 60.26 3.39 11.67 53.67 7.66	14.58
05 12 23 00-0202			5/8" Thick <small>(05 12 23 00-0120)</small>		
05 12 23 00-0203	LF		4" x 4" x 5/8" Angle Iron <i>For >100 To 250, Deduct</i> <i>For >250 To 500, Deduct</i> <i>For >500 To 1,000, Deduct</i> <i>For >1,000, Deduct</i> <i>For 316 Stainless Steel, Add</i> <i>For Aluminum, Add</i> <i>For Galvanized Steel, Add</i> <i>For High Strength Steel (HSS), Add</i>	22.01 -0.81 -1.36 -2.18 -3.00 35.84 2.02 6.94 4.40	8.11
05 12 23 00-0204	LF		5" x 3-1/2" x 5/8" Angle Iron <i>For >100 To 250, Deduct</i> <i>For >250 To 500, Deduct</i> <i>For >500 To 1,000, Deduct</i> <i>For >1,000, Deduct</i> <i>For 316 Stainless Steel, Add</i> <i>For Aluminum, Add</i> <i>For Galvanized Steel, Add</i> <i>For High Strength Steel (HSS), Add</i>	23.55 -0.87 -1.46 -2.33 -3.21 38.37 2.16 7.43 4.71	8.68
05 12 23 00-0205	LF		5" x 5" x 5/8" Angle Iron <i>For >100 To 250, Deduct</i> <i>For >250 To 500, Deduct</i> <i>For >500 To 1,000, Deduct</i> <i>For >1,000, Deduct</i> <i>For 316 Stainless Steel, Add</i> <i>For Aluminum, Add</i> <i>For Galvanized Steel, Add</i> <i>For High Strength Steel (HSS), Add</i>	28.04 -1.03 -1.73 -2.78 -3.82 45.66 2.57 8.85 5.61	10.33
05 12 23 00-0206	LF		6" x 4" x 5/8" Angle Iron <i>For >100 To 250, Deduct</i> <i>For >250 To 500, Deduct</i> <i>For >500 To 1,000, Deduct</i> <i>For >1,000, Deduct</i> <i>For 316 Stainless Steel, Add</i> <i>For Aluminum, Add</i> <i>For Galvanized Steel, Add</i> <i>For High Strength Steel (HSS), Add</i>	28.04 -1.03 -1.73 -2.78 -3.82 45.66 2.57 8.85 5.61	10.33
05 12 23 00-0207	LF		6" x 6" x 5/8" Angle Iron <i>For >100 To 250, Deduct</i> <i>For >250 To 500, Deduct</i> <i>For >500 To 1,000, Deduct</i> <i>For >1,000, Deduct</i> <i>For 316 Stainless Steel, Add</i> <i>For Aluminum, Add</i> <i>For Galvanized Steel, Add</i> <i>For High Strength Steel (HSS), Add</i>	33.94 -1.25 -2.10 -3.36 -4.63 55.26 3.11 10.71 6.79	12.50
05 12 23 00-0208	LF		7" x 4" x 5/8" Angle Iron <i>For >100 To 250, Deduct</i> <i>For >250 To 500, Deduct</i> <i>For >500 To 1,000, Deduct</i> <i>For >1,000, Deduct</i> <i>For 316 Stainless Steel, Add</i> <i>For Aluminum, Add</i> <i>For Galvanized Steel, Add</i> <i>For High Strength Steel (HSS), Add</i>	30.99 -1.14 -1.92 -3.07 -4.23 50.46 2.84 9.78 6.20	11.41

05 Metals**05 10 Structural Metal Framing****05 12 Structural Steel Framing**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 12 23 00-0209	LF		8" x 6" x 5/8" Angle Iron	39.96	14.72
			<i>For >100 To 250, Deduct</i>	-1.47	
			<i>For >250 To 500, Deduct</i>	-2.47	
			<i>For >500 To 1,000, Deduct</i>	-3.96	
			<i>For >1,000, Deduct</i>	-5.45	
			<i>For 316 Stainless Steel, Add</i>	65.06	
			<i>For Aluminum, Add</i>	3.66	
			<i>For Galvanized Steel, Add</i>	12.60	
			<i>For High Strength Steel (HSS), Add</i>	7.99	
05 12 23 00-0210	LF		8" x 8" x 5/8" Angle Iron	45.85	16.89
			<i>For >100 To 250, Deduct</i>	-1.69	
			<i>For >250 To 500, Deduct</i>	-2.84	
			<i>For >500 To 1,000, Deduct</i>	-4.54	
			<i>For >1,000, Deduct</i>	-6.25	
			<i>For 316 Stainless Steel, Add</i>	74.66	
			<i>For Aluminum, Add</i>	4.20	
			<i>For Galvanized Steel, Add</i>	14.46	
			<i>For High Strength Steel (HSS), Add</i>	9.17	
05 12 23 00-0211			3/4" Thick <small>(05 12 23 00-0120)</small>		
05 12 23 00-0212	LF		4" x 4" x 3/4" Angle Iron	25.15	8.96
			<i>For >100 To 250, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-1.53	
			<i>For >500 To 1,000, Deduct</i>	-2.45	
			<i>For >1,000, Deduct</i>	-3.38	
			<i>For 316 Stainless Steel, Add</i>	42.24	
			<i>For Aluminum, Add</i>	2.38	
			<i>For Galvanized Steel, Add</i>	8.18	
			<i>For High Strength Steel (HSS), Add</i>	5.03	
05 12 23 00-0213	LF		5" x 3-1/2" x 3/4" Angle Iron	26.90	9.59
			<i>For >100 To 250, Deduct</i>	-0.96	
			<i>For >250 To 500, Deduct</i>	-1.63	
			<i>For >500 To 1,000, Deduct</i>	-2.62	
			<i>For >1,000, Deduct</i>	-3.62	
			<i>For 316 Stainless Steel, Add</i>	45.18	
			<i>For Aluminum, Add</i>	2.54	
			<i>For Galvanized Steel, Add</i>	8.75	
			<i>For High Strength Steel (HSS), Add</i>	5.38	
05 12 23 00-0214	LF		5" x 5" x 3/4" Angle Iron	32.08	11.43
			<i>For >100 To 250, Deduct</i>	-1.14	
			<i>For >250 To 500, Deduct</i>	-1.95	
			<i>For >500 To 1,000, Deduct</i>	-3.13	
			<i>For >1,000, Deduct</i>	-4.31	
			<i>For 316 Stainless Steel, Add</i>	53.89	
			<i>For Aluminum, Add</i>	3.03	
			<i>For Galvanized Steel, Add</i>	10.44	
			<i>For High Strength Steel (HSS), Add</i>	6.42	
05 12 23 00-0215	LF		6" x 4" x 3/4" Angle Iron	32.08	11.43
			<i>For >100 To 250, Deduct</i>	-1.14	
			<i>For >250 To 500, Deduct</i>	-1.95	
			<i>For >500 To 1,000, Deduct</i>	-3.13	
			<i>For >1,000, Deduct</i>	-4.31	
			<i>For 316 Stainless Steel, Add</i>	53.89	
			<i>For Aluminum, Add</i>	3.03	
			<i>For Galvanized Steel, Add</i>	10.44	
			<i>For High Strength Steel (HSS), Add</i>	6.42	
05 12 23 00-0216	LF		6" x 6" x 3/4" Angle Iron	39.00	13.89
			<i>For >100 To 250, Deduct</i>	-1.39	
			<i>For >250 To 500, Deduct</i>	-2.36	
			<i>For >500 To 1,000, Deduct</i>	-3.80	
			<i>For >1,000, Deduct</i>	-5.24	
			<i>For 316 Stainless Steel, Add</i>	65.50	
			<i>For Aluminum, Add</i>	3.68	
			<i>For Galvanized Steel, Add</i>	12.69	
			<i>For High Strength Steel (HSS), Add</i>	7.80	
05 12 23 00-0217	LF		7" x 4" x 3/4" Angle Iron	35.60	12.68
			<i>For >100 To 250, Deduct</i>	-1.27	
			<i>For >250 To 500, Deduct</i>	-2.16	
			<i>For >500 To 1,000, Deduct</i>	-3.47	
			<i>For >1,000, Deduct</i>	-4.78	
			<i>For 316 Stainless Steel, Add</i>	59.81	
			<i>For Aluminum, Add</i>	3.36	
			<i>For Galvanized Steel, Add</i>	11.59	
			<i>For High Strength Steel (HSS), Add</i>	7.12	
05 12 23 00-0218	LF		8" x 4" x 3/4" Angle Iron	39.00	13.89
			<i>For >100 To 250, Deduct</i>	-1.39	
			<i>For >250 To 500, Deduct</i>	-2.36	
			<i>For >500 To 1,000, Deduct</i>	-3.80	
			<i>For >1,000, Deduct</i>	-5.24	
			<i>For 316 Stainless Steel, Add</i>	65.50	
			<i>For Aluminum, Add</i>	3.68	
			<i>For Galvanized Steel, Add</i>	12.69	
			<i>For High Strength Steel (HSS), Add</i>	7.80	



Metals	05	05
Structural Metal Framing	05 10	
Structural Steel Framing	05 12	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 12 23 00-0219 LF 8" x 6" x 3/4" Angle Iron	45.94	16.37
For >100 To 250, Deduct	-1.64	
For >250 To 500, Deduct	-2.79	
For >500 To 1,000, Deduct	-4.48	
For >1,000, Deduct	-6.17	
For 316 Stainless Steel, Add	77.18	
For Aluminum, Add	4.34	
For Galvanized Steel, Add	14.95	
For High Strength Steel (HSS), Add	9.19	
05 12 23 00-0220 LF 8" x 8" x 3/4" Angle Iron	52.87	18.83
For >100 To 250, Deduct	-1.88	
For >250 To 500, Deduct	-3.21	
For >500 To 1,000, Deduct	-5.15	
For >1,000, Deduct	-7.10	
For 316 Stainless Steel, Add	88.83	
For Aluminum, Add	5.00	
For Galvanized Steel, Add	17.21	
For High Strength Steel (HSS), Add	10.57	
05 12 23 00-0221 7/8" Thick <small>(05 12 23 00-0120)</small>		
05 12 23 00-0222 LF 5" x 5" x 7/8" Angle Iron	35.79	12.29
For >100 To 250, Deduct	-1.23	
For >250 To 500, Deduct	-2.12	
For >500 To 1,000, Deduct	-3.43	
For >1,000, Deduct	-4.73	
For 316 Stainless Steel, Add	62.08	
For Aluminum, Add	3.49	
For Galvanized Steel, Add	12.03	
For High Strength Steel (HSS), Add	7.16	
05 12 23 00-0223 LF 6" x 4" x 7/8" Angle Iron	35.79	12.29
For >100 To 250, Deduct	-1.23	
For >250 To 500, Deduct	-2.12	
For >500 To 1,000, Deduct	-3.43	
For >1,000, Deduct	-4.73	
For 316 Stainless Steel, Add	62.08	
For Aluminum, Add	3.49	
For Galvanized Steel, Add	12.03	
For High Strength Steel (HSS), Add	7.16	
05 12 23 00-0224 LF 6" x 6" x 7/8" Angle Iron	43.56	14.96
For >100 To 250, Deduct	-1.50	
For >250 To 500, Deduct	-2.58	
For >500 To 1,000, Deduct	-4.17	
For >1,000, Deduct	-5.76	
For 316 Stainless Steel, Add	75.58	
For Aluminum, Add	4.25	
For Galvanized Steel, Add	14.64	
For High Strength Steel (HSS), Add	8.71	
05 12 23 00-0225 LF 8" x 6" x 7/8" Angle Iron	51.46	17.67
For >100 To 250, Deduct	-1.77	
For >250 To 500, Deduct	-3.05	
For >500 To 1,000, Deduct	-4.93	
For >1,000, Deduct	-6.80	
For 316 Stainless Steel, Add	89.28	
For Aluminum, Add	5.02	
For Galvanized Steel, Add	17.30	
For High Strength Steel (HSS), Add	10.29	
05 12 23 00-0226 LF 8" x 8" x 7/8" Angle Iron	59.22	20.34
For >100 To 250, Deduct	-2.03	
For >250 To 500, Deduct	-3.51	
For >500 To 1,000, Deduct	-5.67	
For >1,000, Deduct	-7.83	
For 316 Stainless Steel, Add	102.72	
For Aluminum, Add	5.78	
For Galvanized Steel, Add	19.90	
For High Strength Steel (HSS), Add	11.84	
05 12 23 00-0227 Bar Channel <small>(05 12 23 00-0119)</small>		
05 12 23 00-0228 LF 1" x 1/2" x 1/8" Thick Bar Channel	3.49	
For 316 Stainless Steel, Add	2.50	
For Aluminum, Add	0.14	
For Galvanized Steel, Add	0.48	
For 304 Stainless Steel, Add	2.22	
For High Strength Steel (HSS), Add	0.70	
05 12 23 00-0229 LF 1-1/4" x 1/2" x 1/8" Thick Bar Channel	3.88	
For 316 Stainless Steel, Add	2.98	
For Aluminum, Add	0.17	
For Galvanized Steel, Add	0.58	
For 304 Stainless Steel, Add	2.65	
For High Strength Steel (HSS), Add	0.78	

05 Metals**05 10 Structural Metal Framing****05 12 Structural Steel Framing**

MINOR		TOTAL DIRECT	DEMOLITION
CSI	UOM DESCRIPTION	UNIT COST	UNIT COST
05 12 23 00-0230	LF 1-1/2" x 1/2" x 1/8" Thick Bar Channel.....	4.22	
	For 316 Stainless Steel, Add	3.30	
	For Aluminum, Add	0.19	
	For Galvanized Steel, Add	0.64	
	For 304 Stainless Steel, Add	2.94	
	For High Strength Steel (HSS), Add	0.84	
05 12 23 00-0231	LF 1-1/2" x 3/4" x 1/8" Thick Bar Channel.....	4.89	
	For 316 Stainless Steel, Add	3.42	
	For Aluminum, Add	0.19	
	For Galvanized Steel, Add	0.66	
	For 304 Stainless Steel, Add	3.05	
	For High Strength Steel (HSS), Add	0.98	
05 12 23 00-0232	LF 2" x 1/2" x 1/8" Thick Bar Channel.....	5.13	
	For 316 Stainless Steel, Add	4.19	
	For Aluminum, Add	0.24	
	For Galvanized Steel, Add	0.81	
	For 304 Stainless Steel, Add	3.73	
05 12 23 00-0233	LF 2" x 1" x 1/8" Thick Bar Channel.....	6.93	
	For 316 Stainless Steel, Add	4.70	
	For Aluminum, Add	0.26	
	For Galvanized Steel, Add	0.91	
	For 304 Stainless Steel, Add	4.19	
05 12 23 00-0234	Channels - C <small>(05 12 23 00-0119)</small>		
05 12 23 00-0235	LF C2 x 1.78 - 2" Wide Channel.....	5.74	3.37
	For >100 To 250, Deduct	-0.34	
	For >250 To 500, Deduct	-0.48	
	For >500 To 1,000, Deduct	-0.74	
	For >1,000, Deduct	-0.99	
	For 316 Stainless Steel, Add	4.00	
	For Aluminum, Add	0.23	
	For Galvanized Steel, Add	0.78	
	For 304 Stainless Steel, Add	3.56	
05 12 23 00-0236	LF C3 x 4.1 - 3" Wide Channel.....	9.37	4.84
	For >100 To 250, Deduct	-0.48	
	For >250 To 500, Deduct	-0.72	
	For >500 To 1,000, Deduct	-1.11	
	For >1,000, Deduct	-1.51	
	For 316 Stainless Steel, Add	9.34	
	For Aluminum, Add	0.53	
	For Galvanized Steel, Add	1.81	
	For 304 Stainless Steel, Add	8.32	
05 12 23 00-0237	LF C3 x 5 - 3" Wide Channel.....	11.44	5.91
	For >100 To 250, Deduct	-0.59	
	For >250 To 500, Deduct	-0.88	
	For >500 To 1,000, Deduct	-1.36	
	For >1,000, Deduct	-1.84	
	For 316 Stainless Steel, Add	11.42	
	For Aluminum, Add	0.64	
	For Galvanized Steel, Add	2.21	
	For 304 Stainless Steel, Add	10.17	
05 12 23 00-0238	LF C3 x 6 - 3" Wide Channel.....	13.73	7.09
	For >100 To 250, Deduct	-0.71	
	For >250 To 500, Deduct	-1.05	
	For >500 To 1,000, Deduct	-1.63	
	For >1,000, Deduct	-2.21	
	For 316 Stainless Steel, Add	13.70	
	For Aluminum, Add	0.77	
	For Galvanized Steel, Add	2.65	
	For 304 Stainless Steel, Add	12.20	
05 12 23 00-0239	LF C4 x 5.4 - 4" Wide Channel.....	11.60	5.81
	For >100 To 250, Deduct	-0.58	
	For >250 To 500, Deduct	-0.87	
	For >500 To 1,000, Deduct	-1.36	
	For >1,000, Deduct	-1.84	
	For 316 Stainless Steel, Add	12.32	
	For Aluminum, Add	0.69	
	For Galvanized Steel, Add	2.39	
	For 304 Stainless Steel, Add	10.97	
05 12 23 00-0240	LF C4 x 7.25 - 4" Wide Channel.....	15.57	7.80
	For >100 To 250, Deduct	-0.78	
	For >250 To 500, Deduct	-1.17	
	For >500 To 1,000, Deduct	-1.82	
	For >1,000, Deduct	-2.47	
	For 316 Stainless Steel, Add	16.54	
	For Aluminum, Add	0.93	
	For Galvanized Steel, Add	3.21	
	For 304 Stainless Steel, Add	14.73	



Metals	05	05
Structural Metal Framing	05 10	
Structural Steel Framing	05 12	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 12 23 00-0241	LF		C5 x 6.7 - 5" Wide Channel	13.82	6.77
			<i>For >100 To 250, Deduct</i>	-0.68	
			<i>For >250 To 500, Deduct</i>	-1.02	
			<i>For >500 To 1,000, Deduct</i>	-1.60	
			<i>For >1,000, Deduct</i>	-2.17	
			<i>For 316 Stainless Steel, Add</i>	15.30	
			<i>For Aluminum, Add</i>	0.86	
			<i>For Galvanized Steel, Add</i>	2.96	
			<i>For 304 Stainless Steel, Add</i>	13.62	
05 12 23 00-0242	LF		C5 x 9 - 5" Wide Channel	18.56	9.11
			<i>For >100 To 250, Deduct</i>	-0.91	
			<i>For >250 To 500, Deduct</i>	-1.37	
			<i>For >500 To 1,000, Deduct</i>	-2.14	
			<i>For >1,000, Deduct</i>	-2.91	
			<i>For 316 Stainless Steel, Add</i>	20.54	
			<i>For Aluminum, Add</i>	1.16	
			<i>For Galvanized Steel, Add</i>	3.98	
			<i>For 304 Stainless Steel, Add</i>	18.30	
05 12 23 00-0243	LF		C6 x 8.2 - 6" Wide Channel	16.70	8.13
			<i>For >100 To 250, Deduct</i>	-0.81	
			<i>For >250 To 500, Deduct</i>	-1.23	
			<i>For >500 To 1,000, Deduct</i>	-1.92	
			<i>For >1,000, Deduct</i>	-2.61	
			<i>For 316 Stainless Steel, Add</i>	18.72	
			<i>For Aluminum, Add</i>	1.05	
			<i>For Galvanized Steel, Add</i>	3.63	
			<i>For 304 Stainless Steel, Add</i>	16.67	
05 12 23 00-0244	LF		C6 x 10.5 - 6" Wide Channel	21.37	10.42
			<i>For >100 To 250, Deduct</i>	-1.04	
			<i>For >250 To 500, Deduct</i>	-1.58	
			<i>For >500 To 1,000, Deduct</i>	-2.46	
			<i>For >1,000, Deduct</i>	-3.34	
			<i>For 316 Stainless Steel, Add</i>	23.97	
			<i>For Aluminum, Add</i>	1.35	
			<i>For Galvanized Steel, Add</i>	4.64	
			<i>For 304 Stainless Steel, Add</i>	21.35	
05 12 23 00-0245	LF		C6 x 13 - 6" Wide Channel	26.47	12.89
			<i>For >100 To 250, Deduct</i>	-1.29	
			<i>For >250 To 500, Deduct</i>	-1.95	
			<i>For >500 To 1,000, Deduct</i>	-3.04	
			<i>For >1,000, Deduct</i>	-4.14	
			<i>For 316 Stainless Steel, Add</i>	29.66	
			<i>For Aluminum, Add</i>	1.67	
			<i>For Galvanized Steel, Add</i>	5.75	
			<i>For 304 Stainless Steel, Add</i>	26.42	
05 12 23 00-0246	LF		C7 x 9.8 - 7" Wide Channel	19.90	9.68
			<i>For >100 To 250, Deduct</i>	-0.97	
			<i>For >250 To 500, Deduct</i>	-1.47	
			<i>For >500 To 1,000, Deduct</i>	-2.29	
			<i>For >1,000, Deduct</i>	-3.11	
			<i>For 316 Stainless Steel, Add</i>	22.37	
			<i>For Aluminum, Add</i>	1.26	
			<i>For Galvanized Steel, Add</i>	4.33	
			<i>For 304 Stainless Steel, Add</i>	19.92	
05 12 23 00-0247	LF		C7 x 12.25 - 7" Wide Channel	24.87	12.10
			<i>For >100 To 250, Deduct</i>	-1.21	
			<i>For >250 To 500, Deduct</i>	-1.83	
			<i>For >500 To 1,000, Deduct</i>	-2.86	
			<i>For >1,000, Deduct</i>	-3.88	
			<i>For 316 Stainless Steel, Add</i>	27.97	
			<i>For Aluminum, Add</i>	1.57	
			<i>For Galvanized Steel, Add</i>	5.42	
			<i>For 304 Stainless Steel, Add</i>	24.91	
05 12 23 00-0248	LF		C7 x 14.75 - 7" Wide Channel	29.96	14.57
			<i>For >100 To 250, Deduct</i>	-1.46	
			<i>For >250 To 500, Deduct</i>	-2.21	
			<i>For >500 To 1,000, Deduct</i>	-3.44	
			<i>For >1,000, Deduct</i>	-4.68	
			<i>For 316 Stainless Steel, Add</i>	33.66	
			<i>For Aluminum, Add</i>	1.89	
			<i>For Galvanized Steel, Add</i>	6.52	
			<i>For 304 Stainless Steel, Add</i>	29.98	
05 12 23 00-0249	LF		C8 x 11.5 - 8" Wide Channel	22.40	10.65
			<i>For >100 To 250, Deduct</i>	-1.07	
			<i>For >250 To 500, Deduct</i>	-1.63	
			<i>For >500 To 1,000, Deduct</i>	-2.54	
			<i>For >1,000, Deduct</i>	-3.46	
			<i>For 316 Stainless Steel, Add</i>	26.24	
			<i>For Aluminum, Add</i>	1.48	
			<i>For Galvanized Steel, Add</i>	5.08	
			<i>For 304 Stainless Steel, Add</i>	23.37	

05 Metals**05 10 Structural Metal Framing****05 12 Structural Steel Framing**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 12 23 00-0250	LF		C8 x 13.75 - 8" Wide Channel.....	26.79	12.74
			<i>For >100 To 250, Deduct</i>	-1.27	
			<i>For >250 To 500, Deduct</i>	-1.94	
			<i>For >500 To 1,000, Deduct</i>	-3.04	
			<i>For >1,000, Deduct</i>	-4.13	
			<i>For 316 Stainless Steel, Add</i>	31.39	
			<i>For Aluminum, Add</i>	1.77	
			<i>For Galvanized Steel, Add</i>	6.08	
			<i>For 304 Stainless Steel, Add</i>	27.96	
05 12 23 00-0251	LF		C8 x 18.75 - 8" Wide Channel.....	36.53	17.37
			<i>For >100 To 250, Deduct</i>	-1.74	
			<i>For >250 To 500, Deduct</i>	-2.65	
			<i>For >500 To 1,000, Deduct</i>	-4.14	
			<i>For >1,000, Deduct</i>	-5.63	
			<i>For 316 Stainless Steel, Add</i>	42.82	
			<i>For Aluminum, Add</i>	2.41	
			<i>For Galvanized Steel, Add</i>	8.30	
			<i>For 304 Stainless Steel, Add</i>	38.13	
05 12 23 00-0252	LF		C9 x 13.4 - 9" Wide Channel.....	26.11	12.41
			<i>For >100 To 250, Deduct</i>	-1.24	
			<i>For >250 To 500, Deduct</i>	-1.89	
			<i>For >500 To 1,000, Deduct</i>	-2.96	
			<i>For >1,000, Deduct</i>	-4.03	
			<i>For 316 Stainless Steel, Add</i>	30.59	
			<i>For Aluminum, Add</i>	1.72	
			<i>For Galvanized Steel, Add</i>	5.93	
			<i>For 304 Stainless Steel, Add</i>	27.25	
05 12 23 00-0253	LF		C9 x 15 - 9" Wide Channel.....	29.22	13.89
			<i>For >100 To 250, Deduct</i>	-1.39	
			<i>For >250 To 500, Deduct</i>	-2.12	
			<i>For >500 To 1,000, Deduct</i>	-3.31	
			<i>For >1,000, Deduct</i>	-4.51	
			<i>For 316 Stainless Steel, Add</i>	34.24	
			<i>For Aluminum, Add</i>	1.93	
			<i>For Galvanized Steel, Add</i>	6.63	
			<i>For 304 Stainless Steel, Add</i>	30.50	
05 12 23 00-0254	LF		C9 x 20 - 9" Wide Channel.....	38.97	18.52
			<i>For >100 To 250, Deduct</i>	-1.85	
			<i>For >250 To 500, Deduct</i>	-2.83	
			<i>For >500 To 1,000, Deduct</i>	-4.42	
			<i>For >1,000, Deduct</i>	-6.01	
			<i>For 316 Stainless Steel, Add</i>	45.66	
			<i>For Aluminum, Add</i>	2.57	
			<i>For Galvanized Steel, Add</i>	8.85	
			<i>For 304 Stainless Steel, Add</i>	40.67	
05 12 23 00-0255	LF		C10 x 15.3 - 10" Wide Channel.....	29.80	14.17
			<i>For >100 To 250, Deduct</i>	-1.42	
			<i>For >250 To 500, Deduct</i>	-2.16	
			<i>For >500 To 1,000, Deduct</i>	-3.38	
			<i>For >1,000, Deduct</i>	-4.60	
			<i>For 316 Stainless Steel, Add</i>	34.91	
			<i>For Aluminum, Add</i>	1.96	
			<i>For Galvanized Steel, Add</i>	6.76	
			<i>For 304 Stainless Steel, Add</i>	31.09	
05 12 23 00-0256	LF		C10 x 20 - 10" Wide Channel.....	38.97	18.52
			<i>For >100 To 250, Deduct</i>	-1.85	
			<i>For >250 To 500, Deduct</i>	-2.83	
			<i>For >500 To 1,000, Deduct</i>	-4.42	
			<i>For >1,000, Deduct</i>	-6.01	
			<i>For 316 Stainless Steel, Add</i>	45.66	
			<i>For Aluminum, Add</i>	2.57	
			<i>For Galvanized Steel, Add</i>	8.85	
			<i>For 304 Stainless Steel, Add</i>	40.67	
05 12 23 00-0257	LF		C10 x 25 - 10" Wide Channel.....	48.70	23.15
			<i>For >100 To 250, Deduct</i>	-2.32	
			<i>For >250 To 500, Deduct</i>	-3.53	
			<i>For >500 To 1,000, Deduct</i>	-5.52	
			<i>For >1,000, Deduct</i>	-7.51	
			<i>For 316 Stainless Steel, Add</i>	57.06	
			<i>For Aluminum, Add</i>	3.21	
			<i>For Galvanized Steel, Add</i>	11.05	
			<i>For 304 Stainless Steel, Add</i>	50.82	
05 12 23 00-0258	LF		C10 x 30 - 10" Wide Channel.....	58.45	27.78
			<i>For >100 To 250, Deduct</i>	-2.78	
			<i>For >250 To 500, Deduct</i>	-4.24	
			<i>For >500 To 1,000, Deduct</i>	-6.63	
			<i>For >1,000, Deduct</i>	-9.02	
			<i>For 316 Stainless Steel, Add</i>	68.48	
			<i>For Aluminum, Add</i>	3.85	
			<i>For Galvanized Steel, Add</i>	13.27	
			<i>For 304 Stainless Steel, Add</i>	60.99	



Metals	05	05
Structural Metal Framing	05 10	
Structural Steel Framing	05 12	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 12 23 00-0259 LF C12 x 20.7 - 12" Wide Channel	40.34	19.17
For >100 To 250, Deduct	-1.92	
For >250 To 500, Deduct	-2.93	
For >500 To 1,000, Deduct	-4.57	
For >1,000, Deduct	-6.22	
For 316 Stainless Steel, Add	47.26	
For Aluminum, Add	2.66	
For Galvanized Steel, Add	9.16	
For 304 Stainless Steel, Add	42.09	
05 12 23 00-0260 LF C12 x 25 - 12" Wide Channel	48.70	23.15
For >100 To 250, Deduct	-2.32	
For >250 To 500, Deduct	-3.53	
For >500 To 1,000, Deduct	-5.52	
For >1,000, Deduct	-7.51	
For 316 Stainless Steel, Add	57.06	
For Aluminum, Add	3.21	
For Galvanized Steel, Add	11.05	
For 304 Stainless Steel, Add	50.82	
05 12 23 00-0261 LF C12 x 30 - 12" Wide Channel	58.45	27.78
For >100 To 250, Deduct	-2.78	
For >250 To 500, Deduct	-4.24	
For >500 To 1,000, Deduct	-6.63	
For >1,000, Deduct	-9.02	
For 316 Stainless Steel, Add	68.48	
For Aluminum, Add	3.85	
For Galvanized Steel, Add	13.27	
For 304 Stainless Steel, Add	60.99	
05 12 23 00-0262 LF C15 x 33.9 - 15" Wide Channel	66.04	31.40
For >100 To 250, Deduct	-3.14	
For >250 To 500, Deduct	-4.79	
For >500 To 1,000, Deduct	-7.49	
For >1,000, Deduct	-10.19	
For 316 Stainless Steel, Add	77.38	
For Aluminum, Add	4.35	
For Galvanized Steel, Add	14.99	
For 304 Stainless Steel, Add	68.91	
05 12 23 00-0263 LF C15 x 40 - 15" Wide Channel	77.93	37.05
For >100 To 250, Deduct	-3.71	
For >250 To 500, Deduct	-5.65	
For >500 To 1,000, Deduct	-8.84	
For >1,000, Deduct	-12.02	
For 316 Stainless Steel, Add	91.30	
For Aluminum, Add	5.14	
For Galvanized Steel, Add	17.69	
For 304 Stainless Steel, Add	81.31	
05 12 23 00-0264 LF C15 x 50 - 15" Wide Channel	97.42	46.31
For >100 To 250, Deduct	-4.63	
For >250 To 500, Deduct	-7.07	
For >500 To 1,000, Deduct	-11.05	
For >1,000, Deduct	-15.03	
For 316 Stainless Steel, Add	114.14	
For Aluminum, Add	6.42	
For Galvanized Steel, Add	22.12	
For 304 Stainless Steel, Add	101.66	
05 12 23 00-0265 Miscellaneous Channels - MC (05 12 23 00-0119)		
05 12 23 00-0266 LF MC6 x 12 - 6" Wide Channel	24.43	11.91
For >100 To 250, Deduct	-1.19	
For >250 To 500, Deduct	-1.80	
For >500 To 1,000, Deduct	-2.81	
For >1,000, Deduct	-3.62	
For 316 Stainless Steel, Add	27.39	
For Aluminum, Add	1.54	
For Galvanized Steel, Add	5.31	
For 304 Stainless Steel, Add	24.40	
05 12 23 00-0267 LF MC6 x 15.1 - 6" Wide Channel	30.74	14.98
For >100 To 250, Deduct	-1.50	
For >250 To 500, Deduct	-2.27	
For >500 To 1,000, Deduct	-3.53	
For >1,000, Deduct	-4.80	
For 316 Stainless Steel, Add	34.46	
For Aluminum, Add	1.94	
For Galvanized Steel, Add	6.68	
For 304 Stainless Steel, Add	30.69	
05 12 23 00-0268 LF MC6 x 15.3 - 6" Wide Channel	31.14	15.18
For >100 To 250, Deduct	-1.52	
For >250 To 500, Deduct	-2.30	
For >500 To 1,000, Deduct	-3.58	
For >1,000, Deduct	-4.86	
For 316 Stainless Steel, Add	34.91	
For Aluminum, Add	1.96	
For Galvanized Steel, Add	6.76	
For 304 Stainless Steel, Add	31.09	

05 Metals**05 10 Structural Metal Framing****05 12 Structural Steel Framing**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 12 23 00-0269	LF		MC6 x 16.3 - 6" Wide Channel.....	33.19	16.16
			<i>For >100 To 250, Deduct</i>	-1.62	
			<i>For >250 To 500, Deduct</i>	-2.45	
			<i>For >500 To 1,000, Deduct</i>	-3.82	
			<i>For >1,000, Deduct</i>	-5.18	
			<i>For 316 Stainless Steel, Add</i>	37.22	
			<i>For Aluminum, Add</i>	2.09	
			<i>For Galvanized Steel, Add</i>	7.21	
			<i>For 304 Stainless Steel, Add</i>	33.15	
05 12 23 00-0270	LF		MC6 x 18 - 6" Wide Channel.....	36.64	17.86
			<i>For >100 To 250, Deduct</i>	-1.79	
			<i>For >250 To 500, Deduct</i>	-2.70	
			<i>For >500 To 1,000, Deduct</i>	-4.21	
			<i>For >1,000, Deduct</i>	-5.72	
			<i>For 316 Stainless Steel, Add</i>	41.09	
			<i>For Aluminum, Add</i>	2.31	
			<i>For Galvanized Steel, Add</i>	7.96	
			<i>For 304 Stainless Steel, Add</i>	36.59	
05 12 23 00-0271	LF		MC7 x 17.6 - 7" Wide Channel.....	35.74	17.39
			<i>For >100 To 250, Deduct</i>	-1.74	
			<i>For >250 To 500, Deduct</i>	-2.63	
			<i>For >500 To 1,000, Deduct</i>	-4.11	
			<i>For >1,000, Deduct</i>	-5.58	
			<i>For 316 Stainless Steel, Add</i>	40.16	
			<i>For Aluminum, Add</i>	2.26	
			<i>For Galvanized Steel, Add</i>	7.78	
			<i>For 304 Stainless Steel, Add</i>	35.77	
05 12 23 00-0272	LF		MC7 x 19.1 - 7" Wide Channel.....	38.78	18.87
			<i>For >100 To 250, Deduct</i>	-1.89	
			<i>For >250 To 500, Deduct</i>	-2.86	
			<i>For >500 To 1,000, Deduct</i>	-4.46	
			<i>For >1,000, Deduct</i>	-6.05	
			<i>For 316 Stainless Steel, Add</i>	43.58	
			<i>For Aluminum, Add</i>	2.45	
			<i>For Galvanized Steel, Add</i>	8.44	
			<i>For 304 Stainless Steel, Add</i>	38.82	
05 12 23 00-0273	LF		MC7 x 22.7 - 7" Wide Channel.....	46.10	22.43
			<i>For >100 To 250, Deduct</i>	-2.24	
			<i>For >250 To 500, Deduct</i>	-3.40	
			<i>For >500 To 1,000, Deduct</i>	-5.30	
			<i>For >1,000, Deduct</i>	-7.20	
			<i>For 316 Stainless Steel, Add</i>	51.81	
			<i>For Aluminum, Add</i>	2.91	
			<i>For Galvanized Steel, Add</i>	10.04	
			<i>For 304 Stainless Steel, Add</i>	46.14	
05 12 23 00-0274	LF		MC8 x 8.5 - 8" Wide Channel.....	16.56	7.87
			<i>For >100 To 250, Deduct</i>	-0.79	
			<i>For >250 To 500, Deduct</i>	-1.20	
			<i>For >500 To 1,000, Deduct</i>	-1.88	
			<i>For >1,000, Deduct</i>	-2.55	
			<i>For 316 Stainless Steel, Add</i>	19.39	
			<i>For Aluminum, Add</i>	1.09	
			<i>For Galvanized Steel, Add</i>	3.76	
			<i>For 304 Stainless Steel, Add</i>	17.27	
05 12 23 00-0275	LF		MC8 x 18.7 - 8" Wide Channel.....	36.43	17.32
			<i>For >100 To 250, Deduct</i>	-1.73	
			<i>For >250 To 500, Deduct</i>	-2.64	
			<i>For >500 To 1,000, Deduct</i>	-4.13	
			<i>For >1,000, Deduct</i>	-5.62	
			<i>For 316 Stainless Steel, Add</i>	42.69	
			<i>For Aluminum, Add</i>	2.40	
			<i>For Galvanized Steel, Add</i>	8.27	
			<i>For 304 Stainless Steel, Add</i>	38.02	
05 12 23 00-0276	LF		MC8 x 20 - 8" Wide Channel.....	38.97	18.52
			<i>For >100 To 250, Deduct</i>	-1.85	
			<i>For >250 To 500, Deduct</i>	-2.83	
			<i>For >500 To 1,000, Deduct</i>	-4.42	
			<i>For >1,000, Deduct</i>	-6.01	
			<i>For 316 Stainless Steel, Add</i>	45.66	
			<i>For Aluminum, Add</i>	2.57	
			<i>For Galvanized Steel, Add</i>	8.85	
			<i>For 304 Stainless Steel, Add</i>	40.67	
05 12 23 00-0277	LF		MC8 x 21.4 - 8" Wide Channel.....	41.70	19.82
			<i>For >100 To 250, Deduct</i>	-1.98	
			<i>For >250 To 500, Deduct</i>	-3.02	
			<i>For >500 To 1,000, Deduct</i>	-4.73	
			<i>For >1,000, Deduct</i>	-6.43	
			<i>For 316 Stainless Steel, Add</i>	48.86	
			<i>For Aluminum, Add</i>	2.75	
			<i>For Galvanized Steel, Add</i>	9.47	
			<i>For 304 Stainless Steel, Add</i>	43.52	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 12 23 00-0278 LF MC8 x 22.8 - 8" Wide Channel	44.41	21.13
For >100 To 250, Deduct	-2.11	
For >250 To 500, Deduct	-3.22	
For >500 To 1,000, Deduct	-5.04	
For >1,000, Deduct	-6.85	
For 316 Stainless Steel, Add	52.03	
For Aluminum, Add	2.93	
For Galvanized Steel, Add	10.08	
For 304 Stainless Steel, Add	46.34	
05 12 23 00-0279 LF MC9 x 23.9 - 9" Wide Channel	46.56	22.13
For >100 To 250, Deduct	-2.21	
For >250 To 500, Deduct	-3.38	
For >500 To 1,000, Deduct	-5.28	
For >1,000, Deduct	-7.18	
For 316 Stainless Steel, Add	54.56	
For Aluminum, Add	3.07	
For Galvanized Steel, Add	10.57	
For 304 Stainless Steel, Add	48.59	
05 12 23 00-0280 LF MC9 x 25.4 - 9" Wide Channel	49.48	23.52
For >100 To 250, Deduct	-2.35	
For >250 To 500, Deduct	-3.59	
For >500 To 1,000, Deduct	-5.61	
For >1,000, Deduct	-7.63	
For 316 Stainless Steel, Add	57.98	
For Aluminum, Add	3.26	
For Galvanized Steel, Add	11.23	
For 304 Stainless Steel, Add	51.64	
05 12 23 00-0281 LF MC10 x 6.5 - 10" Wide Channel.....	12.67	6.02
For >100 To 250, Deduct	-0.60	
For >250 To 500, Deduct	-0.92	
For >500 To 1,000, Deduct	-1.44	
For >1,000, Deduct	-1.95	
For 316 Stainless Steel, Add	14.85	
For Aluminum, Add	0.84	
For Galvanized Steel, Add	2.88	
For 304 Stainless Steel, Add	13.22	
05 12 23 00-0282 LF MC10 x 8.4 - 10" Wide Channel.....	16.36	7.78
For >100 To 250, Deduct	-0.78	
For >250 To 500, Deduct	-1.19	
For >500 To 1,000, Deduct	-1.86	
For >1,000, Deduct	-2.52	
For 316 Stainless Steel, Add	19.17	
For Aluminum, Add	1.08	
For Galvanized Steel, Add	3.71	
For 304 Stainless Steel, Add	17.07	
05 12 23 00-0283 LF MC10 x 21.9 - 10" Wide Channel.....	42.66	20.29
For >100 To 250, Deduct	-2.03	
For >250 To 500, Deduct	-3.09	
For >500 To 1,000, Deduct	-4.84	
For >1,000, Deduct	-6.58	
For 316 Stainless Steel, Add	49.98	
For Aluminum, Add	2.81	
For Galvanized Steel, Add	9.68	
For 304 Stainless Steel, Add	44.52	
05 12 23 00-0284 LF MC10 x 24.9 - 10" Wide Channel.....	48.51	23.07
For >100 To 250, Deduct	-2.31	
For >250 To 500, Deduct	-3.52	
For >500 To 1,000, Deduct	-5.50	
For >1,000, Deduct	-7.48	
For 316 Stainless Steel, Add	56.83	
For Aluminum, Add	3.20	
For Galvanized Steel, Add	11.01	
For 304 Stainless Steel, Add	50.62	
05 12 23 00-0285 LF MC10 x 25.3 - 10" Wide Channel.....	49.29	23.44
For >100 To 250, Deduct	-2.34	
For >250 To 500, Deduct	-3.58	
For >500 To 1,000, Deduct	-5.59	
For >1,000, Deduct	-7.60	
For 316 Stainless Steel, Add	57.76	
For Aluminum, Add	3.25	
For Galvanized Steel, Add	11.19	
For 304 Stainless Steel, Add	51.44	
05 12 23 00-0286 LF MC10 x 28.3 - 10" Wide Channel.....	55.15	26.21
For >100 To 250, Deduct	-2.62	
For >250 To 500, Deduct	-4.00	
For >500 To 1,000, Deduct	-6.25	
For >1,000, Deduct	-8.51	
For 316 Stainless Steel, Add	64.61	
For Aluminum, Add	3.63	
For Galvanized Steel, Add	12.52	
For 304 Stainless Steel, Add	57.54	

05 Metals**05 10 Structural Metal Framing****05 12 Structural Steel Framing**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 12 23 00-0287	LF		MC10 x 28.5 - 10" Wide Channel.....	55.53	26.40
			<i>For >100 To 250, Deduct</i>	-2.64	
			<i>For >250 To 500, Deduct</i>	-4.03	
			<i>For >500 To 1,000, Deduct</i>	-6.30	
			<i>For >1,000, Deduct</i>	-8.56	
			<i>For 316 Stainless Steel, Add</i>	65.06	
			<i>For Aluminum, Add</i>	3.66	
			<i>For Galvanized Steel, Add</i>	12.60	
			<i>For 304 Stainless Steel, Add</i>	57.94	
05 12 23 00-0288	LF		MC10 x 33.6 - 10" Wide Channel.....	65.47	31.12
			<i>For >100 To 250, Deduct</i>	-3.11	
			<i>For >250 To 500, Deduct</i>	-4.75	
			<i>For >500 To 1,000, Deduct</i>	-7.42	
			<i>For >1,000, Deduct</i>	-10.10	
			<i>For 316 Stainless Steel, Add</i>	76.70	
			<i>For Aluminum, Add</i>	4.31	
			<i>For Galvanized Steel, Add</i>	14.86	
			<i>For 304 Stainless Steel, Add</i>	68.31	
05 12 23 00-0289	LF		MC10 x 41.1 - 10" Wide Channel.....	80.08	38.07
			<i>For >100 To 250, Deduct</i>	-3.81	
			<i>For >250 To 500, Deduct</i>	-5.81	
			<i>For >500 To 1,000, Deduct</i>	-9.08	
			<i>For >1,000, Deduct</i>	-12.35	
			<i>For 316 Stainless Steel, Add</i>	93.82	
			<i>For Aluminum, Add</i>	5.28	
			<i>For Galvanized Steel, Add</i>	18.18	
			<i>For 304 Stainless Steel, Add</i>	83.56	
05 12 23 00-0290	LF		MC12 x 30.9 - 12" Wide Channel.....	60.21	28.61
			<i>For >100 To 250, Deduct</i>	-2.86	
			<i>For >250 To 500, Deduct</i>	-4.37	
			<i>For >500 To 1,000, Deduct</i>	-6.83	
			<i>For >1,000, Deduct</i>	-9.29	
			<i>For 316 Stainless Steel, Add</i>	70.53	
			<i>For Aluminum, Add</i>	3.97	
			<i>For Galvanized Steel, Add</i>	13.66	
			<i>For 304 Stainless Steel, Add</i>	62.81	
05 12 23 00-0291	LF		MC12 x 32.9 - 12" Wide Channel.....	64.10	30.47
			<i>For >100 To 250, Deduct</i>	-3.05	
			<i>For >250 To 500, Deduct</i>	-4.65	
			<i>For >500 To 1,000, Deduct</i>	-7.27	
			<i>For >1,000, Deduct</i>	-9.89	
			<i>For 316 Stainless Steel, Add</i>	75.10	
			<i>For Aluminum, Add</i>	4.22	
			<i>For Galvanized Steel, Add</i>	14.55	
			<i>For 304 Stainless Steel, Add</i>	66.89	
05 12 23 00-0292	LF		MC12 x 35 - 12" Wide Channel.....	68.20	32.42
			<i>For >100 To 250, Deduct</i>	-3.24	
			<i>For >250 To 500, Deduct</i>	-4.95	
			<i>For >500 To 1,000, Deduct</i>	-7.73	
			<i>For >1,000, Deduct</i>	-10.52	
			<i>For 316 Stainless Steel, Add</i>	79.90	
			<i>For Aluminum, Add</i>	4.49	
			<i>For Galvanized Steel, Add</i>	15.48	
			<i>For 304 Stainless Steel, Add</i>	71.16	
05 12 23 00-0293	LF		MC12 x 37 - 12" Wide Channel.....	72.09	34.27
			<i>For >100 To 250, Deduct</i>	-3.43	
			<i>For >250 To 500, Deduct</i>	-5.23	
			<i>For >500 To 1,000, Deduct</i>	-8.17	
			<i>For >1,000, Deduct</i>	-11.12	
			<i>For 316 Stainless Steel, Add</i>	84.45	
			<i>For Aluminum, Add</i>	4.75	
			<i>For Galvanized Steel, Add</i>	16.36	
			<i>For 304 Stainless Steel, Add</i>	75.21	
05 12 23 00-0294	LF		MC12 x 40 - 12" Wide Channel.....	77.93	37.05
			<i>For >100 To 250, Deduct</i>	-3.71	
			<i>For >250 To 500, Deduct</i>	-5.65	
			<i>For >500 To 1,000, Deduct</i>	-8.84	
			<i>For >1,000, Deduct</i>	-12.02	
			<i>For 316 Stainless Steel, Add</i>	91.30	
			<i>For Aluminum, Add</i>	5.14	
			<i>For Galvanized Steel, Add</i>	17.69	
			<i>For 304 Stainless Steel, Add</i>	81.31	
05 12 23 00-0295	LF		MC12 x 45 - 12" Wide Channel.....	87.68	41.69
			<i>For >100 To 250, Deduct</i>	-4.17	
			<i>For >250 To 500, Deduct</i>	-6.36	
			<i>For >500 To 1,000, Deduct</i>	-9.94	
			<i>For >1,000, Deduct</i>	-13.52	
			<i>For 316 Stainless Steel, Add</i>	102.72	
			<i>For Aluminum, Add</i>	5.78	
			<i>For Galvanized Steel, Add</i>	19.90	
			<i>For 304 Stainless Steel, Add</i>	91.49	



Metals	05	05
Structural Metal Framing	05 10	
Structural Steel Framing	05 12	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 12 23 00-0296	LF		MC12 x 50 - 12" Wide Channel	97.42	46.32
			<i>For >100 To 250, Deduct</i>	-4.63	
			<i>For >250 To 500, Deduct</i>	-7.07	
			<i>For >500 To 1,000, Deduct</i>	-11.05	
			<i>For >1,000, Deduct</i>	-15.03	
			<i>For 316 Stainless Steel, Add</i>	114.14	
			<i>For Aluminum, Add</i>	6.42	
			<i>For Galvanized Steel, Add</i>	22.12	
			<i>For 304 Stainless Steel, Add</i>	101.66	
05 12 23 00-0297	LF		MC13 x 31.8 - 13" Wide Channel.....	61.95	29.45
			<i>For >100 To 250, Deduct</i>	-2.95	
			<i>For >250 To 500, Deduct</i>	-4.49	
			<i>For >500 To 1,000, Deduct</i>	-7.02	
			<i>For >1,000, Deduct</i>	-9.56	
			<i>For 316 Stainless Steel, Add</i>	72.58	
			<i>For Aluminum, Add</i>	4.08	
			<i>For Galvanized Steel, Add</i>	14.06	
			<i>For 304 Stainless Steel, Add</i>	64.64	
05 12 23 00-0298	LF		MC13 x 35 - 13" Wide Channel	68.20	32.42
			<i>For >100 To 250, Deduct</i>	-3.24	
			<i>For >250 To 500, Deduct</i>	-4.95	
			<i>For >500 To 1,000, Deduct</i>	-7.73	
			<i>For >1,000, Deduct</i>	-10.52	
			<i>For 316 Stainless Steel, Add</i>	79.90	
			<i>For Aluminum, Add</i>	4.49	
			<i>For Galvanized Steel, Add</i>	15.48	
			<i>For 304 Stainless Steel, Add</i>	71.16	
05 12 23 00-0299	LF		MC13 x 40 - 13" Wide Channel	77.93	37.05
			<i>For >100 To 250, Deduct</i>	-3.71	
			<i>For >250 To 500, Deduct</i>	-5.65	
			<i>For >500 To 1,000, Deduct</i>	-8.84	
			<i>For >1,000, Deduct</i>	-12.02	
			<i>For 316 Stainless Steel, Add</i>	91.30	
			<i>For Aluminum, Add</i>	5.14	
			<i>For Galvanized Steel, Add</i>	17.69	
			<i>For 304 Stainless Steel, Add</i>	81.31	
05 12 23 00-0300	LF		MC13 x 50 - 13" Wide Channel	97.42	46.32
			<i>For >100 To 250, Deduct</i>	-4.63	
			<i>For >250 To 500, Deduct</i>	-7.07	
			<i>For >500 To 1,000, Deduct</i>	-11.05	
			<i>For >1,000, Deduct</i>	-15.03	
			<i>For 316 Stainless Steel, Add</i>	114.14	
			<i>For Aluminum, Add</i>	6.42	
			<i>For Galvanized Steel, Add</i>	22.12	
			<i>For 304 Stainless Steel, Add</i>	101.66	
05 12 23 00-0301	LF		MC18 x 42.7 - 18" Wide Channel.....	83.20	39.55
			<i>For >100 To 250, Deduct</i>	-3.96	
			<i>For >250 To 500, Deduct</i>	-6.04	
			<i>For >500 To 1,000, Deduct</i>	-9.43	
			<i>For >1,000, Deduct</i>	-12.83	
			<i>For 316 Stainless Steel, Add</i>	97.47	
			<i>For Aluminum, Add</i>	5.48	
			<i>For Galvanized Steel, Add</i>	18.89	
			<i>For 304 Stainless Steel, Add</i>	86.81	
05 12 23 00-0302	LF		MC18 x 45.8 - 18" Wide Channel.....	89.23	42.42
			<i>For >100 To 250, Deduct</i>	-4.24	
			<i>For >250 To 500, Deduct</i>	-6.47	
			<i>For >500 To 1,000, Deduct</i>	-10.12	
			<i>For >1,000, Deduct</i>	-13.76	
			<i>For 316 Stainless Steel, Add</i>	104.54	
			<i>For Aluminum, Add</i>	5.88	
			<i>For Galvanized Steel, Add</i>	20.26	
			<i>For 304 Stainless Steel, Add</i>	93.11	
05 12 23 00-0303	LF		MC18 x 51.9 - 18" Wide Channel.....	101.11	48.07
			<i>For >100 To 250, Deduct</i>	-4.81	
			<i>For >250 To 500, Deduct</i>	-7.33	
			<i>For >500 To 1,000, Deduct</i>	-11.46	
			<i>For >1,000, Deduct</i>	-15.59	
			<i>For 316 Stainless Steel, Add</i>	118.46	
			<i>For Aluminum, Add</i>	6.66	
			<i>For Galvanized Steel, Add</i>	22.95	
			<i>For 304 Stainless Steel, Add</i>	105.51	
05 12 23 00-0304	LF		MC18 x 58 - 18" Wide Channel	113.00	53.72
			<i>For >100 To 250, Deduct</i>	-5.37	
			<i>For >250 To 500, Deduct</i>	-8.20	
			<i>For >500 To 1,000, Deduct</i>	-12.81	
			<i>For >1,000, Deduct</i>	-17.43	
			<i>For 316 Stainless Steel, Add</i>	132.38	
			<i>For Aluminum, Add</i>	7.45	
			<i>For Galvanized Steel, Add</i>	25.65	
			<i>For 304 Stainless Steel, Add</i>	117.90	

05 12 23 00-0305 Structural Bar Tees (05 12 23 00-0119)

05 Metals**05 10 Structural Metal Framing****05 12 Structural Steel Framing**

MINOR		TOTAL DIRECT	DEMOLITION
CSI	UOM DESCRIPTION	UNIT COST	UNIT COST
05 12 23 00-0306	LF 3/4" x 3/4" x 1/8" Structural Bar Tee.....	3.86	2.47
	For >100 To 250, Deduct	-0.25	
	For >250 To 500, Deduct	-0.34	
	For >500 To 1,000, Deduct	-0.52	
	For >1,000, Deduct	-0.70	
	For 316 Stainless Steel, Add	1.86	
	For Aluminum, Add	0.10	
	For Galvanized Steel, Add	0.36	
	For 304 Stainless Steel, Add	1.65	
05 12 23 00-0307	LF 1" x 1" x 1/8" Structural Bar Tee	4.66	2.90
	For >100 To 250, Deduct	-0.29	
	For >250 To 500, Deduct	-0.41	
	For >500 To 1,000, Deduct	-0.62	
	For >1,000, Deduct	-0.83	
	For 316 Stainless Steel, Add	2.53	
	For Aluminum, Add	0.14	
	For Galvanized Steel, Add	0.49	
	For 304 Stainless Steel, Add	2.25	
05 12 23 00-0308	LF 1-1/2" x 1-1/2" x 1/4" Structural Bar Tee	6.73	3.35
	For >100 To 250, Deduct	-0.34	
	For >250 To 500, Deduct	-0.50	
	For >500 To 1,000, Deduct	-0.78	
	For >1,000, Deduct	-1.06	
	For 316 Stainless Steel, Add	7.23	
	For Aluminum, Add	0.41	
	For Galvanized Steel, Add	1.40	
	For 304 Stainless Steel, Add	6.44	
05 12 23 00-0309	LF 2" x 2" x 1/4" Structural Bar Tee	9.22	4.39
	For >100 To 250, Deduct	-0.44	
	For >250 To 500, Deduct	-0.67	
	For >500 To 1,000, Deduct	-1.05	
	For >1,000, Deduct	-1.42	
	For 316 Stainless Steel, Add	10.78	
	For Aluminum, Add	0.61	
	For Galvanized Steel, Add	2.09	
	For 304 Stainless Steel, Add	9.60	
05 12 23 00-0310	LF 2-1/2" x 2-1/2" x 3/8" Structural Bar Tee	13.11	5.29
	For >100 To 250, Deduct	-0.53	
	For >250 To 500, Deduct	-0.86	
	For >500 To 1,000, Deduct	-1.36	
	For >1,000, Deduct	-1.87	
	For 316 Stainless Steel, Add	19.36	
	For Aluminum, Add	1.09	
	For Galvanized Steel, Add	3.75	
	For 304 Stainless Steel, Add	17.24	
05 12 23 00-0311	LF 3" x 3" x 3/8" Structural Bar Tee	16.30	6.77
	For >100 To 250, Deduct	-0.68	
	For >250 To 500, Deduct	-1.09	
	For >500 To 1,000, Deduct	-1.72	
	For >1,000, Deduct	-2.35	
	For 316 Stainless Steel, Add	23.23	
	For Aluminum, Add	1.31	
	For Galvanized Steel, Add	4.50	
	For 304 Stainless Steel, Add	20.69	
05 12 23 00-0312	Structural Zees <small>(05 12 23 00-0119)</small>		
05 12 23 00-0313	LF 1-1/4" x 1-3/4" x 1-3/4" x 3/16" Structural Zee.....	7.84	3.35
	For >100 To 250, Deduct	-0.34	
	For >250 To 500, Deduct	-0.53	
	For >500 To 1,000, Deduct	-0.84	
	For >1,000, Deduct	-1.15	
	For 316 Stainless Steel, Add	10.78	
	For Aluminum, Add	0.61	
	For Galvanized Steel, Add	2.09	
	For 304 Stainless Steel, Add	9.60	
05 12 23 00-0314	LF 2-11/16" x 3" x 2-11/16" x 1/4" Structural Zee.....	13.40	4.01
	For >100 To 250, Deduct	-0.40	
	For >250 To 500, Deduct	-0.73	
	For >500 To 1,000, Deduct	-1.20	
	For >1,000, Deduct	-1.67	
	For 316 Stainless Steel, Add	25.82	
	For Aluminum, Add	1.45	
	For Galvanized Steel, Add	5.00	
	For 304 Stainless Steel, Add	23.00	
05 12 23 00-0315	LF 3-1/16" x 4" x 3-1/16" x 1/4" Structural Zee.....	15.91	4.52
	For >100 To 250, Deduct	-0.45	
	For >250 To 500, Deduct	-0.85	
	For >500 To 1,000, Deduct	-1.40	
	For >1,000, Deduct	-1.95	
	For 316 Stainless Steel, Add	31.62	
	For Aluminum, Add	1.78	
	For Galvanized Steel, Add	6.13	
	For 304 Stainless Steel, Add	28.16	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 12 23 00-0316 LF 3-1/4" x 5" x 3-1/4" x 5/16" Structural Zee.....	20.85	5.16
For >100 To 250, Deduct	-0.52	
For >250 To 500, Deduct	-1.04	
For >500 To 1,000, Deduct	-1.73	
For >1,000, Deduct	-2.42	
For 316 Stainless Steel, Add	44.70	
For Aluminum, Add	2.51	
For Galvanized Steel, Add	8.66	
For 304 Stainless Steel, Add	39.81	
05 12 23 00-0317 LF 3-1/2" x 6" x 3-1/2" x 3/8" Structural Zee.....	26.40	5.62
For >100 To 250, Deduct	-0.56	
For >250 To 500, Deduct	-1.22	
For >500 To 1,000, Deduct	-2.07	
For >1,000, Deduct	-2.92	
For 316 Stainless Steel, Add	60.51	
For Aluminum, Add	3.40	
For Galvanized Steel, Add	11.72	
For 304 Stainless Steel, Add	53.89	
05 12 23 00-0318 Junior I-Beams (05 12 23 00-0119)		
05 12 23 00-0319 LF 3" Junior I-Beam, 2.9 LB/LF.....	10.90	4.84
For >100 To 250, Deduct	-0.48	
For >250 To 500, Deduct	-0.76	
For >500 To 1,000, Deduct	-1.19	
For >1,000, Deduct	-1.62	
For 316 Stainless Steel, Add	14.24	
For Aluminum, Add	0.80	
For Galvanized Steel, Add	2.76	
For 304 Stainless Steel, Add	12.68	
05 12 23 00-0320 LF 4" Junior I-Beam, 3.2 LB/LF.....	11.97	5.29
For >100 To 250, Deduct	-0.53	
For >250 To 500, Deduct	-0.83	
For >500 To 1,000, Deduct	-1.30	
For >1,000, Deduct	-1.78	
For 316 Stainless Steel, Add	15.71	
For Aluminum, Add	0.88	
For Galvanized Steel, Add	3.04	
For 304 Stainless Steel, Add	13.99	
05 12 23 00-0321 LF 5" Junior I-Beam, 3.8 LB/LF.....	13.57	5.81
For >100 To 250, Deduct	-0.58	
For >250 To 500, Deduct	-0.92	
For >500 To 1,000, Deduct	-1.45	
For >1,000, Deduct	-1.99	
For 316 Stainless Steel, Add	18.62	
For Aluminum, Add	1.05	
For Galvanized Steel, Add	3.61	
For 304 Stainless Steel, Add	16.59	
05 12 23 00-0322 LF 6" Junior I-Beam, 4.4 LB/LF.....	15.17	6.33
For >100 To 250, Deduct	-0.63	
For >250 To 500, Deduct	-1.01	
For >500 To 1,000, Deduct	-1.60	
For >1,000, Deduct	-2.19	
For 316 Stainless Steel, Add	21.57	
For Aluminum, Add	1.21	
For Galvanized Steel, Add	4.18	
For 304 Stainless Steel, Add	19.21	
05 12 23 00-0323 LF 7" Junior I-Beam, 5.5 LB/LF.....	17.47	6.77
For >100 To 250, Deduct	-0.68	
For >250 To 500, Deduct	-1.11	
For >500 To 1,000, Deduct	-1.78	
For >1,000, Deduct	-2.44	
For 316 Stainless Steel, Add	26.98	
For Aluminum, Add	1.52	
For Galvanized Steel, Add	5.23	
For 304 Stainless Steel, Add	24.03	
05 12 23 00-0324 LF 8" Junior I-Beam, 6.5 LB/LF.....	19.60	7.23
For >100 To 250, Deduct	-0.72	
For >250 To 500, Deduct	-1.21	
For >500 To 1,000, Deduct	-1.94	
For >1,000, Deduct	-2.68	
For 316 Stainless Steel, Add	31.87	
For Aluminum, Add	1.79	
For Galvanized Steel, Add	6.18	
For 304 Stainless Steel, Add	28.39	
05 12 23 00-0325 LF 10" Junior I-Beam, 9 LB/LF.....	24.82	8.26
For >100 To 250, Deduct	-0.83	
For >250 To 500, Deduct	-1.45	
For >500 To 1,000, Deduct	-2.34	
For >1,000, Deduct	-3.24	
For 316 Stainless Steel, Add	44.16	
For Aluminum, Add	2.48	
For Galvanized Steel, Add	8.56	
For 304 Stainless Steel, Add	39.33	

05 Metals**05 10 Structural Metal Framing****05 12 Structural Steel Framing**

MINOR		TOTAL DIRECT	DEMOLITION
CSI	UOM DESCRIPTION	UNIT COST	UNIT COST
05 12 23 00-0326	LF 12" Junior I-Beam, 11.8 LB/LF	31.17	9.81
	<i>For >100 To 250, Deduct</i>	-0.98	
	<i>For >250 To 500, Deduct</i>	-1.76	
	<i>For >500 To 1,000, Deduct</i>	-2.87	
	<i>For >1,000, Deduct</i>	-3.97	
	<i>For 316 Stainless Steel, Add</i>	57.89	
	<i>For Aluminum, Add</i>	3.26	
	<i>For Galvanized Steel, Add</i>	11.22	
	<i>For 304 Stainless Steel, Add</i>	51.56	
05 12 23 00-0327	Round Stock <small>(05 12 23 00-0119)</small>		
05 12 23 00-0328	LF 1/4" Carbon Steel Rounds, ASTM A108	1.54	
	<i>For 316 Stainless Steel, Add</i>	2.14	
	<i>For Aluminum, Add</i>	0.12	
	<i>For Galvanized Steel, Add</i>	0.42	
	<i>For 304 Stainless Steel, Add</i>	1.91	
05 12 23 00-0329	LF 3/8" Carbon Steel Rounds, ASTM A108	2.30	
	<i>For 316 Stainless Steel, Add</i>	4.22	
	<i>For Aluminum, Add</i>	0.24	
	<i>For Galvanized Steel, Add</i>	0.82	
	<i>For 304 Stainless Steel, Add</i>	3.76	
05 12 23 00-0330	LF 1/2" Carbon Steel Rounds, ASTM A108	3.09	
	<i>For 316 Stainless Steel, Add</i>	6.43	
	<i>For Aluminum, Add</i>	0.36	
	<i>For Galvanized Steel, Add</i>	1.25	
	<i>For 304 Stainless Steel, Add</i>	5.73	
05 12 23 00-0331	LF 5/8" Carbon Steel Rounds, ASTM A108	4.56	
	<i>For 316 Stainless Steel, Add</i>	10.75	
	<i>For Aluminum, Add</i>	0.60	
	<i>For Galvanized Steel, Add</i>	2.08	
	<i>For 304 Stainless Steel, Add</i>	9.58	
05 12 23 00-0332	LF 3/4" Carbon Steel Rounds, ASTM A108	5.43	
	<i>For 316 Stainless Steel, Add</i>	12.77	
	<i>For Aluminum, Add</i>	0.72	
	<i>For Galvanized Steel, Add</i>	2.47	
	<i>For 304 Stainless Steel, Add</i>	11.37	
05 12 23 00-0333	LF 7/8" Carbon Steel Rounds, ASTM A108	6.31	
	<i>For 316 Stainless Steel, Add</i>	14.91	
	<i>For Aluminum, Add</i>	0.84	
	<i>For Galvanized Steel, Add</i>	2.89	
	<i>For 304 Stainless Steel, Add</i>	13.28	
05 12 23 00-0334	LF 1" Carbon Steel Rounds, ASTM A108	9.05	
	<i>For 316 Stainless Steel, Add</i>	22.72	
	<i>For Aluminum, Add</i>	1.28	
	<i>For Galvanized Steel, Add</i>	4.40	
	<i>For 304 Stainless Steel, Add</i>	20.24	
05 12 23 00-0335	LF 1-1/8" Carbon Steel Rounds, ASTM A108	11.03	
	<i>For 316 Stainless Steel, Add</i>	27.62	
	<i>For Aluminum, Add</i>	1.55	
	<i>For Galvanized Steel, Add</i>	5.35	
	<i>For 304 Stainless Steel, Add</i>	24.60	
05 12 23 00-0336	LF 1-1/4" Carbon Steel Rounds, ASTM A108	13.22	
	<i>For 316 Stainless Steel, Add</i>	32.48	
	<i>For Aluminum, Add</i>	1.83	
	<i>For Galvanized Steel, Add</i>	6.29	
	<i>For 304 Stainless Steel, Add</i>	28.93	
05 12 23 00-0337	LF 1-3/8" Carbon Steel Rounds, ASTM A108	15.97	
	<i>For 316 Stainless Steel, Add</i>	39.65	
	<i>For Aluminum, Add</i>	2.23	
	<i>For Galvanized Steel, Add</i>	7.68	
	<i>For 304 Stainless Steel, Add</i>	35.31	
05 12 23 00-0338	LF 1-1/2" Carbon Steel Rounds, ASTM A108	17.90	
	<i>For 316 Stainless Steel, Add</i>	43.49	
	<i>For Aluminum, Add</i>	2.45	
	<i>For Galvanized Steel, Add</i>	8.43	
	<i>For 304 Stainless Steel, Add</i>	38.73	
05 12 23 00-0339	LF 1-5/8" Carbon Steel Rounds, ASTM A108	20.77	
	<i>For 316 Stainless Steel, Add</i>	49.28	
	<i>For Aluminum, Add</i>	2.77	
	<i>For Galvanized Steel, Add</i>	9.55	
	<i>For 304 Stainless Steel, Add</i>	43.89	
05 12 23 00-0340	LF 1-3/4" Carbon Steel Rounds, ASTM A108	25.10	
	<i>For 316 Stainless Steel, Add</i>	57.34	
	<i>For Aluminum, Add</i>	3.23	
	<i>For Galvanized Steel, Add</i>	11.11	
	<i>For 304 Stainless Steel, Add</i>	51.07	
05 12 23 00-0341	LF 1-7/8" Carbon Steel Rounds, ASTM A108	30.46	
	<i>For 316 Stainless Steel, Add</i>	67.17	
	<i>For Aluminum, Add</i>	3.78	
	<i>For Galvanized Steel, Add</i>	13.01	
	<i>For 304 Stainless Steel, Add</i>	59.82	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 12 23 00-0342 LF 2" Carbon Steel Rounds, ASTM A108.....	34.98	
<i>For 316 Stainless Steel, Add</i>	74.72	
<i>For Aluminum, Add</i>	4.20	
<i>For Galvanized Steel, Add</i>	14.48	
<i>For 304 Stainless Steel, Add</i>	66.55	
05 12 23 00-0343 LF 2-1/8" Carbon Steel Rounds, ASTM A108.....	41.12	
<i>For 316 Stainless Steel, Add</i>	85.34	
<i>For Aluminum, Add</i>	4.80	
<i>For Galvanized Steel, Add</i>	16.54	
<i>For 304 Stainless Steel, Add</i>	76.01	
05 12 23 00-0344 LF 2-1/4" Carbon Steel Rounds, ASTM A108.....	46.60	
<i>For 316 Stainless Steel, Add</i>	95.97	
<i>For Aluminum, Add</i>	5.40	
<i>For Galvanized Steel, Add</i>	18.59	
<i>For 304 Stainless Steel, Add</i>	85.47	
05 12 23 00-0345 LF 2-3/8" Carbon Steel Rounds, ASTM A108.....	53.41	
<i>For 316 Stainless Steel, Add</i>	109.76	
<i>For Aluminum, Add</i>	6.17	
<i>For Galvanized Steel, Add</i>	21.27	
<i>For 304 Stainless Steel, Add</i>	97.76	
05 12 23 00-0346 LF 2-1/2" Carbon Steel Rounds, ASTM A108.....	59.39	
<i>For 316 Stainless Steel, Add</i>	118.27	
<i>For Aluminum, Add</i>	6.65	
<i>For Galvanized Steel, Add</i>	22.92	
<i>For 304 Stainless Steel, Add</i>	105.34	
05 12 23 00-0347 LF 2-5/8" Carbon Steel Rounds, ASTM A108.....	71.88	
<i>For 316 Stainless Steel, Add</i>	150.24	
<i>For Aluminum, Add</i>	8.45	
<i>For Galvanized Steel, Add</i>	29.11	
<i>For 304 Stainless Steel, Add</i>	133.81	
05 12 23 00-0348 LF 2-3/4" Carbon Steel Rounds, ASTM A108.....	81.79	
<i>For 316 Stainless Steel, Add</i>	171.33	
<i>For Aluminum, Add</i>	9.64	
<i>For Galvanized Steel, Add</i>	33.19	
<i>For 304 Stainless Steel, Add</i>	152.59	
05 12 23 00-0349 LF 2-7/8 Carbon Steel Rounds, ASTM A108.....	91.24	
<i>For 316 Stainless Steel, Add</i>	190.94	
<i>For Aluminum, Add</i>	10.74	
<i>For Galvanized Steel, Add</i>	37.00	
<i>For 304 Stainless Steel, Add</i>	170.06	
05 12 23 00-0350 LF 3" Carbon Steel Rounds, ASTM A108.....	96.35	
<i>For 316 Stainless Steel, Add</i>	196.67	
<i>For Aluminum, Add</i>	11.06	
<i>For Galvanized Steel, Add</i>	38.11	
<i>For 304 Stainless Steel, Add</i>	175.16	
05 12 23 00-0351 LF 3-1/8" Carbon Steel Rounds, ASTM A108.....	101.04	
<i>For 316 Stainless Steel, Add</i>	201.02	
<i>For Aluminum, Add</i>	11.31	
<i>For Galvanized Steel, Add</i>	38.95	
<i>For 304 Stainless Steel, Add</i>	179.04	
05 12 23 00-0352 LF 3-1/4" Carbon Steel Rounds, ASTM A108.....	106.93	
<i>For 316 Stainless Steel, Add</i>	209.22	
<i>For Aluminum, Add</i>	11.77	
<i>For Galvanized Steel, Add</i>	40.54	
<i>For 304 Stainless Steel, Add</i>	186.33	
05 12 23 00-0353 LF 3-1/2" Carbon Steel Rounds, ASTM A108.....	128.66	
<i>For 316 Stainless Steel, Add</i>	265.47	
<i>For Aluminum, Add</i>	14.93	
<i>For Galvanized Steel, Add</i>	51.44	
<i>For 304 Stainless Steel, Add</i>	236.44	
05 12 23 00-0354 LF 3-5/8" Carbon Steel Rounds, ASTM A108.....	142.65	
<i>For 316 Stainless Steel, Add</i>	296.96	
<i>For Aluminum, Add</i>	16.70	
<i>For Galvanized Steel, Add</i>	57.54	
<i>For 304 Stainless Steel, Add</i>	264.48	
05 12 23 00-0355 LF 3-3/4" Carbon Steel Rounds, ASTM A108.....	153.27	
<i>For 316 Stainless Steel, Add</i>	317.66	
<i>For Aluminum, Add</i>	17.87	
<i>For Galvanized Steel, Add</i>	61.55	
<i>For 304 Stainless Steel, Add</i>	282.92	
05 12 23 00-0356 LF 4" Carbon Steel Rounds, ASTM A108.....	171.19	
<i>For 316 Stainless Steel, Add</i>	361.70	
<i>For Aluminum, Add</i>	20.35	
<i>For Galvanized Steel, Add</i>	70.08	
<i>For 304 Stainless Steel, Add</i>	322.14	
05 12 23 00-0357 Square Stock (05 12 23 00-0119)		
05 12 23 00-0358 LF 3/8" Square Bar Stock.....	1.32	
<i>For 316 Stainless Steel, Add</i>	1.09	
<i>For Aluminum, Add</i>	0.06	
<i>For Galvanized Steel, Add</i>	0.21	
<i>For 304 Stainless Steel, Add</i>	0.97	

05 Metals**05 10 Structural Metal Framing****05 12 Structural Steel Framing**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 12 23 00-0359	LF		1/2" Square Bar Stock.....	1.68	
			For 316 Stainless Steel, Add	1.92	
			For Aluminum, Add	0.11	
			For Galvanized Steel, Add	0.37	
			For 304 Stainless Steel, Add	1.71	
05 12 23 00-0360	LF		5/8" Square Bar Stock.....	2.14	
			For 316 Stainless Steel, Add	3.01	
			For Aluminum, Add	0.17	
			For Galvanized Steel, Add	0.58	
			For 304 Stainless Steel, Add	2.68	
05 12 23 00-0361	LF		3/4" Square Bar Stock.....	2.80	
			For 316 Stainless Steel, Add	4.35	
			For Aluminum, Add	0.24	
			For Galvanized Steel, Add	0.84	
			For 304 Stainless Steel, Add	3.88	
05 12 23 00-0362	LF		7/8" Square Bar Stock.....	3.54	
			For 316 Stainless Steel, Add	6.05	
			For Aluminum, Add	0.34	
			For Galvanized Steel, Add	1.17	
			For 304 Stainless Steel, Add	5.39	
05 12 23 00-0363	LF		1" Square Bar Stock.....	4.37	
			For 316 Stainless Steel, Add	7.74	
			For Aluminum, Add	0.44	
			For Galvanized Steel, Add	1.50	
			For 304 Stainless Steel, Add	6.90	
05 12 23 00-0364	LF		1-1/4" Square Bar Stock.....	6.85	
			For 316 Stainless Steel, Add	12.10	
			For Aluminum, Add	0.68	
			For Galvanized Steel, Add	2.34	
			For 304 Stainless Steel, Add	10.77	
05 12 23 00-0365	LF		1-1/2" Square Bar Stock.....	9.75	
			For 316 Stainless Steel, Add	17.41	
			For Aluminum, Add	0.98	
			For Galvanized Steel, Add	3.37	
			For 304 Stainless Steel, Add	15.50	
05 12 23 00-0366	LF		1-3/4" Square Bar Stock.....	14.75	
			For 316 Stainless Steel, Add	24.22	
			For Aluminum, Add	1.36	
			For Galvanized Steel, Add	4.69	
			For 304 Stainless Steel, Add	21.57	
05 12 23 00-0367	LF		2" Square Bar Stock.....	21.73	
			For 316 Stainless Steel, Add	30.98	
			For Aluminum, Add	1.74	
			For Galvanized Steel, Add	6.00	
			For 304 Stainless Steel, Add	27.59	
05 12 23 00-0368			Steel Tubing <small>(05 12 23 00-0119)</small>		
			Note: General purpose low-carbon steel.		
05 12 23 00-0369			Square Steel Tubing <small>(05 12 23 00-0368)</small>		
05 12 23 00-0370			0.06" Wall Thickness <small>(05 12 23 00-0369)</small>		
05 12 23 00-0371	LF		1/2" x 1/2" x 0.06" Square Steel Tubing.....	1.50	0.46
			For >100 To 250, Deduct	-0.05	
			For >250 To 500, Deduct	-0.08	
			For >500 To 1,000, Deduct	-0.14	
			For >1,000, Deduct	-0.19	
			For 316 Stainless Steel, Add	2.85	
			For Aluminum, Add	0.16	
			For Galvanized Steel, Add	0.55	
			For 304 Stainless Steel, Add	2.54	
05 12 23 00-0372	LF		3/4" x 3/4" x 0.06" Square Steel Tubing.....	2.32	0.72
			For >100 To 250, Deduct	-0.07	
			For >250 To 500, Deduct	-0.13	
			For >500 To 1,000, Deduct	-0.21	
			For >1,000, Deduct	-0.30	
			For 316 Stainless Steel, Add	4.32	
			For Aluminum, Add	0.24	
			For Galvanized Steel, Add	0.84	
			For 304 Stainless Steel, Add	3.85	
05 12 23 00-0373	LF		1" x 1" x 0.06" Square Steel Tubing.....	3.13	1.32
			For >100 To 250, Deduct	-0.10	
			For >250 To 500, Deduct	-0.18	
			For >500 To 1,000, Deduct	-0.29	
			For >1,000, Deduct	-0.40	
			For 316 Stainless Steel, Add	5.79	
			For Aluminum, Add	0.33	
			For Galvanized Steel, Add	1.12	
			For 304 Stainless Steel, Add	5.16	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 12 23 00-0374 LF 1-1/4" x 1-1/4" x 0.06" Square Steel Tubing	4.11	1.26
For >100 To 250, Deduct	-0.13	
For >250 To 500, Deduct	-0.23	
For >500 To 1,000, Deduct	-0.37	
For >1,000, Deduct	-0.52	
For 316 Stainless Steel, Add	7.81	
For Aluminum, Add	0.44	
For Galvanized Steel, Add	1.51	
For 304 Stainless Steel, Add	6.95	
05 12 23 00-0375 LF 1-1/2" x 1-1/2" x 0.06" Square Steel Tubing	4.89	1.52
For >100 To 250, Deduct	-0.15	
For >250 To 500, Deduct	-0.27	
For >500 To 1,000, Deduct	-0.45	
For >1,000, Deduct	-0.62	
For 316 Stainless Steel, Add	9.18	
For Aluminum, Add	0.52	
For Galvanized Steel, Add	1.78	
For 304 Stainless Steel, Add	8.18	
05 12 23 00-0376 0.083" Wall Thickness <small>(05 12 23 00-0369)</small>		
05 12 23 00-0377 LF 3/4" x 3/4" x 0.083" Square Steel Tubing	2.71	0.86
For >100 To 250, Deduct	-0.09	
For >250 To 500, Deduct	-0.15	
For >500 To 1,000, Deduct	-0.25	
For >1,000, Deduct	-0.35	
For 316 Stainless Steel, Add	5.02	
For Aluminum, Add	0.28	
For Galvanized Steel, Add	0.97	
For 304 Stainless Steel, Add	4.47	
05 12 23 00-0378 LF 1" x 1" x 0.083" Square Steel Tubing	3.91	1.17
For >100 To 250, Deduct	-0.12	
For >250 To 500, Deduct	-0.21	
For >500 To 1,000, Deduct	-0.35	
For >1,000, Deduct	-0.49	
For 316 Stainless Steel, Add	7.52	
For Aluminum, Add	0.42	
For Galvanized Steel, Add	1.46	
For 304 Stainless Steel, Add	6.70	
05 12 23 00-0379 LF 1-1/4" x 1-1/4" x 0.083" Square Steel Tubing	4.75	1.49
For >100 To 250, Deduct	-0.15	
For >250 To 500, Deduct	-0.27	
For >500 To 1,000, Deduct	-0.44	
For >1,000, Deduct	-0.60	
For 316 Stainless Steel, Add	8.86	
For Aluminum, Add	0.50	
For Galvanized Steel, Add	1.72	
For 304 Stainless Steel, Add	7.89	
05 12 23 00-0380 LF 1-1/2" x 1-1/2" x 0.083" Square Steel Tubing	5.77	1.81
For >100 To 250, Deduct	-0.18	
For >250 To 500, Deduct	-0.33	
For >500 To 1,000, Deduct	-0.53	
For >1,000, Deduct	-0.74	
For 316 Stainless Steel, Add	10.72	
For Aluminum, Add	0.60	
For Galvanized Steel, Add	2.08	
For 304 Stainless Steel, Add	9.55	
05 12 23 00-0381 LF 2" x 2" x 0.083" Square Steel Tubing	7.42	2.42
For >100 To 250, Deduct	-0.24	
For >250 To 500, Deduct	-0.43	
For >500 To 1,000, Deduct	-0.69	
For >1,000, Deduct	-0.96	
For 316 Stainless Steel, Add	13.47	
For Aluminum, Add	0.76	
For Galvanized Steel, Add	2.61	
For 304 Stainless Steel, Add	12.00	
05 12 23 00-0382 0.12" Wall Thickness <small>(05 12 23 00-0369)</small>		
05 12 23 00-0383 LF 1" x 1" x 0.12" Square Steel Tubing	4.35	1.39
For >100 To 250, Deduct	-0.14	
For >250 To 500, Deduct	-0.25	
For >500 To 1,000, Deduct	-0.40	
For >1,000, Deduct	-0.56	
For 316 Stainless Steel, Add	8.00	
For Aluminum, Add	0.45	
For Galvanized Steel, Add	1.55	
For 304 Stainless Steel, Add	7.13	

05 Metals**05 10 Structural Metal Framing****05 12 Structural Steel Framing**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 12 23 00-0384	LF		1-1/4" x 1-1/4" x 0.12" Square Steel Tubing.....	5.62	1.79
			<i>For >100 To 250, Deduct</i>	-0.18	
			<i>For >250 To 500, Deduct</i>	-0.32	
			<i>For >500 To 1,000, Deduct</i>	-0.52	
			<i>For >1,000, Deduct</i>	-0.72	
			<i>For 316 Stainless Steel, Add</i>	10.34	
			<i>For Aluminum, Add</i>	0.58	
			<i>For Galvanized Steel, Add</i>	2.00	
			<i>For 304 Stainless Steel, Add</i>	9.21	
05 12 23 00-0385	LF		1-1/2" x 1-1/2" x 0.12" Square Steel Tubing.....	6.89	2.18
			<i>For >100 To 250, Deduct</i>	-0.22	
			<i>For >250 To 500, Deduct</i>	-0.39	
			<i>For >500 To 1,000, Deduct</i>	-0.64	
			<i>For >1,000, Deduct</i>	-0.88	
			<i>For 316 Stainless Steel, Add</i>	12.74	
			<i>For Aluminum, Add</i>	0.72	
			<i>For Galvanized Steel, Add</i>	2.47	
			<i>For 304 Stainless Steel, Add</i>	11.34	
05 12 23 00-0386	LF		2" x 2" x 0.12" Square Steel Tubing.....	9.34	2.97
			<i>For >100 To 250, Deduct</i>	-0.30	
			<i>For >250 To 500, Deduct</i>	-0.53	
			<i>For >500 To 1,000, Deduct</i>	-0.86	
			<i>For >1,000, Deduct</i>	-1.20	
			<i>For 316 Stainless Steel, Add</i>	17.18	
			<i>For Aluminum, Add</i>	0.97	
			<i>For Galvanized Steel, Add</i>	3.33	
			<i>For 304 Stainless Steel, Add</i>	15.30	
05 12 23 00-0387			1/8" Wall Thickness (05 12 23 00-0369)		
05 12 23 00-0388	LF		2" x 2" x 1/8" Square Steel Tubing.....	8.59	3.09
			<i>For >100 To 250, Deduct</i>	-0.31	
			<i>For >250 To 500, Deduct</i>	-0.52	
			<i>For >500 To 1,000, Deduct</i>	-0.84	
			<i>For >1,000, Deduct</i>	-1.16	
			<i>For 316 Stainless Steel, Add</i>	14.30	
			<i>For Aluminum, Add</i>	0.80	
			<i>For Galvanized Steel, Add</i>	2.77	
			<i>For 304 Stainless Steel, Add</i>	12.74	
05 12 23 00-0389	LF		2-1/2" x 2-1/2" x 1/8" Square Steel Tubing.....	11.25	3.92
			<i>For >100 To 250, Deduct</i>	-0.39	
			<i>For >250 To 500, Deduct</i>	-0.67	
			<i>For >500 To 1,000, Deduct</i>	-1.08	
			<i>For >1,000, Deduct</i>	-1.50	
			<i>For 316 Stainless Steel, Add</i>	19.33	
			<i>For Aluminum, Add</i>	1.09	
			<i>For Galvanized Steel, Add</i>	3.74	
			<i>For 304 Stainless Steel, Add</i>	17.21	
05 12 23 00-0390	LF		3" x 3" x 1/8" Square Steel Tubing.....	13.27	4.74
			<i>For >100 To 250, Deduct</i>	-0.47	
			<i>For >250 To 500, Deduct</i>	-0.81	
			<i>For >500 To 1,000, Deduct</i>	-1.30	
			<i>For >1,000, Deduct</i>	-1.79	
			<i>For 316 Stainless Steel, Add</i>	22.24	
			<i>For Aluminum, Add</i>	1.25	
			<i>For Galvanized Steel, Add</i>	4.31	
			<i>For 304 Stainless Steel, Add</i>	19.81	
05 12 23 00-0391	LF		3-1/2" x 3-1/2" x 1/8" Square Steel Tubing.....	15.41	5.57
			<i>For >100 To 250, Deduct</i>	-0.56	
			<i>For >250 To 500, Deduct</i>	-0.94	
			<i>For >500 To 1,000, Deduct</i>	-1.51	
			<i>For >1,000, Deduct</i>	-2.08	
			<i>For 316 Stainless Steel, Add</i>	25.57	
			<i>For Aluminum, Add</i>	1.44	
			<i>For Galvanized Steel, Add</i>	4.95	
			<i>For 304 Stainless Steel, Add</i>	22.77	
05 12 23 00-0392	LF		4" x 4" x 1/8" Square Steel Tubing.....	17.10	6.38
			<i>For >100 To 250, Deduct</i>	-0.64	
			<i>For >250 To 500, Deduct</i>	-1.07	
			<i>For >500 To 1,000, Deduct</i>	-1.71	
			<i>For >1,000, Deduct</i>	-2.35	
			<i>For 316 Stainless Steel, Add</i>	27.46	
			<i>For Aluminum, Add</i>	1.54	
			<i>For Galvanized Steel, Add</i>	5.32	
			<i>For 304 Stainless Steel, Add</i>	24.45	
05 12 23 00-0393			3/16" Wall Thickness (05 12 23 00-0369)		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 12 23 00-0394 LF 2" x 2" x 3/16" Square Steel Tubing.....	9.74	3.48
For >100 To 250, Deduct	-0.35	
For >250 To 500, Deduct	-0.59	
For >500 To 1,000, Deduct	-0.95	
For >1,000, Deduct	-1.31	
For 316 Stainless Steel, Add	16.29	
For Aluminum, Add	0.92	
For Galvanized Steel, Add	3.16	
For 304 Stainless Steel, Add	14.51	
05 12 23 00-0395 LF 2-1/2" x 2-1/2" x 3/16" Square Steel Tubing.....	12.61	4.51
For >100 To 250, Deduct	-0.45	
For >250 To 500, Deduct	-0.77	
For >500 To 1,000, Deduct	-1.23	
For >1,000, Deduct	-1.70	
For 316 Stainless Steel, Add	21.09	
For Aluminum, Add	1.19	
For Galvanized Steel, Add	4.09	
For 304 Stainless Steel, Add	18.78	
05 12 23 00-0396 LF 3" x 3" x 3/16" Square Steel Tubing.....	15.49	5.55
For >100 To 250, Deduct	-0.55	
For >250 To 500, Deduct	-0.94	
For >500 To 1,000, Deduct	-1.51	
For >1,000, Deduct	-2.09	
For 316 Stainless Steel, Add	25.92	
For Aluminum, Add	1.46	
For Galvanized Steel, Add	5.02	
For 304 Stainless Steel, Add	23.09	
05 12 23 00-0397 LF 3-1/2" x 3-1/2" x 3/16" Square Steel Tubing.....	18.38	6.57
For >100 To 250, Deduct	-0.66	
For >250 To 500, Deduct	-1.12	
For >500 To 1,000, Deduct	-1.80	
For >1,000, Deduct	-2.47	
For 316 Stainless Steel, Add	30.75	
For Aluminum, Add	1.73	
For Galvanized Steel, Add	5.96	
For 304 Stainless Steel, Add	27.39	
05 12 23 00-0398 LF 4" x 4" x 3/16" Square Steel Tubing.....	21.24	7.60
For >100 To 250, Deduct	-0.76	
For >250 To 500, Deduct	-1.29	
For >500 To 1,000, Deduct	-2.08	
For >1,000, Deduct	-2.86	
For 316 Stainless Steel, Add	35.52	
For Aluminum, Add	2.00	
For Galvanized Steel, Add	6.88	
For 304 Stainless Steel, Add	31.64	
05 12 23 00-0399 LF 4-1/2" x 4-1/2" x 3/16" Square Steel Tubing.....	24.12	8.64
For >100 To 250, Deduct	-0.86	
For >250 To 500, Deduct	-1.47	
For >500 To 1,000, Deduct	-2.36	
For >1,000, Deduct	-3.25	
For 316 Stainless Steel, Add	40.35	
For Aluminum, Add	2.27	
For Galvanized Steel, Add	7.82	
For 304 Stainless Steel, Add	35.94	
05 12 23 00-0400 LF 5" x 5" x 3/16" Square Steel Tubing.....	26.99	9.66
For >100 To 250, Deduct	-0.97	
For >250 To 500, Deduct	-1.64	
For >500 To 1,000, Deduct	-2.64	
For >1,000, Deduct	-3.63	
For 316 Stainless Steel, Add	45.15	
For Aluminum, Add	2.54	
For Galvanized Steel, Add	8.75	
For 304 Stainless Steel, Add	40.21	
05 12 23 00-0401 LF 6" x 6" x 3/16" Square Steel Tubing.....	32.76	11.73
For >100 To 250, Deduct	-1.17	
For >250 To 500, Deduct	-1.99	
For >500 To 1,000, Deduct	-3.20	
For >1,000, Deduct	-4.41	
For 316 Stainless Steel, Add	54.82	
For Aluminum, Add	3.08	
For Galvanized Steel, Add	10.62	
For 304 Stainless Steel, Add	48.82	
05 12 23 00-0402 1/4" Wall Thickness (05 12 23 00-0399)		
05 12 23 00-0403 LF 2" x 2" x 1/4" Square Steel Tubing.....	10.29	3.49
For >100 To 250, Deduct	-0.35	
For >250 To 500, Deduct	-0.61	
For >500 To 1,000, Deduct	-0.98	
For >1,000, Deduct	-1.35	
For 316 Stainless Steel, Add	18.02	
For Aluminum, Add	1.01	
For Galvanized Steel, Add	3.49	
For 304 Stainless Steel, Add	16.05	

05 Metals**05 10 Structural Metal Framing****05 12 Structural Steel Framing**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 12 23 00-0404	LF		2-1/2" x 2-1/2" x 1/4" Square Steel Tubing.....	13.52	4.59
			<i>For >100 To 250, Deduct</i>	-0.46	
			<i>For >250 To 500, Deduct</i>	-0.80	
			<i>For >500 To 1,000, Deduct</i>	-1.29	
			<i>For >1,000, Deduct</i>	-1.78	
			<i>For 316 Stainless Steel, Add</i>	23.68	
			<i>For Aluminum, Add</i>	1.33	
			<i>For Galvanized Steel, Add</i>	4.59	
			<i>For 304 Stainless Steel, Add</i>	21.09	
05 12 23 00-0405	LF		3" x 3" x 1/4" Square Steel Tubing.....	16.74	5.69
			<i>For >100 To 250, Deduct</i>	-0.57	
			<i>For >250 To 500, Deduct</i>	-0.99	
			<i>For >500 To 1,000, Deduct</i>	-1.60	
			<i>For >1,000, Deduct</i>	-2.20	
			<i>For 316 Stainless Steel, Add</i>	29.31	
			<i>For Aluminum, Add</i>	1.65	
			<i>For Galvanized Steel, Add</i>	5.68	
			<i>For 304 Stainless Steel, Add</i>	26.11	
05 12 23 00-0406	LF		3-1/2" x 3-1/2" x 1/4" Square Steel Tubing.....	19.98	6.78
			<i>For >100 To 250, Deduct</i>	-0.68	
			<i>For >250 To 500, Deduct</i>	-1.18	
			<i>For >500 To 1,000, Deduct</i>	-1.90	
			<i>For >1,000, Deduct</i>	-2.63	
			<i>For 316 Stainless Steel, Add</i>	34.98	
			<i>For Aluminum, Add</i>	1.97	
			<i>For Galvanized Steel, Add</i>	6.78	
			<i>For 304 Stainless Steel, Add</i>	31.15	
05 12 23 00-0407	LF		4" x 4" x 1/4" Square Steel Tubing.....	23.21	7.88
			<i>For >100 To 250, Deduct</i>	-0.79	
			<i>For >250 To 500, Deduct</i>	-1.37	
			<i>For >500 To 1,000, Deduct</i>	-2.21	
			<i>For >1,000, Deduct</i>	-3.05	
			<i>For 316 Stainless Steel, Add</i>	40.64	
			<i>For Aluminum, Add</i>	2.29	
			<i>For Galvanized Steel, Add</i>	7.87	
			<i>For 304 Stainless Steel, Add</i>	36.20	
05 12 23 00-0408	LF		4-1/2" x 4-1/2" x 1/4" Square Steel Tubing.....	26.45	8.98
			<i>For >100 To 250, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-1.56	
			<i>For >500 To 1,000, Deduct</i>	-2.52	
			<i>For >1,000, Deduct</i>	-3.48	
			<i>For 316 Stainless Steel, Add</i>	46.30	
			<i>For Aluminum, Add</i>	2.60	
			<i>For Galvanized Steel, Add</i>	8.97	
			<i>For 304 Stainless Steel, Add</i>	41.24	
05 12 23 00-0409	LF		5" x 5" x 1/4" Square Steel Tubing.....	29.70	10.09
			<i>For >100 To 250, Deduct</i>	-1.01	
			<i>For >250 To 500, Deduct</i>	-1.75	
			<i>For >500 To 1,000, Deduct</i>	-2.83	
			<i>For >1,000, Deduct</i>	-3.91	
			<i>For 316 Stainless Steel, Add</i>	52.00	
			<i>For Aluminum, Add</i>	2.93	
			<i>For Galvanized Steel, Add</i>	10.08	
			<i>For 304 Stainless Steel, Add</i>	46.31	
05 12 23 00-0410	LF		6" x 6" x 1/4" Square Steel Tubing.....	36.17	12.28
			<i>For >100 To 250, Deduct</i>	-1.23	
			<i>For >250 To 500, Deduct</i>	-2.13	
			<i>For >500 To 1,000, Deduct</i>	-3.45	
			<i>For >1,000, Deduct</i>	-4.76	
			<i>For 316 Stainless Steel, Add</i>	63.33	
			<i>For Aluminum, Add</i>	3.56	
			<i>For Galvanized Steel, Add</i>	12.27	
			<i>For 304 Stainless Steel, Add</i>	56.40	
05 12 23 00-0411			Rectangular Steel Tubing (05 12 23 00-0368)		
05 12 23 00-0412			3/16" Wall Thickness (05 12 23 00-0411)		
05 12 23 00-0413	LF		3" x 2" x 3/16" Square Steel Tubing.....	12.61	4.51
			<i>For >100 To 250, Deduct</i>	-0.45	
			<i>For >250 To 500, Deduct</i>	-0.77	
			<i>For >500 To 1,000, Deduct</i>	-1.23	
			<i>For >1,000, Deduct</i>	-1.70	
			<i>For 316 Stainless Steel, Add</i>	21.09	
			<i>For Aluminum, Add</i>	1.19	
			<i>For Galvanized Steel, Add</i>	4.09	
			<i>For 304 Stainless Steel, Add</i>	18.78	
05 12 23 00-0414	LF		4" x 2" x 3/16" Square Steel Tubing.....	15.49	5.55
			<i>For >100 To 250, Deduct</i>	-0.55	
			<i>For >250 To 500, Deduct</i>	-0.94	
			<i>For >500 To 1,000, Deduct</i>	-1.51	
			<i>For >1,000, Deduct</i>	-2.09	
			<i>For 316 Stainless Steel, Add</i>	25.92	
			<i>For Aluminum, Add</i>	1.46	
			<i>For Galvanized Steel, Add</i>	5.02	
			<i>For 304 Stainless Steel, Add</i>	23.09	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 12 23 00-0415 LF 4" x 3" x 3/16" Square Steel Tubing.....	18.38	6.57
For >100 To 250, Deduct	-0.66	
For >250 To 500, Deduct	-1.12	
For >500 To 1,000, Deduct	-1.80	
For >1,000, Deduct	-2.47	
For 316 Stainless Steel, Add	30.75	
For Aluminum, Add	1.73	
For Galvanized Steel, Add	5.96	
For 304 Stainless Steel, Add	27.39	
05 12 23 00-0416 LF 5" x 2" x 3/16" Square Steel Tubing.....	18.38	6.57
For >100 To 250, Deduct	-0.66	
For >250 To 500, Deduct	-1.12	
For >500 To 1,000, Deduct	-1.80	
For >1,000, Deduct	-2.47	
For 316 Stainless Steel, Add	30.75	
For Aluminum, Add	1.73	
For Galvanized Steel, Add	5.96	
For 304 Stainless Steel, Add	27.39	
05 12 23 00-0417 LF 5" x 3" x 3/16" Square Steel Tubing.....	21.24	7.60
For >100 To 250, Deduct	-0.76	
For >250 To 500, Deduct	-1.29	
For >500 To 1,000, Deduct	-2.08	
For >1,000, Deduct	-2.86	
For 316 Stainless Steel, Add	35.52	
For Aluminum, Add	2.00	
For Galvanized Steel, Add	6.88	
For 304 Stainless Steel, Add	31.64	
05 12 23 00-0418 LF 5" x 4" x 3/16" Square Steel Tubing.....	24.12	8.64
For >100 To 250, Deduct	-0.86	
For >250 To 500, Deduct	-1.47	
For >500 To 1,000, Deduct	-2.36	
For >1,000, Deduct	-3.25	
For 316 Stainless Steel, Add	40.35	
For Aluminum, Add	2.27	
For Galvanized Steel, Add	7.82	
For 304 Stainless Steel, Add	35.94	
05 12 23 00-0419 LF 6" x 2" x 3/16" Square Steel Tubing.....	21.24	7.60
For >100 To 250, Deduct	-0.76	
For >250 To 500, Deduct	-1.29	
For >500 To 1,000, Deduct	-2.08	
For >1,000, Deduct	-2.86	
For 316 Stainless Steel, Add	35.52	
For Aluminum, Add	2.00	
For Galvanized Steel, Add	6.88	
For 304 Stainless Steel, Add	31.64	
05 12 23 00-0420 LF 6" x 3" x 3/16" Square Steel Tubing.....	24.12	8.64
For >100 To 250, Deduct	-0.86	
For >250 To 500, Deduct	-1.47	
For >500 To 1,000, Deduct	-2.36	
For >1,000, Deduct	-3.25	
For 316 Stainless Steel, Add	40.35	
For Aluminum, Add	2.27	
For Galvanized Steel, Add	7.82	
For 304 Stainless Steel, Add	35.94	
05 12 23 00-0421 LF 6" x 4" x 3/16" Square Steel Tubing.....	26.99	9.66
For >100 To 250, Deduct	-0.97	
For >250 To 500, Deduct	-1.64	
For >500 To 1,000, Deduct	-2.64	
For >1,000, Deduct	-3.63	
For 316 Stainless Steel, Add	45.15	
For Aluminum, Add	2.54	
For Galvanized Steel, Add	8.75	
For 304 Stainless Steel, Add	40.21	
05 12 23 00-0422 1/4" Wall Thickness (05 12 23 00-0411)		
05 12 23 00-0423 LF 3" x 2" x 1/4" Square Steel Tubing.....	13.52	4.59
For >100 To 250, Deduct	-0.46	
For >250 To 500, Deduct	-0.80	
For >500 To 1,000, Deduct	-1.29	
For >1,000, Deduct	-1.78	
For 316 Stainless Steel, Add	23.68	
For Aluminum, Add	1.33	
For Galvanized Steel, Add	4.59	
For 304 Stainless Steel, Add	21.09	
05 12 23 00-0424 LF 4" x 2" x 1/4" Square Steel Tubing.....	16.74	5.69
For >100 To 250, Deduct	-0.57	
For >250 To 500, Deduct	-0.99	
For >500 To 1,000, Deduct	-1.60	
For >1,000, Deduct	-2.20	
For 316 Stainless Steel, Add	29.31	
For Aluminum, Add	1.65	
For Galvanized Steel, Add	5.68	
For 304 Stainless Steel, Add	26.11	

05 Metals**05 10 Structural Metal Framing****05 12 Structural Steel Framing**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 12 23 00-0425	LF		4" x 3" x 1/4" Square Steel Tubing.....	19.98	6.78
			<i>For >100 To 250, Deduct</i>	-0.68	
			<i>For >250 To 500, Deduct</i>	-1.18	
			<i>For >500 To 1,000, Deduct</i>	-1.90	
			<i>For >1,000, Deduct</i>	-2.63	
			<i>For 316 Stainless Steel, Add</i>	34.98	
			<i>For Aluminum, Add</i>	1.97	
			<i>For Galvanized Steel, Add</i>	6.78	
			<i>For 304 Stainless Steel, Add</i>	31.15	
05 12 23 00-0426	LF		5" x 2" x 1/4" Square Steel Tubing.....	19.98	6.78
			<i>For >100 To 250, Deduct</i>	-0.68	
			<i>For >250 To 500, Deduct</i>	-1.18	
			<i>For >500 To 1,000, Deduct</i>	-1.90	
			<i>For >1,000, Deduct</i>	-2.63	
			<i>For 316 Stainless Steel, Add</i>	34.98	
			<i>For Aluminum, Add</i>	1.97	
			<i>For Galvanized Steel, Add</i>	6.78	
			<i>For 304 Stainless Steel, Add</i>	31.15	
05 12 23 00-0427	LF		5" x 3" x 1/4" Square Steel Tubing.....	23.21	7.88
			<i>For >100 To 250, Deduct</i>	-0.79	
			<i>For >250 To 500, Deduct</i>	-1.37	
			<i>For >500 To 1,000, Deduct</i>	-2.21	
			<i>For >1,000, Deduct</i>	-3.05	
			<i>For 316 Stainless Steel, Add</i>	40.64	
			<i>For Aluminum, Add</i>	2.29	
			<i>For Galvanized Steel, Add</i>	7.87	
			<i>For 304 Stainless Steel, Add</i>	36.20	
05 12 23 00-0428	LF		5" x 4" x 1/4" Square Steel Tubing.....	26.45	8.98
			<i>For >100 To 250, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-1.56	
			<i>For >500 To 1,000, Deduct</i>	-2.52	
			<i>For >1,000, Deduct</i>	-3.48	
			<i>For 316 Stainless Steel, Add</i>	46.30	
			<i>For Aluminum, Add</i>	2.60	
			<i>For Galvanized Steel, Add</i>	8.97	
			<i>For 304 Stainless Steel, Add</i>	41.24	
05 12 23 00-0429	LF		6" x 2" x 1/4" Square Steel Tubing.....	23.21	7.88
			<i>For >100 To 250, Deduct</i>	-0.79	
			<i>For >250 To 500, Deduct</i>	-1.37	
			<i>For >500 To 1,000, Deduct</i>	-2.21	
			<i>For >1,000, Deduct</i>	-3.05	
			<i>For 316 Stainless Steel, Add</i>	40.64	
			<i>For Aluminum, Add</i>	2.29	
			<i>For Galvanized Steel, Add</i>	7.87	
			<i>For 304 Stainless Steel, Add</i>	36.20	
05 12 23 00-0430	LF		6" x 3" x 1/4" Square Steel Tubing.....	26.45	8.98
			<i>For >100 To 250, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-1.56	
			<i>For >500 To 1,000, Deduct</i>	-2.52	
			<i>For >1,000, Deduct</i>	-3.48	
			<i>For 316 Stainless Steel, Add</i>	46.30	
			<i>For Aluminum, Add</i>	2.60	
			<i>For Galvanized Steel, Add</i>	8.97	
			<i>For 304 Stainless Steel, Add</i>	41.24	
05 12 23 00-0431	LF		6" x 4" x 1/4" Square Steel Tubing.....	29.70	10.09
			<i>For >100 To 250, Deduct</i>	-1.01	
			<i>For >250 To 500, Deduct</i>	-1.75	
			<i>For >500 To 1,000, Deduct</i>	-2.83	
			<i>For >1,000, Deduct</i>	-3.91	
			<i>For 316 Stainless Steel, Add</i>	52.00	
			<i>For Aluminum, Add</i>	2.93	
			<i>For Galvanized Steel, Add</i>	10.08	
			<i>For 304 Stainless Steel, Add</i>	46.31	
05 12 23 00-0432			Round Steel Tubing <small>(05 12 23 00-0368)</small>		
05 12 23 00-0433			0.065" Wall Thickness <small>(05 12 23 00-0432)</small>		
05 12 23 00-0434	LF		1" Diameter x 0.065" Round Steel Tubing	2.70	0.84
			<i>For >100 To 250, Deduct</i>	-0.08	
			<i>For >250 To 500, Deduct</i>	-0.15	
			<i>For >500 To 1,000, Deduct</i>	-0.25	
			<i>For >1,000, Deduct</i>	-0.34	
			<i>For 316 Stainless Steel, Add</i>	5.06	
			<i>For Aluminum, Add</i>	0.28	
			<i>For Galvanized Steel, Add</i>	0.98	
			<i>For 304 Stainless Steel, Add</i>	4.50	
05 12 23 00-0435	LF		1-1/4" Diameter x 0.065" Round Steel Tubing	3.43	1.07
			<i>For >100 To 250, Deduct</i>	-0.11	
			<i>For >250 To 500, Deduct</i>	-0.19	
			<i>For >500 To 1,000, Deduct</i>	-0.31	
			<i>For >1,000, Deduct</i>	-0.43	
			<i>For 316 Stainless Steel, Add</i>	6.43	
			<i>For Aluminum, Add</i>	0.36	
			<i>For Galvanized Steel, Add</i>	1.25	
			<i>For 304 Stainless Steel, Add</i>	5.73	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 12 23 00-0436 LF 1-1/2" Diameter x 0.065" Round Steel Tubing	4.14	1.29
<i>For >100 To 250, Deduct</i>	-0.13	
<i>For >250 To 500, Deduct</i>	-0.23	
<i>For >500 To 1,000, Deduct</i>	-0.38	
<i>For >1,000, Deduct</i>	-0.52	
<i>For 316 Stainless Steel, Add</i>	7.78	
<i>For Aluminum, Add</i>	0.44	
<i>For Galvanized Steel, Add</i>	1.51	
<i>For 304 Stainless Steel, Add</i>	6.93	
05 12 23 00-0437 LF 2" Diameter x 0.065" Round Steel Tubing	5.58	1.73
<i>For >100 To 250, Deduct</i>	-0.17	
<i>For >250 To 500, Deduct</i>	-0.31	
<i>For >500 To 1,000, Deduct</i>	-0.51	
<i>For >1,000, Deduct</i>	-0.71	
<i>For 316 Stainless Steel, Add</i>	10.46	
<i>For Aluminum, Add</i>	0.59	
<i>For Galvanized Steel, Add</i>	2.03	
<i>For 304 Stainless Steel, Add</i>	9.32	
05 12 23 00-0438 LF 2-1/2" Diameter x 0.065" Round Steel Tubing	7.03	2.18
<i>For >100 To 250, Deduct</i>	-0.22	
<i>For >250 To 500, Deduct</i>	-0.39	
<i>For >500 To 1,000, Deduct</i>	-0.64	
<i>For >1,000, Deduct</i>	-0.89	
<i>For 316 Stainless Steel, Add</i>	13.18	
<i>For Aluminum, Add</i>	0.74	
<i>For Galvanized Steel, Add</i>	2.55	
<i>For 304 Stainless Steel, Add</i>	11.74	
05 12 23 00-0439 LF 3" Diameter x 0.065" Round Steel Tubing	8.46	2.63
<i>For >100 To 250, Deduct</i>	-0.26	
<i>For >250 To 500, Deduct</i>	-0.47	
<i>For >500 To 1,000, Deduct</i>	-0.77	
<i>For >1,000, Deduct</i>	-1.07	
<i>For 316 Stainless Steel, Add</i>	15.87	
<i>For Aluminum, Add</i>	0.89	
<i>For Galvanized Steel, Add</i>	3.08	
<i>For 304 Stainless Steel, Add</i>	14.14	
05 12 23 00-0440 LF 3-1/2" Diameter x 0.065" Round Steel Tubing	9.92	3.08
<i>For >100 To 250, Deduct</i>	-0.31	
<i>For >250 To 500, Deduct</i>	-0.56	
<i>For >500 To 1,000, Deduct</i>	-0.91	
<i>For >1,000, Deduct</i>	-1.26	
<i>For 316 Stainless Steel, Add</i>	18.59	
<i>For Aluminum, Add</i>	1.05	
<i>For Galvanized Steel, Add</i>	3.60	
<i>For 304 Stainless Steel, Add</i>	16.56	
05 12 23 00-0441 LF 4" Diameter x 0.065" Round Steel Tubing	11.36	3.52
<i>For >100 To 250, Deduct</i>	-0.35	
<i>For >250 To 500, Deduct</i>	-0.64	
<i>For >500 To 1,000, Deduct</i>	-1.04	
<i>For >1,000, Deduct</i>	-1.44	
<i>For 316 Stainless Steel, Add</i>	21.31	
<i>For Aluminum, Add</i>	1.20	
<i>For Galvanized Steel, Add</i>	4.13	
<i>For 304 Stainless Steel, Add</i>	18.98	
05 12 23 00-0442 0.083" Wall Thickness <small>(05 12 23 00-0432)</small>		
05 12 23 00-0443 LF 1" Diameter x 0.083" Round Steel Tubing	2.94	0.92
<i>For >100 To 250, Deduct</i>	-0.09	
<i>For >250 To 500, Deduct</i>	-0.17	
<i>For >500 To 1,000, Deduct</i>	-0.27	
<i>For >1,000, Deduct</i>	-0.37	
<i>For 316 Stainless Steel, Add</i>	5.47	
<i>For Aluminum, Add</i>	0.31	
<i>For Galvanized Steel, Add</i>	1.06	
<i>For 304 Stainless Steel, Add</i>	4.87	
05 12 23 00-0444 LF 1-1/4" Diameter x 0.083" Round Steel Tubing	3.74	1.17
<i>For >100 To 250, Deduct</i>	-0.12	
<i>For >250 To 500, Deduct</i>	-0.21	
<i>For >500 To 1,000, Deduct</i>	-0.34	
<i>For >1,000, Deduct</i>	-0.48	
<i>For 316 Stainless Steel, Add</i>	6.98	
<i>For Aluminum, Add</i>	0.39	
<i>For Galvanized Steel, Add</i>	1.35	
<i>For 304 Stainless Steel, Add</i>	6.21	
05 12 23 00-0445 LF 1-1/2" Diameter x 0.083" Round Steel Tubing	4.53	1.42
<i>For >100 To 250, Deduct</i>	-0.14	
<i>For >250 To 500, Deduct</i>	-0.26	
<i>For >500 To 1,000, Deduct</i>	-0.42	
<i>For >1,000, Deduct</i>	-0.58	
<i>For 316 Stainless Steel, Add</i>	8.45	
<i>For Aluminum, Add</i>	0.48	
<i>For Galvanized Steel, Add</i>	1.64	
<i>For 304 Stainless Steel, Add</i>	7.52	

05 Metals**05 10 Structural Metal Framing****05 12 Structural Steel Framing**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 12 23 00-0446	LF		2" Diameter x 0.083" Round Steel Tubing	6.14	1.92
			<i>For >100 To 250, Deduct</i>	-0.19	
			<i>For >250 To 500, Deduct</i>	-0.35	
			<i>For >500 To 1,000, Deduct</i>	-0.56	
			<i>For >1,000, Deduct</i>	-0.78	
			<i>For 316 Stainless Steel, Add</i>	11.46	
			<i>For Aluminum, Add</i>	0.64	
			<i>For Galvanized Steel, Add</i>	2.22	
			<i>For 304 Stainless Steel, Add</i>	10.20	
05 12 23 00-0447	LF		2-1/2" Diameter x 0.083" Round Steel Tubing	7.74	2.43
			<i>For >100 To 250, Deduct</i>	-0.24	
			<i>For >250 To 500, Deduct</i>	-0.44	
			<i>For >500 To 1,000, Deduct</i>	-0.71	
			<i>For >1,000, Deduct</i>	-0.98	
			<i>For 316 Stainless Steel, Add</i>	14.43	
			<i>For Aluminum, Add</i>	0.81	
			<i>For Galvanized Steel, Add</i>	2.80	
			<i>For 304 Stainless Steel, Add</i>	12.85	
05 12 23 00-0448	LF		3" Diameter x 0.083" Round Steel Tubing	9.34	2.92
			<i>For >100 To 250, Deduct</i>	-0.29	
			<i>For >250 To 500, Deduct</i>	-0.53	
			<i>For >500 To 1,000, Deduct</i>	-0.86	
			<i>For >1,000, Deduct</i>	-1.19	
			<i>For 316 Stainless Steel, Add</i>	17.41	
			<i>For Aluminum, Add</i>	0.98	
			<i>For Galvanized Steel, Add</i>	3.37	
			<i>For 304 Stainless Steel, Add</i>	15.50	
05 12 23 00-0449	LF		3-1/2" Diameter x 0.083" Round Steel Tubing	10.94	3.42
			<i>For >100 To 250, Deduct</i>	-0.34	
			<i>For >250 To 500, Deduct</i>	-0.62	
			<i>For >500 To 1,000, Deduct</i>	-1.00	
			<i>For >1,000, Deduct</i>	-1.39	
			<i>For 316 Stainless Steel, Add</i>	20.42	
			<i>For Aluminum, Add</i>	1.15	
			<i>For Galvanized Steel, Add</i>	3.96	
			<i>For 304 Stainless Steel, Add</i>	18.18	
05 12 23 00-0450	LF		4" Diameter x 0.083" Round Steel Tubing	12.54	3.93
			<i>For >100 To 250, Deduct</i>	-0.39	
			<i>For >250 To 500, Deduct</i>	-0.71	
			<i>For >500 To 1,000, Deduct</i>	-1.15	
			<i>For >1,000, Deduct</i>	-1.59	
			<i>For 316 Stainless Steel, Add</i>	23.39	
			<i>For Aluminum, Add</i>	1.32	
			<i>For Galvanized Steel, Add</i>	4.53	
			<i>For 304 Stainless Steel, Add</i>	20.83	
05 12 23 00-0451			0.125" Wall Thickness (05 12 23 00-0432)		
05 12 23 00-0452	LF		2" Diameter x 0.125" Round Steel Tubing	6.74	2.43
			<i>For >100 To 250, Deduct</i>	-0.24	
			<i>For >250 To 500, Deduct</i>	-0.41	
			<i>For >500 To 1,000, Deduct</i>	-0.66	
			<i>For >1,000, Deduct</i>	-0.91	
			<i>For 316 Stainless Steel, Add</i>	11.23	
			<i>For Aluminum, Add</i>	0.63	
			<i>For Galvanized Steel, Add</i>	2.18	
			<i>For 304 Stainless Steel, Add</i>	10.00	
05 12 23 00-0453	LF		2-1/2" Diameter x 0.125" Round Steel Tubing	8.55	3.07
			<i>For >100 To 250, Deduct</i>	-0.31	
			<i>For >250 To 500, Deduct</i>	-0.52	
			<i>For >500 To 1,000, Deduct</i>	-0.84	
			<i>For >1,000, Deduct</i>	-1.15	
			<i>For 316 Stainless Steel, Add</i>	14.24	
			<i>For Aluminum, Add</i>	0.80	
			<i>For Galvanized Steel, Add</i>	2.76	
			<i>For 304 Stainless Steel, Add</i>	12.68	
05 12 23 00-0454	LF		3" Diameter x 0.125" Round Steel Tubing	10.33	3.71
			<i>For >100 To 250, Deduct</i>	-0.37	
			<i>For >250 To 500, Deduct</i>	-0.63	
			<i>For >500 To 1,000, Deduct</i>	-1.01	
			<i>For >1,000, Deduct</i>	-1.39	
			<i>For 316 Stainless Steel, Add</i>	17.22	
			<i>For Aluminum, Add</i>	0.97	
			<i>For Galvanized Steel, Add</i>	3.34	
			<i>For 304 Stainless Steel, Add</i>	15.33	
05 12 23 00-0455	LF		3-1/2" Diameter x 0.125" Round Steel Tubing	12.14	4.37
			<i>For >100 To 250, Deduct</i>	-0.44	
			<i>For >250 To 500, Deduct</i>	-0.74	
			<i>For >500 To 1,000, Deduct</i>	-1.19	
			<i>For >1,000, Deduct</i>	-1.64	
			<i>For 316 Stainless Steel, Add</i>	20.22	
			<i>For Aluminum, Add</i>	1.14	
			<i>For Galvanized Steel, Add</i>	3.92	
			<i>For 304 Stainless Steel, Add</i>	18.01	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 12 23 00-0456 LF 4" Diameter x 0.125" Round Steel Tubing	13.93	5.01
For >100 To 250, Deduct	-0.50	
For >250 To 500, Deduct	-0.85	
For >500 To 1,000, Deduct	-1.36	
For >1,000, Deduct	-1.88	
For 316 Stainless Steel, Add	23.20	
For Aluminum, Add	1.31	
For Galvanized Steel, Add	4.50	
For 304 Stainless Steel, Add	20.66	
05 12 23 00-0457 Flat Steel Bar <small>(05 12 23 00-0119)</small>		
05 12 23 00-0458 1/8" Thick <small>(05 12 23 00-0457)</small>		
05 12 23 00-0459 LF 1/8" Thick x 1" Wide Flat Steel Bar	2.20	1.21
For 316 Stainless Steel, Add	1.25	
For Aluminum, Add	0.07	
For Galvanized Steel, Add	0.24	
For 304 Stainless Steel, Add	1.11	
05 12 23 00-0460 LF 1/8" Thick x 2" Wide Flat Steel Bar	3.36	1.81
For 316 Stainless Steel, Add	2.08	
For Aluminum, Add	0.12	
For Galvanized Steel, Add	0.40	
For 304 Stainless Steel, Add	1.85	
05 12 23 00-0461 LF 1/8" Thick x 4" Wide Flat Steel Bar	5.01	2.55
For 316 Stainless Steel, Add	3.81	
For Aluminum, Add	0.21	
For Galvanized Steel, Add	0.74	
For 304 Stainless Steel, Add	3.39	
05 12 23 00-0462 LF 1/8" Thick x 6" Wide Flat Steel Bar	6.79	3.46
For 316 Stainless Steel, Add	5.12	
For Aluminum, Add	0.29	
For Galvanized Steel, Add	0.99	
For 304 Stainless Steel, Add	4.56	
05 12 23 00-0463 3/16" Thick <small>(05 12 23 00-0457)</small>		
05 12 23 00-0464 LF 3/16" Thick x 1" Wide Flat Steel Bar	2.84	1.50
For 316 Stainless Steel, Add	1.92	
For Aluminum, Add	0.11	
For Galvanized Steel, Add	0.37	
For 304 Stainless Steel, Add	1.71	
05 12 23 00-0465 LF 3/16" Thick x 2" Wide Flat Steel Bar	4.40	2.24
For 316 Stainless Steel, Add	3.30	
For Aluminum, Add	0.19	
For Galvanized Steel, Add	0.64	
For 304 Stainless Steel, Add	2.94	
05 12 23 00-0466 LF 3/16" Thick x 4" Wide Flat Steel Bar	5.61	2.59
For 316 Stainless Steel, Add	5.57	
For Aluminum, Add	0.31	
For Galvanized Steel, Add	1.08	
For 304 Stainless Steel, Add	4.96	
05 12 23 00-0467 LF 3/16" Thick x 6" Wide Flat Steel Bar	7.78	3.58
For 316 Stainless Steel, Add	7.71	
For Aluminum, Add	0.43	
For Galvanized Steel, Add	1.49	
For 304 Stainless Steel, Add	6.87	
05 12 23 00-0468 1/4" Thick <small>(05 12 23 00-0457)</small>		
05 12 23 00-0469 LF 1/4" Thick x 1" Wide Flat Steel Bar	2.97	1.58
For 316 Stainless Steel, Add	1.89	
For Aluminum, Add	0.11	
For Galvanized Steel, Add	0.37	
For 304 Stainless Steel, Add	1.68	
05 12 23 00-0470 LF 1/4" Thick x 2" Wide Flat Steel Bar	4.75	2.38
For 316 Stainless Steel, Add	3.81	
For Aluminum, Add	0.21	
For Galvanized Steel, Add	0.74	
For 304 Stainless Steel, Add	3.39	
05 12 23 00-0471 LF 1/4" Thick x 4" Wide Flat Steel Bar	6.38	2.71
For 316 Stainless Steel, Add	7.39	
For Aluminum, Add	0.42	
For Galvanized Steel, Add	1.43	
For 304 Stainless Steel, Add	6.58	
05 12 23 00-0472 LF 1/4" Thick x 6" Wide Flat Steel Bar	9.31	4.01
For 316 Stainless Steel, Add	10.50	
For Aluminum, Add	0.59	
For Galvanized Steel, Add	2.03	
For 304 Stainless Steel, Add	9.35	
05 12 23 00-0473 3/8" Thick <small>(05 12 23 00-0457)</small>		

05 Metals**05 10 Structural Metal Framing****05 12 Structural Steel Framing**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 12 23 00-0474	LF		3/8" Thick x 1" Wide Flat Steel Bar	3.61	1.78
			<i>For 316 Stainless Steel, Add</i>	2.98	
			<i>For Aluminum, Add</i>	0.17	
			<i>For Galvanized Steel, Add</i>	0.58	
			<i>For 304 Stainless Steel, Add</i>	2.65	
05 12 23 00-0475	LF		3/8" Thick x 2" Wide Flat Steel Bar	5.72	2.67
			<i>For 316 Stainless Steel, Add</i>	5.47	
			<i>For Aluminum, Add</i>	0.31	
			<i>For Galvanized Steel, Add</i>	1.06	
			<i>For 304 Stainless Steel, Add</i>	4.87	
05 12 23 00-0476	LF		3/8" Thick x 4" Wide Flat Steel Bar	8.00	3.05
			<i>For 316 Stainless Steel, Add</i>	10.94	
			<i>For Aluminum, Add</i>	0.62	
			<i>For Galvanized Steel, Add</i>	2.12	
			<i>For 304 Stainless Steel, Add</i>	9.75	
05 12 23 00-0477	LF		3/8" Thick x 6" Wide Flat Steel Bar	11.59	4.51
			<i>For 316 Stainless Steel, Add</i>	15.39	
			<i>For Aluminum, Add</i>	0.87	
			<i>For Galvanized Steel, Add</i>	2.98	
			<i>For 304 Stainless Steel, Add</i>	13.71	
05 12 23 00-0478			1/2" Thick <small>(05 12 23 00-0457)</small>		
05 12 23 00-0479	LF		1/2" Thick x 1" Wide Flat Steel Bar	4.13	1.95
			<i>For 316 Stainless Steel, Add</i>	3.81	
			<i>For Aluminum, Add</i>	0.21	
			<i>For Galvanized Steel, Add</i>	0.74	
			<i>For 304 Stainless Steel, Add</i>	3.39	
05 12 23 00-0480	LF		1/2" Thick x 2" Wide Flat Steel Bar	6.60	2.94
			<i>For 316 Stainless Steel, Add</i>	6.98	
			<i>For Aluminum, Add</i>	0.39	
			<i>For Galvanized Steel, Add</i>	1.35	
			<i>For 304 Stainless Steel, Add</i>	6.21	
05 12 23 00-0481	LF		1/2" Thick x 4" Wide Flat Steel Bar	8.75	3.35
			<i>For 316 Stainless Steel, Add</i>	11.90	
			<i>For Aluminum, Add</i>	0.67	
			<i>For Galvanized Steel, Add</i>	2.31	
			<i>For 304 Stainless Steel, Add</i>	10.60	
05 12 23 00-0482	LF		1/2" Thick x 6" Wide Flat Steel Bar	14.88	4.96
			<i>For 316 Stainless Steel, Add</i>	23.74	
			<i>For Aluminum, Add</i>	1.34	
			<i>For Galvanized Steel, Add</i>	4.60	
			<i>For 304 Stainless Steel, Add</i>	21.15	
05 12 23 00-0483			Flat Steel Plate <small>(05 12 23 00-0119)</small>		
05 12 23 00-0484	SF		1/8" Thick Flat Steel Plate	10.59	5.19
			<i>For 316 Stainless Steel, Add</i>	8.96	
			<i>For Aluminum, Add</i>	0.50	
			<i>For Galvanized Steel, Add</i>	1.74	
			<i>For 304 Stainless Steel, Add</i>	7.98	
05 12 23 00-0485	SF		3/16" Thick Flat Steel Plate	11.56	5.37
			<i>For 316 Stainless Steel, Add</i>	11.20	
			<i>For Aluminum, Add</i>	0.63	
			<i>For Galvanized Steel, Add</i>	2.17	
			<i>For 304 Stainless Steel, Add</i>	9.98	
05 12 23 00-0486	SF		1/4" Thick Flat Steel Plate	13.50	6.02
			<i>For 316 Stainless Steel, Add</i>	14.27	
			<i>For Aluminum, Add</i>	0.80	
			<i>For Galvanized Steel, Add</i>	2.77	
			<i>For 304 Stainless Steel, Add</i>	12.71	
05 12 23 00-0487	SF		3/8" Thick Flat Steel Plate	17.18	6.77
			<i>For 316 Stainless Steel, Add</i>	22.43	
			<i>For Aluminum, Add</i>	1.26	
			<i>For Galvanized Steel, Add</i>	4.35	
			<i>For 304 Stainless Steel, Add</i>	19.98	
05 12 23 00-0488	SF		1/2" Thick Flat Steel Plate	19.91	7.45
			<i>For 316 Stainless Steel, Add</i>	27.94	
			<i>For Aluminum, Add</i>	1.57	
			<i>For Galvanized Steel, Add</i>	5.41	
			<i>For 304 Stainless Steel, Add</i>	24.88	
05 12 23 00-0489	SF		3/4" Thick Flat Steel Plate	30.35	9.22
			<i>For 316 Stainless Steel, Add</i>	52.38	
			<i>For Aluminum, Add</i>	2.95	
			<i>For Galvanized Steel, Add</i>	10.15	
			<i>For 304 Stainless Steel, Add</i>	46.65	
05 12 23 00-0490	SF		1" Thick Flat Steel Plate	39.88	11.53
			<i>For 316 Stainless Steel, Add</i>	71.71	
			<i>For Aluminum, Add</i>	4.03	
			<i>For Galvanized Steel, Add</i>	13.89	
			<i>For 304 Stainless Steel, Add</i>	63.87	

05 13 Structural Stainless-Steel Framing (05 10)



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 13 00 00-0001			Stainless Steel Tube (05 13)		
05 13 00 00-0002	LF		1" x 1" Stainless Steel Tube.....	23.43	
05 13 00 00-0003	LF		1-1/2" x 1-1/2" Stainless Steel Tube	30.38	
05 13 00 00-0004	LF		2" x 2" Stainless Steel Tube.....	40.28	
05 14			Structural Aluminum Framing (05 10)		
05 14 16			Structural Aluminum Framing (05 14)		
05 14 16 00-0001			Rolled Or Plate Shapes (05 14 16)		
			Note: 1" through 10" member.		
05 14 16 00-0002	LB		Structural Aluminum, Up To 2,000 LB / Order 1" To 10" Rolled / Plate Structural Members	7.62	4.02
05 14 16 00-0003	LB		Structural Aluminum, >2,000 - 9,999 LB / Order 1" To 10" Rolled / Plate Structural Members.....	7.37	2.71
05 14 16 00-0004			Aluminum Extrusions (05 14 16)		
05 14 16 00-0005	LB		Aluminum Extrusions, Stock Shapes 1" To 10" Rolled / Plate Structural Members	6.81	2.71
05 14 16 00-0006	LB		Aluminum Extrusions, Custom Shapes 1" To 10" Rolled / Plate Structural Members.....	7.04	2.71
05 14 16 00-0007			Aluminum Tubing (05 14 16)		
05 14 16 00-0008	LB		Aluminum Extrusions, Tubular Shapes 1" To 10" Rolled / Plate Structural Members.....	8.13	2.90
05 14 16 00-0009	LF		1" x 1" Aluminum Tubing, 1/8" Wall Thickness	10.69	4.73
05 14 16 00-0010	LF		1-1/4" x 1-1/4" Aluminum Tubing, 1/8" Wall Thickness.....	12.03	5.16
05 14 16 00-0011	LF		1-1/2" x 1-1/2" Aluminum Tubing, 1/8" Wall Thickness.....	13.97	6.03
05 14 16 00-0012	LF		2" x 2" Aluminum Tubing, 1/8" Wall Thickness	15.47	6.45
05 14 16 00-0013	LF		4" x 4" Aluminum Tubing, 1/4" Wall Thickness	28.16	8.17
05 14 16 00-0014	LF		2" x 5" Aluminum Tubing, 1/4" Wall Thickness	24.04	7.32
05 15			Wire Rope Assemblies (05 10)		
05 15 16			Steel Wire Rope Assemblies (05 15)		
			Note: IWRC = Independent Wire Rope Center; IPS = Improved Plow Steel; XIP = Extra Improved Plow Steel.		
05 15 16 00-0001			6x7 Class Bright, IPS, Fiber Core (05 15 16)		
05 15 16 00-0002	LF		1/16" Diameter 6x7 Class Bright Wire Rope IPS, Fiber Core	0.31	0.06
			For 7x7 Strand Core, Add	0.01	
			For <100, Add	0.08	
			For >500 To 1,000, Deduct	-0.02	
			For >1,000 To 2,000, Deduct	-0.02	
			For >2,000, Deduct	-0.03	
05 15 16 00-0003	LF		3/32" Diameter 6x7 Class Bright Wire Rope IPS, Fiber Core	0.35	0.07
			For 7x7 Strand Core, Add	0.01	
			For <100, Add	0.09	
			For >500 To 1,000, Deduct	-0.02	
			For >1,000 To 2,000, Deduct	-0.03	
			For >2,000, Deduct	-0.04	
05 15 16 00-0004	LF		1/8" Diameter 6x7 Class Bright Wire Rope IPS, Fiber Core	0.46	0.08
			For 7x7 Strand Core, Add	0.02	
			For <100, Add	0.13	
			For >500 To 1,000, Deduct	-0.02	
			For >1,000 To 2,000, Deduct	-0.03	
			For >2,000, Deduct	-0.05	
05 15 16 00-0005	LF		5/32" Diameter 6x7 Class Bright Wire Rope IPS, Fiber Core	0.51	0.09
			For 7x7 Strand Core, Add	0.02	
			For <100, Add	0.14	
			For >500 To 1,000, Deduct	-0.03	
			For >1,000 To 2,000, Deduct	-0.04	
			For >2,000, Deduct	-0.05	
05 15 16 00-0006	LF		3/16" Diameter 6x7 Class Bright Wire Rope IPS, Fiber Core	0.72	0.09
			For 7x7 Strand Core, Add	0.03	
			For <100, Add	0.21	
			For >500 To 1,000, Deduct	-0.04	
			For >1,000 To 2,000, Deduct	-0.05	
			For >2,000, Deduct	-0.07	
05 15 16 00-0007	LF		1/4" Diameter 6x7 Class Bright Wire Rope IPS, Fiber Core	0.94	0.09
			For 7x7 Strand Core, Add	0.04	
			For <100, Add	0.29	
			For >500 To 1,000, Deduct	-0.05	
			For >1,000 To 2,000, Deduct	-0.07	
			For >2,000, Deduct	-0.09	
05 15 16 00-0008	LF		5/16" Diameter 6x7 Class Bright Wire Rope IPS, Fiber Core	1.19	0.09
			For 7x7 Strand Core, Add	0.05	
			For <100, Add	0.36	
			For >500 To 1,000, Deduct	-0.06	
			For >1,000 To 2,000, Deduct	-0.09	
			For >2,000, Deduct	-0.12	

05 Metals**05 10 Structural Metal Framing****05 15 Wire Rope Assemblies**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 15 16 00-0009	LF		3/8" Diameter 6x7 Class Bright Wire Rope IPS, Fiber Core.....	1.51	0.09
			<i>For 7x7 Strand Core, Add</i>	0.06	
			<i>For <100, Add</i>	0.46	
			<i>For >500 To 1,000, Deduct</i>	-0.08	
			<i>For >1,000 To 2,000, Deduct</i>	-0.11	
			<i>For >2,000, Deduct</i>	-0.15	
05 15 16 00-0010	LF		7/16" Diameter 6x7 Class Bright Wire Rope IPS, Fiber Core.....	1.87	0.17
			<i>For 7x7 Strand Core, Add</i>	0.07	
			<i>For <100, Add</i>	0.55	
			<i>For >500 To 1,000, Deduct</i>	-0.09	
			<i>For >1,000 To 2,000, Deduct</i>	-0.14	
			<i>For >2,000, Deduct</i>	-0.19	
05 15 16 00-0011	LF		1/2" Diameter 6x7 Class Bright Wire Rope IPS, Fiber Core.....	2.21	0.17
			<i>For 7x7 Strand Core, Add</i>	0.08	
			<i>For <100, Add</i>	0.64	
			<i>For >500 To 1,000, Deduct</i>	-0.11	
			<i>For >1,000 To 2,000, Deduct</i>	-0.17	
			<i>For >2,000, Deduct</i>	-0.22	
05 15 16 00-0012	LF		9/16" Diameter 6x7 Class Bright Wire Rope IPS, Fiber Core.....	2.68	0.26
			<i>For 7x7 Strand Core, Add</i>	0.09	
			<i>For <100, Add</i>	0.77	
			<i>For >500 To 1,000, Deduct</i>	-0.13	
			<i>For >1,000 To 2,000, Deduct</i>	-0.20	
			<i>For >2,000, Deduct</i>	-0.27	
05 15 16 00-0013	LF		5/8" Diameter 6x7 Class Bright Wire Rope IPS, Fiber Core.....	3.09	0.34
			<i>For 7x7 Strand Core, Add</i>	0.10	
			<i>For <100, Add</i>	0.88	
			<i>For >500 To 1,000, Deduct</i>	-0.15	
			<i>For >1,000 To 2,000, Deduct</i>	-0.23	
			<i>For >2,000, Deduct</i>	-0.31	
05 15 16 00-0014	LF		3/4" Diameter 6x7 Class Bright Wire Rope IPS, Fiber Core.....	4.16	0.43
			<i>For 7x7 Strand Core, Add</i>	0.14	
			<i>For <100, Add</i>	1.17	
			<i>For >500 To 1,000, Deduct</i>	-0.21	
			<i>For >1,000 To 2,000, Deduct</i>	-0.31	
			<i>For >2,000, Deduct</i>	-0.42	
05 15 16 00-0015			6x19 Class Bright, IPS, IWRC ^(05 15 16)		
05 15 16 00-0016	LF		1/4" Diameter 6x19 Class Bright Wire Rope IPS, IWRC.....	1.48	0.09
			<i>For <100, Add</i>	0.48	
			<i>For >500 To 1,000, Deduct</i>	-0.07	
			<i>For >1,000 To 2,000, Deduct</i>	-0.11	
			<i>For >2,000, Deduct</i>	-0.15	
			<i>For 7x19 Strand Core, Add</i>	0.26	
			<i>For Heavy Duty IWRC Rating, Add</i>	0.32	
			<i>For 7x19 Galvanized, Add</i>	0.70	
05 15 16 00-0017	LF		5/16" Diameter 6x19 Class Bright Wire Rope IPS, IWRC.....	1.75	0.09
			<i>For <100, Add</i>	0.55	
			<i>For >500 To 1,000, Deduct</i>	-0.09	
			<i>For >1,000 To 2,000, Deduct</i>	-0.13	
			<i>For >2,000, Deduct</i>	-0.18	
			<i>For 7x19 Strand Core, Add</i>	0.29	
			<i>For Heavy Duty IWRC Rating, Add</i>	0.36	
			<i>For 7x19 Galvanized, Add</i>	0.79	
05 15 16 00-0018	LF		3/8" Diameter 6x19 Class Bright Wire Rope IPS, IWRC.....	2.10	0.17
			<i>For <100, Add</i>	0.65	
			<i>For >500 To 1,000, Deduct</i>	-0.11	
			<i>For >1,000 To 2,000, Deduct</i>	-0.16	
			<i>For >2,000, Deduct</i>	-0.21	
			<i>For 7x19 Strand Core, Add</i>	0.33	
			<i>For Heavy Duty IWRC Rating, Add</i>	0.42	
			<i>For 7x19 Galvanized, Add</i>	0.91	
05 15 16 00-0019	LF		7/16" Diameter 6x19 Class Bright Wire Rope IPS, IWRC.....	2.48	0.17
			<i>For <100, Add</i>	0.75	
			<i>For >500 To 1,000, Deduct</i>	-0.12	
			<i>For >1,000 To 2,000, Deduct</i>	-0.19	
			<i>For >2,000, Deduct</i>	-0.25	
			<i>For 7x19 Strand Core, Add</i>	0.38	
			<i>For Heavy Duty IWRC Rating, Add</i>	0.47	
			<i>For 7x19 Galvanized, Add</i>	1.03	
05 15 16 00-0020	LF		1/2" Diameter 6x19 Class Bright Wire Rope IPS, IWRC.....	2.91	0.26
			<i>For <100, Add</i>	0.86	
			<i>For >500 To 1,000, Deduct</i>	-0.15	
			<i>For >1,000 To 2,000, Deduct</i>	-0.22	
			<i>For >2,000, Deduct</i>	-0.29	
			<i>For 7x19 Strand Core, Add</i>	0.42	
			<i>For Heavy Duty IWRC Rating, Add</i>	0.53	
			<i>For 7x19 Galvanized, Add</i>	1.16	
05 15 16 00-0021	LF		9/16" Diameter 6x19 Class Bright Wire Rope IPS, IWRC.....	3.44	0.34
			<i>For <100, Add</i>	1.00	
			<i>For >500 To 1,000, Deduct</i>	-0.17	
			<i>For >1,000 To 2,000, Deduct</i>	-0.26	
			<i>For >2,000, Deduct</i>	-0.34	
			<i>For 7x19 Strand Core, Add</i>	0.48	
			<i>For Heavy Duty IWRC Rating, Add</i>	0.61	
			<i>For 7x19 Galvanized, Add</i>	1.33	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 15 16 00-0022 LF 5/8" Diameter 6x19 Class Bright Wire Rope IPS, IWRC.....	3.96	0.34
<i>For <100, Add</i>	1.14	
<i>For >500 To 1,000, Deduct</i>	-0.20	
<i>For >1,000 To 2,000, Deduct</i>	-0.30	
<i>For >2,000, Deduct</i>	-0.40	
<i>For 7x19 Strand Core, Add</i>	0.54	
<i>For Heavy Duty IWRC Rating, Add</i>	0.68	
<i>For 7x19 Galvanized, Add</i>	1.49	
05 15 16 00-0023 LF 3/4" Diameter 6x19 Class Bright Wire Rope IPS, IWRC.....	5.61	0.60
<i>For <100, Add</i>	1.60	
<i>For >500 To 1,000, Deduct</i>	-0.28	
<i>For >1,000 To 2,000, Deduct</i>	-0.42	
<i>For >2,000, Deduct</i>	-0.56	
<i>For 7x19 Strand Core, Add</i>	0.76	
<i>For Heavy Duty IWRC Rating, Add</i>	0.95	
<i>For 7x19 Galvanized, Add</i>	2.09	
05 15 16 00-0024 LF 7/8" Diameter 6x19 Class Bright Wire Rope IPS, IWRC.....	7.41	0.68
<i>For <100, Add</i>	2.10	
<i>For >500 To 1,000, Deduct</i>	-0.37	
<i>For >1,000 To 2,000, Deduct</i>	-0.56	
<i>For >2,000, Deduct</i>	-0.74	
<i>For 7x19 Strand Core, Add</i>	0.99	
<i>For Heavy Duty IWRC Rating, Add</i>	1.24	
<i>For 7x19 Galvanized, Add</i>	2.72	
05 15 16 00-0025 LF 1" Diameter 6x19 Class Bright Wire Rope IPS, IWRC.....	9.34	0.95
<i>For <100, Add</i>	2.62	
<i>For >500 To 1,000, Deduct</i>	-0.47	
<i>For >1,000 To 2,000, Deduct</i>	-0.70	
<i>For >2,000, Deduct</i>	-0.93	
<i>For 7x19 Strand Core, Add</i>	1.22	
<i>For Heavy Duty IWRC Rating, Add</i>	1.52	
<i>For 7x19 Galvanized, Add</i>	3.35	
05 15 16 00-0026 6x37 Class Bright, IPS, IWRC <small>(05 15 16)</small>		
05 15 16 00-0027 LF 1/4" Diameter 6x37 Class Bright Wire Rope IPS, IWRC.....	1.86	0.09
<i>For <100, Add</i>	0.61	
<i>For >500 To 1,000, Deduct</i>	-0.09	
<i>For >1,000 To 2,000, Deduct</i>	-0.14	
<i>For >2,000, Deduct</i>	-0.19	
<i>For XIPS Wire, Add</i>	0.05	
05 15 16 00-0028 LF 5/16" Diameter 6x37 Class Bright Wire Rope IPS, IWRC.....	2.22	0.09
<i>For <100, Add</i>	0.72	
<i>For >500 To 1,000, Deduct</i>	-0.11	
<i>For >1,000 To 2,000, Deduct</i>	-0.17	
<i>For >2,000, Deduct</i>	-0.22	
<i>For XIPS Wire, Add</i>	0.05	
05 15 16 00-0029 LF 3/8" Diameter 6x37 Class Bright Wire Rope IPS, IWRC.....	2.67	0.17
<i>For <100, Add</i>	0.85	
<i>For >500 To 1,000, Deduct</i>	-0.13	
<i>For >1,000 To 2,000, Deduct</i>	-0.20	
<i>For >2,000, Deduct</i>	-0.27	
<i>For XIPS Wire, Add</i>	0.06	
05 15 16 00-0030 LF 7/16" Diameter 6x37 Class Bright Wire Rope IPS, IWRC.....	3.09	0.17
<i>For <100, Add</i>	0.96	
<i>For >500 To 1,000, Deduct</i>	-0.15	
<i>For >1,000 To 2,000, Deduct</i>	-0.23	
<i>For >2,000, Deduct</i>	-0.31	
<i>For XIPS Wire, Add</i>	0.07	
05 15 16 00-0031 LF 1/2" Diameter 6x37 Class Bright Wire Rope IPS, IWRC.....	3.61	0.26
<i>For <100, Add</i>	1.10	
<i>For >500 To 1,000, Deduct</i>	-0.18	
<i>For >1,000 To 2,000, Deduct</i>	-0.27	
<i>For >2,000, Deduct</i>	-0.36	
<i>For XIPS Wire, Add</i>	0.09	
05 15 16 00-0032 LF 9/16" Diameter 6x37 Class Bright Wire Rope IPS, IWRC.....	4.18	0.34
<i>For <100, Add</i>	1.26	
<i>For >500 To 1,000, Deduct</i>	-0.21	
<i>For >1,000 To 2,000, Deduct</i>	-0.31	
<i>For >2,000, Deduct</i>	-0.42	
<i>For XIPS Wire, Add</i>	0.10	
05 15 16 00-0033 LF 5/8" Diameter 6x37 Class Bright Wire Rope IPS, IWRC.....	4.76	0.34
<i>For <100, Add</i>	1.42	
<i>For >500 To 1,000, Deduct</i>	-0.24	
<i>For >1,000 To 2,000, Deduct</i>	-0.36	
<i>For >2,000, Deduct</i>	-0.48	
<i>For XIPS Wire, Add</i>	0.11	
05 15 16 00-0034 LF 3/4" Diameter 6x37 Class Bright Wire Rope IPS, IWRC.....	6.37	0.60
<i>For <100, Add</i>	1.87	
<i>For >500 To 1,000, Deduct</i>	-0.32	
<i>For >1,000 To 2,000, Deduct</i>	-0.48	
<i>For >2,000, Deduct</i>	-0.64	
<i>For XIPS Wire, Add</i>	0.15	

05 Metals**05 10 Structural Metal Framing****05 15 Wire Rope Assemblies**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 15 16 00-0035	LF		7/8" Diameter 6x37 Class Bright Wire Rope IPS, IWRC.....	8.23	0.68
			<i>For <100, Add</i>	2.39	
			<i>For >500 To 1,000, Deduct</i>	-0.41	
			<i>For >1,000 To 2,000, Deduct</i>	-0.62	
			<i>For >2,000, Deduct</i>	-0.82	
			<i>For XIPS Wire, Add</i>	0.19	
05 15 16 00-0036	LF		1" Diameter 6x37 Class Bright Wire Rope IPS, IWRC.....	10.37	0.95
			<i>For <100, Add</i>	2.99	
			<i>For >500 To 1,000, Deduct</i>	-0.52	
			<i>For >1,000 To 2,000, Deduct</i>	-0.78	
			<i>For >2,000, Deduct</i>	-1.04	
			<i>For XIPS Wire, Add</i>	0.24	
05 15 16 00-0037			6x19 And 6x37 Swaged Wire Rope ^(05 15 16)		
05 15 16 00-0038	LF		1/2" Diameter 6x19 And 6x37 Swaged Wire Rope.....	5.09	0.34
			<i>For <100, Add</i>	1.56	
			<i>For >500 To 1,000, Deduct</i>	-0.25	
			<i>For >1,000 To 2,000, Deduct</i>	-0.38	
			<i>For >2,000, Deduct</i>	-0.51	
05 15 16 00-0039	LF		9/16" Diameter 6x19 And 6x37 Swaged Wire Rope.....	5.71	0.34
			<i>For <100, Add</i>	1.76	
			<i>For >500 To 1,000, Deduct</i>	-0.29	
			<i>For >1,000 To 2,000, Deduct</i>	-0.43	
			<i>For >2,000, Deduct</i>	-0.57	
05 15 16 00-0040	LF		5/8" Diameter 6x19 And 6x37 Swaged Wire Rope.....	7.06	0.43
			<i>For <100, Add</i>	2.18	
			<i>For >500 To 1,000, Deduct</i>	-0.35	
			<i>For >1,000 To 2,000, Deduct</i>	-0.53	
			<i>For >2,000, Deduct</i>	-0.71	
05 15 16 00-0041	LF		3/4" Diameter 6x19 And 6x37 Swaged Wire Rope.....	8.72	0.68
			<i>For <100, Add</i>	2.62	
			<i>For >500 To 1,000, Deduct</i>	-0.44	
			<i>For >1,000 To 2,000, Deduct</i>	-0.65	
			<i>For >2,000, Deduct</i>	-0.87	
05 15 16 00-0042	LF		7/8" Diameter 6x19 And 6x37 Swaged Wire Rope.....	10.85	0.87
			<i>For <100, Add</i>	3.22	
			<i>For >500 To 1,000, Deduct</i>	-0.54	
			<i>For >1,000 To 2,000, Deduct</i>	-0.81	
			<i>For >2,000, Deduct</i>	-1.09	
05 15 16 00-0043	LF		1" Diameter 6x19 And 6x37 Swaged Wire Rope.....	13.42	1.12
			<i>For <100, Add</i>	3.93	
			<i>For >500 To 1,000, Deduct</i>	-0.67	
			<i>For >1,000 To 2,000, Deduct</i>	-1.01	
			<i>For >2,000, Deduct</i>	-1.34	

05 40 Cold-Formed Metal Framing ⁽⁰⁵⁾

Note: Includes all connecting bolts and welds.

05 41 Structural Metal Stud Framing ^(05 40)

Note: Includes all necessary framing studs, bridging, fasteners necessary to attach to floors, walls, ceilings and a metal stiffener at half height. Per SF of wall area measures one side. Do not deduct for openings of less than 25 SF when calculating total wall square footage.

05 41 00 00-0001 18 Gauge, Load Bearing, Structural Metal Stud Framing With Tracks And Runners ^(05 41)

05 41 00 00-0002	SF		2-1/2" Width, 16" On Center, 18 Gauge, Load Bearing, Structural Metal Stud Framing With Tracks And Runners.....	2.51	0.61
			<i>For Walls >10' High, Add</i>	0.50	
			<i>For Curved Wall, Add</i>	0.43	
			<i>For Up To 200, Add</i>	0.79	
			<i>For >200 To 500, Add</i>	0.40	
			<i>For 12" On Center, Add</i>	0.43	
			<i>For 24" On Center, Deduct</i>	-0.43	
05 41 00 00-0003	SF		3-5/8" Width, 16" On Center, 18 Gauge, Load Bearing, Structural Metal Stud Framing With Tracks And Runners.....	3.24	0.61
			<i>For Walls >10' High, Add</i>	0.65	
			<i>For Curved Wall, Add</i>	0.45	
			<i>For Up To 200, Add</i>	0.95	
			<i>For >200 To 500, Add</i>	0.48	
			<i>For 12" On Center, Add</i>	0.57	
			<i>For 24" On Center, Deduct</i>	-0.57	
05 41 00 00-0004	SF		4" Width, 16" On Center, 18 Gauge, Load Bearing, Structural Metal Stud Framing With Tracks And Runners.....	3.37	0.61
			<i>For Walls >10' High, Add</i>	0.67	
			<i>For Curved Wall, Add</i>	0.47	
			<i>For Up To 200, Add</i>	0.99	
			<i>For >200 To 500, Add</i>	0.49	
			<i>For 12" On Center, Add</i>	0.60	
			<i>For 24" On Center, Deduct</i>	-0.60	
05 41 00 00-0005	SF		6" Width, 16" On Center, 18 Gauge, Load Bearing, Structural Metal Stud Framing With Tracks And Runners.....	4.24	0.68
			<i>For Walls >10' High, Add</i>	0.85	
			<i>For Curved Wall, Add</i>	0.49	
			<i>For Up To 200, Add</i>	1.18	
			<i>For >200 To 500, Add</i>	0.59	
			<i>For 12" On Center, Add</i>	0.77	
			<i>For 24" On Center, Deduct</i>	-0.77	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
	05 41 00 00-0006	SF		8" Width, 16" On Center, 18 Gauge, Load Bearing, Structural Metal Stud Framing With Tracks And Runners.....	4.72	0.75
				<i>For Walls >10' High, Add</i>	<i>0.94</i>	
				<i>For Curved Wall, Add</i>	<i>0.51</i>	
				<i>For Up To 200, Add</i>	<i>1.29</i>	
				<i>For >200 To 500, Add</i>	<i>0.64</i>	
				<i>For 12" On Center, Add</i>	<i>0.86</i>	
				<i>For 24" On Center, Deduct</i>	<i>-0.86</i>	
	05 41 00 00-0007			16 Gauge, Load Bearing, Structural Metal Stud Framing With Tracks And Runners <small>(05 41)</small>		
	05 41 00 00-0008	SF		2-1/2" Width, 16" On Center, 16 Gauge, Load Bearing, Structural Metal Stud Framing With Tracks And Runners	3.12	0.61
				<i>For Walls >10' High, Add</i>	<i>0.62</i>	
				<i>For Curved Wall, Add</i>	<i>0.45</i>	
				<i>For Up To 200, Add</i>	<i>0.93</i>	
				<i>For >200 To 500, Add</i>	<i>0.46</i>	
				<i>For 12" On Center, Add</i>	<i>0.55</i>	
				<i>For 24" On Center, Deduct</i>	<i>-0.55</i>	
	05 41 00 00-0009	SF		3-5/8" Width, 16" On Center, 16 Gauge, Load Bearing, Structural Metal Stud Framing With Tracks And Runners	3.59	0.62
				<i>For Walls >10' High, Add</i>	<i>0.72</i>	
				<i>For Curved Wall, Add</i>	<i>0.48</i>	
				<i>For Up To 200, Add</i>	<i>1.04</i>	
				<i>For >200 To 500, Add</i>	<i>0.52</i>	
				<i>For 12" On Center, Add</i>	<i>0.64</i>	
				<i>For 24" On Center, Deduct</i>	<i>-0.64</i>	
	05 41 00 00-0010	SF		4" Width, 16" On Center, 16 Gauge, Load Bearing, Structural Metal Stud Framing With Tracks And Runners.....	3.78	0.62
				<i>For Walls >10' High, Add</i>	<i>0.76</i>	
				<i>For Curved Wall, Add</i>	<i>0.50</i>	
				<i>For Up To 200, Add</i>	<i>1.09</i>	
				<i>For >200 To 500, Add</i>	<i>0.54</i>	
				<i>For 12" On Center, Add</i>	<i>0.67</i>	
				<i>For 24" On Center, Deduct</i>	<i>-0.67</i>	
	05 41 00 00-0011	SF		6" Width, 16" On Center, 16 Gauge, Load Bearing, Structural Metal Stud Framing With Tracks And Runners.....	4.73	0.75
				<i>For Walls >10' High, Add</i>	<i>0.95</i>	
				<i>For Curved Wall, Add</i>	<i>0.52</i>	
				<i>For Up To 200, Add</i>	<i>1.29</i>	
				<i>For >200 To 500, Add</i>	<i>0.65</i>	
				<i>For 12" On Center, Add</i>	<i>0.86</i>	
				<i>For 24" On Center, Deduct</i>	<i>-0.86</i>	
	05 41 00 00-0012	SF		8" Width, 16" On Center, 16 Gauge, Load Bearing, Structural Metal Stud Framing With Tracks And Runners.....	5.19	0.82
				<i>For Walls >10' High, Add</i>	<i>1.04</i>	
				<i>For Curved Wall, Add</i>	<i>0.54</i>	
				<i>For Up To 200, Add</i>	<i>1.40</i>	
				<i>For >200 To 500, Add</i>	<i>0.70</i>	
				<i>For 12" On Center, Add</i>	<i>0.95</i>	
				<i>For 24" On Center, Deduct</i>	<i>-0.95</i>	
	05 41 00 00-0013			14 Gauge, Load Bearing, Structural Metal Stud Framing With Tracks And Runners <small>(05 41)</small>		
	05 41 00 00-0014	SF		3-5/8" Width, 16" On Center, 14 Gauge, Load Bearing, Structural Metal Stud Framing With Tracks And Runners	4.26	0.85
				<i>For Walls >10' High, Add</i>	<i>0.85</i>	
				<i>For Curved Wall, Add</i>	<i>0.57</i>	
				<i>For Up To 200, Add</i>	<i>1.23</i>	
				<i>For >200 To 500, Add</i>	<i>0.62</i>	
				<i>For 12" On Center, Add</i>	<i>0.76</i>	
				<i>For 24" On Center, Deduct</i>	<i>-0.76</i>	
	05 41 00 00-0015	SF		4" Width, 16" On Center, 14 Gauge, Load Bearing, Structural Metal Stud Framing With Tracks And Runners.....	4.37	0.87
				<i>For Walls >10' High, Add</i>	<i>0.87</i>	
				<i>For Curved Wall, Add</i>	<i>0.58</i>	
				<i>For Up To 200, Add</i>	<i>1.26</i>	
				<i>For >200 To 500, Add</i>	<i>0.63</i>	
				<i>For 12" On Center, Add</i>	<i>0.78</i>	
				<i>For 24" On Center, Deduct</i>	<i>-0.78</i>	
	05 41 00 00-0016	SF		6" Width, 16" On Center, 14 Gauge, Load Bearing, Structural Metal Stud Framing With Tracks And Runners.....	5.43	0.92
				<i>For Walls >10' High, Add</i>	<i>1.09</i>	
				<i>For Curved Wall, Add</i>	<i>0.61</i>	
				<i>For Up To 200, Add</i>	<i>1.49</i>	
				<i>For >200 To 500, Add</i>	<i>0.75</i>	
				<i>For 12" On Center, Add</i>	<i>0.98</i>	
				<i>For 24" On Center, Deduct</i>	<i>-0.98</i>	
	05 41 00 00-0017	SF		8" Width, 16" On Center, 14 Gauge, Load Bearing, Structural Metal Stud Framing With Tracks And Runners.....	5.95	0.96
				<i>For Walls >10' High, Add</i>	<i>1.19</i>	
				<i>For Curved Wall, Add</i>	<i>0.64</i>	
				<i>For Up To 200, Add</i>	<i>1.61</i>	
				<i>For >200 To 500, Add</i>	<i>0.81</i>	
				<i>For 12" On Center, Add</i>	<i>1.08</i>	
				<i>For 24" On Center, Deduct</i>	<i>-1.08</i>	
	05 43			Slotted Channel Framing <small>(05 40)</small>		
	05 43 00 00-0001			Unistrut Channel <small>(05 43)</small>		
	05 43 00 00-0002			Steel Unistrut Channel <small>(05 43 00 00-0001)</small>		

05 Metals**05 40 Cold-Formed Metal Framing****05 43 Slotted Channel Framing**

MINOR		TOTAL DIRECT	DEMOLITION
CSI	UOM DESCRIPTION	UNIT COST	UNIT COST
05 43 00 00-0003	LF 1-5/8" Wide x 1-5/8" High, 12 Gauge, Steel Unistrut Channel <i>For Powder Coating, Add</i> <i>For Galvanizing, Add</i>	8.39 0.68 0.77	1.94
05 43 00 00-0004	LF 1-5/8" Wide x 1-3/8" High, 12 Gauge, Steel Unistrut Channel <i>For Powder Coating, Add</i> <i>For Galvanizing, Add</i>	8.61 0.71 0.80	1.94
05 43 00 00-0005	LF 1-5/8" Wide x 13/16" High, 12 Gauge, Steel Unistrut Channel..... <i>For Powder Coating, Add</i> <i>For Galvanizing, Add</i>	8.95 0.76 0.86	1.94
05 43 00 00-0006	LF 1-5/8" Wide x 1-5/8" High, 14 Gauge, Steel Unistrut Channel <i>For Powder Coating, Add</i> <i>For Galvanizing, Add</i>	7.96 0.61 0.69	1.94
05 43 00 00-0007	LF 1-5/8" Wide x 13/16" High, 14 Gauge, Steel Unistrut Channel..... <i>For Powder Coating, Add</i> <i>For Galvanizing, Add</i>	7.00 0.47 0.53	1.94
05 43 00 00-0008	Stainless Steel Unistrut Channel (05 43 00 00-0001)		
05 43 00 00-0009	LF 1-5/8" Wide x 1-5/8" High, 12 Gauge, Stainless Steel Unistrut Channel.....	21.23	1.94
05 43 00 00-0010	LF 1-5/8" Wide x 13/16" High, 14 Gauge, Stainless Steel Unistrut Channel.....	15.00	1.94
05 43 00 00-0011	Unistrut Closure Strips (05 43)		
05 43 00 00-0012	LF Raceway Closure Strip For Unistrut Channel	4.25	0.43
05 43 00 00-0013	Lock Nuts With Spring For Unistrut Channel (05 43) Note: Includes hex bolt.		
05 43 00 00-0014	EA 1/4-20 Steel Lock Nut With Spring For Unistrut Channel	5.62	
05 43 00 00-0015	EA 3/8-16 Steel Lock Nut With Spring For Unistrut Channel.....	6.08	
05 43 00 00-0016	EA 1/2-13 Steel Lock Nut With Spring For Unistrut Channel.....	6.43	
05 43 00 00-0017	EA 5/8-11 Steel Lock Nut With Spring For Unistrut Channel.....	8.31	
05 43 00 00-0018	Lock Nuts Without Spring For Unistrut Channel (05 43) Note: Includes hex bolt.		
05 43 00 00-0019	EA 1/4-20 Steel Lock Nut Without Spring For Unistrut Channel	5.63	
05 43 00 00-0020	EA 3/8-16 Steel Lock Nut Without Spring For Unistrut Channel.....	6.15	
05 43 00 00-0021	EA 1/2-13 Steel Lock Nut Without Spring For Unistrut Channel.....	6.46	
05 43 00 00-0022	EA 5/8-11 Steel Lock Nut Without Spring For Unistrut Channel.....	8.86	
05 43 00 00-0023	Beam Clamp For Unistrut Channel (05 43)		
05 43 00 00-0024	EA Unistrut Beam Clamp, 1-5/8" Channel P2675.....	16.42	6.45
05 43 00 00-0025	EA Unistrut Beam Clamp, 1-5/8" Channel P2676.....	19.69	6.45
05 43 00 00-0026	EA Add For Unistrut Swivel Nut, P2676.....	1.78	
05 43 00 00-0027	Beam Clamp Clevis Hangers (05 43)		
05 43 00 00-0028	EA Up To 3/8" Rod, Beam Clamp Clevis Hanger (Unistrut P2674)	17.55	6.45
05 43 00 00-0029	EA Up To 1/2" Rod, Beam Clamp Clevis Hanger (Unistrut P2677)	20.16	6.45
05 43 00 00-0030	EA Add For Unistrut Swivel Nut.....	1.78	
05 43 00 00-0031	EA Unistrut Bracket For Shelves	95.87	8.61
05 45 Metal Support Assemblies (05 40)			
05 45 13 Mechanical Metal Supports (05 45) See CSI section 23 05 29 00-0000 for metal supports.			
05 45 16 Electrical Metal Supports (05 45) See CSI section 26 05 29 00-0000 for metal supports.			
05 50 Metal Fabrications (05)			
05 51 Metal Stairs (05 50)			
05 51 13 Metal Pan Stairs (05 51) Note: Open concrete filled metal pan stair and landing including steel stringer, safety nosing and concrete. Excludes handrail. See CSI section 05 52 13 00-0000 for handrails.			
05 51 13 00-0001 Open Concrete Filled Metal Pan Stair And Landing (05 51 13) Note: Includes steel stringer, safety nosing and concrete. Excludes handrail.			
05 51 13 00-0002	RSR 3'-6" Wide Open Concrete Filled Metal Pan Tread Stair..... <i>For Closed Riser, Add</i>	539.68 61.34	24.93
05 51 13 00-0003	RSR 4'-0" Wide Open Concrete Filled Metal Pan Tread Stair..... <i>For Closed Riser, Add</i>	614.02 69.69	29.08
05 51 13 00-0004	RSR 5'-0" Wide Open Concrete Filled Metal Pan Tread Stair..... <i>For Closed Riser, Add</i>	685.59 77.60	34.07
05 51 13 00-0005	SF Concrete Filled Steel Pan Landing..... Note: Conventional shape.	72.58	4.15



	MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 51 19	Metal Grating Stairs <small>(05 51)</small> Note: Open steel grating tread metal stair and landing including steel stringers, safety nosing and 2 pipe handrail.		
05 51 19 00-001	Open Steel Grating Tread Metal Stair And Landing <small>(05 51 19)</small> Note: Includes steel stringers, safety nosing and 2 pipe handrail.		
05 51 19 00-002	RSR 3'-6" Wide Open Steel Grating Tread Metal Stair <i>For Closed Riser, Add</i> <i>For Galvanized Steel, Add</i>	271.60 31.65 51.28	33.24
05 51 19 00-003	RSR 4'-0" Wide Open Steel Grating Tread Metal Stair <i>For Closed Riser, Add</i> <i>For Galvanized Steel, Add</i>	291.33 33.67 53.72	38.22
05 51 19 00-004	RSR 5'-0" Wide Open Steel Grating Tread Metal Stair <i>For Closed Riser, Add</i> <i>For Galvanized Steel, Add</i>	324.16 37.21 58.61	44.87
05 51 19 00-005	SF Steel Grating Landing With Framing And 2 Pipe Handrail Note: Conventional shape. <i>For Galvanized Steel, Add</i>	51.77 8.79	4.15
05 51 33	Metal Ladders <small>(05 51)</small> Note: Includes factory prime.		
05 51 33 13	Vertical Metal Ladders <small>(05 51 33)</small>		
05 51 33 13-0001	Vertical Ladders <small>(05 51 33 13)</small> Note: Climbing rungs are 3/4" corrugated steel round rungs on 12" centers. Stand-off brackets are 7"		
05 51 33 13-0002	VL 20" Wide Vertical Steel Ladder Primed <i>For Galvanized Steel, Add</i> <i>For Aluminum, Add</i>	76.24 11.24 22.48	9.97
05 51 33 13-0003	VL 24" Wide Vertical Steel Ladder Primed <i>For Galvanized Steel, Add</i> <i>For Aluminum, Add</i>	87.63 14.09 28.18	9.97
05 51 33 13-0004	VL 20" Wide Vertical Steel Caged Ladder Primed <i>For Galvanized Steel, Add</i> <i>For Aluminum, Add</i>	183.57 32.65 65.30	16.61
05 51 33 13-0005	VL 24" Wide Vertical Steel Caged Ladder Primed <i>For Galvanized Steel, Add</i> <i>For Aluminum, Add</i>	206.35 38.35 76.70	16.61
05 51 33 13-0006	Vertical Ladders Options <small>(05 51 33 13)</small>		
05 51 33 13-0007	EA 20" Wide Vertical Steel Ladder Walk-Thru Handrails, Primed Note: Extends 42" above landing surface. Includes mounting bracket. <i>For Galvanized Steel, Add</i> <i>For Aluminum, Add</i>	205.34 35.76 71.52	31.16
05 51 33 13-0008	EA 24" Wide Vertical Steel Ladder Walk-Thru Handrails, Primed Note: Extends 42" above landing surface. Includes mounting bracket. <i>For Galvanized Steel, Add</i> <i>For Aluminum, Add</i>	224.24 39.44 78.88	33.24
05 51 33 13-0009	EA Security Cage Entry Gate With Lockable Hasp	283.69	10.39
05 51 33 13-0010	EA 6' Security Ladder Guard	632.60	62.31
05 51 33 13-0011	EA 8' Security Ladder Guard	755.39	72.70
05 51 33 13-0012	EA Safety Chain Attachment	113.37	
05 51 33 13-0013	Welded Steel Ladder Cages <small>(05 51 33 13)</small> Note: For existing fixed ladders up to 20" wide. Excludes the ladder.		
05 51 33 13-0014	Powder Coated, Welded Steel Ladder Cages <small>(05 51 33 13-0013)</small>		
05 51 33 13-0015	EA 7-1/2' Length, Powder Coated, Welded Steel Ladder Cage	1,174.07	124.63
05 51 33 13-0016	EA 8-1/2' Length, Powder Coated, Welded Steel Ladder Cage	1,271.13	128.79
05 51 33 13-0017	EA 9-1/2' Length, Powder Coated, Welded Steel Ladder Cage	1,348.89	132.94
05 51 33 13-0018	EA 10-1/2' Length, Powder Coated, Welded Steel Ladder Cage	1,431.80	137.10
05 51 33 13-0019	EA 11-1/2' Length, Powder Coated, Welded Steel Ladder Cage	1,481.28	141.25
05 51 33 13-0020	EA 12-1/2' Length, Powder Coated, Welded Steel Ladder Cage	1,560.32	145.40
05 51 33 13-0021	EA 13-1/2' Length, Powder Coated, Welded Steel Ladder Cage	1,630.37	149.56
05 51 33 13-0022	EA 14-1/2' Length, Powder Coated, Welded Steel Ladder Cage	1,721.00	153.72
05 51 33 13-0023	EA 15-1/2' Length, Powder Coated, Welded Steel Ladder Cage	1,809.05	157.87
05 51 33 13-0024	EA 16-1/2' Length, Powder Coated, Welded Steel Ladder Cage	1,881.66	162.03
05 51 33 13-0025	EA 17-1/2' Length, Powder Coated, Welded Steel Ladder Cage	1,969.73	166.18
05 51 33 13-0026	EA 18-1/2' Length, Powder Coated, Welded Steel Ladder Cage	2,055.21	170.33
05 51 33 13-0027	EA 19-1/2' Length, Powder Coated, Welded Steel Ladder Cage	2,139.40	174.49
05 51 33 13-0028	EA 20-1/2' Length, Powder Coated, Welded Steel Ladder Cage	2,290.48	178.64
05 51 33 13-0029	EA 21-1/2' Length, Powder Coated, Welded Steel Ladder Cage	2,337.38	182.79
05 51 33 13-0030	EA 22-1/2' Length, Powder Coated, Welded Steel Ladder Cage	2,416.43	186.95
05 51 33 13-0031	EA 23-1/2' Length, Powder Coated, Welded Steel Ladder Cage	2,489.05	191.10
05 51 33 13-0032	EA 24-1/2' Length, Powder Coated, Welded Steel Ladder Cage	2,556.53	195.26
05 51 33 13-0033	EA 25-1/2' Length, Powder Coated, Welded Steel Ladder Cage	2,703.75	199.42
05 51 33 13-0034	EA 26-1/2' Length, Powder Coated, Welded Steel Ladder Cage	2,784.08	203.57
05 51 33 13-0035	EA 27-1/2' Length, Powder Coated, Welded Steel Ladder Cage	2,859.29	207.72
05 51 33 13-0036	Stainless Steel, Welded Steel Ladder Cages <small>(05 51 33 13-0013)</small>		
05 51 33 13-0037	EA 7-1/2' Length, Stainless Steel, Welded Steel Ladder Cage	2,694.98	124.63



MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

05 51 33 13-0038	EA	8-1/2' Length, Stainless Steel, Welded Steel Ladder Cage.....	2,876.40	128.79
05 51 33 13-0039	EA	9-1/2' Length, Stainless Steel, Welded Steel Ladder Cage.....	3,176.91	132.94
05 51 33 13-0040	EA	10-1/2' Length, Stainless Steel, Welded Steel Ladder Cage.....	3,326.41	137.10
05 51 33 13-0041	EA	11-1/2' Length, Stainless Steel, Welded Steel Ladder Cage.....	3,452.60	141.25
05 51 33 13-0042	EA	12-1/2' Length, Stainless Steel, Welded Steel Ladder Cage.....	3,619.28	145.40
05 51 33 13-0043	EA	13-1/2' Length, Stainless Steel, Welded Steel Ladder Cage.....	3,917.34	149.56
05 51 33 13-0044	EA	14-1/2' Length, Stainless Steel, Welded Steel Ladder Cage.....	4,069.30	153.72
05 51 33 13-0045	EA	15-1/2' Length, Stainless Steel, Welded Steel Ladder Cage.....	4,226.17	157.87
05 51 33 13-0046	EA	16-1/2' Length, Stainless Steel, Welded Steel Ladder Cage.....	4,397.76	162.03
05 51 33 13-0047	EA	17-1/2' Length, Stainless Steel, Welded Steel Ladder Cage.....	4,701.98	166.18
05 51 33 13-0048	EA	18-1/2' Length, Stainless Steel, Welded Steel Ladder Cage.....	4,855.16	170.33
05 51 33 13-0049	EA	19-1/2' Length, Stainless Steel, Welded Steel Ladder Cage.....	5,000.97	174.49
05 51 33 13-0050	EA	20-1/2' Length, Stainless Steel, Welded Steel Ladder Cage.....	5,241.33	178.64
05 51 33 13-0051	EA	21-1/2' Length, Stainless Steel, Welded Steel Ladder Cage.....	5,511.15	182.79
05 51 33 13-0052	EA	22-1/2' Length, Stainless Steel, Welded Steel Ladder Cage.....	5,661.88	186.95
05 51 33 13-0053	EA	23-1/2' Length, Stainless Steel, Welded Steel Ladder Cage.....	5,816.30	191.10
05 51 33 13-0054	EA	24-1/2' Length, Stainless Steel, Welded Steel Ladder Cage.....	5,960.89	195.26
05 51 33 13-0055	EA	25-1/2' Length, Stainless Steel, Welded Steel Ladder Cage.....	6,328.93	199.42
05 51 33 13-0056	EA	26-1/2' Length, Stainless Steel, Welded Steel Ladder Cage.....	6,473.52	203.57
05 51 33 13-0057	EA	27-1/2' Length, Stainless Steel, Welded Steel Ladder Cage.....	6,621.80	207.72

05 51 33 16 Inclined Metal Ladders (05 51 33)

05 51 33 16-0001 Industrial Ship Ladder, Incline Stairs (05 51 33 16)

Note: Includes factory prime.

05 51 33 16-0002	RSR	3' Wide Industrial Steel Ship Ladder With 2 Rails Each Side.....	205.86	41.55
		For Aluminum, Add	61.39	

05 51 33 23 Alternating Tread Ladders (05 51 33)

05 51 33 23-0001 Vertical Ladders With Alternating Tread (05 51 33 23)

05 51 33 23-0002	EA	4' Vertical Height Aluminum Alternating Tread Ladder	1,330.89	124.63
		For Stainless Steel, Add	196.80	
		For Primed Steel, Deduct	-191.42	
05 51 33 23-0003	EA	5' Vertical Height Aluminum Alternating Tread Ladder	1,513.97	132.11
		For Stainless Steel, Add	240.90	
		For Primed Steel, Deduct	-223.30	
05 51 33 23-0004	EA	6' Vertical Height Aluminum Alternating Tread Ladder	1,665.51	132.11
		For Stainless Steel, Add	288.67	
		For Primed Steel, Deduct	-241.55	
05 51 33 23-0005	EA	7' Vertical Height Aluminum Alternating Tread Ladder	1,916.46	166.01
		For Stainless Steel, Add	347.24	
		For Primed Steel, Deduct	-256.61	
05 51 33 23-0006	EA	8' Vertical Height Aluminum Alternating Tread Ladder	2,093.44	171.89
		For Stainless Steel, Add	388.99	
		For Primed Steel, Deduct	-298.53	
05 51 33 23-0007	EA	9' Vertical Height Aluminum Alternating Tread Ladder	2,227.34	171.89
		For Stainless Steel, Add	453.51	
		For Primed Steel, Deduct	-293.53	
05 51 33 23-0008	EA	10' Vertical Height Aluminum Alternating Tread Ladder.....	2,449.06	191.75
		For Stainless Steel, Add	497.40	
		For Primed Steel, Deduct	-327.55	
05 51 33 23-0009	EA	11' Vertical Height Aluminum Alternating Tread Ladder.....	2,599.08	191.75
		For Stainless Steel, Add	546.61	
		For Primed Steel, Deduct	-347.07	
05 51 33 23-0010	EA	12' Vertical Height Aluminum Alternating Tread Ladder.....	2,715.81	191.75
		For Stainless Steel, Add	623.99	
		For Primed Steel, Deduct	-346.65	

05 52 Metal Railings (05 50)

05 52 13 Pipe And Tube Railings (05 52)

Note: Includes sleeves, grouting, connection bolts (where necessary) and drilling of bolt (where necessary).

05 52 13 00-0001 Welded Steel Pipe Railing (05 52 13)

Note: Includes field welds and touch-up of welds.

05 52 13 00-0002 One Rail, Up To 42" High, Welded Steel Pipe Railings (05 52 13 00-0001)

Note: Includes factory primed posts and one rail.



Metals	05	05
Metal Fabrications	05 50	
Metal Railings	05 52	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 52 13 00-0003 LF 1" Diameter, One Rail, Up To 42" High, Welded Steel Pipe Railing	34.28	8.31
For Schedule 80 Handrail, Add	2.61	
For Additional Off Set Handrail, ADA Attachment, Add	11.81	
For Aluminum, Satin Finish, Add	7.42	
For Aluminum, Clear Anodized Finish, Add	11.49	
For Aluminum, Dark Anodized Finish, Add	13.25	
For Galvanizing, Add	7.07	
For Wrought Iron, Add	3.43	
For Solid Steel Rails, Add	6.86	
For 304 Stainless Steel, Add	56.54	
For 316 Stainless Steel, Add	63.61	
For 2" Wheel Guard, Add	1.68	
For 4" High Kick Plate, Add	2.21	
For 6" High Kick Plate, Add	3.53	
For Curved Rail, Add	15.59	
For Handrail With Supported Safety Edge Expanded Metal Panels, Add	11.20	
For Mounting On Stairs, Add	4.26	
For Mounting On Slopes, Add	1.66	
For Post Base Flange With Screws, Add Per Post	19.16	
For Embedded Stainless Steel Post Sleeves (Excludes Core Drilling), Add Per Post	28.99	
For Custom Design Or Shapes (Square Tops, etc), Add	12.99	
For Nylon Coating, Add	2.65	
05 52 13 00-0004 LF 1-1/4" Diameter, One Rail, Up To 42" High, Welded Steel Pipe Railing	37.33	8.31
For Schedule 80 Handrail, Add	3.70	
For Additional Off Set Handrail, ADA Attachment, Add	11.81	
For Aluminum, Satin Finish, Add	8.70	
For Aluminum, Clear Anodized Finish, Add	13.47	
For Aluminum, Dark Anodized Finish, Add	15.54	
For Galvanizing, Add	8.29	
For Wrought Iron, Add	3.73	
For Solid Steel Rails, Add	7.47	
For 304 Stainless Steel, Add	66.30	
For 316 Stainless Steel, Add	74.59	
For 2" Wheel Guard, Add	1.97	
For 4" High Kick Plate, Add	2.59	
For 6" High Kick Plate, Add	4.14	
For Curved Rail, Add	17.42	
For Handrail With Supported Safety Edge Expanded Metal Panels, Add	11.20	
For Mounting On Stairs, Add	4.56	
For Mounting On Slopes, Add	1.66	
For Post Base Flange With Screws, Add Per Post	19.16	
For Embedded Stainless Steel Post Sleeves (Excludes Core Drilling), Add Per Post	28.99	
For Custom Design Or Shapes (Square Tops, etc), Add	14.51	
For Nylon Coating, Add	3.11	
05 52 13 00-0005 LF 1-1/2" Diameter, One Rail, Up To 42" High, Welded Steel Pipe Railing	40.37	8.31
For Schedule 80 Handrail, Add	3.70	
For Additional Off Set Handrail, ADA Attachment, Add	11.81	
For Aluminum, Satin Finish, Add	9.98	
For Aluminum, Clear Anodized Finish, Add	15.44	
For Aluminum, Dark Anodized Finish, Add	17.82	
For Galvanizing, Add	9.50	
For Wrought Iron, Add	4.04	
For Solid Steel Rails, Add	8.07	
For 304 Stainless Steel, Add	76.03	
For 316 Stainless Steel, Add	85.54	
For 2" Wheel Guard, Add	2.26	
For 4" High Kick Plate, Add	2.97	
For 6" High Kick Plate, Add	4.75	
For Curved Rail, Add	19.24	
For Handrail With Supported Safety Edge Expanded Metal Panels, Add	11.20	
For Mounting On Stairs, Add	4.87	
For Mounting On Slopes, Add	1.66	
For Post Base Flange With Screws, Add Per Post	19.16	
For Embedded Stainless Steel Post Sleeves (Excludes Core Drilling), Add Per Post	28.99	
For Custom Design Or Shapes (Square Tops, etc), Add	16.03	
For Nylon Coating, Add	3.56	
05 52 13 00-0006 LF 2" Diameter, One Rail, Up To 42" High, Welded Steel Pipe Railing	45.65	8.31
For Schedule 80 Handrail, Add	4.15	
For Additional Off Set Handrail, ADA Attachment, Add	11.81	
For Aluminum, Satin Finish, Add	12.20	
For Aluminum, Clear Anodized Finish, Add	18.88	
For Aluminum, Dark Anodized Finish, Add	21.78	
For Galvanizing, Add	11.62	
For Wrought Iron, Add	4.57	
For Solid Steel Rails, Add	9.13	
For 304 Stainless Steel, Add	92.93	
For 316 Stainless Steel, Add	104.54	
For 2" Wheel Guard, Add	2.76	
For 4" High Kick Plate, Add	3.63	
For 6" High Kick Plate, Add	5.81	
For Curved Rail, Add	22.41	
For Handrail With Supported Safety Edge Expanded Metal Panels, Add	11.20	
For Mounting On Stairs, Add	5.40	
For Mounting On Slopes, Add	1.66	
For Post Base Flange With Screws, Add Per Post	19.16	
For Embedded Stainless Steel Post Sleeves (Excludes Core Drilling), Add Per Post	28.99	
For Custom Design Or Shapes (Square Tops, etc), Add	18.67	
For Nylon Coating, Add	4.36	

05	Metals
05 50	Metal Fabrications
05 52	Metal Railings



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 52 13 00-0007	LF		2-1/2" Diameter, One Rail, Up To 42" High, Welded Steel Pipe Railing	51.98	8.31
			<i>For Schedule 80 Handrail, Add</i>	4.60	
			<i>For Additional Off Set Handrail, ADA Attachment, Add</i>	11.81	
			<i>For Aluminum, Satin Finish, Add</i>	14.86	
			<i>For Aluminum, Clear Anodized Finish, Add</i>	22.99	
			<i>For Aluminum, Dark Anodized Finish, Add</i>	26.53	
			<i>For Galvanizing, Add</i>	14.15	
			<i>For Wrought Iron, Add</i>	5.20	
			<i>For Solid Steel Rails, Add</i>	10.40	
			<i>For 304 Stainless Steel, Add</i>	113.18	
			<i>For 316 Stainless Steel, Add</i>	127.33	
			<i>For 2" Wheel Guard, Add</i>	3.36	
			<i>For 4" High Kick Plate, Add</i>	4.42	
			<i>For 6" High Kick Plate, Add</i>	7.07	
			<i>For Curved Rail, Add</i>	26.21	
			<i>For Handrail With Supported Safety Edge Expanded Metal Panels, Add</i>	11.20	
			<i>For Mounting On Stairs, Add</i>	6.03	
			<i>For Mounting On Slopes, Add</i>	1.66	
			<i>For Post Base Flange With Screws, Add Per Post</i>	19.16	
			<i>For Embedded Stainless Steel Post Sleeves (Excludes Core Drilling), Add Per Post</i>	28.99	
			<i>For Custom Design Or Shapes (Square Tops, etc), Add</i>	21.84	
			<i>For Nylon Coating, Add</i>	5.31	
05 52 13 00-0008			Two Rail, Up To 42" High, Welded Steel Pipe Railings <small>(05 52 13 00-0001)</small>		
			Note: Includes factory primed posts and two rails.		
05 52 13 00-0009	LF		1" Diameter, Two Rail, Up To 42" High, Welded Steel Pipe Railing.....	38.70	8.31
			<i>For Schedule 80 Handrail, Add</i>	2.61	
			<i>For Additional Off Set Handrail, ADA Attachment, Add</i>	11.81	
			<i>For Aluminum, Satin Finish, Add</i>	9.28	
			<i>For Aluminum, Clear Anodized Finish, Add</i>	14.36	
			<i>For Aluminum, Dark Anodized Finish, Add</i>	16.57	
			<i>For Galvanizing, Add</i>	8.84	
			<i>For Wrought Iron, Add</i>	3.87	
			<i>For Solid Steel Rails, Add</i>	7.74	
			<i>For 304 Stainless Steel, Add</i>	70.69	
			<i>For 316 Stainless Steel, Add</i>	79.52	
			<i>For 2" Wheel Guard, Add</i>	2.10	
			<i>For 4" High Kick Plate, Add</i>	2.76	
			<i>For 6" High Kick Plate, Add</i>	4.42	
			<i>For Curved Rail, Add</i>	18.24	
			<i>For Handrail With Supported Safety Edge Expanded Metal Panels, Add</i>	11.20	
			<i>For Mounting On Stairs, Add</i>	4.70	
			<i>For Mounting On Slopes, Add</i>	1.66	
			<i>For Post Base Flange With Screws, Add Per Post</i>	19.16	
			<i>For Embedded Stainless Steel Post Sleeves (Excludes Core Drilling), Add Per Post</i>	28.99	
			<i>For Custom Design Or Shapes (Square Tops, etc), Add</i>	15.20	
			<i>For Nylon Coating, Add</i>	3.31	
05 52 13 00-0010	LF		1-1/4" Diameter, Two Rail, Up To 42" High, Welded Steel Pipe Railing	42.50	8.31
			<i>For Schedule 80 Handrail, Add</i>	3.70	
			<i>For Additional Off Set Handrail, ADA Attachment, Add</i>	11.81	
			<i>For Aluminum, Satin Finish, Add</i>	10.87	
			<i>For Aluminum, Clear Anodized Finish, Add</i>	16.83	
			<i>For Aluminum, Dark Anodized Finish, Add</i>	19.42	
			<i>For Galvanizing, Add</i>	10.36	
			<i>For Wrought Iron, Add</i>	4.25	
			<i>For Solid Steel Rails, Add</i>	8.50	
			<i>For 304 Stainless Steel, Add</i>	82.85	
			<i>For 316 Stainless Steel, Add</i>	93.20	
			<i>For 2" Wheel Guard, Add</i>	2.46	
			<i>For 4" High Kick Plate, Add</i>	3.24	
			<i>For 6" High Kick Plate, Add</i>	5.18	
			<i>For Curved Rail, Add</i>	20.52	
			<i>For Handrail With Supported Safety Edge Expanded Metal Panels, Add</i>	11.20	
			<i>For Mounting On Stairs, Add</i>	5.08	
			<i>For Mounting On Slopes, Add</i>	1.66	
			<i>For Post Base Flange With Screws, Add Per Post</i>	19.16	
			<i>For Embedded Stainless Steel Post Sleeves (Excludes Core Drilling), Add Per Post</i>	28.99	
			<i>For Custom Design Or Shapes (Square Tops, etc), Add</i>	17.10	
			<i>For Nylon Coating, Add</i>	3.88	



Metals	05	05
Metal Fabrications	05 50	
Metal Railings	05 52	

MINOR	TOTAL DIRECT	DEMOLITION
CSI UOM DESCRIPTION	UNIT COST	UNIT COST
05 52 13 00-0011 LF 1-1/2" Diameter, Two Rail, Up To 42" High, Welded Steel Pipe Railing	46.31	8.31
For Schedule 80 Handrail, Add	3.70	
For Additional Off Set Handrail, ADA Attachment, Add	11.81	
For Aluminum, Satin Finish, Add	12.47	
For Aluminum, Clear Anodized Finish, Add	19.31	
For Aluminum, Dark Anodized Finish, Add	22.28	
For Galvanizing, Add	11.88	
For Wrought Iron, Add	4.63	
For Solid Steel Rails, Add	9.26	
For 304 Stainless Steel, Add	95.04	
For 316 Stainless Steel, Add	106.92	
For 2" Wheel Guard, Add	2.82	
For 4" High Kick Plate, Add	3.71	
For 6" High Kick Plate, Add	5.94	
For Curved Rail, Add	22.80	
For Handrail With Supported Safety Edge Expanded Metal Panels, Add	11.20	
For Mounting On Stairs, Add	5.46	
For Mounting On Slopes, Add	1.66	
For Post Base Flange With Screws, Add Per Post	19.16	
For Embedded Stainless Steel Post Sleeves (Excludes Core Drilling), Add Per Post	28.99	
For Custom Design Or Shapes (Square Tops, etc), Add	19.00	
For Nylon Coating, Add	4.46	
05 52 13 00-0012 LF 2" Diameter, Two Rail, Up To 42" High, Welded Steel Pipe Railing	52.91	8.31
For Schedule 80 Handrail, Add	4.15	
For Additional Off Set Handrail, ADA Attachment, Add	11.81	
For Aluminum, Satin Finish, Add	15.25	
For Aluminum, Clear Anodized Finish, Add	23.60	
For Aluminum, Dark Anodized Finish, Add	27.23	
For Galvanizing, Add	14.52	
For Wrought Iron, Add	5.29	
For Solid Steel Rails, Add	10.58	
For 304 Stainless Steel, Add	116.16	
For 316 Stainless Steel, Add	130.68	
For 2" Wheel Guard, Add	3.45	
For 4" High Kick Plate, Add	4.54	
For 6" High Kick Plate, Add	7.26	
For Curved Rail, Add	26.76	
For Handrail With Supported Safety Edge Expanded Metal Panels, Add	11.20	
For Mounting On Stairs, Add	6.12	
For Mounting On Slopes, Add	1.66	
For Post Base Flange With Screws, Add Per Post	19.16	
For Embedded Stainless Steel Post Sleeves (Excludes Core Drilling), Add Per Post	28.99	
For Custom Design Or Shapes (Square Tops, etc), Add	22.30	
For Nylon Coating, Add	5.45	
05 52 13 00-0013 LF 2-1/2" Diameter, Two Rail, Up To 42" High, Welded Steel Pipe Railing	60.82	8.31
For Schedule 80 Handrail, Add	4.60	
For Additional Off Set Handrail, ADA Attachment, Add	11.81	
For Aluminum, Satin Finish, Add	18.57	
For Aluminum, Clear Anodized Finish, Add	28.74	
For Aluminum, Dark Anodized Finish, Add	33.16	
For Galvanizing, Add	17.68	
For Wrought Iron, Add	6.08	
For Solid Steel Rails, Add	12.16	
For 304 Stainless Steel, Add	141.47	
For 316 Stainless Steel, Add	159.16	
For 2" Wheel Guard, Add	4.20	
For 4" High Kick Plate, Add	5.53	
For 6" High Kick Plate, Add	8.84	
For Curved Rail, Add	31.51	
For Handrail With Supported Safety Edge Expanded Metal Panels, Add	11.20	
For Mounting On Stairs, Add	6.91	
For Mounting On Slopes, Add	1.66	
For Post Base Flange With Screws, Add Per Post	19.16	
For Embedded Stainless Steel Post Sleeves (Excludes Core Drilling), Add Per Post	28.99	
For Custom Design Or Shapes (Square Tops, etc), Add	26.26	
For Nylon Coating, Add	6.63	

05 52 13 00-0014 Three Rail, Up To 42" High, Welded Steel Pipe Railings (05 52 13 00-0001)
 Note: Includes factory primed posts and three rails.

05	Metals
05 50	Metal Fabrications
05 52	Metal Railings



MINOR

CSI UOM DESCRIPTION

TOTAL DIRECT
UNIT COSTDEMOLITION
UNIT COST

05 52 13 00-0015	LF 1" Diameter, Three Rail, Up To 42" High, Welded Steel Pipe Railing.....	51.51	9.97
	For Schedule 80 Handrail, Add	3.91	
	For Additional Off Set Handrail, ADA Attachment, Add	12.48	
	For Aluminum, Satin Finish, Add	13.26	
	For Aluminum, Clear Anodized Finish, Add	20.52	
	For Aluminum, Dark Anodized Finish, Add	23.68	
	For Galvanizing, Add	12.63	
	For Wrought Iron, Add	5.15	
	For Solid Steel Rails, Add	10.30	
	For 304 Stainless Steel, Add	101.02	
	For 316 Stainless Steel, Add	113.65	
	For 2" Wheel Guard, Add	3.00	
	For 4" High Kick Plate, Add	3.95	
	For 6" High Kick Plate, Add	6.31	
	For Curved Rail, Add	24.92	
	For Handrail With Supported Safety Edge Expanded Metal Panels, Add	11.20	
	For Mounting On Stairs, Add	6.15	
	For Mounting On Slopes, Add	1.99	
	For Post Base Flange With Screws, Add Per Post	19.49	
	For Embedded Stainless Steel Post Sleeves (Excludes Core Drilling), Add Per Post	29.49	
	For Custom Design Or Shapes (Square Tops, etc), Add	20.77	
	For Nylon Coating, Add	4.74	
05 52 13 00-0016	LF 1-1/4" Diameter, Three Rail, Up To 42" High, Welded Steel Pipe Railing.....	56.95	9.97
	For Schedule 80 Handrail, Add	5.38	
	For Additional Off Set Handrail, ADA Attachment, Add	12.48	
	For Aluminum, Satin Finish, Add	15.54	
	For Aluminum, Clear Anodized Finish, Add	24.06	
	For Aluminum, Dark Anodized Finish, Add	27.76	
	For Galvanizing, Add	14.80	
	For Wrought Iron, Add	5.70	
	For Solid Steel Rails, Add	11.39	
	For 304 Stainless Steel, Add	118.43	
	For 316 Stainless Steel, Add	133.24	
	For 2" Wheel Guard, Add	3.52	
	For 4" High Kick Plate, Add	4.63	
	For 6" High Kick Plate, Add	7.40	
	For Curved Rail, Add	28.19	
	For Handrail With Supported Safety Edge Expanded Metal Panels, Add	11.20	
	For Mounting On Stairs, Add	6.69	
	For Mounting On Slopes, Add	1.99	
	For Post Base Flange With Screws, Add Per Post	19.49	
	For Embedded Stainless Steel Post Sleeves (Excludes Core Drilling), Add Per Post	29.49	
	For Custom Design Or Shapes (Square Tops, etc), Add	23.49	
	For Nylon Coating, Add	5.55	
05 52 13 00-0017	LF 1-1/2" Diameter, Three Rail, Up To 42" High, Welded Steel Pipe Railing.....	62.39	9.97
	For Schedule 80 Handrail, Add	5.38	
	For Additional Off Set Handrail, ADA Attachment, Add	12.48	
	For Aluminum, Satin Finish, Add	17.83	
	For Aluminum, Clear Anodized Finish, Add	27.59	
	For Aluminum, Dark Anodized Finish, Add	31.84	
	For Galvanizing, Add	16.98	
	For Wrought Iron, Add	6.24	
	For Solid Steel Rails, Add	12.48	
	For 304 Stainless Steel, Add	135.84	
	For 316 Stainless Steel, Add	152.82	
	For 2" Wheel Guard, Add	4.03	
	For 4" High Kick Plate, Add	5.31	
	For 6" High Kick Plate, Add	8.49	
	For Curved Rail, Add	31.45	
	For Handrail With Supported Safety Edge Expanded Metal Panels, Add	11.20	
	For Mounting On Stairs, Add	7.24	
	For Mounting On Slopes, Add	1.99	
	For Post Base Flange With Screws, Add Per Post	19.49	
	For Embedded Stainless Steel Post Sleeves (Excludes Core Drilling), Add Per Post	29.49	
	For Custom Design Or Shapes (Square Tops, etc), Add	26.21	
	For Nylon Coating, Add	6.37	
05 52 13 00-0018	LF 2" Diameter, Three Rail, Up To 42" High, Welded Steel Pipe Railing.....	71.84	9.97
	For Schedule 80 Handrail, Add	5.97	
	For Additional Off Set Handrail, ADA Attachment, Add	12.48	
	For Aluminum, Satin Finish, Add	21.80	
	For Aluminum, Clear Anodized Finish, Add	33.74	
	For Aluminum, Dark Anodized Finish, Add	38.93	
	For Galvanizing, Add	20.76	
	For Wrought Iron, Add	7.18	
	For Solid Steel Rails, Add	14.37	
	For 304 Stainless Steel, Add	166.08	
	For 316 Stainless Steel, Add	186.84	
	For 2" Wheel Guard, Add	4.93	
	For 4" High Kick Plate, Add	6.49	
	For 6" High Kick Plate, Add	10.38	
	For Curved Rail, Add	37.12	
	For Handrail With Supported Safety Edge Expanded Metal Panels, Add	11.20	
	For Mounting On Stairs, Add	8.18	
	For Mounting On Slopes, Add	1.99	
	For Post Base Flange With Screws, Add Per Post	19.49	
	For Embedded Stainless Steel Post Sleeves (Excludes Core Drilling), Add Per Post	29.49	
	For Custom Design Or Shapes (Square Tops, etc), Add	30.94	
	For Nylon Coating, Add	7.79	



Metals	05	05
Metal Fabrications	05 50	
Metal Railings	05 52	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 52 13 00-0019 LF 2-1/2" Diameter, Three Rail, Up To 42" High, Welded Steel Pipe Railing.....	83.09	9.97
For Schedule 80 Handrail, Add	6.57	
For Additional Off Set Handrail, ADA Attachment, Add	12.48	
For Aluminum, Satin Finish, Add	26.52	
For Aluminum, Clear Anodized Finish, Add	41.05	
For Aluminum, Dark Anodized Finish, Add	47.36	
For Galvanizing, Add	25.26	
For Wrought Iron, Add	8.31	
For Solid Steel Rails, Add	16.62	
For 304 Stainless Steel, Add	202.08	
For 316 Stainless Steel, Add	227.34	
For 2" Wheel Guard, Add	6.00	
For 4" High Kick Plate, Add	7.89	
For 6" High Kick Plate, Add	12.63	
For Curved Rail, Add	43.87	
For Handrail With Supported Safety Edge Expanded Metal Panels, Add	11.20	
For Mounting On Stairs, Add	9.31	
For Mounting On Slopes, Add	1.99	
For Post Base Flange With Screws, Add Per Post	19.49	
For Embedded Stainless Steel Post Sleeves (Excludes Core Drilling), Add Per Post	29.49	
For Custom Design Or Shapes (Square Tops, etc), Add	36.56	
For Nylon Coating, Add	9.47	
05 52 13 00-0020 Four Rail, Up To 42" High, Welded Steel Pipe Railings (05 52 13 00-0001)		
Note: Includes factory primed posts and four rails.		
05 52 13 00-0021 LF 1" Diameter, Four Rail, Up To 42" High, Welded Steel Pipe Railing.....	62.02	11.63
For Schedule 80 Handrail, Add	5.42	
For Additional Off Set Handrail, ADA Attachment, Add	13.14	
For Aluminum, Satin Finish, Add	16.28	
For Aluminum, Clear Anodized Finish, Add	25.19	
For Aluminum, Dark Anodized Finish, Add	29.06	
For Galvanizing, Add	15.50	
For Wrought Iron, Add	6.20	
For Solid Steel Rails, Add	12.40	
For 304 Stainless Steel, Add	124.00	
For 316 Stainless Steel, Add	139.50	
For 2" Wheel Guard, Add	3.68	
For 4" High Kick Plate, Add	4.84	
For 6" High Kick Plate, Add	7.75	
For Curved Rail, Add	30.23	
For Handrail With Supported Safety Edge Expanded Metal Panels, Add	11.20	
For Mounting On Stairs, Add	7.37	
For Mounting On Slopes, Add	2.33	
For Post Base Flange With Screws, Add Per Post	19.83	
For Embedded Stainless Steel Post Sleeves (Excludes Core Drilling), Add Per Post	29.99	
For Custom Design Or Shapes (Square Tops, etc), Add	25.19	
For Nylon Coating, Add	5.81	
05 52 13 00-0022 LF 1-1/4" Diameter, Four Rail, Up To 42" High, Welded Steel Pipe Railing.....	60.70	11.63
For Schedule 80 Handrail, Add	7.25	
For Additional Off Set Handrail, ADA Attachment, Add	13.14	
For Aluminum, Satin Finish, Add	15.72	
For Aluminum, Clear Anodized Finish, Add	24.33	
For Aluminum, Dark Anodized Finish, Add	28.07	
For Galvanizing, Add	14.97	
For Wrought Iron, Add	6.07	
For Solid Steel Rails, Add	12.14	
For 304 Stainless Steel, Add	119.78	
For 316 Stainless Steel, Add	134.75	
For 2" Wheel Guard, Add	3.56	
For 4" High Kick Plate, Add	4.68	
For 6" High Kick Plate, Add	7.49	
For Curved Rail, Add	29.44	
For Handrail With Supported Safety Edge Expanded Metal Panels, Add	11.20	
For Mounting On Stairs, Add	7.23	
For Mounting On Slopes, Add	2.33	
For Post Base Flange With Screws, Add Per Post	19.83	
For Embedded Stainless Steel Post Sleeves (Excludes Core Drilling), Add Per Post	29.99	
For Custom Design Or Shapes (Square Tops, etc), Add	24.53	
For Nylon Coating, Add	5.61	

05	Metals
05 50	Metal Fabrications
05 52	Metal Railings



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 52 13 00-0023	LF		1-1/2" Diameter, Four Rail, Up To 42" High, Welded Steel Pipe Railing.....	59.38	11.63
			<i>For Schedule 80 Handrail, Add</i>	7.25	
			<i>For Additional Off Set Handrail, ADA Attachment, Add</i>	13.14	
			<i>For Aluminum, Satin Finish, Add</i>	15.17	
			<i>For Aluminum, Clear Anodized Finish, Add</i>	23.47	
			<i>For Aluminum, Dark Anodized Finish, Add</i>	27.08	
			<i>For Galvanizing, Add</i>	14.44	
			<i>For Wrought Iron, Add</i>	5.94	
			<i>For Solid Steel Rails, Add</i>	11.88	
			<i>For 304 Stainless Steel, Add</i>	115.55	
			<i>For 316 Stainless Steel, Add</i>	130.00	
			<i>For 2" Wheel Guard, Add</i>	3.43	
			<i>For 4" High Kick Plate, Add</i>	4.51	
			<i>For 6" High Kick Plate, Add</i>	7.22	
			<i>For Curved Rail, Add</i>	28.65	
			<i>For Handrail With Supported Safety Edge Expanded Metal Panels, Add</i>	11.20	
			<i>For Mounting On Stairs, Add</i>	7.10	
			<i>For Mounting On Slopes, Add</i>	2.33	
			<i>For Post Base Flange With Screws, Add Per Post</i>	19.83	
			<i>For Embedded Stainless Steel Post Sleeves (Excludes Core Drilling), Add Per Post</i>	29.99	
			<i>For Custom Design Or Shapes (Square Tops, etc), Add</i>	23.87	
			<i>For Nylon Coating, Add</i>	5.42	
05 52 13 00-0024	LF		2" Diameter, Four Rail, Up To 42" High, Welded Steel Pipe Railing.....	82.43	11.63
			<i>For Schedule 80 Handrail, Add</i>	7.99	
			<i>For Additional Off Set Handrail, ADA Attachment, Add</i>	13.14	
			<i>For Aluminum, Satin Finish, Add</i>	24.85	
			<i>For Aluminum, Clear Anodized Finish, Add</i>	38.45	
			<i>For Aluminum, Dark Anodized Finish, Add</i>	44.37	
			<i>For Galvanizing, Add</i>	23.66	
			<i>For Wrought Iron, Add</i>	8.24	
			<i>For Solid Steel Rails, Add</i>	16.49	
			<i>For 304 Stainless Steel, Add</i>	189.31	
			<i>For 316 Stainless Steel, Add</i>	212.98	
			<i>For 2" Wheel Guard, Add</i>	5.62	
			<i>For 4" High Kick Plate, Add</i>	7.40	
			<i>For 6" High Kick Plate, Add</i>	11.83	
			<i>For Curved Rail, Add</i>	42.48	
			<i>For Handrail With Supported Safety Edge Expanded Metal Panels, Add</i>	11.20	
			<i>For Mounting On Stairs, Add</i>	9.41	
			<i>For Mounting On Slopes, Add</i>	2.33	
			<i>For Post Base Flange With Screws, Add Per Post</i>	19.83	
			<i>For Embedded Stainless Steel Post Sleeves (Excludes Core Drilling), Add Per Post</i>	29.99	
			<i>For Custom Design Or Shapes (Square Tops, etc), Add</i>	35.40	
			<i>For Nylon Coating, Add</i>	8.87	
05 52 13 00-0025	LF		2-1/2" Diameter, Four Rail, Up To 42" High, Welded Steel Pipe Railing.....	95.03	11.63
			<i>For Schedule 80 Handrail, Add</i>	8.73	
			<i>For Additional Off Set Handrail, ADA Attachment, Add</i>	13.14	
			<i>For Aluminum, Satin Finish, Add</i>	30.14	
			<i>For Aluminum, Clear Anodized Finish, Add</i>	46.64	
			<i>For Aluminum, Dark Anodized Finish, Add</i>	53.82	
			<i>For Galvanizing, Add</i>	28.70	
			<i>For Wrought Iron, Add</i>	9.50	
			<i>For Solid Steel Rails, Add</i>	19.01	
			<i>For 304 Stainless Steel, Add</i>	229.63	
			<i>For 316 Stainless Steel, Add</i>	258.34	
			<i>For 2" Wheel Guard, Add</i>	6.82	
			<i>For 4" High Kick Plate, Add</i>	8.97	
			<i>For 6" High Kick Plate, Add</i>	14.35	
			<i>For Curved Rail, Add</i>	50.04	
			<i>For Handrail With Supported Safety Edge Expanded Metal Panels, Add</i>	11.20	
			<i>For Mounting On Stairs, Add</i>	10.67	
			<i>For Mounting On Slopes, Add</i>	2.33	
			<i>For Post Base Flange With Screws, Add Per Post</i>	19.83	
			<i>For Embedded Stainless Steel Post Sleeves (Excludes Core Drilling), Add Per Post</i>	29.99	
			<i>For Custom Design Or Shapes (Square Tops, etc), Add</i>	41.70	
			<i>For Nylon Coating, Add</i>	10.76	
05 52 13 00-0026			Wall Bracket Mounted, Up To 42" High, Welded Steel Pipe Railings <small>(05 52 13)</small>		
			Note: Includes factory primed, fasteners and field touch-up of welds.		
05 52 13 00-0027	LF		1" Diameter, Wall Bracket Mounted, Up To 42" High, Welded Steel Pipe Railing.....	29.37	4.99
			<i>For Schedule 80 Handrail, Add</i>	1.64	
			<i>For Stainless Steel, Add</i>	33.82	
			<i>For Aluminum, Satin Finish, Add</i>	7.10	
			<i>For Curved Rail, Add</i>	8.81	
			<i>For Aluminum, Clear Anodized Finish, Add</i>	10.99	
			<i>For Aluminum, Dark Anodized Finish, Add</i>	12.68	
			<i>For Galvanized Finish, Add</i>	5.07	
05 52 13 00-0028	LF		1-1/4" Diameter, Wall Bracket Mounted, Up To 42" High, Welded Steel Pipe Railing.....	29.91	4.99
			<i>For Schedule 80 Handrail, Add</i>	1.82	
			<i>For Stainless Steel, Add</i>	34.90	
			<i>For Aluminum, Satin Finish, Add</i>	7.33	
			<i>For Curved Rail, Add</i>	8.97	
			<i>For Aluminum, Clear Anodized Finish, Add</i>	11.34	
			<i>For Aluminum, Dark Anodized Finish, Add</i>	13.09	
			<i>For Galvanized Finish, Add</i>	5.24	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 52 13 00-0029 LF 1-1/2" Diameter, Wall Bracket Mounted, Up To 42" High, Welded Steel Pipe Railing <i>For Schedule 80 Handrail, Add</i> <i>For Stainless Steel, Add</i> <i>For Aluminum, Satin Finish, Add</i> <i>For Curved Rail, Add</i> <i>For Aluminum, Clear Anodized Finish, Add</i> <i>For Aluminum, Dark Anodized Finish, Add</i> <i>For Galvanized Finish, Add</i>	30.46 4.26 36.00 7.56 9.14 11.70 13.50 5.40	4.99
05 52 13 00-0030 LF 2" Diameter, Wall Bracket Mounted, Up To 42" High, Welded Steel Pipe Railing <i>For Schedule 80 Handrail, Add</i> <i>For Stainless Steel, Add</i> <i>For Aluminum, Satin Finish, Add</i> <i>For Curved Rail, Add</i> <i>For Aluminum, Clear Anodized Finish, Add</i> <i>For Aluminum, Dark Anodized Finish, Add</i> <i>For Galvanized Finish, Add</i>	36.73 2.15 48.54 10.19 11.02 15.78 18.20 7.28	4.99
05 52 13 00-0031 LF 2-1/2" Diameter, Wall Bracket Mounted, Up To 42" High, Welded Steel Pipe Railing <i>For Schedule 80 Handrail, Add</i> <i>For Stainless Steel, Add</i> <i>For Aluminum, Satin Finish, Add</i> <i>For Curved Rail, Add</i> <i>For Aluminum, Clear Anodized Finish, Add</i> <i>For Aluminum, Dark Anodized Finish, Add</i> <i>For Galvanized Finish, Add</i>	41.91 2.30 58.90 12.37 12.57 19.14 22.09 8.84	4.99
05 52 13 00-0032 Custom Shapes, Wall Bracket Mounted, Up To 42" High, Welded Steel Pipe Railings <small>(05 52 13)</small> Note: Includes factory primed, fasteners and field touch-up of welds.		
05 52 13 00-0033 LF 1" Diameter, Custom Shapes, Wall Bracket Mounted, Up To 42" High, Welded Steel Pipe Railing <i>For Schedule 80 Handrail, Add</i> <i>For Stainless Steel, Add</i> <i>For Aluminum, Satin Finish, Add</i> <i>For Curved Rail, Add</i> <i>For Aluminum, Clear Anodized Finish, Add</i> <i>For Aluminum, Dark Anodized Finish, Add</i> <i>For Galvanized Finish, Add</i>	35.78 1.64 46.64 9.79 10.73 15.16 17.49 7.00	5.23
05 52 13 00-0034 LF 1-1/4" Diameter, Custom Shapes, Wall Bracket Mounted, Up To 42" High, Welded Steel Pipe Railing <i>For Schedule 80 Handrail, Add</i> <i>For Stainless Steel, Add</i> <i>For Aluminum, Satin Finish, Add</i> <i>For Curved Rail, Add</i> <i>For Aluminum, Clear Anodized Finish, Add</i> <i>For Aluminum, Dark Anodized Finish, Add</i> <i>For Galvanized Finish, Add</i>	36.54 1.82 48.16 10.11 10.96 15.65 18.06 7.22	5.23
05 52 13 00-0035 LF 1-1/2" Diameter, Custom Shapes, Wall Bracket Mounted, Up To 42" High, Welded Steel Pipe Railing <i>For Schedule 80 Handrail, Add</i> <i>For Stainless Steel, Add</i> <i>For Aluminum, Satin Finish, Add</i> <i>For Curved Rail, Add</i> <i>For Aluminum, Clear Anodized Finish, Add</i> <i>For Aluminum, Dark Anodized Finish, Add</i> <i>For Galvanized Finish, Add</i>	37.11 4.26 49.30 10.35 11.13 16.02 18.49 7.40	5.23
05 52 13 00-0036 LF 2" Diameter, Custom Shapes, Wall Bracket Mounted, Up To 42" High, Welded Steel Pipe Railing <i>For Schedule 80 Handrail, Add</i> <i>For Stainless Steel, Add</i> <i>For Aluminum, Satin Finish, Add</i> <i>For Curved Rail, Add</i> <i>For Aluminum, Clear Anodized Finish, Add</i> <i>For Aluminum, Dark Anodized Finish, Add</i> <i>For Galvanized Finish, Add</i>	45.87 2.15 66.82 14.03 13.76 21.72 25.06 10.02	5.23
05 52 13 00-0037 LF 2-1/2" Diameter, Custom Shapes, Wall Bracket Mounted, Up To 42" High, Welded Steel Pipe Railing <i>For Schedule 80 Handrail, Add</i> <i>For Stainless Steel, Add</i> <i>For Aluminum, Satin Finish, Add</i> <i>For Curved Rail, Add</i> <i>For Aluminum, Clear Anodized Finish, Add</i> <i>For Aluminum, Dark Anodized Finish, Add</i> <i>For Galvanized Finish, Add</i>	51.60 2.30 78.28 16.44 15.48 25.44 29.36 11.74	5.23
05 52 13 00-0038 Remove And Reinstall Pipe Railing <small>(05 52 13)</small>		
05 52 13 00-0039 LF Remove And Reinstall Wall Bracket Mounted Pipe Railing	18.70	
05 52 13 00-0040 LF Remove And Reinstall Floor Mounted Pipe Railing	24.38	
05 52 13 00-0041 EA Install New Railing Bracket..... <i>For Stainless Steel, Add</i>	50.49 51.12	

05 53 Metal Gratings (05 50)

05 53 13 Bar Gratings (05 53)



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 53 13 00-0001			Welded Grating ^(05 53 13) Note: Sizes are for height and width of bearing bars. Welded grating is open grid grating which has bearing bars and cross bars locked in place by resistance welding, or conventional hand welding. Resistance welded grating is produced on precise automated production equipment by combining hydraulic pressure with a powerful electric current to fuse - electroforge - the cross bar and bearing bar into a single rigid panel.		
05 53 13 00-0002			Steel, Welded Grating ^(05 53 13 00-0001) Note: Bearing bars at 1-3/16" O.C., crossbars at 4" O.C., bolted or tack welded, unpainted steel, and in all sizes.		
05 53 13 00-0003	SF		3/4" x 1/8" Steel, Welded Grating.....	7.55	0.91
			For One Coat Of Shop Applied Paint (Red Or Black), Add	0.22	
			For Galvanized Steel, Add	0.97	
			For 304 Stainless Steel, Add	18.36	
			Note: Bearing bars at 1-3/16" O.C. and crossbars at 4" O.C.		
			For Bearing Bars At 15/16" O.C., Add	1.67	
			For Crossbars At 2" O.C., Add	0.62	
			For Set In Place Without Bolting Or Tack Welding, Deduct	-1.37	
05 53 13 00-0004	SF		3/4" x 3/16" Steel, Welded Grating.....	9.92	0.91
			For One Coat Of Shop Applied Paint (Red Or Black), Add	0.22	
			For Galvanized Steel, Add	1.38	
			For 304 Stainless Steel, Add	25.97	
			Note: Bearing bars at 1-3/16" O.C. and crossbars at 4" O.C.		
			For Bearing Bars At 15/16" O.C., Add	2.36	
			For Crossbars At 2" O.C., Add	0.87	
			For Set In Place Without Bolting Or Tack Welding, Deduct	-1.43	
05 53 13 00-0005	SF		1" x 1/8" Steel, Welded Grating.....	9.07	0.91
			For One Coat Of Shop Applied Paint (Red Or Black), Add	0.22	
			For Galvanized Steel, Add	1.23	
			For 304 Stainless Steel, Add	23.24	
			Note: Bearing bars at 1-3/16" O.C. and crossbars at 4" O.C.		
			For Bearing Bars At 15/16" O.C., Add	2.11	
			For Crossbars At 2" O.C., Add	0.78	
			For Serrated Wear Surface, Add	0.16	
			For Set In Place Without Bolting Or Tack Welding, Deduct	-1.41	
05 53 13 00-0006	SF		1" x 3/16" Steel, Welded Grating.....	12.29	0.91
			For One Coat Of Shop Applied Paint (Red Or Black), Add	0.22	
			For Galvanized Steel, Add	1.78	
			For 304 Stainless Steel, Add	33.58	
			Note: Bearing bars at 1-3/16" O.C. and crossbars at 4" O.C.		
			For Bearing Bars At 15/16" O.C., Add	3.05	
			For Crossbars At 2" O.C., Add	1.13	
			For Serrated Wear Surface, Add	0.16	
			For Set In Place Without Bolting Or Tack Welding, Deduct	-1.49	
05 53 13 00-0007	SF		1" x 1/4" Steel, Welded Grating.....	15.51	0.91
			For One Coat Of Shop Applied Paint (Red Or Black), Add	0.22	
			For Galvanized Steel, Add	2.33	
			For 304 Stainless Steel, Add	43.91	
			Note: Bearing bars at 1-3/16" O.C. and crossbars at 4" O.C.		
			For Bearing Bars At 15/16" O.C., Add	3.99	
			For Crossbars At 2" O.C., Add	1.48	
			For Serrated Wear Surface, Add	0.16	
			For Set In Place Without Bolting Or Tack Welding, Deduct	-1.57	
05 53 13 00-0008	SF		1-1/4" x 1/8" Steel, Welded Grating	10.61	0.91
			For One Coat Of Shop Applied Paint (Red Or Black), Add	0.22	
			For Galvanized Steel, Add	1.49	
			For 304 Stainless Steel, Add	28.18	
			Note: Bearing bars at 1-3/16" O.C. and crossbars at 4" O.C.		
			For Bearing Bars At 15/16" O.C., Add	2.56	
			For Crossbars At 2" O.C., Add	0.95	
			For Serrated Wear Surface, Add	0.16	
			For Set In Place Without Bolting Or Tack Welding, Deduct	-1.45	
05 53 13 00-0009	SF		1-1/4" x 3/16" Steel, Welded Grating	14.52	0.91
			For One Coat Of Shop Applied Paint (Red Or Black), Add	0.22	
			For Galvanized Steel, Add	2.16	
			For 304 Stainless Steel, Add	40.73	
			Note: Bearing bars at 1-3/16" O.C. and crossbars at 4" O.C.		
			For Bearing Bars At 15/16" O.C., Add	3.71	
			For Crossbars At 2" O.C., Add	1.37	
			For Serrated Wear Surface, Add	0.16	
			For Set In Place Without Bolting Or Tack Welding, Deduct	-1.54	
05 53 13 00-0010	SF		1-1/2" x 1/8" Steel, Welded Grating	12.15	0.91
			For One Coat Of Shop Applied Paint (Red Or Black), Add	0.22	
			For Galvanized Steel, Add	1.75	
			For 304 Stainless Steel, Add	33.13	
			Note: Bearing bars at 1-3/16" O.C. and crossbars at 4" O.C.		
			For Bearing Bars At 15/16" O.C., Add	3.01	
			For Crossbars At 2" O.C., Add	1.11	
			For Serrated Wear Surface, Add	0.16	
			For Set In Place Without Bolting Or Tack Welding, Deduct	-1.48	
05 53 13 00-0011	SF		1-1/2" x 3/16" Steel, Welded Grating	17.29	1.12
			For One Coat Of Shop Applied Paint (Red Or Black), Add	0.22	
			For Galvanized Steel, Add	2.56	
			For 304 Stainless Steel, Add	48.31	
			Note: Bearing bars at 1-3/16" O.C. and crossbars at 4" O.C.		
			For Bearing Bars At 15/16" O.C., Add	4.39	
			For Crossbars At 2" O.C., Add	1.63	
			For Serrated Wear Surface, Add	0.16	
			For Set In Place Without Bolting Or Tack Welding, Deduct	-1.88	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 53 13 00-0012 SF 1-1/2" x 1/4" Steel, Welded Grating <i>For One Coat Of Shop Applied Paint (Red Or Black), Add</i> <i>For Galvanized Steel, Add</i> <i>For 304 Stainless Steel, Add</i> <i>Note: Bearing bars at 1-3/16" O.C. and crossbars at 4" O.C.</i> <i>For Bearing Bars At 15/16" O.C., Add</i> <i>For Crossbars At 2" O.C., Add</i> <i>For Serrated Wear Surface, Add</i> <i>For Set In Place Without Bolting Or Tack Welding, Deduct</i>	22.18 0.22 3.39 64.01 5.82 2.15 0.16 -2.00	1.12
05 53 13 00-0013 SF 1-3/4" x 3/16" Steel, Welded Grating <i>For One Coat Of Shop Applied Paint (Red Or Black), Add</i> <i>For Galvanized Steel, Add</i> <i>For 304 Stainless Steel, Add</i> <i>Note: Bearing bars at 1-3/16" O.C. and crossbars at 4" O.C.</i> <i>For Bearing Bars At 15/16" O.C., Add</i> <i>For Crossbars At 2" O.C., Add</i> <i>For Serrated Wear Surface, Add</i> <i>For Set In Place Without Bolting Or Tack Welding, Deduct</i>	19.67 0.22 2.96 55.95 5.09 1.88 0.16 -1.94	1.12
05 53 13 00-0014 SF 2" x 3/16" Steel, Welded Grating <i>For One Coat Of Shop Applied Paint (Red Or Black), Add</i> <i>For Galvanized Steel, Add</i> <i>For 304 Stainless Steel, Add</i> <i>Note: Bearing bars at 1-3/16" O.C. and crossbars at 4" O.C.</i> <i>For Bearing Bars At 15/16" O.C., Add</i> <i>For Crossbars At 2" O.C., Add</i> <i>For Serrated Wear Surface, Add</i> <i>For Set In Place Without Bolting Or Tack Welding, Deduct</i>	21.91 0.22 3.34 63.14 5.74 2.12 0.16 -1.99	1.12
05 53 13 00-0015 SF 2-1/4" x 3/16" Steel, Welded Grating <i>For One Coat Of Shop Applied Paint (Red Or Black), Add</i> <i>For Galvanized Steel, Add</i> <i>For 304 Stainless Steel, Add</i> <i>Note: Bearing bars at 1-3/16" O.C. and crossbars at 4" O.C.</i> <i>For Bearing Bars At 15/16" O.C., Add</i> <i>For Crossbars At 2" O.C., Add</i> <i>For Serrated Wear Surface, Add</i> <i>For Set In Place Without Bolting Or Tack Welding, Deduct</i>	24.28 0.22 3.75 70.75 6.44 2.38 0.16 -2.05	1.12
05 53 13 00-0016 SF 2-1/2" x 3/16" Steel, Welded Grating <i>For One Coat Of Shop Applied Paint (Red Or Black), Add</i> <i>For Galvanized Steel, Add</i> <i>For 304 Stainless Steel, Add</i> <i>Note: Bearing bars at 1-3/16" O.C. and crossbars at 4" O.C.</i> <i>For Bearing Bars At 15/16" O.C., Add</i> <i>For Crossbars At 2" O.C., Add</i> <i>For Serrated Wear Surface, Add</i> <i>For Set In Place Without Bolting Or Tack Welding, Deduct</i>	26.51 0.22 4.13 77.91 7.09 2.62 0.16 -2.11	1.12
05 53 13 00-0017 Pressure Locked Grating <small>(05 53 13)</small> Note: Sizes are for height and width of bearing bars. Pressure locked grating is an open grid grating which is an assembly of tight-fitting, slotted bearing bars and cross bars, interlocked together. The permanent locking of the bars is accomplished by slotting the bearing bars with a wider 'dovetail' shape at the bottom of the slot. The bearing bar slot is usually 1/2 the depth of the cross bar. The cross bars are slotted to a depth slightly less than half its depth. When the bars are pressed together under hydraulic pressure, the cross bar material is forced into the 'dovetail' shape of the bearing bar notch, forming a strong, rigid unit.		
05 53 13 00-0018 Steel, Pressure Locked Grating <small>(05 53 13 00-0017)</small> Note: Bearing bars at 1-3/16" O.C., crossbars at 4" O.C., bolted or tack welded, unpainted steel, and in all sizes.		
05 53 13 00-0019 SF 3/4" x 1/8" Steel, Pressure Locked Grating <i>For One Coat Of Shop Applied Paint (Red Or Black), Add</i> <i>For Galvanized Steel, Add</i> <i>For 304 Stainless Steel, Add</i> <i>Note: Bearing bars at 1-3/16" O.C. and crossbars at 4" O.C.</i> <i>For Bearing Bars At 15/16" O.C., Add</i> <i>For Crossbars At 2" O.C., Add</i> <i>For Set In Place Without Bolting Or Tack Welding, Deduct</i>	13.76 0.22 1.96 22.32 3.48 1.29 -1.52	0.91
05 53 13 00-0020 SF 3/4" x 3/16" Steel, Pressure Locked Grating <i>For One Coat Of Shop Applied Paint (Red Or Black), Add</i> <i>For Galvanized Steel, Add</i> <i>For 304 Stainless Steel, Add</i> <i>Note: Bearing bars at 1-3/16" O.C. and crossbars at 4" O.C.</i> <i>For Bearing Bars At 15/16" O.C., Add</i> <i>For Crossbars At 2" O.C., Add</i> <i>For Set In Place Without Bolting Or Tack Welding, Deduct</i>	16.81 0.22 2.46 28.03 4.37 1.62 -1.60	0.91
05 53 13 00-0021 SF 1" x 1/8" Steel, Pressure Locked Grating <i>For One Coat Of Shop Applied Paint (Red Or Black), Add</i> <i>For Galvanized Steel, Add</i> <i>For 304 Stainless Steel, Add</i> <i>Note: Bearing bars at 1-3/16" O.C. and crossbars at 4" O.C.</i> <i>For Bearing Bars At 15/16" O.C., Add</i> <i>For Crossbars At 2" O.C., Add</i> <i>For Serrated Wear Surface, Add</i> <i>For Set In Place Without Bolting Or Tack Welding, Deduct</i>	15.07 0.22 2.17 24.77 3.87 1.43 0.16 -1.56	0.91

05	Metals
05 50	Metal Fabrications
05 53	Metal Gratings



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 53 13 00-0022	SF		1" x 3/16" Steel, Pressure Locked Grating.....	20.30	0.91
			For One Coat Of Shop Applied Paint (Red Or Black), Add	0.22	
			For Galvanized Steel, Add	3.03	
			For 304 Stainless Steel, Add	34.56	
			Note: Bearing bars at 1-3/16" O.C. and crossbars at 4" O.C.		
			For Bearing Bars At 7/16" O.C., Add	26.78	
			For Bearing Bars At 15/16" O.C., Add	5.39	
			For Crossbars At 2" O.C., Add	1.99	
			For Serrated Wear Surface, Add	0.16	
			For Set In Place Without Bolting Or Tack Welding, Deduct	-1.69	
05 53 13 00-0023	SF		1-1/4" x 1/8" Steel, Pressure Locked Grating.....	16.81	0.91
			For One Coat Of Shop Applied Paint (Red Or Black), Add	0.22	
			For Galvanized Steel, Add	2.46	
			For 304 Stainless Steel, Add	28.03	
			Note: Bearing bars at 1-3/16" O.C. and crossbars at 4" O.C.		
			For Bearing Bars At 15/16" O.C., Add	4.37	
			For Crossbars At 2" O.C., Add	1.62	
			For Serrated Wear Surface, Add	0.16	
			For Set In Place Without Bolting Or Tack Welding, Deduct	-1.60	
05 53 13 00-0024	SF		1-1/4" x 3/16" Steel, Pressure Locked Grating.....	22.72	0.91
			For One Coat Of Shop Applied Paint (Red Or Black), Add	0.22	
			For Galvanized Steel, Add	3.43	
			For 304 Stainless Steel, Add	39.09	
			Note: Bearing bars at 1-3/16" O.C. and crossbars at 4" O.C.		
			For Bearing Bars At 15/16" O.C., Add	6.10	
			For Crossbars At 2" O.C., Add	2.26	
			For Serrated Wear Surface, Add	0.16	
			For Set In Place Without Bolting Or Tack Welding, Deduct	-1.75	
05 53 13 00-0025	SF		1-1/2" x 1/8" Steel, Pressure Locked Grating.....	18.64	0.91
			For One Coat Of Shop Applied Paint (Red Or Black), Add	0.22	
			For Galvanized Steel, Add	2.76	
			For 304 Stainless Steel, Add	31.45	
			Note: Bearing bars at 1-3/16" O.C. and crossbars at 4" O.C.		
			For Bearing Bars At 15/16" O.C., Add	4.91	
			For Crossbars At 2" O.C., Add	1.82	
			For Serrated Wear Surface, Add	0.16	
			For Set In Place Without Bolting Or Tack Welding, Deduct	-1.65	
05 53 13 00-0026	SF		1-1/2" x 3/16" Steel, Pressure Locked Grating.....	25.67	1.12
			For One Coat Of Shop Applied Paint (Red Or Black), Add	0.22	
			For Galvanized Steel, Add	3.84	
			For 304 Stainless Steel, Add	43.84	
			Note: Bearing bars at 1-3/16" O.C. and crossbars at 4" O.C.		
			For Bearing Bars At 7/16" O.C., Add	33.97	
			For Bearing Bars At 15/16" O.C., Add	6.84	
			For Crossbars At 2" O.C., Add	2.53	
			For Serrated Wear Surface, Add	0.16	
			For Set In Place Without Bolting Or Tack Welding, Deduct	-2.09	
05 53 13 00-0027	SF		1-3/4" x 3/16" Steel, Pressure Locked Grating.....	28.22	1.12
			For One Coat Of Shop Applied Paint (Red Or Black), Add	0.22	
			For Galvanized Steel, Add	4.26	
			For 304 Stainless Steel, Add	48.61	
			Note: Bearing bars at 1-3/16" O.C. and crossbars at 4" O.C.		
			For Bearing Bars At 15/16" O.C., Add	7.59	
			For Crossbars At 2" O.C., Add	2.81	
			For Serrated Wear Surface, Add	0.16	
			For Set In Place Without Bolting Or Tack Welding, Deduct	-2.15	
05 53 13 00-0028	SF		2" x 3/16" Steel, Pressure Locked Grating.....	30.30	1.12
			For One Coat Of Shop Applied Paint (Red Or Black), Add	0.22	
			For Galvanized Steel, Add	4.60	
			For 304 Stainless Steel, Add	52.50	
			Note: Bearing bars at 1-3/16" O.C. and crossbars at 4" O.C.		
			For Bearing Bars At 15/16" O.C., Add	8.19	
			For Crossbars At 2" O.C., Add	3.03	
			For Serrated Wear Surface, Add	0.16	
			For Set In Place Without Bolting Or Tack Welding, Deduct	-2.20	
05 53 13 00-0029	SF		2-1/4" x 3/16" Steel, Pressure Locked Grating.....	32.30	1.12
			For One Coat Of Shop Applied Paint (Red Or Black), Add	0.22	
			For Galvanized Steel, Add	4.93	
			For 304 Stainless Steel, Add	56.24	
			Note: Bearing bars at 1-3/16" O.C. and crossbars at 4" O.C.		
			For Bearing Bars At 15/16" O.C., Add	8.78	
			For Crossbars At 2" O.C., Add	3.25	
			For Serrated Wear Surface, Add	0.16	
			For Set In Place Without Bolting Or Tack Welding, Deduct	-2.25	
05 53 13 00-0030	SF		2-1/2" x 3/16" Steel, Pressure Locked Grating.....	34.03	1.12
			For One Coat Of Shop Applied Paint (Red Or Black), Add	0.22	
			For Galvanized Steel, Add	5.21	
			For 304 Stainless Steel, Add	59.48	
			Note: Bearing bars at 1-3/16" O.C. and crossbars at 4" O.C.		
			For Bearing Bars At 15/16" O.C., Add	9.28	
			For Crossbars At 2" O.C., Add	3.43	
			For Serrated Wear Surface, Add	0.16	
			For Set In Place Without Bolting Or Tack Welding, Deduct	-2.30	

05 53 13 00-0031 Aluminum, Type 6063, Pressure Locked Grating (05 53 13 00-0017)

Note: Bearing bars at 1-3/16" O.C., crossbars at 4" O.C., bolted in place, and in all sizes.



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 53 13 00-0032 SF 3/4" x 1/8" Aluminum, Pressure Locked Grating.....	10.08	0.91
<i>For Bearing Bars At 15/16" O.C., Add</i>	2.41	
<i>For Crossbars At 2" O.C., Add</i>	0.89	
<i>For Set In Place Without Bolting, Deduct</i>	-1.43	
05 53 13 00-0033 SF 3/4" x 3/16" Aluminum, Pressure Locked Grating.....	13.46	0.91
<i>For Bearing Bars At 15/16" O.C., Add</i>	3.40	
<i>For Crossbars At 2" O.C., Add</i>	1.26	
<i>For Set In Place Without Bolting, Deduct</i>	-1.52	
05 53 13 00-0034 SF 1" x 1/8" Aluminum, Pressure Locked Grating.....	12.73	0.91
<i>For Bearing Bars At 15/16" O.C., Add</i>	3.18	
<i>For Crossbars At 2" O.C., Add</i>	1.18	
<i>For Serrated Wear Surface, Add</i>	0.16	
<i>For Set In Place Without Bolting, Deduct</i>	-1.50	
05 53 13 00-0035 SF 1" x 3/16" Aluminum, Pressure Locked Grating.....	17.11	0.91
<i>For Bearing Bars At 7/16" O.C., Add</i>	22.16	
<i>For Bearing Bars At 15/16" O.C., Add</i>	4.46	
<i>For Crossbars At 2" O.C., Add</i>	1.65	
<i>For Serrated Wear Surface, Add</i>	0.16	
<i>For Set In Place Without Bolting, Deduct</i>	-1.61	
05 53 13 00-0036 SF 1-1/4" x 1/8" Aluminum, Pressure Locked Grating.....	14.66	0.91
<i>For Bearing Bars At 15/16" O.C., Add</i>	3.75	
<i>For Crossbars At 2" O.C., Add</i>	1.39	
<i>For Serrated Wear Surface, Add</i>	0.16	
<i>For Set In Place Without Bolting, Deduct</i>	-1.55	
05 53 13 00-0037 SF 1-1/4" x 3/16" Aluminum, Pressure Locked Grating.....	19.43	0.91
<i>For Bearing Bars At 15/16" O.C., Add</i>	5.14	
<i>For Crossbars At 2" O.C., Add</i>	1.90	
<i>For Serrated Wear Surface, Add</i>	0.16	
<i>For Set In Place Without Bolting, Deduct</i>	-1.67	
05 53 13 00-0038 SF 1-1/2" x 1/8" Aluminum, Pressure Locked Grating.....	16.47	0.91
<i>For Bearing Bars At 15/16" O.C., Add</i>	4.27	
<i>For Crossbars At 2" O.C., Add</i>	1.58	
<i>For Serrated Wear Surface, Add</i>	0.16	
<i>For Set In Place Without Bolting, Deduct</i>	-1.59	
05 53 13 00-0039 SF 1-1/2" x 3/16" Aluminum, Pressure Locked Grating.....	21.82	0.91
<i>For Bearing Bars At 7/16" O.C., Add</i>	28.99	
<i>For Bearing Bars At 15/16" O.C., Add</i>	5.84	
<i>For Crossbars At 2" O.C., Add</i>	2.16	
<i>For Serrated Wear Surface, Add</i>	0.16	
<i>For Set In Place Without Bolting, Deduct</i>	-1.73	
05 53 13 00-0040 SF 1-3/4" x 3/16" Aluminum, Pressure Locked Grating.....	24.11	0.91
<i>For Bearing Bars At 15/16" O.C., Add</i>	6.51	
<i>For Crossbars At 2" O.C., Add</i>	2.41	
<i>For Serrated Wear Surface, Add</i>	0.16	
<i>For Set In Place Without Bolting, Deduct</i>	-1.78	
05 53 13 00-0041 SF 2" x 3/16" Aluminum, Pressure Locked Grating.....	26.82	0.91
<i>For Bearing Bars At 15/16" O.C., Add</i>	7.30	
<i>For Crossbars At 2" O.C., Add</i>	2.70	
<i>For Serrated Wear Surface, Add</i>	0.16	
<i>For Set In Place Without Bolting, Deduct</i>	-1.85	
05 53 13 00-0042 SF 2-1/4" x 3/16" Aluminum, Pressure Locked Grating.....	28.95	0.91
<i>For Bearing Bars At 15/16" O.C., Add</i>	7.92	
<i>For Crossbars At 2" O.C., Add</i>	2.93	
<i>For Serrated Wear Surface, Add</i>	0.16	
<i>For Set In Place Without Bolting, Deduct</i>	-1.90	
05 53 13 00-0043 SF 2-1/2" x 3/16" Aluminum, Pressure Locked Grating.....	31.48	0.91
<i>For Bearing Bars At 15/16" O.C., Add</i>	8.66	
<i>For Crossbars At 2" O.C., Add</i>	3.20	
<i>For Serrated Wear Surface, Add</i>	0.16	
<i>For Set In Place Without Bolting, Deduct</i>	-1.97	
05 53 13 00-0044 Swage Locked Grating <small>(05 53 13)</small>		
<small>Note: Sizes are for height and width of bearing bars. Swage locked grating is an open grid grating where bearing bars are pre-punched to receive a cross bar without penetrating or cutting the top surface of the bearing bar. The cross bar is then inserted through the pre-punched hole and deformed by swaging or squeezing under hydraulic pressure to permanently lock the bars in place.</small>		
05 53 13 00-0045 Steel, Swage Locked Grating <small>(05 53 13 00-0044)</small>		
<small>Note: Bearing bars at 1-3/16" O.C., crossbars at 4" O.C., bolted or tack welded, unpainted steel, and in all sizes.</small>		
05 53 13 00-0046 SF 1" x 3/16" Steel, Swaged Grating.....	22.16	0.91
<i>For One Coat Of Shop Applied Paint (Red Or Black), Add</i>	0.22	
<i>For Galvanized Steel, Add</i>	1.87	
<i>For 304 Stainless Steel, Add</i>	33.71	
<small>Note: Bearing bars at 1-3/16" O.C. and crossbars at 4" O.C.</small>		
<i>For Bearing Bars At 15/16" O.C., Add</i>	13.01	
<i>For Crossbars At 2" O.C., Add</i>	1.63	
<i>For Serrated Wear Surface, Add</i>	0.16	
<i>For Set In Place Without Bolting Or Tack Welding, Deduct</i>	-1.73	

05	Metals
05 50	Metal Fabrications
05 53	Metal Gratings



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 53 13 00-0047	SF		1-1/4" x 3/16" Steel, Swaged Grating.....	24.66	0.91
			For One Coat Of Shop Applied Paint (Red Or Black), Add	0.22	
			For Galvanized Steel, Add	2.10	
			For 304 Stainless Steel, Add	37.85	
			Note: Bearing bars at 1-3/16" O.C. and crossbars at 4" O.C.		
			For Bearing Bars At 15/16" O.C., Add	14.61	
			For Crossbars At 2" O.C., Add	1.83	
			For Serrated Wear Surface, Add	0.16	
			For Set In Place Without Bolting Or Tack Welding, Deduct	-1.80	
05 53 13 00-0048	SF		1-1/2" x 3/16" Steel, Swaged Grating.....	27.04	1.12
			For One Coat Of Shop Applied Paint (Red Or Black), Add	0.22	
			For Galvanized Steel, Add	2.28	
			For 304 Stainless Steel, Add	41.12	
			Note: Bearing bars at 1-3/16" O.C. and crossbars at 4" O.C.		
			For Bearing Bars At 15/16" O.C., Add	15.87	
			For Crossbars At 2" O.C., Add	1.98	
			For Serrated Wear Surface, Add	0.16	
			For Set In Place Without Bolting Or Tack Welding, Deduct	-2.12	
05 53 13 00-0049	SF		1-3/4" x 3/16" Steel, Swaged Grating.....	30.88	1.12
			For One Coat Of Shop Applied Paint (Red Or Black), Add	0.22	
			For Galvanized Steel, Add	2.63	
			For 304 Stainless Steel, Add	47.49	
			Note: Bearing bars at 1-3/16" O.C. and crossbars at 4" O.C.		
			For Bearing Bars At 15/16" O.C., Add	18.33	
			For Crossbars At 2" O.C., Add	2.29	
			For Serrated Wear Surface, Add	0.16	
			For Set In Place Without Bolting Or Tack Welding, Deduct	-2.22	
05 53 13 00-0050	SF		2" x 3/16" Steel, Swaged Grating.....	34.74	1.12
			For One Coat Of Shop Applied Paint (Red Or Black), Add	0.22	
			For Galvanized Steel, Add	2.99	
			For 304 Stainless Steel, Add	53.89	
			Note: Bearing bars at 1-3/16" O.C. and crossbars at 4" O.C.		
			For Bearing Bars At 15/16" O.C., Add	20.80	
			For Crossbars At 2" O.C., Add	2.60	
			For Serrated Wear Surface, Add	0.16	
			For Set In Place Without Bolting Or Tack Welding, Deduct	-2.31	
05 53 13 00-0051	SF		2-1/4" x 3/16" Steel, Swaged Grating.....	38.58	1.12
			For One Coat Of Shop Applied Paint (Red Or Black), Add	0.22	
			For Galvanized Steel, Add	3.34	
			For 304 Stainless Steel, Add	60.25	
			Note: Bearing bars at 1-3/16" O.C. and crossbars at 4" O.C.		
			For Bearing Bars At 15/16" O.C., Add	23.26	
			For Crossbars At 2" O.C., Add	2.91	
			For Serrated Wear Surface, Add	0.16	
			For Set In Place Without Bolting Or Tack Welding, Deduct	-2.41	
05 53 13 00-0052	SF		2-1/2" x 3/16" Steel, Swaged Grating.....	42.44	1.12
			For One Coat Of Shop Applied Paint (Red Or Black), Add	0.22	
			For Galvanized Steel, Add	3.70	
			For 304 Stainless Steel, Add	66.65	
			Note: Bearing bars at 1-3/16" O.C. and crossbars at 4" O.C.		
			For Bearing Bars At 15/16" O.C., Add	25.73	
			For Crossbars At 2" O.C., Add	3.22	
			For Serrated Wear Surface, Add	0.16	
			For Set In Place Without Bolting Or Tack Welding, Deduct	-2.51	
05 53 13 00-0053			Aluminum Grating, Type 6063, Swage Locked <small>(05 53 13 00-0044)</small>		
			Note: Bearing bars at 1-3/16" O.C., crossbars at 4" O.C., bolted in place, and in all sizes.		
05 53 13 00-0054	SF		1" x 1/8" Aluminum, Swaged Grating.....	11.80	0.91
			For Bearing Bars At 15/16" O.C., Add	6.38	
			For Crossbars At 2" O.C., Add	0.80	
			For Serrated Wear Surface, Add	0.16	
			For Set In Place Without Bolting, Deduct	-1.48	
05 53 13 00-0055	SF		1" x 3/16" Aluminum, Swaged Grating.....	15.14	0.91
			For Bearing Bars At 15/16" O.C., Add	8.52	
			For Crossbars At 2" O.C., Add	1.06	
			For Serrated Wear Surface, Add	0.16	
			For Set In Place Without Bolting, Deduct	-1.56	
05 53 13 00-0056	SF		1-1/4" x 1/8" Aluminum, Swaged Grating.....	13.30	0.91
			For Bearing Bars At 15/16" O.C., Add	7.34	
			For Crossbars At 2" O.C., Add	0.92	
			For Serrated Wear Surface, Add	0.16	
			For Set In Place Without Bolting, Deduct	-1.51	
05 53 13 00-0057	SF		1-1/4" x 3/16" Aluminum, Swaged Grating.....	17.38	0.91
			For Bearing Bars At 15/16" O.C., Add	9.95	
			For Crossbars At 2" O.C., Add	1.24	
			For Serrated Wear Surface, Add	0.16	
			For Set In Place Without Bolting, Deduct	-1.61	
05 53 13 00-0058	SF		1-1/2" x 1/8" Aluminum, Swaged Grating.....	15.08	0.91
			For Bearing Bars At 15/16" O.C., Add	8.48	
			For Crossbars At 2" O.C., Add	1.06	
			For Serrated Wear Surface, Add	0.16	
			For Set In Place Without Bolting, Deduct	-1.56	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 53 13 00-0059 SF 1-1/2" x 3/16" Aluminum, Swaged Grating.....	19.79	0.91
For Bearing Bars At 15/16" O.C., Add	11.49	
For Crossbars At 2" O.C., Add	1.44	
For Serrated Wear Surface, Add	0.16	
For Set In Place Without Bolting, Deduct	-1.68	
05 53 13 00-0060 SF 1-3/4" x 3/16" Aluminum, Swaged Grating.....	22.56	0.91
For Bearing Bars At 15/16" O.C., Add	13.27	
For Crossbars At 2" O.C., Add	1.66	
For Serrated Wear Surface, Add	0.16	
For Set In Place Without Bolting, Deduct	-1.74	
05 53 13 00-0061 SF 2" x 3/16" Aluminum, Swaged Grating.....	25.32	0.91
For Bearing Bars At 15/16" O.C., Add	15.03	
For Crossbars At 2" O.C., Add	1.88	
For Serrated Wear Surface, Add	0.16	
For Set In Place Without Bolting, Deduct	-1.81	
05 53 13 00-0062 SF 2-1/4" x 3/16" Aluminum, Swaged Grating.....	28.09	0.91
For Bearing Bars At 15/16" O.C., Add	16.81	
For Crossbars At 2" O.C., Add	2.10	
For Serrated Wear Surface, Add	0.16	
For Set In Place Without Bolting, Deduct	-1.88	
05 53 13 00-0063 SF 2-1/2" x 3/16" Aluminum, Swaged Grating.....	30.84	0.91
For Bearing Bars At 15/16" O.C., Add	18.57	
For Crossbars At 2" O.C., Add	2.32	
For Serrated Wear Surface, Add	0.16	
For Set In Place Without Bolting, Deduct	-1.95	
05 53 13 00-0064 Riveted Grating <small>(05 53 13)</small>		
Note: Riveted grating is an open grid grating where bearing bars are pre-punched to receive a solid round rivet. Crimp/lacing bars are pre-punched as well and then formed into a reticulated shape. Bearing bars and crimp bars are then assembled and clamped in place by rivets which are cold driven under hydraulic pressure to permanently lock the assembly together.		
05 53 13 00-0065 Steel, Riveted Grating <small>(05 53 13 00-0064)</small>		
Note: 1" clear opening, bolted or tack welded in place, unpainted steel, all sizes.		
05 53 13 00-0066 SF 3/4" x 1/8", 7.0 LB/SF, Steel, Riveted Grating.....	41.59	0.91
For One Coat Of Shop Applied Paint (Red Or Black), Add	0.22	
For Galvanized Steel, Add	1.91	
For 304 Stainless Steel, Add	34.15	
For 5/8" Clear Opening, Add	13.72	
For Set In Place Without Bolting Or Tack Welding, Deduct	-2.22	
05 53 13 00-0067 SF 3/4" x 3/16", 8.5 LB/SF, Steel, Riveted Grating.....	48.87	0.91
For One Coat Of Shop Applied Paint (Red Or Black), Add	0.22	
For Galvanized Steel, Add	2.26	
For 304 Stainless Steel, Add	40.41	
For 5/8" Clear Opening, Add	16.23	
For Set In Place Without Bolting Or Tack Welding, Deduct	-2.40	
05 53 13 00-0068 SF 1" x 1/8", 8.0 LB/SF, Steel, Riveted Grating.....	44.94	0.91
For One Coat Of Shop Applied Paint (Red Or Black), Add	0.22	
For Galvanized Steel, Add	2.07	
For 304 Stainless Steel, Add	37.03	
For 5/8" Clear Opening, Add	14.87	
For Serrated Wear Surface, Add	0.16	
For Set In Place Without Bolting Or Tack Welding, Deduct	-2.30	
05 53 13 00-0069 SF 1" x 3/16", 9.5 LB/SF, Steel, Riveted Grating.....	51.64	0.91
For One Coat Of Shop Applied Paint (Red Or Black), Add	0.22	
For Galvanized Steel, Add	2.39	
For 304 Stainless Steel, Add	42.79	
For 5/8" Clear Opening, Add	17.18	
For Serrated Wear Surface, Add	0.16	
For Set In Place Without Bolting Or Tack Welding, Deduct	-2.47	
05 53 13 00-0070 SF 1-1/4" x 1/8", 9.0 LB/SF, Steel, Riveted Grating.....	47.72	0.91
For One Coat Of Shop Applied Paint (Red Or Black), Add	0.22	
For Galvanized Steel, Add	2.20	
For 304 Stainless Steel, Add	39.42	
For 5/8" Clear Opening, Add	15.83	
For Serrated Wear Surface, Add	0.16	
For Set In Place Without Bolting Or Tack Welding, Deduct	-2.37	
05 53 13 00-0071 SF 1-1/4" x 3/16", 11.1 LB/SF, Steel, Riveted Grating.....	56.81	0.91
For One Coat Of Shop Applied Paint (Red Or Black), Add	0.22	
For Galvanized Steel, Add	2.64	
For 304 Stainless Steel, Add	47.23	
For 5/8" Clear Opening, Add	18.97	
For Serrated Wear Surface, Add	0.16	
For Set In Place Without Bolting Or Tack Welding, Deduct	-2.60	
05 53 13 00-0072 SF 1-1/2" x 1/8", 10.1 LB/SF, Steel, Riveted Grating.....	50.80	1.12
For One Coat Of Shop Applied Paint (Red Or Black), Add	0.22	
For Galvanized Steel, Add	2.33	
For 304 Stainless Steel, Add	41.71	
For 5/8" Clear Opening, Add	16.75	
For Serrated Wear Surface, Add	0.16	
For Set In Place Without Bolting Or Tack Welding, Deduct	-2.71	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 53 13 00-0073	SF	1-1/2" x 3/16", 12.5 LB/SF, Steel, Riveted Grating.....	60.52	1.12	
		<i>For One Coat Of Shop Applied Paint (Red Or Black), Add</i>	0.22		
		<i>For Galvanized Steel, Add</i>	2.80		
		<i>For 304 Stainless Steel, Add</i>	50.06		
		<i>For 5/8" Clear Opening, Add</i>	20.11		
		<i>For Serrated Wear Surface, Add</i>	0.16		
		<i>For Set In Place Without Bolting Or Tack Welding, Deduct</i>	-2.96		
05 53 13 00-0074	SF	1-3/4" x 3/16", 14.0 LB/SF, Steel, Riveted Grating.....	65.48	1.12	
		<i>For One Coat Of Shop Applied Paint (Red Or Black), Add</i>	0.22		
		<i>For Galvanized Steel, Add</i>	3.04		
		<i>For 304 Stainless Steel, Add</i>	54.32		
		<i>For 5/8" Clear Opening, Add</i>	21.82		
		<i>For Serrated Wear Surface, Add</i>	0.16		
		<i>For Set In Place Without Bolting Or Tack Welding, Deduct</i>	-3.08		
05 53 13 00-0075	SF	2" x 3/16", 17.0 LB/SF, Steel, Riveted Grating.....	76.55	1.12	
		<i>For One Coat Of Shop Applied Paint (Red Or Black), Add</i>	0.22		
		<i>For Galvanized Steel, Add</i>	3.57		
		<i>For 304 Stainless Steel, Add</i>	63.83		
		<i>For 5/8" Clear Opening, Add</i>	25.64		
		<i>For Serrated Wear Surface, Add</i>	0.16		
		<i>For Set In Place Without Bolting Or Tack Welding, Deduct</i>	-3.36		
05 53 13 00-0076	SF	2-1/4" x 3/16", 18.5 LB/SF, Steel, Riveted Grating.....	80.40	1.12	
		<i>For One Coat Of Shop Applied Paint (Red Or Black), Add</i>	0.22		
		<i>For Galvanized Steel, Add</i>	3.75		
		<i>For 304 Stainless Steel, Add</i>	67.14		
		<i>For 5/8" Clear Opening, Add</i>	26.97		
		<i>For Serrated Wear Surface, Add</i>	0.16		
		<i>For Set In Place Without Bolting Or Tack Welding, Deduct</i>	-3.45		
05 53 13 00-0077	SF	2-1/2" x 3/16", 20.0 LB/SF, Steel, Riveted Grating.....	83.84	1.12	
		<i>For One Coat Of Shop Applied Paint (Red Or Black), Add</i>	0.22		
		<i>For Galvanized Steel, Add</i>	3.92		
		<i>For 304 Stainless Steel, Add</i>	70.09		
		<i>For 5/8" Clear Opening, Add</i>	28.15		
		<i>For Serrated Wear Surface, Add</i>	0.16		
		<i>For Set In Place Without Bolting Or Tack Welding, Deduct</i>	-3.54		
05 53 13 00-0078		Aluminum, Riveted Grating <small>(05 53 13 00-0064)</small>			
		Note: 1" clear opening, bolted in place and in all sizes.			
05 53 13 00-0079	SF	3/4" x 1/8", 2.4 LB/SF, Aluminum, Riveted Grating.....	24.60	0.91	
		<i>For 5/8" Clear Opening, Add</i>	7.86		
		<i>For Set In Place Without Bolting, Deduct</i>	-1.80		
05 53 13 00-0080	SF	3/4" x 3/16", 2.9 LB/SF, Aluminum, Riveted Grating.....	29.11	0.91	
		<i>For 5/8" Clear Opening, Add</i>	9.41		
		<i>For Set In Place Without Bolting, Deduct</i>	-1.91		
05 53 13 00-0081	SF	1" x 1/8", 2.7 LB/SF, Aluminum, Riveted Grating.....	27.01	0.91	
		<i>For 5/8" Clear Opening, Add</i>	8.69		
		<i>For Serrated Wear Surface, Add</i>	0.16		
		<i>For Set In Place Without Bolting, Deduct</i>	-1.86		
05 53 13 00-0082	SF	1" x 3/16", 3.2 LB/SF, Aluminum, Riveted Grating.....	31.41	0.91	
		<i>For 5/8" Clear Opening, Add</i>	10.21		
		<i>For Serrated Wear Surface, Add</i>	0.16		
		<i>For Set In Place Without Bolting, Deduct</i>	-1.97		
05 53 13 00-0083	SF	1-1/4" x 1/8", 3.1 LB/SF, Aluminum, Riveted Grating.....	30.23	0.91	
		<i>For 5/8" Clear Opening, Add</i>	9.80		
		<i>For Serrated Wear Surface, Add</i>	0.16		
		<i>For Set In Place Without Bolting, Deduct</i>	-1.94		
05 53 13 00-0084	SF	1-1/4" x 3/16", 3.8 LB/SF, Aluminum, Riveted Grating.....	36.34	0.91	
		<i>For 5/8" Clear Opening, Add</i>	11.91		
		<i>For Serrated Wear Surface, Add</i>	0.16		
		<i>For Set In Place Without Bolting, Deduct</i>	-2.09		
05 53 13 00-0085	SF	1-1/2" x 1/8", 3.4 LB/SF, Aluminum, Riveted Grating.....	32.43	0.91	
		<i>For 5/8" Clear Opening, Add</i>	10.56		
		<i>For Serrated Wear Surface, Add</i>	0.16		
		<i>For Set In Place Without Bolting, Deduct</i>	-1.99		
05 53 13 00-0086	SF	1-1/2" x 3/16", 4.3 LB/SF, Aluminum, Riveted Grating.....	40.19	0.91	
		<i>For 5/8" Clear Opening, Add</i>	13.23		
		<i>For Serrated Wear Surface, Add</i>	0.16		
		<i>For Set In Place Without Bolting, Deduct</i>	-2.19		
05 53 13 00-0087	SF	1-3/4" x 3/16", 4.8 LB/SF, Aluminum, Riveted Grating.....	44.25	0.91	
		<i>For 5/8" Clear Opening, Add</i>	14.63		
		<i>For Serrated Wear Surface, Add</i>	0.16		
		<i>For Set In Place Without Bolting, Deduct</i>	-2.29		
05 53 13 00-0088	SF	2" x 3/16", 5.8 LB/SF, Aluminum, Riveted Grating.....	52.61	0.91	
		<i>For 5/8" Clear Opening, Add</i>	17.52		
		<i>For Serrated Wear Surface, Add</i>	0.16		
		<i>For Set In Place Without Bolting, Deduct</i>	-2.50		
05 53 13 00-0089	SF	2-1/4" x 3/16", 6.4 LB/SF, Aluminum, Riveted Grating.....	57.34	0.91	
		<i>For 5/8" Clear Opening, Add</i>	19.15		
		<i>For Serrated Wear Surface, Add</i>	0.16		
		<i>For Set In Place Without Bolting, Deduct</i>	-2.61		
05 53 13 00-0090	SF	2-1/2" x 3/16", 7.2 LB/SF, Aluminum, Riveted Grating.....	63.70	0.91	
		<i>For 5/8" Clear Opening, Add</i>	21.35		
		<i>For Serrated Wear Surface, Add</i>	0.16		
		<i>For Set In Place Without Bolting, Deduct</i>	-2.77		



Metals	05	05
Metal Fabrications	05 50	
Metal Floor Plates	05 54	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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05 54 Metal Floor Plates (05 50)

05 54 00 00-0001 Steel Floor Plates (05 54)

05 54 00 00-0002	SF	16 Gauge Steel Raised Or Diamond Pattern Floor Plates.....	10.77	1.08
05 54 00 00-0003	SF	14 Gauge Steel Raised Or Diamond Pattern Floor Plates.....	12.23	1.08
05 54 00 00-0004	SF	12 Gauge Steel Raised Or Diamond Pattern Floor Plates.....	15.18	1.08
05 54 00 00-0005	SF	1/8" Steel Raised Or Diamond Pattern Floor Plates	20.23	1.17
05 54 00 00-0006	SF	1/4" Steel Raised Or Diamond Pattern Floor Plates	25.52	1.25

05 54 00 00-0007 Aluminum Alloy Floor Plates (05 54)

05 54 00 00-0008	SF	0.125" Aluminum Alloy Raised Or Diamond Pattern Floor Plate.....	15.66	0.91
05 54 00 00-0009	SF	0.188" Aluminum Alloy Raised Or Diamond Pattern Floor Plate.....	17.96	1.08
05 54 00 00-0010	SF	0.25" Aluminum Alloy Raised Or Diamond Pattern Floor Plate.....	20.28	1.17

05 54 00 00-0011 Type 304 Stainless Steel Floor Plates (05 54)

05 54 00 00-0012	SF	1/8" Type 304 Stainless Steel Raised Or Diamond Pattern Floor Plate.....	26.44	1.25
		<i>For 316 Stainless Steel, Add</i>	7.38	
05 54 00 00-0013	SF	3/16" Type 304 Stainless Steel Raised Or Diamond Pattern Floor Plate.....	31.60	1.41
		<i>For 316 Stainless Steel, Add</i>	8.86	
05 54 00 00-0014	SF	1/4" Type 304 Stainless Raised Or Diamond Pattern Steel Floor Plate.....	40.91	1.67
		<i>For 316 Stainless Steel, Add</i>	11.57	

05 55 Metal Stair Treads And Nosings (05 50)

05 55 13 Metal Stair Treads (05 55)

05 55 13 00-0001 Abrasive Cast Aluminum Stair Treads (05 55 13)

Note: Includes abrasive diamond pattern surface and anchors. Excludes stringers.

05 55 13 00-0002	LF	8" Depth, 5/16" Thick, 1/4" Lip, Abrasive Cast Aluminum Stair Tread	37.28	3.95
		<i>For 3/8" Thick, Add</i>	7.74	
05 55 13 00-0003	LF	9" Depth, 5/16" Thick, 1/4" Lip, Abrasive Cast Aluminum Stair Tread	40.96	3.95
		<i>For 3/8" Thick, Add</i>	8.66	
05 55 13 00-0004	LF	10" Depth, 5/16" Thick, 1/4" Lip, Abrasive Cast Aluminum Stair Tread	44.63	3.95
		<i>For 3/8" Thick, Add</i>	9.58	
05 55 13 00-0005	LF	11" Depth, 5/16" Thick, 1/4" Lip, Abrasive Cast Aluminum Stair Tread	48.32	3.95
		<i>For 3/8" Thick, Add</i>	10.50	
05 55 13 00-0006	LF	12" Depth, 5/16" Thick, 1/4" Lip, Abrasive Cast Aluminum Stair Tread	51.98	3.95
		<i>For 3/8" Thick, Add</i>	11.41	

05 55 13 00-0007 Abrasive Cast Iron Stair Treads (05 55 13)

Note: Includes abrasive diamond pattern surface and anchors. Excludes stringers.

05 55 13 00-0008	LF	8" Depth, 3/8" Thick, 1/4" Lip, Abrasive Cast Iron Stair Tread	51.55	3.95
05 55 13 00-0009	LF	9" Depth, 3/8" Thick, 1/4" Lip, Abrasive Cast Iron Stair Tread	57.00	3.95
05 55 13 00-0010	LF	10" Depth, 3/8" Thick, 1/4" Lip, Abrasive Cast Iron Stair Tread	62.46	3.95
05 55 13 00-0011	LF	11" Depth, 3/8" Thick, 1/4" Lip, Abrasive Cast Iron Stair Tread	67.91	3.95
05 55 13 00-0012	LF	12" Depth, 3/8" Thick, 1/4" Lip, Abrasive Cast Iron Stair Tread	73.37	3.95

05 55 13 00-0013 Aluminum/Ceramic Grit Coating, Extruded Aluminum Safety Stair Treads (05 55 13)

Note: Includes extruded aluminum base with diamond hard aluminum oxide abrasive filler/surface. Includes anchors. Excludes stringers.

05 55 13 00-0014	LF	6-1/2" Depth, 5/32" Thick, 1-1/16" Lip, Aluminum/Ceramic Grit Coating, Extruded Aluminum Safety Stair Tread.....	20.08	3.95
05 55 13 00-0015	LF	9" Depth, 5/32" Thick, 1-1/16" Lip, Aluminum/Ceramic Grit Coating, Extruded Aluminum Safety Stair Tread.....	23.41	3.95
05 55 13 00-0016	LF	11" Depth, 5/32" Thick, 1-1/16" Lip, Aluminum/Ceramic Grit Coating, Extruded Aluminum Safety Stair Tread.....	24.88	3.95

05 55 13 00-0017 Aluminum/Ceramic Grit Coating, Extruded Aluminum Renovation Stair Treads (05 55 13)

Note: Includes extruded aluminum base with diamond hard aluminum oxide abrasive filler/surface. Includes anchors. Excludes stringers.

05 55 13 00-0018	LF	8" Depth, 9/32" Thick, 1-1/8" Lip, Aluminum/Ceramic Grit Coating, Extruded Aluminum Renovation Stair Tread	29.28	3.95
		<i>For Epoxy Sealed For Corrosive Environment, Add</i>	2.31	
		<i>For Two Color Tread, Add</i>	1.74	
05 55 13 00-0019	LF	9" Depth, 9/32" Thick, 1-1/8" Lip, Aluminum/Ceramic Grit Coating, Extruded Aluminum Renovation Stair Tread	29.55	3.95
		<i>For Epoxy Sealed For Corrosive Environment, Add</i>	2.31	
		<i>For Two Color Tread, Add</i>	1.74	
05 55 13 00-0020	LF	11" Depth, 9/32" Thick, 1-1/8" Lip, Aluminum/Ceramic Grit Coating, Extruded Aluminum Renovation Stair Tread	35.55	3.95
		<i>For Epoxy Sealed For Corrosive Environment, Add</i>	2.31	
		<i>For Two Color Tread, Add</i>	1.74	
05 55 13 00-0021	LF	12" Depth, 9/32" Thick, 1-1/8" Lip, Aluminum/Ceramic Grit Coating, Extruded Aluminum Renovation Stair Tread	40.80	3.95
		<i>For Epoxy Sealed For Corrosive Environment, Add</i>	2.31	
		<i>For Two Color Tread, Add</i>	1.74	
05 55 13 00-0022	LF	15" Depth, 9/32" Thick, 1-1/8" Lip, Aluminum/Ceramic Grit Coating, Extruded Aluminum Renovation Stair Tread	47.65	3.95
		<i>For Epoxy Sealed For Corrosive Environment, Add</i>	2.31	
		<i>For Two Color Tread, Add</i>	1.74	

05 Metals**05 50 Metal Fabrications****05 55 Metal Stair Treads And Nosings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 55 13 00-0023			Stair Landing Treads <small>(05 55 13)</small>		
05 55 13 00-0024			Abrasive Cast Aluminum Stair Landing Treads <small>(05 55 13 00-0023)</small> Note: Includes abrasive diamond pattern surface and anchors.		
05 55 13 00-0025	SF		5/16" Thick, Abrasive Cast Aluminum Landing Treads..... <i>For 3/8" Thick, Add</i>	51.98 11.41	3.95
05 55 13 00-0026			Abrasive Cast Iron Stair Landing Treads <small>(05 55 13 00-0023)</small> Note: Includes abrasive diamond pattern surface and anchors.		
05 55 13 00-0027	SF		3/8" Thick, Abrasive Cast Iron Landing Treads.....	73.37	3.95
05 55 13 00-0028			Aluminum/Ceramic Grit Coating, Extruded Aluminum Renovation Stair Landing Treads <small>(05 55 13 00-0023)</small> Note: Includes extruded aluminum base with diamond hard aluminum oxide abrasive filler/surface. Includes anchors.		
05 55 13 00-0029	SF		9/32" Thick, Aluminum/Ceramic Grit Coating, Extruded Aluminum Renovation Stair Landing Treads <i>For Epoxy Sealed For Corrosive Environment, Add</i>	48.25 2.31	3.95
05 55 13 00-0030			Open Cast Iron Stair Tread <small>(05 55 13)</small> Note: Includes steel stringers, safety nosing and 2 pipe handrail. Excludes landings.		
05 55 13 00-0031	RSR		3'-6" Wide, Open Cast Iron Stair Tread..... <i>For Closed Riser, Add</i>	372.22 31.67	33.24
05 55 13 00-0032	RSR		4'-0" Wide, Open Cast Iron Stair Tread..... <i>For Closed Riser, Add</i>	420.89 35.70	38.22
05 55 13 00-0033	RSR		5'-0" Wide, Open Cast Iron Stair Tread..... <i>For Closed Riser, Add</i>	465.49 39.42	44.87
05 55 16			Metal Stair Nosings <small>(05 55)</small>		
05 55 16 00-0001			Abrasive Cast Aluminum Nosings <small>(05 55 16)</small> Note: Includes abrasive diamond pattern surface and anchors.		
05 55 16 00-0002	LF		3" Depth, 5/16" Thick, 1/4" Lip, Abrasive Cast Aluminum Nosing <i>For 3/8" Thick, Add</i>	15.96 2.91	2.70
05 55 16 00-0003	LF		4" Depth, 5/16" Thick, 1/4" Lip, Abrasive Cast Aluminum Nosing <i>For 3/8" Thick, Add</i>	19.52 3.80	2.70
05 55 16 00-0004	LF		6" Depth, 5/16" Thick, 1/4" Lip, Abrasive Cast Aluminum Nosing <i>For 3/8" Thick, Add</i>	27.43 5.78	2.70
05 55 16 00-0005			Abrasive Cast Iron Nosings <small>(05 55 16)</small> Note: Includes abrasive diamond pattern surface and anchors.		
05 55 16 00-0006	LF		3" Depth, 5/16" Thick, 1/4" Lip, Abrasive Cast Iron Nosing..... <i>For 3/8" Thick, Add</i>	18.56 3.56	2.70
05 55 16 00-0007	LF		4" Depth, 5/16" Thick, 1/4" Lip, Abrasive Cast Iron Nosing..... <i>For 3/8" Thick, Add</i>	22.93 4.65	2.70
05 55 16 00-0008	LF		6" Depth, 5/16" Thick, 1/4" Lip, Abrasive Cast Iron Nosing..... <i>For 3/8" Thick, Add</i>	31.57 6.81	2.70
05 55 16 00-0009			Aluminum/Ceramic Grit Coating, Extruded Aluminum Nosings <small>(05 55 16)</small> Note: Includes extruded aluminum base with diamond hard aluminum oxide abrasive filler/surface. Includes anchors.		
05 55 16 00-0010	LF		1-7/8" Depth, 1/4" Thick, 1/4" Lip, Aluminum/Ceramic Grit Coating, Extruded Aluminum Nosing.....	13.56	2.70
05 55 16 00-0011	LF		3" Depth, 1/4" Thick, 1/4" Lip, Aluminum/Ceramic Grit Coating, Extruded Aluminum Nosing.....	15.27	2.70
05 55 16 00-0012	LF		4" Depth, 1/4" Thick, 1/4" Lip, Aluminum/Ceramic Grit Coating, Extruded Aluminum Nosing.....	16.58	2.70
05 55 16 00-0013	LF		6" Depth, 1/4" Thick, 1/4" Lip, Aluminum/Ceramic Grit Coating, Extruded Aluminum Nosing.....	20.64	2.70
05 55 16 00-0014	LF		1-7/8" Depth, 1/4" Thick, 1-1/8" Lip, Aluminum/Ceramic Grit Coating, Extruded Aluminum Nosing.....	14.02	2.70
05 55 16 00-0015	LF		3" Depth, 1/4" Thick, 1-1/8" Lip, Aluminum/Ceramic Grit Coating, Extruded Aluminum Nosing.....	15.48	2.70
05 55 16 00-0016	LF		4" Depth, 1/4" Thick, 1-1/8" Lip, Aluminum/Ceramic Grit Coating, Extruded Aluminum Nosing.....	16.92	2.70
05 55 16 00-0017	LF		3" Depth, 1/4" Thick, 1-3/4" Lip, Aluminum/Ceramic Grit Coating, Extruded Aluminum Nosing.....	16.04	2.70
05 56			Metal Castings <small>(05 50)</small>		
05 56 00 00-0001			Castings <small>(05 56)</small>		
05 56 00 00-0002	LB		Up To 150 LB, Miscellaneous Castings, Light Section.....	3.05	0.42
05 56 00 00-0003	LB		>150 LB, Miscellaneous Castings, Heavy Section.....	4.97	0.34
05 58			Formed Metal Fabrications <small>(05 50)</small>		
05 58 16			Formed Metal Enclosures <small>(05 58)</small>		
05 58 16 00-0001			Drip Pan <small>(05 58 16)</small>		
05 58 16 00-0002	SF		Stainless Steel Drip Pan.....	58.05	4.03
05 58 16 00-0003	SF		Galvanized Steel Drip Pan.....	57.36	4.03
05 58 16 00-0004	SF		Aluminum Drip Pan.....	40.39	3.22
05 58 16 00-0005	SF		Plastic Drip Pan.....	11.07	2.82



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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05 58 23 Formed Metal Guards (05 58)

05 58 23 00-0001	EA	Protective Guard Rails (05 58 23) Note: Includes painted finish.		
05 58 23 00-0002	EA	2-Rib, 11 Gauge Steel, Protective Guard Rails (05 58 23 00-0001) Note: Steel King Armor Guard.		
05 58 23 00-0003	EA	Bolt-On, 2-Rib, 11 Gauge Steel, Protective Guard Rails (05 58 23 00-0002) Note: Excludes posts. Includes fasteners.		
05 58 23 00-0004	EA	1' Length, 10-1/2" Height, Bolt-On, 2-Rib, 11 Gauge Steel, Protective Guard Rail	107.28	12.94
05 58 23 00-0005	EA	2' Length, 10-1/2" Height, Bolt-On, 2-Rib, 11 Gauge Steel, Protective Guard Rail	125.67	12.94
05 58 23 00-0006	EA	3' Length, 10-1/2" Height, Bolt-On, 2-Rib, 11 Gauge Steel, Protective Guard Rail	143.02	12.94
05 58 23 00-0007	EA	4' Length, 10-1/2" Height, Bolt-On, 2-Rib, 11 Gauge Steel, Protective Guard Rail	161.40	12.94
05 58 23 00-0008	EA	5' Length, 10-1/2" Height, Bolt-On, 2-Rib, 11 Gauge Steel, Protective Guard Rail	178.85	12.94
05 58 23 00-0009	EA	6' Length, 10-1/2" Height, Bolt-On, 2-Rib, 11 Gauge Steel, Protective Guard Rail	201.46	12.94
05 58 23 00-0010	EA	7' Length, 10-1/2" Height, Bolt-On, 2-Rib, 11 Gauge Steel, Protective Guard Rail	216.86	12.94
05 58 23 00-0011	EA	8' Length, 10-1/2" Height, Bolt-On, 2-Rib, 11 Gauge Steel, Protective Guard Rail	240.72	12.94
05 58 23 00-0012	EA	9' Length, 10-1/2" Height, Bolt-On, 2-Rib, 11 Gauge Steel, Protective Guard Rail	256.37	12.94
05 58 23 00-0013	EA	10' Length, 10-1/2" Height, Bolt-On, 2-Rib, 11 Gauge Steel, Protective Guard Rail	267.55	12.94
05 58 23 00-0014	EA	Posts For 2-Rib Guard Rails (05 58 23 00-0002) Note: Includes drilling, surface mounting plate and anchors.		
05 58 23 00-0015	EA	12" Height, Single Rail Post For 2-Rib Guard Rails	216.90	26.95
05 58 23 00-0016	EA	42" Height, Triple Rail Post For 2-Rib Guard Rails	280.76	26.95
05 58 23 00-0017	EA	3-Rib, 11 Gauge Steel, Protective Guard Rails (05 58 23 00-0001) Note: Steel King Steel Guard.		
05 58 23 00-0018	EA	Bolt-On, 3-Rib, 11 Gauge Steel, Protective Guard Rails (05 58 23 00-0017) Note: Excludes posts. Includes fasteners.		
05 58 23 00-0019	EA	1' Length, 15" Height, Bolt-On, 3-Rib, 11 Gauge Steel, Protective Guard Rail	118.37	12.94
05 58 23 00-0020	EA	2' Length, 15" Height, Bolt-On, 3-Rib, 11 Gauge Steel, Protective Guard Rail	130.59	12.94
05 58 23 00-0021	EA	3' Length, 15" Height, Bolt-On, 3-Rib, 11 Gauge Steel, Protective Guard Rail	145.85	12.94
05 58 23 00-0022	EA	4' Length, 15" Height, Bolt-On, 3-Rib, 11 Gauge Steel, Protective Guard Rail	160.11	12.94
05 58 23 00-0023	EA	5' Length, 15" Height, Bolt-On, 3-Rib, 11 Gauge Steel, Protective Guard Rail	176.61	12.94
05 58 23 00-0024	EA	6' Length, 15" Height, Bolt-On, 3-Rib, 11 Gauge Steel, Protective Guard Rail	184.56	12.94
05 58 23 00-0025	EA	7' Length, 15" Height, Bolt-On, 3-Rib, 11 Gauge Steel, Protective Guard Rail	203.69	12.94
05 58 23 00-0026	EA	8' Length, 15" Height, Bolt-On, 3-Rib, 11 Gauge Steel, Protective Guard Rail	219.84	12.94
05 58 23 00-0027	EA	9' Length, 15" Height, Bolt-On, 3-Rib, 11 Gauge Steel, Protective Guard Rail	236.99	12.94
05 58 23 00-0028	EA	10' Length, 15" Height, Bolt-On, 3-Rib, 11 Gauge Steel, Protective Guard Rail	254.38	12.94
05 58 23 00-0029	EA	Lift-Out, 3-Rib, 11 Gauge Steel, Protective Guard Rails (05 58 23 00-0017) Note: Excludes posts. Includes fasteners and lift-out mounting plate.		
05 58 23 00-0030	EA	1' Length, 15" Height, Lift-Out, 3-Rib, 11 Gauge Steel, Protective Guard Rail	173.38	12.94
05 58 23 00-0031	EA	2' Length, 15" Height, Lift-Out, 3-Rib, 11 Gauge Steel, Protective Guard Rail	186.80	12.94
05 58 23 00-0032	EA	3' Length, 15" Height, Lift-Out, 3-Rib, 11 Gauge Steel, Protective Guard Rail	200.71	12.94
05 58 23 00-0033	EA	4' Length, 15" Height, Lift-Out, 3-Rib, 11 Gauge Steel, Protective Guard Rail	216.86	12.94
05 58 23 00-0034	EA	5' Length, 15" Height, Lift-Out, 3-Rib, 11 Gauge Steel, Protective Guard Rail	233.01	12.94
05 58 23 00-0035	EA	6' Length, 15" Height, Lift-Out, 3-Rib, 11 Gauge Steel, Protective Guard Rail	246.18	12.94
05 58 23 00-0036	EA	7' Length, 15" Height, Lift-Out, 3-Rib, 11 Gauge Steel, Protective Guard Rail	261.34	12.94
05 58 23 00-0037	EA	8' Length, 15" Height, Lift-Out, 3-Rib, 11 Gauge Steel, Protective Guard Rail	278.48	12.94
05 58 23 00-0038	EA	9' Length, 15" Height, Lift-Out, 3-Rib, 11 Gauge Steel, Protective Guard Rail	296.87	12.94
05 58 23 00-0039	EA	10' Length, 15" Height, Lift-Out, 3-Rib, 11 Gauge Steel, Protective Guard Rail	313.02	12.94
05 58 23 00-0040	EA	Posts For 3-Rib Guard Rails (05 58 23 00-0017) Note: Includes drilling, surface mounting plate and anchors.		
05 58 23 00-0041	EA	18" Height, Single Rail Post For 3-Rib Guard Rails	191.46	26.95
05 58 23 00-0042	EA	42" Height, Double Rail Post For 3-Rib Guard Rails	243.24	26.95
05 58 23 00-0043	EA	All-Welded, Protective Guards (05 58 23) Note: Surface mounted inverted-U style protective barriers. Includes painted finish, drilling, surface mounting plate and anchors.		
05 58 23 00-0044	EA	All-Welded, Protective Guards (05 58 23 00-0043)		
05 58 23 00-0045	EA	36" Length, 9" Height, 4-1/2" Diameter Steel Pipe, All-Welded, Protective Guard	250.03	35.94
05 58 23 00-0046	EA	48" Length, 9" Height, 4-1/2" Diameter Steel Pipe, All-Welded, Protective Guard	262.45	35.94
05 58 23 00-0047	EA	36" Length, 16" Height, 4-1/2" Diameter Steel Pipe, All-Welded, Protective Guard	269.66	35.94
05 58 23 00-0048	EA	48" Length, 16" Height, 4-1/2" Diameter Steel Pipe, All-Welded, Protective Guard	280.34	35.94
05 58 23 00-0049	EA	36" Length, 24" Height, 4-1/2" Diameter Steel Pipe, All-Welded, Protective Guard	277.86	35.94
05 58 23 00-0050	EA	48" Length, 24" Height, 4-1/2" Diameter Steel Pipe, All-Welded, Protective Guard	291.03	35.94
05 58 23 00-0051	EA	36" Length, 36" Height, 4-1/2" Diameter Steel Pipe, All-Welded, Protective Guard	294.75	35.94
05 58 23 00-0052	EA	48" Length, 36" Height, 4-1/2" Diameter Steel Pipe, All-Welded, Protective Guard	298.98	35.94
05 58 23 00-0053	EA	48" Length, 42" Height, 4-1/2" Diameter Steel Pipe, All-Welded, Protective Guard	319.10	35.94

05 Metals**05 50 Metal Fabrications****05 58 Formed Metal Fabrications**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 58 23 00-0054			Corner Style, All-Welded, Protective Guards <small>(05 58 23 00-0043)</small>		
05 58 23 00-0055	EA		24" Length, 24" Height, 4-1/2" Diameter Steel Pipe, Corner Style, All-Welded, Protective Guard.....	327.06	35.94
05 58 23 00-0056	EA		30" Length, 24" Height, 4-1/2" Diameter Steel Pipe, Corner Style, All-Welded, Protective Guard.....	341.96	35.94
05 58 23 00-0057	EA		24" Length, 36" Height, 4-1/2" Diameter Steel Pipe, Corner Style, All-Welded, Protective Guard.....	348.18	35.94
05 58 23 00-0058	EA		30" Length, 36" Height, 4-1/2" Diameter Steel Pipe, Corner Style, All-Welded, Protective Guard.....	378.74	35.94
05 58 23 00-0059			Warehouse Safety Bollards <small>(05 58 23)</small>		
			Note: Includes painted finish, drilling, surface mounting plate and anchors.		
05 58 23 00-0060	EA		24" Height, 4-1/2" Diameter Steel Pipe, Bolt Down, Warehouse Safety Bollard.....	158.38	26.95
05 58 23 00-0061	EA		36" Height, 4-1/2" Diameter Steel Pipe, Bolt Down, Warehouse Safety Bollard.....	182.93	26.95
05 58 23 00-0062	EA		42" Height, 4-1/2" Diameter Steel Pipe, Bolt Down, Warehouse Safety Bollard.....	208.92	26.95
05 58 23 00-0063	EA		36" Height, 5-1/2" Diameter Steel Pipe, Bolt Down, Warehouse Safety Bollard.....	216.02	26.95
05 58 23 00-0064	EA		42" Height, 5-1/2" Diameter Steel Pipe, Bolt Down, Warehouse Safety Bollard.....	232.42	26.95
05 59			Metal Specialties <small>(05 50)</small>		
05 59 65			Chain <small>(05 59)</small>		
05 59 65 00-0001			Alloy Steel Chain, Self Colored, Cut Length <small>(05 59 65)</small>		
			Note: Includes all connecting links, double clevis mid-Links, slip or grab hooks, or shackles as required.		
05 59 65 00-0002	LF		3/16" Diameter Alloy Steel Chain, Cut Length, Self Colored.....	3.78	0.81
			For Plastic Dipped, Add.....	0.33	
05 59 65 00-0003	LF		1/4" Diameter Alloy Steel Chain, Cut Length, Self Colored.....	5.08	1.08
			For Plastic Dipped, Add.....	0.44	
05 59 65 00-0004	LF		3/8" Diameter Alloy Steel Chain, Cut Length, Self Colored.....	8.26	2.15
			For Plastic Dipped, Add.....	0.59	
05 59 65 00-0005	LF		1/2" Diameter Alloy Steel Chain, Cut Length, Self Colored.....	13.33	3.63
			For Plastic Dipped, Add.....	0.91	
05 59 65 00-0006	LF		5/8" Diameter Alloy Steel Chain, Cut Length, Self Colored.....	22.50	6.13
			For Plastic Dipped, Add.....	1.53	
05 59 65 00-0007	LF		3/4" Diameter Alloy Steel Chain, Cut Length, Self Colored.....	31.57	8.61
			For Plastic Dipped, Add.....	2.15	
05 59 65 00-0008	LF		7/8" Diameter Alloy Steel Chain, Cut Length, Self Colored.....	42.58	10.76
			For Plastic Dipped, Add.....	3.16	
05 59 65 00-0009	LF		1" Diameter Alloy Steel Chain, Cut Length, Self Colored.....	60.98	14.34
			For Plastic Dipped, Add.....	4.84	
05 59 65 00-0010	LF		1-1/4" Diameter Alloy Steel Chain, Cut Length, Self Colored.....	98.29	21.52
			For Plastic Dipped, Add.....	8.29	
05 59 69			Metal Panels <small>(05 59)</small>		
05 59 69 00-0001			Woven And Welded Wire Cloth <small>(05 59 69)</small>		
			Note: Excludes frame and fastening to frame. See CSI section 05 12 23 00-0087 for spot welding.		
05 59 69 00-0002			Plain Steel Woven And Welded Wire Cloth Panels <small>(05 59 69 00-0001)</small>		
05 59 69 00-0003			2" Square Wire Spacing <small>(05 59 69 00-0002)</small>		
05 59 69 00-0004	SF		0.12" Thick Wire, 2" Spacing, 0.44 LB/SF Woven And Welded Wire Cloth Panels.....	6.69	2.30
			For Up To 2 SF Panel, Add.....	1.95	
			For >2 To 6 SF Panel, Add.....	1.13	
			For >15 To 40 SF, Deduct.....	-0.18	
			For >40 SF, Deduct.....	-0.54	
			For Galvanized, Add.....	1.82	
			For Aluminum, Add.....	2.18	
			For 304 Stainless Steel, Add.....	8.71	
			For 316 Stainless Steel, Add.....	9.98	
05 59 69 00-0005	SF		0.135" Thick Wire, 2" Spacing, 0.55 LB/SF Woven And Welded Wire Cloth Panels.....	7.18	2.40
			For Up To 2 SF Panel, Add.....	2.07	
			For >2 To 6 SF Panel, Add.....	1.20	
			For >15 To 40 SF, Deduct.....	-0.20	
			For >40 SF, Deduct.....	-0.60	
			For Galvanized, Add.....	2.00	
			For Aluminum, Add.....	2.39	
			For 304 Stainless Steel, Add.....	9.58	
			For 316 Stainless Steel, Add.....	10.97	
05 59 69 00-0006	SF		0.148" Thick Wire, 2" Spacing, 0.65 LB/SF Woven And Welded Wire Cloth Panels.....	7.65	2.65
			For Up To 2 SF Panel, Add.....	2.24	
			For >2 To 6 SF Panel, Add.....	1.29	
			For >15 To 40 SF, Deduct.....	-0.21	
			For >40 SF, Deduct.....	-0.62	
			For Galvanized, Add.....	2.06	
			For Aluminum, Add.....	2.47	
			For 304 Stainless Steel, Add.....	9.89	
			For 316 Stainless Steel, Add.....	11.33	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 59 69 00-0007 SF 0.162" Thick Wire, 2" Spacing, 0.78 LB/SF Woven And Welded Wire Cloth Panels	8.06	2.77
For Up To 2 SF Panel, Add	2.35	
For >2 To 6 SF Panel, Add	1.36	
For >15 To 40 SF, Deduct	-0.22	
For >40 SF, Deduct	-0.66	
For Galvanized, Add	2.19	
For Aluminum, Add	2.63	
For 304 Stainless Steel, Add	10.51	
For 316 Stainless Steel, Add	12.05	
05 59 69 00-0008 SF 0.177" Thick Wire, 2" Spacing, 0.92 LB/SF Woven And Welded Wire Cloth Panels	8.84	3.10
For Up To 2 SF Panel, Add	2.59	
For >2 To 6 SF Panel, Add	1.50	
For >15 To 40 SF, Deduct	-0.24	
For >40 SF, Deduct	-0.71	
For Galvanized, Add	2.36	
For Aluminum, Add	2.83	
For 304 Stainless Steel, Add	11.30	
For 316 Stainless Steel, Add	12.95	
05 59 69 00-0009 SF 0.192" Thick Wire, 2" Spacing, 1.08 LB/SF Woven And Welded Wire Cloth Panels	10.14	3.45
For Up To 2 SF Panel, Add	2.95	
For >2 To 6 SF Panel, Add	1.71	
For >15 To 40 SF, Deduct	-0.28	
For >40 SF, Deduct	-0.83	
For Galvanized, Add	2.77	
For Aluminum, Add	3.32	
For 304 Stainless Steel, Add	13.27	
For 316 Stainless Steel, Add	15.21	
05 59 69 00-0010 SF 0.207" Thick Wire, 2" Spacing, 1.25 LB/SF Woven And Welded Wire Cloth Panels	11.46	3.79
For Up To 2 SF Panel, Add	3.30	
For >2 To 6 SF Panel, Add	1.91	
For >15 To 40 SF, Deduct	-0.32	
For >40 SF, Deduct	-0.96	
For Galvanized, Add	3.20	
For Aluminum, Add	3.84	
For 304 Stainless Steel, Add	15.36	
For 316 Stainless Steel, Add	17.60	
05 59 69 00-0011 SF 0.225" Thick Wire, 2" Spacing, 1.46 LB/SF Woven And Welded Wire Cloth Panels	13.09	4.22
For Up To 2 SF Panel, Add	3.74	
For >2 To 6 SF Panel, Add	2.15	
For >15 To 40 SF, Deduct	-0.37	
For >40 SF, Deduct	-1.12	
For Galvanized, Add	3.74	
For Aluminum, Add	4.48	
For 304 Stainless Steel, Add	17.93	
For 316 Stainless Steel, Add	20.54	
05 59 69 00-0012 1-3/4" Square Wire Spacing <small>(05 59 69 00-0002)</small>		
05 59 69 00-0013 SF 0.12" Thick Wire, 1-3/4" Spacing, 0.49 LB/SF Woven And Welded Wire Cloth Panels	7.02	2.44
For Up To 2 SF Panel, Add	2.05	
For >2 To 6 SF Panel, Add	1.19	
For >15 To 40 SF, Deduct	-0.19	
For >40 SF, Deduct	-0.57	
For Galvanized, Add	1.89	
For Aluminum, Add	2.27	
For 304 Stainless Steel, Add	9.07	
For 316 Stainless Steel, Add	10.40	
05 59 69 00-0014 SF 0.135" Thick Wire, 1-3/4" Spacing, 0.62 LB/SF Woven And Welded Wire Cloth Panels	7.70	2.57
For Up To 2 SF Panel, Add	2.22	
For >2 To 6 SF Panel, Add	1.28	
For >15 To 40 SF, Deduct	-0.21	
For >40 SF, Deduct	-0.64	
For Galvanized, Add	2.14	
For Aluminum, Add	2.57	
For 304 Stainless Steel, Add	10.27	
For 316 Stainless Steel, Add	11.77	
05 59 69 00-0015 SF 0.148" Thick Wire, 1-3/4" Spacing, 0.74 LB/SF Woven And Welded Wire Cloth Panels	8.31	2.88
For Up To 2 SF Panel, Add	2.43	
For >2 To 6 SF Panel, Add	1.41	
For >15 To 40 SF, Deduct	-0.22	
For >40 SF, Deduct	-0.67	
For Galvanized, Add	2.24	
For Aluminum, Add	2.68	
For 304 Stainless Steel, Add	10.73	
For 316 Stainless Steel, Add	12.29	
05 59 69 00-0016 SF 0.162" Thick Wire, 1-3/4" Spacing, 0.88 LB/SF Woven And Welded Wire Cloth Panels	8.67	2.97
For Up To 2 SF Panel, Add	2.53	
For >2 To 6 SF Panel, Add	1.46	
For >15 To 40 SF, Deduct	-0.24	
For >40 SF, Deduct	-0.71	
For Galvanized, Add	2.36	
For Aluminum, Add	2.83	
For 304 Stainless Steel, Add	11.30	
For 316 Stainless Steel, Add	12.95	

05	Metals
05 50	Metal Fabrications
05 59	Metal Specialties



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 59 69 00-0017	SF		0.177" Thick Wire, 1-3/4" Spacing, 1.04 LB/SF Woven And Welded Wire Cloth Panels	9.51	3.33
			<i>For Up To 2 SF Panel, Add</i>	2.79	
			<i>For >2 To 6 SF Panel, Add</i>	1.62	
			<i>For >15 To 40 SF, Deduct</i>	-0.25	
			<i>For >40 SF, Deduct</i>	-0.76	
			<i>For Galvanized, Add</i>	2.54	
			<i>For Aluminum, Add</i>	3.04	
			<i>For 304 Stainless Steel, Add</i>	12.17	
			<i>For 316 Stainless Steel, Add</i>	13.94	
05 59 69 00-0018	SF		0.192" Thick Wire, 1-3/4" Spacing, 1.22 LB/SF Woven And Welded Wire Cloth Panels	10.91	3.71
			<i>For Up To 2 SF Panel, Add</i>	3.17	
			<i>For >2 To 6 SF Panel, Add</i>	1.84	
			<i>For >15 To 40 SF, Deduct</i>	-0.30	
			<i>For >40 SF, Deduct</i>	-0.89	
			<i>For Galvanized, Add</i>	2.98	
			<i>For Aluminum, Add</i>	3.57	
			<i>For 304 Stainless Steel, Add</i>	14.28	
			<i>For 316 Stainless Steel, Add</i>	16.36	
05 59 69 00-0019	SF		0.207" Thick Wire, 1-3/4" Spacing, 1.41 LB/SF Woven And Welded Wire Cloth Panels	12.31	4.08
			<i>For Up To 2 SF Panel, Add</i>	3.55	
			<i>For >2 To 6 SF Panel, Add</i>	2.05	
			<i>For >15 To 40 SF, Deduct</i>	-0.34	
			<i>For >40 SF, Deduct</i>	-1.03	
			<i>For Galvanized, Add</i>	3.44	
			<i>For Aluminum, Add</i>	4.12	
			<i>For 304 Stainless Steel, Add</i>	16.49	
			<i>For 316 Stainless Steel, Add</i>	18.89	
05 59 69 00-0020	SF		0.225" Thick Wire, 1-3/4" Spacing, 1.65 LB/SF Woven And Welded Wire Cloth Panels	14.09	4.54
			<i>For Up To 2 SF Panel, Add</i>	4.03	
			<i>For >2 To 6 SF Panel, Add</i>	2.32	
			<i>For >15 To 40 SF, Deduct</i>	-0.40	
			<i>For >40 SF, Deduct</i>	-1.21	
			<i>For Galvanized, Add</i>	4.02	
			<i>For Aluminum, Add</i>	4.82	
			<i>For 304 Stainless Steel, Add</i>	19.30	
			<i>For 316 Stainless Steel, Add</i>	22.11	
05 59 69 00-0021			1-1/2" Square Wire Spacing <small>(05 59 69 00-0002)</small>		
05 59 69 00-0022	SF		0.12" Thick Wire, 1-1/2" Spacing, 0.57 LB/SF Woven And Welded Wire Cloth Panels	7.78	2.71
			<i>For Up To 2 SF Panel, Add</i>	2.27	
			<i>For >2 To 6 SF Panel, Add</i>	1.32	
			<i>For >15 To 40 SF, Deduct</i>	-0.21	
			<i>For >40 SF, Deduct</i>	-0.63	
			<i>For Galvanized, Add</i>	2.10	
			<i>For Aluminum, Add</i>	2.51	
			<i>For 304 Stainless Steel, Add</i>	10.06	
			<i>For 316 Stainless Steel, Add</i>	11.52	
05 59 69 00-0023	SF		0.135" Thick Wire, 1-1/2" Spacing, 0.72 LB/SF Woven And Welded Wire Cloth Panels	8.51	2.84
			<i>For Up To 2 SF Panel, Add</i>	2.46	
			<i>For >2 To 6 SF Panel, Add</i>	1.42	
			<i>For >15 To 40 SF, Deduct</i>	-0.24	
			<i>For >40 SF, Deduct</i>	-0.71	
			<i>For Galvanized, Add</i>	2.37	
			<i>For Aluminum, Add</i>	2.84	
			<i>For 304 Stainless Steel, Add</i>	11.35	
			<i>For 316 Stainless Steel, Add</i>	13.01	
05 59 69 00-0024	SF		0.148" Thick Wire, 1-1/2" Spacing, 0.85 LB/SF Woven And Welded Wire Cloth Panels	9.09	3.15
			<i>For Up To 2 SF Panel, Add</i>	2.66	
			<i>For >2 To 6 SF Panel, Add</i>	1.54	
			<i>For >15 To 40 SF, Deduct</i>	-0.24	
			<i>For >40 SF, Deduct</i>	-0.73	
			<i>For Galvanized, Add</i>	2.45	
			<i>For Aluminum, Add</i>	2.93	
			<i>For 304 Stainless Steel, Add</i>	11.74	
			<i>For 316 Stainless Steel, Add</i>	13.45	
05 59 69 00-0025	SF		0.162" Thick Wire, 1-1/2" Spacing, 1.02 LB/SF Woven And Welded Wire Cloth Panels	9.57	3.28
			<i>For Up To 2 SF Panel, Add</i>	2.79	
			<i>For >2 To 6 SF Panel, Add</i>	1.61	
			<i>For >15 To 40 SF, Deduct</i>	-0.26	
			<i>For >40 SF, Deduct</i>	-0.78	
			<i>For Galvanized, Add</i>	2.60	
			<i>For Aluminum, Add</i>	3.12	
			<i>For 304 Stainless Steel, Add</i>	12.48	
			<i>For 316 Stainless Steel, Add</i>	14.30	
05 59 69 00-0026	SF		0.177" Thick Wire, 1-1/2" Spacing, 1.2 LB/SF Woven And Welded Wire Cloth Panels	10.46	3.66
			<i>For Up To 2 SF Panel, Add</i>	3.07	
			<i>For >2 To 6 SF Panel, Add</i>	1.78	
			<i>For >15 To 40 SF, Deduct</i>	-0.28	
			<i>For >40 SF, Deduct</i>	-0.84	
			<i>For Galvanized, Add</i>	2.79	
			<i>For Aluminum, Add</i>	3.34	
			<i>For 304 Stainless Steel, Add</i>	13.37	
			<i>For 316 Stainless Steel, Add</i>	15.32	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 59 69 00-0027 SF 0.192" Thick Wire, 1-1/2" Spacing, 1.4 LB/SF Woven And Welded Wire Cloth Panels	11.92	4.07
For Up To 2 SF Panel, Add	3.47	
For >2 To 6 SF Panel, Add	2.01	
For >15 To 40 SF, Deduct	-0.33	
For >40 SF, Deduct	-0.98	
For Galvanized, Add	3.25	
For Aluminum, Add	3.90	
For 304 Stainless Steel, Add	15.60	
For 316 Stainless Steel, Add	17.88	
05 59 69 00-0028 SF 0.207" Thick Wire, 1-1/2" Spacing, 1.62 LB/SF Woven And Welded Wire Cloth Panels	13.47	4.47
For Up To 2 SF Panel, Add	3.88	
For >2 To 6 SF Panel, Add	2.24	
For >15 To 40 SF, Deduct	-0.38	
For >40 SF, Deduct	-1.13	
For Galvanized, Add	3.76	
For Aluminum, Add	4.51	
For 304 Stainless Steel, Add	18.05	
For 316 Stainless Steel, Add	20.68	
05 59 69 00-0029 SF 0.225" Thick Wire, 1-1/2" Spacing, 1.89 LB/SF Woven And Welded Wire Cloth Panels	15.36	4.95
For Up To 2 SF Panel, Add	4.39	
For >2 To 6 SF Panel, Add	2.52	
For >15 To 40 SF, Deduct	-0.44	
For >40 SF, Deduct	-1.32	
For Galvanized, Add	4.39	
For Aluminum, Add	5.26	
For 304 Stainless Steel, Add	21.05	
For 316 Stainless Steel, Add	24.12	
05 59 69 00-0030 1-1/4" Square Wire Spacing <small>(05 59 69 00-0002)</small>		
05 59 69 00-0031 SF 0.105" Thick Wire, 1-1/4" Spacing, 0.52 LB/SF Woven And Welded Wire Cloth Panels	8.00	2.92
For Up To 2 SF Panel, Add	2.38	
For >2 To 6 SF Panel, Add	1.39	
For >15 To 40 SF, Deduct	-0.21	
For >40 SF, Deduct	-0.62	
For Galvanized, Add	2.05	
For Aluminum, Add	2.46	
For 304 Stainless Steel, Add	9.84	
For 316 Stainless Steel, Add	11.28	
05 59 69 00-0032 SF 0.12" Thick Wire, 1-1/4" Spacing, 0.68 LB/SF Woven And Welded Wire Cloth Panels	8.63	3.06
For Up To 2 SF Panel, Add	2.54	
For >2 To 6 SF Panel, Add	1.48	
For >15 To 40 SF, Deduct	-0.23	
For >40 SF, Deduct	-0.68	
For Galvanized, Add	2.27	
For Aluminum, Add	2.72	
For 304 Stainless Steel, Add	10.90	
For 316 Stainless Steel, Add	12.49	
05 59 69 00-0033 SF 0.135" Thick Wire, 1-1/4" Spacing, 0.85 LB/SF Woven And Welded Wire Cloth Panels	9.34	3.19
For Up To 2 SF Panel, Add	2.72	
For >2 To 6 SF Panel, Add	1.57	
For >15 To 40 SF, Deduct	-0.25	
For >40 SF, Deduct	-0.76	
For Galvanized, Add	2.54	
For Aluminum, Add	3.05	
For 304 Stainless Steel, Add	12.19	
For 316 Stainless Steel, Add	13.97	
05 59 69 00-0034 SF 0.148" Thick Wire, 1-1/4" Spacing, 1.01 LB/SF Woven And Welded Wire Cloth Panels	9.62	3.25
For Up To 2 SF Panel, Add	2.79	
For >2 To 6 SF Panel, Add	1.61	
For >15 To 40 SF, Deduct	-0.26	
For >40 SF, Deduct	-0.79	
For Galvanized, Add	2.64	
For Aluminum, Add	3.17	
For 304 Stainless Steel, Add	12.67	
For 316 Stainless Steel, Add	14.52	
05 59 69 00-0035 SF 0.162" Thick Wire, 1-1/4" Spacing, 1.2 LB/SF Woven And Welded Wire Cloth Panels	10.46	3.67
For Up To 2 SF Panel, Add	3.07	
For >2 To 6 SF Panel, Add	1.78	
For >15 To 40 SF, Deduct	-0.28	
For >40 SF, Deduct	-0.83	
For Galvanized, Add	2.78	
For Aluminum, Add	3.34	
For 304 Stainless Steel, Add	13.34	
For 316 Stainless Steel, Add	15.29	
05 59 69 00-0036 SF 0.177" Thick Wire, 1-1/4" Spacing, 1.42 LB/SF Woven And Welded Wire Cloth Panels	11.79	4.13
For Up To 2 SF Panel, Add	3.46	
For >2 To 6 SF Panel, Add	2.01	
For >15 To 40 SF, Deduct	-0.31	
For >40 SF, Deduct	-0.94	
For Galvanized, Add	3.14	
For Aluminum, Add	3.77	
For 304 Stainless Steel, Add	15.07	
For 316 Stainless Steel, Add	17.27	

05	Metals
05 50	Metal Fabrications
05 59	Metal Specialties



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 59 69 00-0037	SF		0.192" Thick Wire, 1-1/4" Spacing, 1.65 LB/SF Woven And Welded Wire Cloth Panels	13.37	4.56
			<i>For Up To 2 SF Panel, Add</i>	3.89	
			<i>For >2 To 6 SF Panel, Add</i>	2.25	
			<i>For >15 To 40 SF, Deduct</i>	-0.36	
			<i>For >40 SF, Deduct</i>	-1.09	
			<i>For Galvanized, Add</i>	3.65	
			<i>For Aluminum, Add</i>	4.37	
			<i>For 304 Stainless Steel, Add</i>	17.50	
			<i>For 316 Stainless Steel, Add</i>	20.05	
05 59 69 00-0038	SF		0.207" Thick Wire, 1-1/4" Spacing, 1.9 LB/SF Woven And Welded Wire Cloth Panels	15.04	4.98
			<i>For Up To 2 SF Panel, Add</i>	4.34	
			<i>For >2 To 6 SF Panel, Add</i>	2.50	
			<i>For >15 To 40 SF, Deduct</i>	-0.42	
			<i>For >40 SF, Deduct</i>	-1.26	
			<i>For Galvanized, Add</i>	4.20	
			<i>For Aluminum, Add</i>	5.04	
			<i>For 304 Stainless Steel, Add</i>	20.16	
			<i>For 316 Stainless Steel, Add</i>	23.10	
05 59 69 00-0039	SF		0.225" Thick Wire, 1-1/4" Spacing, 2.22 LB/SF Woven And Welded Wire Cloth Panels	17.19	5.54
			<i>For Up To 2 SF Panel, Add</i>	4.91	
			<i>For >2 To 6 SF Panel, Add</i>	2.83	
			<i>For >15 To 40 SF, Deduct</i>	-0.49	
			<i>For >40 SF, Deduct</i>	-1.47	
			<i>For Galvanized, Add</i>	4.91	
			<i>For Aluminum, Add</i>	5.89	
			<i>For 304 Stainless Steel, Add</i>	23.54	
			<i>For 316 Stainless Steel, Add</i>	26.98	
05 59 69 00-0040			1" Square Wire Spacing (05 59 69 00-0002)		
05 59 69 00-0041	SF		0.105" Thick Wire, 1" Spacing, 0.64 LB/SF Woven And Welded Wire Cloth Panels.....	9.15	3.42
			<i>For Up To 2 SF Panel, Add</i>	2.74	
			<i>For >2 To 6 SF Panel, Add</i>	1.60	
			<i>For >15 To 40 SF, Deduct</i>	-0.23	
			<i>For >40 SF, Deduct</i>	-0.69	
			<i>For Galvanized, Add</i>	2.30	
			<i>For Aluminum, Add</i>	2.75	
			<i>For 304 Stainless Steel, Add</i>	11.02	
			<i>For 316 Stainless Steel, Add</i>	12.62	
05 59 69 00-0042	SF		0.12" Thick Wire, 1" Spacing, 0.83 LB/SF Woven And Welded Wire Cloth Panels.....	9.79	3.56
			<i>For Up To 2 SF Panel, Add</i>	2.91	
			<i>For >2 To 6 SF Panel, Add</i>	1.69	
			<i>For >15 To 40 SF, Deduct</i>	-0.25	
			<i>For >40 SF, Deduct</i>	-0.76	
			<i>For Galvanized, Add</i>	2.52	
			<i>For Aluminum, Add</i>	3.02	
			<i>For 304 Stainless Steel, Add</i>	12.10	
			<i>For 316 Stainless Steel, Add</i>	13.86	
05 59 69 00-0043	SF		0.135" Thick Wire, 1" Spacing, 1.04 LB/SF Woven And Welded Wire Cloth Panels.....	10.19	3.71
			<i>For Up To 2 SF Panel, Add</i>	3.03	
			<i>For >2 To 6 SF Panel, Add</i>	1.76	
			<i>For >15 To 40 SF, Deduct</i>	-0.26	
			<i>For >40 SF, Deduct</i>	-0.78	
			<i>For Galvanized, Add</i>	2.62	
			<i>For Aluminum, Add</i>	3.14	
			<i>For 304 Stainless Steel, Add</i>	12.55	
			<i>For 316 Stainless Steel, Add</i>	14.38	
05 59 69 00-0044	SF		0.148" Thick Wire, 1" Spacing, 1.23 LB/SF Woven And Welded Wire Cloth Panels.....	10.88	3.77
			<i>For Up To 2 SF Panel, Add</i>	3.18	
			<i>For >2 To 6 SF Panel, Add</i>	1.84	
			<i>For >15 To 40 SF, Deduct</i>	-0.29	
			<i>For >40 SF, Deduct</i>	-0.88	
			<i>For Galvanized, Add</i>	2.93	
			<i>For Aluminum, Add</i>	3.51	
			<i>For 304 Stainless Steel, Add</i>	14.04	
			<i>For 316 Stainless Steel, Add</i>	16.09	
05 59 69 00-0045	SF		0.162" Thick Wire, 1" Spacing, 1.46 LB/SF Woven And Welded Wire Cloth Panels.....	12.12	4.25
			<i>For Up To 2 SF Panel, Add</i>	3.56	
			<i>For >2 To 6 SF Panel, Add</i>	2.06	
			<i>For >15 To 40 SF, Deduct</i>	-0.32	
			<i>For >40 SF, Deduct</i>	-0.97	
			<i>For Galvanized, Add</i>	3.22	
			<i>For Aluminum, Add</i>	3.86	
			<i>For 304 Stainless Steel, Add</i>	15.46	
			<i>For 316 Stainless Steel, Add</i>	17.71	
05 59 69 00-0046	SF		0.177" Thick Wire, 1" Spacing, 1.72 LB/SF Woven And Welded Wire Cloth Panels.....	13.59	4.76
			<i>For Up To 2 SF Panel, Add</i>	3.99	
			<i>For >2 To 6 SF Panel, Add</i>	2.31	
			<i>For >15 To 40 SF, Deduct</i>	-0.36	
			<i>For >40 SF, Deduct</i>	-1.09	
			<i>For Galvanized, Add</i>	3.62	
			<i>For Aluminum, Add</i>	4.34	
			<i>For 304 Stainless Steel, Add</i>	17.38	
			<i>For 316 Stainless Steel, Add</i>	19.91	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 59 69 00-0047 SF 0.192" Thick Wire, 1" Spacing, 2.01 LB/SF Woven And Welded Wire Cloth Panels	15.51	5.28
For Up To 2 SF Panel, Add	4.51	
For >2 To 6 SF Panel, Add	2.61	
For >15 To 40 SF, Deduct	-0.42	
For >40 SF, Deduct	-1.27	
For Galvanized, Add	4.23	
For Aluminum, Add	5.08	
For 304 Stainless Steel, Add	20.30	
For 316 Stainless Steel, Add	23.27	
05 59 69 00-0048 SF 0.207" Thick Wire, 1" Spacing, 2.31 LB/SF Woven And Welded Wire Cloth Panels	17.42	5.78
For Up To 2 SF Panel, Add	5.02	
For >2 To 6 SF Panel, Add	2.90	
For >15 To 40 SF, Deduct	-0.49	
For >40 SF, Deduct	-1.46	
For Galvanized, Add	4.86	
For Aluminum, Add	5.83	
For 304 Stainless Steel, Add	23.33	
For 316 Stainless Steel, Add	26.73	
05 59 69 00-0049 SF 0.225" Thick Wire, 1" Spacing, 2.69 LB/SF Woven And Welded Wire Cloth Panels	19.84	6.39
For Up To 2 SF Panel, Add	5.67	
For >2 To 6 SF Panel, Add	3.26	
For >15 To 40 SF, Deduct	-0.57	
For >40 SF, Deduct	-1.70	
For Galvanized, Add	5.66	
For Aluminum, Add	6.79	
For 304 Stainless Steel, Add	27.17	
For 316 Stainless Steel, Add	31.13	
05 59 69 00-0050 3/4" Square Wire Spacing (05 59 69 00-0002)		
05 59 69 00-0051 SF 0.105" Thick Wire, 3/4" Spacing, 0.83 LB/SF Woven And Welded Wire Cloth Panels	9.25	3.42
For Up To 2 SF Panel, Add	2.76	
For >2 To 6 SF Panel, Add	1.61	
For >15 To 40 SF, Deduct	-0.24	
For >40 SF, Deduct	-0.71	
For Galvanized, Add	2.35	
For Aluminum, Add	2.82	
For 304 Stainless Steel, Add	11.28	
For 316 Stainless Steel, Add	12.93	
05 59 69 00-0052 SF 0.12" Thick Wire, 3/4" Spacing, 1.07 LB/SF Woven And Welded Wire Cloth Panels	10.33	3.84
For Up To 2 SF Panel, Add	3.09	
For >2 To 6 SF Panel, Add	1.80	
For >15 To 40 SF, Deduct	-0.26	
For >40 SF, Deduct	-0.78	
For Galvanized, Add	2.62	
For Aluminum, Add	3.14	
For 304 Stainless Steel, Add	12.55	
For 316 Stainless Steel, Add	14.38	
05 59 69 00-0053 SF 0.135" Thick Wire, 3/4" Spacing, 1.33 LB/SF Woven And Welded Wire Cloth Panels	11.46	4.33
For Up To 2 SF Panel, Add	3.45	
For >2 To 6 SF Panel, Add	2.01	
For >15 To 40 SF, Deduct	-0.28	
For >40 SF, Deduct	-0.85	
For Galvanized, Add	2.85	
For Aluminum, Add	3.41	
For 304 Stainless Steel, Add	13.66	
For 316 Stainless Steel, Add	15.65	
05 59 69 00-0054 SF 0.148" Thick Wire, 3/4" Spacing, 1.58 LB/SF Woven And Welded Wire Cloth Panels	12.37	4.61
For Up To 2 SF Panel, Add	3.70	
For >2 To 6 SF Panel, Add	2.16	
For >15 To 40 SF, Deduct	-0.31	
For >40 SF, Deduct	-0.93	
For Galvanized, Add	3.11	
For Aluminum, Add	3.73	
For 304 Stainless Steel, Add	14.93	
For 316 Stainless Steel, Add	17.11	
05 59 69 00-0055 SF 0.162" Thick Wire, 3/4" Spacing, 1.87 LB/SF Woven And Welded Wire Cloth Panels	14.29	5.19
For Up To 2 SF Panel, Add	4.24	
For >2 To 6 SF Panel, Add	2.47	
For >15 To 40 SF, Deduct	-0.37	
For >40 SF, Deduct	-1.10	
For Galvanized, Add	3.68	
For Aluminum, Add	4.42	
For 304 Stainless Steel, Add	17.66	
For 316 Stainless Steel, Add	20.24	
05 59 69 00-0056 SF 0.177" Thick Wire, 3/4" Spacing, 2.2 LB/SF Woven And Welded Wire Cloth Panels	16.40	5.80
For Up To 2 SF Panel, Add	4.83	
For >2 To 6 SF Panel, Add	2.80	
For >15 To 40 SF, Deduct	-0.43	
For >40 SF, Deduct	-1.30	
For Galvanized, Add	4.33	
For Aluminum, Add	5.20	
For 304 Stainless Steel, Add	20.78	
For 316 Stainless Steel, Add	23.82	

05	Metals
05 50	Metal Fabrications
05 59	Metal Specialties



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 59 69 00-0057	SF		0.192" Thick Wire, 3/4" Spacing, 2.56 LB/SF Woven And Welded Wire Cloth Panels.....	18.64	6.41
			<i>For Up To 2 SF Panel, Add</i>	5.44	
			<i>For >2 To 6 SF Panel, Add</i>	3.15	
			<i>For >15 To 40 SF, Deduct</i>	-0.50	
			<i>For >40 SF, Deduct</i>	-1.51	
			<i>For Galvanized, Add</i>	5.04	
			<i>For Aluminum, Add</i>	6.05	
			<i>For 304 Stainless Steel, Add</i>	24.19	
			<i>For 316 Stainless Steel, Add</i>	27.72	
05 59 69 00-0058	SF		0.207" Thick Wire, 3/4" Spacing, 2.93 LB/SF Woven And Welded Wire Cloth Panels.....	20.84	6.98
			<i>For Up To 2 SF Panel, Add</i>	6.03	
			<i>For >2 To 6 SF Panel, Add</i>	3.48	
			<i>For >15 To 40 SF, Deduct</i>	-0.58	
			<i>For >40 SF, Deduct</i>	-1.73	
			<i>For Galvanized, Add</i>	5.77	
			<i>For Aluminum, Add</i>	6.92	
			<i>For 304 Stainless Steel, Add</i>	27.70	
			<i>For 316 Stainless Steel, Add</i>	31.74	
05 59 69 00-0059	SF		0.225" Thick Wire, 3/4" Spacing, 3.41 LB/SF Woven And Welded Wire Cloth Panels.....	23.71	7.71
			<i>For Up To 2 SF Panel, Add</i>	6.80	
			<i>For >2 To 6 SF Panel, Add</i>	3.91	
			<i>For >15 To 40 SF, Deduct</i>	-0.67	
			<i>For >40 SF, Deduct</i>	-2.01	
			<i>For Galvanized, Add</i>	6.72	
			<i>For Aluminum, Add</i>	8.06	
			<i>For 304 Stainless Steel, Add</i>	32.23	
			<i>For 316 Stainless Steel, Add</i>	36.93	
05 59 69 00-0060			1/2" Square Wire Spacing <small>(05 59 69 00-0002)</small>		
05 59 69 00-0061	SF		0.105" Thick Wire, 1/2" Spacing, 1.18 LB/SF Woven And Welded Wire Cloth Panels.....	9.68	3.65
			<i>For Up To 2 SF Panel, Add</i>	2.91	
			<i>For >2 To 6 SF Panel, Add</i>	1.70	
			<i>For >15 To 40 SF, Deduct</i>	-0.24	
			<i>For >40 SF, Deduct</i>	-0.72	
			<i>For Galvanized, Add</i>	2.41	
			<i>For Aluminum, Add</i>	2.89	
			<i>For 304 Stainless Steel, Add</i>	11.54	
			<i>For 316 Stainless Steel, Add</i>	13.23	
05 59 69 00-0062	SF		0.12" Thick Wire, 1/2" Spacing, 1.51 LB/SF Woven And Welded Wire Cloth Panels.....	11.36	4.44
			<i>For Up To 2 SF Panel, Add</i>	3.46	
			<i>For >2 To 6 SF Panel, Add</i>	2.03	
			<i>For >15 To 40 SF, Deduct</i>	-0.27	
			<i>For >40 SF, Deduct</i>	-0.81	
			<i>For Galvanized, Add</i>	2.72	
			<i>For Aluminum, Add</i>	3.26	
			<i>For 304 Stainless Steel, Add</i>	13.03	
			<i>For 316 Stainless Steel, Add</i>	14.93	
05 59 69 00-0063	SF		0.135" Thick Wire, 1/2" Spacing, 1.88 LB/SF Woven And Welded Wire Cloth Panels.....	13.71	5.25
			<i>For Up To 2 SF Panel, Add</i>	4.14	
			<i>For >2 To 6 SF Panel, Add</i>	2.42	
			<i>For >15 To 40 SF, Deduct</i>	-0.34	
			<i>For >40 SF, Deduct</i>	-1.01	
			<i>For Galvanized, Add</i>	3.35	
			<i>For Aluminum, Add</i>	4.02	
			<i>For 304 Stainless Steel, Add</i>	16.08	
			<i>For 316 Stainless Steel, Add</i>	18.43	
05 59 69 00-0064	SF		0.148" Thick Wire, 1/2" Spacing, 2.22 LB/SF Woven And Welded Wire Cloth Panels.....	15.78	5.90
			<i>For Up To 2 SF Panel, Add</i>	4.73	
			<i>For >2 To 6 SF Panel, Add</i>	2.76	
			<i>For >15 To 40 SF, Deduct</i>	-0.40	
			<i>For >40 SF, Deduct</i>	-1.19	
			<i>For Galvanized, Add</i>	3.96	
			<i>For Aluminum, Add</i>	4.75	
			<i>For 304 Stainless Steel, Add</i>	18.98	
			<i>For 316 Stainless Steel, Add</i>	21.75	
05 59 69 00-0065	SF		0.162" Thick Wire, 1/2" Spacing, 2.61 LB/SF Woven And Welded Wire Cloth Panels.....	18.08	6.58
			<i>For Up To 2 SF Panel, Add</i>	5.37	
			<i>For >2 To 6 SF Panel, Add</i>	3.13	
			<i>For >15 To 40 SF, Deduct</i>	-0.47	
			<i>For >40 SF, Deduct</i>	-1.40	
			<i>For Galvanized, Add</i>	4.65	
			<i>For Aluminum, Add</i>	5.58	
			<i>For 304 Stainless Steel, Add</i>	22.32	
			<i>For 316 Stainless Steel, Add</i>	25.58	
05 59 69 00-0066	SF		0.177" Thick Wire, 1/2" Spacing, 3.06 LB/SF Woven And Welded Wire Cloth Panels.....	20.69	7.34
			<i>For Up To 2 SF Panel, Add</i>	6.09	
			<i>For >2 To 6 SF Panel, Add</i>	3.54	
			<i>For >15 To 40 SF, Deduct</i>	-0.55	
			<i>For >40 SF, Deduct</i>	-1.64	
			<i>For Galvanized, Add</i>	5.46	
			<i>For Aluminum, Add</i>	6.55	
			<i>For 304 Stainless Steel, Add</i>	26.18	
			<i>For 316 Stainless Steel, Add</i>	30.00	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 59 69 00-0067	SF		0.192" Thick Wire, 1/2" Spacing, 3.54 LB/SF Woven And Welded Wire Cloth Panels	23.37	8.06
			<i>For Up To 2 SF Panel, Add</i>	6.82	
			<i>For >2 To 6 SF Panel, Add</i>	3.95	
			<i>For >15 To 40 SF, Deduct</i>	-0.63	
			<i>For >40 SF, Deduct</i>	-1.89	
			<i>For Galvanized, Add</i>	6.31	
			<i>For Aluminum, Add</i>	7.57	
			<i>For 304 Stainless Steel, Add</i>	30.29	
			<i>For 316 Stainless Steel, Add</i>	34.71	
05 59 69 00-0068	SF		0.207" Thick Wire, 1/2" Spacing, 4.04 LB/SF Woven And Welded Wire Cloth Panels	26.06	8.75
			<i>For Up To 2 SF Panel, Add</i>	7.54	
			<i>For >2 To 6 SF Panel, Add</i>	4.36	
			<i>For >15 To 40 SF, Deduct</i>	-0.72	
			<i>For >40 SF, Deduct</i>	-2.16	
			<i>For Galvanized, Add</i>	7.20	
			<i>For Aluminum, Add</i>	8.64	
			<i>For 304 Stainless Steel, Add</i>	34.56	
			<i>For 316 Stainless Steel, Add</i>	39.60	
05 59 69 00-0069	SF		0.225" Thick Wire, 1/2" Spacing, 4.68 LB/SF Woven And Welded Wire Cloth Panels	27.22	9.62
			<i>For Up To 2 SF Panel, Add</i>	8.01	
			<i>For >2 To 6 SF Panel, Add</i>	4.65	
			<i>For >15 To 40 SF, Deduct</i>	-0.72	
			<i>For >40 SF, Deduct</i>	-2.16	
			<i>For Galvanized, Add</i>	7.20	
			<i>For Aluminum, Add</i>	8.64	
			<i>For 304 Stainless Steel, Add</i>	34.56	
			<i>For 316 Stainless Steel, Add</i>	39.60	
05 59 69 00-0070			Expanded Metal Panels <small>(05 59 69)</small>		
			Note: Excludes frame and fastening to frame. See CSI section 05 12 23 00-0087 for spot welding.		
05 59 69 00-0071			Plain Flattened Expanded Metal Diamond Shape Panels <small>(05 59 69 00-0070)</small>		
			Note: Excludes frame and fastening to frame. See CSI section 05 12 23 00-0087 for spot welding.		
05 59 69 00-0072	SF		1/4" #20-F Plain Expanded Metal Panel, 0.82 LB/SF	8.35	3.15
			<i>For Galvanized, Add</i>	2.08	
			<i>For Aluminum, Add</i>	2.49	
			<i>For 304 Stainless Steel, Add</i>	9.96	
			<i>For 316 Stainless Steel, Add</i>	11.41	
05 59 69 00-0073	SF		1/4" #18-F Plain Expanded Metal Panel, 1.08 LB/SF	10.47	3.45
			<i>For Galvanized, Add</i>	2.93	
			<i>For Aluminum, Add</i>	3.52	
			<i>For 304 Stainless Steel, Add</i>	14.06	
			<i>For 316 Stainless Steel, Add</i>	16.12	
05 59 69 00-0074	SF		1/2" #20-F Plain Expanded Metal Panel, 0.40 LB/SF	6.02	2.44
			<i>For Galvanized, Add</i>	1.39	
			<i>For Aluminum, Add</i>	1.67	
			<i>For 304 Stainless Steel, Add</i>	6.67	
			<i>For 316 Stainless Steel, Add</i>	7.65	
05 59 69 00-0075	SF		1/2" #18-F Plain Expanded Metal Panel, 0.66 LB/SF	6.58	2.65
			<i>For Galvanized, Add</i>	1.53	
			<i>For Aluminum, Add</i>	1.83	
			<i>For 304 Stainless Steel, Add</i>	7.32	
			<i>For 316 Stainless Steel, Add</i>	8.39	
05 59 69 00-0076	SF		1/2" #16-F Plain Expanded Metal Panel, 0.82 LB/SF	7.46	3.15
			<i>For Galvanized, Add</i>	1.63	
			<i>For Aluminum, Add</i>	1.96	
			<i>For 304 Stainless Steel, Add</i>	7.82	
			<i>For 316 Stainless Steel, Add</i>	8.97	
05 59 69 00-0077	SF		1/2" #13-F Plain Expanded Metal Panel, 1.4 LB/SF	9.56	4.07
			<i>For Galvanized, Add</i>	2.07	
			<i>For Aluminum, Add</i>	2.48	
			<i>For 304 Stainless Steel, Add</i>	9.94	
			<i>For 316 Stainless Steel, Add</i>	11.39	
05 59 69 00-0078	SF		3/4" #16-F Plain Expanded Metal Panel, 0.51 LB/SF	5.27	2.40
			<i>For Galvanized, Add</i>	1.04	
			<i>For Aluminum, Add</i>	1.25	
			<i>For 304 Stainless Steel, Add</i>	4.99	
			<i>For 316 Stainless Steel, Add</i>	5.72	
05 59 69 00-0079	SF		3/4" #14-F Plain Expanded Metal Panel, 0.63 LB/SF	5.90	2.57
			<i>For Galvanized, Add</i>	1.24	
			<i>For Aluminum, Add</i>	1.49	
			<i>For 304 Stainless Steel, Add</i>	5.95	
			<i>For 316 Stainless Steel, Add</i>	6.82	
05 59 69 00-0080	SF		3/4" #13-F Plain Expanded Metal Panel, 0.75 LB/SF	6.73	2.88
			<i>For Galvanized, Add</i>	1.45	
			<i>For Aluminum, Add</i>	1.73	
			<i>For 304 Stainless Steel, Add</i>	6.94	
			<i>For 316 Stainless Steel, Add</i>	7.95	
05 59 69 00-0081	SF		3/4" #9-F Plain Expanded Metal Panel, 1.71 LB/SF	10.63	4.76
			<i>For Galvanized, Add</i>	2.14	
			<i>For Aluminum, Add</i>	2.57	
			<i>For 304 Stainless Steel, Add</i>	10.27	
			<i>For 316 Stainless Steel, Add</i>	11.77	

05 Metals**05 50 Metal Fabrications****05 59 Metal Specialties**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 59 69 00-0082	SF		1" #16-F Plain Expanded Metal Panel, 0.41 LB/SF	5.91	2.92
			<i>For Galvanized, Add</i>	1.01	
			<i>For Aluminum, Add</i>	1.21	
			<i>For 304 Stainless Steel, Add</i>	4.82	
			<i>For 316 Stainless Steel, Add</i>	5.53	
05 59 69 00-0083	SF		1-1/2" #16-F Plain Expanded Metal Panel, 0.38 LB/SF	5.08	2.30
			<i>For Galvanized, Add</i>	1.01	
			<i>For Aluminum, Add</i>	1.21	
			<i>For 304 Stainless Steel, Add</i>	4.85	
			<i>For 316 Stainless Steel, Add</i>	5.56	
05 59 69 00-0084	SF		1-1/2" #13-F Plain Expanded Metal Panel, 0.57 LB/SF	5.87	2.71
			<i>For Galvanized, Add</i>	1.14	
			<i>For Aluminum, Add</i>	1.37	
			<i>For 304 Stainless Steel, Add</i>	5.47	
			<i>For 316 Stainless Steel, Add</i>	6.27	
05 59 69 00-0085	SF		1-1/2" #9-F Plain Expanded Metal Panel, 1.14 LB/SF	9.07	3.65
			<i>For Galvanized, Add</i>	2.10	
			<i>For Aluminum, Add</i>	2.52	
			<i>For 304 Stainless Steel, Add</i>	10.08	
			<i>For 316 Stainless Steel, Add</i>	11.55	

05 70 Decorative Metal ⁽⁰⁵⁾

Note: Includes anchors and related accessories.

05 71 Decorative Metal Stairs ^(05 70)**05 71 13 Fabricated Metal Spiral Stairs** ^(05 71)

Note: Includes factory prime.

05 71 13 00-0001 Spiral Stairs, Stock Units ^(05 71 13)

Note: Includes factory prime.

05 71 13 00-0002 Steel Tread ^(05 71 13 00-0001)

05 71 13 00-0003	VLF		3'-6" Diameter, Spiral Steel Stair With Rails.....	258.04	41.55
			<i>For Galvanized, Add</i>	122.47	
05 71 13 00-0004	VLF		4' Diameter, Spiral Steel Stair With Rails.....	292.80	45.70
			<i>For Galvanized, Add</i>	140.98	
05 71 13 00-0005	VLF		4'-6" Diameter, Spiral Steel Stair With Rails.....	323.47	49.85
			<i>For Galvanized, Add</i>	156.64	
05 71 13 00-0006	VLF		5' Diameter, Spiral Steel Stair With Rails.....	347.04	54.01
			<i>For Galvanized, Add</i>	167.32	

05 73 Decorative Metal Railings ^(05 70)

Note: Factory primed. Includes brackets.

05 73 00 00-0001 Railings; Vertical Square Bars At 6" ^(05 73)

Note: Centers with shaped top rails (round, square, rectangular, diamond, triangular or other shape).

05 73 00 00-0002	LF		Steel Ornamental Handrail Vertical Square Bars At 6", Shaped Top Rail, Up To 42" High	63.09	9.14
			<i>For Rake Or Angle Railings, Add</i>	8.36	
			<i>For Curved Railings, Add</i>	17.87	
			<i>For 4" On Center Standards, Add</i>	1.97	
			<i>For 4-1/2" On Center Standards, Add</i>	1.58	
			<i>For 5" On Center Standards, Add</i>	1.05	
			<i>For 5-1/2" On Center Standards, Add</i>	0.53	
			<i>For Each Field Bending Of Rails, Add</i>	11.71	
			<i>For Galvanized, Add</i>	3.68	
05 73 00 00-0003	LF		Aluminum Ornamental Handrail Vertical Square Bars At 6", Shaped Top Rail, Up To 42" High.....	79.73	12.46
			<i>For Rake Or Angle Railings, Add</i>	11.04	
			<i>For Curved Railings, Add</i>	21.27	
			<i>For 4" On Center Standards, Add</i>	2.18	
			<i>For 4-1/2" On Center Standards, Add</i>	1.74	
			<i>For 5" On Center Standards, Add</i>	1.16	
			<i>For 5-1/2" On Center Standards, Add</i>	0.58	
			<i>For Each Field Bending Of Rails, Add</i>	15.16	
05 73 00 00-0004	LF		Bronze Ornamental Handrail Vertical Square Bars At 6", Shaped Top Rail, Up To 42" High	190.51	20.77
			<i>For Rake Or Angle Railings, Add</i>	20.91	
			<i>For Curved Railings, Add</i>	66.14	
			<i>For 4" On Center Standards, Add</i>	8.80	
			<i>For 4-1/2" On Center Standards, Add</i>	7.04	
			<i>For 5" On Center Standards, Add</i>	4.70	
			<i>For 5-1/2" On Center Standards, Add</i>	2.35	
			<i>For Each Field Bending Of Rails, Add</i>	20.78	
05 73 00 00-0005	LF		Stainless Steel Ornamental Handrail Vertical Square Bars At 6", Shaped Top Rail, Up To 42" High	205.33	16.61
			<i>For Rake Or Angle Railings, Add</i>	21.25	
			<i>For Curved Railings, Add</i>	74.91	
			<i>For 4" On Center Standards, Add</i>	10.34	
			<i>For 4-1/2" On Center Standards, Add</i>	8.27	
			<i>For 5" On Center Standards, Add</i>	5.51	
			<i>For 5-1/2" On Center Standards, Add</i>	2.76	
			<i>For Each Field Bending Of Rails, Add</i>	19.37	



Metals	05	05
Decorative Metal	05 70	
Decorative Metal Railings	05 73	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 73 00 00-0006	LF		Black Wrought Iron Ornamental Handrail Vertical Square Bars At 6", Shaped Top Rail, Up To 42" High.....	143.04	25.34
			<i>For Rake Or Angle Railings, Add</i>	15.22	
			<i>For Curved Railings, Add</i>	51.01	
			<i>For 4" On Center Standards, Add</i>	6.93	
			<i>For 4-1/2" On Center Standards, Add</i>	5.54	
			<i>For 5" On Center Standards, Add</i>	3.69	
			<i>For 5-1/2" On Center Standards, Add</i>	1.85	
			<i>For Each Field Bending Of Rails, Add</i>	15.17	
05 73 00 00-0007			Laminated Metal Or Wood Handrails With Metal Supports (05 73)		
05 73 00 00-0008	LF		2-1/2" Laminated Metal Or Wood Handrail Round/Oval Shape With Metal Supports.....	158.90	4.15
			<i>For Rake Or Angle Railings, Add</i>	12.17	
			<i>For Curved Railings, Add</i>	69.96	
			<i>For 4" On Center Standards, Add</i>	10.81	
			<i>For 4-1/2" On Center Standards, Add</i>	8.65	
			<i>For 5" On Center Standards, Add</i>	5.77	
			<i>For 5-1/2" On Center Standards, Add</i>	2.88	
			<i>For Each Field Bending Of Rails, Add</i>	6.19	
05 73 00 00-0009			Plain Handrails (05 73)		
05 73 00 00-0010	LF		2" Brass Handrail.....	34.77	9.47
05 73 00 00-0011	EA		90 Degree Angle For 2" Brass Handrail.....	82.63	32.98
05 73 00 00-0012	EA		End Cap For 2" Brass Handrail.....	39.13	16.54
05 73 00 00-0013	EA		Brass Bracket And Joint For 2" Brass Handrail.....	63.39	32.98
05 73 00 00-0014	LF		2" Stainless Steel Handrail.....	62.69	17.23
05 73 00 00-0015			Restoration Of Existing Metal Handrail And Railing (05 73)		
			Note: Task include rust removal by grinding, cleaning, surface prep and one coat of protective primer. See CSI section 09 91 13 00-0366 for painting.		
05 73 00 00-0016	LF		Refinish Metal Handrail.....	7.96	
05 73 00 00-0017	LF		Refinish Wrought Iron Balustrade.....	7.92	
05 73 00 00-0018			Remove And Reinstall Ornamental Railing (05 73)		
05 73 00 00-0019	LF		Remove And Reinstall Ornamental Handrail And Pickets.....	76.44	
05 75			Decorative Formed Metal (05 70)		
05 75 00 00-0001			Metal Sheets, Installed On Walls (05 75)		
			Note: Includes field fabrication (bending) where noted.		
05 75 00 00-0002			Copper Sheets, Installed On Walls (05 75 00 00-0001)		
			Note: Includes field fabrication.		
05 75 00 00-0003	SF		0.0162" (12 Ounce) Thick Copper Sheet, Installed On Walls.....	14.74	1.50
			<i>For >16 To 200 SF, Deduct</i>	-0.89	
			<i>For >200 To 500 SF, Deduct</i>	-1.78	
			<i>For >500 SF, Deduct</i>	-2.51	
05 75 00 00-0004	SF		0.0215" (16 Ounce) Thick Copper Sheet, Installed On Walls.....	18.00	1.68
			<i>For >16 To 200 SF, Deduct</i>	-1.07	
			<i>For >200 To 500 SF, Deduct</i>	-2.14	
			<i>For >500 SF, Deduct</i>	-3.04	
05 75 00 00-0005	SF		0.0242" (18 Ounce) Thick Copper Sheet, Installed On Walls.....	19.64	1.81
			<i>For >16 To 200 SF, Deduct</i>	-1.16	
			<i>For >200 To 500 SF, Deduct</i>	-2.33	
			<i>For >500 SF, Deduct</i>	-3.31	
05 75 00 00-0006	SF		0.027" (20 Ounce) Thick Copper Sheet, Installed On Walls.....	21.11	1.90
			<i>For >16 To 200 SF, Deduct</i>	-1.25	
			<i>For >200 To 500 SF, Deduct</i>	-2.49	
			<i>For >500 SF, Deduct</i>	-3.55	
05 75 00 00-0007	SF		0.0323" (24 Ounce) Thick Copper Sheet, Installed On Walls.....	23.72	1.99
			<i>For >16 To 200 SF, Deduct</i>	-1.39	
			<i>For >200 To 500 SF, Deduct</i>	-2.77	
			<i>For >500 SF, Deduct</i>	-3.96	
05 75 00 00-0008	SF		0.0431" (32 Ounce) Thick Copper Sheet, Installed On Walls.....	29.17	2.08
			<i>For >16 To 200 SF, Deduct</i>	-1.67	
			<i>For >200 To 500 SF, Deduct</i>	-3.33	
			<i>For >500 SF, Deduct</i>	-4.79	
05 75 00 00-0009	SF		0.052" (40 Ounce) Thick Copper Sheet, Installed On Walls.....	33.64	2.18
			<i>For >16 To 200 SF, Deduct</i>	-1.90	
			<i>For >200 To 500 SF, Deduct</i>	-3.80	
			<i>For >500 SF, Deduct</i>	-5.48	
05 75 00 00-0010	SF		0.0646" (48 Ounce) Thick Copper Sheet, Installed On Walls.....	40.19	2.36
			<i>For >16 To 200 SF, Deduct</i>	-2.25	
			<i>For >200 To 500 SF, Deduct</i>	-4.49	
			<i>For >500 SF, Deduct</i>	-6.50	
05 75 00 00-0011	SF		0.08" Thick Copper Sheet, Installed On Walls.....	48.66	2.54
			<i>For >16 To 200 SF, Deduct</i>	-2.69	
			<i>For >200 To 500 SF, Deduct</i>	-5.37	
			<i>For >500 SF, Deduct</i>	-7.81	

05 Metals**05 70 Decorative Metal****05 75 Decorative Formed Metal**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
05 75 00 00-0012	SF		0.125" Thick Copper Sheet, Installed On Walls	69.44	2.72
			<i>For >16 To 200 SF, Deduct</i>	-3.74	
			<i>For >200 To 500 SF, Deduct</i>	-7.49	
			<i>For >500 SF, Deduct</i>	-10.96	
05 75 00 00-0013			Stainless Steel Sheets, Installed On Walls <small>(05 75 00 00-0001)</small>		
			Note: Includes field fabrication.		
05 75 00 00-0014	SF		0.026" Thick (24 Gauge) 304 Brushed Stainless Steel Sheet, Installed On Walls	15.95	2.80
			<i>For 316 Stainless Steel, Add</i>	1.43	
			<i>For >16 To 200 SF, Deduct</i>	-1.08	
			<i>For >200 To 500 SF, Deduct</i>	-2.15	
			<i>For >500 SF, Deduct</i>	-2.95	
05 75 00 00-0015	SF		0.0312" Thick (22 Gauge) 304 Brushed Stainless Steel Sheet, Installed On Walls	17.65	3.01
			<i>For 316 Stainless Steel, Add</i>	1.68	
			<i>For >16 To 200 SF, Deduct</i>	-1.18	
			<i>For >200 To 500 SF, Deduct</i>	-2.37	
			<i>For >500 SF, Deduct</i>	-3.25	
05 75 00 00-0016	SF		0.0375" Thick (20 Gauge) 304 Brushed Stainless Steel Sheet, Installed On Walls	19.19	3.23
			<i>For 316 Stainless Steel, Add</i>	1.88	
			<i>For >16 To 200 SF, Deduct</i>	-1.28	
			<i>For >200 To 500 SF, Deduct</i>	-2.56	
			<i>For >500 SF, Deduct</i>	-3.52	
05 75 00 00-0017	SF		0.050" Thick (18 Gauge) 304 Brushed Stainless Steel Sheet, Installed On Walls	22.61	3.65
			<i>For 316 Stainless Steel, Add</i>	2.39	
			<i>For >16 To 200 SF, Deduct</i>	-1.50	
			<i>For >200 To 500 SF, Deduct</i>	-2.99	
			<i>For >500 SF, Deduct</i>	-4.12	
05 75 00 00-0018	SF		0.0625" Thick (16 gauge) 304 Brushed Stainless Steel Sheet, Installed On Walls	25.98	4.09
			<i>For 316 Stainless Steel, Add</i>	2.89	
			<i>For >16 To 200 SF, Deduct</i>	-1.71	
			<i>For >200 To 500 SF, Deduct</i>	-3.42	
			<i>For >500 SF, Deduct</i>	-4.72	
05 75 00 00-0019	SF		0.078" Thick (14 Gauge) 304 Brushed Stainless Steel Sheet, Installed On Walls	30.68	4.73
			<i>For 316 Stainless Steel, Add</i>	3.53	
			<i>For >16 To 200 SF, Deduct</i>	-2.01	
			<i>For >200 To 500 SF, Deduct</i>	-4.01	
			<i>For >500 SF, Deduct</i>	-5.55	
05 75 00 00-0020	SF		0.125" Thick (11 Gauge) 304 Brushed Stainless Steel Sheet, Installed On Walls	39.11	5.16
			<i>For 316 Stainless Steel, Add</i>	5.54	
			<i>For >16 To 200 SF, Deduct</i>	-2.47	
			<i>For >200 To 500 SF, Deduct</i>	-4.94	
			<i>For >500 SF, Deduct</i>	-6.90	
05 75 00 00-0021	SF		3/16" Thick (7 Gauge) 304 Brushed Stainless Steel Sheet, Installed On Walls	49.27	5.60
			<i>For 316 Stainless Steel, Add</i>	8.07	
			<i>For >16 To 200 SF, Deduct</i>	-3.02	
			<i>For >200 To 500 SF, Deduct</i>	-6.05	
			<i>For >500 SF, Deduct</i>	-8.51	
05 75 00 00-0022	SF		1/4" Thick (3 Gauge) 304 Brushed Stainless Steel Sheet, Installed On Walls	62.04	6.03
			<i>For 316 Stainless Steel, Add</i>	11.38	
			<i>For >16 To 200 SF, Deduct</i>	-3.70	
			<i>For >200 To 500 SF, Deduct</i>	-7.41	
			<i>For >500 SF, Deduct</i>	-10.51	
05 75 00 00-0023	SF		3/8" Thick 304 Brushed Stainless Steel Sheet, Installed On Walls	94.38	6.45
			<i>For 316 Stainless Steel, Add</i>	20.57	
			<i>For >16 To 200 SF, Deduct</i>	-5.36	
			<i>For >200 To 500 SF, Deduct</i>	-10.73	
			<i>For >500 SF, Deduct</i>	-15.45	
05 75 00 00-0024	SF		1/2" Thick 304 Brushed Stainless Steel Sheet, Installed On Walls	118.88	7.53
			<i>For 316 Stainless Steel, Add</i>	26.63	
			<i>For >16 To 200 SF, Deduct</i>	-6.70	
			<i>For >200 To 500 SF, Deduct</i>	-13.39	
			<i>For >500 SF, Deduct</i>	-19.34	
05 75 00 00-0025			Aluminum Sheets, Installed On Walls <small>(05 75 00 00-0001)</small>		
			Note: Includes field fabrication.		
05 75 00 00-0026	SF		0.016" Thick (26 Gauge) Aluminum Sheet, Installed On Walls	8.15	1.50
			<i>For >16 To 200 SF, Deduct</i>	-0.56	
			<i>For >200 To 500 SF, Deduct</i>	-1.12	
			<i>For >500 SF, Deduct</i>	-1.52	
05 75 00 00-0027	SF		0.020" Thick (24 Gauge) Aluminum Sheet, Installed On Walls	9.20	1.68
			<i>For >16 To 200 SF, Deduct</i>	-0.63	
			<i>For >200 To 500 SF, Deduct</i>	-1.26	
			<i>For >500 SF, Deduct</i>	-1.72	
05 75 00 00-0028	SF		0.025" Thick (22 Gauge) Aluminum Sheet, Installed On Walls	10.16	1.81
			<i>For >16 To 200 SF, Deduct</i>	-0.69	
			<i>For >200 To 500 SF, Deduct</i>	-1.38	
			<i>For >500 SF, Deduct</i>	-1.89	
05 75 00 00-0029	SF		0.032" Thick (20 Gauge) Aluminum Sheet, Installed On Walls	11.11	1.90
			<i>For >16 To 200 SF, Deduct</i>	-0.75	
			<i>For >200 To 500 SF, Deduct</i>	-1.49	
			<i>For >500 SF, Deduct</i>	-2.05	



Metals	05
Decorative Metal	05 70
Decorative Formed Metal	05 75

05

MINOR				TOTAL DIRECT	DEMOLITION
CSI	UOM	DESCRIPTION		UNIT COST	UNIT COST
05 75 00 00-0030	SF	0.040" Thick (18 Gauge) Aluminum Sheet, Installed On Walls..... <i>For >16 To 200 SF, Deduct</i> <i>For >200 To 500 SF, Deduct</i> <i>For >500 SF, Deduct</i>		12.04 -0.80 -1.60 -2.21	1.99
05 75 00 00-0031	SF	0.050" Thick (16 Gauge) Aluminum Sheet, Installed On Walls..... <i>For >16 To 200 SF, Deduct</i> <i>For >200 To 500 SF, Deduct</i> <i>For >500 SF, Deduct</i>		13.04 -0.86 -1.72 -2.37	2.08
05 75 00 00-0032	SF	0.064" Thick (14 Gauge) Aluminum Sheet, Installed On Walls..... <i>For >16 To 200 SF, Deduct</i> <i>For >200 To 500 SF, Deduct</i> <i>For >500 SF, Deduct</i>		14.25 -0.93 -1.86 -2.57	2.18
05 75 00 00-0033	SF	0.090" Thick (11 Gauge) Aluminum Sheet, Installed On Walls..... <i>For >16 To 200 SF, Deduct</i> <i>For >200 To 500 SF, Deduct</i> <i>For >500 SF, Deduct</i>		16.88 -1.10 -2.20 -3.04	2.54
05 75 00 00-0034		Galvanized Steel Sheets, Installed On Walls (05 75 00 00-0001) Note: Includes field fabrication.			
05 75 00 00-0035	SF	0.0217" (26 Gauge) Thick Galvanized Steel Sheet, Installed On Walls..... <i>For >16 To 200 SF, Deduct</i> <i>For >200 To 500 SF, Deduct</i> <i>For >500 SF, Deduct</i>		9.06 -0.63 -1.25 -1.70	1.72
05 75 00 00-0036	SF	0.0276" (24 Gauge) Thick Galvanized Steel Sheet, Installed On Walls..... <i>For >16 To 200 SF, Deduct</i> <i>For >200 To 500 SF, Deduct</i> <i>For >500 SF, Deduct</i>		9.64 -0.66 -1.33 -1.81	1.81
05 75 00 00-0037	SF	0.0336" (22 Gauge) Thick Galvanized Steel Sheet, Installed On Walls..... <i>For >16 To 200 SF, Deduct</i> <i>For >200 To 500 SF, Deduct</i> <i>For >500 SF, Deduct</i>		10.06 -0.69 -1.39 -1.89	1.90
05 75 00 00-0038	SF	0.0396" (20 Gauge) Thick Galvanized Steel Sheet, Installed On Walls..... <i>For >16 To 200 SF, Deduct</i> <i>For >200 To 500 SF, Deduct</i> <i>For >500 SF, Deduct</i>		10.65 -0.73 -1.46 -2.00	1.99
05 75 00 00-0039	SF	0.0516" (18 Gauge) Thick Galvanized Steel Sheet, Installed On Walls..... <i>For >16 To 200 SF, Deduct</i> <i>For >200 To 500 SF, Deduct</i> <i>For >500 SF, Deduct</i>		11.40 -0.78 -1.56 -2.13	2.08
05 75 00 00-0040	SF	0.0635" (16 Gauge) Thick Galvanized Steel Sheet, Installed On Walls..... <i>For >16 To 200 SF, Deduct</i> <i>For >200 To 500 SF, Deduct</i> <i>For >500 SF, Deduct</i>		12.20 -0.83 -1.66 -2.27	2.18
05 75 00 00-0041	SF	0.0785" (14 Gauge) Thick Galvanized Steel Sheet, Installed On Walls..... <i>For >16 To 200 SF, Deduct</i> <i>For >200 To 500 SF, Deduct</i> <i>For >500 SF, Deduct</i>		13.83 -0.93 -1.85 -2.55	2.36
05 75 00 00-0042	SF	0.1084" (12 Gauge) Thick Galvanized Steel Sheet, Installed On Walls..... <i>For >16 To 200 SF, Deduct</i> <i>For >200 To 500 SF, Deduct</i> <i>For >500 SF, Deduct</i>		15.67 -1.04 -2.08 -2.86	2.54
05 75 00 00-0043	SF	0.1382" (10 Gauge) Thick Galvanized Steel Sheet, Installed On Walls..... <i>For >16 To 200 SF, Deduct</i> <i>For >200 To 500 SF, Deduct</i> <i>For >500 SF, Deduct</i>		17.23 -1.13 -2.27 -3.13	2.72
05 75 00 00-0044		Galvanized Zinc-Plated Steel Sheets, Installed On Walls (05 75 00 00-0001) Note: Includes field fabrication.			
05 75 00 00-0045	SF	0.013" Thick Galvanized Zinc Plated Steel Sheet, Installed On Walls..... <i>For >16 To 200 SF, Deduct</i> <i>For >200 To 500 SF, Deduct</i> <i>For >500 SF, Deduct</i>		7.25 -0.50 -0.99 -1.35	1.33
05 75 00 00-0046	SF	0.016" Thick Galvanized Zinc Plated Steel Sheet, Installed On Walls..... <i>For >16 To 200 SF, Deduct</i> <i>For >200 To 500 SF, Deduct</i> <i>For >500 SF, Deduct</i>		8.34 -0.57 -1.14 -1.55	1.50
05 75 00 00-0047	SF	0.019" Thick Galvanized Zinc Plated Steel Sheet, Installed On Walls..... <i>For >16 To 200 SF, Deduct</i> <i>For >200 To 500 SF, Deduct</i> <i>For >500 SF, Deduct</i>		9.43 -0.64 -1.28 -1.75	1.68
05 75 00 00-0048	SF	0.024" Thick Galvanized Zinc Plated Steel Sheet, Installed On Walls..... <i>For >16 To 200 SF, Deduct</i> <i>For >200 To 500 SF, Deduct</i> <i>For >500 SF, Deduct</i>		10.36 -0.70 -1.40 -1.92	1.81

END OF SECTION 05

05	05	Metals
	05 70	Decorative Metal
	05 75	Decorative Formed Metal



MINOR	TOTAL DIRECT	DEMOLITION
CSI UOM DESCRIPTION	UNIT COST	UNIT COST

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MINOR	CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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06 Wood, Plastics, and Composites

06 05 Common Work Results For Wood, Plastics, And Composites

06 05 23 Wood, Plastic, And Composite Fastenings (06 05)

Note: For additional fasteners above normal conditions, for replacing existing fasteners, for relocating existing materials or fixtures, or for different fasteners required due to load limits on standard fasteners.

06 05 23 00-001 Threaded Anchor Bolts (06 05 23)

Note: Threaded on two ends with two nuts and flat washers.

06 05 23 00-0002	EA 1/2" Diameter x 4" Long, Threaded Anchor Bolt.....	8.47	
	For >10 To 50, Deduct	-0.26	
	For >50 To 100, Deduct	-0.60	
	For >100 To 250, Deduct	-1.19	
	For >250 To 500, Deduct	-2.05	
	For >500, Deduct	-2.90	
06 05 23 00-0003	EA 1/2" Diameter x 7-1/2" Long, Threaded Anchor Bolt.....	11.33	
	For >10 To 50, Deduct	-0.28	
	For >50 To 100, Deduct	-0.70	
	For >100 To 250, Deduct	-1.40	
	For >250 To 500, Deduct	-2.37	
	For >500, Deduct	-3.35	
06 05 23 00-0004	EA 3/4" Diameter x 7-1/2" Long, Threaded Anchor Bolt.....	12.47	
	For >10 To 50, Deduct	-0.28	
	For >50 To 100, Deduct	-0.73	
	For >100 To 250, Deduct	-1.45	
	For >250 To 500, Deduct	-2.46	
	For >500, Deduct	-3.46	
06 05 23 00-0005	EA 3/4" Diameter x 12" Long, Threaded Anchor Bolt.....	24.85	
	For >10 To 50, Deduct	-0.38	
	For >50 To 100, Deduct	-1.19	
	For >100 To 250, Deduct	-2.38	
	For >250 To 500, Deduct	-3.94	
	For >500, Deduct	-5.51	

06 05 23 00-0006 Framing Anchors (06 05 23)

06 05 23 00-0007	EA 10 Gauge Framing Anchor.....	4.70	
	For >10 To 50, Deduct	-0.21	
	For >50 To 100, Deduct	-0.43	
	For >100 To 250, Deduct	-0.85	
	For >250 To 500, Deduct	-1.48	
	For >500, Deduct	-2.11	

2.16

06 05 23 00-0008 Holddown Anchors (06 05 23)

06 05 23 00-0009	EA 8-5/8" High x 2-1/2" Wide x 2-1/4" Deep, 12 Gauge, Hold Downs, (Simpson Strong Tie® HD3B).....	30.95	
	For >10 To 50, Deduct	-1.11	
	For >50 To 100, Deduct	-2.44	
	For >100 To 250, Deduct	-4.89	
	For >250 To 500, Deduct	-8.45	
	For >500, Deduct	-12.01	
06 05 23 00-0010	EA 9-3/8" High x 2-1/2" Wide x 2-1/2" Deep, 10 Gauge, Hold Downs, (Simpson Strong Tie® HD5B).....	43.81	
	For >10 To 50, Deduct	-1.11	
	For >50 To 100, Deduct	-2.77	
	For >100 To 250, Deduct	-5.53	
	For >250 To 500, Deduct	-9.41	
	For >500, Deduct	-13.29	
06 05 23 00-0011	EA 12-3/8" High x 2-1/2" Wide x 2-1/2" Deep, 10 Gauge, Hold Downs, (Simpson Strong Tie® HD7B).....	49.74	
	For >10 To 50, Deduct	-1.22	
	For >50 To 100, Deduct	-3.08	
	For >100 To 250, Deduct	-6.15	
	For >250 To 500, Deduct	-10.45	
	For >500, Deduct	-14.75	
06 05 23 00-0012	EA 14" High x 2-1/2" Wide x 2-1/2" Deep, 7 Gauge, Hold Downs, (Simpson Strong Tie® HD9B).....	60.96	
	For >10 To 50, Deduct	-1.37	
	For >50 To 100, Deduct	-3.57	
	For >100 To 250, Deduct	-7.14	
	For >250 To 500, Deduct	-12.08	
	For >500, Deduct	-17.02	
06 05 23 00-0013	EA 20-5/16" High x 3-1/2" Wide x 4-1/2" Deep, 3 Gauge, Hold Downs, (Simpson Strong Tie® HD12).....	122.02	
	For >10 To 50, Deduct	-1.72	
	For >50 To 100, Deduct	-5.64	
	For >100 To 250, Deduct	-11.27	
	For >250 To 500, Deduct	-18.63	
	For >500, Deduct	-25.99	
06 05 23 00-0014	EA 24-1/2" High x 3-1/2" Wide x 4-1/2" Deep, 3 Gauge, Hold Downs, (Simpson Strong Tie® HD19).....	140.64	
	For >10 To 50, Deduct	-1.80	
	For >50 To 100, Deduct	-6.21	
	For >100 To 250, Deduct	-12.42	
	For >250 To 500, Deduct	-20.43	
	For >500, Deduct	-28.43	

06 Wood, Plastics, and Composites**06 05 Common Work Results For Wood, Plastics, And Composites****06 05 23 Wood, Plastic, And Composite Fastenings**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 05 23 00-0015 Joist And Beam Hangers <small>(06 05 23)</small>		
06 05 23 00-0016 EA 18 Gauge Joist Hanger, For 2" x 4" Joist, Also Acceptable For Beam Hangers	4.72	2.01
For >10 To 50, Deduct	-0.21	
For >50 To 100, Deduct	-0.43	
For >100 To 250, Deduct	-0.85	
For >250 To 500, Deduct	-1.48	
For >500, Deduct	-2.12	
06 05 23 00-0017 EA 18 Gauge Joist Hanger, For 2" x 6"-2" x 10" Joist, Also Acceptable For Beam Hangers.....	5.47	2.01
For >10 To 50, Deduct	-0.22	
For >50 To 100, Deduct	-0.46	
For >100 To 250, Deduct	-0.93	
For >250 To 500, Deduct	-1.61	
For >500, Deduct	-2.29	
06 05 23 00-0018 EA 16 Gauge Joist Hanger, For 3" x 6"-3" x 9" Joist, Also Acceptable For Beam Hangers.....	7.21	2.01
For >10 To 50, Deduct	-0.22	
For >50 To 100, Deduct	-0.52	
For >100 To 250, Deduct	-1.03	
For >250 To 500, Deduct	-1.78	
For >500, Deduct	-2.52	
06 05 23 00-0019 EA 16 Gauge Joist Hanger, For 3" x 10"-3" x 14" Joist, Also Acceptable For Beam Hangers.....	7.38	2.01
For >10 To 50, Deduct	-0.22	
For >50 To 100, Deduct	-0.52	
For >100 To 250, Deduct	-1.04	
For >250 To 500, Deduct	-1.79	
For >500, Deduct	-2.53	
06 05 23 00-0020 EA 16 Gauge Joist Hanger, For 4" x 6"-4" x 8" Joist, Also Acceptable For Beam Hangers.....	7.41	2.08
For >10 To 50, Deduct	-0.23	
For >50 To 100, Deduct	-0.53	
For >100 To 250, Deduct	-1.07	
For >250 To 500, Deduct	-1.83	
For >500, Deduct	-2.59	
06 05 23 00-0021 EA 16 Gauge Joist Hanger, For 4" x 10"-4" x 14" Joist, Also Acceptable For Beam Hangers.....	7.88	2.08
For >10 To 50, Deduct	-0.23	
For >50 To 100, Deduct	-0.54	
For >100 To 250, Deduct	-1.09	
For >250 To 500, Deduct	-1.86	
For >500, Deduct	-2.64	
06 05 23 00-0022 Post Framing <small>(06 05 23)</small>		
06 05 23 00-0023 EA 16 Gauge Post Framing With 4" x 4" Base	9.96	2.52
For >10 To 50, Deduct	-0.28	
For >50 To 100, Deduct	-0.66	
For >100 To 250, Deduct	-1.33	
For >250 To 500, Deduct	-2.27	
For >500, Deduct	-3.21	
06 05 23 00-0024 EA 16 Gauge Post Framing With 4" x 4" Cap.....	8.21	2.52
For >10 To 50, Deduct	-0.28	
For >50 To 100, Deduct	-0.62	
For >100 To 250, Deduct	-1.24	
For >250 To 500, Deduct	-2.14	
For >500, Deduct	-3.03	
06 05 23 00-0025 Rafter Anchors <small>(06 05 23)</small>		
06 05 23 00-0026 EA 1-1/2" Wide x 5-1/4" Long, 18 Gauge Rafter Anchor	5.27	2.23
For >10 To 50, Deduct	-0.25	
For >50 To 100, Deduct	-0.50	
For >100 To 250, Deduct	-1.01	
For >250 To 500, Deduct	-1.76	
For >500, Deduct	-2.51	
06 05 23 00-0027 EA 1-1/2" Wide x 10-3/4" Long, 18 Gauge Rafter Anchor	5.46	2.23
For >10 To 50, Deduct	-0.25	
For >50 To 100, Deduct	-0.51	
For >100 To 250, Deduct	-1.02	
For >250 To 500, Deduct	-1.77	
For >500, Deduct	-2.53	
06 05 23 00-0028 EA Galvanized Rigid Rafter Connector, For 2" x 6".....	6.66	2.23
For >10 To 50, Deduct	-0.25	
For >50 To 100, Deduct	-0.54	
For >100 To 250, Deduct	-1.08	
For >250 To 500, Deduct	-1.86	
For >500, Deduct	-2.65	
06 05 23 00-0029 Bolts And Fasteners <small>(06 05 23)</small>		
06 05 23 00-0030 Carriage Bolts <small>(06 05 23 00-0029)</small>		
Note: Includes drilling of holes in any material. Includes nut and washer.		
06 05 23 00-0031 Zinc Plated Steel, Low Carbon/Grade 2, Carriage Bolts <small>(06 05 23 00-0030)</small>		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 05 23 00-0032 EA 1/4" Diameter x 2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Carriage Bolt.....	9.55	
<i>For >10 To 50, Deduct</i>	-0.47	
<i>For >50 To 100, Deduct</i>	-0.94	
<i>For >100 To 250, Deduct</i>	-1.88	
<i>For >250 To 500, Deduct</i>	-3.28	
<i>For >500, Deduct</i>	-4.69	
06 05 23 00-0033 EA 1/4" Diameter x 4" Length, Zinc Plated Steel, Low Carbon/Grade 2, Carriage Bolt.....	9.64	
<i>For >10 To 50, Deduct</i>	-0.47	
<i>For >50 To 100, Deduct</i>	-0.94	
<i>For >100 To 250, Deduct</i>	-1.88	
<i>For >250 To 500, Deduct</i>	-3.29	
<i>For >500, Deduct</i>	-4.70	
06 05 23 00-0034 EA 1/4" Diameter x 6" Length, Zinc Plated Steel, Low Carbon/Grade 2, Carriage Bolt.....	9.70	
<i>For >10 To 50, Deduct</i>	-0.47	
<i>For >50 To 100, Deduct</i>	-0.94	
<i>For >100 To 250, Deduct</i>	-1.88	
<i>For >250 To 500, Deduct</i>	-3.29	
<i>For >500, Deduct</i>	-4.70	
06 05 23 00-0035 EA 1/4" Diameter x 8" Length, Zinc Plated Steel, Low Carbon/Grade 2, Carriage Bolt.....	11.33	
<i>For >10 To 50, Deduct</i>	-0.54	
<i>For >50 To 100, Deduct</i>	-1.09	
<i>For >100 To 250, Deduct</i>	-2.18	
<i>For >250 To 500, Deduct</i>	-3.81	
<i>For >500, Deduct</i>	-5.45	
06 05 23 00-0036 EA 3/8" Diameter x 2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Carriage Bolt.....	10.53	
<i>For >10 To 50, Deduct</i>	-0.50	
<i>For >50 To 100, Deduct</i>	-1.02	
<i>For >100 To 250, Deduct</i>	-2.04	
<i>For >250 To 500, Deduct</i>	-3.56	
<i>For >500, Deduct</i>	-5.08	
06 05 23 00-0037 EA 3/8" Diameter x 4" Length, Zinc Plated Steel, Low Carbon/Grade 2, Carriage Bolt.....	11.41	
<i>For >10 To 50, Deduct</i>	-0.54	
<i>For >50 To 100, Deduct</i>	-1.09	
<i>For >100 To 250, Deduct</i>	-2.19	
<i>For >250 To 500, Deduct</i>	-3.82	
<i>For >500, Deduct</i>	-5.45	
06 05 23 00-0038 EA 3/8" Diameter x 6" Length, Zinc Plated Steel, Low Carbon/Grade 2, Carriage Bolt.....	11.56	
<i>For >10 To 50, Deduct</i>	-0.54	
<i>For >50 To 100, Deduct</i>	-1.10	
<i>For >100 To 250, Deduct</i>	-2.20	
<i>For >250 To 500, Deduct</i>	-3.83	
<i>For >500, Deduct</i>	-5.47	
06 05 23 00-0039 EA 3/8" Diameter x 8" Length, Zinc Plated Steel, Low Carbon/Grade 2, Carriage Bolt.....	13.82	
<i>For >10 To 50, Deduct</i>	-0.65	
<i>For >50 To 100, Deduct</i>	-1.32	
<i>For >100 To 250, Deduct</i>	-2.63	
<i>For >250 To 500, Deduct</i>	-4.59	
<i>For >500, Deduct</i>	-6.55	
06 05 23 00-0040 EA 3/8" Diameter x 10" Length, Zinc Plated Steel, Low Carbon/Grade 2, Carriage Bolt.....	15.00	
<i>For >10 To 50, Deduct</i>	-0.68	
<i>For >50 To 100, Deduct</i>	-1.40	
<i>For >100 To 250, Deduct</i>	-2.80	
<i>For >250 To 500, Deduct</i>	-4.88	
<i>For >500, Deduct</i>	-6.96	
06 05 23 00-0041 EA 3/8" Diameter x 12" Length, Zinc Plated Steel, Low Carbon/Grade 2, Carriage Bolt.....	16.89	
<i>For >10 To 50, Deduct</i>	-0.75	
<i>For >50 To 100, Deduct</i>	-1.55	
<i>For >100 To 250, Deduct</i>	-3.11	
<i>For >250 To 500, Deduct</i>	-5.41	
<i>For >500, Deduct</i>	-7.72	
06 05 23 00-0042 EA 1/2" Diameter x 2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Carriage Bolt.....	11.74	
<i>For >10 To 50, Deduct</i>	-0.54	
<i>For >50 To 100, Deduct</i>	-1.10	
<i>For >100 To 250, Deduct</i>	-2.20	
<i>For >250 To 500, Deduct</i>	-3.85	
<i>For >500, Deduct</i>	-5.49	
06 05 23 00-0043 EA 1/2" Diameter x 4" Length, Zinc Plated Steel, Low Carbon/Grade 2, Carriage Bolt.....	12.84	
<i>For >10 To 50, Deduct</i>	-0.57	
<i>For >50 To 100, Deduct</i>	-1.18	
<i>For >100 To 250, Deduct</i>	-2.37	
<i>For >250 To 500, Deduct</i>	-4.12	
<i>For >500, Deduct</i>	-5.88	
06 05 23 00-0044 EA 1/2" Diameter x 6" Length, Zinc Plated Steel, Low Carbon/Grade 2, Carriage Bolt.....	13.69	
<i>For >10 To 50, Deduct</i>	-0.61	
<i>For >50 To 100, Deduct</i>	-1.26	
<i>For >100 To 250, Deduct</i>	-2.52	
<i>For >250 To 500, Deduct</i>	-4.38	
<i>For >500, Deduct</i>	-6.25	
06 05 23 00-0045 EA 1/2" Diameter x 8" Length, Zinc Plated Steel, Low Carbon/Grade 2, Carriage Bolt.....	15.35	
<i>For >10 To 50, Deduct</i>	-0.68	
<i>For >50 To 100, Deduct</i>	-1.41	
<i>For >100 To 250, Deduct</i>	-2.82	
<i>For >250 To 500, Deduct</i>	-4.91	
<i>For >500, Deduct</i>	-7.00	

06 Wood, Plastics, and Composites**06 05 Common Work Results For Wood, Plastics, And Composites****06 05 23 Wood, Plastic, And Composite Fastenings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 05 23 00-0046	EA		1/2" Diameter x 10" Length, Zinc Plated Steel, Low Carbon/Grade 2, Carriage Bolt	18.03	
			<i>For >10 To 50, Deduct</i>	-0.79	
			<i>For >50 To 100, Deduct</i>	-1.64	
			<i>For >100 To 250, Deduct</i>	-3.27	
			<i>For >250 To 500, Deduct</i>	-5.70	
			<i>For >500, Deduct</i>	-8.12	
06 05 23 00-0047	EA		1/2" Diameter x 12" Length, Zinc Plated Steel, Low Carbon/Grade 2, Carriage Bolt	20.19	
			<i>For >10 To 50, Deduct</i>	-0.86	
			<i>For >50 To 100, Deduct</i>	-1.80	
			<i>For >100 To 250, Deduct</i>	-3.60	
			<i>For >250 To 500, Deduct</i>	-6.26	
			<i>For >500, Deduct</i>	-8.92	
06 05 23 00-0048	EA		3/4" Diameter x 2" Length, Zinc Plated Steel, Low Carbon/Grade 2, Carriage Bolt	15.97	
			<i>For >10 To 50, Deduct</i>	-0.65	
			<i>For >50 To 100, Deduct</i>	-1.37	
			<i>For >100 To 250, Deduct</i>	-2.74	
			<i>For >250 To 500, Deduct</i>	-4.75	
			<i>For >500, Deduct</i>	-6.77	
06 05 23 00-0049	EA		3/4" Diameter x 4" Length, Zinc Plated Steel, Low Carbon/Grade 2, Carriage Bolt	17.31	
			<i>For >10 To 50, Deduct</i>	-0.68	
			<i>For >50 To 100, Deduct</i>	-1.46	
			<i>For >100 To 250, Deduct</i>	-2.91	
			<i>For >250 To 500, Deduct</i>	-5.05	
			<i>For >500, Deduct</i>	-7.19	
06 05 23 00-0050	EA		3/4" Diameter x 6" Length, Zinc Plated Steel, Low Carbon/Grade 2, Carriage Bolt	20.72	
			<i>For >10 To 50, Deduct</i>	-0.79	
			<i>For >50 To 100, Deduct</i>	-1.70	
			<i>For >100 To 250, Deduct</i>	-3.41	
			<i>For >250 To 500, Deduct</i>	-5.90	
			<i>For >500, Deduct</i>	-8.39	
06 05 23 00-0051	EA		3/4" Diameter x 8" Length, Zinc Plated Steel, Low Carbon/Grade 2, Carriage Bolt	23.26	
			<i>For >10 To 50, Deduct</i>	-0.83	
			<i>For >50 To 100, Deduct</i>	-1.82	
			<i>For >100 To 250, Deduct</i>	-3.64	
			<i>For >250 To 500, Deduct</i>	-6.29	
			<i>For >500, Deduct</i>	-8.94	
06 05 23 00-0052	EA		3/4" Diameter x 10" Length, Zinc Plated Steel, Low Carbon/Grade 2, Carriage Bolt	25.24	
			<i>For >10 To 50, Deduct</i>	-0.90	
			<i>For >50 To 100, Deduct</i>	-1.98	
			<i>For >100 To 250, Deduct</i>	-3.95	
			<i>For >250 To 500, Deduct</i>	-6.83	
			<i>For >500, Deduct</i>	-9.70	
06 05 23 00-0053	EA		3/4" Diameter x 12" Length, Zinc Plated Steel, Low Carbon/Grade 2, Carriage Bolt	25.76	
			<i>For >10 To 50, Deduct</i>	-0.93	
			<i>For >50 To 100, Deduct</i>	-2.05	
			<i>For >100 To 250, Deduct</i>	-4.09	
			<i>For >250 To 500, Deduct</i>	-7.07	
			<i>For >500, Deduct</i>	-10.05	
06 05 23 00-0054			Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Carriage Bolts (06 05 23 00-0030)		
06 05 23 00-0055	EA		1/4" Diameter x 2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Carriage Bolt	9.72	
			<i>For >10 To 50, Deduct</i>	-0.47	
			<i>For >50 To 100, Deduct</i>	-0.94	
			<i>For >100 To 250, Deduct</i>	-1.89	
			<i>For >250 To 500, Deduct</i>	-3.29	
			<i>For >500, Deduct</i>	-4.70	
06 05 23 00-0056	EA		1/4" Diameter x 4" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Carriage Bolt	9.90	
			<i>For >10 To 50, Deduct</i>	-0.47	
			<i>For >50 To 100, Deduct</i>	-0.95	
			<i>For >100 To 250, Deduct</i>	-1.89	
			<i>For >250 To 500, Deduct</i>	-3.31	
			<i>For >500, Deduct</i>	-4.72	
06 05 23 00-0057	EA		1/4" Diameter x 6" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Carriage Bolt	10.10	
			<i>For >10 To 50, Deduct</i>	-0.47	
			<i>For >50 To 100, Deduct</i>	-0.95	
			<i>For >100 To 250, Deduct</i>	-1.90	
			<i>For >250 To 500, Deduct</i>	-3.32	
			<i>For >500, Deduct</i>	-4.74	
06 05 23 00-0058	EA		1/4" Diameter x 8" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Carriage Bolt	11.99	
			<i>For >10 To 50, Deduct</i>	-0.54	
			<i>For >50 To 100, Deduct</i>	-1.11	
			<i>For >100 To 250, Deduct</i>	-2.22	
			<i>For >250 To 500, Deduct</i>	-3.86	
			<i>For >500, Deduct</i>	-5.51	
06 05 23 00-0059	EA		3/8" Diameter x 2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Carriage Bolt	10.77	
			<i>For >10 To 50, Deduct</i>	-0.50	
			<i>For >50 To 100, Deduct</i>	-1.02	
			<i>For >100 To 250, Deduct</i>	-2.05	
			<i>For >250 To 500, Deduct</i>	-3.57	
			<i>For >500, Deduct</i>	-5.10	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 05 23 00-0060 EA 3/8" Diameter x 4" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Carriage Bolt	11.78	
<i>For >10 To 50, Deduct</i>	-0.54	
<i>For >50 To 100, Deduct</i>	-1.10	
<i>For >100 To 250, Deduct</i>	-2.21	
<i>For >250 To 500, Deduct</i>	-3.85	
<i>For >500, Deduct</i>	-5.49	
06 05 23 00-0061 EA 3/8" Diameter x 6" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Carriage Bolt	12.00	
<i>For >10 To 50, Deduct</i>	-0.54	
<i>For >50 To 100, Deduct</i>	-1.11	
<i>For >100 To 250, Deduct</i>	-2.22	
<i>For >250 To 500, Deduct</i>	-3.86	
<i>For >500, Deduct</i>	-5.51	
06 05 23 00-0062 EA 3/8" Diameter x 8" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Carriage Bolt	14.49	
<i>For >10 To 50, Deduct</i>	-0.65	
<i>For >50 To 100, Deduct</i>	-1.33	
<i>For >100 To 250, Deduct</i>	-2.66	
<i>For >250 To 500, Deduct</i>	-4.64	
<i>For >500, Deduct</i>	-6.62	
06 05 23 00-0063 EA 3/8" Diameter x 10" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Carriage Bolt	15.75	
<i>For >10 To 50, Deduct</i>	-0.68	
<i>For >50 To 100, Deduct</i>	-1.42	
<i>For >100 To 250, Deduct</i>	-2.84	
<i>For >250 To 500, Deduct</i>	-4.94	
<i>For >500, Deduct</i>	-7.04	
06 05 23 00-0064 EA 3/8" Diameter x 12" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Carriage Bolt	17.59	
<i>For >10 To 50, Deduct</i>	-0.75	
<i>For >50 To 100, Deduct</i>	-1.57	
<i>For >100 To 250, Deduct</i>	-3.14	
<i>For >250 To 500, Deduct</i>	-5.47	
<i>For >500, Deduct</i>	-7.79	
06 05 23 00-0065 EA 1/2" Diameter x 2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Carriage Bolt	12.29	
<i>For >10 To 50, Deduct</i>	-0.54	
<i>For >50 To 100, Deduct</i>	-1.12	
<i>For >100 To 250, Deduct</i>	-2.23	
<i>For >250 To 500, Deduct</i>	-3.89	
<i>For >500, Deduct</i>	-5.54	
06 05 23 00-0066 EA 1/2" Diameter x 4" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Carriage Bolt	13.28	
<i>For >10 To 50, Deduct</i>	-0.57	
<i>For >50 To 100, Deduct</i>	-1.19	
<i>For >100 To 250, Deduct</i>	-2.39	
<i>For >250 To 500, Deduct</i>	-4.16	
<i>For >500, Deduct</i>	-5.92	
06 05 23 00-0067 EA 1/2" Diameter x 6" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Carriage Bolt	14.21	
<i>For >10 To 50, Deduct</i>	-0.61	
<i>For >50 To 100, Deduct</i>	-1.27	
<i>For >100 To 250, Deduct</i>	-2.54	
<i>For >250 To 500, Deduct</i>	-4.42	
<i>For >500, Deduct</i>	-6.31	
06 05 23 00-0068 EA 1/2" Diameter x 8" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Carriage Bolt	16.10	
<i>For >10 To 50, Deduct</i>	-0.68	
<i>For >50 To 100, Deduct</i>	-1.43	
<i>For >100 To 250, Deduct</i>	-2.85	
<i>For >250 To 500, Deduct</i>	-4.96	
<i>For >500, Deduct</i>	-7.07	
06 05 23 00-0069 EA 1/2" Diameter x 10" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Carriage Bolt	18.77	
<i>For >10 To 50, Deduct</i>	-0.79	
<i>For >50 To 100, Deduct</i>	-1.65	
<i>For >100 To 250, Deduct</i>	-3.31	
<i>For >250 To 500, Deduct</i>	-5.75	
<i>For >500, Deduct</i>	-8.20	
06 05 23 00-0070 EA 1/2" Diameter x 12" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Carriage Bolt	20.76	
<i>For >10 To 50, Deduct</i>	-0.86	
<i>For >50 To 100, Deduct</i>	-1.81	
<i>For >100 To 250, Deduct</i>	-3.62	
<i>For >250 To 500, Deduct</i>	-6.30	
<i>For >500, Deduct</i>	-8.97	
06 05 23 00-0071 EA 3/4" Diameter x 2" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Carriage Bolt	17.65	
<i>For >10 To 50, Deduct</i>	-0.65	
<i>For >50 To 100, Deduct</i>	-1.41	
<i>For >100 To 250, Deduct</i>	-2.82	
<i>For >250 To 500, Deduct</i>	-4.88	
<i>For >500, Deduct</i>	-6.94	
06 05 23 00-0072 EA 3/4" Diameter x 4" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Carriage Bolt	18.48	
<i>For >10 To 50, Deduct</i>	-0.68	
<i>For >50 To 100, Deduct</i>	-1.49	
<i>For >100 To 250, Deduct</i>	-2.97	
<i>For >250 To 500, Deduct</i>	-5.14	
<i>For >500, Deduct</i>	-7.31	
06 05 23 00-0073 EA 3/4" Diameter x 6" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Carriage Bolt	21.55	
<i>For >10 To 50, Deduct</i>	-0.79	
<i>For >50 To 100, Deduct</i>	-1.72	
<i>For >100 To 250, Deduct</i>	-3.45	
<i>For >250 To 500, Deduct</i>	-5.96	
<i>For >500, Deduct</i>	-8.48	

06 Wood, Plastics, and Composites**06 05 Common Work Results For Wood, Plastics, And Composites****06 05 23 Wood, Plastic, And Composite Fastenings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 05 23 00-0074	EA		3/4" Diameter x 8" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Carriage Bolt	23.20	
			<i>For >10 To 50, Deduct</i>	-0.83	
			<i>For >50 To 100, Deduct</i>	-1.82	
			<i>For >100 To 250, Deduct</i>	-3.64	
			<i>For >250 To 500, Deduct</i>	-6.29	
			<i>For >500, Deduct</i>	-8.93	
06 05 23 00-0075	EA		3/4" Diameter x 10" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Carriage Bolt	26.33	
			<i>For >10 To 50, Deduct</i>	-0.90	
			<i>For >50 To 100, Deduct</i>	-2.00	
			<i>For >100 To 250, Deduct</i>	-4.01	
			<i>For >250 To 500, Deduct</i>	-6.91	
			<i>For >500, Deduct</i>	-9.81	
06 05 23 00-0076	EA		3/4" Diameter x 12" Length, Hot Dipped Galvanized Steel, Low Carbon/Grade 2, Carriage Bolt	28.02	
			<i>For >10 To 50, Deduct</i>	-0.93	
			<i>For >50 To 100, Deduct</i>	-2.10	
			<i>For >100 To 250, Deduct</i>	-4.20	
			<i>For >250 To 500, Deduct</i>	-7.24	
			<i>For >500, Deduct</i>	-10.27	
06 05 23 00-0077			304/18-8 Stainless Steel, Carriage Bolts <small>(06 05 23 00-0030)</small>	10.07	
06 05 23 00-0078	EA		1/4" Diameter x 2" Length, 304/18-8 Stainless Steel, Carriage Bolt	10.07	
			<i>For >10 To 50, Deduct</i>	-0.47	
			<i>For >50 To 100, Deduct</i>	-0.95	
			<i>For >100 To 250, Deduct</i>	-1.90	
			<i>For >250 To 500, Deduct</i>	-3.32	
			<i>For >500, Deduct</i>	-4.74	
06 05 23 00-0079	EA		1/4" Diameter x 4" Length, 304/18-8 Stainless Steel, Carriage Bolt	10.88	
			<i>For >10 To 50, Deduct</i>	-0.47	
			<i>For >50 To 100, Deduct</i>	-0.97	
			<i>For >100 To 250, Deduct</i>	-1.94	
			<i>For >250 To 500, Deduct</i>	-3.38	
			<i>For >500, Deduct</i>	-4.82	
06 05 23 00-0080	EA		1/4" Diameter x 6" Length, 304/18-8 Stainless Steel, Carriage Bolt	11.42	
			<i>For >10 To 50, Deduct</i>	-0.47	
			<i>For >50 To 100, Deduct</i>	-0.99	
			<i>For >100 To 250, Deduct</i>	-1.97	
			<i>For >250 To 500, Deduct</i>	-3.42	
			<i>For >500, Deduct</i>	-4.87	
06 05 23 00-0081	EA		1/4" Diameter x 8" Length, 304/18-8 Stainless Steel, Carriage Bolt	18.59	
			<i>For >10 To 50, Deduct</i>	-0.54	
			<i>For >50 To 100, Deduct</i>	-1.27	
			<i>For >100 To 250, Deduct</i>	-2.55	
			<i>For >250 To 500, Deduct</i>	-4.36	
			<i>For >500, Deduct</i>	-6.17	
06 05 23 00-0082	EA		3/8" Diameter x 2" Length, 304/18-8 Stainless Steel, Carriage Bolt	11.56	
			<i>For >10 To 50, Deduct</i>	-0.50	
			<i>For >50 To 100, Deduct</i>	-1.04	
			<i>For >100 To 250, Deduct</i>	-2.09	
			<i>For >250 To 500, Deduct</i>	-3.63	
			<i>For >500, Deduct</i>	-5.18	
06 05 23 00-0083	EA		3/8" Diameter x 4" Length, 304/18-8 Stainless Steel, Carriage Bolt	13.45	
			<i>For >10 To 50, Deduct</i>	-0.54	
			<i>For >50 To 100, Deduct</i>	-1.14	
			<i>For >100 To 250, Deduct</i>	-2.29	
			<i>For >250 To 500, Deduct</i>	-3.97	
			<i>For >500, Deduct</i>	-5.66	
06 05 23 00-0084	EA		3/8" Diameter x 6" Length, 304/18-8 Stainless Steel, Carriage Bolt	13.71	
			<i>For >10 To 50, Deduct</i>	-0.54	
			<i>For >50 To 100, Deduct</i>	-1.15	
			<i>For >100 To 250, Deduct</i>	-2.30	
			<i>For >250 To 500, Deduct</i>	-3.99	
			<i>For >500, Deduct</i>	-5.68	
06 05 23 00-0085	EA		3/8" Diameter x 8" Length, 304/18-8 Stainless Steel, Carriage Bolt	24.33	
			<i>For >10 To 50, Deduct</i>	-0.65	
			<i>For >50 To 100, Deduct</i>	-1.58	
			<i>For >100 To 250, Deduct</i>	-3.16	
			<i>For >250 To 500, Deduct</i>	-5.38	
			<i>For >500, Deduct</i>	-7.61	
06 05 23 00-0086	EA		3/8" Diameter x 10" Length, 304/18-8 Stainless Steel, Carriage Bolt	29.28	
			<i>For >10 To 50, Deduct</i>	-0.68	
			<i>For >50 To 100, Deduct</i>	-1.76	
			<i>For >100 To 250, Deduct</i>	-3.51	
			<i>For >250 To 500, Deduct</i>	-5.95	
			<i>For >500, Deduct</i>	-8.39	
06 05 23 00-0087	EA		3/8" Diameter x 12" Length, 304/18-8 Stainless Steel, Carriage Bolt	32.77	
			<i>For >10 To 50, Deduct</i>	-0.75	
			<i>For >50 To 100, Deduct</i>	-1.95	
			<i>For >100 To 250, Deduct</i>	-3.90	
			<i>For >250 To 500, Deduct</i>	-6.60	
			<i>For >500, Deduct</i>	-9.31	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 05 23 00-0088 EA 1/2" Diameter x 2" Length, 304/18-8 Stainless Steel, Carriage Bolt	14.40	
<i>For >10 To 50, Deduct</i>	-0.54	
<i>For >50 To 100, Deduct</i>	-1.17	
<i>For >100 To 250, Deduct</i>	-2.34	
<i>For >250 To 500, Deduct</i>	-4.04	
<i>For >500, Deduct</i>	-5.75	
06 05 23 00-0089 EA 1/2" Diameter x 4" Length, 304/18-8 Stainless Steel, Carriage Bolt	16.24	
<i>For >10 To 50, Deduct</i>	-0.57	
<i>For >50 To 100, Deduct</i>	-1.27	
<i>For >100 To 250, Deduct</i>	-2.54	
<i>For >250 To 500, Deduct</i>	-4.38	
<i>For >500, Deduct</i>	-6.22	
06 05 23 00-0090 EA 1/2" Diameter x 6" Length, 304/18-8 Stainless Steel, Carriage Bolt	19.43	
<i>For >10 To 50, Deduct</i>	-0.61	
<i>For >50 To 100, Deduct</i>	-1.40	
<i>For >100 To 250, Deduct</i>	-2.80	
<i>For >250 To 500, Deduct</i>	-4.82	
<i>For >500, Deduct</i>	-6.83	
06 05 23 00-0091 EA 1/2" Diameter x 8" Length, 304/18-8 Stainless Steel, Carriage Bolt	30.03	
<i>For >10 To 50, Deduct</i>	-0.68	
<i>For >50 To 100, Deduct</i>	-1.77	
<i>For >100 To 250, Deduct</i>	-3.55	
<i>For >250 To 500, Deduct</i>	-6.01	
<i>For >500, Deduct</i>	-8.46	
06 05 23 00-0092 EA 1/2" Diameter x 10" Length, 304/18-8 Stainless Steel, Carriage Bolt	33.97	
<i>For >10 To 50, Deduct</i>	-0.79	
<i>For >50 To 100, Deduct</i>	-2.03	
<i>For >100 To 250, Deduct</i>	-4.07	
<i>For >250 To 500, Deduct</i>	-6.89	
<i>For >500, Deduct</i>	-9.72	
06 05 23 00-0093 EA 1/2" Diameter x 12" Length, 304/18-8 Stainless Steel, Carriage Bolt	52.20	
<i>For >10 To 50, Deduct</i>	-0.86	
<i>For >50 To 100, Deduct</i>	-2.60	
<i>For >100 To 250, Deduct</i>	-5.20	
<i>For >250 To 500, Deduct</i>	-8.66	
<i>For >500, Deduct</i>	-12.12	
06 05 23 00-0094 EA 3/4" Diameter x 4" Length, 304/18-8 Stainless Steel, Carriage Bolt	40.58	
<i>For >10 To 50, Deduct</i>	-0.68	
<i>For >50 To 100, Deduct</i>	-2.04	
<i>For >100 To 250, Deduct</i>	-4.08	
<i>For >250 To 500, Deduct</i>	-6.80	
<i>For >500, Deduct</i>	-9.52	
06 05 23 00-0095 EA 3/4" Diameter x 6" Length, 304/18-8 Stainless Steel, Carriage Bolt	56.93	
<i>For >10 To 50, Deduct</i>	-0.79	
<i>For >50 To 100, Deduct</i>	-2.61	
<i>For >100 To 250, Deduct</i>	-5.22	
<i>For >250 To 500, Deduct</i>	-8.61	
<i>For >500, Deduct</i>	-12.01	
06 05 23 00-0096 EA 3/4" Diameter x 8" Length, 304/18-8 Stainless Steel, Carriage Bolt	62.95	
<i>For >10 To 50, Deduct</i>	-0.83	
<i>For >50 To 100, Deduct</i>	-2.81	
<i>For >100 To 250, Deduct</i>	-5.63	
<i>For >250 To 500, Deduct</i>	-9.27	
<i>For >500, Deduct</i>	-12.91	
06 05 23 00-0097 EA 3/4" Diameter x 10" Length, 304/18-8 Stainless Steel, Carriage Bolt	91.93	
<i>For >10 To 50, Deduct</i>	-0.90	
<i>For >50 To 100, Deduct</i>	-3.64	
<i>For >100 To 250, Deduct</i>	-7.29	
<i>For >250 To 500, Deduct</i>	-11.83	
<i>For >500, Deduct</i>	-16.37	
06 05 23 00-0098 EA 3/4" Diameter x 12" Length, 304/18-8 Stainless Steel, Carriage Bolt	96.68	
<i>For >10 To 50, Deduct</i>	-0.93	
<i>For >50 To 100, Deduct</i>	-3.82	
<i>For >100 To 250, Deduct</i>	-7.64	
<i>For >250 To 500, Deduct</i>	-12.39	
<i>For >500, Deduct</i>	-17.14	
06 05 23 00-0099 316 Stainless Steel, Carriage Bolts <small>(06 05 23 00-0030)</small>		
06 05 23 00-0100 EA 1/4" Diameter x 2" Length, 316 Stainless Steel, Carriage Bolt.....	13.83	
<i>For >10 To 50, Deduct</i>	-0.47	
<i>For >50 To 100, Deduct</i>	-1.05	
<i>For >100 To 250, Deduct</i>	-2.09	
<i>For >250 To 500, Deduct</i>	-3.60	
<i>For >500, Deduct</i>	-5.12	
06 05 23 00-0101 EA 1/4" Diameter x 4" Length, 316 Stainless Steel, Carriage Bolt.....	15.25	
<i>For >10 To 50, Deduct</i>	-0.47	
<i>For >50 To 100, Deduct</i>	-1.08	
<i>For >100 To 250, Deduct</i>	-2.16	
<i>For >250 To 500, Deduct</i>	-3.71	
<i>For >500, Deduct</i>	-5.26	

06 Wood, Plastics, and Composites**06 05 Common Work Results For Wood, Plastics, And Composites****06 05 23 Wood, Plastic, And Composite Fastenings**

MINOR		TOTAL DIRECT	DEMOLITION
CSI	UOM DESCRIPTION	UNIT COST	UNIT COST
06 05 23 00-0102	EA 3/8" Diameter x 2" Length, 316 Stainless Steel, Carriage Bolt.....	16.47	
	For >10 To 50, Deduct	-0.50	
	For >50 To 100, Deduct	-1.17	
	For >100 To 250, Deduct	-2.33	
	For >250 To 500, Deduct	-4.00	
	For >500, Deduct	-5.67	
06 05 23 00-0103	EA 3/8" Diameter x 4" Length, 316 Stainless Steel, Carriage Bolt.....	19.17	
	For >10 To 50, Deduct	-0.54	
	For >50 To 100, Deduct	-1.29	
	For >100 To 250, Deduct	-2.58	
	For >250 To 500, Deduct	-4.40	
	For >500, Deduct	-6.23	
06 05 23 00-0104	EA 1/2" Diameter x 2" Length, 316 Stainless Steel, Carriage Bolt.....	25.51	
	For >10 To 50, Deduct	-0.54	
	For >50 To 100, Deduct	-1.45	
	For >100 To 250, Deduct	-2.89	
	For >250 To 500, Deduct	-4.88	
	For >500, Deduct	-6.86	
06 05 23 00-0105	EA 1/2" Diameter x 4" Length, 316 Stainless Steel, Carriage Bolt.....	27.76	
	For >10 To 50, Deduct	-0.57	
	For >50 To 100, Deduct	-1.56	
	For >100 To 250, Deduct	-3.11	
	For >250 To 500, Deduct	-5.24	
	For >500, Deduct	-7.37	
06 05 23 00-0106	EA 1/2" Diameter x 6" Length, 316 Stainless Steel, Carriage Bolt.....	29.90	
	For >10 To 50, Deduct	-0.61	
	For >50 To 100, Deduct	-1.66	
	For >100 To 250, Deduct	-3.33	
	For >250 To 500, Deduct	-5.60	
	For >500, Deduct	-7.87	
06 05 23 00-0107	Hex Lag Bolts <small>(06 05 23 00-0029)</small>		
	Note: Includes drilling of holes in any material.		
06 05 23 00-0108	Zinc Plated Steel, Hex Lag Bolts <small>(06 05 23 00-0107)</small>		
06 05 23 00-0109	EA 1/4" Diameter x 2" Length, Zinc Plated Steel, Hex Lag Bolt.....	9.11	
	For >10 To 50, Deduct	-0.45	
	For >50 To 100, Deduct	-0.90	
	For >100 To 250, Deduct	-1.80	
	For >250 To 500, Deduct	-3.15	
	For >500, Deduct	-4.50	
06 05 23 00-0110	EA 1/4" Diameter x 4" Length, Zinc Plated Steel, Hex Lag Bolt.....	9.20	
	For >10 To 50, Deduct	-0.45	
	For >50 To 100, Deduct	-0.90	
	For >100 To 250, Deduct	-1.81	
	For >250 To 500, Deduct	-3.16	
	For >500, Deduct	-4.51	
06 05 23 00-0111	EA 1/4" Diameter x 6" Length, Zinc Plated Steel, Hex Lag Bolt.....	9.36	
	For >10 To 50, Deduct	-0.45	
	For >50 To 100, Deduct	-0.91	
	For >100 To 250, Deduct	-1.82	
	For >250 To 500, Deduct	-3.17	
	For >500, Deduct	-4.53	
06 05 23 00-0112	EA 3/8" Diameter x 2" Length, Zinc Plated Steel, Hex Lag Bolt.....	10.04	
	For >10 To 50, Deduct	-0.49	
	For >50 To 100, Deduct	-0.99	
	For >100 To 250, Deduct	-1.97	
	For >250 To 500, Deduct	-3.45	
	For >500, Deduct	-4.92	
06 05 23 00-0113	EA 3/8" Diameter x 4" Length, Zinc Plated Steel, Hex Lag Bolt.....	10.89	
	For >10 To 50, Deduct	-0.52	
	For >50 To 100, Deduct	-1.06	
	For >100 To 250, Deduct	-2.12	
	For >250 To 500, Deduct	-3.70	
	For >500, Deduct	-5.28	
06 05 23 00-0114	EA 3/8" Diameter x 6" Length, Zinc Plated Steel, Hex Lag Bolt.....	11.08	
	For >10 To 50, Deduct	-0.52	
	For >50 To 100, Deduct	-1.06	
	For >100 To 250, Deduct	-2.13	
	For >250 To 500, Deduct	-3.71	
	For >500, Deduct	-5.30	
06 05 23 00-0115	EA 3/8" Diameter x 8" Length, Zinc Plated Steel, Hex Lag Bolt.....	13.56	
	For >10 To 50, Deduct	-0.63	
	For >50 To 100, Deduct	-1.28	
	For >100 To 250, Deduct	-2.57	
	For >250 To 500, Deduct	-4.48	
	For >500, Deduct	-6.39	
06 05 23 00-0116	EA 3/8" Diameter x 10" Length, Zinc Plated Steel, Hex Lag Bolt.....	14.37	
	For >10 To 50, Deduct	-0.66	
	For >50 To 100, Deduct	-1.36	
	For >100 To 250, Deduct	-2.71	
	For >250 To 500, Deduct	-4.73	
	For >500, Deduct	-6.75	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 05 23 00-0117 EA 1/2" Diameter x 2" Length, Zinc Plated Steel, Hex Lag Bolt.....	11.09	
<i>For >10 To 50, Deduct</i>	-0.53	
<i>For >50 To 100, Deduct</i>	-1.07	
<i>For >100 To 250, Deduct</i>	-2.14	
<i>For >250 To 500, Deduct</i>	-3.74	
<i>For >500, Deduct</i>	-5.33	
06 05 23 00-0118 EA 1/2" Diameter x 4" Length, Zinc Plated Steel, Hex Lag Bolt.....	12.07	
<i>For >10 To 50, Deduct</i>	-0.56	
<i>For >50 To 100, Deduct</i>	-1.15	
<i>For >100 To 250, Deduct</i>	-2.29	
<i>For >250 To 500, Deduct</i>	-4.00	
<i>For >500, Deduct</i>	-5.72	
06 05 23 00-0119 EA 1/2" Diameter x 6" Length, Zinc Plated Steel, Hex Lag Bolt.....	13.12	
<i>For >10 To 50, Deduct</i>	-0.60	
<i>For >50 To 100, Deduct</i>	-1.23	
<i>For >100 To 250, Deduct</i>	-2.45	
<i>For >250 To 500, Deduct</i>	-4.28	
<i>For >500, Deduct</i>	-6.10	
06 05 23 00-0120 EA 1/2" Diameter x 8" Length, Zinc Plated Steel, Hex Lag Bolt.....	14.92	
<i>For >10 To 50, Deduct</i>	-0.67	
<i>For >50 To 100, Deduct</i>	-1.38	
<i>For >100 To 250, Deduct</i>	-2.75	
<i>For >250 To 500, Deduct</i>	-4.80	
<i>For >500, Deduct</i>	-6.84	
06 05 23 00-0121 EA 1/2" Diameter x 10" Length, Zinc Plated Steel, Hex Lag Bolt.....	17.58	
<i>For >10 To 50, Deduct</i>	-0.78	
<i>For >50 To 100, Deduct</i>	-1.60	
<i>For >100 To 250, Deduct</i>	-3.20	
<i>For >250 To 500, Deduct</i>	-5.58	
<i>For >500, Deduct</i>	-7.96	
06 05 23 00-0122 EA 1/2" Diameter x 12" Length, Zinc Plated Steel, Hex Lag Bolt.....	19.18	
<i>For >10 To 50, Deduct</i>	-0.85	
<i>For >50 To 100, Deduct</i>	-1.75	
<i>For >100 To 250, Deduct</i>	-3.50	
<i>For >250 To 500, Deduct</i>	-6.09	
<i>For >500, Deduct</i>	-8.68	
06 05 23 00-0123 EA 3/4" Diameter x 4" Length, Zinc Plated Steel, Hex Lag Bolt.....	16.05	
<i>For >10 To 50, Deduct</i>	-0.67	
<i>For >50 To 100, Deduct</i>	-1.40	
<i>For >100 To 250, Deduct</i>	-2.81	
<i>For >250 To 500, Deduct</i>	-4.88	
<i>For >500, Deduct</i>	-6.96	
06 05 23 00-0124 EA 3/4" Diameter x 6" Length, Zinc Plated Steel, Hex Lag Bolt.....	19.14	
<i>For >10 To 50, Deduct</i>	-0.78	
<i>For >50 To 100, Deduct</i>	-1.64	
<i>For >100 To 250, Deduct</i>	-3.28	
<i>For >250 To 500, Deduct</i>	-5.70	
<i>For >500, Deduct</i>	-8.11	
06 05 23 00-0125 EA 3/4" Diameter x 8" Length, Zinc Plated Steel, Hex Lag Bolt.....	21.12	
<i>For >10 To 50, Deduct</i>	-0.81	
<i>For >50 To 100, Deduct</i>	-1.74	
<i>For >100 To 250, Deduct</i>	-3.49	
<i>For >250 To 500, Deduct</i>	-6.04	
<i>For >500, Deduct</i>	-8.59	
06 05 23 00-0126 EA 3/4" Diameter x 10" Length, Zinc Plated Steel, Hex Lag Bolt.....	23.69	
<i>For >10 To 50, Deduct</i>	-0.88	
<i>For >50 To 100, Deduct</i>	-1.91	
<i>For >100 To 250, Deduct</i>	-3.82	
<i>For >250 To 500, Deduct</i>	-6.62	
<i>For >500, Deduct</i>	-9.41	
06 05 23 00-0127 EA 3/4" Diameter x 12" Length, Zinc Plated Steel, Hex Lag Bolt.....	26.46	
<i>For >10 To 50, Deduct</i>	-0.92	
<i>For >50 To 100, Deduct</i>	-2.03	
<i>For >100 To 250, Deduct</i>	-4.07	
<i>For >250 To 500, Deduct</i>	-7.02	
<i>For >500, Deduct</i>	-9.97	
06 05 23 00-0128 Hot Dipped Galvanized Steel, Hex Lag Bolts <small>(06 05 23 00-0107)</small>		
06 05 23 00-0129 EA 1/4" Diameter x 2" Length, Hot Dipped Galvanized Steel, Hex Lag Bolt.....	9.15	
<i>For >10 To 50, Deduct</i>	-0.45	
<i>For >50 To 100, Deduct</i>	-0.90	
<i>For >100 To 250, Deduct</i>	-1.80	
<i>For >250 To 500, Deduct</i>	-3.16	
<i>For >500, Deduct</i>	-4.51	
06 05 23 00-0130 EA 1/4" Diameter x 4" Length, Hot Dipped Galvanized Steel, Hex Lag Bolt.....	9.28	
<i>For >10 To 50, Deduct</i>	-0.45	
<i>For >50 To 100, Deduct</i>	-0.91	
<i>For >100 To 250, Deduct</i>	-1.81	
<i>For >250 To 500, Deduct</i>	-3.17	
<i>For >500, Deduct</i>	-4.52	

06 Wood, Plastics, and Composites**06 05 Common Work Results For Wood, Plastics, And Composites****06 05 23 Wood, Plastic, And Composite Fastenings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 05 23 00-0131	EA		1/4" Diameter x 6" Length, Hot Dipped Galvanized Steel, Hex Lag Bolt.....	9.41	
			<i>For >10 To 50, Deduct</i>	-0.45	
			<i>For >50 To 100, Deduct</i>	-0.91	
			<i>For >100 To 250, Deduct</i>	-1.82	
			<i>For >250 To 500, Deduct</i>	-3.18	
			<i>For >500, Deduct</i>	-4.53	
06 05 23 00-0132	EA		3/8" Diameter x 2" Length, Hot Dipped Galvanized Steel, Hex Lag Bolt.....	10.11	
			<i>For >10 To 50, Deduct</i>	-0.49	
			<i>For >50 To 100, Deduct</i>	-0.99	
			<i>For >100 To 250, Deduct</i>	-1.97	
			<i>For >250 To 500, Deduct</i>	-3.45	
			<i>For >500, Deduct</i>	-4.93	
06 05 23 00-0133	EA		3/8" Diameter x 4" Length, Hot Dipped Galvanized Steel, Hex Lag Bolt.....	11.00	
			<i>For >10 To 50, Deduct</i>	-0.52	
			<i>For >50 To 100, Deduct</i>	-1.06	
			<i>For >100 To 250, Deduct</i>	-2.12	
			<i>For >250 To 500, Deduct</i>	-3.71	
			<i>For >500, Deduct</i>	-5.29	
06 05 23 00-0134	EA		3/8" Diameter x 6" Length, Hot Dipped Galvanized Steel, Hex Lag Bolt.....	11.21	
			<i>For >10 To 50, Deduct</i>	-0.52	
			<i>For >50 To 100, Deduct</i>	-1.07	
			<i>For >100 To 250, Deduct</i>	-2.13	
			<i>For >250 To 500, Deduct</i>	-3.72	
			<i>For >500, Deduct</i>	-5.31	
06 05 23 00-0135	EA		3/8" Diameter x 8" Length, Hot Dipped Galvanized Steel, Hex Lag Bolt.....	13.81	
			<i>For >10 To 50, Deduct</i>	-0.63	
			<i>For >50 To 100, Deduct</i>	-1.29	
			<i>For >100 To 250, Deduct</i>	-2.58	
			<i>For >250 To 500, Deduct</i>	-4.50	
			<i>For >500, Deduct</i>	-6.41	
06 05 23 00-0136	EA		3/8" Diameter x 10" Length, Hot Dipped Galvanized Steel, Hex Lag Bolt.....	14.79	
			<i>For >10 To 50, Deduct</i>	-0.66	
			<i>For >50 To 100, Deduct</i>	-1.37	
			<i>For >100 To 250, Deduct</i>	-2.73	
			<i>For >250 To 500, Deduct</i>	-4.76	
			<i>For >500, Deduct</i>	-6.79	
06 05 23 00-0137	EA		1/2" Diameter x 2" Length, Hot Dipped Galvanized Steel, Hex Lag Bolt.....	11.28	
			<i>For >10 To 50, Deduct</i>	-0.53	
			<i>For >50 To 100, Deduct</i>	-1.07	
			<i>For >100 To 250, Deduct</i>	-2.15	
			<i>For >250 To 500, Deduct</i>	-3.75	
			<i>For >500, Deduct</i>	-5.35	
06 05 23 00-0138	EA		1/2" Diameter x 4" Length, Hot Dipped Galvanized Steel, Hex Lag Bolt.....	12.18	
			<i>For >10 To 50, Deduct</i>	-0.56	
			<i>For >50 To 100, Deduct</i>	-1.15	
			<i>For >100 To 250, Deduct</i>	-2.30	
			<i>For >250 To 500, Deduct</i>	-4.01	
			<i>For >500, Deduct</i>	-5.73	
06 05 23 00-0139	EA		1/2" Diameter x 6" Length, Hot Dipped Galvanized Steel, Hex Lag Bolt.....	13.31	
			<i>For >10 To 50, Deduct</i>	-0.60	
			<i>For >50 To 100, Deduct</i>	-1.23	
			<i>For >100 To 250, Deduct</i>	-2.46	
			<i>For >250 To 500, Deduct</i>	-4.29	
			<i>For >500, Deduct</i>	-6.12	
06 05 23 00-0140	EA		1/2" Diameter x 8" Length, Hot Dipped Galvanized Steel, Hex Lag Bolt.....	15.50	
			<i>For >10 To 50, Deduct</i>	-0.67	
			<i>For >50 To 100, Deduct</i>	-1.39	
			<i>For >100 To 250, Deduct</i>	-2.78	
			<i>For >250 To 500, Deduct</i>	-4.84	
			<i>For >500, Deduct</i>	-6.90	
06 05 23 00-0141	EA		1/2" Diameter x 10" Length, Hot Dipped Galvanized Steel, Hex Lag Bolt.....	17.86	
			<i>For >10 To 50, Deduct</i>	-0.78	
			<i>For >50 To 100, Deduct</i>	-1.61	
			<i>For >100 To 250, Deduct</i>	-3.22	
			<i>For >250 To 500, Deduct</i>	-5.60	
			<i>For >500, Deduct</i>	-7.99	
06 05 23 00-0142	EA		1/2" Diameter x 12" Length, Hot Dipped Galvanized Steel, Hex Lag Bolt.....	19.87	
			<i>For >10 To 50, Deduct</i>	-0.85	
			<i>For >50 To 100, Deduct</i>	-1.77	
			<i>For >100 To 250, Deduct</i>	-3.53	
			<i>For >250 To 500, Deduct</i>	-6.14	
			<i>For >500, Deduct</i>	-8.75	
06 05 23 00-0143	EA		3/4" Diameter x 4" Length, Hot Dipped Galvanized Steel, Hex Lag Bolt.....	16.47	
			<i>For >10 To 50, Deduct</i>	-0.67	
			<i>For >50 To 100, Deduct</i>	-1.42	
			<i>For >100 To 250, Deduct</i>	-2.83	
			<i>For >250 To 500, Deduct</i>	-4.91	
			<i>For >500, Deduct</i>	-7.00	
06 05 23 00-0144	EA		3/4" Diameter x 6" Length, Hot Dipped Galvanized Steel, Hex Lag Bolt.....	19.52	
			<i>For >10 To 50, Deduct</i>	-0.78	
			<i>For >50 To 100, Deduct</i>	-1.65	
			<i>For >100 To 250, Deduct</i>	-3.30	
			<i>For >250 To 500, Deduct</i>	-5.73	
			<i>For >500, Deduct</i>	-8.15	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 05 23 00-0145 EA 3/4" Diameter x 8" Length, Hot Dipped Galvanized Steel, Hex Lag Bolt.....	21.76	
<i>For >10 To 50, Deduct</i>	-0.81	
<i>For >50 To 100, Deduct</i>	-1.76	
<i>For >100 To 250, Deduct</i>	-3.52	
<i>For >250 To 500, Deduct</i>	-6.09	
<i>For >500, Deduct</i>	-8.66	
06 05 23 00-0146 EA 3/4" Diameter x 10" Length, Hot Dipped Galvanized Steel, Hex Lag Bolt.....	25.20	
<i>For >10 To 50, Deduct</i>	-0.88	
<i>For >50 To 100, Deduct</i>	-1.95	
<i>For >100 To 250, Deduct</i>	-3.90	
<i>For >250 To 500, Deduct</i>	-6.73	
<i>For >500, Deduct</i>	-9.56	
06 05 23 00-0147 EA 3/4" Diameter x 12" Length, Hot Dipped Galvanized Steel, Hex Lag Bolt.....	28.07	
<i>For >10 To 50, Deduct</i>	-0.92	
<i>For >50 To 100, Deduct</i>	-2.08	
<i>For >100 To 250, Deduct</i>	-4.15	
<i>For >250 To 500, Deduct</i>	-7.14	
<i>For >500, Deduct</i>	-10.13	
06 05 23 00-0148 304/18-8 Stainless Steel, Hex Lag Bolts <small>(06 05 23 00-0107)</small>		
06 05 23 00-0149 EA 1/4" Diameter x 2" Length, 304/18-8 Stainless Steel, Hex Lag Bolt.....	9.49	
<i>For >10 To 50, Deduct</i>	-0.45	
<i>For >50 To 100, Deduct</i>	-0.91	
<i>For >100 To 250, Deduct</i>	-1.82	
<i>For >250 To 500, Deduct</i>	-3.18	
<i>For >500, Deduct</i>	-4.54	
06 05 23 00-0150 EA 1/4" Diameter x 4" Length, 304/18-8 Stainless Steel, Hex Lag Bolt.....	9.87	
<i>For >10 To 50, Deduct</i>	-0.45	
<i>For >50 To 100, Deduct</i>	-0.92	
<i>For >100 To 250, Deduct</i>	-1.84	
<i>For >250 To 500, Deduct</i>	-3.21	
<i>For >500, Deduct</i>	-4.58	
06 05 23 00-0151 EA 1/4" Diameter x 6" Length, 304/18-8 Stainless Steel, Hex Lag Bolt.....	10.91	
<i>For >10 To 50, Deduct</i>	-0.45	
<i>For >50 To 100, Deduct</i>	-0.95	
<i>For >100 To 250, Deduct</i>	-1.89	
<i>For >250 To 500, Deduct</i>	-3.29	
<i>For >500, Deduct</i>	-4.68	
06 05 23 00-0152 EA 3/8" Diameter x 2" Length, 304/18-8 Stainless Steel, Hex Lag Bolt.....	11.09	
<i>For >10 To 50, Deduct</i>	-0.49	
<i>For >50 To 100, Deduct</i>	-1.01	
<i>For >100 To 250, Deduct</i>	-2.02	
<i>For >250 To 500, Deduct</i>	-3.52	
<i>For >500, Deduct</i>	-5.03	
06 05 23 00-0153 EA 3/8" Diameter x 4" Length, 304/18-8 Stainless Steel, Hex Lag Bolt.....	12.36	
<i>For >10 To 50, Deduct</i>	-0.52	
<i>For >50 To 100, Deduct</i>	-1.10	
<i>For >100 To 250, Deduct</i>	-2.19	
<i>For >250 To 500, Deduct</i>	-3.81	
<i>For >500, Deduct</i>	-5.43	
06 05 23 00-0154 EA 3/8" Diameter x 6" Length, 304/18-8 Stainless Steel, Hex Lag Bolt.....	13.02	
<i>For >10 To 50, Deduct</i>	-0.52	
<i>For >50 To 100, Deduct</i>	-1.11	
<i>For >100 To 250, Deduct</i>	-2.22	
<i>For >250 To 500, Deduct</i>	-3.86	
<i>For >500, Deduct</i>	-5.49	
06 05 23 00-0155 EA 3/8" Diameter x 8" Length, 304/18-8 Stainless Steel, Hex Lag Bolt.....	24.33	
<i>For >10 To 50, Deduct</i>	-0.63	
<i>For >50 To 100, Deduct</i>	-1.55	
<i>For >100 To 250, Deduct</i>	-3.10	
<i>For >250 To 500, Deduct</i>	-5.28	
<i>For >500, Deduct</i>	-7.47	
06 05 23 00-0156 EA 3/8" Diameter x 10" Length, 304/18-8 Stainless Steel, Hex Lag Bolt.....	33.10	
<i>For >10 To 50, Deduct</i>	-0.66	
<i>For >50 To 100, Deduct</i>	-1.82	
<i>For >100 To 250, Deduct</i>	-3.65	
<i>For >250 To 500, Deduct</i>	-6.13	
<i>For >500, Deduct</i>	-8.62	
06 05 23 00-0157 EA 1/2" Diameter x 2" Length, 304/18-8 Stainless Steel, Hex Lag Bolt.....	13.12	
<i>For >10 To 50, Deduct</i>	-0.53	
<i>For >50 To 100, Deduct</i>	-1.12	
<i>For >100 To 250, Deduct</i>	-2.24	
<i>For >250 To 500, Deduct</i>	-3.89	
<i>For >500, Deduct</i>	-5.54	
06 05 23 00-0158 EA 1/2" Diameter x 4" Length, 304/18-8 Stainless Steel, Hex Lag Bolt.....	15.21	
<i>For >10 To 50, Deduct</i>	-0.56	
<i>For >50 To 100, Deduct</i>	-1.23	
<i>For >100 To 250, Deduct</i>	-2.45	
<i>For >250 To 500, Deduct</i>	-4.24	
<i>For >500, Deduct</i>	-6.03	

06 Wood, Plastics, and Composites**06 05 Common Work Results For Wood, Plastics, And Composites****06 05 23 Wood, Plastic, And Composite Fastenings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 05 23 00-0159	EA		1/2" Diameter x 6" Length, 304/18-8 Stainless Steel, Hex Lag Bolt.....	18.30	
			<i>For >10 To 50, Deduct</i>	-0.60	
			<i>For >50 To 100, Deduct</i>	-1.36	
			<i>For >100 To 250, Deduct</i>	-2.71	
			<i>For >250 To 500, Deduct</i>	-4.66	
			<i>For >500, Deduct</i>	-6.62	
06 05 23 00-0160	EA		1/2" Diameter x 8" Length, 304/18-8 Stainless Steel, Hex Lag Bolt.....	35.06	
			<i>For >10 To 50, Deduct</i>	-0.67	
			<i>For >50 To 100, Deduct</i>	-1.88	
			<i>For >100 To 250, Deduct</i>	-3.76	
			<i>For >250 To 500, Deduct</i>	-6.31	
			<i>For >500, Deduct</i>	-8.86	
06 05 23 00-0161	EA		1/2" Diameter x 10" Length, 304/18-8 Stainless Steel, Hex Lag Bolt.....	47.05	
			<i>For >10 To 50, Deduct</i>	-0.78	
			<i>For >50 To 100, Deduct</i>	-2.34	
			<i>For >100 To 250, Deduct</i>	-4.68	
			<i>For >250 To 500, Deduct</i>	-7.79	
			<i>For >500, Deduct</i>	-10.91	
06 05 23 00-0162	EA		1/2" Diameter x 12" Length, 304/18-8 Stainless Steel, Hex Lag Bolt.....	54.67	
			<i>For >10 To 50, Deduct</i>	-0.85	
			<i>For >50 To 100, Deduct</i>	-2.64	
			<i>For >100 To 250, Deduct</i>	-5.27	
			<i>For >250 To 500, Deduct</i>	-8.75	
			<i>For >500, Deduct</i>	-12.23	
06 05 23 00-0163	EA		3/4" Diameter x 4" Length, 304/18-8 Stainless Steel, Hex Lag Bolt.....	50.13	
			<i>For >10 To 50, Deduct</i>	-0.67	
			<i>For >50 To 100, Deduct</i>	-2.26	
			<i>For >100 To 250, Deduct</i>	-4.51	
			<i>For >250 To 500, Deduct</i>	-7.44	
			<i>For >500, Deduct</i>	-10.37	
06 05 23 00-0164	EA		3/4" Diameter x 6" Length, 304/18-8 Stainless Steel, Hex Lag Bolt.....	57.36	
			<i>For >10 To 50, Deduct</i>	-0.78	
			<i>For >50 To 100, Deduct</i>	-2.60	
			<i>For >100 To 250, Deduct</i>	-5.19	
			<i>For >250 To 500, Deduct</i>	-8.56	
			<i>For >500, Deduct</i>	-11.94	
06 05 23 00-0165	EA		3/4" Diameter x 8" Length, 304/18-8 Stainless Steel, Hex Lag Bolt.....	59.70	
			<i>For >10 To 50, Deduct</i>	-0.81	
			<i>For >50 To 100, Deduct</i>	-2.71	
			<i>For >100 To 250, Deduct</i>	-5.42	
			<i>For >250 To 500, Deduct</i>	-8.93	
			<i>For >500, Deduct</i>	-12.45	
06 05 23 00-0166	EA		3/4" Diameter x 10" Length, 304/18-8 Stainless Steel, Hex Lag Bolt.....	81.50	
			<i>For >10 To 50, Deduct</i>	-0.88	
			<i>For >50 To 100, Deduct</i>	-3.36	
			<i>For >100 To 250, Deduct</i>	-6.72	
			<i>For >250 To 500, Deduct</i>	-10.95	
			<i>For >500, Deduct</i>	-15.19	
06 05 23 00-0167	EA		3/4" Diameter x 12" Length, 304/18-8 Stainless Steel, Hex Lag Bolt.....	88.71	
			<i>For >10 To 50, Deduct</i>	-0.92	
			<i>For >50 To 100, Deduct</i>	-3.59	
			<i>For >100 To 250, Deduct</i>	-7.18	
			<i>For >250 To 500, Deduct</i>	-11.69	
			<i>For >500, Deduct</i>	-16.20	
06 05 23 00-0168			Supports <small>(06 05 23)</small>		
06 05 23 00-0169			Shear Plates <small>(06 05 23 00-0168)</small>		
06 05 23 00-0170	EA		2-5/8" Diameter, Shear Plate.....	7.99	2.66
			<i>For >10 To 50, Deduct</i>	-0.30	
			<i>For >50 To 100, Deduct</i>	-0.65	
			<i>For >100 To 250, Deduct</i>	-1.30	
			<i>For >250 To 500, Deduct</i>	-2.24	
			<i>For >500, Deduct</i>	-3.19	
06 05 23 00-0171	EA		4" Diameter, Shear Plate.....	10.89	2.80
			<i>For >10 To 50, Deduct</i>	-0.31	
			<i>For >50 To 100, Deduct</i>	-0.74	
			<i>For >100 To 250, Deduct</i>	-1.48	
			<i>For >250 To 500, Deduct</i>	-2.53	
			<i>For >500, Deduct</i>	-3.59	
06 05 23 00-0172			Sill Anchors <small>(06 05 23 00-0168)</small>		
06 05 23 00-0173	EA		Sill Anchor Embedded In Concrete.....	6.79	2.80
			<i>For >10 To 50, Deduct</i>	-0.31	
			<i>For >50 To 100, Deduct</i>	-0.64	
			<i>For >100 To 250, Deduct</i>	-1.28	
			<i>For >250 To 500, Deduct</i>	-2.23	
			<i>For >500, Deduct</i>	-3.18	
06 05 23 00-0174			Spike Grids <small>(06 05 23 00-0168)</small>		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 05 23 00-0175 EA 4" x 4" Flat Or Curved Spike Grid	6.70	2.66
<i>For >10 To 50, Deduct</i>	-0.30	
<i>For >50 To 100, Deduct</i>	-0.62	
<i>For >100 To 250, Deduct</i>	-1.23	
<i>For >250 To 500, Deduct</i>	-2.15	
<i>For >500, Deduct</i>	-3.06	
06 05 23 00-0176 Split Rings <small>(06 05 23 00-0168)</small>		
06 05 23 00-0177 EA 2-1/2" Diameter Split Ring	7.14	2.66
<i>For >10 To 50, Deduct</i>	-0.30	
<i>For >50 To 100, Deduct</i>	-0.63	
<i>For >100 To 250, Deduct</i>	-1.25	
<i>For >250 To 500, Deduct</i>	-2.18	
<i>For >500, Deduct</i>	-3.11	
06 05 23 00-0178 EA 4" Diameter Split Ring.....	8.48	2.94
<i>For >10 To 50, Deduct</i>	-0.33	
<i>For >50 To 100, Deduct</i>	-0.70	
<i>For >100 To 250, Deduct</i>	-1.41	
<i>For >250 To 500, Deduct</i>	-2.43	
<i>For >500, Deduct</i>	-3.46	
06 05 23 00-0179 Toothed Rings <small>(06 05 23 00-0168)</small>		
06 05 23 00-0180 EA 2-5/8" Or 4" Toothed Ring.....	8.83	2.66
<i>For >10 To 50, Deduct</i>	-0.30	
<i>For >50 To 100, Deduct</i>	-0.67	
<i>For >100 To 250, Deduct</i>	-1.34	
<i>For >250 To 500, Deduct</i>	-2.31	
<i>For >500, Deduct</i>	-3.28	
06 05 23 00-0181 Straps And Shields <small>(06 05 23)</small>		
06 05 23 00-0182 Shield Plate <small>(06 05 23 00-0181)</small>		
06 05 23 00-0183 EA 5" Wide x 8" Long, 16 Gauge, Shield Plate (Simpson Strong Tie® PSPN58Z)	4.88	
<i>For >10 To 50, Deduct</i>	-0.04	
<i>For >50 To 100, Deduct</i>	-0.17	
<i>For >100 To 250, Deduct</i>	-0.33	
<i>For >250 To 500, Deduct</i>	-0.59	
<i>For >500, Deduct</i>	-0.90	
06 05 23 00-0184 EA 5" Wide x 16" Long, 16 Gauge, Shield Plate (Simpson Strong Tie® PSPN516Z)	7.38	
<i>For >10 To 50, Deduct</i>	-0.05	
<i>For >50 To 100, Deduct</i>	-0.24	
<i>For >100 To 250, Deduct</i>	-0.48	
<i>For >250 To 500, Deduct</i>	-0.82	
<i>For >500, Deduct</i>	-1.23	
06 05 23 00-0185 Strap Ties <small>(06 05 23 00-0181)</small>		
06 05 23 00-0186 EA 1-1/4" Wide x 9" Long, 20 Gauge, Strap Tie (Simpson Strong Tie® LSTA9).....	1.95	
<i>For >10 To 50, Deduct</i>	-0.04	
<i>For >50 To 100, Deduct</i>	-0.08	
<i>For >100 To 250, Deduct</i>	-0.17	
<i>For >250 To 500, Deduct</i>	-0.33	
<i>For >500, Deduct</i>	-0.53	
06 05 23 00-0187 EA 1-1/4" Wide x 12" Long, 20 Gauge, Strap Tie (Simpson Strong Tie® LSTA12).....	2.00	
<i>For >10 To 50, Deduct</i>	-0.04	
<i>For >50 To 100, Deduct</i>	-0.09	
<i>For >100 To 250, Deduct</i>	-0.17	
<i>For >250 To 500, Deduct</i>	-0.33	
<i>For >500, Deduct</i>	-0.53	
06 05 23 00-0188 EA 1-1/4" Wide x 15" Long, 20 Gauge, Strap Tie (Simpson Strong Tie® LSTA15).....	2.64	
<i>For >10 To 50, Deduct</i>	-0.04	
<i>For >50 To 100, Deduct</i>	-0.11	
<i>For >100 To 250, Deduct</i>	-0.22	
<i>For >250 To 500, Deduct</i>	-0.42	
<i>For >500, Deduct</i>	-0.68	
06 05 23 00-0189 EA 1-1/4" Wide x 18" Long, 20 Gauge, Strap Tie (Simpson Strong Tie® LSTA18).....	2.78	
<i>For >10 To 50, Deduct</i>	-0.04	
<i>For >50 To 100, Deduct</i>	-0.11	
<i>For >100 To 250, Deduct</i>	-0.23	
<i>For >250 To 500, Deduct</i>	-0.43	
<i>For >500, Deduct</i>	-0.69	
06 05 23 00-0190 EA 1-1/4" Wide x 21" Long, 20 Gauge, Strap Tie (Simpson Strong Tie® LSTA21).....	2.91	
<i>For >10 To 50, Deduct</i>	-0.04	
<i>For >50 To 100, Deduct</i>	-0.12	
<i>For >100 To 250, Deduct</i>	-0.24	
<i>For >250 To 500, Deduct</i>	-0.44	
<i>For >500, Deduct</i>	-0.70	

06 Wood, Plastics, and Composites**06 05 Common Work Results For Wood, Plastics, And Composites****06 05 23 Wood, Plastic, And Composite Fastenings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 05 23 00-0191	EA		1-1/4" Wide x 24" Long, 20 Gauge, Strap Tie (Simpson Strong Tie® LSTA24).....	3.41	
			<i>For >10 To 50, Deduct</i>	-0.05	
			<i>For >50 To 100, Deduct</i>	-0.14	
			<i>For >100 To 250, Deduct</i>	-0.28	
			<i>For >250 To 500, Deduct</i>	-0.53	
			<i>For >500, Deduct</i>	-0.84	
06 05 23 00-0192	EA		1-1/4" Wide x 30" Long, 20 Gauge, Strap Tie (Simpson Strong Tie® LSTA30).....	3.75	
			<i>For >10 To 50, Deduct</i>	-0.05	
			<i>For >50 To 100, Deduct</i>	-0.15	
			<i>For >100 To 250, Deduct</i>	-0.30	
			<i>For >250 To 500, Deduct</i>	-0.55	
			<i>For >500, Deduct</i>	-0.87	
06 05 23 00-0193	EA		1-1/4" Wide x 36" Long, 20 Gauge, Strap Tie (Simpson Strong Tie® LSTA36).....	4.47	
			<i>For >10 To 50, Deduct</i>	-0.06	
			<i>For >50 To 100, Deduct</i>	-0.17	
			<i>For >100 To 250, Deduct</i>	-0.35	
			<i>For >250 To 500, Deduct</i>	-0.65	
			<i>For >500, Deduct</i>	-1.03	
06 05 23 00-0194	EA		1-1/4" Wide x 9" Long, 18 Gauge, Strap Tie (Simpson Strong Tie® MSTA9).....	2.00	
			<i>For >10 To 50, Deduct</i>	-0.04	
			<i>For >50 To 100, Deduct</i>	-0.09	
			<i>For >100 To 250, Deduct</i>	-0.17	
			<i>For >250 To 500, Deduct</i>	-0.33	
			<i>For >500, Deduct</i>	-0.53	
06 05 23 00-0195	EA		1-1/4" Wide x 12" Long, 18 Gauge, Strap Tie (Simpson Strong Tie® MSTA12).....	2.17	
			<i>For >10 To 50, Deduct</i>	-0.04	
			<i>For >50 To 100, Deduct</i>	-0.09	
			<i>For >100 To 250, Deduct</i>	-0.18	
			<i>For >250 To 500, Deduct</i>	-0.34	
			<i>For >500, Deduct</i>	-0.55	
06 05 23 00-0196	EA		1-1/4" Wide x 15" Long, 18 Gauge, Strap Tie (Simpson Strong Tie® MSTA15).....	2.74	
			<i>For >10 To 50, Deduct</i>	-0.04	
			<i>For >50 To 100, Deduct</i>	-0.11	
			<i>For >100 To 250, Deduct</i>	-0.23	
			<i>For >250 To 500, Deduct</i>	-0.43	
			<i>For >500, Deduct</i>	-0.69	
06 05 23 00-0197	EA		1-1/4" Wide x 18" Long, 18 Gauge, Strap Tie (Simpson Strong Tie® MSTA18).....	2.94	
			<i>For >10 To 50, Deduct</i>	-0.04	
			<i>For >50 To 100, Deduct</i>	-0.12	
			<i>For >100 To 250, Deduct</i>	-0.24	
			<i>For >250 To 500, Deduct</i>	-0.44	
			<i>For >500, Deduct</i>	-0.71	
06 05 23 00-0198	EA		1-1/4" Wide x 21" Long, 18 Gauge, Strap Tie (Simpson Strong Tie® MSTA21).....	3.12	
			<i>For >10 To 50, Deduct</i>	-0.04	
			<i>For >50 To 100, Deduct</i>	-0.12	
			<i>For >100 To 250, Deduct</i>	-0.25	
			<i>For >250 To 500, Deduct</i>	-0.46	
			<i>For >500, Deduct</i>	-0.72	
06 05 23 00-0199	EA		1-1/4" Wide x 24" Long, 18 Gauge, Strap Tie (Simpson Strong Tie® MSTA24).....	3.68	
			<i>For >10 To 50, Deduct</i>	-0.05	
			<i>For >50 To 100, Deduct</i>	-0.15	
			<i>For >100 To 250, Deduct</i>	-0.29	
			<i>For >250 To 500, Deduct</i>	-0.55	
			<i>For >500, Deduct</i>	-0.86	
06 05 23 00-0200	EA		1-1/4" Wide x 30" Long, 18 Gauge, Strap Tie (Simpson Strong Tie® MSTA30).....	3.96	
			<i>For >10 To 50, Deduct</i>	-0.05	
			<i>For >50 To 100, Deduct</i>	-0.15	
			<i>For >100 To 250, Deduct</i>	-0.31	
			<i>For >250 To 500, Deduct</i>	-0.57	
			<i>For >500, Deduct</i>	-0.89	
06 05 23 00-0201	EA		1-1/4" Wide x 36" Long, 18 Gauge, Strap Tie (Simpson Strong Tie® MSTA36).....	4.79	
			<i>For >10 To 50, Deduct</i>	-0.06	
			<i>For >50 To 100, Deduct</i>	-0.18	
			<i>For >100 To 250, Deduct</i>	-0.37	
			<i>For >250 To 500, Deduct</i>	-0.67	
			<i>For >500, Deduct</i>	-1.06	
06 05 23 00-0202	EA		1-1/4" Wide x 36" Long, 18 Gauge, Strap Tie (Simpson Strong Tie® MSTA49).....	6.19	
			<i>For >10 To 50, Deduct</i>	-0.07	
			<i>For >50 To 100, Deduct</i>	-0.23	
			<i>For >100 To 250, Deduct</i>	-0.45	
			<i>For >250 To 500, Deduct</i>	-0.82	
			<i>For >500, Deduct</i>	-1.28	
06 05 23 00-0203	EA		1-1/4" Wide x 9" Long, 16 Gauge, Strap Tie (Simpson Strong Tie® ST9).....	2.23	
			<i>For >10 To 50, Deduct</i>	-0.04	
			<i>For >50 To 100, Deduct</i>	-0.09	
			<i>For >100 To 250, Deduct</i>	-0.18	
			<i>For >250 To 500, Deduct</i>	-0.35	
			<i>For >500, Deduct</i>	-0.55	
06 05 23 00-0204	EA		1-1/4" Wide x 12" Long, 16 Gauge, Strap Tie (Simpson Strong Tie® ST12).....	2.43	
			<i>For >10 To 50, Deduct</i>	-0.04	
			<i>For >50 To 100, Deduct</i>	-0.10	
			<i>For >100 To 250, Deduct</i>	-0.19	
			<i>For >250 To 500, Deduct</i>	-0.36	
			<i>For >500, Deduct</i>	-0.57	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 05 23 00-0205 EA 1-1/4" Wide x 18" Long, 16 Gauge, Strap Tie (Simpson Strong Tie® ST18).....	3.26	
<i>For >10 To 50, Deduct</i>	-0.04	
<i>For >50 To 100, Deduct</i>	-0.13	
<i>For >100 To 250, Deduct</i>	-0.25	
<i>For >250 To 500, Deduct</i>	-0.47	
<i>For >500, Deduct</i>	-0.74	
06 05 23 00-0206 EA 1-1/4" Wide x 22" Long, 16 Gauge, Strap Tie® (Simpson Strong Tie ST22).....	4.24	
<i>For >10 To 50, Deduct</i>	-0.05	
<i>For >50 To 100, Deduct</i>	-0.16	
<i>For >100 To 250, Deduct</i>	-0.32	
<i>For >250 To 500, Deduct</i>	-0.59	
<i>For >500, Deduct</i>	-0.92	
06 05 23 00-0207 EA 1-3/8" Wide x 6" Long, 12 Gauge, Strap Tie (Simpson Strong Tie® HRS6).....	2.81	
<i>For >10 To 50, Deduct</i>	-0.04	
<i>For >50 To 100, Deduct</i>	-0.11	
<i>For >100 To 250, Deduct</i>	-0.21	
<i>For >250 To 500, Deduct</i>	-0.39	
<i>For >500, Deduct</i>	-0.61	
06 05 23 00-0208 EA 1-3/8" Wide x 8" Long, 12 Gauge, Strap Tie (Simpson Strong Tie® HRS8).....	2.97	
<i>For >10 To 50, Deduct</i>	-0.04	
<i>For >50 To 100, Deduct</i>	-0.11	
<i>For >100 To 250, Deduct</i>	-0.22	
<i>For >250 To 500, Deduct</i>	-0.40	
<i>For >500, Deduct</i>	-0.63	
06 05 23 00-0209 EA 1-3/8" Wide x 12" Long, 12 Gauge, Strap Tie (Simpson Strong Tie® HRS12).....	4.02	
<i>For >10 To 50, Deduct</i>	-0.04	
<i>For >50 To 100, Deduct</i>	-0.15	
<i>For >100 To 250, Deduct</i>	-0.29	
<i>For >250 To 500, Deduct</i>	-0.53	
<i>For >500, Deduct</i>	-0.81	
06 05 23 00-0210 EA 2-1/16" Wide x 27" Long, 12 Gauge, Medium Strap Tie (Simpson Strong Tie® MST27).....	7.17	
<i>For >10 To 50, Deduct</i>	-0.05	
<i>For >50 To 100, Deduct</i>	-0.23	
<i>For >100 To 250, Deduct</i>	-0.47	
<i>For >250 To 500, Deduct</i>	-0.81	
<i>For >500, Deduct</i>	-1.21	
06 05 23 00-0211 EA 2-1/16" Wide x 37" Long, 12 Gauge, Medium Strap Tie (Simpson Strong Tie® MST37).....	9.68	
<i>For >10 To 50, Deduct</i>	-0.06	
<i>For >50 To 100, Deduct</i>	-0.31	
<i>For >100 To 250, Deduct</i>	-0.61	
<i>For >250 To 500, Deduct</i>	-1.04	
<i>For >500, Deduct</i>	-1.55	
06 05 23 00-0212 EA 2-1/16" Wide x 48" Long, 12 Gauge, Medium Strap Tie (Simpson Strong Tie® MST48).....	12.77	
<i>For >10 To 50, Deduct</i>	-0.07	
<i>For >50 To 100, Deduct</i>	-0.39	
<i>For >100 To 250, Deduct</i>	-0.78	
<i>For >250 To 500, Deduct</i>	-1.32	
<i>For >500, Deduct</i>	-1.94	
06 05 23 00-0213 EA 2-1/16" Wide x 60" Long, 12 Gauge, Medium Strap Tie (Simpson Strong Tie® MST60).....	18.47	
<i>For >10 To 50, Deduct</i>	-0.08	
<i>For >50 To 100, Deduct</i>	-0.54	
<i>For >100 To 250, Deduct</i>	-1.09	
<i>For >250 To 500, Deduct</i>	-1.79	
<i>For >500, Deduct</i>	-2.59	
06 05 23 00-0214 EA 2-1/16" Wide x 72" Long, 12 Gauge, Medium Strap Tie (Simpson Strong Tie® MST72).....	23.79	
<i>For >10 To 50, Deduct</i>	-0.09	
<i>For >50 To 100, Deduct</i>	-0.68	
<i>For >100 To 250, Deduct</i>	-1.37	
<i>For >250 To 500, Deduct</i>	-2.23	
<i>For >500, Deduct</i>	-3.20	
06 05 23 00-0215 EA 3" Wide x 28" Long, 16 Gauge, Strap Ties (Simpson Strong Tie® MSTC28).....	7.68	
<i>For >10 To 50, Deduct</i>	-0.05	
<i>For >50 To 100, Deduct</i>	-0.25	
<i>For >100 To 250, Deduct</i>	-0.49	
<i>For >250 To 500, Deduct</i>	-0.85	
<i>For >500, Deduct</i>	-1.26	
06 05 23 00-0216 EA 3" Wide x 40" Long, 16 Gauge, Strap Ties (Simpson Strong Tie® MSTC40).....	10.42	
<i>For >10 To 50, Deduct</i>	-0.06	
<i>For >50 To 100, Deduct</i>	-0.32	
<i>For >100 To 250, Deduct</i>	-0.65	
<i>For >250 To 500, Deduct</i>	-1.10	
<i>For >500, Deduct</i>	-1.62	
06 05 23 00-0217 EA 3" Wide x 52" Long, 16 Gauge, Strap Ties (Simpson Strong Tie® MSTC52).....	12.98	
<i>For >10 To 50, Deduct</i>	-0.07	
<i>For >50 To 100, Deduct</i>	-0.40	
<i>For >100 To 250, Deduct</i>	-0.79	
<i>For >250 To 500, Deduct</i>	-1.33	
<i>For >500, Deduct</i>	-1.96	
06 05 23 00-0218 EA 3" Wide x 66" Long, 16 Gauge, Strap Ties (Simpson Strong Tie® MSTC66).....	18.87	
<i>For >10 To 50, Deduct</i>	-0.08	
<i>For >50 To 100, Deduct</i>	-0.55	
<i>For >100 To 250, Deduct</i>	-1.11	
<i>For >250 To 500, Deduct</i>	-1.82	
<i>For >500, Deduct</i>	-2.63	

06 Wood, Plastics, and Composites**06 05 Common Work Results For Wood, Plastics, And Composites****06 05 23 Wood, Plastic, And Composite Fastenings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 05 23 00-0219			Twist Strap Ties <small>(06 05 23 00-0181)</small>		
06 05 23 00-0220	EA		1-1/4" Wide x 9" Long, 16 Gauge, Twist Strap Tie (Simpson Strong Tie® TS9).....	2.50	
			<i>For >10 To 50, Deduct</i>	-0.04	
			<i>For >50 To 100, Deduct</i>	-0.10	
			<i>For >100 To 250, Deduct</i>	-0.20	
			<i>For >250 To 500, Deduct</i>	-0.37	
			<i>For >500, Deduct</i>	-0.58	
06 05 23 00-0221	EA		1-1/4" Wide x 12" Long, 16 Gauge, Twist Strap Tie (Simpson Strong Tie® TS12).....	2.88	
			<i>For >10 To 50, Deduct</i>	-0.04	
			<i>For >50 To 100, Deduct</i>	-0.11	
			<i>For >100 To 250, Deduct</i>	-0.22	
			<i>For >250 To 500, Deduct</i>	-0.40	
			<i>For >500, Deduct</i>	-0.62	
06 05 23 00-0222	EA		1-1/4" Wide x 18" Long, 16 Gauge, Twist Strap Tie (Simpson Strong Tie® TS18).....	3.87	
			<i>For >10 To 50, Deduct</i>	-0.04	
			<i>For >50 To 100, Deduct</i>	-0.14	
			<i>For >100 To 250, Deduct</i>	-0.28	
			<i>For >250 To 500, Deduct</i>	-0.51	
			<i>For >500, Deduct</i>	-0.80	
06 05 23 00-0223	EA		1-1/4" Wide x 22" Long, 16 Gauge, Twist Strap Tie (Simpson Strong Tie® TS22).....	4.60	
			<i>For >10 To 50, Deduct</i>	-0.05	
			<i>For >50 To 100, Deduct</i>	-0.17	
			<i>For >100 To 250, Deduct</i>	-0.34	
			<i>For >250 To 500, Deduct</i>	-0.62	
			<i>For >500, Deduct</i>	-0.96	
06 05 23 00-0224			Retrofit Plate Strap <small>(06 05 23 00-0181)</small>		
06 05 23 00-0225	EA		1-3/8" Wide x 18" Long, 16 Gauge, Retrofit Plate Strap (Simpson Strong Tie® RPS18).....	3.45	
			<i>For >10 To 50, Deduct</i>	-0.04	
			<i>For >50 To 100, Deduct</i>	-0.13	
			<i>For >100 To 250, Deduct</i>	-0.26	
			<i>For >250 To 500, Deduct</i>	-0.48	
			<i>For >500, Deduct</i>	-0.76	
06 05 23 00-0226	EA		1-3/8" Wide x 22" Long, 16 Gauge, Retrofit Plate Strap (Simpson Strong Tie® RPS22).....	3.81	
			<i>For >10 To 50, Deduct</i>	-0.04	
			<i>For >50 To 100, Deduct</i>	-0.14	
			<i>For >100 To 250, Deduct</i>	-0.28	
			<i>For >250 To 500, Deduct</i>	-0.51	
			<i>For >500, Deduct</i>	-0.79	
06 05 23 00-0227	EA		1-3/8" Wide x 28" Long, 16 Gauge, Retrofit Plate Strap (Simpson Strong Tie® RPS28).....	4.36	
			<i>For >10 To 50, Deduct</i>	-0.04	
			<i>For >50 To 100, Deduct</i>	-0.15	
			<i>For >100 To 250, Deduct</i>	-0.31	
			<i>For >250 To 500, Deduct</i>	-0.55	
			<i>For >500, Deduct</i>	-0.85	
06 05 23 00-0228			Stud Shoe <small>(06 05 23 00-0181)</small>		
06 05 23 00-0229	EA		6" High With 3-1/4" Wide Tabs For 2X Stud, 16 Gauge, Stud Shoe (Simpson Strong Tie® SS1.5).....	6.32	
			<i>For >10 To 50, Deduct</i>	-0.05	
			<i>For >50 To 100, Deduct</i>	-0.21	
			<i>For >100 To 250, Deduct</i>	-0.42	
			<i>For >250 To 500, Deduct</i>	-0.74	
			<i>For >500, Deduct</i>	-1.13	
06 05 23 00-0230	EA		6" High With 3-1/4" Wide Tabs For 3X Stud, 16 Gauge, Stud Shoe (Simpson Strong Tie® SS2.5).....	9.48	
			<i>For >10 To 50, Deduct</i>	-0.05	
			<i>For >50 To 100, Deduct</i>	-0.29	
			<i>For >100 To 250, Deduct</i>	-0.58	
			<i>For >250 To 500, Deduct</i>	-0.98	
			<i>For >500, Deduct</i>	-1.44	
06 05 23 00-0231	EA		6" High With 3-1/4" Wide Tabs For 2-2X Studs, 16 Gauge, Stud Shoe (Simpson Strong Tie® SS3).....	10.13	
			<i>For >10 To 50, Deduct</i>	-0.05	
			<i>For >50 To 100, Deduct</i>	-0.31	
			<i>For >100 To 250, Deduct</i>	-0.61	
			<i>For >250 To 500, Deduct</i>	-1.03	
			<i>For >500, Deduct</i>	-1.51	
06 05 23 00-0232	EA		6" High With 3-1/4" Wide Tabs For 3-2X Studs, 16 Gauge, Stud Shoe (Simpson Strong Tie SS4.5).....	13.41	
			<i>For >10 To 50, Deduct</i>	-0.05	
			<i>For >50 To 100, Deduct</i>	-0.39	
			<i>For >100 To 250, Deduct</i>	-0.78	
			<i>For >250 To 500, Deduct</i>	-1.28	
			<i>For >500, Deduct</i>	-1.84	
06 05 23 00-0233	EA		7-1/8" High With 3-1/4" Wide Tabs For 2X Studs, 16 Gauge, Stud Shoe (Simpson Strong Tie HSS2-SDS1.5).....	15.04	
			<i>For >10 To 50, Deduct</i>	-0.05	
			<i>For >50 To 100, Deduct</i>	-0.43	
			<i>For >100 To 250, Deduct</i>	-0.86	
			<i>For >250 To 500, Deduct</i>	-1.40	
			<i>For >500, Deduct</i>	-2.00	
06 05 23 00-0234	EA		7-1/8" High With 3-1/4" Wide Tabs For 2-2X Studs, 16 Gauge, Stud Shoe (Simpson Strong Tie HSS2-2-SDS3).....	18.56	
			<i>For >10 To 50, Deduct</i>	-0.05	
			<i>For >50 To 100, Deduct</i>	-0.52	
			<i>For >100 To 250, Deduct</i>	-1.04	
			<i>For >250 To 500, Deduct</i>	-1.66	
			<i>For >500, Deduct</i>	-2.35	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 05 23 00-0235 EA 7-1/8" High With 3-1/4" Wide Tabs For 3-2X Studs, 16 Gauge, Stud Shoe (Simpson Strong Tie HSS2-3-SDS3)	18.56	
<i>For >10 To 50, Deduct</i>	-0.05	
<i>For >50 To 100, Deduct</i>	-0.52	
<i>For >100 To 250, Deduct</i>	-1.04	
<i>For >250 To 500, Deduct</i>	-1.66	
<i>For >500, Deduct</i>	-2.35	
06 05 23 00-0236 EA 7-1/8" High With 3-1/4" Wide Tabs For 4X Studs, 16 Gauge, Stud Shoe (Simpson Strong Tie HSS4-SDS3).....	18.56	
<i>For >10 To 50, Deduct</i>	-0.05	
<i>For >50 To 100, Deduct</i>	-0.52	
<i>For >100 To 250, Deduct</i>	-1.04	
<i>For >250 To 500, Deduct</i>	-1.66	
<i>For >500, Deduct</i>	-2.35	
06 05 23 00-0237 Nail Stops <small>(06 05 23 00-0181)</small>		
06 05 23 00-0238 EA 1-1/2" Wide x 3" Long, 16 Gauge, Nail Stops (Simpson Strong Tie® NS1).....	1.83	
<i>For >10 To 50, Deduct</i>	-0.04	
<i>For >50 To 100, Deduct</i>	-0.08	
<i>For >100 To 250, Deduct</i>	-0.16	
<i>For >250 To 500, Deduct</i>	-0.32	
<i>For >500, Deduct</i>	-0.51	
06 05 23 00-0239 EA 1-1/2" Wide x 6" Long, 16 Gauge, Nail Stops (Simpson Strong Tie® NS2).....	2.11	
<i>For >10 To 50, Deduct</i>	-0.04	
<i>For >50 To 100, Deduct</i>	-0.09	
<i>For >100 To 250, Deduct</i>	-0.18	
<i>For >250 To 500, Deduct</i>	-0.34	
<i>For >500, Deduct</i>	-0.54	

06 10 Rough Carpentry (06)

06 11 Wood Framing (06 10)

Note: All framing lumber is grade #2 or better unless otherwise listed. Dimensions are nominal. See CSI section 06 05 23 00-0000 for anchors and supports.

06 11 13 Engineered Wood Products (06 11)

Note: All framing lumber is grade #2 or better unless otherwise listed. Dimensions are nominal.

06 11 13 00-0001 Built-Up Members (06 11 13)

Note: A structural framing member made from fastening separate pieces of lumber together.

06 11 13 00-0002 Built-Up Beams Or Joists (06 11 13 00-0001)

06 11 13 00-0003 LF Two 2" x 6" Built-up Wood Beam Or Joist.....	3.17	1.23
<i>For Each Additional 2" x_ " In The Built Up Member, Add</i>	0.65	
06 11 13 00-0004 LF Two 2" x 8" Built-up Wood Beam Or Joist.....	4.01	1.45
<i>For Each Additional 2" x_ " In The Built Up Member, Add</i>	0.92	
06 11 13 00-0005 LF Two 2" x 10" Built-up Wood Beam Or Joist.....	5.15	1.74
<i>For Each Additional 2" x_ " In The Built Up Member, Add</i>	1.27	

06 11 16 Mechanically Graded Lumber (06 11)

06 11 16 00-0001 Rafters And Joists (06 11 16)

06 11 16 00-0002 Rafters (06 11 16 00-0001)

Note: An inclined roof framing member to which a roof covering is attached.

06 11 16 00-0003 LF 2" x 6" Wood Rafter	1.80	0.88
06 11 16 00-0004 LF 2" x 8" Wood Rafter	2.14	0.95
06 11 16 00-0005 LF 2" x 10" Wood Rafter	3.08	1.37
06 11 16 00-0006 LF 2" x 12" Wood Rafter	3.57	1.53
06 11 16 00-0007 LF 2" x 14" Wood Rafter	3.89	1.67
06 11 16 00-0008 LF 2" x 6" Pressure Treated Wood Rafter.....	2.25	0.88
06 11 16 00-0009 LF 2" x 8" Pressure Treated Wood Rafter.....	2.76	0.95
06 11 16 00-0010 LF 2" x 10" Pressure Treated Wood Rafter.....	3.71	1.37
06 11 16 00-0011 LF 2" x 12" Pressure Treated Wood Rafter.....	4.50	1.53

06 11 16 00-0012 Joists (06 11 16 00-0001)

Note: A series of parallel beams to support floors or ceilings.

06 11 16 00-0013 LF 2" x 6" Pressure Treated Wood Floor Joist	2.04	0.72
06 11 16 00-0014 LF 2" x 8" Pressure Treated Wood Floor Joist	2.62	0.79
06 11 16 00-0015 LF 2" x 10" Pressure Treated Wood Floor Joist.....	3.20	1.02
06 11 16 00-0016 LF 2" x 12" Pressure Treated Wood Floor Joist.....	4.00	1.16

06 11 16 00-0017 Purlins (06 11 16 00-0001)

Note: A horizontal structural member in a roof, supporting the loads from the roof deck or sheathing.

06 11 16 00-0018 LF 2" x 4" Wood Purlin	1.26	0.44
06 11 16 00-0019 LF 2" x 6" Wood Purlin	1.60	0.48
06 11 16 00-0020 LF 2" x 8" Wood Purlin	1.96	0.53
06 11 16 00-0021 LF 2" x 10" Wood Purlin.....	2.43	0.58
06 11 16 00-0022 LF 2" x 4" Pressure Treated Wood Purlin	1.53	0.44
06 11 16 00-0023 LF 2" x 6" Pressure Treated Wood Purlin	2.05	0.48
06 11 16 00-0024 LF 2" x 8" Pressure Treated Wood Purlin	2.58	0.53

06 Wood, Plastics, and Composites**06 10 Rough Carpentry****06 11 Wood Framing**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 11 16 00-0025	LF		2" x 10" Pressure Treated Wood Purlin	3.06	0.58
06 11 16 00-0026			Framing <small>(06 11 16)</small>		
06 11 16 00-0027			Partition Framing <small>(06 11 16 00-0026)</small>		
06 11 16 00-0028	LF		2" x 4" Wood Stud Framing, For Partition Walls.....	1.21	0.58
06 11 16 00-0029	LF		2" x 6" Wood Stud Framing, For Partition Walls.....	1.52	0.62
06 11 16 00-0030	LF		2" x 8" Wood Stud Framing, For Partition Walls.....	1.82	0.65
06 11 16 00-0031	LF		2" x 4" Pressure Treated Wood Stud Framing, For Partition Walls.....	1.48	0.58
06 11 16 00-0032	LF		2" x 6" Pressure Treated Wood Stud Framing, For Partition Walls.....	1.97	0.62
06 11 16 00-0033	LF		2" x 8" Pressure Treated Wood Stud Framing, For Partition Walls.....	2.44	0.65
06 11 16 00-0034			Sills And Plates <small>(06 11 16)</small>		
06 11 16 00-0035			Sills <small>(06 11 16 00-0034)</small>		
			Note: A horizontal member which rests on and is attached to the foundation.		
06 11 16 00-0036	LF		2" x 4" Wood Sill	2.01	1.09
			For "Green" Materials (FSC and SCS certified), Add	0.06	
06 11 16 00-0037	LF		2" x 6" Wood Sill	2.45	1.23
			For "Green" Materials (FSC and SCS certified), Add	0.10	
06 11 16 00-0038	LF		2" x 8" Wood Sill	2.96	1.37
			For "Green" Materials (FSC and SCS certified), Add	0.14	
06 11 16 00-0039	LF		2" x 4" Pressure Treated Wood Sill.....	2.28	1.09
06 11 16 00-0040	LF		2" x 6" Pressure Treated Wood Sill.....	2.90	1.23
06 11 16 00-0041	LF		2" x 8" Pressure Treated Wood Sill.....	3.58	1.37
06 11 16 00-0042			Plates <small>(06 11 16 00-0034)</small>		
			Note: A horizontal member connecting and terminating studs, posts, joists, rafters, etc. such as the top and bottom plate on a stud framed partition wall.		
06 11 16 00-0043	LF		2" x 4" Wood Plate	2.01	1.09
			For "Green" Materials (FSC and SCS certified), Add	0.06	
06 11 16 00-0044	LF		2" x 6" Wood Plate	2.45	1.23
			For "Green" Materials (FSC and SCS certified), Add	0.10	
06 11 16 00-0045	LF		2" x 8" Wood Plate	2.94	1.37
			For "Green" Materials (FSC and SCS certified), Add	0.14	
06 11 16 00-0046	LF		2" x 4" Pressure Treated Wood Plate	2.28	1.09
06 11 16 00-0047	LF		2" x 6" Pressure Treated Wood Plate	2.90	1.23
06 11 16 00-0048	LF		2" x 8" Pressure Treated Wood Plate	3.56	1.37
06 11 16 00-0049			Sills And Plates From Redwood <small>(06 11 16 00-0034)</small>		
06 11 16 00-0050			Construction Grade/Rough <small>(06 11 16 00-0049)</small>		
06 11 16 00-0051	LF		2" x 6" Redwood, Construction Grade/Rough.....	3.43	1.23
06 11 16 00-0052	LF		2" x 8" Redwood, Construction Grade/Rough.....	4.52	1.37
06 11 16 00-0053	LF		2" x 10" Redwood, Construction Grade/Rough.....	5.48	1.53
06 11 16 00-0054	LF		2" x 12" Redwood, Construction Grade/Rough.....	6.62	1.67
06 11 16 00-0055			Con Heart/Smooth <small>(06 11 16 00-0049)</small>		
06 11 16 00-0056	LF		2" x 6" Redwood, Con Heart/Smooth.....	4.12	1.23
06 11 16 00-0057	LF		2" x 8" Redwood, Con Heart/Smooth.....	5.56	1.37
06 11 16 00-0058	LF		2" x 10" Redwood, Con Heart/Smooth.....	7.24	1.53
06 11 16 00-0059	LF		2" x 12" Redwood, Con Heart/Smooth.....	8.70	1.67
06 11 16 00-0060			Suspended Ceiling Framing <small>(06 11 16)</small>		
06 11 16 00-0061	LF		1" x 2" Wood Suspended Ceiling Framing	1.62	0.95
06 11 16 00-0062	LF		1" x 3" Wood Suspended Ceiling Framing	1.79	1.02
06 11 16 00-0063	LF		2" x 2" Wood Suspended Ceiling Framing	1.95	1.09
06 11 16 00-0064	LF		2" x 4" Wood Suspended Ceiling Framing	2.31	1.23
06 11 16 00-0065	LF		1" x 2" Pressure Treated Wood Suspended Ceiling Framing	1.84	0.95
06 11 16 00-0066	LF		1" x 3" Pressure Treated Wood Suspended Ceiling Framing	1.78	1.02
06 11 16 00-0067	LF		2" x 2" Pressure Treated Wood Suspended Ceiling Framing	2.19	1.09
06 11 16 00-0068	LF		2" x 4" Pressure Treated Wood Suspended Ceiling Framing	2.53	1.23
06 11 16 00-0069			Posts And Girts <small>(06 11 16)</small>		
06 11 16 00-0070			Posts <small>(06 11 16 00-0069)</small>		
			Note: A vertical, upright framing member.		
06 11 16 00-0071	LF		4" x 4" Wood Post.....	2.87	1.37
06 11 16 00-0072	LF		4" x 5" Wood Post.....	3.27	1.60
06 11 16 00-0073	LF		4" x 6" Wood Post.....	3.60	1.74
06 11 16 00-0074	LF		6" x 6" Wood Post.....	4.01	1.88
06 11 16 00-0075	LF		8" x 8" Wood Post.....	4.41	1.95
06 11 16 00-0076	LF		10" x 10" Wood Post.....	4.82	2.25
06 11 16 00-0077	LF		4" x 4" Pressure Treated Wood Post	3.77	1.37
06 11 16 00-0078	LF		4" x 6" Pressure Treated Wood Post	4.88	1.74



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 11 16 00-0079 LF 6" x 6" Pressure Treated Wood Post	6.29	1.88
06 11 16 00-0080 Girts <small>(06 11 16 00-0069)</small>		
<small>Note: A horizontal member at intermediate level between columns, studs, or posts.</small>		
06 11 16 00-0081 LF 2" x 4" Wood Girt	1.43	0.52
06 11 16 00-0082 LF 2" x 6" Wood Girt	1.79	0.57
06 11 16 00-0083 LF 2" x 8" Wood Girt	2.17	0.63
06 11 16 00-0084 LF 2" x 10" Wood Girt	2.66	0.69
06 11 16 00-0085 LF 4" x 4" Wood Girt	2.78	1.05
06 11 16 00-0086 LF 4" x 5" Wood Girt	3.18	1.18
06 11 16 00-0087 LF 4" x 6" Wood Girt	3.58	1.30
06 11 16 00-0088 LF 6" x 6" Wood Girt	3.99	1.43
06 11 16 00-0089 LF 8" x 8" Wood Girt	4.40	1.57
06 11 16 00-0090 LF 10" x 10" Wood Girt	4.81	1.71
06 11 16 00-0091 LF 2" x 4" Pressure Treated Wood Girt.....	1.70	0.52
06 11 16 00-0092 LF 2" x 6" Pressure Treated Wood Girt.....	2.24	0.57
06 11 16 00-0093 LF 2" x 8" Pressure Treated Wood Girt.....	2.79	0.63
06 11 16 00-0094 LF 2" x 10" Pressure Treated Wood Girt.....	3.29	0.69
06 11 16 00-0095 LF 4" x 4" Pressure Treated Wood Girt.....	3.77	1.05
06 11 16 00-0096 LF 4" x 6" Pressure Treated Wood Girt.....	4.88	1.30
06 11 16 00-0097 LF 6" x 6" Pressure Treated Wood Girt.....	6.29	1.43
06 11 16 00-0098 Construction Grade/Rough Redwood Posts <small>(06 11 16 00-0069)</small>		
06 11 16 00-0099 LF 4" x 4" Redwood, Construction Grade/Rough Post.....	5.22	1.37
<i>For Smooth "Clear", Add</i>	0.63	
06 11 16 00-0100 LF 4" x 5" Redwood, Construction Grade/Rough Post.....	6.25	1.60
<i>For Smooth "Clear", Add</i>	0.78	
06 11 16 00-0101 LF 4" x 6" Redwood, Construction Grade/Rough Post.....	7.31	1.74
<i>For Smooth "Clear", Add</i>	0.94	
06 11 16 00-0102 LF 4" x 8" Redwood, Construction Grade/Rough Post.....	8.99	1.79
<i>For Smooth "Clear", Add</i>	1.25	
06 11 16 00-0103 LF 4" x 10" Redwood, Construction Grade/Rough Post.....	10.72	1.91
<i>For Smooth "Clear", Add</i>	1.57	
06 11 16 00-0104 LF 6" x 6" Redwood, Construction Grade/Rough Post.....	9.93	1.88
<i>For Smooth "Clear", Add</i>	1.41	
06 11 16 00-0105 LF 6" x 8" Redwood, Construction Grade/Rough Post.....	12.38	1.95
<i>For Smooth "Clear", Add</i>	1.88	
06 11 16 00-0106 LF 6" x 10" Redwood, Construction Grade/Rough Post.....	14.81	1.84
<i>For Smooth "Clear", Add</i>	2.35	
06 11 16 00-0107 LF 8" x 8" Redwood, Construction Grade/Rough Post.....	15.67	1.95
<i>For Smooth "Clear", Add</i>	2.51	
06 11 16 00-0108 Stair Stringers <small>(06 11 16)</small>		
06 11 16 00-0109 LF 2" x 10" Wood Stair Stringer	5.60	2.90
<i>For "Green" Materials (FSC and SCS certified), Add</i>	0.19	
06 11 16 00-0110 LF 2" x 12" Wood Stair Stringer	6.64	3.41
<i>For "Green" Materials (FSC and SCS certified), Add</i>	0.23	
06 11 16 00-0111 LF 2" x 10" Pressure Treated Wood Stair Stringer.....	6.25	2.90
06 11 16 00-0112 LF 2" x 12" Pressure Treated Wood Stair Stringer.....	7.55	3.41
06 11 16 00-0113 Blocking <small>(06 11 16)</small>		
06 11 16 00-0114 Pressure Treated Lattice <small>(06 11 16 00-0113)</small>		
06 11 16 00-0115 SF 3/4" Thick Pressure Treated Wood Lattice	4.86	1.53
06 11 16 00-0116 Roofing Nailers <small>(06 11 16)</small>		
06 11 16 00-0117 LF 2" x 4" Pressure Treated Lumber, For Roofing Nailers.....	2.32	0.58
06 11 16 00-0118 LF 2" x 6" Pressure Treated Lumber, For Roofing Nailers.....	2.83	0.62
06 11 16 00-0119 LF 2" x 8" Pressure Treated Lumber, For Roofing Nailers.....	3.34	0.65
06 11 16 00-0120 Roofing Sleepers <small>(06 11 16)</small>		
06 11 16 00-0121 LF 2" x 4" Pressure Treated Lumber, For Roofing Sleepers.....	1.19	
06 11 16 00-0122 LF 4" x 4" Pressure Treated Lumber, For Roofing Sleepers.....	2.73	
06 11 16 00-0123 LF 4" x 6" Pressure Treated Lumber, For Roofing Sleepers.....	3.57	
06 11 16 00-0124 LF 6" x 6" Pressure Treated Lumber, For Roofing Sleepers.....	4.86	
06 11 16 00-0125 Canopy Framing, Bridging, And Furring <small>(06 11 16)</small>		
06 11 16 00-0126 Wood And Steel Bridging <small>(06 11 16 00-0126)</small>		
06 11 16 00-0127 Wood Bridging <small>(06 11 16 00-0126)</small>		
06 11 16 00-0128 EA 1 Pair Wood Bridging, 1" x 3" Cross Type	5.91	2.54
<small>Note: For joists spaced at 16" on center.</small>		
06 11 16 00-0129 EA 1 Pair Wood Bridging, 2" x 3" Cross Type	6.12	2.54
<small>Note: For joists spaced at 16" on center.</small>		

06 Wood, Plastics, and Composites**06 10 Rough Carpentry****06 11 Wood Framing**

MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
06 11 16 00-0130		Steel Bridging (06 11 16 00-0126)			
06 11 16 00-0131	EA	1 Pair Steel Bridging, Wood Joists At 16" On Center.....	6.88		2.54
06 11 16 00-0132	EA	1 Pair Steel Bridging, Wood Joists At 24" On Center.....	6.86		2.54
06 11 16 00-0133		Light Framing, Trim And Furring (06 11 16 00-0125)			
06 11 16 00-0134		Redwood Light Framing, Trim And Furring (06 11 16 00-0133)			
06 11 16 00-0135	LF	1" x 1" Redwood Light Framing, Trim And Furring.....	1.29		0.59
06 11 16 00-0136	LF	1" x 2" Redwood Light Framing, Trim And Furring.....	1.52		0.65
06 11 16 00-0137	LF	1" x 4" Redwood Light Framing, Trim And Furring.....	1.88		0.72
06 11 16 00-0138	LF	1" x 6" Redwood Light Framing, Trim And Furring.....	2.29		0.79
06 11 16 00-0139	LF	1" x 8" Redwood Light Framing, Trim And Furring.....	2.74		0.88
06 11 16 00-0140	LF	1" x 10" Redwood Light Framing, Trim And Furring.....	3.22		0.96
06 11 16 00-0141	LF	2" x 2" Redwood Light Framing, Trim And Furring.....	2.30		0.79
06 11 16 00-0142	LF	2" x 4" Redwood Light Framing, Trim And Furring.....	2.76		0.88
06 11 16 00-0143		Poplar Light Framing, Trim And Furring (06 11 16 00-0133)			
06 11 16 00-0144	LF	1" x 1" Poplar Light Framing, Trim And Furring.....	1.54		0.59
06 11 16 00-0145	LF	1" x 2" Poplar Light Framing, Trim And Furring.....	1.91		0.65
06 11 16 00-0146	LF	1" x 4" Poplar Light Framing, Trim And Furring.....	2.43		0.72
06 11 16 00-0147	LF	1" x 6" Poplar Light Framing, Trim And Furring.....	3.15		0.79
06 11 16 00-0148	LF	1" x 8" Poplar Light Framing, Trim And Furring.....	3.67		0.88
06 11 16 00-0149	LF	1" x 10" Poplar Light Framing, Trim And Furring.....	4.90		0.96
06 11 16 00-0150	LF	1" x 12" Poplar Light Framing, Trim And Furring.....	5.32		0.96
06 11 16 00-0151	LF	2" x 2" Poplar Light Framing, Trim And Furring.....	4.21		0.79
06 11 16 00-0152	LF	2" x 4" Poplar Light Framing, Trim And Furring.....	4.73		0.88
06 11 16 00-0153	LF	2" x 6" Poplar Light Framing, Trim And Furring.....	6.38		0.96
06 11 16 00-0154		Maple Light Framing, Trim And Furring (06 11 16 00-0133)			
06 11 16 00-0155	LF	1" x 4" Maple Light Framing, Trim And Furring.....	3.51		0.72
06 11 16 00-0156	LF	1" x 6" Maple Light Framing, Trim And Furring.....	4.82		0.79
06 11 16 00-0157	LF	1" x 8" Maple Light Framing, Trim And Furring.....	6.16		0.88
06 13		Heavy Timber Construction (06 10)			
06 13 23		Heavy Timber Framing (06 13)			
06 13 23 00-0001		Heavy Timber Framing (06 13 23) Note: Excludes fasteners.			
06 13 23 00-0002		Heavy Timber Beams (06 13 23 00-0001)			
06 13 23 00-0003		Pine, Heavy Timber Beams (06 13 23 00-0002)			
06 13 23 00-0004	LF	4" x 4", Pine, Heavy Timber Beam.....	3.78		1.29
06 13 23 00-0005	LF	4" x 6", Pine, Heavy Timber Beam.....	4.51		1.34
06 13 23 00-0006	LF	4" x 8", Pine, Heavy Timber Beam.....	5.21		1.39
06 13 23 00-0007	LF	4" x 10", Pine, Heavy Timber Beam.....	6.64		1.49
06 13 23 00-0008	LF	4" x 12", Pine, Heavy Timber Beam.....	7.82		1.58
06 13 23 00-0009	LF	6" x 6", Pine, Heavy Timber Beam.....	5.60		1.45
06 13 23 00-0010	LF	6" x 8", Pine, Heavy Timber Beam.....	6.63		1.53
06 13 23 00-0011	LF	6" x 10", Pine, Heavy Timber Beam.....	8.78		1.63
06 13 23 00-0012	LF	6" x 12", Pine, Heavy Timber Beam.....	10.34		1.67
06 13 23 00-0013	LF	8" x 8", Pine, Heavy Timber Beam.....	7.99		1.58
06 13 23 00-0014	LF	8" x 10", Pine, Heavy Timber Beam.....	10.62		1.63
06 13 23 00-0015	LF	8" x 12", Pine, Heavy Timber Beam.....	12.73		1.67
06 13 23 00-0016	LF	10" x 10", Pine, Heavy Timber Beam.....	12.60		1.67
06 13 23 00-0017	LF	10" x 12", Pine, Heavy Timber Beam.....	15.30		1.81
06 13 23 00-0018	LF	12" x 12", Pine, Heavy Timber Beam.....	18.00		1.99
06 13 23 00-0019		Douglas Fir, Heavy Timber Beams (06 13 23 00-0002)			
06 13 23 00-0020	LF	4" x 4", Douglas Fir, Heavy Timber Beam.....	3.90		1.29
06 13 23 00-0021	LF	4" x 6", Douglas Fir, Heavy Timber Beam.....	4.69		1.34
06 13 23 00-0022	LF	4" x 8", Douglas Fir, Heavy Timber Beam.....	5.46		1.39
06 13 23 00-0023	LF	4" x 10", Douglas Fir, Heavy Timber Beam.....	7.01		1.49
06 13 23 00-0024	LF	4" x 12", Douglas Fir, Heavy Timber Beam.....	8.28		1.58
06 13 23 00-0025	LF	6" x 6", Douglas Fir, Heavy Timber Beam.....	5.87		1.45
06 13 23 00-0026	LF	6" x 8", Douglas Fir, Heavy Timber Beam.....	6.99		1.53
06 13 23 00-0027	LF	6" x 10", Douglas Fir, Heavy Timber Beam.....	9.33		1.63
06 13 23 00-0028	LF	6" x 12", Douglas Fir, Heavy Timber Beam.....	11.05		1.67
06 13 23 00-0029	LF	8" x 8", Douglas Fir, Heavy Timber Beam.....	8.47		1.58
06 13 23 00-0030	LF	8" x 10", Douglas Fir, Heavy Timber Beam.....	11.35		1.63
06 13 23 00-0031	LF	8" x 12", Douglas Fir, Heavy Timber Beam.....	13.67		1.67
06 13 23 00-0032	LF	10" x 10", Douglas Fir, Heavy Timber Beam.....	13.51		1.67
06 13 23 00-0033	LF	10" x 12", Douglas Fir, Heavy Timber Beam.....	16.45		1.81



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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06 13 23 00-0034	LF	12" x 12", Douglas Fir, Heavy Timber Beam.....	19.39	1.99
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06 13 23 00-0035 Pressure Treated, Heavy Timber Beams (06 13 23 00-0002)

06 13 23 00-0036	LF	4" x 4", Pressure Treated, Heavy Timber Beam	3.73	1.29
06 13 23 00-0037	LF	4" x 6", Pressure Treated, Heavy Timber Beam	4.53	1.34
06 13 23 00-0038	LF	4" x 8", Pressure Treated, Heavy Timber Beam	5.21	1.39
06 13 23 00-0039	LF	4" x 10", Pressure Treated, Heavy Timber Beam	6.65	1.49
06 13 23 00-0040	LF	4" x 12", Pressure Treated, Heavy Timber Beam	7.82	1.58
06 13 23 00-0041	LF	6" x 6", Pressure Treated, Heavy Timber Beam	5.60	1.45
06 13 23 00-0042	LF	6" x 8", Pressure Treated, Heavy Timber Beam	5.89	1.53
06 13 23 00-0043	LF	6" x 10", Pressure Treated, Heavy Timber Beam	8.47	1.63
06 13 23 00-0044	LF	6" x 12", Pressure Treated, Heavy Timber Beam	10.16	1.67
06 13 23 00-0045	LF	8" x 8", Pressure Treated, Heavy Timber Beam	10.19	1.58
06 13 23 00-0046	LF	8" x 10", Pressure Treated, Heavy Timber Beam	11.71	1.63
06 13 23 00-0047	LF	8" x 12", Pressure Treated, Heavy Timber Beam	13.64	1.67
06 13 23 00-0048	LF	10" x 10", Pressure Treated, Heavy Timber Beam	13.70	1.67
06 13 23 00-0049	LF	10" x 12", Pressure Treated, Heavy Timber Beam	17.83	1.81
06 13 23 00-0050	LF	12" x 12", Pressure Treated, Heavy Timber Beam	21.04	1.99

06 13 23 00-0051 Heavy Timber Columns (06 13 23 00-0001)

06 13 23 00-0052 Pine, Heavy Timber Columns (06 13 23 00-0051)

06 13 23 00-0053	LF	4" x 4", Pine, Heavy Timber Column.....	2.56	0.68
06 13 23 00-0054	LF	4" x 6", Pine, Heavy Timber Column.....	3.25	0.71
06 13 23 00-0055	LF	4" x 8", Pine, Heavy Timber Column.....	3.89	0.73
06 13 23 00-0056	LF	4" x 10", Pine, Heavy Timber Column.....	5.24	0.78
06 13 23 00-0057	LF	4" x 12", Pine, Heavy Timber Column.....	6.33	0.83
06 13 23 00-0058	LF	6" x 6", Pine, Heavy Timber Column.....	4.24	0.75
06 13 23 00-0059	LF	6" x 8", Pine, Heavy Timber Column.....	5.21	0.79
06 13 23 00-0060	LF	6" x 10", Pine, Heavy Timber Column.....	7.23	0.85
06 13 23 00-0061	LF	6" x 12", Pine, Heavy Timber Column.....	8.76	0.88
06 13 23 00-0062	LF	8" x 8", Pine, Heavy Timber Column.....	6.50	0.83
06 13 23 00-0063	LF	8" x 10", Pine, Heavy Timber Column.....	9.07	0.85
06 13 23 00-0064	LF	8" x 12", Pine, Heavy Timber Column.....	11.12	0.90
06 13 23 00-0065	LF	10" x 10", Pine, Heavy Timber Column.....	10.98	0.90
06 13 23 00-0066	LF	10" x 12", Pine, Heavy Timber Column.....	13.59	0.96
06 13 23 00-0067	LF	12" x 12", Pine, Heavy Timber Column.....	16.11	1.05

06 13 23 00-0068 Douglas Fir, Heavy Timber Columns (06 13 23 00-0051)

06 13 23 00-0069	LF	4" x 4", Douglas Fir, Heavy Timber Column.....	2.68	0.68
06 13 23 00-0070	LF	4" x 6", Douglas Fir, Heavy Timber Column.....	3.43	0.71
06 13 23 00-0071	LF	4" x 8", Douglas Fir, Heavy Timber Column.....	4.14	0.73
06 13 23 00-0072	LF	4" x 10", Douglas Fir, Heavy Timber Column.....	5.61	0.78
06 13 23 00-0073	LF	4" x 12", Douglas Fir, Heavy Timber Column.....	6.79	0.83
06 13 23 00-0074	LF	6" x 6", Douglas Fir, Heavy Timber Column.....	4.51	0.75
06 13 23 00-0075	LF	6" x 8", Douglas Fir, Heavy Timber Column.....	5.57	0.79
06 13 23 00-0076	LF	6" x 10", Douglas Fir, Heavy Timber Column.....	7.78	0.85
06 13 23 00-0077	LF	6" x 12", Douglas Fir, Heavy Timber Column.....	9.47	0.88
06 13 23 00-0078	LF	8" x 8", Douglas Fir, Heavy Timber Column.....	6.98	0.83
06 13 23 00-0079	LF	8" x 10", Douglas Fir, Heavy Timber Column.....	9.80	0.85
06 13 23 00-0080	LF	8" x 12", Douglas Fir, Heavy Timber Column.....	12.06	0.90
06 13 23 00-0081	LF	10" x 10", Douglas Fir, Heavy Timber Column.....	11.89	0.90
06 13 23 00-0082	LF	10" x 12", Douglas Fir, Heavy Timber Column.....	14.74	0.96
06 13 23 00-0083	LF	12" x 12", Douglas Fir, Heavy Timber Column.....	17.50	1.05

06 13 23 00-0084 Pressure Treated, Heavy Timber Columns (06 13 23 00-0051)

06 13 23 00-0085	LF	4" x 4", Pressure Treated, Heavy Timber Column	2.51	0.68
06 13 23 00-0086	LF	4" x 6", Pressure Treated, Heavy Timber Column	3.27	0.71
06 13 23 00-0087	LF	4" x 8", Pressure Treated, Heavy Timber Column	3.89	0.73
06 13 23 00-0088	LF	4" x 10", Pressure Treated, Heavy Timber Column	5.25	0.78
06 13 23 00-0089	LF	4" x 12", Pressure Treated, Heavy Timber Column	6.33	0.83
06 13 23 00-0090	LF	6" x 6", Pressure Treated, Heavy Timber Column	4.24	0.75
06 13 23 00-0091	LF	6" x 8", Pressure Treated, Heavy Timber Column	4.47	0.79
06 13 23 00-0092	LF	6" x 10", Pressure Treated, Heavy Timber Column	6.92	0.85
06 13 23 00-0093	LF	6" x 12", Pressure Treated, Heavy Timber Column	8.58	0.88
06 13 23 00-0094	LF	8" x 8", Pressure Treated, Heavy Timber Column	8.70	0.83
06 13 23 00-0095	LF	8" x 10", Pressure Treated, Heavy Timber Column	10.16	0.85
06 13 23 00-0096	LF	8" x 12", Pressure Treated, Heavy Timber Column	12.03	0.90
06 13 23 00-0097	LF	10" x 10", Pressure Treated, Heavy Timber Column	12.08	0.90
06 13 23 00-0098	LF	10" x 12", Pressure Treated, Heavy Timber Column	16.12	0.96
06 13 23 00-0099	LF	12" x 12", Pressure Treated, Heavy Timber Column	19.15	1.05

06 15 Wood Decking (06 10)

06 15 13 Wood Floor Decking (06 15)

06 Wood, Plastics, and Composites**06 10 Rough Carpentry****06 15 Wood Decking**

MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
06 15 13 00-0001		Wood Deck Systems <small>(06 15 13)</small> Note: Includes the deck, joists, girders, posts (8' O.C.), pickets and railing.			
06 15 13 00-0002		Pressure Treated Wood Deck System <small>(06 15 13 00-0001)</small>			
06 15 13 00-0003		2" x 8" Joists At 16" On Center, Pressure Treated Wood Deck System <small>(06 15 13 00-0002)</small>			
06 15 13 00-0004	SF	5/4" x 4" Pressure Treated Decking, 2" x 8" Pressure Treated Joists 16" On Center, Wood Deck System	24.89		5.52
06 15 13 00-0005	SF	5/4" x 6" Pressure Treated Decking, 2" x 8" Pressure Treated Joists 16" On Center, Wood Deck System	24.02		5.25
06 15 13 00-0006	SF	2" x 4" Pressure Treated Decking, 2" x 8" Pressure Treated Joists 16" On Center, Wood Deck System	25.78		5.66
06 15 13 00-0007	SF	2" x 6" Pressure Treated Decking, 2" x 8" Pressure Treated Joists 16" On Center, Wood Deck System	24.93		5.38
06 15 13 00-0008		2" x 10" Joists At 16" On Center, Pressure Treated Wood Deck System <small>(06 15 13 00-0002)</small>			
06 15 13 00-0009	SF	5/4" x 4" Pressure Treated Decking, 2" x 10" Pressure Treated Joists 16" On Center, Wood Deck System	25.70		5.66
06 15 13 00-0010	SF	5/4" x 6" Pressure Treated Decking, 2" x 10" Pressure Treated Joists 16" On Center, Wood Deck System	24.82		5.38
06 15 13 00-0011	SF	2" x 4" Pressure Treated Decking, 2" x 10" Pressure Treated Joists 16" On Center, Wood Deck System	26.61		5.81
06 15 13 00-0012	SF	2" x 6" Pressure Treated Decking, 2" x 10" Pressure Treated Joists 16" On Center	25.73		5.52
06 15 13 00-0013		2" x 10" Joists At 24" On Center, Pressure Treated Wood Deck System <small>(06 15 13 00-0002)</small>			
06 15 13 00-0014	SF	5/4" x 4" Pressure Treated Decking, 2" x 10" Pressure Treated Joists 24" On Center, Wood Deck System	24.89		5.52
06 15 13 00-0015	SF	5/4" x 6" Pressure Treated Decking, 2" x 10" Pressure Treated Joists 24" On Center, Wood Deck System	24.02		5.25
06 15 13 00-0016	SF	2" x 4" Pressure Treated Decking, 2" x 10" Pressure Treated Joists 24" On Center, Wood Deck System	25.78		5.66
06 15 13 00-0017	SF	2" x 6" Pressure Treated Decking, 2" x 10" Pressure Treated Joists 24" On Center, Wood Deck System	24.93		5.38
06 15 13 00-0018		Redwood With Pressure Treated Joists, Wood Deck System <small>(06 15 13 00-0001)</small>			
06 15 13 00-0019		2" x 8" Joists At 16" On Center, Redwood With Pressure Treated Joists, Wood Deck System <small>(06 15 13 00-0018)</small>			
06 15 13 00-0020	SF	5/4" x 4" Redwood Decking, 2" x 8" Pressure Treated Joists 16" On Center, Wood Deck System.....	26.35		5.52
06 15 13 00-0021	SF	5/4" x 6" Redwood Decking, 2" x 8" Pressure Treated Joists 16" On Center, Wood Deck System.....	25.56		4.91
06 15 13 00-0022	SF	2" x 4" Redwood Decking, 2" x 8" Pressure Treated Joists 16" On Center, Wood Deck System.....	27.62		5.66
06 15 13 00-0023	SF	2" x 6" Redwood Decking, 2" x 8" Pressure Treated Joists 16" On Center, Wood Deck System.....	26.66		5.38
06 15 13 00-0024		2" x 10" Joists At 16" On Center, Redwood With Pressure Treated Joists, Wood Deck System <small>(06 15 13 00-0018)</small>			
06 15 13 00-0025	SF	5/4" x 4" Redwood Decking, 2" x 10" Pressure Treated Joists 16" On Center, Wood Deck System.....	28.00		5.66
06 15 13 00-0026	SF	5/4" x 6" Redwood Decking, 2" x 10" Pressure Treated Joists 16" On Center, Wood Deck System.....	27.19		5.38
06 15 13 00-0027	SF	2" x 4" Redwood Decking, 2" x 10" Pressure Treated Joists 16" On Center, Wood Deck System	29.36		5.81
06 15 13 00-0028	SF	2" x 6" Redwood Decking, 2" x 10" Pressure Treated Joists 16" On Center, Wood Deck System	28.39		5.52
06 15 13 00-0029		2" x 10" Joists At 24" On Center, Redwood With Pressure Treated Joists, Wood Deck System <small>(06 15 13 00-0018)</small>			
06 15 13 00-0030	SF	5/4" x 4" Redwood Decking, 2" x 10" Pressure Treated Joists 24" On Center, Wood Deck System.....	26.94		5.52
06 15 13 00-0031	SF	5/4" x 6" Redwood Decking, 2" x 10" Pressure Treated Joists 24" On Center, Wood Deck System.....	26.15		5.25
06 15 13 00-0032	SF	2" x 4" Redwood Decking, 2" x 10" Pressure Treated Joists 24" On Center, Wood Deck System	28.24		5.66
06 15 13 00-0033	SF	2" x 6" Redwood Decking, 2" x 10" Pressure Treated Joists 24" On Center, Wood Deck System	27.75		5.38
06 15 13 00-0034		Wood Ramp Systems <small>(06 15 13)</small> Note: Includes the decking, joists, girders, posts at corners and along ramp, pickets and railing.			
06 15 13 00-0035		Pressure Treated Wood Ramp System <small>(06 15 13 00-0034)</small>			
06 15 13 00-0036		2" x 6" Joists, Pressure Treated Wood Ramp System <small>(06 15 13 00-0035)</small>			
06 15 13 00-0037	SF	5/4" x 4" Pressure Treated Decking, 2" x 6" Pressure Treated Joists, Wood Ramp System	29.15		5.38
06 15 13 00-0038	SF	5/4" x 6" Pressure Treated Decking, 2" x 6" Pressure Treated Joists, Wood Ramp System	28.06		5.11
06 15 13 00-0039	SF	2" x 4" Pressure Treated Decking, 2" x 6" Pressure Treated Joists, Wood Ramp System	30.13		5.52
06 15 13 00-0040	SF	2" x 6" Pressure Treated Decking, 2" x 6" Pressure Treated Joists, Wood Ramp System	29.04		5.25
06 15 13 00-0041		2" x 8" Joists, Pressure Treated Wood Ramp System <small>(06 15 13 00-0035)</small>			
06 15 13 00-0042	SF	5/4" x 4" Pressure Treated Decking, 2" x 8" Pressure Treated Joists, Wood Ramp System	30.05		5.52
06 15 13 00-0043	SF	5/4" x 6" Pressure Treated Decking, 2" x 8" Pressure Treated Joists, Wood Ramp System	28.93		5.25
06 15 13 00-0044	SF	2" x 4" Pressure Treated Decking, 2" x 8" Pressure Treated Joists, Wood Ramp System	31.07		5.66
06 15 13 00-0045	SF	2" x 6" Pressure Treated Decking, 2" x 8" Pressure Treated Joists, Wood Ramp System	29.96		5.38
06 15 13 00-0046		2" x 10" Joists, Pressure Treated Wood Ramp System <small>(06 15 13 00-0035)</small>			
06 15 13 00-0047	SF	5/4" x 4" Pressure Treated Decking, 2" x 10" Pressure Treated Joists, Wood Ramp System	30.97		5.65
06 15 13 00-0048	SF	5/4" x 6" Pressure Treated Decking, 2" x 10" Pressure Treated Joists, Wood Ramp System	29.85		5.38
06 15 13 00-0049	SF	2" x 4" Pressure Treated Decking, 2" x 10" Pressure Treated Joists, Wood Ramp System	32.03		5.81
06 15 13 00-0050	SF	2" x 6" Pressure Treated Decking, 2" x 10" Pressure Treated Joists, Wood Ramp System	30.89		5.52



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 15 13 00-0051 Redwood With Pressure Treated Joists, Wood Ramp System <small>(06 15 13 00-0034)</small>		
06 15 13 00-0052 2" x 6" Joists, Redwood With Pressure Treated Joists, Wood Ramp System <small>(06 15 13 00-0051)</small>		
06 15 13 00-0053 SF 5/4" x 4" Redwood Decking, 2" x 6" Pressure Treated Joists, Wood Ramp System.....	30.53	5.38
06 15 13 00-0054 SF 5/4" x 6" Redwood Decking, 2" x 6" Pressure Treated Joists, Wood Ramp System.....	29.50	5.11
06 15 13 00-0055 SF 2" x 4" Redwood Decking, 2" x 6" Pressure Treated Joists, Wood Ramp System.....	31.86	5.52
06 15 13 00-0056 SF 2" x 6" Redwood Decking, 2" x 6" Pressure Treated Joists, Wood Ramp System.....	30.66	5.25
06 15 13 00-0057 2" x 8" Joists, Redwood With Pressure Treated Joists, Wood Ramp System <small>(06 15 13 00-0051)</small>		
06 15 13 00-0058 SF 5/4" x 4" Redwood Decking, 2" x 8" Pressure Treated Joists, Wood Ramp System.....	31.51	5.52
06 15 13 00-0059 SF 5/4" x 6" Redwood Decking, 2" x 8" Pressure Treated Joists, Wood Ramp System.....	30.47	5.25
06 15 13 00-0060 SF 2" x 4" Redwood Decking, 2" x 8" Pressure Treated Joists, Wood Ramp System.....	32.91	5.66
06 15 13 00-0061 SF 2" x 6" Redwood Decking, 2" x 8" Pressure Treated Joists, Wood Ramp System.....	31.69	5.38
06 15 13 00-0062 2" x 10" Joists, Redwood With Pressure Treated Joists, Wood Ramp System <small>(06 15 13 00-0051)</small>		
06 15 13 00-0063 SF 5/4" x 4" Redwood Decking, 2" x 10" Pressure Treated Joists, Wood Ramp System.....	33.28	5.65
06 15 13 00-0064 SF 5/4" x 6" Redwood Decking, 2" x 10" Pressure Treated Joists, Wood Ramp System.....	32.22	5.38
06 15 13 00-0065 SF 2" x 4" Redwood Decking, 2" x 10" Pressure Treated Joists, Wood Ramp System.....	34.78	5.81
06 15 13 00-0066 SF 2" x 6" Redwood Decking, 2" x 10" Pressure Treated Joists, Wood Ramp System.....	33.85	5.52
06 15 13 00-0067 Cedar With Pressure Treated Joists, Wood Ramp System <small>(06 15 13 00-0034)</small>		
06 15 13 00-0068 2" x 6" Joists, Cedar With Pressure Treated Joists, Wood Ramp System <small>(06 15 13 00-0067)</small>		
06 15 13 00-0069 SF 5/4" x 4" Cedar Decking, 2" x 6" Pressure Treated Joists, Wood Ramp System.....	29.64	5.38
06 15 13 00-0070 SF 5/4" x 6" Cedar Decking, 2" x 6" Pressure Treated Joists, Wood Ramp System.....	28.57	5.11
06 15 13 00-0071 SF 2" x 4" Cedar Decking, 2" x 6" Pressure Treated Joists, Wood Ramp System.....	30.66	5.52
06 15 13 00-0072 SF 2" x 6" Cedar Decking, 2" x 6" Pressure Treated Joists, Wood Ramp System.....	29.59	5.25
06 15 13 00-0073 2" x 8" Joists, Cedar With Pressure Treated Joists, Wood Ramp System <small>(06 15 13 00-0067)</small>		
06 15 13 00-0074 SF 5/4" x 4" Cedar Decking, 2" x 8" Pressure Treated Joists, Wood Ramp System.....	30.56	5.52
06 15 13 00-0075 SF 5/4" x 6" Cedar Decking, 2" x 8" Pressure Treated Joists, Wood Ramp System.....	29.47	5.25
06 15 13 00-0076 SF 2" x 4" Cedar Decking, 2" x 8" Pressure Treated Joists, Wood Ramp System.....	31.63	5.66
06 15 13 00-0077 SF 2" x 6" Cedar Decking, 2" x 8" Pressure Treated Joists, Wood Ramp System.....	30.54	5.38
06 15 13 00-0078 2" x 10" Joists, Cedar With Pressure Treated Joists, Wood Ramp System <small>(06 15 13 00-0067)</small>		
06 15 13 00-0079 SF 5/4" x 4" Cedar Decking, 2" x 10" Pressure Treated Joists, Wood Ramp System.....	31.54	5.65
06 15 13 00-0080 SF 5/4" x 6" Cedar Decking, 2" x 10" Pressure Treated Joists, Wood Ramp System.....	30.42	5.38
06 15 13 00-0081 SF 2" x 4" Cedar Decking, 2" x 10" Pressure Treated Joists, Wood Ramp System.....	32.62	5.81
06 15 13 00-0082 SF 2" x 6" Cedar Decking, 2" x 10" Pressure Treated Joists, Wood Ramp System.....	31.52	5.52
06 15 13 00-0083 Wood Stair Systems <small>(06 15 13)</small>		
Note: Includes the decking, joists, girders, posts at corners and along stairs, pickets and railing.		
06 15 13 00-0084 Pressure Treated Wood Stair System <small>(06 15 13 00-0083)</small>		
06 15 13 00-0085 2" x 10" Joists, Pressure Treated Wood Stair System <small>(06 15 13 00-0084)</small>		
06 15 13 00-0086 RSR 3' Wide, 5/4" x 4" Pressure Treated Decking With 2" x 10" Pressure Treated Joists, Wood Stair System.....	78.22	13.25
06 15 13 00-0087 RSR 3' Wide, 5/4" x 6" Pressure Treated Decking With 2" x 10" Pressure Treated Joists, Wood Stair System.....	76.06	12.59
06 15 13 00-0088 RSR 3' Wide, 2" x 4" Pressure Treated Decking With 2" x 10" Pressure Treated Joists, Wood Stair System.....	80.58	13.60
06 15 13 00-0089 RSR 3' Wide, 2" x 6" Pressure Treated Decking With 2" x 10" Pressure Treated Joists, Wood Stair System.....	78.06	12.92
06 15 13 00-0090 RSR 3'-6" Wide, 5/4" x 4" Pressure Treated Decking With 2" x 10" Pressure Treated Joists, Wood Stair System.....	82.12	13.92
06 15 13 00-0091 RSR 3'-6" Wide, 5/4" x 6" Pressure Treated Decking With 2" x 10" Pressure Treated Joists, Wood Stair System.....	79.87	13.22
06 15 13 00-0092 RSR 3'-6" Wide, 2" x 4" Pressure Treated Decking With 2" x 10" Pressure Treated Joists, Wood Stair System.....	84.61	14.28
06 15 13 00-0093 RSR 3'-6" Wide, 2" x 6" Pressure Treated Decking With 2" x 10" Pressure Treated Joists, Wood Stair System.....	81.97	13.56
06 15 13 00-0094 RSR 4' Wide, 5/4" x 4" Pressure Treated Decking With 2" x 10" Pressure Treated Joists, Wood Stair System.....	86.15	14.61
06 15 13 00-0095 RSR 4' Wide, 5/4" x 6" Pressure Treated Decking With 2" x 10" Pressure Treated Joists, Wood Stair System.....	83.77	13.88
06 15 13 00-0096 RSR 4' Wide, 2" x 4" Pressure Treated Decking With 2" x 10" Pressure Treated Joists, Wood Stair System.....	88.75	15.00
06 15 13 00-0097 RSR 4' Wide, 2" x 6" Pressure Treated Decking With 2" x 10" Pressure Treated Joists, Wood Stair System.....	85.99	14.23
06 15 13 00-0098 RSR 5' Wide, 5/4" x 4" Pressure Treated Decking With 2" x 10" Pressure Treated Joists, Wood Stair System.....	91.35	15.35
06 15 13 00-0099 RSR 5' Wide, 5/4" x 6" Pressure Treated Decking With 2" x 10" Pressure Treated Joists, Wood Stair System.....	88.90	14.58
06 15 13 00-0100 RSR 5' Wide, 2" x 4" Pressure Treated Decking With 2" x 10" Pressure Treated Joists, Wood Stair System.....	94.13	15.74
06 15 13 00-0101 RSR 5' Wide, 2" x 6" Pressure Treated Decking With 2" x 10" Pressure Treated Joists, Wood Stair System.....	91.25	14.95
06 15 13 00-0102 2" x 12" Joists, Pressure Treated Wood Stair System <small>(06 15 13 00-0084)</small>		
06 15 13 00-0103 RSR 3' Wide, 5/4" x 4" Pressure Treated Decking With 2" x 12" Pressure Treated Joists, Wood Stair System.....	79.92	13.59
06 15 13 00-0104 RSR 3' Wide, 5/4" x 6" Pressure Treated Decking With 2" x 12" Pressure Treated Joists, Wood Stair System.....	77.43	12.91
06 15 13 00-0105 RSR 3' Wide, 2" x 4" Pressure Treated Decking With 2" x 12" Pressure Treated Joists, Wood Stair System.....	82.41	13.93
06 15 13 00-0106 RSR 3' Wide, 2" x 6" Pressure Treated Decking With 2" x 12" Pressure Treated Joists, Wood Stair System.....	79.87	13.24
06 15 13 00-0107 RSR 3'-6" Wide, 5/4" x 4" Pressure Treated Decking With 2" x 12" Pressure Treated Joists, Wood Stair System.....	83.91	14.27
06 15 13 00-0108 RSR 3'-6" Wide, 5/4" x 6" Pressure Treated Decking With 2" x 12" Pressure Treated Joists, Wood Stair System.....	81.31	13.55

06 Wood, Plastics, and Composites**06 10 Rough Carpentry****06 15 Wood Decking**

MINOR		TOTAL DIRECT	DEMOLITION
CSI	UOM DESCRIPTION	UNIT COST	UNIT COST
06 15 13 00-0109	RSR 3'-6" Wide, 2" x 4" Pressure Treated Decking With 2" x 12" Pressure Treated Joists, Wood Stair System.....	86.53	14.63
06 15 13 00-0110	RSR 3'-6" Wide, 2" x 6" Pressure Treated Decking With 2" x 12" Pressure Treated Joists, Wood Stair System.....	83.88	13.90
06 15 13 00-0111	RSR 4' Wide, 5/4" x 4" Pressure Treated Decking With 2" x 12" Pressure Treated Joists, Wood Stair System.....	88.04	14.98
06 15 13 00-0112	RSR 4' Wide, 5/4" x 6" Pressure Treated Decking With 2" x 12" Pressure Treated Joists, Wood Stair System.....	85.29	14.23
06 15 13 00-0113	RSR 4' Wide, 2" x 4" Pressure Treated Decking With 2" x 12" Pressure Treated Joists, Wood Stair System.....	90.78	15.36
06 15 13 00-0114	RSR 4' Wide, 2" x 6" Pressure Treated Decking With 2" x 12" Pressure Treated Joists, Wood Stair System.....	87.99	14.60
06 15 13 00-0115	RSR 5' Wide, 5/4" x 4" Pressure Treated Decking With 2" x 12" Pressure Treated Joists, Wood Stair System.....	93.34	15.73
06 15 13 00-0116	RSR 5' Wide, 5/4" x 6" Pressure Treated Decking With 2" x 12" Pressure Treated Joists, Wood Stair System.....	90.50	14.94
06 15 13 00-0117	RSR 5' Wide, 2" x 4" Pressure Treated Decking With 2" x 12" Pressure Treated Joists, Wood Stair System.....	96.26	16.14
06 15 13 00-0118	RSR 5' Wide, 2" x 6" Pressure Treated Decking With 2" x 12" Pressure Treated Joists, Wood Stair System.....	93.35	15.32
06 15 13 00-0119	Redwood With Pressure Treated Joists, Wood Stair System <small>(06 15 13 00-0083)</small>		
06 15 13 00-0120	2" x 10" Joists, Redwood With Pressure Treated Joists, Wood Stair System		
	<small>(06 15 13 00-0119)</small>		
06 15 13 00-0121	RSR 3' Wide, 5/4" x 4" Redwood Decking With 2" x 10" Pressure Treated Joists, Wood Stair System.....	86.36	13.25
06 15 13 00-0122	RSR 3' Wide, 5/4" x 6" Redwood Decking With 2" x 10" Pressure Treated Joists, Wood Stair System.....	84.13	12.59
06 15 13 00-0123	RSR 3' Wide, 2" x 4" Redwood Decking With 2" x 10" Pressure Treated Joists, Wood Stair System.....	89.23	13.60
06 15 13 00-0124	RSR 3' Wide, 2" x 6" Redwood Decking With 2" x 10" Pressure Treated Joists, Wood Stair System.....	86.97	12.92
06 15 13 00-0125	RSR 3'-6" Wide, 5/4" x 4" Redwood Decking With 2" x 10" Pressure Treated Joists, Wood Stair System.....	90.67	13.92
06 15 13 00-0126	RSR 3'-6" Wide, 5/4" x 6" Redwood Decking With 2" x 10" Pressure Treated Joists, Wood Stair System.....	88.34	13.22
06 15 13 00-0127	RSR 3'-6" Wide, 2" x 4" Redwood Decking With 2" x 10" Pressure Treated Joists, Wood Stair System.....	93.69	14.28
06 15 13 00-0128	RSR 3'-6" Wide, 2" x 6" Redwood Decking With 2" x 10" Pressure Treated Joists, Wood Stair System.....	91.32	13.56
06 15 13 00-0129	RSR 4' Wide, 5/4" x 4" Redwood Decking With 2" x 10" Pressure Treated Joists, Wood Stair System.....	95.08	14.61
06 15 13 00-0130	RSR 4' Wide, 5/4" x 6" Redwood Decking With 2" x 10" Pressure Treated Joists, Wood Stair System.....	92.63	13.88
06 15 13 00-0131	RSR 4' Wide, 2" x 4" Redwood Decking With 2" x 10" Pressure Treated Joists, Wood Stair System.....	98.25	15.00
06 15 13 00-0132	RSR 4' Wide, 2" x 6" Redwood Decking With 2" x 10" Pressure Treated Joists, Wood Stair System.....	95.76	14.23
06 15 13 00-0133	RSR 5' Wide, 5/4" x 4" Redwood Decking With 2" x 10" Pressure Treated Joists, Wood Stair System.....	101.18	15.35
06 15 13 00-0134	RSR 5' Wide, 5/4" x 6" Redwood Decking With 2" x 10" Pressure Treated Joists, Wood Stair System.....	98.64	14.58
06 15 13 00-0135	RSR 5' Wide, 2" x 4" Redwood Decking With 2" x 10" Pressure Treated Joists, Wood Stair System.....	104.57	15.74
06 15 13 00-0136	RSR 5' Wide, 2" x 6" Redwood Decking With 2" x 10" Pressure Treated Joists, Wood Stair System.....	102.00	14.95
06 15 13 00-0137	2" x 12" Joists, Redwood With Pressure Treated Joists, Wood Stair System		
	<small>(06 15 13 00-0119)</small>		
06 15 13 00-0138	RSR 3' Wide, 5/4" x 4" Redwood Decking With 2" x 12" Pressure Treated Joists, Wood Stair System.....	85.66	13.59
06 15 13 00-0139	RSR 3' Wide, 5/4" x 6" Redwood Decking With 2" x 12" Pressure Treated Joists, Wood Stair System.....	83.38	12.91
06 15 13 00-0140	RSR 3' Wide, 2" x 4" Redwood Decking With 2" x 12" Pressure Treated Joists, Wood Stair System.....	88.39	13.93
06 15 13 00-0141	RSR 3' Wide, 2" x 6" Redwood Decking With 2" x 12" Pressure Treated Joists, Wood Stair System.....	86.13	13.24
06 15 13 00-0142	RSR 3'-6" Wide, 5/4" x 4" Redwood Decking With 2" x 12" Pressure Treated Joists, Wood Stair System.....	89.94	14.27
06 15 13 00-0143	RSR 3'-6" Wide, 5/4" x 6" Redwood Decking With 2" x 12" Pressure Treated Joists, Wood Stair System.....	87.55	13.55
06 15 13 00-0144	RSR 3'-6" Wide, 2" x 4" Redwood Decking With 2" x 12" Pressure Treated Joists, Wood Stair System.....	92.81	14.63
06 15 13 00-0145	RSR 3'-6" Wide, 2" x 6" Redwood Decking With 2" x 12" Pressure Treated Joists, Wood Stair System.....	90.45	13.90
06 15 13 00-0146	RSR 4' Wide, 5/4" x 4" Redwood Decking With 2" x 12" Pressure Treated Joists, Wood Stair System.....	94.34	14.98
06 15 13 00-0147	RSR 4' Wide, 5/4" x 6" Redwood Decking With 2" x 12" Pressure Treated Joists, Wood Stair System.....	91.81	14.23
06 15 13 00-0148	RSR 4' Wide, 2" x 4" Redwood Decking With 2" x 12" Pressure Treated Joists, Wood Stair System.....	97.34	15.36
06 15 13 00-0149	RSR 4' Wide, 2" x 6" Redwood Decking With 2" x 12" Pressure Treated Joists, Wood Stair System.....	94.85	14.60
06 15 13 00-0150	RSR 5' Wide, 5/4" x 4" Redwood Decking With 2" x 12" Pressure Treated Joists, Wood Stair System.....	100.27	15.73
06 15 13 00-0151	RSR 5' Wide, 5/4" x 6" Redwood Decking With 2" x 12" Pressure Treated Joists, Wood Stair System.....	97.67	14.94
06 15 13 00-0152	RSR 5' Wide, 2" x 4" Redwood Decking With 2" x 12" Pressure Treated Joists, Wood Stair System.....	103.48	16.14
06 15 13 00-0153	RSR 5' Wide, 2" x 6" Redwood Decking With 2" x 12" Pressure Treated Joists, Wood Stair System.....	100.91	15.32
06 15 13 00-0154	Wood Deck And Ramp Systems Repairs <small>(06 15 13)</small>		
	Note: Includes removal of material and screws. Excludes anchors and bolts.		
06 15 13 00-0155	Deck Joist Or Girt <small>(06 15 13 00-0154)</small>		
	See CSI section 06 11 16 00-0012 for treated wood joist replacement.		
06 15 13 00-0156	Deck Boards <small>(06 15 13 00-0154)</small>		
06 15 13 00-0157	LF 5/4" x 4" Round Edge Pressure Treated Deck Boards.....	1.56	0.56
06 15 13 00-0158	LF 5/4" x 6" Round Edge Pressure Treated Deck Boards.....	1.72	0.66
06 15 13 00-0159	LF 2" x 4" Round Edge Pressure Treated Deck Boards.....	1.68	0.66
06 15 13 00-0160	LF 2" x 6" Round Edge Pressure Treated Deck Boards.....	2.26	0.76
06 15 13 00-0161	LF 2" x 8" Round Edge Pressure Treated Deck Boards.....	2.91	0.92
06 15 13 00-0162	LF 2" x 10" Round Edge Pressure Treated Deck Boards.....	3.57	1.12
06 15 13 00-0163	LF 2" x 12" Round Edge Pressure Treated Deck Boards.....	4.43	1.32
06 15 13 00-0164	LF 2" x 4" Round Edge Cedar Deck Boards.....	1.85	0.66
06 15 13 00-0165	LF 2" x 6" Round Edge Cedar Deck Boards.....	2.40	0.76
06 15 13 00-0166	LF 2" x 4" Round Edge Redwood Deck Boards.....	2.04	0.66
06 15 13 00-0167	LF 2" x 6" Round Edge Redwood Deck Boards.....	2.69	0.76
06 15 13 00-0168	Deck Railing And Pickets <small>(06 15 13 00-0154)</small>		
06 15 13 00-0169	LF 2" x 4" Pressure Treated Deck Railing.....	1.68	0.66
06 15 13 00-0170	LF 2" x 2" Pressure Treated Deck Railing Picket.....	1.11	0.51
06 15 13 00-0171	LF 2" x 4" Cedar Deck Railing.....	1.85	0.66
06 15 13 00-0172	LF 2" x 2" Cedar Deck Railing Picket.....	1.37	0.51
06 15 13 00-0173	LF 2" x 4" Redwood Deck Railing.....	2.04	0.66
06 15 13 00-0174	LF 2" x 2" Redwood Deck Railing Picket.....	1.52	0.51



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 15 13 00-0175 Deck Posts <small>(06 15 13 00-0154)</small> See CSI section 06 11 16 00-0069 for treated wood post replacement, 06 51 13 00-0024 for plastic/composite lumber column replacement.		
06 16 Sheathing <small>(06 10)</small>		
06 16 23 Subflooring <small>(06 16)</small>		
06 16 23 00-0001 Board Type Subflooring <small>(06 16 23)</small>		
06 16 23 00-0002 SF 1" x 8" Regular Surface Board Type Subfloor.....	1.99	0.58
Note: 4 Sides Laid In A Regular Pattern.		
For Water Resistant Coating Or Treatment, Add	0.04	
For Foil Backing, Add	0.07	
For Tongue And Groove, Add	0.05	
06 16 23 00-0003 SF 1" x 8" Diagonal Surface Board Type Subfloor.....	2.24	0.72
Note: 4 Sides Laid In A Diagonal Pattern.		
For Water Resistant Coating Or Treatment, Add	0.04	
For Foil Backing, Add	0.07	
For Tongue And Groove, Add	0.05	
06 16 23 00-0004 SF 1" x 10" Regular Surface Board Type Subfloor.....	1.91	0.51
Note: 4 sides laid in a regular pattern.		
For Water Resistant Coating Or Treatment, Add	0.04	
For Foil Backing, Add	0.07	
For Tongue And Groove, Add	0.05	
06 16 23 00-0005 SF 1" x 10" Diagonal Surface Board Type Subfloor.....	2.08	0.58
Note: 4 sides laid in a diagonal pattern.		
For Water Resistant Coating Or Treatment, Add	0.04	
For Foil Backing, Add	0.07	
For Tongue And Groove, Add	0.05	
06 16 33 Wood Board Sheathing <small>(06 16)</small>		
06 16 33 00-0001 Plywood <small>(06 16 33)</small>		
06 16 33 00-0002 Roof Decking <small>(06 16 33 00-0001)</small>		
06 16 33 00-0003 SF 3/8" Thick CDX Plywood Roof Decking.....	1.31	0.37
Note: Applied to wood rafters.		
For Shear Wall Construction, Add	0.17	
For Exterior CC Grade Plywood, Add	0.07	
For Application To Metal Studs, Joists, Or Rafters, Add	0.17	
For ACQ Preservative Treatment, Add	0.22	
For Selective Replacement <400 (Includes Removal Of Damaged Plywood And Fitting New Plywood To Size), Add	1.28	
For Fire Retardant Treatment, Add	0.36	
For >3,200 To 6,400, Deduct	-0.01	
For >6,400 To 12,800, Deduct	-0.02	
For >12,800, Deduct	-0.03	
06 16 33 00-0004 SF 1/2" Thick CDX Plywood Roof Decking.....	1.49	0.44
Note: Applied to wood rafters.		
For Shear Wall Construction, Add	0.19	
For Exterior CC Grade Plywood, Add	0.08	
For Application To Metal Studs, Joists, Or Rafters, Add	0.19	
For ACQ Preservative Treatment, Add	0.26	
For Selective Replacement <400 (Includes Removal Of Damaged Plywood And Fitting New Plywood To Size), Add	1.41	
For Fire Retardant Treatment, Add	0.43	
For >3,200 To 6,400, Deduct	-0.01	
For >6,400 To 12,800, Deduct	-0.02	
For >12,800, Deduct	-0.03	
06 16 33 00-0005 SF 5/8" Thick CDX Plywood Roof Decking.....	1.70	0.44
Note: Applied to wood rafters.		
For Shear Wall Construction, Add	0.20	
For Exterior CC Grade Plywood, Add	0.10	
For Application To Metal Studs, Joists, Or Rafters, Add	0.20	
For ACQ Preservative Treatment, Add	0.33	
For Selective Replacement <400 (Includes Removal Of Damaged Plywood And Fitting New Plywood To Size), Add	1.52	
For Fire Retardant Treatment, Add	0.55	
For >3,200 To 6,400, Deduct	-0.01	
For >6,400 To 12,800, Deduct	-0.03	
For >12,800, Deduct	-0.04	
For Tongue And Groove, Add	0.05	
06 16 33 00-0006 SF 3/4" Thick CDX Plywood Roof Decking.....	1.88	0.51
Note: Applied to wood rafters.		
For Shear Wall Construction, Add	0.22	
For Exterior CC Grade Plywood, Add	0.12	
For Application To Metal Studs, Joists, Or Rafters, Add	0.22	
For ACQ Preservative Treatment, Add	0.38	
For Selective Replacement <400 (Includes Removal Of Damaged Plywood And Fitting New Plywood To Size), Add	1.62	
For Fire Retardant Treatment, Add	0.63	
For >3,200 To 6,400, Deduct	-0.02	
For >6,400 To 12,800, Deduct	-0.03	
For >12,800, Deduct	-0.05	
For Tongue And Groove, Add	0.06	

06 Wood, Plastics, and Composites**06 10 Rough Carpentry****06 16 Sheathing**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 16 33 00-0007	SF		1" Thick CDX Plywood Roof Decking..... Note: Applied to wood rafters.	2.26	0.58
			<i>For Shear Wall Construction, Add</i>	0.24	
			<i>For Exterior CC Grade Plywood, Add</i>	0.16	
			<i>For Application To Metal Studs, Joists, Or Rafters, Add</i>	0.24	
			<i>For ACQ Preservative Treatment, Add</i>	0.52	
			<i>For Selective Replacement <400 (Includes Removal Of Damaged Plywood And Fitting New Plywood To Size), Add</i>	1.77	
			<i>For Fire Retardant Treatment, Add</i>	0.85	
			<i>For >3,200 To 6,400, Deduct</i>	-0.02	
			<i>For >6,400 To 12,800, Deduct</i>	-0.04	
			<i>For >12,800, Deduct</i>	-0.06	
			<i>For Tongue And Groove, Add</i>	0.08	
06 16 33 00-0008			Wall Sheathing <small>(06 16 33 00-0001)</small>		
06 16 33 00-0009	SF		1/4" Interior BC Plywood Wall Sheathing..... Note: Applied to wall studs.	1.53	0.51
			<i>For Shear Wall Construction, Add</i>	0.22	
			<i>For Exterior CC Grade Plywood, Add</i>	0.07	
			<i>For Application To Metal Studs, Joists, Or Rafters, Add</i>	0.22	
			<i>For Ceiling Installation, Add</i>	0.11	
			<i>For Selective Replacement <400 (Includes Removal Of Damaged Plywood And Fitting New Plywood To Size), Add</i>	1.62	
			<i>For Fire Retardant Treatment, Add</i>	0.36	
			<i>For >3,200 To 6,400, Deduct</i>	-0.01	
			<i>For >6,400 To 12,800, Deduct</i>	-0.02	
			<i>For >12,800, Deduct</i>	-0.03	
06 16 33 00-0010	SF		5/16" Interior BC Plywood Wall Sheathing..... Note: Applied to wall studs.	1.55	0.51
			<i>For Shear Wall Construction, Add</i>	0.22	
			<i>For Exterior CC Grade Plywood, Add</i>	0.07	
			<i>For Application To Metal Studs, Joists, Or Rafters, Add</i>	0.22	
			<i>For Ceiling Installation, Add</i>	0.11	
			<i>For Selective Replacement <400 (Includes Removal Of Damaged Plywood And Fitting New Plywood To Size), Add</i>	1.62	
			<i>For Fire Retardant Treatment, Add</i>	0.37	
			<i>For >3,200 To 6,400, Deduct</i>	-0.01	
			<i>For >6,400 To 12,800, Deduct</i>	-0.02	
			<i>For >12,800, Deduct</i>	-0.03	
06 16 33 00-0011	SF		3/8" Interior BC Plywood Wall Sheathing..... Note: Applied to wall studs.	1.60	0.58
			<i>For Shear Wall Construction, Add</i>	0.22	
			<i>For Exterior CC Grade Plywood, Add</i>	0.08	
			<i>For Application To Metal Studs, Joists, Or Rafters, Add</i>	0.22	
			<i>For Ceiling Installation, Add</i>	0.11	
			<i>For Selective Replacement <400 (Includes Removal Of Damaged Plywood And Fitting New Plywood To Size), Add</i>	1.62	
			<i>For Fire Retardant Treatment, Add</i>	0.41	
			<i>For >3,200 To 6,400, Deduct</i>	-0.01	
			<i>For >6,400 To 12,800, Deduct</i>	-0.02	
			<i>For >12,800, Deduct</i>	-0.03	
06 16 33 00-0012	SF		1/2" Interior BC Plywood Wall Sheathing..... Note: Applied to wall studs.	1.81	0.58
			<i>For Shear Wall Construction, Add</i>	0.23	
			<i>For Exterior CC Grade Plywood, Add</i>	0.10	
			<i>For Application To Metal Studs, Joists, Or Rafters, Add</i>	0.23	
			<i>For Ceiling Installation, Add</i>	0.12	
			<i>For Selective Replacement <400 (Includes Removal Of Damaged Plywood And Fitting New Plywood To Size), Add</i>	1.74	
			<i>For Fire Retardant Treatment, Add</i>	0.51	
			<i>For >3,200 To 6,400, Deduct</i>	-0.01	
			<i>For >6,400 To 12,800, Deduct</i>	-0.03	
			<i>For >12,800, Deduct</i>	-0.04	
06 16 33 00-0013	SF		5/8" Interior BC Plywood Wall Sheathing..... Note: Applied to wall studs.	2.03	0.65
			<i>For Shear Wall Construction, Add</i>	0.25	
			<i>For Exterior CC Grade Plywood, Add</i>	0.12	
			<i>For Application To Metal Studs, Joists, Or Rafters, Add</i>	0.25	
			<i>For Ceiling Installation, Add</i>	0.12	
			<i>For Selective Replacement <400 (Includes Removal Of Damaged Plywood And Fitting New Plywood To Size), Add</i>	1.86	
			<i>For Fire Retardant Treatment, Add</i>	0.62	
			<i>For >3,200 To 6,400, Deduct</i>	-0.02	
			<i>For >6,400 To 12,800, Deduct</i>	-0.03	
			<i>For >12,800, Deduct</i>	-0.05	
06 16 33 00-0014	SF		3/4" Interior BC Plywood Wall Sheathing..... Note: Applied to wall studs.	2.24	0.72
			<i>For Shear Wall Construction, Add</i>	0.27	
			<i>For Exterior CC Grade Plywood, Add</i>	0.14	
			<i>For Application To Metal Studs, Joists, Or Rafters, Add</i>	0.27	
			<i>For Ceiling Installation, Add</i>	0.13	
			<i>For Selective Replacement <400 (Includes Removal Of Damaged Plywood And Fitting New Plywood To Size), Add</i>	2.01	
			<i>For Fire Retardant Treatment, Add</i>	0.71	
			<i>For >3,200 To 6,400, Deduct</i>	-0.02	
			<i>For >6,400 To 12,800, Deduct</i>	-0.04	
			<i>For >12,800, Deduct</i>	-0.05	
06 16 33 00-0015			Floor Decking <small>(06 16 33 00-0001)</small>		
			Note: Includes patching of seams and all fastener holes where necessary.		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 16 33 00-0016 SF 1/2" AC Fir Plywood Floor Decking.....	1.71	0.44
Note: Applied to floor or joists.		
For Selective Replacement <400 (Includes Removal Of Damaged Plywood And Fitting New Plywood To Size), Add	1.37	
For Fire Retardant Treatment, Add	0.63	
For >3,200 To 6,400, Deduct	-0.02	
For >6,400 To 12,800, Deduct	-0.03	
For >12,800, Deduct	-0.05	
For ACQ Preservative Treatment, Add	0.38	
For Exterior Glue, Add	0.07	
For Marine Grade, Add	0.63	
For Tongue And Groove, Add	0.06	
06 16 33 00-0017 SF 5/8" AC Fir Plywood Floor Decking.....	1.92	0.44
Note: Applied to floor or joists.		
For Selective Replacement <400 (Includes Removal Of Damaged Plywood And Fitting New Plywood To Size), Add	1.49	
For Fire Retardant Treatment, Add	0.73	
For >3,200 To 6,400, Deduct	-0.02	
For >6,400 To 12,800, Deduct	-0.04	
For >12,800, Deduct	-0.06	
For ACQ Preservative Treatment, Add	0.45	
For Exterior Glue, Add	0.09	
For Marine Grade, Add	0.73	
For Tongue And Groove, Add	0.07	
06 16 33 00-0018 SF 3/4" AC Fir Plywood Floor Decking.....	2.06	0.44
Note: Applied to floor or joists.		
For Selective Replacement <400 (Includes Removal Of Damaged Plywood And Fitting New Plywood To Size), Add	1.58	
For Fire Retardant Treatment, Add	0.80	
For >3,200 To 6,400, Deduct	-0.02	
For >6,400 To 12,800, Deduct	-0.04	
For >12,800, Deduct	-0.06	
For ACQ Preservative Treatment, Add	0.48	
For Exterior Glue, Add	0.09	
For Marine Grade, Add	0.79	
For Tongue And Groove, Add	0.07	
06 16 33 00-0019 Underlayment Grade Subfloor <small>(06 16 33 00-0001)</small>		
Note: Includes patching of seams and all fastener holes where necessary.		
06 16 33 00-0020 SF 1/4" Thick Plywood Underlayment BC Grade Subfloor	1.24	0.44
For Fire Retardant Treatment, Add	0.32	
For >3,200 To 6,400, Deduct	-0.01	
For >6,400 To 12,800, Deduct	-0.02	
For >12,800, Deduct	-0.02	
06 16 33 00-0021 SF 3/8" Thick Plywood Underlayment BC Grade Subfloor	1.33	0.44
For Fire Retardant Treatment, Add	0.35	
For >3,200 To 6,400, Deduct	-0.01	
For >6,400 To 12,800, Deduct	-0.02	
For >12,800, Deduct	-0.03	
06 16 33 00-0022 SF 1/2" Thick Plywood Underlayment BC Grade Subfloor	1.38	0.51
For Fire Retardant Treatment, Add	0.38	
For >3,200 To 6,400, Deduct	-0.01	
For >6,400 To 12,800, Deduct	-0.02	
For >12,800, Deduct	-0.03	
06 16 33 00-0023 SF 5/8" Thick Plywood Underlayment BC Grade Subfloor	1.58	0.51
For Fire Retardant Treatment, Add	0.45	
For >3,200 To 6,400, Deduct	-0.01	
For >6,400 To 12,800, Deduct	-0.02	
For >12,800, Deduct	-0.03	
For Tongue And Groove, Add	0.04	
06 16 33 00-0024 SF 3/4" Thick Plywood Underlayment BC Grade Subfloor	1.70	0.51
For Fire Retardant Treatment, Add	0.55	
For >3,200 To 6,400, Deduct	-0.01	
For >6,400 To 12,800, Deduct	-0.03	
For >12,800, Deduct	-0.04	
For Tongue And Groove, Add	0.05	
06 16 33 00-0025 SF 1-1/8" Thick Plywood Underlayment BC Grade Subfloor	2.17	0.58
For Fire Retardant Treatment, Add	0.83	
For >3,200 To 6,400, Deduct	-0.02	
For >6,400 To 12,800, Deduct	-0.04	
For >12,800, Deduct	-0.06	
For Tongue And Groove, Add	0.07	
06 16 33 00-0026 SF 3/8" Thick Plywood CDX Grade Subfloor.....	1.43	0.44
For Fire Retardant Treatment, Add	0.43	
For >3,200 To 6,400, Deduct	-0.01	
For >6,400 To 12,800, Deduct	-0.02	
For >12,800, Deduct	-0.03	
06 16 33 00-0027 SF 5/8" Thick Plywood CDX Grade Subfloor.....	1.81	0.51
For Fire Retardant Treatment, Add	0.65	
For >3,200 To 6,400, Deduct	-0.02	
For >6,400 To 12,800, Deduct	-0.03	
For >12,800, Deduct	-0.05	
06 16 33 00-0028 Oriented Strand Board <small>(06 16 33)</small>		
06 16 33 00-0029 On Roof <small>(06 16 33 00-0028)</small>		

06 Wood, Plastics, and Composites**06 10 Rough Carpentry****06 16 Sheathing**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 16 33 00-0030	SF		3/8" Thick Structural Oriented Strand Board On Roof.....	1.13	0.44
			<i>For >3,200 To 6,400, Deduct</i>	-0.01	
			<i>For >6,400 To 12,800, Deduct</i>	-0.01	
			<i>For >12,800, Deduct</i>	-0.02	
			<i>For Fire Retardant Treatment, Add</i>	0.22	
			<i>For Selective Replacement <400 (Includes Removal Of Damaged OSB And Fitting New OSB To Size), Add</i>	1.28	
06 16 33 00-0031	SF		1/2" Thick Structural Oriented Strand Board On Roof.....	1.27	0.44
			<i>For >3,200 To 6,400, Deduct</i>	-0.01	
			<i>For >6,400 To 12,800, Deduct</i>	-0.01	
			<i>For >12,800, Deduct</i>	-0.02	
			<i>For Fire Retardant Treatment, Add</i>	0.26	
			<i>For Selective Replacement <400 (Includes Removal Of Damaged OSB And Fitting New OSB To Size), Add</i>	1.41	
06 16 33 00-0032	SF		5/8" Thick Structural Oriented Strand Board On Roof.....	1.49	0.51
			<i>For >3,200 To 6,400, Deduct</i>	-0.01	
			<i>For >6,400 To 12,800, Deduct</i>	-0.02	
			<i>For >12,800, Deduct</i>	-0.03	
			<i>For Fire Retardant Treatment, Add</i>	0.38	
			<i>For Selective Replacement <400 (Includes Removal Of Damaged OSB And Fitting New OSB To Size), Add</i>	1.52	
06 16 33 00-0033	SF		3/4" Thick Structural Oriented Strand Board On Roof.....	1.72	0.51
			<i>For >3,200 To 6,400, Deduct</i>	-0.01	
			<i>For >6,400 To 12,800, Deduct</i>	-0.03	
			<i>For >12,800, Deduct</i>	-0.04	
			<i>For Fire Retardant Treatment, Add</i>	0.51	
			<i>For Selective Replacement <400 (Includes Removal Of Damaged OSB And Fitting New OSB To Size), Add</i>	1.62	
06 16 33 00-0034			On Walls <small>(06 16 33 00-0028)</small>		
06 16 33 00-0035	SF		3/8" Thick Structural Oriented Strand Board On Walls	1.36	0.51
			<i>For >3,200 To 6,400, Deduct</i>	-0.01	
			<i>For >6,400 To 12,800, Deduct</i>	-0.01	
			<i>For >12,800, Deduct</i>	-0.02	
			<i>For Fire Retardant Treatment, Add</i>	0.22	
			<i>For Selective Replacement <400 (Includes Removal Of Damaged OSB And Fitting New OSB To Size), Add</i>	1.62	
06 16 33 00-0036	SF		1/2" Thick Structural Oriented Strand Board On Walls	1.49	0.58
			<i>For >3,200 To 6,400, Deduct</i>	-0.01	
			<i>For >6,400 To 12,800, Deduct</i>	-0.01	
			<i>For >12,800, Deduct</i>	-0.02	
			<i>For Fire Retardant Treatment, Add</i>	0.26	
			<i>For Selective Replacement <400 (Includes Removal Of Damaged OSB And Fitting New OSB To Size), Add</i>	1.74	
06 16 33 00-0037	SF		5/8" Thick Structural Oriented Strand Board On Walls	1.72	0.65
			<i>For >3,200 To 6,400, Deduct</i>	-0.01	
			<i>For >6,400 To 12,800, Deduct</i>	-0.02	
			<i>For >12,800, Deduct</i>	-0.03	
			<i>For Fire Retardant Treatment, Add</i>	0.38	
			<i>For Selective Replacement <400 (Includes Removal Of Damaged OSB And Fitting New OSB To Size), Add</i>	1.86	
06 16 33 00-0038	SF		3/4" Thick Structural Oriented Strand Board On Walls	1.98	0.65
			<i>For >3,200 To 6,400, Deduct</i>	-0.01	
			<i>For >6,400 To 12,800, Deduct</i>	-0.03	
			<i>For >12,800, Deduct</i>	-0.04	
			<i>For Fire Retardant Treatment, Add</i>	0.51	
			<i>For Selective Replacement <400 (Includes Removal Of Damaged OSB And Fitting New OSB To Size), Add</i>	2.01	
06 16 33 00-0039			On Floors <small>(06 16 33 00-0028)</small>		
			Note: Includes patching of seams and all fastener holes where necessary.		
06 16 33 00-0040	SF		3/8" Thick Structural Oriented Strand Board On Floors	1.16	0.44
			<i>For >3,200 To 6,400, Deduct</i>	-0.01	
			<i>For >6,400 To 12,800, Deduct</i>	-0.01	
			<i>For >12,800, Deduct</i>	-0.02	
			<i>For Fire Retardant Treatment, Add</i>	0.22	
			<i>For Selective Replacement <400 (Includes Removal Of Damaged OSB And Fitting New OSB To Size), Add</i>	1.32	
06 16 33 00-0041	SF		1/2" Thick Structural Oriented Strand Board On Floors	1.38	0.51
			<i>For >3,200 To 6,400, Deduct</i>	-0.01	
			<i>For >6,400 To 12,800, Deduct</i>	-0.01	
			<i>For >12,800, Deduct</i>	-0.02	
			<i>For Fire Retardant Treatment, Add</i>	0.26	
			<i>For Selective Replacement <400 (Includes Removal Of Damaged OSB And Fitting New OSB To Size), Add</i>	1.58	
06 16 33 00-0042	SF		5/8" Thick Structural Oriented Strand Board On Floors	1.62	0.58
			<i>For >3,200 To 6,400, Deduct</i>	-0.01	
			<i>For >6,400 To 12,800, Deduct</i>	-0.02	
			<i>For >12,800, Deduct</i>	-0.03	
			<i>For Fire Retardant Treatment, Add</i>	0.38	
			<i>For Selective Replacement <400 (Includes Removal Of Damaged OSB And Fitting New OSB To Size), Add</i>	1.71	
06 16 33 00-0043	SF		3/4" Thick Structural Oriented Strand Board On Floors	1.88	0.65
			<i>For >3,200 To 6,400, Deduct</i>	-0.01	
			<i>For >6,400 To 12,800, Deduct</i>	-0.03	
			<i>For >12,800, Deduct</i>	-0.04	
			<i>For Fire Retardant Treatment, Add</i>	0.51	
			<i>For Selective Replacement <400 (Includes Removal Of Damaged OSB And Fitting New OSB To Size), Add</i>	1.86	
06 16 33 00-0044			Particle Board <small>(06 16 33)</small>		
06 16 33 00-0045			Particle Board Floor Decking <small>(06 16 33 00-0044)</small>		
			Note: Includes patching of seams and all fastener holes where necessary.		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 16 33 00-0046 SF 3/8" Particle Board Floor Decking..... Note: Applied to plywood subfloor. For Fire Retardant Treatment Add For >3,200 To 6,400, Deduct For >6,400 To 12,800, Deduct For >12,800, Deduct For Tongue And Groove, Add	1.19 0.27 -0.01 -0.02 -0.03 0.02	0.37
06 16 33 00-0047 SF 1/2" Particle Board Floor Decking..... Note: Applied to plywood subfloor. For Fire Retardant Treatment Add For >3,200 To 6,400, Deduct For >6,400 To 12,800, Deduct For >12,800, Deduct For Tongue And Groove, Add	1.37 0.36 -0.01 -0.02 -0.04 0.03	0.37
06 16 33 00-0048 SF 5/8" Particle Board Floor Decking..... Note: Applied to plywood subfloor. For Fire Retardant Treatment Add For >3,200 To 6,400, Deduct For >6,400 To 12,800, Deduct For >12,800, Deduct For Tongue And Groove, Add	1.53 0.45 -0.02 -0.03 -0.05 0.04	0.44
06 16 33 00-0049 SF 3/4" Particle Board Floor Decking..... Note: Applied to plywood subfloor. For Fire Retardant Treatment Add For >3,200 To 6,400, Deduct For >6,400 To 12,800, Deduct For >12,800, Deduct For Tongue And Groove, Add	1.68 0.53 -0.02 -0.03 -0.05 0.05	0.44

06 16 43 Gypsum Sheathing (06 16)

06 16 43 00-0001 Exterior Gypsum Sheathing (06 16 43) Note: Includes moisture resistant core and fiberglass mats on both sides and long edges.		
06 16 43 00-0002 SF 1/2" Exterior Gypsum Sheathing (GP Dens-Glass Gold)..... For Selective Replacement <400 (Includes Removal Of Damaged Gypsum And Fitting New Gypsum To Size), Add For Application To Metal Studs, Joists, Or Rafters, Add For Ceiling Installation, Add For >3,200 To 6,400, Deduct For >6,400 To 12,800, Deduct For >12,800, Deduct	2.08 1.74 0.23 0.12 -0.02 -0.04 -0.06	0.58
06 16 43 00-0003 SF 5/8" Exterior Gypsum Sheathing (GP Dens-Glass Gold)..... For Selective Replacement <400 (Includes Removal Of Damaged Gypsum And Fitting New Gypsum To Size), Add For Application To Metal Studs, Joists, Or Rafters, Add For Ceiling Installation, Add For >3,200 To 6,400, Deduct For >6,400 To 12,800, Deduct For >12,800, Deduct	2.24 1.86 0.25 0.12 -0.02 -0.04 -0.06	0.72

06 17 Shop-Fabricated Structural Wood (06 10)

06 17 13 Laminated Veneer Lumber (06 17)

06 17 13 00-0001 Laminated Veneer Lumber (LVL) (06 17 13)		
06 17 13 00-0002 LF 1-3/4" Wide x 5-1/2" Deep Laminated Veneer Lumber (LVL).....	5.31	1.25
06 17 13 00-0003 LF 1-3/4" Wide x 7-1/4" Deep Laminated Veneer Lumber (LVL).....	5.85	1.27
06 17 13 00-0004 LF 1-3/4" Wide x 9-1/2" Deep Laminated Veneer Lumber (LVL).....	6.48	1.29
06 17 13 00-0005 LF 1-3/4" Wide x 11-7/8" Deep Laminated Veneer Lumber (LVL).....	7.28	1.31
06 17 13 00-0006 LF 1-3/4" Wide x 14" Deep Laminated Veneer Lumber (LVL).....	7.87	1.33
06 17 13 00-0007 LF 1-3/4" Wide x 16" Deep Laminated Veneer Lumber (LVL).....	8.70	1.38
06 17 13 00-0008 LF 1-3/4" Wide x 18" Deep Laminated Veneer Lumber (LVL).....	9.89	1.40
06 17 13 00-0009 LF 1-3/4" Wide x 24" Deep Laminated Veneer Lumber (LVL).....	13.62	1.60

06 17 23 Parallel Strand Lumber (06 17)

06 17 23 00-0001 Laminated Strand Lumber (LSL) (06 17 23)		
06 17 23 00-0002 LF 2" x 4" Laminated Strand Lumber (LSL).....	1.84	0.58
06 17 23 00-0003 LF 2" x 6" Laminated Strand Lumber (LSL).....	2.52	0.62

06 17 33 Wood I-Joists (06 17)

06 17 33 00-0001 Prefabricated Wood I-Joists (06 17 33)		
06 17 33 00-0002 LF 9-1/2" Deep, 3/8" Web With 1-1/2" x 1-3/4" Flanges Prefabricated Wood I-Joist, Up To 30' Length..... For I-Joists 30' To 40' In Length, Add For I-Joists >40' In Length, Add	3.37 0.38 0.92	0.86
06 17 33 00-0003 LF 11-7/8" Deep, 3/8" Web With 1-1/2" x 1-3/4" Flanges Prefabricated Wood I-Joist, Up To 30' Length..... For I-Joists 30' To 40' In Length, Add For I-Joists >40' In Length, Add	3.62 0.42 1.03	0.95
06 17 33 00-0004 LF 14" Deep, 3/8" Web With 1-1/2" x 1-3/4" Flanges Prefabricated Wood I-Joist, Up To 30' Length..... For I-Joists 30' To 40' In Length, Add For I-Joists >40' In Length, Add	4.24 0.47 1.16	1.07

06 Wood, Plastics, and Composites**06 10 Rough Carpentry****06 17 Shop-Fabricated Structural Wood**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 17 33 00-0005	LF		16" Deep, 3/8" Web With 1-1/2" x 1-3/4" Flanges Prefabricated Wood I-Joist, Up To 30' Length.....	4.78	1.19
			<i>For I-Joists 30' To 40' In Length, Add</i>	0.52	
			<i>For I-Joists >40' In Length, Add</i>	1.29	
06 17 43 Rim Boards <small>(06 17)</small>					
06 17 43 00-0001			Oriented Strand Board (OSB) Rim Board <small>(06 17 43)</small>		
06 17 43 00-0002	LF		1-1/8" Wide x 9-1/2" Deep, Oriented Strand Board (OSB) Rim Board.....	4.25	1.29
06 17 43 00-0003	LF		1-1/8" Wide x 11-7/8" Deep, Oriented Strand Board (OSB) Rim Board.....	4.68	1.31
06 17 43 00-0004	LF		1-1/8" Wide x 14" Deep, Oriented Strand Board (OSB) Rim Board.....	5.17	1.33
06 17 53 Shop-Fabricated Wood Trusses <small>(06 17)</small>					
06 17 53 00-0001			Pre-Assembled Wood Roof Trusses <small>(06 17 53)</small>		
			Note: For King Post, Queen Post, Fink or Howe types. Includes 2" x 4" top and bottom chords up to 42' and with 2" x 6" top and bottom chords >42'.		
06 17 53 00-0002	EA		10' Pre-Assembled Wood Roof Truss, 4 In 12 Slope.....	130.54	50.04
			<i>For Up To 15, Add</i>	2.29	
			<i>For >35, Deduct</i>	-1.52	
			<i>For 3 In 12 Slope, Add</i>	0.91	
			<i>For 5 In 12 Slope, Add</i>	2.44	
			<i>For 6 In 12 Slope, Add</i>	4.57	
			<i>For 7 In 12 Slope, Add</i>	6.09	
			<i>For 8 In 12 Slope, Add</i>	7.31	
06 17 53 00-0003	EA		12' Pre-Assembled Wood Roof Truss, 4 In 12 Slope.....	145.18	54.80
			<i>For Up To 15, Add</i>	2.67	
			<i>For >35, Deduct</i>	-1.78	
			<i>For 3 In 12 Slope, Add</i>	1.07	
			<i>For 5 In 12 Slope, Add</i>	2.85	
			<i>For 6 In 12 Slope, Add</i>	5.34	
			<i>For 7 In 12 Slope, Add</i>	7.12	
			<i>For 8 In 12 Slope, Add</i>	8.54	
06 17 53 00-0004	EA		14' Pre-Assembled Wood Roof Truss, 4 In 12 Slope.....	161.96	59.57
			<i>For Up To 15, Add</i>	3.21	
			<i>For >35, Deduct</i>	-2.14	
			<i>For 3 In 12 Slope, Add</i>	1.28	
			<i>For 5 In 12 Slope, Add</i>	3.43	
			<i>For 6 In 12 Slope, Add</i>	6.42	
			<i>For 7 In 12 Slope, Add</i>	8.56	
			<i>For 8 In 12 Slope, Add</i>	10.28	
06 17 53 00-0005	EA		16' Pre-Assembled Wood Roof Truss, 4 In 12 Slope.....	184.31	64.33
			<i>For Up To 15, Add</i>	4.17	
			<i>For >35, Deduct</i>	-2.78	
			<i>For 3 In 12 Slope, Add</i>	1.67	
			<i>For 5 In 12 Slope, Add</i>	4.45	
			<i>For 6 In 12 Slope, Add</i>	8.35	
			<i>For 7 In 12 Slope, Add</i>	11.13	
			<i>For 8 In 12 Slope, Add</i>	13.35	
06 17 53 00-0006	EA		18' Pre-Assembled Wood Roof Truss, 4 In 12 Slope.....	203.45	69.10
			<i>For Up To 15, Add</i>	4.89	
			<i>For >35, Deduct</i>	-3.26	
			<i>For 3 In 12 Slope, Add</i>	1.96	
			<i>For 5 In 12 Slope, Add</i>	5.22	
			<i>For 6 In 12 Slope, Add</i>	9.79	
			<i>For 7 In 12 Slope, Add</i>	13.05	
			<i>For 8 In 12 Slope, Add</i>	15.66	
06 17 53 00-0007	EA		20' Pre-Assembled Wood Roof Truss, 4 In 12 Slope.....	213.42	76.25
			<i>For Up To 15, Add</i>	4.57	
			<i>For >35, Deduct</i>	-3.05	
			<i>For 3 In 12 Slope, Add</i>	1.83	
			<i>For 5 In 12 Slope, Add</i>	4.87	
			<i>For 6 In 12 Slope, Add</i>	9.14	
			<i>For 7 In 12 Slope, Add</i>	12.19	
			<i>For 8 In 12 Slope, Add</i>	14.62	
06 17 53 00-0008	EA		22' Pre-Assembled Wood Roof Truss, 4 In 12 Slope.....	224.73	121.52
			<i>For Up To 15, Add</i>	4.70	
			<i>For >35, Deduct</i>	-3.14	
			<i>For 3 In 12 Slope, Add</i>	1.88	
			<i>For 5 In 12 Slope, Add</i>	5.02	
			<i>For 6 In 12 Slope, Add</i>	9.41	
			<i>For 7 In 12 Slope, Add</i>	12.54	
			<i>For 8 In 12 Slope, Add</i>	15.05	
06 17 53 00-0009	EA		24' Pre-Assembled Wood Roof Truss, 4 In 12 Slope.....	239.57	85.78
			<i>For Up To 15, Add</i>	5.10	
			<i>For >35, Deduct</i>	-3.40	
			<i>For 3 In 12 Slope, Add</i>	2.04	
			<i>For 5 In 12 Slope, Add</i>	5.44	
			<i>For 6 In 12 Slope, Add</i>	10.20	
			<i>For 7 In 12 Slope, Add</i>	13.60	
			<i>For 8 In 12 Slope, Add</i>	16.32	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 17 53 00-0010 EA 26' Pre-Assembled Wood Roof Truss, 4 In 12 Slope.....	255.01	135.81
For Up To 15, Add	5.54	
For >35, Deduct	-3.70	
For 3 In 12 Slope, Add	2.22	
For 5 In 12 Slope, Add	5.91	
For 6 In 12 Slope, Add	11.09	
For 7 In 12 Slope, Add	14.78	
For 8 In 12 Slope, Add	17.74	
06 17 53 00-0011 EA 28' Pre-Assembled Wood Roof Truss, 4 In 12 Slope.....	271.20	95.31
For Up To 15, Add	6.04	
For >35, Deduct	-4.03	
For 3 In 12 Slope, Add	2.42	
For 5 In 12 Slope, Add	6.45	
For 6 In 12 Slope, Add	12.09	
For 7 In 12 Slope, Add	16.12	
For 8 In 12 Slope, Add	19.34	
06 17 53 00-0012 EA 30' Pre-Assembled Wood Roof Truss, 4 In 12 Slope.....	283.28	150.11
For Up To 15, Add	6.23	
For >35, Deduct	-4.16	
For 3 In 12 Slope, Add	2.49	
For 5 In 12 Slope, Add	6.65	
For 6 In 12 Slope, Add	12.47	
For 7 In 12 Slope, Add	16.63	
For 8 In 12 Slope, Add	19.95	
06 17 53 00-0013 EA 32' Pre-Assembled Wood Roof Truss, 4 In 12 Slope.....	296.35	102.46
For Up To 15, Add	6.86	
For >35, Deduct	-4.57	
For 3 In 12 Slope, Add	2.74	
For 5 In 12 Slope, Add	7.32	
For 6 In 12 Slope, Add	13.72	
For 7 In 12 Slope, Add	18.29	
For 8 In 12 Slope, Add	21.95	
06 17 53 00-0014 EA 34' Pre-Assembled Wood Roof Truss, 4 In 12 Slope.....	324.08	160.88
For Up To 15, Add	8.22	
For >35, Deduct	-5.48	
For 3 In 12 Slope, Add	3.29	
For 5 In 12 Slope, Add	8.77	
For 6 In 12 Slope, Add	16.45	
For 7 In 12 Slope, Add	21.93	
For 8 In 12 Slope, Add	26.31	
06 17 53 00-0015 EA 36' Pre-Assembled Wood Roof Truss, 4 In 12 Slope.....	337.48	109.60
For Up To 15, Add	8.87	
For >35, Deduct	-5.91	
For 3 In 12 Slope, Add	3.55	
For 5 In 12 Slope, Add	9.46	
For 6 In 12 Slope, Add	17.74	
For 7 In 12 Slope, Add	23.65	
For 8 In 12 Slope, Add	28.38	
06 17 53 00-0016 EA 38' Pre-Assembled Wood Roof Truss, 4 In 12 Slope.....	355.09	171.55
For Up To 15, Add	9.48	
For >35, Deduct	-6.32	
For 3 In 12 Slope, Add	3.79	
For 5 In 12 Slope, Add	10.11	
For 6 In 12 Slope, Add	18.95	
For 7 In 12 Slope, Add	25.27	
For 8 In 12 Slope, Add	30.32	
06 17 53 00-0017 EA 40' Pre-Assembled Wood Roof Truss, 4 In 12 Slope.....	367.32	119.14
For Up To 15, Add	9.68	
For >35, Deduct	-6.45	
For 3 In 12 Slope, Add	3.87	
For 5 In 12 Slope, Add	10.32	
For 6 In 12 Slope, Add	19.36	
For 7 In 12 Slope, Add	25.81	
For 8 In 12 Slope, Add	30.97	
06 17 53 00-0018 EA 42' Pre-Assembled Wood Roof Truss, 4 In 12 Slope.....	404.14	185.85
For Up To 15, Add	11.73	
For >35, Deduct	-7.82	
For 3 In 12 Slope, Add	4.69	
For 5 In 12 Slope, Add	12.51	
For 6 In 12 Slope, Add	23.45	
For 7 In 12 Slope, Add	31.27	
For 8 In 12 Slope, Add	37.52	
06 17 53 00-0019 EA 44' Pre-Assembled Wood Roof Truss, 4 In 12 Slope.....	440.22	128.67
For Up To 15, Add	13.72	
For >35, Deduct	-9.14	
For 3 In 12 Slope, Add	5.49	
For 5 In 12 Slope, Add	14.63	
For 6 In 12 Slope, Add	27.43	
For 7 In 12 Slope, Add	36.58	
For 8 In 12 Slope, Add	43.89	

06 Wood, Plastics, and Composites**06 10 Rough Carpentry****06 17 Shop-Fabricated Structural Wood**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 17 53 00-0020	EA		46' Pre-Assembled Wood Roof Truss, 4 In 12 Slope.....	455.64	133.43
			<i>For Up To 15, Add</i>	14.16	
			<i>For >35, Deduct</i>	-9.44	
			<i>For 3 In 12 Slope, Add</i>	5.66	
			<i>For 5 In 12 Slope, Add</i>	15.10	
			<i>For 6 In 12 Slope, Add</i>	28.32	
			<i>For 7 In 12 Slope, Add</i>	37.76	
			<i>For 8 In 12 Slope, Add</i>	45.31	
06 17 53 00-0021	EA		48' Pre-Assembled Wood Roof Truss, 4 In 12 Slope.....	478.19	138.20
			<i>For Up To 15, Add</i>	15.14	
			<i>For >35, Deduct</i>	-10.09	
			<i>For 3 In 12 Slope, Add</i>	6.05	
			<i>For 5 In 12 Slope, Add</i>	16.14	
			<i>For 6 In 12 Slope, Add</i>	30.27	
			<i>For 7 In 12 Slope, Add</i>	40.36	
			<i>For 8 In 12 Slope, Add</i>	48.43	
06 17 53 00-0022	EA		50' Pre-Assembled Wood Roof Truss, 4 In 12 Slope.....	544.23	142.96
			<i>For Up To 15, Add</i>	19.37	
			<i>For >35, Deduct</i>	-12.92	
			<i>For 3 In 12 Slope, Add</i>	7.75	
			<i>For 5 In 12 Slope, Add</i>	20.66	
			<i>For 6 In 12 Slope, Add</i>	38.75	
			<i>For 7 In 12 Slope, Add</i>	51.66	
			<i>For 8 In 12 Slope, Add</i>	61.99	
06 17 53 00-0023	EA		52' Pre-Assembled Wood Roof Truss, 4 In 12 Slope.....	516.95	128.57
			<i>For Up To 15, Add</i>	17.33	
			<i>For >35, Deduct</i>	-11.55	
			<i>For 3 In 12 Slope, Add</i>	6.93	
			<i>For 5 In 12 Slope, Add</i>	18.48	
			<i>For 6 In 12 Slope, Add</i>	34.65	
			<i>For 7 In 12 Slope, Add</i>	46.21	
			<i>For 8 In 12 Slope, Add</i>	55.45	
06 17 53 00-0024	EA		54' Pre-Assembled Wood Roof Truss, 4 In 12 Slope.....	542.41	150.11
			<i>For Up To 15, Add</i>	18.16	
			<i>For >35, Deduct</i>	-12.11	
			<i>For 3 In 12 Slope, Add</i>	7.27	
			<i>For 5 In 12 Slope, Add</i>	19.38	
			<i>For 6 In 12 Slope, Add</i>	36.33	
			<i>For 7 In 12 Slope, Add</i>	48.44	
			<i>For 8 In 12 Slope, Add</i>	58.13	
06 17 53 00-0025	EA		56' Pre-Assembled Wood Roof Truss, 4 In 12 Slope.....	563.85	139.15
			<i>For Up To 15, Add</i>	19.06	
			<i>For >35, Deduct</i>	-12.71	
			<i>For 3 In 12 Slope, Add</i>	7.62	
			<i>For 5 In 12 Slope, Add</i>	20.33	
			<i>For 6 In 12 Slope, Add</i>	38.12	
			<i>For 7 In 12 Slope, Add</i>	50.82	
			<i>For 8 In 12 Slope, Add</i>	60.98	
06 17 53 00-0026	EA		58' Pre-Assembled Wood Roof Truss, 4 In 12 Slope.....	582.72	157.26
			<i>For Up To 15, Add</i>	20.12	
			<i>For >35, Deduct</i>	-13.41	
			<i>For 3 In 12 Slope, Add</i>	8.05	
			<i>For 5 In 12 Slope, Add</i>	21.46	
			<i>For 6 In 12 Slope, Add</i>	40.23	
			<i>For 7 In 12 Slope, Add</i>	53.64	
			<i>For 8 In 12 Slope, Add</i>	64.37	
06 17 53 00-0027	EA		60' Pre-Assembled Wood Roof Truss, 4 In 12 Slope.....	594.75	159.64
			<i>For Up To 15, Add</i>	20.66	
			<i>For >35, Deduct</i>	-13.77	
			<i>For 3 In 12 Slope, Add</i>	8.26	
			<i>For 5 In 12 Slope, Add</i>	22.04	
			<i>For 6 In 12 Slope, Add</i>	41.32	
			<i>For 7 In 12 Slope, Add</i>	55.09	
			<i>For 8 In 12 Slope, Add</i>	66.11	
06 17 53 00-0028			Pre-Assembled Wood Gable End Roof Trusses <small>(06 17 53)</small>		
			Note: 24" on center gable studs. Includes 2" x 4" top and bottom chords up to 42' and with 2" x 6" top and bottom chords >42'.		
06 17 53 00-0029	EA		10' Pre-Assembled Wood Gable End Roof Truss, 4 In 12 Slope.....	134.41	50.04
			<i>For 3 In 12 Slope, Add</i>	1.03	
			<i>For 5 In 12 Slope, Add</i>	2.75	
			<i>For 6 In 12 Slope, Add</i>	5.15	
			<i>For 7 In 12 Slope, Add</i>	6.87	
			<i>For 8 In 12 Slope, Add</i>	8.24	
			<i>For 16" On Center Gable Studs, Add</i>	6.87	
06 17 53 00-0030	EA		12' Pre-Assembled Wood Gable End Roof Truss, 4 In 12 Slope.....	149.71	54.80
			<i>For 3 In 12 Slope, Add</i>	1.20	
			<i>For 5 In 12 Slope, Add</i>	3.21	
			<i>For 6 In 12 Slope, Add</i>	6.02	
			<i>For 7 In 12 Slope, Add</i>	8.02	
			<i>For 8 In 12 Slope, Add</i>	9.63	
			<i>For 16" On Center Gable Studs, Add</i>	8.02	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 17 53 00-0031 EA 14' Pre-Assembled Wood Gable End Roof Truss, 4 In 12 Slope	167.41	59.57
<i>For 3 In 12 Slope, Add</i>	1.45	
<i>For 5 In 12 Slope, Add</i>	3.86	
<i>For 6 In 12 Slope, Add</i>	7.24	
<i>For 7 In 12 Slope, Add</i>	9.65	
<i>For 8 In 12 Slope, Add</i>	11.58	
<i>For 16" On Center Gable Studs, Add</i>	9.65	
06 17 53 00-0032 EA 16' Pre-Assembled Wood Gable End Roof Truss, 4 In 12 Slope	191.39	64.33
<i>For 3 In 12 Slope, Add</i>	1.88	
<i>For 5 In 12 Slope, Add</i>	5.02	
<i>For 6 In 12 Slope, Add</i>	9.41	
<i>For 7 In 12 Slope, Add</i>	12.54	
<i>For 8 In 12 Slope, Add</i>	15.05	
<i>For 16" On Center Gable Studs, Add</i>	12.54	
06 17 53 00-0033 EA 18' Pre-Assembled Wood Gable End Roof Truss, 4 In 12 Slope	211.75	69.10
<i>For 3 In 12 Slope, Add</i>	2.21	
<i>For 5 In 12 Slope, Add</i>	5.88	
<i>For 6 In 12 Slope, Add</i>	11.03	
<i>For 7 In 12 Slope, Add</i>	14.71	
<i>For 8 In 12 Slope, Add</i>	17.65	
<i>For 16" On Center Gable Studs, Add</i>	14.71	
06 17 53 00-0034 EA 20' Pre-Assembled Wood Gable End Roof Truss, 4 In 12 Slope	229.88	76.25
<i>For 3 In 12 Slope, Add</i>	2.32	
<i>For 5 In 12 Slope, Add</i>	6.19	
<i>For 6 In 12 Slope, Add</i>	11.61	
<i>For 7 In 12 Slope, Add</i>	15.48	
<i>For 8 In 12 Slope, Add</i>	18.57	
<i>For 16" On Center Gable Studs, Add</i>	15.48	
06 17 53 00-0035 EA 22' Pre-Assembled Wood Gable End Roof Truss, 4 In 12 Slope	241.67	81.01
<i>For 3 In 12 Slope, Add</i>	2.39	
<i>For 5 In 12 Slope, Add</i>	6.37	
<i>For 6 In 12 Slope, Add</i>	11.95	
<i>For 7 In 12 Slope, Add</i>	15.93	
<i>For 8 In 12 Slope, Add</i>	19.12	
<i>For 16" On Center Gable Studs, Add</i>	15.93	
06 17 53 00-0036 EA 24' Pre-Assembled Wood Gable End Roof Truss, 4 In 12 Slope	257.95	85.78
<i>For 3 In 12 Slope, Add</i>	2.59	
<i>For 5 In 12 Slope, Add</i>	6.91	
<i>For 6 In 12 Slope, Add</i>	12.96	
<i>For 7 In 12 Slope, Add</i>	17.28	
<i>For 8 In 12 Slope, Add</i>	20.74	
<i>For 16" On Center Gable Studs, Add</i>	17.28	
06 17 53 00-0037 EA 26' Pre-Assembled Wood Gable End Roof Truss, 4 In 12 Slope	274.96	90.54
<i>For 3 In 12 Slope, Add</i>	2.82	
<i>For 5 In 12 Slope, Add</i>	7.51	
<i>For 6 In 12 Slope, Add</i>	14.08	
<i>For 7 In 12 Slope, Add</i>	18.77	
<i>For 8 In 12 Slope, Add</i>	22.53	
<i>For 16" On Center Gable Studs, Add</i>	18.77	
06 17 53 00-0038 EA 28' Pre-Assembled Wood Gable End Roof Truss, 4 In 12 Slope	292.96	95.31
<i>For 3 In 12 Slope, Add</i>	3.07	
<i>For 5 In 12 Slope, Add</i>	8.19	
<i>For 6 In 12 Slope, Add</i>	15.35	
<i>For 7 In 12 Slope, Add</i>	20.47	
<i>For 8 In 12 Slope, Add</i>	24.56	
<i>For 16" On Center Gable Studs, Add</i>	20.47	
06 17 53 00-0039 EA 30' Pre-Assembled Wood Gable End Roof Truss, 4 In 12 Slope	306.64	100.07
<i>For 3 In 12 Slope, Add</i>	3.19	
<i>For 5 In 12 Slope, Add</i>	8.52	
<i>For 6 In 12 Slope, Add</i>	15.97	
<i>For 7 In 12 Slope, Add</i>	21.30	
<i>For 8 In 12 Slope, Add</i>	25.56	
<i>For 16" On Center Gable Studs, Add</i>	21.30	
06 17 53 00-0040 EA 32' Pre-Assembled Wood Gable End Roof Truss, 4 In 12 Slope	322.05	102.46
<i>For 3 In 12 Slope, Add</i>	3.51	
<i>For 5 In 12 Slope, Add</i>	9.37	
<i>For 6 In 12 Slope, Add</i>	17.57	
<i>For 7 In 12 Slope, Add</i>	23.43	
<i>For 8 In 12 Slope, Add</i>	28.11	
<i>For 16" On Center Gable Studs, Add</i>	23.43	
06 17 53 00-0041 EA 34' Pre-Assembled Wood Gable End Roof Truss, 4 In 12 Slope	354.88	107.22
<i>For 3 In 12 Slope, Add</i>	4.21	
<i>For 5 In 12 Slope, Add</i>	11.24	
<i>For 6 In 12 Slope, Add</i>	21.07	
<i>For 7 In 12 Slope, Add</i>	28.09	
<i>For 8 In 12 Slope, Add</i>	33.71	
<i>For 16" On Center Gable Studs, Add</i>	28.09	
06 17 53 00-0042 EA 36' Pre-Assembled Wood Gable End Roof Truss, 4 In 12 Slope	370.72	109.60
<i>For 3 In 12 Slope, Add</i>	4.55	
<i>For 5 In 12 Slope, Add</i>	12.12	
<i>For 6 In 12 Slope, Add</i>	22.73	
<i>For 7 In 12 Slope, Add</i>	30.30	
<i>For 8 In 12 Slope, Add</i>	36.36	
<i>For 16" On Center Gable Studs, Add</i>	30.30	

06 Wood, Plastics, and Composites**06 10 Rough Carpentry****06 17 Shop-Fabricated Structural Wood**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 17 53 00-0043	EA	38'	Pre-Assembled Wood Gable End Roof Truss, 4 In 12 Slope.....	390.59	114.37
			<i>For 3 In 12 Slope, Add</i>	4.86	
			<i>For 5 In 12 Slope, Add</i>	12.95	
			<i>For 6 In 12 Slope, Add</i>	24.28	
			<i>For 7 In 12 Slope, Add</i>	32.37	
			<i>For 8 In 12 Slope, Add</i>	38.84	
			<i>For 16" On Center Gable Studs, Add</i>	32.37	
06 17 53 00-0044	EA	40'	Pre-Assembled Wood Gable End Roof Truss, 4 In 12 Slope.....	414.00	119.14
			<i>For 3 In 12 Slope, Add</i>	5.27	
			<i>For 5 In 12 Slope, Add</i>	14.06	
			<i>For 6 In 12 Slope, Add</i>	26.36	
			<i>For 7 In 12 Slope, Add</i>	35.15	
			<i>For 8 In 12 Slope, Add</i>	42.18	
			<i>For 16" On Center Gable Studs, Add</i>	35.15	
06 17 53 00-0045	EA	42'	Pre-Assembled Wood Gable End Roof Truss, 4 In 12 Slope.....	460.69	123.90
			<i>For 3 In 12 Slope, Add</i>	6.39	
			<i>For 5 In 12 Slope, Add</i>	17.03	
			<i>For 6 In 12 Slope, Add</i>	31.93	
			<i>For 7 In 12 Slope, Add</i>	42.58	
			<i>For 8 In 12 Slope, Add</i>	51.09	
			<i>For 16" On Center Gable Studs, Add</i>	42.58	
06 17 53 00-0046	EA	44'	Pre-Assembled Wood Gable End Roof Truss, 4 In 12 Slope.....	506.37	128.67
			<i>For 3 In 12 Slope, Add</i>	7.47	
			<i>For 5 In 12 Slope, Add</i>	19.92	
			<i>For 6 In 12 Slope, Add</i>	37.36	
			<i>For 7 In 12 Slope, Add</i>	49.81	
			<i>For 8 In 12 Slope, Add</i>	59.77	
			<i>For 16" On Center Gable Studs, Add</i>	49.81	
06 17 53 00-0047	EA	46'	Pre-Assembled Wood Gable End Roof Truss, 4 In 12 Slope.....	523.93	133.43
			<i>For 3 In 12 Slope, Add</i>	7.71	
			<i>For 5 In 12 Slope, Add</i>	20.57	
			<i>For 6 In 12 Slope, Add</i>	38.56	
			<i>For 7 In 12 Slope, Add</i>	51.41	
			<i>For 8 In 12 Slope, Add</i>	61.70	
			<i>For 16" On Center Gable Studs, Add</i>	51.41	
06 17 53 00-0048	EA	48'	Pre-Assembled Wood Gable End Roof Truss, 4 In 12 Slope.....	551.17	138.20
			<i>For 3 In 12 Slope, Add</i>	8.24	
			<i>For 5 In 12 Slope, Add</i>	21.98	
			<i>For 6 In 12 Slope, Add</i>	41.22	
			<i>For 7 In 12 Slope, Add</i>	54.96	
			<i>For 8 In 12 Slope, Add</i>	65.95	
			<i>For 16" On Center Gable Studs, Add</i>	54.96	
06 17 53 00-0049	EA	50'	Pre-Assembled Wood Gable End Roof Truss, 4 In 12 Slope.....	601.23	142.96
			<i>For 3 In 12 Slope, Add</i>	9.46	
			<i>For 5 In 12 Slope, Add</i>	25.22	
			<i>For 6 In 12 Slope, Add</i>	47.30	
			<i>For 7 In 12 Slope, Add</i>	63.06	
			<i>For 8 In 12 Slope, Add</i>	75.67	
			<i>For 16" On Center Gable Studs, Add</i>	63.06	
06 17 53 00-0050	EA	52'	Pre-Assembled Wood Gable End Roof Truss, 4 In 12 Slope.....	614.97	147.73
			<i>For 3 In 12 Slope, Add</i>	9.59	
			<i>For 5 In 12 Slope, Add</i>	25.56	
			<i>For 6 In 12 Slope, Add</i>	47.93	
			<i>For 7 In 12 Slope, Add</i>	63.90	
			<i>For 8 In 12 Slope, Add</i>	76.68	
			<i>For 16" On Center Gable Studs, Add</i>	63.90	
06 17 53 00-0051	EA	54'	Pre-Assembled Wood Gable End Roof Truss, 4 In 12 Slope.....	635.17	150.11
			<i>For 3 In 12 Slope, Add</i>	10.05	
			<i>For 5 In 12 Slope, Add</i>	26.80	
			<i>For 6 In 12 Slope, Add</i>	50.24	
			<i>For 7 In 12 Slope, Add</i>	66.99	
			<i>For 8 In 12 Slope, Add</i>	80.39	
			<i>For 16" On Center Gable Studs, Add</i>	66.99	
06 17 53 00-0052	EA	56'	Pre-Assembled Wood Gable End Roof Truss, 4 In 12 Slope.....	661.16	154.88
			<i>For 3 In 12 Slope, Add</i>	10.54	
			<i>For 5 In 12 Slope, Add</i>	28.11	
			<i>For 6 In 12 Slope, Add</i>	52.71	
			<i>For 7 In 12 Slope, Add</i>	70.28	
			<i>For 8 In 12 Slope, Add</i>	84.34	
			<i>For 16" On Center Gable Studs, Add</i>	70.28	
06 17 53 00-0053	EA	58'	Pre-Assembled Wood Gable End Roof Truss, 4 In 12 Slope.....	685.43	157.26
			<i>For 3 In 12 Slope, Add</i>	11.13	
			<i>For 5 In 12 Slope, Add</i>	29.67	
			<i>For 6 In 12 Slope, Add</i>	55.64	
			<i>For 7 In 12 Slope, Add</i>	74.18	
			<i>For 8 In 12 Slope, Add</i>	89.02	
			<i>For 16" On Center Gable Studs, Add</i>	74.18	
06 17 53 00-0054	EA	60'	Pre-Assembled Wood Gable End Roof Truss, 4 In 12 Slope.....	700.25	159.64
			<i>For 3 In 12 Slope, Add</i>	11.43	
			<i>For 5 In 12 Slope, Add</i>	30.48	
			<i>For 6 In 12 Slope, Add</i>	57.15	
			<i>For 7 In 12 Slope, Add</i>	76.19	
			<i>For 8 In 12 Slope, Add</i>	91.43	
			<i>For 16" On Center Gable Studs, Add</i>	76.19	



	MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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06 18 Glued-Laminated Construction (06 10)

06 18 13 Glued-Laminated Beams (06 18)

06 18 13 00-0001 Glue Laminated Straight Beams (06 18 13)

Note: Based on southern yellow pine or hemlock lumber with waterproof glue and factor applied sealer.

06 18 13 00-0002	LF	3-1/2" x 6" Glue Laminated Straight Beam	6.90	2.00
06 18 13 00-0003	LF	3-1/2" x 7-1/2" Glue Laminated Straight Beam	8.60	2.50
06 18 13 00-0004	LF	3-1/2" x 9" Glue Laminated Straight Beam	10.33	3.01
06 18 13 00-0005	LF	3-1/2" x 9-1/2" Glue Laminated Straight Beam	10.90	3.17
06 18 13 00-0006	LF	3-1/2" x 10-1/2" Glue Laminated Straight Beam	12.05	3.50
06 18 13 00-0007	LF	3-1/2" x 12" Glue Laminated Straight Beam	13.77	4.00
06 18 13 00-0008	LF	3-1/2" x 13-1/2" Glue Laminated Straight Beam	15.50	4.50
06 18 13 00-0009	LF	3-1/2" x 14" Glue Laminated Straight Beam	16.06	4.67
06 18 13 00-0010	LF	3-1/2" x 15" Glue Laminated Straight Beam	17.22	5.00
06 18 13 00-0011	LF	3-1/2" x 16" Glue Laminated Straight Beam	18.37	5.34
06 18 13 00-0012	LF	3-1/2" x 16-1/2" Glue Laminated Straight Beam	18.94	5.51
06 18 13 00-0013	LF	3-1/2" x 18" Glue Laminated Straight Beam	20.66	6.01
06 18 13 00-0014	LF	3-1/2" x 19-1/2" Glue Laminated Straight Beam	22.38	6.51
06 18 13 00-0015	LF	3-1/2" x 21" Glue Laminated Straight Beam	24.10	7.01
06 18 13 00-0016	LF	3-1/2" x 22.5" Glue Laminated Straight Beam	25.84	7.51
06 18 13 00-0017	LF	5-1/2" x 6" Glue Laminated Straight Beam	10.82	3.14
06 18 13 00-0018	LF	5-1/2" x 7-1/2" Glue Laminated Straight Beam	13.53	3.94
06 18 13 00-0019	LF	5-1/2" x 9" Glue Laminated Straight Beam	16.23	4.72
06 18 13 00-0020	LF	5-1/2" x 9-1/2" Glue Laminated Straight Beam	17.14	4.98
06 18 13 00-0021	LF	5-1/2" x 10-1/2" Glue Laminated Straight Beam	18.94	5.51
06 18 13 00-0022	LF	5-1/2" x 12" Glue Laminated Straight Beam	21.65	6.29
06 18 13 00-0023	LF	5-1/2" x 13-1/2" Glue Laminated Straight Beam	24.35	7.08
06 18 13 00-0024	LF	5-1/2" x 14" Glue Laminated Straight Beam	25.25	7.34
06 18 13 00-0025	LF	5-1/2" x 15" Glue Laminated Straight Beam	27.06	7.86
06 18 13 00-0026	LF	5-1/2" x 16" Glue Laminated Straight Beam	28.86	8.39
06 18 13 00-0027	LF	5-1/2" x 16-1/2" Glue Laminated Straight Beam	29.76	8.65
06 18 13 00-0028	LF	5-1/2" x 18" Glue Laminated Straight Beam	32.47	9.44
06 18 13 00-0029	LF	5-1/2" x 19-1/2" Glue Laminated Straight Beam	35.17	10.23
06 18 13 00-0030	LF	5-1/2" x 21" Glue Laminated Straight Beam	37.88	11.02
06 18 13 00-0031	LF	5-1/2" x 22.5" Glue Laminated Straight Beam	40.59	11.80
06 18 13 00-0032	LF	5-1/2" x 24" Glue Laminated Straight Beam	43.29	12.59
06 18 13 00-0033	LF	6-3/4" x 9" Glue Laminated Straight Beam	19.94	5.79
06 18 13 00-0034	LF	6-3/4" x 9-1/2" Glue Laminated Straight Beam	21.03	6.12
06 18 13 00-0035	LF	6-3/4" x 10-1/2" Glue Laminated Straight Beam	23.24	6.76
06 18 13 00-0036	LF	6-3/4" x 12" Glue Laminated Straight Beam	26.57	7.72
06 18 13 00-0037	LF	6-3/4" x 13-1/2" Glue Laminated Straight Beam	29.89	8.69
06 18 13 00-0038	LF	6-3/4" x 14" Glue Laminated Straight Beam	30.99	9.01
06 18 13 00-0039	LF	6-3/4" x 15" Glue Laminated Straight Beam	33.20	9.65
06 18 13 00-0040	LF	6-3/4" x 16" Glue Laminated Straight Beam	35.43	10.29
06 18 13 00-0041	LF	6-3/4" x 16-1/2" Glue Laminated Straight Beam	36.53	10.62
06 18 13 00-0042	LF	6-3/4" x 18" Glue Laminated Straight Beam	39.84	11.59
06 18 13 00-0043	LF	6-3/4" x 19-1/2" Glue Laminated Straight Beam	43.16	12.55
06 18 13 00-0044	LF	6-3/4" x 21" Glue Laminated Straight Beam	46.49	13.52
06 18 13 00-0045	LF	6-3/4" x 22.5" Glue Laminated Straight Beam	49.80	14.48
06 18 13 00-0046	LF	6-3/4" x 24" Glue Laminated Straight Beam	53.13	15.45
06 18 13 00-0047	LF	8-3/4" x 9" Glue Laminated Straight Beam	25.84	7.51
06 18 13 00-0048	LF	8-3/4" x 9-1/2" Glue Laminated Straight Beam	27.26	7.92
06 18 13 00-0049	LF	8-3/4" x 10-1/2" Glue Laminated Straight Beam	30.12	8.76
06 18 13 00-0050	LF	8-3/4" x 12" Glue Laminated Straight Beam	34.43	10.01
06 18 13 00-0051	LF	8-3/4" x 13-1/2" Glue Laminated Straight Beam	38.74	11.26
06 18 13 00-0052	LF	8-3/4" x 14" Glue Laminated Straight Beam	40.17	11.68
06 18 13 00-0053	LF	8-3/4" x 15" Glue Laminated Straight Beam	43.04	12.51
06 18 13 00-0054	LF	8-3/4" x 16" Glue Laminated Straight Beam	45.91	13.35
06 18 13 00-0055	LF	8-3/4" x 16-1/2" Glue Laminated Straight Beam	47.34	13.76
06 18 13 00-0056	LF	8-3/4" x 18" Glue Laminated Straight Beam	51.65	15.01
06 18 13 00-0057	LF	8-3/4" x 19-1/2" Glue Laminated Straight Beam	55.96	16.26
06 18 13 00-0058	LF	8-3/4" x 21" Glue Laminated Straight Beam	60.27	17.52
06 18 13 00-0059	LF	8-3/4" x 22.5" Glue Laminated Straight Beam	64.56	18.77
06 18 13 00-0060	LF	8-3/4" x 24" Glue Laminated Straight Beam	68.87	20.02

06 18 13 00-0061 Glue Laminated Decking (06 18 13)

06 18 13 00-0062	LF	2" - 4" Thick x 4" Wide Glue Laminated Decking	3.48	1.24
06 18 13 00-0063	LF	2" - 4" Thick x 6" Wide Glue Laminated Decking	3.57	1.24
06 18 13 00-0064	LF	2" - 4" Thick x 8" Wide Glue Laminated Decking	3.65	1.17

06 18 16 Glued-Laminated Columns (06 18)

06 18 16 00-0001 Glue Laminated Structural Units (06 18 16)

Note: Based on southern yellow pine or hemlock lumber in 2" laminations with waterproof glue and factor applied sealer.

06 18 16 00-0002	LF	3-1/4" x 7-1/2" Glue Laminated Purlin Or Column	10.42	2.54
06 18 16 00-0003	LF	3-1/4" x 9-1/4" Glue Laminated Purlin Or Column	11.75	2.82
06 18 16 00-0004	LF	5-1/4" x 9-1/4" Glue Laminated Purlin Or Column	21.92	6.02

06 Wood, Plastics, and Composites**06 10 Rough Carpentry****06 18 Glued-Laminated Construction**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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06 18 16 00-0005	LF		5-1/4" x 13" Glue Laminated Purlin Or Column.....	24.14	6.31
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06 20 Finish Carpentry (06)**06 22 Millwork** (06 20)**06 22 13 Standard Pattern Wood Trim** (06 22)**06 22 13 00-0001 Pine Moldings (All Dimensions Are Nominal)** (06 22 13)

06 22 13 00-0002	LF		1/4" x 1-1/4" Wood Lattice Strip.....	1.87	0.71
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.27	
06 22 13 00-0003	LF		1/4" x 1-5/8" Wood Lattice Strip.....	1.95	0.57
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.27	
06 22 13 00-0004	LF		1/4" x 2-1/2" Wood Lattice Strip.....	2.40	0.57
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.27	
06 22 13 00-0005	LF		1/4" x 3-1/2" Wood Lattice Strip.....	2.67	0.57
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.27	

06 22 13 00-0006 Ceilings (All Dimensions Are Nominal) (06 22 13)**06 22 13 00-0007 White Pine** (06 22 13 00-0006)

06 22 13 00-0008	LF		9/16" x 3-5/8" White Pine Crown Or Bed Molding.....	8.35	2.52
			<i>For Birch, Add</i>	1.71	
			<i>For Mahogany, Oak, Maple Or Walnut, Add</i>	2.50	
			<i>For Poplar, Add</i>	0.95	
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.83	
			<i>For Stain Grade Material (No Finger Joints), Add</i>	0.62	
06 22 13 00-0009	LF		1 1/16" x 4-5/8" White Pine Crown Or Bed Molding.....	11.10	3.02
			<i>For Birch, Add</i>	2.44	
			<i>For Mahogany, Oak, Maple Or Walnut, Add</i>	3.49	
			<i>For Poplar, Add</i>	1.36	
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.99	
			<i>For Stain Grade Material (No Finger Joints), Add</i>	0.88	
06 22 13 00-0010	LF		3/4" x 3/4" White Pine Crown Or Bed Molding.....	4.29	1.72
			<i>For Birch, Add</i>	0.51	
			<i>For Mahogany, Oak, Maple Or Walnut, Add</i>	0.93	
			<i>For Poplar, Add</i>	0.28	
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.66	
			<i>For Stain Grade Material (No Finger Joints), Add</i>	0.18	
06 22 13 00-0011	LF		9/16" x 1-5/8" White Pine Crown Or Bed Molding.....	4.80	1.72
			<i>For Birch, Add</i>	0.69	
			<i>For Mahogany, Oak, Maple Or Walnut, Add</i>	1.16	
			<i>For Poplar, Add</i>	0.39	
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.66	
			<i>For Stain Grade Material (No Finger Joints), Add</i>	0.25	
06 22 13 00-0012	LF		9/16" x 2-1/4" White Pine Crown Or Bed Molding.....	6.27	2.16
			<i>For Birch, Add</i>	0.96	
			<i>For Mahogany, Oak, Maple Or Walnut, Add</i>	1.57	
			<i>For Poplar, Add</i>	0.54	
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.83	
			<i>For Stain Grade Material (No Finger Joints), Add</i>	0.35	
06 22 13 00-0013	LF		3/4" x 3-1/2" White Pine Crown Or Bed Molding.....	7.12	2.16
			<i>For Birch, Add</i>	1.27	
			<i>For Mahogany, Oak, Maple Or Walnut, Add</i>	1.95	
			<i>For Poplar, Add</i>	0.71	
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.83	
			<i>For Stain Grade Material (No Finger Joints), Add</i>	0.46	
06 22 13 00-0014	LF		5/8" x 4-1/4" White Pine Crown Or Bed Molding.....	8.82	2.59
			<i>For Birch, Add</i>	1.62	
			<i>For Mahogany, Oak, Maple Or Walnut, Add</i>	2.46	
			<i>For Poplar, Add</i>	0.90	
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.99	
			<i>For Stain Grade Material (No Finger Joints), Add</i>	0.59	
06 22 13 00-0015	LF		1" x 2" White Pine Dentil Molding.....	4.42	2.01
			<i>For Birch, Add</i>	0.56	
			<i>For Mahogany, Oak, Maple Or Walnut, Add</i>	0.98	
			<i>For Poplar, Add</i>	0.31	
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.66	
			<i>For Stain Grade Material (No Finger Joints), Add</i>	0.20	
06 22 13 00-0016	LF		9/16" x 1-3/4" White Pine Cove Molding.....	3.68	1.51
			<i>For Birch, Add</i>	0.55	
			<i>For Mahogany, Oak, Maple Or Walnut, Add</i>	0.90	
			<i>For Poplar, Add</i>	0.30	
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.50	
			<i>For Stain Grade Material (No Finger Joints), Add</i>	0.20	
06 22 13 00-0017	LF		1 1/16" x 2-3/4" White Pine Cove Molding.....	5.31	1.51
			<i>For Birch, Add</i>	1.13	
			<i>For Mahogany, Oak, Maple Or Walnut, Add</i>	1.63	
			<i>For Poplar, Add</i>	0.63	
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.50	
			<i>For Stain Grade Material (No Finger Joints), Add</i>	0.41	



MINOR	TOTAL DIRECT	DEMOLITION
CSI UOM DESCRIPTION	UNIT COST	UNIT COST
06 22 13 00-0018 LF 3/8" x 3/8" White Pine Cove Molding	2.22	0.87
<i>For Birch, Add</i>	0.26	
<i>For Mahogany, Oak, Maple Or Walnut, Add</i>	0.47	
<i>For Poplar, Add</i>	0.14	
<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.35	
<i>For Stain Grade Material (No Finger Joints), Add</i>	0.09	
06 22 13 00-0019 LF 1/2" x 1/2" White Pine Cove Molding	2.40	0.87
<i>For Birch, Add</i>	0.32	
<i>For Mahogany, Oak, Maple Or Walnut, Add</i>	0.56	
<i>For Poplar, Add</i>	0.18	
<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.35	
<i>For Stain Grade Material (No Finger Joints), Add</i>	0.12	
06 22 13 00-0020 LF 5/8" x 5/8" White Pine Cove Molding	3.15	1.08
<i>For Birch, Add</i>	0.49	
<i>For Mahogany, Oak, Maple Or Walnut, Add</i>	0.79	
<i>For Poplar, Add</i>	0.27	
<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.41	
<i>For Stain Grade Material (No Finger Joints), Add</i>	0.18	
06 22 13 00-0021 LF 3/4" x 3/4" White Pine Cove Molding	3.15	1.08
<i>For Birch, Add</i>	0.49	
<i>For Mahogany, Oak, Maple Or Walnut, Add</i>	0.79	
<i>For Poplar, Add</i>	0.27	
<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.41	
<i>For Stain Grade Material (No Finger Joints), Add</i>	0.18	
06 22 13 00-0022 LF 15/16" x 15/16" White Pine Cove Molding	3.98	1.08
<i>For Birch, Add</i>	0.79	
<i>For Mahogany, Oak, Maple Or Walnut, Add</i>	1.16	
<i>For Poplar, Add</i>	0.44	
<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.41	
<i>For Stain Grade Material (No Finger Joints), Add</i>	0.28	
06 22 13 00-0023 LF 7-1/2" Wide Mullion Covers	24.06	1.29
<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.59	
06 22 13 00-0024 LF Three Piece Mullion Trim, 2 Cove Moldings	30.31	1.29
<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.59	
06 22 13 00-0025 Cedar Trim <small>(06 22 13 00-0006)</small>		
06 22 13 00-0026 LF 2" x 4" Cedar Ceiling Trim	7.55	3.62
<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	1.20	
06 22 13 00-0027 Oak Trim <small>(06 22 13 00-0006)</small>		
06 22 13 00-0028 LF 1" x 8" Clear Oak Ceiling Trim	7.73	3.34
<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	1.11	
06 22 13 00-0029 Closet Poles <small>(06 22 13)</small>		
06 22 13 00-0030 LF 1-1/8" Diameter Pine Closet Poles.....	5.50	1.86
06 22 13 00-0031 LF 1-5/8" Diameter Pine Closet Poles.....	7.72	1.86
06 22 13 00-0032 LF 2" Diameter Pine Closet Poles.....	10.23	2.08
06 25 Prefinished Paneling <small>(06 20)</small>		
06 25 16 Prefinished Plywood Paneling <small>(06 25)</small>		
06 25 16 00-0001 Hardboard Panels <small>(06 25 16)</small>		
Note: Excludes furring and trim.		
06 25 16 00-0002 Tempered Hardboard Panels <small>(06 25 16 00-0001)</small>		
06 25 16 00-0003 SF 1/4" Tempered Hardboard Panels	3.74	1.30
<i>For Waterproof Glue, Add</i>	0.05	
<i>For Ceiling Installation, Add</i>	0.89	
<i>For Glue Laminated Installation, Add</i>	0.19	
<i>For 1/8" Thick Paneling, Deduct</i>	-0.34	
<i>For 1/2" Thick Paneling, Add</i>	0.77	
<i>For 5/8" Thick Paneling, Add</i>	0.93	
<i>For 3/4" Thick Paneling, Add</i>	1.14	
<i>For Fire Retardant Treatment (Class I), Add</i>	0.61	
06 40 Architectural Woodwork <small>(06)</small>		
06 41 Architectural Wood Casework <small>(06 40)</small>		
06 41 13 Wood-Veneer-Faced Architectural Cabinets <small>(06 41)</small>		

06 Wood, Plastics, and Composites**06 40 Architectural Woodwork****06 41 Architectural Wood Casework**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 41 13 00-0001 Wood-Veneer Faced Cabinets <small>(06 41 13)</small> Note: AWI Custom Grade, good quality mill-made modular units, prefinished with solid hardwood face frames, hardwood door frames and drawer fronts, hardwood veneer on raised door panels (front and back), glued mortise, dowel, and dado joint construction, full backs (1/8" vinyl laminated plywood), vinyl laminated cabinet interiors, vinyl laminated composition drawer bodies with nylon and metal guides. Includes self-closing hinges, door and drawer pulls, mounting hardware and adjustable shelves. Use appropriate modifiers for the following grades: Economy Grade - Cabinets with melamine laminated to particleboard, in textured colors or wood grain print finish; Premium Grade - Cabinets with solid hardwood fronts and frames, mitered corners and solid wood drawer bodies with steel guides and ball bearings; Laboratory Grade - Cabinets with chemical resistant finish on premium grade.		
06 41 13 00-0002 Base Cabinets <small>(06 41 13 00-0001)</small> Note: Excludes tops or finish.		
06 41 13 00-0003 Base Cabinets, Single Drawer And Single Door <small>(06 41 13 00-0002)</small>		
06 41 13 00-0004 Base Cabinets 34-1/2" High x 24" Deep <small>(06 41 13 00-0003)</small>		
06 41 13 00-0005 EA Up To 15" Width, 34-1/2" High x 24" Deep Base Cabinet.....	275.50	40.96
Note: Prefinished with solid hardwood face frames, hardwood door frames and drawer fronts. Hardwood veneer on raised door panels. Excludes top.		
For ADA Cabinet Units (Includes All ADA Hardware), Add	43.42	
For 3 Drawer Unit, Add	86.84	
For 4 Drawer Unit, Add	108.55	
For Plastic Laminate On Particle Board, Deduct	-43.42	
Note: (Plastic Laminate On Hardwood For Doors)		
For Premium Grade Plywood With Plastic Laminate, Deduct	-21.71	
For Economy Grade, Deduct	-86.84	
For Premium Grade, Add	108.55	
For Laboratory Grade, Add	141.11	
For Unfinished (Natural, Wood), Deduct	-32.56	
06 41 13 00-0006 EA >15" To 18" Width, 34-1/2" High x 24" Deep Base Cabinet.....	303.71	50.31
Note: Prefinished with solid hardwood face frames, hardwood door frames and drawer fronts. Hardwood veneer on raised door panels. Excludes top.		
For ADA Cabinet Units (Includes All ADA Hardware), Add	46.41	
For 3 Drawer Unit, Add	92.83	
For 4 Drawer Unit, Add	116.04	
For Plastic Laminate On Particle Board, Deduct	-46.41	
Note: (Plastic Laminate On Hardwood For Doors)		
For Premium Grade Plywood With Plastic Laminate, Deduct	-23.21	
For Economy Grade, Deduct	-92.83	
For Premium Grade, Add	116.04	
For Laboratory Grade, Add	150.85	
For Unfinished (Natural, Wood), Deduct	-34.81	
06 41 13 00-0007 EA >18" To 21" Width, 34-1/2" High x 24" Deep Base Cabinet.....	325.24	57.50
Note: Prefinished with solid hardwood face frames, hardwood door frames and drawer fronts. Hardwood veneer on raised door panels. Excludes top.		
For ADA Cabinet Units (Includes All ADA Hardware), Add	48.66	
For 3 Drawer Unit, Add	97.32	
For 4 Drawer Unit, Add	121.65	
For Plastic Laminate On Particle Board, Deduct	-48.66	
Note: (Plastic Laminate On Hardwood For Doors)		
For Premium Grade Plywood With Plastic Laminate, Deduct	-24.33	
For Economy Grade, Deduct	-97.32	
For Premium Grade, Add	121.65	
For Laboratory Grade, Add	158.15	
For Unfinished (Natural, Wood), Deduct	-36.50	
06 41 13 00-0008 EA >21" To 24" Width, 34-1/2" High x 24" Deep Base Cabinet.....	372.48	66.85
Note: Prefinished with solid hardwood face frames, hardwood door frames and drawer fronts. Hardwood veneer on raised door panels. Excludes top.		
For ADA Cabinet Units (Includes All ADA Hardware), Add	55.45	
For 3 Drawer Unit, Add	110.90	
For 4 Drawer Unit, Add	138.63	
For Plastic Laminate On Particle Board, Deduct	-55.45	
Note: (Plastic Laminate On Hardwood For Doors)		
For Premium Grade Plywood With Plastic Laminate, Deduct	-27.73	
For Economy Grade, Deduct	-110.90	
For Premium Grade, Add	138.63	
For Laboratory Grade, Add	180.22	
For Unfinished (Natural, Wood), Deduct	-41.59	
06 41 13 00-0009 Base Cabinets 30" High x 24" Deep <small>(06 41 13 00-0003)</small>		
06 41 13 00-0010 EA Up To 15" Width, 30" High x 24" Deep Base Cabinet.....	242.94	40.96
Note: Prefinished with solid hardwood face frames, hardwood door frames and drawer fronts. Hardwood veneer on raised door panels. Excludes top.		
For ADA Cabinet Units (Includes All ADA Hardware), Add	36.91	
For 3 Drawer Unit, Add	73.81	
For 4 Drawer Unit, Add	92.27	
For Plastic Laminate On Particle Board, Deduct	-36.91	
Note: (Plastic Laminate On Hardwood For Doors)		
For Premium Grade Plywood With Plastic Laminate, Deduct	-18.45	
For Economy Grade, Deduct	-73.81	
For Premium Grade, Add	92.27	
For Laboratory Grade, Add	119.94	
For Unfinished (Natural, Wood), Deduct	-27.68	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 41 13 00-0011 EA >15" To 18" Width, 30" High x 24" Deep Base Cabinet.....	268.90	50.31
Note: Prefinished with solid hardwood face frames, hardwood door frames and drawer fronts. Hardwood veneer on raised door panels. Excludes top.		
For ADA Cabinet Units (Includes All ADA Hardware), Add	39.45	
For 3 Drawer Unit, Add	78.90	
For 4 Drawer Unit, Add	98.63	
For Plastic Laminate On Particle Board, Deduct	-39.45	
Note: (Plastic Laminate On Hardwood For Doors)		
For Premium Grade Plywood With Plastic Laminate, Deduct	-19.73	
For Economy Grade, Deduct	-78.90	
For Premium Grade, Add	98.63	
For Laboratory Grade, Add	128.22	
For Unfinished (Natural, Wood), Deduct	-29.59	
06 41 13 00-0012 EA >18" To 21" Width, 30" High x 24" Deep Base Cabinet.....	288.74	57.50
Note: Prefinished with solid hardwood face frames, hardwood door frames and drawer fronts. Hardwood veneer on raised door panels. Excludes top.		
For ADA Cabinet Units (Includes All ADA Hardware), Add	41.36	
For 3 Drawer Unit, Add	82.72	
For 4 Drawer Unit, Add	103.40	
For Plastic Laminate On Particle Board, Deduct	-41.36	
Note: (Plastic Laminate On Hardwood For Doors)		
For Premium Grade Plywood With Plastic Laminate, Deduct	-20.68	
For Economy Grade, Deduct	-82.72	
For Premium Grade, Add	103.40	
For Laboratory Grade, Add	134.42	
For Unfinished (Natural, Wood), Deduct	-31.02	
06 41 13 00-0013 EA >21" To 24" Width, 30" High x 24" Deep Base Cabinet.....	330.89	66.12
Note: Prefinished with solid hardwood face frames, hardwood door frames and drawer fronts. Hardwood veneer on raised door panels. Excludes top.		
For ADA Cabinet Units (Includes All ADA Hardware), Add	47.13	
For 3 Drawer Unit, Add	94.27	
For 4 Drawer Unit, Add	117.84	
For Plastic Laminate On Particle Board, Deduct	-47.13	
Note: (Plastic Laminate On Hardwood For Doors)		
For Premium Grade Plywood With Plastic Laminate, Deduct	-23.57	
For Economy Grade, Deduct	-94.27	
For Premium Grade, Add	117.84	
For Laboratory Grade, Add	153.19	
For Unfinished (Natural, Wood), Deduct	-35.35	
06 41 13 00-0014 Base Cabinets 34-1/2" High x 24" Deep, Custom Built In Place (06 41 13 00-0003)		
06 41 13 00-0015 LF Up To 15" Width, 34-1/2" High x 24" Deep Built In Place Base Cabinet.....	246.99	51.03
Note: Prefinished with solid hardwood face frames, hardwood door frames and drawer fronts. Hardwood veneer on raised door panels. Excludes top.		
For ADA Cabinet Units (Includes All ADA Hardware), Add	34.74	
For 3 Drawer Unit, Add	69.47	
For 4 Drawer Unit, Add	86.84	
For Plastic Laminate On Particle Board, Deduct	-34.74	
Note: (Plastic Laminate On Hardwood For Doors)		
For Premium Grade Plywood With Plastic Laminate, Deduct	-17.37	
For Economy Grade, Deduct	-69.47	
For Premium Grade, Add	86.84	
For Laboratory Grade, Add	112.89	
For Unfinished (Natural, Wood), Deduct	-26.05	
06 41 13 00-0016 LF >15" To 18" Width, 34-1/2" High x 24" Deep Built In Place Base Cabinet.....	225.87	49.59
Note: Prefinished with solid hardwood face frames, hardwood door frames and drawer fronts. Hardwood veneer on raised door panels. Excludes top.		
For ADA Cabinet Units (Includes All ADA Hardware), Add	30.94	
For 3 Drawer Unit, Add	61.88	
For 4 Drawer Unit, Add	77.36	
For Plastic Laminate On Particle Board, Deduct	-30.94	
Note: (Plastic Laminate On Hardwood For Doors)		
For Premium Grade Plywood With Plastic Laminate, Deduct	-15.47	
For Economy Grade, Deduct	-61.88	
For Premium Grade, Add	77.36	
For Laboratory Grade, Add	100.56	
For Unfinished (Natural, Wood), Deduct	-23.21	
06 41 13 00-0017 LF >18" To 24" Width, 34-1/2" High x 24" Deep Built In Place Base Cabinet.....	208.03	48.16
Note: Prefinished with solid hardwood face frames, hardwood door frames and drawer fronts. Hardwood veneer on raised door panels. Excludes top.		
For ADA Cabinet Units (Includes All ADA Hardware), Add	27.81	
For 3 Drawer Unit, Add	55.61	
For 4 Drawer Unit, Add	69.52	
For Plastic Laminate On Particle Board, Deduct	-27.81	
Note: (Plastic Laminate On Hardwood For Doors)		
For Premium Grade Plywood With Plastic Laminate, Deduct	-13.90	
For Economy Grade, Deduct	-55.61	
For Premium Grade, Add	69.52	
For Laboratory Grade, Add	90.37	
For Unfinished (Natural, Wood), Deduct	-20.85	

06 Wood, Plastics, and Composites**06 40 Architectural Woodwork****06 41 Architectural Wood Casework**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 41 13 00-0018	LF		>24" To 30" Width, 34-1/2" High x 24" Deep Built In Place Base Cabinet 191.37 Note: Prefinished with solid hardwood face frames, hardwood door frames and drawer fronts. Hardwood veneer on raised door panels. Excludes top. For ADA Cabinet Units (Includes All ADA Hardware), Add 25.05 For 3 Drawer Unit, Add 50.10 For 4 Drawer Unit, Add 62.63 For Plastic Laminate On Particle Board, Deduct -25.05 Note: (Plastic Laminate On Hardwood For Doors) For Premium Grade Plywood With Plastic Laminate, Deduct -12.53 For Economy Grade, Deduct -50.10 For Premium Grade, Add 62.63 For Laboratory Grade, Add 81.41 For Unfinished (Natural, Wood), Deduct -18.79	191.37	46.00
06 41 13 00-0019			Base Cabinets, Double Drawer And Double Door (06 41 13 00-0002)		
06 41 13 00-0020			34-1/2" High x 24" Deep (06 41 13 00-0019)		
06 41 13 00-0021	EA		24" To 27" Wide, 34-1/2" High x 24" Deep 2-Drawer/2-Door Cabinet..... 436.85 Note: Prefinished with solid hardwood face frames, hardwood door frames and drawer fronts. Hardwood veneer on raised door panels. Excludes top. For ADA Cabinet Units (Includes All ADA Hardware), Add 65.38 For Plastic Laminate On Particle Board, Deduct -65.38 Note: (Plastic Laminate On Hardwood For Doors) For Premium Grade Plywood With Plastic Laminate, Deduct -32.69 For Economy Grade, Deduct -130.76 For Premium Grade, Add 163.45 For Laboratory Grade, Add 212.48 For Unfinished (Natural, Wood), Deduct -49.03 For 3 Drawer Unit, Add 32.69 For Sink Base With Sink Front (No Drawer), Deduct -49.03	436.85	54.98
06 41 13 00-0022	EA		>27"-30" Wide, 34-1/2" High x 24" Deep 2-Drawer/2-Door Cabinet..... 465.83 Note: Prefinished with solid hardwood face frames, hardwood door frames and drawer fronts. Hardwood veneer on raised door panels. Excludes top. For ADA Cabinet Units (Includes All ADA Hardware), Add 69.59 For Plastic Laminate On Particle Board, Deduct -69.59 Note: (Plastic Laminate On Hardwood For Doors) For Premium Grade Plywood With Plastic Laminate, Deduct -34.80 For Economy Grade, Deduct -139.18 For Premium Grade, Add 173.98 For Laboratory Grade, Add 226.17 For Unfinished (Natural, Wood), Deduct -52.19 For 3 Drawer Unit, Add 34.80 For Sink Base With Sink Front (No Drawer), Deduct -52.19	465.83	58.94
06 41 13 00-0023	EA		>30"-33" Wide, 34-1/2" High x 24" Deep 2-Drawer/2-Door Cabinet..... 485.06 Note: Prefinished with solid hardwood face frames, hardwood door frames and drawer fronts. Hardwood veneer on raised door panels. Excludes top. For ADA Cabinet Units (Includes All ADA Hardware), Add 72.86 For Plastic Laminate On Particle Board, Deduct -72.86 Note: (Plastic Laminate On Hardwood For Doors) For Premium Grade Plywood With Plastic Laminate, Deduct -36.43 For Economy Grade, Deduct -145.73 For Premium Grade, Add 182.16 For Laboratory Grade, Add 236.81 For Unfinished (Natural, Wood), Deduct -54.65 For 3 Drawer Unit, Add 36.43 For Sink Base With Sink Front (No Drawer), Deduct -54.65	485.06	60.37
06 41 13 00-0024	EA		>33"-36" Wide, 34-1/2" High x 24" Deep 2-Drawer/2-Door Cabinet..... 497.92 Note: Prefinished with solid hardwood face frames, hardwood door frames and drawer fronts. Hardwood veneer on raised door panels. Excludes top. For ADA Cabinet Units (Includes All ADA Hardware), Add 74.86 For Plastic Laminate On Particle Board, Deduct -74.86 Note: (Plastic Laminate On Hardwood For Doors) For Premium Grade Plywood With Plastic Laminate, Deduct -37.43 For Economy Grade, Deduct -149.72 For Premium Grade, Add 187.15 For Laboratory Grade, Add 243.30 For Unfinished (Natural, Wood), Deduct -56.15 For 3 Drawer Unit, Add 37.43 For Sink Base With Sink Front (No Drawer), Deduct -56.15	497.92	61.81
06 41 13 00-0025	EA		>36"-42" Wide, 34-1/2" High x 24" Deep 2-Drawer/2-Door Cabinet..... 532.93 Note: Prefinished with solid hardwood face frames, hardwood door frames and drawer fronts. Hardwood veneer on raised door panels. Excludes top. For ADA Cabinet Units (Includes All ADA Hardware), Add 79.85 For Plastic Laminate On Particle Board, Deduct -79.85 Note: (Plastic Laminate On Hardwood For Doors) For Premium Grade Plywood With Plastic Laminate, Deduct -39.93 For Economy Grade, Deduct -159.70 For Premium Grade, Add 199.63 For Laboratory Grade, Add 259.51 For Unfinished (Natural, Wood), Deduct -59.89 For 3 Drawer Unit, Add 39.93 For Sink Base With Sink Front (No Drawer), Deduct -59.89	532.93	66.85



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 41 13 00-0026 EA >42"-48" Wide, 34-1/2" High x 24" Deep 2-Drawer/2-Door Cabinet.....	568.91	75.47
Note: Prefinished with solid hardwood face frames, hardwood door frames and drawer fronts. Hardwood veneer on raised door panels. Excludes top.		
For ADA Cabinet Units (Includes All ADA Hardware), Add	83.59	
For Plastic Laminate On Particle Board, Deduct	-83.59	
Note: (Plastic Laminate On Hardwood For Doors)		
For Premium Grade Plywood With Plastic Laminate, Deduct	-41.80	
For Economy Grade, Deduct	-167.19	
For Premium Grade, Add	208.99	
For Laboratory Grade, Add	271.68	
For Unfinished (Natural, Wood), Deduct	-62.70	
For 3 Drawer Unit, Add	41.80	
For Sink Base With Sink Front (No Drawer), Deduct	-62.70	
06 41 13 00-0027 30" High x 24" Deep <small>(06 41 13 00-0019)</small>		
06 41 13 00-0028 EA 24" Wide, 30" High x 24" Deep 2-Drawer/2-Door Cabinet.....	299.57	74.46
Note: Prefinished with solid hardwood face frames, hardwood door frames and drawer fronts. Hardwood veneer on raised door panels. Excludes top.		
For ADA Cabinet Units (Includes All ADA Hardware), Add	38.54	
For Plastic Laminate On Particle Board, Deduct	-38.54	
Note: (Plastic Laminate On Hardwood For Doors)		
For Premium Grade Plywood With Plastic Laminate, Deduct	-19.27	
For Economy Grade, Deduct	-77.07	
For Premium Grade, Add	96.34	
For Laboratory Grade, Add	125.24	
For Unfinished (Natural, Wood), Deduct	-28.90	
For 3 Drawer Unit, Add	19.27	
For Sink Base With Sink Front (No Drawer), Deduct	-28.90	
06 41 13 00-0029 EA 30" Wide, 30" High x 24" Deep 2-Drawer/2-Door Cabinet.....	427.59	83.01
Note: Prefinished with solid hardwood face frames, hardwood door frames and drawer fronts. Hardwood veneer on raised door panels. Excludes top.		
For ADA Cabinet Units (Includes All ADA Hardware), Add	61.95	
For Plastic Laminate On Particle Board, Deduct	-61.95	
Note: (Plastic Laminate On Hardwood For Doors)		
For Premium Grade Plywood With Plastic Laminate, Deduct	-30.98	
For Economy Grade, Deduct	-123.91	
For Premium Grade, Add	154.89	
For Laboratory Grade, Add	201.35	
For Unfinished (Natural, Wood), Deduct	-46.47	
For 3 Drawer Unit, Add	30.98	
For Sink Base With Sink Front (No Drawer), Deduct	-46.47	
06 41 13 00-0030 EA 36" Wide, 30" High x 24" Deep 2-Drawer/2-Door Cabinet.....	495.20	86.03
Note: Prefinished with solid hardwood face frames, hardwood door frames and drawer fronts. Hardwood veneer on raised door panels. Excludes top.		
For ADA Cabinet Units (Includes All ADA Hardware), Add	74.26	
For Plastic Laminate On Particle Board, Deduct	-74.26	
Note: (Plastic Laminate On Hardwood For Doors)		
For Premium Grade Plywood With Plastic Laminate, Deduct	-37.13	
For Economy Grade, Deduct	-148.51	
For Premium Grade, Add	185.64	
For Laboratory Grade, Add	241.33	
For Unfinished (Natural, Wood), Deduct	-55.69	
For 3 Drawer Unit, Add	37.13	
For Sink Base With Sink Front (No Drawer), Deduct	-55.69	
06 41 13 00-0031 EA 42" Wide, 30" High x 24" Deep 2-Drawer/2-Door Cabinet.....	592.63	93.57
Note: Prefinished with solid hardwood face frames, hardwood door frames and drawer fronts. Hardwood veneer on raised door panels. Excludes top.		
For ADA Cabinet Units (Includes All ADA Hardware), Add	91.79	
For Plastic Laminate On Particle Board, Deduct	-91.79	
Note: (Plastic Laminate On Hardwood For Doors)		
For Premium Grade Plywood With Plastic Laminate, Deduct	-45.89	
For Economy Grade, Deduct	-183.58	
For Premium Grade, Add	229.47	
For Laboratory Grade, Add	298.31	
For Unfinished (Natural, Wood), Deduct	-68.84	
For 3 Drawer Unit, Add	45.89	
For Sink Base With Sink Front (No Drawer), Deduct	-68.84	
06 41 13 00-0032 EA 48" Wide, 30" High x 24" Deep 2-Drawer/2-Door Cabinet.....	672.50	105.65
Note: Prefinished with solid hardwood face frames, hardwood door frames and drawer fronts. Hardwood veneer on raised door panels. Excludes top.		
For ADA Cabinet Units (Includes All ADA Hardware), Add	104.31	
For Plastic Laminate On Particle Board, Deduct	-104.31	
Note: (Plastic Laminate On Hardwood For Doors)		
For Premium Grade Plywood With Plastic Laminate, Deduct	-52.16	
For Economy Grade, Deduct	-208.63	
For Premium Grade, Add	260.79	
For Laboratory Grade, Add	339.02	
For Unfinished (Natural, Wood), Deduct	-78.24	
For 3 Drawer Unit, Add	52.16	
For Sink Base With Sink Front (No Drawer), Deduct	-78.24	
06 41 13 00-0033 34-1/2" High x 24" Deep, Custom Built In Place <small>(06 41 13 00-0019)</small>		

06 Wood, Plastics, and Composites**06 40 Architectural Woodwork****06 41 Architectural Wood Casework**

MINOR				TOTAL DIRECT	DEMOLITION
CSI	UOM	DESCRIPTION		UNIT COST	UNIT COST
06 41 13 00-0034	LF	24" To 30" Wide, 34-1/2" High x 24" Deep Built In Place 2-Drawer/2-Door Cabinet.....	209.61		49.59
		Note: Prefinished with solid hardwood face frames, hardwood door frames and drawer fronts. Hardwood veneer on raised door panels. Excludes top.			
		For ADA Cabinet Units (Includes All ADA Hardware), Add	27.84		
		For Plastic Laminate On Particle Board, Deduct	-27.84		
		Note: (Plastic Laminate On Hardwood For Doors)			
		For Premium Grade Plywood With Plastic Laminate, Deduct	-13.92		
		For Economy Grade, Deduct	-55.67		
		For Premium Grade, Add	69.59		
		For Laboratory Grade, Add	90.47		
		For Unfinished (Natural, Wood), Deduct	-20.88		
		For 3 Drawer Unit, Add	13.92		
		For Sink Base With Sink Front (No Drawer), Deduct	-20.88		
06 41 13 00-0035	LF	>30" To 36" Wide, 34-1/2" High x 24" Deep Built In Place 2-Drawer/2-Door Cabinet.....	189.60		45.28
		Note: Prefinished with solid hardwood face frames, hardwood door frames and drawer fronts. Hardwood veneer on raised door panels. Excludes top.			
		For ADA Cabinet Units (Includes All ADA Hardware), Add	24.98		
		For Plastic Laminate On Particle Board, Deduct	-24.98		
		Note: (Plastic Laminate On Hardwood For Doors)			
		For Premium Grade Plywood With Plastic Laminate, Deduct	-12.49		
		For Economy Grade, Deduct	-49.96		
		For Premium Grade, Add	62.46		
		For Laboratory Grade, Add	81.19		
		For Unfinished (Natural, Wood), Deduct	-18.74		
		For 3 Drawer Unit, Add	12.49		
		For Sink Base With Sink Front (No Drawer), Deduct	-18.74		
06 41 13 00-0036	LF	>36" To 42" Wide, 34-1/2" High x 24" Deep Built In Place 2-Drawer/2-Door Cabinet.....	174.46		42.40
		Note: Prefinished with solid hardwood face frames, hardwood door frames and drawer fronts. Hardwood veneer on raised door panels. Excludes top.			
		For ADA Cabinet Units (Includes All ADA Hardware), Add	22.82		
		For Plastic Laminate On Particle Board, Deduct	-22.82		
		Note: (Plastic Laminate On Hardwood For Doors)			
		For Premium Grade Plywood With Plastic Laminate, Deduct	-11.41		
		For Economy Grade, Deduct	-45.64		
		For Premium Grade, Add	57.05		
		For Laboratory Grade, Add	74.16		
		For Unfinished (Natural, Wood), Deduct	-17.11		
		For 3 Drawer Unit, Add	11.41		
		For Sink Base With Sink Front (No Drawer), Deduct	-17.11		
06 41 13 00-0037	LF	>42" To 48" Wide, 34-1/2" High x 24" Deep Built In Place 2-Drawer/2-Door Cabinet.....	162.03		40.25
		Note: Prefinished with solid hardwood face frames, hardwood door frames and drawer fronts. Hardwood veneer on raised door panels. Excludes top.			
		For ADA Cabinet Units (Includes All ADA Hardware), Add	20.91		
		For Plastic Laminate On Particle Board, Deduct	-20.91		
		Note: (Plastic Laminate On Hardwood For Doors)			
		For Premium Grade Plywood With Plastic Laminate, Deduct	-10.45		
		For Economy Grade, Deduct	-41.81		
		For Premium Grade, Add	52.27		
		For Laboratory Grade, Add	67.94		
		For Unfinished (Natural, Wood), Deduct	-15.68		
		For 3 Drawer Unit, Add	10.45		
		For Sink Base With Sink Front (No Drawer), Deduct	-15.68		
06 41 13 00-0038		Vanity Bases (06 41 13 00-0002)			
06 41 13 00-0039	EA	30" High x 21" Deep x 24" Wide Vanity Bases, 2 Door.....	338.40		53.48
		Note: Prefinished with solid hardwood face frames, hardwood door frames and drawer fronts. Hardwood veneer on raised door panels. Excludes top.			
		For ADA Cabinet Units (Includes All ADA Hardware), Add	46.30		
		For Plastic Laminate On Particle Board, Deduct	-46.30		
		Note: (Plastic Laminate On Hardwood For Doors)			
		For Premium Grade Plywood With Plastic Laminate, Deduct	-23.15		
		For Economy Grade, Deduct	-92.60		
		For Premium Grade, Add	115.76		
		For Laboratory Grade, Add	150.48		
		For Unfinished (Natural, Wood), Deduct	-34.73		
06 41 13 00-0040	EA	30" High x 21" Deep x 30" Wide Vanity Bases, 2 Door.....	383.99		59.51
		Note: Prefinished with solid hardwood face frames, hardwood door frames and drawer fronts. Hardwood veneer on raised door panels. Excludes top.			
		For ADA Cabinet Units (Includes All ADA Hardware), Add	53.23		
		For Plastic Laminate On Particle Board, Deduct	-53.23		
		Note: (Plastic Laminate On Hardwood For Doors)			
		For Premium Grade Plywood With Plastic Laminate, Deduct	-26.62		
		For Economy Grade, Deduct	-106.47		
		For Premium Grade, Add	133.09		
		For Laboratory Grade, Add	173.01		
		For Unfinished (Natural, Wood), Deduct	-39.93		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 41 13 00-0041 EA 30" High x 21" Deep x 36" Wide Vanity Bases, 2 Door.....	480.20	61.95
Note: Prefinished with solid hardwood face frames, hardwood door frames and drawer fronts. Hardwood veneer on raised door panels. Excludes top.		
For ADA Cabinet Units (Includes All ADA Hardware), Add	71.26	
For Plastic Laminate On Particle Board, Deduct	-71.26	
Note: (Plastic Laminate On Hardwood For Doors)		
For Premium Grade Plywood With Plastic Laminate, Deduct	-35.63	
For Economy Grade, Deduct	-142.51	
For Premium Grade, Add	178.14	
For Laboratory Grade, Add	231.58	
For Unfinished (Natural, Wood), Deduct	-53.44	
06 41 13 00-0042 EA 30" High x 21" Deep x 48" Wide Vanity Bases, 2 Door.....	573.69	75.47
Note: Prefinished with solid hardwood face frames, hardwood door frames and drawer fronts. Hardwood veneer on raised door panels. Excludes top.		
For ADA Cabinet Units (Includes All ADA Hardware), Add	84.56	
For Plastic Laminate On Particle Board, Deduct	-84.56	
Note: (Plastic Laminate On Hardwood For Doors)		
For Premium Grade Plywood With Plastic Laminate, Deduct	-42.28	
For Economy Grade, Deduct	-169.13	
For Premium Grade, Add	211.41	
For Laboratory Grade, Add	274.83	
For Unfinished (Natural, Wood), Deduct	-63.42	
06 41 13 00-0043 Wall Cabinets (06 41 13 00-0001)		
06 41 13 00-0044 Wall Cabinets 36" High x 13" Deep (06 41 13 00-0043)		
06 41 13 00-0045 Single Door Type Units (06 41 13 00-0044)		
06 41 13 00-0046 EA Up To 15" Wide, 36" High x 13" Deep Single Door Wall Cabinet	233.30	51.74
Note: Prefinished with solid hardwood face frames, hardwood door frames. Hardwood veneer on raised door panels.		
For Plastic Laminate On Particle Board, Deduct	-33.73	
Note: (Plastic Laminate On Hardwood For Doors)		
For Premium Grade Plywood With Plastic Laminate, Deduct	-16.86	
For Economy Grade, Deduct	-67.45	
For Premium Grade, Add	84.32	
For Laboratory Grade, Add	109.61	
For Unfinished (Natural, Wood), Deduct	-25.29	
06 41 13 00-0047 EA >15" To 18" Wide, 36" High x 13" Deep Single Door Wall Cabinet.....	262.64	52.82
Note: Prefinished with solid hardwood face frames, hardwood door frames. Hardwood veneer on raised door panels.		
For Plastic Laminate On Particle Board, Deduct	-39.32	
Note: (Plastic Laminate On Hardwood For Doors)		
For Premium Grade Plywood With Plastic Laminate, Deduct	-19.66	
For Economy Grade, Deduct	-78.63	
For Premium Grade, Add	98.29	
For Laboratory Grade, Add	127.78	
For Unfinished (Natural, Wood), Deduct	-29.49	
06 41 13 00-0048 EA >18" To 24" Wide, 36" High x 13" Deep Single Door Wall Cabinet.....	292.99	54.62
Note: Prefinished with solid hardwood face frames, hardwood door frames. Hardwood veneer on raised door panels.		
For Plastic Laminate On Particle Board, Deduct	-44.92	
Note: (Plastic Laminate On Hardwood For Doors)		
For Premium Grade Plywood With Plastic Laminate, Deduct	-22.46	
For Economy Grade, Deduct	-89.83	
For Premium Grade, Add	112.29	
For Laboratory Grade, Add	145.98	
For Unfinished (Natural, Wood), Deduct	-33.69	
06 41 13 00-0049 EA >24" To 30" Wide, 36" High x 13" Deep Single Door Wall Cabinet.....	343.71	58.94
Note: Prefinished with solid hardwood face frames, hardwood door frames. Hardwood veneer on raised door panels.		
For Plastic Laminate On Particle Board, Deduct	-53.90	
Note: (Plastic Laminate On Hardwood For Doors)		
For Premium Grade Plywood With Plastic Laminate, Deduct	-26.95	
For Economy Grade, Deduct	-107.80	
For Premium Grade, Add	134.75	
For Laboratory Grade, Add	175.18	
For Unfinished (Natural, Wood), Deduct	-40.43	
06 41 13 00-0050 Double Door Type Units (06 41 13 00-0044)		
06 41 13 00-0051 EA Up To 24" Wide, 36" High x 13" Deep Double Door Wall Cabinet.....	301.22	60.37
Note: Prefinished with solid hardwood face frames, hardwood door frames. Hardwood veneer on raised door panels.		
For Plastic Laminate On Particle Board, Deduct	-44.98	
Note: (Plastic Laminate On Hardwood For Doors)		
For Premium Grade Plywood With Plastic Laminate, Deduct	-22.49	
For Economy Grade, Deduct	-89.96	
For Premium Grade, Add	112.46	
For Laboratory Grade, Add	146.19	
For Unfinished (Natural, Wood), Deduct	-33.74	

06 Wood, Plastics, and Composites**06 40 Architectural Woodwork****06 41 Architectural Wood Casework**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 41 13 00-0052	EA		>24" To 30" Wide, 36" High x 13" Deep Double Door Wall Cabinet.....354.77 Note: Prefinished with solid hardwood face frames, hardwood door frames. Hardwood veneer on raised door panels. <i>For Plastic Laminate On Particle Board, Deduct</i> -54.50 <i>Note: (Plastic Laminate On Hardwood For Doors)</i> <i>For Premium Grade Plywood With Plastic Laminate, Deduct</i> -27.25 <i>For Economy Grade, Deduct</i> -109.00 <i>For Premium Grade, Add</i> 136.25 <i>For Laboratory Grade, Add</i> 177.12 <i>For Unfinished (Natural, Wood), Deduct</i> -40.87	354.77	66.12
06 41 13 00-0053	EA		>30" To 36" Wide, 36" High x 13" Deep Double Door Wall Cabinet.....395.76 Note: Prefinished with solid hardwood face frames, hardwood door frames. Hardwood veneer on raised door panels. <i>For Plastic Laminate On Particle Board, Deduct</i> -62.28 <i>Note: (Plastic Laminate On Hardwood For Doors)</i> <i>For Premium Grade Plywood With Plastic Laminate, Deduct</i> -31.14 <i>For Economy Grade, Deduct</i> -124.57 <i>For Premium Grade, Add</i> 155.71 <i>For Laboratory Grade, Add</i> 202.42 <i>For Unfinished (Natural, Wood), Deduct</i> -46.71	395.76	67.56
06 41 13 00-0054	EA		>36" To 42" Wide, 36" High x 13" Deep Double Door Wall Cabinet.....429.12 Note: Prefinished with solid hardwood face frames, hardwood door frames. Hardwood veneer on raised door panels. <i>For Plastic Laminate On Particle Board, Deduct</i> -68.27 <i>Note: (Plastic Laminate On Hardwood For Doors)</i> <i>For Premium Grade Plywood With Plastic Laminate, Deduct</i> -34.14 <i>For Economy Grade, Deduct</i> -136.54 <i>For Premium Grade, Add</i> 170.68 <i>For Laboratory Grade, Add</i> 221.88 <i>For Unfinished (Natural, Wood), Deduct</i> -51.20	429.12	70.08
06 41 13 00-0055	EA		>42" To 48" Wide, 36" High x 13" Deep Double Door Wall Cabinet.....476.93 Note: Prefinished with solid hardwood face frames, hardwood door frames. Hardwood veneer on raised door panels. <i>For Plastic Laminate On Particle Board, Deduct</i> -76.96 <i>Note: (Plastic Laminate On Hardwood For Doors)</i> <i>For Premium Grade Plywood With Plastic Laminate, Deduct</i> -38.48 <i>For Economy Grade, Deduct</i> -153.91 <i>For Premium Grade, Add</i> 192.39 <i>For Laboratory Grade, Add</i> 250.11 <i>For Unfinished (Natural, Wood), Deduct</i> -57.72	476.93	73.31
06 41 13 00-0056			Wall Cabinets 30" High x 13" Deep (06 41 13 00-0043)		
06 41 13 00-0057			Single Door Type Units (06 41 13 00-0056)		
06 41 13 00-0058	EA		Up To 12" Wide, 30" High x 13" Deep Single Door Wall Cabinet.....183.95 Note: Prefinished with solid hardwood face frames, hardwood door frames. Hardwood veneer on raised door panels. <i>For Plastic Laminate On Particle Board, Deduct</i> -26.45 <i>Note: (Plastic Laminate On Hardwood For Doors)</i> <i>For Premium Grade Plywood With Plastic Laminate, Deduct</i> -13.23 <i>For Economy Grade, Deduct</i> -52.90 <i>For Premium Grade, Add</i> 66.13 <i>For Laboratory Grade, Add</i> 85.96 <i>For Unfinished (Natural, Wood), Deduct</i> -19.84	183.95	40.87
06 41 13 00-0059	EA		>12" To 15" Wide, 30" High x 13" Deep Single Door Wall Cabinet.....208.61 Note: Prefinished with solid hardwood face frames, hardwood door frames. Hardwood veneer on raised door panels. <i>For Plastic Laminate On Particle Board, Deduct</i> -30.94 <i>Note: (Plastic Laminate On Hardwood For Doors)</i> <i>For Premium Grade Plywood With Plastic Laminate, Deduct</i> -15.47 <i>For Economy Grade, Deduct</i> -61.88 <i>For Premium Grade, Add</i> 77.36 <i>For Laboratory Grade, Add</i> 100.56 <i>For Unfinished (Natural, Wood), Deduct</i> -23.21	208.61	42.64
06 41 13 00-0060	EA		>15" To 18" Wide, 30" High x 13" Deep Single Door Wall Cabinet.....226.00 Note: Prefinished with solid hardwood face frames, hardwood door frames. Hardwood veneer on raised door panels. <i>For Plastic Laminate On Particle Board, Deduct</i> -34.19 <i>Note: (Plastic Laminate On Hardwood For Doors)</i> <i>For Premium Grade Plywood With Plastic Laminate, Deduct</i> -17.09 <i>For Economy Grade, Deduct</i> -68.37 <i>For Premium Grade, Add</i> 85.47 <i>For Laboratory Grade, Add</i> 111.10 <i>For Unfinished (Natural, Wood), Deduct</i> -25.64	226.00	43.54
06 41 13 00-0061	EA		>18" To 24" Wide, 30" High x 13" Deep Single Door Wall Cabinet.....244.16 Note: Prefinished with solid hardwood face frames, hardwood door frames. Hardwood veneer on raised door panels. <i>For Plastic Laminate On Particle Board, Deduct</i> -37.43 <i>Note: (Plastic Laminate On Hardwood For Doors)</i> <i>For Premium Grade Plywood With Plastic Laminate, Deduct</i> -18.72 <i>For Economy Grade, Deduct</i> -74.86 <i>For Premium Grade, Add</i> 93.58 <i>For Laboratory Grade, Add</i> 121.65 <i>For Unfinished (Natural, Wood), Deduct</i> -28.07	244.16	45.08



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 41 13 00-0062 Double Door Type Units <small>(06 41 13 00-0056)</small>		
06 41 13 00-0063 EA Up To 27" Wide, 30" High x 13" Deep Double Door Wall Cabinet.....	269.07	46.04
Note: Prefinished with solid hardwood face frames, hardwood door frames. Hardwood veneer on raised door panels.		
<i>For Plastic Laminate On Particle Board, Deduct</i>		
<i>Note: (Plastic Laminate On Hardwood For Doors)</i>		
<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>		
<i>For Economy Grade, Deduct</i>		
<i>For Premium Grade, Add</i>		
<i>For Laboratory Grade, Add</i>		
<i>For Unfinished (Natural, Wood), Deduct</i>		
06 41 13 00-0064 EA >27" To 30" Wide, 30" High x 13" Deep Double Door Wall Cabinet.....	286.73	47.18
Note: Prefinished with solid hardwood face frames, hardwood door frames. Hardwood veneer on raised door panels.		
<i>For Plastic Laminate On Particle Board, Deduct</i>		
<i>Note: (Plastic Laminate On Hardwood For Doors)</i>		
<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>		
<i>For Economy Grade, Deduct</i>		
<i>For Premium Grade, Add</i>		
<i>For Laboratory Grade, Add</i>		
<i>For Unfinished (Natural, Wood), Deduct</i>		
06 41 13 00-0065 EA >30" To 36" Wide, 30" High x 13" Deep Double Door Wall Cabinet.....	320.61	48.32
Note: Prefinished with solid hardwood face frames, hardwood door frames. Hardwood veneer on raised door panels.		
<i>For Plastic Laminate On Particle Board, Deduct</i>		
<i>Note: (Plastic Laminate On Hardwood For Doors)</i>		
<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>		
<i>For Economy Grade, Deduct</i>		
<i>For Premium Grade, Add</i>		
<i>For Laboratory Grade, Add</i>		
<i>For Unfinished (Natural, Wood), Deduct</i>		
06 41 13 00-0066 EA >36" To 42" Wide, 30" High x 13" Deep Double Door Wall Cabinet.....	346.99	49.45
Note: Prefinished with solid hardwood face frames, hardwood door frames. Hardwood veneer on raised door panels.		
<i>For Plastic Laminate On Particle Board, Deduct</i>		
<i>Note: (Plastic Laminate On Hardwood For Doors)</i>		
<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>		
<i>For Economy Grade, Deduct</i>		
<i>For Premium Grade, Add</i>		
<i>For Laboratory Grade, Add</i>		
<i>For Unfinished (Natural, Wood), Deduct</i>		
06 41 13 00-0067 EA >42" To 48" Wide, 30" High x 13" Deep Double Door Wall Cabinet.....	383.90	50.02
Note: Prefinished with solid hardwood face frames, hardwood door frames. Hardwood veneer on raised door panels.		
<i>For Plastic Laminate On Particle Board, Deduct</i>		
<i>Note: (Plastic Laminate On Hardwood For Doors)</i>		
<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>		
<i>For Economy Grade, Deduct</i>		
<i>For Premium Grade, Add</i>		
<i>For Laboratory Grade, Add</i>		
<i>For Unfinished (Natural, Wood), Deduct</i>		
06 41 13 00-0068 Wall Cabinets 24" High x 13" Deep <small>(06 41 13 00-0043)</small>		
06 41 13 00-0069 Double Door Type Units <small>(06 41 13 00-0068)</small>		
06 41 13 00-0070 EA Up To 24" Wide, 24" High x 13" Deep Double Door Wall Cabinet.....	236.90	37.38
Note: Prefinished with solid hardwood face frames, hardwood door frames. Hardwood veneer on raised door panels.		
<i>For Plastic Laminate On Particle Board, Deduct</i>		
<i>Note: (Plastic Laminate On Hardwood For Doors)</i>		
<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>		
<i>For Economy Grade, Deduct</i>		
<i>For Premium Grade, Add</i>		
<i>For Laboratory Grade, Add</i>		
<i>For Unfinished (Natural, Wood), Deduct</i>		
06 41 13 00-0071 EA >24" To 30" Wide, 24" High x 13" Deep Double Door Wall Cabinet.....	252.97	39.17
Note: Prefinished with solid hardwood face frames, hardwood door frames. Hardwood veneer on raised door panels.		
<i>For Plastic Laminate On Particle Board, Deduct</i>		
<i>Note: (Plastic Laminate On Hardwood For Doors)</i>		
<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>		
<i>For Economy Grade, Deduct</i>		
<i>For Premium Grade, Add</i>		
<i>For Laboratory Grade, Add</i>		
<i>For Unfinished (Natural, Wood), Deduct</i>		
06 41 13 00-0072 EA >30" To 36" Wide, 24" High x 13" Deep Double Door Wall Cabinet.....	275.56	40.32
Note: Prefinished with solid hardwood face frames, hardwood door frames. Hardwood veneer on raised door panels.		
<i>For Plastic Laminate On Particle Board, Deduct</i>		
<i>Note: (Plastic Laminate On Hardwood For Doors)</i>		
<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>		
<i>For Economy Grade, Deduct</i>		
<i>For Premium Grade, Add</i>		
<i>For Laboratory Grade, Add</i>		
<i>For Unfinished (Natural, Wood), Deduct</i>		

06 Wood, Plastics, and Composites**06 40 Architectural Woodwork****06 41 Architectural Wood Casework**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 41 13 00-0073	EA		>36" To 42" Wide, 24" High x 13" Deep Double Door Wall Cabinet..... Note: Prefinished with solid hardwood face frames, hardwood door frames. Hardwood veneer on raised door panels. <i>For Plastic Laminate On Particle Board, Deduct</i> <i>Note: (Plastic Laminate On Hardwood For Doors)</i> <i>For Premium Grade Plywood With Plastic Laminate, Deduct</i> <i>For Economy Grade, Deduct</i> <i>For Premium Grade, Add</i> <i>For Laboratory Grade, Add</i> <i>For Unfinished (Natural, Wood), Deduct</i>	300.03 -49.66 -24.83 -99.32 124.15 161.39 -37.24	40.96
06 41 13 00-0074			Wall Cabinets 15" High x 13" Deep (06 41 13 00-0043)		
06 41 13 00-0075			Double Door Type Units (06 41 13 00-0074)		
06 41 13 00-0076	EA		Up To 24" Wide, 15" High x 13" Deep Double Door Wall Cabinet Note: Prefinished with solid hardwood face frames, hardwood door frames. Hardwood veneer on raised door panels. <i>For Plastic Laminate On Particle Board, Deduct</i> <i>Note: (Plastic Laminate On Hardwood For Doors)</i> <i>For Premium Grade Plywood With Plastic Laminate, Deduct</i> <i>For Economy Grade, Deduct</i> <i>For Premium Grade, Add</i> <i>For Laboratory Grade, Add</i> <i>For Unfinished (Natural, Wood), Deduct</i>	209.97 -33.69 -16.84 -67.38 84.22 109.49 -25.27	32.84
06 41 13 00-0077	EA		>24" To 30" Wide, 15" High x 13" Deep Double Door Wall Cabinet..... Note: Prefinished with solid hardwood face frames, hardwood door frames. Hardwood veneer on raised door panels. <i>For Plastic Laminate On Particle Board, Deduct</i> <i>Note: (Plastic Laminate On Hardwood For Doors)</i> <i>For Premium Grade Plywood With Plastic Laminate, Deduct</i> <i>For Economy Grade, Deduct</i> <i>For Premium Grade, Add</i> <i>For Laboratory Grade, Add</i> <i>For Unfinished (Natural, Wood), Deduct</i>	221.73 -35.43 -17.72 -70.87 88.59 115.16 -26.58	35.22
06 41 13 00-0078	EA		>30" To 36" Wide, 15" High x 13" Deep Double Door Wall Cabinet..... Note: Prefinished with solid hardwood face frames, hardwood door frames. Hardwood veneer on raised door panels. <i>For Plastic Laminate On Particle Board, Deduct</i> <i>Note: (Plastic Laminate On Hardwood For Doors)</i> <i>For Premium Grade Plywood With Plastic Laminate, Deduct</i> <i>For Economy Grade, Deduct</i> <i>For Premium Grade, Add</i> <i>For Laboratory Grade, Add</i> <i>For Unfinished (Natural, Wood), Deduct</i>	244.37 -38.68 -19.34 -77.36 96.70 125.70 -29.01	40.32
06 41 13 00-0079	EA		>36" To 42" Wide, 15" High x 13" Deep Double Door Wall Cabinet..... Note: Prefinished with solid hardwood face frames, hardwood door frames. Hardwood veneer on raised door panels. <i>For Plastic Laminate On Particle Board, Deduct</i> <i>Note: (Plastic Laminate On Hardwood For Doors)</i> <i>For Premium Grade Plywood With Plastic Laminate, Deduct</i> <i>For Economy Grade, Deduct</i> <i>For Premium Grade, Add</i> <i>For Laboratory Grade, Add</i> <i>For Unfinished (Natural, Wood), Deduct</i>	264.37 -42.67 -21.34 -85.34 106.68 138.68 -32.00	40.32
06 41 13 00-0080			Wall Cabinets 12" High x 13" Deep (06 41 13 00-0043)		
06 41 13 00-0081	EA		18" to 30" Wide, 12" High x 13" Deep Double Door Wall Cabinet..... Note: Prefinished with solid hardwood face frames, hardwood door frames. Hardwood veneer on raised door panels. <i>For Plastic Laminate On Particle Board, Deduct</i> <i>Note: (Plastic Laminate On Hardwood For Doors)</i> <i>For Premium Grade Plywood With Plastic Laminate, Deduct</i> <i>For Economy Grade, Deduct</i> <i>For Premium Grade, Add</i> <i>For Laboratory Grade, Add</i> <i>For Unfinished (Natural, Wood), Deduct</i>	195.85 -30.19 -15.10 -60.39 75.49 98.13 -22.65	22.13
06 41 13 00-0082	EA		>30" Wide, 12" High x 13" Deep Double Door Wall Cabinet..... Note: Prefinished with solid hardwood face frames, hardwood door frames. Hardwood veneer on raised door panels. <i>For Plastic Laminate On Particle Board, Deduct</i> <i>Note: (Plastic Laminate On Hardwood For Doors)</i> <i>For Premium Grade Plywood With Plastic Laminate, Deduct</i> <i>For Economy Grade, Deduct</i> <i>For Premium Grade, Add</i> <i>For Laboratory Grade, Add</i> <i>For Unfinished (Natural, Wood), Deduct</i>	228.48 -35.43 -17.72 -70.87 88.59 115.16 -26.58	16.60
06 41 13 00-0083			Wall Cabinets 36" High x 13" Deep, Custom Built In Place (06 41 13 00-0043)		
06 41 13 00-0084			Single Door Type Units (06 41 13 00-0083)		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 41 13 00-0085 LF Up To 15" Wide, 36" High x 13" Deep Built In Place Single Door Wall Cabinet.....	212.51	54.62
Note: Prefinished with solid hardwood face frames, hardwood door frames. Hardwood veneer on raised door panels.		
For Plastic Laminate On Particle Board, Deduct	-26.98	
Note: (Plastic Laminate On Hardwood For Doors)		
For Premium Grade Plywood With Plastic Laminate, Deduct	-13.49	
For Economy Grade, Deduct	-53.96	
For Premium Grade, Add	67.45	
For Laboratory Grade, Add	87.68	
For Unfinished (Natural, Wood), Deduct	-20.23	
06 41 13 00-0086 LF >15 To 18" Wide, 36" High x 13" Deep Built In Place Single Door Wall Cabinet.....	197.17	46.00
Note: Prefinished with solid hardwood face frames, hardwood door frames. Hardwood veneer on raised door panels.		
For Plastic Laminate On Particle Board, Deduct	-26.21	
Note: (Plastic Laminate On Hardwood For Doors)		
For Premium Grade Plywood With Plastic Laminate, Deduct	-13.11	
For Economy Grade, Deduct	-52.42	
For Premium Grade, Add	65.53	
For Laboratory Grade, Add	85.18	
For Unfinished (Natural, Wood), Deduct	-19.66	
06 41 13 00-0087 LF >18 To 24" Wide, 36" High x 13" Deep Built In Place Single Door Wall Cabinet.....	163.32	35.94
Note: Prefinished with solid hardwood face frames, hardwood door frames. Hardwood veneer on raised door panels.		
For Plastic Laminate On Particle Board, Deduct	-22.46	
Note: (Plastic Laminate On Hardwood For Doors)		
For Premium Grade Plywood With Plastic Laminate, Deduct	-11.23	
For Economy Grade, Deduct	-44.92	
For Premium Grade, Add	56.15	
For Laboratory Grade, Add	72.99	
For Unfinished (Natural, Wood), Deduct	-16.84	
06 41 13 00-0088 LF >24 To 30" Wide, 36" High x 13" Deep Built In Place Single Door Wall Cabinet.....	152.41	30.91
Note: Prefinished with solid hardwood face frames, hardwood door frames. Hardwood veneer on raised door panels.		
For Plastic Laminate On Particle Board, Deduct	-21.57	
Note: (Plastic Laminate On Hardwood For Doors)		
For Premium Grade Plywood With Plastic Laminate, Deduct	-10.79	
For Economy Grade, Deduct	-43.14	
For Premium Grade, Add	53.93	
For Laboratory Grade, Add	70.10	
For Unfinished (Natural, Wood), Deduct	-16.18	
06 41 13 00-0089 Double Door Type Units (06 41 13 00-0083)		
06 41 13 00-0090 LF Up To 24" Wide, 36" High x 13" Deep Built In Place Double Door Wall Cabinet.....	169.93	40.25
Note: Prefinished with solid hardwood face frames, hardwood door frames. Hardwood veneer on raised door panels.		
For Plastic Laminate On Particle Board, Deduct	-22.49	
Note: (Plastic Laminate On Hardwood For Doors)		
For Premium Grade Plywood With Plastic Laminate, Deduct	-11.24	
For Economy Grade, Deduct	-44.97	
For Premium Grade, Add	56.22	
For Laboratory Grade, Add	73.08	
For Unfinished (Natural, Wood), Deduct	-16.86	
06 41 13 00-0091 LF >24" To 30" Wide, 36" High x 13" Deep Built In Place Double Door Wall Cabinet.....	157.83	34.50
Note: Prefinished with solid hardwood face frames, hardwood door frames. Hardwood veneer on raised door panels.		
For Plastic Laminate On Particle Board, Deduct	-21.79	
Note: (Plastic Laminate On Hardwood For Doors)		
For Premium Grade Plywood With Plastic Laminate, Deduct	-10.90	
For Economy Grade, Deduct	-43.58	
For Premium Grade, Add	54.48	
For Laboratory Grade, Add	70.82	
For Unfinished (Natural, Wood), Deduct	-16.34	
06 41 13 00-0092 LF >30" To 36" Wide, 36" High x 13" Deep Built In Place Double Door Wall Cabinet.....	146.21	29.47
Note: Prefinished with solid hardwood face frames, hardwood door frames. Hardwood veneer on raised door panels.		
For Plastic Laminate On Particle Board, Deduct	-20.76	
Note: (Plastic Laminate On Hardwood For Doors)		
For Premium Grade Plywood With Plastic Laminate, Deduct	-10.38	
For Economy Grade, Deduct	-41.52	
For Premium Grade, Add	51.91	
For Laboratory Grade, Add	67.48	
For Unfinished (Natural, Wood), Deduct	-15.57	
06 41 13 00-0093 LF >36" To 42" Wide, 36" High x 13" Deep Built In Place Double Door Wall Cabinet.....	134.91	25.87
Note: Prefinished with solid hardwood face frames, hardwood door frames. Hardwood veneer on raised door panels.		
For Plastic Laminate On Particle Board, Deduct	-19.51	
Note: (Plastic Laminate On Hardwood For Doors)		
For Premium Grade Plywood With Plastic Laminate, Deduct	-9.75	
For Economy Grade, Deduct	-39.01	
For Premium Grade, Add	48.77	
For Laboratory Grade, Add	63.39	
For Unfinished (Natural, Wood), Deduct	-14.63	

06 Wood, Plastics, and Composites**06 40 Architectural Woodwork****06 41 Architectural Wood Casework**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 41 13 00-0094	LF		>42" To 48" Wide, 36" High x 13" Deep Built In Place Double Door Wall Cabinet..... Note: Prefinished with solid hardwood face frames, hardwood door frames. Hardwood veneer on raised door panels. <i>For Plastic Laminate On Particle Board, Deduct</i> <i>Note: (Plastic Laminate On Hardwood For Doors)</i> <i>For Premium Grade Plywood With Plastic Laminate, Deduct</i> <i>For Economy Grade, Deduct</i> <i>For Premium Grade, Add</i> <i>For Laboratory Grade, Add</i> <i>For Unfinished (Natural, Wood), Deduct</i>	130.71 -19.24 -9.62 -38.48 48.11 62.54 -14.43	24.44
06 41 13 00-0095			Accessories <small>(06 41 13 00-0001)</small> See CSI section 06 41 93 00-0001 for cabinet hardware.		
06 41 13 00-0096	EA		Wall Corner Cabinet With Shelving..... Note: Prefinished with solid hardwood face frames, hardwood door frames. Hardwood veneer on raised door panels. <i>For Plastic Laminate On Particle Board, Deduct</i> <i>Note: (Plastic Laminate On Hardwood For Doors)</i> <i>For Premium Grade Plywood With Plastic Laminate, Deduct</i> <i>For Economy Grade, Deduct</i> <i>For Premium Grade, Add</i> <i>For Laboratory Grade, Add</i> <i>For Unfinished (Natural, Wood), Deduct</i>	291.56 -22.39 -11.20 -44.78 55.98 72.77 -16.79	80.82
06 41 13 00-0097	EA		Wall Lazy Susan With Cabinet Enclosure..... Note: Prefinished with solid hardwood face frames, hardwood door frames. Hardwood veneer on raised door panels. <i>For Plastic Laminate On Particle Board, Deduct</i> <i>Note: (Plastic Laminate On Hardwood For Doors)</i> <i>For Premium Grade Plywood With Plastic Laminate, Deduct</i> <i>For Economy Grade, Deduct</i> <i>For Premium Grade, Add</i> <i>For Laboratory Grade, Add</i> <i>For Unfinished (Natural, Wood), Deduct</i>	426.32 -56.53 -28.26 -113.06 141.32 183.72 -42.40	64.66
06 41 13 00-0098	EA		Base Lazy Susan With Cabinet Enclosure..... Note: Prefinished with solid hardwood face frames, hardwood door frames. Hardwood veneer on raised door panels. <i>For Plastic Laminate On Particle Board, Deduct</i> <i>Note: (Plastic Laminate On Hardwood For Doors)</i> <i>For Premium Grade Plywood With Plastic Laminate, Deduct</i> <i>For Economy Grade, Deduct</i> <i>For Premium Grade, Add</i> <i>For Laboratory Grade, Add</i> <i>For Unfinished (Natural, Wood), Deduct</i>	513.37 -78.73 -39.36 -157.46 196.82 255.87 -59.05	53.88
06 41 13 00-0099	EA		Broom Cabinet..... Note: Prefinished with solid hardwood face frames, hardwood door frames. Hardwood veneer on raised door panels. <i>For Plastic Laminate On Particle Board, Deduct</i> <i>Note: (Plastic Laminate On Hardwood For Doors)</i> <i>For Premium Grade Plywood With Plastic Laminate, Deduct</i> <i>For Economy Grade, Deduct</i> <i>For Premium Grade, Add</i> <i>For Laboratory Grade, Add</i> <i>For Unfinished (Natural, Wood), Deduct</i>	551.64 -89.80 -44.90 -179.61 224.51 291.86 -67.35	46.19
06 41 13 00-0100	EA		Base Corner Cabinet..... Note: Prefinished with solid hardwood face frames, hardwood door frames. Hardwood veneer on raised door panels. <i>For Plastic Laminate On Particle Board, Deduct</i> <i>Note: (Plastic Laminate On Hardwood For Doors)</i> <i>For Premium Grade Plywood With Plastic Laminate, Deduct</i> <i>For Economy Grade, Deduct</i> <i>For Premium Grade, Add</i> <i>For Laboratory Grade, Add</i> <i>For Unfinished (Natural, Wood), Deduct</i>	233.96 -33.86 -16.93 -67.72 84.66 110.05 -25.40	32.32
06 41 13 00-0101	EA		Base Range Cabinet..... Note: Prefinished with solid hardwood face frames, hardwood door frames. Hardwood veneer on raised door panels. <i>For Plastic Laminate On Particle Board, Deduct</i> <i>Note: (Plastic Laminate On Hardwood For Doors)</i> <i>For Premium Grade Plywood With Plastic Laminate, Deduct</i> <i>For Economy Grade, Deduct</i> <i>For Premium Grade, Add</i> <i>For Laboratory Grade, Add</i> <i>For Unfinished (Natural, Wood), Deduct</i>	221.87 -33.60 -16.80 -67.20 84.00 109.19 -25.20	26.94
06 41 13 00-0102	EA		Double Oven Cabinet..... Note: Prefinished with solid hardwood face frames, hardwood door frames. <i>For Plastic Laminate On Particle Board, Deduct</i> <i>Note: (Plastic Laminate On Hardwood For Doors)</i> <i>For Premium Grade Plywood With Plastic Laminate, Deduct</i> <i>For Economy Grade, Deduct</i> <i>For Premium Grade, Add</i> <i>For Laboratory Grade, Add</i> <i>For Unfinished (Natural, Wood), Deduct</i>	292.64 -45.60 -22.80 -91.20 114.00 148.19 -34.20	32.32



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 41 13 00-0103 EA Microwave Cabinet Note: Prefinished with solid hardwood face frames, hardwood door frames. <i>For Plastic Laminate On Particle Board, Deduct</i> Note: (Plastic Laminate On Hardwood For Doors) <i>For Premium Grade Plywood With Plastic Laminate, Deduct</i> <i>For Economy Grade, Deduct</i> <i>For Premium Grade, Add</i> <i>For Laboratory Grade, Add</i> <i>For Unfinished (Natural, Wood), Deduct</i>	199.10 -31.20 -15.60 -62.40 78.00 101.40 -23.40	21.55
06 41 13 00-0104 EA 30" Flipper Door And Cabinet Note: Prefinished with solid hardwood face frames, hardwood door frames. Hardwood veneer on raised door panels. <i>For Plastic Laminate On Particle Board, Deduct</i> Note: (Plastic Laminate On Hardwood For Doors) <i>For Premium Grade Plywood With Plastic Laminate, Deduct</i> <i>For Economy Grade, Deduct</i> <i>For Premium Grade, Add</i> <i>For Laboratory Grade, Add</i> <i>For Unfinished (Natural, Wood), Deduct</i>	252.35 -33.95 -16.97 -67.89 84.87 110.32 -25.46	41.31
06 41 13 00-0105 EA 36" Flipper Door And Cabinet Note: Prefinished with solid hardwood face frames, hardwood door frames. Hardwood veneer on raised door panels. <i>For Plastic Laminate On Particle Board, Deduct</i> Note: (Plastic Laminate On Hardwood For Doors) <i>For Premium Grade Plywood With Plastic Laminate, Deduct</i> <i>For Economy Grade, Deduct</i> <i>For Premium Grade, Add</i> <i>For Laboratory Grade, Add</i> <i>For Unfinished (Natural, Wood), Deduct</i>	269.45 -37.37 -18.68 -74.73 93.42 121.44 -28.02	41.31
06 41 13 00-0106 EA 48" Flipper Door And Cabinet Note: Prefinished with solid hardwood face frames, hardwood door frames. Hardwood veneer on raised door panels. <i>For Plastic Laminate On Particle Board, Deduct</i> Note: (Plastic Laminate On Hardwood For Doors) <i>For Premium Grade Plywood With Plastic Laminate, Deduct</i> <i>For Economy Grade, Deduct</i> <i>For Premium Grade, Add</i> <i>For Laboratory Grade, Add</i> <i>For Unfinished (Natural, Wood), Deduct</i>	297.81 -43.04 -21.52 -86.08 107.60 139.87 -32.28	41.31
06 41 13 00-0107 EA For Keyed Lock In Door Or Drawer	35.30	
06 41 13 00-0108 SET Tamper-Proof Screw Sets Per Panel.....	8.16	
06 41 13 00-0109 Residential Housing Cabinetwork (06 41 13) Note: Include hinges, mounting hardware and door pulls. Economy grade: Stock-grade cabinets with flush-face doors. Doors made from veneered particleboard. Standard grade: Stock-grade cabinets with raised panel or cathedral doors. Interior panel may be plywood. Lower grade plastic-laminate face cabinets. High grade: Semi-custom cabinets with raised panel or cathedral doors. Higher grade: Same as High Grade but with plastic-laminate face and foil-face face cabinets. Deluxe grade: Semi-custom cabinets with raised panel or cathedral doors. May include special slide-out drawers, pull-out baskets, glass doors, or foil-face. Materials include cherry, pecan, and Shaker-style maple or pine. Custom grade: Custom cabinets with raised panel or cathedral doors. May include special slide-out drawers, pull-out baskets, mullion or leaded glass doors. Materials include cherry, pecan, and Shaker-style maple or pine. Custom deluxe grade: Same as Custom Grade, may have some curved wood cabinets and more custom features.		
06 41 13 00-0110 EA 15" x 30" Wall Cabinet <i>For Plastic Laminate On Particle Board, Deduct</i> <i>For Economy Grade, Deduct</i> <i>For Premium Grade Plywood With Plastic Laminate, Deduct</i> <i>For High Grade, Add</i> <i>For Higher Grade, Add</i> <i>For Deluxe Grade, Add</i> <i>For Custom Deluxe Grade, Add</i> <i>For Custom Built In Place, Add</i>	119.66 -28.05 -16.03 -8.02 8.02 16.03 32.06 36.01 23.99	19.76
06 41 13 00-0111 EA 30" x 30" Wall Cabinet <i>For Plastic Laminate On Particle Board, Deduct</i> <i>For Economy Grade, Deduct</i> <i>For Premium Grade Plywood With Plastic Laminate, Deduct</i> <i>For High Grade, Add</i> <i>For Higher Grade, Add</i> <i>For Deluxe Grade, Add</i> <i>For Custom Deluxe Grade, Add</i> <i>For Custom Built In Place, Add</i>	171.85 -42.30 -24.17 -12.09 12.09 24.17 48.34 53.44 35.31	25.51
06 41 13 00-0112 EA 33" x 30" Wall Cabinet <i>For Plastic Laminate On Particle Board, Deduct</i> <i>For Economy Grade, Deduct</i> <i>For Premium Grade Plywood With Plastic Laminate, Deduct</i> <i>For High Grade, Add</i> <i>For Higher Grade, Add</i> <i>For Deluxe Grade, Add</i> <i>For Custom Deluxe Grade, Add</i> <i>For Custom Built In Place, Add</i>	183.58 -44.89 -25.65 -12.83 12.83 25.65 51.30 56.83 37.60	27.66

06 Wood, Plastics, and Composites**06 40 Architectural Woodwork****06 41 Architectural Wood Casework**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 41	13 00-0113	EA	36" x 30" Wall Cabinet	190.15	29.09
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-46.18	
			<i>For Economy Grade, Deduct</i>	-26.39	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-13.20	
			<i>For High Grade, Add</i>	13.20	
			<i>For Higher Grade, Add</i>	26.39	
			<i>For Deluxe Grade, Add</i>	52.78	
			<i>For Custom Deluxe Grade, Add</i>	58.60	
			<i>For Custom Built In Place, Add</i>	38.81	
06 41	13 00-0114	EA	39" x 30" Wall Cabinet	201.62	30.53
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-49.20	
			<i>For Economy Grade, Deduct</i>	-28.12	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-14.06	
			<i>For High Grade, Add</i>	14.06	
			<i>For Higher Grade, Add</i>	28.12	
			<i>For Deluxe Grade, Add</i>	56.23	
			<i>For Custom Deluxe Grade, Add</i>	62.34	
			<i>For Custom Built In Place, Add</i>	41.25	
06 41	13 00-0115	EA	42" x 30" Wall Cabinet	209.02	30.53
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-51.79	
			<i>For Economy Grade, Deduct</i>	-29.60	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-14.80	
			<i>For High Grade, Add</i>	14.80	
			<i>For Higher Grade, Add</i>	29.60	
			<i>For Deluxe Grade, Add</i>	59.19	
			<i>For Custom Deluxe Grade, Add</i>	65.30	
			<i>For Custom Built In Place, Add</i>	43.10	
06 41	13 00-0116	EA	45" x 30" Wall Cabinet	220.73	32.69
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-54.38	
			<i>For Economy Grade, Deduct</i>	-31.08	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-15.54	
			<i>For High Grade, Add</i>	15.54	
			<i>For Higher Grade, Add</i>	31.08	
			<i>For Deluxe Grade, Add</i>	62.15	
			<i>For Custom Deluxe Grade, Add</i>	68.69	
			<i>For Custom Built In Place, Add</i>	45.38	
06 41	13 00-0117	EA	48" x 30" Wall Cabinet	228.13	32.69
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-56.97	
			<i>For Economy Grade, Deduct</i>	-32.56	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-16.28	
			<i>For High Grade, Add</i>	16.28	
			<i>For Higher Grade, Add</i>	32.56	
			<i>For Deluxe Grade, Add</i>	65.11	
			<i>For Custom Deluxe Grade, Add</i>	71.65	
			<i>For Custom Built In Place, Add</i>	47.23	
06 41	13 00-0118	EA	30" x 34-1/2" Microwave Cabinet	236.56	27.66
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-63.44	
			<i>For Economy Grade, Deduct</i>	-36.25	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-18.13	
			<i>For High Grade, Add</i>	18.13	
			<i>For Higher Grade, Add</i>	36.25	
			<i>For Deluxe Grade, Add</i>	72.51	
			<i>For Custom Deluxe Grade, Add</i>	78.04	
			<i>For Custom Built In Place, Add</i>	50.85	
06 41	13 00-0119	EA	30" x 46-1/2" Microwave Cabinet	309.51	32.69
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-85.46	
			<i>For Economy Grade, Deduct</i>	-48.83	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-24.42	
			<i>For High Grade, Add</i>	24.42	
			<i>For Higher Grade, Add</i>	48.83	
			<i>For Deluxe Grade, Add</i>	97.66	
			<i>For Custom Deluxe Grade, Add</i>	104.20	
			<i>For Custom Built In Place, Add</i>	67.58	
06 41	13 00-0120	EA	30" x 12" x 34-1/2" Microwave Cabinet	232.27	25.51
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-63.44	
			<i>For Economy Grade, Deduct</i>	-36.25	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-18.13	
			<i>For High Grade, Add</i>	18.13	
			<i>For Higher Grade, Add</i>	36.25	
			<i>For Deluxe Grade, Add</i>	72.51	
			<i>For Custom Deluxe Grade, Add</i>	77.61	
			<i>For Custom Built In Place, Add</i>	50.42	
06 41	13 00-0121	EA	30" x 12" x 46-1/2" Microwave Cabinet	309.51	32.69
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-85.46	
			<i>For Economy Grade, Deduct</i>	-48.83	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-24.42	
			<i>For High Grade, Add</i>	24.42	
			<i>For Higher Grade, Add</i>	48.83	
			<i>For Deluxe Grade, Add</i>	97.66	
			<i>For Custom Deluxe Grade, Add</i>	104.20	
			<i>For Custom Built In Place, Add</i>	67.58	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 41 13 00-0122 EA 30" x 21" Microwave Cabinet.....	167.83	22.28
For Plastic Laminate On Particle Board, Deduct	-43.16	
For Economy Grade, Deduct	-24.66	
For Premium Grade Plywood With Plastic Laminate, Deduct	-12.33	
For High Grade, Add	12.33	
For Higher Grade, Add	24.66	
For Deluxe Grade, Add	49.32	
For Custom Deluxe Grade, Add	53.78	
For Custom Built In Place, Add	35.28	
06 41 13 00-0123 EA 30" x 15" Wall Cabinet.....	129.91	25.51
For Plastic Laminate On Particle Board, Deduct	-27.62	
For Economy Grade, Deduct	-15.78	
For Premium Grade Plywood With Plastic Laminate, Deduct	-7.89	
For High Grade, Add	7.89	
For Higher Grade, Add	15.78	
For Deluxe Grade, Add	31.57	
For Custom Deluxe Grade, Add	36.67	
For Custom Built In Place, Add	24.83	
06 41 13 00-0124 EA 24" x 24" Wall Cabinet, 2 Doors.....	130.86	22.28
For Plastic Laminate On Particle Board, Deduct	-30.21	
For Economy Grade, Deduct	-17.26	
For Premium Grade Plywood With Plastic Laminate, Deduct	-8.63	
For High Grade, Add	8.63	
For Higher Grade, Add	17.26	
For Deluxe Grade, Add	34.53	
For Custom Deluxe Grade, Add	38.98	
For Custom Built In Place, Add	26.03	
06 41 13 00-0125 EA 27" x 24" Wall Cabinet.....	134.56	22.28
For Plastic Laminate On Particle Board, Deduct	-31.51	
For Economy Grade, Deduct	-18.00	
For Premium Grade Plywood With Plastic Laminate, Deduct	-9.00	
For High Grade, Add	9.00	
For Higher Grade, Add	18.00	
For Deluxe Grade, Add	36.01	
For Custom Deluxe Grade, Add	40.46	
For Custom Built In Place, Add	26.96	
06 41 13 00-0126 EA 30" x 24" Wall Cabinet.....	143.49	25.51
For Plastic Laminate On Particle Board, Deduct	-32.37	
For Economy Grade, Deduct	-18.50	
For Premium Grade Plywood With Plastic Laminate, Deduct	-9.25	
For High Grade, Add	9.25	
For Higher Grade, Add	18.50	
For Deluxe Grade, Add	37.00	
For Custom Deluxe Grade, Add	42.10	
For Custom Built In Place, Add	28.22	
06 41 13 00-0127 EA 33" x 24" Wall Cabinet.....	152.75	27.66
For Plastic Laminate On Particle Board, Deduct	-34.10	
For Economy Grade, Deduct	-19.48	
For Premium Grade Plywood With Plastic Laminate, Deduct	-9.74	
For High Grade, Add	9.74	
For Higher Grade, Add	19.48	
For Deluxe Grade, Add	38.97	
For Custom Deluxe Grade, Add	44.50	
For Custom Built In Place, Add	29.89	
06 41 13 00-0128 EA 36" x 24" Wall Cabinet.....	158.08	29.09
For Plastic Laminate On Particle Board, Deduct	-34.96	
For Economy Grade, Deduct	-19.98	
For Premium Grade Plywood With Plastic Laminate, Deduct	-9.99	
For High Grade, Add	9.99	
For Higher Grade, Add	19.98	
For Deluxe Grade, Add	39.95	
For Custom Deluxe Grade, Add	45.77	
For Custom Built In Place, Add	30.79	
06 41 13 00-0129 EA 39" x 24" Wall Cabinet.....	165.86	30.53
For Plastic Laminate On Particle Board, Deduct	-36.69	
For Economy Grade, Deduct	-20.96	
For Premium Grade Plywood With Plastic Laminate, Deduct	-10.48	
For High Grade, Add	10.48	
For Higher Grade, Add	20.96	
For Deluxe Grade, Add	41.93	
For Custom Deluxe Grade, Add	48.03	
For Custom Built In Place, Add	32.31	
06 41 13 00-0130 EA 42" x 24" Wall Cabinet.....	173.26	30.53
For Plastic Laminate On Particle Board, Deduct	-39.28	
For Economy Grade, Deduct	-22.44	
For Premium Grade Plywood With Plastic Laminate, Deduct	-11.22	
For High Grade, Add	11.22	
For Higher Grade, Add	22.44	
For Deluxe Grade, Add	44.89	
For Custom Deluxe Grade, Add	50.99	
For Custom Built In Place, Add	34.16	

06 Wood, Plastics, and Composites**06 40 Architectural Woodwork****06 41 Architectural Wood Casework**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 41 13 00-0131	EA		45" x 24" Wall Cabinet	187.43	32.69
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-42.73	
			<i>For Economy Grade, Deduct</i>	-24.42	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-12.21	
			<i>For High Grade, Add</i>	12.21	
			<i>For Higher Grade, Add</i>	24.42	
			<i>For Deluxe Grade, Add</i>	48.83	
			<i>For Custom Deluxe Grade, Add</i>	55.37	
			<i>For Custom Built In Place, Add</i>	37.06	
06 41 13 00-0132	EA		48" x 24" Wall Cabinet	194.83	32.69
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-45.32	
			<i>For Economy Grade, Deduct</i>	-25.90	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-12.95	
			<i>For High Grade, Add</i>	12.95	
			<i>For Higher Grade, Add</i>	25.90	
			<i>For Deluxe Grade, Add</i>	51.79	
			<i>For Custom Deluxe Grade, Add</i>	58.33	
			<i>For Custom Built In Place, Add</i>	38.91	
06 41 13 00-0133	EA		24" x 24" Blind Corner Wall Cabinet	127.14	22.28
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-28.92	
			<i>For Economy Grade, Deduct</i>	-16.52	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-8.26	
			<i>For High Grade, Add</i>	8.26	
			<i>For Higher Grade, Add</i>	16.52	
			<i>For Deluxe Grade, Add</i>	33.05	
			<i>For Custom Deluxe Grade, Add</i>	37.50	
			<i>For Custom Built In Place, Add</i>	25.11	
06 41 13 00-0134	EA		30" x 24" Blind Corner Wall Cabinet	143.49	25.51
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-32.37	
			<i>For Economy Grade, Deduct</i>	-18.50	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-9.25	
			<i>For High Grade, Add</i>	9.25	
			<i>For Higher Grade, Add</i>	18.50	
			<i>For Deluxe Grade, Add</i>	37.00	
			<i>For Custom Deluxe Grade, Add</i>	42.10	
			<i>For Custom Built In Place, Add</i>	28.22	
06 41 13 00-0135	EA		36" x 24" Blind Corner Wall Cabinet	158.04	29.09
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-34.96	
			<i>For Economy Grade, Deduct</i>	-19.98	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-9.99	
			<i>For High Grade, Add</i>	9.99	
			<i>For Higher Grade, Add</i>	19.98	
			<i>For Deluxe Grade, Add</i>	39.95	
			<i>For Custom Deluxe Grade, Add</i>	45.77	
			<i>For Custom Built In Place, Add</i>	30.79	
06 41 13 00-0136	EA		42" x 24" Blind Corner Wall Cabinet	173.26	30.53
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-39.28	
			<i>For Economy Grade, Deduct</i>	-22.44	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-11.22	
			<i>For High Grade, Add</i>	11.22	
			<i>For Higher Grade, Add</i>	22.44	
			<i>For Deluxe Grade, Add</i>	44.89	
			<i>For Custom Deluxe Grade, Add</i>	50.99	
			<i>For Custom Built In Place, Add</i>	34.16	
06 41 13 00-0137	EA		48" x 24" Blind Corner Wall Cabinet	194.83	32.69
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-45.32	
			<i>For Economy Grade, Deduct</i>	-25.90	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-12.95	
			<i>For High Grade, Add</i>	12.95	
			<i>For Higher Grade, Add</i>	25.90	
			<i>For Deluxe Grade, Add</i>	51.79	
			<i>For Custom Deluxe Grade, Add</i>	58.33	
			<i>For Custom Built In Place, Add</i>	38.91	
06 41 13 00-0138	EA		9" x 42" Wall Cabinet	127.16	22.28
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-28.92	
			<i>For Economy Grade, Deduct</i>	-16.52	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-8.26	
			<i>For High Grade, Add</i>	8.26	
			<i>For Higher Grade, Add</i>	16.52	
			<i>For Deluxe Grade, Add</i>	33.05	
			<i>For Custom Deluxe Grade, Add</i>	37.50	
			<i>For Custom Built In Place, Add</i>	25.11	
06 41 13 00-0139	EA		12" x 42" Wall Cabinet	133.33	22.28
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-31.08	
			<i>For Economy Grade, Deduct</i>	-17.76	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-8.88	
			<i>For High Grade, Add</i>	8.88	
			<i>For Higher Grade, Add</i>	17.76	
			<i>For Deluxe Grade, Add</i>	35.52	
			<i>For Custom Deluxe Grade, Add</i>	39.97	
			<i>For Custom Built In Place, Add</i>	26.65	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 41 13 00-0140 EA 15" x 42" Wall Cabinet.....	140.73	22.28
For Plastic Laminate On Particle Board, Deduct	-33.67	
For Economy Grade, Deduct	-19.24	
For Premium Grade Plywood With Plastic Laminate, Deduct	-9.62	
For High Grade, Add	9.62	
For Higher Grade, Add	19.24	
For Deluxe Grade, Add	38.48	
For Custom Deluxe Grade, Add	42.93	
For Custom Built In Place, Add	28.50	
06 41 13 00-0141 EA 18" x 42" Wall Cabinet.....	148.12	22.28
For Plastic Laminate On Particle Board, Deduct	-36.25	
For Economy Grade, Deduct	-20.72	
For Premium Grade Plywood With Plastic Laminate, Deduct	-10.36	
For High Grade, Add	10.36	
For Higher Grade, Add	20.72	
For Deluxe Grade, Add	41.43	
For Custom Deluxe Grade, Add	45.89	
For Custom Built In Place, Add	30.35	
06 41 13 00-0142 EA 21" x 42" Wall Cabinet.....	160.75	25.51
For Plastic Laminate On Particle Board, Deduct	-38.41	
For Economy Grade, Deduct	-21.95	
For Premium Grade Plywood With Plastic Laminate, Deduct	-10.98	
For High Grade, Add	10.98	
For Higher Grade, Add	21.95	
For Deluxe Grade, Add	43.90	
For Custom Deluxe Grade, Add	49.00	
For Custom Built In Place, Add	32.54	
06 41 13 00-0143 EA 24" x 42" Wall Cabinet.....	169.38	25.51
For Plastic Laminate On Particle Board, Deduct	-41.43	
For Economy Grade, Deduct	-23.68	
For Premium Grade Plywood With Plastic Laminate, Deduct	-11.84	
For High Grade, Add	11.84	
For Higher Grade, Add	23.68	
For Deluxe Grade, Add	47.35	
For Custom Deluxe Grade, Add	52.45	
For Custom Built In Place, Add	34.70	
06 41 13 00-0144 EA 24" x 42" Wall Cabinet, 2 Doors.....	182.95	25.51
For Plastic Laminate On Particle Board, Deduct	-46.18	
For Economy Grade, Deduct	-26.39	
For Premium Grade Plywood With Plastic Laminate, Deduct	-13.20	
For High Grade, Add	13.20	
For Higher Grade, Add	26.39	
For Deluxe Grade, Add	52.78	
For Custom Deluxe Grade, Add	57.88	
For Custom Built In Place, Add	38.09	
06 41 13 00-0145 EA 30" x 42" Wall Cabinet.....	200.80	27.66
For Plastic Laminate On Particle Board, Deduct	-50.93	
For Economy Grade, Deduct	-29.10	
For Premium Grade Plywood With Plastic Laminate, Deduct	-14.55	
For High Grade, Add	14.55	
For Higher Grade, Add	29.10	
For Deluxe Grade, Add	58.20	
For Custom Deluxe Grade, Add	63.73	
For Custom Built In Place, Add	41.91	
06 41 13 00-0146 EA 33" x 42" Wall Cabinet.....	212.34	29.09
For Plastic Laminate On Particle Board, Deduct	-53.95	
For Economy Grade, Deduct	-30.83	
For Premium Grade Plywood With Plastic Laminate, Deduct	-15.41	
For High Grade, Add	15.41	
For Higher Grade, Add	30.83	
For Deluxe Grade, Add	61.66	
For Custom Deluxe Grade, Add	67.48	
For Custom Built In Place, Add	44.36	
06 41 13 00-0147 EA 36" x 42" Wall Cabinet.....	218.93	30.53
For Plastic Laminate On Particle Board, Deduct	-55.24	
For Economy Grade, Deduct	-31.57	
For Premium Grade Plywood With Plastic Laminate, Deduct	-15.78	
For High Grade, Add	15.78	
For Higher Grade, Add	31.57	
For Deluxe Grade, Add	63.14	
For Custom Deluxe Grade, Add	69.25	
For Custom Built In Place, Add	45.57	
06 41 13 00-0148 EA 36" Base Cabinet.....	243.00	35.20
For Plastic Laminate On Particle Board, Deduct	-60.42	
For Economy Grade, Deduct	-34.53	
For Premium Grade Plywood With Plastic Laminate, Deduct	-17.26	
For High Grade, Add	17.26	
For Higher Grade, Add	34.53	
For Deluxe Grade, Add	69.06	
For Custom Deluxe Grade, Add	76.09	
For Custom Built In Place, Add	50.20	

06 Wood, Plastics, and Composites**06 40 Architectural Woodwork****06 41 Architectural Wood Casework**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 41	13 00-0149	EA	39" Base Cabinet.....	250.40	35.20
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-63.01	
			<i>For Economy Grade, Deduct</i>	-36.01	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-18.00	
			<i>For High Grade, Add</i>	18.00	
			<i>For Higher Grade, Add</i>	36.01	
			<i>For Deluxe Grade, Add</i>	72.02	
			<i>For Custom Deluxe Grade, Add</i>	79.05	
			<i>For Custom Built In Place, Add</i>	52.05	
06 41	13 00-0150	EA	42" Base Cabinet.....	262.83	37.71
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-65.60	
			<i>For Economy Grade, Deduct</i>	-37.49	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-18.74	
			<i>For High Grade, Add</i>	18.74	
			<i>For Higher Grade, Add</i>	37.49	
			<i>For Deluxe Grade, Add</i>	74.98	
			<i>For Custom Deluxe Grade, Add</i>	82.52	
			<i>For Custom Built In Place, Add</i>	54.40	
06 41	13 00-0151	EA	45" Base Cabinet.....	270.23	37.71
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-68.19	
			<i>For Economy Grade, Deduct</i>	-38.97	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-19.48	
			<i>For High Grade, Add</i>	19.48	
			<i>For Higher Grade, Add</i>	38.97	
			<i>For Deluxe Grade, Add</i>	77.94	
			<i>For Custom Deluxe Grade, Add</i>	85.48	
			<i>For Custom Built In Place, Add</i>	56.25	
06 41	13 00-0152	EA	48" Base Cabinet.....	283.78	42.02
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-69.92	
			<i>For Economy Grade, Deduct</i>	-39.95	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-19.98	
			<i>For High Grade, Add</i>	19.98	
			<i>For Higher Grade, Add</i>	39.95	
			<i>For Deluxe Grade, Add</i>	79.91	
			<i>For Custom Deluxe Grade, Add</i>	88.31	
			<i>For Custom Built In Place, Add</i>	58.34	
06 41	13 00-0153	EA	12"-4 Drawer Bases Cabinet.....	200.83	19.03
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-56.97	
			<i>For Economy Grade, Deduct</i>	-32.56	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-16.28	
			<i>For High Grade, Add</i>	16.28	
			<i>For Higher Grade, Add</i>	32.56	
			<i>For Deluxe Grade, Add</i>	65.11	
			<i>For Custom Deluxe Grade, Add</i>	68.92	
			<i>For Custom Built In Place, Add</i>	44.50	
06 41	13 00-0154	EA	15"-4 Drawer Bases Cabinet.....	219.63	22.28
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-61.29	
			<i>For Economy Grade, Deduct</i>	-35.02	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-17.51	
			<i>For High Grade, Add</i>	17.51	
			<i>For Higher Grade, Add</i>	35.02	
			<i>For Deluxe Grade, Add</i>	70.04	
			<i>For Custom Deluxe Grade, Add</i>	74.50	
			<i>For Custom Built In Place, Add</i>	48.23	
06 41	13 00-0155	EA	18"-4 Drawer Bases Cabinet.....	238.41	25.51
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-65.60	
			<i>For Economy Grade, Deduct</i>	-37.49	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-18.74	
			<i>For High Grade, Add</i>	18.74	
			<i>For Higher Grade, Add</i>	37.49	
			<i>For Deluxe Grade, Add</i>	74.98	
			<i>For Custom Deluxe Grade, Add</i>	80.07	
			<i>For Custom Built In Place, Add</i>	51.96	
06 41	13 00-0156	EA	21"-4 Drawer Bases Cabinet.....	256.49	28.38
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-69.92	
			<i>For Economy Grade, Deduct</i>	-39.95	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-19.98	
			<i>For High Grade, Add</i>	19.98	
			<i>For Higher Grade, Add</i>	39.95	
			<i>For Deluxe Grade, Add</i>	79.91	
			<i>For Custom Deluxe Grade, Add</i>	85.58	
			<i>For Custom Built In Place, Add</i>	55.61	
06 41	13 00-0157	EA	24"-4 Drawer Bases Cabinet.....	257.93	29.09
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-69.92	
			<i>For Economy Grade, Deduct</i>	-39.95	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-19.98	
			<i>For High Grade, Add</i>	19.98	
			<i>For Higher Grade, Add</i>	39.95	
			<i>For Deluxe Grade, Add</i>	79.91	
			<i>For Custom Deluxe Grade, Add</i>	85.72	
			<i>For Custom Built In Place, Add</i>	55.76	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 41 13 00-0158 EA 30"-4 Drawer Bases Cabinet	302.82	33.05
For Plastic Laminate On Particle Board, Deduct	-82.87	
For Economy Grade, Deduct	-47.35	
For Premium Grade Plywood With Plastic Laminate, Deduct	-23.68	
For High Grade, Add	23.68	
For Higher Grade, Add	47.35	
For Deluxe Grade, Add	94.70	
For Custom Deluxe Grade, Add	101.31	
For Custom Built In Place, Add	65.80	
06 41 13 00-0159 EA 33"-4 Drawer Bases Cabinet	315.16	33.05
For Plastic Laminate On Particle Board, Deduct	-87.19	
For Economy Grade, Deduct	-49.82	
For Premium Grade Plywood With Plastic Laminate, Deduct	-24.91	
For High Grade, Add	24.91	
For Higher Grade, Add	49.82	
For Deluxe Grade, Add	99.64	
For Custom Deluxe Grade, Add	106.25	
For Custom Built In Place, Add	68.88	
06 41 13 00-0160 EA 36"-4 Drawer Bases Cabinet	341.65	35.20
For Plastic Laminate On Particle Board, Deduct	-94.95	
For Economy Grade, Deduct	-54.26	
For Premium Grade Plywood With Plastic Laminate, Deduct	-27.13	
For High Grade, Add	27.13	
For Higher Grade, Add	54.26	
For Deluxe Grade, Add	108.52	
For Custom Deluxe Grade, Add	115.55	
For Custom Built In Place, Add	74.86	
06 41 13 00-0161 EA 12"-3 Drawer Bases Cabinet	200.83	19.03
For Plastic Laminate On Particle Board, Deduct	-56.97	
For Economy Grade, Deduct	-32.56	
For Premium Grade Plywood With Plastic Laminate, Deduct	-16.28	
For High Grade, Add	16.28	
For Higher Grade, Add	32.56	
For Deluxe Grade, Add	65.11	
For Custom Deluxe Grade, Add	68.92	
For Custom Built In Place, Add	44.50	
06 41 13 00-0162 EA 15"-3 Drawer Bases Cabinet	219.63	22.28
For Plastic Laminate On Particle Board, Deduct	-61.29	
For Economy Grade, Deduct	-35.02	
For Premium Grade Plywood With Plastic Laminate, Deduct	-17.51	
For High Grade, Add	17.51	
For Higher Grade, Add	35.02	
For Deluxe Grade, Add	70.04	
For Custom Deluxe Grade, Add	74.50	
For Custom Built In Place, Add	48.23	
06 41 13 00-0163 EA 18"-3 Drawer Bases Cabinet	238.40	25.51
For Plastic Laminate On Particle Board, Deduct	-65.60	
For Economy Grade, Deduct	-37.49	
For Premium Grade Plywood With Plastic Laminate, Deduct	-18.74	
For High Grade, Add	18.74	
For Higher Grade, Add	37.49	
For Deluxe Grade, Add	74.98	
For Custom Deluxe Grade, Add	80.07	
For Custom Built In Place, Add	51.96	
06 41 13 00-0164 EA 21"-3 Drawer Bases Cabinet	256.49	28.38
For Plastic Laminate On Particle Board, Deduct	-69.92	
For Economy Grade, Deduct	-39.95	
For Premium Grade Plywood With Plastic Laminate, Deduct	-19.98	
For High Grade, Add	19.98	
For Higher Grade, Add	39.95	
For Deluxe Grade, Add	79.91	
For Custom Deluxe Grade, Add	85.58	
For Custom Built In Place, Add	55.61	
06 41 13 00-0165 EA 24"-3 Drawer Bases Cabinet	257.93	29.09
For Plastic Laminate On Particle Board, Deduct	-69.92	
For Economy Grade, Deduct	-39.95	
For Premium Grade Plywood With Plastic Laminate, Deduct	-19.98	
For High Grade, Add	19.98	
For Higher Grade, Add	39.95	
For Deluxe Grade, Add	79.91	
For Custom Deluxe Grade, Add	85.72	
For Custom Built In Place, Add	55.76	
06 41 13 00-0166 EA 30"-3 Drawer Bases Cabinet	302.84	33.05
For Plastic Laminate On Particle Board, Deduct	-82.87	
For Economy Grade, Deduct	-47.35	
For Premium Grade Plywood With Plastic Laminate, Deduct	-23.68	
For High Grade, Add	23.68	
For Higher Grade, Add	47.35	
For Deluxe Grade, Add	94.70	
For Custom Deluxe Grade, Add	101.31	
For Custom Built In Place, Add	65.80	

06 Wood, Plastics, and Composites**06 40 Architectural Woodwork****06 41 Architectural Wood Casework**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 41 13 00-0167	EA		33"-3 Drawer Bases Cabinet.....	315.18	33.05
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-87.19	
			<i>For Economy Grade, Deduct</i>	-49.82	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-24.91	
			<i>For High Grade, Add</i>	24.91	
			<i>For Higher Grade, Add</i>	49.82	
			<i>For Deluxe Grade, Add</i>	99.64	
			<i>For Custom Deluxe Grade, Add</i>	106.25	
			<i>For Custom Built In Place, Add</i>	68.88	
06 41 13 00-0168	EA		36"-3 Drawer Bases Cabinet.....	341.67	35.20
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-94.95	
			<i>For Economy Grade, Deduct</i>	-54.26	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-27.13	
			<i>For High Grade, Add</i>	27.13	
			<i>For Higher Grade, Add</i>	54.26	
			<i>For Deluxe Grade, Add</i>	108.52	
			<i>For Custom Deluxe Grade, Add</i>	115.55	
			<i>For Custom Built In Place, Add</i>	74.86	
06 41 13 00-0169	EA		24" Enclosed Sink Base Cabinet, 1 Door, 1 Drawer With Tamper-Proof Screw Mounted Front Panel.....	171.61	29.09
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-39.71	
			<i>For Economy Grade, Deduct</i>	-22.69	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-11.35	
			<i>For High Grade, Add</i>	11.35	
			<i>For Higher Grade, Add</i>	22.69	
			<i>For Deluxe Grade, Add</i>	45.38	
			<i>For Custom Deluxe Grade, Add</i>	51.20	
			<i>For Custom Built In Place, Add</i>	34.18	
06 41 13 00-0170	EA		24" Enclosed Sink Base Cabinet, 2 Doors, 2 Drawers With Tamper-Proof Screw Mounted Front Panel	174.08	29.09
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-40.57	
			<i>For Economy Grade, Deduct</i>	-23.18	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-11.59	
			<i>For High Grade, Add</i>	11.59	
			<i>For Higher Grade, Add</i>	23.18	
			<i>For Deluxe Grade, Add</i>	46.37	
			<i>For Custom Deluxe Grade, Add</i>	52.18	
			<i>For Custom Built In Place, Add</i>	34.80	
06 41 13 00-0171	EA		27" Enclosed Sink Base Cabinet, 2 Doors, 2 Drawers With Tamper-Proof Screw Mounted Front Panel	179.42	30.53
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-41.43	
			<i>For Economy Grade, Deduct</i>	-23.68	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-11.84	
			<i>For High Grade, Add</i>	11.84	
			<i>For Higher Grade, Add</i>	23.68	
			<i>For Deluxe Grade, Add</i>	47.35	
			<i>For Custom Deluxe Grade, Add</i>	53.46	
			<i>For Custom Built In Place, Add</i>	35.70	
06 41 13 00-0172	EA		30" Enclosed Sink Base Cabinet, 2 Doors, 2 Drawers With Tamper-Proof Screw Mounted Front Panel	189.38	33.05
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-43.16	
			<i>For Economy Grade, Deduct</i>	-24.66	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-12.33	
			<i>For High Grade, Add</i>	12.33	
			<i>For Higher Grade, Add</i>	24.66	
			<i>For Deluxe Grade, Add</i>	49.32	
			<i>For Custom Deluxe Grade, Add</i>	55.93	
			<i>For Custom Built In Place, Add</i>	37.43	
06 41 13 00-0173	EA		33" Enclosed Sink Base Cabinet, 2 Doors, 2 Drawers With Tamper-Proof Screw Mounted Front Panel	194.32	33.05
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-44.89	
			<i>For Economy Grade, Deduct</i>	-25.65	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-12.83	
			<i>For High Grade, Add</i>	12.83	
			<i>For Higher Grade, Add</i>	25.65	
			<i>For Deluxe Grade, Add</i>	51.30	
			<i>For Custom Deluxe Grade, Add</i>	57.91	
			<i>For Custom Built In Place, Add</i>	38.67	
06 41 13 00-0174	EA		36" Enclosed Sink Base Cabinet, 2 Doors, 2 Drawers With Tamper-Proof Screw Mounted Front Panel	203.56	35.20
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-46.61	
			<i>For Economy Grade, Deduct</i>	-26.64	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-13.32	
			<i>For High Grade, Add</i>	13.32	
			<i>For Higher Grade, Add</i>	26.64	
			<i>For Deluxe Grade, Add</i>	53.27	
			<i>For Custom Deluxe Grade, Add</i>	60.31	
			<i>For Custom Built In Place, Add</i>	40.33	
06 41 13 00-0175	EA		39" Enclosed Sink Base Cabinet, 2 Doors, 2 Drawers With Tamper-Proof Screw Mounted Front Panel	210.96	35.20
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-49.20	
			<i>For Economy Grade, Deduct</i>	-28.12	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-14.06	
			<i>For High Grade, Add</i>	14.06	
			<i>For Higher Grade, Add</i>	28.12	
			<i>For Deluxe Grade, Add</i>	56.23	
			<i>For Custom Deluxe Grade, Add</i>	63.27	
			<i>For Custom Built In Place, Add</i>	42.18	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 41 13 00-0176 EA 42" Enclosed Sink Base Cabinet, 2 Doors, 2 Drawers With Tamper-Proof Screw Mounted Front Panel	223.38	37.71
For Plastic Laminate On Particle Board, Deduct	-51.79	
For Economy Grade, Deduct	-29.60	
For Premium Grade Plywood With Plastic Laminate, Deduct	-14.80	
For High Grade, Add	14.80	
For Higher Grade, Add	29.60	
For Deluxe Grade, Add	59.19	
For Custom Deluxe Grade, Add	66.73	
For Custom Built In Place, Add	44.54	
06 41 13 00-0177 EA 45" Enclosed Sink Base Cabinet, 2 Doors, 2 Drawers With Tamper-Proof Screw Mounted Front Panel	230.78	37.71
For Plastic Laminate On Particle Board, Deduct	-54.38	
For Economy Grade, Deduct	-31.08	
For Premium Grade Plywood With Plastic Laminate, Deduct	-15.54	
For High Grade, Add	15.54	
For Higher Grade, Add	31.08	
For Deluxe Grade, Add	62.15	
For Custom Deluxe Grade, Add	69.69	
For Custom Built In Place, Add	46.39	
06 41 13 00-0178 EA 48" Enclosed Sink Base Cabinet, 2 Doors, 2 Drawers With Tamper-Proof Screw Mounted Front Panel	246.79	42.02
For Plastic Laminate On Particle Board, Deduct	-56.97	
For Economy Grade, Deduct	-32.56	
For Premium Grade Plywood With Plastic Laminate, Deduct	-16.28	
For High Grade, Add	16.28	
For Higher Grade, Add	32.56	
For Deluxe Grade, Add	65.11	
For Custom Deluxe Grade, Add	73.51	
For Custom Built In Place, Add	49.10	
06 41 13 00-0179 EA 12" Base Cabinet (Full Height Doors)	136.70	19.03
For Plastic Laminate On Particle Board, Deduct	-34.53	
For Economy Grade, Deduct	-19.73	
For Premium Grade Plywood With Plastic Laminate, Deduct	-9.87	
For High Grade, Add	9.87	
For Higher Grade, Add	19.73	
For Deluxe Grade, Add	39.46	
For Custom Deluxe Grade, Add	43.27	
For Custom Built In Place, Add	28.47	
06 41 13 00-0180 EA 15" Base Cabinet (Full Height Doors)	151.82	22.28
For Plastic Laminate On Particle Board, Deduct	-37.55	
For Economy Grade, Deduct	-21.46	
For Premium Grade Plywood With Plastic Laminate, Deduct	-10.73	
For High Grade, Add	10.73	
For Higher Grade, Add	21.46	
For Deluxe Grade, Add	42.91	
For Custom Deluxe Grade, Add	47.37	
For Custom Built In Place, Add	31.27	
06 41 13 00-0181 EA 18" Base Cabinet (Full Height Doors)	163.22	25.51
For Plastic Laminate On Particle Board, Deduct	-39.28	
For Economy Grade, Deduct	-22.44	
For Premium Grade Plywood With Plastic Laminate, Deduct	-11.22	
For High Grade, Add	11.22	
For Higher Grade, Add	22.44	
For Deluxe Grade, Add	44.89	
For Custom Deluxe Grade, Add	49.99	
For Custom Built In Place, Add	33.16	
06 41 13 00-0182 EA 21" Base Cabinet (Full Height Doors)	177.62	28.38
For Plastic Laminate On Particle Board, Deduct	-42.30	
For Economy Grade, Deduct	-24.17	
For Premium Grade Plywood With Plastic Laminate, Deduct	-12.09	
For High Grade, Add	12.09	
For Higher Grade, Add	24.17	
For Deluxe Grade, Add	48.34	
For Custom Deluxe Grade, Add	54.02	
For Custom Built In Place, Add	35.89	
06 41 13 00-0183 EA 24" Base Cabinet (Full Height Doors)	188.91	29.09
For Plastic Laminate On Particle Board, Deduct	-45.75	
For Economy Grade, Deduct	-26.14	
For Premium Grade Plywood With Plastic Laminate, Deduct	-13.07	
For High Grade, Add	13.07	
For Higher Grade, Add	26.14	
For Deluxe Grade, Add	52.28	
For Custom Deluxe Grade, Add	58.10	
For Custom Built In Place, Add	38.50	
06 41 13 00-0184 EA 24" Base Cabinet, 2 Doors (Full Height Doors)	198.78	29.09
For Plastic Laminate On Particle Board, Deduct	-49.20	
For Economy Grade, Deduct	-28.12	
For Premium Grade Plywood With Plastic Laminate, Deduct	-14.06	
For High Grade, Add	14.06	
For Higher Grade, Add	28.12	
For Deluxe Grade, Add	56.23	
For Custom Deluxe Grade, Add	62.05	
For Custom Built In Place, Add	40.97	

06 Wood, Plastics, and Composites**06 40 Architectural Woodwork****06 41 Architectural Wood Casework**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 41 13 00-0185	EA		27" Base Cabinet (Full Height Doors)	211.48	30.53
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-52.65	
			<i>For Economy Grade, Deduct</i>	-30.09	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-15.04	
			<i>For High Grade, Add</i>	15.04	
			<i>For Higher Grade, Add</i>	30.09	
			<i>For Deluxe Grade, Add</i>	60.18	
			<i>For Custom Deluxe Grade, Add</i>	66.28	
			<i>For Custom Built In Place, Add</i>	43.71	
06 41 13 00-0186	EA		30" Base Cabinet (Full Height Doors)	223.92	33.05
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-55.24	
			<i>For Economy Grade, Deduct</i>	-31.57	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-15.78	
			<i>For High Grade, Add</i>	15.78	
			<i>For Higher Grade, Add</i>	31.57	
			<i>For Deluxe Grade, Add</i>	63.14	
			<i>For Custom Deluxe Grade, Add</i>	69.74	
			<i>For Custom Built In Place, Add</i>	46.07	
06 41 13 00-0187	EA		33" Base Cabinet (Full Height Doors)	231.32	33.05
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-57.83	
			<i>For Economy Grade, Deduct</i>	-33.05	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-16.52	
			<i>For High Grade, Add</i>	16.52	
			<i>For Higher Grade, Add</i>	33.05	
			<i>For Deluxe Grade, Add</i>	66.10	
			<i>For Custom Deluxe Grade, Add</i>	72.70	
			<i>For Custom Built In Place, Add</i>	47.92	
06 41 13 00-0188	EA		36" Base Cabinet (Full Height Doors)	243.02	35.20
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-60.42	
			<i>For Economy Grade, Deduct</i>	-34.53	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-17.26	
			<i>For High Grade, Add</i>	17.26	
			<i>For Higher Grade, Add</i>	34.53	
			<i>For Deluxe Grade, Add</i>	69.06	
			<i>For Custom Deluxe Grade, Add</i>	76.09	
			<i>For Custom Built In Place, Add</i>	50.20	
06 41 13 00-0189	EA		39" Base Cabinet (Full Height Doors)	250.42	35.20
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-63.01	
			<i>For Economy Grade, Deduct</i>	-36.01	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-18.00	
			<i>For High Grade, Add</i>	18.00	
			<i>For Higher Grade, Add</i>	36.01	
			<i>For Deluxe Grade, Add</i>	72.02	
			<i>For Custom Deluxe Grade, Add</i>	79.05	
			<i>For Custom Built In Place, Add</i>	52.05	
06 41 13 00-0190	EA		42" Base Cabinet (Full Height Doors)	262.83	37.71
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-65.60	
			<i>For Economy Grade, Deduct</i>	-37.49	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-18.74	
			<i>For High Grade, Add</i>	18.74	
			<i>For Higher Grade, Add</i>	37.49	
			<i>For Deluxe Grade, Add</i>	74.98	
			<i>For Custom Deluxe Grade, Add</i>	82.52	
			<i>For Custom Built In Place, Add</i>	54.40	
06 41 13 00-0191	EA		48" Base Cabinet (Full Height Doors)	283.77	42.02
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-69.92	
			<i>For Economy Grade, Deduct</i>	-39.95	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-19.98	
			<i>For High Grade, Add</i>	19.98	
			<i>For Higher Grade, Add</i>	39.95	
			<i>For Deluxe Grade, Add</i>	79.91	
			<i>For Custom Deluxe Grade, Add</i>	88.31	
			<i>For Custom Built In Place, Add</i>	58.34	
06 41 13 00-0192	EA		27" x 24" x 84" Oven / Microwave Cabinet.....	430.98	30.53
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-129.48	
			<i>For Economy Grade, Deduct</i>	-73.99	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-36.99	
			<i>For High Grade, Add</i>	36.99	
			<i>For Higher Grade, Add</i>	73.99	
			<i>For Deluxe Grade, Add</i>	147.98	
			<i>For Custom Deluxe Grade, Add</i>	154.08	
			<i>For Custom Built In Place, Add</i>	98.59	
06 41 13 00-0193	EA		30" x 24" x 84" Oven / Microwave Cabinet.....	460.69	33.05
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-138.11	
			<i>For Economy Grade, Deduct</i>	-78.92	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-39.46	
			<i>For High Grade, Add</i>	39.46	
			<i>For Higher Grade, Add</i>	78.92	
			<i>For Deluxe Grade, Add</i>	157.84	
			<i>For Custom Deluxe Grade, Add</i>	164.45	
			<i>For Custom Built In Place, Add</i>	105.26	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 41 13 00-0194 EA 33" x 24" x 84" Oven / Microwave Cabinet	485.35	33.05
For Plastic Laminate On Particle Board, Deduct	-146.74	
For Economy Grade, Deduct	-83.85	
For Premium Grade Plywood With Plastic Laminate, Deduct	-41.93	
For High Grade, Add	41.93	
For Higher Grade, Add	83.85	
For Deluxe Grade, Add	167.71	
For Custom Deluxe Grade, Add	174.32	
For Custom Built In Place, Add	111.43	
06 41 13 00-0195 EA 27" x 24" x 84" Universal Oven Cabinet.....	430.98	30.53
For Plastic Laminate On Particle Board, Deduct	-129.48	
For Economy Grade, Deduct	-73.99	
For Premium Grade Plywood With Plastic Laminate, Deduct	-36.99	
For High Grade, Add	36.99	
For Higher Grade, Add	73.99	
For Deluxe Grade, Add	147.98	
For Custom Deluxe Grade, Add	154.08	
For Custom Built In Place, Add	98.59	
06 41 13 00-0196 EA 30" x 24" x 84" Universal Oven Cabinet.....	460.69	33.05
For Plastic Laminate On Particle Board, Deduct	-138.11	
For Economy Grade, Deduct	-78.92	
For Premium Grade Plywood With Plastic Laminate, Deduct	-39.46	
For High Grade, Add	39.46	
For Higher Grade, Add	78.92	
For Deluxe Grade, Add	157.84	
For Custom Deluxe Grade, Add	164.45	
For Custom Built In Place, Add	105.26	
06 41 13 00-0197 EA 6" x 30" Wall Quarter Circle Shelf	78.77	19.03
For Plastic Laminate On Particle Board, Deduct	-14.24	
For Economy Grade, Deduct	-8.14	
For Premium Grade Plywood With Plastic Laminate, Deduct	-4.07	
For High Grade, Add	4.07	
For Higher Grade, Add	8.14	
For Deluxe Grade, Add	16.28	
For Custom Deluxe Grade, Add	20.08	
For Custom Built In Place, Add	13.98	
06 41 13 00-0198 EA 6" x 52" Wall Quarter Circle Shelf	92.63	22.28
For Plastic Laminate On Particle Board, Deduct	-16.83	
For Economy Grade, Deduct	-9.62	
For Premium Grade Plywood With Plastic Laminate, Deduct	-4.81	
For High Grade, Add	4.81	
For Higher Grade, Add	9.62	
For Deluxe Grade, Add	19.24	
For Custom Deluxe Grade, Add	23.69	
For Custom Built In Place, Add	16.48	
06 41 13 00-0199 EA 12" x 96", 3/4" Utility Shelf	35.44	5.39
For Plastic Laminate On Particle Board, Deduct	-8.63	
For Economy Grade, Deduct	-4.93	
For Premium Grade Plywood With Plastic Laminate, Deduct	-2.47	
For High Grade, Add	2.47	
For Higher Grade, Add	4.93	
For Deluxe Grade, Add	9.86	
For Custom Deluxe Grade, Add	10.94	
For Custom Built In Place, Add	7.24	
06 41 13 00-0200 EA 24" x 96", 3/4" Utility Shelf	60.11	5.39
For Plastic Laminate On Particle Board, Deduct	-17.27	
For Economy Grade, Deduct	-9.87	
For Premium Grade Plywood With Plastic Laminate, Deduct	-4.93	
For High Grade, Add	4.93	
For Higher Grade, Add	9.87	
For Deluxe Grade, Add	19.73	
For Custom Deluxe Grade, Add	20.81	
For Custom Built In Place, Add	13.41	
06 41 13 00-0201 EA 9" x 9" Shelf Brace Support	29.17	7.18
For Plastic Laminate On Particle Board, Deduct	-5.18	
For Economy Grade, Deduct	-2.96	
For Premium Grade Plywood With Plastic Laminate, Deduct	-1.48	
For High Grade, Add	1.48	
For Higher Grade, Add	2.96	
For Deluxe Grade, Add	5.92	
For Custom Deluxe Grade, Add	7.36	
For Custom Built In Place, Add	5.14	
06 41 13 00-0202 EA 24" Wall Decorator End Panels	45.20	7.18
For Plastic Laminate On Particle Board, Deduct	-10.79	
For Economy Grade, Deduct	-6.17	
For Premium Grade Plywood With Plastic Laminate, Deduct	-3.08	
For High Grade, Add	3.08	
For Higher Grade, Add	6.17	
For Deluxe Grade, Add	12.33	
For Custom Deluxe Grade, Add	13.77	
For Custom Built In Place, Add	9.14	

06 Wood, Plastics, and Composites**06 40 Architectural Woodwork****06 41 Architectural Wood Casework**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 41 13 00-0203	EA		30" Wall Decorator End Panels.....	46.63	7.91
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-10.79	
			<i>For Economy Grade, Deduct</i>	-6.17	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-3.08	
			<i>For High Grade, Add</i>	3.08	
			<i>For Higher Grade, Add</i>	6.17	
			<i>For Deluxe Grade, Add</i>	12.33	
			<i>For Custom Deluxe Grade, Add</i>	13.91	
			<i>For Custom Built In Place, Add</i>	9.29	
06 41 13 00-0204	EA		42" Wall Decorator End Panels.....	54.94	8.98
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-12.95	
			<i>For Economy Grade, Deduct</i>	-7.40	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-3.70	
			<i>For High Grade, Add</i>	3.70	
			<i>For Higher Grade, Add</i>	7.40	
			<i>For Deluxe Grade, Add</i>	14.80	
			<i>For Custom Deluxe Grade, Add</i>	16.59	
			<i>For Custom Built In Place, Add</i>	11.04	
06 41 13 00-0205	EA		36" Scalloped Valance.....	25.47	7.18
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-3.89	
			<i>For Economy Grade, Deduct</i>	-2.22	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-1.11	
			<i>For High Grade, Add</i>	1.11	
			<i>For Higher Grade, Add</i>	2.22	
			<i>For Deluxe Grade, Add</i>	4.44	
			<i>For Custom Deluxe Grade, Add</i>	5.88	
			<i>For Custom Built In Place, Add</i>	4.21	
06 41 13 00-0206	EA		48" Scalloped Valance.....	27.93	7.18
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-4.75	
			<i>For Economy Grade, Deduct</i>	-2.71	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-1.36	
			<i>For High Grade, Add</i>	1.36	
			<i>For Higher Grade, Add</i>	2.71	
			<i>For Deluxe Grade, Add</i>	5.42	
			<i>For Custom Deluxe Grade, Add</i>	6.86	
			<i>For Custom Built In Place, Add</i>	4.83	
06 41 13 00-0207	EA		60" Scalloped Valance.....	34.10	7.18
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-6.91	
			<i>For Economy Grade, Deduct</i>	-3.95	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-1.97	
			<i>For High Grade, Add</i>	1.97	
			<i>For Higher Grade, Add</i>	3.95	
			<i>For Deluxe Grade, Add</i>	7.89	
			<i>For Custom Deluxe Grade, Add</i>	9.33	
			<i>For Custom Built In Place, Add</i>	6.37	
06 41 13 00-0208	EA		72" Scalloped Valance.....	41.50	7.18
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-9.50	
			<i>For Economy Grade, Deduct</i>	-5.43	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-2.71	
			<i>For High Grade, Add</i>	2.71	
			<i>For Higher Grade, Add</i>	5.43	
			<i>For Deluxe Grade, Add</i>	10.85	
			<i>For Custom Deluxe Grade, Add</i>	12.29	
			<i>For Custom Built In Place, Add</i>	8.22	
06 41 13 00-0209	EA		36" Straight Valance.....	25.47	7.18
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-3.89	
			<i>For Economy Grade, Deduct</i>	-2.22	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-1.11	
			<i>For High Grade, Add</i>	1.11	
			<i>For Higher Grade, Add</i>	2.22	
			<i>For Deluxe Grade, Add</i>	4.44	
			<i>For Custom Deluxe Grade, Add</i>	5.88	
			<i>For Custom Built In Place, Add</i>	4.21	
06 41 13 00-0210	EA		48" Straight Valance.....	27.93	7.18
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-4.75	
			<i>For Economy Grade, Deduct</i>	-2.71	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-1.36	
			<i>For High Grade, Add</i>	1.36	
			<i>For Higher Grade, Add</i>	2.71	
			<i>For Deluxe Grade, Add</i>	5.42	
			<i>For Custom Deluxe Grade, Add</i>	6.86	
			<i>For Custom Built In Place, Add</i>	4.83	
06 41 13 00-0211	EA		60" Straight Valance.....	34.10	7.18
			<i>For Plastic Laminate On Particle Board, Deduct</i>	-6.91	
			<i>For Economy Grade, Deduct</i>	-3.95	
			<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-1.97	
			<i>For High Grade, Add</i>	1.97	
			<i>For Higher Grade, Add</i>	3.95	
			<i>For Deluxe Grade, Add</i>	7.89	
			<i>For Custom Deluxe Grade, Add</i>	9.33	
			<i>For Custom Built In Place, Add</i>	6.37	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 41 13 00-0212 EA 72" Straight Valance	41.50	7.18
<i>For Plastic Laminate On Particle Board, Deduct</i>	-9.50	
<i>For Economy Grade, Deduct</i>	-5.43	
<i>For Premium Grade Plywood With Plastic Laminate, Deduct</i>	-2.71	
<i>For High Grade, Add</i>	2.71	
<i>For Higher Grade, Add</i>	5.43	
<i>For Deluxe Grade, Add</i>	10.85	
<i>For Custom Deluxe Grade, Add</i>	12.29	
<i>For Custom Built In Place, Add</i>	8.22	
06 41 13 00-0213 Removal And Reinstallation Of Cabinet Or Counters (06 41 13)		
Note: Includes storage, cleaning and supply materials. Any height or width.		
06 41 13 00-0214 LF Remove And Reinstall Wood Base Cabinets	54.99	
06 41 13 00-0215 LF Remove And Reinstall Wall Cabinets	47.81	
06 41 13 00-0216 LF Remove And Reinstall Plastic Laminated Countertops	11.22	
06 41 93 Cabinet And Drawer Hardware (06 41)		
06 41 93 00-0001 Cabinet Hardware (06 41 93)		
Note: Includes all mounting screws.		
06 41 93 00-0002 EA Hinges, Concealed, Steel, Full Or Half Overlay, Self Closing	17.97	7.18
06 41 93 00-0003 EA Hinges, Semi Concealed, Brass	21.48	7.18
06 41 93 00-0004 EA Pull Handles, Solid Brass	15.42	6.11
06 41 93 00-0005 EA Pull Knobs, Solid Brass	14.26	4.67
06 41 93 00-0006 EA Cabinet Ball And Catch	24.79	7.18
06 41 93 00-0007 EA Cabinet Drawer Lock Square Style, Surface Mount	54.28	7.18
06 41 93 00-0008 EA Cabinet Drawer Lock Square Style, Mortise Mount	100.51	10.78
06 41 93 00-0009 EA Cabinet Drawer Lock For Hollow Metal Drawers	30.25	6.11
06 41 93 00-0010 EA Door Catch	21.61	6.11
06 41 93 00-0011 EA Surface Bolt, Solid Brass	31.35	6.11
06 42 Wood Paneling (06 40)		
Note: Includes glue for installation.		
06 42 13 Wood Board Paneling (06 42)		
06 42 13 00-0001 Solid Wood Paneling (06 42 13)		
06 42 13 00-0002 7/16" Solid Wood Paneling, Tongue And Groove, 3" To 5" Wide (06 42 13 00-0001)		
06 42 13 00-0003 SF Homestead Cedar Paneling Tongue And Groove, 7/16"	6.82	1.51
06 42 13 00-0004 SF Homestead Juniper Paneling Tongue And Groove, 7/16"	7.19	1.51
06 42 13 00-0005 7/16" Solid Wood Paneling, Tongue And Groove, 6" To 10" Wide (06 42 13 00-0001)		
06 42 13 00-0006 SF 8" Random Plank Tongue And Groove, 7/16"	8.64	1.44
06 42 13 00-0007 SF 8" Solid Plank Tongue And Groove, 7/16"	8.00	1.44
06 42 13 00-0008 1/2" Solid Wood Paneling, Tongue And Groove, 4" To 6" Wide (06 42 13 00-0001)		
06 42 13 00-0009 SF Alder Wood Tongue And Groove Paneling, 1/2"	7.93	1.51
06 42 13 00-0010 1" Solid Wood Paneling, Shiplap, 6" To 8" Wide (06 42 13 00-0001)		
06 42 13 00-0011 SF 1" Teredo (Driftwood) Wood Shiplap	5.07	1.29
06 42 16 Flush Wood Paneling (06 42)		
06 42 16 00-0001 Veneer Hardboard Panels (06 42 16)		
06 42 16 00-0002 SF 1/4" Veneer Paneling (Mapes)	4.19	1.30
<i>For Waterproof Glue, Add</i>	0.09	
<i>For Ceiling Installation, Add</i>	0.89	
06 42 16 00-0003 Plywood Unfinished With Trim 1/4" Thick (06 42 16)		
06 42 16 00-0004 Birch (06 42 16 00-0003)		
06 42 16 00-0005 SF 1/4" Unfinished Birch Plywood, Natural Faced With Trim	3.58	1.16
<i>For Waterproof Glue, Add</i>	0.07	
<i>For Ceiling Installation, Add</i>	0.78	
<i>For Installation On Metal Studs Or Furring, Add</i>	0.29	
<i>For Glue Laminated Installation, Add</i>	0.18	
<i>For Lumber Core, Add</i>	0.11	
<i>For 1/8" Thick Paneling, Deduct</i>	-0.34	
<i>For 1/2" Thick Paneling, Add</i>	0.84	
<i>For 5/8" Thick Paneling, Add</i>	1.04	
<i>For 3/4" Thick Paneling, Add</i>	1.30	
<i>For Fire Retardant Treatment (Class I), Add</i>	0.77	

06 Wood, Plastics, and Composites**06 40 Architectural Woodwork****06 42 Wood Paneling**

MINOR		TOTAL DIRECT	DEMOLITION
CSI	UOM DESCRIPTION	UNIT COST	UNIT COST
06 42 16 00-0006	Top Grade Plywood Prefinished With Trim 1/4" Thick (06 42 16)		
06 42 16 00-0007	SF 1/4" Top Grade Plywood, Birch Veneer Prefinished With Trim	3.98	1.30
	For Flitch Matched Veneer, Add	0.54	
	For Second Grade Veneer, Deduct	-0.11	
	For Third Grade Veneer, Deduct	-0.16	
	For Waterproof Glue, Add	0.08	
	For Ceiling Installation, Add	0.87	
	For Installation On Metal Studs Or Furring, Add	0.32	
	For Glue Laminated Installation, Add	0.20	
	For Lumber Core, Add	0.12	
	For 1/8" Thick Paneling, Deduct	-0.38	
	For 1/2" Thick Paneling, Add	0.93	
	For 5/8" Thick Paneling, Add	1.16	
	For 3/4" Thick Paneling, Add	1.45	
	For Fire Retardant Treatment (Class I), Add	0.85	
06 42 16 00-0008	SF 1/4" Top Grade Plywood, Cherry Veneer Prefinished With Trim.....	4.46	1.30
	For Flitch Matched Veneer, Add	0.78	
	For Second Grade Veneer, Deduct	-0.16	
	For Third Grade Veneer, Deduct	-0.23	
	For Waterproof Glue, Add	0.11	
	For Ceiling Installation, Add	0.87	
	For Installation On Metal Studs Or Furring, Add	0.32	
	For Glue Laminated Installation, Add	0.22	
	For Lumber Core, Add	0.17	
	For 1/8" Thick Paneling, Deduct	-0.46	
	For 1/2" Thick Paneling, Add	1.19	
	For 5/8" Thick Paneling, Add	1.52	
	For 3/4" Thick Paneling, Add	1.94	
	For Fire Retardant Treatment (Class I), Add	1.23	
06 42 16 00-0009	SF 1/4" Top Grade Plywood, Mahogany Veneer Prefinished With Trim.....	5.97	1.30
	For Flitch Matched Veneer, Add	1.35	
	For Second Grade Veneer, Deduct	-0.27	
	For Third Grade Veneer, Deduct	-0.41	
	For Waterproof Glue, Add	0.19	
	For Ceiling Installation, Add	0.98	
	For Installation On Metal Studs Or Furring, Add	0.36	
	For Glue Laminated Installation, Add	0.30	
	For Lumber Core, Add	0.30	
	For 1/8" Thick Paneling, Deduct	-0.68	
	For 1/2" Thick Paneling, Add	1.85	
	For 5/8" Thick Paneling, Add	2.42	
	For 3/4" Thick Paneling, Add	3.15	
	For Fire Retardant Treatment (Class I), Add	2.13	
06 42 16 00-0010	SF 1/4" Top Grade Plywood, Red Oak Veneer Prefinished With Trim	4.10	1.30
	For Flitch Matched Veneer, Add	0.60	
	For Second Grade Veneer, Deduct	-0.12	
	For Third Grade Veneer, Deduct	-0.18	
	For Waterproof Glue, Add	0.08	
	For Ceiling Installation, Add	0.87	
	For Installation On Metal Studs Or Furring, Add	0.32	
	For Glue Laminated Installation, Add	0.21	
	For Lumber Core, Add	0.13	
	For 1/8" Thick Paneling, Deduct	-0.40	
	For 1/2" Thick Paneling, Add	1.00	
	For 5/8" Thick Paneling, Add	1.25	
	For 3/4" Thick Paneling, Add	1.57	
	For Fire Retardant Treatment (Class I), Add	0.95	
06 42 16 00-0011	SF 1/4" Top Grade Plywood, Walnut Veneer Prefinished With Trim	5.20	1.30
	For Flitch Matched Veneer, Add	1.15	
	For Second Grade Veneer, Deduct	-0.23	
	For Third Grade Veneer, Deduct	-0.35	
	For Waterproof Glue, Add	0.16	
	For Ceiling Installation, Add	0.87	
	For Installation On Metal Studs Or Furring, Add	0.32	
	For Glue Laminated Installation, Add	0.26	
	For Lumber Core, Add	0.25	
	For 1/8" Thick Paneling, Deduct	-0.59	
	For 1/2" Thick Paneling, Add	1.59	
	For 5/8" Thick Paneling, Add	2.07	
	For 3/4" Thick Paneling, Add	2.69	
	For Fire Retardant Treatment (Class I), Add	1.82	
06 42 16 00-0012	SF 1/4" Top Grade Plywood, Maple Veneer Prefinished With Trim.....	4.12	1.30
	For Flitch Matched Veneer, Add	0.61	
	For Second Grade Veneer, Deduct	-0.12	
	For Third Grade Veneer, Deduct	-0.18	
	For Waterproof Glue, Add	0.09	
	For Ceiling Installation, Add	0.87	
	For Installation On Metal Studs Or Furring, Add	0.32	
	For Glue Laminated Installation, Add	0.21	
	For Lumber Core, Add	0.13	
	For 1/8" Thick Paneling, Deduct	-0.41	
	For 1/2" Thick Paneling, Add	1.01	
	For 5/8" Thick Paneling, Add	1.26	
	For 3/4" Thick Paneling, Add	1.59	
	For Fire Retardant Treatment (Class I), Add	0.96	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 42 16 00-0013				Accessories (06 42 16)		
06 42 16 00-0014	EA			Aluminum Panel Retainer "J" With Bolt.....	14.76	
06 42 19				Plastic-Laminate-Faced Wood Paneling (06 42)		
06 42 19 00-0001				Plastic Laminate (06 42 19)		
				Note: Standard colors and patterns.		
06 42 19 00-0002	SF			1/16" Plastic Laminate Faced Panel.....	5.78	2.52
				Note: Includes cutting to fit.		
06 43				Wood Stairs And Railings (06 40)		
06 43 16				Wood Railings (06 43)		
06 43 16 00-0001				Handrails (06 43 16)		
06 43 16 00-0002				Pine, Fir, Interior Grade Or Pressure Treated Exterior Handrails (06 43 16 00-0001)		
06 43 16 00-0003	LF			1-1/2" X 1-3/4" Wood Handrail.....	10.39	5.03
				For Curved Surfaces With A 2'-0" Maximum Radius, Add	1.65	
06 43 16 00-0004	LF			1-1/2" X 2-1/2" Wood Handrail.....	12.43	5.53
				For Curved Surfaces With A 2'-0" Maximum Radius, Add	1.82	
06 43 16 00-0005	LF			Contour Style Wood Rails.....	17.01	5.03
				For Curved Surfaces With A 2'-0" Maximum Radius, Add	2.31	
06 43 16 00-0006	LF			1-1/2" Diameter Wood Rail With Brackets.....	9.83	3.59
06 43 16 00-0007	LF			1-3/4" Diameter Wood Rail With Brackets.....	11.60	3.95
06 43 16 00-0008	LF			2" Diameter Wood Rail With Brackets.....	15.12	4.31
06 43 16 00-0009	LF			2-1/2" Diameter Wood Rail With Brackets.....	17.97	5.03
06 43 16 00-0010				Handrails, Custom Hardwood With Supports (06 43 16 00-0001)		
06 43 16 00-0011	LF			1-1/2" x 4-1/2" Oak Custom Hardwood Wall Handrail With Metal Supports At 6" On Center.....	22.19	6.18
				For Curved Surfaces With A 2'-0" Maximum Radius, Add	3.15	
06 43 16 00-0012	LF			2" X 8" Red Oak Custom Hardwood Horizontal Handrail With Metal Supports At 6" On Center.....	56.51	6.32
				For Curved Surfaces With A 2'-0" Maximum Radius, Add	3.25	
06 43 16 00-0013	LF			2" X 8" Red Oak Custom Hardwood Raking Handrail With Metal Supports At 6" On Center.....	58.25	7.11
				For Curved Surfaces With A 2'-0" Maximum Radius, Add	3.65	
06 43 16 00-0014	LF			2" x 9-1/2" Red Oak Custom Hardwood Horizontal Handrail With Metal Supports At 6" On Center.....	77.31	7.11
				For Curved Surfaces With A 2'-0" Maximum Radius, Add	3.62	
06 43 16 00-0015	LF			2" X 9-1/2" Red Oak Custom Hardwood Rake Handrail With Metal Supports @ 6" On Center, Metal Balusters.....	79.08	7.91
				For Curved Surfaces With A 2'-0" Maximum Radius, Add	4.03	
06 44				Ornamental Woodwork (06 40)		
06 44 39				Wood Posts And Columns (06 44)		
06 44 39 00-0001				Columns (06 44 39)		
06 44 39 00-0002				Pine Colonial Columns, Round Tapered With Cap And Base (06 44 39 00-0001)		
				Note: Paint grade/finger jointed pine.		
06 44 39 00-0003	LF			6" Diameter Plain Column, Pine Colonial Columns, Round Tapered With Cap And Base.....	41.06	5.40
06 44 39 00-0004	LF			8" Diameter Plain Column, Pine Colonial Columns, Round Tapered With Cap And Base.....	52.10	7.89
06 44 39 00-0005	LF			10" Diameter Plain Column, Pine Colonial Columns, Round Tapered With Cap And Base.....	63.36	9.14
06 44 39 00-0006	LF			12" Diameter Plain Column, Pine Colonial Columns, Round Tapered With Cap And Base.....	74.94	9.56
06 44 39 00-0007	LF			14" Diameter Plain Column, Pine Colonial Columns, Round Tapered With Cap And Base.....	160.79	10.81
06 44 39 00-0008	LF			16" Diameter Plain Column, Pine Colonial Columns, Round Tapered With Cap And Base.....	186.15	11.63
06 44 39 00-0009	LF			18" Diameter Plain Column, Pine Colonial Columns, Round Tapered With Cap And Base.....	223.07	12.46
06 44 39 00-0010	LF			20" Diameter Plain Column, Pine Colonial Columns, Round Tapered With Cap And Base.....	265.29	13.29
06 44 39 00-0011	LF			6" Diameter Fluted Column, Pine Colonial Columns, Round Tapered With Cap And Base.....	46.73	5.40
06 44 39 00-0012	LF			8" Diameter Fluted Column, Pine Colonial Columns, Round Tapered With Cap And Base.....	56.65	7.89
06 44 39 00-0013	LF			10" Diameter Fluted Column, Pine Colonial Columns, Round Tapered With Cap And Base.....	69.64	9.14
06 44 39 00-0014	LF			12" Diameter Fluted Column, Pine Colonial Columns, Round Tapered With Cap And Base.....	81.65	9.56
06 44 39 00-0015	LF			14" Diameter Fluted Column, Pine Colonial Columns, Round Tapered With Cap And Base.....	174.41	10.81
06 44 39 00-0016	LF			16" Diameter Fluted Column, Pine Colonial Columns, Round Tapered With Cap And Base.....	235.04	11.63
06 44 39 00-0017	LF			18" Diameter Fluted Column, Pine Colonial Columns, Round Tapered With Cap And Base.....	253.35	12.46
06 44 39 00-0018	LF			20" Diameter Fluted Column, Pine Colonial Columns, Round Tapered With Cap And Base.....	284.75	13.29
06 44 39 00-0019				Pine Colonial Columns, Round Non Tapered With Cap And Base (06 44 39 00-0001)		
				Note: Paint grade/finger jointed pine.		
06 44 39 00-0020	LF			6" Diameter Plain Column, Pine Colonial Columns, Round Tapered With Cap And Base.....	48.68	5.40
06 44 39 00-0021	LF			8" Diameter Plain Column, Pine Colonial Columns, Round Non Tapered With Cap And Base.....	60.76	7.89
06 44 39 00-0022	LF			10" Diameter Plain Column, Pine Colonial Columns, Round Non Tapered With Cap And Base.....	74.61	9.14
06 44 39 00-0023	LF			12" Diameter Plain Column, Pine Colonial Columns, Round Non Tapered With Cap And Base.....	89.00	9.56
06 44 39 00-0024	LF			14" Diameter Plain Column, Pine Colonial Columns, Round Non Tapered With Cap And Base.....	196.07	10.81
06 44 39 00-0025	LF			16" Diameter Plain Column, Pine Colonial Columns, Round Non Tapered With Cap And Base.....	227.47	11.63
06 44 39 00-0026	LF			18" Diameter Plain Column, Pine Colonial Columns, Round Non Tapered With Cap And Base.....	273.32	12.46
06 44 39 00-0027	LF			20" Diameter Plain Column, Pine Colonial Columns, Round Non Tapered With Cap And Base.....	325.81	13.29
06 44 39 00-0028	LF			6" Diameter Fluted Column, Pine Colonial Columns, Round Non Tapered With Cap And Base.....	55.77	5.40
06 44 39 00-0029	LF			8" Diameter Fluted Column, Pine Colonial Columns, Round Non Tapered With Cap And Base.....	66.96	7.89

06 Wood, Plastics, and Composites**06 40 Architectural Woodwork****06 44 Ornamental Woodwork**

MINOR				TOTAL DIRECT	DEMOLITION
CSI	UOM	DESCRIPTION		UNIT COST	UNIT COST
06 44 39 00-0030	LF	10" Diameter Fluted Column, Pine Colonial Columns, Round Non Tapered With Cap And Base	82.75		9.14
06 44 39 00-0031	LF	12" Diameter Fluted Column, Pine Colonial Columns, Round Non Tapered With Cap And Base	97.61		9.56
06 44 39 00-0032	LF	14" Diameter Fluted Column, Pine Colonial Columns, Round Non Tapered With Cap And Base	213.13		10.81
06 44 39 00-0033	LF	16" Diameter Fluted Column, Pine Colonial Columns, Round Non Tapered With Cap And Base	288.75		11.63
06 44 39 00-0034	LF	18" Diameter Fluted Column, Pine Colonial Columns, Round Non Tapered With Cap And Base	311.28		12.46
06 44 39 00-0035	LF	20" Diameter Fluted Column, Pine Colonial Columns, Round Non Tapered With Cap And Base	350.23		13.29
06 44 39 00-0036		Pine Classical Columns, Round Tapered With Cap And Base (06 44 39 00-0001)			
		Note: Paint grade/finger jointed pine.			
06 44 39 00-0037	LF	6" Diameter Plain Column, Pine Classical Columns, Round Tapered With Cap And Base	43.76		5.40
06 44 39 00-0038	LF	8" Diameter Plain Column, Pine Classical Columns, Round Tapered With Cap And Base	55.34		7.89
06 44 39 00-0039	LF	10" Diameter Plain Column, Pine Classical Columns, Round Tapered With Cap And Base	67.44		9.14
06 44 39 00-0040	LF	12" Diameter Plain Column, Pine Classical Columns, Round Tapered With Cap And Base	79.98		9.56
06 44 39 00-0041	LF	6" Diameter Fluted Column, Pine Classical Columns, Round Tapered With Cap And Base	49.93		5.40
06 44 39 00-0042	LF	8" Diameter Fluted Column, Pine Classical Columns, Round Tapered With Cap And Base	60.29		7.89
06 44 39 00-0043	LF	10" Diameter Fluted Column, Pine Classical Columns, Round Tapered With Cap And Base	74.28		9.14
06 44 39 00-0044	LF	12" Diameter Fluted Column, Pine Classical Columns, Round Tapered With Cap And Base	87.29		9.56
06 44 39 00-0045		Redwood Colonial Columns, Round Tapered With Cap And Base (06 44 39 00-0001)			
		Note: Paint grade/finger jointed redwood.			
06 44 39 00-0046	LF	6" Diameter Plain Column, Redwood Colonial Columns, Round Tapered With Cap And Base.....	66.42		5.40
06 44 39 00-0047	LF	8" Diameter Plain Column, Redwood Colonial Columns, Round Tapered With Cap And Base.....	80.66		7.89
06 44 39 00-0048	LF	10" Diameter Plain Column, Redwood Colonial Columns, Round Tapered With Cap And Base.....	99.92		9.14
06 44 39 00-0049	LF	12" Diameter Plain Column, Redwood Colonial Columns, Round Tapered With Cap And Base.....	121.23		9.56
06 44 39 00-0050	LF	6" Diameter Fluted Column, Redwood Colonial Columns, Round Tapered With Cap And Base.....	75.93		5.40
06 44 39 00-0051	LF	8" Diameter Fluted Column, Redwood Colonial Columns, Round Tapered With Cap And Base.....	90.82		7.89
06 44 39 00-0052	LF	10" Diameter Fluted Column, Redwood Colonial Columns, Round Tapered With Cap And Base.....	111.82		9.14
06 44 39 00-0053	LF	12" Diameter Fluted Column, Redwood Colonial Columns, Round Tapered With Cap And Base.....	136.80		9.56
06 44 39 00-0054		Ornamental Or Decorative Cap And Bases, Resin (06 44 39 00-0001)			
		Note: For tapered wood columns.			
06 44 39 00-0055	EA	6" Resin Corinthian Capital And Base.....	204.13		11.22
06 44 39 00-0056	EA	8" Resin Corinthian Capital And Base.....	306.13		12.46
06 44 39 00-0057	EA	10" Resin Corinthian Capital And Base.....	424.92		14.54
06 44 39 00-0058	EA	12" Resin Corinthian Capital And Base.....	541.56		16.61
06 44 39 00-0059	EA	6" Resin Greek Erectheum Cap And Base	182.50		11.22
06 44 39 00-0060	EA	8" Resin Greek Erectheum Cap And Base	252.05		12.46
06 44 39 00-0061	EA	10" Resin Greek Erectheum Cap And Base	312.45		14.54
06 44 39 00-0062	EA	12" Resin Greek Erectheum Cap And Base	407.45		16.61
06 44 39 00-0063	EA	6" Resin Roman Ionic Capital And Base.....	191.99		11.63
06 44 39 00-0064	EA	8" Resin Roman Ionic Capital And Base.....	252.05		12.46
06 44 39 00-0065	EA	10" Resin Roman Ionic Capital And Base.....	312.45		14.54
06 44 39 00-0066	EA	12" Resin Roman Ionic Capital And Base.....	396.64		16.61
06 44 39 00-0067	EA	6" Resin Scamozzi Capital And Base	194.15		11.63
06 44 39 00-0068	EA	8" Resin Scamozzi Capital And Base	273.68		12.46
06 44 39 00-0069	EA	10" Resin Scamozzi Capital And Base	323.26		14.54
06 44 39 00-0070	EA	12" Resin Scamozzi Capital And Base	442.06		16.61
06 44 39 00-0071	EA	6" Resin Temple Of Winds Cap And Base.....	194.15		11.63
06 44 39 00-0072	EA	8" Resin Temple Of Winds Cap And Base.....	297.48		12.46
06 44 39 00-0073	EA	10" Resin Temple Of Winds Cap And Base.....	392.49		14.54
06 44 39 00-0074	EA	12" Resin Temple Of Winds Cap And Base.....	485.32		16.61
06 44 39 00-0075		Ornamental Or Decorative Cap And Bases, Plaster (06 44 39 00-0001)			
		Note: For tapered wood columns.			
06 44 39 00-0076	EA	6" Plaster Corinthian Capital And Base.....	405.30		11.22
06 44 39 00-0077	EA	8" Plaster Corinthian Capital And Base.....	455.38		12.46
06 44 39 00-0078	EA	10" Plaster Corinthian Capital And Base.....	578.50		14.54
06 44 39 00-0079	EA	12" Plaster Corinthian Capital And Base.....	636.74		16.61
06 44 39 00-0080	EA	6" Plaster Greek Erectheum Cap And Base	271.18		11.22
06 44 39 00-0081	EA	8" Plaster Greek Erectheum Cap And Base	314.78		12.46
06 44 39 00-0082	EA	10" Plaster Greek Erectheum Cap And Base	388.16		14.54
06 44 39 00-0083	EA	12" Plaster Greek Erectheum Cap And Base	487.49		16.61
06 44 39 00-0084	EA	6" Plaster Roman Ionic Capital And Base.....	261.21		11.63
06 44 39 00-0085	EA	8" Plaster Roman Ionic Capital And Base.....	340.74		12.46
06 44 39 00-0086	EA	10" Plaster Roman Ionic Capital And Base.....	411.96		14.54
06 44 39 00-0087	EA	12" Plaster Roman Ionic Capital And Base.....	487.49		16.61
06 44 39 00-0088	EA	6" Plaster Scamozzi Capital And Base	308.80		11.63
06 44 39 00-0089	EA	8" Plaster Scamozzi Capital And Base	407.80		12.46
06 44 39 00-0090	EA	10" Plaster Scamozzi Capital And Base	459.53		14.54
06 44 39 00-0091	EA	12" Plaster Scamozzi Capital And Base	582.66		16.61
06 44 39 00-0092	EA	6" Plaster Temple Of Winds Cap And Base.....	261.21		11.63
06 44 39 00-0093	EA	8" Plaster Temple Of Winds Cap And Base.....	336.41		12.46
06 44 39 00-0094	EA	10" Plaster Temple Of Winds Cap And Base.....	437.91		14.54
06 44 39 00-0095	EA	12" Plaster Temple Of Winds Cap And Base.....	558.87		16.61
06 44 39 00-0096	EA	6" Plaster Empire Capital And Base	293.66		11.63
06 44 39 00-0097	EA	8" Plaster Empire Capital And Base	358.04		12.46
06 44 39 00-0098	EA	10" Plaster Empire Capital And Base.....	435.75		14.54



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 44 39 00-0099 EA 12" Plaster Empire Capital And Base	487.49	16.61
06 46 Wood Trim (06 40)		
06 46 13 Wood Door and Window Casings (06 46)		
06 46 13 00-0001 Door and Window Casings (06 46 13)		
06 46 13 00-0002 LF 1-1/8" Wide Plain Pine Door And Window Molding..... <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	3.22 0.59	1.15
06 46 13 00-0003 LF 1-1/8" Wide Detailed Pine Door And Window Molding..... <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	3.25 0.59	1.15
06 46 13 00-0004 LF 2-1/2" Wide Pine Complete Door And Window Trim..... <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	3.95 0.59	1.15
06 46 19 Wood Base And Shoe Moldings (06 46)		
06 46 19 00-0001 Base And Shoe Molding (06 46 19)		
06 46 19 00-0002 LF 1/2" x 1/2" Pine Quarter Round Trim	3.39	1.37
<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.69	
06 46 19 00-0003 LF 3/4" x 3/4" Pine Quarter Round Trim	3.59	1.37
<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.69	
06 46 19 00-0004 LF 3-1/2" High White Pine Base Molding, All Dimensions Are Nominal.....	4.16	0.87
<i>For Clear Birch, Add</i>	0.41	
<i>For Clear Mahogany, Oak, Maple Or Walnut, Add</i>	0.87	
<i>For Stain Grade Material (No Finger Joints), Add</i>	0.23	
<i>For Clear Poplar, Add</i>	0.26	
06 46 19 00-0005 LF 4-1/2" High White Pine Base Molding, All Dimensions Are Nominal.....	5.07	1.08
<i>For Clear Birch, Add</i>	0.47	
<i>For Clear Mahogany, Oak, Maple Or Walnut, Add</i>	1.03	
<i>For Stain Grade Material (No Finger Joints), Add</i>	0.27	
<i>For Clear Poplar, Add</i>	0.30	
06 46 19 00-0006 LF 5-1/2" High White Pine Base Molding, All Dimensions Are Nominal.....	6.24	1.22
<i>For Clear Birch, Add</i>	0.73	
<i>For Clear Mahogany, Oak, Maple Or Walnut, Add</i>	1.43	
<i>For Stain Grade Material (No Finger Joints), Add</i>	0.41	
<i>For Clear Poplar, Add</i>	0.46	
06 46 19 00-0007 LF 3/4" x 1" Oak Base Shoe	4.11	1.37
06 46 19 00-0008 LF 3/4" x 1" White Pine Base Shoe, Stain Grade.....	4.00	1.37
06 46 19 00-0009 LF 3/4" x 1" White Pine Base Shoe, Paint Grade.....	3.74	1.37
06 46 23 Wood Chair Rails (06 46)		
06 46 23 00-0001 Chair Rails (06 46 23)		
06 46 23 00-0002 LF 5/8" x 2-1/2" White Pine Shaped Chair Rail.....	4.98	1.29
<i>For Birch, Add</i>	0.68	
<i>For Mahogany, Oak, Maple Or Walnut, Add</i>	1.24	
<i>For Poplar, Add</i>	0.42	
06 46 23 00-0003 LF 5/8" x 3-1/2" White Pine Shaped Chair Rail.....	6.05	1.29
<i>For Birch, Add</i>	1.02	
<i>For Mahogany, Oak, Maple Or Walnut, Add</i>	1.72	
<i>For Poplar, Add</i>	0.64	
06 46 23 00-0004 LF 1/2" x 1-5/8" White Pine Shaped Chair Rail.....	3.71	1.29
<i>For Birch, Add</i>	0.50	
<i>For Mahogany, Oak, Maple Or Walnut, Add</i>	0.91	
<i>For Poplar, Add</i>	0.31	
06 46 26 Wood Cornices (06 46)		
06 46 26 00-0001 Wood Cornices (06 46 26)		
06 46 26 00-0002 LF 1" x 2" White Pine Cornices, All Dimensions Are Nominal.....	3.83	1.29
<i>For Birch, Add</i>	0.35	
<i>For Mahogany, Oak, Maple, Or Walnut, Add</i>	0.72	
<i>For Poplar, Add</i>	0.43	
06 46 26 00-0003 LF 1" x 4" White Pine Cornices, All Dimensions Are Nominal.....	4.73	1.37
<i>For Birch, Add</i>	0.63	
<i>For Mahogany, Oak, Maple, Or Walnut, Add</i>	1.08	
<i>For Poplar, Add</i>	0.78	
06 46 26 00-0004 LF 1" x 6" White Pine Cornices, All Dimensions Are Nominal.....	6.43	1.44
<i>For Birch, Add</i>	1.19	
<i>For Mahogany, Oak, Maple, Or Walnut, Add</i>	1.80	
<i>For Poplar, Add</i>	1.49	
06 46 26 00-0005 LF 1" x 8" White Pine Cornices, All Dimensions Are Nominal.....	7.38	1.44
<i>For Birch, Add</i>	1.48	
<i>For Mahogany, Oak, Maple, Or Walnut, Add</i>	2.18	
<i>For Poplar, Add</i>	1.85	
06 46 26 00-0006 LF 1" x 10" White Pine Cornices, All Dimensions Are Nominal.....	8.47	1.51
<i>For Birch, Add</i>	1.82	
<i>For Mahogany, Oak, Maple, Or Walnut, Add</i>	2.61	
<i>For Poplar, Add</i>	2.27	

06 Wood, Plastics, and Composites**06 40 Architectural Woodwork****06 46 Wood Trim**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 46 26 00-0007	LF		1" x 12" White Pine Cornices, All Dimensions Are Nominal..... <i>For Birch, Add</i> <i>For Mahogany, Oak, Maple, Or Walnut, Add</i> <i>For Poplar, Add</i>	10.78 2.59 3.59 3.24	1.65
06 46 29 Wood Fasciae And Soffits (06 46)					
06 46 29 00-0001			Fascia Board (06 46 29)		
06 46 29 00-0002			Pine Fascia Board (06 46 29 00-0001)		
06 46 29 00-0003	LF		1" x 6" Pine Fascia Board.....	3.47	1.44
06 46 29 00-0004	LF		1" x 8" Pine Fascia Board.....	3.99	1.59
06 46 29 00-0005	LF		1" x 10" Pine Fascia Board.....	4.34	1.67
06 46 29 00-0006	LF		1" x 12" Pine Fascia Board.....	5.14	1.87
06 46 29 00-0007	LF		2" x 6" Pine Fascia Board.....	3.43	1.44
06 46 29 00-0008	LF		2" x 8" Pine Fascia Board.....	3.93	1.59
06 46 29 00-0009	LF		2" x 10" Pine Fascia Board.....	4.43	1.67
06 46 29 00-0010	LF		2" x 12" Pine Fascia Board.....	5.42	1.87
06 46 29 00-0011	LF		2" x 6" Trim, Exterior, Pine, Resawn Fascia.....	4.14	1.44
06 46 29 00-0012	LF		2" x 8" Trim, Exterior, Pine, Resawn Fascia.....	4.87	1.59
06 46 29 00-0013	LF		2" x 10" Trim, Exterior, Pine, Resawn Fascia.....	5.48	1.67
06 46 29 00-0014	LF		2" x 12" Trim, Exterior, Pine, Resawn Fascia.....	6.97	1.87
06 46 29 00-0015			Cedar Fascia Board (06 46 29 00-0001)		
06 46 29 00-0016	LF		1" x 6" Cedar Fascia Board.....	3.76	1.44
06 46 29 00-0017	LF		1" x 8" Cedar Fascia Board.....	4.44	1.59
06 46 29 00-0018	LF		1" x 10" Cedar Fascia Board.....	5.20	1.67
06 46 29 00-0019	LF		1" x 12" Cedar Fascia Board.....	6.35	1.87
06 46 29 00-0020			Engineered Wood Fascia Board (06 46 29 00-0001)		
06 46 29 00-0021	LF		1" x 6" Engineered Wood Fascia Board.....	3.31	1.44
06 46 29 00-0022	LF		1" x 8" Engineered Wood Fascia Board.....	3.77	1.59
06 46 29 00-0023	LF		1" x 12" Engineered Wood Fascia Board.....	4.62	1.87
06 46 29 00-0024			Soffit (06 46 29)		
06 46 29 00-0025			Sanded Plywood Soffit (06 46 29 00-0024)		
06 46 29 00-0026	SF		3/8" Thick, Sanded Plywood Soffit.....	2.97	1.09
06 46 29 00-0027	SF		1/2" Thick, Sanded Plywood Soffit.....	3.26	1.15
06 46 29 00-0028	SF		5/8" Thick, Sanded Plywood Soffit.....	3.42	1.20
06 46 29 00-0029	SF		3/4" Thick, Sanded Plywood Soffit.....	3.79	1.26
06 46 29 00-0030			MDO Plywood Soffit (06 46 29 00-0024)		
06 46 29 00-0031	SF		3/8" Thick, MDO Plywood Soffit.....	3.33	1.09
06 46 29 00-0032	SF		1/2" Thick, MDO Plywood Soffit.....	3.72	1.15
06 46 29 00-0033	SF		3/4" Thick, MDO Plywood Soffit.....	4.68	1.26
06 46 29 00-0034			Exterior Ceiling Gypsum Board Soffit (06 46 29 00-0024)		
06 46 29 00-0035	SF		1/2" Thick, Exterior Ceiling Gypsum Board Soffit.....	2.37	0.95
06 46 29 00-0036	SF		5/8" Thick, Fire Rated, Exterior Ceiling Gypsum Board Soffit.....	2.57	1.00
06 46 36 Custom Molding (06 46)					
Note: Includes set-up, knife charge, gluing (Where necessary for widths over 7-1/2"). All dimensions are nominal.					
06 46 36 00-0001			Ash (06 46 36)		
06 46 36 00-0002	LF		3/4" x 1-1/2" Custom Shaped Ash..... <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	4.69 0.58	0.79
06 46 36 00-0003	LF		3/4" x 2-1/2" Custom Shaped Ash..... <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	5.85 0.60	0.79
06 46 36 00-0004	LF		3/4" x 3-1/2" Custom Shaped Ash..... <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	7.02 0.62	0.79
06 46 36 00-0005	LF		3/4" x 4-1/2" Custom Shaped Ash..... <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	8.18 0.64	0.87
06 46 36 00-0006	LF		3/4" x 5-1/2" Custom Shaped Ash..... <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	9.42 0.67	0.87
06 46 36 00-0007	LF		3/4" x 6-1/2" Custom Shaped Ash..... <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	10.66 0.71	0.94
06 46 36 00-0008	LF		3/4" x 7-1/2" Custom Shaped Ash..... <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	11.82 0.73	0.94
06 46 36 00-0009	LF		3/4" x 8-1/2" Custom Shaped Ash..... <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	12.99 0.75	0.94
06 46 36 00-0010	LF		3/4" x 9-1/2" Custom Shaped Ash..... <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	14.12 0.76	1.01
06 46 36 00-0011	LF		3/4" x 10-1/2" Custom Shaped Ash..... <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	15.38 0.80	1.01



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 46 36 00-0012 LF 3/4" x 11-1/2" Custom Shaped Ash <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	16.57 0.83	1.08
06 46 36 00-0013 LF 1" x 1-1/2" Custom Shaped Ash <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	5.51 0.60	0.79
06 46 36 00-0014 LF 1" x 2-1/2" Custom Shaped Ash <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	7.03 0.62	0.79
06 46 36 00-0015 LF 1" x 3-1/2" Custom Shaped Ash <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	8.55 0.63	0.87
06 46 36 00-0016 LF 1" x 4-1/2" Custom Shaped Ash <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	10.08 0.65	0.87
06 46 36 00-0017 LF 1" x 5-1/2" Custom Shaped Ash <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	11.71 0.69	0.94
06 46 36 00-0018 LF 1" x 6-1/2" Custom Shaped Ash <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	13.32 0.73	0.94
06 46 36 00-0019 LF 1" x 7-1/2" Custom Shaped Ash <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	14.83 0.75	0.94
06 46 36 00-0020 LF 1" x 8-1/2" Custom Shaped Ash <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	16.36 0.77	1.01
06 46 36 00-0021 LF 1" x 9-1/2" Custom Shaped Ash <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	17.88 0.78	1.01
06 46 36 00-0022 LF 1" x 10-1/2" Custom Shaped Ash <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	19.49 0.82	1.08
06 46 36 00-0023 LF 1" x 11-1/2" Custom Shaped Ash <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	21.05 0.84	1.08
06 46 36 00-0024 LF 1-1/4" x 1-1/2" Custom Shaped Ash <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	6.53 0.61	0.79
06 46 36 00-0025 LF 1-1/4" x 2-1/2" Custom Shaped Ash <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	8.54 0.63	0.79
06 46 36 00-0026 LF 1-1/4" x 3-1/2" Custom Shaped Ash <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	10.56 0.65	0.87
06 46 36 00-0027 LF 1-1/4" x 4-1/2" Custom Shaped Ash <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	12.58 0.67	0.87
06 46 36 00-0028 LF 1-1/4" x 5-1/2" Custom Shaped Ash <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	14.67 0.71	0.94
06 46 36 00-0029 LF 1-1/4" x 6-1/2" Custom Shaped Ash <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	16.76 0.75	0.94
06 46 36 00-0030 LF 1-1/4" x 7-1/2" Custom Shaped Ash <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	18.76 0.76	1.01
06 46 36 00-0031 LF 1-1/4" x 8-1/2" Custom Shaped Ash <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	20.79 0.78	1.01
06 46 36 00-0032 LF 1-1/4" x 9-1/2" Custom Shaped Ash <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	22.76 0.79	1.01
06 46 36 00-0033 LF 1-1/4" x 10-1/2" Custom Shaped Ash <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	24.87 0.83	1.08
06 46 36 00-0034 LF 1-1/4" x 11-1/2" Custom Shaped Ash <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	26.92 0.86	1.15
06 46 36 00-0035 LF 1-1/2" x 1-1/2" Custom Shaped Ash <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	8.00 0.63	0.79
06 46 36 00-0036 LF 1-1/2" x 2-1/2" Custom Shaped Ash <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	10.71 0.65	0.87
06 46 36 00-0037 LF 1-1/2" x 3-1/2" Custom Shaped Ash <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	13.42 0.67	0.87
06 46 36 00-0038 LF 1-1/2" x 4-1/2" Custom Shaped Ash <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	16.12 0.69	0.94
06 46 36 00-0039 LF 1-1/2" x 5-1/2" Custom Shaped Ash <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	18.84 0.71	0.94
06 46 36 00-0040 LF 1-1/2" x 6-1/2" Custom Shaped Ash <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	21.70 0.76	1.01
06 46 36 00-0041 LF 1-1/2" x 7-1/2" Custom Shaped Ash <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	24.44 0.78	1.01
06 46 36 00-0042 LF 1-1/2" x 8-1/2" Custom Shaped Ash <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	27.12 0.80	1.01
06 46 36 00-0043 LF 1-1/2" x 9-1/2" Custom Shaped Ash <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	29.79 0.81	1.08
06 46 36 00-0044 LF 1-1/2" x 10-1/2" Custom Shaped Ash <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	32.85 0.85	1.08
06 46 36 00-0045 LF 1-1/2" x 11-1/2" Custom Shaped Ash <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	35.33 0.88	1.15
06 46 36 00-0046 Basswood <small>(06 46 36)</small>		
06 46 36 00-0047 LF 3/4" x 1-1/2" Custom Shaped Basswood <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	3.97 0.58	0.79
06 46 36 00-0048 LF 3/4" x 2-1/2" Custom Shaped Basswood <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	4.77 0.60	0.79
06 46 36 00-0049 LF 3/4" x 3-1/2" Custom Shaped Basswood <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	5.57 0.62	0.79
06 46 36 00-0050 LF 3/4" x 4-1/2" Custom Shaped Basswood <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	6.38 0.64	0.87
06 46 36 00-0051 LF 3/4" x 5-1/2" Custom Shaped Basswood <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	7.26 0.67	0.87
06 46 36 00-0052 LF 3/4" x 6-1/2" Custom Shaped Basswood <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	8.14 0.71	0.94

06 Wood, Plastics, and Composites**06 40 Architectural Woodwork****06 46 Wood Trim**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 46 36 00-0053	LF		3/4" x 7-1/2" Custom Shaped Basswood <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	8.94 0.73	0.94
06 46 36 00-0054	LF		3/4" x 8-1/2" Custom Shaped Basswood <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	9.75 0.75	1.01
06 46 36 00-0055	LF		3/4" x 9-1/2" Custom Shaped Basswood <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	10.51 0.76	1.01
06 46 36 00-0056	LF		3/4" x 10-1/2" Custom Shaped Basswood <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	11.41 0.80	1.08
06 46 36 00-0057	LF		3/4" x 11-1/2" Custom Shaped Basswood <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	12.24 0.83	1.08
06 46 36 00-0058	LF		1" x 1-1/2" Custom Shaped Basswood <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	4.48 0.60	0.79
06 46 36 00-0059	LF		1" x 2-1/2" Custom Shaped Basswood <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	5.49 0.62	0.79
06 46 36 00-0060	LF		1" x 3-1/2" Custom Shaped Basswood <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	6.49 0.63	0.87
06 46 36 00-0061	LF		1" x 4-1/2" Custom Shaped Basswood <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	7.50 0.65	0.87
06 46 36 00-0062	LF		1" x 5-1/2" Custom Shaped Basswood <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	8.62 0.69	0.94
06 46 36 00-0063	LF		1" x 6-1/2" Custom Shaped Basswood <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	9.71 0.73	0.94
06 46 36 00-0064	LF		1" x 7-1/2" Custom Shaped Basswood <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	10.71 0.75	1.01
06 46 36 00-0065	LF		1" x 8-1/2" Custom Shaped Basswood <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	11.72 0.77	1.01
06 46 36 00-0066	LF		1" x 9-1/2" Custom Shaped Basswood <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	12.73 0.78	1.01
06 46 36 00-0067	LF		1" x 10-1/2" Custom Shaped Basswood <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	13.82 0.82	1.08
06 46 36 00-0068	LF		1" x 11-1/2" Custom Shaped Basswood <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	14.87 0.84	1.08
06 46 36 00-0069	LF		1-1/2" x 1-1/2" Custom Shaped Basswood <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	5.97 0.61	0.79
06 46 36 00-0070	LF		1-1/2" x 2-1/2" Custom Shaped Basswood <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	7.69 0.63	0.79
06 46 36 00-0071	LF		1-1/2" x 3-1/2" Custom Shaped Basswood <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	9.42 0.65	0.87
06 46 36 00-0072	LF		1-1/2" x 4-1/2" Custom Shaped Basswood <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	11.16 0.67	0.87
06 46 36 00-0073	LF		1-1/2" x 5-1/2" Custom Shaped Basswood <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	12.97 0.71	0.94
06 46 36 00-0074	LF		1-1/2" x 6-1/2" Custom Shaped Basswood <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	14.78 0.75	1.01
06 46 36 00-0075	LF		1-1/2" x 7-1/2" Custom Shaped Basswood <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	16.49 0.76	1.01
06 46 36 00-0076	LF		1-1/2" x 8-1/2" Custom Shaped Basswood <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	18.24 0.78	1.01
06 46 36 00-0077	LF		1-1/2" x 9-1/2" Custom Shaped Basswood <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	19.93 0.79	1.01
06 46 36 00-0078	LF		1-1/2" x 10-1/2" Custom Shaped Basswood <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	21.76 0.83	1.08
06 46 36 00-0079	LF		1-1/2" x 11-1/2" Custom Shaped Basswood <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	23.52 0.86	1.15
06 46 36 00-0080	LF		3-1/2" x 3-1/2" Custom Shaped Basswood <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	22.04 0.71	0.94
06 46 36 00-0081	LF		3-1/2" x 4-1/2" Custom Shaped Basswood <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	26.92 0.74	0.94
06 46 36 00-0082	LF		3-1/2" x 5-1/2" Custom Shaped Basswood <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	31.73 0.76	1.01
06 46 36 00-0083	LF		3-1/2" x 6-1/2" Custom Shaped Basswood <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	36.69 0.81	1.08
06 46 36 00-0084	LF		3-1/2" x 7-1/2" Custom Shaped Basswood <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	41.50 0.83	1.08
06 46 36 00-0085	LF		3-1/2" x 8-1/2" Custom Shaped Basswood <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	46.44 0.86	1.15
06 46 36 00-0086	LF		3-1/2" x 9-1/2" Custom Shaped Basswood <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	51.19 0.88	1.15
06 46 36 00-0087	LF		3-1/2" x 10-1/2" Custom Shaped Basswood <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	56.00 0.89	1.15
06 46 36 00-0088	LF		3-1/2" x 11-1/2" Custom Shaped Basswood <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	60.96 0.94	1.22
06 46 36 00-0089			Birch <small>(06 46 36)</small>		
06 46 36 00-0090	LF		3/4" x 1-1/2" Custom Shaped Birch <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	4.23 0.58	0.79
06 46 36 00-0091	LF		3/4" x 2-1/2" Custom Shaped Birch <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	5.16 0.60	0.79
06 46 36 00-0092	LF		3/4" x 3-1/2" Custom Shaped Birch <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	6.09 0.62	0.79
06 46 36 00-0093	LF		3/4" x 4-1/2" Custom Shaped Birch <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	7.02 0.64	0.87



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 46 36 00-0094	LF	3/4"	3/4" x 5-1/2" Custom Shaped Birch <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	8.03 0.67	0.87
06 46 36 00-0095	LF	3/4"	3/4" x 6-1/2" Custom Shaped Birch <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	9.04 0.71	0.94
06 46 36 00-0096	LF	3/4"	3/4" x 7-1/2" Custom Shaped Birch <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	9.97 0.73	0.94
06 46 36 00-0097	LF	3/4"	3/4" x 8-1/2" Custom Shaped Birch <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	10.91 0.75	0.94
06 46 36 00-0098	LF	3/4"	3/4" x 9-1/2" Custom Shaped Birch <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	11.80 0.76	1.01
06 46 36 00-0099	LF	3/4"	3/4" x 10-1/2" Custom Shaped Birch <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	12.83 0.80	1.01
06 46 36 00-0100	LF	3/4"	3/4" x 11-1/2" Custom Shaped Birch <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	13.79 0.83	1.08
06 46 36 00-0101	LF	1"	1" x 1-1/2" Custom Shaped Birch <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	4.87 0.60	0.79
06 46 36 00-0102	LF	1"	1" x 2-1/2" Custom Shaped Birch <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	6.05 0.62	0.79
06 46 36 00-0103	LF	1"	1" x 3-1/2" Custom Shaped Birch <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	7.27 0.63	0.87
06 46 36 00-0104	LF	1"	1" x 4-1/2" Custom Shaped Birch <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	8.48 0.65	0.87
06 46 36 00-0105	LF	1"	1" x 5-1/2" Custom Shaped Birch <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	9.78 0.69	0.94
06 46 36 00-0106	LF	1"	1" x 6-1/2" Custom Shaped Birch <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	11.05 0.73	0.94
06 46 36 00-0107	LF	1"	1" x 7-1/2" Custom Shaped Birch <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	12.25 0.75	0.94
06 46 36 00-0108	LF	1"	1" x 8-1/2" Custom Shaped Birch <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	13.48 0.77	1.01
06 46 36 00-0109	LF	1"	1" x 9-1/2" Custom Shaped Birch <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	14.66 0.78	1.01
06 46 36 00-0110	LF	1"	1" x 10-1/2" Custom Shaped Birch <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	15.94 0.82	1.08
06 46 36 00-0111	LF	1"	1" x 11-1/2" Custom Shaped Birch <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	17.19 0.84	1.08
06 46 36 00-0112	LF	1-1/4"	1-1/4" x 1-1/2" Custom Shaped Birch <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	5.61 0.61	0.79
06 46 36 00-0113	LF	1-1/4"	1-1/4" x 2-1/2" Custom Shaped Birch <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	7.15 0.63	0.79
06 46 36 00-0114	LF	1-1/4"	1-1/4" x 3-1/2" Custom Shaped Birch <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	8.70 0.65	0.87
06 46 36 00-0115	LF	1-1/4"	1-1/4" x 4-1/2" Custom Shaped Birch <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	10.26 0.67	0.87
06 46 36 00-0116	LF	1-1/4"	1-1/4" x 5-1/2" Custom Shaped Birch <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	11.89 0.71	0.94
06 46 36 00-0117	LF	1-1/4"	1-1/4" x 6-1/2" Custom Shaped Birch <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	13.51 0.75	0.94
06 46 36 00-0118	LF	1-1/4"	1-1/4" x 7-1/2" Custom Shaped Birch <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	15.05 0.76	1.01
06 46 36 00-0119	LF	1-1/4"	1-1/4" x 8-1/2" Custom Shaped Birch <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	16.62 0.78	1.01
06 46 36 00-0120	LF	1-1/4"	1-1/4" x 9-1/2" Custom Shaped Birch <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	18.13 0.79	1.01
06 46 36 00-0121	LF	1-1/4"	1-1/4" x 10-1/2" Custom Shaped Birch <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	19.78 0.83	1.08
06 46 36 00-0122	LF	1-1/4"	1-1/4" x 11-1/2" Custom Shaped Birch <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	21.35 0.86	1.15
06 46 36 00-0123	LF	1-1/2"	1-1/2" x 1-1/2" Custom Shaped Birch <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	6.77 0.63	0.79
06 46 36 00-0124	LF	1-1/2"	1-1/2" x 2-1/2" Custom Shaped Birch <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	8.86 0.65	0.87
06 46 36 00-0125	LF	1-1/2"	1-1/2" x 3-1/2" Custom Shaped Birch <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	10.94 0.67	0.87
06 46 36 00-0126	LF	1-1/2"	1-1/2" x 4-1/2" Custom Shaped Birch <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	13.03 0.69	0.94
06 46 36 00-0127	LF	1-1/2"	1-1/2" x 5-1/2" Custom Shaped Birch <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	15.13 0.71	0.94
06 46 36 00-0128	LF	1-1/2"	1-1/2" x 6-1/2" Custom Shaped Birch <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	17.37 0.76	1.01
06 46 36 00-0129	LF	1-1/2"	1-1/2" x 7-1/2" Custom Shaped Birch <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	19.45 0.78	1.01
06 46 36 00-0130	LF	1-1/2"	1-1/2" x 8-1/2" Custom Shaped Birch <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	21.56 0.80	1.01
06 46 36 00-0131	LF	1-1/2"	1-1/2" x 9-1/2" Custom Shaped Birch <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	23.61 0.81	1.08
06 46 36 00-0132	LF	1-1/2"	1-1/2" x 10-1/2" Custom Shaped Birch <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	26.05 0.85	1.08
06 46 36 00-0133	LF	1-1/2"	1-1/2" x 11-1/2" Custom Shaped Birch <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	27.91 0.88	1.15

06 46 36 00-0134 Clear Western Cedar (06 46 36)

06 Wood, Plastics, and Composites**06 40 Architectural Woodwork****06 46 Wood Trim**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 46 36 00-0135 LF 3/4" x 1-1/2" Custom Shaped Clear West Cedar <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	4.23 0.58	0.79
06 46 36 00-0136 LF 3/4" x 2-1/2" Custom Shaped Clear West Cedar <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	5.16 0.60	0.79
06 46 36 00-0137 LF 3/4" x 3-1/2" Custom Shaped Clear West Cedar <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	6.09 0.62	0.79
06 46 36 00-0138 LF 3/4" x 4-1/2" Custom Shaped Clear West Cedar <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	7.02 0.64	0.87
06 46 36 00-0139 LF 3/4" x 5-1/2" Custom Shaped Clear West Cedar <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	8.03 0.67	0.87
06 46 36 00-0140 LF 3/4" x 6-1/2" Custom Shaped Clear West Cedar <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	9.04 0.71	0.94
06 46 36 00-0141 LF 1" x 1-1/2" Custom Shaped Clear West Cedar <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	4.92 0.60	0.79
06 46 36 00-0142 LF 1" x 2-1/2" Custom Shaped Clear West Cedar <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	6.16 0.62	0.79
06 46 36 00-0143 LF 1" x 3-1/2" Custom Shaped Clear West Cedar <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	7.40 0.63	0.87
06 46 36 00-0144 LF 1" x 4-1/2" Custom Shaped Clear West Cedar <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	8.63 0.65	0.87
06 46 36 00-0145 LF 1" x 5-1/2" Custom Shaped Clear West Cedar <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	9.96 0.69	0.94
06 46 36 00-0146 LF 1" x 6-1/2" Custom Shaped Clear West Cedar <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	11.28 0.73	0.94
06 46 36 00-0147 LF 1-1/4" x 1-1/2" Custom Shaped Clear West Cedar <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	6.28 0.61	0.79
06 46 36 00-0148 LF 1-1/4" x 2-1/2" Custom Shaped Clear West Cedar <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	8.16 0.63	0.79
06 46 36 00-0149 LF 1-1/4" x 3-1/2" Custom Shaped Clear West Cedar <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	10.04 0.65	0.87
06 46 36 00-0150 LF 1-1/4" x 4-1/2" Custom Shaped Clear West Cedar <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	11.93 0.67	0.87
06 46 36 00-0151 LF 1-1/4" x 5-1/2" Custom Shaped Clear West Cedar <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	13.90 0.71	0.94
06 46 36 00-0152 LF 1-1/4" x 6-1/2" Custom Shaped Clear West Cedar <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	15.86 0.75	0.94
06 46 36 00-0153 LF 1-1/2" x 1-1/2" Custom Shaped Clear West Cedar <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	6.46 0.63	0.79
06 46 36 00-0154 LF 1-1/2" x 2-1/2" Custom Shaped Clear West Cedar <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	8.39 0.65	0.87
06 46 36 00-0155 LF 1-1/2" x 3-1/2" Custom Shaped Clear West Cedar <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	10.33 0.67	0.87
06 46 36 00-0156 LF 1-1/2" x 4-1/2" Custom Shaped Clear West Cedar <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	12.26 0.69	0.94
06 46 36 00-0157 LF 1-1/2" x 5-1/2" Custom Shaped Clear West Cedar <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	14.20 0.71	0.94
06 46 36 00-0158 LF 1-1/2" x 6-1/2" Custom Shaped Clear West Cedar <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	16.29 0.76	1.01
06 46 36 00-0159 LF 3-1/2" x 3-1/2" Custom Shaped Clear West Cedar <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	19.57 0.71	0.94
06 46 36 00-0160 LF 3-1/2" x 4-1/2" Custom Shaped Clear West Cedar <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	23.83 0.74	0.94
06 46 36 00-0161 LF 3-1/2" x 5-1/2" Custom Shaped Clear West Cedar <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	28.02 0.76	1.01
06 46 36 00-0162 LF 3-1/2" x 6-1/2" Custom Shaped Clear West Cedar <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	32.36 0.81	1.08
06 46 36 00-0163 LF 3-1/2" x 7-1/2" Custom Shaped Clear West Cedar <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	36.55 0.83	1.08
06 46 36 00-0164 LF 3-1/2" x 8-1/2" Custom Shaped Clear West Cedar <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	40.82 0.86	1.15
06 46 36 00-0165 LF 3-1/2" x 9-1/2" Custom Shaped Clear West Cedar <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	45.01 0.88	1.15
06 46 36 00-0166 LF 3-1/2" x 10-1/2" Custom Shaped Clear West Cedar <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	49.20 0.89	1.15
06 46 36 00-0167 LF 3-1/2" x 11-1/2" Custom Shaped Clear West Cedar <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	53.54 0.94	1.22
06 46 36 00-0168 Cherry (06 46 36)		
06 46 36 00-0169 LF 3/4" x 1-1/2" Custom Shaped Cherry <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	5.05 0.58	0.79
06 46 36 00-0170 LF 3/4" x 2-1/2" Custom Shaped Cherry <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	6.40 0.60	0.79
06 46 36 00-0171 LF 3/4" x 3-1/2" Custom Shaped Cherry <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	7.74 0.62	0.79
06 46 36 00-0172 LF 3/4" x 4-1/2" Custom Shaped Cherry <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	9.08 0.64	0.87
06 46 36 00-0173 LF 3/4" x 5-1/2" Custom Shaped Cherry <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	10.50 0.67	0.87
06 46 36 00-0174 LF 3/4" x 6-1/2" Custom Shaped Cherry <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	11.92 0.71	0.94
06 46 36 00-0175 LF 3/4" x 7-1/2" Custom Shaped Cherry <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	13.26 0.73	0.94



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 46 36 00-0176	LF	3/4"	8-1/2" Custom Shaped Cherry <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	14.62 0.75	0.94
06 46 36 00-0177	LF	3/4"	9-1/2" Custom Shaped Cherry <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	15.92 0.76	1.01
06 46 36 00-0178	LF	3/4"	10-1/2" Custom Shaped Cherry <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	17.36 0.80	1.01
06 46 36 00-0179	LF	3/4"	11-1/2" Custom Shaped Cherry <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	18.73 0.83	1.08
06 46 36 00-0180	LF	1"	1-1/2" Custom Shaped Cherry <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	5.95 0.60	0.79
06 46 36 00-0181	LF	1"	2-1/2" Custom Shaped Cherry <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	7.70 0.62	0.79
06 46 36 00-0182	LF	1"	3-1/2" Custom Shaped Cherry <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	9.46 0.63	0.87
06 46 36 00-0183	LF	1"	4-1/2" Custom Shaped Cherry <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	11.21 0.65	0.87
06 46 36 00-0184	LF	1"	5-1/2" Custom Shaped Cherry <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	13.05 0.69	0.94
06 46 36 00-0185	LF	1"	6-1/2" Custom Shaped Cherry <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	14.89 0.73	0.94
06 46 36 00-0186	LF	1"	7-1/2" Custom Shaped Cherry <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	16.63 0.75	0.94
06 46 36 00-0187	LF	1"	8-1/2" Custom Shaped Cherry <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	18.42 0.77	1.01
06 46 36 00-0188	LF	1"	9-1/2" Custom Shaped Cherry <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	20.12 0.78	1.01
06 46 36 00-0189	LF	1"	10-1/2" Custom Shaped Cherry <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	21.96 0.82	1.08
06 46 36 00-0190	LF	1"	11-1/2" Custom Shaped Cherry <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	23.76 0.84	1.08
06 46 36 00-0191	LF	1-1/4"	1-1/2" Custom Shaped Cherry <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	6.92 0.61	0.79
06 46 36 00-0192	LF	1-1/4"	2-1/2" Custom Shaped Cherry <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	9.14 0.63	0.79
06 46 36 00-0193	LF	1-1/4"	3-1/2" Custom Shaped Cherry <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	11.33 0.65	0.87
06 46 36 00-0194	LF	1-1/4"	4-1/2" Custom Shaped Cherry <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	13.56 0.67	0.87
06 46 36 00-0195	LF	1-1/4"	5-1/2" Custom Shaped Cherry <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	15.83 0.71	0.94
06 46 36 00-0196	LF	1-1/4"	6-1/2" Custom Shaped Cherry <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	18.12 0.75	0.94
06 46 36 00-0197	LF	1-1/4"	7-1/2" Custom Shaped Cherry <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	20.31 0.76	1.01
06 46 36 00-0198	LF	1-1/4"	8-1/2" Custom Shaped Cherry <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	22.54 0.78	1.01
06 46 36 00-0199	LF	1-1/4"	9-1/2" Custom Shaped Cherry <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	24.69 0.79	1.01
06 46 36 00-0200	LF	1-1/4"	10-1/2" Custom Shaped Cherry <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	27.01 0.83	1.08
06 46 36 00-0201	LF	1-1/4"	11-1/2" Custom Shaped Cherry <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	29.23 0.86	1.15
06 46 36 00-0202	LF	1-1/2"	1-1/2" Custom Shaped Cherry <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	8.72 0.63	0.79
06 46 36 00-0203	LF	1-1/2"	2-1/2" Custom Shaped Cherry <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	11.79 0.65	0.87
06 46 36 00-0204	LF	1-1/2"	3-1/2" Custom Shaped Cherry <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	14.86 0.67	0.87
06 46 36 00-0205	LF	1-1/2"	4-1/2" Custom Shaped Cherry <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	17.93 0.69	0.94
06 46 36 00-0206	LF	1-1/2"	5-1/2" Custom Shaped Cherry <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	21.00 0.71	0.94
06 46 36 00-0207	LF	1-1/2"	6-1/2" Custom Shaped Cherry <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	24.22 0.76	1.01
06 46 36 00-0208	LF	1-1/2"	7-1/2" Custom Shaped Cherry <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	27.28 0.78	1.01
06 46 36 00-0209	LF	1-1/2"	8-1/2" Custom Shaped Cherry <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	30.36 0.80	1.01
06 46 36 00-0210	LF	1-1/2"	9-1/2" Custom Shaped Cherry <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	33.39 0.81	1.08
06 46 36 00-0211	LF	1-1/2"	10-1/2" Custom Shaped Cherry <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	36.61 0.85	1.08
06 46 36 00-0212	LF	1-1/2"	11-1/2" Custom Shaped Cherry <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	39.66 0.88	1.15
06 46 36 00-0213			Cypress <small>(06 46 36)</small>		
06 46 36 00-0214	LF	3/4"	1-1/2" Custom Shaped Cypress <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	3.97 0.58	0.79
06 46 36 00-0215	LF	3/4"	2-1/2" Custom Shaped Cypress <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	4.77 0.60	0.79
06 46 36 00-0216	LF	3/4"	3-1/2" Custom Shaped Cypress <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	5.57 0.62	0.79

06 Wood, Plastics, and Composites**06 40 Architectural Woodwork****06 46 Wood Trim**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 46 36 00-0217	LF		3/4" x 4-1/2" Custom Shaped Cypress.....	6.38	0.87
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.64	
06 46 36 00-0218	LF		3/4" x 5-1/2" Custom Shaped Cypress.....	7.26	0.87
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.67	
06 46 36 00-0219	LF		3/4" x 6-1/2" Custom Shaped Cypress.....	8.14	0.94
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.71	
06 46 36 00-0220	LF		3/4" x 7-1/2" Custom Shaped Cypress.....	9.14	0.94
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.73	
06 46 36 00-0221	LF		3/4" x 8-1/2" Custom Shaped Cypress.....	9.98	0.94
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.75	
06 46 36 00-0222	LF		3/4" x 9-1/2" Custom Shaped Cypress.....	11.54	1.01
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.76	
06 46 36 00-0223	LF		3/4" x 10-1/2" Custom Shaped Cypress.....	12.54	1.01
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.80	
06 46 36 00-0224	LF		1" x 1-1/2" Custom Shaped Cypress.....	5.12	0.79
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.60	
06 46 36 00-0225	LF		1" x 2-1/2" Custom Shaped Cypress.....	6.44	0.79
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.62	
06 46 36 00-0226	LF		1" x 3-1/2" Custom Shaped Cypress.....	7.78	0.87
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.63	
06 46 36 00-0227	LF		1" x 4-1/2" Custom Shaped Cypress.....	9.12	0.87
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.65	
06 46 36 00-0228	LF		1" x 5-1/2" Custom Shaped Cypress.....	10.55	0.94
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.69	
06 46 36 00-0229	LF		1" x 6-1/2" Custom Shaped Cypress.....	11.95	0.94
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.73	
06 46 36 00-0230	LF		1" x 7-1/2" Custom Shaped Cypress.....	13.28	0.94
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.75	
06 46 36 00-0231	LF		1" x 8-1/2" Custom Shaped Cypress.....	14.63	1.01
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.77	
06 46 36 00-0232	LF		1" x 9-1/2" Custom Shaped Cypress.....	15.95	1.01
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.78	
06 46 36 00-0233	LF		1" x 10-1/2" Custom Shaped Cypress.....	17.40	1.08
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.82	
06 46 36 00-0234	LF		1" x 11-1/2" Custom Shaped Cypress.....	18.73	1.08
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.84	
06 46 36 00-0235	LF		1-1/2" x 1-1/2" Custom Shaped Cypress.....	5.94	0.79
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.63	
06 46 36 00-0236	LF		1-1/2" x 2-1/2" Custom Shaped Cypress.....	7.62	0.87
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.65	
06 46 36 00-0237	LF		1-1/2" x 3-1/2" Custom Shaped Cypress.....	9.30	0.87
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.67	
06 46 36 00-0238	LF		1-1/2" x 4-1/2" Custom Shaped Cypress.....	10.97	0.94
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.69	
06 46 36 00-0239	LF		1-1/2" x 5-1/2" Custom Shaped Cypress.....	12.66	0.94
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.71	
06 46 36 00-0240	LF		1-1/2" x 6-1/2" Custom Shaped Cypress.....	14.49	1.01
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.76	
06 46 36 00-0241	LF		1-1/2" x 7-1/2" Custom Shaped Cypress.....	16.15	1.01
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.78	
06 46 36 00-0242	LF		1-1/2" x 8-1/2" Custom Shaped Cypress.....	17.85	1.01
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.80	
06 46 36 00-0243	LF		1-1/2" x 9-1/2" Custom Shaped Cypress.....	21.03	1.08
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.81	
06 46 36 00-0244	LF		1-1/2" x 10-1/2" Custom Shaped Cypress.....	22.91	1.08
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.85	
06 46 36 00-0245			Fir <small>(06 46 36)</small>		
06 46 36 00-0246	LF		3/4" x 1-1/2" Custom Shaped Fir.....	4.38	0.79
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.58	
06 46 36 00-0247	LF		3/4" x 2-1/2" Custom Shaped Fir.....	5.39	0.79
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.60	
06 46 36 00-0248	LF		3/4" x 3-1/2" Custom Shaped Fir.....	6.40	0.79
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.62	
06 46 36 00-0249	LF		3/4" x 4-1/2" Custom Shaped Fir.....	7.41	0.87
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.64	
06 46 36 00-0250	LF		3/4" x 5-1/2" Custom Shaped Fir.....	8.49	0.87
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.67	
06 46 36 00-0251	LF		3/4" x 6-1/2" Custom Shaped Fir.....	9.58	0.94
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.71	
06 46 36 00-0252	LF		3/4" x 7-1/2" Custom Shaped Fir.....	10.59	0.94
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.73	
06 46 36 00-0253	LF		3/4" x 8-1/2" Custom Shaped Fir.....	11.60	0.94
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.75	
06 46 36 00-0254	LF		3/4" x 9-1/2" Custom Shaped Fir.....	12.57	1.01
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.76	
06 46 36 00-0255	LF		3/4" x 10-1/2" Custom Shaped Fir.....	13.68	1.08
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.80	
06 46 36 00-0256	LF		1" x 1-1/2" Custom Shaped Fir.....	5.12	0.79
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.60	
06 46 36 00-0257	LF		1" x 2-1/2" Custom Shaped Fir.....	6.44	0.79
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.62	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 46 36 00-0258 LF 1" x 3-1/2" Custom Shaped Fir <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	7.78 0.63	0.87
06 46 36 00-0259 LF 1" x 4-1/2" Custom Shaped Fir <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	9.12 0.65	0.87
06 46 36 00-0260 LF 1" x 5-1/2" Custom Shaped Fir <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	10.55 0.69	0.94
06 46 36 00-0261 LF 1" x 6-1/2" Custom Shaped Fir <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	11.95 0.73	0.94
06 46 36 00-0262 LF 1" x 7-1/2" Custom Shaped Fir <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	13.28 0.75	0.94
06 46 36 00-0263 LF 1" x 8-1/2" Custom Shaped Fir <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	14.63 0.77	1.01
06 46 36 00-0264 LF 1" x 9-1/2" Custom Shaped Fir <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	15.95 0.78	1.01
06 46 36 00-0265 LF 1" x 10-1/2" Custom Shaped Fir <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	17.40 0.82	1.08
06 46 36 00-0266 LF 1" x 11-1/2" Custom Shaped Fir <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	18.73 0.84	1.08
06 46 36 00-0267 LF 1-1/4" x 1-1/2" Custom Shaped Fir <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	5.68 0.61	0.79
06 46 36 00-0268 LF 1-1/4" x 2-1/2" Custom Shaped Fir <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	7.28 0.63	0.79
06 46 36 00-0269 LF 1-1/4" x 3-1/2" Custom Shaped Fir <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	8.86 0.65	0.87
06 46 36 00-0270 LF 1-1/4" x 4-1/2" Custom Shaped Fir <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	10.46 0.67	0.87
06 46 36 00-0271 LF 1-1/4" x 5-1/2" Custom Shaped Fir <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	12.12 0.71	0.94
06 46 36 00-0272 LF 1-1/4" x 6-1/2" Custom Shaped Fir <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	13.80 0.75	0.94
06 46 36 00-0273 LF 1-1/4" x 7-1/2" Custom Shaped Fir <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	15.36 0.76	1.01
06 46 36 00-0274 LF 1-1/4" x 8-1/2" Custom Shaped Fir <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	16.98 0.78	1.01
06 46 36 00-0275 LF 1-1/4" x 9-1/2" Custom Shaped Fir <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	18.51 0.79	1.01
06 46 36 00-0276 LF 1-1/4" x 10-1/2" Custom Shaped Fir <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	20.21 0.83	1.08
06 46 36 00-0277 LF 1-1/4" x 11-1/2" Custom Shaped Fir <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	21.82 0.86	1.15
06 46 36 00-0278 LF 1-1/2" x 1-1/2" Custom Shaped Fir <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	6.46 0.63	0.79
06 46 36 00-0279 LF 1-1/2" x 2-1/2" Custom Shaped Fir <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	8.39 0.65	0.87
06 46 36 00-0280 LF 1-1/2" x 3-1/2" Custom Shaped Fir <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	10.33 0.67	0.87
06 46 36 00-0281 LF 1-1/2" x 4-1/2" Custom Shaped Fir <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	12.26 0.69	0.94
06 46 36 00-0282 LF 1-1/2" x 5-1/2" Custom Shaped Fir <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	14.20 0.71	0.94
06 46 36 00-0283 LF 1-1/2" x 6-1/2" Custom Shaped Fir <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	16.29 0.76	1.01
06 46 36 00-0284 LF 1-1/2" x 7-1/2" Custom Shaped Fir <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	18.21 0.78	1.01
06 46 36 00-0285 LF 1-1/2" x 8-1/2" Custom Shaped Fir <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	20.17 0.80	1.08
06 46 36 00-0286 LF 1-1/2" x 9-1/2" Custom Shaped Fir <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	22.06 0.81	1.08
06 46 36 00-0287 LF 1-1/2" x 10-1/2" Custom Shaped Fir <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	24.09 0.85	1.15
06 46 36 00-0288 LF 1-1/2" x 11-1/2" Custom Shaped Fir <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	26.06 0.88	1.15
06 46 36 00-0289 LF 2-1/2" x 1-1/2" Custom Shaped Fir <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	10.29 0.66	0.87
06 46 36 00-0290 LF 2-1/2" x 2-1/2" Custom Shaped Fir <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	14.07 0.68	0.87
06 46 36 00-0291 LF 2-1/2" x 3-1/2" Custom Shaped Fir <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	17.85 0.69	0.94
06 46 36 00-0292 LF 2-1/2" x 4-1/2" Custom Shaped Fir <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	21.70 0.73	0.94
06 46 36 00-0293 LF 2-1/2" x 5-1/2" Custom Shaped Fir <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	25.48 0.74	0.94
06 46 36 00-0294 LF 2-1/2" x 6-1/2" Custom Shaped Fir <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	29.40 0.79	1.01
06 46 36 00-0295 LF 2-1/2" x 7-1/2" Custom Shaped Fir <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	33.19 0.81	1.08
06 46 36 00-0296 LF 2-1/2" x 8-1/2" Custom Shaped Fir <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	37.09 0.84	1.08
06 46 36 00-0297 LF 2-1/2" x 9-1/2" Custom Shaped Fir <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	40.82 0.86	1.15
06 46 36 00-0298 LF 2-1/2" x 10-1/2" Custom Shaped Fir <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	44.60 0.88	1.15
06 46 36 00-0299 LF 3-1/2" x 3-1/2" Custom Shaped Fir <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	22.09 0.71	0.94

06 Wood, Plastics, and Composites**06 40 Architectural Woodwork****06 46 Wood Trim**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 46 36 00-0300	LF		3-1/2" x 4-1/2" Custom Shaped Fir <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	26.92 0.74	0.94
06 46 36 00-0301	LF		3-1/2" x 5-1/2" Custom Shaped Fir <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	31.73 0.76	1.01
06 46 36 00-0302	LF		3-1/2" x 6-1/2" Custom Shaped Fir <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	36.69 0.81	1.08
06 46 36 00-0303	LF		3-1/2" x 7-1/2" Custom Shaped Fir <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	41.50 0.83	1.08
06 46 36 00-0304	LF		3-1/2" x 8-1/2" Custom Shaped Fir <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	46.38 0.86	1.15
06 46 36 00-0305	LF		3-1/2" x 9-1/2" Custom Shaped Fir <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	51.19 0.88	1.15
06 46 36 00-0306	LF		3-1/2" x 10-1/2" Custom Shaped Fir <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	56.00 0.89	1.15
06 46 36 00-0307			Honduran Mahogany <small>(06 46 36)</small>		
06 46 36 00-0308	LF		3/4" x 1-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	5.36 0.58	0.79
06 46 36 00-0309	LF		3/4" x 2-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	6.86 0.60	0.79
06 46 36 00-0310	LF		3/4" x 3-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	8.36 0.62	0.79
06 46 36 00-0311	LF		3/4" x 4-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	9.85 0.64	0.87
06 46 36 00-0312	LF		3/4" x 5-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	11.43 0.67	0.87
06 46 36 00-0313	LF		3/4" x 6-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	13.00 0.71	0.94
06 46 36 00-0314	LF		3/4" x 7-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	14.50 0.73	0.94
06 46 36 00-0315	LF		3/4" x 8-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	16.01 0.75	1.01
06 46 36 00-0316	LF		3/4" x 9-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	17.46 0.76	1.01
06 46 36 00-0317	LF		3/4" x 10-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	19.06 0.80	1.08
06 46 36 00-0318	LF		3/4" x 11-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	20.59 0.83	1.08
06 46 36 00-0319	LF		1" x 1-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	6.41 0.60	0.79
06 46 36 00-0320	LF		1" x 2-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	8.37 0.62	0.79
06 46 36 00-0321	LF		1" x 3-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	10.36 0.63	0.87
06 46 36 00-0322	LF		1" x 4-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	12.34 0.65	0.87
06 46 36 00-0323	LF		1" x 5-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	14.42 0.69	0.94
06 46 36 00-0324	LF		1" x 6-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	16.46 0.73	0.94
06 46 36 00-0325	LF		1" x 7-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	18.43 0.75	1.01
06 46 36 00-0326	LF		1" x 8-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	20.43 0.77	1.01
06 46 36 00-0327	LF		1" x 9-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	22.38 0.78	1.01
06 46 36 00-0328	LF		1" x 10-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	24.43 0.82	1.08
06 46 36 00-0329	LF		1" x 11-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	26.72 0.84	1.08
06 46 36 00-0330	LF		1-1/4" x 1-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	7.23 0.61	0.79
06 46 36 00-0331	LF		1-1/4" x 2-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	9.60 0.63	0.79
06 46 36 00-0332	LF		1-1/4" x 3-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	11.95 0.65	0.87
06 46 36 00-0333	LF		1-1/4" x 4-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	14.33 0.67	0.87
06 46 36 00-0334	LF		1-1/4" x 5-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	16.75 0.71	0.94
06 46 36 00-0335	LF		1-1/4" x 6-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	19.21 0.75	1.01
06 46 36 00-0336	LF		1-1/4" x 7-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	21.54 0.76	1.01
06 46 36 00-0337	LF		1-1/4" x 8-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	23.93 0.78	1.01
06 46 36 00-0338	LF		1-1/4" x 9-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	25.72 0.79	1.01
06 46 36 00-0339	LF		1-1/4" x 10-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	28.71 0.83	1.08
06 46 36 00-0340	LF		1-1/4" x 11-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	31.09 0.86	1.15



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 46 36 00-0341	LF	1-1/2"	1-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	8.83 0.63	0.79
06 46 36 00-0342	LF	1-1/2"	2-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	11.95 0.65	0.87
06 46 36 00-0343	LF	1-1/2"	3-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	15.06 0.67	0.87
06 46 36 00-0344	LF	1-1/2"	4-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	18.18 0.69	0.87
06 46 36 00-0345	LF	1-1/2"	5-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	21.31 0.71	0.94
06 46 36 00-0346	LF	1-1/2"	6-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	24.58 0.76	1.01
06 46 36 00-0347	LF	1-1/2"	7-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	27.69 0.78	1.01
06 46 36 00-0348	LF	1-1/2"	8-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	30.83 0.80	1.08
06 46 36 00-0349	LF	1-1/2"	9-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	33.91 0.81	1.08
06 46 36 00-0350	LF	1-1/2"	10-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	37.12 0.85	1.08
06 46 36 00-0351	LF	1-1/2"	11-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	40.32 0.88	1.15
06 46 36 00-0352	LF	2"	1-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	10.40 0.64	0.87
06 46 36 00-0353	LF	2"	2-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	14.29 0.66	0.87
06 46 36 00-0354	LF	2"	3-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	18.14 0.68	0.87
06 46 36 00-0355	LF	2"	4-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	22.09 0.71	0.94
06 46 36 00-0356	LF	2"	5-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	25.95 0.73	0.94
06 46 36 00-0357	LF	2"	6-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	29.97 0.78	1.01
06 46 36 00-0358	LF	2"	7-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	33.83 0.79	1.01
06 46 36 00-0359	LF	2"	8-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	37.78 0.82	1.08
06 46 36 00-0360	LF	2"	9-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	41.64 0.84	1.08
06 46 36 00-0361	LF	2"	10-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	45.53 0.86	1.15
06 46 36 00-0362	LF	2"	11-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	49.54 0.91	1.22
06 46 36 00-0363	LF	2-1/2"	1-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	12.66 0.66	0.87
06 46 36 00-0364	LF	2-1/2"	2-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	16.86 0.68	0.87
06 46 36 00-0365	LF	2-1/2"	3-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	21.56 0.69	0.94
06 46 36 00-0366	LF	2-1/2"	4-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	26.34 0.73	0.94
06 46 36 00-0367	LF	2-1/2"	5-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	31.04 0.74	0.94
06 46 36 00-0368	LF	2-1/2"	6-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	35.89 0.79	1.01
06 46 36 00-0369	LF	2-1/2"	7-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	40.60 0.81	1.08
06 46 36 00-0370	LF	2-1/2"	8-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	45.39 0.84	1.08
06 46 36 00-0371	LF	2-1/2"	9-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	50.09 0.86	1.15
06 46 36 00-0372	LF	2-1/2"	10-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	54.80 0.88	1.15
06 46 36 00-0373	LF	2-1/2"	11-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	59.65 0.93	1.22
06 46 36 00-0374	LF	3-1/2"	3-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	29.05 0.71	0.94
06 46 36 00-0375	LF	3-1/2"	4-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	35.68 0.74	0.94
06 46 36 00-0376	LF	3-1/2"	5-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	42.24 0.76	1.01
06 46 36 00-0377	LF	3-1/2"	6-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	48.94 0.81	1.08
06 46 36 00-0378	LF	3-1/2"	7-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	55.50 0.83	1.08
06 46 36 00-0379	LF	3-1/2"	8-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	62.14 0.86	1.15
06 46 36 00-0380	LF	3-1/2"	9-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	68.70 0.88	1.15
06 46 36 00-0381	LF	3-1/2"	10-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	75.26 0.89	1.15
06 46 36 00-0382	LF	3-1/2"	11-1/2" Custom Shaped Honduras Mahogany <i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	81.97 0.94	1.22

06 Wood, Plastics, and Composites**06 40 Architectural Woodwork****06 46 Wood Trim**MINOR
CSI UOM DESCRIPTIONTOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

MINOR	CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 46 36 00-0383	Maple ^(06 46 36)		
06 46 36 00-0384	LF 3/4" x 1-1/2" Custom Shaped Maple.....	4.18	0.79
06 46 36 00-0385	LF 3/4" x 2-1/2" Custom Shaped Maple.....	5.08	0.79
06 46 36 00-0386	LF 3/4" x 3-1/2" Custom Shaped Maple.....	5.99	0.79
06 46 36 00-0387	LF 3/4" x 4-1/2" Custom Shaped Maple.....	6.89	0.87
06 46 36 00-0388	LF 3/4" x 5-1/2" Custom Shaped Maple.....	7.87	0.87
06 46 36 00-0389	LF 3/4" x 6-1/2" Custom Shaped Maple.....	8.86	0.94
06 46 36 00-0390	LF 3/4" x 7-1/2" Custom Shaped Maple.....	9.76	0.94
06 46 36 00-0391	LF 3/4" x 8-1/2" Custom Shaped Maple.....	10.68	0.94
06 46 36 00-0392	LF 3/4" x 9-1/2" Custom Shaped Maple.....	11.54	1.01
06 46 36 00-0393	LF 3/4" x 10-1/2" Custom Shaped Maple.....	12.54	1.08
06 46 36 00-0394	LF 3/4" x 11-1/2" Custom Shaped Maple.....	13.48	1.08
06 46 36 00-0395	LF 1" x 1-1/2" Custom Shaped Maple.....	4.87	0.79
06 46 36 00-0396	LF 1" x 2-1/2" Custom Shaped Maple.....	6.05	0.79
06 46 36 00-0397	LF 1" x 3-1/2" Custom Shaped Maple.....	7.27	0.87
06 46 36 00-0398	LF 1" x 4-1/2" Custom Shaped Maple.....	8.48	0.87
06 46 36 00-0399	LF 1" x 5-1/2" Custom Shaped Maple.....	9.78	0.94
06 46 36 00-0400	LF 1" x 6-1/2" Custom Shaped Maple.....	11.05	0.94
06 46 36 00-0401	LF 1" x 7-1/2" Custom Shaped Maple.....	12.25	0.94
06 46 36 00-0402	LF 1" x 8-1/2" Custom Shaped Maple.....	13.48	1.01
06 46 36 00-0403	LF 1" x 9-1/2" Custom Shaped Maple.....	14.66	1.01
06 46 36 00-0404	LF 1" x 10-1/2" Custom Shaped Maple.....	15.42	1.08
06 46 36 00-0405	LF 1" x 11-1/2" Custom Shaped Maple.....	17.19	1.08
06 46 36 00-0406	LF 1-1/4" x 1-1/2" Custom Shaped Maple.....	5.45	0.79
06 46 36 00-0407	LF 1-1/4" x 2-1/2" Custom Shaped Maple.....	6.92	0.79
06 46 36 00-0408	LF 1-1/4" x 3-1/2" Custom Shaped Maple.....	8.39	0.87
06 46 36 00-0409	LF 1-1/4" x 4-1/2" Custom Shaped Maple.....	9.87	0.87
06 46 36 00-0410	LF 1-1/4" x 5-1/2" Custom Shaped Maple.....	11.42	0.94
06 46 36 00-0411	LF 1-1/4" x 6-1/2" Custom Shaped Maple.....	12.97	0.94
06 46 36 00-0412	LF 1-1/4" x 7-1/2" Custom Shaped Maple.....	14.43	1.01
06 46 36 00-0413	LF 1-1/4" x 8-1/2" Custom Shaped Maple.....	15.93	1.01
06 46 36 00-0414	LF 1-1/4" x 9-1/2" Custom Shaped Maple.....	17.36	1.01
06 46 36 00-0415	LF 1-1/4" x 10-1/2" Custom Shaped Maple.....	18.93	1.08
06 46 36 00-0416	LF 1-1/4" x 11-1/2" Custom Shaped Maple.....	20.43	1.15
06 46 36 00-0417	LF 1-1/2" x 1-1/2" Custom Shaped Maple.....	6.66	0.79
06 46 36 00-0418	LF 1-1/2" x 2-1/2" Custom Shaped Maple.....	8.70	0.87
06 46 36 00-0419	LF 1-1/2" x 3-1/2" Custom Shaped Maple.....	10.74	0.87
06 46 36 00-0420	LF 1-1/2" x 4-1/2" Custom Shaped Maple.....	12.78	0.94
06 46 36 00-0421	LF 1-1/2" x 5-1/2" Custom Shaped Maple.....	14.82	0.94
06 46 36 00-0422	LF 1-1/2" x 6-1/2" Custom Shaped Maple.....	17.01	1.01
06 46 36 00-0423	LF 1-1/2" x 7-1/2" Custom Shaped Maple.....	19.04	1.01
06 46 36 00-0424	LF 1-1/2" x 8-1/2" Custom Shaped Maple.....	21.35	1.08
06 46 36 00-0425	LF 1-1/2" x 9-1/2" Custom Shaped Maple.....	23.09	1.08
06 46 36 00-0426	LF 1-1/2" x 10-1/2" Custom Shaped Maple.....	25.28	1.15
06 46 36 00-0427	LF 1-1/2" x 11-1/2" Custom Shaped Maple.....	27.29	1.15
06 46 36 00-0428	LF 2" x 1-1/2" Custom Shaped Maple.....	8.59	0.87
06 46 36 00-0429	LF 2" x 2-1/2" Custom Shaped Maple.....	11.58	0.87
06 46 36 00-0430	LF 2" x 3-1/2" Custom Shaped Maple.....	14.54	0.87
06 46 36 00-0431	LF 2" x 4-1/2" Custom Shaped Maple.....	17.59	0.94
06 46 36 00-0432	LF 2" x 5-1/2" Custom Shaped Maple.....	20.54	0.94
06 46 36 00-0433	LF 2" x 6-1/2" Custom Shaped Maple.....	23.66	1.01
06 46 36 00-0434	LF 2" x 7-1/2" Custom Shaped Maple.....	26.62	1.01
06 46 36 00-0435	LF 2" x 8-1/2" Custom Shaped Maple.....	29.67	1.08
06 46 36 00-0436	LF 2" x 9-1/2" Custom Shaped Maple.....	32.63	1.08
06 46 36 00-0437	LF 2" x 10-1/2" Custom Shaped Maple.....	35.62	1.15
06 46 36 00-0438	LF 2" x 11-1/2" Custom Shaped Maple.....	38.98	1.22
06 46 36 00-0439	LF 3-1/2" x 3-1/2" Custom Shaped Maple.....	31.11	0.94
06 46 36 00-0440	LF 3-1/2" x 4-1/2" Custom Shaped Maple.....	38.25	0.94
06 46 36 00-0441	LF 3-1/2" x 5-1/2" Custom Shaped Maple.....	45.33	1.01
06 46 36 00-0442	LF 3-1/2" x 6-1/2" Custom Shaped Maple.....	52.55	1.08
06 46 36 00-0443	LF 3-1/2" x 7-1/2" Custom Shaped Maple.....	59.62	1.08
06 46 36 00-0444	LF 3-1/2" x 8-1/2" Custom Shaped Maple.....	66.78	1.15
06 46 36 00-0445	LF 3-1/2" x 9-1/2" Custom Shaped Maple.....	73.85	1.15
06 46 36 00-0446	LF 3-1/2" x 10-1/2" Custom Shaped Maple.....	80.93	1.15
06 46 36 00-0447	LF 3-1/2" x 11-1/2" Custom Shaped Maple.....	88.15	1.22
06 46 36 00-0448	Appl Soft Maple ^(06 46 36)		
06 46 36 00-0449	LF 3/4" x 1-1/2" Custom Shaped Appl Soft Maple.....	4.23	0.79
06 46 36 00-0450	LF 3/4" x 2-1/2" Custom Shaped Appl Soft Maple.....	5.16	0.79
06 46 36 00-0451	LF 3/4" x 3-1/2" Custom Shaped Appl Soft Maple.....	6.09	0.79
06 46 36 00-0452	LF 3/4" x 4-1/2" Custom Shaped Appl Soft Maple.....	7.02	0.87
06 46 36 00-0453	LF 3/4" x 5-1/2" Custom Shaped Appl Soft Maple.....	8.03	0.87
06 46 36 00-0454	LF 3/4" x 6-1/2" Custom Shaped Appl Soft Maple.....	9.04	0.94
06 46 36 00-0455	LF 3/4" x 7-1/2" Custom Shaped Appl Soft Maple.....	9.97	0.94
06 46 36 00-0456	LF 3/4" x 8-1/2" Custom Shaped Appl Soft Maple.....	10.91	0.94
06 46 36 00-0457	LF 3/4" x 9-1/2" Custom Shaped Appl Soft Maple.....	11.80	1.01
06 46 36 00-0458	LF 3/4" x 10-1/2" Custom Shaped Appl Soft Maple.....	12.83	1.08
06 46 36 00-0459	LF 3/4" x 11-1/2" Custom Shaped Appl Soft Maple.....	13.79	1.08



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 46 36 00-0460 LF 1" x 1-1/2" Custom Shaped Appl Soft Maple	4.74	0.79
06 46 36 00-0461 LF 1" x 2-1/2" Custom Shaped Appl Soft Maple	5.87	0.79
06 46 36 00-0462 LF 1" x 3-1/2" Custom Shaped Appl Soft Maple	7.01	0.87
06 46 36 00-0463 LF 1" x 4-1/2" Custom Shaped Appl Soft Maple	8.12	0.87
06 46 36 00-0464 LF 1" x 5-1/2" Custom Shaped Appl Soft Maple	9.40	0.94
06 46 36 00-0465 LF 1" x 6-1/2" Custom Shaped Appl Soft Maple	10.61	0.94
06 46 36 00-0466 LF 1" x 7-1/2" Custom Shaped Appl Soft Maple	11.74	0.94
06 46 36 00-0467 LF 1" x 8-1/2" Custom Shaped Appl Soft Maple	12.88	1.01
06 46 36 00-0468 LF 1" x 9-1/2" Custom Shaped Appl Soft Maple	14.02	1.01
06 46 36 00-0469 LF 1" x 10-1/2" Custom Shaped Appl Soft Maple	15.24	1.08
06 46 36 00-0470 LF 1" x 11-1/2" Custom Shaped Appl Soft Maple	16.42	1.08
06 46 36 00-0471 LF 1-1/4" x 1-1/2" Custom Shaped Appl Soft Maple	5.22	0.79
06 46 36 00-0472 LF 1-1/4" x 2-1/2" Custom Shaped Appl Soft Maple	6.59	0.79
06 46 36 00-0473 LF 1-1/4" x 3-1/2" Custom Shaped Appl Soft Maple	7.93	0.87
06 46 36 00-0474 LF 1-1/4" x 4-1/2" Custom Shaped Appl Soft Maple	9.31	0.87
06 46 36 00-0475 LF 1-1/4" x 5-1/2" Custom Shaped Appl Soft Maple	10.73	0.94
06 46 36 00-0476 LF 1-1/4" x 6-1/2" Custom Shaped Appl Soft Maple	12.18	0.94
06 46 36 00-0477 LF 1-1/4" x 7-1/2" Custom Shaped Appl Soft Maple	13.51	1.01
06 46 36 00-0478 LF 1-1/4" x 8-1/2" Custom Shaped Appl Soft Maple	14.89	1.01
06 46 36 00-0479 LF 1-1/4" x 9-1/2" Custom Shaped Appl Soft Maple	16.20	1.01
06 46 36 00-0480 LF 1-1/4" x 10-1/2" Custom Shaped Appl Soft Maple	17.66	1.08
06 46 36 00-0481 LF 1-1/4" x 11-1/2" Custom Shaped Appl Soft Maple	19.04	1.15
06 46 36 00-0482 LF 1-1/2" x 1-1/2" Custom Shaped Appl Soft Maple	6.15	0.79
06 46 36 00-0483 LF 1-1/2" x 2-1/2" Custom Shaped Appl Soft Maple	7.93	0.87
06 46 36 00-0484 LF 1-1/2" x 3-1/2" Custom Shaped Appl Soft Maple	9.71	0.87
06 46 36 00-0485 LF 1-1/2" x 4-1/2" Custom Shaped Appl Soft Maple	11.49	0.94
06 46 36 00-0486 LF 1-1/2" x 5-1/2" Custom Shaped Appl Soft Maple	13.28	0.94
06 46 36 00-0487 LF 1-1/2" x 6-1/2" Custom Shaped Appl Soft Maple	15.21	1.01
06 46 36 00-0488 LF 1-1/2" x 7-1/2" Custom Shaped Appl Soft Maple	16.98	1.01
06 46 36 00-0489 LF 1-1/2" x 8-1/2" Custom Shaped Appl Soft Maple	18.78	1.08
06 46 36 00-0490 LF 1-1/2" x 9-1/2" Custom Shaped Appl Soft Maple	20.52	1.08
06 46 36 00-0491 LF 1-1/2" x 10-1/2" Custom Shaped Appl Soft Maple	22.40	1.15
06 46 36 00-0492 LF 1-1/2" x 11-1/2" Custom Shaped Appl Soft Maple	24.20	1.15
06 46 36 00-0493 Red Oak <small>(06 46 36)</small>		
06 46 36 00-0494 LF 3/4" x 1-1/2" Custom Shaped Red Oak	4.49	0.79
06 46 36 00-0495 LF 3/4" x 2-1/2" Custom Shaped Red Oak	5.55	0.79
06 46 36 00-0496 LF 3/4" x 3-1/2" Custom Shaped Red Oak	6.60	0.79
06 46 36 00-0497 LF 3/4" x 4-1/2" Custom Shaped Red Oak	7.66	0.87
06 46 36 00-0498 LF 3/4" x 5-1/2" Custom Shaped Red Oak	8.80	0.87
06 46 36 00-0499 LF 3/4" x 6-1/2" Custom Shaped Red Oak	9.94	0.94
06 46 36 00-0500 LF 3/4" x 7-1/2" Custom Shaped Red Oak	11.00	0.94
06 46 36 00-0501 LF 3/4" x 8-1/2" Custom Shaped Red Oak	12.07	0.94
06 46 36 00-0502 LF 3/4" x 9-1/2" Custom Shaped Red Oak	13.09	1.01
06 46 36 00-0503 LF 3/4" x 10-1/2" Custom Shaped Red Oak	14.24	1.08
06 46 36 00-0504 LF 3/4" x 11-1/2" Custom Shaped Red Oak	15.33	1.08
06 46 36 00-0505 LF 1" x 1-1/2" Custom Shaped Red Oak	5.30	0.79
06 46 36 00-0506 LF 1" x 2-1/2" Custom Shaped Red Oak	6.75	0.79
06 46 36 00-0507 LF 1" x 3-1/2" Custom Shaped Red Oak	8.17	0.87
06 46 36 00-0508 LF 1" x 4-1/2" Custom Shaped Red Oak	10.13	0.87
06 46 36 00-0509 LF 1" x 5-1/2" Custom Shaped Red Oak	11.12	0.94
06 46 36 00-0510 LF 1" x 6-1/2" Custom Shaped Red Oak	12.65	0.94
06 46 36 00-0511 LF 1" x 7-1/2" Custom Shaped Red Oak	14.06	0.94
06 46 36 00-0512 LF 1" x 8-1/2" Custom Shaped Red Oak	15.48	1.01
06 46 36 00-0513 LF 1" x 9-1/2" Custom Shaped Red Oak	16.90	1.01
06 46 36 00-0514 LF 1" x 10-1/2" Custom Shaped Red Oak	18.43	1.08
06 46 36 00-0515 LF 1" x 11-1/2" Custom Shaped Red Oak	19.89	1.08
06 46 36 00-0516 LF 1-1/4" x 1-1/2" Custom Shaped Red Oak	6.46	0.79
06 46 36 00-0517 LF 1-1/4" x 2-1/2" Custom Shaped Red Oak	8.44	0.79
06 46 36 00-0518 LF 1-1/4" x 3-1/2" Custom Shaped Red Oak	10.40	0.87
06 46 36 00-0519 LF 1-1/4" x 4-1/2" Custom Shaped Red Oak	12.40	0.87
06 46 36 00-0520 LF 1-1/4" x 5-1/2" Custom Shaped Red Oak	14.44	0.94
06 46 36 00-0521 LF 1-1/4" x 6-1/2" Custom Shaped Red Oak	16.50	0.94
06 46 36 00-0522 LF 1-1/4" x 7-1/2" Custom Shaped Red Oak	18.45	1.01
06 46 36 00-0523 LF 1-1/4" x 8-1/2" Custom Shaped Red Oak	20.46	1.01
06 46 36 00-0524 LF 1-1/4" x 9-1/2" Custom Shaped Red Oak	22.38	1.01
06 46 36 00-0525 LF 1-1/4" x 10-1/2" Custom Shaped Red Oak	24.46	1.08
06 46 36 00-0526 LF 1-1/4" x 11-1/2" Custom Shaped Red Oak	26.45	1.15
06 46 36 00-0527 LF 1-1/2" x 1-1/2" Custom Shaped Red Oak	8.83	0.79
06 46 36 00-0528 LF 1-1/2" x 2-1/2" Custom Shaped Red Oak	11.95	0.87
06 46 36 00-0529 LF 1-1/2" x 3-1/2" Custom Shaped Red Oak	15.06	0.87
06 46 36 00-0530 LF 1-1/2" x 4-1/2" Custom Shaped Red Oak	18.18	0.87
06 46 36 00-0531 LF 1-1/2" x 5-1/2" Custom Shaped Red Oak	21.31	0.94
06 46 36 00-0532 LF 1-1/2" x 6-1/2" Custom Shaped Red Oak	24.63	1.01
06 46 36 00-0533 LF 1-1/2" x 7-1/2" Custom Shaped Red Oak	27.69	1.01
06 46 36 00-0534 LF 1-1/2" x 8-1/2" Custom Shaped Red Oak	31.34	1.08
06 46 36 00-0535 LF 1-1/2" x 9-1/2" Custom Shaped Red Oak	33.91	1.08
06 46 36 00-0536 LF 1-1/2" x 10-1/2" Custom Shaped Red Oak	37.12	1.08
06 46 36 00-0537 LF 1-1/2" x 11-1/2" Custom Shaped Red Oak	40.27	1.15
06 46 36 00-0538 LF 2" x 1-1/2" Custom Shaped Red Oak	13.23	0.87

06 Wood, Plastics, and Composites**06 40 Architectural Woodwork****06 46 Wood Trim**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 46 36 00-0539 LF 2" x 2-1/2" Custom Shaped Red Oak.....	18.54	0.87
06 46 36 00-0540 LF 2" x 3-1/2" Custom Shaped Red Oak.....	23.81	0.87
06 46 36 00-0541 LF 2" x 4-1/2" Custom Shaped Red Oak.....	29.18	0.94
06 46 36 00-0542 LF 2" x 5-1/2" Custom Shaped Red Oak.....	34.45	0.94
06 46 36 00-0543 LF 2" x 6-1/2" Custom Shaped Red Oak.....	39.88	1.01
06 46 36 00-0544 LF 2" x 7-1/2" Custom Shaped Red Oak.....	45.16	1.01
06 46 36 00-0545 LF 2" x 8-1/2" Custom Shaped Red Oak.....	50.52	1.08
06 46 36 00-0546 LF 2" x 9-1/2" Custom Shaped Red Oak.....	55.81	1.08
06 46 36 00-0547 LF 2" x 10-1/2" Custom Shaped Red Oak.....	61.11	1.15
06 46 36 00-0548 LF 2" x 11-1/2" Custom Shaped Red Oak.....	66.53	1.22
06 46 36 00-0549 White Oak (06 46 36)		
06 46 36 00-0550 LF 3/4" x 1-1/2" Custom Shaped White Oak.....	4.54	0.79
06 46 36 00-0551 LF 3/4" x 2-1/2" Custom Shaped White Oak.....	5.62	0.79
06 46 36 00-0552 LF 3/4" x 3-1/2" Custom Shaped White Oak.....	6.71	0.79
06 46 36 00-0553 LF 3/4" x 4-1/2" Custom Shaped White Oak.....	7.79	0.87
06 46 36 00-0554 LF 3/4" x 5-1/2" Custom Shaped White Oak.....	8.96	0.87
06 46 36 00-0555 LF 3/4" x 6-1/2" Custom Shaped White Oak.....	10.12	0.94
06 46 36 00-0556 LF 3/4" x 7-1/2" Custom Shaped White Oak.....	11.20	0.94
06 46 36 00-0557 LF 3/4" x 8-1/2" Custom Shaped White Oak.....	12.30	0.94
06 46 36 00-0558 LF 3/4" x 9-1/2" Custom Shaped White Oak.....	13.34	1.01
06 46 36 00-0559 LF 3/4" x 10-1/2" Custom Shaped White Oak.....	14.53	1.08
06 46 36 00-0560 LF 3/4" x 11-1/2" Custom Shaped White Oak.....	15.64	1.08
06 46 36 00-0561 LF 1" x 1-1/2" Custom Shaped White Oak.....	5.30	0.79
06 46 36 00-0562 LF 1" x 2-1/2" Custom Shaped White Oak.....	6.75	0.79
06 46 36 00-0563 LF 1" x 3-1/2" Custom Shaped White Oak.....	8.17	0.87
06 46 36 00-0564 LF 1" x 4-1/2" Custom Shaped White Oak.....	10.13	0.87
06 46 36 00-0565 LF 1" x 5-1/2" Custom Shaped White Oak.....	11.12	0.94
06 46 36 00-0566 LF 1" x 6-1/2" Custom Shaped White Oak.....	12.65	0.94
06 46 36 00-0567 LF 1" x 7-1/2" Custom Shaped White Oak.....	14.06	0.94
06 46 36 00-0568 LF 1" x 8-1/2" Custom Shaped White Oak.....	15.48	1.01
06 46 36 00-0569 LF 1" x 9-1/2" Custom Shaped White Oak.....	16.90	1.01
06 46 36 00-0570 LF 1" x 10-1/2" Custom Shaped White Oak.....	18.43	1.08
06 46 36 00-0571 LF 1" x 11-1/2" Custom Shaped White Oak.....	19.89	1.08
06 46 36 00-0572 LF 1-1/4" x 1-1/2" Custom Shaped White Oak.....	6.53	0.79
06 46 36 00-0573 LF 1-1/4" x 2-1/2" Custom Shaped White Oak.....	8.54	0.79
06 46 36 00-0574 LF 1-1/4" x 3-1/2" Custom Shaped White Oak.....	10.56	0.87
06 46 36 00-0575 LF 1-1/4" x 4-1/2" Custom Shaped White Oak.....	12.58	0.87
06 46 36 00-0576 LF 1-1/4" x 5-1/2" Custom Shaped White Oak.....	14.67	0.94
06 46 36 00-0577 LF 1-1/4" x 6-1/2" Custom Shaped White Oak.....	16.76	0.94
06 46 36 00-0578 LF 1-1/4" x 7-1/2" Custom Shaped White Oak.....	18.76	1.01
06 46 36 00-0579 LF 1-1/4" x 8-1/2" Custom Shaped White Oak.....	20.79	1.01
06 46 36 00-0580 LF 1-1/4" x 9-1/2" Custom Shaped White Oak.....	22.76	1.01
06 46 36 00-0581 LF 1-1/4" x 10-1/2" Custom Shaped White Oak.....	24.87	1.08
06 46 36 00-0582 LF 1-1/4" x 11-1/2" Custom Shaped White Oak.....	26.92	1.15
06 46 36 00-0583 LF 1-1/2" x 1-1/2" Custom Shaped White Oak.....	10.37	0.79
06 46 36 00-0584 LF 1-1/2" x 2-1/2" Custom Shaped White Oak.....	14.26	0.87
06 46 36 00-0585 LF 1-1/2" x 3-1/2" Custom Shaped White Oak.....	18.15	0.87
06 46 36 00-0586 LF 1-1/2" x 4-1/2" Custom Shaped White Oak.....	22.05	0.94
06 46 36 00-0587 LF 1-1/2" x 5-1/2" Custom Shaped White Oak.....	25.95	0.94
06 46 36 00-0588 LF 1-1/2" x 6-1/2" Custom Shaped White Oak.....	29.99	1.01
06 46 36 00-0589 LF 1-1/2" x 7-1/2" Custom Shaped White Oak.....	33.87	1.01
06 46 36 00-0590 LF 1-1/2" x 8-1/2" Custom Shaped White Oak.....	37.78	1.08
06 46 36 00-0591 LF 1-1/2" x 9-1/2" Custom Shaped White Oak.....	41.12	1.08
06 46 36 00-0592 LF 1-1/2" x 10-1/2" Custom Shaped White Oak.....	45.62	1.15
06 46 36 00-0593 LF 1-1/2" x 11-1/2" Custom Shaped White Oak.....	49.54	1.15
06 46 36 00-0594 White Pine (06 46 36)		
06 46 36 00-0595 LF 3/4" x 1-1/2" Custom Shaped White Pine.....	5.00	0.79
06 46 36 00-0596 LF 3/4" x 2-1/2" Custom Shaped White Pine.....	6.32	0.79
06 46 36 00-0597 LF 3/4" x 3-1/2" Custom Shaped White Pine.....	7.63	0.79
06 46 36 00-0598 LF 3/4" x 4-1/2" Custom Shaped White Pine.....	8.95	0.87
06 46 36 00-0599 LF 3/4" x 5-1/2" Custom Shaped White Pine.....	10.35	0.87
06 46 36 00-0600 LF 3/4" x 6-1/2" Custom Shaped White Pine.....	11.74	0.94
06 46 36 00-0601 LF 3/4" x 7-1/2" Custom Shaped White Pine.....	13.06	0.94
06 46 36 00-0602 LF 3/4" x 8-1/2" Custom Shaped White Pine.....	14.38	0.94
06 46 36 00-0603 LF 3/4" x 9-1/2" Custom Shaped White Pine.....	16.43	1.01
06 46 36 00-0604 LF 3/4" x 10-1/2" Custom Shaped White Pine.....	17.93	1.08
06 46 36 00-0605 LF 1" x 1-1/2" Custom Shaped White Pine.....	5.56	0.79
06 46 36 00-0606 LF 1" x 2-1/2" Custom Shaped White Pine.....	7.13	0.79
06 46 36 00-0607 LF 1" x 3-1/2" Custom Shaped White Pine.....	8.68	0.87
06 46 36 00-0608 LF 1" x 4-1/2" Custom Shaped White Pine.....	10.26	0.87
06 46 36 00-0609 LF 1" x 5-1/2" Custom Shaped White Pine.....	11.89	0.94
06 46 36 00-0610 LF 1" x 6-1/2" Custom Shaped White Pine.....	13.55	0.94
06 46 36 00-0611 LF 1" x 7-1/2" Custom Shaped White Pine.....	15.09	0.94
06 46 36 00-0612 LF 1" x 8-1/2" Custom Shaped White Pine.....	16.67	1.01
06 46 36 00-0613 LF 1" x 9-1/2" Custom Shaped White Pine.....	18.19	1.01
06 46 36 00-0614 LF 1" x 10-1/2" Custom Shaped White Pine.....	19.85	1.08
06 46 36 00-0615 LF 1" x 11-1/2" Custom Shaped White Pine.....	21.44	1.08



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 46 36 00-0616 LF 1-1/4" x 1-1/2" Custom Shaped White Pine	6.22	0.79
06 46 36 00-0617 LF 1-1/4" x 2-1/2" Custom Shaped White Pine	8.08	0.79
06 46 36 00-0618 LF 1-1/4" x 3-1/2" Custom Shaped White Pine	9.99	0.87
06 46 36 00-0619 LF 1-1/4" x 4-1/2" Custom Shaped White Pine	11.80	0.87
06 46 36 00-0620 LF 1-1/4" x 5-1/2" Custom Shaped White Pine	13.74	0.94
06 46 36 00-0621 LF 1-1/4" x 6-1/2" Custom Shaped White Pine	15.68	0.94
06 46 36 00-0622 LF 1-1/4" x 7-1/2" Custom Shaped White Pine	17.52	1.01
06 46 36 00-0623 LF 1-1/4" x 8-1/2" Custom Shaped White Pine	19.40	1.01
06 46 36 00-0624 LF 1-1/4" x 9-1/2" Custom Shaped White Pine	21.22	1.01
06 46 36 00-0625 LF 1-1/4" x 10-1/2" Custom Shaped White Pine	23.17	1.08
06 46 36 00-0626 LF 1-1/4" x 11-1/2" Custom Shaped White Pine	25.06	1.15
06 46 36 00-0627 LF 1-1/2" x 1-1/2" Custom Shaped White Pine	7.69	0.79
06 46 36 00-0628 LF 1-1/2" x 2-1/2" Custom Shaped White Pine	10.25	0.87
06 46 36 00-0629 LF 1-1/2" x 3-1/2" Custom Shaped White Pine	12.80	0.87
06 46 36 00-0630 LF 1-1/2" x 4-1/2" Custom Shaped White Pine	15.35	0.94
06 46 36 00-0631 LF 1-1/2" x 5-1/2" Custom Shaped White Pine	17.91	0.94
06 46 36 00-0632 LF 1-1/2" x 6-1/2" Custom Shaped White Pine	20.61	1.01
06 46 36 00-0633 LF 1-1/2" x 7-1/2" Custom Shaped White Pine	23.16	1.01
06 46 36 00-0634 LF 1-1/2" x 8-1/2" Custom Shaped White Pine	25.73	1.08
06 46 36 00-0635 LF 1-1/2" x 9-1/2" Custom Shaped White Pine	28.76	1.08
06 46 36 00-0636 LF 1-1/2" x 10-1/2" Custom Shaped White Pine	30.89	1.15
06 46 36 00-0637 LF 1-1/2" x 11-1/2" Custom Shaped White Pine	33.48	1.15
06 46 36 00-0638 LF 2" x 1-1/2" Custom Shaped White Pine	11.56	0.87
06 46 36 00-0639 LF 2" x 2-1/2" Custom Shaped White Pine	16.01	0.87
06 46 36 00-0640 LF 2" x 3-1/2" Custom Shaped White Pine	20.46	0.87
06 46 36 00-0641 LF 2" x 4-1/2" Custom Shaped White Pine	24.98	0.94
06 46 36 00-0642 LF 2" x 5-1/2" Custom Shaped White Pine	29.43	0.94
06 46 36 00-0643 LF 2" x 6-1/2" Custom Shaped White Pine	34.01	1.01
06 46 36 00-0644 LF 2" x 7-1/2" Custom Shaped White Pine	38.46	1.01
06 46 36 00-0645 LF 2" x 8-1/2" Custom Shaped White Pine	42.98	1.08
06 46 36 00-0646 LF 2" x 9-1/2" Custom Shaped White Pine	47.44	1.08
06 46 36 00-0647 LF 2" x 10-1/2" Custom Shaped White Pine	51.89	1.15
06 46 36 00-0648 LF 2" x 11-1/2" Custom Shaped White Pine	56.49	1.22
06 46 36 00-0649 LF 2-1/2" x 1-1/2" Custom Shaped White Pine	13.69	0.87
06 46 36 00-0650 LF 2-1/2" x 2-1/2" Custom Shaped White Pine	19.17	0.87
06 46 36 00-0651 LF 2-1/2" x 3-1/2" Custom Shaped White Pine	24.65	0.94
06 46 36 00-0652 LF 2-1/2" x 4-1/2" Custom Shaped White Pine	30.20	0.94
06 46 36 00-0653 LF 2-1/2" x 5-1/2" Custom Shaped White Pine	35.68	0.94
06 46 36 00-0654 LF 2-1/2" x 6-1/2" Custom Shaped White Pine	41.29	1.01
06 46 36 00-0655 LF 2-1/2" x 7-1/2" Custom Shaped White Pine	46.78	1.08
06 46 36 00-0656 LF 2-1/2" x 8-1/2" Custom Shaped White Pine	52.34	1.08
06 46 36 00-0657 LF 2-1/2" x 9-1/2" Custom Shaped White Pine	57.82	1.15
06 46 36 00-0658 LF 2-1/2" x 10-1/2" Custom Shaped White Pine	63.29	1.15
06 46 36 00-0659 LF 2-1/2" x 11-1/2" Custom Shaped White Pine	68.92	1.22
06 46 36 00-0660 LF 3-1/2" x 3-1/2" Custom Shaped White Pine	33.99	0.94
06 46 36 00-0661 LF 3-1/2" x 4-1/2" Custom Shaped White Pine	41.86	0.94
06 46 36 00-0662 LF 3-1/2" x 5-1/2" Custom Shaped White Pine	49.65	1.01
06 46 36 00-0663 LF 3-1/2" x 6-1/2" Custom Shaped White Pine	57.60	1.08
06 46 36 00-0664 LF 3-1/2" x 7-1/2" Custom Shaped White Pine	65.39	1.08
06 46 36 00-0665 LF 3-1/2" x 8-1/2" Custom Shaped White Pine	73.27	1.15
06 46 36 00-0666 LF 3-1/2" x 9-1/2" Custom Shaped White Pine	81.06	1.15
06 46 36 00-0667 LF 3-1/2" x 10-1/2" Custom Shaped White Pine	88.86	1.15
06 46 36 00-0668 LF 3-1/2" x 11-1/2" Custom Shaped White Pine	96.80	1.22

06 46 36 00-0669

Clear Yellow Pine (06 46 36)

06 46 36 00-0670 LF 3/4" x 1-1/2" Custom Shaped "C" Y Pine	3.56	0.79
06 46 36 00-0671 LF 3/4" x 2-1/2" Custom Shaped "C" Y Pine	4.16	0.79
06 46 36 00-0672 LF 3/4" x 3-1/2" Custom Shaped "C" Y Pine	4.75	0.79
06 46 36 00-0673 LF 3/4" x 4-1/2" Custom Shaped "C" Y Pine	5.35	0.87
06 46 36 00-0674 LF 3/4" x 5-1/2" Custom Shaped "C" Y Pine	6.02	0.87
06 46 36 00-0675 LF 3/4" x 6-1/2" Custom Shaped "C" Y Pine	6.70	0.94
06 46 36 00-0676 LF 3/4" x 7-1/2" Custom Shaped "C" Y Pine	7.29	0.94
06 46 36 00-0677 LF 3/4" x 8-1/2" Custom Shaped "C" Y Pine	7.90	0.94
06 46 36 00-0678 LF 1" x 1-1/2" Custom Shaped "C" Y Pine	4.02	0.79
06 46 36 00-0679 LF 1" x 2-1/2" Custom Shaped "C" Y Pine	4.82	0.79
06 46 36 00-0680 LF 1" x 3-1/2" Custom Shaped "C" Y Pine	5.59	0.87
06 46 36 00-0681 LF 1" x 4-1/2" Custom Shaped "C" Y Pine	6.39	0.87
06 46 36 00-0682 LF 1" x 5-1/2" Custom Shaped "C" Y Pine	7.26	0.94
06 46 36 00-0683 LF 1" x 6-1/2" Custom Shaped "C" Y Pine	8.14	0.94
06 46 36 00-0684 LF 1" x 7-1/2" Custom Shaped "C" Y Pine	9.16	0.94
06 46 36 00-0685 LF 1" x 8-1/2" Custom Shaped "C" Y Pine	10.00	1.01
06 46 36 00-0686 LF 1-1/2" x 1-1/2" Custom Shaped "C" Y Pine	4.60	0.79
06 46 36 00-0687 LF 1-1/2" x 2-1/2" Custom Shaped "C" Y Pine	5.61	0.87
06 46 36 00-0688 LF 1-1/2" x 3-1/2" Custom Shaped "C" Y Pine	6.62	0.87
06 46 36 00-0689 LF 1-1/2" x 4-1/2" Custom Shaped "C" Y Pine	7.63	0.94
06 46 36 00-0690 LF 1-1/2" x 5-1/2" Custom Shaped "C" Y Pine	8.64	0.94
06 46 36 00-0691 LF 1-1/2" x 6-1/2" Custom Shaped "C" Y Pine	9.80	1.01
06 46 36 00-0692 LF 1-1/2" x 7-1/2" Custom Shaped "C" Y Pine	10.80	1.01
06 46 36 00-0693 LF 1-1/2" x 8-1/2" Custom Shaped "C" Y Pine	11.82	1.08
06 46 36 00-0694 LF 1-1/2" x 9-1/2" Custom Shaped "C" Y Pine	13.56	1.08

06 Wood, Plastics, and Composites**06 40 Architectural Woodwork****06 46 Wood Trim**

MINOR				TOTAL DIRECT	DEMOLITION
CSI	UOM	DESCRIPTION		UNIT COST	UNIT COST
06 46 36 00-0695	LF	1-1/2" x 10-1/2" Custom Shaped "C" Y Pine.....		14.00	1.15
06 46 36 00-0696		Poplar <small>(06 46 36)</small>			
06 46 36 00-0697	LF	3/4" x 1-1/2" Custom Shaped Poplar		3.71	0.79
06 46 36 00-0698	LF	3/4" x 2-1/2" Custom Shaped Poplar		4.39	0.79
06 46 36 00-0699	LF	3/4" x 3-1/2" Custom Shaped Poplar		5.06	0.79
06 46 36 00-0700	LF	3/4" x 4-1/2" Custom Shaped Poplar		5.73	0.87
06 46 36 00-0701	LF	3/4" x 5-1/2" Custom Shaped Poplar		6.48	0.87
06 46 36 00-0702	LF	3/4" x 6-1/2" Custom Shaped Poplar		7.24	0.94
06 46 36 00-0703	LF	3/4" x 7-1/2" Custom Shaped Poplar		7.91	0.94
06 46 36 00-0704	LF	3/4" x 8-1/2" Custom Shaped Poplar		8.59	0.94
06 46 36 00-0705	LF	3/4" x 9-1/2" Custom Shaped Poplar		9.22	1.01
06 46 36 00-0706	LF	3/4" x 10-1/2" Custom Shaped Poplar		10.00	1.08
06 46 36 00-0707	LF	3/4" x 11-1/2" Custom Shaped Poplar		10.75	1.08
06 46 36 00-0708	LF	1" x 1-1/2" Custom Shaped Poplar		4.22	0.79
06 46 36 00-0709	LF	1" x 2-1/2" Custom Shaped Poplar		5.10	0.79
06 46 36 00-0710	LF	1" x 3-1/2" Custom Shaped Poplar		5.98	0.87
06 46 36 00-0711	LF	1" x 4-1/2" Custom Shaped Poplar		6.86	0.87
06 46 36 00-0712	LF	1" x 5-1/2" Custom Shaped Poplar		7.85	0.94
06 46 36 00-0713	LF	1" x 6-1/2" Custom Shaped Poplar		8.81	0.94
06 46 36 00-0714	LF	1" x 7-1/2" Custom Shaped Poplar		9.68	0.94
06 46 36 00-0715	LF	1" x 8-1/2" Custom Shaped Poplar		10.57	1.01
06 46 36 00-0716	LF	1" x 9-1/2" Custom Shaped Poplar		11.44	1.01
06 46 36 00-0717	LF	1" x 10-1/2" Custom Shaped Poplar		12.41	1.08
06 46 36 00-0718	LF	1" x 11-1/2" Custom Shaped Poplar		13.33	1.08
06 46 36 00-0719	LF	1-1/4" x 1-1/2" Custom Shaped Poplar		4.68	0.79
06 46 36 00-0720	LF	1-1/4" x 2-1/2" Custom Shaped Poplar		5.76	0.79
06 46 36 00-0721	LF	1-1/4" x 3-1/2" Custom Shaped Poplar		6.85	0.87
06 46 36 00-0722	LF	1-1/4" x 4-1/2" Custom Shaped Poplar		7.94	0.87
06 46 36 00-0723	LF	1-1/4" x 5-1/2" Custom Shaped Poplar		9.11	0.94
06 46 36 00-0724	LF	1-1/4" x 6-1/2" Custom Shaped Poplar		10.27	0.94
06 46 36 00-0725	LF	1-1/4" x 7-1/2" Custom Shaped Poplar		11.34	1.01
06 46 36 00-0726	LF	1-1/4" x 8-1/2" Custom Shaped Poplar		12.45	1.01
06 46 36 00-0727	LF	1-1/4" x 9-1/2" Custom Shaped Poplar		13.49	1.01
06 46 36 00-0728	LF	1-1/4" x 10-1/2" Custom Shaped Poplar		14.68	1.08
06 46 36 00-0729	LF	1-1/4" x 11-1/2" Custom Shaped Poplar		15.79	1.15
06 46 36 00-0730	LF	1-1/2" x 1-1/2" Custom Shaped Poplar		5.74	0.79
06 46 36 00-0731	LF	1-1/2" x 2-1/2" Custom Shaped Poplar		7.31	0.87
06 46 36 00-0732	LF	1-1/2" x 3-1/2" Custom Shaped Poplar		8.88	0.87
06 46 36 00-0733	LF	1-1/2" x 4-1/2" Custom Shaped Poplar		10.46	0.94
06 46 36 00-0734	LF	1-1/2" x 5-1/2" Custom Shaped Poplar		12.04	0.94
06 46 36 00-0735	LF	1-1/2" x 6-1/2" Custom Shaped Poplar		13.76	1.01
06 46 36 00-0736	LF	1-1/2" x 7-1/2" Custom Shaped Poplar		15.33	1.01
06 46 36 00-0737	LF	1-1/2" x 8-1/2" Custom Shaped Poplar		16.92	1.08
06 46 36 00-0738	LF	1-1/2" x 9-1/2" Custom Shaped Poplar		18.46	1.08
06 46 36 00-0739	LF	1-1/2" x 10-1/2" Custom Shaped Poplar		20.13	1.15
06 46 36 00-0740	LF	1-1/2" x 11-1/2" Custom Shaped Poplar		21.73	1.15
06 46 36 00-0741	LF	2" x 1-1/2" Custom Shaped Poplar		7.31	0.87
06 46 36 00-0742	LF	2" x 2-1/2" Custom Shaped Poplar		9.65	0.87
06 46 36 00-0743	LF	2" x 3-1/2" Custom Shaped Poplar		11.96	0.87
06 46 36 00-0744	LF	2" x 4-1/2" Custom Shaped Poplar		14.37	0.94
06 46 36 00-0745	LF	2" x 5-1/2" Custom Shaped Poplar		16.68	0.94
06 46 36 00-0746	LF	2" x 6-1/2" Custom Shaped Poplar		19.16	1.01
06 46 36 00-0747	LF	2" x 7-1/2" Custom Shaped Poplar		21.47	1.01
06 46 36 00-0748	LF	2" x 8-1/2" Custom Shaped Poplar		23.87	1.08
06 46 36 00-0749	LF	2" x 9-1/2" Custom Shaped Poplar		26.19	1.08
06 46 36 00-0750	LF	2" x 10-1/2" Custom Shaped Poplar		28.54	1.15
06 46 36 00-0751	LF	2" x 11-1/2" Custom Shaped Poplar		31.00	1.22
06 46 36 00-0752	LF	2-1/2" x 1-1/2" Custom Shaped Poplar		8.90	0.87
06 46 36 00-0753	LF	2-1/2" x 2-1/2" Custom Shaped Poplar		11.99	0.87
06 46 36 00-0754	LF	2-1/2" x 3-1/2" Custom Shaped Poplar		15.07	0.94
06 46 36 00-0755	LF	2-1/2" x 4-1/2" Custom Shaped Poplar		18.22	0.94
06 46 36 00-0756	LF	2-1/2" x 5-1/2" Custom Shaped Poplar		21.31	0.94
06 46 36 00-0757	LF	2-1/2" x 6-1/2" Custom Shaped Poplar		24.53	1.01
06 46 36 00-0758	LF	2-1/2" x 7-1/2" Custom Shaped Poplar		27.62	1.08
06 46 36 00-0759	LF	2-1/2" x 8-1/2" Custom Shaped Poplar		30.79	1.08
06 46 36 00-0760	LF	2-1/2" x 9-1/2" Custom Shaped Poplar		33.87	1.15
06 46 36 00-0761	LF	2-1/2" x 10-1/2" Custom Shaped Poplar		36.95	1.15
06 46 36 00-0762	LF	2-1/2" x 11-1/2" Custom Shaped Poplar		40.18	1.22
06 46 36 00-0763	LF	3-1/2" x 3-1/2" Custom Shaped Poplar		20.39	0.94
06 46 36 00-0764	LF	3-1/2" x 4-1/2" Custom Shaped Poplar		24.86	0.94
06 46 36 00-0765	LF	3-1/2" x 5-1/2" Custom Shaped Poplar		29.26	1.01
06 46 36 00-0766	LF	3-1/2" x 6-1/2" Custom Shaped Poplar		33.85	1.08
06 46 36 00-0767	LF	3-1/2" x 7-1/2" Custom Shaped Poplar		38.20	1.08
06 46 36 00-0768	LF	3-1/2" x 8-1/2" Custom Shaped Poplar		42.68	1.15
06 46 36 00-0769	LF	3-1/2" x 9-1/2" Custom Shaped Poplar		47.07	1.15
06 46 36 00-0770	LF	3-1/2" x 10-1/2" Custom Shaped Poplar		51.47	1.15
06 46 36 00-0771	LF	3-1/2" x 11-1/2" Custom Shaped Poplar		56.01	1.22



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
				06 46 36 00-0772 Clear Heart Redwood <small>(06 46 36)</small>		
			LF	3/4" x 1-1/2" Custom Shaped Clear Heart Redwood	4.44	0.79
			LF	3/4" x 2-1/2" Custom Shaped Clear Heart Redwood	5.47	0.79
			LF	3/4" x 3-1/2" Custom Shaped Clear Heart Redwood	6.50	0.79
			LF	3/4" x 4-1/2" Custom Shaped Clear Heart Redwood	7.53	0.87
			LF	3/4" x 5-1/2" Custom Shaped Clear Heart Redwood	8.65	0.87
			LF	3/4" x 6-1/2" Custom Shaped Clear Heart Redwood	9.76	0.94
			LF	3/4" x 7-1/2" Custom Shaped Clear Heart Redwood	11.82	0.94
			LF	3/4" x 8-1/2" Custom Shaped Clear Heart Redwood	12.99	0.94
			LF	3/4" x 9-1/2" Custom Shaped Clear Heart Redwood	13.06	1.01
			LF	3/4" x 10-1/2" Custom Shaped Clear Heart Redwood	13.96	1.08
			LF	1" x 1-1/2" Custom Shaped Clear Heart Redwood	5.25	0.79
			LF	1" x 2-1/2" Custom Shaped Clear Heart Redwood	6.65	0.79
			LF	1" x 3-1/2" Custom Shaped Clear Heart Redwood	8.04	0.87
			LF	1" x 4-1/2" Custom Shaped Clear Heart Redwood	9.43	0.87
			LF	1" x 5-1/2" Custom Shaped Clear Heart Redwood	10.94	0.94
			LF	1" x 6-1/2" Custom Shaped Clear Heart Redwood	12.41	0.94
			LF	1" x 7-1/2" Custom Shaped Clear Heart Redwood	15.60	0.94
			LF	1" x 8-1/2" Custom Shaped Clear Heart Redwood	17.24	1.01
			LF	1" x 9-1/2" Custom Shaped Clear Heart Redwood	18.83	1.01
			LF	1" x 10-1/2" Custom Shaped Clear Heart Redwood	20.55	1.08
			LF	1-1/2" x 1-1/2" Custom Shaped Clear Heart Redwood	6.77	0.79
			LF	1-1/2" x 2-1/2" Custom Shaped Clear Heart Redwood	8.86	0.87
			LF	1-1/2" x 3-1/2" Custom Shaped Clear Heart Redwood	10.94	0.87
			LF	1-1/2" x 4-1/2" Custom Shaped Clear Heart Redwood	13.03	0.94
			LF	1-1/2" x 5-1/2" Custom Shaped Clear Heart Redwood	15.13	0.94
			LF	1-1/2" x 6-1/2" Custom Shaped Clear Heart Redwood	17.42	1.01
			LF	1-1/2" x 7-1/2" Custom Shaped Clear Heart Redwood	23.16	1.01
			LF	1-1/2" x 8-1/2" Custom Shaped Clear Heart Redwood	25.73	1.08
			LF	1-1/2" x 9-1/2" Custom Shaped Clear Heart Redwood	30.30	1.08
			LF	1-1/2" x 10-1/2" Custom Shaped Clear Heart Redwood	33.16	1.15
			LF	3-1/2" x 3-1/2" Custom Shaped Clear Heart Redwood	31.93	0.94
			LF	3-1/2" x 4-1/2" Custom Shaped Clear Heart Redwood	39.28	0.94
			LF	3-1/2" x 5-1/2" Custom Shaped Clear Heart Redwood	46.56	1.01
			LF	3-1/2" x 6-1/2" Custom Shaped Clear Heart Redwood	53.99	1.08
			LF	3-1/2" x 7-1/2" Custom Shaped Clear Heart Redwood	61.27	1.08
			LF	3-1/2" x 8-1/2" Custom Shaped Clear Heart Redwood	68.63	1.15
			LF	3-1/2" x 9-1/2" Custom Shaped Clear Heart Redwood	75.91	1.15
			LF	3-1/2" x 10-1/2" Custom Shaped Clear Heart Redwood	83.19	1.15
			LF	3-1/2" x 11-1/2" Custom Shaped Clear Heart Redwood	90.62	1.22
				06 46 36 00-0812 Teak <small>(06 46 36)</small>		
			LF	3/4" x 1-1/2" Custom Shaped Teak	11.34	0.79
			LF	3/4" x 2-1/2" Custom Shaped Teak	15.82	0.79
			LF	3/4" x 3-1/2" Custom Shaped Teak	20.30	0.79
			LF	3/4" x 4-1/2" Custom Shaped Teak	24.79	0.87
			LF	3/4" x 5-1/2" Custom Shaped Teak	29.35	0.87
			LF	3/4" x 6-1/2" Custom Shaped Teak	33.91	0.94
			LF	3/4" x 7-1/2" Custom Shaped Teak	38.40	0.94
			LF	3/4" x 8-1/2" Custom Shaped Teak	42.89	0.94
			LF	3/4" x 9-1/2" Custom Shaped Teak	47.33	1.01
			LF	3/4" x 10-1/2" Custom Shaped Teak	51.92	1.08
			LF	3/4" x 11-1/2" Custom Shaped Teak	56.43	1.08
			LF	1-1/2" x 1-1/2" Custom Shaped Teak	25.51	0.79
			LF	1-1/2" x 2-1/2" Custom Shaped Teak	29.25	0.87
			LF	1-1/2" x 3-1/2" Custom Shaped Teak	38.14	0.87
			LF	1-1/2" x 4-1/2" Custom Shaped Teak	47.02	0.94
			LF	1-1/2" x 5-1/2" Custom Shaped Teak	55.92	0.94
			LF	1-1/2" x 6-1/2" Custom Shaped Teak	64.70	1.01
			LF	1-1/2" x 7-1/2" Custom Shaped Teak	73.83	1.01
			LF	1-1/2" x 8-1/2" Custom Shaped Teak	82.74	1.08
			LF	1-1/2" x 9-1/2" Custom Shaped Teak	91.59	1.08
			LF	1-1/2" x 10-1/2" Custom Shaped Teak	100.58	1.15
			LF	1-1/2" x 11-1/2" Custom Shaped Teak	109.49	1.15
				06 46 36 00-0835 Walnut <small>(06 46 36)</small>		
			LF	3/4" x 1-1/2" Custom Shaped Walnut	6.44	0.79
			LF	3/4" x 2-1/2" Custom Shaped Walnut	8.48	0.79
			LF	3/4" x 3-1/2" Custom Shaped Walnut	10.52	0.79
			LF	3/4" x 4-1/2" Custom Shaped Walnut	12.56	0.87
			LF	3/4" x 5-1/2" Custom Shaped Walnut	14.67	0.87
			LF	3/4" x 6-1/2" Custom Shaped Walnut	16.79	0.94
			LF	3/4" x 7-1/2" Custom Shaped Walnut	18.83	0.94
			LF	3/4" x 8-1/2" Custom Shaped Walnut	20.87	0.94
			LF	3/4" x 9-1/2" Custom Shaped Walnut	22.87	1.01
			LF	3/4" x 10-1/2" Custom Shaped Walnut	25.01	1.08
			LF	3/4" x 11-1/2" Custom Shaped Walnut	27.07	1.08
			LF	1" x 1-1/2" Custom Shaped Walnut	7.62	0.79

06 Wood, Plastics, and Composites**06 40 Architectural Woodwork****06 46 Wood Trim**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 46 36 00-0848	LF	1"	1" x 2-1/2" Custom Shaped Walnut.....	10.22	0.79
06 46 36 00-0849	LF	1"	1" x 3-1/2" Custom Shaped Walnut.....	12.80	0.87
06 46 36 00-0850	LF	1"	1" x 4-1/2" Custom Shaped Walnut.....	15.41	0.87
06 46 36 00-0851	LF	1"	1" x 5-1/2" Custom Shaped Walnut.....	18.07	0.94
06 46 36 00-0852	LF	1"	1" x 6-1/2" Custom Shaped Walnut.....	20.76	0.94
06 46 36 00-0853	LF	1"	1" x 7-1/2" Custom Shaped Walnut.....	23.33	0.94
06 46 36 00-0854	LF	1"	1" x 8-1/2" Custom Shaped Walnut.....	25.94	1.01
06 46 36 00-0855	LF	1"	1" x 9-1/2" Custom Shaped Walnut.....	28.49	1.01
06 46 36 00-0856	LF	1"	1" x 10-1/2" Custom Shaped Walnut.....	31.18	1.08
06 46 36 00-0857	LF	1"	1" x 11-1/2" Custom Shaped Walnut.....	33.80	1.08
06 46 36 00-0858	LF	1-1/4"	1-1/4" x 1-1/2" Custom Shaped Walnut.....	9.24	0.79
06 46 36 00-0859	LF	1-1/4"	1-1/4" x 2-1/2" Custom Shaped Walnut.....	12.61	0.79
06 46 36 00-0860	LF	1-1/4"	1-1/4" x 3-1/2" Custom Shaped Walnut.....	15.96	0.87
06 46 36 00-0861	LF	1-1/4"	1-1/4" x 4-1/2" Custom Shaped Walnut.....	19.35	0.87
06 46 36 00-0862	LF	1-1/4"	1-1/4" x 5-1/2" Custom Shaped Walnut.....	22.78	0.94
06 46 36 00-0863	LF	1-1/4"	1-1/4" x 6-1/2" Custom Shaped Walnut.....	26.24	0.94
06 46 36 00-0864	LF	1-1/4"	1-1/4" x 7-1/2" Custom Shaped Walnut.....	29.58	1.01
06 46 36 00-0865	LF	1-1/4"	1-1/4" x 8-1/2" Custom Shaped Walnut.....	32.97	1.01
06 46 36 00-0866	LF	1-1/4"	1-1/4" x 9-1/2" Custom Shaped Walnut.....	36.28	1.01
06 46 36 00-0867	LF	1-1/4"	1-1/4" x 10-1/2" Custom Shaped Walnut.....	39.76	1.08
06 46 36 00-0868	LF	1-1/4"	1-1/4" x 11-1/2" Custom Shaped Walnut.....	43.14	1.15
06 46 36 00-0869	LF	1-1/2"	1-1/2" x 1-1/2" Custom Shaped Walnut.....	12.33	0.79
06 46 36 00-0870	LF	1-1/2"	1-1/2" x 2-1/2" Custom Shaped Walnut.....	17.20	0.87
06 46 36 00-0871	LF	1-1/2"	1-1/2" x 3-1/2" Custom Shaped Walnut.....	22.07	0.87
06 46 36 00-0872	LF	1-1/2"	1-1/2" x 4-1/2" Custom Shaped Walnut.....	26.94	0.94
06 46 36 00-0873	LF	1-1/2"	1-1/2" x 5-1/2" Custom Shaped Walnut.....	31.82	0.94
06 46 36 00-0874	LF	1-1/2"	1-1/2" x 6-1/2" Custom Shaped Walnut.....	36.84	1.01
06 46 36 00-0875	LF	1-1/2"	1-1/2" x 7-1/2" Custom Shaped Walnut.....	41.70	1.01
06 46 36 00-0876	LF	1-1/2"	1-1/2" x 8-1/2" Custom Shaped Walnut.....	46.59	1.08
06 46 36 00-0877	LF	1-1/2"	1-1/2" x 9-1/2" Custom Shaped Walnut.....	51.93	1.08
06 46 36 00-0878	LF	1-1/2"	1-1/2" x 10-1/2" Custom Shaped Walnut.....	56.39	1.15
06 46 36 00-0879	LF	1-1/2"	1-1/2" x 11-1/2" Custom Shaped Walnut.....	61.29	1.15
06 46 36 00-0880	LF	2"	2" x 1-1/2" Custom Shaped Walnut.....	20.31	0.87
06 46 36 00-0881	LF	2"	2" x 2-1/2" Custom Shaped Walnut.....	29.15	0.87
06 46 36 00-0882	LF	2"	2" x 3-1/2" Custom Shaped Walnut.....	37.97	0.87
06 46 36 00-0883	LF	2"	2" x 4-1/2" Custom Shaped Walnut.....	46.87	0.94
06 46 36 00-0884	LF	2"	2" x 5-1/2" Custom Shaped Walnut.....	55.69	0.94
06 46 36 00-0885	LF	2"	2" x 6-1/2" Custom Shaped Walnut.....	64.66	1.01
06 46 36 00-0886	LF	2"	2" x 7-1/2" Custom Shaped Walnut.....	73.48	1.01
06 46 36 00-0887	LF	2"	2" x 8-1/2" Custom Shaped Walnut.....	82.38	1.08
06 46 36 00-0888	LF	2"	2" x 9-1/2" Custom Shaped Walnut.....	91.21	1.08
06 46 36 00-0889	LF	2"	2" x 10-1/2" Custom Shaped Walnut.....	100.05	1.15
06 46 36 00-0890	LF	2"	2" x 11-1/2" Custom Shaped Walnut.....	109.02	1.22
06 46 36 00-0891	LF	2-1/2"	2-1/2" x 1-1/2" Custom Shaped Walnut.....	25.27	0.87
06 46 36 00-0892	LF	2-1/2"	2-1/2" x 2-1/2" Custom Shaped Walnut.....	36.56	0.87
06 46 36 00-0893	LF	2-1/2"	2-1/2" x 3-1/2" Custom Shaped Walnut.....	47.83	0.94
06 46 36 00-0894	LF	2-1/2"	2-1/2" x 4-1/2" Custom Shaped Walnut.....	59.17	0.94
06 46 36 00-0895	LF	2-1/2"	2-1/2" x 5-1/2" Custom Shaped Walnut.....	70.44	0.94
06 46 36 00-0896	LF	2-1/2"	2-1/2" x 6-1/2" Custom Shaped Walnut.....	81.85	1.01
06 46 36 00-0897	LF	2-1/2"	2-1/2" x 7-1/2" Custom Shaped Walnut.....	93.13	1.08
06 46 36 00-0898	LF	2-1/2"	2-1/2" x 8-1/2" Custom Shaped Walnut.....	104.49	1.08
06 46 36 00-0899	LF	2-1/2"	2-1/2" x 9-1/2" Custom Shaped Walnut.....	115.76	1.15
06 46 36 00-0900	LF	2-1/2"	2-1/2" x 10-1/2" Custom Shaped Walnut.....	127.03	1.15
06 46 36 00-0901	LF	2-1/2"	2-1/2" x 11-1/2" Custom Shaped Walnut.....	138.45	1.22

06 48 Wood Frames (06 40)

Note: All door frames include perimeter caulk, sealant (as required), anchors and silencers.

06 48 13 Exterior Wood Door Frames (06 48)**06 48 13 00-0001 Exterior Door Frames** (06 48 13)

Note: 6'-8" and 7'-2" frames are the same price as 7' frames. Custom made with threshold, includes all trim molding, up to 8" depth.

06 48 13 00-0002	EA	3' x 7'	Pine Exterior Door Frame Custom Made With Threshold And Trim.....	224.37	40.84
			<i>For Birch, Add</i>	49.97	
			<i>For Mahogany, Add</i>	121.35	
06 48 13 00-0003	EA	3'-6" x 7'	Pine Exterior Door Frame Custom Made With Threshold And Trim.....	236.06	42.80
			<i>For Birch, Add</i>	52.79	
			<i>For Mahogany, Add</i>	128.21	
06 48 13 00-0004	EA	4' x 7'	Pine Exterior Door Frame Custom Made With Threshold And Trim.....	247.76	44.46
			<i>For Birch, Add</i>	55.62	
			<i>For Mahogany, Add</i>	135.07	
06 48 13 00-0005	EA	5' x 7'	Pine Exterior Door Frame Custom Made With Threshold And Trim.....	270.26	47.59
			<i>For Birch, Add</i>	61.26	
			<i>For Mahogany, Add</i>	148.78	
06 48 13 00-0006	EA	6' x 7'	Pine Exterior Door Frame Custom Made With Threshold And Trim.....	293.19	51.00
			<i>For Birch, Add</i>	66.91	
			<i>For Mahogany, Add</i>	162.50	
06 48 13 00-0007	EA	3' x 7'	Walnut Exterior Door Frame Custom Made With Threshold And Trim.....	344.20	40.98
06 48 13 00-0008	EA	3'-6" x 7'	Walnut Exterior Door Frame Custom Made With Threshold And Trim.....	349.99	42.80
06 48 13 00-0009	EA	4' x 7'	Walnut Exterior Door Frame Custom Made With Threshold And Trim.....	355.76	44.62



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 48 13 00-0010 EA 5' x 7' Walnut Exterior Door Frame Custom Made With Threshold And Trim	365.92	47.52
06 48 13 00-0011 EA 6' x 7' Walnut Exterior Door Frame Custom Made With Threshold And Trim	377.61	51.14
06 48 13 00-0012 EA 3' x 7' Oak Exterior Door Frame Custom Made With Threshold And Trim	265.66	40.98
06 48 13 00-0013 EA 3'-6" x 7' Oak Exterior Door Frame Custom Made With Threshold And Trim	278.54	42.80
06 48 13 00-0014 EA 4' x 7' Oak Exterior Door Frame Custom Made With Threshold And Trim	291.50	44.62
06 48 13 00-0015 EA 5' x 7' Oak Exterior Door Frame Custom Made With Threshold And Trim	315.83	47.52
06 48 13 00-0016 EA 6' x 7' Oak Exterior Door Frame Custom Made With Threshold And Trim	341.60	51.14

06 48 16 Interior Wood Door Frames (06 48)

06 48 16 00-0001 Interior Door Frames (06 48 16)

Note: 6'-8" and 7'-2" frames are the same price as 7' frames. Custom made, includes all trim molding.

06 48 16 00-0002 EA 2'-0" Or 2'-4" x 7' Pine Interior Door Frame Custom Made With Threshold And Trim	112.75	19.44
For Oak Or Maple, Add	22.91	
For Birch, Add	25.86	
For Mahogany, Add	62.81	
For Walnut Frame, Add	33.25	
06 48 16 00-0003 EA 2'-6" x 7' Pine Interior Door Frame Custom Made With Threshold And Trim	113.56	19.52
For Oak Or Maple, Add	23.10	
For Birch, Add	26.08	
For Mahogany, Add	63.33	
For Walnut Frame, Add	33.53	
06 48 16 00-0004 EA 2'-8" x 7' Pine Interior Door Frame Custom Made With Threshold And Trim	114.88	19.87
For Oak Or Maple, Add	23.27	
For Birch, Add	26.27	
For Mahogany, Add	63.81	
For Walnut Frame, Add	33.78	
06 48 16 00-0005 EA 3' x 7' Pine Interior Door Frame Custom Made With Threshold And Trim	116.61	20.38
For Oak Or Maple, Add	23.50	
For Birch, Add	26.53	
For Mahogany, Add	64.44	
For Walnut Frame, Add	34.11	
06 48 16 00-0006 EA 3'-4" x 7' Pine Interior Door Frame Custom Made With Threshold And Trim	119.27	20.89
For Oak Or Maple, Add	24.00	
For Birch, Add	27.10	
For Mahogany, Add	65.81	
For Walnut Frame, Add	34.84	
06 48 16 00-0007 EA 4' x 7' Pine Interior Door Frame Custom Made With Threshold And Trim	125.94	22.20
For Oak Or Maple, Add	25.27	
For Birch, Add	28.53	
For Mahogany, Add	69.28	
For Walnut Frame, Add	36.68	
06 48 16 00-0008 EA 5' x 7' Pine Interior Door Frame Custom Made With Threshold And Trim	133.69	24.01
For Oak Or Maple, Add	26.54	
For Birch, Add	29.97	
For Mahogany, Add	72.78	
For Walnut Frame, Add	38.53	
06 48 16 00-0009 EA 6' x 7' Pine Interior Door Frame Custom Made With Threshold And Trim	140.72	25.54
For Oak Or Maple, Add	27.81	
For Birch, Add	31.40	
For Mahogany, Add	76.25	
For Walnut Frame, Add	40.37	
06 48 16 00-0010 LF 4-9/16", Pine Interior Door Frame	4.83	1.74
For Oak Or Maple, Add	0.42	
For Birch, Add	0.47	
For Mahogany, Add	1.15	
For Walnut Frame, Add	0.61	

06 50 Structural Plastics (06)

06 51 Structural Plastic Shapes And Plates (06 50)

06 51 13 Plastic Lumber (06 51)

Note: Available in gray, redwood, black. Plastic lumber can be cut with saw for desired length or shape, drilled, screwed, nailed or stapled.

06 51 13 00-0001 Beams And Girders, Recycled Plastic Lumber (06 51 13)

06 51 13 00-0002 LF 2" x 6", Beam Or Girder, Recycled Plastic Lumber	8.49	1.17
For Reinforced Structural Plastic Lumber, Add	2.52	
Note: High density polyethylene combined with fiberglass.		
For Brown Color, Add	0.61	
For White Color, Add	2.90	
For All Other Colors (Except Black, Brown Or White), Add	2.46	
06 51 13 00-0003 LF 2" x 8", Beam Or Girder, Recycled Plastic Lumber	10.51	1.27
For Reinforced Structural Plastic Lumber, Add	3.22	
Note: High density polyethylene combined with fiberglass.		
For Brown Color, Add	0.78	
For White Color, Add	3.70	
For All Other Colors (Except Black, Brown Or White), Add	3.13	

06 Wood, Plastics, and Composites**06 50 Structural Plastics****06 51 Structural Plastic Shapes And Plates**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 51 13 00-0004	LF	2" x 10", Beam Or Girder, Recycled Plastic Lumber	.....	12.78	1.37
		<i>For Reinforced Structural Plastic Lumber, Add</i>		4.01	
		<i>Note: High density polyethylene combined with fiberglass.</i>			
		<i>For Brown Color, Add</i>		0.97	
		<i>For White Color, Add</i>		4.60	
		<i>For All Other Colors (Except Black, Brown Or White), Add</i>		3.90	
06 51 13 00-0005	LF	3" x 10", Beam Or Girder, Recycled Plastic Lumber	.....	20.30	1.63
		<i>For Reinforced Structural Plastic Lumber, Add</i>		6.65	
		<i>Note: High density polyethylene combined with fiberglass.</i>			
		<i>For Brown Color, Add</i>		1.62	
		<i>For White Color, Add</i>		7.64	
		<i>For All Other Colors (Except Black, Brown Or White), Add</i>		6.47	
06 51 13 00-0006	LF	3" x 12", Beam Or Girder, Recycled Plastic Lumber	.....	22.82	1.83
		<i>For Reinforced Structural Plastic Lumber, Add</i>		7.48	
		<i>Note: High density polyethylene combined with fiberglass.</i>			
		<i>For Brown Color, Add</i>		1.82	
		<i>For White Color, Add</i>		8.59	
		<i>For All Other Colors (Except Black, Brown Or White), Add</i>		7.28	
06 51 13 00-0007	LF	4" x 4", Beam Or Girder, Recycled Plastic Lumber	.....	11.62	1.58
		<i>For Reinforced Structural Plastic Lumber, Add</i>		3.47	
		<i>Note: High density polyethylene combined with fiberglass.</i>			
		<i>For Brown Color, Add</i>		0.84	
		<i>For White Color, Add</i>		3.98	
		<i>For All Other Colors (Except Black, Brown Or White), Add</i>		3.37	
06 51 13 00-0008	LF	4" x 6", Beam Or Girder, Recycled Plastic Lumber	.....	16.38	1.68
		<i>For Reinforced Structural Plastic Lumber, Add</i>		5.18	
		<i>Note: High density polyethylene combined with fiberglass.</i>			
		<i>For Brown Color, Add</i>		1.26	
		<i>For White Color, Add</i>		5.95	
		<i>For All Other Colors (Except Black, Brown Or White), Add</i>		5.04	
06 51 13 00-0009	LF	5" x 5", Beam Or Girder, Recycled Plastic Lumber	.....	17.29	1.73
		<i>For Reinforced Structural Plastic Lumber, Add</i>		5.48	
		<i>Note: High density polyethylene combined with fiberglass.</i>			
		<i>For Brown Color, Add</i>		1.33	
		<i>For White Color, Add</i>		6.30	
		<i>For All Other Colors (Except Black, Brown Or White), Add</i>		5.34	
06 51 13 00-0010	LF	6" x 6", Beam Or Girder, Recycled Plastic Lumber	.....	23.34	1.88
		<i>For Reinforced Structural Plastic Lumber, Add</i>		7.64	
		<i>Note: High density polyethylene combined with fiberglass.</i>			
		<i>For Brown Color, Add</i>		1.86	
		<i>For White Color, Add</i>		8.78	
		<i>For All Other Colors (Except Black, Brown Or White), Add</i>		7.43	
06 51 13 00-0011	LF	6" x 8", Beam Or Girder, Recycled Plastic Lumber	.....	31.43	1.98
		<i>For Reinforced Structural Plastic Lumber, Add</i>		10.58	
		<i>Note: High density polyethylene combined with fiberglass.</i>			
		<i>For Brown Color, Add</i>		2.57	
		<i>For White Color, Add</i>		12.16	
		<i>For All Other Colors (Except Black, Brown Or White), Add</i>		10.30	
06 51 13 00-0012		Joists, Recycled Plastic Lumber <small>(06 51 13)</small>			
06 51 13 00-0013	LF	2" x 4", Joist, Recycled Plastic Lumber	.....	5.61	0.65
		<i>For Reinforced Structural Plastic Lumber, Add</i>		1.72	
		<i>Note: High density polyethylene combined with fiberglass.</i>			
		<i>For Brown Color, Add</i>		0.42	
		<i>For White Color, Add</i>		1.98	
		<i>For All Other Colors (Except Black, Brown Or White), Add</i>		1.68	
06 51 13 00-0014	LF	2" x 6", Joist, Recycled Plastic Lumber	.....	7.77	0.69
		<i>For Reinforced Structural Plastic Lumber, Add</i>		2.52	
		<i>Note: High density polyethylene combined with fiberglass.</i>			
		<i>For Brown Color, Add</i>		0.61	
		<i>For White Color, Add</i>		2.90	
		<i>For All Other Colors (Except Black, Brown Or White), Add</i>		2.46	
06 51 13 00-0015	LF	2" x 8", Joist, Recycled Plastic Lumber	.....	9.79	0.76
		<i>For Reinforced Structural Plastic Lumber, Add</i>		3.22	
		<i>Note: High density polyethylene combined with fiberglass.</i>			
		<i>For Brown Color, Add</i>		0.78	
		<i>For White Color, Add</i>		3.70	
		<i>For All Other Colors (Except Black, Brown Or White), Add</i>		3.13	
06 51 13 00-0016	LF	2" x 10", Joist, Recycled Plastic Lumber	.....	12.13	0.92
		<i>For Reinforced Structural Plastic Lumber, Add</i>		4.01	
		<i>Note: High density polyethylene combined with fiberglass.</i>			
		<i>For Brown Color, Add</i>		0.97	
		<i>For White Color, Add</i>		4.60	
		<i>For All Other Colors (Except Black, Brown Or White), Add</i>		3.90	
06 51 13 00-0017	LF	3" x 10", Joist, Recycled Plastic Lumber	.....	19.51	1.07
		<i>For Reinforced Structural Plastic Lumber, Add</i>		6.65	
		<i>Note: High density polyethylene combined with fiberglass.</i>			
		<i>For Brown Color, Add</i>		1.62	
		<i>For White Color, Add</i>		7.64	
		<i>For All Other Colors (Except Black, Brown Or White), Add</i>		6.47	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 51 13 00-0018 LF 3" x 12", Joist, Recycled Plastic Lumber .....22.17		1.37
For Reinforced Structural Plastic Lumber, Add	7.48	
Note: High density polyethylene combined with fiberglass.		
For Brown Color, Add	1.82	
For White Color, Add	8.59	
For All Other Colors (Except Black, Brown Or White), Add	7.28	
06 51 13 00-0019 LF 4" x 4", Joist, Recycled Plastic Lumber .....10.74		0.97
For Reinforced Structural Plastic Lumber, Add	3.47	
Note: High density polyethylene combined with fiberglass.		
For Brown Color, Add	0.84	
For White Color, Add	3.98	
For All Other Colors (Except Black, Brown Or White), Add	3.37	
06 51 13 00-0020 LF 4" x 6", Joist, Recycled Plastic Lumber .....15.44		1.02
For Reinforced Structural Plastic Lumber, Add	5.18	
Note: High density polyethylene combined with fiberglass.		
For Brown Color, Add	1.26	
For White Color, Add	5.95	
For All Other Colors (Except Black, Brown Or White), Add	5.04	
06 51 13 00-0021 LF 5" x 5", Joist, Recycled Plastic Lumber .....16.42		1.12
For Reinforced Structural Plastic Lumber, Add	5.48	
Note: High density polyethylene combined with fiberglass.		
For Brown Color, Add	1.33	
For White Color, Add	6.30	
For All Other Colors (Except Black, Brown Or White), Add	5.34	
06 51 13 00-0022 LF 6" x 6", Joist, Recycled Plastic Lumber .....22.46		1.27
For Reinforced Structural Plastic Lumber, Add	7.64	
Note: High density polyethylene combined with fiberglass.		
For Brown Color, Add	1.86	
For White Color, Add	8.78	
For All Other Colors (Except Black, Brown Or White), Add	7.43	
06 51 13 00-0023 LF 6" x 8", Joist, Recycled Plastic Lumber .....30.56		1.37
For Reinforced Structural Plastic Lumber, Add	10.58	
Note: High density polyethylene combined with fiberglass.		
For Brown Color, Add	2.57	
For White Color, Add	12.16	
For All Other Colors (Except Black, Brown Or White), Add	10.30	
06 51 13 00-0024 Columns, Recycled Plastic Lumber (06 51 13)		
06 51 13 00-0025 LF 4" x 4", Column, Recycled Plastic Lumber .....12.35		2.09
For Reinforced Structural Plastic Lumber, Add	3.47	
Note: High density polyethylene combined with fiberglass.		
For Brown Color, Add	0.84	
For White Color, Add	3.98	
For All Other Colors (Except Black, Brown Or White), Add	3.37	
06 51 13 00-0026 LF 4" x 6", Column, Recycled Plastic Lumber .....18.20		2.94
For Reinforced Structural Plastic Lumber, Add	5.18	
Note: High density polyethylene combined with fiberglass.		
For Brown Color, Add	1.26	
For White Color, Add	5.95	
For All Other Colors (Except Black, Brown Or White), Add	5.04	
06 51 13 00-0027 LF 5" x 5", Column, Recycled Plastic Lumber .....19.54		3.30
For Reinforced Structural Plastic Lumber, Add	5.48	
Note: High density polyethylene combined with fiberglass.		
For Brown Color, Add	1.33	
For White Color, Add	6.30	
For All Other Colors (Except Black, Brown Or White), Add	5.34	
06 51 13 00-0028 LF 6" x 6", Column, Recycled Plastic Lumber .....26.01		3.75
For Reinforced Structural Plastic Lumber, Add	7.64	
Note: High density polyethylene combined with fiberglass.		
For Brown Color, Add	1.86	
For White Color, Add	8.78	
For All Other Colors (Except Black, Brown Or White), Add	7.43	
06 51 13 00-0029 LF 6" x 8", Column, Recycled Plastic Lumber .....35.20		4.62
For Reinforced Structural Plastic Lumber, Add	10.58	
Note: High density polyethylene combined with fiberglass.		
For Brown Color, Add	2.57	
For White Color, Add	12.16	
For All Other Colors (Except Black, Brown Or White), Add	10.30	
06 51 13 00-0030 Walls, Recycled Plastic Lumber (06 51 13)		
06 51 13 00-0031 LF 2" x 3", Walls, Recycled Plastic Lumber .....5.03		0.65
For Reinforced Structural Plastic Lumber, Add	1.51	
Note: High density polyethylene combined with fiberglass.		
For Brown Color, Add	0.37	
For White Color, Add	1.73	
For All Other Colors (Except Black, Brown Or White), Add	1.47	
06 51 13 00-0032 LF 2" x 4", Walls, Recycled Plastic Lumber .....5.75		0.76
For Reinforced Structural Plastic Lumber, Add	1.72	
Note: High density polyethylene combined with fiberglass.		
For Brown Color, Add	0.42	
For White Color, Add	1.98	
For All Other Colors (Except Black, Brown Or White), Add	1.68	

06 Wood, Plastics, and Composites**06 50 Structural Plastics****06 51 Structural Plastic Shapes And Plates**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 51 13 00-0033	LF		2" x 6", Walls, Recycled Plastic Lumber	7.98	0.81
			<i>For Reinforced Structural Plastic Lumber, Add</i>	2.52	
			<i>Note: High density polyethylene combined with fiberglass.</i>		
			<i>For Brown Color, Add</i>	0.61	
			<i>For White Color, Add</i>	2.90	
			<i>For All Other Colors (Except Black, Brown Or White), Add</i>	2.46	
06 51 13 00-0034	LF		2" x 8", Walls, Recycled Plastic Lumber	9.93	0.86
			<i>For Reinforced Structural Plastic Lumber, Add</i>	3.22	
			<i>Note: High density polyethylene combined with fiberglass.</i>		
			<i>For Brown Color, Add</i>	0.78	
			<i>For White Color, Add</i>	3.70	
			<i>For All Other Colors (Except Black, Brown Or White), Add</i>	3.13	
06 51 13 00-0035			Other Shapes, Recycled Plastic Lumber <small>(06 51 13)</small>		
06 51 13 00-0036	LF		5/4" x 4", Other Shapes, Recycled Plastic Lumber	4.79	0.58
			<i>For Reinforced Structural Plastic Lumber, Add</i>	1.44	
			<i>Note: High density polyethylene combined with fiberglass.</i>		
			<i>For Brown Color, Add</i>	0.35	
			<i>For White Color, Add</i>	1.66	
			<i>For All Other Colors (Except Black, Brown Or White), Add</i>	1.40	
06 51 13 00-0037	LF		5/4" x 6", Other Shapes, Recycled Plastic Lumber	6.42	0.65
			<i>For Reinforced Structural Plastic Lumber, Add</i>	2.02	
			<i>Note: High density polyethylene combined with fiberglass.</i>		
			<i>For Brown Color, Add</i>	0.49	
			<i>For White Color, Add</i>	2.32	
			<i>For All Other Colors (Except Black, Brown Or White), Add</i>	1.97	
06 51 13 00-0038	LF		5/4" x 8", Other Shapes, Recycled Plastic Lumber	7.30	0.65
			<i>For Reinforced Structural Plastic Lumber, Add</i>	2.35	
			<i>Note: High density polyethylene combined with fiberglass.</i>		
			<i>For Brown Color, Add</i>	0.57	
			<i>For White Color, Add</i>	2.70	
			<i>For All Other Colors (Except Black, Brown Or White), Add</i>	2.29	
06 51 13 00-0039	LF		1" x 4", Other Shapes, Recycled Plastic Lumber	2.95	0.58
			<i>For Reinforced Structural Plastic Lumber, Add</i>	0.76	
			<i>Note: High density polyethylene combined with fiberglass.</i>		
			<i>For Brown Color, Add</i>	0.19	
			<i>For White Color, Add</i>	0.88	
			<i>For All Other Colors (Except Black, Brown Or White), Add</i>	0.74	
06 51 13 00-0040	LF		1" x 6", Other Shapes, Recycled Plastic Lumber	4.13	0.65
			<i>For Reinforced Structural Plastic Lumber, Add</i>	1.18	
			<i>Note: High density polyethylene combined with fiberglass.</i>		
			<i>For Brown Color, Add</i>	0.29	
			<i>For White Color, Add</i>	1.35	
			<i>For All Other Colors (Except Black, Brown Or White), Add</i>	1.14	
06 51 13 00-0041	LF		1" x 6", Tongue And Grooved, Other Shapes, Recycled Plastic Lumber	4.13	0.65
			<i>For Reinforced Structural Plastic Lumber, Add</i>	1.18	
			<i>Note: High density polyethylene combined with fiberglass.</i>		
			<i>For Brown Color, Add</i>	0.29	
			<i>For White Color, Add</i>	1.35	
			<i>For All Other Colors (Except Black, Brown Or White), Add</i>	1.14	
06 51 13 00-0042	LF		2" x 2", Other Shapes, Recycled Plastic Lumber	3.31	0.56
			<i>For Reinforced Structural Plastic Lumber, Add</i>	0.93	
			<i>Note: High density polyethylene combined with fiberglass.</i>		
			<i>For Brown Color, Add</i>	0.23	
			<i>For White Color, Add</i>	1.07	
			<i>For All Other Colors (Except Black, Brown Or White), Add</i>	0.90	
06 51 13 00-0043	LF		2" x 3", Other Shapes, Recycled Plastic Lumber	5.03	0.65
			<i>For Reinforced Structural Plastic Lumber, Add</i>	1.51	
			<i>Note: High density polyethylene combined with fiberglass.</i>		
			<i>For Brown Color, Add</i>	0.37	
			<i>For White Color, Add</i>	1.73	
			<i>For All Other Colors (Except Black, Brown Or White), Add</i>	1.47	
06 51 13 00-0044	LF		2" x 4", Other Shapes, Recycled Plastic Lumber	5.75	0.76
			<i>For Reinforced Structural Plastic Lumber, Add</i>	1.72	
			<i>Note: High density polyethylene combined with fiberglass.</i>		
			<i>For Brown Color, Add</i>	0.42	
			<i>For White Color, Add</i>	1.98	
			<i>For All Other Colors (Except Black, Brown Or White), Add</i>	1.68	
06 51 13 00-0045	LF		2" x 6", Other Shapes, Recycled Plastic Lumber	7.98	0.81
			<i>For Reinforced Structural Plastic Lumber, Add</i>	2.52	
			<i>Note: High density polyethylene combined with fiberglass.</i>		
			<i>For Brown Color, Add</i>	0.61	
			<i>For White Color, Add</i>	2.90	
			<i>For All Other Colors (Except Black, Brown Or White), Add</i>	2.46	
06 51 13 00-0046	LF		2" x 8", Other Shapes, Recycled Plastic Lumber	9.93	0.86
			<i>For Reinforced Structural Plastic Lumber, Add</i>	3.22	
			<i>Note: High density polyethylene combined with fiberglass.</i>		
			<i>For Brown Color, Add</i>	0.78	
			<i>For White Color, Add</i>	3.70	
			<i>For All Other Colors (Except Black, Brown Or White), Add</i>	3.13	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 51 13 00-0047 LF 2" x 10", Other Shapes, Recycled Plastic Lumber	12.13	0.92
For Reinforced Structural Plastic Lumber, Add	4.01	
Note: High density polyethylene combined with fiberglass.		
For Brown Color, Add	0.97	
For White Color, Add	4.60	
For All Other Colors (Except Black, Brown Or White), Add	3.90	
06 51 13 00-0048 LF 2" x 12", Other Shapes, Recycled Plastic Lumber	16.26	0.97
For Reinforced Structural Plastic Lumber, Add	5.51	
Note: High density polyethylene combined with fiberglass.		
For Brown Color, Add	1.34	
For White Color, Add	6.33	
For All Other Colors (Except Black, Brown Or White), Add	5.36	
06 51 13 00-0049 LF 3" x 4", Other Shapes, Recycled Plastic Lumber	8.39	0.89
For Reinforced Structural Plastic Lumber, Add	2.63	
Note: High density polyethylene combined with fiberglass.		
For Brown Color, Add	0.64	
For White Color, Add	3.03	
For All Other Colors (Except Black, Brown Or White), Add	2.56	
06 51 13 00-0050 LF 3" x 6", Other Shapes, Recycled Plastic Lumber	11.77	0.95
For Reinforced Structural Plastic Lumber, Add	3.86	
Note: High density polyethylene combined with fiberglass.		
For Brown Color, Add	0.94	
For White Color, Add	4.43	
For All Other Colors (Except Black, Brown Or White), Add	3.75	
06 51 13 00-0051 LF 3" x 8", Other Shapes, Recycled Plastic Lumber	16.04	1.02
For Reinforced Structural Plastic Lumber, Add	5.41	
Note: High density polyethylene combined with fiberglass.		
For Brown Color, Add	1.31	
For White Color, Add	6.21	
For All Other Colors (Except Black, Brown Or White), Add	5.26	
06 51 13 00-0052 LF 3" x 10", Other Shapes, Recycled Plastic Lumber	19.51	1.07
For Reinforced Structural Plastic Lumber, Add	6.65	
Note: High density polyethylene combined with fiberglass.		
For Brown Color, Add	1.62	
For White Color, Add	7.64	
For All Other Colors (Except Black, Brown Or White), Add	6.47	
06 51 13 00-0053 LF 3" x 12", Other Shapes, Recycled Plastic Lumber	22.17	1.37
For Reinforced Structural Plastic Lumber, Add	7.48	
Note: High density polyethylene combined with fiberglass.		
For Brown Color, Add	1.82	
For White Color, Add	8.59	
For All Other Colors (Except Black, Brown Or White), Add	7.28	
06 51 13 00-0054 LF 4" x 4", Other Shapes, Recycled Plastic Lumber	10.74	0.97
For Reinforced Structural Plastic Lumber, Add	3.47	
Note: High density polyethylene combined with fiberglass.		
For Brown Color, Add	0.84	
For White Color, Add	3.98	
For All Other Colors (Except Black, Brown Or White), Add	3.37	
06 51 13 00-0055 LF 4" x 6", Other Shapes, Recycled Plastic Lumber	15.44	1.02
For Reinforced Structural Plastic Lumber, Add	5.18	
Note: High density polyethylene combined with fiberglass.		
For Brown Color, Add	1.26	
For White Color, Add	5.95	
For All Other Colors (Except Black, Brown Or White), Add	5.04	
06 51 13 00-0056 LF 4" x 8", Other Shapes, Recycled Plastic Lumber	22.01	1.10
For Reinforced Structural Plastic Lumber, Add	7.56	
Note: High density polyethylene combined with fiberglass.		
For Brown Color, Add	1.84	
For White Color, Add	8.69	
For All Other Colors (Except Black, Brown Or White), Add	7.36	
06 51 13 00-0057 LF 5" x 5", Other Shapes, Recycled Plastic Lumber	16.42	1.12
For Reinforced Structural Plastic Lumber, Add	5.48	
Note: High density polyethylene combined with fiberglass.		
For Brown Color, Add	1.33	
For White Color, Add	6.30	
For All Other Colors (Except Black, Brown Or White), Add	5.34	
06 51 13 00-0058 LF 6" x 6", Other Shapes, Recycled Plastic Lumber	22.46	1.27
For Reinforced Structural Plastic Lumber, Add	7.64	
Note: High density polyethylene combined with fiberglass.		
For Brown Color, Add	1.86	
For White Color, Add	8.78	
For All Other Colors (Except Black, Brown Or White), Add	7.43	
06 51 13 00-0059 LF 6" x 8", Other Shapes, Recycled Plastic Lumber	30.56	1.37
For Reinforced Structural Plastic Lumber, Add	10.58	
Note: High density polyethylene combined with fiberglass.		
For Brown Color, Add	2.57	
For White Color, Add	12.16	
For All Other Colors (Except Black, Brown Or White), Add	10.30	
06 51 13 00-0060 LF 6" x 12", Other Shapes, Recycled Plastic Lumber	45.24	1.53
For Reinforced Structural Plastic Lumber, Add	15.93	
Note: High density polyethylene combined with fiberglass.		
For Brown Color, Add	3.88	
For White Color, Add	18.30	
For All Other Colors (Except Black, Brown Or White), Add	15.50	

06 Wood, Plastics, and Composites**06 50 Structural Plastics****06 51 Structural Plastic Shapes And Plates**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 51 13 00-0061	LF	8" x 8", Other Shapes, Recycled Plastic Lumber	.....	39.40	1.47
		<i>For Reinforced Structural Plastic Lumber, Add</i>		13.80	
		<i>Note: High density polyethylene combined with fiberglass.</i>			
		<i>For Brown Color, Add</i>		3.36	
		<i>For White Color, Add</i>		15.85	
		<i>For All Other Colors (Except Black, Brown Or White), Add</i>		13.43	
06 51 13 00-0062	LF	8" x 10", Other Shapes, Recycled Plastic Lumber	.....	52.71	1.53
		<i>For Reinforced Structural Plastic Lumber, Add</i>		18.70	
		<i>Note: High density polyethylene combined with fiberglass.</i>			
		<i>For Brown Color, Add</i>		4.55	
		<i>For White Color, Add</i>		21.48	
		<i>For All Other Colors (Except Black, Brown Or White), Add</i>		18.19	
06 51 13 00-0063	LF	10" x 10", Other Shapes, Recycled Plastic Lumber	.....	72.67	1.60
		<i>For Reinforced Structural Plastic Lumber, Add</i>		26.05	
		<i>Note: High density polyethylene combined with fiberglass.</i>			
		<i>For Brown Color, Add</i>		6.34	
		<i>For White Color, Add</i>		29.92	
		<i>For All Other Colors (Except Black, Brown Or White), Add</i>		25.34	
06 51 13 00-0064	LF	2" Diameter, Other Shapes, Recycled Plastic Lumber	.....	3.62	0.51
		<i>For Reinforced Structural Plastic Lumber, Add</i>		1.07	
		<i>Note: High density polyethylene combined with fiberglass.</i>			
		<i>For Brown Color, Add</i>		0.26	
		<i>For White Color, Add</i>		1.23	
		<i>For All Other Colors (Except Black, Brown Or White), Add</i>		1.04	
06 51 13 00-0065	LF	3-1/2" Diameter, Other Shapes, Recycled Plastic Lumber	.....	10.62	0.65
		<i>For Reinforced Structural Plastic Lumber, Add</i>		3.58	
		<i>Note: High density polyethylene combined with fiberglass.</i>			
		<i>For Brown Color, Add</i>		0.87	
		<i>For White Color, Add</i>		4.11	
		<i>For All Other Colors (Except Black, Brown Or White), Add</i>		3.48	
06 51 13 00-0066	LF	4" Diameter, Other Shapes, Recycled Plastic Lumber	.....	11.69	0.76
		<i>For Reinforced Structural Plastic Lumber, Add</i>		3.92	
		<i>Note: High density polyethylene combined with fiberglass.</i>			
		<i>For Brown Color, Add</i>		0.95	
		<i>For White Color, Add</i>		4.51	
		<i>For All Other Colors (Except Black, Brown Or White), Add</i>		3.82	
06 51 13 00-0067	LF	5" Diameter, Other Shapes, Recycled Plastic Lumber	.....	14.48	0.92
		<i>For Reinforced Structural Plastic Lumber, Add</i>		4.88	
		<i>Note: High density polyethylene combined with fiberglass.</i>			
		<i>For Brown Color, Add</i>		1.19	
		<i>For White Color, Add</i>		5.60	
		<i>For All Other Colors (Except Black, Brown Or White), Add</i>		4.74	
06 51 13 00-0068	LF	6" Diameter, Other Shapes, Recycled Plastic Lumber	.....	32.29	1.07
		<i>For Reinforced Structural Plastic Lumber, Add</i>		11.38	
		<i>Note: High density polyethylene combined with fiberglass.</i>			
		<i>For Brown Color, Add</i>		2.77	
		<i>For White Color, Add</i>		13.07	
		<i>For All Other Colors (Except Black, Brown Or White), Add</i>		11.07	
06 51 13 00-0069	SF	1/8" Thick, Other Shapes, Recycled Plastic Sheeting	.....	3.49	0.56
06 51 13 00-0070	SF	1/4" Thick, Other Shapes, Recycled Plastic Sheeting	.....	5.74	0.58
06 51 13 00-0071	SF	3/8" Thick, Other Shapes, Recycled Plastic Sheeting	.....	7.73	0.62
06 51 13 00-0072	SF	1/2" Thick, Other Shapes, Recycled Plastic Sheeting	.....	11.88	0.64

06 52 Plastic Structural Assemblies (06 50)**06 52 13 Plastic Columns** (06 52)**06 52 13 00-0001 Round Fiberglass Columns** (06 52 13)

06 52 13 00-0002	LF	6" Diameter, Round Fiberglass Column	.....	16.18	5.48
06 52 13 00-0003	LF	8" Diameter, Round Fiberglass Column	.....	22.82	7.97
06 52 13 00-0004	LF	10" Diameter, Round Fiberglass Column	.....	26.57	8.98
06 52 13 00-0005	LF	12" Diameter, Round Fiberglass Column	.....	33.19	9.39
06 52 13 00-0006	LF	15" Diameter, Round Fiberglass Column	.....	40.60	10.85
06 52 13 00-0007	EA	6" Diameter, Base And Cap For Round Fiberglass Columns	.....	31.23	10.39
06 52 13 00-0008	EA	8" Diameter, Base And Cap For Round Fiberglass Columns	.....	34.65	11.22
06 52 13 00-0009	EA	10" Diameter, Base And Cap For Round Fiberglass Columns	.....	40.99	12.46
06 52 13 00-0010	EA	12" Diameter, Base And Cap For Round Fiberglass Columns	.....	57.46	13.29
06 52 13 00-0011	EA	15" Diameter, Base And Cap For Round Fiberglass Columns	.....	78.54	14.54

06 52 13 00-0012 Fluted Fiberglass Columns (06 52 13)

06 52 13 00-0013	LF	6" Diameter, Fluted Fiberglass Column	.....	17.20	5.48
06 52 13 00-0014	LF	8" Diameter, Fluted Fiberglass Column	.....	24.18	7.97
06 52 13 00-0015	LF	10" Diameter, Fluted Fiberglass Column	.....	28.30	8.98
06 52 13 00-0016	LF	12" Diameter, Fluted Fiberglass Column	.....	36.09	9.39
06 52 13 00-0017	LF	15" Diameter, Fluted Fiberglass Column	.....	44.38	10.89
06 52 13 00-0018	EA	6" Diameter, Base And Cap For Fluted Fiberglass Columns	.....	33.32	10.39
06 52 13 00-0019	EA	8" Diameter, Base And Cap For Fluted Fiberglass Columns	.....	37.10	11.22
06 52 13 00-0020	EA	10" Diameter, Base And Cap For Fluted Fiberglass Columns	.....	44.21	12.46
06 52 13 00-0021	EA	12" Diameter, Base And Cap For Fluted Fiberglass Columns	.....	63.63	13.29
06 52 13 00-0022	EA	15" Diameter, Base And Cap For Fluted Fiberglass Columns	.....	88.43	14.54



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 52 13 00-0023 Ornamental Or Decorative Cap And Base For Fiberglass Columns <small>(06 52 13)</small>		
06 52 13 00-0024 EA 8" Roman Ionic Cap And Base For Fiberglass Columns	135.53	12.46
06 52 13 00-0025 EA 10" Roman Ionic Cap And Base For Fiberglass Columns	180.98	14.54
06 52 13 00-0026 EA 12" Roman Ionic Cap And Base For Fiberglass Columns	232.04	16.61
06 52 13 00-0027 EA 8" Scamozzi Cap And Base For Fiberglass Columns	161.43	12.46
06 52 13 00-0028 EA 10" Scamozzi Cap And Base For Fiberglass Columns	194.28	14.54
06 52 13 00-0029 EA 12" Scamozzi Cap And Base For Fiberglass Columns	283.84	16.61
06 52 13 00-0030 EA 8" Corinthian Cap And Base For Fiberglass Columns	203.43	12.46
06 52 13 00-0031 EA 10" Corinthian Cap And Base For Fiberglass Columns	246.78	14.54
06 52 13 00-0032 EA 12" Corinthian Cap And Base For Fiberglass Columns	327.24	16.61
06 52 13 00-0033 EA 8" Temple Of Winds Cap And Base For Fiberglass Columns	137.63	12.46
06 52 13 00-0034 EA 10" Temple Of Winds Cap And Base For Fiberglass Columns	185.18	14.54
06 52 13 00-0035 EA 12" Temple Of Winds Cap And Base For Fiberglass Columns	236.24	16.61
06 52 13 00-0036 EA 8" Greek Erectheum Cap And Base For Fiberglass Columns	137.63	12.46
06 52 13 00-0037 EA 10" Greek Erectheum Cap And Base For Fiberglass Columns	165.58	14.54
06 52 13 00-0038 EA 12" Greek Erectheum Cap And Base For Fiberglass Columns	218.74	16.61
 06 53 Plastic Decking <small>(06 50)</small>		
06 53 16 Plastic Stair Treads <small>(06 53)</small>		
06 53 16 00-0001 Fiberglass Reinforced Plastic Stair Treads <small>(06 53 16)</small>		
Note: Includes standard colors and anchors. Excludes stringers.		
06 53 16 00-0002 LF 1" Fiberglass Reinforced Plastic Stair Tread With Safety Nosing, 12" Wide Excluding Stringer.....	24.19	2.15
06 53 16 00-0003 LF 1-1/2" Fiberglass Reinforced Plastic Stair Tread With Safety Nosing, 12" Wide Excluding Stringer.....	28.55	2.59
06 53 16 00-0004 LF 2" Fiberglass Reinforced Plastic Stair Tread With Safety Nosing, 12" Wide Excluding Stringer.....	45.93	2.84
 06 60 Plastic Fabrications <small>(06)</small>		
06 65 Plastic Trim <small>(06 60)</small>		
06 65 00 00-0001 Plastic Moldings <small>(06 65)</small>		
Note: All dimensions are nominal.		
06 65 00 00-0002 Base, Plastic Moldings <small>(06 65 00 00-0001)</small>		
06 65 00 00-0003 LF 3-1/2" High, Base, Plastic Molding.....	3.94	1.44
06 65 00 00-0004 LF 4-1/2" High, Base, Plastic Molding.....	4.82	1.79
06 65 00 00-0005 LF 3/4" x 1", Base Shoe, Plastic Molding.....	3.72	1.51
 06 65 00 00-0006 Cornice, Plastic Moldings <small>(06 65 00 00-0001)</small>		
06 65 00 00-0007 LF 1" x 2" Cornice, Plastic Molding	3.67	1.44
06 65 00 00-0008 LF 1" x 4" Cornice, Plastic Molding	4.43	1.51
06 65 00 00-0009 LF 1" x 6" Cornice, Plastic Molding	5.86	1.58
06 65 00 00-0010 LF 1" x 8" Cornice, Plastic Molding	6.66	1.65
06 65 00 00-0011 LF 1" x 10" Cornice, Plastic Molding	7.60	1.72
06 65 00 00-0012 LF 1" x 12" Cornice, Plastic Molding	9.54	1.79
 06 65 00 00-0013 Crown Or Bed, Plastic Moldings <small>(06 65 00 00-0001)</small>		
06 65 00 00-0014 LF 9/16" x 1-5/8" Crown Or Bed, Plastic Molding.....	6.06	1.44
06 65 00 00-0015 LF 9/16" x 2-1/4" Crown Or Bed, Plastic Molding.....	8.06	1.79
06 65 00 00-0016 LF 9/16" x 3-1/2" Crown Or Bed, Plastic Molding.....	8.37	1.79
06 65 00 00-0017 LF 9/16" x 3-5/8" Crown Or Bed, Plastic Molding.....	8.68	1.79
06 65 00 00-0018 LF 5/8" x 4-1/4" Crown Or Bed, Plastic Molding.....	11.24	2.16
06 65 00 00-0019 LF 11/16" x 4-5/8" Crown Or Bed, Plastic Molding.....	13.14	2.16
 06 65 00 00-0020 Dentil, Plastic Moldings <small>(06 65 00 00-0001)</small>		
06 65 00 00-0021 LF 11/16" x 1-3/8" Dentil, Plastic Molding	5.25	1.44
06 65 00 00-0022 LF 5/8" x 2-1/2" Dentil, Plastic Molding	5.83	1.44
06 65 00 00-0023 LF 1-3/8" x 3-3/8" Dentil, Plastic Molding	7.14	1.44
06 65 00 00-0024 LF 1-1/2" x 4-1/2" Dentil, Plastic Molding	9.41	1.44
 06 65 00 00-0025 Cove, Plastic Moldings <small>(06 65 00 00-0001)</small>		
06 65 00 00-0026 LF 3/8" x 3/8" Cove, Plastic Molding	2.10	0.79
06 65 00 00-0027 LF 1/2" x 1/2" Cove, Plastic Molding	2.25	0.79
06 65 00 00-0028 LF 5/8" x 5/8" Cove, Plastic Molding	2.92	0.94
06 65 00 00-0029 LF 3/4" x 3/4" Cove, Plastic Molding	2.92	0.94
06 65 00 00-0030 LF 15/16" x 15/16" Cove, Plastic Molding	3.60	0.94
06 65 00 00-0031 LF 9/16" x 1-3/4" Cove, Plastic Molding	4.68	1.08
06 65 00 00-0032 LF 11/16" x 2-3/4" Cove, Plastic Molding	6.12	1.08
 06 65 00 00-0033 Chair Rail, Plastic Moldings <small>(06 65 00 00-0001)</small>		
06 65 00 00-0034 LF 1/2" x 1-5/8" Chair Rail, Plastic Molding.....	3.44	1.08
06 65 00 00-0035 LF 5/8" x 2-1/2" Chair Rail, Plastic Molding.....	4.62	1.44

06 Wood, Plastics, and Composites**06 60 Plastic Fabrications****06 65 Plastic Trim**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 65 00 00-0036	LF		5/8" x 3-1/2" Chair Rail, Plastic Molding.....	5.50	1.44
06 65 00 00-0037			Door, Plastic Moldings (06 65 00 00-0001)		
06 65 00 00-0038	LF		1-1/8" Wide, Door, Plastic Molding	3.11	1.29
06 65 00 00-0039	LF		1-1/8" Wide, Detailed Door, Plastic Molding	3.13	1.29
06 65 00 00-0040			Trim, Plastic Moldings (06 65 00 00-0001)		
06 65 00 00-0041	LF		1/2" x 1/2" Quarter Round Trim, Plastic Molding.....	3.32	1.51
06 65 00 00-0042	LF		3/4" x 3/4" Quarter Round Trim, Plastic Molding.....	3.65	1.51
06 65 00 00-0043	LF		1-1/4" x 2" Brick Mould, Plastic Molding.....	4.11	1.44
06 65 00 00-0044	LF		1-17/32" x 1-1/2" x 1-3/8" Sill Nose, Plastic Molding.....	4.69	1.44
06 65 00 00-0045	LF		11/16" x 1-5/8" Drip Cap, Plastic Molding.....	3.55	1.44
06 65 00 00-0046	LF		2-3/4" x 2" Water Table, Plastic Molding.....	5.11	1.44
06 65 00 00-0047	LF		3/8" x 2" Garage Door Stop, Plastic Molding.....	3.87	1.44
06 65 00 00-0048			Extruded Polyvinyl Chloride (PVC) Trimboard (06 65)		
			Note: As manufactured by Azek or Kleer. All dimensions are nominal.		
06 65 00 00-0049	LF		1" x 4" Extruded Polyvinyl Chloride (PVC) Trimboard.....	2.42	0.57
06 65 00 00-0050	LF		1" x 6" Extruded Polyvinyl Chloride (PVC) Trimboard.....	3.42	0.64
06 65 00 00-0051	LF		1" x 8" Extruded Polyvinyl Chloride (PVC) Trimboard.....	4.45	0.71
06 65 00 00-0052	LF		1" x 10" Extruded Polyvinyl Chloride (PVC) Trimboard.....	5.35	0.74
06 65 00 00-0053	LF		1" x 12" Extruded Polyvinyl Chloride (PVC) Trimboard.....	6.32	0.76
06 65 00 00-0054	LF		5/4" x 4" Extruded Polyvinyl Chloride (PVC) Trimboard.....	2.94	0.57
06 65 00 00-0055	LF		5/4" x 6" Extruded Polyvinyl Chloride (PVC) Trimboard.....	4.22	0.64
06 65 00 00-0056	LF		5/4" x 8" Extruded Polyvinyl Chloride (PVC) Trimboard.....	5.34	0.71
06 65 00 00-0057	LF		5/4" x 10" Extruded Polyvinyl Chloride (PVC) Trimboard.....	6.57	0.74
06 65 00 00-0058	LF		5/4" x 12" Extruded Polyvinyl Chloride (PVC) Trimboard.....	7.68	0.76
06 65 00 00-0059	LF		3-1/2" x 3-1/2" Extruded Polyvinyl Chloride (PVC) Corner Board	6.29	0.74
06 65 00 00-0060	LF		5-1/2" x 5-1/2" Extruded Polyvinyl Chloride (PVC) Corner Board	8.29	0.76
06 65 00 00-0061	SF		1/2" Smooth/Wood Grain Reversible Extruded Polyvinyl Chloride (PVC) Sheets.....	4.42	0.64
06 65 00 00-0062	SF		3/4" Smooth/Wood Grain Reversible Extruded Polyvinyl Chloride (PVC) Sheets.....	6.32	0.71
06 70 Structural Composites (06)					
06 74 Composite Gratings (06 70)					
06 74 13 Fiberglass Reinforced Gratings (06 74)					
06 74 13 00-0001			Molded Fiberglass Gratings And Coverings (06 74 13)		
06 74 13 00-0002			Vi-Corr Resin System (06 74 13 00-0001)		
			Note: Orange or dark gray.		
06 74 13 00-0003	SF		1" Molded Fiberglass Grate, 1" x 4" Mesh, Vi-Corr Resin, Meniscus Top.....	29.91	1.55
06 74 13 00-0004	SF		1" Molded Fiberglass Grate, 1-1/2" Square Mesh, Vi-Corr Resin, Meniscus Top	29.07	1.55
06 74 13 00-0005	SF		1-1/2" Molded Fiberglass Grate, 1-1/2" Square Mesh, Vi-Corr Resin, Meniscus Top.....	37.80	1.55
06 74 13 00-0006	SF		2" Molded Fiberglass Grate, 2" x 2" Mesh, Vi-Corr Resin, Meniscus Top.....	41.02	1.98
06 74 13 00-0007	SF		1" Molded Fiberglass Grating, 1" x 4" Mesh, Vi-Corr Resin, Applied Grit Top	31.37	1.55
06 74 13 00-0008	SF		1" Molded Fiberglass Grate, 1-1/2" Square Mesh, Vi-Corr Resin, Applied Grit Top.....	30.50	1.55
06 74 13 00-0009	SF		1-1/2" Molded Fiberglass Grate, 1-1/2" Square Mesh, Vi-Corr Resin, Applied Grit Top	39.91	1.55
06 74 13 00-0010	SF		2" Molded Fiberglass Grating, 2" x 2" Mesh, Vi-Corr Resin, Applied Grit Top	43.00	1.98
06 74 13 00-0011	SF		1/4" Vi-Corr Resin Polyester Resin, Fiberplate Covering.....	28.28	1.24
06 74 13 00-0012	SF		1/2" Vi-Corr Resin Polyester Resin, Fiberplate Covering	45.63	1.36
06 74 13 00-0013	SF		3/4" Vi-Corr Resin Polyester Resin, Fiberplate Covering	62.43	1.50
06 74 13 00-0014			IFR Fire Retardant Isophthalic Resin (06 74 13 00-0001)		
06 74 13 00-0015	SF		1" Molded Fiberglass Grate, 1" x 4" Mesh, IFR Fire Retardant Isophthalic Resin, Meniscus Top	27.55	1.55
06 74 13 00-0016	SF		1" Molded Fiberglass Grate, 1-1/2" Square Mesh, IFR Fire Retardant Isophthalic Resin, Meniscus Top	25.83	1.55
06 74 13 00-0017	SF		1-1/2" Molded Fiberglass Grate, 1-1/2" Square Mesh, IFR Fire Retardant Isophthalic Resin, Meniscus Top.....	33.11	1.55
06 74 13 00-0018	SF		2" Molded Fiberglass Grating, 2" x 2" Mesh, IFR Fire Retardant Isophthalic Resin, Meniscus Top.....	35.81	1.98
06 74 13 00-0019	SF		1" Molded Fiberglass Grating, 1" x 4" Mesh, IFR Fire Retardant Isophthalic Resin, Applied Grit Top	28.74	1.55
06 74 13 00-0020	SF		1" Molded Fiberglass Grate, 1-1/2" Square Mesh, IFR Fire Retardant Isophthalic Resin, Applied Grit Top	26.51	1.55
06 74 13 00-0021	SF		1-1/2" Molded Fiberglass Grate, 1-1/2" Square Mesh, IFR Fire Retardant Isophthalic Resin, Applied Grit Top	36.07	1.98
06 74 13 00-0022	SF		2" Molded Fiberglass Grating, 2" x 2" Mesh, IFR Fire Retardant Isophthalic Resin, Applied Grit Top	37.78	1.98
06 74 13 00-0023	SF		1/4" IFR Fire Retardant Isophthalic Resin Polyester Resin, Fiberplate Covering.....	24.97	1.24
06 74 13 00-0024	SF		1/2" IFR Fire Retardant Isophthalic Resin Polyester Resin, Fiberplate Covering.....	35.24	1.36
06 74 13 00-0025	SF		3/4" IFR Fire Retardant Isophthalic Resin Polyester Resin, Fiberplate Covering.....	48.30	1.50
06 74 13 00-0026			Corvex Polyester Resin (06 74 13 00-0001)		
			Note: Dark gray.		
06 74 13 00-0027	SF		1" Molded Fiberglass Grate, 1" x 4" Mesh, Corvex Polyester Resin, Meniscus Top.....	23.44	1.55
06 74 13 00-0028	SF		1" Molded Fiberglass Grate, 1-1/2" Square Mesh, Corvex Polyester Resin, Meniscus Top	22.53	1.55
06 74 13 00-0029	SF		1-1/2" Molded Fiberglass Grate, 1-1/2" Square Mesh, Corvex Polyester Resin, Meniscus Top	27.22	1.55
06 74 13 00-0030	SF		2" Molded Fiberglass Grating, 2" x 2" Mesh, Corvex Polyester Resin, Meniscus Top	31.34	1.98
06 74 13 00-0031	SF		1" Molded Fiberglass Grating, 1" x 4" Mesh, Corvex Polyester Resin, Applied Grit Top.....	24.95	1.55
06 74 13 00-0032	SF		1" Molded Fiberglass Grate, 1-1/2" Square Mesh, Corvex Polyester Resin, Applied Grit Top.....	24.03	1.55



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 74 13 00-0033	SF			1-1/2" Molded Fiberglass Grate, 1-1/2" Square Mesh, Corvex Polyester Resin, Applied Grit Top	28.97	1.55
06 74 13 00-0034	SF			2" Molded Fiberglass Grating, 2" x 2" Mesh, Corvex Polyester Resin, Applied Grit Top	32.84	1.98
06 74 13 00-0035	SF			1/4" Corvex Polyester Resin, Fiberplate Covering	22.09	1.24
06 74 13 00-0036	SF			1/2" Corvex Polyester Resin, Fiberplate Covering	35.08	1.36
06 74 13 00-0037	SF			3/4" Corvex Polyester Resin, Fiberplate Covering	48.56	1.50
06 74 13 00-0038				XFR Extra Fire Retardant <small>(06 74 13 00-0001)</small>		
06 74 13 00-0039	SF			1" Molded Fiberglass Grate, 1" x 4" Mesh, XFR Extra Fire Retardant, Meniscus Top	34.29	1.55
06 74 13 00-0040	SF			1" Molded Fiberglass Grate, 1-1/2" Square Mesh, XFR Extra Fire Retardant, Meniscus Top	33.30	1.55
06 74 13 00-0041	SF			1-1/2" Molded Fiberglass Grate, 1-1/2" Square Mesh, XFR Extra Fire Retardant, Meniscus Top	45.43	1.55
06 74 13 00-0042	SF			2" Molded Fiberglass Grating, 2" x 2" Mesh, XFR Extra Fire Retardant, Meniscus Top	48.62	1.98
06 74 13 00-0043	SF			1" Molded Fiberglass Grating, 1" x 4" Mesh XFR Extra Fire Retardant, Applied Grit Top	35.77	1.55
06 74 13 00-0044	SF			1" Molded Fiberglass Grate, 1-1/2" Square Mesh, XFR Extra Fire Retardant, Applied Grit Top	34.80	1.55
06 74 13 00-0045	SF			1-1/2" Molded Fiberglass Grate, 1-1/2" Square Mesh, XFR Extra Fire Retardant, Applied Grit Top	47.18	1.55
06 74 13 00-0046	SF			2" Molded Fiberglass Grating, 2" x 2" Mesh, XFR Extra Fire Retardant, Applied Grit Top	50.75	1.98
06 74 13 00-0047	SF			1/4" XFR Extra Fire Retardant Resin, Fiberplate Covering	32.35	1.24
06 74 13 00-0048	SF			1/2" XFR Extra Fire Retardant Resin, Fiberplate Covering	52.13	1.36
06 74 13 00-0049				ELS Extremely Low Smoke Resin <small>(06 74 13 00-0001)</small>		
06 74 13 00-0050	SF			1" Molded Fiberglass Grate, 1" x 4" Mesh, ELS Extremity Low Smoke Resin, Meniscus Top	35.15	1.55
06 74 13 00-0051	SF			1" Molded Fiberglass Grate, 1-1/2" Square Mesh, ELS Extremity Low Smoke Resin, Meniscus Top	34.10	1.55
06 74 13 00-0052	SF			1-1/2" Molded Fiberglass Grate, 1-1/2" Square Mesh, ELS Extremity Low Smoke Resin, Meniscus Top	44.23	1.55
06 74 13 00-0053	SF			2" Molded Fiberglass Grating, 2" x 2" Mesh, ELS Extremity Low Smoke Resin, Meniscus Top	47.48	1.98
06 74 13 00-0054	SF			1" Molded Fiberglass Grating, 1" x 4" Mesh, ELS Extremity Low Smoke Resin, Applied Grit Top	36.52	1.55
06 74 13 00-0055	SF			1" Molded Fiberglass Grate, 1-1/2" Square Mesh, ELS Extremity Low Smoke Resin, Applied Grit Top	35.66	1.55
06 74 13 00-0056	SF			1-1/2" Molded Fiberglass Grate, 1-1/2" Square Mesh, ELS Extremity Low Smoke Resin, Applied Grit Top	45.91	1.55
06 74 13 00-0057	SF			2" Molded Fiberglass Grating, 2" x 2" Mesh, ELS Extremity Low Smoke Resin, Applied Grit Top	49.19	1.98
06 74 13 00-0058	SF			1/4" ELS Extremity Low Smoke Resin, Fiberplate Covering	36.12	1.24
06 74 13 00-0059	SF			1/2 ELS Extremity Low Smoke Resin, Fiberplate Covering	64.88	1.36
06 74 13 00-0060				Pultruded Fiberglass Grating <small>(06 74 13)</small>		
06 74 13 00-0061				ISOFR Isophthalic Polyester Resin System <small>(06 74 13 00-0060)</small>		
				Note: For moderately corrosive environments, green.		
06 74 13 00-0062				1" ISOFR Isophthalic Polyester Resin System <small>(06 74 13 00-0061)</small>		
06 74 13 00-0063	SF			1" Pultruded Fiberglass Grate, 6" Bar Space, 50% Open, ISOFR Isophthalic Polyester Resin	25.11	1.98
06 74 13 00-0064	SF			1" Pultruded Fiberglass Grate, 12" Bar Space, 50% Open, ISOFR Isophthalic Polyester Resin	22.33	1.55
06 74 13 00-0065	SF			1" Pultruded Fiberglass Grate, 6" Bar Space, 40% Open, ISOFR Isophthalic Polyester Resin	28.35	1.98
06 74 13 00-0066	SF			1" Pultruded Fiberglass Grate, 12" Bar Space, 40% Open, ISOFR Isophthalic Polyester Resin	26.24	1.55
06 74 13 00-0067	SF			1" Pultruded Fiberglass Grate, 6" Bar Space, 38% Open, ISOFR Isophthalic Polyester Resin	19.68	1.98
06 74 13 00-0068	SF			1" Pultruded Fiberglass Grate, 12" Bar Space, 38% Open, ISOFR Isophthalic Polyester Resin	17.48	1.55
06 74 13 00-0069	SF			1" Pultruded Fiberglass Grate, 6" Bar Space, 25% Open, ISOFR Isophthalic Polyester Resin	22.48	1.98
06 74 13 00-0070	SF			1" Pultruded Fiberglass Grate, 12" Bar Space, 25% Open, ISOFR Isophthalic Polyester Resin	20.34	1.55
06 74 13 00-0071				1-1/2" ISOFR Isophthalic Polyester Resin System <small>(06 74 13 00-0061)</small>		
06 74 13 00-0072	SF			1-1/2" Pultruded Fiberglass Grate, 6" Bar Space, 50% Open, ISOFR Isophthalic Polyester Resin	28.31	1.98
06 74 13 00-0073	SF			1-1/2" Pultruded Fiberglass Grate, 12" Bar Space, 50% Open, ISOFR Isophthalic Polyester Resin	25.61	1.55
06 74 13 00-0074	SF			1-1/2" Pultruded Fiberglass Grate, 6" Bar Space, 40% Open, ISOFR Isophthalic Polyester Resin	31.78	1.98
06 74 13 00-0075	SF			1-1/2" Pultruded Fiberglass Grate, 12" Bar Space, 40% Open, ISOFR Isophthalic Polyester Resin	29.84	1.55
06 74 13 00-0076	SF			1-1/2" Pultruded Fiberglass Grate, 6" Bar Space, 25% Open, ISOFR Isophthalic Polyester Resin	24.94	1.98
06 74 13 00-0077	SF			1-1/2" Pultruded Fiberglass Grate, 12" Bar Space, 25% Open, ISOFR Isophthalic Polyester Resin	22.79	1.55
06 74 13 00-0078				2" ISOFR Isophthalic Polyester Resin System <small>(06 74 13 00-0061)</small>		
06 74 13 00-0079	SF			2" Pultruded Fiberglass Grate, 6" Bar Space, 50% Open, ISOFR Isophthalic Polyester Resin	24.74	1.98
06 74 13 00-0080	SF			2" Pultruded Fiberglass Grate, 12" Bar Space, 50% Open, ISOFR Isophthalic Polyester Resin	27.32	1.98
06 74 13 00-0081	SF			2" Pultruded Fiberglass Grate, 6" Bar Space, 33% Open, ISOFR Isophthalic Polyester Resin	32.92	1.98
06 74 13 00-0082	SF			2" Pultruded Fiberglass Grate, 12" Bar Space, 33% Open, ISOFR Isophthalic Polyester Resin	31.09	1.98
06 74 13 00-0083				VERF Vinyl Ester Resin System <small>(06 74 13 00-0060)</small>		
06 74 13 00-0084				1" VERF Vinyl Ester Resin System <small>(06 74 13 00-0083)</small>		
06 74 13 00-0085	SF			1" Pultruded Fiberglass Grate, 6" Bar Space, 50% Open, VERF Vinyl Ester Resin	26.57	1.55
06 74 13 00-0086	SF			1" Pultruded Fiberglass Grate, 12" Bar Space, 50% Open, VERF Vinyl Ester Resin	23.80	1.55
06 74 13 00-0087	SF			1" Pultruded Fiberglass Grate, 6" Bar Space, 40% Open, VERF Vinyl Ester Resin	29.84	1.55
06 74 13 00-0088	SF			1" Pultruded Fiberglass Grate, 12" Bar Space, 40% Open, VERF Vinyl Ester Resin	34.20	1.55
06 74 13 00-0089	SF			1" Pultruded Fiberglass Grate, 6" Bar Space, 38% Open, VERF Vinyl Ester Resin	20.48	1.55
06 74 13 00-0090	SF			1" Pultruded Fiberglass Grate, 12" Bar Space, 38% Open, VERF Vinyl Ester Resin	18.34	1.55
06 74 13 00-0091	SF			1" Pultruded Fiberglass Grate, 6" Bar Space, 25% Open, VERF Vinyl Ester Resin	23.46	1.55
06 74 13 00-0092	SF			1" Pultruded Fiberglass Grate, 12" Bar Space, 25% Open, VERF Vinyl Ester Resin	21.55	1.55
06 74 13 00-0093				1-1/2" VERF Vinyl Ester Resin System <small>(06 74 13 00-0083)</small>		
06 74 13 00-0094	SF			1-1/2" Pultruded Fiberglass Grate, 6" Bar Space, 50% Open, VERF Vinyl Ester Resin	29.14	1.55
06 74 13 00-0095	SF			1-1/2" Pultruded Fiberglass Grate, 12" Bar Space, 50% Open, VERF Vinyl Ester Resin	26.40	1.55

06 Wood, Plastics, and Composites**06 70 Structural Composites****06 74 Composite Gratings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 74 13 00-0096	SF		1-1/2" Pultruded Fiberglass Grate, 6" Bar Space, 40% Open, VEF Vinyl Ester Resin	33.26	1.55
06 74 13 00-0097	SF		1-1/2" Pultruded Fiberglass Grate, 12" Bar Space, 40% Open, VEF Vinyl Ester Resin	31.08	1.55
06 74 13 00-0098	SF		1-1/2" Pultruded Fiberglass Grate, 6" Bar Space, 25% Open, VEF Vinyl Ester Resin	26.22	1.55
06 74 13 00-0099	SF		1-1/2" Pultruded Fiberglass Grate, 12" Bar Space, 25% Open, VEF Vinyl Ester Resin	24.18	1.55
06 74 13 00-0100			2" VEF Vinyl Ester Resin System (06 74 13 00-0083)		
06 74 13 00-0101	SF		2" Pultruded Fiberglass Grate, 6" Bar Space, 50% Open, VEF Vinyl Ester Resin	25.96	1.98
06 74 13 00-0102	SF		2" Pultruded Fiberglass Grate, 12" Bar Space, 50% Open, VEF Vinyl Ester Resin	23.98	1.98
06 74 13 00-0103	SF		2" Pultruded Fiberglass Grate, 6" Bar Space, 33% Open, VEF Vinyl Ester Resin	34.64	1.98
06 74 13 00-0104	SF		2" Pultruded Fiberglass Grate, 12" Bar Space, 33% Open, VEF Vinyl Ester Resin	33.66	1.98
06 74 13 00-0105			Moltruded Fiberglass Rigidex Grating (06 74 13 00-0060)		
06 74 13 00-0106	SF		Rigidex I, 1-1/2" Deep Fiberglass Grating, 1-1/2" x 4" Bar Space, Metallic Grey Color, Moltruded, Corvex Resin	11.84	1.72
06 74 13 00-0107	SF		Rigidex I, 2" Deep Fiberglass Grating, 1-1/2" x 4" Bar Space, Metallic Grey Color, Moltruded, Corvex Resin	14.31	2.15
06 74 13 00-0108	SF		Rigidex II, 1-1/2" Deep Fiberglass Grating, 1" x 4" Bar Space, Yellow Color, Moltruded, SOFR Resin	15.44	1.72
06 74 13 00-0109	SF		Rigidex II, 2" Deep Fiberglass Grating, 1" x 4" Bar Space, Yellow Color, Moltruded, ISOFR Resin	17.91	2.15

06 80 Composite Fabrications (06)**06 81 Composite Railings** (06 80)**06 81 13 Glass-Fiber-Reinforced Plastic Railings** (06 81)**06 81 13 00-0001 Fiberglass Handrail Assembly** (06 81 13)

Note: Assembly includes posts, rails, kick plates, fasteners and accessories. Not to be used in conjunction with handrail components.

06 81 13 00-0002	LF		Fiberglass Side Mount Handrail, 2 1/8" Square Tube Posts Up To 42" High, Set 5' On Center, Two Horizontal 1-3/4" Square Tube Rails, 4" Kickplate, Stainless Steel Fasteners And Accessories	55.96	17.21
			<i>For Each LF Of Anchoring Posts Into Masonry Or Concrete, Add</i>	3.00	
			<i>For Sloped Floor Installation, Add</i>	4.52	
			<i>For Stair Installation (Without Kickplates), Add</i>	8.50	
06 81 13 00-0003	LF		Fiberglass Top Mount Handrail, 2 1/8" Square Tube Posts Up To 42" High, Set 5' On Center, Two Horizontal 1-3/4" Square Tube Rails, 4" Kickplate, Stainless Steel Fasteners And Accessories	62.26	16.13
06 81 13 00-0004	LF		Fiberglass Handrail For Stairs, 2 1/8" Square Tube Posts Up To 42" High, Set 5' On Center, Two Horizontal 1-3/4" Square Tube Rails, Stainless Steel Fasteners And Accessories	61.12	21.52

06 81 13 00-0005 Fiberglass Handrail Components (06 81 13)

Note: This section is only to be used when entire handrail assembly is not required.

06 81 13 00-0006	LF		Fiberglass Kickplate (12' Sections) With Splice Kit	13.27	4.31
06 81 13 00-0007	LF		Fiberglass Kickplate (24' sections) With Splice Kit	11.97	4.31
06 81 13 00-0008	EA		Fiberglass Side Mount Post For Handrail	122.47	25.82
06 81 13 00-0009	EA		Fiberglass Top Mount Post For Handrail With Stainless Steel Base	137.39	17.21
06 81 13 00-0010	LF		Fiberglass Square Tube For Horizontal Handrail, ISOFR 1-3/4" x 1/8" (12' sections)	14.59	5.16
06 81 13 00-0011	LF		Fiberglass Square Tube For Horizontal Handrail, ISOFR 1-3/4" x 1/8" (24' sections)	13.92	5.16
06 81 13 00-0012	LF		Fiberglass Square Tube For Horizontal Handrail, ISOFR 2-1/8" x 3/16" (21' sections)	14.92	5.16

06 82 Composite Trim (06 80)**06 82 00 00-0001 Fiberglass Castings** (06 82)**06 82 00 00-0002 Fiberglass Angle, Equal Legs** (06 82 00 00-0001)

06 82 00 00-0003	LF		1" x 1" x 1/8" Thick Fiberglass Angle, ISOFR Isophthalic Polyester Resin	7.15	2.59
06 82 00 00-0004	LF		1" x 1" x 1/8" Thick Fiberglass Angle, VEF Vinyl Ester Resin	7.46	2.59
06 82 00 00-0005	LF		3" x 3" x 1/4" Thick Fiberglass Angle, ISOFR Isophthalic Polyester Resin	12.83	3.10
06 82 00 00-0006	LF		3" x 3" x 1/4" Thick Fiberglass Angle, VEF Vinyl Ester Resin	14.07	3.10
06 82 00 00-0007	LF		4" x 4" x 1/4" Thick Fiberglass Angle, ISOFR Isophthalic Polyester Resin	14.15	3.10
06 82 00 00-0008	LF		4" x 4" x 1/4" Thick Fiberglass Angle, VEF Vinyl Ester Resin	15.04	3.10
06 82 00 00-0009	LF		4" x 4" x 3/8" Thick Fiberglass Angle, ISOFR Isophthalic Polyester Resin	16.25	3.10
06 82 00 00-0010	LF		4" x 4" x 3/8" Thick Fiberglass Angle, VEF Vinyl Ester Resin	18.17	3.10
06 82 00 00-0011	LF		6" x 6" x 1/2" Thick Fiberglass Angle, ISOFR Isophthalic Polyester Resin	42.42	3.87
06 82 00 00-0012	LF		6" x 6" x 1/2" Thick Fiberglass Angle, VEF Vinyl Ester Resin	48.61	3.87

06 82 00 00-0013 Fiberglass Channels (06 82 00 00-0001)

06 82 00 00-0014	LF		3" x 1" x 1/4" Fiberglass Channel, ISOFR Isophthalic Polyester Resin	8.29	3.87
06 82 00 00-0015	LF		3" x 1" x 1/4" Fiberglass Channel, VEF Vinyl Ester Resin	8.60	3.87
06 82 00 00-0016	LF		4" x 1 1/8" x 1/4" Fiberglass Channel, ISOFR Isophthalic Polyester Resin	16.41	4.39
06 82 00 00-0017	LF		4" x 1 1/8" x 1/4" Fiberglass Channel, VEF Vinyl Ester Resin	16.41	4.39
06 82 00 00-0018	LF		6" x 1 11/16" x 3/8" Fiberglass Channel, ISOFR Isophthalic Polyester Resin	25.10	4.39
06 82 00 00-0019	LF		6" x 1 11/16" x 3/8" Fiberglass Channel, VEF Vinyl Ester Resin	29.01	4.39
06 82 00 00-0020	LF		8" x 2 3/16" x 3/8" Fiberglass Channel, ISOFR Isophthalic Polyester Resin	23.64	4.39
06 82 00 00-0021	LF		8" x 2 3/16" x 3/8" Fiberglass Channel, VEF Vinyl Ester Resin	28.66	4.39
06 82 00 00-0022	LF		10" x 2-3/4" x 1/2" Fiberglass Channel, ISOFR Isophthalic Polyester Resin	36.05	6.03
06 82 00 00-0023	LF		10" x 2-3/4" x 1/2" Fiberglass Channel, VEF Vinyl Ester Resin	41.09	6.03



		MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
06 82 00 00-0024 Fiberglass Wide Flange Beams <small>(06 82 00 00-0001)</small>				
	LF	4" x 4" x 1/4" Fiberglass Wide Flange Beam, ISOFR Isophthalic Polyester Resin.....	22.55	5.16
	LF	4" x 4" x 1/4" Fiberglass Wide Flange Beam, VERF Vinyl Ester Resin.....	24.50	5.16
	LF	6" x 6" x 1/4" Fiberglass Wide Flange Beam, ISOFR Isophthalic Polyester Resin.....	28.73	6.20
	LF	6" x 6" x 1/4" Fiberglass Wide Flange Beam, VERF Vinyl Ester Resin.....	29.66	6.20
	LF	8" x 8" x 3/8" Fiberglass Wide Flange Beam, ISOFR Isophthalic Polyester Resin.....	45.62	7.75
	LF	8" x 8" x 3/8" Fiberglass Wide Flange Beam, VERF Vinyl Ester Resin.....	56.63	7.75
	LF	10" x 10" x 1/2" Fiberglass Wide Flange Beam, ISOFR Isophthalic Polyester Resin.....	98.84	9.47
	LF	10" x 10" x 1/2" Fiberglass Wide Flange Beam, VERF Vinyl Ester Resin.....	110.87	9.47
06 82 00 00-0033 Fiberglass Flat Sheet <small>(06 82 00 00-0001)</small>				
Note: Not to be used for bathroom board.				
	SF	1/8" Thick Fiberglass Flat Sheet, ISOFR Isophthalic Polyester Resin.....	18.68	4.39
	SF	1/8" Thick Fiberglass Flat Sheet, VERF Vinyl Ester Resin.....	19.45	4.39
	SF	1/4" Thick Fiberglass Flat Sheet, ISOFR Isophthalic Polyester Resin.....	28.79	5.16
	SF	1/4" Thick Fiberglass Flat Sheet, VERF Vinyl Ester Resin.....	32.88	5.16
	SF	3/8" Thick Fiberglass Flat Sheet, ISOFR Isophthalic Polyester Resin.....	38.82	6.20
	SF	3/8" Thick Fiberglass Flat Sheet, VERF Vinyl Ester Resin.....	44.96	6.20
	SF	1/2" Thick Fiberglass Flat Sheet, ISOFR Isophthalic Polyester Resin.....	52.16	7.75
	SF	1/2" Thick Fiberglass Flat Sheet, VERF Vinyl Ester Resin.....	61.55	7.75
06 82 00 00-0042 Fiberglass Bars <small>(06 82 00 00-0001)</small>				
06 82 00 00-0043 Square Bars <small>(06 82 00 00-0042)</small>				
	LF	1" Square Fiberglass Solid Square Bar, ISO Isophthalic Polyester Resin.....	11.26	3.10
	LF	1-1/4" Square Fiberglass Solid Square Bar, ISO Isophthalic Polyester Resin.....	15.86	4.56
	LF	1-1/2" Square Fiberglass Solid Square Bar, ISOFR Isophthalic Polyester Resin.....	18.53	6.03
06 82 00 00-0047 Round Bars <small>(06 82 00 00-0042)</small>				
	LF	1/4" Diameter Fiberglass Solid Round Bar, ISOFR Isophthalic Polyester Resin.....	7.43	2.59
	LF	1" Diameter Fiberglass Solid Round Bar, ISOFR Isophthalic Polyester Resin.....	15.40	3.87
	LF	1" Diameter Fiberglass Solid Round Bar, VERF Vinyl Ester Resin.....	17.27	3.87
	LF	1-1/4" Diameter Fiberglass Solid Round Bar, ISOFR Isophthalic Polyester Resin.....	22.48	3.87
	LF	1-1/2" Diameter Fiberglass Solid Round Bar, ISOFR Isophthalic Polyester Resin.....	26.79	4.39
06 82 00 00-0053 Fiberglass Tubes <small>(06 82 00 00-0001)</small>				
06 82 00 00-0054 Square Tube <small>(06 82 00 00-0053)</small>				
	LF	1" x 1" x 1/8" Thick Fiberglass Square Tube, ISOFR Isophthalic Polyester Resin.....	8.27	2.59
	LF	1" x 1" x 1/8" Thick Fiberglass Square Tube, VERF Vinyl Ester Resin.....	8.87	2.59
	LF	2" x 2" x 1/8" Thick Fiberglass Square Tube, ISOFR Isophthalic Polyester Resin.....	12.00	3.10
	LF	2" x 2" x 1/8" Thick Fiberglass Square Tube, VERF Vinyl Ester Resin.....	13.06	3.10
	LF	3" x 3" x 1/4" Thick Fiberglass Square Tube, ISOFR Isophthalic Polyester Resin.....	22.25	3.87
	LF	3" x 3" x 1/4" Thick Fiberglass Square Tube, VERF Vinyl Ester Resin.....	24.71	3.87
	LF	4" x 4" x 1/4" Thick Fiberglass Square Tube, ISOFR Isophthalic Polyester Resin.....	26.21	4.65
	LF	4" x 4" x 1/4" Thick Fiberglass Square Tube, VERF Vinyl Ester Resin.....	33.05	4.65
06 82 00 00-0063 Round Tube <small>(06 82 00 00-0053)</small>				
	LF	1" Diameter x 1/8" Thick Fiberglass Round Tube, ISOFR Isophthalic Polyester Resin.....	7.95	2.59
	LF	1" Diameter x 1/8" Thick Fiberglass Round Tube, VERF Vinyl Ester Resin.....	8.23	2.59
	LF	2" Diameter x 1/4" Thick Fiberglass Round Tube, ISOFR Isophthalic Polyester Resin.....	14.36	3.10
	LF	2" Diameter x 1/4" Thick Fiberglass Round Tube, VERF Vinyl Ester Resin.....	15.26	3.10
06 82 00 00-0068 Fiberglass Threaded Rods <small>(06 82 00 00-0001)</small>				
	LF	3/8" Diameter Fiberglass Threaded Rod, VERF Vinyl Ester Resin.....	10.26	1.98
	LF	1/2" Diameter Fiberglass Threaded Rod, VERF Vinyl Ester Resin.....	10.88	1.98
	LF	5/8" Diameter Fiberglass Threaded Rod, VERF Vinyl Ester Resin.....	12.48	2.23
	LF	3/4" Diameter Fiberglass Threaded Rod, VERF Vinyl Ester Resin.....	13.69	2.23
	LF	1" Diameter Fiberglass Threaded Rod, VERF Vinyl Ester Resin.....	15.06	2.23
06 82 00 00-0074 Grating Support Legs, VEFR Resin <small>(06 82 00 00-0001)</small>				
	EA	Grating Support Legs, Fixed Height With Base Miscellaneous Fiberglass Castings.....	15.64	
	EA	Grate Support Legs Fixed Height Without Base Miscellaneous Fiberglass Castings.....	6.70	
	EA	Grating Support Legs, Adjustable To 60" Miscellaneous Fiberglass Castings.....	25.21	
06 82 00 00-0078 Fiberglass Netting <small>(06 82 00 00-0001)</small>				
	SF	1/2" x 1/2" Mesh, Clear Flexible Fiberglass Netting.....	0.61	0.29
	SF	1/2" x 2" Mesh, Clear Flexible Fiberglass Netting.....	0.61	0.29
	SF	3/4" x 5/8" Mesh, Clear Flexible Fiberglass Netting.....	0.61	0.29
	SF	7/8" x 7/8" Mesh, Clear Flexible Fiberglass Netting.....	0.61	0.29
	SF	1" x 1" Mesh, Clear Flexible Fiberglass Netting.....	0.61	0.29
	SF	1/2" x 1/2" Mesh, Green Flexible Fiberglass Netting.....	0.60	0.29

06 Wood, Plastics, and Composites**06 80 Composite Fabrications****06 82 Composite Trim**

MINOR			TOTAL DIRECT	DEMOLITION
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST
06 82 00 00-0085	SF	1/2" x 2" Mesh, Green Flexible Fiberglass Netting.....	0.60	0.29
06 82 00 00-0086	SF	3/4" x 5/8" Mesh, Green Flexible Fiberglass Netting.....	0.60	0.29
06 82 00 00-0087	SF	7/8" x 7/8" Mesh, Green Flexible Fiberglass Netting.....	0.60	0.29
06 82 00 00-0088	SF	1" x 1" Mesh, Green Flexible Fiberglass Netting.....	0.60	0.29
06 82 00 00-0089		Fiberglass Stair Treads <small>(06 82)</small>		
06 82 00 00-0090		Fiberglass Stair Treads <small>(06 82 00 00-0089)</small>		
06 82 00 00-0091		10-1/2" Deep Isophthalic Resin System <small>(06 82 00 00-0090)</small>		
06 82 00 00-0092	EA	1" Fiberglass Stair Tread, 10-1/2" Deep x 24" Wide Isophthalic Resin System	62.65	13.52
06 82 00 00-0093	EA	1" Fiberglass Stair Tread, 10-1/2" Deep x 30" Wide Isophthalic Resin System	71.59	13.52
06 82 00 00-0094	EA	1" Fiberglass Stair Tread, 10-1/2" Deep x 36" Wide Isophthalic Resin System	80.53	13.52
06 82 00 00-0095	EA	1" Fiberglass Stair Tread, 10-1/2" Deep x 42" Wide Isophthalic Resin System	89.47	13.52
06 82 00 00-0096	EA	1-1/2" Fiberglass Stair Tread, 10-1/2" Deep x 24" Wide Isophthalic Resin System	68.01	13.52
06 82 00 00-0097	EA	1-1/2" Fiberglass Stair Tread, 10-1/2" Deep x 30" Wide Isophthalic Resin System	78.29	13.52
06 82 00 00-0098	EA	1-1/2" Fiberglass Stair Tread, 10-1/2" Deep x 36" Wide Isophthalic Resin System	88.57	13.52
06 82 00 00-0099	EA	1-1/2" Fiberglass Stair Tread, 10-1/2" Deep x 42" Wide Isophthalic Resin System	98.85	13.52
06 82 00 00-0100	EA	2" Fiberglass Stair Tread, 10-1/2" Deep x 24" Wide Isophthalic Resin System	76.23	13.52
06 82 00 00-0101	EA	2" Fiberglass Stair Tread, 10-1/2" Deep x 30" Wide Isophthalic Resin System	88.57	13.52
06 82 00 00-0102	EA	2" Fiberglass Stair Tread, 10-1/2" Deep x 36" Wide Isophthalic Resin System	100.91	13.52
06 82 00 00-0103	EA	2" Fiberglass Stair Tread, 10-1/2" Deep x 42" Wide Isophthalic Resin System	113.24	13.52
06 82 00 00-0104		12" Deep Isophthalic Resin System <small>(06 82 00 00-0090)</small>		
06 82 00 00-0105	EA	1" Fiberglass Stair Tread, 12" Deep x 24" Wide Isophthalic Resin System	67.76	13.52
06 82 00 00-0106	EA	1" Fiberglass Stair Tread, 12" Deep x 30" Wide Isophthalic Resin System	77.97	13.52
06 82 00 00-0107	EA	1" Fiberglass Stair Tread, 12" Deep x 36" Wide Isophthalic Resin System	88.19	13.52
06 82 00 00-0108	EA	1" Fiberglass Stair Tread, 12" Deep x 42" Wide Isophthalic Resin System	98.41	13.52
06 82 00 00-0109	EA	1-1/2" Fiberglass Stair Tread, 12" Deep x 24" Wide Isophthalic Resin System	73.89	13.52
06 82 00 00-0110	EA	1-1/2" Fiberglass Stair Tread, 12" Deep x 30" Wide Isophthalic Resin System	85.63	13.52
06 82 00 00-0111	EA	1-1/2" Fiberglass Stair Tread, 12" Deep x 36" Wide Isophthalic Resin System	97.39	13.52
06 82 00 00-0112	EA	1-1/2" Fiberglass Stair Tread, 12" Deep x 42" Wide Isophthalic Resin System	109.13	13.52
06 82 00 00-0113	EA	2" Fiberglass Stair Tread, 12" Deep x 24" Wide Isophthalic Resin System	83.29	13.52
06 82 00 00-0114	EA	2" Fiberglass Stair Tread, 12" Deep x 30" Wide Isophthalic Resin System	97.38	13.52
06 82 00 00-0115	EA	2" Fiberglass Stair Tread, 12" Deep x 36" Wide Isophthalic Resin System	111.48	13.52
06 82 00 00-0116	EA	2" Fiberglass Stair Tread, 12" Deep x 42" Wide Isophthalic Resin System	125.58	13.52
06 82 00 00-0117		Other Fiberglass <small>(06 82)</small>		
06 82 00 00-0118		Fiberglass Splash Blocks <small>(06 82 00 00-0117)</small>		
06 82 00 00-0119	EA	Standard Size Fiberglass Splash Block	11.50	2.92

END OF SECTION 06



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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07 Thermal And Moisture Protection

07 01 Operation And Maintenance Of Thermal And Moisture Protection ⁽⁰⁷⁾

07 01 20 Maintenance Of Thermal Protection ^(07 01)

07 01 20 00-0001 Stucco Repair ^(07 01 20)

Note: Per location.

07 01 20 00-0002 Crack Repairs ^(07 01 20 00-0001)

Note: Includes plaster weld.

07 01 20 00-0003	LF	Up To 10', Chip, Clean And Repair Crack In Stucco	13.92
07 01 20 00-0004	LF	>10' To 50', Chip, Clean And Repair Crack In Stucco	11.16
07 01 20 00-0005	LF	>50' To 100', Chip, Clean And Repair Crack In Stucco	9.09
07 01 20 00-0006	LF	>100' To 250', Chip, Clean And Repair Crack In Stucco	7.02
07 01 20 00-0007	LF	>250' To 500', Chip, Clean And Repair Crack In Stucco	5.64
07 01 20 00-0008	LF	>500', Chip, Clean And Repair Crack In Stucco	4.27

07 01 20 00-0009 Hole Repairs ^(07 01 20 00-0001)

Note: Includes plaster weld.

07 01 20 00-0010	SF	Up To 10 SF, Cut And Patch Hole In Stucco To Match Existing	13.10
07 01 20 00-0011	SF	>10 To 50 SF, Cut And Patch Hole In Stucco To Match Existing	11.56
07 01 20 00-0012	SF	>50 To 100 SF, Cut And Patch Hole In Stucco To Match Existing	10.63
07 01 20 00-0013	SF	>100 To 250 SF, Cut And Patch Hole In Stucco To Match Existing	9.86
07 01 20 00-0014	SF	>250 To 500 SF, Cut And Patch Hole In Stucco To Match Existing	9.20
07 01 20 00-0015	SF	>500 SF, Cut And Patch Hole In Stucco To Match Existing	8.45

07 01 20 00-0016 Damage Repairs ^(07 01 20 00-0001)

Note: Includes plaster weld.

07 01 20 00-0017	SF	Up To 10 SF, Chip, Clean And Repair Stucco	24.92
07 01 20 00-0018	SF	>10 To 50 SF, Chip, Clean And Repair Stucco	18.02
07 01 20 00-0019	SF	>50 To 250 SF, Chip, Clean And Repair Stucco	13.19
07 01 20 00-0020	SF	>250 SF, Chip, Clean And Repair Stucco	10.44

07 01 50 Maintenance Of Membrane Roofing ^(07 01)

07 01 50 19 Preparation For Re-Roofing ^(07 01 50)

07 01 50 19-0001 Preparation For Re-Roofing ^(07 01 50 19)

07 01 50 19-0002	SQ	Remove Pea Gravel Ballast From Roof, Vacuum And Disposal	19.27
07 01 50 19-0003	SQ	Remove Gravel Ballast From Roof, Vacuum And Disposal	32.11

07 01 50 91 Roofing Restoration ^(07 01 50)

07 01 50 91-0001 Pressure Wash Membrane Roofing ^(07 01 50 91)

07 01 50 91-0002	SF	Up To 2,500 PSI, Pressure Wash Membrane Roofing	0.13
		<i>For Up To 100, Add</i>	<i>0.10</i>
		<i>For >100 To 250, Add</i>	<i>0.05</i>
		<i>For >250 To 500, Add</i>	<i>0.02</i>
		<i>For >5,000 To 10,000, Deduct</i>	<i>-0.01</i>
		<i>For >10,000 To 15,000, Deduct</i>	<i>-0.01</i>
		<i>For >15,000 To 30,000, Deduct</i>	<i>-0.02</i>
		<i>For >30,000, Deduct</i>	<i>-0.03</i>

07 05 Common Work Results For Thermal And Moisture Protection

⁽⁰⁷⁾

07 05 13 Small Quantities And Repairs For Roofing ^(07 05)

07 05 13 00-0001 Roof Repair ^(07 05 13)

Note: Less than 100 SF area.

07 05 13 00-0002	LF	Heat Weld Roofing Seams For Repair	4.85
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07 05 13 00-0003 Small Quantity Labor Set-Up Charge ^(07 05 13)

Note: For use with all roofing tasks where the total roof quantity is 4 squares or less. This adjustment is to allow for minimum charge for labor. Excludes material cost or labor to install material.

07 05 13 00-0004	EA	Labor Crew Up-Charge For 1 SQ Or Less	865.66
07 05 13 00-0005	EA	Labor Crew Up-Charge For >1 To 2 SQ	647.69
07 05 13 00-0006	EA	Labor Crew Up-Charge For >2 To 3 SQ	432.83
07 05 13 00-0007	EA	Labor Crew Up-Charge For >3 To 4 SQ	215.90

07 Thermal And Moisture Protection
07 05 Common Work Results For Thermal And Moisture Protection
07 05 13 Small Quantities And Repairs For Roofing



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 05 13 00-0008 Emergency Roof Patch (07 05 13) Note: 4 Hour response time.		
07 05 13 00-0009 EA Mobilize For Emergency Roof Patching.....	287.63	
07 05 13 00-0010 EA Granule Emergency Roof Patch Cover 16 SF	72.28	
07 05 13 00-0011 Adhesives (07 05 13) Note: For repair of seams.		
07 05 13 00-0012 Mastic Sealer (07 05 13 00-0011)		
07 05 13 00-0013 Applied At Joints Only (07 05 13 00-0012)		
07 05 13 00-0014 LF Mastic Sealer, 1/4" Bead At Joint.....	2.89	1.23

07 10 Dampproofing And Waterproofing (07)

Note: The following tasks are for application to vertical (walls and foundations) surfaces. For horizontal (flat) surfaces apply the appropriate modifier to reduce the labor cost. Waterproofing is the treatment of a surface or structure to PREVENT the passage of water under hydrostatic pressure. Dampproofing is the treatment of a surface or structure to RESIST the passage of water in the absence of hydrostatic pressure.

07 11 Dampproofing (07 10)

07 11 13 Bituminous Dampproofing (07 11)

07 11 13 00-0001 Fibrous Asphalt Dampproofing, Brush, Roller Or Spray (07 11 13)		
07 11 13 00-0002 CSF 1 Coat, Fibrous Asphalt Dampproofing, Brush, Roller Or Spray	103.61	
07 11 13 00-0003 CSF 2 Coats, Fibrous Asphalt Dampproofing, Brush, Roller Or Spray	161.23	
07 11 13 00-0004 Fibrous Asphalt Dampproofing, Troweled On (07 11 13)		
07 11 13 00-0005 CSF Primer And 1 Coat, Fibrous Asphalt Dampproofing, Troweled On.....	176.68	
07 11 13 00-0006 CSF Primer And 2 Coats, Fibrous Asphalt Dampproofing, Troweled On.....	271.81	
07 11 13 00-0007 Asphaltic Paint Dampproofing (07 11 13)		
07 11 13 00-0008 CSF 1 Coat, Asphaltic Paint Dampproofing, Brushed On.....	83.92	
07 11 13 00-0009 CSF 2 Coats, Asphaltic Paint Dampproofing, Brushed On	154.87	
07 11 19 Sheet Dampproofing (07 11)		
07 11 19 00-0001 Neoprene (07 11 19)		
07 11 19 00-0002 SF 1/16" Patch Neoprene Roof (5-20 SF).....	23.99	

07 13 Sheet Waterproofing (07 10)

07 13 13 Bituminous Sheet Waterproofing (07 13)

07 13 13 00-0001 15 LB Asphalt Saturated Organic Felt Sheet Waterproofing, Hot-Mopped (07 13 13)		
07 13 13 00-0002 CSF 1 Ply, 15 LB Asphalt Saturated Organic Felt Sheet Waterproofing, Hot-Mopped	191.62	75.42
For 30 LB Felt, Add	30.59	
For Application To Horizontal Surfaces, Deduct	-22.62	
07 13 13 00-0003 CSF 2 Ply, 15 LB Asphalt Saturated Organic Felt Sheet Waterproofing, Hot-Mopped	233.87	84.84
For 30 LB Felt, Add	48.14	
For Application To Horizontal Surfaces, Deduct	-25.45	
07 13 13 00-0004 CSF 3 Ply, 15 LB Asphalt Saturated Organic Felt Sheet Waterproofing, Hot-Mopped	276.11	94.27
For 30 LB Felt, Add	65.68	
For Application To Horizontal Surfaces, Deduct	-28.28	
07 13 13 00-0005 CSF 4 Ply, 15 LB Asphalt Saturated Organic Felt Sheet Waterproofing, Hot-Mopped	318.35	103.70
For 30 LB Felt, Add	83.22	
For Application To Horizontal Surfaces, Deduct	-31.11	
07 13 13 00-0006 CSF 5 Ply, 15 LB Asphalt Saturated Organic Felt Sheet Waterproofing, Hot-Mopped	360.61	113.13
For 30 LB Felt, Add	100.77	
For Application To Horizontal Surfaces, Deduct	-33.94	
07 13 13 00-0007 Asphalt Coated Protective Board (07 13 13)		
07 13 13 00-0008 CSF 1/8" Asphalt Coated Protective Board.....	177.76	69.36
For Application To Horizontal Surfaces, Deduct	-23.13	
07 13 13 00-0009 CSF 1/4" Asphalt Coated Protective Board.....	249.11	72.02
For Application To Horizontal Surfaces, Deduct	-24.01	
07 13 13 00-0010 CSF 3/8" Asphalt Coated Protective Board.....	335.20	75.05
For Application To Horizontal Surfaces, Deduct	-25.01	
07 13 13 00-0011 CSF 1/2" Asphalt Coated Protective Board.....	378.12	78.07
For Application To Horizontal Surfaces, Deduct	-26.03	

07 13 53 Elastomeric Sheet Waterproofing (07 13)

07 13 53 00-0001 Rubberized Membrane Sheet (07 13 53)		
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MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 13 53 00-0002 SF 215 Mil Rubberized Asphalt Membrane Sheet, Vertical Surface <i>For Floor Surfaces, Deduct</i>	5.24 -0.73	0.72
07 13 53 00-0003 Ethylene Propylene Diene Monomer (EPDM) (07 13 53)		
07 13 53 00-0004 CSF 45 Mil Ethylene Propylene Diene Monomer (EPDM) Membrane <i>For Application To Horizontal Surfaces, Deduct</i>	365.24 -30.24	100.83
07 13 53 00-0005 CSF 60 Mil Ethylene Propylene Diene Monomer (EPDM) Membrane <i>For Application To Horizontal Surfaces, Deduct</i>	440.76 -30.24	100.83
07 13 53 00-0006 Butyl Sheet Waterproofing (07 13 53)		
07 13 53 00-0007 CSF 1/32" Butyl Sheet Waterproofing..... <i>For Joint Taping, Add</i> <i>For Each Additional Ply, Add</i> <i>For Application To Horizontal Surfaces, Deduct</i>	73.67 9.49 54.10 -3.79	25.21
07 13 53 00-0008 CSF 1/16" Butyl Sheet Waterproofing..... <i>For Joint Taping, Add</i> <i>For Each Additional Ply, Add</i> <i>For Application To Horizontal Surfaces, Deduct</i>	89.07 10.26 64.88 -3.79	25.21
07 13 53 00-0009 Butyl With Nylon (07 13 53)		
07 13 53 00-0010 CSF 1/32" Butyl Elastomeric Waterproofing With Nylon <i>For Joint Taping, Add</i> <i>For Each Additional Ply, Add</i> <i>For Application To Horizontal Surfaces, Deduct</i>	82.47 9.93 60.26 -3.79	25.21
07 13 53 00-0011 CSF 1/16" Butyl Elastomeric Waterproofing With Nylon <i>For Joint Taping, Add</i> <i>For Each Additional Ply, Add</i> <i>For Application To Horizontal Surfaces, Deduct</i>	92.37 10.43 67.19 -3.79	25.21
07 13 53 00-0012 Neoprene Sheet Waterproofing (07 13 53)		
07 13 53 00-0013 CSF 1/32" Neoprene Sheet Waterproofing <i>For Joint Taping, Add</i> <i>For Each Additional Ply, Add</i> <i>For Application To Horizontal Surfaces, Deduct</i>	133.13 12.47 95.72 -3.79	25.21
07 13 53 00-0014 CSF 1/16" Neoprene Sheet Waterproofing <i>For Joint Taping, Add</i> <i>For Each Additional Ply, Add</i> <i>For Application To Horizontal Surfaces, Deduct</i>	198.69 15.74 141.61 -3.79	25.21
07 13 53 00-0015 Neoprene With Nylon (07 13 53)		
07 13 53 00-0016 CSF 1/32" Neoprene Elastomeric Waterproofing With Nylon <i>For Joint Taping, Add</i> <i>For Each Additional Ply, Add</i> <i>For Application To Horizontal Surfaces, Deduct</i>	139.97 12.81 100.51 -3.79	25.21
07 13 53 00-0017 CSF 1/16" Neoprene Elastomeric Waterproofing With Nylon <i>For Joint Taping, Add</i> <i>For Each Additional Ply, Add</i> <i>For Application To Horizontal Surfaces, Deduct</i>	209.62 16.29 149.26 -3.79	25.21
07 13 53 00-0018 Plastic Vapor Barrier (Polyethylene) (07 13 53)		
07 13 53 00-0019 CSF 4 Mil Polyethylene Vapor Barrier <i>For Joint Taping, Add</i> <i>For Each Additional Ply, Add</i> <i>For Application To Horizontal Surfaces, Deduct</i>	21.40 5.53 16.92 -2.91	8.76
07 13 53 00-0020 CSF 6 Mil Polyethylene Vapor Barrier <i>For Joint Taping, Add</i> <i>For Each Additional Ply, Add</i> <i>For Application To Horizontal Surfaces, Deduct</i>	22.30 5.58 17.55 -2.91	8.76
07 13 53 00-0021 CSF 10 Mil Polyethylene Vapor Barrier <i>For Joint Taping, Add</i> <i>For Each Additional Ply, Add</i> <i>For Application To Horizontal Surfaces, Deduct</i>	24.97 5.71 19.42 -2.91	8.76
07 13 53 00-0022 CSF 60 Mil Polyethylene Vapor Barrier With Bentonite <i>Note: Includes seam tape, liquid mastic, anchors and termination bar.</i> <i>For Joint Taping, Add</i> <i>For Each Additional Ply, Add</i> <i>For Application To Horizontal Surfaces, Deduct</i>	94.01 9.66 67.96 -3.23	8.76
07 13 53 00-0023 Plastic Vapor Barrier (PVC) (07 13 53)		
07 13 53 00-0024 CSF 10 Mil Polyvinyl Chloride (PVC) Vapor Barrier..... <i>For Joint Taping, Add</i> <i>For Each Additional Ply, Add</i> <i>For Application To Horizontal Surfaces, Deduct</i>	34.72 6.20 26.24 -2.91	9.70

07 Thermal And Moisture Protection**07 10 Dampproofing And Waterproofing****07 13 Sheet Waterproofing**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 13 53 00-0025	CSF		20 Mil Polyvinyl Chloride (PVC) Vapor Barrier	46.59	10.06
			<i>For Joint Taping, Add</i>	6.96	
			<i>For Each Additional Ply, Add</i>	34.63	
			<i>For Application To Horizontal Surfaces, Deduct</i>	-3.02	
07 13 53 00-0026	CSF		30 Mil Polyvinyl Chloride (PVC) Vapor Barrier	62.61	10.41
			<i>For Joint Taping, Add</i>	7.92	
			<i>For Each Additional Ply, Add</i>	45.91	
			<i>For Application To Horizontal Surfaces, Deduct</i>	-3.12	
07 13 53 00-0027			Vinyl Plastic Vapor Barrier (07 13 53)		
07 13 53 00-0028	CSF		Tu-Tuf 4, 4 Mil Vinyl Plastic Vapor Barrier With Fiberglass Insulation At Joints.....	26.21	8.98
07 14			Fluid-Applied Waterproofing (07 10)		
07 14 13			Hot Fluid-Applied Rubberized Asphalt Waterproofing (07 14)		
07 14 13 00-0001			Hot Applied Rubberized Asphalt Waterproofing Coating (07 14 13)		
07 14 13 00-0002	SF		90 Mil Hot Applied Rubberized Asphalt Waterproofing Coating, Vertical Surface.....	1.95	0.72
			Note: Includes primer.		
			<i>For Floor Surfaces, Deduct</i>	-0.31	
			<i>For Reinforcing Fabric, Add</i>	0.31	
07 14 13 00-0003	SF		125 Mil Hot Applied Rubberized Asphalt Waterproofing Coating, Vertical Surface.....	1.70	
			Note: Includes primer.		
			<i>For Floor Surfaces, Deduct</i>	-0.23	
			<i>For Application To Horizontal Surfaces, Deduct</i>	-0.15	
			<i>For Reinforcing Fabric, Add</i>	0.31	
07 16			Cementitious And Reactive Waterproofing (07 10)		
07 16 13			Polymer Modified Cement Waterproofing (07 16)		
07 16 13 00-0001	SF		Polymer Modified Cementitious Waterproofing Assembly, 2 Coats.....	3.35	
			Note: As manufactured by Thoro Consumer Products. Includes Thoroseal, Acryl 60, acrylic waterproof coating and white pigmented acrylic copolymer primer.		
07 16 16			Crystalline Waterproofing (07 16)		
07 16 16 00-0001	SF		Crystalline Cementitious Waterproofing, 2 Coats (Xypex Concentrate).....	4.03	
07 16 19			Metal Oxide Waterproofing (07 16)		
07 16 19 00-0001			Metallic Oxide Waterproofing (07 16 19)		
			Note: Includes one broom applied bond coat and three brush applied waterproof coats. Excludes concrete repairs to subbase and final protective concrete surface coat. See CSI section 03 54 16 00-0001 for self leveling underlayment for concrete floors.		
07 16 19 00-0002	CSF		Catalyzed Metallic Waterproofing Treatment, Metal Oxide Waterproofing (Euclid Iron Waterpeller).....	342.54	
			<i>For Application To Horizontal Surfaces, Deduct</i>	-45.14	
07 17			Bentonite Waterproofing (07 10)		
07 17 13			Bentonite Panel Waterproofing (07 17)		
07 17 13 00-0001	CSF		3/16" Bentonite Waterproofing Panels	323.16	82.75
			<i>For Application To Horizontal Surfaces, Deduct</i>	-24.83	
07 17 13 00-0002	CSF		1/4" Bentonite Waterproofing Panels	289.31	87.43
			<i>For Application To Horizontal Surfaces, Deduct</i>	-26.87	
07 17 13 00-0003	CSF		5/8" Bentonite Waterproofing Panels	412.51	91.18
			<i>For Application To Horizontal Surfaces, Deduct</i>	-27.35	
07 17 13 00-0004	CSF		3/8" Granular Bentonite, Troweled.....	331.75	75.84
			<i>For Application To Horizontal Surfaces, Deduct</i>	-22.74	
07 19			Water Repellents (07 10)		
07 19 13			Acrylic Sealer (07 19)		
			Note: Per coat.		
07 19 13 00-0001	SF		Acrylic Sealer, Spray On Concrete	1.56	
07 19 13 00-0002	SF		Acrylic Sealer, Spray On Concrete Block/Brick.....	1.87	
07 19 13 00-0003	SF		Acrylic Sealer, Spray On Stone.....	2.05	
07 19 16			Silane Water Repellents (07 19)		
07 19 16 00-0001			Silane Concrete Sealer (07 19 16)		
07 19 16 00-0002	SF		Water Based, Silane Penetrating Water Repellent, Spray On Concrete (Specchem SpecSilane 40 WB).....	0.39	
07 19 16 00-0003	SF		Water Based, Silane Penetrating Water Repellent, Spray On Concrete Block/Brick (Specchem SpecSilane 40 WB).....	0.58	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 19 16 00-0004 Silane/Siloxane Concrete Sealer <small>(07 19 16)</small>		
07 19 16 00-0005 SF Solvent Based, Silane/Siloxane Concrete Penetrating Sealer (Anti-Hydro Aridox 40).....	1.08	
<small>Note: 40% silane, alcohol based.</small>		
07 19 16 00-0006 SF Water-Based, Silane/Siloxane Concrete Sealer (Prosoco Inc. Saltguard WB)	0.31	
<small>Note: 200 SF/GAL</small>		
07 20 Thermal Protection <small>(07)</small>		
07 21 Thermal Insulation <small>(07 20)</small>		
07 21 13 Board Insulation <small>(07 21)</small>		
<small>Note: Types are stock sizes, mastic applied. See CSI section 07 22 16 00-0001 for rigid insulation for roofs.</small>		
07 21 13 13 Foam Board Insulation <small>(07 21 13)</small>		
07 21 13 13-0001 Foam Glass (Cellular Glass), Foam Board Insulation <small>(07 21 13 13)</small>		
07 21 13 13-0002 SF 1" Thick, R3.44, Foam Glass (Cellular Glass), Foam Board Insulation.....	2.25	0.25
<small>For Horizontal Surface Application, Deduct</small>		
<small>For Vapor Barrier, Integral With Insulation, Add</small>		
<small>For Mechanically Fastened To Wood Or Steel, Deduct</small>		
<small>For Mechanically Fastened To Concrete, Add</small>		
<small>For Mechanically Fastened To Gypsum, Add</small>		
07 21 13 13-0003 SF 1-1/2" Thick, R5.16, Foam Glass (Cellular Glass), Foam Board Insulation	3.15	0.25
<small>For Horizontal Surface Application, Deduct</small>		
<small>For Vapor Barrier, Integral With Insulation, Add</small>		
<small>For Mechanically Fastened To Wood Or Steel, Deduct</small>		
<small>For Mechanically Fastened To Concrete, Add</small>		
<small>For Mechanically Fastened To Gypsum, Add</small>		
07 21 13 13-0004 SF 2" Thick, R6.88, Foam Glass (Cellular Glass), Foam Board Insulation.....	3.75	0.25
<small>For Horizontal Surface Application, Deduct</small>		
<small>For Vapor Barrier, Integral With Insulation, Add</small>		
<small>For Mechanically Fastened To Wood Or Steel, Deduct</small>		
<small>For Mechanically Fastened To Concrete, Add</small>		
<small>For Mechanically Fastened To Gypsum, Add</small>		
07 21 13 13-0005 SF 2-3/4" Thick, R8.17, Foam Glass (Cellular Glass), Foam Board Insulation	4.95	0.26
<small>For Horizontal Surface Application, Deduct</small>		
<small>For Vapor Barrier, Integral With Insulation, Add</small>		
<small>For Mechanically Fastened To Wood Or Steel, Deduct</small>		
<small>For Mechanically Fastened To Concrete, Add</small>		
<small>For Mechanically Fastened To Gypsum, Add</small>		
07 21 13 13-0006 Expanded Polystyrene, Foam Board Insulation <small>(07 21 13 13)</small>		
07 21 13 13-0007 SF 3/8" Thick, R1.44, Molded Expanded Polystyrene, Foam Board Insulation (MEPS).....	0.99	0.24
<small>For Horizontal Surface Application, Deduct</small>		
<small>For Vapor Barrier, Integral With Insulation, Add</small>		
<small>For Mechanically Fastened To Wood Or Steel, Deduct</small>		
<small>For Mechanically Fastened To Concrete, Add</small>		
<small>For Mechanically Fastened To Gypsum, Add</small>		
07 21 13 13-0008 SF 1/2" Thick, R1.93, Molded Expanded Polystyrene, Foam Board Insulation (MEPS).....	1.04	0.24
<small>For Horizontal Surface Application, Deduct</small>		
<small>For Vapor Barrier, Integral With Insulation, Add</small>		
<small>For Mechanically Fastened To Wood Or Steel, Deduct</small>		
<small>For Mechanically Fastened To Concrete, Add</small>		
<small>For Mechanically Fastened To Gypsum, Add</small>		
07 21 13 13-0009 SF 3/4" Thick, R2.89, Molded Expanded Polystyrene, Foam Board Insulation (MEPS).....	1.19	0.24
<small>For Horizontal Surface Application, Deduct</small>		
<small>For Vapor Barrier, Integral With Insulation, Add</small>		
<small>For Mechanically Fastened To Wood Or Steel, Deduct</small>		
<small>For Mechanically Fastened To Concrete, Add</small>		
<small>For Mechanically Fastened To Gypsum, Add</small>		
07 21 13 13-0010 SF 1" Thick, R3.85, Molded Expanded Polystyrene, Foam Board Insulation (MEPS)	1.33	0.25
<small>For Horizontal Surface Application, Deduct</small>		
<small>For Vapor Barrier, Integral With Insulation, Add</small>		
<small>For Mechanically Fastened To Wood Or Steel, Deduct</small>		
<small>For Mechanically Fastened To Concrete, Add</small>		
<small>For Mechanically Fastened To Gypsum, Add</small>		
07 21 13 13-0011 SF 2" Thick, R7.70, Molded Expanded Polystyrene, Foam Board Insulation (MEPS)	1.91	0.25
<small>For Horizontal Surface Application, Deduct</small>		
<small>For Vapor Barrier, Integral With Insulation, Add</small>		
<small>For Mechanically Fastened To Wood Or Steel, Deduct</small>		
<small>For Mechanically Fastened To Concrete, Add</small>		
<small>For Mechanically Fastened To Gypsum, Add</small>		
07 21 13 13-0012 SF 3" Thick, R11.55, Molded Expanded Polystyrene, Foam Board Insulation (MEPS).....	2.49	0.26
<small>For Horizontal Surface Application, Deduct</small>		
<small>For Vapor Barrier, Integral With Insulation, Add</small>		
<small>For Mechanically Fastened To Wood Or Steel, Deduct</small>		
<small>For Mechanically Fastened To Concrete, Add</small>		
<small>For Mechanically Fastened To Gypsum, Add</small>		

07 Thermal And Moisture Protection**07 20 Thermal Protection****07 21 Thermal Insulation**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 21 13 13-0013	SF		4" Thick, R15.40, Molded Expanded Polystyrene, Foam Board Insulation (MEPS).....	3.07	0.27
			<i>For Horizontal Surface Application, Deduct</i>	-0.04	
			<i>For Vapor Barrier, Integral With Insulation, Add</i>	0.05	
			<i>For Mechanically Fastened To Wood Or Steel, Add</i>	0.01	
			<i>For Mechanically Fastened To Concrete, Add</i>	0.16	
			<i>For Mechanically Fastened To Gypsum, Add</i>	0.30	
07 21 13 13-0014	SF		5" Thick, R19.25, Molded Expanded Polystyrene, Foam Board Insulation (MEPS).....	3.65	0.27
			<i>For Horizontal Surface Application, Deduct</i>	-0.05	
			<i>For Vapor Barrier, Integral With Insulation, Add</i>	0.05	
			<i>For Mechanically Fastened To Wood Or Steel, Add</i>	0.07	
			<i>For Mechanically Fastened To Concrete, Add</i>	0.22	
			<i>For Mechanically Fastened To Gypsum, Add</i>	0.35	
07 21 13 13-0015	SF		6" Thick, R23.1, Molded Expanded Polystyrene, Foam Board Insulation (MEPS).....	4.24	0.28
			<i>For Horizontal Surface Application, Deduct</i>	-0.05	
			<i>For Vapor Barrier, Integral With Insulation, Add</i>	0.05	
			<i>For Mechanically Fastened To Wood Or Steel, Add</i>	0.28	
			<i>For Mechanically Fastened To Concrete, Add</i>	0.43	
			<i>For Mechanically Fastened To Gypsum, Add</i>	0.43	
07 21 13 13-0016			Extruded Polystyrene, Foam Board Insulation (07 21 13 13)		
			Note: 15 PSI compressive strength.		
07 21 13 13-0017	SF		3/8" Thick, R1.9, Extruded Polystyrene, Foam Board Insulation.....	1.12	0.24
			<i>For Horizontal Surface Application, Deduct</i>	-0.04	
			<i>For Vapor Barrier, Integral With Insulation, Add</i>	0.05	
			<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.14	
			<i>For Mechanically Fastened To Concrete, Add</i>	0.03	
			<i>For Mechanically Fastened To Gypsum, Add</i>	0.18	
			<i>For 25 PSI Compressive Strength, Add</i>	0.11	
			<i>For 40 PSI Compressive Strength, Add</i>	0.27	
			<i>For 60 PSI Compressive Strength, Add</i>	0.43	
			<i>For 115 PSI Compressive Strength, Add</i>	1.87	
07 21 13 13-0018	SF		1/2" Thick, R2.5, Extruded Polystyrene, Foam Board Insulation.....	1.31	0.24
			<i>For Horizontal Surface Application, Deduct</i>	-0.04	
			<i>For Vapor Barrier, Integral With Insulation, Add</i>	0.05	
			<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.14	
			<i>For Mechanically Fastened To Concrete, Add</i>	0.03	
			<i>For Mechanically Fastened To Gypsum, Add</i>	0.18	
			<i>For 25 PSI Compressive Strength, Add</i>	0.14	
			<i>For 40 PSI Compressive Strength, Add</i>	0.34	
			<i>For 60 PSI Compressive Strength, Add</i>	0.54	
			<i>For 115 PSI Compressive Strength, Add</i>	2.35	
07 21 13 13-0019	SF		3/4" Thick, R3.7, Extruded Polystyrene, Foam Board Insulation.....	1.46	0.24
			<i>For Horizontal Surface Application, Deduct</i>	-0.04	
			<i>For Vapor Barrier, Integral With Insulation, Add</i>	0.05	
			<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.14	
			<i>For Mechanically Fastened To Concrete, Add</i>	0.03	
			<i>For Mechanically Fastened To Gypsum, Add</i>	0.18	
			<i>For 25 PSI Compressive Strength, Add</i>	0.17	
			<i>For 40 PSI Compressive Strength, Add</i>	0.40	
			<i>For 60 PSI Compressive Strength, Add</i>	0.63	
			<i>For 115 PSI Compressive Strength, Add</i>	2.74	
07 21 13 13-0020	SF		1" Thick, R5.0, Extruded Polystyrene, Foam Board Insulation.....	1.54	0.25
			<i>For Horizontal Surface Application, Deduct</i>	-0.04	
			<i>For Vapor Barrier, Integral With Insulation, Add</i>	0.05	
			<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.14	
			<i>For Mechanically Fastened To Concrete, Add</i>	0.03	
			<i>For Mechanically Fastened To Gypsum, Add</i>	0.18	
			<i>For 25 PSI Compressive Strength, Add</i>	0.18	
			<i>For 40 PSI Compressive Strength, Add</i>	0.43	
			<i>For 60 PSI Compressive Strength, Add</i>	0.68	
			<i>For 115 PSI Compressive Strength, Add</i>	2.95	
07 21 13 13-0021	SF		2" Thick, R10.0, Extruded Polystyrene, Foam Board Insulation.....	2.33	0.25
			<i>For Horizontal Surface Application, Deduct</i>	-0.04	
			<i>For Vapor Barrier, Integral With Insulation, Add</i>	0.05	
			<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.09	
			<i>For Mechanically Fastened To Concrete, Add</i>	0.05	
			<i>For Mechanically Fastened To Gypsum, Add</i>	0.20	
			<i>For 25 PSI Compressive Strength, Add</i>	0.31	
			<i>For 40 PSI Compressive Strength, Add</i>	0.73	
			<i>For 60 PSI Compressive Strength, Add</i>	1.13	
			<i>For 115 PSI Compressive Strength, Add</i>	4.95	
07 21 13 13-0022	SF		3" Thick, R15.0, Extruded Polystyrene, Foam Board Insulation.....	3.12	0.26
			<i>For Horizontal Surface Application, Deduct</i>	-0.04	
			<i>For Vapor Barrier, Integral With Insulation, Add</i>	0.05	
			<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.05	
			<i>For Mechanically Fastened To Concrete, Add</i>	0.09	
			<i>For Mechanically Fastened To Gypsum, Add</i>	0.25	
			<i>For 25 PSI Compressive Strength, Add</i>	0.43	
			<i>For 40 PSI Compressive Strength, Add</i>	1.02	
			<i>For 60 PSI Compressive Strength, Add</i>	1.58	
			<i>For 115 PSI Compressive Strength, Add</i>	6.96	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 21 13 13-0023 SF 4" Thick, R20.0, Extruded Polystyrene, Foam Board Insulation	3.52	0.27
<i>For Horizontal Surface Application, Deduct</i>	-0.04	
<i>For Vapor Barrier, Integral With Insulation, Add</i>	0.05	
<i>For Mechanically Fastened To Wood Or Steel, Add</i>	0.01	
<i>For Mechanically Fastened To Concrete, Add</i>	0.16	
<i>For Mechanically Fastened To Gypsum, Add</i>	0.30	
<i>For 25 PSI Compressive Strength, Add</i>	0.49	
<i>For 40 PSI Compressive Strength, Add</i>	1.17	
<i>For 60 PSI Compressive Strength, Add</i>	1.81	
<i>For 115 PSI Compressive Strength, Add</i>	7.96	
07 21 13 16 Fibrous Board Insulation (07 21 13)		
07 21 13 16-0001 Wood Fiber (Cellulosic-Fiber), Fibrous Board Insulation (07 21 13 16)		
07 21 13 16-0002 SF 1" Thick, R2.6, Wood Fiber (Cellulosic-Fiber), Fibrous Board Insulation	1.44	0.31
<i>For Horizontal Surface Application, Deduct</i>	-0.05	
<i>For Vapor Barrier, Integral With Insulation, Add</i>	0.05	
<i>For Factory Painted On One Surface Add</i>	0.17	
<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.14	
<i>For Mechanically Fastened To Concrete, Add</i>	0.06	
<i>For Mechanically Fastened To Gypsum, Add</i>	0.21	
07 21 13 16-0003 SF 2" Thick, R5.2, Wood Fiber (Cellulosic-Fiber), Fibrous Board Insulation	2.14	0.37
<i>For Horizontal Surface Application, Deduct</i>	-0.06	
<i>For Vapor Barrier, Integral With Insulation, Add</i>	0.05	
<i>For Factory Painted On One Surface Add</i>	0.17	
<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.09	
<i>For Mechanically Fastened To Concrete, Add</i>	0.11	
<i>For Mechanically Fastened To Gypsum, Add</i>	0.26	
07 21 13 16-0004 SF 3" Thick, R7.8, Wood Fiber (Cellulosic-Fiber), Fibrous Board Insulation	2.82	0.43
<i>For Horizontal Surface Application, Deduct</i>	-0.07	
<i>For Vapor Barrier, Integral With Insulation, Add</i>	0.05	
<i>For Factory Painted On One Surface Add</i>	0.17	
<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.05	
<i>For Mechanically Fastened To Concrete, Add</i>	0.19	
<i>For Mechanically Fastened To Gypsum, Add</i>	0.35	
07 21 13 16-0005 Fiberglass, Fibrous Board Insulation (07 21 13 16)		
07 21 13 16-0006 SF 1" Thick, R4.2, Fiberglass, Fibrous Board Insulation	2.59	0.25
<i>For Horizontal Surface Application, Deduct</i>	-0.04	
<i>For Vapor Barrier, Integral With Insulation, Add</i>	0.05	
<i>For Factory Painted On One Surface Add</i>	0.17	
<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.14	
<i>For Mechanically Fastened To Concrete, Add</i>	0.03	
<i>For Mechanically Fastened To Gypsum, Add</i>	0.18	
07 21 13 16-0007 SF 1-1/2" Thick, R6.0, Fiberglass, Fibrous Board Insulation	2.90	0.25
<i>For Horizontal Surface Application, Deduct</i>	-0.04	
<i>For Vapor Barrier, Integral With Insulation, Add</i>	0.05	
<i>For Factory Painted On One Surface Add</i>	0.17	
<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.09	
<i>For Mechanically Fastened To Concrete, Add</i>	0.05	
<i>For Mechanically Fastened To Gypsum, Add</i>	0.18	
07 21 13 16-0008 SF 2" Thick, R8.0, Fiberglass, Fibrous Board Insulation	3.57	0.25
<i>For Horizontal Surface Application, Deduct</i>	-0.04	
<i>For Vapor Barrier, Integral With Insulation, Add</i>	0.05	
<i>For Factory Painted On One Surface Add</i>	0.17	
<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.09	
<i>For Mechanically Fastened To Concrete, Add</i>	0.05	
<i>For Mechanically Fastened To Gypsum, Add</i>	0.20	
07 21 13 16-0009 SF 2-1/2" Thick, R10.0, Fiberglass, Fibrous Board Insulation	4.11	0.25
<i>For Horizontal Surface Application, Deduct</i>	-0.04	
<i>For Vapor Barrier, Integral With Insulation, Add</i>	0.05	
<i>For Factory Painted On One Surface Add</i>	0.17	
<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.05	
<i>For Mechanically Fastened To Concrete, Add</i>	0.09	
<i>For Mechanically Fastened To Gypsum, Add</i>	0.23	
07 21 13 16-0010 SF 3" Thick, R12.4, Fiberglass, Fibrous Board Insulation	4.23	0.26
<i>For Horizontal Surface Application, Deduct</i>	-0.04	
<i>For Vapor Barrier, Integral With Insulation, Add</i>	0.05	
<i>For Factory Painted On One Surface Add</i>	0.17	
<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.05	
<i>For Mechanically Fastened To Concrete, Add</i>	0.09	
<i>For Mechanically Fastened To Gypsum, Add</i>	0.25	
07 21 13 19 Mineral Board Insulation (07 21 13)		
07 21 13 19-0001 High-Density Fiberboard, Mineral Board Insulation (07 21 13 19)		
07 21 13 19-0002 SF 1/2" Thick, R1.3, High-Density Fiberboard, Mineral Board Insulation	1.09	0.28
<i>For Horizontal Surface Application, Deduct</i>	-0.05	
<i>For Vapor Barrier, Integral With Insulation, Add</i>	0.05	
<i>For Factory Painted On One Surface Add</i>	0.17	
<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.14	
<i>For Mechanically Fastened To Concrete, Add</i>	0.04	
<i>For Mechanically Fastened To Gypsum, Add</i>	0.19	

07 Thermal And Moisture Protection**07 20 Thermal Protection****07 21 Thermal Insulation**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 21 13 19-0003	SF	25/32"	Thick, R1.9, High-Density Fiberboard, Mineral Board Insulation	1.31	0.29
			<i>For Horizontal Surface Application, Deduct</i>	-0.05	
			<i>For Vapor Barrier, Integral With Insulation, Add</i>	0.05	
			<i>For Factory Painted On One Surface Add</i>	0.17	
			<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.14	
			<i>For Mechanically Fastened To Concrete, Add</i>	0.05	
			<i>For Mechanically Fastened To Gypsum, Add</i>	0.20	
07 21 13 19-0004	SF	1"	Thick, R2.5, High-Density Fiberboard, Mineral Board Insulation	1.51	0.31
			<i>For Horizontal Surface Application, Deduct</i>	-0.05	
			<i>For Vapor Barrier, Integral With Insulation, Add</i>	0.05	
			<i>For Factory Painted On One Surface Add</i>	0.17	
			<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.14	
			<i>For Mechanically Fastened To Concrete, Add</i>	0.06	
			<i>For Mechanically Fastened To Gypsum, Add</i>	0.21	
07 21 13 19-0005	SF	1-1/2"	Thick, R3.8, High-Density Fiberboard, Mineral Board Insulation	1.89	0.34
			<i>For Horizontal Surface Application, Deduct</i>	-0.06	
			<i>For Vapor Barrier, Integral With Insulation, Add</i>	0.05	
			<i>For Factory Painted On One Surface Add</i>	0.17	
			<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.09	
			<i>For Mechanically Fastened To Concrete, Add</i>	0.09	
			<i>For Mechanically Fastened To Gypsum, Add</i>	0.22	
07 21 13 19-0006	SF	2"	Thick, R5.0, High-Density Fiberboard, Mineral Board Insulation	2.28	0.37
			<i>For Horizontal Surface Application, Deduct</i>	-0.06	
			<i>For Vapor Barrier, Integral With Insulation, Add</i>	0.05	
			<i>For Factory Painted On One Surface Add</i>	0.17	
			<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.09	
			<i>For Mechanically Fastened To Concrete, Add</i>	0.11	
			<i>For Mechanically Fastened To Gypsum, Add</i>	0.26	
07 21 13 19-0007	SF	3"	Thick, R7.5, High-Density Fiberboard, Mineral Board Insulation	1.07	0.43
			<i>For Horizontal Surface Application, Deduct</i>	-0.07	
			<i>For Vapor Barrier, Integral With Insulation, Add</i>	0.05	
			<i>For Factory Painted On One Surface Add</i>	0.17	
			<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.05	
			<i>For Mechanically Fastened To Concrete, Add</i>	0.19	
			<i>For Mechanically Fastened To Gypsum, Add</i>	0.35	

07 21 16 Blanket Insulation (07 21)

Note: All insulation rolls or batts applied to wood or steel studs or between rafters or between metal building "skin" and framing.

07 21 16 00-0001			Fiberglass Flexible Insulation (07 21 16)		
			Note: Rolls or batts.		
07 21 16 00-0002			Kraft Faced, Fiberglass Flexible Insulation (07 21 16 00-0001)		
07 21 16 00-0003	SF	3-1/2"	Thick, Kraft Faced, R-11 Fiberglass Flexible Insulation.....	0.95	0.27
07 21 16 00-0004	SF	3-1/2"	Thick, Kraft Faced, R-13 Fiberglass Flexible Insulation.....	1.03	0.27
07 21 16 00-0005	SF	3-1/2"	Thick, Kraft Faced, R-15 Fiberglass Flexible Insulation.....	1.06	0.27
07 21 16 00-0006	SF	5-1/2"	Thick, Kraft Faced, R-21 Fiberglass Flexible Insulation.....	1.43	0.27
07 21 16 00-0007	SF	6-1/4"	Thick, Kraft Faced, R-19 Fiberglass Flexible Insulation.....	1.16	0.27
07 21 16 00-0008	SF	9-1/2"	Thick, Kraft Faced, R-30 Fiberglass Flexible Insulation.....	1.83	0.34
07 21 16 00-0009	SF	12"	Thick, Kraft Faced, R-38 Fiberglass Flexible Insulation.....	1.95	0.34
07 21 16 00-0010			Unfaced, Fiberglass Flexible Insulation (07 21 16 00-0001)		
07 21 16 00-0011	SF	3-1/2"	Thick, Unfaced, R-11 Fiberglass Flexible Insulation.....	0.89	0.27
07 21 16 00-0012	SF	3-1/2"	Thick, Unfaced, R-13 Fiberglass Flexible Insulation.....	0.99	0.27
07 21 16 00-0013	SF	3-1/2"	Thick, Unfaced, R-15 Fiberglass Flexible Insulation.....	1.35	0.27
07 21 16 00-0014	SF	5-1/2"	Thick, Unfaced, R-21 Fiberglass Flexible Insulation.....	1.37	0.27
07 21 16 00-0015	SF	6-1/4"	Thick, Unfaced, R-19 Fiberglass Flexible Insulation.....	1.12	0.27
07 21 16 00-0016	SF	9-1/2"	Thick, Unfaced, R-30 Fiberglass Flexible Insulation.....	1.71	0.34
07 21 16 00-0017	SF	12"	Thick, Unfaced, R-38 Fiberglass Flexible Insulation.....	1.88	0.34
07 21 16 00-0018			Foil Faced, Fiberglass Flexible Insulation (07 21 16 00-0001)		
07 21 16 00-0019	SF	3-1/2"	Thick, Foil Faced, R-11 Fiberglass Flexible Insulation	1.10	0.27
07 21 16 00-0020	SF	3-1/2"	Thick, Foil Faced, R-13 Fiberglass Flexible Insulation	1.24	0.27
07 21 16 00-0021	SF	6-1/4"	Thick, Foil Faced, R-19 Fiberglass Flexible Insulation	1.35	0.27
07 21 16 00-0022	SF	10-1/4"	Thick, Foil Faced, R-38 Fiberglass Flexible Insulation	2.05	0.34
07 21 16 00-0023	SF	12"	Thick, Foil Faced, R-38 Fiberglass Flexible Insulation.....	2.22	0.34
07 21 16 00-0024			Poly-Encapsulated, Fiberglass Flexible Insulation (07 21 16 00-0001)		
07 21 16 00-0025	SF	3-1/2"	Thick, Poly-Encapsulated, R-11 Fiberglass Flexible Insulation	0.98	0.27
07 21 16 00-0026	SF	3-1/2"	Thick, Poly-Encapsulated, R-13 Fiberglass Flexible Insulation	1.06	0.27
07 21 16 00-0027	SF	5-1/2"	Thick, Poly-Encapsulated, R-21 Fiberglass Flexible Insulation	1.48	0.27
07 21 16 00-0028	SF	6-1/2"	Thick, Poly-Encapsulated, R-19 Fiberglass Flexible Insulation	1.17	0.27
07 21 16 00-0029	SF	8-1/4"	Thick, Poly-Encapsulated, R-25 Fiberglass Flexible Insulation	1.83	0.34
07 21 16 00-0030	SF	10-1/4"	Thick, Poly-Encapsulated, R-30 Fiberglass Flexible Insulation	1.88	0.34
07 21 16 00-0031			Mineral Wool Flexible Insulation (07 21 16)		
07 21 16 00-0032			Kraft Faced, Mineral Wool Flexible Insulation (07 21 16 00-0031)		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 21 16 00-0033 SF 3-1/2" Kraft Faced, R-11 Mineral Wool Flexible Insulation.....	1.07	0.27
07 21 16 00-0034 SF 6-1/4" Kraft Faced, R-19 Mineral Wool Flexible Insulation.....	1.45	0.27
07 21 16 00-0035 SF 9-1/2" Kraft Faced, R-30 Mineral Wool Flexible Insulation.....	2.36	0.27
07 21 16 00-0036 SF 12" Kraft Faced, R-38 Mineral Wool Flexible Insulation.....	2.71	0.27
07 21 16 00-0037 Unfaced, Mineral Wool Flexible Insulation (07 21 16 00-0031)		
07 21 16 00-0038 SF 3-1/2" Unfaced, R-11 Mineral Wool Flexible Insulation.....	0.99	0.27
07 21 16 00-0039 SF 6-1/4" Unfaced, R-19 Mineral Wool Flexible Insulation.....	1.32	0.27
07 21 16 00-0040 SF 9-1/2" Unfaced, R-30 Mineral Wool Flexible Insulation.....	2.11	0.27
07 21 16 00-0041 SF 12" Unfaced, R-38 Mineral Wool Flexible Insulation.....	2.41	0.27
07 21 16 00-0042 Natural Cotton Insulation (07 21 16)		
07 21 16 00-0043 UltraTouch Natural Cotton Insulation (07 21 16 00-0042)		
Note: 85% recycled denim cotton.		
07 21 16 00-0044 SF 3-1/2", R-13 UltraTouch Natural Cotton Insulation.....	1.51	0.27
07 21 16 00-0045 SF 5-1/2", R-19 UltraTouch Natural Cotton Insulation.....	1.72	0.27
07 21 16 00-0046 SF 5-1/2", R-21 UltraTouch Natural Cotton Insulation.....	1.93	0.27
07 21 16 00-0047 SF 8", R-30 UltraTouch Natural Cotton Insulation.....	2.64	0.27
07 21 23 Loose-Fill Insulation (07 21)		
07 21 23 00-0001 Poured Type, Loose Fill Insulation (07 21 23)		
07 21 23 00-0002 CF R-3.5/Inch, Poured Type, Fiberglass Loose Fill Insulation.....	4.22	1.58
07 21 23 00-0003 CF R-3.7/Inch, Poured Type, Cellulose Loose Fill Insulation.....	4.58	1.58
07 21 23 00-0004 Concrete Block Wall Cavity Insulation (07 21 23)		
07 21 23 00-0005 CF R-2.7, Vermiculite Or Perlite, Concrete Block Wall Cavity Insulation.....	6.18	1.58
07 21 23 00-0006 CF R-4, Polystyrene Foam, Concrete Block Wall Cavity Insulation.....	6.11	1.58
07 21 26 Blown Insulation (07 21)		
07 21 26 00-0001 Fiberglass Blown-In Insulation (07 21 26)		
07 21 26 00-0002 Attic, Fiberglass Blown-In Insulation (07 21 26 00-0001)		
07 21 26 00-0003 SF 3-3/4" Thick, R-13 Attic, Fiberglass Blown In Insulation.....	1.04	0.78
07 21 26 00-0004 SF 6-1/4" Thick, R-19 Attic, Fiberglass Blown In Insulation.....	1.32	0.93
07 21 26 00-0005 SF 7-1/4" Thick, R-22 Attic, Fiberglass Blown In Insulation.....	1.46	1.01
07 21 26 00-0006 SF 10-1/4" Thick, R-30 Attic, Fiberglass Blown In Insulation.....	1.71	1.09
07 21 26 00-0007 SF 12-3/4" Thick, R-38 Attic, Fiberglass Blown In Insulation.....	1.97	1.17
07 21 26 00-0008 SF 13-1/2" Thick, R-40 Attic, Fiberglass Blown In Insulation.....	2.14	1.25
07 21 26 00-0009 SF 14-3/4" Thick, R-44 Attic, Fiberglass Blown In Insulation.....	2.19	1.25
07 21 26 00-0010 SF 16-1/2" Thick, R-49 Attic, Fiberglass Blown In Insulation.....	2.30	1.25
07 21 26 00-0011 SF 19" Thick, R-56 Attic, Fiberglass Blown In Insulation.....	2.55	1.25
07 21 26 00-0012 SF 21" Thick, R-60 Attic, Fiberglass Blown In Insulation.....	2.56	1.25
07 21 26 00-0013 New Wall, Fiberglass Blown-In Insulation (07 21 26 00-0001)		
07 21 26 00-0014 SF 3-1/2" Thick, R-15 New Wall, Fiberglass Blown In Insulation.....	1.49	0.78
07 21 26 00-0015 SF 5-1/2" Thick, R-23 New Wall, Fiberglass Blown In Insulation.....	1.99	0.93
07 21 26 00-0016 SF 7-1/4" Thick, R-31 New Wall, Fiberglass Blown In Insulation.....	2.38	1.01
07 21 26 00-0017 SF 9-1/4" Thick, R-39 New Wall, Fiberglass Blown In Insulation.....	2.84	1.09
07 21 26 00-0018 Existing Wall, Fiberglass Blown-In Insulation (07 21 26 00-0001)		
Note: Includes drilling. Excludes patching.		
07 21 26 00-0019 SF 3-1/2" Thick, R-15 Existing Wall, Fiberglass Blown In Insulation.....	1.41	0.78
07 21 26 00-0020 SF 5-1/2" Thick, R-23 Existing Wall, Fiberglass Blown In Insulation.....	1.91	0.93
07 21 26 00-0021 SF 7-1/4" Thick, R-31 Existing Wall, Fiberglass Blown In Insulation.....	2.30	1.01
07 21 26 00-0022 SF 9-1/4" Thick, R-39 Existing Wall, Fiberglass Blown In Insulation.....	2.76	1.09
07 21 26 00-0023 Cellulose Blown-In Insulation (07 21 26)		
07 21 26 00-0024 Attic, Cellulose Blown-In Insulation (07 21 26 00-0023)		
07 21 26 00-0025 SF 3-3/4" Thick, R-13 Attic, Cellulose Blown In Insulation.....	1.06	0.78
07 21 26 00-0026 SF 5-1/2" Thick, R-19 Attic, Cellulose Blown In Insulation.....	1.28	0.86
07 21 26 00-0027 SF 6-1/4" Thick, R-22 Attic, Cellulose Blown In Insulation.....	1.43	0.93
07 21 26 00-0028 SF 7-3/4" Thick, R-28 Attic, Cellulose Blown In Insulation.....	1.68	1.01
07 21 26 00-0029 SF 8-1/2" Thick, R-30 Attic, Cellulose Blown In Insulation.....	1.72	1.01
07 21 26 00-0030 SF 10-1/2" Thick, R-38 Attic, Cellulose Blown In Insulation.....	2.01	1.09
07 21 26 00-0031 SF 11" Thick, R-40 Attic, Cellulose Blown In Insulation.....	2.07	1.09
07 21 26 00-0032 SF 13-3/4" Thick, R-50 Attic, Cellulose Blown In Insulation.....	2.43	1.17
07 21 26 00-0033 SF 16-1/2" Thick, R-60 Attic, Cellulose Blown In Insulation.....	2.78	1.25

07 Thermal And Moisture Protection**07 20 Thermal Protection****07 21 Thermal Insulation**

MINOR		TOTAL DIRECT		DEMOLITION
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST
07 21 26 00-0034		New Wall, Cellulose Blown-In Insulation (07 21 26 00-0023)		
07 21 26 00-0035	SF	3-1/2" Thick, R-13 New Wall, Cellulose Blown In Insulation	1.45	0.78
07 21 26 00-0036	SF	5-1/2" Thick, R-20 New Wall, Cellulose Blown In Insulation	1.94	0.93
07 21 26 00-0037	SF	7-1/4" Thick, R-27 New Wall, Cellulose Blown In Insulation	2.30	1.01
07 21 26 00-0038	SF	9-1/4" Thick, R-34 New Wall, Cellulose Blown In Insulation	2.74	1.09
07 21 26 00-0039		Existing Wall, Cellulose Blown-In Insulation (07 21 26 00-0023)		
		Note: Includes drilling. Excludes patching.		
07 21 26 00-0040	SF	3-1/2" Thick, R-13 Existing Wall, Cellulose Blown In Insulation	1.37	0.78
07 21 26 00-0041	SF	5-1/2" Thick, R-20 Existing Wall, Cellulose Blown In Insulation	1.86	0.93
07 21 26 00-0042	SF	7-1/4" Thick, R-27 Existing Wall, Cellulose Blown In Insulation	2.22	1.01
07 21 26 00-0043	SF	9-1/4" Thick, R-34 Existing Wall, Cellulose Blown In Insulation	2.66	1.09
07 21 53		Reflective Insulation (07 21)		
07 21 53 00-0001		Reflective Barrier Insulation (Foil - Single Bubble - Foil) (07 21 53)		
07 21 53 00-0002	SF	3/16" Nominal Thickness, Reflective Barrier Insulation, With Single Bubble Air Space	0.63	
07 22		Roof And Deck Insulation (07 20)		
07 22 16		Roof Board Insulation (07 22)		
		Note: Use these items for specified related installations with systems per CSI section 07 50 00. Items are for single layer of panels attached per FM I-90 requirements. Types are stock sizes set in cold applied adhesive. Apply modifiers for specified alternate attachment.		
07 22 16 00-0001		Rigid Board Roofing Insulation (07 22 16)		
07 22 16 00-0002		High-Density Fiberboard, Roof Board Insulation (07 22 16 00-0001)		
07 22 16 00-0003	SF	1/2" Thick, R1.3, High-Density Fiberboard, Roof Board Insulation	1.40	
		For Hot-Mopped, Deduct	-0.15	
		For Mechanically Fastened To Wood Or Steel, Deduct	-0.14	
		For Mechanically Fastened To Concrete, Add	0.14	
		For Mechanically Fastened To Gypsum, Add	0.29	
07 22 16 00-0004	SF	25/32" Thick, R1.9, High-Density Fiberboard, Roof Board Insulation	1.64	
		For Hot-Mopped, Deduct	-0.15	
		For Mechanically Fastened To Wood Or Steel, Deduct	-0.14	
		For Mechanically Fastened To Concrete, Add	0.16	
		For Mechanically Fastened To Gypsum, Add	0.31	
07 22 16 00-0005	SF	1" Thick, R2.5, High-Density Fiberboard, Roof Board Insulation	1.86	
		For Hot-Mopped, Deduct	-0.14	
		For Mechanically Fastened To Wood Or Steel, Deduct	-0.14	
		For Mechanically Fastened To Concrete, Add	0.17	
		For Mechanically Fastened To Gypsum, Add	0.32	
07 22 16 00-0006	SF	1-1/2" Thick, R3.8, High-Density Fiberboard, Roof Board Insulation	2.28	
		For Hot-Mopped, Deduct	-0.14	
		For Mechanically Fastened To Wood Or Steel, Deduct	-0.09	
		For Mechanically Fastened To Concrete, Add	0.22	
		For Mechanically Fastened To Gypsum, Add	0.35	
07 22 16 00-0007	SF	2" Thick, R5, High-Density Fiberboard, Roof Board Insulation	2.69	
		For Hot-Mopped, Deduct	-0.13	
		For Mechanically Fastened To Wood Or Steel, Deduct	-0.09	
		For Mechanically Fastened To Concrete, Add	0.25	
		For Mechanically Fastened To Gypsum, Add	0.40	
07 22 16 00-0008		Wood Fiber (Cellulosic-Fiber), Roof Board Insulation (07 22 16 00-0001)		
07 22 16 00-0009	SF	1/2" Thick, R1.3, Wood Fiber (Cellulosic-Fiber), Roof Board Insulation	1.51	
		For Hot-Mopped, Deduct	-0.14	
		For Mechanically Fastened To Wood Or Steel, Deduct	-0.14	
		For Mechanically Fastened To Concrete, Add	0.17	
		For Mechanically Fastened To Gypsum, Add	0.32	
07 22 16 00-0010	SF	1" Thick, R2.6, Wood Fiber (Cellulosic-Fiber), Roof Board Insulation	1.79	
		For Hot-Mopped, Deduct	-0.14	
		For Mechanically Fastened To Wood Or Steel, Deduct	-0.14	
		For Mechanically Fastened To Concrete, Add	0.17	
		For Mechanically Fastened To Gypsum, Add	0.32	
07 22 16 00-0011		Perlite, Roof Board Insulation (07 22 16 00-0001)		
07 22 16 00-0012	SF	1/2" Thick, R1.32, Perlite, Roof Board Insulation	1.36	
		For Hot-Mopped, Deduct	-0.16	
		For Mechanically Fastened To Wood Or Steel, Deduct	-0.14	
		For Mechanically Fastened To Concrete, Add	0.11	
		For Mechanically Fastened To Gypsum, Add	0.26	
07 22 16 00-0013	SF	3/4" Thick, R2.08, Perlite, Roof Board Insulation	1.49	
		For Hot-Mopped, Deduct	-0.16	
		For Mechanically Fastened To Wood Or Steel, Deduct	-0.14	
		For Mechanically Fastened To Concrete, Add	0.11	
		For Mechanically Fastened To Gypsum, Add	0.26	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 22 16 00-0014 SF 1" Thick, R2.78, Perlite, Roof Board Insulation.....	1.66	
<i>For Hot-Mopped, Deduct</i>	-0.16	
<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.14	
<i>For Mechanically Fastened To Concrete, Add</i>	0.12	
<i>For Mechanically Fastened To Gypsum, Add</i>	0.27	
07 22 16 00-0015 SF 1-1/2" Thick, R4.17, Perlite, Roof Board Insulation.....	2.05	
<i>For Hot-Mopped, Deduct</i>	-0.16	
<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.09	
<i>For Mechanically Fastened To Concrete, Add</i>	0.14	
<i>For Mechanically Fastened To Gypsum, Add</i>	0.27	
07 22 16 00-0016 SF 2" Thick, R5.56, Perlite, Roof Board Insulation.....	2.30	
<i>For Hot-Mopped, Deduct</i>	-0.16	
<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.09	
<i>For Mechanically Fastened To Concrete, Add</i>	0.14	
<i>For Mechanically Fastened To Gypsum, Add</i>	0.29	
07 22 16 00-0017 Basalt Rock Wool, Roof Board Insulation (07 22 16 00-0001)		
07 22 16 00-0018 SF 1" Thick, R3.5, Basalt Rock Wool, Roof Board Insulation.....	1.87	
<i>For Hot-Mopped, Deduct</i>	-0.16	
<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.14	
<i>For Mechanically Fastened To Concrete, Add</i>	0.12	
<i>For Mechanically Fastened To Gypsum, Add</i>	0.27	
07 22 16 00-0019 SF 2" Thick, R7.4, Basalt Rock Wool, Roof Board Insulation.....	2.50	
<i>For Hot-Mopped, Deduct</i>	-0.16	
<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.09	
<i>For Mechanically Fastened To Concrete, Add</i>	0.14	
<i>For Mechanically Fastened To Gypsum, Add</i>	0.29	
07 22 16 00-0020 SF 3" Thick, R11.1, Basalt Rock Wool, Roof Board Insulation.....	3.23	
<i>For Hot-Mopped, Deduct</i>	-0.16	
<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.05	
<i>For Mechanically Fastened To Concrete, Add</i>	0.19	
<i>For Mechanically Fastened To Gypsum, Add</i>	0.35	
07 22 16 00-0021 Foam Glass (Cellular Glass), Roof Board Insulation (07 22 16 00-0001)		
07 22 16 00-0022 SF 1-1/2" Thick, R5.16, Foam Glass (Cellular Glass), Roof Board Insulation.....	3.43	
<i>For Hot-Mopped, Deduct</i>	-0.16	
<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.09	
<i>For Mechanically Fastened To Concrete, Add</i>	0.14	
<i>For Mechanically Fastened To Gypsum, Add</i>	0.27	
07 22 16 00-0023 SF 2" Thick, R6.88, Foam Glass (Cellular Glass), Roof Board Insulation.....	4.04	
<i>For Hot-Mopped, Deduct</i>	-0.16	
<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.09	
<i>For Mechanically Fastened To Concrete, Add</i>	0.14	
<i>For Mechanically Fastened To Gypsum, Add</i>	0.29	
07 22 16 00-0024 SF 2-3/4" Thick, R8.17, Foam Glass (Cellular Glass), Roof Board Insulation.....	5.24	
<i>For Hot-Mopped, Deduct</i>	-0.16	
<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.05	
<i>For Mechanically Fastened To Concrete, Add</i>	0.19	
<i>For Mechanically Fastened To Gypsum, Add</i>	0.35	
07 22 16 00-0025 SF 3-1/2" Thick, R12.04, Foam Glass (Cellular Glass), Roof Board Insulation.....	6.44	
<i>For Hot-Mopped, Deduct</i>	-0.16	
<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	0.01	
<i>For Mechanically Fastened To Concrete, Add</i>	0.25	
<i>For Mechanically Fastened To Gypsum, Add</i>	0.36	
07 22 16 00-0026 Molded Expanded Polystyrene, Roof Board Insulation (07 22 16 00-0001)		
07 22 16 00-0027 SF 3/8" Thick, R1.44, Molded Expanded Polystyrene, Roof Board Insulation (MEPS).....	1.26	
<i>For Loose-Laid, Deduct</i>	-0.67	
<i>For Hot-Mopped, Deduct</i>	-0.16	
<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.14	
<i>For Mechanically Fastened To Concrete, Add</i>	0.11	
<i>For Mechanically Fastened To Gypsum, Add</i>	0.26	
07 22 16 00-0028 SF 1/2" Thick, R1.93, Molded Expanded Polystyrene, Roof Board Insulation (MEPS).....	1.31	
<i>For Loose-Laid, Deduct</i>	-0.67	
<i>For Hot-Mopped, Deduct</i>	-0.16	
<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.14	
<i>For Mechanically Fastened To Concrete, Add</i>	0.11	
<i>For Mechanically Fastened To Gypsum, Add</i>	0.26	
07 22 16 00-0029 SF 3/4" Thick, R2.89, Molded Expanded Polystyrene, Roof Board Insulation (MEPS).....	1.46	
<i>For Loose-Laid, Deduct</i>	-0.67	
<i>For Hot-Mopped, Deduct</i>	-0.16	
<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.14	
<i>For Mechanically Fastened To Concrete, Add</i>	0.11	
<i>For Mechanically Fastened To Gypsum, Add</i>	0.26	
07 22 16 00-0030 SF 1" Thick, R3.85, Molded Expanded Polystyrene, Roof Board Insulation (MEPS).....	1.60	
<i>For Loose-Laid, Deduct</i>	-0.67	
<i>For Hot-Mopped, Deduct</i>	-0.16	
<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.14	
<i>For Mechanically Fastened To Concrete, Add</i>	0.11	
<i>For Mechanically Fastened To Gypsum, Add</i>	0.26	

07 Thermal And Moisture Protection**07 20 Thermal Protection****07 22 Roof And Deck Insulation**

MINOR		TOTAL DIRECT	DEMOLITION
CSI	UOM DESCRIPTION	UNIT COST	UNIT COST
07 22 16 00-0031	SF 2" Thick, R7.70, Molded Expanded Polystyrene, Roof Board Insulation (MEPS)	2.19	
	<i>For Loose-Laid, Deduct</i>	-0.68	
	<i>For Hot-Mopped, Deduct</i>	-0.16	
	<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.09	
	<i>For Mechanically Fastened To Concrete, Add</i>	0.14	
	<i>For Mechanically Fastened To Gypsum, Add</i>	0.29	
07 22 16 00-0032	SF 3" Thick, R11.55, Molded Expanded Polystyrene, Roof Board Insulation (MEPS)	2.78	
	<i>For Loose-Laid, Deduct</i>	-0.69	
	<i>For Hot-Mopped, Deduct</i>	-0.16	
	<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.05	
	<i>For Mechanically Fastened To Concrete, Add</i>	0.19	
	<i>For Mechanically Fastened To Gypsum, Add</i>	0.35	
07 22 16 00-0033	SF 4" Thick, R15.40, Molded Expanded Polystyrene, Roof Board Insulation (MEPS)	3.38	
	<i>For Loose-Laid, Deduct</i>	-0.71	
	<i>For Hot-Mopped, Deduct</i>	-0.16	
	<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	0.01	
	<i>For Mechanically Fastened To Concrete, Add</i>	0.26	
	<i>For Mechanically Fastened To Gypsum, Add</i>	0.40	
07 22 16 00-0034	SF 5" Thick, R19.25, Molded Expanded Polystyrene, Roof Board Insulation (MEPS)	3.96	
	<i>For Loose-Laid, Deduct</i>	-0.71	
	<i>For Hot-Mopped, Deduct</i>	-0.15	
	<i>For Mechanically Fastened To Wood Or Steel, Add</i>	0.07	
	<i>For Mechanically Fastened To Concrete, Add</i>	0.32	
	<i>For Mechanically Fastened To Gypsum, Add</i>	0.45	
07 22 16 00-0035	SF 6" Thick, R23.1, Molded Expanded Polystyrene, Roof Board Insulation (MEPS)	4.56	
	<i>For Loose-Laid, Deduct</i>	-0.72	
	<i>For Hot-Mopped, Deduct</i>	-0.15	
	<i>For Mechanically Fastened To Wood Or Steel, Add</i>	0.28	
	<i>For Mechanically Fastened To Concrete, Add</i>	0.54	
	<i>For Mechanically Fastened To Gypsum, Add</i>	0.54	
07 22 16 00-0036	Extruded Polystyrene, Roof Board Insulation <small>(07 22 16 00-0001)</small>		
	Note: 15 PSI compressive strength.		
07 22 16 00-0037	SF 3/4" Thick, R3.7, Extruded Polystyrene, Roof Board Insulation	1.73	
	<i>For Loose-Laid, Deduct</i>	-0.67	
	<i>For Hot-Mopped, Deduct</i>	-0.16	
	<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.14	
	<i>For Mechanically Fastened To Concrete, Add</i>	0.11	
	<i>For Mechanically Fastened To Gypsum, Add</i>	0.26	
	<i>For 25 PSI Compressive Strength, Add</i>	0.17	
	<i>For 40 PSI Compressive Strength, Add</i>	0.40	
	<i>For 60 PSI Compressive Strength, Add</i>	0.64	
	<i>For 115 PSI Compressive Strength, Add</i>	2.77	
07 22 16 00-0038	SF 1" Thick, R5.0, Extruded Polystyrene, Roof Board Insulation	1.82	
	<i>For Loose-Laid, Deduct</i>	-0.68	
	<i>For Hot-Mopped, Deduct</i>	-0.16	
	<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.14	
	<i>For Mechanically Fastened To Concrete, Add</i>	0.12	
	<i>For Mechanically Fastened To Gypsum, Add</i>	0.27	
	<i>For 25 PSI Compressive Strength, Add</i>	0.18	
	<i>For 40 PSI Compressive Strength, Add</i>	0.43	
	<i>For 60 PSI Compressive Strength, Add</i>	0.69	
	<i>For 115 PSI Compressive Strength, Add</i>	2.97	
07 22 16 00-0039	SF 1-1/2" Thick, R7.5, Extruded Polystyrene, Roof Board Insulation	2.21	
	<i>For Loose-Laid, Deduct</i>	-0.68	
	<i>For Hot-Mopped, Deduct</i>	-0.16	
	<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.09	
	<i>For Mechanically Fastened To Concrete, Add</i>	0.14	
	<i>For Mechanically Fastened To Gypsum, Add</i>	0.27	
	<i>For 25 PSI Compressive Strength, Add</i>	0.24	
	<i>For 40 PSI Compressive Strength, Add</i>	0.58	
	<i>For 60 PSI Compressive Strength, Add</i>	0.92	
	<i>For 100 PSI Compressive Strength, Add</i>	1.17	
	<i>For 115 PSI Compressive Strength, Add</i>	3.98	
07 22 16 00-0040	SF 2" Thick, R10.0, Extruded Polystyrene, Roof Board Insulation	2.62	
	<i>For Loose-Laid, Deduct</i>	-0.69	
	<i>For Hot-Mopped, Deduct</i>	-0.16	
	<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.09	
	<i>For Mechanically Fastened To Concrete, Add</i>	0.14	
	<i>For Mechanically Fastened To Gypsum, Add</i>	0.29	
	<i>For 25 PSI Compressive Strength, Add</i>	0.31	
	<i>For 40 PSI Compressive Strength, Add</i>	0.73	
	<i>For 60 PSI Compressive Strength, Add</i>	1.14	
	<i>For 115 PSI Compressive Strength, Add</i>	4.98	
07 22 16 00-0041	SF 2-1/2" Thick, R12.5, Extruded Polystyrene, Roof Board Insulation	3.01	
	<i>For Loose-Laid, Deduct</i>	-0.69	
	<i>For Hot-Mopped, Deduct</i>	-0.16	
	<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.05	
	<i>For Mechanically Fastened To Concrete, Add</i>	0.18	
	<i>For Mechanically Fastened To Gypsum, Add</i>	0.32	
	<i>For 25 PSI Compressive Strength, Add</i>	0.37	
	<i>For 40 PSI Compressive Strength, Add</i>	0.87	
	<i>For 60 PSI Compressive Strength, Add</i>	1.37	
	<i>For 100 PSI Compressive Strength, Add</i>	1.76	
	<i>For 115 PSI Compressive Strength, Add</i>	5.98	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 22 16 00-0042 SF 3" Thick, R15.0, Extruded Polystyrene, Roof Board Insulation	3.41	
<i>For Loose-Laid, Deduct</i>	-0.69	
<i>For Hot-Mopped, Deduct</i>	-0.16	
<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.05	
<i>For Mechanically Fastened To Concrete, Add</i>	0.19	
<i>For Mechanically Fastened To Gypsum, Add</i>	0.35	
<i>For 25 PSI Compressive Strength, Add</i>	0.43	
<i>For 40 PSI Compressive Strength, Add</i>	1.02	
<i>For 60 PSI Compressive Strength, Add</i>	1.60	
<i>For 115 PSI Compressive Strength, Add</i>	6.99	
07 22 16 00-0043 SF 4" Thick, R20.0, Extruded Polystyrene, Roof Board Insulation	3.82	
<i>For Loose-Laid, Deduct</i>	-0.70	
<i>For Hot-Mopped, Deduct</i>	-0.16	
<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	0.01	
<i>For Mechanically Fastened To Concrete, Add</i>	0.25	
<i>For Mechanically Fastened To Gypsum, Add</i>	0.39	
<i>For 25 PSI Compressive Strength, Add</i>	0.49	
<i>For 40 PSI Compressive Strength, Add</i>	1.17	
<i>For 60 PSI Compressive Strength, Add</i>	1.82	
<i>For 115 PSI Compressive Strength, Add</i>	7.99	
07 22 16 00-0044 Polyisocyanurate Board Roofing Insulation (07 22 16 00-0001)		
07 22 16 00-0045 SF 3/4" Thick, R5.1, Polyisocyanurate, Roof Board Insulation	1.56	
<i>For Loose-Laid, Deduct</i>	-0.67	
<i>For Hot-Mopped, Deduct</i>	-0.16	
<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.14	
<i>For Mechanically Fastened To Concrete, Add</i>	0.11	
<i>For Mechanically Fastened To Gypsum, Add</i>	0.26	
<i>For Foil Facer, Add</i>	0.36	
<i>For 25 PSI Compressive Strength, Add</i>	0.09	
07 22 16 00-0046 SF 1" Thick, R7.14, Polyisocyanurate, Roof Board Insulation	1.62	
<i>For Loose-Laid, Deduct</i>	-0.68	
<i>For Hot-Mopped, Deduct</i>	-0.16	
<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.14	
<i>For Mechanically Fastened To Concrete, Add</i>	0.12	
<i>For Mechanically Fastened To Gypsum, Add</i>	0.27	
<i>For Foil Facer, Add</i>	0.36	
<i>For 25 PSI Compressive Strength, Add</i>	0.09	
07 22 16 00-0047 SF 1-1/2" Thick, R10.87, Polyisocyanurate, Roof Board Insulation	1.71	
<i>For Loose-Laid, Deduct</i>	-0.68	
<i>For Hot-Mopped, Deduct</i>	-0.16	
<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.09	
<i>For Mechanically Fastened To Concrete, Add</i>	0.14	
<i>For Mechanically Fastened To Gypsum, Add</i>	0.27	
<i>For Foil Facer, Add</i>	0.36	
<i>For 25 PSI Compressive Strength, Add</i>	0.10	
07 22 16 00-0048 SF 2" Thick, R14.29, Polyisocyanurate, Roof Board Insulation	1.94	
<i>For Loose-Laid, Deduct</i>	-0.69	
<i>For Hot-Mopped, Deduct</i>	-0.16	
<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.09	
<i>For Mechanically Fastened To Concrete, Add</i>	0.14	
<i>For Mechanically Fastened To Gypsum, Add</i>	0.29	
<i>For Foil Facer, Add</i>	0.36	
<i>For 25 PSI Compressive Strength, Add</i>	0.12	
07 22 16 00-0049 SF 2-1/2" Thick, R16.67, Polyisocyanurate, Roof Board Insulation	2.16	
<i>For Loose-Laid, Deduct</i>	-0.69	
<i>For Hot-Mopped, Deduct</i>	-0.16	
<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.05	
<i>For Mechanically Fastened To Concrete, Add</i>	0.18	
<i>For Mechanically Fastened To Gypsum, Add</i>	0.32	
<i>For Foil Facer, Add</i>	0.36	
<i>For 25 PSI Compressive Strength, Add</i>	0.15	
07 22 16 00-0050 SF 3" Thick, R21.74, Polyisocyanurate, Roof Board Insulation	2.39	
<i>For Loose-Laid, Deduct</i>	-0.69	
<i>For Hot-Mopped, Deduct</i>	-0.16	
<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.05	
<i>For Mechanically Fastened To Concrete, Add</i>	0.19	
<i>For Mechanically Fastened To Gypsum, Add</i>	0.35	
<i>For Foil Facer, Add</i>	0.36	
<i>For 25 PSI Compressive Strength, Add</i>	0.17	
07 22 16 00-0051 SF 3-1/2" Thick, R25, Polyisocyanurate, Roof Board Insulation	2.64	
<i>For Loose-Laid, Deduct</i>	-0.70	
<i>For Hot-Mopped, Deduct</i>	-0.16	
<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	0.01	
<i>For Mechanically Fastened To Concrete, Add</i>	0.25	
<i>For Mechanically Fastened To Gypsum, Add</i>	0.36	
<i>For Foil Facer, Add</i>	0.36	
<i>For 25 PSI Compressive Strength, Add</i>	0.19	
07 22 16 00-0052 SF 4" Thick, R28.8, Polyisocyanurate, Roof Board Insulation	2.87	
<i>For Loose-Laid, Deduct</i>	-0.70	
<i>For Hot-Mopped, Deduct</i>	-0.16	
<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	0.01	
<i>For Mechanically Fastened To Concrete, Add</i>	0.25	
<i>For Mechanically Fastened To Gypsum, Add</i>	0.39	
<i>For Foil Facer, Add</i>	0.36	
<i>For 25 PSI Compressive Strength, Add</i>	0.21	

07 Thermal And Moisture Protection**07 20 Thermal Protection****07 22 Roof And Deck Insulation**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 22 16 00-0053			High-Density Polyisocyanurate Cover Board And Roofing Insulation (07 22 16 00-0001)		
07 22 16 00-0054	SF		1/2" Thick, R2.5, High-Density Polyisocyanurate Cover Board And Roofing Insulation.....	1.76	
			<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.14	
			<i>For Mechanically Fastened To Concrete, Add</i>	0.14	
			<i>For Mechanically Fastened To Gypsum, Add</i>	0.29	
07 22 16 00-0055			Gypsum-Fiber, Roof Board Insulation (USG Securock) (07 22 16 00-0001)		
07 22 16 00-0056	SF		1/4" Thick, R0.2, Gypsum-Fiber, Roof Board Insulation (USG Securock Gypsum).....	1.68	
			<i>For Hot-Mopped, Deduct</i>	-0.15	
			<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.14	
			<i>For Mechanically Fastened To Concrete, Add</i>	0.14	
			<i>For Mechanically Fastened To Gypsum, Add</i>	0.29	
07 22 16 00-0057	SF		3/8" Thick, R0.3, Gypsum-Fiber, Roof Board Insulation (USG Securock Gypsum).....	1.77	
			<i>For Hot-Mopped, Deduct</i>	-0.15	
			<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.14	
			<i>For Mechanically Fastened To Concrete, Add</i>	0.14	
			<i>For Mechanically Fastened To Gypsum, Add</i>	0.29	
07 22 16 00-0058	SF		1/2" Thick, R0.5, Gypsum-Fiber, Roof Board Insulation (USG Securock Gypsum).....	1.83	
			<i>For Hot-Mopped, Deduct</i>	-0.15	
			<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.14	
			<i>For Mechanically Fastened To Concrete, Add</i>	0.14	
			<i>For Mechanically Fastened To Gypsum, Add</i>	0.29	
07 22 16 00-0059	SF		5/8" Thick, R0.6, Gypsum-Fiber, Roof Board Insulation (USG Securock Gypsum).....	1.87	
			<i>For Hot-Mopped, Deduct</i>	-0.15	
			<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.14	
			<i>For Mechanically Fastened To Concrete, Add</i>	0.14	
			<i>For Mechanically Fastened To Gypsum, Add</i>	0.29	
07 22 16 00-0060			Glass-Mat, Roof Board Insulation (USG Securock) (07 22 16 00-0001)		
07 22 16 00-0061	SF		1/4" Thick, R0.36, Glass-Mat, Roof Board Insulation (USG Securock Glass-Mat).....	1.65	
			<i>For Hot-Mopped, Deduct</i>	-0.15	
			<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.14	
			<i>For Mechanically Fastened To Concrete, Add</i>	0.14	
			<i>For Mechanically Fastened To Gypsum, Add</i>	0.29	
07 22 16 00-0062	SF		1/2" Thick, R0.53, Glass-Mat, Roof Board Insulation (USG Securock Glass-Mat).....	1.79	
			<i>For Hot-Mopped, Deduct</i>	-0.15	
			<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.14	
			<i>For Mechanically Fastened To Concrete, Add</i>	0.14	
			<i>For Mechanically Fastened To Gypsum, Add</i>	0.29	
07 22 16 00-0063	SF		5/8" Thick, R0.54, Glass-Mat, Roof Board Insulation (USG Securock Glass-Mat).....	1.82	
			<i>For Hot-Mopped, Deduct</i>	-0.15	
			<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.14	
			<i>For Mechanically Fastened To Concrete, Add</i>	0.14	
			<i>For Mechanically Fastened To Gypsum, Add</i>	0.29	
07 22 16 00-0064			Polyisocyanurate And Oriented Strand Board, Nailbase Roof Board Insulation (07 22 16 00-0001)		
			Note: Includes a polyisocyanurate foam core bonded to a 7/16" oriented strand board (OSB) facer.		
07 22 16 00-0065	SF		1.5" Thick, R6.6, Polyisocyanurate And Oriented Strand Board, Nailbase Roof Board Insulation.....	2.80	
			<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.09	
			<i>For Mechanically Fastened To Concrete, Add</i>	0.25	
			<i>For Mechanically Fastened To Gypsum, Add</i>	0.40	
07 22 16 00-0066	SF		2" Thick, R9.6, Polyisocyanurate And Oriented Strand Board, Nailbase Roof Board Insulation.....	2.93	
			<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.09	
			<i>For Mechanically Fastened To Concrete, Add</i>	0.25	
			<i>For Mechanically Fastened To Gypsum, Add</i>	0.40	
07 22 16 00-0067	SF		2.5" Thick, R12.7, Polyisocyanurate And Oriented Strand Board, Nailbase Roof Board Insulation.....	3.12	
			<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.05	
			<i>For Mechanically Fastened To Concrete, Add</i>	0.30	
			<i>For Mechanically Fastened To Gypsum, Add</i>	0.44	
07 22 16 00-0068	SF		3" Thick, R15.9, Polyisocyanurate And Oriented Strand Board, Nailbase Roof Board Insulation.....	3.23	
			<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.05	
			<i>For Mechanically Fastened To Concrete, Add</i>	0.30	
			<i>For Mechanically Fastened To Gypsum, Add</i>	0.46	
07 22 16 00-0069	SF		3.5" Thick, R19.1, Polyisocyanurate And Oriented Strand Board, Nailbase Roof Board Insulation.....	3.50	
			<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	0.01	
			<i>For Mechanically Fastened To Concrete, Add</i>	0.37	
			<i>For Mechanically Fastened To Gypsum, Add</i>	0.48	
07 22 16 00-0070	SF		4" Thick, R22.3, Polyisocyanurate And Oriented Strand Board, Nailbase Roof Board Insulation.....	3.61	
			<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	0.01	
			<i>For Mechanically Fastened To Concrete, Add</i>	0.37	
			<i>For Mechanically Fastened To Gypsum, Add</i>	0.51	
07 22 16 00-0071	SF		4.5" Thick, R25.6, Polyisocyanurate And Oriented Strand Board, Nailbase Roof Board Insulation.....	3.81	
			<i>For Mechanically Fastened To Wood Or Steel, Add</i>	0.07	
			<i>For Mechanically Fastened To Concrete, Add</i>	0.46	
			<i>For Mechanically Fastened To Gypsum, Add</i>	0.59	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 22 16 00-0072 Polyisocyanurate And Oriented Strand Board With Air Vent Spacer Strips, Nailbase Roof Board Insulation <small>(07 22 16 00-0001)</small>		
<i>Note: Includes a polyisocyanurate foam core bonded to a 7/16" oriented strand board (OSB) facer.</i>		
07 22 16 00-0073 SF 2.5" Thick, R6.0, Polyisocyanurate And Oriented Strand Board With Air Vent Spacer Strips, Nailbase Roof Board Insulation	2.82	
<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.05	
<i>For Mechanically Fastened To Concrete, Add</i>	0.29	
<i>For Mechanically Fastened To Gypsum, Add</i>	0.43	
07 22 16 00-0074 SF 3" Thick, R9.0, Polyisocyanurate And Oriented Strand Board With Air Vent Spacer Strips, Nailbase Roof Board Insulation	3.06	
<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.05	
<i>For Mechanically Fastened To Concrete, Add</i>	0.29	
<i>For Mechanically Fastened To Gypsum, Add</i>	0.45	
07 22 16 00-0075 SF 3.5" Thick, R12.1, Polyisocyanurate And Oriented Strand Board With Air Vent Spacer Strips, Nailbase Roof Board Insulation	3.35	
<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	0.01	
<i>For Mechanically Fastened To Concrete, Add</i>	0.36	
<i>For Mechanically Fastened To Gypsum, Add</i>	0.47	
07 22 16 00-0076 SF 4" Thick, R15.3, Polyisocyanurate And Oriented Strand Board With Air Vent Spacer Strips, Nailbase Roof Board Insulation	3.52	
<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	0.01	
<i>For Mechanically Fastened To Concrete, Add</i>	0.36	
<i>For Mechanically Fastened To Gypsum, Add</i>	0.50	
07 22 16 00-0077 SF 4.5" Thick, R18.5, Polyisocyanurate And Oriented Strand Board With Air Vent Spacer Strips, Nailbase Roof Board Insulation	3.77	
<i>For Mechanically Fastened To Wood Or Steel, Add</i>	0.07	
<i>For Mechanically Fastened To Concrete, Add</i>	0.43	
<i>For Mechanically Fastened To Gypsum, Add</i>	0.56	
07 22 16 00-0078 SF 5" Thick, R21.7, Polyisocyanurate And Oriented Strand Board With Air Vent Spacer Strips, Nailbase Roof Board Insulation	4.02	
<i>For Mechanically Fastened To Wood Or Steel, Add</i>	0.07	
<i>For Mechanically Fastened To Concrete, Add</i>	0.43	
<i>For Mechanically Fastened To Gypsum, Add</i>	0.56	
07 22 16 00-0079 SF 5.5" Thick, R25.0, Polyisocyanurate And Oriented Strand Board With Air Vent Spacer Strips, Nailbase Roof Board Insulation	4.49	
<i>For Mechanically Fastened To Wood Or Steel, Add</i>	0.28	
<i>For Mechanically Fastened To Concrete, Add</i>	0.67	
<i>For Mechanically Fastened To Gypsum, Add</i>	0.67	
07 22 16 00-0080 Rigid Board Tapered Roofing Insulation <small>(07 22 16)</small>		
<i>Note: Includes tapered board and filler board required to maintain slope starting at 1/2" minimum thickness. Excludes base layer of board, if required. Average thickness and average R-value of tapered system excludes thickness and R-value of base layer insulation and/or coverboard.</i>		
07 22 16 00-0081 Tapered Polyisocyanurate Board <small>(07 22 16 00-0080)</small>		
<i>Note: Includes polyurethane adhesive.</i>		
07 22 16 00-0082 1/8" Slope, Tapered Polyisocyanurate Board <small>(07 22 16 00-0081)</small>		
07 22 16 00-0083 SF 2.25" Average Thickness (13.5 Average R-Value), 1/8" Slope, Tapered Polyisocyanurate Board	2.81	
<i>For 25 PSI Compressive Strength, Add</i>	0.17	
<i>For Hot-Mopped, Deduct</i>	-0.12	
<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.05	
<i>For Mechanically Fastened To Concrete, Add</i>	0.23	
<i>For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add</i>	0.64	
07 22 16 00-0084 SF 2.75" Average Thickness (16.5 Average R-Value), 1/8" Slope, Tapered Polyisocyanurate Board	4.01	
<i>For 25 PSI Compressive Strength, Add</i>	0.20	
<i>For Hot-Mopped, Deduct</i>	-0.24	
<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.05	
<i>For Mechanically Fastened To Concrete, Add</i>	0.45	
<i>For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add</i>	1.10	
07 22 16 00-0085 SF 3.25" Average Thickness (19.5 Average R-Value), 1/8" Slope, Tapered Polyisocyanurate Board	4.32	
<i>For 25 PSI Compressive Strength, Add</i>	0.23	
<i>For Hot-Mopped, Deduct</i>	-0.24	
<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.05	
<i>For Mechanically Fastened To Concrete, Add</i>	0.45	
<i>For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add</i>	1.12	
07 22 16 00-0086 SF 3.75" Average Thickness (22.5 Average R-Value), 1/8" Slope, Tapered Polyisocyanurate Board	4.62	
<i>For 25 PSI Compressive Strength, Add</i>	0.26	
<i>For Hot-Mopped, Deduct</i>	-0.24	
<i>For Mechanically Fastened To Wood Or Steel, Add</i>	0.01	
<i>For Mechanically Fastened To Concrete, Add</i>	0.51	
<i>For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add</i>	1.13	
07 22 16 00-0087 SF 4.25" Average Thickness (25.5 Average R-Value), 1/8" Slope, Tapered Polyisocyanurate Board	4.92	
<i>For 25 PSI Compressive Strength, Add</i>	0.29	
<i>For Hot-Mopped, Deduct</i>	-0.24	
<i>For Mechanically Fastened To Wood Or Steel, Add</i>	0.01	
<i>For Mechanically Fastened To Concrete, Add</i>	0.51	
<i>For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add</i>	1.16	
07 22 16 00-0088 SF 4.75" Average Thickness (28.5 Average R-Value), 1/8" Slope, Tapered Polyisocyanurate Board	6.11	
<i>For 25 PSI Compressive Strength, Add</i>	0.32	
<i>For Hot-Mopped, Deduct</i>	-0.34	
<i>For Mechanically Fastened To Wood Or Steel, Add</i>	0.07	
<i>For Mechanically Fastened To Concrete, Add</i>	0.79	
<i>For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add</i>	1.65	

07 Thermal And Moisture Protection**07 20 Thermal Protection****07 22 Roof And Deck Insulation**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 22 16 00-0089	SF		5.25" Average Thickness (31.5 Average R-Value), 1/8" Slope, Tapered Polyisocyanurate Board	6.41	
			<i>For 25 PSI Compressive Strength, Add</i>	0.35	
			<i>For Hot-Mopped, Deduct</i>	-0.34	
			<i>For Mechanically Fastened To Wood Or Steel, Add</i>	0.07	
			<i>For Mechanically Fastened To Concrete, Add</i>	0.79	
			<i>For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add</i>	1.65	
07 22 16 00-0090	SF		5.75" Average Thickness (34.5 Average R-Value), 1/8" Slope, Tapered Polyisocyanurate Board	6.71	
			<i>For 25 PSI Compressive Strength, Add</i>	0.38	
			<i>For Hot-Mopped, Deduct</i>	-0.34	
			<i>For Mechanically Fastened To Wood Or Steel, Add</i>	0.28	
			<i>For Mechanically Fastened To Concrete, Add</i>	1.00	
			<i>For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add</i>	1.73	
07 22 16 00-0091	SF		6.25" Average Thickness (37.5 Average R-Value), 1/8" Slope, Tapered Polyisocyanurate Board	7.01	
			<i>For 25 PSI Compressive Strength, Add</i>	0.41	
			<i>For Hot-Mopped, Deduct</i>	-0.34	
			<i>For Mechanically Fastened To Wood Or Steel, Add</i>	0.28	
			<i>For Mechanically Fastened To Concrete, Add</i>	1.00	
			<i>For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add</i>	1.73	
07 22 16 00-0092	SF		6.75" Average Thickness (40.5 Average R-Value), 1/8" Slope, Tapered Polyisocyanurate Board	8.21	
			<i>For 25 PSI Compressive Strength, Add</i>	0.44	
			<i>For Hot-Mopped, Deduct</i>	-0.46	
			<i>For Mechanically Fastened To Wood Or Steel, Add</i>	0.35	
			<i>For Mechanically Fastened To Concrete, Add</i>	1.30	
			<i>For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add</i>	2.33	
07 22 16 00-0093			1/4" Slope, Tapered Polyisocyanurate Board <small>(07 22 16 00-0081)</small>		
07 22 16 00-0094	SF		2" Average Thickness (12 Average R-Value), 1/4" Slope, Tapered Polyisocyanurate Board	2.66	
			<i>For 25 PSI Compressive Strength, Add</i>	0.16	
			<i>For Hot-Mopped, Deduct</i>	-0.12	
			<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.05	
			<i>For Mechanically Fastened To Concrete, Add</i>	0.23	
			<i>For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add</i>	0.64	
07 22 16 00-0095	SF		3" Average Thickness (18 Average R-Value), 1/4" Slope, Tapered Polyisocyanurate Board	4.16	
			<i>For 25 PSI Compressive Strength, Add</i>	0.22	
			<i>For Hot-Mopped, Deduct</i>	-0.24	
			<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.05	
			<i>For Mechanically Fastened To Concrete, Add</i>	0.45	
			<i>For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add</i>	1.10	
07 22 16 00-0096	SF		4" Average Thickness (24 Average R-Value), 1/4" Slope, Tapered Polyisocyanurate Board	4.77	
			<i>For 25 PSI Compressive Strength, Add</i>	0.28	
			<i>For Hot-Mopped, Deduct</i>	-0.24	
			<i>For Mechanically Fastened To Wood Or Steel, Add</i>	0.01	
			<i>For Mechanically Fastened To Concrete, Add</i>	0.51	
			<i>For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add</i>	1.13	
07 22 16 00-0097	SF		5" Average Thickness (30 Average R-Value), 1/4" Slope, Tapered Polyisocyanurate Board	6.26	
			<i>For 25 PSI Compressive Strength, Add</i>	0.34	
			<i>For Hot-Mopped, Deduct</i>	-0.34	
			<i>For Mechanically Fastened To Wood Or Steel, Add</i>	0.07	
			<i>For Mechanically Fastened To Concrete, Add</i>	0.79	
			<i>For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add</i>	1.65	
07 22 16 00-0098	SF		6" Average Thickness (36 Average R-Value), 1/4" Slope, Tapered Polyisocyanurate Board	6.86	
			<i>For 25 PSI Compressive Strength, Add</i>	0.40	
			<i>For Hot-Mopped, Deduct</i>	-0.34	
			<i>For Mechanically Fastened To Wood Or Steel, Add</i>	0.28	
			<i>For Mechanically Fastened To Concrete, Add</i>	1.00	
			<i>For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add</i>	1.73	
07 22 16 00-0099	SF		7" Average Thickness (42 Average R-Value), 1/4" Slope, Tapered Polyisocyanurate Board	8.36	
			<i>For 25 PSI Compressive Strength, Add</i>	0.46	
			<i>For Hot-Mopped, Deduct</i>	-0.46	
			<i>For Mechanically Fastened To Wood Or Steel, Add</i>	0.35	
			<i>For Mechanically Fastened To Concrete, Add</i>	1.30	
			<i>For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add</i>	2.33	
07 22 16 00-0100			1/2" Slope, Tapered Polyisocyanurate Board <small>(07 22 16 00-0081)</small>		
07 22 16 00-0101	SF		3.5" Average Thickness (21 Average R-Value), 1/2" Slope, Tapered Polyisocyanurate Board	4.47	
			<i>For 25 PSI Compressive Strength, Add</i>	0.25	
			<i>For Hot-Mopped, Deduct</i>	-0.24	
			<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.05	
			<i>For Mechanically Fastened To Concrete, Add</i>	0.45	
			<i>For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add</i>	1.12	
07 22 16 00-0102	SF		5.5" Average Thickness (33 Average R-Value), 1/2" Slope, Tapered Polyisocyanurate Board	6.56	
			<i>For 25 PSI Compressive Strength, Add</i>	0.37	
			<i>For Hot-Mopped, Deduct</i>	-0.34	
			<i>For Mechanically Fastened To Wood Or Steel, Add</i>	0.07	
			<i>For Mechanically Fastened To Concrete, Add</i>	0.79	
			<i>For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add</i>	1.65	
07 22 16 00-0103	SF		7.5" Average Thickness (45 Average R-Value), 1/2" Slope, Tapered Polyisocyanurate Board	8.66	
			<i>For 25 PSI Compressive Strength, Add</i>	0.49	
			<i>For Hot-Mopped, Deduct</i>	-0.46	
			<i>For Mechanically Fastened To Wood Or Steel, Add</i>	0.35	
			<i>For Mechanically Fastened To Concrete, Add</i>	1.30	
			<i>For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add</i>	2.33	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 22 16 00-0104 SF 9.5" Average Thickness (57 Average R-Value), 1/2" Slope, Tapered Polyisocyanurate Board <i>For 25 PSI Compressive Strength, Add</i> <i>For Hot-Mopped, Deduct</i> <i>For Mechanically Fastened To Wood Or Steel, Add</i> <i>For Mechanically Fastened To Concrete, Add</i>	10.78 0.61 -0.58 0.67 1.84	
07 22 16 00-0105 Tapered Expanded Polystyrene Board (EPS) (07 22 16 00-0080) Note: Includes polyurethane adhesive.		
07 22 16 00-0106 1/8" Slope, Tapered Expanded Polystyrene Board (EPS) (07 22 16 00-0105)		
07 22 16 00-0107 SF 2.25" Average Thickness (10.13 Average R-Value), 1/8" Slope, Tapered Expanded Polystyrene Board (EPS) <i>For Mechanically Fastened To Wood Or Steel, Deduct</i> <i>For Mechanically Fastened To Concrete, Add</i> <i>For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add</i>	2.47 -0.05 0.23 0.64	
07 22 16 00-0108 SF 2.75" Average Thickness (12.38 Average R-Value), 1/8" Slope, Tapered Expanded Polystyrene Board (EPS) <i>For Mechanically Fastened To Wood Or Steel, Deduct</i> <i>For Mechanically Fastened To Concrete, Add</i> <i>For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add</i>	3.68 -0.05 0.45 1.10	
07 22 16 00-0109 SF 3.25" Average Thickness (14.63 Average R-Value), 1/8" Slope, Tapered Expanded Polystyrene Board (EPS) <i>For Mechanically Fastened To Wood Or Steel, Deduct</i> <i>For Mechanically Fastened To Concrete, Add</i> <i>For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add</i>	3.91 -0.05 0.45 1.12	
07 22 16 00-0110 SF 3.75" Average Thickness (16.88 Average R-Value), 1/8" Slope, Tapered Expanded Polystyrene Board (EPS) <i>For Mechanically Fastened To Wood Or Steel, Add</i> <i>For Mechanically Fastened To Concrete, Add</i> <i>For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add</i>	4.13 0.01 0.51 1.13	
07 22 16 00-0111 SF 4.25" Average Thickness (19.13 Average R-Value), 1/8" Slope, Tapered Expanded Polystyrene Board (EPS) <i>For Mechanically Fastened To Wood Or Steel, Add</i> <i>For Mechanically Fastened To Concrete, Add</i> <i>For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add</i>	4.36 0.01 0.51 1.16	
07 22 16 00-0112 SF 4.75" Average Thickness (21.38 Average R-Value), 1/8" Slope, Tapered Expanded Polystyrene Board (EPS) <i>For Mechanically Fastened To Wood Or Steel, Add</i> <i>For Mechanically Fastened To Concrete, Add</i> <i>For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add</i>	5.55 0.07 0.79 1.65	
07 22 16 00-0113 SF 5.25" Average Thickness (23.63 Average R-Value), 1/8" Slope, Tapered Expanded Polystyrene Board (EPS) <i>For Mechanically Fastened To Wood Or Steel, Add</i> <i>For Mechanically Fastened To Concrete, Add</i> <i>For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add</i>	5.78 0.07 0.79 1.65	
07 22 16 00-0114 SF 5.75" Average Thickness (25.88 Average R-Value), 1/8" Slope, Tapered Expanded Polystyrene Board (EPS) <i>For Mechanically Fastened To Wood Or Steel, Add</i> <i>For Mechanically Fastened To Concrete, Add</i> <i>For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add</i>	6.01 0.28 1.00 1.73	
07 22 16 00-0115 SF 6.25" Average Thickness (28.13 Average R-Value), 1/8" Slope, Tapered Expanded Polystyrene Board (EPS) <i>For Mechanically Fastened To Wood Or Steel, Add</i> <i>For Mechanically Fastened To Concrete, Add</i> <i>For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add</i>	6.23 0.28 1.00 1.73	
07 22 16 00-0116 SF 6.75" Average Thickness (30.38 Average R-Value), 1/8" Slope, Tapered Expanded Polystyrene Board (EPS) <i>For Mechanically Fastened To Wood Or Steel, Add</i> <i>For Mechanically Fastened To Concrete, Add</i> <i>For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add</i>	7.43 0.35 1.30 2.33	
07 22 16 00-0117 1/4" Slope, Tapered Expanded Polystyrene Board (EPS) (07 22 16 00-0105)		
07 22 16 00-0118 SF 2" Average Thickness (9 Average R-Value), 1/4" Slope, Tapered Expanded Polystyrene Board (EPS) <i>For Mechanically Fastened To Wood Or Steel, Deduct</i> <i>For Mechanically Fastened To Concrete, Add</i> <i>For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add</i>	2.36 -0.05 0.23 0.64	
07 22 16 00-0119 SF 3" Average Thickness (13.5 Average R-Value), 1/4" Slope, Tapered Expanded Polystyrene Board (EPS) <i>For Mechanically Fastened To Wood Or Steel, Deduct</i> <i>For Mechanically Fastened To Concrete, Add</i> <i>For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add</i>	3.79 -0.05 0.45 1.10	
07 22 16 00-0120 SF 4" Average Thickness (18 Average R-Value), 1/4" Slope, Tapered Expanded Polystyrene Board (EPS) <i>For Mechanically Fastened To Wood Or Steel, Add</i> <i>For Mechanically Fastened To Concrete, Add</i> <i>For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add</i>	4.25 0.01 0.51 1.13	
07 22 16 00-0121 SF 5" Average Thickness (22.5 Average R-Value), 1/4" Slope, Tapered Expanded Polystyrene Board (EPS) <i>For Mechanically Fastened To Wood Or Steel, Add</i> <i>For Mechanically Fastened To Concrete, Add</i> <i>For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add</i>	5.67 0.07 0.79 1.65	
07 22 16 00-0122 SF 6" Average Thickness (27 Average R-Value), 1/4" Slope, Tapered Expanded Polystyrene Board (EPS) <i>For Mechanically Fastened To Wood Or Steel, Add</i> <i>For Mechanically Fastened To Concrete, Add</i> <i>For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add</i>	6.12 0.28 1.00 1.73	
07 22 16 00-0123 SF 7" Average Thickness (31.5 Average R-Value), 1/4" Slope, Tapered Expanded Polystyrene Board (EPS) <i>For Mechanically Fastened To Wood Or Steel, Add</i> <i>For Mechanically Fastened To Concrete, Add</i> <i>For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add</i>	7.54 0.35 1.30 2.33	
07 22 16 00-0124 1/2" Slope, Tapered Expanded Polystyrene Board (EPS) (07 22 16 00-0105)		
07 22 16 00-0125 SF 3.5" Average Thickness (15.75 Average R-Value), 1/2" Slope, Tapered Expanded Polystyrene Board (EPS) <i>For Mechanically Fastened To Wood Or Steel, Deduct</i> <i>For Mechanically Fastened To Concrete, Add</i> <i>For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add</i>	4.02 -0.05 0.45 1.12	

07 Thermal And Moisture Protection**07 20 Thermal Protection****07 22 Roof And Deck Insulation**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 22 16 00-0126 SF 5.5" Average Thickness (24.75 Average R-Value), 1/2" Slope, Tapered Expanded Polystyrene Board (EPS)	5.89	
For Mechanically Fastened To Wood Or Steel, Add	0.07	
For Mechanically Fastened To Concrete, Add	0.79	
For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add	1.65	
07 22 16 00-0127 SF 7.5" Average Thickness (33.75 Average R-Value), 1/2" Slope, Tapered Expanded Polystyrene Board (EPS)	7.77	
For Mechanically Fastened To Wood Or Steel, Add	0.35	
For Mechanically Fastened To Concrete, Add	1.30	
For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add	2.33	
07 22 16 00-0128 SF 9.5" Average Thickness (42.75 Average R-Value), 1/2" Slope, Tapered Expanded Polystyrene Board (EPS)	9.89	
For Mechanically Fastened To Wood Or Steel, Add	0.67	
For Mechanically Fastened To Concrete, Add	1.84	
07 22 16 00-0129 Tapered Extruded Polystyrene Board (XEPS) (07 22 16 00-0080)		
Note: Includes polyurethane adhesive.		
07 22 16 00-0130 1/8" Slope, Tapered Extruded Polystyrene Board (XEPS) (07 22 16 00-0129)		
07 22 16 00-0131 SF 2.25" Average Thickness (12.38 Average R-Value), 1/8" Slope, Tapered Extruded Polystyrene Board (XEPS).....	2.74	
For Mechanically Fastened To Wood Or Steel, Deduct	-0.05	
For Mechanically Fastened To Concrete, Add	0.23	
For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add	0.64	
07 22 16 00-0132 SF 2.75" Average Thickness (15.125 Average R-Value), 1/8" Slope, Tapered Extruded Polystyrene Board (XEPS).....	3.95	
For Mechanically Fastened To Wood Or Steel, Deduct	-0.05	
For Mechanically Fastened To Concrete, Add	0.45	
For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add	1.10	
07 22 16 00-0133 SF 3.25" Average Thickness (17.88 Average R-Value), 1/8" Slope, Tapered Extruded Polystyrene Board (XEPS).....	4.23	
For Mechanically Fastened To Wood Or Steel, Deduct	-0.05	
For Mechanically Fastened To Concrete, Add	0.45	
For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add	1.12	
07 22 16 00-0134 SF 3.75" Average Thickness (20.63 Average R-Value), 1/8" Slope, Tapered Extruded Polystyrene Board (XEPS).....	4.52	
For Mechanically Fastened To Wood Or Steel, Add	0.01	
For Mechanically Fastened To Concrete, Add	0.51	
For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add	1.13	
07 22 16 00-0135 SF 4.25" Average Thickness (23.38 Average R-Value), 1/8" Slope, Tapered Extruded Polystyrene Board (XEPS).....	4.81	
For Mechanically Fastened To Wood Or Steel, Add	0.01	
For Mechanically Fastened To Concrete, Add	0.51	
For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add	1.16	
07 22 16 00-0136 SF 4.75" Average Thickness (26.13 Average R-Value), 1/8" Slope, Tapered Extruded Polystyrene Board (XEPS).....	6.00	
For Mechanically Fastened To Wood Or Steel, Add	0.07	
For Mechanically Fastened To Concrete, Add	0.79	
For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add	1.65	
07 22 16 00-0137 SF 5.25" Average Thickness (28.88 Average R-Value), 1/8" Slope, Tapered Extruded Polystyrene Board (XEPS).....	6.29	
For Mechanically Fastened To Wood Or Steel, Add	0.07	
For Mechanically Fastened To Concrete, Add	0.79	
For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add	1.65	
07 22 16 00-0138 SF 5.75" Average Thickness (31.63 Average R-Value), 1/8" Slope, Tapered Extruded Polystyrene Board (XEPS).....	6.57	
For Mechanically Fastened To Wood Or Steel, Add	0.28	
For Mechanically Fastened To Concrete, Add	1.00	
For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add	1.73	
07 22 16 00-0139 SF 6.25" Average Thickness (34.38 Average R-Value), 1/8" Slope, Tapered Extruded Polystyrene Board (XEPS).....	6.86	
For Mechanically Fastened To Wood Or Steel, Add	0.28	
For Mechanically Fastened To Concrete, Add	1.00	
For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add	1.73	
07 22 16 00-0140 SF 6.75" Average Thickness (37.13 Average R-Value), 1/8" Slope, Tapered Extruded Polystyrene Board (XEPS).....	8.05	
For Mechanically Fastened To Wood Or Steel, Add	0.35	
For Mechanically Fastened To Concrete, Add	1.30	
For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add	2.33	
07 22 16 00-0141 1/4" Slope, Tapered Extruded Polystyrene Board (XEPS) (07 22 16 00-0129)		
07 22 16 00-0142 SF 2" Average Thickness (11 Average R-Value), 1/4" Slope, Tapered Extruded Polystyrene Board (XEPS).....	2.60	
For Mechanically Fastened To Wood Or Steel, Deduct	-0.05	
For Mechanically Fastened To Concrete, Add	0.23	
For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add	0.64	
07 22 16 00-0143 SF 3" Average Thickness (16.5 Average R-Value), 1/4" Slope, Tapered Extruded Polystyrene Board (XEPS).....	4.09	
For Mechanically Fastened To Wood Or Steel, Deduct	-0.05	
For Mechanically Fastened To Concrete, Add	0.45	
For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add	1.10	
07 22 16 00-0144 SF 4" Average Thickness (22 Average R-Value), 1/4" Slope, Tapered Extruded Polystyrene Board (XEPS).....	4.66	
For Mechanically Fastened To Wood Or Steel, Add	0.01	
For Mechanically Fastened To Concrete, Add	0.51	
For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add	1.13	
07 22 16 00-0145 SF 5" Average Thickness (27.5 Average R-Value), 1/4" Slope, Tapered Extruded Polystyrene Board (XEPS).....	6.14	
For Mechanically Fastened To Wood Or Steel, Add	0.07	
For Mechanically Fastened To Concrete, Add	0.79	
For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add	1.65	
07 22 16 00-0146 SF 6" Average Thickness (33 Average R-Value), 1/4" Slope, Tapered Extruded Polystyrene Board (XEPS).....	6.72	
For Mechanically Fastened To Wood Or Steel, Add	0.28	
For Mechanically Fastened To Concrete, Add	1.00	
For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add	1.73	
07 22 16 00-0147 SF 7" Average Thickness (38.5 Average R-Value), 1/4" Slope, Tapered Extruded Polystyrene Board (XEPS).....	8.20	
For Mechanically Fastened To Wood Or Steel, Add	0.35	
For Mechanically Fastened To Concrete, Add	1.30	
For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add	2.33	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 22 16 00-0148 1/2" Slope, Tapered Extruded Polystyrene Board (XEPS) <small>(07 22 16 00-0129)</small>		
07 22 16 00-0149 SF 3.5" Average Thickness (19.25 Average R-Value), 1/2" Slope, Tapered Extruded Polystyrene Board (XEPS).....	4.38	
For Mechanically Fastened To Wood Or Steel, Deduct	-0.05	
For Mechanically Fastened To Concrete, Add	0.45	
For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add	1.12	
07 22 16 00-0150 SF 5.5" Average Thickness (30.25 Average R-Value), 1/2" Slope, Tapered Extruded Polystyrene Board (XEPS).....	6.43	
For Mechanically Fastened To Wood Or Steel, Add	0.07	
For Mechanically Fastened To Concrete, Add	0.79	
For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add	1.65	
07 22 16 00-0151 SF 7.5" Average Thickness (41.25 Average R-Value), 1/2" Slope, Tapered Extruded Polystyrene Board (XEPS).....	8.48	
For Mechanically Fastened To Wood Or Steel, Add	0.35	
For Mechanically Fastened To Concrete, Add	1.30	
For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add	2.33	
07 22 16 00-0152 SF 9.5" Average Thickness (52.25 Average R-Value), 1/2" Slope, Tapered Extruded Polystyrene Board (XEPS).....	10.55	
For Mechanically Fastened To Wood Or Steel, Add	0.67	
For Mechanically Fastened To Concrete, Add	1.84	
07 22 16 00-0153 Tapered Perlite Board <small>(07 22 16 00-0080)</small>		
Note: Includes polyurethane adhesive.		
07 22 16 00-0154 1/8" Slope, Tapered Perlite Board <small>(07 22 16 00-0153)</small>		
07 22 16 00-0155 SF 2.25" Average Thickness (6.26 Average R-Value), 1/8" Slope, Tapered Perlite Board	3.68	
For Hot-Mopped, Deduct	-0.12	
For Mechanically Fastened To Wood Or Steel, Deduct	-0.05	
For Mechanically Fastened To Concrete, Add	0.23	
For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add	0.64	
07 22 16 00-0156 SF 2.75" Average Thickness (7.65 Average R-Value), 1/8" Slope, Tapered Perlite Board	4.69	
For Hot-Mopped, Deduct	-0.24	
For Mechanically Fastened To Wood Or Steel, Deduct	-0.05	
For Mechanically Fastened To Concrete, Add	0.45	
For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add	1.10	
07 22 16 00-0157 SF 3.25" Average Thickness (9.04 Average R-Value), 1/8" Slope, Tapered Perlite Board	5.21	
For Hot-Mopped, Deduct	-0.24	
For Mechanically Fastened To Wood Or Steel, Deduct	-0.05	
For Mechanically Fastened To Concrete, Add	0.45	
For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add	1.12	
07 22 16 00-0158 SF 3.75" Average Thickness (10.43 Average R-Value), 1/8" Slope, Tapered Perlite Board	5.64	
For Hot-Mopped, Deduct	-0.24	
For Mechanically Fastened To Wood Or Steel, Add	0.01	
For Mechanically Fastened To Concrete, Add	0.51	
For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add	1.13	
07 22 16 00-0159 SF 4.25" Average Thickness (11.82 Average R-Value), 1/8" Slope, Tapered Perlite Board	6.15	
For Hot-Mopped, Deduct	-0.24	
For Mechanically Fastened To Wood Or Steel, Add	0.01	
For Mechanically Fastened To Concrete, Add	0.51	
For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add	1.16	
07 22 16 00-0160 SF 4.75" Average Thickness (13.21 Average R-Value), 1/8" Slope, Tapered Perlite Board	7.14	
For Hot-Mopped, Deduct	-0.34	
For Mechanically Fastened To Wood Or Steel, Add	0.07	
For Mechanically Fastened To Concrete, Add	0.79	
For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add	1.65	
07 22 16 00-0161 SF 5.25" Average Thickness (14.60 Average R-Value), 1/8" Slope, Tapered Perlite Board	7.66	
For Hot-Mopped, Deduct	-0.34	
For Mechanically Fastened To Wood Or Steel, Add	0.07	
For Mechanically Fastened To Concrete, Add	0.79	
For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add	1.65	
07 22 16 00-0162 SF 5.75" Average Thickness (15.99 Average R-Value), 1/8" Slope, Tapered Perlite Board	8.09	
For Hot-Mopped, Deduct	-0.34	
For Mechanically Fastened To Wood Or Steel, Add	0.28	
For Mechanically Fastened To Concrete, Add	1.00	
For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add	1.73	
07 22 16 00-0163 SF 6.25" Average Thickness (17.38 Average R-Value), 1/8" Slope, Tapered Perlite Board	8.60	
For Hot-Mopped, Deduct	-0.34	
For Mechanically Fastened To Wood Or Steel, Add	0.28	
For Mechanically Fastened To Concrete, Add	1.00	
For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add	1.73	
07 22 16 00-0164 SF 6.75" Average Thickness (18.77 Average R-Value), 1/8" Slope, Tapered Perlite Board	9.60	
For Hot-Mopped, Deduct	-0.46	
For Mechanically Fastened To Wood Or Steel, Add	0.35	
For Mechanically Fastened To Concrete, Add	1.30	
For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add	2.33	
07 22 16 00-0165 1/4" Slope, Tapered Perlite Board <small>(07 22 16 00-0153)</small>		
07 22 16 00-0166 SF 2" Average Thickness (5.56 Average R-Value), 1/4" Slope, Tapered Perlite Board	3.43	
For Hot-Mopped, Deduct	-0.12	
For Mechanically Fastened To Wood Or Steel, Deduct	-0.05	
For Mechanically Fastened To Concrete, Add	0.23	
For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add	0.64	
07 22 16 00-0167 SF 3" Average Thickness (8.34 Average R-Value), 1/4" Slope, Tapered Perlite Board	4.95	
For Hot-Mopped, Deduct	-0.24	
For Mechanically Fastened To Wood Or Steel, Deduct	-0.05	
For Mechanically Fastened To Concrete, Add	0.45	
For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add	1.10	

07 Thermal And Moisture Protection**07 20 Thermal Protection****07 22 Roof And Deck Insulation**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 22 16 00-0168	SF		4" Average Thickness (11.12 Average R-Value), 1/4" Slope, Tapered Perlite Board	5.90	
			<i>For Hot-Mopped, Deduct</i>	-0.24	
			<i>For Mechanically Fastened To Wood Or Steel, Add</i>	0.01	
			<i>For Mechanically Fastened To Concrete, Add</i>	0.51	
			<i>For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add</i>	1.13	
07 22 16 00-0169	SF		5" Average Thickness (13.9 Average R-Value), 1/4" Slope, Tapered Perlite Board	7.40	
			<i>For Hot-Mopped, Deduct</i>	-0.34	
			<i>For Mechanically Fastened To Wood Or Steel, Add</i>	0.07	
			<i>For Mechanically Fastened To Concrete, Add</i>	0.79	
			<i>For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add</i>	1.65	
07 22 16 00-0170	SF		6" Average Thickness (16.68 Average R-Value), 1/4" Slope, Tapered Perlite Board	8.35	
			<i>For Hot-Mopped, Deduct</i>	-0.34	
			<i>For Mechanically Fastened To Wood Or Steel, Add</i>	0.28	
			<i>For Mechanically Fastened To Concrete, Add</i>	1.00	
			<i>For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add</i>	1.73	
07 22 16 00-0171	SF		7" Average Thickness (19.46 Average R-Value), 1/4" Slope, Tapered Perlite Board	9.86	
			<i>For Hot-Mopped, Deduct</i>	-0.46	
			<i>For Mechanically Fastened To Wood Or Steel, Add</i>	0.35	
			<i>For Mechanically Fastened To Concrete, Add</i>	1.30	
			<i>For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add</i>	2.33	
07 22 16 00-0172			1/2" Slope, Tapered Perlite Board (07 22 16 00-0153)		
07 22 16 00-0173	SF		3.5" Average Thickness (9.73 Average R-Value), 1/2" Slope, Tapered Perlite Board	5.46	
			<i>For Hot-Mopped, Deduct</i>	-0.24	
			<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.05	
			<i>For Mechanically Fastened To Concrete, Add</i>	0.45	
			<i>For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add</i>	1.12	
07 22 16 00-0174	SF		5.5" Average Thickness (15.29 Average R-Value), 1/2" Slope, Tapered Perlite Board	7.91	
			<i>For Hot-Mopped, Deduct</i>	-0.34	
			<i>For Mechanically Fastened To Wood Or Steel, Add</i>	0.07	
			<i>For Mechanically Fastened To Concrete, Add</i>	0.79	
			<i>For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add</i>	1.65	
07 22 16 00-0175	SF		7.5" Average Thickness (20.85 Average R-Value), 1/2" Slope, Tapered Perlite Board	10.37	
			<i>For Hot-Mopped, Deduct</i>	-0.46	
			<i>For Mechanically Fastened To Wood Or Steel, Add</i>	0.35	
			<i>For Mechanically Fastened To Concrete, Add</i>	1.30	
			<i>For Mechanically Fastened To Cementitious Wood Fiber Or Gypsum, Add</i>	2.33	
07 22 16 00-0176	SF		9.5" Average Thickness (26.41 Average R-Value), 1/2" Slope, Tapered Perlite Board	12.84	
			<i>For Hot-Mopped, Deduct</i>	-0.58	
			<i>For Mechanically Fastened To Wood Or Steel, Add</i>	0.67	
			<i>For Mechanically Fastened To Concrete, Add</i>	1.84	
07 22 16 00-0177			Demolish Rigid Board Roofing Insulation (07 22 16)		
			Note: Includes removing any combination of roofing insulation systems and/or recovery board. Includes removal of any basic roof accessories and any sheet metals; except special existing conditions (mechanical equipment piping, electrical, ducts, etc.).		
07 22 16 00-0178	SF		Demolish Up To 1/2" Average Thickness, Rigid Board Roofing Insulation	0.41	
07 22 16 00-0179	SF		Demolish >1/2" To 1" Average Thickness, Rigid Board Roofing Insulation	0.42	
07 22 16 00-0180	SF		Demolish >1" To 2" Average Thickness, Rigid Board Roofing Insulation	0.43	
07 22 16 00-0181	SF		Demolish >2" To 3" Average Thickness, Rigid Board Roofing Insulation	0.45	
07 22 16 00-0182	SF		Demolish >3" To 4" Average Thickness, Rigid Board Roofing Insulation	0.46	
07 22 16 00-0183	SF		Demolish >4" To 5" Average Thickness, Rigid Board Roofing Insulation	0.47	
07 22 16 00-0184	SF		Demolish >5" To 6" Average Thickness, Rigid Board Roofing Insulation	0.48	
07 22 16 00-0185	SF		Demolish >6" To 7" Average Thickness, Rigid Board Roofing Insulation	0.49	
07 22 16 00-0186	SF		Demolish >7" To 8" Average Thickness, Rigid Board Roofing Insulation	0.50	
07 22 16 00-0187	SF		Demolish >8" To 9" Average Thickness, Rigid Board Roofing Insulation	0.51	
07 22 16 00-0188	SF		Demolish >9" To 10" Average Thickness, Rigid Board Roofing Insulation	0.52	
07 22 16 00-0189	SF		Demolish >10" To 11" Average Thickness, Rigid Board Roofing Insulation	0.54	
07 22 16 00-0190	SF		Demolish >11" To 12" Average Thickness, Rigid Board Roofing Insulation	0.55	
07 24			Exterior Insulation And Finish Systems (07 20)		
07 24 13			Polymer-Based Exterior Insulation And Finish System (07 24)		
07 24 13 00-0001			Exterior Insulation Finishing System (EIFS) (07 24 13)		
07 24 13 00-0002			Insulation For Exterior Insulation Finishing Systems (EIFS) (07 24 13 00-0001)		
07 24 13 00-0003	SF		1" Thick, R3.85, Molded Expanded Polystyrene, Foam Board Insulation For Exterior Insulation Finishing Systems (EIFS), Adhesive Applied	2.31	
			<i>For Up To 100, Add</i>	0.53	
			<i>For >100 To 500, Add</i>	0.26	
			<i>For >5,000, Deduct</i>	-0.11	
			<i>For Adhesive And Mechanically Fastened To Wood Or Steel, Add</i>	0.38	
			<i>For Adhesive And Mechanically Fastened To Concrete Or Masonry, Add</i>	0.67	
07 24 13 00-0004	SF		1-1/2" Thick, R5.78, Molded Expanded Polystyrene, Foam Board Insulation For Exterior Insulation Finishing Systems (EIFS), Adhesive Applied	2.59	
			<i>For Up To 100, Add</i>	0.53	
			<i>For >100 To 500, Add</i>	0.26	
			<i>For >5,000, Deduct</i>	-0.11	
			<i>For Adhesive And Mechanically Fastened To Wood Or Steel, Add</i>	0.40	
			<i>For Adhesive And Mechanically Fastened To Concrete Or Masonry, Add</i>	0.68	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 24 13 00-0005 SF 2" Thick, R7.70, Molded Expanded Polystyrene, Foam Board Insulation For Exterior Insulation Finishing Systems (EIFS), Adhesive Applied	2.88	
<i>For Up To 100, Add</i>	0.53	
<i>For >100 To 500, Add</i>	0.26	
<i>For >5,000, Deduct</i>	-0.11	
<i>For Adhesive And Mechanically Fastened To Wood Or Steel, Add</i>	0.45	
<i>For Adhesive And Mechanically Fastened To Concrete Or Masonry, Add</i>	0.75	
07 24 13 00-0006 SF 2-1/2" Thick, R9.63, Molded Expanded Polystyrene, Foam Board Insulation For Exterior Insulation Finishing Systems (EIFS), Adhesive Applied	3.16	
<i>For Up To 100, Add</i>	0.53	
<i>For >100 To 500, Add</i>	0.26	
<i>For >5,000, Deduct</i>	-0.11	
<i>For Adhesive And Mechanically Fastened To Wood Or Steel, Add</i>	0.50	
<i>For Adhesive And Mechanically Fastened To Concrete Or Masonry, Add</i>	0.79	
07 24 13 00-0007 SF 3" Thick, R11.55, Molded Expanded Polystyrene, Foam Board Insulation For Exterior Insulation Finishing Systems (EIFS), Adhesive Applied	3.45	
<i>For Up To 100, Add</i>	0.53	
<i>For >100 To 500, Add</i>	0.26	
<i>For >5,000, Deduct</i>	-0.11	
<i>For Adhesive And Mechanically Fastened To Wood Or Steel, Add</i>	0.50	
<i>For Adhesive And Mechanically Fastened To Concrete Or Masonry, Add</i>	0.79	
07 24 13 00-0008 SF 4" Thick, R15.40, Molded Expanded Polystyrene, Foam Board Insulation For Exterior Insulation Finishing Systems (EIFS), Adhesive Applied	4.02	
<i>For Up To 100, Add</i>	0.53	
<i>For >100 To 500, Add</i>	0.26	
<i>For >5,000, Deduct</i>	-0.11	
<i>For Adhesive And Mechanically Fastened To Wood Or Steel, Add</i>	0.57	
<i>For Adhesive And Mechanically Fastened To Concrete Or Masonry, Add</i>	0.86	
07 24 13 00-0009 Fiberglass Reinforcing Mesh For Exterior Insulation Finishing Systems (EIFS) <small>(07 24 13 00-0001)</small>		
<i>Note: Includes applying a layer of base coat to the insulation board and fully embedding the reinforcing fabric in the wet base coat.</i>		
07 24 13 00-0010 SF 4.3 OZ, Fiberglass Reinforcing Mesh For Exterior Insulation Finishing Systems (EIFS) (Dryvit S-Mesh), Embedded In A Layer Of Base Coat	3.12	
<i>For Up To 100, Add</i>	1.06	
<i>For >100 To 500, Add</i>	0.53	
<i>For >5,000, Deduct</i>	-0.21	
07 24 13 00-0011 SF 6.0 OZ, Fiberglass Reinforcing Mesh For Exterior Insulation Finishing Systems (EIFS) (Dryvit SP-Mesh), Embedded In A Layer Of Base Coat	3.42	
<i>For Up To 100, Add</i>	1.06	
<i>For >100 To 500, Add</i>	0.53	
<i>For >5,000, Deduct</i>	-0.21	
07 24 13 00-0012 SF 15.0 OZ, Fiberglass Reinforcing Mesh For Exterior Insulation Finishing Systems (EIFS) (Dryvit Panzer® 15), Embedded In A Layer Of Base Coat	4.21	
<i>For Up To 100, Add</i>	1.06	
<i>For >100 To 500, Add</i>	0.53	
<i>For >5,000, Deduct</i>	-0.21	
07 24 13 00-0013 SF 20.0 OZ, Fiberglass Reinforcing Mesh For Exterior Insulation Finishing Systems (EIFS) (Dryvit Panzer® 20), Embedded In A Layer Of Base Coat	4.45	
<i>For Up To 100, Add</i>	1.06	
<i>For >100 To 500, Add</i>	0.53	
<i>For >5,000, Deduct</i>	-0.21	
07 24 13 00-0014 Base Coats For Exterior Insulation Finishing Systems (EIFS) <small>(07 24 13 00-0001)</small>		
07 24 13 00-0015 SF Polymer-Based, Fiber-Reinforced Base Coat For Exterior Insulation Finishing Systems (EIFS) (Dryvit Genesis® DM)	1.52	
<i>For Up To 100, Add</i>	0.53	
<i>For >100 To 500, Add</i>	0.26	
<i>For >5,000, Deduct</i>	-0.11	
07 24 13 00-0016 SF Acrylic-Modified, Fiber-Reinforced Base Coat For Exterior Insulation Finishing Systems (EIFS) (Dryvit Genesis®)	1.74	
<i>For Up To 100, Add</i>	0.53	
<i>For >100 To 500, Add</i>	0.26	
<i>For >5,000, Deduct</i>	-0.11	
07 24 13 00-0017 SF Water Resistant, Acrylic Co-Polymer Base Coat For Exterior Insulation Finishing Systems (EIFS) (Dryvit Dryflex®)	2.92	
<i>For Up To 100, Add</i>	0.53	
<i>For >100 To 500, Add</i>	0.26	
<i>For >5,000, Deduct</i>	-0.11	
07 24 13 00-0018 SF Hydrostatic Water Resistant, Acrylic Co-Polymer Base Coat For Exterior Insulation Finishing Systems (EIFS) (Dryvit Dryflex®)	3.85	
<i>For Up To 100, Add</i>	0.53	
<i>For >100 To 500, Add</i>	0.26	
<i>For >5,000, Deduct</i>	-0.11	
07 24 13 00-0019 Finish Coats For Exterior Insulation Finishing Systems (EIFS) <small>(07 24 13 00-0001)</small>		
<i>Note: Includes all standard manufacturers' colors.</i>		
07 24 13 00-0020 SF 100% Acrylic-Based Aggregate Fine Finish Coat For Exterior Insulation Finishing Systems (EIFS) (Dryvit DPR Finish)	2.65	
<i>For Up To 100, Add</i>	1.06	
<i>For >100 To 500, Add</i>	0.53	
<i>For >5,000, Deduct</i>	-0.21	

07 Thermal And Moisture Protection**07 20 Thermal Protection****07 24 Exterior Insulation And Finish Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 24 13 00-0021	SF		100% Acrylic-Based Aggregate Textured Finish Coat For Exterior Insulation Finishing Systems (EIFS) (Dryvit DPR Finish).....	2.69	
			For Up To 100, Add	1.06	
			For >100 To 500, Add	0.53	
			For >5,000, Deduct	-0.21	
07 24 13 00-0022	SF		Lightweight Elastic, 100% Acrylic-Based Aggregate Fine Finish Coat For Exterior Insulation Finishing Systems (EIFS) (Dryvit E™ Finish).....	3.04	
			For Up To 100, Add	1.06	
			For >100 To 500, Add	0.53	
			For >5,000, Deduct	-0.21	
07 24 13 00-0023	SF		Lightweight Elastic, 100% Acrylic-Based Aggregate Textured Finish Coat For Exterior Insulation Finishing Systems (EIFS) (Dryvit E™ Finish).....	3.35	
			For Up To 100, Add	1.06	
			For >100 To 500, Add	0.53	
			For >5,000, Deduct	-0.21	
07 24 13 00-0024	SF		Mildew Resistant, 100% Acrylic-Based Aggregate Fine Finish Coat For Exterior Insulation Finishing Systems (EIFS) (Dryvit PMR™ Finish).....	3.04	
			For Up To 100, Add	1.06	
			For >100 To 500, Add	0.53	
			For >5,000, Deduct	-0.21	
07 24 13 00-0025	SF		Mildew Resistant, 100% Acrylic-Based Aggregate Textured Finish Coat For Exterior Insulation Finishing Systems (EIFS) (Dryvit PMR™ Finish).....	3.35	
			For Up To 100, Add	1.06	
			For >100 To 500, Add	0.53	
			For >5,000, Deduct	-0.21	
07 24 13 00-0026	SF		Flexible Elastomeric, 100% Acrylic-Based Smooth Finish Coat For Exterior Insulation Finishing Systems (EIFS) (Dryvit Weatherlastic® Smooth).....	2.74	
			For Up To 100, Add	1.06	
			For >100 To 500, Add	0.53	
			For >5,000, Deduct	-0.21	
07 24 13 00-0027	SF		Flexible Elastomeric, 100% Acrylic-Based Textured Finish Coat For Exterior Insulation Finishing Systems (EIFS) (Dryvit Weatherlastic®).....	3.06	
			For Up To 100, Add	1.06	
			For >100 To 500, Add	0.53	
			For >5,000, Deduct	-0.21	
07 24 13 00-0028	SF		100% Acrylic-Based Finish With Multi-Colored Quartz Aggregates, Finish Coat For Exterior Insulation Finishing Systems (EIFS) (Dryvit Ameristone™).....	5.81	
			For Up To 100, Add	1.06	
			For >100 To 500, Add	0.53	
			For >5,000, Deduct	-0.21	
07 24 13 00-0029			Primer And Sealers For Exterior Insulation Finishing Systems (EIFS) (07 24 13 00-0001)		
07 24 13 00-0030	SF		100% Acrylic-Based Primer/Adhesion Promoter For Exterior Insulation Finishing Systems (EIFS) (Dryvit Prymit®).....	0.78	
			For Up To 100, Add	0.30	
			For >100 To 500, Add	0.15	
			For >5,000, Deduct	-0.06	
07 24 13 00-0031	SF		100% Acrylic Emulsion Primer/Sealer For Exterior Insulation Finishing Systems (EIFS) (Dryvit SealClear™).....	0.80	
			For Up To 100, Add	0.30	
			For >100 To 500, Add	0.15	
			For >5,000, Deduct	-0.06	
07 24 13 00-0032			Air/Water/Vapor Barriers For Exterior Insulation Finishing Systems (EIFS) (07 24 13 00-0001)		
07 24 13 00-0033	SF		Smooth, High Performance, Polymer-Based, Non-Cementitious Water-Resistive Membrane And Air Barrier For Exterior Insulation Finishing Systems (EIFS) (Dryvit Backstop® NT™), Per Coat.....	1.04	
			For Up To 100, Add	0.30	
			For >100 To 500, Add	0.15	
			For >5,000, Deduct	-0.06	
07 24 13 00-0034	SF		Texture, High Performance, Polymer-Based, Non-Cementitious Water-Resistive Membrane And Air Barrier For Exterior Insulation Finishing Systems (EIFS) (Dryvit Backstop® NT™), Per Coat.....	1.26	
			For Up To 100, Add	0.30	
			For >100 To 500, Add	0.15	
			For >5,000, Deduct	-0.06	
07 24 13 00-0035			Drainage Accessories For Exterior Insulation Finishing Systems (EIFS) (07 24 13 00-0001)		
07 24 13 00-0036	SF		1/8" Thick, Flexible Polyamide Drainage Mat For Exterior Insulation Finishing Systems (EIFS) (Dryvit Drainage Mat).....	1.56	
			For Up To 100, Add	0.33	
			For >100 To 500, Add	0.17	
			For >5,000, Deduct	-0.07	
07 24 13 00-0037			Starter Tracks For Exterior Insulation Finishing Systems (EIFS) (07 24 13 00-0001)		
07 24 13 00-0038	LF		1" Width, PVC Perforated "J" Channel Drainage Track (Dryvit Starter Trac STWP).....	2.22	
07 24 13 00-0039	LF		1-1/2" Width, PVC Perforated "J" Channel Drainage Track (Dryvit Starter Trac STWP).....	2.38	
07 24 13 00-0040	LF		2" Width, PVC Perforated "J" Channel Drainage Track (Dryvit Starter Trac STWP).....	2.58	
07 24 13 00-0041	LF		3" Width, PVC Perforated "J" Channel Drainage Track (Dryvit Starter Trac STWP).....	2.98	
07 24 13 00-0042	LF		1" Width, PVC Perforated "J" Channel Drainage Track With Drip Edge (Dryvit Starter Trac STDE).....	2.38	
07 24 13 00-0043	LF		1-1/2" Width, PVC Perforated "J" Channel Drainage Track With Drip Edge (Dryvit Starter Trac STDE).....	2.58	
07 24 13 00-0044	LF		2" Width, PVC Perforated "J" Channel Drainage Track With Drip Edge (Dryvit Starter Trac STDE).....	2.77	
07 24 13 00-0045	LF		3" Width, PVC Perforated "J" Channel Drainage Track With Drip Edge (Dryvit Starter Trac STDE).....	3.21	



MINOR	CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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07 24 13 00-0046	Demolish Exterior Insulation Finishing Systems (EIFS) <small>(07 24 13 00-0001)</small>		
07 24 13 00-0047	SF Demolish Exterior Insulation Finishing Systems (EIFS).....	1.99	
	Note: Includes demolition of all finish coats, base coats, reinforcing layers and insulation layers down to the substrate. Excludes demolition of sheathing.		
	<i>For Up To 100, Add</i>	1.00	
	<i>For >100 To 500, Add</i>	0.50	
	<i>For >5,000, Deduct</i>	-0.20	

07 25 Weather Barriers (07)

07 26 Vapor Retarders (07 25)

07 26 13 Above-Grade Vapor Retarders (07 26)

07 26 13 00-0001	CSF Two Layer Kraft Paper Laminated With Asphalt, Grade "B" Building Paper (Aquabar B).....	18.62	
07 26 13 00-0002	CSF Asphalt Saturated Kraft Building Paper, Grade D, "Jumbo Tex".....	17.49	
07 26 13 00-0003	CSF 60 Minute Asphalt Saturated Kraft Building Paper, Grade D, "Super Jumbo Tex 60 Minute".....	21.10	
07 26 13 00-0004	CSF Two Ply 60 Minute Asphalt Saturated Kraft Building Paper, Grade D, "Two Ply Super Jumbo Tex 60 Minute".....	26.41	
07 26 13 00-0005	CSF Regular Weight Red Rosin Sized Sheathing.....	27.36	
07 26 13 00-0006	CLF 6" Wide Two Layer Kraft Paper Laminated With Asphalt, Building Flashing Paper (Bond Beam Paper).....	55.29	
07 26 13 00-0007	CLF 4" Wide Self Adhering Butyl Sealing Tape.....	80.08	
07 26 13 00-0008	CLF 6" Wide Self Adhesive Butyl Sealing Tape.....	113.26	
07 26 13 00-0009	CLF 9" Wide Self Adhesive Butyl Sealing Tape.....	154.49	
07 26 13 00-0010	CSF Building Wrap (Tyvek).....	44.56	

07 27 Air Barriers (07 25)

07 27 23 Board Product Air Barriers (07 27)

07 27 23 00-0001 Barriers For Plenums (07 27 23)

07 27 23 00-0002	SF 0.5" Thick Leaded Vinyl Acoustic Plenum Barrier 0.48 LB/SF.....	7.71	2.16
	<i>For Up To 50, Add</i>	2.85	
	<i>For >50 To 200, Add</i>	1.62	
	<i>For >200 To 500, Add</i>	0.60	
	<i>For >2,500, Deduct</i>	-0.39	
07 27 23 00-0003	SF 0.625" Thick Leaded Vinyl Acoustic Plenum Barrier 0.87 LB/SF.....	8.33	2.16
	<i>For Up To 50, Add</i>	3.10	
	<i>For >50 To 200, Add</i>	1.76	
	<i>For >200 To 500, Add</i>	0.65	
	<i>For >2,500, Deduct</i>	-0.42	
07 27 23 00-0004	SF Aluminum Foil Fiberglass Reinforced Plenum Bar Parallel With Joists 1" Thick.....	3.03	1.44
	<i>For Up To 50, Add</i>	1.50	
	<i>For >50 To 200, Add</i>	0.83	
	<i>For >200 To 500, Add</i>	0.28	
	<i>For >2,500, Deduct</i>	-0.15	
07 27 23 00-0005	SF Aluminum Foil Fiberglass Reinforced Plenum Bar Perpendicular With Joists 1" Thick.....	5.52	2.16
	<i>For Up To 50, Add</i>	2.68	
	<i>For >50 To 200, Add</i>	1.48	
	<i>For >200 To 500, Add</i>	0.51	
	<i>For >2,500, Deduct</i>	-0.28	
07 27 23 00-0006	SF Aluminum Mesh Barrier For Plenum Kraft Paper Backed.....	4.18	1.44
	<i>For Up To 50, Add</i>	1.67	
	<i>For >50 To 200, Add</i>	0.94	
	<i>For >200 To 500, Add</i>	0.34	
	<i>For >2,500, Deduct</i>	-0.21	
07 27 23 00-0007	SF 1/64" Thick Sheet Lead Barrier For Plenum 1 LB/SF.....	5.85	1.44
	<i>For Up To 50, Add</i>	1.84	
	<i>For >50 To 200, Add</i>	1.07	
	<i>For >200 To 500, Add</i>	0.41	
	<i>For >2,500, Deduct</i>	-0.29	

07 30 Steep Slope Roofing (07)

Note: Includes starter strips and 15 year warranty unless otherwise noted and all warranties are No Dollar Limit (NDL) to include labor, material and equipment.

07 31 Shingles And Shakes (07 30)

07 31 13 Asphalt Shingles (07 31)

07 31 13 00-0001 Three Tab Fiberglass Reinforced, Asphalt Composition Shingle (07 31 13)

07 31 13 00-0002	SQ 200 LB/SQ, 5" Exposure, Three Tab Fiberglass Reinforced, Asphalt Composition Shingle (CertainTeed CT 20).....	208.88	135.96
	<i>For >50 To 75, Deduct</i>	-3.41	
	<i>For >75 To 100, Deduct</i>	-9.06	
	<i>For >100 To 200, Deduct</i>	-15.56	
	<i>For >200, Deduct</i>	-24.30	
	<i>For Steep Roof, Over 7 To 12, Add</i>	39.57	

07 Thermal And Moisture Protection**07 30 Steep Slope Roofing****07 31 Shingles And Shakes**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 31 13 00-0003	SQ		220 LB/SQ, 5" Exposure, Three Tab Fiberglass Reinforced, Asphalt Composition Shingle (CertainTeed XT 25).....	219.05	142.78
			<i>For >50 To 75, Deduct</i>	-3.57	
			<i>For >75 To 100, Deduct</i>	-9.49	
			<i>For >100 To 200, Deduct</i>	-16.31	
			<i>For >200, Deduct</i>	-25.47	
			<i>For Steep Roof, Over 7 To 12, Add</i>	41.54	
07 31 13 00-0004	SQ		230 LB/SQ, 5" Exposure, Three Tab Fiberglass Reinforced, Asphalt Composition Shingle (CertainTeed XT 30).....	253.91	149.91
			<i>For >50 To 75, Deduct</i>	-4.70	
			<i>For >75 To 100, Deduct</i>	-11.64	
			<i>For >100 To 200, Deduct</i>	-19.75	
			<i>For >200, Deduct</i>	-30.09	
			<i>For Steep Roof, Over 7 To 12, Add</i>	43.63	
07 31 13 00-0005			Architectural Fiberglass Reinforced, Asphalt Composition Shingle <small>(07 31 13)</small>		
			Note: Excludes underlayment, drip edges, and ridge vent.		
07 31 13 00-0006	SQ		245 LB/SQ, 5" Exposure, Two Layer Laminated Fiberglass Reinforced, Asphalt Composition Shingle (CertainTeed Landmark).....	260.41	173.57
			<i>For >50 To 75, Deduct</i>	-4.11	
			<i>For >75 To 100, Deduct</i>	-11.13	
			<i>For >100 To 200, Deduct</i>	-19.18	
			<i>For >200, Deduct</i>	-30.15	
			<i>For Steep Roof, Over 7 To 12, Add</i>	50.49	
07 31 13 00-0007	SQ		240 LB/SQ, 8" Exposure, Four Tab Fiberglass Reinforced, Asphalt Composition Shingle (CertainTeed Highland Slate).....	276.15	165.26
			<i>For >50 To 75, Deduct</i>	-5.04	
			<i>For >75 To 100, Deduct</i>	-12.57	
			<i>For >100 To 200, Deduct</i>	-21.36	
			<i>For >200, Deduct</i>	-32.65	
			<i>For Steep Roof, Over 7 To 12, Add</i>	48.09	
07 31 13 00-0008	SQ		265 LB/SQ, 5" Exposure, Two Layer Laminated Fiberglass Reinforced, Asphalt Composition Shingle (CertainTeed Landmark Plus).....	299.07	182.25
			<i>For >50 To 75, Deduct</i>	-5.33	
			<i>For >75 To 100, Deduct</i>	-13.48	
			<i>For >100 To 200, Deduct</i>	-22.96	
			<i>For >200, Deduct</i>	-35.24	
			<i>For Steep Roof, Over 7 To 12, Add</i>	53.03	
07 31 13 00-0009	SQ		235 LB/SQ, 8" Exposure, Four Tab Fiberglass Reinforced, Asphalt Composition Shingle (CertainTeed Hatteras).....	289.31	157.40
			<i>For >50 To 75, Deduct</i>	-5.85	
			<i>For >75 To 100, Deduct</i>	-13.81	
			<i>For >100 To 200, Deduct</i>	-23.24	
			<i>For >200, Deduct</i>	-34.78	
			<i>For Steep Roof, Over 7 To 12, Add</i>	45.79	
07 31 13 00-0010	SQ		300 LB/SQ, 5" Exposure, Two Layer Laminated Fiberglass Reinforced, Asphalt Composition Shingle (CertainTeed Landmark Premium).....	324.63	191.37
			<i>For >50 To 75, Deduct</i>	-6.03	
			<i>For >75 To 100, Deduct</i>	-14.90	
			<i>For >100 To 200, Deduct</i>	-25.27	
			<i>For >200, Deduct</i>	-38.49	
			<i>For Steep Roof, Over 7 To 12, Add</i>	55.66	
07 31 13 00-0011	SQ		300 LB/SQ, 5" Exposure, Random Laminated Tabs, One Piece, Fiberglass Reinforced, Asphalt Composition Shingle (CertainTeed Independence).....	346.72	191.37
			<i>For >50 To 75, Deduct</i>	-6.91	
			<i>For >75 To 100, Deduct</i>	-16.44	
			<i>For >100 To 200, Deduct</i>	-27.70	
			<i>For >200, Deduct</i>	-41.58	
			<i>For Steep Roof, Over 7 To 12, Add</i>	55.66	
07 31 13 00-0012	SQ		355 LB/SQ, 4" Exposure, Sculpted Edge, Two Layer Laminated Fiberglass Reinforced, Asphalt Composition Shingle (CertainTeed Presidential Shake).....	378.58	210.95
			<i>For >50 To 75, Deduct</i>	-7.47	
			<i>For >75 To 100, Deduct</i>	-17.87	
			<i>For >100 To 200, Deduct</i>	-30.14	
			<i>For >200, Deduct</i>	-45.33	
			<i>For Steep Roof, Over 7 To 12, Add</i>	61.38	
07 31 13 00-0013	SQ		340 LB/SQ, 5" Exposure, Three Layer Laminated Fiberglass Reinforced, Asphalt Composition Shingle (CertainTeed Landmark TL).....	375.68	200.94
			<i>For >50 To 75, Deduct</i>	-7.72	
			<i>For >75 To 100, Deduct</i>	-18.08	
			<i>For >100 To 200, Deduct</i>	-30.37	
			<i>For >200, Deduct</i>	-45.29	
			<i>For Steep Roof, Over 7 To 12, Add</i>	58.44	
07 31 13 00-0014	SQ		300 LB/SQ, 5" Exposure, Reflective Two Layer Laminated Fiberglass Reinforced, Asphalt Composition Shingle (CertainTeed Landmark Solaris).....	373.88	191.37
			<i>For >50 To 75, Deduct</i>	-8.00	
			<i>For >75 To 100, Deduct</i>	-18.34	
			<i>For >100 To 200, Deduct</i>	-30.69	
			<i>For >200, Deduct</i>	-45.39	
			<i>For Steep Roof, Over 7 To 12, Add</i>	55.66	
07 31 13 00-0015	SQ		355 LB/SQ, 8" Exposure, Two Full Size Layers, Four Tab Fiberglass Reinforced, Asphalt Composition Shingle (CertainTeed Centennial Slate).....	438.04	210.95
			<i>For >50 To 75, Deduct</i>	-9.85	
			<i>For >75 To 100, Deduct</i>	-22.03	
			<i>For >100 To 200, Deduct</i>	-36.68	
			<i>For >200, Deduct</i>	-53.65	
			<i>For Steep Roof, Over 7 To 12, Add</i>	61.38	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 31 13 00-0016 SQ 355 LB/SQ, 8" Exposure, Scalloped Cut, Two Full Size Layers, Four Tab Fiberglass Reinforced, Asphalt Composition Shingle (CertainTeed Carriage House).....	453.52	210.95
<i>For >50 To 75, Deduct</i>	-10.47	
<i>For >75 To 100, Deduct</i>	-23.11	
<i>For >100 To 200, Deduct</i>	-38.38	
<i>For >200, Deduct</i>	-55.82	
<i>For Steep Roof, Over 7 To 12, Add</i>	61.38	
07 31 13 00-0017 SQ 480 LB/SQ, 4" Exposure, Sculpted Edge, Three Layer Laminated Fiberglass Reinforced, Asphalt Composition Shingle (CertainTeed Presidential Shake TL).....	503.90	232.61
<i>For >50 To 75, Deduct</i>	-11.70	
<i>For >75 To 100, Deduct</i>	-25.76	
<i>For >100 To 200, Deduct</i>	-42.74	
<i>For >200, Deduct</i>	-62.09	
<i>For Steep Roof, Over 7 To 12, Add</i>	67.67	
07 31 13 00-0018 SQ 425 LB/SQ, 8" Exposure, Random Laminated Tabs, Two Full Size Layers, Four Tab Fiberglass Reinforced, Asphalt Composition Shingle (CertainTeed GrandManor).....	496.50	221.49
<i>For >50 To 75, Deduct</i>	-11.80	
<i>For >75 To 100, Deduct</i>	-25.69	
<i>For >100 To 200, Deduct</i>	-42.53	
<i>For >200, Deduct</i>	-61.45	
<i>For Steep Roof, Over 7 To 12, Add</i>	64.44	
07 31 13 00-0019 Accessories (07 31 13)		
07 31 13 00-0020 LF Hip And Ridge Roll Vent	4.88	0.82
Note: Excludes shingles.		
07 31 13 00-0021 LF Three Tab Hip And Ridge Shingles	2.92	2.03
07 31 13 00-0022 LF Architectural Hip And Ridge Shingles.....	3.53	2.25
07 31 13 00-0023 SQ Demolish Additional Layers Of Shingles.....	74.18	
07 31 16 Metal Shingles (07 31)		
07 31 16 00-0001 Aluminum Shingles (07 31 16)		
07 31 16 00-0002 SQ Aluminum Shingles, Mill Finish, 0.020" Thick	440.97	120.06
<i>For Colors, Anodized Finish, Add</i>	30.00	
<i>For Bonderized Finish, Add</i>	47.00	
<i>For 1" Factory Applied Polystyrene, Add</i>	37.00	
07 31 16 00-0003 SQ Aluminum Shingles, Mill Finish, 0.030" Thick	585.57	131.23
<i>For Colors, Anodized Finish, Add</i>	30.00	
<i>For Bonderized Finish, Add</i>	47.00	
<i>For 1" Factory Applied Polystyrene, Add</i>	37.00	
07 31 16 00-0004 LF Aluminum Shingles, Ridge Cap, 0.020" Thick	7.83	1.73
07 31 16 00-0005 LF Aluminum Shingles, Ridge Cap, 0.030" Thick	8.15	1.73
07 31 16 00-0006 LF Aluminum Shingles, Valley Section For Above, 0.020" Thick	5.38	1.73
07 31 16 00-0007 LF Aluminum Shingles, Valley Section For Above, 0.030" Thick	6.03	1.73
07 31 16 00-0008 Galvanized Steel Shingles (07 31 16)		
07 31 16 00-0009 SQ 24 Gauge Steel Shingles, Galvanized	333.86	107.34
<i>For Factory Applied 1" Polystyrene Insulation, Add</i>	24.75	
<i>For >50 To 75, Deduct</i>	-4.77	
<i>For >75 To 100, Deduct</i>	-13.71	
<i>For >100 To 200, Deduct</i>	-23.84	
<i>For >200, Deduct</i>	-32.78	
<i>For Steep Roof, Over 7 To 12, Add</i>	68.71	
07 31 16 00-0010 SQ 26 Gauge Steel Shingles, Galvanized	322.21	106.48
<i>For Factory Applied 1" Polystyrene Insulation, Add</i>	24.75	
<i>For >50 To 75, Deduct</i>	-4.37	
<i>For >75 To 100, Deduct</i>	-12.98	
<i>For >100 To 200, Deduct</i>	-22.67	
<i>For >200, Deduct</i>	-31.27	
<i>For Steep Roof, Over 7 To 12, Add</i>	68.12	
07 31 16 00-0011 SQ 24 Gauge Steel Shingles, Galvanized And Bonderized.....	505.74	106.48
<i>For Factory Applied 1" Polystyrene Insulation, Add</i>	24.75	
<i>For >50 To 75, Deduct</i>	-11.71	
<i>For >75 To 100, Deduct</i>	-25.82	
<i>For >100 To 200, Deduct</i>	-42.86	
<i>For >200, Deduct</i>	-56.97	
<i>For Steep Roof, Over 7 To 12, Add</i>	68.12	
07 31 16 00-0012 SQ 26 Gauge Steel Shingles, Galvanized And Bonderized.....	469.63	106.48
<i>For Factory Applied 1" Polystyrene Insulation, Add</i>	24.75	
<i>For >50 To 75, Deduct</i>	-10.27	
<i>For >75 To 100, Deduct</i>	-23.29	
<i>For >100 To 200, Deduct</i>	-38.89	
<i>For >200, Deduct</i>	-51.91	
<i>For Steep Roof, Over 7 To 12, Add</i>	68.12	
07 31 16 00-0013 LF Ridge Or Valley.....	5.31	1.43
<i>For Factory Applied 1" Polystyrene Insulation, Add</i>	24.75	
<i>For >50 To 75, Deduct</i>	-0.10	
<i>For >75 To 100, Deduct</i>	-0.25	
<i>For >100 To 200, Deduct</i>	-0.42	
<i>For >200, Deduct</i>	-0.56	
<i>For Steep Roof, Over 7 To 12, Add</i>	0.90	

07 Thermal And Moisture Protection**07 30 Steep Slope Roofing****07 31 Shingles And Shakes**MINOR
CSI UOM DESCRIPTIONTOTAL DIRECT DEMOLITION
UNIT COST UNIT COST**07 31 19 Mineral-Fiber Cement Shingles** (07 31)

07 31 19 00-0001	Mineral Fiber Shingles (07 31 19)		
07 31 19 00-0002	SQ Mineral Fiber Strip Shingles, 14" X 30", 325 LB/SQ.....	474.09	72.02
	<i>For Steep Roof, Over 7 To 12, Add</i>	46.10	
07 31 19 00-0003	SQ Mineral Fiber, Shakes, 9.35" x 16", 500 LB/SQ	682.79	131.08
	<i>For Steep Roof, Over 7 To 12, Add</i>	83.89	
07 31 19 00-0004	SQ Mineral Fiber, Hexagonal Shape, 16" X 16", per SQ	476.27	96.15
	<i>For Steep Roof, Over 7 To 12, Add</i>	61.53	
07 31 19 00-0005	SQ Mineral Fiber, Square, 16" X 16", per SQ	445.57	96.15
	<i>For Steep Roof, Over 7 To 12, Add</i>	61.53	
07 31 19 00-0006	CLF Mineral Fiber, Strip Shingles, Starters, 8" x 30", 255 LB Per 100 LF	355.00	96.15
07 31 19 00-0007	CLF Mineral Fiber, Hip And Ridge Shingles, 4-3/4" x 14", 380 LB Per 100 LF	1,159.52	288.09
07 31 19 00-0008	CLF Mineral Fiber, Hip And Ridge Shingles, 5-3/8" X 14", per 100 LF	1,213.24	288.09

07 31 26 Slate Shingles (07 31)

Note: Includes 30 LB felt and fasteners.

07 31 26 00-0001	Shingles Including 30 LB Felt And Nails (07 31 26)		
07 31 26 00-0002	SQ Slate Shingles, Buckingham, Virginia Black, 3/16" Thick.....	1,031.37	183.10
	<i>For >50 To 75, Deduct</i>	-24.98	
	<i>For >75 To 100, Deduct</i>	-53.89	
	<i>For >100 To 200, Deduct</i>	-89.04	
	<i>For >200, Deduct</i>	-117.95	
	<i>For Graduated Shapes, Add</i>	93.68	
	<i>For Steep Roof, Over 7 To 12, Add</i>	130.20	
07 31 26 00-0003	SQ Slate Shingles, Buckingham, Virginia Black, 1/4" Thick.....	1,206.37	183.10
	<i>For >50 To 75, Deduct</i>	-31.98	
	<i>For >75 To 100, Deduct</i>	-66.14	
	<i>For >100 To 200, Deduct</i>	-108.29	
	<i>For >200, Deduct</i>	-142.45	
	<i>For Graduated Shapes, Add</i>	119.93	
	<i>For Steep Roof, Over 7 To 12, Add</i>	130.20	
07 31 26 00-0004	SQ Slate Shingles, Penn Black Bangor	1,153.87	183.10
	<i>For >50 To 75, Deduct</i>	-29.88	
	<i>For >75 To 100, Deduct</i>	-62.46	
	<i>For >100 To 200, Deduct</i>	-102.51	
	<i>For >200, Deduct</i>	-135.10	
	<i>For Graduated Shapes, Add</i>	112.05	
	<i>For Steep Roof, Over 7 To 12, Add</i>	130.20	
07 31 26 00-0005	SQ Slate Shingles, Vermont, Unfading Colors, Green.....	1,171.37	183.10
	<i>For >50 To 75, Deduct</i>	-30.58	
	<i>For >75 To 100, Deduct</i>	-63.69	
	<i>For >100 To 200, Deduct</i>	-104.44	
	<i>For >200, Deduct</i>	-137.55	
	<i>For Graduated Shapes, Add</i>	114.68	
	<i>For Steep Roof, Over 7 To 12, Add</i>	130.20	
07 31 26 00-0006	SQ Slate Shingles, Vermont, Unfading Colors, Semi-Weathered, Green/Gray	1,241.37	183.10
	<i>For >50 To 75, Deduct</i>	-33.38	
	<i>For >75 To 100, Deduct</i>	-68.59	
	<i>For >100 To 200, Deduct</i>	-112.14	
	<i>For >200, Deduct</i>	-147.35	
	<i>For Graduated Shapes, Add</i>	125.18	
	<i>For Steep Roof, Over 7 To 12, Add</i>	130.20	
07 31 26 00-0007	SQ Slate Shingles, Vermont, Unfading Color, Purple	1,153.87	183.10
	<i>For >50 To 75, Deduct</i>	-29.88	
	<i>For >75 To 100, Deduct</i>	-62.46	
	<i>For >100 To 200, Deduct</i>	-102.51	
	<i>For >200, Deduct</i>	-135.10	
	<i>For Graduated Shapes, Add</i>	112.05	
	<i>For Steep Roof, Over 7 To 12, Add</i>	130.20	
07 31 26 00-0008	SQ Slate Shingles, Vermont, Unfading Color, Black Or Gray	1,101.37	183.10
	<i>For >50 To 75, Deduct</i>	-27.78	
	<i>For >75 To 100, Deduct</i>	-58.79	
	<i>For >100 To 200, Deduct</i>	-96.74	
	<i>For >200, Deduct</i>	-127.75	
	<i>For Graduated Shapes, Add</i>	104.18	
	<i>For Steep Roof, Over 7 To 12, Add</i>	130.20	
07 31 26 00-0009	SQ Slate Shingles, Vermont, Unfading Color, Red	2,194.87	183.10
	<i>For >50 To 75, Deduct</i>	-71.52	
	<i>For >75 To 100, Deduct</i>	-135.33	
	<i>For >100 To 200, Deduct</i>	-217.02	
	<i>For >200, Deduct</i>	-280.84	
	<i>For Graduated Shapes, Add</i>	268.20	
	<i>For Steep Roof, Over 7 To 12, Add</i>	130.20	
07 31 26 00-0010	SQ Slate Shingles, Vermont, Unfading Color, Variegated Purple	1,153.87	183.10
	<i>For >50 To 75, Deduct</i>	-29.88	
	<i>For >75 To 100, Deduct</i>	-62.46	
	<i>For >100 To 200, Deduct</i>	-102.51	
	<i>For >200, Deduct</i>	-135.10	
	<i>For Graduated Shapes, Add</i>	112.05	
	<i>For Steep Roof, Over 7 To 12, Add</i>	130.20	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 31 29 Wood Shingles And Shakes (07 31)		
07 31 29 13 Wood Shingles (07 31 29)		
07 31 29 13-0001 #1 Grade, Red Cedar Shingles (07 31 29 13)		
07 31 29 13-0002 #1 Grade, Red Cedar Shingles Installed On Roofs (07 31 29 13-0001)		
07 31 29 13-0003 SQ 3-3/4" Exposure, 16" Shingle, #1 Grade, Red Cedar Shingles Installed On Roof.....	526.23	143.68
<i>For Steep Roof, Over 7 To 12, Add</i>	91.96	
<i>For CCA Treated, Add</i>	35.83	
07 31 29 13-0004 SQ 5" Exposure, 16" Shingle, #1 Grade, Red Cedar Shingles Installed On Roof.....	382.73	107.76
<i>For Steep Roof, Over 7 To 12, Add</i>	68.97	
<i>For CCA Treated, Add</i>	25.08	
07 31 29 13-0005 SQ 4-1/2" Exposure, 18" Shingle, #1 Grade, Red Cedar Shingles Installed On Roof.....	465.20	122.13
<i>For Steep Roof, Over 7 To 12, Add</i>	78.16	
<i>For CCA Treated, Add</i>	33.14	
07 31 29 13-0006 SQ 5-1/2" Exposure, 18" Shingle, #1 Grade, Red Cedar Shingles Installed On Roof.....	381.22	100.57
<i>For Steep Roof, Over 7 To 12, Add</i>	64.37	
<i>For CCA Treated, Add</i>	27.01	
07 31 29 13-0007 SQ 5-3/4" Exposure, 24" Shingle, #1 Grade, Red Cedar Shingles Installed On Roof.....	491.38	95.18
<i>For Steep Roof, Over 7 To 12, Add</i>	60.92	
<i>For CCA Treated, Add</i>	45.15	
07 31 29 13-0008 SQ 7-1/2" Exposure, 24" Shingle, #1 Grade, Red Cedar Shingles Installed On Roof.....	382.87	80.82
<i>For Steep Roof, Over 7 To 12, Add</i>	51.72	
<i>For CCA Treated, Add</i>	33.18	
07 31 29 13-0009 #1 Grade, Red Cedar Shingles Installed On Walls (07 31 29 13-0001)		
07 31 29 13-0010 SQ 7" Exposure, 16" Shingle, #1 Grade, Red Cedar Shingles Installed On Wall	378.06	129.31
<i>For CCA Treated, Add</i>	17.92	
07 31 29 13-0011 SQ 8" Exposure, 18" Shingle, #1 Grade, Red Cedar Shingles Installed On Wall	368.44	122.13
<i>For CCA Treated, Add</i>	18.63	
07 31 29 13-0012 SQ 10-1/2" Exposure, 24" Shingle, #1 Grade, Red Cedar Shingles Installed On Wall	369.95	105.97
<i>For CCA Treated, Add</i>	23.70	
07 31 29 13-0013 #2 Grade, Red Cedar Shingles (07 31 29 13)		
07 31 29 13-0014 #2 Grade, Red Cedar Shingles Installed On Roofs (07 31 29 13-0013)		
07 31 29 13-0015 SQ 3-1/2" Exposure, 16" Shingle, #2 Grade, Red Cedar Shingles Installed On Roof.....	494.65	150.86
<i>For Steep Roof, Over 7 To 12, Add</i>	96.55	
<i>For CCA Treated, Add</i>	28.94	
07 31 29 13-0016 SQ 4" Exposure, 16" Shingle, #2 Grade, Red Cedar Shingles Installed On Roof.....	441.81	136.49
<i>For Steep Roof, Over 7 To 12, Add</i>	87.36	
<i>For CCA Treated, Add</i>	25.32	
07 31 29 13-0017 SQ 4" Exposure, 18" Shingle, #2 Grade, Red Cedar Shingles Installed On Roof.....	468.14	136.49
<i>For Steep Roof, Over 7 To 12, Add</i>	87.36	
<i>For CCA Treated, Add</i>	29.27	
07 31 29 13-0018 SQ 4-1/2" Exposure, 18" Shingle, #2 Grade, Red Cedar Shingles Installed On Roof.....	417.85	122.13
<i>For Steep Roof, Over 7 To 12, Add</i>	78.16	
<i>For CCA Treated, Add</i>	26.04	
07 31 29 13-0019 SQ 5-3/4" Exposure, 24" Shingle, #2 Grade, Red Cedar Shingles Installed On Roof.....	400.38	95.18
<i>For Steep Roof, Over 7 To 12, Add</i>	60.92	
<i>For CCA Treated, Add</i>	31.50	
07 31 29 13-0020 SQ 6-1/2" Exposure, 24" Shingle, #2 Grade, Red Cedar Shingles Installed On Roof.....	328.80	82.62
<i>For Steep Roof, Over 7 To 12, Add</i>	52.87	
<i>For CCA Treated, Add</i>	24.54	
07 31 29 13-0021 #2 Grade, Red Cedar Shingles Installed On Walls (07 31 29 13-0013)		
07 31 29 13-0022 SQ 6" Exposure, 16" Shingle, #2 Grade, Red Cedar Shingles Installed On Wall	369.46	136.49
<i>For CCA Treated, Add</i>	14.47	
07 31 29 13-0023 SQ 7" Exposure, 18" Shingle, #2 Grade, Red Cedar Shingles Installed On Wall	356.20	129.31
<i>For CCA Treated, Add</i>	14.64	
07 31 29 13-0024 SQ 9" Exposure, 24" Shingle, #2 Grade, Red Cedar Shingles Installed On Wall	340.14	114.94
<i>For CCA Treated, Add</i>	16.54	
07 31 29 16 Wood Shakes (07 31 29)		
07 31 29 16-0001 #1 Grade, Red Cedar Shakes (07 31 29 16)		
07 31 29 16-0002 #1 Grade, Red Cedar Shakes Installed On Roofs (07 31 29 16-0001)		
07 31 29 16-0003 SQ 8-1/2" Exposure, 1/2" Thick, 18" Shake, #1 Grade, Red Cedar Shakes Installed On Roof	387.83	116.74
<i>For Steep Roof, Over 7 To 12, Add</i>	74.71	
<i>For CCA Treated, Add</i>	23.15	
07 31 29 16-0004 SQ 8-1/2" Exposure, 3/4" Thick, 18" Shake, #1 Grade, Red Cedar Shakes Installed On Roof	439.28	116.74
<i>For Steep Roof, Over 7 To 12, Add</i>	74.71	
<i>For CCA Treated, Add</i>	30.87	
07 31 29 16-0005 SQ 10" Exposure, 1/2" Thick, 24" Shake, #1 Grade, Red Cedar Shakes Installed On Roof.....	402.61	95.18
<i>For Steep Roof, Over 7 To 12, Add</i>	60.92	
<i>For CCA Treated, Add</i>	31.83	

07 Thermal And Moisture Protection**07 30 Steep Slope Roofing****07 31 Shingles And Shakes**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 31 29 16-0006	SQ		10" Exposure, 3/4" Thick, 24" Shake, #1 Grade, Red Cedar Shakes Installed On Roof..... <i>For Steep Roof, Over 7 To 12, Add</i> <i>For CCA Treated, Add</i>	424.47 60.92 35.11	95.18
07 31 29 16-0007			#1 Grade, Red Cedar Shakes Installed On Walls (07 31 29 16-0001)		
07 31 29 16-0008	SQ		8-1/2" Exposure, 1/2" Thick, 18" Shake, #1 Grade, Red Cedar Shakes Installed On Wall <i>For CCA Treated, Add</i>	405.79 23.15	125.72
07 31 29 16-0009	SQ		8-1/2" Exposure, 3/4" Thick, 18" Shake, #1 Grade, Red Cedar Shakes Installed On Wall <i>For CCA Treated, Add</i>	457.24 30.87	125.72
07 31 29 16-0010	SQ		10" Exposure, 1/2" Thick, 24" Shake, #1 Grade, Red Cedar Shakes Installed On Wall <i>For CCA Treated, Add</i>	427.75 31.83	107.76
07 31 29 16-0011	SQ		10" Exposure, 3/4" Thick, 24" Shake, #1 Grade, Red Cedar Shakes Installed On Wall <i>For CCA Treated, Add</i>	449.61 35.11	107.76
07 31 29 17			Wood Hip And Ridge Cap (07 31 29)		
07 31 29 17-0001			Accessories (07 31 29 17)		
07 31 29 17-0002	LF		Hip Or Ridge Cap For Wood Shingles Or Shakes <i>For Steep Roof, Over 7 To 12, Add</i> <i>For CCA Treated Ridge, Add</i>	6.25 0.70 0.61	0.94
07 31 33			Composite Rubber Shingles (07 31)		
07 31 33 00-0001			Synthetic Polymeric Rubber Slate Shingles (07 31 33) Note: As manufactured by EcoStar.		
07 31 33 00-0002	SQ		Class C Rectangular Edges Polymeric Rubber Slate Shingles, 7.0" Exposure Note: Gray or black. <i>For Purple Or Green Color, Add</i> <i>For Brown Or Red Color, Add</i> <i>For Steep Roof, Over 7 To 12, Add</i> <i>For >50 To 75, Deduct</i> <i>For >75 To 100, Deduct</i> <i>For >100 To 200, Deduct</i> <i>For >200, Deduct</i> <i>For 6.5" Exposure, Add</i> <i>For 6.0" Exposure, Add</i>	743.31 67.45 172.84 102.96 -10.54 -29.12 -47.70 -74.33 51.56 103.12	160.90
07 31 33 00-0003	SQ		Class A Rectangular Edges Polymeric Rubber Slate Shingles, 7.0" Exposure..... Note: Fire resistant. Gray or black. <i>For Purple, Green, Brown Or Red, Add</i> <i>For Steep Roof, Over 7 To 12, Add</i> <i>For >50 To 75, Deduct</i> <i>For >75 To 100, Deduct</i> <i>For >100 To 200, Deduct</i> <i>For >200, Deduct</i> <i>For 6.5" Exposure, Add</i> <i>For 6.0" Exposure, Add</i>	1,024.34 105.39 102.96 -17.56 -43.17 -68.78 -102.43 71.64 143.27	160.90
07 31 33 00-0004	SQ		Class C Shaped Polymeric Rubber Slate Shingle, 7.0" Exposure Note: Beaver tail, chisel point or beveled edges. Gray or black. <i>For Purple, Green, Brown Or Red, Add</i> <i>For Steep Roof, Over 7 To 12, Add</i> <i>For >50 To 75, Deduct</i> <i>For >75 To 100, Deduct</i> <i>For >100 To 200, Deduct</i> <i>For >200, Deduct</i> <i>For 6.5" Exposure, Add</i> <i>For 6.0" Exposure, Add</i>	859.02 193.41 102.96 -13.43 -34.91 -56.38 -85.90 59.83 119.65	160.90
07 31 33 00-0005	SQ		Class A Shaped Polymeric Rubber Slate Shingle, 7.0" Exposure Note: Fire resistant. Beaver tail, chisel point or beveled edges. Gray or black. <i>For Purple, Green, Brown Or Red, Add</i> <i>For Steep Roof, Over 7 To 12, Add</i> <i>For >50 To 75, Deduct</i> <i>For >75 To 100, Deduct</i> <i>For >100 To 200, Deduct</i> <i>For >200, Deduct</i> <i>For 6.5" Exposure, Add</i> <i>For 6.0" Exposure, Add</i>	1,082.20 83.65 102.96 -19.01 -46.07 -73.12 -108.22 75.77 151.53	160.90
07 31 33 00-0006	LF		Hip Or Ridge Polymeric Rubber Slate Shingle..... Note: Beveled or pointed edges, gray or black.	9.74	1.08
07 32			Roof Tiles (07 30)		
07 32 13			Clay Roof Tiles (07 32) Note: 8-1/4" x 11" exposure. Includes mortar, fasteners, felt underlayment and 90# cap sheet.		
07 32 13 00-0001			Clay Roofing Tile 8-1/4" x 11" Exposure (07 32 13) Note: Includes mortar, fasteners, felt underlayment and 90# cap sheet.		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 32 13 00-0002 SQ Lanai Or Classic Tile, 158 Piece Per SQ	914.14	173.65
For >25 To 50, Deduct	-34.01	
For >50 To 75, Deduct	-65.36	
For >75 To 100, Deduct	-91.05	
For >100 To 200, Deduct	-111.07	
For >200, Deduct	-125.42	
For 20 Year Warranty, Add	39.68	
07 32 13 00-0003 SQ Americana (Most Colors) Tile Roofing, 158 Piece Per SQ.....	1,099.07	173.65
For >25 To 50, Deduct	-45.10	
For >50 To 75, Deduct	-83.86	
For >75 To 100, Deduct	-115.09	
For >100 To 200, Deduct	-138.81	
For >200, Deduct	-155.01	
For 20 Year Warranty, Add	52.62	
07 32 13 00-0004 SQ Americana (Green, Gray Or Brown) Tile, 158 Piece Per SQ	1,099.07	173.65
For >25 To 50, Deduct	-45.10	
For >50 To 75, Deduct	-83.86	
For >75 To 100, Deduct	-115.09	
For >100 To 200, Deduct	-138.81	
For >200, Deduct	-155.01	
For 20 Year Warranty, Add	52.62	
07 32 13 00-0005 SQ Americana (Blue) Tile, 158 Piece Per SQ.....	1,255.98	173.65
For >25 To 50, Deduct	-54.52	
For >50 To 75, Deduct	-99.55	
For >75 To 100, Deduct	-135.49	
For >100 To 200, Deduct	-162.35	
For >200, Deduct	-180.12	
For 20 Year Warranty, Add	63.60	
07 32 13 00-0006 SQ French Tile Roofing, Red, 133 Piece Per SQ	1,090.85	212.32
For >25 To 50, Deduct	-39.97	
For >50 To 75, Deduct	-77.24	
For >75 To 100, Deduct	-107.84	
For >100 To 200, Deduct	-131.78	
For >200, Deduct	-149.06	
For 20 Year Warranty, Add	46.64	
07 32 13 00-0007 SQ French Tile Roofing, Blue Or Green, 133 Piece Per SQ.....	1,366.88	212.32
For >25 To 50, Deduct	-56.54	
For >50 To 75, Deduct	-104.84	
For >75 To 100, Deduct	-143.72	
For >100 To 200, Deduct	-173.19	
For >200, Deduct	-193.22	
For 20 Year Warranty, Add	65.96	
07 32 13 00-0008 SQ Norman Tile Roofing, 317 Piece Per SQ	1,744.71	286.43
For >25 To 50, Deduct	-70.32	
For >50 To 75, Deduct	-131.52	
For >75 To 100, Deduct	-181.00	
For >100 To 200, Deduct	-218.76	
For >200, Deduct	-244.79	
For 20 Year Warranty, Add	82.04	
07 32 13 00-0009 SQ Williamsburg Tile Roofing, Aged Cedar, 158 Piece Per SQ	952.74	212.32
For >25 To 50, Deduct	-31.69	
For >50 To 75, Deduct	-63.43	
For >75 To 100, Deduct	-89.89	
For >100 To 200, Deduct	-111.06	
For >200, Deduct	-126.96	
For 20 Year Warranty, Add	36.97	
07 32 13 00-0010 SQ Williamsburg Tile Roofing, Gray Or Green, 158 Piece Per SQ.....	1,176.35	212.32
For >25 To 50, Deduct	-45.10	
For >50 To 75, Deduct	-85.79	
For >75 To 100, Deduct	-118.96	
For >100 To 200, Deduct	-144.61	
For >200, Deduct	-162.74	
For 20 Year Warranty, Add	52.62	
07 32 13 00-0011 SQ Spanish Tile Roofing, Red, 171 Piece Per SQ.....	817.53	158.97
For >25 To 50, Deduct	-29.97	
For >50 To 75, Deduct	-57.90	
For >75 To 100, Deduct	-80.84	
For >100 To 200, Deduct	-98.78	
For >200, Deduct	-111.73	
For 20 Year Warranty, Add	34.97	
07 32 13 00-0012 SQ Spanish Tile Roofing, Blend, 171 Piece Per SQ.....	1,058.50	158.97
For >25 To 50, Deduct	-44.43	
For >50 To 75, Deduct	-82.00	
For >75 To 100, Deduct	-112.17	
For >100 To 200, Deduct	-134.93	
For >200, Deduct	-150.28	
For 20 Year Warranty, Add	51.84	
07 32 13 00-0013 SQ Spanish Tile Roofing, Glazed White, 171 Piece Per SQ.....	1,265.85	158.97
For >25 To 50, Deduct	-56.87	
For >50 To 75, Deduct	-102.74	
For >75 To 100, Deduct	-139.12	
For >100 To 200, Deduct	-166.03	
For >200, Deduct	-183.46	
For 20 Year Warranty, Add	66.35	

07 Thermal And Moisture Protection**07 30 Steep Slope Roofing****07 32 Roof Tiles**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 32 13 00-0014	SQ		Two Piece Mission Tile Roofing, 192 Piece Per SQ	1,530.31	249.19
			<i>For >25 To 50, Deduct</i>	-61.92	
			<i>For >50 To 75, Deduct</i>	-115.65	
			<i>For >75 To 100, Deduct</i>	-159.07	
			<i>For >100 To 200, Deduct</i>	-192.17	
			<i>For >200, Deduct</i>	-214.95	
			<i>For 20 Year Warranty, Add</i>	72.24	
07 32 13 00-0015	SQ		One Piece Mission Tile Roofing, 75 Piece Per SQ	673.16	173.65
			<i>For >25 To 50, Deduct</i>	-19.55	
			<i>For >50 To 75, Deduct</i>	-41.27	
			<i>For >75 To 100, Deduct</i>	-59.72	
			<i>For >100 To 200, Deduct</i>	-74.92	
			<i>For >200, Deduct</i>	-86.87	
			<i>For 20 Year Warranty, Add</i>	22.81	
07 32 13 00-0016	SQ		One Piece Mission Tile Roofing, 134 Piece Per SQ	899.86	249.19
			<i>For >25 To 50, Deduct</i>	-24.09	
			<i>For >50 To 75, Deduct</i>	-52.61	
			<i>For >75 To 100, Deduct</i>	-77.11	
			<i>For >100 To 200, Deduct</i>	-97.60	
			<i>For >200, Deduct</i>	-114.07	
			<i>For 20 Year Warranty, Add</i>	28.10	

07 32 16 Concrete Roof Tiles (07 32)**07 32 16 00-0001 Corrugated Tiles And Shakes Nailed To Wood (07 32 16)**

Note: Includes 30 lb felt underlayment.

07 32 16 00-0002	SQ		13" x 16-1/2" Concrete Roof Tile, 90/SQ, 950 LB/SQ, Earhtone Colors, Corrugated	701.59	263.23
			<i>For >50 To 75, Deduct</i>	-7.00	
			<i>For >75 To 100, Deduct</i>	-25.42	
			<i>For >100 To 200, Deduct</i>	-45.58	
			<i>For >200, Deduct</i>	-64.00	
			<i>For Steep Roof, Over 7 To 12, Add</i>	168.49	
07 32 16 00-0003	SQ		13" x 16-1/2" Concrete Roof Tile, 90/SQ, 950 LB/SQ, Custom Blues, Corrugated	882.76	263.23
			<i>For >50 To 75, Deduct</i>	-14.25	
			<i>For >75 To 100, Deduct</i>	-38.10	
			<i>For >100 To 200, Deduct</i>	-65.51	
			<i>For >200, Deduct</i>	-89.36	
			<i>For Steep Roof, Over 7 To 12, Add</i>	168.49	
07 32 16 00-0004	SQ		13" x 16-1/2" Concrete Roof Tile, 90/SQ, 950 LB/SQ, Custom Greens Corrugated	737.82	263.23
			<i>For >50 To 75, Deduct</i>	-8.45	
			<i>For >75 To 100, Deduct</i>	-27.95	
			<i>For >100 To 200, Deduct</i>	-49.57	
			<i>For >200, Deduct</i>	-69.07	
			<i>For Steep Roof, Over 7 To 12, Add</i>	168.49	
07 32 16 00-0005	SQ		13" x 16-1/2" Concrete Roof Tile, 90/SQ, 950 LB/SQ, Colors, Shakes	691.45	235.52
			<i>For >50 To 75, Deduct</i>	-8.81	
			<i>For >75 To 100, Deduct</i>	-27.20	
			<i>For >100 To 200, Deduct</i>	-47.79	
			<i>For >200, Deduct</i>	-66.18	
			<i>For Steep Roof, Over 7 To 12, Add</i>	150.75	

07 32 16 00-0006 Accessories (07 32 16)

07 32 16 00-0007	EA		Ridge And Hip, 10" X 16-1/2", 8 LB Each For Concrete Tile Roof	3.06	
07 32 16 00-0008	EA		Rake, 6-1/2" X 16-3/4", 9 LB Each For Concrete Tile Roof	2.01	
07 32 16 00-0009	EA		Mansard Hip, 10" X 16-1/2", 9.2 LB Each For Concrete Tile Roof	3.04	
07 32 16 00-0010	EA		Hip Starter, 10" X 16-1/2", 10.5 LB Each For Concrete Tile Roof	3.48	
07 32 16 00-0011	EA		3 Or 4 Way Apex, 10" Each Side, 11.5 LB Each For Concrete Tile Roof	3.62	

07 34 Roofing Underlayment (07 30)**07 34 00 00-0001 Mechanically Fastened, Roofing Underlayment (07 34)**

Note: Standard slope.

07 34 00 00-0002	SQ		15 LB, Asphalt Saturated Organic Felt Roofing Underlayment, Mechanically Fastened	19.30	5.18
			<i>For Steep Roof, Over 7 To 12, Add</i>	3.32	
			<i>For >50 To 75, Deduct</i>	-0.36	
			<i>For >75 To 100, Deduct</i>	-0.88	
			<i>For >100 To 200, Deduct</i>	-1.50	
			<i>For >200, Deduct</i>	-2.29	
07 34 00 00-0003	SQ		30 LB, Asphalt Saturated Organic Felt Roofing Underlayment, Mechanically Fastened	29.19	7.13
			<i>For Steep Roof, Over 7 To 12, Add</i>	4.56	
			<i>For >50 To 75, Deduct</i>	-0.60	
			<i>For >75 To 100, Deduct</i>	-1.40	
			<i>For >100 To 200, Deduct</i>	-2.36	
			<i>For >200, Deduct</i>	-3.52	
07 34 00 00-0004	SQ		30 LB, Asphalt Saturated Organic Felt Shake Underlayment, Mechanically Fastened	32.00	7.13
			<i>For Steep Roof, Over 7 To 12, Add</i>	4.56	
			<i>For >50 To 75, Deduct</i>	-0.71	
			<i>For >75 To 100, Deduct</i>	-1.60	
			<i>For >100 To 200, Deduct</i>	-2.66	
			<i>For >200, Deduct</i>	-3.91	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 34 00 00-0005 SQ Fire Rated, Polypropylene Roofing Underlayment, Mechanically Fastened (Rex™ Synfelt)	37.55	10.81
<i>For Steep Roof, Over 7 To 12, Add</i>	6.92	
<i>For >50 To 75, Deduct</i>	-0.64	
<i>For >75 To 100, Deduct</i>	-1.66	
<i>For >100 To 200, Deduct</i>	-2.83	
<i>For >200, Deduct</i>	-4.39	
07 34 00 00-0006 SQ 17 Mil, Fire Rated, High Temperature, Coated Woven Synthetic Roofing Underlayment, Mechanically Fastened (TITANIUM™ UDL 25).....	40.88	10.81
<i>For Steep Roof, Over 7 To 12, Add</i>	6.92	
<i>For >50 To 75, Deduct</i>	-0.77	
<i>For >75 To 100, Deduct</i>	-1.89	
<i>For >100 To 200, Deduct</i>	-3.20	
<i>For >200, Deduct</i>	-4.86	
07 34 00 00-0007 SQ 25 Mil, Fire Rated, High Temperature, Coated Woven Synthetic Roofing Underlayment, Mechanically Fastened (TITANIUM™ UDL 30).....	46.37	10.81
<i>For Steep Roof, Over 7 To 12, Add</i>	6.92	
<i>For >50 To 75, Deduct</i>	-0.99	
<i>For >75 To 100, Deduct</i>	-2.27	
<i>For >100 To 200, Deduct</i>	-3.80	
<i>For >200, Deduct</i>	-5.63	
07 34 00 00-0008 SQ 30 Mil, Fire Rated, High Temperature, Coated Woven Synthetic Roofing Underlayment, Mechanically Fastened (TITANIUM™ UDL 50).....	43.63	10.81
<i>For Steep Roof, Over 7 To 12, Add</i>	6.92	
<i>For >50 To 75, Deduct</i>	-0.88	
<i>For >75 To 100, Deduct</i>	-2.08	
<i>For >100 To 200, Deduct</i>	-3.50	
<i>For >200, Deduct</i>	-5.24	
07 34 00 00-0009 Self-Adhering, Roofing Underlayment (07.34)		
Note: Standard slope.		
07 34 00 00-0010 SQ 48 Mil, Fire Rated, Polymeric Asphalt Surfaced, Fiberglass Mat Reinforced, SBS Modified Roofing Underlayment, Self-Adhering (Owens Corning® WeatherLock® Mat)	71.74	13.11
<i>For Steep Roof, Over 7 To 12, Add</i>	8.38	
<i>For >50 To 75, Deduct</i>	-1.82	
<i>For >75 To 100, Deduct</i>	-3.84	
<i>For >100 To 200, Deduct</i>	-6.32	
<i>For >200, Deduct</i>	-9.00	
07 34 00 00-0011 SQ 60 Mil, Fire Rated, Granule Surfaced, Rubberized Asphalt Adhesive, Roofing Underlayment, Self-Adhering (Grace Basik®).....	103.55	13.11
<i>For Steep Roof, Over 7 To 12, Add</i>	8.38	
<i>For >50 To 75, Deduct</i>	-3.09	
<i>For >75 To 100, Deduct</i>	-6.07	
<i>For >100 To 200, Deduct</i>	-9.82	
<i>For >200, Deduct</i>	-13.45	
07 34 00 00-0012 SQ 53 Mil, Fire Rated, Granule Surfaced, Fiberglass Mat Reinforced, SBS Modified Roofing Underlayment, Self- Adhering (Owens Corning® WeatherLock® G).....	75.67	13.11
<i>For Steep Roof, Over 7 To 12, Add</i>	8.38	
<i>For >50 To 75, Deduct</i>	-1.98	
<i>For >75 To 100, Deduct</i>	-4.12	
<i>For >100 To 200, Deduct</i>	-6.75	
<i>For >200, Deduct</i>	-9.55	
07 34 00 00-0013 SQ 65 Mil, Fire Rated, Polyester Non Woven Fabric Surfaced, Fiberglass Mat Reinforced, SBS Modified Roofing Underlayment, Self Adhering (Owens Corning® WeatherLock® Specialty Tile And Metal)	71.74	13.11
<i>For Steep Roof, Over 7 To 12, Add</i>	8.38	
<i>For >50 To 75, Deduct</i>	-1.82	
<i>For >75 To 100, Deduct</i>	-3.84	
<i>For >100 To 200, Deduct</i>	-6.32	
<i>For >200, Deduct</i>	-9.00	
07 34 00 00-0014 SQ 45 Mil, Fire Rated, High Temperature, Synthetic Polymer Surfaced, Modified Rubberized Asphalt, Roofing Underlayment, Self-Adhering (TITANIUM™ PSU-30)	98.96	13.11
<i>For Steep Roof, Over 7 To 12, Add</i>	8.38	
<i>For >50 To 75, Deduct</i>	-2.91	
<i>For >75 To 100, Deduct</i>	-5.75	
<i>For >100 To 200, Deduct</i>	-9.31	
<i>For >200, Deduct</i>	-12.81	
07 34 00 00-0015 SQ 25 Mil, Fire Rated, Embossed Surface, Rubberized Asphalt Adhesive, High Density Cross Laminated Polyethylene Reinforcement, Roofing Underlayment, Self-Adhering (Grace Select).....	84.59	13.11
<i>For Steep Roof, Over 7 To 12, Add</i>	8.38	
<i>For >50 To 75, Deduct</i>	-2.34	
<i>For >75 To 100, Deduct</i>	-4.74	
<i>For >100 To 200, Deduct</i>	-7.73	
<i>For >200, Deduct</i>	-10.79	
07 34 00 00-0016 SQ 40 Mil, Fire Rated, Embossed Surface, Rubberized Asphalt Adhesive, High Density Cross Laminated Polyethylene Reinforcement, Roofing Underlayment, Self-Adhering (Grace Ice And Water Shield®)	121.62	13.11
<i>For Steep Roof, Over 7 To 12, Add</i>	8.38	
<i>For >50 To 75, Deduct</i>	-3.82	
<i>For >75 To 100, Deduct</i>	-7.33	
<i>For >100 To 200, Deduct</i>	-11.81	
<i>For >200, Deduct</i>	-15.98	

07 Thermal And Moisture Protection**07 30 Steep Slope Roofing****07 34 Roofing Underlayment**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 34 00 00-0017	SQ		40 Mil, Fire Rated, High Temperature, Embossed Surface, Rubberized Asphalt Adhesive, High Density Cross Laminated Polyethylene Reinforcement, Roofing Underlayment, Self-Adhering (Grace Ice And Water Shield® HT).....	137.84	13.11
			<i>For Steep Roof, Over 7 To 12, Add</i>	8.38	
			<i>For >50 To 75, Deduct</i>	-4.47	
			<i>For >75 To 100, Deduct</i>	-8.47	
			<i>For >100 To 200, Deduct</i>	-13.59	
			<i>For >200, Deduct</i>	-18.25	
07 34 00 00-0018	SQ		30 Mil, Fire Rated, High Temperature, Fire Rated, Embossed Surface, Butyl Rubber Based Adhesive, High Density Cross Laminated Polyethylene Reinforcement, Roofing Underlayment, Self-Adhering (Grace Ultra)	198.71	13.11
			<i>For Steep Roof, Over 7 To 12, Add</i>	8.38	
			<i>For >50 To 75, Deduct</i>	-6.90	
			<i>For >75 To 100, Deduct</i>	-12.73	
			<i>For >100 To 200, Deduct</i>	-20.29	
			<i>For >200, Deduct</i>	-26.77	

07 40 Roofing And Siding Panels ⁽⁰⁷⁾

Note: Includes placement of materials on roof up to 2-1/2 stories. All new roof installations include flood testing.

07 41 Roof Panels ^(07 40)

Note: Includes standard fasteners, grommets, cleats for installation.

07 41 13 Metal Roof Panels ^(07 41)**07 41 13 00-0001 Exposed Fastener Metal Roofing** ^(07 41 13)

Note: Includes 15 year warranty and all warranties are no dollar limit to include material and labor.

07 41 13 00-0002 Galvanized Exposed Fastener Metal Roofing ^(07 41 13 00-0001)**07 41 13 00-0003 Galvanized Steel Exposed Fastener Metal Roof Panels** ^(07 41 13 00-0002)

07 41 13 00-0004	SF		18 Gauge Galvanized Exposed Fastener Metal Roof Panels	5.93	0.68
			<i>For Fluoropolymer (Kynar) Coating, Add</i>	0.64	
			<i>For Steep Roof, Over 7 To 12, Add</i>	0.96	
07 41 13 00-0005	SF		20 Gauge Galvanized Exposed Fastener Metal Roof Panels	5.41	0.68
			<i>For Fluoropolymer (Kynar) Coating, Add</i>	0.64	
			<i>For Steep Roof, Over 7 To 12, Add</i>	0.96	
07 41 13 00-0006	SF		22 Gauge Galvanized Exposed Fastener Metal Roof Panels	5.05	0.68
			<i>For Fluoropolymer (Kynar) Coating, Add</i>	0.64	
			<i>For Steep Roof, Over 7 To 12, Add</i>	0.96	
07 41 13 00-0007	SF		24 Gauge Galvanized Exposed Fastener Metal Roof Panels	4.69	0.68
			<i>For Fluoropolymer (Kynar) Coating, Add</i>	0.64	
			<i>For Steep Roof, Over 7 To 12, Add</i>	0.96	
07 41 13 00-0008	SF		26 Gauge Galvanized Exposed Fastener Metal Roof Panels	4.40	0.68
			<i>For Fluoropolymer (Kynar) Coating, Add</i>	0.64	
			<i>For Steep Roof, Over 7 To 12, Add</i>	0.96	
07 41 13 00-0009	SF		29 Gauge Galvanized Exposed Fastener Metal Roof Panels	4.14	0.68
			<i>For Fluoropolymer (Kynar) Coating, Add</i>	0.64	
			<i>For Steep Roof, Over 7 To 12, Add</i>	0.96	
07 41 13 00-0010	SF		30 Gauge Galvanized Exposed Fastener Metal Roof Panels	4.04	0.68
			<i>For Fluoropolymer (Kynar) Coating, Add</i>	0.64	
			<i>For Steep Roof, Over 7 To 12, Add</i>	0.96	
07 41 13 00-0011			Galvanized Exposed Fastener Metal Roof Accessories ^(07 41 13 00-0002)		
			See CSI section 07 41 13 00-0038 for accessories.		
07 41 13 00-0012	LF		Ridge Flashing For Galvanized Steel Exposed Fastener Roofing	28.85	3.00
			<i>For Steep Roof, Over 7 To 12, Add</i>	3.81	
			<i>For Fluoropolymer (Kynar) Coating, Add</i>	1.69	
07 41 13 00-0013	LF		Eave Flashing For Galvanized Steel Exposed Fastener Roofing	21.95	3.00
			<i>For Steep Roof, Over 7 To 12, Add</i>	3.81	
			<i>For Fluoropolymer (Kynar) Coating, Add</i>	1.00	
07 41 13 00-0014	LF		Valley Flashing For Galvanized Steel Exposed Fastener Roofing	35.51	3.00
			<i>For Steep Roof, Over 7 To 12, Add</i>	3.81	
			<i>For Fluoropolymer (Kynar) Coating, Add</i>	2.36	
07 41 13 00-0015	LF		Hip Flashing For Galvanized Steel Exposed Fastener Roofing	29.45	3.00
			<i>For Steep Roof, Over 7 To 12, Add</i>	3.81	
			<i>For Fluoropolymer (Kynar) Coating, Add</i>	1.75	
07 41 13 00-0016			Aluminum Exposed Fastener Metal Roofing ^(07 41 13 00-0001)		
07 41 13 00-0017			Aluminum Exposed Fastener Metal Roof Panels ^(07 41 13 00-0016)		
07 41 13 00-0018	SF		0.0155" Aluminum Exposed Fastener Metal Roof Panels.....	3.89	0.68
			<i>For Fluoropolymer (Kynar) Coating, Add</i>	0.64	
			<i>For Steep Roof, Over 7 To 12, Add</i>	0.96	
07 41 13 00-0019	SF		0.018" Aluminum Exposed Fastener Metal Roof Panels.....	4.03	0.68
			<i>For Fluoropolymer (Kynar) Coating, Add</i>	0.64	
			<i>For Steep Roof, Over 7 To 12, Add</i>	0.96	
07 41 13 00-0020	SF		0.024" Aluminum Exposed Fastener Metal Roof Panels.....	4.38	0.68
			<i>For Fluoropolymer (Kynar) Coating, Add</i>	0.64	
			<i>For Steep Roof, Over 7 To 12, Add</i>	0.96	
07 41 13 00-0021	SF		0.032" Aluminum Exposed Fastener Metal Roof Panels.....	4.84	0.68
			<i>For Fluoropolymer (Kynar) Coating, Add</i>	0.64	
			<i>For Steep Roof, Over 7 To 12, Add</i>	0.96	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 41 13 00-0022 SF 0.040" Aluminum Exposed Fastener Metal Roof Panels <i>For Fluoropolymer (Kynar) Coating, Add</i> <i>For Steep Roof, Over 7 To 12, Add</i>	5.30 0.64 0.96	0.68
07 41 13 00-0023 SF 0.050" Aluminum Exposed Fastener Metal Roof Panels <i>For Fluoropolymer (Kynar) Coating, Add</i> <i>For Steep Roof, Over 7 To 12, Add</i>	5.87 0.64 0.96	0.68
07 41 13 00-0024 Aluminum Exposed Fastener Metal Roof Accessories (07 41 13 00-0016)		
07 41 13 00-0025 LF Ridge Flashing For Aluminum Exposed Fastener Metal Roofing..... <i>For Steep Roof, Over 7 To 12, Add</i> <i>For Fluoropolymer (Kynar) Coating, Add</i>	28.51 2.40 2.10	3.00
07 41 13 00-0026 LF Eave Flashing For Aluminum Exposed Fastener Metal Roofing..... <i>For Steep Roof, Over 7 To 12, Add</i> <i>For Fluoropolymer (Kynar) Coating, Add</i>	19.89 2.40 1.24	3.00
07 41 13 00-0027 LF Valley Flashing For Aluminum Exposed Fastener Metal Roofing..... <i>For Steep Roof, Over 7 To 12, Add</i> <i>For Fluoropolymer (Kynar) Coating, Add</i>	36.83 2.40 2.93	3.00
07 41 13 00-0028 LF Hip Flashing For Aluminum Exposed Fastener Metal Roofing..... <i>For Steep Roof, Over 7 To 12, Add</i> <i>For Fluoropolymer (Kynar) Coating, Add</i>	29.27 2.40 2.18	3.00
07 41 13 00-0029 Standing Seam Roofs (07 41 13)		
<p>Note: Includes all profiles of vertical leg and batten style standing seam roofing. Includes all clips, neoprene closures, metal closures, battens, tape sealer, tube sealant, fasteners, vent material, panel starters and cleats. Based on Garland R-Mer Clad or R-Mer Seam architectural roofing, R-Mer Loc architectural/structural roofing, and R-Mer Span structural roofing. Architectural roofing requires a solid substrate and underlayment, requires a minimum 3:12 pitch, and includes a 20 year no dollar limit warranty. Architectural/structural roofing does not require a solid substrate or underlayment, requires a minimum 3:12 pitch, and includes a 25 year no dollar limit warranty. Structural roofing does not require a solid substrate or underlayment, requires a minimum 1/4" per foot slope, and includes a 25 year no dollar limit warranty.</p>		
07 41 13 00-0030 Galvanized Steel Standing Seam Concealed Fastener Roofing (07 41 13 00-0029)		
<p>Note: All steel is galvanized G90 rated or galvalume. Factory paint finish is Kynar 500, Hylar 5000 or equal PVC finish.</p>		
07 41 13 00-0031 Galvanized Steel Standing Seam Concealed Fastener Roofing (07 41 13 00-0030)		
07 41 13 00-0032 SF Architectural 24 Gauge Galvanized Steel Standing Seam Concealed Fastener Roofing <i>For Steep Roof, Over 6 To 12, Add</i> <i>For 140 MPH Wind Load, Add</i> <i>For Panels <16" Wide, Add</i> <i>For Up To 1,500, Add</i> <i>For >1,500 To 5,000, Add</i> <i>For >5,000 To 10,000, Add</i>	11.69 1.19 0.55 1.32 2.92 1.75 0.29	1.58
07 41 13 00-0033 SF Architectural 22 Gauge Galvanized Steel Standing Seam Concealed Fastener Roofing <i>For Steep Roof, Over 6 To 12, Add</i> <i>For 140 MPH Wind Load, Add</i> <i>For Panels <16" Wide, Add</i> <i>For Up To 1,500, Add</i> <i>For >1,500 To 5,000, Add</i> <i>For >5,000 To 10,000, Add</i>	12.42 1.19 0.57 1.36 3.11 1.86 0.31	1.58
07 41 13 00-0034 SF Architectural/Structural 24 Gauge Galvanized Steel Standing Seam Concealed Fastener Roofing <i>For Steep Roof, Over 6 To 12, Add</i> <i>For 140 MPH Wind Load, Add</i> <i>For Panels <16" Wide, Add</i> <i>For Up To 1,500, Add</i> <i>For >1,500 To 5,000, Add</i> <i>For >5,000 To 10,000, Add</i>	11.05 1.19 0.54 1.29 2.76 1.66 0.28	1.58
07 41 13 00-0035 SF Architectural/Structural 22 Gauge Galvanized Steel Standing Seam Concealed Fastener Roofing <i>For Steep Roof, Over 6 To 12, Add</i> <i>For 140 MPH Wind Load, Add</i> <i>For Panels <16" Wide, Add</i> <i>For Up To 1,500, Add</i> <i>For >1,500 To 5,000, Add</i> <i>For >5,000 To 10,000, Add</i>	11.30 1.19 0.54 1.30 2.83 1.70 0.28	1.58
07 41 13 00-0036 SF Structural 24 Gauge Galvanized Steel Standing Seam Concealed Fastener Roofing..... <i>For Steep Roof, Over 6 To 12, Add</i> <i>For 140 MPH Wind Load, Add</i> <i>For Panels <16" Wide, Add</i> <i>For Up To 1,500, Add</i> <i>For >1,500 To 5,000, Add</i> <i>For >5,000 To 10,000, Add</i>	11.59 1.19 0.55 1.31 2.90 1.74 0.29	1.58
07 41 13 00-0037 SF Structural 22 Gauge Galvanized Steel Standing Seam Concealed Fastener Roofing..... <i>For Steep Roof, Over 6 To 12, Add</i> <i>For 140 MPH Wind Load, Add</i> <i>For Panels <16" Wide, Add</i> <i>For Up To 1,500, Add</i> <i>For >1,500 To 5,000, Add</i> <i>For >5,000 To 10,000, Add</i>	12.65 1.19 0.57 1.37 3.16 1.90 0.32	1.58
07 41 13 00-0038 Accessories For Galvanized Steel Standing Seam Roofing (07 41 13 00-0030)		
07 41 13 00-0039 LF Ridge Flashing For Galvanized Steel Standing Seam Concealed Fastener Roofing..... <i>For Steep Roof, Over 6 To 12, Add</i> <i>For 140 MPH Wind Load, Add</i>	30.54 3.57 1.56	4.76

07 Thermal And Moisture Protection**07 40 Roofing And Siding Panels****07 41 Roof Panels**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 41 13 00-0040	LF		Eave Flashing For Galvanized Steel Standing Seam Concealed Fastener Roofing..... <i>For Steep Roof, Over 6 To 12, Add</i> <i>For 140 MPH Wind Load, Add</i>	22.96 3.57 1.41	4.76
07 41 13 00-0041	LF		Valley Flashing For Galvanized Steel Standing Seam Concealed Fastener Roofing <i>For Steep Roof, Over 6 To 12, Add</i> <i>For 140 MPH Wind Load, Add</i>	37.86 3.57 1.71	4.76
07 41 13 00-0042	LF		Hip Flashing For Galvanized Steel Standing Seam Concealed Fastener Roofing..... <i>For Steep Roof, Over 6 To 12, Add</i> <i>For 140 MPH Wind Load, Add</i>	31.21 3.57 1.58	4.76
07 41 13 00-0043			Aluminum Standing Seam Concealed Fastener Roofing (07 41 13 00-0029) Note: Factory paint finish is Kynar 500, Hylar 5000 or equal PVCF finish.		
07 41 13 00-0044			Aluminum Standing Seam Concealed Fastener Roofing (07 41 13 00-0043)		
07 41 13 00-0045	SF		Architectural 0.032" Aluminum Standing Seam Concealed Fastener Roofing..... <i>For Steep Roof, Over 6 To 12, Add</i> <i>For 140 MPH Wind Load, Add</i> <i>For Panels <16" Wide, Add</i> <i>For Up To 1,500, Add</i> <i>For >1,500 To 5,000, Add</i> <i>For >5,000 To 10,000, Add</i>	12.20 1.19 0.56 1.34 3.05 1.83 0.31	1.58
07 41 13 00-0046	SF		Architectural 0.040" Aluminum Standing Seam Concealed Fastener Roofing..... <i>For Steep Roof, Over 6 To 12, Add</i> <i>For 140 MPH Wind Load, Add</i> <i>For Panels <16" Wide, Add</i> <i>For Up To 1,500, Add</i> <i>For >1,500 To 5,000, Add</i> <i>For >5,000 To 10,000, Add</i>	12.82 1.19 0.57 1.38 3.21 1.92 0.32	1.58
07 41 13 00-0047	SF		Architectural/Structural Or Structural 0.032" Aluminum Standing Seam Concealed Fastener Roofing <i>For Steep Roof, Over 6 To 12, Add</i> <i>For 140 MPH Wind Load, Add</i> <i>For Panels <16" Wide, Add</i> <i>For Up To 1,500, Add</i> <i>For >1,500 To 5,000, Add</i> <i>For >5,000 To 10,000, Add</i>	11.85 1.19 0.55 1.33 2.96 1.78 0.30	1.58
07 41 13 00-0048	SF		Architectural/Structural Or Structural 0.040" Aluminum Standing Seam Concealed Fastener Roofing <i>For Steep Roof, Over 6 To 12, Add</i> <i>For 140 MPH Wind Load, Add</i> <i>For Panels <16" Wide, Add</i> <i>For Up To 1,500, Add</i> <i>For >1,500 To 5,000, Add</i> <i>For >5,000 To 10,000, Add</i>	12.98 1.19 0.58 1.38 3.25 1.95 0.32	1.58
07 41 13 00-0049			Accessories For Aluminum Standing Seam Roofing (07 41 13 00-0043)		
07 41 13 00-0050	LF		Ridge Flashing For Aluminum Standing Seam Concealed Fastener Roofing..... <i>For Steep Roof, Over 6 To 12, Add</i> <i>For 140 MPH Wind Load, Add</i>	35.03 3.57 1.65	4.76
07 41 13 00-0051	LF		Eave Flashing For Aluminum Standing Seam Concealed Fastener Roofing..... <i>For Steep Roof, Over 6 To 12, Add</i> <i>For 140 MPH Wind Load, Add</i>	25.55 3.57 1.46	4.76
07 41 13 00-0052	LF		Valley Flashing For Aluminum Standing Seam Concealed Fastener Roofing <i>For Steep Roof, Over 6 To 12, Add</i> <i>For 140 MPH Wind Load, Add</i>	44.18 3.57 1.84	4.76
07 41 13 00-0053	LF		Hip Flashing For Aluminum Standing Seam Concealed Fastener Roofing..... <i>For Steep Roof, Over 6 To 12, Add</i> <i>For 140 MPH Wind Load, Add</i>	35.87 3.57 1.67	4.76
07 41 13 00-0054			Copper Standing Seam Concealed Fastener Roofing (07 41 13 00-0029)		
07 41 13 00-0055			Copper Standing Seam Concealed Fastener Roofing (07 41 13 00-0054)		
07 41 13 00-0056	SF		Architectural 16 Ounce Copper Standing Seam Concealed Fastener Roofing..... <i>For Steep Roof, Over 6 To 12, Add</i> <i>For 140 MPH Wind Load, Add</i> <i>For Panels <16" Wide, Add</i> <i>For Up To 1,500, Add</i> <i>For >1,500 To 5,000, Add</i> <i>For >5,000 To 10,000, Add</i>	31.12 1.79 1.10 2.66 7.78 4.67 0.78	2.38
07 41 13 00-0057	SF		Architectural 20 Ounce Copper Standing Seam Concealed Fastener Roofing..... <i>For Steep Roof, Over 6 To 12, Add</i> <i>For 140 MPH Wind Load, Add</i> <i>For Panels <16" Wide, Add</i> <i>For Up To 1,500, Add</i> <i>For >1,500 To 5,000, Add</i> <i>For >5,000 To 10,000, Add</i>	37.41 1.79 1.22 2.97 9.35 5.61 0.94	2.38
07 41 13 00-0058			Accessories For Copper Standing Seam Concealed Fastener Roofing (07 41 13 00-0054)		
07 41 13 00-0059	LF		Ridge Flashing For Copper Standing Seam Concealed Fastener Roofing..... <i>For Steep Roof, Over 6 To 12, Add</i> <i>For 140 MPH Wind Load, Add</i>	93.51 3.57 2.82	4.76



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 41 13 00-0060 LF Eave Flashing For Copper Standing Seam Concealed Fastener Roofing..... <i>For Steep Roof, Over 6 To 12, Add</i> <i>For 140 MPH Wind Load, Add</i>	53.99 3.57 2.03	4.76
07 41 13 00-0061 LF Valley Flashing For Copper Standing Seam Concealed Fastener Roofing <i>For Steep Roof, Over 6 To 12, Add</i> <i>For 140 MPH Wind Load, Add</i>	130.88 3.57 3.57	4.76
07 41 13 00-0062 LF Hip Flashing For Copper Standing Seam Concealed Fastener Roofing..... <i>For Steep Roof, Over 6 To 12, Add</i> <i>For 140 MPH Wind Load, Add</i>	96.46 3.57 2.88	4.76
07 41 13 00-0063 Stainless Steel Standing Seam Concealed Fastener Roofing (07 41 13 00-0029)		
07 41 13 00-0064 Stainless Steel Standing Seam Concealed Fastener Roofing (07 41 13 00-0063)		
07 41 13 00-0065 SF Architectural 24 Gauge T304 Stainless Steel Standing Seam Concealed Fastener Roofing <i>For Steep Roof, Over 6 To 12, Add</i> <i>For 140 MPH Wind Load, Add</i> <i>For Panels <16" Wide, Add</i> <i>For Up To 1,500, Add</i> <i>For >1,500 To 5,000, Add</i> <i>For >5,000 To 10,000, Add</i>	23.71 1.79 0.95 2.29 5.93 3.56 0.59	2.38
07 41 13 00-0066 SF Architectural 22 Gauge T304 Stainless Steel Standing Seam Concealed Fastener Roofing <i>For Steep Roof, Over 6 To 12, Add</i> <i>For 140 MPH Wind Load, Add</i> <i>For Panels <16" Wide, Add</i> <i>For Up To 1,500, Add</i> <i>For >1,500 To 5,000, Add</i> <i>For >5,000 To 10,000, Add</i>	27.49 1.79 1.03 2.48 6.87 4.12 0.69	2.38
07 41 13 00-0067 SF Architectural 24 Gauge T316 Stainless Steel Standing Seam Concealed Fastener Roofing <i>For Steep Roof, Over 6 To 12, Add</i> <i>For 140 MPH Wind Load, Add</i> <i>For Panels <16" Wide, Add</i> <i>For Up To 1,500, Add</i> <i>For >1,500 To 5,000, Add</i> <i>For >5,000 To 10,000, Add</i>	31.97 1.79 1.12 2.70 7.99 4.80 0.80	2.38
07 41 13 00-0068 SF Architectural 22 Gauge T316 Stainless Steel Standing Seam Concealed Fastener Roofing <i>For Steep Roof, Over 6 To 12, Add</i> <i>For 140 MPH Wind Load, Add</i> <i>For Panels <16" Wide, Add</i> <i>For Up To 1,500, Add</i> <i>For >1,500 To 5,000, Add</i> <i>For >5,000 To 10,000, Add</i>	37.71 1.79 1.23 2.99 9.43 5.66 0.94	2.38
07 41 13 00-0069 Accessories For Stainless Steel Standing Seam Concealed Fastener Roofing (07 41 13 00-0063)		
07 41 13 00-0070 LF Ridge Flashing For Stainless Steel Standing Seam Concealed Fastener Roofing..... <i>For Steep Roof, Over 6 To 12, Add</i> <i>For 140 MPH Wind Load, Add</i>	82.76 4.02 2.73	4.76
07 41 13 00-0071 LF Eave Flashing For Stainless Steel Standing Seam Concealed Fastener Roofing..... <i>For Steep Roof, Over 6 To 12, Add</i> <i>For 140 MPH Wind Load, Add</i>	49.17 4.02 2.06	4.76
07 41 13 00-0072 LF Valley Flashing For Stainless Steel Standing Seam Concealed Fastener Roofing..... <i>For Steep Roof, Over 6 To 12, Add</i> <i>For 140 MPH Wind Load, Add</i>	114.52 4.02 3.36	4.76
07 41 13 00-0073 LF Hip Flashing For Stainless Steel Standing Seam Concealed Fastener Roofing..... <i>For Steep Roof, Over 6 To 12, Add</i> <i>For 140 MPH Wind Load, Add</i>	85.27 4.02 2.78	4.76
07 41 13 00-0074 Metal Roof Surfacing (07 41 13)		
07 41 13 00-0075 SF Acrylic, Metal Roof Primer, One Coat..... <i>For Steep Roof, Over 7 To 12, Add</i>	0.29 0.05	
07 41 13 00-0076 SF Acrylic Elastomeric, Surface Or Base Coating For Metal Roofing, One Coat..... Note: 55% solids by volume. <i>For Steep Roof, Over 7 To 12, Add</i>	0.41 0.05	
07 41 33 Plastic Roof Panels (07 41)		
07 41 33 00-0001 Polyvinyl Chloride (PVC) Roofing Panels (07 41 33)		
07 41 33 00-0002 Polyvinyl Chloride (PVC) Roofing Panels (07 41 33 00-0001)		
07 41 33 00-0003 SF Solid Polyvinyl Chloride (PVC) Roofing Panels, 8" Wide.....	3.83	1.44
07 41 33 00-0004 SF Solid Polyvinyl Chloride (PVC) Roofing Panels, 10" Wide.....	3.61	1.30
07 41 33 00-0005 SF Solid Polyvinyl Chloride (PVC) Roofing Panels, Double 8" Wide.....	3.93	1.44
07 41 33 00-0006 SF Solid Polyvinyl Chloride (PVC) Roofing Panels, Double 10" Wide.....	3.69	1.30
07 41 33 00-0007 Polyvinyl Chloride (PVC) Roofing Accessories (07 41 33 00-0001)		
07 41 33 00-0008 LF 1" "J" Channel, Starter Strip Trim.....	2.44	1.08
07 41 33 00-0009 LF 3-1/2" "J" Channel, Starter Strip Trim.....	3.23	1.08
07 41 33 00-0010 LF Outside Corner Post, 7/8" Pocket.....	3.46	1.08
07 41 33 00-0011 LF Inside Corner Post, 7/8" Pocket.....	2.85	1.08

07 Thermal And Moisture Protection**07 40 Roofing And Siding Panels****07 41 Roof Panels**

MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
07 41 33 00-0012		Fiberglass Roofing Panel (07 41 33)			
07 41 33 00-0013		Corrugated Panels (07 41 33 00-0012)			
07 41 33 00-0014	SF	8 Ounce Corrugated Fiberglass Panel.....	4.03		1.16
07 41 33 00-0015	SF	12 Ounce Corrugated Fiberglass Panel.....	4.59		1.16
07 42		Wall Panels (07 40)			
07 42 63		Fabricated Wall Panel Assemblies (07 42)			
07 42 63 00-0001		24 Gauge, Galvanized Steel Insulated Tongue And Groove Metal Siding Panels (07 42 63)			
		Note: G-90 galvanized steel, 24 gauge exterior face and 24 gauge interior liner. Galvalume AZ-55 coating designation with texture. Non-CFC polyurethane foam core. Standard color on exterior and interior panels. CF Mesa Profile wall panels as manufactured by Metl-Span Corporation.			
07 42 63 00-0002	SF	2" Polyurethane Foam, 24 Gauge (Each Side), Galvanized Steel Insulated Tongue And Groove Metal Siding Panels.....	12.89		1.73
		For AZ-50 Aluminum-Zinc Coated Exterior, Add	0.24		
		For Premium Exterior Colors, Add	0.12		
07 42 63 00-0003	SF	2-1/2" Polyurethane Foam, 24 Gauge (Each Side), Galvanized Steel Insulated Tongue And Groove Metal Siding Panels.....	14.52		1.95
		For AZ-50 Aluminum-Zinc Coated Exterior, Add	0.24		
		For Premium Exterior Colors, Add	0.12		
07 42 63 00-0004	SF	3" Polyurethane Foam, 24 Gauge (Each Side), Galvanized Steel Insulated Tongue And Groove Metal Siding Panels.....	15.93		2.21
		For AZ-50 Aluminum-Zinc Coated Exterior, Add	0.24		
		For Premium Exterior Colors, Add	0.12		
07 42 63 00-0005	SF	4" Polyurethane Foam, 24 Gauge (Each Side), Galvanized Steel Insulated Tongue And Groove Metal Siding Panels.....	17.88		2.92
		For AZ-50 Aluminum-Zinc Coated Exterior, Add	0.24		
		For Premium Exterior Colors, Add	0.12		
07 46		Siding (07 40)			
07 46 16		Aluminum Siding (07 46)			
		Note: Includes all necessary furring strips, trim for corners, windows and doors.			
07 46 16 00-0001		Aluminum Coil Stock Cladding (07 46 16)			
		Note: Per SF of board, includes overlapage.			
07 46 16 00-0002	SF	Aluminum Cladding, 0.016" Thick.....	6.39		2.50
07 46 16 00-0003	SF	Aluminum Cladding, 0.019" Thick.....	6.43		2.50
07 46 16 00-0004	SF	Aluminum Cladding, 0.024" Thick.....	6.50		2.50
07 46 16 00-0005		Aluminum Siding Panels For Structural Steel Framing (07 46 16)			
		Note: Includes fasteners.			
07 46 16 00-0006		Corrugated (07 46 16 00-0005)			
07 46 16 00-0007	SF	0.019" Corrugated Aluminum Siding Panel, Mill Finish, Including Fasteners.....	3.85		1.49
07 46 16 00-0008	SF	0.021" Corrugated Aluminum Siding Panel, Mill Finish, Including Fasteners.....	3.97		1.49
07 46 16 00-0009	SF	0.024" Corrugated Aluminum Siding Panel, Mill Finish, Including Fasteners.....	4.25		1.49
07 46 16 00-0010	SF	0.032" Corrugated Aluminum Siding Panel, Mill Finish, Including Fasteners.....	4.73		1.49
07 46 16 00-0011	SF	0.019" Corrugated Aluminum Siding Panel, Painted Finish, Including Fasteners.....	4.08		1.49
07 46 16 00-0012	SF	0.021" Corrugated Aluminum Siding Panel, Painted Finish, Including Fasteners.....	4.19		1.49
07 46 16 00-0013	SF	0.024" Corrugated Aluminum Siding Panel, Painted Finish, Including Fasteners.....	4.51		1.49
07 46 16 00-0014	SF	0.032" Corrugated Aluminum Siding Panel, Painted Finish, Including Fasteners.....	5.14		1.49
07 46 16 00-0015		V- Beam (07 46 16 00-0005)			
07 46 16 00-0016	SF	0.032" Aluminum V-Beam Siding Panel, Mill Finish, Including Fasteners.....	4.75		1.49
07 46 16 00-0017	SF	0.040" Aluminum V-Beam Siding Panel, Mill Finish, Including Fasteners.....	5.00		1.49
07 46 16 00-0018	SF	0.050" Aluminum V-Beam Siding Panel, Mill Finish, Including Fasteners.....	5.32		1.49
07 46 16 00-0019	SF	0.032" Aluminum V-Beam Siding Panel, Painted Finish, Including Fasteners.....	5.11		1.49
07 46 16 00-0020	SF	0.040" Aluminum V-Beam Siding Panel, Painted Finish, Including Fasteners.....	5.54		1.49
07 46 16 00-0021	SF	0.050" Aluminum V-Beam Siding Panel, Painted Finish, Including Fasteners.....	6.54		1.49
07 46 16 00-0022		Rib (07 46 16 00-0005)			
07 46 16 00-0023	SF	0.032" Aluminum Siding Panel With 4" Rib, Mill Finish, Including Fasteners.....	5.07		1.49
07 46 16 00-0024	SF	0.040" Aluminum Siding Panel With 4" Rib, Mill Finish, Including Fasteners.....	5.32		1.49
07 46 16 00-0025	SF	0.050" Aluminum Siding Panel With 4" Rib, Mill Finish, Including Fasteners.....	5.65		1.49
07 46 16 00-0026	SF	0.032" Aluminum Siding Panel With 4" Rib, Painted Finish, Including Fasteners.....	5.30		1.49
07 46 16 00-0027	SF	0.040" Aluminum Siding Panel With 4" Rib, Painted Finish, Including Fasteners.....	5.71		1.49
07 46 16 00-0028	SF	0.050" Aluminum Siding Panel With 4" Rib, Painted Finish, Including Fasteners.....	5.96		1.49
07 46 16 00-0029		Aluminum Soffit And Fascia (07 46 16)			
		Note: Excludes J-channel.			



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 46 16 00-0030 LF 6" Overhang, 0.019" Thick, Solid Or Vented Aluminum Soffit..... <i>For 0.015" Thick, Deduct</i>	2.77 -0.05	1.01
07 46 16 00-0031 LF 10" Overhang, 0.019" Thick, Solid Or Vented Aluminum Soffit..... <i>For 0.015" Thick, Deduct</i>	3.38 -0.09	1.06
07 46 16 00-0032 LF 1" Overhang, 0.019" Thick, Solid Or Vented Aluminum Soffit <i>For 0.015" Thick, Deduct</i>	3.68 -0.11	1.09
07 46 16 00-0033 LF 1'-6" Overhang, 0.019" Thick, Solid Or Vented Aluminum Soffit <i>For 0.015" Thick, Deduct</i>	4.55 -0.16	1.15
07 46 16 00-0034 LF 2' Overhang, 0.019" Thick, Solid Or Vented Aluminum Soffit <i>For 0.015" Thick, Deduct</i>	5.52 -0.20	1.25
07 46 16 00-0035 LF 3' Overhang, 0.019" Thick, Solid Or Vented Aluminum Soffit <i>For 0.015" Thick, Deduct</i>	7.28 -0.31	1.38
07 46 16 00-0036 LF 4' Overhang, 0.019" Thick, Solid Or Vented Aluminum Soffit <i>For 0.015" Thick, Deduct</i>	9.06 -0.42	1.53
07 46 16 00-0037 LF 5' Overhang, 0.019" Thick, Solid Or Vented Aluminum Soffit <i>For 0.015" Thick, Deduct</i>	10.87 -0.53	1.68
07 46 16 00-0038 LF 4" Exposure, 0.024" Thick, Aluminum Fascia	3.20	0.99
07 46 16 00-0039 LF 6" Exposure, 0.024" Thick, Aluminum Fascia	3.48	1.01
07 46 16 00-0040 LF 8" Exposure, 0.024" Thick, Aluminum Fascia	4.05	1.04
07 46 16 00-0041 LF 10" Exposure, 0.024" Thick, Aluminum Fascia	4.66	1.06
07 46 16 00-0042 Aluminum Siding Accessories <small>(07 46 16)</small>		
07 46 16 00-0043 LF 3/8" Pocket, Aluminum J-Channel	2.18	0.95
07 46 16 00-0044 LF 1/2" Pocket, Aluminum J-Channel	2.18	0.95
07 46 16 00-0045 LF 3/4" Pocket, Aluminum J-Channel	2.52	0.95
07 46 16 00-0046 LF 3/8" Pocket, Aluminum F-Channel.....	2.31	0.95
07 46 16 00-0047 LF 1/2" Pocket, Aluminum F-Channel.....	2.31	0.95
07 46 19 Steel Siding <small>(07 46)</small>		
Note: Includes fasteners, all necessary furring strips, trim for corners, windows and doors.		
07 46 19 00-0001 Steel Siding Panels For Structural Steel Framing <small>(07 46 19)</small>		
Note: Included fasteners.		
07 46 19 00-0002 Corrugated, Painted <small>(07 46 19 00-0001)</small>		
Note: Factory applied.		
07 46 19 00-0003 SF 20 Gauge Corrugated Steel Siding Panel, Including Fasteners And Painted..... <i>For Galvanized Instead Of Painted Steel, Add</i>	6.80 0.95	1.49
07 46 19 00-0004 SF 22 Gauge Corrugated Steel Siding Panel, Including Fasteners And Painted <i>For Galvanized Instead Of Painted Steel, Add</i>	6.29 0.82	1.49
07 46 19 00-0005 SF 24 Gauge Corrugated Steel Siding Panel, Including Fasteners And Painted <i>For Galvanized Instead Of Painted Steel, Add</i>	6.16 0.79	1.49
07 46 19 00-0006 SF 26 Gauge Corrugated Steel Siding Panel, Including Fasteners And Painted <i>For Galvanized Instead Of Painted Steel, Add</i>	4.67 0.42	1.49
07 46 19 00-0007 SF 28 Gauge Corrugated Steel Siding Panel, Including Fasteners And Painted <i>For Galvanized Instead Of Painted Steel, Add</i>	4.56 0.39	1.49
07 46 19 00-0008 SF 30 Gauge Corrugated Steel Siding Panel, Including Fasteners And Painted <i>For Galvanized Instead Of Painted Steel, Add</i>	4.49 0.37	1.49
07 46 19 00-0009 Box Rib, Painted <small>(07 46 19 00-0001)</small>		
Note: Factory applied.		
07 46 19 00-0010 SF 20 Gauge Box Rib Steel Siding Panel, Painted With Fasteners <i>For Galvanized Instead Of Painted Steel, Add</i>	6.42 0.86	1.49
07 46 19 00-0011 SF 22 Gauge Box Rib Steel Siding Panel, Painted With Fasteners <i>For Galvanized Instead Of Painted Steel, Add</i>	6.19 0.80	1.49
07 46 19 00-0012 SF 24 Gauge Box Rib Steel Siding Panel, Painted With Fasteners <i>For Galvanized Instead Of Painted Steel, Add</i>	6.04 0.76	1.49
07 46 19 00-0013 SF 26 Gauge Box Rib Steel Siding Panel, Painted With Fasteners <i>For Galvanized Instead Of Painted Steel, Add</i>	5.78 0.70	1.49
07 46 19 00-0014 SF 28 Gauge Box Rib Steel Siding Panel, Painted With Fasteners <i>For Galvanized Instead Of Painted Steel, Add</i>	5.24 0.56	1.49
07 46 19 00-0015 Steel Siding For Wood Frame <small>(07 46 19)</small>		
Note: Horizontal clapboard, double 5" profiler, 1/2" deep butt, wood grain pattern. Includes fasteners, trim and all accessories.		
07 46 19 00-0016 SF Horizontal Clapboard.....	6.24	0.75
07 46 23 Wood Siding <small>(07 46)</small>		
Note: Includes all necessary furring strips, trim for corners, windows and doors.		
07 46 23 00-0001 Wood Lap Siding <small>(07 46 23)</small>		
07 46 23 00-0002 LF 8" Wide Rough Sawn Cedar Lap Siding	2.69	1.08
07 46 23 00-0003 LF 10" Wide Rough Sawn Cedar Lap Siding	2.98	1.15
07 46 23 00-0004 LF 12" Wide Rough Sawn Cedar Lap Siding	3.28	1.23
07 46 23 00-0005 LF 6" To 8" Wide Southern Yellow Pine Lap Siding, D Grade	2.85	1.08
07 46 23 00-0006 LF 6" To 8" Wide Spruce Lap Siding, #2 Or Better	3.12	1.08
07 46 23 00-0007 LF 6" To 8" Wide Western Red Cedar, B Grade Lap Siding	3.70	1.08
07 46 23 00-0008 LF 6" To 8" Wide Western Red Cedar, A Grade Lap Siding	3.93	1.08
07 46 23 00-0009 LF 6" To 8" Wide Clear Heart Redwood Lap Siding.....	3.61	1.08

07 Thermal And Moisture Protection**07 40 Roofing And Siding Panels****07 46 Siding**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 46 23 00-0010	LF		1" x 8" Cedar Round Or Flat Front Siding, Log Cabin.....	2.97	1.15
07 46 23 00-0011	LF		1" x 8" Cedar Beveled Siding, Channel, Rustic.....	2.97	1.15
07 46 23 00-0012			Tongue And Groove Siding (07 46 23)		
07 46 23 00-0013	SF		1" x 6" Tongue And Groove Southern Yellow Pine Siding	2.68	1.08
07 46 23 00-0014	SF		1" x 8" Tongue And Groove Southern Yellow Pine Siding	2.92	1.08
07 46 23 00-0015	SF		1" x 6" 105 Southern Yellow Pine Siding	2.74	1.08
07 46 23 00-0016	SF		1" x 8" 105 Southern Yellow Pine Siding	3.52	1.08
07 46 29			Plywood Siding (07 46)		
			Note: Includes all necessary furring strips, trim for corners, windows and doors.		
07 46 29 00-0001			T-111 Siding (07 46 29)		
07 46 29 00-0002	SF		5/8" T-111 Fir, Fine Grade Siding, Paint Ready Applied To Blackboard / Stud.....	2.03	0.51
			For Pressure Treated, Add	0.18	
07 46 29 00-0003	SF		5/8" T-111 Cedar, Fine Grade Siding, Paint Ready Applied To Blackboard / Stud.....	2.00	0.51
			For Pressure Treated, Add	0.18	
07 46 33			Plastic Siding (07 46)		
			Note: Includes all necessary furring strips, trim for corners, windows and doors.		
07 46 33 00-0001			Vinyl Siding (07 46 33)		
			Note: Includes standard manufacturer's colors.		
07 46 33 00-0002			Vinyl Siding Panels (07 46 33 00-0001)		
			Note: Excludes J-channels, starter strips and trim.		
07 46 33 00-0003			Horizontal Vinyl Siding Panels (07 46 33 00-0002)		
			Note: Includes single, double or triple profiles. Includes traditional clapboard or dutch lap styles.		
07 46 33 00-0004	SF		7" Exposure, 0.044" Thick, Horizontal Vinyl Siding Panel.....	3.22	1.23
			For 0.040" Thick, Deduct	-0.11	
			For 0.042" Thick, Deduct	0.07	
			For 0.046" Thick, Add	0.33	
			For Manufacturer's Custom Colors, Add	0.04	
07 46 33 00-0005	SF		8" Exposure, 0.044" Thick, Horizontal Vinyl Siding Panel.....	3.08	1.16
			For 0.040" Thick, Deduct	-0.11	
			For 0.042" Thick, Deduct	0.07	
			For 0.046" Thick, Add	0.33	
			For Manufacturer's Custom Colors, Add	0.04	
07 46 33 00-0006	SF		9" Exposure, 0.044" Thick, Horizontal Vinyl Siding Panel.....	2.97	1.11
			For 0.040" Thick, Deduct	-0.11	
			For 0.042" Thick, Deduct	0.07	
			For 0.046" Thick, Add	0.33	
			For Manufacturer's Custom Colors, Add	0.04	
07 46 33 00-0007	SF		10" Exposure, 0.044" Thick, Horizontal Vinyl Siding Panel.....	2.87	1.05
			For 0.040" Thick, Deduct	-0.11	
			For 0.042" Thick, Deduct	0.07	
			For 0.046" Thick, Add	0.33	
			For Manufacturer's Custom Colors, Add	0.04	
07 46 33 00-0008	SF		12" Exposure, 0.044" Thick, Horizontal Vinyl Siding Panel.....	2.71	0.98
			For 0.040" Thick, Deduct	-0.11	
			For 0.042" Thick, Deduct	0.07	
			For 0.046" Thick, Add	0.33	
			For Manufacturer's Custom Colors, Add	0.04	
07 46 33 00-0009			Vertical Vinyl Siding Panels (07 46 33 00-0002)		
07 46 33 00-0010	SF		7" Exposure, 0.048" Thick, Board And Batten, Vinyl Siding Panel.....	3.81	1.23
			For Manufacturer's Custom Colors, Add	0.07	
07 46 33 00-0011			Vinyl Siding Accessories (07 46 33 00-0001)		
07 46 33 00-0012	LF		3/4" Pocket, Outside Corner Post For Vinyl Siding	3.39	0.95
			For Manufacturer's Custom Colors, Add	0.08	
07 46 33 00-0013	LF		1-1/8" Pocket, Outside Corner Post For Vinyl Siding	5.98	0.95
			For Manufacturer's Custom Colors, Add	0.20	
07 46 33 00-0014	LF		3/4" Pocket, Inside Corner Post For Vinyl Siding	2.94	0.95
			For Manufacturer's Custom Colors, Add	0.05	
07 46 33 00-0015	LF		1-1/8" Pocket, Inside Corner Post For Vinyl Siding	3.43	0.95
			For Manufacturer's Custom Colors, Add	0.08	
07 46 33 00-0016	LF		3/8" Pocket, J-Channel For Vinyl Siding	2.16	0.95
			For Manufacturer's Custom Colors, Add	0.02	
07 46 33 00-0017	LF		1/2" Pocket, J-Channel For Vinyl Siding	2.12	0.95
			For Manufacturer's Custom Colors, Add	0.02	
07 46 33 00-0018	LF		5/8" Pocket, J-Channel For Vinyl Siding	2.13	0.95
			For Manufacturer's Custom Colors, Add	0.02	
07 46 33 00-0019	LF		3/4" Pocket, J-Channel For Vinyl Siding	2.16	0.95
			For Manufacturer's Custom Colors, Add	0.02	
07 46 33 00-0020	LF		1" Pocket, J-Channel For Vinyl Siding	2.35	0.95
			For Manufacturer's Custom Colors, Add	0.02	
07 46 33 00-0021	LF		1-1/4" Pocket, J-Channel For Vinyl Siding	2.37	0.95
			For Manufacturer's Custom Colors, Add	0.02	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 46 33 00-0022 LF 2-1/2" Pocket, J-Channel For Vinyl Siding..... <i>For Manufacturer's Custom Colors, Add</i>	3.98 0.08	0.95
07 46 33 00-0023 LF 1/2" Pocket, F-Channel For Vinyl Siding..... <i>For Manufacturer's Custom Colors, Add</i>	1.87 0.02	0.95
07 46 33 00-0024 LF 3/4" Pocket, 3-3/4" Lineals For Vinyl Siding..... <i>For Manufacturer's Custom Colors, Add</i>	4.45 0.09	1.30
07 46 33 00-0025 LF 3/4" Pocket, 5" Lineals For Vinyl Siding..... <i>For Manufacturer's Custom Colors, Add</i>	4.52 0.10	1.30
07 46 33 00-0026 LF 1-1/8" Pocket, 3-1/2" Lineals For Vinyl Siding..... <i>For Manufacturer's Custom Colors, Add</i>	4.45 0.09	1.30
07 46 33 00-0027 LF 3/8" Pocket, 1-7/8" H-Mold For Vinyl Siding..... <i>For Manufacturer's Custom Colors, Add</i>	3.53 0.08	0.95
07 46 33 00-0028 LF Vinyl Starter Strip For Vinyl Siding..... <i>For Manufacturer's Custom Colors, Add</i>	3.16 0.06	0.95
07 46 33 00-0029 LF Undersill Trim For Vinyl Siding..... <i>For Manufacturer's Custom Colors, Add</i>	2.32 0.02	0.95
07 46 33 00-0030 Vinyl Soffit And Fascia (07 46 33 00-0001) Note: Excludes J-channel.		
07 46 33 00-0031 LF 6" Overhang, 0.044" Thick, Solid Or Vented Vinyl Soffit..... <i>For 0.038" Thick, Deduct</i> <i>For 0.040" Thick, Deduct</i> <i>For 0.046" Thick, Add</i> <i>For Manufacturer's Custom Colors, Add</i>	2.53 -0.10 -0.06 0.11 0.03	1.01
07 46 33 00-0032 LF 10" Overhang, 0.044" Thick, Solid Or Vented Vinyl Soffit..... <i>For 0.038" Thick, Deduct</i> <i>For 0.040" Thick, Deduct</i> <i>For 0.046" Thick, Add</i> <i>For Manufacturer's Custom Colors, Add</i>	2.97 -0.18 -0.11 0.19 0.04	1.06
07 46 33 00-0033 LF 1" Overhang, 0.044" Thick, Solid Or Vented Vinyl Soffit..... <i>For 0.038" Thick, Deduct</i> <i>For 0.040" Thick, Deduct</i> <i>For 0.046" Thick, Add</i> <i>For Manufacturer's Custom Colors, Add</i>	3.19 -0.23 -0.15 0.22 0.05	1.09
07 46 33 00-0034 LF 1'-6" Overhang, 0.044" Thick, Solid Or Vented Vinyl Soffit..... <i>For 0.038" Thick, Deduct</i> <i>For 0.040" Thick, Deduct</i> <i>For 0.046" Thick, Add</i> <i>For Manufacturer's Custom Colors, Add</i>	3.81 -0.35 -0.23 0.34 0.08	1.15
07 46 33 00-0035 LF 2' Overhang, 0.044" Thick, Solid Or Vented Vinyl Soffit..... <i>For 0.038" Thick, Deduct</i> <i>For 0.040" Thick, Deduct</i> <i>For 0.046" Thick, Add</i> <i>For Manufacturer's Custom Colors, Add</i>	4.54 -0.45 -0.29 0.45 0.10	1.25
07 46 33 00-0036 LF 3' Overhang, 0.044" Thick, Solid Or Vented Vinyl Soffit..... <i>For 0.038" Thick, Deduct</i> <i>For 0.040" Thick, Deduct</i> <i>For 0.046" Thick, Add</i> <i>For Manufacturer's Custom Colors, Add</i>	5.81 -0.70 -0.46 0.67 0.15	1.38
07 46 33 00-0037 LF 4' Overhang, 0.044" Thick, Solid Or Vented Vinyl Soffit..... <i>For 0.038" Thick, Deduct</i> <i>For 0.040" Thick, Deduct</i> <i>For 0.046" Thick, Add</i> <i>For Manufacturer's Custom Colors, Add</i>	7.09 -0.92 -0.60 0.89 0.20	1.53
07 46 33 00-0038 LF 5' Overhang, 0.044" Thick, Solid Or Vented Vinyl Soffit..... <i>For 0.038" Thick, Deduct</i> <i>For 0.040" Thick, Deduct</i> <i>For 0.046" Thick, Add</i> <i>For Manufacturer's Custom Colors, Add</i>	8.42 -1.17 -0.77 1.12 0.25	1.68
07 46 33 00-0039 LF 4" Exposure, Vinyl Fascia..... <i>For Manufacturer's Custom Colors, Add</i>	2.68 0.04	0.99
07 46 33 00-0040 LF 6" Exposure, Vinyl Fascia..... <i>For Manufacturer's Custom Colors, Add</i>	2.94 0.05	1.01
07 46 33 00-0041 LF 8" Exposure, Vinyl Fascia..... <i>For Manufacturer's Custom Colors, Add</i>	3.09 0.05	1.04
07 46 33 00-0042 LF 10" Exposure, Vinyl Fascia..... <i>For Manufacturer's Custom Colors, Add</i>	3.29 0.06	1.06
07 46 33 00-0043 Fiberglass Siding (07 46 33)		
07 46 33 00-0044 Corrugated Panels (07 46 33 00-0043)		
07 46 33 00-0045 SF 6 Ounce Corrugated Fiberglass Panels.....	4.09	1.45
07 46 33 00-0046 SF 8 Ounce Corrugated Fiberglass Panels.....	4.32	1.30
07 46 33 00-0047 SF 12 Ounce Corrugated Fiberglass Panels.....	4.75	1.30
07 46 33 00-0048 Flat Panels (07 46 33 00-0043)		
07 46 33 00-0049 SF 6 Ounce Flat Fiberglass Panels.....	3.94	1.30
07 46 33 00-0050 SF 8 Ounce Flat Fiberglass Panels.....	4.32	1.30

07 46 46 Fiber-Cement Siding (07 46)
Note: Smooth or patterns. Includes sealer and primer.

07 Thermal And Moisture Protection**07 40 Roofing And Siding Panels****07 46 Siding**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 46 46 00-0001			5/16" Thick, Fiber Cement Lap Siding (07 46 46)		
07 46 46 00-0002	SF		5-1/4" Board with 4" Exposure, 5/16" Thick, Fiber Cement Lap Siding.....	4.35	1.53
07 46 46 00-0003	SF		6-1/4" Board with 5" Exposure, 5/16" Thick, Fiber Cement Lap Siding.....	4.14	1.45
07 46 46 00-0004	SF		7-1/4" Board with 6" Exposure, 5/16" Thick, Fiber Cement Lap Siding.....	4.05	1.41
07 46 46 00-0005	SF		8-1/4" Board with 7" Exposure, 5/16" Thick, Fiber Cement Lap Siding.....	3.96	1.37
07 46 46 00-0006	SF		9-1/2" Board with 8" Exposure, 5/16" Thick, Fiber Cement Lap Siding.....	3.78	1.30
07 46 46 00-0007	SF		12" Board with 10-3/4" Exposure, 5/16" Thick, Fiber Cement Lap Siding.....	3.60	1.23
07 46 46 00-0008	LF		Starter Strip, Fiber Cement Lap Siding.....	0.95	0.37
07 46 46 00-0009			Fiber Cement Shingle Siding (07 46 46)		
07 46 46 00-0010	SF		Fiber Cement Shingle Siding.....	6.68	1.34
07 46 46 00-0011			Fiber Cement Vertical Panel Siding (07 46 46)		
07 46 46 00-0012	SF		Fiber Cement Vertical Panel Siding.....	3.20	1.09
07 46 46 00-0013			Fiber Cement Trim Boards (07 46 46)		
07 46 46 00-0014			7/16" Thick, Fiber Cement Trim Boards (07 46 46 00-0013)		
07 46 46 00-0015	LF		4" Wide, 7/16" Thick, Fiber Cement Trim Board.....	2.08	0.72
07 46 46 00-0016	LF		6" Wide, 7/16" Thick, Fiber Cement Trim Board.....	2.66	0.79
07 46 46 00-0017	LF		8" Wide, 7/16" Thick, Fiber Cement Trim Board.....	3.19	0.88
07 46 46 00-0018	LF		12" Wide, 7/16" Thick, Fiber Cement Trim Board.....	4.20	1.02
07 46 46 00-0019			3/4" Thick Fiber Cement Trim Boards (07 46 46 00-0013)		
07 46 46 00-0020	LF		4" Wide, 3/4" Thick, Fiber Cement Trim Board.....	2.19	0.72
07 46 46 00-0021	LF		6" Wide, 3/4" Thick, Fiber Cement Trim Board.....	2.82	0.79
07 46 46 00-0022	LF		8" Wide, 3/4" Thick, Fiber Cement Trim Board.....	3.46	0.88
07 46 46 00-0023	LF		12" Wide, 3/4" Thick, Fiber Cement Trim Board.....	3.62	1.02
07 46 46 00-0024			1" Thick Fiber Cement Trim Boards (07 46 46 00-0013)		
07 46 46 00-0025	LF		4" Wide, 1" Thick, Fiber Cement Trim Board.....	2.32	0.72
07 46 46 00-0026	LF		6" Wide, 1" Thick, Fiber Cement Trim Board.....	3.05	0.79
07 46 46 00-0027	LF		8" Wide, 1" Thick, Fiber Cement Trim Board.....	3.80	0.88
07 46 46 00-0028	LF		12" Wide, 1" Thick, Fiber Cement Trim Board.....	5.07	1.02
07 46 46 00-0029			Fiber Cement Fascia Board (07 46 46)		
07 46 46 00-0030	LF		5/4" x 3-1/2" Fiber Cement Fascia Board.....	3.98	1.44
07 46 46 00-0031	LF		5/4" x 5-1/2" Fiber Cement Fascia Board.....	4.96	1.59
07 46 46 00-0032	LF		5/4" x 7-1/4" Fiber Cement Fascia Board.....	5.51	1.59
07 46 46 00-0033	LF		5/4" x 11-1/4" Fiber Cement Fascia Board.....	7.29	1.87
07 46 46 00-0034			Fiber Cement Soffit Boards (07 46 46)		
07 46 46 00-0035	SF		1/4" Thick, Non Vented Fiber Cement Soffit.....	4.08	1.04
07 46 46 00-0036	SF		1/4" Thick, Vented Fiber Cement Soffit.....	4.34	1.04
07 46 63			Fabricated Panel Assemblies With Siding (07 46)		
07 46 63 00-0001			Metal Liner Panels (07 46 63)		
07 46 63 00-0002			Galvanized Metal Liner Panels (07 46 63 00-0001)		
07 46 63 00-0003	SF		24 Gauge, 1-3/8" Thick Galvanized Metal Liner Panel.....	5.81	1.21
07 46 63 00-0004	SF		22 Gauge, 1-3/8" Thick Galvanized Metal Liner Panel.....	6.34	1.21
07 46 63 00-0005	SF		20 Gauge, 1-3/8" Thick Galvanized Metal Liner Panel.....	7.29	1.21
07 46 63 00-0006	SF		18 Gauge, 1-3/8" Thick Galvanized Metal Liner Panel.....	7.38	1.21

07 50 Membrane Roofing (07)

Note: Includes placement of materials on roof up to 2-1/2 stories. See CSI section 07 22 16 00-0000 for insulation, 07 60 00 00-0000 for additional flashing, sheet metal and trim, 07 70 00 00-0000 for additional roof accessories.

07 51 Built-Up Bituminous Roofing (07 50)**07 51 13 Built-Up Asphalt Roofing** (07 51)**07 51 13 00-0001 Built-Up Asphalt Roofing Components** (07 51 13)**07 51 13 00-0002 Built-Up Asphalt Membrane Roofing** (07 51 13 00-0001)

Note: Includes all standard manufacturers' colors including white for granule and smooth surfaced cap sheets and flashing. See CSI section 07 51 13 00-0066 for built-up roofing demolition.

07 51 13 00-0003 Cold Adhesive Applied, Built-Up Asphalt Membrane Roofing (07 51 13 00-0002)

Note: Includes applying cold adhesive and embedding the membrane.



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 51 13 00-0004 Cold Adhesive Applied, Built-Up Asphalt Roofing Base, Ply And Cap Sheets <small>(07 51 13 00-0003)</small>		
07 51 13 00-0005 SQ Type IV, Asphalt Coated Fiberglass Ply Sheet, Cold Adhesive Applied	56.04	
<i>For Up To 10, Add</i>	10.16	
<i>For >10 To 25, Add</i>	7.71	
07 51 13 00-0006 SQ Asphalt Coated Polyester And Fiberglass Scrim, Base Or Ply Sheet, Cold Adhesive Applied	137.65	
<i>For Up To 10, Add</i>	14.24	
<i>For >10 To 25, Add</i>	11.79	
07 51 13 00-0007 Cold Adhesive Applied, Built-Up Asphalt Roofing Flashing <small>(07 51 13 00-0003)</small>		
07 51 13 00-0008 SF Asphalt Coated Polyester And Fiberglass Scrim, Flashing, Cold Adhesive Applied.....	3.64	
07 51 13 00-0009 Hot-Mopped, Built-Up Asphalt Membrane Roofing <small>(07 51 13 00-0002)</small>		
<small>Note: Includes mopping hot asphalt and embedding the membrane.</small>		
07 51 13 00-0010 Hot-Mopped, Built-Up Asphalt Roofing Base, Ply And Cap Sheets <small>(07 51 13 00-0009)</small>		
07 51 13 00-0011 SQ Type IV, Asphalt Coated Fiberglass Ply Sheet, Hot-Mopped.....	44.02	
<i>For Up To 10, Add</i>	9.56	
<i>For >10 To 25, Add</i>	7.11	
07 51 13 00-0012 SQ Type VI, Asphalt Coated Fiberglass Ply Sheet, Hot-Mopped.....	46.35	
<i>For Up To 10, Add</i>	9.68	
<i>For >10 To 25, Add</i>	7.22	
07 51 13 00-0013 SQ Fine Mineral Surfaced, Asphalt Coated Fiberglass Base Sheet, Hot-Mopped.....	49.00	
<i>For Up To 10, Add</i>	9.81	
<i>For >10 To 25, Add</i>	7.36	
07 51 13 00-0014 SQ Asphalt Coated Fiberglass Venting Base Sheet, Hot-Mopped	78.32	
<i>For Up To 10, Add</i>	11.28	
<i>For >10 To 25, Add</i>	8.82	
07 51 13 00-0015 SQ Asphalt Coated Polyester And Fiberglass Scrim, Base Or Ply Sheet, Hot-Mopped	125.64	
<i>For Up To 10, Add</i>	13.64	
<i>For >10 To 25, Add</i>	11.19	
07 51 13 00-0016 SQ Granule Surfaced, Asphalt Coated Fiberglass Cap Sheet, Hot-Mopped	98.60	
<i>For Up To 10, Add</i>	12.99	
<i>For >10 To 25, Add</i>	10.30	
07 51 13 00-0017 Hot-Mopped, Built-Up Asphalt Roofing Flashing <small>(07 51 13 00-0009)</small>		
07 51 13 00-0018 SF Asphalt Coated Polyester And Fiberglass Scrim, Flashing, Hot-Mopped	2.55	
07 51 13 00-0019 Mechanically Fastened, Built-Up Asphalt Membrane Roofing <small>(07 51 13 00-0002)</small>		
<small>Note: Includes fasteners.</small>		
07 51 13 00-0020 Mechanically Fastened, Built-Up Asphalt Roofing Base, Ply And Cap Sheets <small>(07 51 13 00-0019)</small>		
07 51 13 00-0021 SQ Type VI, Asphalt Coated Fiberglass Ply Sheet, Mechanically Fastened.....	40.70	
<i>For Up To 10, Add</i>	5.71	
<i>For >10 To 25, Add</i>	4.49	
07 51 13 00-0022 SQ Asphalt Coated Fiberglass Venting Base Sheet, Mechanically Fastened.....	72.67	
<i>For Up To 10, Add</i>	7.31	
<i>For >10 To 25, Add</i>	6.08	
07 51 13 00-0023 SQ Asphalt Coated Polyester And Fiberglass Scrim, Base Or Ply Sheet, Mechanically Fastened	119.99	
<i>For Up To 10, Add</i>	9.67	
<i>For >10 To 25, Add</i>	8.45	
07 51 13 00-0024 Mechanically Fastened, Built-Up Asphalt Roofing Flashing <small>(07 51 13 00-0019)</small>		
07 51 13 00-0025 SF Asphalt Coated Polyester And Fiberglass Scrim, Flashing, Mechanically Fastened	2.94	
07 51 13 00-0026 Asphalt Saturated Organic Felt <small>(07 51 13 00-0001)</small>		
07 51 13 00-0027 Cold Adhesive Applied, Asphalt Saturated Organic Felt <small>(07 51 13 00-0026)</small>		
<small>Note: Includes applying cold adhesive and embedding the felt.</small>		
07 51 13 00-0028 SQ 15 LB, Asphalt Saturated Organic Base Or Ply Sheet, Cold Adhesive Applied	54.59	
<i>For Up To 10, Add</i>	10.09	
<i>For >10 To 25, Add</i>	7.64	
07 51 13 00-0029 SQ 30 LB, Asphalt Saturated Organic Base Or Ply Sheet, Cold Adhesive Applied	60.59	
<i>For Up To 10, Add</i>	10.39	
<i>For >10 To 25, Add</i>	7.94	
07 51 13 00-0030 Hot-Mopped, Asphalt Saturated Organic Felt <small>(07 51 13 00-0026)</small>		
<small>Note: Includes mopping hot asphalt and embedding the felt.</small>		
07 51 13 00-0031 SQ 15 LB, Asphalt Saturated Organic Base Or Ply Sheet, Hot-Mopped	42.57	
<i>For Up To 10, Add</i>	9.49	
<i>For >10 To 25, Add</i>	7.03	
07 51 13 00-0032 SQ 30 LB, Asphalt Saturated Organic Base Or Ply Sheet, Hot-Mopped	48.57	
<i>For Up To 10, Add</i>	9.79	
<i>For >10 To 25, Add</i>	7.33	

07 Thermal And Moisture Protection**07 50 Membrane Roofing****07 51 Built-Up Bituminous Roofing**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 51 13 00-0033			Mechanically Fastened, Asphalt Saturated Organic Felt (07 51 13 00-0026) Note: Includes fasteners.		
07 51 13 00-0034	SQ		15 LB, Asphalt Saturated Organic Base Or Ply Sheet, Mechanically Fastened.....	21.28	
			For Up To 10, Add	4.74	
			For >10 To 25, Add	3.51	
07 51 13 00-0035	SQ		30 LB, Asphalt Saturated Organic Base Or Ply Sheet, Mechanically Fastened.....	27.28	
			For Up To 10, Add	5.04	
			For >10 To 25, Add	3.81	
07 51 13 00-0036			Surfacing (07 51 13 00-0001)		
07 51 13 00-0037	SQ		400 LB/SQ Gravel Roofing Ballast, Set In Hot Asphalt Flood Coat.....	98.06	
			For Up To 10, Add	23.30	
			For >10 To 25, Add	17.17	
07 51 13 00-0038	SQ		400 LB/SQ Gravel Roofing Ballast, Set In Cold Adhesive Flood Coat.....	133.37	
			For Up To 10, Add	25.06	
			For >10 To 25, Add	18.93	
07 51 13 00-0039	CY		Gravel Roofing Ballast, Spread To Desired Thickness.....	111.63	
			Note: Excludes hot asphalt or cold adhesive.		
07 51 13 00-0040	SQ		Protective Polypropylene Fabric Mat, Loose Laid.....	28.36	
			Note: Installed as a separator mat (under membrane), a crushed stone mat (above membrane) or as a stone separator mat in ballasted systems.		
			For Up To 10, Add	3.85	
			For >10 To 25, Add	3.04	
07 51 13 00-0041	SQ		Clay-Stabilized, Water-Based Asphalt Emulsion With Reinforcing Fibers, Weather-Proofing Surface Coating, Price Per Coat.....	58.26	
			Note: Protective coating for use over built-up, SBS and APP modified bitumen, metal, concrete and wood roofs.		
			For Up To 10, Add	7.33	
			For >10 To 25, Add	5.86	
07 51 13 00-0042	SQ		Fibrated Aluminum, Asphalt-Based, Reflective Weather-Proofing Surface Coating, Price Per Coat.....	52.42	
			Note: Protective and reflective coating for use over built-up, SBS and APP modified bitumen and metal roofs.		
			For Up To 10, Add	7.04	
			For >10 To 25, Add	5.57	
07 51 13 00-0043	SQ		Aluminum Flakes And Reinforcing Fibers Suspended In Emulsified Asphalt, Reflective Surface Coating, Price Per Coat.....	68.36	
			Note: Reflective coating for use over smooth-surfaced built-up roofs.		
			For Up To 10, Add	7.83	
			For >10 To 25, Add	6.36	
07 51 13 00-0044	SQ		100% Acrylic Elastomeric, Reflective Surface Coating, Price Per Coat.....	68.88	
			Note: Reflective coating for use over built-up, SBS and APP modified bitumen roofs. For use on smooth or granule surfaced roofing systems.		
			For Up To 10, Add	7.86	
			For >10 To 25, Add	6.39	
			For Installation Over Granule Surfaced Asphalt Roof Systems, Add	19.32	
07 51 13 00-0045	SQ		100% Acrylic Elastomeric, Bleed Blocking Base Coating, Price Per Coat.....	71.02	
			Note: Bleed blocking coating for use over built-up, SBS and APP modified bitumen roofs. For use on smooth or granule surfaced roofing systems.		
			For Up To 10, Add	7.97	
			For >10 To 25, Add	6.50	
			For Installation Over Granule Surfaced Asphalt Roof Systems, Add	20.02	
07 51 13 00-0046	SF		Ceramic Coated Roofing Granules, Hand Broadcast.....	1.34	
			Note: For application over liquid flashing/membranes, asphalt bleed-out areas, modified or BUR membrane repairs, etc.		
07 51 13 00-0047	SF		Energy Star, Ceramic Coated Roofing Granules, Hand Broadcast.....	2.70	
			Note: For application over liquid flashing/membranes, asphalt bleed-out areas, modified or BUR membrane repairs, etc.		
07 51 13 00-0048			Walkway Pads (07 51 13 00-0001) Note: Set in hot asphalt or cold adhesive.		
07 51 13 00-0049	LF		5/16" Thick, 32" Wide, Skid Resistant, SBS Modified Bitumen Walkway Pad.....	14.12	
07 51 13 00-0050	LF		1/2" Thick, 32" Wide, Skid Resistant, SBS Modified Bitumen Walkway Pad.....	16.63	
07 51 13 00-0051			Cant And Tapered Edge Strips (07 51 13 00-0001)		
07 51 13 00-0052	LF		2" x 2" Perlite Cant Strip.....	2.57	
07 51 13 00-0053	LF		3" x 3" Perlite Cant Strip.....	2.63	
07 51 13 00-0054	LF		4" x 4" Perlite Cant Strip.....	2.90	
07 51 13 00-0055	LF		3" x 3" Pressure Treated Wood Cant Strip, Cut Diagonally.....	2.72	
07 51 13 00-0056	LF		4" x 4" Pressure Treated Wood Cant Strip, Cut Diagonally.....	2.82	
07 51 13 00-0057	LF		1/2" x 6" Perlite Tapered Edge Strip.....	2.88	
07 51 13 00-0058	LF		1/2" x 12" Perlite Tapered Edge Strip.....	3.19	
07 51 13 00-0059	LF		1" x 12" Perlite Tapered Edge Strip.....	3.28	
07 51 13 00-0060	LF		1" x 24" Perlite Tapered Edge Strip.....	3.61	
07 51 13 00-0061	LF		1-1/2" x 12" Perlite Tapered Edge Strip.....	3.58	
07 51 13 00-0062	LF		1-1/2" x 18" Perlite Tapered Edge Strip.....	4.17	
07 51 13 00-0063	LF		1-1/2" x 24" Perlite Tapered Edge Strip.....	4.60	
07 51 13 00-0064			Asphalt Primer (07 51 13 00-0001)		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 51 13 00-0065 SQ Asphalt Primer For Roofing Systems.....	22.57	
Note: Foundation coating for hot-mopped and cold applied asphalt coatings, roof cements, and asphalt based roof adhesives. For use on weathered roofing, asphalt, concrete, gypsum, masonry, block, brick and metal surfaces.		
07 51 13 00-0066 Demolish Built-Up Roofing (07 51 13 00-0001)		
Note: For removing any asphalt, coal tar or modified bitumen roofing system, including surfacing material down to the insulation or recovery board. Includes removal of any basic roof accessories and any sheet metals; except special existing conditions (mechanical equipment piping, electrical, ducts, etc.).		
07 51 13 00-0067 SQ Demolish Gravel/Slag Surfaced, Built Up Roofing System.....	259.61	
For Up To 10, Add 64.39		
For >10 To 25, Add 38.63		
07 51 13 00-0068 SQ Demolish Cap Sheet Surfaced, Built Up Roofing System.....	200.27	
Note: Includes protective surfacing.		
For Up To 10, Add 49.67		
For >10 To 25, Add 29.80		
07 51 13 00-0069 Roofing System Warranty (07 51 13 00-0001)		
Note: The warranty tasks below are only to be used in conjunction with the built-up bituminous and modified bituminous membrane roofing sections. The appropriate task is to be applied to the completed roofing membrane systems, not individual components. All warranties are no dollar limit to include material, equipment and labor.		
07 51 13 00-0070 EA Up To 70 SQ, 10 Year, Built-Up Bituminous Or Modified Bituminous Membrane, Roofing System Warranty.....	350.00	
07 51 13 00-0071 SQ >70 SQ, 10 Year, Built-Up Bituminous Or Modified Bituminous Membrane, Roofing System Warranty.....	5.00	
07 51 13 00-0072 EA Up To 50 SQ, 15 Year, Built-Up Bituminous Or Modified Bituminous Membrane, Roofing System Warranty.....	400.00	
07 51 13 00-0073 SQ >50 SQ, 15 Year, Built-Up Bituminous Or Modified Bituminous Membrane, Roofing System Warranty.....	8.00	
07 51 13 00-0074 EA Up To 50 SQ, 20 Year, Built-Up Bituminous Or Modified Bituminous Membrane, Roofing System Warranty.....	550.00	
07 51 13 00-0075 SQ >50 SQ, 20 Year, Built-Up Bituminous Or Modified Bituminous Membrane, Roofing System Warranty.....	11.00	
07 51 13 00-0076 Built-Up Roofing Components (Garland) (07 51 13)		
Note: All tasks presented as a single layer. Adhesives are priced separately.		
07 51 13 00-0077 Modified Cap Membranes (07 51 13 00-0076)		
07 51 13 00-0078 Modified Cap Membranes, Hot/Cold Applied (07 51 13 00-0077)		
Note: As manufactured by Garland. Pricing represents single ply per square. Includes 30 year leak-free warranty.		
07 51 13 00-0079 SQ Stressply® FR Mineral Dual Fiberglass Reinforced SBS-Modified Fiberglass Reinforced Membrane, Minimum 145 Mil.....	316.33	
07 51 13 00-0080 SQ Stressply® Plus Poly/Fiberglass Reinforced, Smooth SBS-Modified Membrane With Recycled Rubber, 105 Mil.....	222.66	
07 51 13 00-0081 SQ Stressply® Plus FR Mineral Poly/Fiberglass Reinforced SBS-Modified Fiberglass Reinforced Membrane With Recycled Rubber, Minimum 155 Mil.....	274.99	
07 51 13 00-0082 SQ Stressply® E Eco-Responsible, Smooth SBS/SIS Membrane With High Recycled Content And Renewable Materials.....	285.66	
07 51 13 00-0083 SQ Stressply® E FR Mineral Eco-Responsible, SBS/SIS Membrane With High Recycled Content And Renewable Materials, Minimum 160 Mil.....	404.33	
07 51 13 00-0084 SQ Stressply® EUV SPF Fiberglass Reinforced, Minimum Poly/Fiberglass Reinforced White T-24 SBS/SIS-Modified Membrane With Recycled Rubber, 160 Mil.....	445.66	
07 51 13 00-0085 SQ Versiply® 80 Dual Fiberglass Reinforced SBS-Modified Membrane, 80 Mil.....	185.20	
Note: Low strength cap sheet for hot or cold modified systems used with gravel.		
07 51 13 00-0086 SQ Versiply® Mineral Dual Fiberglass Reinforced SBS-Modified Membrane, Minimum 145 Mil.....	234.99	
07 51 13 00-0087 SQ BiFlex® Cap Fiberglass Reinforced, Mineral Surfaced SBS Modified Membrane, 140 Mil.....	181.66	
07 51 13 00-0088 Modified Cap Membranes, Self-Adhering (07 51 13 00-0077)		
Note: As manufactured by Garland. Pricing represents single ply per square. Includes 25 year leak-free warranty.		
07 51 13 00-0089 SQ Stressply® SA FR Mineral SBS-Modified Self-Adhering Fiberglass Reinforced Membrane, Minimum 140 Mil.....	280.66	
Note: Self adhering system. One HPR SA FR base with one ply Stress Ply SA FR cap sheet.		
07 51 13 00-0090 Modified Cap Membranes, Torch-Applied (07 51 13 00-0077)		
Note: As manufactured by Garland. Pricing represents single ply per square. Includes 30 year leak-free warranty.		
07 51 13 00-0091 SQ Stressply® IV Dual Fiberglass Reinforced, Smooth SBS-Modified Membrane, Torch Applied, 180 Mil.....	345.66	
Note: Smooth surfaced SBS torch modified top ply of torch system with gravel.		
07 51 13 00-0092 SQ Stressply® IV Mineral Dual Fiberglass Reinforced SBS-Modified Membrane, Torch Applied, Minimum 195 Mil.....	374.99	
07 51 13 00-0093 SQ Stressply® IV UV Mineral Fiberglass Reinforced, Starburst Surface SBS-Modified Membrane, Torch Applied, Title 24 Compliant, 195 Mil.....	396.33	
07 51 13 00-0094 Modified Cap Membranes, Coal Tar Pitch Systems (07 51 13 00-0077)		
Note: As manufactured by Garland. Pricing represents single ply per square. Includes 30 year leak-free warranty.		
07 51 13 00-0095 SQ Millennium® Poly/Fiberglass Reinforced, Smooth SBS-Modified Coal Tar Membrane, Minimum 120 Mil.....	316.23	
07 51 13 00-0096 SQ Millennium® FR Mineral Poly/Fiberglass Reinforced SBS-Modified Coal Tar Fiberglass Reinforced Membrane, Minimum 160 Mil.....	501.66	
07 51 13 00-0097 SQ Millennium® Mineral Poly/Fiberglass Reinforced SBS-Modified Coal Tar Membrane, Minimum 160 Mil.....	409.66	
07 51 13 00-0098 Base Plies (07 51 13 00-0076)		
Note: Used with modified cap membranes, underlayment for metal systems, and reinforcement for restoration systems.		
07 51 13 00-0099 SQ Flexbase® 120 Fiberglass Reinforced SBS-Modified Base Sheet Used As Base Ply With Biflex Cap, 120 Mil.....	301.66	
07 51 13 00-0100 SQ Flexbase® 80 Fiberglass Reinforced SBS-Modified Base Sheet Used As Base Ply With Biflex Cap, 80 Mil.....	178.66	

07 Thermal And Moisture Protection**07 50 Membrane Roofing****07 51 Built-Up Bituminous Roofing**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 51	13 00-0101	SQ	HPR® Aqua Shield Styrene-Butadiene Rubber (SBR)-Modified Fiberglass Reinforced Self-Adhering Underlayment For Ice And Water Protection, 60 Mil.....	112.70	
07 51	13 00-0102	SQ	HPR® Glasbase Heavy Duty Double Coated ASTM D 4601, Type II Fiberglass, Type II, 55 Mil..... Note: Glasbase used in cold system, nailed to deck, or inner ply 2 plies with cap.	41.87	
07 51	13 00-0103	SQ	HPR® Glasfelt Asphalt Saturated Fiberglass Felt, ASTM D 2178 Type IV, 20 Mil..... Note: Inner ply felts for hot applied built up and modified BUR systems.	28.40	
07 51	13 00-0104	SQ	HPR® Premium Glasbase High Strength, Double Coated Premium Base Sheet, Far Exceeds ASTM D 4601 Type II, 55 Mil.....	63.20	
07 51	13 00-0105	SQ	HPR® Premium Glasfelt Premium Asphalt Saturated Fiberglass Felt, ASTM D 2178 Type VI, 25 Mil.....	37.20	
07 51	13 00-0106	SQ	HPR® Tribase Premium Poly/Fiberglass Reinforced SBS-Modified Base Sheet, 60 Mil..... Note: Inner plies for cold applied modified, SBS modified, or 2 plies under cap sheet.	109.23	
07 51	13 00-0107	SQ	Millennium® Base Poly/Fiberglass Reinforced Coal Tar Base Sheet For Cold Millennium Systems, 80 Mil.....	180.90	
07 51	13 00-0108	SQ	HPR® SA FR Base Sheet SBS Modified Self-Adhering Underlayment Used In SP SA Fiberglass Reinforced Systems, Minimum 80 Mil..... Note: Self adhering base ply for self adhering 2 ply system.	157.66	
07 51	13 00-0109	SQ	HPR® Torch Base Sheet Fiberglass Reinforced SBS-Modified Base Sheet Used As Base Ply For Torch Applied Membranes, 110 Mil..... Note: Torch base sheet used as base ply for torch applied system.	212.66	
07 51	13 00-0110	SQ	StressBase® 120 Fiberglass Reinforced SBS-Modified Underlayment Used With VersiPly And StressPly Cap Sheets, 120 Mil.....	158.20	
07 51	13 00-0111	SQ	StressBase® 80 Fiberglass Reinforced, Smooth SBS-Modified Underlayment Used With VersiPly And StressPly Cap Sheets, 80 Mil.....	131.87	
07 51	13 00-0112	LF	Garmesh® 6" SBS Coated Woven Fiberglass Reinforcing Fabric.....	3.33	
07 51	13 00-0113	SQ	Grip Polyester® Firm Polyester Reinforcement Used For Cold Application Over Smooth BUR Or Modified Roof Systems.....	35.30	
07 51	13 00-0114	SQ	Grip Polyester® Soft Polyester Reinforcement Used For Cold Applications Over Metal, Modified, Or Single Ply Roof Systems.....	32.90	
07 51	13 00-0115	LF	Grip Polyester® Soft 12" Polyester Reinforcement Used For Cold Applications Over Metal, Modified, Or Single Ply Roof Systems.....	4.30	
07 51	13 00-0116	LF	Grip Polyester® Soft 4" Polyester Reinforcement Used For Cold Applications Over Metal, Modified, Or Single Ply Roof Systems.....	3.20	
07 51	13 00-0117	LF	Grip Polyester® Soft 6" Polyester Reinforcement Used For Cold Applications Over Metal, Modified, Or Single Ply Roof Systems.....	3.27	
07 51	13 00-0118	SQ	4873 HPR® Polyscrim Plus Polyester Reinforcement For Hot Bitumen Applications.....	69.90	
07 51	13 00-0119		Coatings And Mastics For Roof Installation, Restoration And Repairs (07 51 13 00-0076)		
07 51	13 00-0120	SQ	Water Based Roof Primer, GarlaPrime VOC Primer (1 GAL/SQ).....	29.86	
07 51	13 00-0121	SQ	All-Knight™ Primer Bleed Blocker For Asphalt And Coal Tar Roofs Used With White-Knight, Garla-Brite And Pyramic Roof Systems (0.5 GAL/SQ).....	41.46	
07 51	13 00-0122	SQ	Black-Knight® Primer (0.5 GAL/SQ).....	21.06	
07 51	13 00-0123	SQ	Black-Knight® Cold, Cold Process Polymer Modified Coal Tar, Interply (1.5-2.0 GAL/SQ).....	75.26	
07 51	13 00-0124	SQ	Black-Knight® Cold, Cold Process Polymer Modified Coal Tar, Flood Coat (4-5 GAL/SQ).....	180.35	
07 51	13 00-0125	SQ	Black-Knight® Cold, Cold Process Polymer Modified Coal Tar, Restoration (6-8 GAL/SQ).....	287.67	
07 51	13 00-0126	SQ	Black-Knight® LV Hot Applied Polymer Modified Lower Viscosity Coal Tar Adhesive, Interply (30 LB/SQ).....	95.21	
07 51	13 00-0127	SQ	Black-Knight® LV Hot Applied Polymer Modified Lower Viscosity Coal Tar Adhesive, Flood Coat (70 LB/SQ).....	209.27	
07 51	13 00-0128	SQ	Energizer® K Plus FR Cold Applied SBS Modified Asphalt Coating With Kevlar® For Smooth And Mineral Restoration, One Coat (3 GAL/SQ).....	86.55	
07 51	13 00-0129	SQ	Energizer® K Plus FR Cold Applied SBS Modified Asphalt Coating With Kevlar® For Smooth And Mineral Restoration, Restoration (6 GAL/SQ).....	165.68	
07 51	13 00-0130	SQ	Energizer® LO Low Odor Cold Applied Polyurethane Modified Asphalt Liquid Membrane For Smooth And Mineral Restoration, One Coat (3 GAL/SQ).....	206.51	
07 51	13 00-0131	SQ	Energizer® LO Low Odor Cold Applied Polyurethane Modified Asphalt Liquid Membrane For Smooth And Mineral Restoration, Restoration (6 GAL/SQ).....	405.69	
07 51	13 00-0132	SQ	Garlastic® KM Plus Premium Hot Applied, SEBS Modified Adhesive/Waterproof, Interply (25 LB/SQ).....	76.77	
07 51	13 00-0133	SQ	Garlastic® KM Plus Premium Hot Applied, SEBS Modified Adhesive/Waterproof, Flood Coat (60 LB/SQ).....	170.27	
07 51	13 00-0134	SQ	Green-Lock® Flashing Adhesive 100% Solids Polyether, Zero VOC, Flashing Adhesive To Be Used With SBS Sheets Only (2-3 GAL/SQ).....	233.20	
07 51	13 00-0135	SQ	Green-Lock® Membrane Adhesive 100% Solids Polyether, Zero VOC, Membrane Adhesive To Be Used With SBS Sheets Only (2.0-2.5 GAL/SQ).....	165.35	
07 51	13 00-0136	SQ	HPR® All-Temp Asphalt Hot Applied, High Softening Point, High Penetration Mopping Asphalt, Interply (25 LB/SQ).....	44.60	
07 51	13 00-0137	SQ	HPR® All-Temp Asphalt Hot Applied, High Softening Point, High Penetration Mopping Asphalt, Flood Coat (60 LB/SQ).....	93.07	
07 51	13 00-0138	SQ	Insul-Lock® E HR Bio-Based High Rise Urethane Insulation Adhesive For New Construction Or Gravel (150 SF/Cartridge).....	77.80	
07 51	13 00-0139	SQ	Insul-Lock® HR High Rise Urethane Insulation Adhesive For New Construction Or Gravel Recovers (150 SF/Cartridge).....	77.44	
07 51	13 00-0140	SQ	Insul-Lock® HR Universal Primer All-Purpose Water Based Primer Designed For Use With The Insul-Lock Products (150-200 SF/GAL)..... Note: Adheres all insulation layers for cold systems.	33.92	
07 51	13 00-0141	SQ	Pyramic® White, Water-Based Acrylic, Low VOC, Reflective Roof Coating, Energy Star, Top Coat Required (1-1.5 GAL/SQ).....	59.62	
07 51	13 00-0142	SQ	Pyramic® Base Coat, Water-Based, Acrylic, Low VOC, Base Coating For A Pyramic System, Top Coat Required (1-1.5 GAL/SQ).....	59.06	
07 51	13 00-0143	LF	Silver-Flash® Aluminized Asphalt Fibered Trowel Grade Mastic Used With GarMesh (1 GAL/7 LF).....	11.29	
07 51	13 00-0144	SQ	Solex® White, Kynar Acrylic Topcoat Roof Coating Used With Pyramic Base Coat (0.5 GAL/SQ).....	111.06	
07 51	13 00-0145	SQ	Tuff-Flash™ Multi-Purpose Asphaltic Polyurethane Liquid Flashing Membrane Used With Reinforcing Fabric (2-2.5 GAL/SQ).....	200.65	
07 51	13 00-0146	SQ	Weatherscreen™ Rubberized, Fiber-Reinforced Fire-Rated Restoration For Modified And Gravel, Flood Coat (4-5 GAL/SQ).....	110.07	
07 51	13 00-0147	SQ	Weatherscreen™ Rubberized, Fiber-Reinforced Fire-Rated Restoration For Modified And Gravel, Restoration (6-8 GAL/SQ).....	152.48	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 51 13 00-0148 SQ Weatherking® Cold Applied Rubber Modified Asphalt Interply Adhesive For Slopes Up To 3:12, Interply (2.5 GAL/SQ).....	67.35	
07 51 13 00-0149 SQ Weatherking® Flashing Adhesive Brush Grade, Cold Applied Asphalt Adhesive For Flashings In A Weatherking System (2-3 GAL/SQ).....	192.25	
07 51 13 00-0150 SQ Weatherking® Plus WC Cold Applied Rubber Modified, VOC Compliant Asphalt Interply Adhesive For Slopes Up To 2:12, Interply (2.5 GAL/SQ).....	66.85	

Note: Inner ply and flood coat SEBS modified adhesive for all cold systems with gravel.

07 52 Modified Bituminous Membrane Roofing (07 50)

07 52 13 Atactic-Polypropylene Modified Bituminous Membrane Roofing (07 52)

Note: Includes all standard manufacturers' colors including white for granule and smooth surfaced cap sheets and flashing. See CSI section 07 51 13 00-0001 for additional components such as concrete primers, cant strips, surfacing, walkway boards, demolition and warranties.

07 52 13 11 Cold Adhesive Applied Atactic-Polypropylene-Modified Bituminous Membrane Roofing (07 52 13)

07 52 13 11-0001 Cold Adhesive Applied Atactic-Polypropylene-Modified Bituminous Membrane Roofing (07 52 13 11)

Note: Includes fiberglass and/or polyester reinforcement. Includes applying cold adhesive and embedding the membrane. Includes heat welding side and end laps when required.

07 52 13 11-0002 Cold Adhesive Applied, Atactic-Polypropylene (APP) Modified Bitumen Roofing Base, Ply And Cap Sheets (07 52 13 11-0001)

07 52 13 11-0003 SQ 80 Mil, Atactic-Polypropylene (APP) Modified Bitumen Base Sheet, Cold Adhesive Applied.....	95.16
For Up To 10, Add	12.12
For >10 To 25, Add	9.66
07 52 13 11-0004 SQ 90 Mil, Atactic-Polypropylene (APP) Modified Bitumen Base Or Ply Sheet, Cold Adhesive Applied.....	113.80
For Up To 10, Add	13.05
For >10 To 25, Add	10.60
07 52 13 11-0005 SQ 160 Mil, Atactic-Polypropylene (APP) Modified Bitumen Ply Sheet, Cold Adhesive Applied.....	185.76
For Up To 10, Add	16.65
For >10 To 25, Add	14.19
07 52 13 11-0006 SQ 160 Mil, Smooth Surfaced, Atactic-Polypropylene (APP) Modified Bitumen Cap Sheet, Cold Adhesive Applied.....	188.10
For Up To 10, Add	17.46
For >10 To 25, Add	14.78
07 52 13 11-0007 SQ 160 Mil, Granule Surfaced, Atactic-Polypropylene (APP) Modified Bitumen Cap Sheet, Cold Adhesive Applied.....	128.64
For Up To 10, Add	14.49
For >10 To 25, Add	11.80
For Factory Applied White Reflective Surfacing, Add	52.37
07 52 13 11-0008 SQ 160 Mil, Fire Rated, Granule Surfaced, Atactic-Polypropylene (APP) Modified Bitumen Cap Sheet, Cold Adhesive Applied.....	147.49
For Up To 10, Add	15.43
For >10 To 25, Add	12.75
For Factory Applied White Reflective Surfacing, Add	52.37
07 52 13 11-0009 SQ 180 Mil, Fire Rated, Granule Surfaced, Atactic-Polypropylene (APP) Modified Bitumen Cap Sheet, Cold Adhesive Applied.....	198.84
For Up To 10, Add	18.00
For >10 To 25, Add	15.31
For Factory Applied White Reflective Surfacing, Add	52.37

07 52 13 11-0010 Cold Adhesive Applied, Atactic-Polypropylene (APP) Modified Bitumen Roofing Flashing (07 52 13 11-0001)

07 52 13 11-0011 SF 160 Mil, Smooth Surfaced, Atactic-Polypropylene (APP) Modified Bitumen Flashing, Cold Adhesive Applied.....	4.12
07 52 13 11-0012 SF 180 Mil, Fire Rated, Granule Surfaced, Atactic-Polypropylene (APP) Modified Bitumen Flashing, Cold Adhesive Applied.....	4.23
For Factory Applied White Reflective Surfacing, Add	0.52

07 52 13 13 Torch-Applied Atactic-Polypropylene-Modified Bituminous Membrane Roofing (07 52 13)

07 52 13 13-0001 Torch-Applied Atactic-Polypropylene-Modified Bituminous Membrane Roofing (07 52 13 13)

Note: Includes fiberglass and/or polyester reinforcement. Includes adhering the membrane with a torch.

07 52 13 13-0002 Torch-Applied, APP Modified Bitumen Roofing Base, Ply And Cap Sheets (07 52 13 13-0001)

07 52 13 13-0003 SQ 80 Mil, APP Modified Bitumen Base Sheet, Torch-Applied.....	65.12
For Up To 10, Add	8.78
For >10 To 25, Add	6.94
07 52 13 13-0004 SQ 90 Mil, APP Modified Bitumen Base Or Ply Sheet, Torch-Applied.....	83.76
For Up To 10, Add	9.71
For >10 To 25, Add	7.87
07 52 13 13-0005 SQ 150 Mil, APP Modified Bitumen Ply Sheet, Torch-Applied.....	92.51
For Up To 10, Add	10.15
For >10 To 25, Add	8.31
07 52 13 13-0006 SQ 160 Mil, APP Modified Bitumen Ply Sheet, Torch-Applied.....	97.28
For Up To 10, Add	10.38
For >10 To 25, Add	8.54

07 Thermal And Moisture Protection**07 50 Membrane Roofing****07 52 Modified Bituminous Membrane Roofing**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 52 13 13-0007	SQ		180 Mil, APP Modified Bitumen Ply Sheet, Torch-Applied.....	135.99	
			<i>For Up To 10, Add</i>	12.32	
			<i>For >10 To 25, Add</i>	10.48	
07 52 13 13-0008	SQ		150 Mil, Smooth Surfaced, APP Modified Bitumen Cap Sheet, Torch-Applied.....	93.62	
			<i>For Up To 10, Add</i>	10.53	
			<i>For >10 To 25, Add</i>	8.58	
07 52 13 13-0009	SQ		160 Mil, Smooth Surfaced, APP Modified Bitumen Cap Sheet, Torch-Applied.....	99.58	
			<i>For Up To 10, Add</i>	10.83	
			<i>For >10 To 25, Add</i>	8.88	
07 52 13 13-0010	SQ		180 Mil, Smooth Surfaced, APP Modified Bitumen Cap Sheet, Torch-Applied.....	137.10	
			<i>For Up To 10, Add</i>	12.71	
			<i>For >10 To 25, Add</i>	10.76	
07 52 13 13-0011	SQ		160 Mil, Granule Surfaced, APP Modified Bitumen Cap Sheet, Torch-Applied.....	97.37	
			<i>For Up To 10, Add</i>	10.72	
			<i>For >10 To 25, Add</i>	8.77	
			<i>For Factory Applied White Reflective Surfacing, Add</i>	52.37	
07 52 13 13-0012	SQ		170 Mil, Granule Surfaced, APP Modified Bitumen Cap Sheet, Torch-Applied.....	103.16	
			<i>For Up To 10, Add</i>	11.01	
			<i>For >10 To 25, Add</i>	9.06	
			<i>For Factory Applied White Reflective Surfacing, Add</i>	52.37	
07 52 13 13-0013	SQ		160 Mil, Fire Rated, Granule Surfaced, APP Modified Bitumen Cap Sheet, Torch-Applied.....	117.35	
			<i>For Up To 10, Add</i>	11.72	
			<i>For >10 To 25, Add</i>	9.77	
			<i>For Factory Applied White Reflective Surfacing, Add</i>	52.37	
07 52 13 13-0014	SQ		170 Mil, Fire Rated, Granule Surfaced, APP Modified Bitumen Cap Sheet, Torch-Applied.....	119.08	
			<i>For Up To 10, Add</i>	11.80	
			<i>For >10 To 25, Add</i>	9.85	
			<i>For Factory Applied White Reflective Surfacing, Add</i>	52.37	
07 52 13 13-0015	SQ		180 Mil, Fire Rated, Granule Surfaced, APP Modified Bitumen Cap Sheet, Torch-Applied.....	167.57	
			<i>For Up To 10, Add</i>	14.23	
			<i>For >10 To 25, Add</i>	12.28	
			<i>For Factory Applied White Reflective Surfacing, Add</i>	52.37	
07 52 13 13-0016			Torch-Applied, APP Modified Bitumen Roofing Flashing (07 52 13 13-0001)		
07 52 13 13-0017	SF		150 Mil, Smooth Surfaced, APP Modified Bitumen Flashing, Torch-Applied.....	1.85	
07 52 13 13-0018	SF		160 Mil, Smooth Surfaced, APP Modified Bitumen Flashing, Torch-Applied.....	1.91	
07 52 13 13-0019	SF		180 Mil, Smooth Surfaced, APP Modified Bitumen Flashing, Torch-Applied.....	2.28	
07 52 13 13-0020	SF		170 Mil, Granule Surfaced, APP Modified Bitumen Flashing, Torch-Applied.....	1.95	
			<i>For Factory Applied White Reflective Surfacing, Add</i>	0.52	
07 52 13 13-0021	SF		170 Mil, Fire Rated, Granule Surfaced, APP Modified Bitumen Flashing, Torch-Applied.....	2.10	
			<i>For Factory Applied White Reflective Surfacing, Add</i>	0.52	
07 52 13 13-0022	SF		180 Mil, Fire Rated, Granule Surfaced, APP Modified Bitumen Flashing, Torch-Applied.....	2.59	
			<i>For Factory Applied White Reflective Surfacing, Add</i>	0.52	
07 52 13 14			Mechanically Fastened Atactic-Polypropylene-Modified Bituminous Membrane Roofing (07 52 13)		
07 52 13 14-0001			Mechanically Fastened Atactic-Polypropylene-Modified Bituminous Membrane Roofing (07 52 13 14) Note: Includes fiberglass and/or polyester reinforcement. Includes fasteners.		
07 52 13 14-0002			Mechanically Fastened, APP Modified Bitumen Roofing Base And Ply Sheets (07 52 13 14-0001)		
07 52 13 14-0003	SQ		90 Mil, APP Modified Bitumen Base Or Ply Sheet, Mechanically Fastened.....	96.13	
			<i>For Up To 10, Add</i>	8.48	
			<i>For >10 To 25, Add</i>	7.26	
07 52 16			Styrene-Butadiene-Styrene Modified Bituminous Membrane Roofing (07 52) Note: Includes all standard manufacturers' colors including white for granule and smooth surfaced cap sheets and flashing. See CSI section 07 51 13 00-0001 for additional components such as concrete primers, cant strips, surfacing, walkway boards, demolition and warranties.		
07 52 16 11			Cold Adhesive Applied Styrene-Butadiene-Styrene Modified Bituminous Membrane Roofing (07 52 16)		
07 52 16 11-0001			Cold Adhesive Applied Styrene-Butadiene-Styrene Modified Bituminous Membrane Roofing (07 52 16 11) Note: Includes fiberglass and/or polyester reinforcement. Includes applying cold adhesive and embedding the membrane. Includes heat welding side and end laps when required.		
07 52 16 11-0002			Cold Adhesive Applied, SBS Modified Bitumen Roofing Base, Ply And Cap Sheets (07 52 16 11-0001)		
07 52 16 11-0003	SQ		50 Mil, SBS Modified Bitumen Base Sheet, Cold Adhesive Applied.....	76.92	
			<i>For Up To 10, Add</i>	11.21	
			<i>For >10 To 25, Add</i>	8.75	
07 52 16 11-0004	SQ		80 Mil, SBS Modified Bitumen Base Sheet, Cold Adhesive Applied.....	97.61	
			<i>For Up To 10, Add</i>	12.24	
			<i>For >10 To 25, Add</i>	9.79	
07 52 16 11-0005	SQ		90 Mil, SBS Modified Bitumen Base Sheet, Cold Adhesive Applied.....	100.28	
			<i>For Up To 10, Add</i>	12.37	
			<i>For >10 To 25, Add</i>	9.92	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 52 16 11-0006 SQ 120 Mil, SBS Modified Bitumen Base Or Ply Sheet, Cold Adhesive Applied	133.28	
<i>For Up To 10, Add</i>	14.02	
<i>For >10 To 25, Add</i>	11.57	
07 52 16 11-0007 SQ 125 Mil, SBS Modified Bitumen Ply Sheet, Cold Adhesive Applied	166.68	
<i>For Up To 10, Add</i>	15.69	
<i>For >10 To 25, Add</i>	13.24	
07 52 16 11-0008 SQ 140 Mil, Smooth Surfaced, SBS Modified Bitumen Cap Sheet, Cold Adhesive Applied	141.33	
<i>For Up To 10, Add</i>	15.12	
<i>For >10 To 25, Add</i>	12.44	
07 52 16 11-0009 SQ 150 Mil, Smooth Surfaced, SBS Modified Bitumen Cap Sheet, Cold Adhesive Applied	144.92	
<i>For Up To 10, Add</i>	15.30	
<i>For >10 To 25, Add</i>	12.62	
07 52 16 11-0010 SQ 125 Mil, Granule Surfaced, SBS Modified Bitumen Cap Sheet, Cold Adhesive Applied.....	128.10	
<i>For Up To 10, Add</i>	14.46	
<i>For >10 To 25, Add</i>	11.78	
<i>For Factory Applied White Reflective Surfacing, Add</i>	52.37	
07 52 16 11-0011 SQ 140 Mil, Granule Surfaced, SBS Modified Bitumen Cap Sheet, Cold Adhesive Applied.....	129.65	
<i>For Up To 10, Add</i>	14.54	
<i>For >10 To 25, Add</i>	11.85	
<i>For Factory Applied White Reflective Surfacing, Add</i>	52.37	
07 52 16 11-0012 SQ 150 Mil, Granule Surfaced, SBS Modified Bitumen Cap Sheet, Cold Adhesive Applied.....	143.97	
<i>For Up To 10, Add</i>	15.26	
<i>For >10 To 25, Add</i>	12.57	
<i>For Factory Applied White Reflective Surfacing, Add</i>	52.37	
07 52 16 11-0013 SQ 160 Mil, Granule Surfaced, SBS Modified Bitumen Cap Sheet, Cold Adhesive Applied.....	146.35	
<i>For Up To 10, Add</i>	15.38	
<i>For >10 To 25, Add</i>	12.69	
<i>For Factory Applied White Reflective Surfacing, Add</i>	52.37	
07 52 16 11-0014 SQ 170 Mil, Granule Surfaced, SBS Modified Bitumen Cap Sheet, Cold Adhesive Applied.....	167.23	
<i>For Up To 10, Add</i>	16.42	
<i>For >10 To 25, Add</i>	13.73	
<i>For Factory Applied White Reflective Surfacing, Add</i>	52.37	
07 52 16 11-0015 SQ 180 Mil, Granule Surfaced, SBS Modified Bitumen Cap Sheet, Cold Adhesive Applied.....	205.26	
<i>For Up To 10, Add</i>	18.32	
<i>For >10 To 25, Add</i>	15.64	
<i>For Factory Applied White Reflective Surfacing, Add</i>	52.37	
07 52 16 11-0016 SQ 125 Mil, Fire Rated, Granule Surfaced, SBS Modified Bitumen Cap Sheet, Cold Adhesive Applied.....	130.69	
<i>For Up To 10, Add</i>	14.59	
<i>For >10 To 25, Add</i>	11.91	
<i>For Factory Applied White Reflective Surfacing, Add</i>	52.37	
07 52 16 11-0017 SQ 140 Mil, Fire Rated, Granule Surfaced, SBS Modified Bitumen Cap Sheet, Cold Adhesive Applied.....	134.43	
<i>For Up To 10, Add</i>	14.78	
<i>For >10 To 25, Add</i>	12.09	
<i>For Factory Applied White Reflective Surfacing, Add</i>	52.37	
07 52 16 11-0018 SQ 150 Mil, Fire Rated, Granule Surfaced, SBS Modified Bitumen Cap Sheet, Cold Adhesive Applied.....	154.70	
<i>For Up To 10, Add</i>	15.79	
<i>For >10 To 25, Add</i>	13.11	
<i>For Factory Applied White Reflective Surfacing, Add</i>	52.37	
07 52 16 11-0019 SQ 160 Mil, Fire Rated, Granule Surfaced, SBS Modified Bitumen Cap Sheet, Cold Adhesive Applied.....	155.18	
<i>For Up To 10, Add</i>	15.82	
<i>For >10 To 25, Add</i>	13.13	
<i>For Factory Applied White Reflective Surfacing, Add</i>	52.37	
07 52 16 11-0020 SQ 170 Mil, Fire Rated, Granule Surfaced, SBS Modified Bitumen Cap Sheet, Cold Adhesive Applied.....	164.25	
<i>For Up To 10, Add</i>	16.27	
<i>For >10 To 25, Add</i>	13.58	
<i>For Factory Applied White Reflective Surfacing, Add</i>	52.37	
07 52 16 11-0021 Cold Adhesive Applied, SBS Modified Bitumen Roofing Flashing (07 52 16 11-0001)		
07 52 16 11-0022 SF 150 Mil, Smooth Surfaced, SBS Modified Bitumen Flashing, Cold Adhesive Applied	3.69	
07 52 16 11-0023 SF 125 Mil, Granule Surfaced, SBS Modified Bitumen Flashing, Cold Adhesive Applied	3.52	
<i>For Factory Applied White Reflective Surfacing, Add</i>	0.52	
07 52 16 11-0024 SF 140 Mil, Granule Surfaced, SBS Modified Bitumen Flashing, Cold Adhesive Applied.....	3.54	
<i>For Factory Applied White Reflective Surfacing, Add</i>	0.52	
07 52 16 11-0025 SF 160 Mil, Granule Surfaced, SBS Modified Bitumen Flashing, Cold Adhesive Applied.....	3.71	
<i>For Factory Applied White Reflective Surfacing, Add</i>	0.52	
07 52 16 11-0026 SF 170 Mil, Granule Surfaced, SBS Modified Bitumen Flashing, Cold Adhesive Applied.....	3.91	
<i>For Factory Applied White Reflective Surfacing, Add</i>	0.52	
07 52 16 11-0027 SF 180 Mil, Granule Surfaced, SBS Modified Bitumen Flashing, Cold Adhesive Applied.....	4.29	
<i>For Factory Applied White Reflective Surfacing, Add</i>	0.52	
07 52 16 11-0028 SF 125 Mil, Fire Rated, Granule Surfaced, SBS Modified Bitumen Flashing, Cold Adhesive Applied	3.55	
<i>For Factory Applied White Reflective Surfacing, Add</i>	0.52	
07 52 16 11-0029 SF 140 Mil, Fire Rated, Granule Surfaced, SBS Modified Bitumen Flashing, Cold Adhesive Applied	3.59	
<i>For Factory Applied White Reflective Surfacing, Add</i>	0.52	
07 52 16 11-0030 SF 160 Mil, Fire Rated, Granule Surfaced, SBS Modified Bitumen Flashing, Cold Adhesive Applied	3.79	
<i>For Factory Applied White Reflective Surfacing, Add</i>	0.52	
07 52 16 11-0031 SF 170 Mil, Fire Rated, Granule Surfaced, SBS Modified Bitumen Flashing, Cold Adhesive Applied	3.88	
<i>For Factory Applied White Reflective Surfacing, Add</i>	0.52	
07 52 16 11-0032 SF 145 Mil, Aluminum Foil Surfaced, SBS Modified Bitumen Flashing, Cold Adhesive Applied	4.63	
07 52 16 11-0033 SF 160 Mil, Copper Foil Surfaced, SBS Modified Bitumen Flashing, Cold Adhesive Applied	7.31	

07 52 16 12 Hot-Mopped Styrene-Butadiene-Styrene Modified Bituminous Membrane Roofing (07 52 16)

07 Thermal And Moisture Protection**07 50 Membrane Roofing****07 52 Modified Bituminous Membrane Roofing**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 52 16 12-0001			Hot-Mopped Styrene-Butadiene-Styrene Modified Bituminous Membrane Roofing <small>(07 52 16 12)</small>		
			Note: Includes fiberglass and/or polyester reinforcement. Includes mopping hot asphalt and embedding the membrane.		
07 52 16 12-0002			Hot-Mopped, SBS Modified Bitumen Roofing Base, Ply And Cap Sheets <small>(07 52 16 12-0001)</small>		
07 52 16 12-0003	SQ		50 Mil, SBS Modified Bitumen Base Sheet, Hot-Mopped	64.90	
			<i>For Up To 10, Add</i>	10.60	
			<i>For >10 To 25, Add</i>	8.15	
07 52 16 12-0004	SQ		80 Mil, SBS Modified Bitumen Base Sheet, Hot-Mopped	85.59	
			<i>For Up To 10, Add</i>	11.64	
			<i>For >10 To 25, Add</i>	9.19	
07 52 16 12-0005	SQ		90 Mil, SBS Modified Bitumen Base Sheet, Hot-Mopped	88.26	
			<i>For Up To 10, Add</i>	11.77	
			<i>For >10 To 25, Add</i>	9.32	
07 52 16 12-0006	SQ		120 Mil, SBS Modified Bitumen Base Or Ply Sheet, Hot-Mopped.....	121.26	
			<i>For Up To 10, Add</i>	13.42	
			<i>For >10 To 25, Add</i>	10.97	
07 52 16 12-0007	SQ		125 Mil, SBS Modified Bitumen Ply Sheet, Hot-Mopped.....	154.66	
			<i>For Up To 10, Add</i>	15.09	
			<i>For >10 To 25, Add</i>	12.64	
07 52 16 12-0008	SQ		140 Mil, Smooth Surfaced, SBS Modified Bitumen Cap Sheet, Hot-Mopped	129.36	
			<i>For Up To 10, Add</i>	14.53	
			<i>For >10 To 25, Add</i>	11.84	
07 52 16 12-0009	SQ		150 Mil, Smooth Surfaced, SBS Modified Bitumen Cap Sheet, Hot-Mopped	132.96	
			<i>For Up To 10, Add</i>	14.71	
			<i>For >10 To 25, Add</i>	12.02	
07 52 16 12-0010	SQ		125 Mil, Granule Surfaced, SBS Modified Bitumen Cap Sheet, Hot-Mopped.....	116.14	
			<i>For Up To 10, Add</i>	13.87	
			<i>For >10 To 25, Add</i>	11.18	
			<i>For Factory Applied White Reflective Surfacing, Add</i>	52.37	
07 52 16 12-0011	SQ		140 Mil, Granule Surfaced, SBS Modified Bitumen Cap Sheet, Hot-Mopped.....	117.69	
			<i>For Up To 10, Add</i>	13.94	
			<i>For >10 To 25, Add</i>	11.26	
			<i>For Factory Applied White Reflective Surfacing, Add</i>	52.37	
07 52 16 12-0012	SQ		150 Mil, Granule Surfaced, SBS Modified Bitumen Cap Sheet, Hot-Mopped.....	132.00	
			<i>For Up To 10, Add</i>	14.66	
			<i>For >10 To 25, Add</i>	11.97	
			<i>For Factory Applied White Reflective Surfacing, Add</i>	52.37	
07 52 16 12-0013	SQ		160 Mil, Granule Surfaced, SBS Modified Bitumen Cap Sheet, Hot-Mopped.....	134.39	
			<i>For Up To 10, Add</i>	14.78	
			<i>For >10 To 25, Add</i>	12.09	
			<i>For Factory Applied White Reflective Surfacing, Add</i>	52.37	
07 52 16 12-0014	SQ		170 Mil, Granule Surfaced, SBS Modified Bitumen Cap Sheet, Hot-Mopped.....	155.26	
			<i>For Up To 10, Add</i>	15.82	
			<i>For >10 To 25, Add</i>	13.14	
			<i>For Factory Applied White Reflective Surfacing, Add</i>	52.37	
07 52 16 12-0015	SQ		180 Mil, Granule Surfaced, SBS Modified Bitumen Cap Sheet, Hot-Mopped.....	193.29	
			<i>For Up To 10, Add</i>	17.72	
			<i>For >10 To 25, Add</i>	15.04	
			<i>For Factory Applied White Reflective Surfacing, Add</i>	52.37	
07 52 16 12-0016	SQ		125 Mil, Fire Rated, Granule Surfaced, SBS Modified Bitumen Cap Sheet, Hot-Mopped	118.72	
			<i>For Up To 10, Add</i>	13.99	
			<i>For >10 To 25, Add</i>	11.31	
			<i>For Factory Applied White Reflective Surfacing, Add</i>	52.37	
07 52 16 12-0017	SQ		140 Mil, Fire Rated, Granule Surfaced, SBS Modified Bitumen Cap Sheet, Hot-Mopped	122.46	
			<i>For Up To 10, Add</i>	14.18	
			<i>For >10 To 25, Add</i>	11.50	
			<i>For Factory Applied White Reflective Surfacing, Add</i>	52.37	
07 52 16 12-0018	SQ		150 Mil, Fire Rated, Granule Surfaced, SBS Modified Bitumen Cap Sheet, Hot-Mopped	142.74	
			<i>For Up To 10, Add</i>	15.20	
			<i>For >10 To 25, Add</i>	12.51	
			<i>For Factory Applied White Reflective Surfacing, Add</i>	52.37	
07 52 16 12-0019	SQ		160 Mil, Fire Rated, Granule Surfaced, SBS Modified Bitumen Cap Sheet, Hot-Mopped	143.21	
			<i>For Up To 10, Add</i>	15.22	
			<i>For >10 To 25, Add</i>	12.53	
			<i>For Factory Applied White Reflective Surfacing, Add</i>	52.37	
07 52 16 12-0020	SQ		170 Mil, Fire Rated, Granule Surfaced, SBS Modified Bitumen Cap Sheet, Hot-Mopped	152.28	
			<i>For Up To 10, Add</i>	15.67	
			<i>For >10 To 25, Add</i>	12.99	
			<i>For Factory Applied White Reflective Surfacing, Add</i>	52.37	
07 52 16 12-0021			Hot-Mopped, SBS Modified Bitumen Roofing Flashing <small>(07 52 16 12-0001)</small>		
07 52 16 12-0022	SF		150 Mil, Smooth Surfaced, SBS Modified Bitumen Flashing, Hot-Mopped.....	2.60	
07 52 16 12-0023	SF		125 Mil, Granule Surfaced, SBS Modified Bitumen Flashing, Hot-Mopped	2.43	
			<i>For Factory Applied White Reflective Surfacing, Add</i>	0.52	
07 52 16 12-0024	SF		140 Mil, Granule Surfaced, SBS Modified Bitumen Flashing, Hot-Mopped	2.45	
			<i>For Factory Applied White Reflective Surfacing, Add</i>	0.52	
07 52 16 12-0025	SF		150 Mil, Granule Surfaced, SBS Modified Bitumen Flashing, Hot-Mopped	2.59	
			<i>For Factory Applied White Reflective Surfacing, Add</i>	0.52	
07 52 16 12-0026	SF		160 Mil, Granule Surfaced, SBS Modified Bitumen Flashing, Hot-Mopped	2.61	
			<i>For Factory Applied White Reflective Surfacing, Add</i>	0.52	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 52 16 12-0027 SF 170 Mil, Granule Surfaced, SBS Modified Bitumen Flashing, Hot-Mopped..... <i>For Factory Applied White Reflective Surfacing, Add</i>	2.82 0.52	
07 52 16 12-0028 SF 180 Mil, Granule Surfaced, SBS Modified Bitumen Flashing, Hot-Mopped..... <i>For Factory Applied White Reflective Surfacing, Add</i>	3.20 0.52	
07 52 16 12-0029 SF 125 Mil, Fire Rated, Granule Surfaced, SBS Modified Bitumen Flashing, Hot-Mopped..... <i>For Factory Applied White Reflective Surfacing, Add</i>	2.46 0.52	
07 52 16 12-0030 SF 140 Mil, Fire Rated, Granule Surfaced, SBS Modified Bitumen Flashing, Hot-Mopped..... <i>For Factory Applied White Reflective Surfacing, Add</i>	2.49 0.52	
07 52 16 12-0031 SF 160 Mil, Fire Rated, Granule Surfaced, SBS Modified Bitumen Flashing, Hot-Mopped..... <i>For Factory Applied White Reflective Surfacing, Add</i>	2.66 0.52	
07 52 16 12-0032 SF 170 Mil, Fire Rated, Granule Surfaced, SBS Modified Bitumen Flashing, Hot-Mopped..... <i>For Factory Applied White Reflective Surfacing, Add</i>	2.79 0.52	
07 52 16 12-0033 SF 145 Mil, Aluminum Foil Surfaced, SBS Modified Bitumen Flashing, Hot-Mopped.....	3.53	
07 52 16 12-0034 SF 160 Mil, Copper Foil Surfaced, SBS Modified Bitumen Flashing, Hot-Mopped.....	6.22	

07 52 16 13 Torch-Applied Styrene-Butadiene-Styrene Modified Bituminous Membrane Roofing (07 52 16)

07 52 16 13-0001 Torch-Applied Styrene-Butadiene-Styrene Modified Bituminous Membrane Roofing (07 52 16 13)
 Note: Includes fiberglass and/or polyester reinforcement. Includes adhering the membrane with a torch.

07 52 16 13-0002 Torch-Applied, SBS Modified Bitumen Roofing Base, Ply And Cap Sheets (07 52 16 13-0001)

07 52 16 13-0003 SQ 120 Mil, SBS Modified Bitumen Base Or Ply Sheet, Torch-Applied..... <i>For Up To 10, Add</i> <i>For >10 To 25, Add</i>	109.21 10.98 9.14	
07 52 16 13-0004 SQ 150 Mil, Granule Surfaced, SBS Modified Bitumen Cap Sheet, Torch-Applied..... <i>For Up To 10, Add</i> <i>For >10 To 25, Add</i> <i>For Factory Applied White Reflective Surfacing, Add</i>	98.75 10.79 8.84 52.37	
07 52 16 13-0005 SQ 160 Mil, Granule Surfaced, SBS Modified Bitumen Cap Sheet, Torch-Applied..... <i>For Up To 10, Add</i> <i>For >10 To 25, Add</i> <i>For Factory Applied White Reflective Surfacing, Add</i>	112.34 11.47 9.52 52.37	
07 52 16 13-0006 SQ 180 Mil, Granule Surfaced, SBS Modified Bitumen Cap Sheet, Torch-Applied..... <i>For Up To 10, Add</i> <i>For >10 To 25, Add</i> <i>For Factory Applied White Reflective Surfacing, Add</i>	173.99 14.55 12.60 52.37	
07 52 16 13-0007 SQ 150 Mil, Fire Rated, Granule Surfaced, SBS Modified Bitumen Cap Sheet, Torch-Applied..... <i>For Up To 10, Add</i> <i>For >10 To 25, Add</i> <i>For Factory Applied White Reflective Surfacing, Add</i>	102.63 10.98 9.03 52.37	
07 52 16 13-0008 SQ 160 Mil, Fire Rated, Granule Surfaced, SBS Modified Bitumen Cap Sheet, Torch-Applied..... <i>For Up To 10, Add</i> <i>For >10 To 25, Add</i> <i>For Factory Applied White Reflective Surfacing, Add</i>	118.67 11.78 9.83 52.37	
07 52 16 13-0009 SQ 165 Mil, Fire Rated, Granule Surfaced, SBS Modified Bitumen Cap Sheet, Torch-Applied..... <i>For Up To 10, Add</i> <i>For >10 To 25, Add</i> <i>For Factory Applied White Reflective Surfacing, Add</i>	123.76 12.04 10.09 52.37	
07 52 16 13-0010 SQ 180 Mil, Fire Rated, Granule Surfaced, SBS Modified Bitumen Cap Sheet, Torch-Applied..... <i>For Up To 10, Add</i> <i>For >10 To 25, Add</i> <i>For Factory Applied White Reflective Surfacing, Add</i>	161.18 13.91 11.96 52.37	

07 52 16 13-0011 Torch-Applied, SBS Modified Bitumen Roofing Flashing (07 52 16 13-0001)

07 52 16 13-0012 SF 150 Mil, Smooth Surfaced, SBS Modified Bitumen Flashing, Torch-Applied.....	2.05	
07 52 16 13-0013 SF 150 Mil, Granule Surfaced, SBS Modified Bitumen Flashing, Torch-Applied..... <i>For Factory Applied White Reflective Surfacing, Add</i>	2.04 0.52	
07 52 16 13-0014 SF 180 Mil, Granule Surfaced, SBS Modified Bitumen Flashing, Torch-Applied..... <i>For Factory Applied White Reflective Surfacing, Add</i>	2.65 0.52	
07 52 16 13-0015 SF 160 Mil, Fire Rated, Granule Surfaced, SBS Modified Bitumen Flashing, Torch-Applied..... <i>For Factory Applied White Reflective Surfacing, Add</i>	2.11 0.52	
07 52 16 13-0016 SF 165 Mil, Fire Rated, Granule Surfaced, SBS Modified Bitumen Flashing, Torch-Applied..... <i>For Factory Applied White Reflective Surfacing, Add</i>	2.15 0.52	
07 52 16 13-0017 SF 180 Mil, Fire Rated, Granule Surfaced, SBS Modified Bitumen Flashing, Torch-Applied..... <i>For Factory Applied White Reflective Surfacing, Add</i>	2.53 0.52	
07 52 16 13-0018 SF 150 Mil, Aluminum Foil Surfaced, SBS Modified Bitumen Flashing, Torch-Applied.....	2.61	
07 52 16 13-0019 SF 160 Mil, Copper Foil Surfaced, SBS Modified Bitumen Flashing, Torch-Applied.....	5.67	

07 52 16 14 Mechanically Fastened Styrene-Butadiene-Styrene Modified Bituminous Membrane Roofing (07 52 16)

07 52 16 14-0001 Mechanically Fastened Styrene-Butadiene-Styrene Modified Bituminous Membrane Roofing (07 52 16 14)
 Note: Includes fiberglass and/or polyester reinforcement. Includes fasteners.

07 52 16 14-0002 Mechanically Fastened, SBS Modified Bitumen Roofing Base And Ply Sheets (07 52 16 14-0001)

07 Thermal And Moisture Protection**07 50 Membrane Roofing****07 52 Modified Bituminous Membrane Roofing**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 52 16 14-0003	SQ		35 Mil, SBS Modified Bitumen Ply Sheet, Mechanically Fastened.....	75.57	
			<i>For Up To 10, Add</i>	7.45	
			<i>For >10 To 25, Add</i>	6.23	
07 52 16 14-0004	SQ		50 Mil, SBS Modified Bitumen Base Sheet, Mechanically Fastened.....	59.25	
			<i>For Up To 10, Add</i>	6.64	
			<i>For >10 To 25, Add</i>	5.41	
07 52 16 14-0005	SQ		80 Mil, SBS Modified Bitumen Base Sheet, Mechanically Fastened.....	75.32	
			<i>For Up To 10, Add</i>	7.44	
			<i>For >10 To 25, Add</i>	6.22	
07 52 16 14-0006	SQ		90 Mil, SBS Modified Bitumen Base Sheet, Mechanically Fastened.....	93.07	
			<i>For Up To 10, Add</i>	8.33	
			<i>For >10 To 25, Add</i>	7.10	
07 52 16 14-0007	SQ		120 Mil, SBS Modified Bitumen Base Or Ply Sheet, Mechanically Fastened.....	115.61	
			<i>For Up To 10, Add</i>	9.46	
			<i>For >10 To 25, Add</i>	8.23	
07 52 16 14-0008			Mechanically Fastened, SBS Modified Bitumen Roofing Flashing (07 52 16 14-0001)		
07 52 16 14-0009	SF		150 Mil, Smooth Surfaced, SBS Modified Bitumen Flashing, Mechanically Fastened.....	1.69	
07 52 16 14-0010	SF		160 Mil, Granule Surfaced, SBS Modified Bitumen Flashing, Mechanically Fastened.....	1.72	
07 52 16 15			Self-Adhering Styrene-Butadiene-Styrene Modified Bituminous Membrane Roofing (07 52 16)		
07 52 16 15-0001			Self-Adhering Styrene-Butadiene-Styrene Modified Bituminous Membrane Roofing (07 52 16 15)		
			Note: Includes fiberglass and/or polyester reinforcement. Includes removing the release film(s) from the membrane and applying the membrane.		
07 52 16 15-0002			Self-Adhering, SBS Modified Bitumen Roofing Base, Ply And Cap Sheets (07 52 16 15-0001)		
07 52 16 15-0003	SQ		60 Mil, SBS Modified Bitumen Base Sheet, Self-Adhering	62.51	
			<i>For Up To 10, Add</i>	7.54	
			<i>For >10 To 25, Add</i>	6.07	
07 52 16 15-0004	SQ		70 Mil, SBS Modified Bitumen Base Sheet, Self-Adhering	65.89	
			<i>For Up To 10, Add</i>	7.71	
			<i>For >10 To 25, Add</i>	6.24	
07 52 16 15-0005	SQ		120 Mil, SBS Modified Bitumen Base Sheet, Self-Adhering	107.66	
			<i>For Up To 10, Add</i>	10.13	
			<i>For >10 To 25, Add</i>	8.55	
07 52 16 15-0006	SQ		150 Mil, Granule Surfaced, SBS Modified Bitumen Cap Sheet, Self-Adhering.....	127.48	
			<i>For Up To 10, Add</i>	11.12	
			<i>For >10 To 25, Add</i>	9.54	
			<i>For Factory Applied White Reflective Surfacing, Add</i>	52.37	
07 52 16 15-0007	SQ		160 Mil, Granule Surfaced, SBS Modified Bitumen Cap Sheet, Self-Adhering.....	185.93	
			<i>For Up To 10, Add</i>	14.04	
			<i>For >10 To 25, Add</i>	12.46	
			<i>For Factory Applied White Reflective Surfacing, Add</i>	52.37	
07 52 16 15-0008			Self-Adhering, SBS Modified Bitumen Roofing Flashing (07 52 16 15-0001)		
07 52 16 15-0009	SF		70 Mil, SBS Modified Bitumen Flashing, Self-Adhering	2.03	
07 52 16 15-0010	SF		150 Mil, Granule Surfaced, SBS Modified Bitumen Flashing, Self-Adhering	2.23	
			<i>For Factory Applied White Reflective Surfacing, Add</i>	0.52	
07 52 16 15-0011	SF		160 Mil, Granule Surfaced, SBS Modified Bitumen Flashing, Self-Adhering	2.81	
			<i>For Factory Applied White Reflective Surfacing, Add</i>	0.52	
07 53			Elastomeric Membrane Roofing (07 50)		
			Note: Includes 10 year warranty. All warranties are no dollar limit to include material, equipment and labor. Excludes concrete primer, insulation, slip sheets, wood nailers, cant strips, coping removal and reinstallation, gravel stop, walkway pads and drainage devices. See CSI section 07 26 13 00-0000 for wood deck building paper.		
07 53 16			Chlorosulfonate-Polyethylene Roofing (07 53)		
07 53 16 00-0001			Chlorosulfonated Polyethylene-Hypalon (CSPE) Roofing Membranes (07 53 16)		
			Note: Includes hot air welding or adhesive bonding of seams.		
07 53 16 00-0002	SQ		45 Mil, Single Ply CSPE Roofing Membrane, Fully Adhered	270.66	59.34
			Note: Includes adhesive.		
			<i>For Up To 10, Add</i>	48.86	
			<i>For >10 To 25, Add</i>	37.08	
			<i>For 15 Year Warranty, Add</i>	3.00	
07 53 16 00-0003	SQ		45 Mil, Single Ply CSPE Roofing Membrane, Ballasted.....	185.89	29.67
			Note: Includes ballast.		
			<i>For Up To 10, Add</i>	26.96	
			<i>For >10 To 25, Add</i>	21.07	
			<i>For 15 Year Warranty, Add</i>	3.00	
07 53 16 00-0004	SQ		45 Mil, Single Ply CSPE Roofing Membrane, Mechanically Fastened.....	207.69	44.50
			Note: Includes fasteners.		
			<i>For Up To 10, Add</i>	36.87	
			<i>For >10 To 25, Add</i>	28.04	
			<i>For 15 Year Warranty, Add</i>	3.00	



MINOR	CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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07 53 23 Ethylene-Propylene-Diene-Monomer Roofing ^(07 53)

07 53 23 00-0001	Ethylene Propylene Diene Monomer (EPDM) Roofing Membranes ^(07 53 23) Note: Includes splicing of seams using adhesive or seam tape. Black ethylene propylene diene monomer (EPDM).		
07 53 23 00-0002	SQ 45 Mil, Single Ply Ethylene Propylene Diene Monomer (EPDM) Roofing Membrane, Ballasted Note: Includes ballast.	144.60	29.67
	<i>For Up To 10, Add</i>	24.89	
	<i>For >10 To 25, Add</i>	19.00	
	<i>For 15 Year Warranty, Add</i>	3.00	
	<i>For Low Slope Fire Rated, Add</i>	4.21	
	<i>For Reinforced Ethylene Propylene Diene Monomer (EPDM), Add</i>	11.36	
07 53 23 00-0003	SQ 60 Mil, Single Ply Ethylene Propylene Diene Monomer (EPDM) Roofing Membrane, Ballasted Note: Includes ballast.	161.74	31.52
	<i>For Up To 10, Add</i>	26.85	
	<i>For >10 To 25, Add</i>	20.60	
	<i>For 15 Year Warranty, Add</i>	3.00	
	<i>For 20 Year Warranty, Add</i>	6.00	
	<i>For 25 Year Warranty, Add</i>	8.00	
	<i>For Low Slope Fire Rated, Add</i>	4.21	
	<i>For Reinforced Ethylene Propylene Diene Monomer (EPDM), Add</i>	11.36	
07 53 23 00-0004	SQ 90 Mil, Single Ply Ethylene Propylene Diene Monomer (EPDM) Roofing Membrane, Ballasted Note: Includes ballast.	235.25	33.37
	<i>For Up To 10, Add</i>	31.63	
	<i>For >10 To 25, Add</i>	25.01	
	<i>For 15 Year Warranty, Add</i>	3.00	
	<i>For 20 Year Warranty, Add</i>	6.00	
	<i>For 25 Year Warranty, Add</i>	8.00	
	<i>For Low Slope Fire Rated, Add</i>	4.21	
07 53 23 00-0005	SQ 45 Mil, Single Ply Ethylene Propylene Diene Monomer (EPDM) Roofing Membrane, Partially Adhered (40%) Note: Includes adhesive and fasteners.	176.33	44.50
	<i>For Up To 10, Add</i>	35.31	
	<i>For >10 To 25, Add</i>	26.48	
	<i>For 15 Year Warranty, Add</i>	3.00	
	<i>For Low Slope Fire Rated, Add</i>	4.21	
	<i>For Low VOC Adhesive, Add</i>	18.80	
	<i>For Reinforced Ethylene Propylene Diene Monomer (EPDM), Add</i>	11.36	
	<i>For White Ethylene Propylene Diene Monomer (EPDM) Or Factory Applied White Coating, Add</i>	40.15	
	<i>For Integral Polyester Fleece-Backing, Add</i>	58.70	
07 53 23 00-0006	SQ 60 Mil, Single Ply Ethylene Propylene Diene Monomer (EPDM) Roofing Membrane, Partially Adhered (40%) Note: Includes adhesive and fasteners.	193.48	46.36
	<i>For Up To 10, Add</i>	37.27	
	<i>For >10 To 25, Add</i>	28.07	
	<i>For 15 Year Warranty, Add</i>	3.00	
	<i>For 20 Year Warranty, Add</i>	6.00	
	<i>For 25 Year Warranty, Add</i>	8.00	
	<i>For Low Slope Fire Rated, Add</i>	4.21	
	<i>For Low VOC Adhesive, Add</i>	18.80	
	<i>For Reinforced Ethylene Propylene Diene Monomer (EPDM), Add</i>	11.36	
	<i>For White Ethylene Propylene Diene Monomer (EPDM) Or Factory Applied White Coating, Add</i>	40.15	
	<i>For Integral Polyester Fleece-Backing, Add</i>	64.87	
07 53 23 00-0007	SQ 90 Mil, Single Ply Ethylene Propylene Diene Monomer (EPDM) Roofing Membrane, Partially Adhered (40%) Note: Includes adhesive and fasteners.	266.99	48.21
	<i>For Up To 10, Add</i>	42.05	
	<i>For >10 To 25, Add</i>	32.48	
	<i>For 15 Year Warranty, Add</i>	3.00	
	<i>For 20 Year Warranty, Add</i>	6.00	
	<i>For 25 Year Warranty, Add</i>	8.00	
	<i>For Low Slope Fire Rated, Add</i>	4.21	
	<i>For Low VOC Adhesive, Add</i>	18.80	
	<i>For White Ethylene Propylene Diene Monomer (EPDM) Or Factory Applied White Coating, Add</i>	40.15	
	<i>For Integral Polyester Fleece-Backing, Add</i>	71.60	
07 53 23 00-0008	SQ 45 Mil, Single Ply Ethylene Propylene Diene Monomer (EPDM) Roofing Membrane, Fully Adhered Note: Includes adhesive and fasteners.	233.22	59.34
	<i>For Up To 10, Add</i>	46.98	
	<i>For >10 To 25, Add</i>	35.21	
	<i>For 15 Year Warranty, Add</i>	3.00	
	<i>For Low Slope Fire Rated, Add</i>	4.21	
	<i>For Reinforced Ethylene Propylene Diene Monomer (EPDM), Add</i>	11.36	
	<i>For Low VOC Adhesive, Add</i>	46.99	
	<i>For White Ethylene Propylene Diene Monomer (EPDM) Or Factory Applied White Coating, Add</i>	40.15	
	<i>For Integral Polyester Fleece-Backing, Add</i>	58.70	
07 53 23 00-0009	SQ 60 Mil, Single Ply Ethylene Propylene Diene Monomer (EPDM) Roofing Membrane, Fully Adhered Note: Includes adhesive and fasteners.	250.36	61.20
	<i>For Up To 10, Add</i>	48.94	
	<i>For >10 To 25, Add</i>	36.80	
	<i>For 15 Year Warranty, Add</i>	3.00	
	<i>For 20 Year Warranty, Add</i>	6.00	
	<i>For 25 Year Warranty, Add</i>	8.00	
	<i>For Low Slope Fire Rated, Add</i>	4.21	
	<i>For Reinforced Ethylene Propylene Diene Monomer (EPDM), Add</i>	11.36	
	<i>For Low VOC Adhesive, Add</i>	46.99	
	<i>For White Ethylene Propylene Diene Monomer (EPDM) Or Factory Applied White Coating, Add</i>	40.15	
	<i>For Integral Polyester Fleece-Backing, Add</i>	64.87	

07 Thermal And Moisture Protection**07 50 Membrane Roofing****07 53 Elastomeric Membrane Roofing**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 53 23 00-0010	SQ		90 Mil, Single Ply Ethylene Propylene Diene Monomer (EPDM) Roofing Membrane, Fully Adhered.....	323.87	63.05
			Note: Includes adhesive and fasteners.		
			For Up To 10, Add	53.72	
			For >10 To 25, Add	41.21	
			For 15 Year Warranty, Add	3.00	
			For 20 Year Warranty, Add	6.00	
			For 25 Year Warranty, Add	8.00	
			For Low Slope Fire Rated, Add	4.21	
			For Low VOC Adhesive, Add	46.99	
			For White Ethylene Propylene Diene Monomer (EPDM) Or Factory Applied White Coating, Add	40.15	
			For Integral Polyester Fleece-Backing, Add	71.60	
07 53 23 00-0011	SQ		45 Mil, Single Ply Ethylene Propylene Diene Monomer (EPDM) Roofing Membrane, Mechanically Fastened	166.28	44.50
			Note: Includes fasteners.		
			For Up To 10, Add	34.80	
			For >10 To 25, Add	25.97	
			For 15 Year Warranty, Add	3.00	
			For Low Slope Fire Rated, Add	4.21	
			For Reinforced Ethylene Propylene Diene Monomer (EPDM), Add	11.36	
			For White Ethylene Propylene Diene Monomer (EPDM) Or Factory Applied White Coating, Add	40.15	
07 53 23 00-0012	SQ		60 Mil, Single Ply Ethylene Propylene Diene Monomer (EPDM) Roofing Membrane, Mechanically Fastened	183.43	46.36
			Note: Includes fasteners.		
			For Up To 10, Add	36.77	
			For >10 To 25, Add	27.57	
			For 15 Year Warranty, Add	3.00	
			For 20 Year Warranty, Add	6.00	
			For 25 Year Warranty, Add	8.00	
			For Low Slope Fire Rated, Add	4.21	
			For Reinforced Ethylene Propylene Diene Monomer (EPDM), Add	11.36	
			For White Ethylene Propylene Diene Monomer (EPDM) Or Factory Applied White Coating, Add	40.15	
07 53 23 00-0013	SQ		90 Mil, Single Ply Ethylene Propylene Diene Monomer (EPDM) Roofing Membrane, Mechanically Fastened	256.94	48.21
			Note: Includes fasteners.		
			For Up To 10, Add	41.55	
			For >10 To 25, Add	31.98	
			For 15 Year Warranty, Add	3.00	
			For 20 Year Warranty, Add	6.00	
			For 25 Year Warranty, Add	8.00	
			For Low Slope Fire Rated, Add	4.21	
			For White Ethylene Propylene Diene Monomer (EPDM) Or Factory Applied White Coating, Add	40.15	
07 53 23 00-0014			Ethylene Propylene Diene Monomer (EPDM) Roofing Membrane		
			Accessories <small>(07 53 23)</small>		
07 53 23 00-0015	SQ		Acrylic, Ethylene Propylene Diene Monomer (EPDM) Roofing Primer, Price Per Coat	39.46	
			For Up To 10, Add	6.39	
			For >10 To 25, Add	4.92	
07 53 23 00-0016	SQ		Acrylic Elastomeric, Surface Or Base Coating For Ethylene Propylene Diene Monomer (EPDM) Roofing, Price Per Coat	40.69	
			Note: 55% solids by volume.		
			For Up To 10, Add	6.45	
			For >10 To 25, Add	4.98	
07 53 23 00-0017	EA		Up To 4" Pipe Diameter, Prefabricated Ethylene Propylene Diene Monomer (EPDM) Pipe Cone/Boot.....	26.04	7.05
			Note: Includes attaching the boot to the membrane, caulking around the pipe and installing a draw band.		
07 53 23 00-0018	EA		>4" To 8" Pipe Diameter, Prefabricated Ethylene Propylene Diene Monomer (EPDM) Pipe Cone/Boot.....	35.76	7.05
			Note: Includes attaching the boot to the membrane, caulking around the pipe and installing a draw band.		
07 53 23 00-0019	EA		>8" To 13" Pipe Diameter, Prefabricated Ethylene Propylene Diene Monomer (EPDM) Pipe Cone/Boot.....	63.80	7.05
			Note: Includes attaching the boot to the membrane, caulking around the pipe and installing a draw band.		
07 53 23 00-0020	EA		6" Diameter, Prefabricated Ethylene Propylene Diene Monomer (EPDM) Penetration Pocket.....	83.80	7.79
			Note: Includes attaching the pocket to the membrane, sealing around the penetration and filling the pocket with pourable sealer.		
07 53 23 00-0021	LF		30" Wide, Ethylene Propylene Diene Monomer (EPDM) Walkway Protection Pad.....	19.68	4.30
			Note: Includes factory installed peel and stick adhesive tape.		
07 53 23 00-0022	SF		Ethylene Propylene Diene Monomer (EPDM) Membrane Base Flashing.....	3.86	1.11
07 53 23 00-0023	SF		Ethylene Propylene Diene Monomer (EPDM) Membrane Curb Flashing	4.96	1.67
07 53 29			Polyisobutylene Roofing <small>(07 53)</small>		
07 53 29 00-0001			Polyisobutylene (PIB) Roofing Membranes <small>(07 53 29)</small>		
			Note: Includes integral polyester fleece-backing. Includes splicing of seams using adhesive or seam tape.		
07 53 29 00-0002	SQ		100 Mil, Single Ply PIB Roofing Membrane, Ballasted.....	276.42	33.37
			Note: Includes ballast.		
			For Up To 10, Add	33.69	
			For >10 To 25, Add	27.07	
			For 15 Year Warranty, Add	3.00	
			For 20 Year Warranty, Add	6.00	
			For 25 Year Warranty, Add	8.00	
07 53 29 00-0003	SQ		100 Mil, Single Ply PIB Roofing Membrane, Partially Adhered (40%).....	314.18	48.21
			Note: Includes adhesive.		
			For Up To 10, Add	44.41	
			For >10 To 25, Add	34.84	
			For 15 Year Warranty, Add	3.00	
			For 20 Year Warranty, Add	6.00	
			For 25 Year Warranty, Add	8.00	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 53 29 00-0004 SQ 100 Mil, Single Ply PIB Roofing Membrane, Fully Adhered	380.11	63.05
Note: Includes adhesive.		
<i>For Up To 10, Add</i>	56.54	
<i>For >10 To 25, Add</i>	44.03	
<i>For 15 Year Warranty, Add</i>	3.00	
<i>For 20 Year Warranty, Add</i>	6.00	
<i>For 25 Year Warranty, Add</i>	8.00	
07 54 19 Thermoplastic Membrane Roofing (07 50)		
Note: Includes 10 year warranty. All warranties are no dollar limit to include material, equipment and labor. Excludes concrete primer, insulation, slip sheets, wood nailers, cant strips, coping removal and reinstallation, gravel stop, walkway pads and drainage devices. See CSI section 07 26 13 00-0000 for wood deck building paper.		
07 54 19 Polyvinyl-Chloride Roofing (07 54)		
07 54 19 00-0001 Reinforced Polyvinyl Chloride (RPVC) Roofing Membranes (07 54 19)		
Note: Includes polyester fabric reinforcement and hot air welding of seams. RPVC membranes meet or exceed all of the requirements of ASTM D4434 Type III.		
07 54 19 00-0002 SQ 48 Mil, Single Ply Reinforced Polyvinyl Chloride (RPVC) Roofing Membrane, Ballasted	178.75	29.67
Note: Includes ballast.		
<i>For Up To 10, Add</i>	26.60	
<i>For >10 To 25, Add</i>	20.71	
<i>For 15 Year Warranty, Add</i>	3.00	
<i>For Colors, Add</i>	26.00	
<i>For Integral Polyester Fleece-Backing, Add</i>	40.70	
07 54 19 00-0003 SQ 60 Mil, Single Ply Reinforced Polyvinyl Chloride (RPVC) Roofing Membrane, Ballasted	203.74	31.52
Note: Includes ballast.		
<i>For Up To 10, Add</i>	28.95	
<i>For >10 To 25, Add</i>	22.70	
<i>For 15 Year Warranty, Add</i>	3.00	
<i>For 20 Year Warranty, Add</i>	6.00	
<i>For 25 Year Warranty, Add</i>	8.00	
<i>For Colors, Add</i>	26.00	
<i>For Integral Polyester Fleece-Backing, Add</i>	40.70	
07 54 19 00-0004 SQ 72 Mil, Single Ply Reinforced Polyvinyl Chloride (RPVC) Roofing Membrane, Ballasted	232.80	32.45
Note: Includes ballast.		
<i>For Up To 10, Add</i>	30.96	
<i>For >10 To 25, Add</i>	24.52	
<i>For 15 Year Warranty, Add</i>	3.00	
<i>For 20 Year Warranty, Add</i>	6.00	
<i>For 25 Year Warranty, Add</i>	8.00	
<i>For Colors, Add</i>	26.00	
<i>For Integral Polyester Fleece-Backing, Add</i>	40.70	
07 54 19 00-0005 SQ 80 Mil, Single Ply Reinforced Polyvinyl Chloride (RPVC) Roofing Membrane, Ballasted	246.48	33.37
Note: Includes ballast.		
<i>For Up To 10, Add</i>	32.19	
<i>For >10 To 25, Add</i>	25.57	
<i>For 15 Year Warranty, Add</i>	3.00	
<i>For 20 Year Warranty, Add</i>	6.00	
<i>For 25 Year Warranty, Add</i>	8.00	
<i>For Colors, Add</i>	26.00	
<i>For Integral Polyester Fleece-Backing, Add</i>	40.70	
07 54 19 00-0006 SQ 48 Mil, Single Ply Reinforced Polyvinyl Chloride (RPVC) Roofing Membrane, Fully Adhered.....	250.19	59.34
Note: Includes adhesive.		
<i>For Up To 10, Add</i>	47.83	
<i>For >10 To 25, Add</i>	36.06	
<i>For 15 Year Warranty, Add</i>	3.00	
<i>For Colors, Add</i>	26.00	
<i>For Low VOC Adhesive, Add</i>	33.61	
<i>For Integral Polyester Fleece-Backing, Add</i>	40.70	
07 54 19 00-0007 SQ 60 Mil, Single Ply Reinforced Polyvinyl Chloride (RPVC) Roofing Membrane, Fully Adhered.....	275.19	61.20
Note: Includes adhesive.		
<i>For Up To 10, Add</i>	50.19	
<i>For >10 To 25, Add</i>	38.04	
<i>For 15 Year Warranty, Add</i>	3.00	
<i>For 20 Year Warranty, Add</i>	6.00	
<i>For 25 Year Warranty, Add</i>	8.00	
<i>For Colors, Add</i>	26.00	
<i>For Low VOC Adhesive, Add</i>	33.61	
<i>For Integral Polyester Fleece-Backing, Add</i>	40.70	
07 54 19 00-0008 SQ 72 Mil, Single Ply Reinforced Polyvinyl Chloride (RPVC) Roofing Membrane, Fully Adhered.....	304.24	62.12
Note: Includes adhesive.		
<i>For Up To 10, Add</i>	52.19	
<i>For >10 To 25, Add</i>	39.86	
<i>For 15 Year Warranty, Add</i>	3.00	
<i>For 20 Year Warranty, Add</i>	6.00	
<i>For 25 Year Warranty, Add</i>	8.00	
<i>For Colors, Add</i>	26.00	
<i>For Low VOC Adhesive, Add</i>	33.61	
<i>For Integral Polyester Fleece-Backing, Add</i>	40.70	

07 Thermal And Moisture Protection**07 50 Membrane Roofing****07 54 Thermoplastic Membrane Roofing**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 54 19 00-0009	SQ		80 Mil, Single Ply Reinforced Polyvinyl Chloride (RPVC) Roofing Membrane, Fully Adhered.....	317.92	63.05
			Note: Includes adhesive.		
			For Up To 10, Add	53.43	
			For >10 To 25, Add	40.92	
			For 15 Year Warranty, Add	3.00	
			For 20 Year Warranty, Add	6.00	
			For 25 Year Warranty, Add	8.00	
			For Colors, Add	26.00	
			For Low VOC Adhesive, Add	33.61	
			For Integral Polyester Fleece-Backing, Add	40.70	
07 54 19 00-0010	SQ		48 Mil, Single Ply Reinforced Polyvinyl Chloride (RPVC) Roofing Membrane, Mechanically Fastened.....	196.45	44.50
			Note: Includes fasteners.		
			For Up To 10, Add	36.31	
			For >10 To 25, Add	27.48	
			For 15 Year Warranty, Add	3.00	
			For Colors, Add	26.00	
			For Integral Polyester Fleece-Backing, Add	40.70	
07 54 19 00-0011	SQ		60 Mil, Single Ply Reinforced Polyvinyl Chloride (RPVC) Roofing Membrane, Mechanically Fastened.....	221.44	46.36
			Note: Includes fasteners.		
			For Up To 10, Add	38.67	
			For >10 To 25, Add	29.47	
			For 15 Year Warranty, Add	3.00	
			For 20 Year Warranty, Add	6.00	
			For 25 Year Warranty, Add	8.00	
			For Colors, Add	26.00	
			For Integral Polyester Fleece-Backing, Add	40.70	
07 54 19 00-0012	SQ		72 Mil, Single Ply Reinforced Polyvinyl Chloride (RPVC) Roofing Membrane, Mechanically Fastened.....	250.49	47.29
			Note: Includes fasteners.		
			For Up To 10, Add	40.67	
			For >10 To 25, Add	31.29	
			For 15 Year Warranty, Add	3.00	
			For 20 Year Warranty, Add	6.00	
			For 25 Year Warranty, Add	8.00	
			For Colors, Add	26.00	
			For Integral Polyester Fleece-Backing, Add	40.70	
07 54 19 00-0013	SQ		80 Mil, Single Ply Reinforced Polyvinyl Chloride (RPVC) Roofing Membrane, Mechanically Fastened.....	264.18	48.21
			Note: Includes fasteners.		
			For Up To 10, Add	41.91	
			For >10 To 25, Add	32.34	
			For 15 Year Warranty, Add	3.00	
			For 20 Year Warranty, Add	6.00	
			For 25 Year Warranty, Add	8.00	
			For Colors, Add	26.00	
			For Integral Polyester Fleece-Backing, Add	40.70	
07 54 19 00-0014			Reinforced Polyvinyl Chloride (RPVC) Roofing Membrane Accessories (07 54 19)		
07 54 19 00-0015	SQ		Acrylic, Polyvinyl Chloride (PVC) Roofing Cleaner/Primer, Price Per Coat.....	39.46	
			For Up To 10, Add	6.39	
			For >10 To 25, Add	4.92	
07 54 19 00-0016	SQ		Acrylic Elastomeric, Surface Or Base Coating For Polyvinyl Chloride (PVC) Roofing, Price Per Coat.....	40.69	
			Note: 55% solids by volume.		
			For Up To 10, Add	6.45	
			For >10 To 25, Add	4.98	
07 54 19 00-0017	EA		Up To 3" Pipe Diameter, Prefabricated Polyvinyl Chloride (PVC) Pipe Cone/Boot.....	40.47	6.30
			Note: Includes attaching the boot to the membrane, caulking around the pipe and installing a draw band.		
07 54 19 00-0018	EA		>3" To 7" Pipe Diameter, Prefabricated Polyvinyl Chloride (PVC) Pipe Cone/Boot.....	55.90	7.05
			Note: Includes attaching the boot to the membrane, caulking around the pipe and installing a draw band.		
07 54 19 00-0019	EA		>7" To 12" Pipe Diameter, Prefabricated Polyvinyl Chloride (PVC) Pipe Cone/Boot.....	70.89	7.79
			Note: Includes attaching the boot to the membrane, caulking around the pipe and installing a draw band.		
07 54 19 00-0020	EA		6" Diameter, Prefabricated Polyvinyl Chloride (PVC) Penetration Pocket.....	89.13	7.79
			Note: Includes attaching the pocket to the membrane, sealing around the penetration and filling the pocket with pourable sealer.		
07 54 19 00-0021	LF		36" Wide, Polyvinyl Chloride (PVC) Walkway Protection Pad.....	17.17	4.30
07 54 19 00-0022	SF		Polyvinyl Chloride (PVC) Membrane Base Flashing.....	4.50	1.11
07 54 19 00-0023	SF		Polyvinyl Chloride (PVC) Membrane Curb Flashing.....	5.60	1.67
07 54 19 00-0024	SF		Polyvinyl Chloride (PVC) Clad Edge Metal Or Base Flashing.....	5.91	1.11
			Note: 20 Mil polyvinyl chloride (PVC) membrane laminated to 24 gauge galvanized steel.		
07 54 23			Thermoplastic-Polyolefin Roofing (07 54)		
07 54 23 00-0001			Thermoplastic Polyolefin (TPO) Roofing Membranes (07 54 23)		
			Note: Includes polyester fabric reinforcement and hot air welding of seams.		
07 54 23 00-0002	SQ		45 Mil, Single Ply TPO Roofing Membrane, Fully Adhered.....	225.98	59.34
			Note: Includes adhesive.		
			For Up To 10, Add	46.62	
			For >10 To 25, Add	34.85	
			For 15 Year Warranty, Add	3.00	
			For Low VOC Adhesive, Add	46.99	
			For Integral Polyester Fleece-Backing, Add	33.25	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 54 23 00-0003 SQ 60 Mil, Single Ply TPO Roofing Membrane, Fully Adhered Note: Includes adhesive.	240.29	61.20
<i>For Up To 10, Add</i>	48.44	
<i>For >10 To 25, Add</i>	36.30	
<i>For 15 Year Warranty, Add</i>	3.00	
<i>For 20 Year Warranty, Add</i>	6.00	
<i>For 25 Year Warranty, Add</i>	8.00	
<i>For Low VOC Adhesive, Add</i>	46.99	
<i>For Integral Polyester Fleece-Backing, Add</i>	33.25	
07 54 23 00-0004 SQ 80 Mil, Single Ply TPO Roofing Membrane, Fully Adhered Note: Includes adhesive.	298.44	63.05
<i>For Up To 10, Add</i>	52.45	
<i>For >10 To 25, Add</i>	39.94	
<i>For 15 Year Warranty, Add</i>	3.00	
<i>For 20 Year Warranty, Add</i>	6.00	
<i>For 25 Year Warranty, Add</i>	8.00	
<i>For Low VOC Adhesive, Add</i>	46.99	
<i>For Integral Polyester Fleece-Backing, Add</i>	33.25	
07 54 23 00-0005 SQ 45 Mil, Single Ply TPO Roofing Membrane, Mechanically Fastened Note: Includes fasteners.	155.06	44.50
<i>For Up To 10, Add</i>	34.24	
<i>For >10 To 25, Add</i>	25.41	
<i>For 15 Year Warranty, Add</i>	3.00	
<i>For Integral Polyester Fleece-Backing, Add</i>	33.25	
07 54 23 00-0006 SQ 60 Mil, Single Ply TPO Roofing Membrane, Mechanically Fastened Note: Includes fasteners.	169.37	46.36
<i>For Up To 10, Add</i>	36.06	
<i>For >10 To 25, Add</i>	26.86	
<i>For 15 Year Warranty, Add</i>	3.00	
<i>For 20 Year Warranty, Add</i>	6.00	
<i>For 25 Year Warranty, Add</i>	8.00	
<i>For Integral Polyester Fleece-Backing, Add</i>	33.25	
07 54 23 00-0007 SQ 80 Mil, Single Ply TPO Roofing Membrane, Mechanically Fastened Note: Includes fasteners.	227.52	48.21
<i>For Up To 10, Add</i>	40.07	
<i>For >10 To 25, Add</i>	30.51	
<i>For 15 Year Warranty, Add</i>	3.00	
<i>For 20 Year Warranty, Add</i>	6.00	
<i>For 25 Year Warranty, Add</i>	8.00	
<i>For Integral Polyester Fleece-Backing, Add</i>	33.25	
07 54 23 00-0008 Thermoplastic Polyolefin (TPO) Roofing Membrane Accessories (07 54 23)		
07 54 23 00-0009 SQ Acrylic, TPO Roofing Primer, Price Per Coat..... <i>For Up To 10, Add</i>	46.23	
<i>For >10 To 25, Add</i>	6.73	
<i>For Tan Or Gray Color, Add</i>	5.26	
07 54 23 00-0010 SQ Acrylic Elastomeric, Surface Or Base Coating For TPO Roofing, Price Per Coat..... Note: 55% solids by volume.	40.69	
<i>For Up To 10, Add</i>	6.45	
<i>For >10 To 25, Add</i>	4.98	
<i>For Tan Or Gray Color, Add</i>	1.29	
07 54 23 00-0011 EA Up To 3" Pipe Diameter, Prefabricated TPO Pipe Cone/Boot Note: Includes attaching the boot to the membrane, caulking around the pipe and installing a draw band.	35.30	6.30
07 54 23 00-0012 EA >3" To 8" Pipe Diameter, Prefabricated TPO Pipe Cone/Boot..... Note: Includes attaching the boot to the membrane, caulking around the pipe and installing a draw band.	38.22	7.05
07 54 23 00-0013 EA 6" Diameter, Prefabricated TPO Penetration Pocket Note: Includes attaching the pocket to the membrane, sealing around the penetration and filling the pocket with pourable sealer.	67.60	7.79
07 54 23 00-0014 LF 30" Wide, TPO Walkway Protection Pad	16.98	4.30
07 54 23 00-0015 SF TPO Membrane Base Flashing.....	4.67	1.11
07 54 23 00-0016 SF TPO Curb Flashing	4.37	1.11
<i>For Tan Or Gray Color, Add</i>	0.05	
07 54 23 00-0017 SF TPO Clad Edge Metal Or Base Flashing	6.62	1.11
Note: 20 Mil TPO membrane laminated to 24 gauge galvanized steel.		
07 56 Fluid-Applied Roofing (07 50)		
07 56 00 00-0001 Neoprene Hypalon Liquid Roofing, 5 Coats (07 56)		
07 56 00 00-0002 SQ 60 Mil 5 Coat Spray-on Neoprene Hypalon Liquid Roofing <i>For Each Additional Coat, Add</i>	780.72	96.62
<i>For Each Additional Coat, Add</i>	117.11	
07 56 00 00-0003 Vinyl Spray Liquid Roofing (07 56)		
07 56 00 00-0004 SQ 2 Mil Vinyl Liquid Roofing.....	714.16	101.83
07 56 00 00-0005 SQ 4 Mil Vinyl Liquid Roofing.....	799.00	113.72
07 56 00 00-0006 Silicone Elastomeric Liquid Roofing (07 56)		
07 56 00 00-0007 SQ 65% Solids, Silicone Elastomeric Spray-on Roofing, 3 Coats, 16 Mil Per Coat.....	242.07	58.35
07 56 00 00-0008 SQ 65% Solids, Silicone Elastomeric Rolled-on Roofing, 3 Coats, 16 Mil Per Coat.....	298.62	58.35
07 56 00 00-0009 SQ 65% Solids, Silicone Elastomeric Brushed-on Roofing, 3 Coats, 16 Mil Per Coat.....	341.15	58.35

07 Thermal And Moisture Protection**07 50 Membrane Roofing****07 56 Fluid-Applied Roofing**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 56 00 00-0010 High Tensile Elastomeric Roof Coating ^(07 56)		
07 56 00 00-0011 SQ Up To 45 SQ, High Tensile Elastomeric Roof Coating (Roof Mate HT).....	64.69	
Note: Includes 20 year warranty		
07 56 00 00-0012 SQ > 45 To 100 SQ, High Tensile Elastomeric Roof Coating (Roof Mate HT).....	59.12	
Note: Includes 20 year warranty		
07 56 00 00-0013 SQ > 100 To 500 SQ, High Tensile Elastomeric Roof Coating (Roof Mate HT).....	52.57	
Note: Includes 20 year warranty		
07 56 00 00-0014 SQ > 500 SQ, High Tensile Elastomeric Roof Coating (Roof Mate HT).....	46.26	
Note: Includes 20 year warranty		
07 56 00 00-0015 Elastomeric Asphalt/Urethane Liquid Roofing Membrane ^(07 56)		
07 56 00 00-0016 SQ 90 Mil, Elastomeric Asphalt/Urethane Liquid Roofing Membrane.....	682.17	58.35
Note: Includes applying a 30 mil base coat, rolling in a stichbonded polyester reinforcing scrim and applying a 60 mil second coat.		
07 56 00 00-0017 Urethane Liquid Roofing Membrane ^(07 56)		
Note: Garland White Knight Energy Star single component urethane restoration system. 10 year warranty. Used for restoration of membrane, built up, metal and modified roofing systems.		
07 56 00 00-0018 SQ Ulti-Mat™ 38" Non-Woven Fiberglass Reinforcing Membrane For White-Knight Systems.....	43.38	
07 56 00 00-0019 LF Ulti-Mat™ 6" Non-Woven Fiberglass Reinforcing Membrane For White-Knight Systems.....	3.27	
07 56 00 00-0020 SQ White-Knight® Premium Multi-Purpose Urethane Restoration Reflective Coating For Metal, Membrane, BUR, Single-Ply (2 GAL/SQ).....	201.55	
07 56 00 00-0021 SQ White-Knight® Metal Primer One Component Metal Primer For Placement Under The White-Knight System (0.25 GAL/SQ).....	43.24	
07 56 00 00-0022 SQ White-Knight® Plus High Strength, Multi-Purpose Urethane Restoration Coating For Metal, Membrane, BUR, Single-Ply (2 GAL/SQ).....	238.75	
07 56 00 00-0023 SQ White-Knight® Plus Base Coat High Strength, Multi-Purpose Urethane Restoration Coating For Metal, Membrane, BUR, Single-Ply (0.5 GAL/SQ).....	66.66	
07 56 00 00-0024 SQ White-Knight® WC Multi-Purpose, VOC Compliant, Urethane Restoration Coating For Metal, Membrane, BUR, Single-Ply (2 GAL/SQ).....	251.55	
07 56 00 00-0025 SQ White-Star Premium, White Polyurea Restoration Adhesive For Mineral And Smooth Modified And BUR (2 GAL/SQ).....	244.35	
07 58 Roll Roofing ^(07 50)		
07 58 00 00-0001 Prepared Roll Roofing ^(07 58)		
Note: Fastened with roofing nails and roofing cement. Includes fasteners and adhesive. Excludes warranty. See CSI section 07 51 13 00-0033 for underlayment.		
07 58 00 00-0002 SQ Granule Surfaced, 90 LB, Asphalt Saturated Organic Felt Roll Roofing.....	118.55	21.61
07 59 Membrane Roofing Accessories ^(07 50)		
07 59 00 00-0001 Membrane Roofing Accessories ^(07 59)		
07 59 00 00-0002 LF Roofing Membrane Termination Bar.....	3.01	1.04
Note: Includes fasteners and caulking.		
07 60 Flashing And Sheet Metal ⁽⁰⁷⁾		
Note: Includes placement of materials on roof up to 2-1/2 stories.		
07 62 Sheet Metal Flashing And Trim ^(07 60)		
07 62 00 00-0001 Lead Flashing And Trim ^(07 62)		
07 62 00 00-0002 SF 2.5 LB/SF Sheet Lead Flashing.....	16.24	3.62
07 62 00 00-0003 SF 4 LB/SF Sheet Lead Flashing.....	21.04	3.62
07 62 00 00-0004 Copper Flashing And Trim ^(07 62)		
07 62 00 00-0005 Copper Flashing And Trim ^(07 62 00 00-0004)		
07 62 00 00-0006 SF 16 Ounce, 0.021" Thick, Copper Flashing And Trim.....	14.55	3.54
For >500 To 2,000, Deduct	-2.03	
For >2,000, Deduct	-2.41	
For Copper Valley For Steep Slope Roofing, Add	1.40	
For Wrap Around Window Panning, Add	7.00	
07 62 00 00-0007 SF 20 Ounce, 0.027" Thick, Copper Flashing And Trim.....	15.06	3.62
For >500 To 2,000, Deduct	-2.10	
For >2,000, Deduct	-2.49	
For Copper Valley For Steep Slope Roofing, Add	1.46	
For Wrap Around Window Panning, Add	7.32	
07 62 00 00-0008 SF 24 Ounce, 0.032" Thick, Copper Flashing And Trim.....	16.94	3.87
For >500 To 2,000, Deduct	-2.36	
For >2,000, Deduct	-2.82	
For Copper Valley For Steep Slope Roofing, Add	1.53	
For Wrap Around Window Panning, Add	7.66	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 62 00 00-0009 SF 32 Ounce, 0.043" Thick, Copper Flashing And Trim..... <i>For >500 To 2,000, Deduct</i> <i>For >2,000, Deduct</i> <i>For Copper Valley For Steep Slope Roofing, Add</i> <i>For Wrap Around Window Panning, Add</i>	20.42 -2.82 -3.43 1.61 8.04	4.03
07 62 00 00-0010 Stainless Steel Flashing And Trim (07 62)		
07 62 00 00-0011 Stainless Steel Flashing And Trim (07 62 00 00-0010)		
07 62 00 00-0012 SF 32 Gauge, 0.010" Thick, Stainless Steel Flashing And Trim..... <i>For Wrap Around Window Panning, Add</i> <i>For Mechanically Keyed Flashing, Add</i>	7.44 4.97 0.99	1.93
07 62 00 00-0013 SF 28 Gauge, 0.015" Thick, Stainless Steel Flashing And Trim..... <i>For Wrap Around Window Panning, Add</i> <i>For Mechanically Keyed Flashing, Add</i>	8.67 4.97 1.48	2.26
07 62 00 00-0014 SF 26 Gauge, 0.018" Thick, Stainless Steel Flashing And Trim..... <i>For Wrap Around Window Panning, Add</i> <i>For Mechanically Keyed Flashing, Add</i>	9.92 5.30 1.85	2.66
07 62 00 00-0015 SF 24 Gauge, 0.025" Thick, Stainless Steel Flashing And Trim..... <i>For Wrap Around Window Panning, Add</i> <i>For Mechanically Keyed Flashing, Add</i>	11.75 5.59 2.46	2.82
07 62 00 00-0016 Stainless Steel Drip Edge (07 62 00 00-0010) Note: Girth (stretch-out) equals the total (flattened) width of the drip edge.		
07 62 00 00-0017 26 Gauge, Stainless Steel Drip Edge (07 62 00 00-0016)		
07 62 00 00-0018 LF Up To 5" Girth, 26 Gauge, Stainless Steel Drip Edge.....	4.36	0.72
07 62 00 00-0019 LF >5" To 7" Girth, 26 Gauge, Stainless Steel Drip Edge.....	5.33	0.72
07 62 00 00-0020 LF >7" To 9" Girth, 26 Gauge, Stainless Steel Drip Edge.....	6.06	0.72
07 62 00 00-0021 LF >9" To 12" Girth, 26 Gauge, Stainless Steel Drip Edge.....	7.27	0.72
07 62 00 00-0022 LF >12" To 15" Girth, 26 Gauge, Stainless Steel Drip Edge.....	9.22	0.72
07 62 00 00-0023 24 Gauge, Stainless Steel Drip Edge (07 62 00 00-0016)		
07 62 00 00-0024 LF Up To 5" Girth, 24 Gauge, Stainless Steel Drip Edge.....	5.27	0.72
07 62 00 00-0025 LF >5" To 7" Girth, 24 Gauge, Stainless Steel Drip Edge.....	6.55	0.72
07 62 00 00-0026 LF >7" To 9" Girth, 24 Gauge, Stainless Steel Drip Edge.....	7.52	0.72
07 62 00 00-0027 LF >9" To 12" Girth, 24 Gauge, Stainless Steel Drip Edge.....	9.11	0.72
07 62 00 00-0028 LF >12" To 15" Girth, 24 Gauge, Stainless Steel Drip Edge.....	11.66	0.72
07 62 00 00-0029 22 Gauge, Stainless Steel Drip Edge (07 62 00 00-0016)		
07 62 00 00-0030 LF Up To 5" Girth, 22 Gauge, Stainless Steel Drip Edge.....	6.35	0.72
07 62 00 00-0031 LF >5" To 7" Girth, 22 Gauge, Stainless Steel Drip Edge.....	7.99	0.72
07 62 00 00-0032 LF >7" To 9" Girth, 22 Gauge, Stainless Steel Drip Edge.....	9.22	0.72
07 62 00 00-0033 LF >9" To 12" Girth, 22 Gauge, Stainless Steel Drip Edge.....	11.27	0.72
07 62 00 00-0034 LF >12" To 15" Girth, 22 Gauge, Stainless Steel Drip Edge.....	14.54	0.72
07 62 00 00-0035 Aluminum Flashing And Trim (07 62)		
07 62 00 00-0036 Aluminum Flashing And Trim (07 62 00 00-0035)		
07 62 00 00-0037 SF 0.013" Thick, Mill Finish, Aluminum Flashing And Trim..... <i>For Baked Aluminum Colors, Add</i> <i>For Wrap Around Window Panning, Add</i>	7.66 0.21 5.55	2.50
07 62 00 00-0038 SF 0.016" Thick, Mill Finish, Aluminum Flashing And Trim..... <i>For Baked Aluminum Colors, Add</i> <i>For Wrap Around Window Panning, Add</i>	8.12 0.26 5.55	2.50
07 62 00 00-0039 SF 0.019" Thick, Mill Finish, Aluminum Flashing And Trim..... <i>For Baked Aluminum Colors, Add</i> <i>For Wrap Around Window Panning, Add</i>	8.48 0.29 5.55	2.50
07 62 00 00-0040 SF 0.024" Thick, Mill Finish, Aluminum Flashing And Trim..... <i>For Baked Aluminum Colors, Add</i> <i>For Wrap Around Window Panning, Add</i>	9.01 0.35 5.55	2.50
07 62 00 00-0041 SF 0.032" Thick, Mill Finish, Aluminum Flashing And Trim..... <i>For Baked Aluminum Colors, Add</i> <i>For Wrap Around Window Panning, Add</i>	9.75 0.42 5.55	2.50
07 62 00 00-0042 SF 0.040" Thick, Mill Finish, Aluminum Flashing And Trim..... <i>For Baked Aluminum Colors, Add</i> <i>For Wrap Around Window Panning, Add</i>	10.20 0.47 5.55	2.50
07 62 00 00-0043 SF 0.050" Thick, Mill Finish, Aluminum Flashing And Trim..... <i>For Baked Aluminum Colors, Add</i> <i>For Wrap Around Window Panning, Add</i>	10.57 0.50 5.55	2.50
07 62 00 00-0044 Aluminum Drip Edge (07 62 00 00-0035) Note: Girth (stretch-out) equals the total (flattened) width of the drip edge.		
07 62 00 00-0045 KYNAR 500® Finish, Aluminum Drip Edge (07 62 00 00-0044)		
07 62 00 00-0046 0.016" Thick, KYNAR 500® Finish, Aluminum Drip Edge (07 62 00 00-0045)		
07 62 00 00-0047 LF Up To 5" Girth, 0.016" Thick, KYNAR 500® Finish, Aluminum Drip Edge.....	3.18	0.72

07 Thermal And Moisture Protection**07 60 Flashing And Sheet Metal****07 62 Sheet Metal Flashing And Trim**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 62 00 00-0048 LF >5" To 7" Girth, 0.016" Thick, KYNAR 500® Finish, Aluminum Drip Edge	3.81	0.72
07 62 00 00-0049 LF >7" To 9" Girth, 0.016" Thick, KYNAR 500® Finish, Aluminum Drip Edge	4.18	0.72
07 62 00 00-0050 LF >9" To 12" Girth, 0.016" Thick, KYNAR 500® Finish, Aluminum Drip Edge	4.92	0.72
07 62 00 00-0051 LF >12" To 15" Girth, 0.016" Thick, KYNAR 500® Finish, Aluminum Drip Edge	6.24	0.72
07 62 00 00-0052 0.019" Thick, KYNAR 500® Finish, Aluminum Drip Edge (07 62 00 00-0045)		
07 62 00 00-0053 LF Up To 5" Girth, 0.019" Thick, KYNAR 500® Finish, Aluminum Drip Edge	3.39	0.72
07 62 00 00-0054 LF >5" To 7" Girth, 0.019" Thick, KYNAR 500® Finish, Aluminum Drip Edge	4.04	0.72
07 62 00 00-0055 LF >7" To 9" Girth, 0.019" Thick, KYNAR 500® Finish, Aluminum Drip Edge	4.53	0.72
07 62 00 00-0056 LF >9" To 12" Girth, 0.019" Thick, KYNAR 500® Finish, Aluminum Drip Edge	5.34	0.72
07 62 00 00-0057 LF >12" To 15" Girth, 0.019" Thick, KYNAR 500® Finish, Aluminum Drip Edge	6.64	0.72
07 62 00 00-0058 0.025" Thick, KYNAR 500® Finish, Aluminum Drip Edge (07 62 00 00-0045)		
07 62 00 00-0059 LF Up To 5" Girth, 0.025" Thick, KYNAR 500® Finish, Aluminum Drip Edge	3.60	0.72
07 62 00 00-0060 LF >5" To 7" Girth, 0.025" Thick, KYNAR 500® Finish, Aluminum Drip Edge	4.32	0.72
07 62 00 00-0061 LF >7" To 9" Girth, 0.025" Thick, KYNAR 500® Finish, Aluminum Drip Edge	4.86	0.72
07 62 00 00-0062 LF >9" To 12" Girth, 0.025" Thick, KYNAR 500® Finish, Aluminum Drip Edge	5.76	0.72
07 62 00 00-0063 LF >12" To 15" Girth, 0.025" Thick, KYNAR 500® Finish, Aluminum Drip Edge	7.19	0.72
07 62 00 00-0064 0.032" Thick, KYNAR 500® Finish, Aluminum Drip Edge (07 62 00 00-0045)		
07 62 00 00-0065 LF Up To 5" Girth, 0.032" Thick, KYNAR 500® Finish, Aluminum Drip Edge	4.02	0.72
07 62 00 00-0066 LF >5" To 7" Girth, 0.032" Thick, KYNAR 500® Finish, Aluminum Drip Edge	4.87	0.72
07 62 00 00-0067 LF >7" To 9" Girth, 0.032" Thick, KYNAR 500® Finish, Aluminum Drip Edge	5.52	0.72
07 62 00 00-0068 LF >9" To 12" Girth, 0.032" Thick, KYNAR 500® Finish, Aluminum Drip Edge	6.59	0.72
07 62 00 00-0069 LF >12" To 15" Girth, 0.032" Thick, KYNAR 500® Finish, Aluminum Drip Edge	8.31	0.72
07 62 00 00-0070 0.040" Thick, KYNAR 500® Finish, Aluminum Drip Edge (07 62 00 00-0045)		
07 62 00 00-0071 LF Up To 5" Girth, 0.040" Thick, KYNAR 500® Finish, Aluminum Drip Edge	4.15	0.72
07 62 00 00-0072 LF >5" To 7" Girth, 0.040" Thick, KYNAR 500® Finish, Aluminum Drip Edge	5.08	0.72
07 62 00 00-0073 LF >7" To 9" Girth, 0.040" Thick, KYNAR 500® Finish, Aluminum Drip Edge	5.74	0.72
07 62 00 00-0074 LF >9" To 12" Girth, 0.040" Thick, KYNAR 500® Finish, Aluminum Drip Edge	6.87	0.72
07 62 00 00-0075 LF >12" To 15" Girth, 0.040" Thick, KYNAR 500® Finish, Aluminum Drip Edge	8.68	0.72
07 62 00 00-0076 0.050" Thick, KYNAR 500® Finish, Aluminum Drip Edge (07 62 00 00-0045)		
07 62 00 00-0077 LF Up To 5" Girth, 0.050" Thick, KYNAR 500® Finish, Aluminum Drip Edge	4.64	0.72
07 62 00 00-0078 LF >5" To 7" Girth, 0.050" Thick, KYNAR 500® Finish, Aluminum Drip Edge	5.71	0.72
07 62 00 00-0079 LF >7" To 9" Girth, 0.050" Thick, KYNAR 500® Finish, Aluminum Drip Edge	6.51	0.72
07 62 00 00-0080 LF >9" To 12" Girth, 0.050" Thick, KYNAR 500® Finish, Aluminum Drip Edge	7.84	0.72
07 62 00 00-0081 LF >12" To 15" Girth, 0.050" Thick, KYNAR 500® Finish, Aluminum Drip Edge	9.98	0.72
07 62 00 00-0082 0.063" Thick, KYNAR 500® Finish, Aluminum Drip Edge (07 62 00 00-0045)		
07 62 00 00-0083 LF Up To 5" Girth, 0.063" Thick, KYNAR 500® Finish, Aluminum Drip Edge	5.34	0.72
07 62 00 00-0084 LF >5" To 7" Girth, 0.063" Thick, KYNAR 500® Finish, Aluminum Drip Edge	6.64	0.72
07 62 00 00-0085 LF >7" To 9" Girth, 0.063" Thick, KYNAR 500® Finish, Aluminum Drip Edge	7.61	0.72
07 62 00 00-0086 LF >9" To 12" Girth, 0.063" Thick, KYNAR 500® Finish, Aluminum Drip Edge	9.24	0.72
07 62 00 00-0087 LF >12" To 15" Girth, 0.063" Thick, KYNAR 500® Finish, Aluminum Drip Edge	11.83	0.72
07 62 00 00-0088 0.080" Thick, KYNAR 500® Finish, Aluminum Drip Edge (07 62 00 00-0045)		
07 62 00 00-0089 LF Up To 5" Girth, 0.080" Thick, KYNAR 500® Finish, Aluminum Drip Edge	6.17	0.72
07 62 00 00-0090 LF >5" To 7" Girth, 0.080" Thick, KYNAR 500® Finish, Aluminum Drip Edge	7.75	0.72
07 62 00 00-0091 LF >7" To 9" Girth, 0.080" Thick, KYNAR 500® Finish, Aluminum Drip Edge	8.93	0.72
07 62 00 00-0092 LF >9" To 12" Girth, 0.080" Thick, KYNAR 500® Finish, Aluminum Drip Edge	10.91	0.72
07 62 00 00-0093 LF >12" To 15" Girth, 0.080" Thick, KYNAR 500® Finish, Aluminum Drip Edge	14.06	0.72
07 62 00 00-0094 Mill Finish, Aluminum Drip Edge (07 62 00 00-0044)		
07 62 00 00-0095 0.016" Thick, Mill Finish, Aluminum Drip Edge (07 62 00 00-0094)		
07 62 00 00-0096 LF Up To 5" Girth, 0.016" Thick, Mill Finish, Aluminum Drip Edge	2.64	0.72
07 62 00 00-0097 LF >5" To 7" Girth, 0.016" Thick, Mill Finish, Aluminum Drip Edge	3.07	0.72
07 62 00 00-0098 LF >7" To 9" Girth, 0.016" Thick, Mill Finish, Aluminum Drip Edge	3.33	0.72
07 62 00 00-0099 LF >9" To 12" Girth, 0.016" Thick, Mill Finish, Aluminum Drip Edge	3.84	0.72
07 62 00 00-0100 LF >12" To 15" Girth, 0.016" Thick, Mill Finish, Aluminum Drip Edge	4.75	0.72
07 62 00 00-0101 0.019" Thick, Mill Finish, Aluminum Drip Edge (07 62 00 00-0094)		
07 62 00 00-0102 LF Up To 5" Girth, 0.019" Thick, Mill Finish, Aluminum Drip Edge	2.78	0.72
07 62 00 00-0103 LF >5" To 7" Girth, 0.019" Thick, Mill Finish, Aluminum Drip Edge	3.23	0.72
07 62 00 00-0104 LF >7" To 9" Girth, 0.019" Thick, Mill Finish, Aluminum Drip Edge	3.57	0.72
07 62 00 00-0105 LF >9" To 12" Girth, 0.019" Thick, Mill Finish, Aluminum Drip Edge	4.13	0.72
07 62 00 00-0106 LF >12" To 15" Girth, 0.019" Thick, Mill Finish, Aluminum Drip Edge	5.02	0.72



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
				07 62 00 00-0107 0.025" Thick, Mill Finish, Aluminum Drip Edge <small>(07 62 00 00-0094)</small>		
				07 62 00 00-0108 LF Up To 5" Girth, 0.025" Thick, Mill Finish, Aluminum Drip Edge.....	2.93	0.72
				07 62 00 00-0109 LF >5" To 7" Girth, 0.025" Thick, Mill Finish, Aluminum Drip Edge.....	3.42	0.72
				07 62 00 00-0110 LF >7" To 9" Girth, 0.025" Thick, Mill Finish, Aluminum Drip Edge.....	3.80	0.72
				07 62 00 00-0111 LF >9" To 12" Girth, 0.025" Thick, Mill Finish, Aluminum Drip Edge.....	4.42	0.72
				07 62 00 00-0112 LF >12" To 15" Girth, 0.025" Thick, Mill Finish, Aluminum Drip Edge.....	5.41	0.72
				07 62 00 00-0113 0.032" Thick, Mill Finish, Aluminum Drip Edge <small>(07 62 00 00-0094)</small>		
				07 62 00 00-0114 LF Up To 5" Girth, 0.032" Thick, Mill Finish, Aluminum Drip Edge.....	3.22	0.72
				07 62 00 00-0115 LF >5" To 7" Girth, 0.032" Thick, Mill Finish, Aluminum Drip Edge.....	3.81	0.72
				07 62 00 00-0116 LF >7" To 9" Girth, 0.032" Thick, Mill Finish, Aluminum Drip Edge.....	4.26	0.72
				07 62 00 00-0117 LF >9" To 12" Girth, 0.032" Thick, Mill Finish, Aluminum Drip Edge.....	4.99	0.72
				07 62 00 00-0118 LF >12" To 15" Girth, 0.032" Thick, Mill Finish, Aluminum Drip Edge.....	6.18	0.72
				07 62 00 00-0119 0.040" Thick, Mill Finish, Aluminum Drip Edge <small>(07 62 00 00-0094)</small>		
				07 62 00 00-0120 LF Up To 5" Girth, 0.040" Thick, Mill Finish, Aluminum Drip Edge.....	3.31	0.72
				07 62 00 00-0121 LF >5" To 7" Girth, 0.040" Thick, Mill Finish, Aluminum Drip Edge.....	3.95	0.72
				07 62 00 00-0122 LF >7" To 9" Girth, 0.040" Thick, Mill Finish, Aluminum Drip Edge.....	4.41	0.72
				07 62 00 00-0123 LF >9" To 12" Girth, 0.040" Thick, Mill Finish, Aluminum Drip Edge.....	5.18	0.72
				07 62 00 00-0124 LF >12" To 15" Girth, 0.040" Thick, Mill Finish, Aluminum Drip Edge.....	6.43	0.72
				07 62 00 00-0125 0.050" Thick, Mill Finish, Aluminum Drip Edge <small>(07 62 00 00-0094)</small>		
				07 62 00 00-0126 LF Up To 5" Girth, 0.050" Thick, Mill Finish, Aluminum Drip Edge.....	3.65	0.72
				07 62 00 00-0127 LF >5" To 7" Girth, 0.050" Thick, Mill Finish, Aluminum Drip Edge.....	4.38	0.72
				07 62 00 00-0128 LF >7" To 9" Girth, 0.050" Thick, Mill Finish, Aluminum Drip Edge.....	4.94	0.72
				07 62 00 00-0129 LF >9" To 12" Girth, 0.050" Thick, Mill Finish, Aluminum Drip Edge.....	5.86	0.72
				07 62 00 00-0130 LF >12" To 15" Girth, 0.050" Thick, Mill Finish, Aluminum Drip Edge.....	7.33	0.72
				07 62 00 00-0131 0.063" Thick, Mill Finish, Aluminum Drip Edge <small>(07 62 00 00-0094)</small>		
				07 62 00 00-0132 LF Up To 5" Girth, 0.063" Thick, Mill Finish, Aluminum Drip Edge.....	4.13	0.72
				07 62 00 00-0133 LF >5" To 7" Girth, 0.063" Thick, Mill Finish, Aluminum Drip Edge.....	5.02	0.72
				07 62 00 00-0134 LF >7" To 9" Girth, 0.063" Thick, Mill Finish, Aluminum Drip Edge.....	5.70	0.72
				07 62 00 00-0135 LF >9" To 12" Girth, 0.063" Thick, Mill Finish, Aluminum Drip Edge.....	6.82	0.72
				07 62 00 00-0136 LF >12" To 15" Girth, 0.063" Thick, Mill Finish, Aluminum Drip Edge.....	8.61	0.72
				07 62 00 00-0137 0.080" Thick, Mill Finish, Aluminum Drip Edge <small>(07 62 00 00-0094)</small>		
				07 62 00 00-0138 LF Up To 5" Girth, 0.080" Thick, Mill Finish, Aluminum Drip Edge.....	4.70	0.72
				07 62 00 00-0139 LF >5" To 7" Girth, 0.080" Thick, Mill Finish, Aluminum Drip Edge.....	5.79	0.72
				07 62 00 00-0140 LF >7" To 9" Girth, 0.080" Thick, Mill Finish, Aluminum Drip Edge.....	6.61	0.72
				07 62 00 00-0141 LF >9" To 12" Girth, 0.080" Thick, Mill Finish, Aluminum Drip Edge.....	7.97	0.72
				07 62 00 00-0142 LF >12" To 15" Girth, 0.080" Thick, Mill Finish, Aluminum Drip Edge.....	10.14	0.72
				07 62 00 00-0143 Clear Anodized Finish, Aluminum Drip Edge <small>(07 62 00 00-0044)</small>		
				07 62 00 00-0144 0.016" Thick, Clear Anodized Finish, Aluminum Drip Edge <small>(07 62 00 00-0143)</small>		
				07 62 00 00-0145 LF Up To 5" Girth, 0.016" Thick, Clear Anodized Finish, Aluminum Drip Edge.....	3.28	0.72
				07 62 00 00-0146 LF >5" To 7" Girth, 0.016" Thick, Clear Anodized Finish, Aluminum Drip Edge.....	3.95	0.72
				07 62 00 00-0147 LF >7" To 9" Girth, 0.016" Thick, Clear Anodized Finish, Aluminum Drip Edge.....	4.34	0.72
				07 62 00 00-0148 LF >9" To 12" Girth, 0.016" Thick, Clear Anodized Finish, Aluminum Drip Edge.....	5.13	0.72
				07 62 00 00-0149 LF >12" To 15" Girth, 0.016" Thick, Clear Anodized Finish, Aluminum Drip Edge.....	6.53	0.72
				07 62 00 00-0150 0.019" Thick, Clear Anodized Finish, Aluminum Drip Edge <small>(07 62 00 00-0143)</small>		
				07 62 00 00-0151 LF Up To 5" Girth, 0.019" Thick, Clear Anodized Finish, Aluminum Drip Edge.....	3.51	0.72
				07 62 00 00-0152 LF >5" To 7" Girth, 0.019" Thick, Clear Anodized Finish, Aluminum Drip Edge.....	4.19	0.72
				07 62 00 00-0153 LF >7" To 9" Girth, 0.019" Thick, Clear Anodized Finish, Aluminum Drip Edge.....	4.71	0.72
				07 62 00 00-0154 LF >9" To 12" Girth, 0.019" Thick, Clear Anodized Finish, Aluminum Drip Edge.....	5.57	0.72
				07 62 00 00-0155 LF >12" To 15" Girth, 0.019" Thick, Clear Anodized Finish, Aluminum Drip Edge.....	6.95	0.72
				07 62 00 00-0156 0.025" Thick, Clear Anodized Finish, Aluminum Drip Edge <small>(07 62 00 00-0143)</small>		
				07 62 00 00-0157 LF Up To 5" Girth, 0.025" Thick, Clear Anodized Finish, Aluminum Drip Edge.....	3.73	0.72
				07 62 00 00-0158 LF >5" To 7" Girth, 0.025" Thick, Clear Anodized Finish, Aluminum Drip Edge.....	4.49	0.72
				07 62 00 00-0159 LF >7" To 9" Girth, 0.025" Thick, Clear Anodized Finish, Aluminum Drip Edge.....	5.07	0.72
				07 62 00 00-0160 LF >9" To 12" Girth, 0.025" Thick, Clear Anodized Finish, Aluminum Drip Edge.....	6.01	0.72
				07 62 00 00-0161 LF >12" To 15" Girth, 0.025" Thick, Clear Anodized Finish, Aluminum Drip Edge.....	7.54	0.72
				07 62 00 00-0162 0.032" Thick, Clear Anodized Finish, Aluminum Drip Edge <small>(07 62 00 00-0143)</small>		
				07 62 00 00-0163 LF Up To 5" Girth, 0.032" Thick, Clear Anodized Finish, Aluminum Drip Edge.....	4.17	0.72
				07 62 00 00-0164 LF >5" To 7" Girth, 0.032" Thick, Clear Anodized Finish, Aluminum Drip Edge.....	5.08	0.72
				07 62 00 00-0165 LF >7" To 9" Girth, 0.032" Thick, Clear Anodized Finish, Aluminum Drip Edge.....	5.77	0.72
				07 62 00 00-0166 LF >9" To 12" Girth, 0.032" Thick, Clear Anodized Finish, Aluminum Drip Edge.....	6.90	0.72

07 Thermal And Moisture Protection**07 60 Flashing And Sheet Metal****07 62 Sheet Metal Flashing And Trim**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 62 00 00-0167 LF >12" To 15" Girth, 0.032" Thick, Clear Anodized Finish, Aluminum Drip Edge.....	8.72	0.72
07 62 00 00-0168 0.040" Thick, Clear Anodized Finish, Aluminum Drip Edge (07 62 00 00-0143)		
07 62 00 00-0169 LF Up To 5" Girth, 0.040" Thick, Clear Anodized Finish, Aluminum Drip Edge.....	4.32	0.72
07 62 00 00-0170 LF >5" To 7" Girth, 0.040" Thick, Clear Anodized Finish, Aluminum Drip Edge.....	5.30	0.72
07 62 00 00-0171 LF >7" To 9" Girth, 0.040" Thick, Clear Anodized Finish, Aluminum Drip Edge.....	6.00	0.72
07 62 00 00-0172 LF >9" To 12" Girth, 0.040" Thick, Clear Anodized Finish, Aluminum Drip Edge.....	7.19	0.72
07 62 00 00-0173 LF >12" To 15" Girth, 0.040" Thick, Clear Anodized Finish, Aluminum Drip Edge.....	9.11	0.72
07 62 00 00-0174 0.050" Thick, Clear Anodized Finish, Aluminum Drip Edge (07 62 00 00-0143)		
07 62 00 00-0175 LF Up To 5" Girth, 0.050" Thick, Clear Anodized Finish, Aluminum Drip Edge.....	4.83	0.72
07 62 00 00-0176 LF >5" To 7" Girth, 0.050" Thick, Clear Anodized Finish, Aluminum Drip Edge.....	5.96	0.72
07 62 00 00-0177 LF >7" To 9" Girth, 0.050" Thick, Clear Anodized Finish, Aluminum Drip Edge.....	6.81	0.72
07 62 00 00-0178 LF >9" To 12" Girth, 0.050" Thick, Clear Anodized Finish, Aluminum Drip Edge.....	8.23	0.72
07 62 00 00-0179 LF >12" To 15" Girth, 0.050" Thick, Clear Anodized Finish, Aluminum Drip Edge.....	10.49	0.72
07 62 00 00-0180 0.063" Thick, Clear Anodized Finish, Aluminum Drip Edge (07 62 00 00-0143)		
07 62 00 00-0181 LF Up To 5" Girth, 0.063" Thick, Clear Anodized Finish, Aluminum Drip Edge.....	5.57	0.72
07 62 00 00-0182 LF >5" To 7" Girth, 0.063" Thick, Clear Anodized Finish, Aluminum Drip Edge.....	6.95	0.72
07 62 00 00-0183 LF >7" To 9" Girth, 0.063" Thick, Clear Anodized Finish, Aluminum Drip Edge.....	7.98	0.72
07 62 00 00-0184 LF >9" To 12" Girth, 0.063" Thick, Clear Anodized Finish, Aluminum Drip Edge.....	9.70	0.72
07 62 00 00-0185 LF >12" To 15" Girth, 0.063" Thick, Clear Anodized Finish, Aluminum Drip Edge.....	12.46	0.72
07 62 00 00-0186 0.080" Thick, Clear Anodized Finish, Aluminum Drip Edge (07 62 00 00-0143)		
07 62 00 00-0187 LF Up To 5" Girth, 0.080" Thick, Clear Anodized Finish, Aluminum Drip Edge.....	6.46	0.72
07 62 00 00-0188 LF >5" To 7" Girth, 0.080" Thick, Clear Anodized Finish, Aluminum Drip Edge.....	8.13	0.72
07 62 00 00-0189 LF >7" To 9" Girth, 0.080" Thick, Clear Anodized Finish, Aluminum Drip Edge.....	9.38	0.72
07 62 00 00-0190 LF >9" To 12" Girth, 0.080" Thick, Clear Anodized Finish, Aluminum Drip Edge.....	11.47	0.72
07 62 00 00-0191 LF >12" To 15" Girth, 0.080" Thick, Clear Anodized Finish, Aluminum Drip Edge.....	14.82	0.72
07 62 00 00-0192 Steel Flashing And Trim (07 62)		
07 62 00 00-0193 Galvanized Steel Flashing And Trim (07 62 00 00-0192)		
07 62 00 00-0194 SF 26 Gauge, Galvanized Steel Flashing.....	9.48	2.58
For Wrap Around Window Panning, Add	5.59	
07 62 00 00-0195 SF 24 Gauge, Galvanized Steel Flashing.....	9.79	2.58
For Wrap Around Window Panning, Add	5.59	
07 62 00 00-0196 Galvanized Steel Drip Edge (07 62 00 00-0192)		
Note: Girth (stretch-out) equals the total (flattened) width of the drip edge.		
07 62 00 00-0197 Galvanized Steel Drip Edge (07 62 00 00-0196)		
07 62 00 00-0198 26 Gauge, Galvanized Steel Drip Edge (07 62 00 00-0197)		
07 62 00 00-0199 LF Up To 5" Girth, 26 Gauge, Galvanized Steel Drip Edge.....	2.99	0.72
07 62 00 00-0200 LF >5" To 7" Girth, 26 Gauge, Galvanized Steel Drip Edge.....	3.52	0.72
07 62 00 00-0201 LF >7" To 9" Girth, 26 Gauge, Galvanized Steel Drip Edge.....	3.90	0.72
07 62 00 00-0202 LF >9" To 12" Girth, 26 Gauge, Galvanized Steel Drip Edge.....	4.54	0.72
07 62 00 00-0203 LF >12" To 15" Girth, 26 Gauge, Galvanized Steel Drip Edge.....	5.57	0.72
07 62 00 00-0204 24 Gauge, Galvanized Steel Drip Edge (07 62 00 00-0197)		
07 62 00 00-0205 LF Up To 5" Girth, 24 Gauge, Galvanized Steel Drip Edge.....	3.22	0.72
07 62 00 00-0206 LF >5" To 7" Girth, 24 Gauge, Galvanized Steel Drip Edge.....	3.83	0.72
07 62 00 00-0207 LF >7" To 9" Girth, 24 Gauge, Galvanized Steel Drip Edge.....	4.27	0.72
07 62 00 00-0208 LF >9" To 12" Girth, 24 Gauge, Galvanized Steel Drip Edge.....	5.01	0.72
07 62 00 00-0209 LF >12" To 15" Girth, 24 Gauge, Galvanized Steel Drip Edge.....	6.19	0.72
07 62 00 00-0210 KYNAR 500® Finish, Galvanized Steel Drip Edge (07 62 00 00-0196)		
07 62 00 00-0211 26 Gauge, KYNAR 500® Finish, Galvanized Steel Drip Edge (07 62 00 00-0210)		
07 62 00 00-0212 LF Up To 5" Girth, 26 Gauge, KYNAR 500® Finish, Galvanized Steel Drip Edge.....	3.69	0.72
07 62 00 00-0213 LF >5" To 7" Girth, 26 Gauge, KYNAR 500® Finish, Galvanized Steel Drip Edge.....	4.46	0.72
07 62 00 00-0214 LF >7" To 9" Girth, 26 Gauge, KYNAR 500® Finish, Galvanized Steel Drip Edge.....	5.00	0.72
07 62 00 00-0215 LF >9" To 12" Girth, 26 Gauge, KYNAR 500® Finish, Galvanized Steel Drip Edge.....	5.94	0.72
07 62 00 00-0216 LF >12" To 15" Girth, 26 Gauge, KYNAR 500® Finish, Galvanized Steel Drip Edge.....	7.43	0.72
07 62 00 00-0217 24 Gauge, KYNAR 500® Finish, Galvanized Steel Drip Edge (07 62 00 00-0210)		
07 62 00 00-0218 LF Up To 5" Girth, 24 Gauge, KYNAR 500® Finish, Galvanized Steel Drip Edge.....	4.03	0.72
07 62 00 00-0219 LF >5" To 7" Girth, 24 Gauge, KYNAR 500® Finish, Galvanized Steel Drip Edge.....	4.91	0.72
07 62 00 00-0220 LF >7" To 9" Girth, 24 Gauge, KYNAR 500® Finish, Galvanized Steel Drip Edge.....	5.54	0.72
07 62 00 00-0221 LF >9" To 12" Girth, 24 Gauge, KYNAR 500® Finish, Galvanized Steel Drip Edge.....	6.61	0.72
07 62 00 00-0222 LF >12" To 15" Girth, 24 Gauge, KYNAR 500® Finish, Galvanized Steel Drip Edge.....	8.33	0.72



MINOR	CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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07 63 Sheet Metal Roofing Specialties (07 60)

07 63 00 00-0001 Pitch Pockets (07 63)

Note: Cut into deck, filled with non-shrink grout, includes blocking.

07 63 00 00-0002 24 Gauge Galvanized Sheet Metal, Non-Shrink Grout Filled Pitch Pockets (07 63 00 00-0001)

07 63 00 00-0003	EA 4" x 4" 24 Gauge Galvanized Sheet Metal, Non-Shrink Grout Filled Pitch Pocket.....	45.82	
	<i>For Pourable Sealer Filled, Add</i>	22.31	
	<i>For Pourable Sealer Top Filled (2" Non-Shrink Grout Topped With 2" Pourable Sealer), Add</i>	11.16	
07 63 00 00-0004	EA 6" x 6" 24 Gauge Galvanized Sheet Metal, Non-Shrink Grout Filled Pitch Pocket.....	51.74	
	<i>For Pourable Sealer Filled, Add</i>	50.21	
	<i>For Pourable Sealer Top Filled (2" Non-Shrink Grout Topped With 2" Pourable Sealer), Add</i>	25.12	
07 63 00 00-0005	EA 8" x 8" 24 Gauge Galvanized Sheet Metal, Non-Shrink Grout Filled Pitch Pocket.....	59.19	
	<i>For Pourable Sealer Filled, Add</i>	89.25	
	<i>For Pourable Sealer Top Filled (2" Non-Shrink Grout Topped With 2" Pourable Sealer), Add</i>	44.53	
07 63 00 00-0006	EA 8" x 10" 24 Gauge Galvanized Sheet Metal, Non-Shrink Grout Filled Pitch Pocket.....	63.64	
	<i>For Pourable Sealer Filled, Add</i>	111.56	
	<i>For Pourable Sealer Top Filled (2" Non-Shrink Grout Topped With 2" Pourable Sealer), Add</i>	55.82	
07 63 00 00-0007	EA 8" x 12" 24 Gauge Galvanized Sheet Metal, Non-Shrink Grout Filled Pitch Pocket.....	67.52	
	<i>For Pourable Sealer Filled, Add</i>	133.87	
	<i>For Pourable Sealer Top Filled (2" Non-Shrink Grout Topped With 2" Pourable Sealer), Add</i>	66.94	
07 63 00 00-0008	SF 24 Gauge Galvanized Sheet Metal, Non-Shrink Grout Filled Pitch Pocket.....	74.05	
	<i>For Pourable Sealer Filled, Add</i>	200.80	
	<i>For Pourable Sealer Top Filled (2" Non-Shrink Grout Topped With 2" Pourable Sealer), Add</i>	100.18	

07 63 00 00-0009 16 Ounce Copper Sheet Metal, Non-Shrink Grout Filled Pitch Pockets (07 63 00 00-0001)

07 63 00 00-0010	EA 4" x 4" 16 Ounce Copper Sheet Metal, Non-Shrink Grout Filled Pitch Pocket.....	66.22	
	<i>For Pourable Sealer Filled, Add</i>	22.31	
	<i>For Pourable Sealer Top Filled (2" Non-Shrink Grout Topped With 2" Pourable Sealer), Add</i>	11.16	
07 63 00 00-0011	EA 6" x 6" 16 Ounce Copper Sheet Metal, Non-Shrink Grout Filled Pitch Pocket.....	75.53	
	<i>For Pourable Sealer Filled, Add</i>	50.21	
	<i>For Pourable Sealer Top Filled (2" Non-Shrink Grout Topped With 2" Pourable Sealer), Add</i>	25.12	
07 63 00 00-0012	EA 8" x 8" 16 Ounce Copper Sheet Metal, Non-Shrink Grout Filled Pitch Pocket.....	87.20	
	<i>For Pourable Sealer Filled, Add</i>	89.25	
	<i>For Pourable Sealer Top Filled (2" Non-Shrink Grout Topped With 2" Pourable Sealer), Add</i>	44.53	
07 63 00 00-0013	EA 8" x 10" 16 Ounce Copper Sheet Metal, Non-Shrink Grout Filled Pitch Pocket.....	94.53	
	<i>For Pourable Sealer Filled, Add</i>	111.56	
	<i>For Pourable Sealer Top Filled (2" Non-Shrink Grout Topped With 2" Pourable Sealer), Add</i>	55.82	
07 63 00 00-0014	EA 8" x 12" 16 Ounce Copper Sheet Metal, Non-Shrink Grout Filled Pitch Pocket.....	99.48	
	<i>For Pourable Sealer Filled, Add</i>	133.87	
	<i>For Pourable Sealer Top Filled (2" Non-Shrink Grout Topped With 2" Pourable Sealer), Add</i>	66.94	
07 63 00 00-0015	SF 16 Ounce Copper Sheet Metal, Non-Shrink Grout Filled Pitch Pocket.....	108.10	
	<i>For Pourable Sealer Filled, Add</i>	200.80	
	<i>For Pourable Sealer Top Filled (2" Non-Shrink Grout Topped With 2" Pourable Sealer), Add</i>	100.18	

07 63 00 00-0016 24 Gauge Stainless Steel Sheet Metal, Non-Shrink Grout Filled Pitch Pockets (07 63 00 00-0001)

07 63 00 00-0017	EA 4" x 4" 24 Gauge Stainless Steel Sheet Metal, Non-Shrink Grout Filled Pitch Pocket.....	57.22	
	<i>For Pourable Sealer Filled, Add</i>	22.31	
	<i>For Pourable Sealer Top Filled (2" Non-Shrink Grout Topped With 2" Pourable Sealer), Add</i>	11.16	
07 63 00 00-0018	EA 6" x 6" 24 Gauge Stainless Steel Sheet Metal, Non-Shrink Grout Filled Pitch Pocket.....	64.60	
	<i>For Pourable Sealer Filled, Add</i>	50.21	
	<i>For Pourable Sealer Top Filled (2" Non-Shrink Grout Topped With 2" Pourable Sealer), Add</i>	25.12	
07 63 00 00-0019	EA 8" x 8" 24 Gauge Stainless Steel Sheet Metal, Non-Shrink Grout Filled Pitch Pocket.....	70.80	
	<i>For Pourable Sealer Filled, Add</i>	89.25	
	<i>For Pourable Sealer Top Filled (2" Non-Shrink Grout Topped With 2" Pourable Sealer), Add</i>	44.53	
07 63 00 00-0020	EA 8" x 10" 24 Gauge Stainless Steel Sheet Metal, Non-Shrink Grout Filled Pitch Pocket.....	75.02	
	<i>For Pourable Sealer Filled, Add</i>	111.56	
	<i>For Pourable Sealer Top Filled (2" Non-Shrink Grout Topped With 2" Pourable Sealer), Add</i>	55.82	
07 63 00 00-0021	EA 8" x 12" 24 Gauge Stainless Steel Sheet Metal, Non-Shrink Grout Filled Pitch Pocket.....	78.61	
	<i>For Pourable Sealer Filled, Add</i>	133.87	
	<i>For Pourable Sealer Top Filled (2" Non-Shrink Grout Topped With 2" Pourable Sealer), Add</i>	66.94	
07 63 00 00-0022	SF 24 Gauge Stainless Steel Sheet Metal, Non-Shrink Grout Filled Pitch Pocket.....	84.38	
	<i>For Pourable Sealer Filled, Add</i>	200.80	
	<i>For Pourable Sealer Top Filled (2" Non-Shrink Grout Topped With 2" Pourable Sealer), Add</i>	100.18	

07 63 00 00-0023 Clean, Repair And Refill Existing Pitch Pockets With Non-Shrink Grout (07 63 00 00-0001)

Note: Includes removing existing filler and refilling with non-shrink grout.

07 63 00 00-0024	EA Clean, Repair And Refill Existing 4" x 4" Pitch Pocket With Non-Shrink Grout.....	44.26	
	<i>For Pourable Sealer Filled, Add</i>	22.31	
	<i>For Pourable Sealer Top Filled (2" Non-Shrink Grout Topped With 2" Pourable Sealer), Add</i>	11.16	
07 63 00 00-0025	EA Clean, Repair And Refill Existing 6" x 6" Pitch Pocket With Non-Shrink Grout.....	47.01	
	<i>For Pourable Sealer Filled, Add</i>	50.21	
	<i>For Pourable Sealer Top Filled (2" Non-Shrink Grout Topped With 2" Pourable Sealer), Add</i>	25.12	
07 63 00 00-0026	EA Clean, Repair And Refill Existing 8" x 8" Pitch Pocket With Non-Shrink Grout.....	50.30	
	<i>For Pourable Sealer Filled, Add</i>	89.25	
	<i>For Pourable Sealer Top Filled (2" Non-Shrink Grout Topped With 2" Pourable Sealer), Add</i>	44.53	

07 Thermal And Moisture Protection**07 60 Flashing And Sheet Metal****07 63 Sheet Metal Roofing Specialties**

MINOR		TOTAL DIRECT	DEMOLITION
CSI	UOM DESCRIPTION	UNIT COST	UNIT COST
07 63 00 00-0027	EA Clean, Repair And Refill Existing 8" x 10" Pitch Pocket With Non-Shrink Grout <i>For Pourable Sealer Filled, Add</i> <i>For Pourable Sealer Top Filled (2" Non-Shrink Grout Topped With 2" Pourable Sealer), Add</i>	52.78 111.56 55.82	
07 63 00 00-0028	EA Clean, Repair And Refill Existing 8" x 12" Pitch Pocket With Non-Shrink Grout <i>For Pourable Sealer Filled, Add</i> <i>For Pourable Sealer Top Filled (2" Non-Shrink Grout Topped With 2" Pourable Sealer), Add</i>	55.28 133.87 66.94	
07 63 00 00-0029	SF Clean, Repair And Refill Existing Pitch Pocket With Non-Shrink Grout <i>For Pourable Sealer Filled, Add</i> <i>For Pourable Sealer Top Filled (2" Non-Shrink Grout Topped With 2" Pourable Sealer), Add</i>	59.87 200.80 100.18	
07 63 00 00-0030	Lead Pipe Flashing For Roofs <small>(07 63)</small> Note: Includes 6" skirt base.		
07 63 00 00-0031	EA 1-1/4" ID x 12" Riser Pipe, 4 LB Lead Pipe Flashing For Roofs, Fits 3/4" Pipe.....	67.71	21.00
07 63 00 00-0032	EA 1-1/2" ID x 12" Riser Pipe, 4 LB Lead Pipe Flashing For Roofs, Fits 1" Pipe.....	67.71	21.00
07 63 00 00-0033	EA 2-3/4" ID x 12" Riser Pipe, 4 LB Lead Pipe Flashing For Roofs, Fits 2" Pipe.....	82.12	21.00
07 63 00 00-0034	EA 3-3/4" ID x 12" Riser Pipe, 4 LB Lead Pipe Flashing For Roofs, Fits 3" Pipe.....	90.35	21.00
07 63 00 00-0035	EA 4-1/4" ID x 12" Riser Pipe, 4 LB Lead Pipe Flashing For Roofs, Fits 3-1/2" Pipe	94.47	21.00
07 63 00 00-0036	EA 4-3/4" ID x 12" Riser Pipe, 4 LB Lead Pipe Flashing For Roofs, Fits 4" Pipe.....	96.53	21.00
07 63 00 00-0037	EA 6-7/8" ID x 12" Riser Pipe, 4 LB Lead Pipe Flashing For Roofs, Fits 6" Pipe.....	117.11	21.00
07 63 00 00-0038	EA 8-7/8" ID x 12" Riser Pipe, 4 LB Lead Pipe Flashing For Roofs, Fits 8" Pipe.....	126.37	21.00
07 63 00 00-0039	Galvanized Metal Flashing With Neoprene Collar, Shingle Roofing <small>(07 63)</small>		
07 63 00 00-0040	EA 2" Vent Through Roof, Galvanized Metal Flashing With Neoprene Collar, Shingle Roofing	47.96	13.57
07 63 00 00-0041	EA 3" Vent Through Roof, Galvanized Metal Flashing With Neoprene Collar, Shingle Roofing	48.49	13.57
07 63 00 00-0042	EA 4" Vent Through Roof, Galvanized Metal Flashing With Neoprene Collar, Shingle Roofing	50.36	13.57
07 63 00 00-0043	EA 6" Vent Through Roof, Galvanized Metal Flashing With Neoprene Collar, Shingle Roofing	59.73	13.57
07 65 Flexible Flashing <small>(07 60)</small>			
07 65 16 Modified Bituminous Sheet Flashing <small>(07 65)</small>			
07 65 16 00-0001	Liquid Flashing System For Modified And BUR Systems <small>(07 65 16)</small> See CSI section 07 51 13 00-0036 for ceramic coated roofing granules.		
07 65 16 00-0002	SF 60 Mil, Urethane Elastomer Liquid Applied Flashing..... Note: Includes applying a 30 mil base coat, rolling in a stitchbonded polyester reinforcing scrim and applying a 30 mil second coat.	6.91	1.48
07 65 19 Plastic Sheet Flashing <small>(07 65)</small>			
07 65 19 00-0001	Plastic Flashing And Trim <small>(07 65 19)</small>		
07 65 19 00-0002	Neoprene Flashing <small>(07 65 19 00-0001)</small>		
07 65 19 00-0003	60 Mil Thick <small>(07 65 19 00-0002)</small>		
07 65 19 00-0004	LF 6" Wide Strip, 60 Mil, Neoprene Flashing	5.77	1.95
07 65 19 00-0005	LF 12" Wide Strip, 60 Mil, Neoprene Flashing	7.45	2.09
07 65 19 00-0006	LF 18" Wide Strip, 60 Mil, Neoprene Flashing	9.35	2.30
07 65 19 00-0007	LF 24" Wide Strip, 60 Mil, Neoprene Flashing	11.38	2.59
07 65 33 Plastic Flashing <small>(07 65)</small>			
07 65 33 00-0001	Neoprene Roof Boot <small>(07 65 33)</small>		
07 65 33 00-0002	EA Neoprene Roof Boot For 2" Diameter Pipe	24.91	5.98
07 65 33 00-0003	EA Neoprene Roof Boot For 3" Diameter Pipe	28.99	6.70
07 65 33 00-0004	EA Neoprene Roof Boot For 4" Diameter Pipe	31.97	7.20
07 70 Roof And Wall Specialties And Accessories <small>(07)</small>	Note: Includes placement of materials on roof up to 2-1/2 stories.		
07 71 Roof Specialties <small>(07 70)</small>			
07 71 13 Manufactured Copings <small>(07 71)</small>			
07 71 13 00-0001	Galvanized Steel Copings <small>(07 71 13)</small>		
07 71 13 00-0002	KYNAR 500® Finish, Galvanized Steel Coping System With Galvanized Steel Cleats <small>(07 71 13 00-0001)</small> Note: Stretch-out width = face height + wall thickness + back leg. Coping system includes matching joint splice plate, galvanized steel cleats and stainless steel fasteners.		
07 71 13 00-0003	LF 10" To 14" Wide (Stretch-out), 24 Gauge, KYNAR 500® Finish, Galvanized Steel Coping System With Galvanized Steel Cleats	17.63	1.56
07 71 13 00-0004	LF >14" To 16" Wide (Stretch-out), 24 Gauge, KYNAR 500® Finish, Galvanized Steel Coping System With Galvanized Steel Cleats	18.62	1.69
07 71 13 00-0005	LF >16" To 22" Wide (Stretch-out), 24 Gauge, KYNAR 500® Finish, Galvanized Steel Coping System With Galvanized Steel Cleats	21.17	1.77
07 71 13 00-0006	LF >22" To 30" Wide (Stretch-out), 24 Gauge, KYNAR 500® Finish, Galvanized Steel Coping System With Galvanized Steel Cleats	24.55	1.95



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 71 13 00-0007 LF >30" To 42" Wide (Stretch-out), 24 Gauge, KYNAR 500® Finish, Galvanized Steel Coping System With Galvanized Steel Cleats	29.55	2.03
07 71 13 00-0008 Aluminum Copings <small>(07 71 13)</small>		
07 71 13 00-0009 Mill Finish, Aluminum Coping System With Galvanized Steel Cleats <small>(07 71 13 00-0009)</small>		
<small>Note: Stretch-out width = face height + wall thickness + back leg. Coping system includes matching joint splice plate, galvanized steel cleats and stainless steel fasteners.</small>		
07 71 13 00-0010 0.040" Thick, Mill Finish, Aluminum Coping System With Galvanized Steel Cleats <small>(07 71 13 00-0009)</small>		
07 71 13 00-0011 LF 10" To 14" Wide (Stretch-out), 0.040" Thick, Mill Finish, Aluminum Coping System With Galvanized Steel Cleats	14.12	1.56
07 71 13 00-0012 LF >14" To 16" Wide (Stretch-out), 0.040" Thick, Mill Finish, Aluminum Coping System With Galvanized Steel Cleats	15.09	1.69
07 71 13 00-0013 LF >16" To 22" Wide (Stretch-out), 0.040" Thick, Mill Finish, Aluminum Coping System With Galvanized Steel Cleats	17.51	1.77
07 71 13 00-0014 LF >22" To 30" Wide (Stretch-out), 0.040" Thick, Mill Finish, Aluminum Coping System With Galvanized Steel Cleats	20.84	1.95
07 71 13 00-0015 LF >30" To 42" Wide (Stretch-out), 0.040" Thick, Mill Finish, Aluminum Coping System With Galvanized Steel Cleats	25.75	2.03
07 71 13 00-0016 0.050" Thick, Mill Finish, Aluminum Coping System With Galvanized Steel Cleats <small>(07 71 13 00-0009)</small>		
07 71 13 00-0017 LF 10" To 14" Wide (Stretch-out), 0.050" Thick, Mill Finish, Aluminum Coping System With Galvanized Steel Cleats	15.27	1.56
07 71 13 00-0018 LF >14" To 16" Wide (Stretch-out), 0.050" Thick, Mill Finish, Aluminum Coping System With Galvanized Steel Cleats	16.32	1.69
07 71 13 00-0019 LF >16" To 22" Wide (Stretch-out), 0.050" Thick, Mill Finish, Aluminum Coping System With Galvanized Steel Cleats	18.96	1.77
07 71 13 00-0020 LF >22" To 30" Wide (Stretch-out), 0.050" Thick, Mill Finish, Aluminum Coping System With Galvanized Steel Cleats	22.60	1.95
07 71 13 00-0021 LF >30" To 42" Wide (Stretch-out), 0.050" Thick, Mill Finish, Aluminum Coping System With Galvanized Steel Cleats	27.98	2.03
07 71 13 00-0022 0.063" Thick, Mill Finish, Aluminum Coping System With Galvanized Steel Cleats <small>(07 71 13 00-0009)</small>		
07 71 13 00-0023 LF 10" To 14" Wide (Stretch-out), 0.063" Thick, Mill Finish, Aluminum Coping System With Galvanized Steel Cleats	16.22	1.56
07 71 13 00-0024 LF >14" To 16" Wide (Stretch-out), 0.063" Thick, Mill Finish, Aluminum Coping System With Galvanized Steel Cleats	17.41	1.69
07 71 13 00-0025 LF >16" To 22" Wide (Stretch-out), 0.063" Thick, Mill Finish, Aluminum Coping System With Galvanized Steel Cleats	20.77	1.77
07 71 13 00-0026 LF >22" To 30" Wide (Stretch-out), 0.063" Thick, Mill Finish, Aluminum Coping System With Galvanized Steel Cleats	25.84	1.95
07 71 13 00-0027 LF >30" To 42" Wide (Stretch-out), 0.063" Thick, Mill Finish, Aluminum Coping System With Galvanized Steel Cleats	33.23	2.03
07 71 13 00-0028 KYNAR 500® Finish, Aluminum Coping System With Galvanized Steel Cleats <small>(07 71 13 00-0008)</small>		
<small>Note: Stretch-out width = face height + wall thickness + back leg. Coping system includes matching joint splice plate, galvanized steel cleats and stainless steel fasteners.</small>		
07 71 13 00-0029 0.040" Thick, KYNAR 500® Finish, Aluminum Coping System With Galvanized Steel Cleats <small>(07 71 13 00-0028)</small>		
07 71 13 00-0030 LF 10" To 14" Wide (Stretch-out), 0.040" Thick, KYNAR 500® Finish, Aluminum Coping System With Galvanized Steel Cleats	19.31	1.56
07 71 13 00-0031 LF >14" To 16" Wide (Stretch-out), 0.040" Thick, KYNAR 500® Finish, Aluminum Coping System With Galvanized Steel Cleats	20.62	1.69
07 71 13 00-0032 LF >16" To 22" Wide (Stretch-out), 0.040" Thick, KYNAR 500® Finish, Aluminum Coping System With Galvanized Steel Cleats	24.06	1.77
07 71 13 00-0033 LF >22" To 30" Wide (Stretch-out), 0.040" Thick, KYNAR 500® Finish, Aluminum Coping System With Galvanized Steel Cleats	28.76	1.95
07 71 13 00-0034 LF >30" To 42" Wide (Stretch-out), 0.040" Thick, KYNAR 500® Finish, Aluminum Coping System With Galvanized Steel Cleats	35.81	2.03
07 71 13 00-0035 0.050" Thick, KYNAR 500® Finish, Aluminum Coping System With Galvanized Steel Cleats <small>(07 71 13 00-0028)</small>		
07 71 13 00-0036 LF 10" To 14" Wide (Stretch-out), 0.050" Thick, KYNAR 500® Finish, Aluminum Coping System With Galvanized Steel Cleats	20.98	1.56
07 71 13 00-0037 LF >14" To 16" Wide (Stretch-out), 0.050" Thick, KYNAR 500® Finish, Aluminum Coping System With Galvanized Steel Cleats	22.40	1.69
07 71 13 00-0038 LF >16" To 22" Wide (Stretch-out), 0.050" Thick, KYNAR 500® Finish, Aluminum Coping System With Galvanized Steel Cleats	26.17	1.77
07 71 13 00-0039 LF >22" To 30" Wide (Stretch-out), 0.050" Thick, KYNAR 500® Finish, Aluminum Coping System With Galvanized Steel Cleats	31.31	1.95
07 71 13 00-0040 LF >30" To 42" Wide (Stretch-out), 0.050" Thick, KYNAR 500® Finish, Aluminum Coping System With Galvanized Steel Cleats	39.05	2.03
07 71 13 00-0041 0.063" Thick, KYNAR 500® Finish, Aluminum Coping System With Galvanized Steel Cleats <small>(07 71 13 00-0028)</small>		
07 71 13 00-0042 LF 10" To 14" Wide (Stretch-out), 0.063" Thick, KYNAR 500® Finish, Aluminum Coping System With Galvanized Steel Cleats	22.36	1.56
07 71 13 00-0043 LF >14" To 16" Wide (Stretch-out), 0.063" Thick, KYNAR 500® Finish, Aluminum Coping System With Galvanized Steel Cleats	23.99	1.69
07 71 13 00-0044 LF >16" To 22" Wide (Stretch-out), 0.063" Thick, KYNAR 500® Finish, Aluminum Coping System With Galvanized Steel Cleats	28.80	1.77
07 71 13 00-0045 LF >22" To 30" Wide (Stretch-out), 0.063" Thick, KYNAR 500® Finish, Aluminum Coping System With Galvanized Steel Cleats	36.02	1.95

07	Thermal And Moisture Protection
07 70	Roof And Wall Specialties And Accessories
07 71	Roof Specialties



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 71 13 00-0046	LF		>30" To 42" Wide (Stretch-out), 0.063" Thick, KYNAR 500® Finish, Aluminum Coping System With Galvanized Steel Cleats.....	46.66	2.03
07 71 13 00-0047			Clear Anodized Finish, Aluminum Coping System With Galvanized Steel Cleats (07 71 13 00-0008) Note: Stretch-out width = face height + wall thickness + back leg. Coping system includes matching joint splice plate, galvanized steel cleats and stainless steel fasteners.		
07 71 13 00-0048			0.040" Thick, Clear Anodized Finish, Aluminum Coping System With Galvanized Steel Cleats (07 71 13 00-0047)		
07 71 13 00-0049	LF		10" To 14" Wide (Stretch-out), 0.040" Thick, Clear Anodized Finish, Aluminum Coping System With Galvanized Steel Cleats.....	20.31	1.56
07 71 13 00-0050	LF		>14" To 16" Wide (Stretch-out), 0.040" Thick, Clear Anodized Finish, Aluminum Coping System With Galvanized Steel Cleats.....	21.68	1.69
07 71 13 00-0051	LF		>16" To 22" Wide (Stretch-out), 0.040" Thick, Clear Anodized Finish, Aluminum Coping System With Galvanized Steel Cleats.....	25.33	1.77
07 71 13 00-0052	LF		>22" To 30" Wide (Stretch-out), 0.040" Thick, Clear Anodized Finish, Aluminum Coping System With Galvanized Steel Cleats.....	30.29	1.95
07 71 13 00-0053	LF		>30" To 42" Wide (Stretch-out), 0.040" Thick, Clear Anodized Finish, Aluminum Coping System With Galvanized Steel Cleats.....	37.75	2.03
07 71 13 00-0054			0.050" Thick, Clear Anodized Finish, Aluminum Coping System With Galvanized Steel Cleats (07 71 13 00-0047)		
07 71 13 00-0055	LF		10" To 14" Wide (Stretch-out), 0.050" Thick, Clear Anodized Finish, Aluminum Coping System With Galvanized Steel Cleats.....	22.09	1.56
07 71 13 00-0056	LF		>14" To 16" Wide (Stretch-out), 0.050" Thick, Clear Anodized Finish, Aluminum Coping System With Galvanized Steel Cleats.....	23.57	1.69
07 71 13 00-0057	LF		>16" To 22" Wide (Stretch-out), 0.050" Thick, Clear Anodized Finish, Aluminum Coping System With Galvanized Steel Cleats.....	27.56	1.77
07 71 13 00-0058	LF		>22" To 30" Wide (Stretch-out), 0.050" Thick, Clear Anodized Finish, Aluminum Coping System With Galvanized Steel Cleats.....	33.00	1.95
07 71 13 00-0059	LF		>30" To 42" Wide (Stretch-out), 0.050" Thick, Clear Anodized Finish, Aluminum Coping System With Galvanized Steel Cleats.....	41.19	2.03
07 71 13 00-0060			0.063" Thick, Clear Anodized Finish, Aluminum Coping System With Galvanized Steel Cleats (07 71 13 00-0047)		
07 71 13 00-0061	LF		10" To 14" Wide (Stretch-out), 0.063" Thick, Clear Anodized Finish, Aluminum Coping System With Galvanized Steel Cleats.....	23.54	1.56
07 71 13 00-0062	LF		>14" To 16" Wide (Stretch-out), 0.063" Thick, Clear Anodized Finish, Aluminum Coping System With Galvanized Steel Cleats.....	25.26	1.69
07 71 13 00-0063	LF		>16" To 22" Wide (Stretch-out), 0.063" Thick, Clear Anodized Finish, Aluminum Coping System With Galvanized Steel Cleats.....	30.35	1.77
07 71 13 00-0064	LF		>22" To 30" Wide (Stretch-out), 0.063" Thick, Clear Anodized Finish, Aluminum Coping System With Galvanized Steel Cleats.....	37.98	1.95
07 71 13 00-0065	LF		>30" To 42" Wide (Stretch-out), 0.063" Thick, Clear Anodized Finish, Aluminum Coping System With Galvanized Steel Cleats.....	49.26	2.03
07 71 13 00-0066			Remove And Reinstall Metal Coping (07 71 13)		
07 71 13 00-0067	LF		Remove And Reinstall Metal Coping.....	5.59	
07 71 19			Manufactured Gravel Stops And Fasciae (07 71)		
07 71 19 00-0001			Gravel Stop (07 71 19)		
07 71 19 00-0002			Aluminum Gravel Stop (07 71 19 00-0001)		
07 71 19 00-0003			Aluminum Gravel Stop (07 71 19 00-0002)		
07 71 19 00-0004			KYNAR 500® Finish, Aluminum Gravel Stop (07 71 19 00-0003)		
07 71 19 00-0005			0.032" Thick, KYNAR 500® Finish, Aluminum Gravel Stop (07 71 19 00-0004)		
07 71 19 00-0006	LF		4" To 6" Face Height, 0.032" Thick, KYNAR 500® Finish, Aluminum Gravel Stop.....	10.43	1.30
07 71 19 00-0007	LF		>6" To 10" Face Height, 0.032" Thick, KYNAR 500® Finish, Aluminum Gravel Stop.....	10.58	1.34
07 71 19 00-0008	LF		>10" To 18" Face Height, 0.032" Thick, KYNAR 500® Finish, Aluminum Gravel Stop.....	10.77	1.39
07 71 19 00-0009			0.040" Thick, KYNAR 500® Finish, Aluminum Gravel Stop (07 71 19 00-0004)		
07 71 19 00-0010	LF		4" To 6" Face Height, 0.040" Thick, KYNAR 500® Finish, Aluminum Gravel Stop.....	11.01	1.30
07 71 19 00-0011	LF		>6" To 10" Face Height, 0.040" Thick, KYNAR 500® Finish, Aluminum Gravel Stop.....	11.18	1.34
07 71 19 00-0012	LF		>10" To 18" Face Height, 0.040" Thick, KYNAR 500® Finish, Aluminum Gravel Stop.....	11.40	1.39
07 71 19 00-0013			0.050" Thick, KYNAR 500® Finish, Aluminum Gravel Stop (07 71 19 00-0004)		
07 71 19 00-0014	LF		4" To 6" Face Height, 0.050" Thick, KYNAR 500® Finish, Aluminum Gravel Stop.....	11.76	1.30
07 71 19 00-0015	LF		>6" To 10" Face Height, 0.050" Thick, KYNAR 500® Finish, Aluminum Gravel Stop.....	11.90	1.34
07 71 19 00-0016	LF		>10" To 18" Face Height, 0.050" Thick, KYNAR 500® Finish, Aluminum Gravel Stop.....	12.20	1.39



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
				07 71 19 00-0017 0.063" Thick, KYNAR 500® Finish, Aluminum Gravel Stop <small>(07 71 19 00-0004)</small>		
			LF	07 71 19 00-0018 4" To 6" Face Height, 0.063" Thick, KYNAR 500® Finish, Aluminum Gravel Stop.....	12.27	1.30
			LF	07 71 19 00-0019 >6" To 10" Face Height, 0.063" Thick, KYNAR 500® Finish, Aluminum Gravel Stop.....	12.43	1.34
			LF	07 71 19 00-0020 >10" To 18" Face Height, 0.063" Thick, KYNAR 500® Finish, Aluminum Gravel Stop.....	12.76	1.39
				07 71 19 00-0021 Mill Finish, Aluminum Gravel Stop <small>(07 71 19 00-0003)</small>		
				07 71 19 00-0022 0.032" Thick, Mill Finish, Aluminum Gravel Stop <small>(07 71 19 00-0021)</small>		
			LF	07 71 19 00-0023 4" To 6" Face Height, 0.032" Thick, Mill Finish, Aluminum Gravel Stop.....	7.23	1.30
			LF	07 71 19 00-0024 >6" To 10" Face Height, 0.032" Thick, Mill Finish, Aluminum Gravel Stop.....	7.54	1.34
			LF	07 71 19 00-0025 >10" To 18" Face Height, 0.032" Thick, Mill Finish, Aluminum Gravel Stop.....	7.88	1.39
				07 71 19 00-0026 0.040" Thick, Mill Finish, Aluminum Gravel Stop <small>(07 71 19 00-0021)</small>		
			LF	07 71 19 00-0027 4" To 6" Face Height, 0.040" Thick, Mill Finish, Aluminum Gravel Stop.....	7.71	1.30
			LF	07 71 19 00-0028 >6" To 10" Face Height, 0.040" Thick, Mill Finish, Aluminum Gravel Stop.....	7.96	1.34
			LF	07 71 19 00-0029 >10" To 18" Face Height, 0.040" Thick, Mill Finish, Aluminum Gravel Stop.....	8.20	1.39
				07 71 19 00-0030 0.050" Thick, Mill Finish, Aluminum Gravel Stop <small>(07 71 19 00-0021)</small>		
			LF	07 71 19 00-0031 4" To 6" Face Height, 0.050" Thick, Mill Finish, Aluminum Gravel Stop.....	8.19	1.30
			LF	07 71 19 00-0032 >6" To 10" Face Height, 0.050" Thick, Mill Finish, Aluminum Gravel Stop.....	8.44	1.34
			LF	07 71 19 00-0033 >10" To 18" Face Height, 0.050" Thick, Mill Finish, Aluminum Gravel Stop.....	8.72	1.39
				07 71 19 00-0034 0.063" Thick, Mill Finish, Aluminum Gravel Stop <small>(07 71 19 00-0021)</small>		
			LF	07 71 19 00-0035 4" To 6" Face Height, 0.063" Thick, Mill Finish, Aluminum Gravel Stop.....	8.71	1.30
			LF	07 71 19 00-0036 >6" To 10" Face Height, 0.063" Thick, Mill Finish, Aluminum Gravel Stop.....	8.92	1.34
			LF	07 71 19 00-0037 >10" To 18" Face Height, 0.063" Thick, Mill Finish, Aluminum Gravel Stop.....	9.11	1.39
				07 71 19 00-0038 Clear Anodized Finish, Aluminum Gravel Stop <small>(07 71 19 00-0003)</small>		
				07 71 19 00-0039 0.032" Thick, Clear Anodized Finish, Aluminum Gravel Stop <small>(07 71 19 00-0038)</small>		
			LF	07 71 19 00-0040 4" To 6" Face Height, 0.032" Thick, Clear Anodized Finish, Aluminum Gravel Stop.....	12.20	1.30
			LF	07 71 19 00-0041 >6" To 10" Face Height, 0.032" Thick, Clear Anodized Finish, Aluminum Gravel Stop.....	12.43	1.34
			LF	07 71 19 00-0042 >10" To 18" Face Height, 0.032" Thick, Clear Anodized Finish, Aluminum Gravel Stop.....	12.64	1.39
				07 71 19 00-0043 0.040" Thick, Clear Anodized Finish, Aluminum Gravel Stop <small>(07 71 19 00-0038)</small>		
			LF	07 71 19 00-0044 4" To 6" Face Height, 0.040" Thick, Clear Anodized Finish, Aluminum Gravel Stop.....	12.90	1.30
			LF	07 71 19 00-0045 >6" To 10" Face Height, 0.040" Thick, Clear Anodized Finish, Aluminum Gravel Stop.....	13.16	1.34
			LF	07 71 19 00-0046 >10" To 18" Face Height, 0.040" Thick, Clear Anodized Finish, Aluminum Gravel Stop.....	13.40	1.39
				07 71 19 00-0047 0.050" Thick, Clear Anodized Finish, Aluminum Gravel Stop <small>(07 71 19 00-0038)</small>		
			LF	07 71 19 00-0048 4" To 6" Face Height, 0.050" Thick, Clear Anodized Finish, Aluminum Gravel Stop.....	13.80	1.30
			LF	07 71 19 00-0049 >6" To 10" Face Height, 0.050" Thick, Clear Anodized Finish, Aluminum Gravel Stop.....	14.02	1.34
			LF	07 71 19 00-0050 >10" To 18" Face Height, 0.050" Thick, Clear Anodized Finish, Aluminum Gravel Stop.....	14.20	1.39
				07 71 19 00-0051 0.063" Thick, Clear Anodized Finish, Aluminum Gravel Stop <small>(07 71 19 00-0038)</small>		
			LF	07 71 19 00-0052 4" To 6" Face Height, 0.063" Thick, Clear Anodized Finish, Aluminum Gravel Stop.....	14.41	1.30
			LF	07 71 19 00-0053 >6" To 10" Face Height, 0.063" Thick, Clear Anodized Finish, Aluminum Gravel Stop.....	14.66	1.34
			LF	07 71 19 00-0054 >10" To 18" Face Height, 0.063" Thick, Clear Anodized Finish, Aluminum Gravel Stop.....	14.86	1.39
				07 71 19 00-0055 Aluminum Gravel Stop System With Continuous Cleat <small>(07 71 19 00-0002)</small> Note: Includes matching joint splice plate, galvanized steel cleats and stainless steel fasteners.		
				07 71 19 00-0056 KYNAR 500® Finish, Aluminum Gravel Stop System With Continuous Cleat <small>(07 71 19 00-0055)</small>		
				07 71 19 00-0057 0.032" Thick, KYNAR 500® Finish, Aluminum Gravel Stop System With Continuous Cleat <small>(07 71 19 00-0056)</small>		
			LF	07 71 19 00-0058 4" To 6" Face Height, 0.032" Thick, KYNAR 500® Finish, Aluminum Gravel Stop System With Continuous Cleat.....	13.20	2.16
			LF	07 71 19 00-0059 >6" To 10" Face Height, 0.032" Thick, KYNAR 500® Finish, Aluminum Gravel Stop System With Continuous Cleat.....	13.73	2.23
			LF	07 71 19 00-0060 >10" To 18" Face Height, 0.032" Thick, KYNAR 500® Finish, Aluminum Gravel Stop System With Continuous Cleat.....	14.38	2.30
				07 71 19 00-0061 0.040" Thick, KYNAR 500® Finish, Aluminum Gravel Stop System With Continuous Cleat <small>(07 71 19 00-0056)</small>		
			LF	07 71 19 00-0062 4" To 6" Face Height, 0.040" Thick, KYNAR 500® Finish, Aluminum Gravel Stop System With Continuous Cleat.....	13.78	2.16
			LF	07 71 19 00-0063 >6" To 10" Face Height, 0.040" Thick, KYNAR 500® Finish, Aluminum Gravel Stop System With Continuous Cleat.....	14.33	2.23

07	Thermal And Moisture Protection
07 70	Roof And Wall Specialties And Accessories
07 71	Roof Specialties



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 71 19 00-0064 LF >10" To 18" Face Height, 0.040" Thick, KYNAR 500® Finish, Aluminum Gravel Stop System With Continuous Cleat.....	15.01	2.30
07 71 19 00-0065 0.050" Thick, KYNAR 500® Finish, Aluminum Gravel Stop System With Continuous Cleat (07 71 19 00-0056)		
07 71 19 00-0066 LF 4" To 6" Face Height, 0.050" Thick, KYNAR 500® Finish, Aluminum Gravel Stop System With Continuous Cleat	14.53	2.16
07 71 19 00-0067 LF >6" To 10" Face Height, 0.050" Thick, KYNAR 500® Finish, Aluminum Gravel Stop System With Continuous Cleat.....	15.05	2.23
07 71 19 00-0068 LF >10" To 18" Face Height, 0.050" Thick, KYNAR 500® Finish, Aluminum Gravel Stop System With Continuous Cleat.....	15.81	2.30
07 71 19 00-0069 0.063" Thick, KYNAR 500® Finish, Aluminum Gravel Stop System With Continuous Cleat (07 71 19 00-0056)		
07 71 19 00-0070 LF 4" To 6" Face Height, 0.063" Thick, KYNAR 500® Finish, Aluminum Gravel Stop System With Continuous Cleat	15.04	2.16
07 71 19 00-0071 LF >6" To 10" Face Height, 0.063" Thick, KYNAR 500® Finish, Aluminum Gravel Stop System With Continuous Cleat.....	15.58	2.23
07 71 19 00-0072 LF >10" To 18" Face Height, 0.063" Thick, KYNAR 500® Finish, Aluminum Gravel Stop System With Continuous Cleat.....	16.37	2.30
07 71 19 00-0073 Mill Finish, Aluminum Gravel Stop System With Continuous Cleat (07 71 19 00-0055)		
07 71 19 00-0074 0.032" Thick, Mill Finish, Aluminum Gravel Stop System With Continuous Cleat (07 71 19 00-0073)		
07 71 19 00-0075 LF 4" To 6" Face Height, 0.032" Thick, Mill Finish, Aluminum Gravel Stop System With Continuous Cleat	10.44	2.16
07 71 19 00-0076 LF >6" To 10" Face Height, 0.032" Thick, Mill Finish, Aluminum Gravel Stop System With Continuous Cleat.....	10.86	2.23
07 71 19 00-0077 LF >10" To 18" Face Height, 0.032" Thick, Mill Finish, Aluminum Gravel Stop System With Continuous Cleat.....	11.37	2.30
07 71 19 00-0078 0.040" Thick, Mill Finish, Aluminum Gravel Stop System With Continuous Cleat (07 71 19 00-0073)		
07 71 19 00-0079 LF 4" To 6" Face Height, 0.040" Thick, Mill Finish, Aluminum Gravel Stop System With Continuous Cleat.....	10.84	2.16
07 71 19 00-0080 LF >6" To 10" Face Height, 0.040" Thick, Mill Finish, Aluminum Gravel Stop System With Continuous Cleat.....	11.27	2.23
07 71 19 00-0081 LF >10" To 18" Face Height, 0.040" Thick, Mill Finish, Aluminum Gravel Stop System With Continuous Cleat.....	11.81	2.30
07 71 19 00-0082 0.050" Thick, Mill Finish, Aluminum Gravel Stop System With Continuous Cleat (07 71 19 00-0073)		
07 71 19 00-0083 LF 4" To 6" Face Height, 0.050" Thick, Mill Finish, Aluminum Gravel Stop System With Continuous Cleat.....	11.36	2.16
07 71 19 00-0084 LF >6" To 10" Face Height, 0.050" Thick, Mill Finish, Aluminum Gravel Stop System With Continuous Cleat.....	11.77	2.23
07 71 19 00-0085 LF >10" To 18" Face Height, 0.050" Thick, Mill Finish, Aluminum Gravel Stop System With Continuous Cleat.....	12.33	2.30
07 71 19 00-0086 0.063" Thick, Mill Finish, Aluminum Gravel Stop System With Continuous Cleat (07 71 19 00-0073)		
07 71 19 00-0087 LF 4" To 6" Face Height, 0.063" Thick, Mill Finish, Aluminum Gravel Stop System With Continuous Cleat.....	11.71	2.16
07 71 19 00-0088 LF >6" To 10" Face Height, 0.063" Thick, Mill Finish, Aluminum Gravel Stop System With Continuous Cleat.....	12.13	2.23
07 71 19 00-0089 LF >10" To 18" Face Height, 0.063" Thick, Mill Finish, Aluminum Gravel Stop System With Continuous Cleat.....	12.72	2.30
07 71 19 00-0090 Clear Anodized Finish, Aluminum Gravel Stop System With Continuous Cleat (07 71 19 00-0055)		
07 71 19 00-0091 0.032" Thick, Clear Anodized Finish, Aluminum Gravel Stop System With Continuous Cleat (07 71 19 00-0090)		
07 71 19 00-0092 LF 4" To 6" Face Height, 0.032" Thick, Clear Anodized Finish, Aluminum Gravel Stop System With Continuous Cleat.....	14.97	2.16
07 71 19 00-0093 LF >6" To 10" Face Height, 0.032" Thick, Clear Anodized Finish, Aluminum Gravel Stop System With Continuous Cleat.....	15.58	2.23
07 71 19 00-0094 LF >10" To 18" Face Height, 0.032" Thick, Clear Anodized Finish, Aluminum Gravel Stop System With Continuous Cleat.....	16.25	2.30
07 71 19 00-0095 0.040" Thick, Clear Anodized Finish, Aluminum Gravel Stop System With Continuous Cleat (07 71 19 00-0090)		
07 71 19 00-0096 LF 4" To 6" Face Height, 0.040" Thick, Clear Anodized Finish, Aluminum Gravel Stop System With Continuous Cleat.....	15.67	2.16
07 71 19 00-0097 LF >6" To 10" Face Height, 0.040" Thick, Clear Anodized Finish, Aluminum Gravel Stop System With Continuous Cleat.....	16.31	2.23
07 71 19 00-0098 LF >10" To 18" Face Height, 0.040" Thick, Clear Anodized Finish, Aluminum Gravel Stop System With Continuous Cleat.....	17.01	2.30
07 71 19 00-0099 0.050" Thick, Clear Anodized Finish, Aluminum Gravel Stop System With Continuous Cleat (07 71 19 00-0090)		
07 71 19 00-0100 LF 4" To 6" Face Height, 0.050" Thick, Clear Anodized Finish, Aluminum Gravel Stop System With Continuous Cleat.....	16.57	2.16
07 71 19 00-0101 LF >6" To 10" Face Height, 0.050" Thick, Clear Anodized Finish, Aluminum Gravel Stop System With Continuous Cleat.....	17.17	2.23



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 71 19 00-0102 LF >10" To 18" Face Height, 0.050" Thick, Clear Anodized Finish, Aluminum Gravel Stop System With Continuous Cleat.....	17.81	2.30
07 71 19 00-0103 0.063" Thick, Clear Anodized Finish, Aluminum Gravel Stop System With Continuous Cleat (07 71 19 00-0090)		
07 71 19 00-0104 LF 4" To 6" Face Height, 0.063" Thick, Clear Anodized Finish, Aluminum Gravel Stop System With Continuous Cleat.....	17.18	2.16
07 71 19 00-0105 LF >6" To 10" Face Height, 0.063" Thick, Clear Anodized Finish, Aluminum Gravel Stop System With Continuous Cleat.....	17.81	2.23
07 71 19 00-0106 LF >10" To 18" Face Height, 0.063" Thick, Clear Anodized Finish, Aluminum Gravel Stop System With Continuous Cleat.....	18.47	2.30
07 71 19 00-0107 Stainless Steel Gravel Stop (07 71 19 00-0001)		
07 71 19 00-0108 Stainless Steel Gravel Stop (07 71 19 00-0107)		
07 71 19 00-0109 26 Gauge, Stainless Steel Gravel Stop (07 71 19 00-0108)		
07 71 19 00-0110 LF 4" To 6" Face Height, 26 Gauge, Stainless Steel Gravel Stop.....	8.55	1.30
07 71 19 00-0111 LF >6" To 10" Face Height, 26 Gauge, Stainless Steel Gravel Stop.....	10.65	1.34
07 71 19 00-0112 LF >10" To 18" Face Height, 26 Gauge, Stainless Steel Gravel Stop.....	15.04	1.39
07 71 19 00-0113 24 Gauge, Stainless Steel Gravel Stop (07 71 19 00-0108)		
07 71 19 00-0114 LF 4" To 6" Face Height, 24 Gauge, Stainless Steel Gravel Stop.....	10.28	1.30
07 71 19 00-0115 LF >6" To 10" Face Height, 24 Gauge, Stainless Steel Gravel Stop.....	12.96	1.34
07 71 19 00-0116 LF >10" To 18" Face Height, 24 Gauge, Stainless Steel Gravel Stop.....	18.49	1.39
07 71 19 00-0117 22 Gauge, Stainless Steel Gravel Stop (07 71 19 00-0108)		
07 71 19 00-0118 LF 4" To 6" Face Height, 22 Gauge, Stainless Steel Gravel Stop.....	12.11	1.30
07 71 19 00-0119 LF >6" To 10" Face Height, 22 Gauge, Stainless Steel Gravel Stop.....	15.41	1.34
07 71 19 00-0120 LF >10" To 18" Face Height, 22 Gauge, Stainless Steel Gravel Stop.....	22.16	1.39
07 71 19 00-0121 Stainless Steel Gravel Stop System With Continuous Cleat (07 71 19 00-0107)		
Note: Includes matching joint splice plate, galvanized steel cleats and stainless steel fasteners.		
07 71 19 00-0122 26 Gauge, Stainless Steel Gravel Stop System With Continuous Cleat (07 71 19 00-0121)		
07 71 19 00-0123 LF 4" To 6" Face Height, 26 Gauge, Stainless Steel Gravel Stop System With Continuous Cleat.....	11.45	2.16
07 71 19 00-0124 LF >6" To 10" Face Height, 26 Gauge, Stainless Steel Gravel Stop System With Continuous Cleat.....	13.97	2.23
07 71 19 00-0125 LF >10" To 18" Face Height, 26 Gauge, Stainless Steel Gravel Stop System With Continuous Cleat.....	18.87	2.30
07 71 19 00-0126 24 Gauge, Stainless Steel Gravel Stop System With Continuous Cleat (07 71 19 00-0121)		
07 71 19 00-0127 LF 4" To 6" Face Height, 24 Gauge, Stainless Steel Gravel Stop System With Continuous Cleat.....	13.18	2.16
07 71 19 00-0128 LF >6" To 10" Face Height, 24 Gauge, Stainless Steel Gravel Stop System With Continuous Cleat.....	16.28	2.23
07 71 19 00-0129 LF >10" To 18" Face Height, 24 Gauge, Stainless Steel Gravel Stop System With Continuous Cleat.....	22.32	2.30
07 71 19 00-0130 22 Gauge, Stainless Steel Gravel Stop System With Continuous Cleat (07 71 19 00-0121)		
07 71 19 00-0131 LF 4" To 6" Face Height, 22 Gauge, Stainless Steel Gravel Stop System With Continuous Cleat.....	15.01	2.16
07 71 19 00-0132 LF >6" To 10" Face Height, 22 Gauge, Stainless Steel Gravel Stop System With Continuous Cleat.....	18.73	2.23
07 71 19 00-0133 LF >10" To 18" Face Height, 22 Gauge, Stainless Steel Gravel Stop System With Continuous Cleat.....	25.99	2.30
07 71 19 00-0134 Galvanized Steel Gravel Stop (07 71 19 00-0001)		
07 71 19 00-0135 Galvanized Steel Gravel Stop (07 71 19 00-0134)		
07 71 19 00-0136 KYNAR 500® Finish, Galvanized Steel Gravel Stop (07 71 19 00-0135)		
07 71 19 00-0137 24 Gauge, KYNAR 500® Finish, Galvanized Steel Gravel Stop (07 71 19 00-0136)		
07 71 19 00-0138 LF 4" To 6" Face Height, 24 Gauge, KYNAR 500® Finish, Galvanized Steel Gravel Stop.....	9.45	1.30
07 71 19 00-0139 LF >6" To 10" Face Height, 24 Gauge, KYNAR 500® Finish, Galvanized Steel Gravel Stop.....	9.58	1.34
07 71 19 00-0140 LF >10" To 18" Face Height, 24 Gauge, KYNAR 500® Finish, Galvanized Steel Gravel Stop.....	9.80	1.39
07 71 19 00-0141 Galvanized Steel Gravel Stop System With Continuous Cleat (07 71 19 00-0134)		
Note: Includes matching joint splice plate, galvanized steel cleats and stainless steel fasteners.		
07 71 19 00-0142 KYNAR 500® Finish, Galvanized Steel Gravel Stop System With Continuous Cleat (07 71 19 00-0141)		
07 71 19 00-0143 24 Gauge, KYNAR 500® Finish, Galvanized Steel Gravel Stop System With Continuous Cleat (07 71 19 00-0142)		
07 71 19 00-0144 LF 4" To 6" Face Height, 24 Gauge, KYNAR 500® Finish, Galvanized Steel Gravel Stop System With Continuous Cleat.....	12.22	2.16
07 71 19 00-0145 LF >6" To 10" Face Height, 24 Gauge, KYNAR 500® Finish, Galvanized Steel Gravel Stop System With Continuous Cleat.....	12.73	2.23

07	07 Thermal And Moisture Protection
07 70	Roof And Wall Specialties And Accessories
07 71	Roof Specialties



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 71 19 00-0146 LF >10" To 18" Face Height, 24 Gauge, KYNAR 500® Finish, Galvanized Steel Gravel Stop System With Continuous Cleat.....	13.41	2.30
07 71 19 00-0147 Copper Gravel Stop (07 71 19 00-0001)		
07 71 19 00-0148 Copper Gravel Stop (07 71 19 00-0147)		
07 71 19 00-0149 20 Ounce, Copper Gravel Stop (07 71 19 00-0148)		
07 71 19 00-0150 LF 4" To 6" Face Height, 20 Ounce, Copper Gravel Stop.....	36.74	1.30
07 71 19 00-0151 LF >6" To 10" Face Height, 20 Ounce, Copper Gravel Stop.....	41.65	1.34
07 71 19 00-0152 LF >10" To 18" Face Height, 20 Ounce, Copper Gravel Stop.....	47.87	1.39
07 71 19 00-0153 16 Ounce, Copper Gravel Stop (07 71 19 00-0148)		
07 71 19 00-0154 LF 4" To 6" Face Height, 16 Ounce, Copper Gravel Stop.....	44.84	1.30
07 71 19 00-0155 LF >6" To 10" Face Height, 16 Ounce, Copper Gravel Stop.....	51.55	1.34
07 71 19 00-0156 LF >10" To 18" Face Height, 16 Ounce, Copper Gravel Stop.....	58.67	1.39
07 71 19 00-0157 Copper Gravel Stop System With Continuous Cleat (07 71 19 00-0147) Note: Includes matching joint splice plate, galvanized steel cleats and stainless steel fasteners.		
07 71 19 00-0158 20 Ounce, Copper Gravel Stop System With Continuous Cleat (07 71 19 00-0157)		
07 71 19 00-0159 LF 4" To 6" Face Height, 20 Ounce, Copper Gravel Stop System With Continuous Cleat	39.64	2.16
07 71 19 00-0160 LF >6" To 10" Face Height, 20 Ounce, Copper Gravel Stop System With Continuous Cleat	44.97	2.23
07 71 19 00-0161 LF >10" To 18" Face Height, 20 Ounce, Copper Gravel Stop System With Continuous Cleat	51.70	2.30
07 71 19 00-0162 16 Ounce, Copper Gravel Stop System With Continuous Cleat (07 71 19 00-0157)		
07 71 19 00-0163 LF 4" To 6" Face Height, 16 Ounce, Copper Gravel Stop System With Continuous Cleat	47.74	2.16
07 71 19 00-0164 LF >6" To 10" Face Height, 16 Ounce, Copper Gravel Stop System With Continuous Cleat	54.87	2.23
07 71 19 00-0165 LF >10" To 18" Face Height, 16 Ounce, Copper Gravel Stop System With Continuous Cleat	62.50	2.30
07 71 19 00-0166 Fascia (07 71 19)		
07 71 19 00-0167 Snap-On Cover Fascia (07 71 19 00-0166) Note: Includes matching joint splice plate, galvanized steel cleats and stainless steel fasteners.		
07 71 19 00-0168 Galvanized Steel Snap-On Cover Fascia (07 71 19 00-0167)		
07 71 19 00-0169 KYNAR 500® Finish, Galvanized Steel Snap-On Cover Fascia (07 71 19 00-0168)		
07 71 19 00-0170 24 Gauge, KYNAR 500® Finish, Galvanized Steel Snap-On Cover Fascia (07 71 19 00-0169)		
07 71 19 00-0171 LF 3" To 5" Face Height, 24 Gauge, KYNAR 500® Finish, Galvanized Steel Snap-On Cover Fascia System With Continuous Cleat.....	12.28	1.80
07 71 19 00-0172 LF >5" To 7" Face Height, 24 Gauge, KYNAR 500® Finish, Galvanized Steel Snap-On Cover Fascia System With Continuous Cleat.....	13.62	1.87
07 71 19 00-0173 LF >7" To 9" Face Height, 24 Gauge, KYNAR 500® Finish, Galvanized Steel Snap-On Cover Fascia System With Continuous Cleat.....	14.51	1.95
07 71 19 00-0174 Accessories For KYNAR 500® Finish, Galvanized Steel Snap-On Cover Fascia Systems (07 71 19 00-0169)		
07 71 19 00-0175 Fascia Sumps For KYNAR 500® Finish, Galvanized Steel Snap-On Cover Fascia Systems (07 71 19 00-0174)		
07 71 19 00-0176 EA Fascia Sump For 3" To 5" Face Height, KYNAR 500® Finish, Galvanized Steel Snap-On Cover Fascia Systems	72.84	2.52
07 71 19 00-0177 EA Fascia Sump For >5" To 7" Face Height, KYNAR 500® Finish, Galvanized Steel Snap-On Cover Fascia Systems	77.58	2.52
07 71 19 00-0178 EA Fascia Sump For >7" To 9" Face Height, KYNAR 500® Finish, Galvanized Steel Snap-On Cover Fascia Systems	80.56	2.52
07 71 19 00-0179 Fascia Spillout Scuppers For KYNAR 500® Finish, Galvanized Steel Snap-On Cover Fascia Systems (07 71 19 00-0174)		
07 71 19 00-0180 EA Fascia Spillout Scupper For 3" To 5" Face Height, KYNAR 500® Finish, Galvanized Steel Snap-On Cover Fascia Systems.....	59.92	2.52
07 71 19 00-0181 EA Fascia Spillout Scupper For >5" To 7" Face Height, KYNAR 500® Finish, Galvanized Steel Snap-On Cover Fascia Systems	62.32	2.52
07 71 19 00-0182 EA Fascia Spillout Scupper For >7" To 9" Face Height, KYNAR 500® Finish, Galvanized Steel Snap-On Cover Fascia Systems	63.77	2.52
07 71 19 00-0183 Aluminum Snap-On Cover Fascia (07 71 19 00-0167)		
07 71 19 00-0184 KYNAR 500® Finish, Aluminum Snap-On Cover Fascia System With Continuous Cleat (07 71 19 00-0183)		
07 71 19 00-0185 0.040" Thick, KYNAR 500® Finish, Aluminum Snap-On Cover Fascia System With Continuous Cleat (07 71 19 00-0184)		
07 71 19 00-0186 LF 3" To 5" Face Height, 0.040" Thick, KYNAR 500® Finish, Aluminum Snap-On Cover Fascia System With Continuous Cleat.....	13.24	1.80



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 71 19 00-0187 LF >5" To 7" Face Height, 0.040" Thick, KYNAR 500® Finish, Aluminum Snap-On Cover Fascia System With Continuous Cleat.....	14.91	1.87
07 71 19 00-0188 LF >7" To 9" Face Height, 0.040" Thick, KYNAR 500® Finish, Aluminum Snap-On Cover Fascia System With Continuous Cleat.....	15.80	1.95
07 71 19 00-0189 0.050" Thick, KYNAR 500® Finish, Aluminum Snap-On Cover Fascia System With Continuous Cleat (07 71 19 00-0184)		
07 71 19 00-0190 LF 3" To 5" Face Height, 0.050" Thick, KYNAR 500® Finish, Aluminum Snap-On Cover Fascia System With Continuous Cleat.....	13.87	1.80
07 71 19 00-0191 LF >5" To 7" Face Height, 0.050" Thick, KYNAR 500® Finish, Aluminum Snap-On Cover Fascia System With Continuous Cleat.....	15.72	1.87
07 71 19 00-0192 LF >7" To 9" Face Height, 0.050" Thick, KYNAR 500® Finish, Aluminum Snap-On Cover Fascia System With Continuous Cleat.....	16.71	1.95
07 71 19 00-0193 Accessories For KYNAR 500® Finish, Aluminum Snap-On Cover Fascia Systems (07 71 19 00-0184)		
07 71 19 00-0194 Fascia Sumps For KYNAR 500® Finish, Aluminum Snap-On Cover Fascia Systems (07 71 19 00-0193)		
07 71 19 00-0195 EA Fascia Sump For 3" To 5" Face Height, KYNAR 500® Finish, Aluminum Snap-On Cover Fascia Systems.....	81.75	2.52
07 71 19 00-0196 EA Fascia Sump For >5" To 7" Face Height, KYNAR 500® Finish, Aluminum Snap-On Cover Fascia Systems.....	88.56	2.52
07 71 19 00-0197 EA Fascia Sump For >7" To 9" Face Height, KYNAR 500® Finish, Aluminum Snap-On Cover Fascia Systems.....	91.54	2.52
07 71 19 00-0198 Fascia Spillout Scuppers For KYNAR 500® Finish, Aluminum Snap-On Cover Fascia Systems (07 71 19 00-0193)		
07 71 19 00-0199 EA Fascia Spillout Scupper For 3" To 5" Face Height, KYNAR 500® Finish, Aluminum Snap-On Cover Fascia Systems.....	64.95	2.52
07 71 19 00-0200 EA Fascia Spillout Scupper For >5" To 7" Face Height, KYNAR 500® Finish, Aluminum Snap-On Cover Fascia Systems.....	68.35	2.52
07 71 19 00-0201 EA Fascia Spillout Scupper For >7" To 9" Face Height, KYNAR 500® Finish, Aluminum Snap-On Cover Fascia Systems.....	69.83	2.52
07 71 19 00-0202 Clear Anodized Finish, Aluminum Snap-On Cover Fascia System With Continuous Cleat (07 71 19 00-0183)		
07 71 19 00-0203 0.040" Thick, Clear Anodized Finish, Aluminum Snap-On Cover Fascia System With Continuous Cleat (07 71 19 00-0202)		
07 71 19 00-0204 LF 3" To 5" Face Height, 0.040" Thick, Clear Anodized Finish, Aluminum Snap-On Cover Fascia System With Continuous Cleat.....	15.17	1.80
07 71 19 00-0205 LF >5" To 7" Face Height, 0.040" Thick, Clear Anodized Finish, Aluminum Snap-On Cover Fascia System With Continuous Cleat.....	17.14	1.87
07 71 19 00-0206 LF >7" To 9" Face Height, 0.040" Thick, Clear Anodized Finish, Aluminum Snap-On Cover Fascia System With Continuous Cleat.....	18.18	1.95
07 71 19 00-0207 0.050" Thick, Clear Anodized Finish, Aluminum Snap-On Cover Fascia System With Continuous Cleat (07 71 19 00-0202)		
07 71 19 00-0208 LF 3" To 5" Face Height, 0.050" Thick, Clear Anodized Finish, Aluminum Snap-On Cover Fascia System With Continuous Cleat.....	15.92	1.80
07 71 19 00-0209 LF >5" To 7" Face Height, 0.050" Thick, Clear Anodized Finish, Aluminum Snap-On Cover Fascia System With Continuous Cleat.....	18.11	1.87
07 71 19 00-0210 LF >7" To 9" Face Height, 0.050" Thick, Clear Anodized Finish, Aluminum Snap-On Cover Fascia System With Continuous Cleat.....	19.27	1.95
07 71 19 00-0211 Accessories For Clear Anodized Finish, Aluminum Snap-On Cover Fascia Systems (07 71 19 00-0202)		
07 71 19 00-0212 Fascia Sumps For Clear Anodized Finish, Aluminum Snap-On Cover Fascia Systems (07 71 19 00-0211)		
07 71 19 00-0213 EA Fascia Sump For 3" To 5" Face Height, Clear Anodized Finish, Aluminum Snap-On Cover Fascia Systems.....	100.92	2.52
07 71 19 00-0214 EA Fascia Sump For >5" To 7" Face Height, Clear Anodized Finish, Aluminum Snap-On Cover Fascia Systems.....	109.44	2.52
07 71 19 00-0215 EA Fascia Sump For >7" To 9" Face Height, Clear Anodized Finish, Aluminum Snap-On Cover Fascia Systems.....	113.16	2.52
07 71 19 00-0216 Fascia Spillout Scuppers For Clear Anodized Finish, Aluminum Snap-On Cover Fascia Systems (07 71 19 00-0211)		
07 71 19 00-0217 EA Fascia Spillout Scupper For 3" To 5" Face Height, Clear Anodized Finish, Aluminum Snap-On Cover Fascia Systems.....	79.93	2.52
07 71 19 00-0218 EA Fascia Spillout Scupper For >5" To 7" Face Height, Clear Anodized Finish, Aluminum Snap-On Cover Fascia Systems.....	84.17	2.52
07 71 19 00-0219 EA Fascia Spillout Scupper For >7" To 9" Face Height, Clear Anodized Finish, Aluminum Snap-On Cover Fascia Systems.....	86.03	2.52

07	Thermal And Moisture Protection
07 70	Roof And Wall Specialties And Accessories
07 71	Roof Specialties



MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

07 71 23 Manufactured Gutters And Downspouts (07 71)

Note: Includes all necessary support straps.

07 71 23 00-0001	Aluminum Gutters And Downspouts (07 71 23)		
07 71 23 00-0002	Aluminum Gutters (07 71 23 00-0001)		
	Note: Includes drop outlets, hangers and fasteners. Excludes end caps, miters and downspouts.		
07 71 23 00-0003	K-Style Aluminum Gutters (07 71 23 00-0002)		
07 71 23 00-0004	LF 5", 0.027" Thick, K-Style Aluminum Gutter	5.03	2.01
	For Kynar 500® Finish, Add	0.76	
07 71 23 00-0005	LF 6", 0.027" Thick, K-Style Aluminum Gutter	5.50	2.01
	For Kynar 500® Finish, Add	0.97	
07 71 23 00-0006	LF 5", 0.032" Thick, K-Style Aluminum Gutter	5.28	2.01
	For Kynar 500® Finish, Add	0.87	
07 71 23 00-0007	LF 6", 0.032" Thick, K-Style Aluminum Gutter	5.81	2.01
	For Kynar 500® Finish, Add	1.11	
07 71 23 00-0008	LF 7", 0.032" Thick, K-Style Aluminum Gutter	11.30	2.01
	For Kynar 500® Finish, Add	3.58	
07 71 23 00-0009	LF 8", 0.032" Thick, K-Style Aluminum Gutter	12.04	2.01
	For Kynar 500® Finish, Add	3.91	
07 71 23 00-0010	LF 8", 0.040" Thick, K-Style Aluminum Gutter	13.71	2.01
	For Kynar 500® Finish, Add	4.66	
07 71 23 00-0011	Half Round Aluminum Gutters (07 71 23 00-0002)		
07 71 23 00-0012	LF 5", 0.027" Thick, Half Round Aluminum Gutter	9.89	2.01
	For Kynar 500® Finish, Add	2.94	
07 71 23 00-0013	LF 6", 0.032" Thick, Half Round Aluminum Gutter	11.87	2.01
	For Kynar 500® Finish, Add	3.83	
07 71 23 00-0014	Box Style Aluminum Gutters (07 71 23 00-0002)		
07 71 23 00-0015	LF 6", 0.027" Thick, Box Style Aluminum Gutter	9.42	2.01
	For Kynar 500® Finish, Add	2.73	
07 71 23 00-0016	LF 6", 0.032" Thick, Box Style Aluminum Gutter	9.45	2.01
	For Kynar 500® Finish, Add	2.75	
07 71 23 00-0017	LF 7", 0.032" Thick, Box Style Aluminum Gutter	10.95	2.01
	For Kynar 500® Finish, Add	3.42	
07 71 23 00-0018	LF 8", 0.032" Thick, Box Style Aluminum Gutter	12.30	2.01
	For Kynar 500® Finish, Add	4.03	
07 71 23 00-0019	Aluminum Gutter End Caps (07 71 23 00-0001)		
07 71 23 00-0020	K-Style, Aluminum Gutter End Caps (07 71 23 00-0019)		
07 71 23 00-0021	EA 5", K-Style Aluminum Gutter End Cap	2.20	
	For Kynar 500® Finish, Add	0.27	
07 71 23 00-0022	EA 6", K-Style Aluminum Gutter End Cap	2.67	
	For Kynar 500® Finish, Add	0.48	
07 71 23 00-0023	EA 7", K-Style Aluminum Gutter End Cap	5.56	
	For Kynar 500® Finish, Add	1.78	
07 71 23 00-0024	EA 8", K-Style Aluminum Gutter End Cap	6.45	
	For Kynar 500® Finish, Add	2.18	
07 71 23 00-0025	Half Round, Aluminum Gutter End Caps (07 71 23 00-0019)		
07 71 23 00-0026	EA 5", Half Round Aluminum Gutter End Cap	3.41	
	For Kynar 500® Finish, Add	0.81	
07 71 23 00-0027	EA 6", Half Round Aluminum Gutter End Cap	5.17	
	For Kynar 500® Finish, Add	1.60	
07 71 23 00-0028	Box Style, Aluminum Gutter End Caps (07 71 23 00-0019)		
07 71 23 00-0029	EA 6", Box Style Aluminum Gutter End Cap	6.05	
	For Kynar 500® Finish, Add	2.00	
07 71 23 00-0030	EA 7", Box Style Aluminum Gutter End Cap	6.56	
	For Kynar 500® Finish, Add	2.23	
07 71 23 00-0031	EA 8", Box Style Aluminum Gutter End Cap	7.66	
	For Kynar 500® Finish, Add	2.72	
07 71 23 00-0032	Aluminum Gutter Miters (07 71 23 00-0001)		
	Note: Inside or outside miters.		
07 71 23 00-0033	K-Style, Aluminum Gutter Miters (07 71 23 00-0032)		
07 71 23 00-0034	EA 5", K-Style Aluminum Gutter Miter	7.45	
	For Kynar 500® Finish, Add	2.08	
07 71 23 00-0035	EA 6", K-Style Aluminum Gutter Miter	10.83	
	For Kynar 500® Finish, Add	3.60	
07 71 23 00-0036	EA 7", K-Style Aluminum Gutter Miter	41.36	
	For Kynar 500® Finish, Add	17.34	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 71 23 00-0037 EA 8", K-Style Aluminum Gutter Miter <i>For Kynar 500® Finish, Add</i>	44.79 18.89	
07 71 23 00-0038 Half Round, Aluminum Gutter Miters (07 71 23 00-0032)		
07 71 23 00-0039 EA 5", Half Round Aluminum Gutter Miter..... <i>For Kynar 500® Finish, Add</i>	15.94 5.90	
07 71 23 00-0040 EA 6", Half Round Aluminum Gutter Miter..... <i>For Kynar 500® Finish, Add</i>	26.98 10.87	
07 71 23 00-0041 Box Style, Aluminum Gutter Miters (07 71 23 00-0032)		
07 71 23 00-0042 EA 6", Box Style Aluminum Gutter Miter..... <i>For Kynar 500® Finish, Add</i>	33.03 13.59	
07 71 23 00-0043 EA 7", Box Style Aluminum Gutter Miter..... <i>For Kynar 500® Finish, Add</i>	51.00 21.68	
07 71 23 00-0044 EA 8", Box Style Aluminum Gutter Miter..... <i>For Kynar 500® Finish, Add</i>	55.28 23.61	
07 71 23 00-0045 Aluminum Gutter Wire Strainers (07 71 23 00-0001)		
07 71 23 00-0046 EA 3" Diameter, Round Aluminum Wire Strainer..... <i>For Kynar 500® Finish, Add</i>	8.81 2.08	2.01
07 71 23 00-0047 EA 4" Diameter, Round Aluminum Wire Strainer..... <i>For Kynar 500® Finish, Add</i>	12.70 3.83	2.01
07 71 23 00-0048 Aluminum Downspouts (07 71 23 00-0001) Note: Includes elbows, hangers and fasteners.		
07 71 23 00-0049 Round Aluminum Downspouts (07 71 23 00-0048)		
07 71 23 00-0050 LF 3" Diameter, Round Aluminum Downspout..... <i>For Kynar 500® Finish, Add</i>	4.40 1.04	1.93
07 71 23 00-0051 LF 4" Diameter, Round Aluminum Downspout..... <i>For Kynar 500® Finish, Add</i>	4.94 1.28	1.93
07 71 23 00-0052 Rectangular Aluminum Downspouts (07 71 23 00-0048)		
07 71 23 00-0053 LF 2" x 3", Rectangular Aluminum Downspout <i>For Kynar 500® Finish, Add</i>	3.27 0.53	1.93
07 71 23 00-0054 LF 3" x 4", Rectangular Aluminum Downspout <i>For Kynar 500® Finish, Add</i>	3.96 0.84	1.93
07 71 23 00-0055 LF 4" x 5", Rectangular Aluminum Downspout <i>For Kynar 500® Finish, Add</i>	6.86 2.15	1.93
07 71 23 00-0056 Aluminum Devices (07 71 23 00-0001)		
07 71 23 00-0057 EA Thru-Wall Aluminum Scupper Outlet <i>For Kynar 500® Finish, Add</i>	98.68 20.10	16.20
07 71 23 00-0058 EA Aluminum Leader/Conductor Head..... <i>For Kynar 500® Finish, Add</i>	136.41 45.18	18.01
07 71 23 00-0059 Copper Gutters And Downspouts (07 71 23)		
07 71 23 00-0060 Copper Gutters (07 71 23 00-0059) Note: Includes drop outlets, hangers and fasteners. Excludes end caps, miters and downspouts.		
07 71 23 00-0061 K-Style Copper Gutters (07 71 23 00-0060)		
07 71 23 00-0062 LF 4", 16 Ounce, K-Style Copper Gutter.....	12.01	2.01
07 71 23 00-0063 LF 5", 16 Ounce, K-Style Copper Gutter.....	17.41	2.01
07 71 23 00-0064 LF 6", 16 Ounce, K-Style Copper Gutter.....	20.87	2.01
07 71 23 00-0065 LF 5", 20 Ounce, K-Style Copper Gutter.....	22.47	2.01
07 71 23 00-0066 LF 6", 20 Ounce, K-Style Copper Gutter.....	28.03	2.01
07 71 23 00-0067 LF 7", 20 Ounce, K-Style Copper Gutter.....	32.55	2.01
07 71 23 00-0068 LF 8", 20 Ounce, K-Style Copper Gutter.....	35.88	2.01
07 71 23 00-0069 Half Round Copper Gutters (07 71 23 00-0060)		
07 71 23 00-0070 LF 5", 16 Ounce, Half Round Copper Gutter	14.78	2.01
07 71 23 00-0071 LF 6", 16 Ounce, Half Round Copper Gutter	18.91	2.01
07 71 23 00-0072 LF 7", 16 Ounce, Half Round Copper Gutter	32.64	2.01
07 71 23 00-0073 LF 5", 20 Ounce, Half Round Copper Gutter	17.54	2.01
07 71 23 00-0074 LF 6", 20 Ounce, Half Round Copper Gutter	21.84	2.01
07 71 23 00-0075 LF 7", 20 Ounce, Half Round Copper Gutter	34.43	2.01
07 71 23 00-0076 LF 8", 20 Ounce, Half Round Copper Gutter	38.86	2.01
07 71 23 00-0077 Copper Gutter End Caps (07 71 23 00-0059)		
07 71 23 00-0078 K-Style, Copper Gutter End Caps (07 71 23 00-0077)		
07 71 23 00-0079 EA 4", K-Style Copper Gutter End Cap	4.59	

07	Thermal And Moisture Protection
07 70	Roof And Wall Specialties And Accessories
07 71	Roof Specialties



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 71 23 00-080	EA		5", K-Style Copper Gutter End Cap	4.92	
07 71 23 00-081	EA		6", K-Style Copper Gutter End Cap	5.25	
07 71 23 00-082	EA		7", K-Style Copper Gutter End Cap	14.08	
07 71 23 00-083	EA		8", K-Style Copper Gutter End Cap	17.18	
07 71 23 00-084			Half Round, Copper Gutter End Caps (07 71 23 00-0077)		
07 71 23 00-085	EA		4", Half Round Copper Gutter End Cap	5.57	
07 71 23 00-086	EA		5", Half Round Copper Gutter End Cap	6.27	
07 71 23 00-087	EA		6", Half Round Copper Gutter End Cap	9.50	
07 71 23 00-088	EA		7", Half Round Copper Gutter End Cap	28.74	
07 71 23 00-089	EA		8", Half Round Copper Gutter End Cap	33.96	
07 71 23 00-090			Copper Gutter Miters (07 71 23 00-0059)		
			Note: Inside or outside miters.		
07 71 23 00-091			K-Style, Copper Gutter Miters (07 71 23 00-0090)		
07 71 23 00-092	EA		4", K-Style Copper Gutter Miter	24.95	
07 71 23 00-093	EA		5", K-Style Copper Gutter Miter	28.34	
07 71 23 00-094	EA		6", K-Style Copper Gutter Miter	42.70	
07 71 23 00-095	EA		7", K-Style Copper Gutter Miter	62.41	
07 71 23 00-096	EA		8", K-Style Copper Gutter Miter	73.73	
07 71 23 00-097			Half Round, Copper Gutter Miters (07 71 23 00-0090)		
07 71 23 00-098	EA		4", Half Round Copper Gutter Miter	41.81	
07 71 23 00-099	EA		5", Half Round Copper Gutter Miter	37.69	
07 71 23 00-100	EA		6", Half Round Copper Gutter Miter	56.22	
07 71 23 00-101	EA		7", Half Round Copper Gutter Miter	67.66	
07 71 23 00-102	EA		8", Half Round Copper Gutter Miter	80.53	
07 71 23 00-103			Copper Gutter Wire Strainers (07 71 23 00-0059)		
07 71 23 00-104	EA		2" Diameter, Round Copper Wire Strainer	11.18	2.01
07 71 23 00-105	EA		3" Diameter, Round Copper Wire Strainer	13.47	2.01
07 71 23 00-106	EA		4" Diameter, Round Copper Wire Strainer	20.96	2.01
07 71 23 00-107	EA		5" Diameter, Round Copper Wire Strainer	27.49	2.01
07 71 23 00-108	EA		6" Diameter, Round Copper Wire Strainer	32.96	2.01
07 71 23 00-109			Copper Downspouts (07 71 23 00-0059)		
			Note: Includes elbows, hangers and fasteners.		
07 71 23 00-110			Round Copper Downspouts (07 71 23 00-0109)		
07 71 23 00-111	LF		2" Diameter, 16 Ounce, Round Copper Downspout	19.19	1.93
07 71 23 00-112	LF		3" Diameter, 16 Ounce, Round Copper Downspout	13.35	1.93
07 71 23 00-113	LF		4" Diameter, 16 Ounce, Round Copper Downspout	16.84	1.93
07 71 23 00-114	LF		5" Diameter, 16 Ounce, Round Copper Downspout	26.93	1.93
07 71 23 00-115	LF		6" Diameter, 16 Ounce, Round Copper Downspout	34.64	1.93
07 71 23 00-116	LF		3" Diameter, 20 Ounce, Round Copper Downspout	18.08	1.93
07 71 23 00-117	LF		4" Diameter, 20 Ounce, Round Copper Downspout	23.47	1.93
07 71 23 00-118	LF		5" Diameter, 20 Ounce, Round Copper Downspout	35.69	1.93
07 71 23 00-119			Square Copper Downspouts (07 71 23 00-0109)		
07 71 23 00-120	LF		3" Diameter, 16 Ounce, Square Copper Downspout	9.23	1.93
07 71 23 00-121	LF		4" Diameter, 16 Ounce, Square Copper Downspout	11.55	1.93
07 71 23 00-122	LF		5" Diameter, 16 Ounce, Square Copper Downspout	16.55	1.93
07 71 23 00-123	LF		3" Diameter, 20 Ounce, Square Copper Downspout	10.67	1.93
07 71 23 00-124	LF		4" Diameter, 20 Ounce, Square Copper Downspout	13.56	1.93
07 71 23 00-125	LF		5" Diameter, 20 Ounce, Square Copper Downspout	19.49	1.93
07 71 23 00-126			Rectangular Copper Downspouts (07 71 23 00-0109)		
07 71 23 00-127	LF		2" x 3", 16 Ounce, Rectangular Copper Downspout	13.71	1.93
07 71 23 00-128	LF		3" x 4", 16 Ounce, Rectangular Copper Downspout	17.35	1.93
07 71 23 00-129	LF		4" x 5", 16 Ounce, Rectangular Copper Downspout	24.70	1.93
07 71 23 00-130	LF		2" x 3", 20 Ounce, Rectangular Copper Downspout	15.98	1.93
07 71 23 00-131	LF		3" x 4", 20 Ounce, Rectangular Copper Downspout	20.49	1.93
07 71 23 00-132	LF		4" x 5", 20 Ounce, Rectangular Copper Downspout	29.44	1.93
07 71 23 00-133			Copper Devices And Accessories (07 71 23 00-0059)		
07 71 23 00-134	EA		Thru-Wall Copper Scupper Outlet.....	151.32	16.20
07 71 23 00-135	EA		Copper Leader/Conductor Head	221.27	18.01
07 71 23 00-136	EA		Copper Eave Box.....	99.82	12.07
07 71 23 00-137			Galvanized Steel Gutters And Downspouts (07 71 23)		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 71 23 00-0138 Galvanized Steel Gutters (07 71 23 00-0137) Note: Includes drop outlets, hangers and fasteners. Excludes end caps, miters and downspouts.		
07 71 23 00-0139 K-Style Galvanized Steel Gutters (07 71 23 00-0138)		
07 71 23 00-0140 LF 5", 26 Gauge, K-Style Galvanized Steel Gutter <i>For Kynar 500® Finish, Add</i>	6.05 1.22	2.01
07 71 23 00-0141 LF 6", 26 Gauge, K-Style Galvanized Steel Gutter <i>For Kynar 500® Finish, Add</i>	6.87 1.58	2.01
07 71 23 00-0142 LF 7", 26 Gauge, K-Style Galvanized Steel Gutter <i>For Kynar 500® Finish, Add</i>	14.18 4.87	2.01
07 71 23 00-0143 LF 8", 24 Gauge, K-Style Galvanized Steel Gutter <i>For Kynar 500® Finish, Add</i>	14.59 5.06	2.01
07 71 23 00-0144 Half Round Galvanized Steel Gutters (07 71 23 00-0138)		
07 71 23 00-0145 LF 5", 26 Gauge, Half Round Galvanized Steel Gutter <i>For Kynar 500® Finish, Add</i>	8.83 2.47	2.01
07 71 23 00-0146 LF 6", 26 Gauge, Half Round Galvanized Steel Gutter <i>For Kynar 500® Finish, Add</i>	10.97 3.43	2.01
07 71 23 00-0147 LF 7", 26 Gauge, Half Round Galvanized Steel Gutter <i>For Kynar 500® Finish, Add</i>	27.63 10.93	2.01
07 71 23 00-0148 LF 8", 26 Gauge, Half Round Galvanized Steel Gutter <i>For Kynar 500® Finish, Add</i>	29.13 11.60	2.01
07 71 23 00-0149 Box Style Galvanized Steel Gutters (07 71 23 00-0138)		
07 71 23 00-0150 LF 5", 24 Gauge, Box Style Galvanized Steel Gutter <i>For Kynar 500® Finish, Add</i> <i>For 22 Gauge, Add</i>	10.08 3.03 1.01	2.01
07 71 23 00-0151 LF 6", 24 Gauge, Box Style Galvanized Steel Gutter <i>For Kynar 500® Finish, Add</i> <i>For 22 Gauge, Add</i>	11.58 3.70 1.23	2.01
07 71 23 00-0152 LF 7", 24 Gauge, Box Style Galvanized Steel Gutter <i>For Kynar 500® Finish, Add</i> <i>For 22 Gauge, Add</i>	15.25 5.36 1.79	2.01
07 71 23 00-0153 LF 8", 24 Gauge, Box Style Galvanized Steel Gutter <i>For Kynar 500® Finish, Add</i> <i>For 22 Gauge, Add</i>	16.27 5.81 1.94	2.01
07 71 23 00-0154 Galvanized Steel Gutter End Caps (07 71 23 00-0137)		
07 71 23 00-0155 K-Style, Galvanized Steel Gutter End Caps (07 71 23 00-0154)		
07 71 23 00-0156 EA 5", K-Style Galvanized Steel Gutter End Cap <i>For Kynar 500® Finish, Add</i>	3.22 0.72	
07 71 23 00-0157 EA 6", K-Style Galvanized Steel Gutter End Cap <i>For Kynar 500® Finish, Add</i>	3.65 0.92	
07 71 23 00-0158 EA 7", K-Style Galvanized Steel Gutter End Cap <i>For Kynar 500® Finish, Add</i>	7.42 2.61	
07 71 23 00-0159 EA 8", K-Style Galvanized Steel Gutter End Cap <i>For Kynar 500® Finish, Add</i>	10.58 4.04	
07 71 23 00-0160 Half Round, Galvanized Steel Gutter End Caps (07 71 23 00-0154)		
07 71 23 00-0161 EA 5", Half Round Galvanized Steel Gutter End Cap <i>For Kynar 500® Finish, Add</i>	4.03 1.09	
07 71 23 00-0162 EA 6", Half Round Galvanized Steel Gutter End Cap <i>For Kynar 500® Finish, Add</i>	4.57 1.33	
07 71 23 00-0163 EA 7", Half Round Galvanized Steel Gutter End Cap <i>For Kynar 500® Finish, Add</i>	8.15 2.94	
07 71 23 00-0164 EA 8", Half Round Galvanized Steel Gutter End Cap <i>For Kynar 500® Finish, Add</i>	10.86 4.16	
07 71 23 00-0165 Box Style, Galvanized Steel Gutter End Caps (07 71 23 00-0154)		
07 71 23 00-0166 EA 5", Box Style Galvanized Steel Gutter End Cap <i>For Kynar 500® Finish, Add</i>	6.88 2.37	
07 71 23 00-0167 EA 6", Box Style Galvanized Steel Gutter End Cap <i>For Kynar 500® Finish, Add</i>	8.20 2.97	
07 71 23 00-0168 EA 7", Box Style Galvanized Steel Gutter End Cap <i>For Kynar 500® Finish, Add</i>	9.13 3.38	
07 71 23 00-0169 EA 8", Box Style Galvanized Steel Gutter End Cap <i>For Kynar 500® Finish, Add</i>	12.09 4.72	
07 71 23 00-0170 Galvanized Steel Gutter Miters (07 71 23 00-0137) Note: Inside or outside miters.		
07 71 23 00-0171 K-Style, Galvanized Steel Gutter Miters (07 71 23 00-0170)		
07 71 23 00-0172 EA 5", K-Style Galvanized Steel Gutter Miter <i>For Kynar 500® Finish, Add</i>	13.77 4.93	
07 71 23 00-0173 EA 6", K-Style Galvanized Steel Gutter Miter <i>For Kynar 500® Finish, Add</i>	23.77 9.43	

07	Thermal And Moisture Protection
07 70	Roof And Wall Specialties And Accessories
07 71	Roof Specialties



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 71 23 00-0174	EA		7", K-Style Galvanized Steel Gutter Miter..... <i>For Kynar 500® Finish, Add</i>	39.67 16.58	
07 71 23 00-0175	EA		8", K-Style Galvanized Steel Gutter Miter..... <i>For Kynar 500® Finish, Add</i>	44.60 18.80	
07 71 23 00-0176			Half Round, Galvanized Steel Gutter Miters (07 71 23 00-0170)		
07 71 23 00-0177	EA		5", Half Round Galvanized Steel Gutter Miter..... <i>For Kynar 500® Finish, Add</i>	19.96 7.71	
07 71 23 00-0178	EA		6", Half Round Galvanized Steel Gutter Miter..... <i>For Kynar 500® Finish, Add</i>	22.40 8.81	
07 71 23 00-0179	EA		7", Half Round Galvanized Steel Gutter Miter..... <i>For Kynar 500® Finish, Add</i>	69.41 29.97	
07 71 23 00-0180	EA		8", Half Round Galvanized Steel Gutter Miter..... <i>For Kynar 500® Finish, Add</i>	73.11 31.63	
07 71 23 00-0181			Box Style, Galvanized Steel Gutter Miters (07 71 23 00-0170)		
07 71 23 00-0182	EA		5", Box Style Galvanized Steel Gutter Miter..... <i>For Kynar 500® Finish, Add</i>	18.72 7.16	
07 71 23 00-0183	EA		6", Box Style Galvanized Steel Gutter Miter..... <i>For Kynar 500® Finish, Add</i>	31.96 13.11	
07 71 23 00-0184	EA		7", Box Style Galvanized Steel Gutter Miter..... <i>For Kynar 500® Finish, Add</i>	42.13 17.69	
07 71 23 00-0185	EA		8", Box Style Galvanized Steel Gutter Miter..... <i>For Kynar 500® Finish, Add</i>	44.60 18.80	
07 71 23 00-0186			Galvanized Steel Gutter Wire Strainers (07 71 23 00-0137)		
07 71 23 00-0187	EA		3" Diameter, Round Galvanized Steel Wire Strainer..... <i>For Kynar 500® Finish, Add</i>	7.87 1.66	2.01
07 71 23 00-0188	EA		4" Diameter, Round Galvanized Steel Wire Strainer..... <i>For Kynar 500® Finish, Add</i>	11.00 3.06	2.01
07 71 23 00-0189			Galvanized Steel Downspouts (07 71 23 00-0137) Note: Includes elbows, hangers and fasteners.		
07 71 23 00-0190			Round Galvanized Steel Downspouts (07 71 23 00-0189)		
07 71 23 00-0191	LF		3" Diameter, 26 Gauge, Round Galvanized Steel Downspout..... <i>For Kynar 500® Finish, Add</i>	4.06 0.89	1.93
07 71 23 00-0192	LF		4" Diameter, 26 Gauge, Round Galvanized Steel Downspout..... <i>For Kynar 500® Finish, Add</i>	4.90 1.26	1.93
07 71 23 00-0193	LF		5" Diameter, 26 Gauge, Round Galvanized Steel Downspout..... <i>For Kynar 500® Finish, Add</i>	6.46 1.97	1.93
07 71 23 00-0194	LF		6" Diameter, 26 Gauge, Round Galvanized Steel Downspout..... <i>For Kynar 500® Finish, Add</i>	13.66 5.21	1.93
07 71 23 00-0195			Square Galvanized Steel Downspouts (07 71 23 00-0189)		
07 71 23 00-0196	LF		4" x 4", 26 Gauge, Square Galvanized Steel Downspout..... <i>For Kynar 500® Finish, Add</i>	4.53 1.10	1.93
07 71 23 00-0197	LF		5" x 5", 26 Gauge, Square Galvanized Steel Downspout..... <i>For Kynar 500® Finish, Add</i>	5.64 1.60	1.93
07 71 23 00-0198			Rectangular Galvanized Steel Downspouts (07 71 23 00-0189)		
07 71 23 00-0199	LF		2" x 3", 26 Gauge, Rectangular Galvanized Steel Downspout..... <i>For Kynar 500® Finish, Add</i>	4.12 0.91	1.93
07 71 23 00-0200	LF		3" x 4", 26 Gauge, Rectangular Galvanized Steel Downspout..... <i>For Kynar 500® Finish, Add</i>	5.10 1.35	1.93
07 71 23 00-0201	LF		4" x 5", 26 Gauge, Rectangular Galvanized Steel Downspout..... <i>For Kynar 500® Finish, Add</i>	8.96 3.09	1.93
07 71 23 00-0202			Galvanized Steel Devices (07 71 23 00-0137)		
07 71 23 00-0203	EA		Galvanized Steel Leader/Conductor Head..... <i>For Kynar 500® Finish, Add</i>	161.81 56.61	18.01
07 71 23 00-0204	EA		Thru-Wall Galvanized Steel Scupper Outlet..... <i>For Kynar 500® Finish, Add</i>	100.71 21.01	16.20
07 71 23 00-0205			Stainless Steel Gutters And Downspouts (07 71 23) Note: AISI type 304 stainless steel.		
07 71 23 00-0206			Stainless Steel Gutters (07 71 23 00-0205) Note: Includes drop outlets, hangers and fasteners. Excludes end caps, miters and downspouts.		
07 71 23 00-0207			K-Style Stainless Steel Gutters (07 71 23 00-0206)		
07 71 23 00-0208	LF		5", 0.018" Thick, K-Style Stainless Steel Gutter.....	15.44	2.01
07 71 23 00-0209	LF		6", 0.018" Thick, K-Style Stainless Steel Gutter.....	18.46	2.01



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 71 23 00-0210 Half Round Stainless Steel Gutters <small>(07 71 23 00-0206)</small>		
07 71 23 00-0211 LF 5", 0.018" Thick, Half Round Stainless Steel Gutter	21.65	2.01
07 71 23 00-0212 LF 6", 0.018" Thick, Half Round Stainless Steel Gutter	26.19	2.01
07 71 23 00-0213 Stainless Steel Gutter End Caps <small>(07 71 23 00-0205)</small>		
07 71 23 00-0214 K-Style, Stainless Steel Gutter End Caps <small>(07 71 23 00-0213)</small>		
07 71 23 00-0215 EA 5", K-Style Stainless Steel Gutter End Cap	5.39	
07 71 23 00-0216 EA 6", K-Style Stainless Steel Gutter End Cap	6.15	
07 71 23 00-0217 Half Round, Stainless Steel Gutter End Caps <small>(07 71 23 00-0213)</small>		
07 71 23 00-0218 EA 5", Half Round Stainless Steel Gutter End Cap	6.34	
07 71 23 00-0219 EA 6", Half Round Stainless Steel Gutter End Cap	7.28	
07 71 23 00-0220 Stainless Steel Gutter Miters <small>(07 71 23 00-0205)</small>		
Note: Inside or outside box miters.		
07 71 23 00-0221 K-Style, Stainless Steel Gutter Miters <small>(07 71 23 00-0220)</small>		
07 71 23 00-0222 EA 5", K-Style Stainless Steel Gutter Miter	22.35	
07 71 23 00-0223 EA 6", K-Style Stainless Steel Gutter Miter	37.48	
07 71 23 00-0224 Half Round, Stainless Steel Gutter Miters <small>(07 71 23 00-0220)</small>		
07 71 23 00-0225 EA 5", Half Round Stainless Steel Gutter Miter	60.16	
07 71 23 00-0226 EA 6", Half Round Stainless Steel Gutter Miter	74.00	
07 71 23 00-0227 Stainless Steel Gutter Wire Strainers <small>(07 71 23 00-0205)</small>		
07 71 23 00-0228 EA 3" Diameter, Round Stainless Steel Wire Strainer	23.97	2.01
07 71 23 00-0229 EA 4" Diameter, Round Stainless Steel Wire Strainer	24.51	2.01
07 71 23 00-0230 Stainless Steel Downspouts <small>(07 71 23 00-0205)</small>		
Note: Includes elbows, hangers and fasteners.		
07 71 23 00-0231 Round Stainless Steel Downspouts <small>(07 71 23 00-0230)</small>		
07 71 23 00-0232 LF 3" Diameter, 0.018" Thick, Round Stainless Steel Downspout	15.08	1.93
07 71 23 00-0233 LF 4" Diameter, 0.018" Thick, Round Stainless Steel Downspout	26.88	1.93
07 71 23 00-0234 LF 5" Diameter, 0.018" Thick, Round Stainless Steel Downspout	41.32	1.93
07 71 23 00-0235 Rectangular Stainless Steel Downspouts <small>(07 71 23 00-0230)</small>		
07 71 23 00-0236 LF 2" x 3", 0.018" Thick, Rectangular Stainless Steel Downspout	10.12	1.93
07 71 23 00-0237 LF 3" x 4", 0.018" Thick, Rectangular Stainless Steel Downspout	13.38	1.93
07 71 23 00-0238 LF 4" x 5", 0.018" Thick, Rectangular Stainless Steel Downspout	32.57	1.93
07 71 23 00-0239 Stainless Steel Devices <small>(07 71 23 00-0205)</small>		
07 71 23 00-0240 EA Thru-Wall Stainless Steel Scupper Outlet	180.79	18.11
07 71 23 00-0241 EA Stainless Steel Leader/Conductor Head	216.36	18.11
07 71 23 00-0242 Vinyl Gutters And Downspouts <small>(07 71 23)</small>		
07 71 23 00-0243 Vinyl Gutters <small>(07 71 23 00-0242)</small>		
Note: Includes drop outlets, hangers and fasteners. Excludes end caps, miters and downspouts.		
07 71 23 00-0244 K-Style Vinyl Gutters <small>(07 71 23 00-0243)</small>		
07 71 23 00-0245 LF 4", K-Style Vinyl Gutter	6.67	2.01
07 71 23 00-0246 LF 5", K-Style Vinyl Gutter	8.38	2.01
07 71 23 00-0247 Half Round Vinyl Gutters <small>(07 71 23 00-0243)</small>		
07 71 23 00-0248 LF 4", Half Round Vinyl Gutter	6.87	2.01
07 71 23 00-0249 LF 5", Half Round Vinyl Gutter	7.18	2.01
07 71 23 00-0250 Vinyl Gutter End Caps <small>(07 71 23 00-0242)</small>		
07 71 23 00-0251 K-Style, Vinyl Gutter End Caps <small>(07 71 23 00-0250)</small>		
07 71 23 00-0252 EA 4", K-Style Vinyl Gutter End Cap	4.02	
07 71 23 00-0253 EA 5", K-Style Vinyl Gutter End Cap	5.44	
07 71 23 00-0254 Half Round, Vinyl Gutter End Caps <small>(07 71 23 00-0250)</small>		
07 71 23 00-0255 EA 4", Half Round Vinyl Gutter End Cap	4.54	
07 71 23 00-0256 EA 5", Half Round Vinyl Gutter End Cap	4.31	

07	Thermal And Moisture Protection
07 70	Roof And Wall Specialties And Accessories
07 71	Roof Specialties



MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

07 71 23 00-0257	Vinyl Gutter Miters <small>(07 71 23 00-0242)</small> Note: Inside or outside miters.		
07 71 23 00-0258	K-Style, Vinyl Gutter Miters <small>(07 71 23 00-0257)</small>		
07 71 23 00-0259	EA 4", K-Style Vinyl Gutter Miter	9.75	
07 71 23 00-0260	EA 5", K-Style Vinyl Gutter Miter	14.33	
07 71 23 00-0261	Half Round, Vinyl Gutter Miters <small>(07 71 23 00-0257)</small>		
07 71 23 00-0262	EA 4", Half Round Vinyl Gutter Miter	9.75	
07 71 23 00-0263	EA 5", Half Round Vinyl Gutter Miter	10.54	
07 71 23 00-0264	Vinyl Downspouts <small>(07 71 23 00-0242)</small> Note: Includes elbows, hangers and fasteners.		
07 71 23 00-0265	Round Vinyl Downspouts <small>(07 71 23 00-0264)</small>		
07 71 23 00-0266	LF 2-1/2" Diameter, Round Vinyl Downspout	4.36	1.93
07 71 23 00-0267	LF 3" Diameter, Round Vinyl Downspout	4.52	1.93
07 71 23 00-0268	Square Vinyl Downspouts <small>(07 71 23 00-0264)</small>		
07 71 23 00-0269	LF 2-1/2", Square Vinyl Downspout	4.29	1.93
07 71 23 00-0270	Rectangular Vinyl Downspouts <small>(07 71 23 00-0264)</small>		
07 71 23 00-0271	LF 2" x 3", Rectangular Vinyl Downspout	5.36	1.93
07 71 23 00-0272	Gutter And Downspout Boot <small>(07 71 23)</small>		
07 71 23 00-0273	Cast Iron Roof Drainage Downspout Boots <small>(07 71 23 00-0272)</small>		
07 71 23 00-0274	EA 2" x 3" Cast Iron Roof Drainage Downspout Boot	209.72	2.90
07 71 23 00-0275	EA 3" x 4" Cast Iron Roof Drainage Downspout Boot	220.26	2.90
07 71 23 00-0276	EA 4" x 5" Cast Iron Roof Drainage Downspout Boot	262.83	2.90
07 71 23 00-0277	Leaf Guards And Cleaning <small>(07 71 23)</small>		
07 71 23 00-0278	LF Aluminum Mesh Gutter Leaf Guard	1.68	0.57
07 71 23 00-0279	LF Vinyl Mesh Gutter Leaf Guard	1.74	0.57
07 71 23 00-0280	LF 6" Wide Stainless Steel Gutter Leaf Guard, 1/4" x 1/4" x 0.08" Wire	11.14	0.71
07 71 23 00-0281	LF 9" Wide Stainless Steel Gutter Leaf Guard, 1/4" x 1/4" x 0.08" Wire	16.00	0.71
07 71 23 00-0282	LF 6" Wide Stainless Steel Gutter Leaf Guard, 3/8" x 3/8" Mesh	8.47	0.71
07 71 23 00-0283	LF 9" Wide Stainless Steel Gutter Leaf Guard, 3/8" x 3/8" Mesh	13.13	0.71
07 71 23 00-0284	EA Cleanout Roof Drain	104.11	
	Note: Includes removing dome and flushing.		
07 71 23 00-0285	LF Clean Gutters And Downspouts	1.12	
07 71 26	Reglets <small>(07 71)</small>		
07 71 26 00-0001	Counter Flashing With Reglet <small>(07 71 26)</small> Note: Includes reglet cut.		
07 71 26 00-0002	Galvanized Steel Counter Flashing With Reglet <small>(07 71 26 00-0001)</small>		
07 71 26 00-0003	Galvanized Steel Counter Flashing With Reglet <small>(07 71 26 00-0002)</small>		
07 71 26 00-0004	LF 28 Gauge, Up To 12" Wide, Galvanized Steel Counter Flashing With Reglet	9.06	3.20
07 71 26 00-0005	LF 26 Gauge, Up To 12" Wide, Galvanized Steel Counter Flashing With Reglet	9.13	3.20
07 71 26 00-0006	LF 24 Gauge, Up To 12" Wide, Galvanized Steel Counter Flashing With Reglet	9.26	3.20
07 71 26 00-0007	LF 22 Gauge, Up To 12" Wide, Galvanized Steel Counter Flashing With Reglet	9.74	3.20
07 71 26 00-0008	LF 20 Gauge, Up To 12" Wide, Galvanized Steel Counter Flashing With Reglet	10.01	3.20
07 71 26 00-0009	LF 18 Gauge, Up To 12" Wide, Galvanized Steel Counter Flashing With Reglet	10.32	3.20
07 71 26 00-0010	KYNAR 500® Finish, Galvanized Steel Counter Flashing With Reglet <small>(07 71 26 00-0002)</small>		
07 71 26 00-0011	LF 28 Gauge, Up To 12" Wide, KYNAR 500® Finish, Galvanized Steel Counter Flashing With Reglet	10.25	3.20
07 71 26 00-0012	LF 26 Gauge, Up To 12" Wide, KYNAR 500® Finish, Galvanized Steel Counter Flashing With Reglet	10.35	3.20
07 71 26 00-0013	LF 24 Gauge, Up To 12" Wide, KYNAR 500® Finish, Galvanized Steel Counter Flashing With Reglet	10.54	3.20
07 71 26 00-0014	LF 22 Gauge, Up To 12" Wide, KYNAR 500® Finish, Galvanized Steel Counter Flashing With Reglet	11.23	3.20
07 71 26 00-0015	LF 20 Gauge, Up To 12" Wide, KYNAR 500® Finish, Galvanized Steel Counter Flashing With Reglet	11.63	3.20
07 71 26 00-0016	LF 18 Gauge, Up To 12" Wide, KYNAR 500® Finish, Galvanized Steel Counter Flashing With Reglet	12.09	3.20
07 71 26 00-0017	Aluminum Counter Flashing With Reglet <small>(07 71 26 00-0001)</small>		
07 71 26 00-0018	KYNAR 500® Finish, Aluminum Counter Flashing With Reglet <small>(07 71 26 00-0017)</small>		
07 71 26 00-0019	LF 0.019" Thick, Up To 12" Wide, KYNAR 500® Finish, Aluminum Counter Flashing With Reglet	9.98	3.20
07 71 26 00-0020	LF 0.025" Thick, Up To 12" Wide, KYNAR 500® Finish, Aluminum Counter Flashing With Reglet	10.54	3.20



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 71 26 00-0021 LF 0.032" Thick, Up To 12" Wide, KYNAR 500® Finish, Aluminum Counter Flashing With Reglet.....	11.11	3.20
07 71 26 00-0022 LF 0.040" Thick, Up To 12" Wide, KYNAR 500® Finish, Aluminum Counter Flashing With Reglet.....	11.52	3.20
07 71 26 00-0023 LF 0.050" Thick, Up To 12" Wide, KYNAR 500® Finish, Aluminum Counter Flashing With Reglet.....	12.42	3.20
07 71 26 00-0024 LF 0.063" Thick, Up To 12" Wide, KYNAR 500® Finish, Aluminum Counter Flashing With Reglet.....	13.74	3.20
07 71 26 00-0025 Mill Finish, Aluminum Counter Flashing With Reglet <small>(07 71 26 00-0017)</small>		
07 71 26 00-0026 LF 0.019" Thick, Up To 12" Wide, Mill Finish, Aluminum Counter Flashing With Reglet	8.69	3.20
07 71 26 00-0027 LF 0.025" Thick, Up To 12" Wide, Mill Finish, Aluminum Counter Flashing With Reglet	9.05	3.20
07 71 26 00-0028 LF 0.032" Thick, Up To 12" Wide, Mill Finish, Aluminum Counter Flashing With Reglet	9.41	3.20
07 71 26 00-0029 LF 0.040" Thick, Up To 12" Wide, Mill Finish, Aluminum Counter Flashing With Reglet	9.67	3.20
07 71 26 00-0030 LF 0.050" Thick, Up To 12" Wide, Mill Finish, Aluminum Counter Flashing With Reglet	10.25	3.20
07 71 26 00-0031 LF 0.063" Thick, Up To 12" Wide, Mill Finish, Aluminum Counter Flashing With Reglet	11.09	3.20
07 71 26 00-0032 Clear Anodized Finish, Aluminum Counter Flashing With Reglet <small>(07 71 26 00-0017)</small>		
07 71 26 00-0033 LF 0.019" Thick, Up To 12" Wide, Clear Anodized Finish, Aluminum Counter Flashing With Reglet	9.72	3.20
07 71 26 00-0034 LF 0.025" Thick, Up To 12" Wide, Clear Anodized Finish, Aluminum Counter Flashing With Reglet	10.24	3.20
07 71 26 00-0035 LF 0.032" Thick, Up To 12" Wide, Clear Anodized Finish, Aluminum Counter Flashing With Reglet	10.76	3.20
07 71 26 00-0036 LF 0.040" Thick, Up To 12" Wide, Clear Anodized Finish, Aluminum Counter Flashing With Reglet	11.14	3.20
07 71 26 00-0037 LF 0.050" Thick, Up To 12" Wide, Clear Anodized Finish, Aluminum Counter Flashing With Reglet	11.98	3.20
07 71 26 00-0038 LF 0.063" Thick, Up To 12" Wide, Clear Anodized Finish, Aluminum Counter Flashing With Reglet	13.20	3.20
07 71 26 00-0039 Stainless Steel Counter Flashing With Reglet <small>(07 71 26 00-0001)</small>		
07 71 26 00-0040 Stainless Steel Counter Flashing With Reglet <small>(07 71 26 00-0039)</small>		
07 71 26 00-0041 LF 24 Gauge, Up To 12" Wide, Stainless Steel Counter Flashing With Reglet.....	12.93	3.20
07 71 26 00-0042 LF 20 Gauge, Up To 12" Wide, Stainless Steel Counter Flashing With Reglet.....	14.09	3.20
07 71 26 00-0043 Copper Counter Flashing With Reglet <small>(07 71 26 00-0001)</small>		
07 71 26 00-0044 Copper Counter Flashing With Reglet <small>(07 71 26 00-0043)</small>		
07 71 26 00-0045 LF 16 Ounce, Up To 12" Wide, Copper Counter Flashing With Reglet.....	23.57	3.20
07 72 Roof Accessories <small>(07 70)</small>		
07 72 13 Manufactured Curbs <small>(07 72)</small>		
07 72 13 00-0001 Insulated Galvanized Steel, Prefabricated Roof Curbs <small>(07 72 13)</small>		
07 72 13 00-0002 Insulated Galvanized Steel, Prefabricated Roof Curbs <small>(07 72 13 00-0001)</small>		
<small>Note: Includes pressure treated wood nailer, 1-1/2" rigid foam insulation, mill finish galvanized steel exterior wall construction, painted galvanized steel interior wall construction, installation clips and 3/16" wire mesh, 6" x 6" grids, safety security guard with installation clips.</small>		
07 72 13 00-0003 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curbs <small>(07 72 13 00-0002)</small>		
07 72 13 00-0004 9" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curbs <small>(07 72 13 00-0003)</small>		
07 72 13 00-0005 EA 26" x 26" Outside Frame Dimensions, 9" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb	294.28	76.64
<small>For Sloped Roofs Up To 1 In 12 Pitch, Add</small>		
<small>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</small>		
<small>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</small>		
<small>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</small>		
<small>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</small>		
07 72 13 00-0006 EA 26" x 38" Outside Frame Dimensions, 9" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb	300.28	76.64
<small>For Sloped Roofs Up To 1 In 12 Pitch, Add</small>		
<small>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</small>		
<small>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</small>		
<small>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</small>		
<small>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</small>		
07 72 13 00-0007 EA 26" x 50" Outside Frame Dimensions, 9" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb	322.44	86.22
<small>For Sloped Roofs Up To 1 In 12 Pitch, Add</small>		
<small>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</small>		
<small>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</small>		
<small>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</small>		
<small>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</small>		
07 72 13 00-0008 EA 26" x 74" Outside Frame Dimensions, 9" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb	345.44	86.22
<small>For Sloped Roofs Up To 1 In 12 Pitch, Add</small>		
<small>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</small>		
<small>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</small>		
<small>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</small>		
<small>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</small>		
07 72 13 00-0009 EA 26" x 98" Outside Frame Dimensions, 9" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb	362.44	86.22
<small>For Sloped Roofs Up To 1 In 12 Pitch, Add</small>		
<small>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</small>		
<small>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</small>		
<small>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</small>		
<small>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</small>		

07 Thermal And Moisture Protection
07 70 Roof And Wall Specialties And Accessories
07 72 Roof Accessories



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 72 13 00-0010	EA		26" x 122" Outside Frame Dimensions, 9" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add	449.59 35.38 80.34 10.95 55.95 74.95	95.80
07 72 13 00-0011	EA		38" x 38" Outside Frame Dimensions, 9" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add	302.28 22.56 52.79 5.25 45.25 63.25	76.64
07 72 13 00-0012	EA		38" x 50" Outside Frame Dimensions, 9" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add	323.44 23.72 56.07 6.30 48.30 65.30	86.22
07 72 13 00-0013	EA		38" x 62" Outside Frame Dimensions, 9" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add	336.44 25.02 58.67 7.80 51.80 65.80	86.22
07 72 13 00-0014	EA		38" x 74" Outside Frame Dimensions, 9" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add	341.44 25.52 59.67 9.30 57.30 70.30	86.22
07 72 13 00-0015	EA		38" x 98" Outside Frame Dimensions, 9" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add	433.59 33.78 77.14 12.00 65.00 85.00	95.80
07 72 13 00-0016	EA		38" x 122" Outside Frame Dimensions, 9" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add	473.76 36.84 84.21 14.70 75.70 99.70	105.38
07 72 13 00-0017	EA		50" x 50" Outside Frame Dimensions, 9" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add	369.44 28.32 65.27 8.10 52.10 63.10	86.22
07 72 13 00-0018	EA		50" x 62" Outside Frame Dimensions, 9" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add	401.59 30.58 70.74 9.75 50.75 70.75	95.80
07 72 13 00-0019	EA		50" x 74" Outside Frame Dimensions, 9" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add	412.59 31.68 72.94 11.55 46.55 80.55	95.80
07 72 13 00-0020	EA		50" x 86" Outside Frame Dimensions, 9" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add	452.76 34.74 80.01 13.50 58.50 90.50	105.38
07 72 13 00-0021	EA		51" x 99" Outside Frame Dimensions, 9" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add	483.92 36.90 85.29 15.45 71.45 96.45	114.96
07 72 13 00-0022	EA		51" x 122" Outside Frame Dimensions, 9" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add	523.07 39.85 92.16 18.60 81.60 115.60	124.54
07 72 13 00-0023	EA		62" x 62" Outside Frame Dimensions, 9" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add	412.59 31.68 72.94 12.30 45.30 83.30	95.80



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 72 13 00-0024 EA 62-3/8" x 74-3/8" Outside Frame Dimensions, 9" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb	441.76	105.38
<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	33.64	
<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	77.81	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	14.10	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	63.10	
<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	94.10	
07 72 13 00-0025 EA 62" x 86" Outside Frame Dimensions, 9" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb	482.92	114.96
<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	36.80	
<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	85.09	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	18.30	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	67.30	
<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	96.30	
07 72 13 00-0026 EA 62" x 98" Outside Frame Dimensions, 9" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb	492.92	114.96
<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	37.80	
<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	87.09	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	18.30	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	67.30	
<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	117.30	
07 72 13 00-0027 EA 62" x 122" Outside Frame Dimensions, 9" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb	534.07	124.54
<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	40.95	
<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	94.36	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	23.10	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	73.10	
<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	137.10	
07 72 13 00-0028 12" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curbs <small>(07 72 13 00-0003)</small>		
07 72 13 00-0029 EA 26" x 26" Outside Frame Dimensions, 12" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb	307.28	76.64
<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	23.06	
<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	53.79	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	3.30	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	24.30	
<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	35.30	
07 72 13 00-0030 EA 26" x 38" Outside Frame Dimensions, 12" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb	310.28	76.64
<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	23.36	
<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	54.39	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	4.05	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	32.05	
<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	42.05	
07 72 13 00-0031 EA 26" x 50" Outside Frame Dimensions, 12" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb	332.44	86.22
<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	24.62	
<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	57.87	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	4.95	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	39.95	
<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	46.95	
07 72 13 00-0032 EA 26" x 74" Outside Frame Dimensions, 12" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb	358.44	86.22
<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	27.22	
<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	63.07	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	6.60	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	51.60	
<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	58.60	
07 72 13 00-0033 EA 26" x 98" Outside Frame Dimensions, 12" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb	377.44	86.22
<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	29.12	
<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	66.87	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	9.15	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	58.15	
<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	64.15	
07 72 13 00-0034 EA 26" x 122" Outside Frame Dimensions, 12" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb	461.59	95.80
<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	36.58	
<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	82.74	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	10.95	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	55.95	
<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	74.95	
07 72 13 00-0035 EA 38" x 38" Outside Frame Dimensions, 12" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb	311.28	76.64
<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	23.46	
<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	54.59	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	5.25	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	45.25	
<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	63.25	
07 72 13 00-0036 EA 38" x 50" Outside Frame Dimensions, 12" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb	350.44	86.22
<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	26.42	
<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	61.47	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	6.30	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	48.30	
<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	65.30	
07 72 13 00-0037 EA 38" x 62" Outside Frame Dimensions, 12" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb	370.44	86.22
<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	28.42	
<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	65.47	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	7.80	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	51.80	
<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	65.80	

07 Thermal And Moisture Protection
07 70 Roof And Wall Specialties And Accessories
07 72 Roof Accessories



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 72 13 00-0038	EA		38" x 74" Outside Frame Dimensions, 12" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb .....393.44		86.22
			<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	30.72	
			<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	70.07	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	9.30	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	57.30	
			<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	70.30	
07 72 13 00-0039	EA		38" x 98" Outside Frame Dimensions, 12" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb .....449.59		95.80
			<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	35.38	
			<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	80.34	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	12.00	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	65.00	
			<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	85.00	
07 72 13 00-0040	EA		38" x 122" Outside Frame Dimensions, 12" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb .....493.76		105.38
			<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	38.84	
			<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	88.21	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	14.70	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	75.70	
			<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	99.70	
07 72 13 00-0041	EA		50" x 50" Outside Frame Dimensions, 12" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb .....381.44		86.22
			<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	29.52	
			<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	67.67	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	8.10	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	52.10	
			<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	63.10	
07 72 13 00-0042	EA		50" x 62" Outside Frame Dimensions, 12" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb .....411.59		95.80
			<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	31.58	
			<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	72.74	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	9.75	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	50.75	
			<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	70.75	
07 72 13 00-0043	EA		50" x 74" Outside Frame Dimensions, 12" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb .....427.59		95.80
			<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	33.18	
			<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	75.94	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	11.55	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	46.55	
			<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	80.55	
07 72 13 00-0044	EA		50" x 86" Outside Frame Dimensions, 12" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb .....468.76		105.38
			<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	36.34	
			<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	83.21	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	13.50	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	58.50	
			<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	90.50	
07 72 13 00-0045	EA		51" x 99" Outside Frame Dimensions, 12" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb .....502.92		114.96
			<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	38.80	
			<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	89.09	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	15.45	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	71.45	
			<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	96.45	
07 72 13 00-0046	EA		51" x 122" Outside Frame Dimensions, 12" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb .....545.07		124.54
			<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	42.05	
			<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	96.56	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	18.60	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	81.60	
			<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	115.60	
07 72 13 00-0047	EA		62" x 62" Outside Frame Dimensions, 12" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb .....427.59		95.80
			<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	33.18	
			<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	75.94	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	12.30	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	45.30	
			<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	83.30	
07 72 13 00-0048	EA		62-3/8" x 74-3/8" Outside Frame Dimensions, 12" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb .....457.76		105.38
			<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	35.24	
			<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	81.01	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	14.10	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	63.10	
			<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	94.10	
07 72 13 00-0049	EA		62" x 86" Outside Frame Dimensions, 12" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb .....499.92		114.96
			<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	38.50	
			<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	88.49	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	18.30	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	67.30	
			<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	96.30	
07 72 13 00-0050	EA		62" x 98" Outside Frame Dimensions, 12" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb .....512.92		114.96
			<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	39.80	
			<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	91.09	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	18.30	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	67.30	
			<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	117.30	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 72 13 00-0051 EA 62" x 122" Outside Frame Dimensions, 12" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	556.07	124.54
<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	43.15	
<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	98.76	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	23.10	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	73.10	
<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	137.10	
07 72 13 00-0052 14" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curbs <small>(07 72 13 00-0003)</small>		
07 72 13 00-0053 EA 26" x 26" Outside Frame Dimensions, 14" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	314.28	76.64
<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	23.76	
<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	55.19	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	3.30	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	24.30	
<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	35.30	
07 72 13 00-0054 EA 26" x 38" Outside Frame Dimensions, 14" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	317.28	76.64
<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	24.06	
<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	55.79	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	4.05	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	32.05	
<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	42.05	
07 72 13 00-0055 EA 26" x 50" Outside Frame Dimensions, 14" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	337.44	86.22
<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	25.12	
<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	58.87	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	4.95	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	39.95	
<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	46.95	
07 72 13 00-0056 EA 26" x 74" Outside Frame Dimensions, 14" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	386.44	86.22
<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	28.02	
<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	64.67	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	6.60	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	51.60	
<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	58.60	
07 72 13 00-0057 EA 26" x 98" Outside Frame Dimensions, 14" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	388.44	86.22
<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	30.22	
<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	69.07	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	9.15	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	58.15	
<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	64.15	
07 72 13 00-0058 EA 26" x 122" Outside Frame Dimensions, 14" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	475.59	95.80
<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	37.98	
<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	85.54	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	10.95	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	55.95	
<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	74.95	
07 72 13 00-0059 EA 38" x 38" Outside Frame Dimensions, 14" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	317.28	76.64
<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	24.06	
<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	55.79	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	5.25	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	45.25	
<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	63.25	
07 72 13 00-0060 EA 38" x 50" Outside Frame Dimensions, 14" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	337.44	86.22
<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	25.12	
<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	58.87	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	6.30	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	48.30	
<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	65.30	
07 72 13 00-0061 EA 38" x 62" Outside Frame Dimensions, 14" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	388.44	86.22
<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	30.22	
<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	69.07	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	7.80	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	51.80	
<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	65.80	
07 72 13 00-0062 EA 38" x 74" Outside Frame Dimensions, 14" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	412.44	86.22
<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	32.62	
<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	73.87	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	9.30	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	57.30	
<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	70.30	
07 72 13 00-0063 EA 38" x 98" Outside Frame Dimensions, 14" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	461.59	95.80
<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	36.58	
<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	82.74	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	12.00	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	65.00	
<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	85.00	
07 72 13 00-0064 EA 38" x 122" Outside Frame Dimensions, 14" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	506.76	105.38
<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	40.14	
<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	90.81	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	14.70	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	75.70	
<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	99.70	

07 Thermal And Moisture Protection
07 70 Roof And Wall Specialties And Accessories
07 72 Roof Accessories



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 72 13 00-0065	EA		50" x 50" Outside Frame Dimensions, 14" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	389.44 30.32 69.27 8.10 52.10 63.10	86.22
07 72 13 00-0066	EA		50" x 62" Outside Frame Dimensions, 14" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	422.59 32.68 74.94 9.75 50.75 70.75	95.80
07 72 13 00-0067	EA		50" x 74" Outside Frame Dimensions, 14" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	437.59 34.18 77.94 11.55 46.55 80.55	95.80
07 72 13 00-0068	EA		50" x 86" Outside Frame Dimensions, 14" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	480.76 37.54 85.61 13.50 58.50 90.50	105.38
07 72 13 00-0069	EA		51" x 99" Outside Frame Dimensions, 14" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	514.92 40.00 91.49 15.45 71.45 96.45	114.96
07 72 13 00-0070	EA		51" x 122" Outside Frame Dimensions, 14" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	559.07 43.45 99.36 18.60 81.60 115.60	124.54
07 72 13 00-0071	EA		62" x 62" Outside Frame Dimensions, 14" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	437.59 34.18 77.94 12.30 45.30 83.30	95.80
07 72 13 00-0072	EA		62-3/8" x 74-3/8" Outside Frame Dimensions, 14" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	468.76 36.34 83.21 14.10 63.10 94.10	105.38
07 72 13 00-0073	EA		62" x 86" Outside Frame Dimensions, 14" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	512.92 39.80 91.09 18.30 67.30 96.30	114.96
07 72 13 00-0074	EA		62" x 98" Outside Frame Dimensions, 14" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	525.92 41.10 93.69 18.30 67.30 117.30	114.96
07 72 13 00-0075	EA		62" x 122" Outside Frame Dimensions, 14" Height, 18 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	571.07 44.65 101.76 23.10 73.10 137.10	124.54
07 72 13 00-0076			14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curbs (07 72 13 00-0002)		
07 72 13 00-0077			9" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curbs (07 72 13 00-0076)		
07 72 13 00-0078	EA		26" x 26" Outside Frame Dimensions, 9" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	283.28 20.66 48.99 3.30 24.30 35.30	76.64
07 72 13 00-0079	EA		26" x 38" Outside Frame Dimensions, 9" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	296.28 21.96 51.59 4.05 32.05 42.05	76.64



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 72 13 00-0080 EA 26" x 50" Outside Frame Dimensions, 9" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 To 3 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	340.44 25.42 59.47 4.95 39.95 46.95	86.22
07 72 13 00-0081 EA 26" x 74" Outside Frame Dimensions, 9" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	370.44 28.42 65.47 6.60 51.60 58.60	86.22
07 72 13 00-0082 EA 26" x 98" Outside Frame Dimensions, 9" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	392.44 30.62 69.87 9.15 58.15 64.15	86.22
07 72 13 00-0083 EA 26" x 122" Outside Frame Dimensions, 9" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	491.59 39.58 88.74 10.95 55.95 74.95	95.80
07 72 13 00-0084 EA 38" x 38" Outside Frame Dimensions, 9" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	320.28 24.36 56.39 5.25 45.25 63.25	76.64
07 72 13 00-0085 EA 38" x 50" Outside Frame Dimensions, 9" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	348.44 26.22 61.07 6.30 48.30 65.30	86.22
07 72 13 00-0086 EA 38" x 62" Outside Frame Dimensions, 9" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	358.44 27.22 63.07 7.80 51.80 65.80	86.22
07 72 13 00-0087 EA 38" x 74" Outside Frame Dimensions, 9" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	367.44 28.12 64.87 9.30 57.30 70.30	86.22
07 72 13 00-0088 EA 38" x 98" Outside Frame Dimensions, 9" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	467.59 37.18 83.94 12.00 65.00 85.00	95.80
07 72 13 00-0089 EA 38" x 122" Outside Frame Dimensions, 9" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	513.76 40.84 92.21 14.70 75.70 99.70	105.38
07 72 13 00-0090 EA 50" x 50" Outside Frame Dimensions, 9" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	393.44 30.72 70.07 8.10 52.10 63.10	86.22
07 72 13 00-0091 EA 50" x 62" Outside Frame Dimensions, 9" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	426.59 33.08 75.74 9.75 50.75 70.75	95.80
07 72 13 00-0092 EA 50" x 74" Outside Frame Dimensions, 9" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	442.59 34.68 78.94 11.55 46.55 80.55	95.80
07 72 13 00-0093 EA 50" x 86" Outside Frame Dimensions, 9" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	486.76 38.14 86.81 13.50 58.50 90.50	105.38

07 Thermal And Moisture Protection
07 70 Roof And Wall Specialties And Accessories
07 72 Roof Accessories



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 72 13 00-0094	EA		51" x 99" Outside Frame Dimensions, 9" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	520.92 40.60 92.69 15.45 71.45 96.45	114.96
07 72 13 00-0095	EA		51" x 122" Outside Frame Dimensions, 9" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	566.07 44.15 100.76 18.60 81.60 115.60	124.54
07 72 13 00-0096	EA		62" x 62" Outside Frame Dimensions, 9" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	442.59 34.68 78.94 12.30 45.30 83.30	95.80
07 72 13 00-0097	EA		62-3/8" x 74-3/8" Outside Frame Dimensions, 9" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	473.76 36.84 84.21 14.10 63.10 94.10	105.38
07 72 13 00-0098	EA		62" x 86" Outside Frame Dimensions, 9" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	518.92 40.40 92.29 18.30 67.30 96.30	114.96
07 72 13 00-0099	EA		62" x 98" Outside Frame Dimensions, 9" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	532.92 41.80 95.09 18.30 67.30 117.30	114.96
07 72 13 00-0100	EA		62" x 122" Outside Frame Dimensions, 9" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	579.07 45.45 103.36 23.10 73.10 137.10	124.54
07 72 13 00-0101			12" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curbs (07 72 13 00-0076)		
07 72 13 00-0102	EA		26" x 26" Outside Frame Dimensions, 12" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	292.28 21.56 50.79 3.30 24.30 35.30	76.64
07 72 13 00-0103	EA		26" x 38" Outside Frame Dimensions, 12" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	307.28 23.06 53.79 4.05 32.05 42.05	76.64
07 72 13 00-0104	EA		26" x 50" Outside Frame Dimensions, 12" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	355.44 26.92 62.47 4.95 39.95 46.95	86.22
07 72 13 00-0105	EA		26" x 74" Outside Frame Dimensions, 12" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	388.44 30.22 69.07 6.60 51.60 58.60	86.22
07 72 13 00-0106	EA		26" x 98" Outside Frame Dimensions, 12" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	415.44 32.92 74.47 9.15 58.15 64.15	86.22
07 72 13 00-0107	EA		26" x 122" Outside Frame Dimensions, 12" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	495.59 39.98 89.54 10.95 55.95 74.95	95.80



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 72 13 00-0108 EA 38" x 38" Outside Frame Dimensions, 12" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	333.28	76.64
For Sloped Roofs Up To 1 In 12 To 3 In 12 Pitch, Add	25.66	
For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add	58.99	
For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add	5.25	
For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add	45.25	
For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add	63.25	
07 72 13 00-0109 EA 38" x 50" Outside Frame Dimensions, 12" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	364.44	86.22
For Sloped Roofs Up To 1 In 12 Pitch, Add	27.82	
For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add	64.27	
For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add	6.30	
For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add	48.30	
For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add	65.30	
07 72 13 00-0110 EA 38" x 62" Outside Frame Dimensions, 12" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	377.44	86.22
For Sloped Roofs Up To 1 In 12 Pitch, Add	29.12	
For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add	66.87	
For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add	7.80	
For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add	51.80	
For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add	65.80	
07 72 13 00-0111 EA 38" x 74" Outside Frame Dimensions, 12" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	389.44	86.22
For Sloped Roofs Up To 1 In 12 Pitch, Add	30.32	
For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add	69.27	
For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add	9.30	
For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add	57.30	
For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add	70.30	
07 72 13 00-0112 EA 38" x 98" Outside Frame Dimensions, 12" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	491.59	95.80
For Sloped Roofs Up To 1 In 12 Pitch, Add	39.58	
For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add	88.74	
For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add	12.00	
For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add	65.00	
For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add	85.00	
07 72 13 00-0113 EA 38" x 122" Outside Frame Dimensions, 12" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	542.76	105.38
For Sloped Roofs Up To 1 In 12 Pitch, Add	43.74	
For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add	98.01	
For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add	14.70	
For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add	75.70	
For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add	99.70	
07 72 13 00-0114 EA 50" x 50" Outside Frame Dimensions, 12" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	411.44	86.22
For Sloped Roofs Up To 1 In 12 Pitch, Add	32.52	
For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add	73.67	
For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add	8.10	
For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add	52.10	
For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add	63.10	
07 72 13 00-0115 EA 50" x 62" Outside Frame Dimensions, 12" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	446.59	95.80
For Sloped Roofs Up To 1 In 12 Pitch, Add	35.08	
For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add	79.74	
For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add	9.75	
For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add	50.75	
For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add	70.75	
07 72 13 00-0116 EA 50" x 74" Outside Frame Dimensions, 12" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	465.59	95.80
For Sloped Roofs Up To 1 In 12 Pitch, Add	36.98	
For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add	83.54	
For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add	11.55	
For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add	46.55	
For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add	80.55	
07 72 13 00-0117 EA 50" x 86" Outside Frame Dimensions, 12" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	510.76	105.38
For Sloped Roofs Up To 1 In 12 Pitch, Add	40.54	
For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add	91.61	
For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add	13.50	
For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add	58.50	
For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add	90.50	
07 72 13 00-0118 EA 51" x 99" Outside Frame Dimensions, 12" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	548.92	114.96
For Sloped Roofs Up To 1 In 12 Pitch, Add	43.40	
For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add	98.29	
For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add	15.45	
For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add	71.45	
For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add	96.45	
07 72 13 00-0119 EA 51" x 122" Outside Frame Dimensions, 12" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	598.07	124.54
For Sloped Roofs Up To 1 In 12 Pitch, Add	47.35	
For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add	107.16	
For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add	18.60	
For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add	81.60	
For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add	115.60	
07 72 13 00-0120 EA 62" x 62" Outside Frame Dimensions, 12" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	465.59	95.80
For Sloped Roofs Up To 1 In 12 Pitch, Add	36.98	
For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add	83.54	
For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add	12.30	
For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add	45.30	
For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add	83.30	
07 72 13 00-0121 EA 62-3/8" x 74-3/8" Outside Frame Dimensions, 12" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	499.76	105.38
For Sloped Roofs Up To 1 In 12 Pitch, Add	39.44	
For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add	89.41	
For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add	14.10	
For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add	63.10	
For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add	94.10	

07	Thermal And Moisture Protection
07 70	Roof And Wall Specialties And Accessories
07 72	Roof Accessories



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 72 13 00-0122	EA		62" x 86" Outside Frame Dimensions, 12" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	546.92	114.96
			<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	43.20	
			<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	97.89	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	18.30	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	67.30	
			<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	96.30	
07 72 13 00-0123	EA		62" x 98" Outside Frame Dimensions, 12" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	561.92	114.96
			<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	44.70	
			<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	100.89	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	18.30	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	67.30	
			<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	117.30	
07 72 13 00-0124	EA		62" x 122" Outside Frame Dimensions, 12" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	613.07	124.54
			<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	48.85	
			<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	110.16	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	23.10	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	73.10	
			<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	137.10	
07 72 13 00-0125			14" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curbs <small>(07 72 13 00-0076)</small>		
07 72 13 00-0126	EA		26" x 26" Outside Frame Dimensions, 14" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	299.28	76.64
			<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	22.26	
			<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	52.19	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	3.30	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	24.30	
			<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	35.30	
07 72 13 00-0127	EA		26" x 38" Outside Frame Dimensions, 14" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	315.28	76.64
			<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	23.86	
			<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	55.39	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	4.05	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	32.05	
			<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	42.05	
07 72 13 00-0128	EA		26" x 50" Outside Frame Dimensions, 14" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	364.44	86.22
			<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	27.82	
			<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	64.27	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	4.95	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	39.95	
			<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	46.95	
07 72 13 00-0129	EA		26" x 74" Outside Frame Dimensions, 14" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	400.44	86.22
			<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	31.42	
			<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	71.47	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	6.60	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	51.60	
			<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	58.60	
07 72 13 00-0130	EA		26" x 98" Outside Frame Dimensions, 14" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	430.44	86.22
			<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	34.42	
			<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	77.47	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	9.15	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	58.15	
			<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	64.15	
07 72 13 00-0131	EA		26" x 122" Outside Frame Dimensions, 14" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	527.59	95.80
			<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	43.18	
			<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	95.94	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	10.95	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	55.95	
			<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	74.95	
07 72 13 00-0132	EA		38" x 38" Outside Frame Dimensions, 14" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	343.28	76.64
			<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	26.66	
			<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	60.99	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	5.25	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	45.25	
			<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	63.25	
07 72 13 00-0133	EA		38" x 50" Outside Frame Dimensions, 14" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	381.44	86.22
			<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	29.52	
			<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	67.67	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	6.30	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	48.30	
			<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	65.30	
07 72 13 00-0134	EA		38" x 62" Outside Frame Dimensions, 14" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	399.44	86.22
			<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	31.32	
			<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	71.27	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	7.80	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	51.80	
			<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	65.80	
07 72 13 00-0135	EA		38" x 74" Outside Frame Dimensions, 14" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	403.44	86.22
			<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	31.72	
			<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	72.07	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	9.30	
			<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	57.30	
			<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	70.30	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 72 13 00-0136 EA 38" x 98" Outside Frame Dimensions, 14" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	509.59	95.80
For Sloped Roofs Up To 1 In 12 Pitch, Add	41.38	
For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add	92.34	
For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add	12.00	
For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add	65.00	
For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add	85.00	
07 72 13 00-0137 EA 38" x 122" Outside Frame Dimensions, 14" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	562.76	105.38
For Sloped Roofs Up To 1 In 12 Pitch, Add	45.74	
For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add	102.01	
For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add	14.70	
For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add	75.70	
For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add	99.70	
07 72 13 00-0138 EA 50" x 50" Outside Frame Dimensions, 14" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	423.44	86.22
For Sloped Roofs Up To 1 In 12 Pitch, Add	33.72	
For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add	76.07	
For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add	8.10	
For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add	52.10	
For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add	63.10	
07 72 13 00-0139 EA 50" x 62" Outside Frame Dimensions, 14" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	459.59	95.80
For Sloped Roofs Up To 1 In 12 Pitch, Add	36.38	
For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add	82.34	
For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add	9.75	
For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add	50.75	
For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add	70.75	
07 72 13 00-0140 EA 50" x 74" Outside Frame Dimensions, 14" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	480.59	95.80
For Sloped Roofs Up To 1 In 12 Pitch, Add	38.48	
For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add	86.54	
For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add	11.55	
For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add	46.55	
For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add	80.55	
07 72 13 00-0141 EA 50" x 86" Outside Frame Dimensions, 14" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	528.76	105.38
For Sloped Roofs Up To 1 In 12 Pitch, Add	42.34	
For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add	95.21	
For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add	13.50	
For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add	58.50	
For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add	90.50	
07 72 13 00-0142 EA 51" x 99" Outside Frame Dimensions, 14" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	566.92	114.96
For Sloped Roofs Up To 1 In 12 Pitch, Add	45.20	
For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add	101.89	
For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add	15.45	
For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add	71.45	
For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add	96.45	
07 72 13 00-0143 EA 51" x 122" Outside Frame Dimensions, 14" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	620.07	124.54
For Sloped Roofs Up To 1 In 12 Pitch, Add	49.55	
For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add	111.56	
For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add	18.60	
For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add	81.60	
For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add	115.60	
07 72 13 00-0144 EA 62" x 62" Outside Frame Dimensions, 14" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	480.59	95.80
For Sloped Roofs Up To 1 In 12 Pitch, Add	38.48	
For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add	86.54	
For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add	12.30	
For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add	45.30	
For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add	83.30	
07 72 13 00-0145 EA 62-3/8" x 74-3/8" Outside Frame Dimensions, 14" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	517.76	105.38
For Sloped Roofs Up To 1 In 12 Pitch, Add	41.24	
For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add	93.01	
For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add	14.10	
For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add	63.10	
For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add	94.10	
07 72 13 00-0146 EA 62" x 86" Outside Frame Dimensions, 14" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	563.92	114.96
For Sloped Roofs Up To 1 In 12 Pitch, Add	44.90	
For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add	101.29	
For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add	18.30	
For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add	67.30	
For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add	96.30	
07 72 13 00-0147 EA 62" x 98" Outside Frame Dimensions, 14" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	581.92	114.96
For Sloped Roofs Up To 1 In 12 Pitch, Add	46.70	
For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add	104.89	
For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add	18.30	
For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add	67.30	
For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add	117.30	
07 72 13 00-0148 EA 62" x 122" Outside Frame Dimensions, 14" Height, 14 Gauge, Insulated Galvanized Steel, Prefabricated Roof Curb.....	635.07	124.54
For Sloped Roofs Up To 1 In 12 Pitch, Add	51.05	
For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add	114.56	
For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add	23.10	
For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add	73.10	
For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add	137.10	

07	Thermal And Moisture Protection
07 70	Roof And Wall Specialties And Accessories
07 72	Roof Accessories



MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

07 72 13 00-0149	Insulated Galvanized Steel, Adjustable Width Prefabricated Roof Curbs ^(07 72 13 00-0001) Note: Includes 1" rigid foam insulation, mill finish galvanized steel exterior wall construction, painted galvanized steel interior wall construction and installation clips.		
07 72 13 00-0150	6" Height, 18 Gauge, Insulated Galvanized Steel, Adjustable Width Prefabricated Roof Curbs ^(07 72 13 00-0149)		
07 72 13 00-0151	EA 14-1/2" To 23" Square Outside Dimensions, 6" Height, 18 Gauge, Insulated Galvanized Steel, Adjustable Width Prefabricated Roof Curb.....	340.92	76.64
	For Sloped Roofs Up To 1 In 12 Pitch, Add	26.43	
	For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add	60.52	
07 72 13 00-0152	EA 23-1/2" To 32" Square Outside Dimensions, 6" Height, 18 Gauge, Insulated Galvanized Steel, Adjustable Width Prefabricated Roof Curb.....	424.22	76.64
	For Sloped Roofs Up To 1 In 12 Pitch, Add	34.76	
	For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add	77.18	
07 72 13 00-0153	EA 32-1/2" To 41" Square Outside Dimensions, 6" Height, 18 Gauge, Insulated Galvanized Steel, Adjustable Width Prefabricated Roof Curb.....	489.70	86.22
	For Sloped Roofs Up To 1 In 12 Pitch, Add	40.35	
	For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add	89.32	
07 72 13 00-0154	EA 41" To 49-1/2" Square Outside Dimensions, 6" Height, 18 Gauge, Insulated Galvanized Steel, Adjustable Width Prefabricated Roof Curb.....	556.22	86.22
	For Sloped Roofs Up To 1 In 12 Pitch, Add	47.00	
	For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add	102.62	
07 72 13 00-0155	EA 50" To 58-1/2" Square Outside Dimensions, 6" Height, 18 Gauge, Insulated Galvanized Steel, Adjustable Width Prefabricated Roof Curb.....	614.04	95.80
	For Sloped Roofs Up To 1 In 12 Pitch, Add	51.82	
	For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add	113.23	
07 72 13 00-0156	12" Height, 18 Gauge, Insulated Galvanized Steel, Adjustable Width Prefabricated Roof Curbs ^(07 72 13 00-0149)		
07 72 13 00-0157	EA 14-1/2" To 23" Square Outside Dimensions, 12" Height, 18 Gauge, Insulated Galvanized Steel, Adjustable Width Prefabricated Roof Curb.....	462.89	76.64
	For Sloped Roofs Up To 1 In 12 Pitch, Add	38.63	
	For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add	84.91	
07 72 13 00-0158	EA 23-1/2" To 32" Square Outside Dimensions, 12" Height, 18 Gauge, Insulated Galvanized Steel, Adjustable Width Prefabricated Roof Curb.....	575.94	76.64
	For Sloped Roofs Up To 1 In 12 Pitch, Add	49.93	
	For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add	107.52	
07 72 13 00-0159	EA 32-1/2" To 41" Square Outside Dimensions, 12" Height, 18 Gauge, Insulated Galvanized Steel, Adjustable Width Prefabricated Roof Curb.....	598.29	86.22
	For Sloped Roofs Up To 1 In 12 Pitch, Add	51.21	
	For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add	111.04	
07 72 13 00-0160	EA 41" To 49-1/2" Square Outside Dimensions, 12" Height, 18 Gauge, Insulated Galvanized Steel, Adjustable Width Prefabricated Roof Curb.....	640.79	86.22
	For Sloped Roofs Up To 1 In 12 Pitch, Add	55.46	
	For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add	119.54	
07 72 13 00-0161	EA 50" To 58-1/2" Square Outside Dimensions, 12" Height, 18 Gauge, Insulated Galvanized Steel, Adjustable Width Prefabricated Roof Curb.....	719.44	95.80
	For Sloped Roofs Up To 1 In 12 Pitch, Add	62.36	
	For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add	134.31	
07 72 13 00-0162	EA 64" To 72-1/2" Square Outside Dimensions, 12" Height, 18 Gauge, Insulated Galvanized Steel, Adjustable Width Prefabricated Roof Curb.....	902.24	105.38
	For Sloped Roofs Up To 1 In 12 Pitch, Add	79.69	
	For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add	169.91	
07 72 13 00-0163	18" To 24" Height, 16 Gauge, Ventilated Galvanized Steel, Adjustable Width Prefabricated Roof Curbs ^(07 72 13 00-0149)		
07 72 13 00-0164	EA 17-1/2" To 22" Square Outside Dimensions, 24" Height, 16 Gauge, Ventilated Galvanized Steel, Adjustable Width Prefabricated Roof Curb.....	663.28	76.64
	For Sloped Roofs Up To 1 In 12 Pitch, Add	58.66	
	For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add	124.99	
07 72 13 00-0165	EA 24" To 29" Square Outside Dimensions, 24" Height, 16 Gauge, Ventilated Galvanized Steel, Adjustable Width Prefabricated Roof Curb.....	778.88	76.64
	For Sloped Roofs Up To 1 In 12 Pitch, Add	70.22	
	For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add	148.11	
07 72 13 00-0166	EA 31" To 46" Square Outside Dimensions, 18" Height, 16 Gauge, Insulated Galvanized Steel, Adjustable Width Prefabricated Roof Curb.....	935.32	86.22
	For Sloped Roofs Up To 1 In 12 Pitch, Add	84.91	
	For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add	178.44	
07 72 13 00-0167	Wood, Prefabricated Roof Curbs ^(07 72 13) Note: Includes Douglas fir construction, galvanized steel corner straps and installation clips. Includes 3/16" wire mesh, 6" x 6" grids, safety security guard with installation clips.		
07 72 13 00-0168	Wood Framed, Prefabricated Roof Curbs ^(07 72 13 00-0167)		
07 72 13 00-0169	2 x 6 Wood Framed, Prefabricated Roof Curbs ^(07 72 13 00-0168)		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 72 13 00-0170 EA 26" x 26" Outside Frame Dimensions, 2 x 6 Wood Framed, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	234.28 15.76 39.19 3.30 24.30 35.30	76.64
07 72 13 00-0171 EA 26" x 50" Outside Frame Dimensions, 2 x 6 Wood Framed, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	259.44 17.32 43.27 4.95 39.95 46.95	86.22
07 72 13 00-0172 EA 26" x 98" Outside Frame Dimensions, 2 x 6 Wood Framed, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	285.44 19.92 48.47 9.15 58.15 64.15	86.22
07 72 13 00-0173 EA 38" x 62" Outside Frame Dimensions, 2 x 6 Wood Framed, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	282.44 19.62 47.87 7.80 51.80 65.80	86.22
07 72 13 00-0174 EA 38" x 74" Outside Frame Dimensions, 2 x 6 Wood Framed, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	289.44 20.32 49.27 9.30 57.30 70.30	86.22
07 72 13 00-0175 EA 38" x 98" Outside Frame Dimensions, 2 x 6 Wood Framed, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	325.59 22.98 55.54 12.00 65.00 85.00	95.80
07 72 13 00-0176 EA 50" x 50" Outside Frame Dimensions, 2 x 6 Wood Framed, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	287.44 20.12 48.87 8.10 52.10 63.10	86.22
07 72 13 00-0177 EA 50" x 74" Outside Frame Dimensions, 2 x 6 Wood Framed, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	334.59 23.88 57.34 11.55 46.55 80.55	95.80
07 72 13 00-0178 EA 51" x 99" Outside Frame Dimensions, 2 x 6 Wood Framed, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	372.92 25.80 63.09 15.45 71.45 96.45	114.96
07 72 13 00-0179 EA 62" x 62" Outside Frame Dimensions, 2 x 6 Wood Framed, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	316.59 22.08 53.74 12.30 45.30 83.30	95.80
07 72 13 00-0180 EA 62-3/8" x 74-3/8" Outside Frame Dimensions, 2 x 6 Wood Framed, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	347.76 24.24 59.01 14.10 63.10 94.10	105.38
07 72 13 00-0181 EA 62" x 98" Outside Frame Dimensions, 2 x 6 Wood Framed, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	392.92 27.80 67.09 18.30 67.30 117.30	114.96
07 72 13 00-0182 2 x 8 Wood Framed, Prefabricated Roof Curbs <small>(07 72 13 00-0168)</small>		
07 72 13 00-0183 EA 26" x 26" Outside Frame Dimensions, 2 x 8 Wood Framed, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	240.28 16.36 40.39 3.30 24.30 35.30	76.64

07 Thermal And Moisture Protection
07 70 Roof And Wall Specialties And Accessories
07 72 Roof Accessories



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 72 13 00-0184	EA		26" x 50" Outside Frame Dimensions, 2 x 8 Wood Framed, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	266.44 18.02 44.67 4.95 39.95 46.95	86.22
07 72 13 00-0185	EA		26" x 98" Outside Frame Dimensions, 2 x 8 Wood Framed, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	304.44 21.82 52.27 9.15 58.15 64.15	86.22
07 72 13 00-0186	EA		38" x 62" Outside Frame Dimensions, 2 x 8 Wood Framed, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	294.44 20.82 50.27 7.80 51.80 65.80	86.22
07 72 13 00-0187	EA		38" x 74" Outside Frame Dimensions, 2 x 8 Wood Framed, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	304.44 21.82 52.27 9.30 57.30 70.30	86.22
07 72 13 00-0188	EA		38" x 98" Outside Frame Dimensions, 2 x 8 Wood Framed, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	340.59 24.48 58.54 12.00 65.00 85.00	95.80
07 72 13 00-0189	EA		50" x 50" Outside Frame Dimensions, 2 x 8 Wood Framed, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	298.44 21.22 51.07 8.10 52.10 63.10	86.22
07 72 13 00-0190	EA		50" x 74" Outside Frame Dimensions, 2 x 8 Wood Framed, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	348.59 25.28 60.14 11.55 46.55 80.55	95.80
07 72 13 00-0191	EA		51" x 99" Outside Frame Dimensions, 2 x 8 Wood Framed, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	386.92 27.20 65.89 15.45 71.45 96.45	114.96
07 72 13 00-0192	EA		62" x 62" Outside Frame Dimensions, 2 x 8 Wood Framed, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	327.59 23.18 55.94 12.30 45.30 83.30	95.80
07 72 13 00-0193	EA		62-3/8" x 74-3/8" Outside Frame Dimensions, 2 x 8 Wood Framed, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	360.76 25.54 61.61 14.10 63.10 94.10	105.38
07 72 13 00-0194	EA		62" x 98" Outside Frame Dimensions, 2 x 8 Wood Framed, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	406.92 29.20 69.89 18.30 67.30 117.30	114.96
07 72 13 00-0195			2 x 10 Wood Framed, Prefabricated Roof Curbs (07 72 13 00-0188)		
07 72 13 00-0196	EA		26" x 26" Outside Frame Dimensions, 2 x 10 Wood Framed, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	244.28 16.76 41.19 3.30 24.30 35.30	76.64
07 72 13 00-0197	EA		26" x 50" Outside Frame Dimensions, 2 x 10 Wood Framed, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	273.44 18.72 46.07 4.95 39.95 46.95	86.22



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 72 13 00-0198 EA 26" x 98" Outside Frame Dimensions, 2 x 10 Wood Framed, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	306.44 22.02 52.67 9.15 58.15 64.15	86.22
07 72 13 00-0199 EA 38" x 62" Outside Frame Dimensions, 2 x 10 Wood Framed, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	301.44 21.52 51.67 7.80 51.80 65.80	86.22
07 72 13 00-0200 EA 38" x 74" Outside Frame Dimensions, 2 x 10 Wood Framed, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	313.44 22.72 54.07 9.30 57.30 70.30	86.22
07 72 13 00-0201 EA 38" x 98" Outside Frame Dimensions, 2 x 10 Wood Framed, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	350.59 25.48 60.54 12.00 65.00 85.00	95.80
07 72 13 00-0202 EA 50" x 50" Outside Frame Dimensions, 2 x 10 Wood Framed, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	305.44 21.92 52.47 8.10 52.10 63.10	86.22
07 72 13 00-0203 EA 50" x 74" Outside Frame Dimensions, 2 x 10 Wood Framed, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	357.59 26.18 61.94 11.55 46.55 80.55	95.80
07 72 13 00-0204 EA 51" x 99" Outside Frame Dimensions, 2 x 10 Wood Framed, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	395.92 28.10 67.69 15.45 71.45 96.45	114.96
07 72 13 00-0205 EA 62" x 62" Outside Frame Dimensions, 2 x 10 Wood Framed, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	334.59 23.88 57.34 12.30 45.30 83.30	95.80
07 72 13 00-0206 EA 62-3/8" x 74-3/8" Outside Frame Dimensions, 2 x 10 Wood Framed, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	368.76 26.34 63.21 14.10 63.10 94.10	105.38
07 72 13 00-0207 EA 62" x 98" Outside Frame Dimensions, 2 x 10 Wood Framed, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	416.92 30.20 71.89 18.30 67.30 117.30	114.96
07 72 13 00-0208 2 x 12 Wood Framed, Prefabricated Roof Curbs <small>(07 72 13 00-0168)</small>		
07 72 13 00-0209 EA 26" x 26" Outside Frame Dimensions, 2 x 12 Wood Framed, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	249.28 17.26 42.19 3.30 24.30 35.30	76.64
07 72 13 00-0210 EA 26" x 50" Outside Frame Dimensions, 2 x 12 Wood Framed, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	277.44 19.12 46.87 4.95 39.95 46.95	86.22
07 72 13 00-0211 EA 26" x 98" Outside Frame Dimensions, 2 x 12 Wood Framed, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	315.44 22.92 54.47 9.15 58.15 64.15	86.22

07 Thermal And Moisture Protection
07 70 Roof And Wall Specialties And Accessories
07 72 Roof Accessories



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 72 13 00-0212	EA		38" x 74" Outside Frame Dimensions, 2 x 12 Wood Framed, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	323.44 23.72 56.07 9.30 57.30 70.30	86.22
07 72 13 00-0213	EA		38" x 98" Outside Frame Dimensions, 2 x 12 Wood Framed, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	361.59 26.58 62.74 12.00 65.00 85.00	95.80
07 72 13 00-0214	EA		50" x 50" Outside Frame Dimensions, 2 x 12 Wood Framed, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	314.44 22.82 54.27 8.10 52.10 63.10	86.22
07 72 13 00-0215	EA		50" x 74" Outside Frame Dimensions, 2 x 12 Wood Framed, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	367.59 27.18 63.94 11.55 46.55 80.55	95.80
07 72 13 00-0216	EA		51" x 99" Outside Frame Dimensions, 2 x 12 Wood Framed, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	407.92 29.30 70.09 15.45 71.45 96.45	114.96
07 72 13 00-0217	EA		62-3/8" x 74-3/8" Outside Frame Dimensions, 2 x 12 Wood Framed, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	376.76 27.14 64.81 14.10 63.10 94.10	105.38
07 72 13 00-0218			Wood Framed With Liner, Prefabricated Roof Curbs <small>(07 72 13 00-0167)</small>		
07 72 13 00-0219			2 x 6 Wood Framed With Liner, Prefabricated Roof Curbs <small>(07 72 13 00-0218)</small>		
07 72 13 00-0220	EA		26" x 26" Outside Frame Dimensions, 2 x 6 Wood Framed With Liner, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	242.28 16.56 40.79 3.30 24.30 35.30	76.64
07 72 13 00-0221	EA		26" x 50" Outside Frame Dimensions, 2 x 6 Wood Framed With Liner, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	266.44 18.02 44.67 4.95 39.95 46.95	86.22
07 72 13 00-0222	EA		26" x 98" Outside Frame Dimensions, 2 x 6 Wood Framed With Liner, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	298.44 21.22 51.07 9.15 58.15 64.15	86.22
07 72 13 00-0223	EA		38" x 62" Outside Frame Dimensions, 2 x 6 Wood Framed With Liner, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	291.44 20.52 49.67 7.80 51.80 65.80	86.22
07 72 13 00-0224	EA		38" x 74" Outside Frame Dimensions, 2 x 6 Wood Framed With Liner, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	300.44 21.42 51.47 9.30 57.30 70.30	86.22
07 72 13 00-0225	EA		38" x 98" Outside Frame Dimensions, 2 x 6 Wood Framed With Liner, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	337.59 24.18 57.94 12.00 65.00 85.00	95.80
07 72 13 00-0226	EA		50" x 50" Outside Frame Dimensions, 2 x 6 Wood Framed With Liner, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	296.44 21.02 50.67 8.10 52.10 63.10	86.22



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 72 13 00-0227 EA 50" x 74" Outside Frame Dimensions, 2 x 6 Wood Framed With Liner, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	345.59 24.98 59.54 11.55 46.55 80.55	95.80
07 72 13 00-0228 EA 51" x 99" Outside Frame Dimensions, 2 x 6 Wood Framed With Liner, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	383.92 26.90 65.29 15.45 71.45 96.45	114.96
07 72 13 00-0229 EA 62" x 62" Outside Frame Dimensions, 2 x 6 Wood Framed With Liner, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	328.59 23.28 56.14 12.30 45.30 83.30	95.80
07 72 13 00-0230 EA 62-3/8" x 74-3/8" Outside Frame Dimensions, 2 x 6 Wood Framed With Liner, Prefabricated Roof Curb..... <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	358.76 25.34 61.21 14.10 63.10 94.10	105.38
07 72 13 00-0231 EA 62" x 98" Outside Frame Dimensions, 2 x 6 Wood Framed With Liner, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	406.92 29.20 69.89 18.30 67.30 117.30	114.96
07 72 13 00-0232 2 x 8 Wood Framed With Liner, Prefabricated Roof Curbs (07 72 13 00-0218)		
07 72 13 00-0233 EA 26" x 26" Outside Frame Dimensions, 2 x 8 Wood Framed With Liner, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	249.28 17.26 42.19 3.30 24.30 35.30	76.64
07 72 13 00-0234 EA 26" x 50" Outside Frame Dimensions, 2 x 8 Wood Framed With Liner, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	274.44 18.82 46.27 4.95 39.95 46.95	86.22
07 72 13 00-0235 EA 26" x 98" Outside Frame Dimensions, 2 x 8 Wood Framed With Liner, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	310.44 22.42 53.47 9.15 58.15 64.15	86.22
07 72 13 00-0236 EA 38" x 62" Outside Frame Dimensions, 2 x 8 Wood Framed With Liner, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	303.44 21.72 52.07 7.80 51.80 65.80	86.22
07 72 13 00-0237 EA 38" x 74" Outside Frame Dimensions, 2 x 8 Wood Framed With Liner, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	316.44 23.02 54.67 9.30 57.30 70.30	86.22
07 72 13 00-0238 EA 38" x 98" Outside Frame Dimensions, 2 x 8 Wood Framed With Liner, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	355.59 25.98 61.54 12.00 65.00 85.00	95.80
07 72 13 00-0239 EA 50" x 50" Outside Frame Dimensions, 2 x 8 Wood Framed With Liner, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	310.44 22.42 53.47 8.10 52.10 63.10	86.22
07 72 13 00-0240 EA 50" x 74" Outside Frame Dimensions, 2 x 8 Wood Framed With Liner, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	362.59 26.68 62.94 11.55 46.55 80.55	95.80

07 Thermal And Moisture Protection
07 70 Roof And Wall Specialties And Accessories
07 72 Roof Accessories



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 72 13 00-0241	EA		51" x 99" Outside Frame Dimensions, 2 x 8 Wood Framed With Liner, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	402.92 28.80 69.09 15.45 71.45 96.45	114.96
07 72 13 00-0242	EA		62" x 62" Outside Frame Dimensions, 2 x 8 Wood Framed With Liner, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	341.59 24.58 58.74 12.30 45.30 83.30	95.80
07 72 13 00-0243	EA		62-3/8" x 74-3/8" Outside Frame Dimensions, 2 x 8 Wood Framed With Liner, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	373.76 26.84 64.21 14.10 63.10 94.10	105.38
07 72 13 00-0244	EA		62" x 98" Outside Frame Dimensions, 2 x 8 Wood Framed With Liner, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	423.92 30.90 73.29 18.30 67.30 117.30	114.96
07 72 13 00-0245			2 x 10 Wood Framed With Liner, Prefabricated Roof Curbs <small>(07 72 13 00-0218)</small>		
07 72 13 00-0246	EA		26" x 26" Outside Frame Dimensions, 2 x 10 Wood Framed With Liner, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	255.28 17.86 43.39 3.30 24.30 35.30	76.64
07 72 13 00-0247	EA		26" x 50" Outside Frame Dimensions, 2 x 10 Wood Framed With Liner, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	282.44 19.62 47.87 4.95 39.95 46.95	86.22
07 72 13 00-0248	EA		26" x 98" Outside Frame Dimensions, 2 x 10 Wood Framed With Liner, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	322.44 23.62 55.87 9.15 58.15 64.15	86.22
07 72 13 00-0249	EA		38" x 62" Outside Frame Dimensions, 2 x 10 Wood Framed With Liner, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	312.44 22.62 53.87 7.80 51.80 65.80	86.22
07 72 13 00-0250	EA		38" x 74" Outside Frame Dimensions, 2 x 10 Wood Framed With Liner, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	328.44 24.22 57.07 9.30 57.30 70.30	86.22
07 72 13 00-0251	EA		38" x 98" Outside Frame Dimensions, 2 x 10 Wood Framed With Liner, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	368.59 27.28 64.14 12.00 65.00 85.00	95.80
07 72 13 00-0252	EA		50" x 50" Outside Frame Dimensions, 2 x 10 Wood Framed With Liner, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	319.44 23.32 55.27 8.10 52.10 63.10	86.22
07 72 13 00-0253	EA		50" x 74" Outside Frame Dimensions, 2 x 10 Wood Framed With Liner, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	373.59 27.78 65.14 11.55 46.55 80.55	95.80
07 72 13 00-0254	EA		51" x 99" Outside Frame Dimensions, 2 x 10 Wood Framed With Liner, Prefabricated Roof Curb <i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i> <i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i> <i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i> <i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	414.92 30.00 71.49 15.45 71.45 96.45	114.96



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 72 13 00-0255 EA 62" x 62" Outside Frame Dimensions, 2 x 10 Wood Framed With Liner, Prefabricated Roof Curb	351.59	95.80
<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	25.58	
<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	60.74	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	12.30	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	45.30	
<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	83.30	
07 72 13 00-0256 EA 62-3/8" x 74-3/8" Outside Frame Dimensions, 2 x 10 Wood Framed With Liner, Prefabricated Roof Curb	384.76	105.38
<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	27.94	
<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	66.41	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	14.10	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	63.10	
<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	94.10	
07 72 13 00-0257 EA 62" x 98" Outside Frame Dimensions, 2 x 10 Wood Framed With Liner, Prefabricated Roof Curb	436.92	114.96
<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	32.20	
<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	75.89	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	18.30	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	67.30	
<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	117.30	
07 72 13 00-0258 2 x 12 Wood Framed With Liner, Prefabricated Roof Curbs <small>(07 72 13 00-0218)</small>		
07 72 13 00-0259 EA 26" x 26" Outside Frame Dimensions, 2 x 12 Wood Framed With Liner, Prefabricated Roof Curb	267.28	76.64
<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	19.06	
<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	45.79	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	3.30	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	24.30	
<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	35.30	
07 72 13 00-0260 EA 26" x 50" Outside Frame Dimensions, 2 x 12 Wood Framed With Liner, Prefabricated Roof Curb	288.44	86.22
<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	20.22	
<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	49.07	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	4.95	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	39.95	
<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	46.95	
07 72 13 00-0261 EA 26" x 98" Outside Frame Dimensions, 2 x 12 Wood Framed With Liner, Prefabricated Roof Curb	331.44	86.22
<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	24.52	
<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	57.67	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	9.15	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	58.15	
<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	64.15	
07 72 13 00-0262 EA 38" x 74" Outside Frame Dimensions, 2 x 12 Wood Framed With Liner, Prefabricated Roof Curb	338.44	86.22
<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	25.22	
<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	59.07	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	9.30	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	57.30	
<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	70.30	
07 72 13 00-0263 EA 38" x 98" Outside Frame Dimensions, 2 x 12 Wood Framed With Liner, Prefabricated Roof Curb	406.59	95.80
<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	31.08	
<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	71.74	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	12.00	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	65.00	
<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	85.00	
07 72 13 00-0264 EA 50" x 50" Outside Frame Dimensions, 2 x 12 Wood Framed With Liner, Prefabricated Roof Curb	348.44	86.22
<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	26.22	
<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	61.07	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	8.10	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	52.10	
<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	63.10	
07 72 13 00-0265 EA 50" x 74" Outside Frame Dimensions, 2 x 12 Wood Framed With Liner, Prefabricated Roof Curb	408.59	95.80
<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	31.28	
<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	72.14	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	11.55	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	46.55	
<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	80.55	
07 72 13 00-0266 EA 51" x 99" Outside Frame Dimensions, 2 x 12 Wood Framed With Liner, Prefabricated Roof Curb	454.92	114.96
<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	34.00	
<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	79.49	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	15.45	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	71.45	
<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	96.45	
07 72 13 00-0267 EA 62-3/8" x 74-3/8" Outside Frame Dimensions, 2 x 12 Wood Framed With Liner, Prefabricated Roof Curb	421.76	105.38
<i>For Sloped Roofs Up To 1 In 12 Pitch, Add</i>	31.64	
<i>For Sloped Roofs >1 In 12 To 3 In 12 Pitch, Add</i>	73.81	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Clip Attached, Safety Security Guard, Add</i>	14.10	
<i>For 3/16" Wire Diameter, 4" x 4" Grids, Z Channel Attached, Safety Security Guard, Add</i>	63.10	
<i>For 1/2" Diameter, 8" On Center, Hot Rolled Steel, Burglar Bars, Add</i>	94.10	
07 72 23 Relief Vents <small>(07 72)</small>		
07 72 23 00-0001 Wind Driven Turbine Ventilators <small>(07 72 23)</small>		
Note: Excludes curb or flange base.		
07 72 23 00-0002 Galvanized Steel, Wind Driven Turbine Ventilators <small>(07 72 23 00-0001)</small>		
07 72 23 00-0003 EA 6" Neck Diameter, 26 Gauge, Galvanized Steel, Outside Braced, Wind Driven Turbine Ventilator	89.92	22.53
<i>For Curb Or Flange Base, Add</i>	106.34	

07	Thermal And Moisture Protection
07 70	Roof And Wall Specialties And Accessories
07 72	Roof Accessories



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 72 23 00-0004	EA		9" Neck Diameter, 26 Gauge, Galvanized Steel, Outside Braced, Wind Driven Turbine Ventilator	107.31	24.95
			<i>For Curb Or Flange Base, Add</i>	117.30	
07 72 23 00-0005	EA		12" Neck Diameter, 26 Gauge, Galvanized Steel, Outside Braced, Wind Driven Turbine Ventilator	116.99	29.77
			<i>For Curb Or Flange Base, Add</i>	132.11	
07 72 23 00-0006	EA		15" Neck Diameter, 26 Gauge, Galvanized Steel, Outside Braced, Wind Driven Turbine Ventilator	215.18	33.00
			<i>For Curb Or Flange Base, Add</i>	201.24	
07 72 23 00-0007	EA		18" Neck Diameter, 26 Gauge, Galvanized Steel, Outside Braced, Wind Driven Turbine Ventilator	293.16	37.02
			<i>For Curb Or Flange Base, Add</i>	218.85	
07 72 23 00-0008	EA		21" Neck Diameter, 26 Gauge, Galvanized Steel, Outside Braced, Wind Driven Turbine Ventilator	351.87	40.24
			<i>For Curb Or Flange Base, Add</i>	237.28	
07 72 23 00-0009	EA		24" Neck Diameter, 26 Gauge, Galvanized Steel, Outside Braced, Wind Driven Turbine Ventilator	447.21	45.07
			<i>For Curb Or Flange Base, Add</i>	287.78	
07 72 23 00-0010	EA		36" Neck Diameter, 26 Gauge, Galvanized Steel, Outside Braced, Wind Driven Turbine Ventilator	733.50	60.36
			<i>For Curb Or Flange Base, Add</i>	462.18	
07 72 23 00-0011			Mill Finish Aluminum, Wind Driven Turbine Ventilators (07 72 23 00-0001)		
07 72 23 00-0012	EA		6" Neck Diameter, 0.025", Mill Finish Aluminum, Outside Braced, Wind Driven Turbine Ventilator	94.43	22.53
			<i>For Curb Or Flange Base, Add</i>	116.31	
07 72 23 00-0013	EA		9" Neck Diameter, 0.025", Mill Finish Aluminum, Outside Braced, Wind Driven Turbine Ventilator	117.12	24.95
			<i>For Curb Or Flange Base, Add</i>	128.33	
07 72 23 00-0014	EA		12" Neck Diameter, 0.025", Mill Finish Aluminum, Outside Braced, Wind Driven Turbine Ventilator	131.62	29.77
			<i>For Curb Or Flange Base, Add</i>	143.35	
07 72 23 00-0015	EA		15" Neck Diameter, 0.025", Mill Finish Aluminum, Outside Braced, Wind Driven Turbine Ventilator	229.70	33.00
			<i>For Curb Or Flange Base, Add</i>	236.96	
07 72 23 00-0016	EA		18" Neck Diameter, 0.025", Mill Finish Aluminum, Outside Braced, Wind Driven Turbine Ventilator	295.14	37.02
			<i>For Curb Or Flange Base, Add</i>	253.97	
07 72 23 00-0017	EA		21" Neck Diameter, 0.025", Mill Finish Aluminum, Outside Braced, Wind Driven Turbine Ventilator	371.77	40.24
			<i>For Curb Or Flange Base, Add</i>	285.34	
07 72 23 00-0018	EA		24" Neck Diameter, 0.025", Mill Finish Aluminum, Outside Braced, Wind Driven Turbine Ventilator	500.00	45.07
			<i>For Curb Or Flange Base, Add</i>	343.25	
07 72 23 00-0019	EA		36" Neck Diameter, 0.025", Mill Finish Aluminum, Outside Braced, Wind Driven Turbine Ventilator	743.22	60.36
			<i>For Curb Or Flange Base, Add</i>	512.83	
07 72 23 00-0020			Stationary Siphon Ventilators (07 72 23)		
			Note: Excludes curb or flange base.		
07 72 23 00-0021			Galvanized Steel, Stationary Siphon Ventilators (07 72 23 00-0020)		
07 72 23 00-0022	EA		6" Neck Diameter, 26 Gauge, Galvanized Steel, Stationary Siphon Ventilator	77.25	22.53
			<i>For Curb Or Flange Base, Add</i>	106.34	
07 72 23 00-0023	EA		9" Neck Diameter, 26 Gauge, Galvanized Steel, Stationary Siphon Ventilator	100.06	24.95
			<i>For Curb Or Flange Base, Add</i>	117.30	
07 72 23 00-0024	EA		12" Neck Diameter, 26 Gauge, Galvanized Steel, Stationary Siphon Ventilator	111.05	29.77
			<i>For Curb Or Flange Base, Add</i>	132.11	
07 72 23 00-0025	EA		15" Neck Diameter, 26 Gauge, Galvanized Steel, Stationary Siphon Ventilator	182.65	33.00
			<i>For Curb Or Flange Base, Add</i>	201.24	
07 72 23 00-0026	EA		18" Neck Diameter, 26 Gauge, Galvanized Steel, Stationary Siphon Ventilator	210.84	37.02
			<i>For Curb Or Flange Base, Add</i>	218.85	
07 72 23 00-0027	EA		21" Neck Diameter, 26 Gauge, Galvanized Steel, Stationary Siphon Ventilator	293.69	40.24
			<i>For Curb Or Flange Base, Add</i>	237.28	
07 72 23 00-0028	EA		24" Neck Diameter, 26 Gauge, Galvanized Steel, Stationary Siphon Ventilator	379.79	45.07
			<i>For Curb Or Flange Base, Add</i>	287.78	
07 72 23 00-0029	EA		36" Neck Diameter, 26 Gauge, Galvanized Steel, Stationary Siphon Ventilator	548.53	60.36
			<i>For Curb Or Flange Base, Add</i>	462.18	
07 72 23 00-0030			Mill Finish Aluminum, Stationary Siphon Ventilators (07 72 23 00-0020)		
07 72 23 00-0031	EA		6" Neck Diameter, 0.025", Mill Finish Aluminum, Stationary Siphon Ventilator	90.98	22.53
			<i>For Curb Or Flange Base, Add</i>	116.31	
07 72 23 00-0032	EA		9" Neck Diameter, 0.025", Mill Finish Aluminum, Stationary Siphon Ventilator	119.18	24.95
			<i>For Curb Or Flange Base, Add</i>	128.33	
07 72 23 00-0033	EA		12" Neck Diameter, 0.025", Mill Finish Aluminum, Stationary Siphon Ventilator	133.36	29.77
			<i>For Curb Or Flange Base, Add</i>	143.35	
07 72 23 00-0034	EA		15" Neck Diameter, 0.025", Mill Finish Aluminum, Stationary Siphon Ventilator	213.43	33.00
			<i>For Curb Or Flange Base, Add</i>	236.96	
07 72 23 00-0035	EA		18" Neck Diameter, 0.025", Mill Finish Aluminum, Stationary Siphon Ventilator	267.48	37.02
			<i>For Curb Or Flange Base, Add</i>	253.97	
07 72 23 00-0036	EA		21" Neck Diameter, 0.025", Mill Finish Aluminum, Stationary Siphon Ventilator	326.82	40.24
			<i>For Curb Or Flange Base, Add</i>	285.34	
07 72 23 00-0037	EA		24" Neck Diameter, 0.025", Mill Finish Aluminum, Stationary Siphon Ventilator	465.44	45.07
			<i>For Curb Or Flange Base, Add</i>	343.25	
07 72 23 00-0038	EA		36" Neck Diameter, 0.025", Mill Finish Aluminum, Stationary Siphon Ventilator	699.05	60.36
			<i>For Curb Or Flange Base, Add</i>	512.83	
07 72 23 00-0039			Spun Aluminum, Stationary Mushroom Gravity Ventilators (07 72 23)		
			Note: Includes flange base and bird screen. Excludes curb.		
07 72 23 00-0040	EA		8" Orifice Diameter, Spun Aluminum, Stationary Mushroom Gravity Ventilator	189.23	36.22
			<i>For Backdraft Damper, Add</i>	93.87	
			<i>For Curb Base, Add</i>	144.55	
07 72 23 00-0041	EA		10" Orifice Diameter, Spun Aluminum, Stationary Mushroom Gravity Ventilator	232.02	40.24
			<i>For Backdraft Damper, Add</i>	102.71	
			<i>For Curb Base, Add</i>	158.17	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 72 23 00-0042 EA 12" Orifice Diameter, Spun Aluminum, Stationary Mushroom Gravity Ventilator <i>For Backdraft Damper, Add</i> <i>For Curb Base, Add</i>	263.19 140.26 200.19	48.28
07 72 23 00-0043 EA 16" Orifice Diameter, Spun Aluminum, Stationary Mushroom Gravity Ventilator <i>For Backdraft Damper, Add</i> <i>For Curb Base, Add</i>	319.43 160.14 231.58	53.12
07 72 23 00-0044 EA 24" Orifice Diameter, Spun Aluminum, Stationary Mushroom Gravity Ventilator <i>For Backdraft Damper, Add</i> <i>For Curb Base, Add</i>	831.56 201.00 305.25	72.43
07 72 23 00-0045 EA 30" Orifice Diameter, Spun Aluminum, Stationary Mushroom Gravity Ventilator <i>For Backdraft Damper, Add</i> <i>For Curb Base, Add</i>	1,014.34 237.44 364.52	83.70
07 72 23 00-0046 EA 36" Orifice Diameter, Spun Aluminum, Stationary Mushroom Gravity Ventilator <i>For Backdraft Damper, Add</i> <i>For Curb Base, Add</i>	1,377.85 237.44 380.50	96.58
07 72 23 00-0047 EA 42" Orifice Diameter, Spun Aluminum, Stationary Mushroom Gravity Ventilator <i>For Backdraft Damper, Add</i> <i>For Curb Base, Add</i>	1,929.18 248.49 394.90	104.63
07 72 23 00-0048 EA 48" Orifice Diameter, Spun Aluminum, Stationary Mushroom Gravity Ventilator <i>For Backdraft Damper, Add</i> <i>For Curb Base, Add</i>	2,766.56 276.10 443.55	112.67
07 72 23 00-0049 Galvanized Steel, Stationary Gooseneck Ventilators (07 72 23) Note: Includes flange base and bird screen. Excludes curb.		
07 72 23 00-0050 EA 8" x 8", 26 Gauge, Galvanized Steel, Stationary Gooseneck Ventilator	312.78	40.24
07 72 23 00-0051 EA 12" x 12", 26 Gauge, Galvanized Steel, Stationary Gooseneck Ventilator.....	369.98	53.12
07 72 23 00-0052 EA 16" x 16", 26 Gauge, Galvanized Steel, Stationary Gooseneck Ventilator.....	530.59	72.43
07 72 23 00-0053 EA 24" x 24", 26 Gauge, Galvanized Steel, Stationary Gooseneck Ventilator.....	808.43	83.70
07 72 26 Ridge Vents (07 72)		
07 72 26 00-0001 Aluminum Ridge Vents (07 72 26)		
07 72 26 00-0002 LF Aluminum Ridge Vent Strips	7.11	2.34
07 72 26 00-0003 EA Aluminum Ridge Univent Connectors	34.27	14.49
07 72 26 00-0004 EA Aluminum Ridge Univent End Cap	33.12	14.49
07 72 26 00-0005 Galvanized Ridge Vents (07 72 26)		
07 72 26 00-0006 LF Galvanized Sheet Metal Ridge Vent Strips.....	8.38	2.50
07 72 29 Rafter Vent (07 72)		
07 72 29 00-0001 Rafter Vent (07 72 29) Note: Built-in baffle is designed to help keep air flowing freely from soffits to ridge vents.		
07 72 29 00-0002 EA 22" x 4' Rafter Vent.....	6.00	
07 72 29 00-0003 EA 14" x 4' Rafter Vent.....	5.46	
07 72 33 Roof Hatches (07 72) Note: Includes curb with integral insulation, lockable hatch and gaskets.		
07 72 33 00-0001 Galvanized Steel Cover And Curb (07 72 33)		
07 72 33 00-0002 EA 2'-6" x 3'-0" Galvanized Steel Roof Hatch (Bilco S-20)	863.86	107.81
07 72 33 00-0003 EA 2'-6" x 4'-6" Galvanized Steel Roof Hatch (Bilco NB-20)	1,262.40	119.79
07 72 33 00-0004 EA 2'-6" x 8'-0" Galvanized Steel Roof Hatch (Bilco L-20).....	2,222.55	163.37
07 72 33 00-0005 EA 3'-0" x 3'-0" Galvanized Steel Roof Hatch (Bilco E-20)	1,243.29	119.79
07 72 33 00-0006 EA 4'-0" x 4'-0" Galvanized Steel Roof Hatch.....	1,402.75	133.12
07 72 33 00-0007 EA 3'-0" x 8'-0" Galvanized Steel Roof Hatch.....	2,296.60	181.56
07 72 33 00-0008 Aluminum Cover And Curb (07 72 33)		
07 72 33 00-0009 EA 2'-6" x 3'-0" Aluminum Roof Hatch (Bilco S-50)	979.15	107.81
07 72 33 00-0010 EA 2'-6" x 4'-6" Aluminum Roof Hatch (Bilco NB-50).....	1,279.93	119.79
07 72 33 00-0011 EA 2'-6" x 8'-0" Aluminum Roof Hatch (Bilco L-50).....	2,345.81	163.37
07 72 33 00-0012 EA 3'-0" x 3'-0" Aluminum Roof Hatch (Bilco E-50)	1,254.44	119.79
07 72 33 00-0013 EA 4'-0" x 4'-0" Aluminum Roof Hatch (Bilco F-50)	2,262.93	133.12
07 72 33 00-0014 EA 3'-0" x 8'-0" Aluminum Roof Hatch	2,474.59	181.56
07 72 33 00-0015 EA 3'-0" x 2'-6" Aluminum Roof Scuttle With Skylight (Bilco GS-50)	1,412.69	119.79
07 72 33 00-0016 Steel, Plain, Primed (07 72 33)		
07 72 33 00-0017 EA 2'-6" x 3'-0" Plain Steel Roof Hatch Primed (Bilco S-20).....	828.99	107.81
07 72 33 00-0018 EA 2'-6" x 4'-6" Plain Steel Roof Hatch Primed (Bilco NB-20)	1,117.58	119.79
07 72 33 00-0019 EA 2'-6" x 8'-0" Plain Steel Roof Hatch Primed (Bilco L-20).....	1,530.90	163.37
07 72 33 00-0020 EA 3'-0" x 3'-0" Plain Steel Roof Hatch Primed (Bilco E-20).....	1,037.41	119.79
07 72 33 00-0021 EA 4'-0" x 4'-0" Plain Steel Roof Hatch Primed	1,269.93	133.12
07 72 33 00-0022 EA 3'-0" x 8'-0" Plain Steel Roof Hatch Primed	1,725.46	181.56

07	Thermal And Moisture Protection
07 70	Roof And Wall Specialties And Accessories
07 72	Roof Accessories



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 72 33 00-0023			Stainless Steel <small>(07 72 33)</small>		
07 72 33 00-0024	EA		2'-6" x 3'-0" Stainless Steel Roof Hatch (Bilco S-90).....	2,225.07	107.81
07 72 33 00-0025	EA		2'-6" x 4'-6" Stainless Steel Roof Hatch (Bilco NB-90).....	4,289.27	119.79
07 72 33 00-0026	EA		2'-6" x 8'-0" Stainless Steel Roof Hatch (Bilco L-90).....	6,456.17	163.37
07 72 33 00-0027	EA		3'-0" x 3'-0" Stainless Steel Roof Hatch (Bilco E-90).....	3,436.90	119.79
07 72 33 00-0028	EA		4'-0" x 4'-0" Stainless Steel Roof Hatch.....	7,304.32	133.12
07 72 33 00-0029	EA		3'-0" x 8'-0" Stainless Steel Roof Hatch.....	8,170.68	181.56
07 72 33 00-0030			Remove And Reinstall Roof Hatch <small>(07 72 33)</small>		
			Note: Includes storage, cleaning and supply materials.		
07 72 33 00-0031	EA		Remove And Reinstall Roof Hatch (All Types).....	331.62	
07 72 33 00-0032			Aluminum Cover And Galvanized Steel Curb <small>(07 72 33)</small>		
07 72 33 00-0033	EA		Aluminum Cover, Galvanized Steel Curb 3'-0" x 2'-6" Roof (Bilco S-40).....	947.27	119.79
07 72 33 00-0034	EA		Aluminum Cover, Galvanized Steel Curb 2'-6" x 4'-6" Roof (Bilco NB-40).....	1,248.05	133.12
07 72 33 00-0035	EA		Aluminum Cover, Galvanized Steel Curb 2'-6" x 8'-0" Roof (Bilco L-40).....	2,262.93	181.49
07 72 33 00-0036	EA		Aluminum Cover, Galvanized Steel Curb 3'-0" x 3'-0" Roof (Bilco E-40).....	1,228.94	123.53
07 72 33 00-0037	EA		Aluminum Cover, Galvanized Steel Curb 4'-0" x 4'-0" Roof (Bilco F-40).....	2,192.80	136.86
07 72 33 00-0038			Roof Hatch Accessories <small>(07 72 33)</small>		
07 72 33 00-0039	EA		Roof Hatch Ladderup Safety Post (Bilco LU-1).....	563.32	56.16
07 72 36			Smoke Vents <small>(07 72)</small>		
07 72 36 00-0001			Fire Vent <small>(07 72 36)</small>		
07 72 36 00-0002			Galvanized Steel Covers And Curb <small>(07 72 36 00-0001)</small>		
07 72 36 00-0003	EA		4'-0" x 4'-0" Galvanized Steel Covers And Curb, Smoke And Fire Vent (Bilco DSH-4848).....	2,221.81	99.87
07 72 36 00-0004	EA		4'-0" x 6'-0" Galvanized Steel Covers And Curb, Smoke And Fire Vent (Bilco DSH-4872).....	2,556.90	137.32
07 72 36 00-0005	EA		4'-0" x 7'-6" Galvanized Steel Covers And Curb, Smoke And Fire Vent (Bilco DSH-4890).....	2,914.33	149.82
07 72 36 00-0006	EA		4'-0" x 8'-0" Galvanized Steel Covers And Curb, Smoke And Fire Vent (Bilco DSH-4896).....	2,972.05	157.30
07 72 36 00-0007	EA		5'-0" x 5'-0" Galvanized Steel Covers And Curb, Smoke And Fire Vent (Bilco DSH-6060).....	3,446.83	137.32
07 72 36 00-0008	EA		5'-0" x 6'-0" Galvanized Steel Covers And Curb, Smoke And Fire Vent (Bilco DSH-6072).....	3,664.79	149.82
07 72 36 00-0009	EA		5'-0" x 7'-0" Galvanized Steel Covers And Curb, Smoke And Fire Vent (Bilco DSH-6084).....	3,869.44	162.32
07 72 36 00-0010	EA		5'-0" x 8'-0" Galvanized Steel Covers And Curb, Smoke And Fire Vent (Bilco DSH-6096).....	4,406.17	174.82
07 72 36 00-0011	EA		5'-0" x 10'-0" Galvanized Steel Covers And Curb, Smoke And Fire Vent (Bilco DSH-60120).....	5,467.58	187.25
07 72 36 00-0012	EA		5'-6" x 5'-6" Galvanized Steel Covers And Curb, Smoke And Fire Vent (Bilco DSH-6666).....	3,663.56	162.32
07 72 36 00-0013	EA		5'-6" x 12'-0" Galvanized Steel Covers And Curb, Smoke And Fire Vent (Bilco DSH-66114).....	7,704.47	199.75
07 72 36 00-0014	EA		6'-0" x 6'-0" Galvanized Steel Covers And Curb, Smoke And Fire Vent (Bilco DSH-7272).....	4,223.25	212.26
07 72 36 00-0015			Aluminum Covers And Galvanized Steel Curb <small>(07 72 36 00-0001)</small>		
07 72 36 00-0016	EA		4'-0" x 4'-0" Aluminum Covers And Galvanized Steel Curb, Smoke And Fire Vent (Bilco DSH-4848A).....	2,215.43	99.87
07 72 36 00-0017	EA		4'-0" x 6'-0" Aluminum Covers And Galvanized Steel Curb, Smoke And Fire Vent (Bilco DSH-4872A).....	2,532.99	137.32
07 72 36 00-0018	EA		4'-0" x 7'-6" Aluminum Covers And Galvanized Steel Curb, Smoke And Fire Vent (Bilco DSH-4890A).....	2,851.37	149.82
07 72 36 00-0019	EA		4'-0" x 8'-0" Aluminum Covers And Galvanized Steel Curb, Smoke And Fire Vent (Bilco DSH-4896A).....	2,951.86	157.30
07 72 36 00-0020	EA		5'-0" x 5'-0" Aluminum Covers And Galvanized Steel Curb, Smoke And Fire Vent (Bilco DSH-6060A).....	2,870.90	137.32
07 72 36 00-0021	EA		5'-0" x 6'-0" Aluminum Covers And Galvanized Steel Curb, Smoke And Fire Vent (Bilco DSH-6072A).....	3,678.42	149.82
07 72 36 00-0022	EA		5'-0" x 7'-0" Aluminum Covers And Galvanized Steel Curb, Smoke And Fire Vent (Bilco DSH-6084A).....	3,923.82	162.32
07 72 36 00-0023	EA		5'-0" x 8'-0" Aluminum Covers And Galvanized Steel Curb, Smoke And Fire Vent (Bilco DSH-6096A).....	3,819.61	174.82
07 72 36 00-0024	EA		5'-0" x 10'-0" Aluminum Covers And Galvanized Steel Curb, Smoke And Fire Vent (Bilco DSH-60120A).....	5,381.24	187.25
07 72 36 00-0025	EA		5'-6" x 5'-6" Aluminum Covers And Galvanized Steel Curb, Smoke And Fire Vent (Bilco DSH-6666A).....	3,705.27	162.32
07 72 36 00-0026	EA		5'-6" x 12'-0" Aluminum Covers And Galvanized Steel Curb, Smoke And Fire Vent (Bilco DSH-66144A).....	7,070.37	199.75
07 72 36 00-0027	EA		6'-0" x 6'-0" Aluminum Covers And Galvanized Steel Curb, Smoke And Fire Vent (Bilco DSH-7272A).....	3,620.75	212.26
07 72 36 00-0028			Aluminum Covers And Curb <small>(07 72 36 00-0001)</small>		
07 72 36 00-0029	EA		4'-0" x 4'-0" Aluminum Covers And Curb, Smoke And Fire Vent (Bilco DSH-4848B).....	2,419.45	99.87
07 72 36 00-0030	EA		4'-0" x 6'-0" Aluminum Covers And Curb, Smoke And Fire Vent (Bilco DSH-4872B).....	2,870.90	137.32
07 72 36 00-0031	EA		4'-0" x 7'-6" Aluminum Covers And Curb, Smoke And Fire Vent (Bilco DSH-4890B).....	3,151.02	149.82
07 72 36 00-0032	EA		4'-0" x 8'-0" Aluminum Covers And Curb, Smoke And Fire Vent (Bilco DSH-4896B).....	3,334.39	157.30
07 72 36 00-0033	EA		5'-0" x 5'-0" Aluminum Covers And Curb, Smoke And Fire Vent (Bilco DSH-6060B).....	3,023.92	137.32
07 72 36 00-0034	EA		5'-0" x 6'-0" Aluminum Covers And Curb, Smoke And Fire Vent (Bilco DSH-6072B).....	3,833.21	149.82
07 72 36 00-0035	EA		5'-0" x 7'-0" Aluminum Covers And Curb, Smoke And Fire Vent (Bilco DSH-6084B).....	4,068.68	162.32
07 72 36 00-0036	EA		5'-0" x 8'-0" Aluminum Covers And Curb, Smoke And Fire Vent (Bilco DSH-6096B).....	4,202.15	174.82
07 72 36 00-0037	EA		5'-0" x 10'-0" Aluminum Covers And Curb, Smoke And Fire Vent (Bilco DSH-60120B).....	5,107.09	187.25
07 72 36 00-0038	EA		5'-6" x 5'-6" Aluminum Covers And Curb, Smoke And Fire Vent (Bilco DSH-6666B).....	3,883.79	162.32
07 72 36 00-0039	EA		5'-6" x 12'-0" Aluminum Covers And Curb, Smoke And Fire Vent (Bilco DSH-66114B).....	7,727.05	199.75
07 72 36 00-0040	EA		6'-0" x 6'-0" Aluminum Covers And Curb, Smoke And Fire Vent (Bilco DSH-7272B).....	4,003.29	212.26
07 72 36 00-0041			Polycarbonate Translucent Cover With Aluminum Frame And Aluminum Curb <small>(07 72 36)</small>		
07 72 36 00-0042	EA		4'-0" x 4'-0" Polycarbonate Translucent Cover With Aluminum Frame And Aluminum Curb, Smoke And Fire Vent (Bilco LV4848B).....	2,393.95	99.58



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 72 36 00-0043 EA 4'-0" x 6'-0" Polycarbonate Translucent Cover With Aluminum Frame And Aluminum Curb, Smoke And Fire Vent (Bilco LV4872B).....	3,030.28	137.32
07 72 36 00-0044 EA 4'-0" x 8'-0" Polycarbonate Translucent Cover With Aluminum Frame And Aluminum Curb, Smoke And Fire Vent (Bilco LV4896B).....	3,200.49	157.30
07 72 36 00-0045 EA 5'-0" x 5'-0" Polycarbonate Translucent Cover With Aluminum Frame And Aluminum Curb, Smoke And Fire Vent (Bilco LV6060B).....	3,444.70	137.32
07 72 36 00-0046 EA 5'-0" x 8'-0" Polycarbonate Translucent Cover With Aluminum Frame And Aluminum Curb, Smoke And Fire Vent (Bilco LV6096B).....	3,628.36	174.82
07 72 46 Roof Walkways (07 72)		
07 72 46 00-0001 Recycled Rubber Walkway Pads (07 72 46)		
07 72 46 00-0002 SF 3/8" Thick, Button Surface, Recycled Rubber Walkway Pad <i>For Diamond Surface, Add</i>	7.04 0.55	1.86
07 72 46 00-0003 SF 1/2" Thick, Button Surface, Recycled Rubber Walkway Pad <i>For Diamond Surface, Add</i>	7.80 0.64	2.23
07 72 46 00-0004 SF 3/4" Thick, Button Surface, Recycled Rubber Walkway Pad <i>For Diamond Surface, Add</i>	8.61 0.72	2.23
07 72 63 Waste Containment Assemblies (07 72)		
07 72 63 00-0001 Rooftop Oil And Grease Containment System (07 72 63)		
07 72 63 00-0002 Light Duty, Rooftop Oil And Grease Containment System (Grease Guard® GRD-E) (07 72 63 00-0001)		
07 72 63 00-0003 EA 48" Length, 48" Width, 3.5" Height, Light Duty, Rooftop Oil And Grease Containment System (Grease Guard® GRD100-E).....	1,628.51	144.05
07 72 63 00-0004 EA 60" Length, 60" Width, 3.5" Height, Light Duty, Rooftop Oil And Grease Containment System (Grease Guard® GRD101-E).....	1,811.70	144.05
07 72 63 00-0005 EA 60" Length, 90" Width, 3.5" Height, Light Duty, Rooftop Oil And Grease Containment System (Grease Guard® GRD106-E).....	2,209.29	149.81
07 72 63 00-0006 EA 72" Length, 72" Width, 3.5" Height, Light Duty, Rooftop Oil And Grease Containment System (Grease Guard® GRD102-E).....	2,198.81	149.81
07 72 63 00-0007 EA 72" Length, 108" Width, 3.5" Height, Light Duty, Rooftop Oil And Grease Containment System (Grease Guard® GRD103-E).....	2,855.24	162.06
07 72 63 00-0008 EA 72" Length, 144" Width, 3.5" Height, Light Duty, Rooftop Oil And Grease Containment System (Grease Guard® GRD111-E).....	2,245.30	162.06
07 72 63 00-0009 EA 90" Length, 90" Width, 3.5" Height, Light Duty, Rooftop Oil And Grease Containment System (Grease Guard® GRD105-E).....	2,508.09	192.01
07 72 63 00-0010 EA 108" Length, 108" Width, 3.5" Height, Light Duty, Rooftop Oil And Grease Containment System (Grease Guard® GRD112-E).....	3,673.07	240.06
07 72 63 00-0011 EA 120" Length, 120" Width, 3.5" Height, Light Duty, Rooftop Oil And Grease Containment System (Grease Guard® GRD107-E).....	4,531.70	240.06
07 72 63 00-0012 EA 144" Length, 144" Width, 3.5" Height, Light Duty, Rooftop Oil And Grease Containment System (Grease Guard® GRD113-E).....	5,709.70	240.06
07 72 63 00-0013 Heavy Duty, Rooftop Oil And Grease Containment System (Grease Guard® GRD) (07 72 63 00-0001)		
07 72 63 00-0014 EA 48" Length, 48" Width, 3.5" Height, Heavy Duty, Rooftop Oil And Grease Containment System (Grease Guard® GRD100).....	1,987.09	144.05
07 72 63 00-0015 EA 60" Length, 60" Width, 3.5" Height, Heavy Duty, Rooftop Oil And Grease Containment System (Grease Guard® GRD101).....	2,225.32	144.05
07 72 63 00-0016 EA 60" Length, 90" Width, 3.5" Height, Heavy Duty, Rooftop Oil And Grease Containment System (Grease Guard® GRD106).....	2,735.46	149.81
07 72 63 00-0017 EA 72" Length, 72" Width, 3.5" Height, Heavy Duty, Rooftop Oil And Grease Containment System (Grease Guard® GRD102).....	2,782.59	149.81
07 72 63 00-0018 EA 72" Length, 108" Width, 3.5" Height, Heavy Duty, Rooftop Oil And Grease Containment System (Grease Guard® GRD103).....	3,946.85	162.06
07 72 63 00-0019 EA 72" Length, 144" Width, 3.5" Height, Heavy Duty, Rooftop Oil And Grease Containment System (Grease Guard® GRD111).....	4,321.19	162.06
07 72 63 00-0020 EA 90" Length, 90" Width, 3.5" Height, Heavy Duty, Rooftop Oil And Grease Containment System (Grease Guard® GRD105).....	4,036.87	192.01
07 72 63 00-0021 EA 108" Length, 108" Width, 3.5" Height, Heavy Duty, Rooftop Oil And Grease Containment System (Grease Guard® GRD112).....	4,557.88	240.06
07 72 63 00-0022 EA 120" Length, 120" Width, 3.5" Height, Heavy Duty, Rooftop Oil And Grease Containment System (Grease Guard® GRD107).....	5,675.67	240.06
07 72 63 00-0023 EA 144" Length, 144" Width, 3.5" Height, Heavy Duty, Rooftop Oil And Grease Containment System (Grease Guard® GRD113).....	7,207.06	240.06
07 72 63 00-0024 Replacement Filter Sets For Rooftop Oil And Grease Containment System (07 72 63) Note: Includes removing old filters and installing new filters.		
07 72 63 00-0025 Top And Center Replacement Filter Sets For Rooftop Oil And Grease Containment System (07 72 63 00-0024)		
07 72 63 00-0026 Light Duty, Top And Center Replacement Filter Sets For Rooftop Oil And Grease Containment System (07 72 63 00-0025)		
07 72 63 00-0027 SET 48" Length, 48" Width, 3.5" Height, Light Duty, Top And Center Replacement Filter Set For Rooftop Oil And Grease Containment System (Grease Guard® FIL100-E).....	132.54	

07 Thermal And Moisture Protection**07 70 Roof And Wall Specialties And Accessories****07 72 Roof Accessories**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 72 63 00-0028 SET 60" Length, 60" Width, 3.5" Height, Light Duty, Top And Center Replacement Filter Set For Rooftop Oil And Grease Containment System (Grease Guard® FIL101-E)	184.90	
07 72 63 00-0029 SET 60" Length, 90" Width, 3.5" Height, Light Duty, Top And Center Replacement Filter Set For Rooftop Oil And Grease Containment System (Grease Guard® FIL106-E)	263.42	
07 72 63 00-0030 SET 72" Length, 72" Width, 3.5" Height, Light Duty, Top And Center Replacement Filter Set For Rooftop Oil And Grease Containment System (Grease Guard® FIL102-E)	244.46	
07 72 63 00-0031 SET 72" Length, 108" Width, 3.5" Height, Light Duty, Top And Center Replacement Filter Set For Rooftop Oil And Grease Containment System (Grease Guard® FIL103-E)	453.88	
07 72 63 00-0032 SET 72" Length, 144" Width, 3.5" Height, Light Duty, Top And Center Replacement Filter Set For Rooftop Oil And Grease Containment System (Grease Guard® FIL111-E)	459.11	
07 72 63 00-0033 SET 90" Length, 90" Width, 3.5" Height, Light Duty, Top And Center Replacement Filter Set For Rooftop Oil And Grease Containment System (Grease Guard® FIL105-E)	356.37	
07 72 63 00-0034 SET 108" Length, 108" Width, 3.5" Height, Light Duty, Top And Center Replacement Filter Set For Rooftop Oil And Grease Containment System (Grease Guard® FIL112-E)	461.08	
07 72 63 00-0035 SET 120" Length, 120" Width, 3.5" Height, Light Duty, Top And Center Replacement Filter Set For Rooftop Oil And Grease Containment System (Grease Guard® FIL107-E)	673.12	
07 72 63 00-0036 SET 144" Length, 144" Width, 3.5" Height, Light Duty, Top And Center Replacement Filter Set For Rooftop Oil And Grease Containment System (Grease Guard® FIL113-E)	885.16	
07 72 63 00-0037 Complete Replacement Filter Sets For Rooftop Oil And Grease Containment System (07 72 63 00-0024)		
07 72 63 00-0038 Light Duty, Complete Replacement Filter Sets For Rooftop Oil And Grease Containment System (07 72 63 00-0037)		
07 72 63 00-0039 SET 48" Length, 48" Width, 3.5" Height, Light Duty, Complete Replacement Filter Set For Rooftop Oil And Grease Containment System (Grease Guard® FIL100-EC)	274.22	
07 72 63 00-0040 SET 60" Length, 60" Width, 3.5" Height, Light Duty, Complete Replacement Filter Set For Rooftop Oil And Grease Containment System (Grease Guard® FIL101-EC)	363.23	
07 72 63 00-0041 SET 60" Length, 90" Width, 3.5" Height, Light Duty, Complete Replacement Filter Set For Rooftop Oil And Grease Containment System (Grease Guard® FIL106-EC)	525.54	
07 72 63 00-0042 SET 72" Length, 72" Width, 3.5" Height, Light Duty, Complete Replacement Filter Set For Rooftop Oil And Grease Containment System (Grease Guard® FIL102-EC)	490.85	
07 72 63 00-0043 SET 72" Length, 108" Width, 3.5" Height, Light Duty, Complete Replacement Filter Set For Rooftop Oil And Grease Containment System (Grease Guard® FIL103-EC)	938.49	
07 72 63 00-0044 SET 72" Length, 144" Width, 3.5" Height, Light Duty, Complete Replacement Filter Set For Rooftop Oil And Grease Containment System (Grease Guard® FIL111-EC)	943.72	
07 72 63 00-0045 SET 90" Length, 90" Width, 3.5" Height, Light Duty, Complete Replacement Filter Set For Rooftop Oil And Grease Containment System (Grease Guard® FIL105-EC)	702.24	
07 72 63 00-0046 SET 108" Length, 108" Width, 3.5" Height, Light Duty, Complete Replacement Filter Set For Rooftop Oil And Grease Containment System (Grease Guard® FIL112-EC)	945.70	
07 72 63 00-0047 SET 120" Length, 120" Width, 3.5" Height, Light Duty, Complete Replacement Filter Set For Rooftop Oil And Grease Containment System (Grease Guard® FIL107-EC)	1,382.86	
07 72 63 00-0048 SET 144" Length, 144" Width, 3.5" Height, Light Duty, Complete Replacement Filter Set For Rooftop Oil And Grease Containment System (Grease Guard® FIL113-EC)	1,838.36	
07 72 63 00-0049 Heavy Duty, Complete Replacement Filter Sets For Rooftop Oil And Grease Containment System (07 72 63 00-0037)		
07 72 63 00-0050 SET 48" Length, 48" Width, 3.5" Height, Heavy Duty, Complete Replacement Filter Set For Rooftop Oil And Grease Containment System (Grease Guard® FIL100-C)	339.67	
07 72 63 00-0051 SET 60" Length, 60" Width, 3.5" Height, Heavy Duty, Complete Replacement Filter Set For Rooftop Oil And Grease Containment System (Grease Guard® FIL101-C)	420.83	
07 72 63 00-0052 SET 60" Length, 90" Width, 3.5" Height, Heavy Duty, Complete Replacement Filter Set For Rooftop Oil And Grease Containment System (Grease Guard® FIL106-C)	614.54	
07 72 63 00-0053 SET 72" Length, 72" Width, 3.5" Height, Heavy Duty, Complete Replacement Filter Set For Rooftop Oil And Grease Containment System (Grease Guard® FIL102-C)	582.47	
07 72 63 00-0054 SET 72" Length, 108" Width, 3.5" Height, Heavy Duty, Complete Replacement Filter Set For Rooftop Oil And Grease Containment System (Grease Guard® FIL103-C)	1,129.58	
07 72 63 00-0055 SET 72" Length, 144" Width, 3.5" Height, Heavy Duty, Complete Replacement Filter Set For Rooftop Oil And Grease Containment System (Grease Guard® FIL111-C)	1,124.35	
07 72 63 00-0056 SET 90" Length, 90" Width, 3.5" Height, Heavy Duty, Complete Replacement Filter Set For Rooftop Oil And Grease Containment System (Grease Guard® FIL105-C)	822.67	
07 72 63 00-0057 SET 108" Length, 108" Width, 3.5" Height, Heavy Duty, Complete Replacement Filter Set For Rooftop Oil And Grease Containment System (Grease Guard® FIL112-C)	1,136.79	
07 72 63 00-0058 SET 120" Length, 120" Width, 3.5" Height, Heavy Duty, Complete Replacement Filter Set For Rooftop Oil And Grease Containment System (Grease Guard® FIL107-C)	1,592.29	
07 72 63 00-0059 SET 144" Length, 144" Width, 3.5" Height, Heavy Duty, Complete Replacement Filter Set For Rooftop Oil And Grease Containment System (Grease Guard® FIL113-C)	2,212.70	
07 73 Roof Protection Board (07 70)		
07 73 00 00-0001 Roof Protection Board (Georgia-Pacific DensDeck®) (07 73)		
Note: Use these items for specified related installations with systems per CSI section 07 50 00. Items are for single layer of panels attached per FM I-90 requirements. Types are stock sizes set in cold applied adhesive. Apply modifiers for specified alternate attachment.		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 73 00 00-0002 SF 1/4" Thick, Fiberglass Mat Faced, Moisture Resistant Gypsum Core, Roof Protection Board (Georgia-Pacific DensDeck®).....	2.28	0.36
<i>For No Adhesive, Deduct</i>	-0.47	
<i>For Hot-Mopped, Deduct</i>	-0.09	
<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.14	
<i>For Mechanically Fastened To Concrete, Add</i>	0.37	
<i>For Mechanically Fastened To Gypsum, Add</i>	0.52	
07 73 00 00-0003 SF 1/2" Thick, Fiberglass Mat Faced, Moisture Resistant Gypsum Core, Roof Protection Board (Georgia-Pacific DensDeck®).....	2.57	0.39
<i>For No Adhesive, Deduct</i>	-0.49	
<i>For Hot-Mopped, Deduct</i>	-0.07	
<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.14	
<i>For Mechanically Fastened To Concrete, Add</i>	0.42	
<i>For Mechanically Fastened To Gypsum, Add</i>	0.57	
07 73 00 00-0004 SF 5/8" Thick, Fiberglass Mat Faced, Moisture Resistant Gypsum Core, Roof Protection Board (Georgia-Pacific DensDeck®).....	2.72	0.43
<i>For No Adhesive, Deduct</i>	-0.50	
<i>For Hot-Mopped, Deduct</i>	-0.06	
<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.14	
<i>For Mechanically Fastened To Concrete, Add</i>	0.46	
<i>For Mechanically Fastened To Gypsum, Add</i>	0.61	
07 73 00 00-0005 SF 1/4" Thick, Surface Primed, Fiberglass Mat Faced, Moisture Resistant Gypsum Core, Roof Protection Board (Georgia-Pacific DensDeck® Prime).....	2.31	0.36
<i>For No Adhesive, Deduct</i>	-0.47	
<i>For Hot-Mopped, Deduct</i>	-0.09	
<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.14	
<i>For Mechanically Fastened To Concrete, Add</i>	0.37	
<i>For Mechanically Fastened To Gypsum, Add</i>	0.52	
07 73 00 00-0006 SF 1/2" Thick, Surface Primed, Fiberglass Mat Faced, Moisture Resistant Gypsum Core, Roof Protection Board (Georgia-Pacific DensDeck® Prime).....	2.62	0.39
<i>For No Adhesive, Deduct</i>	-0.49	
<i>For Hot-Mopped, Deduct</i>	-0.07	
<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.14	
<i>For Mechanically Fastened To Concrete, Add</i>	0.42	
<i>For Mechanically Fastened To Gypsum, Add</i>	0.57	
07 73 00 00-0007 SF 5/8" Thick, Surface Primed, Fiberglass Mat Faced, Moisture Resistant Gypsum Core, Roof Protection Board (Georgia-Pacific DensDeck® Prime).....	2.77	0.43
<i>For No Adhesive, Deduct</i>	-0.50	
<i>For Hot-Mopped, Deduct</i>	-0.06	
<i>For Mechanically Fastened To Wood Or Steel, Deduct</i>	-0.14	
<i>For Mechanically Fastened To Concrete, Add</i>	0.46	
<i>For Mechanically Fastened To Gypsum, Add</i>	0.61	

07 76 Roof Pavers (07 70)

07 76 16 Roof Decking Pavers (07 76)

07 76 16 00-0001 Roof Pavers (07 76 16)

Note: For walkway application over roofing system.

07 76 16 00-0002 SF Up To 100 SF, 2" Concrete Roof Paver.....	9.41	4.83
<i>For 1-1/2" Thickness, Deduct</i>	-0.80	
<i>For 2-1/2" Thickness, Add</i>	0.80	
<i>For 3" Thickness, Add</i>	1.59	
07 76 16 00-0003 SF >100 To 200 SF, 2" Concrete Roof Paver.....	7.96	3.64
<i>For 1-1/2" Thickness, Deduct</i>	-0.66	
<i>For 2-1/2" Thickness, Add</i>	0.66	
<i>For 3" Thickness, Add</i>	1.32	
07 76 16 00-0004 SF >200 To 400 SF, 2" Concrete Roof Paver.....	6.76	2.90
<i>For 1-1/2" Thickness, Deduct</i>	-0.55	
<i>For 2-1/2" Thickness, Add</i>	0.55	
<i>For 3" Thickness, Add</i>	1.09	
07 76 16 00-0005 SF >400 To 1,000 SF, 2" Concrete Roof Paver.....	6.03	2.52
<i>For 1-1/2" Thickness, Deduct</i>	-0.48	
<i>For 2-1/2" Thickness, Add</i>	0.48	
<i>For 3" Thickness, Add</i>	0.96	
07 76 16 00-0006 SF >1,000 SF, 2" Concrete Roof Paver.....	5.55	2.30
<i>For 1-1/2" Thickness, Deduct</i>	-0.44	
<i>For 2-1/2" Thickness, Add</i>	0.44	
<i>For 3" Thickness, Add</i>	0.88	

07 76 16 00-0007 Roof Paver Pedestal (07 76 16)

07 76 16 00-0008 EA 2" To 3" High Adjustable Roof Paver Pedestal, 2" Base, 2" Top (Hanover Elevator).....	13.62	0.72
07 76 16 00-0009 EA 3" To 4-3/4" High Adjustable Roof Paver Pedestal, 3" Base, 3" Top (Hanover Elevator).....	14.34	0.72
07 76 16 00-0010 EA 4-3/4" To 7-3/4" High Adjustable Roof Paver Pedestal, 4" Base, 4" Top (Hanover Elevator).....	15.07	0.72
07 76 16 00-0011 EA Adjustable Roof Paver Pedestal Coupler, Adds 2-1/2" To 4" (Hanover Elevator).....	7.48	0.72
07 76 16 00-0012 EA Stay Bar, Used With Roof Paver Pedestals >16' High (Hanover Elevator).....	6.96	0.72
07 76 16 00-0013 EA 5/8" High Tab Roof Paver Pedestal (Hanover High Tab Pedestal).....	7.11	0.72
Note: Stackable.		
07 76 16 00-0014 EA 1/16" And 1/8" Flexible Leveling Plates For Roof Paver Pedestal.....	3.97	0.72
Note: Used with High Tab and Elevator pedestals.		
07 76 16 00-0015 EA Roof Paver Leveling System, Twist To Adjust Pitch (Hanover Compensator).....	5.46	0.72
Note: Each Compensator levels 1/8" of slope and are stackable. Used with High Tab and Elevator pedestals.		

07	Thermal And Moisture Protection
07 70	Roof And Wall Specialties And Accessories
07 76	Roof Pavers



MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

07 76 19 Composite Insulation Concrete Protection Board (07 76)

Note: Manufactured by T. Clear Corp. 25 year warranty.

07 76 19 00-0001 Composite Insulation Concrete Protection Board (07 76 19)

Note: Manufactured by T. Clear Corp. 25 year warranty.

07 76 19 00-0002	SF	2" Extruded Polystyrene Insulation Board Lightguard Composite With 3/8" Latex Modified Concrete, 4.5 PSF	3.25	
		<i>For 20 Year Warranty, Deduct</i>	-0.18	
		<i>For 15 Year Warranty, Deduct</i>	-0.36	
		<i>For 10 Year Warranty, Deduct</i>	-0.49	
		<i>For Winds >90 MPH To 120 MPH Warranty, Add</i>	0.10	
07 76 19 00-0003	SF	3" Extruded Polystyrene Insulation Board Lightguard Composite With 3/8" Latex Modified Concrete, 4.5 PSF	4.20	
		<i>For 20 Year Warranty, Deduct</i>	-0.26	
		<i>For 15 Year Warranty, Deduct</i>	-0.52	
		<i>For 10 Year Warranty, Deduct</i>	-0.70	
		<i>For Winds >90 MPH To 120 MPH Warranty, Add</i>	0.10	
07 76 19 00-0004	SF	2" Extruded Polystyrene Insulation Board Heavyguard Composite With 15/16" Latex Modified Concrete, 11 PSF	4.95	
		<i>For 20 Year Warranty, Deduct</i>	-0.30	
		<i>For 15 Year Warranty, Deduct</i>	-0.60	
		<i>For 10 Year Warranty, Deduct</i>	-0.81	
		<i>For Winds >90 MPH To 120 MPH Warranty, Add</i>	0.10	
07 76 19 00-0005	SF	3" Extruded Polystyrene Insulation Board Heavyguard Composite With 15/16" Latex Modified Concrete, 11 PSF	5.95	
		<i>For 20 Year Warranty, Deduct</i>	-0.37	
		<i>For 15 Year Warranty, Deduct</i>	-0.75	
		<i>For 10 Year Warranty, Deduct</i>	-1.02	
		<i>For Winds >90 MPH To 120 MPH Warranty, Add</i>	0.10	

07 80 Fire And Smoke Protection (07)

07 81 Applied Fireproofing (07 80)

Note: Includes bonding agents as required.

07 81 16 Cementitious Fireproofing (07 81)

07 81 16 00-0001 Cementitious Fireproofing (07 81 16)

07 81 16 00-0002 Spray On Ceiling (Metal Decking Corrugated Or Fluted) (07 81 16 00-0001)

07 81 16 00-0003	SF	Spray Fireproofing For Ceiling, 1 Hour Rated 1/2" Thick Coverage	0.99	0.56
07 81 16 00-0004	SF	Spray Fireproofing For Ceiling, 2 Hour Rated 7/8" Thick Coverage	1.37	0.66

07 81 16 00-0005 Spray On Roofs And Beams (07 81 16 00-0001)

07 81 16 00-0006	SF	Spray Fireproofing For Beams And Roofs, 1 Hour Rated 1-3/8" Thick Coverage	2.02	0.81
07 81 16 00-0007	SF	Spray Fireproofing For Beams And Roofs, 2 Hour Rated 1-1/2" Thick Coverage	2.19	0.88
07 81 16 00-0008	SF	Spray Fireproofing For Beams And Roofs, 2 Hour Rated 1-5/8" Thick Coverage	2.29	0.92

07 81 16 00-0009 Spray On Beams (Min. W8x24) (07 81 16 00-0001)

07 81 16 00-0010	SF	Spray Fireproofing For Beams, 1 Hour Rated 7/16" Thick Coverage (Min W8x24)	0.85	0.44
07 81 16 00-0011	SF	Spray Fireproofing For Beams, 2 Hour Rated 1/2" Thick Coverage (Min W8x24)	1.03	0.56
07 81 16 00-0012	SF	Spray Fireproofing For Beams, 3 Hour Rated 7/8" Thick Coverage (Min W8x24)	1.47	0.66
07 81 16 00-0013	SF	Spray Fireproofing For Beams, 4 Hour Rated 1-1/4" Thick Coverage (Min W8x24)	1.94	0.78

07 81 16 00-0014 Spray On Columns (W10x49) (07 81 16 00-0001)

07 81 16 00-0015	SF	Spray Fireproofing For Columns, 1 Hour Rated 1-3/16" Thick Coverage (W10x49)	1.91	0.73
07 81 16 00-0016	SF	Spray Fireproofing For Columns, 2 Hour Rated 1-1/4" Thick Coverage (W10x49)	2.07	0.78
07 81 16 00-0017	SF	Spray Fireproofing For Columns, 3 Hour Rated 1-7/8" Thick Coverage (W10x49)	2.66	0.92
07 81 16 00-0018	SF	Spray Fireproofing For Columns, 4 Hour Rated 2-1/2" Thick Coverage (W10x49)	3.46	1.10

07 81 16 00-0019 Spray On Columns (W14x228) (07 81 16 00-0001)

07 81 16 00-0020	SF	Spray Fireproofing For Columns, 2 Hour Rated 5/8" Thick Coverage (W14x228)	1.22	0.56
07 81 16 00-0021	SF	Spray Fireproofing For Columns, 3 Hour Rated 7/8" Thick Coverage (W14x228)	1.56	0.66
07 81 16 00-0022	SF	Spray Fireproofing For Columns, 4 Hour Rated 1-1/4" Thick Coverage (W14x228)	2.07	0.81

07 81 16 00-0023 Gunite Fireproofing (07 81 16)

07 81 16 00-0024	SF	Fireproofing, Gunite, Non Reinforced, 1" Thick	2.08	0.46
07 81 16 00-0025	SF	Fireproofing, Gunite, Reinforced, 1" Thick	2.96	0.46

07 81 16 00-0026 Monokote Fireproofing (07 81 16)

07 81 16 00-0027	CSF	Monokote Fireproofing For Structural Steel	220.46	74.06
		Note: Per inch of thickness.		
07 81 16 00-0028	CSF	Monokote Fireproofing For Columns	205.59	1.10
		Note: Per inch of thickness.		
07 81 16 00-0029	CSF	Monokote Fireproofing For Ceiling/Decking	158.30	49.60
		Note: Per inch of thickness.		



MINOR	CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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07 81 23 Intumescent Fireproofing (07 81)

07 81 23 00-0001	Intumescent Thin Film Fireproofing (Albi Clad TF) (07 81 23)		
07 81 23 00-0002	Intumescent Thin Film Fireproofing For Beams (Albi Clad TF) (07 81 23 00-0001)		
	Note: Excludes primer.		
07 81 23 00-0003	SF 1 Hour, Intumescent Thin Film Fireproofing For Beams (Albi Clad TF)	8.80	
	For > 10,000 SF, Deduct	-0.84	
07 81 23 00-0004	SF 1-1/2 Hour, Intumescent Thin Film Fireproofing For Beams (Albi Clad TF)	14.10	
	For > 10,000 SF, Deduct	-1.37	

07 81 23 00-0005 Intumescent Thin Film Fireproofing For Wide Flange Columns (Albi Clad TF) (07 81 23 00-0001)

	Note: Excludes primer.		
07 81 23 00-0006	SF 1 Hour, Intumescent Thin Film Fireproofing For Wide Flange Columns (Albi Clad TF)	5.73	
	For > 10,000 SF, Deduct	-0.53	
07 81 23 00-0007	SF 1-1/2 Hour, Intumescent Thin Film Fireproofing For Wide Flange Columns (Albi Clad TF)	12.65	
	For > 10,000 SF, Deduct	-1.22	
07 81 23 00-0008	SF 2 Hour, Intumescent Thin Film Fireproofing For Wide Flange Columns (Albi Clad TF)	28.55	
	For > 10,000 SF, Deduct	-2.81	
07 81 23 00-0009	SF 2-1/2 Hour, Intumescent Thin Film Fireproofing For Wide Flange Columns (Albi Clad TF)	39.29	
	For > 10,000 SF, Deduct	-3.88	
07 81 23 00-0010	SF 3 Hour, Intumescent Thin Film Fireproofing For Wide Flange Columns (Albi Clad TF)	50.03	
	For > 10,000 SF, Deduct	-4.95	
07 81 23 00-0011	SF 3-1/2 Hour, Intumescent Thin Film Fireproofing For Wide Flange Columns (Albi Clad TF)	60.78	
	For > 10,000 SF, Deduct	-6.02	

07 81 23 00-0012 Intumescent Thin Film Fireproofing For Hollow Section Columns (Albi Clad TF) (07 81 23 00-0001)

	Note: Excludes primer.		
07 81 23 00-0013	SF 1 Hour, Intumescent Thin Film Fireproofing For Hollow Section Columns (Albi Clad TF)	11.52	
	For > 10,000 SF, Deduct	-1.11	
07 81 23 00-0014	SF 1-1/2 Hour, Intumescent Thin Film Fireproofing For Hollow Section Columns (Albi Clad TF)	21.37	
	For > 10,000 SF, Deduct	-2.09	
07 81 23 00-0015	SF 2 Hour, Intumescent Thin Film Fireproofing For Hollow Section Columns (Albi Clad TF)	33.89	
	For > 10,000 SF, Deduct	-3.34	
07 81 23 00-0016	SF 2-1/2 Hour, Intumescent Thin Film Fireproofing For Hollow Section Columns (Albi Clad TF)	47.32	
	For > 10,000 SF, Deduct	-4.68	
07 81 23 00-0017	SF 3 Hour, Intumescent Thin Film Fireproofing For Hollow Section Columns (Albi Clad TF)	59.84	
	For > 10,000 SF, Deduct	-5.93	

07 81 23 00-0018 Intumescent Thin Film Fireproofing (Albi Clad FP) (07 81 23)

07 81 23 00-0019	Intumescent Thin Film Fireproofing For Exposed Wood, Wallboard And Non-Ferrous Substrates (Albi Clad FP) (07 81 23 00-0018)		
	Note: Excludes primer.		
07 81 23 00-0020	SF 1 Hour, Intumescent Thin Film Fireproofing For Exposed Wood, Wallboard And Non-Ferrous Substrates (Albi Clad FP)	5.56	
	For > 10,000 SF, Deduct	-0.53	
07 81 23 00-0021	SF 1-1/2 Hour, Intumescent Thin Film Fireproofing For Exposed Wood, Wallboard And Non-Ferrous Substrates (Albi Clad FP)	12.61	
	For > 10,000 SF, Deduct	-1.23	
07 81 23 00-0022	SF 2 Hour, Intumescent Thin Film Fireproofing For Exposed Wood, Wallboard And Non-Ferrous Substrates (Albi Clad FP)	28.86	
	For > 10,000 SF, Deduct	-2.85	
07 81 23 00-0023	SF 2-1/2 Hour, Intumescent Thin Film Fireproofing For Exposed Wood, Wallboard And Non-Ferrous Substrates (Albi Clad FP)	39.81	
	For > 10,000 SF, Deduct	-3.95	
07 81 23 00-0024	SF 3 Hour, Intumescent Thin Film Fireproofing For Exposed Wood, Wallboard And Non-Ferrous Substrates (Albi Clad FP)	50.78	
	For > 10,000 SF, Deduct	-5.04	

07 81 33 Mineral-Fiber Fireproofing (07 81)

07 81 33 00-0001	Cellulose Fireproofing (07 81 33)		
07 81 33 00-0002	SF Cellulose Fireproofing, Per Inch Of Thickness.....	1.71	0.46

07 82 Board Fireproofing (07 80)

Note: Type A: 1 hour rating. See CSI section 09 23 13 00-0001 for plaster casing and corner bead, 09 29 00 00-0069 for gypsum board casing and corner bead.

07 82 00 00-0001	Fireproofing On Columns (07 82)		
07 82 00 00-0002	Up To 4,500 SF, Fireproofing On Columns (07 82 00 00-0001)		
07 82 00 00-0003	CSF Lath And Cement Plaster, 1 Hour, Mk A, Up To 4,500 SF, Fireproofing On Columns.....	1,005.18	694.33
07 82 00 00-0004	CSF Lath And Cement Plaster, 2 Hour, Mk B, Up To 4,500 SF, Fireproofing On Columns.....	1,812.29	1,239.88
07 82 00 00-0005	CSF Lath And Vermiculite Concrete, 4 Hour, Mk C, Up To 4,500, Fireproofing On Columns.....	1,608.88	1,091.10
07 82 00 00-0006	CSF Lath And Gypsum Plaster, 4 Hour, Mk D, Up To 4,500 SF, Fireproofing On Columns.....	1,094.96	644.74

07 Thermal And Moisture Protection**07 80 Fire And Smoke Protection****07 82 Board Fireproofing**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 82 00 00-0007	CSF		Lath And Gypsum Plaster, 4 Hour, Mk E, Up To 4,500 SF, Fireproofing On Columns	849.18	545.54
07 82 00 00-0008	CSF		Gypsum Board, 2 Hour, Mk F, Up To 4,500 SF, Fireproofing On Columns	1,283.91	843.12
07 82 00 00-0009	CSF		Gypsum Board, 2 Hour, Mk G, Up To 4,500 SF, Fireproofing On Columns.....	739.29	446.35
07 82 00 00-0010			>4,500 SF, Fireproofing On Columns (07 82 00 00-0001)		
07 82 00 00-0011	CSF		Lath And Cement Plaster, 1 Hour, Mk A >4,500 SF, Fireproofing On Columns.....	1,022.84	694.33
07 82 00 00-0012	CSF		Lath And Cement Plaster, 2 Hour, Mk B, >4,500 SF, Fireproofing On Columns.....	1,847.60	1,239.88
07 82 00 00-0013	CSF		Lath And Vermiculite Concrete, 4 Hour, Mk C, >4,500 SF, Fireproofing On Columns	1,661.05	1,091.10
07 82 00 00-0014	CSF		Lath And Gypsum Plaster, 4 Hour, Mk D, >4,500 SF, Fireproofing On Columns.....	963.27	644.74
07 82 00 00-0015	CSF		Lath And Gypsum Plaster, 2 Hour, Mk E, >4,500 SF, Fireproofing On Columns.....	781.27	545.54
07 82 00 00-0016	CSF		Gypsum Board, 2 Hour, Mk F, >4,500 SF, Fireproofing On Columns.....	1,266.21	843.12
07 82 00 00-0017	CSF		Gypsum Board, 2 Hour, Mk G, >4,500 SF, Fireproofing On Columns	723.27	446.35
07 84 Firestopping (07 80)					
07 84 13 Penetration Firestopping (07 84)					
07 84 13 16 Penetration Firestopping Devices (07 84 13)					
07 84 13 16-0001			Firestopping Systems For Cable Penetrations (07 84 13 16)		
07 84 13 16-0002			Intumescent Firestop Cable Sleeve For New Installations (07 84 13 16-0001) Note: Includes putty, escutcheon plates, gaskets and bushings.		
07 84 13 16-0003	EA		1" Diameter Intumescent Firestop Sleeve (STI FS100)	44.36	
07 84 13 16-0004	EA		2" Diameter Intumescent Firestop Sleeve (STI FS201)	60.76	
07 84 13 16-0005	EA		4" Diameter Intumescent Firestop Sleeve (STI FS401)	100.68	
07 84 13 16-0006			Intumescent Firestop Cable Pathway For New Or Existing Cable Installations (07 84 13 16-0001) Note: Includes putty and mounting plates.		
07 84 13 16-0007	EA		1-1/64" x 1-1/64" Intumescent Firestop Cable Pathway Through Up To 9" Thick Walls (STI EZD22)	83.99	
07 84 13 16-0008	EA		3" x 3" Intumescent Firestop Cable Pathway Through Up To 9" Thick Walls (STI EZDP33FWS)	149.34	
07 84 13 16-0009	EA		4" x 4-5/8" Intumescent Firestop Cable Pathway Through Up To 10" Thick Walls (STI EZDP44)	275.93	
07 84 13 16-0010			3M Intumescent Firestopping Multi-Trade Pass Through Device (07 84 13 16)		
07 84 13 16-0011	EA		2.5" Square Opening, Intumescent Firestop Multi-Trade Pass Through Device (3M QP2.5SD).....	189.89	
07 84 13 16-0012	EA		4" Square Opening, Intumescent Firestop Multi-Trade Pass Through Device (3M QP4SD).....	175.40	
07 84 13 16-0013	EA		4" Diameter Intumescent Firestop Multi-Trade Pass Through Device (3M QP2.5SD)	180.90	
07 84 13 16-0014			Intumescent Firestopping Pipe Collar (07 84 13 16)		
07 84 13 16-0015	EA		1-1/2" Intumescent Firestop Pipe Collar (3M ULTRAPPD1.5)	28.58	7.98
07 84 13 16-0016	EA		2" Intumescent Firestop Pipe Collar (3M ULTRAPPD2.0)	34.65	7.98
07 84 13 16-0017	EA		3" Intumescent Firestop Pipe Collar (3M ULTRAPPD3.0)	40.38	8.78
07 84 13 16-0018	EA		4" Intumescent Firestop Pipe Collar (3M ULTRAPPD4.0)	63.63	9.98
07 84 13 16-0019	EA		8" Intumescent Firestop Pipe Collar (Hilti CP644 8")	317.01	11.97
07 84 13 16-0020	EA		10" Intumescent Firestop Pipe Collar (Hilti CP644 10")	409.83	13.17
07 84 13 16-0021			Fire Rated Enclosures (Fire Rated Product Specialties Corp.) (07 84 13 16) Note: Includes fasteners. Excludes additional perimeter caulk where required. See CSI section 07 84 43 00-0001 for perimeter sealant caulk where required.		
07 84 13 16-0022	EA		12.2" Wide x 20.2" Long x 9.5" Deep Fire Rated Enclosure, 1 Hour Rated (FRPS #FN-Z-12-20-9).....	95.42	
07 84 13 16-0023	EA		15.2" Wide x 16.2" Long x 9.5" Deep Fire Rated Enclosure, 1 Hour Rated (FRPS #FN-Z-15-16-9).....	100.68	
07 84 13 16-0024	EA		11.8" Wide x 19.8" Long x 9.12" Deep Fire Rated Enclosure, 1 Hour Rated (FRPS #FN-Z-12-20-9-EXH)	192.35	
07 84 13 16-0025	EA		14.0" Wide x 14.0" Long x 3.2" Deep Fire Rated Enclosure, 1 Hour Rated (FRPS #FN-Z-14-14-3).....	123.82	
07 84 13 16-0026			Intumescent Firestopping Wrap Strips (07 84 13 16)		
07 84 13 16-0027	LF		1/8" Thick, 1-1/2" Wide, Intumescent Firestopping Wrap Strip (STI SpecSeal SSW Series).....	4.68	
07 84 13 19 Penetration Firestopping Caulk (07 84 13)					
07 84 13 19-0001			Intumescent Firestopping For Sealing Pipe Penetrations (07 84 13 19) Note: Includes firestop caulk and batt for floor or ceiling penetration or one side of a wall penetration. 1/2" thick caulk for annular spaces 1" and less. 1" thick caulk for annular spaces 1-1/4" or more.		
07 84 13 19-0002	EA		1" Diameter Hole With 1/2" Pipe, Sealed With Intumescent Firestop Sealant.....	14.50	
			For Intumescent Sealant For Plastic Pipe, Add	0.05	
07 84 13 19-0003	EA		1-1/2" Diameter Hole With 1/2" Pipe, Sealed With Intumescent Firestop Sealant	17.93	
			For Intumescent Sealant For Plastic Pipe, Add	0.28	
07 84 13 19-0004	EA		1-1/2" Diameter Hole With 3/4" Pipe, Sealed With Intumescent Firestop Sealant	17.75	
			For Intumescent Sealant For Plastic Pipe, Add	0.20	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 84 13 19-0005 EA 1-1/2" Diameter Hole With 1" Pipe, Sealed With Intumescent Firestop Sealant <i>For Intumescent Sealant For Plastic Pipe, Add</i>	17.46 0.09	
07 84 13 19-0006 EA 2" Diameter Hole With 1/2" Pipe, Sealed With Intumescent Firestop Sealant <i>For Intumescent Sealant For Plastic Pipe, Add</i>	20.87 0.59	
07 84 13 19-0007 EA 2" Diameter Hole With 3/4" Pipe, Sealed With Intumescent Firestop Sealant <i>For Intumescent Sealant For Plastic Pipe, Add</i>	20.70 0.52	
07 84 13 19-0008 EA 2" Diameter Hole With 1" Pipe, Sealed With Intumescent Firestop Sealant <i>For Intumescent Sealant For Plastic Pipe, Add</i>	20.41 0.40	
07 84 13 19-0009 EA 2" Diameter Hole With 1-1/4" Pipe, Sealed With Intumescent Firestop Sealant <i>For Intumescent Sealant For Plastic Pipe, Add</i>	19.96 0.22	
07 84 13 19-0010 EA 2" Diameter Hole With 1-1/2" Pipe, Sealed With Intumescent Firestop Sealant <i>For Intumescent Sealant For Plastic Pipe, Add</i>	19.57 0.07	
07 84 13 19-0011 EA 2.5" Diameter Hole With 1/2" Pipe, Sealed With Intumescent Firestop Sealant <i>For Intumescent Sealant For Plastic Pipe, Add</i>	25.46 0.99	
07 84 13 19-0012 EA 2.5" Diameter Hole With 3/4" Pipe, Sealed With Intumescent Firestop Sealant <i>For Intumescent Sealant For Plastic Pipe, Add</i>	25.29 0.92	
07 84 13 19-0013 EA 2.5" Diameter Hole With 1" Pipe, Sealed With Intumescent Firestop Sealant <i>For Intumescent Sealant For Plastic Pipe, Add</i>	25.00 0.80	
07 84 13 19-0014 EA 2.5" Diameter Hole With 1-1/4" Pipe, Sealed With Intumescent Firestop Sealant <i>For Intumescent Sealant For Plastic Pipe, Add</i>	24.55 0.62	
07 84 13 19-0015 EA 2.5" Diameter Hole With 1-1/2" Pipe, Sealed With Intumescent Firestop Sealant <i>For Intumescent Sealant For Plastic Pipe, Add</i>	24.17 0.47	
07 84 13 19-0016 EA 2.5" Diameter Hole With 2" Pipe, Sealed With Intumescent Firestop Sealant <i>For Intumescent Sealant For Plastic Pipe, Add</i>	23.26 0.11	
07 84 13 19-0017 EA 3" Diameter Hole With 1/2" Pipe, Sealed With Intumescent Firestop Sealant <i>For Intumescent Sealant For Plastic Pipe, Add</i>	35.40 2.66	
07 84 13 19-0018 EA 3" Diameter Hole With 3/4" Pipe, Sealed With Intumescent Firestop Sealant <i>For Intumescent Sealant For Plastic Pipe, Add</i>	32.27 1.41	
07 84 13 19-0019 EA 3" Diameter Hole With 1" Pipe, Sealed With Intumescent Firestop Sealant <i>For Intumescent Sealant For Plastic Pipe, Add</i>	31.98 1.30	
07 84 13 19-0020 EA 3" Diameter Hole With 1-1/4" Pipe, Sealed With Intumescent Firestop Sealant <i>For Intumescent Sealant For Plastic Pipe, Add</i>	31.53 1.12	
07 84 13 19-0021 EA 3" Diameter Hole With 1-1/2" Pipe, Sealed With Intumescent Firestop Sealant <i>For Intumescent Sealant For Plastic Pipe, Add</i>	31.15 0.96	
07 84 13 19-0022 EA 3" Diameter Hole With 2" Pipe, Sealed With Intumescent Firestop Sealant <i>For Intumescent Sealant For Plastic Pipe, Add</i>	30.24 0.60	
07 84 13 19-0023 EA 3" Diameter Hole With 2-1/2" Pipe, Sealed With Intumescent Firestop Sealant <i>For Intumescent Sealant For Plastic Pipe, Add</i>	29.07 0.13	
07 84 13 19-0024 EA 4" Diameter Hole With 1/2" Pipe, Sealed With Intumescent Firestop Sealant <i>For Intumescent Sealant For Plastic Pipe, Add</i>	48.22 4.92	
07 84 13 19-0025 EA 4" Diameter Hole With 3/4" Pipe, Sealed With Intumescent Firestop Sealant <i>For Intumescent Sealant For Plastic Pipe, Add</i>	47.90 4.79	
07 84 13 19-0026 EA 4" Diameter Hole With 1" Pipe, Sealed With Intumescent Firestop Sealant <i>For Intumescent Sealant For Plastic Pipe, Add</i>	47.38 4.58	
07 84 13 19-0027 EA 4" Diameter Hole With 1-1/4" Pipe, Sealed With Intumescent Firestop Sealant <i>For Intumescent Sealant For Plastic Pipe, Add</i>	46.57 4.26	
07 84 13 19-0028 EA 4" Diameter Hole With 1-1/2" Pipe, Sealed With Intumescent Firestop Sealant <i>For Intumescent Sealant For Plastic Pipe, Add</i>	45.88 3.98	
07 84 13 19-0029 EA 4" Diameter Hole With 2" Pipe, Sealed With Intumescent Firestop Sealant <i>For Intumescent Sealant For Plastic Pipe, Add</i>	40.55 1.85	
07 84 13 19-0030 EA 4" Diameter Hole With 2-1/2" Pipe, Sealed With Intumescent Firestop Sealant <i>For Intumescent Sealant For Plastic Pipe, Add</i>	39.38 1.38	
07 84 13 19-0031 EA 4" Diameter Hole With 3" Pipe, Sealed With Intumescent Firestop Sealant <i>For Intumescent Sealant For Plastic Pipe, Add</i>	37.59 0.67	
07 84 13 19-0032 EA 6" Diameter Hole With 1/2" Pipe, Sealed With Intumescent Firestop Sealant <i>For Intumescent Sealant For Plastic Pipe, Add</i>	78.66 11.35	
07 84 13 19-0033 EA 6" Diameter Hole With 3/4" Pipe, Sealed With Intumescent Firestop Sealant <i>For Intumescent Sealant For Plastic Pipe, Add</i>	78.35 11.22	
07 84 13 19-0034 EA 6" Diameter Hole With 1" Pipe, Sealed With Intumescent Firestop Sealant <i>For Intumescent Sealant For Plastic Pipe, Add</i>	77.83 11.02	
07 84 13 19-0035 EA 6" Diameter Hole With 1-1/4" Pipe, Sealed With Intumescent Firestop Sealant <i>For Intumescent Sealant For Plastic Pipe, Add</i>	77.02 10.69	
07 84 13 19-0036 EA 6" Diameter Hole With 1-1/2" Pipe, Sealed With Intumescent Firestop Sealant <i>For Intumescent Sealant For Plastic Pipe, Add</i>	76.33 10.42	
07 84 13 19-0037 EA 6" Diameter Hole With 2" Pipe, Sealed With Intumescent Firestop Sealant <i>For Intumescent Sealant For Plastic Pipe, Add</i>	74.70 9.76	
07 84 13 19-0038 EA 6" Diameter Hole With 2-1/2" Pipe, Sealed With Intumescent Firestop Sealant <i>For Intumescent Sealant For Plastic Pipe, Add</i>	72.59 8.92	
07 84 13 19-0039 EA 6" Diameter Hole With 3" Pipe, Sealed With Intumescent Firestop Sealant <i>For Intumescent Sealant For Plastic Pipe, Add</i>	69.39 7.64	
07 84 13 19-0040 EA 6" Diameter Hole With 4" Pipe, Sealed With Intumescent Firestop Sealant <i>For Intumescent Sealant For Plastic Pipe, Add</i>	57.33 2.82	
07 84 13 19-0041 EA 8" Diameter Hole With 2-1/2" Pipe, Sealed With Intumescent Firestop Sealant <i>For Intumescent Sealant For Plastic Pipe, Add</i>	105.88 17.92	
07 84 13 19-0042 EA 8" Diameter Hole With 3" Pipe, Sealed With Intumescent Firestop Sealant <i>For Intumescent Sealant For Plastic Pipe, Add</i>	102.67 16.64	
07 84 13 19-0043 EA 8" Diameter Hole With 4" Pipe, Sealed With Intumescent Firestop Sealant <i>For Intumescent Sealant For Plastic Pipe, Add</i>	96.24 14.07	
07 84 13 19-0044 EA 8" Diameter Hole With 6" Pipe, Sealed With Intumescent Firestop Sealant <i>For Intumescent Sealant For Plastic Pipe, Add</i>	70.02 3.58	
07 84 13 19-0045 EA 10" Diameter Hole With 4" Pipe, Sealed With Intumescent Firestop Sealant <i>For Intumescent Sealant For Plastic Pipe, Add</i>	135.96 25.65	
07 84 13 19-0046 EA 10" Diameter Hole With 6" Pipe, Sealed With Intumescent Firestop Sealant <i>For Intumescent Sealant For Plastic Pipe, Add</i>	116.89 18.02	

07 Thermal And Moisture Protection**07 80 Fire And Smoke Protection****07 84 Firestopping**MINOR
CSI UOM DESCRIPTIONTOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

07 84 13 19-0047	EA	10" Diameter Hole With 8" Pipe, Sealed With Intumescent Firestop Sealant..... <i>For Intumescent Sealant For Plastic Pipe, Add</i>	83.24 4.56
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07 84 13 19-0048 Smoke, Noise And Infectious/Dust Control Sealant For Sealing Pipe Penetrations (07 84 13 19)

Note: Includes sealant and fiberglass or mineral wool batt for floor, ceiling or wall penetrations.

07 84 13 19-0049	EA	1-1/2" Diameter Hole With 1/2" Pipe, Sealed With Smoke, Noise And Infectious/Dust Control Sealant (STI SpecSeal Smoke 'N' Sound).....	17.48
07 84 13 19-0050	EA	1-1/2" Diameter Hole With 3/4" Pipe, Sealed With Smoke, Noise And Infectious/Dust Control Sealant (STI SpecSeal Smoke 'N' Sound).....	17.41
07 84 13 19-0051	EA	1-1/2" Diameter Hole With 1" Pipe, Sealed With Smoke, Noise And Infectious/Dust Control Sealant (STI SpecSeal Smoke 'N' Sound).....	17.32
07 84 13 19-0052	EA	2" Diameter Hole With 1/2" Pipe, Sealed With Smoke, Noise And Infectious/Dust Control Sealant (STI SpecSeal Smoke 'N' Sound).....	19.89
07 84 13 19-0053	EA	2" Diameter Hole With 3/4" Pipe, Sealed With Smoke, Noise And Infectious/Dust Control Sealant (STI SpecSeal Smoke 'N' Sound).....	19.82
07 84 13 19-0054	EA	2" Diameter Hole With 1" Pipe, Sealed With Smoke, Noise And Infectious/Dust Control Sealant (STI SpecSeal Smoke 'N' Sound).....	19.73
07 84 13 19-0055	EA	2" Diameter Hole With 1-1/4" Pipe, Sealed With Smoke, Noise And Infectious/Dust Control Sealant (STI SpecSeal Smoke 'N' Sound).....	19.59
07 84 13 19-0056	EA	2" Diameter Hole With 1-1/2" Pipe, Sealed With Smoke, Noise And Infectious/Dust Control Sealant (STI SpecSeal Smoke 'N' Sound).....	19.47
07 84 13 19-0057	EA	2.5" Diameter Hole With 1/2" Pipe, Sealed With Smoke, Noise And Infectious/Dust Control Sealant (STI SpecSeal Smoke 'N' Sound).....	23.84
07 84 13 19-0058	EA	2.5" Diameter Hole With 3/4" Pipe, Sealed With Smoke, Noise And Infectious/Dust Control Sealant (STI SpecSeal Smoke 'N' Sound).....	23.78
07 84 13 19-0059	EA	2.5" Diameter Hole With 1" Pipe, Sealed With Smoke, Noise And Infectious/Dust Control Sealant (STI SpecSeal Smoke 'N' Sound).....	23.68
07 84 13 19-0060	EA	2.5" Diameter Hole With 1-1/4" Pipe, Sealed With Smoke, Noise And Infectious/Dust Control Sealant (STI SpecSeal Smoke 'N' Sound).....	23.55
07 84 13 19-0061	EA	2.5" Diameter Hole With 1-1/2" Pipe, Sealed With Smoke, Noise And Infectious/Dust Control Sealant (STI SpecSeal Smoke 'N' Sound).....	23.42
07 84 13 19-0062	EA	2.5" Diameter Hole With 2" Pipe, Sealed With Smoke, Noise And Infectious/Dust Control Sealant (STI SpecSeal Smoke 'N' Sound).....	23.11
07 84 13 19-0063	EA	3" Diameter Hole With 1/2" Pipe, Sealed With Smoke, Noise And Infectious/Dust Control Sealant (STI SpecSeal Smoke 'N' Sound).....	30.00
07 84 13 19-0064	EA	3" Diameter Hole With 3/4" Pipe, Sealed With Smoke, Noise And Infectious/Dust Control Sealant (STI SpecSeal Smoke 'N' Sound).....	29.94
07 84 13 19-0065	EA	3" Diameter Hole With 1" Pipe, Sealed With Smoke, Noise And Infectious/Dust Control Sealant (STI SpecSeal Smoke 'N' Sound).....	29.85
07 84 13 19-0066	EA	3" Diameter Hole With 1-1/4" Pipe, Sealed With Smoke, Noise And Infectious/Dust Control Sealant (STI SpecSeal Smoke 'N' Sound).....	29.70
07 84 13 19-0067	EA	3" Diameter Hole With 1-1/2" Pipe, Sealed With Smoke, Noise And Infectious/Dust Control Sealant (STI SpecSeal Smoke 'N' Sound).....	29.58
07 84 13 19-0068	EA	3" Diameter Hole With 2" Pipe, Sealed With Smoke, Noise And Infectious/Dust Control Sealant (STI SpecSeal Smoke 'N' Sound).....	29.27
07 84 13 19-0069	EA	3" Diameter Hole With 2-1/2" Pipe, Sealed With Smoke, Noise And Infectious/Dust Control Sealant (STI SpecSeal Smoke 'N' Sound).....	28.84
07 84 13 19-0070	EA	4" Diameter Hole With 1/2" Pipe, Sealed With Smoke, Noise And Infectious/Dust Control Sealant (STI SpecSeal Smoke 'N' Sound).....	38.27
07 84 13 19-0071	EA	4" Diameter Hole With 3/4" Pipe, Sealed With Smoke, Noise And Infectious/Dust Control Sealant (STI SpecSeal Smoke 'N' Sound).....	38.20
07 84 13 19-0072	EA	4" Diameter Hole With 1" Pipe, Sealed With Smoke, Noise And Infectious/Dust Control Sealant (STI SpecSeal Smoke 'N' Sound).....	38.11
07 84 13 19-0073	EA	4" Diameter Hole With 1-1/4" Pipe, Sealed With Smoke, Noise And Infectious/Dust Control Sealant (STI SpecSeal Smoke 'N' Sound).....	37.96
07 84 13 19-0074	EA	4" Diameter Hole With 1-1/2" Pipe, Sealed With Smoke, Noise And Infectious/Dust Control Sealant (STI SpecSeal Smoke 'N' Sound).....	37.81
07 84 13 19-0075	EA	4" Diameter Hole With 2" Pipe, Sealed With Smoke, Noise And Infectious/Dust Control Sealant (STI SpecSeal Smoke 'N' Sound).....	37.50
07 84 13 19-0076	EA	4" Diameter Hole With 2-1/2" Pipe, Sealed With Smoke, Noise And Infectious/Dust Control Sealant (STI SpecSeal Smoke 'N' Sound).....	37.10
07 84 13 19-0077	EA	4" Diameter Hole With 3" Pipe, Sealed With Smoke, Noise And Infectious/Dust Control Sealant (STI SpecSeal Smoke 'N' Sound).....	36.48
07 84 13 19-0078	EA	6" Diameter Hole With 1/2" Pipe, Sealed With Smoke, Noise And Infectious/Dust Control Sealant (STI SpecSeal Smoke 'N' Sound).....	55.70
07 84 13 19-0079	EA	6" Diameter Hole With 3/4" Pipe, Sealed With Smoke, Noise And Infectious/Dust Control Sealant (STI SpecSeal Smoke 'N' Sound).....	55.63
07 84 13 19-0080	EA	6" Diameter Hole With 1" Pipe, Sealed With Smoke, Noise And Infectious/Dust Control Sealant (STI SpecSeal Smoke 'N' Sound).....	55.54
07 84 13 19-0081	EA	6" Diameter Hole With 1-1/4" Pipe, Sealed With Smoke, Noise And Infectious/Dust Control Sealant (STI SpecSeal Smoke 'N' Sound).....	55.40
07 84 13 19-0082	EA	6" Diameter Hole With 1-1/2" Pipe, Sealed With Smoke, Noise And Infectious/Dust Control Sealant (STI SpecSeal Smoke 'N' Sound).....	55.28
07 84 13 19-0083	EA	6" Diameter Hole With 2" Pipe, Sealed With Smoke, Noise And Infectious/Dust Control Sealant (STI SpecSeal Smoke 'N' Sound).....	54.97
07 84 13 19-0084	EA	6" Diameter Hole With 2-1/2" Pipe, Sealed With Smoke, Noise And Infectious/Dust Control Sealant (STI SpecSeal Smoke 'N' Sound).....	54.53
07 84 13 19-0085	EA	6" Diameter Hole With 3" Pipe, Sealed With Smoke, Noise And Infectious/Dust Control Sealant (STI SpecSeal Smoke 'N' Sound).....	53.95
07 84 13 19-0086	EA	6" Diameter Hole With 4" Pipe, Sealed With Smoke, Noise And Infectious/Dust Control Sealant (STI SpecSeal Smoke 'N' Sound).....	52.68



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 84 13 19-0087 EA 8" Diameter Hole With 2-1/2" Pipe, Sealed With Smoke, Noise And Infectious/Dust Control Sealant (STI SpecSeal Smoke 'N' Sound).....	69.62	
07 84 13 19-0088 EA 8" Diameter Hole With 3" Pipe, Sealed With Smoke, Noise And Infectious/Dust Control Sealant (STI SpecSeal Smoke 'N' Sound).....	69.03	
07 84 13 19-0089 EA 8" Diameter Hole With 4" Pipe, Sealed With Smoke, Noise And Infectious/Dust Control Sealant (STI SpecSeal Smoke 'N' Sound).....	67.76	
07 84 13 19-0090 EA 8" Diameter Hole With 6" Pipe, Sealed With Smoke, Noise And Infectious/Dust Control Sealant (STI SpecSeal Smoke 'N' Sound).....	64.17	
07 84 13 19-0091 EA 10" Diameter Hole With 4" Pipe, Sealed With Smoke, Noise And Infectious/Dust Control Sealant (STI SpecSeal Smoke 'N' Sound).....	84.07	
07 84 13 19-0092 EA 10" Diameter Hole With 6" Pipe, Sealed With Smoke, Noise And Infectious/Dust Control Sealant (STI SpecSeal Smoke 'N' Sound).....	80.48	
07 84 13 19-0093 EA 10" Diameter Hole With 8" Pipe, Sealed With Smoke, Noise And Infectious/Dust Control Sealant (STI SpecSeal Smoke 'N' Sound).....	75.72	
 07 84 16 Annular Space Protection (07 84)		
07 84 16 00-0001 Intumescent Firestopping For Electrical Outlet Boxes (07 84 16)		
07 84 16 00-0002 Intumescent Putty Pads For Wrapping Outlet Box Exteriors (07 84 16 00-0001)		
07 84 16 00-0003 EA 1 Gang Outlet Box, Intumescent Firestop Putty Exterior Wrap (3M MPP+).....	24.01	
07 84 16 00-0004 EA 2 Gang Outlet Box, Intumescent Firestop Putty Exterior Wrap (3M MPP+).....	35.08	
07 84 16 00-0005 EA 3 Gang Outlet Box, Intumescent Firestop Putty Exterior Wrap (3M MPP+).....	36.52	
07 84 16 00-0006 EA 4 Gang Outlet Box, Intumescent Firestop Putty Exterior Wrap (3M MPP+).....	37.96	
07 84 16 00-0007 EA 5 Gang Outlet Box, Intumescent Firestop Putty Exterior Wrap (3M MPP+).....	39.39	
07 84 16 00-0008 EA 6 Gang Outlet Box, Intumescent Firestop Putty Exterior Wrap (3M MPP+).....	50.48	
 07 84 16 00-0009 Intumescent Firestop Gasket For Wall Plates (07 84 16 00-0001)		
07 84 16 00-0010 EA Single Switch Wall Plate, Intumescent Firestop Gasket (RectorSeal 66276)	9.51	
07 84 16 00-0011 EA Double Switch Wall Plate, Intumescent Firestop Gasket (RectorSeal 66274)	9.91	
07 84 16 00-0012 EA Single Receptacle Wall Plate, Intumescent Firestop Gasket (RectorSeal 66272)	9.16	
07 84 16 00-0013 EA Double Receptacle Wall Plate, Intumescent Firestop Gasket (RectorSeal 66270).....	9.94	
07 84 16 00-0014 EA Single Decor Wall Plate, Intumescent Firestop Gasket (RectorSeal 66266)	9.64	
07 84 16 00-0015 EA Double Decor Wall Plate, Intumescent Firestop Gasket (RectorSeal 66265).....	9.21	
 07 84 16 00-0016 Intumescent Fire Barrier Pillows For Sealing Large Openings (07 84 16)		
07 84 16 00-0017 EA 2" x 4" x 9" Intumescent Fire Barrier Pillow (3M FB249).....	26.75	
07 84 16 00-0018 EA 2" x 6" x 9" Intumescent Fire Barrier Pillow (3M FB269).....	28.73	
07 84 16 00-0019 EA 3" x 6" x 9" Intumescent Fire Barrier Pillow (3M FB369).....	31.17	
 07 84 16 00-0020 Intumescent Fire Barrier Sheets For Sealing Large Openings (07 84 16)		
Note: Price includes intumescent sheet, mounting fasteners and caulk for sealing one side of an opening.		
07 84 16 00-0021 EA 16" x 28" Intumescent Firestop Sheet (3M CS-195+16x28)	236.69	
07 84 16 00-0022 EA 36" x 24" Intumescent Firestop Sheet (3M CS-195+3x2)	338.09	
07 84 16 00-0023 EA 36" x 36" Intumescent Firestop Sheet (3M CS-195+3x3)	461.42	
 07 84 16 00-0024 Endothermic Mat Wrap Fire Barrier (07 84 16)		
Note: Price includes endothermic mat wrap and sealant. Excludes cavity fill material; putty or fireproof caulk/sealant. See CSI section 07 84 16 00-0026 for filling openings.		
07 84 16 00-0025 SF 0.408" Thick Aluminum Foil Faced Endothermic Mat (3M Interam E-5A-4).....	34.99	
 07 84 16 00-0026 Firestopping Caulk For Filling Opening (07 84 16)		
07 84 16 00-0027 GAL Latex Based Intumescent Fire Barrier Sealant (3M CP-25WB+).....	134.16	
 07 84 16 00-0028 Firestopping Mortar For Filling Opening (07 84 16)		
07 84 16 00-0029 CF Light-Weight Portland Cement-Based Firestop Mortar (STI SpecSeal SSM Series).....	126.09	
 07 84 23 Silicone Firestopping Foams (07 84)		
07 84 23 00-0001 Silicone RTV Foam Seal For Blank Openings (07 84 23)		
07 84 23 00-0002 EA 2" Diameter Hole Sealed With RTV Silicone Fire Barrier Foam.....	29.89	
07 84 23 00-0003 EA 4" Diameter Hole Sealed With RTV Silicone Fire Barrier Foam.....	74.52	
07 84 23 00-0004 EA 6" Diameter Hole Sealed With RTV Silicone Fire Barrier Foam.....	135.34	
07 84 23 00-0005 EA 8" Diameter Hole Sealed With RTV Silicone Fire Barrier Foam.....	210.75	
07 84 23 00-0006 EA 10" Diameter Hole Sealed With RTV Silicone Fire Barrier Foam.....	304.38	
07 84 23 00-0007 EA 12" Diameter Hole Sealed With RTV Silicone Fire Barrier Foam.....	412.69	
 07 84 43 Joint Firestopping (07 84)		
07 84 43 00-0001 Intumescent Firestopping Sealant For Joints (07 84 43)		
07 84 43 00-0002 CLF 1/4" x 1/4" Joint, Intumescent Firestop Sealant	298.16	114.94
07 84 43 00-0003 CLF 1/4" x 3/8" Joint, Intumescent Firestop Sealant	346.64	122.13

07 Thermal And Moisture Protection**07 80 Fire And Smoke Protection****07 84 Firestopping**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 84 43 00-0004	CLF		1/4" x 1/2" Joint, Intumescent Firestop Sealant.....	380.77	122.13
07 84 43 00-0005	CLF		3/8" x 3/8" Joint, Intumescent Firestop Sealant.....	397.84	122.13
07 84 43 00-0006	CLF		3/8" x 1/2" Joint, Intumescent Firestop Sealant.....	449.05	122.13
07 84 43 00-0007	CLF		3/8" x 5/8" Joint, Intumescent Firestop Sealant.....	514.67	129.32
07 84 43 00-0008	CLF		3/8" x 3/4" Joint, Intumescent Firestop Sealant.....	580.19	136.49
07 84 43 00-0009	CLF		1/2" x 1/2" Joint, Intumescent Firestop Sealant.....	531.74	129.32
07 84 43 00-0010	CLF		1/2" x 5/8" Joint, Intumescent Firestop Sealant.....	628.74	143.68
07 84 43 00-0011	CLF		1/2" x 3/4" Joint, Intumescent Firestop Sealant.....	711.39	150.87
07 84 43 00-0012	CLF		1/2" x 7/8" Joint, Intumescent Firestop Sealant.....	794.01	158.04
07 84 43 00-0013	CLF		1/2" x 1" Joint, Intumescent Firestop Sealant.....	977.30	215.50
07 84 43 00-0014	CLF		3/4" x 3/4" Joint, Intumescent Firestop Sealant.....	1,074.28	229.90
07 84 43 00-0015	CLF		1" x 1" Joint, Intumescent Firestop Sealant.....	1,566.52	237.06

07 84 43 00-0016 Passive Smoke And Fire Protection Sealant For Joints (07 84 43)

07 84 43 00-0017	CLF		1/4" x 1/4" Joint, Non-Halogenated Latex-Based Elastomeric, Passive Smoke And Fire Protection Sealant (STI SpecSeal ES Series).....	269.49	114.94
07 84 43 00-0018	CLF		1/4" x 3/8" Joint, Non-Halogenated Latex-Based Elastomeric, Passive Smoke And Fire Protection Sealant (STI SpecSeal ES Series).....	303.61	122.13
07 84 43 00-0019	CLF		1/4" x 1/2" Joint, Non-Halogenated Latex-Based Elastomeric, Passive Smoke And Fire Protection Sealant (STI SpecSeal ES Series).....	323.40	122.13
07 84 43 00-0020	CLF		3/8" x 3/8" Joint, Non-Halogenated Latex-Based Elastomeric, Passive Smoke And Fire Protection Sealant (STI SpecSeal ES Series).....	333.30	122.13
07 84 43 00-0021	CLF		3/8" x 1/2" Joint, Non-Halogenated Latex-Based Elastomeric, Passive Smoke And Fire Protection Sealant (STI SpecSeal ES Series).....	362.99	122.13
07 84 43 00-0022	CLF		3/8" x 5/8" Joint, Non-Halogenated Latex-Based Elastomeric, Passive Smoke And Fire Protection Sealant (STI SpecSeal ES Series).....	407.11	129.32
07 84 43 00-0023	CLF		3/8" x 3/4" Joint, Non-Halogenated Latex-Based Elastomeric, Passive Smoke And Fire Protection Sealant (STI SpecSeal ES Series).....	451.11	136.49
07 84 43 00-0024	CLF		1/2" x 1/2" Joint, Non-Halogenated Latex-Based Elastomeric, Passive Smoke And Fire Protection Sealant (STI SpecSeal ES Series).....	417.01	129.32
07 84 43 00-0025	CLF		1/2" x 5/8" Joint, Non-Halogenated Latex-Based Elastomeric, Passive Smoke And Fire Protection Sealant (STI SpecSeal ES Series).....	485.32	143.68
07 84 43 00-0026	CLF		1/2" x 3/4" Joint, Non-Halogenated Latex-Based Elastomeric, Passive Smoke And Fire Protection Sealant (STI SpecSeal ES Series).....	539.29	150.87
07 84 43 00-0027	CLF		1/2" x 7/8" Joint, Non-Halogenated Latex-Based Elastomeric, Passive Smoke And Fire Protection Sealant (STI SpecSeal ES Series).....	593.22	158.04
07 84 43 00-0028	CLF		1/2" x 1" Joint, Non-Halogenated Latex-Based Elastomeric, Passive Smoke And Fire Protection Sealant (STI SpecSeal ES Series).....	747.83	215.50
07 84 43 00-0029	CLF		3/4" x 3/4" Joint, Non-Halogenated Latex-Based Elastomeric, Passive Smoke And Fire Protection Sealant (STI SpecSeal ES Series).....	816.12	229.90
07 84 43 00-0030	CLF		1" x 1" Joint, Non-Halogenated Latex-Based Elastomeric, Passive Smoke And Fire Protection Sealant (STI SpecSeal ES Series).....	1,107.58	237.06

07 84 56 Fire Safing (07 84)**07 84 56 13 Fibrous Fire Safing (07 84 56)****07 84 56 13-0001 Thermal Barrier Wrap (07 84 56 13)**

Note: Includes cutting wrap to fit pipe or conduit and sealing edges.

07 84 56 13-0002	SF		1/2" Thick Fire Barrier Plenum Wrap (3M Plenum Wrap 5A).....	7.18	
			<i>For Work In Restricted Working Space, Add</i>	0.86	
07 84 56 13-0003	SF		1-1/2" Thick Fire Barrier Duct Wrap (3M Duct Wrap 15A).....	11.83	
			<i>Note: Includes cutting wrap to fit pipe or conduit and sealing edges.</i>		
			<i>For Work In Restricted Working Space, Add</i>	0.86	
07 84 56 13-0004	SF		2" Thick Fire Barrier Duct Wrap (3M Duct Wrap 20A).....	12.95	
			<i>Note: Includes cutting wrap to fit pipe or conduit and sealing edges.</i>		
			<i>For Work In Restricted Working Space, Add</i>	0.86	

07 84 56 13-0005 FireMaster Blanket Wrap Fireproofing (07 84 56 13)

07 84 56 13-0006	SF		1/2" Thermal Ceramics FireMaster Blanket Wrap.....	12.91	7.40
			<i>For Work In Restricted Working Space, Add</i>	2.97	
			<i>For >500 To 5,000, Deduct</i>	-1.19	
			<i>For >5,000, Deduct</i>	-2.10	
07 84 56 13-0007	SF		1" Thermal Ceramics FireMaster Blanket Wrap.....	15.39	7.40
			<i>For Work In Restricted Working Space, Add</i>	2.97	
			<i>For >500 To 5,000, Deduct</i>	-1.76	
			<i>For >5,000, Deduct</i>	-3.02	
07 84 56 13-0008	SF		1-1/2" Thermal Ceramics FireMaster Blanket Wrap.....	18.11	7.40
			<i>For Work In Restricted Working Space, Add</i>	2.97	
			<i>For >500 To 5,000, Deduct</i>	-2.38	
			<i>For >5,000, Deduct</i>	-4.03	
07 84 56 13-0009	SF		2" Thermal Ceramics FireMaster Blanket Wrap.....	20.83	7.40
			<i>For Work In Restricted Working Space, Add</i>	2.97	
			<i>For >500 To 5,000, Deduct</i>	-3.01	
			<i>For >5,000, Deduct</i>	-5.03	

07 90 Joint Protection (07)**07 91 Preformed Joint Seals (07 90)**



MINOR	CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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07 91 23 Backer Rods (07 91)**07 91 23 00-0001 Backer Rods** (07 91 23)

07 91 23 00-0002	LF	1/4" Polyethylene Or Polyurethane Backer Rod	1.16	0.36
07 91 23 00-0003	LF	3/8" Polyethylene Or Polyurethane Backer Rod	1.25	0.36
07 91 23 00-0004	LF	1/2" Polyethylene Or Polyurethane Backer Rod	1.34	0.36
07 91 23 00-0005	LF	5/8" Polyethylene Or Polyurethane Backer Rod	1.43	0.36
07 91 23 00-0006	LF	3/4" Polyethylene Or Polyurethane Backer Rod	1.49	0.43
07 91 23 00-0007	LF	7/8" Polyethylene Or Polyurethane Backer Rod	1.57	0.43
07 91 23 00-0008	LF	1" Polyethylene Or Polyurethane Backer Rod	1.73	0.43
07 91 23 00-0009	LF	1-1/4" Polyethylene Or Polyurethane Backer Rod	1.90	0.50
07 91 23 00-0010	LF	1-1/2" Polyethylene Or Polyurethane Backer Rod	2.12	0.57
07 91 23 00-0011	LF	2" Polyethylene Or Polyurethane Backer Rod	2.49	0.65
07 91 23 00-0012	LF	3" Polyethylene Or Polyurethane Backer Rod	3.77	0.79

07 91 26 Joint Fillers (07 91)**07 91 26 00-0001 Butyl Rubber Fillers** (07 91 26)

07 91 26 00-0002	LF	1/4" x 1/4" Butyl Rubber Filler	1.45	0.43
		<i>For Coloring, Add</i>	<i>0.00</i>	
07 91 26 00-0003	LF	1/2" x 1/2" Butyl Rubber Filler	4.15	1.23
		<i>For Coloring, Add</i>	<i>0.02</i>	
07 91 26 00-0004	LF	1/2" x 3/4" Butyl Rubber Filler	4.74	1.30
		<i>For Coloring, Add</i>	<i>0.03</i>	
07 91 26 00-0005	LF	3/4" x 3/4" Butyl Rubber Filler	4.83	1.37
07 91 26 00-0006	LF	1" x 1" Butyl Rubber Filler	4.39	1.52

07 91 26 00-0007 Closed Cell Neoprene (07 91 26)

07 91 26 00-0008	CLF	1/8" x 3" Neoprene Gasket Closed Cell, Adhesive	290.97	83.11
07 91 26 00-0009	CLF	1/8" x 6" Neoprene Gasket Closed Cell, Adhesive	483.89	120.06
07 91 26 00-0010	CLF	1/4" x 3" Neoprene Gasket Closed Cell, Adhesive	377.99	102.92
07 91 26 00-0011	CLF	1/4" x 6" Neoprene Gasket Closed Cell, Adhesive	448.52	108.03
07 91 26 00-0012	CLF	1/2" x 6" Neoprene Gasket Closed Cell, Adhesive	683.38	166.22
07 91 26 00-0013	CLF	1/2" x 9" Neoprene Gasket Closed Cell, Adhesive	794.08	180.06
07 91 26 00-0014	CLF	1/2" x 12" Neoprene Gasket Closed Cell, Adhesive	758.88	130.94

07 91 26 00-0015 Closed Cell Polyvinyl Chloride (07 91 26)

07 91 26 00-0016	CLF	1/8" x 3" Polyethylene Joint Backing, Closed Cell	294.68	102.92
07 91 26 00-0017	CLF	1/8" x 6" Polyethylene Joint Backing, Closed Cell	506.14	166.22
07 91 26 00-0018	CLF	1/4" x 3" Polyethylene Joint Backing, Closed Cell	387.46	141.89
07 91 26 00-0019	CLF	1/4" x 6" Polyethylene Joint Backing, Closed Cell	472.01	149.81
07 91 26 00-0020	CLF	1/2" x 6" Polyethylene Joint Backing, Closed Cell	718.21	229.75
07 91 26 00-0021	CLF	1/2" x 9" Polyethylene Joint Backing, Closed Cell	845.59	249.35
07 91 26 00-0022	CLF	1/2" x 12" Polyethylene Joint Backing, Closed Cell	1,127.59	298.90

07 91 26 00-0023 Silicon RTV Foam Penetration Seal (07 91 26)

07 91 26 00-0024	CLF	1/4" x 1/2" Silicon RTV Foam Seal	113.59	16.49
07 91 26 00-0025	CLF	1/2" x 1/2" Silicon RTV Foam Seal	227.17	32.92
07 91 26 00-0026	CLF	1/2" x 3/4" Silicon RTV Foam Seal	338.91	48.90
07 91 26 00-0027	CLF	3/4" x 3/4" Silicon RTV Foam Seal	483.73	65.91
07 91 26 00-0028	CLF	1/8" x 1" Silicon RTV Foam Seal	113.59	16.49
07 91 26 00-0029	CLF	1/8" x 3" Silicon RTV Foam Seal	338.62	48.76
07 91 26 00-0030	CLF	1/4" x 3" Silicon RTV Foam Seal	596.16	73.25
07 91 26 00-0031	CLF	1/4" x 6" Silicon RTV Foam Seal	1,191.05	145.99
07 91 26 00-0032	CLF	1/2" x 6" Silicon RTV Foam Seal	2,282.89	263.53
07 91 26 00-0033	CLF	1/2" x 9" Silicon RTV Foam Seal	3,477.29	411.68
07 91 26 00-0034	CLF	1/2" x 12" Silicon RTV Foam Seal	5,013.42	658.72

07 91 26 00-0035 Seals O-Ring Type Cord "J-Seal" (07 91 26)

07 91 26 00-0036	LF	1/4" Seals O-Ring Cord, J-Seal	3.08	0.93
07 91 26 00-0037	LF	1/2" Seals O-Ring Cord, J-Seal	3.27	0.93
07 91 26 00-0038	LF	3/4" Seals O-Ring Cord, J-Seal	3.45	1.00
07 91 26 00-0039	LF	1" Seals O-Ring Cord, J-Seal	3.66	1.08
07 91 26 00-0040	LF	1-1/4" Seals O-Ring Cord, J-Seal	3.94	1.16
07 91 26 00-0041	LF	1-1/2" Seals O-Ring Cord, J-Seal	4.13	1.16
07 91 26 00-0042	LF	1-3/4" Seals O-Ring Cord, J-Seal	4.39	1.23
07 91 26 00-0043	LF	2" Seals O-Ring Cord, J-Seal	4.56	1.23

07 91 33 Expansion Joint Seal Systems (07 91)**07 91 33 00-0001 Expansion Joint Seal Systems (Wabo®)** (07 91 33)**07 91 33 00-0002 Coated Foam, Pre-Compressed, Elastomeric Expansion Joint Seal Systems (Wabo® HSeal)** (07 91 33 00-0001)

Note: Includes a pre-compressed seal, epoxy adhesive and traffic grade elastomeric top coating.

07 Thermal And Moisture Protection**07 90 Joint Protection****07 91 Prefomed Joint Seals**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 91 33 00-0003	LF		1/2" Minimum, 1-1/2" Maximum Joint Opening, Coated Foam, Pre-Compressed, Elastomeric Expansion Joint Seal System (Wabo® HSeal 25EH)	49.66	4.57
07 91 33 00-0004	LF		3/4" Minimum, 2-1/4" Maximum Joint Opening, Coated Foam, Pre-Compressed, Elastomeric Expansion Joint Seal System (Wabo® HSeal 40EH)	66.00	4.79
07 91 33 00-0005	LF		1" Minimum, 3" Maximum Joint Opening, Coated Foam, Pre-Compressed, Elastomeric Expansion Joint Seal System (Wabo® HSeal 50EH).....	83.24	5.01
07 91 33 00-0006	LF		1-1/4" Minimum, 3-3/4" Maximum Joint Opening, Coated Foam, Pre-Compressed, Elastomeric Expansion Joint Seal System (Wabo® HSeal 65EH)	102.40	5.22
07 91 33 00-0007	LF		1-1/2" Minimum, 4-1/2" Maximum Joint Opening, Coated Foam, Pre-Compressed, Elastomeric Expansion Joint Seal System (Wabo® HSeal 75EH)	132.40	5.44
07 91 33 00-0008	LF		1-3/4" Minimum, 5-1/4" Maximum Joint Opening, Coated Foam, Pre-Compressed, Elastomeric Expansion Joint Seal System (Wabo® HSeal 90EH)	151.89	5.66
07 91 33 00-0009	LF		2" Minimum, 6" Maximum Joint Opening, Coated Foam, Pre-Compressed, Elastomeric Expansion Joint Seal System (Wabo® HSeal 100EH).....	176.04	5.87
07 91 33 00-0010			Neoprene, Prefomed Elastomeric Horizontal Expansion Joint Seal Systems (Wabo® CompressionSeal) (07 91 33 00-0001)		
Note: Includes prefomed neoprene joint seal and lubricant adhesive.					
07 91 33 00-0011	LF		0.625" Minimum, 1.381" Maximum Joint Opening, Neoprene, Prefomed Elastomeric Horizontal Expansion Joint Seal System (Wabo® CompressionSeal WA-162).....	26.11	4.57
07 91 33 00-0012	LF		0.688" Minimum, 1.488" Maximum Joint Opening, Neoprene, Prefomed Elastomeric Horizontal Expansion Joint Seal System (Wabo® CompressionSeal WA-175).....	28.40	4.64
07 91 33 00-0013	LF		0.875" Minimum, 1.700" Maximum Joint Opening, Neoprene, Prefomed Elastomeric Horizontal Expansion Joint Seal System (Wabo® CompressionSeal WA-200).....	34.04	4.70
07 91 33 00-0014	LF		0.953" Minimum, 1.913" Maximum Joint Opening, Neoprene, Prefomed Elastomeric Horizontal Expansion Joint Seal System (Wabo® CompressionSeal WA-225).....	36.05	4.79
07 91 33 00-0015	LF		1.000" Minimum, 2.125" Maximum Joint Opening, Neoprene, Prefomed Elastomeric Horizontal Expansion Joint Seal System (Wabo® CompressionSeal WA-250).....	38.45	4.85
07 91 33 00-0016	LF		1.125" Minimum, 2.550" Maximum Joint Opening, Neoprene, Prefomed Elastomeric Horizontal Expansion Joint Seal System (Wabo® CompressionSeal WA-300).....	46.79	4.91
07 91 33 00-0017	LF		1.375" Minimum, 2.975" Maximum Joint Opening, Neoprene, Prefomed Elastomeric Horizontal Expansion Joint Seal System (Wabo® CompressionSeal WA-350).....	57.40	5.01
07 91 33 00-0018	LF		1.625" Minimum, 3.400" Maximum Joint Opening, Neoprene, Prefomed Elastomeric Horizontal Expansion Joint Seal System (Wabo® CompressionSeal WA-400).....	67.66	5.22
07 91 33 00-0019	LF		1.687" Minimum, 4.250" Maximum Joint Opening, Neoprene, Prefomed Elastomeric Horizontal Expansion Joint Seal System (Wabo® CompressionSeal WA-500).....	76.44	5.44
07 91 33 00-0020			Santoprene®, Prefomed Elastomeric Vertical Expansion Joint Seal Systems (Wabo® CompressionSeal) (07 91 33 00-0001)		
Note: Includes prefomed Santoprene® joint seal and lubricant adhesive.					
07 91 33 00-0021	LF		0.500" Minimum, 1.500" Maximum Joint Opening, Santoprene®, Prefomed Elastomeric Vertical Expansion Joint Seal System (Wabo® CompressionSeal WE-100).....	22.10	4.57
07 91 33 00-0022	LF		0.688" Minimum, 1.938" Maximum Joint Opening, Santoprene®, Prefomed Elastomeric Vertical Expansion Joint Seal System (Wabo® CompressionSeal WE-225).....	28.35	4.79
07 91 33 00-0023	LF		1.063" Minimum, 2.125" Maximum Joint Opening, Santoprene®, Prefomed Elastomeric Vertical Expansion Joint Seal System (Wabo® CompressionSeal WE-250).....	34.51	5.01
07 91 33 00-0024	LF		1.250" Minimum, 2.563" Maximum Joint Opening, Santoprene®, Prefomed Elastomeric Vertical Expansion Joint Seal System (Wabo® CompressionSeal WE-300).....	36.38	5.12
07 91 33 00-0025	LF		1.250" Minimum, 3.375" Maximum Joint Opening, Santoprene®, Prefomed Elastomeric Vertical Expansion Joint Seal System (Wabo® CompressionSeal WE-400).....	40.22	5.22
07 91 33 00-0026	LF		1.438" Minimum, 4.250" Maximum Joint Opening, Santoprene®, Prefomed Elastomeric Vertical Expansion Joint Seal System (Wabo® CompressionSeal WE-500).....	57.03	5.44
07 91 33 00-0027	LF		1.813" Minimum, 5.125" Maximum Joint Opening, Santoprene®, Prefomed Elastomeric Vertical Expansion Joint Seal System (Wabo® CompressionSeal WE-600).....	77.82	5.66
07 91 33 00-0028			Coated Foam, Pre-Compressed, Elastomeric Expansion Joint Seal Systems (Wabo® Seismic WeatherSeal) (07 91 33 00-0001)		
Note: Includes a pre-compressed foam seal and silicone sealant.					
07 91 33 00-0029	LF		1/2" Minimum, 1-1/2" Maximum Joint Opening, Coated Foam, Pre-Compressed, Elastomeric Expansion Joint Seal System (Wabo® Seismic WeatherSeal SWS-100).....	18.15	1.81
07 91 33 00-0030	LF		3/4" Minimum, 2-1/4" Maximum Joint Opening, Coated Foam, Pre-Compressed, Elastomeric Expansion Joint Seal System (Wabo® Seismic WeatherSeal SWS-150).....	30.23	1.88
07 91 33 00-0031	LF		1" Minimum, 3" Maximum Joint Opening, Coated Foam, Pre-Compressed, Elastomeric Expansion Joint Seal System (Wabo® Seismic WeatherSeal SWS-200).....	45.35	1.95
07 91 33 00-0032	LF		1-1/4" Minimum, 3-3/4" Maximum Joint Opening, Coated Foam, Pre-Compressed, Elastomeric Expansion Joint Seal System (Wabo® Seismic WeatherSeal SWS-250).....	57.09	2.03
07 91 33 00-0033	LF		1-1/2" Minimum, 4-1/2" Maximum Joint Opening, Coated Foam, Pre-Compressed, Elastomeric Expansion Joint Seal System (Wabo® Seismic WeatherSeal SWS-300).....	75.02	2.11
07 91 33 00-0034	LF		1-3/4" Minimum, 5-1/4" Maximum Joint Opening, Coated Foam, Pre-Compressed, Elastomeric Expansion Joint Seal System (Wabo® Seismic WeatherSeal SWS-350).....	99.13	2.18
07 91 33 00-0035	LF		2" Minimum, 6" Maximum Joint Opening, Coated Foam, Pre-Compressed, Elastomeric Expansion Joint Seal System (Wabo® Seismic WeatherSeal SWS-400).....	121.51	2.25
07 91 33 00-0036	LF		2-1/2" Minimum, 7-1/2" Maximum Joint Opening, Coated Foam, Pre-Compressed, Elastomeric Expansion Joint Seal System (Wabo® Seismic WeatherSeal SWS-500).....	163.73	2.32
07 91 33 00-0037	LF		3" Minimum, 9" Maximum Joint Opening, Coated Foam, Pre-Compressed, Elastomeric Expansion Joint Seal System (Wabo® Seismic WeatherSeal SWS-600).....	191.10	2.39



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 91 33 00-0038			Silicone Faced Foam, Preformed Elastomeric Expansion Joint Seal Systems (Wabo® WeatherSeal II) <small>(07 91 33 00-0001)</small> Note: Includes a pre-compressed foam seal and silicone sealant.		
07 91 33 00-0039	LF		0.75" Minimum, 1.25" Maximum Joint Opening, Silicone Faced Foam, Preformed Elastomeric Expansion Joint Seal System (Wabo® WeatherSeal II WS-100)	17.72	1.81
07 91 33 00-0040	LF		1.13" Minimum, 1.88" Maximum Joint Opening, Silicone Faced Foam, Preformed Elastomeric Expansion Joint Seal System (Wabo® WeatherSeal II WS-150)	23.29	1.88
07 91 33 00-0041	LF		1.50" Minimum, 2.50" Maximum Joint Opening, Silicone Faced Foam, Preformed Elastomeric Expansion Joint Seal System (Wabo® WeatherSeal II WS-200)	31.14	1.95
07 91 33 00-0042	LF		1.88" Minimum, 3.13" Maximum Joint Opening, Silicone Faced Foam, Preformed Elastomeric Expansion Joint Seal System (Wabo® WeatherSeal II WS-250)	42.12	2.03
07 91 33 00-0043	LF		2.25" Minimum, 3.75" Maximum Joint Opening, Silicone Faced Foam, Preformed Elastomeric Expansion Joint Seal System (Wabo® WeatherSeal II WS-300)	48.02	2.11
07 91 33 00-0044	LF		2.63" Minimum, 4.38" Maximum Joint Opening, Silicone Faced Foam, Preformed Elastomeric Expansion Joint Seal System (Wabo® WeatherSeal II WS-350)	66.49	2.18
07 91 33 00-0045	LF		3.00" Minimum, 5.00" Maximum Joint Opening, Silicone Faced Foam, Preformed Elastomeric Expansion Joint Seal System (Wabo® WeatherSeal II WS-400)	89.19	2.25
07 91 33 00-0046	LF		3.75" Minimum, 6.25" Maximum Joint Opening, Silicone Faced Foam, Preformed Elastomeric Expansion Joint Seal System (Wabo® WeatherSeal II WS-500)	96.28	2.32
07 92			Joint Sealants <small>(07 90)</small>		
07 92 13			Elastomeric Joint Sealants <small>(07 92)</small>		
07 92 13 00-0001			Silicone Sealant And Caulking <small>(07 92 13)</small>		
07 92 13 00-0002	CLF		1/4" x 1/4" Joint, Silicone Sealant And Caulking	271.45	114.94
			For Coloring, Add	14.96	
			For 1 Part Mildew Resistant, Add	14.55	
			For High-Modulus Non-Acid Curing, Add	8.31	
07 92 13 00-0003	CLF		1/4" x 3/8" Joint, Silicone Sealant And Caulking	299.41	118.54
			For Coloring, Add	22.44	
			For 1 Part Mildew Resistant, Add	21.82	
			For High-Modulus Non-Acid Curing, Add	12.47	
07 92 13 00-0004	CLF		1/4" x 1/2" Joint, Silicone Sealant And Caulking	327.34	122.13
			For Coloring, Add	29.92	
			For 1 Part Mildew Resistant, Add	29.09	
			For High-Modulus Non-Acid Curing, Add	16.62	
07 92 13 00-0005	CLF		3/8" x 3/8" Joint, Silicone Sealant And Caulking	337.73	122.13
			For Coloring, Add	33.66	
			For 1 Part Mildew Resistant, Add	32.73	
			For High-Modulus Non-Acid Curing, Add	18.70	
07 92 13 00-0006	CLF		3/8" x 1/2" Joint, Silicone Sealant And Caulking	376.14	125.72
			For Coloring, Add	44.88	
			For 1 Part Mildew Resistant, Add	43.63	
			For High-Modulus Non-Acid Curing, Add	24.93	
07 92 13 00-0007	CLF		3/8" x 5/8" Joint, Silicone Sealant And Caulking	414.48	129.32
			For Coloring, Add	56.10	
			For 1 Part Mildew Resistant, Add	54.54	
			For High-Modulus Non-Acid Curing, Add	31.17	
07 92 13 00-0008	CLF		3/8" x 3/4" Joint, Silicone Sealant And Caulking	459.96	136.49
			For Coloring, Add	67.32	
			For 1 Part Mildew Resistant, Add	65.45	
			For High-Modulus Non-Acid Curing, Add	37.40	
07 92 13 00-0009	CLF		1/2" x 1/2" Joint, Silicone Sealant And Caulking	424.87	129.32
			For Coloring, Add	59.84	
			For 1 Part Mildew Resistant, Add	58.18	
			For High-Modulus Non-Acid Curing, Add	33.25	
07 92 13 00-0010	CLF		1/2" x 5/8" Joint, Silicone Sealant And Caulking	495.15	143.68
			For Coloring, Add	74.80	
			For 1 Part Mildew Resistant, Add	72.73	
			For High-Modulus Non-Acid Curing, Add	41.56	
07 92 13 00-0011	CLF		1/2" x 3/4" Joint, Silicone Sealant And Caulking	551.09	150.87
			For Coloring, Add	89.77	
			For 1 Part Mildew Resistant, Add	87.27	
			For High-Modulus Non-Acid Curing, Add	49.87	
07 92 13 00-0012	CLF		1/2" x 7/8" Joint, Silicone Sealant And Caulking	606.99	158.04
			For Coloring, Add	104.73	
			For 1 Part Mildew Resistant, Add	101.82	
			For High-Modulus Non-Acid Curing, Add	58.18	
07 92 13 00-0013	CLF		1/2" x 1" Joint, Silicone Sealant And Caulking	655.72	161.63
			For Coloring, Add	119.69	
			For 1 Part Mildew Resistant, Add	116.36	
			For High-Modulus Non-Acid Curing, Add	66.49	
07 92 13 00-0014	CLF		3/4" x 3/4" Joint, Silicone Sealant And Caulking	704.53	165.22
			For Coloring, Add	134.65	
			For 1 Part Mildew Resistant, Add	130.91	
			For High-Modulus Non-Acid Curing, Add	74.80	
07 92 13 00-0015	CLF		1" x 1" Joint, Silicone Sealant And Caulking	1,024.13	179.60
			For Coloring, Add	239.37	
			For 1 Part Mildew Resistant, Add	232.73	
			For High-Modulus Non-Acid Curing, Add	132.99	

07 Thermal And Moisture Protection**07 90 Joint Protection****07 92 Joint Sealants**MINOR
CSI UOM DESCRIPTIONTOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

07 92 13 00-0016 Acrylic/Latex Sealant And Caulking (07 92 13)			
07 92 13 00-0017	CLF 1/4" x 1/4" Joint, Acrylic/Latex Sealant And Caulking	251.13	114.94
07 92 13 00-0018	CLF 1/4" x 3/8" Joint, Acrylic/Latex Sealant And Caulking	268.91	118.54
07 92 13 00-0019	CLF 1/4" x 1/2" Joint, Acrylic/Latex Sealant And Caulking	286.68	122.13
07 92 13 00-0020	CLF 3/8" x 3/8" Joint, Acrylic/Latex Sealant And Caulking	291.99	122.13
07 92 13 00-0021	CLF 3/8" x 1/2" Joint, Acrylic/Latex Sealant And Caulking	315.16	125.72
07 92 13 00-0022	CLF 3/8" x 5/8" Joint, Acrylic/Latex Sealant And Caulking	338.26	129.32
07 92 13 00-0023	CLF 3/8" x 3/4" Joint, Acrylic/Latex Sealant And Caulking	368.49	136.49
07 92 13 00-0024	CLF 1/2" x 1/2" Joint, Acrylic/Latex Sealant And Caulking	343.57	129.32
07 92 13 00-0025	CLF 1/2" x 5/8" Joint, Acrylic/Latex Sealant And Caulking	393.52	143.68
07 92 13 00-0026	CLF 1/2" x 3/4" Joint, Acrylic/Latex Sealant And Caulking	429.13	150.87
07 92 13 00-0027	CLF 1/2" x 7/8" Joint, Acrylic/Latex Sealant And Caulking	464.70	158.04
07 92 13 00-0028	CLF 1/2" x 1" Joint, Acrylic/Latex Sealant And Caulking	493.10	161.63
07 92 13 00-0029	CLF 3/4" x 3/4" Joint, Acrylic/Latex Sealant And Caulking	521.59	165.22
07 92 13 00-0030	CLF 1" x 1" Joint, Acrylic/Latex Sealant And Caulking	698.90	179.60

07 92 13 00-0031 Polyurethane Sealant And Caulking (07 92 13)			
Note: 1 or 2 part, non-sag.			
07 92 13 00-0032	CLF 1/4" x 1/4" Joint, Polyurethane Sealant And Caulking	261.77	114.94
07 92 13 00-0033	CLF 1/4" x 3/8" Joint, Polyurethane Sealant And Caulking	284.87	119.25
07 92 13 00-0034	CLF 1/4" x 1/2" Joint, Polyurethane Sealant And Caulking	307.97	122.13
07 92 13 00-0035	CLF 3/8" x 3/8" Joint, Polyurethane Sealant And Caulking	315.94	122.13
07 92 13 00-0036	CLF 3/8" x 1/2" Joint, Polyurethane Sealant And Caulking	347.09	125.72
07 92 13 00-0037	CLF 3/8" x 5/8" Joint, Polyurethane Sealant And Caulking	378.17	129.32
07 92 13 00-0038	CLF 3/8" x 3/4" Joint, Polyurethane Sealant And Caulking	416.38	136.49
07 92 13 00-0039	CLF 1/2" x 1/2" Joint, Polyurethane Sealant And Caulking	386.13	129.32
07 92 13 00-0040	CLF 1/2" x 5/8" Joint, Polyurethane Sealant And Caulking	446.73	143.68
07 92 13 00-0041	CLF 1/2" x 3/4" Joint, Polyurethane Sealant And Caulking	492.98	150.87
07 92 13 00-0042	CLF 1/2" x 7/8" Joint, Polyurethane Sealant And Caulking	539.20	158.04
07 92 13 00-0043	CLF 1/2" x 1" Joint, Polyurethane Sealant And Caulking	578.24	161.63
07 92 13 00-0044	CLF 3/4" x 3/4" Joint, Polyurethane Sealant And Caulking	617.37	165.22
07 92 13 00-0045	CLF 3/4" x 1" Joint, Polyurethane Sealant And Caulking	741.68	179.60

07 92 13 00-0046 Flexible Polysulfide Sealant And Caulking, Clear (07 92 13)			
Note: 1 or 2 part, non-sag.			
07 92 13 00-0047	CLF 1/4" x 1/4" Joint, Polysulfide Sealant And Caulking	264.80	114.94
07 92 13 00-0048	CLF 1/4" x 3/8" Joint, Polysulfide Sealant And Caulking	289.42	119.98
07 92 13 00-0049	CLF 1/4" x 1/2" Joint, Polysulfide Sealant And Caulking	314.03	122.13
07 92 13 00-0050	CLF 3/8" x 3/8" Joint, Polysulfide Sealant And Caulking	322.76	122.13
07 92 13 00-0051	CLF 3/8" x 1/2" Joint, Polysulfide Sealant And Caulking	356.20	125.72
07 92 13 00-0052	CLF 3/8" x 5/8" Joint, Polysulfide Sealant And Caulking	389.54	129.32
07 92 13 00-0053	CLF 3/8" x 3/4" Joint, Polysulfide Sealant And Caulking	430.02	136.49
07 92 13 00-0054	CLF 1/2" x 1/2" Joint, Polysulfide Sealant And Caulking	398.26	129.32
07 92 13 00-0055	CLF 1/2" x 5/8" Joint, Polysulfide Sealant And Caulking	461.90	143.68
07 92 13 00-0056	CLF 1/2" x 3/4" Joint, Polysulfide Sealant And Caulking	511.18	150.87
07 92 13 00-0057	CLF 1/2" x 7/8" Joint, Polysulfide Sealant And Caulking	560.43	158.04
07 92 13 00-0058	CLF 1/2" x 1" Joint, Polysulfide Sealant And Caulking	602.50	161.63
07 92 13 00-0059	CLF 3/4" x 3/4" Joint, Polysulfide Sealant And Caulking	644.67	165.22
07 92 13 00-0060	CLF 3/4" x 1" Joint, Polysulfide Sealant And Caulking	778.07	179.60

07 92 13 00-0061 Flexible Polyurethane Security Sealant And Caulking (07 92 13)			
Note: 1 or 2 part, non-sag.			
07 92 13 00-0062	CLF 1/4" x 1/4" Joint, Flexible Polyurethane Security Sealant And Caulking	272.20	114.94
07 92 13 00-0063	CLF 1/4" x 3/8" Joint, Flexible Polyurethane Security Sealant And Caulking	300.52	119.25
07 92 13 00-0064	CLF 1/4" x 1/2" Joint, Flexible Polyurethane Security Sealant And Caulking	328.83	122.13
07 92 13 00-0065	CLF 3/8" x 3/8" Joint, Flexible Polyurethane Security Sealant And Caulking	339.40	122.13
07 92 13 00-0066	CLF 3/8" x 1/2" Joint, Flexible Polyurethane Security Sealant And Caulking	378.38	125.72
07 92 13 00-0067	CLF 3/8" x 5/8" Joint, Flexible Polyurethane Security Sealant And Caulking	417.28	129.32
07 92 13 00-0068	CLF 3/8" x 3/4" Joint, Flexible Polyurethane Security Sealant And Caulking	463.31	136.49
07 92 13 00-0069	CLF 1/2" x 1/2" Joint, Flexible Polyurethane Security Sealant And Caulking	427.85	129.32
07 92 13 00-0070	CLF 1/2" x 5/8" Joint, Flexible Polyurethane Security Sealant And Caulking	498.88	143.68
07 92 13 00-0071	CLF 1/2" x 3/4" Joint, Flexible Polyurethane Security Sealant And Caulking	555.56	150.87
07 92 13 00-0072	CLF 1/2" x 7/8" Joint, Flexible Polyurethane Security Sealant And Caulking	612.20	158.04
07 92 13 00-0073	CLF 1/2" x 1" Joint, Flexible Polyurethane Security Sealant And Caulking	661.68	161.63
07 92 13 00-0074	CLF 3/4" x 3/4" Joint, Flexible Polyurethane Security Sealant And Caulking	711.24	165.22
07 92 13 00-0075	CLF 3/4" x 1" Joint, Flexible Polyurethane Security Sealant And Caulking	866.84	179.60

07 92 19 Acoustical Joint Sealants (07 92)

07 92 19 00-0001 Acoustical Sealant (07 92 19)			
07 92 19 00-0002	CLF 1/4" x 1/4" Joint, Acoustical Sealant	240.95	107.76
	For Coloring, Add	9.16	
	For 1 Part Mildew Resistant, Add	8.91	
	For High-Modulus Non-Acid Curing, Add	5.09	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
07 92 19 00-0003 CLF 1/4" x 3/8" Joint, Acoustical Sealant	265.02	114.94
<i>For Coloring, Add</i>	12.64	
<i>For 1 Part Mildew Resistant, Add</i>	12.29	
<i>For High-Modulus Non-Acid Curing, Add</i>	7.02	
07 92 19 00-0004 CLF 1/4" x 1/2" Joint, Acoustical Sealant	285.04	122.13
<i>For Coloring, Add</i>	14.70	
<i>For 1 Part Mildew Resistant, Add</i>	14.29	
<i>For High-Modulus Non-Acid Curing, Add</i>	8.16	
07 92 19 00-0005 CLF 3/8" x 3/8" Joint, Acoustical Sealant	300.85	122.13
<i>For Coloring, Add</i>	20.39	
<i>For 1 Part Mildew Resistant, Add</i>	19.82	
<i>For High-Modulus Non-Acid Curing, Add</i>	11.33	
07 92 19 00-0006 CLF 3/8" x 1/2" Joint, Acoustical Sealant	324.54	125.72
<i>For Coloring, Add</i>	26.31	
<i>For 1 Part Mildew Resistant, Add</i>	25.57	
<i>For High-Modulus Non-Acid Curing, Add</i>	14.61	
07 92 19 00-0007 CLF 1/2" x 1/2" Joint, Acoustical Sealant	361.61	129.32
<i>For Coloring, Add</i>	37.07	
<i>For 1 Part Mildew Resistant, Add</i>	36.04	
<i>For High-Modulus Non-Acid Curing, Add</i>	20.59	

07 95 Expansion Control (07 90)

07 95 13 Expansion Joint Cover Assemblies (07 95)

Note: Includes necessary waterproofing mastics/caulking.

07 95 13 00-0001 Floor Assembly Type (07 95 13)

07 95 13 00-0002 With 1" Space (07 95 13 00-0001)

07 95 13 00-0003	LF	Aluminum Expansion Joint Cover, 1" Opening Floor Assembly Type.....	36.19	5.16
07 95 13 00-0004	LF	Bronze Expansion Joint Cover, 1" Opening Floor Assembly Type	64.39	5.16
07 95 13 00-0005	LF	Stainless Steel Expansion Joint Cover, 1" Opening Floor Assembly Type.....	71.00	5.16

07 95 13 00-0006 With 2" Space (07 95 13 00-0001)

07 95 13 00-0007	LF	Aluminum Expansion Joint Cover, 2" Opening Floor Assembly Type.....	42.96	5.16
07 95 13 00-0008	LF	Bronze Expansion Joint Cover, 2" Opening Floor Assembly Type	78.30	5.16
07 95 13 00-0009	LF	Stainless Steel Expansion Joint Cover, 2" Opening Floor Assembly Type.....	95.18	5.16

07 95 13 00-0010 Ceiling And Wall Assembly Type (07 95 13)

07 95 13 00-0011 With 1" Space (07 95 13 00-0010)

07 95 13 00-0012	LF	Aluminum Expansion Joint Cover, 1" Opening Ceiling And Wall Assembly Type.....	29.42	5.16
07 95 13 00-0013	LF	Bronze Expansion Joint Cover, 1" Opening Ceiling And Wall Assembly Type	50.48	5.16
07 95 13 00-0014	LF	Stainless Steel Expansion Joint Cover, 1" Opening Ceiling And Wall Assembly Type.....	58.91	5.16

07 95 13 00-0015 With 2" Space (07 95 13 00-0010)

07 95 13 00-0016	LF	Aluminum Expansion Joint Cover, 2" Opening Ceiling And Wall Assembly Type.....	33.48	5.16
07 95 13 00-0017	LF	Bronze Expansion Joint Cover, 2" Opening Ceiling And Wall Assembly Type	57.43	5.16
07 95 13 00-0018	LF	Stainless Steel Expansion Joint Cover, 2" Opening Ceiling And Wall Assembly Type.....	71.00	5.16

07 95 13 00-0019 Exterior Roof Aluminum Expansion Assemblies (07 95 13)

07 95 13 00-0020 Roof To Roof (07 95 13 00-0019)

07 95 13 00-0021	LF	Exterior Roof To Roof Expansion Joint, 1" Opening Aluminum Assemblies	36.44	3.44
07 95 13 00-0022	LF	Exterior Roof To Roof Expansion Joint, 2" Opening Aluminum Assemblies	42.14	3.44
07 95 13 00-0023	LF	Exterior Roof To Roof Expansion Joint, 3" Opening Aluminum Assemblies	46.07	3.44

07 95 13 00-0024 Roof To Wall (07 95 13 00-0019)

07 95 13 00-0025	LF	Exterior Roof To Wall Expansion Joint, 1" Opening Aluminum Assemblies.....	30.19	3.44
07 95 13 00-0026	LF	Exterior Roof To Wall Expansion Joint, 2" Opening Aluminum Assemblies.....	37.16	3.44

07 95 13 00-0027 Flat Wall To Wall (07 95 13 00-0019)

07 95 13 00-0028	LF	Exterior Wall To Wall Expansion Joint, 1" Opening Aluminum Assemblies	24.10	3.44
07 95 13 00-0029	LF	Exterior Wall To Wall Expansion Joint, 2" Opening Aluminum Assemblies	28.29	3.44
07 95 13 00-0030	LF	Exterior Wall To Wall Expansion Joint, 3" Opening Aluminum Assemblies	33.34	3.44

07 95 13 00-0031 Corner To Flat Wall (07 95 13 00-0019)

07 95 13 00-0032	LF	Exterior Corner To Wall Expansion Joint, 1" Opening Aluminum Assemblies	24.02	3.44
07 95 13 00-0033	LF	Exterior Corner To Wall Expansion Joint, 2" Opening Aluminum Assemblies	26.81	3.44
07 95 13 00-0034	LF	Exterior Corner To Wall Expansion Joint, 3" Opening Aluminum Assemblies	34.65	3.44

07

07 Thermal And Moisture Protection

07 90 Joint Protection

07 95 Expansion Control



MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

END OF SECTION 07



MINOR	CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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08 Openings

08 01 Operation And Maintenance Of Openings ⁽⁰⁸⁾

08 01 10 Operation And Maintenance Of Doors And Frames ^(08 01)

08 01 11 Operation and Maintenance of Metal Doors and Frames ^(08 01 10)

08 01 11 00-0001	Hollow Metal Door Repair ^(08 01 11)		
Note: Repairs are based on holes or damage of less than 1/2 of a square foot.			
08 01 11 00-0002	SF Patch Small Drill Holes		7.31
08 01 11 00-0003	LF Patch Deep Scrapes Or Cuts In Doors		36.53
08 01 11 00-0004	IN Patch Holes Larger Than Normal Drill Holes (By Diameter Of Holes)		10.96

08 01 50 Operation And Maintenance Of Windows ^(08 01)

08 01 52 Operation and Maintenance of Wood Windows ^(08 01 50)

08 01 52 61 Wood Window Repairs ^(08 01 52)

08 01 52 61-0001	Window Restoration And Replacement ^(08 01 52 61)		
08 01 52 61-0002	EA Remove And Replace Sash Guides		7.98
08 01 52 61-0003	EA Remove And Replace Window Arms		22.46
08 01 52 61-0004	EA Remove And Replace Window Crank Operator		24.64
08 01 52 61-0005	EA Remove And Replace Brass Window Sash Pull		15.63
08 01 52 61-0006	EA Remove And Replace Brass Window Sash Lock		14.12
08 01 52 61-0007	EA Remove And Replace Window Balance, Removable Sash Window		17.01
Note: Channel, spiral or coil balance.			
08 01 52 61-0008	EA Remove And Replace Window Balance, Sash Window Requiring The Removal And Replacement Of Wooden Stops And/Or Casing		52.95
Note: Channel, spiral or coil balance.			
For Replacing Two Balances In One Window, Deduct			-19.84

08 01 80 Maintenance of Glazing ^(08 01)

08 01 81 Maintenance of Glass Glazing ^(08 01 80)

08 01 81 00-0001	Glazing Compound Repair ^(08 01 81)		
08 01 81 00-0002	LF Remove And Replace Damaged, Broken Or Cracked Window Glazing Up To 1/2" Wide		3.76

08 05 Common Work Results For Openings ⁽⁰⁸⁾

08 05 13 Door Options And Modifications ^(08 05)

Note: Excludes removal and reinstallation of door.

08 05 13 00-0001 Door Vision Panels (Pemko LT-S1) ^(08 05 13)

Note: Factory primed or powder coated. See CSI section 08 81 00 00-0000 for glazing.

08 05 13 00-0002	EA For Up To 1 SF, Factory Installed 20 Gauge Galvannealed Steel Frame With 3/8" Glazing Pocket For Vision Glass In Door, Add		73.12
For 9/16" To 1-1/16" Glazing Pocket, Add			36.56
08 05 13 00-0003	EA For >1 To 2 SF, Factory Installed 20 Gauge Galvannealed Steel Frame With 3/8" Glazing Pocket For Vision Glass In Door, Add		92.56
For 9/16" To 1-1/16" Glazing Pocket, Add			46.28
08 05 13 00-0004	EA For >2 To 4 SF, Factory Installed 20 Gauge Galvannealed Steel Frame With 3/8" Glazing Pocket For Vision Glass In Door, Add		107.37
For 9/16" To 1-1/16" Glazing Pocket, Add			53.69
08 05 13 00-0005	EA For >4 To 6 SF, Factory Installed 20 Gauge Galvannealed Steel Frame With 3/8" Glazing Pocket For Vision Glass In Door, Add		136.98
For 9/16" To 1-1/16" Glazing Pocket, Add			68.49
08 05 13 00-0006	EA For >6 To 8 SF, Factory Installed 20 Gauge Galvannealed Steel Frame With 3/8" Glazing Pocket For Vision Glass In Door, Add		177.71
For 9/16" To 1-1/16" Glazing Pocket, Add			88.86
08 05 13 00-0007	EA For >8 To 10 SF, Factory Installed 20 Gauge Galvannealed Steel Frame With 3/8" Glazing Pocket For Vision Glass In Door, Add		226.76
For 9/16" To 1-1/16" Glazing Pocket, Add			113.38
08 05 13 00-0008	EA For >10 SF, Factory Installed 20 Gauge Galvannealed Steel Frame With 3/8" Glazing Pocket For Vision Glass In Door, Add		240.65
For 9/16" To 1-1/16" Glazing Pocket, Add			120.33
08 05 13 00-0009	EA For Up To 1 SF, Site Installed 20 Gauge Galvannealed Steel Frame With 3/8" Glazing Pocket For Vision Glass In Door, Add		138.34
For 9/16" To 1-1/16" Glazing Pocket, Add			33.24
08 05 13 00-0010	EA For >1 To 2 SF, Site Installed 20 Gauge Galvannealed Steel Frame With 3/8" Glazing Pocket For Vision Glass In Door, Add		163.20
For 9/16" To 1-1/16" Glazing Pocket, Add			42.07
08 05 13 00-0011	EA For >2 To 4 SF, Site Installed 20 Gauge Galvannealed Steel Frame With 3/8" Glazing Pocket For Vision Glass In Door, Add		183.86
For 9/16" To 1-1/16" Glazing Pocket, Add			48.81

08 Openings**08 05 Common Work Results For Openings****08 05 13 Door Options And Modifications**

MINOR		TOTAL DIRECT		DEMOLITION
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST
08 05 13 00-0012	EA	For >4 To 6 SF, Site Installed 20 Gauge Galvanized Steel Frame With 3/8" Glazing Pocket For Vision Glass In Door, Add	217.96	
		For 9/16" To 1-1/16" Glazing Pocket, Add	62.27	
08 05 13 00-0013	EA	For >6 To 8 SF, Site Installed 20 Gauge Galvanized Steel Frame With 3/8" Glazing Pocket For Vision Glass In Door, Add	262.17	
		For 9/16" To 1-1/16" Glazing Pocket, Add	80.78	
08 05 13 00-0014	EA	For >8 To 10 SF, Site Installed 20 Gauge Galvanized Steel Frame With 3/8" Glazing Pocket For Vision Glass In Door, Add	313.96	
		For 9/16" To 1-1/16" Glazing Pocket, Add	103.08	
08 05 13 00-0015	EA	For >10 SF, Site Installed 20 Gauge Galvanized Steel Frame With 3/8" Glazing Pocket For Vision Glass In Door, Add	333.76	
		For 9/16" To 1-1/16" Glazing Pocket, Add	109.39	
08 05 13 00-0016		Door Louvers, Inverted "Y" 50% Free Air (Pemko LV-IY) (08 05 13)		
		Note: Factory primed or powder coated.		
08 05 13 00-0017	EA	For Up To 1 SF, Factory Installed 20 Gauge Galvanized Inverted "Y" Blades, 18 Gauge Galvanized Frame Louver In Door, Add	90.71	
08 05 13 00-0018	EA	For >1 To 2 SF, Factory Installed 20 Gauge Galvanized Inverted "Y" Blades, 18 Gauge Galvanized Frame Louver In Door, Add	101.81	
08 05 13 00-0019	EA	For >2 To 4 SF, Factory Installed 20 Gauge Galvanized Inverted "Y" Blades, 18 Gauge Galvanized Frame Louver In Door, Add	135.13	
08 05 13 00-0020	EA	For >4 To 6 SF, Factory Installed 20 Gauge Galvanized Inverted "Y" Blades, 18 Gauge Galvanized Frame Louver In Door, Add	214.73	
08 05 13 00-0021	EA	For >6 To 8 SF, Factory Installed 20 Gauge Galvanized Inverted "Y" Blades, 18 Gauge Galvanized Frame Louver In Door, Add	284.15	
08 05 13 00-0022	EA	For >8 To 10 SF, Factory Installed 20 Gauge Galvanized Inverted "Y" Blades, 18 Gauge Galvanized Frame Louver In Door, Add	353.57	
08 05 13 00-0023	EA	For >10 SF, Factory Installed 20 Gauge Galvanized Inverted "Y" Blades, 18 Gauge Galvanized Frame Louver In Door, Add	402.62	
08 05 13 00-0024	EA	For Up To 1 SF, Site Installed 20 Gauge Galvanized Inverted "Y" Blades, 18 Gauge Galvanized Frame Louver In Door, Add	144.61	
08 05 13 00-0025	EA	For >1 To 2 SF, Site Installed 20 Gauge Galvanized Inverted "Y" Blades, 18 Gauge Galvanized Frame Louver In Door, Add	161.10	
08 05 13 00-0026	EA	For >2 To 4 SF, Site Installed 20 Gauge Galvanized Inverted "Y" Blades, 18 Gauge Galvanized Frame Louver In Door, Add	199.82	
08 05 13 00-0027	EA	For >4 To 6 SF, Site Installed 20 Gauge Galvanized Inverted "Y" Blades, 18 Gauge Galvanized Frame Louver In Door, Add	284.81	
08 05 13 00-0028	EA	For >6 To 8 SF, Site Installed 20 Gauge Galvanized Inverted "Y" Blades, 18 Gauge Galvanized Frame Louver In Door, Add	359.62	
08 05 13 00-0029	EA	For >8 To 10 SF, Site Installed 20 Gauge Galvanized Inverted "Y" Blades, 18 Gauge Galvanized Frame Louver In Door, Add	434.43	
08 05 13 00-0030	EA	For >10 SF, Site Installed 20 Gauge Galvanized Inverted "Y" Blades, 18 Gauge Galvanized Frame Louver In Door, Add	488.87	
08 05 13 00-0031		Door Hardware Preparation (08 05 13)		
08 05 13 00-0032	EA	Prepare Existing Wood Door (Rated) For Mortise Hardware	132.90	
		Note: Requires door to be taken off site for UL certification.		
08 05 13 00-0033	EA	Prepare Existing Wood Door (Non Rated) For Mortise Hardware	61.07	
08 05 13 00-0034	EA	Prepare Existing Wood Door (Rated) For Cylindrical Hardware	107.76	
		Note: Requires door to be taken off site for UL certification.		
08 05 13 00-0035	EA	Prepare Existing Wood Door (Non Rated) For Cylindrical Hardware	17.95	
08 05 13 00-0036	EA	Prepare Existing Wood Door (Rated) For Concealed Vertical Rod	197.58	
		Note: Requires door to be taken off site for UL certification.		
08 05 13 00-0037	EA	Prepare Existing Wood Door (Non Rated) For Concealed Vertical Rod	125.72	
08 05 13 00-0038	EA	Prepare Existing Wood Door (Rated) For Electric Hardware	132.90	
		Note: Requires door to be taken off site for UL certification.		
08 05 13 00-0039	EA	Prepare Existing Door (Non Rated) For Electric Hardware	61.07	
08 05 13 00-0040		Door Modifications (08 05 13)		
08 05 13 00-0041	EA	Remove And Reinstall Door	61.09	
08 05 13 00-0042	EA	Remove And Reinstall Metal Door Frame	119.79	
08 05 13 00-0043	EA	Trim Bottom Of Existing Steel Door For Installation Of Carpet Or Tile	64.69	
		Note: Excludes removal and reinstallation of door.		
08 05 13 00-0044	EA	Modify Metal Door Frame For Door Swing	768.04	
		Note: Includes removal of door, blank hinge plates, continuous hinge, blank strike plate, new strike plate and reinstallation of door.		
08 05 13 00-0045	EA	For Factory Installed Sound Proofing (STC 28) In Metal Door, Add	90.75	
08 05 13 00-0046	SF	For 16 Gauge Steel Metal Plate Bolted On Door	17.82	
		Note: Includes mounting hardware.		
08 05 13 00-0047	EA	Remove And Reinstall Wood Door Frame	72.54	
08 05 13 00-0048	EA	Trim Bottom Of Existing Wood Door For Installation Of Carpet Or Tile	32.64	
		Note: Excludes removal and reinstallation of door.		

08 10 Doors And Frames (08)**08 11 Metal Doors And Frames** (08 10)**08 11 63 Metal Screen And Storm Doors And Frames** (08 11)



Openings	08	08
Doors And Frames	08 10	
Metal Doors And Frames	08 11	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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08 11 63 13 Steel Screen And Storm Doors And Frames (08 11 63)

08 11 63 13-0001	Steel Screen Door (08 11 63 13)		
	Note: Includes frame, trim, necessary anchors and hardware (closures, chain and spring, latching, screens, etc.).		
08 11 63 13-0002	EA 2'-8" x 7" Steel Screen Door, Residential, With Frame, Trim, Hardware.....	632.58	98.82
08 11 63 13-0003	EA 3' x 7" Steel Screen Door, Residential, With Frame, Trim, Hardware.....	639.80	102.42
08 11 63 13-0004	EA Steel Combination Type Residential Storm Door, With Mesh And Tempered Glass With Frame, Trim, Hardware.....	682.94	102.42

08 11 63 23 Aluminum Screen And Storm Doors And Frames (08 11 63)

08 11 63 23-0001	Aluminum Combination Type With Tempered Glass At Top And Bottom (08 11 63 23)		
	Note: Includes frame trim, necessary anchors and usual hardware (closures, chain and spring, latching, screens, etc.).		
08 11 63 23-0002	EA Aluminum Combination Type Residential Storm Door, Tempered Glass Top With Frame, Trim, Hardware <i>For Special Finished, Add</i>	364.74 26.52	57.50
08 11 63 23-0003	EA Aluminum Combination Type Residential Storm Door, Tempered Glass Top And Bottom With Frame, Trim, Hardware.....	379.65	57.50
08 11 63 23-0004	EA Aluminum Screen Door.....	245.27	35.92
08 11 63 23-0005	SF Repair Screen Door.....	5.17	

08 11 73 Sliding Metal Fire Doors (08 11)

08 11 73 00-0001	Motor Operated Fire Door (08 11 73)		
	Note: With fusible link, 3 hour rating. Excludes electrical hook-up of motor.		
08 11 73 00-0002	EA 3' x 6' 8" Sliding Metal Fire Door, Motor Operated Door With 3 Hour Rating.....	3,475.79	430.36
08 11 73 00-0003	EA 3' 8" x 6' 8" Sliding Metal Fire Door, Motor Operated Door With 3 Hour Rating.....	3,696.32	430.36
08 11 73 00-0004	EA 4' x 8' Sliding Metal Fire Door, Motor Operated Door With 3 Hour Rating.....	4,064.73	430.36
08 11 73 00-0005	EA 5' x 8' Sliding Metal Fire Door, Motor Operated Door With 3 Hour Rating.....	4,466.11	430.36

08 12 Metal Frames (08 10)

Note: All door frames include perimeter caulk, sealant (as required), anchors and silencers.

08 12 13 Hollow Metal Frames (08 12)

08 12 13 13 Standard Hollow Metal Frames (08 12 13)

Note: Shop prime coat. See CSI section 04 05 16 26-0017 for grouting frames.

08 12 13 13-0001	Metal Frames 4-3/4" Depth x 16 Gauge, Knock-Down (08 12 13 13)		
08 12 13 13-0002	6'-8" Through 7'-2" High (08 12 13 13-0001)		
08 12 13 13-0003	EA 2' x 6'-8" Through 7'-2" x 4-3/4" Deep Metal Door Frame, 16 Gauge.....	192.93	53.90
	<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	12.77	
	<i>For Welded Frames, Add</i>	45.00	
	<i>For Galvanized Frames, Add</i>	10.21	
	<i>For Type 304 Stainless Steel Frame, Add</i>	158.61	
	<i>For Type 316 Stainless Steel Frame, Add</i>	184.14	
	<i>For Baked Enamel Finish, Add</i>	41.71	
	<i>For 3/4 Hour Rating, Add</i>	30.70	
	<i>For 1-1/2 Hour Rating, Add</i>	35.08	
	<i>For 3 Hour Rating, Add</i>	43.86	
	<i>For 18 Gauge Frame, Deduct</i>	-8.51	
	<i>For 14 Gauge Frame, Add</i>	21.28	
	<i>For 12 Gauge Frame, Add</i>	32.35	
08 12 13 13-0004	EA 2'-4" x 6'-8" Through 7'-2" x 4-3/4" Deep Metal Door Frame, 16 Gauge.....	219.92	59.29
	<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	15.20	
	<i>For Welded Frames, Add</i>	45.00	
	<i>For Galvanized Frames, Add</i>	12.16	
	<i>For Type 304 Stainless Steel Frame, Add</i>	188.32	
	<i>For Type 316 Stainless Steel Frame, Add</i>	218.72	
	<i>For Baked Enamel Finish, Add</i>	48.19	
	<i>For 3/4 Hour Rating, Add</i>	30.70	
	<i>For 1-1/2 Hour Rating, Add</i>	35.08	
	<i>For 3 Hour Rating, Add</i>	43.86	
	<i>For 18 Gauge Frame, Deduct</i>	-10.13	
	<i>For 14 Gauge Frame, Add</i>	25.33	
	<i>For 12 Gauge Frame, Add</i>	38.51	
08 12 13 13-0005	EA 2'-6" x 6'-8" Through 7'-2" x 4-3/4" Deep Metal Door Frame, 16 Gauge.....	228.72	62.89
	<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	15.44	
	<i>For Welded Frames, Add</i>	45.00	
	<i>For Galvanized Frames, Add</i>	12.35	
	<i>For Type 304 Stainless Steel Frame, Add</i>	191.60	
	<i>For Type 316 Stainless Steel Frame, Add</i>	222.48	
	<i>For Baked Enamel Finish, Add</i>	49.75	
	<i>For 3/4 Hour Rating, Add</i>	30.70	
	<i>For 1-1/2 Hour Rating, Add</i>	35.08	
	<i>For 3 Hour Rating, Add</i>	43.86	
	<i>For 18 Gauge Frame, Deduct</i>	-10.30	
	<i>For 14 Gauge Frame, Add</i>	25.74	
	<i>For 12 Gauge Frame, Add</i>	39.12	

08	Openings
08 10	Doors And Frames
08 12	Metal Frames



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 12 13 13-0006	EA		2'-8" x 6'-8" Through 7'-2" x 4-3/4" Deep Metal Door Frame, 16 Gauge	239.50	68.28
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	15.44	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	12.35	
			<i>For Type 304 Stainless Steel Frame, Add</i>	192.14	
			<i>For Type 316 Stainless Steel Frame, Add</i>	223.02	
			<i>For Baked Enamel Finish, Add</i>	51.37	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-10.30	
			<i>For 14 Gauge Frame, Add</i>	25.74	
			<i>For 12 Gauge Frame, Add</i>	39.12	
08 12 13 13-0007	EA		2'-10" x 6'-8" Through 7'-2" x 4-3/4" Deep Metal Door Frame 16 Gauge	244.72	70.08
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	15.69	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	12.55	
			<i>For Type 304 Stainless Steel Frame, Add</i>	195.23	
			<i>For Type 316 Stainless Steel Frame, Add</i>	226.60	
			<i>For Baked Enamel Finish, Add</i>	52.39	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-10.46	
			<i>For 14 Gauge Frame, Add</i>	26.14	
			<i>For 12 Gauge Frame, Add</i>	39.74	
08 12 13 13-0008	EA		3' x 6'-8" Through 7'-2" x 4-3/4" Deep Metal Door Frame, 16 Gauge.....	249.93	71.87
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	15.93	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	12.74	
			<i>For Type 304 Stainless Steel Frame, Add</i>	198.33	
			<i>For Type 316 Stainless Steel Frame, Add</i>	230.19	
			<i>For Baked Enamel Finish, Add</i>	53.42	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-10.62	
			<i>For 14 Gauge Frame, Add</i>	26.55	
			<i>For 12 Gauge Frame, Add</i>	40.35	
08 12 13 13-0009	EA		3'-4" x 6'-8" Through 7'-2" x 4-3/4" Deep Metal Door Frame, 16 Gauge	264.42	75.47
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	17.02	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	13.62	
			<i>For Type 304 Stainless Steel Frame, Add</i>	211.83	
			<i>For Type 316 Stainless Steel Frame, Add</i>	245.88	
			<i>For Baked Enamel Finish, Add</i>	56.69	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-11.35	
			<i>For 14 Gauge Frame, Add</i>	28.37	
			<i>For 12 Gauge Frame, Add</i>	43.13	
08 12 13 13-0010	EA		3'-6" x 6'-8" Through 7'-2" x 4-3/4" Deep Metal Door Frame, 16 Gauge	271.61	79.06
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	17.02	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	13.62	
			<i>For Type 304 Stainless Steel Frame, Add</i>	212.19	
			<i>For Type 316 Stainless Steel Frame, Add</i>	246.24	
			<i>For Baked Enamel Finish, Add</i>	57.77	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-11.35	
			<i>For 14 Gauge Frame, Add</i>	28.37	
			<i>For 12 Gauge Frame, Add</i>	43.13	
08 12 13 13-0011	EA		4' x 6'-8" Through 7'-2" x 4-3/4" Deep Metal Door Frame, 16 Gauge.....	282.84	82.65
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	17.63	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	14.10	
			<i>For Type 304 Stainless Steel Frame, Add</i>	219.84	
			<i>For Type 316 Stainless Steel Frame, Add</i>	255.10	
			<i>For Baked Enamel Finish, Add</i>	60.06	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-11.75	
			<i>For 14 Gauge Frame, Add</i>	29.39	
			<i>For 12 Gauge Frame, Add</i>	44.67	



Openings	08	08
Doors And Frames	08 10	
Metal Frames	08 12	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 12 13 13-0012 EA 5' x 6'-8" Through 7'-2" x 4-3/4" Deep Metal Door Frame, 16 Gauge.....	294.09	86.25
For Auxiliary Frame Reinforcement For Hinges, Add	18.24	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	14.59	
For Type 304 Stainless Steel Frame, Add	227.50	
For Type 316 Stainless Steel Frame, Add	263.98	
For Baked Enamel Finish, Add	62.35	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-12.16	
For 14 Gauge Frame, Add	30.40	
For 12 Gauge Frame, Add	46.21	
08 12 13 13-0013 EA 5'-4" x 6'-8" Through 7'-2" x 4-3/4" Deep Metal Door Frame, 16 Gauge	301.28	89.84
For Auxiliary Frame Reinforcement For Hinges, Add	18.24	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	14.59	
For Type 304 Stainless Steel Frame, Add	227.86	
For Type 316 Stainless Steel Frame, Add	264.34	
For Baked Enamel Finish, Add	63.43	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-12.16	
For 14 Gauge Frame, Add	30.40	
For 12 Gauge Frame, Add	46.21	
08 12 13 13-0014 EA 5'-8" x 6'-8" Through 7'-2" x 4-3/4" Deep Metal Door Frame, 16 Gauge	306.90	91.64
For Auxiliary Frame Reinforcement For Hinges, Add	18.54	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	14.83	
For Type 304 Stainless Steel Frame, Add	231.68	
For Type 316 Stainless Steel Frame, Add	268.77	
For Baked Enamel Finish, Add	64.58	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-12.36	
For 14 Gauge Frame, Add	30.91	
For 12 Gauge Frame, Add	46.98	
08 12 13 13-0015 EA 6' x 6'-8" Through 7'-2" x 4-3/4" Deep Metal Door Frame, 16 Gauge.....	312.51	93.43
For Auxiliary Frame Reinforcement For Hinges, Add	18.85	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	15.08	
For Type 304 Stainless Steel Frame, Add	235.51	
For Type 316 Stainless Steel Frame, Add	273.21	
For Baked Enamel Finish, Add	65.72	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-12.57	
For 14 Gauge Frame, Add	31.41	
For 12 Gauge Frame, Add	47.75	
08 12 13 13-0016 EA 7' x 6'-8" Through 7'-2" x 4-3/4" Deep Metal Door Frame, 16 Gauge.....	324.22	95.23
For Auxiliary Frame Reinforcement For Hinges, Add	20.06	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	16.05	
For Type 304 Stainless Steel Frame, Add	250.29	
For Type 316 Stainless Steel Frame, Add	290.42	
For Baked Enamel Finish, Add	68.70	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-13.38	
For 14 Gauge Frame, Add	33.44	
For 12 Gauge Frame, Add	50.83	
08 12 13 13-0017 EA 8' x 6'-8" Through 7'-2" x 4-3/4" Deep Metal Door Frame, 16 Gauge.....	335.92	97.03
For Auxiliary Frame Reinforcement For Hinges, Add	21.28	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	17.02	
For Type 304 Stainless Steel Frame, Add	265.05	
For Type 316 Stainless Steel Frame, Add	307.61	
For Baked Enamel Finish, Add	71.67	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-14.19	
For 14 Gauge Frame, Add	35.47	
For 12 Gauge Frame, Add	53.91	

08 12 13 13-0018 >7'-2" Through 9'-0" High (08 12 13 13-0001)

08	Openings
08 10	Doors And Frames
08 12	Metal Frames



MINOR

CSI UOM DESCRIPTION

TOTAL DIRECT
UNIT COSTDEMOLITION
UNIT COST

08 12 13 13-0019	EA 2' x >7'-2" Through 9' x 4-3/4" Deep Metal Door Frame, 16 Gauge.....	202.39	53.90
	<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	14.19	
	<i>For Welded Frames, Add</i>	45.00	
	<i>For Galvanized Frames, Add</i>	11.35	
	<i>For Type 304 Stainless Steel Frame, Add</i>	175.63	
	<i>For Type 316 Stainless Steel Frame, Add</i>	204.01	
	<i>For Baked Enamel Finish, Add</i>	44.55	
	<i>For 3/4 Hour Rating, Add</i>	30.70	
	<i>For 1-1/2 Hour Rating, Add</i>	35.08	
	<i>For 3 Hour Rating, Add</i>	43.86	
	<i>For 18 Gauge Frame, Deduct</i>	-9.46	
	<i>For 14 Gauge Frame, Add</i>	23.65	
	<i>For 12 Gauge Frame, Add</i>	35.94	
08 12 13 13-0020	EA 2'-4" x >7'-2" Through 9' x 4-3/4" Deep Metal Door Frame, 16 Gauge.....	231.18	59.29
	<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	16.89	
	<i>For Welded Frames, Add</i>	45.00	
	<i>For Galvanized Frames, Add</i>	13.51	
	<i>For Type 304 Stainless Steel Frame, Add</i>	208.59	
	<i>For Type 316 Stainless Steel Frame, Add</i>	242.37	
	<i>For Baked Enamel Finish, Add</i>	51.57	
	<i>For 3/4 Hour Rating, Add</i>	30.70	
	<i>For 1-1/2 Hour Rating, Add</i>	35.08	
	<i>For 3 Hour Rating, Add</i>	43.86	
	<i>For 18 Gauge Frame, Deduct</i>	-11.26	
	<i>For 14 Gauge Frame, Add</i>	28.15	
	<i>For 12 Gauge Frame, Add</i>	42.78	
08 12 13 13-0021	EA 2'-6" x >7'-2" Through 9' x 4-3/4" Deep Metal Door Frame, 16 Gauge.....	240.16	62.89
	<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	17.16	
	<i>For Welded Frames, Add</i>	45.00	
	<i>For Galvanized Frames, Add</i>	13.73	
	<i>For Type 304 Stainless Steel Frame, Add</i>	212.19	
	<i>For Type 316 Stainless Steel Frame, Add</i>	246.51	
	<i>For Baked Enamel Finish, Add</i>	53.18	
	<i>For 3/4 Hour Rating, Add</i>	30.70	
	<i>For 1-1/2 Hour Rating, Add</i>	35.08	
	<i>For 3 Hour Rating, Add</i>	43.86	
	<i>For 18 Gauge Frame, Deduct</i>	-11.44	
	<i>For 14 Gauge Frame, Add</i>	28.60	
	<i>For 12 Gauge Frame, Add</i>	43.47	
08 12 13 13-0022	EA 2'-8" x >7'-2" Through 9' x 4-3/4" Deep Metal Door Frame, 16 Gauge.....	250.94	68.28
	<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	17.16	
	<i>For Welded Frames, Add</i>	45.00	
	<i>For Galvanized Frames, Add</i>	13.73	
	<i>For Type 304 Stainless Steel Frame, Add</i>	212.73	
	<i>For Type 316 Stainless Steel Frame, Add</i>	247.05	
	<i>For Baked Enamel Finish, Add</i>	54.80	
	<i>For 3/4 Hour Rating, Add</i>	30.70	
	<i>For 1-1/2 Hour Rating, Add</i>	35.08	
	<i>For 3 Hour Rating, Add</i>	43.86	
	<i>For 18 Gauge Frame, Deduct</i>	-11.44	
	<i>For 14 Gauge Frame, Add</i>	28.60	
	<i>For 12 Gauge Frame, Add</i>	43.47	
08 12 13 13-0023	EA 2'-10" x >7'-2" Through 9' x 4-3/4" Deep Metal Door Frame, 16 Gauge.....	256.34	70.08
	<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	17.43	
	<i>For Welded Frames, Add</i>	45.00	
	<i>For Galvanized Frames, Add</i>	13.94	
	<i>For Type 304 Stainless Steel Frame, Add</i>	216.15	
	<i>For Type 316 Stainless Steel Frame, Add</i>	251.01	
	<i>For Baked Enamel Finish, Add</i>	55.88	
	<i>For 3/4 Hour Rating, Add</i>	30.70	
	<i>For 1-1/2 Hour Rating, Add</i>	35.08	
	<i>For 3 Hour Rating, Add</i>	43.86	
	<i>For 18 Gauge Frame, Deduct</i>	-11.62	
	<i>For 14 Gauge Frame, Add</i>	29.05	
	<i>For 12 Gauge Frame, Add</i>	44.15	
08 12 13 13-0024	EA 3' x >7'-2" Through 9' x 4-3/4" Deep Metal Door Frame, 16 Gauge.....	261.73	71.87
	<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	17.70	
	<i>For Welded Frames, Add</i>	45.00	
	<i>For Galvanized Frames, Add</i>	14.16	
	<i>For Type 304 Stainless Steel Frame, Add</i>	219.57	
	<i>For Type 316 Stainless Steel Frame, Add</i>	254.97	
	<i>For Baked Enamel Finish, Add</i>	56.96	
	<i>For 3/4 Hour Rating, Add</i>	30.70	
	<i>For 1-1/2 Hour Rating, Add</i>	35.08	
	<i>For 3 Hour Rating, Add</i>	43.86	
	<i>For 18 Gauge Frame, Deduct</i>	-11.80	
	<i>For 14 Gauge Frame, Add</i>	29.50	
	<i>For 12 Gauge Frame, Add</i>	44.84	



Openings	08	08
Doors And Frames	08 10	
Metal Frames	08 12	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 12 13 13-0025 EA 3'-4" x >7'-2" Through 9' x 4-3/4" Deep Metal Door Frame, 16 Gauge	277.03	75.47
For Auxiliary Frame Reinforcement For Hinges, Add	18.92	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	15.13	
For Type 304 Stainless Steel Frame, Add	234.53	
For Type 316 Stainless Steel Frame, Add	272.36	
For Baked Enamel Finish, Add	60.47	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-12.61	
For 14 Gauge Frame, Add	31.53	
For 12 Gauge Frame, Add	47.92	
08 12 13 13-0026 EA 3'-6" x >7'-2" Through 9' x 4-3/4" Deep Metal Door Frame, 16 Gauge	284.22	79.06
For Auxiliary Frame Reinforcement For Hinges, Add	18.92	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	15.13	
For Type 304 Stainless Steel Frame, Add	234.89	
For Type 316 Stainless Steel Frame, Add	272.72	
For Baked Enamel Finish, Add	61.55	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-12.61	
For 14 Gauge Frame, Add	31.53	
For 12 Gauge Frame, Add	47.92	
08 12 13 13-0027 EA 4' x >7'-2" Through 9' x 4-3/4" Deep Metal Door Frame, 16 Gauge	295.90	82.65
For Auxiliary Frame Reinforcement For Hinges, Add	19.59	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	15.67	
For Type 304 Stainless Steel Frame, Add	243.35	
For Type 316 Stainless Steel Frame, Add	282.53	
For Baked Enamel Finish, Add	63.98	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-13.06	
For 14 Gauge Frame, Add	32.65	
For 12 Gauge Frame, Add	49.63	
08 12 13 13-0028 EA 5' x >7'-2" Through 9' x 4-3/4" Deep Metal Door Frame, 16 Gauge	307.60	86.25
For Auxiliary Frame Reinforcement For Hinges, Add	20.27	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	16.21	
For Type 304 Stainless Steel Frame, Add	251.82	
For Type 316 Stainless Steel Frame, Add	292.36	
For Baked Enamel Finish, Add	66.41	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-13.51	
For 14 Gauge Frame, Add	33.78	
For 12 Gauge Frame, Add	51.34	
08 12 13 13-0029 EA 5'-4" x >7'-2" Through 9' x 4-3/4" Deep Metal Door Frame, 16 Gauge	314.79	89.84
For Auxiliary Frame Reinforcement For Hinges, Add	20.27	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	16.21	
For Type 304 Stainless Steel Frame, Add	252.18	
For Type 316 Stainless Steel Frame, Add	292.72	
For Baked Enamel Finish, Add	67.49	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-13.51	
For 14 Gauge Frame, Add	33.78	
For 12 Gauge Frame, Add	51.34	
08 12 13 13-0030 EA 5'-8" x >7'-2" Through 9' x 4-3/4" Deep Metal Door Frame, 16 Gauge	320.64	91.64
For Auxiliary Frame Reinforcement For Hinges, Add	20.60	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	16.48	
For Type 304 Stainless Steel Frame, Add	256.41	
For Type 316 Stainless Steel Frame, Add	297.62	
For Baked Enamel Finish, Add	68.70	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-13.74	
For 14 Gauge Frame, Add	34.34	
For 12 Gauge Frame, Add	52.20	

08	Openings
08 10	Doors And Frames
08 12	Metal Frames



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 12 13 13-0031	EA		6' x >7'-2" Through 9' x 4-3/4" Deep Metal Door Frame, 16 Gauge.....	326.47	93.43
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	20.94	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	16.75	
			<i>For Type 304 Stainless Steel Frame, Add</i>	260.64	
			<i>For Type 316 Stainless Steel Frame, Add</i>	302.52	
			<i>For Baked Enamel Finish, Add</i>	69.91	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-13.96	
			<i>For 14 Gauge Frame, Add</i>	34.90	
			<i>For 12 Gauge Frame, Add</i>	53.05	
08 12 13 13-0032	EA		7' x >7'-2" Through 9' x 4-3/4" Deep Metal Door Frame, 16 Gauge.....	339.08	95.23
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	22.29	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	17.83	
			<i>For Type 304 Stainless Steel Frame, Add</i>	277.04	
			<i>For Type 316 Stainless Steel Frame, Add</i>	321.63	
			<i>For Baked Enamel Finish, Add</i>	73.16	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-14.86	
			<i>For 14 Gauge Frame, Add</i>	37.16	
			<i>For 12 Gauge Frame, Add</i>	56.48	
08 12 13 13-0033	EA		8' x >7'-2" Through 9' x 4-3/4" Deep Metal Door Frame, 16 Gauge.....	351.69	97.03
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	23.64	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	18.92	
			<i>For Type 304 Stainless Steel Frame, Add</i>	293.44	
			<i>For Type 316 Stainless Steel Frame, Add</i>	340.73	
			<i>For Baked Enamel Finish, Add</i>	76.40	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-15.76	
			<i>For 14 Gauge Frame, Add</i>	39.41	
			<i>For 12 Gauge Frame, Add</i>	59.90	
08 12 13 13-0034			Metal Frames 5-3/4" Depth x 16 Gauge, Knock-Down (08 12 13 13)		
08 12 13 13-0035			6'-8" Through 7'-2" High (08 12 13 13-0034)		
08 12 13 13-0036	EA		2' x 6'-8" Through 7'-2" x 5-3/4" Deep Metal Door Frame, 16 Gauge.....	202.39	53.90
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	14.19	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	11.35	
			<i>For Type 304 Stainless Steel Frame, Add</i>	175.63	
			<i>For Type 316 Stainless Steel Frame, Add</i>	204.01	
			<i>For Baked Enamel Finish, Add</i>	44.55	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-9.46	
			<i>For 14 Gauge Frame, Add</i>	23.65	
			<i>For 12 Gauge Frame, Add</i>	35.94	
08 12 13 13-0037	EA		2'-4" x 6'-8" Through 7'-2" x 5-3/4" Deep Metal Door Frame, 16 Gauge.....	231.18	59.29
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	16.89	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	13.51	
			<i>For Type 304 Stainless Steel Frame, Add</i>	208.59	
			<i>For Type 316 Stainless Steel Frame, Add</i>	242.37	
			<i>For Baked Enamel Finish, Add</i>	51.57	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-11.26	
			<i>For 14 Gauge Frame, Add</i>	28.15	
			<i>For 12 Gauge Frame, Add</i>	42.78	
08 12 13 13-0038	EA		2'-6" x 6'-8" Through 7'-2" x 5-3/4" Deep Metal Door Frame, 16 Gauge.....	240.16	62.89
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	17.16	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	13.73	
			<i>For Type 304 Stainless Steel Frame, Add</i>	212.19	
			<i>For Type 316 Stainless Steel Frame, Add</i>	246.51	
			<i>For Baked Enamel Finish, Add</i>	53.18	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-11.44	
			<i>For 14 Gauge Frame, Add</i>	28.60	
			<i>For 12 Gauge Frame, Add</i>	43.47	



Openings	08	08
Doors And Frames	08 10	
Metal Frames	08 12	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 12 13 13-0039 EA 2'-8" x 6'-8" Through 7'-2" x 5-3/4" Deep Metal Door Frame, 16 Gauge	250.94	68.28
For Auxiliary Frame Reinforcement For Hinges, Add	17.16	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	13.73	
For Type 304 Stainless Steel Frame, Add	212.73	
For Type 316 Stainless Steel Frame, Add	247.05	
For Baked Enamel Finish, Add	54.80	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-11.44	
For 14 Gauge Frame, Add	28.60	
For 12 Gauge Frame, Add	43.47	
08 12 13 13-0040 EA 2'-10" x 6'-8" Through 7'-2" x 5-3/4" Deep Metal Door Frame 16 Gauge	256.34	70.08
For Auxiliary Frame Reinforcement For Hinges, Add	17.43	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	13.94	
For Type 304 Stainless Steel Frame, Add	216.15	
For Type 316 Stainless Steel Frame, Add	251.01	
For Baked Enamel Finish, Add	55.88	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-11.62	
For 14 Gauge Frame, Add	29.05	
For 12 Gauge Frame, Add	44.15	
08 12 13 13-0041 EA 3' x 6'-8" Through 7'-2" x 5-3/4" Deep Metal Door Frame, 16 Gauge.....	261.73	71.87
For Auxiliary Frame Reinforcement For Hinges, Add	17.70	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	14.16	
For Type 304 Stainless Steel Frame, Add	219.57	
For Type 316 Stainless Steel Frame, Add	254.97	
For Baked Enamel Finish, Add	56.96	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-11.80	
For 14 Gauge Frame, Add	29.50	
For 12 Gauge Frame, Add	44.84	
08 12 13 13-0042 EA 3'-4" x 6'-8" Through 7'-2" x 5-3/4" Deep Metal Door Frame, 16 Gauge	277.03	75.47
For Auxiliary Frame Reinforcement For Hinges, Add	18.92	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	15.13	
For Type 304 Stainless Steel Frame, Add	234.53	
For Type 316 Stainless Steel Frame, Add	272.36	
For Baked Enamel Finish, Add	60.47	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-12.61	
For 14 Gauge Frame, Add	31.53	
For 12 Gauge Frame, Add	47.92	
08 12 13 13-0043 EA 3'-6" x 6'-8" Through 7'-2" x 5-3/4" Deep Metal Door Frame, 16 Gauge	284.22	79.06
For Auxiliary Frame Reinforcement For Hinges, Add	18.92	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	15.13	
For Type 304 Stainless Steel Frame, Add	234.89	
For Type 316 Stainless Steel Frame, Add	272.72	
For Baked Enamel Finish, Add	61.55	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-12.61	
For 14 Gauge Frame, Add	31.53	
For 12 Gauge Frame, Add	47.92	
08 12 13 13-0044 EA 4' x 6'-8" Through 7'-2" x 5-3/4" Deep Metal Door Frame, 16 Gauge.....	295.90	82.65
For Auxiliary Frame Reinforcement For Hinges, Add	19.59	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	15.67	
For Type 304 Stainless Steel Frame, Add	243.35	
For Type 316 Stainless Steel Frame, Add	282.53	
For Baked Enamel Finish, Add	63.98	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-13.06	
For 14 Gauge Frame, Add	32.65	
For 12 Gauge Frame, Add	49.63	

08	Openings
08 10	Doors And Frames
08 12	Metal Frames



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 12 13 13-0045	EA		5' x 6'-8" Through 7'-2" x 5-3/4" Deep Metal Door Frame, 16 Gauge.....	307.60	86.25
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	20.27	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	16.21	
			<i>For Type 304 Stainless Steel Frame, Add</i>	251.82	
			<i>For Type 316 Stainless Steel Frame, Add</i>	292.36	
			<i>For Baked Enamel Finish, Add</i>	66.41	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-13.51	
			<i>For 14 Gauge Frame, Add</i>	33.78	
			<i>For 12 Gauge Frame, Add</i>	51.34	
08 12 13 13-0046	EA		5'-4" x 6'-8" Through 7'-2" x 5-3/4" Deep Metal Door Frame, 16 Gauge	314.79	89.84
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	20.27	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	16.21	
			<i>For Type 304 Stainless Steel Frame, Add</i>	252.18	
			<i>For Type 316 Stainless Steel Frame, Add</i>	292.72	
			<i>For Baked Enamel Finish, Add</i>	67.49	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-13.51	
			<i>For 14 Gauge Frame, Add</i>	33.78	
			<i>For 12 Gauge Frame, Add</i>	51.34	
08 12 13 13-0047	EA		5'-8" x 6'-8" Through 7'-2" x 5-3/4" Deep Metal Door Frame, 16 Gauge	320.64	91.64
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	20.60	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	16.48	
			<i>For Type 304 Stainless Steel Frame, Add</i>	256.41	
			<i>For Type 316 Stainless Steel Frame, Add</i>	297.62	
			<i>For Baked Enamel Finish, Add</i>	68.70	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-13.74	
			<i>For 14 Gauge Frame, Add</i>	34.34	
			<i>For 12 Gauge Frame, Add</i>	52.20	
08 12 13 13-0048	EA		6' x 6'-8" Through 7'-2" x 5-3/4" Deep Metal Door Frame, 16 Gauge.....	326.47	93.43
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	20.94	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	16.75	
			<i>For Type 304 Stainless Steel Frame, Add</i>	260.64	
			<i>For Type 316 Stainless Steel Frame, Add</i>	302.52	
			<i>For Baked Enamel Finish, Add</i>	69.91	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-13.96	
			<i>For 14 Gauge Frame, Add</i>	34.90	
			<i>For 12 Gauge Frame, Add</i>	53.05	
08 12 13 13-0049	EA		7' x 6'-8" Through 7'-2" x 5-3/4" Deep Metal Door Frame, 16 Gauge.....	339.08	95.23
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	22.29	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	17.83	
			<i>For Type 304 Stainless Steel Frame, Add</i>	277.04	
			<i>For Type 316 Stainless Steel Frame, Add</i>	321.63	
			<i>For Baked Enamel Finish, Add</i>	73.16	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-14.86	
			<i>For 14 Gauge Frame, Add</i>	37.16	
			<i>For 12 Gauge Frame, Add</i>	56.48	
08 12 13 13-0050	EA		8' x 6'-8" Through 7'-2" x 5-3/4" Deep Metal Door Frame, 16 Gauge.....	351.69	97.03
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	23.64	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	18.92	
			<i>For Type 304 Stainless Steel Frame, Add</i>	293.44	
			<i>For Type 316 Stainless Steel Frame, Add</i>	340.73	
			<i>For Baked Enamel Finish, Add</i>	76.40	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-15.76	
			<i>For 14 Gauge Frame, Add</i>	39.41	
			<i>For 12 Gauge Frame, Add</i>	59.90	

08 12 13 13-0051 >7'-2" Through 9'-0" High (08 12 13 13-0034)



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 12 13 13-0052 EA 2' x >7'-2" Through 9' x 5-3/4" Deep Metal Door Frame, 16 Gauge.....	212.89	53.90
For Auxiliary Frame Reinforcement For Hinges, Add	15.76	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	12.61	
For Type 304 Stainless Steel Frame, Add	194.53	
For Type 316 Stainless Steel Frame, Add	226.06	
For Baked Enamel Finish, Add	47.70	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-10.51	
For 14 Gauge Frame, Add	26.27	
For 12 Gauge Frame, Add	39.93	
08 12 13 13-0053 EA 2'-4" x >7'-2" Through 9' x 5-3/4" Deep Metal Door Frame, 16 Gauge	243.69	59.29
For Auxiliary Frame Reinforcement For Hinges, Add	18.77	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	15.01	
For Type 304 Stainless Steel Frame, Add	231.11	
For Type 316 Stainless Steel Frame, Add	268.64	
For Baked Enamel Finish, Add	55.32	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-12.51	
For 14 Gauge Frame, Add	31.28	
For 12 Gauge Frame, Add	47.54	
08 12 13 13-0054 EA 2'-6" x >7'-2" Through 9' x 5-3/4" Deep Metal Door Frame, 16 Gauge	252.87	62.89
For Auxiliary Frame Reinforcement For Hinges, Add	19.07	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	15.25	
For Type 304 Stainless Steel Frame, Add	235.07	
For Type 316 Stainless Steel Frame, Add	273.20	
For Baked Enamel Finish, Add	57.00	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-12.71	
For 14 Gauge Frame, Add	31.78	
For 12 Gauge Frame, Add	48.30	
08 12 13 13-0055 EA 2'-8" x >7'-2" Through 9' x 5-3/4" Deep Metal Door Frame, 16 Gauge	263.65	68.28
For Auxiliary Frame Reinforcement For Hinges, Add	19.07	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	15.25	
For Type 304 Stainless Steel Frame, Add	235.61	
For Type 316 Stainless Steel Frame, Add	273.74	
For Baked Enamel Finish, Add	58.61	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-12.71	
For 14 Gauge Frame, Add	31.78	
For 12 Gauge Frame, Add	48.30	
08 12 13 13-0056 EA 2'-10" x >7'-2" Through 9' x 5-3/4" Deep Metal Door Frame, 16 Gauge	269.25	70.08
For Auxiliary Frame Reinforcement For Hinges, Add	19.37	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	15.49	
For Type 304 Stainless Steel Frame, Add	239.39	
For Type 316 Stainless Steel Frame, Add	278.12	
For Baked Enamel Finish, Add	59.75	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-12.91	
For 14 Gauge Frame, Add	32.28	
For 12 Gauge Frame, Add	49.06	
08 12 13 13-0057 EA 3' x >7'-2" Through 9' x 5-3/4" Deep Metal Door Frame, 16 Gauge.....	274.84	71.87
For Auxiliary Frame Reinforcement For Hinges, Add	19.67	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	15.73	
For Type 304 Stainless Steel Frame, Add	243.17	
For Type 316 Stainless Steel Frame, Add	282.50	
For Baked Enamel Finish, Add	60.89	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-13.11	
For 14 Gauge Frame, Add	32.78	
For 12 Gauge Frame, Add	49.82	

08 Openings
08 10 Doors And Frames
08 12 Metal Frames



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 12 13 13-0058	EA		3'-4" x >7'-2" Through 9' x 5-3/4" Deep Metal Door Frame, 16 Gauge.....	291.04	75.47
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	21.02	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	16.81	
			<i>For Type 304 Stainless Steel Frame, Add</i>	259.74	
			<i>For Type 316 Stainless Steel Frame, Add</i>	301.78	
			<i>For Baked Enamel Finish, Add</i>	64.67	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-14.01	
			<i>For 14 Gauge Frame, Add</i>	35.03	
			<i>For 12 Gauge Frame, Add</i>	53.24	
08 12 13 13-0059	EA		3'-6" x >7'-2" Through 9' x 5-3/4" Deep Metal Door Frame, 16 Gauge.....	298.23	79.06
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	21.02	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	16.81	
			<i>For Type 304 Stainless Steel Frame, Add</i>	260.10	
			<i>For Type 316 Stainless Steel Frame, Add</i>	302.14	
			<i>For Baked Enamel Finish, Add</i>	65.75	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-14.01	
			<i>For 14 Gauge Frame, Add</i>	35.03	
			<i>For 12 Gauge Frame, Add</i>	53.24	
08 12 13 13-0060	EA		4' x >7'-2" Through 9' x 5-3/4" Deep Metal Door Frame, 16 Gauge.....	310.42	82.65
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	21.77	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	17.41	
			<i>For Type 304 Stainless Steel Frame, Add</i>	269.48	
			<i>For Type 316 Stainless Steel Frame, Add</i>	313.02	
			<i>For Baked Enamel Finish, Add</i>	68.33	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-14.51	
			<i>For 14 Gauge Frame, Add</i>	36.28	
			<i>For 12 Gauge Frame, Add</i>	55.15	
08 12 13 13-0061	EA		5' x >7'-2" Through 9' x 5-3/4" Deep Metal Door Frame, 16 Gauge.....	322.61	86.25
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	22.52	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	18.01	
			<i>For Type 304 Stainless Steel Frame, Add</i>	278.84	
			<i>For Type 316 Stainless Steel Frame, Add</i>	323.88	
			<i>For Baked Enamel Finish, Add</i>	70.91	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-15.01	
			<i>For 14 Gauge Frame, Add</i>	37.53	
			<i>For 12 Gauge Frame, Add</i>	57.05	
08 12 13 13-0062	EA		5'-4" x >7'-2" Through 9' x 5-3/4" Deep Metal Door Frame, 16 Gauge.....	329.80	89.84
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	22.52	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	18.01	
			<i>For Type 304 Stainless Steel Frame, Add</i>	279.20	
			<i>For Type 316 Stainless Steel Frame, Add</i>	324.24	
			<i>For Baked Enamel Finish, Add</i>	71.99	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-15.01	
			<i>For 14 Gauge Frame, Add</i>	37.53	
			<i>For 12 Gauge Frame, Add</i>	57.05	
08 12 13 13-0063	EA		5'-8" x >7'-2" Through 9' x 5-3/4" Deep Metal Door Frame, 16 Gauge.....	335.90	91.64
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	22.89	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	18.31	
			<i>For Type 304 Stainless Steel Frame, Add</i>	283.88	
			<i>For Type 316 Stainless Steel Frame, Add</i>	329.67	
			<i>For Baked Enamel Finish, Add</i>	73.28	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-15.26	
			<i>For 14 Gauge Frame, Add</i>	38.16	
			<i>For 12 Gauge Frame, Add</i>	58.00	



Openings	08	08
Doors And Frames	08 10	
Metal Frames	08 12	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 12 13 13-0064 EA 6' x >7'-2" Through 9' x 5-3/4" Deep Metal Door Frame, 16 Gauge.....	341.98	93.43
For Auxiliary Frame Reinforcement For Hinges, Add	23.27	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	18.61	
For Type 304 Stainless Steel Frame, Add	288.56	
For Type 316 Stainless Steel Frame, Add	335.10	
For Baked Enamel Finish, Add	74.57	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-15.51	
For 14 Gauge Frame, Add	38.78	
For 12 Gauge Frame, Add	58.95	
08 12 13 13-0065 EA 7' x >7'-2" Through 9' x 5-3/4" Deep Metal Door Frame, 16 Gauge.....	355.59	95.23
For Auxiliary Frame Reinforcement For Hinges, Add	24.77	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	19.82	
For Type 304 Stainless Steel Frame, Add	306.76	
For Type 316 Stainless Steel Frame, Add	356.30	
For Baked Enamel Finish, Add	78.11	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-16.51	
For 14 Gauge Frame, Add	41.28	
For 12 Gauge Frame, Add	62.75	
08 12 13 13-0066 EA 8' x >7'-2" Through 9' x 5-3/4" Deep Metal Door Frame, 16 Gauge.....	369.20	97.03
For Auxiliary Frame Reinforcement For Hinges, Add	26.27	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	21.02	
For Type 304 Stainless Steel Frame, Add	324.96	
For Type 316 Stainless Steel Frame, Add	377.50	
For Baked Enamel Finish, Add	81.65	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-17.51	
For 14 Gauge Frame, Add	43.79	
For 12 Gauge Frame, Add	66.55	
08 12 13 13-0067 Metal Frames 6-3/4" Depth x 16 Gauge, Knock-Down (08 12 13 13)		
08 12 13 13-0068 6'-8" Through 7'-2" High (08 12 13 13-0067)		
08 12 13 13-0069 EA 2' x 6'-8" Through 7'-2" x 6-3/4" Deep Metal Door Frame, 16 Gauge.....	257.53	53.90
For Auxiliary Frame Reinforcement For Hinges, Add	22.46	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	17.97	
For Type 304 Stainless Steel Frame, Add	274.89	
For Type 316 Stainless Steel Frame, Add	319.80	
For Baked Enamel Finish, Add	61.09	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-14.97	
For 14 Gauge Frame, Add	37.43	
For 12 Gauge Frame, Add	56.89	
08 12 13 13-0070 EA 2'-4" x 6'-8" Through 7'-2" x 6-3/4" Deep Metal Door Frame, 16 Gauge.....	296.83	59.29
For Auxiliary Frame Reinforcement For Hinges, Add	26.74	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	21.39	
For Type 304 Stainless Steel Frame, Add	326.76	
For Type 316 Stainless Steel Frame, Add	380.23	
For Baked Enamel Finish, Add	71.26	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-17.82	
For 14 Gauge Frame, Add	44.56	
For 12 Gauge Frame, Add	67.73	
08 12 13 13-0071 EA 2'-6" x 6'-8" Through 7'-2" x 6-3/4" Deep Metal Door Frame, 16 Gauge.....	306.86	62.89
For Auxiliary Frame Reinforcement For Hinges, Add	27.16	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	21.73	
For Type 304 Stainless Steel Frame, Add	332.25	
For Type 316 Stainless Steel Frame, Add	386.58	
For Baked Enamel Finish, Add	73.19	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-18.11	
For 14 Gauge Frame, Add	45.27	
For 12 Gauge Frame, Add	68.81	

08	Openings
08 10	Doors And Frames
08 12	Metal Frames



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 12 13 13-0072	EA		2'-8" x 6'-8" Through 7'-2" x 6-3/4" Deep Metal Door Frame, 16 Gauge	317.64	68.28
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	27.16	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	21.73	
			<i>For Type 304 Stainless Steel Frame, Add</i>	332.79	
			<i>For Type 316 Stainless Steel Frame, Add</i>	387.12	
			<i>For Baked Enamel Finish, Add</i>	74.81	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-18.11	
			<i>For 14 Gauge Frame, Add</i>	45.27	
			<i>For 12 Gauge Frame, Add</i>	68.81	
08 12 13 13-0073	EA		2'-10" x 6'-8" Through 7'-2" x 6-3/4" Deep Metal Door Frame 16 Gauge	324.10	70.08
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	27.59	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	22.07	
			<i>For Type 304 Stainless Steel Frame, Add</i>	338.12	
			<i>For Type 316 Stainless Steel Frame, Add</i>	393.30	
			<i>For Baked Enamel Finish, Add</i>	76.21	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-18.40	
			<i>For 14 Gauge Frame, Add</i>	45.99	
			<i>For 12 Gauge Frame, Add</i>	69.90	
08 12 13 13-0074	EA		3' x 6'-8" Through 7'-2" x 6-3/4" Deep Metal Door Frame, 16 Gauge.....	330.54	71.87
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	28.02	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	22.42	
			<i>For Type 304 Stainless Steel Frame, Add</i>	343.43	
			<i>For Type 316 Stainless Steel Frame, Add</i>	399.47	
			<i>For Baked Enamel Finish, Add</i>	77.60	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-18.68	
			<i>For 14 Gauge Frame, Add</i>	46.70	
			<i>For 12 Gauge Frame, Add</i>	70.98	
08 12 13 13-0075	EA		3'-4" x 6'-8" Through 7'-2" x 6-3/4" Deep Metal Door Frame, 16 Gauge	350.56	75.47
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	29.94	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	23.96	
			<i>For Type 304 Stainless Steel Frame, Add</i>	366.88	
			<i>For Type 316 Stainless Steel Frame, Add</i>	426.77	
			<i>For Baked Enamel Finish, Add</i>	82.53	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-19.96	
			<i>For 14 Gauge Frame, Add</i>	49.91	
			<i>For 12 Gauge Frame, Add</i>	75.86	
08 12 13 13-0076	EA		3'-6" x 6'-8" Through 7'-2" x 6-3/4" Deep Metal Door Frame, 16 Gauge	357.75	79.06
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	29.94	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	23.96	
			<i>For Type 304 Stainless Steel Frame, Add</i>	367.24	
			<i>For Type 316 Stainless Steel Frame, Add</i>	427.13	
			<i>For Baked Enamel Finish, Add</i>	83.61	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-19.96	
			<i>For 14 Gauge Frame, Add</i>	49.91	
			<i>For 12 Gauge Frame, Add</i>	75.86	
08 12 13 13-0077	EA		4' x 6'-8" Through 7'-2" x 6-3/4" Deep Metal Door Frame, 16 Gauge.....	372.06	82.65
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	31.01	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	24.81	
			<i>For Type 304 Stainless Steel Frame, Add</i>	380.43	
			<i>For Type 316 Stainless Steel Frame, Add</i>	442.46	
			<i>For Baked Enamel Finish, Add</i>	86.82	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-20.68	
			<i>For 14 Gauge Frame, Add</i>	51.69	
			<i>For 12 Gauge Frame, Add</i>	78.57	



Openings	08	08
Doors And Frames	08 10	
Metal Frames	08 12	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 12 13 13-0078 EA 5' x 6'-8" Through 7'-2" x 6-3/4" Deep Metal Door Frame, 16 Gauge.....	386.38	86.25
For Auxiliary Frame Reinforcement For Hinges, Add	32.08	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	25.67	
For Type 304 Stainless Steel Frame, Add	393.63	
For Type 316 Stainless Steel Frame, Add	457.79	
For Baked Enamel Finish, Add	90.04	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-21.39	
For 14 Gauge Frame, Add	53.47	
For 12 Gauge Frame, Add	81.28	
08 12 13 13-0079 EA 5'-4" x 6'-8" Through 7'-2" x 6-3/4" Deep Metal Door Frame, 16 Gauge	393.57	89.84
For Auxiliary Frame Reinforcement For Hinges, Add	32.08	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	25.67	
For Type 304 Stainless Steel Frame, Add	393.99	
For Type 316 Stainless Steel Frame, Add	458.15	
For Baked Enamel Finish, Add	91.12	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-21.39	
For 14 Gauge Frame, Add	53.47	
For 12 Gauge Frame, Add	81.28	
08 12 13 13-0080 EA 5'-8" x 6'-8" Through 7'-2" x 6-3/4" Deep Metal Door Frame, 16 Gauge	400.74	91.64
For Auxiliary Frame Reinforcement For Hinges, Add	32.62	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	26.10	
For Type 304 Stainless Steel Frame, Add	400.59	
For Type 316 Stainless Steel Frame, Add	465.83	
For Baked Enamel Finish, Add	92.73	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-21.75	
For 14 Gauge Frame, Add	54.37	
For 12 Gauge Frame, Add	82.63	
08 12 13 13-0081 EA 6' x 6'-8" Through 7'-2" x 6-3/4" Deep Metal Door Frame, 16 Gauge.....	407.88	93.43
For Auxiliary Frame Reinforcement For Hinges, Add	33.15	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	26.52	
For Type 304 Stainless Steel Frame, Add	407.18	
For Type 316 Stainless Steel Frame, Add	473.49	
For Baked Enamel Finish, Add	94.34	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-22.10	
For 14 Gauge Frame, Add	55.26	
For 12 Gauge Frame, Add	83.99	
08 12 13 13-0082 EA 7' x 6'-8" Through 7'-2" x 6-3/4" Deep Metal Door Frame, 16 Gauge.....	425.74	95.23
For Auxiliary Frame Reinforcement For Hinges, Add	35.29	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	28.23	
For Type 304 Stainless Steel Frame, Add	433.03	
For Type 316 Stainless Steel Frame, Add	503.61	
For Baked Enamel Finish, Add	99.15	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-23.53	
For 14 Gauge Frame, Add	58.82	
For 12 Gauge Frame, Add	89.41	
08 12 13 13-0083 EA 8' x 6'-8" Through 7'-2" x 6-3/4" Deep Metal Door Frame, 16 Gauge.....	443.60	97.03
For Auxiliary Frame Reinforcement For Hinges, Add	37.43	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	29.94	
For Type 304 Stainless Steel Frame, Add	458.88	
For Type 316 Stainless Steel Frame, Add	533.74	
For Baked Enamel Finish, Add	103.97	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-24.95	
For 14 Gauge Frame, Add	62.39	
For 12 Gauge Frame, Add	94.83	

08 12 13 13-0084 >7'-2" Through 9'-0" High (08 12 13 13-0067)

08	Openings
08 10	Doors And Frames
08 12	Metal Frames



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 12 13 13-0085	EA		2' x >7'-2" Through 9' x 6-3/4" Deep Metal Door Frame, 16 Gauge.....	274.17	53.90
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	24.95	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	19.96	
			<i>For Type 304 Stainless Steel Frame, Add</i>	304.84	
			<i>For Type 316 Stainless Steel Frame, Add</i>	354.75	
			<i>For Baked Enamel Finish, Add</i>	66.08	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-16.64	
			<i>For 14 Gauge Frame, Add</i>	41.59	
			<i>For 12 Gauge Frame, Add</i>	63.22	
08 12 13 13-0086	EA		2'-4" x >7'-2" Through 9' x 6-3/4" Deep Metal Door Frame, 16 Gauge.....	316.64	59.29
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	29.71	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	23.77	
			<i>For Type 304 Stainless Steel Frame, Add</i>	362.42	
			<i>For Type 316 Stainless Steel Frame, Add</i>	421.83	
			<i>For Baked Enamel Finish, Add</i>	77.20	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-19.81	
			<i>For 14 Gauge Frame, Add</i>	49.51	
			<i>For 12 Gauge Frame, Add</i>	75.26	
08 12 13 13-0087	EA		2'-6" x >7'-2" Through 9' x 6-3/4" Deep Metal Door Frame, 16 Gauge.....	326.99	62.89
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	30.18	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	24.15	
			<i>For Type 304 Stainless Steel Frame, Add</i>	368.48	
			<i>For Type 316 Stainless Steel Frame, Add</i>	428.85	
			<i>For Baked Enamel Finish, Add</i>	79.23	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-20.12	
			<i>For 14 Gauge Frame, Add</i>	50.31	
			<i>For 12 Gauge Frame, Add</i>	76.46	
08 12 13 13-0088	EA		2'-8" x >7'-2" Through 9' x 6-3/4" Deep Metal Door Frame, 16 Gauge.....	337.77	68.28
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	30.18	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	24.15	
			<i>For Type 304 Stainless Steel Frame, Add</i>	369.02	
			<i>For Type 316 Stainless Steel Frame, Add</i>	429.39	
			<i>For Baked Enamel Finish, Add</i>	80.85	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-20.12	
			<i>For 14 Gauge Frame, Add</i>	50.31	
			<i>For 12 Gauge Frame, Add</i>	76.46	
08 12 13 13-0089	EA		2'-10" x >7'-2" Through 9' x 6-3/4" Deep Metal Door Frame, 16 Gauge.....	344.53	70.08
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	30.66	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	24.53	
			<i>For Type 304 Stainless Steel Frame, Add</i>	374.89	
			<i>For Type 316 Stainless Steel Frame, Add</i>	436.21	
			<i>For Baked Enamel Finish, Add</i>	82.34	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-20.44	
			<i>For 14 Gauge Frame, Add</i>	51.10	
			<i>For 12 Gauge Frame, Add</i>	77.66	
08 12 13 13-0090	EA		3' x >7'-2" Through 9' x 6-3/4" Deep Metal Door Frame, 16 Gauge.....	351.29	71.87
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	31.13	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	24.91	
			<i>For Type 304 Stainless Steel Frame, Add</i>	380.78	
			<i>For Type 316 Stainless Steel Frame, Add</i>	443.04	
			<i>For Baked Enamel Finish, Add</i>	83.83	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-20.76	
			<i>For 14 Gauge Frame, Add</i>	51.89	
			<i>For 12 Gauge Frame, Add</i>	78.87	



Openings	08	08
Doors And Frames	08 10	
Metal Frames	08 12	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 12 13 13-0091 EA 3'-4" x >7'-2" Through 9' x 6-3/4" Deep Metal Door Frame, 16 Gauge	372.74	75.47
For Auxiliary Frame Reinforcement For Hinges, Add	33.27	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	26.62	
For Type 304 Stainless Steel Frame, Add	406.80	
For Type 316 Stainless Steel Frame, Add	473.35	
For Baked Enamel Finish, Add	89.18	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-22.18	
For 14 Gauge Frame, Add	55.45	
For 12 Gauge Frame, Add	84.29	
08 12 13 13-0092 EA 3'-6" x >7'-2" Through 9' x 6-3/4" Deep Metal Door Frame, 16 Gauge	379.93	79.06
For Auxiliary Frame Reinforcement For Hinges, Add	33.27	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	26.62	
For Type 304 Stainless Steel Frame, Add	407.16	
For Type 316 Stainless Steel Frame, Add	473.71	
For Baked Enamel Finish, Add	90.26	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-22.18	
For 14 Gauge Frame, Add	55.45	
For 12 Gauge Frame, Add	84.29	
08 12 13 13-0093 EA 4' x >7'-2" Through 9' x 6-3/4" Deep Metal Door Frame, 16 Gauge	395.03	82.65
For Auxiliary Frame Reinforcement For Hinges, Add	34.46	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	27.57	
For Type 304 Stainless Steel Frame, Add	421.78	
For Type 316 Stainless Steel Frame, Add	490.70	
For Baked Enamel Finish, Add	93.71	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-22.97	
For 14 Gauge Frame, Add	57.43	
For 12 Gauge Frame, Add	87.30	
08 12 13 13-0094 EA 5' x >7'-2" Through 9' x 6-3/4" Deep Metal Door Frame, 16 Gauge	410.15	86.25
For Auxiliary Frame Reinforcement For Hinges, Add	35.65	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	28.52	
For Type 304 Stainless Steel Frame, Add	436.41	
For Type 316 Stainless Steel Frame, Add	507.71	
For Baked Enamel Finish, Add	97.17	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-23.77	
For 14 Gauge Frame, Add	59.42	
For 12 Gauge Frame, Add	90.31	
08 12 13 13-0095 EA 5'-4" x >7'-2" Through 9' x 6-3/4" Deep Metal Door Frame, 16 Gauge	417.34	89.84
For Auxiliary Frame Reinforcement For Hinges, Add	35.65	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	28.52	
For Type 304 Stainless Steel Frame, Add	436.77	
For Type 316 Stainless Steel Frame, Add	508.07	
For Baked Enamel Finish, Add	98.25	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-23.77	
For 14 Gauge Frame, Add	59.42	
For 12 Gauge Frame, Add	90.31	
08 12 13 13-0096 EA 5'-8" x >7'-2" Through 9' x 6-3/4" Deep Metal Door Frame, 16 Gauge	424.90	91.64
For Auxiliary Frame Reinforcement For Hinges, Add	36.24	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	28.99	
For Type 304 Stainless Steel Frame, Add	444.08	
For Type 316 Stainless Steel Frame, Add	516.57	
For Baked Enamel Finish, Add	99.98	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-24.16	
For 14 Gauge Frame, Add	60.41	
For 12 Gauge Frame, Add	91.82	

08	Openings
08 10	Doors And Frames
08 12	Metal Frames



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 12 13 13-0097	EA		6' x >7'-2" Through 9' x 6-3/4" Deep Metal Door Frame, 16 Gauge.....	432.44	93.43
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	36.84	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	29.47	
			<i>For Type 304 Stainless Steel Frame, Add</i>	451.39	
			<i>For Type 316 Stainless Steel Frame, Add</i>	525.06	
			<i>For Baked Enamel Finish, Add</i>	101.70	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-24.56	
			<i>For 14 Gauge Frame, Add</i>	61.40	
			<i>For 12 Gauge Frame, Add</i>	93.32	
08 12 13 13-0098	EA		7' x >7'-2" Through 9' x 6-3/4" Deep Metal Door Frame, 16 Gauge.....	451.88	95.23
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	39.21	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	31.37	
			<i>For Type 304 Stainless Steel Frame, Add</i>	480.08	
			<i>For Type 316 Stainless Steel Frame, Add</i>	558.51	
			<i>For Baked Enamel Finish, Add</i>	107.00	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-26.14	
			<i>For 14 Gauge Frame, Add</i>	65.36	
			<i>For 12 Gauge Frame, Add</i>	99.34	
08 12 13 13-0099	EA		8' x >7'-2" Through 9' x 6-3/4" Deep Metal Door Frame, 16 Gauge.....	471.33	97.03
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	41.59	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	33.27	
			<i>For Type 304 Stainless Steel Frame, Add</i>	508.79	
			<i>For Type 316 Stainless Steel Frame, Add</i>	591.97	
			<i>For Baked Enamel Finish, Add</i>	112.29	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-27.73	
			<i>For 14 Gauge Frame, Add</i>	69.32	
			<i>For 12 Gauge Frame, Add</i>	105.36	
08 12 13 13-0100			Metal Frames 6-7/8" Through 8-3/4" Depth x 16 Gauge, Knock-Down <small>(08 12 13 13)</small>		
08 12 13 13-0101			6'-8" Through 7'-2" High <small>(08 12 13 13-0100)</small>		
08 12 13 13-0102	EA		2' x 6'-8" Through 7'-2" x 6-7/8" Through 8-3/4" Deep Metal Door Frame, 16 Gauge.....	268.76	53.90
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	24.14	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	19.31	
			<i>For Type 304 Stainless Steel Frame, Add</i>	295.10	
			<i>For Type 316 Stainless Steel Frame, Add</i>	343.39	
			<i>For Baked Enamel Finish, Add</i>	64.46	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-16.10	
			<i>For 14 Gauge Frame, Add</i>	40.24	
			<i>For 12 Gauge Frame, Add</i>	61.16	
08 12 13 13-0103	EA		2'-4" x 6'-8" Through 7'-2" x 6-7/8" Through 8-3/4" Deep Metal Door Frame, 16 Gauge.....	310.20	59.29
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	28.74	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	22.99	
			<i>For Type 304 Stainless Steel Frame, Add</i>	350.83	
			<i>For Type 316 Stainless Steel Frame, Add</i>	408.31	
			<i>For Baked Enamel Finish, Add</i>	75.27	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-19.16	
			<i>For 14 Gauge Frame, Add</i>	47.90	
			<i>For 12 Gauge Frame, Add</i>	72.81	
08 12 13 13-0104	EA		2'-6" x 6'-8" Through 7'-2" x 6-7/8" Through 8-3/4" Deep Metal Door Frame, 16 Gauge.....	320.45	62.89
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	29.20	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	23.36	
			<i>For Type 304 Stainless Steel Frame, Add</i>	356.71	
			<i>For Type 316 Stainless Steel Frame, Add</i>	415.12	
			<i>For Baked Enamel Finish, Add</i>	77.27	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-19.47	
			<i>For 14 Gauge Frame, Add</i>	48.67	
			<i>For 12 Gauge Frame, Add</i>	73.98	



Openings	08	08
Doors And Frames	08 10	
Metal Frames	08 12	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 12 13 13-0105 EA 2'-8" x 6'-8" Through 7'-2" x 6-7/8" Through 8-3/4" Deep Metal Door Frame, 16 Gauge	331.23	68.28
For Auxiliary Frame Reinforcement For Hinges, Add	29.20	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	23.36	
For Type 304 Stainless Steel Frame, Add	357.25	
For Type 316 Stainless Steel Frame, Add	415.66	
For Baked Enamel Finish, Add	78.89	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-19.47	
For 14 Gauge Frame, Add	48.67	
For 12 Gauge Frame, Add	73.98	
08 12 13 13-0106 EA 2'-10" x 6'-8" Through 7'-2" x 6-7/8" Through 8-3/4" Deep Metal Door Frame 16 Gauge	337.89	70.08
For Auxiliary Frame Reinforcement For Hinges, Add	29.66	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	23.73	
For Type 304 Stainless Steel Frame, Add	362.94	
For Type 316 Stainless Steel Frame, Add	422.26	
For Baked Enamel Finish, Add	80.34	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-19.77	
For 14 Gauge Frame, Add	49.44	
For 12 Gauge Frame, Add	75.14	
08 12 13 13-0107 EA 3' x 6'-8" Through 7'-2" x 6-7/8" Through 8-3/4" Deep Metal Door Frame, 16 Gauge	344.55	71.87
For Auxiliary Frame Reinforcement For Hinges, Add	30.12	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	24.10	
For Type 304 Stainless Steel Frame, Add	368.65	
For Type 316 Stainless Steel Frame, Add	428.89	
For Baked Enamel Finish, Add	81.80	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-20.08	
For 14 Gauge Frame, Add	50.20	
For 12 Gauge Frame, Add	76.31	
08 12 13 13-0108 EA 3'-4" x 6'-8" Through 7'-2" x 6-7/8" Through 8-3/4" Deep Metal Door Frame, 16 Gauge	365.53	75.47
For Auxiliary Frame Reinforcement For Hinges, Add	32.19	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	25.75	
For Type 304 Stainless Steel Frame, Add	393.83	
For Type 316 Stainless Steel Frame, Add	458.21	
For Baked Enamel Finish, Add	87.02	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-21.46	
For 14 Gauge Frame, Add	53.65	
For 12 Gauge Frame, Add	81.55	
08 12 13 13-0109 EA 3'-6" x 6'-8" Through 7'-2" x 6-7/8" Through 8-3/4" Deep Metal Door Frame, 16 Gauge	372.72	79.06
For Auxiliary Frame Reinforcement For Hinges, Add	32.19	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	25.75	
For Type 304 Stainless Steel Frame, Add	394.19	
For Type 316 Stainless Steel Frame, Add	458.57	
For Baked Enamel Finish, Add	88.10	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-21.46	
For 14 Gauge Frame, Add	53.65	
For 12 Gauge Frame, Add	81.55	
08 12 13 13-0110 EA 4' x 6'-8" Through 7'-2" x 6-7/8" Through 8-3/4" Deep Metal Door Frame, 16 Gauge	387.57	82.65
For Auxiliary Frame Reinforcement For Hinges, Add	33.34	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	26.67	
For Type 304 Stainless Steel Frame, Add	408.35	
For Type 316 Stainless Steel Frame, Add	475.03	
For Baked Enamel Finish, Add	91.48	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-22.23	
For 14 Gauge Frame, Add	55.57	
For 12 Gauge Frame, Add	84.46	

08	Openings
08 10	Doors And Frames
08 12	Metal Frames



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 12 13 13-0111	EA		5' x 6'-8" Through 7'-2" x 6-7/8" Through 8-3/4" Deep Metal Door Frame, 16 Gauge	402.42	86.25
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	34.49	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	27.59	
			<i>For Type 304 Stainless Steel Frame, Add</i>	422.50	
			<i>For Type 316 Stainless Steel Frame, Add</i>	491.48	
			<i>For Baked Enamel Finish, Add</i>	94.85	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-22.99	
			<i>For 14 Gauge Frame, Add</i>	57.48	
			<i>For 12 Gauge Frame, Add</i>	87.37	
08 12 13 13-0112	EA		5'-4" x 6'-8" Through 7'-2" x 6-7/8" Through 8-3/4" Deep Metal Door Frame, 16 Gauge	409.61	89.84
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	34.49	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	27.59	
			<i>For Type 304 Stainless Steel Frame, Add</i>	422.86	
			<i>For Type 316 Stainless Steel Frame, Add</i>	491.84	
			<i>For Baked Enamel Finish, Add</i>	95.93	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-22.99	
			<i>For 14 Gauge Frame, Add</i>	57.48	
			<i>For 12 Gauge Frame, Add</i>	87.37	
08 12 13 13-0113	EA		5'-8" x 6'-8" Through 7'-2" x 6-7/8" Through 8-3/4" Deep Metal Door Frame, 16 Gauge	417.04	91.64
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	35.06	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	28.05	
			<i>For Type 304 Stainless Steel Frame, Add</i>	429.93	
			<i>For Type 316 Stainless Steel Frame, Add</i>	500.06	
			<i>For Baked Enamel Finish, Add</i>	97.62	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-23.38	
			<i>For 14 Gauge Frame, Add</i>	58.44	
			<i>For 12 Gauge Frame, Add</i>	88.83	
08 12 13 13-0114	EA		6' x 6'-8" Through 7'-2" x 6-7/8" Through 8-3/4" Deep Metal Door Frame, 16 Gauge	424.46	93.43
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	35.64	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	28.51	
			<i>For Type 304 Stainless Steel Frame, Add</i>	437.02	
			<i>For Type 316 Stainless Steel Frame, Add</i>	508.30	
			<i>For Baked Enamel Finish, Add</i>	99.31	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-23.76	
			<i>For 14 Gauge Frame, Add</i>	59.40	
			<i>For 12 Gauge Frame, Add</i>	90.29	
08 12 13 13-0115	EA		7' x 6'-8" Through 7'-2" x 6-7/8" Through 8-3/4" Deep Metal Door Frame, 16 Gauge	443.38	95.23
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	37.94	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	30.35	
			<i>For Type 304 Stainless Steel Frame, Add</i>	464.78	
			<i>For Type 316 Stainless Steel Frame, Add</i>	540.66	
			<i>For Baked Enamel Finish, Add</i>	104.45	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-25.29	
			<i>For 14 Gauge Frame, Add</i>	63.23	
			<i>For 12 Gauge Frame, Add</i>	96.11	
08 12 13 13-0116	EA		8' x 6'-8" Through 7'-2" x 6-7/8" Through 8-3/4" Deep Metal Door Frame, 16 Gauge	462.31	97.03
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	40.24	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	32.19	
			<i>For Type 304 Stainless Steel Frame, Add</i>	492.55	
			<i>For Type 316 Stainless Steel Frame, Add</i>	573.03	
			<i>For Baked Enamel Finish, Add</i>	109.58	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-26.83	
			<i>For 14 Gauge Frame, Add</i>	67.06	
			<i>For 12 Gauge Frame, Add</i>	101.94	

08 12 13 13-0117 >7'-2" Through 9'-0" High (08 12 13 13-0100)



Openings	08	08
Doors And Frames	08 10	
Metal Frames	08 12	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 12 13 13-0118 EA 2' x >7'-2" Through 9' x 6-7/8" Through 8-3/4" Deep Metal Door Frame, 16 Gauge	286.65	53.90
For Auxiliary Frame Reinforcement For Hinges, Add	26.83	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	21.46	
For Type 304 Stainless Steel Frame, Add	327.30	
For Type 316 Stainless Steel Frame, Add	380.95	
For Baked Enamel Finish, Add	69.82	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-17.88	
For 14 Gauge Frame, Add	44.71	
For 12 Gauge Frame, Add	67.96	
08 12 13 13-0119 EA 2'-4" x >7'-2" Through 9' x 6-7/8" Through 8-3/4" Deep Metal Door Frame, 16 Gauge.....	331.49	59.29
For Auxiliary Frame Reinforcement For Hinges, Add	31.94	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	25.55	
For Type 304 Stainless Steel Frame, Add	389.15	
For Type 316 Stainless Steel Frame, Add	453.02	
For Baked Enamel Finish, Add	81.66	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-21.29	
For 14 Gauge Frame, Add	53.23	
For 12 Gauge Frame, Add	80.90	
08 12 13 13-0120 EA 2'-6" x >7'-2" Through 9' x 6-7/8" Through 8-3/4" Deep Metal Door Frame, 16 Gauge.....	342.08	62.89
For Auxiliary Frame Reinforcement For Hinges, Add	32.45	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	25.96	
For Type 304 Stainless Steel Frame, Add	395.65	
For Type 316 Stainless Steel Frame, Add	460.54	
For Baked Enamel Finish, Add	83.76	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-21.63	
For 14 Gauge Frame, Add	54.08	
For 12 Gauge Frame, Add	82.20	
08 12 13 13-0121 EA 2'-8" x >7'-2" Through 9' x 6-7/8" Through 8-3/4" Deep Metal Door Frame, 16 Gauge.....	352.86	68.28
For Auxiliary Frame Reinforcement For Hinges, Add	32.45	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	25.96	
For Type 304 Stainless Steel Frame, Add	396.19	
For Type 316 Stainless Steel Frame, Add	461.08	
For Baked Enamel Finish, Add	85.38	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-21.63	
For 14 Gauge Frame, Add	54.08	
For 12 Gauge Frame, Add	82.20	
08 12 13 13-0122 EA 2'-10" x >7'-2" Through 9' x 6-7/8" Through 8-3/4" Deep Metal Door Frame, 16 Gauge.....	359.86	70.08
For Auxiliary Frame Reinforcement For Hinges, Add	32.96	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	26.37	
For Type 304 Stainless Steel Frame, Add	402.49	
For Type 316 Stainless Steel Frame, Add	468.40	
For Baked Enamel Finish, Add	86.94	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-21.97	
For 14 Gauge Frame, Add	54.93	
For 12 Gauge Frame, Add	83.49	
08 12 13 13-0123 EA 3' x >7'-2" Through 9' x 6-7/8" Through 8-3/4" Deep Metal Door Frame, 16 Gauge	366.86	71.87
For Auxiliary Frame Reinforcement For Hinges, Add	33.47	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	26.77	
For Type 304 Stainless Steel Frame, Add	408.80	
For Type 316 Stainless Steel Frame, Add	475.74	
For Baked Enamel Finish, Add	88.50	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-22.31	
For 14 Gauge Frame, Add	55.78	
For 12 Gauge Frame, Add	84.79	

08	Openings
08 10	Doors And Frames
08 12	Metal Frames



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 12 13 13-0124	EA		3'-4" x >7'-2" Through 9' x 6-7/8" Through 8-3/4" Deep Metal Door Frame, 16 Gauge.....	389.38	75.47
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	35.77	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	28.61	
			<i>For Type 304 Stainless Steel Frame, Add</i>	436.76	
			<i>For Type 316 Stainless Steel Frame, Add</i>	508.29	
			<i>For Baked Enamel Finish, Add</i>	94.17	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-23.85	
			<i>For 14 Gauge Frame, Add</i>	59.61	
			<i>For 12 Gauge Frame, Add</i>	90.61	
08 12 13 13-0125	EA		3'-6" x >7'-2" Through 9' x 6-7/8" Through 8-3/4" Deep Metal Door Frame, 16 Gauge.....	396.57	79.06
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	35.77	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	28.61	
			<i>For Type 304 Stainless Steel Frame, Add</i>	437.12	
			<i>For Type 316 Stainless Steel Frame, Add</i>	508.65	
			<i>For Baked Enamel Finish, Add</i>	95.25	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-23.85	
			<i>For 14 Gauge Frame, Add</i>	59.61	
			<i>For 12 Gauge Frame, Add</i>	90.61	
08 12 13 13-0126	EA		4' x >7'-2" Through 9' x 6-7/8" Through 8-3/4" Deep Metal Door Frame, 16 Gauge.....	412.26	82.65
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	37.04	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	29.64	
			<i>For Type 304 Stainless Steel Frame, Add</i>	452.79	
			<i>For Type 316 Stainless Steel Frame, Add</i>	526.88	
			<i>For Baked Enamel Finish, Add</i>	98.88	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-24.70	
			<i>For 14 Gauge Frame, Add</i>	61.74	
			<i>For 12 Gauge Frame, Add</i>	93.84	
08 12 13 13-0127	EA		5' x >7'-2" Through 9' x 6-7/8" Through 8-3/4" Deep Metal Door Frame, 16 Gauge.....	427.97	86.25
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	38.32	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	30.66	
			<i>For Type 304 Stainless Steel Frame, Add</i>	468.49	
			<i>For Type 316 Stainless Steel Frame, Add</i>	545.13	
			<i>For Baked Enamel Finish, Add</i>	102.52	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-25.55	
			<i>For 14 Gauge Frame, Add</i>	63.87	
			<i>For 12 Gauge Frame, Add</i>	97.08	
08 12 13 13-0128	EA		5'-4" x >7'-2" Through 9' x 6-7/8" Through 8-3/4" Deep Metal Door Frame, 16 Gauge.....	435.16	89.84
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	38.32	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	30.66	
			<i>For Type 304 Stainless Steel Frame, Add</i>	468.85	
			<i>For Type 316 Stainless Steel Frame, Add</i>	545.49	
			<i>For Baked Enamel Finish, Add</i>	103.60	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-25.55	
			<i>For 14 Gauge Frame, Add</i>	63.87	
			<i>For 12 Gauge Frame, Add</i>	97.08	
08 12 13 13-0129	EA		5'-8" x >7'-2" Through 9' x 6-7/8" Through 8-3/4" Deep Metal Door Frame, 16 Gauge.....	443.02	91.64
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	38.96	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	31.17	
			<i>For Type 304 Stainless Steel Frame, Add</i>	476.70	
			<i>For Type 316 Stainless Steel Frame, Add</i>	554.62	
			<i>For Baked Enamel Finish, Add</i>	105.41	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-25.97	
			<i>For 14 Gauge Frame, Add</i>	64.94	
			<i>For 12 Gauge Frame, Add</i>	98.70	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 12 13	13-0130	EA		6' x >7'-2" Through 9' x 6-7/8" Through 8-3/4" Deep Metal Door Frame, 16 Gauge 450.86		93.43
				<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	39.60	
				<i>For Welded Frames, Add</i>	45.00	
				<i>For Galvanized Frames, Add</i>	31.68	
				<i>For Type 304 Stainless Steel Frame, Add</i>	484.54	
				<i>For Type 316 Stainless Steel Frame, Add</i>	563.74	
				<i>For Baked Enamel Finish, Add</i>	107.23	
				<i>For 3/4 Hour Rating, Add</i>	30.70	
				<i>For 1-1/2 Hour Rating, Add</i>	35.08	
				<i>For 3 Hour Rating, Add</i>	43.86	
				<i>For 18 Gauge Frame, Deduct</i>	-26.40	
				<i>For 14 Gauge Frame, Add</i>	66.00	
				<i>For 12 Gauge Frame, Add</i>	100.32	
08 12 13	13-0131	EA		7' x >7'-2" Through 9' x 6-7/8" Through 8-3/4" Deep Metal Door Frame, 16 Gauge 471.49		95.23
				<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	42.15	
				<i>For Welded Frames, Add</i>	45.00	
				<i>For Galvanized Frames, Add</i>	33.72	
				<i>For Type 304 Stainless Steel Frame, Add</i>	515.38	
				<i>For Type 316 Stainless Steel Frame, Add</i>	599.69	
				<i>For Baked Enamel Finish, Add</i>	112.88	
				<i>For 3/4 Hour Rating, Add</i>	30.70	
				<i>For 1-1/2 Hour Rating, Add</i>	35.08	
				<i>For 3 Hour Rating, Add</i>	43.86	
				<i>For 18 Gauge Frame, Deduct</i>	-28.10	
				<i>For 14 Gauge Frame, Add</i>	70.26	
				<i>For 12 Gauge Frame, Add</i>	106.79	
08 12 13	13-0132	EA		8' x >7'-2" Through 9' x 6-7/8" Through 8-3/4" Deep Metal Door Frame, 16 Gauge 492.12		97.03
				<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	44.71	
				<i>For Welded Frames, Add</i>	45.00	
				<i>For Galvanized Frames, Add</i>	35.77	
				<i>For Type 304 Stainless Steel Frame, Add</i>	546.21	
				<i>For Type 316 Stainless Steel Frame, Add</i>	635.63	
				<i>For Baked Enamel Finish, Add</i>	118.53	
				<i>For 3/4 Hour Rating, Add</i>	30.70	
				<i>For 1-1/2 Hour Rating, Add</i>	35.08	
				<i>For 3 Hour Rating, Add</i>	43.86	
				<i>For 18 Gauge Frame, Deduct</i>	-29.81	
				<i>For 14 Gauge Frame, Add</i>	74.52	
				<i>For 12 Gauge Frame, Add</i>	113.26	
08 12 13	13-0133			Metal Frames 8-7/8" Through 13" Depth x 16 Gauge, Knock-Down <small>(08 12 13 13)</small>		
08 12 13	13-0134			6'-8" Through 7'-2" High <small>(08 12 13 13-0133)</small>		
08 12 13	13-0135	EA		2' x 6'-8" Through 7'-2" x 8-7/8" Through 13" Deep Metal Door Frame, 16 Gauge 276.25		53.90
				<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	25.27	
				<i>For Welded Frames, Add</i>	45.00	
				<i>For Galvanized Frames, Add</i>	20.21	
				<i>For Type 304 Stainless Steel Frame, Add</i>	308.58	
				<i>For Type 316 Stainless Steel Frame, Add</i>	359.11	
				<i>For Baked Enamel Finish, Add</i>	66.70	
				<i>For 3/4 Hour Rating, Add</i>	30.70	
				<i>For 1-1/2 Hour Rating, Add</i>	35.08	
				<i>For 3 Hour Rating, Add</i>	43.86	
				<i>For 18 Gauge Frame, Deduct</i>	-16.84	
				<i>For 14 Gauge Frame, Add</i>	42.11	
				<i>For 12 Gauge Frame, Add</i>	64.01	
08 12 13	13-0136	EA		2'-4" x 6'-8" Through 7'-2" x 8-7/8" Through 13" Deep Metal Door Frame, 16 Gauge..... 319.11		59.29
				<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	30.08	
				<i>For Welded Frames, Add</i>	45.00	
				<i>For Galvanized Frames, Add</i>	24.06	
				<i>For Type 304 Stainless Steel Frame, Add</i>	366.87	
				<i>For Type 316 Stainless Steel Frame, Add</i>	427.02	
				<i>For Baked Enamel Finish, Add</i>	77.94	
				<i>For 3/4 Hour Rating, Add</i>	30.70	
				<i>For 1-1/2 Hour Rating, Add</i>	35.08	
				<i>For 3 Hour Rating, Add</i>	43.86	
				<i>For 18 Gauge Frame, Deduct</i>	-20.05	
				<i>For 14 Gauge Frame, Add</i>	50.13	
				<i>For 12 Gauge Frame, Add</i>	76.20	
08 12 13	13-0137	EA		2'-6" x 6'-8" Through 7'-2" x 8-7/8" Through 13" Deep Metal Door Frame, 16 Gauge..... 329.50		62.89
				<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	30.56	
				<i>For Welded Frames, Add</i>	45.00	
				<i>For Galvanized Frames, Add</i>	24.45	
				<i>For Type 304 Stainless Steel Frame, Add</i>	373.00	
				<i>For Type 316 Stainless Steel Frame, Add</i>	434.12	
				<i>For Baked Enamel Finish, Add</i>	79.98	
				<i>For 3/4 Hour Rating, Add</i>	30.70	
				<i>For 1-1/2 Hour Rating, Add</i>	35.08	
				<i>For 3 Hour Rating, Add</i>	43.86	
				<i>For 18 Gauge Frame, Deduct</i>	-20.37	
				<i>For 14 Gauge Frame, Add</i>	50.93	
				<i>For 12 Gauge Frame, Add</i>	77.42	

08	Openings
08 10	Doors And Frames
08 12	Metal Frames



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 12 13 13-0138	EA		2'-8" x 6'-8" Through 7'-2" x 8-7/8" Through 13" Deep Metal Door Frame, 16 Gauge.....	340.28	68.28
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	30.56	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	24.45	
			<i>For Type 304 Stainless Steel Frame, Add</i>	373.54	
			<i>For Type 316 Stainless Steel Frame, Add</i>	434.66	
			<i>For Baked Enamel Finish, Add</i>	81.60	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-20.37	
			<i>For 14 Gauge Frame, Add</i>	50.93	
			<i>For 12 Gauge Frame, Add</i>	77.42	
08 12 13 13-0139	EA		2'-10" x 6'-8" Through 7'-2" x 8-7/8" Through 13" Deep Metal Door Frame 16 Gauge.....	347.09	70.08
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	31.04	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	24.83	
			<i>For Type 304 Stainless Steel Frame, Add</i>	379.50	
			<i>For Type 316 Stainless Steel Frame, Add</i>	441.58	
			<i>For Baked Enamel Finish, Add</i>	83.10	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-20.69	
			<i>For 14 Gauge Frame, Add</i>	51.74	
			<i>For 12 Gauge Frame, Add</i>	78.64	
08 12 13 13-0140	EA		3' x 6'-8" Through 7'-2" x 8-7/8" Through 13" Deep Metal Door Frame, 16 Gauge.....	353.89	71.87
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	31.52	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	25.22	
			<i>For Type 304 Stainless Steel Frame, Add</i>	385.46	
			<i>For Type 316 Stainless Steel Frame, Add</i>	448.50	
			<i>For Baked Enamel Finish, Add</i>	84.61	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-21.02	
			<i>For 14 Gauge Frame, Add</i>	52.54	
			<i>For 12 Gauge Frame, Add</i>	79.86	
08 12 13 13-0141	EA		3'-4" x 6'-8" Through 7'-2" x 8-7/8" Through 13" Deep Metal Door Frame, 16 Gauge.....	375.52	75.47
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	33.69	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	26.95	
			<i>For Type 304 Stainless Steel Frame, Add</i>	411.81	
			<i>For Type 316 Stainless Steel Frame, Add</i>	479.19	
			<i>For Baked Enamel Finish, Add</i>	90.02	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-22.46	
			<i>For 14 Gauge Frame, Add</i>	56.15	
			<i>For 12 Gauge Frame, Add</i>	85.34	
08 12 13 13-0142	EA		3'-6" x 6'-8" Through 7'-2" x 8-7/8" Through 13" Deep Metal Door Frame, 16 Gauge.....	382.71	79.06
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	33.69	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	26.95	
			<i>For Type 304 Stainless Steel Frame, Add</i>	412.17	
			<i>For Type 316 Stainless Steel Frame, Add</i>	479.55	
			<i>For Baked Enamel Finish, Add</i>	91.10	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-22.46	
			<i>For 14 Gauge Frame, Add</i>	56.15	
			<i>For 12 Gauge Frame, Add</i>	85.34	
08 12 13 13-0143	EA		4' x 6'-8" Through 7'-2" x 8-7/8" Through 13" Deep Metal Door Frame, 16 Gauge.....	397.91	82.65
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	34.89	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	27.91	
			<i>For Type 304 Stainless Steel Frame, Add</i>	426.96	
			<i>For Type 316 Stainless Steel Frame, Add</i>	496.75	
			<i>For Baked Enamel Finish, Add</i>	94.58	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-23.26	
			<i>For 14 Gauge Frame, Add</i>	58.15	
			<i>For 12 Gauge Frame, Add</i>	88.39	



Openings	08	08
Doors And Frames	08 10	
Metal Frames	08 12	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 12 13 13-0144 EA 5' x 6'-8" Through 7'-2" x 8-7/8" Through 13" Deep Metal Door Frame, 16 Gauge.....	413.12	86.25
For Auxiliary Frame Reinforcement For Hinges, Add	36.09	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	28.88	
For Type 304 Stainless Steel Frame, Add	441.76	
For Type 316 Stainless Steel Frame, Add	513.95	
For Baked Enamel Finish, Add	98.06	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-24.06	
For 14 Gauge Frame, Add	60.16	
For 12 Gauge Frame, Add	91.44	
08 12 13 13-0145 EA 5'-4" x 6'-8" Through 7'-2" x 8-7/8" Through 13" Deep Metal Door Frame, 16 Gauge.....	420.31	89.84
For Auxiliary Frame Reinforcement For Hinges, Add	36.09	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	28.88	
For Type 304 Stainless Steel Frame, Add	442.12	
For Type 316 Stainless Steel Frame, Add	514.31	
For Baked Enamel Finish, Add	99.14	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-24.06	
For 14 Gauge Frame, Add	60.16	
For 12 Gauge Frame, Add	91.44	
08 12 13 13-0146 EA 5'-8" x 6'-8" Through 7'-2" x 8-7/8" Through 13" Deep Metal Door Frame, 16 Gauge.....	427.92	91.64
For Auxiliary Frame Reinforcement For Hinges, Add	36.70	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	29.36	
For Type 304 Stainless Steel Frame, Add	449.52	
For Type 316 Stainless Steel Frame, Add	522.91	
For Baked Enamel Finish, Add	100.88	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-24.46	
For 14 Gauge Frame, Add	61.16	
For 12 Gauge Frame, Add	92.96	
08 12 13 13-0147 EA 6' x 6'-8" Through 7'-2" x 8-7/8" Through 13" Deep Metal Door Frame, 16 Gauge.....	435.51	93.43
For Auxiliary Frame Reinforcement For Hinges, Add	37.30	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	29.84	
For Type 304 Stainless Steel Frame, Add	456.91	
For Type 316 Stainless Steel Frame, Add	531.51	
For Baked Enamel Finish, Add	102.62	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-24.87	
For 14 Gauge Frame, Add	62.16	
For 12 Gauge Frame, Add	94.49	
08 12 13 13-0148 EA 7' x 6'-8" Through 7'-2" x 8-7/8" Through 13" Deep Metal Door Frame, 16 Gauge.....	455.15	95.23
For Auxiliary Frame Reinforcement For Hinges, Add	39.70	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	31.76	
For Type 304 Stainless Steel Frame, Add	485.97	
For Type 316 Stainless Steel Frame, Add	565.37	
For Baked Enamel Finish, Add	107.98	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-26.47	
For 14 Gauge Frame, Add	66.17	
For 12 Gauge Frame, Add	100.58	
08 12 13 13-0149 EA 8' x 6'-8" Through 7'-2" x 8-7/8" Through 13" Deep Metal Door Frame, 16 Gauge.....	474.79	97.03
For Auxiliary Frame Reinforcement For Hinges, Add	42.11	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	33.69	
For Type 304 Stainless Steel Frame, Add	515.02	
For Type 316 Stainless Steel Frame, Add	599.24	
For Baked Enamel Finish, Add	113.33	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-28.07	
For 14 Gauge Frame, Add	70.18	
For 12 Gauge Frame, Add	106.68	

08 12 13 13-0150 >7'-2" Through 9'-0" High (08 12 13 13-0133)

08	Openings
08 10	Doors And Frames
08 12	Metal Frames



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 12 13 13-0151	EA	2' x >7'-2"	Through 9' x 8-7/8" Through 13" Deep Metal Door Frame, 16 Gauge	294.96	53.90
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	28.07	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	22.46	
			<i>For Type 304 Stainless Steel Frame, Add</i>	342.26	
			<i>For Type 316 Stainless Steel Frame, Add</i>	398.41	
			<i>For Baked Enamel Finish, Add</i>	72.32	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-18.72	
			<i>For 14 Gauge Frame, Add</i>	46.79	
			<i>For 12 Gauge Frame, Add</i>	71.12	
08 12 13 13-0152	EA	2'-4" x >7'-2"	Through 9' x 8-7/8" Through 13" Deep Metal Door Frame, 16 Gauge	341.39	59.29
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	33.42	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	26.74	
			<i>For Type 304 Stainless Steel Frame, Add</i>	406.97	
			<i>For Type 316 Stainless Steel Frame, Add</i>	473.81	
			<i>For Baked Enamel Finish, Add</i>	84.63	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-22.28	
			<i>For 14 Gauge Frame, Add</i>	55.70	
			<i>For 12 Gauge Frame, Add</i>	84.66	
08 12 13 13-0153	EA	2'-6" x >7'-2"	Through 9' x 8-7/8" Through 13" Deep Metal Door Frame, 16 Gauge	352.14	62.89
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	33.96	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	27.16	
			<i>For Type 304 Stainless Steel Frame, Add</i>	413.75	
			<i>For Type 316 Stainless Steel Frame, Add</i>	481.67	
			<i>For Baked Enamel Finish, Add</i>	86.78	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-22.64	
			<i>For 14 Gauge Frame, Add</i>	56.59	
			<i>For 12 Gauge Frame, Add</i>	86.02	
08 12 13 13-0154	EA	2'-8" x >7'-2"	Through 9' x 8-7/8" Through 13" Deep Metal Door Frame, 16 Gauge	362.92	68.28
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	33.96	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	27.16	
			<i>For Type 304 Stainless Steel Frame, Add</i>	414.29	
			<i>For Type 316 Stainless Steel Frame, Add</i>	482.20	
			<i>For Baked Enamel Finish, Add</i>	88.39	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-22.64	
			<i>For 14 Gauge Frame, Add</i>	56.59	
			<i>For 12 Gauge Frame, Add</i>	86.02	
08 12 13 13-0155	EA	2'-10" x >7'-2"	Through 9' x 8-7/8" Through 13" Deep Metal Door Frame, 16 Gauge	370.08	70.08
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	34.49	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	27.59	
			<i>For Type 304 Stainless Steel Frame, Add</i>	420.88	
			<i>For Type 316 Stainless Steel Frame, Add</i>	489.86	
			<i>For Baked Enamel Finish, Add</i>	90.00	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-22.99	
			<i>For 14 Gauge Frame, Add</i>	57.48	
			<i>For 12 Gauge Frame, Add</i>	87.37	
08 12 13 13-0156	EA	3' x >7'-2"	Through 9' x 8-7/8" Through 13" Deep Metal Door Frame, 16 Gauge	377.24	71.87
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	35.03	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	28.02	
			<i>For Type 304 Stainless Steel Frame, Add</i>	427.49	
			<i>For Type 316 Stainless Steel Frame, Add</i>	497.54	
			<i>For Baked Enamel Finish, Add</i>	91.61	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-23.35	
			<i>For 14 Gauge Frame, Add</i>	58.38	
			<i>For 12 Gauge Frame, Add</i>	88.73	



Openings	08	08
Doors And Frames	08 10	
Metal Frames	08 12	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 12 13 13-0157 EA 3'-4" x >7'-2" Through 9' x 8-7/8" Through 13" Deep Metal Door Frame, 16 Gauge.....	400.47	75.47
For Auxiliary Frame Reinforcement For Hinges, Add	37.43	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	29.94	
For Type 304 Stainless Steel Frame, Add	456.72	
For Type 316 Stainless Steel Frame, Add	531.58	
For Baked Enamel Finish, Add	97.50	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-24.95	
For 14 Gauge Frame, Add	62.39	
For 12 Gauge Frame, Add	94.83	
08 12 13 13-0158 EA 3'-6" x >7'-2" Through 9' x 8-7/8" Through 13" Deep Metal Door Frame, 16 Gauge.....	407.66	79.06
For Auxiliary Frame Reinforcement For Hinges, Add	37.43	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	29.94	
For Type 304 Stainless Steel Frame, Add	457.08	
For Type 316 Stainless Steel Frame, Add	531.94	
For Baked Enamel Finish, Add	98.58	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-24.95	
For 14 Gauge Frame, Add	62.39	
For 12 Gauge Frame, Add	94.83	
08 12 13 13-0159 EA 4' x >7'-2" Through 9' x 8-7/8" Through 13" Deep Metal Door Frame, 16 Gauge	423.75	82.65
For Auxiliary Frame Reinforcement For Hinges, Add	38.77	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	31.01	
For Type 304 Stainless Steel Frame, Add	473.48	
For Type 316 Stainless Steel Frame, Add	551.01	
For Baked Enamel Finish, Add	102.33	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-25.85	
For 14 Gauge Frame, Add	64.61	
For 12 Gauge Frame, Add	98.21	
08 12 13 13-0160 EA 5' x >7'-2" Through 9' x 8-7/8" Through 13" Deep Metal Door Frame, 16 Gauge	439.85	86.25
For Auxiliary Frame Reinforcement For Hinges, Add	40.10	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	32.08	
For Type 304 Stainless Steel Frame, Add	489.87	
For Type 316 Stainless Steel Frame, Add	570.08	
For Baked Enamel Finish, Add	106.08	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-26.74	
For 14 Gauge Frame, Add	66.84	
For 12 Gauge Frame, Add	101.60	
08 12 13 13-0161 EA 5'-4" x >7'-2" Through 9' x 8-7/8" Through 13" Deep Metal Door Frame, 16 Gauge.....	447.04	89.84
For Auxiliary Frame Reinforcement For Hinges, Add	40.10	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	32.08	
For Type 304 Stainless Steel Frame, Add	490.23	
For Type 316 Stainless Steel Frame, Add	570.44	
For Baked Enamel Finish, Add	107.16	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-26.74	
For 14 Gauge Frame, Add	66.84	
For 12 Gauge Frame, Add	101.60	
08 12 13 13-0162 EA 5'-8" x >7'-2" Through 9' x 8-7/8" Through 13" Deep Metal Door Frame, 16 Gauge.....	455.10	91.64
For Auxiliary Frame Reinforcement For Hinges, Add	40.77	
For Welded Frames, Add	45.00	
For Galvanized Frames, Add	32.62	
For Type 304 Stainless Steel Frame, Add	498.44	
For Type 316 Stainless Steel Frame, Add	579.99	
For Baked Enamel Finish, Add	109.04	
For 3/4 Hour Rating, Add	30.70	
For 1-1/2 Hour Rating, Add	35.08	
For 3 Hour Rating, Add	43.86	
For 18 Gauge Frame, Deduct	-27.18	
For 14 Gauge Frame, Add	67.96	
For 12 Gauge Frame, Add	103.29	

08	Openings
08 10	Doors And Frames
08 12	Metal Frames



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 12 13 13-0163	EA		6' x >7'-2" Through 9' x 8-7/8" Through 13" Deep Metal Door Frame, 16 Gauge	463.14	93.43
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	41.44	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	33.15	
			<i>For Type 304 Stainless Steel Frame, Add</i>	506.65	
			<i>For Type 316 Stainless Steel Frame, Add</i>	589.53	
			<i>For Baked Enamel Finish, Add</i>	110.91	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-27.63	
			<i>For 14 Gauge Frame, Add</i>	69.07	
			<i>For 12 Gauge Frame, Add</i>	104.99	
08 12 13 13-0164	EA		7' x >7'-2" Through 9' x 8-7/8" Through 13" Deep Metal Door Frame, 16 Gauge	484.56	95.23
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	44.12	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	35.29	
			<i>For Type 304 Stainless Steel Frame, Add</i>	538.90	
			<i>For Type 316 Stainless Steel Frame, Add</i>	627.13	
			<i>For Baked Enamel Finish, Add</i>	116.80	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-29.41	
			<i>For 14 Gauge Frame, Add</i>	73.53	
			<i>For 12 Gauge Frame, Add</i>	111.76	
08 12 13 13-0165	EA		8' x >7'-2" Through 9' x 8-7/8" Through 13" Deep Metal Door Frame, 16 Gauge	505.98	97.03
			<i>For Auxiliary Frame Reinforcement For Hinges, Add</i>	46.79	
			<i>For Welded Frames, Add</i>	45.00	
			<i>For Galvanized Frames, Add</i>	37.43	
			<i>For Type 304 Stainless Steel Frame, Add</i>	571.16	
			<i>For Type 316 Stainless Steel Frame, Add</i>	664.74	
			<i>For Baked Enamel Finish, Add</i>	122.69	
			<i>For 3/4 Hour Rating, Add</i>	30.70	
			<i>For 1-1/2 Hour Rating, Add</i>	35.08	
			<i>For 3 Hour Rating, Add</i>	43.86	
			<i>For 18 Gauge Frame, Deduct</i>	-31.19	
			<i>For 14 Gauge Frame, Add</i>	77.98	
			<i>For 12 Gauge Frame, Add</i>	118.53	
08 12 13 13-0166			Sidelights And Transoms (08 12 13 13)		
08 12 13 13-0167			Steel Transom Sash, Operable (08 12 13 13-0166)		
			Note: Includes hardware.		
08 12 13 13-0168	SF		4-3/4" Deep Steel Transom Sash, 16 Gauge Frame.....	45.51	10.06
			<i>For 18 Gauge Frame, Deduct</i>	-2.54	
			<i>For 14 Gauge Frame, Add</i>	6.35	
			<i>For 12 Gauge Frame, Add</i>	9.64	
08 12 13 13-0169	SF		5-3/4" Deep Steel Transom Sash, 16 Gauge Frame.....	47.49	10.42
			<i>For 18 Gauge Frame, Deduct</i>	-2.67	
			<i>For 14 Gauge Frame, Add</i>	6.66	
			<i>For 12 Gauge Frame, Add</i>	10.13	
08 12 13 13-0170	SF		6-3/4" Deep Steel Transom Sash, 16 Gauge Frame.....	49.54	10.78
			<i>For 18 Gauge Frame, Deduct</i>	-2.80	
			<i>For 14 Gauge Frame, Add</i>	7.00	
			<i>For 12 Gauge Frame, Add</i>	10.63	
08 12 13 13-0171			Sidelights, Steel Frame (08 12 13 13-0166)		
			Note: Excludes glazing. See CSI section 08 80 00 00-0000 for glazing.		
08 12 13 13-0172	SF		4-3/4" Deep Sidelights, 16 Gauge Frame	36.41	10.06
			<i>For 18 Gauge Frame, Deduct</i>	-1.63	
			<i>For 14 Gauge Frame, Add</i>	4.07	
			<i>For 12 Gauge Frame, Add</i>	6.19	
08 12 13 13-0173	SF		5-3/4" Deep Sidelights, 16 Gauge Frame	37.93	10.42
			<i>For 18 Gauge Frame, Deduct</i>	-1.71	
			<i>For 14 Gauge Frame, Add</i>	4.27	
			<i>For 12 Gauge Frame, Add</i>	6.49	
08 12 13 13-0174	SF		6-3/4" Deep Sidelights, 16 Gauge Frame	39.50	10.78
			<i>For 18 Gauge Frame, Deduct</i>	-1.79	
			<i>For 14 Gauge Frame, Add</i>	4.49	
			<i>For 12 Gauge Frame, Add</i>	6.82	
08 12 13 13-0175			Sundry Hollow Metal Frame Sections (08 12 13 13)		
08 12 13 13-0176			Verticals, Mullions (08 12 13 13-0175)		
08 12 13 13-0177	LF		4-3/4" x 1-3/4" Mullions, Vertical 16 Gauge Hollow Metal Frame Section.....	24.68	4.03
			<i>For 18 Gauge Frame, Deduct</i>	-1.46	
			<i>For 14 Gauge Frame, Add</i>	3.64	
			<i>For 12 Gauge Frame, Add</i>	5.53	
			<i>For 3 Hour Frame, Add</i>	8.00	
			<i>For 1-1/2 Hour Frame, Add</i>	5.00	
			<i>For 3/4 Hour Frame, Add</i>	4.00	



Openings	08	08
Doors And Frames	08 10	
Metal Frames	08 12	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 12 13	13-0178	LF	4-3/4" x 2" Mullions, Vertical 16 Gauge Hollow Metal Frame Section..... <i>For 18 Gauge Frame, Deduct</i> <i>For 14 Gauge Frame, Add</i> <i>For 12 Gauge Frame, Add</i> <i>For 3 Hour Frame, Add</i> <i>For 1-1/2 Hour Frame, Add</i> <i>For 3/4 Hour Frame, Add</i>	25.27 -1.51 3.79 5.75 8.00 5.00 4.00	4.03
08 12 13	13-0179	LF	5-1/4" x 1-3/4" Mullions, Vertical 16 Gauge Hollow Metal Frame Section..... <i>For 18 Gauge Frame, Deduct</i> <i>For 14 Gauge Frame, Add</i> <i>For 12 Gauge Frame, Add</i> <i>For 3 Hour Frame, Add</i> <i>For 1-1/2 Hour Frame, Add</i> <i>For 3/4 Hour Frame, Add</i>	24.97 -1.46 3.64 5.53 8.00 5.00 4.00	4.17
08 12 13	13-0180	LF	5-1/4" x 2" Mullions, Vertical 16 Gauge Hollow Metal Frame Section..... <i>For 18 Gauge Frame, Deduct</i> <i>For 14 Gauge Frame, Add</i> <i>For 12 Gauge Frame, Add</i> <i>For 3 Hour Frame, Add</i> <i>For 1-1/2 Hour Frame, Add</i> <i>For 3/4 Hour Frame, Add</i>	25.88 -1.55 3.87 5.87 8.00 5.00 4.00	4.17
08 12 13	13-0181	LF	6-3/4" x 1-3/4" Mullions, Vertical 16 Gauge Hollow Metal Frame Section..... <i>For 18 Gauge Frame, Deduct</i> <i>For 14 Gauge Frame, Add</i> <i>For 12 Gauge Frame, Add</i> <i>For 3 Hour Frame, Add</i> <i>For 1-1/2 Hour Frame, Add</i> <i>For 3/4 Hour Frame, Add</i>	25.93 -1.53 3.82 5.81 8.00 5.00 4.00	4.24
08 12 13	13-0182	LF	6-3/4" x 2" Mullions, Vertical 16 Gauge Hollow Metal Frame Section..... <i>For 18 Gauge Frame, Deduct</i> <i>For 14 Gauge Frame, Add</i> <i>For 12 Gauge Frame, Add</i> <i>For 3 Hour Frame, Add</i> <i>For 1-1/2 Hour Frame, Add</i> <i>For 3/4 Hour Frame, Add</i>	26.28 -1.56 3.91 5.94 8.00 5.00 4.00	4.24
08 12 13 13-0183 Horizontals, Rails <small>(08 12 13 13-0175)</small>					
08 12 13	13-0184	LF	4-3/4" x 1-3/4" Rails, Horizontal 16 Gauge Hollow Metal Frame Section..... <i>For 18 Gauge Frame, Deduct</i> <i>For 14 Gauge Frame, Add</i> <i>For 12 Gauge Frame, Add</i> <i>For 3 Hour Frame, Add</i> <i>For 1-1/2 Hour Frame, Add</i> <i>For 3/4 Hour Frame, Add</i>	17.41 -0.73 1.82 2.77 8.00 5.00 4.00	4.03
08 12 13	13-0185	LF	4-3/4" x 2" Rails, Horizontal 16 Gauge Hollow Metal Frame Section..... <i>For 18 Gauge Frame, Deduct</i> <i>For 14 Gauge Frame, Add</i> <i>For 12 Gauge Frame, Add</i> <i>For 3 Hour Frame, Add</i> <i>For 1-1/2 Hour Frame, Add</i> <i>For 3/4 Hour Frame, Add</i>	18.15 -0.80 2.01 3.05 8.00 5.00 4.00	4.03
08 12 13	13-0186	LF	5-1/4" x 1-3/4" Rails, Horizontal 16 Gauge Hollow Metal Frame Section..... <i>For 18 Gauge Frame, Deduct</i> <i>For 14 Gauge Frame, Add</i> <i>For 12 Gauge Frame, Add</i> <i>For 3 Hour Frame, Add</i> <i>For 1-1/2 Hour Frame, Add</i> <i>For 3/4 Hour Frame, Add</i>	17.70 -0.73 1.82 2.77 8.00 5.00 4.00	4.17
08 12 13	13-0187	LF	5-1/4" x 2" Rails, Horizontal 16 Gauge Hollow Metal Frame Section..... <i>For 18 Gauge Frame, Deduct</i> <i>For 14 Gauge Frame, Add</i> <i>For 12 Gauge Frame, Add</i> <i>For 3 Hour Frame, Add</i> <i>For 1-1/2 Hour Frame, Add</i> <i>For 3/4 Hour Frame, Add</i>	18.44 -0.80 2.01 3.05 8.00 5.00 4.00	4.17
08 12 13	13-0188	LF	6-3/4" x 1-3/4" Rails, Horizontal 16 Gauge Hollow Metal Frame Section..... <i>For 18 Gauge Frame, Deduct</i> <i>For 14 Gauge Frame, Add</i> <i>For 12 Gauge Frame, Add</i> <i>For 3 Hour Frame, Add</i> <i>For 1-1/2 Hour Frame, Add</i> <i>For 3/4 Hour Frame, Add</i>	18.29 -0.76 1.91 2.90 8.00 5.00 4.00	4.24
08 12 13	13-0189	LF	6-3/4" x 2" Rails, Horizontal 16 Gauge Hollow Metal Frame Section..... <i>For 18 Gauge Frame, Deduct</i> <i>For 14 Gauge Frame, Add</i> <i>For 12 Gauge Frame, Add</i> <i>For 3 Hour Frame, Add</i> <i>For 1-1/2 Hour Frame, Add</i> <i>For 3/4 Hour Frame, Add</i>	18.94 -0.83 2.07 3.15 8.00 5.00 4.00	4.24
08 12 13 13-0190 Metal Frames Accessories <small>(08 12 13 13)</small>					
08 12 13	13-0191	EA	For 1 Foot Extension Of New Door Frame.....	26.12	



MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

08 13 Metal Doors (08 10)

Note: Includes machining for all hardware. Excludes finish hardware. See CSI section 08 70 00 00-0000 for finish hardware.

08 13 13 Hollow Metal Doors (08 13)

08 13 13 13 Standard Hollow Metal Doors (08 13 13)

Note: Full flush, impregnated honeycomb core, epoxy baked-on primer.

08 13 13 13-0001 20 Gauge 1-3/4" Unrated Door (08 13 13 13)

08 13 13 13-0002 6'-8" High (08 13 13 13-0001)

08 13 13 13-0003	EA 2' x 6'-8" x 1-3/4" 20 Gauge Metal Door (Unrated).....	414.55	39.53
	<i>For Composite Door Instead Of Full Panel Door, Add</i>	15.10	
	<i>For Type 304 Stainless Steel Door, Add</i>	272.35	
	<i>For Type 316 Stainless Steel Door, Add</i>	440.09	
	<i>For Embossed Panel, Add</i>	80.52	
	<i>For Galvanized Steel, Add</i>	50.32	
	<i>For Baked Enamel Finish, Add</i>	148.08	
	<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
	<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
	<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
	<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
	<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
	<i>For >50 To 100, Deduct</i>	-22.70	
	<i>For >100, Deduct</i>	-33.07	
	<i>For Insulated Door (Polystyrene Core), Add</i>	33.55	
	<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	83.87	
	<i>For Seamless Edge (Welded), Add</i>	41.94	
08 13 13 13-0004	EA 2'-4" x 6'-8" x 1-3/4" 20 Gauge Metal Door (Unrated).....	414.55	39.53
	<i>For Composite Door Instead Of Full Panel Door, Add</i>	15.10	
	<i>For Type 304 Stainless Steel Door, Add</i>	272.35	
	<i>For Type 316 Stainless Steel Door, Add</i>	440.09	
	<i>For Embossed Panel, Add</i>	80.52	
	<i>For Galvanized Steel, Add</i>	50.32	
	<i>For Baked Enamel Finish, Add</i>	148.08	
	<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
	<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
	<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
	<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
	<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
	<i>For >50 To 100, Deduct</i>	-22.70	
	<i>For >100, Deduct</i>	-33.07	
	<i>For Insulated Door (Polystyrene Core), Add</i>	33.55	
	<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	83.87	
	<i>For Seamless Edge (Welded), Add</i>	41.94	
08 13 13 13-0005	EA 2'-6" x 6'-8" x 1-3/4" 20 Gauge Metal Door (Unrated).....	425.00	41.33
	<i>For Composite Door Instead Of Full Panel Door, Add</i>	15.41	
	<i>For Type 304 Stainless Steel Door, Add</i>	278.01	
	<i>For Type 316 Stainless Steel Door, Add</i>	449.19	
	<i>For Embossed Panel, Add</i>	82.16	
	<i>For Galvanized Steel, Add</i>	51.35	
	<i>For Baked Enamel Finish, Add</i>	152.30	
	<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
	<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
	<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
	<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
	<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
	<i>For >50 To 100, Deduct</i>	-23.32	
	<i>For >100, Deduct</i>	-33.94	
	<i>For Insulated Door (Polystyrene Core), Add</i>	34.24	
	<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	85.59	
	<i>For Seamless Edge (Welded), Add</i>	42.79	
08 13 13 13-0006	EA 2'-8" x 6'-8" x 1-3/4" 20 Gauge Metal Door (Unrated).....	430.11	41.33
	<i>For Composite Door Instead Of Full Panel Door, Add</i>	15.64	
	<i>For Type 304 Stainless Steel Door, Add</i>	282.10	
	<i>For Type 316 Stainless Steel Door, Add</i>	455.83	
	<i>For Embossed Panel, Add</i>	83.39	
	<i>For Galvanized Steel, Add</i>	52.12	
	<i>For Baked Enamel Finish, Add</i>	153.83	
	<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
	<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
	<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
	<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
	<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
	<i>For >50 To 100, Deduct</i>	-23.57	
	<i>For >100, Deduct</i>	-34.32	
	<i>For Insulated Door (Polystyrene Core), Add</i>	34.75	
	<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	86.87	
	<i>For Seamless Edge (Welded), Add</i>	43.43	



Openings	08	08
Doors And Frames	08 10	
Metal Doors	08 13	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 13 13 13-0007 EA 2'-10" x 6'-8" x 1-3/4" 20 Gauge Metal Door (Unrated)	433.96	42.22
For Composite Door Instead Of Full Panel Door, Add	15.73	
For Type 304 Stainless Steel Door, Add	283.83	
For Type 316 Stainless Steel Door, Add	458.59	
For Embossed Panel, Add	83.88	
For Galvanized Steel, Add	52.43	
For Baked Enamel Finish, Add	155.52	
For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
For 45 Minutes Rated Door And FM Label, Add	41.40	
For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
For >50 To 100, Deduct	-23.81	
For >100, Deduct	-34.66	
For Insulated Door (Polystyrene Core), Add	34.95	
For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	87.38	
For Seamless Edge (Welded), Add	43.69	
08 13 13 13-0008 EA 3' x 6'-8" x 1-3/4" 20 Gauge Metal Door (Unrated)	437.80	43.12
For Composite Door Instead Of Full Panel Door, Add	15.82	
For Type 304 Stainless Steel Door, Add	285.55	
For Type 316 Stainless Steel Door, Add	461.33	
For Embossed Panel, Add	84.37	
For Galvanized Steel, Add	52.73	
For Baked Enamel Finish, Add	157.22	
For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
For 45 Minutes Rated Door And FM Label, Add	41.40	
For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
For >50 To 100, Deduct	-24.05	
For >100, Deduct	-34.99	
For Insulated Door (Polystyrene Core), Add	35.16	
For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	87.89	
For Seamless Edge (Welded), Add	43.94	
08 13 13 13-0009 EA 3'-4" x 6'-8" x 1-3/4" 20 Gauge Metal Door (Unrated)	464.37	43.12
For Composite Door Instead Of Full Panel Door, Add	17.02	
For Type 304 Stainless Steel Door, Add	306.81	
For Type 316 Stainless Steel Door, Add	495.87	
For Embossed Panel, Add	90.75	
For Galvanized Steel, Add	56.72	
For Baked Enamel Finish, Add	165.19	
For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
For 45 Minutes Rated Door And FM Label, Add	41.40	
For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
For >50 To 100, Deduct	-25.37	
For >100, Deduct	-36.98	
For Insulated Door (Polystyrene Core), Add	37.81	
For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	94.53	
For Seamless Edge (Welded), Add	47.27	
08 13 13 13-0010 EA 3'-6" x 6'-8" x 1-3/4" 20 Gauge Metal Door (Unrated)	478.18	44.92
For Composite Door Instead Of Full Panel Door, Add	17.48	
For Type 304 Stainless Steel Door, Add	315.16	
For Type 316 Stainless Steel Door, Add	509.33	
For Embossed Panel, Add	93.20	
For Galvanized Steel, Add	58.25	
For Baked Enamel Finish, Add	170.41	
For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
For 45 Minutes Rated Door And FM Label, Add	41.40	
For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
For >50 To 100, Deduct	-26.16	
For >100, Deduct	-38.11	
For Insulated Door (Polystyrene Core), Add	38.83	
For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	97.09	
For Seamless Edge (Welded), Add	48.54	
08 13 13 13-0011 EA 4' x 6'-8" x 1-3/4" 20 Gauge Metal Door (Unrated)	526.25	48.51
For Composite Door Instead Of Full Panel Door, Add	19.31	
For Type 304 Stainless Steel Door, Add	348.23	
For Type 316 Stainless Steel Door, Add	562.84	
For Embossed Panel, Add	103.01	
For Galvanized Steel, Add	64.38	
For Baked Enamel Finish, Add	186.98	
For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
For 45 Minutes Rated Door And FM Label, Add	41.40	
For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
For >50 To 100, Deduct	-28.74	
For >100, Deduct	-41.89	
For Insulated Door (Polystyrene Core), Add	42.92	
For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	107.31	
For Seamless Edge (Welded), Add	53.65	

08	Openings
08 10	Doors And Frames
08 13	Metal Doors



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 13 13	13-0012	PR	Pair 2'-6" x 6'-8" x 1-3/4" 20 Gauge Metal Door (Unrated).....	841.75	78.52
			<i>For Composite Door Instead Of Full Panel Door, Add</i>	30.81	
			<i>For Type 304 Stainless Steel Door, Add</i>	555.62	
			<i>For Type 316 Stainless Steel Door, Add</i>	897.98	
			<i>For Embossed Panel, Add</i>	164.33	
			<i>For Galvanized Steel, Add</i>	102.71	
			<i>For Baked Enamel Finish, Add</i>	299.64	
			<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
			<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
			<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
			<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
			<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
			<i>For >50 To 100, Deduct</i>	-46.01	
			<i>For >100, Deduct</i>	-67.06	
			<i>For Insulated Door (Polystyrene Core), Add</i>	68.47	
			<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	171.18	
			<i>For Seamless Edge (Welded), Add</i>	85.59	
08 13 13	13-0013	PR	Pair 2'-8" x 6'-8" x 1-3/4" 20 Gauge Metal Door (Unrated).....	851.97	78.52
			<i>For Composite Door Instead Of Full Panel Door, Add</i>	31.27	
			<i>For Type 304 Stainless Steel Door, Add</i>	563.80	
			<i>For Type 316 Stainless Steel Door, Add</i>	911.26	
			<i>For Embossed Panel, Add</i>	166.78	
			<i>For Galvanized Steel, Add</i>	104.24	
			<i>For Baked Enamel Finish, Add</i>	302.70	
			<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
			<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
			<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
			<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
			<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
			<i>For >50 To 100, Deduct</i>	-46.52	
			<i>For >100, Deduct</i>	-67.82	
			<i>For Insulated Door (Polystyrene Core), Add</i>	69.49	
			<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	173.73	
			<i>For Seamless Edge (Welded), Add</i>	86.87	
08 13 13	13-0014	PR	Pair 2'-10" x 6'-8" x 1-3/4" 20 Gauge Metal Door (Unrated).....	839.16	70.08
			<i>For Composite Door Instead Of Full Panel Door, Add</i>	31.46	
			<i>For Type 304 Stainless Steel Door, Add</i>	566.22	
			<i>For Type 316 Stainless Steel Door, Add</i>	915.72	
			<i>For Embossed Panel, Add</i>	167.76	
			<i>For Galvanized Steel, Add</i>	104.85	
			<i>For Baked Enamel Finish, Add</i>	293.79	
			<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
			<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
			<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
			<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
			<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
			<i>For >50 To 100, Deduct</i>	-45.46	
			<i>For >100, Deduct</i>	-66.44	
			<i>For Insulated Door (Polystyrene Core), Add</i>	69.90	
			<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	174.75	
			<i>For Seamless Edge (Welded), Add</i>	87.38	
08 13 13	13-0015	PR	Pair 3' x 6'-8" x 1-3/4" 20 Gauge Metal Door (Unrated).....	866.96	81.94
			<i>For Composite Door Instead Of Full Panel Door, Add</i>	31.64	
			<i>For Type 304 Stainless Steel Door, Add</i>	570.67	
			<i>For Type 316 Stainless Steel Door, Add</i>	922.22	
			<i>For Embossed Panel, Add</i>	168.74	
			<i>For Galvanized Steel, Add</i>	105.47	
			<i>For Baked Enamel Finish, Add</i>	309.25	
			<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
			<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
			<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
			<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
			<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
			<i>For >50 To 100, Deduct</i>	-47.44	
			<i>For >100, Deduct</i>	-69.12	
			<i>For Insulated Door (Polystyrene Core), Add</i>	70.31	
			<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	175.78	
			<i>For Seamless Edge (Welded), Add</i>	87.89	
08 13 13	13-0016	PR	Pair 3'-6" x 6'-8" x 1-3/4" 20 Gauge Metal Door (Unrated).....	947.37	85.35
			<i>For Composite Door Instead Of Full Panel Door, Add</i>	34.95	
			<i>For Type 304 Stainless Steel Door, Add</i>	629.88	
			<i>For Type 316 Stainless Steel Door, Add</i>	1,018.22	
			<i>For Embossed Panel, Add</i>	186.40	
			<i>For Galvanized Steel, Add</i>	116.50	
			<i>For Baked Enamel Finish, Add</i>	335.42	
			<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
			<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
			<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
			<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
			<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
			<i>For >50 To 100, Deduct</i>	-51.64	
			<i>For >100, Deduct</i>	-75.32	
			<i>For Insulated Door (Polystyrene Core), Add</i>	77.67	
			<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	194.17	
			<i>For Seamless Edge (Welded), Add</i>	97.09	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
	08 13 13 13-0017	PR		Pair 4' x 6'-8" x 1-3/4" 20 Gauge Metal Door (Unrated)	1,042.79	92.17
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	38.63	
				<i>For Type 304 Stainless Steel Door, Add</i>	695.97	
				<i>For Type 316 Stainless Steel Door, Add</i>	1,125.19	
				<i>For Embossed Panel, Add</i>	206.03	
				<i>For Galvanized Steel, Add</i>	128.77	
				<i>For Baked Enamel Finish, Add</i>	368.14	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-56.75	
				<i>For >100, Deduct</i>	-82.82	
				<i>For Insulated Door (Polystyrene Core), Add</i>	85.84	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	214.61	
				<i>For Seamless Edge (Welded), Add</i>	107.31	
	08 13 13 13-0018			7' High <small>(08 13 13 13-0001)</small>		
	08 13 13 13-0019	EA		2' x 7' x 1-3/4" 20 Gauge Metal Door (Unrated)	423.34	39.53
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	15.49	
				<i>For Type 304 Stainless Steel Door, Add</i>	279.38	
				<i>For Type 316 Stainless Steel Door, Add</i>	451.52	
				<i>For Embossed Panel, Add</i>	82.63	
				<i>For Galvanized Steel, Add</i>	51.64	
				<i>For Baked Enamel Finish, Add</i>	150.72	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-23.14	
				<i>For >100, Deduct</i>	-33.73	
				<i>For Insulated Door (Polystyrene Core), Add</i>	34.43	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	86.07	
				<i>For Seamless Edge (Welded), Add</i>	43.04	
	08 13 13 13-0020	EA		2'-4" x 7' x 1-3/4" 20 Gauge Metal Door (Unrated)	423.34	39.53
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	15.49	
				<i>For Type 304 Stainless Steel Door, Add</i>	279.38	
				<i>For Type 316 Stainless Steel Door, Add</i>	451.52	
				<i>For Embossed Panel, Add</i>	82.63	
				<i>For Galvanized Steel, Add</i>	51.64	
				<i>For Baked Enamel Finish, Add</i>	150.72	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-23.14	
				<i>For >100, Deduct</i>	-33.73	
				<i>For Insulated Door (Polystyrene Core), Add</i>	34.43	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	86.07	
				<i>For Seamless Edge (Welded), Add</i>	43.04	
	08 13 13 13-0021	EA		2'-6" x 7' x 1-3/4" 20 Gauge Metal Door (Unrated)	433.97	41.33
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	15.81	
				<i>For Type 304 Stainless Steel Door, Add</i>	285.19	
				<i>For Type 316 Stainless Steel Door, Add</i>	460.85	
				<i>For Embossed Panel, Add</i>	84.32	
				<i>For Galvanized Steel, Add</i>	52.70	
				<i>For Baked Enamel Finish, Add</i>	154.99	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-23.76	
				<i>For >100, Deduct</i>	-34.61	
				<i>For Insulated Door (Polystyrene Core), Add</i>	35.13	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	87.83	
				<i>For Seamless Edge (Welded), Add</i>	43.92	

08 Openings
08 10 Doors And Frames
08 13 Metal Doors



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 13 13	13-0022	EA	2'-8" x 7' x 1-3/4" 20 Gauge Metal Door (Unrated).....	439.22	41.33
			<i>For Composite Door Instead Of Full Panel Door, Add</i>	16.05	
			<i>For Type 304 Stainless Steel Door, Add</i>	289.39	
			<i>For Type 316 Stainless Steel Door, Add</i>	467.67	
			<i>For Embossed Panel, Add</i>	85.58	
			<i>For Galvanized Steel, Add</i>	53.49	
			<i>For Baked Enamel Finish, Add</i>	156.56	
			<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
			<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
			<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
			<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
			<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
			<i>For >50 To 100, Deduct</i>	-24.03	
			<i>For >100, Deduct</i>	-35.01	
			<i>For Insulated Door (Polystyrene Core), Add</i>	35.66	
			<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	89.14	
			<i>For Seamless Edge (Welded), Add</i>	44.57	
08 13 13	13-0023	EA	2'-10" x 7' x 1-3/4" 20 Gauge Metal Door (Unrated).....	443.11	42.22
			<i>For Composite Door Instead Of Full Panel Door, Add</i>	16.14	
			<i>For Type 304 Stainless Steel Door, Add</i>	291.15	
			<i>For Type 316 Stainless Steel Door, Add</i>	470.48	
			<i>For Embossed Panel, Add</i>	86.08	
			<i>For Galvanized Steel, Add</i>	53.80	
			<i>For Baked Enamel Finish, Add</i>	158.27	
			<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
			<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
			<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
			<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
			<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
			<i>For >50 To 100, Deduct</i>	-24.27	
			<i>For >100, Deduct</i>	-35.34	
			<i>For Insulated Door (Polystyrene Core), Add</i>	35.87	
			<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	89.67	
			<i>For Seamless Edge (Welded), Add</i>	44.83	
08 13 13	13-0024	EA	3' x 7' x 1-3/4" 20 Gauge Metal Door (Unrated).....	447.01	43.12
			<i>For Composite Door Instead Of Full Panel Door, Add</i>	16.23	
			<i>For Type 304 Stainless Steel Door, Add</i>	292.92	
			<i>For Type 316 Stainless Steel Door, Add</i>	473.30	
			<i>For Embossed Panel, Add</i>	86.58	
			<i>For Galvanized Steel, Add</i>	54.11	
			<i>For Baked Enamel Finish, Add</i>	159.98	
			<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
			<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
			<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
			<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
			<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
			<i>For >50 To 100, Deduct</i>	-24.51	
			<i>For >100, Deduct</i>	-35.68	
			<i>For Insulated Door (Polystyrene Core), Add</i>	36.08	
			<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	90.19	
			<i>For Seamless Edge (Welded), Add</i>	45.10	
08 13 13	13-0025	EA	3'-4" x 7' x 1-3/4" 20 Gauge Metal Door (Unrated).....	474.28	43.12
			<i>For Composite Door Instead Of Full Panel Door, Add</i>	17.46	
			<i>For Type 304 Stainless Steel Door, Add</i>	314.74	
			<i>For Type 316 Stainless Steel Door, Add</i>	508.75	
			<i>For Embossed Panel, Add</i>	93.13	
			<i>For Galvanized Steel, Add</i>	58.20	
			<i>For Baked Enamel Finish, Add</i>	168.16	
			<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
			<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
			<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
			<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
			<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
			<i>For >50 To 100, Deduct</i>	-25.87	
			<i>For >100, Deduct</i>	-37.73	
			<i>For Insulated Door (Polystyrene Core), Add</i>	38.80	
			<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	97.01	
			<i>For Seamless Edge (Welded), Add</i>	48.50	
08 13 13	13-0026	EA	3'-6" x 7' x 1-3/4" 20 Gauge Metal Door (Unrated).....	488.36	44.92
			<i>For Composite Door Instead Of Full Panel Door, Add</i>	17.93	
			<i>For Type 304 Stainless Steel Door, Add</i>	323.31	
			<i>For Type 316 Stainless Steel Door, Add</i>	522.57	
			<i>For Embossed Panel, Add</i>	95.64	
			<i>For Galvanized Steel, Add</i>	59.78	
			<i>For Baked Enamel Finish, Add</i>	173.46	
			<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
			<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
			<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
			<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
			<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
			<i>For >50 To 100, Deduct</i>	-26.66	
			<i>For >100, Deduct</i>	-38.87	
			<i>For Insulated Door (Polystyrene Core), Add</i>	39.85	
			<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	99.63	
			<i>For Seamless Edge (Welded), Add</i>	49.82	



Openings	08	08
Doors And Frames	08 10	
Metal Doors	08 13	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 13 13 13-0027 EA 4' x 7' x 1-3/4" 20 Gauge Metal Door (Unrated)	537.49	48.51
For Composite Door Instead Of Full Panel Door, Add	19.82	
For Type 304 Stainless Steel Door, Add	357.22	
For Type 316 Stainless Steel Door, Add	577.45	
For Embossed Panel, Add	105.71	
For Galvanized Steel, Add	66.07	
For Baked Enamel Finish, Add	190.36	
For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
For 45 Minutes Rated Door And FM Label, Add	41.40	
For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
For >50 To 100, Deduct	-29.30	
For >100, Deduct	-42.74	
For Insulated Door (Polystyrene Core), Add	44.05	
For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	110.12	
For Seamless Edge (Welded), Add	55.06	
08 13 13 13-0028 PR Pair 2'-6" x 7' x 1-3/4" 20 Gauge Metal Door (Unrated)	859.69	78.52
For Composite Door Instead Of Full Panel Door, Add	31.62	
For Type 304 Stainless Steel Door, Add	569.97	
For Type 316 Stainless Steel Door, Add	921.30	
For Embossed Panel, Add	168.64	
For Galvanized Steel, Add	105.40	
For Baked Enamel Finish, Add	305.02	
For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
For 45 Minutes Rated Door And FM Label, Add	41.40	
For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
For >50 To 100, Deduct	-46.91	
For >100, Deduct	-68.40	
For Insulated Door (Polystyrene Core), Add	70.27	
For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	175.66	
For Seamless Edge (Welded), Add	87.83	
08 13 13 13-0029 PR Pair 2'-8" x 7' x 1-3/4" 20 Gauge Metal Door (Unrated)	870.17	78.52
For Composite Door Instead Of Full Panel Door, Add	32.09	
For Type 304 Stainless Steel Door, Add	578.36	
For Type 316 Stainless Steel Door, Add	934.92	
For Embossed Panel, Add	171.15	
For Galvanized Steel, Add	106.97	
For Baked Enamel Finish, Add	308.16	
For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
For 45 Minutes Rated Door And FM Label, Add	41.40	
For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
For >50 To 100, Deduct	-47.43	
For >100, Deduct	-69.19	
For Insulated Door (Polystyrene Core), Add	71.31	
For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	178.28	
For Seamless Edge (Welded), Add	89.14	
08 13 13 13-0030 PR Pair 2'-10" x 7' x 1-3/4" 20 Gauge Metal Door (Unrated)	857.48	70.08
For Composite Door Instead Of Full Panel Door, Add	32.28	
For Type 304 Stainless Steel Door, Add	580.87	
For Type 316 Stainless Steel Door, Add	939.54	
For Embossed Panel, Add	172.16	
For Galvanized Steel, Add	107.60	
For Baked Enamel Finish, Add	299.29	
For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
For 45 Minutes Rated Door And FM Label, Add	41.40	
For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
For >50 To 100, Deduct	-46.38	
For >100, Deduct	-67.81	
For Insulated Door (Polystyrene Core), Add	71.73	
For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	179.33	
For Seamless Edge (Welded), Add	89.67	
08 13 13 13-0031 PR Pair 3' x 7' x 1-3/4" 20 Gauge Metal Door (Unrated)	885.38	81.94
For Composite Door Instead Of Full Panel Door, Add	32.47	
For Type 304 Stainless Steel Door, Add	585.41	
For Type 316 Stainless Steel Door, Add	946.17	
For Embossed Panel, Add	173.16	
For Galvanized Steel, Add	108.23	
For Baked Enamel Finish, Add	314.77	
For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
For 45 Minutes Rated Door And FM Label, Add	41.40	
For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
For >50 To 100, Deduct	-48.37	
For >100, Deduct	-70.50	
For Insulated Door (Polystyrene Core), Add	72.15	
For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	180.38	
For Seamless Edge (Welded), Add	90.19	

08 Openings
08 10 Doors And Frames
08 13 Metal Doors



MINOR		TOTAL DIRECT	DEMOLITION
CSI	UOM DESCRIPTION	UNIT COST	UNIT COST
08 13 13 13-0032	PR Pair 3'-6" x 7' x 1-3/4" 20 Gauge Metal Door (Unrated)	967.72	85.35
	For Composite Door Instead Of Full Panel Door, Add	35.87	
	For Type 304 Stainless Steel Door, Add	646.16	
	For Type 316 Stainless Steel Door, Add	1,044.67	
	For Embossed Panel, Add	191.29	
	For Galvanized Steel, Add	119.55	
	For Baked Enamel Finish, Add	341.52	
	For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
	For 45 Minutes Rated Door And FM Label, Add	41.40	
	For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
	For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
	For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
	For >50 To 100, Deduct	-52.65	
	For >100, Deduct	-76.85	
	For Insulated Door (Polystyrene Core), Add	79.70	
	For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	199.26	
	For Seamless Edge (Welded), Add	99.63	
08 13 13 13-0033	PR Pair 4' x 7' x 1-3/4" 20 Gauge Metal Door (Unrated)	1,065.28	92.17
	For Composite Door Instead Of Full Panel Door, Add	39.64	
	For Type 304 Stainless Steel Door, Add	713.96	
	For Type 316 Stainless Steel Door, Add	1,154.43	
	For Embossed Panel, Add	211.42	
	For Galvanized Steel, Add	132.14	
	For Baked Enamel Finish, Add	374.89	
	For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
	For 45 Minutes Rated Door And FM Label, Add	41.40	
	For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
	For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
	For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
	For >50 To 100, Deduct	-57.87	
	For >100, Deduct	-84.50	
	For Insulated Door (Polystyrene Core), Add	88.09	
	For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	220.23	
	For Seamless Edge (Welded), Add	110.12	
08 13 13 13-0034	7'-2" High (08 13 13 13-0001)		
08 13 13 13-0035	EA 2' x 7'-2" x 1-3/4" 20 Gauge Metal Door (Unrated)	431.88	39.53
	For Composite Door Instead Of Full Panel Door, Add	15.88	
	For Type 304 Stainless Steel Door, Add	286.21	
	For Type 316 Stainless Steel Door, Add	462.62	
	For Embossed Panel, Add	84.68	
	For Galvanized Steel, Add	52.92	
	For Baked Enamel Finish, Add	153.28	
	For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
	For 45 Minutes Rated Door And FM Label, Add	41.40	
	For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
	For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
	For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
	For >50 To 100, Deduct	-23.57	
	For >100, Deduct	-34.37	
	For Insulated Door (Polystyrene Core), Add	35.28	
	For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	88.21	
	For Seamless Edge (Welded), Add	44.10	
08 13 13 13-0036	EA 2'-4" x 7'-2" x 1-3/4" 20 Gauge Metal Door (Unrated)	431.88	39.53
	For Composite Door Instead Of Full Panel Door, Add	15.88	
	For Type 304 Stainless Steel Door, Add	286.21	
	For Type 316 Stainless Steel Door, Add	462.62	
	For Embossed Panel, Add	84.68	
	For Galvanized Steel, Add	52.92	
	For Baked Enamel Finish, Add	153.28	
	For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
	For 45 Minutes Rated Door And FM Label, Add	41.40	
	For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
	For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
	For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
	For >50 To 100, Deduct	-23.57	
	For >100, Deduct	-34.37	
	For Insulated Door (Polystyrene Core), Add	35.28	
	For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	88.21	
	For Seamless Edge (Welded), Add	44.10	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 13 13 13-0037	EA			2'-6" x 7'-2" x 1-3/4" 20 Gauge Metal Door (Unrated)	442.69	41.33
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	16.20	
				<i>For Type 304 Stainless Steel Door, Add</i>	292.16	
				<i>For Type 316 Stainless Steel Door, Add</i>	472.18	
				<i>For Embossed Panel, Add</i>	86.41	
				<i>For Galvanized Steel, Add</i>	54.01	
				<i>For Baked Enamel Finish, Add</i>	157.60	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-24.20	
				<i>For >100, Deduct</i>	-35.27	
				<i>For Insulated Door (Polystyrene Core), Add</i>	36.00	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	90.01	
				<i>For Seamless Edge (Welded), Add</i>	45.01	
08 13 13 13-0038	EA			2'-8" x 7'-2" x 1-3/4" 20 Gauge Metal Door (Unrated)	448.06	41.33
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	16.44	
				<i>For Type 304 Stainless Steel Door, Add</i>	296.46	
				<i>For Type 316 Stainless Steel Door, Add</i>	479.17	
				<i>For Embossed Panel, Add</i>	87.70	
				<i>For Galvanized Steel, Add</i>	54.81	
				<i>For Baked Enamel Finish, Add</i>	159.21	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-24.47	
				<i>For >100, Deduct</i>	-35.67	
				<i>For Insulated Door (Polystyrene Core), Add</i>	36.54	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	91.35	
				<i>For Seamless Edge (Welded), Add</i>	45.68	
08 13 13 13-0039	EA			2'-10" x 7'-2" x 1-3/4" 20 Gauge Metal Door (Unrated)	452.01	42.22
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	16.54	
				<i>For Type 304 Stainless Steel Door, Add</i>	298.27	
				<i>For Type 316 Stainless Steel Door, Add</i>	482.05	
				<i>For Embossed Panel, Add</i>	88.21	
				<i>For Galvanized Steel, Add</i>	55.13	
				<i>For Baked Enamel Finish, Add</i>	160.94	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-24.71	
				<i>For >100, Deduct</i>	-36.01	
				<i>For Insulated Door (Polystyrene Core), Add</i>	36.76	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	91.89	
				<i>For Seamless Edge (Welded), Add</i>	45.95	
08 13 13 13-0040	EA			3' x 7'-2" x 1-3/4" 20 Gauge Metal Door (Unrated)	455.96	43.12
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	16.64	
				<i>For Type 304 Stainless Steel Door, Add</i>	300.08	
				<i>For Type 316 Stainless Steel Door, Add</i>	484.94	
				<i>For Embossed Panel, Add</i>	88.73	
				<i>For Galvanized Steel, Add</i>	55.46	
				<i>For Baked Enamel Finish, Add</i>	162.66	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-24.95	
				<i>For >100, Deduct</i>	-36.35	
				<i>For Insulated Door (Polystyrene Core), Add</i>	36.97	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	92.43	
				<i>For Seamless Edge (Welded), Add</i>	46.21	
08 13 13 13-0041	EA			3'-4" x 7'-2" x 1-3/4" 20 Gauge Metal Door (Unrated)	483.90	43.12
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	17.89	
				<i>For Type 304 Stainless Steel Door, Add</i>	322.43	
				<i>For Type 316 Stainless Steel Door, Add</i>	521.26	
				<i>For Embossed Panel, Add</i>	95.44	
				<i>For Galvanized Steel, Add</i>	59.65	
				<i>For Baked Enamel Finish, Add</i>	171.05	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-26.35	
				<i>For >100, Deduct</i>	-38.45	
				<i>For Insulated Door (Polystyrene Core), Add</i>	39.77	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	99.41	
				<i>For Seamless Edge (Welded), Add</i>	49.71	

08 Openings
08 10 Doors And Frames
08 13 Metal Doors



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 13 13	13-0042	EA	3'-6" x 7'-2" x 1-3/4" 20 Gauge Metal Door (Unrated)	498.24	44.92
			<i>For Composite Door Instead Of Full Panel Door, Add</i>	18.38	
			<i>For Type 304 Stainless Steel Door, Add</i>	331.21	
			<i>For Type 316 Stainless Steel Door, Add</i>	535.41	
			<i>For Embossed Panel, Add</i>	98.02	
			<i>For Galvanized Steel, Add</i>	61.26	
			<i>For Baked Enamel Finish, Add</i>	176.42	
			<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
			<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
			<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
			<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
			<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
			<i>For >50 To 100, Deduct</i>	-27.16	
			<i>For >100, Deduct</i>	-39.61	
			<i>For Insulated Door (Polystyrene Core), Add</i>	40.84	
			<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	102.10	
			<i>For Seamless Edge (Welded), Add</i>	51.05	
08 13 13	13-0043	EA	4' x 7'-2" x 1-3/4" 20 Gauge Metal Door (Unrated).....	548.42	48.51
			<i>For Composite Door Instead Of Full Panel Door, Add</i>	20.31	
			<i>For Type 304 Stainless Steel Door, Add</i>	365.96	
			<i>For Type 316 Stainless Steel Door, Add</i>	591.66	
			<i>For Embossed Panel, Add</i>	108.33	
			<i>For Galvanized Steel, Add</i>	67.71	
			<i>For Baked Enamel Finish, Add</i>	193.64	
			<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
			<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
			<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
			<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
			<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
			<i>For >50 To 100, Deduct</i>	-29.85	
			<i>For >100, Deduct</i>	-43.56	
			<i>For Insulated Door (Polystyrene Core), Add</i>	45.14	
			<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	112.85	
			<i>For Seamless Edge (Welded), Add</i>	56.42	
08 13 13	13-0044	PR	Pair 2'-6" x 7'-2" x 1-3/4" 20 Gauge Metal Door (Unrated).....	877.11	78.52
			<i>For Composite Door Instead Of Full Panel Door, Add</i>	32.40	
			<i>For Type 304 Stainless Steel Door, Add</i>	583.91	
			<i>For Type 316 Stainless Steel Door, Add</i>	943.94	
			<i>For Embossed Panel, Add</i>	172.82	
			<i>For Galvanized Steel, Add</i>	108.01	
			<i>For Baked Enamel Finish, Add</i>	310.25	
			<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
			<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
			<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
			<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
			<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
			<i>For >50 To 100, Deduct</i>	-47.78	
			<i>For >100, Deduct</i>	-69.71	
			<i>For Insulated Door (Polystyrene Core), Add</i>	72.01	
			<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	180.02	
			<i>For Seamless Edge (Welded), Add</i>	90.01	
08 13 13	13-0045	PR	Pair 2'-8" x 7'-2" x 1-3/4" 20 Gauge Metal Door (Unrated).....	887.86	78.52
			<i>For Composite Door Instead Of Full Panel Door, Add</i>	32.89	
			<i>For Type 304 Stainless Steel Door, Add</i>	592.51	
			<i>For Type 316 Stainless Steel Door, Add</i>	957.92	
			<i>For Embossed Panel, Add</i>	175.40	
			<i>For Galvanized Steel, Add</i>	109.62	
			<i>For Baked Enamel Finish, Add</i>	313.47	
			<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
			<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
			<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
			<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
			<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
			<i>For >50 To 100, Deduct</i>	-48.32	
			<i>For >100, Deduct</i>	-70.52	
			<i>For Insulated Door (Polystyrene Core), Add</i>	73.08	
			<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	182.71	
			<i>For Seamless Edge (Welded), Add</i>	91.35	
08 13 13	13-0046	PR	Pair 2'-10" x 7'-2" x 1-3/4" 20 Gauge Metal Door (Unrated).....	875.27	70.08
			<i>For Composite Door Instead Of Full Panel Door, Add</i>	33.08	
			<i>For Type 304 Stainless Steel Door, Add</i>	595.10	
			<i>For Type 316 Stainless Steel Door, Add</i>	962.66	
			<i>For Embossed Panel, Add</i>	176.43	
			<i>For Galvanized Steel, Add</i>	110.27	
			<i>For Baked Enamel Finish, Add</i>	304.63	
			<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
			<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
			<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
			<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
			<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
			<i>For >50 To 100, Deduct</i>	-47.27	
			<i>For >100, Deduct</i>	-69.15	
			<i>For Insulated Door (Polystyrene Core), Add</i>	73.51	
			<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	183.78	
			<i>For Seamless Edge (Welded), Add</i>	91.89	



Openings	08	08
Doors And Frames	08 10	
Metal Doors	08 13	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 13 13 13-0047 PR Pair 3' x 7'-2" x 1-3/4" 20 Gauge Metal Door (Unrated)	903.28	81.94
For Composite Door Instead Of Full Panel Door, Add	33.27	
For Type 304 Stainless Steel Door, Add	599.73	
For Type 316 Stainless Steel Door, Add	969.44	
For Embossed Panel, Add	177.46	
For Galvanized Steel, Add	110.91	
For Baked Enamel Finish, Add	320.14	
For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
For 45 Minutes Rated Door And FM Label, Add	41.40	
For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
For >50 To 100, Deduct	-49.26	
For >100, Deduct	-71.84	
For Insulated Door (Polystyrene Core), Add	73.94	
For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	184.86	
For Seamless Edge (Welded), Add	92.43	
08 13 13 13-0048 PR Pair 3'-6" x 7'-2" x 1-3/4" 20 Gauge Metal Door (Unrated)	987.49	85.35
For Composite Door Instead Of Full Panel Door, Add	36.76	
For Type 304 Stainless Steel Door, Add	661.97	
For Type 316 Stainless Steel Door, Add	1,070.37	
For Embossed Panel, Add	196.03	
For Galvanized Steel, Add	122.52	
For Baked Enamel Finish, Add	347.45	
For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
For 45 Minutes Rated Door And FM Label, Add	41.40	
For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
For >50 To 100, Deduct	-53.64	
For >100, Deduct	-78.33	
For Insulated Door (Polystyrene Core), Add	81.68	
For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	204.20	
For Seamless Edge (Welded), Add	102.10	
08 13 13 13-0049 PR Pair 4' x 7'-2" x 1-3/4" 20 Gauge Metal Door (Unrated)	1,087.13	92.17
For Composite Door Instead Of Full Panel Door, Add	40.63	
For Type 304 Stainless Steel Door, Add	731.44	
For Type 316 Stainless Steel Door, Add	1,182.83	
For Embossed Panel, Add	216.67	
For Galvanized Steel, Add	135.42	
For Baked Enamel Finish, Add	381.44	
For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
For 45 Minutes Rated Door And FM Label, Add	41.40	
For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
For >50 To 100, Deduct	-58.97	
For >100, Deduct	-86.14	
For Insulated Door (Polystyrene Core), Add	90.28	
For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	225.70	
For Seamless Edge (Welded), Add	112.85	
08 13 13 13-0050 18 Gauge 1-3/4" Unrated Door <small>(08 13 13 13)</small>		
08 13 13 13-0051 6'-8" High <small>(08 13 13 13-0050)</small>		
08 13 13 13-0052 EA 2' x 6'-8" x 1-3/4" 18 Gauge Metal Door (Unrated)	441.69	39.53
For 18 Gauge, Grade II, Heavy Duty, Add	72.53	
For Composite Door Instead Of Full Panel Door, Add	16.32	
For Type 304 Stainless Steel Door, Add	294.06	
For Type 316 Stainless Steel Door, Add	475.37	
For Embossed Panel, Add	87.03	
For Galvanized Steel, Add	54.39	
For Baked Enamel Finish, Add	156.23	
For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
For 45 Minutes Rated Door And FM Label, Add	41.40	
For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
For >50 To 100, Deduct	-24.06	
For >100, Deduct	-35.10	
For 2" Thick Door, Add	28.27	
For Insulated Door (Polystyrene Core), Add	36.26	
For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	90.66	
For Seamless Edge (Welded), Add	45.33	
For Steel Stiffened, Add	90.66	

08 Openings
08 10 Doors And Frames
08 13 Metal Doors



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 13 13	13-0053	EA	2'-4" x 6'-8" x 1-3/4" 18 Gauge Metal Door (Unrated)	441.69	39.53
			<i>For 18 Gauge, Grade II, Heavy Duty, Add</i>	72.53	
			<i>For Composite Door Instead Of Full Panel Door, Add</i>	16.32	
			<i>For Type 304 Stainless Steel Door, Add</i>	294.06	
			<i>For Type 316 Stainless Steel Door, Add</i>	475.37	
			<i>For Embossed Panel, Add</i>	87.03	
			<i>For Galvanized Steel, Add</i>	54.39	
			<i>For Baked Enamel Finish, Add</i>	156.23	
			<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
			<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
			<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
			<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
			<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
			<i>For >50 To 100, Deduct</i>	-24.06	
			<i>For >100, Deduct</i>	-35.10	
			<i>For 2" Thick Door, Add</i>	28.27	
			<i>For Insulated Door (Polystyrene Core), Add</i>	36.26	
			<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	90.66	
			<i>For Seamless Edge (Welded), Add</i>	45.33	
			<i>For Steel Stiffened, Add</i>	90.66	
08 13 13	13-0054	EA	2'-6" x 6'-8" x 1-3/4" 18 Gauge Metal Door (Unrated)	452.70	41.33
			<i>For 18 Gauge, Grade II, Heavy Duty, Add</i>	74.01	
			<i>For Composite Door Instead Of Full Panel Door, Add</i>	16.65	
			<i>For Type 304 Stainless Steel Door, Add</i>	300.17	
			<i>For Type 316 Stainless Steel Door, Add</i>	485.20	
			<i>For Embossed Panel, Add</i>	88.81	
			<i>For Galvanized Steel, Add</i>	55.51	
			<i>For Baked Enamel Finish, Add</i>	160.61	
			<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
			<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
			<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
			<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
			<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
			<i>For >50 To 100, Deduct</i>	-24.70	
			<i>For >100, Deduct</i>	-36.02	
			<i>For 2" Thick Door, Add</i>	28.89	
			<i>For Insulated Door (Polystyrene Core), Add</i>	37.01	
			<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	92.51	
			<i>For Seamless Edge (Welded), Add</i>	46.26	
			<i>For Steel Stiffened, Add</i>	92.51	
08 13 13	13-0055	EA	2'-8" x 6'-8" x 1-3/4" 18 Gauge Metal Door (Unrated)	458.22	41.33
			<i>For 18 Gauge, Grade II, Heavy Duty, Add</i>	75.11	
			<i>For Composite Door Instead Of Full Panel Door, Add</i>	16.90	
			<i>For Type 304 Stainless Steel Door, Add</i>	304.59	
			<i>For Type 316 Stainless Steel Door, Add</i>	492.37	
			<i>For Embossed Panel, Add</i>	90.14	
			<i>For Galvanized Steel, Add</i>	56.34	
			<i>For Baked Enamel Finish, Add</i>	162.26	
			<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
			<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
			<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
			<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
			<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
			<i>For >50 To 100, Deduct</i>	-24.98	
			<i>For >100, Deduct</i>	-36.43	
			<i>For 2" Thick Door, Add</i>	29.30	
			<i>For Insulated Door (Polystyrene Core), Add</i>	37.56	
			<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	93.89	
			<i>For Seamless Edge (Welded), Add</i>	46.95	
			<i>For Steel Stiffened, Add</i>	93.89	
08 13 13	13-0056	EA	2'-10" x 6'-8" x 1-3/4" 18 Gauge Metal Door (Unrated)	462.23	42.22
			<i>For 18 Gauge, Grade II, Heavy Duty, Add</i>	75.56	
			<i>For Composite Door Instead Of Full Panel Door, Add</i>	17.00	
			<i>For Type 304 Stainless Steel Door, Add</i>	306.45	
			<i>For Type 316 Stainless Steel Door, Add</i>	495.34	
			<i>For Embossed Panel, Add</i>	90.67	
			<i>For Galvanized Steel, Add</i>	56.67	
			<i>For Baked Enamel Finish, Add</i>	164.00	
			<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
			<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
			<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
			<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
			<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
			<i>For >50 To 100, Deduct</i>	-25.22	
			<i>For >100, Deduct</i>	-36.78	
			<i>For 2" Thick Door, Add</i>	29.50	
			<i>For Insulated Door (Polystyrene Core), Add</i>	37.78	
			<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	94.45	
			<i>For Seamless Edge (Welded), Add</i>	47.22	
			<i>For Steel Stiffened, Add</i>	94.45	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 13 13	13-0057	EA	3' x 6'-8" x 1-3/4" 18 Gauge Metal Door (Unrated).....	466.24	43.12
			<i>For 18 Gauge, Grade II, Heavy Duty, Add</i>	76.00	
			<i>For Composite Door Instead Of Full Panel Door, Add</i>	17.10	
			<i>For Type 304 Stainless Steel Door, Add</i>	308.30	
			<i>For Type 316 Stainless Steel Door, Add</i>	498.30	
			<i>For Embossed Panel, Add</i>	91.20	
			<i>For Galvanized Steel, Add</i>	57.00	
			<i>For Baked Enamel Finish, Add</i>	165.75	
			<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
			<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
			<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
			<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
			<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
			<i>For >50 To 100, Deduct</i>	-25.47	
			<i>For >100, Deduct</i>	-37.12	
			<i>For 2" Thick Door, Add</i>	29.71	
			<i>For Insulated Door (Polystyrene Core), Add</i>	38.00	
			<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	95.00	
			<i>For Seamless Edge (Welded), Add</i>	47.50	
			<i>For Steel Stiffened, Add</i>	95.00	
08 13 13	13-0058	EA	3'-4" x 6'-8" x 1-3/4" 18 Gauge Metal Door (Unrated)	494.96	43.12
			<i>For 18 Gauge, Grade II, Heavy Duty, Add</i>	81.74	
			<i>For Composite Door Instead Of Full Panel Door, Add</i>	18.39	
			<i>For Type 304 Stainless Steel Door, Add</i>	331.28	
			<i>For Type 316 Stainless Steel Door, Add</i>	535.64	
			<i>For Embossed Panel, Add</i>	98.09	
			<i>For Galvanized Steel, Add</i>	61.31	
			<i>For Baked Enamel Finish, Add</i>	174.36	
			<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
			<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
			<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
			<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
			<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
			<i>For >50 To 100, Deduct</i>	-26.90	
			<i>For >100, Deduct</i>	-39.28	
			<i>For 2" Thick Door, Add</i>	31.79	
			<i>For Insulated Door (Polystyrene Core), Add</i>	40.87	
			<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	102.18	
			<i>For Seamless Edge (Welded), Add</i>	51.09	
			<i>For Steel Stiffened, Add</i>	102.18	
08 13 13	13-0059	EA	3'-6" x 6'-8" x 1-3/4" 18 Gauge Metal Door (Unrated).....	509.60	44.92
			<i>For 18 Gauge, Grade II, Heavy Duty, Add</i>	83.95	
			<i>For Composite Door Instead Of Full Panel Door, Add</i>	18.89	
			<i>For Type 304 Stainless Steel Door, Add</i>	340.30	
			<i>For Type 316 Stainless Steel Door, Add</i>	550.18	
			<i>For Embossed Panel, Add</i>	100.74	
			<i>For Galvanized Steel, Add</i>	62.96	
			<i>For Baked Enamel Finish, Add</i>	179.83	
			<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
			<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
			<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
			<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
			<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
			<i>For >50 To 100, Deduct</i>	-27.73	
			<i>For >100, Deduct</i>	-40.47	
			<i>For 2" Thick Door, Add</i>	32.68	
			<i>For Insulated Door (Polystyrene Core), Add</i>	41.98	
			<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	104.94	
			<i>For Seamless Edge (Welded), Add</i>	52.47	
			<i>For Steel Stiffened, Add</i>	104.94	
08 13 13	13-0060	EA	4' x 6'-8" x 1-3/4" 18 Gauge Metal Door (Unrated).....	560.97	48.51
			<i>For 18 Gauge, Grade II, Heavy Duty, Add</i>	92.79	
			<i>For Composite Door Instead Of Full Panel Door, Add</i>	20.88	
			<i>For Type 304 Stainless Steel Door, Add</i>	376.00	
			<i>For Type 316 Stainless Steel Door, Add</i>	607.97	
			<i>For Embossed Panel, Add</i>	111.35	
			<i>For Galvanized Steel, Add</i>	69.59	
			<i>For Baked Enamel Finish, Add</i>	197.40	
			<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
			<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
			<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
			<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
			<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
			<i>For >50 To 100, Deduct</i>	-30.47	
			<i>For >100, Deduct</i>	-44.50	
			<i>For 2" Thick Door, Add</i>	36.06	
			<i>For Insulated Door (Polystyrene Core), Add</i>	46.39	
			<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	115.99	
			<i>For Seamless Edge (Welded), Add</i>	57.99	
			<i>For Steel Stiffened, Add</i>	115.99	

08 Openings
08 10 Doors And Frames
08 13 Metal Doors



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 13 13-0061	PR		Pair 2'-6" x 6'-8" x 1-3/4" 18 Gauge Metal Door (Unrated).....	897.14	78.52
			For 18 Gauge, Grade II, Heavy Duty, Add	148.02	
			For Composite Door Instead Of Full Panel Door, Add	33.30	
			For Type 304 Stainless Steel Door, Add	599.93	
			For Type 316 Stainless Steel Door, Add	969.98	
			For Embossed Panel, Add	177.62	
			For Galvanized Steel, Add	111.02	
			For Baked Enamel Finish, Add	316.25	
			For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
			For 45 Minutes Rated Door And FM Label, Add	41.40	
			For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
			For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
			For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
			For >50 To 100, Deduct	-48.78	
			For >100, Deduct	-71.21	
			For 2" Thick Door, Add	57.58	
			For Insulated Door (Polystyrene Core), Add	74.01	
			For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	185.03	
			For Seamless Edge (Welded), Add	92.51	
			For Steel Stiffened, Add	185.03	
08 13 13-0062	PR		Pair 2'-8" x 6'-8" x 1-3/4" 18 Gauge Metal Door (Unrated).....	908.19	78.52
			For 18 Gauge, Grade II, Heavy Duty, Add	150.23	
			For Composite Door Instead Of Full Panel Door, Add	33.80	
			For Type 304 Stainless Steel Door, Add	608.77	
			For Type 316 Stainless Steel Door, Add	984.35	
			For Embossed Panel, Add	180.28	
			For Galvanized Steel, Add	112.67	
			For Baked Enamel Finish, Add	319.57	
			For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
			For 45 Minutes Rated Door And FM Label, Add	41.40	
			For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
			For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
			For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
			For >50 To 100, Deduct	-49.34	
			For >100, Deduct	-72.04	
			For 2" Thick Door, Add	58.38	
			For Insulated Door (Polystyrene Core), Add	75.12	
			For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	187.79	
			For Seamless Edge (Welded), Add	93.89	
			For Steel Stiffened, Add	187.79	
08 13 13-0063	PR		Pair 2'-10" x 6'-8" x 1-3/4" 18 Gauge Metal Door (Unrated).....	895.71	70.08
			For 18 Gauge, Grade II, Heavy Duty, Add	151.11	
			For Composite Door Instead Of Full Panel Door, Add	34.00	
			For Type 304 Stainless Steel Door, Add	611.46	
			For Type 316 Stainless Steel Door, Add	989.24	
			For Embossed Panel, Add	181.33	
			For Galvanized Steel, Add	113.33	
			For Baked Enamel Finish, Add	310.76	
			For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
			For 45 Minutes Rated Door And FM Label, Add	41.40	
			For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
			For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
			For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
			For >50 To 100, Deduct	-48.29	
			For >100, Deduct	-70.68	
			For 2" Thick Door, Add	58.28	
			For Insulated Door (Polystyrene Core), Add	75.56	
			For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	188.89	
			For Seamless Edge (Welded), Add	94.45	
			For Steel Stiffened, Add	188.89	
08 13 13-0064	PR		Pair 3' x 6'-8" x 1-3/4" 18 Gauge Metal Door (Unrated).....	923.84	81.94
			For 18 Gauge, Grade II, Heavy Duty, Add	152.00	
			For Composite Door Instead Of Full Panel Door, Add	34.20	
			For Type 304 Stainless Steel Door, Add	616.18	
			For Type 316 Stainless Steel Door, Add	996.17	
			For Embossed Panel, Add	182.40	
			For Galvanized Steel, Add	114.00	
			For Baked Enamel Finish, Add	326.31	
			For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
			For 45 Minutes Rated Door And FM Label, Add	41.40	
			For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
			For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
			For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
			For >50 To 100, Deduct	-50.29	
			For >100, Deduct	-73.38	
			For 2" Thick Door, Add	59.20	
			For Insulated Door (Polystyrene Core), Add	76.00	
			For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	190.00	
			For Seamless Edge (Welded), Add	95.00	
			For Steel Stiffened, Add	190.00	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 13 13 13-0065	PR			Pair 3'-6" x 6'-8" x 1-3/4" 18 Gauge Metal Door (Unrated).....	1,010.21	85.35
				<i>For 18 Gauge, Grade II, Heavy Duty, Add</i>	167.90	
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	37.78	
				<i>For Type 304 Stainless Steel Door, Add</i>	680.15	
				<i>For Type 316 Stainless Steel Door, Add</i>	1,099.91	
				<i>For Embossed Panel, Add</i>	201.48	
				<i>For Galvanized Steel, Add</i>	125.93	
				<i>For Baked Enamel Finish, Add</i>	354.27	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-54.78	
				<i>For >100, Deduct</i>	-80.03	
				<i>For 2" Thick Door, Add</i>	65.13	
				<i>For Insulated Door (Polystyrene Core), Add</i>	83.95	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	209.88	
				<i>For Seamless Edge (Welded), Add</i>	104.94	
				<i>For Steel Stiffened, Add</i>	209.88	
08 13 13 13-0066	PR			Pair 4' x 6'-8" x 1-3/4" 18 Gauge Metal Door (Unrated).....	1,112.24	92.17
				<i>For 18 Gauge, Grade II, Heavy Duty, Add</i>	185.58	
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	41.76	
				<i>For Type 304 Stainless Steel Door, Add</i>	751.53	
				<i>For Type 316 Stainless Steel Door, Add</i>	1,215.47	
				<i>For Embossed Panel, Add</i>	222.69	
				<i>For Galvanized Steel, Add</i>	139.18	
				<i>For Baked Enamel Finish, Add</i>	388.98	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-60.22	
				<i>For >100, Deduct</i>	-88.03	
				<i>For 2" Thick Door, Add</i>	71.88	
				<i>For Insulated Door (Polystyrene Core), Add</i>	92.79	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	231.97	
				<i>For Seamless Edge (Welded), Add</i>	115.99	
				<i>For Steel Stiffened, Add</i>	231.97	
08 13 13 13-0067				7' High <small>(08 13 13 13-0050)</small>		
08 13 13 13-0068	EA			2' x 7' x 1-3/4" 18 Gauge Metal Door (Unrated).....	450.30	39.53
				<i>For 18 Gauge, Grade II, Heavy Duty, Add</i>	74.25	
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	16.71	
				<i>For Type 304 Stainless Steel Door, Add</i>	300.95	
				<i>For Type 316 Stainless Steel Door, Add</i>	486.57	
				<i>For Embossed Panel, Add</i>	89.10	
				<i>For Galvanized Steel, Add</i>	55.69	
				<i>For Baked Enamel Finish, Add</i>	158.81	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-24.49	
				<i>For >100, Deduct</i>	-35.75	
				<i>For 2" Thick Door, Add</i>	28.89	
				<i>For Insulated Door (Polystyrene Core), Add</i>	37.12	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	92.81	
				<i>For Seamless Edge (Welded), Add</i>	46.41	
				<i>For Steel Stiffened, Add</i>	92.81	
08 13 13 13-0069	EA			2'-4" x 7' x 1-3/4" 18 Gauge Metal Door (Unrated).....	450.30	39.53
				<i>For 18 Gauge, Grade II, Heavy Duty, Add</i>	74.25	
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	16.71	
				<i>For Type 304 Stainless Steel Door, Add</i>	300.95	
				<i>For Type 316 Stainless Steel Door, Add</i>	486.57	
				<i>For Embossed Panel, Add</i>	89.10	
				<i>For Galvanized Steel, Add</i>	55.69	
				<i>For Baked Enamel Finish, Add</i>	158.81	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-24.49	
				<i>For >100, Deduct</i>	-35.75	
				<i>For 2" Thick Door, Add</i>	28.89	
				<i>For Insulated Door (Polystyrene Core), Add</i>	37.12	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	92.81	
				<i>For Seamless Edge (Welded), Add</i>	46.41	
				<i>For Steel Stiffened, Add</i>	92.81	

08 Openings
08 10 Doors And Frames
08 13 Metal Doors



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 13 13	13-0070	EA	2'-6" x 7' x 1-3/4" 18 Gauge Metal Door (Unrated).....	461.48	41.33
			<i>For 18 Gauge, Grade II, Heavy Duty, Add</i>	75.77	
			<i>For Composite Door Instead Of Full Panel Door, Add</i>	17.05	
			<i>For Type 304 Stainless Steel Door, Add</i>	307.20	
			<i>For Type 316 Stainless Steel Door, Add</i>	496.61	
			<i>For Embossed Panel, Add</i>	90.92	
			<i>For Galvanized Steel, Add</i>	56.82	
			<i>For Baked Enamel Finish, Add</i>	163.24	
			<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
			<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
			<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
			<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
			<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
			<i>For >50 To 100, Deduct</i>	-25.14	
			<i>For >100, Deduct</i>	-36.68	
			<i>For 2" Thick Door, Add</i>	29.53	
			<i>For Insulated Door (Polystyrene Core), Add</i>	37.88	
			<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	94.71	
			<i>For Seamless Edge (Welded), Add</i>	47.35	
			<i>For Steel Stiffened, Add</i>	94.71	
08 13 13	13-0071	EA	2'-8" x 7' x 1-3/4" 18 Gauge Metal Door (Unrated).....	467.14	41.33
			<i>For 18 Gauge, Grade II, Heavy Duty, Add</i>	76.90	
			<i>For Composite Door Instead Of Full Panel Door, Add</i>	17.30	
			<i>For Type 304 Stainless Steel Door, Add</i>	311.72	
			<i>For Type 316 Stainless Steel Door, Add</i>	503.97	
			<i>For Embossed Panel, Add</i>	92.28	
			<i>For Galvanized Steel, Add</i>	57.67	
			<i>For Baked Enamel Finish, Add</i>	164.94	
			<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
			<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
			<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
			<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
			<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
			<i>For >50 To 100, Deduct</i>	-25.42	
			<i>For >100, Deduct</i>	-37.10	
			<i>For 2" Thick Door, Add</i>	29.94	
			<i>For Insulated Door (Polystyrene Core), Add</i>	38.45	
			<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	96.12	
			<i>For Seamless Edge (Welded), Add</i>	48.06	
			<i>For Steel Stiffened, Add</i>	96.12	
08 13 13	13-0072	EA	2'-10" x 7' x 1-3/4" 18 Gauge Metal Door (Unrated).....	471.20	42.22
			<i>For 18 Gauge, Grade II, Heavy Duty, Add</i>	77.35	
			<i>For Composite Door Instead Of Full Panel Door, Add</i>	17.40	
			<i>For Type 304 Stainless Steel Door, Add</i>	313.62	
			<i>For Type 316 Stainless Steel Door, Add</i>	507.00	
			<i>For Embossed Panel, Add</i>	92.82	
			<i>For Galvanized Steel, Add</i>	58.01	
			<i>For Baked Enamel Finish, Add</i>	166.70	
			<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
			<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
			<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
			<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
			<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
			<i>For >50 To 100, Deduct</i>	-25.67	
			<i>For >100, Deduct</i>	-37.45	
			<i>For 2" Thick Door, Add</i>	30.15	
			<i>For Insulated Door (Polystyrene Core), Add</i>	38.68	
			<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	96.69	
			<i>For Seamless Edge (Welded), Add</i>	48.34	
			<i>For Steel Stiffened, Add</i>	96.69	
08 13 13	13-0073	EA	3' x 7' x 1-3/4" 18 Gauge Metal Door (Unrated).....	475.26	43.12
			<i>For 18 Gauge, Grade II, Heavy Duty, Add</i>	77.80	
			<i>For Composite Door Instead Of Full Panel Door, Add</i>	17.51	
			<i>For Type 304 Stainless Steel Door, Add</i>	315.52	
			<i>For Type 316 Stainless Steel Door, Add</i>	510.03	
			<i>For Embossed Panel, Add</i>	93.36	
			<i>For Galvanized Steel, Add</i>	58.35	
			<i>For Baked Enamel Finish, Add</i>	168.45	
			<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
			<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
			<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
			<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
			<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
			<i>For >50 To 100, Deduct</i>	-25.92	
			<i>For >100, Deduct</i>	-37.80	
			<i>For 2" Thick Door, Add</i>	30.36	
			<i>For Insulated Door (Polystyrene Core), Add</i>	38.90	
			<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	97.25	
			<i>For Seamless Edge (Welded), Add</i>	48.63	
			<i>For Steel Stiffened, Add</i>	97.25	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 13 13	13-0074	EA		3'-4" x 7' x 1-3/4" 18 Gauge Metal Door (Unrated).....	504.66	43.12
				<i>For 18 Gauge, Grade II, Heavy Duty, Add</i>	83.68	
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	18.83	
				<i>For Type 304 Stainless Steel Door, Add</i>	339.04	
				<i>For Type 316 Stainless Steel Door, Add</i>	548.25	
				<i>For Embossed Panel, Add</i>	100.42	
				<i>For Galvanized Steel, Add</i>	62.76	
				<i>For Baked Enamel Finish, Add</i>	177.27	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-27.39	
				<i>For >100, Deduct</i>	-40.01	
				<i>For 2" Thick Door, Add</i>	32.49	
				<i>For Insulated Door (Polystyrene Core), Add</i>	41.84	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	104.60	
				<i>For Seamless Edge (Welded), Add</i>	52.30	
				<i>For Steel Stiffened, Add</i>	104.60	
08 13 13	13-0075	EA		3'-6" x 7' x 1-3/4" 18 Gauge Metal Door (Unrated).....	519.56	44.92
				<i>For 18 Gauge, Grade II, Heavy Duty, Add</i>	85.94	
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	19.34	
				<i>For Type 304 Stainless Steel Door, Add</i>	348.27	
				<i>For Type 316 Stainless Steel Door, Add</i>	563.13	
				<i>For Embossed Panel, Add</i>	103.13	
				<i>For Galvanized Steel, Add</i>	64.46	
				<i>For Baked Enamel Finish, Add</i>	182.82	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-28.22	
				<i>For >100, Deduct</i>	-41.21	
				<i>For 2" Thick Door, Add</i>	33.40	
				<i>For Insulated Door (Polystyrene Core), Add</i>	42.97	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	107.43	
				<i>For Seamless Edge (Welded), Add</i>	53.72	
				<i>For Steel Stiffened, Add</i>	107.43	
08 13 13	13-0076	EA		4' x 7' x 1-3/4" 18 Gauge Metal Door (Unrated).....	571.98	48.51
				<i>For 18 Gauge, Grade II, Heavy Duty, Add</i>	94.99	
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	21.37	
				<i>For Type 304 Stainless Steel Door, Add</i>	384.81	
				<i>For Type 316 Stainless Steel Door, Add</i>	622.29	
				<i>For Embossed Panel, Add</i>	113.99	
				<i>For Galvanized Steel, Add</i>	71.24	
				<i>For Baked Enamel Finish, Add</i>	200.70	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-31.02	
				<i>For >100, Deduct</i>	-45.32	
				<i>For 2" Thick Door, Add</i>	36.86	
				<i>For Insulated Door (Polystyrene Core), Add</i>	47.50	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	118.74	
				<i>For Seamless Edge (Welded), Add</i>	59.37	
				<i>For Steel Stiffened, Add</i>	118.74	
08 13 13	13-0077	PR		Pair 2'-6" x 7' x 1-3/4" 18 Gauge Metal Door (Unrated).....	914.70	78.52
				<i>For 18 Gauge, Grade II, Heavy Duty, Add</i>	151.53	
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	34.09	
				<i>For Type 304 Stainless Steel Door, Add</i>	613.98	
				<i>For Type 316 Stainless Steel Door, Add</i>	992.81	
				<i>For Embossed Panel, Add</i>	181.84	
				<i>For Galvanized Steel, Add</i>	113.65	
				<i>For Baked Enamel Finish, Add</i>	321.52	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-49.66	
				<i>For >100, Deduct</i>	-72.53	
				<i>For 2" Thick Door, Add</i>	58.86	
				<i>For Insulated Door (Polystyrene Core), Add</i>	75.77	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	189.42	
				<i>For Seamless Edge (Welded), Add</i>	94.71	
				<i>For Steel Stiffened, Add</i>	189.42	

08 Openings
08 10 Doors And Frames
08 13 Metal Doors



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 13 13	13-0078	PR	Pair 2'-8" x 7' x 1-3/4" 18 Gauge Metal Door (Unrated)	926.01	78.52
			<i>For 18 Gauge, Grade II, Heavy Duty, Add</i>	153.79	
			<i>For Composite Door Instead Of Full Panel Door, Add</i>	34.60	
			<i>For Type 304 Stainless Steel Door, Add</i>	623.03	
			<i>For Type 316 Stainless Steel Door, Add</i>	1,007.51	
			<i>For Embossed Panel, Add</i>	184.55	
			<i>For Galvanized Steel, Add</i>	115.35	
			<i>For Baked Enamel Finish, Add</i>	324.92	
			<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
			<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
			<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
			<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
			<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
			<i>For >50 To 100, Deduct</i>	-50.23	
			<i>For >100, Deduct</i>	-73.38	
			<i>For 2" Thick Door, Add</i>	59.68	
			<i>For Insulated Door (Polystyrene Core), Add</i>	76.90	
			<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	192.24	
			<i>For Seamless Edge (Welded), Add</i>	96.12	
			<i>For Steel Stiffened, Add</i>	192.24	
08 13 13	13-0079	PR	Pair 2'-10" x 7' x 1-3/4" 18 Gauge Metal Door (Unrated)	913.64	70.08
			<i>For 18 Gauge, Grade II, Heavy Duty, Add</i>	154.70	
			<i>For Composite Door Instead Of Full Panel Door, Add</i>	34.81	
			<i>For Type 304 Stainless Steel Door, Add</i>	625.80	
			<i>For Type 316 Stainless Steel Door, Add</i>	1,012.54	
			<i>For Embossed Panel, Add</i>	185.64	
			<i>For Galvanized Steel, Add</i>	116.02	
			<i>For Baked Enamel Finish, Add</i>	316.14	
			<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
			<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
			<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
			<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
			<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
			<i>For >50 To 100, Deduct</i>	-49.19	
			<i>For >100, Deduct</i>	-72.03	
			<i>For 2" Thick Door, Add</i>	59.58	
			<i>For Insulated Door (Polystyrene Core), Add</i>	77.35	
			<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	193.37	
			<i>For Seamless Edge (Welded), Add</i>	96.69	
			<i>For Steel Stiffened, Add</i>	193.37	
08 13 13	13-0080	PR	Pair 3' x 7' x 1-3/4" 18 Gauge Metal Door (Unrated)	941.88	81.94
			<i>For 18 Gauge, Grade II, Heavy Duty, Add</i>	155.60	
			<i>For Composite Door Instead Of Full Panel Door, Add</i>	35.01	
			<i>For Type 304 Stainless Steel Door, Add</i>	630.61	
			<i>For Type 316 Stainless Steel Door, Add</i>	1,019.62	
			<i>For Embossed Panel, Add</i>	186.72	
			<i>For Galvanized Steel, Add</i>	116.70	
			<i>For Baked Enamel Finish, Add</i>	331.72	
			<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
			<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
			<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
			<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
			<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
			<i>For >50 To 100, Deduct</i>	-51.19	
			<i>For >100, Deduct</i>	-74.74	
			<i>For 2" Thick Door, Add</i>	60.50	
			<i>For Insulated Door (Polystyrene Core), Add</i>	77.80	
			<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	194.51	
			<i>For Seamless Edge (Welded), Add</i>	97.25	
			<i>For Steel Stiffened, Add</i>	194.51	
08 13 13	13-0081	PR	Pair 3'-6" x 7' x 1-3/4" 18 Gauge Metal Door (Unrated)	1,030.13	85.35
			<i>For 18 Gauge, Grade II, Heavy Duty, Add</i>	171.89	
			<i>For Composite Door Instead Of Full Panel Door, Add</i>	38.67	
			<i>For Type 304 Stainless Steel Door, Add</i>	696.09	
			<i>For Type 316 Stainless Steel Door, Add</i>	1,125.81	
			<i>For Embossed Panel, Add</i>	206.27	
			<i>For Galvanized Steel, Add</i>	128.92	
			<i>For Baked Enamel Finish, Add</i>	360.25	
			<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
			<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
			<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
			<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
			<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
			<i>For >50 To 100, Deduct</i>	-55.77	
			<i>For >100, Deduct</i>	-81.53	
			<i>For 2" Thick Door, Add</i>	66.58	
			<i>For Insulated Door (Polystyrene Core), Add</i>	85.94	
			<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	214.86	
			<i>For Seamless Edge (Welded), Add</i>	107.43	
			<i>For Steel Stiffened, Add</i>	214.86	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
	08 13 13 13-0082	PR		Pair 4' x 7' x 1-3/4" 18 Gauge Metal Door (Unrated).....	1,134.26	92.17
				<i>For 18 Gauge, Grade II, Heavy Duty, Add</i>	189.98	
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	42.75	
				<i>For Type 304 Stainless Steel Door, Add</i>	769.15	
				<i>For Type 316 Stainless Steel Door, Add</i>	1,244.10	
				<i>For Embossed Panel, Add</i>	227.98	
				<i>For Galvanized Steel, Add</i>	142.49	
				<i>For Baked Enamel Finish, Add</i>	395.58	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-61.32	
				<i>For >100, Deduct</i>	-89.68	
				<i>For 2" Thick Door, Add</i>	73.48	
				<i>For Insulated Door (Polystyrene Core), Add</i>	94.99	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	237.48	
				<i>For Seamless Edge (Welded), Add</i>	118.74	
				<i>For Steel Stiffened, Add</i>	237.48	
	08 13 13 13-0083			7'-2" High <small>(08 13 13 13-0050)</small>		
	08 13 13 13-0084	EA		2' x 7'-2" x 1-3/4" 18 Gauge Metal Door (Unrated).....	458.91	39.53
				<i>For 18 Gauge, Grade II, Heavy Duty, Add</i>	75.97	
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	17.09	
				<i>For Type 304 Stainless Steel Door, Add</i>	307.83	
				<i>For Type 316 Stainless Steel Door, Add</i>	497.76	
				<i>For Embossed Panel, Add</i>	91.16	
				<i>For Galvanized Steel, Add</i>	56.98	
				<i>For Baked Enamel Finish, Add</i>	161.39	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-24.92	
				<i>For >100, Deduct</i>	-36.39	
				<i>For 2" Thick Door, Add</i>	29.52	
				<i>For Insulated Door (Polystyrene Core), Add</i>	37.99	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	94.96	
				<i>For Seamless Edge (Welded), Add</i>	47.48	
				<i>For Steel Stiffened, Add</i>	94.96	
	08 13 13 13-0085	EA		2'-4" x 7'-2" x 1-3/4" 18 Gauge Metal Door (Unrated).....	458.91	39.53
				<i>For 18 Gauge, Grade II, Heavy Duty, Add</i>	75.97	
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	17.09	
				<i>For Type 304 Stainless Steel Door, Add</i>	307.83	
				<i>For Type 316 Stainless Steel Door, Add</i>	497.76	
				<i>For Embossed Panel, Add</i>	91.16	
				<i>For Galvanized Steel, Add</i>	56.98	
				<i>For Baked Enamel Finish, Add</i>	161.39	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-24.92	
				<i>For >100, Deduct</i>	-36.39	
				<i>For 2" Thick Door, Add</i>	29.52	
				<i>For Insulated Door (Polystyrene Core), Add</i>	37.99	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	94.96	
				<i>For Seamless Edge (Welded), Add</i>	47.48	
				<i>For Steel Stiffened, Add</i>	94.96	
	08 13 13 13-0086	EA		2'-6" x 7'-2" x 1-3/4" 18 Gauge Metal Door (Unrated).....	470.27	41.33
				<i>For 18 Gauge, Grade II, Heavy Duty, Add</i>	77.52	
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	17.44	
				<i>For Type 304 Stainless Steel Door, Add</i>	314.23	
				<i>For Type 316 Stainless Steel Door, Add</i>	508.04	
				<i>For Embossed Panel, Add</i>	93.03	
				<i>For Galvanized Steel, Add</i>	58.14	
				<i>For Baked Enamel Finish, Add</i>	165.88	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-25.58	
				<i>For >100, Deduct</i>	-37.34	
				<i>For 2" Thick Door, Add</i>	30.17	
				<i>For Insulated Door (Polystyrene Core), Add</i>	38.76	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	96.91	
				<i>For Seamless Edge (Welded), Add</i>	48.45	
				<i>For Steel Stiffened, Add</i>	96.91	

08 Openings
08 10 Doors And Frames
08 13 Metal Doors



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 13 13	13-0087	EA	2'-8" x 7'-2" x 1-3/4" 18 Gauge Metal Door (Unrated)	476.05	41.33
			<i>For 18 Gauge, Grade II, Heavy Duty, Add</i>	78.68	
			<i>For Composite Door Instead Of Full Panel Door, Add</i>	17.70	
			<i>For Type 304 Stainless Steel Door, Add</i>	318.85	
			<i>For Type 316 Stainless Steel Door, Add</i>	515.55	
			<i>For Embossed Panel, Add</i>	94.42	
			<i>For Galvanized Steel, Add</i>	59.01	
			<i>For Baked Enamel Finish, Add</i>	167.61	
			<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
			<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
			<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
			<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
			<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
			<i>For >50 To 100, Deduct</i>	-25.87	
			<i>For >100, Deduct</i>	-37.77	
			<i>For 2" Thick Door, Add</i>	30.59	
			<i>For Insulated Door (Polystyrene Core), Add</i>	39.34	
			<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	98.35	
			<i>For Seamless Edge (Welded), Add</i>	49.18	
			<i>For Steel Stiffened, Add</i>	98.35	
08 13 13	13-0088	EA	3' x 7'-2" x 1-3/4" 18 Gauge Metal Door (Unrated).....	484.28	43.12
			<i>For 18 Gauge, Grade II, Heavy Duty, Add</i>	79.61	
			<i>For Composite Door Instead Of Full Panel Door, Add</i>	17.91	
			<i>For Type 304 Stainless Steel Door, Add</i>	322.74	
			<i>For Type 316 Stainless Steel Door, Add</i>	521.75	
			<i>For Embossed Panel, Add</i>	95.53	
			<i>For Galvanized Steel, Add</i>	59.70	
			<i>For Baked Enamel Finish, Add</i>	171.16	
			<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
			<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
			<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
			<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
			<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
			<i>For >50 To 100, Deduct</i>	-26.37	
			<i>For >100, Deduct</i>	-38.48	
			<i>For 2" Thick Door, Add</i>	31.01	
			<i>For Insulated Door (Polystyrene Core), Add</i>	39.80	
			<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	99.51	
			<i>For Seamless Edge (Welded), Add</i>	49.75	
			<i>For Steel Stiffened, Add</i>	99.51	
08 13 13	13-0089	EA	3'-4" x 7'-2" x 1-3/4" 18 Gauge Metal Door (Unrated)	514.36	43.12
			<i>For 18 Gauge, Grade II, Heavy Duty, Add</i>	85.62	
			<i>For Composite Door Instead Of Full Panel Door, Add</i>	19.26	
			<i>For Type 304 Stainless Steel Door, Add</i>	346.80	
			<i>For Type 316 Stainless Steel Door, Add</i>	560.86	
			<i>For Embossed Panel, Add</i>	102.75	
			<i>For Galvanized Steel, Add</i>	64.22	
			<i>For Baked Enamel Finish, Add</i>	180.18	
			<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
			<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
			<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
			<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
			<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
			<i>For >50 To 100, Deduct</i>	-27.87	
			<i>For >100, Deduct</i>	-40.73	
			<i>For 2" Thick Door, Add</i>	33.19	
			<i>For Insulated Door (Polystyrene Core), Add</i>	42.81	
			<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	107.03	
			<i>For Seamless Edge (Welded), Add</i>	53.51	
			<i>For Steel Stiffened, Add</i>	107.03	
08 13 13	13-0090	EA	3'-6" x 7'-2" x 1-3/4" 18 Gauge Metal Door (Unrated)	529.52	44.92
			<i>For 18 Gauge, Grade II, Heavy Duty, Add</i>	87.94	
			<i>For Composite Door Instead Of Full Panel Door, Add</i>	19.79	
			<i>For Type 304 Stainless Steel Door, Add</i>	356.24	
			<i>For Type 316 Stainless Steel Door, Add</i>	576.08	
			<i>For Embossed Panel, Add</i>	105.52	
			<i>For Galvanized Steel, Add</i>	65.95	
			<i>For Baked Enamel Finish, Add</i>	185.81	
			<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
			<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
			<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
			<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
			<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
			<i>For >50 To 100, Deduct</i>	-28.72	
			<i>For >100, Deduct</i>	-41.96	
			<i>For 2" Thick Door, Add</i>	34.12	
			<i>For Insulated Door (Polystyrene Core), Add</i>	43.97	
			<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	109.92	
			<i>For Seamless Edge (Welded), Add</i>	54.96	
			<i>For Steel Stiffened, Add</i>	109.92	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 13 13	13-0091	EA		4' x 7'-2" x 1-3/4" 18 Gauge Metal Door (Unrated).....	582.99	48.51
				<i>For 18 Gauge, Grade II, Heavy Duty, Add</i>	97.19	
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	21.87	
				<i>For Type 304 Stainless Steel Door, Add</i>	393.62	
				<i>For Type 316 Stainless Steel Door, Add</i>	636.60	
				<i>For Embossed Panel, Add</i>	116.63	
				<i>For Galvanized Steel, Add</i>	72.89	
				<i>For Baked Enamel Finish, Add</i>	204.01	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-31.58	
				<i>For >100, Deduct</i>	-46.15	
				<i>For 2" Thick Door, Add</i>	37.66	
				<i>For Insulated Door (Polystyrene Core), Add</i>	48.60	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	121.49	
				<i>For Seamless Edge (Welded), Add</i>	60.75	
				<i>For Steel Stiffened, Add</i>	121.49	
08 13 13	13-0092	PR		Pair 2'-6" x 7'-2" x 1-3/4" 18 Gauge Metal Door (Unrated).....	932.27	78.52
				<i>For 18 Gauge, Grade II, Heavy Duty, Add</i>	155.05	
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	34.89	
				<i>For Type 304 Stainless Steel Door, Add</i>	628.04	
				<i>For Type 316 Stainless Steel Door, Add</i>	1,015.65	
				<i>For Embossed Panel, Add</i>	186.06	
				<i>For Galvanized Steel, Add</i>	116.28	
				<i>For Baked Enamel Finish, Add</i>	326.79	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-50.54	
				<i>For >100, Deduct</i>	-73.85	
				<i>For 2" Thick Door, Add</i>	60.13	
				<i>For Insulated Door (Polystyrene Core), Add</i>	77.52	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	193.81	
				<i>For Seamless Edge (Welded), Add</i>	96.90	
				<i>For Steel Stiffened, Add</i>	193.81	
08 13 13	13-0093	PR		Pair 2'-8" x 7'-2" x 1-3/4" 18 Gauge Metal Door (Unrated).....	943.84	78.52
				<i>For 18 Gauge, Grade II, Heavy Duty, Add</i>	157.36	
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	35.41	
				<i>For Type 304 Stainless Steel Door, Add</i>	637.29	
				<i>For Type 316 Stainless Steel Door, Add</i>	1,030.69	
				<i>For Embossed Panel, Add</i>	188.83	
				<i>For Galvanized Steel, Add</i>	118.02	
				<i>For Baked Enamel Finish, Add</i>	330.26	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-51.12	
				<i>For >100, Deduct</i>	-74.71	
				<i>For 2" Thick Door, Add</i>	60.97	
				<i>For Insulated Door (Polystyrene Core), Add</i>	78.68	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	196.70	
				<i>For Seamless Edge (Welded), Add</i>	98.35	
				<i>For Steel Stiffened, Add</i>	196.70	
08 13 13	13-0094	PR		Pair 2'-10" x 7'-2" x 1-3/4" 18 Gauge Metal Door (Unrated).....	931.58	70.08
				<i>For 18 Gauge, Grade II, Heavy Duty, Add</i>	158.29	
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	35.61	
				<i>For Type 304 Stainless Steel Door, Add</i>	640.15	
				<i>For Type 316 Stainless Steel Door, Add</i>	1,035.87	
				<i>For Embossed Panel, Add</i>	189.94	
				<i>For Galvanized Steel, Add</i>	118.71	
				<i>For Baked Enamel Finish, Add</i>	321.52	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-50.08	
				<i>For >100, Deduct</i>	-73.37	
				<i>For 2" Thick Door, Add</i>	60.88	
				<i>For Insulated Door (Polystyrene Core), Add</i>	79.14	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	197.86	
				<i>For Seamless Edge (Welded), Add</i>	98.93	
				<i>For Steel Stiffened, Add</i>	197.86	

08 Openings
08 10 Doors And Frames
08 13 Metal Doors



MINOR		TOTAL DIRECT	DEMOLITION
CSI	UOM DESCRIPTION	UNIT COST	UNIT COST
08 13 13 13-0095	PR Pair 3' x 7'-2" x 1-3/4" 18 Gauge Metal Door (Unrated)	959.92	81.94
	For 18 Gauge, Grade II, Heavy Duty, Add	159.21	
	For Composite Door Instead Of Full Panel Door, Add	35.82	
	For Type 304 Stainless Steel Door, Add	645.04	
	For Type 316 Stainless Steel Door, Add	1,043.07	
	For Embossed Panel, Add	191.05	
	For Galvanized Steel, Add	119.41	
	For Baked Enamel Finish, Add	337.13	
	For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
	For 45 Minutes Rated Door And FM Label, Add	41.40	
	For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
	For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
	For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
	For >50 To 100, Deduct	-52.09	
	For >100, Deduct	-76.09	
	For 2" Thick Door, Add	61.81	
	For Insulated Door (Polystyrene Core), Add	79.61	
	For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	199.02	
	For Seamless Edge (Welded), Add	99.51	
	For Steel Stiffened, Add	199.02	
08 13 13 13-0096	PR Pair 3'-6" x 7'-2" x 1-3/4" 18 Gauge Metal Door (Unrated)	1,050.05	85.35
	For 18 Gauge, Grade II, Heavy Duty, Add	175.87	
	For Composite Door Instead Of Full Panel Door, Add	39.57	
	For Type 304 Stainless Steel Door, Add	712.02	
	For Type 316 Stainless Steel Door, Add	1,151.70	
	For Embossed Panel, Add	211.05	
	For Galvanized Steel, Add	131.90	
	For Baked Enamel Finish, Add	366.22	
	For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
	For 45 Minutes Rated Door And FM Label, Add	41.40	
	For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
	For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
	For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
	For >50 To 100, Deduct	-56.77	
	For >100, Deduct	-83.02	
	For 2" Thick Door, Add	68.02	
	For Insulated Door (Polystyrene Core), Add	87.94	
	For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	219.84	
	For Seamless Edge (Welded), Add	109.92	
	For Steel Stiffened, Add	219.84	
08 13 13 13-0097	PR Pair 4' x 7'-2" x 1-3/4" 18 Gauge Metal Door (Unrated)	1,156.28	92.17
	For 18 Gauge, Grade II, Heavy Duty, Add	194.39	
	For Composite Door Instead Of Full Panel Door, Add	43.74	
	For Type 304 Stainless Steel Door, Add	786.76	
	For Type 316 Stainless Steel Door, Add	1,272.73	
	For Embossed Panel, Add	233.26	
	For Galvanized Steel, Add	145.79	
	For Baked Enamel Finish, Add	402.19	
	For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
	For 45 Minutes Rated Door And FM Label, Add	41.40	
	For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
	For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
	For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
	For >50 To 100, Deduct	-62.42	
	For >100, Deduct	-91.33	
	For 2" Thick Door, Add	75.07	
	For Insulated Door (Polystyrene Core), Add	97.19	
	For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	242.98	
	For Seamless Edge (Welded), Add	121.49	
	For Steel Stiffened, Add	242.98	
08 13 13 13-0098	8' High (08 13 13 13-0050)		
08 13 13 13-0099	EA 2' x 8' x 1-3/4" 18 Gauge Metal Door (Unrated)	529.90	39.53
	For 18 Gauge, Grade II, Heavy Duty, Add	90.17	
	For Up To 1' Extra Height, Add	124.75	
	For 1' To 1'-6" Extra Height, Add	238.00	
	For Composite Door Instead Of Full Panel Door, Add	20.29	
	For Type 304 Stainless Steel Door, Add	364.63	
	For Type 316 Stainless Steel Door, Add	590.05	
	For Embossed Panel, Add	108.20	
	For Galvanized Steel, Add	67.63	
	For Baked Enamel Finish, Add	182.69	
	For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
	For 45 Minutes Rated Door And FM Label, Add	41.40	
	For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
	For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
	For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
	For >50 To 100, Deduct	-28.47	
	For >100, Deduct	-41.72	
	For 2" Thick Door, Add	34.66	
	For Insulated Door (Polystyrene Core), Add	45.08	
	For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	112.71	
	For Seamless Edge (Welded), Add	56.36	
	For Steel Stiffened, Add	112.71	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 13 13 13-0100	EA			2'-4" x 8' x 1-3/4" 18 Gauge Metal Door (Unrated).....	529.90	39.53
				<i>For 18 Gauge, Grade II, Heavy Duty, Add</i>	90.17	
				<i>For Up To 1' Extra Height, Add</i>	124.75	
				<i>For 1' To 1'-6" Extra Height, Add</i>	238.00	
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	20.29	
				<i>For Type 304 Stainless Steel Door, Add</i>	364.63	
				<i>For Type 316 Stainless Steel Door, Add</i>	590.05	
				<i>For Embossed Panel, Add</i>	108.20	
				<i>For Galvanized Steel, Add</i>	67.63	
				<i>For Baked Enamel Finish, Add</i>	182.69	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-28.47	
				<i>For >100, Deduct</i>	-41.72	
				<i>For 2" Thick Door, Add</i>	34.66	
				<i>For Insulated Door (Polystyrene Core), Add</i>	45.08	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	112.71	
				<i>For Seamless Edge (Welded), Add</i>	56.36	
				<i>For Steel Stiffened, Add</i>	112.71	
08 13 13 13-0101	EA			2'-6" x 8' x 1-3/4" 18 Gauge Metal Door (Unrated).....	542.71	41.33
				<i>For 18 Gauge, Grade II, Heavy Duty, Add</i>	92.01	
				<i>For Up To 1' Extra Height, Add</i>	127.30	
				<i>For 1' To 1'-6" Extra Height, Add</i>	242.87	
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	20.70	
				<i>For Type 304 Stainless Steel Door, Add</i>	372.18	
				<i>For Type 316 Stainless Steel Door, Add</i>	602.21	
				<i>For Embossed Panel, Add</i>	110.41	
				<i>For Galvanized Steel, Add</i>	69.01	
				<i>For Baked Enamel Finish, Add</i>	187.61	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-29.20	
				<i>For >100, Deduct</i>	-42.77	
				<i>For 2" Thick Door, Add</i>	35.42	
				<i>For Insulated Door (Polystyrene Core), Add</i>	46.01	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	115.02	
				<i>For Seamless Edge (Welded), Add</i>	57.51	
				<i>For Steel Stiffened, Add</i>	115.02	
08 13 13 13-0102	EA			2'-8" x 8' x 1-3/4" 18 Gauge Metal Door (Unrated).....	549.57	41.33
				<i>For 18 Gauge, Grade II, Heavy Duty, Add</i>	93.38	
				<i>For Up To 1' Extra Height, Add</i>	129.20	
				<i>For 1' To 1'-6" Extra Height, Add</i>	246.49	
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	21.01	
				<i>For Type 304 Stainless Steel Door, Add</i>	377.67	
				<i>For Type 316 Stainless Steel Door, Add</i>	611.13	
				<i>For Embossed Panel, Add</i>	112.06	
				<i>For Galvanized Steel, Add</i>	70.04	
				<i>For Baked Enamel Finish, Add</i>	189.67	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-29.54	
				<i>For >100, Deduct</i>	-43.28	
				<i>For 2" Thick Door, Add</i>	35.92	
				<i>For Insulated Door (Polystyrene Core), Add</i>	46.69	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	116.73	
				<i>For Seamless Edge (Welded), Add</i>	58.37	
				<i>For Steel Stiffened, Add</i>	116.73	
08 13 13 13-0103	EA			2'-10" x 8' x 1-3/4" 18 Gauge Metal Door (Unrated).....	554.12	42.22
				<i>For 18 Gauge, Grade II, Heavy Duty, Add</i>	93.93	
				<i>For Up To 1' Extra Height, Add</i>	129.96	
				<i>For 1' To 1'-6" Extra Height, Add</i>	247.94	
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	21.14	
				<i>For Type 304 Stainless Steel Door, Add</i>	379.96	
				<i>For Type 316 Stainless Steel Door, Add</i>	614.79	
				<i>For Embossed Panel, Add</i>	112.72	
				<i>For Galvanized Steel, Add</i>	70.45	
				<i>For Baked Enamel Finish, Add</i>	191.57	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-29.82	
				<i>For >100, Deduct</i>	-43.67	
				<i>For 2" Thick Door, Add</i>	36.16	
				<i>For Insulated Door (Polystyrene Core), Add</i>	46.97	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	117.42	
				<i>For Seamless Edge (Welded), Add</i>	58.71	
				<i>For Steel Stiffened, Add</i>	117.42	

08 Openings
08 10 Doors And Frames
08 13 Metal Doors



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 13 13	13-0104	EA	3' x 8' x 1-3/4" 18 Gauge Metal Door (Unrated)	558.66	43.12
			For 18 Gauge, Grade II, Heavy Duty, Add	94.48	
			For Up To 1' Extra Height, Add	130.72	
			For 1' To 1'-6" Extra Height, Add	249.39	
			For Composite Door Instead Of Full Panel Door, Add	21.26	
			For Type 304 Stainless Steel Door, Add	382.24	
			For Type 316 Stainless Steel Door, Add	618.45	
			For Embossed Panel, Add	113.38	
			For Galvanized Steel, Add	70.86	
			For Baked Enamel Finish, Add	193.47	
			For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
			For 45 Minutes Rated Door And FM Label, Add	41.40	
			For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
			For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
			For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
			For >50 To 100, Deduct	-30.09	
			For >100, Deduct	-44.06	
			For 2" Thick Door, Add	36.41	
			For Insulated Door (Polystyrene Core), Add	47.24	
			For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	118.10	
			For Seamless Edge (Welded), Add	59.05	
			For Steel Stiffened, Add	118.10	
08 13 13	13-0105	EA	3'-4" x 8' x 1-3/4" 18 Gauge Metal Door (Unrated).....	594.37	43.12
			For 18 Gauge, Grade II, Heavy Duty, Add	101.62	
			For Up To 1' Extra Height, Add	140.60	
			For 1' To 1'-6" Extra Height, Add	268.24	
			For Composite Door Instead Of Full Panel Door, Add	22.87	
			For Type 304 Stainless Steel Door, Add	410.81	
			For Type 316 Stainless Steel Door, Add	664.87	
			For Embossed Panel, Add	121.95	
			For Galvanized Steel, Add	76.22	
			For Baked Enamel Finish, Add	204.19	
			For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
			For 45 Minutes Rated Door And FM Label, Add	41.40	
			For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
			For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
			For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
			For >50 To 100, Deduct	-31.87	
			For >100, Deduct	-46.73	
			For 2" Thick Door, Add	38.99	
			For Insulated Door (Polystyrene Core), Add	50.81	
			For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	127.03	
			For Seamless Edge (Welded), Add	63.52	
			For Steel Stiffened, Add	127.03	
08 13 13	13-0106	EA	3'-6" x 8' x 1-3/4" 18 Gauge Metal Door (Unrated).....	611.70	44.92
			For 18 Gauge, Grade II, Heavy Duty, Add	104.37	
			For Up To 1' Extra Height, Add	144.40	
			For 1' To 1'-6" Extra Height, Add	275.49	
			For Composite Door Instead Of Full Panel Door, Add	23.48	
			For Type 304 Stainless Steel Door, Add	421.98	
			For Type 316 Stainless Steel Door, Add	682.91	
			For Embossed Panel, Add	125.25	
			For Galvanized Steel, Add	78.28	
			For Baked Enamel Finish, Add	210.46	
			For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
			For 45 Minutes Rated Door And FM Label, Add	41.40	
			For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
			For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
			For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
			For >50 To 100, Deduct	-32.83	
			For >100, Deduct	-48.12	
			For 2" Thick Door, Add	40.08	
			For Insulated Door (Polystyrene Core), Add	52.19	
			For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	130.47	
			For Seamless Edge (Welded), Add	65.23	
			For Steel Stiffened, Add	130.47	
08 13 13	13-0107	EA	4' x 8' x 1-3/4" 18 Gauge Metal Door (Unrated)	673.82	48.51
			For 18 Gauge, Grade II, Heavy Duty, Add	115.36	
			For Up To 1' Extra Height, Add	159.60	
			For 1' To 1'-6" Extra Height, Add	304.49	
			For Composite Door Instead Of Full Panel Door, Add	25.96	
			For Type 304 Stainless Steel Door, Add	466.28	
			For Type 316 Stainless Steel Door, Add	754.68	
			For Embossed Panel, Add	138.43	
			For Galvanized Steel, Add	86.52	
			For Baked Enamel Finish, Add	231.26	
			For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
			For 45 Minutes Rated Door And FM Label, Add	41.40	
			For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
			For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
			For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
			For >50 To 100, Deduct	-36.12	
			For >100, Deduct	-52.96	
			For 2" Thick Door, Add	44.24	
			For Insulated Door (Polystyrene Core), Add	57.68	
			For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	144.20	
			For Seamless Edge (Welded), Add	72.10	
			For Steel Stiffened, Add	144.20	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 13 13	13-0108	PR		Pair 2'-6" x 8' x 1-3/4" 18 Gauge Metal Door (Unrated)	1,077.15	78.52
				<i>For 18 Gauge, Grade II, Heavy Duty, Add</i>	184.02	
				<i>For Up To 1' Extra Height, Add</i>	254.59	
				<i>For 1' To 1'-6" Extra Height, Add</i>	485.73	
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	41.40	
				<i>For Type 304 Stainless Steel Door, Add</i>	743.94	
				<i>For Type 316 Stainless Steel Door, Add</i>	1,204.00	
				<i>For Embossed Panel, Add</i>	220.83	
				<i>For Galvanized Steel, Add</i>	138.02	
				<i>For Baked Enamel Finish, Add</i>	370.26	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-57.78	
				<i>For >100, Deduct</i>	-84.71	
				<i>For 2" Thick Door, Add</i>	70.63	
				<i>For Insulated Door (Polystyrene Core), Add</i>	92.01	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	230.03	
				<i>For Seamless Edge (Welded), Add</i>	115.01	
				<i>For Steel Stiffened, Add</i>	230.03	
08 13 13	13-0109	PR		Pair 2'-8" x 8' x 1-3/4" 18 Gauge Metal Door (Unrated)	1,090.89	78.52
				<i>For 18 Gauge, Grade II, Heavy Duty, Add</i>	186.77	
				<i>For Up To 1' Extra Height, Add</i>	258.40	
				<i>For 1' To 1'-6" Extra Height, Add</i>	492.98	
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	42.02	
				<i>For Type 304 Stainless Steel Door, Add</i>	754.93	
				<i>For Type 316 Stainless Steel Door, Add</i>	1,221.86	
				<i>For Embossed Panel, Add</i>	224.12	
				<i>For Galvanized Steel, Add</i>	140.08	
				<i>For Baked Enamel Finish, Add</i>	374.38	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-58.47	
				<i>For >100, Deduct</i>	-85.74	
				<i>For 2" Thick Door, Add</i>	71.63	
				<i>For Insulated Door (Polystyrene Core), Add</i>	93.39	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	233.46	
				<i>For Seamless Edge (Welded), Add</i>	116.73	
				<i>For Steel Stiffened, Add</i>	233.46	
08 13 13	13-0110	PR		Pair 2'-10" x 8' x 1-3/4" 18 Gauge Metal Door (Unrated)	1,079.49	70.08
				<i>For 18 Gauge, Grade II, Heavy Duty, Add</i>	187.87	
				<i>For Up To 1' Extra Height, Add</i>	259.92	
				<i>For 1' To 1'-6" Extra Height, Add</i>	495.88	
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	42.27	
				<i>For Type 304 Stainless Steel Door, Add</i>	758.48	
				<i>For Type 316 Stainless Steel Door, Add</i>	1,228.15	
				<i>For Embossed Panel, Add</i>	225.44	
				<i>For Galvanized Steel, Add</i>	140.90	
				<i>For Baked Enamel Finish, Add</i>	365.89	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-57.48	
				<i>For >100, Deduct</i>	-84.47	
				<i>For 2" Thick Door, Add</i>	71.61	
				<i>For Insulated Door (Polystyrene Core), Add</i>	93.93	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	234.84	
				<i>For Seamless Edge (Welded), Add</i>	117.42	
				<i>For Steel Stiffened, Add</i>	234.84	
08 13 13	13-0111	PR		Pair 3' x 8' x 1-3/4" 18 Gauge Metal Door (Unrated)	1,108.69	81.94
				<i>For 18 Gauge, Grade II, Heavy Duty, Add</i>	188.97	
				<i>For Up To 1' Extra Height, Add</i>	261.43	
				<i>For 1' To 1'-6" Extra Height, Add</i>	498.78	
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	42.52	
				<i>For Type 304 Stainless Steel Door, Add</i>	764.06	
				<i>For Type 316 Stainless Steel Door, Add</i>	1,236.47	
				<i>For Embossed Panel, Add</i>	226.76	
				<i>For Galvanized Steel, Add</i>	141.72	
				<i>For Baked Enamel Finish, Add</i>	381.77	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-59.53	
				<i>For >100, Deduct</i>	-87.25	
				<i>For 2" Thick Door, Add</i>	72.60	
				<i>For Insulated Door (Polystyrene Core), Add</i>	94.48	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	236.21	
				<i>For Seamless Edge (Welded), Add</i>	118.10	
				<i>For Steel Stiffened, Add</i>	236.21	

08 Openings**08 10 Doors And Frames****08 13 Metal Doors**

MINOR		TOTAL DIRECT	DEMOLITION
CSI	UOM DESCRIPTION	UNIT COST	UNIT COST
08 13 13 13-0112	PR Pair 3'-6" x 8' x 1-3/4" 18 Gauge Metal Door (Unrated)	1,214.40	85.35
	<i>For 18 Gauge, Grade II, Heavy Duty, Add</i>	208.74	
	<i>For Up To 1' Extra Height, Add</i>	288.79	
	<i>For 1' To 1'-6" Extra Height, Add</i>	550.97	
	<i>For Composite Door Instead Of Full Panel Door, Add</i>	46.97	
	<i>For Type 304 Stainless Steel Door, Add</i>	843.50	
	<i>For Type 316 Stainless Steel Door, Add</i>	1,365.36	
	<i>For Embossed Panel, Add</i>	250.49	
	<i>For Galvanized Steel, Add</i>	156.56	
	<i>For Baked Enamel Finish, Add</i>	415.53	
	<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
	<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
	<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
	<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
	<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
	<i>For >50 To 100, Deduct</i>	-64.99	
	<i>For >100, Deduct</i>	-95.35	
	<i>For 2" Thick Door, Add</i>	79.94	
	<i>For Insulated Door (Polystyrene Core), Add</i>	104.37	
	<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	260.93	
	<i>For Seamless Edge (Welded), Add</i>	130.46	
	<i>For Steel Stiffened, Add</i>	260.93	
08 13 13 13-0113	PR Pair 4' x 8' x 1-3/4" 18 Gauge Metal Door (Unrated).....	1,337.93	92.17
	<i>For Composite Door Instead Of Full Panel Door, Add</i>	51.91	
	<i>For Type 304 Stainless Steel Door, Add</i>	932.08	
	<i>For Type 316 Stainless Steel Door, Add</i>	1,508.87	
	<i>For Embossed Panel, Add</i>	276.86	
	<i>For Galvanized Steel, Add</i>	173.04	
	<i>For Baked Enamel Finish, Add</i>	456.68	
	<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
	<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
	<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
	<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
	<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
	<i>For >50 To 100, Deduct</i>	-71.51	
	<i>For >100, Deduct</i>	-104.95	
	<i>For 2" Thick Door, Add</i>	88.24	
	<i>For Insulated Door (Polystyrene Core), Add</i>	115.36	
	<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	288.40	
	<i>For Seamless Edge (Welded), Add</i>	144.20	
	<i>For Steel Stiffened, Add</i>	288.40	
08 13 13 13-0114	16 Gauge 1-3/4" Unrated Door <small>(08 13 13 13)</small>		
08 13 13 13-0115	6'-8" High <small>(08 13 13 13-0114)</small>		
08 13 13 13-0116	EA 2' x 6'-8" x 1-3/4" 16 Gauge Metal Door (Unrated).....	581.31	39.53
	<i>For 16 Gauge, Grade III, Extra Heavy Duty, Add</i>	150.68	
	<i>For 14 Gauge, Grade III, Extra Heavy Duty, Add</i>	200.90	
	<i>For Composite Door Instead Of Full Panel Door, Add</i>	22.60	
	<i>For Type 304 Stainless Steel Door, Add</i>	405.75	
	<i>For Type 316 Stainless Steel Door, Add</i>	656.88	
	<i>For Embossed Panel, Add</i>	120.54	
	<i>For Galvanized Steel, Add</i>	75.34	
	<i>For Baked Enamel Finish, Add</i>	198.11	
	<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
	<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
	<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
	<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
	<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
	<i>For >50 To 100, Deduct</i>	-31.04	
	<i>For >100, Deduct</i>	-45.57	
	<i>For 2" Thick Door, Add</i>	38.39	
	<i>For Insulated Door (Polystyrene Core), Add</i>	50.23	
	<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	125.56	
	<i>For Seamless Edge (Welded), Add</i>	62.78	
	<i>For Steel Stiffened, Add</i>	125.56	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 13 13	13-0117	EA		2'-4" x 6'-8" x 1-3/4" 16 Gauge Metal Door (Unrated)	581.31	39.53
				<i>For 16 Gauge, Grade III, Extra Heavy Duty, Add</i>	150.68	
				<i>For 14 Gauge, Grade III, Extra Heavy Duty, Add</i>	200.90	
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	22.60	
				<i>For Type 304 Stainless Steel Door, Add</i>	405.75	
				<i>For Type 316 Stainless Steel Door, Add</i>	656.88	
				<i>For Embossed Panel, Add</i>	120.54	
				<i>For Galvanized Steel, Add</i>	75.34	
				<i>For Baked Enamel Finish, Add</i>	198.11	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-31.04	
				<i>For >100, Deduct</i>	-45.57	
				<i>For 2" Thick Door, Add</i>	38.39	
				<i>For Insulated Door (Polystyrene Core), Add</i>	50.23	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	125.56	
				<i>For Seamless Edge (Welded), Add</i>	62.78	
				<i>For Steel Stiffened, Add</i>	125.56	
08 13 13	13-0118	EA		2'-6" x 6'-8" x 1-3/4" 16 Gauge Metal Door (Unrated)	595.17	41.33
				<i>For 16 Gauge, Grade III, Extra Heavy Duty, Add</i>	153.76	
				<i>For 14 Gauge, Grade III, Extra Heavy Duty, Add</i>	205.01	
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	23.06	
				<i>For Type 304 Stainless Steel Door, Add</i>	414.15	
				<i>For Type 316 Stainless Steel Door, Add</i>	670.41	
				<i>For Embossed Panel, Add</i>	123.00	
				<i>For Galvanized Steel, Add</i>	76.88	
				<i>For Baked Enamel Finish, Add</i>	203.35	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-31.82	
				<i>For >100, Deduct</i>	-46.70	
				<i>For 2" Thick Door, Add</i>	39.22	
				<i>For Insulated Door (Polystyrene Core), Add</i>	51.25	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	128.13	
				<i>For Seamless Edge (Welded), Add</i>	64.07	
				<i>For Steel Stiffened, Add</i>	128.13	
08 13 13	13-0119	EA		2'-8" x 6'-8" x 1-3/4" 16 Gauge Metal Door (Unrated)	602.82	41.33
				<i>For 16 Gauge, Grade III, Extra Heavy Duty, Add</i>	156.05	
				<i>For 14 Gauge, Grade III, Extra Heavy Duty, Add</i>	208.07	
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	23.41	
				<i>For Type 304 Stainless Steel Door, Add</i>	420.27	
				<i>For Type 316 Stainless Steel Door, Add</i>	680.35	
				<i>For Embossed Panel, Add</i>	124.84	
				<i>For Galvanized Steel, Add</i>	78.03	
				<i>For Baked Enamel Finish, Add</i>	205.64	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-32.21	
				<i>For >100, Deduct</i>	-47.28	
				<i>For 2" Thick Door, Add</i>	39.78	
				<i>For Insulated Door (Polystyrene Core), Add</i>	52.02	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	130.04	
				<i>For Seamless Edge (Welded), Add</i>	65.02	
				<i>For Steel Stiffened, Add</i>	130.04	
08 13 13	13-0120	EA		2'-10" x 6'-8" x 1-3/4" 16 Gauge Metal Door (Unrated)	607.68	42.22
				<i>For 16 Gauge, Grade III, Extra Heavy Duty, Add</i>	156.97	
				<i>For 14 Gauge, Grade III, Extra Heavy Duty, Add</i>	209.29	
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	23.55	
				<i>For Type 304 Stainless Steel Door, Add</i>	422.81	
				<i>For Type 316 Stainless Steel Door, Add</i>	684.42	
				<i>For Embossed Panel, Add</i>	125.58	
				<i>For Galvanized Steel, Add</i>	78.48	
				<i>For Baked Enamel Finish, Add</i>	207.64	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-32.50	
				<i>For >100, Deduct</i>	-47.69	
				<i>For 2" Thick Door, Add</i>	40.05	
				<i>For Insulated Door (Polystyrene Core), Add</i>	52.32	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	130.81	
				<i>For Seamless Edge (Welded), Add</i>	65.40	
				<i>For Steel Stiffened, Add</i>	130.81	

08 Openings
08 10 Doors And Frames
08 13 Metal Doors



MINOR

CSI UOM DESCRIPTION

TOTAL DIRECT
UNIT COSTDEMOLITION
UNIT COST

08 13 13 13-0121	EA 3' x 6'-8" x 1-3/4" 16 Gauge Metal Door (Unrated).....	612.54	43.12
	For 16 Gauge, Grade III, Extra Heavy Duty, Add	157.89	
	For 14 Gauge, Grade III, Extra Heavy Duty, Add	210.52	
	For Composite Door Instead Of Full Panel Door, Add	23.68	
	For Type 304 Stainless Steel Door, Add	425.34	
	For Type 316 Stainless Steel Door, Add	688.49	
	For Embossed Panel, Add	126.31	
	For Galvanized Steel, Add	78.94	
	For Baked Enamel Finish, Add	209.64	
	For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
	For 45 Minutes Rated Door And FM Label, Add	41.40	
	For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
	For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
	For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
	For >50 To 100, Deduct	-32.78	
	For >100, Deduct	-48.10	
	For 2" Thick Door, Add	40.31	
	For Insulated Door (Polystyrene Core), Add	52.63	
	For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	131.57	
	For Seamless Edge (Welded), Add	65.79	
	For Steel Stiffened, Add	131.57	
08 13 13 13-0122	EA 3'-4" x 6'-8" x 1-3/4" 16 Gauge Metal Door (Unrated)	652.32	43.12
	For 16 Gauge, Grade III, Extra Heavy Duty, Add	169.82	
	For 14 Gauge, Grade III, Extra Heavy Duty, Add	226.43	
	For Composite Door Instead Of Full Panel Door, Add	25.47	
	For Type 304 Stainless Steel Door, Add	457.17	
	For Type 316 Stainless Steel Door, Add	740.20	
	For Embossed Panel, Add	135.86	
	For Galvanized Steel, Add	84.91	
	For Baked Enamel Finish, Add	221.57	
	For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
	For 45 Minutes Rated Door And FM Label, Add	41.40	
	For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
	For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
	For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
	For >50 To 100, Deduct	-34.77	
	For >100, Deduct	-51.08	
	For 2" Thick Door, Add	43.20	
	For Insulated Door (Polystyrene Core), Add	56.61	
	For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	141.52	
	For Seamless Edge (Welded), Add	70.76	
	For Steel Stiffened, Add	141.52	
08 13 13 13-0123	EA 3'-6" x 6'-8" x 1-3/4" 16 Gauge Metal Door (Unrated)	671.20	44.92
	For 16 Gauge, Grade III, Extra Heavy Duty, Add	174.41	
	For 14 Gauge, Grade III, Extra Heavy Duty, Add	232.54	
	For Composite Door Instead Of Full Panel Door, Add	26.16	
	For Type 304 Stainless Steel Door, Add	469.58	
	For Type 316 Stainless Steel Door, Add	760.26	
	For Embossed Panel, Add	139.53	
	For Galvanized Steel, Add	87.20	
	For Baked Enamel Finish, Add	228.31	
	For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
	For 45 Minutes Rated Door And FM Label, Add	41.40	
	For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
	For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
	For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
	For >50 To 100, Deduct	-35.81	
	For >100, Deduct	-52.59	
	For 2" Thick Door, Add	44.39	
	For Insulated Door (Polystyrene Core), Add	58.14	
	For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	145.34	
	For Seamless Edge (Welded), Add	72.67	
	For Steel Stiffened, Add	145.34	
08 13 13 13-0124	EA 4' x 6'-8" x 1-3/4" 16 Gauge Metal Door (Unrated).....	739.59	48.51
	For 16 Gauge, Grade III, Extra Heavy Duty, Add	192.77	
	For 14 Gauge, Grade III, Extra Heavy Duty, Add	257.02	
	For Composite Door Instead Of Full Panel Door, Add	28.92	
	For Type 304 Stainless Steel Door, Add	518.90	
	For Type 316 Stainless Steel Door, Add	840.18	
	For Embossed Panel, Add	154.21	
	For Galvanized Steel, Add	96.38	
	For Baked Enamel Finish, Add	250.99	
	For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
	For 45 Minutes Rated Door And FM Label, Add	41.40	
	For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
	For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
	For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
	For >50 To 100, Deduct	-39.41	
	For >100, Deduct	-57.90	
	For 2" Thick Door, Add	49.01	
	For Insulated Door (Polystyrene Core), Add	64.26	
	For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	160.64	
	For Seamless Edge (Welded), Add	80.32	
	For Steel Stiffened, Add	160.64	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 13 13	13-0125	PR		Pair 2'-6" x 6'-8" x 1-3/4" 16 Gauge Metal Door (Unrated).....	1,182.08	78.52
				<i>For 16 Gauge, Grade III, Extra Heavy Duty, Add</i>	307.51	
				<i>For 14 Gauge, Grade III, Extra Heavy Duty, Add</i>	410.02	
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	46.13	
				<i>For Type 304 Stainless Steel Door, Add</i>	827.88	
				<i>For Type 316 Stainless Steel Door, Add</i>	1,340.40	
				<i>For Embossed Panel, Add</i>	246.01	
				<i>For Galvanized Steel, Add</i>	153.76	
				<i>For Baked Enamel Finish, Add</i>	401.74	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-63.03	
				<i>For >100, Deduct</i>	-92.58	
				<i>For 2" Thick Door, Add</i>	78.24	
				<i>For Insulated Door (Polystyrene Core), Add</i>	102.50	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	256.26	
				<i>For Seamless Edge (Welded), Add</i>	128.13	
				<i>For Steel Stiffened, Add</i>	256.26	
08 13 13	13-0126	PR		Pair 2'-8" x 6'-8" x 1-3/4" 16 Gauge Metal Door (Unrated).....	1,197.38	78.52
				<i>For 16 Gauge, Grade III, Extra Heavy Duty, Add</i>	312.10	
				<i>For 14 Gauge, Grade III, Extra Heavy Duty, Add</i>	416.14	
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	46.82	
				<i>For Type 304 Stainless Steel Door, Add</i>	840.12	
				<i>For Type 316 Stainless Steel Door, Add</i>	1,360.29	
				<i>For Embossed Panel, Add</i>	249.68	
				<i>For Galvanized Steel, Add</i>	156.05	
				<i>For Baked Enamel Finish, Add</i>	406.33	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-63.80	
				<i>For >100, Deduct</i>	-93.73	
				<i>For 2" Thick Door, Add</i>	79.35	
				<i>For Insulated Door (Polystyrene Core), Add</i>	104.03	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	260.09	
				<i>For Seamless Edge (Welded), Add</i>	130.04	
				<i>For Steel Stiffened, Add</i>	260.09	
08 13 13	13-0127	PR		Pair 2'-10" x 6'-8" x 1-3/4" 16 Gauge Metal Door (Unrated).....	1,186.61	70.08
				<i>For 16 Gauge, Grade III, Extra Heavy Duty, Add</i>	313.94	
				<i>For 14 Gauge, Grade III, Extra Heavy Duty, Add</i>	418.58	
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	47.09	
				<i>For Type 304 Stainless Steel Door, Add</i>	844.18	
				<i>For Type 316 Stainless Steel Door, Add</i>	1,367.41	
				<i>For Embossed Panel, Add</i>	251.15	
				<i>For Galvanized Steel, Add</i>	156.97	
				<i>For Baked Enamel Finish, Add</i>	398.03	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-62.83	
				<i>For >100, Deduct</i>	-92.50	
				<i>For 2" Thick Door, Add</i>	79.37	
				<i>For Insulated Door (Polystyrene Core), Add</i>	104.65	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	261.62	
				<i>For Seamless Edge (Welded), Add</i>	130.81	
				<i>For Steel Stiffened, Add</i>	261.62	
08 13 13	13-0128	PR		Pair 3' x 6'-8" x 1-3/4" 16 Gauge Metal Door (Unrated).....	1,216.44	81.94
				<i>For 16 Gauge, Grade III, Extra Heavy Duty, Add</i>	315.77	
				<i>For 14 Gauge, Grade III, Extra Heavy Duty, Add</i>	421.03	
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	47.37	
				<i>For Type 304 Stainless Steel Door, Add</i>	850.26	
				<i>For Type 316 Stainless Steel Door, Add</i>	1,376.55	
				<i>For Embossed Panel, Add</i>	252.62	
				<i>For Galvanized Steel, Add</i>	157.89	
				<i>For Baked Enamel Finish, Add</i>	414.09	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-64.92	
				<i>For >100, Deduct</i>	-95.33	
				<i>For 2" Thick Door, Add</i>	80.41	
				<i>For Insulated Door (Polystyrene Core), Add</i>	105.26	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	263.15	
				<i>For Seamless Edge (Welded), Add</i>	131.57	
				<i>For Steel Stiffened, Add</i>	263.15	

08 Openings
08 10 Doors And Frames
08 13 Metal Doors



MINOR		TOTAL DIRECT	DEMOLITION
CSI	UOM DESCRIPTION	UNIT COST	UNIT COST
08 13 13 13-0129	PR Pair 3'-6" x 6'-8" x 1-3/4" 16 Gauge Metal Door (Unrated).....	1,333.42	85.35
	For 16 Gauge, Grade III, Extra Heavy Duty, Add	348.82	
	For 14 Gauge, Grade III, Extra Heavy Duty, Add	465.09	
	For Composite Door Instead Of Full Panel Door, Add	52.32	
	For Type 304 Stainless Steel Door, Add	938.72	
	For Type 316 Stainless Steel Door, Add	1,520.08	
	For Embossed Panel, Add	279.06	
	For Galvanized Steel, Add	174.41	
	For Baked Enamel Finish, Add	451.23	
	For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
	For 45 Minutes Rated Door And FM Label, Add	41.40	
	For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
	For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
	For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
	For >50 To 100, Deduct	-70.94	
	For >100, Deduct	-104.27	
	For 2" Thick Door, Add	88.57	
	For Insulated Door (Polystyrene Core), Add	116.27	
	For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	290.68	
	For Seamless Edge (Welded), Add	145.34	
	For Steel Stiffened, Add	290.68	
08 13 13 13-0130	PR Pair 4' x 6'-8" x 1-3/4" 16 Gauge Metal Door (Unrated).....	1,469.47	92.17
	For 16 Gauge, Grade III, Extra Heavy Duty, Add	385.54	
	For 14 Gauge, Grade III, Extra Heavy Duty, Add	514.05	
	For Composite Door Instead Of Full Panel Door, Add	57.83	
	For Type 304 Stainless Steel Door, Add	1,037.31	
	For Type 316 Stainless Steel Door, Add	1,679.87	
	For Embossed Panel, Add	308.43	
	For Galvanized Steel, Add	192.77	
	For Baked Enamel Finish, Add	496.15	
	For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
	For 45 Minutes Rated Door And FM Label, Add	41.40	
	For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
	For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
	For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
	For >50 To 100, Deduct	-78.08	
	For >100, Deduct	-114.82	
	For 2" Thick Door, Add	97.78	
	For Insulated Door (Polystyrene Core), Add	128.51	
	For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	321.28	
	For Seamless Edge (Welded), Add	160.64	
	For Steel Stiffened, Add	321.28	
08 13 13 13-0131	7' High (08 13 13 13-0114)		
08 13 13 13-0132	EA 2' x 7' x 1-3/4" 16 Gauge Metal Door (Unrated).....	593.23	39.53
	For 16 Gauge, Grade III, Extra Heavy Duty, Add	154.25	
	For 14 Gauge, Grade III, Extra Heavy Duty, Add	205.67	
	For Composite Door Instead Of Full Panel Door, Add	23.14	
	For Type 304 Stainless Steel Door, Add	415.29	
	For Type 316 Stainless Steel Door, Add	672.37	
	For Embossed Panel, Add	123.40	
	For Galvanized Steel, Add	77.13	
	For Baked Enamel Finish, Add	201.69	
	For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
	For 45 Minutes Rated Door And FM Label, Add	41.40	
	For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
	For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
	For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
	For >50 To 100, Deduct	-31.64	
	For >100, Deduct	-46.47	
	For 2" Thick Door, Add	39.25	
	For Insulated Door (Polystyrene Core), Add	51.42	
	For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	128.54	
	For Seamless Edge (Welded), Add	64.27	
	For Steel Stiffened, Add	128.54	
08 13 13 13-0133	EA 2'-4" x 7' x 1-3/4" 16 Gauge Metal Door (Unrated).....	593.23	39.53
	For 16 Gauge, Grade III, Extra Heavy Duty, Add	154.25	
	For 14 Gauge, Grade III, Extra Heavy Duty, Add	205.67	
	For Composite Door Instead Of Full Panel Door, Add	23.14	
	For Type 304 Stainless Steel Door, Add	415.29	
	For Type 316 Stainless Steel Door, Add	672.37	
	For Embossed Panel, Add	123.40	
	For Galvanized Steel, Add	77.13	
	For Baked Enamel Finish, Add	201.69	
	For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
	For 45 Minutes Rated Door And FM Label, Add	41.40	
	For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
	For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
	For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
	For >50 To 100, Deduct	-31.64	
	For >100, Deduct	-46.47	
	For 2" Thick Door, Add	39.25	
	For Insulated Door (Polystyrene Core), Add	51.42	
	For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	128.54	
	For Seamless Edge (Welded), Add	64.27	
	For Steel Stiffened, Add	128.54	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 13 13 13-0134	EA			2'-6" x 7' x 1-3/4" 16 Gauge Metal Door (Unrated).....	607.33	41.33
				<i>For 16 Gauge, Grade III, Extra Heavy Duty, Add</i>	157.40	
				<i>For 14 Gauge, Grade III, Extra Heavy Duty, Add</i>	209.87	
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	23.61	
				<i>For Type 304 Stainless Steel Door, Add</i>	423.88	
				<i>For Type 316 Stainless Steel Door, Add</i>	686.22	
				<i>For Embossed Panel, Add</i>	125.92	
				<i>For Galvanized Steel, Add</i>	78.70	
				<i>For Baked Enamel Finish, Add</i>	206.99	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-32.43	
				<i>For >100, Deduct</i>	-47.62	
				<i>For 2" Thick Door, Add</i>	40.11	
				<i>For Insulated Door (Polystyrene Core), Add</i>	52.47	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	131.17	
				<i>For Seamless Edge (Welded), Add</i>	65.59	
				<i>For Steel Stiffened, Add</i>	131.17	
08 13 13 13-0135	EA			2'-8" x 7' x 1-3/4" 16 Gauge Metal Door (Unrated).....	615.16	41.33
				<i>For 16 Gauge, Grade III, Extra Heavy Duty, Add</i>	159.75	
				<i>For 14 Gauge, Grade III, Extra Heavy Duty, Add</i>	213.00	
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	23.96	
				<i>For Type 304 Stainless Steel Door, Add</i>	430.14	
				<i>For Type 316 Stainless Steel Door, Add</i>	696.40	
				<i>For Embossed Panel, Add</i>	127.80	
				<i>For Galvanized Steel, Add</i>	79.88	
				<i>For Baked Enamel Finish, Add</i>	209.34	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-32.82	
				<i>For >100, Deduct</i>	-48.20	
				<i>For 2" Thick Door, Add</i>	40.67	
				<i>For Insulated Door (Polystyrene Core), Add</i>	53.25	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	133.13	
				<i>For Seamless Edge (Welded), Add</i>	66.56	
				<i>For Steel Stiffened, Add</i>	133.13	
08 13 13 13-0136	EA			2'-10" x 7' x 1-3/4" 16 Gauge Metal Door (Unrated).....	620.09	42.22
				<i>For 16 Gauge, Grade III, Extra Heavy Duty, Add</i>	160.69	
				<i>For 14 Gauge, Grade III, Extra Heavy Duty, Add</i>	214.26	
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	24.10	
				<i>For Type 304 Stainless Steel Door, Add</i>	432.73	
				<i>For Type 316 Stainless Steel Door, Add</i>	700.55	
				<i>For Embossed Panel, Add</i>	128.55	
				<i>For Galvanized Steel, Add</i>	80.35	
				<i>For Baked Enamel Finish, Add</i>	211.36	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-33.12	
				<i>For >100, Deduct</i>	-48.62	
				<i>For 2" Thick Door, Add</i>	40.95	
				<i>For Insulated Door (Polystyrene Core), Add</i>	53.56	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	133.91	
				<i>For Seamless Edge (Welded), Add</i>	66.96	
				<i>For Steel Stiffened, Add</i>	133.91	
08 13 13 13-0137	EA			3' x 7' x 1-3/4" 16 Gauge Metal Door (Unrated)	625.03	43.12
				<i>For 16 Gauge, Grade III, Extra Heavy Duty, Add</i>	161.63	
				<i>For 14 Gauge, Grade III, Extra Heavy Duty, Add</i>	215.51	
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	24.25	
				<i>For Type 304 Stainless Steel Door, Add</i>	435.34	
				<i>For Type 316 Stainless Steel Door, Add</i>	704.73	
				<i>For Embossed Panel, Add</i>	129.31	
				<i>For Galvanized Steel, Add</i>	80.82	
				<i>For Baked Enamel Finish, Add</i>	213.38	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-33.41	
				<i>For >100, Deduct</i>	-49.03	
				<i>For 2" Thick Door, Add</i>	41.22	
				<i>For Insulated Door (Polystyrene Core), Add</i>	53.88	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	134.70	
				<i>For Seamless Edge (Welded), Add</i>	67.35	
				<i>For Steel Stiffened, Add</i>	134.70	

08 Openings
08 10 Doors And Frames
08 13 Metal Doors



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 13 13	13-0138	EA	3'-4" x 7' x 1-3/4" 16 Gauge Metal Door (Unrated).....	665.75	43.12
			For 16 Gauge, Grade III, Extra Heavy Duty, Add	173.85	
			For 14 Gauge, Grade III, Extra Heavy Duty, Add	231.80	
			For Composite Door Instead Of Full Panel Door, Add	26.08	
			For Type 304 Stainless Steel Door, Add	467.91	
			For Type 316 Stainless Steel Door, Add	757.66	
			For Embossed Panel, Add	139.08	
			For Galvanized Steel, Add	86.93	
			For Baked Enamel Finish, Add	225.60	
			For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
			For 45 Minutes Rated Door And FM Label, Add	41.40	
			For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
			For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
			For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
			For >50 To 100, Deduct	-35.44	
			For >100, Deduct	-52.09	
			For 2" Thick Door, Add	44.17	
			For Insulated Door (Polystyrene Core), Add	57.95	
			For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	144.88	
			For Seamless Edge (Welded), Add	72.44	
			For Steel Stiffened, Add	144.88	
08 13 13	13-0139	EA	3'-6" x 7' x 1-3/4" 16 Gauge Metal Door (Unrated).....	685.00	44.92
			For 16 Gauge, Grade III, Extra Heavy Duty, Add	178.55	
			For 14 Gauge, Grade III, Extra Heavy Duty, Add	238.06	
			For Composite Door Instead Of Full Panel Door, Add	26.78	
			For Type 304 Stainless Steel Door, Add	480.62	
			For Type 316 Stainless Steel Door, Add	778.20	
			For Embossed Panel, Add	142.84	
			For Galvanized Steel, Add	89.27	
			For Baked Enamel Finish, Add	232.45	
			For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
			For 45 Minutes Rated Door And FM Label, Add	41.40	
			For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
			For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
			For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
			For >50 To 100, Deduct	-36.50	
			For >100, Deduct	-53.62	
			For 2" Thick Door, Add	45.40	
			For Insulated Door (Polystyrene Core), Add	59.52	
			For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	148.79	
			For Seamless Edge (Welded), Add	74.40	
			For Steel Stiffened, Add	148.79	
08 13 13	13-0140	EA	4' x 7' x 1-3/4" 16 Gauge Metal Door (Unrated).....	754.84	48.51
			For 16 Gauge, Grade III, Extra Heavy Duty, Add	197.34	
			For 14 Gauge, Grade III, Extra Heavy Duty, Add	263.12	
			For Composite Door Instead Of Full Panel Door, Add	29.60	
			For Type 304 Stainless Steel Door, Add	531.10	
			For Type 316 Stainless Steel Door, Add	860.00	
			For Embossed Panel, Add	157.87	
			For Galvanized Steel, Add	98.67	
			For Baked Enamel Finish, Add	255.56	
			For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
			For 45 Minutes Rated Door And FM Label, Add	41.40	
			For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
			For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
			For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
			For >50 To 100, Deduct	-40.17	
			For >100, Deduct	-59.04	
			For 2" Thick Door, Add	50.12	
			For Insulated Door (Polystyrene Core), Add	65.78	
			For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	164.45	
			For Seamless Edge (Welded), Add	82.23	
			For Steel Stiffened, Add	164.45	
08 13 13	13-0141	PR	Pair 2'-6" x 7' x 1-3/4" 16 Gauge Metal Door (Unrated).....	1,206.40	78.52
			For 16 Gauge, Grade III, Extra Heavy Duty, Add	314.81	
			For 14 Gauge, Grade III, Extra Heavy Duty, Add	419.74	
			For Composite Door Instead Of Full Panel Door, Add	47.22	
			For Type 304 Stainless Steel Door, Add	847.34	
			For Type 316 Stainless Steel Door, Add	1,372.02	
			For Embossed Panel, Add	251.85	
			For Galvanized Steel, Add	157.40	
			For Baked Enamel Finish, Add	409.03	
			For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
			For 45 Minutes Rated Door And FM Label, Add	41.40	
			For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
			For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
			For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
			For >50 To 100, Deduct	-64.25	
			For >100, Deduct	-94.41	
			For 2" Thick Door, Add	80.00	
			For Insulated Door (Polystyrene Core), Add	104.94	
			For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	262.34	
			For Seamless Edge (Welded), Add	131.17	
			For Steel Stiffened, Add	262.34	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 13 13	13-0142	PR	Pair 2'-8" x 7' x 1-3/4" 16 Gauge Metal Door (Unrated)	1,222.07	78.52
			<i>For 16 Gauge, Grade III, Extra Heavy Duty, Add</i>	319.51	
			<i>For 14 Gauge, Grade III, Extra Heavy Duty, Add</i>	426.01	
			<i>For Composite Door Instead Of Full Panel Door, Add</i>	47.93	
			<i>For Type 304 Stainless Steel Door, Add</i>	859.88	
			<i>For Type 316 Stainless Steel Door, Add</i>	1,392.39	
			<i>For Embossed Panel, Add</i>	255.61	
			<i>For Galvanized Steel, Add</i>	159.75	
			<i>For Baked Enamel Finish, Add</i>	413.73	
			<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
			<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
			<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
			<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
			<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
			<i>For >50 To 100, Deduct</i>	-65.03	
			<i>For >100, Deduct</i>	-95.58	
			<i>For 2" Thick Door, Add</i>	81.14	
			<i>For Insulated Door (Polystyrene Core), Add</i>	106.50	
			<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	266.26	
			<i>For Seamless Edge (Welded), Add</i>	133.13	
			<i>For Steel Stiffened, Add</i>	266.26	
08 13 13	13-0143	PR	Pair 2'-10" x 7' x 1-3/4" 16 Gauge Metal Door (Unrated)	1,211.44	70.08
			<i>For 16 Gauge, Grade III, Extra Heavy Duty, Add</i>	321.39	
			<i>For 14 Gauge, Grade III, Extra Heavy Duty, Add</i>	428.52	
			<i>For Composite Door Instead Of Full Panel Door, Add</i>	48.21	
			<i>For Type 304 Stainless Steel Door, Add</i>	864.04	
			<i>For Type 316 Stainless Steel Door, Add</i>	1,399.68	
			<i>For Embossed Panel, Add</i>	257.11	
			<i>For Galvanized Steel, Add</i>	160.69	
			<i>For Baked Enamel Finish, Add</i>	405.48	
			<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
			<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
			<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
			<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
			<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
			<i>For >50 To 100, Deduct</i>	-64.08	
			<i>For >100, Deduct</i>	-94.36	
			<i>For 2" Thick Door, Add</i>	81.17	
			<i>For Insulated Door (Polystyrene Core), Add</i>	107.13	
			<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	267.82	
			<i>For Seamless Edge (Welded), Add</i>	133.91	
			<i>For Steel Stiffened, Add</i>	267.82	
08 13 13	13-0144	PR	Pair 3' x 7' x 1-3/4" 16 Gauge Metal Door (Unrated)	1,241.42	81.94
			<i>For 16 Gauge, Grade III, Extra Heavy Duty, Add</i>	323.27	
			<i>For 14 Gauge, Grade III, Extra Heavy Duty, Add</i>	431.02	
			<i>For Composite Door Instead Of Full Panel Door, Add</i>	48.49	
			<i>For Type 304 Stainless Steel Door, Add</i>	870.24	
			<i>For Type 316 Stainless Steel Door, Add</i>	1,409.02	
			<i>For Embossed Panel, Add</i>	258.61	
			<i>For Galvanized Steel, Add</i>	161.63	
			<i>For Baked Enamel Finish, Add</i>	421.58	
			<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
			<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
			<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
			<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
			<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
			<i>For >50 To 100, Deduct</i>	-66.17	
			<i>For >100, Deduct</i>	-97.20	
			<i>For 2" Thick Door, Add</i>	82.22	
			<i>For Insulated Door (Polystyrene Core), Add</i>	107.76	
			<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	269.39	
			<i>For Seamless Edge (Welded), Add</i>	134.70	
			<i>For Steel Stiffened, Add</i>	269.39	
08 13 13	13-0145	PR	Pair 3'-6" x 7' x 1-3/4" 16 Gauge Metal Door (Unrated)	1,361.01	85.35
			<i>For 16 Gauge, Grade III, Extra Heavy Duty, Add</i>	357.10	
			<i>For 14 Gauge, Grade III, Extra Heavy Duty, Add</i>	476.13	
			<i>For Composite Door Instead Of Full Panel Door, Add</i>	53.56	
			<i>For Type 304 Stainless Steel Door, Add</i>	960.79	
			<i>For Type 316 Stainless Steel Door, Add</i>	1,555.95	
			<i>For Embossed Panel, Add</i>	285.68	
			<i>For Galvanized Steel, Add</i>	178.55	
			<i>For Baked Enamel Finish, Add</i>	459.51	
			<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
			<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
			<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
			<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
			<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
			<i>For >50 To 100, Deduct</i>	-72.32	
			<i>For >100, Deduct</i>	-106.34	
			<i>For 2" Thick Door, Add</i>	90.57	
			<i>For Insulated Door (Polystyrene Core), Add</i>	119.03	
			<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	297.58	
			<i>For Seamless Edge (Welded), Add</i>	148.79	
			<i>For Steel Stiffened, Add</i>	297.58	

08	Openings
08 10	Doors And Frames
08 13	Metal Doors



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 13 13	13-0146	PR	Pair 4' x 7' x 1-3/4" 16 Gauge Metal Door (Unrated).....	1,499.97	92.17
			<i>For 16 Gauge, Grade III, Extra Heavy Duty, Add</i>	394.69	
			<i>For 14 Gauge, Grade III, Extra Heavy Duty, Add</i>	526.25	
			<i>For Composite Door Instead Of Full Panel Door, Add</i>	59.20	
			<i>For Type 304 Stainless Steel Door, Add</i>	1,061.71	
			<i>For Type 316 Stainless Steel Door, Add</i>	1,719.52	
			<i>For Embossed Panel, Add</i>	315.75	
			<i>For Galvanized Steel, Add</i>	197.34	
			<i>For Baked Enamel Finish, Add</i>	505.30	
			<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
			<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
			<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
			<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
			<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
			<i>For >50 To 100, Deduct</i>	-79.61	
			<i>For >100, Deduct</i>	-117.11	
			<i>For 2" Thick Door, Add</i>	99.99	
			<i>For Insulated Door (Polystyrene Core), Add</i>	131.56	
			<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	328.91	
			<i>For Seamless Edge (Welded), Add</i>	164.45	
			<i>For Steel Stiffened, Add</i>	328.91	
08 13 13	13-0147		7'-2" High (08 13 13 13-0114)		
08 13 13	13-0148	EA	2' x 7'-2" x 1-3/4" 16 Gauge Metal Door (Unrated).....	605.15	39.53
			<i>For 16 Gauge, Grade III, Extra Heavy Duty, Add</i>	157.83	
			<i>For 14 Gauge, Grade III, Extra Heavy Duty, Add</i>	210.44	
			<i>For Composite Door Instead Of Full Panel Door, Add</i>	23.67	
			<i>For Type 304 Stainless Steel Door, Add</i>	424.83	
			<i>For Type 316 Stainless Steel Door, Add</i>	687.87	
			<i>For Embossed Panel, Add</i>	126.26	
			<i>For Galvanized Steel, Add</i>	78.91	
			<i>For Baked Enamel Finish, Add</i>	205.26	
			<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
			<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
			<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
			<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
			<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
			<i>For >50 To 100, Deduct</i>	-32.23	
			<i>For >100, Deduct</i>	-47.36	
			<i>For 2" Thick Door, Add</i>	40.12	
			<i>For Insulated Door (Polystyrene Core), Add</i>	52.61	
			<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	131.52	
			<i>For Seamless Edge (Welded), Add</i>	65.76	
			<i>For Steel Stiffened, Add</i>	131.52	
08 13 13	13-0149	EA	2'-4" x 7'-2" x 1-3/4" 16 Gauge Metal Door (Unrated).....	605.15	39.53
			<i>For 16 Gauge, Grade III, Extra Heavy Duty, Add</i>	157.83	
			<i>For 14 Gauge, Grade III, Extra Heavy Duty, Add</i>	210.44	
			<i>For Composite Door Instead Of Full Panel Door, Add</i>	23.67	
			<i>For Type 304 Stainless Steel Door, Add</i>	424.83	
			<i>For Type 316 Stainless Steel Door, Add</i>	687.87	
			<i>For Embossed Panel, Add</i>	126.26	
			<i>For Galvanized Steel, Add</i>	78.91	
			<i>For Baked Enamel Finish, Add</i>	205.26	
			<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
			<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
			<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
			<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
			<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
			<i>For >50 To 100, Deduct</i>	-32.23	
			<i>For >100, Deduct</i>	-47.36	
			<i>For 2" Thick Door, Add</i>	40.12	
			<i>For Insulated Door (Polystyrene Core), Add</i>	52.61	
			<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	131.52	
			<i>For Seamless Edge (Welded), Add</i>	65.76	
			<i>For Steel Stiffened, Add</i>	131.52	
08 13 13	13-0150	EA	2'-6" x 7'-2" x 1-3/4" 16 Gauge Metal Door (Unrated).....	619.50	41.33
			<i>For 16 Gauge, Grade III, Extra Heavy Duty, Add</i>	161.06	
			<i>For 14 Gauge, Grade III, Extra Heavy Duty, Add</i>	214.74	
			<i>For Composite Door Instead Of Full Panel Door, Add</i>	24.16	
			<i>For Type 304 Stainless Steel Door, Add</i>	433.61	
			<i>For Type 316 Stainless Steel Door, Add</i>	702.04	
			<i>For Embossed Panel, Add</i>	128.84	
			<i>For Galvanized Steel, Add</i>	80.53	
			<i>For Baked Enamel Finish, Add</i>	210.65	
			<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
			<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
			<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
			<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
			<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
			<i>For >50 To 100, Deduct</i>	-33.04	
			<i>For >100, Deduct</i>	-48.53	
			<i>For 2" Thick Door, Add</i>	40.99	
			<i>For Insulated Door (Polystyrene Core), Add</i>	53.69	
			<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	134.21	
			<i>For Seamless Edge (Welded), Add</i>	67.11	
			<i>For Steel Stiffened, Add</i>	134.21	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 13 13	13-0151	EA		2'-8" x 7'-2" x 1-3/4" 16 Gauge Metal Door (Unrated)	627.51	41.33
				<i>For 16 Gauge, Grade III, Extra Heavy Duty, Add</i>	163.46	
				<i>For 14 Gauge, Grade III, Extra Heavy Duty, Add</i>	217.94	
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	24.52	
				<i>For Type 304 Stainless Steel Door, Add</i>	440.02	
				<i>For Type 316 Stainless Steel Door, Add</i>	712.45	
				<i>For Embossed Panel, Add</i>	130.77	
				<i>For Galvanized Steel, Add</i>	81.73	
				<i>For Baked Enamel Finish, Add</i>	213.05	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-33.44	
				<i>For >100, Deduct</i>	-49.13	
				<i>For 2" Thick Door, Add</i>	41.57	
				<i>For Insulated Door (Polystyrene Core), Add</i>	54.49	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	136.22	
				<i>For Seamless Edge (Welded), Add</i>	68.11	
				<i>For Steel Stiffened, Add</i>	136.22	
08 13 13	13-0152	EA		2'-10" x 7'-2" x 1-3/4" 16 Gauge Metal Door (Unrated)	632.51	42.22
				<i>For 16 Gauge, Grade III, Extra Heavy Duty, Add</i>	164.42	
				<i>For 14 Gauge, Grade III, Extra Heavy Duty, Add</i>	219.22	
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	24.66	
				<i>For Type 304 Stainless Steel Door, Add</i>	442.67	
				<i>For Type 316 Stainless Steel Door, Add</i>	716.70	
				<i>For Embossed Panel, Add</i>	131.53	
				<i>For Galvanized Steel, Add</i>	82.21	
				<i>For Baked Enamel Finish, Add</i>	215.09	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-33.74	
				<i>For >100, Deduct</i>	-49.55	
				<i>For 2" Thick Door, Add</i>	41.85	
				<i>For Insulated Door (Polystyrene Core), Add</i>	54.81	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	137.02	
				<i>For Seamless Edge (Welded), Add</i>	68.51	
				<i>For Steel Stiffened, Add</i>	137.02	
08 13 13	13-0153	EA		3' x 7'-2" x 1-3/4" 16 Gauge Metal Door (Unrated)	637.52	43.12
				<i>For 16 Gauge, Grade III, Extra Heavy Duty, Add</i>	165.38	
				<i>For 14 Gauge, Grade III, Extra Heavy Duty, Add</i>	220.51	
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	24.81	
				<i>For Type 304 Stainless Steel Door, Add</i>	445.33	
				<i>For Type 316 Stainless Steel Door, Add</i>	720.96	
				<i>For Embossed Panel, Add</i>	132.30	
				<i>For Galvanized Steel, Add</i>	82.69	
				<i>For Baked Enamel Finish, Add</i>	217.13	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-34.03	
				<i>For >100, Deduct</i>	-49.97	
				<i>For 2" Thick Door, Add</i>	42.12	
				<i>For Insulated Door (Polystyrene Core), Add</i>	55.13	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	137.82	
				<i>For Seamless Edge (Welded), Add</i>	68.91	
				<i>For Steel Stiffened, Add</i>	137.82	
08 13 13	13-0154	EA		3'-4" x 7'-2" x 1-3/4" 16 Gauge Metal Door (Unrated)	679.18	43.12
				<i>For 16 Gauge, Grade III, Extra Heavy Duty, Add</i>	177.88	
				<i>For 14 Gauge, Grade III, Extra Heavy Duty, Add</i>	237.17	
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	26.68	
				<i>For Type 304 Stainless Steel Door, Add</i>	478.66	
				<i>For Type 316 Stainless Steel Door, Add</i>	775.12	
				<i>For Embossed Panel, Add</i>	142.30	
				<i>For Galvanized Steel, Add</i>	88.94	
				<i>For Baked Enamel Finish, Add</i>	229.63	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-36.12	
				<i>For >100, Deduct</i>	-53.09	
				<i>For 2" Thick Door, Add</i>	45.14	
				<i>For Insulated Door (Polystyrene Core), Add</i>	59.29	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	148.23	
				<i>For Seamless Edge (Welded), Add</i>	74.12	
				<i>For Steel Stiffened, Add</i>	148.23	

08 Openings
08 10 Doors And Frames
08 13 Metal Doors



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 13 13	13-0155	EA	3'-6" x 7'-2" x 1-3/4" 16 Gauge Metal Door (Unrated)	698.80	44.92
			For 16 Gauge, Grade III, Extra Heavy Duty, Add	182.69	
			For 14 Gauge, Grade III, Extra Heavy Duty, Add	243.58	
			For Composite Door Instead Of Full Panel Door, Add	27.40	
			For Type 304 Stainless Steel Door, Add	491.66	
			For Type 316 Stainless Steel Door, Add	796.14	
			For Embossed Panel, Add	146.15	
			For Galvanized Steel, Add	91.34	
			For Baked Enamel Finish, Add	236.59	
			For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
			For 45 Minutes Rated Door And FM Label, Add	41.40	
			For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
			For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
			For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
			For >50 To 100, Deduct	-37.19	
			For >100, Deduct	-54.66	
			For 2" Thick Door, Add	46.40	
			For Insulated Door (Polystyrene Core), Add	60.90	
			For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	152.24	
			For Seamless Edge (Welded), Add	76.12	
			For Steel Stiffened, Add	152.24	
08 13 13	13-0156	EA	4' x 7'-2" x 1-3/4" 16 Gauge Metal Door (Unrated).....	770.09	48.51
			For 16 Gauge, Grade III, Extra Heavy Duty, Add	201.92	
			For 14 Gauge, Grade III, Extra Heavy Duty, Add	269.22	
			For Composite Door Instead Of Full Panel Door, Add	30.29	
			For Type 304 Stainless Steel Door, Add	543.30	
			For Type 316 Stainless Steel Door, Add	879.83	
			For Embossed Panel, Add	161.53	
			For Galvanized Steel, Add	100.96	
			For Baked Enamel Finish, Add	260.14	
			For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
			For 45 Minutes Rated Door And FM Label, Add	41.40	
			For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
			For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
			For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
			For >50 To 100, Deduct	-40.93	
			For >100, Deduct	-60.18	
			For 2" Thick Door, Add	51.22	
			For Insulated Door (Polystyrene Core), Add	67.31	
			For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	168.27	
			For Seamless Edge (Welded), Add	84.13	
			For Steel Stiffened, Add	168.27	
08 13 13	13-0157	PR	Pair 2'-6" x 7'-2" x 1-3/4" 16 Gauge Metal Door (Unrated).....	1,230.73	78.52
			For 16 Gauge, Grade III, Extra Heavy Duty, Add	322.11	
			For 14 Gauge, Grade III, Extra Heavy Duty, Add	429.48	
			For Composite Door Instead Of Full Panel Door, Add	48.32	
			For Type 304 Stainless Steel Door, Add	866.80	
			For Type 316 Stainless Steel Door, Add	1,403.65	
			For Embossed Panel, Add	257.69	
			For Galvanized Steel, Add	161.05	
			For Baked Enamel Finish, Add	416.33	
			For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
			For 45 Minutes Rated Door And FM Label, Add	41.40	
			For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
			For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
			For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
			For >50 To 100, Deduct	-65.46	
			For >100, Deduct	-96.23	
			For 2" Thick Door, Add	81.77	
			For Insulated Door (Polystyrene Core), Add	107.37	
			For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	268.42	
			For Seamless Edge (Welded), Add	134.21	
			For Steel Stiffened, Add	268.42	
08 13 13	13-0158	PR	Pair 2'-8" x 7'-2" x 1-3/4" 16 Gauge Metal Door (Unrated).....	1,246.76	78.52
			For 16 Gauge, Grade III, Extra Heavy Duty, Add	326.92	
			For 14 Gauge, Grade III, Extra Heavy Duty, Add	435.89	
			For Composite Door Instead Of Full Panel Door, Add	49.04	
			For Type 304 Stainless Steel Door, Add	879.63	
			For Type 316 Stainless Steel Door, Add	1,424.49	
			For Embossed Panel, Add	261.53	
			For Galvanized Steel, Add	163.46	
			For Baked Enamel Finish, Add	421.14	
			For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
			For 45 Minutes Rated Door And FM Label, Add	41.40	
			For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
			For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
			For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
			For >50 To 100, Deduct	-66.26	
			For >100, Deduct	-97.43	
			For 2" Thick Door, Add	82.93	
			For Insulated Door (Polystyrene Core), Add	108.97	
			For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	272.43	
			For Seamless Edge (Welded), Add	136.22	
			For Steel Stiffened, Add	272.43	



Openings	08	08
Doors And Frames	08 10	
Metal Doors	08 13	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 13 13 13-0159 PR Pair 2'-10" x 7'-2" x 1-3/4" 16 Gauge Metal Door (Unrated).....	1,236.28	70.08
For 16 Gauge, Grade III, Extra Heavy Duty, Add	328.84	
For 14 Gauge, Grade III, Extra Heavy Duty, Add	438.45	
For Composite Door Instead Of Full Panel Door, Add	49.33	
For Type 304 Stainless Steel Door, Add	883.91	
For Type 316 Stainless Steel Door, Add	1,431.98	
For Embossed Panel, Add	263.07	
For Galvanized Steel, Add	164.42	
For Baked Enamel Finish, Add	412.93	
For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
For 45 Minutes Rated Door And FM Label, Add	41.40	
For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
For >50 To 100, Deduct	-65.32	
For >100, Deduct	-96.22	
For 2" Thick Door, Add	82.97	
For Insulated Door (Polystyrene Core), Add	109.61	
For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	274.03	
For Seamless Edge (Welded), Add	137.02	
For Steel Stiffened, Add	274.03	
08 13 13 13-0160 PR Pair 3' x 7'-2" x 1-3/4" 16 Gauge Metal Door (Unrated).....	1,266.40	81.94
For 16 Gauge, Grade III, Extra Heavy Duty, Add	330.76	
For 14 Gauge, Grade III, Extra Heavy Duty, Add	441.02	
For Composite Door Instead Of Full Panel Door, Add	49.61	
For Type 304 Stainless Steel Door, Add	890.23	
For Type 316 Stainless Steel Door, Add	1,441.50	
For Embossed Panel, Add	264.61	
For Galvanized Steel, Add	165.38	
For Baked Enamel Finish, Add	429.08	
For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
For 45 Minutes Rated Door And FM Label, Add	41.40	
For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
For >50 To 100, Deduct	-67.42	
For >100, Deduct	-99.08	
For 2" Thick Door, Add	84.03	
For Insulated Door (Polystyrene Core), Add	110.25	
For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	275.64	
For Seamless Edge (Welded), Add	137.82	
For Steel Stiffened, Add	275.64	
08 13 13 13-0161 PR Pair 3'-6" x 7'-2" x 1-3/4" 16 Gauge Metal Door (Unrated).....	1,388.61	85.35
For 16 Gauge, Grade III, Extra Heavy Duty, Add	365.38	
For 14 Gauge, Grade III, Extra Heavy Duty, Add	487.17	
For Composite Door Instead Of Full Panel Door, Add	54.81	
For Type 304 Stainless Steel Door, Add	982.87	
For Type 316 Stainless Steel Door, Add	1,591.83	
For Embossed Panel, Add	292.30	
For Galvanized Steel, Add	182.69	
For Baked Enamel Finish, Add	467.79	
For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
For 45 Minutes Rated Door And FM Label, Add	41.40	
For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
For >50 To 100, Deduct	-73.70	
For >100, Deduct	-108.41	
For 2" Thick Door, Add	92.57	
For Insulated Door (Polystyrene Core), Add	121.79	
For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	304.48	
For Seamless Edge (Welded), Add	152.24	
For Steel Stiffened, Add	304.48	
08 13 13 13-0162 PR Pair 4' x 7'-2" x 1-3/4" 16 Gauge Metal Door (Unrated).....	1,530.47	92.17
For 16 Gauge, Grade III, Extra Heavy Duty, Add	403.84	
For 14 Gauge, Grade III, Extra Heavy Duty, Add	538.45	
For Composite Door Instead Of Full Panel Door, Add	60.58	
For Type 304 Stainless Steel Door, Add	1,086.11	
For Type 316 Stainless Steel Door, Add	1,759.17	
For Embossed Panel, Add	323.07	
For Galvanized Steel, Add	201.92	
For Baked Enamel Finish, Add	514.45	
For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
For 45 Minutes Rated Door And FM Label, Add	41.40	
For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
For >50 To 100, Deduct	-81.13	
For >100, Deduct	-119.39	
For 2" Thick Door, Add	102.20	
For Insulated Door (Polystyrene Core), Add	134.61	
For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	336.53	
For Seamless Edge (Welded), Add	168.27	
For Steel Stiffened, Add	336.53	

08 13 13 13-0163 8' High (08 13 13 13-0114)

08 Openings
08 10 Doors And Frames
08 13 Metal Doors



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 13 13	13-0164	EA	2' x 8' x 1-3/4" 16 Gauge Metal Door (Unrated)	703.47	39.53
			For 16 Gauge, Grade III, Extra Heavy Duty, Add	187.32	
			For 14 Gauge, Grade III, Extra Heavy Duty, Add	249.76	
			For Up To 1' Extra Height, Add	172.77	
			For Composite Door Instead Of Full Panel Door, Add	28.10	
			For Type 304 Stainless Steel Door, Add	503.48	
			For Type 316 Stainless Steel Door, Add	815.69	
			For Embossed Panel, Add	149.86	
			For Galvanized Steel, Add	93.66	
			For Baked Enamel Finish, Add	234.76	
			For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
			For 45 Minutes Rated Door And FM Label, Add	41.40	
			For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
			For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
			For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
			For >50 To 100, Deduct	-37.15	
			For >100, Deduct	-54.74	
			For 2" Thick Door, Add	47.25	
			For Insulated Door (Polystyrene Core), Add	62.44	
			For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	156.10	
			For Seamless Edge (Welded), Add	78.05	
			For Steel Stiffened, Add	156.10	
08 13 13	13-0165	EA	2'-4" x 8' x 1-3/4" 16 Gauge Metal Door (Unrated).....	703.47	39.53
			For 16 Gauge, Grade III, Extra Heavy Duty, Add	187.32	
			For 14 Gauge, Grade III, Extra Heavy Duty, Add	249.76	
			For Up To 1' Extra Height, Add	172.77	
			For Composite Door Instead Of Full Panel Door, Add	28.10	
			For Type 304 Stainless Steel Door, Add	503.48	
			For Type 316 Stainless Steel Door, Add	815.69	
			For Embossed Panel, Add	149.86	
			For Galvanized Steel, Add	93.66	
			For Baked Enamel Finish, Add	234.76	
			For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
			For 45 Minutes Rated Door And FM Label, Add	41.40	
			For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
			For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
			For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
			For >50 To 100, Deduct	-37.15	
			For >100, Deduct	-54.74	
			For 2" Thick Door, Add	47.25	
			For Insulated Door (Polystyrene Core), Add	62.44	
			For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	156.10	
			For Seamless Edge (Welded), Add	78.05	
			For Steel Stiffened, Add	156.10	
08 13 13	13-0166	EA	2'-6" x 8' x 1-3/4" 16 Gauge Metal Door (Unrated).....	719.83	41.33
			For 16 Gauge, Grade III, Extra Heavy Duty, Add	191.15	
			For 14 Gauge, Grade III, Extra Heavy Duty, Add	254.87	
			For Up To 1' Extra Height, Add	176.31	
			For Composite Door Instead Of Full Panel Door, Add	28.67	
			For Type 304 Stainless Steel Door, Add	513.88	
			For Type 316 Stainless Steel Door, Add	832.47	
			For Embossed Panel, Add	152.92	
			For Galvanized Steel, Add	95.58	
			For Baked Enamel Finish, Add	240.74	
			For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
			For 45 Minutes Rated Door And FM Label, Add	41.40	
			For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
			For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
			For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
			For >50 To 100, Deduct	-38.06	
			For >100, Deduct	-56.05	
			For 2" Thick Door, Add	48.26	
			For Insulated Door (Polystyrene Core), Add	63.72	
			For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	159.30	
			For Seamless Edge (Welded), Add	79.65	
			For Steel Stiffened, Add	159.30	
08 13 13	13-0167	EA	2'-8" x 8' x 1-3/4" 16 Gauge Metal Door (Unrated).....	729.34	41.33
			For 16 Gauge, Grade III, Extra Heavy Duty, Add	194.01	
			For 14 Gauge, Grade III, Extra Heavy Duty, Add	258.68	
			For Up To 1' Extra Height, Add	178.94	
			For Composite Door Instead Of Full Panel Door, Add	29.10	
			For Type 304 Stainless Steel Door, Add	521.48	
			For Type 316 Stainless Steel Door, Add	844.83	
			For Embossed Panel, Add	155.21	
			For Galvanized Steel, Add	97.00	
			For Baked Enamel Finish, Add	243.60	
			For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
			For 45 Minutes Rated Door And FM Label, Add	41.40	
			For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
			For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
			For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
			For >50 To 100, Deduct	-38.53	
			For >100, Deduct	-56.77	
			For 2" Thick Door, Add	48.95	
			For Insulated Door (Polystyrene Core), Add	64.67	
			For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	161.67	
			For Seamless Edge (Welded), Add	80.84	
			For Steel Stiffened, Add	161.67	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
	08 13 13	13-0168	EA	2'-10" x 8' x 1-3/4" 16 Gauge Metal Door (Unrated).....	734.94	42.22
				<i>For 16 Gauge, Grade III, Extra Heavy Duty, Add</i>	195.15	
				<i>For 14 Gauge, Grade III, Extra Heavy Duty, Add</i>	260.20	
				<i>For Up To 1' Extra Height, Add</i>	179.99	
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	29.27	
				<i>For Type 304 Stainless Steel Door, Add</i>	524.61	
				<i>For Type 316 Stainless Steel Door, Add</i>	849.86	
				<i>For Embossed Panel, Add</i>	156.12	
				<i>For Galvanized Steel, Add</i>	97.57	
				<i>For Baked Enamel Finish, Add</i>	245.82	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-38.86	
				<i>For >100, Deduct</i>	-57.23	
				<i>For 2" Thick Door, Add</i>	49.27	
				<i>For Insulated Door (Polystyrene Core), Add</i>	65.05	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	162.62	
				<i>For Seamless Edge (Welded), Add</i>	81.31	
				<i>For Steel Stiffened, Add</i>	162.62	
	08 13 13	13-0169	EA	3' x 8' x 1-3/4" 16 Gauge Metal Door (Unrated)	740.54	43.12
				<i>For 16 Gauge, Grade III, Extra Heavy Duty, Add</i>	196.29	
				<i>For 14 Gauge, Grade III, Extra Heavy Duty, Add</i>	261.72	
				<i>For Up To 1' Extra Height, Add</i>	181.04	
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	29.44	
				<i>For Type 304 Stainless Steel Door, Add</i>	527.74	
				<i>For Type 316 Stainless Steel Door, Add</i>	854.89	
				<i>For Embossed Panel, Add</i>	157.03	
				<i>For Galvanized Steel, Add</i>	98.14	
				<i>For Baked Enamel Finish, Add</i>	248.04	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-39.18	
				<i>For >100, Deduct</i>	-57.70	
				<i>For 2" Thick Door, Add</i>	49.59	
				<i>For Insulated Door (Polystyrene Core), Add</i>	65.43	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	163.57	
				<i>For Seamless Edge (Welded), Add</i>	81.79	
				<i>For Steel Stiffened, Add</i>	163.57	
	08 13 13	13-0170	EA	3'-4" x 8' x 1-3/4" 16 Gauge Metal Door (Unrated).....	790.00	43.12
				<i>For 16 Gauge, Grade III, Extra Heavy Duty, Add</i>	211.13	
				<i>For 14 Gauge, Grade III, Extra Heavy Duty, Add</i>	281.50	
				<i>For Up To 1' Extra Height, Add</i>	194.73	
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	31.67	
				<i>For Type 304 Stainless Steel Door, Add</i>	567.31	
				<i>For Type 316 Stainless Steel Door, Add</i>	919.19	
				<i>For Embossed Panel, Add</i>	168.90	
				<i>For Galvanized Steel, Add</i>	105.56	
				<i>For Baked Enamel Finish, Add</i>	262.88	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-41.66	
				<i>For >100, Deduct</i>	-61.41	
				<i>For 2" Thick Door, Add</i>	53.18	
				<i>For Insulated Door (Polystyrene Core), Add</i>	70.38	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	175.94	
				<i>For Seamless Edge (Welded), Add</i>	87.97	
				<i>For Steel Stiffened, Add</i>	175.94	

08 Openings
08 10 Doors And Frames
08 13 Metal Doors



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 13 13	13-0171	EA	3'-6" x 8' x 1-3/4" 16 Gauge Metal Door (Unrated).....	812.61	44.92
			For 16 Gauge, Grade III, Extra Heavy Duty, Add	216.83	
			For 14 Gauge, Grade III, Extra Heavy Duty, Add	289.11	
			For Up To 1' Extra Height, Add	199.99	
			For 1' To 1'-6" Extra Height, Add	381.55	
			For Composite Door Instead Of Full Panel Door, Add	32.52	
			For Type 304 Stainless Steel Door, Add	582.71	
			For Type 316 Stainless Steel Door, Add	944.09	
			For Embossed Panel, Add	173.46	
			For Galvanized Steel, Add	108.42	
			For Baked Enamel Finish, Add	270.74	
			For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
			For 45 Minutes Rated Door And FM Label, Add	41.40	
			For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
			For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
			For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
			For >50 To 100, Deduct	-42.88	
			For >100, Deduct	-63.19	
			For 2" Thick Door, Add	54.65	
			For Insulated Door (Polystyrene Core), Add	72.28	
			For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	180.69	
			For Seamless Edge (Welded), Add	90.35	
			For Steel Stiffened, Add	180.69	
08 13 13	13-0172	EA	4' x 8' x 1-3/4" 16 Gauge Metal Door (Unrated)	895.88	48.51
			For 16 Gauge, Grade III, Extra Heavy Duty, Add	239.66	
			For 14 Gauge, Grade III, Extra Heavy Duty, Add	319.54	
			For Up To 1' Extra Height, Add	221.04	
			For 1' To 1'-6" Extra Height, Add	421.71	
			For Composite Door Instead Of Full Panel Door, Add	35.95	
			For Type 304 Stainless Steel Door, Add	643.93	
			For Type 316 Stainless Steel Door, Add	1,043.36	
			For Embossed Panel, Add	191.72	
			For Galvanized Steel, Add	119.83	
			For Baked Enamel Finish, Add	297.87	
			For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
			For 45 Minutes Rated Door And FM Label, Add	41.40	
			For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
			For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
			For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
			For >50 To 100, Deduct	-47.22	
			For >100, Deduct	-69.62	
			For 2" Thick Door, Add	60.34	
			For Insulated Door (Polystyrene Core), Add	79.89	
			For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	199.71	
			For Seamless Edge (Welded), Add	99.86	
			For Steel Stiffened, Add	199.71	
08 13 13	13-0173	PR	Pair 2'-6" x 8' x 1-3/4" 16 Gauge Metal Door (Unrated)	1,431.40	78.52
			For 16 Gauge, Grade III, Extra Heavy Duty, Add	382.31	
			For 14 Gauge, Grade III, Extra Heavy Duty, Add	509.74	
			For Up To 1' Extra Height, Add	352.62	
			For Composite Door Instead Of Full Panel Door, Add	57.35	
			For Type 304 Stainless Steel Door, Add	1,027.34	
			For Type 316 Stainless Steel Door, Add	1,664.52	
			For Embossed Panel, Add	305.85	
			For Galvanized Steel, Add	191.15	
			For Baked Enamel Finish, Add	476.53	
			For 20 Minutes To 30 Minutes Rated Door And FM Label, Add	27.63	
			For 45 Minutes Rated Door And FM Label, Add	41.40	
			For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add	55.27	
			For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add	93.38	
			For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add	131.50	
			For >50 To 100, Deduct	-75.50	
			For >100, Deduct	-111.28	
			For 2" Thick Door, Add	96.32	
			For Insulated Door (Polystyrene Core), Add	127.44	
			For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add	318.59	
			For Seamless Edge (Welded), Add	159.30	
			For Steel Stiffened, Add	318.59	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 13 13	13-0174	PR		Pair 2'-8" x 8' x 1-3/4" 16 Gauge Metal Door (Unrated)	1,450.42	78.52
				<i>For 16 Gauge, Grade III, Extra Heavy Duty, Add</i>	388.01	
				<i>For 14 Gauge, Grade III, Extra Heavy Duty, Add</i>	517.35	
				<i>For Up To 1' Extra Height, Add</i>	357.88	
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	58.20	
				<i>For Type 304 Stainless Steel Door, Add</i>	1,042.56	
				<i>For Type 316 Stainless Steel Door, Add</i>	1,689.25	
				<i>For Embossed Panel, Add</i>	310.41	
				<i>For Galvanized Steel, Add</i>	194.01	
				<i>For Baked Enamel Finish, Add</i>	482.24	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-76.45	
				<i>For >100, Deduct</i>	-112.71	
				<i>For 2" Thick Door, Add</i>	97.70	
				<i>For Insulated Door (Polystyrene Core), Add</i>	129.34	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	323.35	
				<i>For Seamless Edge (Welded), Add</i>	161.67	
				<i>For Steel Stiffened, Add</i>	323.35	
08 13 13	13-0175	PR		Pair 2'-10" x 8' x 1-3/4" 16 Gauge Metal Door (Unrated)	1,441.14	70.08
				<i>For 16 Gauge, Grade III, Extra Heavy Duty, Add</i>	390.30	
				<i>For 14 Gauge, Grade III, Extra Heavy Duty, Add</i>	520.40	
				<i>For Up To 1' Extra Height, Add</i>	359.98	
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	58.54	
				<i>For Type 304 Stainless Steel Door, Add</i>	1,047.80	
				<i>For Type 316 Stainless Steel Door, Add</i>	1,698.29	
				<i>For Embossed Panel, Add</i>	312.24	
				<i>For Galvanized Steel, Add</i>	195.15	
				<i>For Baked Enamel Finish, Add</i>	474.39	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-75.56	
				<i>For >100, Deduct</i>	-111.59	
				<i>For 2" Thick Door, Add</i>	97.83	
				<i>For Insulated Door (Polystyrene Core), Add</i>	130.10	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	325.25	
				<i>For Seamless Edge (Welded), Add</i>	162.62	
				<i>For Steel Stiffened, Add</i>	325.25	
08 13 13	13-0176	PR		Pair 3' x 8' x 1-3/4" 16 Gauge Metal Door (Unrated)	1,472.46	81.94
				<i>For 16 Gauge, Grade III, Extra Heavy Duty, Add</i>	392.58	
				<i>For 14 Gauge, Grade III, Extra Heavy Duty, Add</i>	523.44	
				<i>For Up To 1' Extra Height, Add</i>	362.09	
				<i>For 1' To 1'-6" Extra Height, Add</i>	690.81	
				<i>For Composite Door Instead Of Full Panel Door, Add</i>	58.89	
				<i>For Type 304 Stainless Steel Door, Add</i>	1,055.07	
				<i>For Type 316 Stainless Steel Door, Add</i>	1,709.37	
				<i>For Embossed Panel, Add</i>	314.06	
				<i>For Galvanized Steel, Add</i>	196.29	
				<i>For Baked Enamel Finish, Add</i>	490.90	
				<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
				<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
				<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
				<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
				<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
				<i>For >50 To 100, Deduct</i>	-77.72	
				<i>For >100, Deduct</i>	-114.53	
				<i>For 2" Thick Door, Add</i>	98.97	
				<i>For Insulated Door (Polystyrene Core), Add</i>	130.86	
				<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	327.15	
				<i>For Seamless Edge (Welded), Add</i>	163.58	
				<i>For Steel Stiffened, Add</i>	327.15	

08	Openings
08 10	Doors And Frames
08 13	Metal Doors



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 13 13	13-0177	PR	Pair 3'-6" x 8' x 1'-3/4" 16 Gauge Metal Door (Unrated)	1,616.23	85.35
			<i>For 16 Gauge, Grade III, Extra Heavy Duty, Add</i>	433.66	
			<i>For 14 Gauge, Grade III, Extra Heavy Duty, Add</i>	578.22	
			<i>For Up To 1' Extra Height, Add</i>	399.98	
			<i>For 1' To 1'-6" Extra Height, Add</i>	763.10	
			<i>For Composite Door Instead Of Full Panel Door, Add</i>	65.05	
			<i>For Type 304 Stainless Steel Door, Add</i>	1,164.97	
			<i>For Type 316 Stainless Steel Door, Add</i>	1,887.74	
			<i>For Embossed Panel, Add</i>	346.93	
			<i>For Galvanized Steel, Add</i>	216.83	
			<i>For Baked Enamel Finish, Add</i>	536.08	
			<i>For 20 Minutes To 30 Minutes Rated Door And FM Label, Add</i>	27.63	
			<i>For 45 Minutes Rated Door And FM Label, Add</i>	41.40	
			<i>For 1 Hour To 1-1/2 Hour Rated Door And FM Label, Add</i>	55.27	
			<i>For 2 Hour To 2-1/2 Hour Rated Door And FM Label, Add</i>	93.38	
			<i>For 3 Hour To 3-1/2 Hour Rated Door And FM Label, Add</i>	131.50	
			<i>For >50 To 100, Deduct</i>	-85.08	
			<i>For >100, Deduct</i>	-125.48	
			<i>For 2" Thick Door, Add</i>	109.07	
			<i>For Insulated Door (Polystyrene Core), Add</i>	144.55	
			<i>For Mineral Composite Fire Door Core, 250 Degree Maximum Temperature Rise, Add</i>	361.39	
			<i>For Seamless Edge (Welded), Add</i>	180.69	
			<i>For Steel Stiffened, Add</i>	361.39	
08 13 13	13-0178	PR	Pair 4' x 8' x 1'-3/4" 16 Gauge Metal Door (Unrated)	1,782.05	92.17
			<i>For 1' To 1'-6" Extra Height, Add</i>	843.43	
			<i>For Seamless Edge (Welded), Add</i>	199.71	
			<i>For Steel Stiffened, Add</i>	399.43	

08 13 76 Bifolding Metal Doors (08 13)**08 13 76 00-0001 Bi-Fold Metal Doors (08 13 76)****08 13 76 00-0002 Steel Full Louver Bi-Fold Doors (08 13 76 00-0001)**

08 13 76 00-0003	EA	1'-6", Two 1" Doors, Painted, 24 Gauge Steel, Full Louvered Bi-Fold	144.87	39.52
08 13 76 00-0004	EA	2'-0", Two 1" Doors, Painted, 24 Gauge Steel, Full Louvered Bi-Fold	157.17	43.10
08 13 76 00-0005	EA	2'-6", Two 1" Doors, Painted, 24 Gauge Steel, Full Louvered Bi-Fold	171.16	46.70
08 13 76 00-0006	EA	3'-0", Two 1" Doors, Painted, 24 Gauge Steel, Full Louvered Bi-Fold	192.91	53.88
08 13 76 00-0007	EA	4'-0", Four 1" Doors, Painted, 24 Gauge Steel, Full Louvered Bi-Fold	246.08	57.47
08 13 76 00-0008	EA	5'-0", Four 1" Doors, Painted, 24 Gauge Steel, Full Louvered Bi-Fold	268.03	61.07
08 13 76 00-0009	EA	6'-0", Four 1" Doors, Painted, 24 Gauge Steel, Full Louvered Bi-Fold	284.29	64.66

08 13 76 00-0010 Steel Half Louver, Half Panel Bi-Fold Doors (08 13 76 00-0001)

08 13 76 00-0011	EA	2'-0", Two 1" Doors, Painted, 24 Gauge Steel, Half Louvered Half Paneled Bi-Fold	163.98	43.10
08 13 76 00-0012	EA	2'-6", Two 1" Doors, Painted, 24 Gauge Steel, Half Louvered Half Paneled Bi-Fold	178.54	46.70
08 13 76 00-0013	EA	3'-0", Two 1" Doors, Painted, 24 Gauge Steel, Half Louvered Half Paneled Bi-Fold	197.45	53.88
08 13 76 00-0014	EA	4'-0", Four 1" Doors, Painted, 24 Gauge Steel, Half Louvered Half Paneled Bi-Fold	258.57	57.47
08 13 76 00-0015	EA	5'-0", Four 1" Doors, Painted, 24 Gauge Steel, Half Louvered Half Paneled Bi-Fold	277.11	61.07
08 13 76 00-0016	EA	6'-0", Four 1" Doors, Painted, 24 Gauge Steel, Half Louvered Half Paneled Bi-Fold	297.92	64.66

08 14 Wood Doors (08 10)

Note: Includes machining for all hardware, except mortised locks. Excludes finish hardware. See CSI section 08 70 00 00-0000 for finish hardware.

08 14 16 Flush Wood Doors (08 14)**08 14 16 00-0001 Hollow Core Doors, 1-3/8" Thick (08 14 16)****08 14 16 00-0002 Birch Faced (08 14 16 00-0001)**

08 14 16 00-0003	EA	2'-0" Or 2'-4" x 7' x 1-3/8" Hollow Core, Birch Faced Door	215.29	39.53
		<i>For Each 1' Of Additional Door Height, Add</i>	32.70	
		<i>For >50 To 100, Deduct</i>	-12.74	
		<i>For >100, Deduct</i>	-18.12	
08 14 16 00-0004	EA	2'-6" x 7' x 1-3/8" Hollow Core, Birch Faced Door	228.53	41.33
		<i>For Each 1' Of Additional Door Height, Add</i>	35.01	
		<i>For >50 To 100, Deduct</i>	-13.49	
		<i>For >100, Deduct</i>	-19.21	
08 14 16 00-0005	EA	2'-8" x 7' x 1-3/8" Hollow Core, Birch Faced Door	235.63	41.33
		<i>For Each 1' Of Additional Door Height, Add</i>	36.72	
		<i>For >50 To 100, Deduct</i>	-13.85	
		<i>For >100, Deduct</i>	-19.74	
08 14 16 00-0006	EA	3' x 7' x 1-3/8" Hollow Core, Birch Faced Door	241.72	43.12
		<i>For Each 1' Of Additional Door Height, Add</i>	37.31	
		<i>For >50 To 100, Deduct</i>	-14.24	
		<i>For >100, Deduct</i>	-20.29	
08 14 16 00-0007	EA	3'-4" x 7' x 1-3/8" Hollow Core, Birch Faced Door	256.90	43.12
		<i>For Each 1' Of Additional Door Height, Add</i>	40.96	
		<i>For >50 To 100, Deduct</i>	-15.00	
		<i>For >100, Deduct</i>	-21.42	
08 14 16 00-0008	EA	3'-6" x 7' x 1-3/8" Hollow Core, Birch Faced Door	271.41	44.92
		<i>For Each 1' Of Additional Door Height, Add</i>	43.58	
		<i>For >50 To 100, Deduct</i>	-15.82	
		<i>For >100, Deduct</i>	-22.60	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 14 16 00-0009 PR Pair 2' x 7' x 1-3/8" Hollow Core, Birch Faced Door.....	422.67	75.11
For Each 1' Of Additional Door Height, Add	65.39	
For >50 To 100, Deduct	-24.89	
For >100, Deduct	-35.46	
08 14 16 00-0010 PR Pair 2'-6" x 7' x 1-3/8" Hollow Core, Birch Faced Door	448.80	78.52
For Each 1' Of Additional Door Height, Add	70.02	
For >50 To 100, Deduct	-26.37	
For >100, Deduct	-37.59	
08 14 16 00-0011 PR Pair 3' x 7' x 1-3/8" Hollow Core, Birch Faced Door.....	474.79	81.94
For Each 1' Of Additional Door Height, Add	74.62	
For >50 To 100, Deduct	-27.84	
For >100, Deduct	-39.71	
08 14 16 00-0012 Lauan Faced <small>(08 14 16 00-0001)</small>		
08 14 16 00-0013 EA 2'-0" Or 2'-4" x 7' x 1-3/8" Hollow Core, Lauan Faced Door	180.91	39.53
For Each 1' Of Additional Door Height, Add	24.44	
For >50 To 100, Deduct	-11.02	
For >100, Deduct	-15.54	
08 14 16 00-0014 EA 2'-6" x 7' x 1-3/8" Hollow Core, Lauan Faced Door.....	191.41	41.33
For Each 1' Of Additional Door Height, Add	26.10	
For >50 To 100, Deduct	-11.64	
For >100, Deduct	-16.42	
08 14 16 00-0015 EA 2'-8" x 7' x 1-3/8" Hollow Core, Lauan Faced Door.....	197.23	41.33
For Each 1' Of Additional Door Height, Add	27.50	
For >50 To 100, Deduct	-11.93	
For >100, Deduct	-16.86	
08 14 16 00-0016 EA 3' x 7' x 1-3/8" Hollow Core, Lauan Faced Door	204.94	43.12
For Each 1' Of Additional Door Height, Add	28.49	
For >50 To 100, Deduct	-12.40	
For >100, Deduct	-17.53	
08 14 16 00-0017 EA 3'-4" x 7' x 1-3/8" Hollow Core, Lauan Faced Door.....	216.30	43.12
For Each 1' Of Additional Door Height, Add	31.21	
For >50 To 100, Deduct	-12.97	
For >100, Deduct	-18.38	
08 14 16 00-0018 EA 3'-6" x 7' x 1-3/8" Hollow Core, Lauan Faced Door.....	228.21	44.92
For Each 1' Of Additional Door Height, Add	33.21	
For >50 To 100, Deduct	-13.66	
For >100, Deduct	-19.36	
08 14 16 00-0019 PR Pair 2' x 7' x 1-3/8" Hollow Core, Lauan Faced Door	353.92	75.11
For Each 1' Of Additional Door Height, Add	48.89	
For >50 To 100, Deduct	-21.45	
For >100, Deduct	-30.30	
08 14 16 00-0020 PR Pair 2'-6" x 7' x 1-3/8" Hollow Core, Lauan Faced Door.....	374.58	78.52
For Each 1' Of Additional Door Height, Add	52.21	
For >50 To 100, Deduct	-22.66	
For >100, Deduct	-32.02	
08 14 16 00-0021 PR Pair 3' x 7' x 1-3/8" Hollow Core, Lauan Faced Door.....	401.29	81.94
For Each 1' Of Additional Door Height, Add	56.98	
For >50 To 100, Deduct	-24.16	
For >100, Deduct	-34.19	
08 14 16 00-0022 Tempered Hardboard Faced <small>(08 14 16 00-0001)</small>		
08 14 16 00-0023 EA 2'-0" Or 2'-4" x 7' x 1-3/8" Hollow Core, Hardboard Faced Door	183.67	39.53
For Each 1' Of Additional Door Height, Add	25.11	
For >50 To 100, Deduct	-11.16	
For >100, Deduct	-15.75	
08 14 16 00-0024 EA 2'-6" x 7' x 1-3/8" Hollow Core, Hardboard Faced Door.....	194.89	41.33
For Each 1' Of Additional Door Height, Add	26.94	
For >50 To 100, Deduct	-11.81	
For >100, Deduct	-16.68	
08 14 16 00-0025 EA 2'-8" x 7' x 1-3/8" Hollow Core, Hardboard Faced Door.....	198.51	41.33
For Each 1' Of Additional Door Height, Add	27.81	
For >50 To 100, Deduct	-11.99	
For >100, Deduct	-16.95	
08 14 16 00-0026 EA 3' x 7' x 1-3/8" Hollow Core, Hardboard Faced Door	209.35	43.12
For Each 1' Of Additional Door Height, Add	29.54	
For >50 To 100, Deduct	-12.62	
For >100, Deduct	-17.86	
08 14 16 00-0027 EA 3'-4" x 7' x 1-3/8" Hollow Core, Hardboard Faced Door.....	222.89	43.12
For Each 1' Of Additional Door Height, Add	32.79	
For >50 To 100, Deduct	-13.30	
For >100, Deduct	-18.87	
08 14 16 00-0028 EA 3'-6" x 7' x 1-3/8" Hollow Core, Hardboard Faced Door.....	235.21	44.92
For Each 1' Of Additional Door Height, Add	34.89	
For >50 To 100, Deduct	-14.01	
For >100, Deduct	-19.89	
08 14 16 00-0029 PR Pair 2' x 7' x 1-3/8" Hollow Core, Hardboard Faced Door.....	359.44	75.11
For Each 1' Of Additional Door Height, Add	50.22	
For >50 To 100, Deduct	-21.73	
For >100, Deduct	-30.71	

08 Openings
08 10 Doors And Frames
08 14 Wood Doors



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 14 16 00-0030	PR		Pair 2'-6" x 7' x 1-3/8" Hollow Core, Hardboard Faced Door.....	381.51	78.52
			<i>For Each 1' Of Additional Door Height, Add</i>	53.87	
			<i>For >50 To 100, Deduct</i>	-23.00	
			<i>For >100, Deduct</i>	-32.54	
08 14 16 00-0031	PR		Pair 3' x 7' x 1-3/8" Hollow Core, Hardboard Faced Door.....	410.06	81.94
			<i>For Each 1' Of Additional Door Height, Add</i>	59.09	
			<i>For >50 To 100, Deduct</i>	-24.60	
			<i>For >100, Deduct</i>	-34.85	
08 14 16 00-0032			Solid Core Doors, 1-3/8" Thick, 5 Ply <small>(08 14 16)</small>		
08 14 16 00-0033			Birch Faced <small>(08 14 16 00-0032)</small>		
08 14 16 00-0034	EA		2'-0" Or 2'-4" x 7' x 1-3/8" Solid Core, Birch Faced Door.....	252.51	39.53
			<i>For 7 Ply Core, Add</i>	26.02	
			<i>For Solid Wood Staved Core (Glued Block), Add</i>	43.36	
			<i>Note: Not used in conjunction with fire rating >20 minutes.</i>		
			<i>For Machining for Mortise Lock, Add</i>	35.00	
			<i>For Each 1' Of Additional Door Height, Add</i>	41.63	
			<i>For >50 To 100, Deduct</i>	-14.60	
			<i>For >100, Deduct</i>	-20.91	
08 14 16 00-0035	EA		2'-6" x 7' x 1-3/8" Solid Core, Birch Faced Door.....	265.21	41.33
			<i>For 7 Ply Core, Add</i>	27.38	
			<i>For Solid Wood Staved Core (Glued Block), Add</i>	45.64	
			<i>Note: Not used in conjunction with fire rating >20 minutes.</i>		
			<i>For Machining for Mortise Lock, Add</i>	35.00	
			<i>For Each 1' Of Additional Door Height, Add</i>	43.81	
			<i>For >50 To 100, Deduct</i>	-15.33	
			<i>For >100, Deduct</i>	-21.96	
08 14 16 00-0036	EA		2'-8" x 7' x 1-3/8" Solid Core, Birch Faced Door.....	274.32	41.33
			<i>For 7 Ply Core, Add</i>	28.75	
			<i>For Solid Wood Staved Core (Glued Block), Add</i>	47.92	
			<i>Note: Not used in conjunction with fire rating >20 minutes.</i>		
			<i>For Machining for Mortise Lock, Add</i>	35.00	
			<i>For Each 1' Of Additional Door Height, Add</i>	46.00	
			<i>For >50 To 100, Deduct</i>	-15.78	
			<i>For >100, Deduct</i>	-22.64	
08 14 16 00-0037	EA		3' x 7' x 1-3/8" Solid Core, Birch Faced Door.....	289.03	43.12
			<i>For 7 Ply Core, Add</i>	30.42	
			<i>For Solid Wood Staved Core (Glued Block), Add</i>	50.70	
			<i>Note: Not used in conjunction with fire rating >20 minutes.</i>		
			<i>For Machining for Mortise Lock, Add</i>	35.00	
			<i>For Each 1' Of Additional Door Height, Add</i>	48.67	
			<i>For >50 To 100, Deduct</i>	-16.61	
			<i>For >100, Deduct</i>	-23.83	
08 14 16 00-0038	EA		3'-4" x 7' x 1-3/8" Solid Core, Birch Faced Door.....	311.29	43.12
			<i>For 7 Ply Core, Add</i>	33.76	
			<i>For Solid Wood Staved Core (Glued Block), Add</i>	56.26	
			<i>Note: Not used in conjunction with fire rating >20 minutes.</i>		
			<i>For Machining for Mortise Lock, Add</i>	35.00	
			<i>For Each 1' Of Additional Door Height, Add</i>	54.01	
			<i>For >50 To 100, Deduct</i>	-17.72	
			<i>For >100, Deduct</i>	-25.50	
08 14 16 00-0039	EA		3'-6" x 7' x 1-3/8" Solid Core, Birch Faced Door.....	329.26	44.92
			<i>For 7 Ply Core, Add</i>	35.91	
			<i>For Solid Wood Staved Core (Glued Block), Add</i>	59.86	
			<i>Note: Not used in conjunction with fire rating >20 minutes.</i>		
			<i>For Machining for Mortise Lock, Add</i>	35.00	
			<i>For Each 1' Of Additional Door Height, Add</i>	57.46	
			<i>For >50 To 100, Deduct</i>	-18.71	
			<i>For >100, Deduct</i>	-26.94	
08 14 16 00-0040	PR		Pair 2' x 7' x 1-3/8" Solid Core, Birch Faced Door.....	497.10	75.11
			<i>For 7 Ply Core, Add</i>	52.03	
			<i>For Solid Wood Staved Core (Glued Block), Add</i>	86.72	
			<i>Note: Not used in conjunction with fire rating >20 minutes.</i>		
			<i>For Machining for Mortise Lock, Add</i>	35.00	
			<i>For Each 1' Of Additional Door Height, Add</i>	83.25	
			<i>For >50 To 100, Deduct</i>	-28.61	
			<i>For >100, Deduct</i>	-41.04	
08 14 16 00-0041	PR		Pair 2'-6" x 7' x 1-3/8" Solid Core, Birch Faced Door.....	522.17	78.52
			<i>For 7 Ply Core, Add</i>	54.77	
			<i>For Solid Wood Staved Core (Glued Block), Add</i>	91.28	
			<i>Note: Not used in conjunction with fire rating >20 minutes.</i>		
			<i>For Machining for Mortise Lock, Add</i>	35.00	
			<i>For Each 1' Of Additional Door Height, Add</i>	87.63	
			<i>For >50 To 100, Deduct</i>	-30.03	
			<i>For >100, Deduct</i>	-43.09	
08 14 16 00-0042	PR		Pair 3' x 7' x 1-3/8" Solid Core, Birch Faced Door.....	569.42	81.94
			<i>For 7 Ply Core, Add</i>	60.83	
			<i>For Solid Wood Staved Core (Glued Block), Add</i>	101.39	
			<i>Note: Not used in conjunction with fire rating >20 minutes.</i>		
			<i>For Machining for Mortise Lock, Add</i>	35.00	
			<i>For Each 1' Of Additional Door Height, Add</i>	97.33	
			<i>For >50 To 100, Deduct</i>	-32.57	
			<i>For >100, Deduct</i>	-46.80	



	MINOR	CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
		08 14 16 00-0043 Lauan Faced <small>(08 14 16 00-0032)</small>		
		08 14 16 00-0044 EA 2'-0" Or 2'-4" x 7' x 1-3/8" Solid Core, Lauan Faced Door.....	208.23	39.53
		For 7 Ply Core, Add	19.38	
		For Machining for Mortise Lock, Add	35.00	
		For Each 1' Of Additional Door Height, Add	31.00	
		For >50 To 100, Deduct	-12.39	
		For >100, Deduct	-17.59	
		08 14 16 00-0045 EA 2'-6" x 7' x 1-3/8" Solid Core, Lauan Faced Door.....	218.90	41.33
		For 7 Ply Core, Add	20.44	
		For Machining for Mortise Lock, Add	35.00	
		For Each 1' Of Additional Door Height, Add	32.70	
		For >50 To 100, Deduct	-13.01	
		For >100, Deduct	-18.48	
		08 14 16 00-0046 EA 2'-8" x 7' x 1-3/8" Solid Core, Lauan Faced Door.....	226.02	41.33
		For 7 Ply Core, Add	21.51	
		For Machining for Mortise Lock, Add	35.00	
		For Each 1' Of Additional Door Height, Add	34.41	
		For >50 To 100, Deduct	-13.37	
		For >100, Deduct	-19.02	
		08 14 16 00-0047 EA 3' x 7' x 1-3/8" Solid Core, Lauan Faced Door.....	236.79	43.12
		For 7 Ply Core, Add	22.58	
		For Machining for Mortise Lock, Add	35.00	
		For Each 1' Of Additional Door Height, Add	36.13	
		For >50 To 100, Deduct	-14.00	
		For >100, Deduct	-19.92	
		08 14 16 00-0048 EA 3'-4" x 7' x 1-3/8" Solid Core, Lauan Faced Door.....	253.34	43.12
		For 7 Ply Core, Add	25.06	
		For Machining for Mortise Lock, Add	35.00	
		For Each 1' Of Additional Door Height, Add	40.10	
		For >50 To 100, Deduct	-14.82	
		For >100, Deduct	-21.16	
		08 14 16 00-0049 EA 3'-6" x 7' x 1-3/8" Solid Core, Lauan Faced Door.....	270.00	44.92
		For 7 Ply Core, Add	27.02	
		For Machining for Mortise Lock, Add	35.00	
		For Each 1' Of Additional Door Height, Add	43.24	
		For >50 To 100, Deduct	-15.75	
		For >100, Deduct	-22.50	
		08 14 16 00-0050 PR Pair 2' x 7' x 1-3/8" Solid Core, Lauan Faced Door.....	408.57	75.11
		For 7 Ply Core, Add	38.75	
		For Machining for Mortise Lock, Add	35.00	
		For Each 1' Of Additional Door Height, Add	62.01	
		For >50 To 100, Deduct	-24.18	
		For >100, Deduct	-34.40	
		08 14 16 00-0051 PR Pair 2'-6" x 7' x 1-3/8" Solid Core, Lauan Faced Door.....	429.55	78.52
		For 7 Ply Core, Add	40.88	
		For Machining for Mortise Lock, Add	35.00	
		For Each 1' Of Additional Door Height, Add	65.40	
		For >50 To 100, Deduct	-25.40	
		For >100, Deduct	-36.14	
		08 14 16 00-0052 PR Pair 3' x 7' x 1-3/8" Solid Core, Lauan Faced Door.....	464.93	81.94
		For 7 Ply Core, Add	45.16	
		For Machining for Mortise Lock, Add	35.00	
		For Each 1' Of Additional Door Height, Add	72.26	
		For >50 To 100, Deduct	-27.34	
		For >100, Deduct	-38.97	
		08 14 16 00-0053 Tempered Hardboard Faced <small>(08 14 16 00-0032)</small>		
		08 14 16 00-0054 EA 2'-0" Or 2'-4" x 7' x 1-3/8" Solid Core, Hardboard Faced Door.....	224.94	39.53
		For Machining for Mortise Lock, Add	35.00	
		For Each 1' Of Additional Door Height, Add	35.01	
		For >50 To 100, Deduct	-13.22	
		For >100, Deduct	-18.85	
		08 14 16 00-0055 EA 2'-6" x 7' x 1-3/8" Solid Core, Hardboard Faced Door.....	237.00	41.33
		For Machining for Mortise Lock, Add	35.00	
		For Each 1' Of Additional Door Height, Add	37.04	
		For >50 To 100, Deduct	-13.92	
		For >100, Deduct	-19.84	
		08 14 16 00-0056 EA 2'-8" x 7' x 1-3/8" Solid Core, Hardboard Faced Door.....	245.45	41.33
		For Machining for Mortise Lock, Add	35.00	
		For Each 1' Of Additional Door Height, Add	39.07	
		For >50 To 100, Deduct	-14.34	
		For >100, Deduct	-20.48	
		08 14 16 00-0057 EA 3' x 7' x 1-3/8" Solid Core, Hardboard Faced Door.....	252.18	43.12
		For Machining for Mortise Lock, Add	35.00	
		For Each 1' Of Additional Door Height, Add	39.82	
		For >50 To 100, Deduct	-14.77	
		For >100, Deduct	-21.07	
		08 14 16 00-0058 EA 3'-4" x 7' x 1-3/8" Solid Core, Hardboard Faced Door.....	270.48	43.12
		For Machining for Mortise Lock, Add	35.00	
		For Each 1' Of Additional Door Height, Add	44.22	
		For >50 To 100, Deduct	-15.68	
		For >100, Deduct	-22.44	

08 Openings**08 10 Doors And Frames****08 14 Wood Doors**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 14 16 00-0059	EA		3'-6" x 7' x 1-3/8" Solid Core, Hardboard Faced Door.....	307.45	44.92
			<i>For Machining for Mortise Lock, Add</i>	35.00	
			<i>For Each 1' Of Additional Door Height, Add</i>	52.23	
			<i>For >50 To 100, Deduct</i>	-17.62	
			<i>For >100, Deduct</i>	-25.30	
08 14 16 00-0060	PR		Pair 2' x 7' x 1-3/8" Solid Core, Hardboard Faced Door.....	441.96	75.11
			<i>For Machining for Mortise Lock, Add</i>	35.00	
			<i>For Each 1' Of Additional Door Height, Add</i>	70.02	
			<i>For >50 To 100, Deduct</i>	-25.85	
			<i>For >100, Deduct</i>	-36.90	
08 14 16 00-0061	PR		Pair 2'-6" x 7' x 1-3/8" Solid Core, Hardboard Faced Door.....	465.71	78.52
			<i>For Machining for Mortise Lock, Add</i>	35.00	
			<i>For Each 1' Of Additional Door Height, Add</i>	74.08	
			<i>For >50 To 100, Deduct</i>	-27.21	
			<i>For >100, Deduct</i>	-38.85	
08 14 16 00-0062	PR		Pair 3' x 7' x 1-3/8" Solid Core, Hardboard Faced Door.....	495.72	81.94
			<i>For Machining for Mortise Lock, Add</i>	35.00	
			<i>For Each 1' Of Additional Door Height, Add</i>	79.65	
			<i>For >50 To 100, Deduct</i>	-28.88	
			<i>For >100, Deduct</i>	-41.28	
08 14 16 00-0063			Plastic Laminated Wood Doors (08 14 16 00-0032)		
08 14 16 00-0064	EA		2'-0" Or 2'-4" x 7' x 1-3/8" Solid Core Wood Plastic Laminated Door.....	381.20	39.53
			<i>For Machining for Mortise Lock, Add</i>	35.00	
			<i>For Each 1' Of Additional Door Height, Add</i>	72.51	
			<i>For >50 To 100, Deduct</i>	-21.04	
			<i>For >100, Deduct</i>	-30.57	
08 14 16 00-0065	EA		2'-6" x 7' x 1-3/8" Solid Core Wood Plastic Laminated Door.....	401.41	41.33
			<i>For Machining for Mortise Lock, Add</i>	35.00	
			<i>For Each 1' Of Additional Door Height, Add</i>	76.50	
			<i>For >50 To 100, Deduct</i>	-22.14	
			<i>For >100, Deduct</i>	-32.17	
08 14 16 00-0066	EA		2'-8" x 7' x 1-3/8" Solid Core Wood Plastic Laminated Door.....	418.02	41.33
			<i>For Machining for Mortise Lock, Add</i>	35.00	
			<i>For Each 1' Of Additional Door Height, Add</i>	80.49	
			<i>For >50 To 100, Deduct</i>	-22.97	
			<i>For >100, Deduct</i>	-33.42	
08 14 16 00-0067	EA		3' x 7' x 1-3/8" Solid Core Wood Plastic Laminated Door.....	438.34	43.12
			<i>For Machining for Mortise Lock, Add</i>	35.00	
			<i>For Each 1' Of Additional Door Height, Add</i>	84.50	
			<i>For >50 To 100, Deduct</i>	-24.07	
			<i>For >100, Deduct</i>	-35.03	
08 14 16 00-0068	EA		3'-4" x 7' x 1-3/8" Solid Core Wood Plastic Laminated Door.....	477.06	43.12
			<i>For Machining for Mortise Lock, Add</i>	35.00	
			<i>For Each 1' Of Additional Door Height, Add</i>	93.79	
			<i>For >50 To 100, Deduct</i>	-26.01	
			<i>For >100, Deduct</i>	-37.94	
08 14 16 00-0069	EA		3'-6" x 7' x 1-3/8" Solid Core Wood Plastic Laminated Door.....	505.66	44.92
			<i>For Machining for Mortise Lock, Add</i>	35.00	
			<i>For Each 1' Of Additional Door Height, Add</i>	99.80	
			<i>For >50 To 100, Deduct</i>	-27.53	
			<i>For >100, Deduct</i>	-40.17	
08 14 16 00-0070	PR		Pair 2' x 7' x 1-3/8" Solid Core Wood Plastic Laminated Door.....	754.50	75.11
			<i>For Machining for Mortise Lock, Add</i>	35.00	
			<i>For Each 1' Of Additional Door Height, Add</i>	145.03	
			<i>For >50 To 100, Deduct</i>	-41.48	
			<i>For >100, Deduct</i>	-60.34	
08 14 16 00-0071	PR		Pair 2'-6" x 7' x 1-3/8" Solid Core Wood Plastic Laminated Door.....	794.49	78.52
			<i>For Machining for Mortise Lock, Add</i>	35.00	
			<i>For Each 1' Of Additional Door Height, Add</i>	152.99	
			<i>For >50 To 100, Deduct</i>	-43.65	
			<i>For >100, Deduct</i>	-63.51	
08 14 16 00-0072	PR		Pair 3' x 7' x 1-3/8" Solid Core Wood Plastic Laminated Door.....	868.05	81.94
			<i>For Machining for Mortise Lock, Add</i>	35.00	
			<i>For Each 1' Of Additional Door Height, Add</i>	169.01	
			<i>For >50 To 100, Deduct</i>	-47.50	
			<i>For >100, Deduct</i>	-69.20	
08 14 16 00-0073			Hollow Core Doors, 1-3/4" Thick (08 14 16)		
08 14 16 00-0074			Birch Faced (08 14 16 00-0073)		
08 14 16 00-0075	EA		2'-0" Or 2'-4" x 7' x 1-3/4" Hollow Core, Birch Faced Door.....	249.33	39.53
			<i>For Each 1' Of Additional Door Height, Add</i>	40.86	
			<i>For >50 To 100, Deduct</i>	-14.44	
			<i>For >100, Deduct</i>	-20.68	
08 14 16 00-0076	EA		2'-6" x 7' x 1-3/4" Hollow Core, Birch Faced Door.....	259.33	41.33
			<i>For Each 1' Of Additional Door Height, Add</i>	42.40	
			<i>For >50 To 100, Deduct</i>	-15.03	
			<i>For >100, Deduct</i>	-21.52	
08 14 16 00-0077	EA		2'-8" x 7' x 1-3/4" Hollow Core, Birch Faced Door.....	261.73	41.33
			<i>For Each 1' Of Additional Door Height, Add</i>	42.98	
			<i>For >50 To 100, Deduct</i>	-15.15	
			<i>For >100, Deduct</i>	-21.70	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 14 16 00-0078 EA 3' x 7' x 1-3/4" Hollow Core, Birch Faced Door <i>For Each 1' Of Additional Door Height, Add</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	275.79 45.49 -15.95 -22.84	43.12
08 14 16 00-0079 EA 3'-4" x 7' x 1-3/4" Hollow Core, Birch Faced Door..... <i>For Each 1' Of Additional Door Height, Add</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	303.60 52.16 -17.34 -24.93	43.12
08 14 16 00-0080 EA 3'-6" x 7' x 1-3/4" Hollow Core, Birch Faced Door..... <i>For Each 1' Of Additional Door Height, Add</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	363.60 65.70 -20.43 -29.52	44.92
08 14 16 00-0081 PR Pair 2'-6" x 7' x 1-3/4" Hollow Core, Birch Faced Door <i>For Each 1' Of Additional Door Height, Add</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	490.76 81.73 -28.29 -40.56	75.11
08 14 16 00-0082 PR Pair 2'-6" x 7' x 1-3/4" Hollow Core, Birch Faced Door <i>For Each 1' Of Additional Door Height, Add</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	510.43 84.81 -29.45 -42.21	78.52
08 14 16 00-0083 PR Pair 3' x 7' x 1-3/4" Hollow Core, Birch Faced Door..... <i>For Each 1' Of Additional Door Height, Add</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	542.94 90.98 -31.24 -44.82	81.94
08 14 16 00-0084 Lauan Faced <small>(08 14 16 00-0073)</small>		
08 14 16 00-0085 EA 2'-0" Or 2'-4" x 7' x 1-3/4" Hollow Core, Lauan Faced Door <i>For Each 1' Of Additional Door Height, Add</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	208.45 31.05 -12.40 -17.61	39.53
08 14 16 00-0086 EA 2'-6" x 7' x 1-3/4" Hollow Core, Lauan Faced Door..... <i>For Each 1' Of Additional Door Height, Add</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	220.95 33.19 -13.11 -18.64	41.33
08 14 16 00-0087 EA 2'-8" x 7' x 1-3/4" Hollow Core, Lauan Faced Door..... <i>For Each 1' Of Additional Door Height, Add</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	228.19 34.93 -13.48 -19.18	41.33
08 14 16 00-0088 EA 3' x 7' x 1-3/4" Hollow Core, Lauan Faced Door <i>For Each 1' Of Additional Door Height, Add</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	234.65 35.62 -13.89 -19.76	43.12
08 14 16 00-0089 EA 3'-4" x 7' x 1-3/4" Hollow Core, Lauan Faced Door..... <i>For Each 1' Of Additional Door Height, Add</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	250.97 39.53 -14.70 -20.98	43.12
08 14 16 00-0090 EA 3'-6" x 7' x 1-3/4" Hollow Core, Lauan Faced Door..... <i>For Each 1' Of Additional Door Height, Add</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	275.58 44.58 -16.03 -22.91	44.92
08 14 16 00-0091 PR Pair 2'-6" x 7' x 1-3/4" Hollow Core, Lauan Faced Door..... <i>For Each 1' Of Additional Door Height, Add</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	408.98 62.10 -24.20 -34.43	75.11
08 14 16 00-0092 PR Pair 2'-6" x 7' x 1-3/4" Hollow Core, Lauan Faced Door..... <i>For Each 1' Of Additional Door Height, Add</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	433.67 66.39 -25.61 -36.45	78.52
08 14 16 00-0093 PR Pair 3' x 7' x 1-3/4" Hollow Core, Lauan Faced Door..... <i>For Each 1' Of Additional Door Height, Add</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	460.63 71.22 -27.13 -38.64	81.94
08 14 16 00-0094 Tempered Hardboard <small>(08 14 16 00-0073)</small>		
08 14 16 00-0095 EA 2'-0" Or 2'-4" x 7' x 1-3/4" Hollow Core, Hardboard Faced Door..... <i>For Each 1' Of Additional Door Height, Add</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	209.40 31.28 -12.45 -17.68	39.53
08 14 16 00-0096 EA 2'-6" x 7' x 1-3/4" Hollow Core, Hardboard Faced Door..... <i>For Each 1' Of Additional Door Height, Add</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	216.60 32.15 -12.90 -18.31	41.33
08 14 16 00-0097 EA 2'-8" x 7' x 1-3/4" Hollow Core, Hardboard Faced Door..... <i>For Each 1' Of Additional Door Height, Add</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	223.87 33.89 -13.26 -18.86	41.33
08 14 16 00-0098 EA 3' x 7' x 1-3/4" Hollow Core, Hardboard Faced Door <i>For Each 1' Of Additional Door Height, Add</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	234.69 35.63 -13.89 -19.76	43.12

08 Openings
08 10 Doors And Frames
08 14 Wood Doors



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 14 16 00-0099	EA		3'-4" x 7' x 1-3/4" Hollow Core, Hardboard Faced Door For Each 1' Of Additional Door Height, Add For >50 To 100, Deduct For >100, Deduct	242.97 37.61 -14.30 -20.38	43.12
08 14 16 00-0100	EA		3'-6" x 7' x 1-3/4" Hollow Core, Hardboard Faced Door For Each 1' Of Additional Door Height, Add For >50 To 100, Deduct For >100, Deduct	273.49 44.08 -15.92 -22.76	44.92
08 14 16 00-0101	PR		Pair 2' x 7' x 1-3/4" Hollow Core, Hardboard Faced Door For Each 1' Of Additional Door Height, Add For >50 To 100, Deduct For >100, Deduct	410.88 62.56 -24.30 -34.57	75.11
08 14 16 00-0102	PR		Pair 2'-6" x 7' x 1-3/4" Hollow Core, Hardboard Faced Door For Each 1' Of Additional Door Height, Add For >50 To 100, Deduct For >100, Deduct	424.95 64.30 -25.17 -35.80	78.52
08 14 16 00-0103	PR		Pair 3' x 7' x 1-3/4" Hollow Core, Hardboard Faced Door For Each 1' Of Additional Door Height, Add For >50 To 100, Deduct For >100, Deduct	460.75 71.25 -27.13 -38.65	81.94
08 14 16 00-0104 Oak Or Maple Faced <small>(08 14 16 00-0073)</small>					
08 14 16 00-0105	EA		2'-0" Or 2'-4" x 7' x 1-3/4" Hollow Core, Oak Or Maple Faced Door For Each 1' Of Additional Door Height, Add For >50 To 100, Deduct For >100, Deduct	303.10 53.77 -17.13 -24.71	39.53
08 14 16 00-0106	EA		2'-6" x 7' x 1-3/4" Hollow Core, Oak Or Maple Faced Door For Each 1' Of Additional Door Height, Add For >50 To 100, Deduct For >100, Deduct	315.12 55.79 -17.82 -25.70	41.33
08 14 16 00-0107	EA		2'-8" x 7' x 1-3/4" Hollow Core, Oak Or Maple Faced Door For Each 1' Of Additional Door Height, Add For >50 To 100, Deduct For >100, Deduct	318.27 56.55 -17.98 -25.94	41.33
08 14 16 00-0108	EA		3' x 7' x 1-3/4" Hollow Core, Oak Or Maple Faced Door For Each 1' Of Additional Door Height, Add For >50 To 100, Deduct For >100, Deduct	335.64 59.85 -18.94 -27.33	43.12
08 14 16 00-0109	EA		3'-4" x 7' x 1-3/4" Hollow Core, Oak Or Maple Faced Door For Each 1' Of Additional Door Height, Add For >50 To 100, Deduct For >100, Deduct	372.22 68.63 -20.77 -30.07	43.12
08 14 16 00-0110	EA		3'-6" x 7' x 1-3/4" Hollow Core, Oak Or Maple Faced Door For Each 1' Of Additional Door Height, Add For >50 To 100, Deduct For >100, Deduct	450.05 86.45 -24.75 -36.00	44.92
08 14 16 00-0111	PR		Pair 2' x 7' x 1-3/4" Hollow Core, Oak Or Maple Faced Door For Each 1' Of Additional Door Height, Add For >50 To 100, Deduct For >100, Deduct	598.28 107.54 -33.67 -48.63	75.11
08 14 16 00-0112	PR		Pair 2'-6" x 7' x 1-3/4" Hollow Core, Oak Or Maple Faced Door For Each 1' Of Additional Door Height, Add For >50 To 100, Deduct For >100, Deduct	622.02 111.60 -35.03 -50.58	78.52
08 14 16 00-0113	PR		Pair 3' x 7' x 1-3/4" Hollow Core, Oak Or Maple Faced Door For Each 1' Of Additional Door Height, Add For >50 To 100, Deduct For >100, Deduct	662.65 119.71 -37.23 -53.80	81.94
08 14 16 00-0114 Walnut Faced <small>(08 14 16 00-0073)</small>					
08 14 16 00-0115	EA		2'-0" Or 2'-4" x 7' x 1-3/4" Hollow Core, Walnut Faced Door For Each 1' Of Additional Door Height, Add For >50 To 100, Deduct For >100, Deduct	382.57 72.84 -21.11 -30.67	39.53
08 14 16 00-0116	EA		2'-6" x 7' x 1-3/4" Hollow Core, Walnut Faced Door For Each 1' Of Additional Door Height, Add For >50 To 100, Deduct For >100, Deduct	388.29 73.35 -21.48 -31.19	41.33
08 14 16 00-0117	EA		2'-8" x 7' x 1-3/4" Hollow Core, Walnut Faced Door For Each 1' Of Additional Door Height, Add For >50 To 100, Deduct For >100, Deduct	401.73 76.58 -22.15 -32.20	41.33
08 14 16 00-0118	EA		3' x 7' x 1-3/4" Hollow Core, Walnut Faced Door For Each 1' Of Additional Door Height, Add For >50 To 100, Deduct For >100, Deduct	409.45 77.57 -22.63 -32.87	43.12
08 14 16 00-0119	EA		3'-4" x 7' x 1-3/4" Hollow Core, Walnut Faced Door For Each 1' Of Additional Door Height, Add For >50 To 100, Deduct For >100, Deduct	445.51 86.22 -24.43 -35.57	43.12



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 14 16 00-0120 EA 3'-6" x 7' x 1-3/4" Hollow Core, Walnut Faced Door..... <i>For Each 1' Of Additional Door Height, Add</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	542.24 108.58 -29.36 -42.91	44.92
08 14 16 00-0121 PR Pair 2' x 7' x 1-3/4" Hollow Core, Walnut Faced Door..... <i>For Each 1' Of Additional Door Height, Add</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	756.96 145.62 -41.60 -60.53	75.11
08 14 16 00-0122 PR Pair 2'-6" x 7' x 1-3/4" Hollow Core, Walnut Faced Door <i>For Each 1' Of Additional Door Height, Add</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	768.32 146.71 -42.34 -61.55	78.52
08 14 16 00-0123 PR Pair 3' x 7' x 1-3/4" Hollow Core, Walnut Faced Door..... <i>For Each 1' Of Additional Door Height, Add</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	810.27 155.14 -44.61 -64.87	81.94
08 14 16 00-0124 Solid Core Doors, 1-3/4" Thick, 5 Ply (08 14 16)		
08 14 16 00-0125 Birch Faced (08 14 16 00-0124)		
08 14 16 00-0126 EA 2'-0" Or 2'-4" x 7' x 1-3/4" Solid Core, Birch Faced Door <i>For 7 Ply Core, Add</i> <i>For Solid Wood Staved Core (Glued Block), Add</i> <i>Note: Not used in conjunction with fire rating >20 minutes.</i> <i>For Exterior Grade Door, Add</i> <i>For Machining for Mortise Lock, Add</i> <i>For Commercial Grade 20 Minute Fire Rated Door, Add</i> <i>For Commercial Grade 3/4 Hour Fire Rated Door, Add</i> <i>For Commercial Grade 1 Hour Fire Rated Door, Add</i> <i>For Commercial Grade 1-1/2 Hour Rated Fire Door, Add</i> <i>For Each 1' Of Additional Door Height, Add</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	290.18 31.67 52.78 56.73 35.00 25.33 114.00 158.34 253.34 50.67 -16.49 -23.74	39.53
08 14 16 00-0127 EA 2'-6" x 7' x 1-3/4" Solid Core, Birch Faced Door <i>For 7 Ply Core, Add</i> <i>For Solid Wood Staved Core (Glued Block), Add</i> <i>Note: Not used in conjunction with fire rating >20 minutes.</i> <i>For Exterior Grade Door, Add</i> <i>For Machining for Mortise Lock, Add</i> <i>For Commercial Grade 20 Minute Fire Rated Door, Add</i> <i>For Commercial Grade 3/4 Hour Fire Rated Door, Add</i> <i>For Commercial Grade 1 Hour Fire Rated Door, Add</i> <i>For Commercial Grade 1-1/2 Hour Rated Fire Door, Add</i> <i>For Each 1' Of Additional Door Height, Add</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	282.65 30.00 50.00 54.13 35.00 24.00 108.00 150.00 240.00 48.00 -16.20 -23.27	41.33
08 14 16 00-0128 EA 2'-8" x 7' x 1-3/4" Solid Core, Birch Faced Door <i>For 7 Ply Core, Add</i> <i>For Solid Wood Staved Core (Glued Block), Add</i> <i>Note: Not used in conjunction with fire rating >20 minutes.</i> <i>For Exterior Grade Door, Add</i> <i>For Machining for Mortise Lock, Add</i> <i>For Commercial Grade 20 Minute Fire Rated Door, Add</i> <i>For Commercial Grade 3/4 Hour Fire Rated Door, Add</i> <i>For Commercial Grade 1 Hour Fire Rated Door, Add</i> <i>For Commercial Grade 1-1/2 Hour Rated Fire Door, Add</i> <i>For Each 1' Of Additional Door Height, Add</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	290.99 31.25 52.09 56.22 35.00 25.00 112.50 156.26 250.01 50.00 -16.62 -23.89	41.33
08 14 16 00-0129 EA 3' x 7' x 1-3/4" Solid Core, Birch Faced Door..... <i>For 7 Ply Core, Add</i> <i>For Solid Wood Staved Core (Glued Block), Add</i> <i>Note: Not used in conjunction with fire rating >20 minutes.</i> <i>For Exterior Grade Door, Add</i> <i>For Machining for Mortise Lock, Add</i> <i>For Commercial Grade 20 Minute Fire Rated Door, Add</i> <i>For Commercial Grade 3/4 Hour Fire Rated Door, Add</i> <i>For Commercial Grade 1 Hour Fire Rated Door, Add</i> <i>For Commercial Grade 1-1/2 Hour Rated Fire Door, Add</i> <i>For Each 1' Of Additional Door Height, Add</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	305.70 32.92 54.86 59.18 35.00 26.33 118.50 164.59 263.34 52.67 -17.44 -25.08	43.12
08 14 16 00-0130 EA 3'-4" x 7' x 1-3/4" Solid Core, Birch Faced Door <i>For 7 Ply Core, Add</i> <i>For Solid Wood Staved Core (Glued Block), Add</i> <i>Note: Not used in conjunction with fire rating >20 minutes.</i> <i>For Exterior Grade Door, Add</i> <i>For Machining for Mortise Lock, Add</i> <i>For Commercial Grade 20 Minute Fire Rated Door, Add</i> <i>For Commercial Grade 3/4 Hour Fire Rated Door, Add</i> <i>For Commercial Grade 1 Hour Fire Rated Door, Add</i> <i>For Commercial Grade 1-1/2 Hour Rated Fire Door, Add</i> <i>For Each 1' Of Additional Door Height, Add</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	329.84 36.54 60.90 65.21 35.00 29.23 131.54 182.69 292.31 58.46 -18.65 -26.89	43.12

08 Openings**08 10 Doors And Frames****08 14 Wood Doors**

MINOR		TOTAL DIRECT	DEMOLITION
CSI	UOM DESCRIPTION	UNIT COST	UNIT COST
08 14 16 00-0131	EA 3'-6" x 7' x 1-3/4" Solid Core, Birch Faced Door.....	385.59	44.92
	For 7 Ply Core, Add	44.36	
	For Solid Wood Staved Core (Glued Block), Add	73.94	
	Note: Not used in conjunction with fire rating >20 minutes.		
	For Exterior Grade Door, Add	78.43	
	For Machining for Mortise Lock, Add	35.00	
	For Commercial Grade 20 Minute Fire Rated Door, Add	35.49	
	For Commercial Grade 3/4 Hour Fire Rated Door, Add	159.71	
	For Commercial Grade 1 Hour Fire Rated Door, Add	221.81	
	For Commercial Grade 1-1/2 Hour Rated Fire Door, Add	354.90	
	For Each 1' Of Additional Door Height, Add	70.98	
	For >50 To 100, Deduct	-21.53	
	For >100, Deduct	-31.17	
08 14 16 00-0132	PR Pair 2' x 7' x 1-3/4" Solid Core, Birch Faced Door.....	572.45	75.11
	For 7 Ply Core, Add	63.34	
	For Solid Wood Staved Core (Glued Block), Add	105.56	
	Note: Not used in conjunction with fire rating >20 minutes.		
	For Exterior Grade Door, Add	113.07	
	For Machining for Mortise Lock, Add	35.00	
	For Commercial Grade 20 Minute Fire Rated Door, Add	50.67	
	For Commercial Grade 3/4 Hour Fire Rated Door, Add	228.01	
	For Commercial Grade 1 Hour Fire Rated Door, Add	316.68	
	For Commercial Grade 1-1/2 Hour Rated Fire Door, Add	506.69	
	For Each 1' Of Additional Door Height, Add	101.34	
	For >50 To 100, Deduct	-32.38	
	For >100, Deduct	-46.69	
08 14 16 00-0133	PR Pair 2'-6" x 7' x 1-3/4" Solid Core, Birch Faced Door.....	557.04	78.52
	For 7 Ply Core, Add	60.00	
	For Solid Wood Staved Core (Glued Block), Add	100.00	
	Note: Not used in conjunction with fire rating >20 minutes.		
	For Exterior Grade Door, Add	107.85	
	For Machining for Mortise Lock, Add	35.00	
	For Commercial Grade 20 Minute Fire Rated Door, Add	48.00	
	For Commercial Grade 3/4 Hour Fire Rated Door, Add	216.00	
	For Commercial Grade 1 Hour Fire Rated Door, Add	300.00	
	For Commercial Grade 1-1/2 Hour Rated Fire Door, Add	480.00	
	For Each 1' Of Additional Door Height, Add	96.00	
	For >50 To 100, Deduct	-31.78	
	For >100, Deduct	-45.70	
08 14 16 00-0134	PR Pair 3' x 7' x 1-3/4" Solid Core, Birch Faced Door.....	602.76	81.94
	For 7 Ply Core, Add	65.84	
	For Solid Wood Staved Core (Glued Block), Add	109.73	
	Note: Not used in conjunction with fire rating >20 minutes.		
	For Exterior Grade Door, Add	117.92	
	For Machining for Mortise Lock, Add	35.00	
	For Commercial Grade 20 Minute Fire Rated Door, Add	52.67	
	For Commercial Grade 3/4 Hour Fire Rated Door, Add	237.01	
	For Commercial Grade 1 Hour Fire Rated Door, Add	329.18	
	For Commercial Grade 1-1/2 Hour Rated Fire Door, Add	526.68	
	For Each 1' Of Additional Door Height, Add	105.34	
	For >50 To 100, Deduct	-34.23	
	For >100, Deduct	-49.30	
08 14 16 00-0135	Lauan Faced <small>(08 14 16 00-0124)</small>		
08 14 16 00-0136	EA 2'-0" Or 2'-4" x 7' x 1-3/4" Solid Core, Lauan Faced Door.....	254.89	39.53
	For 7 Ply Core, Add	26.37	
	For Machining for Mortise Lock, Add	35.00	
	For Commercial Grade 20 Minute Fire Rated Door, Add	21.10	
	For Commercial Grade 3/4 Hour Fire Rated Door, Add	94.95	
	For Commercial Grade 1 Hour Fire Rated Door, Add	131.87	
	For Commercial Grade 1-1/2 Hour Rated Fire Door, Add	211.00	
	For Each 1' Of Additional Door Height, Add	42.20	
	For >50 To 100, Deduct	-14.72	
	For >100, Deduct	-21.09	
08 14 16 00-0137	EA 2'-6" x 7' x 1-3/4" Solid Core, Lauan Faced Door.....	258.99	41.33
	For 7 Ply Core, Add	26.45	
	For Machining for Mortise Lock, Add	35.00	
	For Commercial Grade 20 Minute Fire Rated Door, Add	21.16	
	For Commercial Grade 3/4 Hour Fire Rated Door, Add	95.22	
	For Commercial Grade 1 Hour Fire Rated Door, Add	132.26	
	For Commercial Grade 1-1/2 Hour Rated Fire Door, Add	211.61	
	For Each 1' Of Additional Door Height, Add	42.32	
	For >50 To 100, Deduct	-15.02	
	For >100, Deduct	-21.49	
08 14 16 00-0138	EA 2'-8" x 7' x 1-3/4" Solid Core, Lauan Faced Door.....	264.05	41.33
	For 7 Ply Core, Add	27.21	
	For Machining for Mortise Lock, Add	35.00	
	For Commercial Grade 20 Minute Fire Rated Door, Add	21.77	
	For Commercial Grade 3/4 Hour Fire Rated Door, Add	97.96	
	For Commercial Grade 1 Hour Fire Rated Door, Add	136.05	
	For Commercial Grade 1-1/2 Hour Rated Fire Door, Add	217.68	
	For Each 1' Of Additional Door Height, Add	43.54	
	For >50 To 100, Deduct	-15.27	
	For >100, Deduct	-21.87	



Openings	08	08
Doors And Frames	08 10	
Wood Doors	08 14	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 14 16 00-0139 EA 3' x 7' x 1-3/4" Solid Core, Lauan Faced Door	271.32	43.12
For 7 Ply Core, Add	27.76	
For Machining for Mortise Lock, Add	35.00	
For Commercial Grade 20 Minute Fire Rated Door, Add	22.21	
For Commercial Grade 3/4 Hour Fire Rated Door, Add	99.94	
For Commercial Grade 1 Hour Fire Rated Door, Add	138.80	
For Commercial Grade 1-1/2 Hour Rated Fire Door, Add	222.08	
For Each 1' Of Additional Door Height, Add	44.42	
For >50 To 100, Deduct	-15.72	
For >100, Deduct	-22.51	
08 14 16 00-0140 EA 3'-4" x 7' x 1-3/4" Solid Core, Lauan Faced Door.....	288.05	43.12
For 7 Ply Core, Add	30.27	
For Machining for Mortise Lock, Add	35.00	
For Commercial Grade 20 Minute Fire Rated Door, Add	24.22	
For Commercial Grade 3/4 Hour Fire Rated Door, Add	108.97	
For Commercial Grade 1 Hour Fire Rated Door, Add	151.35	
For Commercial Grade 1-1/2 Hour Rated Fire Door, Add	242.16	
For Each 1' Of Additional Door Height, Add	48.43	
For >50 To 100, Deduct	-16.56	
For >100, Deduct	-23.76	
08 14 16 00-0141 EA 3'-6" x 7' x 1-3/4" Solid Core, Lauan Faced Door.....	306.03	44.92
For 7 Ply Core, Add	32.43	
For Machining for Mortise Lock, Add	35.00	
For Commercial Grade 20 Minute Fire Rated Door, Add	25.94	
For Commercial Grade 3/4 Hour Fire Rated Door, Add	116.74	
For Commercial Grade 1 Hour Fire Rated Door, Add	162.14	
For Commercial Grade 1-1/2 Hour Rated Fire Door, Add	259.43	
For Each 1' Of Additional Door Height, Add	51.89	
For >50 To 100, Deduct	-17.55	
For >100, Deduct	-25.20	
08 14 16 00-0142 PR Pair 2' x 7' x 1-3/4" Solid Core, Lauan Faced Door.....	501.87	75.11
For 7 Ply Core, Add	52.75	
For Machining for Mortise Lock, Add	35.00	
For Commercial Grade 20 Minute Fire Rated Door, Add	42.20	
For Commercial Grade 3/4 Hour Fire Rated Door, Add	189.90	
For Commercial Grade 1 Hour Fire Rated Door, Add	263.75	
For Commercial Grade 1-1/2 Hour Rated Fire Door, Add	421.99	
For Each 1' Of Additional Door Height, Add	84.40	
For >50 To 100, Deduct	-28.85	
For >100, Deduct	-41.40	
08 14 16 00-0143 PR Pair 2'-6" x 7' x 1-3/4" Solid Core, Lauan Faced Door	509.74	78.52
For 7 Ply Core, Add	52.91	
For Machining for Mortise Lock, Add	35.00	
For Commercial Grade 20 Minute Fire Rated Door, Add	42.32	
For Commercial Grade 3/4 Hour Fire Rated Door, Add	190.46	
For Commercial Grade 1 Hour Fire Rated Door, Add	264.53	
For Commercial Grade 1-1/2 Hour Rated Fire Door, Add	423.24	
For Each 1' Of Additional Door Height, Add	84.65	
For >50 To 100, Deduct	-29.41	
For >100, Deduct	-42.16	
08 14 16 00-0144 PR Pair 3' x 7' x 1-3/4" Solid Core, Lauan Faced Door.....	534.03	81.94
For 7 Ply Core, Add	55.53	
For Machining for Mortise Lock, Add	35.00	
For Commercial Grade 20 Minute Fire Rated Door, Add	44.42	
For Commercial Grade 3/4 Hour Fire Rated Door, Add	199.89	
For Commercial Grade 1 Hour Fire Rated Door, Add	277.63	
For Commercial Grade 1-1/2 Hour Rated Fire Door, Add	444.20	
For Each 1' Of Additional Door Height, Add	88.84	
For >50 To 100, Deduct	-30.80	
For >100, Deduct	-44.15	
08 14 16 00-0145 Plastic Laminated <small>(08 14 16 00-0124)</small>		
08 14 16 00-0146 EA 2'-0" Or 2'-4" x 7' x 1-3/4" Solid Core Plastic Laminated Door	593.81	39.53
For Machining for Mortise Lock, Add	35.00	
For Commercial Grade 20 Minute Fire Rated Door, Add	61.77	
For Commercial Grade 3/4 Hour Fire Rated Door, Add	277.97	
For Commercial Grade 1 Hour Fire Rated Door, Add	386.06	
For Commercial Grade 1-1/2 Hour Rated Fire Door, Add	617.70	
For Each 1' Of Additional Door Height, Add	123.54	
For >50 To 100, Deduct	-31.67	
For >100, Deduct	-46.51	
08 14 16 00-0147 EA 2'-6" x 7' x 1-3/4" Solid Core Plastic Laminated Door	613.49	41.33
For Machining for Mortise Lock, Add	35.00	
For Commercial Grade 20 Minute Fire Rated Door, Add	63.70	
For Commercial Grade 3/4 Hour Fire Rated Door, Add	286.65	
For Commercial Grade 1 Hour Fire Rated Door, Add	398.13	
For Commercial Grade 1-1/2 Hour Rated Fire Door, Add	637.01	
For Each 1' Of Additional Door Height, Add	127.40	
For >50 To 100, Deduct	-32.74	
For >100, Deduct	-48.08	

08 Openings**08 10 Doors And Frames****08 14 Wood Doors**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 14 16 00-0148	EA		2'-8" x 7' x 1-3/4" Solid Core Plastic Laminated Door .....613.49		41.33
			<i>For Machining for Mortise Lock, Add</i>	35.00	
			<i>For Commercial Grade 20 Minute Fire Rated Door, Add</i>	63.70	
			<i>For Commercial Grade 3/4 Hour Fire Rated Door, Add</i>	286.65	
			<i>For Commercial Grade 1 Hour Fire Rated Door, Add</i>	398.13	
			<i>For Commercial Grade 1-1/2 Hour Rated Fire Door, Add</i>	637.01	
			<i>For Each 1' Of Additional Door Height, Add</i>	127.40	
			<i>For >50 To 100, Deduct</i>	-32.74	
			<i>For >100, Deduct</i>	-48.08	
08 14 16 00-0149	EA		3'-0" x 7' x 1-3/4" Solid Core Plastic Laminated Door .....680.85		43.12
			<i>For Machining for Mortise Lock, Add</i>	35.00	
			<i>For Commercial Grade 20 Minute Fire Rated Door, Add</i>	71.35	
			<i>For Commercial Grade 3/4 Hour Fire Rated Door, Add</i>	321.08	
			<i>For Commercial Grade 1 Hour Fire Rated Door, Add</i>	445.95	
			<i>For Commercial Grade 1-1/2 Hour Rated Fire Door, Add</i>	713.52	
			<i>For Each 1' Of Additional Door Height, Add</i>	142.70	
			<i>For >50 To 100, Deduct</i>	-36.20	
			<i>For >100, Deduct</i>	-53.22	
08 14 16 00-0150	EA		3'-4" x 7' x 1-3/4" Solid Core Plastic Laminated Door .....713.41		43.12
			<i>For Machining for Mortise Lock, Add</i>	35.00	
			<i>For Commercial Grade 20 Minute Fire Rated Door, Add</i>	75.26	
			<i>For Commercial Grade 3/4 Hour Fire Rated Door, Add</i>	338.67	
			<i>For Commercial Grade 1 Hour Fire Rated Door, Add</i>	470.37	
			<i>For Commercial Grade 1-1/2 Hour Rated Fire Door, Add</i>	752.59	
			<i>For Each 1' Of Additional Door Height, Add</i>	150.52	
			<i>For >50 To 100, Deduct</i>	-37.83	
			<i>For >100, Deduct</i>	-55.66	
08 14 16 00-0151	EA		3'-6" x 7' x 1-3/4" Solid Core Plastic Laminated Door .....733.28		44.92
			<i>For Machining for Mortise Lock, Add</i>	35.00	
			<i>For Commercial Grade 20 Minute Fire Rated Door, Add</i>	77.21	
			<i>For Commercial Grade 3/4 Hour Fire Rated Door, Add</i>	347.46	
			<i>For Commercial Grade 1 Hour Fire Rated Door, Add</i>	482.58	
			<i>For Commercial Grade 1-1/2 Hour Rated Fire Door, Add</i>	772.13	
			<i>For Each 1' Of Additional Door Height, Add</i>	154.43	
			<i>For >50 To 100, Deduct</i>	-38.91	
			<i>For >100, Deduct</i>	-57.24	
08 14 16 00-0152	PR		Pair 2' x 7' x 1-3/4" Solid Core Plastic Laminated Door.....1,179.71		75.11
			<i>For Machining for Mortise Lock, Add</i>	35.00	
			<i>For Commercial Grade 20 Minute Fire Rated Door, Add</i>	123.54	
			<i>For Commercial Grade 3/4 Hour Fire Rated Door, Add</i>	555.93	
			<i>For Commercial Grade 1 Hour Fire Rated Door, Add</i>	772.13	
			<i>For Commercial Grade 1-1/2 Hour Rated Fire Door, Add</i>	1,235.40	
			<i>For Each 1' Of Additional Door Height, Add</i>	247.08	
			<i>For >50 To 100, Deduct</i>	-62.74	
			<i>For >100, Deduct</i>	-92.23	
08 14 16 00-0153	PR		Pair 2'-6" x 7' x 1-3/4" Solid Core Plastic Laminated Door .....1,218.70		78.52
			<i>For Machining for Mortise Lock, Add</i>	35.00	
			<i>For Commercial Grade 20 Minute Fire Rated Door, Add</i>	127.40	
			<i>For Commercial Grade 3/4 Hour Fire Rated Door, Add</i>	573.30	
			<i>For Commercial Grade 1 Hour Fire Rated Door, Add</i>	796.25	
			<i>For Commercial Grade 1-1/2 Hour Rated Fire Door, Add</i>	1,273.99	
			<i>For Each 1' Of Additional Door Height, Add</i>	254.80	
			<i>For >50 To 100, Deduct</i>	-64.86	
			<i>For >100, Deduct</i>	-95.33	
08 14 16 00-0154	PR		Pair 3' x 7' x 1-3/4" Solid Core Plastic Laminated Door.....1,353.05		81.94
			<i>For Machining for Mortise Lock, Add</i>	35.00	
			<i>For Commercial Grade 20 Minute Fire Rated Door, Add</i>	142.70	
			<i>For Commercial Grade 3/4 Hour Fire Rated Door, Add</i>	642.16	
			<i>For Commercial Grade 1 Hour Fire Rated Door, Add</i>	891.89	
			<i>For Commercial Grade 1-1/2 Hour Rated Fire Door, Add</i>	1,427.03	
			<i>For Each 1' Of Additional Door Height, Add</i>	285.41	
			<i>For >50 To 100, Deduct</i>	-71.75	
			<i>For >100, Deduct</i>	-105.58	
08 14 16 00-0155			Oak Or Maple Faced (08 14 16 00-0124)		
08 14 16 00-0156	EA		2'-0" Or 2'-4" x 7' x 1-3/4" Solid Core, Oak Or Maple Faced Door .....364.21		39.53
			<i>For 7 Ply Core, Add</i>	42.77	
			<i>For Solid Wood Staved Core (Glued Block), Add</i>	71.29	
			<i>Note: Not used in conjunction with fire rating >20 minutes.</i>		
			<i>For Exterior Grade Door, Add</i>	75.24	
			<i>For Machining for Mortise Lock, Add</i>	35.00	
			<i>For Commercial Grade 20 Minute Fire Rated Door, Add</i>	34.22	
			<i>For Commercial Grade 3/4 Hour Fire Rated Door, Add</i>	153.98	
			<i>For Commercial Grade 1 Hour Fire Rated Door, Add</i>	213.86	
			<i>For Commercial Grade 1-1/2 Hour Rated Fire Door, Add</i>	342.18	
			<i>For Each 1' Of Additional Door Height, Add</i>	68.44	
			<i>For >50 To 100, Deduct</i>	-20.19	
			<i>For >100, Deduct</i>	-29.29	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 14 16 00-0157 EA 2'-6" x 7' x 1-3/4" Solid Core, Oak Or Maple Faced Door	367.80	41.33
For 7 Ply Core, Add	42.77	
For Solid Wood Staved Core (Glued Block), Add	71.29	
Note: Not used in conjunction with fire rating >20 minutes.		
For Exterior Grade Door, Add	75.42	
For Machining for Mortise Lock, Add	35.00	
For Commercial Grade 20 Minute Fire Rated Door, Add	34.22	
For Commercial Grade 3/4 Hour Fire Rated Door, Add	153.98	
For Commercial Grade 1 Hour Fire Rated Door, Add	213.86	
For Commercial Grade 1-1/2 Hour Rated Fire Door, Add	342.18	
For Each 1' Of Additional Door Height, Add	68.44	
For >50 To 100, Deduct	-20.46	
For >100, Deduct	-29.65	
08 14 16 00-0158 EA 2'-8" x 7' x 1-3/4" Solid Core, Oak Or Maple Faced Door	370.72	41.33
For 7 Ply Core, Add	43.21	
For Solid Wood Staved Core (Glued Block), Add	72.02	
Note: Not used in conjunction with fire rating >20 minutes.		
For Exterior Grade Door, Add	76.15	
For Machining for Mortise Lock, Add	35.00	
For Commercial Grade 20 Minute Fire Rated Door, Add	34.57	
For Commercial Grade 3/4 Hour Fire Rated Door, Add	155.56	
For Commercial Grade 1 Hour Fire Rated Door, Add	216.05	
For Commercial Grade 1-1/2 Hour Rated Fire Door, Add	345.68	
For Each 1' Of Additional Door Height, Add	69.14	
For >50 To 100, Deduct	-20.60	
For >100, Deduct	-29.87	
08 14 16 00-0159 EA 3' x 7' x 1-3/4" Solid Core, Oak Or Maple Faced Door	376.99	43.12
For 7 Ply Core, Add	43.61	
For Solid Wood Staved Core (Glued Block), Add	72.69	
Note: Not used in conjunction with fire rating >20 minutes.		
For Exterior Grade Door, Add	77.00	
For Machining for Mortise Lock, Add	35.00	
For Commercial Grade 20 Minute Fire Rated Door, Add	34.89	
For Commercial Grade 3/4 Hour Fire Rated Door, Add	157.00	
For Commercial Grade 1 Hour Fire Rated Door, Add	218.06	
For Commercial Grade 1-1/2 Hour Rated Fire Door, Add	348.89	
For Each 1' Of Additional Door Height, Add	69.78	
For >50 To 100, Deduct	-21.01	
For >100, Deduct	-30.43	
08 14 16 00-0160 EA 3'-4" x 7' x 1-3/4" Solid Core, Oak Or Maple Faced Door	408.92	43.12
For 7 Ply Core, Add	48.40	
For Solid Wood Staved Core (Glued Block), Add	80.67	
Note: Not used in conjunction with fire rating >20 minutes.		
For Exterior Grade Door, Add	84.98	
For Machining for Mortise Lock, Add	35.00	
For Commercial Grade 20 Minute Fire Rated Door, Add	38.72	
For Commercial Grade 3/4 Hour Fire Rated Door, Add	174.24	
For Commercial Grade 1 Hour Fire Rated Door, Add	242.00	
For Commercial Grade 1-1/2 Hour Rated Fire Door, Add	387.20	
For Each 1' Of Additional Door Height, Add	77.44	
For >50 To 100, Deduct	-22.60	
For >100, Deduct	-32.83	
08 14 16 00-0161 EA 3'-6" x 7' x 1-3/4" Solid Core, Oak Or Maple Faced Door	494.74	44.92
For 7 Ply Core, Add	60.74	
For Solid Wood Staved Core (Glued Block), Add	101.23	
Note: Not used in conjunction with fire rating >20 minutes.		
For Exterior Grade Door, Add	105.72	
For Machining for Mortise Lock, Add	35.00	
For Commercial Grade 20 Minute Fire Rated Door, Add	48.59	
For Commercial Grade 3/4 Hour Fire Rated Door, Add	218.65	
For Commercial Grade 1 Hour Fire Rated Door, Add	303.68	
For Commercial Grade 1-1/2 Hour Rated Fire Door, Add	485.88	
For Each 1' Of Additional Door Height, Add	97.18	
For >50 To 100, Deduct	-26.98	
For >100, Deduct	-39.35	
08 14 16 00-0162 PR Pair 2' x 7' x 1-3/4" Solid Core, Oak Or Maple Faced Door	696.82	75.11
For 7 Ply Core, Add	81.99	
For Solid Wood Staved Core (Glued Block), Add	136.65	
Note: Not used in conjunction with fire rating >20 minutes.		
For Exterior Grade Door, Add	144.16	
For Machining for Mortise Lock, Add	35.00	
For Commercial Grade 20 Minute Fire Rated Door, Add	65.59	
For Commercial Grade 3/4 Hour Fire Rated Door, Add	295.17	
For Commercial Grade 1 Hour Fire Rated Door, Add	409.96	
For Commercial Grade 1-1/2 Hour Rated Fire Door, Add	655.93	
For Each 1' Of Additional Door Height, Add	131.19	
For >50 To 100, Deduct	-38.60	
For >100, Deduct	-56.02	

08 Openings**08 10 Doors And Frames****08 14 Wood Doors**

MINOR		TOTAL DIRECT	DEMOLITION
CSI	UOM DESCRIPTION	UNIT COST	UNIT COST
08 14 16 00-0163	PR Pair 2'-6" x 7' x 1-3/4" Solid Core, Oak Or Maple Faced Door	707.51	78.52
	For 7 Ply Core, Add	82.57	
	For Solid Wood Staved Core (Glued Block), Add	137.62	
	Note: Not used in conjunction with fire rating >20 minutes.		
	For Exterior Grade Door, Add	145.47	
	For Machining for Mortise Lock, Add	35.00	
	For Commercial Grade 20 Minute Fire Rated Door, Add	66.06	
	For Commercial Grade 3/4 Hour Fire Rated Door, Add	297.25	
	For Commercial Grade 1 Hour Fire Rated Door, Add	412.85	
	For Commercial Grade 1-1/2 Hour Rated Fire Door, Add	660.56	
	For Each 1' Of Additional Door Height, Add	132.11	
	For >50 To 100, Deduct	-39.30	
	For >100, Deduct	-56.99	
08 14 16 00-0164	PR Pair 3' x 7' x 1-3/4" Solid Core, Oak Or Maple Faced Door.....	744.00	81.94
	For 7 Ply Core, Add	87.02	
	For Solid Wood Staved Core (Glued Block), Add	145.04	
	Note: Not used in conjunction with fire rating >20 minutes.		
	For Exterior Grade Door, Add	153.23	
	For Machining for Mortise Lock, Add	35.00	
	For Commercial Grade 20 Minute Fire Rated Door, Add	69.62	
	For Commercial Grade 3/4 Hour Fire Rated Door, Add	313.28	
	For Commercial Grade 1 Hour Fire Rated Door, Add	435.11	
	For Commercial Grade 1-1/2 Hour Rated Fire Door, Add	696.17	
	For Each 1' Of Additional Door Height, Add	139.23	
	For >50 To 100, Deduct	-41.30	
	For >100, Deduct	-59.90	
08 14 16 00-0165	Walnut Faced <small>(08 14 16 00-0124)</small>		
08 14 16 00-0166	EA 2'-0" Or 2'-4" x 7' x 1-3/4" Solid Core, Walnut Faced Door.....	516.56	39.53
	For 7 Ply Core, Add	65.63	
	For Solid Wood Staved Core (Glued Block), Add	153.13	
	Note: Not used in conjunction with fire rating >20 minutes.		
	For Exterior Grade Door, Add	113.33	
	For Machining for Mortise Lock, Add	35.00	
	For Commercial Grade 20 Minute Fire Rated Door, Add	52.50	
	For Commercial Grade 3/4 Hour Fire Rated Door, Add	236.25	
	For Commercial Grade 1 Hour Fire Rated Door, Add	328.13	
	For Commercial Grade 1-1/2 Hour Rated Fire Door, Add	525.00	
	For Each 1' Of Additional Door Height, Add	105.00	
	For >50 To 100, Deduct	-27.80	
	For >100, Deduct	-40.72	
08 14 16 00-0167	EA 2'-6" x 7' x 1-3/4" Solid Core, Walnut Faced Door.....	520.28	41.33
	For 7 Ply Core, Add	65.64	
	For Solid Wood Staved Core (Glued Block), Add	153.17	
	Note: Not used in conjunction with fire rating >20 minutes.		
	For Exterior Grade Door, Add	113.54	
	For Machining for Mortise Lock, Add	35.00	
	For Commercial Grade 20 Minute Fire Rated Door, Add	52.52	
	For Commercial Grade 3/4 Hour Fire Rated Door, Add	236.32	
	For Commercial Grade 1 Hour Fire Rated Door, Add	328.22	
	For Commercial Grade 1-1/2 Hour Rated Fire Door, Add	525.16	
	For Each 1' Of Additional Door Height, Add	105.03	
	For >50 To 100, Deduct	-28.08	
	For >100, Deduct	-41.09	
08 14 16 00-0168	EA 2'-8" x 7' x 1-3/4" Solid Core, Walnut Faced Door.....	524.81	41.33
	For 7 Ply Core, Add	66.32	
	For Solid Wood Staved Core (Glued Block), Add	154.76	
	Note: Not used in conjunction with fire rating >20 minutes.		
	For Exterior Grade Door, Add	114.67	
	For Machining for Mortise Lock, Add	35.00	
	For Commercial Grade 20 Minute Fire Rated Door, Add	53.06	
	For Commercial Grade 3/4 Hour Fire Rated Door, Add	238.77	
	For Commercial Grade 1 Hour Fire Rated Door, Add	331.62	
	For Commercial Grade 1-1/2 Hour Rated Fire Door, Add	530.59	
	For Each 1' Of Additional Door Height, Add	106.12	
	For >50 To 100, Deduct	-28.31	
	For >100, Deduct	-41.43	
08 14 16 00-0169	EA 3' x 7' x 1-3/4" Solid Core, Walnut Faced Door	551.96	43.12
	For 7 Ply Core, Add	69.86	
	For Solid Wood Staved Core (Glued Block), Add	163.00	
	Note: Not used in conjunction with fire rating >20 minutes.		
	For Exterior Grade Door, Add	120.74	
	For Machining for Mortise Lock, Add	35.00	
	For Commercial Grade 20 Minute Fire Rated Door, Add	55.89	
	For Commercial Grade 3/4 Hour Fire Rated Door, Add	251.48	
	For Commercial Grade 1 Hour Fire Rated Door, Add	349.28	
	For Commercial Grade 1-1/2 Hour Rated Fire Door, Add	558.85	
	For Each 1' Of Additional Door Height, Add	111.77	
	For >50 To 100, Deduct	-29.75	
	For >100, Deduct	-43.55	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 14 16 00-0170	EA			3'-4" x 7' x 1-3/4" Solid Core, Walnut Faced Door For 7 Ply Core, Add For Solid Wood Staved Core (Glued Block), Add Note: Not used in conjunction with fire rating >20 minutes. For Exterior Grade Door, Add For Machining for Mortise Lock, Add For Commercial Grade 20 Minute Fire Rated Door, Add For Commercial Grade 3/4 Hour Fire Rated Door, Add For Commercial Grade 1 Hour Fire Rated Door, Add For Commercial Grade 1-1/2 Hour Rated Fire Door, Add For Each 1' Of Additional Door Height, Add For >50 To 100, Deduct For >100, Deduct	582.56 74.45 173.71 128.39 35.00 59.56 268.01 372.23 595.57 119.11 -31.28 -45.85	43.12
08 14 16 00-0171	EA			3'-6" x 7' x 1-3/4" Solid Core, Walnut Faced Door For 7 Ply Core, Add For Solid Wood Staved Core (Glued Block), Add Note: Not used in conjunction with fire rating >20 minutes. For Exterior Grade Door, Add For Machining for Mortise Lock, Add For Commercial Grade 20 Minute Fire Rated Door, Add For Commercial Grade 3/4 Hour Fire Rated Door, Add For Commercial Grade 1 Hour Fire Rated Door, Add For Commercial Grade 1-1/2 Hour Rated Fire Door, Add For Each 1' Of Additional Door Height, Add For >50 To 100, Deduct For >100, Deduct	715.22 93.81 218.88 160.84 35.00 75.05 337.71 469.04 750.46 150.09 -38.01 -55.89	44.92
08 14 16 00-0172	PR			Pair 2' x 7' x 1-3/4" Solid Core, Walnut Faced Door..... For 7 Ply Core, Add For Solid Wood Staved Core (Glued Block), Add Note: Not used in conjunction with fire rating >20 minutes. For Exterior Grade Door, Add For Machining for Mortise Lock, Add For Commercial Grade 20 Minute Fire Rated Door, Add For Commercial Grade 3/4 Hour Fire Rated Door, Add For Commercial Grade 1 Hour Fire Rated Door, Add For Commercial Grade 1-1/2 Hour Rated Fire Door, Add For Each 1' Of Additional Door Height, Add For >50 To 100, Deduct For >100, Deduct	989.02 125.82 293.58 217.21 35.00 100.66 452.96 629.11 1,006.57 201.31 -53.21 -77.93	75.11
08 14 16 00-0173	PR			Pair 2'-6" x 7' x 1-3/4" Solid Core, Walnut Faced Door For 7 Ply Core, Add For Solid Wood Staved Core (Glued Block), Add Note: Not used in conjunction with fire rating >20 minutes. For Exterior Grade Door, Add For Machining for Mortise Lock, Add For Commercial Grade 20 Minute Fire Rated Door, Add For Commercial Grade 3/4 Hour Fire Rated Door, Add For Commercial Grade 1 Hour Fire Rated Door, Add For Commercial Grade 1-1/2 Hour Rated Fire Door, Add For Each 1' Of Additional Door Height, Add For >50 To 100, Deduct For >100, Deduct	1,001.70 126.70 295.63 219.02 35.00 101.36 456.12 633.50 1,013.59 202.72 -54.01 -79.05	78.52
08 14 16 00-0174	PR			Pair 3' x 7' x 1-3/4" Solid Core, Walnut Faced Door..... For 7 Ply Core, Add For Solid Wood Staved Core (Glued Block), Add Note: Not used in conjunction with fire rating >20 minutes. For Exterior Grade Door, Add For Machining for Mortise Lock, Add For Commercial Grade 20 Minute Fire Rated Door, Add For Commercial Grade 3/4 Hour Fire Rated Door, Add For Commercial Grade 1 Hour Fire Rated Door, Add For Commercial Grade 1-1/2 Hour Rated Fire Door, Add For Each 1' Of Additional Door Height, Add For >50 To 100, Deduct For >100, Deduct	1,081.97 137.72 321.34 237.72 35.00 110.17 495.78 688.58 1,101.73 220.35 -58.20 -85.24	81.94

08 14 16 00-0175 Manufacturer Prefinished Options For Flush Wood Doors (08 14 16)

08 14 16 00-0176	EA	Clear Or Colored Catalyzed Polyurethane Factory Finish For Flush Wood Door Note: Includes any standard manufacturer color on six sides. For Custom Color To Match Non Standard Manufacturer Finish, Add	36.93 12.30
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08 14 66 Wood Screen Doors (08 14)

08 14 66 00-0001 Wood Screen Storm Door, Residential Grade (08 14 66)

Note: Includes frame, trim, necessary anchors and usual hardware (closures, chain and spring, latching, screens, etc.).			
08 14 66 00-0002	EA	2'-8" x 6'-8" Wood Screen Door, Residential, With Frame, Trim, Hardware.....	406.67
08 14 66 00-0003	EA	3' x 6'-8" Wood Screen Door, Residential, With Frame, Trim, Hardware	422.64
08 14 66 00-0004	EA	2'-8" x 7" Wood Screen Door, Residential, With Frame, Trim, Hardware	406.67
08 14 66 00-0005	EA	3' x 7" Wood Screen Door, Residential, With Frame, Trim, Hardware	422.64

08 14 73 Sliding Wood Doors (08 14)

08	Openings
08 10	Doors And Frames
08 14	Wood Doors



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 14 73 00-0001			Lauan Faced Hollow Core Flush Bi-Pass Doors (08 14 73)		
08 14 73 00-0002	EA		4'-0", Two 1-3/8" Unfinished Doors, Lauan Faced, Hollow Core, Flush Bi-Pass.....	232.11	57.47
08 14 73 00-0003	EA		5'-0", Two 1-3/8" Unfinished Doors, Lauan Faced, Hollow Core, Flush Bi-Pass.....	247.28	61.07
08 14 73 00-0004	EA		6'-0", Two 1-3/8" Unfinished Doors, Lauan Faced, Hollow Core, Flush Bi-Pass.....	268.90	64.66
08 14 73 00-0005	EA		8'-0", Four 1-3/8" Unfinished Doors, Lauan Faced, Hollow Core, Flush Bi-Pass.....	368.22	68.25
08 14 73 00-0006			Birch Faced Hollow Core Flush Bi-Pass Doors (08 14 73)		
08 14 73 00-0007	EA		4'-0", Two 1-3/8" Unfinished Doors, Birch Faced, Hollow Core, Flush Bi-Pass.....	247.46	57.47
08 14 73 00-0008	EA		5'-0", Two 1-3/8" Unfinished Doors, Birch Faced, Hollow Core, Flush Bi-Pass.....	271.22	61.07
08 14 73 00-0009	EA		6'-0", Two 1-3/8" Unfinished Doors, Birch Faced, Hollow Core, Flush Bi-Pass.....	295.24	64.66
08 14 73 00-0010	EA		8'-0", Four 1-3/8" Unfinished Doors, Birch Faced, Hollow Core, Flush Bi-Pass.....	398.93	68.25
08 14 73 00-0011			Molded High Density Fiberboard Hollow Core Paneled Bi-Pass Doors (08 14 73)		
08 14 73 00-0012	EA		4'-0", Two 1-3/8" Primed Doors, Molded High Density Fiberboard, Hollow Core, Paneled Bi-Pass.....	247.90	57.47
08 14 73 00-0013	EA		5'-0", Two 1-3/8" Primed Doors, Molded High Density Fiberboard, Hollow Core, Paneled Bi-Pass.....	270.15	61.07
08 14 73 00-0014	EA		6'-0", Two 1-3/8" Primed Doors, Molded High Density Fiberboard, Hollow Core, Paneled Bi-Pass.....	293.47	64.66
08 14 73 00-0015	EA		8'-0", Four 1-3/8" Primed Doors, Molded High Density Fiberboard, Hollow Core, Paneled Bi-Pass.....	399.79	68.25
08 14 73 00-0016			Pocket Door (08 14 73) Note: Includes door, frame and trim, and all mounting and door hardware. See CSI section 08 14 73 00-0069 for accessories to be added.		
08 14 73 00-0017			1-3/8" Thick (08 14 73 00-0016) See CSI section 08 14 73 00-0069 for all jambs and track hardware.		
08 14 73 00-0018			6'-8" High (08 14 73 00-0017)		
08 14 73 00-0019	EA		2' x 6'-8" x 1-3/8" High Wood Pocket Door, Hollow Core, Birch Faced.....	489.40	25.16
			For Oak, Add	121.19	
			For Ash/Hickory, Add	176.52	
			For Walnut, Add	257.31	
			For Cherry, Add	418.46	
08 14 73 00-0020	EA		2'-4" x 6'-8" x 1-3/8" High Wood Pocket Door, Hollow Core, Birch Faced.....	503.63	26.95
			For Oak, Add	124.13	
			For Ash/Hickory, Add	180.80	
			For Walnut, Add	263.55	
			For Cherry, Add	428.60	
08 14 73 00-0021	EA		2'-6" x 6'-8" x 1-3/8" High Wood Pocket Door, Hollow Core, Birch Faced.....	520.53	28.75
			For Oak, Add	127.80	
			For Ash/Hickory, Add	186.15	
			For Walnut, Add	271.35	
			For Cherry, Add	441.29	
08 14 73 00-0022	EA		2'-8" x 6'-8" x 1-3/8" High Wood Pocket Door, Hollow Core, Birch Faced.....	532.10	30.55
			For Oak, Add	130.00	
			For Ash/Hickory, Add	189.35	
			For Walnut, Add	276.02	
			For Cherry, Add	448.89	
08 14 73 00-0023	EA		2'-10" x 6'-8" x 1-3/8" High Wood Pocket Door, Hollow Core, Birch Faced.....	549.02	32.34
			For Oak, Add	133.68	
			For Ash/Hickory, Add	194.70	
			For Walnut, Add	283.82	
			For Cherry, Add	461.58	
08 14 73 00-0024	EA		3' x 6'-8" x 1-3/8" High Wood Pocket Door, Hollow Core, Birch Faced.....	563.25	34.14
			For Oak, Add	136.61	
			For Ash/Hickory, Add	198.98	
			For Walnut, Add	290.06	
			For Cherry, Add	471.72	
08 14 73 00-0025	EA		Pair 2' x 6'-8" x 1-3/8" High Wood Pocket Door, Hollow Core, Birch Faced.....	968.04	44.92
			For Oak, Add	242.38	
			For Ash/Hickory, Add	353.04	
			For Walnut, Add	514.63	
			For Cherry, Add	836.92	
08 14 73 00-0026	EA		Pair 2'-6" x 6'-8" x 1-3/8" High Wood Pocket Door, Hollow Core, Birch Faced.....	1,023.12	48.51
			For Oak, Add	255.60	
			For Ash/Hickory, Add	372.29	
			For Walnut, Add	542.69	
			For Cherry, Add	882.57	
08 14 73 00-0027	EA		Pair 3' x 6'-8" x 1-3/8" High Wood Pocket Door, Hollow Core, Birch Faced.....	1,094.19	52.11
			For Oak, Add	273.23	
			For Ash/Hickory, Add	397.97	
			For Walnut, Add	580.12	
			For Cherry, Add	943.44	
08 14 73 00-0028			7' High (08 14 73 00-0017)		
08 14 73 00-0029	EA		2' x 7' x 1-3/8" High Wood Pocket Door, Hollow Core, Birch Faced.....	582.54	25.16
			For Oak, Add	124.54	
			For Ash/Hickory, Add	124.54	
			For Walnut, Add	204.91	
			For Cherry, Add	384.81	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 14 73 00-0030 EA 2'-4" x 7' x 1-3/8" High Wood Pocket Door, Hollow Core, Birch Faced	610.08	26.95
For Oak, Add	130.15	
For Ash/Hickory, Add	130.15	
For Walnut, Add	214.13	
For Cherry, Add	402.13	
08 14 73 00-0031 EA 2'-6" x 7' x 1-3/8" High Wood Pocket Door, Hollow Core, Birch Faced	629.64	28.75
For Oak, Add	133.89	
For Ash/Hickory, Add	133.89	
For Walnut, Add	220.28	
For Cherry, Add	413.67	
08 14 73 00-0032 EA 2'-8" x 7' x 1-3/8" High Wood Pocket Door, Hollow Core, Birch Faced	646.53	30.55
For Oak, Add	137.00	
For Ash/Hickory, Add	137.00	
For Walnut, Add	225.40	
For Cherry, Add	423.29	
08 14 73 00-0033 EA 2'-10" x 7' x 1-3/8" High Wood Pocket Door, Hollow Core, Birch Faced	660.79	32.34
For Oak, Add	139.49	
For Ash/Hickory, Add	139.49	
For Walnut, Add	229.50	
For Cherry, Add	430.99	
08 14 73 00-0034 EA 3' x 7' x 1-3/8" High Wood Pocket Door, Hollow Core, Birch Faced.....	680.35	34.14
For Oak, Add	143.23	
For Ash/Hickory, Add	143.23	
For Walnut, Add	235.65	
For Cherry, Add	442.53	
08 14 73 00-0035 EA Pair 2' x 7' x 1-3/8" High Wood Pocket Door, Hollow Core, Birch Faced	1,154.32	44.92
For Oak, Add	249.09	
For Ash/Hickory, Add	249.09	
For Walnut, Add	409.82	
For Cherry, Add	769.62	
08 14 73 00-0036 EA Pair 2'-6" x 7' x 1-3/8" High Wood Pocket Door, Hollow Core, Birch Faced.....	1,241.34	48.51
For Oak, Add	267.77	
For Ash/Hickory, Add	267.77	
For Walnut, Add	440.56	
For Cherry, Add	827.34	
08 14 73 00-0037 EA Pair 3' x 7' x 1-3/8" High Wood Pocket Door, Hollow Core, Birch Faced	1,328.37	52.11
For Oak, Add	286.45	
For Ash/Hickory, Add	286.45	
For Walnut, Add	471.30	
For Cherry, Add	885.06	
08 14 73 00-0038 1-3/4" Thick <small>(08 14 73 00-0016)</small>		
See CSI section 08 14 73 00-0069 for all jambs and track hardware.		
08 14 73 00-0039 6'-8" High <small>(08 14 73 00-0038)</small>		
08 14 73 00-0040 EA 2' x 6'-8" x 1-3/4" High Wood Pocket Door, Hollow Core, Birch Faced	742.21	25.16
For Oak, Add	161.91	
For Ash/Hickory, Add	161.91	
For Walnut, Add	266.39	
For Cherry, Add	500.25	
08 14 73 00-0041 EA 2'-4" x 6'-8" x 1-3/4" High Wood Pocket Door, Hollow Core, Birch Faced.....	777.74	26.95
For Oak, Add	169.38	
For Ash/Hickory, Add	169.38	
For Walnut, Add	278.68	
For Cherry, Add	523.34	
08 14 73 00-0042 EA 2'-6" x 6'-8" x 1-3/4" High Wood Pocket Door, Hollow Core, Birch Faced.....	797.29	28.75
For Oak, Add	173.12	
For Ash/Hickory, Add	173.12	
For Walnut, Add	284.83	
For Cherry, Add	534.88	
08 14 73 00-0043 EA 2'-8" x 6'-8" x 1-3/4" High Wood Pocket Door, Hollow Core, Birch Faced.....	819.51	30.55
For Oak, Add	177.47	
For Ash/Hickory, Add	177.47	
For Walnut, Add	292.00	
For Cherry, Add	548.35	
08 14 73 00-0044 EA 2'-10" x 6'-8" x 1-3/4" High Wood Pocket Door, Hollow Core, Birch Faced.....	839.09	32.34
For Oak, Add	181.21	
For Ash/Hickory, Add	181.21	
For Walnut, Add	298.15	
For Cherry, Add	559.90	
08 14 73 00-0045 EA 3' x 6'-8" x 1-3/4" High Wood Pocket Door, Hollow Core, Birch Faced.....	858.65	34.14
For Oak, Add	184.95	
For Ash/Hickory, Add	184.95	
For Walnut, Add	304.30	
For Cherry, Add	571.44	
08 14 73 00-0046 EA Pair 2' x 6'-8" x 1-3/4" High Wood Pocket Door, Hollow Core, Birch Faced.....	1,473.66	44.92
For Oak, Add	323.81	
For Ash/Hickory, Add	323.81	
For Walnut, Add	532.77	
For Cherry, Add	1,000.50	
08 14 73 00-0047 EA Pair 2'-6" x 6'-8" x 1-3/4" High Wood Pocket Door, Hollow Core, Birch Faced	1,576.65	48.51
For Oak, Add	346.23	
For Ash/Hickory, Add	346.23	
For Walnut, Add	569.66	
For Cherry, Add	1,069.77	

08 Openings**08 10 Doors And Frames****08 14 Wood Doors**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 14 73 00-0048	EA		Pair 3' x 6'-8" x 1-3/4" High Wood Pocket Door, Hollow Core, Birch Faced.....	1,684.97	52.11
			<i>For Oak, Add</i>	369.90	
			<i>For Ash/Hickory, Add</i>	369.90	
			<i>For Walnut, Add</i>	608.59	
			<i>For Cherry, Add</i>	1,142.88	
08 14 73 00-0049			7' High (08 14 73 00-0038)		
08 14 73 00-0050	EA		2' x 7' x 1-3/4" High Wood Pocket Door, Hollow Core, Birch Faced.....	795.44	25.16
			<i>For Oak, Add</i>	174.36	
			<i>For Ash/Hickory, Add</i>	174.36	
			<i>For Walnut, Add</i>	286.88	
			<i>For Cherry, Add</i>	538.74	
08 14 73 00-0051	EA		2'-4" x 7' x 1-3/4" High Wood Pocket Door, Hollow Core, Birch Faced	836.28	26.95
			<i>For Oak, Add</i>	183.08	
			<i>For Ash/Hickory, Add</i>	183.08	
			<i>For Walnut, Add</i>	301.22	
			<i>For Cherry, Add</i>	565.67	
08 14 73 00-0052	EA		2'-6" x 7' x 1-3/4" High Wood Pocket Door, Hollow Core, Birch Faced	858.50	28.75
			<i>For Oak, Add</i>	187.44	
			<i>For Ash/Hickory, Add</i>	187.44	
			<i>For Walnut, Add</i>	308.39	
			<i>For Cherry, Add</i>	579.14	
08 14 73 00-0053	EA		2'-8" x 7' x 1-3/4" High Wood Pocket Door, Hollow Core, Birch Faced	880.72	30.55
			<i>For Oak, Add</i>	191.80	
			<i>For Ash/Hickory, Add</i>	191.80	
			<i>For Walnut, Add</i>	315.57	
			<i>For Cherry, Add</i>	592.61	
08 14 73 00-0054	EA		2'-10" x 7' x 1-3/4" High Wood Pocket Door, Hollow Core, Birch Faced	900.30	32.34
			<i>For Oak, Add</i>	195.54	
			<i>For Ash/Hickory, Add</i>	195.54	
			<i>For Walnut, Add</i>	321.71	
			<i>For Cherry, Add</i>	604.15	
08 14 73 00-0055	EA		3' x 7' x 1-3/4" High Wood Pocket Door, Hollow Core, Birch Faced.....	922.52	34.14
			<i>For Oak, Add</i>	199.89	
			<i>For Ash/Hickory, Add</i>	199.89	
			<i>For Walnut, Add</i>	328.89	
			<i>For Cherry, Add</i>	617.62	
08 14 73 00-0056	EA		Pair 2' x 7' x 1-3/4" High Wood Pocket Door, Hollow Core, Birch Faced	1,580.11	44.92
			<i>For Oak, Add</i>	348.72	
			<i>For Ash/Hickory, Add</i>	348.72	
			<i>For Walnut, Add</i>	573.75	
			<i>For Cherry, Add</i>	1,077.47	
08 14 73 00-0057	EA		Pair 2'-6" x 7' x 1-3/4" High Wood Pocket Door, Hollow Core, Birch Faced.....	1,699.06	48.51
			<i>For Oak, Add</i>	374.88	
			<i>For Ash/Hickory, Add</i>	374.88	
			<i>For Walnut, Add</i>	616.79	
			<i>For Cherry, Add</i>	1,158.27	
08 14 73 00-0058	EA		Pair 3' x 7' x 1-3/4" High Wood Pocket Door, Hollow Core, Birch Faced	1,812.71	52.11
			<i>For Oak, Add</i>	399.79	
			<i>For Ash/Hickory, Add</i>	399.79	
			<i>For Walnut, Add</i>	657.77	
			<i>For Cherry, Add</i>	1,235.24	
08 14 73 00-0059			8' High (08 14 73 00-0038)		
08 14 73 00-0060	EA		2' x 8' x 1-3/4" High Wood Pocket Door, Hollow Core, Birch Faced.....	848.66	25.16
			<i>For Oak, Add</i>	186.82	
			<i>For Ash/Hickory, Add</i>	186.82	
			<i>For Walnut, Add</i>	307.37	
			<i>For Cherry, Add</i>	577.21	
08 14 73 00-0061	EA		2'-4" x 8' x 1-3/4" High Wood Pocket Door, Hollow Core, Birch Faced	889.51	26.95
			<i>For Oak, Add</i>	195.54	
			<i>For Ash/Hickory, Add</i>	195.54	
			<i>For Walnut, Add</i>	321.71	
			<i>For Cherry, Add</i>	604.15	
08 14 73 00-0062	EA		2'-6" x 8' x 1-3/4" High Wood Pocket Door, Hollow Core, Birch Faced	914.39	28.75
			<i>For Oak, Add</i>	200.52	
			<i>For Ash/Hickory, Add</i>	200.52	
			<i>For Walnut, Add</i>	329.91	
			<i>For Cherry, Add</i>	619.55	
08 14 73 00-0063	EA		2'-8" x 8' x 1-3/4" High Wood Pocket Door, Hollow Core, Birch Faced	939.27	30.55
			<i>For Oak, Add</i>	205.50	
			<i>For Ash/Hickory, Add</i>	205.50	
			<i>For Walnut, Add</i>	338.11	
			<i>For Cherry, Add</i>	634.94	
08 14 73 00-0064	EA		2'-10" x 8' x 1-3/4" High Wood Pocket Door, Hollow Core, Birch Faced	958.84	32.34
			<i>For Oak, Add</i>	209.23	
			<i>For Ash/Hickory, Add</i>	209.23	
			<i>For Walnut, Add</i>	344.25	
			<i>For Cherry, Add</i>	646.48	
08 14 73 00-0065	EA		3' x 8' x 1-3/4" High Wood Pocket Door, Hollow Core, Birch Faced.....	983.72	34.14
			<i>For Oak, Add</i>	214.22	
			<i>For Ash/Hickory, Add</i>	214.22	
			<i>For Walnut, Add</i>	352.45	
			<i>For Cherry, Add</i>	661.87	



Openings	08	08
Doors And Frames	08 10	
Wood Doors	08 14	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 14 73 00-0066 EA Pair 2' x 8' x 1-3/4" High Wood Pocket Door, Hollow Core, Birch Faced.....	1,686.56	44.92
For Oak, Add	373.63	
For Ash/Hickory, Add	373.63	
For Walnut, Add	614.74	
For Cherry, Add	1,154.43	
08 14 73 00-0067 EA Pair 2'-6" x 8' x 1-3/4" High Wood Pocket Door, Hollow Core, Birch Faced.....	1,810.83	48.51
For Oak, Add	401.03	
For Ash/Hickory, Add	401.03	
For Walnut, Add	659.82	
For Cherry, Add	1,239.08	
08 14 73 00-0068 EA Pair 3' x 8' x 1-3/4" High Wood Pocket Door, Hollow Core, Birch Faced.....	1,935.13	52.11
For Oak, Add	428.43	
For Ash/Hickory, Add	428.43	
For Walnut, Add	704.90	
For Cherry, Add	1,323.75	
08 14 73 00-0069 Accessories (08 14 73 00-0016)		
08 14 73 00-0070 Jamb Replacement (08 14 73 00-0069)		
08 14 73 00-0071 EA 4-9/16 Or 4-3/4" Jamb, Birch.....	98.60	
For Oak, Add	7.08	
For Ash/Hickory, Add	11.09	
For Walnut, Add	24.25	
For Cherry, Add	38.41	
08 14 73 00-0072 EA 5-1/4" Jamb, Birch.....	100.62	
For Oak, Add	7.31	
For Ash/Hickory, Add	11.45	
For Walnut, Add	25.03	
For Cherry, Add	39.65	
08 14 73 00-0073 EA 6-9/16" Or 6-3/4" Jamb, Birch.....	113.76	
For Oak, Add	8.79	
For Ash/Hickory, Add	13.77	
For Walnut, Add	30.12	
For Cherry, Add	47.70	
08 14 73 00-0074 Track And Hardware Replacement Kits (08 14 73 00-0069)		
Note: For double doors, use 2 appropriate sized hardware and 1 converging kit.		
08 14 73 00-0075 EA Up To 2'-6" x 6'-8" Door Track And Hardware.....	217.41	
08 14 73 00-0076 EA 2'-8" x 6'-8" Door Track And Hardware.....	219.46	
08 14 73 00-0077 EA 3' x 6'-8" Door Track And Hardware.....	223.54	
08 14 73 00-0078 EA Up To 2'-6" x 7' Door Track And Hardware.....	262.38	
08 14 73 00-0079 EA 2'-8" x 7' Door Track And Hardware.....	264.42	
08 14 73 00-0080 EA 3' x 7' Door Track And Hardware.....	268.51	
08 14 73 00-0081 EA Up To 2'-6" x 8' Door Track And Hardware.....	282.82	
08 14 73 00-0082 EA 2'-8" x 8' Door Track And Hardware.....	284.86	
08 14 73 00-0083 EA 3' x 8' Door Track And Hardware.....	288.95	
08 14 73 00-0084 EA Double Door Converging Kit.....	31.22	
08 14 76 Bifolding Wood Doors (08 14)		
08 14 76 00-0001 Bi-Fold Wood Doors (08 14 76)		
Note: Includes doors, track, top and bottom pivots, door guide, track stop, panel hinge, bottom pivot bracket, top pivot lock, and 4-door aligner (when necessary). Excludes door frame and knobs.		
08 14 76 00-0002 Lauan Faced Hollow Core Flush Bi-Fold Doors (08 14 76 00-0001)		
08 14 76 00-0003 EA 2'-0", Two 1-3/8" Unfinished Doors, Lauan Faced, Hollow Core, Flush Bi-Fold.....	123.78	43.10
08 14 76 00-0004 EA 2'-6", Two 1-3/8" Unfinished Doors, Lauan Faced, Hollow Core, Flush Bi-Fold.....	130.96	46.70
08 14 76 00-0005 EA 2'-8", Two 1-3/8" Unfinished Doors, Lauan Faced, Hollow Core, Flush Bi-Fold.....	140.65	50.29
08 14 76 00-0006 EA 3'-0", Two 1-3/8" Unfinished Doors, Lauan Faced, Hollow Core, Flush Bi-Fold.....	147.84	53.88
08 14 76 00-0007 EA 4'-0", Four 1-3/8" Unfinished Doors, Lauan Faced, Hollow Core, Flush Bi-Fold.....	187.06	57.47
08 14 76 00-0008 EA 5'-0", Four 1-3/8" Unfinished Doors, Lauan Faced, Hollow Core, Flush Bi-Fold.....	194.25	61.07
08 14 76 00-0009 EA 6'-0", Four 1-3/8" Unfinished Doors, Lauan Faced, Hollow Core, Flush Bi-Fold.....	206.74	64.66
08 14 76 00-0010 Birch Faced Hollow Core Flush Bi-Fold Doors (08 14 76 00-0001)		
08 14 76 00-0011 EA 2'-0", Two 1-3/8" Unfinished Doors, Birch Faced, Hollow Core, Flush Bi-Fold.....	129.92	43.10
08 14 76 00-0012 EA 2'-6", Two 1-3/8" Unfinished Doors, Birch Faced, Hollow Core, Flush Bi-Fold.....	139.11	46.70
08 14 76 00-0013 EA 2'-8", Two 1-3/8" Unfinished Doors, Birch Faced, Hollow Core, Flush Bi-Fold.....	150.15	50.29
08 14 76 00-0014 EA 3'-0", Two 1-3/8" Unfinished Doors, Birch Faced, Hollow Core, Flush Bi-Fold.....	157.34	53.88
08 14 76 00-0015 EA 4'-0", Four 1-3/8" Unfinished Doors, Birch Faced, Hollow Core, Flush Bi-Fold.....	200.18	57.47
08 14 76 00-0016 EA 5'-0", Four 1-3/8" Unfinished Doors, Birch Faced, Hollow Core, Flush Bi-Fold.....	214.71	61.07
08 14 76 00-0017 EA 6'-0", Four 1-3/8" Unfinished Doors, Birch Faced, Hollow Core, Flush Bi-Fold.....	229.99	64.66
08 14 76 00-0018 Oak Faced Hollow Core Flush Bi-Fold Doors (08 14 76 00-0001)		
08 14 76 00-0019 EA 2'-0", Two 1-3/8" Unfinished Doors, Oak Faced, Hollow Core, Flush Bi-Fold.....	130.20	43.10
08 14 76 00-0020 EA 2'-6", Two 1-3/8" Unfinished Doors, Oak Faced, Hollow Core, Flush Bi-Fold.....	143.03	46.70
08 14 76 00-0021 EA 2'-8", Two 1-3/8" Unfinished Doors, Oak Faced, Hollow Core, Flush Bi-Fold.....	153.77	50.29
08 14 76 00-0022 EA 3'-0", Two 1-3/8" Unfinished Doors, Oak Faced, Hollow Core, Flush Bi-Fold.....	160.96	53.88
08 14 76 00-0023 EA 4'-0", Four 1-3/8" Unfinished Doors, Oak Faced, Hollow Core, Flush Bi-Fold.....	203.35	57.47

08	Openings
08 10	Doors And Frames
08 14	Wood Doors



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 14 76 00-0024 EA 5'-0", Four 1-3/8" Unfinished Doors, Oak Faced, Hollow Core, Flush Bi-Fold	211.81	61.07
08 14 76 00-0025 EA 6'-0", Four 1-3/8" Unfinished Doors, Oak Faced, Hollow Core, Flush Bi-Fold	229.99	64.66
08 14 76 00-0026 Pine Raised Panel Bi-Fold Doors (08 14 76 00-0001)		
08 14 76 00-0027 EA 2'-0", Two 1-3/8" Unfinished Doors, Pine Veneer, Raised Panel Bi-Fold.....	312.44	43.10
08 14 76 00-0028 EA 2'-6", Two 1-3/8" Unfinished Doors, Pine Veneer, Raised Panel Bi-Fold.....	356.17	46.70
08 14 76 00-0029 EA 2'-8", Two 1-3/8" Unfinished Doors, Pine Veneer, Raised Panel Bi-Fold.....	405.83	50.29
08 14 76 00-0030 EA 3'-0", Two 1-3/8" Unfinished Doors, Pine Veneer, Raised Panel Bi-Fold.....	413.02	53.88
08 14 76 00-0031 EA 4'-0", Four 1-3/8" Unfinished Doors, Pine Veneer, Raised Panel Bi-Fold.....	567.39	57.47
08 14 76 00-0032 EA 5'-0", Four 1-3/8" Unfinished Doors, Pine Veneer, Raised Panel Bi-Fold.....	647.68	61.07
08 14 76 00-0033 EA 6'-0", Four 1-3/8" Unfinished Doors, Pine Veneer, Raised Panel Bi-Fold.....	739.82	64.66
08 14 76 00-0034 Oak Raised Panel Bi-Fold Doors (08 14 76 00-0001)		
08 14 76 00-0035 EA 2'-0", Two 1-3/8" Unfinished Doors, Oak Veneer, Raised Panel Bi-Fold	396.41	43.10
08 14 76 00-0036 EA 2'-6", Two 1-3/8" Unfinished Doors, Oak Veneer, Raised Panel Bi-Fold	430.26	46.70
08 14 76 00-0037 EA 2'-8", Two 1-3/8" Unfinished Doors, Oak Veneer, Raised Panel Bi-Fold	470.04	50.29
08 14 76 00-0038 EA 3'-0", Two 1-3/8" Unfinished Doors, Oak Veneer, Raised Panel Bi-Fold	477.23	53.88
08 14 76 00-0039 EA 4'-0", Four 1-3/8" Unfinished Doors, Oak Veneer, Raised Panel Bi-Fold.....	735.33	57.47
08 14 76 00-0040 EA 5'-0", Four 1-3/8" Unfinished Doors, Oak Veneer, Raised Panel Bi-Fold.....	795.87	61.07
08 14 76 00-0041 EA 6'-0", Four 1-3/8" Unfinished Doors, Oak Veneer, Raised Panel Bi-Fold.....	868.25	64.66
08 14 76 00-0042 Molded High Density Fiberboard Hollow Core Paneled Bi-Fold Doors (08 14 76 00-0001)		
08 14 76 00-0043 EA 2'-0", Two 1-3/8" Unfinished Doors, Primed, Molded High Density Fiberboard, Hollow Core, Paneled Bi-Fold.....	125.94	43.10
08 14 76 00-0044 EA 2'-6", Two 1-3/8" Unfinished Doors, Primed, Molded High Density Fiberboard, Hollow Core, Paneled Bi-Fold.....	135.64	46.70
08 14 76 00-0045 EA 2'-8", Two 1-3/8" Unfinished Doors, Primed, Molded High Density Fiberboard, Hollow Core, Paneled Bi-Fold.....	148.16	50.29
08 14 76 00-0046 EA 3'-0", Two 1-3/8" Unfinished Doors, Primed, Molded High Density Fiberboard, Hollow Core, Paneled Bi-Fold.....	150.85	53.88
08 14 76 00-0047 EA 4'-0", Four 1-3/8" Unfinished Doors, Primed, Molded High Density Fiberboard, Hollow Core, Paneled Bi-Fold.....	183.50	57.47
08 14 76 00-0048 EA 5'-0", Four 1-3/8" Unfinished Doors, Primed, Molded High Density Fiberboard, Hollow Core, Paneled Bi-Fold.....	197.74	61.07
08 14 76 00-0049 EA 6'-0", Four 1-3/8" Unfinished Doors, Primed, Molded High Density Fiberboard, Hollow Core, Paneled Bi-Fold.....	220.16	64.66
08 16 Composite Doors (08 10)		
Note: Includes machining for all hardware. Excludes finish hardware. See CSI section 08 70 00 00-0000 for finish hardware.		
08 16 13 Fiberglass Doors (08 16)		
See CSI section 08 70 00 00-0000 for finish hardware.		
08 16 13 00-0001 Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Frames And Doors (08 16 13)		
08 16 13 00-0002 Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Doors And Frames (Chem-Pruf) (08 16 13 00-0001)		
08 16 13 00-0003 Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Doors And Frames (Chem-Pruf) (08 16 13 00-0002)		
Note: White, tan, brown or gray finish. Includes factory hardware prep and 25 Mil resin rich gel coat.		
08 16 13 00-0004 Standard, Corrosion-Resistant Fiberglass Reinforced Polyester (FRP) Doors And Frames (Chem-Pruf) (08 16 13 00-0003)		
Note: Includes fiberglass reinforced polyester (FRP) door frame, 4-1/2" x 4-1/2" stainless steel hinges and factory hardware prep. Excludes hardware.		
08 16 13 00-0005 6'-8" High, Standard Corrosion-Resistant Fiberglass Reinforced Polyester (FRP) Doors And Frames (Chem-Pruf) (08 16 13 00-0004)		
08 16 13 00-0006 EA 3' x 6'-8", Standard Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf)	1,663.57	43.12
For Custom Color Finish, Add		88.90
For Stainless Steel Continuous Hinge, Add		197.88
08 16 13 00-0007 EA 3'-6" x 6'-8", Standard Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf).....	1,687.87	44.92
For Custom Color Finish, Add		88.90
For Stainless Steel Continuous Hinge, Add		197.88
08 16 13 00-0008 EA 4' x 6'-8", Standard Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf)	1,850.38	48.51
For Custom Color Finish, Add		88.90
For Stainless Steel Continuous Hinge, Add		197.88
08 16 13 00-0009 PR Pair 3' x 6'-8", Standard Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf).....	3,043.54	81.94
For Custom Color Finish, Add		177.80
For Stainless Steel Continuous Hinge, Add		395.77
08 16 13 00-0010 PR Pair 3'-6" x 6'-8", Standard Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf).....	3,067.62	85.35
For Custom Color Finish, Add		177.80
For Stainless Steel Continuous Hinge, Add		395.77
08 16 13 00-0011 PR Pair 4' x 6'-8", Standard Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf).....	3,416.08	92.17
For Custom Color Finish, Add		177.80
For Stainless Steel Continuous Hinge, Add		395.77
08 16 13 00-0012 7' High, Standard Corrosion-Resistant Fiberglass Reinforced Polyester (FRP) Doors And Frames (Chem-Pruf) (08 16 13 00-0004)		



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
	08 16 13 00-0013	EA		3' x 7', Standard Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf)..... <i>For Custom Color Finish, Add</i> <i>For Stainless Steel Continuous Hinge, Add</i>	1,663.57 88.90 197.88	43.12
	08 16 13 00-0014	EA		3'-6" x 7', Standard Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf)..... <i>For Custom Color Finish, Add</i> <i>For Stainless Steel Continuous Hinge, Add</i>	1,726.99 88.90 197.88	44.92
	08 16 13 00-0015	EA		4' x 7', Standard Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf)..... <i>For Custom Color Finish, Add</i> <i>For Stainless Steel Continuous Hinge, Add</i>	1,891.79 88.90 197.88	48.51
	08 16 13 00-0016	PR		Pair 3' x 7', Standard Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf)..... <i>For Custom Color Finish, Add</i> <i>For Stainless Steel Continuous Hinge, Add</i>	3,043.54 177.80 395.77	81.94
	08 16 13 00-0017	PR		Pair 3'-6" x 7', Standard Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf)..... <i>For Custom Color Finish, Add</i> <i>For Stainless Steel Continuous Hinge, Add</i>	3,259.76 177.80 395.77	85.35
	08 16 13 00-0018	PR		Pair 4' x 7', Standard Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf)..... <i>For Custom Color Finish, Add</i> <i>For Stainless Steel Continuous Hinge, Add</i>	3,498.91 177.80 395.77	92.17
08 16 13 00-0019				Fire Rated, Corrosion-Resistant Fiberglass Reinforced Polyester (FRP) Doors And Frames (Chem-Pruf) <small>(08 16 13 00-0003)</small> Note: Includes fiberglass reinforced polyester (FRP) door frame, 4-1/2" x 4-1/2" stainless steel hinges and factory hardware prep. Excludes hardware.		
08 16 13 00-0020				45 Minute Fire Rated, Corrosion-Resistant Fiberglass Reinforced Polyester (FRP) Doors And Frames (Chem-Pruf) <small>(08 16 13 00-0019)</small>		
08 16 13 00-0021				6'-8" High, 45 Minute Fire Rated, Corrosion-Resistant Fiberglass Reinforced Polyester (FRP) Doors And Frames (Chem-Pruf) <small>(08 16 13 00-0020)</small>		
	08 16 13 00-0022	EA		3' x 6'-8", 45 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf)..... <i>For Custom Color Finish, Add</i> <i>For Stainless Steel Continuous Hinge, Add</i>	2,141.03 88.90 197.88	43.12
	08 16 13 00-0023	EA		3'-6" x 6'-8", 45 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf)..... <i>For Custom Color Finish, Add</i> <i>For Stainless Steel Continuous Hinge, Add</i>	2,186.03 88.90 197.88	44.92
	08 16 13 00-0024	EA		4' x 6'-8", 45 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf)..... <i>For Custom Color Finish, Add</i> <i>For Stainless Steel Continuous Hinge, Add</i>	2,314.02 88.90 197.88	48.51
	08 16 13 00-0025	PR		Pair 3' x 6'-8", 45 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf)..... <i>For Custom Color Finish, Add</i> <i>For Stainless Steel Continuous Hinge, Add</i>	3,756.84 177.80 395.77	81.94
	08 16 13 00-0026	PR		Pair 3'-6" x 6'-8", 45 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf)..... <i>For Custom Color Finish, Add</i> <i>For Stainless Steel Continuous Hinge, Add</i>	3,805.09 177.80 395.77	85.35
	08 16 13 00-0027	PR		Pair 4' x 6'-8", 45 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf)..... <i>For Custom Color Finish, Add</i> <i>For Stainless Steel Continuous Hinge, Add</i>	4,101.77 177.80 395.77	92.17
08 16 13 00-0028				7' High, 45 Minute Fire Rated, Corrosion-Resistant Fiberglass Reinforced Polyester (FRP) Doors And Frames (Chem-Pruf) <small>(08 16 13 00-0020)</small>		
	08 16 13 00-0029	EA		3' x 7', 45 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf)..... <i>For Custom Color Finish, Add</i> <i>For Stainless Steel Continuous Hinge, Add</i>	2,141.03 88.90 197.88	43.12
	08 16 13 00-0030	EA		3'-6" x 7', 45 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf)..... <i>For Custom Color Finish, Add</i> <i>For Stainless Steel Continuous Hinge, Add</i>	2,179.13 88.90 197.88	44.92
	08 16 13 00-0031	EA		4' x 7', 45 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf)..... <i>For Custom Color Finish, Add</i> <i>For Stainless Steel Continuous Hinge, Add</i>	2,363.50 88.90 197.88	48.51
	08 16 13 00-0032	PR		Pair 3' x 7', 45 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf)..... <i>For Custom Color Finish, Add</i> <i>For Stainless Steel Continuous Hinge, Add</i>	3,756.84 177.80 395.77	81.94
	08 16 13 00-0033	PR		Pair 3'-6" x 7', 45 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf)..... <i>For Custom Color Finish, Add</i> <i>For Stainless Steel Continuous Hinge, Add</i>	3,791.28 177.80 395.77	85.35
	08 16 13 00-0034	PR		Pair 4' x 7', 45 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf)..... <i>For Custom Color Finish, Add</i> <i>For Stainless Steel Continuous Hinge, Add</i>	4,200.71 177.80 395.77	92.17

08 Openings**08 10 Doors And Frames****08 16 Composite Doors**

MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
08 16 13 00-0035		60 Minute Fire Rated, Corrosion-Resistant Fiberglass Reinforced Polyester (FRP) Doors And Frames (Chem-Pruf) <small>(08 16 13 00-0019)</small>			
08 16 13 00-0036		6'-8" High, 60 Minute Fire Rated, Corrosion-Resistant Fiberglass Reinforced Polyester (FRP) Doors And Frames (Chem-Pruf) <small>(08 16 13 00-0035)</small>			
08 16 13 00-0037	EA	3' x 6'-8", 60 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf).....	2,141.03		43.12
		<i>For Custom Color Finish, Add</i>	88.90		
		<i>For Stainless Steel Continuous Hinge, Add</i>	197.88		
08 16 13 00-0038	EA	3'-6" x 6'-8", 60 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf).....	2,186.03		44.92
		<i>For Custom Color Finish, Add</i>	88.90		
		<i>For Stainless Steel Continuous Hinge, Add</i>	197.88		
08 16 13 00-0039	EA	4' x 6'-8", 60 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf).....	2,314.02		48.51
		<i>For Custom Color Finish, Add</i>	88.90		
		<i>For Stainless Steel Continuous Hinge, Add</i>	197.88		
08 16 13 00-0040	PR	Pair 3' x 6'-8", 60 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf).....	3,756.84		81.94
		<i>For Custom Color Finish, Add</i>	177.80		
		<i>For Stainless Steel Continuous Hinge, Add</i>	395.77		
08 16 13 00-0041	PR	Pair 3'-6" x 6'-8", 60 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf).....	3,805.09		85.35
		<i>For Custom Color Finish, Add</i>	177.80		
		<i>For Stainless Steel Continuous Hinge, Add</i>	395.77		
08 16 13 00-0042	PR	Pair 4' x 6'-8", 60 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf).....	4,101.77		92.17
		<i>For Custom Color Finish, Add</i>	177.80		
		<i>For Stainless Steel Continuous Hinge, Add</i>	395.77		
08 16 13 00-0043		7' High, 60 Minute Fire Rated, Corrosion-Resistant Fiberglass Reinforced Polyester (FRP) Doors And Frames (Chem-Pruf) <small>(08 16 13 00-0035)</small>			
08 16 13 00-0044	EA	3' x 7', 60 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf).....	2,141.03		43.12
		<i>For Custom Color Finish, Add</i>	88.90		
		<i>For Stainless Steel Continuous Hinge, Add</i>	197.88		
08 16 13 00-0045	EA	3'-6" x 7', 60 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf).....	2,179.13		44.92
		<i>For Custom Color Finish, Add</i>	88.90		
		<i>For Stainless Steel Continuous Hinge, Add</i>	197.88		
08 16 13 00-0046	EA	4' x 7', 60 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf).....	2,363.50		48.51
		<i>For Custom Color Finish, Add</i>	88.90		
		<i>For Stainless Steel Continuous Hinge, Add</i>	197.88		
08 16 13 00-0047	PR	Pair 3' x 7', 60 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf).....	3,756.84		81.94
		<i>For Custom Color Finish, Add</i>	177.80		
		<i>For Stainless Steel Continuous Hinge, Add</i>	395.77		
08 16 13 00-0048	PR	Pair 3'-6" x 7', 60 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf).....	3,791.28		85.35
		<i>For Custom Color Finish, Add</i>	177.80		
		<i>For Stainless Steel Continuous Hinge, Add</i>	395.77		
08 16 13 00-0049	PR	Pair 4' x 7', 60 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf).....	4,200.71		92.17
		<i>For Custom Color Finish, Add</i>	177.80		
		<i>For Stainless Steel Continuous Hinge, Add</i>	395.77		
08 16 13 00-0050		90 Minute Fire Rated, Corrosion-Resistant Fiberglass Reinforced Polyester (FRP) Doors And Frames (Chem-Pruf) <small>(08 16 13 00-0019)</small>			
08 16 13 00-0051		6'-8" High, 90 Minute Fire Rated, Corrosion-Resistant Fiberglass Reinforced Polyester (FRP) Doors And Frames (Chem-Pruf) <small>(08 16 13 00-0050)</small>			
08 16 13 00-0052	EA	3' x 6'-8", 90 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf).....	2,141.03		43.12
		<i>For Custom Color Finish, Add</i>	88.90		
		<i>For Stainless Steel Continuous Hinge, Add</i>	197.88		
08 16 13 00-0053	EA	3'-6" x 6'-8", 90 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf).....	2,186.03		44.92
		<i>For Custom Color Finish, Add</i>	88.90		
		<i>For Stainless Steel Continuous Hinge, Add</i>	197.88		
08 16 13 00-0054	EA	4' x 6'-8", 90 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf).....	2,314.02		48.51
		<i>For Custom Color Finish, Add</i>	88.90		
		<i>For Stainless Steel Continuous Hinge, Add</i>	197.88		
08 16 13 00-0055	PR	Pair 3' x 6'-8", 90 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf).....	3,756.84		81.94
		<i>For Custom Color Finish, Add</i>	177.80		
		<i>For Stainless Steel Continuous Hinge, Add</i>	395.77		



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
	08 16 13 00-0056	PR		Pair 3'-6" x 6'-8", 90 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf) 3,805.09	3,805.09	85.35
				<i>For Custom Color Finish, Add</i> 177.80	177.80	
				<i>For Stainless Steel Continuous Hinge, Add</i> 395.77	395.77	
	08 16 13 00-0057	PR		Pair 4' x 6'-8", 90 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf) 4,163.89	4,163.89	92.17
				<i>For Custom Color Finish, Add</i> 177.80	177.80	
				<i>For Stainless Steel Continuous Hinge, Add</i> 395.77	395.77	
	08 16 13 00-0058			7' High, 90 Minute Fire Rated, Corrosion-Resistant Fiberglass Reinforced Polyester (FRP) Doors And Frames (Chem-Pruf) <small>(08 16 13 00-0050)</small>		
	08 16 13 00-0059	EA		3' x 7', 90 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf) 2,141.03	2,141.03	43.12
				<i>For Custom Color Finish, Add</i> 88.90	88.90	
				<i>For Stainless Steel Continuous Hinge, Add</i> 197.88	197.88	
	08 16 13 00-0060	EA		3'-6" x 7', 90 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf) 2,179.13	2,179.13	44.92
				<i>For Custom Color Finish, Add</i> 88.90	88.90	
				<i>For Stainless Steel Continuous Hinge, Add</i> 197.88	197.88	
	08 16 13 00-0061	EA		4' x 7', 90 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf) 2,363.50	2,363.50	48.51
				<i>For Custom Color Finish, Add</i> 88.90	88.90	
				<i>For Stainless Steel Continuous Hinge, Add</i> 197.88	197.88	
	08 16 13 00-0062	PR		Pair 3' x 7', 90 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf) 3,756.84	3,756.84	81.94
				<i>For Custom Color Finish, Add</i> 177.80	177.80	
				<i>For Stainless Steel Continuous Hinge, Add</i> 395.77	395.77	
	08 16 13 00-0063	PR		Pair 3'-6" x 7', 90 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf) 3,846.51	3,846.51	85.35
				<i>For Custom Color Finish, Add</i> 177.80	177.80	
				<i>For Stainless Steel Continuous Hinge, Add</i> 395.77	395.77	
	08 16 13 00-0064	PR		Pair 4' x 7', 90 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf) 4,265.14	4,265.14	92.17
				<i>For Custom Color Finish, Add</i> 177.80	177.80	
				<i>For Stainless Steel Continuous Hinge, Add</i> 395.77	395.77	
	08 16 13 00-0065			Storm Rated, Corrosion-Resistant Fiberglass Reinforced Polyester (FRP) Doors And Frames (Chem-Pruf) <small>(08 16 13 00-0003)</small>		
				Note: Includes fiberglass reinforced polyester (FRP) door frame, 4-1/2" x 4-1/2" stainless steel hinges and factory hardware prep. Excludes hardware.		
	08 16 13 00-0066			6'-8" High, Storm Rated, Corrosion-Resistant Fiberglass Reinforced Polyester (FRP) Doors And Frames (Chem-Pruf) <small>(08 16 13 00-0065)</small>		
	08 16 13 00-0067	EA		3' x 6'-8", Storm Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf) 1,723.40	1,723.40	43.12
				<i>For Custom Color Finish, Add</i> 88.90	88.90	
				<i>For Stainless Steel Continuous Hinge, Add</i> 197.88	197.88	
	08 16 13 00-0068			7' High, Storm Rated, Corrosion-Resistant Fiberglass Reinforced Polyester (FRP) Doors And Frames (Chem-Pruf) <small>(08 16 13 00-0065)</small>		
	08 16 13 00-0069	EA		3' x 7', Storm Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Chem-Pruf) 1,723.40	1,723.40	43.12
				<i>For Custom Color Finish, Add</i> 88.90	88.90	
				<i>For Stainless Steel Continuous Hinge, Add</i> 197.88	197.88	
	08 16 13 00-0070			Accessories For Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Doors (Chem-Pruf) <small>(08 16 13 00-0002)</small>		
	08 16 13 00-0071	SI		1/4" Tempered, Factory Installed Vision Glass (Chem-Pruf) 0.24	0.24	
	08 16 13 00-0072	SI		1/4" Laminated, Factory Installed Vision Glass (Chem-Pruf) 0.38	0.38	
	08 16 13 00-0073	SI		1/4" Wire, Factory Installed Vision Glass (Chem-Pruf) 0.32	0.32	
	08 16 13 00-0074	SI		1/2" Insulated, Factory Installed Vision Glass (Chem-Pruf) 0.34	0.34	
	08 16 13 00-0075	SI		Factory Installed Molded Louver (Chem-Pruf) 0.24	0.24	
	08 16 13 00-0076	SI		Factory Installed Molded Louver With Insect Screen (Chem-Pruf) 0.32	0.32	
	08 16 13 00-0077	LF		Weather Strip (Chem-Pruf) 6.90	6.90	
	08 16 13 00-0078	LF		Fiberglass Reinforced Polyester (FRP) Astragal With Seal (Chem-Pruf) 9.20	9.20	
	08 16 13 00-0079	LF		1/2" Fiberglass Reinforced Polyester (FRP) Grooved Saddle Threshold (Chem-Pruf) 18.41	18.41	
	08 16 13 00-0080	LF		Fiberglass Reinforced Polyester (FRP) Door Sweep (Chem-Pruf) 23.01	23.01	
	08 16 13 00-0081	LF		2-1/4" Fiberglass Reinforced Polyester (FRP) Center Door Mullion (Chem-Pruf) 44.87	44.87	
	08 16 13 00-0082			Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Doors And Frames (Skule Door) <small>(08 16 13 00-0001)</small>		
	08 16 13 00-0083			Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Doors And Frames (Skule Door) <small>(08 16 13 00-0082)</small>		
				Note: White, tan, brown or gray finish. Includes factory hardware prep.		

08 Openings**08 10 Doors And Frames****08 16 Composite Doors**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 16 13 00-0084			Standard, Corrosion-Resistant Fiberglass Reinforced Polyester (FRP) Doors And Frames (Skule Door) <small>(08 16 13 00-0083)</small> Note: Includes fiberglass reinforced polyester (FRP) door frame, 4-1/2" x 4-1/2" stainless steel hinges and factory hardware prep. Excludes hardware.		
08 16 13 00-0085			6'-8" High, Standard Corrosion-Resistant Fiberglass Reinforced Polyester (FRP) Doors And Frames (Skule Door) <small>(08 16 13 00-0084)</small>		
08 16 13 00-0086	EA		3' x 6'-8", Standard Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door).....	1,317.17	43.12
			<i>For Custom Color Finish, Add</i>	88.90	
			<i>For Stainless Steel Continuous Hinge, Add</i>	197.88	
08 16 13 00-0087	EA		3'-6" x 6'-8", Standard Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door)	1,335.72	44.92
			<i>For Custom Color Finish, Add</i>	88.90	
			<i>For Stainless Steel Continuous Hinge, Add</i>	197.88	
08 16 13 00-0088	EA		4' x 6'-8", Standard Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door).....	1,400.43	48.51
			<i>For Custom Color Finish, Add</i>	88.90	
			<i>For Stainless Steel Continuous Hinge, Add</i>	197.88	
08 16 13 00-0089	PR		Pair 3' x 6'-8", Standard Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door).....	2,443.92	81.94
			<i>For Custom Color Finish, Add</i>	177.80	
			<i>For Stainless Steel Continuous Hinge, Add</i>	395.77	
08 16 13 00-0090	PR		Pair 3'-6" x 6'-8", Standard Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door).....	2,480.67	85.35
			<i>For Custom Color Finish, Add</i>	177.80	
			<i>For Stainless Steel Continuous Hinge, Add</i>	395.77	
08 16 13 00-0091	PR		Pair 4' x 6'-8", Standard Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door).....	2,609.38	92.17
			<i>For Custom Color Finish, Add</i>	177.80	
			<i>For Stainless Steel Continuous Hinge, Add</i>	395.77	
08 16 13 00-0092			7' High, Standard Corrosion-Resistant Fiberglass Reinforced Polyester (FRP) Doors And Frames (Skule Door) <small>(08 16 13 00-0084)</small>		
08 16 13 00-0093	EA		3' x 7', Standard Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door)	1,317.17	43.12
			<i>For Custom Color Finish, Add</i>	88.90	
			<i>For Stainless Steel Continuous Hinge, Add</i>	197.88	
08 16 13 00-0094	EA		3'-6" x 7', Standard Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door).....	1,393.24	44.92
			<i>For Custom Color Finish, Add</i>	88.90	
			<i>For Stainless Steel Continuous Hinge, Add</i>	197.88	
08 16 13 00-0095	EA		4' x 7', Standard Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door)	1,400.43	48.51
			<i>For Custom Color Finish, Add</i>	88.90	
			<i>For Stainless Steel Continuous Hinge, Add</i>	197.88	
08 16 13 00-0096	PR		Pair 3' x 7', Standard Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door).....	2,443.92	81.94
			<i>For Custom Color Finish, Add</i>	177.80	
			<i>For Stainless Steel Continuous Hinge, Add</i>	395.77	
08 16 13 00-0097	PR		Pair 3'-6" x 7', Standard Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door).....	2,595.72	85.35
			<i>For Custom Color Finish, Add</i>	177.80	
			<i>For Stainless Steel Continuous Hinge, Add</i>	395.77	
08 16 13 00-0098	PR		Pair 4' x 7', Standard Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door).....	2,609.38	92.17
			<i>For Custom Color Finish, Add</i>	177.80	
			<i>For Stainless Steel Continuous Hinge, Add</i>	395.77	
08 16 13 00-0099			Fire Rated, Corrosion-Resistant Fiberglass Reinforced Polyester (FRP) Doors And Frames (Skule Door) <small>(08 16 13 00-0083)</small> Note: Includes fiberglass reinforced polyester (FRP) door frame, 4-1/2" x 4-1/2" stainless steel hinges and factory hardware prep. Excludes hardware.		
08 16 13 00-0100			45 Minute Fire Rated, Corrosion-Resistant Fiberglass Reinforced Polyester (FRP) Doors And Frames (Skule Door) <small>(08 16 13 00-0099)</small>		
08 16 13 00-0101			6'-8" High, 45 Minute Fire Rated, Corrosion-Resistant Fiberglass Reinforced Polyester (FRP) Doors And Frames (Skule Door) <small>(08 16 13 00-0100)</small>		
08 16 13 00-0102	EA		3' x 6'-8", 45 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door)	2,180.04	43.12
			<i>For Custom Color Finish, Add</i>	88.90	
			<i>For Stainless Steel Continuous Hinge, Add</i>	197.88	
08 16 13 00-0103	EA		3'-6" x 6'-8", 45 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door)	2,225.05	44.92
			<i>For Custom Color Finish, Add</i>	88.90	
			<i>For Stainless Steel Continuous Hinge, Add</i>	197.88	
08 16 13 00-0104	EA		4' x 6'-8", 45 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door)	2,331.18	48.51
			<i>For Custom Color Finish, Add</i>	88.90	
			<i>For Stainless Steel Continuous Hinge, Add</i>	197.88	
08 16 13 00-0105	PR		Pair 3' x 6'-8", 45 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door)	3,931.51	81.94
			<i>For Custom Color Finish, Add</i>	177.80	
			<i>For Stainless Steel Continuous Hinge, Add</i>	395.77	
08 16 13 00-0106	PR		Pair 3'-6" x 6'-8", 45 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door)	4,021.17	85.35
			<i>For Custom Color Finish, Add</i>	177.80	
			<i>For Stainless Steel Continuous Hinge, Add</i>	395.77	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 16 13 00-0107 PR Pair 4' x 6'-8", 45 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door) <i>For Custom Color Finish, Add</i> <i>For Stainless Steel Continuous Hinge, Add</i>	4,232.72 177.80 395.77	92.17
08 16 13 00-0108 7' High, 45 Minute Fire Rated, Corrosion-Resistant Fiberglass Reinforced Polyester (FRP) Doors And Frames (Skule Door) <small>(08 16 13 00-0100)</small>		
08 16 13 00-0109 EA 3' x 7', 45 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door) <i>For Custom Color Finish, Add</i> <i>For Stainless Steel Continuous Hinge, Add</i>	2,180.04 88.90 197.88	43.12
08 16 13 00-0110 EA 3'-6" x 7', 45 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door) <i>For Custom Color Finish, Add</i> <i>For Stainless Steel Continuous Hinge, Add</i>	2,241.15 88.90 197.88	44.92
08 16 13 00-0111 EA 4' x 7', 45 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door) <i>For Custom Color Finish, Add</i> <i>For Stainless Steel Continuous Hinge, Add</i>	2,380.65 88.90 197.88	48.51
08 16 13 00-0112 PR Pair 3' x 7', 45 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door) <i>For Custom Color Finish, Add</i> <i>For Stainless Steel Continuous Hinge, Add</i>	3,931.51 177.80 395.77	81.94
08 16 13 00-0113 PR Pair 3'-6" x 7', 45 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door) <i>For Custom Color Finish, Add</i> <i>For Stainless Steel Continuous Hinge, Add</i>	4,053.39 177.80 395.77	85.35
08 16 13 00-0114 PR Pair 4' x 7', 45 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door) <i>For Custom Color Finish, Add</i> <i>For Stainless Steel Continuous Hinge, Add</i>	4,331.66 177.80 395.77	92.17
08 16 13 00-0115 60 Minute Fire Rated, Corrosion-Resistant Fiberglass Reinforced Polyester (FRP) Doors And Frames (Skule Door) <small>(08 16 13 00-0099)</small>		
08 16 13 00-0116 6'-8" High, 60 Minute Fire Rated, Corrosion-Resistant Fiberglass Reinforced Polyester (FRP) Doors And Frames (Skule Door) <small>(08 16 13 00-0115)</small>		
08 16 13 00-0117 EA 3' x 6'-8", 60 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door) <i>For Custom Color Finish, Add</i> <i>For Stainless Steel Continuous Hinge, Add</i>	2,180.04 88.90 197.88	43.12
08 16 13 00-0118 EA 3'-6" x 6'-8", 60 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door) <i>For Custom Color Finish, Add</i> <i>For Stainless Steel Continuous Hinge, Add</i>	2,225.05 88.90 197.88	44.92
08 16 13 00-0119 EA 4' x 6'-8", 60 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door) <i>For Custom Color Finish, Add</i> <i>For Stainless Steel Continuous Hinge, Add</i>	2,331.18 88.90 197.88	48.51
08 16 13 00-0120 PR Pair 3' x 6'-8", 60 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door) <i>For Custom Color Finish, Add</i> <i>For Stainless Steel Continuous Hinge, Add</i>	3,931.51 177.80 395.77	81.94
08 16 13 00-0121 PR Pair 3'-6" x 6'-8", 60 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door) <i>For Custom Color Finish, Add</i> <i>For Stainless Steel Continuous Hinge, Add</i>	4,021.17 177.80 395.77	85.35
08 16 13 00-0122 PR Pair 4' x 6'-8", 60 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door) <i>For Custom Color Finish, Add</i> <i>For Stainless Steel Continuous Hinge, Add</i>	4,232.72 177.80 395.77	92.17
08 16 13 00-0123 7' High, 60 Minute Fire Rated, Corrosion-Resistant Fiberglass Reinforced Polyester (FRP) Doors And Frames (Skule Door) <small>(08 16 13 00-0115)</small>		
08 16 13 00-0124 EA 3' x 7', 60 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door) <i>For Custom Color Finish, Add</i> <i>For Stainless Steel Continuous Hinge, Add</i>	2,180.04 88.90 197.88	43.12
08 16 13 00-0125 EA 3'-6" x 7', 60 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door) <i>For Custom Color Finish, Add</i> <i>For Stainless Steel Continuous Hinge, Add</i>	2,241.15 88.90 197.88	44.92
08 16 13 00-0126 EA 4' x 7', 60 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door) <i>For Custom Color Finish, Add</i> <i>For Stainless Steel Continuous Hinge, Add</i>	2,380.65 88.90 197.88	48.51
08 16 13 00-0127 PR Pair 3' x 7', 60 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door) <i>For Custom Color Finish, Add</i> <i>For Stainless Steel Continuous Hinge, Add</i>	3,931.51 177.80 395.77	81.94

08	Openings
08 10	Doors And Frames
08 16	Composite Doors



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 16 13 00-0128	PR		Pair 3'-6" x 7', 60 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door).....	4,053.39	85.35
			<i>For Custom Color Finish, Add</i>	177.80	
			<i>For Stainless Steel Continuous Hinge, Add</i>	395.77	
08 16 13 00-0129	PR		Pair 4' x 7', 60 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door).....	4,331.66	92.17
			<i>For Custom Color Finish, Add</i>	177.80	
			<i>For Stainless Steel Continuous Hinge, Add</i>	395.77	
08 16 13 00-0130			90 Minute Fire Rated, Corrosion-Resistant Fiberglass Reinforced Polyester (FRP) Doors And Frames (Skule Door) (08 16 13 00-0099)		
08 16 13 00-0131			6'-8" High, 90 Minute Fire Rated, Corrosion-Resistant Fiberglass Reinforced Polyester (FRP) Doors And Frames (Skule Door) (08 16 13 00-0130)		
08 16 13 00-0132	EA		3' x 6'-8", 90 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door).....	2,180.04	43.12
			<i>For Custom Color Finish, Add</i>	88.90	
			<i>For Stainless Steel Continuous Hinge, Add</i>	197.88	
08 16 13 00-0133	EA		3'-6" x 6'-8", 90 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door).....	2,225.05	44.92
			<i>For Custom Color Finish, Add</i>	88.90	
			<i>For Stainless Steel Continuous Hinge, Add</i>	197.88	
08 16 13 00-0134	EA		4' x 6'-8", 90 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door).....	2,331.18	48.51
			<i>For Custom Color Finish, Add</i>	88.90	
			<i>For Stainless Steel Continuous Hinge, Add</i>	197.88	
08 16 13 00-0135	PR		Pair 3' x 6'-8", 90 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door).....	3,931.51	81.94
			<i>For Custom Color Finish, Add</i>	177.80	
			<i>For Stainless Steel Continuous Hinge, Add</i>	395.77	
08 16 13 00-0136	PR		Pair 3'-6" x 6'-8", 90 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door).....	4,021.17	85.35
			<i>For Custom Color Finish, Add</i>	177.80	
			<i>For Stainless Steel Continuous Hinge, Add</i>	395.77	
08 16 13 00-0137	PR		Pair 4' x 6'-8", 90 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door).....	4,232.72	92.17
			<i>For Custom Color Finish, Add</i>	177.80	
			<i>For Stainless Steel Continuous Hinge, Add</i>	395.77	
08 16 13 00-0138			7' High, 90 Minute Fire Rated, Corrosion-Resistant Fiberglass Reinforced Polyester (FRP) Doors And Frames (Skule Door) (08 16 13 00-0130)		
08 16 13 00-0139	EA		3' x 7', 90 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door).....	2,180.04	43.12
			<i>For Custom Color Finish, Add</i>	88.90	
			<i>For Stainless Steel Continuous Hinge, Add</i>	197.88	
08 16 13 00-0140	EA		3'-6" x 7', 90 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door).....	2,241.15	44.92
			<i>For Custom Color Finish, Add</i>	88.90	
			<i>For Stainless Steel Continuous Hinge, Add</i>	197.88	
08 16 13 00-0141	EA		4' x 7', 90 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door).....	2,380.65	48.51
			<i>For Custom Color Finish, Add</i>	88.90	
			<i>For Stainless Steel Continuous Hinge, Add</i>	197.88	
08 16 13 00-0142	PR		Pair 3' x 7', 90 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door).....	3,931.51	81.94
			<i>For Custom Color Finish, Add</i>	177.80	
			<i>For Stainless Steel Continuous Hinge, Add</i>	395.77	
08 16 13 00-0143	PR		Pair 3'-6" x 7', 90 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door).....	4,053.39	85.35
			<i>For Custom Color Finish, Add</i>	177.80	
			<i>For Stainless Steel Continuous Hinge, Add</i>	395.77	
08 16 13 00-0144	PR		Pair 4' x 7', 90 Minute Fire Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door).....	4,331.66	92.17
			<i>For Custom Color Finish, Add</i>	177.80	
			<i>For Stainless Steel Continuous Hinge, Add</i>	395.77	
08 16 13 00-0145			Storm Rated, Corrosion-Resistant Fiberglass Reinforced Polyester (FRP) Doors And Frames (Skule Door) (08 16 13 00-0083)		
			Note: Includes fiberglass reinforced polyester (FRP) door frame, 4-1/2" x 4-1/2" stainless steel hinges and factory hardware prep. Excludes hardware.		
08 16 13 00-0146			6'-8" High, Storm Rated, Corrosion-Resistant Fiberglass Reinforced Polyester (FRP) Doors And Frames (Skule Door) (08 16 13 00-0145)		
08 16 13 00-0147	EA		3' x 6'-8", Storm Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door).....	1,489.74	43.12
			<i>For Custom Color Finish, Add</i>	88.90	
			<i>For Stainless Steel Continuous Hinge, Add</i>	197.88	
08 16 13 00-0148			7' High, Storm Rated, Corrosion-Resistant Fiberglass Reinforced Polyester (FRP) Doors And Frames (Skule Door) (08 16 13 00-0145)		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 16 13 00-0149 EA 3' x 7', Storm Rated, Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Door And Frame (Skule Door)..... <i>For Custom Color Finish, Add</i> <i>For Stainless Steel Continuous Hinge, Add</i>	1,489.74 88.90 197.88	43.12
08 16 13 00-0150 Accessories For Corrosion Resistant Fiberglass Reinforced Polyester (FRP) Doors (Skule Door) <small>(08 16 13 00-0082)</small>		
08 16 13 00-0151 SI 1/4" Tempered, Factory Installed Vision Glass (Skule Door).....	0.54	
08 16 13 00-0152 SI 1/4" Laminated, Factory Installed Vision Glass (Skule Door).....	0.56	
08 16 13 00-0153 SI 1/4" Wire, Factory Installed Vision Glass (Skule Door).....	0.59	
08 16 13 00-0154 SI 1/2" Insulated, Factory Installed Vision Glass (Skule Door).....	0.85	
08 16 13 00-0155 SI Factory Installed Molded Louver (Skule Door).....	0.34	
08 16 13 00-0156 SI Factory Installed Molded Louver With Insect Screen (Skule Door).....	0.54	
08 16 13 00-0157 LF Weather Strip (Skule Door).....	4.60	
08 16 13 00-0158 LF Fiberglass Reinforced Polyester (FRP) Astragal With Seal (Skule Door).....	5.75	
08 16 13 00-0159 LF 1/2" Fiberglass Reinforced Polyester (FRP) Grooved Saddle Threshold (Skule Door).....	18.41	
08 16 13 00-0160 LF Fiberglass Reinforced Polyester (FRP) Door Sweep (Skule Door).....	65.58	
08 16 13 00-0161 LF 2-1/4" Fiberglass Reinforced Polyester (FRP) Center Door Mullion (Skule Door).....	25.31	
08 17 Integrated Door Opening Assemblies <small>(08 10)</small>		
08 17 23 Integrated Metal Door Opening Assemblies <small>(08 17)</small>		
08 17 23 00-0001 Pre-Hung Interior Door Units <small>(08 17 23)</small>		
<i>Note: All prehung doors include door, frame, and trim, all mounting hardware (standard duty ball bearing hinges). Excludes lockset.</i>		
08 17 23 00-0002 Hollow Core Doors, 1-3/8" Thick <small>(08 17 23 00-0001)</small>		
08 17 23 00-0003 Birch Faced <small>(08 17 23 00-0002)</small>		
08 17 23 00-0004 EA 2'-0" Or 2'-4" x 7' x 1-3/8" Prehung Hollow Core, Birch Faced Door..... <i>For Each 1' Of Additional Door Height, Add</i>	338.40 59.65	44.92
08 17 23 00-0005 EA 2'-6" x 7' x 1-3/8" Prehung Hollow Core, Birch Faced Door..... <i>For Each 1' Of Additional Door Height, Add</i>	353.66 63.32	44.92
08 17 23 00-0006 EA 2'-8" x 7' x 1-3/8" Prehung Hollow Core, Birch Faced Door..... <i>For Each 1' Of Additional Door Height, Add</i>	372.55 66.99	46.72
08 17 23 00-0007 EA 3' x 7' x 1-3/8" Prehung Hollow Core, Birch Faced Door..... <i>For Each 1' Of Additional Door Height, Add</i>	380.69 68.08	48.51
08 17 23 00-0008 EA 3'-4" x 7' x 1-3/8" Prehung Hollow Core, Birch Faced Door..... <i>For Each 1' Of Additional Door Height, Add</i>	408.39 74.73	48.51
08 17 23 00-0009 EA 3'-6" x 7' x 1-3/8" Prehung Hollow Core, Birch Faced Door..... <i>For Each 1' Of Additional Door Height, Add</i>	431.93 79.51	50.31
08 17 23 00-0010 EA Pair 2' x 7' x 1-3/8" Prehung Hollow Core, Birch Faced Door..... <i>For Each 1' Of Additional Door Height, Add</i>	644.44 119.30	73.67
08 17 23 00-0011 EA Pair 2'-6" x 7' x 1-3/8" Prehung Hollow Core, Birch Faced Door..... <i>For Each 1' Of Additional Door Height, Add</i>	685.80 126.65	79.06
08 17 23 00-0012 EA Pair 3' x 7' x 1-3/8" Prehung Hollow Core, Birch Faced Door..... <i>For Each 1' Of Additional Door Height, Add</i>	736.21 136.15	84.45
08 17 23 00-0013 Luan Faced <small>(08 17 23 00-0002)</small>		
08 17 23 00-0014 EA 2'-0" Or 2'-4" x 7' x 1-3/8" Prehung Hollow Core, Luan Faced Door..... <i>For Each 1' Of Additional Door Height, Add</i>	305.88 51.85	44.92
08 17 23 00-0015 EA 2'-6" x 7' x 1-3/8" Prehung Hollow Core, Luan Faced Door..... <i>For Each 1' Of Additional Door Height, Add</i>	320.53 55.37	44.92
08 17 23 00-0016 EA 2'-8" x 7' x 1-3/8" Prehung Hollow Core, Luan Faced Door..... <i>For Each 1' Of Additional Door Height, Add</i>	336.48 58.33	46.72
08 17 23 00-0017 EA 3' x 7' x 1-3/8" Prehung Hollow Core, Luan Faced Door..... <i>For Each 1' Of Additional Door Height, Add</i>	348.80 60.42	48.51
08 17 23 00-0018 EA 3'-4" x 7' x 1-3/8" Prehung Hollow Core, Luan Faced Door..... <i>For Each 1' Of Additional Door Height, Add</i>	372.87 66.20	48.51
08 17 23 00-0019 EA 3'-6" x 7' x 1-3/8" Prehung Hollow Core, Luan Faced Door..... <i>For Each 1' Of Additional Door Height, Add</i>	394.10 70.43	50.31
08 17 23 00-0020 EA Pair 2' x 7' x 1-3/8" Prehung Hollow Core, Luan Faced Door..... <i>For Each 1' Of Additional Door Height, Add</i>	579.43 103.70	73.67
08 17 23 00-0021 EA Pair 2'-6" x 7' x 1-3/8" Prehung Hollow Core, Luan Faced Door..... <i>For Each 1' Of Additional Door Height, Add</i>	619.44 110.72	79.06
08 17 23 00-0022 EA Pair 3' x 7' x 1-3/8" Prehung Hollow Core, Luan Faced Door..... <i>For Each 1' Of Additional Door Height, Add</i>	672.50 120.86	84.45
08 17 23 00-0023 Tempered Hardboard Faced <small>(08 17 23 00-0002)</small>		
08 17 23 00-0024 EA 2'-0" Or 2'-4" x 7' x 1-3/8" Prehung Hollow Core, Hardboard Faced Door..... <i>For Each 1' Of Additional Door Height, Add</i>	259.20 40.65	44.92
08 17 23 00-0025 EA 2'-6" x 7' x 1-3/8" Prehung Hollow Core, Hardboard Faced Door..... <i>For Each 1' Of Additional Door Height, Add</i>	271.55 43.61	44.92
08 17 23 00-0026 EA 2'-8" x 7' x 1-3/8" Prehung Hollow Core, Hardboard Faced Door..... <i>For Each 1' Of Additional Door Height, Add</i>	281.00 45.02	46.72
08 17 23 00-0027 EA 3' x 7' x 1-3/8" Prehung Hollow Core, Hardboard Faced Door..... <i>For Each 1' Of Additional Door Height, Add</i>	296.32 47.83	48.51
08 17 23 00-0028 EA 3'-4" x 7' x 1-3/8" Prehung Hollow Core, Hardboard Faced Door..... <i>For Each 1' Of Additional Door Height, Add</i>	318.23 53.09	48.51

08 Openings**08 10 Doors And Frames****08 17 Integrated Door Opening Assemblies**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 17 23 00-0029	EA		3'-6" x 7' x 1-3/8" Prehung Hollow Core, Hardboard Faced Door.....	335.99	50.31
			<i>For Each 1' Of Additional Door Height, Add</i>	56.49	
08 17 23 00-0030	EA		Pair 2' x 7' x 1-3/8" Prehung Hollow Core, Hardboard Faced Door.....	486.05	73.67
			<i>For Each 1' Of Additional Door Height, Add</i>	81.29	
08 17 23 00-0031	EA		Pair 2'-6" x 7' x 1-3/8" Prehung Hollow Core, Hardboard Faced Door	521.52	79.06
			<i>For Each 1' Of Additional Door Height, Add</i>	87.22	
08 17 23 00-0032	EA		Pair 3' x 7' x 1-3/8" Prehung Hollow Core, Hardboard Faced Door.....	567.47	84.45
			<i>For Each 1' Of Additional Door Height, Add</i>	95.66	
08 17 23 00-0033			Solid Core Doors, 1-3/8" Thick (08 17 23 00-0001)		
08 17 23 00-0034			Birch Faced (08 17 23 00-0033)		
08 17 23 00-0035	EA		2'-0" Or 2'-4" x 7' x 1-3/8" Prehung Solid Core, Birch Faced Door	455.83	44.92
			<i>For Each 1' Of Additional Door Height, Add</i>	87.84	
08 17 23 00-0036	EA		2'-6" x 7' x 1-3/8" Prehung Solid Core, Birch Faced Door	475.08	44.92
			<i>For Each 1' Of Additional Door Height, Add</i>	92.46	
08 17 23 00-0037	EA		2'-8" x 7' x 1-3/8" Prehung Solid Core, Birch Faced Door	497.88	46.72
			<i>For Each 1' Of Additional Door Height, Add</i>	97.07	
08 17 23 00-0038	EA		3' x 7' x 1-3/8" Prehung Solid Core, Birch Faced Door.....	524.91	48.51
			<i>For Each 1' Of Additional Door Height, Add</i>	102.69	
08 17 23 00-0039	EA		3'-4" x 7' x 1-3/8" Prehung Solid Core, Birch Faced Door	571.90	48.51
			<i>For Each 1' Of Additional Door Height, Add</i>	113.97	
08 17 23 00-0040	EA		3'-6" x 7' x 1-3/8" Prehung Solid Core, Birch Faced Door	617.00	50.31
			<i>For Each 1' Of Additional Door Height, Add</i>	123.93	
08 17 23 00-0041	EA		Pair 2' x 7' x 1-3/8" Prehung Solid Core, Birch Faced Door	879.33	73.67
			<i>For Each 1' Of Additional Door Height, Add</i>	175.68	
08 17 23 00-0042	EA		Pair 2'-6" x 7' x 1-3/8" Prehung Solid Core, Birch Faced Door.....	928.60	79.06
			<i>For Each 1' Of Additional Door Height, Add</i>	184.92	
08 17 23 00-0043	EA		Pair 3' x 7' x 1-3/8" Prehung Solid Core, Birch Faced Door	1,024.66	84.45
			<i>For Each 1' Of Additional Door Height, Add</i>	205.38	
08 17 23 00-0044			Lauan Faced (08 17 23 00-0033)		
08 17 23 00-0045	EA		2'-0" Or 2'-4" x 7' x 1-3/8" Prehung Solid Core, Lauan Faced Door	406.71	44.92
			<i>For Each 1' Of Additional Door Height, Add</i>	76.05	
08 17 23 00-0046	EA		2'-6" x 7' x 1-3/8" Prehung Solid Core, Lauan Faced Door	424.13	44.92
			<i>For Each 1' Of Additional Door Height, Add</i>	80.23	
08 17 23 00-0047	EA		2'-8" x 7' x 1-3/8" Prehung Solid Core, Lauan Faced Door	445.12	46.72
			<i>For Each 1' Of Additional Door Height, Add</i>	84.41	
08 17 23 00-0048	EA		3' x 7' x 1-3/8" Prehung Solid Core, Lauan Faced Door	466.31	48.51
			<i>For Each 1' Of Additional Door Height, Add</i>	88.63	
08 17 23 00-0049	EA		3'-4" x 7' x 1-3/8" Prehung Solid Core, Lauan Faced Door	506.92	48.51
			<i>For Each 1' Of Additional Door Height, Add</i>	98.37	
08 17 23 00-0050	EA		3'-6" x 7' x 1-3/8" Prehung Solid Core, Lauan Faced Door	536.75	50.31
			<i>For Each 1' Of Additional Door Height, Add</i>	104.67	
08 17 23 00-0051	EA		Pair 2' x 7' x 1-3/8" Prehung Solid Core, Lauan Faced Door	781.07	73.67
			<i>For Each 1' Of Additional Door Height, Add</i>	152.10	
08 17 23 00-0052	EA		Pair 2'-6" x 7' x 1-3/8" Prehung Solid Core, Lauan Faced Door	826.72	79.06
			<i>For Each 1' Of Additional Door Height, Add</i>	160.47	
08 17 23 00-0053	EA		Pair 3' x 7' x 1-3/8" Prehung Solid Core, Lauan Faced Door	907.44	84.45
			<i>For Each 1' Of Additional Door Height, Add</i>	177.25	
08 17 23 00-0054			Tempered Hardboard Faced (08 17 23 00-0033)		
08 17 23 00-0055	EA		2'-0" - 2'-4" x 7' x 1-3/8" Prehung Solid Core, Hardboard Faced Door	362.96	44.92
			<i>For Each 1' Of Additional Door Height, Add</i>	65.55	
08 17 23 00-0056	EA		2'-6" x 7' x 1-3/8" Prehung Solid Core, Hardboard Faced Door	378.77	44.92
			<i>For Each 1' Of Additional Door Height, Add</i>	69.34	
08 17 23 00-0057	EA		2'-8" x 7' x 1-3/8" Prehung Solid Core, Hardboard Faced Door	398.23	46.72
			<i>For Each 1' Of Additional Door Height, Add</i>	73.15	
08 17 23 00-0058	EA		3' x 7' x 1-3/8" Prehung Solid Core, Hardboard Faced Door.....	407.69	48.51
			<i>For Each 1' Of Additional Door Height, Add</i>	74.56	
08 17 23 00-0059	EA		3'-4" x 7' x 1-3/8" Prehung Solid Core, Hardboard Faced Door	441.95	48.51
			<i>For Each 1' Of Additional Door Height, Add</i>	82.78	
08 17 23 00-0060	EA		3'-6" x 7' x 1-3/8" Prehung Solid Core, Hardboard Faced Door	467.64	50.31
			<i>For Each 1' Of Additional Door Height, Add</i>	88.08	
08 17 23 00-0061	PR		Pair 2' x 7' x 1-3/8" Prehung Solid Core, Hardboard Faced Door	693.57	73.67
			<i>For Each 1' Of Additional Door Height, Add</i>	131.10	
08 17 23 00-0062	PR		Pair 2'-6" x 7' x 1-3/8" Prehung Solid Core, Hardboard Faced Door	735.97	79.06
			<i>For Each 1' Of Additional Door Height, Add</i>	138.69	
08 17 23 00-0063	PR		Pair 3' x 7' x 1-3/8" Prehung Solid Core, Hardboard Faced Door	790.21	84.45
			<i>For Each 1' Of Additional Door Height, Add</i>	149.12	
08 17 23 00-0064			Hollow Core Doors, 1-3/4" Thick (08 17 23 00-0001)		
08 17 23 00-0065			Birch Faced (08 17 23 00-0064)		
08 17 23 00-0066	EA		2'-0" Or 2'-4" x 7' x 1-3/4" Prehung Hollow Core, Birch Faced Door	400.50	44.92
			<i>For Each 1' Of Additional Door Height, Add</i>	74.56	
08 17 23 00-0067	EA		2'-6" x 7' x 1-3/4" Prehung Hollow Core, Birch Faced Door	412.22	44.92
			<i>For Each 1' Of Additional Door Height, Add</i>	77.37	
08 17 23 00-0068	EA		2'-8" x 7' x 1-3/4" Prehung Hollow Core, Birch Faced Door	420.15	46.72
			<i>For Each 1' Of Additional Door Height, Add</i>	78.41	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
				08 17 23 00-0069 EA 3' x 7' x 1-3/4" Prehung Hollow Core, Birch Faced Door.....	442.86	48.51
				For Each 1' Of Additional Door Height, Add	83.00	
				08 17 23 00-0070 EA 3'-4" x 7' x 1-3/4" Prehung Hollow Core, Birch Faced Door	493.59	48.51
				For Each 1' Of Additional Door Height, Add	95.17	
				08 17 23 00-0071 EA 3'-6" x 7' x 1-3/4" Prehung Hollow Core, Birch Faced Door	556.45	50.31
				For Each 1' Of Additional Door Height, Add	109.40	
				08 17 23 00-0072 EA Pair 2' x 7' x 1-3/4" Prehung Hollow Core, Birch Faced Door	768.68	73.67
				For Each 1' Of Additional Door Height, Add	149.12	
				08 17 23 00-0073 EA Pair 2'-6" x 7' x 1-3/4" Prehung Hollow Core, Birch Faced Door.....	802.88	79.06
				For Each 1' Of Additional Door Height, Add	154.74	
				08 17 23 00-0074 EA Pair 3' x 7' x 1-3/4" Prehung Hollow Core, Birch Faced Door	860.58	84.45
				For Each 1' Of Additional Door Height, Add	166.00	
				08 17 23 00-0075 Luan Faced <small>(08 17 23 00-0064)</small>		
				08 17 23 00-0076 EA 2'-0" Or 2'-4" x 7' x 1-3/4" Prehung Hollow Core, Luan Faced Door	364.29	44.92
				For Each 1' Of Additional Door Height, Add	65.87	
				08 17 23 00-0077 EA 2'-6" x 7' x 1-3/4" Prehung Hollow Core, Luan Faced Door	383.20	44.92
				For Each 1' Of Additional Door Height, Add	70.41	
				08 17 23 00-0078 EA 2'-8" x 7' x 1-3/4" Prehung Hollow Core, Luan Faced Door	402.14	46.72
				For Each 1' Of Additional Door Height, Add	74.09	
				08 17 23 00-0079 EA 3' x 7' x 1-3/4" Prehung Hollow Core, Luan Faced Door.....	411.81	48.51
				For Each 1' Of Additional Door Height, Add	75.55	
				08 17 23 00-0080 EA 3'-4" x 7' x 1-3/4" Prehung Hollow Core, Luan Faced Door	446.42	48.51
				For Each 1' Of Additional Door Height, Add	83.85	
				08 17 23 00-0081 EA 3'-6" x 7' x 1-3/4" Prehung Hollow Core, Luan Faced Door	472.37	50.31
				For Each 1' Of Additional Door Height, Add	89.22	
				08 17 23 00-0082 EA Pair 2' x 7' x 1-3/4" Prehung Hollow Core, Luan Faced Door	696.24	73.67
				For Each 1' Of Additional Door Height, Add	131.74	
				08 17 23 00-0083 EA Pair 2'-6" x 7' x 1-3/4" Prehung Hollow Core, Luan Faced Door.....	744.83	79.06
				For Each 1' Of Additional Door Height, Add	140.81	
				08 17 23 00-0084 EA Pair 3' x 7' x 1-3/4" Prehung Hollow Core, Luan Faced Door	798.47	84.45
				For Each 1' Of Additional Door Height, Add	151.10	
				08 17 23 00-0085 Tempered Hardboard Faced <small>(08 17 23 00-0064)</small>		
				08 17 23 00-0086 EA 2'-0" Or 2'-4" x 7' x 1-3/4" Prehung Hollow Core, Hardboard Faced Door	300.84	44.92
				For Each 1' Of Additional Door Height, Add	50.64	
				08 17 23 00-0087 EA 2'-6" x 7' x 1-3/4" Prehung Hollow Core, Hardboard Faced Door	306.72	44.92
				For Each 1' Of Additional Door Height, Add	52.05	
				08 17 23 00-0088 EA 2'-8" x 7' x 1-3/4" Prehung Hollow Core, Hardboard Faced Door	322.04	46.72
				For Each 1' Of Additional Door Height, Add	54.87	
				08 17 23 00-0089 EA 3' x 7' x 1-3/4" Prehung Hollow Core, Hardboard Faced Door.....	337.37	48.51
				For Each 1' Of Additional Door Height, Add	57.68	
				08 17 23 00-0090 EA 3'-4" x 7' x 1-3/4" Prehung Hollow Core, Hardboard Faced Door	350.75	48.51
				For Each 1' Of Additional Door Height, Add	60.89	
				08 17 23 00-0091 EA 3'-6" x 7' x 1-3/4" Prehung Hollow Core, Hardboard Faced Door	370.60	50.31
				For Each 1' Of Additional Door Height, Add	64.79	
				08 17 23 00-0092 EA Pair 2' x 7' x 1-3/4" Prehung Hollow Core, Hardboard Faced Door.....	569.32	73.67
				For Each 1' Of Additional Door Height, Add	101.28	
				08 17 23 00-0093 EA Pair 2'-6" x 7' x 1-3/4" Prehung Hollow Core, Hardboard Faced Door.....	591.87	79.06
				For Each 1' Of Additional Door Height, Add	104.10	
				08 17 23 00-0094 EA Pair 3' x 7' x 1-3/4" Prehung Hollow Core, Hardboard Faced Door.....	649.58	84.45
				For Each 1' Of Additional Door Height, Add	115.36	
				08 17 23 00-0095 Solid Core Doors, 1-3/4" Thick <small>(08 17 23 00-0001)</small>		
				08 17 23 00-0096 Birch Faced <small>(08 17 23 00-0095)</small>		
				08 17 23 00-0097 EA 2'-0" Or 2'-4" x 7' x 1-3/4" Prehung Solid Core, Birch Faced Door.....	511.88	44.92
				For Each 1' Of Additional Door Height, Add	101.29	
				08 17 23 00-0098 EA 2'-6" x 7' x 1-3/4" Prehung Solid Core, Birch Faced Door	529.45	44.92
				For Each 1' Of Additional Door Height, Add	105.51	
				08 17 23 00-0099 EA 2'-8" x 7' x 1-3/4" Prehung Solid Core, Birch Faced Door	538.92	46.72
				For Each 1' Of Additional Door Height, Add	106.92	
				08 17 23 00-0100 EA 3' x 7' x 1-3/4" Prehung Solid Core, Birch Faced Door	560.09	48.51
				For Each 1' Of Additional Door Height, Add	111.13	
				08 17 23 00-0101 EA 3'-4" x 7' x 1-3/4" Prehung Solid Core, Birch Faced Door	611.03	48.51
				For Each 1' Of Additional Door Height, Add	123.36	
				08 17 23 00-0102 EA 3'-6" x 7' x 1-3/4" Prehung Solid Core, Birch Faced Door	666.06	50.31
				For Each 1' Of Additional Door Height, Add	135.71	
				08 17 23 00-0103 EA Pair 2' x 7' x 1-3/4" Prehung Solid Core, Birch Faced Door	991.42	73.67
				For Each 1' Of Additional Door Height, Add	202.58	
				08 17 23 00-0104 EA Pair 2'-6" x 7' x 1-3/4" Prehung Solid Core, Birch Faced Door.....	1,037.33	79.06
				For Each 1' Of Additional Door Height, Add	211.01	
				08 17 23 00-0105 EA Pair 3' x 7' x 1-3/4" Prehung Solid Core, Birch Faced Door	1,095.02	84.45
				For Each 1' Of Additional Door Height, Add	222.27	
				08 17 23 00-0106 Luan Faced <small>(08 17 23 00-0095)</small>		
				08 17 23 00-0107 EA 2'-0" Or 2'-4" x 7' x 1-3/4" Prehung Solid Core, Luan Faced Door	521.15	44.92
				For Each 1' Of Additional Door Height, Add	103.51	

08 Openings**08 10 Doors And Frames****08 17 Integrated Door Opening Assemblies**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 17 23 00-0108	EA		2'-6" x 7' x 1-3/4" Prehung Solid Core, Luan Faced Door <i>For Each 1' Of Additional Door Height, Add</i>	522.41 103.82	44.92
08 17 23 00-0109	EA		2'-8" x 7' x 1-3/4" Prehung Solid Core, Luan Faced Door <i>For Each 1' Of Additional Door Height, Add</i>	538.42 106.80	46.72
08 17 23 00-0110	EA		3' x 7' x 1-3/4" Prehung Solid Core, Luan Faced Door <i>For Each 1' Of Additional Door Height, Add</i>	551.02 108.96	48.51
08 17 23 00-0111	EA		3'-4" x 7' x 1-3/4" Prehung Solid Core, Luan Faced Door <i>For Each 1' Of Additional Door Height, Add</i>	592.05 118.80	48.51
08 17 23 00-0112	EA		3'-6" x 7' x 1-3/4" Prehung Solid Core, Luan Faced Door <i>For Each 1' Of Additional Door Height, Add</i>	627.32 126.41	50.31
08 17 23 00-0113	EA		Pair 2' x 7' x 1-3/4" Prehung Solid Core, Luan Faced Door <i>For Each 1' Of Additional Door Height, Add</i>	1,009.98 207.03	73.67
08 17 23 00-0114	EA		Pair 2'-6" x 7' x 1-3/4" Prehung Solid Core, Luan Faced Door <i>For Each 1' Of Additional Door Height, Add</i>	1,023.24 207.63	79.06
08 17 23 00-0115	EA		Pair 3' x 7' x 1-3/4" Prehung Solid Core, Luan Faced Door <i>For Each 1' Of Additional Door Height, Add</i>	1,076.87 217.91	84.45
08 17 23 00-0116			Tempered Hardboard Faced <small>(08 17 23 00-0095)</small>		
08 17 23 00-0117	EA		2'-0" Or 2'-4" x 7' x 1-3/4" Prehung Solid Core, Hardboard Faced Door <i>For Each 1' Of Additional Door Height, Add</i>	423.95 80.19	44.92
08 17 23 00-0118	EA		2'-6" x 7' x 1-3/4" Prehung Solid Core, Hardboard Faced Door <i>For Each 1' Of Additional Door Height, Add</i>	429.79 81.59	44.92
08 17 23 00-0119	EA		2'-8" x 7' x 1-3/4" Prehung Solid Core, Hardboard Faced Door <i>For Each 1' Of Additional Door Height, Add</i>	439.27 83.00	46.72
08 17 23 00-0120	EA		3' x 7' x 1-3/4" Prehung Solid Core, Hardboard Faced Door <i>For Each 1' Of Additional Door Height, Add</i>	454.59 85.81	48.51
08 17 23 00-0121	EA		3'-4" x 7' x 1-3/4" Prehung Solid Core, Hardboard Faced Door <i>For Each 1' Of Additional Door Height, Add</i>	480.82 92.11	48.51
08 17 23 00-0122	EA		3'-6" x 7' x 1-3/4" Prehung Solid Core, Hardboard Faced Door <i>For Each 1' Of Additional Door Height, Add</i>	508.99 98.01	50.31
08 17 23 00-0123	EA		Pair 2' x 7' x 1-3/4" Prehung Solid Core, Hardboard Faced Door <i>For Each 1' Of Additional Door Height, Add</i>	815.54 160.37	73.67
08 17 23 00-0124	EA		Pair 2'-6" x 7' x 1-3/4" Prehung Solid Core, Hardboard Faced Door <i>For Each 1' Of Additional Door Height, Add</i>	838.03 163.18	79.06
08 17 23 00-0125	EA		Pair 3' x 7' x 1-3/4" Prehung Solid Core, Hardboard Faced Door <i>For Each 1' Of Additional Door Height, Add</i>	884.02 171.63	84.45
08 17 23 00-0126			Oak Or Maple Faced <small>(08 17 23 00-0095)</small>		
08 17 23 00-0127	EA		2'-0" Or 2'-4" x 7' x 1-3/4" Prehung Solid Core, Oak Or Maple Faced Door <i>For Each 1' Of Additional Door Height, Add</i>	620.50 127.36	44.92
08 17 23 00-0128	EA		2'-6" x 7' x 1-3/4" Prehung Solid Core, Oak Or Maple Faced Door <i>For Each 1' Of Additional Door Height, Add</i>	623.74 128.14	44.92
08 17 23 00-0129	EA		2'-8" x 7' x 1-3/4" Prehung Solid Core, Oak Or Maple Faced Door <i>For Each 1' Of Additional Door Height, Add</i>	654.75 134.72	46.72
08 17 23 00-0130	EA		3' x 7' x 1-3/4" Prehung Solid Core, Oak Or Maple Faced Door <i>For Each 1' Of Additional Door Height, Add</i>	665.52 136.44	48.51
08 17 23 00-0131	EA		3'-4" x 7' x 1-3/4" Prehung Solid Core, Oak Or Maple Faced Door <i>For Each 1' Of Additional Door Height, Add</i>	727.14 151.23	48.51
08 17 23 00-0132	EA		3'-6" x 7' x 1-3/4" Prehung Solid Core, Oak Or Maple Faced Door <i>For Each 1' Of Additional Door Height, Add</i>	803.76 168.75	50.31
08 17 23 00-0133	EA		Pair 2' x 7' x 1-3/4" Prehung Solid Core, Oak Or Maple Faced Door <i>For Each 1' Of Additional Door Height, Add</i>	1,208.66 254.72	73.67
08 17 23 00-0134	EA		Pair 2'-6" x 7' x 1-3/4" Prehung Solid Core, Oak Or Maple Faced Door <i>For Each 1' Of Additional Door Height, Add</i>	1,225.94 256.27	79.06
08 17 23 00-0135	EA		Pair 3' x 7' x 1-3/4" Prehung Solid Core, Oak Or Maple Faced Door <i>For Each 1' Of Additional Door Height, Add</i>	1,305.88 272.88	84.45
08 17 23 00-0136			Walnut Faced <small>(08 17 23 00-0095)</small>		
08 17 23 00-0137	EA		2'-0" Or 2'-4" x 7' x 1-3/4" Prehung Solid Core, Walnut Faced Door <i>For Each 1' Of Additional Door Height, Add</i>	786.23 167.13	44.92
08 17 23 00-0138	EA		2'-6" x 7' x 1-3/4" Prehung Solid Core, Walnut Faced Door <i>For Each 1' Of Additional Door Height, Add</i>	815.18 174.08	44.92
08 17 23 00-0139	EA		2'-8" x 7' x 1-3/4" Prehung Solid Core, Walnut Faced Door <i>For Each 1' Of Additional Door Height, Add</i>	828.47 176.41	46.72
08 17 23 00-0140	EA		3' x 7' x 1-3/4" Prehung Solid Core, Walnut Faced Door <i>For Each 1' Of Additional Door Height, Add</i>	861.07 183.37	48.51
08 17 23 00-0141	EA		3'-4" x 7' x 1-3/4" Prehung Solid Core, Walnut Faced Door <i>For Each 1' Of Additional Door Height, Add</i>	945.13 203.54	48.51
08 17 23 00-0142	EA		3'-6" x 7' x 1-3/4" Prehung Solid Core, Walnut Faced Door <i>For Each 1' Of Additional Door Height, Add</i>	1,033.60 223.91	50.31
08 17 23 00-0143	EA		Pair 2' x 7' x 1-3/4" Prehung Solid Core, Walnut Faced Door <i>For Each 1' Of Additional Door Height, Add</i>	1,540.11 334.26	73.67
08 17 23 00-0144	EA		Pair 2'-6" x 7' x 1-3/4" Prehung Solid Core, Walnut Faced Door <i>For Each 1' Of Additional Door Height, Add</i>	1,608.79 348.16	79.06
08 17 23 00-0145	EA		Pair 3' x 7' x 1-3/4" Prehung Solid Core, Walnut Faced Door <i>For Each 1' Of Additional Door Height, Add</i>	1,696.98 366.74	84.45

08 30 Specialty Doors And Frames (08)



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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08 31 Access Doors And Panels (08 30)

See CSI section 07 72 33 00-0000 for roof hatches, 23 33 33 00-0000 for duct-mounted access doors.

08 31 13 Access Doors And Frames (08 31)

08 31 13 00-0001 Stainless Steel Access Doors (08 31 13)

08 31 13 00-0002 Fire Rated Stainless Steel Access Doors (08 31 13 00-0001)

08 31 13 00-0003	EA	12" x 12" Fire Rated Stainless Steel Access Door With Cam Latch	332.40	39.35
08 31 13 00-0004	EA	12" x 18" Fire Rated Stainless Steel Access Door With Cam Latch	388.01	41.93
08 31 13 00-0005	EA	18" x 18" Fire Rated Stainless Steel Access Door With Cam Latch	454.40	44.35
08 31 13 00-0006	EA	24" x 18" Fire Rated Stainless Steel Access Door With Cam Latch	525.88	46.59
08 31 13 00-0007	EA	24" x 24" Fire Rated Stainless Steel Access Door With Cam Latch	538.22	46.83
08 31 13 00-0008	EA	24" x 36" Fire Rated Stainless Steel Access Door With Cam Latch	696.68	48.28

08 31 13 00-0009 Stainless Steel Access Doors (08 31 13 00-0001)

08 31 13 00-0010	EA	8" x 8" Stainless Steel Access Door With Cam Latch	127.28	30.18
08 31 13 00-0011	EA	12" x 12" Stainless Steel Access Door With Cam Latch	153.44	39.35
08 31 13 00-0012	EA	12" x 18" Stainless Steel Access Door With Cam Latch	222.31	41.93
08 31 13 00-0013	EA	18" x 18" Stainless Steel Access Door With Cam Latch	238.77	44.35
08 31 13 00-0014	EA	24" x 18" Stainless Steel Access Door With Cam Latch	278.51	46.59
08 31 13 00-0015	EA	24" x 24" Stainless Steel Access Door With Cam Latch	319.10	46.83

08 31 13 00-0016 Steel Access Doors (08 31 13)

Note: Includes paintable powder coated finish.

08 31 13 00-0017 Fire Rated Steel Access Doors (08 31 13 00-0016)

08 31 13 00-0018	EA	12" x 12" Fire Rated Steel Access Door With Cam Latch	180.09	39.59
08 31 13 00-0019	EA	12" x 18" Fire Rated Steel Access Door With Cam Latch	222.32	41.93
08 31 13 00-0020	EA	18" x 18" Fire Rated Steel Access Door With Cam Latch	222.40	44.35
08 31 13 00-0021	EA	24" x 18" Fire Rated Steel Access Door With Cam Latch	263.60	46.83
08 31 13 00-0022	EA	24" x 24" Fire Rated Steel Access Door With Cam Latch	275.34	46.83
08 31 13 00-0023	EA	24" x 36" Fire Rated Steel Access Door With Cam Latch	362.63	48.28
08 31 13 00-0024	EA	24" x 48" Fire Rated Steel Access Door With Cam Latch	417.52	50.30
08 31 13 00-0025	EA	36" x 36" Fire Rated Steel Access Door With Cam Latch	514.67	50.30
08 31 13 00-0026	EA	48" x 48" Fire Rated Steel Access Door With Cam Latch	659.97	60.36

08 31 13 00-0027 Steel Access Doors (08 31 13 00-0016)

08 31 13 00-0028	EA	8" x 8" Steel Access Door With Cam Latch	93.87	30.34
08 31 13 00-0029	EA	12" x 12" Steel Access Door With Cam Latch	100.53	39.59
08 31 13 00-0030	EA	12" x 18" Steel Access Door With Cam Latch	115.39	41.93
08 31 13 00-0031	EA	18" x 18" Steel Access Door With Cam Latch	118.73	44.35
08 31 13 00-0032	EA	24" x 18" Steel Access Door With Cam Latch	140.36	46.83
08 31 13 00-0033	EA	24" x 24" Steel Access Door With Cam Latch	143.60	46.83
08 31 13 00-0034	EA	24" x 36" Steel Access Door With Cam Latch	185.91	48.28
08 31 13 00-0035	EA	36" x 36" Steel Access Door With Cam Latch	243.95	50.30

08 31 13 00-0036 Steel Recessed Access Doors For Drywall Application (08 31 13)

Note: Includes paintable powder coated finish.

08 31 13 00-0037	EA	8" x 8" Recessed Steel Access Door With Cam Latch	132.74	30.18
		<i>For Recessed Doors In Acoustical Tile, Add</i>	13.29	
08 31 13 00-0038	EA	12" x 12" Recessed Steel Access Door With Cam Latch	139.00	32.35
		<i>For Recessed Doors In Acoustical Tile, Add</i>	14.72	
08 31 13 00-0039	EA	12" x 18" Recessed Steel Access Door With Cam Latch	149.34	34.20
		<i>For Recessed Doors In Acoustical Tile, Add</i>	15.24	
08 31 13 00-0040	EA	18" x 18" Recessed Steel Access Door With Cam Latch	174.80	36.22
		<i>For Recessed Doors In Acoustical Tile, Add</i>	13.62	
08 31 13 00-0041	EA	24" x 18" Recessed Steel Access Door With Cam Latch	183.93	38.22
		<i>For Recessed Doors In Acoustical Tile, Add</i>	14.46	
08 31 13 00-0042	EA	24" x 24" Recessed Steel Access Door With Cam Latch	201.00	38.22
		<i>For Recessed Doors In Acoustical Tile, Add</i>	11.90	
08 31 13 00-0043	EA	24" x 36" Recessed Steel Access Door With Cam Latch	250.46	48.28
		<i>For Recessed Doors In Acoustical Tile, Add</i>	15.55	
08 31 13 00-0044	EA	36" x 36" Recessed Steel Access Door With Cam Latch	355.86	50.30
		<i>For Recessed Doors In Acoustical Tile, Add</i>	1.95	

08 31 13 00-0045 Steel Crawl Space Doors And Frames (08 31 13)

Note: Includes paintable powder coated finish.

08 31 13 00-0046	EA	24" x 24" Steel Crawl Space Door With Cam Latch	153.02	50.94
08 31 13 00-0047	EA	30" x 24" Steel Crawl Space Door With Cam Latch	214.28	61.73
08 31 13 00-0048	EA	30" x 30" Steel Crawl Space Door With Cam Latch	240.00	67.04

08 32 Sliding Glass Doors (08 30)

Note: Includes stock frames, trim, necessary anchors and Usual hardware.

08 32 13 Sliding Aluminum-Framed Glass Doors (08 32)

08 Openings**08 30 Specialty Doors And Frames****08 32 Sliding Glass Doors**

MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
08 32 13 00-0001		Residential Metal Sliding Glass Door <small>(08 32 13)</small>			
08 32 13 00-0002		Door With 5/8" Insulating Glass <small>(08 32 13 00-0001)</small>			
08 32 13 00-0003	SF	Up To 6' Wide Sliding Glass Door 5/8" Insulated Glass With Frame, Trim, Hardware.....	19.28		3.23
		<i>For Custom Quality, Add</i>	2.68		
		<i>For Tempered Glass, Add</i>	1.42		
		<i>For Anodized Or Colored Aluminum Frames, Add</i>	1.93		
08 32 13 00-0004	SF	>6' Up To 12' Wide Sliding Glass Door 5/8" Insulated Glass With Frame, Trim, Hardware.....	15.25		2.01
		<i>For Custom Quality, Add</i>	2.57		
		<i>For Tempered Glass, Add</i>	1.42		
		<i>For Anodized Or Colored Aluminum Frames, Add</i>	1.85		
08 32 13 00-0005		Door With 1" Insulating Glass <small>(08 32 13 00-0001)</small>			
08 32 13 00-0006	SF	>6' Up To 12' Wide Sliding Glass Door 1" Insulated Glass With Frame, Trim, Hardware.....	21.20		3.23
		<i>For Custom Quality, Add</i>	3.16		
		<i>For Tempered Glass, Add</i>	1.42		
		<i>For Anodized Or Colored Aluminum Frames, Add</i>	2.28		
08 32 13 00-0007	SF	>6' Up To 12' Wide Sliding Glass Door 1" Insulated Glass With Frame, Trim, Hardware.....	17.14		2.01
		<i>For Custom Quality, Add</i>	3.04		
		<i>For Tempered Glass, Add</i>	1.42		
		<i>For Anodized Or Colored Aluminum Frames, Add</i>	2.19		
08 32 13 00-0008		Door With 1/4" Tempered Plate Glass 3.2/SF <small>(08 32 13 00-0001)</small>			
08 32 13 00-0009	SF	Up To 6' Wide Sliding Glass Door 1/4" Insulated Glass With Frame, Trim, Hardware.....	17.71		3.23
08 32 13 00-0010	SF	>6' Up To 12' Wide Sliding Glass Door 1/4" Insulated Glass With Frame, Trim, Hardware.....	13.25		2.01
08 32 19		Sliding Wood-Framed Glass Doors <small>(08 32)</small>			
08 32 19 00-0001		Residential Wood Sliding Doors With 5/8" Glass <small>(08 32 19)</small>			
08 32 19 00-0002	EA	6' x 6' 8" Sliding Glass Door, Wood, 5/8" Insulated Glass With Frame, Trim, Hardware.....	1,893.58		97.03
08 32 19 00-0003	EA	8' x 6' 8" Sliding Glass Door, Wood, 5/8" Insulated Glass With Frame, Trim, Hardware.....	2,311.54		118.59
08 32 19 00-0004	EA	9' x 6' 8" Sliding Glass Door, Wood, 5/8" Insulated Glass With Frame, Trim, Hardware.....	2,671.50		136.55
08 32 19 00-0005	EA	6' x 6' 8" Sliding Glass Door, Wood, 5/8" Insulated Glass With Grille, Frame, Trim, Hardware.....	2,091.33		97.03
08 32 19 00-0006	EA	8' x 6' 8" Sliding Glass Door, Wood, 5/8" Insulated Glass With Grille, Frame, Trim, Hardware.....	2,566.94		118.59
08 32 19 00-0007	EA	9' x 6' 8" Sliding Glass Door, Wood, 5/8" Insulated Glass With Grille, Frame, Trim, Hardware.....	2,987.58		136.55
08 33		Coiling Doors And Grilles <small>(08 30)</small>			
08 33 13		Coiling Counter Doors <small>(08 33)</small>			
08 33 13 00-0001		Aluminum Overhead Coiling Counter Shutters <small>(08 33 13)</small>			
		Note: Includes necessary anchors, track and hardware. Includes clear anodized aluminum finish. Excludes steel framing supports.			
08 33 13 00-0002	EA	4' x 4', Aluminum Overhead Coiling Counter Shutters, Manual Lift.....	1,828.54		344.29
		<i>For Steel Doors, Deduct</i>	-35.00		
		<i>For Stainless Steel Doors, Add</i>	78.00		
		<i>For Fire Rated, Add</i>	65.00		
		<i>For Motor Operator (With Safety Reverse), Add</i>	736.07		
08 33 13 00-0003	EA	6' x 4', Aluminum Overhead Coiling Counter Shutters, Manual Lift.....	2,035.11		344.29
		<i>For Steel Doors, Deduct</i>	-71.00		
		<i>For Stainless Steel Doors, Add</i>	130.00		
		<i>For Fire Rated, Add</i>	65.00		
		<i>For Motor Operator (With Safety Reverse), Add</i>	736.07		
08 33 13 00-0004	EA	8' x 4', Aluminum Overhead Coiling Counter Shutters, Manual Lift.....	2,285.08		365.80
		<i>For Steel Doors, Deduct</i>	-115.00		
		<i>For Stainless Steel Doors, Add</i>	225.00		
		<i>For Fire Rated, Add</i>	65.00		
		<i>For Motor Operator (With Safety Reverse), Add</i>	740.41		
08 33 13 00-0005	EA	10' x 4', Aluminum Overhead Coiling Counter Shutters, Manual Lift.....	2,658.07		430.36
		<i>For Steel Doors, Deduct</i>	-142.00		
		<i>For Stainless Steel Doors, Add</i>	315.00		
		<i>For Fire Rated, Add</i>	65.00		
		<i>For Motor Operator (With Safety Reverse), Add</i>	757.06		
08 33 13 00-0006	EA	4' x 6', Aluminum Overhead Coiling Counter Shutters, Manual Lift.....	1,987.93		344.29
		<i>For Steel Doors, Deduct</i>	-40.00		
		<i>For Stainless Steel Doors, Add</i>	85.00		
		<i>For Fire Rated, Add</i>	65.00		
		<i>For Motor Operator (With Safety Reverse), Add</i>	736.07		
08 33 13 00-0007	EA	6' x 6', Aluminum Overhead Coiling Counter Shutters, Manual Lift.....	2,290.13		382.50
		<i>For Steel Doors, Deduct</i>	-80.00		
		<i>For Stainless Steel Doors, Add</i>	145.00		
		<i>For Fire Rated, Add</i>	65.00		
		<i>For Motor Operator (With Safety Reverse), Add</i>	745.64		
08 33 13 00-0008	EA	10' x 6', Aluminum Overhead Coiling Counter Shutters, Manual Lift.....	2,822.82		430.36
		<i>For Steel Doors, Deduct</i>	-156.00		
		<i>For Stainless Steel Doors, Add</i>	240.00		
		<i>For Fire Rated, Add</i>	65.00		
		<i>For Motor Operator (With Safety Reverse), Add</i>	757.59		



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 33 13 00-0009			Integral Frame And Sill, Aluminum Overhead Coiling Counter Shutters <small>(08 33 13)</small> Note: Includes stainless steel frame and sill, necessary anchors, track and hardware. Includes clear anodized aluminum finish. Excludes steel framing supports.		
08 33 13 00-0010	EA		4' x 4', Integral Frame And Sill, Aluminum Overhead Coiling Counter Shutters, Manual Lift <i>For Steel Doors, Deduct</i> <i>For Stainless Steel Doors, Add</i> <i>For Fire Rated, Add</i> <i>For Motor Operator (With Safety Reverse), Add</i>	6,115.54 -35.00 78.00 65.00 736.07	344.29
08 33 13 00-0011	EA		6' x 4', Integral Frame And Sill, Aluminum Overhead Coiling Counter Shutters, Manual Lift <i>For Steel Doors, Deduct</i> <i>For Stainless Steel Doors, Add</i> <i>For Fire Rated, Add</i> <i>For Motor Operator (With Safety Reverse), Add</i>	6,487.62 -71.00 130.00 65.00 736.07	344.29
08 33 13 00-0012	EA		8' x 4', Integral Frame And Sill, Aluminum Overhead Coiling Counter Shutters, Manual Lift <i>For Steel Doors, Deduct</i> <i>For Stainless Steel Doors, Add</i> <i>For Fire Rated, Add</i> <i>For Motor Operator (With Safety Reverse), Add</i>	6,917.09 -115.00 225.00 65.00 740.41	365.80
08 33 13 00-0013	EA		10' x 4', Integral Frame And Sill, Aluminum Overhead Coiling Counter Shutters, Manual Lift <i>For Steel Doors, Deduct</i> <i>For Stainless Steel Doors, Add</i> <i>For Fire Rated, Add</i> <i>For Motor Operator (With Safety Reverse), Add</i>	7,493.65 -142.00 315.00 65.00 757.06	430.36
08 33 13 00-0014	EA		4' x 6', Integral Frame And Sill, Aluminum Overhead Coiling Counter Shutters, Manual Lift <i>For Steel Doors, Deduct</i> <i>For Stainless Steel Doors, Add</i> <i>For Fire Rated, Add</i> <i>For Motor Operator (With Safety Reverse), Add</i>	6,334.08 -40.00 85.00 65.00 736.07	344.29
08 33 13 00-0015	EA		6' x 6', Integral Frame And Sill, Aluminum Overhead Coiling Counter Shutters, Manual Lift <i>For Steel Doors, Deduct</i> <i>For Stainless Steel Doors, Add</i> <i>For Fire Rated, Add</i> <i>For Motor Operator (With Safety Reverse), Add</i>	6,772.47 -80.00 145.00 65.00 745.64	382.50
08 33 13 00-0016	EA		10' x 6', Integral Frame And Sill, Aluminum Overhead Coiling Counter Shutters, Manual Lift <i>For Steel Doors, Deduct</i> <i>For Stainless Steel Doors, Add</i> <i>For Fire Rated, Add</i> <i>For Motor Operator (With Safety Reverse), Add</i>	7,950.09 -156.00 240.00 65.00 757.59	430.36
08 33 23			Overhead Coiling Doors <small>(08 33)</small>		
08 33 23 00-0001			Galvanized Steel Overhead Coiling Doors (Width x Height) <small>(08 33 23)</small>		
08 33 23 00-0002			26 Gauge Galvanized Steel Overhead Coiling Doors, Storage Unit Style <small>(08 33 23 00-0001)</small>		
08 33 23 00-0003	EA		4' x 7', 26 Gauge Galvanized Steel Overhead Coiling Door, Manual Lift	605.98	197.64
08 33 23 00-0004	EA		4' x 8', 26 Gauge Galvanized Steel Overhead Coiling Door, Manual Lift	670.94	215.62
08 33 23 00-0005	EA		5' x 7', 26 Gauge Galvanized Steel Overhead Coiling Door, Manual Lift	667.55	215.62
08 33 23 00-0006	EA		5' x 8', 26 Gauge Galvanized Steel Overhead Coiling Door, Manual Lift	737.00	233.58
08 33 23 00-0007	EA		6' x 7', 26 Gauge Galvanized Steel Overhead Coiling Door, Manual Lift	729.18	233.58
08 33 23 00-0008	EA		6' x 8', 26 Gauge Galvanized Steel Overhead Coiling Door, Manual Lift	798.24	251.55
08 33 23 00-0009	EA		6' x 9', 26 Gauge Galvanized Steel Overhead Coiling Door, Manual Lift	880.28	269.52
08 33 23 00-0010	EA		8' x 7', 26 Gauge Galvanized Steel Overhead Coiling Door, Manual Lift	774.88	233.58
08 33 23 00-0011	EA		8' x 8', 26 Gauge Galvanized Steel Overhead Coiling Door, Manual Lift	835.13	251.55
08 33 23 00-0012	EA		8' x 9', 26 Gauge Galvanized Steel Overhead Coiling Door, Manual Lift	906.10	269.52
08 33 23 00-0013	EA		8' x 10', 26 Gauge Galvanized Steel Overhead Coiling Door, Manual Lift	1,009.77	287.49
08 33 23 00-0014	EA		10' x 7', 26 Gauge Galvanized Steel Overhead Coiling Door, Manual Lift	937.31	287.49
08 33 23 00-0015	EA		10' x 8', 26 Gauge Galvanized Steel Overhead Coiling Door, Manual Lift	987.48	287.49
08 33 23 00-0016	EA		10' x 9', 26 Gauge Galvanized Steel Overhead Coiling Door, Manual Lift	1,090.34	305.45
08 33 23 00-0017	EA		10' x 10', 26 Gauge Galvanized Steel Overhead Coiling Door, Manual Lift	1,160.75	323.43
08 33 23 00-0018			24 Gauge Galvanized Steel Overhead Coiling Doors <small>(08 33 23 00-0001)</small> Note: With curtain hood (barrel cover).		
08 33 23 00-0019	EA		8' x 7', 24 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift <i>For Insulated, Add</i>	2,067.99 1,235.65	233.58
08 33 23 00-0020	EA		8' x 8', 24 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift <i>For Insulated, Add</i>	2,159.25 1,279.85	251.55
08 33 23 00-0021	EA		8' x 10', 24 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift <i>For Insulated, Add</i>	2,393.41 1,406.95	287.49
08 33 23 00-0022	EA		8' x 12', 24 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift <i>For Insulated, Add</i>	2,562.22 1,533.56	287.49
08 33 23 00-0023	EA		10' x 7', 24 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift <i>For Insulated, Add</i>	2,330.28 1,359.61	287.49
08 33 23 00-0024	EA		10' x 8', 24 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift <i>For Insulated, Add</i>	2,456.47 1,454.25	287.49
08 33 23 00-0025	EA		10' x 10', 24 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift <i>For Insulated, Add</i>	2,654.45 1,554.27	323.43
08 33 23 00-0026	EA		10' x 12', 24 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift <i>For Insulated, Add</i>	2,836.31 1,690.66	323.43
08 33 23 00-0027	EA		12' x 7', 24 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift <i>For Insulated, Add</i>	2,567.40 1,488.98	323.43
08 33 23 00-0028	EA		12' x 8', 24 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift <i>For Insulated, Add</i>	2,785.54 1,604.03	359.36

08 Openings
08 30 Specialty Doors And Frames
08 33 Coiling Doors And Grilles



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 33 23 00-0029	EA		12' x 10', 24 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For Insulated, Add</i>	3,111.43 1,727.16	449.20
08 33 23 00-0030	EA		12' x 12', 24 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For Insulated, Add</i>	3,377.08 1,926.40	449.20
08 33 23 00-0031	EA		14' x 8', 24 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For Insulated, Add</i>	3,349.41 1,905.64	449.20
08 33 23 00-0032	EA		14' x 10', 24 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For Insulated, Add</i>	3,653.71 2,133.87	449.20
08 33 23 00-0033	EA		14' x 12', 24 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For Insulated, Add</i>	3,976.46 2,375.93	449.20
08 33 23 00-0034			22 Gauge Galvanized Steel Overhead Coiling Doors (08 33 23 00-0001) Note: With curtain hood (barrel cover).		
08 33 23 00-0035	EA		4' x 8', 22 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For 20 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	1,810.51 206.90 344.83 1,066.83	215.62
08 33 23 00-0036	EA		4' x 10', 22 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For 20 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	1,984.43 227.59 379.31 1,172.98	233.58
08 33 23 00-0037	EA		4' x 12', 22 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For 20 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	2,111.50 241.25 402.09 1,243.99	251.55
08 33 23 00-0038	EA		6' x 8', 22 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For 20 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	2,000.77 230.04 383.40 1,185.23	233.58
08 33 23 00-0039	EA		6' x 10', 22 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For 20 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	2,190.10 253.04 421.74 1,302.94	251.55
08 33 23 00-0040	EA		6' x 12', 22 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For 20 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	2,402.83 274.18 456.97 1,414.02	287.49
08 33 23 00-0041	EA		6' x 14', 22 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For 20 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	2,908.37 339.24 565.40 1,744.69	323.43
08 33 23 00-0042	EA		6' x 16', 22 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For 20 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	3,414.00 404.29 673.82 2,075.37	359.36
08 33 23 00-0043	EA		8' x 8', 22 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For 20 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	2,163.24 254.41 424.02 1,307.08	233.58
08 33 23 00-0044	EA		8' x 10', 22 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For 20 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	2,440.62 279.85 466.41 1,442.36	287.49
08 33 23 00-0045	EA		8' x 12', 22 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For 20 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	2,738.65 302.99 504.99 1,568.86	359.36
08 33 23 00-0046	EA		8' x 14', 22 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For 20 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	3,224.75 365.14 608.57 1,884.98	395.30
08 33 23 00-0047	EA		8' x 16', 22 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For 20 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	3,711.15 427.28 712.14 2,201.11	431.23
08 33 23 00-0048	EA		10' x 10', 22 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For 20 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	2,786.59 307.49 512.48 1,592.68	368.34
08 33 23 00-0049	EA		10' x 12', 22 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For 20 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	3,176.83 341.77 569.61 1,776.21	449.20
08 33 23 00-0050	EA		10' x 14', 22 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For 20 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	3,789.89 406.81 678.01 2,114.87	539.03
08 33 23 00-0051	EA		10' x 16', 22 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For 20 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	4,439.22 471.85 786.41 2,456.25	646.84
08 33 23 00-0052	EA		10' x 18', 22 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For 20 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	5,108.73 529.06 881.77 2,763.92	790.59



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 33 23 00-0053 EA 10' x 20', 22 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift <i>For 20 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	5,632.83 586.27 977.12 3,060.68	862.46
08 33 23 00-0054 EA 10' x 22', 22 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift <i>For 20 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	6,157.64 643.48 1,072.47 3,357.49	934.33
08 33 23 00-0055 EA 10' x 24', 22 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift <i>For 20 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	6,681.75 700.45 1,167.42 3,653.16	1,006.20
08 33 23 00-0056 EA 12' x 10', 22 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift <i>For 20 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	3,156.36 344.06 573.44 1,785.02	431.23
08 33 23 00-0057 EA 12' x 12', 22 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift <i>For 20 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	3,608.65 379.62 632.70 1,978.94	539.03
08 33 23 00-0058 EA 12' x 14', 22 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift <i>For 20 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	4,326.49 465.75 776.25 2,420.37	610.90
08 33 23 00-0059 EA 12' x 16', 22 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift <i>For 20 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	5,116.64 551.88 919.80 2,867.21	718.71
08 33 23 00-0060 EA 12' x 18', 22 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift <i>For 20 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	5,898.09 626.06 1,043.43 3,259.62	862.46
08 33 23 00-0061 EA 12' x 20', 22 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift <i>For 20 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	6,536.01 700.24 1,167.06 3,641.27	934.33
08 33 23 00-0062 EA 12' x 22', 22 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift <i>For 20 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	7,247.21 774.42 1,290.69 4,028.41	1,042.14
08 33 23 00-0063 EA 12' x 24', 22 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift <i>For 20 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	7,957.90 848.59 1,414.32 4,415.50	1,149.95
08 33 23 00-0064 20 Gauge Galvanized Steel Overhead Coiling Doors (08 33 23 00-0001) Note: With curtain hood (barrel cover)		
08 33 23 00-0065 EA 14' x 10', 20 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	4,009.17 439.70 2,279.33	539.03
08 33 23 00-0066 EA 14' x 12', 20 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	4,550.81 499.40 2,588.61	610.90
08 33 23 00-0067 EA 14' x 14', 20 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	5,198.54 574.98 2,977.30	682.78
08 33 23 00-0068 EA 14' x 16', 20 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	5,780.80 640.64 3,316.42	754.65
08 33 23 00-0069 EA 14' x 18', 20 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	6,541.54 711.71 3,693.32	898.39
08 33 23 00-0070 EA 14' x 20', 20 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	7,158.30 782.69 4,058.98	970.27
08 33 23 00-0071 EA 14' x 22', 20 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	8,563.19 960.93 4,966.41	1,078.07
08 33 23 00-0072 EA 14' x 24', 20 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	9,964.88 1,139.17 5,873.61	1,185.88
08 33 23 00-0073 EA 16' x 10', 20 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	4,959.51 549.89 2,846.47	646.84
08 33 23 00-0074 EA 16' x 12', 20 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	5,572.56 620.27 3,209.15	718.71
08 33 23 00-0075 EA 16' x 14', 20 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	6,192.90 680.99 3,528.91	826.52
08 33 23 00-0076 EA 16' x 16', 20 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	6,831.11 744.50 3,862.59	934.33

08	Openings
08 30	Specialty Doors And Frames
08 33	Coiling Doors And Grilles



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 33 23 00-0077 EA 16' x 18', 20 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	7,452.52 816.07 4,231.24	1,006.20
08 33 23 00-0078 EA 16' x 20', 20 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	8,175.96 902.84 4,675.99	1,078.07
08 33 23 00-0079 EA 16' x 22', 20 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	9,260.30 1,043.95 5,392.30	1,149.95
08 33 23 00-0080 EA 16' x 24', 20 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	10,354.77 1,186.52 6,115.97	1,221.82
08 33 23 00-0081 EA 18' x 10', 20 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	5,420.28 575.79 2,997.58	790.59
08 33 23 00-0082 EA 18' x 12', 20 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	5,970.36 636.90 3,313.83	862.46
08 33 23 00-0083 EA 18' x 14', 20 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	6,848.17 736.17 3,826.38	970.27
08 33 23 00-0084 EA 18' x 16', 20 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	7,601.93 816.74 4,245.47	1,078.07
08 33 23 00-0085 EA 18' x 18', 20 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	8,287.67 898.06 4,662.83	1,149.95
08 33 23 00-0086 EA 18' x 20', 20 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	8,974.42 979.47 5,080.70	1,221.82
08 33 23 00-0087 EA 18' x 22', 20 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	10,241.19 1,147.82 5,933.29	1,293.69
08 33 23 00-0088 EA 18' x 24', 20 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	11,534.85 1,320.63 6,807.93	1,365.55
08 33 23 00-0089 EA 20' x 10', 20 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	6,090.17 654.87 3,403.68	862.46
08 33 23 00-0090 EA 20' x 12', 20 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For 18 Gauge Galvanized Steel Overhead Coiling Door, Add</i> <i>For Insulated, Add</i>	7,119.40 787.75 4,078.81	934.33
08 33 23 00-0091 18 Gauge Galvanized Steel Overhead Coiling Doors (08 33 23 00-0001) Note: With curtain hood (barrel cover).		
08 33 23 00-0092 EA 20' x 14', 18 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For Insulated, Add</i>	8,473.77 4,948.33	1,042.14
08 33 23 00-0093 EA 20' x 16', 18 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For Insulated, Add</i>	9,609.55 5,702.41	1,114.01
08 33 23 00-0094 EA 20' x 18', 18 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For Insulated, Add</i>	10,918.72 6,586.89	1,185.88
08 33 23 00-0095 EA 20' x 20', 18 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For Insulated, Add</i>	12,391.64 7,595.09	1,257.76
08 33 23 00-0096 EA 20' x 22', 18 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For Insulated, Add</i>	13,870.83 8,608.99	1,329.63
08 33 23 00-0097 EA 20' x 24', 18 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For Insulated, Add</i>	15,380.99 9,643.65	1,401.49
08 33 23 00-0098 EA 22' x 10', 18 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For Insulated, Add</i>	6,814.67 3,850.26	934.33
08 33 23 00-0099 EA 22' x 12', 18 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For Insulated, Add</i>	8,010.46 4,649.69	1,006.20
08 33 23 00-0100 EA 22' x 14', 18 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For Insulated, Add</i>	9,467.30 5,595.72	1,114.01
08 33 23 00-0101 EA 22' x 16', 18 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For Insulated, Add</i>	10,959.69 6,619.72	1,185.88
08 33 23 00-0102 EA 22' x 18', 18 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For Insulated, Add</i>	12,462.18 7,647.99	1,257.76
08 33 23 00-0103 EA 22' x 20', 18 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For Insulated, Add</i>	14,124.53 8,799.27	1,329.63
08 33 23 00-0104 EA 22' x 22', 18 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For Insulated, Add</i>	15,795.99 9,954.90	1,401.49
08 33 23 00-0105 EA 22' x 24', 18 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For Insulated, Add</i>	17,453.80 11,102.10	1,473.36
08 33 23 00-0106 EA 24' x 10', 18 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For Insulated, Add</i>	7,474.89 4,248.01	1,006.20
08 33 23 00-0107 EA 24' x 12', 18 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For Insulated, Add</i>	8,338.60 4,797.97	1,078.07
08 33 23 00-0108 EA 24' x 14', 18 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For Insulated, Add</i>	10,265.98 6,099.44	1,185.88
08 33 23 00-0109 EA 24' x 16', 18 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For Insulated, Add</i>	11,942.76 7,258.43	1,257.76
08 33 23 00-0110 EA 24' x 18', 18 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift..... <i>For Insulated, Add</i>	13,547.59 8,366.56	1,329.63



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 33 23 00-0111 EA 24' x 20', 18 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift <i>For Insulated, Add</i>	15,319.32 9,597.40	1,401.49
08 33 23 00-0112 EA 24' x 22', 18 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift <i>For Insulated, Add</i>	17,392.20 11,055.90	1,473.36
08 33 23 00-0113 EA 24' x 24', 18 Gauge Galvanized Steel Overhead Coiling Door, Chain Lift <i>For Insulated, Add</i>	19,524.73 12,556.06	1,545.23
08 33 23 00-0114 Aluminum Overhead Coiling Doors (Width x Height) (08 33 23)		
08 33 23 00-0115 0.04" Aluminum Overhead Coiling Doors (08 33 23 00-0114)		
08 33 23 00-0116 EA 4' x 8', 0.04" Aluminum Overhead Coiling Door, Chain Lift.....	1,419.57	215.62
08 33 23 00-0117 EA 4' x 10', 0.04" Aluminum Overhead Coiling Door, Chain Lift.....	1,552.46	233.58
08 33 23 00-0118 EA 4' x 12', 0.04" Aluminum Overhead Coiling Door, Chain Lift.....	1,950.01	251.55
08 33 23 00-0119 EA 6' x 8', 0.04" Aluminum Overhead Coiling Door, Chain Lift.....	1,748.29	233.58
08 33 23 00-0120 EA 6' x 10', 0.04" Aluminum Overhead Coiling Door, Chain Lift.....	1,904.15	251.55
08 33 23 00-0121 EA 6' x 12', 0.04" Aluminum Overhead Coiling Door, Chain Lift.....	2,095.88	287.49
08 33 23 00-0122 EA 6' x 14', 0.04" Aluminum Overhead Coiling Door, Chain Lift.....	2,323.57	323.43
08 33 23 00-0123 EA 6' x 16', 0.04" Aluminum Overhead Coiling Door, Chain Lift.....	2,553.98	359.36
08 33 23 00-0124 EA 8' x 8', 0.04" Aluminum Overhead Coiling Door, Chain Lift.....	1,896.26	233.58
08 33 23 00-0125 EA 8' x 10', 0.04" Aluminum Overhead Coiling Door, Chain Lift.....	2,166.32	287.49
08 33 23 00-0126 EA 8' x 12', 0.04" Aluminum Overhead Coiling Door, Chain Lift.....	2,474.86	359.36
08 33 23 00-0127 EA 8' x 14', 0.04" Aluminum Overhead Coiling Door, Chain Lift.....	2,702.69	395.30
08 33 23 00-0128 EA 8' x 16', 0.04" Aluminum Overhead Coiling Door, Chain Lift.....	2,931.70	431.23
08 33 23 00-0129 EA 10' x 10', 0.04" Aluminum Overhead Coiling Door, Chain Lift.....	2,523.51	377.32
08 33 23 00-0130 EA 10' x 12', 0.04" Aluminum Overhead Coiling Door, Chain Lift.....	2,828.32	449.20
08 33 23 00-0131 EA 10' x 14', 0.04" Aluminum Overhead Coiling Door, Chain Lift.....	3,206.43	539.03
08 33 23 00-0132 EA 10' x 16', 0.04" Aluminum Overhead Coiling Door, Chain Lift.....	3,621.92	646.84
08 33 23 00-0133 EA 10' x 18', 0.04" Aluminum Overhead Coiling Door, Chain Lift.....	4,251.61	790.59
08 33 23 00-0134 EA 10' x 20', 0.04" Aluminum Overhead Coiling Door, Chain Lift.....	4,735.81	862.46
08 33 23 00-0135 EA 10' x 22', 0.04" Aluminum Overhead Coiling Door, Chain Lift.....	5,217.46	934.33
08 33 23 00-0136 EA 10' x 24', 0.04" Aluminum Overhead Coiling Door, Chain Lift.....	5,700.99	1,006.20
08 33 23 00-0137 EA 12' x 10', 0.04" Aluminum Overhead Coiling Door, Chain Lift.....	2,788.49	431.23
08 33 23 00-0138 EA 12' x 12', 0.04" Aluminum Overhead Coiling Door, Chain Lift.....	3,392.78	539.03
08 33 23 00-0139 EA 12' x 14', 0.04" Aluminum Overhead Coiling Door, Chain Lift.....	3,839.61	610.90
08 33 23 00-0140 EA 12' x 16', 0.04" Aluminum Overhead Coiling Door, Chain Lift.....	4,360.58	718.71
08 33 23 00-0141 EA 12' x 18', 0.04" Aluminum Overhead Coiling Door, Chain Lift.....	5,060.69	862.46
08 33 23 00-0142 EA 12' x 20', 0.04" Aluminum Overhead Coiling Door, Chain Lift.....	5,618.83	934.33
08 33 23 00-0143 EA 12' x 22', 0.04" Aluminum Overhead Coiling Door, Chain Lift.....	6,022.01	1,042.14
08 33 23 00-0144 EA 12' x 24', 0.04" Aluminum Overhead Coiling Door, Chain Lift.....	6,426.80	1,149.95
08 33 23 00-0145 0.05" Aluminum Overhead Coiling Doors (08 33 23 00-0114)		
08 33 23 00-0146 EA 14' x 10', 0.05" Aluminum Overhead Coiling Door, Chain Lift.....	3,242.58	539.03
08 33 23 00-0147 EA 14' x 12', 0.05" Aluminum Overhead Coiling Door, Chain Lift.....	3,819.15	610.90
08 33 23 00-0148 EA 14' x 14', 0.05" Aluminum Overhead Coiling Door, Chain Lift.....	4,385.73	682.78
08 33 23 00-0149 EA 14' x 16', 0.05" Aluminum Overhead Coiling Door, Chain Lift.....	4,911.98	754.65
08 33 23 00-0150 EA 14' x 18', 0.05" Aluminum Overhead Coiling Door, Chain Lift.....	5,613.90	898.39
08 33 23 00-0151 EA 14' x 20', 0.05" Aluminum Overhead Coiling Door, Chain Lift.....	6,172.48	970.27
08 33 23 00-0152 EA 14' x 22', 0.05" Aluminum Overhead Coiling Door, Chain Lift.....	6,813.10	1,078.07
08 33 23 00-0153 EA 14' x 24', 0.05" Aluminum Overhead Coiling Door, Chain Lift.....	7,450.61	1,185.88
08 33 23 00-0154 EA 16' x 10', 0.05" Aluminum Overhead Coiling Door, Chain Lift.....	3,849.00	646.84
08 33 23 00-0155 EA 16' x 12', 0.05" Aluminum Overhead Coiling Door, Chain Lift.....	4,450.13	718.71
08 33 23 00-0156 EA 16' x 14', 0.05" Aluminum Overhead Coiling Door, Chain Lift.....	5,099.90	826.52
08 33 23 00-0157 EA 16' x 16', 0.05" Aluminum Overhead Coiling Door, Chain Lift.....	5,765.56	934.33
08 33 23 00-0158 EA 16' x 18', 0.05" Aluminum Overhead Coiling Door, Chain Lift.....	6,406.88	1,006.20
08 33 23 00-0159 EA 16' x 20', 0.05" Aluminum Overhead Coiling Door, Chain Lift.....	7,087.22	1,078.07
08 33 23 00-0160 EA 16' x 22', 0.05" Aluminum Overhead Coiling Door, Chain Lift.....	7,735.50	1,149.95
08 33 23 00-0161 EA 16' x 24', 0.05" Aluminum Overhead Coiling Door, Chain Lift.....	8,344.45	1,221.82
08 33 23 00-0162 EA 18' x 10', 0.05" Aluminum Overhead Coiling Door, Chain Lift.....	4,420.16	790.59
08 33 23 00-0163 EA 18' x 12', 0.05" Aluminum Overhead Coiling Door, Chain Lift.....	5,059.84	862.46
08 33 23 00-0164 EA 18' x 14', 0.05" Aluminum Overhead Coiling Door, Chain Lift.....	5,830.98	970.27
08 33 23 00-0165 EA 18' x 16', 0.05" Aluminum Overhead Coiling Door, Chain Lift.....	6,592.78	1,078.07
08 33 23 00-0166 EA 18' x 18', 0.05" Aluminum Overhead Coiling Door, Chain Lift.....	7,289.75	1,149.95
08 33 23 00-0167 EA 18' x 20', 0.05" Aluminum Overhead Coiling Door, Chain Lift.....	7,981.97	1,221.82
08 33 23 00-0168 EA 18' x 22', 0.05" Aluminum Overhead Coiling Door, Chain Lift.....	8,673.35	1,293.69
08 33 23 00-0169 EA 18' x 24', 0.05" Aluminum Overhead Coiling Door, Chain Lift.....	9,367.05	1,365.55
08 33 23 00-0170 EA 20' x 10', 0.05" Aluminum Overhead Coiling Door, Chain Lift.....	4,947.12	862.46
08 33 23 00-0171 EA 20' x 12', 0.05" Aluminum Overhead Coiling Door, Chain Lift.....	5,599.04	934.33
08 33 23 00-0172 EA 20' x 14', 0.05" Aluminum Overhead Coiling Door, Chain Lift.....	6,264.95	1,042.14
08 33 23 00-0173 EA 20' x 16', 0.05" Aluminum Overhead Coiling Door, Chain Lift.....	6,911.91	1,114.01
08 33 23 00-0174 EA 20' x 18', 0.05" Aluminum Overhead Coiling Door, Chain Lift.....	7,575.61	1,185.88
08 33 23 00-0175 EA 20' x 20', 0.05" Aluminum Overhead Coiling Door, Chain Lift.....	8,267.25	1,257.76
08 33 23 00-0176 EA 20' x 22', 0.05" Aluminum Overhead Coiling Door, Chain Lift.....	8,961.28	1,329.63
08 33 23 00-0177 EA 20' x 24', 0.05" Aluminum Overhead Coiling Door, Chain Lift.....	9,663.91	1,401.49
08 33 23 00-0178 EA 22' x 10', 0.05" Aluminum Overhead Coiling Door, Chain Lift.....	5,663.09	934.33
08 33 23 00-0179 EA 22' x 12', 0.05" Aluminum Overhead Coiling Door, Chain Lift.....	6,458.10	1,006.20
08 33 23 00-0180 EA 22' x 14', 0.05" Aluminum Overhead Coiling Door, Chain Lift.....	7,281.22	1,114.01
08 33 23 00-0181 EA 22' x 16', 0.05" Aluminum Overhead Coiling Door, Chain Lift.....	8,145.66	1,185.88
08 33 23 00-0182 EA 22' x 18', 0.05" Aluminum Overhead Coiling Door, Chain Lift.....	9,056.74	1,257.76
08 33 23 00-0183 EA 22' x 20', 0.05" Aluminum Overhead Coiling Door, Chain Lift.....	10,032.14	1,329.63

08	Openings
08 30	Specialty Doors And Frames
08 33	Coiling Doors And Grilles



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 33 23 00-0184	EA		22' x 22', 0.05" Aluminum Overhead Coiling Door, Chain Lift	10,862.56	1,401.49
08 33 23 00-0185	EA		22' x 24', 0.05" Aluminum Overhead Coiling Door, Chain Lift	11,696.70	1,473.36
08 33 23 00-0186	EA		24' x 10', 0.05" Aluminum Overhead Coiling Door, Chain Lift	6,203.20	1,006.20
08 33 23 00-0187	EA		24' x 12', 0.05" Aluminum Overhead Coiling Door, Chain Lift	6,738.80	1,078.07
08 33 23 00-0188	EA		24' x 14', 0.05" Aluminum Overhead Coiling Door, Chain Lift	8,030.77	1,185.88
08 33 23 00-0189	EA		24' x 16', 0.05" Aluminum Overhead Coiling Door, Chain Lift	9,008.13	1,257.76
08 33 23 00-0190	EA		24' x 18', 0.05" Aluminum Overhead Coiling Door, Chain Lift	9,928.39	1,329.63
08 33 23 00-0191	EA		24' x 20', 0.05" Aluminum Overhead Coiling Door, Chain Lift	10,852.32	1,401.49
08 33 23 00-0192	EA		24' x 22', 0.05" Aluminum Overhead Coiling Door, Chain Lift	11,906.77	1,473.36
08 33 23 00-0193	EA		24' x 24', 0.05" Aluminum Overhead Coiling Door, Chain Lift	13,004.24	1,545.23
08 33 23 00-0194			Removal And Reinstallation Of Roll-Up Door And Support (08 33 23)		
			Note: Includes storage, cleaning and supply materials.		
08 33 23 00-0195	SF		Remove And Reinstall Metal Roll-up Door And Supports.....	15.38	
08 33 23 00-0196			Overhead Coiling Door Accessories (08 33 23)		
08 33 23 00-0197	LF		Bottom Of Door, Weather Strip Seal For Coiling Doors, Astragal Only.....	2.63	0.90
08 33 23 00-0198	LF		Top Of Door (Lintel), Weather Strip Seal For Coiling Doors	17.44	1.08
08 33 23 00-0199	LF		Side Of Door (Guides), Weather Strip Seal For Coiling Doors.....	16.65	1.08
08 33 23 00-0200	EA		Cylinder Lock For Coiling Doors	170.74	44.92
08 33 23 00-0201	EA		Jackshaft Operator For Coiling Doors.....	1,097.27	143.74
			Note: Includes three button inside station controls and mounting hardware.		
08 33 23 00-0202	EA		Remote Transmitter Kit For Coiling Door Operators	226.94	71.87
08 33 26			Overhead Coiling Grilles (08 33)		
			Note: Includes curtains, guides, counterbalance mechanisms, hardware, operators, frame, supports and/or trim as required.		
08 33 26 00-0001			Steel Overhead Coiling Grilles (Width x Height) (08 33 26)		
08 33 26 00-0002	EA		4' x 4', Steel Overhead Coiling Grilles, Manual Lift	2,224.31	150.62
			For Aluminum With Clear Or Anodized Bronze Finish, Add	430.55	
			For Staggered Brick Pattern, Add	44.85	
			For Lexan Lattice Pattern, Add	269.09	
08 33 26 00-0003	EA		6' x 4', Steel Overhead Coiling Grilles, Manual Lift	2,453.73	150.62
			For Aluminum With Clear Or Anodized Bronze Finish, Add	485.61	
			For Staggered Brick Pattern, Add	50.58	
			For Lexan Lattice Pattern, Add	303.51	
08 33 26 00-0004	EA		8' x 4', Steel Overhead Coiling Grilles, Manual Lift	2,828.75	200.81
			For Aluminum With Clear Or Anodized Bronze Finish, Add	541.19	
			For Staggered Brick Pattern, Add	56.37	
			For Lexan Lattice Pattern, Add	338.24	
08 33 26 00-0005	EA		12' x 4', Steel Overhead Coiling Grilles, Manual Lift	3,380.88	200.81
			For Aluminum With Clear Or Anodized Bronze Finish, Add	673.70	
			For Staggered Brick Pattern, Add	70.18	
			For Lexan Lattice Pattern, Add	421.06	
08 33 26 00-0006	EA		16' x 4', Steel Overhead Coiling Grilles, Manual Lift	4,572.31	301.25
			For Aluminum With Clear Or Anodized Bronze Finish, Add	890.78	
			For Staggered Brick Pattern, Add	92.79	
			For Lexan Lattice Pattern, Add	556.74	
08 33 26 00-0007	EA		20' x 4', Steel Overhead Coiling Grilles, Manual Lift	5,763.74	401.53
			For Aluminum With Clear Or Anodized Bronze Finish, Add	1,107.87	
			For Staggered Brick Pattern, Add	115.40	
			For Lexan Lattice Pattern, Add	692.42	
08 33 26 00-0008	EA		24' x 4', Steel Overhead Coiling Grilles, Manual Lift	7,197.85	482.01
			For Aluminum With Clear Or Anodized Bronze Finish, Add	1,396.44	
			For Staggered Brick Pattern, Add	145.46	
			For Lexan Lattice Pattern, Add	872.77	
08 33 26 00-0009	EA		30' x 4', Steel Overhead Coiling Grilles, Manual Lift	8,833.53	602.51
			For Aluminum With Clear Or Anodized Bronze Finish, Add	1,706.90	
			For Staggered Brick Pattern, Add	177.80	
			For Lexan Lattice Pattern, Add	1,066.81	
08 33 26 00-0010	EA		4' x 6', Steel Overhead Coiling Grilles, Manual Lift	2,399.44	150.62
			For Aluminum With Clear Or Anodized Bronze Finish, Add	472.58	
			For Staggered Brick Pattern, Add	49.23	
			For Lexan Lattice Pattern, Add	295.36	
08 33 26 00-0011	EA		6' x 6', Steel Overhead Coiling Grilles, Manual Lift	2,728.95	150.62
			For Aluminum With Clear Or Anodized Bronze Finish, Add	551.66	
			For Staggered Brick Pattern, Add	57.46	
			For Lexan Lattice Pattern, Add	344.79	
08 33 26 00-0012	EA		8' x 6', Steel Overhead Coiling Grilles, Manual Lift	3,066.77	200.89
			For Aluminum With Clear Or Anodized Bronze Finish, Add	598.31	
			For Staggered Brick Pattern, Add	62.32	
			For Lexan Lattice Pattern, Add	373.94	
08 33 26 00-0013	EA		12' x 6', Steel Overhead Coiling Grilles, Manual Lift	3,702.93	200.89
			For Aluminum With Clear Or Anodized Bronze Finish, Add	750.99	
			For Staggered Brick Pattern, Add	78.23	
			For Lexan Lattice Pattern, Add	469.37	
08 33 26 00-0014	EA		16' x 6', Steel Overhead Coiling Grilles, Manual Lift	5,024.03	301.25
			For Aluminum With Clear Or Anodized Bronze Finish, Add	999.19	
			For Staggered Brick Pattern, Add	104.08	
			For Lexan Lattice Pattern, Add	624.50	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 33 26 00-0015 EA 20' x 6', Steel Overhead Coiling Grilles, Manual Lift <i>For Aluminum With Clear Or Anodized Bronze Finish, Add</i> <i>For Staggered Brick Pattern, Add</i> <i>For Lexan Lattice Pattern, Add</i>	6,342.06 1,247.40 129.94 779.62	401.53
08 33 26 00-0016 EA 24' x 6', Steel Overhead Coiling Grilles, Manual Lift <i>For Aluminum With Clear Or Anodized Bronze Finish, Add</i> <i>For Staggered Brick Pattern, Add</i> <i>For Lexan Lattice Pattern, Add</i>	7,951.25 1,577.25 164.30 985.78	482.01
08 33 26 00-0017 EA 30' x 6', Steel Overhead Coiling Grilles, Manual Lift <i>For Aluminum With Clear Or Anodized Bronze Finish, Add</i> <i>For Staggered Brick Pattern, Add</i> <i>For Lexan Lattice Pattern, Add</i>	9,583.91 1,886.99 196.56 1,179.37	602.51
08 33 26 00-0018 EA 4' x 8', Steel Overhead Coiling Grilles, Manual Lift <i>For Aluminum With Clear Or Anodized Bronze Finish, Add</i> <i>For Staggered Brick Pattern, Add</i> <i>For Lexan Lattice Pattern, Add</i>	2,747.06 535.45 55.78 334.66	180.75
08 33 26 00-0019 EA 6' x 8', Steel Overhead Coiling Grilles, Manual Lift <i>For Aluminum With Clear Or Anodized Bronze Finish, Add</i> <i>For Staggered Brick Pattern, Add</i> <i>For Lexan Lattice Pattern, Add</i>	3,145.14 630.99 65.73 394.37	180.75
08 33 26 00-0020 EA 8' x 8', Steel Overhead Coiling Grilles, Manual Lift <i>For Aluminum With Clear Or Anodized Bronze Finish, Add</i> <i>For Staggered Brick Pattern, Add</i> <i>For Lexan Lattice Pattern, Add</i>	3,773.59 750.58 78.19 469.11	225.94
08 33 26 00-0021 EA 12' x 8', Steel Overhead Coiling Grilles, Manual Lift <i>For Aluminum With Clear Or Anodized Bronze Finish, Add</i> <i>For Staggered Brick Pattern, Add</i> <i>For Lexan Lattice Pattern, Add</i>	4,347.69 888.36 92.54 555.23	225.94
08 33 26 00-0022 EA 16' x 8', Steel Overhead Coiling Grilles, Manual Lift <i>For Aluminum With Clear Or Anodized Bronze Finish, Add</i> <i>For Staggered Brick Pattern, Add</i> <i>For Lexan Lattice Pattern, Add</i>	5,917.73 1,171.97 122.08 732.48	361.51
08 33 26 00-0023 EA 20' x 8', Steel Overhead Coiling Grilles, Manual Lift <i>For Aluminum With Clear Or Anodized Bronze Finish, Add</i> <i>For Staggered Brick Pattern, Add</i> <i>For Lexan Lattice Pattern, Add</i>	7,353.43 1,455.58 151.62 909.74	451.88
08 33 26 00-0024 EA 24' x 8', Steel Overhead Coiling Grilles, Manual Lift <i>For Aluminum With Clear Or Anodized Bronze Finish, Add</i> <i>For Staggered Brick Pattern, Add</i> <i>For Lexan Lattice Pattern, Add</i>	9,304.54 1,861.56 193.91 1,163.47	542.26
08 33 26 00-0025 EA 30' x 8', Steel Overhead Coiling Grilles, Manual Lift <i>For Aluminum With Clear Or Anodized Bronze Finish, Add</i> <i>For Staggered Brick Pattern, Add</i> <i>For Lexan Lattice Pattern, Add</i>	11,343.89 2,269.52 236.41 1,418.45	662.75
08 33 26 00-0026 EA 4' x 10', Steel Overhead Coiling Grilles, Manual Lift <i>For Aluminum With Clear Or Anodized Bronze Finish, Add</i> <i>For Staggered Brick Pattern, Add</i> <i>For Lexan Lattice Pattern, Add</i>	3,035.59 604.70 62.99 377.94	180.75
08 33 26 00-0027 EA 6' x 10', Steel Overhead Coiling Grilles, Manual Lift <i>For Aluminum With Clear Or Anodized Bronze Finish, Add</i> <i>For Staggered Brick Pattern, Add</i> <i>For Lexan Lattice Pattern, Add</i>	3,563.18 731.32 76.18 457.07	180.75
08 33 26 00-0028 EA 8' x 10', Steel Overhead Coiling Grilles, Manual Lift <i>For Aluminum With Clear Or Anodized Bronze Finish, Add</i> <i>For Staggered Brick Pattern, Add</i> <i>For Lexan Lattice Pattern, Add</i>	4,237.95 862.49 89.84 539.05	225.94
08 33 26 00-0029 EA 12' x 10', Steel Overhead Coiling Grilles, Manual Lift <i>For Aluminum With Clear Or Anodized Bronze Finish, Add</i> <i>For Staggered Brick Pattern, Add</i> <i>For Lexan Lattice Pattern, Add</i>	4,956.93 1,035.04 107.82 646.90	225.94
08 33 26 00-0030 EA 16' x 10', Steel Overhead Coiling Grilles, Manual Lift <i>For Aluminum With Clear Or Anodized Bronze Finish, Add</i> <i>For Staggered Brick Pattern, Add</i> <i>For Lexan Lattice Pattern, Add</i>	6,716.83 1,363.75 142.06 852.35	361.51
08 33 26 00-0031 EA 20' x 10', Steel Overhead Coiling Grilles, Manual Lift <i>For Aluminum With Clear Or Anodized Bronze Finish, Add</i> <i>For Staggered Brick Pattern, Add</i> <i>For Lexan Lattice Pattern, Add</i>	8,340.43 1,692.46 176.30 1,057.79	451.88
08 33 26 00-0032 EA 24' x 10', Steel Overhead Coiling Grilles, Manual Lift <i>For Aluminum With Clear Or Anodized Bronze Finish, Add</i> <i>For Staggered Brick Pattern, Add</i> <i>For Lexan Lattice Pattern, Add</i>	10,497.04 2,147.76 223.72 1,342.35	542.26
08 33 26 00-0033 EA 30' x 10', Steel Overhead Coiling Grilles, Manual Lift <i>For Aluminum With Clear Or Anodized Bronze Finish, Add</i> <i>For Staggered Brick Pattern, Add</i> <i>For Lexan Lattice Pattern, Add</i>	13,185.24 2,711.45 282.44 1,694.66	662.75
08 33 26 00-0034 EA 4' x 12', Steel Overhead Coiling Grilles, Manual Lift <i>For Aluminum With Clear Or Anodized Bronze Finish, Add</i> <i>For Staggered Brick Pattern, Add</i> <i>For Lexan Lattice Pattern, Add</i>	3,366.01 684.00 71.25 427.50	180.75
08 33 26 00-0035 EA 6' x 12', Steel Overhead Coiling Grilles, Manual Lift <i>For Aluminum With Clear Or Anodized Bronze Finish, Add</i> <i>For Staggered Brick Pattern, Add</i> <i>For Lexan Lattice Pattern, Add</i>	3,461.65 706.95 73.64 441.84	180.75

08 Openings**08 30 Specialty Doors And Frames****08 33 Coiling Doors And Grilles**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 33 26 00-0036	EA		8' x 12', Steel Overhead Coiling Grilles, Manual Lift <i>For Aluminum With Clear Or Anodized Bronze Finish, Add</i> <i>For Staggered Brick Pattern, Add</i> <i>For Lexan Lattice Pattern, Add</i>	4,207.94 854.82 89.04 534.26	225.94
08 33 26 00-0037	EA		12' x 12', Steel Overhead Coiling Grilles, Manual Lift <i>For Aluminum With Clear Or Anodized Bronze Finish, Add</i> <i>For Staggered Brick Pattern, Add</i> <i>For Lexan Lattice Pattern, Add</i>	5,645.67 1,199.88 124.99 749.92	225.94
08 33 26 00-0038	EA		16' x 12', Steel Overhead Coiling Grilles, Manual Lift <i>For Aluminum With Clear Or Anodized Bronze Finish, Add</i> <i>For Staggered Brick Pattern, Add</i> <i>For Lexan Lattice Pattern, Add</i>	7,846.44 1,634.86 170.30 1,021.79	361.51
08 33 26 00-0039	EA		20' x 12', Steel Overhead Coiling Grilles, Manual Lift <i>For Aluminum With Clear Or Anodized Bronze Finish, Add</i> <i>For Staggered Brick Pattern, Add</i> <i>For Lexan Lattice Pattern, Add</i>	9,912.86 2,069.84 215.61 1,293.65	451.88
08 33 26 00-0040	EA		24' x 12', Steel Overhead Coiling Grilles, Manual Lift <i>For Aluminum With Clear Or Anodized Bronze Finish, Add</i> <i>For Staggered Brick Pattern, Add</i> <i>For Lexan Lattice Pattern, Add</i>	12,025.17 2,514.51 261.93 1,571.57	542.26
08 33 26 00-0041	EA		30' x 12', Steel Overhead Coiling Grilles, Manual Lift <i>For Aluminum With Clear Or Anodized Bronze Finish, Add</i> <i>For Staggered Brick Pattern, Add</i> <i>For Lexan Lattice Pattern, Add</i>	15,004.51 3,148.07 327.92 1,967.55	662.75
08 33 26 00-0042	EA		4' x 14', Steel Overhead Coiling Grilles, Manual Lift <i>For Aluminum With Clear Or Anodized Bronze Finish, Add</i> <i>For Staggered Brick Pattern, Add</i> <i>For Lexan Lattice Pattern, Add</i>	3,956.98 825.83 86.02 516.14	180.75
08 33 26 00-0043	EA		6' x 14', Steel Overhead Coiling Grilles, Manual Lift <i>For Aluminum With Clear Or Anodized Bronze Finish, Add</i> <i>For Staggered Brick Pattern, Add</i> <i>For Lexan Lattice Pattern, Add</i>	4,602.22 980.69 102.16 612.93	180.75
08 33 26 00-0044	EA		8' x 14', Steel Overhead Coiling Grilles, Manual Lift <i>For Aluminum With Clear Or Anodized Bronze Finish, Add</i> <i>For Staggered Brick Pattern, Add</i> <i>For Lexan Lattice Pattern, Add</i>	5,382.79 1,137.25 118.46 710.78	225.94
08 33 26 00-0045	EA		12' x 14', Steel Overhead Coiling Grilles, Manual Lift <i>For Aluminum With Clear Or Anodized Bronze Finish, Add</i> <i>For Staggered Brick Pattern, Add</i> <i>For Lexan Lattice Pattern, Add</i>	6,738.21 1,462.55 152.35 914.09	225.94
08 33 26 00-0046	EA		16' x 14', Steel Overhead Coiling Grilles, Manual Lift <i>For Aluminum With Clear Or Anodized Bronze Finish, Add</i> <i>For Staggered Brick Pattern, Add</i> <i>For Lexan Lattice Pattern, Add</i>	8,973.49 1,905.35 198.47 1,190.85	361.51
08 33 26 00-0047	EA		20' x 14', Steel Overhead Coiling Grilles, Manual Lift <i>For Aluminum With Clear Or Anodized Bronze Finish, Add</i> <i>For Staggered Brick Pattern, Add</i> <i>For Lexan Lattice Pattern, Add</i>	11,072.51 2,348.16 244.60 1,467.60	451.88
08 33 26 00-0048	EA		24' x 14', Steel Overhead Coiling Grilles, Manual Lift <i>For Aluminum With Clear Or Anodized Bronze Finish, Add</i> <i>For Staggered Brick Pattern, Add</i> <i>For Lexan Lattice Pattern, Add</i>	13,229.18 2,803.47 292.03 1,752.17	542.26
08 33 26 00-0049	EA		30' x 14', Steel Overhead Coiling Grilles, Manual Lift <i>For Aluminum With Clear Or Anodized Bronze Finish, Add</i> <i>For Staggered Brick Pattern, Add</i> <i>For Lexan Lattice Pattern, Add</i>	16,965.97 3,618.82 376.96 2,261.76	662.75
08 33 26 00-0050			Coiling Grilles Accessories (08 33 26)		
08 33 26 00-0051	EA		Add For Motor Operator..... Note: Includes motor, supports, push button operator, stationary electronic eye, signal wiring from eye to motor and motor to operator.	2,150.07	36.58
08 33 26 00-0052	LF		For Safety Edge Bottom Bar, Electric, Add.....	60.94	
08 33 26 00-0053	LF		For Overhead Framed Rolling Grille Supports.....	80.78	
08 33 36			Side Coiling Grilles (08 33)		
08 33 36 00-0001			Steel Side Coiling Grilles (Width x Height) (08 33 36)		
08 33 36 00-0002	EA		12' x 8', Steel Side Coiling Grilles, Manually Operated <i>For Aluminum With Clear Or Anodized Bronze Finish, Add</i> <i>For Staggered Brick Pattern, Add</i> <i>For Lexan Lattice Pattern, Add</i>	5,652.05 1,009.89 105.20 631.18	505.42
08 33 36 00-0003	EA		18' x 8', Steel Side Coiling Grilles, Manually Operated <i>For Aluminum With Clear Or Anodized Bronze Finish, Add</i> <i>For Staggered Brick Pattern, Add</i> <i>For Lexan Lattice Pattern, Add</i>	8,033.27 1,482.78 154.46 926.74	649.25
08 33 36 00-0004	EA		24' x 8', Steel Side Coiling Grilles, Manually Operated <i>For Aluminum With Clear Or Anodized Bronze Finish, Add</i> <i>For Staggered Brick Pattern, Add</i> <i>For Lexan Lattice Pattern, Add</i>	10,453.66 1,947.54 202.87 1,217.21	818.63
08 33 36 00-0005	EA		30' x 8', Steel Side Coiling Grilles, Manually Operated <i>For Aluminum With Clear Or Anodized Bronze Finish, Add</i> <i>For Staggered Brick Pattern, Add</i> <i>For Lexan Lattice Pattern, Add</i>	12,726.63 2,434.42 253.59 1,521.51	903.76



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 33 36 00-0006 EA 12' x 10', Steel Side Coiling Grilles, Manually Operated..... For Aluminum With Clear Or Anodized Bronze Finish, Add For Staggered Brick Pattern, Add For Lexan Lattice Pattern, Add	6,902.51 1,261.47 131.40 788.42	576.26
08 33 36 00-0007 EA 18' x 10', Steel Side Coiling Grilles, Manually Operated..... For Aluminum With Clear Or Anodized Bronze Finish, Add For Staggered Brick Pattern, Add For Lexan Lattice Pattern, Add	9,843.29 1,854.59 193.19 1,159.12	740.14
08 33 36 00-0008 EA 24' x 10', Steel Side Coiling Grilles, Manually Operated..... For Aluminum With Clear Or Anodized Bronze Finish, Add For Staggered Brick Pattern, Add For Lexan Lattice Pattern, Add	12,625.43 2,390.16 248.98 1,493.85	932.93
08 33 36 00-0009 EA 30' x 10', Steel Side Coiling Grilles, Manually Operated..... For Aluminum With Clear Or Anodized Bronze Finish, Add For Staggered Brick Pattern, Add For Lexan Lattice Pattern, Add	15,631.38 3,042.14 316.89 1,901.34	1,030.28
08 33 36 00-0010 EA 12' x 12', Steel Side Coiling Grilles, Manually Operated..... For Aluminum With Clear Or Anodized Bronze Finish, Add For Staggered Brick Pattern, Add For Lexan Lattice Pattern, Add	8,164.21 1,514.21 157.73 946.38	649.25
08 33 36 00-0011 EA 18' x 12', Steel Side Coiling Grilles, Manually Operated..... For Aluminum With Clear Or Anodized Bronze Finish, Add For Staggered Brick Pattern, Add For Lexan Lattice Pattern, Add	11,649.09 2,221.97 231.45 1,388.73	833.87
08 33 36 00-0012 EA 24' x 12', Steel Side Coiling Grilles, Manually Operated..... For Aluminum With Clear Or Anodized Bronze Finish, Add For Staggered Brick Pattern, Add For Lexan Lattice Pattern, Add	15,160.74 2,921.31 304.30 1,825.82	1,051.37
08 33 36 00-0013 EA 30' x 12', Steel Side Coiling Grilles, Manually Operated..... For Aluminum With Clear Or Anodized Bronze Finish, Add For Staggered Brick Pattern, Add For Lexan Lattice Pattern, Add	18,530.71 3,651.63 380.38 2,282.27	1,159.82
08 33 36 00-0014 EA 12' x 14', Steel Side Coiling Grilles, Manually Operated..... For Aluminum With Clear Or Anodized Bronze Finish, Add For Staggered Brick Pattern, Add For Lexan Lattice Pattern, Add	9,426.38 1,770.49 184.43 1,106.56	717.84
08 33 36 00-0015 EA 18' x 14', Steel Side Coiling Grilles, Manually Operated..... For Aluminum With Clear Or Anodized Bronze Finish, Add For Staggered Brick Pattern, Add For Lexan Lattice Pattern, Add	13,463.91 2,593.77 270.18 1,621.10	921.83
08 33 36 00-0016 EA 24' x 14', Steel Side Coiling Grilles, Manually Operated..... For Aluminum With Clear Or Anodized Bronze Finish, Add For Staggered Brick Pattern, Add For Lexan Lattice Pattern, Add	17,511.27 3,408.19 355.02 2,130.12	1,162.23
08 33 36 00-0017 EA 30' x 14', Steel Side Coiling Grilles, Manually Operated..... For Aluminum With Clear Or Anodized Bronze Finish, Add For Staggered Brick Pattern, Add For Lexan Lattice Pattern, Add	21,407.55 4,258.03 443.54 2,661.27	1,283.34

08 33 39 High Speed Doors (08 33)

08 33 39 00-0001	2 Ply Fabric Panel, High-Speed Rolling Doors (Rytec® PredaDoor®) (08 33 39) Note: Rytec® PredaDoor® PD5500. Door panel is 2-ply multi-filament Rilon. Includes full width vision panel. Side frames are fully bolted together, anodized aluminum construction with weather seal. Bottom bar releases in either direction when impacted, without damage to door. Drive system is a 3 phase, variable-speed AC Drive with brake and absolute encoder. Opens at 50" per second and closes at 21" per second.		
08 33 39 00-0002	2 Ply Fabric Panel, High-Speed Rolling Doors (Rytec® PredaDoor®) (08 33 39 00-0001)		
08 33 39 00-0003	6' Wide, 2 Ply Fabric Panel, High-Speed Rolling Doors (Rytec® PredaDoor®) (08 33 39 00-0002)		
08 33 39 00-0004	EA 6' x 6', 2 Ply Fabric Panel, High-Speed Rolling Door (Rytec® PredaDoor®).....	8,776.79	287.49
08 33 39 00-0005	EA 6' x 7', 2 Ply Fabric Panel, High-Speed Rolling Door (Rytec® PredaDoor®).....	8,920.57	299.70
08 33 39 00-0006	EA 6' x 8', 2 Ply Fabric Panel, High-Speed Rolling Door (Rytec® PredaDoor®).....	9,094.94	311.92
08 33 39 00-0007	EA 6' x 9', 2 Ply Fabric Panel, High-Speed Rolling Door (Rytec® PredaDoor®).....	9,315.22	324.14
08 33 39 00-0008	EA 6' x 10', 2 Ply Fabric Panel, High-Speed Rolling Door (Rytec® PredaDoor®).....	9,548.75	336.36
08 33 39 00-0009	EA 6' x 11', 2 Ply Fabric Panel, High-Speed Rolling Door (Rytec® PredaDoor®).....	9,941.41	348.58
08 33 39 00-0010	EA 6' x 12', 2 Ply Fabric Panel, High-Speed Rolling Door (Rytec® PredaDoor®).....	10,220.85	360.79
08 33 39 00-0011	7' Wide, 2 Ply Fabric Panel, High-Speed Rolling Doors (Rytec® PredaDoor®) (08 33 39 00-0002)		
08 33 39 00-0012	EA 7' x 6', 2 Ply Fabric Panel, High-Speed Rolling Door (Rytec® PredaDoor®).....	8,951.17	299.70
08 33 39 00-0013	EA 7' x 7', 2 Ply Fabric Panel, High-Speed Rolling Door (Rytec® PredaDoor®).....	9,133.70	311.92
08 33 39 00-0014	EA 7' x 8', 2 Ply Fabric Panel, High-Speed Rolling Door (Rytec® PredaDoor®).....	9,362.14	324.14
08 33 39 00-0015	EA 7' x 9', 2 Ply Fabric Panel, High-Speed Rolling Door (Rytec® PredaDoor®).....	9,603.83	336.36
08 33 39 00-0016	EA 7' x 10', 2 Ply Fabric Panel, High-Speed Rolling Door (Rytec® PredaDoor®).....	9,922.03	348.58
08 33 39 00-0017	EA 7' x 11', 2 Ply Fabric Panel, High-Speed Rolling Door (Rytec® PredaDoor®).....	10,305.51	360.79
08 33 39 00-0018	EA 7' x 12', 2 Ply Fabric Panel, High-Speed Rolling Door (Rytec® PredaDoor®).....	10,608.41	373.01
08 33 39 00-0019	8' Wide, 2 Ply Fabric Panel, High-Speed Rolling Doors (Rytec® PredaDoor®) (08 33 39 00-0002)		

08	Openings
08 30	Specialty Doors And Frames
08 33	Coiling Doors And Grilles



MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	
08 33 39 00-020	EA	8' x 6', 2 Ply Fabric Panel, High-Speed Rolling Door (Rytec® PredaDoor®)	9,164.30		311.92
08 33 39 00-021	EA	8' x 7', 2 Ply Fabric Panel, High-Speed Rolling Door (Rytec® PredaDoor®)	9,391.72		324.14
08 33 39 00-022	EA	8' x 8', 2 Ply Fabric Panel, High-Speed Rolling Door (Rytec® PredaDoor®)	9,642.59		336.36
08 33 39 00-023	EA	8' x 9', 2 Ply Fabric Panel, High-Speed Rolling Door (Rytec® PredaDoor®)	9,969.97		348.58
08 33 39 00-024	EA	8' x 10', 2 Ply Fabric Panel, High-Speed Rolling Door (Rytec® PredaDoor®)	10,265.73		360.79
08 33 39 00-025	EA	8' x 11', 2 Ply Fabric Panel, High-Speed Rolling Door (Rytec® PredaDoor®)	10,682.87		373.01
08 33 39 00-026	EA	8' x 12', 2 Ply Fabric Panel, High-Speed Rolling Door (Rytec® PredaDoor®)	11,025.55		385.23
08 33 39 00-027		9' Wide, 2 Ply Fabric Panel, High-Speed Rolling Doors (Rytec® PredaDoor®) (08 33 39 00-002)			
08 33 39 00-028	EA	9' x 6', 2 Ply Fabric Panel, High-Speed Rolling Door (Rytec® PredaDoor®)	9,422.32		324.14
08 33 39 00-029	EA	9' x 7', 2 Ply Fabric Panel, High-Speed Rolling Door (Rytec® PredaDoor®)	9,672.17		336.36
08 33 39 00-030	EA	9' x 8', 2 Ply Fabric Panel, High-Speed Rolling Door (Rytec® PredaDoor®)	9,999.55		348.58
08 33 39 00-031	EA	9' x 9', 2 Ply Fabric Panel, High-Speed Rolling Door (Rytec® PredaDoor®)	10,304.49		360.79
08 33 39 00-032	EA	9' x 10', 2 Ply Fabric Panel, High-Speed Rolling Door (Rytec® PredaDoor®)	10,624.73		373.01
08 33 39 00-033	EA	9' x 11', 2 Ply Fabric Panel, High-Speed Rolling Door (Rytec® PredaDoor®)	10,957.21		385.23
08 33 39 00-034	EA	9' x 12', 2 Ply Fabric Panel, High-Speed Rolling Door (Rytec® PredaDoor®)	11,321.30		397.45
08 33 39 00-035		10' Wide, 2 Ply Fabric Panel, High-Speed Rolling Doors (Rytec® PredaDoor®) (08 33 39 00-002)			
08 33 39 00-036	EA	10' x 6', 2 Ply Fabric Panel, High-Speed Rolling Door (Rytec® PredaDoor®)	9,696.65		336.36
08 33 39 00-037	EA	10' x 7', 2 Ply Fabric Panel, High-Speed Rolling Door (Rytec® PredaDoor®)	10,030.15		348.58
08 33 39 00-038	EA	10' x 8', 2 Ply Fabric Panel, High-Speed Rolling Door (Rytec® PredaDoor®)	10,333.05		360.79
08 33 39 00-039	EA	10' x 9', 2 Ply Fabric Panel, High-Speed Rolling Door (Rytec® PredaDoor®)	10,655.33		373.01
08 33 39 00-040	EA	10' x 10', 2 Ply Fabric Panel, High-Speed Rolling Door (Rytec® PredaDoor®)	11,013.31		385.23
08 33 39 00-041	EA	10' x 11', 2 Ply Fabric Panel, High-Speed Rolling Door (Rytec® PredaDoor®)	11,381.48		397.45
08 33 39 00-042	EA	10' x 12', 2 Ply Fabric Panel, High-Speed Rolling Door (Rytec® PredaDoor®)	11,694.58		409.66
08 33 39 00-043		11' Wide, 2 Ply Fabric Panel, High-Speed Rolling Doors (Rytec® PredaDoor®) (08 33 39 00-002)			
08 33 39 00-044	EA	11' x 6', 2 Ply Fabric Panel, High-Speed Rolling Door (Rytec® PredaDoor®)	10,048.51		348.58
08 33 39 00-045	EA	11' x 7', 2 Ply Fabric Panel, High-Speed Rolling Door (Rytec® PredaDoor®)	10,358.55		360.79
08 33 39 00-046	EA	11' x 8', 2 Ply Fabric Panel, High-Speed Rolling Door (Rytec® PredaDoor®)	10,684.91		373.01
08 33 39 00-047	EA	11' x 9', 2 Ply Fabric Panel, High-Speed Rolling Door (Rytec® PredaDoor®)	11,043.91		385.23
08 33 39 00-048	EA	11' x 10', 2 Ply Fabric Panel, High-Speed Rolling Door (Rytec® PredaDoor®)	11,279.48		397.45
08 33 39 00-049	EA	11' x 11', 2 Ply Fabric Panel, High-Speed Rolling Door (Rytec® PredaDoor®)	11,745.58		409.66
08 33 39 00-050	EA	11' x 12', 2 Ply Fabric Panel, High-Speed Rolling Door (Rytec® PredaDoor®)	12,127.01		421.88
08 33 39 00-051		12' Wide, 2 Ply Fabric Panel, High-Speed Rolling Doors (Rytec® PredaDoor®) (08 33 39 00-002)			
08 33 39 00-052	EA	12' x 6', 2 Ply Fabric Panel, High-Speed Rolling Door (Rytec® PredaDoor®)	10,366.71		360.79
08 33 39 00-053	EA	12' x 7', 2 Ply Fabric Panel, High-Speed Rolling Door (Rytec® PredaDoor®)	10,702.25		373.01
08 33 39 00-054	EA	12' x 8', 2 Ply Fabric Panel, High-Speed Rolling Door (Rytec® PredaDoor®)	11,067.37		385.23
08 33 39 00-055	EA	12' x 9', 2 Ply Fabric Panel, High-Speed Rolling Door (Rytec® PredaDoor®)	11,312.12		397.45
08 33 39 00-056	EA	12' x 10', 2 Ply Fabric Panel, High-Speed Rolling Door (Rytec® PredaDoor®)	11,632.36		409.66
08 33 39 00-057	EA	12' x 11', 2 Ply Fabric Panel, High-Speed Rolling Door (Rytec® PredaDoor®)	12,169.85		421.88
08 33 39 00-058	EA	12' x 12', 2 Ply Fabric Panel, High-Speed Rolling Door (Rytec® PredaDoor®)	12,544.15		434.11
08 33 39 00-059		Rytec® PredaDoor® Door Options (08 33 39 00-001)			
08 33 39 00-060	EA	Up To 10' Wide Doors, Roll And Motor Hood For Rytec® PredaDoor® High-Speed Rolling Doors	306.00		71.87
08 33 39 00-061	EA	>10' To 15' Wide Doors, Roll And Motor Hood For Rytec® PredaDoor® High-Speed Rolling Doors	510.00		71.87
08 33 39 00-062	SF	Upgrade To 3-Ply Rilon Panel Material For Rytec® PredaDoor® High-Speed Rolling Doors	7.65		
08 33 39 00-063		3 Ply Fabric Panel, High-Speed Rolling Doors (Rytec® Fast-Seal®) (08 33 39 00-063)			
Note: Rytec® Fast-Seal® FS1000. Door panel is heavy-duty 3-ply multi-filament Rilon. Independent opening and closing speeds up to 50" per second. Side frames are fully bolted together, reinforced with front and rear wind bar guides and full height vinyl weather seal on either side of the door panel. Counterbalance system consists of guided counterweights custom-sized to provide to provide proper balancing of each door system. The independent tension system maintains constant panel tensioning. The drive system is a 3 phase, variable speed AC drive motor with brake and absolute encoder. Bottom bar breaks away in either direction without damage to the bar, safety astragal, or side covers.					
08 33 39 00-064		3 Ply Fabric Panel, High-Speed Rolling Doors (Rytec® Fast-Seal®) (08 33 39 00-0063)			
08 33 39 00-065		8' Wide, 3 Ply Fabric Panel, High-Speed Rolling Doors (Rytec® Fast-Seal®) (08 33 39 00-0064)			
08 33 39 00-066	EA	8' x 8', 3 Ply Fabric Panel, High-Speed Rolling Door (Rytec® Fast-Seal®)	12,911.72		431.23
		For NEMA 4X Control Box, Add	675.00		
		For 2 Speed Motor, 60" Open, 30" Close, Add	1,100.00		
		For AC Variable Speed Motor And Controls, Add	2,750.00		
		For 304 Stainless Steel Side Frame Tower, Add	2,200.00		
		For 316 Stainless Steel Side Frame Tower, Add	3,300.00		



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
	08 33 39 00-0067	EA		8' x 9', 3 Ply Fabric Panel, High-Speed Rolling Door (Rytec® Fast-Seal®)..... For NEMA 4X Control Box, Add For 2 Speed Motor, 60" Open, 30" Close, Add For AC Variable Speed Motor And Controls, Add For 304 Stainless Steel Side Frame Tower, Add For 316 Stainless Steel Side Frame Tower, Add	13,504.30 675.00 1,100.00 2,750.00 2,200.00 3,300.00	443.44
	08 33 39 00-0068	EA		8' x 10', 3 Ply Fabric Panel, High-Speed Rolling Door (Rytec® Fast-Seal®)..... For NEMA 4X Control Box, Add For 2 Speed Motor, 60" Open, 30" Close, Add For AC Variable Speed Motor And Controls, Add For 304 Stainless Steel Side Frame Tower, Add For 316 Stainless Steel Side Frame Tower, Add	14,018.33 675.00 1,100.00 2,750.00 2,200.00 3,300.00	455.66
	08 33 39 00-0069	EA		8' x 11', 3 Ply Fabric Panel, High-Speed Rolling Door (Rytec® Fast-Seal®)..... For NEMA 4X Control Box, Add For 2 Speed Motor, 60" Open, 30" Close, Add For AC Variable Speed Motor And Controls, Add For 304 Stainless Steel Side Frame Tower, Add For 316 Stainless Steel Side Frame Tower, Add	14,573.17 675.00 1,100.00 2,750.00 2,200.00 3,300.00	467.89
	08 33 39 00-0070	EA		8' x 12', 3 Ply Fabric Panel, High-Speed Rolling Door (Rytec® Fast-Seal®)..... For NEMA 4X Control Box, Add For 2 Speed Motor, 60" Open, 30" Close, Add For AC Variable Speed Motor And Controls, Add For 304 Stainless Steel Side Frame Tower, Add For 316 Stainless Steel Side Frame Tower, Add	15,202.46 675.00 1,100.00 2,750.00 2,200.00 3,300.00	480.11
	08 33 39 00-0071	EA		8' x 13', 3 Ply Fabric Panel, High-Speed Rolling Door (Rytec® Fast-Seal®)..... For NEMA 4X Control Box, Add For 2 Speed Motor, 60" Open, 30" Close, Add For AC Variable Speed Motor And Controls, Add For 304 Stainless Steel Side Frame Tower, Add For 316 Stainless Steel Side Frame Tower, Add	15,528.82 675.00 1,100.00 2,750.00 2,200.00 3,300.00	492.32
	08 33 39 00-0072	EA		8' x 14', 3 Ply Fabric Panel, High-Speed Rolling Door (Rytec® Fast-Seal®)..... For NEMA 4X Control Box, Add For 2 Speed Motor, 60" Open, 30" Close, Add For AC Variable Speed Motor And Controls, Add For 304 Stainless Steel Side Frame Tower, Add For 316 Stainless Steel Side Frame Tower, Add	16,042.85 675.00 1,100.00 2,750.00 2,200.00 3,300.00	504.54
	08 33 39 00-0073			9' Wide, 3 Ply Fabric Panel, High-Speed Rolling Doors (Rytec® Fast-Seal®) (08 33 39 00-0064)		
	08 33 39 00-0074	EA		9' x 8', 3 Ply Fabric Panel, High-Speed Rolling Door (Rytec® Fast-Seal®)..... For NEMA 4X Control Box, Add For 2 Speed Motor, 60" Open, 30" Close, Add For AC Variable Speed Motor And Controls, Add For 304 Stainless Steel Side Frame Tower, Add For 316 Stainless Steel Side Frame Tower, Add	13,504.30 675.00 1,100.00 2,750.00 3,300.00 4,950.00	443.44
	08 33 39 00-0075	EA		9' x 9', 3 Ply Fabric Panel, High-Speed Rolling Door (Rytec® Fast-Seal®)..... For NEMA 4X Control Box, Add For 2 Speed Motor, 60" Open, 30" Close, Add For AC Variable Speed Motor And Controls, Add For 304 Stainless Steel Side Frame Tower, Add For 316 Stainless Steel Side Frame Tower, Add	14,018.33 675.00 1,100.00 2,750.00 3,300.00 4,950.00	455.66
	08 33 39 00-0076	EA		9' x 10', 3 Ply Fabric Panel, High-Speed Rolling Door (Rytec® Fast-Seal®)..... For NEMA 4X Control Box, Add For 2 Speed Motor, 60" Open, 30" Close, Add For AC Variable Speed Motor And Controls, Add For 304 Stainless Steel Side Frame Tower, Add For 316 Stainless Steel Side Frame Tower, Add	14,573.17 675.00 1,100.00 2,750.00 3,300.00 4,950.00	467.89
	08 33 39 00-0077	EA		9' x 11', 3 Ply Fabric Panel, High-Speed Rolling Door (Rytec® Fast-Seal®)..... For NEMA 4X Control Box, Add For 2 Speed Motor, 60" Open, 30" Close, Add For AC Variable Speed Motor And Controls, Add For 304 Stainless Steel Side Frame Tower, Add For 316 Stainless Steel Side Frame Tower, Add	15,202.46 675.00 1,100.00 2,750.00 3,300.00 4,950.00	480.11
	08 33 39 00-0078	EA		9' x 12', 3 Ply Fabric Panel, High-Speed Rolling Door (Rytec® Fast-Seal®)..... For NEMA 4X Control Box, Add For 2 Speed Motor, 60" Open, 30" Close, Add For AC Variable Speed Motor And Controls, Add For 304 Stainless Steel Side Frame Tower, Add For 316 Stainless Steel Side Frame Tower, Add	15,528.82 675.00 1,100.00 2,750.00 3,300.00 4,950.00	492.32
	08 33 39 00-0079	EA		9' x 13', 3 Ply Fabric Panel, High-Speed Rolling Door (Rytec® Fast-Seal®)..... For NEMA 4X Control Box, Add For 2 Speed Motor, 60" Open, 30" Close, Add For AC Variable Speed Motor And Controls, Add For 304 Stainless Steel Side Frame Tower, Add For 316 Stainless Steel Side Frame Tower, Add	16,042.85 675.00 1,100.00 2,750.00 3,300.00 4,950.00	504.54
	08 33 39 00-0080	EA		9' x 14', 3 Ply Fabric Panel, High-Speed Rolling Door (Rytec® Fast-Seal®)..... For NEMA 4X Control Box, Add For 2 Speed Motor, 60" Open, 30" Close, Add For AC Variable Speed Motor And Controls, Add For 304 Stainless Steel Side Frame Tower, Add For 316 Stainless Steel Side Frame Tower, Add	16,709.89 675.00 1,100.00 2,750.00 3,300.00 4,950.00	516.76



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 33 39 00-0081			10' Wide, 3 Ply Fabric Panel, High-Speed Rolling Doors (Rytec® Fast-Seal®) <small>(08 33 39 00-0064)</small>		
08 33 39 00-0082	EA		10' x 8', 3 Ply Fabric Panel, High-Speed Rolling Door (Rytec® Fast-Seal®).....	14,018.33	455.66
			For NEMA 4X Control Box, Add	675.00	
			For 2 Speed Motor, 60" Open, 30" Close, Add	1,100.00	
			For AC Variable Speed Motor And Controls, Add	2,750.00	
			For 304 Stainless Steel Side Frame Tower, Add	3,300.00	
			For 316 Stainless Steel Side Frame Tower, Add	4,950.00	
08 33 39 00-0083	EA		10' x 9', 3 Ply Fabric Panel, High-Speed Rolling Door (Rytec® Fast-Seal®).....	14,573.17	467.89
			For NEMA 4X Control Box, Add	675.00	
			For 2 Speed Motor, 60" Open, 30" Close, Add	1,100.00	
			For AC Variable Speed Motor And Controls, Add	2,750.00	
			For 304 Stainless Steel Side Frame Tower, Add	3,300.00	
			For 316 Stainless Steel Side Frame Tower, Add	4,950.00	
08 33 39 00-0084	EA		10' x 10', 3 Ply Fabric Panel, High-Speed Rolling Door (Rytec® Fast-Seal®).....	15,202.46	480.11
			For NEMA 4X Control Box, Add	675.00	
			For 2 Speed Motor, 60" Open, 30" Close, Add	1,100.00	
			For AC Variable Speed Motor And Controls, Add	2,750.00	
			For 304 Stainless Steel Side Frame Tower, Add	3,300.00	
			For 316 Stainless Steel Side Frame Tower, Add	4,950.00	
08 33 39 00-0085	EA		10' x 11', 3 Ply Fabric Panel, High-Speed Rolling Door (Rytec® Fast-Seal®).....	15,528.82	492.32
			For NEMA 4X Control Box, Add	675.00	
			For 2 Speed Motor, 60" Open, 30" Close, Add	1,100.00	
			For AC Variable Speed Motor And Controls, Add	2,750.00	
			For 304 Stainless Steel Side Frame Tower, Add	3,300.00	
			For 316 Stainless Steel Side Frame Tower, Add	4,950.00	
08 33 39 00-0086	EA		10' x 12', 3 Ply Fabric Panel, High-Speed Rolling Door (Rytec® Fast-Seal®).....	16,042.85	504.54
			For NEMA 4X Control Box, Add	675.00	
			For 2 Speed Motor, 60" Open, 30" Close, Add	1,100.00	
			For AC Variable Speed Motor And Controls, Add	2,750.00	
			For 304 Stainless Steel Side Frame Tower, Add	3,300.00	
			For 316 Stainless Steel Side Frame Tower, Add	4,950.00	
08 33 39 00-0087	EA		10' x 13', 3 Ply Fabric Panel, High-Speed Rolling Door (Rytec® Fast-Seal®).....	16,709.89	516.76
			For NEMA 4X Control Box, Add	675.00	
			For 2 Speed Motor, 60" Open, 30" Close, Add	1,100.00	
			For AC Variable Speed Motor And Controls, Add	2,750.00	
			For 304 Stainless Steel Side Frame Tower, Add	3,300.00	
			For 316 Stainless Steel Side Frame Tower, Add	4,950.00	
08 33 39 00-0088	EA		10' x 14', 3 Ply Fabric Panel, High-Speed Rolling Door (Rytec® Fast-Seal®).....	17,339.19	528.98
			For NEMA 4X Control Box, Add	675.00	
			For 2 Speed Motor, 60" Open, 30" Close, Add	1,100.00	
			For AC Variable Speed Motor And Controls, Add	2,750.00	
			For 304 Stainless Steel Side Frame Tower, Add	3,300.00	
			For 316 Stainless Steel Side Frame Tower, Add	4,950.00	
08 33 39 00-0089			11' Wide, 3 Ply Fabric Panel, High-Speed Rolling Doors (Rytec® Fast-Seal®) <small>(08 33 39 00-0064)</small>		
08 33 39 00-0090	EA		11' x 8', 3 Ply Fabric Panel, High-Speed Rolling Door (Rytec® Fast-Seal®).....	14,573.17	467.89
			For NEMA 4X Control Box, Add	675.00	
			For 2 Speed Motor, 60" Open, 30" Close, Add	1,100.00	
			For AC Variable Speed Motor And Controls, Add	2,750.00	
			For 304 Stainless Steel Side Frame Tower, Add	4,400.00	
			For 316 Stainless Steel Side Frame Tower, Add	6,600.00	
08 33 39 00-0091	EA		11' x 9', 3 Ply Fabric Panel, High-Speed Rolling Door (Rytec® Fast-Seal®).....	15,202.46	480.11
			For NEMA 4X Control Box, Add	675.00	
			For 2 Speed Motor, 60" Open, 30" Close, Add	1,100.00	
			For AC Variable Speed Motor And Controls, Add	2,750.00	
			For 304 Stainless Steel Side Frame Tower, Add	4,400.00	
			For 316 Stainless Steel Side Frame Tower, Add	6,600.00	
08 33 39 00-0092	EA		11' x 10', 3 Ply Fabric Panel, High-Speed Rolling Door (Rytec® Fast-Seal®).....	15,528.82	492.32
			For NEMA 4X Control Box, Add	675.00	
			For 2 Speed Motor, 60" Open, 30" Close, Add	1,100.00	
			For AC Variable Speed Motor And Controls, Add	2,750.00	
			For 304 Stainless Steel Side Frame Tower, Add	4,400.00	
			For 316 Stainless Steel Side Frame Tower, Add	6,600.00	
08 33 39 00-0093	EA		11' x 11', 3 Ply Fabric Panel, High-Speed Rolling Door (Rytec® Fast-Seal®).....	16,042.85	504.54
			For NEMA 4X Control Box, Add	675.00	
			For 2 Speed Motor, 60" Open, 30" Close, Add	1,100.00	
			For AC Variable Speed Motor And Controls, Add	2,750.00	
			For 304 Stainless Steel Side Frame Tower, Add	4,400.00	
			For 316 Stainless Steel Side Frame Tower, Add	6,600.00	
08 33 39 00-0094	EA		11' x 12', 3 Ply Fabric Panel, High-Speed Rolling Door (Rytec® Fast-Seal®).....	16,709.89	516.76
			For NEMA 4X Control Box, Add	675.00	
			For 2 Speed Motor, 60" Open, 30" Close, Add	1,100.00	
			For AC Variable Speed Motor And Controls, Add	2,750.00	
			For 304 Stainless Steel Side Frame Tower, Add	4,400.00	
			For 316 Stainless Steel Side Frame Tower, Add	6,600.00	
08 33 39 00-0095	EA		11' x 13', 3 Ply Fabric Panel, High-Speed Rolling Door (Rytec® Fast-Seal®).....	17,339.19	528.98
			For NEMA 4X Control Box, Add	675.00	
			For 2 Speed Motor, 60" Open, 30" Close, Add	1,100.00	
			For AC Variable Speed Motor And Controls, Add	2,750.00	
			For 304 Stainless Steel Side Frame Tower, Add	4,400.00	
			For 316 Stainless Steel Side Frame Tower, Add	6,600.00	



Openings	08	08
Specialty Doors And Frames	08 30	
Coiling Doors And Grilles	08 33	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 33 39 00-0096 EA 11' x 14', 3 Ply Fabric Panel, High-Speed Rolling Door (Rytec® Fast-Seal®)..... For NEMA 4X Control Box, Add For 2 Speed Motor, 60" Open, 30" Close, Add For AC Variable Speed Motor And Controls, Add For 304 Stainless Steel Side Frame Tower, Add For 316 Stainless Steel Side Frame Tower, Add	18,042.95 675.00 1,100.00 2,750.00 4,400.00 6,600.00	541.19
08 33 39 00-0097 12' Wide, 3 Ply Fabric Panel, High-Speed Rolling Doors (Rytec® Fast-Seal®) (08 33 39 00-0064)		
08 33 39 00-0098 EA 12' x 8', 3 Ply Fabric Panel, High-Speed Rolling Door (Rytec® Fast-Seal®)..... For NEMA 4X Control Box, Add For 2 Speed Motor, 60" Open, 30" Close, Add For AC Variable Speed Motor And Controls, Add For 304 Stainless Steel Side Frame Tower, Add For 316 Stainless Steel Side Frame Tower, Add	15,202.46 675.00 1,100.00 2,750.00 4,400.00 6,600.00	480.11
08 33 39 00-0099 EA 12' x 9', 3 Ply Fabric Panel, High-Speed Rolling Door (Rytec® Fast-Seal®)..... For NEMA 4X Control Box, Add For 2 Speed Motor, 60" Open, 30" Close, Add For AC Variable Speed Motor And Controls, Add For 304 Stainless Steel Side Frame Tower, Add For 316 Stainless Steel Side Frame Tower, Add	15,528.82 675.00 1,100.00 2,750.00 4,400.00 6,600.00	492.32
08 33 39 00-0100 EA 12' x 10', 3 Ply Fabric Panel, High-Speed Rolling Door (Rytec® Fast-Seal®)..... For NEMA 4X Control Box, Add For 2 Speed Motor, 60" Open, 30" Close, Add For AC Variable Speed Motor And Controls, Add For 304 Stainless Steel Side Frame Tower, Add For 316 Stainless Steel Side Frame Tower, Add	16,042.85 675.00 1,100.00 2,750.00 4,400.00 6,600.00	504.54
08 33 39 00-0101 EA 12' x 11', 3 Ply Fabric Panel, High-Speed Rolling Door (Rytec® Fast-Seal®)..... For NEMA 4X Control Box, Add For 2 Speed Motor, 60" Open, 30" Close, Add For AC Variable Speed Motor And Controls, Add For 304 Stainless Steel Side Frame Tower, Add For 316 Stainless Steel Side Frame Tower, Add	16,709.89 675.00 1,100.00 2,750.00 4,400.00 6,600.00	516.76
08 33 39 00-0102 EA 12' x 12', 3 Ply Fabric Panel, High-Speed Rolling Door (Rytec® Fast-Seal®)..... For NEMA 4X Control Box, Add For 2 Speed Motor, 60" Open, 30" Close, Add For AC Variable Speed Motor And Controls, Add For 304 Stainless Steel Side Frame Tower, Add For 316 Stainless Steel Side Frame Tower, Add	17,339.19 675.00 1,100.00 2,750.00 4,400.00 6,600.00	528.98
08 33 39 00-0103 EA 12' x 13', 3 Ply Fabric Panel, High-Speed Rolling Door (Rytec® Fast-Seal®)..... For NEMA 4X Control Box, Add For 2 Speed Motor, 60" Open, 30" Close, Add For AC Variable Speed Motor And Controls, Add For 304 Stainless Steel Side Frame Tower, Add For 316 Stainless Steel Side Frame Tower, Add	18,042.95 675.00 1,100.00 2,750.00 4,400.00 6,600.00	541.19
08 33 39 00-0104 EA 12' x 14', 3 Ply Fabric Panel, High-Speed Rolling Door (Rytec® Fast-Seal®)..... For NEMA 4X Control Box, Add For 2 Speed Motor, 60" Open, 30" Close, Add For AC Variable Speed Motor And Controls, Add For 304 Stainless Steel Side Frame Tower, Add For 316 Stainless Steel Side Frame Tower, Add	18,546.78 675.00 1,100.00 2,750.00 4,400.00 6,600.00	553.41
08 33 39 00-0105 13' Wide, 3 Ply Fabric Panel, High-Speed Rolling Doors (Rytec® Fast-Seal®) (08 33 39 00-0064)		
08 33 39 00-0106 EA 13' x 8', 3 Ply Fabric Panel, High-Speed Rolling Door (Rytec® Fast-Seal®)..... For NEMA 4X Control Box, Add For 2 Speed Motor, 60" Open, 30" Close, Add For AC Variable Speed Motor And Controls, Add For 304 Stainless Steel Side Frame Tower, Add For 316 Stainless Steel Side Frame Tower, Add	15,917.44 675.00 1,100.00 2,750.00 5,480.00 7,370.00	492.32
08 33 39 00-0107 EA 13' x 9', 3 Ply Fabric Panel, High-Speed Rolling Door (Rytec® Fast-Seal®)..... For NEMA 4X Control Box, Add For 2 Speed Motor, 60" Open, 30" Close, Add For AC Variable Speed Motor And Controls, Add For 304 Stainless Steel Side Frame Tower, Add For 316 Stainless Steel Side Frame Tower, Add	16,578.35 675.00 1,100.00 2,750.00 5,480.00 7,370.00	504.54
08 33 39 00-0108 EA 13' x 10', 3 Ply Fabric Panel, High-Speed Rolling Door (Rytec® Fast-Seal®)..... For NEMA 4X Control Box, Add For 2 Speed Motor, 60" Open, 30" Close, Add For AC Variable Speed Motor And Controls, Add For 304 Stainless Steel Side Frame Tower, Add For 316 Stainless Steel Side Frame Tower, Add	17,204.59 675.00 1,100.00 2,750.00 5,480.00 7,370.00	516.76
08 33 39 00-0109 EA 13' x 11', 3 Ply Fabric Panel, High-Speed Rolling Door (Rytec® Fast-Seal®)..... For NEMA 4X Control Box, Add For 2 Speed Motor, 60" Open, 30" Close, Add For AC Variable Speed Motor And Controls, Add For 304 Stainless Steel Side Frame Tower, Add For 316 Stainless Steel Side Frame Tower, Add	17,933.85 675.00 1,100.00 2,750.00 5,480.00 7,370.00	528.98

08 Openings**08 30 Specialty Doors And Frames****08 33 Coiling Doors And Grilles**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 33 39 00-0110	EA		13' x 12', 3 Ply Fabric Panel, High-Speed Rolling Door (Rytec® Fast-Seal®)..... <i>For NEMA 4X Control Box, Add</i> <i>For 2 Speed Motor, 60" Open, 30" Close, Add</i> <i>For AC Variable Speed Motor And Controls, Add</i> <i>For 304 Stainless Steel Side Frame Tower, Add</i> <i>For 316 Stainless Steel Side Frame Tower, Add</i>	18,660.05 675.00 1,100.00 2,750.00 5,480.00 7,370.00	541.19
08 33 39 00-0111	EA		13' x 13', 3 Ply Fabric Panel, High-Speed Rolling Door (Rytec® Fast-Seal®)..... <i>For NEMA 4X Control Box, Add</i> <i>For 2 Speed Motor, 60" Open, 30" Close, Add</i> <i>For AC Variable Speed Motor And Controls, Add</i> <i>For 304 Stainless Steel Side Frame Tower, Add</i> <i>For 316 Stainless Steel Side Frame Tower, Add</i>	19,196.52 675.00 1,100.00 2,750.00 5,480.00 7,370.00	553.41
08 33 39 00-0112	EA		13' x 14', 3 Ply Fabric Panel, High-Speed Rolling Door (Rytec® Fast-Seal®)..... <i>For NEMA 4X Control Box, Add</i> <i>For 2 Speed Motor, 60" Open, 30" Close, Add</i> <i>For AC Variable Speed Motor And Controls, Add</i> <i>For 304 Stainless Steel Side Frame Tower, Add</i> <i>For 316 Stainless Steel Side Frame Tower, Add</i>	19,601.42 675.00 1,100.00 2,750.00 5,480.00 7,370.00	565.63
08 33 39 00-0113 14' Wide, 3 Ply Fabric Panel, High-Speed Rolling Doors (Rytec® Fast-Seal®) (08 33 39 00-0064)					
08 33 39 00-0114	EA		14' x 8', 3 Ply Fabric Panel, High-Speed Rolling Door (Rytec® Fast-Seal®)..... <i>For NEMA 4X Control Box, Add</i> <i>For 2 Speed Motor, 60" Open, 30" Close, Add</i> <i>For AC Variable Speed Motor And Controls, Add</i> <i>For 304 Stainless Steel Side Frame Tower, Add</i> <i>For 316 Stainless Steel Side Frame Tower, Add</i>	16,578.35 675.00 1,100.00 2,750.00 5,480.00 7,370.00	504.54
08 33 39 00-0115	EA		14' x 9', 3 Ply Fabric Panel, High-Speed Rolling Door (Rytec® Fast-Seal®)..... <i>For NEMA 4X Control Box, Add</i> <i>For 2 Speed Motor, 60" Open, 30" Close, Add</i> <i>For AC Variable Speed Motor And Controls, Add</i> <i>For 304 Stainless Steel Side Frame Tower, Add</i> <i>For 316 Stainless Steel Side Frame Tower, Add</i>	17,204.59 675.00 1,100.00 2,750.00 5,480.00 7,370.00	516.76
08 33 39 00-0116	EA		14' x 10', 3 Ply Fabric Panel, High-Speed Rolling Door (Rytec® Fast-Seal®)..... <i>For NEMA 4X Control Box, Add</i> <i>For 2 Speed Motor, 60" Open, 30" Close, Add</i> <i>For AC Variable Speed Motor And Controls, Add</i> <i>For 304 Stainless Steel Side Frame Tower, Add</i> <i>For 316 Stainless Steel Side Frame Tower, Add</i>	17,933.85 675.00 1,100.00 2,750.00 5,480.00 7,370.00	528.98
08 33 39 00-0117	EA		14' x 11', 3 Ply Fabric Panel, High-Speed Rolling Door (Rytec® Fast-Seal®)..... <i>For NEMA 4X Control Box, Add</i> <i>For 2 Speed Motor, 60" Open, 30" Close, Add</i> <i>For AC Variable Speed Motor And Controls, Add</i> <i>For 304 Stainless Steel Side Frame Tower, Add</i> <i>For 316 Stainless Steel Side Frame Tower, Add</i>	18,660.05 675.00 1,100.00 2,750.00 5,480.00 7,370.00	541.19
08 33 39 00-0118	EA		14' x 12', 3 Ply Fabric Panel, High-Speed Rolling Door (Rytec® Fast-Seal®)..... <i>For NEMA 4X Control Box, Add</i> <i>For 2 Speed Motor, 60" Open, 30" Close, Add</i> <i>For AC Variable Speed Motor And Controls, Add</i> <i>For 304 Stainless Steel Side Frame Tower, Add</i> <i>For 316 Stainless Steel Side Frame Tower, Add</i>	19,196.52 675.00 1,100.00 2,750.00 5,480.00 7,370.00	553.41
08 33 39 00-0119	EA		14' x 13', 3 Ply Fabric Panel, High-Speed Rolling Door (Rytec® Fast-Seal®)..... <i>For NEMA 4X Control Box, Add</i> <i>For 2 Speed Motor, 60" Open, 30" Close, Add</i> <i>For AC Variable Speed Motor And Controls, Add</i> <i>For 304 Stainless Steel Side Frame Tower, Add</i> <i>For 316 Stainless Steel Side Frame Tower, Add</i>	19,601.42 675.00 1,100.00 2,750.00 5,480.00 7,370.00	565.63
08 33 39 00-0120	EA		14' x 14', 3 Ply Fabric Panel, High-Speed Rolling Door (Rytec® Fast-Seal®)..... <i>For NEMA 4X Control Box, Add</i> <i>For 2 Speed Motor, 60" Open, 30" Close, Add</i> <i>For AC Variable Speed Motor And Controls, Add</i> <i>For 304 Stainless Steel Side Frame Tower, Add</i> <i>For 316 Stainless Steel Side Frame Tower, Add</i>	20,208.27 675.00 1,100.00 2,750.00 5,480.00 7,370.00	577.85
08 33 39 00-0121 Rytec® Fast-Seal® Door Options (08 33 39 00-0063)					
08 33 39 00-0122	LF		Strapped Windbar For Rytec® Fast-Seal® High-Speed Rolling Doors Note: Multiply linear foot price x width of door.	30.60	
08 33 39 00-0123	EA		Up To 10' Wide Doors, Roll And Motor Hood For Rytec® Fast-Seal® High-Speed Rolling Doors	306.00	
08 33 39 00-0124	EA		>10' To 15' Wide Doors, Roll And Motor Hood For Rytec® Fast-Seal® High-Speed Rolling Doors	510.00	
08 33 39 00-0125	EA		>15' To 20' Wide Doors, Roll And Motor Hood For Rytec® Fast-Seal® High-Speed Rolling Doors	750.00	
08 33 39 00-0126	EA		One 17" x 17", 2mm Thick, Replaceable Polyvinyl Chloride (PVC) Window With Velcro For Rytec® Fast-Seal® High-Speed Rolling Doors	193.80	
08 33 39 00-0127	EA		Two 17" x 17", 2mm Thick, Replaceable Polyvinyl Chloride (PVC) Windows With Velcro For Rytec® Fast-Seal® High-Speed Rolling Doors	382.50	
			Note: Door must be at least 90" wide.		
08 33 39 00-0128	EA		Three 17" x 17", 2mm Thick, Replaceable Polyvinyl Chloride (PVC) Windows With Velcro For Rytec® Fast-Seal® High-Speed Rolling Doors	484.50	
			Note: Door must be at least 102" wide.		
08 33 39 00-0129	EA		Four 17" x 17", 2mm Thick, Replaceable Polyvinyl Chloride (PVC) Windows With Velcro For Rytec® Fast-Seal® High-Speed Rolling Doors	765.00	
			Note: Door must be at least 136" wide.		
08 33 39 00-0130	EA		One 24" x 24", 2mm Thick, Replaceable Polyvinyl Chloride (PVC) Window With Velcro For Rytec® Fast-Seal® High-Speed Rolling Doors	224.40	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 33 39 00-0131 EA Two 24" x 24", 2mm Thick, Replaceable Polyvinyl Chloride (PVC) Windows With Velcro For Rytec® Fast-Seal® High-Speed Rolling Doors 443.70 Note: Door must be at least 108" wide.	443.70	
08 33 39 00-0132 EA Three 24" x 24", 2mm Thick, Replaceable Polyvinyl Chloride (PVC) Windows With Velcro For Rytec® Fast-Seal® High-Speed Rolling Doors 550.80 Note: Door must be at least 144" wide.	550.80	
08 33 39 00-0133 EA Four 24" x 24", 2mm Thick, Replaceable Polyvinyl Chloride (PVC) Windows With Velcro For Rytec® Fast-Seal® High-Speed Rolling Doors 887.40 Note: Door must be at least 192" wide.	887.40	
08 33 39 00-0134 Aluminum Rigid Panels, High-Speed Rolling Doors (Rytec® Spiral®) (08 33 39) Note: Door panels are double-walled aluminum slats that are 6" high x 1-3/16" thick. Width is variable. Side frames are galvanized steel with full height weatherseal on both sides. There are extension springs in each column for counterbalance. The drive system is a 2 HP, 208,230/460 Volt, three-phase motor with variable speed AC drive. Opening and closing speeds up to 60" per second.		
08 33 39 00-0135 Aluminum Rigid Panels, High-Speed Rolling Doors (Rytec® Spiral®) (08 33 39 00-0134)		
08 33 39 00-0136 8' Wide, Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®) (08 33 39 00-0135)		
08 33 39 00-0137 EA 8' x 8', Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®) 18,410.39	18,410.39	574.97
08 33 39 00-0138 EA 8' x 9', Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®) 18,945.84	18,945.84	587.19
08 33 39 00-0139 EA 8' x 10', Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®) 19,481.30	19,481.30	599.41
08 33 39 00-0140 EA 8' x 11', Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®) 20,016.75	20,016.75	611.63
08 33 39 00-0141 EA 8' x 12', Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®) 20,552.21	20,552.21	623.84
08 33 39 00-0142 EA 8' x 13', Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®) 21,087.66	21,087.66	636.06
08 33 39 00-0143 EA 8' x 14', Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®) 22,644.14	22,644.14	648.28
08 33 39 00-0144 9' Wide, Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®) (08 33 39 00-0135)		
08 33 39 00-0145 EA 9' x 8', Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®) 18,945.84	18,945.84	587.19
08 33 39 00-0146 EA 9' x 9', Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®) 19,481.30	19,481.30	599.41
08 33 39 00-0147 EA 9' x 10', Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®) 20,016.75	20,016.75	611.63
08 33 39 00-0148 EA 9' x 11', Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®) 20,552.21	20,552.21	623.84
08 33 39 00-0149 EA 9' x 12', Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®) 21,087.66	21,087.66	636.06
08 33 39 00-0150 EA 9' x 13', Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®) 21,623.12	21,623.12	648.28
08 33 39 00-0151 EA 9' x 14', Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®) 23,179.59	23,179.59	660.50
08 33 39 00-0152 10' Wide, Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®) (08 33 39 00-0135)		
08 33 39 00-0153 EA 10' x 8', Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®) 19,481.30	19,481.30	599.41
08 33 39 00-0154 EA 10' x 9', Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®) 20,016.75	20,016.75	611.63
08 33 39 00-0155 EA 10' x 10', Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®) 20,552.21	20,552.21	623.84
08 33 39 00-0156 EA 10' x 11', Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®) 21,087.66	21,087.66	636.06
08 33 39 00-0157 EA 10' x 12', Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®) 21,623.12	21,623.12	648.28
08 33 39 00-0158 EA 10' x 13', Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®) 22,158.57	22,158.57	660.50
08 33 39 00-0159 EA 10' x 14', Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®) 23,715.05	23,715.05	672.71
08 33 39 00-0160 11' Wide, Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®) (08 33 39 00-0135)		
08 33 39 00-0161 EA 11' x 8', Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®) 20,016.75	20,016.75	611.63
08 33 39 00-0162 EA 11' x 9', Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®) 20,552.21	20,552.21	623.84
08 33 39 00-0163 EA 11' x 10', Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®) 21,087.66	21,087.66	636.06
08 33 39 00-0164 EA 11' x 11', Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®) 21,623.12	21,623.12	648.28
08 33 39 00-0165 EA 11' x 12', Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®) 22,158.57	22,158.57	660.50
08 33 39 00-0166 EA 11' x 13', Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®) 22,694.03	22,694.03	672.71
08 33 39 00-0167 EA 11' x 14', Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®) 24,249.50	24,249.50	684.93
08 33 39 00-0168 12' Wide, Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®) (08 33 39 00-0135)		
08 33 39 00-0169 EA 12' x 8', Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®) 20,552.21	20,552.21	623.84
08 33 39 00-0170 EA 12' x 9', Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®) 21,087.66	21,087.66	636.06
08 33 39 00-0171 EA 12' x 10', Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®) 21,623.12	21,623.12	648.28
08 33 39 00-0172 EA 12' x 11', Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®) 22,158.57	22,158.57	660.50
08 33 39 00-0173 EA 12' x 12', Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®) 22,694.03	22,694.03	672.71
08 33 39 00-0174 EA 12' x 13', Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®) 23,229.50	23,229.50	684.93
08 33 39 00-0175 EA 12' x 14', Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®) 24,785.97	24,785.97	697.15
08 33 39 00-0176 13' Wide, Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®) (08 33 39 00-0135)		
08 33 39 00-0177 EA 13' x 8', Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®) 21,087.66	21,087.66	636.06
08 33 39 00-0178 EA 13' x 9', Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®) 21,623.12	21,623.12	648.28
08 33 39 00-0179 EA 13' x 10', Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®) 22,158.57	22,158.57	660.50

08	Openings
08 30	Specialty Doors And Frames
08 33	Coiling Doors And Grilles



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 33 39 00-0180	EA		13' x 11', Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®)	22,694.03	672.71
08 33 39 00-0181	EA		13' x 12', Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®)	23,229.50	684.93
08 33 39 00-0182	EA		13' x 13', Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®)	23,764.95	697.15
08 33 39 00-0183	EA		13' x 14', Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®)	25,321.43	709.37
08 33 39 00-0184			14' Wide, Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®) (08 33 39 00-0135)		
08 33 39 00-0185	EA		14' x 8', Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®)	22,644.14	648.28
08 33 39 00-0186	EA		14' x 9', Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®)	23,179.59	660.50
08 33 39 00-0187	EA		14' x 10', Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®)	23,715.05	672.71
08 33 39 00-0188	EA		14' x 11', Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®)	24,249.50	684.93
08 33 39 00-0189	EA		14' x 12', Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®)	24,785.97	697.15
08 33 39 00-0190	EA		14' x 13', Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®)	25,321.43	709.37
08 33 39 00-0191	EA		14' x 14', Aluminum Rigid Panels, High-Speed Rolling Door (Rytec® Spiral®)	25,851.78	721.59
08 33 39 00-0192			Rytec® Spiral® Door Options (08 33 39 00-0134)		
08 33 39 00-0193	EA		Insulated Slats For Rytec® Spiral® High-Speed Rolling Doors	306.00	
			Note: Per door price.		
08 33 39 00-0194	EA		Up To 13' Wide Doors, 6" High x Width Of Door, Window Slats For Rytec® Spiral® High-Speed Rolling Doors	204.00	
			Note: Maximum of 4 per door.		
08 33 39 00-0195	EA		>13' Wide Doors, 6" High x Width Of Door, Window Slats For Rytec® Spiral® High-Speed Rolling Doors	306.00	
			Note: Maximum of 4 per door.		
08 33 39 00-0196	EA		Right Hand Motor Mount For Rytec® Spiral® High-Speed Rolling Doors	581.87	35.94
08 33 39 00-0197	EA		Up To 13' Wide Doors, Full Hood For Rytec® Spiral® High-Speed Rolling Doors	1,673.74	71.87
08 33 39 00-0198	EA		>13' To 16' Wide Doors, Full Hood For Rytec® Spiral® High-Speed Rolling Doors	2,999.74	71.87
08 33 39 00-0199	EA		>16' Wide Doors, Full Hood For Rytec® Spiral® High-Speed Rolling Doors	3,407.74	71.87
08 33 39 00-0200			Activation And Control Box Options For High Speed Doors (08 33 39)		
08 33 39 00-0201	EA		Pull Cord For High-Speed Rolling Doors	148.37	35.94
08 33 39 00-0202	EA		Emergency Stop, Pushbutton Control For High-Speed Rolling Doors	112.44	17.96
08 33 39 00-0203	EA		NEMA 4 Mushroom Remote Pushbutton Control For High-Speed Rolling Doors	137.94	17.96
08 33 39 00-0204	EA		On/Off Key Switch, Remote Control For High-Speed Rolling Doors	148.14	17.96
08 33 39 00-0205	EA		Open/Close/Stop, Remote Pushbutton Control For High-Speed Rolling Doors	265.44	17.96
08 33 39 00-0206	EA		Radio Control For High-Speed Rolling Doors	413.81	32.34
			Note: Includes one receiver and two transmitters.		
08 33 39 00-0207	EA		Floor Loop For High-Speed Rolling Doors	557.55	
			Note: Excludes sealant.		
08 33 39 00-0208	EA		Reflective Type Photo Eye For High-Speed Rolling Doors	357.81	32.34
08 33 39 00-0209	EA		Thru-Beam Type Photo Eye For High-Speed Rolling Doors	464.81	32.34
08 33 39 00-0210	EA		Motion Detector For High-Speed Rolling Doors	400.12	21.56
08 33 39 00-0211	EA		Remote Warning Horn For High-Speed Rolling Doors	275.87	35.94
			Note: Includes wall box and mounting hardware.		
08 33 39 00-0212	EA		Remote Strobe Light For High-Speed Rolling Doors	377.87	35.94
			Note: Includes wall box and mounting hardware.		
08 33 39 00-0213	EA		Remote Warning Horn And Strobe Light For High-Speed Rolling Doors	428.87	35.94
			Note: Includes wall box and mounting hardware.		
08 33 39 00-0214	EA		Red And Green Red Light For High-Speed Rolling Doors	530.87	35.94
			Note: Includes mounting hardware.		
08 33 43			Overhead Coiling Smoke Curtains (08 33)		
08 33 43 00-0001			Elevator Smoke Guard (08 33 43)		
08 33 43 00-0002	EA		Elevator Smoke Guard, 55" Width Housing (Smoke Guard 400)	8,069.62	505.42
08 33 43 00-0003	EA		Elevator Smoke Guard, 64" Width Housing (Smoke Guard 400)	8,350.09	505.42
08 33 43 00-0004	EA		Elevator Smoke Guard, 73" Width Housing (Smoke Guard 400)	8,630.57	505.42
08 34			Special Function Doors (08 30)		
08 34 53			Security Doors And Frames (08 34)		
08 34 53 00-0001			Metal Security Doors, Bullet Resistant (08 34 53)		
			Note: Includes door, frame, hardware hinges, lockset and cylinder, all UL 753 Listed.		
08 34 53 00-0002	SF		Metal Security Door	44.18	7.06
08 34 53 00-0003	EA		Up To 3' x 7' (.38 caliber) Medium-Small Arms Metal Security Door	1,782.49	352.47
08 34 53 00-0004	EA		Up To 3' x 7' (.44 caliber) Super-Small Arms Metal Security Door	2,092.10	374.16
08 34 53 00-0005			Metal Security Doors (08 34 53)		
			Note: Includes standard pitcher handle latch, pneumatic closure, hinges and baked enamel finish.		
08 34 53 00-0006	EA		Up To 3' x 7' Steel Narrowline Security Door (Kane Screens S-501-28-O)	660.38	64.56
			Note: Top and bottom section are #12 mesh 0.028" stainless steel wire cloth with a bottom kick plate.		
08 34 53 00-0007	EA		Up To 3' x 7' Steel Narrowline Security Door (Kane Screens S-503-28-O)	660.38	64.56
			Note: Top section is #12 mesh 0.028" stainless steel wire cloth and bottom section is a double kick panel.		
08 34 53 00-0008	EA		Up To 3' x 7' Steel Narrowline Security Door (Kane Screens S-504-28-O)	926.03	64.56
			Note: Top section includes 1/8" tempered sash unit and #12 mesh 0.028" stainless steel wire cloth. Bottom section is a double kick panel.		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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08 34 63 Detention Doors And Frames (08 34)

08 34 63 13 Steel Detention Doors And Frames (08 34 63)

08 34 63 13-0001 Metal Doors (08 34 63 13)

Note: Flush type reinforced with stiffeners.

08 34 63 13-0002 10 Gauge 1-3/4" Door (08 34 63 13-0001)

08 34 63 13-0003	EA	2' x 6'-8" x 1-3/4" 10 Gauge Metal Door.....	453.91	39.89
08 34 63 13-0004	EA	2'-4" x 6'-8" x 1-3/4" 10 Gauge Metal Door	459.26	39.89
08 34 63 13-0005	EA	2'-6" x 6'-8" x 1-3/4" 10 Gauge Metal Door	464.60	39.89
08 34 63 13-0006	EA	2'-8" x 6'-8" x 1-3/4" 10 Gauge Metal Door	469.95	39.89
08 34 63 13-0007	EA	3' x 6'-8" x 1-3/4" 10 Gauge Metal Door	475.29	39.89
08 34 63 13-0008	EA	3'-4" x 6'-8" x 1-3/4" 10 Gauge Metal Door	502.01	39.89
08 34 63 13-0009	EA	Pair 3' x 6'-8" x 1-3/4" 10 Gauge Metal Door	934.60	71.87
08 34 63 13-0010	EA	2' x 7' x 1-3/4" 10 Gauge Metal Door	487.15	39.89
08 34 63 13-0011	EA	2'-4" x 7' x 1-3/4" 10 Gauge Metal Door	492.71	39.89
08 34 63 13-0012	EA	2'-6" x 7' x 1-3/4" 10 Gauge Metal Door	496.20	39.89
08 34 63 13-0013	EA	2'-8" x 7' x 1-3/4" 10 Gauge Metal Door	544.86	39.89
08 34 63 13-0014	EA	3' x 7' x 1-3/4" 10 Gauge Metal Door	662.32	39.89
08 34 63 13-0015	EA	3'-4" x 7' x 1-3/4" 10 Gauge Metal Door	722.74	39.89
08 34 63 13-0016	EA	Pair 3' x 7' x 1-3/4" 10 Gauge Metal Door	1,050.63	71.87
08 34 63 13-0017	EA	2' x 7'-2" x 1-3/4" 10 Gauge Metal Door	472.62	39.89
08 34 63 13-0018	EA	2'-4" x 7'-2" x 1-3/4" 10 Gauge Metal Door	477.96	39.89
08 34 63 13-0019	EA	2'-6" x 7'-2" x 1-3/4" 10 Gauge Metal Door	483.31	39.89
08 34 63 13-0020	EA	2'-8" x 7'-2" x 1-3/4" 10 Gauge Metal Door	488.65	39.89
08 34 63 13-0021	EA	3' x 7'-2" x 1-3/4" 10 Gauge Metal Door	493.99	39.89
08 34 63 13-0022	EA	3'-4" x 7'-2" x 1-3/4" 10 Gauge Metal Door	520.71	39.89
08 34 63 13-0023	EA	Pair 3' x 7'-2" x 1-3/4" 10 Gauge Metal Door	972.01	71.87

08 34 63 13-0024 Pneumatic Door Operators (08 34 63 13)

08 34 63 13-0025	EA	Pneumatic Cell Entry Door Operator With Hardware Set	3,638.78	
08 34 63 13-0026	EA	Pneumatic Special Housing Cell Door Operator With Hardware Set	4,011.16	
08 34 63 13-0027	EA	Pneumatic MS Cell Door Operator With Hardware Set	5,137.60	
08 34 63 13-0028	EA	Pneumatic Sally Port Door Operator With Hardware Set	6,024.44	
08 34 63 13-0029	EA	Pneumatic Corridor Door Operator With Hardware Set	7,527.45	
08 34 63 13-0030	EA	Emergency Release Cabinet With Seven Gallon Storage Tank, Check Valve, Pressure Gauge, Three Way Valves And Four Release Valves.....	3,717.30	

08 34 73 Sound Control Door Assemblies (08 34)

08 34 73 00-0001 Acoustical Doors And Frames (08 34 73)

08 34 73 00-0002 Steel Acoustical Doors And Frames (08 34 73 00-0001)

Note: Includes seals.

08 34 73 00-0003 Steel Acoustical Doors (08 34 73 00-0002)

Note: Includes hinges.

08 34 73 00-0004	EA	3' x 7', 14 Gauge, STC 50, Steel Acoustical Door (Unrated).....	2,018.65	43.12
		<i>For 60 Minutes Fire Rated, Add</i>	116.72	
		<i>For 3" x 33" Vision Lite, Add</i>	811.07	
		<i>For 20" x 64" Vision Lite, Add</i>	867.93	
08 34 73 00-0005	EA	3'-6" x 7', 14 Gauge, STC 52, Steel Acoustical Door (Unrated).....	2,138.96	44.92
		<i>For 60 Minutes Fire Rated, Add</i>	116.72	
		<i>For 3" x 33" Vision Lite, Add</i>	811.07	
		<i>For 20" x 64" Vision Lite, Add</i>	867.93	
08 34 73 00-0006	EA	4' x 7', 14 Gauge, STC 53, Steel Acoustical Door (Unrated).....	2,262.87	48.51
		<i>For 60 Minutes Fire Rated, Add</i>	116.72	
		<i>For 3" x 33" Vision Lite, Add</i>	811.07	
		<i>For 20" x 64" Vision Lite, Add</i>	867.93	
08 34 73 00-0007	PR	Pair 3' x 7', 14 Gauge, STC 50, Steel Acoustical Doors (Unrated)	4,028.65	81.94
		<i>For 1 Hour Fire Rated, Add</i>	233.44	
		<i>For 3" x 33" Windows, Add</i>	1,622.14	
		<i>For 20" x 64" Windows, Add</i>	1,735.86	

08 34 73 00-0008 Steel Acoustical Door Frames (08 34 73 00-0002)

08 34 73 00-0009	EA	3' x 7', 4-1/2" To 6-1/2" Wall Thickness, 14 Gauge, Split-Frame, Steel Acoustical Door Frame	1,658.13	71.87
08 34 73 00-0010	EA	3' x 7', 6-1/2" To 8-1/2" Wall Thickness, 14 Gauge, Split-Frame, Steel Acoustical Door Frame	1,701.03	71.87
08 34 73 00-0011	EA	3' x 7', 8-1/2" To 10-1/2" Wall Thickness, 14 Gauge, Split-Frame, Steel Acoustical Door Frame	1,743.93	71.87
08 34 73 00-0012	EA	3' x 7', 10-1/2" To 12-1/2" Wall Thickness, 14 Gauge, Split-Frame, Steel Acoustical Door Frame	1,786.83	71.87
08 34 73 00-0013	EA	3'-6" x 7', 4-1/2" To 6-1/2" Wall Thickness, 14 Gauge, Split-Frame, Steel Acoustical Door Frame	1,895.98	79.06
08 34 73 00-0014	EA	3'-6" x 7', 6-1/2" To 8-1/2" Wall Thickness, 14 Gauge, Split-Frame, Steel Acoustical Door Frame	1,943.87	79.06
08 34 73 00-0015	EA	3'-6" x 7', 8-1/2" To 10-1/2" Wall Thickness, 14 Gauge, Split-Frame, Steel Acoustical Door Frame	1,986.76	79.06
08 34 73 00-0016	EA	3'-6" x 7', 10-1/2" To 12-1/2" Wall Thickness, 14 Gauge, Split-Frame, Steel Acoustical Door Frame	2,039.97	79.06
08 34 73 00-0017	EA	4' x 7', 4-1/2" To 6-1/2" Wall Thickness, 14 Gauge, Split-Frame, Steel Acoustical Door Frame	2,137.60	82.65
08 34 73 00-0018	EA	4' x 7', 6-1/2" To 8-1/2" Wall Thickness, 14 Gauge, Split-Frame, Steel Acoustical Door Frame	2,180.50	82.65
08 34 73 00-0019	EA	4' x 7', 8-1/2" To 10-1/2" Wall Thickness, 14 Gauge, Split-Frame, Steel Acoustical Door Frame	2,223.40	82.65
08 34 73 00-0020	EA	4' x 7', 10-1/2" To 12-1/2" Wall Thickness, 14 Gauge, Split-Frame, Steel Acoustical Door Frame	2,271.28	82.65

08 Openings**08 30 Specialty Doors And Frames****08 34 Special Function Doors**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 34 73 00-0021	EA		6' x 7', 4-1/2" To 6-1/2" Wall Thickness, 14 Gauge, Split-Frame, Steel Acoustical Door Frame With Removable Center Mullion.....	3,776.31	93.43
08 34 73 00-0022	EA		6' x 7', 6-1/2" To 8-1/2" Wall Thickness, 14 Gauge, Split-Frame, Steel Acoustical Door Frame With Removable Center Mullion.....	3,817.21	93.43
08 34 73 00-0023	EA		6' x 7', 8-1/2" To 10-1/2" Wall Thickness, 14 Gauge, Split-Frame, Steel Acoustical Door Frame With Removable Center Mullion.....	3,861.11	93.43
08 34 73 00-0024	EA		6' x 7', 10-1/2" To 12-1/2" Wall Thickness, 14 Gauge, Split-Frame, Steel Acoustical Door Frame With Removable Center Mullion.....	3,906.00	93.43
08 34 73 00-0025			Wood Acoustical Door Systems, Prefinished <small>(08 34 73 00-0001)</small>		
			Note: Includes the door, frame, hinges and seals. Per L.A. County Residential Sound Improvement Program Specification (RSIP) 08100 Rated Door		
08 34 73 00-0026	EA		3' x 7', STC 27, Wood Acoustical Door System (Unrated)	1,135.44	129.37
			For 20 Minutes Fire Rated, Add	50.00	
			For 45 Minutes Fire Rated, Add	80.00	
			For 60 Minutes Fire Rated, Add	115.00	
			For 90 Minutes Fire Rated, Add	145.00	
			For Various Door Styles - Wagon Wheel, 6-Panel And View Window, Add	394.52	
08 34 73 00-0027	EA		3' x 7', STC 29, Wood Acoustical Door System (Unrated)	1,226.13	129.37
			For 20 Minutes Fire Rated, Add	50.00	
			For 45 Minutes Fire Rated, Add	80.00	
			For 60 Minutes Fire Rated, Add	115.00	
			For 90 Minutes Fire Rated, Add	145.00	
			For Various Door Styles - Wagon Wheel, 6-Panel And View Window, Add	435.33	
08 34 73 00-0028	EA		3' x 7', STC 30, Wood Acoustical Door System (Unrated)	1,276.52	129.37
			For 20 Minutes Fire Rated, Add	50.00	
			For 45 Minutes Fire Rated, Add	80.00	
			For 60 Minutes Fire Rated, Add	115.00	
			For 90 Minutes Fire Rated, Add	145.00	
			For Various Door Styles - Wagon Wheel, 6-Panel And View Window, Add	458.00	
08 34 73 00-0029	EA		3' x 7', STC 31, Wood Acoustical Door System (Unrated)	1,326.90	129.37
			For 20 Minutes Fire Rated, Add	50.00	
			For 45 Minutes Fire Rated, Add	80.00	
			For 60 Minutes Fire Rated, Add	115.00	
			For 90 Minutes Fire Rated, Add	145.00	
			For Various Door Styles - Wagon Wheel, 6-Panel And View Window, Add	480.67	
08 34 73 00-0030	EA		3' x 7', STC 35, Wood Acoustical Door System (Unrated)	1,548.60	129.37
			For 20 Minutes Fire Rated, Add	50.00	
			For 45 Minutes Fire Rated, Add	80.00	
			For 60 Minutes Fire Rated, Add	115.00	
			For 90 Minutes Fire Rated, Add	145.00	
			For Various Door Styles - Wagon Wheel, 6-Panel And View Window, Add	580.44	
08 34 73 00-0031	EA		3' x 7', STC 41, Wood Acoustical Door System (Unrated)	2,032.29	129.37
			For 20 Minutes Fire Rated, Add	50.00	
			For 45 Minutes Fire Rated, Add	80.00	
			For 60 Minutes Fire Rated, Add	115.00	
			For 90 Minutes Fire Rated, Add	145.00	
			For Various Door Styles - Wagon Wheel, 6-Panel And View Window, Add	798.10	
08 34 73 00-0032	EA		3' x 7', STC 42, Wood Acoustical Door System (Unrated)	2,126.01	129.37
			For 20 Minutes Fire Rated, Add	50.00	
			For 45 Minutes Fire Rated, Add	80.00	
			For 60 Minutes Fire Rated, Add	115.00	
			For 90 Minutes Fire Rated, Add	145.00	
			For Various Door Styles - Wagon Wheel, 6-Panel And View Window, Add	840.27	
08 34 73 00-0033	EA		3' x 7', STC 46, Wood Acoustical Door System (Unrated)	2,500.87	129.37
			For 20 Minutes Fire Rated, Add	50.00	
			For 45 Minutes Fire Rated, Add	80.00	
			For 60 Minutes Fire Rated, Add	115.00	
			For 90 Minutes Fire Rated, Add	145.00	
			For Various Door Styles - Wagon Wheel, 6-Panel And View Window, Add	1,008.96	
08 34 73 00-0034	EA		3' x 7', STC 49, Wood Acoustical Door System (Unrated)	2,780.51	129.37
			For 20 Minutes Fire Rated, Add	50.00	
			For 45 Minutes Fire Rated, Add	80.00	
			For 60 Minutes Fire Rated, Add	115.00	
			For 90 Minutes Fire Rated, Add	145.00	
			For Various Door Styles - Wagon Wheel, 6-Panel And View Window, Add	1,134.80	
08 34 73 00-0035	EA		3'-6" x 7', STC 27, Wood Acoustical Door System (Unrated).....	1,266.94	129.37
			For 20 Minutes Fire Rated, Add	50.00	
			For 45 Minutes Fire Rated, Add	80.00	
			For 60 Minutes Fire Rated, Add	115.00	
			For 90 Minutes Fire Rated, Add	145.00	
			For Various Door Styles - Wagon Wheel, 6-Panel And View Window, Add	453.69	
08 34 73 00-0036	EA		3'-6" x 7', STC 29, Wood Acoustical Door System (Unrated).....	1,371.24	129.37
			For 20 Minutes Fire Rated, Add	50.00	
			For 45 Minutes Fire Rated, Add	80.00	
			For 60 Minutes Fire Rated, Add	115.00	
			For 90 Minutes Fire Rated, Add	145.00	
			For Various Door Styles - Wagon Wheel, 6-Panel And View Window, Add	500.63	
08 34 73 00-0037	EA		3'-6" x 7', STC 30, Wood Acoustical Door System (Unrated).....	1,429.18	129.37
			For 20 Minutes Fire Rated, Add	50.00	
			For 45 Minutes Fire Rated, Add	80.00	
			For 60 Minutes Fire Rated, Add	115.00	
			For 90 Minutes Fire Rated, Add	145.00	
			For Various Door Styles - Wagon Wheel, 6-Panel And View Window, Add	526.70	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 34 73 00-0038	EA	3'-6"	x 7'	STC 31, Wood Acoustical Door System (Unrated).....	1,487.13	129.37
				<i>For 20 Minutes Fire Rated, Add</i>	50.00	
				<i>For 45 Minutes Fire Rated, Add</i>	80.00	
				<i>For 60 Minutes Fire Rated, Add</i>	115.00	
				<i>For 90 Minutes Fire Rated, Add</i>	145.00	
				<i>For Various Door Styles - Wagon Wheel, 6-Panel And View Window, Add</i>	552.78	
08 34 73 00-0039	EA	3'-6"	x 7'	STC 35, Wood Acoustical Door System (Unrated).....	1,742.07	129.37
				<i>For 20 Minutes Fire Rated, Add</i>	50.00	
				<i>For 45 Minutes Fire Rated, Add</i>	80.00	
				<i>For 60 Minutes Fire Rated, Add</i>	115.00	
				<i>For 90 Minutes Fire Rated, Add</i>	145.00	
				<i>For Various Door Styles - Wagon Wheel, 6-Panel And View Window, Add</i>	667.50	
08 34 73 00-0040	EA	3'-6"	x 7'	STC 41, Wood Acoustical Door System (Unrated).....	2,298.32	129.37
				<i>For 20 Minutes Fire Rated, Add</i>	50.00	
				<i>For 45 Minutes Fire Rated, Add</i>	80.00	
				<i>For 60 Minutes Fire Rated, Add</i>	115.00	
				<i>For 90 Minutes Fire Rated, Add</i>	145.00	
				<i>For Various Door Styles - Wagon Wheel, 6-Panel And View Window, Add</i>	917.81	
08 34 73 00-0041	EA	3'-6"	x 7'	STC 42, Wood Acoustical Door System (Unrated).....	2,406.10	129.37
				<i>For 20 Minutes Fire Rated, Add</i>	50.00	
				<i>For 45 Minutes Fire Rated, Add</i>	80.00	
				<i>For 60 Minutes Fire Rated, Add</i>	115.00	
				<i>For 90 Minutes Fire Rated, Add</i>	145.00	
				<i>For Various Door Styles - Wagon Wheel, 6-Panel And View Window, Add</i>	966.31	
08 34 73 00-0042	EA	3'-6"	x 7'	STC 46, Wood Acoustical Door System (Unrated).....	2,837.19	129.37
				<i>For 20 Minutes Fire Rated, Add</i>	50.00	
				<i>For 45 Minutes Fire Rated, Add</i>	80.00	
				<i>For 60 Minutes Fire Rated, Add</i>	115.00	
				<i>For 90 Minutes Fire Rated, Add</i>	145.00	
				<i>For Various Door Styles - Wagon Wheel, 6-Panel And View Window, Add</i>	1,160.30	
08 34 73 00-0043	EA	3'-6"	x 7'	STC 49, Wood Acoustical Door System (Unrated).....	3,158.77	129.37
				<i>For 20 Minutes Fire Rated, Add</i>	50.00	
				<i>For 45 Minutes Fire Rated, Add</i>	80.00	
				<i>For 60 Minutes Fire Rated, Add</i>	115.00	
				<i>For 90 Minutes Fire Rated, Add</i>	145.00	
				<i>For Various Door Styles - Wagon Wheel, 6-Panel And View Window, Add</i>	1,305.01	
08 34 73 00-0044	EA	4' x 7'		STC 27, Wood Acoustical Door System (Unrated).....	1,354.61	129.37
				<i>For 20 Minutes Fire Rated, Add</i>	50.00	
				<i>For 45 Minutes Fire Rated, Add</i>	80.00	
				<i>For 60 Minutes Fire Rated, Add</i>	115.00	
				<i>For 90 Minutes Fire Rated, Add</i>	145.00	
				<i>For Various Door Styles - Wagon Wheel, 6-Panel And View Window, Add</i>	493.14	
08 34 73 00-0045	EA	4' x 7'		STC 29, Wood Acoustical Door System (Unrated).....	1,467.98	129.37
				<i>For 20 Minutes Fire Rated, Add</i>	50.00	
				<i>For 45 Minutes Fire Rated, Add</i>	80.00	
				<i>For 60 Minutes Fire Rated, Add</i>	115.00	
				<i>For 90 Minutes Fire Rated, Add</i>	145.00	
				<i>For Various Door Styles - Wagon Wheel, 6-Panel And View Window, Add</i>	544.16	
08 34 73 00-0046	EA	4' x 7'		STC 30, Wood Acoustical Door System (Unrated).....	1,530.96	129.37
				<i>For 20 Minutes Fire Rated, Add</i>	50.00	
				<i>For 45 Minutes Fire Rated, Add</i>	80.00	
				<i>For 60 Minutes Fire Rated, Add</i>	115.00	
				<i>For 90 Minutes Fire Rated, Add</i>	145.00	
				<i>For Various Door Styles - Wagon Wheel, 6-Panel And View Window, Add</i>	572.50	
08 34 73 00-0047	EA	4' x 7'		STC 31, Wood Acoustical Door System (Unrated).....	1,593.94	129.37
				<i>For 20 Minutes Fire Rated, Add</i>	50.00	
				<i>For 45 Minutes Fire Rated, Add</i>	80.00	
				<i>For 60 Minutes Fire Rated, Add</i>	115.00	
				<i>For 90 Minutes Fire Rated, Add</i>	145.00	
				<i>For Various Door Styles - Wagon Wheel, 6-Panel And View Window, Add</i>	600.84	
08 34 73 00-0048	EA	4' x 7'		STC 35, Wood Acoustical Door System (Unrated).....	1,871.06	129.37
				<i>For 20 Minutes Fire Rated, Add</i>	50.00	
				<i>For 45 Minutes Fire Rated, Add</i>	80.00	
				<i>For 60 Minutes Fire Rated, Add</i>	115.00	
				<i>For 90 Minutes Fire Rated, Add</i>	145.00	
				<i>For Various Door Styles - Wagon Wheel, 6-Panel And View Window, Add</i>	725.54	
08 34 73 00-0049	EA	4' x 7'		STC 41, Wood Acoustical Door System (Unrated).....	2,475.68	129.37
				<i>For 20 Minutes Fire Rated, Add</i>	50.00	
				<i>For 45 Minutes Fire Rated, Add</i>	80.00	
				<i>For 60 Minutes Fire Rated, Add</i>	115.00	
				<i>For 90 Minutes Fire Rated, Add</i>	145.00	
				<i>For Various Door Styles - Wagon Wheel, 6-Panel And View Window, Add</i>	997.62	
08 34 73 00-0050	EA	4' x 7'		STC 42, Wood Acoustical Door System (Unrated).....	2,592.83	129.37
				<i>For 20 Minutes Fire Rated, Add</i>	50.00	
				<i>For 45 Minutes Fire Rated, Add</i>	80.00	
				<i>For 60 Minutes Fire Rated, Add</i>	115.00	
				<i>For 90 Minutes Fire Rated, Add</i>	145.00	
				<i>For Various Door Styles - Wagon Wheel, 6-Panel And View Window, Add</i>	1,050.34	
08 34 73 00-0051	EA	4' x 7'		STC 46, Wood Acoustical Door System (Unrated).....	3,061.41	129.37
				<i>For 20 Minutes Fire Rated, Add</i>	50.00	
				<i>For 45 Minutes Fire Rated, Add</i>	80.00	
				<i>For 60 Minutes Fire Rated, Add</i>	115.00	
				<i>For 90 Minutes Fire Rated, Add</i>	145.00	
				<i>For Various Door Styles - Wagon Wheel, 6-Panel And View Window, Add</i>	1,261.20	

08	Openings
08 30	Specialty Doors And Frames
08 34	Special Function Doors



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 34 73 00-0052 EA 4' x 7', STC 49, Wood Acoustical Door System (Unrated)	3,410.95	129.37
For 20 Minutes Fire Rated, Add	50.00	
For 45 Minutes Fire Rated, Add	80.00	
For 60 Minutes Fire Rated, Add	115.00	
For 90 Minutes Fire Rated, Add	145.00	
For Various Door Styles - Wagon Wheel, 6-Panel And View Window, Add	1,418.49	
08 35 Folding Doors And Grilles (08 30)		
08 35 13 Folding Doors (08 35)		
08 35 13 13 Accordion Folding Doors (08 35 13)		
08 35 13 13-0001 Accordion Folding Doors (08 35 13 13)		
Note: Includes track, fittings and hardware, complete.		
08 35 13 13-0002 SF Vinyl Covered Steel Accordion Doors, Two Layers.....	17.91	7.18
For Fire Retardant, Add	2.86	
08 35 13 13-0003 SF Woven Mahogany/Vinyl Accordion Door.....	12.19	7.18
For Fire Retardant, Add	1.43	
08 35 13 13-0004 SF Economy Vinyl Accordion Door.....	12.13	7.18
For Fire Retardant, Add	1.42	
08 35 13 13-0005 SF Rigid Polyvinyl Chloride (PVC) Accordion Door.....	13.56	7.18
For Fire Retardant, Add	1.77	
08 36 Panel Doors (08 30)		
08 36 13 Sectional Doors (08 36)		
08 36 13 00-0001 Sectional Wood Overhead Doors (08 36 13)		
08 36 13 00-0002 Wood Sectional Overhead Doors (08 36 13 00-0001)		
Note: Includes 1-3/4" door, tracks and hardware. Excludes frame.		
08 36 13 00-0003 EA 8' x 8', Wood Sectional Door, Manual Lift	2,012.44	287.49
08 36 13 00-0004 EA 10' x 10', Wood Sectional Door, Manual Lift	2,513.94	319.11
08 36 13 00-0005 EA 12' x 12', Wood Sectional Door, Manual Lift	3,215.31	382.35
08 36 13 00-0006 EA 14' x 14', Wood Sectional Door, Manual Lift	4,667.27	442.73
08 36 13 00-0007 EA 12' x 16', Wood Sectional Door, Manual Lift	4,985.49	574.97
08 36 13 00-0008 EA 20' x 8', Wood Sectional Door, Manual Lift	4,697.20	718.71
08 36 13 00-0009 EA 20' x 16', Wood Sectional Door, Manual Lift	8,681.02	958.05
08 36 13 00-0010 Residential Grade, Wood Sectional Overhead Doors (08 36 13 00-0001)		
Note: Includes 1-3/4" door, tracks and hardware. Excludes frame.		
08 36 13 00-0011 EA 9' x 7', Residential Grade, Wood Sectional Door, Manual Lift.....	1,040.27	143.74
For Hardboard Face, Add	115.00	
For Insulation, Add	117.00	
For Motor Operator With Remote Controls, Add	369.52	
For Each Glass Vision Panel In Door, Add	50.00	
08 36 13 00-0012 EA 16' x 7', Residential Grade, Wood Sectional Door, Manual Lift.....	1,659.44	143.74
For Hardboard Face, Add	115.00	
For Insulation, Add	117.00	
For Motor Operator With Remote Controls, Add	390.89	
For Each Glass Vision Panel In Door, Add	50.00	
08 36 13 00-0013 Sectional Metal Overhead Doors (08 36 13)		
Note: Includes tracks and all hardware.		
08 36 13 00-0014 Galvanized Steel Sectional Overhead Doors (08 36 13 00-0013)		
08 36 13 00-0015 Non-Insulated, 24 Gauge Galvanized Steel Sectional Doors (08 36 13 00-0014)		
Note: Includes 2" door, tracks and hardware. Excludes frame.		
08 36 13 00-0016 EA 8' x 8', Non Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift.....	982.30	251.55
For 20 Gauge Steel Ribbed, Heavy Duty Door, Add	69.48	
For 16 Gauge Steel Ribbed, Heavy Duty Door, Add	119.80	
For Aluminum, Mill Finish, Add	54.63	
For Aluminum, Anodized Finish, Add	152.86	
08 36 13 00-0017 EA 8' x 10', Non Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift.....	1,153.47	287.49
For 20 Gauge Steel Ribbed, Heavy Duty Door, Add	83.88	
For 16 Gauge Steel Ribbed, Heavy Duty Door, Add	144.63	
For Aluminum, Mill Finish, Add	65.95	
For Aluminum, Anodized Finish, Add	184.54	
08 36 13 00-0018 EA 8' x 12', Non Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift.....	1,426.01	359.36
For 20 Gauge Steel Ribbed, Heavy Duty Door, Add	102.56	
For 16 Gauge Steel Ribbed, Heavy Duty Door, Add	176.83	
For Aluminum, Mill Finish, Add	80.63	
For Aluminum, Anodized Finish, Add	225.63	
08 36 13 00-0019 EA 10' x 8', Non Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift.....	1,109.25	287.49
For 20 Gauge Steel Ribbed, Heavy Duty Door, Add	77.47	
For 16 Gauge Steel Ribbed, Heavy Duty Door, Add	133.57	
For Aluminum, Mill Finish, Add	60.91	
For Aluminum, Anodized Finish, Add	170.44	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 36 13 00-0020 EA 10' x 10', Non Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift..... <i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For Aluminum, Mill Finish, Add</i> <i>For Aluminum, Anodized Finish, Add</i>	1,369.37 94.35 162.67 74.18 207.56	359.36
08 36 13 00-0021 EA 10' x 12', Non Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift..... <i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For Aluminum, Mill Finish, Add</i> <i>For Aluminum, Anodized Finish, Add</i>	1,730.08 115.38 198.94 90.72 253.84	467.16
08 36 13 00-0022 EA 10' x 14', Non Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift..... <i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For Aluminum, Mill Finish, Add</i> <i>For Aluminum, Anodized Finish, Add</i>	2,055.89 131.36 226.49 103.28 288.99	574.97
08 36 13 00-0023 EA 12' x 8', Non Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift..... <i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For Aluminum, Mill Finish, Add</i> <i>For Aluminum, Anodized Finish, Add</i>	1,332.14 88.95 153.36 69.93 195.68	359.36
08 36 13 00-0024 EA 12' x 10', Non Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift..... <i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For Aluminum, Mill Finish, Add</i> <i>For Aluminum, Anodized Finish, Add</i>	1,674.22 107.28 184.97 84.35 236.02	467.16
08 36 13 00-0025 EA 12' x 12', Non Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift..... <i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For Aluminum, Mill Finish, Add</i> <i>For Aluminum, Anodized Finish, Add</i>	2,045.79 129.90 223.96 102.13 285.77	574.97
08 36 13 00-0026 EA 12' x 14', Non Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift..... <i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For Aluminum, Mill Finish, Add</i> <i>For Aluminum, Anodized Finish, Add</i>	2,415.80 152.29 262.56 119.73 335.03	682.78
08 36 13 00-0027 EA 12' x 16', Non Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift..... <i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For Aluminum, Mill Finish, Add</i> <i>For Aluminum, Anodized Finish, Add</i>	2,888.73 179.18 308.92 140.87 394.19	826.52
08 36 13 00-0028 EA 14' x 8', Non Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift..... <i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For Aluminum, Mill Finish, Add</i> <i>For Aluminum, Anodized Finish, Add</i>	1,600.52 96.60 166.55 75.95 212.51	467.16
08 36 13 00-0029 EA 14' x 10', Non Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift..... <i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For Aluminum, Mill Finish, Add</i> <i>For Aluminum, Anodized Finish, Add</i>	1,968.98 118.76 204.76 93.37 261.27	574.97
08 36 13 00-0030 EA 14' x 12', Non Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift..... <i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For Aluminum, Mill Finish, Add</i> <i>For Aluminum, Anodized Finish, Add</i>	2,434.14 144.52 249.18 113.62 317.95	718.71
08 36 13 00-0031 EA 14' x 14', Non Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift..... <i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For Aluminum, Mill Finish, Add</i> <i>For Aluminum, Anodized Finish, Add</i>	2,805.71 167.14 288.17 131.40 367.70	826.52
08 36 13 00-0032 EA 14' x 16', Non Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift..... <i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For Aluminum, Mill Finish, Add</i> <i>For Aluminum, Anodized Finish, Add</i>	3,218.40 195.71 337.44 153.87 430.57	934.33
08 36 13 00-0033 EA 16' x 8', Non Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift..... <i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For Aluminum, Mill Finish, Add</i> <i>For Aluminum, Anodized Finish, Add</i>	1,941.82 114.82 197.97 90.27 252.61	574.97
08 36 13 00-0034 EA 16' x 10', Non Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift..... <i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For Aluminum, Mill Finish, Add</i> <i>For Aluminum, Anodized Finish, Add</i>	2,405.43 140.36 242.00 110.35 308.79	718.71
08 36 13 00-0035 EA 16' x 12', Non Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift..... <i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For Aluminum, Mill Finish, Add</i> <i>For Aluminum, Anodized Finish, Add</i>	2,820.44 169.27 291.85 133.08 372.40	826.52
08 36 13 00-0036 EA 16' x 14', Non Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift..... <i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For Aluminum, Mill Finish, Add</i> <i>For Aluminum, Anodized Finish, Add</i>	3,334.78 212.59 366.53 167.14 467.69	934.33

08 Openings**08 30 Specialty Doors And Frames****08 36 Panel Doors**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 36 13 00-0037	EA		16' x 16', Non Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift	3,879.09	1,078.07
			<i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	249.83	
			<i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	430.74	
			<i>For Aluminum, Mill Finish, Add</i>	196.42	
			<i>For Aluminum, Anodized Finish, Add</i>	549.62	
08 36 13 00-0038	EA		18' x 8', Non Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift	2,465.18	718.71
			<i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	149.02	
			<i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	256.94	
			<i>For Aluminum, Mill Finish, Add</i>	117.16	
			<i>For Aluminum, Anodized Finish, Add</i>	327.85	
08 36 13 00-0039	EA		18' x 10', Non Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift	2,927.52	826.52
			<i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	184.80	
			<i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	318.62	
			<i>For Aluminum, Mill Finish, Add</i>	145.29	
			<i>For Aluminum, Anodized Finish, Add</i>	406.56	
08 36 13 00-0040	EA		18' x 12', Non Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift	3,505.48	934.33
			<i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	237.34	
			<i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	409.21	
			<i>For Aluminum, Mill Finish, Add</i>	186.60	
			<i>For Aluminum, Anodized Finish, Add</i>	522.15	
08 36 13 00-0041	EA		18' x 14', Non Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift	4,050.56	1,078.07
			<i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	274.69	
			<i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	473.60	
			<i>For Aluminum, Mill Finish, Add</i>	215.96	
			<i>For Aluminum, Anodized Finish, Add</i>	604.32	
08 36 13 00-0042	EA		18' x 16', Non Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift	4,643.77	1,221.82
			<i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	319.02	
			<i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	550.03	
			<i>For Aluminum, Mill Finish, Add</i>	250.81	
			<i>For Aluminum, Anodized Finish, Add</i>	701.84	
08 36 13 00-0043	EA		20' x 8', Non Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift	2,805.71	826.52
			<i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	167.14	
			<i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	288.17	
			<i>For Aluminum, Mill Finish, Add</i>	131.40	
			<i>For Aluminum, Anodized Finish, Add</i>	367.70	
08 36 13 00-0044	EA		20' x 10', Non Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift	3,268.06	934.33
			<i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	202.91	
			<i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	349.85	
			<i>For Aluminum, Mill Finish, Add</i>	159.53	
			<i>For Aluminum, Anodized Finish, Add</i>	446.41	
08 36 13 00-0045	EA		20' x 12', Non Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift	3,990.82	1,078.07
			<i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	266.03	
			<i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	458.67	
			<i>For Aluminum, Mill Finish, Add</i>	209.15	
			<i>For Aluminum, Anodized Finish, Add</i>	585.26	
08 36 13 00-0046	EA		20' x 14', Non Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift	4,535.92	1,221.82
			<i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	303.38	
			<i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	523.07	
			<i>For Aluminum, Mill Finish, Add</i>	238.52	
			<i>For Aluminum, Anodized Finish, Add</i>	667.43	
08 36 13 00-0047	EA		20' x 16', Non Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift	5,520.16	1,365.55
			<i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	404.41	
			<i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	697.26	
			<i>For Aluminum, Mill Finish, Add</i>	317.95	
			<i>For Aluminum, Anodized Finish, Add</i>	889.70	
08 36 13 00-0048	EA		22' x 8', Non Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift	3,131.50	934.33
			<i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	183.11	
			<i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	315.71	
			<i>For Aluminum, Mill Finish, Add</i>	143.96	
			<i>For Aluminum, Anodized Finish, Add</i>	402.85	
08 36 13 00-0049	EA		22' x 10', Non Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift	3,824.01	1,078.07
			<i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	241.84	
			<i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	416.97	
			<i>For Aluminum, Mill Finish, Add</i>	190.14	
			<i>For Aluminum, Anodized Finish, Add</i>	532.05	
08 36 13 00-0050	EA		22' x 12', Non Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift	4,501.01	1,221.82
			<i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	298.32	
			<i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	514.34	
			<i>For Aluminum, Mill Finish, Add</i>	234.54	
			<i>For Aluminum, Anodized Finish, Add</i>	656.30	
08 36 13 00-0051	EA		22' x 14', Non Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift	5,269.55	1,365.55
			<i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	368.07	
			<i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	634.60	
			<i>For Aluminum, Mill Finish, Add</i>	289.38	
			<i>For Aluminum, Anodized Finish, Add</i>	809.75	
08 36 13 00-0052	EA		22' x 16', Non Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift	5,925.55	1,509.30
			<i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	421.51	
			<i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	726.74	
			<i>For Aluminum, Mill Finish, Add</i>	331.39	
			<i>For Aluminum, Anodized Finish, Add</i>	927.32	
08 36 13 00-0053	EA		24' x 8', Non Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift	3,494.26	1,078.07
			<i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	194.03	
			<i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	334.53	
			<i>For Aluminum, Mill Finish, Add</i>	152.54	
			<i>For Aluminum, Anodized Finish, Add</i>	426.86	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 36 13 00-0054 EA 24' x 10', Non Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift..... <i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For Aluminum, Mill Finish, Add</i> <i>For Aluminum, Anodized Finish, Add</i>	4,210.82 256.24 441.79 201.46 563.73	1,221.82
08 36 13 00-0055 EA 24' x 12', Non Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift..... <i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For Aluminum, Mill Finish, Add</i> <i>For Aluminum, Anodized Finish, Add</i>	5,061.61 337.92 582.62 265.67 743.42	1,365.55
08 36 13 00-0056 EA 24' x 14', Non Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift..... <i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For Aluminum, Mill Finish, Add</i> <i>For Aluminum, Anodized Finish, Add</i>	5,649.34 381.46 657.69 299.90 839.21	1,509.30
08 36 13 00-0057 EA 24' x 16', Non Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift..... <i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For Aluminum, Mill Finish, Add</i> <i>For Aluminum, Anodized Finish, Add</i>	6,319.33 436.92 753.31 343.51 961.23	1,653.04
08 36 13 00-0058 Insulated, 24 Gauge Galvanized Steel Sectional Doors <small>(08 36 13 00-0014)</small> Note: Includes 2" door with polystyrene insulation, 26 gauge interior cover, tracks and hardware. Excludes frame.		
08 36 13 00-0059 EA 8' x 8', Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift..... <i>For Aluminum, Mill Finish, Add</i> <i>For Aluminum, Anodized Finish, Add</i> <i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	1,210.63 80.66 225.70 35.38 155.66	251.55
08 36 13 00-0060 EA 8' x 10', Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift..... <i>For Aluminum, Mill Finish, Add</i> <i>For Aluminum, Anodized Finish, Add</i> <i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	1,436.88 98.26 274.95 43.10 189.62	287.49
08 36 13 00-0061 EA 8' x 12', Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift..... <i>For Aluminum, Mill Finish, Add</i> <i>For Aluminum, Anodized Finish, Add</i> <i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	1,767.91 119.61 334.69 52.46 230.82	359.36
08 36 13 00-0062 EA 10' x 8', Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift..... <i>For Aluminum, Mill Finish, Add</i> <i>For Aluminum, Anodized Finish, Add</i> <i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	1,405.41 94.67 264.91 41.52 182.70	287.49
08 36 13 00-0063 EA 10' x 10', Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift..... <i>For Aluminum, Mill Finish, Add</i> <i>For Aluminum, Anodized Finish, Add</i> <i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	1,729.14 115.19 322.33 50.52 222.29	359.36
08 36 13 00-0064 EA 10' x 12', Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift..... <i>For Aluminum, Mill Finish, Add</i> <i>For Aluminum, Anodized Finish, Add</i> <i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	2,203.03 144.63 404.72 63.44 279.11	467.16
08 36 13 00-0065 EA 10' x 14', Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift..... <i>For Aluminum, Mill Finish, Add</i> <i>For Aluminum, Anodized Finish, Add</i> <i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	2,572.30 162.15 453.73 71.12 312.92	574.97
08 36 13 00-0066 EA 12' x 8', Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift..... <i>For Aluminum, Mill Finish, Add</i> <i>For Aluminum, Anodized Finish, Add</i> <i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	1,669.88 108.43 303.42 47.56 209.26	359.36
08 36 13 00-0067 EA 12' x 10', Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift..... <i>For Aluminum, Mill Finish, Add</i> <i>For Aluminum, Anodized Finish, Add</i> <i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	2,091.09 131.87 369.01 57.84 254.49	467.16
08 36 13 00-0068 EA 12' x 12', Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift..... <i>For Aluminum, Mill Finish, Add</i> <i>For Aluminum, Anodized Finish, Add</i> <i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	2,552.55 159.90 447.43 70.13 308.57	574.97
08 36 13 00-0069 EA 12' x 14', Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift..... <i>For Aluminum, Mill Finish, Add</i> <i>For Aluminum, Anodized Finish, Add</i> <i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	2,989.84 185.17 518.15 81.21 357.34	682.78
08 36 13 00-0070 EA 12' x 16', Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift..... <i>For Aluminum, Mill Finish, Add</i> <i>For Aluminum, Anodized Finish, Add</i> <i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i> <i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	3,628.52 225.20 630.18 98.77 434.61	826.52

08 Openings**08 30 Specialty Doors And Frames****08 36 Panel Doors**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 36 13 00-0071	EA		14' x 8', Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift.....	2,004.03	467.16
			<i>For Aluminum, Mill Finish, Add</i>	121.95	
			<i>For Aluminum, Anodized Finish, Add</i>	341.23	
			<i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	53.49	
			<i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	235.33	
08 36 13 00-0072	EA		14' x 10', Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift.....	2,483.04	574.97
			<i>For Aluminum, Mill Finish, Add</i>	151.97	
			<i>For Aluminum, Anodized Finish, Add</i>	425.26	
			<i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	66.65	
			<i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	293.28	
08 36 13 00-0073	EA		14' x 12', Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift.....	3,030.26	718.71
			<i>For Aluminum, Mill Finish, Add</i>	181.58	
			<i>For Aluminum, Anodized Finish, Add</i>	508.11	
			<i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	79.64	
			<i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	350.42	
08 36 13 00-0074	EA		14' x 14', Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift.....	3,561.20	826.52
			<i>For Aluminum, Mill Finish, Add</i>	217.53	
			<i>For Aluminum, Anodized Finish, Add</i>	608.70	
			<i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	95.41	
			<i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	419.80	
08 36 13 00-0075	EA		14' x 16', Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift.....	4,080.46	934.33
			<i>For Aluminum, Mill Finish, Add</i>	252.15	
			<i>For Aluminum, Anodized Finish, Add</i>	705.56	
			<i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	110.59	
			<i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	486.60	
08 36 13 00-0076	EA		16' x 8', Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift.....	2,407.68	574.97
			<i>For Aluminum, Mill Finish, Add</i>	143.38	
			<i>For Aluminum, Anodized Finish, Add</i>	401.22	
			<i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	62.89	
			<i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	276.70	
08 36 13 00-0077	EA		16' x 10', Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift.....	3,088.79	718.71
			<i>For Aluminum, Mill Finish, Add</i>	188.26	
			<i>For Aluminum, Anodized Finish, Add</i>	526.78	
			<i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	82.57	
			<i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	363.30	
08 36 13 00-0078	EA		16' x 12', Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift.....	3,600.72	826.52
			<i>For Aluminum, Mill Finish, Add</i>	222.04	
			<i>For Aluminum, Anodized Finish, Add</i>	621.31	
			<i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	97.38	
			<i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	428.49	
08 36 13 00-0079	EA		16' x 14', Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift.....	4,115.58	934.33
			<i>For Aluminum, Mill Finish, Add</i>	256.15	
			<i>For Aluminum, Anodized Finish, Add</i>	716.77	
			<i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	112.35	
			<i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	494.32	
08 36 13 00-0080	EA		16' x 16', Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift.....	4,853.77	1,078.07
			<i>For Aluminum, Mill Finish, Add</i>	307.53	
			<i>For Aluminum, Anodized Finish, Add</i>	860.54	
			<i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	134.88	
			<i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	593.48	
08 36 13 00-0081	EA		18' x 8', Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift.....	2,804.90	718.71
			<i>For Aluminum, Mill Finish, Add</i>	155.89	
			<i>For Aluminum, Anodized Finish, Add</i>	436.22	
			<i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	68.37	
			<i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	300.84	
08 36 13 00-0082	EA		18' x 10', Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift.....	3,444.87	826.52
			<i>For Aluminum, Mill Finish, Add</i>	204.27	
			<i>For Aluminum, Anodized Finish, Add</i>	571.59	
			<i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	89.59	
			<i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	394.20	
08 36 13 00-0083	EA		18' x 12', Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift.....	3,986.80	934.33
			<i>For Aluminum, Mill Finish, Add</i>	241.47	
			<i>For Aluminum, Anodized Finish, Add</i>	675.69	
			<i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	105.91	
			<i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	465.99	
08 36 13 00-0084	EA		18' x 14', Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift.....	4,928.39	1,078.07
			<i>For Aluminum, Mill Finish, Add</i>	316.04	
			<i>For Aluminum, Anodized Finish, Add</i>	884.34	
			<i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	138.61	
			<i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	609.89	
08 36 13 00-0085	EA		18' x 16', Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift.....	5,420.02	1,221.82
			<i>For Aluminum, Mill Finish, Add</i>	339.31	
			<i>For Aluminum, Anodized Finish, Add</i>	949.46	
			<i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	148.82	
			<i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	654.80	
08 36 13 00-0086	EA		20' x 8', Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift.....	3,430.97	826.52
			<i>For Aluminum, Mill Finish, Add</i>	202.68	
			<i>For Aluminum, Anodized Finish, Add</i>	567.16	
			<i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	88.90	
			<i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	391.14	
08 36 13 00-0087	EA		20' x 10', Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift.....	4,019.01	934.33
			<i>For Aluminum, Mill Finish, Add</i>	245.14	
			<i>For Aluminum, Anodized Finish, Add</i>	685.96	
			<i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	107.52	
			<i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	473.08	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 36 13 00-0088 EA 20' x 12', Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift.....	5,078.38	1,078.07
<i>For Aluminum, Mill Finish, Add</i>	333.13	
<i>For Aluminum, Anodized Finish, Add</i>	932.19	
<i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	146.11	
<i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	642.89	
08 36 13 00-0089 EA 20' x 14', Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift.....	5,553.91	1,221.82
<i>For Aluminum, Mill Finish, Add</i>	354.57	
<i>For Aluminum, Anodized Finish, Add</i>	992.17	
<i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	155.51	
<i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	684.26	
08 36 13 00-0090 EA 20' x 16', Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift.....	6,424.53	1,365.55
<i>For Aluminum, Mill Finish, Add</i>	421.05	
<i>For Aluminum, Anodized Finish, Add</i>	1,178.19	
<i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	184.67	
<i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	812.55	
08 36 13 00-0091 EA 22' x 8', Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift.....	3,778.29	934.33
<i>For Aluminum, Mill Finish, Add</i>	217.70	
<i>For Aluminum, Anodized Finish, Add</i>	609.17	
<i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	95.48	
<i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	420.12	
08 36 13 00-0092 EA 22' x 10', Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift.....	4,632.08	1,078.07
<i>For Aluminum, Mill Finish, Add</i>	282.26	
<i>For Aluminum, Anodized Finish, Add</i>	789.82	
<i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	123.80	
<i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	544.70	
08 36 13 00-0093 EA 22' x 12', Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift.....	5,473.44	1,221.82
<i>For Aluminum, Mill Finish, Add</i>	345.40	
<i>For Aluminum, Anodized Finish, Add</i>	966.50	
<i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	151.49	
<i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	666.55	
08 36 13 00-0094 EA 22' x 14', Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift.....	6,147.24	1,365.55
<i>For Aluminum, Mill Finish, Add</i>	389.44	
<i>For Aluminum, Anodized Finish, Add</i>	1,089.74	
<i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	170.81	
<i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	751.54	
08 36 13 00-0095 EA 22' x 16', Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift.....	6,988.56	1,509.30
<i>For Aluminum, Mill Finish, Add</i>	452.58	
<i>For Aluminum, Anodized Finish, Add</i>	1,266.42	
<i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	198.50	
<i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	873.39	
08 36 13 00-0096 EA 24' x 8', Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift.....	4,227.47	1,078.07
<i>For Aluminum, Mill Finish, Add</i>	236.13	
<i>For Aluminum, Anodized Finish, Add</i>	660.75	
<i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	103.57	
<i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	455.69	
08 36 13 00-0097 EA 24' x 10', Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift.....	5,162.49	1,221.82
<i>For Aluminum, Mill Finish, Add</i>	309.95	
<i>For Aluminum, Anodized Finish, Add</i>	867.31	
<i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	135.94	
<i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	598.14	
08 36 13 00-0098 EA 24' x 12', Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift.....	5,962.14	1,365.55
<i>For Aluminum, Mill Finish, Add</i>	368.33	
<i>For Aluminum, Anodized Finish, Add</i>	1,030.69	
<i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	161.55	
<i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	710.82	
08 36 13 00-0099 EA 24' x 14', Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift.....	6,804.92	1,509.30
<i>For Aluminum, Mill Finish, Add</i>	431.64	
<i>For Aluminum, Anodized Finish, Add</i>	1,207.84	
<i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	189.32	
<i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	832.99	
08 36 13 00-0100 EA 24' x 16', Insulated, 24 Gauge Galvanized Steel Sectional Door, Manual Lift.....	7,635.28	1,653.04
<i>For Aluminum, Mill Finish, Add</i>	493.53	
<i>For Aluminum, Anodized Finish, Add</i>	1,381.01	
<i>For 20 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	216.46	
<i>For 16 Gauge Steel Ribbed, Heavy Duty Door, Add</i>	952.42	
08 36 13 00-0101 Residential Grade, Galvanized Steel Sectional Overhead Doors <small>(08 36 13 00-0013)</small>		
<i>Note: Includes track and hardware. Excludes frame.</i>		
08 36 13 00-0102 EA 9' x 7', Non Insulated, 25 Gauge Residential Grade Galvanized Steel Sectional Door, Manual Lift	909.26	143.74
<i>For Aluminum And Fiberglass, Add</i>	170.47	
<i>For Each Glass Vision Panel In Door, Add</i>	27.00	
<i>For Insulated Door, Add</i>	291.45	
08 36 13 00-0103 EA 9' x 8', Non Insulated, 25 Gauge Residential Grade Galvanized Steel Sectional Door, Manual Lift	1,007.95	143.74
<i>For Aluminum And Fiberglass, Add</i>	201.06	
<i>For Each Glass Vision Panel In Door, Add</i>	27.00	
<i>For Insulated Door, Add</i>	343.75	
08 36 13 00-0104 EA 16' x 7', Non Insulated, 25 Gauge Residential Grade Galvanized Steel Sectional Door, Manual Lift	1,319.63	164.44
<i>For Aluminum And Fiberglass, Add</i>	281.91	
<i>For Each Glass Vision Panel In Door, Add</i>	27.00	
<i>For Insulated Door, Add</i>	481.98	
08 36 13 00-0105 EA 16' x 8', Non Insulated, 25 Gauge Residential Grade Galvanized Steel Sectional Door, Manual Lift	1,474.70	164.44
<i>For Aluminum And Fiberglass, Add</i>	329.99	
<i>For Each Glass Vision Panel In Door, Add</i>	27.00	
<i>For Insulated Door, Add</i>	564.17	



MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

08 36 13 00-0106	Remove And Reinstall Sectional Metal Overhead Doors And Supports (08 36 13 00-013)		
	Note: Includes storage, cleaning and supply materials.		
08 36 13 00-0107	SF Remove And Reinstall Sectional Metal Overhead Door And Supports.....	10.31	
08 36 13 00-0108	Sectional Fiberglass Overhead Doors (08 36 13)		
08 36 13 00-0109	Fiberglass Sectional Overhead Doors (08 36 13 00-0108)		
08 36 13 00-0110	Non-Insulated, Fiberglass Sectional Doors (08 36 13 00-0109)		
	Note: Includes 2" door, tracks and hardware. Excludes frame.		
08 36 13 00-0111	EA 8' x 8', Non Insulated, Fiberglass Sectional Door, Manual Lift.....	1,389.45	251.55
08 36 13 00-0112	EA 8' x 10', Non Insulated, Fiberglass Sectional Door, Manual Lift.....	1,643.48	287.49
08 36 13 00-0113	EA 8' x 12', Non Insulated, Fiberglass Sectional Door, Manual Lift.....	1,954.86	359.36
08 36 13 00-0114	EA 10' x 8', Non Insulated, Fiberglass Sectional Door, Manual Lift.....	1,625.99	287.49
08 36 13 00-0115	EA 10' x 10', Non Insulated, Fiberglass Sectional Door, Manual Lift.....	1,929.58	323.43
08 36 13 00-0116	EA 10' x 12', Non Insulated, Fiberglass Sectional Door, Manual Lift.....	2,430.45	449.20
08 36 13 00-0117	EA 10' x 14', Non Insulated, Fiberglass Sectional Door, Manual Lift.....	2,933.82	574.97
08 36 13 00-0118	EA 12' x 8', Non Insulated, Fiberglass Sectional Door, Manual Lift.....	1,930.08	359.36
08 36 13 00-0119	EA 12' x 10', Non Insulated, Fiberglass Sectional Door, Manual Lift.....	2,420.25	449.20
08 36 13 00-0120	EA 12' x 12', Non Insulated, Fiberglass Sectional Door, Manual Lift.....	2,904.37	539.03
08 36 13 00-0121	EA 12' x 14', Non Insulated, Fiberglass Sectional Door, Manual Lift.....	3,567.16	718.71
08 36 13 00-0122	EA 12' x 16', Non Insulated, Fiberglass Sectional Door, Manual Lift.....	4,161.67	862.46
08 36 13 00-0123	EA 14' x 8', Non Insulated, Fiberglass Sectional Door, Manual Lift.....	2,377.75	503.10
08 36 13 00-0124	EA 14' x 10', Non Insulated, Fiberglass Sectional Door, Manual Lift.....	2,872.59	574.97
08 36 13 00-0125	EA 14' x 12', Non Insulated, Fiberglass Sectional Door, Manual Lift.....	3,514.68	718.71
08 36 13 00-0126	EA 14' x 14', Non Insulated, Fiberglass Sectional Door, Manual Lift.....	4,155.84	862.46
08 36 13 00-0127	EA 14' x 16', Non Insulated, Fiberglass Sectional Door, Manual Lift.....	4,654.92	934.33
08 36 13 00-0128	EA 16' x 8', Non Insulated, Fiberglass Sectional Door, Manual Lift.....	2,702.04	574.97
08 36 13 00-0129	EA 16' x 10', Non Insulated, Fiberglass Sectional Door, Manual Lift.....	3,230.89	646.84
08 36 13 00-0130	EA 16' x 12', Non Insulated, Fiberglass Sectional Door, Manual Lift.....	3,912.56	790.59
08 36 13 00-0131	EA 16' x 14', Non Insulated, Fiberglass Sectional Door, Manual Lift.....	4,586.41	934.33
08 36 13 00-0132	EA 16' x 16', Non Insulated, Fiberglass Sectional Door, Manual Lift.....	5,117.02	1,006.20
08 36 13 00-0133	Insulated, Fiberglass Sectional Doors (08 36 13 00-0109)		
	Note: Includes 2" door with polystyrene insulation, tracks and hardware. Excludes frame.		
08 36 13 00-0134	EA 8' x 8', Insulated, Fiberglass Sectional Door, Manual Lift.....	1,681.93	251.55
08 36 13 00-0135	EA 8' x 10', Insulated, Fiberglass Sectional Door, Manual Lift.....	1,996.09	287.49
08 36 13 00-0136	EA 8' x 12', Insulated, Fiberglass Sectional Door, Manual Lift.....	2,362.78	359.36
08 36 13 00-0137	EA 10' x 8', Insulated, Fiberglass Sectional Door, Manual Lift.....	1,972.82	287.49
08 36 13 00-0138	EA 10' x 10', Insulated, Fiberglass Sectional Door, Manual Lift.....	2,352.91	323.43
08 36 13 00-0139	EA 10' x 12', Insulated, Fiberglass Sectional Door, Manual Lift.....	2,936.03	449.20
08 36 13 00-0140	EA 10' x 14', Insulated, Fiberglass Sectional Door, Manual Lift.....	3,522.62	574.97
08 36 13 00-0141	EA 12' x 8', Insulated, Fiberglass Sectional Door, Manual Lift.....	2,329.83	359.36
08 36 13 00-0142	EA 12' x 10', Insulated, Fiberglass Sectional Door, Manual Lift.....	2,922.46	449.20
08 36 13 00-0143	EA 12' x 12', Insulated, Fiberglass Sectional Door, Manual Lift.....	3,507.13	539.03
08 36 13 00-0144	EA 12' x 14', Insulated, Fiberglass Sectional Door, Manual Lift.....	4,269.97	718.71
08 36 13 00-0145	EA 12' x 16', Insulated, Fiberglass Sectional Door, Manual Lift.....	4,965.98	862.46
08 36 13 00-0146	EA 14' x 8', Insulated, Fiberglass Sectional Door, Manual Lift.....	2,830.42	503.10
08 36 13 00-0147	EA 14' x 10', Insulated, Fiberglass Sectional Door, Manual Lift.....	3,441.19	574.97
08 36 13 00-0148	EA 14' x 12', Insulated, Fiberglass Sectional Door, Manual Lift.....	4,200.17	718.71
08 36 13 00-0149	EA 14' x 14', Insulated, Fiberglass Sectional Door, Manual Lift.....	4,958.22	862.46
08 36 13 00-0150	EA 14' x 16', Insulated, Fiberglass Sectional Door, Manual Lift.....	5,574.68	934.33
08 36 13 00-0151	EA 16' x 8', Insulated, Fiberglass Sectional Door, Manual Lift.....	3,214.36	574.97
08 36 13 00-0152	EA 16' x 10', Insulated, Fiberglass Sectional Door, Manual Lift.....	3,870.20	646.84
08 36 13 00-0153	EA 16' x 12', Insulated, Fiberglass Sectional Door, Manual Lift.....	4,681.76	790.59
08 36 13 00-0154	EA 16' x 14', Insulated, Fiberglass Sectional Door, Manual Lift.....	5,483.56	934.33
08 36 13 00-0155	EA 16' x 16', Insulated, Fiberglass Sectional Door, Manual Lift.....	6,141.66	1,006.20
08 36 13 00-0156	Sectional Overhead Door Accessories (08 36 13)		
08 36 13 00-0157	Sectional Overhead Door Accessories (08 36 13 00-0156)		
	See CSI section 08 33 26 00-0052 for safety edge bottom bar.		
08 36 13 00-0158	LF Flap Seal For Sectional Overhead Doors.....	2.63	
08 36 13 00-0159	LF Weather Seal At Top Of Door For Sectional Overhead Doors.....	3.80	
08 36 13 00-0160	LF Astragal Only, Weather Strip At Bottom Of Door For Sectional Overhead Doors.....	2.14	
08 36 13 00-0161	EA Cylinder Lock For Sectional Overhead Doors.....	226.78	
08 36 13 00-0162	EA Manual Chain Hoist For Sectional Overhead Doors.....	378.92	
08 36 13 00-0163	EA Electric Chain Lift Operator For Sectional Overhead Doors.....	1,545.09	
	Note: Includes motor, supports, push button operator, stationary electronic eye, signal wiring from eye to motor and motor to operator.		
08 36 13 00-0164	EA 1/2 HP Trolley Operator For Sectional Overhead Doors.....	698.50	
	Note: Includes motor, supports, push button operator, stationary electronic eye, signal wiring from eye to motor and motor to operator.		
08 36 13 00-0165	SF Up To 2 SF Per Window 1/8" Double Strength Glass (DSB) Glazing For Sectional Overhead Doors.....	18.99	
	Note: Additional cost for factory supplied.		
08 36 13 00-0166	SF >2 SF Per Window 1/8" Double Strength Glass (DSB) Glazing For Sectional Overhead Doors.....	11.85	
	Note: Additional cost for factory supplied.		
08 36 13 00-0167	SF Up To 2 SF Per Window 1/8" Plexiglas Glazing For Sectional Overhead Doors.....	19.86	
	Note: Additional cost for factory supplied.		



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
	08 36 13 00-0168	SF		>2 SF Per Window 1/8" Plexiglas Glazing For Sectional Overhead Doors.....	13.54	
				Note: Additional cost for factory supplied.		
	08 36 13 00-0169	SF		Up To 2 SF Per Window 3/4" Insulated Glazing For Sectional Overhead Doors.....	31.95	
				Note: Additional cost for factory supplied.		
	08 36 13 00-0170	SF		>2 SF Per Window 3/4" Insulated Glazing For Sectional Overhead Doors.....	21.56	
				Note: Additional cost for factory supplied.		
	08 36 13 00-0171	EA		Vertical Lift Track For Sectional Overhead Doors Up To 12' High Door.....	309.88	
				Note: Includes additional installation of vertical track, spring bumpers, counterweights and vertical lift springs.		
	08 36 13 00-0172	EA		Vertical Lift Track For Sectional Overhead Doors >12' To 16' High Door.....	481.15	
				Note: Includes additional installation of vertical track, spring bumpers, counterweights and vertical lift springs.		
	08 36 13 00-0173	EA		Vertical Lift Track For Sectional Overhead Doors >16' To 20' High Door.....	723.64	
				Note: Includes additional installation of vertical track, spring bumpers, counterweights and vertical lift springs.		
	08 36 13 00-0174	SF		25,000 Cycle Spring In Lieu Of 10,000 Cycle For Sectional Overhead Doors.....	0.80	
				Note: Additional cost for factory supplied/installed spring. Per SF of Door.		
	08 36 13 00-0175	SF		50,000 Cycle Spring In Lieu Of 10,000 Cycle For Sectional Overhead Doors.....	1.03	
				Note: Additional cost for factory supplied/installed spring. Per SF of Door.		
	08 36 13 00-0176	SF		100,000 Cycle Spring In Lieu Of 10,000 Cycle For Sectional Overhead Doors.....	1.36	
				Note: Additional cost for factory supplied/installed spring. Per SF of Door.		

08 38 Traffic Doors (08 30)

08 38 13 Flexible Strip Doors (08 38)

08 38 13 00-0001 Clear Polyvinyl Chloride (PVC) Strip Doors (08 38 13)

	08 38 13 00-0002	SF	8" Smooth Strip, 0.080" Thick, 50% Overlap, Clear Polyvinyl Chloride (PVC) Strip Door.....		7.52	3.60
			<i>For Cooler/Freezer Doors, USDA Grade, Add</i>		0.39	
			<i>Note: Low temperature to -40 degree F.</i>			
			<i>For Ribbed Strip Material, Add</i>		0.82	
	08 38 13 00-0003	SF	8" Smooth Strip, 0.080" Thick, 100% Overlap, Clear Polyvinyl Chloride (PVC) Strip Door.....		9.48	3.95
			<i>For Cooler/Freezer Doors, USDA Grade, Add</i>		0.55	
			<i>Note: Low temperature to -40 degree F.</i>			
			<i>For Ribbed Strip Material, Add</i>		1.16	
	08 38 13 00-0004	SF	12" Smooth Strip, 0.120" Thick, 66% Overlap, Clear Polyvinyl Chloride (PVC) Strip Door.....		8.54	3.60
			<i>For Cooler/Freezer Doors, USDA Grade, Add</i>		0.49	
			<i>Note: Low temperature to -40 degree F.</i>			
			<i>For Ribbed Strip Material, Add</i>		1.04	
	08 38 13 00-0005	SF	12" Smooth Strip, 0.120" Thick, 100% Overlap, Clear Polyvinyl Chloride (PVC) Strip Door.....		10.15	3.95
			<i>For Cooler/Freezer Doors, USDA Grade, Add</i>		0.62	
			<i>Note: Low temperature to -40 degree F.</i>			
			<i>For Ribbed Strip Material, Add</i>		1.30	
	08 38 13 00-0006	SF	16" Smooth Strip, 0.160" Thick, 75% Overlap, Clear Polyvinyl Chloride (PVC) Strip Door.....		9.88	3.60
			<i>For Cooler/Freezer Doors, USDA Grade, Add</i>		0.63	
			<i>Note: Low temperature to -40 degree F.</i>			
			<i>For Ribbed Strip Material, Add</i>		1.32	

08 38 13 00-0007 Clear Polyvinyl Chloride (PVC) Replacement Strips (08 38 13)

	08 38 13 00-0008	EA	8" Smooth Strip, 0.080" Thick, 7' Long, Replacement Strip.....		19.72	7.18
			<i>For Cooler/Freezer Doors, USDA Grade, Add</i>		1.25	
			<i>Note: Low temperature to -40 degree F.</i>			
			<i>For Ribbed Strip Material, Add</i>		2.63	
	08 38 13 00-0009	EA	8" Smooth Strip, 0.080" Thick, 8' Long, Replacement Strip.....		21.60	7.18
			<i>For Cooler/Freezer Doors, USDA Grade, Add</i>		1.44	
			<i>Note: Low temperature to -40 degree F.</i>			
			<i>For Ribbed Strip Material, Add</i>		3.03	
	08 38 13 00-0010	EA	12" Smooth Strip, 0.120" Thick, 8' Long, Replacement Strip.....		39.88	7.18
			<i>For Cooler/Freezer Doors, USDA Grade, Add</i>		3.27	
			<i>Note: Low temperature to -40 degree F.</i>			
			<i>For Ribbed Strip Material, Add</i>		6.87	
	08 38 13 00-0011	EA	12" Smooth Strip, 0.120" Thick, 10' Long, Replacement Strip.....		47.81	7.18
			<i>For Cooler/Freezer Doors, USDA Grade, Add</i>		4.06	
			<i>Note: Low temperature to -40 degree F.</i>			
			<i>For Ribbed Strip Material, Add</i>		8.53	
	08 38 13 00-0012	EA	12" Smooth Strip, 0.120" Thick, 12' Long, Replacement Strip.....		56.02	7.18
			<i>For Cooler/Freezer Doors, USDA Grade, Add</i>		4.88	
			<i>Note: Low temperature to -40 degree F.</i>			
			<i>For Ribbed Strip Material, Add</i>		10.26	
	08 38 13 00-0013	EA	16" Smooth Strip, 0.160" Thick, 15' Long, Replacement Strip.....		91.78	7.18
			<i>For Cooler/Freezer Doors, USDA Grade, Add</i>		8.46	
			<i>Note: Low temperature to -40 degree F.</i>			
			<i>For Ribbed Strip Material, Add</i>		17.77	

08 38 16 Flexible Traffic Doors (08 38)

Note: Impact traffic doors also known as double action traffic doors. Includes hardware. Excludes door frame.

	08 38 16 00-0001		0.160" Thick, Clear Polyvinyl Chloride (PVC) Flexible Impact Traffic Doors (TMI Mega-Pro) <small>(08 38 16)</small>			
	08 38 16 00-0002		Double Door, 0.160" Thick, Clear Polyvinyl Chloride (PVC) Flexible Impact Traffic Doors <small>(08 38 16 00-0001)</small>			
	08 38 16 00-0003		Double Door, 0.160" Thick, Clear Polyvinyl Chloride (PVC) Flexible Impact Traffic Doors <small>(08 38 16 00-0002)</small>			

08 Openings**08 30 Specialty Doors And Frames****08 38 Traffic Doors**

MINOR				TOTAL DIRECT	DEMOLITION
CSI	UOM	DESCRIPTION		UNIT COST	UNIT COST
08 38 16 00-0004	EA	72" x 84" Opening, Double Door, 0.160" Thick, Clear Polyvinyl Chloride (PVC) Flexible Impact Traffic Door.....		1,335.51	71.87
08 38 16 00-0005	EA	72" x 96" Opening, Double Door, 0.160" Thick, Clear Polyvinyl Chloride (PVC) Flexible Impact Traffic Door.....		1,437.95	71.87
08 38 16 00-0006	EA	96" x 96" Opening, Double Door, 0.160" Thick, Clear Polyvinyl Chloride (PVC) Flexible Impact Traffic Door.....		2,929.16	82.65
08 38 16 00-0007	EA	96" x 120" Opening, Double Door, 0.160" Thick, Clear Polyvinyl Chloride (PVC) Flexible Impact Traffic Door.....		3,284.27	89.84
08 38 16 00-0008	EA	108" x 108" Opening, Double Door, 0.160" Thick, Clear Polyvinyl Chloride (PVC) Flexible Impact Traffic Door.....		5,057.15	89.84
08 38 16 00-0009	EA	108" x 120" Opening, Double Door, 0.160" Thick, Clear Polyvinyl Chloride (PVC) Flexible Impact Traffic Door.....		5,286.49	89.84
08 38 16 00-0010	EA	120" x 120" Opening, Double Door, 0.160" Thick, Clear Polyvinyl Chloride (PVC) Flexible Impact Traffic Door.....		5,891.56	107.81
08 38 16 00-0011		Double Door With Impact Plate, 0.160" Thick, Clear Polyvinyl Chloride (PVC) Flexible Impact Traffic Doors <small>(08 38 16 00-0002)</small>			
08 38 16 00-0012	EA	72" x 84" Opening, Double Door With Impact Plate, 0.160" Thick, Clear Polyvinyl Chloride (PVC) Flexible Impact Traffic Door.....		1,478.12	71.87
08 38 16 00-0013	EA	72" x 96" Opening, Double Door With Impact Plate, 0.160" Thick, Clear Polyvinyl Chloride (PVC) Flexible Impact Traffic Door.....		1,592.21	71.87
08 38 16 00-0014	EA	96" x 96" Opening, Double Door With Impact Plate, 0.160" Thick, Clear Polyvinyl Chloride (PVC) Flexible Impact Traffic Door.....		3,454.48	82.65
08 38 16 00-0015	EA	96" x 120" Opening, Double Door With Impact Plate, 0.160" Thick, Clear Polyvinyl Chloride (PVC) Flexible Impact Traffic Door.....		3,807.26	89.84
08 38 16 00-0016	EA	108" x 108" Opening, Double Door With Impact Plate, 0.160" Thick, Clear Polyvinyl Chloride (PVC) Flexible Impact Traffic Door.....		5,656.94	89.84
08 38 16 00-0017	EA	108" x 120" Opening, Double Door With Impact Plate, 0.160" Thick, Clear Polyvinyl Chloride (PVC) Flexible Impact Traffic Door.....		5,890.23	89.84
08 38 16 00-0018	EA	120" x 120" Opening, Double Door With Impact Plate, 0.160" Thick, Clear Polyvinyl Chloride (PVC) Flexible Impact Traffic Door.....		6,563.24	107.81
08 38 16 00-0019		0.240" Thick, Double Ply Vinyl Flexible Impact Traffic Doors (Eliason FMP) <small>(08 38 16)</small>			
		Note: Includes pebble embossed finish and a 14" x 16" vinyl window.			
08 38 16 00-0020		Single Door, 0.240" Thick, Double Ply Vinyl Flexible Impact Traffic Doors <small>(08 38 16 00-0019)</small>			
08 38 16 00-0021		84" Height, Single Door, 0.240" Thick, Double Ply Vinyl Flexible Impact Traffic Doors <small>(08 38 16 00-0020)</small>			
08 38 16 00-0022	EA	24" To 36" Width x 84" Height Opening, Single Door, 0.240" Thick, Double Ply Vinyl Flexible Impact Traffic Doors.....		672.54	39.53
08 38 16 00-0023	EA	40" To 44" Width x 84" Height Opening, Single Door, 0.240" Thick, Double Ply Vinyl Flexible Impact Traffic Doors.....		722.53	39.53
08 38 16 00-0024		96" Height, Single Door, 0.240" Thick, Double Ply Vinyl Flexible Impact Traffic Doors <small>(08 38 16 00-0020)</small>			
08 38 16 00-0025	EA	24" To 36" Width x 96" Height Opening, Single Door, 0.240" Thick, Double Ply Vinyl Flexible Impact Traffic Doors.....		722.53	39.53
08 38 16 00-0026	EA	40" To 44" Width x 96" Height Opening, Single Door, 0.240" Thick, Double Ply Vinyl Flexible Impact Traffic Doors.....		736.63	39.53
08 38 16 00-0027		Double Door, 0.240" Thick, Double Ply Vinyl Flexible Impact Traffic Doors <small>(08 38 16 00-0019)</small>			
08 38 16 00-0028		84" Height, Double Door, 0.240" Thick, Double Ply Vinyl Flexible Impact Traffic Doors <small>(08 38 16 00-0027)</small>			
08 38 16 00-0029	EA	48" To 72" Width x 84" Height Opening, Double Door, 0.240" Thick, Double Ply Vinyl Flexible Impact Traffic Doors.....		1,323.50	68.28
08 38 16 00-0030	EA	80" To 88" Width x 84" Height Opening, Double Door, 0.240" Thick, Double Ply Vinyl Flexible Impact Traffic Doors.....		1,423.49	68.28
08 38 16 00-0031		96" Height, Double Door, 0.240" Thick, Double Ply Vinyl Flexible Impact Traffic Doors <small>(08 38 16 00-0027)</small>			
08 38 16 00-0032	EA	48" To 72" Width x 96" Height Opening, Double Door, 0.240" Thick, Double Ply Vinyl Flexible Impact Traffic Doors.....		1,423.49	68.28
08 38 16 00-0033	EA	80" To 88" Width x 96" Height Opening, Double Door, 0.240" Thick, Double Ply Vinyl Flexible Impact Traffic Doors.....		1,451.69	68.28
08 38 19		Rigid Traffic Doors <small>(08 38)</small>			
		Note: Impact traffic doors also known as double action traffic doors. Includes hardware. Excludes door frame.			
08 38 19 00-0001		0.063" Thick, Satin Anodized Finish, Tempered Aluminum Alloy Impact Traffic Doors (Eliason LWP-3) <small>(08 38 19)</small>			
		Note: Includes delta formed vertical edges and a 9" x 14" acrylic window.			
08 38 19 00-0002		Single Door, 0.063" Thick, Satin Anodized Finish, Tempered Aluminum Alloy Impact Traffic Doors <small>(08 38 19 00-0001)</small>			
08 38 19 00-0003		84" Height, Single Door, 0.063" Thick, Satin Anodized Finish, Tempered Aluminum Alloy Impact Traffic Doors <small>(08 38 19 00-0002)</small>			
08 38 19 00-0004	EA	24" x 84" Opening, Single Door, 0.063" Thick, Satin Anodized Finish, Tempered Aluminum Alloy Impact Traffic Door.....		345.67	39.53
		For Each 14" x 16" Window, Add		22.00	
		For Each 15" x 20" Window, Add		28.00	
		For Each 18" x 30" Window, Add		41.00	
08 38 19 00-0005	EA	28" x 84" Opening, Single Door, 0.063" Thick, Satin Anodized Finish, Tempered Aluminum Alloy Impact Traffic Door.....		368.74	39.53
		For Each 14" x 16" Window, Add		22.00	
		For Each 15" x 20" Window, Add		28.00	
		For Each 18" x 30" Window, Add		41.00	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 38 19 00-0006	EA			30" x 84" Opening, Single Door, 0.063" Thick, Satin Anodized Finish, Tempered Aluminum Alloy Impact Traffic Door.....	381.32	41.33
				For Each 14" x 16" Window, Add	22.00	
				For Each 15" x 20" Window, Add	28.00	
				For Each 18" x 30" Window, Add	41.00	
08 38 19 00-0007	EA			32" x 84" Opening, Single Door, 0.063" Thick, Satin Anodized Finish, Tempered Aluminum Alloy Impact Traffic Door.....	395.42	41.33
				For Each 14" x 16" Window, Add	22.00	
				For Each 15" x 20" Window, Add	28.00	
				For Each 18" x 30" Window, Add	41.00	
08 38 19 00-0008	EA			36" x 84" Opening, Single Door, 0.063" Thick, Satin Anodized Finish, Tempered Aluminum Alloy Impact Traffic Door.....	413.13	43.12
				For Each 14" x 16" Window, Add	22.00	
				For Each 15" x 20" Window, Add	28.00	
				For Each 18" x 30" Window, Add	41.00	
08 38 19 00-0009	EA			40" x 84" Opening, Single Door, 0.063" Thick, Satin Anodized Finish, Tempered Aluminum Alloy Impact Traffic Door.....	443.89	43.12
				For Each 14" x 16" Window, Add	22.00	
				For Each 15" x 20" Window, Add	28.00	
				For Each 18" x 30" Window, Add	41.00	
08 38 19 00-0010	EA			42" x 84" Opening, Single Door, 0.063" Thick, Satin Anodized Finish, Tempered Aluminum Alloy Impact Traffic Door.....	463.62	48.51
				For Each 14" x 16" Window, Add	22.00	
				For Each 15" x 20" Window, Add	28.00	
				For Each 18" x 30" Window, Add	41.00	
08 38 19 00-0011				96" Height, Single Door, 0.063" Thick, Satin Anodized Finish, Tempered Aluminum Alloy Impact Traffic Doors <small>(08 38 19 00-0002)</small>		
08 38 19 00-0012	EA			24" x 96" Opening, Single Door, 0.063" Thick, Satin Anodized Finish, Tempered Aluminum Alloy Impact Traffic Door.....	385.41	39.53
				For Each 14" x 16" Window, Add	22.00	
				For Each 15" x 20" Window, Add	28.00	
				For Each 18" x 30" Window, Add	41.00	
08 38 19 00-0013	EA			28" x 96" Opening, Single Door, 0.063" Thick, Satin Anodized Finish, Tempered Aluminum Alloy Impact Traffic Door.....	403.35	39.53
				For Each 14" x 16" Window, Add	22.00	
				For Each 15" x 20" Window, Add	28.00	
				For Each 18" x 30" Window, Add	41.00	
08 38 19 00-0014	EA			30" x 96" Opening, Single Door, 0.063" Thick, Satin Anodized Finish, Tempered Aluminum Alloy Impact Traffic Door.....	417.21	41.33
				For Each 14" x 16" Window, Add	22.00	
				For Each 15" x 20" Window, Add	28.00	
				For Each 18" x 30" Window, Add	41.00	
08 38 19 00-0015	EA			32" x 96" Opening, Single Door, 0.063" Thick, Satin Anodized Finish, Tempered Aluminum Alloy Impact Traffic Door.....	427.46	41.33
				For Each 14" x 16" Window, Add	22.00	
				For Each 15" x 20" Window, Add	28.00	
				For Each 18" x 30" Window, Add	41.00	
08 38 19 00-0016	EA			36" x 96" Opening, Single Door, 0.063" Thick, Satin Anodized Finish, Tempered Aluminum Alloy Impact Traffic Door.....	465.68	43.12
				For Each 14" x 16" Window, Add	22.00	
				For Each 15" x 20" Window, Add	28.00	
				For Each 18" x 30" Window, Add	41.00	
08 38 19 00-0017	EA			40" x 96" Opening, Single Door, 0.063" Thick, Satin Anodized Finish, Tempered Aluminum Alloy Impact Traffic Door.....	473.37	43.12
				For Each 14" x 16" Window, Add	22.00	
				For Each 15" x 20" Window, Add	28.00	
				For Each 18" x 30" Window, Add	41.00	
08 38 19 00-0018	EA			42" x 96" Opening, Single Door, 0.063" Thick, Satin Anodized Finish, Tempered Aluminum Alloy Impact Traffic Door.....	491.82	48.51
				For Each 14" x 16" Window, Add	22.00	
				For Each 15" x 20" Window, Add	28.00	
				For Each 18" x 30" Window, Add	41.00	
08 38 19 00-0019				Double Door, 0.063" Thick, Satin Anodized Finish, Tempered Aluminum Alloy Impact Traffic Doors <small>(08 38 19 00-0001)</small>		
08 38 19 00-0020				84" Height, Double Door, 0.063" Thick, Satin Anodized Finish, Tempered Aluminum Alloy Impact Traffic Doors <small>(08 38 19 00-0019)</small>		
08 38 19 00-0021	EA			48" x 84" Opening, Double Door, 0.063" Thick, Satin Anodized Finish, Tempered Aluminum Alloy Impact Traffic Door.....	669.77	68.28
				For Each 14" x 16" Window, Add	22.00	
				For Each 15" x 20" Window, Add	28.00	
				For Each 18" x 30" Window, Add	41.00	
08 38 19 00-0022	EA			56" x 84" Opening, Double Door, 0.063" Thick, Satin Anodized Finish, Tempered Aluminum Alloy Impact Traffic Door.....	715.92	68.28
				For Each 14" x 16" Window, Add	22.00	
				For Each 15" x 20" Window, Add	28.00	
				For Each 18" x 30" Window, Add	41.00	

08 Openings**08 30 Specialty Doors And Frames****08 38 Traffic Doors**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 38 19 00-0023	EA		60" x 84" Opening, Double Door, 0.063" Thick, Satin Anodized Finish, Tempered Aluminum Alloy Impact Traffic Door.....	733.86	68.28
			For Each 14" x 16" Window, Add	22.00	
			For Each 15" x 20" Window, Add	28.00	
			For Each 18" x 30" Window, Add	41.00	
08 38 19 00-0024	EA		64" x 84" Opening, Double Door, 0.063" Thick, Satin Anodized Finish, Tempered Aluminum Alloy Impact Traffic Door.....	762.06	68.28
			For Each 14" x 16" Window, Add	22.00	
			For Each 15" x 20" Window, Add	28.00	
			For Each 18" x 30" Window, Add	41.00	
08 38 19 00-0025	EA		72" x 84" Opening, Double Door, 0.063" Thick, Satin Anodized Finish, Tempered Aluminum Alloy Impact Traffic Door.....	797.47	71.87
			For Each 14" x 16" Window, Add	22.00	
			For Each 15" x 20" Window, Add	28.00	
			For Each 18" x 30" Window, Add	41.00	
08 38 19 00-0026	EA		80" x 84" Opening, Double Door, 0.063" Thick, Satin Anodized Finish, Tempered Aluminum Alloy Impact Traffic Door.....	859.00	71.87
			For Each 14" x 16" Window, Add	22.00	
			For Each 15" x 20" Window, Add	28.00	
			For Each 18" x 30" Window, Add	41.00	
08 38 19 00-0027	EA		84" x 84" Opening, Double Door, 0.063" Thick, Satin Anodized Finish, Tempered Aluminum Alloy Impact Traffic Door.....	876.95	71.87
			For Each 14" x 16" Window, Add	22.00	
			For Each 15" x 20" Window, Add	28.00	
			For Each 18" x 30" Window, Add	41.00	
08 38 19 00-0028			96" Height, Double Door, 0.063" Thick, Satin Anodized Finish, Tempered Aluminum Alloy Impact Traffic Doors <small>(08 38 19 00-0019)</small>		
08 38 19 00-0029	EA		48" x 96" Opening, Double Door, 0.063" Thick, Satin Anodized Finish, Tempered Aluminum Alloy Impact Traffic Door.....	749.24	68.28
			For Each 14" x 16" Window, Add	22.00	
			For Each 15" x 20" Window, Add	28.00	
			For Each 18" x 30" Window, Add	41.00	
08 38 19 00-0030	EA		56" x 96" Opening, Double Door, 0.063" Thick, Satin Anodized Finish, Tempered Aluminum Alloy Impact Traffic Door.....	785.14	68.28
			For Each 14" x 16" Window, Add	22.00	
			For Each 15" x 20" Window, Add	28.00	
			For Each 18" x 30" Window, Add	41.00	
08 38 19 00-0031	EA		60" x 96" Opening, Double Door, 0.063" Thick, Satin Anodized Finish, Tempered Aluminum Alloy Impact Traffic Door.....	805.65	68.28
			For Each 14" x 16" Window, Add	22.00	
			For Each 15" x 20" Window, Add	28.00	
			For Each 18" x 30" Window, Add	41.00	
08 38 19 00-0032	EA		64" x 96" Opening, Double Door, 0.063" Thick, Satin Anodized Finish, Tempered Aluminum Alloy Impact Traffic Door.....	826.15	68.28
			For Each 14" x 16" Window, Add	22.00	
			For Each 15" x 20" Window, Add	28.00	
			For Each 18" x 30" Window, Add	41.00	
08 38 19 00-0033	EA		72" x 96" Opening, Double Door, 0.063" Thick, Satin Anodized Finish, Tempered Aluminum Alloy Impact Traffic Door.....	902.58	71.87
			For Each 14" x 16" Window, Add	22.00	
			For Each 15" x 20" Window, Add	28.00	
			For Each 18" x 30" Window, Add	41.00	
08 38 19 00-0034	EA		80" x 96" Opening, Double Door, 0.063" Thick, Satin Anodized Finish, Tempered Aluminum Alloy Impact Traffic Door.....	917.97	71.87
			For Each 14" x 16" Window, Add	22.00	
			For Each 15" x 20" Window, Add	28.00	
			For Each 18" x 30" Window, Add	41.00	
08 38 19 00-0035	EA		84" x 96" Opening, Double Door, 0.063" Thick, Satin Anodized Finish, Tempered Aluminum Alloy Impact Traffic Door.....	933.35	71.87
			For Each 14" x 16" Window, Add	22.00	
			For Each 15" x 20" Window, Add	28.00	
			For Each 18" x 30" Window, Add	41.00	
08 38 19 00-0036			3/4" Thick, Polymer Cell Core Impact Traffic Doors (Eliason P-11 Plus) <small>(08 38 19 00-0036)</small>		
			Note: Includes 0.125" thick thermoplastic exterior finish, 14 gauge back channel and a 14" x 16" acrylic window.		
08 38 19 00-0037			Single Door, 3/4" Thick, Polymer Cell Core Impact Traffic Doors <small>(08 38 19 00-0036)</small>		
08 38 19 00-0038			84" Height, Single Door, 3/4" Thick, Polymer Cell Core Impact Traffic Doors <small>(08 38 19 00-0037)</small>		
08 38 19 00-0039	EA		24" x 84" Opening, Single Door, 3/4" Thick, Polymer Cell Core Impact Traffic Door.....	581.53	39.53
			For Each 15" x 20" Window, Add	6.00	
			For Each 18" x 30" Window, Add	19.00	
08 38 19 00-0040	EA		28" x 84" Opening, Single Door, 3/4" Thick, Polymer Cell Core Impact Traffic Door.....	641.77	39.53
			For Each 15" x 20" Window, Add	6.00	
			For Each 18" x 30" Window, Add	19.00	
08 38 19 00-0041	EA		30" x 84" Opening, Single Door, 3/4" Thick, Polymer Cell Core Impact Traffic Door.....	669.73	41.33
			For Each 15" x 20" Window, Add	6.00	
			For Each 18" x 30" Window, Add	19.00	
08 38 19 00-0042	EA		32" x 84" Opening, Single Door, 3/4" Thick, Polymer Cell Core Impact Traffic Door.....	695.36	41.33
			For Each 15" x 20" Window, Add	6.00	
			For Each 18" x 30" Window, Add	19.00	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
				08 38 19 00-0043 EA 36" x 84" Opening, Single Door, 3/4" Thick, Polymer Cell Core Impact Traffic Door 706.67		43.12
				For Each 15" x 20" Window, Add 6.00		
				For Each 18" x 30" Window, Add 19.00		
				08 38 19 00-0044 EA 40" x 84" Opening, Single Door, 3/4" Thick, Polymer Cell Core Impact Traffic Door 759.22		43.12
				For Each 15" x 20" Window, Add 6.00		
				For Each 18" x 30" Window, Add 19.00		
				08 38 19 00-0045 EA 42" x 84" Opening, Single Door, 3/4" Thick, Polymer Cell Core Impact Traffic Door 817.41		48.51
				For Each 15" x 20" Window, Add 6.00		
				For Each 18" x 30" Window, Add 19.00		
				08 38 19 00-0046 EA 44" x 84" Opening, Single Door, 3/4" Thick, Polymer Cell Core Impact Traffic Door 826.38		48.51
				For Each 15" x 20" Window, Add 6.00		
				For Each 18" x 30" Window, Add 19.00		
				08 38 19 00-0047 96" Height, Single Door, 3/4" Thick, Polymer Cell Core Impact Traffic Doors		
				<small>(08 38 19 00-0037)</small>		
				08 38 19 00-0048 EA 24" x 96" Opening, Single Door, 3/4" Thick, Polymer Cell Core Impact Traffic Door 632.80		39.53
				For Each 15" x 20" Window, Add 6.00		
				For Each 18" x 30" Window, Add 19.00		
				08 38 19 00-0049 EA 28" x 96" Opening, Single Door, 3/4" Thick, Polymer Cell Core Impact Traffic Door 695.61		39.53
				For Each 15" x 20" Window, Add 6.00		
				For Each 18" x 30" Window, Add 19.00		
				08 38 19 00-0050 EA 30" x 96" Opening, Single Door, 3/4" Thick, Polymer Cell Core Impact Traffic Door 723.57		41.33
				For Each 15" x 20" Window, Add 6.00		
				For Each 18" x 30" Window, Add 19.00		
				08 38 19 00-0051 EA 32" x 96" Opening, Single Door, 3/4" Thick, Polymer Cell Core Impact Traffic Door 755.61		41.33
				For Each 15" x 20" Window, Add 6.00		
				For Each 18" x 30" Window, Add 19.00		
				08 38 19 00-0052 EA 36" x 96" Opening, Single Door, 3/4" Thick, Polymer Cell Core Impact Traffic Door 782.29		43.12
				For Each 15" x 20" Window, Add 6.00		
				For Each 18" x 30" Window, Add 19.00		
				08 38 19 00-0053 EA 40" x 96" Opening, Single Door, 3/4" Thick, Polymer Cell Core Impact Traffic Door 833.57		43.12
				For Each 15" x 20" Window, Add 6.00		
				For Each 18" x 30" Window, Add 19.00		
				08 38 19 00-0054 EA 42" x 96" Opening, Single Door, 3/4" Thick, Polymer Cell Core Impact Traffic Door 864.84		48.51
				For Each 15" x 20" Window, Add 6.00		
				For Each 18" x 30" Window, Add 19.00		
				08 38 19 00-0055 EA 44" x 96" Opening, Single Door, 3/4" Thick, Polymer Cell Core Impact Traffic Door 896.88		48.51
				For Each 15" x 20" Window, Add 6.00		
				For Each 18" x 30" Window, Add 19.00		
				08 38 19 00-0056 Double Door, 3/4" Thick, Polymer Cell Core Impact Traffic Doors <small>(08 38 19 00-0036)</small>		
				08 38 19 00-0057 84" Height, Double Door, 3/4" Thick, Polymer Cell Core Impact Traffic Doors <small>(08 38 19 00-0056)</small>		
				08 38 19 00-0058 EA 48" x 84" Opening, Double Door, 3/4" Thick, Polymer Cell Core Impact Traffic Door 1,141.48		68.28
				For Each 15" x 20" Window, Add 6.00		
				For Each 18" x 30" Window, Add 19.00		
				08 38 19 00-0059 EA 56" x 84" Opening, Double Door, 3/4" Thick, Polymer Cell Core Impact Traffic Door 1,261.98		68.28
				For Each 15" x 20" Window, Add 6.00		
				For Each 18" x 30" Window, Add 19.00		
				08 38 19 00-0060 EA 60" x 84" Opening, Double Door, 3/4" Thick, Polymer Cell Core Impact Traffic Door 1,310.69		68.28
				For Each 15" x 20" Window, Add 6.00		
				For Each 18" x 30" Window, Add 19.00		
				08 38 19 00-0061 EA 64" x 84" Opening, Double Door, 3/4" Thick, Polymer Cell Core Impact Traffic Door 1,361.96		68.28
				For Each 15" x 20" Window, Add 6.00		
				For Each 18" x 30" Window, Add 19.00		
				08 38 19 00-0062 EA 72" x 84" Opening, Double Door, 3/4" Thick, Polymer Cell Core Impact Traffic Door 1,384.55		71.87
				For Each 15" x 20" Window, Add 6.00		
				For Each 18" x 30" Window, Add 19.00		
				08 38 19 00-0063 EA 80" x 84" Opening, Double Door, 3/4" Thick, Polymer Cell Core Impact Traffic Door 1,489.66		71.87
				For Each 15" x 20" Window, Add 6.00		
				For Each 18" x 30" Window, Add 19.00		
				08 38 19 00-0064 EA 84" x 84" Opening, Double Door, 3/4" Thick, Polymer Cell Core Impact Traffic Door 1,584.52		71.87
				For Each 15" x 20" Window, Add 6.00		
				For Each 18" x 30" Window, Add 19.00		
				08 38 19 00-0065 EA 88" x 84" Opening, Double Door, 3/4" Thick, Polymer Cell Core Impact Traffic Door 1,602.46		71.87
				For Each 15" x 20" Window, Add 6.00		
				For Each 18" x 30" Window, Add 19.00		
				08 38 19 00-0066 96" Height, Double Door, 3/4" Thick, Polymer Cell Core Impact Traffic Doors <small>(08 38 19 00-0056)</small>		
				08 38 19 00-0067 EA 48" x 96" Opening, Double Door, 3/4" Thick, Polymer Cell Core Impact Traffic Door 1,244.03		68.28
				For Each 15" x 20" Window, Add 6.00		
				For Each 18" x 30" Window, Add 19.00		
				08 38 19 00-0068 EA 56" x 96" Opening, Double Door, 3/4" Thick, Polymer Cell Core Impact Traffic Door 1,369.65		68.28
				For Each 15" x 20" Window, Add 6.00		
				For Each 18" x 30" Window, Add 19.00		
				08 38 19 00-0069 EA 60" x 96" Opening, Double Door, 3/4" Thick, Polymer Cell Core Impact Traffic Door 1,418.36		68.28
				For Each 15" x 20" Window, Add 6.00		
				For Each 18" x 30" Window, Add 19.00		

08	Openings
08 30	Specialty Doors And Frames
08 38	Traffic Doors



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 38 19 00-0070	EA		64" x 96" Opening, Double Door, 3/4" Thick, Polymer Cell Core Impact Traffic Door.....	1,482.45	68.28
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0071	EA		72" x 96" Opening, Double Door, 3/4" Thick, Polymer Cell Core Impact Traffic Door.....	1,535.81	71.87
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0072	EA		80" x 96" Opening, Double Door, 3/4" Thick, Polymer Cell Core Impact Traffic Door.....	1,638.35	71.87
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0073	EA		84" x 96" Opening, Double Door, 3/4" Thick, Polymer Cell Core Impact Traffic Door.....	1,679.37	71.87
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0074	EA		88" x 96" Opening, Double Door, 3/4" Thick, Polymer Cell Core Impact Traffic Door.....	1,743.46	71.87
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0075			3/4" Thick, Double Ply Acrylonitrile Butadiene Styrene (ABS) Impact Traffic Doors (Eliason PMP-2) <small>(08 38 19)</small>		
			Note: Includes textured finish, 16 gauge back channel and a 14" x 16" window.		
08 38 19 00-0076			Single Door, 3/4" Thick, Double Ply Acrylonitrile Butadiene Styrene (ABS) Impact Traffic Doors <small>(08 38 19 00-0075)</small>		
08 38 19 00-0077			84" Height, Single Door, 3/4" Thick, Double Ply Acrylonitrile Butadiene Styrene (ABS) Impact Traffic Doors <small>(08 38 19 00-0075)</small>		
08 38 19 00-0078	EA		24" x 84" Opening, Single Door, 3/4" Thick, Double Ply Acrylonitrile Butadiene Styrene (ABS) Impact Traffic Door.....	612.29	39.53
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0079	EA		28" x 84" Opening, Single Door, 3/4" Thick, Double Ply Acrylonitrile Butadiene Styrene (ABS) Impact Traffic Door.....	689.20	39.53
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0080	EA		30" x 84" Opening, Single Door, 3/4" Thick, Double Ply Acrylonitrile Butadiene Styrene (ABS) Impact Traffic Door.....	713.31	41.33
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0081	EA		32" x 84" Opening, Single Door, 3/4" Thick, Double Ply Acrylonitrile Butadiene Styrene (ABS) Impact Traffic Door.....	721.00	41.33
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0082	EA		36" x 84" Opening, Single Door, 3/4" Thick, Double Ply Acrylonitrile Butadiene Styrene (ABS) Impact Traffic Door.....	732.30	43.12
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0083	EA		40" x 84" Opening, Single Door, 3/4" Thick, Double Ply Acrylonitrile Butadiene Styrene (ABS) Impact Traffic Door.....	804.08	43.12
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0084	EA		42" x 84" Opening, Single Door, 3/4" Thick, Double Ply Acrylonitrile Butadiene Styrene (ABS) Impact Traffic Door.....	873.81	48.51
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0085	EA		44" x 84" Opening, Single Door, 3/4" Thick, Double Ply Acrylonitrile Butadiene Styrene (ABS) Impact Traffic Door.....	882.78	48.51
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0086			96" Height, Single Door, 3/4" Thick, Double Ply Acrylonitrile Butadiene Styrene (ABS) Impact Traffic Doors <small>(08 38 19 00-0075)</small>		
08 38 19 00-0087	EA		24" x 96" Opening, Single Door, 3/4" Thick, Double Ply Acrylonitrile Butadiene Styrene (ABS) Impact Traffic Door.....	628.96	39.53
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0088	EA		28" x 96" Opening, Single Door, 3/4" Thick, Double Ply Acrylonitrile Butadiene Styrene (ABS) Impact Traffic Door.....	723.81	39.53
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0089	EA		30" x 96" Opening, Single Door, 3/4" Thick, Double Ply Acrylonitrile Butadiene Styrene (ABS) Impact Traffic Door.....	749.20	41.33
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0090	EA		32" x 96" Opening, Single Door, 3/4" Thick, Double Ply Acrylonitrile Butadiene Styrene (ABS) Impact Traffic Door.....	759.46	41.33
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0091	EA		36" x 96" Opening, Single Door, 3/4" Thick, Double Ply Acrylonitrile Butadiene Styrene (ABS) Impact Traffic Door.....	765.63	43.12
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0092	EA		40" x 96" Opening, Single Door, 3/4" Thick, Double Ply Acrylonitrile Butadiene Styrene (ABS) Impact Traffic Door.....	818.18	43.12
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0093	EA		42" x 96" Opening, Single Door, 3/4" Thick, Double Ply Acrylonitrile Butadiene Styrene (ABS) Impact Traffic Door.....	886.63	48.51
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0094	EA		44" x 96" Opening, Single Door, 3/4" Thick, Double Ply Acrylonitrile Butadiene Styrene (ABS) Impact Traffic Door.....	896.88	48.51
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0095			Double Door, 3/4" Thick, Double Ply Acrylonitrile Butadiene Styrene (ABS) Impact Traffic Doors <small>(08 38 19 00-0075)</small>		



Openings	08	08
Specialty Doors And Frames	08 30	
Traffic Doors	08 38	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 38 19 00-0096 84" Height, Double Door, 3/4" Thick, Double Ply Acrylonitrile Butadiene Styrene (ABS) Impact Traffic Doors <small>(08 38 19 00-0095)</small>		
08 38 19 00-0097 EA 48" x 84" Opening, Double Door, 3/4" Thick, Double Ply Acrylonitrile Butadiene Styrene (ABS) Impact Traffic Door.....	1,203.01	68.28
For Each 15" x 20" Window, Add	6.00	
For Each 18" x 30" Window, Add	19.00	
08 38 19 00-0098 EA 56" x 84" Opening, Double Door, 3/4" Thick, Double Ply Acrylonitrile Butadiene Styrene (ABS) Impact Traffic Door.....	1,356.83	68.28
For Each 15" x 20" Window, Add	6.00	
For Each 18" x 30" Window, Add	19.00	
08 38 19 00-0099 EA 60" x 84" Opening, Double Door, 3/4" Thick, Double Ply Acrylonitrile Butadiene Styrene (ABS) Impact Traffic Door.....	1,397.85	68.28
For Each 15" x 20" Window, Add	6.00	
For Each 18" x 30" Window, Add	19.00	
08 38 19 00-0100 EA 64" x 84" Opening, Double Door, 3/4" Thick, Double Ply Acrylonitrile Butadiene Styrene (ABS) Impact Traffic Door.....	1,413.23	68.28
For Each 15" x 20" Window, Add	6.00	
For Each 18" x 30" Window, Add	19.00	
08 38 19 00-0101 EA 72" x 84" Opening, Double Door, 3/4" Thick, Double Ply Acrylonitrile Butadiene Styrene (ABS) Impact Traffic Door.....	1,435.82	71.87
For Each 15" x 20" Window, Add	6.00	
For Each 18" x 30" Window, Add	19.00	
08 38 19 00-0102 EA 80" x 84" Opening, Double Door, 3/4" Thick, Double Ply Acrylonitrile Butadiene Styrene (ABS) Impact Traffic Door.....	1,579.39	71.87
For Each 15" x 20" Window, Add	6.00	
For Each 18" x 30" Window, Add	19.00	
08 38 19 00-0103 EA 84" x 84" Opening, Double Door, 3/4" Thick, Double Ply Acrylonitrile Butadiene Styrene (ABS) Impact Traffic Door.....	1,697.32	71.87
For Each 15" x 20" Window, Add	6.00	
For Each 18" x 30" Window, Add	19.00	
08 38 19 00-0104 EA 88" x 84" Opening, Double Door, 3/4" Thick, Double Ply Acrylonitrile Butadiene Styrene (ABS) Impact Traffic Door.....	1,715.26	71.87
For Each 15" x 20" Window, Add	6.00	
For Each 18" x 30" Window, Add	19.00	
08 38 19 00-0105 96" Height, Double Door, 3/4" Thick, Double Ply Acrylonitrile Butadiene Styrene (ABS) Impact Traffic Doors <small>(08 38 19 00-0095)</small>		
08 38 19 00-0106 EA 48" x 96" Opening, Double Door, 3/4" Thick, Double Ply Acrylonitrile Butadiene Styrene (ABS) Impact Traffic Door.....	1,236.34	68.28
For Each 15" x 20" Window, Add	6.00	
For Each 18" x 30" Window, Add	19.00	
08 38 19 00-0107 EA 56" x 96" Opening, Double Door, 3/4" Thick, Double Ply Acrylonitrile Butadiene Styrene (ABS) Impact Traffic Door.....	1,426.05	68.28
For Each 15" x 20" Window, Add	6.00	
For Each 18" x 30" Window, Add	19.00	
08 38 19 00-0108 EA 60" x 96" Opening, Double Door, 3/4" Thick, Double Ply Acrylonitrile Butadiene Styrene (ABS) Impact Traffic Door.....	1,469.63	68.28
For Each 15" x 20" Window, Add	6.00	
For Each 18" x 30" Window, Add	19.00	
08 38 19 00-0109 EA 64" x 96" Opening, Double Door, 3/4" Thick, Double Ply Acrylonitrile Butadiene Styrene (ABS) Impact Traffic Door.....	1,490.14	68.28
For Each 15" x 20" Window, Add	6.00	
For Each 18" x 30" Window, Add	19.00	
08 38 19 00-0110 EA 72" x 96" Opening, Double Door, 3/4" Thick, Double Ply Acrylonitrile Butadiene Styrene (ABS) Impact Traffic Door.....	1,502.48	71.87
For Each 15" x 20" Window, Add	6.00	
For Each 18" x 30" Window, Add	19.00	
08 38 19 00-0111 EA 80" x 96" Opening, Double Door, 3/4" Thick, Double Ply Acrylonitrile Butadiene Styrene (ABS) Impact Traffic Door.....	1,607.59	71.87
For Each 15" x 20" Window, Add	6.00	
For Each 18" x 30" Window, Add	19.00	
08 38 19 00-0112 EA 84" x 96" Opening, Double Door, 3/4" Thick, Double Ply Acrylonitrile Butadiene Styrene (ABS) Impact Traffic Door.....	1,722.95	71.87
For Each 15" x 20" Window, Add	6.00	
For Each 18" x 30" Window, Add	19.00	
08 38 19 00-0113 EA 88" x 96" Opening, Double Door, 3/4" Thick, Double Ply Acrylonitrile Butadiene Styrene (ABS) Impact Traffic Door.....	1,743.46	71.87
For Each 15" x 20" Window, Add	6.00	
For Each 18" x 30" Window, Add	19.00	
08 38 19 00-0114 1" Thick, Exterior Grade Solid Wood Core Impact Traffic Doors (Eliaison SCP-2) <small>(08 38 19)</small>		
Note: Includes 0.032" tempered aluminum alloy top panel, 48" high 16 gauge stainless steel front and galvanized back base plate, 14 gauge galvanized steel back channel and a 9" x 14" window.		
08 38 19 00-0115 Single Door, 1" Thick, Exterior Grade Solid Wood Core Impact Traffic Doors <small>(08 38 19 00-0114)</small>		
08 38 19 00-0116 84" Height, Single Door, 1" Thick, Exterior Grade Solid Wood Core Impact Traffic Doors <small>(08 38 19 00-0115)</small>		
08 38 19 00-0117 EA 24" x 84" Opening, Single Door, 1" Thick, Exterior Grade Solid Wood Core Impact Traffic Door.....	766.11	39.53
For Each 14" x 16" Window, Add	22.00	
For Each 15" x 20" Window, Add	28.00	
For Each 18" x 30" Window, Add	41.00	
08 38 19 00-0118 EA 28" x 84" Opening, Single Door, 1" Thick, Exterior Grade Solid Wood Core Impact Traffic Door.....	834.05	39.53
For Each 14" x 16" Window, Add	22.00	
For Each 15" x 20" Window, Add	28.00	
For Each 18" x 30" Window, Add	41.00	
08 38 19 00-0119 EA 30" x 84" Opening, Single Door, 1" Thick, Exterior Grade Solid Wood Core Impact Traffic Door.....	855.59	41.33
For Each 14" x 16" Window, Add	22.00	
For Each 15" x 20" Window, Add	28.00	
For Each 18" x 30" Window, Add	41.00	
08 38 19 00-0120 EA 32" x 84" Opening, Single Door, 1" Thick, Exterior Grade Solid Wood Core Impact Traffic Door.....	872.26	41.33
For Each 14" x 16" Window, Add	22.00	
For Each 15" x 20" Window, Add	28.00	
For Each 18" x 30" Window, Add	41.00	

08 Openings**08 30 Specialty Doors And Frames****08 38 Traffic Doors**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 38 19 00-0121	EA		36" x 84" Opening, Single Door, 1" Thick, Exterior Grade Solid Wood Core Impact Traffic Door.....	904.07	43.12
			<i>For Each 14" x 16" Window, Add</i>	22.00	
			<i>For Each 15" x 20" Window, Add</i>	28.00	
			<i>For Each 18" x 30" Window, Add</i>	41.00	
08 38 19 00-0122	EA		40" x 84" Opening, Single Door, 1" Thick, Exterior Grade Solid Wood Core Impact Traffic Door.....	936.11	43.12
			<i>For Each 14" x 16" Window, Add</i>	22.00	
			<i>For Each 15" x 20" Window, Add</i>	28.00	
			<i>For Each 18" x 30" Window, Add</i>	41.00	
08 38 19 00-0123	EA		42" x 84" Opening, Single Door, 1" Thick, Exterior Grade Solid Wood Core Impact Traffic Door.....	972.51	48.51
			<i>For Each 14" x 16" Window, Add</i>	22.00	
			<i>For Each 15" x 20" Window, Add</i>	28.00	
			<i>For Each 18" x 30" Window, Add</i>	41.00	
08 38 19 00-0124	EA		44" x 84" Opening, Single Door, 1" Thick, Exterior Grade Solid Wood Core Impact Traffic Door.....	994.30	48.51
			<i>For Each 14" x 16" Window, Add</i>	22.00	
			<i>For Each 15" x 20" Window, Add</i>	28.00	
			<i>For Each 18" x 30" Window, Add</i>	41.00	
08 38 19 00-0125			96" Height, Single Door, 1" Thick, Exterior Grade Solid Wood Core Impact Traffic Doors <small>(08 38 19 00-0115)</small>		
08 38 19 00-0126	EA		24" x 96" Opening, Single Door, 1" Thick, Exterior Grade Solid Wood Core Impact Traffic Door.....	823.79	39.53
			<i>For Each 14" x 16" Window, Add</i>	22.00	
			<i>For Each 15" x 20" Window, Add</i>	28.00	
			<i>For Each 18" x 30" Window, Add</i>	41.00	
08 38 19 00-0127	EA		28" x 96" Opening, Single Door, 1" Thick, Exterior Grade Solid Wood Core Impact Traffic Door.....	895.58	39.53
			<i>For Each 14" x 16" Window, Add</i>	22.00	
			<i>For Each 15" x 20" Window, Add</i>	28.00	
			<i>For Each 18" x 30" Window, Add</i>	41.00	
08 38 19 00-0128	EA		30" x 96" Opening, Single Door, 1" Thick, Exterior Grade Solid Wood Core Impact Traffic Door.....	918.40	41.33
			<i>For Each 14" x 16" Window, Add</i>	22.00	
			<i>For Each 15" x 20" Window, Add</i>	28.00	
			<i>For Each 18" x 30" Window, Add</i>	41.00	
08 38 19 00-0129	EA		32" x 96" Opening, Single Door, 1" Thick, Exterior Grade Solid Wood Core Impact Traffic Door.....	927.38	41.33
			<i>For Each 14" x 16" Window, Add</i>	22.00	
			<i>For Each 15" x 20" Window, Add</i>	28.00	
			<i>For Each 18" x 30" Window, Add</i>	41.00	
08 38 19 00-0130	EA		36" x 96" Opening, Single Door, 1" Thick, Exterior Grade Solid Wood Core Impact Traffic Door.....	956.62	43.12
			<i>For Each 14" x 16" Window, Add</i>	22.00	
			<i>For Each 15" x 20" Window, Add</i>	28.00	
			<i>For Each 18" x 30" Window, Add</i>	41.00	
08 38 19 00-0131	EA		40" x 96" Opening, Single Door, 1" Thick, Exterior Grade Solid Wood Core Impact Traffic Door.....	998.92	43.12
			<i>For Each 14" x 16" Window, Add</i>	22.00	
			<i>For Each 15" x 20" Window, Add</i>	28.00	
			<i>For Each 18" x 30" Window, Add</i>	41.00	
08 38 19 00-0132	EA		42" x 96" Opening, Single Door, 1" Thick, Exterior Grade Solid Wood Core Impact Traffic Door.....	1,030.19	48.51
			<i>For Each 14" x 16" Window, Add</i>	22.00	
			<i>For Each 15" x 20" Window, Add</i>	28.00	
			<i>For Each 18" x 30" Window, Add</i>	41.00	
08 38 19 00-0133	EA		44" x 96" Opening, Single Door, 1" Thick, Exterior Grade Solid Wood Core Impact Traffic Door.....	1,051.98	48.51
			<i>For Each 14" x 16" Window, Add</i>	22.00	
			<i>For Each 15" x 20" Window, Add</i>	28.00	
			<i>For Each 18" x 30" Window, Add</i>	41.00	
08 38 19 00-0134			Double Door, 1" Thick, Exterior Grade Solid Wood Core Impact Traffic Doors <small>(08 38 19 00-0114)</small>		
08 38 19 00-0135			84" Height, Double Door, 1" Thick, Exterior Grade Solid Wood Core Impact Traffic Doors <small>(08 38 19 00-0134)</small>		
08 38 19 00-0136	EA		48" x 84" Opening, Double Door, 1" Thick, Exterior Grade Solid Wood Core Impact Traffic Door.....	1,510.65	68.28
			<i>For Each 14" x 16" Window, Add</i>	22.00	
			<i>For Each 15" x 20" Window, Add</i>	28.00	
			<i>For Each 18" x 30" Window, Add</i>	41.00	
08 38 19 00-0137	EA		56" x 84" Opening, Double Door, 1" Thick, Exterior Grade Solid Wood Core Impact Traffic Door.....	1,646.53	68.28
			<i>For Each 14" x 16" Window, Add</i>	22.00	
			<i>For Each 15" x 20" Window, Add</i>	28.00	
			<i>For Each 18" x 30" Window, Add</i>	41.00	
08 38 19 00-0138	EA		60" x 84" Opening, Double Door, 1" Thick, Exterior Grade Solid Wood Core Impact Traffic Door.....	1,682.42	68.28
			<i>For Each 14" x 16" Window, Add</i>	22.00	
			<i>For Each 15" x 20" Window, Add</i>	28.00	
			<i>For Each 18" x 30" Window, Add</i>	41.00	
08 38 19 00-0139	EA		64" x 84" Opening, Double Door, 1" Thick, Exterior Grade Solid Wood Core Impact Traffic Door.....	1,715.74	68.28
			<i>For Each 14" x 16" Window, Add</i>	22.00	
			<i>For Each 15" x 20" Window, Add</i>	28.00	
			<i>For Each 18" x 30" Window, Add</i>	41.00	
08 38 19 00-0140	EA		72" x 84" Opening, Double Door, 1" Thick, Exterior Grade Solid Wood Core Impact Traffic Door.....	1,779.36	71.87
			<i>For Each 14" x 16" Window, Add</i>	22.00	
			<i>For Each 15" x 20" Window, Add</i>	28.00	
			<i>For Each 18" x 30" Window, Add</i>	41.00	
08 38 19 00-0141	EA		80" x 84" Opening, Double Door, 1" Thick, Exterior Grade Solid Wood Core Impact Traffic Door.....	1,843.45	71.87
			<i>For Each 14" x 16" Window, Add</i>	22.00	
			<i>For Each 15" x 20" Window, Add</i>	28.00	
			<i>For Each 18" x 30" Window, Add</i>	41.00	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
	08 38 19 00-0142	EA		84" x 84" Opening, Double Door, 1" Thick, Exterior Grade Solid Wood Core Impact Traffic Door <i>For Each 14" x 16" Window, Add</i> <i>For Each 15" x 20" Window, Add</i> <i>For Each 18" x 30" Window, Add</i>	1,894.72 22.00 28.00 41.00	71.87
	08 38 19 00-0143	EA		88" x 84" Opening, Double Door, 1" Thick, Exterior Grade Solid Wood Core Impact Traffic Door <i>For Each 14" x 16" Window, Add</i> <i>For Each 15" x 20" Window, Add</i> <i>For Each 18" x 30" Window, Add</i>	1,938.30 22.00 28.00 41.00	71.87
08 38 19 00-0144				96" Height, Double Door, 1" Thick, Exterior Grade Solid Wood Core Impact Traffic Doors <small>(08 38 19 00-0134)</small>		
	08 38 19 00-0145	EA		48" x 96" Opening, Double Door, 1" Thick, Exterior Grade Solid Wood Core Impact Traffic Door <i>For Each 14" x 16" Window, Add</i> <i>For Each 15" x 20" Window, Add</i> <i>For Each 18" x 30" Window, Add</i>	1,626.02 22.00 28.00 41.00	68.28
	08 38 19 00-0146	EA		56" x 96" Opening, Double Door, 1" Thick, Exterior Grade Solid Wood Core Impact Traffic Door <i>For Each 14" x 16" Window, Add</i> <i>For Each 15" x 20" Window, Add</i> <i>For Each 18" x 30" Window, Add</i>	1,769.58 22.00 28.00 41.00	68.28
	08 38 19 00-0147	EA		60" x 96" Opening, Double Door, 1" Thick, Exterior Grade Solid Wood Core Impact Traffic Door <i>For Each 14" x 16" Window, Add</i> <i>For Each 15" x 20" Window, Add</i> <i>For Each 18" x 30" Window, Add</i>	1,808.04 22.00 28.00 41.00	68.28
	08 38 19 00-0148	EA		64" x 96" Opening, Double Door, 1" Thick, Exterior Grade Solid Wood Core Impact Traffic Door <i>For Each 14" x 16" Window, Add</i> <i>For Each 15" x 20" Window, Add</i> <i>For Each 18" x 30" Window, Add</i>	1,825.98 22.00 28.00 41.00	68.28
	08 38 19 00-0149	EA		72" x 96" Opening, Double Door, 1" Thick, Exterior Grade Solid Wood Core Impact Traffic Door <i>For Each 14" x 16" Window, Add</i> <i>For Each 15" x 20" Window, Add</i> <i>For Each 18" x 30" Window, Add</i>	1,884.47 22.00 28.00 41.00	71.87
	08 38 19 00-0150	EA		80" x 96" Opening, Double Door, 1" Thick, Exterior Grade Solid Wood Core Impact Traffic Door <i>For Each 14" x 16" Window, Add</i> <i>For Each 15" x 20" Window, Add</i> <i>For Each 18" x 30" Window, Add</i>	1,969.07 22.00 28.00 41.00	71.87
	08 38 19 00-0151	EA		84" x 96" Opening, Double Door, 1" Thick, Exterior Grade Solid Wood Core Impact Traffic Door <i>For Each 14" x 16" Window, Add</i> <i>For Each 15" x 20" Window, Add</i> <i>For Each 18" x 30" Window, Add</i>	2,010.08 22.00 28.00 41.00	71.87
	08 38 19 00-0152	EA		88" x 96" Opening, Double Door, 1" Thick, Exterior Grade Solid Wood Core Impact Traffic Door <i>For Each 14" x 16" Window, Add</i> <i>For Each 15" x 20" Window, Add</i> <i>For Each 18" x 30" Window, Add</i>	2,053.67 22.00 28.00 41.00	71.87
	08 38 19 00-0153			1-1/2" Thick, Polymer Cell Core Impact Traffic Doors (Eliason HCP-10) <small>(08 38 19)</small> Note: Includes 0.125" thick thermoplastic exterior finish, 14" x 16" acrylic window and 18" high easy spring bumpers.		
	08 38 19 00-0154			Single Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Doors <small>(08 38 19 00-0153)</small>		
	08 38 19 00-0155			84" Height, Single Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Doors <small>(08 38 19 00-0154)</small>		
	08 38 19 00-0156	EA		24" x 84" Opening, Single Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Door <i>For Each 15" x 20" Window, Add</i> <i>For Each 18" x 30" Window, Add</i>	753.29 6.00 19.00	39.53
	08 38 19 00-0157	EA		28" x 84" Opening, Single Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Door <i>For Each 15" x 20" Window, Add</i> <i>For Each 18" x 30" Window, Add</i>	790.47 6.00 19.00	39.53
	08 38 19 00-0158	EA		30" x 84" Opening, Single Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Door <i>For Each 15" x 20" Window, Add</i> <i>For Each 18" x 30" Window, Add</i>	827.39 6.00 19.00	41.33
	08 38 19 00-0159	EA		32" x 84" Opening, Single Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Door <i>For Each 15" x 20" Window, Add</i> <i>For Each 18" x 30" Window, Add</i>	849.18 6.00 19.00	41.33
	08 38 19 00-0160	EA		36" x 84" Opening, Single Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Door <i>For Each 15" x 20" Window, Add</i> <i>For Each 18" x 30" Window, Add</i>	906.63 6.00 19.00	43.12
	08 38 19 00-0161	EA		40" x 84" Opening, Single Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Door <i>For Each 15" x 20" Window, Add</i> <i>For Each 18" x 30" Window, Add</i>	950.21 6.00 19.00	43.12
	08 38 19 00-0162	EA		42" x 84" Opening, Single Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Door <i>For Each 15" x 20" Window, Add</i> <i>For Each 18" x 30" Window, Add</i>	995.58 6.00 19.00	48.51
	08 38 19 00-0163	EA		44" x 84" Opening, Single Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Door <i>For Each 15" x 20" Window, Add</i> <i>For Each 18" x 30" Window, Add</i>	1,036.60 6.00 19.00	48.51
	08 38 19 00-0164			90" Height, Single Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Doors <small>(08 38 19 00-0154)</small>		

08 Openings**08 30 Specialty Doors And Frames****08 38 Traffic Doors**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 38 19 00-0165	EA		24" x 90" Opening, Single Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Door.....	778.93	39.53
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0166	EA		28" x 90" Opening, Single Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Door.....	823.79	39.53
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0167	EA		30" x 90" Opening, Single Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Door.....	849.18	41.33
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0168	EA		32" x 90" Opening, Single Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Door.....	879.95	41.33
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0169	EA		36" x 90" Opening, Single Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Door.....	941.24	43.12
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0170	EA		40" x 90" Opening, Single Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Door.....	993.80	43.12
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0171	EA		42" x 90" Opening, Single Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Door.....	1,036.60	48.51
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0172	EA		44" x 90" Opening, Single Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Door.....	1,075.06	48.51
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0173			96" Height, Single Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Doors <small>(08 38 19 00-0154)</small>		
08 38 19 00-0174	EA		24" x 96" Opening, Single Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Door.....	844.30	39.53
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0175	EA		28" x 96" Opening, Single Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Door.....	853.28	39.53
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0176	EA		30" x 96" Opening, Single Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Door.....	894.05	41.33
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0177	EA		32" x 96" Opening, Single Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Door.....	922.25	41.33
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0178	EA		36" x 96" Opening, Single Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Door.....	984.82	43.12
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0179	EA		40" x 96" Opening, Single Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Door.....	1,047.63	43.12
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0180	EA		42" x 96" Opening, Single Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Door.....	1,087.87	48.51
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0181	EA		44" x 96" Opening, Single Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Door.....	1,126.33	48.51
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0182			Double Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Doors <small>(08 38 19 00-0153)</small>		
08 38 19 00-0183			84" Height, Double Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Doors <small>(08 38 19 00-0182)</small>		
08 38 19 00-0184	EA		48" x 84" Opening, Double Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Door.....	1,485.02	68.28
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0185	EA		56" x 84" Opening, Double Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Door.....	1,559.36	68.28
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0186	EA		60" x 84" Opening, Double Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Door.....	1,626.02	68.28
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0187	EA		64" x 84" Opening, Double Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Door.....	1,669.60	68.28
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0188	EA		72" x 84" Opening, Double Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Door.....	1,784.48	71.87
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0189	EA		80" x 84" Opening, Double Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Door.....	1,871.65	71.87
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0190	EA		84" x 84" Opening, Double Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Door.....	1,940.87	71.87
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0191	EA		88" x 84" Opening, Double Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Door.....	2,022.90	71.87
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 38 19 00-0192			90" Height, Double Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Doors <small>(08 38 19 00-0192)</small>		
08 38 19 00-0193	EA		48" x 90" Opening, Double Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Door.....	1,536.29	68.28
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0194	EA		56" x 90" Opening, Double Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Door.....	1,626.02	68.28
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0195	EA		60" x 90" Opening, Double Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Door.....	1,669.60	68.28
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0196	EA		64" x 90" Opening, Double Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Door.....	1,731.13	68.28
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0197	EA		72" x 90" Opening, Double Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Door.....	1,853.70	71.87
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0198	EA		80" x 90" Opening, Double Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Door.....	1,958.81	71.87
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0199	EA		84" x 90" Opening, Double Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Door.....	2,022.90	71.87
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0200	EA		88" x 90" Opening, Double Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Door.....	2,099.81	71.87
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0201			96" Height, Double Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Doors <small>(08 38 19 00-0192)</small>		
08 38 19 00-0202	EA		48" x 96" Opening, Double Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Door.....	1,667.03	68.28
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0203	EA		56" x 96" Opening, Double Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Door.....	1,684.98	68.28
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0204	EA		60" x 96" Opening, Double Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Door.....	1,759.33	68.28
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0205	EA		64" x 96" Opening, Double Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Door.....	1,815.73	68.28
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0206	EA		72" x 96" Opening, Double Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Door.....	1,940.87	71.87
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0207	EA		80" x 96" Opening, Double Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Door.....	2,066.48	71.87
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0208	EA		84" x 96" Opening, Double Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Door.....	2,125.45	71.87
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0209	EA		88" x 96" Opening, Double Door, 1-1/2" Thick, Polymer Cell Core Impact Traffic Door.....	2,202.36	71.87
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0210			1-1/2" Thick, Urethane Foam Core Impact Traffic Doors (Eliason HFG-10) <small>(08 38 19)</small>		
			Note: Includes 0.125" thick thermoplastic exterior finish, 14" x 16" acrylic window, 18" high easy spring bumpers, and perimeter gasketing.		
08 38 19 00-0211			Single Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Doors <small>(08 38 19 00-0210)</small>		
08 38 19 00-0212			84" Height, Single Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Doors <small>(08 38 19 00-0211)</small>		
08 38 19 00-0213	EA		24" x 84" Opening, Single Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Door	753.29	39.53
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0214	EA		28" x 84" Opening, Single Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Door	790.47	39.53
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0215	EA		30" x 84" Opening, Single Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Door	827.39	41.33
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0216	EA		32" x 84" Opening, Single Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Door	849.18	41.33
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0217	EA		36" x 84" Opening, Single Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Door	906.63	43.12
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0218	EA		40" x 84" Opening, Single Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Door	950.21	43.12
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	

08 Openings**08 30 Specialty Doors And Frames****08 38 Traffic Doors**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 38 19 00-0219	EA		42" x 84" Opening, Single Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Door.....	995.58	48.51
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0220	EA		44" x 84" Opening, Single Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Door.....	1,036.60	48.51
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0221			90" Height, Single Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Doors <small>(08 38 19 00-0211)</small>		
08 38 19 00-0222	EA		24" x 90" Opening, Single Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Door.....	778.93	39.53
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0223	EA		28" x 90" Opening, Single Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Door.....	823.79	39.53
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0224	EA		30" x 90" Opening, Single Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Door.....	849.18	41.33
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0225	EA		32" x 90" Opening, Single Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Door.....	879.95	41.33
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0226	EA		36" x 90" Opening, Single Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Door.....	941.24	43.12
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0227	EA		40" x 90" Opening, Single Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Door.....	993.80	43.12
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0228	EA		42" x 90" Opening, Single Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Door.....	1,036.60	48.51
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0229	EA		44" x 90" Opening, Single Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Door.....	1,075.06	48.51
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0230			96" Height, Single Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Doors <small>(08 38 19 00-0211)</small>		
08 38 19 00-0231	EA		24" x 96" Opening, Single Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Door.....	844.30	39.53
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0232	EA		28" x 96" Opening, Single Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Door.....	853.28	39.53
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0233	EA		30" x 96" Opening, Single Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Door.....	894.05	41.33
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0234	EA		32" x 96" Opening, Single Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Door.....	922.25	41.33
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0235	EA		36" x 96" Opening, Single Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Door.....	984.82	43.12
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0236	EA		40" x 96" Opening, Single Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Door.....	1,047.63	43.12
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0237	EA		42" x 96" Opening, Single Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Door.....	1,087.87	48.51
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0238	EA		44" x 96" Opening, Single Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Door.....	1,126.33	48.51
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0239			Double Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Doors <small>(08 38 19 00-0210)</small>		
08 38 19 00-0240			84" Height, Double Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Doors <small>(08 38 19 00-0239)</small>		
08 38 19 00-0241	EA		48" x 84" Opening, Double Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Door.....	1,485.02	68.28
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0242	EA		56" x 84" Opening, Double Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Door.....	1,559.36	68.28
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0243	EA		60" x 84" Opening, Double Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Door.....	1,626.02	68.28
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0244	EA		64" x 84" Opening, Double Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Door.....	1,669.60	68.28
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	
08 38 19 00-0245	EA		72" x 84" Opening, Double Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Door.....	1,784.48	71.87
			<i>For Each 15" x 20" Window, Add</i>	6.00	
			<i>For Each 18" x 30" Window, Add</i>	19.00	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
	08 38 19 00-0246	EA		80" x 84" Opening, Double Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Door <i>For Each 15" x 20" Window, Add</i> <i>For Each 18" x 30" Window, Add</i>	1,871.65 6.00 19.00	71.87
	08 38 19 00-0247	EA		84" x 84" Opening, Double Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Door <i>For Each 15" x 20" Window, Add</i> <i>For Each 18" x 30" Window, Add</i>	1,940.87 6.00 19.00	71.87
	08 38 19 00-0248	EA		88" x 84" Opening, Double Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Door <i>For Each 15" x 20" Window, Add</i> <i>For Each 18" x 30" Window, Add</i>	2,022.90 6.00 19.00	71.87
	08 38 19 00-0249			90" Height, Double Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Doors <small>(08 38 19 00-0239)</small>		
	08 38 19 00-0250	EA		48" x 90" Opening, Double Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Door <i>For Each 15" x 20" Window, Add</i> <i>For Each 18" x 30" Window, Add</i>	1,536.29 6.00 19.00	68.28
	08 38 19 00-0251	EA		56" x 90" Opening, Double Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Door <i>For Each 15" x 20" Window, Add</i> <i>For Each 18" x 30" Window, Add</i>	1,626.02 6.00 19.00	68.28
	08 38 19 00-0252	EA		60" x 90" Opening, Double Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Door <i>For Each 15" x 20" Window, Add</i> <i>For Each 18" x 30" Window, Add</i>	1,669.60 6.00 19.00	68.28
	08 38 19 00-0253	EA		64" x 90" Opening, Double Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Door <i>For Each 15" x 20" Window, Add</i> <i>For Each 18" x 30" Window, Add</i>	1,731.13 6.00 19.00	68.28
	08 38 19 00-0254	EA		72" x 90" Opening, Double Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Door <i>For Each 15" x 20" Window, Add</i> <i>For Each 18" x 30" Window, Add</i>	1,853.70 6.00 19.00	71.87
	08 38 19 00-0255	EA		80" x 90" Opening, Double Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Door <i>For Each 15" x 20" Window, Add</i> <i>For Each 18" x 30" Window, Add</i>	1,958.81 6.00 19.00	71.87
	08 38 19 00-0256	EA		84" x 90" Opening, Double Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Door <i>For Each 15" x 20" Window, Add</i> <i>For Each 18" x 30" Window, Add</i>	2,022.90 6.00 19.00	71.87
	08 38 19 00-0257	EA		88" x 90" Opening, Double Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Door <i>For Each 15" x 20" Window, Add</i> <i>For Each 18" x 30" Window, Add</i>	2,099.81 6.00 19.00	71.87
	08 38 19 00-0258			96" Height, Double Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Doors <small>(08 38 19 00-0239)</small>		
	08 38 19 00-0259	EA		48" x 96" Opening, Double Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Door <i>For Each 15" x 20" Window, Add</i> <i>For Each 18" x 30" Window, Add</i>	1,667.03 6.00 19.00	68.28
	08 38 19 00-0260	EA		56" x 96" Opening, Double Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Door <i>For Each 15" x 20" Window, Add</i> <i>For Each 18" x 30" Window, Add</i>	1,684.98 6.00 19.00	68.28
	08 38 19 00-0261	EA		60" x 96" Opening, Double Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Door <i>For Each 15" x 20" Window, Add</i> <i>For Each 18" x 30" Window, Add</i>	1,759.33 6.00 19.00	68.28
	08 38 19 00-0262	EA		64" x 96" Opening, Double Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Door <i>For Each 15" x 20" Window, Add</i> <i>For Each 18" x 30" Window, Add</i>	1,815.73 6.00 19.00	68.28
	08 38 19 00-0263	EA		72" x 96" Opening, Double Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Door <i>For Each 15" x 20" Window, Add</i> <i>For Each 18" x 30" Window, Add</i>	1,940.87 6.00 19.00	71.87
	08 38 19 00-0264	EA		80" x 96" Opening, Double Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Door <i>For Each 15" x 20" Window, Add</i> <i>For Each 18" x 30" Window, Add</i>	2,066.48 6.00 19.00	71.87
	08 38 19 00-0265	EA		84" x 96" Opening, Double Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Door <i>For Each 15" x 20" Window, Add</i> <i>For Each 18" x 30" Window, Add</i>	2,125.45 6.00 19.00	71.87
	08 38 19 00-0266	EA		88" x 96" Opening, Double Door, 1-1/2" Thick, Urethane Foam Core Impact Traffic Door <i>For Each 15" x 20" Window, Add</i> <i>For Each 18" x 30" Window, Add</i>	2,202.36 6.00 19.00	71.87
	08 38 19 00-0267			Rigid Impact Traffic Door Accessories <small>(08 38 19)</small>		
	08 38 19 00-0268			Bumper Strips For Impact Traffic Doors <small>(08 38 19 00-0267)</small> Note: Includes two bumpers per set.		
	08 38 19 00-0269	SET		24" Wide, Bumper Strips For Impact Traffic Doors	76.18	28.75
	08 38 19 00-0270	SET		30" Wide, Bumper Strips For Impact Traffic Doors	82.59	28.75
	08 38 19 00-0271	SET		36" Wide, Bumper Strips For Impact Traffic Doors	87.71	28.75
	08 38 19 00-0272	SET		48" Wide, Bumper Strips For Impact Traffic Doors	96.69	28.75
	08 38 19 00-0273			Easy Spring Bumpers For Impact Traffic Doors <small>(08 38 19 00-0267)</small> Note: Includes two bumpers per set.		
	08 38 19 00-0274	SET		18" Height, Easy Spring Bumpers For Impact Traffic Doors	180.01	28.75
	08 38 19 00-0275	SET		24" Height, Easy Spring Bumpers For Impact Traffic Doors	233.84	28.75
	08 38 19 00-0276	SET		36" Height, Easy Spring Bumpers For Impact Traffic Doors	337.67	28.75
	08 38 19 00-0277	SET		42" Height, Easy Spring Bumpers For Impact Traffic Doors	387.66	28.75
	08 38 19 00-0278	SET		48" Height, Easy Spring Bumpers For Impact Traffic Doors	438.94	28.75

08	Openings
08 30	Specialty Doors And Frames
08 38	Traffic Doors



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 38 19 00-0279 Scuff Plates For Impact Traffic Doors <small>(08 38 19 00-0267)</small> Note: Includes two 0.090" thermoplastic plates per set.		
08 38 19 00-0280 12" High, Scuff Plates For Impact Traffic Doors <small>(08 38 19 00-0279)</small>		
08 38 19 00-0281 SET 24" Wide x 12" High, Impact Traffic Door Scuff Plates.....	87.71	28.75
08 38 19 00-0282 SET 30" Wide x 12" High, Impact Traffic Door Scuff Plates.....	92.84	28.75
08 38 19 00-0283 SET 36" Wide x 12" High, Impact Traffic Door Scuff Plates.....	99.25	28.75
08 38 19 00-0284 SET 42" Wide x 12" High, Impact Traffic Door Scuff Plates.....	108.22	28.75
08 38 19 00-0285 SET 48" Wide x 12" High, Impact Traffic Door Scuff Plates.....	113.35	28.75
08 38 19 00-0286 24" High, Scuff Plates For Impact Traffic Doors <small>(08 38 19 00-0279)</small>		
08 38 19 00-0287 SET 24" Wide x 24" High, Impact Traffic Door Scuff Plates.....	113.35	28.75
08 38 19 00-0288 SET 30" Wide x 24" High, Impact Traffic Door Scuff Plates.....	136.42	28.75
08 38 19 00-0289 SET 36" Wide x 24" High, Impact Traffic Door Scuff Plates.....	149.24	28.75
08 38 19 00-0290 SET 42" Wide x 24" High, Impact Traffic Door Scuff Plates.....	167.19	28.75
08 38 19 00-0291 SET 48" Wide x 24" High, Impact Traffic Door Scuff Plates.....	178.72	28.75
08 38 19 00-0292 30" High, Scuff Plates For Impact Traffic Doors <small>(08 38 19 00-0279)</small>		
08 38 19 00-0293 SET 24" Wide x 30" High, Impact Traffic Door Scuff Plates.....	136.42	28.75
08 38 19 00-0294 SET 30" Wide x 30" High, Impact Traffic Door Scuff Plates.....	156.93	28.75
08 38 19 00-0295 SET 36" Wide x 30" High, Impact Traffic Door Scuff Plates.....	172.31	28.75
08 38 19 00-0296 SET 42" Wide x 30" High, Impact Traffic Door Scuff Plates.....	200.52	28.75
08 38 19 00-0297 SET 48" Wide x 30" High, Impact Traffic Door Scuff Plates.....	219.74	28.75
08 38 19 00-0298 36" High, Scuff Plates For Impact Traffic Doors <small>(08 38 19 00-0279)</small>		
08 38 19 00-0299 SET 24" Wide x 36" High, Impact Traffic Door Scuff Plates.....	149.24	28.75
08 38 19 00-0300 SET 30" Wide x 36" High, Impact Traffic Door Scuff Plates.....	172.31	28.75
08 38 19 00-0301 SET 36" Wide x 36" High, Impact Traffic Door Scuff Plates.....	197.95	28.75
08 38 19 00-0302 SET 42" Wide x 36" High, Impact Traffic Door Scuff Plates.....	212.05	28.75
08 38 19 00-0303 SET 48" Wide x 36" High, Impact Traffic Door Scuff Plates.....	233.84	28.75
08 38 19 00-0304 48" High, Scuff Plates For Impact Traffic Doors <small>(08 38 19 00-0279)</small>		
08 38 19 00-0305 SET 24" Wide x 48" High, Impact Traffic Door Scuff Plates.....	178.72	28.75
08 38 19 00-0306 SET 30" Wide x 48" High, Impact Traffic Door Scuff Plates.....	219.74	28.75
08 38 19 00-0307 SET 36" Wide x 48" High, Impact Traffic Door Scuff Plates.....	233.84	28.75
08 38 19 00-0308 SET 42" Wide x 48" High, Impact Traffic Door Scuff Plates.....	260.76	28.75
08 38 19 00-0309 SET 48" Wide x 48" High, Impact Traffic Door Scuff Plates.....	290.24	28.75
08 38 19 00-0310 Base Plates For Impact Traffic Doors <small>(08 38 19 00-0267)</small> Note: Includes two base plates per set.		
08 38 19 00-0311 Galvanized, 18 Gauge Base Plates For Impact Traffic Doors <small>(08 38 19 00-0310)</small>		
08 38 19 00-0312 12" High, Galvanized, 18 Gauge Base Plates For Impact Traffic Doors <small>(08 38 19 00-0311)</small>		
08 38 19 00-0313 SET 24" Wide x 12" High, Galvanized, 18 Gauge Base Plates For Impact Traffic Doors.....	85.15	28.75
08 38 19 00-0314 SET 30" Wide x 12" High, Galvanized, 18 Gauge Base Plates For Impact Traffic Doors.....	90.28	28.75
08 38 19 00-0315 SET 36" Wide x 12" High, Galvanized, 18 Gauge Base Plates For Impact Traffic Doors.....	92.84	28.75
08 38 19 00-0316 SET 42" Wide x 12" High, Galvanized, 18 Gauge Base Plates For Impact Traffic Doors.....	104.38	28.75
08 38 19 00-0317 SET 48" Wide x 12" High, Galvanized, 18 Gauge Base Plates For Impact Traffic Doors.....	109.51	28.75
08 38 19 00-0318 24" High, Galvanized, 18 Gauge Base Plates For Impact Traffic Doors <small>(08 38 19 00-0311)</small>		
08 38 19 00-0319 SET 24" Wide x 24" High, Galvanized, 18 Gauge Base Plates For Impact Traffic Doors.....	104.38	28.75
08 38 19 00-0320 SET 30" Wide x 24" High, Galvanized, 18 Gauge Base Plates For Impact Traffic Doors.....	112.07	28.75
08 38 19 00-0321 SET 36" Wide x 24" High, Galvanized, 18 Gauge Base Plates For Impact Traffic Doors.....	119.76	28.75
08 38 19 00-0322 SET 42" Wide x 24" High, Galvanized, 18 Gauge Base Plates For Impact Traffic Doors.....	126.17	28.75
08 38 19 00-0323 SET 48" Wide x 24" High, Galvanized, 18 Gauge Base Plates For Impact Traffic Doors.....	136.42	28.75
08 38 19 00-0324 30" High, Galvanized, 18 Gauge Base Plates For Impact Traffic Doors <small>(08 38 19 00-0311)</small>		
08 38 19 00-0325 SET 24" Wide x 30" High, Galvanized, 18 Gauge Base Plates For Impact Traffic Doors.....	117.20	28.75
08 38 19 00-0326 SET 30" Wide x 30" High, Galvanized, 18 Gauge Base Plates For Impact Traffic Doors.....	123.61	28.75
08 38 19 00-0327 SET 36" Wide x 30" High, Galvanized, 18 Gauge Base Plates For Impact Traffic Doors.....	138.99	28.75
08 38 19 00-0328 SET 42" Wide x 30" High, Galvanized, 18 Gauge Base Plates For Impact Traffic Doors.....	155.65	28.75
08 38 19 00-0329 SET 48" Wide x 30" High, Galvanized, 18 Gauge Base Plates For Impact Traffic Doors.....	163.34	28.75
08 38 19 00-0330 36" High, Galvanized, 18 Gauge Base Plates For Impact Traffic Doors <small>(08 38 19 00-0311)</small>		
08 38 19 00-0331 SET 24" Wide x 36" High, Galvanized, 18 Gauge Base Plates For Impact Traffic Doors.....	123.61	28.75
08 38 19 00-0332 SET 30" Wide x 36" High, Galvanized, 18 Gauge Base Plates For Impact Traffic Doors.....	136.42	28.75
08 38 19 00-0333 SET 36" Wide x 36" High, Galvanized, 18 Gauge Base Plates For Impact Traffic Doors.....	155.65	28.75
08 38 19 00-0334 SET 42" Wide x 36" High, Galvanized, 18 Gauge Base Plates For Impact Traffic Doors.....	171.03	28.75



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 38 19 00-0335 SET 48" Wide x 36" High, Galvanized, 18 Gauge Base Plates For Impact Traffic Doors.....	180.01	28.75
08 38 19 00-0336 48" High, Galvanized, 18 Gauge Base Plates For Impact Traffic Doors (08 38 19 00-0311)		
08 38 19 00-0337 SET 24" Wide x 48" High, Galvanized, 18 Gauge Base Plates For Impact Traffic Doors.....	153.09	28.75
08 38 19 00-0338 SET 30" Wide x 48" High, Galvanized, 18 Gauge Base Plates For Impact Traffic Doors.....	171.03	28.75
08 38 19 00-0339 SET 36" Wide x 48" High, Galvanized, 18 Gauge Base Plates For Impact Traffic Doors.....	195.39	28.75
08 38 19 00-0340 SET 42" Wide x 48" High, Galvanized, 18 Gauge Base Plates For Impact Traffic Doors.....	206.92	28.75
08 38 19 00-0341 SET 48" Wide x 48" High, Galvanized, 18 Gauge Base Plates For Impact Traffic Doors.....	222.31	28.75
08 38 19 00-0342 Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors (08 38 19 00-0310)		
08 38 19 00-0343 12" High, Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors (08 38 19 00-0342)		
08 38 19 00-0344 SET 24" Wide x 12" High, Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	108.22	28.75
08 38 19 00-0345 SET 30" Wide x 12" High, Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	113.35	28.75
08 38 19 00-0346 SET 36" Wide x 12" High, Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	128.73	28.75
08 38 19 00-0347 SET 42" Wide x 12" High, Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	136.42	28.75
08 38 19 00-0348 SET 48" Wide x 12" High, Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	158.21	28.75
08 38 19 00-0349 24" High, Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors (08 38 19 00-0342)		
08 38 19 00-0350 SET 24" Wide x 24" High, Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	144.11	28.75
08 38 19 00-0351 SET 30" Wide x 24" High, Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	167.19	28.75
08 38 19 00-0352 SET 36" Wide x 24" High, Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	190.26	28.75
08 38 19 00-0353 SET 42" Wide x 24" High, Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	218.46	28.75
08 38 19 00-0354 SET 48" Wide x 24" High, Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	244.10	28.75
08 38 19 00-0355 30" High, Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors (08 38 19 00-0342)		
08 38 19 00-0356 SET 24" Wide x 30" High, Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	162.06	28.75
08 38 19 00-0357 SET 30" Wide x 30" High, Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	192.82	28.75
08 38 19 00-0358 SET 36" Wide x 30" High, Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	221.02	28.75
08 38 19 00-0359 SET 42" Wide x 30" High, Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	250.51	28.75
08 38 19 00-0360 SET 48" Wide x 30" High, Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	285.12	28.75
08 38 19 00-0361 36" High, Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors (08 38 19 00-0342)		
08 38 19 00-0362 SET 24" Wide x 36" High, Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	185.13	28.75
08 38 19 00-0363 SET 30" Wide x 36" High, Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	218.46	28.75
08 38 19 00-0364 SET 36" Wide x 36" High, Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	256.92	28.75
08 38 19 00-0365 SET 42" Wide x 36" High, Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	294.09	28.75
08 38 19 00-0366 SET 48" Wide x 36" High, Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	326.13	28.75
08 38 19 00-0367 48" High, Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors (08 38 19 00-0342)		
08 38 19 00-0368 SET 24" Wide x 48" High, Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	226.15	28.75
08 38 19 00-0369 SET 30" Wide x 48" High, Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	305.63	28.75
08 38 19 00-0370 SET 36" Wide x 48" High, Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	326.13	28.75
08 38 19 00-0371 SET 42" Wide x 48" High, Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	387.66	28.75
08 38 19 00-0372 SET 48" Wide x 48" High, Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	423.55	28.75
08 38 19 00-0373 One Galvanized And One Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors (08 38 19 00-0310)		
08 38 19 00-0374 12" High, One Galvanized And One Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors (08 38 19 00-0373)		
08 38 19 00-0375 SET 24" Wide x 12" High, One Galvanized And One Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	97.97	28.75
08 38 19 00-0376 SET 30" Wide x 12" High, One Galvanized And One Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	104.38	28.75
08 38 19 00-0377 SET 36" Wide x 12" High, One Galvanized And One Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	112.07	28.75
08 38 19 00-0378 SET 42" Wide x 12" High, One Galvanized And One Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	121.04	28.75
08 38 19 00-0379 SET 48" Wide x 12" High, One Galvanized And One Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	135.14	28.75
08 38 19 00-0380 24" High, One Galvanized And One Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors (08 38 19 00-0373)		
08 38 19 00-0381 SET 24" Wide x 24" High, One Galvanized And One Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	126.17	28.75
08 38 19 00-0382 SET 30" Wide x 24" High, One Galvanized And One Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	141.55	28.75
08 38 19 00-0383 SET 36" Wide x 24" High, One Galvanized And One Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	156.93	28.75
08 38 19 00-0384 SET 42" Wide x 24" High, One Galvanized And One Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	173.60	28.75
08 38 19 00-0385 SET 48" Wide x 24" High, One Galvanized And One Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	192.82	28.75
08 38 19 00-0386 30" High, One Galvanized And One Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors (08 38 19 00-0373)		

08	Openings
08 30	Specialty Doors And Frames
08 38	Traffic Doors



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 38 19 00-0387	SET		24" Wide x 30" High, One Galvanized And One Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	141.55	28.75
08 38 19 00-0388	SET		30" Wide x 30" High, One Galvanized And One Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	160.78	28.75
08 38 19 00-0389	SET		36" Wide x 30" High, One Galvanized And One Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	182.57	28.75
08 38 19 00-0390	SET		42" Wide x 30" High, One Galvanized And One Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	209.49	28.75
08 38 19 00-0391	SET		48" Wide x 30" High, One Galvanized And One Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	227.43	28.75
08 38 19 00-0392			36" High, One Galvanized And One Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors <small>(08 38 19 00-0373)</small>		
08 38 19 00-0393	SET		24" Wide x 36" High, One Galvanized And One Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	156.93	28.75
08 38 19 00-0394	SET		30" Wide x 36" High, One Galvanized And One Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	182.57	28.75
08 38 19 00-0395	SET		36" Wide x 36" High, One Galvanized And One Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	209.49	28.75
08 38 19 00-0396	SET		42" Wide x 36" High, One Galvanized And One Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	236.41	28.75
08 38 19 00-0397	SET		48" Wide x 36" High, One Galvanized And One Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	256.63	28.75
08 38 19 00-0398			48" High, One Galvanized And One Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors <small>(08 38 19 00-0373)</small>		
08 38 19 00-0399	SET		24" Wide x 48" High, One Galvanized And One Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	192.82	28.75
08 38 19 00-0400	SET		30" Wide x 48" High, One Galvanized And One Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	232.56	28.75
08 38 19 00-0401	SET		36" Wide x 48" High, One Galvanized And One Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	255.63	28.75
08 38 19 00-0402	SET		42" Wide x 48" High, One Galvanized And One Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	301.78	28.75
08 38 19 00-0403	SET		48" Wide x 48" High, One Galvanized And One Stainless Steel, 18 Gauge Base Plates For Impact Traffic Doors.....	314.60	28.75
08 38 19 00-0404			Jamb Guards For Impact Traffic Doors <small>(08 38 19 00-0267)</small>		
08 38 19 00-0405	EA		3" x 9", Jamb Guard For Impact Traffic Doors	132.08	35.94
08 38 19 00-0406	EA		5" x 18", Jamb Guard For Impact Traffic Doors	170.53	35.94
08 38 19 00-0407	EA		5" x 18", Stainless Steel Jamb Guard For Impact Traffic Doors.....	311.53	35.94
08 38 19 00-0408			Other Impact Traffic Door Accessories <small>(08 38 19 00-0267)</small>		
08 38 19 00-0409	EA		Push Plate For Impact Traffic Doors	38.47	17.96
08 38 19 00-0410	EA		Pull Handle For Impact Traffic Doors	47.44	17.96
08 38 19 00-0411	EA		Deadbolt Lock For Impact Traffic Doors	102.56	17.96
08 38 19 00-0412	PR		Lock Hole Reinforcements For Impact Traffic Doors	125.63	17.96
08 38 19 00-0413	PR		Padlock Brackets For Impact Traffic Doors.....	56.41	17.96
08 38 19 00-0414			Impact Traffic Door Knock Down Frames <small>(08 38 19)</small>		
			Note: Frames are 16 gauge galvanized steel with reinforcement at hardware locations.		
08 38 19 00-0415			Single Door, Impact Traffic Door Knock Down Frames <small>(08 38 19 00-0414)</small>		
08 38 19 00-0416			84" Height, Single Door, Impact Traffic Door Knock Down Frames <small>(08 38 19 00-0415)</small>		
08 38 19 00-0417	EA		24" x 84" Opening, Single Door, Impact Traffic Door Knock Down Frame.....	336.76	53.90
08 38 19 00-0418	EA		28" x 84" Opening, Single Door, Impact Traffic Door Knock Down Frame.....	391.15	59.29
08 38 19 00-0419	EA		30" x 84" Opening, Single Door, Impact Traffic Door Knock Down Frame.....	402.68	62.89
08 38 19 00-0420	EA		32" x 84" Opening, Single Door, Impact Traffic Door Knock Down Frame.....	417.27	68.28
08 38 19 00-0421	EA		36" x 84" Opening, Single Door, Impact Traffic Door Knock Down Frame.....	429.37	71.87
08 38 19 00-0422	EA		40" x 84" Opening, Single Door, Impact Traffic Door Knock Down Frame.....	448.31	75.47
08 38 19 00-0423	EA		42" x 84" Opening, Single Door, Impact Traffic Door Knock Down Frame.....	463.38	79.06
08 38 19 00-0424	EA		44" x 84" Opening, Single Door, Impact Traffic Door Knock Down Frame.....	474.86	82.65
08 38 19 00-0425			90" Height, Single Door, Impact Traffic Door Knock Down Frames <small>(08 38 19 00-0415)</small>		
08 38 19 00-0426	EA		24" x 90" Opening, Single Door, Impact Traffic Door Knock Down Frame.....	342.47	53.90
08 38 19 00-0427	EA		28" x 90" Opening, Single Door, Impact Traffic Door Knock Down Frame.....	397.95	59.29
08 38 19 00-0428	EA		30" x 90" Opening, Single Door, Impact Traffic Door Knock Down Frame.....	409.61	62.89
08 38 19 00-0429	EA		32" x 90" Opening, Single Door, Impact Traffic Door Knock Down Frame.....	424.29	68.28
08 38 19 00-0430	EA		36" x 90" Opening, Single Door, Impact Traffic Door Knock Down Frame.....	436.51	71.87
08 38 19 00-0431	EA		40" x 90" Opening, Single Door, Impact Traffic Door Knock Down Frame.....	455.75	75.47
08 38 19 00-0432	EA		42" x 90" Opening, Single Door, Impact Traffic Door Knock Down Frame.....	471.00	79.06
08 38 19 00-0433	EA		44" x 90" Opening, Single Door, Impact Traffic Door Knock Down Frame.....	482.60	82.65
08 38 19 00-0434			96" Height, Single Door, Impact Traffic Door Knock Down Frames <small>(08 38 19 00-0415)</small>		
08 38 19 00-0435	EA		24" x 96" Opening, Single Door, Impact Traffic Door Knock Down Frame.....	350.08	53.90
08 38 19 00-0436	EA		28" x 96" Opening, Single Door, Impact Traffic Door Knock Down Frame.....	407.00	59.29
08 38 19 00-0437	EA		30" x 96" Opening, Single Door, Impact Traffic Door Knock Down Frame.....	418.80	62.89
08 38 19 00-0438	EA		32" x 96" Opening, Single Door, Impact Traffic Door Knock Down Frame.....	431.36	68.28
08 38 19 00-0439	EA		36" x 96" Opening, Single Door, Impact Traffic Door Knock Down Frame.....	446.00	71.87
08 38 19 00-0440	EA		40" x 96" Opening, Single Door, Impact Traffic Door Knock Down Frame.....	463.18	75.47
08 38 19 00-0441	EA		42" x 96" Opening, Single Door, Impact Traffic Door Knock Down Frame.....	481.14	79.06
08 38 19 00-0442	EA		44" x 96" Opening, Single Door, Impact Traffic Door Knock Down Frame.....	493.45	80.86
08 38 19 00-0443			Double Door, Impact Traffic Door Knock Down Frames <small>(08 38 19 00-0414)</small>		
08 38 19 00-0444			84" Height, Double Door, Impact Traffic Door Knock Down Frames <small>(08 38 19 00-0443)</small>		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 38 19 00-0445 EA 48" x 84" Opening, Double Door, Impact Traffic Door Knock Down Frame	481.46	82.65
08 38 19 00-0446 EA 56" x 84" Opening, Double Door, Impact Traffic Door Knock Down Frame	490.66	84.09
08 38 19 00-0447 EA 60" x 84" Opening, Double Door, Impact Traffic Door Knock Down Frame	499.55	86.25
08 38 19 00-0448 EA 64" x 84" Opening, Double Door, Impact Traffic Door Knock Down Frame	514.11	89.84
08 38 19 00-0449 EA 72" x 84" Opening, Double Door, Impact Traffic Door Knock Down Frame	524.81	93.43
08 38 19 00-0450 EA 80" x 84" Opening, Double Door, Impact Traffic Door Knock Down Frame	539.59	94.15
08 38 19 00-0451 EA 84" x 84" Opening, Double Door, Impact Traffic Door Knock Down Frame	550.22	95.23
08 38 19 00-0452 EA 88" x 84" Opening, Double Door, Impact Traffic Door Knock Down Frame	563.65	97.03
08 38 19 00-0453 90" Height, Double Door, Impact Traffic Door Knock Down Frames (08 38 19 00-0443)		
08 38 19 00-0454 EA 48" x 90" Opening, Double Door, Impact Traffic Door Knock Down Frame	489.36	82.65
08 38 19 00-0455 EA 56" x 90" Opening, Double Door, Impact Traffic Door Knock Down Frame	498.67	84.09
08 38 19 00-0456 EA 60" x 90" Opening, Double Door, Impact Traffic Door Knock Down Frame	507.73	86.25
08 38 19 00-0457 EA 64" x 90" Opening, Double Door, Impact Traffic Door Knock Down Frame	522.47	89.84
08 38 19 00-0458 EA 72" x 90" Opening, Double Door, Impact Traffic Door Knock Down Frame	533.27	93.43
08 38 19 00-0459 EA 80" x 90" Opening, Double Door, Impact Traffic Door Knock Down Frame	548.37	94.15
08 38 19 00-0460 EA 84" x 90" Opening, Double Door, Impact Traffic Door Knock Down Frame	559.22	95.23
08 38 19 00-0461 EA 88" x 90" Opening, Double Door, Impact Traffic Door Knock Down Frame	572.89	97.03
08 38 19 00-0462 96" Height, Double Door, Impact Traffic Door Knock Down Frames (08 38 19 00-0443)		
08 38 19 00-0463 EA 48" x 96" Opening, Double Door, Impact Traffic Door Knock Down Frame	498.58	82.65
08 38 19 00-0464 EA 56" x 96" Opening, Double Door, Impact Traffic Door Knock Down Frame	506.67	84.09
08 38 19 00-0465 EA 60" x 96" Opening, Double Door, Impact Traffic Door Knock Down Frame	518.58	86.25
08 38 19 00-0466 EA 64" x 96" Opening, Double Door, Impact Traffic Door Knock Down Frame	530.82	89.84
08 38 19 00-0467 EA 72" x 96" Opening, Double Door, Impact Traffic Door Knock Down Frame	544.49	93.43
08 38 19 00-0468 EA 80" x 96" Opening, Double Door, Impact Traffic Door Knock Down Frame	561.31	94.15
08 38 19 00-0469 EA 84" x 96" Opening, Double Door, Impact Traffic Door Knock Down Frame	571.16	95.23
08 38 19 00-0470 EA 88" x 96" Opening, Double Door, Impact Traffic Door Knock Down Frame	585.27	97.03
08 40 Entrances, Storefronts, And Curtain Walls (08)		
08 42 Entrances (08 40)		
08 42 29 Automatic Entrances (08 42)		
08 42 29 33 Swinging Automatic Entrances (08 42 29)		
Note: Excludes glazing.		
08 42 29 33-0001	Swing Door Operators, Up To 350 LB Panel Weight (08 42 29 33)	
Note: Includes electro-mechanical swinging door operator and electrical controls, aluminum header, connecting hardware, actuating controls, and on/off/hold open switch. Excludes activation device, doors, and power connection. Stanley Magic Force or equal.		
08 42 29 33-0002 EA	Concealed Single Door Swing Door Operator, Up To 350 LB Panel	2,543.71
Note: For new storefront or existing concealed operator installations.		
08 42 29 33-0003 EA	Concealed Pair Of Doors Swing Door Operator, Up To 350 LB Panel	4,283.58
Note: For new storefront or existing concealed operator installations.		
08 42 29 33-0004 EA	Exposed Single Door Swing Door Operator, Up To 350 LB Panel	2,107.81
08 42 29 33-0005 EA	Exposed Pair Of Doors Swing Door Operator, Up To 350 LB Panel	3,732.61
08 42 29 33-0006	Activation Devices For Door Operators (08 42 29 33)	
08 42 29 33-0007 EA	Overhead Active Infrared Presence Detector For Door Operators (MS Sedco DH97)	335.24
Note: Includes wiring harness and relays.		
08 42 29 33-0008 EA	On Door Active Infrared Presence Detector For Door Operator (Stanley Sentrex RS).....	296.84
Note: Includes wiring harness and relays.		
08 42 29 33-0009 EA	Microwave Motion Sensor For Door Operator (MS Sedco D38)	299.90
Note: Includes wiring harness and relays.		
08 42 29 33-0010 EA	Push Plate For Door Operator (MS Sedco 59 Series)	116.84
Note: Excludes wiring from operator to push plate.		
08 42 29 33-0011 EA	Jamb Mounted Push Button For Door Operator (MS Sedco 425 Series)	98.08
Note: Excludes wiring from operator to push button.		
08 42 29 33-0012 EA	Radio Control System For Door Operator (MS Sedco Clearpath)	499.23
Note: Includes receiver and two push plate transmitters.		
For Single Transmitter (Includes Receiver, One Push Plate Transmitter, And One Jamb Mounted Push Button), Deduct -64.00		
08 42 29 33-0013 EA	Combination Digital Camera/Motion Detector For Door Operators (Stanley StanVision)	729.13
Note: Includes wiring harness and relays.		
08 42 29 33-0014 EA	Guard Rail For Door With Operator	155.54
08 44 Curtain Wall And Glazed Assemblies (08 40)		
08 44 13 Glazed Aluminum Curtain Walls (08 44)		
08 44 13 00-0001	Curtain Walls (08 44 13)	
08 44 13 00-0002	Coping Sections (08 44 13 00-0001)	
08 44 13 00-0003 LF	Curtain Wall, 1/8" x 8" Coping Section Shaped (3") Aluminum System Framing Section.....	28.26
For Bronze Anodized Aluminum, Add		1.97
For Stainless Steel, Add		8.65
For Black Anodized Finish, Add		3.55

08 Openings**08 40 Entrances, Storefronts, And Curtain Walls****08 44 Curtain Wall And Glazed Assemblies**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 44 13 00-0004	LF		Curtain Wall, 1/8" x 9" Coping Section Shaped (4") Aluminum System Framing Section	28.96	2.59
			<i>For Bronze Anodized Aluminum, Add</i>	2.08	
			<i>For Stainless Steel, Add</i>	9.07	
			<i>For Black Anodized Finish, Add</i>	3.74	
08 44 13 00-0005	LF		Curtain Wall, 1/8" x 12-1/2" Coping Section Shaped (5-1/2") Aluminum Framing Section.....	35.26	3.44
			<i>For Bronze Anodized Aluminum, Add</i>	2.47	
			<i>For Stainless Steel, Add</i>	10.81	
			<i>For Black Anodized Finish, Add</i>	4.44	
08 44 13 00-0006			Sill Section <small>(08 44 13 00-0001)</small>		
08 44 13 00-0007	LF		Aluminum Curtain Wall, 1/8" x 6" Sill Section Shaped Aluminum System Framing Section	22.05	1.72
			<i>For Bronze Anodized Aluminum, Add</i>	1.71	
			<i>For Stainless Steel, Add</i>	7.38	
			<i>For Black Anodized Finish, Add</i>	3.08	
08 44 13 00-0008	LF		Aluminum Curtain Wall, 1/8" x 7" Sill Section Shaped Aluminum System Framing Section	23.27	1.72
			<i>For Bronze Anodized Aluminum, Add</i>	1.90	
			<i>For Stainless Steel, Add</i>	8.12	
			<i>For Black Anodized Finish, Add</i>	3.41	
08 44 13 00-0009	LF		Aluminum Curtain Wall, 1/8" x 8-1/2" Sill Section Shaped Aluminum System Framing Section	24.50	1.72
			<i>For Bronze Anodized Aluminum, Add</i>	2.08	
			<i>For Stainless Steel, Add</i>	8.85	
			<i>For Black Anodized Finish, Add</i>	3.74	
08 44 13 00-0010			Aluminum Column Covers <small>(08 44 13 00-0001)</small>		
			Note: Includes all clips and fasteners.		
08 44 13 00-0011	LF		Aluminum Column Covers, 1/8" x 26", Shaped.....	53.00	4.31
			<i>For Bronze Anodized Aluminum, Add</i>	4.31	
			<i>For Stainless Steel, Add</i>	18.46	
			<i>For Black Anodized Finish, Add</i>	7.76	
08 44 13 00-0012	LF		Aluminum Column Covers, 1/8" x 34", Shaped.....	62.40	4.31
			<i>For Bronze Anodized Aluminum, Add</i>	5.51	
			<i>For Stainless Steel, Add</i>	23.31	
			<i>For Black Anodized Finish, Add</i>	9.91	
08 44 13 00-0013	LF		Aluminum Column Covers, 1/8" x 38", Shaped.....	65.66	4.31
			<i>For Bronze Anodized Aluminum, Add</i>	5.99	
			<i>For Stainless Steel, Add</i>	25.26	
			<i>For Black Anodized Finish, Add</i>	10.79	
08 44 13 00-0014			Spandrel Covers <small>(08 44 13 00-0001)</small>		
			Note: Where exterior facing only is described in the following the interior face will be tempered hardboard (to be painted).		
08 44 13 00-0015	SF		1" Spandrel Cover, Aluminum Both Faces.....	19.71	1.72
			<i>For Bronze Anodized Aluminum, Add</i>	1.87	
			<i>For Stainless Steel, Add</i>	7.84	
			<i>For Black Anodized Finish, Add</i>	3.37	
08 44 13 00-0016	SF		1" Spandrel Cover, Aluminum Exterior Face.....	17.86	1.72
			<i>For Bronze Anodized Aluminum, Add</i>	1.59	
			<i>For Stainless Steel, Add</i>	6.73	
			<i>For Black Anodized Finish, Add</i>	2.87	
08 44 13 00-0017	SF		1" Spandrel Cover, Epoxy Both Faces.....	33.18	1.72
			<i>For Bronze Anodized Aluminum, Add</i>	3.89	
			<i>For Stainless Steel, Add</i>	15.93	
			<i>For Black Anodized Finish, Add</i>	7.00	
08 44 13 00-0018	SF		1" Spandrel Cover, Epoxy Exterior Face Only	27.96	1.72
			<i>For Bronze Anodized Aluminum, Add</i>	3.11	
			<i>For Stainless Steel, Add</i>	12.79	
			<i>For Black Anodized Finish, Add</i>	5.59	
08 44 13 00-0019	SF		2" Spandrel Cover, Aluminum Both Faces.....	22.79	1.72
			<i>For Bronze Anodized Aluminum, Add</i>	2.05	
			<i>For Stainless Steel, Add</i>	8.66	
			<i>For Black Anodized Finish, Add</i>	3.69	
08 44 13 00-0020	SF		2" Spandrel Cover, Aluminum Exterior Face.....	21.04	1.72
			<i>For Bronze Anodized Aluminum, Add</i>	1.79	
			<i>For Stainless Steel, Add</i>	7.61	
			<i>For Black Anodized Finish, Add</i>	3.22	
08 44 13 00-0021	SF		2" Spandrel Cover, Epoxy Both Faces.....	38.46	1.72
			<i>For Bronze Anodized Aluminum, Add</i>	4.40	
			<i>For Stainless Steel, Add</i>	18.07	
			<i>For Black Anodized Finish, Add</i>	7.92	
08 44 13 00-0022	SF		2" Spandrel Cover, Epoxy Exterior Face Only	32.44	1.72
			<i>For Bronze Anodized Aluminum, Add</i>	3.50	
			<i>For Stainless Steel, Add</i>	14.45	
			<i>For Black Anodized Finish, Add</i>	6.30	
08 44 13 00-0023			Curtain Wall, Aluminum System Framing Sections <small>(08 44 13 00-0001)</small>		
			Note: The prices are based on stock shapes of anodized aluminum, plain color and of 0.125" thickness.		
08 44 13 00-0024	LF		Aluminum System Curtain Wall, 1-1/2" x 3" Jamb Aluminum Framed Window Walls.....	19.20	1.72
			<i>For Bronze Anodized Aluminum, Add</i>	1.86	
			<i>For Stainless Steel, Add</i>	7.76	
			<i>For Black Anodized Finish, Add</i>	3.34	



Openings	08
Entrances, Storefronts, And Curtain Walls	08 40
Curtain Wall And Glazed Assemblies	08 44

08

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 44 13 00-0025	LF		Aluminum System Curtain Wall, 1-1/2" x 3" Head Aluminum Framed Window Walls.....	19.06	1.72
			<i>For Bronze Anodized Aluminum, Add</i>	1.86	
			<i>For Stainless Steel, Add</i>	7.76	
			<i>For Black Anodized Finish, Add</i>	3.34	
08 44 13 00-0026	LF		Aluminum System Curtain Wall, 1-1/2" x 3" Mullion Aluminum Framed Window Walls.....	19.07	1.72
			<i>For Bronze Anodized Aluminum, Add</i>	1.86	
			<i>For Stainless Steel, Add</i>	7.76	
			<i>For Black Anodized Finish, Add</i>	3.34	
			<i>For Corner Mullion, Add</i>	4.10	
08 44 13 00-0027	LF		Aluminum System Curtain Wall, 2" x 4" Jamb Aluminum Framed Window Walls.....	25.12	3.44
			<i>For Bronze Anodized Aluminum, Add</i>	2.22	
			<i>For Stainless Steel, Add</i>	9.39	
			<i>For Black Anodized Finish, Add</i>	3.99	
08 44 13 00-0028	LF		Aluminum System Curtain Wall, 2" x 4" Horizontal Aluminum Framed Window Walls.....	25.12	3.44
			<i>For Bronze Anodized Aluminum, Add</i>	2.22	
			<i>For Stainless Steel, Add</i>	9.39	
			<i>For Black Anodized Finish, Add</i>	3.99	
08 44 13 00-0029	LF		Aluminum System Curtain Wall, 2" x 4" Mullion Aluminum Framed Window Walls.....	25.12	3.44
			<i>For Bronze Anodized Aluminum, Add</i>	2.22	
			<i>For Stainless Steel, Add</i>	9.39	
			<i>For Black Anodized Finish, Add</i>	3.99	
			<i>For Corner Mullion, Add</i>	5.25	
08 44 13 00-0030	LF		Aluminum System Curtain Wall, 2" x 6" Jamb Aluminum Framed Window Walls.....	27.68	3.78
			<i>For Bronze Anodized Aluminum, Add</i>	2.43	
			<i>For Stainless Steel, Add</i>	10.30	
			<i>For Black Anodized Finish, Add</i>	4.38	
08 44 13 00-0031	LF		Aluminum System Curtain Wall, 2" x 6" Horizontal Aluminum Framed Window Walls.....	27.68	3.78
			<i>For Bronze Anodized Aluminum, Add</i>	2.43	
			<i>For Stainless Steel, Add</i>	10.30	
			<i>For Black Anodized Finish, Add</i>	4.38	
08 44 13 00-0032	LF		Aluminum System Curtain Wall, 2" x 6" Mullion Aluminum Framed Window Walls.....	27.68	3.78
			<i>For Bronze Anodized Aluminum, Add</i>	2.43	
			<i>For Stainless Steel, Add</i>	10.30	
			<i>For Black Anodized Finish, Add</i>	4.38	
			<i>For Corner Mullion, Add</i>	5.77	
08 44 13 00-0033	LF		Aluminum System Curtain Wall, 3" x 5-1/2" Jamb Aluminum Framed Window Walls.....	30.38	4.31
			<i>For Bronze Anodized Aluminum, Add</i>	2.64	
			<i>For Stainless Steel, Add</i>	11.22	
			<i>For Black Anodized Finish, Add</i>	4.76	
08 44 13 00-0034	LF		Aluminum System Curtain Wall, 3" x 5-1/2" Horizontal Aluminum Framed Window Walls.....	30.38	4.31
			<i>For Bronze Anodized Aluminum, Add</i>	2.64	
			<i>For Stainless Steel, Add</i>	11.22	
			<i>For Black Anodized Finish, Add</i>	4.76	
08 44 13 00-0035	LF		Aluminum System Curtain Wall, 3" x 5-1/2" Mullion Aluminum Framed Window Walls.....	30.38	4.31
			<i>For Bronze Anodized Aluminum, Add</i>	2.64	
			<i>For Stainless Steel, Add</i>	11.22	
			<i>For Black Anodized Finish, Add</i>	4.76	
			<i>For Corner Mullion, Add</i>	6.32	
08 44 13 00-0036	LF		Aluminum System Curtain Wall, 3" x 6-3/4" Jamb Aluminum Framed Window Walls.....	33.81	4.65
			<i>For Bronze Anodized Aluminum, Add</i>	2.98	
			<i>For Stainless Steel, Add</i>	12.63	
			<i>For Black Anodized Finish, Add</i>	5.37	
08 44 13 00-0037	LF		Aluminum System Curtain Wall, 3" x 6-3/4" Horizontal Aluminum Framed Window Walls.....	33.81	4.65
			<i>For Bronze Anodized Aluminum, Add</i>	2.98	
			<i>For Stainless Steel, Add</i>	12.63	
			<i>For Black Anodized Finish, Add</i>	5.37	
08 44 13 00-0038	LF		Aluminum System Curtain Wall, 3" x 6-3/4" Mullion Aluminum Framed Window Walls.....	33.81	4.65
			<i>For Bronze Anodized Aluminum, Add</i>	2.98	
			<i>For Stainless Steel, Add</i>	12.63	
			<i>For Black Anodized Finish, Add</i>	5.37	
			<i>For Corner Mullion, Add</i>	7.06	
08 44 13 00-0039	LF		Aluminum System Curtain Wall, 3" x 8-3/4" Jamb Aluminum Framed Window Walls.....	38.79	5.16
			<i>For Bronze Anodized Aluminum, Add</i>	3.42	
			<i>For Stainless Steel, Add</i>	14.50	
			<i>For Black Anodized Finish, Add</i>	6.16	
08 44 13 00-0040	LF		Aluminum System Curtain Wall, 3" x 8-3/4" Horizontal Aluminum Framed Window Walls.....	38.79	5.16
			<i>For Bronze Anodized Aluminum, Add</i>	3.42	
			<i>For Stainless Steel, Add</i>	14.50	
			<i>For Black Anodized Finish, Add</i>	6.16	
08 44 13 00-0041	LF		Aluminum System Curtain Wall, 3" x 8-3/4" Mullion Aluminum Framed Window Walls.....	38.79	5.16
			<i>For Bronze Anodized Aluminum, Add</i>	3.42	
			<i>For Stainless Steel, Add</i>	14.50	
			<i>For Black Anodized Finish, Add</i>	6.16	
			<i>For Corner Mullion, Add</i>	8.10	

08 45 Translucent Wall And Roof Assemblies (08 40)

08 45 23 Fiberglass-Sandwich-Panel Assemblies (08 45)

08 45 23 00-0001 Translucent Fiberglass Panels 2-3/4" Thick (08 45 23)

08 45 23 00-0002	SF	<5,000 SF Translucent Fiberglass Panel 2-3/4" Thick, Metal Framed.....	38.33	4.05
		<i>For Aluminum Frame, Add</i>	3.23	
08 45 23 00-0003	SF	>5,000 SF Translucent Fiberglass Panel 2-3/4" Thick, Metal Framed.....	34.89	3.44
		<i>For Aluminum Frame, Add</i>	2.97	

08 Openings**08 40 Entrances, Storefronts, And Curtain Walls****08 45 Translucent Wall And Roof Assemblies**MINOR
CSI UOM DESCRIPTIONTOTAL DIRECT DEMOLITION
UNIT COST UNIT COST**08 50 Windows** (08)

Note: Includes hardware, caulk, sealant and mounting anchors. Operable windows include weather stripping. Demolition includes removal of frame, glass and insect screens.

08 51 Metal Windows (08 50)**08 51 13 Aluminum Windows** (08 51)

Note: All units are of standard brushed finish. See CSI section 08 80 00 00-0000 for glazing.

08 51 13 00-0001	Acoustical Aluminum Windows <small>(08 51 13)</small> Note: Includes standard acrylic paint finish and 1" insulated low-e glazing. Excludes panning and aluminum trim.		
08 51 13 00-0002	Double Hung Aluminum Windows <small>(08 51 13 00-0001)</small>		
08 51 13 00-0003	4-1/2" Frame Depth, HC 40, Side Loading Sash, Double Hung Aluminum Window <small>(08 51 13 00-0002)</small>		
08 51 13 00-0004	EA Up To 10 SF, 4-1/2" Frame Depth, HC 40, Side Loading Sash, Double Hung Aluminum Window	997.76	73.31
	For Tempered Glass, Add	262.67	
	For Installation In Concrete Or Masonry, Add	46.33	
08 51 13 00-0005	EA >10 To 15 SF, 4-1/2" Frame Depth, HC 40, Side Loading Sash, Double Hung Aluminum Window	1,127.23	77.62
	For Tempered Glass, Add	299.36	
	For Installation In Concrete Or Masonry, Add	50.82	
08 51 13 00-0006	EA >15 To 20 SF, 4-1/2" Frame Depth, HC 40, Side Loading Sash, Double Hung Aluminum Window	1,287.62	81.94
	For Tempered Glass, Add	345.32	
	For Installation In Concrete Or Masonry, Add	56.09	
08 51 13 00-0007	EA >20 To 30 SF, 4-1/2" Frame Depth, HC 40, Side Loading Sash, Double Hung Aluminum Window	1,538.66	86.25
	For Tempered Glass, Add	418.48	
	For Installation In Concrete Or Masonry, Add	63.62	
08 51 13 00-0008	SF >30 SF, 4-1/2" Frame Depth, HC 40, Side Loading Sash, Double Hung Aluminum Window	52.51	2.59
	For Tempered Glass, Add	14.46	
	For Installation In Concrete Or Masonry, Add	2.07	
08 51 13 00-0009	Horizontal Sliding Aluminum Windows <small>(08 51 13 00-0001)</small>		
08 51 13 00-0010	Two Rolling Sashes, Horizontal Sliding Aluminum Windows <small>(08 51 13 00-0009)</small>		
08 51 13 00-0011	4-1/2" Frame Depth, HC 55, Two Rolling Sashes, Horizontal Sliding Aluminum Window <small>(08 51 13 00-0010)</small>		
08 51 13 00-0012	EA Up To 6 SF, 4-1/2" Frame Depth, HC 55, Two Rolling Sashes, Horizontal Sliding Aluminum Window	439.98	69.00
	For Tempered Glass, Add	97.50	
	For Installation In Concrete Or Masonry, Add	31.12	
08 51 13 00-0013	EA >6 To 10 SF, 4-1/2" Frame Depth, HC 55, Two Rolling Sashes, Horizontal Sliding Aluminum Window	527.16	73.31
	For Tempered Glass, Add	121.49	
	For Installation In Concrete Or Masonry, Add	34.56	
08 51 13 00-0014	EA >10 To 15 SF, 4-1/2" Frame Depth, HC 55, Two Rolling Sashes, Horizontal Sliding Aluminum Window	606.70	77.62
	For Tempered Glass, Add	143.20	
	For Installation In Concrete Or Masonry, Add	37.81	
08 51 13 00-0015	EA >15 To 20 SF, 4-1/2" Frame Depth, HC 55, Two Rolling Sashes, Horizontal Sliding Aluminum Window	695.96	81.94
	For Tempered Glass, Add	167.82	
	For Installation In Concrete Or Masonry, Add	41.30	
08 51 13 00-0016	EA >20 To 30 SF, 4-1/2" Frame Depth, HC 55, Two Rolling Sashes, Horizontal Sliding Aluminum Window	853.18	86.25
	For Tempered Glass, Add	212.83	
	For Installation In Concrete Or Masonry, Add	46.48	
08 51 13 00-0017	SF >30 SF, 4-1/2" Frame Depth, HC 55, Two Rolling Sashes, Horizontal Sliding Aluminum Window	29.70	2.59
	For Tempered Glass, Add	7.62	
	For Installation In Concrete Or Masonry, Add	1.50	
08 51 13 00-0018	Fixed Aluminum Windows <small>(08 51 13 00-0001)</small>		
08 51 13 00-0019	4-1/2" Frame Depth, HC 50, Fixed Aluminum Window <small>(08 51 13 00-0018)</small>		
08 51 13 00-0020	EA Up To 6 SF, 4-1/2" Frame Depth, HC 50, Fixed Aluminum Window	349.19	69.00
	For Tempered Glass, Add	70.26	
	For Installation In Concrete Or Masonry, Add	28.85	
08 51 13 00-0021	EA >6 To 10 SF, 4-1/2" Frame Depth, HC 50, Fixed Aluminum Window	424.26	73.31
	For Tempered Glass, Add	90.62	
	For Installation In Concrete Or Masonry, Add	31.99	
08 51 13 00-0022	EA >10 To 15 SF, 4-1/2" Frame Depth, HC 50, Fixed Aluminum Window	493.20	77.62
	For Tempered Glass, Add	109.15	
	For Installation In Concrete Or Masonry, Add	34.97	
08 51 13 00-0023	EA >15 To 20 SF, 4-1/2" Frame Depth, HC 50, Fixed Aluminum Window	579.45	81.94
	For Tempered Glass, Add	132.87	
	For Installation In Concrete Or Masonry, Add	38.38	
08 51 13 00-0024	EA >20 To 30 SF, 4-1/2" Frame Depth, HC 50, Fixed Aluminum Window	788.12	86.25
	For Tempered Glass, Add	193.31	
	For Installation In Concrete Or Masonry, Add	44.86	
08 51 13 00-0025	SF >30 SF, 4-1/2" Frame Depth, HC 50, Fixed Aluminum Window	27.54	2.59
	For Tempered Glass, Add	6.97	
	For Installation In Concrete Or Masonry, Add	1.44	
08 51 13 00-0026	Projected Aluminum Windows <small>(08 51 13 00-0001)</small>		



Openings	08	08
Windows	08 50	
Metal Windows	08 51	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 51 13 00-0027			Single Vent, Projected Aluminum Windows <small>(08 51 13 00-0026)</small>		
08 51 13 00-0028			2-1/4" Frame Depth, HC 80, Flush, Single Vent, Projected Aluminum Window <small>(08 51 13 00-0027)</small>		
08 51 13 00-0029	EA		Up To 6 SF, 2-1/4" Frame Depth, HC 80, Flush, Single Vent, Projected Aluminum Window 577.09		69.00
			For Tempered Glass, Add 138.63		
			For Installation In Concrete Or Masonry, Add 34.55		
08 51 13 00-0030	EA		>6 To 10 SF, 2-1/4" Frame Depth, HC 80, Flush, Single Vent, Projected Aluminum Window 663.20		73.31
			For Tempered Glass, Add 162.31		
			For Installation In Concrete Or Masonry, Add 37.96		
08 51 13 00-0031	EA		>10 To 15 SF, 2-1/4" Frame Depth, HC 80, Flush, Single Vent, Projected Aluminum Window 768.61		77.62
			For Tempered Glass, Add 191.77		
			For Installation In Concrete Or Masonry, Add 41.86		
08 51 13 00-0032	SF		>15 SF, 2-1/4" Frame Depth, HC 80, Flush, Single Vent, Projected Aluminum Window 49.02		2.59
			For Tempered Glass, Add 13.41		
			For Installation In Concrete Or Masonry, Add 1.98		
08 51 13 00-0033			Casement Aluminum Windows <small>(08 51 13 00-0001)</small>		
08 51 13 00-0034			Single Vent, Casement Aluminum Windows <small>(08 51 13 00-0033)</small>		
08 51 13 00-0035			2-1/4" Frame Depth, HC 80, Flush, Single Vent, Casement Aluminum Window <small>(08 51 13 00-0034)</small>		
08 51 13 00-0036	EA		Up To 6 SF, 2-1/4" Frame Depth, HC 80, Flush, Single Vent, Casement Aluminum Window 700.85		69.00
			For Tempered Glass, Add 175.76		
			For Installation In Concrete Or Masonry, Add 37.64		
08 51 13 00-0037	EA		>6 To 10 SF, 2-1/4" Frame Depth, HC 80, Flush, Single Vent, Casement Aluminum Window 807.37		73.31
			For Tempered Glass, Add 205.56		
			For Installation In Concrete Or Masonry, Add 41.57		
08 51 13 00-0038	EA		>10 To 15 SF, 2-1/4" Frame Depth, HC 80, Flush, Single Vent, Casement Aluminum Window 936.57		77.62
			For Tempered Glass, Add 242.16		
			For Installation In Concrete Or Masonry, Add 46.05		
08 51 13 00-0039	SF		>15 SF, 2-1/4" Frame Depth, HC 80, Flush, Single Vent, Casement Aluminum Window 60.23		2.59
			For Tempered Glass, Add 16.78		
			For Installation In Concrete Or Masonry, Add 2.26		
08 51 13 00-0040			Aluminum Window Accessories <small>(08 51 13)</small>		
08 51 13 00-0041			Aluminum Window Mullions <small>(08 51 13 00-0040)</small>		
08 51 13 00-0042	LF		Integral Mullions For Aluminum Windows 13.61		3.23
08 51 13 00-0043			Aluminum Window Insect Screens <small>(08 51 13 00-0040)</small>		
			Note: Includes aluminum frames.		
08 51 13 00-0044	SF		<10 SF Area Including Aluminum Frame, Insect Screens For Aluminum Windows 4.47		1.08
08 51 13 00-0045	SF		>10 SF Area Including Aluminum Frame, Insect Screens For Aluminum Windows 3.08		0.87
08 51 13 00-0046	SF		Repair Screen Window 3.60		
08 51 13 00-0047			Aluminum Window Panning <small>(08 51 13 00-0040)</small>		
			Note: Panning price is determined by window size. For windows greater than 30 square feet multiply window square footage by square foot price.		
08 51 13 00-0048	EA		Up To 6 SF Window, Aluminum Window Panning 135.50		27.02
08 51 13 00-0049	EA		>6 To 10 SF Window, Aluminum Window Panning 191.67		45.03
08 51 13 00-0050	EA		>10 To 15 SF Window, Aluminum Window Panning 240.10		67.54
08 51 13 00-0051	EA		>15 To 20 SF Window, Aluminum Window Panning 290.70		90.06
08 51 13 00-0052	EA		>20 To 30 SF Window, Aluminum Window Panning 390.82		135.09
08 51 13 00-0053	SF		>30 SF Window, Aluminum Window Panning 14.57		5.63
08 51 13 00-0054			Aluminum Window Muntins, Grilles Or Dividers <small>(08 51 13 00-0040)</small>		
08 51 13 00-0055	SF		Applied (Per Side) Muntins Grilles Or Dividers For Aluminum Windows 4.80		3.23
08 51 13 00-0056	SF		Internal Only (Between Glass) Muntins, Grilles Or Dividers For Aluminum Windows 6.22		3.23
08 51 13 00-0057	SF		Simulated Divided Lite Muntins Grilles Or Dividers For Aluminum Windows 13.50		3.23
08 51 13 00-0058	SF		True Divided Lite Muntins Grilles Or Dividers For Aluminum Windows 16.04		3.23
08 51 13 00-0059			Other Aluminum Window Accessories <small>(08 51 13 00-0040)</small>		
08 51 13 00-0060	EA		Roto Operator For Casement Aluminum Windows 100.48		14.37
08 51 13 00-0061	EA		Head And Sill Automatic Locks For Hung Aluminum Windows 52.52		14.37

08 52 Wood Windows (08 50)

08 52 16 Plastic-Clad Wood Windows (08 52)

08 52 16 00-0001 Double Hung Wood Clad Windows (08 52 16)

08 Openings**08 50 Windows****08 52 Wood Windows**

MINOR		TOTAL DIRECT	DEMOLITION
CSI	UOM DESCRIPTION	UNIT COST	UNIT COST
08 52 16 00-0002	Double Hung Wood Clad Windows (Andersen 200 TW Series) (08 52 16 00-0001) Note: Includes painted or stained wood interior, colored PVC clad exterior, standard hardware and clear insulated glass. Excludes grilles and insect screens.		
08 52 16 00-0003	35-1/2" Height, Double Hung Wood Clad Windows (Andersen 200 TW Series) (08 52 16 00-0002)		
08 52 16 00-0004	EA 23-1/2" x 35-1/2" Double Hung Wood Clad Window (Andersen 200 TW Series).....	226.07	33.06
	For Low-E Insulated Glass, Add	19.19	
	For Tempered Clear Insulated Glass, Add	31.99	
08 52 16 00-0005	EA 27-1/2" x 35-1/2" Double Hung Wood Clad Window (Andersen 200 TW Series).....	239.33	34.50
	For Low-E Insulated Glass, Add	20.44	
	For Tempered Clear Insulated Glass, Add	34.07	
08 52 16 00-0006	EA 31-1/2" x 35-1/2" Double Hung Wood Clad Window (Andersen 200 TW Series).....	251.71	35.94
	For Low-E Insulated Glass, Add	21.58	
	For Tempered Clear Insulated Glass, Add	35.97	
08 52 16 00-0007	EA 35-1/2" x 35-1/2" Double Hung Wood Clad Window (Andersen 200 TW Series).....	264.09	37.38
	For Low-E Insulated Glass, Add	22.72	
	For Tempered Clear Insulated Glass, Add	37.87	
08 52 16 00-0008	41-1/2" Height, Double Hung Wood Clad Windows (Andersen 200 TW Series) (08 52 16 00-0002)		
08 52 16 00-0009	EA 23-1/2" x 41-1/2" Double Hung Wood Clad Window (Andersen 200 TW Series).....	245.08	35.22
	For Low-E Insulated Glass, Add	20.96	
	For Tempered Clear Insulated Glass, Add	34.93	
08 52 16 00-0010	EA 27-1/2" x 41-1/2" Double Hung Wood Clad Window (Andersen 200 TW Series).....	258.33	36.65
	For Low-E Insulated Glass, Add	22.20	
	For Tempered Clear Insulated Glass, Add	37.00	
08 52 16 00-0011	EA 31-1/2" x 41-1/2" Double Hung Wood Clad Window (Andersen 200 TW Series).....	270.72	38.09
	For Low-E Insulated Glass, Add	23.34	
	For Tempered Clear Insulated Glass, Add	38.91	
08 52 16 00-0012	EA 35-1/2" x 41-1/2" Double Hung Wood Clad Window (Andersen 200 TW Series).....	283.11	39.53
	For Low-E Insulated Glass, Add	24.49	
	For Tempered Clear Insulated Glass, Add	40.81	
08 52 16 00-0013	47-1/2" Height, Double Hung Wood Clad Windows (Andersen 200 TW Series) (08 52 16 00-0002)		
08 52 16 00-0014	EA 23-1/2" x 47-1/2" Double Hung Wood Clad Window (Andersen 200 TW Series).....	264.09	37.38
	For Low-E Insulated Glass, Add	22.72	
	For Tempered Clear Insulated Glass, Add	37.87	
08 52 16 00-0015	EA 27-1/2" x 47-1/2" Double Hung Wood Clad Window (Andersen 200 TW Series).....	276.48	38.81
	For Low-E Insulated Glass, Add	23.86	
	For Tempered Clear Insulated Glass, Add	39.77	
08 52 16 00-0016	EA 31-1/2" x 47-1/2" Double Hung Wood Clad Window (Andersen 200 TW Series).....	289.73	40.25
	For Low-E Insulated Glass, Add	25.11	
	For Tempered Clear Insulated Glass, Add	41.85	
08 52 16 00-0017	EA 35-1/2" x 47-1/2" Double Hung Wood Clad Window (Andersen 200 TW Series).....	302.11	41.69
	For Low-E Insulated Glass, Add	26.25	
	For Tempered Clear Insulated Glass, Add	43.75	
08 52 16 00-0018	53-1/2" Height, Double Hung Wood Clad Windows (Andersen 200 TW Series) (08 52 16 00-0002)		
08 52 16 00-0019	EA 23-1/2" x 53-1/2" Double Hung Wood Clad Window (Andersen 200 TW Series).....	283.11	39.53
	For Low-E Insulated Glass, Add	24.49	
	For Tempered Clear Insulated Glass, Add	40.81	
08 52 16 00-0020	EA 27-1/2" x 53-1/2" Double Hung Wood Clad Window (Andersen 200 TW Series).....	295.50	40.96
	For Low-E Insulated Glass, Add	25.63	
	For Tempered Clear Insulated Glass, Add	42.71	
08 52 16 00-0021	EA 31-1/2" x 53-1/2" Double Hung Wood Clad Window (Andersen 200 TW Series).....	307.88	42.40
	For Low-E Insulated Glass, Add	26.77	
	For Tempered Clear Insulated Glass, Add	44.61	
08 52 16 00-0022	EA 35-1/2" x 53-1/2" Double Hung Wood Clad Window (Andersen 200 TW Series).....	321.12	43.84
	For Low-E Insulated Glass, Add	28.01	
	For Tempered Clear Insulated Glass, Add	46.69	
08 52 16 00-0023	56-1/2" Height, Double Hung Wood Clad Windows (Andersen 200 TW Series) (08 52 16 00-0002)		
08 52 16 00-0024	EA 19-1/2" x 56-1/2" Double Hung Wood Clad Window (Andersen 200 TW Series).....	279.79	39.53
	For Low-E Insulated Glass, Add	24.17	
	For Tempered Clear Insulated Glass, Add	40.29	
08 52 16 00-0025	EA 23-1/2" x 56-1/2" Double Hung Wood Clad Window (Andersen 200 TW Series).....	292.17	40.61
	For Low-E Insulated Glass, Add	25.32	
	For Tempered Clear Insulated Glass, Add	42.19	
08 52 16 00-0026	EA 27-1/2" x 56-1/2" Double Hung Wood Clad Window (Andersen 200 TW Series).....	305.43	42.40
	For Low-E Insulated Glass, Add	26.56	
	For Tempered Clear Insulated Glass, Add	44.27	
08 52 16 00-0027	EA 31-1/2" x 56-1/2" Double Hung Wood Clad Window (Andersen 200 TW Series).....	317.81	43.84
	For Low-E Insulated Glass, Add	27.70	
	For Tempered Clear Insulated Glass, Add	46.17	



Openings	08	08
Windows	08 50	
Wood Windows	08 52	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 52 16 00-0028	EA		35-1/2" x 56-1/2" Double Hung Wood Clad Window (Andersen 200 TW Series)..... <i>For Low-E Insulated Glass, Add</i> <i>For Tempered Clear Insulated Glass, Add</i>	330.20 28.84 48.07	45.28
08 52 16 00-0029	EA		39-1/2" x 56-1/2" Double Hung Wood Clad Window (Andersen 200 TW Series)..... <i>For Low-E Insulated Glass, Add</i> <i>For Tempered Clear Insulated Glass, Add</i>	342.59 29.98 49.97	46.72
08 52 16 00-0030			59-1/2" Height, Double Hung Wood Clad Windows (Andersen 200 TW Series) <small>(08 52 16 00-0002)</small>		
08 52 16 00-0031	EA		19-1/2" x 59-1/2" Double Hung Wood Clad Window (Andersen 200 TW Series)..... <i>For Low-E Insulated Glass, Add</i> <i>For Tempered Clear Insulated Glass, Add</i>	289.73 25.11 41.85	40.25
08 52 16 00-0032	EA		23-1/2" x 59-1/2" Double Hung Wood Clad Window (Andersen 200 TW Series)..... <i>For Low-E Insulated Glass, Add</i> <i>For Tempered Clear Insulated Glass, Add</i>	302.11 26.25 43.75	41.69
08 52 16 00-0033	EA		27-1/2" x 59-1/2" Double Hung Wood Clad Window (Andersen 200 TW Series)..... <i>For Low-E Insulated Glass, Add</i> <i>For Tempered Clear Insulated Glass, Add</i>	314.50 27.39 45.65	43.12
08 52 16 00-0034	EA		31-1/2" x 59-1/2" Double Hung Wood Clad Window (Andersen 200 TW Series)..... <i>For Low-E Insulated Glass, Add</i> <i>For Tempered Clear Insulated Glass, Add</i>	326.88 28.53 47.55	44.56
08 52 16 00-0035	EA		35-1/2" x 59-1/2" Double Hung Wood Clad Window (Andersen 200 TW Series)..... <i>For Low-E Insulated Glass, Add</i> <i>For Tempered Clear Insulated Glass, Add</i>	339.27 29.67 49.46	46.00
08 52 16 00-0036	EA		39-1/2" x 59-1/2" Double Hung Wood Clad Window (Andersen 200 TW Series)..... <i>For Low-E Insulated Glass, Add</i> <i>For Tempered Clear Insulated Glass, Add</i>	352.52 30.92 51.53	47.43
08 52 16 00-0037			65-1/2" Height, Double Hung Wood Clad Windows (Andersen 200 TW Series) <small>(08 52 16 00-0002)</small>		
08 52 16 00-0038	EA		23-1/2" x 65-1/2" Double Hung Wood Clad Window (Andersen 200 TW Series)..... <i>For Low-E Insulated Glass, Add</i> <i>For Tempered Clear Insulated Glass, Add</i>	321.12 28.01 46.69	43.84
08 52 16 00-0039	EA		27-1/2" x 65-1/2" Double Hung Wood Clad Window (Andersen 200 TW Series)..... <i>For Low-E Insulated Glass, Add</i> <i>For Tempered Clear Insulated Glass, Add</i>	333.51 29.15 48.59	45.28
08 52 16 00-0040	EA		31-1/2" x 65-1/2" Double Hung Wood Clad Window (Andersen 200 TW Series)..... <i>For Low-E Insulated Glass, Add</i> <i>For Tempered Clear Insulated Glass, Add</i>	345.89 30.30 50.49	46.72
08 52 16 00-0041	EA		35-1/2" x 65-1/2" Double Hung Wood Clad Window (Andersen 200 TW Series)..... <i>For Low-E Insulated Glass, Add</i> <i>For Tempered Clear Insulated Glass, Add</i>	358.27 31.44 52.39	48.16
08 52 16 00-0042			71-1/2" Height, Double Hung Wood Clad Windows (Andersen 200 TW Series) <small>(08 52 16 00-0002)</small>		
08 52 16 00-0043	EA		23-1/2" x 71-1/2" Double Hung Wood Clad Window (Andersen 200 TW Series)..... <i>For Low-E Insulated Glass, Add</i> <i>For Tempered Clear Insulated Glass, Add</i>	339.27 29.67 49.46	46.00
08 52 16 00-0044	EA		27-1/2" x 71-1/2" Double Hung Wood Clad Window (Andersen 200 TW Series)..... <i>For Low-E Insulated Glass, Add</i> <i>For Tempered Clear Insulated Glass, Add</i>	352.52 30.92 51.53	47.43
08 52 16 00-0045	EA		31-1/2" x 71-1/2" Double Hung Wood Clad Window (Andersen 200 TW Series)..... <i>For Low-E Insulated Glass, Add</i> <i>For Tempered Clear Insulated Glass, Add</i>	364.90 32.06 53.43	48.87
08 52 16 00-0046	EA		35-1/2" x 71-1/2" Double Hung Wood Clad Window (Andersen 200 TW Series)..... <i>For Low-E Insulated Glass, Add</i> <i>For Tempered Clear Insulated Glass, Add</i>	377.29 33.20 55.33	50.31
08 52 16 00-0047			Double Hung Wood Clad Windows (Andersen 400 TW Series) <small>(08 52 16 00-0001)</small>		
Note: Includes painted or stained wood interior, colored PVC clad exterior, standard hardware and Low-E insulated glass. Excludes grilles and insect screens.					
08 52 16 00-0048			36-7/8" Height, Double Hung Wood Clad Windows (Andersen 400 TW Series) <small>(08 52 16 00-0047)</small>		
08 52 16 00-0049	EA		21-5/8" x 36-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	277.23 42.37	33.06
08 52 16 00-0050	EA		25-5/8" x 36-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	293.94 45.13	34.14
08 52 16 00-0051	EA		29-5/8" x 36-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	311.52 48.07	35.57
08 52 16 00-0052	EA		31-5/8" x 36-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	320.73 49.63	36.65
08 52 16 00-0053	EA		33-5/8" x 36-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	329.09 51.01	37.38
08 52 16 00-0054	EA		35-5/8" x 36-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	337.44 52.39	38.09
08 52 16 00-0055	EA		37-5/8" x 36-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	346.66 53.95	38.45

08 Openings**08 50 Windows****08 52 Wood Windows**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 52 16 00-0056	EA		41-5/8" x 36-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	363.37	39.89
			<i>For Tempered Low-E Insulated Glass, Add</i>	56.72	
08 52 16 00-0057	EA		45-5/8" x 36-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	380.94	41.33
			<i>For Tempered Low-E Insulated Glass, Add</i>	59.66	
08 52 16 00-0058			40-7/8" Height, Double Hung Wood Clad Windows (Andersen 400 TW Series) (08 52 16 00-0047)		
08 52 16 00-0059	EA		21-5/8" x 40-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	293.94	34.50
			<i>For Tempered Low-E Insulated Glass, Add</i>	45.13	
08 52 16 00-0060	EA		25-5/8" x 40-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	311.52	35.57
			<i>For Tempered Low-E Insulated Glass, Add</i>	48.07	
08 52 16 00-0061	EA		29-5/8" x 40-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	329.09	37.01
			<i>For Tempered Low-E Insulated Glass, Add</i>	51.01	
08 52 16 00-0062	EA		31-5/8" x 40-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	337.44	38.09
			<i>For Tempered Low-E Insulated Glass, Add</i>	52.39	
08 52 16 00-0063	EA		33-5/8" x 40-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	346.66	38.81
			<i>For Tempered Low-E Insulated Glass, Add</i>	53.95	
08 52 16 00-0064	EA		35-5/8" x 40-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	355.01	39.53
			<i>For Tempered Low-E Insulated Glass, Add</i>	55.33	
08 52 16 00-0065	EA		37-5/8" x 40-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	363.37	39.89
			<i>For Tempered Low-E Insulated Glass, Add</i>	56.72	
08 52 16 00-0066	EA		41-5/8" x 40-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	380.94	41.33
			<i>For Tempered Low-E Insulated Glass, Add</i>	59.66	
08 52 16 00-0067	EA		45-5/8" x 40-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	398.51	42.77
			<i>For Tempered Low-E Insulated Glass, Add</i>	62.60	
08 52 16 00-0068			44-7/8" Height, Double Hung Wood Clad Windows (Andersen 400 TW Series) (08 52 16 00-0047)		
08 52 16 00-0069	EA		21-5/8" x 44-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	311.52	35.94
			<i>For Tempered Low-E Insulated Glass, Add</i>	48.07	
08 52 16 00-0070	EA		25-5/8" x 44-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	329.09	37.01
			<i>For Tempered Low-E Insulated Glass, Add</i>	51.01	
08 52 16 00-0071	EA		29-5/8" x 44-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	346.66	38.45
			<i>For Tempered Low-E Insulated Glass, Add</i>	53.95	
08 52 16 00-0072	EA		31-5/8" x 44-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	355.01	39.53
			<i>For Tempered Low-E Insulated Glass, Add</i>	55.33	
08 52 16 00-0073	EA		33-5/8" x 44-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	363.37	40.25
			<i>For Tempered Low-E Insulated Glass, Add</i>	56.72	
08 52 16 00-0074	EA		35-5/8" x 44-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	372.58	40.96
			<i>For Tempered Low-E Insulated Glass, Add</i>	58.27	
08 52 16 00-0075	EA		37-5/8" x 44-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	380.94	41.33
			<i>For Tempered Low-E Insulated Glass, Add</i>	59.66	
08 52 16 00-0076	EA		41-5/8" x 44-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	398.51	42.77
			<i>For Tempered Low-E Insulated Glass, Add</i>	62.60	
08 52 16 00-0077	EA		45-5/8" x 44-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	416.08	44.20
			<i>For Tempered Low-E Insulated Glass, Add</i>	65.54	
08 52 16 00-0078			48-7/8" Height, Double Hung Wood Clad Windows (Andersen 400 TW Series) (08 52 16 00-0047)		
08 52 16 00-0079	EA		21-5/8" x 48-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	329.09	37.38
			<i>For Tempered Low-E Insulated Glass, Add</i>	51.01	
08 52 16 00-0080	EA		25-5/8" x 48-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	346.66	38.45
			<i>For Tempered Low-E Insulated Glass, Add</i>	53.95	
08 52 16 00-0081	EA		29-5/8" x 48-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	363.37	39.89
			<i>For Tempered Low-E Insulated Glass, Add</i>	56.72	
08 52 16 00-0082	EA		31-5/8" x 48-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	372.58	40.96
			<i>For Tempered Low-E Insulated Glass, Add</i>	58.27	
08 52 16 00-0083	EA		33-5/8" x 48-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	380.94	41.69
			<i>For Tempered Low-E Insulated Glass, Add</i>	59.66	
08 52 16 00-0084	EA		35-5/8" x 48-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	389.29	42.40
			<i>For Tempered Low-E Insulated Glass, Add</i>	61.04	
08 52 16 00-0085	EA		37-5/8" x 48-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	398.51	42.77
			<i>For Tempered Low-E Insulated Glass, Add</i>	62.60	
08 52 16 00-0086	EA		41-5/8" x 48-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	416.08	44.20
			<i>For Tempered Low-E Insulated Glass, Add</i>	65.54	
08 52 16 00-0087	EA		45-5/8" x 48-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	432.80	45.64
			<i>For Tempered Low-E Insulated Glass, Add</i>	68.30	
08 52 16 00-0088			52-7/8" Height, Double Hung Wood Clad Windows (Andersen 400 TW Series) (08 52 16 00-0047)		
08 52 16 00-0089	EA		21-5/8" x 52-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	346.66	38.81
			<i>For Tempered Low-E Insulated Glass, Add</i>	53.95	
08 52 16 00-0090	EA		25-5/8" x 52-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	363.37	39.89
			<i>For Tempered Low-E Insulated Glass, Add</i>	56.72	
08 52 16 00-0091	EA		29-5/8" x 52-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	380.94	41.33
			<i>For Tempered Low-E Insulated Glass, Add</i>	59.66	
08 52 16 00-0092	EA		31-5/8" x 52-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	389.29	42.40
			<i>For Tempered Low-E Insulated Glass, Add</i>	61.04	



Openings	08	08
Windows	08 50	
Wood Windows	08 52	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 52 16 00-0093	EA		33-5/8" x 52-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	398.51 62.60	43.12
08 52 16 00-0094	EA		35-5/8" x 52-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	406.86 63.98	43.84
08 52 16 00-0095	EA		37-5/8" x 52-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	416.08 65.54	44.20
08 52 16 00-0096	EA		41-5/8" x 52-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	432.80 68.30	45.64
08 52 16 00-0097	EA		45-5/8" x 52-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	450.37 71.24	47.08
08 52 16 00-0098			56-7/8" Height, Double Hung Wood Clad Windows (Andersen 400 TW Series) <small>(08 52 16 00-0047)</small>		
08 52 16 00-0099	EA		21-5/8" x 56-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	363.37 56.72	40.25
08 52 16 00-0100	EA		25-5/8" x 56-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	380.94 59.66	41.33
08 52 16 00-0101	EA		29-5/8" x 56-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	398.51 62.60	42.77
08 52 16 00-0102	EA		31-5/8" x 56-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	406.86 63.98	43.84
08 52 16 00-0103	EA		33-5/8" x 56-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	416.08 65.54	44.56
08 52 16 00-0104	EA		35-5/8" x 56-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	424.44 66.92	45.28
08 52 16 00-0105	EA		37-5/8" x 56-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	432.80 68.30	45.64
08 52 16 00-0106	EA		41-5/8" x 56-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	450.37 71.24	47.08
08 52 16 00-0107	EA		45-5/8" x 56-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	467.94 74.18	48.51
08 52 16 00-0108			60-7/8" Height, Double Hung Wood Clad Windows (Andersen 400 TW Series) <small>(08 52 16 00-0047)</small>		
08 52 16 00-0109	EA		21-5/8" x 60-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	380.94 59.66	41.69
08 52 16 00-0110	EA		25-5/8" x 60-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	398.51 62.60	42.77
08 52 16 00-0111	EA		29-5/8" x 60-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	416.08 65.54	44.20
08 52 16 00-0112	EA		31-5/8" x 60-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	424.44 66.92	45.28
08 52 16 00-0113	EA		33-5/8" x 60-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	432.80 68.30	46.00
08 52 16 00-0114	EA		35-5/8" x 60-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	442.02 69.86	46.72
08 52 16 00-0115	EA		37-5/8" x 60-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	450.37 71.24	47.08
08 52 16 00-0116	EA		41-5/8" x 60-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	467.94 74.18	48.51
08 52 16 00-0117	EA		45-5/8" x 60-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	484.65 76.95	49.95
08 52 16 00-0118			64-7/8" Height, Double Hung Wood Clad Windows (Andersen 400 TW Series) <small>(08 52 16 00-0047)</small>		
08 52 16 00-0119	EA		21-5/8" x 64-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	398.51 62.60	43.12
08 52 16 00-0120	EA		25-5/8" x 64-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	416.08 65.54	44.20
08 52 16 00-0121	EA		29-5/8" x 64-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	432.80 68.30	45.64
08 52 16 00-0122	EA		31-5/8" x 64-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	442.02 69.86	46.72
08 52 16 00-0123	EA		33-5/8" x 64-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	450.37 71.24	47.43
08 52 16 00-0124	EA		35-5/8" x 64-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	458.72 72.63	48.16
08 52 16 00-0125	EA		37-5/8" x 64-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	467.94 74.18	48.51
08 52 16 00-0126	EA		41-5/8" x 64-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	484.65 76.95	49.95
08 52 16 00-0127	EA		45-5/8" x 64-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	502.23 79.89	51.39
08 52 16 00-0128			68-7/8" Height, Double Hung Wood Clad Windows (Andersen 400 TW Series) <small>(08 52 16 00-0047)</small>		
08 52 16 00-0129	EA		21-5/8" x 68-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	416.08 65.54	44.56

08 Openings**08 50 Windows****08 52 Wood Windows**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 52 16 00-0130	EA		25-5/8" x 68-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	432.80	45.64
			<i>For Tempered Low-E Insulated Glass, Add</i>	68.30	
08 52 16 00-0131	EA		29-5/8" x 68-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	450.37	47.08
			<i>For Tempered Low-E Insulated Glass, Add</i>	71.24	
08 52 16 00-0132	EA		31-5/8" x 68-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	458.72	48.16
			<i>For Tempered Low-E Insulated Glass, Add</i>	72.63	
08 52 16 00-0133	EA		33-5/8" x 68-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	467.94	48.87
			<i>For Tempered Low-E Insulated Glass, Add</i>	74.18	
08 52 16 00-0134	EA		35-5/8" x 68-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	476.29	49.59
			<i>For Tempered Low-E Insulated Glass, Add</i>	75.57	
08 52 16 00-0135	EA		37-5/8" x 68-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	484.65	49.95
			<i>For Tempered Low-E Insulated Glass, Add</i>	76.95	
08 52 16 00-0136	EA		41-5/8" x 68-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	502.23	51.39
			<i>For Tempered Low-E Insulated Glass, Add</i>	79.89	
08 52 16 00-0137	EA		45-5/8" x 68-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	519.79	52.82
			<i>For Tempered Low-E Insulated Glass, Add</i>	82.83	
08 52 16 00-0138			72-7/8" Height, Double Hung Wood Clad Windows (Andersen 400 TW Series) <small>(08 52 16 00-0047)</small>		
08 52 16 00-0139	EA		21-5/8" x 72-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	432.80	46.00
			<i>For Tempered Low-E Insulated Glass, Add</i>	68.30	
08 52 16 00-0140	EA		25-5/8" x 72-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	450.37	47.08
			<i>For Tempered Low-E Insulated Glass, Add</i>	71.24	
08 52 16 00-0141	EA		29-5/8" x 72-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	467.94	48.51
			<i>For Tempered Low-E Insulated Glass, Add</i>	74.18	
08 52 16 00-0142	EA		31-5/8" x 72-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	476.29	49.59
			<i>For Tempered Low-E Insulated Glass, Add</i>	75.57	
08 52 16 00-0143	EA		33-5/8" x 72-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	484.65	50.31
			<i>For Tempered Low-E Insulated Glass, Add</i>	76.95	
08 52 16 00-0144	EA		35-5/8" x 72-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	493.87	51.03
			<i>For Tempered Low-E Insulated Glass, Add</i>	78.51	
08 52 16 00-0145	EA		37-5/8" x 72-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	502.23	51.39
			<i>For Tempered Low-E Insulated Glass, Add</i>	79.89	
08 52 16 00-0146	EA		41-5/8" x 72-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	519.79	52.82
			<i>For Tempered Low-E Insulated Glass, Add</i>	82.83	
08 52 16 00-0147	EA		45-5/8" x 72-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	537.36	54.26
			<i>For Tempered Low-E Insulated Glass, Add</i>	85.77	
08 52 16 00-0148			76-7/8" Height, Double Hung Wood Clad Windows (Andersen 400 TW Series) <small>(08 52 16 00-0047)</small>		
08 52 16 00-0149	EA		21-5/8" x 76-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	450.37	47.43
			<i>For Tempered Low-E Insulated Glass, Add</i>	71.24	
08 52 16 00-0150	EA		25-5/8" x 76-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	467.94	48.51
			<i>For Tempered Low-E Insulated Glass, Add</i>	74.18	
08 52 16 00-0151	EA		29-5/8" x 76-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	484.65	49.95
			<i>For Tempered Low-E Insulated Glass, Add</i>	76.95	
08 52 16 00-0152	EA		31-5/8" x 76-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	493.87	51.03
			<i>For Tempered Low-E Insulated Glass, Add</i>	78.51	
08 52 16 00-0153	EA		33-5/8" x 76-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	502.23	51.74
			<i>For Tempered Low-E Insulated Glass, Add</i>	79.89	
08 52 16 00-0154	EA		35-5/8" x 76-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	511.44	52.47
			<i>For Tempered Low-E Insulated Glass, Add</i>	81.45	
08 52 16 00-0155	EA		37-5/8" x 76-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	519.79	52.82
			<i>For Tempered Low-E Insulated Glass, Add</i>	82.83	
08 52 16 00-0156	EA		41-5/8" x 76-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	537.36	54.26
			<i>For Tempered Low-E Insulated Glass, Add</i>	85.77	
08 52 16 00-0157	EA		45-5/8" x 76-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	554.09	55.70
			<i>For Tempered Low-E Insulated Glass, Add</i>	88.54	
08 52 16 00-0158			84-7/8" Height, Double Hung Wood Clad Windows (Andersen 400 TW Series) <small>(08 52 16 00-0047)</small>		
08 52 16 00-0159	EA		21-5/8" x 84-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	690.42	50.31
			<i>For Tempered Low-E Insulated Glass, Add</i>	118.10	
08 52 16 00-0160	EA		25-5/8" x 84-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	714.92	51.39
			<i>For Tempered Low-E Insulated Glass, Add</i>	122.43	
08 52 16 00-0161	EA		29-5/8" x 84-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	739.40	52.82
			<i>For Tempered Low-E Insulated Glass, Add</i>	126.75	
08 52 16 00-0162	EA		31-5/8" x 84-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	751.22	53.90
			<i>For Tempered Low-E Insulated Glass, Add</i>	128.83	
08 52 16 00-0163	EA		33-5/8" x 84-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	763.89	54.62
			<i>For Tempered Low-E Insulated Glass, Add</i>	131.07	
08 52 16 00-0164	EA		35-5/8" x 84-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	775.70	55.34
			<i>For Tempered Low-E Insulated Glass, Add</i>	133.15	
08 52 16 00-0165	EA		37-5/8" x 84-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	787.53	55.70
			<i>For Tempered Low-E Insulated Glass, Add</i>	135.22	
08 52 16 00-0166	EA		41-5/8" x 84-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	812.01	57.13
			<i>For Tempered Low-E Insulated Glass, Add</i>	139.55	
08 52 16 00-0167	EA		45-5/8" x 84-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	836.50	58.57
			<i>For Tempered Low-E Insulated Glass, Add</i>	143.87	



Openings	08	08
Windows	08 50	
Wood Windows	08 52	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 52 16 00-0168 88-7/8" Height, Double Hung Wood Clad Windows (Andersen 400 TW Series) (08 52 16 00-0047)		
08 52 16 00-0169 EA 21-5/8" x 88-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	714.92	51.74
For Tempered Low-E Insulated Glass, Add	122.43	
08 52 16 00-0170 EA 25-5/8" x 88-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	739.40	52.82
For Tempered Low-E Insulated Glass, Add	126.75	
08 52 16 00-0171 EA 29-5/8" x 88-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	763.89	54.26
For Tempered Low-E Insulated Glass, Add	131.07	
08 52 16 00-0172 EA 31-5/8" x 88-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	775.70	55.34
For Tempered Low-E Insulated Glass, Add	133.15	
08 52 16 00-0173 EA 33-5/8" x 88-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	787.53	56.06
For Tempered Low-E Insulated Glass, Add	135.22	
08 52 16 00-0174 EA 35-5/8" x 88-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	800.20	56.78
For Tempered Low-E Insulated Glass, Add	137.47	
08 52 16 00-0175 EA 37-5/8" x 88-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	812.01	57.13
For Tempered Low-E Insulated Glass, Add	139.55	
08 52 16 00-0176 EA 41-5/8" x 88-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	836.50	58.57
For Tempered Low-E Insulated Glass, Add	143.87	
08 52 16 00-0177 EA 45-5/8" x 88-7/8" Double Hung Wood Clad Window (Andersen 400 TW Series).....	860.99	60.01
For Tempered Low-E Insulated Glass, Add	148.19	
08 52 16 00-0178 Casement Wood Clad Windows (08 52 16)		
08 52 16 00-0179 Casement Wood Clad Windows (Andersen 200 Series) (08 52 16 00-0178)		
Note: Includes painted or stained wood interior, colored PVC clad exterior, standard hardware and clear insulated glass. Excludes grilles and insect screens.		
08 52 16 00-0180 One Operating Sash, Casement Wood Clad Windows (Andersen 200 Series) (08 52 16 00-0179)		
08 52 16 00-0181 24-1/8" Height, One Operating Sash, Casement Wood Clad Windows (Andersen 200 Series) (08 52 16 00-0180)		
08 52 16 00-0182 EA 17" x 24-1/8", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series)	184.95	27.31
For Tempered Clear Insulated Glass, Add	26.21	
08 52 16 00-0183 EA 20-1/2" x 24-1/8", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series)	195.24	28.03
For Tempered Clear Insulated Glass, Add	27.84	
08 52 16 00-0184 EA 24-1/8" x 24-1/8", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series)	206.93	29.47
For Tempered Clear Insulated Glass, Add	29.60	
08 52 16 00-0185 EA 28-3/8" x 24-1/8", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series)	217.78	30.91
For Tempered Clear Insulated Glass, Add	31.19	
08 52 16 00-0186 28-3/8" Height, One Operating Sash, Casement Wood Clad Windows (Andersen 200 Series) (08 52 16 00-0180)		
08 52 16 00-0187 EA 17" x 28-3/8", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series)	197.99	28.75
For Tempered Clear Insulated Glass, Add	28.24	
08 52 16 00-0188 EA 20-1/2" x 28-3/8", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series)	208.29	29.47
For Tempered Clear Insulated Glass, Add	29.87	
08 52 16 00-0189 EA 24-1/8" x 28-3/8", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series)	219.96	30.91
For Tempered Clear Insulated Glass, Add	31.63	
08 52 16 00-0190 EA 28-3/8" x 28-3/8", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series)	226.33	32.34
For Tempered Clear Insulated Glass, Add	32.33	
08 52 16 00-0191 EA 31-1/2" x 28-3/8", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series)	239.40	33.78
For Tempered Clear Insulated Glass, Add	34.51	
08 52 16 00-0192 35-15/16" Height, One Operating Sash, Casement Wood Clad Windows (Andersen 200 Series) (08 52 16 00-0180)		
08 52 16 00-0193 EA 17" x 35-15/16", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series)	221.32	30.91
For Tempered Clear Insulated Glass, Add	31.90	
08 52 16 00-0194 EA 20-1/2" x 35-15/16", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series)	232.28	32.34
For Tempered Clear Insulated Glass, Add	33.66	
08 52 16 00-0195 EA 24-1/8" x 35-15/16", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series)	243.97	33.42
For Tempered Clear Insulated Glass, Add	35.42	
08 52 16 00-0196 EA 28-3/8" x 35-15/16", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series)	261.75	34.86
For Tempered Clear Insulated Glass, Add	38.41	
08 52 16 00-0197 EA 31-1/2" x 35-15/16", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series)	278.45	35.94
For Tempered Clear Insulated Glass, Add	41.32	
08 52 16 00-0198 EA 35-15/16" x 35-15/16", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series)	294.47	36.65
For Tempered Clear Insulated Glass, Add	44.23	
08 52 16 00-0199 40-13/16" Height, One Operating Sash, Casement Wood Clad Windows (Andersen 200 Series) (08 52 16 00-0180)		
08 52 16 00-0200 EA 17" x 40-13/16", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series)	237.10	33.06
For Tempered Clear Insulated Glass, Add	34.34	
08 52 16 00-0201 EA 20-1/2" x 40-13/16", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series)	247.39	33.78
For Tempered Clear Insulated Glass, Add	35.97	

08 Openings**08 50 Windows****08 52 Wood Windows**

MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
08 52 16 00-0202	EA	24-1/8" x 40-13/16", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series)	259.07		35.22
		<i>For Tempered Clear Insulated Glass, Add</i>	37.73		
08 52 16 00-0203	EA	28-3/8" x 40-13/16", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series)	284.31		36.65
		<i>For Tempered Clear Insulated Glass, Add</i>	42.20		
08 52 16 00-0204	EA	31-1/2" x 40-13/16", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series)	301.77		38.09
		<i>For Tempered Clear Insulated Glass, Add</i>	45.26		
08 52 16 00-0205	EA	35-15/16" x 40-13/16", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series)	318.48		39.53
		<i>For Tempered Clear Insulated Glass, Add</i>	48.03		
08 52 16 00-0206		48" Height, One Operating Sash, Casement Wood Clad Windows			
		(Andersen 200 Series) (08 52 16 00-0180)			
08 52 16 00-0207	EA	17" x 48", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series)	259.80		35.94
		<i>For Tempered Clear Insulated Glass, Add</i>	37.73		
08 52 16 00-0208	EA	20-1/2" x 48", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series)	270.76		36.65
		<i>For Tempered Clear Insulated Glass, Add</i>	39.49		
08 52 16 00-0209	EA	24-1/8" x 48", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series)	282.44		38.09
		<i>For Tempered Clear Insulated Glass, Add</i>	41.25		
08 52 16 00-0210	EA	28-3/8" x 48", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series)	316.82		39.53
		<i>For Tempered Clear Insulated Glass, Add</i>	47.55		
08 52 16 00-0211	EA	31-1/2" x 48", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series)	330.67		40.96
		<i>For Tempered Clear Insulated Glass, Add</i>	49.89		
08 52 16 00-0212	EA	35-15/16" x 48", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series)	351.33		42.40
		<i>For Tempered Clear Insulated Glass, Add</i>	53.45		
08 52 16 00-0213		52-13/16" Height, One Operating Sash, Casement Wood Clad Windows			
		(Andersen 200 Series) (08 52 16 00-0180)			
08 52 16 00-0214	EA	17" x 52-13/16", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series)	274.87		37.38
		<i>For Tempered Clear Insulated Glass, Add</i>	40.17		
08 52 16 00-0215	EA	20-1/2" x 52-13/16", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series)	285.15		38.09
		<i>For Tempered Clear Insulated Glass, Add</i>	41.79		
08 52 16 00-0216	EA	24-1/8" x 52-13/16", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series)	296.84		39.53
		<i>For Tempered Clear Insulated Glass, Add</i>	43.56		
08 52 16 00-0217	EA	28-3/8" x 52-13/16", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series)	339.01		40.96
		<i>For Tempered Clear Insulated Glass, Add</i>	51.41		
08 52 16 00-0218	EA	31-1/2" x 52-13/16", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series)	359.28		42.40
		<i>For Tempered Clear Insulated Glass, Add</i>	55.04		
08 52 16 00-0219	EA	35-15/16" x 52-13/16", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series)	373.17		43.84
		<i>For Tempered Clear Insulated Glass, Add</i>	57.24		
08 52 16 00-0220		59-7/8" Height, One Operating Sash, Casement Wood Clad Windows			
		(Andersen 200 Series) (08 52 16 00-0180)			
08 52 16 00-0221	EA	17" x 59-7/8", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series)	296.84		39.53
		<i>For Tempered Clear Insulated Glass, Add</i>	43.56		
08 52 16 00-0222	EA	20-1/2" x 59-7/8", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series)	307.80		40.96
		<i>For Tempered Clear Insulated Glass, Add</i>	45.32		
08 52 16 00-0223	EA	24-1/8" x 59-7/8", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series)	319.48		42.04
		<i>For Tempered Clear Insulated Glass, Add</i>	47.08		
08 52 16 00-0224	EA	28-3/8" x 59-7/8", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series)	371.14		43.48
		<i>For Tempered Clear Insulated Glass, Add</i>	56.84		
08 52 16 00-0225	EA	31-1/2" x 59-7/8", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series)	385.75		44.56
		<i>For Tempered Clear Insulated Glass, Add</i>	59.33		
08 52 16 00-0226	EA	35-15/16" x 59-7/8", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series)	405.30		46.00
		<i>For Tempered Clear Insulated Glass, Add</i>	62.66		
08 52 16 00-0227		64-13/16" Height, One Operating Sash, Casement Wood Clad Windows			
		(Andersen 200 Series) (08 52 16 00-0180)			
08 52 16 00-0228	EA	17" x 64-13/16", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series)	312.62		41.69
		<i>For Tempered Clear Insulated Glass, Add</i>	45.99		
08 52 16 00-0229	EA	20-1/2" x 64-13/16", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series)	322.91		42.40
		<i>For Tempered Clear Insulated Glass, Add</i>	47.62		
08 52 16 00-0230	EA	24-1/8" x 64-13/16", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series)	334.59		43.84
		<i>For Tempered Clear Insulated Glass, Add</i>	49.38		
08 52 16 00-0231	EA	28-3/8" x 64-13/16", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series)	393.71		45.28
		<i>For Tempered Clear Insulated Glass, Add</i>	60.63		
08 52 16 00-0232	EA	31-1/2" x 64-13/16", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series)	407.36		46.72
		<i>For Tempered Clear Insulated Glass, Add</i>	62.93		
08 52 16 00-0233	EA	35-15/16" x 64-13/16", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series)	427.87		48.16
		<i>For Tempered Clear Insulated Glass, Add</i>	66.46		
08 52 16 00-0234		71-7/8" Height, One Operating Sash, Casement Wood Clad Windows			
		(Andersen 200 Series) (08 52 16 00-0180)			
08 52 16 00-0235	EA	17" x 71-7/8", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series)	334.59		43.84
		<i>For Tempered Clear Insulated Glass, Add</i>	49.38		
08 52 16 00-0236	EA	20-1/2" x 71-7/8", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series)	345.56		45.28
		<i>For Tempered Clear Insulated Glass, Add</i>	51.14		



Openings	08	08
Windows	08 50	
Wood Windows	08 52	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 52 16 00-0237	EA		24-1/8" x 71-7/8", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	357.25 52.91	46.35
08 52 16 00-0238	EA		28-3/8" x 71-7/8", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	425.84 66.05	47.79
08 52 16 00-0239	EA		31-1/2" x 71-7/8", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	442.40 68.93	48.87
08 52 16 00-0240	EA		35-15/16" x 71-7/8", One Operating Sash, Casement Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	460.00 71.88	50.31
08 52 16 00-0241			Two Operating Sashes, Casement Wood Clad Windows (Andersen 200 Series) (08 52 16 00-0179)		
08 52 16 00-0242			24-1/8" Height, Two Operating Sashes, Casement Wood Clad Windows (Andersen 200 Series) (08 52 16 00-0241)		
08 52 16 00-0243	EA		40-3/4" x 24-1/8", Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	321.37 50.19	35.22
08 52 16 00-0244	EA		48" x 24-1/8", Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series)..... <i>For Tempered Clear Insulated Glass, Add</i>	363.81 57.53	38.09
08 52 16 00-0245	EA		56-1/2" x 24-1/8", Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	412.64 66.14	40.96
08 52 16 00-0246			28-3/8" Height, Two Operating Sashes, Casement Wood Clad Windows (Andersen 200 Series) (08 52 16 00-0241)		
08 52 16 00-0247	EA		40-3/4" x 28-3/8", Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	345.75 54.49	36.65
08 52 16 00-0248	EA		48" x 28-3/8", Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series)..... <i>For Tempered Clear Insulated Glass, Add</i>	388.19 61.83	39.53
08 52 16 00-0249	EA		56-1/2" x 28-3/8", Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	437.01 70.44	42.40
08 52 16 00-0250			35-15/16" Height, Two Operating Sashes, Casement Wood Clad Windows (Andersen 200 Series) (08 52 16 00-0241)		
08 52 16 00-0251	EA		33-3/4" x 35-15/16", Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	342.87 53.91	36.65
08 52 16 00-0252	EA		40-3/4" x 35-15/16", Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	385.84 61.50	39.53
08 52 16 00-0253	EA		48" x 35-15/16", Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series)..... <i>For Tempered Clear Insulated Glass, Add</i>	430.89 69.36	42.40
08 52 16 00-0254	EA		56-1/2" x 35-15/16", Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	482.71 78.57	44.92
08 52 16 00-0255	EA		62-3/4" x 35-15/16", Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	517.59 84.69	47.08
08 52 16 00-0256	EA		71-5/8" x 35-15/16", Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	575.47 94.97	50.31
08 52 16 00-0257			40-13/16" Height, Two Operating Sashes, Casement Wood Clad Windows (Andersen 200 Series) (08 52 16 00-0241)		
08 52 16 00-0258	EA		33-3/4" x 40-13/16", Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	372.88 59.20	38.45
08 52 16 00-0259	EA		40-3/4" x 40-13/16", Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	415.86 66.78	40.96
08 52 16 00-0260	EA		48" x 40-13/16", Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series)..... <i>For Tempered Clear Insulated Glass, Add</i>	460.90 74.64	43.84
08 52 16 00-0261	EA		56-1/2" x 40-13/16", Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	512.72 83.86	46.72
08 52 16 00-0262	EA		62-3/4" x 40-13/16", Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	551.20 90.69	48.87
08 52 16 00-0263	EA		71-5/8" x 40-13/16", Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	709.15 120.99	52.11
08 52 16 00-0264			48" Height, Two Operating Sashes, Casement Wood Clad Windows (Andersen 200 Series) (08 52 16 00-0241)		
08 52 16 00-0265	EA		33-3/4" x 48", Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series)..... <i>For Tempered Clear Insulated Glass, Add</i>	417.25 66.92	41.33
08 52 16 00-0266	EA		40-3/4" x 48", Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series)..... <i>For Tempered Clear Insulated Glass, Add</i>	460.90 74.64	43.84
08 52 16 00-0267	EA		48" x 48", Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series)..... <i>For Tempered Clear Insulated Glass, Add</i>	505.95 82.50	46.72
08 52 16 00-0268	EA		56-1/2" x 48", Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series)..... <i>For Tempered Clear Insulated Glass, Add</i>	557.77 91.72	49.59
08 52 16 00-0269	EA		62-3/4" x 48", Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series)..... <i>For Tempered Clear Insulated Glass, Add</i>	594.70 98.24	51.74
08 52 16 00-0270	EA		71-5/8" x 48", Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series)..... <i>For Tempered Clear Insulated Glass, Add</i>	650.53 108.11	54.98

08 Openings**08 50 Windows**

08 52 Wood Windows



MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
08 52 16 00-0271		52-13/16" Height, Two Operating Sashes, Casement Wood Clad Windows (Andersen 200 Series) <small>(08 52 16 00-0241)</small>			
08 52 16 00-0272	EA	33-3/4" x 52-13/16", Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series).....	446.54		42.77
		<i>For Tempered Clear Insulated Glass, Add</i>	72.20		
08 52 16 00-0273	EA	40-3/4" x 52-13/16", Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series).....	489.53		45.28
		<i>For Tempered Clear Insulated Glass, Add</i>	79.79		
08 52 16 00-0274	EA	48" x 52-13/16", Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series).....	529.54		48.16
		<i>For Tempered Clear Insulated Glass, Add</i>	86.65		
08 52 16 00-0275	EA	56-1/2" x 52-13/16", Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series).....	586.40		51.03
		<i>For Tempered Clear Insulated Glass, Add</i>	96.87		
08 52 16 00-0276	EA	62-3/4" x 52-13/16", Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series).....	625.01		53.18
		<i>For Tempered Clear Insulated Glass, Add</i>	103.73		
08 52 16 00-0277	EA	71-5/8" x 52-13/16", Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series).....	679.84		56.42
		<i>For Tempered Clear Insulated Glass, Add</i>	113.40		
08 52 16 00-0278		59-7/8" Height, Two Operating Sashes, Casement Wood Clad Windows (Andersen 200 Series) <small>(08 52 16 00-0241)</small>			
08 52 16 00-0279	EA	33-3/4" x 59-7/8", Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series).....	490.20		45.28
		<i>For Tempered Clear Insulated Glass, Add</i>	79.93		
08 52 16 00-0280	EA	40-3/4" x 59-7/8", Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series).....	533.18		48.16
		<i>For Tempered Clear Insulated Glass, Add</i>	87.52		
08 52 16 00-0281	EA	48" x 59-7/8", Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series).....	578.22		51.03
		<i>For Tempered Clear Insulated Glass, Add</i>	95.38		
08 52 16 00-0282	EA	56-1/2" x 59-7/8", Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series).....	630.05		53.55
		<i>For Tempered Clear Insulated Glass, Add</i>	104.59		
08 52 16 00-0283	EA	62-3/4" x 59-7/8", Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series).....	668.67		55.70
		<i>For Tempered Clear Insulated Glass, Add</i>	111.45		
08 52 16 00-0284	EA	71-5/8" x 59-7/8", Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series).....	722.81		58.94
		<i>For Tempered Clear Insulated Glass, Add</i>	120.99		
08 52 16 00-0285		64-13/16" Height, Two Operating Sashes, Casement Wood Clad Windows (Andersen 200 Series) <small>(08 52 16 00-0241)</small>			
08 52 16 00-0286	EA	33-3/4" x 64-13/16", Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series).....	520.22		47.08
		<i>For Tempered Clear Insulated Glass, Add</i>	85.21		
08 52 16 00-0287	EA	40-3/4" x 64-13/16", Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series).....	563.19		49.59
		<i>For Tempered Clear Insulated Glass, Add</i>	92.80		
08 52 16 00-0288	EA	48" x 64-13/16", Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series).....	608.93		52.47
		<i>For Tempered Clear Insulated Glass, Add</i>	100.80		
08 52 16 00-0289	EA	56-1/2" x 64-13/16", Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series).....	660.74		55.34
		<i>For Tempered Clear Insulated Glass, Add</i>	110.01		
08 52 16 00-0290		71-7/8" Height, Two Operating Sashes, Casement Wood Clad Windows (Andersen 200 Series) <small>(08 52 16 00-0241)</small>			
08 52 16 00-0291	EA	33-3/4" x 71-7/8", Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series).....	563.87		49.59
		<i>For Tempered Clear Insulated Glass, Add</i>	92.94		
08 52 16 00-0292	EA	40-3/4" x 71-7/8", Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series).....	606.84		52.47
		<i>For Tempered Clear Insulated Glass, Add</i>	100.53		
08 52 16 00-0293	EA	48" x 71-7/8", Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series).....	651.89		55.34
		<i>For Tempered Clear Insulated Glass, Add</i>	108.39		
08 52 16 00-0294	EA	56-1/2" x 71-7/8", Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series).....	703.72		57.86
		<i>For Tempered Clear Insulated Glass, Add</i>	117.60		
08 52 16 00-0295		One Stationary Sash And Two Operating Sashes, Casement Wood Clad Windows (Andersen 200 Series) <small>(08 52 16 00-0179)</small>			
08 52 16 00-0296		24-1/8" Height, One Stationary Sash And Two Operating Sashes, Casement Wood Clad Windows (Andersen 200 Series) <small>(08 52 16 00-0295)</small>			
08 52 16 00-0297	EA	71-7/8" x 24-1/8", One Stationary Sash And Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series)	502.58		46.35
		<i>For Tempered Clear Insulated Glass, Add</i>	81.97		
08 52 16 00-0298	EA	84-5/8" x 24-1/8", One Stationary Sash And Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series)	582.46		51.03
		<i>For Tempered Clear Insulated Glass, Add</i>	96.08		
08 52 16 00-0299		28-3/8" Height, One Stationary Sash And Two Operating Sashes, Casement Wood Clad Windows (Andersen 200 Series) <small>(08 52 16 00-0295)</small>			
08 52 16 00-0300	EA	71-7/8" x 28-3/8", One Stationary Sash And Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series)	532.29		47.79
		<i>For Tempered Clear Insulated Glass, Add</i>	87.34		
08 52 16 00-0301	EA	84-5/8" x 28-3/8", One Stationary Sash And Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series)	607.15		52.47
		<i>For Tempered Clear Insulated Glass, Add</i>	100.44		



Openings	08	08
Windows	08 50	
Wood Windows	08 52	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 52 16 00-0302			35-15/16" Height, One Stationary Sash And Two Operating Sashes, Casement Wood Clad Windows (Andersen 200 Series) <small>(08 52 16 00-0295)</small>		
08 52 16 00-0303	EA		61" x 35-15/16", One Stationary Sash And Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series)	512.86	46.72
			<i>For Tempered Clear Insulated Glass, Add</i>	83.89	
08 52 16 00-0304	EA		71-7/8" x 35-15/16", One Stationary Sash And Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series)	576.83	50.31
			<i>For Tempered Clear Insulated Glass, Add</i>	95.24	
08 52 16 00-0305	EA		84-5/8" x 35-15/16", One Stationary Sash And Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series)	655.95	55.34
			<i>For Tempered Clear Insulated Glass, Add</i>	109.20	
08 52 16 00-0306			40-13/16" Height, One Stationary Sash And Two Operating Sashes, Casement Wood Clad Windows (Andersen 200 Series) <small>(08 52 16 00-0295)</small>		
08 52 16 00-0307	EA		61" x 40-13/16", One Stationary Sash And Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series)	541.50	48.87
			<i>For Tempered Clear Insulated Glass, Add</i>	88.89	
08 52 16 00-0308	EA		71-7/8" x 40-13/16", One Stationary Sash And Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series)	607.52	52.11
			<i>For Tempered Clear Insulated Glass, Add</i>	100.66	
08 52 16 00-0309	EA		84-5/8" x 40-13/16", One Stationary Sash And Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series)	685.98	56.78
			<i>For Tempered Clear Insulated Glass, Add</i>	114.48	
08 52 16 00-0310			48" Height, One Stationary Sash And Two Operating Sashes, Casement Wood Clad Windows (Andersen 200 Series) <small>(08 52 16 00-0295)</small>		
08 52 16 00-0311	EA		71-7/8" x 48", One Stationary Sash And Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series)	651.89	54.98
			<i>For Tempered Clear Insulated Glass, Add</i>	108.39	
08 52 16 00-0312	EA		84-5/8" x 48", One Stationary Sash And Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series)	730.34	59.65
			<i>For Tempered Clear Insulated Glass, Add</i>	122.21	
08 52 16 00-0313			52-13/16" Height, One Stationary Sash And Two Operating Sashes, Casement Wood Clad Windows (Andersen 200 Series) <small>(08 52 16 00-0295)</small>		
08 52 16 00-0314	EA		71-7/8" x 52-13/16", One Stationary Sash And Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series)	681.19	56.42
			<i>For Tempered Clear Insulated Glass, Add</i>	113.67	
08 52 16 00-0315	EA		84-5/8" x 52-13/16", One Stationary Sash And Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series)	759.64	61.09
			<i>For Tempered Clear Insulated Glass, Add</i>	127.49	
08 52 16 00-0316			59-7/8" Height, One Stationary Sash And Two Operating Sashes, Casement Wood Clad Windows (Andersen 200 Series) <small>(08 52 16 00-0295)</small>		
08 52 16 00-0317	EA		71-7/8" x 59-7/8", One Stationary Sash And Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series)	724.16	58.94
			<i>For Tempered Clear Insulated Glass, Add</i>	121.26	
08 52 16 00-0318	EA		84-5/8" x 59-7/8", One Stationary Sash And Two Operating Sashes, Casement Wood Clad Window (Andersen 200 Series)	803.29	63.96
			<i>For Tempered Clear Insulated Glass, Add</i>	135.22	
08 52 16 00-0319			Casement Wood Clad Windows (Andersen 400 Series) <small>(08 52 16 00-0178)</small> Note: Includes painted or stained wood interior, colored PVC clad exterior, standard hardware and Low-E insulated glass. Excludes grilles and insect screens.		
08 52 16 00-0320			One Operating Sash, Casement Wood Clad Windows (Andersen 400 Series) <small>(08 52 16 00-0319)</small>		
08 52 16 00-0321			24-1/8" Height, One Operating Sash, Casement Wood Clad Windows (Andersen 400 Series) <small>(08 52 16 00-0320)</small>		
08 52 16 00-0322	EA		17" x 24-1/8", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	216.46	27.31
			<i>For Tempered Low-E Insulated Glass, Add</i>	32.51	
08 52 16 00-0323	EA		20-1/2" x 24-1/8", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	228.78	28.03
			<i>For Tempered Low-E Insulated Glass, Add</i>	34.54	
08 52 16 00-0324	EA		24-1/8" x 24-1/8", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	242.67	29.47
			<i>For Tempered Low-E Insulated Glass, Add</i>	36.75	
08 52 16 00-0325	EA		28-3/8" x 24-1/8", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	255.52	30.91
			<i>For Tempered Low-E Insulated Glass, Add</i>	38.74	
08 52 16 00-0326			28-3/8" Height, One Operating Sash, Casement Wood Clad Windows (Andersen 400 Series) <small>(08 52 16 00-0320)</small>		
08 52 16 00-0327	EA		17" x 28-3/8", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	232.04	28.75
			<i>For Tempered Low-E Insulated Glass, Add</i>	35.05	
08 52 16 00-0328	EA		20-1/2" x 28-3/8", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	244.36	29.47
			<i>For Tempered Low-E Insulated Glass, Add</i>	37.08	

08 Openings**08 50 Windows****08 52 Wood Windows**

MINOR		TOTAL DIRECT		DEMOLITION
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST
08 52 16 00-0329	EA	24-1/8" x 28-3/8", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	258.24	30.91
		<i>For Tempered Low-E Insulated Glass, Add</i>	39.29	
08 52 16 00-0330	EA	28-3/8" x 28-3/8", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	265.48	32.34
		<i>For Tempered Low-E Insulated Glass, Add</i>	40.16	
08 52 16 00-0331	EA	31-1/2" x 28-3/8", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	281.28	33.78
		<i>For Tempered Low-E Insulated Glass, Add</i>	42.89	
08 52 16 00-0332		35-15/16" Height, One Operating Sash, Casement Wood Clad Windows		
		(Andersen 400 Series) <small>(08 52 16 00-0320)</small>		
08 52 16 00-0333	EA	17" x 35-15/16", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	259.94	30.91
		<i>For Tempered Low-E Insulated Glass, Add</i>	39.63	
08 52 16 00-0334	EA	20-1/2" x 35-15/16", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	273.10	32.34
		<i>For Tempered Low-E Insulated Glass, Add</i>	41.83	
08 52 16 00-0335	EA	24-1/8" x 35-15/16", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	287.00	33.42
		<i>For Tempered Low-E Insulated Glass, Add</i>	44.03	
08 52 16 00-0336	EA	28-3/8" x 35-15/16", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	308.50	34.86
		<i>For Tempered Low-E Insulated Glass, Add</i>	47.76	
08 52 16 00-0337	EA	31-1/2" x 35-15/16", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	328.83	35.94
		<i>For Tempered Low-E Insulated Glass, Add</i>	51.39	
08 52 16 00-0338	EA	35-15/16" x 35-15/16", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	348.51	36.65
		<i>For Tempered Low-E Insulated Glass, Add</i>	55.04	
08 52 16 00-0339		40-13/16" Height, One Operating Sash, Casement Wood Clad Windows		
		(Andersen 400 Series) <small>(08 52 16 00-0320)</small>		
08 52 16 00-0340	EA	17" x 40-13/16", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	278.77	33.06
		<i>For Tempered Low-E Insulated Glass, Add</i>	42.67	
08 52 16 00-0341	EA	20-1/2" x 40-13/16", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	291.10	33.78
		<i>For Tempered Low-E Insulated Glass, Add</i>	44.71	
08 52 16 00-0342	EA	24-1/8" x 40-13/16", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	304.98	35.22
		<i>For Tempered Low-E Insulated Glass, Add</i>	46.91	
08 52 16 00-0343	EA	28-3/8" x 40-13/16", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	335.80	36.65
		<i>For Tempered Low-E Insulated Glass, Add</i>	52.50	
08 52 16 00-0344	EA	31-1/2" x 40-13/16", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	357.09	38.09
		<i>For Tempered Low-E Insulated Glass, Add</i>	56.32	
08 52 16 00-0345	EA	35-15/16" x 40-13/16", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	377.25	39.53
		<i>For Tempered Low-E Insulated Glass, Add</i>	59.78	
08 52 16 00-0346		48" Height, One Operating Sash, Casement Wood Clad Windows		
		(Andersen 400 Series) <small>(08 52 16 00-0320)</small>		
08 52 16 00-0347	EA	17" x 48", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	305.71	35.94
		<i>For Tempered Low-E Insulated Glass, Add</i>	46.91	
08 52 16 00-0348	EA	20-1/2" x 48", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	318.87	36.65
		<i>For Tempered Low-E Insulated Glass, Add</i>	49.11	
08 52 16 00-0349	EA	24-1/8" x 48", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	332.75	38.09
		<i>For Tempered Low-E Insulated Glass, Add</i>	51.31	
08 52 16 00-0350	EA	28-3/8" x 48", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	375.00	39.53
		<i>For Tempered Low-E Insulated Glass, Add</i>	59.19	
08 52 16 00-0351	EA	31-1/2" x 48", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	391.78	40.96
		<i>For Tempered Low-E Insulated Glass, Add</i>	62.11	
08 52 16 00-0352	EA	35-15/16" x 48", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	416.88	42.40
		<i>For Tempered Low-E Insulated Glass, Add</i>	66.56	
08 52 16 00-0353		52-13/16" Height, One Operating Sash, Casement Wood Clad Windows		
		(Andersen 400 Series) <small>(08 52 16 00-0320)</small>		
08 52 16 00-0354	EA	17" x 52-13/16", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	323.82	37.38
		<i>For Tempered Low-E Insulated Glass, Add</i>	49.96	
08 52 16 00-0355	EA	20-1/2" x 52-13/16", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	336.13	38.09
		<i>For Tempered Low-E Insulated Glass, Add</i>	51.99	
08 52 16 00-0356	EA	24-1/8" x 52-13/16", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	350.02	39.53
		<i>For Tempered Low-E Insulated Glass, Add</i>	54.19	
08 52 16 00-0357	EA	28-3/8" x 52-13/16", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	402.03	40.96
		<i>For Tempered Low-E Insulated Glass, Add</i>	64.02	
08 52 16 00-0358	EA	31-1/2" x 52-13/16", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	426.82	42.40
		<i>For Tempered Low-E Insulated Glass, Add</i>	68.55	
08 52 16 00-0359	EA	35-15/16" x 52-13/16", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	443.46	43.84
		<i>For Tempered Low-E Insulated Glass, Add</i>	71.30	
08 52 16 00-0360		59-7/8" Height, One Operating Sash, Casement Wood Clad Windows		
		(Andersen 400 Series) <small>(08 52 16 00-0320)</small>		
08 52 16 00-0361	EA	17" x 59-7/8", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	350.02	39.53
		<i>For Tempered Low-E Insulated Glass, Add</i>	54.19	
08 52 16 00-0362	EA	20-1/2" x 59-7/8", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	363.18	40.96
		<i>For Tempered Low-E Insulated Glass, Add</i>	56.39	
08 52 16 00-0363	EA	24-1/8" x 59-7/8", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	377.07	42.04
		<i>For Tempered Low-E Insulated Glass, Add</i>	58.60	



Openings	08	08
Windows	08 50	
Wood Windows	08 52	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 52 16 00-0364 EA 28-3/8" x 59-7/8", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	440.92	43.48
For Tempered Low-E Insulated Glass, Add	70.79	
08 52 16 00-0365 EA 31-1/2" x 59-7/8", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	458.65	44.56
For Tempered Low-E Insulated Glass, Add	73.91	
08 52 16 00-0366 EA 35-15/16" x 59-7/8", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	482.37	46.00
For Tempered Low-E Insulated Glass, Add	78.08	
08 52 16 00-0367 64-13/16" Height, One Operating Sash, Casement Wood Clad Windows (Andersen 400 Series) (08 52 16 00-0320)		
08 52 16 00-0368 EA 17" x 64-13/16", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	368.86	41.69
For Tempered Low-E Insulated Glass, Add	57.24	
08 52 16 00-0369 EA 20-1/2" x 64-13/16", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	381.18	42.40
For Tempered Low-E Insulated Glass, Add	59.27	
08 52 16 00-0370 EA 24-1/8" x 64-13/16", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	395.06	43.84
For Tempered Low-E Insulated Glass, Add	61.48	
08 52 16 00-0371 EA 28-3/8" x 64-13/16", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	468.24	45.28
For Tempered Low-E Insulated Glass, Add	75.54	
08 52 16 00-0372 EA 31-1/2" x 64-13/16", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	484.76	46.72
For Tempered Low-E Insulated Glass, Add	78.41	
08 52 16 00-0373 EA 35-15/16" x 64-13/16", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	509.68	48.16
For Tempered Low-E Insulated Glass, Add	82.82	
08 52 16 00-0374 71-7/8" Height, One Operating Sash, Casement Wood Clad Windows (Andersen 400 Series) (08 52 16 00-0320)		
08 52 16 00-0375 EA 17" x 71-7/8", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	395.06	43.84
For Tempered Low-E Insulated Glass, Add	61.48	
08 52 16 00-0376 EA 20-1/2" x 71-7/8", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	408.23	45.28
For Tempered Low-E Insulated Glass, Add	63.68	
08 52 16 00-0377 EA 24-1/8" x 71-7/8", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	422.12	46.35
For Tempered Low-E Insulated Glass, Add	65.88	
08 52 16 00-0378 EA 28-3/8" x 71-7/8", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	507.14	47.79
For Tempered Low-E Insulated Glass, Add	82.31	
08 52 16 00-0379 EA 31-1/2" x 71-7/8", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	527.30	48.87
For Tempered Low-E Insulated Glass, Add	85.91	
08 52 16 00-0380 EA 35-15/16" x 71-7/8", One Operating Sash, Casement Wood Clad Window (Andersen 400 Series)	548.59	50.31
For Tempered Low-E Insulated Glass, Add	89.59	
08 52 16 00-0381 Two Operating Sashes, Casement Wood Clad Windows (Andersen 400 Series) (08 52 16 00-0319)		
08 52 16 00-0382 24-1/8" Height, Two Operating Sashes, Casement Wood Clad Windows (Andersen 400 Series) (08 52 16 00-0381)		
08 52 16 00-0383 EA 40-3/4" x 24-1/8", Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series)	381.59	35.22
For Tempered Low-E Insulated Glass, Add	62.23	
08 52 16 00-0384 EA 48" x 24-1/8", Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series)	433.20	38.09
For Tempered Low-E Insulated Glass, Add	71.40	
08 52 16 00-0385 EA 56-1/2" x 24-1/8", Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series)	492.80	40.96
For Tempered Low-E Insulated Glass, Add	82.17	
08 52 16 00-0386 28-3/8" Height, Two Operating Sashes, Casement Wood Clad Windows (Andersen 400 Series) (08 52 16 00-0381)		
08 52 16 00-0387 EA 40-3/4" x 28-3/8", Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series)	411.34	36.65
For Tempered Low-E Insulated Glass, Add	67.61	
08 52 16 00-0388 EA 48" x 28-3/8", Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series)	462.96	39.53
For Tempered Low-E Insulated Glass, Add	76.78	
08 52 16 00-0389 EA 56-1/2" x 28-3/8", Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series)	522.54	42.40
For Tempered Low-E Insulated Glass, Add	87.55	
08 52 16 00-0390 35-15/16" Height, Two Operating Sashes, Casement Wood Clad Windows (Andersen 400 Series) (08 52 16 00-0381)		
08 52 16 00-0391 EA 33-3/4" x 35-15/16", Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series)	407.74	36.65
For Tempered Low-E Insulated Glass, Add	66.89	
08 52 16 00-0392 EA 40-3/4" x 35-15/16", Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series)	460.20	39.53
For Tempered Low-E Insulated Glass, Add	76.37	
08 52 16 00-0393 EA 48" x 35-15/16", Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series)	515.07	42.40
For Tempered Low-E Insulated Glass, Add	86.20	
08 52 16 00-0394 EA 56-1/2" x 35-15/16", Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series)	578.41	44.92
For Tempered Low-E Insulated Glass, Add	97.71	
08 52 16 00-0395 EA 62-3/4" x 35-15/16", Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series)	620.94	47.08
For Tempered Low-E Insulated Glass, Add	105.36	
08 52 16 00-0396 EA 71-5/8" x 35-15/16", Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series)	691.67	50.31
For Tempered Low-E Insulated Glass, Add	118.21	
08 52 16 00-0397 40-13/16" Height, Two Operating Sashes, Casement Wood Clad Windows (Andersen 400 Series) (08 52 16 00-0381)		

08 Openings**08 50 Windows****08 52 Wood Windows**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 52 16 00-0398	EA		33-3/4" x 40-13/16", Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series).....	444.36	38.45
			<i>For Tempered Low-E Insulated Glass, Add</i>	73.49	
08 52 16 00-0399	EA		40-3/4" x 40-13/16", Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series).....	496.83	40.96
			<i>For Tempered Low-E Insulated Glass, Add</i>	82.98	
08 52 16 00-0400	EA		48" x 40-13/16", Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series).....	551.69	43.84
			<i>For Tempered Low-E Insulated Glass, Add</i>	92.80	
08 52 16 00-0401	EA		56-1/2" x 40-13/16", Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series).....	615.03	46.72
			<i>For Tempered Low-E Insulated Glass, Add</i>	104.32	
08 52 16 00-0402	EA		62-3/4" x 40-13/16", Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series).....	662.05	48.87
			<i>For Tempered Low-E Insulated Glass, Add</i>	112.86	
08 52 16 00-0403	EA		71-5/8" x 40-13/16", Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series).....	857.87	52.11
			<i>For Tempered Low-E Insulated Glass, Add</i>	150.73	
08 52 16 00-0404			48" Height, Two Operating Sashes, Casement Wood Clad Windows (Andersen 400 Series) (08 52 16 00-0381)		
08 52 16 00-0405	EA		33-3/4" x 48", Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series).....	498.39	41.33
			<i>For Tempered Low-E Insulated Glass, Add</i>	83.15	
08 52 16 00-0406	EA		40-3/4" x 48", Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series).....	551.69	43.84
			<i>For Tempered Low-E Insulated Glass, Add</i>	92.80	
08 52 16 00-0407	EA		48" x 48", Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series).....	606.56	46.72
			<i>For Tempered Low-E Insulated Glass, Add</i>	102.63	
08 52 16 00-0408	EA		56-1/2" x 48", Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series).....	669.90	49.59
			<i>For Tempered Low-E Insulated Glass, Add</i>	114.14	
08 52 16 00-0409	EA		62-3/4" x 48", Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series).....	714.98	51.74
			<i>For Tempered Low-E Insulated Glass, Add</i>	122.30	
08 52 16 00-0410	EA		71-5/8" x 48", Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series).....	783.16	54.98
			<i>For Tempered Low-E Insulated Glass, Add</i>	134.64	
08 52 16 00-0411			52-13/16" Height, Two Operating Sashes, Casement Wood Clad Windows (Andersen 400 Series) (08 52 16 00-0381)		
08 52 16 00-0412	EA		33-3/4" x 52-13/16", Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series).....	534.29	42.77
			<i>For Tempered Low-E Insulated Glass, Add</i>	89.75	
08 52 16 00-0413	EA		40-3/4" x 52-13/16", Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series).....	586.75	45.28
			<i>For Tempered Low-E Insulated Glass, Add</i>	99.24	
08 52 16 00-0414	EA		48" x 52-13/16", Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series).....	636.59	48.16
			<i>For Tempered Low-E Insulated Glass, Add</i>	108.06	
08 52 16 00-0415	EA		56-1/2" x 52-13/16", Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series).....	704.97	51.03
			<i>For Tempered Low-E Insulated Glass, Add</i>	120.58	
08 52 16 00-0416	EA		62-3/4" x 52-13/16", Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series).....	752.16	53.18
			<i>For Tempered Low-E Insulated Glass, Add</i>	129.16	
08 52 16 00-0417	EA		71-5/8" x 52-13/16", Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series).....	819.07	56.42
			<i>For Tempered Low-E Insulated Glass, Add</i>	141.25	
08 52 16 00-0418			59-7/8" Height, Two Operating Sashes, Casement Wood Clad Windows (Andersen 400 Series) (08 52 16 00-0381)		
08 52 16 00-0419	EA		33-3/4" x 59-7/8", Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series).....	587.60	45.28
			<i>For Tempered Low-E Insulated Glass, Add</i>	99.41	
08 52 16 00-0420	EA		40-3/4" x 59-7/8", Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series).....	640.06	48.16
			<i>For Tempered Low-E Insulated Glass, Add</i>	108.89	
08 52 16 00-0421	EA		48" x 59-7/8", Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series).....	694.93	51.03
			<i>For Tempered Low-E Insulated Glass, Add</i>	118.72	
08 52 16 00-0422	EA		56-1/2" x 59-7/8", Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series).....	758.27	53.55
			<i>For Tempered Low-E Insulated Glass, Add</i>	130.24	
08 52 16 00-0423	EA		62-3/4" x 59-7/8", Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series).....	805.47	55.70
			<i>For Tempered Low-E Insulated Glass, Add</i>	138.81	
08 52 16 00-0424	EA		71-5/8" x 59-7/8", Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series).....	871.53	58.94
			<i>For Tempered Low-E Insulated Glass, Add</i>	150.73	
08 52 16 00-0425			64-13/16" Height, Two Operating Sashes, Casement Wood Clad Windows (Andersen 400 Series) (08 52 16 00-0381)		
08 52 16 00-0426	EA		33-3/4" x 64-13/16", Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series).....	624.22	47.08
			<i>For Tempered Low-E Insulated Glass, Add</i>	106.01	
08 52 16 00-0427	EA		40-3/4" x 64-13/16", Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series).....	676.68	49.59
			<i>For Tempered Low-E Insulated Glass, Add</i>	115.50	
08 52 16 00-0428	EA		48" x 64-13/16", Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series).....	732.41	52.47
			<i>For Tempered Low-E Insulated Glass, Add</i>	125.49	
08 52 16 00-0429	EA		56-1/2" x 64-13/16", Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series).....	795.74	55.34
			<i>For Tempered Low-E Insulated Glass, Add</i>	137.01	
08 52 16 00-0430			71-7/8" Height, Two Operating Sashes, Casement Wood Clad Windows (Andersen 400 Series) (08 52 16 00-0381)		
08 52 16 00-0431	EA		33-3/4" x 71-7/8", Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series).....	677.53	49.59
			<i>For Tempered Low-E Insulated Glass, Add</i>	115.67	
08 52 16 00-0432	EA		40-3/4" x 71-7/8", Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series).....	729.98	52.47
			<i>For Tempered Low-E Insulated Glass, Add</i>	125.15	



Openings	08	08
Windows	08 50	
Wood Windows	08 52	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 52 16 00-0433	EA		48" x 71-7/8", Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	784.86 134.98	55.34
08 52 16 00-0434	EA		56-1/2" x 71-7/8", Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	848.21 146.50	57.86
08 52 16 00-0435			One Stationary Sash And Two Operating Sashes, Casement Wood Clad Windows (Andersen 400 Series) <small>(08 52 16 00-0319)</small>		
08 52 16 00-0436			24-1/8" Height, One Stationary Sash And Two Operating Sashes, Casement Wood Clad Windows (Andersen 400 Series) <small>(08 52 16 00-0435)</small>		
08 52 16 00-0437	EA		71-7/8" x 24-1/8", One Stationary Sash And Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	603.79 102.21	46.35
08 52 16 00-0438	EA		84-5/8" x 24-1/8", One Stationary Sash And Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	700.05 119.60	51.03
08 52 16 00-0439			28-3/8" Height, One Stationary Sash And Two Operating Sashes, Casement Wood Clad Windows (Andersen 400 Series) <small>(08 52 16 00-0435)</small>		
08 52 16 00-0440	EA		71-7/8" x 28-3/8", One Stationary Sash And Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	638.95 108.67	47.79
08 52 16 00-0441	EA		84-5/8" x 28-3/8", One Stationary Sash And Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	730.19 125.05	52.47
08 52 16 00-0442			35-15/16" Height, One Stationary Sash And Two Operating Sashes, Casement Wood Clad Windows (Andersen 400 Series) <small>(08 52 16 00-0435)</small>		
08 52 16 00-0443	EA		61" x 35-15/16", One Stationary Sash And Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	615.20 104.35	46.72
08 52 16 00-0444	EA		71-7/8" x 35-15/16", One Stationary Sash And Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	693.36 118.55	50.31
08 52 16 00-0445	EA		84-5/8" x 35-15/16", One Stationary Sash And Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	789.94 136.00	55.34
08 52 16 00-0446			40-13/16" Height, One Stationary Sash And Two Operating Sashes, Casement Wood Clad Windows (Andersen 400 Series) <small>(08 52 16 00-0435)</small>		
08 52 16 00-0447	EA		61" x 40-13/16", One Stationary Sash And Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	650.11 110.62	48.87
08 52 16 00-0448	EA		71-7/8" x 40-13/16", One Stationary Sash And Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	730.83 125.32	52.11
08 52 16 00-0449	EA		84-5/8" x 40-13/16", One Stationary Sash And Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	826.57 142.60	56.78
08 52 16 00-0450			48" Height, One Stationary Sash And Two Operating Sashes, Casement Wood Clad Windows (Andersen 400 Series) <small>(08 52 16 00-0435)</small>		
08 52 16 00-0451	EA		71-7/8" x 48", One Stationary Sash And Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	784.86 134.98	54.98
08 52 16 00-0452	EA		84-5/8" x 48", One Stationary Sash And Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	880.58 152.26	59.65
08 52 16 00-0453			52-13/16" Height, One Stationary Sash And Two Operating Sashes, Casement Wood Clad Windows (Andersen 400 Series) <small>(08 52 16 00-0435)</small>		
08 52 16 00-0454	EA		71-7/8" x 52-13/16", One Stationary Sash And Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	820.77 141.59	56.42
08 52 16 00-0455	EA		84-5/8" x 52-13/16", One Stationary Sash And Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	916.49 158.86	61.09
08 52 16 00-0456			59-7/8" Height, One Stationary Sash And Two Operating Sashes, Casement Wood Clad Windows (Andersen 400 Series) <small>(08 52 16 00-0435)</small>		
08 52 16 00-0457	EA		71-7/8" x 59-7/8", One Stationary Sash And Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	873.22 151.07	58.94

08 Openings**08 50 Windows****08 52 Wood Windows**

MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
08 52 16 00-0458	EA	84-5/8" x 59-7/8", One Stationary Sash And Two Operating Sashes, Casement Wood Clad Window (Andersen 400 Series)	969.80		63.96
		<i>For Tempered Low-E Insulated Glass, Add</i>	168.52		
08 52 16 00-0459		Awning Wood Clad Windows <small>(08 52 16)</small>			
08 52 16 00-0460		Awning Wood Clad Windows (Andersen 200 Series) <small>(08 52 16 00-0459)</small>			
		Note: Includes painted or stained wood interior, colored PVC clad exterior, standard hardware and clear insulated glass. Excludes grilles and insect screens.			
08 52 16 00-0461		Venting, Awning Wood Clad Windows (Andersen 200 Series) <small>(08 52 16 00-0460)</small>			
08 52 16 00-0462		17" Height, Venting, Awning Wood Clad Windows (Andersen 200 Series) <small>(08 52 16 00-0461)</small>			
08 52 16 00-0463	EA	24-1/8" x 17", Venting, Awning Wood Clad Window (Andersen 200 Series)	200.47		29.47
		<i>For Tempered Clear Insulated Glass, Add</i>	28.31		
08 52 16 00-0464	EA	28-3/8" x 17", Venting, Awning Wood Clad Window (Andersen 200 Series)	214.18		30.91
		<i>For Tempered Clear Insulated Glass, Add</i>	30.47		
08 52 16 00-0465	EA	31-1/2" x 17", Venting, Awning Wood Clad Window (Andersen 200 Series)	225.34		31.99
		<i>For Tempered Clear Insulated Glass, Add</i>	32.28		
08 52 16 00-0466	EA	35-15/16" x 17", Venting, Awning Wood Clad Window (Andersen 200 Series)	239.55		33.42
		<i>For Tempered Clear Insulated Glass, Add</i>	34.54		
08 52 16 00-0467	EA	40-13/16" x 17", Venting, Awning Wood Clad Window (Andersen 200 Series)	256.00		35.22
		<i>For Tempered Clear Insulated Glass, Add</i>	37.11		
08 52 16 00-0468	EA	48" x 17", Venting, Awning Wood Clad Window (Andersen 200 Series)	281.40		38.09
		<i>For Tempered Clear Insulated Glass, Add</i>	41.04		
08 52 16 00-0469	EA	52-13/16" x 17", Venting, Awning Wood Clad Window (Andersen 200 Series)	297.15		39.53
		<i>For Tempered Clear Insulated Glass, Add</i>	43.62		
08 52 16 00-0470	EA	59-7/8" x 17", Venting, Awning Wood Clad Window (Andersen 200 Series)	320.47		42.40
		<i>For Tempered Clear Insulated Glass, Add</i>	47.28		
08 52 16 00-0471	EA	64-13/16" x 17", Venting, Awning Wood Clad Window (Andersen 200 Series)	329.86		43.84
		<i>For Tempered Clear Insulated Glass, Add</i>	48.44		
08 52 16 00-0472	EA	71-7/8" x 17", Venting, Awning Wood Clad Window (Andersen 200 Series)	352.96		46.35
		<i>For Tempered Clear Insulated Glass, Add</i>	52.05		
08 52 16 00-0473		20-1/2" Height, Venting, Awning Wood Clad Windows (Andersen 200 Series) <small>(08 52 16 00-0461)</small>			
08 52 16 00-0474	EA	24-1/8" x 20-1/2", Venting, Awning Wood Clad Window (Andersen 200 Series)	211.08		30.91
		<i>For Tempered Clear Insulated Glass, Add</i>	30.00		
08 52 16 00-0475	EA	28-3/8" x 20-1/2", Venting, Awning Wood Clad Window (Andersen 200 Series)	225.82		32.34
		<i>For Tempered Clear Insulated Glass, Add</i>	32.37		
08 52 16 00-0476	EA	31-1/2" x 20-1/2", Venting, Awning Wood Clad Window (Andersen 200 Series)	235.54		33.06
		<i>For Tempered Clear Insulated Glass, Add</i>	33.88		
08 52 16 00-0477	EA	35-15/16" x 20-1/2", Venting, Awning Wood Clad Window (Andersen 200 Series)	251.18		34.50
		<i>For Tempered Clear Insulated Glass, Add</i>	36.44		
08 52 16 00-0478	EA	40-13/16" x 20-1/2", Venting, Awning Wood Clad Window (Andersen 200 Series)	267.64		36.65
		<i>For Tempered Clear Insulated Glass, Add</i>	39.01		
08 52 16 00-0479	EA	48" x 20-1/2", Venting, Awning Wood Clad Window (Andersen 200 Series)	292.37		39.17
		<i>For Tempered Clear Insulated Glass, Add</i>	42.81		
08 52 16 00-0480	EA	52-13/16" x 20-1/2", Venting, Awning Wood Clad Window (Andersen 200 Series)	308.11		40.96
		<i>For Tempered Clear Insulated Glass, Add</i>	45.38		
08 52 16 00-0481	EA	59-7/8" x 20-1/2", Venting, Awning Wood Clad Window (Andersen 200 Series)	332.12		43.12
		<i>For Tempered Clear Insulated Glass, Add</i>	49.17		
08 52 16 00-0482	EA	64-13/16" x 20-1/2", Venting, Awning Wood Clad Window (Andersen 200 Series)	340.72		45.28
		<i>For Tempered Clear Insulated Glass, Add</i>	50.18		
08 52 16 00-0483	EA	71-7/8" x 20-1/2", Venting, Awning Wood Clad Window (Andersen 200 Series)	364.48		47.43
		<i>For Tempered Clear Insulated Glass, Add</i>	53.92		
08 52 16 00-0484	EA	84-5/8" x 20-1/2", Venting, Awning Wood Clad Window (Andersen 200 Series)	545.89		52.47
		<i>For Tempered Clear Insulated Glass, Add</i>	88.34		
08 52 16 00-0485		24-1/8" Height, Venting, Awning Wood Clad Windows (Andersen 200 Series) <small>(08 52 16 00-0461)</small>			
08 52 16 00-0486	EA	24-1/8" x 24-1/8", Venting, Awning Wood Clad Window (Andersen 200 Series)	224.46		32.34
		<i>For Tempered Clear Insulated Glass, Add</i>	32.10		
08 52 16 00-0487	EA	28-3/8" x 24-1/8", Venting, Awning Wood Clad Window (Andersen 200 Series)	238.19		33.78
		<i>For Tempered Clear Insulated Glass, Add</i>	34.27		
08 52 16 00-0488	EA	31-1/2" x 24-1/8", Venting, Awning Wood Clad Window (Andersen 200 Series)	247.61		34.50
		<i>For Tempered Clear Insulated Glass, Add</i>	35.72		
08 52 16 00-0489	EA	35-15/16" x 24-1/8", Venting, Awning Wood Clad Window (Andersen 200 Series)	263.54		35.94
		<i>For Tempered Clear Insulated Glass, Add</i>	38.33		
08 52 16 00-0490	EA	40-13/16" x 24-1/8", Venting, Awning Wood Clad Window (Andersen 200 Series)	280.01		38.09
		<i>For Tempered Clear Insulated Glass, Add</i>	40.91		
08 52 16 00-0491	EA	48" x 24-1/8", Venting, Awning Wood Clad Window (Andersen 200 Series)	305.40		40.61
		<i>For Tempered Clear Insulated Glass, Add</i>	44.84		
08 52 16 00-0492	EA	52-13/16" x 24-1/8", Venting, Awning Wood Clad Window (Andersen 200 Series)	321.15		42.40
		<i>For Tempered Clear Insulated Glass, Add</i>	47.41		
08 52 16 00-0493	EA	59-7/8" x 24-1/8", Venting, Awning Wood Clad Window (Andersen 200 Series)	345.15		44.56
		<i>For Tempered Clear Insulated Glass, Add</i>	51.21		
08 52 16 00-0494	EA	64-13/16" x 24-1/8", Venting, Awning Wood Clad Window (Andersen 200 Series)	352.96		46.72
		<i>For Tempered Clear Insulated Glass, Add</i>	52.05		



Openings	08	08
Windows	08 50	
Wood Windows	08 52	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 52 16 00-0495	EA		71-7/8" x 24-1/8", Venting, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	376.02 55.66	48.87
08 52 16 00-0496	EA		84-5/8" x 24-1/8", Venting, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	573.48 93.28	53.90
08 52 16 00-0497			28-3/8" Height, Venting, Awning Wood Clad Windows (Andersen 200 Series) <small>(08 52 16 00-0461)</small>		
08 52 16 00-0498	EA		24-1/8" x 28-3/8", Venting, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	225.32 31.69	33.78
08 52 16 00-0499	EA		28-3/8" x 28-3/8", Venting, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	245.80 35.22	35.22
08 52 16 00-0500	EA		31-1/2" x 28-3/8", Venting, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	259.10 37.45	35.94
08 52 16 00-0501	EA		35-15/16" x 28-3/8", Venting, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	283.35 41.72	37.38
08 52 16 00-0502	EA		40-13/16" x 28-3/8", Venting, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	307.95 45.92	39.53
08 52 16 00-0503	EA		48" x 28-3/8", Venting, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	344.19 52.02	42.04
08 52 16 00-0504	EA		52-13/16" x 28-3/8", Venting, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	367.39 56.09	43.84
08 52 16 00-0505	EA		59-7/8" x 28-3/8", Venting, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	402.90 62.18	46.00
08 52 16 00-0506	EA		64-13/16" x 28-3/8", Venting, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	416.71 64.22	48.16
08 52 16 00-0507	EA		71-7/8" x 28-3/8", Venting, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	451.18 70.11	50.31
08 52 16 00-0508	EA		84-5/8" x 28-3/8", Venting, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	589.04 95.82	55.34
08 52 16 00-0509			31-1/2" Height, Venting, Awning Wood Clad Windows (Andersen 200 Series) <small>(08 52 16 00-0461)</small>		
08 52 16 00-0510	EA		28-3/8" x 31-1/2", Venting, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	259.10 37.45	35.94
08 52 16 00-0511	EA		31-1/2" x 31-1/2", Venting, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	273.33 39.86	37.01
08 52 16 00-0512	EA		35-15/16" x 31-1/2", Venting, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	292.86 43.19	38.45
08 52 16 00-0513	EA		40-13/16" x 31-1/2", Venting, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	314.85 46.87	40.25
08 52 16 00-0514	EA		48" x 31-1/2", Venting, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	347.04 52.16	43.12
08 52 16 00-0515	EA		52-13/16" x 31-1/2", Venting, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	368.87 55.95	44.56
08 52 16 00-0516	EA		59-7/8" x 31-1/2", Venting, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	400.33 61.24	47.43
08 52 16 00-0517	EA		64-13/16" x 31-1/2", Venting, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	422.31 64.91	48.87
08 52 16 00-0518	EA		71-7/8" x 31-1/2", Venting, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	454.36 70.32	51.39
08 52 16 00-0519	EA		84-5/8" x 31-1/2", Venting, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	626.14 102.80	56.06
08 52 16 00-0520			35-15/16" Height, Venting, Awning Wood Clad Windows (Andersen 200 Series) <small>(08 52 16 00-0461)</small>		
08 52 16 00-0521	EA		31-1/2" x 35-15/16", Venting, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	292.86 43.19	38.45
08 52 16 00-0522	EA		35-15/16" x 35-15/16", Venting, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	320.23 48.09	39.89
08 52 16 00-0523	EA		40-13/16" x 35-15/16", Venting, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	344.82 52.29	41.69
08 52 16 00-0524	EA		48" x 35-15/16", Venting, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	381.06 58.39	44.56
08 52 16 00-0525	EA		52-13/16" x 35-15/16", Venting, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	404.94 62.59	46.00
08 52 16 00-0526	EA		59-7/8" x 35-15/16", Venting, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	439.79 68.55	48.87
08 52 16 00-0527	EA		64-13/16" x 35-15/16", Venting, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	390.30 57.94	50.31
08 52 16 00-0528	EA		71-7/8" x 35-15/16", Venting, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	418.07 62.48	52.82
08 52 16 00-0529			40-3/4" Height, Venting, Awning Wood Clad Windows (Andersen 200 Series) <small>(08 52 16 00-0461)</small>		
08 52 16 00-0530	EA		35-15/16" x 40-3/4", Venting, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	340.76 51.48	41.69
08 52 16 00-0531	EA		40-13/16" x 40-3/4", Venting, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	380.94 58.80	43.84

08 Openings**08 50 Windows****08 52 Wood Windows**

MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
08 52 16 00-0532		48" Height, Venting, Awning Wood Clad Windows (Andersen 200 Series) ^(08 16 00-0461)			
08 52 16 00-0533	EA	35-15/16" x 48", Venting, Awning Wood Clad Window (Andersen 200 Series)	401.39		44.56
		<i>For Tempered Clear Insulated Glass, Add</i>	62.45		
08 52 16 00-0534	EA	40-13/16" x 48", Venting, Awning Wood Clad Window (Andersen 200 Series)	442.25		46.72
		<i>For Tempered Clear Insulated Glass, Add</i>	69.91		
08 52 16 00-0535	EA	48" x 48", Venting, Awning Wood Clad Window (Andersen 200 Series)	502.20		49.23
		<i>For Tempered Clear Insulated Glass, Add</i>	80.75		
08 52 16 00-0536		59-13/16" Height, Venting, Awning Wood Clad Windows (Andersen 200 Series) ^(08 52 16 00-0461)			
08 52 16 00-0537	EA	35-15/16" x 59-13/16", Venting, Awning Wood Clad Window (Andersen 200 Series)	491.81		48.51
		<i>For Tempered Clear Insulated Glass, Add</i>	78.96		
08 52 16 00-0538	EA	40-13/16" x 59-13/16", Venting, Awning Wood Clad Window (Andersen 200 Series)	527.76		50.31
		<i>For Tempered Clear Insulated Glass, Add</i>	85.43		
08 52 16 00-0539		71-7/8" Height, Venting, Awning Wood Clad Windows (Andersen 200 Series) ^(08 52 16 00-0461)			
08 52 16 00-0540	EA	24-1/8" x 71-7/8", Venting, Awning Wood Clad Window (Andersen 200 Series)	534.59		48.87
		<i>For Tempered Clear Insulated Glass, Add</i>	87.37		
08 52 16 00-0541	EA	35-15/16" x 71-7/8", Venting, Awning Wood Clad Window (Andersen 200 Series)	554.85		52.82
		<i>For Tempered Clear Insulated Glass, Add</i>	89.84		
08 52 16 00-0542	EA	40-13/16" x 71-7/8", Venting, Awning Wood Clad Window (Andersen 200 Series)	611.09		54.62
		<i>For Tempered Clear Insulated Glass, Add</i>	100.37		
08 52 16 00-0543	EA	48" x 71-7/8", Venting, Awning Wood Clad Window (Andersen 200 Series)	669.35		57.50
		<i>For Tempered Clear Insulated Glass, Add</i>	110.87		
08 52 16 00-0544		Stationary, Awning Wood Clad Windows (Andersen 200 Series) ^(08 52 16 00-0460)			
08 52 16 00-0545		17" Height, Stationary, Awning Wood Clad Windows (Andersen 200 Series) ^(08 52 16 00-0544)			
08 52 16 00-0546	EA	24-1/8" x 17", Stationary, Awning Wood Clad Window (Andersen 200 Series)	179.47		29.47
		<i>For Tempered Clear Insulated Glass, Add</i>	24.11		
08 52 16 00-0547	EA	28-3/8" x 17", Stationary, Awning Wood Clad Window (Andersen 200 Series)	192.50		30.91
		<i>For Tempered Clear Insulated Glass, Add</i>	26.14		
08 52 16 00-0548	EA	31-1/2" x 17", Stationary, Awning Wood Clad Window (Andersen 200 Series)	201.20		31.99
		<i>For Tempered Clear Insulated Glass, Add</i>	27.45		
08 52 16 00-0549	EA	35-15/16" x 17", Stationary, Awning Wood Clad Window (Andersen 200 Series)	215.15		33.42
		<i>For Tempered Clear Insulated Glass, Add</i>	29.66		
08 52 16 00-0550	EA	40-13/16" x 17", Stationary, Awning Wood Clad Window (Andersen 200 Series)	230.25		35.22
		<i>For Tempered Clear Insulated Glass, Add</i>	31.96		
08 52 16 00-0551	EA	48" x 17", Stationary, Awning Wood Clad Window (Andersen 200 Series)	253.62		38.09
		<i>For Tempered Clear Insulated Glass, Add</i>	35.49		
08 52 16 00-0552	EA	52-13/16" x 17", Stationary, Awning Wood Clad Window (Andersen 200 Series)	267.34		39.53
		<i>For Tempered Clear Insulated Glass, Add</i>	37.66		
08 52 16 00-0553	EA	59-7/8" x 17", Stationary, Awning Wood Clad Window (Andersen 200 Series)	289.31		42.40
		<i>For Tempered Clear Insulated Glass, Add</i>	41.04		
08 52 16 00-0554	EA	64-13/16" x 17", Stationary, Awning Wood Clad Window (Andersen 200 Series)	304.42		43.84
		<i>For Tempered Clear Insulated Glass, Add</i>	43.35		
08 52 16 00-0555	EA	71-7/8" x 17", Stationary, Awning Wood Clad Window (Andersen 200 Series)	326.39		46.35
		<i>For Tempered Clear Insulated Glass, Add</i>	46.73		
08 52 16 00-0556		20-1/2" Height, Stationary, Awning Wood Clad Windows (Andersen 200 Series) ^(08 52 16 00-0544)			
08 52 16 00-0557	EA	24-1/8" x 20-1/2", Stationary, Awning Wood Clad Window (Andersen 200 Series)	189.75		30.91
		<i>For Tempered Clear Insulated Glass, Add</i>	25.73		
08 52 16 00-0558	EA	28-3/8" x 20-1/2", Stationary, Awning Wood Clad Window (Andersen 200 Series)	202.78		32.34
		<i>For Tempered Clear Insulated Glass, Add</i>	27.76		
08 52 16 00-0559	EA	31-1/2" x 20-1/2", Stationary, Awning Wood Clad Window (Andersen 200 Series)	210.83		33.06
		<i>For Tempered Clear Insulated Glass, Add</i>	28.94		
08 52 16 00-0560	EA	35-15/16" x 20-1/2", Stationary, Awning Wood Clad Window (Andersen 200 Series)	226.11		34.50
		<i>For Tempered Clear Insulated Glass, Add</i>	31.42		
08 52 16 00-0561	EA	40-13/16" x 20-1/2", Stationary, Awning Wood Clad Window (Andersen 200 Series)	241.22		36.65
		<i>For Tempered Clear Insulated Glass, Add</i>	33.73		
08 52 16 00-0562	EA	48" x 20-1/2", Stationary, Awning Wood Clad Window (Andersen 200 Series)	263.91		39.17
		<i>For Tempered Clear Insulated Glass, Add</i>	37.11		
08 52 16 00-0563	EA	52-13/16" x 20-1/2", Stationary, Awning Wood Clad Window (Andersen 200 Series)	278.30		40.96
		<i>For Tempered Clear Insulated Glass, Add</i>	39.42		
08 52 16 00-0564	EA	59-7/8" x 20-1/2", Stationary, Awning Wood Clad Window (Andersen 200 Series)	299.60		43.12
		<i>For Tempered Clear Insulated Glass, Add</i>	42.67		
08 52 16 00-0565	EA	64-13/16" x 20-1/2", Stationary, Awning Wood Clad Window (Andersen 200 Series)	315.38		45.28
		<i>For Tempered Clear Insulated Glass, Add</i>	45.11		
08 52 16 00-0566	EA	71-7/8" x 20-1/2", Stationary, Awning Wood Clad Window (Andersen 200 Series)	336.68		47.43
		<i>For Tempered Clear Insulated Glass, Add</i>	48.36		



Openings	08	08
Windows	08 50	
Wood Windows	08 52	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 52 16 00-0567 24-1/8" Height, Stationary, Awning Wood Clad Windows (Andersen 200 Series) <small>(08 52 16 00-0544)</small>		
08 52 16 00-0568 EA 24-1/8" x 24-1/8", Stationary, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	201.42 27.49	32.34
08 52 16 00-0569 EA 28-3/8" x 24-1/8", Stationary, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	214.48 29.53	33.78
08 52 16 00-0570 EA 31-1/2" x 24-1/8", Stationary, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	221.76 30.55	34.50
08 52 16 00-0571 EA 35-15/16" x 24-1/8", Stationary, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	237.11 33.05	35.94
08 52 16 00-0572 EA 40-13/16" x 24-1/8", Stationary, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	252.23 35.35	38.09
08 52 16 00-0573 EA 48" x 24-1/8", Stationary, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	274.91 38.74	40.61
08 52 16 00-0574 EA 52-13/16" x 24-1/8", Stationary, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	289.31 41.04	42.40
08 52 16 00-0575 EA 59-7/8" x 24-1/8", Stationary, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	311.28 44.43	44.56
08 52 16 00-0576 EA 64-13/16" x 24-1/8", Stationary, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	326.39 46.73	46.72
08 52 16 00-0577 EA 71-7/8" x 24-1/8", Stationary, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	348.35 50.12	48.87
08 52 16 00-0578 28-3/8" Height, Stationary, Awning Wood Clad Windows (Andersen 200 Series) <small>(08 52 16 00-0544)</small>		
08 52 16 00-0579 EA 24-1/8" x 28-3/8", Stationary, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	203.64 27.36	33.78
08 52 16 00-0580 EA 28-3/8" x 28-3/8", Stationary, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	220.73 30.20	35.22
08 52 16 00-0581 EA 31-1/2" x 28-3/8", Stationary, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	230.37 31.70	35.94
08 52 16 00-0582 EA 35-15/16" x 28-3/8", Stationary, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	239.98 33.05	37.38
08 52 16 00-0583 EA 40-13/16" x 28-3/8", Stationary, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	271.36 38.60	39.53
08 52 16 00-0584 EA 48" x 28-3/8", Stationary, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	300.83 43.35	42.04
08 52 16 00-0585 EA 52-13/16" x 28-3/8", Stationary, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	319.96 46.60	43.84
08 52 16 00-0586 EA 59-7/8" x 28-3/8", Stationary, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	348.70 51.34	46.00
08 52 16 00-0587 EA 64-13/16" x 28-3/8", Stationary, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	369.24 54.73	48.16
08 52 16 00-0588 EA 71-7/8" x 28-3/8", Stationary, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	397.98 59.47	50.31
08 52 16 00-0589 31-1/2" Height, Stationary, Awning Wood Clad Windows (Andersen 200 Series) <small>(08 52 16 00-0544)</small>		
08 52 16 00-0590 EA 28-3/8" x 31-1/2", Stationary, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	230.37 31.70	35.94
08 52 16 00-0591 EA 31-1/2" x 31-1/2", Stationary, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	242.30 33.65	37.01
08 52 16 00-0592 EA 35-15/16" x 31-1/2", Stationary, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	258.39 36.30	38.45
08 52 16 00-0593 EA 40-13/16" x 31-1/2", Stationary, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	276.93 39.29	40.25
08 52 16 00-0594 EA 48" x 31-1/2", Stationary, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	303.94 43.54	43.12
08 52 16 00-0595 EA 52-13/16" x 31-1/2", Stationary, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	321.75 46.53	44.56
08 52 16 00-0596 EA 59-7/8" x 31-1/2", Stationary, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	348.04 50.78	47.43
08 52 16 00-0597 EA 64-13/16" x 31-1/2", Stationary, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	366.00 53.65	48.87
08 52 16 00-0598 EA 71-7/8" x 31-1/2", Stationary, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	392.30 57.90	51.39
08 52 16 00-0599 35-15/16" Height, Stationary, Awning Wood Clad Windows (Andersen 200 Series) <small>(08 52 16 00-0544)</small>		
08 52 16 00-0600 EA 31-1/2" x 35-15/16", Stationary, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	258.39 36.30	38.45
08 52 16 00-0601 EA 35-15/16" x 35-15/16", Stationary, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	281.61 40.37	39.89
08 52 16 00-0602 EA 40-13/16" x 35-15/16", Stationary, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	301.46 43.62	41.69
08 52 16 00-0603 EA 48" x 35-15/16", Stationary, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	331.60 48.50	44.56
08 52 16 00-0604 EA 52-13/16" x 35-15/16", Stationary, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	350.73 51.75	46.00

08 Openings**08 50 Windows****08 52 Wood Windows**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 52 16 00-0605	EA		59-7/8" x 35-15/16", Stationary, Awning Wood Clad Window (Andersen 200 Series)	379.49	48.87
			<i>For Tempered Clear Insulated Glass, Add</i>	56.49	
08 52 16 00-0606	EA		64-13/16" x 35-15/16", Stationary, Awning Wood Clad Window (Andersen 200 Series)	399.34	50.31
			<i>For Tempered Clear Insulated Glass, Add</i>	59.74	
08 52 16 00-0607	EA		71-7/8" x 35-15/16", Stationary, Awning Wood Clad Window (Andersen 200 Series)	428.08	52.82
			<i>For Tempered Clear Insulated Glass, Add</i>	64.49	
08 52 16 00-0608			Awning Wood Clad Windows (Andersen 400 Series) <small>(08 52 16 00-0459)</small>		
			Note: Includes painted or stained wood interior, colored PVC clad exterior, standard hardware and Low-E insulated glass. Excludes grilles and insect screens.		
08 52 16 00-0609			Venting, Awning Wood Clad Windows (Andersen 400 Series) <small>(08 52 16 00-0608)</small>		
08 52 16 00-0610			17" Height, Venting, Awning Wood Clad Windows (Andersen 400 Series) <small>(08 52 16 00-0609)</small>		
08 52 16 00-0611	EA		24-1/8" x 17", Venting, Awning Wood Clad Window (Andersen 400 Series)	234.01	29.47
			<i>For Tempered Low-E Insulated Glass, Add</i>	35.01	
08 52 16 00-0612	EA		28-3/8" x 17", Venting, Awning Wood Clad Window (Andersen 400 Series)	250.43	30.91
			<i>For Tempered Low-E Insulated Glass, Add</i>	37.72	
08 52 16 00-0613	EA		31-1/2" x 17", Venting, Awning Wood Clad Window (Andersen 400 Series)	263.83	31.99
			<i>For Tempered Low-E Insulated Glass, Add</i>	39.97	
08 52 16 00-0614	EA		35-15/16" x 17", Venting, Awning Wood Clad Window (Andersen 400 Series)	280.88	33.42
			<i>For Tempered Low-E Insulated Glass, Add</i>	42.81	
08 52 16 00-0615	EA		40-13/16" x 17", Venting, Awning Wood Clad Window (Andersen 400 Series)	300.55	35.22
			<i>For Tempered Low-E Insulated Glass, Add</i>	46.02	
08 52 16 00-0616	EA		48" x 17", Venting, Awning Wood Clad Window (Andersen 400 Series)	330.86	38.09
			<i>For Tempered Low-E Insulated Glass, Add</i>	50.94	
08 52 16 00-0617	EA		52-13/16" x 17", Venting, Awning Wood Clad Window (Andersen 400 Series)	349.83	39.53
			<i>For Tempered Low-E Insulated Glass, Add</i>	54.15	
08 52 16 00-0618	EA		59-7/8" x 17", Venting, Awning Wood Clad Window (Andersen 400 Series)	377.73	42.40
			<i>For Tempered Low-E Insulated Glass, Add</i>	58.73	
08 52 16 00-0619	EA		64-13/16" x 17", Venting, Awning Wood Clad Window (Andersen 400 Series)	388.56	43.84
			<i>For Tempered Low-E Insulated Glass, Add</i>	60.18	
08 52 16 00-0620	EA		71-7/8" x 17", Venting, Awning Wood Clad Window (Andersen 400 Series)	416.18	46.35
			<i>For Tempered Low-E Insulated Glass, Add</i>	64.69	
08 52 16 00-0621			20-1/2" Height, Venting, Awning Wood Clad Windows (Andersen 400 Series) <small>(08 52 16 00-0609)</small>		
08 52 16 00-0622	EA		24-1/8" x 20-1/2", Venting, Awning Wood Clad Window (Andersen 400 Series)	246.74	30.91
			<i>For Tempered Low-E Insulated Glass, Add</i>	37.13	
08 52 16 00-0623	EA		28-3/8" x 20-1/2", Venting, Awning Wood Clad Window (Andersen 400 Series)	264.44	32.34
			<i>For Tempered Low-E Insulated Glass, Add</i>	40.10	
08 52 16 00-0624	EA		31-1/2" x 20-1/2", Venting, Awning Wood Clad Window (Andersen 400 Series)	276.05	33.06
			<i>For Tempered Low-E Insulated Glass, Add</i>	41.99	
08 52 16 00-0625	EA		35-15/16" x 20-1/2", Venting, Awning Wood Clad Window (Andersen 400 Series)	294.88	34.50
			<i>For Tempered Low-E Insulated Glass, Add</i>	45.18	
08 52 16 00-0626	EA		40-13/16" x 20-1/2", Venting, Awning Wood Clad Window (Andersen 400 Series)	314.56	36.65
			<i>For Tempered Low-E Insulated Glass, Add</i>	48.39	
08 52 16 00-0627	EA		48" x 20-1/2", Venting, Awning Wood Clad Window (Andersen 400 Series)	344.03	39.17
			<i>For Tempered Low-E Insulated Glass, Add</i>	53.14	
08 52 16 00-0628	EA		52-13/16" x 20-1/2", Venting, Awning Wood Clad Window (Andersen 400 Series)	362.99	40.96
			<i>For Tempered Low-E Insulated Glass, Add</i>	56.36	
08 52 16 00-0629	EA		59-7/8" x 20-1/2", Venting, Awning Wood Clad Window (Andersen 400 Series)	391.74	43.12
			<i>For Tempered Low-E Insulated Glass, Add</i>	61.10	
08 52 16 00-0630	EA		64-13/16" x 20-1/2", Venting, Awning Wood Clad Window (Andersen 400 Series)	401.60	45.28
			<i>For Tempered Low-E Insulated Glass, Add</i>	62.35	
08 52 16 00-0631	EA		71-7/8" x 20-1/2", Venting, Awning Wood Clad Window (Andersen 400 Series)	430.04	47.43
			<i>For Tempered Low-E Insulated Glass, Add</i>	67.03	
08 52 16 00-0632	EA		84-5/8" x 20-1/2", Venting, Awning Wood Clad Window (Andersen 400 Series)	654.47	52.47
			<i>For Tempered Low-E Insulated Glass, Add</i>	110.05	
08 52 16 00-0633			24-1/8" Height, Venting, Awning Wood Clad Windows (Andersen 400 Series) <small>(08 52 16 00-0609)</small>		
08 52 16 00-0634	EA		24-1/8" x 24-1/8", Venting, Awning Wood Clad Window (Andersen 400 Series)	262.74	32.34
			<i>For Tempered Low-E Insulated Glass, Add</i>	39.76	
08 52 16 00-0635	EA		28-3/8" x 24-1/8", Venting, Awning Wood Clad Window (Andersen 400 Series)	279.18	33.78
			<i>For Tempered Low-E Insulated Glass, Add</i>	42.47	
08 52 16 00-0636	EA		31-1/2" x 24-1/8", Venting, Awning Wood Clad Window (Andersen 400 Series)	290.42	34.50
			<i>For Tempered Low-E Insulated Glass, Add</i>	44.28	
08 52 16 00-0637	EA		35-15/16" x 24-1/8", Venting, Awning Wood Clad Window (Andersen 400 Series)	309.61	35.94
			<i>For Tempered Low-E Insulated Glass, Add</i>	47.55	
08 52 16 00-0638	EA		40-13/16" x 24-1/8", Venting, Awning Wood Clad Window (Andersen 400 Series)	329.30	38.09
			<i>For Tempered Low-E Insulated Glass, Add</i>	50.77	
08 52 16 00-0639	EA		48" x 24-1/8", Venting, Awning Wood Clad Window (Andersen 400 Series)	359.60	40.61
			<i>For Tempered Low-E Insulated Glass, Add</i>	55.68	
08 52 16 00-0640	EA		52-13/16" x 24-1/8", Venting, Awning Wood Clad Window (Andersen 400 Series)	378.57	42.40
			<i>For Tempered Low-E Insulated Glass, Add</i>	58.90	
08 52 16 00-0641	EA		59-7/8" x 24-1/8", Venting, Awning Wood Clad Window (Andersen 400 Series)	407.32	44.56
			<i>For Tempered Low-E Insulated Glass, Add</i>	63.64	
08 52 16 00-0642	EA		64-13/16" x 24-1/8", Venting, Awning Wood Clad Window (Andersen 400 Series)	416.18	46.72
			<i>For Tempered Low-E Insulated Glass, Add</i>	64.69	



Openings	08	08
Windows	08 50	
Wood Windows	08 52	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 52 16 00-0643	EA		71-7/8" x 24-1/8", Venting, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	443.75 69.20	48.87
08 52 16 00-0644	EA		84-5/8" x 24-1/8", Venting, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	688.23 116.23	53.90
08 52 16 00-0645			28-3/8" Height, Venting, Awning Wood Clad Windows (Andersen 400 Series) <small>(08 52 16 00-0609)</small>		
08 52 16 00-0646	EA		24-1/8" x 28-3/8", Venting, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	263.09 39.25	33.78
08 52 16 00-0647	EA		28-3/8" x 28-3/8", Venting, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	287.98 43.65	35.22
08 52 16 00-0648	EA		31-1/2" x 28-3/8", Venting, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	304.07 46.44	35.94
08 52 16 00-0649	EA		35-15/16" x 28-3/8", Venting, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	333.65 51.78	37.38
08 52 16 00-0650	EA		40-13/16" x 28-3/8", Venting, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	363.51 57.03	39.53
08 52 16 00-0651	EA		48" x 28-3/8", Venting, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	407.37 64.66	42.04
08 52 16 00-0652	EA		52-13/16" x 28-3/8", Venting, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	435.65 69.74	43.84
08 52 16 00-0653	EA		59-7/8" x 28-3/8", Venting, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	478.79 77.36	46.00
08 52 16 00-0654	EA		64-13/16" x 28-3/8", Venting, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	495.15 79.91	48.16
08 52 16 00-0655	EA		71-7/8" x 28-3/8", Venting, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	610.73 102.02	50.31
08 52 16 00-0656	EA		84-5/8" x 28-3/8", Venting, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	706.97 119.40	55.34
08 52 16 00-0657			31-1/2" Height, Venting, Awning Wood Clad Windows (Andersen 400 Series) <small>(08 52 16 00-0609)</small>		
08 52 16 00-0658	EA		28-3/8" x 31-1/2", Venting, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	304.07 46.44	35.94
08 52 16 00-0659	EA		31-1/2" x 31-1/2", Venting, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	321.31 49.46	37.01
08 52 16 00-0660	EA		35-15/16" x 31-1/2", Venting, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	345.01 53.62	38.45
08 52 16 00-0661	EA		40-13/16" x 31-1/2", Venting, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	371.60 58.22	40.25
08 52 16 00-0662	EA		48" x 31-1/2", Venting, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	410.39 64.83	43.12
08 52 16 00-0663	EA		52-13/16" x 31-1/2", Venting, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	436.96 69.57	44.56
08 52 16 00-0664	EA		59-7/8" x 31-1/2", Venting, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	475.03 76.18	47.43
08 52 16 00-0665	EA		64-13/16" x 31-1/2", Venting, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	501.61 80.77	48.87
08 52 16 00-0666	EA		71-7/8" x 31-1/2", Venting, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	540.41 87.53	51.39
08 52 16 00-0667	EA		84-5/8" x 31-1/2", Venting, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	752.80 128.14	56.06
08 52 16 00-0668			35-15/16" Height, Venting, Awning Wood Clad Windows (Andersen 400 Series) <small>(08 52 16 00-0609)</small>		
08 52 16 00-0669	EA		31-1/2" x 35-15/16", Venting, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	345.01 53.62	38.45
08 52 16 00-0670	EA		35-15/16" x 35-15/16", Venting, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	378.50 59.74	39.89
08 52 16 00-0671	EA		40-13/16" x 35-15/16", Venting, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	408.34 64.99	41.69
08 52 16 00-0672	EA		48" x 35-15/16", Venting, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	452.21 72.62	44.56
08 52 16 00-0673	EA		52-13/16" x 35-15/16", Venting, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	481.33 77.87	46.00
08 52 16 00-0674	EA		59-7/8" x 35-15/16", Venting, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	523.63 85.32	48.87
08 52 16 00-0675	EA		64-13/16" x 35-15/16", Venting, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	460.88 72.05	50.31
08 52 16 00-0676	EA		71-7/8" x 35-15/16", Venting, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	494.34 77.74	52.82
08 52 16 00-0677			40-3/4" Height, Venting, Awning Wood Clad Windows (Andersen 400 Series) <small>(08 52 16 00-0609)</small>		
08 52 16 00-0678	EA		35-15/16" x 40-3/4", Venting, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	399.67 63.98	41.69
08 52 16 00-0679	EA		40-13/16" x 40-3/4", Venting, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	454.75 73.13	44.56

08 Openings**08 50 Windows****08 52 Wood Windows**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 52 16 00-0680			48" Height, Venting, Awning Wood Clad Windows (Andersen 400 Series) ^(08 16 00-0609)		
08 52 16 00-0681	EA		35-15/16" x 48", Venting, Awning Wood Clad Window (Andersen 400 Series)	477.61	44.56
			<i>For Tempered Low-E Insulated Glass, Add</i>	77.70	
08 52 16 00-0682	EA		40-13/16" x 48", Venting, Awning Wood Clad Window (Andersen 400 Series)	527.79	46.72
			<i>For Tempered Low-E Insulated Glass, Add</i>	87.01	
08 52 16 00-0683	EA		48" x 48", Venting, Awning Wood Clad Window (Andersen 400 Series)	601.29	49.23
			<i>For Tempered Low-E Insulated Glass, Add</i>	100.57	
08 52 16 00-0684			59-13/16" Height, Venting, Awning Wood Clad Windows (Andersen 400 Series) ^(08 52 16 00-0609)		
08 52 16 00-0685	EA		35-15/16" x 59-13/16", Venting, Awning Wood Clad Window (Andersen 400 Series)	588.67	48.51
			<i>For Tempered Low-E Insulated Glass, Add</i>	98.33	
08 52 16 00-0686	EA		40-13/16" x 59-13/16", Venting, Awning Wood Clad Window (Andersen 400 Series)	632.70	50.31
			<i>For Tempered Low-E Insulated Glass, Add</i>	106.42	
08 52 16 00-0687			71-7/8" Height, Venting, Awning Wood Clad Windows (Andersen 400 Series) ^(08 52 16 00-0609)		
08 52 16 00-0688	EA		24-1/8" x 71-7/8", Venting, Awning Wood Clad Window (Andersen 400 Series)	641.96	48.87
			<i>For Tempered Low-E Insulated Glass, Add</i>	108.84	
08 52 16 00-0689	EA		35-15/16" x 71-7/8", Venting, Awning Wood Clad Window (Andersen 400 Series)	665.31	52.82
			<i>For Tempered Low-E Insulated Glass, Add</i>	111.93	
08 52 16 00-0690	EA		40-13/16" x 71-7/8", Venting, Awning Wood Clad Window (Andersen 400 Series)	734.71	54.62
			<i>For Tempered Low-E Insulated Glass, Add</i>	125.09	
08 52 16 00-0691	EA		48" x 71-7/8", Venting, Awning Wood Clad Window (Andersen 400 Series)	806.09	57.50
			<i>For Tempered Low-E Insulated Glass, Add</i>	138.22	
08 52 16 00-0692			Stationary, Awning Wood Clad Windows (Andersen 400 Series) ^(08 52 16 00-0608)		
08 52 16 00-0693			17" Height, Stationary, Awning Wood Clad Windows (Andersen 400 Series) ^(08 52 16 00-0692)		
08 52 16 00-0694	EA		24-1/8" x 17", Stationary, Awning Wood Clad Window (Andersen 400 Series)	207.75	29.47
			<i>For Tempered Low-E Insulated Glass, Add</i>	29.76	
08 52 16 00-0695	EA		28-3/8" x 17", Stationary, Awning Wood Clad Window (Andersen 400 Series)	223.33	30.91
			<i>For Tempered Low-E Insulated Glass, Add</i>	32.30	
08 52 16 00-0696	EA		31-1/2" x 17", Stationary, Awning Wood Clad Window (Andersen 400 Series)	233.67	31.99
			<i>For Tempered Low-E Insulated Glass, Add</i>	33.94	
08 52 16 00-0697	EA		35-15/16" x 17", Stationary, Awning Wood Clad Window (Andersen 400 Series)	250.39	33.42
			<i>For Tempered Low-E Insulated Glass, Add</i>	36.71	
08 52 16 00-0698	EA		40-13/16" x 17", Stationary, Awning Wood Clad Window (Andersen 400 Series)	268.36	35.22
			<i>For Tempered Low-E Insulated Glass, Add</i>	39.59	
08 52 16 00-0699	EA		48" x 17", Stationary, Awning Wood Clad Window (Andersen 400 Series)	296.13	38.09
			<i>For Tempered Low-E Insulated Glass, Add</i>	43.99	
08 52 16 00-0700	EA		52-13/16" x 17", Stationary, Awning Wood Clad Window (Andersen 400 Series)	312.57	39.53
			<i>For Tempered Low-E Insulated Glass, Add</i>	46.70	
08 52 16 00-0701	EA		59-7/8" x 17", Stationary, Awning Wood Clad Window (Andersen 400 Series)	338.77	42.40
			<i>For Tempered Low-E Insulated Glass, Add</i>	50.94	
08 52 16 00-0702	EA		64-13/16" x 17", Stationary, Awning Wood Clad Window (Andersen 400 Series)	356.76	43.84
			<i>For Tempered Low-E Insulated Glass, Add</i>	53.82	
08 52 16 00-0703	EA		71-7/8" x 17", Stationary, Awning Wood Clad Window (Andersen 400 Series)	382.97	46.35
			<i>For Tempered Low-E Insulated Glass, Add</i>	58.05	
08 52 16 00-0704			20-1/2" Height, Stationary, Awning Wood Clad Windows (Andersen 400 Series) ^(08 52 16 00-0692)		
08 52 16 00-0705	EA		24-1/8" x 20-1/2", Stationary, Awning Wood Clad Window (Andersen 400 Series)	220.07	30.91
			<i>For Tempered Low-E Insulated Glass, Add</i>	31.80	
08 52 16 00-0706	EA		28-3/8" x 20-1/2", Stationary, Awning Wood Clad Window (Andersen 400 Series)	235.64	32.34
			<i>For Tempered Low-E Insulated Glass, Add</i>	34.34	
08 52 16 00-0707	EA		31-1/2" x 20-1/2", Stationary, Awning Wood Clad Window (Andersen 400 Series)	245.16	33.06
			<i>For Tempered Low-E Insulated Glass, Add</i>	35.81	
08 52 16 00-0708	EA		35-15/16" x 20-1/2", Stationary, Awning Wood Clad Window (Andersen 400 Series)	263.55	34.50
			<i>For Tempered Low-E Insulated Glass, Add</i>	38.91	
08 52 16 00-0709	EA		40-13/16" x 20-1/2", Stationary, Awning Wood Clad Window (Andersen 400 Series)	281.53	36.65
			<i>For Tempered Low-E Insulated Glass, Add</i>	41.79	
08 52 16 00-0710	EA		48" x 20-1/2", Stationary, Awning Wood Clad Window (Andersen 400 Series)	308.46	39.17
			<i>For Tempered Low-E Insulated Glass, Add</i>	46.02	
08 52 16 00-0711	EA		52-13/16" x 20-1/2", Stationary, Awning Wood Clad Window (Andersen 400 Series)	325.73	40.96
			<i>For Tempered Low-E Insulated Glass, Add</i>	48.90	
08 52 16 00-0712	EA		59-7/8" x 20-1/2", Stationary, Awning Wood Clad Window (Andersen 400 Series)	351.09	43.12
			<i>For Tempered Low-E Insulated Glass, Add</i>	52.97	
08 52 16 00-0713	EA		64-13/16" x 20-1/2", Stationary, Awning Wood Clad Window (Andersen 400 Series)	369.93	45.28
			<i>For Tempered Low-E Insulated Glass, Add</i>	56.02	
08 52 16 00-0714	EA		71-7/8" x 20-1/2", Stationary, Awning Wood Clad Window (Andersen 400 Series)	395.28	47.43
			<i>For Tempered Low-E Insulated Glass, Add</i>	60.08	



Openings	08	08
Windows	08 50	
Wood Windows	08 52	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 52 16 00-0715 24-1/8" Height, Stationary, Awning Wood Clad Windows (Andersen 400 Series) <small>(08 52 16 00-0692)</small>		
08 52 16 00-0716 EA 24-1/8" x 24-1/8", Stationary, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	233.95 34.00	32.34
08 52 16 00-0717 EA 28-3/8" x 24-1/8", Stationary, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	249.54 36.54	33.78
08 52 16 00-0718 EA 31-1/2" x 24-1/8", Stationary, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	258.10 37.82	34.50
08 52 16 00-0719 EA 35-15/16" x 24-1/8", Stationary, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	276.58 40.94	35.94
08 52 16 00-0720 EA 40-13/16" x 24-1/8", Stationary, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	294.58 43.82	38.09
08 52 16 00-0721 EA 48" x 24-1/8", Stationary, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	321.49 48.06	40.61
08 52 16 00-0722 EA 52-13/16" x 24-1/8", Stationary, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	338.77 50.94	42.40
08 52 16 00-0723 EA 59-7/8" x 24-1/8", Stationary, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	364.97 55.17	44.56
08 52 16 00-0724 EA 64-13/16" x 24-1/8", Stationary, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	382.97 58.05	46.72
08 52 16 00-0725 EA 71-7/8" x 24-1/8", Stationary, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	409.16 62.28	48.87
08 52 16 00-0726 28-3/8" Height, Stationary, Awning Wood Clad Windows (Andersen 400 Series) <small>(08 52 16 00-0692)</small>		
08 52 16 00-0727 EA 24-1/8" x 28-3/8", Stationary, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	235.99 33.83	33.78
08 52 16 00-0728 EA 28-3/8" x 28-3/8", Stationary, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	256.64 37.38	35.22
08 52 16 00-0729 EA 31-1/2" x 28-3/8", Stationary, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	268.15 39.26	35.94
08 52 16 00-0730 EA 35-15/16" x 28-3/8", Stationary, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	279.45 40.94	37.38
08 52 16 00-0731 EA 40-13/16" x 28-3/8", Stationary, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	317.77 47.89	39.53
08 52 16 00-0732 EA 48" x 28-3/8", Stationary, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	353.17 53.82	42.04
08 52 16 00-0733 EA 52-13/16" x 28-3/8", Stationary, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	376.36 57.88	43.84
08 52 16 00-0734 EA 59-7/8" x 28-3/8", Stationary, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	411.04 63.81	46.00
08 52 16 00-0735 EA 64-13/16" x 28-3/8", Stationary, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	435.81 68.04	48.16
08 52 16 00-0736 EA 71-7/8" x 28-3/8", Stationary, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	470.48 73.97	50.31
08 52 16 00-0737 31-1/2" Height, Stationary, Awning Wood Clad Windows (Andersen 400 Series) <small>(08 52 16 00-0692)</small>		
08 52 16 00-0738 EA 28-3/8" x 31-1/2", Stationary, Awning Wood Clad Window (Andersen 200 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	268.15 39.26	35.94
08 52 16 00-0739 EA 31-1/2" x 31-1/2", Stationary, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	282.52 41.70	37.01
08 52 16 00-0740 EA 35-15/16" x 31-1/2", Stationary, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	301.91 45.00	38.45
08 52 16 00-0741 EA 40-13/16" x 31-1/2", Stationary, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	324.19 48.74	40.25
08 52 16 00-0742 EA 48" x 31-1/2", Stationary, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	356.52 54.05	43.12
08 52 16 00-0743 EA 52-13/16" x 31-1/2", Stationary, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	378.06 57.79	44.56
08 52 16 00-0744 EA 59-7/8" x 31-1/2", Stationary, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	409.67 63.10	47.43
08 52 16 00-0745 EA 64-13/16" x 31-1/2", Stationary, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	431.22 66.70	48.87
08 52 16 00-0746 EA 71-7/8" x 31-1/2", Stationary, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	462.83 72.01	51.39
08 52 16 00-0747 35-15/16" Height, Stationary, Awning Wood Clad Windows (Andersen 400 Series) <small>(08 52 16 00-0692)</small>		
08 52 16 00-0748 EA 31-1/2" x 35-15/16", Stationary, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	301.91 45.00	38.45
08 52 16 00-0749 EA 35-15/16" x 35-15/16", Stationary, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	330.22 50.09	39.89
08 52 16 00-0750 EA 40-13/16" x 35-15/16", Stationary, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	354.14 54.15	41.69
08 52 16 00-0751 EA 48" x 35-15/16", Stationary, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	390.38 60.25	44.56
08 52 16 00-0752 EA 52-13/16" x 35-15/16", Stationary, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	413.58 64.32	46.00

08 Openings**08 50 Windows****08 52 Wood Windows**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 52 16 00-0753	EA		59-7/8" x 35-15/16", Stationary, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	448.26 70.25	48.87
08 52 16 00-0754	EA		64-13/16" x 35-15/16", Stationary, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	472.17 74.31	50.31
08 52 16 00-0755	EA		71-7/8" x 35-15/16", Stationary, Awning Wood Clad Window (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	506.85 80.24	52.82
08 52 16 00-0756			Horizontal Sliding Wood Clad Windows (08 52 16)		
08 52 16 00-0757			One Operating Sash, Horizontal Sliding Wood Clad Windows (Andersen 200 Series) (08 52 16 00-0756) Note: Includes painted or stained wood interior, colored PVC clad exterior, standard hardware and clear insulated glass. Excludes grilles and insect screens.		
08 52 16 00-0758			17-1/2" Height, One Operating Sash, Horizontal Sliding Wood Clad Windows (Andersen 200 Series) (08 52 16 00-0757)		
08 52 16 00-0759	EA		47-1/2" x 17-1/2", One Operating Sash, Horizontal Sliding Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	249.40 34.79	38.09
08 52 16 00-0760			23-1/2" Height, One Operating Sash, Horizontal Sliding Wood Clad Windows (Andersen 200 Series) (08 52 16 00-0757)		
08 52 16 00-0761	EA		35-1/2" x 23-1/2", One Operating Sash, Horizontal Sliding Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	230.04 31.78	35.22
08 52 16 00-0762	EA		47-1/2" x 23-1/2", One Operating Sash, Horizontal Sliding Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	267.93 37.63	40.25
08 52 16 00-0763			35-1/2" Height, One Operating Sash, Horizontal Sliding Wood Clad Windows (Andersen 200 Series) (08 52 16 00-0757)		
08 52 16 00-0764	EA		35-1/2" x 35-1/2", One Operating Sash, Horizontal Sliding Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	267.93 37.63	40.25
08 52 16 00-0765	EA		47-1/2" x 35-1/2", One Operating Sash, Horizontal Sliding Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	305.81 43.48	44.56
08 52 16 00-0766	EA		59-1/2" x 35-1/2", One Operating Sash, Horizontal Sliding Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	343.71 49.34	48.51
08 52 16 00-0767	EA		71-1/2" x 35-1/2", One Operating Sash, Horizontal Sliding Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	381.60 55.19	52.82
08 52 16 00-0768			41-1/2" Height, One Operating Sash, Horizontal Sliding Wood Clad Windows (Andersen 200 Series) (08 52 16 00-0757)		
08 52 16 00-0769	EA		35-1/2" x 41-1/2", One Operating Sash, Horizontal Sliding Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	287.29 40.64	42.40
08 52 16 00-0770	EA		47-1/2" x 41-1/2", One Operating Sash, Horizontal Sliding Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	324.35 46.33	46.72
08 52 16 00-0771	EA		59-1/2" x 41-1/2", One Operating Sash, Horizontal Sliding Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	362.24 52.18	50.67
08 52 16 00-0772	EA		71-1/2" x 41-1/2", One Operating Sash, Horizontal Sliding Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	429.39 63.89	54.98
08 52 16 00-0773			47-1/2" Height, One Operating Sash, Horizontal Sliding Wood Clad Windows (Andersen 200 Series) (08 52 16 00-0757)		
08 52 16 00-0774	EA		35-1/2" x 47-1/2", One Operating Sash, Horizontal Sliding Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	305.81 43.48	44.56
08 52 16 00-0775	EA		47-1/2" x 47-1/2", One Operating Sash, Horizontal Sliding Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	343.71 49.34	48.87
08 52 16 00-0776	EA		59-1/2" x 47-1/2", One Operating Sash, Horizontal Sliding Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	381.60 55.19	52.82
08 52 16 00-0777	EA		71-1/2" x 47-1/2", One Operating Sash, Horizontal Sliding Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	419.50 61.04	57.13
08 52 16 00-0778			53-1/2" Height, One Operating Sash, Horizontal Sliding Wood Clad Windows (Andersen 200 Series) (08 52 16 00-0757)		
08 52 16 00-0779	EA		47-1/2" x 53-1/2", One Operating Sash, Horizontal Sliding Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	362.24 52.18	51.03
08 52 16 00-0780	EA		59-1/2" x 53-1/2", One Operating Sash, Horizontal Sliding Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	400.12 58.03	54.98
08 52 16 00-0781	EA		71-1/2" x 53-1/2", One Operating Sash, Horizontal Sliding Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	438.02 63.89	59.29
08 52 16 00-0782			59-1/2" Height, One Operating Sash, Horizontal Sliding Wood Clad Windows (Andersen 200 Series) (08 52 16 00-0757)		
08 52 16 00-0783	EA		47-1/2" x 59-1/2", One Operating Sash, Horizontal Sliding Wood Clad Window (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	381.60 55.19	53.18



Openings	08	08
Windows	08 50	
Wood Windows	08 52	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 52 16 00-0784	EA		59-1/2" x 59-1/2", One Operating Sash, Horizontal Sliding Wood Clad Window (Andersen 200 Series)..... <i>For Tempered Clear Insulated Glass, Add</i>	419.50 61.04	57.13
08 52 16 00-0785	EA		71-1/2" x 59-1/2", One Operating Sash, Horizontal Sliding Wood Clad Window (Andersen 200 Series)..... <i>For Tempered Clear Insulated Glass, Add</i>	457.45 66.91	61.46
08 52 16 00-0786			Two Operating Sashes, Horizontal Sliding Wood Clad Windows (Andersen 400 Series) (08 52 16 00-0786) Note: Includes painted or stained wood interior, colored PVC clad exterior, standard hardware and Low-E insulated glass. Excludes grilles and insect screens.		
08 52 16 00-0787			22-1/4" Height, Two Operating Sashes, Horizontal Sliding Wood Clad Windows (Andersen 400 Series) (08 52 16 00-0786)		
08 52 16 00-0788	EA		35-1/4" x 22-1/4", Two Operating Sashes, Horizontal Sliding Wood Clad Window (Andersen 400 Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	523.46 90.46	35.22
08 52 16 00-0789	EA		47-1/4" x 22-1/4", Two Operating Sashes, Horizontal Sliding Wood Clad Window (Andersen 400 Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	621.56 108.36	40.25
08 52 16 00-0790			35-1/4" Height, Two Operating Sashes, Horizontal Sliding Wood Clad Windows (Andersen 400 Series) (08 52 16 00-0786)		
08 52 16 00-0791	EA		35-1/4" x 35-1/4", Two Operating Sashes, Horizontal Sliding Wood Clad Window (Andersen 400 Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	629.08 109.86	40.25
08 52 16 00-0792	EA		47-1/4" x 35-1/4", Two Operating Sashes, Horizontal Sliding Wood Clad Window (Andersen 400 Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	728.01 127.92	44.56
08 52 16 00-0793	EA		59-1/4" x 35-1/4", Two Operating Sashes, Horizontal Sliding Wood Clad Window (Andersen 400 Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	826.12 145.82	48.51
08 52 16 00-0794	EA		71-1/4" x 35-1/4", Two Operating Sashes, Horizontal Sliding Wood Clad Window (Andersen 400 Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	924.21 163.71	52.82
08 52 16 00-0795			41-1/4" Height, Two Operating Sashes, Horizontal Sliding Wood Clad Windows (Andersen 400 Series) (08 52 16 00-0786)		
08 52 16 00-0796	EA		35-1/4" x 41-1/4", Two Operating Sashes, Horizontal Sliding Wood Clad Window (Andersen 400 Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	678.55 118.89	42.40
08 52 16 00-0797	EA		47-1/4" x 41-1/4", Two Operating Sashes, Horizontal Sliding Wood Clad Window (Andersen 400 Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	776.65 136.79	46.72
08 52 16 00-0798	EA		59-1/4" x 41-1/4", Two Operating Sashes, Horizontal Sliding Wood Clad Window (Andersen 400 Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	875.58 154.85	50.67
08 52 16 00-0799	EA		71-1/4" x 41-1/4", Two Operating Sashes, Horizontal Sliding Wood Clad Window (Andersen 400 Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	973.68 172.74	54.98
08 52 16 00-0800			47-1/4" Height, Two Operating Sashes, Horizontal Sliding Wood Clad Windows (Andersen 400 Series) (08 52 16 00-0786)		
08 52 16 00-0801	EA		35-1/4" x 47-1/4", Two Operating Sashes, Horizontal Sliding Wood Clad Window (Andersen 400 Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	728.01 127.92	44.56
08 52 16 00-0802	EA		47-1/4" x 47-1/4", Two Operating Sashes, Horizontal Sliding Wood Clad Window (Andersen 400 Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	826.12 145.82	48.87
08 52 16 00-0803	EA		59-1/4" x 47-1/4", Two Operating Sashes, Horizontal Sliding Wood Clad Window (Andersen 400 Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	924.21 163.71	52.82
08 52 16 00-0804	EA		71-1/4" x 47-1/4", Two Operating Sashes, Horizontal Sliding Wood Clad Window (Andersen 400 Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	1,023.15 181.77	57.13
08 52 16 00-0805			59-1/4" Height, Two Operating Sashes, Horizontal Sliding Wood Clad Windows (Andersen 400 Series) (08 52 16 00-0786)		
08 52 16 00-0806	EA		35-1/4" x 59-1/4", Two Operating Sashes, Horizontal Sliding Wood Clad Window (Andersen 400 Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	826.12 145.82	48.87
08 52 16 00-0807	EA		47-1/4" x 59-1/4", Two Operating Sashes, Horizontal Sliding Wood Clad Window (Andersen 400 Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	924.21 163.71	53.18
08 52 16 00-0808	EA		59-1/4" x 59-1/4", Two Operating Sashes, Horizontal Sliding Wood Clad Window (Andersen 400 Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	1,023.15 181.77	57.13
08 52 16 00-0809	EA		71-1/4" x 59-1/4", Two Operating Sashes, Horizontal Sliding Wood Clad Window (Andersen 400 Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	1,121.25 199.67	61.46
08 52 16 00-0810			Picture Wood Clad Windows (08 52 16)		
08 52 16 00-0811			Picture Wood Clad Windows For Awning And Casement Windows (08 52 16 00-0810)		
08 52 16 00-0812			Picture Wood Clad Windows For Awning And Casement Windows (Andersen 200 Series) (08 52 16 00-0811) Note: Includes painted or stained wood interior, colored PVC clad exterior, standard hardware and clear insulated glass. Excludes grilles and insect screens.		
08 52 16 00-0813			12" Height, Picture Wood Clad Windows For Awning And Casement Windows (Andersen 200 Series) (08 52 16 00-0812)		
08 52 16 00-0814	EA		40-13/16" x 12", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series)..... <i>For Tempered Clear Insulated Glass, Add</i>	195.48 27.60	28.75

08 Openings**08 50 Windows****08 52 Wood Windows**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 52 16 00-0815	EA		48" x 12", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	227.37 32.82	31.62
08 52 16 00-0816	EA		52-13/16" x 12", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	241.18 35.01	33.06
08 52 16 00-0817	EA		59-7/8" x 12", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	261.42 38.05	35.94
08 52 16 00-0818	EA		64-13/16" x 12", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	275.33 40.12	37.38
08 52 16 00-0819	EA		71-7/8" x 12", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	295.57 43.16	40.25
08 52 16 00-0820			35-15/16" Height, Picture Wood Clad Windows For Awning And Casement Windows (Andersen 200 Series) (08 52 16 00-0812)		
08 52 16 00-0821	EA		35-15/16" x 35-15/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	219.29 29.77	35.22
08 52 16 00-0822	EA		40-13/16" x 35-15/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	251.02 35.40	37.38
08 52 16 00-0823	EA		48" x 35-15/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	297.93 43.63	39.89
08 52 16 00-0824	EA		52-13/16" x 35-15/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	328.24 49.12	41.33
08 52 16 00-0825	EA		59-7/8" x 35-15/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	373.75 57.21	43.84
08 52 16 00-0826	EA		64-13/16" x 35-15/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	405.47 62.84	45.64
08 52 16 00-0827	EA		71-7/8" x 35-15/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	588.17 98.37	48.16
08 52 16 00-0828			40-13/16" Height, Picture Wood Clad Windows For Awning And Casement Windows (Andersen 200 Series) (08 52 16 00-0812)		
08 52 16 00-0829	EA		35-15/16" x 40-13/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	251.02 35.40	37.38
08 52 16 00-0830	EA		40-13/16" x 40-13/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	282.74 41.02	38.81
08 52 16 00-0831	EA		48" x 40-13/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	329.65 49.26	41.69
08 52 16 00-0832	EA		52-13/16" x 40-13/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	359.97 54.74	43.12
08 52 16 00-0833	EA		59-7/8" x 40-13/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	405.47 62.84	46.00
08 52 16 00-0834	EA		64-13/16" x 40-13/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	437.19 68.46	47.43
08 52 16 00-0835	EA		71-7/8" x 40-13/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	482.69 76.56	50.31
08 52 16 00-0836			48" Height, Picture Wood Clad Windows For Awning And Casement Windows (Andersen 200 Series) (08 52 16 00-0812)		
08 52 16 00-0837	EA		35-15/16" x 48", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	297.93 43.63	40.25
08 52 16 00-0838	EA		40-13/16" x 48", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	329.65 49.26	41.69
08 52 16 00-0839	EA		48" x 48", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	376.56 57.49	44.56
08 52 16 00-0840	EA		52-13/16" x 48", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	406.87 62.98	46.00
08 52 16 00-0841	EA		59-7/8" x 48", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	452.38 71.07	48.87
08 52 16 00-0842	EA		64-13/16" x 48", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	484.10 76.70	50.31
08 52 16 00-0843	EA		71-7/8" x 48", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	529.60 84.79	53.18
08 52 16 00-0844			52-13/16" Height, Picture Wood Clad Windows For Awning And Casement Windows (Andersen 200 Series) (08 52 16 00-0812)		
08 52 16 00-0845	EA		35-15/16" x 52-13/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	328.24 49.12	41.69
08 52 16 00-0846	EA		40-13/16" x 52-13/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	359.97 54.74	43.12
08 52 16 00-0847	EA		48" x 52-13/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	406.87 62.98	46.00
08 52 16 00-0848	EA		52-13/16" x 52-13/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	437.19 68.46	47.43
08 52 16 00-0849	EA		59-7/8" x 52-13/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	482.69 76.56	50.31
08 52 16 00-0850	EA		64-13/16" x 52-13/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	514.42 82.18	51.74
08 52 16 00-0851	EA		71-7/8" x 52-13/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	600.39 98.37	54.62



Openings	08	08
Windows	08 50	
Wood Windows	08 52	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 52 16 00-0852 59-7/8" Height, Picture Wood Clad Windows For Awning And Casement Windows (Andersen 200 Series) <small>(08 52 16 00-0812)</small>		
08 52 16 00-0853 EA 35-15/16" x 59-7/8", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series).....	373.75	43.84
<i>For Tempered Clear Insulated Glass, Add</i>	<i>57.21</i>	
08 52 16 00-0854 EA 40-13/16" x 59-7/8", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series).....	405.47	46.00
<i>For Tempered Clear Insulated Glass, Add</i>	<i>62.84</i>	
08 52 16 00-0855 EA 48" x 59-7/8", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series).....	452.38	48.51
<i>For Tempered Clear Insulated Glass, Add</i>	<i>71.07</i>	
08 52 16 00-0856 EA 52-13/16" x 59-7/8", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series).....	482.69	49.95
<i>For Tempered Clear Insulated Glass, Add</i>	<i>76.56</i>	
08 52 16 00-0857 EA 59-7/8" x 59-7/8", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series).....	528.21	52.47
<i>For Tempered Clear Insulated Glass, Add</i>	<i>84.65</i>	
08 52 16 00-0858 EA 64-13/16" x 59-7/8", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series).....	559.92	54.26
<i>For Tempered Clear Insulated Glass, Add</i>	<i>90.28</i>	
08 52 16 00-0859 EA 71-7/8" x 59-7/8", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series).....	605.43	56.78
<i>For Tempered Clear Insulated Glass, Add</i>	<i>98.37</i>	
08 52 16 00-0860 64-13/16" Height, Picture Wood Clad Windows For Awning And Casement Windows (Andersen 200 Series) <small>(08 52 16 00-0812)</small>		
08 52 16 00-0861 EA 35-15/16" x 64-13/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series).....	405.47	46.00
<i>For Tempered Clear Insulated Glass, Add</i>	<i>62.84</i>	
08 52 16 00-0862 EA 40-13/16" x 64-13/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series).....	437.19	47.43
<i>For Tempered Clear Insulated Glass, Add</i>	<i>68.46</i>	
08 52 16 00-0863 EA 48" x 64-13/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series).....	484.10	50.31
<i>For Tempered Clear Insulated Glass, Add</i>	<i>76.70</i>	
08 52 16 00-0864 EA 52-13/16" x 64-13/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series).....	514.42	51.74
<i>For Tempered Clear Insulated Glass, Add</i>	<i>82.18</i>	
08 52 16 00-0865 EA 59-7/8" x 64-13/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series).....	600.39	54.62
<i>For Tempered Clear Insulated Glass, Add</i>	<i>98.37</i>	
08 52 16 00-0866 71-7/8" Height, Picture Wood Clad Windows For Awning And Casement Windows (Andersen 200 Series) <small>(08 52 16 00-0812)</small>		
08 52 16 00-0867 EA 35-15/16" x 71-7/8", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series).....	450.97	48.16
<i>For Tempered Clear Insulated Glass, Add</i>	<i>70.93</i>	
08 52 16 00-0868 EA 40-13/16" x 71-7/8", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series).....	482.69	50.31
<i>For Tempered Clear Insulated Glass, Add</i>	<i>76.56</i>	
08 52 16 00-0869 EA 48" x 71-7/8", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series).....	529.60	52.82
<i>For Tempered Clear Insulated Glass, Add</i>	<i>84.79</i>	
08 52 16 00-0870 EA 52-13/16" x 71-7/8", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series).....	559.92	54.26
<i>For Tempered Clear Insulated Glass, Add</i>	<i>90.28</i>	
08 52 16 00-0871 EA 59-7/8" x 71-7/8", Picture Wood Clad Window For Awning And Casement Windows (Andersen 200 Series).....	605.43	56.78
<i>For Tempered Clear Insulated Glass, Add</i>	<i>98.37</i>	
08 52 16 00-0872 Picture Wood Clad Windows For Awning And Casement Windows (Andersen 400 Series) <small>(08 52 16 00-0811)</small>		
<i>Note: Includes painted or stained wood interior, colored PVC clad exterior, standard hardware and Low-E insulated glass. Excludes grilles and insect screens.</i>		
08 52 16 00-0873 12" Height, Picture Wood Clad Windows For Awning And Casement Windows (Andersen 400 Series) <small>(08 52 16 00-0872)</small>		
08 52 16 00-0874 EA 40-13/16" x 12", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series).....	227.85	28.75
<i>For Tempered Low-E Insulated Glass, Add</i>	<i>34.07</i>	
08 52 16 00-0875 EA 48" x 12", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series).....	265.87	31.62
<i>For Tempered Low-E Insulated Glass, Add</i>	<i>40.52</i>	
08 52 16 00-0876 EA 52-13/16" x 12", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series).....	282.25	33.06
<i>For Tempered Low-E Insulated Glass, Add</i>	<i>43.23</i>	
08 52 16 00-0877 EA 59-7/8" x 12", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series).....	306.05	35.94
<i>For Tempered Low-E Insulated Glass, Add</i>	<i>46.98</i>	
08 52 16 00-0878 EA 64-13/16" x 12", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series).....	322.39	37.38
<i>For Tempered Low-E Insulated Glass, Add</i>	<i>49.53</i>	
08 52 16 00-0879 EA 71-7/8" x 12", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series).....	346.19	40.25
<i>For Tempered Low-E Insulated Glass, Add</i>	<i>53.28</i>	
08 52 16 00-0880 35-15/16" Height, Picture Wood Clad Windows For Awning And Casement Windows (Andersen 400 Series) <small>(08 52 16 00-0872)</small>		
08 52 16 00-0881 EA 35-15/16" x 35-15/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series).....	254.21	35.22
<i>For Tempered Low-E Insulated Glass, Add</i>	<i>36.76</i>	
08 52 16 00-0882 EA 40-13/16" x 35-15/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series).....	292.54	37.38
<i>For Tempered Low-E Insulated Glass, Add</i>	<i>43.70</i>	
08 52 16 00-0883 EA 48" x 35-15/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series).....	349.10	39.89
<i>For Tempered Low-E Insulated Glass, Add</i>	<i>53.86</i>	
08 52 16 00-0884 EA 52-13/16" x 35-15/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series).....	385.85	41.33
<i>For Tempered Low-E Insulated Glass, Add</i>	<i>60.64</i>	
08 52 16 00-0885 EA 59-7/8" x 35-15/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series).....	440.85	43.84
<i>For Tempered Low-E Insulated Glass, Add</i>	<i>70.63</i>	

08 Openings**08 50 Windows****08 52 Wood Windows**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 52 16 00-0886	EA		64-13/16" x 35-15/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series).....	479.17	45.64
			<i>For Tempered Low-E Insulated Glass, Add</i>	77.58	
08 52 16 00-0887	EA		71-7/8" x 35-15/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series).....	703.55	48.16
			<i>For Tempered Low-E Insulated Glass, Add</i>	121.45	
08 52 16 00-0888			40-13/16" Height, Picture Wood Clad Windows For Awning And Casement Windows (Andersen 400 Series) (08 52 16 00-0872)		
08 52 16 00-0889	EA		35-15/16" x 40-13/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series).....	292.54	37.38
			<i>For Tempered Low-E Insulated Glass, Add</i>	43.70	
08 52 16 00-0890	EA		40-13/16" x 40-13/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series).....	330.85	38.81
			<i>For Tempered Low-E Insulated Glass, Add</i>	50.65	
08 52 16 00-0891	EA		48" x 40-13/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series).....	387.42	41.69
			<i>For Tempered Low-E Insulated Glass, Add</i>	60.81	
08 52 16 00-0892	EA		52-13/16" x 40-13/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series).....	424.17	43.12
			<i>For Tempered Low-E Insulated Glass, Add</i>	67.58	
08 52 16 00-0893	EA		59-7/8" x 40-13/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series).....	479.17	46.00
			<i>For Tempered Low-E Insulated Glass, Add</i>	77.58	
08 52 16 00-0894	EA		64-13/16" x 40-13/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series).....	517.49	47.43
			<i>For Tempered Low-E Insulated Glass, Add</i>	84.52	
08 52 16 00-0895	EA		71-7/8" x 40-13/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series).....	572.49	50.31
			<i>For Tempered Low-E Insulated Glass, Add</i>	94.52	
08 52 16 00-0896			48" Height, Picture Wood Clad Windows For Awning And Casement Windows (Andersen 400 Series) (08 52 16 00-0872)		
08 52 16 00-0897	EA		35-15/16" x 48", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series).....	349.10	40.25
			<i>For Tempered Low-E Insulated Glass, Add</i>	53.86	
08 52 16 00-0898	EA		40-13/16" x 48", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series).....	387.42	41.69
			<i>For Tempered Low-E Insulated Glass, Add</i>	60.81	
08 52 16 00-0899	EA		48" x 48", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series).....	443.98	44.56
			<i>For Tempered Low-E Insulated Glass, Add</i>	70.97	
08 52 16 00-0900	EA		52-13/16" x 48", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series).....	480.73	46.00
			<i>For Tempered Low-E Insulated Glass, Add</i>	77.75	
08 52 16 00-0901	EA		59-7/8" x 48", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series).....	535.74	48.87
			<i>For Tempered Low-E Insulated Glass, Add</i>	87.74	
08 52 16 00-0902	EA		64-13/16" x 48", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series).....	574.05	50.31
			<i>For Tempered Low-E Insulated Glass, Add</i>	94.69	
08 52 16 00-0903	EA		71-7/8" x 48", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series).....	629.05	53.18
			<i>For Tempered Low-E Insulated Glass, Add</i>	104.68	
08 52 16 00-0904			52-13/16" Height, Picture Wood Clad Windows For Awning And Casement Windows (Andersen 400 Series) (08 52 16 00-0872)		
08 52 16 00-0905	EA		35-15/16" x 52-13/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series).....	385.85	41.69
			<i>For Tempered Low-E Insulated Glass, Add</i>	60.64	
08 52 16 00-0906	EA		40-13/16" x 52-13/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series).....	424.17	43.12
			<i>For Tempered Low-E Insulated Glass, Add</i>	67.58	
08 52 16 00-0907	EA		48" x 52-13/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series).....	480.73	46.00
			<i>For Tempered Low-E Insulated Glass, Add</i>	77.75	
08 52 16 00-0908	EA		52-13/16" x 52-13/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series).....	517.49	47.43
			<i>For Tempered Low-E Insulated Glass, Add</i>	84.52	
08 52 16 00-0909	EA		59-7/8" x 52-13/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series).....	572.49	50.31
			<i>For Tempered Low-E Insulated Glass, Add</i>	94.52	
08 52 16 00-0910	EA		64-13/16" x 52-13/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series).....	610.81	51.74
			<i>For Tempered Low-E Insulated Glass, Add</i>	101.46	
08 52 16 00-0911	EA		71-7/8" x 52-13/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series).....	715.77	54.62
			<i>For Tempered Low-E Insulated Glass, Add</i>	121.45	
08 52 16 00-0912			59-7/8" Height, Picture Wood Clad Windows For Awning And Casement Windows (Andersen 400 Series) (08 52 16 00-0872)		
08 52 16 00-0913	EA		35-15/16" x 59-7/8", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series).....	440.85	43.84
			<i>For Tempered Low-E Insulated Glass, Add</i>	70.63	
08 52 16 00-0914	EA		40-13/16" x 59-7/8", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series).....	479.17	46.00
			<i>For Tempered Low-E Insulated Glass, Add</i>	77.58	
08 52 16 00-0915	EA		48" x 59-7/8", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series).....	535.74	48.51
			<i>For Tempered Low-E Insulated Glass, Add</i>	87.74	
08 52 16 00-0916	EA		52-13/16" x 59-7/8", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series).....	572.49	49.95
			<i>For Tempered Low-E Insulated Glass, Add</i>	94.52	
08 52 16 00-0917	EA		59-7/8" x 59-7/8", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series).....	627.49	52.47
			<i>For Tempered Low-E Insulated Glass, Add</i>	104.51	
08 52 16 00-0918	EA		64-13/16" x 59-7/8", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series).....	665.80	54.26
			<i>For Tempered Low-E Insulated Glass, Add</i>	111.46	
08 52 16 00-0919	EA		71-7/8" x 59-7/8", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series).....	720.81	56.78
			<i>For Tempered Low-E Insulated Glass, Add</i>	121.45	
08 52 16 00-0920			64-13/16" Height, Picture Wood Clad Windows For Awning And Casement Windows (Andersen 400 Series) (08 52 16 00-0872)		



Openings	08	08
Windows	08 50	
Wood Windows	08 52	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 52 16 00-0921	EA		35-15/16" x 64-13/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	479.17 77.58	46.00
08 52 16 00-0922	EA		40-13/16" x 64-13/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	517.49 84.52	47.43
08 52 16 00-0923	EA		48" x 64-13/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	574.05 94.69	50.31
08 52 16 00-0924	EA		52-13/16" x 64-13/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	610.81 101.46	51.74
08 52 16 00-0925	EA		59-7/8" x 64-13/16", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	715.77 121.45	54.62
08 52 16 00-0926			71-7/8" Height, Picture Wood Clad Windows For Awning And Casement Windows (Andersen 400 Series) (08 52 16 00-0872)		
08 52 16 00-0927	EA		35-15/16" x 71-7/8", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	534.16 87.57	48.16
08 52 16 00-0928	EA		40-13/16" x 71-7/8", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	572.49 94.52	50.31
08 52 16 00-0929	EA		48" x 71-7/8", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	629.05 104.68	52.82
08 52 16 00-0930	EA		52-13/16" x 71-7/8", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	665.80 111.46	54.26
08 52 16 00-0931	EA		59-7/8" x 71-7/8", Picture Wood Clad Window For Awning And Casement Windows (Andersen 400 Series)..... <i>For Tempered Low-E Insulated Glass, Add</i>	720.81 121.45	56.78
08 52 16 00-0932			Picture Wood Clad Windows For Double Hung Windows (08 52 16 00-0810)		
08 52 16 00-0933			Picture Wood Clad Windows For Double Hung Windows (Andersen 200 Series) (08 52 16 00-0932) Note: Includes painted or stained wood interior, colored PVC clad exterior, standard hardware and clear insulated glass. Excludes grilles and insect screens.		
08 52 16 00-0934			35-1/2" Height, Picture Wood Clad Windows For Double Hung Windows (Andersen 200 Series) (08 52 16 00-0933)		
08 52 16 00-0935	EA		56-1/2" x 35-1/2", Picture Wood Clad Window For Double Hung Windows (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	281.20 38.27	44.92
08 52 16 00-0936	EA		59-1/2" x 35-1/2", Picture Wood Clad Window For Double Hung Windows (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	288.61 39.32	46.00
08 52 16 00-0937			47-1/2" Height, Picture Wood Clad Windows For Double Hung Windows (Andersen 200 Series) (08 52 16 00-0933)		
08 52 16 00-0938	EA		47-1/2" x 47-1/2", Picture Wood Clad Window For Double Hung Windows (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	288.61 39.32	46.00
08 52 16 00-0939	EA		71-1/2" x 47-1/2", Picture Wood Clad Window For Double Hung Windows (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	349.39 48.03	54.62
08 52 16 00-0940			53-1/2" Height, Picture Wood Clad Windows For Double Hung Windows (Andersen 200 Series) (08 52 16 00-0933)		
08 52 16 00-0941	EA		56-1/2" x 53-1/2", Picture Wood Clad Window For Double Hung Windows (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	327.16 44.88	51.39
08 52 16 00-0942	EA		59-1/2" x 53-1/2", Picture Wood Clad Window For Double Hung Windows (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	334.58 45.93	52.47
08 52 16 00-0943			56-1/2" Height, Picture Wood Clad Windows For Double Hung Windows (Andersen 200 Series) (08 52 16 00-0933)		
08 52 16 00-0944	EA		35-1/2" x 56-1/2", Picture Wood Clad Window For Double Hung Windows (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	281.20 38.27	45.28
08 52 16 00-0945	EA		53-1/2" x 56-1/2", Picture Wood Clad Window For Double Hung Windows (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	327.16 44.88	51.39
08 52 16 00-0946			59-1/2" Height, Picture Wood Clad Windows For Double Hung Windows (Andersen 200 Series) (08 52 16 00-0933)		
08 52 16 00-0947	EA		35-1/2" x 59-1/2", Picture Wood Clad Window For Double Hung Windows (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	288.61 39.32	46.00
08 52 16 00-0948	EA		53-1/2" x 59-1/2", Picture Wood Clad Window For Double Hung Windows (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	334.58 45.93	52.47
08 52 16 00-0949	EA		59-1/2" x 59-1/2", Picture Wood Clad Window For Double Hung Windows (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	349.39 48.03	54.62
08 52 16 00-0950	EA		65-1/2" x 59-1/2", Picture Wood Clad Window For Double Hung Windows (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	364.96 50.28	56.78
08 52 16 00-0951			65-1/2" Height, Picture Wood Clad Windows For Double Hung Windows (Andersen 200 Series) (08 52 16 00-0933)		

08 Openings

08 50 Windows

08 52 Wood Windows



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 52 16 00-0952	EA		59-1/2" x 65-1/2", Picture Wood Clad Window For Double Hung Windows (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	364.96 50.28	56.78
08 52 16 00-0953			71-1/2" Height, Picture Wood Clad Windows For Double Hung Windows (Andersen 200 Series) (08 52 16 00-0933)		
08 52 16 00-0954	EA		47-1/2" x 71-1/2", Picture Wood Clad Window For Double Hung Windows (Andersen 200 Series) <i>For Tempered Clear Insulated Glass, Add</i>	349.39 48.03	54.62
08 52 16 00-0955			Picture Wood Clad Windows For Double Hung Windows (Andersen 400 Series) (08 52 16 00-0932) Note: Includes painted or stained wood interior, colored PVC clad exterior, standard hardware and Low-E insulated glass. Excludes grilles and insect screens.		
08 52 16 00-0956			48-7/8" Height, Picture Wood Clad Windows For Double Hung Windows (Andersen 400 Series) (08 52 16 00-0955)		
08 52 16 00-0957	EA		12" x 48-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	302.45 46.98	33.78
08 52 16 00-0958	EA		37-5/8" x 48-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	419.47 66.79	43.12
08 52 16 00-0959	EA		41-5/8" x 48-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	437.36 69.79	44.20
08 52 16 00-0960	EA		47-5/16" x 48-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	464.19 74.29	46.35
08 52 16 00-0961	EA		51-5/16" x 48-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	482.07 77.30	48.16
08 52 16 00-0962	EA		59-5/16" x 48-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	518.59 83.45	50.67
08 52 16 00-0963	EA		67-5/16" x 48-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	555.10 89.60	53.90
08 52 16 00-0964			52-7/8" Height, Picture Wood Clad Windows For Double Hung Windows (Andersen 400 Series) (08 52 16 00-0955)		
08 52 16 00-0965	EA		12" x 52-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	321.08 50.13	35.22
08 52 16 00-0966	EA		37-5/8" x 52-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	437.36 69.79	44.56
08 52 16 00-0967	EA		41-5/8" x 52-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	455.99 72.94	45.64
08 52 16 00-0968	EA		47-5/16" x 52-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	482.07 77.30	47.79
08 52 16 00-0969	EA		51-5/16" x 52-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	500.70 80.45	49.59
08 52 16 00-0970	EA		59-5/16" x 52-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	537.21 86.60	52.11
08 52 16 00-0971	EA		67-5/16" x 52-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	573.73 92.75	55.34
08 52 16 00-0972			56-7/8" Height, Picture Wood Clad Windows For Double Hung Windows (Andersen 400 Series) (08 52 16 00-0955)		
08 52 16 00-0973	EA		12" x 56-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	338.97 53.13	36.65
08 52 16 00-0974	EA		37-5/8" x 56-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	455.99 72.94	46.00
08 52 16 00-0975	EA		41-5/8" x 56-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	473.87 75.94	47.08
08 52 16 00-0976	EA		47-5/16" x 56-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	500.70 80.45	49.23
08 52 16 00-0977	EA		51-5/16" x 56-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	518.59 83.45	51.03
08 52 16 00-0978	EA		59-5/16" x 56-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	555.10 89.60	53.55
08 52 16 00-0979	EA		67-5/16" x 56-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	592.37 95.91	56.78
08 52 16 00-0980			60-7/8" Height, Picture Wood Clad Windows For Double Hung Windows (Andersen 400 Series) (08 52 16 00-0955)		
08 52 16 00-0981	EA		12" x 60-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	357.60 56.28	38.09
08 52 16 00-0982	EA		37-5/8" x 60-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	473.87 75.94	47.43
08 52 16 00-0983	EA		41-5/8" x 60-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	492.51 79.10	48.51
08 52 16 00-0984	EA		47-5/16" x 60-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	518.59 83.45	50.67
08 52 16 00-0985	EA		51-5/16" x 60-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	537.21 86.60	52.47



Openings	08	08
Windows	08 50	
Wood Windows	08 52	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 52 16 00-0986	EA		59-5/16" x 60-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	573.73 92.75	54.98
08 52 16 00-0987	EA		67-5/16" x 60-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	610.26 98.91	58.21
08 52 16 00-0988			64-7/8" Height, Picture Wood Clad Windows For Double Hung Windows (Andersen 400 Series) <small>(08 52 16 00-0955)</small>		
08 52 16 00-0989	EA		12" x 64-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	375.48 59.28	39.53
08 52 16 00-0990	EA		37-5/8" x 64-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	492.51 79.10	48.87
08 52 16 00-0991	EA		41-5/8" x 64-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	511.14 82.25	49.95
08 52 16 00-0992	EA		47-5/16" x 64-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	537.21 86.60	52.11
08 52 16 00-0993	EA		51-5/16" x 64-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	555.10 89.60	53.90
08 52 16 00-0994	EA		59-5/16" x 64-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	592.37 95.91	56.42
08 52 16 00-0995	EA		67-5/16" x 64-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	628.89 102.06	59.65
08 52 16 00-0996			68-7/8" Height, Picture Wood Clad Windows For Double Hung Windows (Andersen 400 Series) <small>(08 52 16 00-0955)</small>		
08 52 16 00-0997	EA		12" x 68-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	394.12 62.44	40.96
08 52 16 00-0998	EA		37-5/8" x 68-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	511.14 82.25	50.31
08 52 16 00-0999	EA		41-5/8" x 68-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	529.03 85.25	51.39
08 52 16 00-1000	EA		47-5/16" x 68-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	555.10 89.60	53.55
08 52 16 00-1001	EA		51-5/16" x 68-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	573.73 92.75	55.34
08 52 16 00-1002	EA		59-5/16" x 68-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	610.26 98.91	57.86
08 52 16 00-1003	EA		67-5/16" x 68-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	646.77 105.06	61.09
08 52 16 00-1004			72-7/8" Height, Picture Wood Clad Windows For Double Hung Windows (Andersen 400 Series) <small>(08 52 16 00-0955)</small>		
08 52 16 00-1005	EA		12" x 72-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	412.00 65.44	42.40
08 52 16 00-1006	EA		37-5/8" x 72-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	529.03 85.25	51.74
08 52 16 00-1007	EA		41-5/8" x 72-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	547.66 88.40	52.82
08 52 16 00-1008	EA		47-5/16" x 72-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	573.73 92.75	54.98
08 52 16 00-1009	EA		51-5/16" x 72-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	592.37 95.91	56.78
08 52 16 00-1010	EA		59-5/16" x 72-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	628.89 102.06	59.29
08 52 16 00-1011	EA		67-5/16" x 72-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	665.41 108.21	62.53
08 52 16 00-1012			76-7/8" Height, Picture Wood Clad Windows For Double Hung Windows (Andersen 400 Series) <small>(08 52 16 00-0955)</small>		
08 52 16 00-1013	EA		12" x 76-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	430.63 68.59	43.84
08 52 16 00-1014	EA		37-5/8" x 76-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	547.66 88.40	53.18
08 52 16 00-1015	EA		41-5/8" x 76-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	565.54 91.40	54.26
08 52 16 00-1016	EA		47-5/16" x 76-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	592.37 95.91	56.42
08 52 16 00-1017	EA		51-5/16" x 76-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	610.26 98.91	58.21
08 52 16 00-1018	EA		59-5/16" x 76-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	646.77 105.06	60.73
08 52 16 00-1019	EA		67-5/16" x 76-7/8", Picture Wood Clad Window For Double Hung Windows (Andersen 400 Series) <i>For Tempered Low-E Insulated Glass, Add</i>	683.29 111.22	63.96
08 52 16 00-1020			Picture Wood Clad Windows For Horizontal Sliding Windows <small>(08 52 16 00-0810)</small>		

08 Openings**08 50 Windows****08 52 Wood Windows**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 52 16 00-1021 Picture Wood Clad Windows For Horizontal Sliding Windows (Andersen 200 Series) <small>(08 52 16 00-1020)</small> Note: Includes painted or stained wood interior, colored PVC clad exterior, standard hardware and clear insulated glass. Excludes grilles and insect screens.		
08 52 16 00-1022 35-1/2" Height, Picture Wood Clad Windows For Horizontal Sliding Windows (Andersen 200 Series) <small>(08 52 16 00-1021)</small>		
08 52 16 00-1023 EA 56-1/2" x 35-1/2", Picture Wood Clad Window For Horizontal Sliding Windows (Andersen 200 Series)	281.20	44.92
For Tempered Clear Insulated Glass, Add	38.27	
08 52 16 00-1024 EA 59-1/2" x 35-1/2", Picture Wood Clad Window For Horizontal Sliding Windows (Andersen 200 Series)	288.61	46.00
For Tempered Clear Insulated Glass, Add	39.32	
08 52 16 00-1025 47-1/2" Height, Picture Wood Clad Windows For Horizontal Sliding Windows (Andersen 200 Series) <small>(08 52 16 00-1021)</small>		
08 52 16 00-1026 EA 47-1/2" x 47-1/2", Picture Wood Clad Window For Horizontal Sliding Windows (Andersen 200 Series)	288.61	46.00
For Tempered Clear Insulated Glass, Add	39.32	
08 52 16 00-1027 EA 71-1/2" x 47-1/2", Picture Wood Clad Window For Horizontal Sliding Windows (Andersen 200 Series)	349.39	54.62
For Tempered Clear Insulated Glass, Add	48.03	
08 52 16 00-1028 53-1/2" Height, Picture Wood Clad Windows For Horizontal Sliding Windows (Andersen 200 Series) <small>(08 52 16 00-1021)</small>		
08 52 16 00-1029 EA 56-1/2" x 53-1/2", Picture Wood Clad Window For Horizontal Sliding Windows (Andersen 200 Series)	327.16	51.39
For Tempered Clear Insulated Glass, Add	44.88	
08 52 16 00-1030 EA 59-1/2" x 53-1/2", Picture Wood Clad Window For Horizontal Sliding Windows (Andersen 200 Series)	334.58	52.47
For Tempered Clear Insulated Glass, Add	45.93	
08 52 16 00-1031 56-1/2" Height, Picture Wood Clad Windows For Horizontal Sliding Windows (Andersen 200 Series) <small>(08 52 16 00-1021)</small>		
08 52 16 00-1032 EA 35-1/2" x 56-1/2", Picture Wood Clad Window For Horizontal Sliding Windows (Andersen 200 Series)	281.20	45.28
For Tempered Clear Insulated Glass, Add	38.27	
08 52 16 00-1033 EA 53-1/2" x 56-1/2", Picture Wood Clad Window For Horizontal Sliding Windows (Andersen 200 Series)	327.16	51.39
For Tempered Clear Insulated Glass, Add	44.88	
08 52 16 00-1034 59-1/2" Height, Picture Wood Clad Windows For Horizontal Sliding Windows (Andersen 200 Series) <small>(08 52 16 00-1021)</small>		
08 52 16 00-1035 EA 35-1/2" x 59-1/2", Picture Wood Clad Window For Horizontal Sliding Windows (Andersen 200 Series)	288.61	46.00
For Tempered Clear Insulated Glass, Add	39.32	
08 52 16 00-1036 EA 53-1/2" x 59-1/2", Picture Wood Clad Window For Horizontal Sliding Windows (Andersen 200 Series)	334.58	52.47
For Tempered Clear Insulated Glass, Add	45.93	
08 52 16 00-1037 EA 59-1/2" x 59-1/2", Picture Wood Clad Window For Horizontal Sliding Windows (Andersen 200 Series)	349.39	54.62
For Tempered Clear Insulated Glass, Add	48.03	
08 52 16 00-1038 EA 65-1/2" x 59-1/2", Picture Wood Clad Window For Horizontal Sliding Windows (Andersen 200 Series)	364.96	56.78
For Tempered Clear Insulated Glass, Add	50.28	
08 52 16 00-1039 65-1/2" Height, Picture Wood Clad Windows For Horizontal Sliding Windows (Andersen 200 Series) <small>(08 52 16 00-1021)</small>		
08 52 16 00-1040 EA 59-1/2" x 65-1/2", Picture Wood Clad Window For Horizontal Sliding Windows (Andersen 200 Series)	364.96	56.78
For Tempered Clear Insulated Glass, Add	50.28	
08 52 16 00-1041 71-1/2" Height, Picture Wood Clad Windows For Horizontal Sliding Windows (Andersen 200 Series) <small>(08 52 16 00-1021)</small>		
08 52 16 00-1042 EA 47-1/2" x 71-1/2", Picture Wood Clad Window For Horizontal Sliding Windows (Andersen 200 Series)	349.39	54.62
For Tempered Clear Insulated Glass, Add	48.03	
08 52 16 00-1043 Basement Wood Clad Windows <small>(08 52 16)</small>		
08 52 16 00-1044 Basement Wood Clad Windows (Andersen 400 Series) <small>(08 52 16 00-1043)</small> Note: Includes painted or stained wood interior, colored PVC clad exterior, standard hardware, Low-E insulated glass and insect screens. Excludes grilles.		
08 52 16 00-1045 EA 32-1/4" x 15-3/4", Basement Wood Clad Window (Andersen 400 Series)	152.27	28.75
08 52 16 00-1046 EA 32-1/4" x 19-3/4", Basement Wood Clad Window (Andersen 400 Series)	159.39	28.75
08 52 16 00-1047 EA 32-1/4" x 23-3/4", Basement Wood Clad Window (Andersen 400 Series)	165.65	28.75
08 52 16 00-1048 Factory Installed Grilles For Wood Clad Windows <small>(08 52 16)</small>		
08 52 16 00-1049 Fixed Grille Installed Between Glass Panes, Factory Installed Grilles For Wood Clad Windows <small>(08 52 16 00-1048)</small>		
08 52 16 00-1050 EA Up To 9 SF Windows, Fixed Grille Installed Between Glass Panes, Factory Installed Grilles For Wood Clad Windows	18.52	
08 52 16 00-1051 EA >9 To 18 SF Windows, Fixed Grille Installed Between Glass Panes, Factory Installed Grilles For Wood Clad Windows	27.29	



Openings	08	08
Windows	08 50	
Wood Windows	08 52	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 52 16 00-1052 EA >18 To 24 SF Windows, Fixed Grille Installed Between Glass Panes, Factory Installed Grilles For Wood Clad Windows.....	37.03	
08 52 16 00-1053 EA >24 To 36 SF Windows, Fixed Grille Installed Between Glass Panes, Factory Installed Grilles For Wood Clad Windows.....	46.78	
08 52 16 00-1054 EA >36 SF Windows, Fixed Grille Installed Between Glass Panes, Factory Installed Grilles For Wood Clad Windows.....	66.27	
08 52 16 00-1055 Fixed Exterior And Removable Interior Grilles, Factory Installed Grilles For Wood Clad Windows (08 52 16 00-1048)		
08 52 16 00-1056 EA Up To 9 SF Windows, Fixed Grille Installed Between Glass Panes, Factory Installed Grilles For Wood Clad Windows.....	29.63	
08 52 16 00-1057 EA >9 To 18 SF Windows, Fixed Grille Installed Between Glass Panes, Factory Installed Grilles For Wood Clad Windows.....	43.66	
08 52 16 00-1058 EA >18 To 24 SF Windows, Fixed Grille Installed Between Glass Panes, Factory Installed Grilles For Wood Clad Windows.....	59.26	
08 52 16 00-1059 EA >24 To 36 SF Windows, Fixed Grille Installed Between Glass Panes, Factory Installed Grilles For Wood Clad Windows.....	74.85	
08 52 16 00-1060 EA >36 SF Windows, Fixed Grille Installed Between Glass Panes, Factory Installed Grilles For Wood Clad Windows.....	106.04	
08 52 16 00-1061 Fixed Exterior And Interior Grilles, Factory Installed Grilles For Wood Clad Windows (08 52 16 00-1048)		
08 52 16 00-1062 EA Up To 9 SF Windows, Fixed Exterior And Interior Grilles, Factory Installed Grilles For Wood Clad Windows.....	35.55	
08 52 16 00-1063 EA >9 To 18 SF Windows, Fixed Exterior And Interior Grilles, Factory Installed Grilles For Wood Clad Windows.....	52.39	
08 52 16 00-1064 EA >18 To 24 SF Windows, Fixed Exterior And Interior Grilles, Factory Installed Grilles For Wood Clad Windows.....	71.11	
08 52 16 00-1065 EA >24 To 36 SF Windows, Fixed Exterior And Interior Grilles, Factory Installed Grilles For Wood Clad Windows.....	89.82	
08 52 16 00-1066 EA >36 SF Windows, Fixed Exterior And Interior Grilles, Factory Installed Grilles For Wood Clad Windows.....	127.24	
08 52 16 00-1067 Fixed Exterior And Interior Grilles With Spacers, Factory Installed Grilles For Wood Clad Windows (08 52 16 00-1048)		
08 52 16 00-1068 EA Up To 9 SF Windows, Fixed Exterior And Interior Grilles With Spacers, Factory Installed Grilles For Wood Clad Windows.....	42.67	
08 52 16 00-1069 EA >9 To 18 SF Windows, Fixed Exterior And Interior Grilles With Spacers, Factory Installed Grilles For Wood Clad Windows.....	62.87	
08 52 16 00-1070 EA >18 To 24 SF Windows, Fixed Exterior And Interior Grilles With Spacers, Factory Installed Grilles For Wood Clad Windows.....	85.33	
08 52 16 00-1071 EA >24 To 36 SF Windows, Fixed Exterior And Interior Grilles With Spacers, Factory Installed Grilles For Wood Clad Windows.....	107.78	
08 52 16 00-1072 EA >36 SF Windows, Fixed Exterior And Interior Grilles With Spacers, Factory Installed Grilles For Wood Clad Windows.....	152.69	
08 52 19 Wood Windows (08 52)		
08 52 19 00-0001 Sash-Only Replacement Kits For Double Hung Wood Windows (08 52 19)		
Note: Includes demo of the existing sashes and jamb liners. Includes two sashes, jamb liners, insulated glass and all hardware needed for installation. Includes primed pine wood interior and exterior. Excludes window frame, trim, insect screens and grilles.		
08 52 19 00-0002 30" Height, Sash-Only Replacement Kits For Double Hung Wood Windows (08 52 19 00-0001)		
08 52 19 00-0003 EA 20" x 30", Sash-Only Replacement Kit For Double Hung Wood Windows.....	225.67	
For Low-E Insulated Glass, Add	19.48	
For Aluminum Clad Exterior, Add	20.87	
08 52 19 00-0004 EA 24" x 30", Sash-Only Replacement Kit For Double Hung Wood Windows.....	239.71	
For Low-E Insulated Glass, Add	20.88	
For Aluminum Clad Exterior, Add	22.37	
08 52 19 00-0005 EA 28" x 30", Sash-Only Replacement Kit For Double Hung Wood Windows.....	254.74	
For Low-E Insulated Glass, Add	22.42	
For Aluminum Clad Exterior, Add	24.02	
08 52 19 00-0006 EA 30" x 30", Sash-Only Replacement Kit For Double Hung Wood Windows.....	262.77	
For Low-E Insulated Glass, Add	23.26	
For Aluminum Clad Exterior, Add	24.93	
08 52 19 00-0007 EA 32" x 30", Sash-Only Replacement Kit For Double Hung Wood Windows.....	269.78	
For Low-E Insulated Glass, Add	23.96	
For Aluminum Clad Exterior, Add	25.68	
08 52 19 00-0008 EA 34" x 30", Sash-Only Replacement Kit For Double Hung Wood Windows.....	278.80	
For Low-E Insulated Glass, Add	24.95	
For Aluminum Clad Exterior, Add	26.73	
08 52 19 00-0009 EA 36" x 30", Sash-Only Replacement Kit For Double Hung Wood Windows.....	282.84	
For Low-E Insulated Glass, Add	25.23	
For Aluminum Clad Exterior, Add	27.03	
08 52 19 00-0010 EA 40" x 30", Sash-Only Replacement Kit For Double Hung Wood Windows.....	300.85	
For Low-E Insulated Glass, Add	27.19	
For Aluminum Clad Exterior, Add	29.13	
08 52 19 00-0011 EA 44" x 30", Sash-Only Replacement Kit For Double Hung Wood Windows.....	315.88	
For Low-E Insulated Glass, Add	28.73	
For Aluminum Clad Exterior, Add	30.78	
08 52 19 00-0012 34" Height, Sash-Only Replacement Kits For Double Hung Wood Windows (08 52 19 00-0001)		

08 Openings**08 50 Windows****08 52 Wood Windows**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 52 19 00-0013	EA		20" x 34", Sash-Only Replacement Kit For Double Hung Wood Windows.....	239.71	
			<i>For Low-E Insulated Glass, Add</i>	20.88	
			<i>For Aluminum Clad Exterior, Add</i>	22.37	
08 52 19 00-0014	EA		24" x 34", Sash-Only Replacement Kit For Double Hung Wood Windows.....	254.74	
			<i>For Low-E Insulated Glass, Add</i>	22.42	
			<i>For Aluminum Clad Exterior, Add</i>	24.02	
08 52 19 00-0015	EA		28" x 34", Sash-Only Replacement Kit For Double Hung Wood Windows.....	267.77	
			<i>For Low-E Insulated Glass, Add</i>	23.96	
			<i>For Aluminum Clad Exterior, Add</i>	25.68	
08 52 19 00-0016	EA		30" x 34", Sash-Only Replacement Kit For Double Hung Wood Windows.....	278.80	
			<i>For Low-E Insulated Glass, Add</i>	24.95	
			<i>For Aluminum Clad Exterior, Add</i>	26.73	
08 52 19 00-0017	EA		32" x 34", Sash-Only Replacement Kit For Double Hung Wood Windows.....	285.81	
			<i>For Low-E Insulated Glass, Add</i>	25.65	
			<i>For Aluminum Clad Exterior, Add</i>	27.48	
08 52 19 00-0018	EA		34" x 34", Sash-Only Replacement Kit For Double Hung Wood Windows.....	293.84	
			<i>For Low-E Insulated Glass, Add</i>	26.49	
			<i>For Aluminum Clad Exterior, Add</i>	28.38	
08 52 19 00-0019	EA		36" x 34", Sash-Only Replacement Kit For Double Hung Wood Windows.....	300.85	
			<i>For Low-E Insulated Glass, Add</i>	27.19	
			<i>For Aluminum Clad Exterior, Add</i>	29.13	
08 52 19 00-0020	EA		40" x 34", Sash-Only Replacement Kit For Double Hung Wood Windows.....	315.88	
			<i>For Low-E Insulated Glass, Add</i>	28.73	
			<i>For Aluminum Clad Exterior, Add</i>	30.78	
08 52 19 00-0021	EA		44" x 34", Sash-Only Replacement Kit For Double Hung Wood Windows.....	330.93	
			<i>For Low-E Insulated Glass, Add</i>	30.27	
			<i>For Aluminum Clad Exterior, Add</i>	32.43	
08 52 19 00-0022			36" Height, Sash-Only Replacement Kits For Double Hung Wood Windows		
			<small>(08 52 19 00-0001)</small>		
08 52 19 00-0023	EA		20" x 36", Sash-Only Replacement Kit For Double Hung Wood Windows.....	246.73	
			<i>For Low-E Insulated Glass, Add</i>	21.72	
			<i>For Aluminum Clad Exterior, Add</i>	23.27	
08 52 19 00-0024	EA		24" x 36", Sash-Only Replacement Kit For Double Hung Wood Windows.....	261.76	
			<i>For Low-E Insulated Glass, Add</i>	23.26	
			<i>For Aluminum Clad Exterior, Add</i>	24.93	
08 52 19 00-0025	EA		28" x 36", Sash-Only Replacement Kit For Double Hung Wood Windows.....	277.80	
			<i>For Low-E Insulated Glass, Add</i>	24.95	
			<i>For Aluminum Clad Exterior, Add</i>	26.73	
08 52 19 00-0026	EA		30" x 36", Sash-Only Replacement Kit For Double Hung Wood Windows.....	284.80	
			<i>For Low-E Insulated Glass, Add</i>	25.65	
			<i>For Aluminum Clad Exterior, Add</i>	27.48	
08 52 19 00-0027	EA		32" x 36", Sash-Only Replacement Kit For Double Hung Wood Windows.....	292.83	
			<i>For Low-E Insulated Glass, Add</i>	26.49	
			<i>For Aluminum Clad Exterior, Add</i>	28.38	
08 52 19 00-0028	EA		34" x 36", Sash-Only Replacement Kit For Double Hung Wood Windows.....	299.84	
			<i>For Low-E Insulated Glass, Add</i>	27.19	
			<i>For Aluminum Clad Exterior, Add</i>	29.13	
08 52 19 00-0029	EA		36" x 36", Sash-Only Replacement Kit For Double Hung Wood Windows.....	307.87	
			<i>For Low-E Insulated Glass, Add</i>	28.03	
			<i>For Aluminum Clad Exterior, Add</i>	30.03	
08 52 19 00-0030	EA		40" x 36", Sash-Only Replacement Kit For Double Hung Wood Windows.....	321.90	
			<i>For Low-E Insulated Glass, Add</i>	29.43	
			<i>For Aluminum Clad Exterior, Add</i>	31.53	
08 52 19 00-0031	EA		44" x 36", Sash-Only Replacement Kit For Double Hung Wood Windows.....	336.94	
			<i>For Low-E Insulated Glass, Add</i>	30.97	
			<i>For Aluminum Clad Exterior, Add</i>	33.18	
08 52 19 00-0032			38" Height, Sash-Only Replacement Kits For Double Hung Wood Windows		
			<small>(08 52 19 00-0001)</small>		
08 52 19 00-0033	EA		20" x 38", Sash-Only Replacement Kit For Double Hung Wood Windows.....	255.75	
			<i>For Low-E Insulated Glass, Add</i>	22.42	
			<i>For Aluminum Clad Exterior, Add</i>	24.02	
08 52 19 00-0034	EA		24" x 38", Sash-Only Replacement Kit For Double Hung Wood Windows.....	270.79	
			<i>For Low-E Insulated Glass, Add</i>	23.96	
			<i>For Aluminum Clad Exterior, Add</i>	25.68	
08 52 19 00-0035	EA		28" x 38", Sash-Only Replacement Kit For Double Hung Wood Windows.....	286.82	
			<i>For Low-E Insulated Glass, Add</i>	25.65	
			<i>For Aluminum Clad Exterior, Add</i>	27.48	
08 52 19 00-0036	EA		30" x 38", Sash-Only Replacement Kit For Double Hung Wood Windows.....	294.84	
			<i>For Low-E Insulated Glass, Add</i>	26.49	
			<i>For Aluminum Clad Exterior, Add</i>	28.38	
08 52 19 00-0037	EA		32" x 38", Sash-Only Replacement Kit For Double Hung Wood Windows.....	301.86	
			<i>For Low-E Insulated Glass, Add</i>	27.19	
			<i>For Aluminum Clad Exterior, Add</i>	29.13	
08 52 19 00-0038	EA		34" x 38", Sash-Only Replacement Kit For Double Hung Wood Windows.....	309.87	
			<i>For Low-E Insulated Glass, Add</i>	28.03	
			<i>For Aluminum Clad Exterior, Add</i>	30.03	
08 52 19 00-0039	EA		36" x 38", Sash-Only Replacement Kit For Double Hung Wood Windows.....	316.89	
			<i>For Low-E Insulated Glass, Add</i>	28.73	
			<i>For Aluminum Clad Exterior, Add</i>	30.78	
08 52 19 00-0040	EA		40" x 38", Sash-Only Replacement Kit For Double Hung Wood Windows.....	331.94	
			<i>For Low-E Insulated Glass, Add</i>	30.27	
			<i>For Aluminum Clad Exterior, Add</i>	32.43	



Openings	08	08
Windows	08 50	
Wood Windows	08 52	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 52 19 00-0041 EA 44" x 38", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	346.97 31.81 34.08	
08 52 19 00-0042 46" Height, Sash-Only Replacement Kits For Double Hung Wood Windows <small>(08 52 19 00-0001)</small>		
08 52 19 00-0043 EA 20" x 46", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	285.81 25.65 27.48	
08 52 19 00-0044 EA 24" x 46", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	300.85 27.19 29.13	
08 52 19 00-0045 EA 28" x 46", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	315.88 28.73 30.78	
08 52 19 00-0046 EA 30" x 46", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	322.90 29.43 31.53	
08 52 19 00-0047 EA 32" x 46", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	330.93 30.27 32.43	
08 52 19 00-0048 EA 34" x 46", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	337.93 30.97 33.18	
08 52 19 00-0049 EA 36" x 46", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	345.96 31.81 34.08	
08 52 19 00-0050 EA 40" x 46", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	361.00 33.35 35.74	
08 52 19 00-0051 EA 44" x 46", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	377.03 35.04 37.54	
08 52 19 00-0052 48" Height, Sash-Only Replacement Kits For Double Hung Wood Windows <small>(08 52 19 00-0001)</small>		
08 52 19 00-0053 EA 20" x 48", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	292.83 26.49 28.38	
08 52 19 00-0054 EA 24" x 48", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	307.87 28.03 30.03	
08 52 19 00-0055 EA 28" x 48", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	321.90 29.43 31.53	
08 52 19 00-0056 EA 30" x 48", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	329.92 30.27 32.43	
08 52 19 00-0057 EA 32" x 48", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	336.94 30.97 33.18	
08 52 19 00-0058 EA 34" x 48", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	344.95 31.81 34.08	
08 52 19 00-0059 EA 36" x 48", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	351.97 32.51 34.83	
08 52 19 00-0060 EA 40" x 48", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	368.01 34.19 36.64	
08 52 19 00-0061 EA 44" x 48", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	383.05 35.74 38.29	
08 52 19 00-0062 50" Height, Sash-Only Replacement Kits For Double Hung Wood Windows <small>(08 52 19 00-0001)</small>		
08 52 19 00-0063 EA 20" x 50", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	301.86 27.19 29.13	
08 52 19 00-0064 EA 24" x 50", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	316.89 28.73 30.78	
08 52 19 00-0065 EA 28" x 50", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	331.94 30.27 32.43	
08 52 19 00-0066 EA 30" x 50", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	338.94 30.97 33.18	
08 52 19 00-0067 EA 32" x 50", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	346.97 31.81 34.08	

08 Openings**08 50 Windows****08 52 Wood Windows**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 52 19 00-0068	EA		34" x 50", Sash-Only Replacement Kit For Double Hung Wood Windows.....	353.98	
			<i>For Low-E Insulated Glass, Add</i>	32.51	
			<i>For Aluminum Clad Exterior, Add</i>	34.83	
08 52 19 00-0069	EA		36" x 50", Sash-Only Replacement Kit For Double Hung Wood Windows.....	362.01	
			<i>For Low-E Insulated Glass, Add</i>	33.35	
			<i>For Aluminum Clad Exterior, Add</i>	35.74	
08 52 19 00-0070	EA		40" x 50", Sash-Only Replacement Kit For Double Hung Wood Windows.....	378.04	
			<i>For Low-E Insulated Glass, Add</i>	35.04	
			<i>For Aluminum Clad Exterior, Add</i>	37.54	
08 52 19 00-0071	EA		44" x 50", Sash-Only Replacement Kit For Double Hung Wood Windows.....	393.08	
			<i>For Low-E Insulated Glass, Add</i>	36.58	
			<i>For Aluminum Clad Exterior, Add</i>	39.19	
08 52 19 00-0072			54" Height, Sash-Only Replacement Kits For Double Hung Wood Windows		
			<small>(08 52 19 00-0001)</small>		
08 52 19 00-0073	EA		20" x 54", Sash-Only Replacement Kit For Double Hung Wood Windows.....	316.89	
			<i>For Low-E Insulated Glass, Add</i>	28.73	
			<i>For Aluminum Clad Exterior, Add</i>	30.78	
08 52 19 00-0074	EA		24" x 54", Sash-Only Replacement Kit For Double Hung Wood Windows.....	331.94	
			<i>For Low-E Insulated Glass, Add</i>	30.27	
			<i>For Aluminum Clad Exterior, Add</i>	32.43	
08 52 19 00-0075	EA		28" x 54", Sash-Only Replacement Kit For Double Hung Wood Windows.....	346.97	
			<i>For Low-E Insulated Glass, Add</i>	31.81	
			<i>For Aluminum Clad Exterior, Add</i>	34.08	
08 52 19 00-0076	EA		30" x 54", Sash-Only Replacement Kit For Double Hung Wood Windows.....	353.98	
			<i>For Low-E Insulated Glass, Add</i>	32.51	
			<i>For Aluminum Clad Exterior, Add</i>	34.83	
08 52 19 00-0077	EA		32" x 54", Sash-Only Replacement Kit For Double Hung Wood Windows.....	362.01	
			<i>For Low-E Insulated Glass, Add</i>	33.35	
			<i>For Aluminum Clad Exterior, Add</i>	35.74	
08 52 19 00-0078	EA		34" x 54", Sash-Only Replacement Kit For Double Hung Wood Windows.....	370.01	
			<i>For Low-E Insulated Glass, Add</i>	34.19	
			<i>For Aluminum Clad Exterior, Add</i>	36.64	
08 52 19 00-0079	EA		36" x 54", Sash-Only Replacement Kit For Double Hung Wood Windows.....	378.04	
			<i>For Low-E Insulated Glass, Add</i>	35.04	
			<i>For Aluminum Clad Exterior, Add</i>	37.54	
08 52 19 00-0080	EA		40" x 54", Sash-Only Replacement Kit For Double Hung Wood Windows.....	393.08	
			<i>For Low-E Insulated Glass, Add</i>	36.58	
			<i>For Aluminum Clad Exterior, Add</i>	39.19	
08 52 19 00-0081	EA		44" x 54", Sash-Only Replacement Kit For Double Hung Wood Windows.....	408.11	
			<i>For Low-E Insulated Glass, Add</i>	38.12	
			<i>For Aluminum Clad Exterior, Add</i>	40.84	
08 52 19 00-0082			58" Height, Sash-Only Replacement Kits For Double Hung Wood Windows		
			<small>(08 52 19 00-0001)</small>		
08 52 19 00-0083	EA		20" x 58", Sash-Only Replacement Kit For Double Hung Wood Windows.....	330.93	
			<i>For Low-E Insulated Glass, Add</i>	30.27	
			<i>For Aluminum Clad Exterior, Add</i>	32.43	
08 52 19 00-0084	EA		24" x 58", Sash-Only Replacement Kit For Double Hung Wood Windows.....	345.96	
			<i>For Low-E Insulated Glass, Add</i>	31.81	
			<i>For Aluminum Clad Exterior, Add</i>	34.08	
08 52 19 00-0085	EA		28" x 58", Sash-Only Replacement Kit For Double Hung Wood Windows.....	361.00	
			<i>For Low-E Insulated Glass, Add</i>	33.35	
			<i>For Aluminum Clad Exterior, Add</i>	35.74	
08 52 19 00-0086	EA		30" x 58", Sash-Only Replacement Kit For Double Hung Wood Windows.....	369.00	
			<i>For Low-E Insulated Glass, Add</i>	34.19	
			<i>For Aluminum Clad Exterior, Add</i>	36.64	
08 52 19 00-0087	EA		32" x 58", Sash-Only Replacement Kit For Double Hung Wood Windows.....	377.03	
			<i>For Low-E Insulated Glass, Add</i>	35.04	
			<i>For Aluminum Clad Exterior, Add</i>	37.54	
08 52 19 00-0088	EA		34" x 58", Sash-Only Replacement Kit For Double Hung Wood Windows.....	384.05	
			<i>For Low-E Insulated Glass, Add</i>	35.74	
			<i>For Aluminum Clad Exterior, Add</i>	38.29	
08 52 19 00-0089	EA		36" x 58", Sash-Only Replacement Kit For Double Hung Wood Windows.....	392.07	
			<i>For Low-E Insulated Glass, Add</i>	36.58	
			<i>For Aluminum Clad Exterior, Add</i>	39.19	
08 52 19 00-0090	EA		40" x 58", Sash-Only Replacement Kit For Double Hung Wood Windows.....	407.10	
			<i>For Low-E Insulated Glass, Add</i>	38.12	
			<i>For Aluminum Clad Exterior, Add</i>	40.84	
08 52 19 00-0091	EA		44" x 58", Sash-Only Replacement Kit For Double Hung Wood Windows.....	421.14	
			<i>For Low-E Insulated Glass, Add</i>	39.52	
			<i>For Aluminum Clad Exterior, Add</i>	42.34	
08 52 19 00-0092			60" Height, Sash-Only Replacement Kits For Double Hung Wood Windows		
			<small>(08 52 19 00-0001)</small>		
08 52 19 00-0093	EA		20" x 60", Sash-Only Replacement Kit For Double Hung Wood Windows.....	336.94	
			<i>For Low-E Insulated Glass, Add</i>	30.97	
			<i>For Aluminum Clad Exterior, Add</i>	33.18	
08 52 19 00-0094	EA		24" x 60", Sash-Only Replacement Kit For Double Hung Wood Windows.....	351.97	
			<i>For Low-E Insulated Glass, Add</i>	32.51	
			<i>For Aluminum Clad Exterior, Add</i>	34.83	



Openings	08	08
Windows	08 50	
Wood Windows	08 52	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 52 19 00-0095	EA		28" x 60", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	368.01 34.19 36.64	
08 52 19 00-0096	EA		30" x 60", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	376.02 35.04 37.54	
08 52 19 00-0097	EA		32" x 60", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	383.05 35.74 38.29	
08 52 19 00-0098	EA		34" x 60", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	391.06 36.58 39.19	
08 52 19 00-0099	EA		36" x 60", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	398.09 37.28 39.94	
08 52 19 00-0100	EA		40" x 60", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	413.12 38.82 41.59	
08 52 19 00-0101	EA		44" x 60", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	428.16 40.36 43.24	
08 52 19 00-0102 62" Height, Sash-Only Replacement Kits For Double Hung Wood Windows					
<small>(08 52 19 00-0001)</small>					
08 52 19 00-0103	EA		20" x 62", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	346.97 31.81 34.08	
08 52 19 00-0104	EA		24" x 62", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	362.01 33.35 35.74	
08 52 19 00-0105	EA		28" x 62", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	378.04 35.04 37.54	
08 52 19 00-0106	EA		30" x 62", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	385.06 35.74 38.29	
08 52 19 00-0107	EA		32" x 62", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	393.08 36.58 39.19	
08 52 19 00-0108	EA		34" x 62", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	400.09 37.28 39.94	
08 52 19 00-0109	EA		36" x 62", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	408.11 38.12 40.84	
08 52 19 00-0110	EA		40" x 62", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	422.15 39.52 42.34	
08 52 19 00-0111	EA		44" x 62", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	437.18 41.06 43.99	
08 52 19 00-0112 66" Height, Sash-Only Replacement Kits For Double Hung Wood Windows					
<small>(08 52 19 00-0001)</small>					
08 52 19 00-0113	EA		20" x 66", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	362.01 33.35 35.74	
08 52 19 00-0114	EA		24" x 66", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	378.04 35.04 37.54	
08 52 19 00-0115	EA		28" x 66", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	393.08 36.58 39.19	
08 52 19 00-0116	EA		30" x 66", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	400.09 37.28 39.94	
08 52 19 00-0117	EA		32" x 66", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	408.11 38.12 40.84	
08 52 19 00-0118	EA		34" x 66", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	415.13 38.82 41.59	
08 52 19 00-0119	EA		36" x 66", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	422.15 39.52 42.34	
08 52 19 00-0120	EA		40" x 66", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	437.18 41.06 43.99	
08 52 19 00-0121	EA		44" x 66", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	452.22 42.60 45.65	

08 Openings**08 50 Windows****08 52 Wood Windows**

MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
08 52 19 00-0122		70" Height, Sash-Only Replacement Kits For Double Hung Wood Windows			
		<small>(08 52 19 00-0001)</small>			
08 52 19 00-0123	EA	20" x 70", Sash-Only Replacement Kit For Double Hung Wood Windows.....	377.03		
		<i>For Low-E Insulated Glass, Add</i>	35.04		
		<i>For Aluminum Clad Exterior, Add</i>	37.54		
08 52 19 00-0124	EA	24" x 70", Sash-Only Replacement Kit For Double Hung Wood Windows.....	392.07		
		<i>For Low-E Insulated Glass, Add</i>	36.58		
		<i>For Aluminum Clad Exterior, Add</i>	39.19		
08 52 19 00-0125	EA	28" x 70", Sash-Only Replacement Kit For Double Hung Wood Windows.....	407.10		
		<i>For Low-E Insulated Glass, Add</i>	38.12		
		<i>For Aluminum Clad Exterior, Add</i>	40.84		
08 52 19 00-0126	EA	30" x 70", Sash-Only Replacement Kit For Double Hung Wood Windows.....	414.12		
		<i>For Low-E Insulated Glass, Add</i>	38.82		
		<i>For Aluminum Clad Exterior, Add</i>	41.59		
08 52 19 00-0127	EA	32" x 70", Sash-Only Replacement Kit For Double Hung Wood Windows.....	421.14		
		<i>For Low-E Insulated Glass, Add</i>	39.52		
		<i>For Aluminum Clad Exterior, Add</i>	42.34		
08 52 19 00-0128	EA	34" x 70", Sash-Only Replacement Kit For Double Hung Wood Windows.....	432.12		
		<i>For Low-E Insulated Glass, Add</i>	40.78		
		<i>For Aluminum Clad Exterior, Add</i>	43.69		
08 52 19 00-0129	EA	36" x 70", Sash-Only Replacement Kit For Double Hung Wood Windows.....	437.22		
		<i>For Low-E Insulated Glass, Add</i>	41.21		
		<i>For Aluminum Clad Exterior, Add</i>	44.15		
08 52 19 00-0130	EA	40" x 70", Sash-Only Replacement Kit For Double Hung Wood Windows.....	451.21		
		<i>For Low-E Insulated Glass, Add</i>	42.60		
		<i>For Aluminum Clad Exterior, Add</i>	45.65		
08 52 19 00-0131	EA	44" x 70", Sash-Only Replacement Kit For Double Hung Wood Windows.....	467.25		
		<i>For Low-E Insulated Glass, Add</i>	44.28		
		<i>For Aluminum Clad Exterior, Add</i>	47.45		
08 52 19 00-0132		74" Height, Sash-Only Replacement Kits For Double Hung Wood Windows			
		<small>(08 52 19 00-0001)</small>			
08 52 19 00-0133	EA	20" x 74", Sash-Only Replacement Kit For Double Hung Wood Windows.....	393.08		
		<i>For Low-E Insulated Glass, Add</i>	36.58		
		<i>For Aluminum Clad Exterior, Add</i>	39.19		
08 52 19 00-0134	EA	24" x 74", Sash-Only Replacement Kit For Double Hung Wood Windows.....	408.11		
		<i>For Low-E Insulated Glass, Add</i>	38.12		
		<i>For Aluminum Clad Exterior, Add</i>	40.84		
08 52 19 00-0135	EA	28" x 74", Sash-Only Replacement Kit For Double Hung Wood Windows.....	422.15		
		<i>For Low-E Insulated Glass, Add</i>	39.52		
		<i>For Aluminum Clad Exterior, Add</i>	42.34		
08 52 19 00-0136	EA	30" x 74", Sash-Only Replacement Kit For Double Hung Wood Windows.....	430.16		
		<i>For Low-E Insulated Glass, Add</i>	40.36		
		<i>For Aluminum Clad Exterior, Add</i>	43.24		
08 52 19 00-0137	EA	32" x 74", Sash-Only Replacement Kit For Double Hung Wood Windows.....	437.18		
		<i>For Low-E Insulated Glass, Add</i>	41.06		
		<i>For Aluminum Clad Exterior, Add</i>	43.99		
08 52 19 00-0138	EA	34" x 74", Sash-Only Replacement Kit For Double Hung Wood Windows.....	445.20		
		<i>For Low-E Insulated Glass, Add</i>	41.90		
		<i>For Aluminum Clad Exterior, Add</i>	44.90		
08 52 19 00-0139	EA	36" x 74", Sash-Only Replacement Kit For Double Hung Wood Windows.....	452.22		
		<i>For Low-E Insulated Glass, Add</i>	42.60		
		<i>For Aluminum Clad Exterior, Add</i>	45.65		
08 52 19 00-0140	EA	40" x 74", Sash-Only Replacement Kit For Double Hung Wood Windows.....	468.26		
		<i>For Low-E Insulated Glass, Add</i>	44.28		
		<i>For Aluminum Clad Exterior, Add</i>	47.45		
08 52 19 00-0141	EA	44" x 74", Sash-Only Replacement Kit For Double Hung Wood Windows.....	483.30		
		<i>For Low-E Insulated Glass, Add</i>	45.83		
		<i>For Aluminum Clad Exterior, Add</i>	49.10		
08 52 19 00-0142		78" Height, Sash-Only Replacement Kits For Double Hung Wood Windows			
		<small>(08 52 19 00-0001)</small>			
08 52 19 00-0143	EA	20" x 78", Sash-Only Replacement Kit For Double Hung Wood Windows.....	412.14		
		<i>For Low-E Insulated Glass, Add</i>	38.12		
		<i>For Aluminum Clad Exterior, Add</i>	40.84		
08 52 19 00-0144	EA	24" x 78", Sash-Only Replacement Kit For Double Hung Wood Windows.....	426.17		
		<i>For Low-E Insulated Glass, Add</i>	39.52		
		<i>For Aluminum Clad Exterior, Add</i>	42.34		
08 52 19 00-0145	EA	28" x 78", Sash-Only Replacement Kit For Double Hung Wood Windows.....	441.21		
		<i>For Low-E Insulated Glass, Add</i>	41.06		
		<i>For Aluminum Clad Exterior, Add</i>	43.99		
08 52 19 00-0146	EA	30" x 78", Sash-Only Replacement Kit For Double Hung Wood Windows.....	449.22		
		<i>For Low-E Insulated Glass, Add</i>	41.90		
		<i>For Aluminum Clad Exterior, Add</i>	44.90		
08 52 19 00-0147	EA	32" x 78", Sash-Only Replacement Kit For Double Hung Wood Windows.....	456.24		
		<i>For Low-E Insulated Glass, Add</i>	42.60		
		<i>For Aluminum Clad Exterior, Add</i>	45.65		
08 52 19 00-0148	EA	34" x 78", Sash-Only Replacement Kit For Double Hung Wood Windows.....	464.26		
		<i>For Low-E Insulated Glass, Add</i>	43.44		
		<i>For Aluminum Clad Exterior, Add</i>	46.55		
08 52 19 00-0149	EA	36" x 78", Sash-Only Replacement Kit For Double Hung Wood Windows.....	472.29		
		<i>For Low-E Insulated Glass, Add</i>	44.28		
		<i>For Aluminum Clad Exterior, Add</i>	47.45		



Openings	08	08
Windows	08 50	
Wood Windows	08 52	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 52 19 00-0150	EA		40" x 78", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	487.31 45.83 49.10	
08 52 19 00-0151	EA		44" x 78", Sash-Only Replacement Kit For Double Hung Wood Windows..... <i>For Low-E Insulated Glass, Add</i> <i>For Aluminum Clad Exterior, Add</i>	502.35 47.37 50.75	
08 52 19 00-0152			Commercial And Institutional Heavy Double Hung Windows (08 52 19) Note: With true divided lites. Performance grade DP 40 in NWWDA I.S. 2-93. Includes complete unit with hardware, blocking and accessories, glazing, caulking, prepare opening, anchors, testing and certifications. Excludes painting.		
08 52 19 00-0153	SF		Up To 21 SF Double Hung Wood Window With True Divided Lite <i>For Insulating Glass, Add</i>	61.14 3.67	8.99
08 52 19 00-0154	SF		21 To 40 SF Double Hung Wood Window With True Divided Lite <i>For Insulating Glass, Add</i>	58.63 3.29	9.99
08 52 19 00-0155	SF		40 SF And Over Double Hung Wood Window With True Divided Lite..... <i>For Insulating Glass, Add</i>	56.48 2.89	11.21
08 52 19 00-0156			Architectural And Historic Reproduction Wood Windows (08 52 19) Note: Fixed casement, awning, and double hung. With true divided lites. Casement performance grade DP 40; awning performance grade DP 25; double hung performance grade DP 30. Includes complete unit with hardware, blocking and accessories, glazing, caulking, prepare opening, anchors, testing and certifications. Excludes painting.		
08 52 19 00-0157	SF		Up To 21 SF Architectural And Historic Reproduction Wood Window <i>For Insulating Glass, Add</i>	65.69 4.06	8.98
08 52 19 00-0158	SF		21 To 40 SF Architectural And Historic Reproduction Wood Window..... <i>For Insulating Glass, Add</i>	61.09 3.50	9.99
08 52 19 00-0159	SF		40 SF And Over Architectural And Historic Reproduction Wood Window..... <i>For Insulating Glass, Add</i>	57.92 3.01	11.21
08 52 19 00-0160			Removal And Reinstallation Of Wood Window And Frame (08 52 19) Note: Includes storage, cleaning and supply materials.		
08 52 19 00-0161	SF		Remove And Reinstall Wood Windows And Frames	22.19	
08 52 66			Wood Window Screens (08 52)		
08 52 66 00-0001			Insect Screens For Wood Clad Windows (08 52 66)		
08 52 66 00-0002	EA		Up To 6 SF, Insect Screen For Wood Clad Windows	29.74	7.31
08 52 66 00-0003	EA		>6 To 9 SF, Insect Screen For Wood Clad Windows	34.06	7.31
08 52 66 00-0004	EA		>9 To 12 SF, Insect Screen For Wood Clad Windows.....	36.23	7.31
08 52 66 00-0005	EA		>12 To 15 SF, Insect Screen For Wood Clad Windows.....	40.55	7.31
08 52 66 00-0006	EA		>15 To 20 SF, Insect Screen For Wood Clad Windows.....	49.19	7.31
08 52 66 00-0007	EA		>20 To 25 SF, Insect Screen For Wood Clad Windows.....	53.52	7.31
08 52 66 00-0008	EA		>25 To 30 SF, Insect Screen For Wood Clad Windows.....	57.84	7.31
08 52 66 00-0009	EA		>30 To 35 SF, Insect Screen For Wood Clad Windows.....	62.16	7.31
08 52 66 00-0010	SF		>35 SF, Insect Screen For Wood Clad Windows.....	1.84	0.15
08 53			Plastic Windows (08 50)		
08 53 13			Vinyl Windows (08 53)		
08 53 13 00-0001			Double Hung Vinyl Windows (08 53 13)		
08 53 13 00-0002			Double Hung Vinyl Windows (Milgard Quiet Line™ Series) (08 53 13 00-0001) Note: Includes white solid vinyl interior and exterior, standard hardware, clear insulated low E glass and insect screen. Pricing calculated by the United Inch (the combined inches of one width and one height). Minimum STC rating of 44 included in price.		
08 53 13 00-0003	EA		Up To 73" UI, Double Hung Vinyl Window (Milgard Quiet Line™ Series)..... <i>For Colored Vinyl, Add</i> <i>For Tempered Glass, Add</i>	472.56 39.71 119.13	37.73
08 53 13 00-0004	EA		>73" To 83" UI, Double Hung Vinyl Window (Milgard Quiet Line™ Series)..... <i>For Colored Vinyl, Add</i> <i>For Tempered Glass, Add</i>	521.24 43.86 131.58	41.33
08 53 13 00-0005	EA		>83" To 93" UI, Double Hung Vinyl Window (Milgard Quiet Line™ Series)..... <i>For Colored Vinyl, Add</i> <i>For Tempered Glass, Add</i>	566.82 47.70 143.09	44.92
08 53 13 00-0006	EA		>93" To 101" UI, Double Hung Vinyl Window (Milgard Quiet Line™ Series)..... <i>For Colored Vinyl, Add</i> <i>For Tempered Glass, Add</i>	599.34 50.23 150.69	48.51
08 53 13 00-0007	EA		>101" To 110" UI, Double Hung Vinyl Window (Milgard Quiet Line™ Series)..... <i>For Colored Vinyl, Add</i> <i>For Tempered Glass, Add</i>	634.18 53.00 158.99	52.11
08 53 13 00-0008	EA		>110" To 120" UI, Double Hung Vinyl Window (Milgard Quiet Line™ Series)..... <i>For Colored Vinyl, Add</i> <i>For Tempered Glass, Add</i>	689.56 57.82 173.45	55.70
08 53 13 00-0009	UI		>120" UI, Double Hung Vinyl Window (Milgard Quiet Line™ Series)..... <i>For Colored Vinyl, Add</i> <i>For Tempered Glass, Add</i>	5.76 0.48 1.45	0.46

08 Openings**08 50 Windows****08 53 Plastic Windows**

MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

08 53 13 00-0010	Casement Vinyl Windows <small>(08 53 13)</small>		
08 53 13 00-0011	Casement Vinyl Windows (Milgard Quiet Line™ Series) <small>(08 53 13 00-0010)</small> Note: Includes white solid vinyl interior and exterior, standard hardware, clear insulated low E glass and insect screen. Pricing calculated by the United Inch (the combined inches of one width and one height). Minimum STC rating of 44 included in price.		
08 53 13 00-0012	One Operating Sash, Casement Vinyl Windows (Milgard Quiet Line™ Series) <small>(08 53 13 00-0011)</small>		
08 53 13 00-0013	EA Up To 53" UI, One Operating Sash, Casement Vinyl Window (Milgard Quiet Line™ Series).....	456.47	30.55
	For Colored Vinyl, Add	39.54	
	For Tempered Glass, Add	118.61	
08 53 13 00-0014	EA >53 To 63" UI, One Operating Sash, Casement Vinyl Window (Milgard Quiet Line™ Series).....	518.68	34.14
	For Colored Vinyl, Add	45.04	
	For Tempered Glass, Add	135.12	
08 53 13 00-0015	EA >63 To 73" UI, One Operating Sash, Casement Vinyl Window (Milgard Quiet Line™ Series).....	574.67	37.73
	For Colored Vinyl, Add	49.92	
	For Tempered Glass, Add	149.76	
08 53 13 00-0016	EA >73 To 83" UI, One Operating Sash, Casement Vinyl Window (Milgard Quiet Line™ Series).....	624.44	41.33
	For Colored Vinyl, Add	54.18	
	For Tempered Glass, Add	162.54	
08 53 13 00-0017	EA >83 To 93" UI, One Operating Sash, Casement Vinyl Window (Milgard Quiet Line™ Series).....	667.99	44.92
	For Colored Vinyl, Add	57.82	
	For Tempered Glass, Add	173.45	
08 53 13 00-0018	EA >93 To 101" UI, One Operating Sash, Casement Vinyl Window (Milgard Quiet Line™ Series).....	693.52	48.51
	For Colored Vinyl, Add	59.65	
	For Tempered Glass, Add	178.95	
08 53 13 00-0019	UI >101" UI, One Operating Sash, Casement Vinyl Window (Milgard Quiet Line™ Series).....	6.85	0.46
	For Colored Vinyl, Add	0.59	
	For Tempered Glass, Add	1.77	
08 53 13 00-0020	Two Operating Sashes, Casement Vinyl Windows (Milgard Quiet Line™ Series) <small>(08 53 13 00-0011)</small>		
08 53 13 00-0021	EA Up To 73" UI, Two Operating Sashes, Casement Vinyl Window (Milgard Quiet Line™ Series).....	767.54	37.73
	For Colored Vinyl, Add	69.21	
	For Tempered Glass, Add	207.62	
08 53 13 00-0022	EA >73 To 83" UI, Two Operating Sashes, Casement Vinyl Window (Milgard Quiet Line™ Series).....	843.73	41.33
	For Colored Vinyl, Add	76.11	
	For Tempered Glass, Add	228.32	
08 53 13 00-0023	EA >83 To 93" UI, Two Operating Sashes, Casement Vinyl Window (Milgard Quiet Line™ Series).....	913.71	44.92
	For Colored Vinyl, Add	82.39	
	For Tempered Glass, Add	247.16	
08 53 13 00-0024	EA >93 To 101" UI, Two Operating Sashes, Casement Vinyl Window (Milgard Quiet Line™ Series).....	960.37	48.51
	For Colored Vinyl, Add	86.33	
	For Tempered Glass, Add	259.00	
08 53 13 00-0025	EA >101 To 110" UI, Two Operating Sashes, Casement Vinyl Window (Milgard Quiet Line™ Series).....	1,010.29	52.11
	For Colored Vinyl, Add	90.61	
	For Tempered Glass, Add	271.82	
08 53 13 00-0026	EA >110 To 120" UI, Two Operating Sashes, Casement Vinyl Window (Milgard Quiet Line™ Series).....	1,062.57	55.70
	For Colored Vinyl, Add	95.12	
	For Tempered Glass, Add	285.35	
08 53 13 00-0027	UI >120" UI, Two Operating Sashes, Casement Vinyl Window (Milgard Quiet Line™ Series).....	8.87	0.46
	For Colored Vinyl, Add	0.79	
	For Tempered Glass, Add	2.38	
08 53 13 00-0028	Horizontal Sliding Vinyl Windows <small>(08 53 13)</small>		
08 53 13 00-0029	Horizontal Sliding Vinyl Windows (Milgard Quiet Line™ Series) <small>(08 53 13 00-0028)</small> Note: Includes white solid vinyl interior and exterior, standard hardware, clear insulated low E glass and insect screen. Pricing calculated by the United Inch (the combined inches of one width and one height). Minimum STC rating of 44 included in price.		
08 53 13 00-0030	EA Up To 73" UI, Horizontal Sliding Vinyl Window (Milgard Quiet Line™ Series).....	427.18	37.73
	For Colored Vinyl, Add	35.17	
	For Tempered Glass, Add	105.51	
08 53 13 00-0031	EA >73 To 83" UI, Horizontal Sliding Vinyl Window (Milgard Quiet Line™ Series).....	469.64	41.33
	For Colored Vinyl, Add	38.70	
	For Tempered Glass, Add	116.10	
08 53 13 00-0032	EA >83 To 93" UI, Horizontal Sliding Vinyl Window (Milgard Quiet Line™ Series).....	509.00	44.92
	For Colored Vinyl, Add	41.92	
	For Tempered Glass, Add	125.75	
08 53 13 00-0033	EA >93 To 101" UI, Horizontal Sliding Vinyl Window (Milgard Quiet Line™ Series).....	536.55	48.51
	For Colored Vinyl, Add	43.95	
	For Tempered Glass, Add	131.86	
08 53 13 00-0034	EA >101 To 110" UI, Horizontal Sliding Vinyl Window (Milgard Quiet Line™ Series).....	565.80	52.11
	For Colored Vinyl, Add	46.16	
	For Tempered Glass, Add	138.48	
08 53 13 00-0035	EA >110 To 120" UI, Horizontal Sliding Vinyl Window (Milgard Quiet Line™ Series).....	614.96	55.70
	For Colored Vinyl, Add	50.36	
	For Tempered Glass, Add	151.07	
08 53 13 00-0036	UI >120" UI, Horizontal Sliding Vinyl Window (Milgard Quiet Line™ Series).....	5.14	0.46
	For Colored Vinyl, Add	0.42	
	For Tempered Glass, Add	1.26	



Openings	08	08
Windows	08 50	
Plastic Windows	08 53	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 53 13 00-0037 Accessories For Vinyl Windows <small>(08 53 13)</small>		
08 53 13 00-0038 Factory Installed Grilles For Vinyl Windows <small>(08 53 13 00-0037)</small>		
08 53 13 00-0039 Fixed Grille Installed Between Glass Panes, Factory Installed Grilles For Vinyl Windows <small>(08 53 13 00-0038)</small>		
08 53 13 00-0040 EA Up To 9 SF Windows, Fixed Grille Installed Between Glass Panes, Factory Installed Grilles For Vinyl Windows.....	19.34	
08 53 13 00-0041 EA >9 To 18 SF Windows, Fixed Grille Installed Between Glass Panes, Factory Installed Grilles For Vinyl Windows.....	24.87	
08 53 13 00-0042 EA >18 To 24 SF Windows, Fixed Grille Installed Between Glass Panes, Factory Installed Grilles For Vinyl Windows.....	32.03	
08 53 13 00-0043 EA >24 To 36 SF Windows, Fixed Grille Installed Between Glass Panes, Factory Installed Grilles For Vinyl Windows.....	37.80	
08 53 13 00-0044 EA >36 SF Windows, Fixed Grille Installed Between Glass Panes, Factory Installed Grilles For Vinyl Windows.....	46.47	
08 53 13 00-0045 Fixed Exterior And Interior Grilles With Spacers, Factory Installed Grilles For Vinyl Windows <small>(08 53 13 00-0038)</small>		
08 53 13 00-0046 EA Up To 9 SF Windows, Fixed Exterior And Interior Grilles With Spacers, Factory Installed Grilles For Vinyl Windows.....	43.96	
08 53 13 00-0047 EA >9 To 18 SF Windows, Fixed Exterior And Interior Grilles With Spacers, Factory Installed Grilles For Vinyl Windows.....	52.75	
08 53 13 00-0048 EA >18 To 24 SF Windows, Fixed Exterior And Interior Grilles With Spacers, Factory Installed Grilles For Vinyl Windows.....	66.56	
08 53 13 00-0049 EA >24 To 36 SF Windows, Fixed Exterior And Interior Grilles With Spacers, Factory Installed Grilles For Vinyl Windows.....	82.89	
08 53 13 00-0050 EA >36 SF Windows, Fixed Exterior And Interior Grilles With Spacers, Factory Installed Grilles For Vinyl Windows.....	99.22	
08 53 66 Vinyl Window Screens <small>(08 53)</small>		
08 53 66 00-0001 Insect Screens For Vinyl Windows <small>(08 53 66)</small>		
08 53 66 00-0002 EA Up To 6 SF, Insect Screen For Vinyl Windows.....	27.17	7.31
08 53 66 00-0003 EA >6 To 9 SF, Insect Screen For Vinyl Windows.....	34.70	7.31
08 53 66 00-0004 EA >9 To 12 SF, Insect Screen For Vinyl Windows.....	37.22	7.31
08 53 66 00-0005 EA >12 To 15 SF, Insect Screen For Vinyl Windows.....	42.24	7.31
08 53 66 00-0006 EA >15 To 20 SF, Insect Screen For Vinyl Windows.....	53.54	7.31
08 53 66 00-0007 EA >20 To 25 SF, Insect Screen For Vinyl Windows.....	58.57	7.31
08 53 66 00-0008 EA >25 To 30 SF, Insect Screen For Vinyl Windows.....	66.10	7.31
08 53 66 00-0009 EA >30 To 35 SF, Insect Screen For Vinyl Windows.....	71.13	7.31
08 53 66 00-0010 SF >35 SF, Insect Screen For Vinyl Windows.....	2.12	0.15
08 56 Special Function Windows <small>(08 50)</small>		
08 56 19 Pass Windows <small>(08 56)</small>		
08 56 19 00-0001 Bullet Resistant Pass Through Service Window, Steel Frame <small>(08 56 19)</small>		
08 56 19 00-0002 EA 24" x 36", Bullet Resistant Pass Through Service Window, 1.25" Acrylic Glazing Level I, Steel Frame.....	2,446.55	516.43
For 1.375" Acrylic Level II Bullet Resistant Glazing, Add	45.00	
For 1.25" Multi-Ply Polycarbonate Level III Bullet Resistant Glazing, Add	295.00	
08 56 19 00-0003 EA 30" x 36", Bullet Resistant Pass Through Service Window, 1.25" Acrylic Glazing Level I, Steel Frame.....	2,665.01	559.47
For 1.375" Acrylic Level II Bullet Resistant Glazing, Add	60.00	
For 1.25" Multi-Ply Polycarbonate Level III Bullet Resistant Glazing, Add	370.00	
08 56 19 00-0004 EA 36" x 36", Bullet Resistant Pass Through Service Window, 1.25" Acrylic Glazing Level I, Steel Frame.....	2,815.51	602.51
For 1.375" Acrylic Level II Bullet Resistant Glazing, Add	70.00	
For 1.25" Multi-Ply Polycarbonate Level III Bullet Resistant Glazing, Add	445.00	
08 56 19 00-0005 EA 48" x 40", Bullet Resistant Pass Through Service Window, 1.25" Acrylic Glazing Level I, Steel Frame.....	3,490.49	688.58
For 1.375" Acrylic Level II Bullet Resistant Glazing, Add	100.00	
For 1.25" Multi-Ply Polycarbonate Level III Bullet Resistant Glazing, Add	650.00	
08 56 19 00-0006 EA 72" x 40", Bullet Resistant Pass Through Service Window, 1.25" Acrylic Glazing Level I, Steel Frame.....	4,807.41	1,032.87
For 1.375" Acrylic Level II Bullet Resistant Glazing, Add	150.00	
For 1.25" Multi-Ply Polycarbonate Level III Bullet Resistant Glazing, Add	975.00	
08 56 56 Security Window Screens <small>(08 56)</small>		
Note: All security window screens include frame and mounting hardware. Operable security screens include hinges and related hardware.		
08 56 56 00-0001 Wire Mesh Security Screen <small>(08 56 56)</small>		
08 56 56 00-0002 Wire Mesh, Inoperable, Security Window Screen <small>(08 56 56 00-0001)</small>		
08 56 56 00-0003 SF 13 Gauge, Wire Mesh, Inoperable, Steel Security Window Screen.....	13.88	3.87
For Painted Steel, Add	0.87	
For Galvanized Steel, Add	1.74	
For Aluminum, Add	3.49	
For Stainless Steel, Add	15.26	
08 56 56 00-0004 SF 11 Gauge, Wire Mesh, Inoperable, Steel Security Window Screen.....	14.13	3.87
For Painted Steel, Add	0.90	
For Galvanized Steel, Add	1.79	
For Aluminum, Add	3.59	
For Stainless Steel, Add	15.70	

08 Openings**08 50 Windows****08 56 Special Function Windows**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 56 56 00-0005	SF		9 Gauge, Wire Mesh, Inoperable, Steel Security Window Screen	15.28	3.87
			<i>For Painted Steel, Add</i>	1.01	
			<i>For Galvanized Steel, Add</i>	2.02	
			<i>For Aluminum, Add</i>	4.05	
			<i>For Stainless Steel, Add</i>	17.71	
08 56 56 00-0006	SF		6 Gauge, Wire Mesh, Inoperable, Steel Security Window Screen	17.74	3.87
			<i>For Painted Steel, Add</i>	1.26	
			<i>For Galvanized Steel, Add</i>	2.52	
			<i>For Aluminum, Add</i>	5.03	
			<i>For Stainless Steel, Add</i>	22.02	
08 56 56 00-0007			Wire Mesh, Operable, Security Window Screen (08 56 56 00-0001)		
08 56 56 00-0008	SF		13 Gauge, Wire Mesh, Operable, Steel Security Window Screen	19.30	4.73
			<i>For Painted Steel, Add</i>	1.24	
			<i>For Galvanized Steel, Add</i>	2.48	
			<i>For Aluminum, Add</i>	4.97	
			<i>For Stainless Steel, Add</i>	21.74	
08 56 56 00-0009	SF		11 Gauge, Wire Mesh, Operable, Steel Security Window Screen	19.68	4.73
			<i>For Painted Steel, Add</i>	1.28	
			<i>For Galvanized Steel, Add</i>	2.56	
			<i>For Aluminum, Add</i>	5.12	
			<i>For Stainless Steel, Add</i>	22.40	
08 56 56 00-0010	SF		9 Gauge, Wire Mesh, Operable, Steel Security Window Screen	21.33	4.73
			<i>For Painted Steel, Add</i>	1.45	
			<i>For Galvanized Steel, Add</i>	2.89	
			<i>For Aluminum, Add</i>	5.78	
			<i>For Stainless Steel, Add</i>	25.29	
08 56 56 00-0011	SF		6 Gauge, Wire Mesh, Operable, Steel Security Window Screen	24.78	4.73
			<i>For Painted Steel, Add</i>	1.79	
			<i>For Galvanized Steel, Add</i>	3.58	
			<i>For Aluminum, Add</i>	7.16	
			<i>For Stainless Steel, Add</i>	31.33	
08 56 56 00-0012			Wire Cloth Security Screen (08 56 56)		
			Note: Wire cloth has from 10 to 12 strands per 1".		
08 56 56 00-0013			Wire Cloth, Inoperable, Security Window Screens (08 56 56 00-0012)		
08 56 56 00-0014	SF		24 Gauge, Wire Cloth, Inoperable, Steel Security Window Screen	9.51	2.59
			<i>For Painted Steel, Add</i>	0.26	
			<i>For Galvanized Steel, Add</i>	0.78	
			<i>For Aluminum, Add</i>	1.56	
			<i>For Stainless Steel, Add</i>	6.50	
08 56 56 00-0015	SF		22 Gauge, Wire Cloth, Inoperable, Steel Security Window Screen	9.86	2.59
			<i>For Painted Steel, Add</i>	0.28	
			<i>For Galvanized Steel, Add</i>	0.83	
			<i>For Aluminum, Add</i>	1.67	
			<i>For Stainless Steel, Add</i>	6.94	
08 56 56 00-0016	SF		20 Gauge, Wire Cloth, Inoperable, Steel Security Window Screen	10.41	2.59
			<i>For Painted Steel, Add</i>	0.31	
			<i>For Galvanized Steel, Add</i>	0.92	
			<i>For Aluminum, Add</i>	1.83	
			<i>For Stainless Steel, Add</i>	7.63	
08 56 56 00-0017	SF		18 Gauge, Wire Cloth, Inoperable, Steel Security Window Screen	11.46	2.59
			<i>For Painted Steel, Add</i>	0.36	
			<i>For Galvanized Steel, Add</i>	1.07	
			<i>For Aluminum, Add</i>	2.15	
			<i>For Stainless Steel, Add</i>	8.94	
08 56 56 00-0018			Wire Cloth, Operable, Security Window Screens (08 56 56 00-0012)		
08 56 56 00-0019	SF		24 Gauge, Wire Cloth, Operable, Steel Security Window Screen	12.57	3.44
			<i>For Painted Steel, Add</i>	0.37	
			<i>For Galvanized Steel, Add</i>	1.11	
			<i>For Aluminum, Add</i>	2.22	
			<i>For Stainless Steel, Add</i>	9.26	
08 56 56 00-0020	SF		22 Gauge, Wire Cloth, Operable, Steel Security Window Screen	13.11	3.44
			<i>For Painted Steel, Add</i>	0.40	
			<i>For Galvanized Steel, Add</i>	1.19	
			<i>For Aluminum, Add</i>	2.39	
			<i>For Stainless Steel, Add</i>	9.94	
08 56 56 00-0021	SF		20 Gauge, Wire Cloth, Operable, Steel Security Window Screen	13.86	3.44
			<i>For Painted Steel, Add</i>	0.44	
			<i>For Galvanized Steel, Add</i>	1.31	
			<i>For Aluminum, Add</i>	2.61	
			<i>For Stainless Steel, Add</i>	10.88	
08 56 56 00-0022	SF		18 Gauge, Wire Cloth, Operable, Steel Security Window Screen	15.36	3.44
			<i>For Painted Steel, Add</i>	0.51	
			<i>For Galvanized Steel, Add</i>	1.53	
			<i>For Aluminum, Add</i>	3.06	
			<i>For Stainless Steel, Add</i>	12.75	



Openings	08	08
Windows	08 50	
Special Function Windows	08 56	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 56 56 00-0023 Expanded Metal Security Screen <small>(08 56 56)</small> Note: Flattened or standard pattern. Dimension given is the short distance across the opening (SWO). The # designation is the pattern number of the expanded metal and is not the gauge.		
08 56 56 00-0024 Expanded Metal, Inoperable, Security Screen <small>(08 56 56 00-0023)</small>		
08 56 56 00-0025 SF 1/4" #18, Thickness 0.04" Expanded Metal, Inoperable, Steel Security Window Screen	17.90	6.45
For Painted Steel, Add	0.51	
For Galvanized Steel, Add	1.52	
For Aluminum, Add	3.05	
For Stainless Steel, Add	12.69	
08 56 56 00-0026 SF 1/2" #13, Thickness 0.07" Expanded Metal, Inoperable, Steel Security Window Screen	21.07	7.75
For Painted Steel, Add	0.58	
For Galvanized Steel, Add	1.74	
For Aluminum, Add	3.48	
For Stainless Steel, Add	14.50	
08 56 56 00-0027 SF 3/4" #13, Thickness 0.07" Expanded Metal, Inoperable, Steel Security Window Screen	23.84	9.47
For Painted Steel, Add	0.63	
For Galvanized Steel, Add	1.90	
For Aluminum, Add	3.80	
For Stainless Steel, Add	15.81	
08 56 56 00-0028 SF 3/4" #9, Thickness 0.12" Expanded Metal, Inoperable, Steel Security Window Screen	28.22	11.19
For Painted Steel, Add	0.72	
For Galvanized Steel, Add	2.17	
For Aluminum, Add	4.34	
For Stainless Steel, Add	18.06	
08 56 56 00-0029 SF 1-1/2" #9, Thickness 0.11" Expanded Metal, Inoperable, Steel Security Window Screen	26.31	10.76
For Painted Steel, Add	0.67	
For Galvanized Steel, Add	2.01	
For Aluminum, Add	4.02	
For Stainless Steel, Add	16.75	
08 56 56 00-0030 SF 3 LB/SF Expanded Metal, Inoperable, Steel Security Window Screen	33.21	13.77
For Painted Steel, Add	0.84	
For Galvanized Steel, Add	2.53	
For Aluminum, Add	5.06	
For Stainless Steel, Add	21.06	
08 56 56 00-0031 Expanded Metal, Operable, Security Screen <small>(08 56 56 00-0023)</small>		
08 56 56 00-0032 SF 1/4" #18, Thickness 0.04" Expanded Metal, Operable, Steel Security Window Screen	23.92	7.75
For Painted Steel, Add	0.72	
For Galvanized Steel, Add	2.17	
For Aluminum, Add	4.34	
For Stainless Steel, Add	18.06	
08 56 56 00-0033 SF 1/2" #13, Thickness 0.07" Expanded Metal, Operable, Steel Security Window Screen	27.74	9.47
For Painted Steel, Add	0.83	
For Galvanized Steel, Add	2.48	
For Aluminum, Add	4.97	
For Stainless Steel, Add	20.69	
08 56 56 00-0034 SF 3/4" #13, Thickness 0.07" Expanded Metal, Operable, Steel Security Window Screen	30.96	10.76
For Painted Steel, Add	0.90	
For Galvanized Steel, Add	2.71	
For Aluminum, Add	5.42	
For Stainless Steel, Add	22.56	
08 56 56 00-0035 SF 1-1/2" #9, Thickness 0.11" Expanded Metal, Operable, Steel Security Window Screen	33.73	12.05
For Painted Steel, Add	0.96	
For Galvanized Steel, Add	2.87	
For Aluminum, Add	5.73	
For Stainless Steel, Add	23.88	
08 56 56 00-0036 SF 3/4" #9, Thickness 0.12" Expanded Metal, Operable, Steel Security Window Screen	36.95	13.77
For Painted Steel, Add	1.03	
For Galvanized Steel, Add	3.09	
For Aluminum, Add	6.18	
For Stainless Steel, Add	25.74	
08 56 56 00-0037 SF 3 LB/SF Expanded Metal, Operable, Steel Security Window Screen	42.08	15.07
For Painted Steel, Add	1.20	
For Galvanized Steel, Add	3.60	
For Aluminum, Add	7.20	
For Stainless Steel, Add	30.00	
08 56 56 00-0038 Perforated Metal Security Screen <small>(08 56 56)</small>		
08 56 56 00-0039 Perforated Metal, Inoperable, Steel Security Window Screen <small>(08 56 56 00-0038)</small>		
08 56 56 00-0040 SF 22 Gauge Perforated Metal, 63% Openings, Inoperable, Steel Security Window Screen	15.26	3.87
For Painted Steel, Add	0.51	
For Galvanized Steel, Add	1.52	
For Aluminum, Add	3.03	
For Stainless Steel, Add	10.10	
08 56 56 00-0041 SF 20 Gauge Perforated Metal, 63% Openings, Inoperable, Steel Security Window Screen	15.66	3.87
For Painted Steel, Add	0.53	
For Galvanized Steel, Add	1.58	
For Aluminum, Add	3.15	
For Stainless Steel, Add	10.50	

08 Openings**08 50 Windows****08 56 Special Function Windows**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 56 56 00-0042 SF 18 Gauge Perforated Metal, 63% Openings, Inoperable, Steel Security Window Screen	17.01	3.87
For Painted Steel, Add	0.59	
For Galvanized Steel, Add	1.78	
For Aluminum, Add	3.56	
For Stainless Steel, Add	11.85	
08 56 56 00-0043 SF 16 Gauge Perforated Metal, 63% Openings, Inoperable, Steel Security Window Screen	19.56	3.87
For Painted Steel, Add	0.72	
For Galvanized Steel, Add	2.16	
For Aluminum, Add	4.32	
For Stainless Steel, Add	14.40	
08 56 56 00-0044 Perforated Metal, Operable, Steel Security Window Screen (08 56 56 00-0038)		
08 56 56 00-0045 SF 22 Gauge Perforated Metal, 63% Openings, Operable, Steel Security Window Screen.....	21.23	4.73
For Painted Steel, Add	0.72	
For Galvanized Steel, Add	2.15	
For Aluminum, Add	4.31	
For Stainless Steel, Add	14.35	
08 56 56 00-0046 SF 20 Gauge Perforated Metal, 63% Openings, Operable, Steel Security Window Screen.....	21.93	4.73
For Painted Steel, Add	0.75	
For Galvanized Steel, Add	2.26	
For Aluminum, Add	4.52	
For Stainless Steel, Add	15.05	
08 56 56 00-0047 SF 18 Gauge Perforated Metal, 63% Openings, Operable, Steel Security Window Screen.....	23.68	4.73
For Painted Steel, Add	0.84	
For Galvanized Steel, Add	2.52	
For Aluminum, Add	5.04	
For Stainless Steel, Add	16.80	
08 56 56 00-0048 SF 16 Gauge Perforated Metal, 63% Openings, Operable, Steel Security Window Screen.....	27.33	4.73
For Painted Steel, Add	1.02	
For Galvanized Steel, Add	3.07	
For Aluminum, Add	6.14	
For Stainless Steel, Add	20.45	
08 56 56 00-0049 Remove And Reinstall Security Screens And Guards (08 56 56)		
08 56 56 00-0050 SF Remove And Reinstall Security Screens	10.82	
08 56 59 Service And Teller Window Units (08 56)		
08 56 59 00-0001 Communicator For Window (08 56 59)		
08 56 59 00-0002 EA Electronic Two-Way Talk-thru Hands-Free Audio Communicator (Haven SC-350).....	1,434.10	172.14
Note: Communicator is designed for applications where a fire shutter or window shade is present. Two-way communication is accomplished through the use of speakers and micro-phones located on each side of the partition. The Master unit is equipped with a 15" gooseneck microphone, power on/off switch, power-on LED, and external volume controls. The Remote Unit is window-mounted and may incorporate a level 3 bullet-resistant insert.		
08 56 59 00-0003 EA Electronic Two-Way Audio Communicator (Haven SC-300).....	1,263.41	172.14
Note: Communicator is designed for application where a cutout in the barrier is impractical. Two-way communication is accomplished through the use of speakers and microphones located on each side of the partition. The master unit is equipped with a 20" gooseneck microphone, power on/off switch, power-on LED, and external volume controls. The Remote unit is vandal-resistant with all controls located within the housing.		
08 60 Roof Windows And Skylights (08)		
Note: Includes hardware, caulk, sealant and necessary anchors.		
08 63 Metal-Framed Skylights (08 60)		
08 63 00 00-0001 Aluminum Framed Skylights (08 63)		
08 63 00 00-0002 Fixed Dome, Aluminum Framed Skylights (08 63 00 00-0001)		
08 63 00 00-0003 Industrial Style Fixed Dome, Aluminum Framed Skylights (08 63 00 00-0002)		
08 63 00 00-0004 Class 1 Hail Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylights (08 63 00 00-0003)		
Note: Includes mill finish aluminum frame, integral condensation and weepage gutters, insulated thermal break, weather sweep, curb seal tape and fasteners. Excludes roof curb.		
08 63 00 00-0005 EA 27-1/4" x 27-1/4" Inside Frame Dimensions, Class 1 Hail Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight	276.28	76.64
08 63 00 00-0006 EA 27-1/4" x 51-1/4" Inside Frame Dimensions, Class 1 Hail Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight	311.28	76.64
08 63 00 00-0007 EA 27-1/4" x 99-1/4" Inside Frame Dimensions, Class 1 Hail Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight	413.44	86.22
08 63 00 00-0008 EA 27-1/4" x 123-1/4" Inside Frame Dimensions, Class 1 Hail Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight	466.59	95.80
08 63 00 00-0009 EA 39-1/4" x 39-1/4" Inside Frame Dimensions, Class 1 Hail Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight	329.28	76.64
08 63 00 00-0010 EA 39-1/4" x 63-1/4" Inside Frame Dimensions, Class 1 Hail Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight	400.44	86.22
08 63 00 00-0011 EA 39-1/4" x 75-1/4" Inside Frame Dimensions, Class 1 Hail Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight	422.44	86.22



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 63 00 00-0012 EA 39-1/4" x 99-1/4" Inside Frame Dimensions, Class 1 Hail Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	484.59	95.80
08 63 00 00-0013 EA 39-1/4" x 123-1/4" Inside Frame Dimensions, Class 1 Hail Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	561.76	105.38
08 63 00 00-0014 EA 51-1/4" x 51-1/4" Inside Frame Dimensions, Class 1 Hail Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	404.44	86.22
08 63 00 00-0015 EA 51-1/4" x 63-1/4" Inside Frame Dimensions, Class 1 Hail Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	447.59	95.80
08 63 00 00-0016 EA 51-1/4" x 75-1/4" Inside Frame Dimensions, Class 1 Hail Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	489.59	95.80
08 63 00 00-0017 EA 51-1/4" x 87-1/4" Inside Frame Dimensions, Class 1 Hail Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	538.76	105.38
08 63 00 00-0018 EA 52-1/4" x 100-1/4" Inside Frame Dimensions, Class 1 Hail Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	595.92	114.96
08 63 00 00-0019 EA 52-1/4" x 123-1/4" Inside Frame Dimensions, Class 1 Hail Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	668.07	124.54
08 63 00 00-0020 EA 63-1/4" x 63-1/4" Inside Frame Dimensions, Class 1 Hail Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	477.59	95.80
08 63 00 00-0021 EA 63-5/8" x 75-5/8" Inside Frame Dimensions, Class 1 Hail Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	525.76	105.38
08 63 00 00-0022 EA 63-1/4" x 87-1/4" Inside Frame Dimensions, Class 1 Hail Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	596.92	114.96
08 63 00 00-0023 EA 63-1/4" x 99-5/8" Inside Frame Dimensions, Class 1 Hail Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	622.92	114.96
08 63 00 00-0024 EA 63-1/4" x 123-1/4" Inside Frame Dimensions, Class 1 Hail Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	715.07	124.54
08 63 00 00-0025 Class 3 Hail Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylights <small>(08 63 00 00-0003)</small>		
<small>Note: Includes mill finish aluminum frame, integral condensation and weepage gutters, insulated thermal break, weather sweep, curb seal tape and fasteners. Excludes roof curb.</small>		
08 63 00 00-0026 EA 27-1/4" x 27-1/4" Inside Frame Dimensions, Class 3 Hail Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	326.28	76.64
08 63 00 00-0027 EA 27-1/4" x 51-1/4" Inside Frame Dimensions, Class 3 Hail Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	360.28	76.64
08 63 00 00-0028 EA 27-1/4" x 99-1/4" Inside Frame Dimensions, Class 3 Hail Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	452.44	86.22
08 63 00 00-0029 EA 27-1/4" x 123-1/4" Inside Frame Dimensions, Class 3 Hail Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	506.59	95.80
08 63 00 00-0030 EA 39-1/4" x 39-1/4" Inside Frame Dimensions, Class 3 Hail Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	365.28	76.64
08 63 00 00-0031 EA 39-1/4" x 63-1/4" Inside Frame Dimensions, Class 3 Hail Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	428.44	86.22
08 63 00 00-0032 EA 39-1/4" x 75-1/4" Inside Frame Dimensions, Class 3 Hail Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	452.44	86.22
08 63 00 00-0033 EA 39-1/4" x 99-1/4" Inside Frame Dimensions, Class 3 Hail Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	518.59	95.80
08 63 00 00-0034 EA 39-1/4" x 123-1/4" Inside Frame Dimensions, Class 3 Hail Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	581.76	105.38
08 63 00 00-0035 EA 51-1/4" x 51-1/4" Inside Frame Dimensions, Class 3 Hail Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	432.44	86.22
08 63 00 00-0036 EA 51-1/4" x 63-1/4" Inside Frame Dimensions, Class 3 Hail Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	479.59	95.80
08 63 00 00-0037 EA 51-1/4" x 75-1/4" Inside Frame Dimensions, Class 3 Hail Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	506.59	95.80
08 63 00 00-0038 EA 51-1/4" x 87-1/4" Inside Frame Dimensions, Class 3 Hail Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	557.76	105.38
08 63 00 00-0039 EA 52-1/4" x 100-1/4" Inside Frame Dimensions, Class 3 Hail Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	605.92	114.96
08 63 00 00-0040 EA 52-1/4" x 123-1/4" Inside Frame Dimensions, Class 3 Hail Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	679.07	124.54
08 63 00 00-0041 EA 63-1/4" x 63-1/4" Inside Frame Dimensions, Class 3 Hail Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	510.59	95.80
08 63 00 00-0042 EA 63-5/8" x 75-5/8" Inside Frame Dimensions, Class 3 Hail Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	561.76	105.38
08 63 00 00-0043 EA 63-1/4" x 87-1/4" Inside Frame Dimensions, Class 3 Hail Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	617.92	114.96
08 63 00 00-0044 EA 63-1/4" x 99-5/8" Inside Frame Dimensions, Class 3 Hail Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	645.92	114.96
08 63 00 00-0045 EA 63-1/4" x 123-1/4" Inside Frame Dimensions, Class 3 Hail Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	730.07	124.54
08 63 00 00-0046 High Velocity Hurricane Zone Rated, Polycarbonate/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylights <small>(08 63 00 00-0003)</small>		
<small>Note: Includes mill finish aluminum frame, integral condensation and weepage gutters, insulated thermal break, weather sweep, curb seal tape and fasteners. Excludes roof curb.</small>		
08 63 00 00-0047 EA 27-1/4" x 27-1/4" Inside Frame Dimensions, High Velocity Hurricane Zone Rated, Polycarbonate/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	330.28	76.64
08 63 00 00-0048 EA 27-1/4" x 51-1/4" Inside Frame Dimensions, High Velocity Hurricane Zone Rated, Polycarbonate/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	368.28	76.64

08 Openings**08 60 Roof Windows And Skylights****08 63 Metal-Framed Skylights**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 63 00 00-0049 EA 27-1/4" x 99-1/4" Inside Frame Dimensions, High Velocity Hurricane Zone Rated, Polycarbonate/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight	463.44	86.22
08 63 00 00-0050 EA 39-1/4" x 39-1/4" Inside Frame Dimensions, High Velocity Hurricane Zone Rated, Polycarbonate/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight	375.28	76.64
08 63 00 00-0051 EA 39-1/4" x 63-1/4" Inside Frame Dimensions, High Velocity Hurricane Zone Rated, Polycarbonate/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight	442.44	86.22
08 63 00 00-0052 EA 39-1/4" x 75-1/4" Inside Frame Dimensions, High Velocity Hurricane Zone Rated, Polycarbonate/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight	463.44	86.22
08 63 00 00-0053 EA 39-1/4" x 99-1/4" Inside Frame Dimensions, High Velocity Hurricane Zone Rated, Polycarbonate/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight	530.59	95.80
08 63 00 00-0054 EA 51-1/4" x 51-1/4" Inside Frame Dimensions, High Velocity Hurricane Zone Rated, Polycarbonate/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight	441.44	86.22
08 63 00 00-0055 EA 51-1/4" x 63-1/4" Inside Frame Dimensions, High Velocity Hurricane Zone Rated, Polycarbonate/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight	487.59	95.80
08 63 00 00-0056 EA 51-1/4" x 75-1/4" Inside Frame Dimensions, High Velocity Hurricane Zone Rated, Polycarbonate/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight	519.59	95.80
08 63 00 00-0057 EA 51-1/4" x 87-1/4" Inside Frame Dimensions, High Velocity Hurricane Zone Rated, Polycarbonate/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight	570.76	105.38
08 63 00 00-0058 EA 52-1/4" x 100-1/4" Inside Frame Dimensions, High Velocity Hurricane Zone Rated, Polycarbonate/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight	621.92	114.96
08 63 00 00-0059 EA 63-1/4" x 63-1/4" Inside Frame Dimensions, High Velocity Hurricane Zone Rated, Polycarbonate/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight	522.59	95.80
08 63 00 00-0060 EA 63-5/8" x 75-5/8" Inside Frame Dimensions, High Velocity Hurricane Zone Rated, Polycarbonate/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight	577.76	105.38
08 63 00 00-0061 EA 63-1/4" x 87-1/4" Inside Frame Dimensions, High Velocity Hurricane Zone Rated, Polycarbonate/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight	633.92	114.96
08 63 00 00-0062 EA 63-1/4" x 99-5/8" Inside Frame Dimensions, High Velocity Hurricane Zone Rated, Polycarbonate/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight	661.92	114.96
08 63 00 00-0063 FM Approved, Polycarbonate/Polycarbonate Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylights <small>(08 63 00 00-0003)</small>		
Note: Includes mill finish aluminum frame, integral condensation and weepage gutters, insulated thermal break, weather sweep, curb seal tape and fasteners. Excludes roof curb.		
08 63 00 00-0064 EA 27-1/4" x 27-1/4" Inside Frame Dimensions, FM Approved, Polycarbonate/Polycarbonate Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	337.28	76.64
08 63 00 00-0065 EA 27-1/4" x 51-1/4" Inside Frame Dimensions, FM Approved, Polycarbonate/Polycarbonate Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	379.28	76.64
08 63 00 00-0066 EA 27-1/4" x 99-1/4" Inside Frame Dimensions, FM Approved, Polycarbonate/Polycarbonate Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	473.44	86.22
08 63 00 00-0067 EA 27-1/4" x 123-1/4" Inside Frame Dimensions, FM Approved, Polycarbonate/Polycarbonate Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	542.59	95.80
08 63 00 00-0068 EA 39-1/4" x 39-1/4" Inside Frame Dimensions, FM Approved, Polycarbonate/Polycarbonate Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	385.28	76.64
08 63 00 00-0069 EA 39-1/4" x 63-1/4" Inside Frame Dimensions, FM Approved, Polycarbonate/Polycarbonate Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	451.44	86.22
08 63 00 00-0070 EA 39-1/4" x 75-1/4" Inside Frame Dimensions, FM Approved, Polycarbonate/Polycarbonate Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	473.44	86.22
08 63 00 00-0071 EA 39-1/4" x 99-1/4" Inside Frame Dimensions, FM Approved, Polycarbonate/Polycarbonate Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	545.59	95.80
08 63 00 00-0072 EA 51-1/4" x 51-1/4" Inside Frame Dimensions, FM Approved, Polycarbonate/Polycarbonate Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	452.44	86.22
08 63 00 00-0073 EA 51-1/4" x 63-1/4" Inside Frame Dimensions, FM Approved, Polycarbonate/Polycarbonate Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	498.59	95.80
08 63 00 00-0074 EA 51-1/4" x 75-1/4" Inside Frame Dimensions, FM Approved, Polycarbonate/Polycarbonate Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	533.59	95.80
08 63 00 00-0075 EA 51-1/4" x 87-1/4" Inside Frame Dimensions, FM Approved, Polycarbonate/Polycarbonate Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	585.76	105.38
08 63 00 00-0076 EA 52-1/4" x 100-1/4" Inside Frame Dimensions, FM Approved, Polycarbonate/Polycarbonate Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	637.92	114.96
08 63 00 00-0077 EA 63-1/4" x 63-1/4" Inside Frame Dimensions, FM Approved, Polycarbonate/Polycarbonate Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	537.59	95.80
08 63 00 00-0078 EA 63-5/8" x 75-5/8" Inside Frame Dimensions, FM Approved, Polycarbonate/Polycarbonate Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	592.76	105.38
08 63 00 00-0079 EA 63-1/4" x 87-1/4" Inside Frame Dimensions, FM Approved, Polycarbonate/Polycarbonate Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	649.92	114.96
08 63 00 00-0080 EA 63-1/4" x 99-5/8" Inside Frame Dimensions, FM Approved, Polycarbonate/Polycarbonate Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Skylight.....	679.92	114.96
08 63 00 00-0081 Curb Top Inserts <small>(08 63 00 00-0003)</small>		
Note: For use with industrial style fixed dome skylights for better u-value and solar heat gain coefficient/shading coefficient (SHGC/SC) properties. Includes mill finish aluminum frame and acrylic or polycarbonate glazing. Excludes roof curb.		
08 63 00 00-0082 Single Glazed, Aluminum Framed Curb Top Inserts <small>(08 63 00 00-0081)</small>		
08 63 00 00-0083 EA 27-1/4" x 51-1/4" Inside Frame Dimensions, Single Glazed, Aluminum Framed Curb Top Insert.....	112.64	38.32
08 63 00 00-0084 EA 51-1/4" x 51-1/4" Inside Frame Dimensions, Single Glazed, Aluminum Framed Curb Top Insert.....	151.22	43.11
08 63 00 00-0085 EA 52-1/4" x 100-1/4" Inside Frame Dimensions, Single Glazed, Aluminum Framed Curb Top Insert.....	246.96	57.48
08 63 00 00-0086 EA 63-5/8" x 75-5/8" Inside Frame Dimensions, Single Glazed, Aluminum Framed Curb Top Insert.....	228.38	52.69
08 63 00 00-0087 EA 63-1/4" x 99-5/8" Inside Frame Dimensions, Single Glazed, Aluminum Framed Curb Top Insert.....	274.96	57.48
08 63 00 00-0088 Double Glazed, Aluminum Framed Curb Top Inserts <small>(08 63 00 00-0081)</small>		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 63 00 00-0089 EA 27-1/4" x 51-1/4" Inside Frame Dimensions, Double Glazed, Aluminum Framed Curb Top Insert.....	153.64	38.32
08 63 00 00-0090 EA 51-1/4" x 51-1/4" Inside Frame Dimensions, Double Glazed, Aluminum Framed Curb Top Insert.....	230.22	43.11
08 63 00 00-0091 EA 52-1/4" x 100-1/4" Inside Frame Dimensions, Double Glazed, Aluminum Framed Curb Top Insert.....	389.96	57.48
08 63 00 00-0092 EA 63-5/8" x 75-5/8" Inside Frame Dimensions, Double Glazed, Aluminum Framed Curb Top Insert.....	380.38	52.69
08 63 00 00-0093 EA 63-1/4" x 99-5/8" Inside Frame Dimensions, Double Glazed, Aluminum Framed Curb Top Insert.....	472.96	57.48
08 63 00 00-0094 Triple Glazed, Aluminum Framed Curb Top Inserts (08 63 00 00-0081)		
08 63 00 00-0095 EA 27-1/4" x 51-1/4" Inside Frame Dimensions, Triple Glazed, Aluminum Framed Curb Top Insert.....	193.64	38.32
08 63 00 00-0096 EA 51-1/4" x 51-1/4" Inside Frame Dimensions, Triple Glazed, Aluminum Framed Curb Top Insert.....	305.22	43.11
08 63 00 00-0097 EA 52-1/4" x 100-1/4" Inside Frame Dimensions, Triple Glazed, Aluminum Framed Curb Top Insert.....	565.96	57.48
08 63 00 00-0098 EA 63-5/8" x 75-5/8" Inside Frame Dimensions, Triple Glazed, Aluminum Framed Curb Top Insert.....	522.38	52.69
08 63 00 00-0099 EA 63-1/4" x 99-5/8" Inside Frame Dimensions, Triple Glazed, Aluminum Framed Curb Top Insert.....	656.96	57.48
08 63 00 00-0100 Pyramid Style Fixed Dome, Aluminum Framed Skylights (08 63 00 00-0002)		
08 63 00 00-0101 Acrylic/Acrylic Double Glazed Prismatic Lens, Pyramid Style Fixed Dome, Aluminum Framed Skylight (08 63 00 00-0100)		
Note: Includes mill finish aluminum frame, integral condensation and weepage gutters, insulated thermal break, weather sweep, curb seal tape and fasteners. Excludes roof curb.		
08 63 00 00-0102 EA 27-1/4" x 27-1/4" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Pyramid Style Fixed Dome, Aluminum Framed Skylight.....	258.28	76.64
08 63 00 00-0103 EA 39-1/4" x 39-1/4" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Pyramid Style Fixed Dome, Aluminum Framed Skylight.....	301.28	76.64
08 63 00 00-0104 EA 51-1/4" x 51-1/4" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Pyramid Style Fixed Dome, Aluminum Framed Skylight.....	376.44	86.22
08 63 00 00-0105 EA 63-1/4" x 63-1/4" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Pyramid Style Fixed Dome, Aluminum Framed Skylight.....	466.59	95.80
08 63 00 00-0106 Polycarbonate/Polycarbonate Double Glazed Prismatic Lens, Pyramid Style Fixed Dome, Aluminum Framed Skylight (08 63 00 00-0100)		
Note: Includes mill finish aluminum frame, integral condensation and weepage gutters, insulated thermal break, weather sweep, curb seal tape and fasteners. Excludes roof curb.		
08 63 00 00-0107 EA 27-1/4" x 27-1/4" Inside Frame Dimensions, Polycarbonate/Polycarbonate Double Glazed Prismatic Lens, Pyramid Style Fixed Dome, Aluminum Framed Skylight.....	336.28	76.64
08 63 00 00-0108 EA 39-1/4" x 39-1/4" Inside Frame Dimensions, Polycarbonate/Polycarbonate Double Glazed Prismatic Lens, Pyramid Style Fixed Dome, Aluminum Framed Skylight.....	381.28	76.64
08 63 00 00-0109 EA 51-1/4" x 51-1/4" Inside Frame Dimensions, Polycarbonate/Polycarbonate Double Glazed Prismatic Lens, Pyramid Style Fixed Dome, Aluminum Framed Skylight.....	449.44	86.22
08 63 00 00-0110 EA 63-1/4" x 63-1/4" Inside Frame Dimensions, Polycarbonate/Polycarbonate Double Glazed Prismatic Lens, Pyramid Style Fixed Dome, Aluminum Framed Skylight.....	533.59	95.80
08 63 00 00-0111 Double Hip Style Fixed Dome, Aluminum Framed Skylights (08 63 00 00-0002)		
08 63 00 00-0112 Acrylic/Acrylic Double Glazed Prismatic Lens, Double Hip Style Fixed Dome, Aluminum Framed Skylight (08 63 00 00-0111)		
Note: Includes mill finish aluminum frame, integral condensation and weepage gutters, insulated thermal break, weather sweep, curb seal tape and fasteners. Excludes roof curb.		
08 63 00 00-0113 EA 27-1/4" x 51-1/4" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Double Hip Style Fixed Dome, Aluminum Framed Skylight.....	295.28	76.64
08 63 00 00-0114 EA 27-1/4" x 99-1/4" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Double Hip Style Fixed Dome, Aluminum Framed Skylight.....	383.44	86.22
08 63 00 00-0115 EA 27-1/4" x 123-1/4" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Double Hip Style Fixed Dome, Aluminum Framed Skylight.....	450.59	95.80
08 63 00 00-0116 EA 39-1/4" x 63-1/4" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Double Hip Style Fixed Dome, Aluminum Framed Skylight.....	362.44	86.22
08 63 00 00-0117 EA 39-1/4" x 75-1/4" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Double Hip Style Fixed Dome, Aluminum Framed Skylight.....	383.44	86.22
08 63 00 00-0118 EA 39-1/4" x 99-1/4" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Double Hip Style Fixed Dome, Aluminum Framed Skylight.....	462.59	95.80
08 63 00 00-0119 EA 39-1/4" x 123-1/4" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Double Hip Style Fixed Dome, Aluminum Framed Skylight.....	540.76	105.38
08 63 00 00-0120 EA 51-1/4" x 63-1/4" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Double Hip Style Fixed Dome, Aluminum Framed Skylight.....	420.59	95.80
08 63 00 00-0121 EA 51-1/4" x 75-1/4" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Double Hip Style Fixed Dome, Aluminum Framed Skylight.....	450.59	95.80
08 63 00 00-0122 EA 51-1/4" x 87-1/4" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Double Hip Style Fixed Dome, Aluminum Framed Skylight.....	502.76	105.38
08 63 00 00-0123 EA 52-1/4" x 100-1/4" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Double Hip Style Fixed Dome, Aluminum Framed Skylight.....	551.92	114.96
08 63 00 00-0124 EA 52-1/4" x 123-1/4" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Double Hip Style Fixed Dome, Aluminum Framed Skylight.....	646.07	124.54
08 63 00 00-0125 EA 63-5/8" x 75-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Double Hip Style Fixed Dome, Aluminum Framed Skylight.....	514.76	105.38
08 63 00 00-0126 EA 63-1/4" x 87-1/4" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Double Hip Style Fixed Dome, Aluminum Framed Skylight.....	581.92	114.96
08 63 00 00-0127 EA 63-1/4" x 99-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Double Hip Style Fixed Dome, Aluminum Framed Skylight.....	612.92	114.96

08 Openings**08 60 Roof Windows And Skylights****08 63 Metal-Framed Skylights**

MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
08 63 00 00-0128	EA	63-1/4" x 123-1/4" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Double Hip Style Fixed Dome, Aluminum Framed Skylight.....	704.07		124.54
08 63 00 00-0129		Polycarbonate/Acrylic Double Glazed Prismatic Lens, Double Hip Style Fixed Dome, Aluminum Framed Skylight <small>(08 63 00 00-0111)</small>			
Note: Includes mill finish aluminum frame, integral condensation and weepage gutters, insulated thermal break, weather sweep, curb seal tape and fasteners. Excludes roof curb.					
08 63 00 00-0130	EA	27-1/4" x 27-1/4" Inside Frame Dimensions, Polycarbonate/Acrylic Double Glazed Prismatic Lens, Double Hip Style Fixed Dome, Aluminum Framed Skylight.....	329.28		76.64
08 63 00 00-0131	EA	27-1/4" x 51-1/4" Inside Frame Dimensions, Polycarbonate/Acrylic Double Glazed Prismatic Lens, Double Hip Style Fixed Dome, Aluminum Framed Skylight.....	365.28		76.64
08 63 00 00-0132	EA	27-1/4" x 99-1/4" Inside Frame Dimensions, Polycarbonate/Acrylic Double Glazed Prismatic Lens, Double Hip Style Fixed Dome, Aluminum Framed Skylight.....	457.44		86.22
08 63 00 00-0133	EA	39-1/4" x 39-1/4" Inside Frame Dimensions, Polycarbonate/Acrylic Double Glazed Prismatic Lens, Double Hip Style Fixed Dome, Aluminum Framed Skylight.....	372.28		76.64
08 63 00 00-0134	EA	39-1/4" x 51-1/4" Inside Frame Dimensions, Polycarbonate/Acrylic Double Glazed Prismatic Lens, Double Hip Style Fixed Dome, Aluminum Framed Skylight.....	417.44		86.22
08 63 00 00-0135	EA	39-1/4" x 63-1/4" Inside Frame Dimensions, Polycarbonate/Acrylic Double Glazed Prismatic Lens, Double Hip Style Fixed Dome, Aluminum Framed Skylight.....	436.44		86.22
08 63 00 00-0136	EA	39-1/4" x 75-1/4" Inside Frame Dimensions, Polycarbonate/Acrylic Double Glazed Prismatic Lens, Double Hip Style Fixed Dome, Aluminum Framed Skylight.....	457.44		86.22
08 63 00 00-0137	EA	39-1/4" x 99-1/4" Inside Frame Dimensions, Polycarbonate/Acrylic Double Glazed Prismatic Lens, Double Hip Style Fixed Dome, Aluminum Framed Skylight.....	525.59		95.80
08 63 00 00-0138	EA	51-1/4" x 51-1/4" Inside Frame Dimensions, Polycarbonate/Acrylic Double Glazed Prismatic Lens, Double Hip Style Fixed Dome, Aluminum Framed Skylight.....	437.44		86.22
08 63 00 00-0139	EA	51-1/4" x 63-1/4" Inside Frame Dimensions, Polycarbonate/Acrylic Double Glazed Prismatic Lens, Double Hip Style Fixed Dome, Aluminum Framed Skylight.....	483.59		95.80
08 63 00 00-0140	EA	51-1/4" x 75-1/4" Inside Frame Dimensions, Polycarbonate/Acrylic Double Glazed Prismatic Lens, Double Hip Style Fixed Dome, Aluminum Framed Skylight.....	513.59		95.80
08 63 00 00-0141	EA	51-1/4" x 87-1/4" Inside Frame Dimensions, Polycarbonate/Acrylic Double Glazed Prismatic Lens, Double Hip Style Fixed Dome, Aluminum Framed Skylight.....	563.76		105.38
08 63 00 00-0142	EA	52-1/4" x 100-1/4" Inside Frame Dimensions, Polycarbonate/Acrylic Double Glazed Prismatic Lens, Double Hip Style Fixed Dome, Aluminum Framed Skylight.....	613.92		114.96
08 63 00 00-0143	EA	63-1/4" x 63-1/4" Inside Frame Dimensions, Polycarbonate/Acrylic Double Glazed Prismatic Lens, Double Hip Style Fixed Dome, Aluminum Framed Skylight.....	515.59		95.80
08 63 00 00-0144	EA	63-5/8" x 75-5/8" Inside Frame Dimensions, Polycarbonate/Acrylic Double Glazed Prismatic Lens, Double Hip Style Fixed Dome, Aluminum Framed Skylight.....	570.76		105.38
08 63 00 00-0145	EA	63-1/4" x 87-1/4" Inside Frame Dimensions, Polycarbonate/Acrylic Double Glazed Prismatic Lens, Double Hip Style Fixed Dome, Aluminum Framed Skylight.....	625.92		114.96
08 63 00 00-0146	EA	63-1/4" x 99-5/8" Inside Frame Dimensions, Polycarbonate/Acrylic Double Glazed Prismatic Lens, Double Hip Style Fixed Dome, Aluminum Framed Skylight.....	652.92		114.96
08 63 00 00-0147		Polycarbonate/Polycarbonate Double Glazed Prismatic Lens, Double Hip Style Fixed Dome, Aluminum Framed Skylight <small>(08 63 00 00-0111)</small>			
Note: Includes mill finish aluminum frame, integral condensation and weepage gutters, insulated thermal break, weather sweep, curb seal tape and fasteners. Excludes roof curb.					
08 63 00 00-0148	EA	27-1/4" x 51-1/4" Inside Frame Dimensions, Polycarbonate/Polycarbonate Double Glazed Prismatic Lens, Double Hip Style Fixed Dome, Aluminum Framed Skylight.....	362.28		76.64
08 63 00 00-0149	EA	27-1/4" x 99-1/4" Inside Frame Dimensions, Polycarbonate/Polycarbonate Double Glazed Prismatic Lens, Double Hip Style Fixed Dome, Aluminum Framed Skylight.....	470.44		86.22
08 63 00 00-0150	EA	39-1/4" x 63-1/4" Inside Frame Dimensions, Polycarbonate/Polycarbonate Double Glazed Prismatic Lens, Double Hip Style Fixed Dome, Aluminum Framed Skylight.....	447.44		86.22
08 63 00 00-0151	EA	39-1/4" x 75-1/4" Inside Frame Dimensions, Polycarbonate/Polycarbonate Double Glazed Prismatic Lens, Double Hip Style Fixed Dome, Aluminum Framed Skylight.....	470.44		86.22
08 63 00 00-0152	EA	39-1/4" x 99-1/4" Inside Frame Dimensions, Polycarbonate/Polycarbonate Double Glazed Prismatic Lens, Double Hip Style Fixed Dome, Aluminum Framed Skylight.....	541.59		95.80
08 63 00 00-0153	EA	51-1/4" x 63-1/4" Inside Frame Dimensions, Polycarbonate/Polycarbonate Double Glazed Prismatic Lens, Double Hip Style Fixed Dome, Aluminum Framed Skylight.....	495.59		95.80
08 63 00 00-0154	EA	51-1/4" x 75-1/4" Inside Frame Dimensions, Polycarbonate/Polycarbonate Double Glazed Prismatic Lens, Double Hip Style Fixed Dome, Aluminum Framed Skylight.....	528.59		95.80
08 63 00 00-0155	EA	51-1/4" x 87-1/4" Inside Frame Dimensions, Polycarbonate/Polycarbonate Double Glazed Prismatic Lens, Double Hip Style Fixed Dome, Aluminum Framed Skylight.....	581.76		105.38
08 63 00 00-0156	EA	52-1/4" x 100-1/4" Inside Frame Dimensions, Polycarbonate/Polycarbonate Double Glazed Prismatic Lens, Double Hip Style Fixed Dome, Aluminum Framed Skylight.....	629.92		114.96
08 63 00 00-0157	EA	63-5/8" x 75-5/8" Inside Frame Dimensions, Polycarbonate/Polycarbonate Double Glazed Prismatic Lens, Double Hip Style Fixed Dome, Aluminum Framed Skylight.....	588.76		105.38
08 63 00 00-0158	EA	63-1/4" x 87-1/4" Inside Frame Dimensions, Polycarbonate/Polycarbonate Double Glazed Prismatic Lens, Double Hip Style Fixed Dome, Aluminum Framed Skylight.....	645.92		114.96
08 63 00 00-0159	EA	63-1/4" x 99-5/8" Inside Frame Dimensions, Polycarbonate/Polycarbonate Double Glazed Prismatic Lens, Double Hip Style Fixed Dome, Aluminum Framed Skylight.....	674.92		114.96
08 63 00 00-0160		Smoke Vent Dome, Aluminum Framed Skylights <small>(08 63 00 00-0001)</small>			
08 63 00 00-0161		Industrial Style Smoke Vent Dome, Aluminum Framed Skylights <small>(08 63 00 00-0160)</small>			
Note: UL listed or FM approved. Includes mill finish aluminum frame, integral condensation and weepage gutters, insulated thermal break, curb seal tape, weather sweep, fasteners, fusible link with a minimum temperature rating of 165 degrees, gas shocks and exterior manual release cable for testing.					
08 63 00 00-0162		Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Smoke Vent Dome, Aluminum Framed Skylights <small>(08 63 00 00-0161)</small>			



Openings	08	08
Roof Windows And Skylights	08 60	
Metal-Framed Skylights	08 63	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 63 00 00-0163 10 LB Uplift Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Smoke Vent Dome, Aluminum Framed Skylights <small>(08 63 00 00-0162)</small>		
08 63 00 00-0164 EA 52-1/4" x 100-1/4" Inside Frame Dimensions, 10 LB Uplift Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Smoke Vent Dome, Aluminum Framed Skylight	1,397.92	114.96
08 63 00 00-0165 EA 63-5/8" x 75-5/8" Inside Frame Dimensions, 10 LB Uplift Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Smoke Vent Dome, Aluminum Framed Skylight	1,306.92	114.96
08 63 00 00-0166 EA 63-1/4" x 99-5/8" Inside Frame Dimensions, 10 LB Uplift Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Smoke Vent Dome, Aluminum Framed Skylight	1,464.92	114.96
08 63 00 00-0167 25 LB Uplift Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Smoke Vent Dome, Aluminum Framed Skylights <small>(08 63 00 00-0162)</small>		
08 63 00 00-0168 EA 52-1/4" x 100-1/4" Inside Frame Dimensions, 25 LB Uplift Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Smoke Vent Dome, Aluminum Framed Skylight	1,796.92	114.96
08 63 00 00-0169 EA 63-5/8" x 75-5/8" Inside Frame Dimensions, 25 LB Uplift Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Smoke Vent Dome, Aluminum Framed Skylight	1,709.92	114.96
08 63 00 00-0170 EA 63-1/4" x 99-5/8" Inside Frame Dimensions, 25 LB Uplift Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Smoke Vent Dome, Aluminum Framed Skylight	1,887.92	114.96
08 63 00 00-0171 30 LB Uplift Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Smoke Vent Dome, Aluminum Framed Skylights <small>(08 63 00 00-0162)</small>		
08 63 00 00-0172 EA 52-1/4" x 100-1/4" Inside Frame Dimensions, 30 LB Uplift Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Smoke Vent Dome, Aluminum Framed Skylight	1,911.92	114.96
08 63 00 00-0173 EA 63-5/8" x 75-5/8" Inside Frame Dimensions, 30 LB Uplift Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Smoke Vent Dome, Aluminum Framed Skylight	1,822.92	114.96
08 63 00 00-0174 EA 63-1/4" x 99-5/8" Inside Frame Dimensions, 30 LB Uplift Rated, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Smoke Vent Dome, Aluminum Framed Skylight	2,000.92	114.96
08 63 00 00-0175 Polycarbonate/Polycarbonate Double Glazed Prismatic Lens, Industrial Style Smoke Vent Dome, Aluminum Framed Skylights <small>(08 63 00 00-0161)</small>		
08 63 00 00-0176 10 LB Uplift Rated, Polycarbonate/Polycarbonate Double Glazed Prismatic Lens, Industrial Style Smoke Vent Dome, Aluminum Framed Skylights <small>(08 63 00 00-0175)</small>		
08 63 00 00-0177 EA 52-1/4" x 100-1/4" Inside Frame Dimensions, 10 LB Uplift Rated, Polycarbonate/Polycarbonate Double Glazed Prismatic Lens, Industrial Style Smoke Vent Dome, Aluminum Framed Skylight.....	1,403.92	114.96
08 63 00 00-0178 EA 63-5/8" x 75-5/8" Inside Frame Dimensions, 10 LB Uplift Rated, Polycarbonate/Polycarbonate Double Glazed Prismatic Lens, Industrial Style Smoke Vent Dome, Aluminum Framed Skylight.....	1,312.92	114.96
08 63 00 00-0179 EA 63-1/4" x 99-5/8" Inside Frame Dimensions, 10 LB Uplift Rated, Polycarbonate/Polycarbonate Double Glazed Prismatic Lens, Industrial Style Smoke Vent Dome, Aluminum Framed Skylight.....	1,473.92	114.96
08 63 00 00-0180 25 LB Uplift Rated, Polycarbonate/Polycarbonate Double Glazed Prismatic Lens, Industrial Style Smoke Vent Dome, Aluminum Framed Skylights <small>(08 63 00 00-0175)</small>		
08 63 00 00-0181 EA 52-1/4" x 100-1/4" Inside Frame Dimensions, 25 LB Uplift Rated, Polycarbonate/Polycarbonate Double Glazed Prismatic Lens, Industrial Style Smoke Vent Dome, Aluminum Framed Skylight.....	1,804.92	114.96
08 63 00 00-0182 EA 63-5/8" x 75-5/8" Inside Frame Dimensions, 25 LB Uplift Rated, Polycarbonate/Polycarbonate Double Glazed Prismatic Lens, Industrial Style Smoke Vent Dome, Aluminum Framed Skylight.....	1,715.92	114.96
08 63 00 00-0183 EA 63-1/4" x 99-5/8" Inside Frame Dimensions, 25 LB Uplift Rated, Polycarbonate/Polycarbonate Double Glazed Prismatic Lens, Industrial Style Smoke Vent Dome, Aluminum Framed Skylight.....	1,897.92	114.96
08 63 00 00-0184 30 LB Uplift Rated, Polycarbonate/Polycarbonate Double Glazed Prismatic Lens, Industrial Style Smoke Vent Dome, Aluminum Framed Skylights <small>(08 63 00 00-0175)</small>		
08 63 00 00-0185 EA 52-1/4" x 100-1/4" Inside Frame Dimensions, 30 LB Uplift Rated, Polycarbonate/Polycarbonate Double Glazed Prismatic Lens, Industrial Style Smoke Vent Dome, Aluminum Framed Skylight.....	1,917.92	114.96
08 63 00 00-0186 EA 63-5/8" x 75-5/8" Inside Frame Dimensions, 30 LB Uplift Rated, Polycarbonate/Polycarbonate Double Glazed Prismatic Lens, Industrial Style Smoke Vent Dome, Aluminum Framed Skylight.....	1,828.92	114.96
08 63 00 00-0187 EA 63-1/4" x 99-5/8" Inside Frame Dimensions, 30 LB Uplift Rated, Polycarbonate/Polycarbonate Double Glazed Prismatic Lens, Industrial Style Smoke Vent Dome, Aluminum Framed Skylight.....	2,010.92	114.96
08 63 00 00-0188 Aluminum Framed Solar Tube Skylights <small>(08 63 00 00-0001)</small> Note: Includes knock down curb with safety security guard, class 1 hail rated double glazed skylight, light shaft top trim, reflective light well, T-bar ceiling frame, acrylic diffuser lens and lens clip.		
08 63 00 00-0189 31-5/8" x 31-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Solar Tube Skylights <small>(08 63 00 00-0188)</small>		

08 Openings**08 60 Roof Windows And Skylights****08 63 Metal-Framed Skylights**

MINOR		TOTAL DIRECT	DEMOLITION
CSI	UOM DESCRIPTION	UNIT COST	UNIT COST
08 63 00 00-0190	EA 2' Shaft Length, 31-5/8" x 31-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Solar Tube Skylight.....	737.56	153.28
	<i>For Class 3 Hail Rated, Add</i>	4.00	
	<i>For Polycarbonate Diffuser Lens, Add</i>	7.00	
	<i>For High Velocity Hurricane Zone Rated, Add</i>	14.00	
	<i>For FM Approved, Add</i>	20.00	
	<i>For 18 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	49.00	
	<i>For 14 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	69.00	
	<i>For Single Blade Louver, Add</i>	490.66	
08 63 00 00-0191	EA 3' Shaft Length, 31-5/8" x 31-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Solar Tube Skylight.....	775.23	157.11
	<i>For Class 3 Hail Rated, Add</i>	4.00	
	<i>For Polycarbonate Diffuser Lens, Add</i>	7.00	
	<i>For High Velocity Hurricane Zone Rated, Add</i>	14.00	
	<i>For FM Approved, Add</i>	20.00	
	<i>For 18 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	49.00	
	<i>For 14 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	69.00	
	<i>For Single Blade Louver, Add</i>	491.42	
08 63 00 00-0192	EA 4' Shaft Length, 31-5/8" x 31-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Solar Tube Skylight.....	811.89	160.94
	<i>For Class 3 Hail Rated, Add</i>	4.00	
	<i>For Polycarbonate Diffuser Lens, Add</i>	7.00	
	<i>For High Velocity Hurricane Zone Rated, Add</i>	14.00	
	<i>For FM Approved, Add</i>	20.00	
	<i>For 18 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	49.00	
	<i>For 14 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	69.00	
	<i>For Single Blade Louver, Add</i>	492.19	
08 63 00 00-0193	EA 5' Shaft Length, 31-5/8" x 31-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Solar Tube Skylight.....	862.55	164.78
	<i>For Class 3 Hail Rated, Add</i>	4.00	
	<i>For Polycarbonate Diffuser Lens, Add</i>	7.00	
	<i>For High Velocity Hurricane Zone Rated, Add</i>	14.00	
	<i>For FM Approved, Add</i>	20.00	
	<i>For 18 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	49.00	
	<i>For 14 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	69.00	
	<i>For Single Blade Louver, Add</i>	492.96	
08 63 00 00-0194	EA 6' Shaft Length, 31-5/8" x 31-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Solar Tube Skylight.....	907.21	168.61
	<i>For Class 3 Hail Rated, Add</i>	4.00	
	<i>For Polycarbonate Diffuser Lens, Add</i>	7.00	
	<i>For High Velocity Hurricane Zone Rated, Add</i>	14.00	
	<i>For FM Approved, Add</i>	20.00	
	<i>For 18 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	49.00	
	<i>For 14 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	69.00	
	<i>For Single Blade Louver, Add</i>	493.72	
08 63 00 00-0195	EA 7' Shaft Length, 31-5/8" x 31-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Solar Tube Skylight.....	943.88	172.44
	<i>For Class 3 Hail Rated, Add</i>	4.00	
	<i>For Polycarbonate Diffuser Lens, Add</i>	7.00	
	<i>For High Velocity Hurricane Zone Rated, Add</i>	14.00	
	<i>For FM Approved, Add</i>	20.00	
	<i>For 18 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	49.00	
	<i>For 14 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	69.00	
	<i>For Single Blade Louver, Add</i>	494.49	
08 63 00 00-0196	EA 8' Shaft Length, 31-5/8" x 31-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Solar Tube Skylight.....	980.54	176.27
	<i>For Class 3 Hail Rated, Add</i>	4.00	
	<i>For Polycarbonate Diffuser Lens, Add</i>	7.00	
	<i>For High Velocity Hurricane Zone Rated, Add</i>	14.00	
	<i>For FM Approved, Add</i>	20.00	
	<i>For 18 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	49.00	
	<i>For 14 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	69.00	
	<i>For Single Blade Louver, Add</i>	495.25	
08 63 00 00-0197	EA 9' Shaft Length, 31-5/8" x 31-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Solar Tube Skylight.....	1,039.20	180.10
	<i>For Class 3 Hail Rated, Add</i>	4.00	
	<i>For Polycarbonate Diffuser Lens, Add</i>	7.00	
	<i>For High Velocity Hurricane Zone Rated, Add</i>	14.00	
	<i>For FM Approved, Add</i>	20.00	
	<i>For 18 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	49.00	
	<i>For 14 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	69.00	
	<i>For Single Blade Louver, Add</i>	496.02	
08 63 00 00-0198	EA 10' Shaft Length, 31-5/8" x 31-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Solar Tube Skylight.....	1,075.87	183.93
	<i>For Class 3 Hail Rated, Add</i>	4.00	
	<i>For Polycarbonate Diffuser Lens, Add</i>	7.00	
	<i>For High Velocity Hurricane Zone Rated, Add</i>	14.00	
	<i>For FM Approved, Add</i>	20.00	
	<i>For 18 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	49.00	
	<i>For 14 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	69.00	
	<i>For Single Blade Louver, Add</i>	496.79	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 63 00 00-0199 EA 11' Shaft Length, 31-5/8" x 31-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Solar Tube Skylight.....	1,113.54	187.76
<i>For Class 3 Hail Rated, Add</i>	4.00	
<i>For Polycarbonate Diffuser Lens, Add</i>	7.00	
<i>For High Velocity Hurricane Zone Rated, Add</i>	14.00	
<i>For FM Approved, Add</i>	20.00	
<i>For 18 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	49.00	
<i>For 14 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	69.00	
<i>For Single Blade Louver, Add</i>	497.55	
08 63 00 00-0200 EA 12' Shaft Length, 31-5/8" x 31-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Solar Tube Skylight.....	1,150.20	191.59
<i>For Class 3 Hail Rated, Add</i>	4.00	
<i>For Polycarbonate Diffuser Lens, Add</i>	7.00	
<i>For High Velocity Hurricane Zone Rated, Add</i>	14.00	
<i>For FM Approved, Add</i>	20.00	
<i>For 18 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	49.00	
<i>For 14 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	69.00	
<i>For Single Blade Louver, Add</i>	498.32	
08 63 00 00-0201 EA 13' Shaft Length, 31-5/8" x 31-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Solar Tube Skylight.....	1,208.86	195.44
<i>For Class 3 Hail Rated, Add</i>	4.00	
<i>For Polycarbonate Diffuser Lens, Add</i>	7.00	
<i>For High Velocity Hurricane Zone Rated, Add</i>	14.00	
<i>For FM Approved, Add</i>	20.00	
<i>For 18 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	49.00	
<i>For 14 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	69.00	
<i>For Single Blade Louver, Add</i>	499.09	
08 63 00 00-0202 EA 14' Shaft Length, 31-5/8" x 31-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Solar Tube Skylight.....	1,245.52	199.27
<i>For Class 3 Hail Rated, Add</i>	4.00	
<i>For Polycarbonate Diffuser Lens, Add</i>	7.00	
<i>For High Velocity Hurricane Zone Rated, Add</i>	14.00	
<i>For FM Approved, Add</i>	20.00	
<i>For 18 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	49.00	
<i>For 14 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	69.00	
<i>For Single Blade Louver, Add</i>	499.85	
08 63 00 00-0203 EA 15' Shaft Length, 31-5/8" x 31-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Solar Tube Skylight.....	1,282.19	203.10
<i>For Class 3 Hail Rated, Add</i>	4.00	
<i>For Polycarbonate Diffuser Lens, Add</i>	7.00	
<i>For High Velocity Hurricane Zone Rated, Add</i>	14.00	
<i>For FM Approved, Add</i>	20.00	
<i>For 18 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	49.00	
<i>For 14 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	69.00	
<i>For Single Blade Louver, Add</i>	500.62	
08 63 00 00-0204 EA 16' Shaft Length, 31-5/8" x 31-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Solar Tube Skylight.....	1,318.85	206.93
<i>For Class 3 Hail Rated, Add</i>	4.00	
<i>For Polycarbonate Diffuser Lens, Add</i>	7.00	
<i>For High Velocity Hurricane Zone Rated, Add</i>	14.00	
<i>For FM Approved, Add</i>	20.00	
<i>For 18 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	49.00	
<i>For 14 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	69.00	
<i>For Single Blade Louver, Add</i>	501.39	
08 63 00 00-0205 31-5/8" x 55-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Solar Tube Skylights <small>(08 63 00 00-0188)</small>		
08 63 00 00-0206 EA 2' Shaft Length, 31-5/8" x 55-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Solar Tube Skylight.....	872.56	153.28
<i>For Class 3 Hail Rated, Add</i>	5.00	
<i>For Polycarbonate Diffuser Lens, Add</i>	8.00	
<i>For High Velocity Hurricane Zone Rated, Add</i>	14.00	
<i>For FM Approved, Add</i>	22.00	
<i>For 18 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	50.00	
<i>For 14 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	86.00	
<i>For Single Blade Louver, Add</i>	490.66	
08 63 00 00-0207 EA 3' Shaft Length, 31-5/8" x 55-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Solar Tube Skylight.....	923.23	157.11
<i>For Class 3 Hail Rated, Add</i>	5.00	
<i>For Polycarbonate Diffuser Lens, Add</i>	8.00	
<i>For High Velocity Hurricane Zone Rated, Add</i>	14.00	
<i>For FM Approved, Add</i>	22.00	
<i>For 18 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	50.00	
<i>For 14 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	86.00	
<i>For Single Blade Louver, Add</i>	491.42	
08 63 00 00-0208 EA 4' Shaft Length, 31-5/8" x 55-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Solar Tube Skylight.....	973.89	160.94
<i>For Class 3 Hail Rated, Add</i>	5.00	
<i>For Polycarbonate Diffuser Lens, Add</i>	8.00	
<i>For High Velocity Hurricane Zone Rated, Add</i>	14.00	
<i>For FM Approved, Add</i>	22.00	
<i>For 18 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	50.00	
<i>For 14 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	86.00	
<i>For Single Blade Louver, Add</i>	492.19	

08 Openings**08 60 Roof Windows And Skylights****08 63 Metal-Framed Skylights**

MINOR		TOTAL DIRECT	DEMOLITION
CSI	UOM DESCRIPTION	UNIT COST	UNIT COST
08 63 00 00-0209	EA 5' Shaft Length, 31-5/8" x 55-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Solar Tube Skylight.....	1,024.55	164.78
	<i>For Class 3 Hail Rated, Add</i>	5.00	
	<i>For Polycarbonate Diffuser Lens, Add</i>	8.00	
	<i>For High Velocity Hurricane Zone Rated, Add</i>	14.00	
	<i>For FM Approved, Add</i>	22.00	
	<i>For 18 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	50.00	
	<i>For 14 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	86.00	
	<i>For Single Blade Louver, Add</i>	492.96	
08 63 00 00-0210	EA 6' Shaft Length, 31-5/8" x 55-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Solar Tube Skylight.....	1,105.21	168.61
	<i>For Class 3 Hail Rated, Add</i>	5.00	
	<i>For Polycarbonate Diffuser Lens, Add</i>	8.00	
	<i>For High Velocity Hurricane Zone Rated, Add</i>	14.00	
	<i>For FM Approved, Add</i>	22.00	
	<i>For 18 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	50.00	
	<i>For 14 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	86.00	
	<i>For Single Blade Louver, Add</i>	493.72	
08 63 00 00-0211	EA 7' Shaft Length, 31-5/8" x 55-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Solar Tube Skylight.....	1,155.88	172.44
	<i>For Class 3 Hail Rated, Add</i>	5.00	
	<i>For Polycarbonate Diffuser Lens, Add</i>	8.00	
	<i>For High Velocity Hurricane Zone Rated, Add</i>	14.00	
	<i>For FM Approved, Add</i>	22.00	
	<i>For 18 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	50.00	
	<i>For 14 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	86.00	
	<i>For Single Blade Louver, Add</i>	494.49	
08 63 00 00-0212	EA 8' Shaft Length, 31-5/8" x 55-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Solar Tube Skylight.....	1,206.54	176.27
	<i>For Class 3 Hail Rated, Add</i>	5.00	
	<i>For Polycarbonate Diffuser Lens, Add</i>	8.00	
	<i>For High Velocity Hurricane Zone Rated, Add</i>	14.00	
	<i>For FM Approved, Add</i>	22.00	
	<i>For 18 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	50.00	
	<i>For 14 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	86.00	
	<i>For Single Blade Louver, Add</i>	495.25	
08 63 00 00-0213	EA 9' Shaft Length, 31-5/8" x 55-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Solar Tube Skylight.....	1,287.20	180.10
	<i>For Class 3 Hail Rated, Add</i>	5.00	
	<i>For Polycarbonate Diffuser Lens, Add</i>	8.00	
	<i>For High Velocity Hurricane Zone Rated, Add</i>	14.00	
	<i>For FM Approved, Add</i>	22.00	
	<i>For 18 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	50.00	
	<i>For 14 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	86.00	
	<i>For Single Blade Louver, Add</i>	496.02	
08 63 00 00-0214	EA 10' Shaft Length, 31-5/8" x 55-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Solar Tube Skylight.....	1,337.87	183.93
	<i>For Class 3 Hail Rated, Add</i>	5.00	
	<i>For Polycarbonate Diffuser Lens, Add</i>	8.00	
	<i>For High Velocity Hurricane Zone Rated, Add</i>	14.00	
	<i>For FM Approved, Add</i>	22.00	
	<i>For 18 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	50.00	
	<i>For 14 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	86.00	
	<i>For Single Blade Louver, Add</i>	496.79	
08 63 00 00-0215	EA 11' Shaft Length, 31-5/8" x 55-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Solar Tube Skylight.....	1,388.54	187.76
	<i>For Class 3 Hail Rated, Add</i>	5.00	
	<i>For Polycarbonate Diffuser Lens, Add</i>	8.00	
	<i>For High Velocity Hurricane Zone Rated, Add</i>	14.00	
	<i>For FM Approved, Add</i>	22.00	
	<i>For 18 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	50.00	
	<i>For 14 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	86.00	
	<i>For Single Blade Louver, Add</i>	497.55	
08 63 00 00-0216	EA 12' Shaft Length, 31-5/8" x 55-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Solar Tube Skylight.....	1,439.20	191.59
	<i>For Class 3 Hail Rated, Add</i>	5.00	
	<i>For Polycarbonate Diffuser Lens, Add</i>	8.00	
	<i>For High Velocity Hurricane Zone Rated, Add</i>	14.00	
	<i>For FM Approved, Add</i>	22.00	
	<i>For 18 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	50.00	
	<i>For 14 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	86.00	
	<i>For Single Blade Louver, Add</i>	498.32	
08 63 00 00-0217	EA 13' Shaft Length, 31-5/8" x 55-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Solar Tube Skylight.....	1,519.86	195.44
	<i>For Class 3 Hail Rated, Add</i>	5.00	
	<i>For Polycarbonate Diffuser Lens, Add</i>	8.00	
	<i>For High Velocity Hurricane Zone Rated, Add</i>	14.00	
	<i>For FM Approved, Add</i>	22.00	
	<i>For 18 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	50.00	
	<i>For 14 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	86.00	
	<i>For Single Blade Louver, Add</i>	499.09	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 63 00 00-0218	EA			14' Shaft Length, 31-5/8" x 55-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Solar Tube Skylight.....	1,570.52	199.27
				<i>For Class 3 Hail Rated, Add</i>	5.00	
				<i>For Polycarbonate Diffuser Lens, Add</i>	8.00	
				<i>For High Velocity Hurricane Zone Rated, Add</i>	14.00	
				<i>For FM Approved, Add</i>	22.00	
				<i>For 18 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	50.00	
				<i>For 14 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	86.00	
				<i>For Single Blade Louver, Add</i>	499.85	
08 63 00 00-0219	EA			15' Shaft Length, 31-5/8" x 55-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Solar Tube Skylight.....	1,621.19	203.10
				<i>For Class 3 Hail Rated, Add</i>	5.00	
				<i>For Polycarbonate Diffuser Lens, Add</i>	8.00	
				<i>For High Velocity Hurricane Zone Rated, Add</i>	14.00	
				<i>For FM Approved, Add</i>	22.00	
				<i>For 18 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	50.00	
				<i>For 14 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	86.00	
				<i>For Single Blade Louver, Add</i>	500.62	
08 63 00 00-0220	EA			16' Shaft Length, 31-5/8" x 55-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Solar Tube Skylight.....	1,671.85	206.93
				<i>For Class 3 Hail Rated, Add</i>	5.00	
				<i>For Polycarbonate Diffuser Lens, Add</i>	8.00	
				<i>For High Velocity Hurricane Zone Rated, Add</i>	14.00	
				<i>For FM Approved, Add</i>	22.00	
				<i>For 18 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	50.00	
				<i>For 14 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	86.00	
				<i>For Single Blade Louver, Add</i>	501.39	
08 63 00 00-0221				55-5/8" x 55-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Solar Tube Skylights <small>(08 63 00 00-0188)</small>		
08 63 00 00-0222	EA			2' Shaft Length, 55-5/8" x 55-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Solar Tube Skylight.....	1,143.88	172.44
				<i>For Class 3 Hail Rated, Add</i>	10.00	
				<i>For Polycarbonate Diffuser Lens, Add</i>	14.00	
				<i>For High Velocity Hurricane Zone Rated, Add</i>	22.00	
				<i>For FM Approved, Add</i>	36.00	
				<i>For 18 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	95.00	
				<i>For 14 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	145.00	
				<i>For Single Blade Louver, Add</i>	494.49	
08 63 00 00-0223	EA			3' Shaft Length, 55-5/8" x 55-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Solar Tube Skylight.....	1,213.54	176.27
				<i>For Class 3 Hail Rated, Add</i>	10.00	
				<i>For Polycarbonate Diffuser Lens, Add</i>	14.00	
				<i>For High Velocity Hurricane Zone Rated, Add</i>	22.00	
				<i>For FM Approved, Add</i>	36.00	
				<i>For 18 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	95.00	
				<i>For 14 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	145.00	
				<i>For Single Blade Louver, Add</i>	495.25	
08 63 00 00-0224	EA			4' Shaft Length, 55-5/8" x 55-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Solar Tube Skylight.....	1,284.20	180.10
				<i>For Class 3 Hail Rated, Add</i>	10.00	
				<i>For Polycarbonate Diffuser Lens, Add</i>	14.00	
				<i>For High Velocity Hurricane Zone Rated, Add</i>	22.00	
				<i>For FM Approved, Add</i>	36.00	
				<i>For 18 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	95.00	
				<i>For 14 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	145.00	
				<i>For Single Blade Louver, Add</i>	496.02	
08 63 00 00-0225	EA			5' Shaft Length, 55-5/8" x 55-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Solar Tube Skylight.....	1,353.87	183.93
				<i>For Class 3 Hail Rated, Add</i>	10.00	
				<i>For Polycarbonate Diffuser Lens, Add</i>	14.00	
				<i>For High Velocity Hurricane Zone Rated, Add</i>	22.00	
				<i>For FM Approved, Add</i>	36.00	
				<i>For 18 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	95.00	
				<i>For 14 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	145.00	
				<i>For Single Blade Louver, Add</i>	496.79	
08 63 00 00-0226	EA			6' Shaft Length, 55-5/8" x 55-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Solar Tube Skylight.....	1,463.54	187.76
				<i>For Class 3 Hail Rated, Add</i>	10.00	
				<i>For Polycarbonate Diffuser Lens, Add</i>	14.00	
				<i>For High Velocity Hurricane Zone Rated, Add</i>	22.00	
				<i>For FM Approved, Add</i>	36.00	
				<i>For 18 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	95.00	
				<i>For 14 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	145.00	
				<i>For Single Blade Louver, Add</i>	497.55	
08 63 00 00-0227	EA			7' Shaft Length, 55-5/8" x 55-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Solar Tube Skylight.....	1,533.20	191.59
				<i>For Class 3 Hail Rated, Add</i>	10.00	
				<i>For Polycarbonate Diffuser Lens, Add</i>	14.00	
				<i>For High Velocity Hurricane Zone Rated, Add</i>	22.00	
				<i>For FM Approved, Add</i>	36.00	
				<i>For 18 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	95.00	
				<i>For 14 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	145.00	
				<i>For Single Blade Louver, Add</i>	498.32	

08 Openings**08 60 Roof Windows And Skylights****08 63 Metal-Framed Skylights**

MINOR		TOTAL DIRECT	DEMOLITION
CSI	UOM DESCRIPTION	UNIT COST	UNIT COST
08 63 00 00-0228	EA 8' Shaft Length, 55-5/8" x 55-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Solar Tube Skylight.....	1,602.86	195.44
	<i>For Class 3 Hail Rated, Add</i>	10.00	
	<i>For Polycarbonate Diffuser Lens, Add</i>	14.00	
	<i>For High Velocity Hurricane Zone Rated, Add</i>	22.00	
	<i>For FM Approved, Add</i>	36.00	
	<i>For 18 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	95.00	
	<i>For 14 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	145.00	
	<i>For Single Blade Louver, Add</i>	499.09	
08 63 00 00-0229	EA 9' Shaft Length, 55-5/8" x 55-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Solar Tube Skylight.....	1,713.52	199.27
	<i>For Class 3 Hail Rated, Add</i>	10.00	
	<i>For Polycarbonate Diffuser Lens, Add</i>	14.00	
	<i>For High Velocity Hurricane Zone Rated, Add</i>	22.00	
	<i>For FM Approved, Add</i>	36.00	
	<i>For 18 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	95.00	
	<i>For 14 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	145.00	
	<i>For Single Blade Louver, Add</i>	499.85	
08 63 00 00-0230	EA 10' Shaft Length, 55-5/8" x 55-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Solar Tube Skylight.....	1,783.19	203.10
	<i>For Class 3 Hail Rated, Add</i>	10.00	
	<i>For Polycarbonate Diffuser Lens, Add</i>	14.00	
	<i>For High Velocity Hurricane Zone Rated, Add</i>	22.00	
	<i>For FM Approved, Add</i>	36.00	
	<i>For 18 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	95.00	
	<i>For 14 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	145.00	
	<i>For Single Blade Louver, Add</i>	500.62	
08 63 00 00-0231	EA 11' Shaft Length, 55-5/8" x 55-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Solar Tube Skylight.....	1,852.85	206.93
	<i>For Class 3 Hail Rated, Add</i>	10.00	
	<i>For Polycarbonate Diffuser Lens, Add</i>	14.00	
	<i>For High Velocity Hurricane Zone Rated, Add</i>	22.00	
	<i>For FM Approved, Add</i>	36.00	
	<i>For 18 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	95.00	
	<i>For 14 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	145.00	
	<i>For Single Blade Louver, Add</i>	501.39	
08 63 00 00-0232	EA 12' Shaft Length, 55-5/8" x 55-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Solar Tube Skylight.....	1,922.52	210.76
	<i>For Class 3 Hail Rated, Add</i>	10.00	
	<i>For Polycarbonate Diffuser Lens, Add</i>	14.00	
	<i>For High Velocity Hurricane Zone Rated, Add</i>	22.00	
	<i>For FM Approved, Add</i>	36.00	
	<i>For 18 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	95.00	
	<i>For 14 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	145.00	
	<i>For Single Blade Louver, Add</i>	502.15	
08 63 00 00-0233	EA 13' Shaft Length, 55-5/8" x 55-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Solar Tube Skylight.....	2,032.18	214.59
	<i>For Class 3 Hail Rated, Add</i>	10.00	
	<i>For Polycarbonate Diffuser Lens, Add</i>	14.00	
	<i>For High Velocity Hurricane Zone Rated, Add</i>	22.00	
	<i>For FM Approved, Add</i>	36.00	
	<i>For 18 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	95.00	
	<i>For 14 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	145.00	
	<i>For Single Blade Louver, Add</i>	502.92	
08 63 00 00-0234	EA 14' Shaft Length, 55-5/8" x 55-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Solar Tube Skylight.....	2,101.85	218.42
	<i>For Class 3 Hail Rated, Add</i>	10.00	
	<i>For Polycarbonate Diffuser Lens, Add</i>	14.00	
	<i>For High Velocity Hurricane Zone Rated, Add</i>	22.00	
	<i>For FM Approved, Add</i>	36.00	
	<i>For 18 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	95.00	
	<i>For 14 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	145.00	
	<i>For Single Blade Louver, Add</i>	503.69	
08 63 00 00-0235	EA 15' Shaft Length, 55-5/8" x 55-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Solar Tube Skylight.....	2,172.51	222.25
	<i>For Class 3 Hail Rated, Add</i>	10.00	
	<i>For Polycarbonate Diffuser Lens, Add</i>	14.00	
	<i>For High Velocity Hurricane Zone Rated, Add</i>	22.00	
	<i>For FM Approved, Add</i>	36.00	
	<i>For 18 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	95.00	
	<i>For 14 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	145.00	
	<i>For Single Blade Louver, Add</i>	504.45	
08 63 00 00-0236	EA 16' Shaft Length, 55-5/8" x 55-5/8" Inside Frame Dimensions, Acrylic/Acrylic Double Glazed Prismatic Lens, Industrial Style Fixed Dome, Aluminum Framed Solar Tube Skylight.....	2,242.17	226.09
	<i>For Class 3 Hail Rated, Add</i>	10.00	
	<i>For Polycarbonate Diffuser Lens, Add</i>	14.00	
	<i>For High Velocity Hurricane Zone Rated, Add</i>	22.00	
	<i>For FM Approved, Add</i>	36.00	
	<i>For 18 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	95.00	
	<i>For 14 Gauge, Insulated Galvanized Steel Roof Curb, Add</i>	145.00	
	<i>For Single Blade Louver, Add</i>	505.22	

08 65 Wood-Framed Skylights (08 60)**08 65 00 00-0001 Wood-Framed Skylights (Andersen 400 Series)** (08 65)



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 65 00 00-0002 EA 16-1/2" x 38", Domed, Wood-Framed Skylight (Andersen 400 Series).....	345.68	89.84
For Tempered Laminated Low-E Insulated Glass, Add	41.50	
For Aluminum Shingle Flashing, Add	33.20	
08 65 00 00-0003 EA 16-1/2" x 46", Domed, Wood-Framed Skylight (Andersen 400 Series).....	352.45	89.84
For Tempered Laminated Low-E Insulated Glass, Add	43.19	
For Aluminum Shingle Flashing, Add	34.55	
08 65 00 00-0004 EA 24-1/2" x 27", Domed, Wood-Framed Skylight (Andersen 400 Series).....	336.36	89.84
For Tempered Laminated Low-E Insulated Glass, Add	39.17	
For Aluminum Shingle Flashing, Add	31.34	
08 65 00 00-0005 EA 24-1/2" x 38", Domed, Wood-Framed Skylight (Andersen 400 Series).....	357.53	89.84
For Tempered Laminated Low-E Insulated Glass, Add	44.46	
For Aluminum Shingle Flashing, Add	35.57	
08 65 00 00-0006 EA 24-1/2" x 46", Domed, Wood-Framed Skylight (Andersen 400 Series).....	375.32	89.84
For Tempered Laminated Low-E Insulated Glass, Add	48.91	
For Aluminum Shingle Flashing, Add	39.13	
08 65 00 00-0007 EA 24-1/2" x 57", Domed, Wood-Framed Skylight (Andersen 400 Series).....	404.12	89.84
For Tempered Laminated Low-E Insulated Glass, Add	56.11	
For Aluminum Shingle Flashing, Add	44.89	
08 65 00 00-0008 EA 24-1/2" x 72", Domed, Wood-Framed Skylight (Andersen 400 Series).....	440.53	89.84
For Tempered Laminated Low-E Insulated Glass, Add	65.21	
For Aluminum Shingle Flashing, Add	52.17	
08 65 00 00-0009 EA 27" x 24-1/2", Domed, Wood-Framed Skylight (Andersen 400 Series).....	336.36	89.84
For Tempered Laminated Low-E Insulated Glass, Add	39.17	
For Aluminum Shingle Flashing, Add	31.34	
08 65 00 00-0010 EA 28" x 38", Domed, Wood-Framed Skylight (Andersen 400 Series).....	379.55	89.84
For Tempered Laminated Low-E Insulated Glass, Add	49.97	
For Aluminum Shingle Flashing, Add	39.97	
08 65 00 00-0011 EA 28" x 46", Domed, Wood-Framed Skylight (Andersen 400 Series).....	404.12	89.84
For Tempered Laminated Low-E Insulated Glass, Add	56.11	
For Aluminum Shingle Flashing, Add	44.89	
08 65 00 00-0012 EA 28" x 57", Domed, Wood-Framed Skylight (Andersen 400 Series).....	432.06	89.84
For Tempered Laminated Low-E Insulated Glass, Add	63.10	
For Aluminum Shingle Flashing, Add	50.48	
08 65 00 00-0013 EA 28" x 72", Domed, Wood-Framed Skylight (Andersen 400 Series).....	469.33	89.84
For Tempered Laminated Low-E Insulated Glass, Add	72.41	
For Aluminum Shingle Flashing, Add	57.93	
08 65 00 00-0014 EA 38" x 16-1/2", Domed, Wood-Framed Skylight (Andersen 400 Series).....	345.68	89.84
For Tempered Laminated Low-E Insulated Glass, Add	41.50	
For Aluminum Shingle Flashing, Add	33.20	
08 65 00 00-0015 EA 38" x 24-1/2", Domed, Wood-Framed Skylight (Andersen 400 Series).....	357.53	89.84
For Tempered Laminated Low-E Insulated Glass, Add	44.46	
For Aluminum Shingle Flashing, Add	35.57	
08 65 00 00-0016 EA 38" x 28", Domed, Wood-Framed Skylight (Andersen 400 Series).....	379.55	89.84
For Tempered Laminated Low-E Insulated Glass, Add	49.97	
For Aluminum Shingle Flashing, Add	39.97	
08 65 00 00-0017 EA 44" x 46", Domed, Wood-Framed Skylight (Andersen 400 Series).....	457.47	89.84
For Tempered Laminated Low-E Insulated Glass, Add	69.45	
For Aluminum Shingle Flashing, Add	55.56	
08 65 00 00-0018 EA 46" x 16-1/2", Domed, Wood-Framed Skylight (Andersen 400 Series).....	352.45	89.84
For Tempered Laminated Low-E Insulated Glass, Add	43.19	
For Aluminum Shingle Flashing, Add	34.55	
08 65 00 00-0019 EA 46" x 24-1/2", Domed, Wood-Framed Skylight (Andersen 400 Series).....	375.32	89.84
For Tempered Laminated Low-E Insulated Glass, Add	48.91	
For Aluminum Shingle Flashing, Add	39.13	
08 65 00 00-0020 EA 46" x 28", Domed, Wood-Framed Skylight (Andersen 400 Series).....	404.12	89.84
For Tempered Laminated Low-E Insulated Glass, Add	56.11	
For Aluminum Shingle Flashing, Add	44.89	
08 65 00 00-0021 EA 46" x 44", Domed, Wood-Framed Skylight (Andersen 400 Series).....	457.47	89.84
For Tempered Laminated Low-E Insulated Glass, Add	69.45	
For Aluminum Shingle Flashing, Add	55.56	
08 65 00 00-0022 EA 57" x 24-1/2", Domed, Wood-Framed Skylight (Andersen 400 Series).....	404.12	89.84
For Tempered Laminated Low-E Insulated Glass, Add	56.11	
For Aluminum Shingle Flashing, Add	44.89	
08 65 00 00-0023 EA 57" x 28", Domed, Wood-Framed Skylight (Andersen 400 Series).....	432.06	89.84
For Tempered Laminated Low-E Insulated Glass, Add	63.10	
For Aluminum Shingle Flashing, Add	50.48	
08 65 00 00-0024 EA 72" x 24-1/2", Domed, Wood-Framed Skylight (Andersen 400 Series).....	440.53	89.84
For Tempered Laminated Low-E Insulated Glass, Add	65.21	
For Aluminum Shingle Flashing, Add	52.17	
08 65 00 00-0025 EA 72" x 28", Domed, Wood-Framed Skylight (Andersen 400 Series).....	469.33	89.84
For Tempered Laminated Low-E Insulated Glass, Add	72.41	
For Aluminum Shingle Flashing, Add	57.93	

08 70 Hardware ⁽⁰⁸⁾

08 71 Door Hardware ^(08 70)

08 71 13 Automatic Door Operators ^(08 71)

08 71 13 00-0001 Automatic Door Operators (LCN) ^(08 71 13)

08 71 13 00-0002 EA	Automatic Door Operator, Surface Mount ADA Door Operator With Pull Arm (LCN 9531)	2,059.38	
Note: Opens doors automatically for wheelchair access, and allows for manual operation for regular pedestrian traffic.			

08 Openings**08 70 Hardware****08 71 Door Hardware**

MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
08 71 13 00-0003	EA	Automatic Door Operator, Surface Mount ADA Door Operator With Push Arm (LCN 9542) Note: Opens doors automatically for wheelchair access, and allows for manual operation for regular pedestrian traffic.	2,059.38		
08 71 16 Door Hardware (08 71)					
Note: All hardware is ANSI/BHMA Grade 1 unless otherwise noted.					
08 71 16 00-0001		Hinges (08 71 16) Note: Unit of measure "PR" indicates that two (2) sets of hinges (top and bottom) are priced. For doors with three (3) sets of hinges (top, middle and bottom), use 1.5 pairs.			
08 71 16 00-0002		Brass/Bronze, Satin Chrome Finish Hinges (08 71 16 00-0001) Note: US26D (BHMA 626) satin chrome finish.			
08 71 16 00-0003		Standard Duty, Full Mortise, Plain Bearing, Brass/Bronze, Satin Chrome Finish Hinges (08 71 16 00-0002) Note: Mortised into the edge of the door and mortised into the rabbet edge of the frame.			
08 71 16 00-0004	PR	3-1/2" x 3-1/2" Standard Duty, Full Mortise, Plain Bearing, Brass/Bronze, Satin Chrome Finish Hinge..... <i>For Clear Coated Bright Brass, Add</i> <i>For Pair Of Non-Removable Pins (NRP), Add</i>	54.50 3.91 6.00		5.03
08 71 16 00-0005	PR	4" x 4" Standard Duty, Full Mortise, Plain Bearing, Brass/Bronze, Satin Chrome Finish Hinge..... <i>For Clear Coated Bright Brass, Add</i> <i>For Pair Of Non-Removable Pins (NRP), Add</i>	59.79 4.35 6.00		7.18
08 71 16 00-0006	PR	4-1/2" x 4-1/2" Standard Duty, Full Mortise, Plain Bearing, Brass/Bronze, Satin Chrome Finish Hinge..... <i>For Clear Coated Bright Brass, Add</i> <i>For Pair Of Non-Removable Pins (NRP), Add</i>	67.03 3.63 6.00		7.91
08 71 16 00-0007		Standard Duty, Full Mortise, Ball Bearing, Brass/Bronze, Satin Chrome Finish Hinges (08 71 16 00-0002) Note: Mortised into the edge of the door and mortised into the rabbet edge of the frame.			
08 71 16 00-0008	PR	3-1/2" x 3-1/2" Standard Duty, Full Mortise, Ball Bearing, Brass/Bronze, Satin Chrome Finish Hinge..... <i>For Clear Coated Bright Brass, Add</i> <i>For Pair Of Non-Removable Pins (NRP), Add</i>	62.90 5.01 6.00		5.03
08 71 16 00-0009	PR	4" x 4" Standard Duty, Full Mortise, Ball Bearing, Brass/Bronze, Satin Chrome Finish Hinge..... <i>For Clear Coated Bright Brass, Add</i> <i>For Pair Of Non-Removable Pins (NRP), Add</i>	71.72 5.01 6.00		7.18
08 71 16 00-0010	PR	4-1/2" x 4-1/2" Standard Duty, Full Mortise, Ball Bearing, Brass/Bronze, Satin Chrome Finish Hinge..... <i>For Clear Coated Bright Brass, Add</i> <i>For Pair Of Non-Removable Pins (NRP), Add</i>	72.68 4.43 6.00		7.91
08 71 16 00-0011	PR	5" x 4-1/2" Standard Duty, Full Mortise, Ball Bearing, Brass/Bronze, Satin Chrome Finish Hinge..... <i>For Clear Coated Bright Brass, Add</i> <i>For Pair Of Non-Removable Pins (NRP), Add</i>	84.91 5.18 6.00		9.34
08 71 16 00-0012	PR	5" x 5" Standard Duty, Full Mortise, Ball Bearing, Brass/Bronze, Satin Chrome Finish Hinge..... <i>For Clear Coated Bright Brass, Add</i> <i>For Pair Of Non-Removable Pins (NRP), Add</i>	85.47 5.26 6.00		9.34
08 71 16 00-0013	PR	6" x 5" Standard Duty, Full Mortise, Ball Bearing, Brass/Bronze, Satin Chrome Finish Hinge..... <i>For Clear Coated Bright Brass, Add</i> <i>For Pair Of Non-Removable Pins (NRP), Add</i>	91.91 6.16 6.00		12.00
08 71 16 00-0014		Standard Duty, Full Mortise, Concealed Ball Bearing, Brass/Bronze, Satin Chrome Finish Hinges (08 71 16 00-0002) Note: Mortised into the edge of the door and mortised into the rabbet edge of the frame.			
08 71 16 00-0015	PR	3-1/2" x 3-1/2", Standard Duty, Full Mortise, Concealed Ball Bearing, Brass/Bronze, Satin Chrome Finish Hinge	71.52		5.03
08 71 16 00-0016	PR	4" x 4", Standard Duty, Full Mortise, Concealed Ball Bearing, Brass/Bronze, Satin Chrome Finish Hinge.....	80.34		7.18
08 71 16 00-0017	PR	4-1/2" x 4-1/2", Standard Duty, Full Mortise, Concealed Ball Bearing, Brass/Bronze, Satin Chrome Finish Hinge	82.06		7.91
08 71 16 00-0018	PR	5" x 4", Standard Duty, Full Mortise, Concealed Ball Bearing, Brass/Bronze, Satin Chrome Finish Hinge.....	95.25		9.34
08 71 16 00-0019		Standard Duty, Half Surface, Ball Bearing, Brass/Bronze, Satin Chrome Finish Hinges (08 71 16 00-0002) Note: Surface mounted to the face of the door and mortised into the rabbet edge of the frame.			
08 71 16 00-0020	PR	4-1/2" x 4-1/2" Standard Duty, Half Surface, Ball Bearing, Brass/Bronze, Satin Chrome Finish Hinge	141.93		7.91
		<i>For Clear Coated Bright Brass, Add</i>	14.12		
		<i>For Pair Of Non-Removable Pins (NRP), Add</i>	6.00		
08 71 16 00-0021	PR	5" x 4" Standard Duty, Half Surface, Ball Bearing, Brass/Bronze, Satin Chrome Finish Hinge.....	159.85		9.34
		<i>For Clear Coated Bright Brass, Add</i>	15.67		
		<i>For Pair Of Non-Removable Pins (NRP), Add</i>	6.00		
08 71 16 00-0022	PR	5" x 5" Standard Duty, Half Surface, Ball Bearing, Brass/Bronze, Satin Chrome Finish Hinge.....	91.09		9.34
		<i>For Clear Coated Bright Brass, Add</i>	6.05		
		<i>For Pair Of Non-Removable Pins (NRP), Add</i>	6.00		
08 71 16 00-0023		Standard Duty, Half Mortise, Ball Bearing, Brass/Bronze, Satin Chrome Finish Hinges (08 71 16 00-0002) Note: Mortised into the edge of the door and surface applied to the face of the frame.			
08 71 16 00-0024	PR	4-1/2" x 4-1/2" Standard Duty, Half Mortise, Ball Bearing, Brass/Bronze, Satin Chrome Finish Hinge.....	129.03		7.91
		<i>For Clear Coated Bright Brass, Add</i>	12.31		
		<i>For Pair Of Non-Removable Pins (NRP), Add</i>	6.00		



Openings	08	08
Hardware	08 70	
Door Hardware	08 71	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-0025 PR 5" x 4" Standard Duty, Half Mortise, Ball Bearing, Brass/Bronze, Satin Chrome Finish Hinge..... <i>For Clear Coated Bright Brass, Add</i> <i>For Pair Of Non-Removable Pins (NRP), Add</i>	152.31 14.62 6.00	9.34
08 71 16 00-0026 Heavy Duty, Full Mortise, Plain Bearing, Brass/Bronze Satin Chrome Finish Hinge <small>(08 71 16 00-0002)</small> Note: Mortised into the edge of the door and mortised into the rabbet edge of the frame.		
08 71 16 00-0027 PR 4-1/2" x 4-1/2" Heavy Duty, Full Mortise, Plain Bearing, Brass/Bronze, Satin Chrome Finish Hinge..... <i>For Clear Coated Bright Brass, Add</i> <i>For Pair Of Non-Removable Pins (NRP), Add</i>	91.01 6.99 6.00	7.91
08 71 16 00-0028 PR 5" x 5" Heavy Duty, Full Mortise, Plain Bearing, Brass/Bronze, Satin Chrome Finish Hinge..... <i>For Clear Coated Bright Brass, Add</i> <i>For Pair Of Non-Removable Pins (NRP), Add</i>	105.17 8.02 6.00	12.00
08 71 16 00-0029 PR 6" x 5" Heavy Duty, Full Mortise, Plain Bearing, Brass/Bronze, Satin Chrome Finish Hinge..... <i>For Clear Coated Bright Brass, Add</i> <i>For Pair Of Non-Removable Pins (NRP), Add</i>	144.93 13.58 6.00	12.00
08 71 16 00-0030 Mortised, Wrought Steel Hinges <small>(08 71 16 00-0001)</small> Note: Clear coated, US 26D satin chrome finish (BHMA 652).		
08 71 16 00-0031 Full Mortise, Plain Bearing, Wrought Steel Hinges <small>(08 71 16 00-0030)</small> Note: Mortised into the edge of the door and mortised into the rabbet edge of the frame.		
08 71 16 00-0032 PR 3-1/2" x 3-1/2", Standard Duty, Full Mortise, Plain Bearing, Wrought Steel Hinge..... <i>For Primed For Paint Finish, Deduct</i> <i>For Bright Chrome Plated Finish US26 (BHMA 625), Add</i> <i>For Satin Brass Plated Clear Coated Finish, Deduct</i> <i>For Stainless Steel, Add</i> <i>For Heavy Duty, Add</i> <i>For Extra Heavy Duty, Add</i> <i>For Pair Of Non-Removable Pins (NRP), Add</i>	33.04 -1.18 0.74 -0.71 3.26 0.89 2.37 6.00	5.03
08 71 16 00-0033 PR 4" x 4", Standard Duty, Full Mortise, Plain Bearing, Wrought Steel Hinge..... <i>For Primed For Paint Finish, Deduct</i> <i>For Bright Chrome Plated Finish US26 (BHMA 625), Add</i> <i>For Satin Brass Plated Clear Coated Finish, Deduct</i> <i>For Stainless Steel, Add</i> <i>For Heavy Duty, Add</i> <i>For Extra Heavy Duty, Add</i> <i>For Pair Of Non-Removable Pins (NRP), Add</i>	42.47 -1.31 0.82 -0.78 3.59 0.98 2.61 6.00	7.18
08 71 16 00-0034 PR 4-1/2" x 4-1/2", Standard Duty, Full Mortise, Plain Bearing, Wrought Steel Hinge..... <i>For Primed For Paint Finish, Deduct</i> <i>For Bright Chrome Plated Finish US26 (BHMA 625), Add</i> <i>For Satin Brass Plated Clear Coated Finish, Deduct</i> <i>For Stainless Steel, Add</i> <i>For Heavy Duty, Add</i> <i>For Extra Heavy Duty, Add</i> <i>For Pair Of Non-Removable Pins (NRP), Add</i>	49.03 -1.59 1.00 -0.96 4.38 1.19 3.18 6.00	7.91
08 71 16 00-0035 Full Mortise, Ball Bearing, Wrought Steel Hinges <small>(08 71 16 00-0030)</small> Note: Mortised into the edge of the door and mortised into the rabbet edge of the frame.		
08 71 16 00-0036 PR 3-1/2" x 3-1/2", Standard Duty, Full Mortise, Ball Bearing, Wrought Steel Hinge..... <i>For Primed For Paint Finish, Deduct</i> <i>For Bright Chrome Plated Finish US26 (BHMA 625), Add</i> <i>For Satin Brass Plated Clear Coated Finish, Deduct</i> <i>For Stainless Steel, Add</i> <i>For Heavy Duty, Add</i> <i>For Extra Heavy Duty, Add</i> <i>For Pair Of Non-Removable Pins (NRP), Add</i>	48.69 -4.31 2.70 -2.59 11.86 3.24 8.63 6.00	5.03
08 71 16 00-0037 PR 4" x 4", Standard Duty, Full Mortise, Ball Bearing, Wrought Steel Hinge..... <i>For Primed For Paint Finish, Deduct</i> <i>For Bright Chrome Plated Finish US26 (BHMA 625), Add</i> <i>For Satin Brass Plated Clear Coated Finish, Deduct</i> <i>For Stainless Steel, Add</i> <i>For Heavy Duty, Add</i> <i>For Extra Heavy Duty, Add</i> <i>For Pair Of Non-Removable Pins (NRP), Add</i>	60.36 -4.88 3.05 -2.93 13.43 3.66 9.77 6.00	7.18
08 71 16 00-0038 PR 4-1/2" x 4-1/2", Standard Duty, Full Mortise, Ball Bearing, Wrought Steel Hinge..... <i>For Primed For Paint Finish, Deduct</i> <i>For Bright Chrome Plated Finish US26 (BHMA 625), Add</i> <i>For Satin Brass Plated Clear Coated Finish, Deduct</i> <i>For Stainless Steel, Add</i> <i>For Heavy Duty, Add</i> <i>For Extra Heavy Duty, Add</i> <i>For Pair Of Non-Removable Pins (NRP), Add</i>	55.72 -2.93 1.83 -1.76 8.06 2.20 5.86 6.00	7.91
08 71 16 00-0039 PR 5" x 4-1/2", Standard Duty, Full Mortise, Ball Bearing, Wrought Steel Hinge..... <i>For Primed For Paint Finish, Deduct</i> <i>For Bright Chrome Plated Finish US26 (BHMA 625), Add</i> <i>For Satin Brass Plated Clear Coated Finish, Deduct</i> <i>For Stainless Steel, Add</i> <i>For Heavy Duty, Add</i> <i>For Extra Heavy Duty, Add</i> <i>For Pair Of Non-Removable Pins (NRP), Add</i>	83.62 -7.14 4.46 -4.29 19.64 5.36 14.28 6.00	9.34

08 Openings**08 70 Hardware****08 71 Door Hardware**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-0040	PR		5" x 5", Standard Duty, Full Mortise, Ball Bearing, Wrought Steel Hinge.....	88.66	9.34
			<i>For Primed For Paint Finish, Deduct</i>	-8.15	
			<i>For Bright Chrome Plated Finish US26 (BHMA 625), Add</i>	5.09	
			<i>For Satin Brass Plated Clear Coated Finish, Deduct</i>	-4.89	
			<i>For Stainless Steel, Add</i>	22.41	
			<i>For Heavy Duty, Add</i>	6.11	
			<i>For Extra Heavy Duty, Add</i>	16.30	
			<i>For Pair Of Non-Removable Pins (NRP), Add</i>	6.00	
08 71 16 00-0041	PR		6" x 5", Standard Duty, Full Mortise, Ball Bearing, Wrought Steel Hinge.....	104.02	9.34
			<i>For Primed For Paint Finish, Deduct</i>	-11.22	
			<i>For Bright Chrome Plated Finish US26 (BHMA 625), Add</i>	7.01	
			<i>For Satin Brass Plated Clear Coated Finish, Deduct</i>	-6.73	
			<i>For Stainless Steel, Add</i>	30.86	
			<i>For Heavy Duty, Add</i>	8.42	
			<i>For Extra Heavy Duty, Add</i>	22.44	
			<i>For Pair Of Non-Removable Pins (NRP), Add</i>	6.00	
08 71 16 00-0042			Half Surface, Plain Bearing, Wrought Steel Hinges <small>(08 71 16 00-0030)</small>		
			Note: Surface mounted to the face of the door and mortised into the rabbit edge of the frame.		
08 71 16 00-0043	PR		3-1/2" x 3-1/2", Standard Duty, Half Surface, Plain Bearing, Wrought Steel Hinge.....	57.73	5.03
			<i>For Primed For Paint Finish, Deduct</i>	-6.12	
			<i>For Bright Chrome Plated Finish US26 (BHMA 625), Add</i>	3.83	
			<i>For Satin Brass Plated Clear Coated Finish, Deduct</i>	-3.67	
			<i>For Stainless Steel, Add</i>	16.84	
			<i>For Heavy Duty, Add</i>	4.59	
			<i>For Extra Heavy Duty, Add</i>	12.24	
			<i>For Pair Of Non-Removable Pins (NRP), Add</i>	6.00	
08 71 16 00-0044	PR		4" x 4", Standard Duty, Half Surface, Plain Bearing, Wrought Steel Hinge.....	70.63	7.18
			<i>For Primed For Paint Finish, Deduct</i>	-6.94	
			<i>For Bright Chrome Plated Finish US26 (BHMA 625), Add</i>	4.34	
			<i>For Satin Brass Plated Clear Coated Finish, Deduct</i>	-4.16	
			<i>For Stainless Steel, Add</i>	19.08	
			<i>For Heavy Duty, Add</i>	5.20	
			<i>For Extra Heavy Duty, Add</i>	13.88	
			<i>For Pair Of Non-Removable Pins (NRP), Add</i>	6.00	
08 71 16 00-0045	PR		4-1/2" x 4-1/2", Standard Duty, Half Surface, Plain Bearing, Wrought Steel Hinge.....	79.84	7.91
			<i>For Primed For Paint Finish, Deduct</i>	-7.75	
			<i>For Bright Chrome Plated Finish US26 (BHMA 625), Add</i>	4.85	
			<i>For Satin Brass Plated Clear Coated Finish, Deduct</i>	-4.65	
			<i>For Stainless Steel, Add</i>	21.32	
			<i>For Heavy Duty, Add</i>	5.82	
			<i>For Extra Heavy Duty, Add</i>	15.51	
			<i>For Pair Of Non-Removable Pins (NRP), Add</i>	6.00	
08 71 16 00-0046	PR		5" x 4-1/2", Standard Duty, Half Surface, Plain Bearing, Wrought Steel Hinge.....	90.76	9.34
			<i>For Primed For Paint Finish, Deduct</i>	-8.57	
			<i>For Bright Chrome Plated Finish US26 (BHMA 625), Add</i>	5.36	
			<i>For Satin Brass Plated Clear Coated Finish, Deduct</i>	-5.14	
			<i>For Stainless Steel, Add</i>	23.57	
			<i>For Heavy Duty, Add</i>	6.43	
			<i>For Extra Heavy Duty, Add</i>	17.14	
			<i>For Pair Of Non-Removable Pins (NRP), Add</i>	6.00	
08 71 16 00-0047			Half Surface, Ball Bearing, Wrought Steel Hinges <small>(08 71 16 00-0030)</small>		
			Note: Surface mounted to the face of the door and mortised into the rabbit edge of the frame.		
08 71 16 00-0048	PR		4" x 4", Standard Duty, Half Surface, Ball Bearing, Wrought Steel Hinge.....	79.81	7.91
			<i>For Primed For Paint Finish, Deduct</i>	-8.77	
			<i>For Bright Chrome Plated Finish US26 (BHMA 625), Add</i>	5.48	
			<i>For Satin Brass Plated Clear Coated Finish, Deduct</i>	-5.26	
			<i>For Stainless Steel, Add</i>	24.13	
			<i>For Heavy Duty, Add</i>	6.58	
			<i>For Extra Heavy Duty, Add</i>	17.55	
			<i>For Pair Of Non-Removable Pins (NRP), Add</i>	6.00	
08 71 16 00-0049	PR		4-1/2" x 4-1/2", Standard Duty, Half Surface, Ball Bearing, Wrought Steel Hinge.....	89.61	7.91
			<i>For Primed For Paint Finish, Deduct</i>	-9.71	
			<i>For Bright Chrome Plated Finish US26 (BHMA 625), Add</i>	6.07	
			<i>For Satin Brass Plated Clear Coated Finish, Deduct</i>	-5.82	
			<i>For Stainless Steel, Add</i>	26.70	
			<i>For Heavy Duty, Add</i>	7.28	
			<i>For Extra Heavy Duty, Add</i>	19.42	
			<i>For Pair Of Non-Removable Pins (NRP), Add</i>	6.00	
08 71 16 00-0050	PR		5" x 5", Standard Duty, Half Surface, Ball Bearing, Wrought Steel Hinge.....	104.02	9.34
			<i>For Primed For Paint Finish, Deduct</i>	-11.22	
			<i>For Bright Chrome Plated Finish US26 (BHMA 625), Add</i>	7.01	
			<i>For Satin Brass Plated Clear Coated Finish, Deduct</i>	-6.73	
			<i>For Stainless Steel, Add</i>	30.86	
			<i>For Heavy Duty, Add</i>	8.42	
			<i>For Extra Heavy Duty, Add</i>	22.44	
			<i>For Pair Of Non-Removable Pins (NRP), Add</i>	6.00	
08 71 16 00-0051			Slide-In, Full Mortise, Ball Bearing, Wrought Steel Hinges <small>(08 71 16 00-0030)</small>		
			Note: Both leaves slide into a cavity prepared in the door and door frame.		



Openings	08	08
Hardware	08 70	
Door Hardware	08 71	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-0052 PR 4-1/2" x 4-1/2", Standard Duty, Slide In, Full Mortise, Ball Bearing, Wrought Steel Hinge.....	56.20	7.91
<i>For Primed For Paint Finish, Deduct</i>	-3.03	
<i>For Bright Chrome Plated Finish US26 (BHMA 625), Add</i>	1.89	
<i>For Satin Brass Plated Clear Coated Finish, Deduct</i>	-1.82	
<i>For Stainless Steel, Add</i>	8.32	
<i>For Heavy Duty, Add</i>	2.27	
<i>For Extra Heavy Duty, Add</i>	6.05	
<i>For Pair Of Non-Removable Pins (NRP), Add</i>	6.00	
08 71 16 00-0053 Blank Butt Hinges (08 71 16 00-0030)		
08 71 16 00-0054 PR 3.5" x 3.5" To 5" x 5", Blank Butt With Screws, Steel Hinge	14.78	3.23
<i>For Primed For Paint Finish, Deduct</i>	-0.39	
<i>For Bright Chrome Plated Finish US26 (BHMA 625), Add</i>	0.24	
<i>For Satin Brass Plated Clear Coated Finish, Deduct</i>	-0.23	
<i>For Stainless Steel, Add</i>	1.06	
<i>For Heavy Duty, Add</i>	0.29	
<i>For Extra Heavy Duty, Add</i>	0.77	
<i>For Pair Of Non-Removable Pins (NRP), Add</i>	6.00	
08 71 16 00-0055 Full Mortise, Single Acting Spring, Wrought Steel Hinges (08 71 16 00-0030)		
Note: Mortised into the edge of the door and mortised into the rabbet edge of the frame.		
08 71 16 00-0056 PR 3-1/2" x 3-1/2", Full Mortise, Single Acting Spring, Wrought Steel Hinge	41.57	5.03
<i>For Primed For Paint Finish, Deduct</i>	-2.89	
<i>For Bright Chrome Plated Finish US26 (BHMA 625), Add</i>	1.81	
<i>For Satin Brass Plated Clear Coated Finish, Deduct</i>	-1.73	
<i>For Stainless Steel, Add</i>	7.95	
08 71 16 00-0057 PR 4" x 4", Full Mortise, Single Acting Spring, Wrought Steel Hinge.....	54.84	7.18
<i>For Primed For Paint Finish, Deduct</i>	-3.78	
<i>For Bright Chrome Plated Finish US26 (BHMA 625), Add</i>	2.36	
<i>For Satin Brass Plated Clear Coated Finish, Deduct</i>	-2.27	
<i>For Stainless Steel, Add</i>	10.40	
08 71 16 00-0058 PR 4-1/2" x 4-1/2", Full Mortise, Single Acting Spring, Wrought Steel Hinge	68.87	7.91
<i>For Primed For Paint Finish, Deduct</i>	-5.56	
<i>For Bright Chrome Plated Finish US26 (BHMA 625), Add</i>	3.48	
<i>For Satin Brass Plated Clear Coated Finish, Deduct</i>	-3.34	
<i>For Stainless Steel, Add</i>	15.29	
08 71 16 00-0059 Offset And Pivot Hinges (08 71 16 00-0001)		
Note: Satin chrome plated, US26D.		
08 71 16 00-0060 Offset Swing Clear Hinges (08 71 16 00-0059)		
Note: For use on 1-3/8" and 1-3/4" doors. Allows doors to swing completely clear of the openings.		
08 71 16 00-0061 EA 4-1/2", Swing Clear, Offset Hinges	47.97	2.25
08 71 16 00-0062 Offset Pivot Hinges (08 71 16 00-0059)		
08 71 16 00-0063 3/4" Offset Pivot Hinges (08 71 16 00-0062)		
08 71 16 00-0064 3/4" Offset Pivot Hinges (08 71 16 00-0063)		
08 71 16 00-0065 Top Mount, 3/4" Offset Pivot Hinges (08 71 16 00-0064)		
08 71 16 00-0066 200 LB Max Door Weight, Top Mount, 3/4" Offset Pivot Hinges (08 71 16 00-0065)		
08 71 16 00-0067 EA Painted Finish, 200 LB Max Door Weight, Top Header Mount, 3/4" Offset Pivot Hinge (Ives 7212 Top)	78.27	7.18
08 71 16 00-0068 EA Satin Chrome Finish, 200 LB Max Door Weight, Top Header Mount, 3/4" Offset Pivot Hinge (Ives 7212 Top).....	104.41	7.18
08 71 16 00-0069 EA Bright Brass Finish, 200 LB Max Door Weight, Top Header Mount, 3/4" Offset Pivot Hinge (Ives 7212 Top).....	118.93	7.18
08 71 16 00-0070 EA Satin Brass Finish, 200 LB Max Door Weight, Top Header Mount, 3/4" Offset Pivot Hinge (Ives 7212 Top).....	118.93	7.18
08 71 16 00-0071 EA Satin Bronze Finish, 200 LB Max Door Weight, Top Header Mount, 3/4" Offset Pivot Hinge (Ives 7212 Top).....	118.93	7.18
08 71 16 00-0072 EA Dark Bronze Finish, 200 LB Max Door Weight, Top Header Mount, 3/4" Offset Pivot Hinge (Ives 7212 Top).....	118.93	7.18
08 71 16 00-0073 EA Bright Chrome Finish, 200 LB Max Door Weight, Top Header Mount, 3/4" Offset Pivot Hinge (Ives 7212 Top)	118.93	7.18
08 71 16 00-0074 EA Painted Finish, 200 LB Max Door Weight, Top Jamb Mount, 3/4" Offset Pivot Hinge (Ives 7212V Top).....	85.82	7.18
08 71 16 00-0075 EA Satin Chrome Finish, 200 LB Max Door Weight, Top Jamb Mount, 3/4" Offset Pivot Hinge (Ives 7212V Top)	108.48	7.18
08 71 16 00-0076 EA Bright Brass Finish, 200 LB Max Door Weight, Top Jamb Mount, 3/4" Offset Pivot Hinge (Ives 7212V Top).....	123.58	7.18
08 71 16 00-0077 EA Satin Brass Finish, 200 LB Max Door Weight, Top Jamb Mount, 3/4" Offset Pivot Hinge (Ives 7212V Top).....	123.58	7.18
08 71 16 00-0078 EA Satin Bronze Finish, 200 LB Max Door Weight, Top Jamb Mount, 3/4" Offset Pivot Hinge (Ives 7212V Top).....	123.58	7.18
08 71 16 00-0079 EA Dark Bronze Finish, 200 LB Max Door Weight, Top Jamb Mount, 3/4" Offset Pivot Hinge (Ives 7212V Top).....	123.58	7.18
08 71 16 00-0080 EA Bright Chrome Finish, 200 LB Max Door Weight, Top Jamb Mount, 3/4" Offset Pivot Hinge (Ives 7212V Top).....	123.58	7.18
08 71 16 00-0081 EA Painted Finish, 200 LB Max Door Weight, Top Header Mount, 3/4" Offset Pivot Hinge (Ives 7222 Top)	78.27	7.18
08 71 16 00-0082 EA Satin Chrome Finish, 200 LB Max Door Weight, Top Header Mount, 3/4" Offset Pivot Hinge (Ives 7222 Top).....	104.41	7.18
08 71 16 00-0083 EA Bright Brass Finish, 200 LB Max Door Weight, Top Header Mount, 3/4" Offset Pivot Hinge (Ives 7222 Top).....	118.93	7.18
08 71 16 00-0084 EA Satin Brass Finish, 200 LB Max Door Weight, Top Header Mount, 3/4" Offset Pivot Hinge (Ives 7222 Top)	118.93	7.18
08 71 16 00-0085 EA Satin Bronze Finish, 200 LB Max Door Weight, Top Header Mount, 3/4" Offset Pivot Hinge (Ives 7222 Top).....	118.93	7.18
08 71 16 00-0086 EA Dark Bronze Finish, 200 LB Max Door Weight, Top Header Mount, 3/4" Offset Pivot Hinge (Ives 7222 Top).....	118.93	7.18
08 71 16 00-0087 EA Bright Chrome Finish, 200 LB Max Door Weight, Top Header Mount, 3/4" Offset Pivot Hinge (Ives 7222 Top)	118.93	7.18
08 71 16 00-0088 500 LB Max Door Weight, Top Mount, 3/4" Offset Pivot Hinges (08 71 16 00-0065)		
08 71 16 00-0089 EA Painted Finish, 500 LB Max Door Weight, Top Header Mount, 3/4" Offset Pivot Hinge (Ives 7215 Top)	81.85	8.99
08 71 16 00-0090 EA Satin Chrome Finish, 500 LB Max Door Weight, Top Header Mount, 3/4" Offset Pivot Hinge (Ives 7215 Top).....	107.99	8.99
08 71 16 00-0091 EA Bright Brass Finish, 500 LB Max Door Weight, Top Header Mount, 3/4" Offset Pivot Hinge (Ives 7215 Top).....	122.51	8.99

08 Openings**08 70 Hardware****08 71 Door Hardware**

MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
08 71 16 00-0092	EA	Satin Brass Finish, 500 LB Max Door Weight, Top Header Mount, 3/4" Offset Pivot Hinge (Ives 7215 Top)	122.51		8.99
08 71 16 00-0093	EA	Satin Bronze Finish, 500 LB Max Door Weight, Top Header Mount, 3/4" Offset Pivot Hinge (Ives 7215 Top)	122.51		8.99
08 71 16 00-0094	EA	Dark Bronze Finish, 500 LB Max Door Weight, Top Header Mount, 3/4" Offset Pivot Hinge (Ives 7215 Top)	122.51		8.99
08 71 16 00-0095	EA	Bright Chrome Finish, 500 LB Max Door Weight, Top Header Mount, 3/4" Offset Pivot Hinge (Ives 7215 Top)	122.51		8.99
08 71 16 00-0096		600 LB Max Door Weight, Top Mount, 3/4" Offset Pivot Hinges <small>(08 71 16 00-0065)</small>			
08 71 16 00-0097	EA	Painted Finish, 600 LB Max Door Weight, Top Header Mount, 3/4" Offset Pivot Hinge (Ives 7226 Top)	81.85		8.99
08 71 16 00-0098	EA	Satin Chrome Finish, 600 LB Max Door Weight, Top Header Mount, 3/4" Offset Pivot Hinge (Ives 7226 Top)	107.99		8.99
08 71 16 00-0099	EA	Bright Brass Finish, 600 LB Max Door Weight, Top Header Mount, 3/4" Offset Pivot Hinge (Ives 7226 Top)	122.51		8.99
08 71 16 00-0100	EA	Satin Brass Finish, 600 LB Max Door Weight, Top Header Mount, 3/4" Offset Pivot Hinge (Ives 7226 Top)	122.51		8.99
08 71 16 00-0101	EA	Satin Bronze Finish, 600 LB Max Door Weight, Top Header Mount, 3/4" Offset Pivot Hinge (Ives 7226 Top)	122.51		8.99
08 71 16 00-0102	EA	Dark Bronze Finish, 600 LB Max Door Weight, Top Header Mount, 3/4" Offset Pivot Hinge (Ives 7226 Top)	122.51		8.99
08 71 16 00-0103	EA	Bright Chrome Finish, 600 LB Max Door Weight, Top Header Mount, 3/4" Offset Pivot Hinge (Ives 7226 Top)	122.51		8.99
08 71 16 00-0104		700 LB Max Door Weight, Top Mount, 3/4" Offset Pivot Hinges <small>(08 71 16 00-0065)</small>			
08 71 16 00-0105	EA	Painted Finish, 700 LB Max Door Weight, Top Header Mount, 3/4" Offset Pivot Hinge (Ives 7227 Top)	81.85		8.99
08 71 16 00-0106	EA	Satin Chrome Finish, 700 LB Max Door Weight, Top Header Mount, 3/4" Offset Pivot Hinge (Ives 7227 Top)	107.99		8.99
08 71 16 00-0107	EA	Bright Brass Finish, 700 LB Max Door Weight, Top Header Mount, 3/4" Offset Pivot Hinge (Ives 7227 Top)	122.51		8.99
08 71 16 00-0108	EA	Satin Brass Finish, 700 LB Max Door Weight, Top Header Mount, 3/4" Offset Pivot Hinge (Ives 7227 Top)	122.51		8.99
08 71 16 00-0109	EA	Satin Bronze Finish, 700 LB Max Door Weight, Top Header Mount, 3/4" Offset Pivot Hinge (Ives 7227 Top)	122.51		8.99
08 71 16 00-0110	EA	Dark Bronze Finish, 700 LB Max Door Weight, Top Header Mount, 3/4" Offset Pivot Hinge (Ives 7227 Top)	122.51		8.99
08 71 16 00-0111	EA	Bright Chrome Finish, 700 LB Max Door Weight, Top Header Mount, 3/4" Offset Pivot Hinge (Ives 7227 Top)	122.51		8.99
08 71 16 00-0112		Intermediate Mount, 3/4" Offset Pivot Hinges <small>(08 71 16 00-0064)</small>			
08 71 16 00-0113		200 LB Max Door Weight, Intermediate Mount, 3/4" Offset Pivot Hinges <small>(08 71 16 00-0112)</small>			
08 71 16 00-0114	EA	Painted Finish, 200 LB Max Door Weight, Intermediate Mount, 3/4" Offset Pivot Hinge (Ives 7212-7212V-7222 INT)	96.85		7.18
08 71 16 00-0115	EA	Satin Chrome Finish, 200 LB Max Door Weight, Intermediate Mount, 3/4" Offset Pivot Hinge (Ives 7212-7212V-7222 INT)	118.93		7.18
08 71 16 00-0116	EA	Bright Brass Finish, 200 LB Max Door Weight, Intermediate Mount, 3/4" Offset Pivot Hinge (Ives 7212-7212V-7222 INT)	134.61		7.18
08 71 16 00-0117	EA	Satin Brass Finish, 200 LB Max Door Weight, Intermediate Mount, 3/4" Offset Pivot Hinge (Ives 7212-7212V-7222 INT)	134.61		7.18
08 71 16 00-0118	EA	Satin Bronze Finish, 200 LB Max Door Weight, Intermediate Mount, 3/4" Offset Pivot Hinge (Ives 7212-7212V-7222 INT)	134.61		7.18
08 71 16 00-0119	EA	Dark Bronze Finish, 200 LB Max Door Weight, Intermediate Mount, 3/4" Offset Pivot Hinge (Ives 7212-7212V-7222 INT)	134.61		7.18
08 71 16 00-0120	EA	Bright Chrome Finish, 200 LB Max Door Weight, Intermediate Mount, 3/4" Offset Pivot Hinge (Ives 7212-7212V-7222 INT)	134.61		7.18
08 71 16 00-0121		500 LB Max Door Weight, Intermediate Mount, 3/4" Offset Pivot Hinges <small>(08 71 16 00-0121)</small>			
08 71 16 00-0122	EA	Painted Finish, 500 LB Max Door Weight, Intermediate Mount, 3/4" Offset Pivot Hinge (Ives 7215 INT)	107.99		8.99
08 71 16 00-0123	EA	Satin Chrome Finish, 500 LB Max Door Weight, Intermediate Mount, 3/4" Offset Pivot Hinge (Ives 7215 INT)	114.96		8.99
08 71 16 00-0124	EA	Bright Brass Finish, 500 LB Max Door Weight, Intermediate Mount, 3/4" Offset Pivot Hinge (Ives 7215 INT)	127.16		8.99
08 71 16 00-0125	EA	Satin Brass Finish, 500 LB Max Door Weight, Intermediate Mount, 3/4" Offset Pivot Hinge (Ives 7215 INT)	127.16		8.99
08 71 16 00-0126	EA	Satin Bronze Finish, 500 LB Max Door Weight, Intermediate Mount, 3/4" Offset Pivot Hinge (Ives 7215 INT)	127.16		8.99
08 71 16 00-0127	EA	Dark Bronze Finish, 500 LB Max Door Weight, Intermediate Mount, 3/4" Offset Pivot Hinge (Ives 7215 INT)	127.16		8.99
08 71 16 00-0128	EA	Bright Chrome Finish, 500 LB Max Door Weight, Intermediate Mount, 3/4" Offset Pivot Hinge (Ives 7215 INT)	127.16		8.99
08 71 16 00-0129		600 LB Max Door Weight, Intermediate Mount, 3/4" Offset Pivot Hinges <small>(08 71 16 00-0121)</small>			
08 71 16 00-0130	EA	Painted Finish, 600 LB Max Door Weight, Intermediate Mount, 3/4" Offset Pivot Hinge (Ives 7226 INT)	107.99		8.99
08 71 16 00-0131	EA	Satin Chrome Finish, 600 LB Max Door Weight, Intermediate Mount, 3/4" Offset Pivot Hinge (Ives 7226 INT)	114.96		8.99
08 71 16 00-0132	EA	Bright Brass Finish, 600 LB Max Door Weight, Intermediate Mount, 3/4" Offset Pivot Hinge (Ives 7226 INT)	127.16		8.99
08 71 16 00-0133	EA	Satin Brass Finish, 600 LB Max Door Weight, Intermediate Mount, 3/4" Offset Pivot Hinge (Ives 7226 INT)	127.16		8.99
08 71 16 00-0134	EA	Satin Bronze Finish, 600 LB Max Door Weight, Intermediate Mount, 3/4" Offset Pivot Hinge (Ives 7226 INT)	127.16		8.99
08 71 16 00-0135	EA	Dark Bronze Finish, 600 LB Max Door Weight, Intermediate Mount, 3/4" Offset Pivot Hinge (Ives 7226 INT)	127.16		8.99
08 71 16 00-0136	EA	Bright Chrome Finish, 600 LB Max Door Weight, Intermediate Mount, 3/4" Offset Pivot Hinge (Ives 7226 INT)	127.16		8.99
08 71 16 00-0137		700 LB Max Door Weight, Intermediate Mount, 3/4" Offset Pivot Hinges <small>(08 71 16 00-0121)</small>			
08 71 16 00-0138	EA	Painted Finish, 700 LB Max Door Weight, Intermediate Mount, 3/4" Offset Pivot Hinge (Ives 7227 INT)	107.99		8.99
08 71 16 00-0139	EA	Satin Chrome Finish, 700 LB Max Door Weight, Intermediate Mount, 3/4" Offset Pivot Hinge (Ives 7227 INT)	114.96		8.99
08 71 16 00-0140	EA	Bright Brass Finish, 700 LB Max Door Weight, Intermediate Mount, 3/4" Offset Pivot Hinge (Ives 7227 INT)	127.16		8.99
08 71 16 00-0141	EA	Satin Brass Finish, 700 LB Max Door Weight, Intermediate Mount, 3/4" Offset Pivot Hinge (Ives 7227 INT)	127.16		8.99
08 71 16 00-0142	EA	Satin Bronze Finish, 700 LB Max Door Weight, Intermediate Mount, 3/4" Offset Pivot Hinge (Ives 7227 INT)	127.16		8.99
08 71 16 00-0143	EA	Dark Bronze Finish, 700 LB Max Door Weight, Intermediate Mount, 3/4" Offset Pivot Hinge (Ives 7227 INT)	127.16		8.99
08 71 16 00-0144	EA	Bright Chrome Finish, 700 LB Max Door Weight, Intermediate Mount, 3/4" Offset Pivot Hinge (Ives 7227 INT)	127.16		8.99
08 71 16 00-0145		Bottom Mount, 3/4" Offset Pivot Hinges <small>(08 71 16 00-0064)</small>			
08 71 16 00-0146		200 LB Max Door Weight, Bottom Mount, 3/4" Offset Pivot Hinges <small>(08 71 16 00-0145)</small>			
08 71 16 00-0147	EA	Painted Finish, 200 LB Max Door Weight, Bottom Jamb Mount, 3/4" Offset Pivot Hinge (Ives 7212 BTM)	85.82		7.18



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-0148	EA		Satin Chrome Finish, 200 LB Max Door Weight, Bottom Jamb Mount, 3/4" Offset Pivot Hinge (Ives 7212 BTM)	108.48	7.18
08 71 16 00-0149	EA		Bright Brass Finish, 200 LB Max Door Weight, Bottom Jamb Mount, 3/4" Offset Pivot Hinge (Ives 7212 BTM)	123.58	7.18
08 71 16 00-0150	EA		Satin Brass Finish, 200 LB Max Door Weight, Bottom Jamb Mount, 3/4" Offset Pivot Hinge (Ives 7212 BTM)	123.58	7.18
08 71 16 00-0151	EA		Satin Bronze Finish, 200 LB Max Door Weight, Bottom Jamb Mount, 3/4" Offset Pivot Hinge (Ives 7212 BTM)	123.58	7.18
08 71 16 00-0152	EA		Dark Bronze Finish, 200 LB Max Door Weight, Bottom Jamb Mount, 3/4" Offset Pivot Hinge (Ives 7212 BTM)	123.58	7.18
08 71 16 00-0153	EA		Bright Chrome Finish, 200 LB Max Door Weight, Bottom Jamb Mount, 3/4" Offset Pivot Hinge (Ives 7212 BTM)	123.58	7.18
08 71 16 00-0154	EA		Painted Finish, 200 LB Max Door Weight, Bottom Jamb Mount, 3/4" Offset Pivot Hinge (Ives 7212 VBTM)	85.82	7.18
08 71 16 00-0155	EA		Satin Chrome Finish, 200 LB Max Door Weight, Bottom Jamb Mount, 3/4" Offset Pivot Hinge (Ives 7212 VBTM)	108.48	7.18
08 71 16 00-0156	EA		Bright Brass Finish, 200 LB Max Door Weight, Bottom Jamb Mount, 3/4" Offset Pivot Hinge (Ives 7212 VBTM)	123.58	7.18
08 71 16 00-0157	EA		Satin Brass Finish, 200 LB Max Door Weight, Bottom Jamb Mount, 3/4" Offset Pivot Hinge (Ives 7212 VBTM)	123.58	7.18
08 71 16 00-0158	EA		Satin Bronze Finish, 200 LB Max Door Weight, Bottom Jamb Mount, 3/4" Offset Pivot Hinge (Ives 7212 VBTM)	123.58	7.18
08 71 16 00-0159	EA		Dark Bronze Finish, 200 LB Max Door Weight, Bottom Jamb Mount, 3/4" Offset Pivot Hinge (Ives 7212 VBTM)	123.58	7.18
08 71 16 00-0160	EA		Bright Chrome Finish, 200 LB Max Door Weight, Bottom Jamb Mount, 3/4" Offset Pivot Hinge (Ives 7212 VBTM)	123.58	7.18
08 71 16 00-0161	EA		Painted Finish, 200 LB Max Door Weight, Bottom Base Plate Mount, 3/4" Offset Pivot Hinge (Ives 7222 BTM)	74.79	7.18
08 71 16 00-0162	EA		Satin Chrome Finish, 200 LB Max Door Weight, Bottom Base Plate Mount, 3/4" Offset Pivot Hinge (Ives 7222 BTM)	100.93	7.18
08 71 16 00-0163	EA		Bright Brass Finish, 200 LB Max Door Weight, Bottom Base Plate Mount, 3/4" Offset Pivot Hinge (Ives 7222 BTM)	116.02	7.18
08 71 16 00-0164	EA		Satin Brass Finish, 200 LB Max Door Weight, Bottom Base Plate Mount, 3/4" Offset Pivot Hinge (Ives 7222 BTM)	116.02	7.18
08 71 16 00-0165	EA		Satin Bronze Finish, 200 LB Max Door Weight, Bottom Base Plate Mount, 3/4" Offset Pivot Hinge (Ives 7222 BTM)	116.02	7.18
08 71 16 00-0166	EA		Dark Bronze Finish, 200 LB Max Door Weight, Bottom Base Plate Mount, 3/4" Offset Pivot Hinge (Ives 7222 BTM)	116.02	7.18
08 71 16 00-0167	EA		Bright Chrome Finish, 200 LB Max Door Weight, Bottom Base Plate Mount, 3/4" Offset Pivot Hinge (Ives 7222 BTM)	116.02	7.18
08 71 16 00-0168			500 LB Max Door Weight, Bottom Mount, 3/4" Offset Pivot Hinges (08 71 16 00-0145)		
08 71 16 00-0169	EA		Satin Chrome Finish, 500 LB Max Door Weight, Bottom Jamb Mount, 3/4" Offset Pivot Hinge (Ives 7215 BTM)	130.06	8.99
08 71 16 00-0170	EA		Bright Brass Finish, 500 LB Max Door Weight, Bottom Jamb Mount, 3/4" Offset Pivot Hinge (Ives 7215 BTM)	138.19	8.99
08 71 16 00-0171	EA		Satin Brass Finish, 500 LB Max Door Weight, Bottom Jamb Mount, 3/4" Offset Pivot Hinge (Ives 7215 BTM)	138.19	8.99
08 71 16 00-0172	EA		Satin Bronze Finish, 500 LB Max Door Weight, Bottom Jamb Mount, 3/4" Offset Pivot Hinge (Ives 7215 BTM)	138.19	8.99
08 71 16 00-0173	EA		Dark Bronze Finish, 500 LB Max Door Weight, Bottom Jamb Mount, 3/4" Offset Pivot Hinge (Ives 7215 BTM)	138.19	8.99
08 71 16 00-0174	EA		Bright Chrome Finish, 500 LB Max Door Weight, Bottom Jamb Mount, 3/4" Offset Pivot Hinge (Ives 7215 BTM)	138.19	8.99
08 71 16 00-0175	EA		Painted Finish, 500 LB Max Door Weight, Bottom Jamb Mount, 3/4" Offset Pivot Hinge (Ives 7215 BTM)	140.51	8.99
08 71 16 00-0176			600 LB Max Door Weight, Bottom Mount, 3/4" Offset Pivot Hinges (08 71 16 00-0145)		
08 71 16 00-0177	EA		Painted Finish, 600 LB Max Door Weight, Bottom Jamb Mount, 3/4" Offset Pivot Hinge (Ives 7226 BTM)	112.06	8.99
08 71 16 00-0178	EA		Satin Chrome Finish, 600 LB Max Door Weight, Bottom Jamb Mount, 3/4" Offset Pivot Hinge (Ives 7226 BTM)	122.51	8.99
08 71 16 00-0179	EA		Bright Brass Finish, 600 LB Max Door Weight, Bottom Jamb Mount, 3/4" Offset Pivot Hinge (Ives 7226 BTM)	130.06	8.99
08 71 16 00-0180	EA		Satin Brass Finish, 600 LB Max Door Weight, Bottom Jamb Mount, 3/4" Offset Pivot Hinge (Ives 7226 BTM)	130.06	8.99
08 71 16 00-0181	EA		Satin Bronze Finish, 600 LB Max Door Weight, Bottom Jamb Mount, 3/4" Offset Pivot Hinge (Ives 7226 BTM)	130.06	8.99
08 71 16 00-0182	EA		Dark Bronze Finish, 600 LB Max Door Weight, Bottom Jamb Mount, 3/4" Offset Pivot Hinge (Ives 7226 BTM)	130.06	8.99
08 71 16 00-0183	EA		Bright Chrome Finish, 600 LB Max Door Weight, Bottom Jamb Mount, 3/4" Offset Pivot Hinge (Ives 7226 BTM)	130.06	8.99
08 71 16 00-0184			700 LB Max Door Weight, Bottom Mount, 3/4" Offset Pivot Hinges (08 71 16 00-0145)		
08 71 16 00-0185	EA		Painted Finish, 700 LB Max Door Weight, Bottom Jamb Mount, 3/4" Offset Pivot Hinge (Ives 7227 BTM)	253.77	8.99
08 71 16 00-0186	EA		Satin Chrome Finish, 700 LB Max Door Weight, Bottom Jamb Mount, 3/4" Offset Pivot Hinge (Ives 7227 BTM)	272.36	8.99
08 71 16 00-0187	EA		Bright Brass Finish, 700 LB Max Door Weight, Bottom Jamb Mount, 3/4" Offset Pivot Hinge (Ives 7227 BTM)	301.99	8.99
08 71 16 00-0188	EA		Satin Brass Finish, 700 LB Max Door Weight, Bottom Jamb Mount, 3/4" Offset Pivot Hinge (Ives 7227 BTM)	301.99	8.99
08 71 16 00-0189	EA		Satin Bronze Finish, 700 LB Max Door Weight, Bottom Jamb Mount, 3/4" Offset Pivot Hinge (Ives 7227 BTM)	301.99	8.99
08 71 16 00-0190	EA		Dark Bronze Finish, 700 LB Max Door Weight, Bottom Jamb Mount, 3/4" Offset Pivot Hinge (Ives 7227 BTM)	301.99	8.99
08 71 16 00-0191	EA		Bright Chrome Finish, 700 LB Max Door Weight, Bottom Jamb Mount, 3/4" Offset Pivot Hinge (Ives 7227 BTM)	301.99	8.99
08 71 16 00-0192			Fire Rated, 3/4" Offset Pivot Hinges (08 71 16 00-0063)		
08 71 16 00-0193			Top Mount, Fire Rated, 3/4" Offset Pivot Hinges (08 71 16 00-0192)		
08 71 16 00-0194			500 LB Max Door Weight, Top Mount, Fire Rated, 3/4" Offset Pivot Hinges (08 71 16 00-0193)		
08 71 16 00-0195	EA		Painted Finish, 500 LB Max Door Weight, Top Header Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7215F Top)	152.14	8.99
08 71 16 00-0196	EA		Satin Stainless Finish, 500 LB Max Door Weight, Top Header Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7215F Top)	179.43	8.99
08 71 16 00-0197	EA		Bright Stainless Finish, 500 LB Max Door Weight, Top Header Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7215F Top)	201.50	8.99
08 71 16 00-0198	EA		Bright Brass Finish, 500 LB Max Door Weight, Top Header Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7215F Top)	201.50	8.99
08 71 16 00-0199	EA		Satin Bronze Finish, 500 LB Max Door Weight, Top Header Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7215F Top)	201.50	8.99
08 71 16 00-0200			600 LB Max Door Weight, Top Mount, Fire Rated, 3/4" Offset Pivot Hinges (08 71 16 00-0193)		
08 71 16 00-0201	EA		Painted Finish, 600 LB Max Door Weight, Top Header Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7226F Top)	152.14	8.99
08 71 16 00-0202	EA		Satin Stainless Finish, 600 LB Max Door Weight, Top Header Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7226F Top)	179.43	8.99
08 71 16 00-0203	EA		Bright Stainless Finish, 600 LB Max Door Weight, Top Header Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7226F Top)	201.50	8.99

08 Openings**08 70 Hardware**

08 71 Door Hardware



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-0204	EA		Bright Brass Finish, 600 LB Max Door Weight, Top Header Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7226F Top)	201.50	8.99
08 71 16 00-0205	EA		Satin Bronze Finish, 600 LB Max Door Weight, Top Header Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7226F Top)	201.50	8.99
08 71 16 00-0206			700 LB Max Door Weight, Top Mount, Fire Rated, 3/4" Offset Pivot Hinges <small>(08 71 16 00-0193)</small>		
08 71 16 00-0207	EA		Painted Finish, 700 LB Max Door Weight, Top Header Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7227F Top)	152.14	8.99
08 71 16 00-0208	EA		Satin Stainless Finish, 700 LB Max Door Weight, Top Header Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7227F Top)	179.43	8.99
08 71 16 00-0209	EA		Bright Stainless Finish, 700 LB Max Door Weight, Top Header Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7227F Top)	201.50	8.99
08 71 16 00-0210	EA		Bright Brass Finish, 700 LB Max Door Weight, Top Header Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7227F Top)	201.50	8.99
08 71 16 00-0211	EA		Satin Bronze Finish, 700 LB Max Door Weight, Top Header Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7227F Top)	201.50	8.99
08 71 16 00-0212			1,000 LB Max Door Weight, Top Mount, Fire Rated, 3/4" Offset Pivot Hinges <small>(08 71 16 00-0193)</small>		
08 71 16 00-0213	EA		Painted Finish, 1,000 LB Max Door Weight, Top Header Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7230F Top)	160.38	10.78
08 71 16 00-0214	EA		Satin Stainless Finish, 1,000 LB Max Door Weight, Top Header Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7230F Top)	183.03	10.78
08 71 16 00-0215	EA		Bright Stainless Finish, 1,000 LB Max Door Weight, Top Header Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7230F Top)	193.49	10.78
08 71 16 00-0216	EA		Bright Brass Finish, 1,000 LB Max Door Weight, Top Header Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7230F Top)	193.49	10.78
08 71 16 00-0217	EA		Satin Bronze Finish, 1,000 LB Max Door Weight, Top Header Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7230F Top)	193.49	10.78
08 71 16 00-0218			1,750 LB Max Door Weight, Top Mount, Fire Rated, 3/4" Offset Pivot Hinges <small>(08 71 16 00-0193)</small>		
08 71 16 00-0219	EA		Painted Finish, 1,750 LB Max Door Weight, Top Header Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7237F Top)	160.38	10.78
08 71 16 00-0220	EA		Satin Stainless Finish, 1,750 LB Max Door Weight, Top Header Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7237F Top)	183.03	10.78
08 71 16 00-0221	EA		Bright Stainless Finish, 1,750 LB Max Door Weight, Top Header Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7237F Top)	193.49	10.78
08 71 16 00-0222	EA		Bright Brass Finish, 1,750 LB Max Door Weight, Top Header Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7237F Top)	193.49	10.78
08 71 16 00-0223	EA		Satin Bronze Finish, 1,750 LB Max Door Weight, Top Header Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7237F Top)	193.49	10.78
08 71 16 00-0224			Intermediate Mount, Fire Rated, 3/4" Offset Pivot Hinges <small>(08 71 16 00-0192)</small>		
08 71 16 00-0225			500 LB Max Door Weight, Intermediate Mount, Fire Rated, 3/4" Offset Pivot Hinges <small>(08 71 16 00-0224)</small>		
08 71 16 00-0226	EA		Painted Finish, 500 LB Max Door Weight, Intermediate Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7215 FINT)	156.78	8.99
08 71 16 00-0227	EA		Satin Stainless Finish, 500 LB Max Door Weight, Intermediate Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7215 FINT)	182.33	8.99
08 71 16 00-0228	EA		Bright Stainless Finish, 500 LB Max Door Weight, Intermediate Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7215 FINT)	189.89	8.99
08 71 16 00-0229	EA		Bright Brass Finish, 500 LB Max Door Weight, Intermediate Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7215 FINT)	189.89	8.99
08 71 16 00-0230	EA		Satin Bronze Finish, 500 LB Max Door Weight, Intermediate Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7215 FINT)	189.89	8.99
08 71 16 00-0231			600 LB Max Door Weight, Intermediate Mount, Fire Rated, 3/4" Offset Pivot Hinges <small>(08 71 16 00-0224)</small>		
08 71 16 00-0232	EA		Painted Finish, 600 LB Max Door Weight, Intermediate Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7226 FINT)	156.78	8.99
08 71 16 00-0233	EA		Satin Stainless Finish, 600 LB Max Door Weight, Intermediate Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7226 FINT)	182.33	8.99
08 71 16 00-0234	EA		Bright Stainless Finish, 600 LB Max Door Weight, Intermediate Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7226 FINT)	189.89	8.99
08 71 16 00-0235	EA		Bright Brass Finish, 600 LB Max Door Weight, Intermediate Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7226 FINT)	189.89	8.99
08 71 16 00-0236	EA		Satin Bronze Finish, 600 LB Max Door Weight, Intermediate Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7226 FINT)	189.89	8.99
08 71 16 00-0237			700 LB Max Door Weight, Intermediate Mount, Fire Rated, 3/4" Offset Pivot Hinges <small>(08 71 16 00-0224)</small>		
08 71 16 00-0238	EA		Painted Finish, 700 LB Max Door Weight, Intermediate Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7227 FINT)	156.78	8.99



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-0239 EA Satin Stainless Finish, 700 LB Max Door Weight, Intermediate Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7227 FINT)	182.33	8.99
08 71 16 00-0240 EA Bright Stainless Finish, 700 LB Max Door Weight, Intermediate Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7227 FINT)	189.89	8.99
08 71 16 00-0241 EA Bright Brass Finish, 700 LB Max Door Weight, Intermediate Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7227 FINT)	189.89	8.99
08 71 16 00-0242 EA Satin Bronze Finish, 700 LB Max Door Weight, Intermediate Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7227 FINT)	189.89	8.99
08 71 16 00-0243 1,000 LB Max Door Weight, Intermediate Mount, Fire Rated, 3/4" Offset Pivot Hinges (08 71 16 00-0224)		
08 71 16 00-0244 EA Painted Finish, 1,000 LB Max Door Weight, Intermediate Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7230 FINT)	175.48	10.78
08 71 16 00-0245 EA Satin Stainless Finish, 1,000 LB Max Door Weight, Intermediate Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7230 FINT)	201.61	10.78
08 71 16 00-0246 EA Bright Stainless Finish, 1,000 LB Max Door Weight, Intermediate Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7230 FINT)	208.58	10.78
08 71 16 00-0247 EA Bright Brass Finish, 1,000 LB Max Door Weight, Intermediate Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7230 FINT)	208.58	10.78
08 71 16 00-0248 EA Satin Bronze Finish, 1,000 LB Max Door Weight, Intermediate Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7230 FINT)	208.58	10.78
08 71 16 00-0249 1,750 LB Max Door Weight, Intermediate Mount, Fire Rated, 3/4" Offset Pivot Hinges (08 71 16 00-0224)		
08 71 16 00-0250 EA Painted Finish, 1,750 LB Max Door Weight, Intermediate Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7237 FINT)	175.48	10.78
08 71 16 00-0251 EA Satin Stainless Finish, 1,750 LB Max Door Weight, Intermediate Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7237 FINT)	201.61	10.78
08 71 16 00-0252 EA Bright Stainless Finish, 1,750 LB Max Door Weight, Intermediate Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7237 FINT)	208.58	10.78
08 71 16 00-0253 EA Bright Brass Finish, 1,750 LB Max Door Weight, Intermediate Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7237 FINT)	208.58	10.78
08 71 16 00-0254 EA Satin Bronze Finish, 1,750 LB Max Door Weight, Intermediate Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7237 FINT)	208.58	10.78
08 71 16 00-0255 Bottom Mount, Fire Rated, 3/4" Offset Pivot Hinges (08 71 16 00-0192)		
08 71 16 00-0256 500 LB Max Door Weight, Bottom Mount, Fire Rated, 3/4" Offset Pivot Hinges (08 71 16 00-0255)		
08 71 16 00-0257 EA Painted Finish, 500 LB Max Door Weight, Bottom Jamb Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7215F BTM)	174.79	8.99
08 71 16 00-0258 EA Satin Stainless Finish, 500 LB Max Door Weight, Bottom Jamb Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7215F BTM)	216.03	8.99
08 71 16 00-0259 EA Bright Stainless Finish, 500 LB Max Door Weight, Bottom Jamb Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7215F BTM)	231.71	8.99
08 71 16 00-0260 EA Bright Brass Finish, 500 LB Max Door Weight, Bottom Jamb Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7215F BTM)	231.71	8.99
08 71 16 00-0261 EA Satin Bronze Finish, 500 LB Max Door Weight, Bottom Jamb Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7215F BTM)	231.71	8.99
08 71 16 00-0262 600 LB Max Door Weight, Bottom Mount, Fire Rated, 3/4" Offset Pivot Hinges (08 71 16 00-0255)		
08 71 16 00-0263 EA Painted Finish, 600 LB Max Door Weight, Bottom Jamb Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7226F BTM)	171.88	8.99
08 71 16 00-0264 EA Satin Stainless Finish, 600 LB Max Door Weight, Bottom Jamb Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7226F BTM)	182.33	8.99
08 71 16 00-0265 EA Bright Stainless Finish, 600 LB Max Door Weight, Bottom Jamb Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7226F BTM)	209.06	8.99
08 71 16 00-0266 EA Bright Brass Finish, 600 LB Max Door Weight, Bottom Jamb Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7226F BTM)	209.06	8.99
08 71 16 00-0267 EA Satin Bronze Finish, 600 LB Max Door Weight, Bottom Jamb Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7226F BTM)	209.06	8.99
08 71 16 00-0268 1,000 LB Max Door Weight, Bottom Mount, Fire Rated, 3/4" Offset Pivot Hinges (08 71 16 00-0255)		
08 71 16 00-0269 EA Painted Finish, 1,000 LB Max Door Weight, Bottom Jamb Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7230F BTM)	197.55	10.78
08 71 16 00-0270 EA Satin Stainless Finish, 1,000 LB Max Door Weight, Bottom Jamb Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7230F BTM)	219.63	10.78
08 71 16 00-0271 EA Bright Stainless Finish, 1,000 LB Max Door Weight, Bottom Jamb Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7230F BTM)	227.75	10.78
08 71 16 00-0272 EA Bright Brass Finish, 1,000 LB Max Door Weight, Bottom Jamb Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7230F BTM)	227.75	10.78
08 71 16 00-0273 EA Satin Bronze Finish, 1,000 LB Max Door Weight, Bottom Jamb Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7230F BTM)	227.75	10.78

08 Openings**08 70 Hardware****08 71 Door Hardware**

MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
08 71 16 00-0274		1,750 LB Max Door Weight, Bottom Mount, Fire Rated, 3/4" Offset Pivot Hinges <small>(08 71 16 00-0255)</small>			
08 71 16 00-0275	EA	Painted Finish, 1,750 LB Max Door Weight, Bottom Jamb Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7237F BTM).....	279.45		10.78
08 71 16 00-0276	EA	Satin Stainless Finish, 1,750 LB Max Door Weight, Bottom Jamb Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7237F BTM).....	298.04		10.78
08 71 16 00-0277	EA	Bright Stainless Finish, 1,750 LB Max Door Weight, Bottom Jamb Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7237F BTM).....	305.59		10.78
08 71 16 00-0278	EA	Bright Brass Finish, 1,750 LB Max Door Weight, Bottom Jamb Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7237F BTM).....	305.59		10.78
08 71 16 00-0279	EA	Satin Bronze Finish, 1,750 LB Max Door Weight, Bottom Jamb Mount, Fire Rated, 3/4" Offset Pivot Hinge (Ives 7237F BTM).....	305.59		10.78
08 71 16 00-0280		1-1/2" Offset Pivot Hinges <small>(08 71 16 00-0062)</small>			
08 71 16 00-0281		Fire Rated, 1-1/2" Offset Pivot Hinges <small>(08 71 16 00-0280)</small>			
08 71 16 00-0282		Top Mount, Fire Rated, 1-1/2" Offset Pivot Hinges <small>(08 71 16 00-0281)</small>			
08 71 16 00-0283		400 LB Max Door Weight, Top Mount, Fire Rated, 1-1/2" Offset Pivot Hinges <small>(08 71 16 00-0282)</small>			
08 71 16 00-0284	EA	Painted Finish, 400 LB Max Door Weight, Top Header Mount, Fire Rated, 1-1/2" Offset Pivot Hinge (Ives 7244 Top).....	179.43		8.99
08 71 16 00-0285	EA	Satin Stainless Finish, 400 LB Max Door Weight, Top Header Mount, Fire Rated, 1-1/2" Offset Pivot Hinge (Ives 7244 Top).....	193.95		8.99
08 71 16 00-0286	EA	Bright Stainless Finish, 400 LB Max Door Weight, Top Header Mount, Fire Rated, 1-1/2" Offset Pivot Hinge (Ives 7244 Top).....	204.98		8.99
08 71 16 00-0287	EA	Bright Bronze Finish, 400 LB Max Door Weight, Top Header Mount, Fire Rated, 1-1/2" Offset Pivot Hinge (Ives 7244 Top).....	204.98		8.99
08 71 16 00-0288	EA	Satin Bronze Finish, 400 LB Max Door Weight, Top Header Mount, Fire Rated, 1-1/2" Offset Pivot Hinge (Ives 7244 Top).....	204.98		8.99
08 71 16 00-0289		500 LB Max Door Weight, Top Mount, Fire Rated, 1-1/2" Offset Pivot Hinges <small>(08 71 16 00-0282)</small>			
08 71 16 00-0290	EA	Painted Finish, 500 LB Max Door Weight, Top Header Mount, Fire Rated, 1-1/2" Offset Pivot Hinge (Ives 7245 Top).....	179.43		8.99
08 71 16 00-0291	EA	Satin Stainless Finish, 500 LB Max Door Weight, Top Header Mount, Fire Rated, 1-1/2" Offset Pivot Hinge (Ives 7245 Top).....	193.95		8.99
08 71 16 00-0292	EA	Bright Stainless Finish, 500 LB Max Door Weight, Top Header Mount, Fire Rated, 1-1/2" Offset Pivot Hinge (Ives 7245 Top).....	204.98		8.99
08 71 16 00-0293	EA	Bright Bronze Finish, 500 LB Max Door Weight, Top Header Mount, Fire Rated, 1-1/2" Offset Pivot Hinge (Ives 7245 Top).....	204.98		8.99
08 71 16 00-0294	EA	Satin Bronze Finish, 500 LB Max Door Weight, Top Header Mount, Fire Rated, 1-1/2" Offset Pivot Hinge (Ives 7245 Top).....	204.98		8.99
08 71 16 00-0295		Intermediate Mount, Fire Rated, 1-1/2" Offset Pivot Hinges <small>(08 71 16 00-0281)</small>			
08 71 16 00-0296		400 LB Max Door Weight, Intermediate Mount, Fire Rated, 1-1/2" Offset Pivot Hinges <small>(08 71 16 00-0295)</small>			
08 71 16 00-0297	EA	Painted Finish, 400 LB Max Door Weight, Intermediate Mount, Fire Rated, 1-1/2" Offset Pivot Hinge (Ives 7244 FINT).....	186.40		8.99
08 71 16 00-0298	EA	Satin Stainless Finish, 400 LB Max Door Weight, Intermediate Mount, Fire Rated, 1-1/2" Offset Pivot Hinge (Ives 7244 FINT).....	209.06		8.99
08 71 16 00-0299	EA	Bright Stainless Finish, 400 LB Max Door Weight, Intermediate Mount, Fire Rated, 1-1/2" Offset Pivot Hinge (Ives 7244 FINT).....	220.09		8.99
08 71 16 00-0300	EA	Bright Brass Finish, 400 LB Max Door Weight, Intermediate Mount, Fire Rated, 1-1/2" Offset Pivot Hinge (Ives 7244 FINT).....	220.09		8.99
08 71 16 00-0301	EA	Satin Bronze Finish, 400 LB Max Door Weight, Intermediate Mount, Fire Rated, 1-1/2" Offset Pivot Hinge (Ives 7244 FINT).....	220.09		8.99
08 71 16 00-0302		500 LB Max Door Weight, Intermediate Mount, Fire Rated, 1-1/2" Offset Pivot Hinges <small>(08 71 16 00-0295)</small>			
08 71 16 00-0303	EA	Painted Finish, 500 LB Max Door Weight, Intermediate Mount, Fire Rated, 1-1/2" Offset Pivot Hinge (Ives 7245 FINT).....	186.40		8.99
08 71 16 00-0304	EA	Satin Stainless Finish, 500 LB Max Door Weight, Intermediate Mount, Fire Rated, 1-1/2" Offset Pivot Hinge (Ives 7245 FINT).....	209.06		8.99
08 71 16 00-0305	EA	Bright Stainless Finish, 500 LB Max Door Weight, Intermediate Mount, Fire Rated, 1-1/2" Offset Pivot Hinge (Ives 7245 FINT).....	220.09		8.99
08 71 16 00-0306	EA	Bright Brass Finish, 500 LB Max Door Weight, Intermediate Mount, Fire Rated, 1-1/2" Offset Pivot Hinge (Ives 7245 FINT).....	220.09		8.99
08 71 16 00-0307	EA	Satin Bronze Finish, 500 LB Max Door Weight, Intermediate Mount, Fire Rated, 1-1/2" Offset Pivot Hinge (Ives 7245 FINT).....	220.09		8.99
08 71 16 00-0308		Bottom Mount, Fire Rated, 1-1/2" Offset Pivot Hinges <small>(08 71 16 00-0281)</small>			
08 71 16 00-0309		400 LB Max Door Weight, Bottom Mount, Fire Rated, 1-1/2" Offset Pivot Hinges <small>(08 71 16 00-0308)</small>			



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
	08 71 16 00-0310	EA		Painted Finish, 400 LB Max Door Weight, Bottom Base Plate Mount, Fire Rated, 1-1/2" Offset Pivot Hinge (Ives 7244 BTM).....	182.33	8.99
	08 71 16 00-0311	EA		Satin Stainless Finish, 400 LB Max Door Weight, Bottom Base Plate Mount, Fire Rated, 1-1/2" Offset Pivot Hinge (Ives 7244 BTM)	209.06	8.99
	08 71 16 00-0312	EA		Bright Stainless Finish, 400 LB Max Door Weight, Bottom Base Plate Mount, Fire Rated, 1-1/2" Offset Pivot Hinge (Ives 7244 BTM)	220.09	8.99
	08 71 16 00-0313	EA		Bright Brass Finish, 400 LB Max Door Weight, Bottom Base Plate Mount, Fire Rated, 1-1/2" Offset Pivot Hinge (Ives 7244 BTM)	220.09	8.99
	08 71 16 00-0314	EA		Satin Bronze Finish, 400 LB Max Door Weight, Bottom Base Plate Mount, Fire Rated, 1-1/2" Offset Pivot Hinge (Ives 7244 BTM)	220.09	8.99
	08 71 16 00-0315			500 LB Max Door Weight, Bottom Mount, Fire Rated, 1-1/2" Offset Pivot Hinges <small>(08 71 16 00-0308)</small>		
	08 71 16 00-0316	EA		Painted Finish, 500 LB Max Door Weight, Bottom Base Plate Mount, Fire Rated, 1-1/2" Offset Pivot Hinge (Ives 7245 BTM).....	294.44	8.99
	08 71 16 00-0317	EA		Satin Stainless Finish, 500 LB Max Door Weight, Bottom Base Plate Mount, Fire Rated, 1-1/2" Offset Pivot Hinge (Ives 7245 BTM)	324.64	8.99
	08 71 16 00-0318	EA		Bright Stainless Finish, 500 LB Max Door Weight, Bottom Base Plate Mount, Fire Rated, 1-1/2" Offset Pivot Hinge (Ives 7245 BTM)	332.19	8.99
	08 71 16 00-0319	EA		Bright Brass Finish, 500 LB Max Door Weight, Bottom Base Plate Mount, Fire Rated, 1-1/2" Offset Pivot Hinge (Ives 7245 BTM)	332.19	8.99
	08 71 16 00-0320	EA		Satin Bronze Finish, 500 LB Max Door Weight, Bottom Base Plate Mount, Fire Rated, 1-1/2" Offset Pivot Hinge (Ives 7245 BTM)	332.19	8.99
	08 71 16 00-0321			Center Hung Pivot Hinges <small>(08 71 16 00-0059)</small>		
	08 71 16 00-0322			Top Mount, Center Hung Pivot Hinges <small>(08 71 16 00-0321)</small>		
	08 71 16 00-0323			300 LB Max Door Weight, Top Mount, Center Hung Pivot Hinges <small>(08 71 16 00-0322)</small>		
	08 71 16 00-0324	EA		Painted Finish, 300 LB Max Door Weight, Top Header Mount, Center Hung Pivot Hinge (Ives 7253 Top).....	93.37	7.18
	08 71 16 00-0325	EA		Satin Chrome Finish, 300 LB Max Door Weight, Top Header Mount, Center Hung Pivot Hinge (Ives 7253 Top)	100.93	7.18
	08 71 16 00-0326	EA		Bright Brass Finish, 300 LB Max Door Weight, Top Header Mount, Center Hung Pivot Hinge (Ives 7253 Top)	100.93	7.18
	08 71 16 00-0327	EA		Satin Brass Finish, 300 LB Max Door Weight, Top Header Mount, Center Hung Pivot Hinge (Ives 7253 Top).....	100.93	7.18
	08 71 16 00-0328	EA		Satin Bronze Finish, 300 LB Max Door Weight, Top Header Mount, Center Hung Pivot Hinge (Ives 7253 Top).....	100.93	7.18
	08 71 16 00-0329	EA		Dark Bronze Finish, 300 LB Max Door Weight, Top Header Mount, Center Hung Pivot Hinge (Ives 7253 Top).....	100.93	7.18
	08 71 16 00-0330	EA		Bright Chrome Finish, 300 LB Max Door Weight, Top Header Mount, Center Hung Pivot Hinge (Ives 7253 Top).....	100.93	7.18
	08 71 16 00-0331			500 LB Max Door Weight, Top Mount, Center Hung Pivot Hinges <small>(08 71 16 00-0322)</small>		
	08 71 16 00-0332	EA		Painted Finish, 500 LB Max Door Weight, Top Header Mount, Center Hung Pivot Hinge (Ives 7255 Top).....	96.95	8.99
	08 71 16 00-0333	EA		Satin Chrome Finish, 500 LB Max Door Weight, Top Header Mount, Center Hung Pivot Hinge (Ives 7255 Top)	104.51	8.99
	08 71 16 00-0334	EA		Bright Brass Finish, 500 LB Max Door Weight, Top Header Mount, Center Hung Pivot Hinge (Ives 7255 Top)	104.51	8.99
	08 71 16 00-0335	EA		Satin Brass Finish, 500 LB Max Door Weight, Top Header Mount, Center Hung Pivot Hinge (Ives 7255 Top).....	104.51	8.99
	08 71 16 00-0336	EA		Satin Bronze Finish, 500 LB Max Door Weight, Top Header Mount, Center Hung Pivot Hinge (Ives 7255 Top).....	104.51	8.99
	08 71 16 00-0337	EA		Dark Bronze Finish, 500 LB Max Door Weight, Top Header Mount, Center Hung Pivot Hinge (Ives 7255 Top).....	104.51	8.99
	08 71 16 00-0338	EA		Bright Chrome Finish, 500 LB Max Door Weight, Top Header Mount, Center Hung Pivot Hinge (Ives 7255 Top).....	104.51	8.99
	08 71 16 00-0339			600 LB Max Door Weight, Top Mount, Center Hung Pivot Hinges <small>(08 71 16 00-0322)</small>		
	08 71 16 00-0340	EA		Painted Finish, 600 LB Max Door Weight, Top Header Mount, Center Hung Pivot Hinge (Ives 7256 Top).....	96.95	8.99
	08 71 16 00-0341	EA		Satin Chrome Finish, 600 LB Max Door Weight, Top Header Mount, Center Hung Pivot Hinge (Ives 7256 Top)	104.51	8.99
	08 71 16 00-0342	EA		Bright Brass Finish, 600 LB Max Door Weight, Top Header Mount, Center Hung Pivot Hinge (Ives 7256 Top)	104.51	8.99
	08 71 16 00-0343	EA		Satin Brass Finish, 600 LB Max Door Weight, Top Header Mount, Center Hung Pivot Hinge (Ives 7256 Top).....	104.51	8.99
	08 71 16 00-0344	EA		Satin Bronze Finish, 600 LB Max Door Weight, Top Header Mount, Center Hung Pivot Hinge (Ives 7256 Top).....	104.51	8.99
	08 71 16 00-0345	EA		Dark Bronze Finish, 600 LB Max Door Weight, Top Header Mount, Center Hung Pivot Hinge (Ives 7256 Top).....	104.51	8.99
	08 71 16 00-0346	EA		Bright Chrome Finish, 600 LB Max Door Weight, Top Header Mount, Center Hung Pivot Hinge (Ives 7256 Top).....	104.51	8.99
	08 71 16 00-0347			1,000 LB Max Door Weight, Top Mount, Center Hung Pivot Hinges <small>(08 71 16 00-0322)</small>		
	08 71 16 00-0348	EA		Painted Finish, 1,000 LB Max Door Weight, Top Header Mount, Center Hung Pivot Hinge (Ives 7259 Top).....	152.82	10.78
	08 71 16 00-0349	EA		Satin Chrome Finish, 1,000 LB Max Door Weight, Top Header Mount, Center Hung Pivot Hinge (Ives 7259 Top)	178.39	10.78
	08 71 16 00-0350	EA		Bright Brass Finish, 1,000 LB Max Door Weight, Top Header Mount, Center Hung Pivot Hinge (Ives 7259 Top)	205.10	10.78
	08 71 16 00-0351	EA		Satin Brass Finish, 1,000 LB Max Door Weight, Top Header Mount, Center Hung Pivot Hinge (Ives 7259 Top).....	205.10	10.78
	08 71 16 00-0352	EA		Satin Bronze Finish, 1,000 LB Max Door Weight, Top Header Mount, Center Hung Pivot Hinge (Ives 7259 Top)	205.10	10.78
	08 71 16 00-0353	EA		Dark Bronze Finish, 1,000 LB Max Door Weight, Top Header Mount, Center Hung Pivot Hinge (Ives 7259 Top).....	205.10	10.78
	08 71 16 00-0354	EA		Bright Chrome Finish, 1,000 LB Max Door Weight, Top Header Mount, Center Hung Pivot Hinge (Ives 7259 Top).....	205.10	10.78
	08 71 16 00-0355			Bottom Mount, Center Hung Pivot Hinges <small>(08 71 16 00-0321)</small>		
	08 71 16 00-0356			300 LB Max Door Weight, Bottom Mount, Center Hung Pivot Hinges <small>(08 71 16 00-0355)</small>		
	08 71 16 00-0357	EA		Painted Finish, 300 LB Max Door Weight, Bottom Base Plate Mount, Center Hung Pivot Hinge (Ives 7253 BTM).....	71.30	7.18
	08 71 16 00-0358	EA		Satin Chrome Finish, 300 LB Max Door Weight, Bottom Base Plate Mount, Center Hung Pivot Hinge (Ives 7253 BTM).....	82.34	7.18
	08 71 16 00-0359	EA		Bright Brass Finish, 300 LB Max Door Weight, Bottom Base Plate Mount, Center Hung Pivot Hinge (Ives 7253 BTM).....	93.37	7.18
	08 71 16 00-0360	EA		Satin Brass Finish, 300 LB Max Door Weight, Bottom Base Plate Mount, Center Hung Pivot Hinge (Ives 7253 BTM).....	93.37	7.18

08 Openings**08 70 Hardware****08 71 Door Hardware**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-0361	EA		Satin Bronze Finish, 300 LB Max Door Weight, Bottom Base Plate Mount, Center Hung Pivot Hinge (Ives 7253 BTM).....	93.37	7.18
08 71 16 00-0362	EA		Dark Bronze Finish, 300 LB Max Door Weight, Bottom Base Plate Mount, Center Hung Pivot Hinge (Ives 7253 BTM).....	93.37	7.18
08 71 16 00-0363	EA		Bright Chrome Finish, 300 LB Max Door Weight, Bottom Base Plate Mount, Center Hung Pivot Hinge (Ives 7253 BTM).....	93.37	7.18
08 71 16 00-0364			500 LB Max Door Weight, Bottom Mount, 3/4" Offset Pivot Hinges (08 71 16 00-0355)		
08 71 16 00-0365	EA		Painted Finish, 500 LB Max Door Weight, Bottom Base Plate Mount, Center Hung Pivot Hinge (Ives 7255 BTM).....	104.51	8.99
08 71 16 00-0366	EA		Satin Chrome Finish, 500 LB Max Door Weight, Bottom Base Plate Mount, Center Hung Pivot Hinge (Ives 7255 BTM).....	107.99	8.99
08 71 16 00-0367	EA		Bright Brass Finish, 500 LB Max Door Weight, Bottom Base Plate Mount, Center Hung Pivot Hinge (Ives 7255 BTM).....	107.99	8.99
08 71 16 00-0368	EA		Satin Brass Finish, 500 LB Max Door Weight, Bottom Base Plate Mount, Center Hung Pivot Hinge (Ives 7255 BTM).....	107.99	8.99
08 71 16 00-0369	EA		Satin Bronze Finish, 500 LB Max Door Weight, Bottom Base Plate Mount, Center Hung Pivot Hinge (Ives 7255 BTM).....	107.99	8.99
08 71 16 00-0370	EA		Dark Bronze Finish, 500 LB Max Door Weight, Bottom Base Plate Mount, Center Hung Pivot Hinge (Ives 7255 BTM).....	107.99	8.99
08 71 16 00-0371	EA		Bright Chrome Finish, 500 LB Max Door Weight, Bottom Base Plate Mount, Center Hung Pivot Hinge (Ives 7255 BTM).....	107.99	8.99
08 71 16 00-0372	EA		Painted Finish, 500 LB Max Door Weight, Bottom Jamb Mount, Center Hung Pivot Hinge (Ives 7255 JBTM).....	104.51	8.99
08 71 16 00-0373	EA		Satin Chrome Finish, 500 LB Max Door Weight, Bottom Jamb Mount, Center Hung Pivot Hinge (Ives 7255 JBTM).....	107.99	8.99
08 71 16 00-0374	EA		Bright Brass Finish, 500 LB Max Door Weight, Bottom Jamb Mount, Center Hung Pivot Hinge (Ives 7255 JBTM).....	107.99	8.99
08 71 16 00-0375	EA		Satin Brass Finish, 500 LB Max Door Weight, Bottom Jamb Mount, Center Hung Pivot Hinge (Ives 7255 JBTM).....	107.99	8.99
08 71 16 00-0376	EA		Satin Bronze Finish, 500 LB Max Door Weight, Bottom Jamb Mount, Center Hung Pivot Hinge (Ives 7255 JBTM).....	107.99	8.99
08 71 16 00-0377	EA		Dark Bronze Finish, 500 LB Max Door Weight, Bottom Jamb Mount, Center Hung Pivot Hinge (Ives 7255 JBTM).....	107.99	8.99
08 71 16 00-0378	EA		Bright Chrome Finish, 500 LB Max Door Weight, Bottom Jamb Mount, Center Hung Pivot Hinge (Ives 7255 JBTM).....	107.99	8.99
08 71 16 00-0379			600 LB Max Door Weight, Bottom Mount, Center Hung Pivot Hinges (08 71 16 00-0355)		
08 71 16 00-0380	EA		Painted Finish, 600 LB Max Door Weight, Bottom Base Plate Mount, Center Hung Pivot Hinge (Ives 7256 BTM).....	209.06	8.99
08 71 16 00-0381	EA		Satin Chrome Finish, 600 LB Max Door Weight, Bottom Base Plate Mount, Center Hung Pivot Hinge (Ives 7256 BTM).....	220.09	8.99
08 71 16 00-0382	EA		Bright Brass Finish, 600 LB Max Door Weight, Bottom Base Plate Mount, Center Hung Pivot Hinge (Ives 7256 BTM).....	231.71	8.99
08 71 16 00-0383	EA		Satin Brass Finish, 600 LB Max Door Weight, Bottom Base Plate Mount, Center Hung Pivot Hinge (Ives 7256 BTM).....	231.71	8.99
08 71 16 00-0384	EA		Satin Bronze Finish, 600 LB Max Door Weight, Bottom Base Plate Mount, Center Hung Pivot Hinge (Ives 7256 BTM).....	231.71	8.99
08 71 16 00-0385	EA		Dark Bronze Finish, 600 LB Max Door Weight, Bottom Base Plate Mount, Center Hung Pivot Hinge (Ives 7256 BTM).....	231.71	8.99
08 71 16 00-0386	EA		Bright Chrome Finish, 600 LB Max Door Weight, Bottom Base Plate Mount, Center Hung Pivot Hinge (Ives 7256 BTM).....	231.71	8.99
08 71 16 00-0387			1,000 LB Max Door Weight, Bottom Mount, Center Hung Pivot Hinges (08 71 16 00-0355)		
08 71 16 00-0388	EA		Painted Finish, 1,000 LB Max Door Weight, Bottom Base Plate Mount, Center Hung Pivot Hinge (Ives 7259 BTM).....	384.00	10.78
08 71 16 00-0389	EA		Satin Chrome Finish, 1,000 LB Max Door Weight, Bottom Base Plate Mount, Center Hung Pivot Hinge (Ives 7259 BTM).....	395.03	10.78
08 71 16 00-0390	EA		Bright Brass Finish, 1,000 LB Max Door Weight, Bottom Base Plate Mount, Center Hung Pivot Hinge (Ives 7259 BTM).....	410.14	10.78
08 71 16 00-0391	EA		Satin Brass Finish, 1,000 LB Max Door Weight, Bottom Base Plate Mount, Center Hung Pivot Hinge (Ives 7259 BTM).....	410.14	10.78
08 71 16 00-0392	EA		Satin Bronze Finish, 1,000 LB Max Door Weight, Bottom Base Plate Mount, Center Hung Pivot Hinge (Ives 7259 BTM).....	410.14	10.78
08 71 16 00-0393	EA		Dark Bronze Finish, 1,000 LB Max Door Weight, Bottom Base Plate Mount, Center Hung Pivot Hinge (Ives 7259 BTM).....	410.14	10.78
08 71 16 00-0394	EA		Bright Chrome Finish, 1,000 LB Max Door Weight, Bottom Base Plate Mount, Center Hung Pivot Hinge (Ives 7259 BTM).....	410.14	10.78
08 71 16 00-0395			Continuous Steel Hinges (08 71 16 00-0001)		
08 71 16 00-0396	LF		1-1/2" Wide, Continuous Steel Hinge.....	13.59	2.87
			For Stainless Steel, Add	1.15	
			For Brass Or Nickel, Add	1.25	
			For Aluminum, Add	0.41	
			For Medium Gauge, Deduct	-0.42	
08 71 16 00-0397	LF		2" Wide, Continuous Steel Hinge.....	13.74	2.87
			For Stainless Steel, Add	1.23	
			For Brass Or Nickel, Add	1.34	
			For Aluminum, Add	0.44	
			For Medium Gauge, Deduct	-0.45	
08 71 16 00-0398	LF		2-1/2" Wide, Continuous Steel Hinge.....	14.01	2.87
			For Stainless Steel, Add	1.38	
			For Brass Or Nickel, Add	1.50	
			For Aluminum, Add	0.49	
			For Medium Gauge, Deduct	-0.50	



Openings	08	08
Hardware	08 70	
Door Hardware	08 71	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-0399	LF		3" Wide, Continuous Steel Hinge..... <i>For Stainless Steel, Add</i> <i>For Brass Or Nickel, Add</i> <i>For Aluminum, Add</i> <i>For Medium Gauge, Deduct</i>	14.33 1.55 1.69 0.55 -0.56	2.87
08 71 16 00-0400			Continuous Geared Hinges (08 71 16 00-0001)		
08 71 16 00-0401	LF		Half Surface, Aluminum Geared Continuous Hinge, Standard Duty (Roton 780-053)..... <i>For Bronze Finish, Add</i> <i>For Heavy Duty, Add</i>	32.82 7.99 5.69	2.87
08 71 16 00-0402	LF		Full Surface, Aluminum Geared Continuous Hinge, Standard Duty (Roton 780-057)..... <i>For Bronze Finish, Add</i> <i>For Heavy Duty, Add</i>	35.32 8.93 6.36	2.87
08 71 16 00-0403	LF		Concealed (Full Mortise), Aluminum Geared Continuous Hinge, Standard Duty (Roton 780-112)..... <i>For Bronze Finish, Add</i>	22.84 4.25	2.87
08 71 16 00-0404	LF		Concealed (Full Mortise), Aluminum Geared Continuous Hinge, Heavy Duty (Roton 780-112HD)..... <i>For Bronze Finish, Add</i>	26.45 5.60	2.87
08 71 16 00-0405			Mortised, Primed Steel, Double Acting Spring Hinges (08 71 16 00-0001)		
08 71 16 00-0406	PR		2", Mortised, Primed Steel, Double Acting Spring Hinge <i>For Satin Brass, Add</i>	71.91 11.22	5.03
08 71 16 00-0407	PR		3", Mortised, Primed Steel, Double Acting Spring Hinge <i>For Satin Brass, Add</i>	79.11 11.22	6.47
08 71 16 00-0408	PR		4", Mortised, Primed Steel, Double Acting Spring Hinge <i>For Satin Brass, Add</i>	88.85 11.84	7.91
08 71 16 00-0409	PR		5", Mortised, Primed Steel, Double Acting Spring Hinge <i>For Satin Brass, Add</i>	114.95 16.38	9.34
08 71 16 00-0410	PR		6", Mortised, Primed Steel, Double Acting Spring Hinge <i>For Satin Brass, Add</i>	129.04 18.03	10.78
08 71 16 00-0411	PR		7", Mortised, Primed Steel, Double Acting Spring Hinge <i>For Satin Brass, Add</i>	154.17 22.34	12.22
08 71 16 00-0412	PR		8", Mortised, Primed Steel, Double Acting Spring Hinge <i>For Satin Brass, Add</i>	205.19 32.86	34.14
08 71 16 00-0413			Security Hinges (08 71 16 00-0001)		
08 71 16 00-0414	EA		4-1/2" x 4-1/2", Non Removable Pin, Full Mortise, Ball Bearing, Steel Security Hinge.....	27.15	5.03
08 71 16 00-0415			Concealed Circuit Electric Hinge Option (08 71 16 00-0001) Note: Excludes the hinge. These tasks are used in conjunction with other hinges in the Construction Task Catalog® to electrify the hinge.		
08 71 16 00-0416	EA		4 Wire Concealed Circuit Electric Hinge Option.....	152.72	
08 71 16 00-0417	EA		6 Wire Concealed Circuit Electric Hinge Option.....	180.32	
08 71 16 00-0418	EA		8 Wire Concealed Circuit Electric Hinge Option.....	207.91	
08 71 16 00-0419			Hinge Filler Plates For Door Frames (08 71 16 00-0001)		
08 71 16 00-0420	PR		Hinge Filler Plates For Door Frames.....	12.18	3.60
08 71 16 00-0421			Door Trim (08 71 16)		
08 71 16 00-0422			Floor Stops, Wall Stops And Bumpers (08 71 16 00-0421)		
08 71 16 00-0423			Floor Stops (08 71 16 00-0422)		
08 71 16 00-0424			Aluminum Floor Stops (08 71 16 00-0423)		
08 71 16 00-0425	EA		1-5/16" Overall Height, Satin Aluminum Finish, Aluminum Floor Stop (Ives FS430).....	19.44	8.99
08 71 16 00-0426	EA		1" Overall Height, 3/16" Base Height, Satin Aluminum Finish, Aluminum Dome Floor Stop (Ives FS436).....	20.90	8.99
08 71 16 00-0427	EA		1-3/8" Overall Height, 9/16" Base Height, Satin Aluminum Finish, Aluminum Dome Floor Stop (Ives FS438).....	21.46	8.99
08 71 16 00-0428	EA		2-1/8" Overall Height, Satin Aluminum Finish, Aluminum Floor Stop (Ives FS441).....	29.98	8.99
08 71 16 00-0429	EA		3" Overall Height, Satin Aluminum Finish, Aluminum Floor Stop (Ives FS444/448).....	31.00	8.99
08 71 16 00-0430			Brass Floor Stops (08 71 16 00-0423)		
08 71 16 00-0431	EA		1" Overall Height, 3/16" Base Height, Satin Chrome Finish, Brass Dome Floor Stop (Ives FS436).....	21.11	8.99
08 71 16 00-0432	EA		1" Overall Height, 3/16" Base Height, Satin Brass Finish, Brass Dome Floor Stop (Ives FS436).....	21.67	8.99
08 71 16 00-0433	EA		1" Overall Height, 3/16" Base Height, Bright Brass Finish, Brass Dome Floor Stop (Ives FS436).....	21.67	8.99
08 71 16 00-0434	EA		1" Overall Height, 3/16" Base Height, Bright Chrome Finish, Brass Dome Floor Stop (Ives FS436).....	21.89	8.99
08 71 16 00-0435	EA		1" Overall Height, 3/16" Base Height, Satin Bronze Finish, Brass Dome Floor Stop (Ives FS436).....	22.17	8.99
08 71 16 00-0436	EA		1" Overall Height, 3/16" Base Height, Dark Bronze Finish, Brass Dome Floor Stop (Ives FS436).....	22.17	8.99
08 71 16 00-0437	EA		1" Overall Height, 3/16" Base Height, Satin Nickel Finish, Brass Dome Floor Stop (Ives FS436).....	22.17	8.99
08 71 16 00-0438	EA		1-3/8" Overall Height, 9/16" Base Height, Satin Chrome Finish, Brass Dome Floor Stop (Ives FS438).....	21.46	8.99
08 71 16 00-0439	EA		1-3/8" Overall Height, 9/16" Base Height, Satin Brass Finish, Brass Dome Floor Stop (Ives FS438).....	22.31	8.99
08 71 16 00-0440	EA		1-3/8" Overall Height, 9/16" Base Height, Bright Brass Finish, Brass Dome Floor Stop (Ives FS438).....	22.31	8.99
08 71 16 00-0441	EA		1-3/8" Overall Height, 9/16" Base Height, Bright Chrome Finish, Brass Dome Floor Stop (Ives FS438).....	22.64	8.99
08 71 16 00-0442	EA		1-3/8" Overall Height, 9/16" Base Height, Satin Bronze Finish, Brass Dome Floor Stop (Ives FS438).....	22.93	8.99
08 71 16 00-0443	EA		1-3/8" Overall Height, 9/16" Base Height, Dark Bronze Finish, Brass Dome Floor Stop (Ives FS438).....	22.93	8.99
08 71 16 00-0444	EA		1-3/8" Overall Height, 9/16" Base Height, Satin Nickel Finish, Brass Dome Floor Stop (Ives FS438).....	24.27	8.99

08 Openings**08 70 Hardware****08 71 Door Hardware**

MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
08 71 16 00-0445	EA	1" Overall Height, 5/32" Base Height, Satin Chrome Finish, Brass Dome Floor Stop (Ives FS13)	22.37		8.99
08 71 16 00-0446	EA	1" Overall Height, 5/32" Base Height, Bright Brass Finish, Brass Dome Floor Stop (Ives FS13)	22.37		8.99
08 71 16 00-0447	EA	1" Overall Height, 5/32" Base Height, Bright Chrome Finish, Brass Dome Floor Stop (Ives FS13)	23.29		8.99
08 71 16 00-0448	EA	1" Overall Height, 5/32" Base Height, Satin Brass Finish, Brass Dome Floor Stop (Ives FS13)	23.29		8.99
08 71 16 00-0449	EA	1" Overall Height, 5/32" Base Height, Satin Bronze Finish, Brass Dome Floor Stop (Ives FS13)	23.29		8.99
08 71 16 00-0450	EA	1" Overall Height, 5/32" Base Height, Dark Bronze Finish, Brass Dome Floor Stop (Ives FS13)	23.29		8.99
08 71 16 00-0451	EA	1-11/32" Overall Height, 1/2" Base Height, Satin Chrome Finish, Brass Dome Floor Stop (Ives FS17)	23.01		8.99
08 71 16 00-0452	EA	1-11/32" Overall Height, 1/2" Base Height, Bright Brass Finish, Brass Dome Floor Stop (Ives FS17)	23.01		8.99
08 71 16 00-0453	EA	1-11/32" Overall Height, 1/2" Base Height, Bright Chrome Finish, Brass Dome Floor Stop (Ives FS17)	23.91		8.99
08 71 16 00-0454	EA	1-11/32" Overall Height, 1/2" Base Height, Satin Brass Finish, Brass Dome Floor Stop (Ives FS17)	23.91		8.99
08 71 16 00-0455	EA	1-11/32" Overall Height, 1/2" Base Height, Satin Bronze Finish, Brass Dome Floor Stop (Ives FS17)	23.91		8.99
08 71 16 00-0456	EA	1-11/32" Overall Height, 1/2" Base Height, Dark Bronze Finish, Brass Dome Floor Stop (Ives FS17)	23.91		8.99
08 71 16 00-0457	EA	2-1/8" Overall Height, Satin Chrome Finish, Brass Floor Stop (Ives FS441)	30.80		8.99
08 71 16 00-0458	EA	2-1/8" Overall Height, Bright Brass Finish, Brass Floor Stop (Ives FS441)	31.20		8.99
08 71 16 00-0459	EA	2-1/8" Overall Height, Dark Bronze Finish, Brass Floor Stop (Ives FS441)	32.17		8.99
08 71 16 00-0460	EA	2-1/8" Overall Height, Satin Brass Finish, Brass Floor Stop (Ives FS441)	32.96		8.99
08 71 16 00-0461	EA	2-1/8" Overall Height, Satin Bronze Finish, Brass Floor Stop (Ives FS441)	32.96		8.99
08 71 16 00-0462	EA	2-1/8" Overall Height, Bright Chrome Finish, Brass Floor Stop (Ives FS441)	36.18		8.99
08 71 16 00-0463	EA	2-1/8" Overall Height, Satin Nickel Finish, Brass Floor Stop (Ives FS441)	36.18		8.99
08 71 16 00-0464	EA	3" Overall Height, Dark Bronze Finish, Brass Floor Stop (Ives FS444/448)	34.99		8.99
08 71 16 00-0465	EA	3" Overall Height, Satin Chrome Finish, Brass Floor Stop (Ives FS444/448)	35.56		8.99
08 71 16 00-0466	EA	3" Overall Height, Satin Brass Finish, Brass Floor Stop (Ives FS444/448)	35.56		8.99
08 71 16 00-0467	EA	3" Overall Height, Bright Brass Finish, Brass Floor Stop (Ives FS444/448)	35.56		8.99
08 71 16 00-0468	EA	3" Overall Height, Satin Bronze Finish, Brass Floor Stop (Ives FS444/448)	35.56		8.99
08 71 16 00-0469	EA	3" Overall Height, Bright Chrome Finish, Brass Floor Stop (Ives FS444/448)	39.97		8.99
08 71 16 00-0470	EA	3" Overall Height, Satin Nickel Finish, Brass Floor Stop (Ives FS444/448)	39.97		8.99
08 71 16 00-0471	EA	1-5/16" Overall Height, Satin Brass Finish, Brass Floor Stop (Ives FS430)	26.01		8.99
08 71 16 00-0472	EA	1-5/16" Overall Height, Bright Brass Finish, Brass Floor Stop (Ives FS430)	26.74		8.99
08 71 16 00-0473	EA	1-5/16" Overall Height, Satin Chrome Finish, Brass Floor Stop (Ives FS430)	28.40		8.99
08 71 16 00-0474	EA	1-5/16" Overall Height, Bright Chrome Finish, Brass Floor Stop (Ives FS430)	28.40		8.99
08 71 16 00-0475	EA	1-5/16" Overall Height, Dark Bronze Finish, Brass Floor Stop (Ives FS430)	28.40		8.99
08 71 16 00-0476	EA	1-5/16" Overall Height, Satin Nickel Finish, Brass Floor Stop (Ives FS430)	28.89		8.99
08 71 16 00-0477		Steel Floor Stops (08 71 16 00-0423)			
08 71 16 00-0478	EA	2-5/8" Overall Height, Zinc Plated Finish, Wrought Steel Floor Stop (Ives FS434)	23.14		8.99
08 71 16 00-0479	EA	1-1/2" Overall Height, Grout In, Molded Rubber Security Floor Stop (Ives FS18S) Note: Includes drilling, Excludes Grout.	50.41		8.99
08 71 16 00-0480	EA	3-1/2" Overall Height, Grout In, Molded Rubber Security Floor Stop (Ives FS18L) Note: Includes drilling, Excludes Grout.	52.73		8.99
08 71 16 00-0481		Wall Stops (08 71 16 00-0422)			
08 71 16 00-0482		Aluminum Wall Stops (08 71 16 00-0481)			
08 71 16 00-0483	EA	3-3/4" Projection, Residential Rigid Type, Satin Aluminum Finish, Aluminum Wall Stop (Ives 60)	9.21		3.60
08 71 16 00-0484	EA	3-3/4" Projection, Rigid Type, Satin Aluminum Finish, Aluminum Wall Stop (Ives WS65)	13.53		5.39
08 71 16 00-0485		Brass Wall Stops (08 71 16 00-0481)			
08 71 16 00-0486	EA	3-3/4" Projection, Residential Rigid Type, Satin Chrome Finish, Brass Wall Stop (Ives 60)	14.20		3.60
08 71 16 00-0487	EA	3-3/4" Projection, Residential Rigid Type, Satin Brass Finish, Brass Wall Stop (Ives 60)	14.20		3.60
08 71 16 00-0488	EA	3-3/4" Projection, Residential Rigid Type, Bright Brass Finish, Brass Wall Stop (Ives 60)	14.20		3.60
08 71 16 00-0489	EA	3-3/4" Projection, Residential Rigid Type, Satin Nickel Finish, Brass Wall Stop (Ives 60)	16.37		3.60
08 71 16 00-0490	EA	3-3/4" Projection, Residential Rigid Type, Bright Chrome Finish, Brass Wall Stop (Ives 60)	16.58		3.60
08 71 16 00-0491	EA	3-3/4" Projection, Residential Rigid Type, Satin Bronze Finish, Brass Wall Stop (Ives 60)	16.58		3.60
08 71 16 00-0492	EA	3-3/4" Projection, Residential Rigid Type, Dark Bronze Finish, Brass Wall Stop (Ives 60)	16.58		3.60
08 71 16 00-0493	EA	3-3/4" Projection, Rigid Type, Satin Chrome Finish, Brass Wall Stop (Ives WS11)	36.71		5.39
08 71 16 00-0494	EA	3-3/4" Projection, Rigid Type, Dark Bronze Finish, Brass Wall Stop (Ives WS11)	37.48		5.39
08 71 16 00-0495	EA	3-3/4" Projection, Rigid Type, Bright Brass Finish, Brass Wall Stop (Ives WS11)	37.48		5.39
08 71 16 00-0496	EA	3-3/4" Projection, Rigid Type, Satin Bronze Finish, Brass Wall Stop (Ives WS11)	37.48		5.39
08 71 16 00-0497	EA	3-3/4" Projection, Rigid Type, Bright Chrome Finish, Brass Wall Stop (Ives WS11)	37.48		5.39
08 71 16 00-0498	EA	3-3/4" Projection, Rigid Type, Satin Brass Finish, Brass Wall Stop (Ives WS11)	37.48		5.39
08 71 16 00-0499	EA	3-3/4" Projection, Rigid Type, Bright Brass Finish, Brass Wall Stop (Ives WS443/447)	31.31		5.39
08 71 16 00-0500	EA	3-3/4" Projection, Rigid Type, Satin Bronze Finish, Brass Wall Stop (Ives WS443/447)	35.46		5.39
08 71 16 00-0501	EA	3-3/4" Projection, Rigid Type, Bright Chrome Finish, Brass Wall Stop (Ives WS443/447)	35.46		5.39
08 71 16 00-0502	EA	3-3/4" Projection, Rigid Type, Dark Bronze Finish, Brass Wall Stop (Ives WS443/447)	35.46		5.39
08 71 16 00-0503	EA	3-3/4" Projection, Rigid Type, Satin Chrome Finish, Brass Wall Stop (Ives WS443/447)	35.46		5.39
08 71 16 00-0504	EA	3-3/4" Projection, Rigid Type, Satin Brass Finish, Brass Wall Stop (Ives WS443/447)	36.44		5.39
08 71 16 00-0505	EA	3-3/4" Projection, Rigid Type, Satin Nickel Finish, Brass Wall Stop (Ives WS443/447)	36.44		5.39
08 71 16 00-0506	EA	3-3/4" Projection, Rigid Type, Satin Chrome Finish, Brass Wall Stop (Ives WS33)	56.90		5.39
08 71 16 00-0507		Steel Wall Stops (08 71 16 00-0481)			
08 71 16 00-0508	EA	3" Projection, Residential Spring Type, Bright Brass Finish, Steel Wall Stop (Ives 63)	7.60		3.60
08 71 16 00-0509		Hinge Pin Door Stops (08 71 16 00-0422)			
08 71 16 00-0510		Aluminum Hinge Pin Door Stops (08 71 16 00-0509)			
08 71 16 00-0511	EA	Satin Aluminum Finish, Aluminum Hinge Pin Door Stop (Ives 70)	15.64		7.18



Openings	08	08
Hardware	08 70	
Door Hardware	08 71	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-0512 Brass Hinge Pin Door Stops <small>(08 71 16 00-0509)</small>		
08 71 16 00-0513 EA Satin Brass Finish, Brass Residential Hinge Pin Door Stop (Ives 72).....	15.88	7.18
08 71 16 00-0514 EA Satin Brass Finish, Brass Hinge Pin Door Stop (Ives 73)	17.39	7.18
08 71 16 00-0515 EA Satin Chrome Finish, Brass Hinge Pin Door Stop (Ives 70).....	21.03	7.18
08 71 16 00-0516 EA Satin Brass Finish, Brass Hinge Pin Door Stop (Ives 70)	21.03	7.18
08 71 16 00-0517 EA Bright Brass Finish, Brass Hinge Pin Door Stop (Ives 70).....	21.03	7.18
08 71 16 00-0518 EA Bright Chrome Finish, Brass Hinge Pin Door Stop (Ives 70).....	22.73	7.18
08 71 16 00-0519 EA Satin Bronze Finish, Brass Hinge Pin Door Stop (Ives 70).....	22.73	7.18
08 71 16 00-0520 EA Dark Bronze Finish, Brass Hinge Pin Door Stop (Ives 70).....	22.73	7.18
08 71 16 00-0521 EA Satin Nickel Finish, Brass Hinge Pin Door Stop (Ives 70).....	22.73	7.18
08 71 16 00-0522 Wall Bumpers <small>(08 71 16 00-0422)</small>		
08 71 16 00-0523 Brass Wall Bumpers <small>(08 71 16 00-0522)</small>		
08 71 16 00-0524 EA 2-1/2" Base Diameter, Convex Or Concave Rubber Insert, Satin Chrome Finish, Wrought Brass Wall Bumper (Ives WS406/407).....	20.34	8.99
08 71 16 00-0525 EA 2-1/2" Base Diameter, Convex Or Concave Rubber Insert, Satin Brass Finish, Wrought Brass Wall Bumper (Ives WS406/407).....	20.34	8.99
08 71 16 00-0526 EA 2-1/2" Base Diameter, Convex Or Concave Rubber Insert, Bright Brass Finish, Wrought Brass Wall Bumper (Ives WS406/407).....	20.34	8.99
08 71 16 00-0527 EA 2-1/2" Base Diameter, Convex Or Concave Rubber Insert, Bright Chrome Finish, Wrought Brass Wall Bumper (Ives WS406/407).....	20.55	8.99
08 71 16 00-0528 EA 2-1/2" Base Diameter, Convex Or Concave Rubber Insert, Satin Bronze Finish, Wrought Brass Wall Bumper (Ives WS406/407).....	20.55	8.99
08 71 16 00-0529 EA 2-1/2" Base Diameter, Convex Or Concave Rubber Insert, Dark Bronze Finish, Wrought Brass Wall Bumper (Ives WS406/407).....	20.55	8.99
08 71 16 00-0530 EA 2-1/2" Base Diameter, Convex Or Concave Rubber Insert, Satin Nickel Finish, Wrought Brass Wall Bumper (Ives WS406/407).....	20.55	8.99
08 71 16 00-0531 EA 2-1/2" Base Diameter, Convex Or Concave Rubber Insert, Bright Brass Finish, Cast Brass Wall Bumper (Ives WS401/402).....	27.55	8.99
08 71 16 00-0532 EA 2-1/2" Base Diameter, Convex Or Concave Rubber Insert, Satin Chrome Finish, Cast Brass Wall Bumper (Ives WS401/402).....	29.45	8.99
08 71 16 00-0533 EA 2-1/2" Base Diameter, Convex Or Concave Rubber Insert, Bright Chrome Finish, Cast Brass Wall Bumper (Ives WS401/402).....	29.45	8.99
08 71 16 00-0534 EA 2-1/2" Base Diameter, Convex Or Concave Rubber Insert, Satin Brass Finish, Cast Brass Wall Bumper (Ives WS401/402).....	29.45	8.99
08 71 16 00-0535 EA 2-1/2" Base Diameter, Convex Or Concave Rubber Insert, Satin Bronze Finish, Cast Brass Wall Bumper (Ives WS401/402).....	29.45	8.99
08 71 16 00-0536 EA 2-1/2" Base Diameter, Convex Or Concave Rubber Insert, Dark Bronze Finish, Cast Brass Wall Bumper (Ives WS401/402).....	29.45	8.99
08 71 16 00-0537 EA 2-1/2" Base Diameter, Convex Or Concave Rubber Insert, Satin Nickel Finish, Cast Brass Wall Bumper (Ives WS401/402).....	29.87	8.99
08 71 16 00-0538 Rubber Wall Bumpers <small>(08 71 16 00-0522)</small>		
08 71 16 00-0539 EA 1-7/8" Base Diameter, Adhesive-Backed, Concave Rubber Wall Bumper (Ives WS411R-W).....	19.59	8.99
08 71 16 00-0540 Holders <small>(08 71 16 00-0421)</small>		
08 71 16 00-0541 Plunger Type Door Holders <small>(08 71 16 00-0540)</small>		
08 71 16 00-0542 Aluminum Plunger Type Door Holders <small>(08 71 16 00-0541)</small>		
08 71 16 00-0543 EA Satin Aluminum Finish, Aluminum Plunger Type Door Holder (Ives FS1153)	38.60	5.39
08 71 16 00-0544 Brass Plunger Type Door Holders <small>(08 71 16 00-0541)</small>		
08 71 16 00-0545 EA Satin Chrome Finish, Brass Plunger Type Door Holder (Ives FS1154)	60.97	5.39
08 71 16 00-0546 EA Bright Chrome Finish, Brass Plunger Type Door Holder (Ives FS1154)	60.97	5.39
08 71 16 00-0547 EA Satin Brass Finish, Brass Plunger Type Door Holder (Ives FS1154)	60.97	5.39
08 71 16 00-0548 EA Bright Brass Finish, Brass Plunger Type Door Holder (Ives FS1154)	60.97	5.39
08 71 16 00-0549 EA Satin Bronze Finish, Brass Plunger Type Door Holder (Ives FS1154)	60.97	5.39
08 71 16 00-0550 EA Dark Bronze Finish, Brass Plunger Type Door Holder (Ives FS1154)	60.97	5.39
08 71 16 00-0551 EA Satin Nickel Finish, Brass Plunger Type Door Holder (Ives FS1154)	60.97	5.39
08 71 16 00-0552 Kick Down Door Holders <small>(08 71 16 00-0540)</small>		
08 71 16 00-0553 Aluminum Kick Down Door Holders <small>(08 71 16 00-0552)</small>		
08 71 16 00-0554 EA Satin Aluminum Finish, Aluminum Kick Down Door Holder (Ives FS455).....	15.32	5.39
08 71 16 00-0555 Brass Kick Down Door Holders <small>(08 71 16 00-0552)</small>		
08 71 16 00-0556 EA Satin Brass Finish, Brass Kick Down Door Holder (Ives FS455)	29.23	5.39
08 71 16 00-0557 EA Bright Brass Finish, Brass Kick Down Door Holder (Ives FS455).....	29.23	5.39
08 71 16 00-0558 EA Satin Bronze Finish, Brass Kick Down Door Holder (Ives FS455).....	29.23	5.39
08 71 16 00-0559 EA Satin Chrome Finish, Brass Kick Down Door Holder (Ives FS455).....	32.86	5.39
08 71 16 00-0560 EA Bright Chrome Finish, Brass Kick Down Door Holder (Ives FS455).....	32.86	5.39
08 71 16 00-0561 EA Dark Bronze Finish, Brass Kick Down Door Holder (Ives FS455).....	32.86	5.39

08 Openings**08 70 Hardware****08 71 Door Hardware**

MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	
08 71 16 00-0562	EA	Satin Nickel Finish, Brass Kick Down Door Holder (Ives FS455).....	33.77		5.39
08 71 16 00-0563		Steel Kick Down Door Holders (08 71 16 00-0552)			
08 71 16 00-0564	EA	Steel Kick Down Door Holder (Ives FS544).....	18.13		5.39
08 71 16 00-0565		Floor Mounted Door Holders (08 71 16 00-0540)			
08 71 16 00-0566		Brass Floor Mounted Door Holders (08 71 16 00-0565)			
08 71 16 00-0567	EA	Up To 1/2" Door To Floor Clearance, Satin Chrome Finish, Brass Floor Stop And Automatic Door Holder (Ives FS40).....	57.37		10.78
		For >1/2" To 1-1/16" Door To Floor Clearance, Add	1.78		
		For >1-1/16" To 1-9/16" Door To Floor Clearance, Add	10.53		
		For >1-9/16" To 2-11/16" Door To Floor Clearance, Add	15.80		
08 71 16 00-0568	EA	Up To 1/2" Door To Floor Clearance, Satin Brass Finish, Brass Floor Stop And Automatic Door Holder (Ives FS40).....	57.37		10.78
		For >1/2" To 1-1/16" Door To Floor Clearance, Add	1.78		
		For >1-1/16" To 1-9/16" Door To Floor Clearance, Add	10.53		
		For >1-9/16" To 2-11/16" Door To Floor Clearance, Add	15.80		
08 71 16 00-0569	EA	Up To 1/2" Door To Floor Clearance, Bright Chrome Finish, Brass Floor Stop And Automatic Door Holder (Ives FS40).....	69.42		10.78
		For >1/2" To 1-1/16" Door To Floor Clearance, Add	1.78		
		For >1-1/16" To 1-9/16" Door To Floor Clearance, Add	10.53		
		For >1-9/16" To 2-11/16" Door To Floor Clearance, Add	15.80		
08 71 16 00-0570	EA	Up To 1/2" Door To Floor Clearance, Bright Brass Finish, Brass Floor Stop And Automatic Door Holder (Ives FS40).....	69.42		10.78
		For >1/2" To 1-1/16" Door To Floor Clearance, Add	1.78		
		For >1-1/16" To 1-9/16" Door To Floor Clearance, Add	10.53		
		For >1-9/16" To 2-11/16" Door To Floor Clearance, Add	15.80		
08 71 16 00-0571	EA	Up To 1/2" Door To Floor Clearance, Satin Bronze Finish, Brass Floor Stop And Automatic Door Holder (Ives FS40).....	69.42		10.78
		For >1/2" To 1-1/16" Door To Floor Clearance, Add	1.78		
		For >1-1/16" To 1-9/16" Door To Floor Clearance, Add	10.53		
		For >1-9/16" To 2-11/16" Door To Floor Clearance, Add	15.80		
08 71 16 00-0572	EA	Up To 1/2" Door To Floor Clearance, Dark Bronze Finish, Brass Floor Stop And Automatic Door Holder (Ives FS40).....	69.42		10.78
		For >1/2" To 1-1/16" Door To Floor Clearance, Add	1.78		
		For >1-1/16" To 1-9/16" Door To Floor Clearance, Add	10.53		
		For >1-9/16" To 2-11/16" Door To Floor Clearance, Add	15.80		
08 71 16 00-0573		Wall Mounted Door Holders (08 71 16 00-0540)			
08 71 16 00-0574		Aluminum Wall Mounted Door Holders (08 71 16 00-0573)			
08 71 16 00-0575	EA	4" Projection, Rigid Type, Satin Aluminum Finish, Aluminum Wall Stop And Manual Door Holder (Ives WS20).....	48.80		6.29
08 71 16 00-0576	EA	Wall Mounted, Satin Aluminum Finish, Aluminum Automatic Door Holder (Ives WS40).....	72.59		10.78
08 71 16 00-0577		Brass Wall Mounted Door Holders (08 71 16 00-0573)			
08 71 16 00-0578	EA	3-11/16" Projection, Rigid Type, Bright Brass Finish, Brass Wall Stop And Manual Door Holder (Ives WS445/449).....	45.15		6.29
08 71 16 00-0579	EA	3-11/16" Projection, Rigid Type, Satin Chrome Finish, Brass Wall Stop And Manual Door Holder (Ives WS445/449).....	51.69		6.29
08 71 16 00-0580	EA	3-11/16" Projection, Rigid Type, Bright Chrome Finish, Brass Wall Stop And Manual Door Holder (Ives WS445/449).....	51.69		6.29
08 71 16 00-0581	EA	3-11/16" Projection, Rigid Type, Satin Brass Finish, Brass Wall Stop And Manual Door Holder (Ives WS445/449).....	51.69		6.29
08 71 16 00-0582	EA	3-11/16" Projection, Rigid Type, Satin Bronze Finish, Brass Wall Stop And Manual Door Holder (Ives WS445/449).....	51.69		6.29
08 71 16 00-0583	EA	3-11/16" Projection, Rigid Type, Dark Bronze Finish, Brass Wall Stop And Manual Door Holder (Ives WS445/449).....	51.69		6.29
08 71 16 00-0584	EA	3-11/16" Projection, Rigid Type, Satin Nickel Finish, Brass Wall Stop And Manual Door Holder (Ives WS445/449).....	53.22		6.29
08 71 16 00-0585	EA	4" Projection, Rigid Type, Satin Chrome Finish, Brass Wall Stop And Manual Door Holder (Ives WS20).....	50.62		6.29
08 71 16 00-0586	EA	4" Projection, Rigid Type, Bright Chrome Finish, Brass Wall Stop And Manual Door Holder (Ives WS20).....	59.54		6.29
08 71 16 00-0587	EA	4" Projection, Rigid Type, Satin Brass Finish, Brass Wall Stop And Manual Door Holder (Ives WS20).....	59.54		6.29
08 71 16 00-0588	EA	4" Projection, Rigid Type, Bright Brass Finish, Brass Wall Stop And Manual Door Holder (Ives WS20).....	59.54		6.29
08 71 16 00-0589	EA	4" Projection, Rigid Type, Satin Bronze Finish, Brass Wall Stop And Manual Door Holder (Ives WS20).....	59.54		6.29
08 71 16 00-0590	EA	4" Projection, Rigid Type, Dark Bronze Finish, Brass Wall Stop And Manual Door Holder (Ives WS20).....	59.54		6.29
08 71 16 00-0591	EA	Wall Mounted, Satin Chrome Finish, Brass Automatic Door Holder (Ives WS40).....	81.49		10.78
08 71 16 00-0592	EA	Wall Mounted, Bright Chrome Finish, Brass Automatic Door Holder (Ives WS40).....	85.49		10.78
08 71 16 00-0593	EA	Wall Mounted, Satin Brass Finish, Brass Automatic Door Holder (Ives WS40).....	85.49		10.78
08 71 16 00-0594	EA	Wall Mounted, Bright Brass Finish, Brass Automatic Door Holder (Ives WS40).....	85.49		10.78
08 71 16 00-0595	EA	Wall Mounted, Satin Bronze Finish, Brass Automatic Door Holder (Ives WS40).....	85.49		10.78
08 71 16 00-0596	EA	Wall Mounted, Dark Bronze Finish, Brass Automatic Door Holder (Ives WS40).....	85.49		10.78
08 71 16 00-0597		Overhead Door Holders (08 71 16 00-0540)			
08 71 16 00-0598		Surface Mounted, Overhead Door Holders (08 71 16 00-0597)			
08 71 16 00-0599	EA	Surface Mounted, Aluminum Finish, Overhead Door Holder/Stop Without Hold Open (Glynn Johnson 81).....	254.53		17.96
		For Hold Open, Add	26.36		
08 71 16 00-0600	EA	Surface Mounted, Dark Bronze Finish, Overhead Door Holder/Stop Without Hold Open (Glynn Johnson 81).....	288.18		17.96
		For Hold Open, Add	31.21		
08 71 16 00-0601	EA	Surface Mounted, Polished Brass Finish, Overhead Door Holder/Stop Without Hold Open (Glynn Johnson 81).....	288.18		17.96
		For Hold Open, Add	31.21		



Openings	08	08
Hardware	08 70	
Door Hardware	08 71	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-0602 EA Surface Mounted, Polished Chrome Finish, Overhead Door Holder/Stop Without Hold Open (Glynn Johnson 81).....	288.18	17.96
<i>For Hold Open, Add</i>	31.21	
08 71 16 00-0603 EA Surface Mounted, Stainless Steel Finish, Overhead Door Holder/Stop Without Hold Open (Glynn Johnson 81).....	287.04	17.96
<i>For Hold Open, Add</i>	31.05	
08 71 16 00-0604 Heavy Duty, Surface Mounted, Overhead Door Holders (08 71 16 00-0597)		
Note: With or without hold open feature.		
08 71 16 00-0605 EA Heavy Duty, Surface Mounted, Aluminum Finish, Overhead Door Holder/Stop (Glynn Johnson 90)	203.72	17.96
08 71 16 00-0606 EA Heavy Duty, Surface Mounted, Stainless Steel Finish, Overhead Door Holder/Stop (Glynn Johnson 90)	284.06	17.96
08 71 16 00-0607 EA Heavy Duty, Surface Mounted, Dark Bronze Finish, Overhead Door Holder/Stop (Glynn Johnson 90)	319.08	17.96
08 71 16 00-0608 EA Heavy Duty, Surface Mounted, Polished Brass Finish, Overhead Door Holder/Stop (Glynn Johnson 90)	319.08	17.96
08 71 16 00-0609 EA Heavy Duty, Surface Mounted, Polished Chrome Finish, Overhead Door Holder/Stop (Glynn Johnson 90).....	319.08	17.96
08 71 16 00-0610 Concealed Mounted, Overhead Door Holders (08 71 16 00-0597)		
Note: With or without hold open feature.		
08 71 16 00-0611 EA Concealed Mounted, Aluminum Finish, Overhead Door Holder/Stop (Glynn Johnson 100)	275.59	17.96
08 71 16 00-0612 EA Concealed Mounted, Stainless Steel Finish, Overhead Door Holder/Stop (Glynn Johnson 100)	275.59	17.96
08 71 16 00-0613 EA Concealed Mounted, Dark Bronze Finish, Overhead Door Holder/Stop (Glynn Johnson 100)	289.33	17.96
08 71 16 00-0614 EA Concealed Mounted, Polished Brass Finish, Overhead Door Holder/Stop (Glynn Johnson 100)	301.00	17.96
08 71 16 00-0615 EA Concealed Mounted, Polished Chrome Finish, Overhead Door Holder/Stop (Glynn Johnson 100)	301.00	17.96
08 71 16 00-0616 Silencers (08 71 16 00-0421)		
08 71 16 00-0617 EA Replacement Rubber Door Silencers	1.04	0.71
Note: For repair / maintenance only. This task is not to be used in conjunction with new door or frame installations.		
08 71 16 00-0618 Bolts (08 71 16 00-0421)		
08 71 16 00-0619 Brass Surface Bolts (08 71 16 00-0618)		
08 71 16 00-0620 EA 8" Length, Satin Chrome Finish, Brass Surface Bolt With Strike (Ives SB1640).....	81.41	8.99
08 71 16 00-0621 EA 8" Length, Bright Brass Finish, Brass Surface Bolt With Strike (Ives SB1640).....	86.70	8.99
08 71 16 00-0622 EA 8" Length, Dark Bronze Finish, Brass Surface Bolt With Strike (Ives SB1640).....	86.70	8.99
08 71 16 00-0623 Steel Surface Bolts (08 71 16 00-0618)		
08 71 16 00-0624 EA 8" Length, Zinc Plated Finish, Steel Surface Bolt With Strike (Ives SB453).....	40.44	8.99
08 71 16 00-0625 EA 8" Length, Bright Brass Finish, Steel Surface Bolt With Strike (Ives SB453).....	40.44	8.99
08 71 16 00-0626 EA 8" Length, Satin Brass Finish, Steel Surface Bolt With Strike (Ives SB453).....	40.44	8.99
08 71 16 00-0627 EA 8" Length, Satin Bronze Finish, Steel Surface Bolt With Strike (Ives SB453).....	45.06	8.99
08 71 16 00-0628 EA 8" Length, Satin Chrome Finish, Steel Surface Bolt With Strike (Ives SB453).....	45.73	8.99
08 71 16 00-0629 EA 8" Length, Dark Bronze Finish, Steel Surface Bolt With Strike (Ives SB453).....	47.04	8.99
08 71 16 00-0630 EA 12" Length, Zinc Plated Finish, Steel Surface Bolt With Strike (Ives SB453).....	46.38	8.99
08 71 16 00-0631 EA 12" Length, Satin Bronze Finish, Steel Surface Bolt With Strike (Ives SB453).....	48.37	8.99
08 71 16 00-0632 EA 12" Length, Dark Bronze Finish, Steel Surface Bolt With Strike (Ives SB453).....	51.01	8.99
08 71 16 00-0633 EA 12" Length, Satin Chrome Finish, Steel Surface Bolt With Strike (Ives SB453).....	52.99	8.99
08 71 16 00-0634 EA 12" Length, Zinc Plated Finish, Steel Surface Bolt With Strike (Ives SB360).....	79.43	8.99
08 71 16 00-0635 Door Viewer (08 71 16 00-0421)		
08 71 16 00-0636 Brass Door Viewer (08 71 16 00-0635)		
08 71 16 00-0637 EA 120 Degree Angle Of View, Satin Chrome Finish, Brass One-Way Door Viewer (Ives U700).....	24.27	8.99
08 71 16 00-0638 EA 120 Degree Angle Of View, Satin Brass Finish, Brass One-Way Door Viewer (Ives U700)	24.27	8.99
08 71 16 00-0639 EA 120 Degree Angle Of View, Dark Bronze Finish, Brass One-Way Door Viewer (Ives U700).....	24.27	8.99
08 71 16 00-0640 EA 150 Degree Angle Of View, Satin Chrome Finish, Brass One-Way Door Viewer (Ives U696).....	27.22	8.99
08 71 16 00-0641 EA 150 Degree Angle Of View, Dark Bronze Finish, Brass One-Way Door Viewer (Ives U696).....	27.22	8.99
08 71 16 00-0642 EA 150 Degree Angle Of View, Satin Brass Finish, Brass One-Way Door Viewer (Ives U696).....	27.22	8.99
08 71 16 00-0643 EA 190 Degree Angle Of View, Satin Chrome Finish, Brass One-Way Wide Angle Door Viewer (Ives U698)	30.86	8.99
08 71 16 00-0644 EA 190 Degree Angle Of View, Bright Brass Finish, Brass One-Way Wide Angle Door Viewer (Ives U698).....	30.86	8.99
08 71 16 00-0645 Door Knockers (08 71 16 00-0421)		
08 71 16 00-0646 Brass Door Knockers (08 71 16 00-0645)		
08 71 16 00-0647 EA 5-15/16" Length, 3" Width, Bright Brass Finish, Brass Door Knocker (Ives 3125)	33.38	8.99
08 71 16 00-0648 EA 5-15/16" Length, 3" Width, Satin Chrome Finish, Brass Door Knocker (Ives 3125).....	36.18	8.99
08 71 16 00-0649 EA 5-15/16" Length, 3" Width, Bright Chrome Finish, Brass Door Knocker (Ives 3125).....	36.18	8.99
08 71 16 00-0650 EA 5-15/16" Length, 3" Width, Satin Nickel Finish, Brass Door Knocker (Ives 3125).....	36.18	8.99
08 71 16 00-0651 EA 8-1/2" Length, 4-1/8" Width, Bright Brass Finish, Brass Door Knocker (Ives 3107)	46.82	8.99
08 71 16 00-0652 EA 8-1/2" Length, 4-1/8" Width, Satin Nickel Finish, Brass Door Knocker (Ives 3107).....	53.59	8.99
08 71 16 00-0653 Hasps (08 71 16 00-0421)		
08 71 16 00-0654 EA 3-1/4", Zinc Plated Finish, Steel Hasp Assembly.....	17.38	6.78
08 71 16 00-0655 EA 4-1/2", Zinc Plated Finish, Steel Hasp Assembly.....	18.51	7.18
08 71 16 00-0656 EA 6", Zinc Plated Finish, Steel Hasp Assembly	22.88	8.09
08 71 16 00-0657 EA 6", Zinc Plated Finish, Steel High Security Hasp Assembly.....	77.54	9.70

08 Openings**08 70 Hardware****08 71 Door Hardware**

MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
08 71 16 00-0658		Flush Bolts <small>(08 71 16 00-042 1)</small>			
08 71 16 00-0659		Flush Bolts For Metal Doors <small>(08 71 16 00-0658)</small>			
08 71 16 00-0660		Brass Flush Bolts For Metal Doors <small>(08 71 16 00-0659)</small>			
08 71 16 00-0661		Manual, Brass Flush Bolts For Metal Doors <small>(08 71 16 00-0660)</small>			
		Note: Includes brass construction with bright brass, satin brass, satin bronze, dark bronze, satin nickel, bright chrome or satin chrome finish.			
08 71 16 00-0662	EA	Top Or Bottom Bolt, Manual, Brass Flush Bolt For Metal Doors (Ives FB457/458)	32.51		8.99
08 71 16 00-0663		Automatic, Brass Flush Bolts For Metal Doors <small>(08 71 16 00-0660)</small>			
		Note: Includes brass construction with bright brass, satin brass, satin bronze or dark bronze finish.			
08 71 16 00-0664	EA	Top Bolt Only, Automatic, Brass Flush Bolt For Metal Doors (Ives FB31T)	70.70		8.99
08 71 16 00-0665	EA	Bottom Bolt Only, Automatic, Brass Flush Bolt For Metal Doors (Ives FB31B)	70.70		8.99
08 71 16 00-0666	EA	Top And Bottom Bolt, Automatic, Brass Flush Bolt For Metal Doors (Ives FB31P)	128.69		14.38
08 71 16 00-0667	EA	Top Bolt With Auxiliary Fire Latch, Automatic, Brass Flush Bolt For Metal Doors (Ives FB32)	125.10		12.57
08 71 16 00-0668	EA	Top Bolt With Auxiliary Fire Latch And Retrofit Plate, Automatic, Brass Flush Bolt For Metal Doors (Ives FB33)	130.20		13.48
08 71 16 00-0669		Constant Latching, Brass Flush Bolts For Metal Doors <small>(08 71 16 00-0660)</small>			
		Note: Includes brass construction with bright brass, satin brass, satin bronze or dark bronze finish.			
08 71 16 00-0670	EA	Top Bolt Only, Constant Latching, Brass Flush Bolt For Metal Doors (Ives FB51T)	70.11		8.99
08 71 16 00-0671	EA	Top And Bottom Bolt, Constant Latching, Brass Flush Bolt For Metal Doors (Ives FB51P)	128.69		14.38
08 71 16 00-0672	EA	Top Bolt With Auxiliary Fire Latch, Constant Latching, Brass Flush Bolt For Metal Doors (Ives FB52)	125.10		12.57
08 71 16 00-0673	EA	Top Bolt With Auxiliary Fire Latch And Retrofit Plate, Constant Latching, Brass Flush Bolt For Metal Doors (Ives FB53)	130.20		13.48
08 71 16 00-0674		Stainless Steel Flush Bolts For Metal Doors <small>(08 71 16 00-0659)</small>			
08 71 16 00-0675		Automatic, Stainless Steel Flush Bolts For Metal Doors <small>(08 71 16 00-0674)</small>			
		Note: Includes stainless steel construction with bright or satin finish.			
08 71 16 00-0676	EA	Top Bolt Only, Automatic, Stainless Steel Flush Bolt For Metal Doors (Ives FB31T)	70.70		8.99
08 71 16 00-0677	EA	Bottom Bolt Only, Automatic, Stainless Steel Flush Bolt For Metal Doors (Ives FB31B)	70.70		8.99
08 71 16 00-0678	EA	Top And Bottom Bolt, Automatic, Stainless Steel Flush Bolt For Metal Doors (Ives FB31P)	128.69		14.38
08 71 16 00-0679	EA	Top Bolt With Auxiliary Fire Latch, Automatic, Stainless Steel Flush Bolt For Metal Doors (Ives FB32)	125.10		12.57
08 71 16 00-0680	EA	Top Bolt With Auxiliary Fire Latch And Retrofit Plate, Automatic, Stainless Steel Flush Bolt For Metal Doors (Ives FB33)	130.20		13.48
08 71 16 00-0681		Constant Latching, Stainless Steel Flush Bolts For Metal Doors <small>(08 71 16 00-0674)</small>			
		Note: Includes stainless steel construction with bright or satin finish.			
08 71 16 00-0682	EA	Top Bolt Only, Constant Latching, Stainless Steel Flush Bolt For Metal Doors (Ives FB51T)	70.11		8.99
08 71 16 00-0683	EA	Top And Bottom Bolt, Constant Latching, Stainless Steel Flush Bolt For Metal Doors (Ives FB51P)	128.69		14.38
08 71 16 00-0684	EA	Top Bolt With Auxiliary Fire Latch, Constant Latching, Stainless Steel Flush Bolt For Metal Doors (Ives FB52)	125.10		12.57
08 71 16 00-0685	EA	Top Bolt With Auxiliary Fire Latch And Retrofit Plate, Constant Latching, Stainless Steel Flush Bolt For Metal Doors (Ives FB53)	130.20		13.48
08 71 16 00-0686		Flush Bolts For Wood Doors <small>(08 71 16 00-0658)</small>			
08 71 16 00-0687		Brass Flush Bolts For Wood Doors <small>(08 71 16 00-0686)</small>			
08 71 16 00-0688		Manual, Brass Flush Bolts For Wood Doors <small>(08 71 16 00-0687)</small>			
		Note: Includes brass construction with bright brass, satin brass, satin bronze, dark bronze, satin nickel, bright chrome or satin chrome finish.			
08 71 16 00-0689	EA	Top Or Bottom Bolt, Manual, Brass Flush Bolt For Wood Doors (Ives FB358)	37.45		8.99
08 71 16 00-0690		Automatic, Brass Flush Bolts For Wood Doors <small>(08 71 16 00-0687)</small>			
		Note: Includes brass construction with bright brass, satin brass, satin bronze or dark bronze finish.			
08 71 16 00-0691	EA	Top Bolt Only, Automatic, Brass Flush Bolt For Wood Doors (Ives FB41T)	73.27		8.99
08 71 16 00-0692	EA	Bottom Bolt Only, Automatic, Brass Flush Bolt For Metal Doors (Ives FB41B)	73.27		8.99
08 71 16 00-0693	EA	Top And Bottom Bolt, Automatic, Brass Flush Bolt For Wood Doors (Ives FB41P)	134.24		14.38
08 71 16 00-0694	EA	Top Bolt With Auxiliary Fire Latch, Automatic, Brass Flush Bolt For Wood Doors (Ives FB42)	130.65		12.57
08 71 16 00-0695		Constant Latching, Brass Flush Bolts For Wood Doors <small>(08 71 16 00-0687)</small>			
		Note: Includes brass construction with bright brass, satin brass, satin bronze or dark bronze finish.			
08 71 16 00-0696	EA	Top Bolt Only, Constant Latching, Brass Flush Bolt For Wood Doors (Ives FB61T)	72.76		8.99
08 71 16 00-0697	EA	Top And Bottom Bolt, Constant Latching, Brass Flush Bolt For Wood Doors (Ives FB61P)	134.24		14.38
08 71 16 00-0698	EA	Top Bolt With Auxiliary Fire Latch, Constant Latching, Brass Flush Bolt For Wood Doors (Ives FB62)	130.65		12.57
08 71 16 00-0699		Stainless Steel Flush Bolts For Wood Doors <small>(08 71 16 00-0686)</small>			
08 71 16 00-0700		Automatic, Stainless Steel Flush Bolts For Wood Doors <small>(08 71 16 00-0699)</small>			
		Note: Includes stainless steel construction with bright or satin finish.			
08 71 16 00-0701	EA	Top Bolt Only, Automatic, Stainless Steel Flush Bolt For Wood Doors (Ives FB41T)	73.27		8.99
08 71 16 00-0702	EA	Bottom Bolt Only, Automatic, Stainless Steel Flush Bolt For Metal Doors (Ives FB41B)	73.27		8.99



MINOR			TOTAL DIRECT	DEMOLITION
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST
08 71 16 00-0703	EA	Top And Bottom Bolt, Automatic, Stainless Steel Flush Bolt For Wood Doors (Ives FB41P)	134.24	14.38
08 71 16 00-0704	EA	Top Bolt With Auxiliary Fire Latch, Automatic, Stainless Steel Flush Bolt For Wood Doors (Ives FB42)	130.65	12.57
08 71 16 00-0705		Constant Latching, Stainless Steel Flush Bolts For Wood Doors (08 71 16 00-0699)		
Note: Includes stainless steel construction with bright or satin finish.				
08 71 16 00-0706	EA	Top Bolt Only, Constant Latching, Stainless Steel Flush Bolt For Wood Doors (Ives FB61T)	72.76	8.99
08 71 16 00-0707	EA	Top And Bottom Bolt, Constant Latching, Stainless Steel Flush Bolt For Wood Doors (Ives FB61P)	134.24	14.38
08 71 16 00-0708	EA	Top Bolt With Auxiliary Fire Latch, Constant Latching, Stainless Steel Flush Bolt For Wood Doors (Ives FB62)	130.65	12.57
08 71 16 00-0709		Dust Proof Strikes (08 71 16 00-0658)		
08 71 16 00-0710	EA	Satin Brass Finish, Brass Dust Proof Strike (Ives DP1)	28.53	7.18
08 71 16 00-0711	EA	Satin Chrome Finish, Brass Dust Proof Strike (Ives DP1)	28.53	7.18
08 71 16 00-0712	EA	Bright Brass Finish, Brass Dust Proof Strike (Ives DP1)	28.53	7.18
08 71 16 00-0713	EA	Satin Bronze Finish, Brass Dust Proof Strike (Ives DP1)	28.53	7.18
08 71 16 00-0714	EA	Dark Bronze Finish, Brass Dust Proof Strike (Ives DP1)	28.53	7.18
08 71 16 00-0715	EA	Satin Bronze Finish, Brass Dust Proof Strike With Plate (Ives DP2)	32.22	7.18
08 71 16 00-0716	EA	Satin Chrome Finish, Brass Dust Proof Strike With Plate (Ives DP2)	32.22	7.18
08 71 16 00-0717	EA	Satin Brass Finish, Brass Dust Proof Strike With Plate (Ives DP2)	32.22	7.18
08 71 16 00-0718	EA	Bright Brass Finish, Brass Dust Proof Strike With Plate (Ives DP2)	32.22	7.18
08 71 16 00-0719	EA	Dark Bronze Finish, Brass Dust Proof Strike With Plate (Ives DP2)	32.22	7.18
08 71 16 00-0720		Roller Bumpers (08 71 16 00-0421)		
08 71 16 00-0721		Brass Roller Bumpers (08 71 16 00-0720)		
08 71 16 00-0722	EA	5" Length, Bright Brass Finish, Brass Offset Arm Roller Bumper (Ives RB470)	28.52	5.39
08 71 16 00-0723	EA	5" Length, Satin Chrome Finish, Brass Offset Arm Roller Bumper (Ives RB470)	32.94	5.39
08 71 16 00-0724	EA	5" Length, Bright Chrome Finish, Brass Offset Arm Roller Bumper (Ives RB470)	32.94	5.39
08 71 16 00-0725	EA	4-1/2" Length, Bright Brass Finish, Brass Straight Arm Roller Bumper (Ives RB471)	27.52	5.39
08 71 16 00-0726	EA	4-1/2" Length, Satin Chrome Finish, Brass Straight Arm Roller Bumper (Ives RB471)	30.89	5.39
08 71 16 00-0727	EA	4-1/2" Length, Bright Chrome Finish, Brass Straight Arm Roller Bumper (Ives RB471)	30.89	5.39
08 71 16 00-0728	EA	4-1/2" Length, Satin Brass Finish, Brass Straight Arm Roller Bumper (Ives RB471)	30.89	5.39
08 71 16 00-0729	EA	6" Length, Bright Brass Finish, Brass Straight Arm Roller Bumper (Ives RB472)	28.59	5.39
08 71 16 00-0730	EA	6" Length, Satin Nickel Finish, Brass Straight Arm Roller Bumper (Ives RB472)	30.97	5.39
08 71 16 00-0731	EA	6" Length, Satin Chrome Finish, Brass Straight Arm Roller Bumper (Ives RB472)	32.09	5.39
08 71 16 00-0732	EA	6" Length, Bright Chrome Finish, Brass Straight Arm Roller Bumper (Ives RB472)	32.09	5.39
08 71 16 00-0733	EA	6" Length, Satin Brass Finish, Brass Straight Arm Roller Bumper (Ives RB472)	32.09	5.39
08 71 16 00-0734	EA	6" Length, Satin Bronze Finish, Brass Straight Arm Roller Bumper (Ives RB472)	32.09	5.39
08 71 16 00-0735	EA	6" Length, Dark Bronze Finish, Brass Straight Arm Roller Bumper (Ives RB472)	32.09	5.39
08 71 16 00-0736		Other Door Trim (08 71 16 00-0421)		
08 71 16 00-0737		Coat And Hat Hooks (08 71 16 00-0736)		
08 71 16 00-0738		Aluminum Coat And Hat Hooks (08 71 16 00-0737)		
08 71 16 00-0739	EA	1-1/4" Height, 1-1/4" Width, Bright Brass Finish, Aluminum Wardrobe Hook (Ives 581)	12.13	5.39
08 71 16 00-0740	EA	1-1/4" Height, 1-1/4" Width, Aluminum Finish, Aluminum Wardrobe Hook (Ives 581)	12.13	5.39
08 71 16 00-0741	EA	1-1/4" Height, 1-1/4" Width, Satin Nickel Finish, Aluminum Wardrobe Hook (Ives 581)	12.21	5.39
08 71 16 00-0742	EA	1-3/4" Height, 1-1/4" Width, Satin Bronze Finish, Aluminum Coat And Hat Hook (Ives 571)	12.08	5.39
08 71 16 00-0743	EA	1-3/4" Height, 1-1/4" Width, Bright Brass Finish, Aluminum Coat And Hat Hook (Ives 571)	12.08	5.39
08 71 16 00-0744	EA	1-3/4" Height, 1-1/4" Width, Aluminum Finish, Aluminum Coat And Hat Hook (Ives 571)	12.08	5.39
08 71 16 00-0745	EA	1-3/4" Height, 1-1/4" Width, Satin Nickel Finish, Aluminum Coat And Hat Hook (Ives 571)	12.21	5.39
08 71 16 00-0746	EA	1-1/2" Height, 2-1/2" Width, Satin Brass Finish, Aluminum Coat And Hat Hook (Ives 405)	12.63	5.39
08 71 16 00-0747	EA	1-1/2" Height, 2-1/2" Width, Bright Brass Finish, Aluminum Coat And Hat Hook (Ives 405)	12.63	5.39
08 71 16 00-0748	EA	1-1/2" Height, 2-1/2" Width, Satin Bronze Finish, Aluminum Coat And Hat Hook (Ives 405)	12.63	5.39
08 71 16 00-0749	EA	1-1/2" Height, 2-1/2" Width, Dark Bronze Finish, Aluminum Coat And Hat Hook (Ives 405)	12.63	5.39
08 71 16 00-0750	EA	1-1/2" Height, 2-1/2" Width, Aluminum Finish, Aluminum Coat And Hat Hook (Ives 405)	12.63	5.39
08 71 16 00-0751		Brass Coat And Hat Hooks (08 71 16 00-0737)		
08 71 16 00-0752	EA	1-1/4" Height, 1-1/4" Width, Bright Brass Finish, Brass Wardrobe Hook (Ives 581)	14.38	5.39
08 71 16 00-0753	EA	1-1/4" Height, 1-1/4" Width, Satin Brass Finish, Brass Wardrobe Hook (Ives 581)	14.59	5.39
08 71 16 00-0754	EA	1-1/4" Height, 1-1/4" Width, Dark Bronze Finish, Brass Wardrobe Hook (Ives 581)	14.94	5.39
08 71 16 00-0755	EA	1-1/4" Height, 1-1/4" Width, Satin Chrome Finish, Brass Wardrobe Hook (Ives 581)	14.94	5.39
08 71 16 00-0756	EA	1-1/4" Height, 1-1/4" Width, Satin Nickel Finish, Brass Wardrobe Hook (Ives 581)	15.16	5.39
08 71 16 00-0757	EA	1-3/4" Height, 1-1/4" Width, Bright Brass Finish, Brass Coat And Hat Hook (Ives 571)	15.85	5.39
08 71 16 00-0758	EA	1-3/4" Height, 1-1/4" Width, Satin Brass Finish, Brass Coat And Hat Hook (Ives 571)	16.84	5.39
08 71 16 00-0759	EA	1-3/4" Height, 1-1/4" Width, Dark Bronze Finish, Brass Coat And Hat Hook (Ives 571)	16.84	5.39
08 71 16 00-0760	EA	1-3/4" Height, 1-1/4" Width, Satin Chrome Finish, Brass Coat And Hat Hook (Ives 571)	16.84	5.39
08 71 16 00-0761	EA	1-3/4" Height, 1-1/4" Width, Satin Nickel Finish, Brass Coat And Hat Hook (Ives 571)	17.06	5.39
08 71 16 00-0762		Door Plates And Pulls (08 71 16)		
08 71 16 00-0763		Kick Plate (08 71 16 00-0762)		
Note: Ives 8400.				
08 71 16 00-0764		Aluminum Base Material Kick Plate (08 71 16 00-0763)		

08 Openings**08 70 Hardware****08 71 Door Hardware**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-0765			Satin Aluminum Finish, Aluminum Kick Plate (08 71 16 00-0764)		
08 71 16 00-0766	EA		8" x 22", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	32.49	5.39
			For Four Beveled Edges, Add	1.76	
			For Counter Sink Holes, Add	5.60	
			For UL Label (Fire Rated), Add	9.80	
08 71 16 00-0767	EA		8" x 24", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	33.50	5.39
			For Four Beveled Edges, Add	1.76	
			For Counter Sink Holes, Add	5.60	
			For UL Label (Fire Rated), Add	9.80	
08 71 16 00-0768	EA		8" x 26", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	34.48	5.39
			For Four Beveled Edges, Add	1.76	
			For Counter Sink Holes, Add	5.60	
			For UL Label (Fire Rated), Add	9.80	
08 71 16 00-0769	EA		8" x 28", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	16.08	5.39
			For Four Beveled Edges, Add	1.76	
			For Counter Sink Holes, Add	5.60	
			For UL Label (Fire Rated), Add	9.80	
08 71 16 00-0770	EA		8" x 30", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	37.92	5.75
			For Four Beveled Edges, Add	1.76	
			For Counter Sink Holes, Add	5.60	
			For UL Label (Fire Rated), Add	9.80	
08 71 16 00-0771	EA		8" x 32", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	38.90	5.75
			For Four Beveled Edges, Add	1.76	
			For Counter Sink Holes, Add	5.60	
			For UL Label (Fire Rated), Add	9.80	
08 71 16 00-0772	EA		8" x 34", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	39.90	5.75
			For Four Beveled Edges, Add	1.76	
			For Counter Sink Holes, Add	5.60	
			For UL Label (Fire Rated), Add	9.80	
08 71 16 00-0773	EA		8" x 36", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	40.89	5.75
			For Four Beveled Edges, Add	1.76	
			For Counter Sink Holes, Add	5.60	
			For UL Label (Fire Rated), Add	9.80	
08 71 16 00-0774	EA		8" x 38", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	43.32	6.11
			For Four Beveled Edges, Add	1.76	
			For Counter Sink Holes, Add	5.60	
			For UL Label (Fire Rated), Add	9.80	
08 71 16 00-0775	EA		8" x 40", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	44.32	6.11
			For Four Beveled Edges, Add	1.76	
			For Counter Sink Holes, Add	5.60	
			For UL Label (Fire Rated), Add	9.80	
08 71 16 00-0776	EA		8" x 42", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	45.30	6.11
			For Four Beveled Edges, Add	1.76	
			For Counter Sink Holes, Add	5.60	
			For UL Label (Fire Rated), Add	9.80	
08 71 16 00-0777	EA		8" x 44", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	47.74	6.47
			For Four Beveled Edges, Add	1.76	
			For Counter Sink Holes, Add	5.60	
			For UL Label (Fire Rated), Add	9.80	
08 71 16 00-0778	EA		8" x 46", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	48.74	6.47
			For Four Beveled Edges, Add	1.76	
			For Counter Sink Holes, Add	5.60	
			For UL Label (Fire Rated), Add	9.80	
08 71 16 00-0779	EA		8" x 48", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	49.72	6.47
			For Four Beveled Edges, Add	1.76	
			For Counter Sink Holes, Add	5.60	
			For UL Label (Fire Rated), Add	9.80	
08 71 16 00-0780	EA		10" x 22", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	35.24	5.39
			For Four Beveled Edges, Add	1.76	
			For Counter Sink Holes, Add	5.60	
			For UL Label (Fire Rated), Add	9.80	
08 71 16 00-0781	EA		10" x 24", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	36.48	5.39
			For Four Beveled Edges, Add	1.76	
			For Counter Sink Holes, Add	5.60	
			For UL Label (Fire Rated), Add	9.80	
08 71 16 00-0782	EA		10" x 26", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	37.71	5.39
			For Four Beveled Edges, Add	1.76	
			For Counter Sink Holes, Add	5.60	
			For UL Label (Fire Rated), Add	9.80	
08 71 16 00-0783	EA		10" x 28", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	38.96	5.39
			For Four Beveled Edges, Add	1.76	
			For Counter Sink Holes, Add	5.60	
			For UL Label (Fire Rated), Add	9.80	
08 71 16 00-0784	EA		10" x 30", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	41.64	5.75
			For Four Beveled Edges, Add	1.76	
			For Counter Sink Holes, Add	5.60	
			For UL Label (Fire Rated), Add	9.80	
08 71 16 00-0785	EA		10" x 32", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	42.88	5.75
			For Four Beveled Edges, Add	1.76	
			For Counter Sink Holes, Add	5.60	
			For UL Label (Fire Rated), Add	9.80	
08 71 16 00-0786	EA		10" x 34", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	44.13	5.75
			For Four Beveled Edges, Add	1.76	
			For Counter Sink Holes, Add	5.60	
			For UL Label (Fire Rated), Add	9.80	



Openings	08	08
Hardware	08 70	
Door Hardware	08 71	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71	16 00-0787	EA	10" x 36", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	45.36 1.76 5.60 9.80	5.75
08 71	16 00-0788	EA	10" x 38", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	48.05 1.76 5.60 9.80	6.11
08 71	16 00-0789	EA	10" x 40", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	49.29 1.76 5.60 9.80	6.11
08 71	16 00-0790	EA	10" x 42", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	50.53 1.76 5.60 9.80	6.11
08 71	16 00-0791	EA	10" x 44", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	53.21 1.76 5.60 9.80	6.47
08 71	16 00-0792	EA	10" x 46", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	54.44 1.76 5.60 9.80	6.47
08 71	16 00-0793	EA	10" x 48", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	55.68 1.76 5.60 9.80	6.47
08 71	16 00-0794	EA	12" x 22", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	37.97 1.76 5.60 9.80	5.39
08 71	16 00-0795	EA	12" x 24", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	39.45 1.76 5.60 9.80	5.39
08 71	16 00-0796	EA	12" x 26", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	40.96 1.76 5.60 9.80	5.39
08 71	16 00-0797	EA	12" x 28", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	42.42 1.76 5.60 9.80	5.39
08 71	16 00-0798	EA	12" x 30", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	45.36 1.76 5.60 9.80	5.75
08 71	16 00-0799	EA	12" x 32", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	46.85 1.76 5.60 9.80	5.75
08 71	16 00-0800	EA	12" x 34", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	48.34 1.76 5.60 9.80	5.75
08 71	16 00-0801	EA	12" x 36", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	49.84 1.76 5.60 9.80	5.75
08 71	16 00-0802	EA	12" x 38", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	52.77 1.76 5.60 9.80	6.11
08 71	16 00-0803	EA	12" x 40", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	54.25 1.76 5.60 9.80	6.11
08 71	16 00-0804	EA	12" x 42", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	55.75 1.76 5.60 9.80	6.11
08 71	16 00-0805	EA	12" x 44", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	58.67 1.76 5.60 9.80	6.47
08 71	16 00-0806	EA	12" x 46", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	60.16 1.76 5.60 9.80	6.47
08 71	16 00-0807	EA	12" x 48", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	61.66 1.76 5.60 9.80	6.47

08 Openings**08 70 Hardware****08 71 Door Hardware**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-0808	EA		14" x 22", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	42.12	5.75
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0809	EA		14" x 24", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	43.86	5.75
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0810	EA		14" x 26", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	45.63	5.75
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0811	EA		14" x 28", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	47.37	5.75
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0812	EA		14" x 30", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	50.53	6.11
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0813	EA		14" x 32", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	52.27	6.11
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0814	EA		14" x 34", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	54.01	6.11
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0815	EA		14" x 36", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	55.75	6.11
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0816	EA		14" x 38", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	58.92	6.47
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0817	EA		14" x 40", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	60.65	6.47
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0818	EA		14" x 42", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	62.39	6.47
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0819	EA		14" x 44", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	65.57	6.83
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0820	EA		14" x 46", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	67.32	6.83
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0821	EA		14" x 48", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	69.06	6.83
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0822	EA		16" x 22", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	44.87	5.75
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0823	EA		16" x 24", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	46.85	5.75
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0824	EA		16" x 26", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	48.85	5.75
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0825	EA		16" x 28", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	50.83	5.75
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0826	EA		16" x 30", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	52.27	6.11
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0827	EA		16" x 32", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	56.26	6.11
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0828	EA		16" x 34", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	58.25	6.11
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	



Openings	08	08
Hardware	08 70	
Door Hardware	08 71	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-0829	EA		16" x 36", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	60.23 1.76 5.60 9.80	6.11
08 71 16 00-0830	EA		16" x 38", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	63.64 1.76 5.60 9.80	6.47
08 71 16 00-0831	EA		16" x 40", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	65.64 1.76 5.60 9.80	6.47
08 71 16 00-0832	EA		16" x 42", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	67.62 1.76 5.60 9.80	6.47
08 71 16 00-0833	EA		16" x 44", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	71.04 1.76 5.60 9.80	6.83
08 71 16 00-0834	EA		16" x 46", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	73.03 1.76 5.60 9.80	6.83
08 71 16 00-0835	EA		16" x 48", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	75.04 1.76 5.60 9.80	6.83
08 71 16 00-0836	EA		18" x 22", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	49.17 6.30 5.60 9.80	5.75
08 71 16 00-0837	EA		18" x 24", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	51.56 6.30 5.60 9.80	5.75
08 71 16 00-0838	EA		18" x 26", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	53.94 6.30 5.60 9.80	5.75
08 71 16 00-0839	EA		18" x 28", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	56.32 6.30 5.60 9.80	5.75
08 71 16 00-0840	EA		18" x 30", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	60.13 6.30 5.60 9.80	6.11
08 71 16 00-0841	EA		18" x 32", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	62.51 6.30 5.60 9.80	6.11
08 71 16 00-0842	EA		18" x 34", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	64.89 6.30 5.60 9.80	6.11
08 71 16 00-0843	EA		18" x 36", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	67.27 6.30 5.60 9.80	6.11
08 71 16 00-0844	EA		18" x 38", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	71.08 6.30 5.60 9.80	6.47
08 71 16 00-0845	EA		18" x 40", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	73.46 6.30 5.60 9.80	6.47
08 71 16 00-0846	EA		18" x 42", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	75.84 6.30 5.60 9.80	6.47
08 71 16 00-0847	EA		18" x 44", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	79.66 6.30 5.60 9.80	6.83
08 71 16 00-0848	EA		18" x 46", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	82.04 6.30 5.60 9.80	6.83
08 71 16 00-0849	EA		18" x 48", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	84.42 6.30 5.60 9.80	6.83

08 Openings**08 70 Hardware****08 71 Door Hardware**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-0850	EA		20" x 22", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	53.52	6.11
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0851	EA		20" x 24", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	56.17	6.11
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0852	EA		20" x 26", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	58.81	6.11
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0853	EA		20" x 28", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	61.45	6.11
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0854	EA		20" x 30", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	65.53	6.47
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0855	EA		20" x 32", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	68.17	6.47
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0856	EA		20" x 34", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	70.81	6.47
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0857	EA		20" x 36", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	73.46	6.47
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0858	EA		20" x 38", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	77.54	6.83
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0859	EA		20" x 40", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	80.19	6.83
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0860	EA		20" x 42", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	82.83	6.83
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0861	EA		20" x 44", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	86.91	7.18
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0862	EA		20" x 46", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	89.56	7.18
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0863	EA		20" x 48", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	92.20	7.18
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0864	EA		22" x 22", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	56.43	6.11
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0865	EA		22" x 24", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	59.34	6.11
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0866	EA		22" x 26", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	62.24	6.11
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0867	EA		22" x 28", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	65.15	6.11
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0868	EA		22" x 30", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	69.50	6.47
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0869	EA		22" x 32", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	72.41	6.47
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0870	EA		22" x 34", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate.....	75.31	6.47
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	



Openings	08	08
Hardware	08 70	
Door Hardware	08 71	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71	16 00-0871	EA	22" x 36", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	78.22	6.47
				6.30	
				5.60	
				9.80	
08 71	16 00-0872	EA	22" x 38", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	82.57	6.83
				6.30	
				5.60	
				9.80	
08 71	16 00-0873	EA	22" x 40", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	85.47	6.83
				6.30	
				5.60	
				9.80	
08 71	16 00-0874	EA	22" x 42", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	88.38	6.83
				6.30	
				5.60	
				9.80	
08 71	16 00-0875	EA	22" x 44", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	92.73	7.18
				6.30	
				5.60	
				9.80	
08 71	16 00-0876	EA	22" x 46", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	95.63	7.18
				6.30	
				5.60	
				9.80	
08 71	16 00-0877	EA	22" x 48", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	98.54	7.18
				6.30	
				5.60	
				9.80	
08 71	16 00-0878	EA	24" x 22", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	59.34	6.11
				6.30	
				5.60	
				9.80	
08 71	16 00-0879	EA	24" x 24", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	62.51	6.11
				6.30	
				5.60	
				9.80	
08 71	16 00-0880	EA	24" x 26", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	65.69	6.11
				6.30	
				5.60	
				9.80	
08 71	16 00-0881	EA	24" x 28", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	68.86	6.11
				6.30	
				5.60	
				9.80	
08 71	16 00-0882	EA	24" x 30", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	73.46	6.47
				6.30	
				5.60	
				9.80	
08 71	16 00-0883	EA	24" x 32", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	76.63	6.47
				6.30	
				5.60	
				9.80	
08 71	16 00-0884	EA	24" x 34", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	79.80	6.47
				6.30	
				5.60	
				9.80	
08 71	16 00-0885	EA	24" x 36", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	82.98	6.47
				6.30	
				5.60	
				9.80	
08 71	16 00-0886	EA	24" x 38", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	87.59	6.83
				6.30	
				5.60	
				9.80	
08 71	16 00-0887	EA	24" x 40", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	90.76	6.83
				6.30	
				5.60	
				9.80	
08 71	16 00-0888	EA	24" x 42", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	93.93	6.83
				6.30	
				5.60	
				9.80	
08 71	16 00-0889	EA	24" x 44", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	98.54	7.18
				6.30	
				5.60	
				9.80	
08 71	16 00-0890	EA	24" x 46", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	101.72	7.18
				6.30	
				5.60	
				9.80	
08 71	16 00-0891	EA	24" x 48", 0.050" Thick, Satin Aluminum Finish, Aluminum Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	104.89	7.18
				6.30	
				5.60	
				9.80	

08 Openings**08 70 Hardware****08 71 Door Hardware**

MINOR		TOTAL DIRECT	DEMOLITION
CSI	UOM DESCRIPTION	UNIT COST	UNIT COST
08 71 16 00-0892	Brass Base Material Kick Plate <small>(08 71 16 00-0763)</small>		
08 71 16 00-0893	Bright/Satin Brass Finish, Brass Kick Plate <small>(08 71 16 00-0892)</small>		
08 71 16 00-0894	EA 8" x 22", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	57.74	5.39
	For Four Beveled Edges, Add	1.76	
	For Counter Sink Holes, Add	5.60	
	For UL Label (Fire Rated), Add	9.80	
08 71 16 00-0895	EA 8" x 24", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	61.02	5.39
	For Four Beveled Edges, Add	1.76	
	For Counter Sink Holes, Add	5.60	
	For UL Label (Fire Rated), Add	9.80	
08 71 16 00-0896	EA 8" x 26", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	64.32	5.39
	For Four Beveled Edges, Add	1.76	
	For Counter Sink Holes, Add	5.60	
	For UL Label (Fire Rated), Add	9.80	
08 71 16 00-0897	EA 8" x 28", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	67.60	5.39
	For Four Beveled Edges, Add	1.76	
	For Counter Sink Holes, Add	5.60	
	For UL Label (Fire Rated), Add	9.80	
08 71 16 00-0898	EA 8" x 30", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	72.33	5.75
	For Four Beveled Edges, Add	1.76	
	For Counter Sink Holes, Add	5.60	
	For UL Label (Fire Rated), Add	9.80	
08 71 16 00-0899	EA 8" x 32", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	75.64	5.75
	For Four Beveled Edges, Add	1.76	
	For Counter Sink Holes, Add	5.60	
	For UL Label (Fire Rated), Add	9.80	
08 71 16 00-0900	EA 8" x 34", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	78.92	5.75
	For Four Beveled Edges, Add	1.76	
	For Counter Sink Holes, Add	5.60	
	For UL Label (Fire Rated), Add	9.80	
08 71 16 00-0901	EA 8" x 36", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	82.20	5.75
	For Four Beveled Edges, Add	1.76	
	For Counter Sink Holes, Add	5.60	
	For UL Label (Fire Rated), Add	9.80	
08 71 16 00-0902	EA 8" x 38", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	86.93	6.11
	For Four Beveled Edges, Add	1.76	
	For Counter Sink Holes, Add	5.60	
	For UL Label (Fire Rated), Add	9.80	
08 71 16 00-0903	EA 8" x 40", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	90.21	6.11
	For Four Beveled Edges, Add	1.76	
	For Counter Sink Holes, Add	5.60	
	For UL Label (Fire Rated), Add	9.80	
08 71 16 00-0904	EA 8" x 42", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	93.50	6.11
	For Four Beveled Edges, Add	1.76	
	For Counter Sink Holes, Add	5.60	
	For UL Label (Fire Rated), Add	9.80	
08 71 16 00-0905	EA 8" x 44", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	98.21	6.47
	For Four Beveled Edges, Add	1.76	
	For Counter Sink Holes, Add	5.60	
	For UL Label (Fire Rated), Add	9.80	
08 71 16 00-0906	EA 8" x 46", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	101.52	6.47
	For Four Beveled Edges, Add	1.76	
	For Counter Sink Holes, Add	5.60	
	For UL Label (Fire Rated), Add	9.80	
08 71 16 00-0907	EA 8" x 48", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	104.81	6.47
	For Four Beveled Edges, Add	1.76	
	For Counter Sink Holes, Add	5.60	
	For UL Label (Fire Rated), Add	9.80	
08 71 16 00-0908	EA 10" x 22", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	66.79	5.39
	For Four Beveled Edges, Add	1.76	
	For Counter Sink Holes, Add	5.60	
	For UL Label (Fire Rated), Add	9.80	
08 71 16 00-0909	EA 10" x 24", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	70.89	5.39
	For Four Beveled Edges, Add	1.76	
	For Counter Sink Holes, Add	5.60	
	For UL Label (Fire Rated), Add	9.80	
08 71 16 00-0910	EA 10" x 26", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	75.01	5.39
	For Four Beveled Edges, Add	1.76	
	For Counter Sink Holes, Add	5.60	
	For UL Label (Fire Rated), Add	9.80	
08 71 16 00-0911	EA 10" x 28", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	79.12	5.39
	For Four Beveled Edges, Add	1.76	
	For Counter Sink Holes, Add	5.60	
	For UL Label (Fire Rated), Add	9.80	
08 71 16 00-0912	EA 10" x 30", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	84.65	5.75
	For Four Beveled Edges, Add	1.76	
	For Counter Sink Holes, Add	5.60	
	For UL Label (Fire Rated), Add	9.80	
08 71 16 00-0913	EA 10" x 32", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	88.77	5.75
	For Four Beveled Edges, Add	1.76	
	For Counter Sink Holes, Add	5.60	
	For UL Label (Fire Rated), Add	9.80	



Openings	08	08
Hardware	08 70	
Door Hardware	08 71	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71	16 00-0914	EA	10" x 34", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	92.89 1.76 5.60 9.80	5.75
08 71	16 00-0915	EA	10" x 36", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	97.00 1.76 5.60 9.80	5.75
08 71	16 00-0916	EA	10" x 38", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	102.54 1.76 5.60 9.80	6.11
08 71	16 00-0917	EA	10" x 40", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	106.66 1.76 5.60 9.80	6.11
08 71	16 00-0918	EA	10" x 42", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	110.78 1.76 5.60 9.80	6.11
08 71	16 00-0919	EA	10" x 44", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	116.31 1.76 5.60 9.80	6.47
08 71	16 00-0920	EA	10" x 46", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	120.43 1.76 5.60 9.80	6.47
08 71	16 00-0921	EA	10" x 48", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	124.54 1.76 5.60 9.80	6.47
08 71	16 00-0922	EA	12" x 22", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	75.81 1.76 5.60 9.80	5.39
08 71	16 00-0923	EA	12" x 24", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	80.76 1.76 5.60 9.80	5.39
08 71	16 00-0924	EA	12" x 26", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	85.69 1.76 5.60 9.80	5.39
08 71	16 00-0925	EA	12" x 28", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	90.62 1.76 5.60 9.80	5.39
08 71	16 00-0926	EA	12" x 30", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	97.00 1.76 5.60 9.80	5.75
08 71	16 00-0927	EA	12" x 32", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	101.94 1.76 5.60 9.80	5.75
08 71	16 00-0928	EA	12" x 34", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	106.87 1.76 5.60 9.80	5.75
08 71	16 00-0929	EA	12" x 36", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	111.79 1.76 5.60 9.80	5.75
08 71	16 00-0930	EA	12" x 38", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	118.19 1.76 5.60 9.80	6.11
08 71	16 00-0931	EA	12" x 40", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	123.11 1.76 5.60 9.80	6.11
08 71	16 00-0932	EA	12" x 42", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	128.04 1.76 5.60 9.80	6.11
08 71	16 00-0933	EA	12" x 44", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	134.40 1.76 5.60 9.80	6.47
08 71	16 00-0934	EA	12" x 46", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	139.32 1.76 5.60 9.80	6.47

08 Openings**08 70 Hardware****08 71 Door Hardware**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-0935	EA		12" x 48", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	144.28	6.47
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0936	EA		14" x 22", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	86.31	5.75
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0937	EA		14" x 24", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	92.06	5.75
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0938	EA		14" x 26", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	97.82	5.75
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0939	EA		14" x 28", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	103.58	5.75
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0940	EA		14" x 30", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	110.78	6.11
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0941	EA		14" x 32", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	116.54	6.11
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0942	EA		14" x 34", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	122.28	6.11
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0943	EA		14" x 36", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	128.04	6.11
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0944	EA		14" x 38", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	135.23	6.47
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0945	EA		14" x 40", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	140.98	6.47
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0946	EA		14" x 42", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	146.73	6.47
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0947	EA		14" x 44", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	153.93	6.83
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0948	EA		14" x 46", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	159.69	6.83
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0949	EA		14" x 48", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	165.45	6.83
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0950	EA		16" x 22", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	95.34	5.75
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0951	EA		16" x 24", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	101.94	5.75
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0952	EA		16" x 26", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	108.51	5.75
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0953	EA		16" x 28", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	115.10	5.75
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0954	EA		16" x 30", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	123.11	6.11
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0955	EA		16" x 32", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	129.68	6.11
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	



Openings	08	08
Hardware	08 70	
Door Hardware	08 71	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71	16 00-0956	EA	16" x 34", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	136.26 1.76 5.60 9.80	6.11
08 71	16 00-0957	EA	16" x 36", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	142.85 1.76 5.60 9.80	6.11
08 71	16 00-0958	EA	16" x 38", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	150.85 1.76 5.60 9.80	6.47
08 71	16 00-0959	EA	16" x 40", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	157.42 1.76 5.60 9.80	6.47
08 71	16 00-0960	EA	16" x 42", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	164.01 1.76 5.60 9.80	6.47
08 71	16 00-0961	EA	16" x 44", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	172.02 1.76 5.60 9.80	6.83
08 71	16 00-0962	EA	16" x 46", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	178.59 1.76 5.60 9.80	6.83
08 71	16 00-0963	EA	16" x 48", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	185.18 1.76 5.60 9.80	6.83
08 71	16 00-0964	EA	18" x 22", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	130.06 6.30 5.60 9.80	5.75
08 71	16 00-0965	EA	18" x 24", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	139.78 6.30 5.60 9.80	5.75
08 71	16 00-0966	EA	18" x 26", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	149.50 6.30 5.60 9.80	5.75
08 71	16 00-0967	EA	18" x 28", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	159.25 6.30 5.60 9.80	5.75
08 71	16 00-0968	EA	18" x 30", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	170.42 6.30 5.60 9.80	6.11
08 71	16 00-0969	EA	18" x 32", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	180.14 6.30 5.60 9.80	6.11
08 71	16 00-0970	EA	18" x 34", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	189.89 6.30 5.60 9.80	6.11
08 71	16 00-0971	EA	18" x 36", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	199.61 6.30 5.60 9.80	6.11
08 71	16 00-0972	EA	18" x 38", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	210.79 6.30 5.60 9.80	6.47
08 71	16 00-0973	EA	18" x 40", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	220.52 6.30 5.60 9.80	6.47
08 71	16 00-0974	EA	18" x 42", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	230.23 6.30 5.60 9.80	6.47
08 71	16 00-0975	EA	18" x 44", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	241.42 6.30 5.60 9.80	6.83
08 71	16 00-0976	EA	18" x 46", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	251.14 6.30 5.60 9.80	6.83

08 Openings**08 70 Hardware****08 71 Door Hardware**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-0977	EA		18" x 48", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	260.87	6.83
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0978	EA		20" x 22", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	143.39	6.11
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0979	EA		20" x 24", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	154.19	6.11
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0980	EA		20" x 26", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	165.02	6.11
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0981	EA		20" x 28", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	175.81	6.11
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0982	EA		20" x 30", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	188.07	6.47
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0983	EA		20" x 32", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	198.88	6.47
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0984	EA		20" x 34", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	209.69	6.47
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0985	EA		20" x 36", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	220.52	6.47
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0986	EA		20" x 38", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	232.75	6.83
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0987	EA		20" x 40", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	243.57	6.83
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0988	EA		20" x 42", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	254.39	6.83
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0989	EA		20" x 44", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	266.63	7.18
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0990	EA		20" x 46", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	277.46	7.18
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0991	EA		20" x 48", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	288.25	7.18
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0992	EA		22" x 22", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	155.29	6.11
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0993	EA		22" x 24", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	167.17	6.11
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0994	EA		22" x 26", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	179.06	6.11
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0995	EA		22" x 28", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	190.96	6.11
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0996	EA		22" x 30", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	204.29	6.47
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-0997	EA		22" x 32", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	216.19	6.47
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	



Openings	08	08
Hardware	08 70	
Door Hardware	08 71	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71	16 00-0998	EA	22" x 34", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	228.08 6.30 5.60 9.80	6.47
08 71	16 00-0999	EA	22" x 36", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	239.98 6.30 5.60 9.80	6.47
08 71	16 00-1000	EA	22" x 38", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	253.30 6.30 5.60 9.80	6.83
08 71	16 00-1001	EA	22" x 40", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	265.19 6.30 5.60 9.80	6.83
08 71	16 00-1002	EA	22" x 42", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	277.10 6.30 5.60 9.80	6.83
08 71	16 00-1003	EA	22" x 44", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	290.43 6.30 5.60 9.80	7.18
08 71	16 00-1004	EA	22" x 46", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	302.33 6.30 5.60 9.80	7.18
08 71	16 00-1005	EA	22" x 48", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	314.20 6.30 5.60 9.80	7.18
08 71	16 00-1006	EA	24" x 22", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	167.17 6.30 5.60 9.80	6.11
08 71	16 00-1007	EA	24" x 24", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	180.14 6.30 5.60 9.80	6.11
08 71	16 00-1008	EA	24" x 26", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	193.13 6.30 5.60 9.80	6.11
08 71	16 00-1009	EA	24" x 28", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	206.11 6.30 5.60 9.80	6.11
08 71	16 00-1010	EA	24" x 30", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	220.52 6.30 5.60 9.80	6.47
08 71	16 00-1011	EA	24" x 32", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	233.48 6.30 5.60 9.80	6.47
08 71	16 00-1012	EA	24" x 34", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	246.46 6.30 5.60 9.80	6.47
08 71	16 00-1013	EA	24" x 36", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	260.15 6.30 5.60 9.80	6.47
08 71	16 00-1014	EA	24" x 38", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	273.85 6.30 5.60 9.80	6.83
08 71	16 00-1015	EA	24" x 40", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	286.81 6.30 5.60 9.80	6.83
08 71	16 00-1016	EA	24" x 42", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	299.79 6.30 5.60 9.80	6.83
08 71	16 00-1017	EA	24" x 44", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	314.20 6.30 5.60 9.80	7.18
08 71	16 00-1018	EA	24" x 46", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	327.20 6.30 5.60 9.80	7.18

08 Openings**08 70 Hardware****08 71 Door Hardware**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-1019	EA		24" x 48", 0.050" Thick, Bright/Satin Brass Finish, Brass Kick Plate.....	340.17	7.18
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1020			Bright/Satin Chrome Finish, Brass Kick Plate (08 71 16 00-0892)		
08 71 16 00-1021	EA		8" x 22", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate.....	61.46	5.39
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1022	EA		8" x 24", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate.....	65.09	5.39
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1023	EA		8" x 26", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate.....	68.71	5.39
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1024	EA		8" x 28", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate.....	72.34	5.39
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1025	EA		8" x 30", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate.....	77.41	5.75
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1026	EA		8" x 32", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate.....	81.03	5.75
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1027	EA		8" x 34", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate.....	84.65	5.75
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1028	EA		8" x 36", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate.....	88.28	5.75
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1029	EA		8" x 38", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate.....	93.35	6.11
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1030	EA		8" x 40", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate.....	96.99	6.11
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1031	EA		8" x 42", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate.....	100.62	6.11
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1032	EA		8" x 44", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate.....	105.68	6.47
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1033	EA		8" x 46", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate.....	109.30	6.47
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1034	EA		8" x 48", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate.....	112.93	6.47
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1035	EA		10" x 22", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate.....	71.44	5.39
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1036	EA		10" x 24", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate.....	75.97	5.39
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1037	EA		10" x 26", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate.....	80.50	5.39
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1038	EA		10" x 28", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate.....	85.03	5.39
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1039	EA		10" x 30", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate.....	91.02	5.75
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	



Openings	08	08
Hardware	08 70	
Door Hardware	08 71	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71	16 00-1040	EA	10" x 32", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	95.55 1.76 5.60 9.80	5.75
08 71	16 00-1041	EA	10" x 34", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	100.08 1.76 5.60 9.80	5.75
08 71	16 00-1042	EA	10" x 36", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	104.61 1.76 5.60 9.80	5.75
08 71	16 00-1043	EA	10" x 38", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	110.59 1.76 5.60 9.80	6.11
08 71	16 00-1044	EA	10" x 40", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	115.12 1.76 5.60 9.80	6.11
08 71	16 00-1045	EA	10" x 42", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	119.65 1.76 5.60 9.80	6.11
08 71	16 00-1046	EA	10" x 44", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	125.61 1.76 5.60 9.80	6.47
08 71	16 00-1047	EA	10" x 46", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	130.15 1.76 5.60 9.80	6.47
08 71	16 00-1048	EA	10" x 48", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	134.68 1.76 5.60 9.80	6.47
08 71	16 00-1049	EA	12" x 22", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	81.41 1.76 5.60 9.80	5.39
08 71	16 00-1050	EA	12" x 24", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	86.84 1.76 5.60 9.80	5.39
08 71	16 00-1051	EA	12" x 26", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	92.30 1.76 5.60 9.80	5.39
08 71	16 00-1052	EA	12" x 28", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	97.74 1.76 5.60 9.80	5.39
08 71	16 00-1053	EA	12" x 30", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	104.61 1.76 5.60 9.80	5.75
08 71	16 00-1054	EA	12" x 32", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	110.06 1.76 5.60 9.80	5.75
08 71	16 00-1055	EA	12" x 34", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	115.50 1.76 5.60 9.80	5.75
08 71	16 00-1056	EA	12" x 36", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	120.93 1.76 5.60 9.80	5.75
08 71	16 00-1057	EA	12" x 38", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	127.81 1.76 5.60 9.80	6.11
08 71	16 00-1058	EA	12" x 40", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	133.25 1.76 5.60 9.80	6.11
08 71	16 00-1059	EA	12" x 42", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	138.70 1.76 5.60 9.80	6.11
08 71	16 00-1060	EA	12" x 44", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	145.56 1.76 5.60 9.80	6.47

08 Openings**08 70 Hardware****08 71 Door Hardware**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-1061	EA		12" x 46", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	151.02 1.76 5.60 9.80	6.47
08 71 16 00-1062	EA		12" x 48", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	156.46 1.76 5.60 9.80	6.47
08 71 16 00-1063	EA		14" x 22", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	92.81 1.76 5.60 9.80	5.75
08 71 16 00-1064	EA		14" x 24", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	99.18 1.76 5.60 9.80	5.75
08 71 16 00-1065	EA		14" x 26", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	105.53 1.76 5.60 9.80	5.75
08 71 16 00-1066	EA		14" x 28", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	111.87 1.76 5.60 9.80	5.75
08 71 16 00-1067	EA		14" x 30", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	119.65 1.76 5.60 9.80	6.11
08 71 16 00-1068	EA		14" x 32", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	126.00 1.76 5.60 9.80	6.11
08 71 16 00-1069	EA		14" x 34", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	132.34 1.76 5.60 9.80	6.11
08 71 16 00-1070	EA		14" x 36", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	138.70 1.76 5.60 9.80	6.11
08 71 16 00-1071	EA		14" x 38", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	146.49 1.76 5.60 9.80	6.47
08 71 16 00-1072	EA		14" x 40", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	152.83 1.76 5.60 9.80	6.47
08 71 16 00-1073	EA		14" x 42", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	159.17 1.76 5.60 9.80	6.47
08 71 16 00-1074	EA		14" x 44", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	155.52 1.76 5.60 9.80	6.83
08 71 16 00-1075	EA		14" x 46", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	173.30 1.76 5.60 9.80	6.83
08 71 16 00-1076	EA		14" x 48", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	179.65 1.76 5.60 9.80	6.83
08 71 16 00-1077	EA		16" x 22", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	102.81 1.76 5.60 9.80	5.75
08 71 16 00-1078	EA		16" x 24", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	110.06 1.76 5.60 9.80	5.75
08 71 16 00-1079	EA		16" x 26", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	117.31 1.76 5.60 9.80	5.75
08 71 16 00-1080	EA		16" x 28", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	124.56 1.76 5.60 9.80	5.75
08 71 16 00-1081	EA		16" x 30", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	133.25 1.76 5.60 9.80	6.11



Openings	08	08
Hardware	08 70	
Door Hardware	08 71	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71	16 00-1082	EA	16" x 32", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	140.53 1.76 5.60 9.80	6.11
08 71	16 00-1083	EA	16" x 34", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	147.77 1.76 5.60 9.80	6.11
08 71	16 00-1084	EA	16" x 36", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	155.03 1.76 5.60 9.80	6.11
08 71	16 00-1085	EA	16" x 38", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	163.70 1.76 5.60 9.80	6.47
08 71	16 00-1086	EA	16" x 40", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	170.96 1.76 5.60 9.80	6.47
08 71	16 00-1087	EA	16" x 42", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	178.21 1.76 5.60 9.80	6.47
08 71	16 00-1088	EA	16" x 44", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	186.90 1.76 5.60 9.80	6.83
08 71	16 00-1089	EA	16" x 46", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	194.17 1.76 5.60 9.80	6.83
08 71	16 00-1090	EA	16" x 48", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	201.42 1.76 5.60 9.80	6.83
08 71	16 00-1091	EA	18" x 22", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	142.35 6.30 5.60 9.80	5.75
08 71	16 00-1092	EA	18" x 24", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	153.21 6.30 5.60 9.80	5.75
08 71	16 00-1093	EA	18" x 26", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	164.05 6.30 5.60 9.80	5.75
08 71	16 00-1094	EA	18" x 28", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	174.91 6.30 5.60 9.80	5.75
08 71	16 00-1095	EA	18" x 30", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	187.19 6.30 5.60 9.80	6.11
08 71	16 00-1096	EA	18" x 32", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	198.04 6.30 5.60 9.80	6.11
08 71	16 00-1097	EA	18" x 34", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	208.89 6.30 5.60 9.80	6.11
08 71	16 00-1098	EA	18" x 36", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	219.74 6.30 5.60 9.80	6.11
08 71	16 00-1099	EA	18" x 38", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	232.01 6.30 5.60 9.80	6.47
08 71	16 00-1100	EA	18" x 40", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	242.87 6.30 5.60 9.80	6.47
08 71	16 00-1101	EA	18" x 42", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	253.73 6.30 5.60 9.80	6.47
08 71	16 00-1102	EA	18" x 44", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	266.01 6.30 5.60 9.80	6.83

08 Openings**08 70 Hardware****08 71 Door Hardware**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-1103	EA		18" x 46", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	276.87 6.30 5.60 9.80	6.83
08 71 16 00-1104	EA		18" x 48", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	287.71 6.30 5.60 9.80	6.83
08 71 16 00-1105	EA		20" x 22", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	157.04 6.30 5.60 9.80	6.11
08 71 16 00-1106	EA		20" x 24", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	169.12 6.30 5.60 9.80	6.11
08 71 16 00-1107	EA		20" x 26", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	181.16 6.30 5.60 9.80	6.11
08 71 16 00-1108	EA		20" x 28", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	193.23 6.30 5.60 9.80	6.11
08 71 16 00-1109	EA		20" x 30", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	206.70 6.30 5.60 9.80	6.47
08 71 16 00-1110	EA		20" x 32", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	218.75 6.30 5.60 9.80	6.47
08 71 16 00-1111	EA		20" x 34", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	230.82 6.30 5.60 9.80	6.47
08 71 16 00-1112	EA		20" x 36", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	242.87 6.30 5.60 9.80	6.47
08 71 16 00-1113	EA		20" x 38", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	256.38 6.30 5.60 9.80	6.83
08 71 16 00-1114	EA		20" x 40", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	268.42 6.30 5.60 9.80	6.83
08 71 16 00-1115	EA		20" x 42", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	280.47 6.30 5.60 9.80	6.83
08 71 16 00-1116	EA		20" x 44", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	293.98 6.30 5.60 9.80	7.18
08 71 16 00-1117	EA		20" x 46", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	306.03 6.30 5.60 9.80	7.18
08 71 16 00-1118	EA		20" x 48", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	318.09 6.30 5.60 9.80	7.18
08 71 16 00-1119	EA		22" x 22", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	170.31 6.30 5.60 9.80	6.11
08 71 16 00-1120	EA		22" x 24", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	183.58 6.30 5.60 9.80	6.11
08 71 16 00-1121	EA		22" x 26", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	196.84 6.30 5.60 9.80	6.11
08 71 16 00-1122	EA		22" x 28", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	210.09 6.30 5.60 9.80	6.11
08 71 16 00-1123	EA		22" x 30", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	224.80 6.30 5.60 9.80	6.47



Openings	08	08
Hardware	08 70	
Door Hardware	08 71	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71	16 00-1124	EA	22" x 32", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	238.05 6.30 5.60 9.80	6.47
08 71	16 00-1125	EA	22" x 34", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	251.31 6.30 5.60 9.80	6.47
08 71	16 00-1126	EA	22" x 36", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	264.57 6.30 5.60 9.80	6.47
08 71	16 00-1127	EA	22" x 38", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	279.28 6.30 5.60 9.80	6.83
08 71	16 00-1128	EA	22" x 40", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	292.54 6.30 5.60 9.80	6.83
08 71	16 00-1129	EA	22" x 42", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	305.80 6.30 5.60 9.80	6.83
08 71	16 00-1130	EA	22" x 44", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	320.49 6.30 5.60 9.80	7.18
08 71	16 00-1131	EA	22" x 46", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	333.75 6.30 5.60 9.80	7.18
08 71	16 00-1132	EA	22" x 48", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	347.02 6.30 5.60 9.80	7.18
08 71	16 00-1133	EA	24" x 22", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	183.58 6.30 5.60 9.80	6.11
08 71	16 00-1134	EA	24" x 24", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	198.04 6.30 5.60 9.80	6.11
08 71	16 00-1135	EA	24" x 26", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	212.50 6.30 5.60 9.80	6.11
08 71	16 00-1136	EA	24" x 28", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	226.97 6.30 5.60 9.80	6.11
08 71	16 00-1137	EA	24" x 30", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	242.87 6.30 5.60 9.80	6.47
08 71	16 00-1138	EA	24" x 32", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	257.33 6.30 5.60 9.80	6.47
08 71	16 00-1139	EA	24" x 34", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	271.82 6.30 5.60 9.80	6.47
08 71	16 00-1140	EA	24" x 36", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	286.27 6.30 5.60 9.80	6.47
08 71	16 00-1141	EA	24" x 38", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	302.17 6.30 5.60 9.80	6.83
08 71	16 00-1142	EA	24" x 40", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	316.65 6.30 5.60 9.80	6.83
08 71	16 00-1143	EA	24" x 42", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	331.12 6.30 5.60 9.80	6.83
08 71	16 00-1144	EA	24" x 44", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	347.02 6.30 5.60 9.80	7.18

08 Openings**08 70 Hardware****08 71 Door Hardware**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-1145	EA		24" x 46", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate	361.49	7.18
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1146	EA		24" x 48", 0.050" Thick, Bright/Satin Chrome Finish, Brass Kick Plate	375.96	7.18
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1147			Satin/Dark Bronze Finish, Brass Kick Plate <small>(08 71 16 00-0892)</small>		
08 71 16 00-1148	EA		8" x 22", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate	62.17	5.39
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1149	EA		8" x 24", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate	65.84	5.39
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1150	EA		8" x 26", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate	69.55	5.39
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1151	EA		8" x 28", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate	73.22	5.39
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1152	EA		8" x 30", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate	78.37	5.75
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1153	EA		8" x 32", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate	82.06	5.75
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1154	EA		8" x 34", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate	85.75	5.75
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1155	EA		8" x 36", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate	89.44	5.75
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1156	EA		8" x 38", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate	94.55	6.11
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1157	EA		8" x 40", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate	98.26	6.11
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1158	EA		8" x 42", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate	101.95	6.11
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1159	EA		8" x 44", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate	107.07	6.47
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1160	EA		8" x 46", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate	110.76	6.47
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1161	EA		8" x 48", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate	114.45	6.47
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1162	EA		10" x 22", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate	72.31	5.39
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1163	EA		10" x 24", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate	76.93	5.39
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1164	EA		10" x 26", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate	81.53	5.39
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1165	EA		10" x 28", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate	86.14	5.39
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	



Openings	08	08
Hardware	08 70	
Door Hardware	08 71	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71	16 00-1166	EA	10" x 30", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	92.20 1.76 5.60 9.80	5.75
08 71	16 00-1167	EA	10" x 32", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	96.82 1.76 5.60 9.80	5.75
08 71	16 00-1168	EA	10" x 34", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	101.42 1.76 5.60 9.80	5.75
08 71	16 00-1169	EA	10" x 36", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	106.03 1.76 5.60 9.80	5.75
08 71	16 00-1170	EA	10" x 38", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	112.10 1.76 5.60 9.80	6.11
08 71	16 00-1171	EA	10" x 40", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	116.71 1.76 5.60 9.80	6.11
08 71	16 00-1172	EA	10" x 42", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	121.31 1.76 5.60 9.80	6.11
08 71	16 00-1173	EA	10" x 44", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	127.38 1.76 5.60 9.80	6.47
08 71	16 00-1174	EA	10" x 46", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	131.98 1.76 5.60 9.80	6.47
08 71	16 00-1175	EA	10" x 48", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	136.59 1.76 5.60 9.80	6.47
08 71	16 00-1176	EA	12" x 22", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	82.46 1.76 5.60 9.80	5.39
08 71	16 00-1177	EA	12" x 24", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	88.00 1.76 5.60 9.80	5.39
08 71	16 00-1178	EA	12" x 26", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	93.53 1.76 5.60 9.80	5.39
08 71	16 00-1179	EA	12" x 28", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	99.07 1.76 5.60 9.80	5.39
08 71	16 00-1180	EA	12" x 30", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	106.03 1.76 5.60 9.80	5.75
08 71	16 00-1181	EA	12" x 32", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	111.58 1.76 5.60 9.80	5.75
08 71	16 00-1182	EA	12" x 34", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	117.12 1.76 5.60 9.80	5.75
08 71	16 00-1183	EA	12" x 36", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	122.65 1.76 5.60 9.80	5.75
08 71	16 00-1184	EA	12" x 38", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	129.63 1.76 5.60 9.80	6.11
08 71	16 00-1185	EA	12" x 40", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	135.16 1.76 5.60 9.80	6.11
08 71	16 00-1186	EA	12" x 42", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	140.69 1.76 5.60 9.80	6.11

08 Openings**08 70 Hardware****08 71 Door Hardware**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-1187	EA		12" x 44", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	147.66 1.76 5.60 9.80	6.47
08 71 16 00-1188	EA		12" x 46", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	153.21 1.76 5.60 9.80	6.47
08 71 16 00-1189	EA		12" x 48", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	158.73 1.76 5.60 9.80	6.47
08 71 16 00-1190	EA		14" x 22", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	94.04 1.76 5.60 9.80	5.75
08 71 16 00-1191	EA		14" x 24", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	100.51 1.76 5.60 9.80	5.75
08 71 16 00-1192	EA		14" x 26", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	106.96 1.76 5.60 9.80	5.75
08 71 16 00-1193	EA		14" x 28", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	113.42 1.76 5.60 9.80	5.75
08 71 16 00-1194	EA		14" x 30", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	121.31 1.76 5.60 9.80	6.11
08 71 16 00-1195	EA		14" x 32", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	127.78 1.76 5.60 9.80	6.11
08 71 16 00-1196	EA		14" x 34", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	134.23 1.76 5.60 9.80	6.11
08 71 16 00-1197	EA		14" x 36", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	140.69 1.76 5.60 9.80	6.11
08 71 16 00-1198	EA		14" x 38", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	148.58 1.76 5.60 9.80	6.47
08 71 16 00-1199	EA		14" x 40", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	155.04 1.76 5.60 9.80	6.47
08 71 16 00-1200	EA		14" x 42", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	161.49 1.76 5.60 9.80	6.47
08 71 16 00-1201	EA		14" x 44", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	169.40 1.76 5.60 9.80	6.83
08 71 16 00-1202	EA		14" x 46", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	175.88 1.76 5.60 9.80	6.83
08 71 16 00-1203	EA		14" x 48", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	182.33 1.76 5.60 9.80	6.83
08 71 16 00-1204	EA		16" x 22", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	104.20 1.76 5.60 9.80	5.75
08 71 16 00-1205	EA		16" x 24", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	111.58 1.76 5.60 9.80	5.75
08 71 16 00-1206	EA		16" x 26", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	118.95 1.76 5.60 9.80	5.75
08 71 16 00-1207	EA		16" x 28", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	126.34 1.76 5.60 9.80	5.75



Openings	08	08
Hardware	08 70	
Door Hardware	08 71	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71	16 00-1208	EA	16" x 30", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	135.16 1.76 5.60 9.80	6.11
08 71	16 00-1209	EA	16" x 32", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	142.54 1.76 5.60 9.80	6.11
08 71	16 00-1210	EA	16" x 34", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	149.92 1.76 5.60 9.80	6.11
08 71	16 00-1211	EA	16" x 36", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	157.30 1.76 5.60 9.80	6.11
08 71	16 00-1212	EA	16" x 38", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	166.13 1.76 5.60 9.80	6.47
08 71	16 00-1213	EA	16" x 40", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	173.51 1.76 5.60 9.80	6.47
08 71	16 00-1214	EA	16" x 42", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	180.89 1.76 5.60 9.80	6.47
08 71	16 00-1215	EA	16" x 44", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	189.69 1.76 5.60 9.80	6.83
08 71	16 00-1216	EA	16" x 46", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	197.09 1.76 5.60 9.80	6.83
08 71	16 00-1217	EA	16" x 48", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	204.47 1.76 5.60 9.80	6.83
08 71	16 00-1218	EA	18" x 22", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	142.35 6.30 5.60 9.80	5.75
08 71	16 00-1219	EA	18" x 24", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	153.21 6.30 5.60 9.80	5.75
08 71	16 00-1220	EA	18" x 26", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	164.05 6.30 5.60 9.80	5.75
08 71	16 00-1221	EA	18" x 28", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	174.91 6.30 5.60 9.80	5.75
08 71	16 00-1222	EA	18" x 30", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	187.19 6.30 5.60 9.80	6.11
08 71	16 00-1223	EA	18" x 32", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	198.04 6.30 5.60 9.80	6.11
08 71	16 00-1224	EA	18" x 34", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	208.89 6.30 5.60 9.80	6.11
08 71	16 00-1225	EA	18" x 36", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	219.74 6.30 5.60 9.80	6.11
08 71	16 00-1226	EA	18" x 38", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	232.01 6.30 5.60 9.80	6.47
08 71	16 00-1227	EA	18" x 40", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	242.87 6.30 5.60 9.80	6.47
08 71	16 00-1228	EA	18" x 42", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	253.73 6.30 5.60 9.80	6.47

08 Openings**08 70 Hardware****08 71 Door Hardware**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-1229	EA		18" x 44", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	266.01 6.30 5.60 9.80	6.83
08 71 16 00-1230	EA		18" x 46", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	276.87 6.30 5.60 9.80	6.83
08 71 16 00-1231	EA		18" x 48", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	287.71 6.30 5.60 9.80	6.83
08 71 16 00-1232	EA		20" x 22", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	157.04 6.30 5.60 9.80	6.11
08 71 16 00-1233	EA		20" x 24", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	169.12 6.30 5.60 9.80	6.11
08 71 16 00-1234	EA		20" x 26", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	181.16 6.30 5.60 9.80	6.11
08 71 16 00-1235	EA		20" x 28", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	193.23 6.30 5.60 9.80	6.11
08 71 16 00-1236	EA		20" x 30", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	206.70 6.30 5.60 9.80	6.47
08 71 16 00-1237	EA		20" x 32", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	218.75 6.30 5.60 9.80	6.47
08 71 16 00-1238	EA		20" x 34", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	230.82 6.30 5.60 9.80	6.47
08 71 16 00-1239	EA		20" x 36", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	242.87 6.30 5.60 9.80	6.47
08 71 16 00-1240	EA		20" x 38", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	256.38 6.30 5.60 9.80	6.83
08 71 16 00-1241	EA		20" x 40", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	268.42 6.30 5.60 9.80	6.83
08 71 16 00-1242	EA		20" x 42", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	280.47 6.30 5.60 9.80	6.83
08 71 16 00-1243	EA		20" x 44", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	293.98 6.30 5.60 9.80	7.18
08 71 16 00-1244	EA		20" x 46", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	306.03 6.30 5.60 9.80	7.18
08 71 16 00-1245	EA		20" x 48", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	318.09 6.30 5.60 9.80	7.18
08 71 16 00-1246	EA		22" x 22", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	170.31 6.30 5.60 9.80	6.11
08 71 16 00-1247	EA		22" x 24", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	183.58 6.30 5.60 9.80	6.11
08 71 16 00-1248	EA		22" x 26", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	196.84 6.30 5.60 9.80	6.11
08 71 16 00-1249	EA		22" x 28", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	210.09 6.30 5.60 9.80	6.11



Openings	08	08
Hardware	08 70	
Door Hardware	08 71	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71	16 00-1250	EA	22" x 30", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	224.80 6.30 5.60 9.80	6.47
08 71	16 00-1251	EA	22" x 32", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	238.05 6.30 5.60 9.80	6.47
08 71	16 00-1252	EA	22" x 34", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	251.31 6.30 5.60 9.80	6.47
08 71	16 00-1253	EA	22" x 36", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	264.57 6.30 5.60 9.80	6.47
08 71	16 00-1254	EA	22" x 38", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	279.28 6.30 5.60 9.80	6.83
08 71	16 00-1255	EA	22" x 40", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	292.54 6.30 5.60 9.80	6.83
08 71	16 00-1256	EA	22" x 42", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	305.80 6.30 5.60 9.80	6.83
08 71	16 00-1257	EA	22" x 44", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	320.49 6.30 5.60 9.80	7.18
08 71	16 00-1258	EA	22" x 46", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	333.75 6.30 5.60 9.80	7.18
08 71	16 00-1259	EA	22" x 48", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	347.02 6.30 5.60 9.80	7.18
08 71	16 00-1260	EA	24" x 22", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	183.58 6.30 5.60 9.80	6.11
08 71	16 00-1261	EA	24" x 24", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	198.04 6.30 5.60 9.80	6.11
08 71	16 00-1262	EA	24" x 26", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	212.50 6.30 5.60 9.80	6.11
08 71	16 00-1263	EA	24" x 28", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	226.97 6.30 5.60 9.80	6.11
08 71	16 00-1264	EA	24" x 30", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	242.87 6.30 5.60 9.80	6.47
08 71	16 00-1265	EA	24" x 32", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	257.33 6.30 5.60 9.80	6.47
08 71	16 00-1266	EA	24" x 34", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	271.82 6.30 5.60 9.80	6.47
08 71	16 00-1267	EA	24" x 36", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	286.27 6.30 5.60 9.80	6.47
08 71	16 00-1268	EA	24" x 38", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	302.17 6.30 5.60 9.80	6.83
08 71	16 00-1269	EA	24" x 40", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	316.65 6.30 5.60 9.80	6.83
08 71	16 00-1270	EA	24" x 42", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	331.12 6.30 5.60 9.80	6.83

08 Openings**08 70 Hardware****08 71 Door Hardware**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-1271	EA		24" x 44", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	347.02 6.30 5.60 9.80	7.18
08 71 16 00-1272	EA		24" x 46", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	361.49 6.30 5.60 9.80	7.18
08 71 16 00-1273	EA		24" x 48", 0.050" Thick, Satin/Dark Bronze Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	375.96 6.30 5.60 9.80	7.18
08 71 16 00-1274 Satin Nickel Finish, Brass Kick Plate <small>(08 71 16 00-0892)</small>					
08 71 16 00-1275	EA		8" x 22", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	62.17 1.76 5.60 9.80	5.39
08 71 16 00-1276	EA		8" x 24", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	65.84 1.76 5.60 9.80	5.39
08 71 16 00-1277	EA		8" x 26", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	69.55 1.76 5.60 9.80	5.39
08 71 16 00-1278	EA		8" x 28", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	73.22 1.76 5.60 9.80	5.39
08 71 16 00-1279	EA		8" x 30", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	78.37 1.76 5.60 9.80	5.75
08 71 16 00-1280	EA		8" x 32", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	82.06 1.76 5.60 9.80	5.75
08 71 16 00-1281	EA		8" x 34", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	85.75 1.76 5.60 9.80	5.75
08 71 16 00-1282	EA		8" x 36", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	89.44 1.76 5.60 9.80	5.75
08 71 16 00-1283	EA		8" x 38", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	94.55 1.76 5.60 9.80	6.11
08 71 16 00-1284	EA		8" x 40", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	98.26 1.76 5.60 9.80	6.11
08 71 16 00-1285	EA		8" x 42", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	101.95 1.76 5.60 9.80	6.11
08 71 16 00-1286	EA		8" x 44", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	107.07 1.76 5.60 9.80	6.47
08 71 16 00-1287	EA		8" x 46", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	110.76 1.76 5.60 9.80	6.47
08 71 16 00-1288	EA		8" x 48", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	114.45 1.76 5.60 9.80	6.47
08 71 16 00-1289	EA		10" x 22", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	72.31 1.76 5.60 9.80	5.39
08 71 16 00-1290	EA		10" x 24", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	76.93 1.76 5.60 9.80	5.39
08 71 16 00-1291	EA		10" x 26", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	81.53 1.76 5.60 9.80	5.39



Openings	08	08
Hardware	08 70	
Door Hardware	08 71	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71	16 00-1292	EA	10" x 28", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	86.14 1.76 5.60 9.80	5.39
08 71	16 00-1293	EA	10" x 30", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	92.20 1.76 5.60 9.80	5.75
08 71	16 00-1294	EA	10" x 32", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	96.82 1.76 5.60 9.80	5.75
08 71	16 00-1295	EA	10" x 34", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	101.42 1.76 5.60 9.80	5.75
08 71	16 00-1296	EA	10" x 36", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	106.03 1.76 5.60 9.80	5.75
08 71	16 00-1297	EA	10" x 38", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	112.10 1.76 5.60 9.80	6.11
08 71	16 00-1298	EA	10" x 40", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	116.71 1.76 5.60 9.80	6.11
08 71	16 00-1299	EA	10" x 42", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	121.31 1.76 5.60 9.80	6.11
08 71	16 00-1300	EA	10" x 44", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	127.38 1.76 5.60 9.80	6.47
08 71	16 00-1301	EA	10" x 46", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	131.98 1.76 5.60 9.80	6.47
08 71	16 00-1302	EA	10" x 48", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	136.59 1.76 5.60 9.80	6.47
08 71	16 00-1303	EA	12" x 22", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	82.46 1.76 5.60 9.80	5.39
08 71	16 00-1304	EA	12" x 24", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	88.00 1.76 5.60 9.80	5.39
08 71	16 00-1305	EA	12" x 26", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	93.53 1.76 5.60 9.80	5.39
08 71	16 00-1306	EA	12" x 28", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	99.07 1.76 5.60 9.80	5.39
08 71	16 00-1307	EA	12" x 30", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	106.03 1.76 5.60 9.80	5.75
08 71	16 00-1308	EA	12" x 32", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	111.58 1.76 5.60 9.80	5.75
08 71	16 00-1309	EA	12" x 34", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	117.12 1.76 5.60 9.80	5.75
08 71	16 00-1310	EA	12" x 36", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	122.65 1.76 5.60 9.80	5.75
08 71	16 00-1311	EA	12" x 38", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	129.63 1.76 5.60 9.80	6.11
08 71	16 00-1312	EA	12" x 40", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	135.16 1.76 5.60 9.80	6.11

08 Openings**08 70 Hardware****08 71 Door Hardware**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-1313	EA		12" x 42", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	140.69 1.76 5.60 9.80	6.11
08 71 16 00-1314	EA		12" x 44", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	147.66 1.76 5.60 9.80	6.47
08 71 16 00-1315	EA		12" x 46", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	153.21 1.76 5.60 9.80	6.47
08 71 16 00-1316	EA		12" x 48", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	158.73 1.76 5.60 9.80	6.47
08 71 16 00-1317	EA		14" x 22", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	94.04 1.76 5.60 9.80	5.75
08 71 16 00-1318	EA		14" x 24", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	100.51 1.76 5.60 9.80	5.75
08 71 16 00-1319	EA		14" x 26", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	106.96 1.76 5.60 9.80	5.75
08 71 16 00-1320	EA		14" x 28", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	113.42 1.76 5.60 9.80	5.75
08 71 16 00-1321	EA		14" x 30", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	121.31 1.76 5.60 9.80	6.11
08 71 16 00-1322	EA		14" x 32", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	127.78 1.76 5.60 9.80	6.11
08 71 16 00-1323	EA		14" x 34", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	134.23 1.76 5.60 9.80	6.11
08 71 16 00-1324	EA		14" x 36", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	140.69 1.76 5.60 9.80	6.11
08 71 16 00-1325	EA		14" x 38", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	148.58 1.76 5.60 9.80	6.47
08 71 16 00-1326	EA		14" x 40", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	155.04 1.76 5.60 9.80	6.47
08 71 16 00-1327	EA		14" x 42", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	161.49 1.76 5.60 9.80	6.47
08 71 16 00-1328	EA		14" x 44", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	169.40 1.76 5.60 9.80	6.83
08 71 16 00-1329	EA		14" x 46", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	175.88 1.76 5.60 9.80	6.83
08 71 16 00-1330	EA		14" x 48", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	182.33 1.76 5.60 9.80	6.83
08 71 16 00-1331	EA		16" x 22", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	104.20 1.76 5.60 9.80	5.75
08 71 16 00-1332	EA		16" x 24", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	111.58 1.76 5.60 9.80	5.75
08 71 16 00-1333	EA		16" x 26", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	118.95 1.76 5.60 9.80	5.75



Openings	08	08
Hardware	08 70	
Door Hardware	08 71	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71	16 00-1334	EA	16" x 28", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	126.34 1.76 5.60 9.80	5.75
08 71	16 00-1335	EA	16" x 30", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	135.16 1.76 5.60 9.80	6.11
08 71	16 00-1336	EA	16" x 32", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	142.54 1.76 5.60 9.80	6.11
08 71	16 00-1337	EA	16" x 34", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	149.92 1.76 5.60 9.80	6.11
08 71	16 00-1338	EA	16" x 36", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	157.30 1.76 5.60 9.80	6.11
08 71	16 00-1339	EA	16" x 38", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	166.13 1.76 5.60 9.80	6.47
08 71	16 00-1340	EA	16" x 40", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	173.51 1.76 5.60 9.80	6.47
08 71	16 00-1341	EA	16" x 42", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	180.89 1.76 5.60 9.80	6.47
08 71	16 00-1342	EA	16" x 44", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	189.69 1.76 5.60 9.80	6.83
08 71	16 00-1343	EA	16" x 46", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	197.09 1.76 5.60 9.80	6.83
08 71	16 00-1344	EA	16" x 48", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	204.47 1.76 5.60 9.80	6.83
08 71	16 00-1345	EA	18" x 22", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	142.35 6.30 5.60 9.80	5.75
08 71	16 00-1346	EA	18" x 24", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	153.21 6.30 5.60 9.80	5.75
08 71	16 00-1347	EA	18" x 26", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	164.05 6.30 5.60 9.80	5.75
08 71	16 00-1348	EA	18" x 28", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	174.91 6.30 5.60 9.80	5.75
08 71	16 00-1349	EA	18" x 30", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	187.19 6.30 5.60 9.80	6.11
08 71	16 00-1350	EA	18" x 32", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	198.04 6.30 5.60 9.80	6.11
08 71	16 00-1351	EA	18" x 34", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	208.89 6.30 5.60 9.80	6.11
08 71	16 00-1352	EA	18" x 36", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	219.74 6.30 5.60 9.80	6.11
08 71	16 00-1353	EA	18" x 38", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	232.01 6.30 5.60 9.80	6.47
08 71	16 00-1354	EA	18" x 40", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	242.87 6.30 5.60 9.80	6.47

08 Openings**08 70 Hardware****08 71 Door Hardware**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-1355	EA		18" x 42", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	253.73 6.30 5.60 9.80	6.47
08 71 16 00-1356	EA		18" x 44", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	266.01 6.30 5.60 9.80	6.83
08 71 16 00-1357	EA		18" x 46", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	276.87 6.30 5.60 9.80	6.83
08 71 16 00-1358	EA		18" x 48", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	287.71 6.30 5.60 9.80	6.83
08 71 16 00-1359	EA		20" x 22", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	157.04 6.30 5.60 9.80	6.11
08 71 16 00-1360	EA		20" x 24", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	169.12 6.30 5.60 9.80	6.11
08 71 16 00-1361	EA		20" x 26", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	181.16 6.30 5.60 9.80	6.11
08 71 16 00-1362	EA		20" x 28", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	193.23 6.30 5.60 9.80	6.11
08 71 16 00-1363	EA		20" x 30", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	206.70 6.30 5.60 9.80	6.47
08 71 16 00-1364	EA		20" x 32", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	218.75 6.30 5.60 9.80	6.47
08 71 16 00-1365	EA		20" x 34", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	230.82 6.30 5.60 9.80	6.47
08 71 16 00-1366	EA		20" x 36", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	242.87 6.30 5.60 9.80	6.47
08 71 16 00-1367	EA		20" x 38", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	256.38 6.30 5.60 9.80	6.83
08 71 16 00-1368	EA		20" x 40", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	268.42 6.30 5.60 9.80	6.83
08 71 16 00-1369	EA		20" x 42", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	280.47 6.30 5.60 9.80	6.83
08 71 16 00-1370	EA		20" x 44", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	293.98 6.30 5.60 9.80	7.18
08 71 16 00-1371	EA		20" x 46", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	306.03 6.30 5.60 9.80	7.18
08 71 16 00-1372	EA		20" x 48", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	318.09 6.30 5.60 9.80	7.18
08 71 16 00-1373	EA		22" x 22", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	170.31 6.30 5.60 9.80	6.11
08 71 16 00-1374	EA		22" x 24", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	183.58 6.30 5.60 9.80	6.11
08 71 16 00-1375	EA		22" x 26", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	196.84 6.30 5.60 9.80	6.11



Openings	08	08
Hardware	08 70	
Door Hardware	08 71	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-1376	EA		22" x 28", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	210.09 6.30 5.60 9.80	6.11
08 71 16 00-1377	EA		22" x 30", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	224.80 6.30 5.60 9.80	6.47
08 71 16 00-1378	EA		22" x 32", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	238.05 6.30 5.60 9.80	6.47
08 71 16 00-1379	EA		22" x 34", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	251.31 6.30 5.60 9.80	6.47
08 71 16 00-1380	EA		22" x 36", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	264.57 6.30 5.60 9.80	6.47
08 71 16 00-1381	EA		22" x 38", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	279.28 6.30 5.60 9.80	6.83
08 71 16 00-1382	EA		22" x 40", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	292.54 6.30 5.60 9.80	6.83
08 71 16 00-1383	EA		22" x 42", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	305.80 6.30 5.60 9.80	6.83
08 71 16 00-1384	EA		22" x 44", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	320.49 6.30 5.60 9.80	7.18
08 71 16 00-1385	EA		22" x 46", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	333.75 6.30 5.60 9.80	7.18
08 71 16 00-1386	EA		22" x 48", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	347.02 6.30 5.60 9.80	7.18
08 71 16 00-1387	EA		24" x 22", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	183.58 6.30 5.60 9.80	6.11
08 71 16 00-1388	EA		24" x 24", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	198.04 6.30 5.60 9.80	6.11
08 71 16 00-1389	EA		24" x 26", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	212.50 6.30 5.60 9.80	6.11
08 71 16 00-1390	EA		24" x 28", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	226.97 6.30 5.60 9.80	6.11
08 71 16 00-1391	EA		24" x 30", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	242.87 6.30 5.60 9.80	6.47
08 71 16 00-1392	EA		24" x 32", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	257.33 6.30 5.60 9.80	6.47
08 71 16 00-1393	EA		24" x 34", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	271.82 6.30 5.60 9.80	6.47
08 71 16 00-1394	EA		24" x 36", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	286.27 6.30 5.60 9.80	6.47
08 71 16 00-1395	EA		24" x 38", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	302.17 6.30 5.60 9.80	6.83
08 71 16 00-1396	EA		24" x 40", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	316.65 6.30 5.60 9.80	6.83

08 Openings**08 70 Hardware****08 71 Door Hardware**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-1397	EA		24" x 42", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate	331.12	6.83
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1398	EA		24" x 44", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate	347.02	7.18
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1399	EA		24" x 46", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate	361.49	7.18
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1400	EA		24" x 48", 0.050" Thick, Satin Nickel Finish, Brass Kick Plate	375.96	7.18
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1401			Stainless Base Material Kick Plate (08 71 16 00-0763)		
08 71 16 00-1402			Satin Stainless Finish, Stainless Kick Plate (08 71 16 00-1401)		
08 71 16 00-1403	EA		8" x 22", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate	34.23	5.39
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1404	EA		8" x 24", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate	35.40	5.39
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1405	EA		8" x 26", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate	36.53	5.39
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1406	EA		8" x 28", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate	37.71	5.39
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1407	EA		8" x 30", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate	40.29	5.75
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1408	EA		8" x 32", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate	41.43	5.75
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1409	EA		8" x 34", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate	42.61	5.75
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1410	EA		8" x 36", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate	43.75	5.75
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1411	EA		8" x 38", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate	46.35	6.11
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1412	EA		8" x 40", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate	47.50	6.11
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1413	EA		8" x 42", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate	48.65	6.11
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1414	EA		8" x 44", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate	51.23	6.47
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1415	EA		8" x 46", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate	52.39	6.47
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1416	EA		8" x 48", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate	53.53	6.47
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1417	EA		10" x 22", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate	37.40	5.39
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1418	EA		10" x 24", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate	38.85	5.39
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	



Openings	08	08
Hardware	08 70	
Door Hardware	08 71	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71	16 00-1419	EA	10" x 26", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	40.30 1.76 5.60 9.80	5.39
08 71	16 00-1420	EA	10" x 28", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	41.73 1.76 5.60 9.80	5.39
08 71	16 00-1421	EA	10" x 30", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	44.62 1.76 5.60 9.80	5.75
08 71	16 00-1422	EA	10" x 32", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	46.06 1.76 5.60 9.80	5.75
08 71	16 00-1423	EA	10" x 34", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	47.49 1.76 5.60 9.80	5.75
08 71	16 00-1424	EA	10" x 36", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	48.92 1.76 5.60 9.80	5.75
08 71	16 00-1425	EA	10" x 38", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	51.83 1.76 5.60 9.80	6.11
08 71	16 00-1426	EA	10" x 40", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	53.26 1.76 5.60 9.80	6.11
08 71	16 00-1427	EA	10" x 42", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	54.69 1.76 5.60 9.80	6.11
08 71	16 00-1428	EA	10" x 44", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	57.57 1.76 5.60 9.80	6.47
08 71	16 00-1429	EA	10" x 46", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	59.01 1.76 5.60 9.80	6.47
08 71	16 00-1430	EA	10" x 48", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	60.45 1.76 5.60 9.80	6.47
08 71	16 00-1431	EA	12" x 22", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	40.58 1.76 5.60 9.80	5.39
08 71	16 00-1432	EA	12" x 24", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	42.31 1.76 5.60 9.80	5.39
08 71	16 00-1433	EA	12" x 26", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	44.04 1.76 5.60 9.80	5.39
08 71	16 00-1434	EA	12" x 28", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	45.77 1.76 5.60 9.80	5.39
08 71	16 00-1435	EA	12" x 30", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	48.92 1.76 5.60 9.80	5.75
08 71	16 00-1436	EA	12" x 32", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	50.66 1.76 5.60 9.80	5.75
08 71	16 00-1437	EA	12" x 34", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	52.38 1.76 5.60 9.80	5.75
08 71	16 00-1438	EA	12" x 36", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	54.12 1.76 5.60 9.80	5.75
08 71	16 00-1439	EA	12" x 38", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	57.28 1.76 5.60 9.80	6.11

08 Openings**08 70 Hardware****08 71 Door Hardware**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-1440	EA		12" x 40", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate	59.02	6.11
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1441	EA		12" x 42", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate	60.76	6.11
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1442	EA		12" x 44", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate	63.90	6.47
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1443	EA		12" x 46", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate	65.64	6.47
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1444	EA		12" x 48", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate	67.36	6.47
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1445	EA		14" x 22", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate	45.19	5.75
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1446	EA		14" x 24", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate	47.21	5.75
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1447	EA		14" x 26", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate	49.23	5.75
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1448	EA		14" x 28", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate	51.25	5.75
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1449	EA		14" x 30", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate	54.69	6.11
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1450	EA		14" x 32", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate	56.71	6.11
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1451	EA		14" x 34", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate	58.73	6.11
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1452	EA		14" x 36", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate	60.76	6.11
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1453	EA		14" x 38", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate	64.21	6.47
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1454	EA		14" x 40", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate	66.20	6.47
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1455	EA		14" x 42", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate	68.23	6.47
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1456	EA		14" x 44", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate	71.69	6.83
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1457	EA		14" x 46", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate	73.71	6.83
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1458	EA		14" x 48", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate	75.73	6.83
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1459	EA		16" x 22", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate	48.36	5.75
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1460	EA		16" x 24", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate	50.66	5.75
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	



Openings	08	08
Hardware	08 70	
Door Hardware	08 71	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71	16 00-1461	EA	16" x 26", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	52.97 1.76 5.60 9.80	5.75
08 71	16 00-1462	EA	16" x 28", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	55.27 1.76 5.60 9.80	5.75
08 71	16 00-1463	EA	16" x 30", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	59.02 1.76 5.60 9.80	6.11
08 71	16 00-1464	EA	16" x 32", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	61.32 1.76 5.60 9.80	6.11
08 71	16 00-1465	EA	16" x 34", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	63.63 1.76 5.60 9.80	6.11
08 71	16 00-1466	EA	16" x 36", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	65.93 1.76 5.60 9.80	6.11
08 71	16 00-1467	EA	16" x 38", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	69.66 1.76 5.60 9.80	6.47
08 71	16 00-1468	EA	16" x 40", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	71.98 1.76 5.60 9.80	6.47
08 71	16 00-1469	EA	16" x 42", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	74.29 1.76 5.60 9.80	6.47
08 71	16 00-1470	EA	16" x 44", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	78.03 1.76 5.60 9.80	6.83
08 71	16 00-1471	EA	16" x 46", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	80.33 1.76 5.60 9.80	6.83
08 71	16 00-1472	EA	16" x 48", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	82.65 1.76 5.60 9.80	6.83
08 71	16 00-1473	EA	18" x 22", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	52.84 6.30 5.60 9.80	5.75
08 71	16 00-1474	EA	18" x 24", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	55.56 6.30 5.60 9.80	5.75
08 71	16 00-1475	EA	18" x 26", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	58.26 6.30 5.60 9.80	5.75
08 71	16 00-1476	EA	18" x 28", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	60.97 6.30 5.60 9.80	5.75
08 71	16 00-1477	EA	18" x 30", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	65.14 6.30 5.60 9.80	6.11
08 71	16 00-1478	EA	18" x 32", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	67.84 6.30 5.60 9.80	6.11
08 71	16 00-1479	EA	18" x 34", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	70.55 6.30 5.60 9.80	6.11
08 71	16 00-1480	EA	18" x 36", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	73.25 6.30 5.60 9.80	6.11
08 71	16 00-1481	EA	18" x 38", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	77.41 6.30 5.60 9.80	6.47

08 Openings**08 70 Hardware****08 71 Door Hardware**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-1482	EA		18" x 40", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	80.12 6.30 5.60 9.80	6.47
08 71 16 00-1483	EA		18" x 42", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	82.82 6.30 5.60 9.80	6.47
08 71 16 00-1484	EA		18" x 44", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	86.98 6.30 5.60 9.80	6.83
08 71 16 00-1485	EA		18" x 46", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	89.71 6.30 5.60 9.80	6.83
08 71 16 00-1486	EA		18" x 48", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	92.41 6.30 5.60 9.80	6.83
08 71 16 00-1487	EA		20" x 22", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	57.60 6.30 5.60 9.80	6.11
08 71 16 00-1488	EA		20" x 24", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	60.61 6.30 5.60 9.80	6.11
08 71 16 00-1489	EA		20" x 26", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	63.63 6.30 5.60 9.80	6.11
08 71 16 00-1490	EA		20" x 28", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	66.63 6.30 5.60 9.80	6.11
08 71 16 00-1491	EA		20" x 30", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	71.08 6.30 5.60 9.80	6.47
08 71 16 00-1492	EA		20" x 32", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	74.10 6.30 5.60 9.80	6.47
08 71 16 00-1493	EA		20" x 34", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	77.10 6.30 5.60 9.80	6.47
08 71 16 00-1494	EA		20" x 36", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	80.12 6.30 5.60 9.80	6.47
08 71 16 00-1495	EA		20" x 38", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	84.57 6.30 5.60 9.80	6.83
08 71 16 00-1496	EA		20" x 40", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	87.59 6.30 5.60 9.80	6.83
08 71 16 00-1497	EA		20" x 42", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	90.61 6.30 5.60 9.80	6.83
08 71 16 00-1498	EA		20" x 44", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	95.05 6.30 5.60 9.80	7.18
08 71 16 00-1499	EA		20" x 46", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	98.07 6.30 5.60 9.80	7.18
08 71 16 00-1500	EA		20" x 48", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	101.08 6.30 5.60 9.80	7.18
08 71 16 00-1501	EA		22" x 22", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	60.90 6.30 5.60 9.80	6.11
08 71 16 00-1502	EA		22" x 24", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	64.23 6.30 5.60 9.80	6.11



Openings	08	08
Hardware	08 70	
Door Hardware	08 71	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71	16 00-1503	EA	22" x 26", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	67.53 6.30 5.60 9.80	6.11
08 71	16 00-1504	EA	22" x 28", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	70.86 6.30 5.60 9.80	6.11
08 71	16 00-1505	EA	22" x 30", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	75.59 6.30 5.60 9.80	6.47
08 71	16 00-1506	EA	22" x 32", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	78.92 6.30 5.60 9.80	6.47
08 71	16 00-1507	EA	22" x 34", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	82.23 6.30 5.60 9.80	6.47
08 71	16 00-1508	EA	22" x 36", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	85.54 6.30 5.60 9.80	6.47
08 71	16 00-1509	EA	22" x 38", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	90.29 6.30 5.60 9.80	6.83
08 71	16 00-1510	EA	22" x 40", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	93.61 6.30 5.60 9.80	6.83
08 71	16 00-1511	EA	22" x 42", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	96.94 6.30 5.60 9.80	6.83
08 71	16 00-1512	EA	22" x 44", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	101.68 6.30 5.60 9.80	7.18
08 71	16 00-1513	EA	22" x 46", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	105.01 6.30 5.60 9.80	7.18
08 71	16 00-1514	EA	22" x 48", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	108.30 6.30 5.60 9.80	7.18
08 71	16 00-1515	EA	24" x 22", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	64.23 6.30 5.60 9.80	6.11
08 71	16 00-1516	EA	24" x 24", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	67.84 6.30 5.60 9.80	6.11
08 71	16 00-1517	EA	24" x 26", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	71.47 6.30 5.60 9.80	6.11
08 71	16 00-1518	EA	24" x 28", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	75.07 6.30 5.60 9.80	6.11
08 71	16 00-1519	EA	24" x 30", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	80.12 6.30 5.60 9.80	6.47
08 71	16 00-1520	EA	24" x 32", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	83.74 6.30 5.60 9.80	6.47
08 71	16 00-1521	EA	24" x 34", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	87.35 6.30 5.60 9.80	6.47
08 71	16 00-1522	EA	24" x 36", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	90.97 6.30 5.60 9.80	6.47
08 71	16 00-1523	EA	24" x 38", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	96.03 6.30 5.60 9.80	6.83

08 Openings**08 70 Hardware****08 71 Door Hardware**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-1524	EA		24" x 40", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	99.64 6.30 5.60 9.80	6.83
08 71 16 00-1525	EA		24" x 42", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	103.26 6.30 5.60 9.80	6.83
08 71 16 00-1526	EA		24" x 44", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	108.30 6.30 5.60 9.80	7.18
08 71 16 00-1527	EA		24" x 46", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	111.93 6.30 5.60 9.80	7.18
08 71 16 00-1528	EA		24" x 48", 0.050" Thick, Satin Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	115.56 6.30 5.60 9.80	7.18
08 71 16 00-1529			Bright Stainless Finish, Stainless Kick Plate (08 71 16 00-1401)		
08 71 16 00-1530	EA		8" x 22", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	50.76 1.76 5.60 9.80	5.39
08 71 16 00-1531	EA		8" x 24", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	53.42 1.76 5.60 9.80	5.39
08 71 16 00-1532	EA		8" x 26", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	56.07 1.76 5.60 9.80	5.39
08 71 16 00-1533	EA		8" x 28", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	58.72 1.76 5.60 9.80	5.39
08 71 16 00-1534	EA		8" x 30", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	62.81 1.76 5.60 9.80	5.75
08 71 16 00-1535	EA		8" x 32", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	65.47 1.76 5.60 9.80	5.75
08 71 16 00-1536	EA		8" x 34", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	68.12 1.76 5.60 9.80	5.75
08 71 16 00-1537	EA		8" x 36", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	70.78 1.76 5.60 9.80	5.75
08 71 16 00-1538	EA		8" x 38", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	74.86 1.76 5.60 9.80	6.11
08 71 16 00-1539	EA		8" x 40", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	77.52 1.76 5.60 9.80	6.11
08 71 16 00-1540	EA		8" x 42", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	80.19 1.76 5.60 9.80	6.11
08 71 16 00-1541	EA		8" x 44", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	84.26 1.76 5.60 9.80	6.47
08 71 16 00-1542	EA		8" x 46", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	86.92 1.76 5.60 9.80	6.47
08 71 16 00-1543	EA		8" x 48", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	89.56 1.76 5.60 9.80	6.47
08 71 16 00-1544	EA		10" x 22", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	58.06 1.76 5.60 9.80	5.39



Openings	08	08
Hardware	08 70	
Door Hardware	08 71	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71	16 00-1545	EA	10" x 24", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	61.37 1.76 5.60 9.80	5.39
08 71	16 00-1546	EA	10" x 26", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	64.70 1.76 5.60 9.80	5.39
08 71	16 00-1547	EA	10" x 28", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	68.02 1.76 5.60 9.80	5.39
08 71	16 00-1548	EA	10" x 30", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	72.76 1.76 5.60 9.80	5.75
08 71	16 00-1549	EA	10" x 32", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	76.08 1.76 5.60 9.80	5.75
08 71	16 00-1550	EA	10" x 34", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	79.41 1.76 5.60 9.80	5.75
08 71	16 00-1551	EA	10" x 36", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	82.73 1.76 5.60 9.80	5.75
08 71	16 00-1552	EA	10" x 38", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	87.48 1.76 5.60 9.80	6.11
08 71	16 00-1553	EA	10" x 40", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	90.80 1.76 5.60 9.80	6.11
08 71	16 00-1554	EA	10" x 42", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	94.13 1.76 5.60 9.80	6.11
08 71	16 00-1555	EA	10" x 44", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	98.85 1.76 5.60 9.80	6.47
08 71	16 00-1556	EA	10" x 46", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	102.19 1.76 5.60 9.80	6.47
08 71	16 00-1557	EA	10" x 48", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	105.50 1.76 5.60 9.80	6.47
08 71	16 00-1558	EA	12" x 22", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	65.35 1.76 5.60 9.80	5.39
08 71	16 00-1559	EA	12" x 24", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	69.34 1.76 5.60 9.80	5.39
08 71	16 00-1560	EA	12" x 26", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	73.33 1.76 5.60 9.80	5.39
08 71	16 00-1561	EA	12" x 28", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	77.31 1.76 5.60 9.80	5.39
08 71	16 00-1562	EA	12" x 30", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	82.73 1.76 5.60 9.80	5.75
08 71	16 00-1563	EA	12" x 32", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	86.69 1.76 5.60 9.80	5.75
08 71	16 00-1564	EA	12" x 34", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	90.69 1.76 5.60 9.80	5.75
08 71	16 00-1565	EA	12" x 36", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	94.67 1.76 5.60 9.80	5.75

08 Openings**08 70 Hardware**

08 71 Door Hardware



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-1566	EA		12" x 38", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	100.09 1.76 5.60 9.80	6.11
08 71 16 00-1567	EA		12" x 40", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	104.07 1.76 5.60 9.80	6.11
08 71 16 00-1568	EA		12" x 42", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	108.05 1.76 5.60 9.80	6.11
08 71 16 00-1569	EA		12" x 44", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	113.47 1.76 5.60 9.80	6.47
08 71 16 00-1570	EA		12" x 46", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	117.44 1.76 5.60 9.80	6.47
08 71 16 00-1571	EA		12" x 48", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	121.42 1.76 5.60 9.80	6.47
08 71 16 00-1572	EA		14" x 22", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	74.10 1.76 5.60 9.80	5.75
08 71 16 00-1573	EA		14" x 24", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	78.75 1.76 5.60 9.80	5.75
08 71 16 00-1574	EA		14" x 26", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	83.40 1.76 5.60 9.80	5.75
08 71 16 00-1575	EA		14" x 28", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	88.04 1.76 5.60 9.80	5.75
08 71 16 00-1576	EA		14" x 30", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	94.13 1.76 5.60 9.80	6.11
08 71 16 00-1577	EA		14" x 32", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	98.76 1.76 5.60 9.80	6.11
08 71 16 00-1578	EA		14" x 34", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	103.41 1.76 5.60 9.80	6.11
08 71 16 00-1579	EA		14" x 36", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	108.05 1.76 5.60 9.80	6.11
08 71 16 00-1580	EA		14" x 38", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	114.13 1.76 5.60 9.80	6.47
08 71 16 00-1581	EA		14" x 40", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	118.78 1.76 5.60 9.80	6.47
08 71 16 00-1582	EA		14" x 42", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	123.43 1.76 5.60 9.80	6.47
08 71 16 00-1583	EA		14" x 44", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	129.51 1.76 5.60 9.80	6.83
08 71 16 00-1584	EA		14" x 46", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	134.14 1.76 5.60 9.80	6.83
08 71 16 00-1585	EA		14" x 48", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	138.78 1.76 5.60 9.80	6.83
08 71 16 00-1586	EA		16" x 22", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	81.39 1.76 5.60 9.80	5.75



Openings	08	08
Hardware	08 70	
Door Hardware	08 71	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71	16 00-1587	EA	16" x 24", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	86.69 1.76 5.60 9.80	5.75
08 71	16 00-1588	EA	16" x 26", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	92.02 1.76 5.60 9.80	5.75
08 71	16 00-1589	EA	16" x 28", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	97.32 1.76 5.60 9.80	5.75
08 71	16 00-1590	EA	16" x 30", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	104.07 1.76 5.60 9.80	6.11
08 71	16 00-1591	EA	16" x 32", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	109.38 1.76 5.60 9.80	6.11
08 71	16 00-1592	EA	16" x 34", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	114.68 1.76 5.60 9.80	6.11
08 71	16 00-1593	EA	16" x 36", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	119.99 1.76 5.60 9.80	6.11
08 71	16 00-1594	EA	16" x 38", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	126.73 1.76 5.60 9.80	6.47
08 71	16 00-1595	EA	16" x 40", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	132.03 1.76 5.60 9.80	6.47
08 71	16 00-1596	EA	16" x 42", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	137.34 1.76 5.60 9.80	6.47
08 71	16 00-1597	EA	16" x 44", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	144.09 1.76 5.60 9.80	6.83
08 71	16 00-1598	EA	16" x 46", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	149.42 1.76 5.60 9.80	6.83
08 71	16 00-1599	EA	16" x 48", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	154.73 1.76 5.60 9.80	6.83
08 71	16 00-1600	EA	18" x 22", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	89.47 6.30 5.60 9.80	5.75
08 71	16 00-1601	EA	18" x 24", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	95.54 6.30 5.60 9.80	5.75
08 71	16 00-1602	EA	18" x 26", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	101.56 6.30 5.60 9.80	5.75
08 71	16 00-1603	EA	18" x 28", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	107.62 6.30 5.60 9.80	5.75
08 71	16 00-1604	EA	18" x 30", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	115.11 6.30 5.60 9.80	6.11
08 71	16 00-1605	EA	18" x 32", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	121.13 6.30 5.60 9.80	6.11
08 71	16 00-1606	EA	18" x 34", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	127.19 6.30 5.60 9.80	6.11
08 71	16 00-1607	EA	18" x 36", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	136.67 6.30 5.60 9.80	6.11

08 Openings**08 70 Hardware****08 71 Door Hardware**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-1608	EA		18" x 38", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate.....	140.71	6.47
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1609	EA		18" x 40", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate.....	146.75	6.47
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1610	EA		18" x 42", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate.....	152.80	6.47
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1611	EA		18" x 44", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate.....	160.28	6.83
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1612	EA		18" x 46", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate.....	166.32	6.83
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1613	EA		18" x 48", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate.....	172.36	6.83
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1614	EA		20" x 22", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate.....	98.32	6.11
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1615	EA		20" x 24", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate.....	105.02	6.11
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1616	EA		20" x 26", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate.....	111.74	6.11
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1617	EA		20" x 28", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate.....	118.45	6.11
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1618	EA		20" x 30", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate.....	126.60	6.47
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1619	EA		20" x 32", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate.....	133.33	6.47
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1620	EA		20" x 34", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate.....	140.02	6.47
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1621	EA		20" x 36", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate.....	146.75	6.47
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1622	EA		20" x 38", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate.....	154.89	6.83
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1623	EA		20" x 40", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate.....	161.62	6.83
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1624	EA		20" x 42", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate.....	168.34	6.83
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1625	EA		20" x 44", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate.....	176.48	7.18
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1626	EA		20" x 46", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate.....	183.20	7.18
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1627	EA		20" x 48", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate.....	189.91	7.18
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1628	EA		22" x 22", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate.....	105.70	6.11
			<i>For Four Beveled Edges, Add</i>	6.30	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	



Openings	08	08
Hardware	08 70	
Door Hardware	08 71	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71	16 00-1629	EA	22" x 24", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	113.08 6.30 5.60 9.80	6.11
08 71	16 00-1630	EA	22" x 26", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	120.46 6.30 5.60 9.80	6.11
08 71	16 00-1631	EA	22" x 28", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	127.85 6.30 5.60 9.80	6.11
08 71	16 00-1632	EA	22" x 30", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	136.67 6.30 5.60 9.80	6.47
08 71	16 00-1633	EA	22" x 32", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	144.06 6.30 5.60 9.80	6.47
08 71	16 00-1634	EA	22" x 34", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	151.46 6.30 5.60 9.80	6.47
08 71	16 00-1635	EA	22" x 36", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	158.84 6.30 5.60 9.80	6.47
08 71	16 00-1636	EA	22" x 38", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	167.66 6.30 5.60 9.80	6.83
08 71	16 00-1637	EA	22" x 40", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	175.04 6.30 5.60 9.80	6.83
08 71	16 00-1638	EA	22" x 42", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	182.42 6.30 5.60 9.80	6.83
08 71	16 00-1639	EA	22" x 44", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	191.25 6.30 5.60 9.80	7.18
08 71	16 00-1640	EA	22" x 46", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	198.65 6.30 5.60 9.80	7.18
08 71	16 00-1641	EA	22" x 48", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	206.03 6.30 5.60 9.80	7.18
08 71	16 00-1642	EA	24" x 22", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	113.08 6.30 5.60 9.80	6.11
08 71	16 00-1643	EA	24" x 24", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	121.13 6.30 5.60 9.80	6.11
08 71	16 00-1644	EA	24" x 26", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	129.20 6.30 5.60 9.80	6.11
08 71	16 00-1645	EA	24" x 28", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	137.25 6.30 5.60 9.80	6.11
08 71	16 00-1646	EA	24" x 30", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	146.75 6.30 5.60 9.80	6.47
08 71	16 00-1647	EA	24" x 32", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	154.80 6.30 5.60 9.80	6.47
08 71	16 00-1648	EA	24" x 34", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	162.86 6.30 5.60 9.80	6.47
08 71	16 00-1649	EA	24" x 36", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	170.92 6.30 5.60 9.80	6.47

08 Openings**08 70 Hardware****08 71 Door Hardware**

MINOR		TOTAL DIRECT	DEMOLITION
CSI	UOM DESCRIPTION	UNIT COST	UNIT COST
08 71 16 00-1650	EA 24" x 38", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	180.42 6.30 5.60 9.80	6.83
08 71 16 00-1651	EA 24" x 40", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	188.47 6.30 5.60 9.80	6.83
08 71 16 00-1652	EA 24" x 42", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	196.54 6.30 5.60 9.80	6.83
08 71 16 00-1653	EA 24" x 44", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	206.03 6.30 5.60 9.80	7.18
08 71 16 00-1654	EA 24" x 46", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	214.10 6.30 5.60 9.80	7.18
08 71 16 00-1655	EA 24" x 48", 0.050" Thick, Bright Stainless Finish, Stainless Kick Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	222.15 6.30 5.60 9.80	7.18
08 71 16 00-1656	Plastic Kick Plate (08 71 16 00-0763)		
08 71 16 00-1657	Clear Or Black Finish, Plastic Kick Plate (08 71 16 00-1656) Note: With four beveled edges.		
08 71 16 00-1658	EA 8" x 22", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	50.76	5.39
08 71 16 00-1659	EA 8" x 24", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	53.42	5.39
08 71 16 00-1660	EA 8" x 26", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	56.07	5.39
08 71 16 00-1661	EA 8" x 28", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	58.72	5.39
08 71 16 00-1662	EA 8" x 30", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	62.81	5.75
08 71 16 00-1663	EA 8" x 32", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	65.47	5.75
08 71 16 00-1664	EA 8" x 34", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	68.12	5.75
08 71 16 00-1665	EA 8" x 36", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	70.78	5.75
08 71 16 00-1666	EA 8" x 38", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	74.86	6.11
08 71 16 00-1667	EA 8" x 40", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	77.52	6.11
08 71 16 00-1668	EA 8" x 42", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	80.19	6.11
08 71 16 00-1669	EA 8" x 44", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	84.26	6.47
08 71 16 00-1670	EA 8" x 46", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	86.92	6.47
08 71 16 00-1671	EA 8" x 48", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	89.56	6.47
08 71 16 00-1672	EA 10" x 22", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	58.06	5.39
08 71 16 00-1673	EA 10" x 24", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	61.37	5.39
08 71 16 00-1674	EA 10" x 26", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	64.70	5.39
08 71 16 00-1675	EA 10" x 28", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	68.02	5.39
08 71 16 00-1676	EA 10" x 30", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	72.76	5.75
08 71 16 00-1677	EA 10" x 32", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	76.08	5.75
08 71 16 00-1678	EA 10" x 34", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	79.41	5.75
08 71 16 00-1679	EA 10" x 36", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	82.73	5.75
08 71 16 00-1680	EA 10" x 38", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	87.48	6.11
08 71 16 00-1681	EA 10" x 40", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	90.80	6.11
08 71 16 00-1682	EA 10" x 42", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	94.13	6.11
08 71 16 00-1683	EA 10" x 44", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	98.85	6.47
08 71 16 00-1684	EA 10" x 46", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	102.19	6.47
08 71 16 00-1685	EA 10" x 48", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	105.50	6.47
08 71 16 00-1686	EA 12" x 22", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	65.35	5.39
08 71 16 00-1687	EA 12" x 24", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	69.34	5.39
08 71 16 00-1688	EA 12" x 26", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	73.33	5.39
08 71 16 00-1689	EA 12" x 28", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	77.31	5.39
08 71 16 00-1690	EA 12" x 30", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	82.73	5.75
08 71 16 00-1691	EA 12" x 32", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	86.69	5.75
08 71 16 00-1692	EA 12" x 34", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	90.69	5.75
08 71 16 00-1693	EA 12" x 36", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	94.67	5.75
08 71 16 00-1694	EA 12" x 38", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	100.09	6.11
08 71 16 00-1695	EA 12" x 40", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	104.07	6.11
08 71 16 00-1696	EA 12" x 42", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	108.05	6.11
08 71 16 00-1697	EA 12" x 44", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	113.47	6.47
08 71 16 00-1698	EA 12" x 46", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	117.44	6.47
08 71 16 00-1699	EA 12" x 48", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	121.42	6.47
08 71 16 00-1700	EA 14" x 22", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	74.10	5.75
08 71 16 00-1701	EA 14" x 24", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	78.75	5.75
08 71 16 00-1702	EA 14" x 26", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	83.40	5.75
08 71 16 00-1703	EA 14" x 28", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	88.04	5.75
08 71 16 00-1704	EA 14" x 30", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	94.13	6.11
08 71 16 00-1705	EA 14" x 32", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	98.76	6.11
08 71 16 00-1706	EA 14" x 34", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	103.41	6.11
08 71 16 00-1707	EA 14" x 36", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	108.05	6.11
08 71 16 00-1708	EA 14" x 38", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	114.13	6.47
08 71 16 00-1709	EA 14" x 40", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	118.78	6.47
08 71 16 00-1710	EA 14" x 42", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate	123.43	6.47



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-1711	EA			14" x 44", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	129.51	6.83
08 71 16 00-1712	EA			14" x 46", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	134.14	6.83
08 71 16 00-1713	EA			14" x 48", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	138.78	6.83
08 71 16 00-1714	EA			16" x 22", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	81.39	5.75
08 71 16 00-1715	EA			16" x 24", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	86.69	5.75
08 71 16 00-1716	EA			16" x 26", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	92.02	5.75
08 71 16 00-1717	EA			16" x 28", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	97.32	5.75
08 71 16 00-1718	EA			16" x 30", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	104.07	6.11
08 71 16 00-1719	EA			16" x 32", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	109.38	6.11
08 71 16 00-1720	EA			16" x 34", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	114.68	6.11
08 71 16 00-1721	EA			16" x 36", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	119.99	6.11
08 71 16 00-1722	EA			16" x 38", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	126.73	6.47
08 71 16 00-1723	EA			16" x 40", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	132.03	6.47
08 71 16 00-1724	EA			16" x 42", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	137.34	6.47
08 71 16 00-1725	EA			16" x 44", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	144.09	6.83
08 71 16 00-1726	EA			16" x 46", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	149.42	6.83
08 71 16 00-1727	EA			16" x 48", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	154.73	6.83
08 71 16 00-1728	EA			18" x 22", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	89.47	5.75
08 71 16 00-1729	EA			18" x 24", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	95.54	5.75
08 71 16 00-1730	EA			18" x 26", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	101.56	5.75
08 71 16 00-1731	EA			18" x 28", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	107.62	5.75
08 71 16 00-1732	EA			18" x 30", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	115.11	6.11
08 71 16 00-1733	EA			18" x 32", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	121.13	6.11
08 71 16 00-1734	EA			18" x 34", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	127.19	6.11
08 71 16 00-1735	EA			18" x 36", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	136.67	6.11
08 71 16 00-1736	EA			18" x 38", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	140.71	6.47
08 71 16 00-1737	EA			18" x 40", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	146.75	6.47
08 71 16 00-1738	EA			18" x 42", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	152.80	6.47
08 71 16 00-1739	EA			18" x 44", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	160.28	6.83
08 71 16 00-1740	EA			18" x 46", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	166.32	6.83
08 71 16 00-1741	EA			18" x 48", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	172.36	6.83
08 71 16 00-1742	EA			20" x 22", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	98.32	6.11
08 71 16 00-1743	EA			20" x 24", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	105.02	6.11
08 71 16 00-1744	EA			20" x 26", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	111.74	6.11
08 71 16 00-1745	EA			20" x 28", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	118.45	6.11
08 71 16 00-1746	EA			20" x 30", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	126.60	6.47
08 71 16 00-1747	EA			20" x 32", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	133.33	6.47
08 71 16 00-1748	EA			20" x 34", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	140.02	6.47
08 71 16 00-1749	EA			20" x 36", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	146.75	6.47
08 71 16 00-1750	EA			20" x 38", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	154.89	6.83
08 71 16 00-1751	EA			20" x 40", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	161.62	6.83
08 71 16 00-1752	EA			20" x 42", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	168.34	6.83
08 71 16 00-1753	EA			20" x 44", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	176.48	7.18
08 71 16 00-1754	EA			20" x 46", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	183.20	7.18
08 71 16 00-1755	EA			20" x 48", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	189.91	7.18
08 71 16 00-1756	EA			22" x 22", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	105.70	6.11
08 71 16 00-1757	EA			22" x 24", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	113.08	6.11
08 71 16 00-1758	EA			22" x 26", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	120.46	6.11
08 71 16 00-1759	EA			22" x 28", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	127.85	6.11
08 71 16 00-1760	EA			22" x 30", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	136.67	6.47
08 71 16 00-1761	EA			22" x 32", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	144.06	6.47
08 71 16 00-1762	EA			22" x 34", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	151.46	6.47
08 71 16 00-1763	EA			22" x 36", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	158.84	6.47
08 71 16 00-1764	EA			22" x 38", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	167.66	6.83
08 71 16 00-1765	EA			22" x 40", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	175.04	6.83
08 71 16 00-1766	EA			22" x 42", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	182.42	6.83
08 71 16 00-1767	EA			22" x 44", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	191.25	7.18
08 71 16 00-1768	EA			22" x 46", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	198.65	7.18
08 71 16 00-1769	EA			22" x 48", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	206.03	7.18
08 71 16 00-1770	EA			24" x 22", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	113.08	6.11
08 71 16 00-1771	EA			24" x 24", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	121.13	6.11
08 71 16 00-1772	EA			24" x 26", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	129.20	6.11
08 71 16 00-1773	EA			24" x 28", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	137.25	6.11
08 71 16 00-1774	EA			24" x 30", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	146.75	6.47
08 71 16 00-1775	EA			24" x 32", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	154.80	6.47
08 71 16 00-1776	EA			24" x 34", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	162.86	6.47
08 71 16 00-1777	EA			24" x 36", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	170.92	6.47
08 71 16 00-1778	EA			24" x 38", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	180.42	6.83
08 71 16 00-1779	EA			24" x 40", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	188.47	6.83
08 71 16 00-1780	EA			24" x 42", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	196.54	6.83
08 71 16 00-1781	EA			24" x 44", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	206.03	7.18
08 71 16 00-1782	EA			24" x 46", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	214.10	7.18
08 71 16 00-1783	EA			24" x 48", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Kick Plate.....	222.15	7.18

- 08 71 16 00-1784 Mop Plate (08 71 16 00-0762)
Note: Ives 8400.
- 08 71 16 00-1785 Aluminum Base Material Mop Plate (08 71 16 00-1784)
- 08 71 16 00-1786 Satin Aluminum Finish, Aluminum Mop Plate (08 71 16 00-1785)

08 Openings**08 70 Hardware****08 71 Door Hardware**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-1787	EA		4" x 22", 0.050" Thick, Satin Aluminum Finish, Aluminum Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	27.48 1.76 5.60 9.80	5.25
08 71 16 00-1788	EA		4" x 24", 0.050" Thick, Satin Aluminum Finish, Aluminum Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	28.09 1.76 5.60 9.80	5.25
08 71 16 00-1789	EA		4" x 26", 0.050" Thick, Satin Aluminum Finish, Aluminum Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	28.67 1.76 5.60 9.80	5.25
08 71 16 00-1790	EA		4" x 28", 0.050" Thick, Satin Aluminum Finish, Aluminum Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	29.28 1.76 5.60 9.80	5.25
08 71 16 00-1791	EA		4" x 30", 0.050" Thick, Satin Aluminum Finish, Aluminum Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	30.75 1.76 5.60 9.80	5.46
08 71 16 00-1792	EA		4" x 32", 0.050" Thick, Satin Aluminum Finish, Aluminum Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	31.34 1.76 5.60 9.80	5.46
08 71 16 00-1793	EA		4" x 34", 0.050" Thick, Satin Aluminum Finish, Aluminum Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	31.94 1.76 5.60 9.80	5.46
08 71 16 00-1794	EA		4" x 36", 0.050" Thick, Satin Aluminum Finish, Aluminum Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	32.53 1.76 5.60 9.80	5.46
08 71 16 00-1795	EA		4" x 38", 0.050" Thick, Satin Aluminum Finish, Aluminum Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	34.35 1.76 5.60 9.80	5.75
08 71 16 00-1796	EA		4" x 40", 0.050" Thick, Satin Aluminum Finish, Aluminum Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	34.95 1.76 5.60 9.80	5.75
08 71 16 00-1797	EA		4" x 42", 0.050" Thick, Satin Aluminum Finish, Aluminum Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	35.54 1.76 5.60 9.80	5.75
08 71 16 00-1798	EA		4" x 44", 0.050" Thick, Satin Aluminum Finish, Aluminum Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	37.58 1.76 5.60 9.80	6.11
08 71 16 00-1799	EA		4" x 46", 0.050" Thick, Satin Aluminum Finish, Aluminum Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	38.19 1.76 5.60 9.80	6.11
08 71 16 00-1800	EA		4" x 48", 0.050" Thick, Satin Aluminum Finish, Aluminum Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	38.77 1.76 5.60 9.80	6.11
08 71 16 00-1801	EA		6" x 22", 0.050" Thick, Satin Aluminum Finish, Aluminum Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	30.76 1.76 5.60 9.80	5.25
08 71 16 00-1802	EA		6" x 24", 0.050" Thick, Satin Aluminum Finish, Aluminum Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	31.66 1.76 5.60 9.80	5.25
08 71 16 00-1803	EA		6" x 26", 0.050" Thick, Satin Aluminum Finish, Aluminum Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	32.56 1.76 5.60 9.80	5.25
08 71 16 00-1804	EA		6" x 28", 0.050" Thick, Satin Aluminum Finish, Aluminum Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	33.45 1.76 5.60 9.80	5.25
08 71 16 00-1805	EA		6" x 30", 0.050" Thick, Satin Aluminum Finish, Aluminum Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	35.23 1.76 5.60 9.80	5.46
08 71 16 00-1806	EA		6" x 32", 0.050" Thick, Satin Aluminum Finish, Aluminum Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	36.11 1.76 5.60 9.80	5.46
08 71 16 00-1807	EA		6" x 34", 0.050" Thick, Satin Aluminum Finish, Aluminum Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	37.02 1.76 5.60 9.80	5.46



Openings	08	08
Hardware	08 70	
Door Hardware	08 71	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-1808	EA		6" x 36", 0.050" Thick, Satin Aluminum Finish, Aluminum Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	37.91 1.76 5.60 9.80	5.46
08 71 16 00-1809	EA		6" x 38", 0.050" Thick, Satin Aluminum Finish, Aluminum Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	40.03 1.76 5.60 9.80	5.75
08 71 16 00-1810	EA		6" x 40", 0.050" Thick, Satin Aluminum Finish, Aluminum Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	40.92 1.76 5.60 9.80	5.75
08 71 16 00-1811	EA		6" x 42", 0.050" Thick, Satin Aluminum Finish, Aluminum Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	41.83 1.76 5.60 9.80	5.75
08 71 16 00-1812	EA		6" x 44", 0.050" Thick, Satin Aluminum Finish, Aluminum Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	44.16 1.76 5.60 9.80	6.11
08 71 16 00-1813	EA		6" x 46", 0.050" Thick, Satin Aluminum Finish, Aluminum Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	45.06 1.76 5.60 9.80	6.11
08 71 16 00-1814	EA		6" x 48", 0.050" Thick, Satin Aluminum Finish, Aluminum Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	45.95 1.76 5.60 9.80	6.11
08 71 16 00-1815			Brass Base Material Mop Plate <small>(08 71 16 00-1784)</small>		
08 71 16 00-1816			Bright/Satin Brass Finish, Brass Mop Plate <small>(08 71 16 00-1815)</small>		
08 71 16 00-1817	EA		4" x 22", 0.050" Thick, Bright/Satin Brass Finish, Brass Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	40.09 1.76 5.60 9.80	5.25
08 71 16 00-1818	EA		4" x 24", 0.050" Thick, Bright/Satin Brass Finish, Brass Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	41.85 1.76 5.60 9.80	5.25
08 71 16 00-1819	EA		4" x 26", 0.050" Thick, Bright/Satin Brass Finish, Brass Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	43.59 1.76 5.60 9.80	5.25
08 71 16 00-1820	EA		4" x 28", 0.050" Thick, Bright/Satin Brass Finish, Brass Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	45.35 1.76 5.60 9.80	5.25
08 71 16 00-1821	EA		4" x 30", 0.050" Thick, Bright/Satin Brass Finish, Brass Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	47.95 1.76 5.60 9.80	5.46
08 71 16 00-1822	EA		4" x 32", 0.050" Thick, Bright/Satin Brass Finish, Brass Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	49.69 1.76 5.60 9.80	5.46
08 71 16 00-1823	EA		4" x 34", 0.050" Thick, Bright/Satin Brass Finish, Brass Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	51.45 1.76 5.60 9.80	5.46
08 71 16 00-1824	EA		4" x 36", 0.050" Thick, Bright/Satin Brass Finish, Brass Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	53.19 1.76 5.60 9.80	5.46
08 71 16 00-1825	EA		4" x 38", 0.050" Thick, Bright/Satin Brass Finish, Brass Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	56.16 1.76 5.60 9.80	5.75
08 71 16 00-1826	EA		4" x 40", 0.050" Thick, Bright/Satin Brass Finish, Brass Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	57.90 1.76 5.60 9.80	5.75
08 71 16 00-1827	EA		4" x 42", 0.050" Thick, Bright/Satin Brass Finish, Brass Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	59.64 1.76 5.60 9.80	5.75
08 71 16 00-1828	EA		4" x 44", 0.050" Thick, Bright/Satin Brass Finish, Brass Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	62.83 1.76 5.60 9.80	6.11
08 71 16 00-1829	EA		4" x 46", 0.050" Thick, Bright/Satin Brass Finish, Brass Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	64.57 1.76 5.60 9.80	6.11

08 Openings**08 70 Hardware****08 71 Door Hardware**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-1830	EA		4" x 48", 0.050" Thick, Bright/Satin Brass Finish, Brass Mop Plate.....	66.33	6.11
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1831	EA		6" x 22", 0.050" Thick, Bright/Satin Brass Finish, Brass Mop Plate.....	49.71	5.25
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1832	EA		6" x 24", 0.050" Thick, Bright/Satin Brass Finish, Brass Mop Plate.....	52.32	5.25
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1833	EA		6" x 26", 0.050" Thick, Bright/Satin Brass Finish, Brass Mop Plate.....	54.94	5.25
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1834	EA		6" x 28", 0.050" Thick, Bright/Satin Brass Finish, Brass Mop Plate.....	57.55	5.25
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1835	EA		6" x 30", 0.050" Thick, Bright/Satin Brass Finish, Brass Mop Plate.....	61.04	5.46
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1836	EA		6" x 32", 0.050" Thick, Bright/Satin Brass Finish, Brass Mop Plate.....	63.67	5.46
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1837	EA		6" x 34", 0.050" Thick, Bright/Satin Brass Finish, Brass Mop Plate.....	66.27	5.46
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1838	EA		6" x 36", 0.050" Thick, Bright/Satin Brass Finish, Brass Mop Plate.....	68.90	5.46
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1839	EA		6" x 38", 0.050" Thick, Bright/Satin Brass Finish, Brass Mop Plate.....	72.72	5.75
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1840	EA		6" x 40", 0.050" Thick, Bright/Satin Brass Finish, Brass Mop Plate.....	75.35	5.75
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1841	EA		6" x 42", 0.050" Thick, Bright/Satin Brass Finish, Brass Mop Plate.....	77.97	5.75
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1842	EA		6" x 44", 0.050" Thick, Bright/Satin Brass Finish, Brass Mop Plate.....	82.02	6.11
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1843	EA		6" x 46", 0.050" Thick, Bright/Satin Brass Finish, Brass Mop Plate.....	84.64	6.11
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1844	EA		6" x 48", 0.050" Thick, Bright/Satin Brass Finish, Brass Mop Plate.....	87.25	6.11
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1845			Bright/Satin Chrome Finish, Brass Mop Plate <small>(08 71 16 00-1815)</small>		
08 71 16 00-1846	EA		4" x 22", 0.050" Thick, Bright/Satin Chrome Finish, Brass Mop Plate.....	41.91	5.25
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1847	EA		4" x 24", 0.050" Thick, Bright/Satin Chrome Finish, Brass Mop Plate.....	43.81	5.25
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1848	EA		4" x 26", 0.050" Thick, Bright/Satin Chrome Finish, Brass Mop Plate.....	45.72	5.25
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1849	EA		4" x 28", 0.050" Thick, Bright/Satin Chrome Finish, Brass Mop Plate.....	47.63	5.25
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1850	EA		4" x 30", 0.050" Thick, Bright/Satin Chrome Finish, Brass Mop Plate.....	50.40	5.46
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	



Openings	08	08
Hardware	08 70	
Door Hardware	08 71	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71	16 00-1851	EA	4" x 32", 0.050" Thick, Bright/Satin Chrome Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	52.32 1.76 5.60 9.80	5.46
08 71	16 00-1852	EA	4" x 34", 0.050" Thick, Bright/Satin Chrome Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	54.23 1.76 5.60 9.80	5.46
08 71	16 00-1853	EA	4" x 36", 0.050" Thick, Bright/Satin Chrome Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	56.13 1.76 5.60 9.80	5.46
08 71	16 00-1854	EA	4" x 38", 0.050" Thick, Bright/Satin Chrome Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	59.26 1.76 5.60 9.80	5.75
08 71	16 00-1855	EA	4" x 40", 0.050" Thick, Bright/Satin Chrome Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	61.18 1.76 5.60 9.80	5.75
08 71	16 00-1856	EA	4" x 42", 0.050" Thick, Bright/Satin Chrome Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	63.09 1.76 5.60 9.80	5.75
08 71	16 00-1857	EA	4" x 44", 0.050" Thick, Bright/Satin Chrome Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	66.44 1.76 5.60 9.80	6.11
08 71	16 00-1858	EA	4" x 46", 0.050" Thick, Bright/Satin Chrome Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	68.34 1.76 5.60 9.80	6.11
08 71	16 00-1859	EA	4" x 48", 0.050" Thick, Bright/Satin Chrome Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	70.25 1.76 5.60 9.80	6.11
08 71	16 00-1860	EA	6" x 22", 0.050" Thick, Bright/Satin Chrome Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	52.41 1.76 5.60 9.80	5.25
08 71	16 00-1861	EA	6" x 24", 0.050" Thick, Bright/Satin Chrome Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	55.26 1.76 5.60 9.80	5.25
08 71	16 00-1862	EA	6" x 26", 0.050" Thick, Bright/Satin Chrome Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	58.13 1.76 5.60 9.80	5.25
08 71	16 00-1863	EA	6" x 28", 0.050" Thick, Bright/Satin Chrome Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	61.00 1.76 5.60 9.80	5.25
08 71	16 00-1864	EA	6" x 30", 0.050" Thick, Bright/Satin Chrome Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	64.72 1.76 5.60 9.80	5.46
08 71	16 00-1865	EA	6" x 32", 0.050" Thick, Bright/Satin Chrome Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	67.59 1.76 5.60 9.80	5.46
08 71	16 00-1866	EA	6" x 34", 0.050" Thick, Bright/Satin Chrome Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	70.44 1.76 5.60 9.80	5.46
08 71	16 00-1867	EA	6" x 36", 0.050" Thick, Bright/Satin Chrome Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	73.32 1.76 5.60 9.80	5.46
08 71	16 00-1868	EA	6" x 38", 0.050" Thick, Bright/Satin Chrome Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	77.41 1.76 5.60 9.80	5.75
08 71	16 00-1869	EA	6" x 40", 0.050" Thick, Bright/Satin Chrome Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	80.26 1.76 5.60 9.80	5.75
08 71	16 00-1870	EA	6" x 42", 0.050" Thick, Bright/Satin Chrome Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	83.13 1.76 5.60 9.80	5.75
08 71	16 00-1871	EA	6" x 44", 0.050" Thick, Bright/Satin Chrome Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	87.42 1.76 5.60 9.80	6.11

08 Openings**08 70 Hardware****08 71 Door Hardware**

MINOR		TOTAL DIRECT	DEMOLITION
CSI	UOM DESCRIPTION	UNIT COST	UNIT COST
08 71 16 00-1872	EA 6" x 46", 0.050" Thick, Bright/Satin Chrome Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	90.29 1.76 5.60 9.80	6.11
08 71 16 00-1873	EA 6" x 48", 0.050" Thick, Bright/Satin Chrome Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	93.16 1.76 5.60 9.80	6.11
08 71 16 00-1874	Satin/Dark Bronze Finish, Brass Mop Plate (08 71 16 00-1815)		
08 71 16 00-1875	EA 4" x 22", 0.050" Thick, Satin/Dark Bronze Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	42.25 1.76 5.60 9.80	5.25
08 71 16 00-1876	EA 4" x 24", 0.050" Thick, Satin/Dark Bronze Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	44.19 1.76 5.60 9.80	5.25
08 71 16 00-1877	EA 4" x 26", 0.050" Thick, Satin/Dark Bronze Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	46.13 1.76 5.60 9.80	5.25
08 71 16 00-1878	EA 4" x 28", 0.050" Thick, Satin/Dark Bronze Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	48.07 1.76 5.60 9.80	5.25
08 71 16 00-1879	EA 4" x 30", 0.050" Thick, Satin/Dark Bronze Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	50.88 1.76 5.60 9.80	5.46
08 71 16 00-1880	EA 4" x 32", 0.050" Thick, Satin/Dark Bronze Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	52.83 1.76 5.60 9.80	5.46
08 71 16 00-1881	EA 4" x 34", 0.050" Thick, Satin/Dark Bronze Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	54.78 1.76 5.60 9.80	5.46
08 71 16 00-1882	EA 4" x 36", 0.050" Thick, Satin/Dark Bronze Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	56.72 1.76 5.60 9.80	5.46
08 71 16 00-1883	EA 4" x 38", 0.050" Thick, Satin/Dark Bronze Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	59.86 1.76 5.60 9.80	5.75
08 71 16 00-1884	EA 4" x 40", 0.050" Thick, Satin/Dark Bronze Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	61.81 1.76 5.60 9.80	5.75
08 71 16 00-1885	EA 4" x 42", 0.050" Thick, Satin/Dark Bronze Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	63.76 1.76 5.60 9.80	5.75
08 71 16 00-1886	EA 4" x 44", 0.050" Thick, Satin/Dark Bronze Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	67.14 1.76 5.60 9.80	6.11
08 71 16 00-1887	EA 4" x 46", 0.050" Thick, Satin/Dark Bronze Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	69.09 1.76 5.60 9.80	6.11
08 71 16 00-1888	EA 4" x 48", 0.050" Thick, Satin/Dark Bronze Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	71.01 1.76 5.60 9.80	6.11
08 71 16 00-1889	EA 6" x 22", 0.050" Thick, Satin/Dark Bronze Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	52.92 1.76 5.60 9.80	5.25
08 71 16 00-1890	EA 6" x 24", 0.050" Thick, Satin/Dark Bronze Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	55.85 1.76 5.60 9.80	5.25
08 71 16 00-1891	EA 6" x 26", 0.050" Thick, Satin/Dark Bronze Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	58.76 1.76 5.60 9.80	5.25
08 71 16 00-1892	EA 6" x 28", 0.050" Thick, Satin/Dark Bronze Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	416.46 1.76 5.60 9.80	5.25



Openings	08	08
Hardware	08 70	
Door Hardware	08 71	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-1893	EA		6" x 30", 0.050" Thick, Satin/Dark Bronze Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	65.44 1.76 5.60 9.80	5.46
08 71 16 00-1894	EA		6" x 32", 0.050" Thick, Satin/Dark Bronze Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	68.35 1.76 5.60 9.80	5.46
08 71 16 00-1895	EA		6" x 34", 0.050" Thick, Satin/Dark Bronze Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	71.26 1.76 5.60 9.80	5.46
08 71 16 00-1896	EA		6" x 36", 0.050" Thick, Satin/Dark Bronze Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	74.16 1.76 5.60 9.80	5.46
08 71 16 00-1897	EA		6" x 38", 0.050" Thick, Satin/Dark Bronze Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	78.31 1.76 5.60 9.80	5.75
08 71 16 00-1898	EA		6" x 40", 0.050" Thick, Satin/Dark Bronze Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	81.22 1.76 5.60 9.80	5.75
08 71 16 00-1899	EA		6" x 42", 0.050" Thick, Satin/Dark Bronze Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	84.13 1.76 5.60 9.80	5.75
08 71 16 00-1900	EA		6" x 44", 0.050" Thick, Satin/Dark Bronze Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	88.47 1.76 5.60 9.80	6.11
08 71 16 00-1901	EA		6" x 46", 0.050" Thick, Satin/Dark Bronze Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	91.38 1.76 5.60 9.80	6.11
08 71 16 00-1902	EA		6" x 48", 0.050" Thick, Satin/Dark Bronze Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	94.29 1.76 5.60 9.80	6.11
08 71 16 00-1903			Satin Nickel Finish, Brass Mop Plate (08 71 16 00-1815)		
08 71 16 00-1904	EA		4" x 22", 0.050" Thick, Satin/Nickel Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	42.67 1.76 5.60 9.80	5.25
08 71 16 00-1905	EA		4" x 24", 0.050" Thick, Satin/Nickel Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	44.62 1.76 5.60 9.80	5.25
08 71 16 00-1906	EA		4" x 26", 0.050" Thick, Satin/Nickel Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	46.62 1.76 5.60 9.80	5.25
08 71 16 00-1907	EA		4" x 28", 0.050" Thick, Satin/Nickel Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	48.60 1.76 5.60 9.80	5.25
08 71 16 00-1908	EA		4" x 30", 0.050" Thick, Satin/Nickel Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	51.45 1.76 5.60 9.80	5.46
08 71 16 00-1909	EA		4" x 32", 0.050" Thick, Satin/Nickel Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	53.41 1.76 5.60 9.80	5.46
08 71 16 00-1910	EA		4" x 34", 0.050" Thick, Satin/Nickel Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	55.39 1.76 5.60 9.80	5.46
08 71 16 00-1911	EA		4" x 36", 0.050" Thick, Satin/Nickel Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	57.37 1.76 5.60 9.80	5.46
08 71 16 00-1912	EA		4" x 38", 0.050" Thick, Satin/Nickel Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	60.59 1.76 5.60 9.80	5.75
08 71 16 00-1913	EA		4" x 40", 0.050" Thick, Satin/Nickel Finish, Brass Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	62.55 1.76 5.60 9.80	5.75

08 Openings**08 70 Hardware****08 71 Door Hardware**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-1914	EA		4" x 42", 0.050" Thick, Satin/Nickel Finish, Brass Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	64.52 1.76 5.60 9.80	5.75
08 71 16 00-1915	EA		4" x 44", 0.050" Thick, Satin/Nickel Finish, Brass Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	67.95 1.76 5.60 9.80	6.11
08 71 16 00-1916	EA		4" x 46", 0.050" Thick, Satin/Nickel Finish, Brass Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	69.93 1.76 5.60 9.80	6.11
08 71 16 00-1917	EA		4" x 48", 0.050" Thick, Satin/Nickel Finish, Brass Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	71.89 1.76 5.60 9.80	6.11
08 71 16 00-1918	EA		6" x 22", 0.050" Thick, Satin/Nickel Finish, Brass Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	53.54 1.76 5.60 9.80	5.25
08 71 16 00-1919	EA		6" x 24", 0.050" Thick, Satin/Nickel Finish, Brass Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	56.50 1.76 5.60 9.80	5.25
08 71 16 00-1920	EA		6" x 26", 0.050" Thick, Satin/Nickel Finish, Brass Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	59.47 1.76 5.60 9.80	5.25
08 71 16 00-1921	EA		6" x 28", 0.050" Thick, Satin/Nickel Finish, Brass Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	62.43 1.76 5.60 9.80	5.25
08 71 16 00-1922	EA		6" x 30", 0.050" Thick, Satin/Nickel Finish, Brass Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	66.27 1.76 5.60 9.80	5.46
08 71 16 00-1923	EA		6" x 32", 0.050" Thick, Satin/Nickel Finish, Brass Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	69.23 1.76 5.60 9.80	5.46
08 71 16 00-1924	EA		6" x 34", 0.050" Thick, Satin/Nickel Finish, Brass Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	72.20 1.76 5.60 9.80	5.46
08 71 16 00-1925	EA		6" x 36", 0.050" Thick, Satin/Nickel Finish, Brass Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	75.17 1.76 5.60 9.80	5.46
08 71 16 00-1926	EA		6" x 38", 0.050" Thick, Satin/Nickel Finish, Brass Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	79.36 1.76 5.60 9.80	5.75
08 71 16 00-1927	EA		6" x 40", 0.050" Thick, Satin/Nickel Finish, Brass Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	82.33 1.76 5.60 9.80	5.75
08 71 16 00-1928	EA		6" x 42", 0.050" Thick, Satin/Nickel Finish, Brass Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	85.30 1.76 5.60 9.80	5.75
08 71 16 00-1929	EA		6" x 44", 0.050" Thick, Satin/Nickel Finish, Brass Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	89.70 1.76 5.60 9.80	6.11
08 71 16 00-1930	EA		6" x 46", 0.050" Thick, Satin/Nickel Finish, Brass Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	92.66 1.76 5.60 9.80	6.11
08 71 16 00-1931	EA		6" x 48", 0.050" Thick, Satin/Nickel Finish, Brass Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	95.64 1.76 5.60 9.80	6.11
08 71 16 00-1932			Stainless Base Material Mop Plate (08 71 16 00-1784)		
08 71 16 00-1933			Satin Stainless Finish, Stainless Mop Plate (08 71 16 00-1932)		
08 71 16 00-1934	EA		4" x 22", 0.050" Thick, Satin Stainless Finish, Stainless Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	27.90 1.76 5.60 9.80	5.25
08 71 16 00-1935	EA		4" x 24", 0.050" Thick, Satin Stainless Finish, Stainless Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	28.52 1.76 5.60 9.80	5.25



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71	16 00-1936	EA		4" x 26", 0.050" Thick, Satin Stainless Finish, Stainless Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	29.16 1.76 5.60 9.80	5.25
08 71	16 00-1937	EA		4" x 28", 0.050" Thick, Satin Stainless Finish, Stainless Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	29.79 1.76 5.60 9.80	5.25
08 71	16 00-1938	EA		4" x 30", 0.050" Thick, Satin Stainless Finish, Stainless Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	31.30 1.76 5.60 9.80	5.46
08 71	16 00-1939	EA		4" x 32", 0.050" Thick, Satin Stainless Finish, Stainless Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	31.94 1.76 5.60 9.80	5.46
08 71	16 00-1940	EA		4" x 34", 0.050" Thick, Satin Stainless Finish, Stainless Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	32.56 1.76 5.60 9.80	5.46
08 71	16 00-1941	EA		4" x 36", 0.050" Thick, Satin Stainless Finish, Stainless Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	33.20 1.76 5.60 9.80	5.46
08 71	16 00-1942	EA		4" x 38", 0.050" Thick, Satin Stainless Finish, Stainless Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	35.05 1.76 5.60 9.80	5.75
08 71	16 00-1943	EA		4" x 40", 0.050" Thick, Satin Stainless Finish, Stainless Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	35.69 1.76 5.60 9.80	5.75
08 71	16 00-1944	EA		4" x 42", 0.050" Thick, Satin Stainless Finish, Stainless Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	36.33 1.76 5.60 9.80	5.75
08 71	16 00-1945	EA		4" x 44", 0.050" Thick, Satin Stainless Finish, Stainless Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	38.39 1.76 5.60 9.80	6.11
08 71	16 00-1946	EA		4" x 46", 0.050" Thick, Satin Stainless Finish, Stainless Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	39.03 1.76 5.60 9.80	6.11
08 71	16 00-1947	EA		4" x 48", 0.050" Thick, Satin Stainless Finish, Stainless Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	39.66 1.76 5.60 9.80	6.11
08 71	16 00-1948	EA		6" x 22", 0.050" Thick, Satin Stainless Finish, Stainless Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	31.37 1.76 5.60 9.80	5.25
08 71	16 00-1949	EA		6" x 24", 0.050" Thick, Satin Stainless Finish, Stainless Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	32.33 1.76 5.60 9.80	5.25
08 71	16 00-1950	EA		6" x 26", 0.050" Thick, Satin Stainless Finish, Stainless Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	33.28 1.76 5.60 9.80	5.25
08 71	16 00-1951	EA		6" x 28", 0.050" Thick, Satin Stainless Finish, Stainless Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	34.24 1.76 5.60 9.80	5.25
08 71	16 00-1952	EA		6" x 30", 0.050" Thick, Satin Stainless Finish, Stainless Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	36.05 1.76 5.60 9.80	5.46
08 71	16 00-1953	EA		6" x 32", 0.050" Thick, Satin Stainless Finish, Stainless Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	37.00 1.76 5.60 9.80	5.46
08 71	16 00-1954	EA		6" x 34", 0.050" Thick, Satin Stainless Finish, Stainless Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	37.96 1.76 5.60 9.80	5.46
08 71	16 00-1955	EA		6" x 36", 0.050" Thick, Satin Stainless Finish, Stainless Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	38.91 1.76 5.60 9.80	5.46
08 71	16 00-1956	EA		6" x 38", 0.050" Thick, Satin Stainless Finish, Stainless Mop Plate <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	41.09 1.76 5.60 9.80	5.75

08 Openings**08 70 Hardware****08 71 Door Hardware**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-1957	EA		6" x 40", 0.050" Thick, Satin Stainless Finish, Stainless Mop Plate	42.03	5.75
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1958	EA		6" x 42", 0.050" Thick, Satin Stainless Finish, Stainless Mop Plate	42.98	5.75
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1959	EA		6" x 44", 0.050" Thick, Satin Stainless Finish, Stainless Mop Plate	45.38	6.11
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1960	EA		6" x 46", 0.050" Thick, Satin Stainless Finish, Stainless Mop Plate	46.32	6.11
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1961	EA		6" x 48", 0.050" Thick, Satin Stainless Finish, Stainless Mop Plate	47.28	6.11
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1962			Bright Stainless Finish, Stainless Mop Plate (08 71 16 00-1932)		
08 71 16 00-1963	EA		4" x 22", 0.050" Thick, Bright Stainless Finish, Stainless Mop Plate	36.43	5.25
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1964	EA		4" x 24", 0.050" Thick, Bright Stainless Finish, Stainless Mop Plate	37.85	5.25
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1965	EA		4" x 26", 0.050" Thick, Bright Stainless Finish, Stainless Mop Plate	39.27	5.25
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1966	EA		4" x 28", 0.050" Thick, Bright Stainless Finish, Stainless Mop Plate	40.66	5.25
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1967	EA		4" x 30", 0.050" Thick, Bright Stainless Finish, Stainless Mop Plate	42.95	5.46
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1968	EA		4" x 32", 0.050" Thick, Bright Stainless Finish, Stainless Mop Plate	44.36	5.46
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1969	EA		4" x 34", 0.050" Thick, Bright Stainless Finish, Stainless Mop Plate	45.78	5.46
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1970	EA		4" x 36", 0.050" Thick, Bright Stainless Finish, Stainless Mop Plate	47.20	5.46
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1971	EA		4" x 38", 0.050" Thick, Bright Stainless Finish, Stainless Mop Plate	49.82	5.75
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1972	EA		4" x 40", 0.050" Thick, Bright Stainless Finish, Stainless Mop Plate	51.23	5.75
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1973	EA		4" x 42", 0.050" Thick, Bright Stainless Finish, Stainless Mop Plate	52.65	5.75
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1974	EA		4" x 44", 0.050" Thick, Bright Stainless Finish, Stainless Mop Plate	55.50	6.11
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1975	EA		4" x 46", 0.050" Thick, Bright Stainless Finish, Stainless Mop Plate	56.92	6.11
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1976	EA		4" x 48", 0.050" Thick, Bright Stainless Finish, Stainless Mop Plate	58.32	6.11
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	
08 71 16 00-1977	EA		6" x 22", 0.050" Thick, Bright Stainless Finish, Stainless Mop Plate	44.19	5.25
			<i>For Four Beveled Edges, Add</i>	1.76	
			<i>For Counter Sink Holes, Add</i>	5.60	
			<i>For UL Label (Fire Rated), Add</i>	9.80	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-1978 EA 6" x 24", 0.050" Thick, Bright Stainless Finish, Stainless Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	46.33 1.76 5.60 9.80	5.25
08 71 16 00-1979 EA 6" x 26", 0.050" Thick, Bright Stainless Finish, Stainless Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	48.45 1.76 5.60 9.80	5.25
08 71 16 00-1980 EA 6" x 28", 0.050" Thick, Bright Stainless Finish, Stainless Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	50.56 1.76 5.60 9.80	5.25
08 71 16 00-1981 EA 6" x 30", 0.050" Thick, Bright Stainless Finish, Stainless Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	53.54 1.76 5.60 9.80	5.46
08 71 16 00-1982 EA 6" x 32", 0.050" Thick, Bright Stainless Finish, Stainless Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	55.66 1.76 5.60 9.80	5.46
08 71 16 00-1983 EA 6" x 34", 0.050" Thick, Bright Stainless Finish, Stainless Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	57.77 1.76 5.60 9.80	5.46
08 71 16 00-1984 EA 6" x 36", 0.050" Thick, Bright Stainless Finish, Stainless Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	59.89 1.76 5.60 9.80	5.46
08 71 16 00-1985 EA 6" x 38", 0.050" Thick, Bright Stainless Finish, Stainless Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	63.24 1.76 5.60 9.80	5.75
08 71 16 00-1986 EA 6" x 40", 0.050" Thick, Bright Stainless Finish, Stainless Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	65.36 1.76 5.60 9.80	5.75
08 71 16 00-1987 EA 6" x 42", 0.050" Thick, Bright Stainless Finish, Stainless Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	67.48 1.76 5.60 9.80	5.75
08 71 16 00-1988 EA 6" x 44", 0.050" Thick, Bright Stainless Finish, Stainless Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	71.03 1.76 5.60 9.80	6.11
08 71 16 00-1989 EA 6" x 46", 0.050" Thick, Bright Stainless Finish, Stainless Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	73.14 1.76 5.60 9.80	6.11
08 71 16 00-1990 EA 6" x 48", 0.050" Thick, Bright Stainless Finish, Stainless Mop Plate..... <i>For Four Beveled Edges, Add</i> <i>For Counter Sink Holes, Add</i> <i>For UL Label (Fire Rated), Add</i>	75.26 1.76 5.60 9.80	6.11
08 71 16 00-1991 Plastic Mop Plate <small>(08 71 16 00-1784)</small>		
08 71 16 00-1992 Clear Or Black Finish, Plastic Mop Plate <small>(08 71 16 00-1991)</small> Note: With four beveled edges.		
08 71 16 00-1993 EA 4" x 22", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Plastic Mop Plate..... Note: 4 sides beveled.	26.72	5.25
08 71 16 00-1994 EA 4" x 24", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Plastic Mop Plate..... Note: 4 sides beveled.	27.25	5.25
08 71 16 00-1995 EA 4" x 26", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Plastic Mop Plate..... Note: 4 sides beveled.	27.79	5.25
08 71 16 00-1996 EA 4" x 28", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Plastic Mop Plate..... Note: 4 sides beveled.	28.31	5.25
08 71 16 00-1997 EA 4" x 30", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Plastic Mop Plate..... Note: 4 sides beveled.	29.71	5.46
08 71 16 00-1998 EA 4" x 32", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Plastic Mop Plate..... Note: 4 sides beveled.	30.24	5.46
08 71 16 00-1999 EA 4" x 34", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Plastic Mop Plate..... Note: 4 sides beveled.	30.76	5.46
08 71 16 00-2000 EA 4" x 36", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Plastic Mop Plate..... Note: 4 sides beveled.	31.30	5.46
08 71 16 00-2001 EA 4" x 38", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Plastic Mop Plate..... Note: 4 sides beveled.	33.05	5.75
08 71 16 00-2002 EA 4" x 40", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Plastic Mop Plate..... Note: 4 sides beveled.	33.58	5.75
08 71 16 00-2003 EA 4" x 42", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Plastic Mop Plate..... Note: 4 sides beveled.	34.10	5.75
08 71 16 00-2004 EA 4" x 44", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Plastic Mop Plate..... Note: 4 sides beveled.	36.07	6.11
08 71 16 00-2005 EA 4" x 46", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Plastic Mop Plate..... Note: 4 sides beveled.	36.61	6.11
08 71 16 00-2006 EA 4" x 48", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Plastic Mop Plate..... Note: 4 sides beveled.	37.13	6.11

08 Openings**08 70 Hardware****08 71 Door Hardware**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-2007	EA		6" x 22", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Plastic Mop Plate Note: 4 sides beveled.	29.63	5.25
08 71 16 00-2008	EA		6" x 24", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Plastic Mop Plate Note: 4 sides beveled.	30.43	5.25
08 71 16 00-2009	EA		6" x 26", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Plastic Mop Plate Note: 4 sides beveled.	31.22	5.25
08 71 16 00-2010	EA		6" x 28", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Plastic Mop Plate Note: 4 sides beveled.	32.01	5.25
08 71 16 00-2011	EA		6" x 30", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Plastic Mop Plate Note: 4 sides beveled.	33.68	5.46
08 71 16 00-2012	EA		6" x 32", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Plastic Mop Plate Note: 4 sides beveled.	34.47	5.46
08 71 16 00-2013	EA		6" x 34", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Plastic Mop Plate Note: 4 sides beveled.	35.26	5.46
08 71 16 00-2014	EA		6" x 36", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Plastic Mop Plate Note: 4 sides beveled.	36.05	5.46
08 71 16 00-2015	EA		6" x 38", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Plastic Mop Plate Note: 4 sides beveled.	38.07	5.75
08 71 16 00-2016	EA		6" x 40", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Plastic Mop Plate Note: 4 sides beveled.	38.86	5.75
08 71 16 00-2017	EA		6" x 42", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Plastic Mop Plate Note: 4 sides beveled.	39.65	5.75
08 71 16 00-2018	EA		6" x 44", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Plastic Mop Plate Note: 4 sides beveled.	41.89	6.11
08 71 16 00-2019	EA		6" x 46", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Plastic Mop Plate Note: 4 sides beveled.	42.68	6.11
08 71 16 00-2020	EA		6" x 48", 1/8" Thick, Clear Or Black Finish, High Impact Polyethylene Plastic Mop Plate Note: 4 sides beveled.	43.47	6.11
08 71 16 00-2021			Armor Door Plate (08 71 16 00-0762) Note: Size ranges of 26" to 48" high, 22" to 48" wide. Ives 8400.		
08 71 16 00-2022	SF		4 to 8 SF, 0.050" Thick, Satin Aluminum Finish, Aluminum Door Armor Plate.....	13.12	0.90
08 71 16 00-2023	SF		>8 to 16 SF, 0.050" Thick, Satin Aluminum Finish, Aluminum Door Armor Plate.....	12.32	0.71
08 71 16 00-2024	SF		4 to 8 SF, 0.050" Thick, Satin Stainless Finish, Stainless Door Armor Plate	14.45	0.90
08 71 16 00-2025	SF		>8 to 16 SF, 0.050" Thick, Satin Stainless Finish, Stainless Door Armor Plate	13.65	0.71
08 71 16 00-2026	SF		4 to 8 SF, 0.050" Thick, Bright Stainless Finish, Stainless Door Armor Plate	27.77	0.90
08 71 16 00-2027	SF		>8 to 16 SF, 0.050" Thick, Bright Stainless Finish, Stainless Door Armor Plate	26.97	0.71
08 71 16 00-2028			Pull Handle And Plates (08 71 16 00-0762)		
08 71 16 00-2029			Pull Handle (08 71 16 00-2028)		
08 71 16 00-2030	EA		3/4" Diameter Aluminum Door Pulls, 6" Long..... <i>For Stainless Steel, Add</i> <i>For Brass, Add</i>	47.15 9.84 13.36	5.93
08 71 16 00-2031	EA		3/4" Diameter Aluminum Door Pulls, 8" Long..... <i>For Stainless Steel, Add</i> <i>For Brass, Add</i>	47.15 9.84 13.36	5.93
08 71 16 00-2032	EA		3/4" Diameter Aluminum Door Pulls, 10" Long..... <i>For Stainless Steel, Add</i> <i>For Brass, Add</i>	49.46 10.81 14.67	5.93
08 71 16 00-2033	EA		1" Diameter Aluminum Door Pulls, 8" Long	54.93	5.93
			<i>For Stainless Steel, Add</i> <i>For Brass, Add</i>	13.11 17.79	
08 71 16 00-2034	EA		1" Diameter Aluminum Door Pulls, 10" Long..... <i>For Stainless Steel, Add</i> <i>For Brass, Add</i>	58.06 14.42 19.57	5.93
08 71 16 00-2035	EA		1" Diameter Aluminum Door Pulls, 12" Long..... <i>For Stainless Steel, Add</i> <i>For Brass, Add</i>	62.20 16.16 21.93	5.93
08 71 16 00-2036	EA		1" Flattened x 1/2" Round Aluminum Door Pulls, 6" Long..... <i>For Stainless Steel, Add</i> <i>For Brass, Add</i>	50.01 11.04 14.99	5.93
08 71 16 00-2037	EA		1" Flattened x 1/2" Round Aluminum Door Pulls, 8" Long..... <i>For Stainless Steel, Add</i> <i>For Brass, Add</i>	50.01 11.04 14.99	5.93
08 71 16 00-2038	EA		1" Flattened x 1/2" Round Aluminum Door Pulls, 10" Long..... <i>For Stainless Steel, Add</i> <i>For Brass, Add</i>	52.61 12.13 16.47	5.93
08 71 16 00-2039	EA		1" Diameter Stainless Steel Offset Door Pulls, 8" Long	88.43	5.93
			<i>For Bright Stainless Steel US32 (BHMA 629) Finish, Add</i> <i>For Brass, Add</i>	12.23 11.26	
08 71 16 00-2040	EA		1" Diameter Stainless Steel Offset Door Pulls, 10" Long	92.65	5.93
			<i>For Bright Stainless Steel US32 (BHMA 629) Finish, Add</i> <i>For Brass, Add</i>	13.03 11.99	
08 71 16 00-2041	EA		1" Diameter Stainless Steel Offset Door Pulls, 12" Long	96.88	5.93
			<i>For Bright Stainless Steel US32 (BHMA 629) Finish, Add</i> <i>For Brass, Add</i>	13.83 12.73	
08 71 16 00-2042	EA		1" Diameter Stainless Steel Offset Door Pulls, 18" Long	116.57	5.93
			<i>For Bright Stainless Steel US32 (BHMA 629) Finish, Add</i> <i>For Brass, Add</i>	17.55 16.16	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-2043 Pull Plate <small>(08 71 16 00-2028)</small>		
08 71 16 00-2044 EA 3-1/2" x 15" Aluminum Pull Plate Door Hardware.....	45.34	4.49
<i>For Stainless Steel, Add</i>	16.15	
<i>For Brass, Add</i>	20.54	
08 71 16 00-2045 EA 4" x 16" Aluminum Pull Plate Door Hardware.....	46.29	4.49
<i>For Stainless Steel, Add</i>	16.71	
<i>For Brass, Add</i>	21.25	
08 71 16 00-2046 EA 6" x 16" Aluminum Pull Plate Door Hardware.....	48.46	4.49
<i>For Stainless Steel, Add</i>	18.00	
<i>For Brass, Add</i>	22.88	
08 71 16 00-2047 Push Bars And Plates <small>(08 71 16 00-0762)</small>		
08 71 16 00-2048 Push Bars <small>(08 71 16 00-2047)</small>		
08 71 16 00-2049 EA 3/8" x 2-1/2" Bronze Push Bar, Rectangular, With Base Plate.....	163.96	4.49
Note: Up to 34" wide. All finishes.		
08 71 16 00-2050 EA 3/4" Diameter Stainless Steel Push Bar, Up To 34" Wide.....	110.66	4.49
<i>For Brass Push Bar, Add</i>	16.13	
08 71 16 00-2051 EA 1" Diameter Stainless Steel Push Bar, Up To 34" Wide.....	114.56	4.49
<i>For Brass Push Bar, Add</i>	16.81	
08 71 16 00-2052 EA 1-1/4" Diameter Stainless Steel Push Bar, Up To 34" Wide.....	211.15	4.49
<i>For Brass Push Bar, Add</i>	33.62	
08 71 16 00-2053 Push Plates <small>(08 71 16 00-2047)</small>		
08 71 16 00-2054 Aluminum Push Plates <small>(08 71 16 00-2053)</small>		
08 71 16 00-2055 Clear Anodized Finish, Aluminum Push Plates <small>(08 71 16 00-2054)</small>		
Note: Ives 8200 Series.		
08 71 16 00-2056 EA 3" x 12", Clear Anodized Finish, Aluminum Push Plate Door Hardware.....	24.84	4.49
08 71 16 00-2057 EA 4" x 16", Clear Anodized Finish, Aluminum Push Plate Door Hardware.....	24.84	4.49
08 71 16 00-2058 EA 6" x 16", Clear Anodized Finish, Aluminum Push Plate Door Hardware.....	24.84	4.49
08 71 16 00-2059 EA 8" x 16", Clear Anodized Finish, Aluminum Push Plate Door Hardware.....	26.58	4.49
08 71 16 00-2060 Stainless Steel Push Plates <small>(08 71 16 00-2053)</small>		
08 71 16 00-2061 Satin Finish, Stainless Steel Push Plates <small>(08 71 16 00-2060)</small>		
Note: Ives 8200 Series.		
08 71 16 00-2062 EA 3" x 12", Satin Finish, Stainless Steel Push Plate Door Hardware.....	24.84	4.49
08 71 16 00-2063 EA 4" x 16", Satin Finish, Stainless Steel Push Plate Door Hardware.....	26.18	4.49
08 71 16 00-2064 EA 6" x 16", Satin Finish, Stainless Steel Push Plate Door Hardware.....	29.23	4.49
08 71 16 00-2065 EA 8" x 16", Satin Finish, Stainless Steel Push Plate Door Hardware.....	33.75	4.49
08 71 16 00-2066 Brass Push Plates <small>(08 71 16 00-2053)</small>		
08 71 16 00-2067 Bright/Satin Brass Finish, Brass Push Plates <small>(08 71 16 00-2066)</small>		
Note: Ives 8200 Series.		
08 71 16 00-2068 EA 3" x 12", Bright/Satin Brass Finish, Brass Push Plate Door Hardware.....	28.92	4.49
08 71 16 00-2069 EA 4" x 16", Bright/Satin Brass Finish, Brass Push Plate Door Hardware.....	32.36	4.49
08 71 16 00-2070 EA 6" x 16", Bright/Satin Brass Finish, Brass Push Plate Door Hardware.....	40.63	4.49
08 71 16 00-2071 EA 8" x 16", Bright/Satin Brass Finish, Brass Push Plate Door Hardware.....	46.07	4.49
08 71 16 00-2072 Bright/Satin Chrome Finish, Brass Push Plates <small>(08 71 16 00-2066)</small>		
Note: Ives 8200 Series.		
08 71 16 00-2073 EA 3" x 12", Bright/Satin Chrome Finish, Brass Push Plate Door Hardware.....	31.67	4.49
08 71 16 00-2074 EA 4" x 16", Bright/Satin Chrome Finish, Brass Push Plate Door Hardware.....	34.46	4.49
08 71 16 00-2075 EA 6" x 16", Bright/Satin Chrome Finish, Brass Push Plate Door Hardware.....	42.04	4.49
08 71 16 00-2076 EA 8" x 16", Bright/Satin Chrome Finish, Brass Push Plate Door Hardware.....	49.51	4.49
08 71 16 00-2077 Satin/Dark Bronze Finish, Brass Push Plates <small>(08 71 16 00-2066)</small>		
Note: Ives 8200 Series.		
08 71 16 00-2078 EA 3" x 12", Satin/Dark Bronze Finish, Brass Push Plate Door Hardware.....	31.67	4.49
08 71 16 00-2079 EA 4" x 16", Satin/Dark Bronze Finish, Brass Push Plate Door Hardware.....	34.46	4.49
08 71 16 00-2080 EA 6" x 16", Satin/Dark Bronze Finish, Brass Push Plate Door Hardware.....	43.38	4.49
08 71 16 00-2081 EA 8" x 16", Satin/Dark Bronze Finish, Brass Push Plate Door Hardware.....	50.26	4.49
08 71 16 00-2082 Satin Nickel Finish, Brass Push Plates <small>(08 71 16 00-2066)</small>		
Note: Ives 8200 Series.		
08 71 16 00-2083 EA 3" x 12", Satin Nickel Finish, Brass Push Plate Door Hardware.....	31.67	4.49
08 71 16 00-2084 EA 4" x 16", Satin Nickel Finish, Brass Push Plate Door Hardware.....	35.16	4.49
08 71 16 00-2085 EA 6" x 16", Satin Nickel Finish, Brass Push Plate Door Hardware.....	45.50	4.49
08 71 16 00-2086 EA 8" x 16", Satin Nickel Finish, Brass Push Plate Door Hardware.....	52.38	4.49
08 71 16 00-2087 Exit Devices <small>(08 71 16)</small>		

08 Openings**08 70 Hardware**

08 71 Door Hardware



MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
08 71 16 00-2088		Push Bar Exit Device, Von Duprin Series 22 <small>(08 71 16 00-2087)</small>			
		Note: Grade 1, BHMA 156.3.			
08 71 16 00-2089	EA	3' Push Bar Exit Device, Rim Type	500.50		80.86
		Note: Anodized finish: aluminum or dark brown. Von Duprin Series 22.			
		<i>For 4' Push Bar, Add</i>	13.00		
08 71 16 00-2090	EA	3' Push Bar Exit Device, Rim Type, Fire Rated.....	556.87		80.86
		Note: Anodized finish: aluminum or dark brown. Von Duprin Series 22-F.			
		<i>For 4' Push Bar, Add</i>	13.00		
08 71 16 00-2091	EA	3' Push Bar Exit Device, Surface Vertical Rods	726.09		97.03
		Note: Anodized finish: aluminum or dark brown. Von Duprin Series 2227.			
		<i>For 4' Push Bar, Add</i>	13.00		
08 71 16 00-2092	EA	3' Push Bar Exit Device, Surface Vertical Rods, Fire Rated	866.49		89.84
		Note: Anodized finish: aluminum or dark brown. Von Duprin Series 2227-F.			
		<i>For 4' Push Bar, Add</i>	13.00		
08 71 16 00-2093	EA	Dummy Trim (210DT), Von Duprin Series 22	67.79		13.48
		Note: Anodized finish: aluminum or dark brown.			
08 71 16 00-2094	EA	Night Latch Trim (210NL) With Cylinder, Von Duprin Series 22.....	151.06		17.96
		Note: Anodized finish: aluminum or dark brown.			
08 71 16 00-2095	EA	Knob Trim (210K) With Cylinder, Von Duprin Series 22	279.22		26.95
		Note: Anodized finish: aluminum or dark brown.			
08 71 16 00-2096	EA	Lever Trim (230L) With Cylinder, Von Duprin Series 22	276.62		26.95
		Note: Anodized finish: aluminum or dark brown.			
08 71 16 00-2097	EA	Thumbpiece Trim (230TP) With Cylinder, Von Duprin Series 22	275.97		26.95
		Note: Anodized finish: aluminum or dark brown.			
08 71 16 00-2098	EA	Knob - Blank Escutcheon (210K-BE), Von Duprin Series 22	215.52		26.95
		Note: Anodized finish: aluminum or dark brown.			
08 71 16 00-2099	EA	Exit Only Trim Plate (230EO), Von Duprin Series 22.....	87.25		10.78
		Note: Anodized finish: aluminum or dark brown.			
08 71 16 00-2100	EA	Dummy Trim (230DT), Von Duprin Series 22	100.94		13.48
		Note: Anodized finish: aluminum or dark brown.			
08 71 16 00-2101	EA	Night Latch Trim (230NL) With Cylinder, Von Duprin Series 22.....	185.51		17.96
		Note: Anodized finish: aluminum or dark brown.			
08 71 16 00-2102	EA	Lever - Blank Escutcheon (230L-BE), Von Duprin Series 22	212.92		26.95
		Note: Anodized finish: aluminum or dark brown.			
08 71 16 00-2103	EA	Thumbpiece - Blank Escutcheon (230TP-BE), Von Duprin Series 22.....	212.27		26.95
		Note: Anodized finish: aluminum or dark brown.			
08 71 16 00-2104		Push Bar Exit Device, Narrow Stile, Von Duprin Series 33/35 <small>(08 71 16 00-2087)</small>			
		Note: Grade 1, BHMA 156.3. Series 33 has a ribbed case, Series 35 has a smooth case.			
08 71 16 00-2105	EA	3' Push Bar Exit Device, Rim Type, Narrow Stile.....	940.37		80.86
		Note: Aluminum anodized finish. Von Duprin Series 33/35.			
		<i>For 4' Push Bar, Add</i>	13.00		
		<i>For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add</i>	74.21		
		<i>For Satin Chrome Plated US26D (BHMA 626) Finish, Add</i>	142.41		
		<i>For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add</i>	27.54		
		<i>For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add</i>	211.63		
08 71 16 00-2106	EA	3' Push Bar Exit Device, Surface Vertical Rods, Narrow Stile.....	1,277.94		97.03
		Note: Aluminum anodized finish. Von Duprin Series 3327/3527.			
		<i>For 4' Push Bar, Add</i>	13.00		
		<i>For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add</i>	104.37		
		<i>For Satin Chrome Plated US26D (BHMA 626) Finish, Add</i>	200.27		
		<i>For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add</i>	38.73		
		<i>For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add</i>	297.61		
08 71 16 00-2107	EA	3' Push Bar Exit Device, Surface Vertical Rods, Fire Rated, Narrow Stile.....	1,302.64		97.03
		Note: Aluminum anodized finish. Von Duprin Series 3327-F/3527-F.			
		<i>For 4' Push Bar, Add</i>	13.00		
		<i>For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add</i>	106.90		
		<i>For Satin Chrome Plated US26D (BHMA 626) Finish, Add</i>	205.13		
		<i>For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add</i>	39.67		
		<i>For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add</i>	304.82		
08 71 16 00-2108	EA	3' Push Bar Exit Device, Concealed Vertical Rods, Narrow Stile.....	1,326.57		111.41
		Note: Aluminum anodized finish. Von Duprin Series 3347/3547.			
		<i>For 4' Push Bar, Add</i>	13.00		
		<i>For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add</i>	105.30		
		<i>For Satin Chrome Plated US26D (BHMA 626) Finish, Add</i>	202.06		
		<i>For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add</i>	39.08		
		<i>For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add</i>	300.26		
08 71 16 00-2109	EA	3' Push Bar Exit Device, Concealed Vertical Rods, Fire Rated, Narrow Stile	1,390.27		111.41
		Note: Aluminum anodized finish. Von Duprin Series 3347-F/3547-F.			
		<i>For 4' Push Bar, Add</i>	13.00		
		<i>For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add</i>	111.82		
		<i>For Satin Chrome Plated US26D (BHMA 626) Finish, Add</i>	214.58		
		<i>For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add</i>	41.50		
		<i>For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add</i>	318.86		
08 71 16 00-2110	EA	3' Push Bar Exit Device, Concealed Vertical Rods, Narrow Stile.....	1,479.32		111.41
		Note: Aluminum anodized finish. Von Duprin Series 3348/3548.			
		<i>For 4' Push Bar, Add</i>	13.00		
		<i>For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add</i>	120.94		
		<i>For Satin Chrome Plated US26D (BHMA 626) Finish, Add</i>	232.08		
		<i>For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add</i>	44.88		
		<i>For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add</i>	344.87		



Openings	08	08
Hardware	08 70	
Door Hardware	08 71	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71	16 00-2111	EA	3' Push Bar Exit Device, Concealed Vertical Rods, Fire Rated, Narrow Stile..... Note: Aluminum anodized finish. Von Duprin Series 3348-F/3548-F. <i>For 4' Push Bar, Add</i> <i>For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add</i> <i>For Satin Chrome Plated US26D (BHMA 626) Finish, Add</i> <i>For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add</i> <i>For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add</i>	1,543.02	111.41
				13.00	
				127.46	
				244.59	
				47.30	
				363.47	
08 71	16 00-2112	EA	Dummy Trim (DT), Von Duprin Series 33/35..... Note: Anodized finish: aluminum or dark brown. <i>For Satin Chrome Plated US26D (BHMA 626) Finish, Add</i> <i>For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add</i> <i>For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add</i>	210.14	13.48
				34.23	
				6.62	
				50.87	
08 71	16 00-2113	EA	Night Latch Less Pull (NL-OP With Cylinder, Von Duprin Series 33/35)..... Note: Anodized finish: aluminum or dark brown. <i>For Satin Chrome Plated US26D (BHMA 626) Finish, Add</i> <i>For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add</i> <i>For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add</i>	264.81	17.96
				42.15	
				8.15	
				62.63	
08 71	16 00-2114	EA	Lever (NL) With Cylinder, Von Duprin Series 33/35..... Note: Anodized finish: aluminum or dark brown. <i>For Satin Chrome Plated US26D (BHMA 626) Finish, Add</i> <i>For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add</i> <i>For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add</i>	421.46	17.96
				72.93	
				14.10	
				108.38	
08 71	16 00-2115	EA	Lever Trim (360L) With Cylinder, Von Duprin Series 33/35..... Note: Anodized finish: aluminum or dark brown. <i>For Satin Chrome Plated US26D (BHMA 626) Finish, Add</i> <i>For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add</i> <i>For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add</i>	528.17	26.95
				89.66	
				17.34	
				133.24	
08 71	16 00-2116	EA	Lever - Blank Escutcheon (360L-BE) With Cylinder, Von Duprin Series 33/35..... Note: Anodized finish: aluminum or dark brown. <i>For Satin Chrome Plated US26D (BHMA 626) Finish, Add</i> <i>For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add</i> <i>For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add</i>	507.37	26.95
				85.58	
				16.55	
				127.17	
08 71	16 00-2117	EA	Lever Dummy Trim (360L-DT) With Cylinder, Von Duprin Series 33/35..... Note: Anodized finish: aluminum or dark brown. <i>For Satin Chrome Plated US26D (BHMA 626) Finish, Add</i> <i>For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add</i> <i>For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add</i>	497.62	26.95
				83.66	
				16.18	
				124.32	
08 71	16 00-2118	EA	Thumbturn Trim (360T) With Cylinder, Von Duprin Series 33/35..... Note: Anodized finish: aluminum or dark brown. <i>For Satin Chrome Plated US26D (BHMA 626) Finish, Add</i> <i>For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add</i> <i>For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add</i>	502.17	26.95
				84.55	
				16.35	
				125.65	
08 71	16 00-2119		Push Bar Exit Device, Von Duprin Series 98/99 <small>(08 71 16 00-2087)</small> Note: Grade 1, BHMA 156.3. Series 98 has a smooth case, Series 99 has a grooved case.		
08 71	16 00-2120	EA	3' Push Bar Exit Device, Rim Type, Von Duprin Series 98/99..... Note: Clear anodized satin aluminum US28 (BHMA 628) finish. <i>For 4' Push Bar, Add</i> <i>For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add</i> <i>For Satin Chrome Plated US26D (BHMA 626) Finish, Add</i> <i>For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add</i> <i>For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add</i> <i>For Satin Brass, Clear Coated US4 (BHMA 606) Finish, Add</i> <i>For Satin Stainless Steel, US32D (BHMA 630) Finish, Add</i> <i>For Standard Baseplate Cylinder Dogging (CD), Add</i> <i>For Special Center Case Dogging (SD), Add</i> <i>For Cylinder Dogging Indicator (CI), Add</i> <i>For Dogging Indicator (DI), Add</i> <i>For Vision Impaired Touchpad, Raised Letters and Braille, Add</i> <i>For Safety Glow Touchpad, Add</i>	832.47	80.86
				13.00	
				37.63	
				59.83	
				95.61	
				195.54	
				61.69	
				90.68	
				41.11	
				172.13	
				114.57	
				105.25	
				53.18	
				191.86	
08 71	16 00-2121	EA	3' Push Bar Exit Device, Rim Type, Fire Rated, Von Duprin Series 98-F/99-F..... Note: Clear anodized satin aluminum US28 (BHMA 628) finish. <i>For 4' Push Bar, Add</i> <i>For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add</i> <i>For Satin Chrome Plated US26D (BHMA 626) Finish, Add</i> <i>For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add</i> <i>For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add</i> <i>For Satin Brass, Clear Coated US4 (BHMA 606) Finish, Add</i> <i>For Satin Stainless Steel, US32D (BHMA 630) Finish, Add</i> <i>For Vision Impaired Touchpad, Raised Letters and Braille, Add</i> <i>For Safety Glow Touchpad, Add</i>	940.37	80.86
				13.00	
				44.21	
				70.30	
				112.34	
				229.75	
				72.48	
				106.54	
				53.18	
				191.86	
08 71	16 00-2122	EA	3' Push Bar Exit Device, Rim Type, Von Duprin Series XP98/XP99..... Note: Clear anodized satin aluminum US28 (BHMA 628) finish. <i>For 4' Push Bar, Add</i> <i>For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add</i> <i>For Satin Chrome Plated US26D (BHMA 626) Finish, Add</i> <i>For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add</i> <i>For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add</i> <i>For Satin Brass, Clear Coated US4 (BHMA 606) Finish, Add</i> <i>For Satin Stainless Steel, US32D (BHMA 630) Finish, Add</i> <i>For Standard Baseplate Cylinder Dogging (CD), Add</i> <i>For Special Center Case Dogging (SD), Add</i> <i>For Cylinder Dogging Indicator (CI), Add</i> <i>For Dogging Indicator (DI), Add</i> <i>For Vision Impaired Touchpad, Raised Letters and Braille, Add</i> <i>For Safety Glow Touchpad, Add</i>	904.62	80.86
				13.00	
				42.03	
				66.83	
				106.80	
				218.41	
				68.90	
				101.28	
				41.11	
				172.13	
				114.57	
				105.25	
				53.18	
				191.86	

08 Openings**08 70 Hardware****08 71 Door Hardware**

MINOR		TOTAL DIRECT		DEMOLITION
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST
08 71 16 00-2123	EA	3' Push Bar Exit Device, Rim Type, Fire Rated, Von Duprin Series XP98-F/XP99-F	1,009.92	80.86
		Note: Clear anodized satin aluminum US28 (BHMA 628) finish.		
		For 4' Push Bar, Add	13.00	
		For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add	48.45	
		For Satin Chrome Plated US26D (BHMA 626) Finish, Add	77.05	
		For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add	123.12	
		For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add	251.79	
		For Satin Brass, Clear Coated US4 (BHMA 606) Finish, Add	79.43	
		For Satin Stainless Steel, US32D (BHMA 630) Finish, Add	116.76	
		For Vision Impaired Touchpad, Raised Letters and Braille, Add	53.18	
		For Safety Glow Touchpad, Add	191.86	
08 71 16 00-2124	EA	3' Push Bar Exit Device, Surface Vertical Rods, Von Duprin Series 9827/9927	1,179.79	97.03
		Note: Clear anodized satin aluminum US28 (BHMA 628) finish.		
		For 4' Push Bar, Add	13.00	
		For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add	56.18	
		For Satin Chrome Plated US26D (BHMA 626) Finish, Add	89.34	
		For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add	142.76	
		For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add	291.97	
		For Satin Brass, Clear Coated US4 (BHMA 606) Finish, Add	92.11	
		For Satin Stainless Steel, US32D (BHMA 630) Finish, Add	135.39	
		For Standard Baseplate Cylinder Dogging (CD), Add	41.11	
		For Special Center Case Dogging (SD), Add	172.13	
		For Cylinder Dogging Indicator (CI), Add	114.57	
		For Dogging Indicator (DI), Add	105.25	
		For Vision Impaired Touchpad, Raised Letters and Braille, Add	53.18	
		For Safety Glow Touchpad, Add	191.86	
08 71 16 00-2125	EA	3' Push Bar Exit Device, Surface Vertical Rods, Fire Rated, Von Duprin Series 9827-F/9927-F	1,326.04	97.03
		Note: Clear anodized satin aluminum US28 (BHMA 628) finish.		
		For 4' Push Bar, Add	13.00	
		For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add	65.11	
		For Satin Chrome Plated US26D (BHMA 626) Finish, Add	103.53	
		For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add	165.43	
		For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add	338.33	
		For Satin Brass, Clear Coated US4 (BHMA 606) Finish, Add	106.73	
		For Satin Stainless Steel, US32D (BHMA 630) Finish, Add	156.89	
		For Vision Impaired Touchpad, Raised Letters and Braille, Add	53.18	
		For Safety Glow Touchpad, Add	191.86	
08 71 16 00-2126	EA	3' Push Bar Exit Device, Concealed Vertical Rods, Von Duprin Series 9847/9947	1,243.37	111.41
		Note: Clear anodized satin aluminum US28 (BHMA 628) finish.		
		For 4' Push Bar, Add	13.00	
		For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add	87.89	
		For Satin Chrome Plated US26D (BHMA 626) Finish, Add	91.67	
		For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add	146.49	
		For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add	299.60	
		For Satin Brass, Clear Coated US4 (BHMA 606) Finish, Add	94.51	
		For Satin Stainless Steel, US32D (BHMA 630) Finish, Add	138.93	
		For Standard Baseplate Cylinder Dogging (CD), Add	41.11	
		For Special Center Case Dogging (SD), Add	172.13	
		For Cylinder Dogging Indicator (CI), Add	114.57	
		For Dogging Indicator (DI), Add	105.25	
		For Vision Impaired Touchpad, Raised Letters and Braille, Add	53.18	
		For Safety Glow Touchpad, Add	191.86	
08 71 16 00-2127	EA	3' Push Bar Exit Device, Concealed Vertical Rods, Fire Rated, Von Duprin Series 9847-F/9947-F	1,392.87	111.41
		Note: Clear anodized satin aluminum US28 (BHMA 628) finish.		
		For 4' Push Bar, Add	13.00	
		For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add	101.80	
		For Satin Chrome Plated US26D (BHMA 626) Finish, Add	106.18	
		For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add	169.66	
		For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add	346.99	
		For Satin Brass, Clear Coated US4 (BHMA 606) Finish, Add	109.46	
		For Satin Stainless Steel, US32D (BHMA 630) Finish, Add	160.91	
		For Vision Impaired Touchpad, Raised Letters and Braille, Add	53.18	
		For Safety Glow Touchpad, Add	191.86	
08 71 16 00-2128	EA	3' Push Bar Exit Device, Concealed Vertical Rods, Von Duprin Series 9848/9948	1,396.12	111.41
		Note: Clear anodized satin aluminum US28 (BHMA 628) finish.		
		For 4' Push Bar, Add	13.00	
		For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add	102.10	
		For Satin Chrome Plated US26D (BHMA 626) Finish, Add	106.49	
		For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add	170.17	
		For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add	348.02	
		For Satin Brass, Clear Coated US4 (BHMA 606) Finish, Add	109.79	
		For Satin Stainless Steel, US32D (BHMA 630) Finish, Add	161.38	
		For Standard Baseplate Cylinder Dogging (CD), Add	41.11	
		For Special Center Case Dogging (SD), Add	172.13	
		For Cylinder Dogging Indicator (CI), Add	114.57	
		For Dogging Indicator (DI), Add	105.25	
		For Vision Impaired Touchpad, Raised Letters and Braille, Add	53.18	
		For Safety Glow Touchpad, Add	191.86	



Openings	08	08
Hardware	08 70	
Door Hardware	08 71	

MINOR				TOTAL DIRECT	DEMOLITION
CSI	UOM	DESCRIPTION		UNIT COST	UNIT COST
08 71 16 00-2129	EA	3' Push Bar Exit Device, Concealed Vertical Rods, Fire Rated, Von Duprin Series 9848-F/9948-F.....	1,545.62		111.41
		Note: Clear anodized satin aluminum US28 (BHMA 628) finish.			
		For 4' Push Bar, Add	13.00		
		For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add	116.00		
		For Satin Chrome Plated US26D (BHMA 626) Finish, Add	120.99		
		For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add	193.34		
		For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add	395.41		
		For Satin Brass, Clear Coated US4 (BHMA 606) Finish, Add	124.74		
		For Satin Stainless Steel, US32D (BHMA 630) Finish, Add	183.36		
		For Vision Impaired Touchpad, Raised Letters and Braille, Add	53.18		
		For Safety Glow Touchpad, Add	191.86		
08 71 16 00-2130	EA	3' Push Bar Exit Device, Wood Door Concealed Vertical Rods, Von Duprin Series 9847WDC/9947WDC.....	1,351.92		111.41
		Note: Clear anodized satin aluminum US28 (BHMA 628) finish.			
		For 4' Push Bar, Add	13.00		
		For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add	97.99		
		For Satin Chrome Plated US26D (BHMA 626) Finish, Add	102.20		
		For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add	163.32		
		For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add	334.01		
		For Satin Brass, Clear Coated US4 (BHMA 606) Finish, Add	105.37		
		For Satin Stainless Steel, US32D (BHMA 630) Finish, Add	154.89		
		For Standard Baseplate Cylinder Dogging (CD), Add	41.11		
		For Special Center Case Dogging (SD), Add	172.13		
		For Cylinder Dogging Indicator (CI), Add	114.57		
		For Dogging Indicator (DI), Add	105.25		
		For Vision Impaired Touchpad, Raised Letters and Braille, Add	53.18		
		For Safety Glow Touchpad, Add	191.86		
08 71 16 00-2131	EA	3' Push Bar Exit Device, Wood Door Concealed Vertical Rods, Fire Rated, Von Duprin Series 9847WDC-F/9947WDC-F.....	1,520.27		111.41
		Note: Clear anodized satin aluminum US28 (BHMA 628) finish.			
		For 4' Push Bar, Add	13.00		
		For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add	113.65		
		For Satin Chrome Plated US26D (BHMA 626) Finish, Add	118.53		
		For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add	189.41		
		For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add	387.37		
		For Satin Brass, Clear Coated US4 (BHMA 606) Finish, Add	122.20		
		For Satin Stainless Steel, US32D (BHMA 630) Finish, Add	179.63		
		For Vision Impaired Touchpad, Raised Letters and Braille, Add	53.18		
		For Safety Glow Touchpad, Add	191.86		
08 71 16 00-2132	EA	3' Push Bar Exit Device, Surface Three Point Latch, Von Duprin Series 9857/9957.....	1,464.49		97.03
		Note: Clear anodized satin aluminum US28 (BHMA 628) finish.			
		For 4' Push Bar, Add	13.00		
		For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add	73.55		
		For Satin Chrome Plated US26D (BHMA 626) Finish, Add	116.96		
		For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add	186.89		
		For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add	382.22		
		For Satin Brass, Clear Coated US4 (BHMA 606) Finish, Add	120.58		
		For Satin Stainless Steel, US32D (BHMA 630) Finish, Add	177.25		
		For Standard Baseplate Cylinder Dogging (CD), Add	41.11		
		For Special Center Case Dogging (SD), Add	172.13		
		For Cylinder Dogging Indicator (CI), Add	114.57		
		For Dogging Indicator (DI), Add	105.25		
		For Vision Impaired Touchpad, Raised Letters and Braille, Add	53.18		
		For Safety Glow Touchpad, Add	191.86		
08 71 16 00-2133	EA	3' Push Bar Exit Device, Surface Three Point Latch, Fire Rated, Von Duprin Series 9857-F/9957-F.....	1,561.34		97.03
		Note: Clear anodized satin aluminum US28 (BHMA 628) finish.			
		For 4' Push Bar, Add	13.00		
		For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add	79.46		
		For Satin Chrome Plated US26D (BHMA 626) Finish, Add	126.35		
		For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add	201.90		
		For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add	412.92		
		For Satin Brass, Clear Coated US4 (BHMA 606) Finish, Add	130.26		
		For Satin Stainless Steel, US32D (BHMA 630) Finish, Add	191.48		
		For Standard Baseplate Cylinder Dogging (CD), Add	41.11		
		For Special Center Case Dogging (SD), Add	172.13		
		For Cylinder Dogging Indicator (CI), Add	114.57		
		For Dogging Indicator (DI), Add	105.25		
		For Vision Impaired Touchpad, Raised Letters and Braille, Add	53.18		
		For Safety Glow Touchpad, Add	191.86		
08 71 16 00-2134	EA	3' Push Bar Exit Device, Mortise Lock, Von Duprin Series 9875/9975.....	1,171.07		100.62
		Note: Clear anodized satin aluminum US28 (BHMA 628) finish.			
		For 4' Push Bar, Add	13.00		
		For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add	33.36		
		For Satin Chrome Plated US26D (BHMA 626) Finish, Add	87.45		
		For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add	139.74		
		For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add	285.79		
		For Satin Brass, Clear Coated US4 (BHMA 606) Finish, Add	90.16		
		For Satin Stainless Steel, US32D (BHMA 630) Finish, Add	132.53		
		For Standard Baseplate Cylinder Dogging (CD), Add	41.11		
		For Special Center Case Dogging (SD), Add	172.13		
		For Cylinder Dogging Indicator (CI), Add	114.57		
		For Dogging Indicator (DI), Add	105.25		
		For Vision Impaired Touchpad, Raised Letters and Braille, Add	53.18		
		For Safety Glow Touchpad, Add	191.86		

08 Openings**08 70 Hardware****08 71 Door Hardware**

MINOR		TOTAL DIRECT	DEMOLITION
CSI	UOM DESCRIPTION	UNIT COST	UNIT COST
08 71 16 00-2135	EA 3' Push Bar Exit Device, Mortise Lock, Fire Rated, Von Duprin Series 9875-F/9975-F Note: Clear anodized satin aluminum US28 (BHMA 628) finish.	1,280.92	100.62
	<i>For 4' Push Bar, Add</i>	13.00	
	<i>For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add</i>	37.42	
	<i>For Satin Chrome Plated US26D (BHMA 626) Finish, Add</i>	98.11	
	<i>For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add</i>	156.77	
	<i>For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add</i>	320.61	
	<i>For Satin Brass, Clear Coated US4 (BHMA 606) Finish, Add</i>	101.14	
	<i>For Satin Stainless Steel, US32D (BHMA 630) Finish, Add</i>	148.68	
	<i>For Vision Impaired Touchpad, Raised Letters and Braille, Add</i>	53.18	
	<i>For Safety Glow Touchpad, Add</i>	191.86	
08 71 16 00-2136	EA 3' Push Bar Exit Device, Concealed Vertical Cable, Von Duprin Series 9849/9949 Note: Clear anodized satin aluminum US28 (BHMA 628) finish.	1,289.52	111.41
	<i>For 4' Push Bar, Add</i>	13.00	
	<i>For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add</i>	92.19	
	<i>For Satin Chrome Plated US26D (BHMA 626) Finish, Add</i>	96.15	
	<i>For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add</i>	153.64	
	<i>For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add</i>	314.23	
	<i>For Satin Brass, Clear Coated US4 (BHMA 606) Finish, Add</i>	99.13	
	<i>For Satin Stainless Steel, US32D (BHMA 630) Finish, Add</i>	145.71	
	<i>For Standard Baseplate Cylinder Dogging (CD), Add</i>	41.11	
	<i>For Special Center Case Dogging (SD), Add</i>	172.13	
	<i>For Cylinder Dogging Indicator (CI), Add</i>	114.57	
	<i>For Dogging Indicator (DI), Add</i>	105.25	
	<i>For Vision Impaired Touchpad, Raised Letters and Braille, Add</i>	53.18	
	<i>For Safety Glow Touchpad, Add</i>	191.86	
08 71 16 00-2137	EA 3' Push Bar Exit Device, Concealed Vertical Cable, Fire Rated, Von Duprin Series 9849-F/9949-F Note: Clear anodized satin aluminum US28 (BHMA 628) finish.	1,398.72	111.41
	<i>For 4' Push Bar, Add</i>	13.00	
	<i>For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add</i>	102.34	
	<i>For Satin Chrome Plated US26D (BHMA 626) Finish, Add</i>	106.74	
	<i>For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add</i>	170.57	
	<i>For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add</i>	348.84	
	<i>For Satin Brass, Clear Coated US4 (BHMA 606) Finish, Add</i>	110.05	
	<i>For Satin Stainless Steel, US32D (BHMA 630) Finish, Add</i>	161.77	
	<i>For Standard Baseplate Cylinder Dogging (CD), Add</i>	41.11	
	<i>For Special Center Case Dogging (SD), Add</i>	172.13	
	<i>For Cylinder Dogging Indicator (CI), Add</i>	114.57	
	<i>For Dogging Indicator (DI), Add</i>	105.25	
	<i>For Vision Impaired Touchpad, Raised Letters and Braille, Add</i>	53.18	
	<i>For Safety Glow Touchpad, Add</i>	191.86	
08 71 16 00-2138	EA 3' Push Bar Exit Device, Wood Door Concealed Vertical Cable, Von Duprin Series 9849WDC/9949WDC Note: Clear anodized satin aluminum US28 (BHMA 628) finish.	1,402.62	111.41
	<i>For 4' Push Bar, Add</i>	13.00	
	<i>For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add</i>	102.70	
	<i>For Satin Chrome Plated US26D (BHMA 626) Finish, Add</i>	107.12	
	<i>For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add</i>	171.17	
	<i>For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add</i>	350.08	
	<i>For Satin Brass, Clear Coated US4 (BHMA 606) Finish, Add</i>	110.44	
	<i>For Satin Stainless Steel, US32D (BHMA 630) Finish, Add</i>	162.34	
	<i>For Standard Baseplate Cylinder Dogging (CD), Add</i>	41.11	
	<i>For Special Center Case Dogging (SD), Add</i>	172.13	
	<i>For Cylinder Dogging Indicator (CI), Add</i>	114.57	
	<i>For Dogging Indicator (DI), Add</i>	105.25	
	<i>For Vision Impaired Touchpad, Raised Letters and Braille, Add</i>	53.18	
	<i>For Safety Glow Touchpad, Add</i>	191.86	
08 71 16 00-2139	EA 3' Push Bar Exit Device, Wood Door Concealed Vertical Cable, Fire Rated, Von Duprin Series 9849WDC-F/9949WDC-F Note: Clear anodized satin aluminum US28 (BHMA 628) finish.	1,597.62	111.41
	<i>For 4' Push Bar, Add</i>	13.00	
	<i>For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add</i>	120.84	
	<i>For Satin Chrome Plated US26D (BHMA 626) Finish, Add</i>	126.04	
	<i>For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add</i>	201.40	
	<i>For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add</i>	411.89	
	<i>For Satin Brass, Clear Coated US4 (BHMA 606) Finish, Add</i>	129.94	
	<i>For Satin Stainless Steel, US32D (BHMA 630) Finish, Add</i>	191.00	
	<i>For Standard Baseplate Cylinder Dogging (CD), Add</i>	41.11	
	<i>For Special Center Case Dogging (SD), Add</i>	172.13	
	<i>For Cylinder Dogging Indicator (CI), Add</i>	114.57	
	<i>For Dogging Indicator (DI), Add</i>	105.25	
	<i>For Vision Impaired Touchpad, Raised Letters and Braille, Add</i>	53.18	
	<i>For Safety Glow Touchpad, Add</i>	191.86	
08 71 16 00-2140	EA 3' Push Bar Exit Device, Chexit Delayed Egress, Von Duprin Series CX98/CX99 Note: Clear anodized satin aluminum US28 (BHMA 628) finish.	1,813.50	93.43
	<i>For 4' Push Bar, Add</i>	13.00	
	<i>For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add</i>	242.10	
	<i>For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add</i>	495.14	
	<i>For Satin Brass, Clear Coated US4 (BHMA 606) Finish, Add</i>	156.20	
	<i>For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add</i>	58.10	
	<i>For Satin Chrome Plated US26D (BHMA 626) Finish, Add</i>	65.29	
	<i>For Center Case Dogging (CD-CX), Add</i>	185.83	
	<i>For Vision Impaired Touchpad, Raised Letters and Braille, Add</i>	53.18	
	<i>For Safety Glow Touchpad, Add</i>	191.86	



Openings	08	08
Hardware	08 70	
Door Hardware	08 71	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-2141	EA		3' Push Bar Exit Device, Chexit Delayed Egress, Fire Rated, Von Duprin Series CX98-F/CX99-F.....	1,921.40	93.43
			Note: Excludes power supply. Clear anodized satin aluminum US28 (BHMA 628) finish.		
			For 4' Push Bar, Add	13.00	
			For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add	258.83	
			For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add	529.34	
			For Satin Brass, Clear Coated US4 (BHMA 606) Finish, Add	166.99	
			For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add	62.12	
			For Satin Chrome Plated US26D (BHMA 626) Finish, Add	69.80	
			For Vision Impaired Touchpad, Raised Letters and Braille, Add	53.18	
			For Safety Glow Touchpad, Add	191.86	
08 71 16 00-2142	EA		3' Push Bar Exit Device, Mortise Chexit Delayed Egress, Von Duprin Series CX9875/CX9975.....	2,159.30	114.99
			Note: Excludes power supply. Clear anodized satin aluminum US28 (BHMA 628) finish.		
			For 4' Push Bar, Add	13.00	
			For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add	286.23	
			For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add	585.39	
			For Satin Brass, Clear Coated US4 (BHMA 606) Finish, Add	184.67	
			For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add	68.70	
			For Satin Chrome Plated US26D (BHMA 626) Finish, Add	77.19	
			For Center Case Dogging (CD-CX), Add	185.83	
			For Vision Impaired Touchpad, Raised Letters and Braille, Add	53.18	
			For Safety Glow Touchpad, Add	191.86	
08 71 16 00-2143	EA		3' Push Bar Exit Device, Mortise Chexit Delayed Egress, Fire Rated, Von Duprin Series CX9875-F/CX9975-F.....	2,269.15	114.99
			Note: Excludes power supply. Clear anodized satin aluminum US28 (BHMA 628) finish.		
			For 4' Push Bar, Add	13.00	
			For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add	303.26	
			For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add	620.21	
			For Satin Brass, Clear Coated US4 (BHMA 606) Finish, Add	195.65	
			For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add	72.78	
			For Satin Chrome Plated US26D (BHMA 626) Finish, Add	81.78	
			For Vision Impaired Touchpad, Raised Letters and Braille, Add	53.18	
			For Safety Glow Touchpad, Add	191.86	
08 71 16 00-2144	EA		3' Push Bar Exit Device, Electric Latch Retraction, Von Duprin Series E98/E99.....	1,176.50	93.43
			Note: Excludes power supply. Clear anodized satin aluminum US28 (BHMA 628) finish.		
			For 4' Push Bar, Add	13.00	
			For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add	143.37	
			For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add	293.21	
			For Satin Brass, Clear Coated US4 (BHMA 606) Finish, Add	92.50	
			For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add	34.41	
			For Satin Chrome Plated US26D (BHMA 626) Finish, Add	53.09	
			For Standard Baseplate Cylinder Dogging (CD), Add	41.11	
			For Special Center Case Dogging (SD), Add	172.13	
			For Dogging Indicator (DI), Add	105.25	
			For Quiet Electric Latch Retraction (QEL), Add	78.93	
			For Vision Impaired Touchpad, Raised Letters and Braille, Add	53.18	
			For Safety Glow Touchpad, Add	191.86	
08 71 16 00-2145	EA		3' Push Bar Exit Device, Electric Latch Retraction, Fire Rated, Von Duprin Series E98-F/E99-F.....	1,284.40	93.43
			Note: Excludes power supply. Clear anodized satin aluminum US28 (BHMA 628) finish.		
			For 4' Push Bar, Add	13.00	
			For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add	160.09	
			For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add	327.41	
			For Satin Brass, Clear Coated US4 (BHMA 606) Finish, Add	103.29	
			For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add	38.42	
			For Satin Chrome Plated US26D (BHMA 626) Finish, Add	59.29	
			For Vision Impaired Touchpad, Raised Letters and Braille, Add	53.18	
			For Safety Glow Touchpad, Add	191.86	
08 71 16 00-2146	EA		3' Push Bar Exit Device, Mortise Electric Latch Retraction, Von Duprin Series E9875/E9975.....	1,522.30	114.99
			Note: Excludes power supply. Clear anodized satin aluminum US28 (BHMA 628) finish.		
			For 4' Push Bar, Add	13.00	
			For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add	187.50	
			For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add	383.46	
			For Satin Brass, Clear Coated US4 (BHMA 606) Finish, Add	120.97	
			For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add	45.00	
			For Satin Chrome Plated US26D (BHMA 626) Finish, Add	69.43	
			For Standard Baseplate Cylinder Dogging (CD), Add	41.11	
			For Special Center Case Dogging (SD), Add	172.13	
			For Dogging Indicator (DI), Add	105.25	
			For Quiet Electric Latch Retraction (QEL), Add	78.93	
			For Vision Impaired Touchpad, Raised Letters and Braille, Add	53.18	
			For Safety Glow Touchpad, Add	191.86	
08 71 16 00-2147	EA		3' Push Bar Exit Device, Mortise Electric Latch Retraction, Fire Rated, Von Duprin Series E9875-F/E9975-F.....	1,632.15	114.99
			Note: Excludes power supply. Clear anodized satin aluminum US28 (BHMA 628) finish.		
			For 4' Push Bar, Add	13.00	
			For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add	204.52	
			For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add	418.28	
			For Satin Brass, Clear Coated US4 (BHMA 606) Finish, Add	131.95	
			For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add	49.09	
			For Satin Chrome Plated US26D (BHMA 626) Finish, Add	75.74	
			For Vision Impaired Touchpad, Raised Letters and Braille, Add	53.18	
			For Safety Glow Touchpad, Add	191.86	
08 71 16 00-2148	EA		Exit Only Trim Plate (EO), Von Duprin Series 98/99.....	97.82	10.78
			Note: Satin chrome plated US26D (BHMA 626) finish.		
			For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add	2.07	
			For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add	3.11	
			For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add	11.74	

08 Openings**08 70 Hardware****08 71 Door Hardware**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71	16 00-2149	EA	Dummy Trim (DT), Von Duprin Series 98/99..... Note: Satin chrome plated US26D (BHMA 626) finish. <i>For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add</i> <i>For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add</i> <i>For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add</i>	143.38 3.22 4.83 18.26	13.48
08 71	16 00-2150	EA	Night Latch (NL) Pull Trim With 110NL Cylinder, Von Duprin Series 98/99..... Note: Satin chrome plated US26D (BHMA 626) finish. <i>For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add</i> <i>For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add</i> <i>For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add</i>	229.12 5.36 8.05 30.40	17.96
08 71	16 00-2151	EA	Night Latch (NL) Pull Trim Without Cylinder, Von Duprin Series 98/99..... Note: Satin chrome plated US26D (BHMA 626) finish. <i>For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add</i> <i>For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add</i> <i>For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add</i>	165.42 3.45 5.18 19.57	17.96
08 71	16 00-2152	EA	Lever Trim (L) With 110NL Cylinder, Von Duprin Series 98/99..... Note: Satin chrome plated US26D (BHMA 626) finish. <i>For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add</i> <i>For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add</i> <i>For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add</i>	383.89 9.36 14.04 53.04	26.95
08 71	16 00-2153	EA	Lever Trim (L) Without Cylinder, Von Duprin Series 98/99..... Note: Satin chrome plated US26D (BHMA 626) finish. <i>For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add</i> <i>For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add</i> <i>For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add</i>	320.19 7.45 11.17 42.21	26.95
08 71	16 00-2154	EA	Lever - Blank Escutcheon (L-BE), Von Duprin Series 98/99..... Note: Satin chrome plated US26D (BHMA 626) finish. <i>For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add</i> <i>For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add</i> <i>For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add</i>	320.19 7.45 11.17 42.21	26.95
08 71	16 00-2155	EA	Lever - Night Latch (L-NL) With 110NL Cylinder, Von Duprin Series 98/99..... Note: Satin chrome plated US26D (BHMA 626) finish. <i>For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add</i> <i>For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add</i> <i>For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add</i>	329.07 7.72 11.57 43.72	26.95
08 71	16 00-2156	EA	Lever - Night Latch (L-NL) Without Cylinder, Von Duprin Series 98/99..... Note: Satin chrome plated US26D (BHMA 626) finish. <i>For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add</i> <i>For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add</i> <i>For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add</i>	265.37 5.81 8.71 32.90	26.95
08 71	16 00-2157	EA	Lever Dummy Trim (L-DT), Von Duprin Series 98/99..... Note: Satin chrome plated US26D (BHMA 626) finish. <i>For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add</i> <i>For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add</i> <i>For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add</i>	265.37 5.81 8.71 32.90	26.95
08 71	16 00-2158	EA	Knob Trim (K) With 110NL Cylinder, Von Duprin Series 98/99..... Note: Satin chrome plated US26D (BHMA 626) finish. <i>For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add</i> <i>For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add</i> <i>For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add</i>	320.31 7.45 11.18 42.23	26.95
08 71	16 00-2159	EA	Knob Trim (K) Without Cylinder, Von Duprin Series 98/99..... Note: Satin chrome plated US26D (BHMA 626) finish. <i>For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add</i> <i>For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add</i> <i>For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add</i>	256.61 5.54 8.31 31.41	26.95
08 71	16 00-2160	EA	Knob - Blank Escutcheon (K-BE), Von Duprin Series 98/99..... Note: Satin chrome plated US26D (BHMA 626) finish. <i>For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add</i> <i>For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add</i> <i>For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add</i>	256.61 5.54 8.31 31.41	26.95
08 71	16 00-2161	EA	Knob - Night Latch (K-NL) With 110NL Cylinder, Von Duprin Series 98/99..... Note: Satin chrome plated US26D (BHMA 626) finish. <i>For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add</i> <i>For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add</i> <i>For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add</i>	315.37 7.31 10.96 41.40	26.95
08 71	16 00-2162	EA	Knob - Night Latch (K-NL) Without Cylinder, Von Duprin Series 98/99..... Note: Satin chrome plated US26D (BHMA 626) finish. <i>For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add</i> <i>For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add</i> <i>For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add</i>	251.67 5.39 8.09 30.57	26.95
08 71	16 00-2163	EA	Knob Dummy Trim (K-DT) Without Cylinder, Von Duprin Series 98/99..... Note: Satin chrome plated US26D (BHMA 626) finish. <i>For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add</i> <i>For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add</i> <i>For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add</i>	251.67 5.39 8.09 30.57	26.95
08 71	16 00-2164	EA	Thumbpiece Trim (TP) With 110NL Cylinder, Von Duprin Series 98/99..... Note: Satin chrome plated US26D (BHMA 626) finish. <i>For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add</i> <i>For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add</i> <i>For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add</i>	288.51 6.50 9.75 36.83	26.95
08 71	16 00-2165	EA	Thumbpiece Trim (TP) Without Cylinder, Von Duprin Series 98/99..... Note: Satin chrome plated US26D (BHMA 626) finish. <i>For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add</i> <i>For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add</i> <i>For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add</i>	224.81 4.59 6.88 26.00	26.95



Openings	08	08
Hardware	08 70	
Door Hardware	08 71	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-2166	EA		Thumbpiece - Blank Escutcheon (T-BE), Von Duprin Series 98/99.....	224.81	26.95
			Note: Satin chrome plated US26D (BHMA 626) finish.		
			<i>For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add</i>	4.59	
			<i>For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add</i>	6.88	
			<i>For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add</i>	26.00	
08 71 16 00-2167	EA		Push/Pull Hospital Latch Trim (HL) With 110NL Cylinder, Von Duprin Series 98/99	242.16	26.95
			Note: Satin chrome plated US26D (BHMA 626) finish.		
			<i>For Duranodic Dark Bronze US313 (BHMA 710) Finish, Add</i>	5.11	
			<i>For Satin Bronze, Clear Coated US10 (BHMA 612) Finish, Add</i>	7.66	
			<i>For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add</i>	28.95	
08 71 16 00-2168			Option And Kits For Series 22, 33, 35, 98 Or 99 <small>(08 71 16 00-2087)</small>		
08 71 16 00-2169	EA		Alarm Kit With Switch And 9 Volt Battery Back-up.....	638.01	26.95
08 71 16 00-2170	EA		Power Supply For Chexit Or Electric Latch Devices (Von Duprin PS914)	489.50	26.95
			Note: 4 amp @ 12 volt DC, 2 amp @ 24 volt DC.		
			<i>For Battery Backup (Includes Board And 2 Batteries), Add</i>	66.45	
			<i>For Fire Alarm Interface, Add</i>	33.22	
			<i>For 2 Relay Panic Device Control Board, Add</i>	96.35	
			<i>For 2 Relay Quiet Electric Latch Panic Device Control Board, Add</i>	112.95	
			<i>For 4 Relay Output Board, Add</i>	93.02	
			<i>For 4 Relay Logic Board, Add</i>	255.13	
			<i>For Fused 8 Zone Distribution Board, Add</i>	33.22	
08 71 16 00-2171	EA		Jamb Mounted Concealed Electric Power Transfer (Von Duprin EPT-10)	456.55	26.95
08 71 16 00-2172	EA		Power Supply, 2 Amp (Von Duprin PS902)	209.29	26.95
			Note: 2A@12/24 VDC		
			<i>For Battery Backup (Includes Board And 2 Batteries), Add</i>	66.45	
			<i>For Fire Alarm Interface, Add</i>	33.22	
			<i>For 2 Relay Quiet Electric Latch Panic Device Control Board, Add</i>	112.95	
			<i>For 4 Relay Output Board, Add</i>	93.02	
			<i>For 4 Relay Logic Board, Add</i>	255.13	
			<i>For Fused 8 Zone Distribution Board, Add</i>	33.22	
08 71 16 00-2173	EA		Power Supply, 4 Amp (Von Duprin PS904)	330.90	26.95
			Note: 4A@12/24 VDC		
			<i>For Battery Backup (Includes Board And 2 Batteries), Add</i>	66.45	
			<i>For Fire Alarm Interface, Add</i>	33.22	
			<i>For 2 Relay Quiet Electric Latch Panic Device Control Board, Add</i>	112.95	
			<i>For 4 Relay Output Board, Add</i>	93.02	
			<i>For 4 Relay Logic Board, Add</i>	255.13	
			<i>For Fused 8 Zone Distribution Board, Add</i>	33.22	
08 71 16 00-2174	EA		Request to Exit Push Pad Monitor Switch (RX)	140.64	17.96
08 71 16 00-2175			Removable Verticals, Mullions (Von Duprin) <small>(08 71 16 00-2087)</small>		
08 71 16 00-2176	EA		7'-2" Removable Steel Mullion, 2" x 3" x 1/8" Wall Thickness (Von Duprin 4954-72)	370.87	17.96
			Note: For use with Von Duprin Panic rim devices.		
			<i>For Owner Furnished Material, Deduct</i>	-299.00	
08 71 16 00-2177	EA		8'-2" Removable Steel Mullion, 2" x 3" x 1/8" Wall Thickness (Von Duprin 4954-82)	394.27	17.96
			Note: For use with Von Duprin Panic rim devices.		
			<i>For Owner Furnished Material, Deduct</i>	-322.40	
08 71 16 00-2178	EA		10'-2" Removable Steel Mullion, 2" x 3" x 1/8" Wall Thickness (Von Duprin 4954-102)	646.67	17.96
			Note: For use with Von Duprin Panic rim devices.		
			<i>For Owner Furnished Material, Deduct</i>	-574.80	
08 71 16 00-2179	EA		7'-6" Keyed Removable Steel Mullion, 2" x 3" x 1/8" Wall Thickness (Von Duprin KR4954-76)	634.85	21.56
			Note: For use with Von Duprin Panic rim devices.		
			<i>For Owner Furnished Material, Deduct</i>	-548.60	
08 71 16 00-2180	EA		8'-6" Keyed Removable Steel Mullion, 2" x 3" x 1/8" Wall Thickness (Von Duprin KR4954-86)	658.25	21.56
			Note: For use with Von Duprin Panic rim devices.		
			<i>For Owner Furnished Material, Deduct</i>	-572.00	
08 71 16 00-2181	EA		10'-6" Keyed Removable Steel Mullion, 2" x 3" x 1/8" Wall Thickness (Von Duprin KR4954-106)	709.60	21.56
			Note: For use with Von Duprin Panic rim devices.		
			<i>For Owner Furnished Material, Deduct</i>	-623.35	
08 71 16 00-2182	EA		7'-3" Removable Steel Mullion, 2" x 3" x 1/8" Wall Thickness, Fire Rated (Von Duprin 9954-73).....	534.67	17.96
			Note: For use with Von Duprin Panic rim devices.		
			<i>For Owner Furnished Material, Deduct</i>	-462.80	
08 71 16 00-2183	EA		8'-3" Removable Steel Mullion, 2" x 3" x 1/8" Wall Thickness, Fire Rated (Von Duprin 9954-83).....	558.72	17.96
			Note: For use with Von Duprin Panic rim devices.		
			<i>For Owner Furnished Material, Deduct</i>	-486.85	
08 71 16 00-2184	EA		10'-3" Removable Steel Mullion, 2" x 3" x 1/8" Wall Thickness, Fire Rated (Von Duprin 9954-103).....	607.47	17.96
			Note: For use with Von Duprin Panic rim devices.		
			<i>For Owner Furnished Material, Deduct</i>	-535.60	
08 71 16 00-2185	EA		7'-5" Keyed Removable Steel Mullion, 2" x 3" x 1/8" Wall Thickness, Fire Rated (Von Duprin KR9954-75).....	824.00	21.56
			Note: For use with Von Duprin Panic rim devices.		
			<i>For Owner Furnished Material, Deduct</i>	-737.75	
08 71 16 00-2186	EA		8'-5" Keyed Removable Steel Mullion, 2" x 3" x 1/8" Wall Thickness, Fire Rated (Von Duprin KR9954-85).....	848.05	21.56
			Note: For use with Von Duprin Panic rim devices.		
			<i>For Owner Furnished Material, Deduct</i>	-761.80	
08 71 16 00-2187	EA		10'-5" Keyed Removable Steel Mullion, 2" x 3" x 1/8" Wall Thickness, Fire Rated (Von Duprin KR9954-105).....	1,603.81	21.56
			Note: For use with Von Duprin Panic rim devices.		
			<i>For Owner Furnished Material, Deduct</i>	-1,517.56	
08 71 16 00-2188	EA		Mullion Stabilizer Set (Von Duprin 154)	77.50	14.38
			Note: For use with Von Duprin Panic rim devices.		
			<i>For Owner Furnished Material, Deduct</i>	-48.75	

08 Openings

08 70 Hardware

08 71 Door Hardware



MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
08 71 16 00-2189		Cross Bar Exit Device, Narrow Stile, Von Duprin Series 55 <small>(08 71 16 00-2087)</small>			
		Note: Grade 1, BHMA 156.3.			
08 71 16 00-2190	EA	42" Crossbar Exit Device, Rim Type, Narrow Stile	1,457.12		80.86
		Note: Anodized finish: dull brass or dull bronze. Von Duprin Series 55.			
		For Satin Chrome Plated US26D (BHMA 626) Finish, Add	156.43		
		For Dark Oxidized Satin Bronze, Oil Rubbed, US10B (BHMA 613) Finish, Add	180.02		
		For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add	237.13		
		For Bright Stainless Steel US32 (BHMA 629) Finish, Add	258.23		
08 71 16 00-2191	EA	42" Crossbar Exit Device, Concealed Vertical Rod, Narrow Stile	1,875.82		111.41
		Note: Anodized finish: dull brass or dull bronze. Von Duprin Series 5547.			
		For Satin Chrome Plated US26D (BHMA 626) Finish, Add	198.77		
		For Dark Oxidized Satin Bronze, Oil Rubbed, US10B (BHMA 613) Finish, Add	228.74		
		For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add	301.31		
		For Bright Stainless Steel US32 (BHMA 629) Finish, Add	328.13		
08 71 16 00-2192	EA	42" Crossbar Exit Device, Concealed Vertical Rod, Narrow Stile, Fire Rated.....	2,051.97		111.41
		Note: Anodized finish: dull brass or dull bronze. Von Duprin Series 5547-F.			
		For Satin Chrome Plated US26D (BHMA 626) Finish, Add	220.97		
		For Dark Oxidized Satin Bronze, Oil Rubbed, US10B (BHMA 613) Finish, Add	254.29		
		For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add	334.96		
		For Bright Stainless Steel US32 (BHMA 629) Finish, Add	364.77		
08 71 16 00-2193	EA	42" Crossbar Exit Device, Wood Door Concealed Vertical Rod, Narrow Stile	1,919.37		111.41
		Note: Anodized finish: dull brass or dull bronze. Von Duprin Series 5547WDC.			
		For Satin Chrome Plated US26D (BHMA 626) Finish, Add	204.26		
		For Dark Oxidized Satin Bronze, Oil Rubbed, US10B (BHMA 613) Finish, Add	235.06		
		For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add	309.63		
		For Bright Stainless Steel US32 (BHMA 629) Finish, Add	337.19		
08 71 16 00-2194	EA	42" Crossbar Exit Device, Wood Door Concealed Vertical Rod, Narrow Stile, Fire Rated.....	2,090.32		111.41
		Note: Anodized finish: dull brass or dull bronze. Von Duprin Series 5547WDC-F.			
		For Satin Chrome Plated US26D (BHMA 626) Finish, Add	225.80		
		For Dark Oxidized Satin Bronze, Oil Rubbed, US10B (BHMA 613) Finish, Add	259.85		
		For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add	342.28		
		For Bright Stainless Steel US32 (BHMA 629) Finish, Add	372.75		
08 71 16 00-2195	EA	42" Crossbar Exit Device, Mortise Lock, Narrow Stile.....	1,453.82		100.62
		Note: Anodized finish: dull brass or dull bronze. Von Duprin Series 5575.			
		For Satin Chrome Plated US26D (BHMA 626) Finish, Add	149.22		
		For Dark Oxidized Satin Bronze, Oil Rubbed, US10B (BHMA 613) Finish, Add	171.72		
		For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add	226.20		
		For Bright Stainless Steel US32 (BHMA 629) Finish, Add	246.33		
08 71 16 00-2196	EA	42" Crossbar Exit Device, Mortise Lock, Narrow Stile, Fire Rated.....	1,568.87		100.62
		Note: Anodized finish: dull brass or dull bronze. Von Duprin Series 5575-F.			
		For Satin Chrome Plated US26D (BHMA 626) Finish, Add	163.72		
		For Dark Oxidized Satin Bronze, Oil Rubbed, US10B (BHMA 613) Finish, Add	188.41		
		For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add	248.18		
		For Bright Stainless Steel US32 (BHMA 629) Finish, Add	270.26		
08 71 16 00-2197	EA	Dummy Trim (DT) Pull Bracket, Von Duprin Series 55	249.79		13.48
		Note: Anodized finish: dull brass or dull bronze.			
		For Satin Chrome Plated US26D (BHMA 626) Finish, Add	26.95		
		For Dark Oxidized Satin Bronze, Oil Rubbed, US10B (BHMA 613) Finish, Add	31.01		
		For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add	40.85		
		For Bright Stainless Steel US32 (BHMA 629) Finish, Add	44.48		
08 71 16 00-2198	EA	Cylinder Assembly, Von Duprin Series 55	110.76		19.04
		Note: Anodized finish: dull brass or dull bronze.			
		For Satin Chrome Plated US26D (BHMA 626) Finish, Add	7.62		
		For Dark Oxidized Satin Bronze, Oil Rubbed, US10B (BHMA 613) Finish, Add	8.77		
		For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add	11.55		
		For Bright Stainless Steel US32 (BHMA 629) Finish, Add	12.57		
08 71 16 00-2199	EA	Night Latch Pull Trim (NL) With Cylinder, Von Duprin Series 55.....	422.11		19.04
		Note: Anodized finish: dull brass or dull bronze.			
		For Satin Chrome Plated US26D (BHMA 626) Finish, Add	46.85		
		For Dark Oxidized Satin Bronze, Oil Rubbed, US10B (BHMA 613) Finish, Add	53.91		
		For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add	71.01		
		For Bright Stainless Steel US32 (BHMA 629) Finish, Add	77.33		
08 71 16 00-2200	EA	Thumbturn Trim (376T) With Cylinder, Von Duprin Series 55.....	451.47		26.95
		Note: Anodized finish: dull brass or dull bronze.			
		For Satin Chrome Plated US26D (BHMA 626) Finish, Add	47.83		
		For Dark Oxidized Satin Bronze, Oil Rubbed, US10B (BHMA 613) Finish, Add	55.04		
		For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add	72.50		
		For Bright Stainless Steel US32 (BHMA 629) Finish, Add	78.96		
08 71 16 00-2201	EA	Thumbturn - Blank Escutcheon (376T-BE), Von Duprin Series 55	366.97		26.95
		Note: Anodized finish: dull brass or dull bronze.			
		For Satin Chrome Plated US26D (BHMA 626) Finish, Add	37.18		
		For Dark Oxidized Satin Bronze, Oil Rubbed, US10B (BHMA 613) Finish, Add	42.79		
		For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add	56.36		
		For Bright Stainless Steel US32 (BHMA 629) Finish, Add	61.38		
08 71 16 00-2202	EA	Lever Trim (371L) With Cylinder, Von Duprin Series 55	451.47		26.95
		Note: Anodized finish: dull brass or dull bronze.			
		For Satin Chrome Plated US26D (BHMA 626) Finish, Add	47.83		
		For Dark Oxidized Satin Bronze, Oil Rubbed, US10B (BHMA 613) Finish, Add	55.04		
		For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add	72.50		
		For Bright Stainless Steel US32 (BHMA 629) Finish, Add	78.96		
08 71 16 00-2203	EA	Lever Trim (575L) With Cylinder, Von Duprin Series 55	520.37		26.95
		Note: Anodized finish: dull brass or dull bronze.			
		For Satin Chrome Plated US26D (BHMA 626) Finish, Add	56.51		
		For Dark Oxidized Satin Bronze, Oil Rubbed, US10B (BHMA 613) Finish, Add	65.03		
		For Bright Brass, Clear Coated US3 (BHMA 605) Or Bright Chrome Plated US26 (BHMA 625) Finish, Add	85.66		
		For Bright Stainless Steel US32 (BHMA 629) Finish, Add	93.29		



Openings	08	08
Hardware	08 70	
Door Hardware	08 71	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-2204 Cross Bar Exit Device, Von Duprin Series 88 <small>(08 71 16 00-2087)</small>		
Note: Grade 1, BHMA 156.3.		
08 71 16 00-2205 EA 42" Crossbar Exit Device, Rim Type.....	919.57	80.86
Note: Anodized finish; dull brass or dull bronze. Von Duprin Series 88.		
For Satin Chrome Plated US26D (BHMA 626) Finish, Add	21.82	
For Dark Oxidized Satin Bronze, Oil Rubbed, US10B (BHMA 613) Finish, Add	22.53	
For Bright Stainless Steel US32 (BHMA 629) Finish, Add	192.18	
For Bright Stainless Steel US32 (BHMA 629) Finish, Add	192.18	
08 71 16 00-2206 EA 42" Crossbar Exit Device, Rim Type, Fire Rated.....	1,074.92	80.86
Note: Anodized finish; dull brass or dull bronze. Von Duprin Series 88-F.		
For Satin Chrome Plated US26D (BHMA 626) Finish, Add	26.64	
For Dark Oxidized Satin Bronze, Oil Rubbed, US10B (BHMA 613) Finish, Add	27.50	
For Bright Stainless Steel US32 (BHMA 629) Finish, Add	234.59	
For Bright Stainless Steel US32 (BHMA 629) Finish, Add	234.59	
08 71 16 00-2207 EA 42" Crossbar Exit Device, Surface Vertical Rods.....	1,190.84	97.03
Note: Anodized finish; dull brass or dull bronze. Von Duprin Series 8827.		
For Satin Chrome Plated US26D (BHMA 626) Finish, Add	28.90	
For Dark Oxidized Satin Bronze, Oil Rubbed, US10B (BHMA 613) Finish, Add	29.83	
For Bright Stainless Steel US32 (BHMA 629) Finish, Add	254.46	
For Bright Stainless Steel US32 (BHMA 629) Finish, Add	254.46	
08 71 16 00-2208 EA 42" Crossbar Exit Device, Surface Vertical Rods, Fire Rated.....	1,526.89	97.03
Note: Anodized finish; dull brass or dull bronze. Von Duprin Series 8827-F.		
For Satin Chrome Plated US26D (BHMA 626) Finish, Add	39.31	
For Dark Oxidized Satin Bronze, Oil Rubbed, US10B (BHMA 613) Finish, Add	40.58	
For Bright Stainless Steel US32 (BHMA 629) Finish, Add	346.20	
For Bright Stainless Steel US32 (BHMA 629) Finish, Add	346.20	
08 71 16 00-2209 EA 42" Crossbar Exit Device, Concealed Vertical Rods.....	1,145.81	111.41
Note: Anodized finish; dull brass or dull bronze. Von Duprin Series 8847.		
For Satin Chrome Plated US26D (BHMA 626) Finish, Add	26.27	
For Dark Oxidized Satin Bronze, Oil Rubbed, US10B (BHMA 613) Finish, Add	27.12	
For Bright Stainless Steel US32 (BHMA 629) Finish, Add	231.38	
For Bright Stainless Steel US32 (BHMA 629) Finish, Add	231.38	
08 71 16 00-2210 EA 42" Crossbar Exit Device, Concealed Vertical Rods, Fire Rated.....	1,451.37	111.41
Note: Anodized finish; dull brass or dull bronze. Von Duprin Series 8847-F.		
For Satin Chrome Plated US26D (BHMA 626) Finish, Add	35.75	
For Dark Oxidized Satin Bronze, Oil Rubbed, US10B (BHMA 613) Finish, Add	36.90	
For Bright Stainless Steel US32 (BHMA 629) Finish, Add	314.80	
For Bright Stainless Steel US32 (BHMA 629) Finish, Add	314.80	
08 71 16 00-2211 EA 42" Crossbar Exit Device, Mortise Lock.....	1,231.52	100.62
Note: Anodized finish; dull brass or dull bronze. Von Duprin Series 8875.		
For Satin Chrome Plated US26D (BHMA 626) Finish, Add	29.82	
For Dark Oxidized Satin Bronze, Oil Rubbed, US10B (BHMA 613) Finish, Add	30.78	
For Bright Stainless Steel US32 (BHMA 629) Finish, Add	262.63	
For Bright Stainless Steel US32 (BHMA 629) Finish, Add	262.63	
08 71 16 00-2212 EA 42" Crossbar Exit Device, Mortise Lock, Fire Rated.....	1,310.82	100.62
Note: Anodized finish; dull brass or dull bronze. Von Duprin Series 8875-F.		
For Satin Chrome Plated US26D (BHMA 626) Finish, Add	32.28	
For Dark Oxidized Satin Bronze, Oil Rubbed, US10B (BHMA 613) Finish, Add	33.32	
For Bright Stainless Steel US32 (BHMA 629) Finish, Add	284.27	
For Bright Stainless Steel US32 (BHMA 629) Finish, Add	284.27	
08 71 16 00-2213 EA Dummy Trim (DT), Von Duprin Series 88.....	138.64	13.48
Note: Anodized finish; dull brass or dull bronze.		
For Satin Chrome Plated US26D (BHMA 626) Finish, Add	3.18	
For Dark Oxidized Satin Bronze, Oil Rubbed, US10B (BHMA 613) Finish, Add	3.29	
For Bright Stainless Steel US32 (BHMA 629) Finish, Add	28.04	
For Bright Stainless Steel US32 (BHMA 629) Finish, Add	28.04	
08 71 16 00-2214 EA Night Latch Pull Trim (NL) With Cylinder, Von Duprin Series 88.....	222.56	17.96
Note: Anodized finish; dull brass or dull bronze.		
For Satin Chrome Plated US26D (BHMA 626) Finish, Add	5.34	
For Dark Oxidized Satin Bronze, Oil Rubbed, US10B (BHMA 613) Finish, Add	5.51	
For Bright Stainless Steel US32 (BHMA 629) Finish, Add	47.02	
For Bright Stainless Steel US32 (BHMA 629) Finish, Add	47.02	
08 71 16 00-2215 EA Thumbturn Trim (376T Or 377T) With Cylinder, Von Duprin Series 88.....	387.77	26.95
Note: Anodized finish; dull brass or dull bronze.		
For Satin Chrome Plated US26D (BHMA 626) Finish, Add	9.79	
For Dark Oxidized Satin Bronze, Oil Rubbed, US10B (BHMA 613) Finish, Add	10.11	
For Bright Stainless Steel US32 (BHMA 629) Finish, Add	86.24	
For Bright Stainless Steel US32 (BHMA 629) Finish, Add	86.24	
08 71 16 00-2216 EA Lever Trim (373L) With Cylinder, Von Duprin Series 88.....	361.77	26.95
Note: Anodized finish; dull brass or dull bronze.		
For Satin Chrome Plated US26D (BHMA 626) Finish, Add	8.99	
For Dark Oxidized Satin Bronze, Oil Rubbed, US10B (BHMA 613) Finish, Add	9.28	
For Bright Stainless Steel US32 (BHMA 629) Finish, Add	79.14	
For Bright Stainless Steel US32 (BHMA 629) Finish, Add	79.14	
08 71 16 00-2217 EA Knob Trim (K) With Cylinder, Von Duprin Series 88.....	274.02	26.95
Note: Anodized finish; dull brass or dull bronze.		
For Satin Chrome Plated US26D (BHMA 626) Finish, Add	6.27	
For Dark Oxidized Satin Bronze, Oil Rubbed, US10B (BHMA 613) Finish, Add	6.47	
For Bright Stainless Steel US32 (BHMA 629) Finish, Add	55.19	
For Bright Stainless Steel US32 (BHMA 629) Finish, Add	55.19	

08 Openings**08 70 Hardware****08 71 Door Hardware**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-2218	EA		Thumbpiece Trim (TP) With Cylinder, Von Duprin Series 88.....	274.02	26.95
			Note: Anodized finish: dull brass or dull bronze.		
			For Satin Chrome Plated US26D (BHMA 626) Finish, Add	6.27	
			For Dark Oxidized Satin Bronze, Oil Rubbed, US10B (BHMA 613) Finish, Add	6.47	
			For Bright Stainless Steel US32 (BHMA 629) Finish, Add	55.19	
			For Bright Stainless Steel US32 (BHMA 629) Finish, Add	55.19	
08 71 16 00-2219			Push Bar Exit Device, Precision Hardware Apex 2000 Series (08 71 16 00-2087)		
			Note: Grade 1, BHMA 156.3. Anodized Aluminum Finish.		
08 71 16 00-2220	EA		3' Push Bar Exit Device, Rim Type (Precision Hardware 2100 Series).....	880.81	80.86
			For 4' Push Bar, Add	13.00	
			For Owner Furnished Material, Deduct	-665.19	
08 71 16 00-2221	EA		3' Push Bar Exit Device, Rim Type, Fire Rated (Precision Hardware 2100 Series).....	926.51	80.86
			For 4' Push Bar, Add	13.00	
			For Owner Furnished Material, Deduct	-710.89	
08 71 16 00-2222	EA		3' Push Bar Exit Device, Surface Vertical Rod (Top Only) (Precision Hardware 2200 Series)	1,197.58	97.03
			For 4' Push Bar, Add	13.00	
			For Owner Furnished Material, Deduct	-938.84	
08 71 16 00-2223	EA		3' Push Bar Exit Device, Surface Vertical Rod (Top Only), Fire Rated (Precision Hardware 2200 Series).....	1,243.28	97.03
			For 4' Push Bar, Add	13.00	
			For Owner Furnished Material, Deduct	-984.54	
08 71 16 00-2224	EA		Exit Only, Cover Plate, Lever/Knob Trim (Precision 4901)	108.14	10.78
			For Owner Furnished Material, Deduct	-79.39	
08 71 16 00-2225	EA		Exit Only, Dummy Trim, Lever/Knob Trim (Precision 4902A)	277.11	13.48
			For Owner Furnished Material, Deduct	-241.17	
08 71 16 00-2226	EA		Key Retracts Latchbolt, Lever/Knob Trim (Precision 4903A)	313.04	26.95
			For Owner Furnished Material, Deduct	-241.17	
08 71 16 00-2227	EA		Key Controls Lever/Knob, Lever/Knob Trim (Precision 4908A)	373.19	26.95
			For Owner Furnished Material, Deduct	-301.32	
08 71 16 00-2228	EA		Key Controls Lever, Lever/Knob Trim (Precision V4908A)	373.19	26.95
			For Owner Furnished Material, Deduct	-301.32	
08 71 16 00-2229	EA		Lever/Knob Always Active, Lever/Knob Trim (Precision 4914A).....	373.19	26.95
			For Owner Furnished Material, Deduct	-301.32	
08 71 16 00-2230	EA		Exit Only, Cover Plate, Pull Trim (Precision 1701).....	81.67	10.78
			For Owner Furnished Material, Deduct	-52.92	
08 71 16 00-2231	EA		Exit Only, Dummy Trim, Pull Trim (Precision 1702A).....	167.05	13.48
			For Owner Furnished Material, Deduct	-131.11	
08 71 16 00-2232	EA		Key Retracts Latchbolt, Pull Trim (Precision 1703A)	181.42	17.96
			For Owner Furnished Material, Deduct	-131.11	
08 71 16 00-2233	EA		Key Controls Thumb Piece, Pull Trim (Precision 1705A).....	255.90	26.95
			For Owner Furnished Material, Deduct	-184.03	
08 71 16 00-2234	EA		Thumb Piece Always Active, Pull Trim (Precision 1715A).....	255.90	26.95
			For Owner Furnished Material, Deduct	-184.03	
08 71 16 00-2235			Door Closers (08 71 16)		
			Note: Includes standard cover and arm.		
08 71 16 00-2236	EA		Surface Mounted Standard Duty Door Closer (LCN 1460 Series)	283.32	20.84
			For Delayed Action, Add	12.60	
			For AVB (5 LB Per Push), Add	6.60	
			For Fusible Link Arm, Add	39.60	
			For Shock Absorbing Arm, Add	19.80	
			For Hold Open Arm, Add	13.80	
			For Plated Brass Finish, Add	101.40	
			For Plated Finish With Clear Coat, Add	127.20	
			For Parallel Arm, Add	22.40	
08 71 16 00-2237	EA		Surface Mounted Heavy Duty Door Closer (LCN 4010/4020/4110 Series).....	343.07	20.84
			For Delayed Action, Add	12.60	
			For AVB (5 LB Per Push), Add	6.60	
			For Fusible Link Arm, Add	39.60	
			For Shock Absorbing Arm, Add	19.80	
			For Hold Open Arm, Add	13.80	
			For Plated Brass Finish, Add	101.40	
			For Plated Finish With Clear Coat, Add	127.20	
08 71 16 00-2238	EA		Surface Mounted Heavy Duty Door Closer (LCN 4040XP/4041 Series).....	352.57	20.84
			For Delayed Action, Add	12.60	
			For AVB (5 LB Per Push), Add	6.60	
			For Fusible Link Arm, Add	39.60	
			For Shock Absorbing Arm, Add	19.80	
			For Hold Open Arm, Add	13.80	
			For Plated Brass Finish, Add	101.40	
			For Plated Finish With Clear Coat, Add	127.20	
			For Spring Cush Arm, Add	67.20	
			For Parallel Arm And PA Shoe, Add	22.40	
			For Stainless Steel Finish, Add	145.00	
08 71 16 00-2239	EA		Surface Mounted High Security Door Closer, Metal Cover (LCN 4510).....	364.46	20.84
			For Delayed Action, Add	12.60	
			For AVB (5 LB Per Push), Add	6.60	
			For Fusible Link Arm, Add	39.60	
			For Shock Absorbing Arm, Add	19.80	
			For Hold Open Arm, Add	13.80	
			For Plated Brass Finish, Add	101.40	
			For Plated Finish With Clear Coat, Add	127.20	
08 71 16 00-2240	EA		Surface Mounted Standard Duty Door Closer (Norton 8301).....	238.57	20.84
			For Parallel Arm, Add	22.40	



Openings	08	08
Hardware	08 70	
Door Hardware	08 71	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-2241 EA Surface Mounted Standard Duty Door Closer (Norton 8501)	240.57	20.84
For Parallel Arm, Add	22.40	
08 71 16 00-2242 EA Screen Door - Closer	31.33	7.83
08 71 16 00-2243 EA Screen Door - Locking Handle.....	35.34	11.24
08 71 16 00-2244 Concealed Door Closers (08 71 16)		
08 71 16 00-2245 EA Floor Concealed Door Closer, Non Hold Open (Rixson 27/28).....	800.69	61.81
08 71 16 00-2246 EA Floor Concealed Door Closer, Selective Hold Open (Rixson 27/27).....	856.69	61.81
08 71 16 00-2247 EA Concealed (In Door) Overhead Door Closer (LCN 3130)	405.36	25.16
For Delayed Action, Add	12.60	
For Hold Open Arm, Add	13.80	
For Plated Brass Finish, Add	101.40	
For Plated Finish With Clear Coat, Add	127.20	
08 71 16 00-2248 EA Concealed (In Frame) Overhead Door Closer (LCN 5010).....	438.12	25.16
For Delayed Action, Add	12.60	
For Hold Open Arm, Add	13.80	
For Plated Brass Finish, Add	101.40	
For Plated Finish With Clear Coat, Add	127.20	
08 71 16 00-2249 Locks And Latches (08 71 16)		
Note: All locksets are supplied with knob, lever or thumb piece, set of 3 keys and include construction cores. Multi purchase locksets are keyed alike and to the existing master key. The cost for boring hole or preparing mortise is included with the new door.		
08 71 16 00-2250 Locksmith Services (08 71 16 00-2249)		
08 71 16 00-2251 EA Provide Extra Keys (Above The Three Provided For New Locks) Or Duplicate Keys.....	1.13	
For >50, Deduct	-0.23	
08 71 16 00-2252 EA Rekey Existing Cylinder To Match Existing Cylinders Or Master Key.....	86.28	
For >5, Deduct	-8.63	
08 71 16 00-2253 EA Replace Cylinder With Owner Supplied Cylinder.....	86.28	
For >5, Deduct	-8.63	
08 71 16 00-2254 EA Replace Cylinder With New Cylinder.....	98.27	
Note: Excludes core.		
For >5, Deduct	-8.63	
08 71 16 00-2255 EA Open Locked Doors.....	86.28	
08 71 16 00-2256 EA Install Owner Furnished Cores And Cylinders.....	36.27	
08 71 16 00-2257 Mortise Locksets And Latchsets (08 71 16 00-2249)		
Note: Satin chrome plated US 26D (BHMA 626) - BHMA 156.13 Grade 1. Levers or knobs.		
08 71 16 00-2258 EA Passage/Closet F01 Mortise Latchset	324.85	17.96
Note: Both sides always unlocked.		
For Bright Brass, Clear Coated US3 (BHMA 605) Finish, Add	8.35	
For Oxidized Satin Bronze, Oil Rubbed US10B (BHMA 613) Finish, Add	7.59	
For Satin Brass Clear Coat US4 (BHMA 606) Finish, Add	12.65	
For Satin Stainless Steel US32D (BHMA 630) Finish, Add	89.30	
08 71 16 00-2259 EA Bath/Bedroom Privacy F02 Mortise Lockset.....	381.06	17.96
Note: Locked with thumb knob inside.		
For Bright Brass, Clear Coated US3 (BHMA 605) Finish, Add	10.20	
For Oxidized Satin Bronze, Oil Rubbed US10B (BHMA 613) Finish, Add	9.28	
For Satin Brass Clear Coat US4 (BHMA 606) Finish, Add	15.46	
For Satin Stainless Steel US32D (BHMA 630) Finish, Add	109.14	
08 71 16 00-2260 EA Entrance/Office F04 Mortise Lockset.....	420.82	17.96
Note: Locked with key outside and thumb knob inside.		
For Bright Brass, Clear Coated US3 (BHMA 605) Finish, Add	11.52	
For Oxidized Satin Bronze, Oil Rubbed US10B (BHMA 613) Finish, Add	10.47	
For Satin Brass Clear Coat US4 (BHMA 606) Finish, Add	17.45	
For Satin Stainless Steel US32D (BHMA 630) Finish, Add	123.18	
08 71 16 00-2261 EA Classroom F05 Mortise Lockset	394.70	17.96
Note: Locked with key outside. Inside always unlocked.		
For Bright Brass, Clear Coated US3 (BHMA 605) Finish, Add	10.65	
For Oxidized Satin Bronze, Oil Rubbed US10B (BHMA 613) Finish, Add	9.68	
For Satin Brass Clear Coat US4 (BHMA 606) Finish, Add	16.14	
For Satin Stainless Steel US32D (BHMA 630) Finish, Add	113.96	
For Security Function (Double Cylinder) With Visual Indicator, Add	39.33	
08 71 16 00-2262 EA Storeroom/Closet F07 Mortise Lockset.....	394.70	17.96
Note: Locked with key outside. Inside always unlocked. Fixed outside handle.		
For Bright Brass, Clear Coated US3 (BHMA 605) Finish, Add	10.65	
For Oxidized Satin Bronze, Oil Rubbed US10B (BHMA 613) Finish, Add	9.68	
For Satin Brass Clear Coat US4 (BHMA 606) Finish, Add	16.14	
For Satin Stainless Steel US32D (BHMA 630) Finish, Add	113.96	
08 71 16 00-2263 EA Entrance F08 Mortise Lockset	437.47	17.96
Note: Locked with key outside and thumb knob inside.		
For Bright Brass, Clear Coated US3 (BHMA 605) Finish, Add	12.06	
For Oxidized Satin Bronze, Oil Rubbed US10B (BHMA 613) Finish, Add	10.97	
For Satin Brass Clear Coat US4 (BHMA 606) Finish, Add	18.28	
For Satin Stainless Steel US32D (BHMA 630) Finish, Add	129.06	
08 71 16 00-2264 EA Dormitory/Exit F13 Mortise Lockset.....	380.67	17.96
Note: Locked with key outside and thumb knob inside.		
For Bright Brass, Clear Coated US3 (BHMA 605) Finish, Add	10.19	
For Oxidized Satin Bronze, Oil Rubbed US10B (BHMA 613) Finish, Add	9.26	
For Satin Brass Clear Coat US4 (BHMA 606) Finish, Add	15.44	
For Satin Stainless Steel US32D (BHMA 630) Finish, Add	109.01	

08 Openings**08 70 Hardware****08 71 Door Hardware**MINOR
CSI UOM DESCRIPTIONTOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

08 71 16 00-2265	Locks And Latches (08 71 16 00-2249)		
08 71 16 00-2266	Preassembled Locks And Latches (08 71 16 00-2265)		
	Note: Satin chrome plated US 26D (BHMA 626) - BHMA 156.2-1989 Grade 1, with knob handles.		
08 71 16 00-2267	EA Passage/Closet F36 Pre-Assembled Latchset.....	548.27	17.96
	Note: Both sides always unlocked.		
	For Oxidized Satin Bronze, Oil Rubbed US10B (BHMA 613) Finish, Add	14.29	
	For Satin Brass Clear Coat US4 (BHMA 606) Finish, Add	23.82	
	For Satin Stainless Steel US32D (BHMA 630) Finish, Add	168.17	
	For Bright Chrome Plated Finish US26 (BHMA 625) Finish, Add	88.61	
	For Grade 2 With Lever Handles, Deduct	-185.32	
	For Grade 2 With Knobs, Deduct	-319.19	
08 71 16 00-2268	EA Bath/Bedroom Privacy F37 Pre-Assembled Lockset	589.92	17.96
	Note: Locked with push button inside.		
	For Oxidized Satin Bronze, Oil Rubbed US10B (BHMA 613) Finish, Add	15.54	
	For Satin Brass Clear Coat US4 (BHMA 606) Finish, Add	25.90	
	For Satin Stainless Steel US32D (BHMA 630) Finish, Add	182.87	
	For Bright Chrome Plated Finish US26 (BHMA 625) Finish, Add	96.36	
	For Grade 2 With Lever Handles, Deduct	-201.52	
	For Grade 2 With Knobs, Deduct	-347.09	
08 71 16 00-2269	EA Entrance/Office F41 Pre-Assembled Lockset	664.60	17.96
	Note: Locked with key outside and push button inside.		
	For Oxidized Satin Bronze, Oil Rubbed US10B (BHMA 613) Finish, Add	17.78	
	For Satin Brass Clear Coat US4 (BHMA 606) Finish, Add	29.64	
	For Satin Stainless Steel US32D (BHMA 630) Finish, Add	209.23	
	For Bright Chrome Plated Finish US26 (BHMA 625) Finish, Add	110.25	
	For Grade 2 With Lever Handles, Deduct	-230.57	
	For Grade 2 With Knobs, Deduct	-397.13	
08 71 16 00-2270	EA Classroom F42 Pre-Assembled Lockset.....	664.60	17.96
	Note: Locked with key outside. Inside always unlocked.		
	For Oxidized Satin Bronze, Oil Rubbed US10B (BHMA 613) Finish, Add	17.78	
	For Satin Brass Clear Coat US4 (BHMA 606) Finish, Add	29.64	
	For Satin Stainless Steel US32D (BHMA 630) Finish, Add	209.23	
	For Bright Chrome Plated Finish US26 (BHMA 625) Finish, Add	110.25	
	For Grade 2 With Lever Handles, Deduct	-230.57	
	For Grade 2 With Knobs, Deduct	-397.13	
08 71 16 00-2271	EA Storeroom/Closet F44 Pre-Assembled Lockset	664.60	17.96
	Note: Locked with key outside. Inside always unlocked. Fixed outside handle.		
	For Oxidized Satin Bronze, Oil Rubbed US10B (BHMA 613) Finish, Add	17.78	
	For Satin Brass Clear Coat US4 (BHMA 606) Finish, Add	29.64	
	For Satin Stainless Steel US32D (BHMA 630) Finish, Add	209.23	
	For Bright Chrome Plated Finish US26 (BHMA 625) Finish, Add	110.25	
	For Grade 2 With Lever Handles, Deduct	-230.57	
	For Grade 2 With Knobs, Deduct	-397.13	
08 71 16 00-2272	Bored Locks And Latches (08 71 16 00-2265)		
	Note: Satin chrome plated US 26D (BHMA 626) - BHMA 156.2-1989, Grade 1, 6 pins or 7 pins. Levers or knobs.		
08 71 16 00-2273	EA Passage/Closet F75 Bored Latchset.....	183.73	17.96
	Note: Both sides always unlocked.		
	For Oxidized Satin Bronze, Oil Rubbed US10B (BHMA 613) Finish, Add	3.36	
	For Satin Brass Clear Coat US4 (BHMA 606) Finish, Add	5.59	
	For Satin Stainless Steel US32D (BHMA 630) Finish, Add	39.49	
	For Bright Chrome Plated Finish US26 (BHMA 625) Finish, Add	20.81	
	For Grade 2, Deduct	-5.59	
	For Bright Brass, Clear Coated US3 (BHMA 605) Finish, Add	2.24	
	For Interchangeable Core, Add	9.45	
08 71 16 00-2274	EA Bath/Bedroom Privacy F76 Bored Lockset	210.41	17.96
	Note: Locked with push button inside.		
	For Oxidized Satin Bronze, Oil Rubbed US10B (BHMA 613) Finish, Add	4.16	
	For Satin Brass Clear Coat US4 (BHMA 606) Finish, Add	6.93	
	For Satin Stainless Steel US32D (BHMA 630) Finish, Add	48.90	
	For Bright Chrome Plated Finish US26 (BHMA 625) Finish, Add	25.77	
	For Grade 2, Deduct	-6.93	
	For Bright Brass, Clear Coated US3 (BHMA 605) Finish, Add	2.77	
	For Interchangeable Core, Add	9.45	
08 71 16 00-2275	EA Entrance/Office F82 Bored Lockset	231.91	17.96
	Note: Locked with key outside and push button inside.		
	For Oxidized Satin Bronze, Oil Rubbed US10B (BHMA 613) Finish, Add	4.80	
	For Satin Brass Clear Coat US4 (BHMA 606) Finish, Add	8.00	
	For Satin Stainless Steel US32D (BHMA 630) Finish, Add	56.49	
	For Bright Chrome Plated Finish US26 (BHMA 625) Finish, Add	29.77	
	For Grade 2, Deduct	-8.00	
	For Bright Brass, Clear Coated US3 (BHMA 605) Finish, Add	3.20	
	For Interchangeable Core, Add	9.45	
08 71 16 00-2276	EA Classroom F84 Bored Lockset.....	231.91	17.96
	Note: Locked with key outside. Inside always unlocked.		
	For Oxidized Satin Bronze, Oil Rubbed US10B (BHMA 613) Finish, Add	4.80	
	For Satin Brass Clear Coat US4 (BHMA 606) Finish, Add	8.00	
	For Satin Stainless Steel US32D (BHMA 630) Finish, Add	56.49	
	For Bright Chrome Plated Finish US26 (BHMA 625) Finish, Add	29.77	
	For Grade 2, Deduct	-8.00	
	For Bright Brass, Clear Coated US3 (BHMA 605) Finish, Add	3.20	
	For Interchangeable Core, Add	9.45	



Openings	08	08
Hardware	08 70	
Door Hardware	08 71	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-2277	EA		Storeroom/Closet F86 Bored Lockset..... Note: Locked with key outside. Inside always unlocked. Fixed outside handle. <i>For Oxidized Satin Bronze, Oil Rubbed US10B (BHMA 613) Finish, Add</i> 4.80 <i>For Satin Brass Clear Coat US4 (BHMA 606) Finish, Add</i> 8.00 <i>For Satin Stainless Steel US32D (BHMA 630) Finish, Add</i> 56.49 <i>For Bright Chrome Plated Finish US26 (BHMA 625) Finish, Add</i> 29.77 <i>For Grade 2, Deduct</i> -8.00 <i>For Bright Brass, Clear Coated US3 (BHMA 605) Finish, Add</i> 3.20 <i>For Interchangeable Core, Add</i> 9.45	231.91	17.96
08 71 16 00-2278	EA		Corridor/Dormitory F90 Bored Lockset..... Note: Locked with key outside and push button inside. <i>For Oxidized Satin Bronze, Oil Rubbed US10B (BHMA 613) Finish, Add</i> 4.80 <i>For Satin Brass Clear Coat US4 (BHMA 606) Finish, Add</i> 8.00 <i>For Satin Stainless Steel US32D (BHMA 630) Finish, Add</i> 56.49 <i>For Bright Chrome Plated Finish US26 (BHMA 625) Finish, Add</i> 29.77 <i>For Grade 2, Deduct</i> -8.00 <i>For Bright Brass, Clear Coated US3 (BHMA 605) Finish, Add</i> 3.20 <i>For Interchangeable Core, Add</i> 9.45	231.91	17.96
08 71 16 00-2279			Other Locks (08 71 16 00-2249) Note: BHMA A156.5.		
08 71 16 00-2280	PR		Screen Door - Hinges.....	19.67	6.24
08 71 16 00-2281	EA		Steel Exit Lock With Alarm, Single Door Satin Chrome Plated, BHMA E0421	587.34	93.43
08 71 16 00-2282	EA		Exit Lock With Alarm At Active Leaf And Vertical Rod - Inactive Leaf Rod For Inactive Leaf (Pair Doors) Steel With Satin Chrome Plating BHMA - E0461	1,326.66	186.86
08 71 16 00-2283			Pushbutton Combination Locks (08 71 16 00-2249)		
08 71 16 00-2284			Mechanical Pushbutton Combination Locks (08 71 16 00-2283) Note: Passage option allows access without using the lock entry code and is activated from the inside with a thumbturn or key. Lockout option disables the lock from the inside so that the entry code cannot be used to gain access.		
08 71 16 00-2285			Mechanical Pushbutton Combination Locks (Kaba® Simplex® 1000 Series) (08 71 16 00-2284) Note: Satin chrome or antique brass finish.		
08 71 16 00-2286	EA		Five Button, Cylindrical Locking Device, Mechanical Pushbutton Combination Lock, Knob (Kaba® Simplex® 1000 Series).....	478.86	45.34
			<i>For Bright Chrome Or Bright Brass Finish, Add</i> 17.50		
08 71 16 00-2287	EA		Five Button, Cylindrical Locking Device With Passage, Mechanical Pushbutton Combination Lock, Knob (Kaba® Simplex® 1000 Series).....	513.86	45.34
			<i>For Bright Chrome Or Bright Brass Finish, Add</i> 17.50		
08 71 16 00-2288	EA		Five Button, Cylindrical Locking Device, Mechanical Pushbutton Combination Lock With Key Override, Knob (Kaba® Simplex® 1000 Series).....	527.86	45.34
			<i>For Bright Chrome Or Bright Brass Finish, Add</i> 17.50		
08 71 16 00-2289	EA		Five Button, Cylindrical Locking Device With Passage, Mechanical Pushbutton Combination Lock With Key Override, Knob (Kaba® Simplex® 1000 Series).....	562.86	45.34
			<i>For Bright Chrome Or Bright Brass Finish, Add</i> 17.50		
08 71 16 00-2290	EA		Five Button, Cylindrical Locking Device, Mechanical Pushbutton Combination Lock, Lever (Kaba® Simplex® L1000 Series).....	538.36	45.34
			<i>For Bright Chrome Or Bright Brass Finish, Add</i> 17.50		
08 71 16 00-2291	EA		Five Button, Cylindrical Locking Device With Passage, Mechanical Pushbutton Combination Lock, Lever (Kaba® Simplex® L1000 Series).....	573.36	45.34
			<i>For Bright Chrome Or Bright Brass Finish, Add</i> 17.50		
08 71 16 00-2292	EA		Five Button, Cylindrical Locking Device, Mechanical Pushbutton Combination Lock With Key Override, Lever (Kaba® Simplex® L1000 Series).....	587.36	45.34
			<i>For Bright Chrome Or Bright Brass Finish, Add</i> 17.50		
08 71 16 00-2293	EA		Five Button, Cylindrical Locking Device With Passage, Mechanical Pushbutton Combination Lock With Key Override, Lever (Kaba® Simplex® L1000 Series).....	622.36	45.34
			<i>For Bright Chrome Or Bright Brass Finish, Add</i> 17.50		
08 71 16 00-2294			Mechanical Pushbutton Combination Locks (Kaba® Simplex® 5000 Series) (08 71 16 00-2284) Note: ANSI/BHMA Grade 1, Satin chrome finish or black with satin chrome accents.		
08 71 16 00-2295	EA		Five Button, Cylindrical Locking Device, Mechanical Pushbutton Combination Lock With Key Override, Knob Or Lever (Kaba® Simplex® 5000 Series).....	529.96	45.34
			<i>For Bright Chrome, Bright Brass Or Satin Brass Finish, Add</i> 17.50 <i>For Dark Bronze Finish With Brass Accents, Add</i> 70.00		
08 71 16 00-2296	EA		Five Button, Cylindrical Locking Device With Passage, Mechanical Pushbutton Combination Lock With Key Override, Knob Or Lever (Kaba® Simplex® 5000 Series).....	557.96	45.34
			<i>For Bright Chrome, Bright Brass Or Satin Brass Finish, Add</i> 17.50 <i>For Dark Bronze Finish With Brass Accents, Add</i> 70.00		
08 71 16 00-2297	EA		Five Button, Mortise Locking Device, Mechanical Pushbutton Combination Lock With Key Override, Lever (Kaba® Simplex® 5000 Series).....	613.96	45.34
			<i>For Bright Chrome, Bright Brass Or Satin Brass Finish, Add</i> 17.50 <i>For Dark Bronze Finish With Brass Accents, Add</i> 70.00		
08 71 16 00-2298	EA		Five Button, Mortise Locking Device With Passage, Mechanical Pushbutton Combination Lock With Key Override, Lever (Kaba® Simplex® 5000 Series).....	634.96	45.34
			<i>For Bright Chrome, Bright Brass Or Satin Brass Finish, Add</i> 17.50 <i>For Dark Bronze Finish With Brass Accents, Add</i> 70.00		
08 71 16 00-2299	EA		Five Button, Mortise Locking Device With Deadbolt And Lockout, Mechanical Pushbutton Combination Lock With Key Override, Lever (Kaba® Simplex® 5000 Series).....	634.96	45.34
			<i>For Bright Chrome, Bright Brass Or Satin Brass Finish, Add</i> 17.50 <i>For Dark Bronze Finish With Brass Accents, Add</i> 70.00		



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-2300	EA		Five Button, Exit Trim, Mechanical Pushbutton Combination Lock With Key Override, Lever (Kaba® Simplex® 5000 Series).....	599.96	45.34
			<i>For Bright Chrome, Bright Brass Or Satin Brass Finish, Add</i>	17.50	
			<i>For Dark Bronze Finish With Brass Accents, Add</i>	70.00	
08 71 16 00-2301			Mechanical Pushbutton Combination Locks (Kaba® Simplex® 8100 Series) <small>(08 71 16 00-2284)</small> Note: Satin chrome or antique brass finish.		
08 71 16 00-2302	EA		Five Button, Mortise Locking Device With Passage And Lockout, Mechanical Pushbutton Combination Lock With Key Override, Lever (Kaba® Simplex® 8100 Series).....	639.86	45.34
			<i>For Bright Chrome Or Bright Brass Finish, Add</i>	17.50	
08 71 16 00-2303	EA		Five Button, Mortise Locking Device With Deadbolt, Passage And Lockout, Mechanical Pushbutton Combination Lock With Key Override, Lever (Kaba® Simplex® 8100 Series).....	660.86	45.34
			<i>For Bright Chrome Or Bright Brass Finish, Add</i>	17.50	
08 71 16 00-2304			Mechanical Pushbutton Combination Locks (Kaba® Simplex® LD 450/470) <small>(08 71 16 00-2284)</small> Note: Satin stainless, bright brass or antique brass finish.		
08 71 16 00-2305	EA		Twelve Button, Tubular Latch Locking Device, Light Duty, Mechanical Pushbutton Combination Lock, Knob (Kaba® Simplex® LD 450 Series).....	277.96	45.34
08 71 16 00-2306	EA		Twelve Button, Tubular Latch Locking Device With Passage, Light Duty, Mechanical Pushbutton Combination Lock, Lever (Kaba® Simplex® LD 470 Series).....	370.36	45.34
08 71 16 00-2307			Electrical Pushbutton Combination Locks <small>(08 71 16 00-2283)</small> Note: Privacy option limits access to privileged users (master codes).		
08 71 16 00-2308			Electrical Pushbutton Combination Locks (Kaba® E-Plex® 2000 Series) <small>(08 71 16 00-2307)</small> Note: ANSI/BHMA Grade 1. Satin chrome finish. Includes 100 access codes and 1,000 audit events.		
08 71 16 00-2309	EA		Twelve Button, Cylindrical Locking Device, Electrical Pushbutton Combination Lock, Lever (Kaba® E-Plex® 2000 Series).....	496.36	45.34
			<i>For Satin Brass Finish, Add</i>	17.50	
08 71 16 00-2310	EA		Twelve Button, Mortise Locking Device, Electrical Pushbutton Combination Lock, Lever (Kaba® E-Plex® 2000 Series).....	580.36	45.34
			<i>For Satin Brass Finish, Add</i>	17.50	
08 71 16 00-2311	EA		Twelve Button, Mortise Locking Device With Deadbolt, Electrical Pushbutton Combination Lock, Lever (Kaba® E-Plex® 2000 Series).....	601.36	45.34
			<i>For Satin Brass Finish, Add</i>	17.50	
08 71 16 00-2312	EA		Twelve Button, Exit Trim, Electrical Pushbutton Combination Lock, Lever (Kaba® E-Plex® 2000 Series).....	566.36	45.34
			<i>For Satin Brass Finish, Add</i>	17.50	
08 71 16 00-2313	EA		Twelve Button, Cylindrical Locking Device, Electrical Pushbutton Combination Lock With Key Override, Lever (Kaba® E-Plex® 2000 Series).....	531.36	45.34
			<i>For Satin Brass Finish, Add</i>	17.50	
08 71 16 00-2314	EA		Twelve Button, Cylindrical Locking Device With Privacy, Electrical Pushbutton Combination Lock With Key Override, Lever (Kaba® E-Plex® 2000 Series).....	601.36	45.34
			<i>For Satin Brass Finish, Add</i>	17.50	
08 71 16 00-2315	EA		Twelve Button, Mortise Locking Device, Electrical Pushbutton Combination Lock With Key Override, Lever (Kaba® E-Plex® 2000 Series).....	615.36	45.34
			<i>For Satin Brass Finish, Add</i>	17.50	
08 71 16 00-2316	EA		Twelve Button, Mortise Locking Device With Deadbolt, Electrical Pushbutton Combination Lock With Key Override, Lever (Kaba® E-Plex® 2000 Series).....	636.36	45.34
			<i>For Satin Brass Finish, Add</i>	17.50	
08 71 16 00-2317	EA		Twelve Button, Exit Trim, Electrical Pushbutton Combination Lock With Key Override, Lever (Kaba® E-Plex® 2000 Series).....	601.36	45.34
			<i>For Satin Brass Finish, Add</i>	17.50	
08 71 16 00-2318			Narrow Stile Application, Electrical Pushbutton Combination Locks (Kaba® E-Plex® 3000 Series) <small>(08 71 16 00-2307)</small> Note: ANSI/BHMA Grade 1. Satin chrome finish. Includes 300 access codes and 9,000 audit events.		
08 71 16 00-2319	EA		Twelve Button, Mortise Locking Device, Narrow Stile Application, Electrical Pushbutton Combination Lock With Key Override, Lever (Kaba® E-Plex® 3000 Series).....	636.36	45.34
			<i>For Dark Bronze Finish With Brass Accents, Add</i>	70.00	
			<i>For Remote Unlock, Add</i>	83.20	
			Note: Excludes momentary contact switch.		
08 71 16 00-2320	EA		Twelve Button, Mortise Locking Device With Deadbolt, Narrow Stile Application, Electrical Pushbutton Combination Lock With Key Override, Lever (Kaba® E-Plex® 3000 Series).....	636.36	45.34
			<i>For Dark Bronze Finish With Brass Accents, Add</i>	70.00	
			<i>For Remote Unlock, Add</i>	83.20	
			Note: Excludes momentary contact switch.		
08 71 16 00-2321			Narrow Stile Application, Electrical Pushbutton Combination Locks (Kaba® E-Plex® 3200 Series) <small>(08 71 16 00-2307)</small> Note: ANSI/BHMA Grade 1. Satin chrome finish. Includes 3,000 access codes and 30,000 audit events.		
08 71 16 00-2322	EA		Twelve Button, Mortise Locking Device, Narrow Stile Application, Electrical Pushbutton Combination Lock With Key Override, Lever (Kaba® E-Plex® 3200 Series).....	744.86	45.34
			<i>For Dark Bronze Finish With Brass Accents, Add</i>	70.00	
			<i>For Remote Unlock, Add</i>	83.20	
			Note: Excludes momentary contact switch.		



Openings	08	08
Hardware	08 70	
Door Hardware	08 71	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-2323 EA Twelve Button, Mortise Locking Device With Deadbolt, Narrow Stile Application, Electrical Pushbutton Combination Lock With Key Override, Lever (Kaba® E-Plex® 3200 Series).....	744.86	45.34
For Dark Bronze Finish With Brass Accents, Add	70.00	
For Remote Unlock, Add	83.20	
Note: Excludes momentary contact switch.		
08 71 16 00-2324 Electrical Pushbutton Combination Locks (Kaba® E-Plex® 5200 Series) (08 71 16 00-2307)		
Note: ANSI/BHMA Grade 1. Satin chrome finish. Includes 3,000 access codes and 30,000 audit events.		
08 71 16 00-2325 EA Twelve Button, Cylindrical Locking Device, Electrical Pushbutton Combination Lock With Key Override, Lever (Kaba® E-Plex® 5200 Series).....	800.86	45.34
For Bright Chrome, Bright Brass Or Satin Brass Finish, Add	17.50	
For Dark Bronze Finish With Brass Accents, Add	70.00	
For Remote Unlock, Add	83.20	
Note: Excludes momentary contact switch.		
08 71 16 00-2326 EA Twelve Button, Cylindrical Locking Device With Privacy, Electrical Pushbutton Combination Lock With Key Override, Lever (Kaba® E-Plex® 5200 Series).....	870.86	45.34
For Bright Chrome, Bright Brass Or Satin Brass Finish, Add	17.50	
For Dark Bronze Finish With Brass Accents, Add	70.00	
For Remote Unlock, Add	83.20	
Note: Excludes momentary contact switch.		
08 71 16 00-2327 EA Twelve Button, Mortise Locking Device, Electrical Pushbutton Combination Lock With Key Override, Lever (Kaba® E-Plex® 5200 Series).....	884.86	45.34
For Bright Chrome, Bright Brass Or Satin Brass Finish, Add	17.50	
For Dark Bronze Finish With Brass Accents, Add	70.00	
For Remote Unlock, Add	83.20	
Note: Excludes momentary contact switch.		
08 71 16 00-2328 EA Twelve Button, Mortise Locking Device With Deadbolt, Electrical Pushbutton Combination Lock With Key Override, Lever (Kaba® E-Plex® 5200 Series).....	905.86	45.34
For Bright Chrome, Bright Brass Or Satin Brass Finish, Add	17.50	
For Dark Bronze Finish With Brass Accents, Add	70.00	
For Remote Unlock, Add	83.20	
Note: Excludes momentary contact switch.		
08 71 16 00-2329 EA Twelve Button, Exit Trim, Electrical Pushbutton Combination Lock With Key Override, Lever (Kaba® E-Plex® 5200 Series).....	870.86	45.34
For Bright Chrome, Bright Brass Or Satin Brass Finish, Add	17.50	
For Dark Bronze Finish With Brass Accents, Add	70.00	
For Remote Unlock, Add	83.20	
Note: Excludes momentary contact switch.		
08 71 16 00-2330 Electrical Pushbutton Combination Lock/Card Readers (Kaba® E-Plex® 5800 Series) (08 71 16 00-2307)		
Note: ANSI/BHMA Grade 1. Satin chrome or black with satin chrome accents finish. Includes 3,000 access codes and 30,000 audit events.		
08 71 16 00-2331 EA Twelve Button, Cylindrical Locking Device, Electrical Pushbutton Combination Lock/Card Reader With Key Override, Lever (Kaba® E-Plex® 5800 Series).....	1,133.36	45.34
For Bright Chrome, Bright Brass Or Satin Brass Finish, Add	17.50	
For Dark Bronze Finish With Brass Accents, Add	70.00	
For Remote Unlock, Add	83.20	
Note: Excludes momentary contact switch.		
08 71 16 00-2332 EA Twelve Button, Cylindrical Locking Device With Privacy, Electrical Pushbutton Combination Lock/Card Reader With Key Override, Lever (Kaba® E-Plex® 5800 Series).....	1,203.36	45.34
For Bright Chrome, Bright Brass Or Satin Brass Finish, Add	17.50	
For Dark Bronze Finish With Brass Accents, Add	70.00	
For Remote Unlock, Add	83.20	
Note: Excludes momentary contact switch.		
08 71 16 00-2333 EA Twelve Button, Mortise Locking Device, Electrical Pushbutton Combination Lock/Card Reader With Key Override, Lever (Kaba® E-Plex® 5800 Series).....	1,217.36	45.34
For Bright Chrome, Bright Brass Or Satin Brass Finish, Add	17.50	
For Dark Bronze Finish With Brass Accents, Add	70.00	
For Remote Unlock, Add	83.20	
Note: Excludes momentary contact switch.		
08 71 16 00-2334 EA Twelve Button, Mortise Locking Device With Deadbolt, Electrical Pushbutton Combination Lock/Card Reader With Key Override, Lever (Kaba® E-Plex® 5800 Series).....	1,238.36	45.34
For Bright Chrome, Bright Brass Or Satin Brass Finish, Add	17.50	
For Dark Bronze Finish With Brass Accents, Add	70.00	
For Remote Unlock, Add	83.20	
Note: Excludes momentary contact switch.		
08 71 16 00-2335 EA Twelve Button, Exit Trim, Electrical Pushbutton Combination Lock/Card Reader With Key Override, Lever (Kaba® E-Plex® 5800 Series).....	1,203.36	45.34
For Bright Chrome, Bright Brass Or Satin Brass Finish, Add	17.50	
For Dark Bronze Finish With Brass Accents, Add	70.00	
For Remote Unlock, Add	83.20	
Note: Excludes momentary contact switch.		
08 71 16 00-2336 Entry/Egress, Electrical Pushbutton Combination Lock/Card Readers (Kaba® E-Plex® 5886 Series) (08 71 16 00-2307)		
Note: ANSI/BHMA Grade 1. Satin chrome or black with satin chrome accents finish. Includes 3,000 access codes and 30,000 audit events.		

08 Openings**08 70 Hardware****08 71 Door Hardware**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-2337	EA		Twelve Button, Mortise Locking Device, Entry/Egress, Electrical Pushbutton Combination Lock/Card Reader With Key Override, Lever (Kaba® E-Plex® 5886 Series).....	1,609.36	45.34
			<i>For Dark Bronze Finish With Brass Accents, Add</i>	70.00	
			<i>For Bright Chrome, Bright Brass Or Satin Brass Finish, Add</i>	35.00	
08 71 16 00-2338			Stand Alone Access Controller, Electrical Pushbutton Combination Lock/Card Readers (Kaba® E-Plex® 5870 Series) (08 71 16 00-2307)		
			Note: ANSI/BHMA Grade 1. Satin chrome or black with satin chrome accents finish. Includes 3,000 access codes and 30,000 audit events.		
08 71 16 00-2339	EA		Twelve Button, Stand Alone Access Controller, Electrical Pushbutton Combination Lock/Card Reader (Kaba® E-Plex® 5870 Series).....	1,010.86	45.34
			<i>For Bright Chrome, Bright Brass Or Satin Brass Finish, Add</i>	17.50	
			<i>For Dark Bronze Finish With Brass Accents, Add</i>	70.00	
08 71 16 00-2340			Electrical Pushbutton Combination Lock Accessories (Kaba® E-Plex®) (08 71 16 00-2307)		
08 71 16 00-2341	EA		Standard Software Implementation Kit (Kaba® E-Plex®).....	495.09	
08 71 16 00-2342	EA		Enterprise Software Implementation Kit (Kaba® E-Plex®).....	635.09	
08 71 16 00-2343	EA		E-Plex General FIPS Software Implementation Kit (Kaba® E-Plex®).....	845.09	
08 71 16 00-2344	EA		USB FIPS/DESFire Card Reader/Enroller (Kaba® E-Plex®).....	251.04	
08 71 16 00-2345	EA		High Capacity Battery Kit (Kaba® E-Plex® E5x00 Series).....	76.93	
			Note: Includes 4 C-cell battery pack.		
08 71 16 00-2346	EA		12-24 VDC Power Interface Kit (Kaba® E-Plex® E5x00 Series).....	91.63	
08 71 16 00-2347			Self-Powered, Electrical Pushbutton Combination Locks (Kaba® PowerPlex® 2000 Series) (08 71 16 00-2307)		
			Note: ANSI/BHMA Grade 1. Satin chrome finish.		
08 71 16 00-2348	EA		Twelve Button, Cylindrical Locking Device, Self-Powered, Electrical Pushbutton Combination Lock, Lever (Kaba® PowerPlex® 2000 Series).....	618.86	45.34
			<i>For Satin Brass Finish, Add</i>	17.50	
			<i>For Owner Furnished Material, Deduct</i>	-437.50	
08 71 16 00-2349	EA		Twelve Button, Mortise Locking Device, Self-Powered, Electrical Pushbutton Combination Lock, Lever (Kaba® PowerPlex® 2000 Series).....	702.86	45.34
			<i>For Satin Brass Finish, Add</i>	17.50	
			<i>For Owner Furnished Material, Deduct</i>	-521.50	
08 71 16 00-2350	EA		Twelve Button, Mortise Locking Device With Deadbolt, Self-Powered, Electrical Pushbutton Combination Lock, Lever (Kaba® PowerPlex® 2000 Series).....	723.86	45.34
			<i>For Satin Brass Finish, Add</i>	17.50	
			<i>For Owner Furnished Material, Deduct</i>	-542.50	
08 71 16 00-2351	EA		Twelve Button, Exit Trim, Self-Powered, Electrical Pushbutton Combination Lock, Lever (Kaba® PowerPlex® 2000 Series).....	688.86	45.34
			<i>For Satin Brass Finish, Add</i>	17.50	
			<i>For Owner Furnished Material, Deduct</i>	-507.50	
08 71 16 00-2352	EA		Twelve Button, Cylindrical Locking Device, Self-Powered, Electrical Pushbutton Combination Lock With Key Override, Lever (Kaba® PowerPlex® 2000 Series).....	653.86	45.34
			<i>For Satin Brass Finish, Add</i>	17.50	
			<i>For Owner Furnished Material, Deduct</i>	-472.50	
08 71 16 00-2353	EA		Twelve Button, Cylindrical Locking Device With Privacy, Self-Powered, Electrical Pushbutton Combination Lock With Key Override, Lever (Kaba® PowerPlex® 2000 Series).....	723.86	45.34
			<i>For Satin Brass Finish, Add</i>	17.50	
			<i>For Owner Furnished Material, Deduct</i>	-542.50	
08 71 16 00-2354	EA		Twelve Button, Mortise Locking Device, Self-Powered, Electrical Pushbutton Combination Lock With Key Override, Lever (Kaba® PowerPlex® 2000 Series).....	737.86	45.34
			<i>For Satin Brass Finish, Add</i>	17.50	
			<i>For Owner Furnished Material, Deduct</i>	-556.50	
08 71 16 00-2355	EA		Twelve Button, Mortise Locking Device With Deadbolt, Self-Powered, Electrical Pushbutton Combination Lock With Key Override, Lever (Kaba® PowerPlex® 2000 Series).....	758.86	45.34
			<i>For Satin Brass Finish, Add</i>	17.50	
			<i>For Owner Furnished Material, Deduct</i>	-577.50	
08 71 16 00-2356	EA		Twelve Button, Exit Trim, Self-Powered, Electrical Pushbutton Combination Lock With Key Override, Lever (Kaba® PowerPlex® 2000 Series).....	723.86	45.34
			<i>For Satin Brass Finish, Add</i>	17.50	
			<i>For Owner Furnished Material, Deduct</i>	-542.50	
08 71 16 00-2357			Electrical Pushbutton Combination Locks (Schlage) (08 71 16 00-2307)		
			Note: ANSI/BHMA Grade 1. Satin chrome finish.		
08 71 16 00-2358	EA		Class 100, Cylindrical, Classroom/Storeroom, Keypad, Sparta Lever, Standalone Electronic Lock (Schlage CO100CY70KP626BD-D).....	546.79	44.92
			<i>For Owner Furnished Material, Deduct</i>	-367.11	
08 71 16 00-2359	EA		Class 200, Cylindrical, Classroom/Storeroom, Keypad, Sparta Lever, Standalone Electronic Lock (Schlage CO200CY70KP-D).....	629.21	44.92
			<i>For Owner Furnished Material, Deduct</i>	-449.53	
08 71 16 00-2360	EA		Class 200, Cylindrical, Classroom/Storeroom, Magnetic Strip + Keypad, Sparta Lever, Standalone Electronic Lock (Schlage CO200CY70MSK626).....	706.80	44.92
			<i>For Owner Furnished Material, Deduct</i>	-527.12	
08 71 16 00-2361	EA		Class 200, Cylindrical, Classroom/Storeroom, Keypad, Sparta Lever, Standalone Electronic Lock (Schlage AD200CY70KP626).....	915.51	44.92
			<i>For Owner Furnished Material, Deduct</i>	-735.83	



Openings	08	08
Hardware	08 70	
Door Hardware	08 71	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-2362	EA		Class 200, Cylindrical, Classroom/Storeroom, Magnetic Strip + Keypad, Sparta Lever, Standalone Electronic Lock (Schlage AD200CY70MKS626).....	998.46	44.92
			<i>For Owner Furnished Material, Deduct</i>	<i>-818.78</i>	
08 71 16 00-2363	EA		Class 400, Cylindrical, Classroom/Storeroom, Magnetic Strip + Keypad, Sparta Lever, Networked Wireless Electronic Lock (Schlage AD400CY70MSKSPA626).....	1,095.86	44.92
			<i>For Owner Furnished Material, Deduct</i>	<i>-916.18</i>	
08 71 16 00-2364	EA		Class 300, Cylindrical, Classroom/Storeroom, Magnetic Strip + Keypad, Sparta Lever, Networked Wireless Electronic Lock (Schlage AD300CY70MSKSPA626).....	1,009.16	44.92
			<i>For Owner Furnished Material, Deduct</i>	<i>-829.48</i>	
08 71 16 00-2365			Residential Locks And Latchsets <small>(08 71 16 00-2249)</small>		
08 71 16 00-2366	EA		Entry Lock Core Replacement, Master Keyed - Falcon Or Equal.....	47.23	
08 71 16 00-2367	EA		Deadbolt Core Replacement, Master Keyed - Falcon Or Equal.....	50.23	
08 71 16 00-2368	EA		Residential Entry Lockset With Knobs (Master Keyed).....	51.58	10.88
08 71 16 00-2369	EA		Residential Privacy Lockset With Knobs.....	50.67	10.88
08 71 16 00-2370	EA		Residential Passage Lockset With Knobs.....	50.55	10.88
08 71 16 00-2371	EA		Residential Dummy Lockset With Knobs.....	40.43	9.07
08 71 16 00-2372	EA		Residential Entry Lockset With Levers (Master Keyed).....	57.83	10.88
08 71 16 00-2373	EA		Residential Privacy Lockset With Levers.....	55.75	10.88
08 71 16 00-2374	EA		Residential Passage Lockset With Levers.....	54.25	10.88
08 71 16 00-2375	EA		Residential Dummy Lockset With Levers.....	41.15	9.07
08 71 16 00-2376			Deadbolts <small>(08 71 16 00-2249)</small>		
08 71 16 00-2377			Cylindrical Deadbolts, Grade 1, ANSI 156.5 <small>(08 71 16 00-2376)</small>		
			Note: 2-3/8" or 2-3/4" backset.		
08 71 16 00-2378	EA		Single Cylinder Deadbolt, Key One Side, Knob One Side.....	118.70	17.96
			Note: Cylindrical, ANSI Grade 1, interchangeable core, bright brass or satin chromium finish.		
			<i>For Bright Chromium Or Oiled Rubbed Bronze Finish, Add</i>	<i>4.20</i>	
08 71 16 00-2379	EA		Double Cylinder Deadbolt, Key Both Sides.....	134.90	17.96
			Note: Cylindrical, ANSI Grade 1, interchangeable core, bright brass or satin chromium finish.		
			<i>For Bright Chromium Or Oiled Rubbed Bronze Finish, Add</i>	<i>4.20</i>	
08 71 16 00-2380			Cylindrical Deadbolts, Grade 2, ANSI 156.5 <small>(08 71 16 00-2376)</small>		
			Note: 2-3/8" or 2-3/4" backset.		
08 71 16 00-2381	EA		Single Cylinder Deadbolt, Key One Side, Knob One Side.....	107.60	17.96
			Note: Cylindrical, ANSI Grade 2, interchangeable core, bright brass or satin chromium finish.		
			<i>For Bright Chromium Or Oiled Rubbed Bronze Finish, Add</i>	<i>4.20</i>	
08 71 16 00-2382	EA		Double Cylinder Deadbolt, Key Both Sides.....	125.30	17.96
			Note: Cylindrical, ANSI Grade 2, interchangeable core, bright brass or satin chromium finish.		
			<i>For Bright Chromium Or Oiled Rubbed Bronze Finish, Add</i>	<i>4.20</i>	
08 71 16 00-2383			Small Case Mortised Deadbolts, Grade 1, ANSI 156.5 <small>(08 71 16 00-2376)</small>		
			Note: Interchangeable cores with small case size, 4-1/2" x 3-1/2" nominal.		
08 71 16 00-2384	EA		Small Case Mortised Deadbolt, Key One Side, Knob One Side.....	153.47	17.96
			Note: ANSI Grade 1, interchangeable cores, all finishes. Case size 4-1/2" x 3-1/2" (nominal).		
08 71 16 00-2385	EA		Small Case Mortised Deadbolt, Key Both Sides.....	168.47	17.96
			Note: ANSI Grade 1, interchangeable cores, all finishes. Case size 4-1/2" x 3-1/2" (nominal). Also used for Classroom version.		
08 71 16 00-2386	EA		Small Case Mortised Deadbolt, Key One Side, Cover Plate One Side.....	150.47	17.96
			Note: ANSI Grade 1, interchangeable cores, all finishes. Case size 4-1/2" x 3-1/2" (nominal).		
08 71 16 00-2387			Mortised Deadbolts, Grade 1, ANSI 156.5 <small>(08 71 16 00-2376)</small>		
			Note: Interchangeable cores with standard case size, 4-1/2" x 6" nominal.		
08 71 16 00-2388	EA		Mortised Deadbolt, Key One Side, Knob One Side.....	194.27	17.96
			Note: ANSI Grade 1, interchangeable cores, all finishes. Case size 4-1/2" x 6" (nominal).		
08 71 16 00-2389	EA		Mortised Deadbolt, Key Both Sides.....	218.87	17.96
			Note: ANSI Grade 1, interchangeable cores, all finishes. Case size 4-1/2" x 6" (nominal). Also used for Classroom version.		
08 71 16 00-2390	EA		Mortised Deadbolt, Key One Side, Cover Plate One Side.....	173.27	17.96
			Note: ANSI Grade 1, interchangeable cores, all finishes. Case size 4-1/2" x 6" (nominal).		
08 71 16 00-2391			Surface Mounted Deadbolts <small>(08 71 16 00-2376)</small>		
08 71 16 00-2392	EA		Single Cylinder Surface Mounted Deadbolt.....	83.43	17.96
			Note: Key one side, knob one side, bright brass finish.		
			<i>For Brushed Chrome Finish, Add</i>	<i>10.50</i>	
08 71 16 00-2393	EA		Double Cylinder Surface Mounted Deadbolt.....	94.27	17.96
			Note: Key both sides, bright brass finish.		
			<i>For Brushed Chrome Finish, Add</i>	<i>10.50</i>	
08 71 16 00-2394	EA		Single Cylinder Surface Mounted Interlocking Deadbolt.....	102.89	17.96
			Note: Jimmy proof, key one side, knob one side, bright brass finish.		
			<i>For Brushed Chrome Finish, Add</i>	<i>10.50</i>	
08 71 16 00-2395	EA		Double Cylinder Surface Mounted Interlocking Deadbolt.....	113.73	17.96
			Note: Jimmy proof, key both sides, bright brass finish.		
			<i>For Brushed Chrome Finish, Add</i>	<i>10.50</i>	

08 Openings**08 70 Hardware****08 71 Door Hardware**

MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
08 71 16 00-2396 Surface Mounted Deadlatches (08 71 16 00-2249)					
08 71 16 00-2397	EA	Single Cylinder Surface Mounted Deadlatch Note: Key one side, knob one side, bright brass finish.	84.28		17.96
For Brushed Chrome Finish, Add			10.50		
08 71 16 00-2398	EA	Single Cylinder Surface Mounted Interlocking Deadlatch Note: Jimmy proof, key one side, knob one side, bright brass finish.	102.93		17.96
For Brushed Chrome Finish, Add			10.50		
08 71 16 00-2399 Electric Strikes (08 71 16 00-2249)					
08 71 16 00-2400	EA	Aluminum/Steel Body Electric Strike (Von Duprin 5100).....	222.09		35.94
08 71 16 00-2401	EA	Stainless Steel Body Electric Strike For Rim Mounted Lock (Von Duprin 6112).....	477.14		35.94
08 71 16 00-2402	EA	Stainless Steel Body Electric Strike (Von Duprin 6215).....	503.12		35.94
08 71 16 00-2403	EA	Dual Voltage Electric Strike, Stainless Steel Body, 12/24 Volts DC, 3,070 LB Static Strength (HES 1006)	356.07		35.94
08 71 16 00-2404	EA	Fire Rated Electric Strike, Stainless Steel Body, 12/24 Volts DC, 3,000 LB Static Strength (HES 4500)	354.05		35.94
08 71 16 00-2405	EA	Low Profile Electric Strike, Steel Body, 12/24 Volts DC, 1,500 LB Static Strength (HES 5000).....	180.15		35.94
08 71 16 00-2406	EA	Adjustable Electric Strike, Steel Body, 12/24 Volts DC, 1,500 LB Static Strength (HES 5200).....	180.15		35.94
08 71 16 00-2407	EA	Electric Strike With Preload, Stainless Steel Body, 12/24 Volts DC, 1,500 LB Static Strength, Cylindrical Or Rim Exit Device (HES 7000).....	227.38		35.94
08 71 16 00-2408	EA	Cylindrical Lock Electric Strike, Stainless Steel Body, 12/24 Volts DC, 1,500 LB Static Strength (HES 7500).....	394.44		35.94
08 71 16 00-2409	EA	Compact Concealed Electric Strike, Stainless Steel Body, 12/24 Volts DC, 1,500 LB Static Strength (HES 8000)	202.03		35.94
08 71 16 00-2410	EA	Fire Rated Compact Concealed Electric Strike, Stainless Steel Body, 12/24 Volts DC, 1,500 LB Static Strength (HES 8300).....	363.58		35.94
08 71 16 00-2411	EA	Fire Rated Concealed Electric Strike, Stainless Steel Body, 12/24 Volts DC, 1,500 LB Static Strength (HES 8500).....	322.86		35.94
08 71 16 00-2412	EA	Slim Line Surface Mounted Electric Strike, Stainless Steel Body, 12/24 Volts DC, 1,500 LB Static Strength (HES 9400)	385.22		47.43
08 71 16 00-2413	EA	Fire Rated Surface Mounted Electric Strike, Stainless Steel Body, 12/24 Volts DC, 1,500 LB Static Strength, Rim Exit Device (HES 9500).....	436.01		47.43
08 71 16 00-2414	EA	Surface Mounted Electric Strike, Stainless Steel Body, 12/24 Volts DC, 1,500 LB Static Strength, Rim Exit Device (HES 9600).....	385.49		47.43
08 71 16 00-2415 Electric Hardware (08 71 16 00-2249)					
08 71 16 00-2416	EA	Electrified Cylindrical Lock Option..... Note: Excludes the lock. This task is used in conjunction with other locks in the CTC to electrify the lock.	109.01		
08 71 16 00-2417	EA	Electrified Mortise Lock Option Note: Excludes the lock. This task is used in conjunction with other locks in the CTC to electrify the lock.	125.99		
08 71 16 00-2418	EA	24" Long, 3/8" Flexible Aluminum Conduit, Armored Power Transfer Door Loop	68.02		17.96
08 71 16 00-2419	EA	1 Amp At 12/24 Volt DC, Door Hardware Power Supply.....	208.90		17.96
08 71 16 00-2420	EA	3 Amp At 12 Volt DC, 2 Amp At 24 Volt DC, Door Hardware Power Supply.....	360.11		17.96
08 71 16 00-2421	EA	4.5 Amp At 12 Volt DC, 3 Amp At 24 Volt DC, Door Hardware Power Supply.....	549.70		17.96
08 71 16 00-2422	EA	6 Amp At 12 Volt DC, 4 Amp At 24 Volt DC, Door Hardware Power Supply.....	607.18		17.96
08 71 16 00-2423	EA	9 Amp At 12 Volt DC, 6 Amp At 24 Volt DC, Door Hardware Power Supply.....	724.43		17.96
08 71 16 00-2424	EA	15 Amp At 12 Volt DC, 10 Amp At 24 Volt DC, Door Hardware Power Supply.....	877.85		17.96
08 71 16 00-2425	EA	18" Long, 1/4" Flexible Aluminum Conduit, Armored Power Transfer Door Loop	58.13		17.96
08 71 16 00-2426	EA	24" Long, 1/4" Flexible Aluminum Conduit, Armored Power Transfer Door Loop	59.30		17.96
08 71 16 00-2427	EA	30" Long, 1/4" Flexible Aluminum Conduit, Armored Power Transfer Door Loop	66.45		17.96
08 71 16 00-2428	EA	45" Long, 1/4" Flexible Aluminum Conduit, Armored Power Transfer Door Loop	67.87		17.96
08 71 16 00-2429	EA	60" Long, 1/4" Flexible Aluminum Conduit, Armored Power Transfer Door Loop	68.59		17.96
08 71 16 00-2430	EA	72" Long, 1/4" Flexible Aluminum Conduit, Armored Power Transfer Door Loop	72.70		17.96
08 71 16 00-2431	EA	12" Long, 3/8" Flexible Aluminum Conduit, Armored Power Transfer Door Loop	58.87		17.96
08 71 16 00-2432	EA	18" Long, 3/8" Flexible Aluminum Conduit, Armored Power Transfer Door Loop	64.61		17.96
08 71 16 00-2433	EA	36" Long, 3/8" Flexible Aluminum Conduit, Armored Power Transfer Door Loop	69.15		17.96
08 71 16 00-2434	EA	49" Long, 3/8" Flexible Aluminum Conduit, Armored Power Transfer Door Loop	76.99		17.96
08 71 16 00-2435	EA	60" Long, 3/8" Flexible Aluminum Conduit, Armored Power Transfer Door Loop	79.17		17.96
08 71 16 00-2436	EA	12" Long, 1/2" Flexible Aluminum Conduit, Armored Power Transfer Door Loop	66.04		17.96
08 71 16 00-2437	EA	18" Long, 1/2" Flexible Aluminum Conduit, Armored Power Transfer Door Loop	74.07		17.96
08 71 16 00-2438	EA	18" Long, 1/4" Flexible Conduit, Stainless Steel Armored Power Transfer Door Loop	46.97		17.96
08 71 16 00-2439	EA	24" Long, 1/4" Flexible Conduit, Stainless Steel Armored Power Transfer Door Loop	53.18		17.96
08 71 16 00-2440	EA	30" Long, 1/4" Flexible Conduit, Stainless Steel Armored Power Transfer Door Loop	56.47		17.96
08 71 16 00-2441	EA	36" Long, 1/4" Flexible Conduit, Stainless Steel Armored Power Transfer Door Loop	59.98		17.96
08 71 16 00-2442	EA	60" Long, 1/4" Flexible Conduit, Stainless Steel Armored Power Transfer Door Loop	78.27		17.96
08 71 16 00-2443	EA	72" Long, 1/4" Flexible Conduit, Stainless Steel Armored Power Transfer Door Loop	85.91		17.96
08 71 16 00-2444	EA	12" Long, 3/8" Flexible Conduit, Stainless Steel Armored Power Transfer Door Loop	49.51		17.96
08 71 16 00-2445	EA	18" Long, 3/8" Flexible Conduit, Stainless Steel Armored Power Transfer Door Loop	51.90		17.96
08 71 16 00-2446	EA	24" Long, 3/8" Flexible Conduit, Stainless Steel Armored Power Transfer Door Loop	59.03		17.96
08 71 16 00-2447	EA	36" Long, 3/8" Flexible Conduit, Stainless Steel Armored Power Transfer Door Loop	70.38		17.96
08 71 16 00-2448	EA	48" Long, 3/8" Flexible Conduit, Stainless Steel Armored Power Transfer Door Loop	80.53		17.96
08 71 16 00-2449	EA	60" Long, 3/8" Flexible Conduit, Stainless Steel Armored Power Transfer Door Loop	97.19		17.96
08 71 16 00-2450	EA	12" Long, 1/2" Flexible Conduit, Stainless Steel Armored Power Transfer Door Loop	53.50		17.96
08 71 16 00-2451	EA	18" Long, 1/2" Flexible Conduit, Stainless Steel Armored Power Transfer Door Loop	57.17		17.96
08 71 16 00-2452	EA	Two 18 Gauge Wire, Door Frame To Edge Of Door Electrical Power Transfer.....	375.13		17.96
08 71 16 00-2453	EA	Ten 24 Gauge Wire, Door Frame To Edge Of Door Electrical Power Transfer.....	409.51		25.16
08 71 16 00-2454 Magnetic Locks (08 71 16 00-2249)					
08 71 16 00-2455	EA	Electromagnetic Lock, 500 lb. Holding Force, Stainless Steel (Schlage 40).....	452.74		86.25
08 71 16 00-2456	EA	Electromagnetic Lock, 500 lb. Holding Force, Stainless Steel (Schlage 40TJ).....	542.63		97.03
08 71 16 00-2457	EA	Electromagnetic Lock, 1,000 lb. Holding Force, Stainless Steel (Schlage 70).....	528.19		86.25
08 71 16 00-2458	EA	Electromagnetic Lock, 1,000 lb. Holding Force, Stainless Steel (Schlage 70TJ).....	617.92		97.03
08 71 16 00-2459	EA	Electromagnetic Lock, 500 lb. Holding Force, Aluminum (Schlage M420).....	553.09		93.43



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 16 00-2460 EA Electromagnetic Lock, 1,000 lb. Holding Force, Aluminum (Schlage M450)	604.83	93.43
08 71 16 00-2461 EA Electromagnetic Lock, 1500 lb. Holding Force, Aluminum (Schlage M490)	645.11	93.43
08 71 16 00-2462 EA Electromagnetic Lock, 500 lb. Holding Force, Aluminum (Schlage M420P)	709.20	107.81
Note: Includes magnetic bond sensor, door position switch and relock time delay.		
08 71 16 00-2463 EA Electromagnetic Lock, 1,000 lb. Holding Force, Aluminum (Schlage M450P)	777.98	107.81
Note: Includes magnetic bond sensor, door position switch and relock time delay.		
08 71 16 00-2464 EA Electromagnetic Lock, 1500 lb. Holding Force, Aluminum (Schlage M490P)	808.96	107.81
Note: Includes magnetic bond sensor, door position switch and relock time delay.		
08 71 16 00-2465 EA 2 Amp Output Current, 12-24 Volt DC, 4 Relay with Fire Alarm (Schlage PS902)	242.67	35.94
08 71 16 00-2466 EA 4 Amp Output Current, 12-24 Volt DC, 4 Relay with Fire Alarm (Schlage PS904)	397.20	35.94
08 71 16 00-2467 EA 6 Amp Output Current, 12-24 Volt DC, 4 Relay with Fire Alarm (Schlage PS906)	477.52	35.94
08 71 16 00-2468 Door Coordinators (08 71 16)		
08 71 16 00-2469 EA 32" COR Series Door Coordinator	276.12	22.46
Note: Satin chrome finish. Includes two mounting brackets.		
<i>For Anodized Aluminum Finish, Deduct</i>		
	-74.51	
08 71 16 00-2470 EA 42" COR Series Door Coordinator	289.89	23.36
Note: Satin chrome finish. Includes two mounting brackets.		
<i>For Anodized Aluminum Finish, Deduct</i>		
	-78.58	
08 71 16 00-2471 EA 52" COR Series Door Coordinator	296.92	24.26
Note: Satin chrome finish. Includes two mounting brackets.		
<i>For Anodized Aluminum Finish, Deduct</i>		
	-79.96	
08 71 16 00-2472 EA 60" COR Series Door Coordinator	309.78	25.16
Note: Satin chrome finish. Includes two mounting brackets.		
<i>For Anodized Aluminum Finish, Deduct</i>		
	-83.66	
08 71 16 00-2473 EA 72" COR Series Door Coordinator	331.76	26.05
Note: Satin chrome finish. Includes two mounting brackets.		
<i>For Anodized Aluminum Finish, Deduct</i>		
	-91.02	
08 71 16 00-2474 EA Up To 20" Filler Bar For Door Coordinator	65.74	7.18
<i>For Anodized Aluminum Finish, Deduct</i>		
	-14.80	
08 71 16 00-2475 EA Up To 32" Filler Bar For Door Coordinator	72.47	8.09
<i>For Anodized Aluminum Finish, Deduct</i>		
	-16.05	
08 71 16 00-2476 EA Up To 44" Filler Bar For Door Coordinator	83.15	8.99
<i>For Anodized Aluminum Finish, Deduct</i>		
	-18.88	
08 71 16 00-2477 EA CB1 Carry Bar For Door Coordinator	62.24	8.99
<i>For Anodized Aluminum Finish, Deduct</i>		
	-10.52	
08 71 16 00-2478 EA 7" Projection COR Series Gravity Type Door Coordinator	92.05	13.48
<i>For Anodized Aluminum Finish, Deduct</i>		
	-15.26	
08 71 16 00-2479 EA 9" Projection COR Series Gravity Type Door Coordinator	98.16	13.48
<i>For Anodized Aluminum Finish, Deduct</i>		
	-17.70	
08 71 16 00-2480 Removal And Reinstallation Of Door Hardware (08 71 16)		
Note: Includes storage and cleaning.		
08 71 16 00-2481 EA Remove And Reinstall Door Lockset, Entrance	53.90	
08 71 16 00-2482 EA Remove And Reinstall Door Lockset, Mortise	86.24	
08 71 16 00-2483 EA Remove And Reinstall Deadbolt Lock	57.50	
08 71 16 00-2484 PR Remove And Reinstall Butts/Hinges	14.38	
08 71 16 00-2485 EA Remove And Reinstall Door Bumper	5.03	
08 71 16 00-2486 EA Remove And Reinstall Surface Mounted Panic Device	143.74	
08 71 16 00-2487 EA Remove And Reinstall Kick Plate	17.96	
08 71 16 00-2488 EA Remove And Reinstall Push Plate	14.38	
08 71 16 00-2489 EA Remove And Reinstall Surface Mounted Door Closer Or Holder	71.87	
08 71 16 00-2490 EA Remove And Reinstall Door Handles	10.78	
08 71 16 00-2491 Electromagnetic Door Release (08 71 16)		
08 71 16 00-2492 EA Electro-Magnetic Door Release, Wall Mount, Surface 120 Volt AC, 24 Volt AC/DC, 12 Volt DC	337.76	45.28
08 71 16 00-2493 EA Electro-Magnetic Door Release, Wall Mount, Recessed 120 Volt AC, 24 Volt AC/DC, 12 Volt DC	330.17	45.28
08 71 16 00-2494 EA Electro-Magnetic Door Release, Wall Mount, Recessed, Adjustable 120 Volt AC, 24 Volt AC/DC, 12 Volt DC	368.44	45.28
08 71 16 00-2495 EA Electro-Magnetic Door Release, Wall Mount, Surface Or Recessed, High Hold 24 Volt AC/DC	594.31	45.28
08 71 16 00-2496 EA Electro-Magnetic Door Release, Sliding Door 24 Volt DC	574.17	45.28
08 71 16 00-2497 EA Electro-Magnetic Door Release, Overhead Door 120 Volt AC, 24 Volt AC/DC, 12 Volt DC	574.17	45.28
08 71 16 00-2498 EA Electro-Magnetic Door Release, Floor Mount, Single Door 120 Volt AC, 24 Volt AC/DC, 12 Volt DC	524.91	45.28
08 71 16 00-2499 EA Electro-Magnetic Door Release, Floor Mount, Back-to-Back Door 120 Volt AC, 24 Volt AC/DC, 12 Volt DC	649.46	45.28
08 71 16 00-2500 EA Photo Electric Smoke Detector Suitable For Door Holder Release	623.02	45.28
08 71 16 00-2501 EA Ionization Type Smoke Detector Suitable For Door Holder Release	763.14	45.28
08 71 19 Weatherstripping And Seals (08 71)		
08 71 19 00-0001 Weather-Stripping And Seals (08 71 19)		
08 71 19 00-0002 Astragals (08 71 19 00-0001)		
Note: Astragal and meeting stile seals are used to seal the gap between a pair of doors.		
08 71 19 00-0003 Adhesive Backed Astragals (08 71 19 00-0002)		
08 71 19 00-0004 LF 7/16" Width, 9/32" Height, Edge Mount, Single Fin, Adhesive Backed Flexible Astragal (Pemko S771)	2.67	0.54
08 71 19 00-0005 LF 1/2" Width, 3/16" Height, Edge Mount, Double Fin, Adhesive Backed Flexible Astragal (Pemko S772)	2.95	0.54
08 71 19 00-0006 LF 1-1/8" Width, 3/16" Height, Mullion Mount, Adhesive Backed Mullion Gasketing (Pemko 5110)	2.31	0.54

08 Openings**08 70 Hardware**

08 71 Door Hardware



MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
08 71 19 00-0007		Overlapping Astragals (08 71 19 00-0002)			
08 71 19 00-0008		Aluminum, Overlapping Astragals (08 71 19 00-0007)			
08 71 19 00-0009	LF	2" Width, 1/8" Height, Clear Anodized Aluminum, Overlapping Astragal (Pemko 357C)	11.06		3.23
		For Color Anodized Finish, Add	1.40		
08 71 19 00-0010		Stainless Steel, Overlapping Astragals (08 71 19 00-0007)			
08 71 19 00-0011	LF	2" Width, 1/8" Height, Stainless Steel, Overlapping Astragal (Pemko 357SS)	21.03		3.23
08 71 19 00-0012		"T" Astragals (08 71 19 00-0002)			
08 71 19 00-0013		Aluminum, "T" Astragals (08 71 19 00-0012)			
08 71 19 00-0014	LF	1" Width, 11/16" Height, Mill Aluminum, "T" Astragal (Pemko 359A)	7.65		3.23
		For Color Anodized Finish, Add	0.44		
08 71 19 00-0015	LF	Vinyl Insert, 3/4" Width, 1/4" Height, Mill Aluminum, "T" Astragal (Pemko 356AV)	9.29		3.23
		For Color Anodized Finish, Add	0.58		
08 71 19 00-0016	LF	Vinyl Or Pile Insert, 1-3/8" Width, 1/4" Height, Clear Anodized Aluminum, "T" Astragal (Pemko 355CP)	9.54		3.23
		For Color Anodized Finish, Add	1.10		
		For Silicone Insert, Add	0.63		
08 71 19 00-0017	LF	Neoprene Sponge Insert, 1-1/8" Width, 1/2" Height, Clear Anodized Aluminum, "T" Astragal (Pemko 352CR)	16.57		3.23
		For Color Anodized Finish, Add	3.56		
08 71 19 00-0018		Brass/Bronze, "T" Astragals (08 71 19 00-0012)			
08 71 19 00-0019	LF	Vinyl Or Pile Insert, 1-3/8" Width, 1/4" Height, Brass/Bronze, "T" Astragal (Pemko 355BP)	48.89		3.23
		For Silicone Insert, Add	0.63		
08 71 19 00-0020		Locking Astragals (08 71 19 00-0002)			
08 71 19 00-0021		Outswing Locking Astragals (08 71 19 00-0020)			
		Note: Includes two units. A housing containing the locking bolt which fastens to the inactive leaf and a "T" astragal with a seal that fastens to the active leaf.			
08 71 19 00-0022		Aluminum, Outswing Locking Astragals (08 71 19 00-0021)			
08 71 19 00-0023	LF	Slide Bolt, 1-1/4" Width, 3/8" Height, Clear Anodized Aluminum, Slimline Style, Outswing Locking Astragal (Pemko 3443CS)	21.74		3.23
		Note: Includes pile seal at inner door edge and neoprene bottom seal.			
		For Color Anodized Finish, Add	3.07		
08 71 19 00-0024	LF	Locking Springbolt, 1-1/4" Width, 3/8" Height, Clear Anodized Aluminum, Slimline Style, Outswing Locking Astragal (Pemko 3444CS)	25.03		3.23
		Note: Includes pile seal at inner door edge and neoprene bottom seal.			
		For Color Anodized Finish, Add	3.73		
08 71 19 00-0025	LF	Slide Bolt, 1-13/32" Width, 11/16" Height, Gold Anodized Aluminum, Colonial Style, Outswing Locking Astragal (Pemko 3445BDQ)	24.23		3.23
		Note: Includes pile seal at inner door edge and kerf-in foam bottom seal.			
		For Thermal Break, Add	1.07		
08 71 19 00-0026	LF	Locking Springbolt, 1-13/32" Width, 11/16" Height, Gold Anodized Aluminum, Colonial Style, Outswing Locking Astragal (Pemko 3446BDGQ)	26.90		3.23
		Note: Includes pile seal at inner door edge and kerf-in foam bottom seal.			
		For Thermal Break, Add	1.23		
08 71 19 00-0027		Inswing Locking Astragals (08 71 19 00-0020)			
		Note: Includes one unit containing the locking bolt and astragal with seal, which fastens to the inactive leaf.			
08 71 19 00-0028		Wood, Inswing Locking Astragals (08 71 19 00-0027)			
08 71 19 00-0029	LF	Flush Bolt, 1-1/4" Width, 1/2" Height, Wood, Inswing Locking Astragal (Pemko 34832)	25.23		3.23
08 71 19 00-0030	LF	Flush Bolt, 1-1/4" Width, 1-3/16" Height, Wood, Inswing Locking Astragal (Pemko 3481Q)	25.11		3.23
		Note: Includes kerf-in foam seal.			
08 71 19 00-0031		Aluminum, Inswing Locking Astragals (08 71 19 00-0027)			
08 71 19 00-0032	LF	Slide Bolt, 1-3/8" Width, 9/32" Height, Clear Anodized Aluminum, Slimline Style, Inswing Locking Astragal (Pemko 3493CV)	14.84		3.23
		Note: Includes pile seal at inner door edge and neoprene bottom seal.			
		For Silicone Insert, Add	0.63		
		For Color Anodized Finish, Add	1.69		
08 71 19 00-0033	LF	Locking Springbolt, 1-3/8" Width, 9/32" Height, Clear Anodized Aluminum, Slimline Style, Inswing Locking Astragal (Pemko 3494CV)	17.59		3.23
		Note: Includes pile seal at inner door edge and neoprene bottom seal.			
		For Silicone Insert, Add	0.63		
		For Color Anodized Finish, Add	2.24		
08 71 19 00-0034	LF	Slide Bolt, 1-13/32" Width, 3/4" Height, Clear Anodized Aluminum, Colonial Style, Inswing Locking Astragal (Pemko 3495CQ)	15.88		3.23
		Note: Includes pile seal at inner door edge and kerf-in foam bottom seal.			
		For Magnetic Kerf-In Insert, Add	0.47		
		For Color Anodized Finish, Add	1.90		



Openings	08	08
Hardware	08 70	
Door Hardware	08 71	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 19 00-0035	LF		Locking Springbolt, 1-13/32" Width, 3/4" Height, Clear Anodized Aluminum, Colonial Style, Inswing Locking Astragal (Pemko 3496CQ).....	18.61	3.23
			Note: Includes pile seal at inner door edge and kerf-in foam bottom seal.		
			For Magnetic Kerf-In Insert, Add	0.47	
			For Color Anodized Finish, Add	2.44	
08 71 19 00-0036			Security Astragals (08 71 19 00-0002)		
08 71 19 00-0037	LF		Vinyl Seal, 1/2" Thick Cam, 1-3/4" Width, Clear Anodized Aluminum, Security Astragal (Pemko 378C).....	13.93	3.23
			For Color Anodized Finish, Add	7.54	
08 71 19 00-0038	LF		2-1/4" Width, 10 Gauge Galvanized Steel, Offset Security Bar, Security Astragal (Pemko 3572SP)	22.58	3.23
08 71 19 00-0039			Meeting Stile Astragals (08 71 19 00-0002)		
08 71 19 00-0040			One Piece, Meeting Stile Astragals (08 71 19 00-0039)		
			Note: Includes an astragal for one door only.		
08 71 19 00-0041	LF		1/4" Vinyl Or Pile Insert, 5/32" Width, 13/32" Height, Surface/Mortise Mount, Clear Anodized Aluminum, One Piece, Meeting Stile Astragal (Pemko 369AP).....	9.19	3.23
			For Color Anodized Finish, Add	0.84	
08 71 19 00-0042	LF		1/4" Neoprene Loop Insert, 7/16" Width, 3/4" Height, Surface/Mortise Mount, Mill Aluminum, One Piece, Meeting Stile Astragal (Pemko 313AN)	14.27	4.81
			For Color Anodized Finish, Add	1.87	
08 71 19 00-0043	LF		9/16" Neoprene Loop Insert, 3/4" Width, 1-3/8" Height, Surface/Mortise Mount, Clear Anodized Aluminum, One Piece, Meeting Stile Astragal (Pemko 314CN)	18.34	4.81
			For Color Anodized Finish, Add	0.87	
08 71 19 00-0044	LF		15/16" Neoprene Loop Insert, 1-1/8" Width, 1-3/4" Height, Surface/Mortise Mount, Clear Anodized Aluminum, One Piece, Meeting Stile Astragal (Pemko 358CN)	18.86	4.81
			For Color Anodized Finish, Add	2.32	
08 71 19 00-0045	LF		1/8" Width, 1-1/2" Height, Side Mount, Spring Bronze, One Piece, Meeting Stile Astragal (Pemko B71).....	28.77	4.81
08 71 19 00-0046			Two Piece, Meeting Stile Split Astragals (08 71 19 00-0039)		
			Note: Includes one astragal for each door.		
08 71 19 00-0047	LF		1/4" Vinyl Insert, 13/16" Width, 1/4" Height, Face Mount, Mill Aluminum, Two Piece, Meeting Stile Split Astragals (Pemko 297AV)	11.75	4.81
			For Silicone Insert, Add	0.95	
			For Color Anodized Finish, Add	2.15	
08 71 19 00-0048	LF		1/4" Vinyl Insert, 11/16" Width, 1/4" Height, Face Mount, Mill Aluminum, Two Piece, Meeting Stile Split Astragals (Pemko 316AV)	11.75	4.81
			For Color Anodized Finish, Add	2.15	
08 71 19 00-0049	LF		1/4" Vinyl Insert, 7/8" Width, 1/4" Height, Face Mount, Mill Aluminum, Two Piece, Meeting Stile Split Astragals (Pemko 303AV)	11.75	4.81
			For Silicone Insert, Add	0.95	
			For Color Anodized Finish, Add	2.15	
08 71 19 00-0050	LF		3/8" Neoprene Insert, 7/8" Width, 3/16" Height, Face Mount, Clear Anodized Aluminum, Two Piece, Meeting Stile Split Astragals (Pemko 305CN).....	17.45	4.81
			For Silicone Insert, Add	0.63	
			For Color Anodized Finish, Add	1.57	
08 71 19 00-0051	LF		3/8" Brush Insert, 3/4" Width, 1/4" Height, Face Mount, Clear Anodized Aluminum, Two Piece, Meeting Stile Split Astragals (Pemko 18041CNC).....	14.65	4.81
			For Color Anodized Finish, Add	2.02	
08 71 19 00-0052	LF		5/8" Brush Insert, 3/4" Width, 1/4" Height, Face Mount, Clear Anodized Aluminum, Two Piece, Meeting Stile Split Astragals (Pemko 18061CNC).....	15.02	4.81
			For Color Anodized Finish, Add	2.17	
08 71 19 00-0053	LF		3/16" Vinyl Or Pile Insert, 3/4" Width, 3/8" Height, Face Mount, Clear Anodized Aluminum, Two Piece, Meeting Stile Split Astragals With Concealed Fasteners (Pemko 29310CV)	17.83	4.81
			For Color Anodized Finish, Add	4.12	
			For Silicone Insert, Add	0.95	
08 71 19 00-0054	LF		3/8" Brush Insert, 7/8" Width, 1/4" Height, Face Mount, Clear Anodized Aluminum, Two Piece, Meeting Stile Split Astragals With Concealed Fasteners (Pemko 29324CNC)	18.20	4.81
			For Color Anodized Finish, Add	3.44	
08 71 19 00-0055	LF		5/8" Brush Insert, 7/8" Width, 1/4" Height, Face Mount, Clear Anodized Aluminum, Two Piece, Meeting Stile Split Astragals With Concealed Fasteners (Pemko 29326CNC)	18.57	4.81
			For Color Anodized Finish, Add	3.59	
08 71 19 00-0056			Two Piece, Adjustable Meeting Stile Split Astragals (08 71 19 00-0039)		
			Note: Includes one astragal for each door.		
08 71 19 00-0057			Aluminum, Two Piece, Meeting Stile Adjustable Split Astragals (08 71 19 00-0056)		
08 71 19 00-0058	LF		3/8" Vinyl Or Pile Insert, 21/32" Width, 9/16" Height, Face Mount, Clear Anodized Aluminum, Two Piece, Meeting Stile Adjustable Split Astragals (Pemko 354CP).....	31.85	4.81
			For Color Anodized Finish, Add	5.56	
			For Silicone Insert, Add	0.63	
08 71 19 00-0059	LF		3/8" Vinyl Or Pile Insert, 1" Width, 9/16" Height, Face Mount, Clear Anodized Aluminum, Two Piece, Meeting Stile Adjustable Split Astragals (Pemko 351CP)	32.43	4.81
			For Silicone Insert, Add	0.63	
			For Color Anodized Finish, Add	4.57	
08 71 19 00-0060			Brass/Bronze, Two Piece, Meeting Stile Adjustable Split Astragals (08 71 19 00-0056)		
08 71 19 00-0061	LF		3/8" Vinyl Or Pile Insert, 21/32" Width, 9/16" Height, Mortise Mount, Brass/Bronze, Two Piece, Meeting Stile Adjustable Split Astragals (Pemko 354BP).....	153.56	4.81
			For Silicone Insert, Add	0.63	

08 Openings**08 70 Hardware****08 71 Door Hardware**

MINOR		TOTAL DIRECT		DEMOLITION
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST
08 71 19 00-0062	LF	3/8" Vinyl Or Pile Insert, 1" Width, 9/16" Height, Face Mount, Brass/Bronze, Two Piece, Meeting Stile Adjustable Split Astragals (Pemko 351BP).....	143.49	4.81
		<i>For Silicone Insert, Add</i>	0.63	
08 71 19 00-0063		Door Sweeps (08 71 19 00-0001)		
08 71 19 00-0064		Tack On Door Sweeps (08 71 19 00-0063)		
08 71 19 00-0065	LF	For Sealing Up To 3/4" Gap, Side Mount, Vinyl Tack On Door Sweep (Pemko V365).....	4.25	1.79
08 71 19 00-0066	LF	For Sealing Up To 5/8" Gap, Bottom Mount, Rubber Tack On Door Sweep (Pemko R364).....	4.30	1.79
08 71 19 00-0067	LF	For Sealing Up To 1-3/8" Gap, Bottom Mount, Vinyl Tack On Door Sweep (Pemko P361V).....	4.47	1.79
08 71 19 00-0068		Aluminum Retainer Door Sweeps (08 71 19 00-0063)		
08 71 19 00-0069		35 Degree, Aluminum Retainer Door Sweeps (08 71 19 00-0068) Note: The retainer mounts to the door face with the sweep positioned 35 degrees from the door. Includes clear anodized finish.		
08 71 19 00-0070	LF	5/16" Brush Insert, 35 Degree, Aluminum Retainer Door Sweep (Pemko 35041CNB).....	9.89	3.59
		<i>For Color Anodized Finish, Add</i>	1.08	
08 71 19 00-0071	LF	1/2" Brush Insert, 35 Degree, Aluminum Retainer Door Sweep (Pemko 35061CNB).....	10.17	3.59
		<i>For Color Anodized Finish, Add</i>	1.05	
08 71 19 00-0072		45 Degree, Aluminum Retainer Door Sweeps (08 71 19 00-0068) Note: The retainer mounts to the door face with the sweep positioned 45 degrees from the door. Includes clear anodized finish.		
08 71 19 00-0073	LF	1-3/4" Brush Insert, 45 Degree, Aluminum Retainer Door Sweep (Pemko 45175CNB).....	14.66	3.59
		<i>For Color Anodized Finish, Add</i>	2.99	
08 71 19 00-0074	LF	2-1/2" Brush Insert, 45 Degree, Aluminum Retainer Door Sweep (Pemko 45250CNB).....	15.78	3.59
		<i>For Color Anodized Finish, Add</i>	3.44	
08 71 19 00-0075	LF	4" Brush Insert, 45 Degree, Aluminum Retainer Door Sweep (Pemko 45400CNB).....	18.21	3.59
		<i>For Color Anodized Finish, Add</i>	4.41	
08 71 19 00-0076		90 Degree, Aluminum Retainer Door Sweeps (08 71 19 00-0068) Note: The retainer mounts to the door bottom with the sweep positioned perpendicular to the threshold. Includes clear anodized finish.		
08 71 19 00-0077	LF	3/8" Brush Insert, 90 Degree, Aluminum Retainer Door Sweep (Pemko 90041CNB).....	10.83	3.59
		<i>For Color Anodized Finish, Add</i>	0.37	
08 71 19 00-0078	LF	5/8" Brush Insert, 90 Degree, Aluminum Retainer Door Sweep (Pemko 90062CNB).....	10.73	3.59
		<i>For Color Anodized Finish, Add</i>	0.36	
08 71 19 00-0079	LF	1" Brush Insert, 90 Degree, Aluminum Retainer Door Sweep (Pemko 90100CNB).....	11.39	3.59
		<i>For Color Anodized Finish, Add</i>	1.47	
08 71 19 00-0080	LF	1-3/8" Brush Insert, 90 Degree, Aluminum Retainer Door Sweep (Pemko 90137CNB).....	11.67	3.59
		<i>For Color Anodized Finish, Add</i>	1.80	
08 71 19 00-0081	LF	7/16" Neoprene Insert, 90 Degree, Aluminum Retainer Door Sweep (Pemko 315CN).....	10.54	3.59
		<i>For Color Anodized Finish, Add</i>	0.84	
08 71 19 00-0082	LF	11/16" Neoprene Insert, 90 Degree, Aluminum Retainer Door Sweep (Pemko 368CN).....	13.16	3.59
		<i>For Color Anodized Finish, Add</i>	1.20	
08 71 19 00-0083	LF	15/16" Neoprene Insert, 90 Degree, Aluminum Retainer Door Sweep (Pemko 321CN).....	11.11	3.59
		<i>For Color Anodized Finish, Add</i>	0.79	
08 71 19 00-0084	LF	9/16" Vinyl Insert, 90 Degree, Aluminum Retainer Door Sweep (Pemko 308AV).....	8.65	3.59
		Note: Includes mill finish.		
		<i>For Color Anodized Finish, Add</i>	0.74	
08 71 19 00-0085	LF	1" Vinyl Insert, 90 Degree, Aluminum Retainer Door Sweep (Pemko 307AV).....	8.72	3.59
		Note: Includes mill finish.		
		<i>For Color Anodized Finish, Add</i>	0.77	
08 71 19 00-0086	LF	1-9/16" Vinyl Insert, 90 Degree, Aluminum Retainer Door Sweep (Pemko 56AV).....	9.52	3.59
		Note: Includes mill finish.		
		<i>For Color Anodized Finish, Add</i>	0.82	
08 71 19 00-0087		180 Degree, Aluminum Retainer Door Sweeps (08 71 19 00-0068) Note: The retainer mounts to the door face with the sweep positioned perpendicular to the threshold. Includes clear anodized finish.		
08 71 19 00-0088		180 Degree, Aluminum Retainer Door Sweeps (08 71 19 00-0087)		
08 71 19 00-0089	LF	3/8" Brush Insert, 180 Degree, Aluminum Retainer Door Sweep (Pemko 18041CNB).....	9.70	3.59
		<i>For Color Anodized Finish, Add</i>	1.01	
08 71 19 00-0090	LF	5/8" Brush Insert, 180 Degree, Aluminum Retainer Door Sweep (Pemko 18061CNB).....	9.89	3.59
		<i>For Color Anodized Finish, Add</i>	1.08	
08 71 19 00-0091	LF	1" Brush Insert, 180 Degree, Aluminum Retainer Door Sweep (Pemko 18100CNB).....	11.39	3.59
		<i>For Color Anodized Finish, Add</i>	1.47	
08 71 19 00-0092		180 Degree, Concealed Fastener, Aluminum Retainer Door Sweeps (08 71 19 00-0087)		
08 71 19 00-0093	LF	3/8" Brush Insert, 180 Degree, Concealed Fastener, Aluminum Retainer Door Sweep (Pemko 29324CNB).....	11.48	3.59
		<i>For Color Anodized Finish, Add</i>	1.72	
08 71 19 00-0094	LF	5/8" Brush Insert, 180 Degree, Concealed Fastener, Aluminum Retainer Door Sweep (Pemko 29326CNB).....	11.67	3.59
		<i>For Color Anodized Finish, Add</i>	1.80	
08 71 19 00-0095	LF	1" Brush Insert, 180 Degree, Concealed Fastener, Aluminum Retainer Door Sweep (Pemko 293100CNB).....	12.45	3.59
		<i>For Color Anodized Finish, Add</i>	2.11	



Openings	08	08
Hardware	08 70	
Door Hardware	08 71	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 19 00-0096 Mortised, Aluminum Retainer Door Sweeps <small>(08 71 19 00-0068)</small>		
Note: The retainer is mortised into the door bottom with the sweep positioned perpendicular to the threshold. Includes mill finish. Excludes mortising.		
08 71 19 00-0097 LF 1/4" Brush Insert, Mortised, Aluminum Retainer Door Sweep (Pemko 5025ASB).....	8.86	3.59
08 71 19 00-0098 LF 13/32" Brush Insert, Mortised, Aluminum Retainer Door Sweep (Pemko 5041ANB).....	8.86	3.59
08 71 19 00-0099 LF 5/8" Brush Insert, Mortised, Aluminum Retainer Door Sweep (Pemko 5061ANB).....	8.96	3.59
08 71 19 00-0100 Aluminum Retainer Door Sweeps With Rain Drip <small>(08 71 19 00-0063)</small>		
08 71 19 00-0101 90 Degree, Aluminum Retainer Door Sweeps With Rain Drip <small>(08 71 19 00-0100)</small>		
Note: The retainer mounts to the door bottom with the sweep positioned perpendicular to the threshold. Includes mill finish.		
08 71 19 00-0102 LF 1/4" Vinyl Insert, 90 Degree, Aluminum Retainer Door Sweep (Pemko 3452AV).....	8.68	3.59
For Color Anodized Finish, Add	1.05	
08 71 19 00-0103 LF 1/2" Vinyl Insert, 90 Degree, Aluminum Retainer Door Sweep (Pemko 345AV).....	9.89	3.59
For Color Anodized Finish, Add	1.08	
08 71 19 00-0104 LF 3/8" Brush Insert, 90 Degree, Aluminum Retainer Door Sweeps With Rain Drip (Pemko 3452CNB).....	10.80	3.59
Note: Includes clear anodized finish.		
For Color Anodized Finish, Add	0.72	
08 71 19 00-0105 LF 7/16" Brush Insert, 90 Degree, Aluminum Retainer Door Sweeps With Rain Drip (Pemko 345ANB).....	10.97	3.59
For Color Anodized Finish, Add	0.76	
08 71 19 00-0106 Brass/Bronze Retainer Door Sweeps <small>(08 71 19 00-0063)</small>		
08 71 19 00-0107 90 Degree, Brass/Bronze Retainer Door Sweeps <small>(08 71 19 00-0106)</small>		
Note: The retainer mounts to the door bottom with the sweep positioned perpendicular to the threshold.		
08 71 19 00-0108 LF 7/16" Neoprene Insert, 90 Degree, Brass/Bronze Retainer Door Sweep (Pemko 315BN).....	12.79	3.59
08 71 19 00-0109 Oak Retainer Door Sweeps <small>(08 71 19 00-0063)</small>		
08 71 19 00-0110 90 Degree, Oak Retainer Door Sweeps <small>(08 71 19 00-0109)</small>		
Note: The retainer mounts to the door bottom with the sweep positioned perpendicular to the threshold.		
08 71 19 00-0111 LF 9/16" Brush Insert, 90 Degree, Oak Retainer Door Sweep (Pemko 18062WNB).....	10.64	3.59
08 71 19 00-0112 LF 15/16" Brush Insert, 90 Degree, Oak Retainer Door Sweep (Pemko 18100WNB).....	12.11	3.59
08 71 19 00-0113 Door Shoes And Bottoms <small>(08 71 19 00-0001)</small>		
08 71 19 00-0114 Door Shoes <small>(08 71 19 00-0113)</small>		
08 71 19 00-0115 Aluminum Retainer Door Shoes <small>(08 71 19 00-0114)</small>		
08 71 19 00-0116 Bottom Mount, Aluminum Retainer Door Shoes <small>(08 71 19 00-0115)</small>		
08 71 19 00-0117 LF Vinyl Insert, 1-3/16" Width, Bottom Mount, Aluminum Retainer Door Shoe (Pemko 234AV).....	9.42	3.59
For Color Anodized Finish, Add	0.90	
For Thermo-Plastic Elastomer Insert, Add	0.68	
08 71 19 00-0118 LF Vinyl Insert, 1-3/8" Width, Bottom Mount, Aluminum Retainer Door Shoe (Pemko 209AV).....	9.70	3.59
For Color Anodized Finish, Add	1.01	
08 71 19 00-0119 LF Notched Vinyl Insert, 1-3/16" Width, Bottom Mount, Aluminum Retainer Door Shoe (Pemko 2343AV).....	12.41	3.59
For Color Anodized Finish, Add	1.05	
08 71 19 00-0120 Side Mount, Aluminum Retainer Door Shoes <small>(08 71 19 00-0115)</small>		
08 71 19 00-0121 LF Vinyl Insert, 1-3/4" Width, Side Mount, Aluminum Retainers Door Shoe (Pemko 318AV).....	10.64	3.59
For Color Anodized Finish, Add	1.38	
For Thermo-Plastic Elastomer Insert, Add	0.68	
08 71 19 00-0122 L Or U Shaped, Aluminum Retainer Door Shoes <small>(08 71 19 00-0115)</small>		
08 71 19 00-0123 LF Vinyl Insert, 1-1/4" Width, L-Shaped, Aluminum Retainer Door Shoe (Pemko 211AV).....	9.89	3.59
For Color Anodized Finish, Add	1.36	
For Thermo-Plastic Elastomer Insert, Add	0.42	
08 71 19 00-0124 LF Vinyl Insert, 1-3/8" Width, U-Shaped, Aluminum Retainer Door Shoe (Pemko 220AV).....	10.45	3.59
For Color Anodized Finish, Add	1.31	
For Thermo-Plastic Elastomer Insert, Add	0.42	
08 71 19 00-0125 LF Vinyl Insert, 1-3/4" Width, U-Shaped, Aluminum Retainer Door Shoe (Pemko 217AV).....	10.64	3.59
For Color Anodized Finish, Add	1.38	
For Thermo-Plastic Elastomer Insert, Add	0.42	
08 71 19 00-0126 LF Notched Vinyl Insert, 1-5/16" Width, L-Shaped, Aluminum Retainer Door Shoe (Pemko 2113AV).....	14.44	3.59
For Color Anodized Finish, Add	1.45	
08 71 19 00-0127 LF Notched Vinyl Insert, 1-3/4" Width, U-Shaped, Aluminum Retainer Door Shoe (Pemko 2173AV).....	14.63	3.59
For Color Anodized Finish, Add	1.49	
08 71 19 00-0128 L Or U Shaped With Rain Drip, Aluminum Retainer Door Shoes <small>(08 71 19 00-0115)</small>		
08 71 19 00-0129 LF Vinyl Insert, 1-1/4" Width, L-Shaped With Rain Drip, Aluminum Retainer Door Shoe (Pemko 210AV).....	10.08	3.59
For Color Anodized Finish, Add	1.45	
For Thermo-Plastic Elastomer Insert, Add	0.42	

08 Openings**08 70 Hardware****08 71 Door Hardware**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 19 00-0130 LF Vinyl Insert, 1-3/8" Width, U-Shaped With Rain Drip, Aluminum Retainer Door Shoe (Pemko 215AV).....	10.64	3.59
For Color Anodized Finish, Add	1.38	
For Thermo-Plastic Elastomer Insert, Add	0.42	
08 71 19 00-0131 LF Vinyl Insert, 1-3/4" Width, U-Shaped With Rain Drip, Aluminum Retainer Door Shoe (Pemko 216AV).....	10.73	3.59
For Color Anodized Finish, Add	1.42	
For Thermo-Plastic Elastomer Insert, Add	0.42	
08 71 19 00-0132 Vinyl Door Shoes (08 71 19 00-0114)		
08 71 19 00-0133 LF 1-3/4" Width, L-Shaped, Vinyl Door Shoe (Pemko V80).....	11.91	3.59
08 71 19 00-0134 LF 1-3/4" Width, U-Shaped, Vinyl Door Shoe (Pemko 2170DV).....	14.03	3.59
08 71 19 00-0135 Door Bottoms (08 71 19 00-0113)		
08 71 19 00-0136 Automatic Door Bottoms (08 71 19 00-0135)		
08 71 19 00-0137 Aluminum Automatic Door Bottoms (08 71 19 00-0136)		
08 71 19 00-0138 LF Sponge Neoprene Insert, 9/16" Width, 1-7/8" Height, Surface/Mortise Mount, Aluminum Retainer, Automatic Door Bottom (Pemko 4131CRL).....	19.49	3.59
For Color Anodized Finish, Add	2.46	
08 71 19 00-0139 LF Sponge Neoprene Insert, 31/32" Width, 2-1/8" Height, Surface/Mortise Mount, Aluminum Retainer, Automatic Door Bottom (Pemko 4301CRL).....	27.20	3.59
For Color Anodized Finish, Add	4.00	
08 71 19 00-0140 Door Top Protection (08 71 19 00-0001)		
08 71 19 00-0141 LF Aluminum, Door Top Cover For 1-3/8" Wood Doors (Pemko PA343).....	7.80	2.87
For Dark Bronze Or Gold Anodized Aluminum Or Painted White, Add	0.56	
08 71 19 00-0142 LF Aluminum, Door Top Cover For 1-3/4" Wood Doors (Pemko PA344).....	7.80	2.87
For Dark Bronze Or Gold Anodized Aluminum Or Painted White, Add	0.56	
08 71 19 00-0143 LF 2-1/2" Aluminum Overhead Rain Drip With Slotted Holes (Pemko 346C).....	8.88	2.87
For Dark Bronze Or Gold Anodized Aluminum Or Painted White, Add	0.86	
08 71 19 00-0144 EA For 20 Oz Copper Drip Cap For Exterior Door.....	95.49	
08 71 19 00-0145 Perimeter Gasketing Weather-Strip (08 71 19 00-0001)		
Note: Perimeter gasketing is used to seal the gap around the top and the two sides of a door assembly.		
08 71 19 00-0146 Adhesive Backed Perimeter Gasketing Weather-Strip (08 71 19 00-0145)		
08 71 19 00-0147 LF 3/8" x 3/16", Silicon Compression Bulb, Adhesive Backed Perimeter Gasketing Weather-Strip (Pemko PK33).....	2.45	1.79
For Intumescent Seal, Add	1.50	
08 71 19 00-0148 LF 1/2" x 3/16", Silicon Compression Bulb, Adhesive Backed Perimeter Gasketing Weather-Strip (Pemko PK55).....	2.48	1.79
For Intumescent Seal, Add	1.50	
08 71 19 00-0149 LF 1/2" x 1/4", Silicon Compression Bulb, Adhesive Backed Perimeter Gasketing Weather-Strip (Pemko S88).....	3.32	1.79
08 71 19 00-0150 LF 7/16" x 5/16", Silicone Single Fin, Adhesive Backed Perimeter Gasketing Weather-Strip (Pemko S44).....	2.65	1.79
08 71 19 00-0151 LF 5/16" x 1/2", Silicone Single Fin, Adhesive Backed Perimeter Gasketing Weather-Strip (Pemko S77).....	3.38	1.79
For Intumescent Seal, Add	1.50	
08 71 19 00-0152 LF 1/2" x 3/8", Silicone Triple Fin, Hospitality, Adhesive Backed Perimeter Gasketing Weather-Strip (Pemko S773).....	3.16	1.79
For Intumescent Seal, Add	1.50	
08 71 19 00-0153 LF 7/16" x 5/16", Intumescent And Silicone Single Fin, Adhesive Backed Perimeter Gasketing Weather-Strip (Pemko HSS2000xS44).....	4.06	1.79
08 71 19 00-0154 LF 1/2" x 1/4", Intumescent And Silicon Compression Bulb, Adhesive Backed Perimeter Gasketing Weather-Strip (Pemko HSS2000xS88).....	3.78	1.79
08 71 19 00-0155 Kerf-In Perimeter Gasketing Weather-Strip (08 71 19 00-0145)		
08 71 19 00-0156 LF 3/8" x 1/4" Silicone Bulb, Kerf-In Perimeter Gasketing Weather-Strip (Pemko P50).....	2.23	1.79
08 71 19 00-0157 LF 7/16" x 3/8" Silicone Bulb, Kerf-In Perimeter Gasketing Weather-Strip (Pemko S52).....	3.14	1.79
08 71 19 00-0158 LF 3/8" Foam, Kerf-In Perimeter Gasketing Weather-Strip (Pemko Q103).....	2.45	1.79
08 71 19 00-0159 LF 5/8" Foam, Kerf-In Perimeter Gasketing Weather-Strip (Pemko Q102).....	2.42	1.79
08 71 19 00-0160 LF 3/8" Magnetic, Kerf-In Perimeter Gasketing Weather-Strip (Pemko MAG349).....	3.04	1.79
08 71 19 00-0161 Cushion/Spring Perimeter Gasketing Weather-Strip (08 71 19 00-0145)		
08 71 19 00-0162 Spring Bronze Perimeter Gasketing Weather-Strip (08 71 19 00-0161)		
08 71 19 00-0163 LF 1-1/8" Spring Bronze Perimeter Gasketing Weather-Strip (Pemko B70C).....	6.34	1.79
08 71 19 00-0164 LF 1-1/4" Spring Bronze Perimeter Gasketing Weather-Strip (Pemko B70D).....	6.34	1.79
08 71 19 00-0165 LF 1-3/8" Spring Bronze Perimeter Gasketing Weather-Strip (Pemko B70E).....	6.89	1.79
08 71 19 00-0166 LF 1-1/2" Spring Bronze Perimeter Gasketing Weather-Strip (Pemko B70F).....	7.00	1.79
08 71 19 00-0167 Cushion "V", Spring Bronze Perimeter Gasketing Weather-Strip (08 71 19 00-0161)		
08 71 19 00-0168 LF 5/8" Cushion "V", Spring Bronze Perimeter Gasketing Weather-Strip (Pemko B73).....	6.04	1.79
08 71 19 00-0169 LF 7/8" Cushion "V", Spring Bronze Perimeter Gasketing Weather-Strip (Pemko B74).....	6.89	1.79
08 71 19 00-0170 LF 1-1/8" Cushion "V", Spring Bronze Perimeter Gasketing Weather-Strip (Pemko B75).....	7.81	1.79
08 71 19 00-0171 Aluminum Retainer, Perimeter Gasketing Weather-Strip (08 71 19 00-0145)		
08 71 19 00-0172 Aluminum Retainer, Perimeter Gasketing Weather-Strip (08 71 19 00-0171)		



Openings	08	08
Hardware	08 70	
Door Hardware	08 71	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 19 00-0173	LF		1/4" Vinyl Insert, 13/16" Width, 1/4" Height, Mill Aluminum Retainer, Perimeter Gasketing Weather-Strip (Pemko 297AV) <i>For Silicone Insert, Add</i> <i>For Color Anodized Finish, Add</i>	4.66 0.95 1.07	1.79
08 71 19 00-0174	LF		1/4" Vinyl Insert, 11/16" Width, 1/4" Height, Mill Aluminum Retainer, Perimeter Gasketing Weather-Strip (Pemko 316AV) <i>For Silicone Insert, Add</i> <i>For Color Anodized Finish, Add</i>	4.66 0.95 1.07	1.79
08 71 19 00-0175	LF		1/4" Vinyl Insert, 7/8" Width, 1/4" Height, Mill Aluminum Retainer, Perimeter Gasketing Weather-Strip (Pemko 303AV) <i>For Silicone Insert, Add</i> <i>For Color Anodized Finish, Add</i>	4.66 0.95 1.07	1.79
08 71 19 00-0176	LF		3/8" Neoprene Insert, 7/8" Width, 3/16" Height, Clear Anodized Aluminum Retainer, Perimeter Gasketing Weather-Strip (Pemko 305CN)..... <i>For Silicone Insert, Add</i> <i>For Color Anodized Finish, Add</i>	7.52 0.63 0.79	1.79
08 71 19 00-0177	LF		3/16" Vinyl Or Pile Insert, 3/4" Width, 3/8" Height, Clear Anodized Aluminum Retainer, Perimeter Gasketing Weather-Strip With Concealed Fasteners (Pemko 29310CV)..... <i>For Color Anodized Finish, Add</i> <i>For Silicone Insert, Add</i>	7.70 2.06 0.95	1.79
08 71 19 00-0178	LF		Neoprene Sponge Insert, 1-5/8" Width, 7/16" Height, Clear Anodized Aluminum Retainer, Perimeter Gasketing Weather-Strip (Pemko 375CR)..... <i>For Color Anodized Finish, Add</i>	7.70 1.44	1.79
08 71 19 00-0179			Heavy Duty, Aluminum Retainer, Perimeter Gasketing Weather-Strip (08 71 19 00-0171)		
08 71 19 00-0180			Standard Jamb, Heavy Duty, Aluminum Retainer, Perimeter Gasketing Weather-Strip (08 71 19 00-0179)		
08 71 19 00-0181	LF		1/4" Vinyl Insert, 1-1/2" Width, 1/4" Height, Standard Jamb, Heavy Duty, Mill Aluminum Retainer, Perimeter Gasketing Weather-Strip (Pemko 290AV) <i>For Silicone Insert, Add</i>	7.38 0.95	1.79
08 71 19 00-0182			Head Section, Heavy Duty, Aluminum Retainer, Perimeter Gasketing Weather-Strip (08 71 19 00-0179)		
08 71 19 00-0183	LF		1/4" Vinyl Insert, 1-1/2" Width, 1/4" Height, Head Section, Heavy Duty, Mill Aluminum Retainer, Perimeter Gasketing Weather-Strip (Pemko 2891AV).....	8.12	1.79
08 71 19 00-0184			Brass/Bronze Retainer, Perimeter Gasketing Weather-Strip (08 71 19 00-0145)		
08 71 19 00-0185			Brass/Bronze Retainer, Perimeter Gasketing Weather-Strip (08 71 19 00-0184)		
08 71 19 00-0186	LF		3/8" Neoprene Insert, 7/8" Width, 3/16" Height, Brass/Bronze Retainer, Perimeter Gasketing Weather-Strip (Pemko 305BR) <i>For Silicone Insert, Add</i>	20.09 1.58	1.79
08 71 19 00-0187	LF		Neoprene Sponge Insert, 1-5/8" Width, 7/16" Height, Brass/Bronze Retainer, Perimeter Gasketing Weather-Strip (Pemko 375BR).....	34.87	1.79
08 71 19 00-0188			Heavy Duty, Brass/Bronze Retainer, Perimeter Gasketing Weather-Strip (08 71 19 00-0184)		
08 71 19 00-0189			Standard Jamb, Heavy Duty, Brass/Bronze Retainer, Perimeter Gasketing Weather-Strip (08 71 19 00-0188)		
08 71 19 00-0190	LF		1/4" Vinyl Insert, 1-1/2" Width, 1/4" Height, Standard Jamb, Heavy Duty, Brass/Bronze Retainer, Perimeter Gasketing Weather-Strip (Pemko 290BV) <i>For Silicone Insert, Add</i>	29.96 0.63	1.79
08 71 19 00-0191			Aluminum Interlock, Perimeter Gasketing Weather-Strip (08 71 19 00-0145)		
08 71 19 00-0192	LF		Side Mount, Mill Aluminum, Interlock Perimeter Gasketing Weather-Strip (Pemko 335AR, 336A)..... Note: For weather-stripping latch or hinge side of door. Includes aluminum interlocking devices for door and door frame. <i>For Color Anodized Finish, Add</i>	11.05 1.55	3.59
08 71 19 00-0193	LF		Top Mount, Mill Aluminum, Interlock Perimeter Gasketing Weather-Strip (Pemko 347A, 68AR) Note: For weather-stripping the top of doors. Includes rain drip shield and aluminum interlocking devices for door and door frame. <i>For Color Anodized Finish, Add</i>	11.38 1.68	3.59
08 71 19 00-0194			Adjustable Aluminum Retainer, Perimeter Gasketing Weather-Strip (08 71 19 00-0145) Note: Seals gaps from 1/16" to 1/4".		
08 71 19 00-0195	LF		Sponge Neoprene Insert, 7/8" Width, 1-3/8" Height, Adjustable, Clear Anodized Aluminum Retainer, Stop Gasketing Weather-Strip (Pemko 350CSR) <i>For Color Anodized Finish, Add</i>	12.80 1.84	1.79
08 71 19 00-0196	LF		Sponge Neoprene Insert, 7/8" Width, 1-3/8" Height, Adjustable, Clear Anodized Aluminum Retainer, Jamb Gasketing Weather-Strip (Pemko 350CR)..... <i>For Color Anodized Finish, Add</i>	13.46 1.97	1.79
08 71 21			Thresholds (08 71)		

08 Openings**08 70 Hardware**

08 71 Door Hardware



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 21 00-0001			Thresholds <small>(08 71 21)</small> Note: Includes material, fasteners, installation, caulk and sealants.		
08 71 21 00-0002			Metal Thresholds <small>(08 71 21 00-0001)</small>		
08 71 21 00-0003			Saddle Thresholds <small>(08 71 21 00-0002)</small>		
08 71 21 00-0004			Aluminum Saddle Thresholds <small>(08 71 21 00-0003)</small> Note: Includes mill finish.		
08 71 21 00-0005			3/16" Height, Aluminum Saddle Thresholds <small>(08 71 21 00-0004)</small>		
08 71 21 00-0006	LF		2-1/4" Width, 3/16" Height, Aluminum Saddle Threshold (Pemko 173A)	17.92	5.75
			<i>For Color Anodized Finish, Add</i>	1.42	
08 71 21 00-0007			1/4" Height, Aluminum Saddle Thresholds <small>(08 71 21 00-0004)</small>		
08 71 21 00-0008	LF		3" Width, 1/4" Height, Aluminum Saddle Threshold (Pemko 151A)	19.51	5.75
			<i>For Color Anodized Finish, Add</i>	2.06	
08 71 21 00-0009	LF		4" Width, 1/4" Height, Aluminum Saddle Threshold (Pemko 270A)	23.00	7.18
			<i>For Color Anodized Finish, Add</i>	3.54	
08 71 21 00-0010	LF		5" Width, 1/4" Height, Aluminum Saddle Threshold (Pemko 271A)	31.41	7.18
			<i>For Color Anodized Finish, Add</i>	6.73	
08 71 21 00-0011	LF		6" Width, 1/4" Height, Aluminum Saddle Threshold (Pemko 272A)	26.92	7.18
			<i>For Color Anodized Finish, Add</i>	3.14	
08 71 21 00-0012	LF		7" Width, 1/4" Height, Aluminum Saddle Threshold (Pemko 276A)	30.10	7.18
			<i>For Color Anodized Finish, Add</i>	3.04	
08 71 21 00-0013	LF		8" Width, 1/4" Height, Aluminum Saddle Threshold (Pemko 2748A)	36.14	8.62
			<i>For Color Anodized Finish, Add</i>	3.65	
08 71 21 00-0014	LF		9" Width, 1/4" Height, Aluminum Saddle Threshold (Pemko 2749A)	38.29	8.62
			<i>For Color Anodized Finish, Add</i>	4.18	
08 71 21 00-0015	LF		10" Width, 1/4" Height, Aluminum Saddle Threshold (Pemko 2750A)	41.72	8.62
			<i>For Color Anodized Finish, Add</i>	5.04	
08 71 21 00-0016			5/16" Height, Aluminum Saddle Thresholds <small>(08 71 21 00-0004)</small>		
08 71 21 00-0017	LF		2-1/2" Width, 5/16" Height, Aluminum Saddle Threshold (Pemko 166A)	19.23	5.75
			<i>For Color Anodized Finish, Add</i>	1.70	
08 71 21 00-0018			1/2" Height, Aluminum Saddle Thresholds <small>(08 71 21 00-0004)</small>		
08 71 21 00-0019	LF		3" Width, 1/2" Height, Aluminum Saddle Threshold (Pemko 169A)	19.32	5.75
			<i>For Color Anodized Finish, Add</i>	2.48	
08 71 21 00-0020	LF		4" Width, 1/2" Height, Aluminum Saddle Threshold (Pemko 170A)	23.75	7.18
			<i>For Color Anodized Finish, Add</i>	4.06	
08 71 21 00-0021	LF		5" Width, 1/2" Height, Aluminum Saddle Threshold (Pemko 171A)	25.57	7.18
			<i>For Color Anodized Finish, Add</i>	3.81	
08 71 21 00-0022	LF		6" Width, 1/2" Height, Aluminum Saddle Threshold (Pemko 172A)	27.11	7.18
			<i>For Color Anodized Finish, Add</i>	3.21	
08 71 21 00-0023	LF		7" Width, 1/2" Height, Aluminum Saddle Threshold (Pemko 176A)	30.10	7.18
			<i>For Color Anodized Finish, Add</i>	3.04	
08 71 21 00-0024	LF		8" Width, 1/2" Height, Aluminum Saddle Threshold (Pemko 2548A)	37.26	8.62
			<i>For Color Anodized Finish, Add</i>	5.50	
08 71 21 00-0025	LF		9" Width, 1/2" Height, Aluminum Saddle Threshold (Pemko 2549A)	39.23	8.62
			<i>For Color Anodized Finish, Add</i>	7.07	
08 71 21 00-0026	LF		10" Width, 1/2" Height, Aluminum Saddle Threshold (Pemko 2550A)	41.19	8.62
			<i>For Color Anodized Finish, Add</i>	7.85	
08 71 21 00-0027			Brass/Bronze Saddle Thresholds <small>(08 71 21 00-0003)</small>		
08 71 21 00-0028			3/16" Height, Brass/Bronze Saddle Thresholds <small>(08 71 21 00-0027)</small>		
08 71 21 00-0029	LF		2-1/4" Width, 3/16" Height, Brass/Bronze Saddle Threshold (Pemko 173B)	59.25	5.75
08 71 21 00-0030			1/4" Height, Brass/Bronze Saddle Thresholds <small>(08 71 21 00-0027)</small>		
08 71 21 00-0031	LF		3" Width, 1/4" Height, Brass/Bronze Saddle Threshold (Pemko 151B)	93.57	5.75
08 71 21 00-0032	LF		4" Width, 1/4" Height, Brass/Bronze Saddle Threshold (Pemko 270B)	112.99	7.18
08 71 21 00-0033	LF		5" Width, 1/4" Height, Brass/Bronze Saddle Threshold (Pemko 271B)	136.75	7.18
08 71 21 00-0034	LF		6" Width, 1/4" Height, Brass/Bronze Saddle Threshold (Pemko 272B)	159.85	7.18
08 71 21 00-0035	LF		7" Width, 1/4" Height, Brass/Bronze Saddle Threshold (Pemko 276B)	186.25	7.18
08 71 21 00-0036	LF		8" Width, 1/4" Height, Brass/Bronze Saddle Threshold (Pemko 274X4B)	239.36	8.62
08 71 21 00-0037			1/2" Height, Brass/Bronze Saddle Thresholds <small>(08 71 21 00-0027)</small>		
08 71 21 00-0038	LF		4" Width, 1/2" Height, Brass/Bronze Saddle Threshold (Pemko 170B)	123.55	7.18
08 71 21 00-0039	LF		5" Width, 1/2" Height, Brass/Bronze Saddle Threshold (Pemko 171B)	149.95	7.18
08 71 21 00-0040	LF		6" Width, 1/2" Height, Brass/Bronze Saddle Threshold (Pemko 172B)	176.35	7.18
08 71 21 00-0041	LF		7" Width, 1/2" Height, Brass/Bronze Saddle Threshold (Pemko 176B)	209.35	7.18
08 71 21 00-0042	LF		8" Width, 1/2" Height, Brass/Bronze Saddle Threshold (Pemko 254X4B)	297.66	8.62
08 71 21 00-0043	LF		10" Width, 1/2" Height, Brass/Bronze Saddle Threshold (Pemko 255X5B)	282.52	8.62



Openings	08	08
Hardware	08 70	
Door Hardware	08 71	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 21 00-0044 Stainless Steel Saddle Thresholds <small>(08 71 21 00-0003)</small>		
08 71 21 00-0045 1/2" Height, Stainless Steel Saddle Thresholds <small>(08 71 21 00-0044)</small>		
08 71 21 00-0046 LF 4" Width, 1/2" Height, Stainless Steel Saddle Threshold (Pemko 175SS)	103.75	7.18
08 71 21 00-0047 LF 5" Width, 1/2" Height, Stainless Steel Saddle Threshold (Pemko 154SS)	110.35	7.18
08 71 21 00-0048 Half Saddle Thresholds <small>(08 71 21 00-0002)</small>		
08 71 21 00-0049 Aluminum Half Saddle Thresholds <small>(08 71 21 00-0048)</small>		
<i>Note: Includes mill finish.</i>		
08 71 21 00-0050 3/4" Height, Aluminum Half Saddle Thresholds <small>(08 71 21 00-0049)</small>		
08 71 21 00-0051 LF 5" Width, 3/4" Height, Aluminum Half Saddle Threshold (Pemko 1875A)	27.33	7.18
<i>For Color Anodized Finish, Add</i>	3.75	
08 71 21 00-0052 LF 7" Width, 3/4" Height, Aluminum Half Saddle Threshold (Pemko 1877A)	34.12	7.18
<i>For Color Anodized Finish, Add</i>	1.62	
08 71 21 00-0053 Offset Saddle Thresholds <small>(08 71 21 00-0002)</small>		
08 71 21 00-0054 Aluminum Offset Saddle Thresholds <small>(08 71 21 00-0053)</small>		
<i>Note: Includes mill finish.</i>		
08 71 21 00-0055 1/2" Height, Aluminum Offset Saddle Thresholds <small>(08 71 21 00-0054)</small>		
08 71 21 00-0056 LF 5-1/2" Width, 1/2" Height, 1/4" Offset, Aluminum Offset Saddle Threshold (Pemko 158A)	27.39	7.18
<i>For Color Anodized Finish, Add</i>	4.72	
08 71 21 00-0057 LF 7" Width, 1/2" Height, 1/4" Offset, Aluminum Offset Saddle Threshold (Pemko 2727A)	29.82	7.18
<i>For Color Anodized Finish, Add</i>	4.15	
08 71 21 00-0058 3/4" Height, Aluminum Offset Saddle Thresholds <small>(08 71 21 00-0054)</small>		
08 71 21 00-0059 LF 5-1/2" Width, 3/4" Height, 1/2" Offset, Aluminum Offset Saddle Threshold (Pemko 157A)	27.39	7.18
<i>For Color Anodized Finish, Add</i>	4.72	
08 71 21 00-0060 1" Height, Aluminum Offset Saddle Thresholds <small>(08 71 21 00-0054)</small>		
08 71 21 00-0061 LF 7" Width, 1" Height, 1/2" Offset, Aluminum Offset Saddle Threshold (Pemko 182A)	30.76	7.18
<i>For Color Anodized Finish, Add</i>	4.48	
08 71 21 00-0062 Modular Ramp Thresholds <small>(08 71 21 00-0001)</small>		
<i>Note: Includes mill finish.</i>		
08 71 21 00-0063 Flush, Aluminum Modular Ramp Thresholds <small>(08 71 21 00-0062)</small>		
08 71 21 00-0064 LF 6-1/8" Length, 1/2" Height, Flush, Aluminum Modular Ramp Threshold (Pemko R.5FA)	27.91	7.18
<i>For Non-Slip Surfacing, Add</i>	40.62	
08 71 21 00-0065 LF 9-1/4" Length, 3/4" Height, Flush, Aluminum Modular Ramp Threshold (Pemko R.75FA)	34.35	7.91
<i>For Non-Slip Surfacing, Add</i>	51.94	
08 71 21 00-0066 LF 12-3/8" Length, 1" Height, Flush, Aluminum Modular Ramp Threshold (Pemko R1FA)	43.18	8.98
<i>For Non-Slip Surfacing, Add</i>	70.64	
08 71 21 00-0067 LF 15-1/2" Length, 1-1/4" Height, Flush, Aluminum Modular Ramp Threshold (Pemko R1.25FA)	53.95	9.33
<i>For Non-Slip Surfacing, Add</i>	95.23	
08 71 21 00-0068 LF 18-5/8" Length, 1-1/2" Height, Flush, Aluminum Modular Ramp Threshold (Pemko R1.5FA)	62.41	10.06
<i>For Non-Slip Surfacing, Add</i>	126.90	
08 71 21 00-0069 LF 21-3/4" Length, 1-3/4" Height, Flush, Aluminum Modular Ramp Threshold (Pemko R1.75FA)	76.71	11.14
<i>For Non-Slip Surfacing, Add</i>	141.54	
08 71 21 00-0070 LF 24-7/8" Length, 2" Height, Flush, Aluminum Modular Ramp Threshold (Pemko R2FA)	85.47	12.21
<i>For Non-Slip Surfacing, Add</i>	158.70	
08 71 21 00-0071 LF 28" Length, 2-1/4" Height, Flush, Aluminum Modular Ramp Threshold (Pemko R2.25FA)	90.63	12.93
<i>For Non-Slip Surfacing, Add</i>	161.93	
08 71 21 00-0072 3-1/2" Top Plate, Offset, Aluminum Modular Ramp Thresholds <small>(08 71 21 00-0062)</small>		
08 71 21 00-0073 LF 12-3/4" Length, 1/2" Height, 3-1/2" Top Plate, Offset, Aluminum Modular Ramp Threshold (Pemko R.5OSSA)	45.76	8.98
<i>For Non-Slip Surfacing, Add</i>	75.09	
08 71 21 00-0074 LF 15-7/8" Length, 3/4" Height, 3-1/2" Top Plate, Offset, Aluminum Modular Ramp Threshold (Pemko R.75OSSA)	53.18	9.33
<i>For Non-Slip Surfacing, Add</i>	93.15	
08 71 21 00-0075 LF 18" Length, 1" Height, 3-1/2" Top Plate, Offset, Aluminum Modular Ramp Threshold (Pemko R1OSSA)	66.09	10.78
<i>For Non-Slip Surfacing, Add</i>	115.80	
08 71 21 00-0076 LF 22-1/8" Length, 1-1/4" Height, 3-1/2" Top Plate, Offset, Aluminum Modular Ramp Threshold (Pemko R1.25OSSA)	62.13	11.49
<i>For Non-Slip Surfacing, Add</i>	101.76	
08 71 21 00-0077 LF 25-1/4" Length, 1-1/2" Height, 3-1/2" Top Plate, Offset, Aluminum Modular Ramp Threshold (Pemko R1.5OSSA)	88.14	12.21
<i>For Non-Slip Surfacing, Add</i>	165.65	
08 71 21 00-0078 LF 28-3/8" Length, 1-3/4" Height, 3-1/2" Top Plate, Offset, Aluminum Modular Ramp Threshold (Pemko R1.75OSSA)	96.16	12.93
<i>For Non-Slip Surfacing, Add</i>	182.78	
08 71 21 00-0079 LF 31-1/2" Length, 2" Height, 3-1/2" Top Plate, Offset, Aluminum Modular Ramp Threshold (Pemko R2OSSA)	116.81	13.65
<i>For Non-Slip Surfacing, Add</i>	232.73	
08 71 21 00-0080 7" Top Plate, Offset, Aluminum Modular Ramp Thresholds <small>(08 71 21 00-0062)</small>		
08 71 21 00-0081 LF 16-1/4" Length, 1/2" Height, 7" Top Plate, Offset, Aluminum Modular Ramp Threshold (Pemko R.5OSA)	52.64	9.70
<i>For Non-Slip Surfacing, Add</i>	93.07	

08 Openings**08 70 Hardware**

08 71 Door Hardware



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 21 00-0082	LF		19-3/8" Length, 3/4" Height, 7" Top Plate, Offset, Aluminum Modular Ramp Threshold (Pemko R.75OSA)	61.47	10.78
			<i>For Non-Slip Surfacing, Add</i>	111.78	
08 71 21 00-0083	LF		22-1/2" Length, 1" Height, 7" Top Plate, Offset, Aluminum Modular Ramp Threshold (Pemko R1OSA)	72.95	11.49
			<i>For Non-Slip Surfacing, Add</i>	134.89	
08 71 21 00-0084	LF		25-5/8" Length, 1-1/4" Height, 7" Top Plate, Offset, Aluminum Modular Ramp Threshold (Pemko R1.25OSA)	81.42	12.21
			<i>For Non-Slip Surfacing, Add</i>	153.87	
08 71 21 00-0085	LF		28-3/4" Length, 1-1/2" Height, 7" Top Plate, Offset, Aluminum Modular Ramp Threshold (Pemko R1.5OSA)	94.99	12.93
			<i>For Non-Slip Surfacing, Add</i>	179.74	
08 71 21 00-0086	LF		31-7/8" Length, 1-3/4" Height, 7" Top Plate, Offset, Aluminum Modular Ramp Threshold (Pemko R1.75OSA)	103.03	13.65
			<i>For Non-Slip Surfacing, Add</i>	196.90	
08 71 21 00-0087	LF		35" Length, 2" Height, 7" Top Plate, Offset, Aluminum Modular Ramp Threshold (Pemko R2OSA)	118.25	14.37
			<i>For Non-Slip Surfacing, Add</i>	223.78	
08 71 21 00-0088			Accessories For Aluminum Modular Ramp Thresholds (08 71 21 00-0062)		
08 71 21 00-0089			Wings/Miter Returns For Flush, Aluminum Modular Ramp Thresholds (08 71 21 00-0088)		
08 71 21 00-0090	PR		Up To 1" Height, Wings/Miter Returns For Flush, Aluminum Modular Ramp Thresholds	118.43	8.98
			<i>For Non-Slip Surfacing, Add</i>	12.06	
08 71 21 00-0091	PR		>1" To 1-1/4" Height, Wings/Miter Returns For Flush, Aluminum Modular Ramp Thresholds	179.96	8.98
			<i>For Non-Slip Surfacing, Add</i>	19.44	
08 71 21 00-0092	PR		>1-1/4" To 2-1/4" Height, Wings/Miter Returns For Flush, Aluminum Modular Ramp Thresholds	353.85	12.57
			<i>For Non-Slip Surfacing, Add</i>	39.44	
08 71 21 00-0093			Wings/Miter Returns For Offset, Aluminum Modular Ramp Thresholds (08 71 21 00-0088)		
08 71 21 00-0094	PR		Up To 1/2" Height, Wings/Miter Returns For Offset, Aluminum Modular Ramp Thresholds	118.43	8.98
			<i>For Non-Slip Surfacing, Add</i>	12.06	
08 71 21 00-0095	PR		>1/2" To 1" Height, Wings/Miter Returns For Offset, Aluminum Modular Ramp Thresholds.....	179.96	8.98
			<i>For Non-Slip Surfacing, Add</i>	19.44	
08 71 21 00-0096	PR		>1" To 2" Height, Wings/Miter Returns For Offset, Aluminum Modular Ramp Thresholds.....	353.85	12.57
			<i>For Non-Slip Surfacing, Add</i>	39.44	
08 71 21 00-0097			Latching Panic Exit Saddle Thresholds (08 71 21 00-0001)		
			Note: Includes vinyl or pile seal.		
08 71 21 00-0098			Aluminum, Latching Panic Exit Saddle Thresholds (08 71 21 00-0097)		
			Note: Includes mill finish.		
08 71 21 00-0099			Aluminum, Latching Panic Exit Saddle Thresholds (08 71 21 00-0098)		
08 71 21 00-0100			7/8" Height, Aluminum, Latching Panic Exit Saddle Thresholds (08 71 21 00-0099)		
08 71 21 00-0101	LF		4" Width, 7/8" Height, Aluminum, Latching Panic Exit Saddle Threshold (Pemko 252X226AP)	32.25	7.18
			<i>For Color Anodized Finish, Add</i>	5.01	
			<i>For Thermoseal, Add</i>	0.63	
08 71 21 00-0102	LF		5" Width, 7/8" Height, Aluminum, Latching Panic Exit Saddle Threshold (Pemko 177AP)	27.48	7.18
			<i>For Color Anodized Finish, Add</i>	4.77	
			<i>For Thermoseal, Add</i>	0.63	
08 71 21 00-0103	LF		6" Width, 7/8" Height, Aluminum, Latching Panic Exit Saddle Threshold (Pemko 254X226AP)	35.24	7.18
			<i>For Color Anodized Finish, Add</i>	6.05	
			<i>For Thermoseal, Add</i>	0.63	
08 71 21 00-0104	LF		7" Width, 7/8" Height, Aluminum, Latching Panic Exit Saddle Threshold (Pemko 255X226AP)	36.55	7.18
			<i>For Color Anodized Finish, Add</i>	6.51	
			<i>For Thermoseal, Add</i>	0.63	
08 71 21 00-0105			1" Height, Aluminum, Latching Panic Exit Saddle Thresholds (08 71 21 00-0099)		
08 71 21 00-0106	LF		3-5/8" Width, 1" Height, Aluminum, Latching Panic Exit Saddle Threshold (Pemko 185AP)	26.36	7.18
			<i>For Color Anodized Finish, Add</i>	4.21	
			<i>For Thermoseal, Add</i>	0.63	
08 71 21 00-0107	LF		5" Width, 1" Height, Aluminum, Latching Panic Exit Saddle Threshold (Pemko 181AP)	27.67	7.18
			<i>For Color Anodized Finish, Add</i>	4.86	
			<i>For Thermoseal, Add</i>	0.63	
08 71 21 00-0108			Thermal Barrier, Aluminum, Latching Panic Exit Saddle Thresholds (08 71 21 00-0098)		
08 71 21 00-0109			7/8" Height, Thermal Barrier, Aluminum, Latching Panic Exit Saddle Thresholds (08 71 21 00-0108)		
08 71 21 00-0110	LF		4-1/8" Width, 7/8" Height, Thermal Barrier, Aluminum, Latching Panic Exit Saddle Threshold (Pemko 252X226AFGP)	29.07	7.18
			<i>For Color Anodized Finish, Add</i>	4.45	
			<i>For Thermoseal, Add</i>	0.63	
08 71 21 00-0111	LF		5-1/8" Width, 7/8" Height, Thermal Barrier, Aluminum, Latching Panic Exit Saddle Threshold (Pemko 253X226AFGP)	30.29	7.18
			<i>For Color Anodized Finish, Add</i>	4.94	
			<i>For Thermoseal, Add</i>	0.63	
08 71 21 00-0112	LF		6-1/8" Width, 7/8" Height, Thermal Barrier, Aluminum, Latching Panic Exit Saddle Threshold (Pemko 254X226AFGP)	32.06	7.18
			<i>For Color Anodized Finish, Add</i>	4.94	
			<i>For Thermoseal, Add</i>	0.63	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 21 00-0113	LF		7-1/8" Width, 7/8" Height, Thermal Barrier, Aluminum, Latching Panic Exit Saddle Threshold (Pemko 255X226AFGP).....	34.07	7.18
			<i>For Color Anodized Finish, Add</i>	5.64	
			<i>For Thermoseal, Add</i>	0.63	
08 71 21 00-0114			Brass/Bronze, Latching Panic Exit Saddle Thresholds (08 71 21 00-0097)		
08 71 21 00-0115			Brass/Bronze, Latching Panic Exit Saddle Thresholds (08 71 21 00-0114)		
08 71 21 00-0116			7/8" Height, Brass/Bronze, Latching Panic Exit Saddle Thresholds (08 71 21 00-0115)		
08 71 21 00-0117	LF		4" Width, 7/8" Height, Brass/Bronze, Latching Panic Exit Saddle Threshold (Pemko 252X226BV).....	177.67	7.18
			<i>For Thermoseal, Add</i>	0.63	
08 71 21 00-0118	LF		5" Width, 7/8" Height, Brass/Bronze, Latching Panic Exit Saddle Threshold (Pemko 177BV).....	164.47	7.18
			<i>For Thermoseal, Add</i>	0.63	
08 71 21 00-0119	LF		6" Width, 7/8" Height, Brass/Bronze, Latching Panic Exit Saddle Threshold (Pemko 254X226BV).....	238.39	7.18
			<i>For Thermoseal, Add</i>	0.63	
08 71 21 00-0120	LF		7" Width, 7/8" Height, Brass/Bronze, Latching Panic Exit Saddle Threshold (Pemko 255X226BV).....	212.78	7.18
			<i>For Thermoseal, Add</i>	0.63	
08 71 21 00-0121			1" Height, Brass/Bronze, Latching Panic Exit Saddle Thresholds (08 71 21 00-0115)		
08 71 21 00-0122	LF		5" Width, 1" Height, Brass/Bronze, Latching Panic Exit Saddle Threshold (Pemko 181BV).....	174.77	7.18
			<i>For Thermoseal, Add</i>	0.63	
08 71 21 00-0123			Thermal Barrier, Brass/Bronze, Latching Panic Exit Saddle Thresholds (08 71 21 00-0114)		
08 71 21 00-0124			7/8" Height, Thermal Barrier, Brass/Bronze, Latching Panic Exit Saddle Thresholds (08 71 21 00-0123)		
08 71 21 00-0125	LF		4-1/8" Width, 7/8" Height, Thermal Barrier, Brass/Bronze, Latching Panic Exit Saddle Threshold (Pemko 252X226BFGV).....	179.45	7.91
			<i>For Thermoseal, Add</i>	0.63	
08 71 21 00-0126	LF		5-1/8" Width, 7/8" Height, Thermal Barrier, Brass/Bronze, Latching Panic Exit Saddle Threshold (Pemko 253X226BFGV).....	188.55	7.91
			<i>For Thermoseal, Add</i>	0.63	
08 71 21 00-0127	LF		6-1/8" Width, 7/8" Height, Thermal Barrier, Brass/Bronze, Latching Panic Exit Saddle Threshold (Pemko 254X226BFGV).....	237.79	7.91
			<i>For Thermoseal, Add</i>	0.63	
08 71 21 00-0128	LF		7-1/8" Width, 7/8" Height, Thermal Barrier, Brass/Bronze, Latching Panic Exit Saddle Threshold (Pemko 255X226BFGV).....	215.65	8.26
			<i>For Thermoseal, Add</i>	0.63	
08 71 21 00-0129			Carpet Separator Thresholds (08 71 21 00-0001)		
08 71 21 00-0130			Aluminum, Carpet Separator Thresholds (08 71 21 00-0129) Note: Includes mill finish.		
08 71 21 00-0131			3/8" Height, Aluminum, Carpet Separator Thresholds (08 71 21 00-0130)		
08 71 21 00-0132	LF		2-1/2" Width, 3/8" Height, Aluminum, Carpet Separator Threshold (Pemko 174C).....	20.07	5.75
			<i>For Color Anodized Finish, Add</i>	2.28	
08 71 21 00-0133			7/16" Height, Aluminum, Carpet Separator Thresholds (08 71 21 00-0130)		
08 71 21 00-0134	LF		1-3/4" Width, 7/16" Height, Aluminum, Carpet Separator Threshold (Pemko 236A).....	16.50	5.03
			<i>For Color Anodized Finish, Add</i>	1.38	
08 71 21 00-0135	LF		4" Width, 7/16" Height, Aluminum, Carpet Separator Threshold (Pemko 2364A).....	24.96	5.75
			<i>For Color Anodized Finish, Add</i>	2.80	
08 71 21 00-0136	LF		6" Width, 7/16" Height, Aluminum, Carpet Separator Threshold (Pemko 2366A).....	28.89	5.75
			<i>For Color Anodized Finish, Add</i>	4.38	
08 71 21 00-0137			1/2" Height, Aluminum, Carpet Separator Thresholds (08 71 21 00-0130)		
08 71 21 00-0138	LF		1-3/8" Width, 1/2" Height, Aluminum, Carpet Separator Threshold (Pemko 1951A).....	15.28	5.03
			<i>For Color Anodized Finish, Add</i>	0.68	
08 71 21 00-0139			3/4" Height, Aluminum, Carpet Separator Thresholds (08 71 21 00-0130)		
08 71 21 00-0140	LF		1-3/4" Width, 3/4" Height, Aluminum, Carpet Separator Threshold (Pemko 246A).....	16.50	5.03
			<i>For Color Anodized Finish, Add</i>	1.18	
08 71 21 00-0141	LF		3" Width, 3/4" Height, Aluminum, Carpet Separator Threshold (Pemko 230A).....	25.24	7.18
			<i>For Color Anodized Finish, Add</i>	2.92	
08 71 21 00-0142	LF		4" Width, 3/4" Height, Aluminum, Carpet Separator Threshold (Pemko 2464A).....	26.36	7.18
			<i>For Color Anodized Finish, Add</i>	2.52	
08 71 21 00-0143			Brass/Bronze, Carpet Separator Thresholds (08 71 21 00-0129)		
08 71 21 00-0144			3/8" Height, Brass/Bronze, Carpet Separator Thresholds (08 71 21 00-0143)		
08 71 21 00-0145	LF		2-1/2" Width, 3/8" Height, Brass/Bronze, Carpet Separator Threshold (Pemko 174B).....	95.02	5.75

08	Openings
08 70	Hardware
08 71	Door Hardware



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 21 00-0146			7/16" Height, Brass/Bronze, Carpet Separator Thresholds (08 71 21 00-0143)		
08 71 21 00-0147	LF		1-3/4" Width, 7/16" Height, Brass/Bronze, Carpet Separator Threshold (Pemko 236B)	126.91	5.03
08 71 21 00-0148	LF		4" Width, 7/16" Height, Brass/Bronze, Carpet Separator Threshold (Pemko 2364B)	113.65	7.18
08 71 21 00-0149			Vinyl Transition Thresholds (08 71 21 00-0001) Note: Serves as a transition where carpet meets carpet, tile, VCT or concrete beneath a door.		
08 71 21 00-0150			Carpet To Carpet, Vinyl Transition Thresholds (08 71 21 00-0149) Note: Serves as a transition where carpet meets carpet beneath a door.		
08 71 21 00-0151	LF		2-3/4" Width, 23/32" Height, Carpet To Carpet, Vinyl Transition Threshold (Pemko V232BL).....	23.50	5.75
08 71 21 00-0152			Carpet To Tile, Vinyl Transition Thresholds (08 71 21 00-0149) Note: Serves as a transition where carpet meets tile beneath a door.		
08 71 21 00-0153	LF		2-3/4" Width, 23/32" Height, Carpet To Tile, Vinyl Transition Threshold (Pemko V2325BL).....	23.50	5.75
08 71 21 00-0154			Carpet To Concrete, Vinyl Transition Thresholds (08 71 21 00-0149) Note: Serves as a transition where carpet meets concrete beneath a door.		
08 71 21 00-0155	LF		3-1/2" Width, 23/32" Height, Carpet To Concrete, Vinyl Transition Threshold (Pemko V2320BL).....	25.72	7.18
08 71 21 00-0156			Carpet To VCT Tile, Vinyl Transition Thresholds (08 71 21 00-0149) Note: Serves as a transition where carpet meets VCT Tile beneath a door.		
08 71 21 00-0157	LF		3-7/16" Width, 23/32" Height, Carpet To VCT Tile, Vinyl Transition Threshold (Pemko V2322BL).....	27.23	7.18
08 71 21 00-0158			Residential Thresholds (08 71 21 00-0001)		
08 71 21 00-0159			Wood Residential Thresholds (08 71 21 00-0158)		
08 71 21 00-0160	LF		1-1/4" Width, 1/4" Height, Oak Residential Threshold (Pemko 2219W).....	10.69	3.59
08 71 21 00-0161	LF		1-3/4" Width, 5/16" Height, Oak Residential Threshold (Pemko 2175W).....	11.01	3.59
08 71 21 00-0162	LF		3" Width, 3/8" Height, Oak Residential Threshold (Pemko 2300W).....	14.32	3.83
08 71 21 00-0163	LF		3-1/2" Width, 1/2" Height, Oak Residential Threshold (Pemko 2350W).....	14.58	3.97
08 71 21 00-0164	LF		5" Width, 1/2" Height, Oak Residential Threshold (Pemko 2500W).....	21.10	4.08
08 71 21 00-0165			Vinyl Top, Wood Residential Thresholds (08 71 21 00-0158)		
08 71 21 00-0166	LF		1-5/8" Width, 15/16" Height, Vinyl Top, Wood Residential Threshold (Pemko 208OAK).....	12.41	3.59
08 71 21 00-0167	LF		3-1/2" Width, 1-1/8" Height, Vinyl Top, Wood Residential Threshold (Pemko 203OAK).....	14.86	3.97
08 71 21 00-0168	LF		3-5/8" Width, 1-3/8" Height, Vinyl Top, Wood Residential Threshold (Pemko 204OAK).....	25.80	3.97
08 71 21 00-0169			Vinyl Top, Aluminum Residential Thresholds (08 71 21 00-0158)		
08 71 21 00-0170	LF		1-3/8" Width, 1/2" Height, Vinyl Top, Aluminum Residential Threshold (Pemko 208AV).....	12.44	3.59
			<i>For Color Anodized Finish, Add</i>	1.38	
08 71 21 00-0171	LF		3-1/4" Width, 3/4" Height, Vinyl Top, Aluminum Residential Threshold (Pemko 206AV).....	14.40	3.97
			<i>For Color Anodized Finish, Add</i>	1.80	
08 71 21 00-0172	LF		3-1/2" Width, 1-1/8" Height, Vinyl Top, Aluminum Residential Threshold (Pemko 207AV).....	15.14	3.97
			<i>For Color Anodized Finish, Add</i>	2.09	
08 71 21 00-0173			Interlocking Residential Thresholds (08 71 21 00-0158)		
08 71 21 00-0174			Aluminum Interlocking Residential Thresholds (08 71 21 00-0173)		
08 71 21 00-0175			1/2" Height, Aluminum Interlocking Residential Thresholds (08 71 21 00-0174)		
08 71 21 00-0176	LF		4-1/4" Width, 1/2" Height, Aluminum Interlocking Residential Threshold (Pemko 114A).....	25.44	4.08
			<i>For Color Anodized Finish, Add</i>	4.57	
08 71 21 00-0177			5/8" Height, Aluminum Interlocking Residential Thresholds (08 71 21 00-0174)		
08 71 21 00-0178	LF		3" Width, 5/8" Height, Aluminum Interlocking Residential Threshold (Pemko 121A).....	17.50	3.83
			<i>For Color Anodized Finish, Add</i>	2.38	
08 71 21 00-0179	LF		3-1/2" Width, 5/8" Height, Aluminum Interlocking Residential Threshold (Pemko 110A).....	16.17	3.97
			<i>For Color Anodized Finish, Add</i>	3.13	
08 71 21 00-0180	LF		4-1/4" Width, 5/8" Height, Aluminum Interlocking Residential Threshold (Pemko 115A).....	18.52	4.08
			<i>For Color Anodized Finish, Add</i>	2.50	
08 71 21 00-0181			7/8" Height, Aluminum Interlocking Residential Thresholds (08 71 21 00-0174)		
08 71 21 00-0182	LF		4-1/2" Width, 7/8" Height, Aluminum Interlocking Residential Threshold (Pemko 120A).....	20.01	4.08
			<i>For Color Anodized Finish, Add</i>	4.91	
08 71 21 00-0183			Brass/Bronze Interlocking Residential Thresholds (08 71 21 00-0173)		
08 71 21 00-0184			1/2" Height, Brass/Bronze Interlocking Residential Thresholds (08 71 21 00-0183)		
08 71 21 00-0185	LF		4-1/4" Width, 1/2" Height, Brass/Bronze Interlocking Residential Threshold (Pemko 114B).....	132.30	4.08



Openings	08	08
Hardware	08 70	
Door Hardware	08 71	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 71 21 00-0186 5/8" Height, Brass/Bronze Interlocking Residential Thresholds <small>(08 71 21 00-0183)</small>		
08 71 21 00-0187 LF 3-1/2" Width, 5/8" Height, Brass/Bronze Interlocking Residential Threshold (Pemko 110B)	99.01	3.97
08 71 21 00-0188 7/8" Height, Brass/Bronze Interlocking Residential Thresholds <small>(08 71 21 00-0183)</small>		
08 71 21 00-0189 LF 4-1/2" Width, 7/8" Height, Brass/Bronze Interlocking Residential Threshold (Pemko 120B)	135.60	4.08
08 71 21 00-0190 LF 5-3/4" Width, 7/8" Height, 3/4" Offset, Brass/Bronze Interlocking Residential Threshold (Pemko 123B)	195.29	4.20
08 71 21 00-0191 Residential Door Sills <small>(08 71 21 00-0001)</small>		
08 71 21 00-0192 Fixed Aluminum Residential Door Sills <small>(08 71 21 00-0191)</small>		
08 71 21 00-0193 LF 4-9/16" Width, 1-1/4" Height, Fixed Aluminum Residential Door Sill (Pemko 84514A)	15.53	4.08
For Color Anodized Finish, Add	2.67	
08 71 21 00-0194 LF 5-5/8" Width, 1-1/4" Height, Fixed Aluminum Residential Door Sill (Pemko 85514A)	16.55	4.20
For Color Anodized Finish, Add	2.42	
08 71 21 00-0195 Adjustable Aluminum Top, Aluminum Residential Door Sills <small>(08 71 21 00-0191)</small>		
08 71 21 00-0196 LF 4-7/8" Width, 1-1/8" To 1-3/8" Height, Adjustable Aluminum Top, Aluminum Residential Door Sill (Pemko 94518A)	21.24	4.08
For Color Anodized Finish, Add	3.86	
08 71 21 00-0197 LF 5-3/4" Width, 1-1/8" To 1-3/8" Height, Adjustable Aluminum Top, Aluminum Residential Door Sill (Pemko 95518A)	21.80	4.20
For Color Anodized Finish, Add	3.96	
08 71 21 00-0198 Adjustable Wood Top, Aluminum Residential Door Sills <small>(08 71 21 00-0191)</small>		
08 71 21 00-0199 LF 3-3/4" Width, 1-1/8" To 1-3/8" Height, Adjustable Aluminum Top, Aluminum Residential Door Sill (Pemko 93518AW)	21.39	3.97
For Color Anodized Finish, Add	4.02	
08 71 21 00-0200 LF 4-7/8" Width, 1-1/8" To 1-3/8" Height, Adjustable Aluminum Top, Aluminum Residential Door Sill (Pemko 94518AW)	21.69	4.08
For Color Anodized Finish, Add	2.87	
08 71 21 00-0201 LF 5-3/4" Width, 1-1/8" To 1-3/8" Height, Adjustable Aluminum Top, Aluminum Residential Door Sill (Pemko 95518AW)	22.60	4.20
For Color Anodized Finish, Add	3.03	
08 71 21 00-0202 Extenders For Aluminum Residential Door Sills <small>(08 71 21 00-0191)</small>		
08 71 21 00-0203 LF 3/4" Extender For Aluminum Residential Door Sills (Pemko EXT3/4A)	9.52	3.59
For Color Anodized Finish, Add	1.64	
08 71 21 00-0204 LF 2" Extender For Aluminum Residential Door Sills (Pemko EXT2A)	10.26	3.59
For Color Anodized Finish, Add	1.54	
08 71 21 00-0205 LF 3" Extender For Aluminum Residential Door Sills (Pemko EXT3A)	11.01	3.59
For Color Anodized Finish, Add	0.96	
08 71 21 00-0206 Stone Thresholds <small>(08 71 21 00-0001)</small>		
08 71 21 00-0207 Marble Thresholds <small>(08 71 21 00-0206)</small>		
08 71 21 00-0208 LF 2" Width, 5/8" Height, Plain Marble Threshold	13.42	5.41
08 71 21 00-0209 LF 4" Width, 5/8" Height, Plain Marble Threshold	14.42	5.41
08 71 21 00-0210 LF 6" Width, 5/8" Height, Plain Marble Threshold	15.75	5.41
08 71 21 00-0211 LF 4" Width, 7/8" Height, Plain Marble Threshold	18.78	5.41
08 71 21 00-0212 LF 6" Width, 7/8" Height, Plain Marble Threshold	22.30	5.41
08 71 21 00-0213 Corian Thresholds <small>(08 71 21 00-0206)</small>		
08 71 21 00-0214 LF Up To 5-3/4" Width, Corian Threshold	47.28	5.96
08 71 53 Security Door Hardware <small>(08 71)</small>		
08 71 53 00-0001 Door Exit Alarm Hardware <small>(08 71 53)</small>		
08 71 53 00-0002 EA Door Or Wall Mount Exit Alarm, Audible Alarm, 9 Volt Battery Back-up (Detex EAX-500)	201.74	26.95
08 71 53 00-0003 EA Weatherized Door Or Wall Mount Exit Alarm, Audible Alarm, 9 Volt Battery Back-up (Detex EAX-500W)	276.46	26.95
08 71 53 00-0004 EA Door Or Wall Mount Exit Alarm, Audible Alarm, 9 Volt Battery Back-up (Detex EAX-300)	233.66	26.95
Note: Door propped alarm for applications where doors may be used for egress or ingress, but may not be held or propped open. Door open times from 1 second to 4 minutes (15 second default) are field selectable.		
08 71 53 00-0005 EA Weatherized Door Or Wall Mount Exit Alarm, Audible Alarm, 9 Volt Battery Back-up (Detex EAX-300W)	299.74	26.95
Note: Door propped alarm for applications where doors may be used for egress or ingress, but may not be held or propped open. Door open times from 1 second to 4 minutes (15 second default) are field selectable.		
08 71 53 00-0006 EA Wall Mount Exit Alarm, Audible Alarm, AC/DC (Detex EAX-2500)	349.43	35.94
08 71 53 00-0007 EA Surface Mounted Magnetic Switch (Detex MS-1039S or MS-1059S)	62.29	35.94
Note: For use with Detex EAX exit alarms.		
08 74 Access Control Hardware <small>(08 70)</small>		
08 74 16 Keypad Access Control Hardware <small>(08 74)</small>		
08 74 16 00-0001 Vindicator Security Alarm System <small>(08 74 16)</small>		

08	Openings
08 70	Hardware
08 74	Access Control Hardware



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 74 16 00-0002 EA Switch, Balanced Magnetic Door (Security) Vindicator #192-30894-00.....	953.97	167.70
08 74 16 00-0003 EA Detector, Passive Infrared (Security) Vindicator #316-30812-00.....	1,203.84	217.97
08 74 16 00-0004 EA Premise Control Unit (Security) Vindicator #548-32004-01.....	6,079.71	477.76
08 74 16 00-0005 EA Access Manager (Security Key Pad) Vindicator #548-31894-01.....	2,858.42	407.14
08 74 16 00-0006 EA ALS Duress Switch (Security) Vindicator #192-30810-00.....	789.12	222.71

08 75 Window Hardware (08 70)

08 75 00 00-0001	Window Opener Electric, With 1/2 HP Motor <small>(08 75)</small>		
08 75 00 00-0002 EA Gym Window Electronic Opener.....	1,176.30	153.08	

08 79 Hardware Accessories (08 70)

08 79 00 00-0001	Pad Locks <small>(08 79)</small>		
08 79 00 00-0002 EA Combination Padlock.....	14.58	3.60	
08 79 00 00-0003 EA Resetttable Combination Padlock With Control Key, 4 Digit, 2" Wide Case, 1" Shackle Height.....	33.55	3.60	
08 79 00 00-0004 EA Resetttable Combination Padlock, 4 Digit, 2" Wide Case, 1" Shackle Height.....	30.98	3.60	
08 79 00 00-0005 EA Resetttable Combination Padlock, 4 Digit, 2" Wide Case, 2-1/4" Shackle Height.....	34.17	3.60	
08 79 00 00-0006 EA Commercial U-Bar Lock.....	41.53	3.60	
08 79 00 00-0007 EA Weather Tough Padlocks Keyed Alike.....	34.81	3.60	
08 79 00 00-0008 EA High Security Padlocks.....	31.40	3.60	
08 79 00 00-0009 EA Standard Key, Medium Security Padlock Keyed Alike.....	16.45	3.60	

08 79 00 00-0010 Key Cabinet (08 79)

08 79 00 00-0011	Key Cabinets <small>(08 79 00 00-0010)</small>		
08 79 00 00-0012 EA Wall Mounted Key Cabinet, Up To 30 Keys.....	272.36	12.93	
08 79 00 00-0013 EA Wall Mounted Key Cabinet, Up To 60 Keys.....	367.37	14.37	
08 79 00 00-0014 EA Wall Mounted Key Cabinet, Up To 240 Keys.....	823.36	21.55	
08 79 00 00-0015 EA Wall Mounted Key Cabinet, Up To 1,200 Keys.....	2,119.43	28.74	
08 79 00 00-0016 EA Drawer Type Key Cabinet, Up To 600 Keys.....	2,260.42	19.03	
08 79 00 00-0017 EA Drawer Type Key Cabinet, Up To 2,400 Keys.....	5,103.50	14.37	
08 79 00 00-0018 EA Tray Type Key Cabinet, Up To 20 Keys.....	114.59	5.75	
08 79 00 00-0019 EA Tray Type Key Cabinet, Up To 50 Keys.....	163.29	7.18	

08 79 00 00-0020 Key Boxes Wall Mounted On Any Type Wall, With Anchor (08 79 00 00-0010)

08 79 00 00-0021 EA Key Box, Metal, 30 Key Hooks, Key Lock Door 3" Deep x 10" Wide x 12" High.....	156.73	10.78	
08 79 00 00-0022 EA Key Box, Metal, 60 Key Hooks, Key Lock Door, 3" Deep x 10" Wide x 12" High.....	177.35	10.78	
08 79 00 00-0023 EA Relocate Key Box, Metal, 3" Deep x 10" Wide x 12" High, Including Storage And Cleaning.....	36.65		
08 79 00 00-0024 EA Relocate Heavy Duty Key Box, With Combo Lock Door, Including Storage And Cleaning.....	82.65		

08 80 Glazing (08)

Note: Includes neoprene setting blocks and spacers and elastomeric sealants for all glazing tasks. Demolition for all glazing includes removal of glazing (broken or whole), sealant compound and/or astragal, taking down and resetting mullion where necessary.

08 81 Glass Glazing (08 80)

08 81 23 Factory Installed Glass (08 81)

08 81 23 00-0001	Clear Float Factory Installed Glass <small>(08 81 23)</small>		
08 81 23 00-0002	Clear Float Factory Installed Glass <small>(08 81 23 00-0001)</small>		
	Note: Type I, Class I, Quality Q3.		
08 81 23 00-0003 SF 1/8" Thick, Clear Float Factory Installed Glass.....	1.80		
For >50 To 200, Deduct	-0.05		
For >200 To 400, Deduct	-0.11		
For >400, Deduct	-0.16		
For Tinted Glass, Add	0.45		
For Reflective Coated Glass, Add	0.81		
For Low-E Coated Glass, Add	0.45		
08 81 23 00-0004 SF 3/16" Thick, Clear Float Factory Installed Glass.....	1.93		
For >50 To 200, Deduct	-0.06		
For >200 To 400, Deduct	-0.12		
For >400, Deduct	-0.17		
For Tinted Glass, Add	0.48		
For Reflective Coated Glass, Add	0.87		
For Low-E Coated Glass, Add	0.48		
08 81 23 00-0005 SF 1/4" Thick, Clear Float Factory Installed Glass.....	2.34		
For >50 To 200, Deduct	-0.07		
For >200 To 400, Deduct	-0.14		
For >400, Deduct	-0.21		
For Tinted Glass, Add	0.59		
For Reflective Coated Glass, Add	1.05		
For Low-E Coated Glass, Add	0.59		



Openings	08	08
Glazing	08 80	
Glass Glazing	08 81	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 81 23 00-0006 SF 5/16" Thick, Clear Float Factory Installed Glass	3.89	
For >50 To 200, Deduct	-0.12	
For >200 To 400, Deduct	-0.23	
For >400, Deduct	-0.35	
For Tinted Glass, Add	0.97	
For Reflective Coated Glass, Add	1.75	
For Low-E Coated Glass, Add	0.97	
08 81 23 00-0007 SF 3/8" Thick, Clear Float Factory Installed Glass	5.66	
For >50 To 200, Deduct	-0.17	
For >200 To 400, Deduct	-0.34	
For >400, Deduct	-0.51	
For Tinted Glass, Add	1.42	
For Reflective Coated Glass, Add	2.55	
For Low-E Coated Glass, Add	1.42	
08 81 23 00-0008 SF 1/2" Thick, Clear Float Factory Installed Glass	6.22	
For >50 To 200, Deduct	-0.19	
For >200 To 400, Deduct	-0.37	
For >400, Deduct	-0.56	
For Tinted Glass, Add	1.56	
For Reflective Coated Glass, Add	2.80	
For Low-E Coated Glass, Add	1.56	
08 81 23 00-0009 SF 5/8" Thick, Clear Float Factory Installed Glass	7.44	
For >50 To 200, Deduct	-0.22	
For >200 To 400, Deduct	-0.45	
For >400, Deduct	-0.67	
For Tinted Glass, Add	1.86	
For Reflective Coated Glass, Add	3.35	
For Low-E Coated Glass, Add	1.86	
08 81 23 00-0010 SF 3/4" Thick, Clear Float Factory Installed Glass	9.19	
For >50 To 200, Deduct	-0.28	
For >200 To 400, Deduct	-0.55	
For >400, Deduct	-0.83	
For Tinted Glass, Add	2.30	
For Reflective Coated Glass, Add	4.14	
For Low-E Coated Glass, Add	2.30	
08 81 23 00-0011 Heat Treated Factory Installed Glass (08 81 23)		
08 81 23 00-0012 Tempered, Clear Float Factory Installed Glass (08 81 23 00-0011)		
Note: Type I, Class I, Quality Q3.		
08 81 23 00-0013 SF 1/8" Thick, Tempered, Clear Float Factory Installed Glass	2.61	
For >50 To 200, Deduct	-0.08	
For >200 To 400, Deduct	-0.16	
For >400, Deduct	-0.23	
For Tinted Glass, Add	0.65	
For Reflective Coated Glass, Add	1.17	
For Low-E Coated Glass, Add	0.65	
08 81 23 00-0014 SF 3/16" Thick, Tempered, Clear Float Factory Installed Glass	2.79	
For >50 To 200, Deduct	-0.08	
For >200 To 400, Deduct	-0.17	
For >400, Deduct	-0.25	
For Tinted Glass, Add	0.70	
For Reflective Coated Glass, Add	1.26	
For Low-E Coated Glass, Add	0.70	
08 81 23 00-0015 SF 1/4" Thick, Tempered, Clear Float Factory Installed Glass	3.39	
For >50 To 200, Deduct	-0.10	
For >200 To 400, Deduct	-0.20	
For >400, Deduct	-0.31	
For Tinted Glass, Add	0.85	
For Reflective Coated Glass, Add	1.53	
For Low-E Coated Glass, Add	0.85	
08 81 23 00-0016 SF 5/16" Thick, Tempered, Clear Float Factory Installed Glass	5.65	
For >50 To 200, Deduct	-0.17	
For >200 To 400, Deduct	-0.34	
For >400, Deduct	-0.51	
For Tinted Glass, Add	1.41	
For Reflective Coated Glass, Add	2.54	
For Low-E Coated Glass, Add	1.41	
08 81 23 00-0017 SF 3/8" Thick, Tempered, Clear Float Factory Installed Glass	8.21	
For >50 To 200, Deduct	-0.25	
For >200 To 400, Deduct	-0.49	
For >400, Deduct	-0.74	
For Tinted Glass, Add	2.05	
For Reflective Coated Glass, Add	3.69	
For Low-E Coated Glass, Add	2.05	
08 81 23 00-0018 SF 1/2" Thick, Tempered, Clear Float Factory Installed Glass	9.02	
For >50 To 200, Deduct	-0.27	
For >200 To 400, Deduct	-0.54	
For >400, Deduct	-0.81	
For Tinted Glass, Add	2.26	
For Reflective Coated Glass, Add	4.06	
For Low-E Coated Glass, Add	2.26	

08 Openings**08 80 Glazing****08 81 Glass Glazing**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 81 23 00-0019	SF		5/8" Thick, Tempered, Clear Float Factory Installed Glass.....	10.79	
			<i>For >50 To 200, Deduct</i>	-0.32	
			<i>For >200 To 400, Deduct</i>	-0.65	
			<i>For >400, Deduct</i>	-0.97	
			<i>For Tinted Glass, Add</i>	2.70	
			<i>For Reflective Coated Glass, Add</i>	4.86	
			<i>For Low-E Coated Glass, Add</i>	2.70	
08 81 23 00-0020	SF		3/4" Thick, Tempered, Clear Float Factory Installed Glass.....	13.33	
			<i>For >50 To 200, Deduct</i>	-0.40	
			<i>For >200 To 400, Deduct</i>	-0.80	
			<i>For >400, Deduct</i>	-1.20	
			<i>For Tinted Glass, Add</i>	3.33	
			<i>For Reflective Coated Glass, Add</i>	6.00	
			<i>For Low-E Coated Glass, Add</i>	3.33	
08 81 23 00-0021			Patterned Factory Installed Glass <small>(08 81 23)</small>		
08 81 23 00-0022			Rough Obscure, Factory Installed Glass <small>(08 81 23 00-0021)</small>		
			Note: Class II, Form 3, Finish F1.		
08 81 23 00-0023	SF		1/4" Thick, Rough Obscure, Factory Installed Glass.....	5.12	
08 81 23 00-0024			Patterned, Figured Factory Installed Glass <small>(08 81 23 00-0021)</small>		
			Note: Kind HS, Type II, Class I, Form 3, Quality Q8, Finish F2, Pattern P4.		
08 81 23 00-0025	SF		1/8" Thick, Patterned, Figured Factory Installed Glass.....	3.11	
08 81 23 00-0026	SF		7/32" Thick, Patterned, Figured Factory Installed Glass.....	3.11	
08 81 23 00-0027			Wired Factory Installed Glass <small>(08 81 23)</small>		
08 81 23 00-0028			Square Or Diamond Pattern, Wired Factory Installed Glass <small>(08 81 23 00-0027)</small>		
			Note: Class I, Form 2, Mesh M1 Or M2, Pattern P2.		
08 81 23 00-0029	SF		1/4" Thick, Square Pattern, Wired Factory Installed Glass.....	8.05	
08 81 23 00-0030	SF		1/4" Thick, Diamond Pattern, Wired Factory Installed Glass.....	8.05	
08 81 23 00-0031			Polished, Wired Factory Installed Glass <small>(08 81 23 00-0027)</small>		
08 81 23 00-0032	SF		1/4" Thick, Polished, Wired Factory Installed Glass.....	8.80	
08 81 23 00-0033			Frosted Factory Installed Glass <small>(08 81 23)</small>		
08 81 23 00-0034			Frosted Factory Installed Glass <small>(08 81 23 00-0033)</small>		
08 81 23 00-0035	SF		1/8" Thick, Frosted Factory Installed Glass.....	4.07	
			<i>For >50 To 200, Deduct</i>	-0.12	
			<i>For >200 To 400, Deduct</i>	-0.24	
			<i>For >400, Deduct</i>	-0.37	
08 81 23 00-0036	SF		3/16" Thick, Frosted Factory Installed Glass.....	5.34	
			<i>For >50 To 200, Deduct</i>	-0.16	
			<i>For >200 To 400, Deduct</i>	-0.32	
			<i>For >400, Deduct</i>	-0.48	
08 81 23 00-0037	SF		1/4" Thick, Frosted Factory Installed Glass.....	6.75	
			<i>For >50 To 200, Deduct</i>	-0.20	
			<i>For >200 To 400, Deduct</i>	-0.41	
			<i>For >400, Deduct</i>	-0.61	
08 81 23 00-0038	SF		3/8" Thick, Frosted Factory Installed Glass.....	10.09	
			<i>For >50 To 200, Deduct</i>	-0.30	
			<i>For >200 To 400, Deduct</i>	-0.61	
			<i>For >400, Deduct</i>	-0.91	
08 81 23 00-0039			Fire Rated Factory Installed Glass <small>(08 81 23)</small>		
08 81 23 00-0040			Fire Rated Factory Installed Glass <small>(08 81 23 00-0039)</small>		
08 81 23 00-0041	SF		20 Minute, Fire Rated Factory Installed Glass.....	11.05	
08 81 23 00-0042	SF		45 Minute, Fire Rated Factory Installed Glass.....	22.00	
08 81 23 00-0043	SF		60 Minute, Fire Rated Factory Installed Glass.....	34.00	
08 81 23 00-0044	SF		90 Minute, Fire Rated Factory Installed Glass.....	45.00	
08 81 23 00-0045			Laminated Factory Installed Glass <small>(08 81 23)</small>		
08 81 23 00-0046			Laminated Glass With PVB Interlayer, Factory Installed Glass <small>(08 81 23 00-0045)</small>		
			Note: Type I, Class I, Quality Q3.		
08 81 23 00-0047	SF		1/4" Thick, Laminated Glass With PVB Interlayer, Factory Installed Glass.....	7.17	
			<i>For >50 To 200, Deduct</i>	-0.22	
			<i>For >200 To 400, Deduct</i>	-0.43	
			<i>For >400, Deduct</i>	-0.65	
			<i>For Tinted Glass, Add</i>	1.79	
			<i>For Reflective Coated Glass, Add</i>	3.23	
			<i>For Low-E Coated Glass, Add</i>	1.79	
			<i>For One Piece Heat Strengthened Glass, Add</i>	1.43	
			<i>For One Piece Fully Tempered Glass, Add</i>	1.43	



Openings	08	08
Glazing	08 80	
Glass Glazing	08 81	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 81 23 00-0048 SF 3/8" Thick, Laminated Glass With PVB Interlayer, Factory Installed Glass.....	8.95	
For >50 To 200, Deduct	-0.27	
For >200 To 400, Deduct	-0.54	
For >400, Deduct	-0.81	
For Tinted Glass, Add	2.24	
For Reflective Coated Glass, Add	4.03	
For Low-E Coated Glass, Add	2.24	
For One Piece Heat Strengthened Glass, Add	1.79	
For One Piece Fully Tempered Glass, Add	1.79	
08 81 23 00-0049 SF 1/2" Thick, Laminated Glass With PVB Interlayer, Factory Installed Glass.....	12.16	
For >50 To 200, Deduct	-0.36	
For >200 To 400, Deduct	-0.73	
For >400, Deduct	-1.09	
For Tinted Glass, Add	3.04	
For Reflective Coated Glass, Add	5.47	
For Low-E Coated Glass, Add	3.04	
For One Piece Heat Strengthened Glass, Add	2.43	
For One Piece Fully Tempered Glass, Add	2.43	
08 81 23 00-0050 Insulated Factory Installed Glass (08 81 23)		
08 81 23 00-0051 Insulated, Factory Installed Glass (08 81 23 00-0050)		
Note: Type I, Class I, Quality Q3.		
08 81 23 00-0052 SF 1/2" Thick, Insulated Factory Installed Glass.....	5.19	
Note: Two 1/8" lites with 1/4" air space.		
For >50 To 200, Deduct	-0.16	
For >200 To 400, Deduct	-0.31	
For >400, Deduct	-0.47	
For Tinted Glass, Add	1.30	
For Reflective Coated Glass, Add	2.34	
For Low-E Coated Glass, Add	1.30	
For One Piece Heat Strengthened Glass, Add	1.04	
For One Piece Fully Tempered Glass, Add	1.04	
For One Piece Obscure Glass, Add	2.21	
For Argon Gas, Add	1.43	
08 81 23 00-0053 SF 5/8" Thick, Insulated Factory Installed Glass.....	5.25	
Note: Two 3/16" lites with 1/4" air space.		
For >50 To 200, Deduct	-0.16	
For >200 To 400, Deduct	-0.32	
For >400, Deduct	-0.47	
For Tinted Glass, Add	1.31	
For Reflective Coated Glass, Add	2.36	
For Low-E Coated Glass, Add	1.31	
For One Piece Heat Strengthened Glass, Add	1.05	
For One Piece Fully Tempered Glass, Add	1.05	
For One Piece Obscure Glass, Add	2.23	
For Argon Gas, Add	1.44	
08 81 23 00-0054 SF 3/4" Thick, Insulated Factory Installed Glass.....	5.50	
Note: Two 1/4" lites with 1/4" air space.		
For >50 To 200, Deduct	-0.17	
For >200 To 400, Deduct	-0.33	
For >400, Deduct	-0.50	
For Tinted Glass, Add	1.38	
For Reflective Coated Glass, Add	2.48	
For Low-E Coated Glass, Add	1.38	
For One Piece Heat Strengthened Glass, Add	1.10	
For One Piece Fully Tempered Glass, Add	1.10	
For One Piece Obscure Glass, Add	2.34	
For Argon Gas, Add	1.51	
08 81 23 00-0055 SF 1" Thick, Insulated Factory Installed Glass.....	6.67	
Note: Two 1/4" lites with 1/2" air space.		
For >50 To 200, Deduct	-0.20	
For >200 To 400, Deduct	-0.40	
For >400, Deduct	-0.60	
For Tinted Glass, Add	1.67	
For Reflective Coated Glass, Add	3.00	
For Low-E Coated Glass, Add	1.67	
For One Piece Heat Strengthened Glass, Add	1.33	
For One Piece Fully Tempered Glass, Add	1.33	
For One Piece Obscure Glass, Add	2.83	
For Argon Gas, Add	1.83	
08 81 26 Field Installed Glass (08 81)		
08 81 26 00-0001 Clear Float Field Installed Glass (08 81 26)		
08 81 26 00-0002 Clear Float Field Installed Glass (08 81 26 00-0001)		
Note: Type I, Class I, Quality Q3.		

08 Openings**08 80 Glazing****08 81 Glass Glazing**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 81 26 00-0003	SF		1/8" Thick, Clear Float Field Installed Glass	11.70	
			For >50 To 200, Deduct	-0.05	
			For >200 To 400, Deduct	-0.11	
			For >400, Deduct	-0.16	
			For Glass Removal And Preparing Opening For New Glazing, Add	9.90	
			For Tinted Glass, Add	0.45	
			For Reflective Coated Glass, Add	0.81	
			For Low-E Coated Glass, Add	0.45	
08 81 26 00-0004	SF		3/16" Thick, Clear Float Field Installed Glass	12.59	
			For >50 To 200, Deduct	-0.06	
			For >200 To 400, Deduct	-0.12	
			For >400, Deduct	-0.17	
			For Glass Removal And Preparing Opening For New Glazing, Add	10.66	
			For Tinted Glass, Add	0.48	
			For Reflective Coated Glass, Add	0.87	
			For Low-E Coated Glass, Add	0.48	
08 81 26 00-0005	SF		1/4" Thick, Clear Float Field Installed Glass	13.76	
			For >50 To 200, Deduct	-0.07	
			For >200 To 400, Deduct	-0.14	
			For >400, Deduct	-0.21	
			For Glass Removal And Preparing Opening For New Glazing, Add	11.42	
			For Tinted Glass, Add	0.59	
			For Reflective Coated Glass, Add	1.05	
			For Low-E Coated Glass, Add	0.59	
08 81 26 00-0006	SF		5/16" Thick, Clear Float Field Installed Glass	16.82	
			For >50 To 200, Deduct	-0.12	
			For >200 To 400, Deduct	-0.23	
			For >400, Deduct	-0.35	
			For Glass Removal And Preparing Opening For New Glazing, Add	12.93	
			For Tinted Glass, Add	0.97	
			For Reflective Coated Glass, Add	1.75	
			For Low-E Coated Glass, Add	0.97	
08 81 26 00-0007	SF		3/8" Thick, Clear Float Field Installed Glass	20.12	
			For >50 To 200, Deduct	-0.17	
			For >200 To 400, Deduct	-0.34	
			For >400, Deduct	-0.51	
			For Glass Removal And Preparing Opening For New Glazing, Add	14.46	
			For Tinted Glass, Add	1.42	
			For Reflective Coated Glass, Add	2.55	
			For Low-E Coated Glass, Add	1.42	
08 81 26 00-0008	SF		1/2" Thick, Clear Float Field Installed Glass	22.20	
			For >50 To 200, Deduct	-0.19	
			For >200 To 400, Deduct	-0.37	
			For >400, Deduct	-0.56	
			For Glass Removal And Preparing Opening For New Glazing, Add	15.98	
			For Tinted Glass, Add	1.56	
			For Reflective Coated Glass, Add	2.80	
			For Low-E Coated Glass, Add	1.56	
08 81 26 00-0009	SF		5/8" Thick, Clear Float Field Installed Glass	27.23	
			For >50 To 200, Deduct	-0.22	
			For >200 To 400, Deduct	-0.45	
			For >400, Deduct	-0.67	
			For Glass Removal And Preparing Opening For New Glazing, Add	19.79	
			For Tinted Glass, Add	1.86	
			For Reflective Coated Glass, Add	3.35	
			For Low-E Coated Glass, Add	1.86	
08 81 26 00-0010	SF		3/4" Thick, Clear Float Field Installed Glass	32.78	
			For >50 To 200, Deduct	-0.28	
			For >200 To 400, Deduct	-0.55	
			For >400, Deduct	-0.83	
			For Glass Removal And Preparing Opening For New Glazing, Add	23.59	
			For Tinted Glass, Add	2.30	
			For Reflective Coated Glass, Add	4.14	
			For Low-E Coated Glass, Add	2.30	
08 81 26 00-0011			Heat Treated Field Installed Glass <small>(08 81 26)</small>		
08 81 26 00-0012			Tempered, Clear Float Field Installed Glass <small>(08 81 26 00-0011)</small>		
			Note: Type I, Class I, Quality Q3.		
08 81 26 00-0013	SF		1/8" Thick, Tempered, Clear Float Field Installed Glass	12.51	
			For >50 To 200, Deduct	-0.08	
			For >200 To 400, Deduct	-0.16	
			For >400, Deduct	-0.23	
			For Glass Removal And Preparing Opening For New Glazing, Add	9.90	
			For Tinted Glass, Add	0.65	
			For Reflective Coated Glass, Add	1.17	
			For Low-E Coated Glass, Add	0.65	
08 81 26 00-0014	SF		3/16" Thick, Tempered, Clear Float Field Installed Glass	13.45	
			For >50 To 200, Deduct	-0.08	
			For >200 To 400, Deduct	-0.17	
			For >400, Deduct	-0.25	
			For Glass Removal And Preparing Opening For New Glazing, Add	10.66	
			For Tinted Glass, Add	0.70	
			For Reflective Coated Glass, Add	1.26	
			For Low-E Coated Glass, Add	0.70	



Openings	08	08
Glazing	08 80	
Glass Glazing	08 81	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 81 26 00-0015 SF 1/4" Thick, Tempered, Clear Float Field Installed Glass.....	14.81	
For >50 To 200, Deduct	-0.10	
For >200 To 400, Deduct	-0.20	
For >400, Deduct	-0.31	
For Glass Removal And Preparing Opening For New Glazing, Add	11.42	
For Tinted Glass, Add	0.85	
For Reflective Coated Glass, Add	1.53	
For Low-E Coated Glass, Add	0.85	
08 81 26 00-0016 SF 5/16" Thick, Tempered, Clear Float Field Installed Glass.....	18.58	
For >50 To 200, Deduct	-0.17	
For >200 To 400, Deduct	-0.34	
For >400, Deduct	-0.51	
For Glass Removal And Preparing Opening For New Glazing, Add	12.93	
For Tinted Glass, Add	1.41	
For Reflective Coated Glass, Add	2.54	
For Low-E Coated Glass, Add	1.41	
08 81 26 00-0017 SF 3/8" Thick, Tempered, Clear Float Field Installed Glass.....	22.67	
For >50 To 200, Deduct	-0.25	
For >200 To 400, Deduct	-0.49	
For >400, Deduct	-0.74	
For Glass Removal And Preparing Opening For New Glazing, Add	14.46	
For Tinted Glass, Add	2.05	
For Reflective Coated Glass, Add	3.69	
For Low-E Coated Glass, Add	2.05	
08 81 26 00-0018 SF 1/2" Thick, Tempered, Clear Float Field Installed Glass.....	25.00	
For >50 To 200, Deduct	-0.27	
For >200 To 400, Deduct	-0.54	
For >400, Deduct	-0.81	
For Glass Removal And Preparing Opening For New Glazing, Add	15.98	
For Tinted Glass, Add	2.26	
For Reflective Coated Glass, Add	4.06	
For Low-E Coated Glass, Add	2.26	
08 81 26 00-0019 SF 5/8" Thick, Tempered, Clear Float Field Installed Glass.....	30.58	
For >50 To 200, Deduct	-0.32	
For >200 To 400, Deduct	-0.65	
For >400, Deduct	-0.97	
For Glass Removal And Preparing Opening For New Glazing, Add	19.79	
For Tinted Glass, Add	2.70	
For Reflective Coated Glass, Add	4.86	
For Low-E Coated Glass, Add	2.70	
08 81 26 00-0020 SF 3/4" Thick, Tempered, Clear Float Field Installed Glass.....	36.92	
For >50 To 200, Deduct	-0.40	
For >200 To 400, Deduct	-0.80	
For >400, Deduct	-1.20	
For Glass Removal And Preparing Opening For New Glazing, Add	23.59	
For Tinted Glass, Add	3.33	
For Reflective Coated Glass, Add	6.00	
For Low-E Coated Glass, Add	3.33	
08 81 26 00-0021 Patterned Field Installed Glass (08 81 26)		
08 81 26 00-0022 Rough Obscure Field Installed Glass (08 81 26 00-0021)		
Note: Class II, Form 3, Finish F1.		
08 81 26 00-0023 SF 1/4" Thick, Rough Obscure Field Installed Glass.....	16.54	
For Glass Removal And Preparing Opening For New Glazing, Add	11.42	
08 81 26 00-0024 Patterned, Figured Field Installed Glass (08 81 26 00-0021)		
Note: Kind HS, Type II, Class I, Form 3, Quality Q8, Finish F2, Pattern P4.		
08 81 26 00-0025 SF 1/8" Thick, Patterned, Figured Field Installed Glass.....	13.01	
For Glass Removal And Preparing Opening For New Glazing, Add	9.90	
08 81 26 00-0026 SF 7/32" Thick, Patterned, Figured Field Installed Glass.....	14.15	
For Glass Removal And Preparing Opening For New Glazing, Add	11.04	
08 81 26 00-0027 Wired Field Installed Glass (08 81 26)		
08 81 26 00-0028 Square Or Diamond Pattern, Wired Field Installed Glass (08 81 26 00-0027)		
Note: Class I, Form 2, Mesh M1 Or M2, Pattern P2.		
08 81 26 00-0029 SF 1/4" Thick, Square Pattern, Wired Field Installed Glass.....	19.47	
For Glass Removal And Preparing Opening For New Glazing, Add	11.42	
08 81 26 00-0030 SF 1/4" Thick, Diamond Pattern, Wired Field Installed Glass.....	19.47	
For Glass Removal And Preparing Opening For New Glazing, Add	11.42	
08 81 26 00-0031 Polished, Wired Field Installed Glass (08 81 26 00-0027)		
08 81 26 00-0032 SF 1/4" Thick, Polished, Wired Field Installed Glass.....	20.22	
For Glass Removal And Preparing Opening For New Glazing, Add	11.42	
08 81 26 00-0033 Frosted Field Installed Glass (08 81 26)		
08 81 26 00-0034 Frosted Field Installed Glass (08 81 26 00-0033)		

08 Openings**08 80 Glazing****08 81 Glass Glazing**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 81 26 00-0035	SF		1/8" Thick, Frosted Field Installed Glass.....	13.97	
			<i>For >50 To 200, Deduct</i>	-0.12	
			<i>For >200 To 400, Deduct</i>	-0.24	
			<i>For >400, Deduct</i>	-0.37	
			<i>For Glass Removal And Preparing Opening For New Glazing, Add</i>	9.90	
08 81 26 00-0036	SF		3/16" Thick, Frosted Field Installed Glass.....	16.00	
			<i>For >50 To 200, Deduct</i>	-0.16	
			<i>For >200 To 400, Deduct</i>	-0.32	
			<i>For >400, Deduct</i>	-0.48	
			<i>For Glass Removal And Preparing Opening For New Glazing, Add</i>	10.66	
08 81 26 00-0037	SF		1/4" Thick, Frosted Field Installed Glass.....	18.17	
			<i>For >50 To 200, Deduct</i>	-0.20	
			<i>For >200 To 400, Deduct</i>	-0.41	
			<i>For >400, Deduct</i>	-0.61	
			<i>For Glass Removal And Preparing Opening For New Glazing, Add</i>	11.42	
08 81 26 00-0038	SF		3/8" Thick, Frosted Field Installed Glass.....	24.55	
			<i>For >50 To 200, Deduct</i>	-0.30	
			<i>For >200 To 400, Deduct</i>	-0.61	
			<i>For >400, Deduct</i>	-0.91	
			<i>For Glass Removal And Preparing Opening For New Glazing, Add</i>	14.46	
08 81 26 00-0039			Fire Rated Field Installed Glass (08 81 26)		
08 81 26 00-0040			Fire Rated Field Installed Glass (08 81 26 00-0039)		
08 81 26 00-0041	SF		20 Minute, Fire Rated Field Installed Glass.....	22.47	
			<i>For Glass Removal And Preparing Opening For New Glazing, Add</i>	11.42	
08 81 26 00-0042	SF		45 Minute, Fire Rated Field Installed Glass.....	33.42	
			<i>For Glass Removal And Preparing Opening For New Glazing, Add</i>	11.42	
08 81 26 00-0043	SF		60 Minute, Fire Rated Field Installed Glass.....	45.42	
			<i>For Glass Removal And Preparing Opening For New Glazing, Add</i>	11.42	
08 81 26 00-0044	SF		90 Minute, Fire Rated Field Installed Glass.....	56.42	
			<i>For Glass Removal And Preparing Opening For New Glazing, Add</i>	11.42	
08 81 26 00-0045			Laminated Field Installed Glass (08 81 26)		
08 81 26 00-0046			Laminated Glass With PVB Interlayer, Field Installed Glass (08 81 26 00-0045) Note: Type I, Class I, Quality Q3.		
08 81 26 00-0047	SF		1/4" Thick, Laminated Glass With PVB Interlayer, Field Installed Glass.....	18.59	
			<i>For >50 To 200, Deduct</i>	-0.22	
			<i>For >200 To 400, Deduct</i>	-0.43	
			<i>For >400, Deduct</i>	-0.65	
			<i>For Glass Removal And Preparing Opening For New Glazing, Add</i>	11.42	
			<i>For Tinted Glass, Add</i>	1.79	
			<i>For Reflective Coated Glass, Add</i>	3.23	
			<i>For Low-E Coated Glass, Add</i>	1.79	
			<i>For One Piece Heat Strengthened Glass, Add</i>	1.43	
			<i>For One Piece Fully Tempered Glass, Add</i>	1.43	
08 81 26 00-0048	SF		3/8" Thick, Laminated Glass With PVB Interlayer, Field Installed Glass.....	23.41	
			<i>For >50 To 200, Deduct</i>	-0.27	
			<i>For >200 To 400, Deduct</i>	-0.54	
			<i>For >400, Deduct</i>	-0.81	
			<i>For Glass Removal And Preparing Opening For New Glazing, Add</i>	14.46	
			<i>For Tinted Glass, Add</i>	2.24	
			<i>For Reflective Coated Glass, Add</i>	4.03	
			<i>For Low-E Coated Glass, Add</i>	2.24	
			<i>For One Piece Heat Strengthened Glass, Add</i>	1.79	
			<i>For One Piece Fully Tempered Glass, Add</i>	1.79	
08 81 26 00-0049	SF		1/2" Thick, Laminated Glass With PVB Interlayer, Field Installed Glass.....	28.14	
			<i>For >50 To 200, Deduct</i>	-0.36	
			<i>For >200 To 400, Deduct</i>	-0.73	
			<i>For >400, Deduct</i>	-1.09	
			<i>For Glass Removal And Preparing Opening For New Glazing, Add</i>	15.98	
			<i>For Tinted Glass, Add</i>	3.04	
			<i>For Reflective Coated Glass, Add</i>	5.47	
			<i>For Low-E Coated Glass, Add</i>	3.04	
			<i>For One Piece Heat Strengthened Glass, Add</i>	2.43	
			<i>For One Piece Fully Tempered Glass, Add</i>	2.43	
08 81 26 00-0050			Insulated Field Installed Glass (08 81 26)		
08 81 26 00-0051			Insulated Glass, Field Installed Glass (08 81 26 00-0050) Note: Type I, Class I, Quality Q3.		



Openings	08	08
Glazing	08 80	
Glass Glazing	08 81	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 81 26 00-0052 SF 1/2" Thick, Insulated Field Installed Glass 18.50 Note: Two 1/8" lites with 1/4" air space. For >50 To 200, Deduct -0.16 For >200 To 400, Deduct -0.31 For >400, Deduct -0.47 For Glass Removal And Preparing Opening For New Glazing, Add 13.31 For Tinted Glass, Add 1.30 For Reflective Coated Glass, Add 2.34 For Low-E Coated Glass, Add 1.30 For One Piece Heat Strengthened Glass, Add 1.04 For One Piece Fully Tempered Glass, Add 1.04 For One Piece Obscure Glass, Add 2.21 For Argon Gas, Add 1.43		
08 81 26 00-0053 SF 5/8" Thick, Insulated Field Installed Glass 19.46 Note: Two 3/16" lites with 1/4" air space. For >50 To 200, Deduct -0.16 For >200 To 400, Deduct -0.32 For >400, Deduct -0.47 For Glass Removal And Preparing Opening For New Glazing, Add 14.21 For Tinted Glass, Add 1.31 For Reflective Coated Glass, Add 2.36 For Low-E Coated Glass, Add 1.31 For One Piece Heat Strengthened Glass, Add 1.05 For One Piece Fully Tempered Glass, Add 1.05 For One Piece Obscure Glass, Add 2.23 For Argon Gas, Add 1.44		
08 81 26 00-0054 SF 3/4" Thick, Insulated Field Installed Glass 21.00 Note: Two 1/4" lites with 1/4" air space. For >50 To 200, Deduct -0.17 For >200 To 400, Deduct -0.33 For >400, Deduct -0.50 For Glass Removal And Preparing Opening For New Glazing, Add 15.50 For Tinted Glass, Add 1.38 For Reflective Coated Glass, Add 2.48 For Low-E Coated Glass, Add 1.38 For One Piece Heat Strengthened Glass, Add 1.10 For One Piece Fully Tempered Glass, Add 1.10 For One Piece Obscure Glass, Add 2.34 For Argon Gas, Add 1.51		
08 81 26 00-0055 SF 1" Thick, Insulated Field Installed Glass 22.65 Note: Two 1/4" lites with 1/2" air space. For >50 To 200, Deduct -0.20 For >200 To 400, Deduct -0.40 For >400, Deduct -0.60 For Glass Removal And Preparing Opening For New Glazing, Add 15.98 For Tinted Glass, Add 1.67 For Reflective Coated Glass, Add 3.00 For Low-E Coated Glass, Add 1.67 For One Piece Heat Strengthened Glass, Add 1.33 For One Piece Fully Tempered Glass, Add 1.33 For One Piece Obscure Glass, Add 2.83 For Argon Gas, Add 1.83		
08 81 26 00-0056 Spandrel Field Installed Glass (08 81 26)		
08 81 26 00-0057 Monolithic Float Glass Panels Ceramic Back, Coated, Field Installed Glass (08 81 26 00-0056)		
08 81 26 00-0058 SF 1/4" - 5/16" Spandrel Glass, Up To 1,000 SF, Field Installed Glass 18.48 For Glass Removal And Preparing Opening For New Glazing, Add 12.68		
08 81 26 00-0059 SF 1/4" - 5/16" Spandrel Glass, >1,000 SF, Field Installed Glass 17.24 For Glass Removal And Preparing Opening For New Glazing, Add 12.68		
08 81 26 00-0060 Insulating Float Glass Panels Ceramic Back, Coated, Tempered, Field Installed Glass (08 81 26 00-0056)		
08 81 26 00-0061 1/4" Glass With 1" Fiberglass Insulation, Field Installed Glass (08 81 26 00-0060) Note: Also with aluminum foil vapor barrier.		
08 81 26 00-0062 SF 1/4" Spandrel Glass With 1" Fiberglass Insulation Up To 20,000 SF, Foil Vapor Barrier, Field Installed Glass 19.78 For Glass Removal And Preparing Opening For New Glazing, Add 12.68		
08 81 26 00-0063 SF 1/4" Spandrel Glass With 1" Fiberglass Insulation >20,000 SF, Foil Vapor Barrier, Field Installed Glass 18.37 For Glass Removal And Preparing Opening For New Glazing, Add 12.68		
08 81 26 00-0064 1/4" Glass With 3/4 To 7/8" Insulation, Field Installed Glass (08 81 26 00-0060)		
08 81 26 00-0065 SF 1/4" Spandrel Glass, 3/4" - 7/8" Insulation 24 Gauge Steel Interfacing, Field Installed Glass 22.23 For Glass Removal And Preparing Opening For New Glazing, Add 12.68		
08 81 26 00-0066 SF 1/4" Spandrel Glass, 3/4" - 7/8" Insulation 16 Gauge Steel Interfacing, Field Installed Glass 19.46 For Glass Removal And Preparing Opening For New Glazing, Add 12.68		
08 83 Mirrors (08 80) Note: Kind FT, Type I, Class I, Quality Q1.		
08 83 13 Mirrored Glass Glazing (08 83)		

08 Openings**08 80 Glazing****08 83 Mirrors**

MINOR		TOTAL DIRECT	DEMOLITION
CSI	UOM DESCRIPTION	UNIT COST	UNIT COST
08 83 13 00-0001	Mirror Glass <small>(08 83 13)</small>		
08 83 13 00-0002	One-Way Vision Glass (Transparent Mirrors) <small>(08 83 13 00-0001)</small>		
08 83 13 00-0003	SF 1/4" One-Way Vision Glass (Transparent Mirrors).....	27.48	5.70
	For >50 To 200, Deduct	-0.49	
	For >200 To 400, Deduct	-0.81	
	For >400, Deduct	-1.30	
08 83 13 00-0004	Tempered, One-Way Vision Glass (Transparent Mirrors) <small>(08 83 13 00-0001)</small>		
08 83 13 00-0005	SF 1/4" Tempered, One-Way Vision Glass (Transparent Mirrors).....	34.92	5.70
	For >50 To 200, Deduct	-0.71	
	For >200 To 400, Deduct	-1.18	
	For >400, Deduct	-1.89	
08 83 13 00-0006	Clear Mirror Glass <small>(08 83 13 00-0001)</small>		
08 83 13 00-0007	SF 1/8" Clear Mirror Glass.....	12.73	4.56
	For >50 To 200, Deduct	-0.11	
	For >200 To 400, Deduct	-0.18	
	For >400, Deduct	-0.29	
08 83 13 00-0008	SF 3/16" Clear Mirror Glass.....	14.86	5.32
	For >50 To 200, Deduct	-0.13	
	For >200 To 400, Deduct	-0.22	
	For >400, Deduct	-0.35	
08 83 13 00-0009	SF 1/4" Clear Mirror Glass.....	16.14	5.70
	For >50 To 200, Deduct	-0.15	
	For >200 To 400, Deduct	-0.24	
	For >400, Deduct	-0.39	
08 83 13 00-0010	Tempered, Clear Mirror Glass <small>(08 83 13 00-0001)</small>		
08 83 13 00-0011	SF 1/8" Tempered, Clear Mirror Glass.....	16.85	4.56
	For >50 To 200, Deduct	-0.23	
	For >200 To 400, Deduct	-0.39	
	For >400, Deduct	-0.62	
08 83 13 00-0012	SF 3/16" Tempered, Clear Mirror Glass.....	19.22	5.32
	For >50 To 200, Deduct	-0.26	
	For >200 To 400, Deduct	-0.44	
	For >400, Deduct	-0.70	
08 83 13 00-0013	SF 1/4" Tempered, Clear Mirror Glass.....	21.00	5.70
	For >50 To 200, Deduct	-0.29	
	For >200 To 400, Deduct	-0.49	
	For >400, Deduct	-0.78	
08 83 13 00-0014	Clear Mirror Glass With Laminated Safety Backing <small>(08 83 13 00-0001)</small>		
08 83 13 00-0015	SF 1/4" Clear Mirror Glass With Laminated Safety Backing.....	23.43	5.70
	For >50 To 200, Deduct	-0.36	
	For >200 To 400, Deduct	-0.61	
	For >400, Deduct	-0.97	
08 83 13 00-0016	Laminated Safety Mirror Glass <small>(08 83 13 00-0001)</small>		
	Note: Clear glass laminated to face of mirror with PVB interlayer.		
08 83 13 00-0017	SF 1/4" Laminated Safety Mirror Glass.....	42.35	5.70
	For >50 To 200, Deduct	-0.93	
	For >200 To 400, Deduct	-1.55	
	For >400, Deduct	-2.49	
08 83 13 00-0018	Accessories For Mirror Glass <small>(08 83 13)</small>		
08 83 13 00-0019	LF 1/8" Aluminum J-Channel For Mounting Mirror Glass.....	3.24	
08 83 13 00-0020	LF 3/16" Aluminum J-Channel For Mounting Mirror Glass.....	3.29	
08 83 13 00-0021	LF 1/4" Aluminum J-Channel For Mounting Mirror Glass.....	3.94	
08 83 13 00-0022	LF Aluminum Frame For Mounting Mirror Glass.....	4.85	
08 84	Plastic Glazing <small>(08 80)</small>		
08 84 00 00-0001	Clear Polycarbonate Glazing (GE Lexan) <small>(08 84)</small>		
08 84 00 00-0002	SF 1/8" Thick, Clear Polycarbonate Glazing (GE Lexan).....	14.12	
	For >50 To 200, Deduct	-0.35	
	For >200 To 400, Deduct	-0.69	
	For >400, Deduct	-1.04	
	For Glass Removal And Preparing Opening For New Glazing, Add	7.18	
08 84 00 00-0003	SF 3/16" Thick, Clear Polycarbonate Glazing (GE Lexan).....	16.56	
	For >50 To 200, Deduct	-0.46	
	For >200 To 400, Deduct	-0.91	
	For >400, Deduct	-1.37	
	For Glass Removal And Preparing Opening For New Glazing, Add	7.46	



Openings	08	08
Glazing	08 80	
Plastic Glazing	08 84	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 84 00 00-0004 SF 1/4" Thick, Clear Polycarbonate Glazing (GE Lexan)	19.38	
For >50 To 200, Deduct	-0.58	
For >200 To 400, Deduct	-1.16	
For >400, Deduct	-1.74	
For Glass Removal And Preparing Opening For New Glazing, Add	7.76	
08 84 00 00-0005 SF 3/8" Thick, Clear Polycarbonate Glazing (GE Lexan)	26.34	
For >50 To 200, Deduct	-0.92	
For >200 To 400, Deduct	-1.84	
For >400, Deduct	-2.75	
For Glass Removal And Preparing Opening For New Glazing, Add	7.98	
08 84 00 00-0006 SF 1/2" Thick, Clear Polycarbonate Glazing (GE Lexan)	35.63	
For >50 To 200, Deduct	-1.35	
For >200 To 400, Deduct	-2.71	
For >400, Deduct	-4.06	
For Glass Removal And Preparing Opening For New Glazing, Add	8.56	
08 84 00 00-0007 Mar-Resistant, Clear Polycarbonate Glazing (GE Lexan MR10) (08 84)		
08 84 00 00-0008 SF 1/8" Thick, Mar-Resistant, Clear Polycarbonate Glazing (GE Lexan MR10)	23.74	
For >50 To 200, Deduct	-0.83	
For >200 To 400, Deduct	-1.66	
For >400, Deduct	-2.48	
For Glass Removal And Preparing Opening For New Glazing, Add	7.18	
08 84 00 00-0009 SF 3/16" Thick, Mar-Resistant, Clear Polycarbonate Glazing (GE Lexan MR10)	31.18	
For >50 To 200, Deduct	-1.19	
For >200 To 400, Deduct	-2.37	
For >400, Deduct	-3.56	
For Glass Removal And Preparing Opening For New Glazing, Add	7.46	
08 84 00 00-0010 SF 1/4" Thick, Mar-Resistant, Clear Polycarbonate Glazing (GE Lexan MR10)	31.65	
For >50 To 200, Deduct	-1.19	
For >200 To 400, Deduct	-2.39	
For >400, Deduct	-3.58	
For Glass Removal And Preparing Opening For New Glazing, Add	7.76	
08 84 00 00-0011 SF 3/8" Thick, Mar-Resistant, Clear Polycarbonate Glazing (GE Lexan MR10)	42.48	
For >50 To 200, Deduct	-1.73	
For >200 To 400, Deduct	-3.45	
For >400, Deduct	-5.18	
For Glass Removal And Preparing Opening For New Glazing, Add	7.98	
08 84 00 00-0012 SF 1/2" Thick, Mar-Resistant, Clear Polycarbonate Glazing (GE Lexan MR10)	49.50	
For >50 To 200, Deduct	-2.05	
For >200 To 400, Deduct	-4.09	
For >400, Deduct	-6.14	
For Glass Removal And Preparing Opening For New Glazing, Add	8.56	
08 84 00 00-0013 Clear Acrylic Glazing (Plexiglas) (08 84)		
08 84 00 00-0014 SF 1/10" Thick, Clear Acrylic Glazing (Plexiglas)	10.51	
For >50 To 200, Deduct	-0.18	
For >200 To 400, Deduct	-0.37	
For >400, Deduct	-0.55	
For Glass Removal And Preparing Opening For New Glazing, Add	6.85	
For Colored, Add	0.73	
For Shatterproof, Add	2.20	
For Mirrored, Add	2.93	
08 84 00 00-0015 SF 1/8" Thick, Clear Acrylic Glazing (Plexiglas)	11.24	
For >50 To 200, Deduct	-0.20	
For >200 To 400, Deduct	-0.41	
For >400, Deduct	-0.61	
For Glass Removal And Preparing Opening For New Glazing, Add	7.18	
For Colored, Add	0.81	
For Shatterproof, Add	2.44	
For Mirrored, Add	3.25	
08 84 00 00-0016 SF 3/16" Thick, Clear Acrylic Glazing (Plexiglas)	13.66	
For >50 To 200, Deduct	-0.31	
For >200 To 400, Deduct	-0.62	
For >400, Deduct	-0.93	
For Glass Removal And Preparing Opening For New Glazing, Add	7.46	
For Colored, Add	1.24	
For Shatterproof, Add	3.72	
For Mirrored, Add	4.96	
08 84 00 00-0017 SF 1/4" Thick, Clear Acrylic Glazing (Plexiglas)	15.77	
For >50 To 200, Deduct	-0.40	
For >200 To 400, Deduct	-0.80	
For >400, Deduct	-1.20	
For Glass Removal And Preparing Opening For New Glazing, Add	7.76	
For Colored, Add	1.60	
For Shatterproof, Add	4.81	
For Mirrored, Add	6.41	
08 84 00 00-0018 SF 5/16" Thick, Clear Acrylic Glazing (Plexiglas)	16.67	
For >50 To 200, Deduct	-0.44	
For >200 To 400, Deduct	-0.89	
For >400, Deduct	-1.33	
For Glass Removal And Preparing Opening For New Glazing, Add	7.80	
For Colored, Add	1.77	
For Shatterproof, Add	5.32	
For Mirrored, Add	7.10	

08 Openings**08 80 Glazing****08 84 Plastic Glazing**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 84 00 00-0019	SF		3/8" Thick, Clear Acrylic Glazing (Plexiglas)	17.92	
			<i>For >50 To 200, Deduct</i>	-0.50	
			<i>For >200 To 400, Deduct</i>	-0.99	
			<i>For >400, Deduct</i>	-1.49	
			<i>For Glass Removal And Preparing Opening For New Glazing, Add</i>	7.98	
			<i>For Colored, Add</i>	1.99	
			<i>For Shatterproof, Add</i>	5.96	
			<i>For Mirrored, Add</i>	7.95	
08 84 00 00-0020	SF		1/2" Thick, Clear Acrylic Glazing (Plexiglas)	22.23	
			<i>For >50 To 200, Deduct</i>	-0.68	
			<i>For >200 To 400, Deduct</i>	-1.37	
			<i>For >400, Deduct</i>	-2.05	
			<i>For Glass Removal And Preparing Opening For New Glazing, Add</i>	8.56	
			<i>For Colored, Add</i>	2.73	
			<i>For Shatterproof, Add</i>	8.20	
			<i>For Mirrored, Add</i>	10.94	
08 84 00 00-0021	SF		3/4" Thick, Clear Acrylic Glazing (Plexiglas)	31.22	
			<i>For >50 To 200, Deduct</i>	-1.02	
			<i>For >200 To 400, Deduct</i>	-2.04	
			<i>For >400, Deduct</i>	-3.06	
			<i>For Glass Removal And Preparing Opening For New Glazing, Add</i>	10.84	
08 84 00 00-0022	SF		1" Thick, Clear Acrylic Glazing (Plexiglas)	42.15	
			<i>For >50 To 200, Deduct</i>	-1.52	
			<i>For >200 To 400, Deduct</i>	-3.04	
			<i>For >400, Deduct</i>	-4.56	
			<i>For Glass Removal And Preparing Opening For New Glazing, Add</i>	11.77	

08 85 Glazing Accessories (08 80)

Note: Applicable to reglazing tasks only, new window installations include the gasket.

08 85 00 00-0001 Neoprene Glazing Gaskets, Tongued Section Or Tongued Mullion (08 85)

Note: For glass sizes listed.

08 85 00 00-0002	LF		Neoprene Glazing Gasket, 1/4" Glass Tongued Section / Tongued Mullion.....	6.55	1.52
08 85 00 00-0003	LF		Neoprene Glazing Gasket, 3/8" Glass Tongued Section / Tongued Mullion.....	6.79	1.52
08 85 00 00-0004	LF		Neoprene Glazing Gasket, 1/2" Glass Tongued Section / Tongued Mullion.....	6.92	1.52
08 85 00 00-0005	LF		Neoprene Glazing Gasket, 3/4" Glass Tongued Section / Tongued Mullion.....	7.18	1.52
08 85 00 00-0006	LF		Neoprene Glazing Gasket, 1" Glass Tongued Section / Tongued Mullion.....	7.47	1.52

08 85 00 00-0007 Mullion Section, For Glass Sizes Listed (08 85)

08 85 00 00-0008	LF		Mullion Section For 1/4" Glass.....	3.29	0.76
08 85 00 00-0009	LF		Mullion Section For 3/8" Glass.....	3.99	0.76
08 85 00 00-0010	LF		Mullion Section For 1/2" Glass.....	4.57	0.76
08 85 00 00-0011	LF		Mullion Section For 3/4" Glass.....	5.70	0.76
08 85 00 00-0012	LF		Mullion Section For 1" Glass.....	6.59	0.76
08 85 00 00-0013	EA		Mullion Section Molded Corners	135.93	25.11

08 85 00 00-0014 Framing For Glass Windscreens (08 85)

Note: Excludes glazing.

08 85 00 00-0015	LF		1-1/4" x 1-1/2" Aluminum Framed Window Walls.....	11.14	1.72
			<i>For Bronze Anodized Aluminum, Add</i>	0.96	
			<i>For Stainless Steel, Add</i>	4.08	
			<i>For Black Anodized Finish, Add</i>	1.73	
08 85 00 00-0016	LF		1-1/2" x 2" Aluminum Framed Window Walls.....	13.31	2.15
			<i>For Bronze Anodized Aluminum, Add</i>	1.22	
			<i>For Stainless Steel, Add</i>	5.15	
			<i>For Black Anodized Finish, Add</i>	2.20	
08 85 00 00-0017	LF		1-1/2" x 3" Aluminum Framed Window Walls.....	15.77	1.72
			<i>For Bronze Anodized Aluminum, Add</i>	1.46	
			<i>For Stainless Steel, Add</i>	6.15	
			<i>For Black Anodized Finish, Add</i>	2.63	
08 85 00 00-0018	LF		1-1/2" x 4" Aluminum Framed Window Walls.....	19.39	2.59
			<i>For Bronze Anodized Aluminum, Add</i>	1.75	
			<i>For Stainless Steel, Add</i>	7.37	
			<i>For Black Anodized Finish, Add</i>	3.14	
08 85 00 00-0019	LF		2" x 3" Aluminum Framed Window Walls.....	18.83	2.15
			<i>For Bronze Anodized Aluminum, Add</i>	1.86	
			<i>For Stainless Steel, Add</i>	7.75	
			<i>For Black Anodized Finish, Add</i>	3.34	
08 85 00 00-0020	LF		2" x 4" Aluminum Framed Window Walls.....	23.40	2.59
			<i>For Bronze Anodized Aluminum, Add</i>	2.22	
			<i>For Stainless Steel, Add</i>	9.30	
			<i>For Black Anodized Finish, Add</i>	3.99	

08 87 Glazing Surface Films (08 80)**08 87 13 Solar Control Films** (08 87)

Note: Applied directly to one side of glazing with adhesive.

08 87 13 00-0001 Window Tinting And Film (08 87 13)

Note: Applied directly to one side of glazing with adhesive. Includes cleaning of window glazing prior to installation.



Openings	08	08
Glazing	08 80	
Glazing Surface Films	08 87	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 87 13 00-0002 SF Tinted, Solar Control Window Film	4.98	
08 87 13 00-0003 SF Obscurant, Solar Control Window Film.....	4.98	
08 87 13 00-0004 SF Tinted, Abrasion Resistant, Solar Control Window Film (3M Scotchtint™).....	6.56	
08 87 13 00-0005 SF Low E, Abrasion Resistant, Solar Control Window Film (3M Scotchtint™).....	6.88	
08 87 23 Safety And Security Films (08 87)		
08 87 23 16 Security Films (08 87 23)		
Note: Applied directly to one side of glazing with adhesive and secured at window frame with clear silicone adhesive.		
08 87 23 16-0001 High Performance, Security And Safety Glazing Films (08 87 23 16)		
Note: Includes cleaning of window glazing prior to installation.		
08 87 23 16-0002 Clear, High Performance, Security And Safety Glazing Films (08 87 23 16-0001)		
08 87 23 16-0003 SF 0.002" Clear, High Performance, Security And Safety Glazing Film (3M Scotchshield™ SCLARL150)	10.67	
For >1,000 To 5,000, Deduct	-0.49	
For >5,000, Deduct	-0.67	
08 87 23 16-0004 SF 0.004" Clear, High Performance, Security And Safety Glazing Film (3M Scotchshield™ SCLARL400)	11.27	
For >1,000 To 5,000, Deduct	-0.52	
For >5,000, Deduct	-0.73	
08 87 23 16-0005 SF 0.006" Clear, High Performance, Security And Safety Glazing Film (3M Scotchshield™ Ultra600)	12.10	
For >1,000 To 5,000, Deduct	-0.55	
For >5,000, Deduct	-0.81	
08 87 23 16-0006 Tinted, High Performance Sun/Solar, Security And Safety Glazing Films (08 87 23 16-0001)		
08 87 23 16-0007 SF 0.004" Silver, 20% Transmission, High Performance Sun/Solar, Security And Safety Glazing Film (3M Scotchshield™ S20SIAR400).....	11.93	
For >1,000 To 5,000, Deduct	-0.54	
For >5,000, Deduct	-0.80	
08 87 23 16-0008 SF 0.004" Neutral, 35% Transmission, High Performance Sun/Solar, Security And Safety Glazing Film (3M Scotchshield™ S35NEAR400)	11.93	
For >1,000 To 5,000, Deduct	-0.54	
For >5,000, Deduct	-0.80	
08 87 23 16-0009 SF 0.004" Neutral, 50% Transmission, High Performance Sun/Solar, Security And Safety Glazing Film (3M Scotchshield™ S50NEAR400)	11.93	
For >1,000 To 5,000, Deduct	-0.54	
For >5,000, Deduct	-0.80	
08 87 23 16-0010 Security And Safety Glazing Films (08 87 23 16)		
Note: Includes cleaning of window glazing prior to installation.		
08 87 23 16-0011 SF 0.007" Clear Security And Safety Glazing Film (3M Scotchshield™ SH7CLARL)	10.02	
For >1,000 To 5,000, Deduct	-0.47	
For >5,000, Deduct	-0.60	
08 87 23 16-0012 SF 0.008" Clear Security And Safety Glazing Film (3M Scotchshield™ SH8CLARL)	10.18	
For >1,000 To 5,000, Deduct	-0.48	
For >5,000, Deduct	-0.62	
08 87 23 16-0013 SF 0.014" Clear Security And Safety Glazing Film (3M Scotchshield™ SH14CLARL)	11.67	
For >1,000 To 5,000, Deduct	-0.53	
For >5,000, Deduct	-0.77	
08 87 23 16-0014 Anti-Graffiti Glazing Films (08 87 23 16)		
Note: Includes cleaning of window glazing prior to installation.		
08 87 23 16-0015 SF 0.004" Clear Anti-Graffiti Glazing Film (3M Scotchgard™ AG-4).....	10.02	
For >1,000 To 5,000, Deduct	-0.47	
For >5,000, Deduct	-0.60	
08 87 23 16-0016 SF 0.007" Clear Anti-Graffiti Glazing Film (3M Scotchgard™ AG-7).....	10.18	
For >1,000 To 5,000, Deduct	-0.48	
For >5,000, Deduct	-0.62	
08 88 Special Function Glazing (08 88)		
08 88 53 Security Glazing (08 88)		
08 88 53 00-0001 Forced Entry And/Or Ballistic Resistant All Glass Laminate (08 88 53)		
08 88 53 00-0002 Ballistic Resistant Glass (08 88 53 00-0001)		
08 88 53 00-0003 SF 1.28" All Glass Laminate Ballistic Resistant Glass, Level 1, 16.2 LB/SF, For A Single Piece, Up To 15 SF	72.29	19.03
For Glass Removal And Preparing Opening For New Glazing, Add	47.18	
08 88 53 00-0004 SF 1.28" All Glass Laminate Ballistic Resistant Glass, Level 1, 16.2 LB/SF, For A Single Piece, >15 SF	80.80	19.03
For Glass Removal And Preparing Opening For New Glazing, Add	47.18	
08 88 53 00-0005 SF 1.55" All Glass Laminate Ballistic Resistant Glass, Level 2, 21.2 LB/SF, For A Single Piece, Up To 15 SF	91.53	21.31
For Glass Removal And Preparing Opening For New Glazing, Add	53.28	
08 88 53 00-0006 SF 1.55" All Glass Laminate Ballistic Resistant Glass, Level 2, 21.2 LB/SF, For A Single Piece, >15 SF	98.63	21.31
For Glass Removal And Preparing Opening For New Glazing, Add	53.28	
08 88 53 00-0007 SF 2.05" All Glass Laminate Ballistic Resistant Glass, Level 3, 26.1 LB/SF, For A Single Piece, Up To 15 SF	112.26	24.35
For Glass Removal And Preparing Opening For New Glazing, Add	60.88	
08 88 53 00-0008 SF 2.05" All Glass Laminate Ballistic Resistant Glass, Level 3, 26.1 LB/SF, For A Single Piece, >15 SF	117.97	24.35
For Glass Removal And Preparing Opening For New Glazing, Add	60.88	

08	Openings
08 80	Glazing
08 88	Special Function Glazing



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 88 53 00-0009			Forced Entry Resistant Glass (08 88 53 00-0001)		
08 88 53 00-0010	SF		5/16" Forced Entry Resistant Laminated Glass Sheet <i>For Glass Removal And Preparing Opening For New Glazing, Add</i>	26.69 11.89	5.70
08 88 53 00-0011	SF		1/2" Forced Entry Resistant Laminated Glass Sheet <i>For Glass Removal And Preparing Opening For New Glazing, Add</i>	29.98 12.68	6.09
08 88 53 00-0012	SF		11/16" Forced Entry Resistant Laminated Glass Sheet <i>For Glass Removal And Preparing Opening For New Glazing, Add</i>	33.86 13.59	6.47
08 88 53 00-0013	SF		7/8" Forced Entry Resistant Laminated Glass Sheet <i>For Glass Removal And Preparing Opening For New Glazing, Add</i>	37.96 14.64	7.23
08 88 53 00-0014			Glass Clad Polycarbonate (08 88 53)		
08 88 53 00-0015	SF		0.76" Ballistic Resistant Glass/Poly, Level 1, 6.4 LB/SF <i>For Glass Removal And Preparing Opening For New Glazing, Add</i>	100.19 57.84	22.83
08 88 53 00-0016	SF		0.8125" Ballistic Resistant Glass/Poly, Level 2, 8.99 LB/SF <i>For Glass Removal And Preparing Opening For New Glazing, Add</i>	113.17 66.97	26.79
08 88 53 00-0017	SF		1.18" Ballistic Resistant Glass/Poly, Level 3, 11.5 LB/SF <i>For Glass Removal And Preparing Opening For New Glazing, Add</i>	139.90 76.10	30.44
08 88 53 00-0018			Ballistic Resistant Acrylic (08 88 53)		
08 88 53 00-0019	SF		1.25" Ballistic Resistant Acrylic Glass, Level 1, 7.7 LB/SF <i>For Glass Removal And Preparing Opening For New Glazing, Add</i>	151.34 57.84	22.83
08 88 53 00-0020	SF		1.378" Ballistic Resistant Acrylic Glass, Level 2, 8.5 LB/SF <i>For Glass Removal And Preparing Opening For New Glazing, Add</i>	176.97 66.97	26.64
08 88 53 00-0021	SF		1.25" Ballistic Resistant Acrylic Glass, Level 3, 7.5 LB/SF <i>For Glass Removal And Preparing Opening For New Glazing, Add</i>	230.10 76.10	30.44
08 88 53 00-0022			Ballistic Resistant Fiberglass (08 88 53)		
08 88 53 00-0023	SF		5/16" Ballistic Resistant Fiberglass, Level 1, 3.2 LB/SF <i>For Glass Removal And Preparing Opening For New Glazing, Add</i>	44.54 28.92	14.46
08 88 53 00-0024	SF		3/8" Ballistic Resistant Fiberglass, Level 2, 3.5 LB/SF <i>For Glass Removal And Preparing Opening For New Glazing, Add</i>	52.33 33.49	16.74
08 88 53 00-0025	SF		7/16" Ballistic Resistant Fiberglass, Level 3, 4.5 LB/SF <i>For Glass Removal And Preparing Opening For New Glazing, Add</i>	59.40 38.06	19.03
08 88 53 00-0026			Forced Entry And/Or Ballistic Resistant Polycarbonate (08 88 53)		
08 88 53 00-0027			Forced Entry Resistant Monolithic Polycarbonate (08 88 53 00-0026) Note: GE-Lexan MR10.		
08 88 53 00-0028	SF		1/2" Overall Nominal Thickness, H.P. White TP-0500.01 Note: Level 1 or ASTM F1233, Class II (Step 5). <i>For Glass Removal And Preparing Opening For New Glazing, Add</i>	72.97 46.13	34.55
08 88 53 00-0029			Forced Entry Resistant Glass Clad Polycarbonate Laminate (08 88 53 00-0026) Note: Chemically strengthened clear glass laminated to each side of a polycarbonate core. GE-Insulgard.		
08 88 53 00-0030	SF		9/16" Overall Nominal Thickness, H.P. White TP-0500.01, Level 1 <i>For Glass Removal And Preparing Opening For New Glazing, Add</i>	90.21 57.08	22.83
08 88 53 00-0031			Forced Entry Resistant Polycarbonate Laminate (08 88 53 00-0026) Note: GE-Lexgard MPC-500.		
08 88 53 00-0032	SF		1/2" Overall Nominal Thickness, H.P. White TP-0500.01 Note: Level II (Step 12) Or ASTM 1233 Class III (Step 15). <i>For Glass Removal And Preparing Opening For New Glazing, Add</i>	108.70 60.88	43.83
08 88 53 00-0033			Fire Resistant, Forced Entry Resistant Polycarbonate Laminate (08 88 53 00-0026) Note: Wire glass clad. Chemically strengthened wire glass laminated to each side of a polycarbonate core. GE-Firegard.		
08 88 53 00-0034	SF		7/8" Overall Nominal Thickness, H.P. White TP-0500.01, Level I Note: UL-9 Fire Resistant. <i>For Glass Removal And Preparing Opening For New Glazing, Add</i>	118.65 64.68	27.04
08 88 53 00-0035			Insulated, Forced Entry Resistant Polycarbonate Laminate (08 88 53 00-0026) Note: Glass clad. Chemically strengthened wire glass laminated to each side of a polycarbonate core. GE-Insulgard.		
08 88 53 00-0036	SF		1-5/16" Overall Nominal Thickness, H.P. White TP-0500.01 Note: Level I (1/4" tempered float glass, 1/2" airspace). <i>For Glass Removal And Preparing Opening For New Glazing, Add</i>	102.06 57.08	22.83
08 88 53 00-0037			Ballistic And Forced Entry Resistant Polycarbonate Laminate (08 88 53 00-0026)		
08 88 53 00-0038	SF		1" Nominal Thickness, Ballistic Or Forced Entry Resistant Note: 1" is the overall nominal thickness. (GE-Lexgard MP-1000) forced entry resistance: H.P. White TP-0500.01, level V (step 42) or ASTM 1233 class V (Step 40) ballistic resistance: UL 752, level 2-high powered small arms (.357 Magnum handgun). <i>For Glass Removal And Preparing Opening For New Glazing, Add</i>	234.20 126.33	50.84



Openings	08	08
Glazing	08 80	
Special Function Glazing	08 88	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 88 53 00-0039	SF		1-1/4" Nominal Thickness, Ballistic Or Forced Entry Resistant..... Note: 1 1/4" is the overall nominal thickness. (GE-Lexgard MP-1000) forced entry resistance: H.P. White TP-0500.01, level V (Step 42) or ASTM 1233 class V (step 40) ballistic resistance: UL 752, level 3-super high powered small arms (.44 Magnum handgun). <i>For Glass Removal And Preparing Opening For New Glazing, Add</i>	236.75 126.33	50.84
08 88 53 00-0040			Ballistic Resistant Glass Clad Polycarbonate Laminate (08 88 53 00-0026) Note: Chemically strengthened clear glass laminated to attack side of a polycarbonate core.		
08 88 53 00-0041	SF		1-5/16" Overall Nominal Thickness, Ballistic Resistant..... Note: UL 752, Level 4 - Super High Powered Rifle (.30-06 Rifle), (GE-Armor-Gard). <i>For Glass Removal And Preparing Opening For New Glazing, Add</i>	156.15 85.24	32.22

08 90 Louvers And Vents (08)

08 91 Louvers (08 90)

08 91 13 Motorized Wall Louvers (08 91)

08 91 13 00-0001			Motorized Wall Louver Actuator (08 91 13) See CSI section 08 91 16 00-0001 for adjustable intake wall louvers.		
08 91 13 00-0002	EA		115 Volt Actuator For Adjustable Intake Louver.....	1,042.77	68.43
08 91 13 00-0003	EA		230 Volt Actuator For Adjustable Intake Louver.....	1,581.57	68.43
08 91 13 00-0004	EA		24 Volt Actuator For Adjustable Intake Louver.....	1,119.57	68.43
08 91 13 00-0005	EA		115 Volt Hazardous Location Actuator For Adjustable Intake Louver.....	4,282.17	68.43

08 91 16 Operable Wall Louvers (08 91)

08 91 16 00-0001			Adjustable Intake Wall Louvers (08 91 16) See CSI section 08 91 16 00-0137 for adjustable intake wall louver operators.		
08 91 16 00-0002	EA		12" Wide x 12" High Adjustable Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. Excludes actuator. <i>For Flange Frame, Add</i> <i>For Clear Lacquer Finish, Add</i> <i>For Baked Enamel Standard Colors, Add</i> <i>For Anodized Finish, Add</i> <i>For Kynar™ Standard Colors Finish, Add</i>	282.83 24.66 49.32 73.98 98.64 135.63	18.11
08 91 16 00-0003	EA		12" Wide x 18" High Adjustable Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. Excludes actuator. <i>For Flange Frame, Add</i> <i>For Clear Lacquer Finish, Add</i> <i>For Baked Enamel Standard Colors, Add</i> <i>For Anodized Finish, Add</i> <i>For Kynar™ Standard Colors Finish, Add</i>	353.27 30.90 61.80 92.70 123.60 169.95	22.14
08 91 16 00-0004	EA		12" Wide x 24" High Adjustable Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. Excludes actuator. <i>For Flange Frame, Add</i> <i>For Clear Lacquer Finish, Add</i> <i>For Baked Enamel Standard Colors, Add</i> <i>For Anodized Finish, Add</i> <i>For Kynar™ Standard Colors Finish, Add</i>	417.73 36.54 73.08 109.62 146.16 200.97	26.16
08 91 16 00-0005	EA		12" Wide x 30" High Adjustable Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. Excludes actuator. <i>For Flange Frame, Add</i> <i>For Clear Lacquer Finish, Add</i> <i>For Baked Enamel Standard Colors, Add</i> <i>For Anodized Finish, Add</i> <i>For Kynar™ Standard Colors Finish, Add</i>	488.77 42.84 85.68 128.52 171.36 235.62	30.19
08 91 16 00-0006	EA		12" Wide x 36" High Adjustable Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. Excludes actuator. <i>For Flange Frame, Add</i> <i>For Clear Lacquer Finish, Add</i> <i>For Baked Enamel Standard Colors, Add</i> <i>For Anodized Finish, Add</i> <i>For Kynar™ Standard Colors Finish, Add</i>	550.83 48.24 96.48 144.72 192.96 265.32	34.21
08 91 16 00-0007	EA		12" Wide x 42" High Adjustable Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. Excludes actuator. <i>For Flange Frame, Add</i> <i>For Clear Lacquer Finish, Add</i> <i>For Baked Enamel Standard Colors, Add</i> <i>For Anodized Finish, Add</i> <i>For Kynar™ Standard Colors Finish, Add</i>	649.47 57.30 114.60 171.90 229.20 315.15	38.24
08 91 16 00-0008	EA		12" Wide x 48" High Adjustable Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. Excludes actuator. <i>For Flange Frame, Add</i> <i>For Clear Lacquer Finish, Add</i> <i>For Baked Enamel Standard Colors, Add</i> <i>For Anodized Finish, Add</i> <i>For Kynar™ Standard Colors Finish, Add</i>	739.73 65.52 131.04 196.56 262.08 360.36	42.26

08	Openings
08 90	Louvers And Vents
08 91	Louvers



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 91 16 00-0009	EA		12" Wide x 54" High Adjustable Intake Louver, Galvanized Aluminum.....	822.00	48.30
			Note: Includes bird screen. Excludes actuator.		
			<i>For Flange Frame, Add</i>	72.54	
			<i>For Clear Lacquer Finish, Add</i>	145.08	
			<i>For Baked Enamel Standard Colors, Add</i>	217.62	
			<i>For Anodized Finish, Add</i>	290.16	
			<i>For Kynar™ Standard Colors Finish, Add</i>	398.97	
08 91 16 00-0010	EA		12" Wide x 60" High Adjustable Intake Louver, Galvanized Aluminum.....	877.44	52.33
			Note: Includes bird screen. Excludes actuator.		
			<i>For Flange Frame, Add</i>	77.28	
			<i>For Clear Lacquer Finish, Add</i>	154.56	
			<i>For Baked Enamel Standard Colors, Add</i>	231.84	
			<i>For Anodized Finish, Add</i>	309.12	
			<i>For Kynar™ Standard Colors Finish, Add</i>	425.04	
08 91 16 00-0011	EA		12" Wide x 66" High Adjustable Intake Louver, Galvanized Aluminum.....	946.70	56.34
			Note: Includes bird screen. Excludes actuator.		
			<i>For Flange Frame, Add</i>	83.40	
			<i>For Clear Lacquer Finish, Add</i>	166.80	
			<i>For Baked Enamel Standard Colors, Add</i>	250.20	
			<i>For Anodized Finish, Add</i>	333.60	
			<i>For Kynar™ Standard Colors Finish, Add</i>	458.70	
08 91 16 00-0012	EA		12" Wide x 72" High Adjustable Intake Louver, Galvanized Aluminum.....	1,007.54	60.37
			Note: Includes bird screen. Excludes actuator.		
			<i>For Flange Frame, Add</i>	88.68	
			<i>For Clear Lacquer Finish, Add</i>	177.36	
			<i>For Baked Enamel Standard Colors, Add</i>	266.04	
			<i>For Anodized Finish, Add</i>	354.72	
			<i>For Kynar™ Standard Colors Finish, Add</i>	487.74	
08 91 16 00-0013	EA		12" Wide x 78" High Adjustable Intake Louver, Galvanized Aluminum.....	1,085.20	64.40
			Note: Includes bird screen. Excludes actuator.		
			<i>For Flange Frame, Add</i>	95.64	
			<i>For Clear Lacquer Finish, Add</i>	191.28	
			<i>For Baked Enamel Standard Colors, Add</i>	286.92	
			<i>For Anodized Finish, Add</i>	382.56	
			<i>For Kynar™ Standard Colors Finish, Add</i>	526.02	
08 91 16 00-0014	EA		12" Wide x 84" High Adjustable Intake Louver, Galvanized Aluminum.....	1,159.84	68.43
			Note: Includes bird screen. Excludes actuator.		
			<i>For Flange Frame, Add</i>	102.30	
			<i>For Clear Lacquer Finish, Add</i>	204.60	
			<i>For Baked Enamel Standard Colors, Add</i>	306.90	
			<i>For Anodized Finish, Add</i>	409.20	
			<i>For Kynar™ Standard Colors Finish, Add</i>	562.65	
08 91 16 00-0015	EA		12" Wide x 90" High Adjustable Intake Louver, Galvanized Aluminum.....	1,252.92	74.46
			Note: Includes bird screen. Excludes actuator.		
			<i>For Flange Frame, Add</i>	110.40	
			<i>For Clear Lacquer Finish, Add</i>	220.80	
			<i>For Baked Enamel Standard Colors, Add</i>	331.20	
			<i>For Anodized Finish, Add</i>	441.60	
			<i>For Kynar™ Standard Colors Finish, Add</i>	607.20	
08 91 16 00-0016	EA		12" Wide x 96" High Adjustable Intake Louver, Galvanized Aluminum.....	1,322.00	80.50
			Note: Includes bird screen. Excludes actuator.		
			<i>For Flange Frame, Add</i>	116.10	
			<i>For Clear Lacquer Finish, Add</i>	232.20	
			<i>For Baked Enamel Standard Colors, Add</i>	348.30	
			<i>For Anodized Finish, Add</i>	464.40	
			<i>For Kynar™ Standard Colors Finish, Add</i>	638.55	
08 91 16 00-0017	EA		18" Wide x 12" High Adjustable Intake Louver, Galvanized Aluminum.....	317.87	22.14
			Note: Includes bird screen. Excludes actuator.		
			<i>For Flange Frame, Add</i>	27.36	
			<i>For Clear Lacquer Finish, Add</i>	54.72	
			<i>For Baked Enamel Standard Colors, Add</i>	82.08	
			<i>For Anodized Finish, Add</i>	109.44	
			<i>For Kynar™ Standard Colors Finish, Add</i>	150.48	
08 91 16 00-0018	EA		18" Wide x 18" High Adjustable Intake Louver, Galvanized Aluminum.....	401.34	28.17
			Note: Includes bird screen. Excludes actuator.		
			<i>For Flange Frame, Add</i>	34.50	
			<i>For Clear Lacquer Finish, Add</i>	69.00	
			<i>For Baked Enamel Standard Colors, Add</i>	103.50	
			<i>For Anodized Finish, Add</i>	138.00	
			<i>For Kynar™ Standard Colors Finish, Add</i>	189.75	
08 91 16 00-0019	EA		18" Wide x 24" High Adjustable Intake Louver, Galvanized Aluminum.....	470.60	32.20
			Note: Includes bird screen. Excludes actuator.		
			<i>For Flange Frame, Add</i>	40.62	
			<i>For Clear Lacquer Finish, Add</i>	81.24	
			<i>For Baked Enamel Standard Colors, Add</i>	121.86	
			<i>For Anodized Finish, Add</i>	162.48	
			<i>For Kynar™ Standard Colors Finish, Add</i>	223.41	
08 91 16 00-0020	EA		18" Wide x 30" High Adjustable Intake Louver, Galvanized Aluminum.....	585.70	40.24
			Note: Includes bird screen. Excludes actuator.		
			<i>For Flange Frame, Add</i>	50.52	
			<i>For Clear Lacquer Finish, Add</i>	101.04	
			<i>For Baked Enamel Standard Colors, Add</i>	151.56	
			<i>For Anodized Finish, Add</i>	202.08	
			<i>For Kynar™ Standard Colors Finish, Add</i>	277.86	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 91 16 00-0021	EA			18" Wide x 36" High Adjustable Intake Louver, Galvanized Aluminum.....	665.74	44.27
				Note: Includes bird screen. Excludes actuator.		
				For Flange Frame, Add	57.72	
				For Clear Lacquer Finish, Add	115.44	
				For Baked Enamel Standard Colors, Add	173.16	
				For Anodized Finish, Add	230.88	
				For Kynar™ Standard Colors Finish, Add	317.46	
08 91 16 00-0022	EA			18" Wide x 42" High Adjustable Intake Louver, Galvanized Aluminum.....	745.80	48.30
				Note: Includes bird screen. Excludes actuator.		
				For Flange Frame, Add	64.92	
				For Clear Lacquer Finish, Add	129.84	
				For Baked Enamel Standard Colors, Add	194.76	
				For Anodized Finish, Add	259.68	
				For Kynar™ Standard Colors Finish, Add	357.06	
08 91 16 00-0023	EA			18" Wide x 48" High Adjustable Intake Louver, Galvanized Aluminum.....	841.44	52.33
				Note: Includes bird screen. Excludes actuator.		
				For Flange Frame, Add	73.68	
				For Clear Lacquer Finish, Add	147.36	
				For Baked Enamel Standard Colors, Add	221.04	
				For Anodized Finish, Add	294.72	
				For Kynar™ Standard Colors Finish, Add	405.24	
08 91 16 00-0024	EA			18" Wide x 54" High Adjustable Intake Louver, Galvanized Aluminum.....	933.33	58.36
				Note: Includes bird screen. Excludes actuator.		
				For Flange Frame, Add	81.66	
				For Clear Lacquer Finish, Add	163.32	
				For Baked Enamel Standard Colors, Add	244.98	
				For Anodized Finish, Add	326.64	
				For Kynar™ Standard Colors Finish, Add	449.13	
08 91 16 00-0025	EA			18" Wide x 60" High Adjustable Intake Louver, Galvanized Aluminum.....	1,007.20	64.40
				Note: Includes bird screen. Excludes actuator.		
				For Flange Frame, Add	87.84	
				For Clear Lacquer Finish, Add	175.68	
				For Baked Enamel Standard Colors, Add	263.52	
				For Anodized Finish, Add	351.36	
				For Kynar™ Standard Colors Finish, Add	483.12	
08 91 16 00-0026	EA			18" Wide x 66" High Adjustable Intake Louver, Galvanized Aluminum.....	1,077.64	68.43
				Note: Includes bird screen. Excludes actuator.		
				For Flange Frame, Add	94.08	
				For Clear Lacquer Finish, Add	188.16	
				For Baked Enamel Standard Colors, Add	282.24	
				For Anodized Finish, Add	376.32	
				For Kynar™ Standard Colors Finish, Add	517.44	
08 91 16 00-0027	EA			18" Wide x 72" High Adjustable Intake Louver, Galvanized Aluminum.....	1,143.90	72.44
				Note: Includes bird screen. Excludes actuator.		
				For Flange Frame, Add	99.90	
				For Clear Lacquer Finish, Add	199.80	
				For Baked Enamel Standard Colors, Add	299.70	
				For Anodized Finish, Add	399.60	
				For Kynar™ Standard Colors Finish, Add	549.45	
08 91 16 00-0028	EA			18" Wide x 78" High Adjustable Intake Louver, Galvanized Aluminum.....	1,229.34	76.47
				Note: Includes bird screen. Excludes actuator.		
				For Flange Frame, Add	107.64	
				For Clear Lacquer Finish, Add	215.28	
				For Baked Enamel Standard Colors, Add	322.92	
				For Anodized Finish, Add	430.56	
				For Kynar™ Standard Colors Finish, Add	592.02	
08 91 16 00-0029	EA			18" Wide x 84" High Adjustable Intake Louver, Galvanized Aluminum.....	1,311.80	80.50
				Note: Includes bird screen. Excludes actuator.		
				For Flange Frame, Add	115.08	
				For Clear Lacquer Finish, Add	230.16	
				For Baked Enamel Standard Colors, Add	345.24	
				For Anodized Finish, Add	460.32	
				For Kynar™ Standard Colors Finish, Add	632.94	
08 91 16 00-0030	EA			18" Wide x 90" High Adjustable Intake Louver, Galvanized Aluminum.....	1,412.67	86.53
				Note: Includes bird screen. Excludes actuator.		
				For Flange Frame, Add	123.96	
				For Clear Lacquer Finish, Add	247.92	
				For Baked Enamel Standard Colors, Add	371.88	
				For Anodized Finish, Add	495.84	
				For Kynar™ Standard Colors Finish, Add	681.78	
08 91 16 00-0031	EA			18" Wide x 96" High Adjustable Intake Louver, Galvanized Aluminum.....	1,489.54	92.57
				Note: Includes bird screen. Excludes actuator.		
				For Flange Frame, Add	130.44	
				For Clear Lacquer Finish, Add	260.88	
				For Baked Enamel Standard Colors, Add	391.32	
				For Anodized Finish, Add	521.76	
				For Kynar™ Standard Colors Finish, Add	717.42	
08 91 16 00-0032	EA			24" Wide x 12" High Adjustable Intake Louver, Galvanized Aluminum.....	355.93	26.16
				Note: Includes bird screen. Excludes actuator.		
				For Flange Frame, Add	30.36	
				For Clear Lacquer Finish, Add	60.72	
				For Baked Enamel Standard Colors, Add	91.08	
				For Anodized Finish, Add	121.44	
				For Kynar™ Standard Colors Finish, Add	166.98	

08	Openings
08 90	Louvers And Vents
08 91	Louvers



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 91 16 00-0033	EA		24" Wide x 18" High Adjustable Intake Louver, Galvanized Aluminum.....	451.40	32.20
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	38.70	
			For Clear Lacquer Finish, Add	77.40	
			For Baked Enamel Standard Colors, Add	116.10	
			For Anodized Finish, Add	154.80	
			For Kynar™ Standard Colors Finish, Add	212.85	
08 91 16 00-0034	EA		24" Wide x 24" High Adjustable Intake Louver, Galvanized Aluminum.....	558.87	38.24
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	48.24	
			For Clear Lacquer Finish, Add	96.48	
			For Baked Enamel Standard Colors, Add	144.72	
			For Anodized Finish, Add	192.96	
			For Kynar™ Standard Colors Finish, Add	265.32	
08 91 16 00-0035	EA		24" Wide x 30" High Adjustable Intake Louver, Galvanized Aluminum.....	659.57	46.29
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	56.70	
			For Clear Lacquer Finish, Add	113.40	
			For Baked Enamel Standard Colors, Add	170.10	
			For Anodized Finish, Add	226.80	
			For Kynar™ Standard Colors Finish, Add	311.85	
08 91 16 00-0036	EA		24" Wide x 36" High Adjustable Intake Louver, Galvanized Aluminum.....	747.43	50.31
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	64.68	
			For Clear Lacquer Finish, Add	129.36	
			For Baked Enamel Standard Colors, Add	194.04	
			For Anodized Finish, Add	258.72	
			For Kynar™ Standard Colors Finish, Add	355.74	
08 91 16 00-0037	EA		24" Wide x 42" High Adjustable Intake Louver, Galvanized Aluminum.....	840.07	54.34
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	73.14	
			For Clear Lacquer Finish, Add	146.28	
			For Baked Enamel Standard Colors, Add	219.42	
			For Anodized Finish, Add	292.56	
			For Kynar™ Standard Colors Finish, Add	402.27	
08 91 16 00-0038	EA		24" Wide x 48" High Adjustable Intake Louver, Galvanized Aluminum.....	954.74	60.37
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	83.40	
			For Clear Lacquer Finish, Add	166.80	
			For Baked Enamel Standard Colors, Add	250.20	
			For Anodized Finish, Add	333.60	
			For Kynar™ Standard Colors Finish, Add	458.70	
08 91 16 00-0039	EA		24" Wide x 54" High Adjustable Intake Louver, Galvanized Aluminum.....	1,052.44	68.43
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	91.56	
			For Clear Lacquer Finish, Add	183.12	
			For Baked Enamel Standard Colors, Add	274.68	
			For Anodized Finish, Add	366.24	
			For Kynar™ Standard Colors Finish, Add	503.58	
08 91 16 00-0040	EA		24" Wide x 60" High Adjustable Intake Louver, Galvanized Aluminum.....	1,127.70	72.44
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	98.28	
			For Clear Lacquer Finish, Add	196.56	
			For Baked Enamel Standard Colors, Add	294.84	
			For Anodized Finish, Add	393.12	
			For Kynar™ Standard Colors Finish, Add	540.54	
08 91 16 00-0041	EA		24" Wide x 66" High Adjustable Intake Louver, Galvanized Aluminum.....	1,211.00	80.50
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	105.00	
			For Clear Lacquer Finish, Add	210.00	
			For Baked Enamel Standard Colors, Add	315.00	
			For Anodized Finish, Add	420.00	
			For Kynar™ Standard Colors Finish, Add	577.50	
08 91 16 00-0042	EA		24" Wide x 72" High Adjustable Intake Louver, Galvanized Aluminum.....	1,287.44	84.53
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	111.84	
			For Clear Lacquer Finish, Add	223.68	
			For Baked Enamel Standard Colors, Add	335.52	
			For Anodized Finish, Add	447.36	
			For Kynar™ Standard Colors Finish, Add	615.12	
08 91 16 00-0043	EA		24" Wide x 78" High Adjustable Intake Louver, Galvanized Aluminum.....	1,390.90	88.54
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	121.38	
			For Clear Lacquer Finish, Add	242.76	
			For Baked Enamel Standard Colors, Add	364.14	
			For Anodized Finish, Add	485.52	
			For Kynar™ Standard Colors Finish, Add	667.59	
08 91 16 00-0044	EA		24" Wide x 84" High Adjustable Intake Louver, Galvanized Aluminum.....	1,478.74	92.57
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	129.36	
			For Clear Lacquer Finish, Add	258.72	
			For Baked Enamel Standard Colors, Add	388.08	
			For Anodized Finish, Add	517.44	
			For Kynar™ Standard Colors Finish, Add	711.48	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 91 16 00-0045	EA		24" Wide x 90" High Adjustable Intake Louver, Galvanized Aluminum.....	1,589.81	98.61
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	139.26	
			For Clear Lacquer Finish, Add	278.52	
			For Baked Enamel Standard Colors, Add	417.78	
			For Anodized Finish, Add	557.04	
			For Kynar™ Standard Colors Finish, Add	765.93	
08 91 16 00-0046	EA		24" Wide x 96" High Adjustable Intake Louver, Galvanized Aluminum.....	1,672.10	104.64
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	146.28	
			For Clear Lacquer Finish, Add	292.56	
			For Baked Enamel Standard Colors, Add	438.84	
			For Anodized Finish, Add	585.12	
			For Kynar™ Standard Colors Finish, Add	804.54	
08 91 16 00-0047	EA		30" Wide x 12" High Adjustable Intake Louver, Galvanized Aluminum.....	396.97	30.19
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	33.66	
			For Clear Lacquer Finish, Add	67.32	
			For Baked Enamel Standard Colors, Add	100.98	
			For Anodized Finish, Add	134.64	
			For Kynar™ Standard Colors Finish, Add	185.13	
08 91 16 00-0048	EA		30" Wide x 18" High Adjustable Intake Louver, Galvanized Aluminum.....	528.70	40.24
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	44.82	
			For Clear Lacquer Finish, Add	89.64	
			For Baked Enamel Standard Colors, Add	134.46	
			For Anodized Finish, Add	179.28	
			For Kynar™ Standard Colors Finish, Add	246.51	
08 91 16 00-0049	EA		30" Wide x 24" High Adjustable Intake Louver, Galvanized Aluminum.....	627.17	46.29
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	53.46	
			For Clear Lacquer Finish, Add	106.92	
			For Baked Enamel Standard Colors, Add	160.38	
			For Anodized Finish, Add	213.84	
			For Kynar™ Standard Colors Finish, Add	294.03	
08 91 16 00-0050	EA		30" Wide x 30" High Adjustable Intake Louver, Galvanized Aluminum.....	734.64	52.33
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	63.00	
			For Clear Lacquer Finish, Add	126.00	
			For Baked Enamel Standard Colors, Add	189.00	
			For Anodized Finish, Add	252.00	
			For Kynar™ Standard Colors Finish, Add	346.50	
08 91 16 00-0051	EA		30" Wide x 36" High Adjustable Intake Louver, Galvanized Aluminum.....	830.30	56.34
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	71.76	
			For Clear Lacquer Finish, Add	143.52	
			For Baked Enamel Standard Colors, Add	215.28	
			For Anodized Finish, Add	287.04	
			For Kynar™ Standard Colors Finish, Add	394.68	
08 91 16 00-0052	EA		30" Wide x 42" High Adjustable Intake Louver, Galvanized Aluminum.....	929.97	62.38
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	80.52	
			For Clear Lacquer Finish, Add	161.04	
			For Baked Enamel Standard Colors, Add	241.56	
			For Anodized Finish, Add	322.08	
			For Kynar™ Standard Colors Finish, Add	442.86	
08 91 16 00-0053	EA		30" Wide x 48" High Adjustable Intake Louver, Galvanized Aluminum.....	1,048.42	66.41
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	91.56	
			For Clear Lacquer Finish, Add	183.12	
			For Baked Enamel Standard Colors, Add	274.68	
			For Anodized Finish, Add	366.24	
			For Kynar™ Standard Colors Finish, Add	503.58	
08 91 16 00-0054	EA		30" Wide x 54" High Adjustable Intake Louver, Galvanized Aluminum.....	1,150.50	72.44
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	100.56	
			For Clear Lacquer Finish, Add	201.12	
			For Baked Enamel Standard Colors, Add	301.68	
			For Anodized Finish, Add	402.24	
			For Kynar™ Standard Colors Finish, Add	553.08	
08 91 16 00-0055	EA		30" Wide x 60" High Adjustable Intake Louver, Galvanized Aluminum.....	1,234.14	76.47
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	108.12	
			For Clear Lacquer Finish, Add	216.24	
			For Baked Enamel Standard Colors, Add	324.36	
			For Anodized Finish, Add	432.48	
			For Kynar™ Standard Colors Finish, Add	594.66	
08 91 16 00-0056	EA		30" Wide x 66" High Adjustable Intake Louver, Galvanized Aluminum.....	1,327.04	84.53
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	115.80	
			For Clear Lacquer Finish, Add	231.60	
			For Baked Enamel Standard Colors, Add	347.40	
			For Anodized Finish, Add	463.20	
			For Kynar™ Standard Colors Finish, Add	636.90	

08	Openings
08 90	Louvers And Vents
08 91	Louvers



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 91 16 00-0057	EA		30" Wide x 72" High Adjustable Intake Louver, Galvanized Aluminum.....	1,415.31	90.56
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	123.42	
			For Clear Lacquer Finish, Add	246.84	
			For Baked Enamel Standard Colors, Add	370.26	
			For Anodized Finish, Add	493.68	
			For Kynar™ Standard Colors Finish, Add	678.81	
08 91 16 00-0058	EA		30" Wide x 78" High Adjustable Intake Louver, Galvanized Aluminum.....	1,525.37	94.58
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	133.62	
			For Clear Lacquer Finish, Add	267.24	
			For Baked Enamel Standard Colors, Add	400.86	
			For Anodized Finish, Add	534.48	
			For Kynar™ Standard Colors Finish, Add	734.91	
08 91 16 00-0059	EA		30" Wide x 84" High Adjustable Intake Louver, Galvanized Aluminum.....	1,621.01	98.61
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	142.38	
			For Clear Lacquer Finish, Add	284.76	
			For Baked Enamel Standard Colors, Add	427.14	
			For Anodized Finish, Add	569.52	
			For Kynar™ Standard Colors Finish, Add	783.09	
08 91 16 00-0060	EA		30" Wide x 90" High Adjustable Intake Louver, Galvanized Aluminum.....	1,737.50	104.64
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	152.82	
			For Clear Lacquer Finish, Add	305.64	
			For Baked Enamel Standard Colors, Add	458.46	
			For Anodized Finish, Add	611.28	
			For Kynar™ Standard Colors Finish, Add	840.51	
08 91 16 00-0061	EA		30" Wide x 96" High Adjustable Intake Louver, Galvanized Aluminum.....	1,830.57	110.68
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	160.92	
			For Clear Lacquer Finish, Add	321.84	
			For Baked Enamel Standard Colors, Add	482.76	
			For Anodized Finish, Add	643.68	
			For Kynar™ Standard Colors Finish, Add	885.06	
08 91 16 00-0062	EA		36" Wide x 12" High Adjustable Intake Louver, Galvanized Aluminum.....	435.03	34.21
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	36.66	
			For Clear Lacquer Finish, Add	73.32	
			For Baked Enamel Standard Colors, Add	109.98	
			For Anodized Finish, Add	146.64	
			For Kynar™ Standard Colors Finish, Add	201.63	
08 91 16 00-0063	EA		36" Wide x 18" High Adjustable Intake Louver, Galvanized Aluminum.....	588.34	44.27
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	49.98	
			For Clear Lacquer Finish, Add	99.96	
			For Baked Enamel Standard Colors, Add	149.94	
			For Anodized Finish, Add	199.92	
			For Kynar™ Standard Colors Finish, Add	274.89	
08 91 16 00-0064	EA		36" Wide x 24" High Adjustable Intake Louver, Galvanized Aluminum.....	687.43	50.31
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	58.68	
			For Clear Lacquer Finish, Add	117.36	
			For Baked Enamel Standard Colors, Add	176.04	
			For Anodized Finish, Add	234.72	
			For Kynar™ Standard Colors Finish, Add	322.74	
08 91 16 00-0065	EA		36" Wide x 30" High Adjustable Intake Louver, Galvanized Aluminum.....	805.10	56.34
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	69.24	
			For Clear Lacquer Finish, Add	138.48	
			For Baked Enamel Standard Colors, Add	207.72	
			For Anodized Finish, Add	276.96	
			For Kynar™ Standard Colors Finish, Add	380.82	
08 91 16 00-0066	EA		36" Wide x 36" High Adjustable Intake Louver, Galvanized Aluminum.....	913.75	61.18
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	79.14	
			For Clear Lacquer Finish, Add	158.28	
			For Baked Enamel Standard Colors, Add	237.42	
			For Anodized Finish, Add	316.56	
			For Kynar™ Standard Colors Finish, Add	435.27	
08 91 16 00-0067	EA		36" Wide x 42" High Adjustable Intake Louver, Galvanized Aluminum.....	1,016.02	66.41
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	88.32	
			For Clear Lacquer Finish, Add	176.64	
			For Baked Enamel Standard Colors, Add	264.96	
			For Anodized Finish, Add	353.28	
			For Kynar™ Standard Colors Finish, Add	485.76	
08 91 16 00-0068	EA		36" Wide x 48" High Adjustable Intake Louver, Galvanized Aluminum.....	1,148.27	70.44
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	100.74	
			For Clear Lacquer Finish, Add	201.48	
			For Baked Enamel Standard Colors, Add	302.22	
			For Anodized Finish, Add	402.96	
			For Kynar™ Standard Colors Finish, Add	554.07	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 91 16 00-0069 EA 36" Wide x 54" High Adjustable Intake Louver, Galvanized Aluminum.....	1,262.94	76.47
Note: Includes bird screen. Excludes actuator.		
<i>For Flange Frame, Add</i>	111.00	
<i>For Clear Lacquer Finish, Add</i>	222.00	
<i>For Baked Enamel Standard Colors, Add</i>	333.00	
<i>For Anodized Finish, Add</i>	444.00	
<i>For Kynar™ Standard Colors Finish, Add</i>	610.50	
08 91 16 00-0070 EA 36" Wide x 60" High Adjustable Intake Louver, Galvanized Aluminum.....	1,356.62	82.51
Note: Includes bird screen. Excludes actuator.		
<i>For Flange Frame, Add</i>	119.16	
<i>For Clear Lacquer Finish, Add</i>	238.32	
<i>For Baked Enamel Standard Colors, Add</i>	357.48	
<i>For Anodized Finish, Add</i>	476.64	
<i>For Kynar™ Standard Colors Finish, Add</i>	655.38	
08 91 16 00-0071 EA 36" Wide x 66" High Adjustable Intake Louver, Galvanized Aluminum.....	1,452.70	88.54
Note: Includes bird screen. Excludes actuator.		
<i>For Flange Frame, Add</i>	127.56	
<i>For Clear Lacquer Finish, Add</i>	255.12	
<i>For Baked Enamel Standard Colors, Add</i>	382.68	
<i>For Anodized Finish, Add</i>	510.24	
<i>For Kynar™ Standard Colors Finish, Add</i>	701.58	
08 91 16 00-0072 EA 36" Wide x 72" High Adjustable Intake Louver, Galvanized Aluminum.....	1,551.77	94.58
Note: Includes bird screen. Excludes actuator.		
<i>For Flange Frame, Add</i>	136.26	
<i>For Clear Lacquer Finish, Add</i>	272.52	
<i>For Baked Enamel Standard Colors, Add</i>	408.78	
<i>For Anodized Finish, Add</i>	545.04	
<i>For Kynar™ Standard Colors Finish, Add</i>	749.43	
08 91 16 00-0073 EA 36" Wide x 78" High Adjustable Intake Louver, Galvanized Aluminum.....	1,672.01	98.61
Note: Includes bird screen. Excludes actuator.		
<i>For Flange Frame, Add</i>	147.48	
<i>For Clear Lacquer Finish, Add</i>	294.96	
<i>For Baked Enamel Standard Colors, Add</i>	442.44	
<i>For Anodized Finish, Add</i>	589.92	
<i>For Kynar™ Standard Colors Finish, Add</i>	811.14	
08 91 16 00-0074 EA 36" Wide x 84" High Adjustable Intake Louver, Galvanized Aluminum.....	1,774.87	102.63
Note: Includes bird screen. Excludes actuator.		
<i>For Flange Frame, Add</i>	156.96	
<i>For Clear Lacquer Finish, Add</i>	313.92	
<i>For Baked Enamel Standard Colors, Add</i>	470.88	
<i>For Anodized Finish, Add</i>	627.84	
<i>For Kynar™ Standard Colors Finish, Add</i>	863.28	
08 91 16 00-0075 EA 36" Wide x 90" High Adjustable Intake Louver, Galvanized Aluminum.....	1,906.34	108.67
Note: Includes bird screen. Excludes actuator.		
<i>For Flange Frame, Add</i>	168.90	
<i>For Clear Lacquer Finish, Add</i>	337.80	
<i>For Baked Enamel Standard Colors, Add</i>	506.70	
<i>For Anodized Finish, Add</i>	675.60	
<i>For Kynar™ Standard Colors Finish, Add</i>	928.95	
08 91 16 00-0076 EA 36" Wide x 96" High Adjustable Intake Louver, Galvanized Aluminum.....	2,004.81	114.71
Note: Includes bird screen. Excludes actuator.		
<i>For Flange Frame, Add</i>	177.54	
<i>For Clear Lacquer Finish, Add</i>	355.08	
<i>For Baked Enamel Standard Colors, Add</i>	532.62	
<i>For Anodized Finish, Add</i>	710.16	
<i>For Kynar™ Standard Colors Finish, Add</i>	976.47	
08 91 16 00-0077 EA 42" Wide x 12" High Adjustable Intake Louver, Galvanized Aluminum.....	497.67	38.24
Note: Includes bird screen. Excludes actuator.		
<i>For Flange Frame, Add</i>	42.12	
<i>For Clear Lacquer Finish, Add</i>	84.24	
<i>For Baked Enamel Standard Colors, Add</i>	126.36	
<i>For Anodized Finish, Add</i>	168.48	
<i>For Kynar™ Standard Colors Finish, Add</i>	231.66	
08 91 16 00-0078 EA 42" Wide x 18" High Adjustable Intake Louver, Galvanized Aluminum.....	634.80	48.30
Note: Includes bird screen. Excludes actuator.		
<i>For Flange Frame, Add</i>	53.82	
<i>For Clear Lacquer Finish, Add</i>	107.64	
<i>For Baked Enamel Standard Colors, Add</i>	161.46	
<i>For Anodized Finish, Add</i>	215.28	
<i>For Kynar™ Standard Colors Finish, Add</i>	296.01	
08 91 16 00-0079 EA 42" Wide x 24" High Adjustable Intake Louver, Galvanized Aluminum.....	744.67	54.34
Note: Includes bird screen. Excludes actuator.		
<i>For Flange Frame, Add</i>	63.60	
<i>For Clear Lacquer Finish, Add</i>	127.20	
<i>For Baked Enamel Standard Colors, Add</i>	190.80	
<i>For Anodized Finish, Add</i>	254.40	
<i>For Kynar™ Standard Colors Finish, Add</i>	349.80	
08 91 16 00-0080 EA 42" Wide x 30" High Adjustable Intake Louver, Galvanized Aluminum.....	870.57	62.38
Note: Includes bird screen. Excludes actuator.		
<i>For Flange Frame, Add</i>	74.58	
<i>For Clear Lacquer Finish, Add</i>	149.16	
<i>For Baked Enamel Standard Colors, Add</i>	223.74	
<i>For Anodized Finish, Add</i>	298.32	
<i>For Kynar™ Standard Colors Finish, Add</i>	410.19	

08	Openings
08 90	Louvers And Vents
08 91	Louvers



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 91 16 00-0081	EA		42" Wide x 36" High Adjustable Intake Louver, Galvanized Aluminum.....	986.02	66.41
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	85.32	
			For Clear Lacquer Finish, Add	170.64	
			For Baked Enamel Standard Colors, Add	255.96	
			For Anodized Finish, Add	341.28	
			For Kynar™ Standard Colors Finish, Add	469.26	
08 91 16 00-0082	EA		42" Wide x 42" High Adjustable Intake Louver, Galvanized Aluminum.....	1,095.47	70.44
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	95.46	
			For Clear Lacquer Finish, Add	190.92	
			For Baked Enamel Standard Colors, Add	286.38	
			For Anodized Finish, Add	381.84	
			For Kynar™ Standard Colors Finish, Add	525.03	
08 91 16 00-0083	EA		42" Wide x 48" High Adjustable Intake Louver, Galvanized Aluminum.....	1,239.12	74.46
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	109.02	
			For Clear Lacquer Finish, Add	218.04	
			For Baked Enamel Standard Colors, Add	327.06	
			For Anodized Finish, Add	436.08	
			For Kynar™ Standard Colors Finish, Add	599.61	
08 91 16 00-0084	EA		42" Wide x 54" High Adjustable Intake Louver, Galvanized Aluminum.....	1,355.60	80.50
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	119.46	
			For Clear Lacquer Finish, Add	238.92	
			For Baked Enamel Standard Colors, Add	358.38	
			For Anodized Finish, Add	477.84	
			For Kynar™ Standard Colors Finish, Add	657.03	
08 91 16 00-0085	EA		42" Wide x 60" High Adjustable Intake Louver, Galvanized Aluminum.....	1,460.67	86.53
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	128.76	
			For Clear Lacquer Finish, Add	257.52	
			For Baked Enamel Standard Colors, Add	386.28	
			For Anodized Finish, Add	515.04	
			For Kynar™ Standard Colors Finish, Add	708.18	
08 91 16 00-0086	EA		42" Wide x 66" High Adjustable Intake Louver, Galvanized Aluminum.....	1,559.14	92.57
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	137.40	
			For Clear Lacquer Finish, Add	274.80	
			For Baked Enamel Standard Colors, Add	412.20	
			For Anodized Finish, Add	549.60	
			For Kynar™ Standard Colors Finish, Add	755.70	
08 91 16 00-0087	EA		42" Wide x 72" High Adjustable Intake Louver, Galvanized Aluminum.....	1,666.61	98.61
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	146.94	
			For Clear Lacquer Finish, Add	293.88	
			For Baked Enamel Standard Colors, Add	440.82	
			For Anodized Finish, Add	587.76	
			For Kynar™ Standard Colors Finish, Add	808.17	
08 91 16 00-0088	EA		42" Wide x 78" High Adjustable Intake Louver, Galvanized Aluminum.....	1,795.87	102.63
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	159.06	
			For Clear Lacquer Finish, Add	318.12	
			For Baked Enamel Standard Colors, Add	477.18	
			For Anodized Finish, Add	636.24	
			For Kynar™ Standard Colors Finish, Add	874.83	
08 91 16 00-0089	EA		42" Wide x 84" High Adjustable Intake Louver, Galvanized Aluminum.....	1,908.31	106.66
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	169.50	
			For Clear Lacquer Finish, Add	339.00	
			For Baked Enamel Standard Colors, Add	508.50	
			For Anodized Finish, Add	678.00	
			For Kynar™ Standard Colors Finish, Add	932.25	
08 91 16 00-0090	EA		42" Wide x 90" High Adjustable Intake Louver, Galvanized Aluminum.....	2,055.40	112.70
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	183.00	
			For Clear Lacquer Finish, Add	366.00	
			For Baked Enamel Standard Colors, Add	549.00	
			For Anodized Finish, Add	732.00	
			For Kynar™ Standard Colors Finish, Add	1,006.50	
08 91 16 00-0091	EA		42" Wide x 96" High Adjustable Intake Louver, Galvanized Aluminum.....	2,158.07	118.73
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	192.06	
			For Clear Lacquer Finish, Add	384.12	
			For Baked Enamel Standard Colors, Add	576.18	
			For Anodized Finish, Add	768.24	
			For Kynar™ Standard Colors Finish, Add	1,056.33	
08 91 16 00-0092	EA		48" Wide x 12" High Adjustable Intake Louver, Galvanized Aluminum.....	538.73	42.26
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	45.42	
			For Clear Lacquer Finish, Add	90.84	
			For Baked Enamel Standard Colors, Add	136.26	
			For Anodized Finish, Add	181.68	
			For Kynar™ Standard Colors Finish, Add	249.81	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 91 16 00-0093	EA		48" Wide x 18" High Adjustable Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. Excludes actuator.	684.24	52.33
			<i>For Flange Frame, Add</i>	57.96	
			<i>For Clear Lacquer Finish, Add</i>	115.92	
			<i>For Baked Enamel Standard Colors, Add</i>	173.88	
			<i>For Anodized Finish, Add</i>	231.84	
			<i>For Kynar™ Standard Colors Finish, Add</i>	318.78	
08 91 16 00-0094	EA		48" Wide x 24" High Adjustable Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. Excludes actuator.	809.54	60.37
			<i>For Flange Frame, Add</i>	68.88	
			<i>For Clear Lacquer Finish, Add</i>	137.76	
			<i>For Baked Enamel Standard Colors, Add</i>	206.64	
			<i>For Anodized Finish, Add</i>	275.52	
			<i>For Kynar™ Standard Colors Finish, Add</i>	378.84	
08 91 16 00-0095	EA		48" Wide x 30" High Adjustable Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. Excludes actuator.	938.02	66.41
			<i>For Flange Frame, Add</i>	80.52	
			<i>For Clear Lacquer Finish, Add</i>	161.04	
			<i>For Baked Enamel Standard Colors, Add</i>	241.56	
			<i>For Anodized Finish, Add</i>	322.08	
			<i>For Kynar™ Standard Colors Finish, Add</i>	442.86	
08 91 16 00-0096	EA		48" Wide x 36" High Adjustable Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. Excludes actuator.	1,065.47	70.44
			<i>For Flange Frame, Add</i>	92.46	
			<i>For Clear Lacquer Finish, Add</i>	184.92	
			<i>For Baked Enamel Standard Colors, Add</i>	277.38	
			<i>For Anodized Finish, Add</i>	369.84	
			<i>For Kynar™ Standard Colors Finish, Add</i>	508.53	
08 91 16 00-0097	EA		48" Wide x 42" High Adjustable Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. Excludes actuator.	1,188.72	74.46
			<i>For Flange Frame, Add</i>	103.98	
			<i>For Clear Lacquer Finish, Add</i>	207.96	
			<i>For Baked Enamel Standard Colors, Add</i>	311.94	
			<i>For Anodized Finish, Add</i>	415.92	
			<i>For Kynar™ Standard Colors Finish, Add</i>	571.89	
08 91 16 00-0098	EA		48" Wide x 48" High Adjustable Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. Excludes actuator.	1,342.40	80.50
			<i>For Flange Frame, Add</i>	118.14	
			<i>For Clear Lacquer Finish, Add</i>	236.28	
			<i>For Baked Enamel Standard Colors, Add</i>	354.42	
			<i>For Anodized Finish, Add</i>	472.56	
			<i>For Kynar™ Standard Colors Finish, Add</i>	649.77	
08 91 16 00-0099	EA		48" Wide x 54" High Adjustable Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. Excludes actuator.	1,469.67	86.53
			<i>For Flange Frame, Add</i>	129.66	
			<i>For Clear Lacquer Finish, Add</i>	259.32	
			<i>For Baked Enamel Standard Colors, Add</i>	388.98	
			<i>For Anodized Finish, Add</i>	518.64	
			<i>For Kynar™ Standard Colors Finish, Add</i>	713.13	
08 91 16 00-0100	EA		48" Wide x 60" High Adjustable Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. Excludes actuator.	1,580.14	92.57
			<i>For Flange Frame, Add</i>	139.50	
			<i>For Clear Lacquer Finish, Add</i>	279.00	
			<i>For Baked Enamel Standard Colors, Add</i>	418.50	
			<i>For Anodized Finish, Add</i>	558.00	
			<i>For Kynar™ Standard Colors Finish, Add</i>	767.25	
08 91 16 00-0101	EA		48" Wide x 66" High Adjustable Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. Excludes actuator.	1,692.41	98.61
			<i>For Flange Frame, Add</i>	149.52	
			<i>For Clear Lacquer Finish, Add</i>	299.04	
			<i>For Baked Enamel Standard Colors, Add</i>	448.56	
			<i>For Anodized Finish, Add</i>	598.08	
			<i>For Kynar™ Standard Colors Finish, Add</i>	822.36	
08 91 16 00-0102	EA		48" Wide x 72" High Adjustable Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. Excludes actuator.	1,802.30	104.64
			<i>For Flange Frame, Add</i>	159.30	
			<i>For Clear Lacquer Finish, Add</i>	318.60	
			<i>For Baked Enamel Standard Colors, Add</i>	477.90	
			<i>For Anodized Finish, Add</i>	637.20	
			<i>For Kynar™ Standard Colors Finish, Add</i>	876.15	
08 91 16 00-0103	EA		48" Wide x 78" High Adjustable Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. Excludes actuator.	1,948.34	108.67
			<i>For Flange Frame, Add</i>	173.10	
			<i>For Clear Lacquer Finish, Add</i>	346.20	
			<i>For Baked Enamel Standard Colors, Add</i>	519.30	
			<i>For Anodized Finish, Add</i>	692.40	
			<i>For Kynar™ Standard Colors Finish, Add</i>	952.05	
08 91 16 00-0104	EA		48" Wide x 84" High Adjustable Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. Excludes actuator.	2,069.80	112.70
			<i>For Flange Frame, Add</i>	184.44	
			<i>For Clear Lacquer Finish, Add</i>	368.88	
			<i>For Baked Enamel Standard Colors, Add</i>	553.32	
			<i>For Anodized Finish, Add</i>	737.76	
			<i>For Kynar™ Standard Colors Finish, Add</i>	1,014.42	

08	Openings
08 90	Louvers And Vents
08 91	Louvers



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 91 16 00-0105	EA		48" Wide x 90" High Adjustable Intake Louver, Galvanized Aluminum.....	2,219.44	116.73
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	198.60	
			For Clear Lacquer Finish, Add	397.20	
			For Baked Enamel Standard Colors, Add	595.80	
			For Anodized Finish, Add	794.40	
			For Kynar™ Standard Colors Finish, Add	1,092.30	
08 91 16 00-0106	EA		48" Wide x 96" High Adjustable Intake Louver, Galvanized Aluminum.....	2,332.31	122.76
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	208.68	
			For Clear Lacquer Finish, Add	417.36	
			For Baked Enamel Standard Colors, Add	626.04	
			For Anodized Finish, Add	834.72	
			For Kynar™ Standard Colors Finish, Add	1,147.74	
08 91 16 00-0107	EA		54" Wide x 12" High Adjustable Intake Louver, Galvanized Aluminum.....	625.20	48.30
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	52.86	
			For Clear Lacquer Finish, Add	105.72	
			For Baked Enamel Standard Colors, Add	158.58	
			For Anodized Finish, Add	211.44	
			For Kynar™ Standard Colors Finish, Add	290.73	
08 91 16 00-0108	EA		54" Wide x 18" High Adjustable Intake Louver, Galvanized Aluminum.....	800.73	58.36
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	68.40	
			For Clear Lacquer Finish, Add	136.80	
			For Baked Enamel Standard Colors, Add	205.20	
			For Anodized Finish, Add	273.60	
			For Kynar™ Standard Colors Finish, Add	376.20	
08 91 16 00-0109	EA		54" Wide x 24" High Adjustable Intake Louver, Galvanized Aluminum.....	938.44	68.43
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	80.16	
			For Clear Lacquer Finish, Add	160.32	
			For Baked Enamel Standard Colors, Add	240.48	
			For Anodized Finish, Add	320.64	
			For Kynar™ Standard Colors Finish, Add	440.88	
08 91 16 00-0110	EA		54" Wide x 30" High Adjustable Intake Louver, Galvanized Aluminum.....	1,076.70	72.44
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	93.18	
			For Clear Lacquer Finish, Add	186.36	
			For Baked Enamel Standard Colors, Add	279.54	
			For Anodized Finish, Add	372.72	
			For Kynar™ Standard Colors Finish, Add	512.49	
08 91 16 00-0111	EA		54" Wide x 36" High Adjustable Intake Louver, Galvanized Aluminum.....	1,226.94	76.47
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	107.40	
			For Clear Lacquer Finish, Add	214.80	
			For Baked Enamel Standard Colors, Add	322.20	
			For Anodized Finish, Add	429.60	
			For Kynar™ Standard Colors Finish, Add	590.70	
08 91 16 00-0112	EA		54" Wide x 42" High Adjustable Intake Louver, Galvanized Aluminum.....	1,361.60	80.50
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	120.06	
			For Clear Lacquer Finish, Add	240.12	
			For Baked Enamel Standard Colors, Add	360.18	
			For Anodized Finish, Add	480.24	
			For Kynar™ Standard Colors Finish, Add	660.33	
08 91 16 00-0113	EA		54" Wide x 48" High Adjustable Intake Louver, Galvanized Aluminum.....	1,539.87	86.53
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	136.68	
			For Clear Lacquer Finish, Add	273.36	
			For Baked Enamel Standard Colors, Add	410.04	
			For Anodized Finish, Add	546.72	
			For Kynar™ Standard Colors Finish, Add	751.74	
08 91 16 00-0114	EA		54" Wide x 54" High Adjustable Intake Louver, Galvanized Aluminum.....	1,713.34	92.57
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	152.82	
			For Clear Lacquer Finish, Add	305.64	
			For Baked Enamel Standard Colors, Add	458.46	
			For Anodized Finish, Add	611.28	
			For Kynar™ Standard Colors Finish, Add	840.51	
08 91 16 00-0115	EA		54" Wide x 60" High Adjustable Intake Louver, Galvanized Aluminum.....	1,843.61	98.61
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	164.64	
			For Clear Lacquer Finish, Add	329.28	
			For Baked Enamel Standard Colors, Add	493.92	
			For Anodized Finish, Add	658.56	
			For Kynar™ Standard Colors Finish, Add	905.52	
08 91 16 00-0116	EA		54" Wide x 66" High Adjustable Intake Louver, Galvanized Aluminum.....	1,972.10	104.64
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	176.28	
			For Clear Lacquer Finish, Add	352.56	
			For Baked Enamel Standard Colors, Add	528.84	
			For Anodized Finish, Add	705.12	
			For Kynar™ Standard Colors Finish, Add	969.54	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 91 16 00-0117 EA 54" Wide x 72" High Adjustable Intake Louver, Galvanized Aluminum.....	2,095.34	108.67
Note: Includes bird screen. Excludes actuator.		
For Flange Frame, Add	187.80	
For Clear Lacquer Finish, Add	375.60	
For Baked Enamel Standard Colors, Add	563.40	
For Anodized Finish, Add	751.20	
For Kynar™ Standard Colors Finish, Add	1,032.90	
08 91 16 00-0118 EA 54" Wide x 78" High Adjustable Intake Louver, Galvanized Aluminum.....	2,258.20	112.70
Note: Includes bird screen. Excludes actuator.		
For Flange Frame, Add	203.28	
For Clear Lacquer Finish, Add	406.56	
For Baked Enamel Standard Colors, Add	609.84	
For Anodized Finish, Add	813.12	
For Kynar™ Standard Colors Finish, Add	1,118.04	
08 91 16 00-0119 EA 54" Wide x 84" High Adjustable Intake Louver, Galvanized Aluminum.....	2,394.04	116.73
Note: Includes bird screen. Excludes actuator.		
For Flange Frame, Add	216.06	
For Clear Lacquer Finish, Add	432.12	
For Baked Enamel Standard Colors, Add	648.18	
For Anodized Finish, Add	864.24	
For Kynar™ Standard Colors Finish, Add	1,188.33	
08 91 16 00-0120 EA 54" Wide x 90" High Adjustable Intake Louver, Galvanized Aluminum.....	2,568.90	120.74
Note: Includes bird screen. Excludes actuator.		
For Flange Frame, Add	232.74	
For Clear Lacquer Finish, Add	465.48	
For Baked Enamel Standard Colors, Add	698.22	
For Anodized Finish, Add	930.96	
For Kynar™ Standard Colors Finish, Add	1,260.07	
08 91 16 00-0121 EA 54" Wide x 96" High Adjustable Intake Louver, Galvanized Aluminum.....	2,700.37	126.78
Note: Includes bird screen. Excludes actuator.		
For Flange Frame, Add	244.68	
For Clear Lacquer Finish, Add	489.36	
For Baked Enamel Standard Colors, Add	734.04	
For Anodized Finish, Add	978.72	
For Kynar™ Standard Colors Finish, Add	1,345.74	
08 91 16 00-0122 EA 60" Wide x 12" High Adjustable Intake Louver, Galvanized Aluminum.....	663.84	52.33
Note: Includes bird screen. Excludes actuator.		
For Flange Frame, Add	55.92	
For Clear Lacquer Finish, Add	111.84	
For Baked Enamel Standard Colors, Add	167.76	
For Anodized Finish, Add	223.68	
For Kynar™ Standard Colors Finish, Add	307.56	
08 91 16 00-0123 EA 60" Wide x 18" High Adjustable Intake Louver, Galvanized Aluminum.....	854.20	64.40
Note: Includes bird screen. Excludes actuator.		
For Flange Frame, Add	72.54	
For Clear Lacquer Finish, Add	145.08	
For Baked Enamel Standard Colors, Add	217.62	
For Anodized Finish, Add	290.16	
For Kynar™ Standard Colors Finish, Add	398.97	
08 91 16 00-0124 EA 60" Wide x 24" High Adjustable Intake Louver, Galvanized Aluminum.....	994.50	72.44
Note: Includes bird screen. Excludes actuator.		
For Flange Frame, Add	84.96	
For Clear Lacquer Finish, Add	169.92	
For Baked Enamel Standard Colors, Add	254.88	
For Anodized Finish, Add	339.84	
For Kynar™ Standard Colors Finish, Add	467.28	
08 91 16 00-0125 EA 60" Wide x 30" High Adjustable Intake Louver, Galvanized Aluminum.....	1,146.54	76.47
Note: Includes bird screen. Excludes actuator.		
For Flange Frame, Add	99.36	
For Clear Lacquer Finish, Add	198.72	
For Baked Enamel Standard Colors, Add	298.08	
For Anodized Finish, Add	397.44	
For Kynar™ Standard Colors Finish, Add	546.48	
08 91 16 00-0126 EA 60" Wide x 36" High Adjustable Intake Louver, Galvanized Aluminum.....	1,306.22	82.51
Note: Includes bird screen. Excludes actuator.		
For Flange Frame, Add	114.12	
For Clear Lacquer Finish, Add	228.24	
For Baked Enamel Standard Colors, Add	342.36	
For Anodized Finish, Add	456.48	
For Kynar™ Standard Colors Finish, Add	627.66	
08 91 16 00-0127 EA 60" Wide x 42" High Adjustable Intake Louver, Galvanized Aluminum.....	1,448.67	86.53
Note: Includes bird screen. Excludes actuator.		
For Flange Frame, Add	127.56	
For Clear Lacquer Finish, Add	255.12	
For Baked Enamel Standard Colors, Add	382.68	
For Anodized Finish, Add	510.24	
For Kynar™ Standard Colors Finish, Add	701.58	
08 91 16 00-0128 EA 60" Wide x 48" High Adjustable Intake Louver, Galvanized Aluminum.....	1,639.54	92.57
Note: Includes bird screen. Excludes actuator.		
For Flange Frame, Add	145.44	
For Clear Lacquer Finish, Add	290.88	
For Baked Enamel Standard Colors, Add	436.32	
For Anodized Finish, Add	581.76	
For Kynar™ Standard Colors Finish, Add	799.92	

08	Openings
08 90	Louvers And Vents
08 91	Louvers



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 91 16 00-0129	EA		60" Wide x 54" High Adjustable Intake Louver, Galvanized Aluminum.....	1,817.81	98.61
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	162.06	
			For Clear Lacquer Finish, Add	324.12	
			For Baked Enamel Standard Colors, Add	486.18	
			For Anodized Finish, Add	648.24	
			For Kynar™ Standard Colors Finish, Add	891.33	
08 91 16 00-0130	EA		60" Wide x 60" High Adjustable Intake Louver, Galvanized Aluminum.....	1,957.10	104.64
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	174.78	
			For Clear Lacquer Finish, Add	349.56	
			For Baked Enamel Standard Colors, Add	524.34	
			For Anodized Finish, Add	699.12	
			For Kynar™ Standard Colors Finish, Add	961.29	
08 91 16 00-0131	EA		60" Wide x 66" High Adjustable Intake Louver, Galvanized Aluminum.....	2,093.97	110.68
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	187.26	
			For Clear Lacquer Finish, Add	374.52	
			For Baked Enamel Standard Colors, Add	561.78	
			For Anodized Finish, Add	749.04	
			For Kynar™ Standard Colors Finish, Add	1,029.93	
08 91 16 00-0132	EA		60" Wide x 72" High Adjustable Intake Louver, Galvanized Aluminum.....	2,225.01	114.71
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	199.56	
			For Clear Lacquer Finish, Add	399.12	
			For Baked Enamel Standard Colors, Add	598.68	
			For Anodized Finish, Add	798.24	
			For Kynar™ Standard Colors Finish, Add	1,097.58	
08 91 16 00-0133	EA		60" Wide x 78" High Adjustable Intake Louver, Galvanized Aluminum.....	2,401.67	118.73
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	216.42	
			For Clear Lacquer Finish, Add	432.84	
			For Baked Enamel Standard Colors, Add	649.26	
			For Anodized Finish, Add	865.68	
			For Kynar™ Standard Colors Finish, Add	1,190.31	
08 91 16 00-0134	EA		60" Wide x 84" High Adjustable Intake Louver, Galvanized Aluminum.....	2,544.11	122.76
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	229.86	
			For Clear Lacquer Finish, Add	459.72	
			For Baked Enamel Standard Colors, Add	689.58	
			For Anodized Finish, Add	919.44	
			For Kynar™ Standard Colors Finish, Add	1,264.23	
08 91 16 00-0135	EA		60" Wide x 90" High Adjustable Intake Louver, Galvanized Aluminum.....	2,727.97	126.78
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	247.44	
			For Clear Lacquer Finish, Add	494.88	
			For Baked Enamel Standard Colors, Add	742.32	
			For Anodized Finish, Add	989.76	
			For Kynar™ Standard Colors Finish, Add	1,360.92	
08 91 16 00-0136	EA		60" Wide x 96" High Adjustable Intake Louver, Galvanized Aluminum.....	2,863.21	130.81
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	260.16	
			For Clear Lacquer Finish, Add	520.32	
			For Baked Enamel Standard Colors, Add	780.48	
			For Anodized Finish, Add	1,040.64	
			For Kynar™ Standard Colors Finish, Add	1,430.88	
08 91 16 00-0137			Adjustable Intake Wall Louvers Operators <small>(08 91 16)</small>		
08 91 16 00-0138	EA		5' Chain Actuator For Adjustable Intake Louver.....	169.84	20.13
08 91 16 00-0139	EA		Panel Crank For Adjustable Intake Louver.....	362.90	8.04
08 91 19			Fixed Louvers <small>(08 91)</small>		
08 91 19 00-0001			Fixed Intake Wall Louvers <small>(08 91 19)</small>		
08 91 19 00-0002	EA		12" Wide x 12" High Fixed Intake Louver, Galvanized Aluminum.....	217.43	18.11
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	18.12	
			For Clear Lacquer Finish, Add	36.24	
			For Baked Enamel Standard Colors, Add	54.36	
			For Anodized Finish, Add	72.48	
			For Kynar™ Standard Colors Finish, Add	99.66	
08 91 19 00-0003	EA		12" Wide x 18" High Fixed Intake Louver, Galvanized Aluminum.....	258.47	22.14
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	21.42	
			For Clear Lacquer Finish, Add	42.84	
			For Baked Enamel Standard Colors, Add	64.26	
			For Anodized Finish, Add	85.68	
			For Kynar™ Standard Colors Finish, Add	117.81	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 91 19 00-0004 EA 12" Wide x 24" High Fixed Intake Louver, Galvanized Aluminum.....	300.13	26.16
Note: Includes bird screen. Excludes actuator.		
<i>For Flange Frame, Add</i>	24.78	
<i>For Clear Lacquer Finish, Add</i>	49.56	
<i>For Baked Enamel Standard Colors, Add</i>	74.34	
<i>For Anodized Finish, Add</i>	99.12	
<i>For Kynar™ Standard Colors Finish, Add</i>	136.29	
08 91 19 00-0005 EA 12" Wide x 30" High Fixed Intake Louver, Galvanized Aluminum.....	351.97	30.19
Note: Includes bird screen. Excludes actuator.		
<i>For Flange Frame, Add</i>	29.16	
<i>For Clear Lacquer Finish, Add</i>	58.32	
<i>For Baked Enamel Standard Colors, Add</i>	87.48	
<i>For Anodized Finish, Add</i>	116.64	
<i>For Kynar™ Standard Colors Finish, Add</i>	160.38	
08 91 19 00-0006 EA 12" Wide x 36" High Fixed Intake Louver, Galvanized Aluminum.....	396.03	34.21
Note: Includes bird screen. Excludes actuator.		
<i>For Flange Frame, Add</i>	32.76	
<i>For Clear Lacquer Finish, Add</i>	65.52	
<i>For Baked Enamel Standard Colors, Add</i>	98.28	
<i>For Anodized Finish, Add</i>	131.04	
<i>For Kynar™ Standard Colors Finish, Add</i>	180.18	
08 91 19 00-0007 EA 12" Wide x 42" High Fixed Intake Louver, Galvanized Aluminum.....	466.47	38.24
Note: Includes bird screen. Excludes actuator.		
<i>For Flange Frame, Add</i>	39.00	
<i>For Clear Lacquer Finish, Add</i>	78.00	
<i>For Baked Enamel Standard Colors, Add</i>	117.00	
<i>For Anodized Finish, Add</i>	156.00	
<i>For Kynar™ Standard Colors Finish, Add</i>	214.50	
08 91 19 00-0008 EA 12" Wide x 48" High Fixed Intake Louver, Galvanized Aluminum.....	505.73	42.26
Note: Includes bird screen. Excludes actuator.		
<i>For Flange Frame, Add</i>	42.12	
<i>For Clear Lacquer Finish, Add</i>	84.24	
<i>For Baked Enamel Standard Colors, Add</i>	126.36	
<i>For Anodized Finish, Add</i>	168.48	
<i>For Kynar™ Standard Colors Finish, Add</i>	231.66	
08 91 19 00-0009 EA 12" Wide x 54" High Fixed Intake Louver, Galvanized Aluminum.....	565.80	48.30
Note: Includes bird screen. Excludes actuator.		
<i>For Flange Frame, Add</i>	46.92	
<i>For Clear Lacquer Finish, Add</i>	93.84	
<i>For Baked Enamel Standard Colors, Add</i>	140.76	
<i>For Anodized Finish, Add</i>	187.68	
<i>For Kynar™ Standard Colors Finish, Add</i>	258.06	
08 91 19 00-0010 EA 12" Wide x 60" High Fixed Intake Louver, Galvanized Aluminum.....	602.04	52.33
Note: Includes bird screen. Excludes actuator.		
<i>For Flange Frame, Add</i>	49.74	
<i>For Clear Lacquer Finish, Add</i>	99.48	
<i>For Baked Enamel Standard Colors, Add</i>	149.22	
<i>For Anodized Finish, Add</i>	198.96	
<i>For Kynar™ Standard Colors Finish, Add</i>	273.57	
08 91 19 00-0011 EA 12" Wide x 66" High Fixed Intake Louver, Galvanized Aluminum.....	650.90	56.34
Note: Includes bird screen. Excludes actuator.		
<i>For Flange Frame, Add</i>	53.82	
<i>For Clear Lacquer Finish, Add</i>	107.64	
<i>For Baked Enamel Standard Colors, Add</i>	161.46	
<i>For Anodized Finish, Add</i>	215.28	
<i>For Kynar™ Standard Colors Finish, Add</i>	296.01	
08 91 19 00-0012 EA 12" Wide x 72" High Fixed Intake Louver, Galvanized Aluminum.....	693.74	60.37
Note: Includes bird screen. Excludes actuator.		
<i>For Flange Frame, Add</i>	57.30	
<i>For Clear Lacquer Finish, Add</i>	114.60	
<i>For Baked Enamel Standard Colors, Add</i>	171.90	
<i>For Anodized Finish, Add</i>	229.20	
<i>For Kynar™ Standard Colors Finish, Add</i>	315.15	
08 91 19 00-0013 EA 12" Wide x 78" High Fixed Intake Louver, Galvanized Aluminum.....	744.40	64.40
Note: Includes bird screen. Excludes actuator.		
<i>For Flange Frame, Add</i>	61.56	
<i>For Clear Lacquer Finish, Add</i>	123.12	
<i>For Baked Enamel Standard Colors, Add</i>	184.68	
<i>For Anodized Finish, Add</i>	246.24	
<i>For Kynar™ Standard Colors Finish, Add</i>	338.58	
08 91 19 00-0014 EA 12" Wide x 84" High Fixed Intake Louver, Galvanized Aluminum.....	792.04	68.43
Note: Includes bird screen. Excludes actuator.		
<i>For Flange Frame, Add</i>	65.52	
<i>For Clear Lacquer Finish, Add</i>	131.04	
<i>For Baked Enamel Standard Colors, Add</i>	196.56	
<i>For Anodized Finish, Add</i>	262.08	
<i>For Kynar™ Standard Colors Finish, Add</i>	360.36	
08 91 19 00-0015 EA 12" Wide x 90" High Fixed Intake Louver, Galvanized Aluminum.....	835.32	74.46
Note: Includes bird screen. Excludes actuator.		
<i>For Flange Frame, Add</i>	68.64	
<i>For Clear Lacquer Finish, Add</i>	137.28	
<i>For Baked Enamel Standard Colors, Add</i>	205.92	
<i>For Anodized Finish, Add</i>	274.56	
<i>For Kynar™ Standard Colors Finish, Add</i>	377.52	

08	Openings
08 90	Louvers And Vents
08 91	Louvers



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 91	19 00-0016	EA	12" Wide x 96" High Fixed Intake Louver, Galvanized Aluminum.....	892.40	80.50
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	73.14	
			For Clear Lacquer Finish, Add	146.28	
			For Baked Enamel Standard Colors, Add	219.42	
			For Anodized Finish, Add	292.56	
			For Kynar™ Standard Colors Finish, Add	402.27	
08 91	19 00-0017	EA	18" Wide x 12" High Fixed Intake Louver, Galvanized Aluminum.....	253.07	22.14
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	20.88	
			For Clear Lacquer Finish, Add	41.76	
			For Baked Enamel Standard Colors, Add	62.64	
			For Anodized Finish, Add	83.52	
			For Kynar™ Standard Colors Finish, Add	114.84	
08 91	19 00-0018	EA	18" Wide x 18" High Fixed Intake Louver, Galvanized Aluminum.....	304.14	28.17
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	24.78	
			For Clear Lacquer Finish, Add	49.56	
			For Baked Enamel Standard Colors, Add	74.34	
			For Anodized Finish, Add	99.12	
			For Kynar™ Standard Colors Finish, Add	136.29	
08 91	19 00-0019	EA	18" Wide x 24" High Fixed Intake Louver, Galvanized Aluminum.....	352.40	32.20
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	28.80	
			For Clear Lacquer Finish, Add	57.60	
			For Baked Enamel Standard Colors, Add	86.40	
			For Anodized Finish, Add	115.20	
			For Kynar™ Standard Colors Finish, Add	158.40	
08 91	19 00-0020	EA	18" Wide x 30" High Fixed Intake Louver, Galvanized Aluminum.....	441.70	40.24
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	36.12	
			For Clear Lacquer Finish, Add	72.24	
			For Baked Enamel Standard Colors, Add	108.36	
			For Anodized Finish, Add	144.48	
			For Kynar™ Standard Colors Finish, Add	198.66	
08 91	19 00-0021	EA	18" Wide x 36" High Fixed Intake Louver, Galvanized Aluminum.....	506.14	44.27
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	41.76	
			For Clear Lacquer Finish, Add	83.52	
			For Baked Enamel Standard Colors, Add	125.28	
			For Anodized Finish, Add	167.04	
			For Kynar™ Standard Colors Finish, Add	229.68	
08 91	19 00-0022	EA	18" Wide x 42" High Fixed Intake Louver, Galvanized Aluminum.....	563.40	48.30
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	46.68	
			For Clear Lacquer Finish, Add	93.36	
			For Baked Enamel Standard Colors, Add	140.04	
			For Anodized Finish, Add	186.72	
			For Kynar™ Standard Colors Finish, Add	256.74	
08 91	19 00-0023	EA	18" Wide x 48" High Fixed Intake Louver, Galvanized Aluminum.....	604.44	52.33
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	49.98	
			For Clear Lacquer Finish, Add	99.96	
			For Baked Enamel Standard Colors, Add	149.94	
			For Anodized Finish, Add	199.92	
			For Kynar™ Standard Colors Finish, Add	274.89	
08 91	19 00-0024	EA	18" Wide x 54" High Fixed Intake Louver, Galvanized Aluminum.....	672.93	58.36
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	55.62	
			For Clear Lacquer Finish, Add	111.24	
			For Baked Enamel Standard Colors, Add	166.86	
			For Anodized Finish, Add	222.48	
			For Kynar™ Standard Colors Finish, Add	305.91	
08 91	19 00-0025	EA	18" Wide x 60" High Fixed Intake Louver, Galvanized Aluminum.....	721.60	64.40
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	59.28	
			For Clear Lacquer Finish, Add	118.56	
			For Baked Enamel Standard Colors, Add	177.84	
			For Anodized Finish, Add	237.12	
			For Kynar™ Standard Colors Finish, Add	326.04	
08 91	19 00-0026	EA	18" Wide x 66" High Fixed Intake Louver, Galvanized Aluminum.....	783.64	68.43
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	64.68	
			For Clear Lacquer Finish, Add	129.36	
			For Baked Enamel Standard Colors, Add	194.04	
			For Anodized Finish, Add	258.72	
			For Kynar™ Standard Colors Finish, Add	355.74	
08 91	19 00-0027	EA	18" Wide x 72" High Fixed Intake Louver, Galvanized Aluminum.....	831.30	72.44
			Note: Includes bird screen. Excludes actuator.		
			For Flange Frame, Add	68.64	
			For Clear Lacquer Finish, Add	137.28	
			For Baked Enamel Standard Colors, Add	205.92	
			For Anodized Finish, Add	274.56	
			For Kynar™ Standard Colors Finish, Add	377.52	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 91	19 00-0028	EA		18" Wide x 78" High Fixed Intake Louver, Galvanized Aluminum.....	884.34	76.47
				Note: Includes bird screen. Excludes actuator.		
				For Flange Frame, Add	73.14	
				For Clear Lacquer Finish, Add	146.28	
				For Baked Enamel Standard Colors, Add	219.42	
				For Anodized Finish, Add	292.56	
				For Kynar™ Standard Colors Finish, Add	402.27	
08 91	19 00-0029	EA		18" Wide x 84" High Fixed Intake Louver, Galvanized Aluminum.....	939.80	80.50
				Note: Includes bird screen. Excludes actuator.		
				For Flange Frame, Add	77.88	
				For Clear Lacquer Finish, Add	155.76	
				For Baked Enamel Standard Colors, Add	233.64	
				For Anodized Finish, Add	311.52	
				For Kynar™ Standard Colors Finish, Add	428.34	
08 91	19 00-0030	EA		18" Wide x 90" High Fixed Intake Louver, Galvanized Aluminum.....	989.67	86.53
				Note: Includes bird screen. Excludes actuator.		
				For Flange Frame, Add	81.66	
				For Clear Lacquer Finish, Add	163.32	
				For Baked Enamel Standard Colors, Add	244.98	
				For Anodized Finish, Add	326.64	
				For Kynar™ Standard Colors Finish, Add	449.13	
08 91	19 00-0031	EA		18" Wide x 96" High Fixed Intake Louver, Galvanized Aluminum.....	1,058.14	92.57
				Note: Includes bird screen. Excludes actuator.		
				For Flange Frame, Add	87.30	
				For Clear Lacquer Finish, Add	174.60	
				For Baked Enamel Standard Colors, Add	261.90	
				For Anodized Finish, Add	349.20	
				For Kynar™ Standard Colors Finish, Add	480.15	
08 91	19 00-0032	EA		24" Wide x 12" High Fixed Intake Louver, Galvanized Aluminum.....	292.93	26.16
				Note: Includes bird screen. Excludes actuator.		
				For Flange Frame, Add	24.06	
				For Clear Lacquer Finish, Add	48.12	
				For Baked Enamel Standard Colors, Add	72.18	
				For Anodized Finish, Add	96.24	
				For Kynar™ Standard Colors Finish, Add	132.33	
08 91	19 00-0033	EA		24" Wide x 18" High Fixed Intake Louver, Galvanized Aluminum.....	349.40	32.20
				Note: Includes bird screen. Excludes actuator.		
				For Flange Frame, Add	28.50	
				For Clear Lacquer Finish, Add	57.00	
				For Baked Enamel Standard Colors, Add	85.50	
				For Anodized Finish, Add	114.00	
				For Kynar™ Standard Colors Finish, Add	156.75	
08 91	19 00-0034	EA		24" Wide x 24" High Fixed Intake Louver, Galvanized Aluminum.....	432.27	38.24
				Note: Includes bird screen. Excludes actuator.		
				For Flange Frame, Add	35.58	
				For Clear Lacquer Finish, Add	71.16	
				For Baked Enamel Standard Colors, Add	106.74	
				For Anodized Finish, Add	142.32	
				For Kynar™ Standard Colors Finish, Add	195.69	
08 91	19 00-0035	EA		24" Wide x 30" High Fixed Intake Louver, Galvanized Aluminum.....	510.17	46.29
				Note: Includes bird screen. Excludes actuator.		
				For Flange Frame, Add	41.76	
				For Clear Lacquer Finish, Add	83.52	
				For Baked Enamel Standard Colors, Add	125.28	
				For Anodized Finish, Add	167.04	
				For Kynar™ Standard Colors Finish, Add	229.68	
08 91	19 00-0036	EA		24" Wide x 36" High Fixed Intake Louver, Galvanized Aluminum.....	583.03	50.31
				Note: Includes bird screen. Excludes actuator.		
				For Flange Frame, Add	48.24	
				For Clear Lacquer Finish, Add	96.48	
				For Baked Enamel Standard Colors, Add	144.72	
				For Anodized Finish, Add	192.96	
				For Kynar™ Standard Colors Finish, Add	265.32	
08 91	19 00-0037	EA		24" Wide x 42" High Fixed Intake Louver, Galvanized Aluminum.....	650.47	54.34
				Note: Includes bird screen. Excludes actuator.		
				For Flange Frame, Add	54.18	
				For Clear Lacquer Finish, Add	108.36	
				For Baked Enamel Standard Colors, Add	162.54	
				For Anodized Finish, Add	216.72	
				For Kynar™ Standard Colors Finish, Add	297.99	
08 91	19 00-0038	EA		24" Wide x 48" High Fixed Intake Louver, Galvanized Aluminum.....	707.54	60.37
				Note: Includes bird screen. Excludes actuator.		
				For Flange Frame, Add	58.68	
				For Clear Lacquer Finish, Add	117.36	
				For Baked Enamel Standard Colors, Add	176.04	
				For Anodized Finish, Add	234.72	
				For Kynar™ Standard Colors Finish, Add	322.74	
08 91	19 00-0039	EA		24" Wide x 54" High Fixed Intake Louver, Galvanized Aluminum.....	783.64	68.43
				Note: Includes bird screen. Excludes actuator.		
				For Flange Frame, Add	64.68	
				For Clear Lacquer Finish, Add	129.36	
				For Baked Enamel Standard Colors, Add	194.04	
				For Anodized Finish, Add	258.72	
				For Kynar™ Standard Colors Finish, Add	355.74	

08	Openings
08 90	Louvers And Vents
08 91	Louvers



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 91	19 00-0040	EA	24" Wide x 60" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. Excludes actuator.	833.70	72.44
			<i>For Flange Frame, Add</i>	68.88	
			<i>For Clear Lacquer Finish, Add</i>	137.76	
			<i>For Baked Enamel Standard Colors, Add</i>	206.64	
			<i>For Anodized Finish, Add</i>	275.52	
			<i>For Kynar™ Standard Colors Finish, Add</i>	378.84	
08 91	19 00-0041	EA	24" Wide x 66" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. Excludes actuator.	916.40	80.50
			<i>For Flange Frame, Add</i>	75.54	
			<i>For Clear Lacquer Finish, Add</i>	151.08	
			<i>For Baked Enamel Standard Colors, Add</i>	226.62	
			<i>For Anodized Finish, Add</i>	302.16	
			<i>For Kynar™ Standard Colors Finish, Add</i>	415.47	
08 91	19 00-0042	EA	24" Wide x 72" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. Excludes actuator.	968.24	84.53
			<i>For Flange Frame, Add</i>	79.92	
			<i>For Clear Lacquer Finish, Add</i>	159.84	
			<i>For Baked Enamel Standard Colors, Add</i>	239.76	
			<i>For Anodized Finish, Add</i>	319.68	
			<i>For Kynar™ Standard Colors Finish, Add</i>	439.56	
08 91	19 00-0043	EA	24" Wide x 78" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. Excludes actuator.	1,035.10	88.54
			<i>For Flange Frame, Add</i>	85.80	
			<i>For Clear Lacquer Finish, Add</i>	171.60	
			<i>For Baked Enamel Standard Colors, Add</i>	257.40	
			<i>For Anodized Finish, Add</i>	343.20	
			<i>For Kynar™ Standard Colors Finish, Add</i>	471.90	
08 91	19 00-0044	EA	24" Wide x 84" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. Excludes actuator.	1,100.74	92.57
			<i>For Flange Frame, Add</i>	91.56	
			<i>For Clear Lacquer Finish, Add</i>	183.12	
			<i>For Baked Enamel Standard Colors, Add</i>	274.68	
			<i>For Anodized Finish, Add</i>	366.24	
			<i>For Kynar™ Standard Colors Finish, Add</i>	503.58	
08 91	19 00-0045	EA	24" Wide x 90" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. Excludes actuator.	1,151.81	98.61
			<i>For Flange Frame, Add</i>	95.46	
			<i>For Clear Lacquer Finish, Add</i>	190.92	
			<i>For Baked Enamel Standard Colors, Add</i>	286.38	
			<i>For Anodized Finish, Add</i>	381.84	
			<i>For Kynar™ Standard Colors Finish, Add</i>	525.03	
08 91	19 00-0046	EA	24" Wide x 96" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. Excludes actuator.	1,234.70	104.64
			<i>For Flange Frame, Add</i>	102.54	
			<i>For Clear Lacquer Finish, Add</i>	205.08	
			<i>For Baked Enamel Standard Colors, Add</i>	307.62	
			<i>For Anodized Finish, Add</i>	410.16	
			<i>For Kynar™ Standard Colors Finish, Add</i>	563.97	
08 91	19 00-0047	EA	30" Wide x 12" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. Excludes actuator.	328.57	30.19
			<i>For Flange Frame, Add</i>	26.82	
			<i>For Clear Lacquer Finish, Add</i>	53.64	
			<i>For Baked Enamel Standard Colors, Add</i>	80.46	
			<i>For Anodized Finish, Add</i>	107.28	
			<i>For Kynar™ Standard Colors Finish, Add</i>	147.51	
08 91	19 00-0048	EA	30" Wide x 18" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. Excludes actuator.	425.50	40.24
			<i>For Flange Frame, Add</i>	34.50	
			<i>For Clear Lacquer Finish, Add</i>	69.00	
			<i>For Baked Enamel Standard Colors, Add</i>	103.50	
			<i>For Anodized Finish, Add</i>	138.00	
			<i>For Kynar™ Standard Colors Finish, Add</i>	189.75	
08 91	19 00-0049	EA	30" Wide x 24" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. Excludes actuator.	496.37	46.29
			<i>For Flange Frame, Add</i>	40.38	
			<i>For Clear Lacquer Finish, Add</i>	80.76	
			<i>For Baked Enamel Standard Colors, Add</i>	121.14	
			<i>For Anodized Finish, Add</i>	161.52	
			<i>For Kynar™ Standard Colors Finish, Add</i>	222.09	
08 91	19 00-0050	EA	30" Wide x 30" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. Excludes actuator.	578.64	52.33
			<i>For Flange Frame, Add</i>	47.40	
			<i>For Clear Lacquer Finish, Add</i>	94.80	
			<i>For Baked Enamel Standard Colors, Add</i>	142.20	
			<i>For Anodized Finish, Add</i>	189.60	
			<i>For Kynar™ Standard Colors Finish, Add</i>	260.70	
08 91	19 00-0051	EA	30" Wide x 36" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. Excludes actuator.	665.90	56.34
			<i>For Flange Frame, Add</i>	55.32	
			<i>For Clear Lacquer Finish, Add</i>	110.64	
			<i>For Baked Enamel Standard Colors, Add</i>	165.96	
			<i>For Anodized Finish, Add</i>	221.28	
			<i>For Kynar™ Standard Colors Finish, Add</i>	304.26	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 91	19 00-0052	EA		30" Wide x 42" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. Excludes actuator.	740.37	62.38
				<i>For Flange Frame, Add</i>	61.56	
				<i>For Clear Lacquer Finish, Add</i>	123.12	
				<i>For Baked Enamel Standard Colors, Add</i>	184.68	
				<i>For Anodized Finish, Add</i>	246.24	
				<i>For Kynar™ Standard Colors Finish, Add</i>	338.58	
08 91	19 00-0053	EA		30" Wide x 48" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. Excludes actuator.	795.82	66.41
				<i>For Flange Frame, Add</i>	66.30	
				<i>For Clear Lacquer Finish, Add</i>	132.60	
				<i>For Baked Enamel Standard Colors, Add</i>	198.90	
				<i>For Anodized Finish, Add</i>	265.20	
				<i>For Kynar™ Standard Colors Finish, Add</i>	364.65	
08 91	19 00-0054	EA		30" Wide x 54" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. Excludes actuator.	873.90	72.44
				<i>For Flange Frame, Add</i>	72.90	
				<i>For Clear Lacquer Finish, Add</i>	145.80	
				<i>For Baked Enamel Standard Colors, Add</i>	218.70	
				<i>For Anodized Finish, Add</i>	291.60	
				<i>For Kynar™ Standard Colors Finish, Add</i>	400.95	
08 91	19 00-0055	EA		30" Wide x 60" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. Excludes actuator.	935.94	76.47
				<i>For Flange Frame, Add</i>	78.30	
				<i>For Clear Lacquer Finish, Add</i>	156.60	
				<i>For Baked Enamel Standard Colors, Add</i>	234.90	
				<i>For Anodized Finish, Add</i>	313.20	
				<i>For Kynar™ Standard Colors Finish, Add</i>	430.65	
08 91	19 00-0056	EA		30" Wide x 66" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. Excludes actuator.	1,031.24	84.53
				<i>For Flange Frame, Add</i>	86.22	
				<i>For Clear Lacquer Finish, Add</i>	172.44	
				<i>For Baked Enamel Standard Colors, Add</i>	258.66	
				<i>For Anodized Finish, Add</i>	344.88	
				<i>For Kynar™ Standard Colors Finish, Add</i>	474.21	
08 91	19 00-0057	EA		30" Wide x 72" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. Excludes actuator.	1,092.51	90.56
				<i>For Flange Frame, Add</i>	91.14	
				<i>For Clear Lacquer Finish, Add</i>	182.28	
				<i>For Baked Enamel Standard Colors, Add</i>	273.42	
				<i>For Anodized Finish, Add</i>	364.56	
				<i>For Kynar™ Standard Colors Finish, Add</i>	501.27	
08 91	19 00-0058	EA		30" Wide x 78" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. Excludes actuator.	1,163.57	94.58
				<i>For Flange Frame, Add</i>	97.44	
				<i>For Clear Lacquer Finish, Add</i>	194.88	
				<i>For Baked Enamel Standard Colors, Add</i>	292.32	
				<i>For Anodized Finish, Add</i>	389.76	
				<i>For Kynar™ Standard Colors Finish, Add</i>	535.92	
08 91	19 00-0059	EA		30" Wide x 84" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. Excludes actuator.	1,234.01	98.61
				<i>For Flange Frame, Add</i>	103.68	
				<i>For Clear Lacquer Finish, Add</i>	207.36	
				<i>For Baked Enamel Standard Colors, Add</i>	311.04	
				<i>For Anodized Finish, Add</i>	414.72	
				<i>For Kynar™ Standard Colors Finish, Add</i>	570.24	
08 91	19 00-0060	EA		30" Wide x 90" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. Excludes actuator.	1,294.10	104.64
				<i>For Flange Frame, Add</i>	108.48	
				<i>For Clear Lacquer Finish, Add</i>	216.96	
				<i>For Baked Enamel Standard Colors, Add</i>	325.44	
				<i>For Anodized Finish, Add</i>	433.92	
				<i>For Kynar™ Standard Colors Finish, Add</i>	596.64	
08 91	19 00-0061	EA		30" Wide x 96" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. Excludes actuator.	1,387.77	110.68
				<i>For Flange Frame, Add</i>	116.64	
				<i>For Clear Lacquer Finish, Add</i>	233.28	
				<i>For Baked Enamel Standard Colors, Add</i>	349.92	
				<i>For Anodized Finish, Add</i>	466.56	
				<i>For Kynar™ Standard Colors Finish, Add</i>	641.52	
08 91	19 00-0062	EA		36" Wide x 12" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. Excludes actuator.	364.83	34.21
				<i>For Flange Frame, Add</i>	29.64	
				<i>For Clear Lacquer Finish, Add</i>	59.28	
				<i>For Baked Enamel Standard Colors, Add</i>	88.92	
				<i>For Anodized Finish, Add</i>	118.56	
				<i>For Kynar™ Standard Colors Finish, Add</i>	163.02	
08 91	19 00-0063	EA		36" Wide x 18" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. Excludes actuator.	478.54	44.27
				<i>For Flange Frame, Add</i>	39.00	
				<i>For Clear Lacquer Finish, Add</i>	78.00	
				<i>For Baked Enamel Standard Colors, Add</i>	117.00	
				<i>For Anodized Finish, Add</i>	156.00	
				<i>For Kynar™ Standard Colors Finish, Add</i>	214.50	

08	Openings
08 90	Louvers And Vents
08 91	Louvers



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 91	19 00-0064	EA	36" Wide x 24" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. Excludes actuator.	553.03	50.31
			<i>For Flange Frame, Add</i>	45.24	
			<i>For Clear Lacquer Finish, Add</i>	90.48	
			<i>For Baked Enamel Standard Colors, Add</i>	135.72	
			<i>For Anodized Finish, Add</i>	180.96	
			<i>For Kynar™ Standard Colors Finish, Add</i>	248.82	
08 91	19 00-0065	EA	36" Wide x 30" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. Excludes actuator.	641.30	56.34
			<i>For Flange Frame, Add</i>	52.86	
			<i>For Clear Lacquer Finish, Add</i>	105.72	
			<i>For Baked Enamel Standard Colors, Add</i>	158.58	
			<i>For Anodized Finish, Add</i>	211.44	
			<i>For Kynar™ Standard Colors Finish, Add</i>	290.73	
08 91	19 00-0066	EA	36" Wide x 36" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	739.75	61.18
			<i>For Flange Frame, Add</i>	61.74	
			<i>For Clear Lacquer Finish, Add</i>	123.48	
			<i>For Baked Enamel Standard Colors, Add</i>	185.22	
			<i>For Anodized Finish, Add</i>	246.96	
			<i>For Kynar™ Standard Colors Finish, Add</i>	339.57	
08 91	19 00-0067	EA	36" Wide x 42" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	816.82	66.41
			<i>For Flange Frame, Add</i>	68.40	
			<i>For Clear Lacquer Finish, Add</i>	136.80	
			<i>For Baked Enamel Standard Colors, Add</i>	205.20	
			<i>For Anodized Finish, Add</i>	273.60	
			<i>For Kynar™ Standard Colors Finish, Add</i>	376.20	
08 91	19 00-0068	EA	36" Wide x 48" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	883.07	70.44
			<i>For Flange Frame, Add</i>	74.22	
			<i>For Clear Lacquer Finish, Add</i>	148.44	
			<i>For Baked Enamel Standard Colors, Add</i>	222.66	
			<i>For Anodized Finish, Add</i>	296.88	
			<i>For Kynar™ Standard Colors Finish, Add</i>	408.21	
08 91	19 00-0069	EA	36" Wide x 54" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	971.94	76.47
			<i>For Flange Frame, Add</i>	81.90	
			<i>For Clear Lacquer Finish, Add</i>	163.80	
			<i>For Baked Enamel Standard Colors, Add</i>	245.70	
			<i>For Anodized Finish, Add</i>	327.60	
			<i>For Kynar™ Standard Colors Finish, Add</i>	450.45	
08 91	19 00-0070	EA	36" Wide x 60" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,039.82	82.51
			<i>For Flange Frame, Add</i>	87.48	
			<i>For Clear Lacquer Finish, Add</i>	174.96	
			<i>For Baked Enamel Standard Colors, Add</i>	262.44	
			<i>For Anodized Finish, Add</i>	349.92	
			<i>For Kynar™ Standard Colors Finish, Add</i>	481.14	
08 91	19 00-0071	EA	36" Wide x 66" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,146.10	88.54
			<i>For Flange Frame, Add</i>	96.90	
			<i>For Clear Lacquer Finish, Add</i>	193.80	
			<i>For Baked Enamel Standard Colors, Add</i>	290.70	
			<i>For Anodized Finish, Add</i>	387.60	
			<i>For Kynar™ Standard Colors Finish, Add</i>	532.95	
08 91	19 00-0072	EA	36" Wide x 72" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,216.97	94.58
			<i>For Flange Frame, Add</i>	102.78	
			<i>For Clear Lacquer Finish, Add</i>	205.56	
			<i>For Baked Enamel Standard Colors, Add</i>	308.34	
			<i>For Anodized Finish, Add</i>	411.12	
			<i>For Kynar™ Standard Colors Finish, Add</i>	565.29	
08 91	19 00-0073	EA	36" Wide x 78" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,292.81	98.61
			<i>For Flange Frame, Add</i>	109.56	
			<i>For Clear Lacquer Finish, Add</i>	219.12	
			<i>For Baked Enamel Standard Colors, Add</i>	328.68	
			<i>For Anodized Finish, Add</i>	438.24	
			<i>For Kynar™ Standard Colors Finish, Add</i>	602.58	
08 91	19 00-0074	EA	36" Wide x 84" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,371.67	102.63
			<i>For Flange Frame, Add</i>	116.64	
			<i>For Clear Lacquer Finish, Add</i>	233.28	
			<i>For Baked Enamel Standard Colors, Add</i>	349.92	
			<i>For Anodized Finish, Add</i>	466.56	
			<i>For Kynar™ Standard Colors Finish, Add</i>	641.52	
08 91	19 00-0075	EA	36" Wide x 90" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,440.14	108.67
			<i>For Flange Frame, Add</i>	122.28	
			<i>For Clear Lacquer Finish, Add</i>	244.56	
			<i>For Baked Enamel Standard Colors, Add</i>	366.84	
			<i>For Anodized Finish, Add</i>	489.12	
			<i>For Kynar™ Standard Colors Finish, Add</i>	672.54	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 91 19 00-0076	EA		36" Wide x 96" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,545.81	114.71
			<i>For Flange Frame, Add</i>	131.64	
			<i>For Clear Lacquer Finish, Add</i>	263.28	
			<i>For Baked Enamel Standard Colors, Add</i>	394.92	
			<i>For Anodized Finish, Add</i>	526.56	
			<i>For Kynar™ Standard Colors Finish, Add</i>	724.02	
08 91 19 00-0077	EA		42" Wide x 12" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	423.87	38.24
			<i>For Flange Frame, Add</i>	34.74	
			<i>For Clear Lacquer Finish, Add</i>	69.48	
			<i>For Baked Enamel Standard Colors, Add</i>	104.22	
			<i>For Anodized Finish, Add</i>	138.96	
			<i>For Kynar™ Standard Colors Finish, Add</i>	191.07	
08 91 19 00-0078	EA		42" Wide x 18" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	520.20	48.30
			<i>For Flange Frame, Add</i>	42.36	
			<i>For Clear Lacquer Finish, Add</i>	84.72	
			<i>For Baked Enamel Standard Colors, Add</i>	127.08	
			<i>For Anodized Finish, Add</i>	169.44	
			<i>For Kynar™ Standard Colors Finish, Add</i>	232.98	
08 91 19 00-0079	EA		42" Wide x 24" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	602.47	54.34
			<i>For Flange Frame, Add</i>	49.38	
			<i>For Clear Lacquer Finish, Add</i>	98.76	
			<i>For Baked Enamel Standard Colors, Add</i>	148.14	
			<i>For Anodized Finish, Add</i>	197.52	
			<i>For Kynar™ Standard Colors Finish, Add</i>	271.59	
08 91 19 00-0080	EA		42" Wide x 30" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	704.37	62.38
			<i>For Flange Frame, Add</i>	57.96	
			<i>For Clear Lacquer Finish, Add</i>	115.92	
			<i>For Baked Enamel Standard Colors, Add</i>	173.88	
			<i>For Anodized Finish, Add</i>	231.84	
			<i>For Kynar™ Standard Colors Finish, Add</i>	318.78	
08 91 19 00-0081	EA		42" Wide x 36" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	810.82	66.41
			<i>For Flange Frame, Add</i>	67.80	
			<i>For Clear Lacquer Finish, Add</i>	135.60	
			<i>For Baked Enamel Standard Colors, Add</i>	203.40	
			<i>For Anodized Finish, Add</i>	271.20	
			<i>For Kynar™ Standard Colors Finish, Add</i>	372.90	
08 91 19 00-0082	EA		42" Wide x 42" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	896.27	70.44
			<i>For Flange Frame, Add</i>	75.54	
			<i>For Clear Lacquer Finish, Add</i>	151.08	
			<i>For Baked Enamel Standard Colors, Add</i>	226.62	
			<i>For Anodized Finish, Add</i>	302.16	
			<i>For Kynar™ Standard Colors Finish, Add</i>	415.47	
08 91 19 00-0083	EA		42" Wide x 48" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	970.32	74.46
			<i>For Flange Frame, Add</i>	82.14	
			<i>For Clear Lacquer Finish, Add</i>	164.28	
			<i>For Baked Enamel Standard Colors, Add</i>	246.42	
			<i>For Anodized Finish, Add</i>	328.56	
			<i>For Kynar™ Standard Colors Finish, Add</i>	451.77	
08 91 19 00-0084	EA		42" Wide x 54" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,059.20	80.50
			<i>For Flange Frame, Add</i>	89.82	
			<i>For Clear Lacquer Finish, Add</i>	179.64	
			<i>For Baked Enamel Standard Colors, Add</i>	269.46	
			<i>For Anodized Finish, Add</i>	359.28	
			<i>For Kynar™ Standard Colors Finish, Add</i>	494.01	
08 91 19 00-0085	EA		42" Wide x 60" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,135.47	86.53
			<i>For Flange Frame, Add</i>	96.24	
			<i>For Clear Lacquer Finish, Add</i>	192.48	
			<i>For Baked Enamel Standard Colors, Add</i>	288.72	
			<i>For Anodized Finish, Add</i>	384.96	
			<i>For Kynar™ Standard Colors Finish, Add</i>	529.32	
08 91 19 00-0086	EA		42" Wide x 66" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,253.14	92.57
			<i>For Flange Frame, Add</i>	106.80	
			<i>For Clear Lacquer Finish, Add</i>	213.60	
			<i>For Baked Enamel Standard Colors, Add</i>	320.40	
			<i>For Anodized Finish, Add</i>	427.20	
			<i>For Kynar™ Standard Colors Finish, Add</i>	587.40	
08 91 19 00-0087	EA		42" Wide x 72" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,329.41	98.61
			<i>For Flange Frame, Add</i>	113.22	
			<i>For Clear Lacquer Finish, Add</i>	226.44	
			<i>For Baked Enamel Standard Colors, Add</i>	339.66	
			<i>For Anodized Finish, Add</i>	452.88	
			<i>For Kynar™ Standard Colors Finish, Add</i>	622.71	

08	Openings
08 90	Louvers And Vents
08 91	Louvers



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 91	19 00-0088	EA	42" Wide x 78" High Fixed Intake Louver, Galvanized Aluminum.....	1,414.87	102.63
			Note: Includes bird screen.		
			<i>For Flange Frame, Add</i>	120.96	
			<i>For Clear Lacquer Finish, Add</i>	241.92	
			<i>For Baked Enamel Standard Colors, Add</i>	362.88	
			<i>For Anodized Finish, Add</i>	483.84	
			<i>For Kynar™ Standard Colors Finish, Add</i>	665.28	
08 91	19 00-0089	EA	42" Wide x 84" High Fixed Intake Louver, Galvanized Aluminum.....	1,500.91	106.66
			Note: Includes bird screen.		
			<i>For Flange Frame, Add</i>	128.76	
			<i>For Clear Lacquer Finish, Add</i>	257.52	
			<i>For Baked Enamel Standard Colors, Add</i>	386.28	
			<i>For Anodized Finish, Add</i>	515.04	
			<i>For Kynar™ Standard Colors Finish, Add</i>	708.18	
08 91	19 00-0090	EA	42" Wide x 90" High Fixed Intake Louver, Galvanized Aluminum.....	1,581.40	112.70
			Note: Includes bird screen.		
			<i>For Flange Frame, Add</i>	135.60	
			<i>For Clear Lacquer Finish, Add</i>	271.20	
			<i>For Baked Enamel Standard Colors, Add</i>	406.80	
			<i>For Anodized Finish, Add</i>	542.40	
			<i>For Kynar™ Standard Colors Finish, Add</i>	745.80	
08 91	19 00-0091	EA	42" Wide x 96" High Fixed Intake Louver, Galvanized Aluminum.....	1,694.87	118.73
			Note: Includes bird screen.		
			<i>For Flange Frame, Add</i>	145.74	
			<i>For Clear Lacquer Finish, Add</i>	291.48	
			<i>For Baked Enamel Standard Colors, Add</i>	437.22	
			<i>For Anodized Finish, Add</i>	582.96	
			<i>For Kynar™ Standard Colors Finish, Add</i>	801.57	
08 91	19 00-0092	EA	48" Wide x 12" High Fixed Intake Louver, Galvanized Aluminum.....	463.73	42.26
			Note: Includes bird screen.		
			<i>For Flange Frame, Add</i>	37.92	
			<i>For Clear Lacquer Finish, Add</i>	75.84	
			<i>For Baked Enamel Standard Colors, Add</i>	113.76	
			<i>For Anodized Finish, Add</i>	151.68	
			<i>For Kynar™ Standard Colors Finish, Add</i>	208.56	
08 91	19 00-0093	EA	48" Wide x 18" High Fixed Intake Louver, Galvanized Aluminum.....	568.44	52.33
			Note: Includes bird screen.		
			<i>For Flange Frame, Add</i>	46.38	
			<i>For Clear Lacquer Finish, Add</i>	92.76	
			<i>For Baked Enamel Standard Colors, Add</i>	139.14	
			<i>For Anodized Finish, Add</i>	185.52	
			<i>For Kynar™ Standard Colors Finish, Add</i>	255.09	
08 91	19 00-0094	EA	48" Wide x 24" High Fixed Intake Louver, Galvanized Aluminum.....	665.54	60.37
			Note: Includes bird screen.		
			<i>For Flange Frame, Add</i>	54.48	
			<i>For Clear Lacquer Finish, Add</i>	108.96	
			<i>For Baked Enamel Standard Colors, Add</i>	163.44	
			<i>For Anodized Finish, Add</i>	217.92	
			<i>For Kynar™ Standard Colors Finish, Add</i>	299.64	
08 91	19 00-0095	EA	48" Wide x 30" High Fixed Intake Louver, Galvanized Aluminum.....	765.22	66.41
			Note: Includes bird screen.		
			<i>For Flange Frame, Add</i>	63.24	
			<i>For Clear Lacquer Finish, Add</i>	126.48	
			<i>For Baked Enamel Standard Colors, Add</i>	189.72	
			<i>For Anodized Finish, Add</i>	252.96	
			<i>For Kynar™ Standard Colors Finish, Add</i>	347.82	
08 91	19 00-0096	EA	48" Wide x 36" High Fixed Intake Louver, Galvanized Aluminum.....	886.67	70.44
			Note: Includes bird screen.		
			<i>For Flange Frame, Add</i>	74.58	
			<i>For Clear Lacquer Finish, Add</i>	149.16	
			<i>For Baked Enamel Standard Colors, Add</i>	223.74	
			<i>For Anodized Finish, Add</i>	298.32	
			<i>For Kynar™ Standard Colors Finish, Add</i>	410.19	
08 91	19 00-0097	EA	48" Wide x 42" High Fixed Intake Louver, Galvanized Aluminum.....	985.32	74.46
			Note: Includes bird screen.		
			<i>For Flange Frame, Add</i>	83.64	
			<i>For Clear Lacquer Finish, Add</i>	167.28	
			<i>For Baked Enamel Standard Colors, Add</i>	250.92	
			<i>For Anodized Finish, Add</i>	334.56	
			<i>For Kynar™ Standard Colors Finish, Add</i>	460.02	
08 91	19 00-0098	EA	48" Wide x 48" High Fixed Intake Louver, Galvanized Aluminum.....	1,067.60	80.50
			Note: Includes bird screen.		
			<i>For Flange Frame, Add</i>	90.66	
			<i>For Clear Lacquer Finish, Add</i>	181.32	
			<i>For Baked Enamel Standard Colors, Add</i>	271.98	
			<i>For Anodized Finish, Add</i>	362.64	
			<i>For Kynar™ Standard Colors Finish, Add</i>	498.63	
08 91	19 00-0099	EA	48" Wide x 54" High Fixed Intake Louver, Galvanized Aluminum.....	1,196.07	86.53
			Note: Includes bird screen.		
			<i>For Flange Frame, Add</i>	102.30	
			<i>For Clear Lacquer Finish, Add</i>	204.60	
			<i>For Baked Enamel Standard Colors, Add</i>	306.90	
			<i>For Anodized Finish, Add</i>	409.20	
			<i>For Kynar™ Standard Colors Finish, Add</i>	562.65	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 91 19 00-0100 EA 48" Wide x 60" High Fixed Intake Louver, Galvanized Aluminum.....	1,253.14	92.57
Note: Includes bird screen.		
<i>For Flange Frame, Add</i>	106.80	
<i>For Clear Lacquer Finish, Add</i>	213.60	
<i>For Baked Enamel Standard Colors, Add</i>	320.40	
<i>For Anodized Finish, Add</i>	427.20	
<i>For Kynar™ Standard Colors Finish, Add</i>	587.40	
08 91 19 00-0101 EA 48" Wide x 66" High Fixed Intake Louver, Galvanized Aluminum.....	1,378.61	98.61
Note: Includes bird screen.		
<i>For Flange Frame, Add</i>	118.14	
<i>For Clear Lacquer Finish, Add</i>	236.28	
<i>For Baked Enamel Standard Colors, Add</i>	354.42	
<i>For Anodized Finish, Add</i>	472.56	
<i>For Kynar™ Standard Colors Finish, Add</i>	649.77	
08 91 19 00-0102 EA 48" Wide x 72" High Fixed Intake Louver, Galvanized Aluminum.....	1,466.30	104.64
Note: Includes bird screen.		
<i>For Flange Frame, Add</i>	125.70	
<i>For Clear Lacquer Finish, Add</i>	251.40	
<i>For Baked Enamel Standard Colors, Add</i>	377.10	
<i>For Anodized Finish, Add</i>	502.80	
<i>For Kynar™ Standard Colors Finish, Add</i>	691.35	
08 91 19 00-0103 EA 48" Wide x 78" High Fixed Intake Louver, Galvanized Aluminum.....	1,561.34	108.67
Note: Includes bird screen.		
<i>For Flange Frame, Add</i>	134.40	
<i>For Clear Lacquer Finish, Add</i>	268.80	
<i>For Baked Enamel Standard Colors, Add</i>	403.20	
<i>For Anodized Finish, Add</i>	537.60	
<i>For Kynar™ Standard Colors Finish, Add</i>	739.20	
08 91 19 00-0104 EA 48" Wide x 84" High Fixed Intake Louver, Galvanized Aluminum.....	1,656.40	112.70
Note: Includes bird screen.		
<i>For Flange Frame, Add</i>	143.10	
<i>For Clear Lacquer Finish, Add</i>	286.20	
<i>For Baked Enamel Standard Colors, Add</i>	429.30	
<i>For Anodized Finish, Add</i>	572.40	
<i>For Kynar™ Standard Colors Finish, Add</i>	787.05	
08 91 19 00-0105 EA 48" Wide x 90" High Fixed Intake Louver, Galvanized Aluminum.....	1,735.84	116.73
Note: Includes bird screen.		
<i>For Flange Frame, Add</i>	150.24	
<i>For Clear Lacquer Finish, Add</i>	300.48	
<i>For Baked Enamel Standard Colors, Add</i>	450.72	
<i>For Anodized Finish, Add</i>	600.96	
<i>For Kynar™ Standard Colors Finish, Add</i>	826.32	
08 91 19 00-0106 EA 48" Wide x 96" High Fixed Intake Louver, Galvanized Aluminum.....	1,866.11	122.76
Note: Includes bird screen.		
<i>For Flange Frame, Add</i>	162.06	
<i>For Clear Lacquer Finish, Add</i>	324.12	
<i>For Baked Enamel Standard Colors, Add</i>	486.18	
<i>For Anodized Finish, Add</i>	648.24	
<i>For Kynar™ Standard Colors Finish, Add</i>	891.33	
08 91 19 00-0107 EA 54" Wide x 12" High Fixed Intake Louver, Galvanized Aluminum.....	514.20	48.30
Note: Includes bird screen.		
<i>For Flange Frame, Add</i>	41.76	
<i>For Clear Lacquer Finish, Add</i>	83.52	
<i>For Baked Enamel Standard Colors, Add</i>	125.28	
<i>For Anodized Finish, Add</i>	167.04	
<i>For Kynar™ Standard Colors Finish, Add</i>	229.68	
08 91 19 00-0108 EA 54" Wide x 18" High Fixed Intake Louver, Galvanized Aluminum.....	630.93	58.36
Note: Includes bird screen.		
<i>For Flange Frame, Add</i>	51.42	
<i>For Clear Lacquer Finish, Add</i>	102.84	
<i>For Baked Enamel Standard Colors, Add</i>	154.26	
<i>For Anodized Finish, Add</i>	205.68	
<i>For Kynar™ Standard Colors Finish, Add</i>	282.81	
08 91 19 00-0109 EA 54" Wide x 24" High Fixed Intake Louver, Galvanized Aluminum.....	738.64	68.43
Note: Includes bird screen.		
<i>For Flange Frame, Add</i>	60.18	
<i>For Clear Lacquer Finish, Add</i>	120.36	
<i>For Baked Enamel Standard Colors, Add</i>	180.54	
<i>For Anodized Finish, Add</i>	240.72	
<i>For Kynar™ Standard Colors Finish, Add</i>	330.99	
08 91 19 00-0110 EA 54" Wide x 30" High Fixed Intake Louver, Galvanized Aluminum.....	844.50	72.44
Note: Includes bird screen.		
<i>For Flange Frame, Add</i>	69.96	
<i>For Clear Lacquer Finish, Add</i>	139.92	
<i>For Baked Enamel Standard Colors, Add</i>	209.88	
<i>For Anodized Finish, Add</i>	279.84	
<i>For Kynar™ Standard Colors Finish, Add</i>	384.78	
08 91 19 00-0111 EA 54" Wide x 36" High Fixed Intake Louver, Galvanized Aluminum.....	989.34	76.47
Note: Includes bird screen.		
<i>For Flange Frame, Add</i>	83.64	
<i>For Clear Lacquer Finish, Add</i>	167.28	
<i>For Baked Enamel Standard Colors, Add</i>	250.92	
<i>For Anodized Finish, Add</i>	334.56	
<i>For Kynar™ Standard Colors Finish, Add</i>	460.02	

08 Openings**08 90 Louvers And Vents****08 91 Louvers**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 91	19 00-0112	EA	54" Wide x 42" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. <i>For Flange Frame, Add</i> <i>For Clear Lacquer Finish, Add</i> <i>For Baked Enamel Standard Colors, Add</i> <i>For Anodized Finish, Add</i> <i>For Kynar™ Standard Colors Finish, Add</i>	1,090.40 92.94 185.88 278.82 371.76 511.17	80.50
08 91	19 00-0113	EA	54" Wide x 48" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. <i>For Flange Frame, Add</i> <i>For Clear Lacquer Finish, Add</i> <i>For Baked Enamel Standard Colors, Add</i> <i>For Anodized Finish, Add</i> <i>For Kynar™ Standard Colors Finish, Add</i>	1,186.47 101.34 202.68 304.02 405.36 557.37	86.53
08 91	19 00-0114	EA	54" Wide x 54" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. <i>For Flange Frame, Add</i> <i>For Clear Lacquer Finish, Add</i> <i>For Baked Enamel Standard Colors, Add</i> <i>For Anodized Finish, Add</i> <i>For Kynar™ Standard Colors Finish, Add</i>	1,326.34 114.12 228.24 342.36 456.48 627.66	92.57
08 91	19 00-0115	EA	54" Wide x 60" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. <i>For Flange Frame, Add</i> <i>For Clear Lacquer Finish, Add</i> <i>For Baked Enamel Standard Colors, Add</i> <i>For Anodized Finish, Add</i> <i>For Kynar™ Standard Colors Finish, Add</i>	1,425.41 122.82 245.64 368.46 491.28 675.51	98.61
08 91	19 00-0116	EA	54" Wide x 66" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. <i>For Flange Frame, Add</i> <i>For Clear Lacquer Finish, Add</i> <i>For Baked Enamel Standard Colors, Add</i> <i>For Anodized Finish, Add</i> <i>For Kynar™ Standard Colors Finish, Add</i>	1,571.90 136.26 272.52 408.78 545.04 749.43	104.64
08 91	19 00-0117	EA	54" Wide x 72" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. <i>For Flange Frame, Add</i> <i>For Clear Lacquer Finish, Add</i> <i>For Baked Enamel Standard Colors, Add</i> <i>For Anodized Finish, Add</i> <i>For Kynar™ Standard Colors Finish, Add</i>	1,666.34 144.90 289.80 434.70 579.60 796.95	108.67
08 91	19 00-0118	EA	54" Wide x 78" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. <i>For Flange Frame, Add</i> <i>For Clear Lacquer Finish, Add</i> <i>For Baked Enamel Standard Colors, Add</i> <i>For Anodized Finish, Add</i> <i>For Kynar™ Standard Colors Finish, Add</i>	1,774.00 154.86 309.72 464.58 619.44 851.73	112.70
08 91	19 00-0119	EA	54" Wide x 84" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. <i>For Flange Frame, Add</i> <i>For Clear Lacquer Finish, Add</i> <i>For Baked Enamel Standard Colors, Add</i> <i>For Anodized Finish, Add</i> <i>For Kynar™ Standard Colors Finish, Add</i>	1,877.44 164.40 328.80 493.20 657.60 904.20	116.73
08 91	19 00-0120	EA	54" Wide x 90" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. <i>For Flange Frame, Add</i> <i>For Clear Lacquer Finish, Add</i> <i>For Baked Enamel Standard Colors, Add</i> <i>For Anodized Finish, Add</i> <i>For Kynar™ Standard Colors Finish, Add</i>	1,963.50 172.20 344.40 516.60 688.80 947.10	120.74
08 91	19 00-0121	EA	54" Wide x 96" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. <i>For Flange Frame, Add</i> <i>For Clear Lacquer Finish, Add</i> <i>For Baked Enamel Standard Colors, Add</i> <i>For Anodized Finish, Add</i> <i>For Kynar™ Standard Colors Finish, Add</i>	2,114.77 186.12 372.24 558.36 744.48 1,023.66	126.78
08 91	19 00-0122	EA	60" Wide x 12" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. <i>For Flange Frame, Add</i> <i>For Clear Lacquer Finish, Add</i> <i>For Baked Enamel Standard Colors, Add</i> <i>For Anodized Finish, Add</i> <i>For Kynar™ Standard Colors Finish, Add</i>	552.84 44.82 89.64 134.46 179.28 246.51	52.33
08 91	19 00-0123	EA	60" Wide x 18" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. <i>For Flange Frame, Add</i> <i>For Clear Lacquer Finish, Add</i> <i>For Baked Enamel Standard Colors, Add</i> <i>For Anodized Finish, Add</i> <i>For Kynar™ Standard Colors Finish, Add</i>	682.00 55.32 110.64 165.96 221.28 304.26	64.40



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 91	19 00-0124	EA	60" Wide x 24" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	791.70	72.44
			<i>For Flange Frame, Add</i>	64.68	
			<i>For Clear Lacquer Finish, Add</i>	129.36	
			<i>For Baked Enamel Standard Colors, Add</i>	194.04	
			<i>For Anodized Finish, Add</i>	258.72	
			<i>For Kynar™ Standard Colors Finish, Add</i>	355.74	
08 91	19 00-0125	EA	60" Wide x 30" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	913.74	76.47
			<i>For Flange Frame, Add</i>	76.08	
			<i>For Clear Lacquer Finish, Add</i>	152.16	
			<i>For Baked Enamel Standard Colors, Add</i>	228.24	
			<i>For Anodized Finish, Add</i>	304.32	
			<i>For Kynar™ Standard Colors Finish, Add</i>	418.44	
08 91	19 00-0126	EA	60" Wide x 36" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,065.62	82.51
			<i>For Flange Frame, Add</i>	90.06	
			<i>For Clear Lacquer Finish, Add</i>	180.12	
			<i>For Baked Enamel Standard Colors, Add</i>	270.18	
			<i>For Anodized Finish, Add</i>	360.24	
			<i>For Kynar™ Standard Colors Finish, Add</i>	495.33	
08 91	19 00-0127	EA	60" Wide x 42" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,178.67	86.53
			<i>For Flange Frame, Add</i>	100.56	
			<i>For Clear Lacquer Finish, Add</i>	201.12	
			<i>For Baked Enamel Standard Colors, Add</i>	301.68	
			<i>For Anodized Finish, Add</i>	402.24	
			<i>For Kynar™ Standard Colors Finish, Add</i>	553.08	
08 91	19 00-0128	EA	60" Wide x 48" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,278.94	92.57
			<i>For Flange Frame, Add</i>	109.38	
			<i>For Clear Lacquer Finish, Add</i>	218.76	
			<i>For Baked Enamel Standard Colors, Add</i>	328.14	
			<i>For Anodized Finish, Add</i>	437.52	
			<i>For Kynar™ Standard Colors Finish, Add</i>	601.59	
08 91	19 00-0129	EA	60" Wide x 54" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,428.41	98.61
			<i>For Flange Frame, Add</i>	123.12	
			<i>For Clear Lacquer Finish, Add</i>	246.24	
			<i>For Baked Enamel Standard Colors, Add</i>	369.36	
			<i>For Anodized Finish, Add</i>	492.48	
			<i>For Kynar™ Standard Colors Finish, Add</i>	677.16	
08 91	19 00-0130	EA	60" Wide x 60" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,534.70	104.64
			<i>For Flange Frame, Add</i>	132.54	
			<i>For Clear Lacquer Finish, Add</i>	265.08	
			<i>For Baked Enamel Standard Colors, Add</i>	397.62	
			<i>For Anodized Finish, Add</i>	530.16	
			<i>For Kynar™ Standard Colors Finish, Add</i>	728.97	
08 91	19 00-0131	EA	60" Wide x 66" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,693.17	110.68
			<i>For Flange Frame, Add</i>	147.18	
			<i>For Clear Lacquer Finish, Add</i>	294.36	
			<i>For Baked Enamel Standard Colors, Add</i>	441.54	
			<i>For Anodized Finish, Add</i>	588.72	
			<i>For Kynar™ Standard Colors Finish, Add</i>	809.49	
08 91	19 00-0132	EA	60" Wide x 72" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,793.61	114.71
			<i>For Flange Frame, Add</i>	156.42	
			<i>For Clear Lacquer Finish, Add</i>	312.84	
			<i>For Baked Enamel Standard Colors, Add</i>	469.26	
			<i>For Anodized Finish, Add</i>	625.68	
			<i>For Kynar™ Standard Colors Finish, Add</i>	860.31	
08 91	19 00-0133	EA	60" Wide x 78" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,907.87	118.73
			<i>For Flange Frame, Add</i>	167.04	
			<i>For Clear Lacquer Finish, Add</i>	334.08	
			<i>For Baked Enamel Standard Colors, Add</i>	501.12	
			<i>For Anodized Finish, Add</i>	668.16	
			<i>For Kynar™ Standard Colors Finish, Add</i>	918.72	
08 91	19 00-0134	EA	60" Wide x 84" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	2,019.71	122.76
			<i>For Flange Frame, Add</i>	177.42	
			<i>For Clear Lacquer Finish, Add</i>	354.84	
			<i>For Baked Enamel Standard Colors, Add</i>	532.26	
			<i>For Anodized Finish, Add</i>	709.68	
			<i>For Kynar™ Standard Colors Finish, Add</i>	975.81	
08 91	19 00-0135	EA	60" Wide x 90" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	2,114.77	126.78
			<i>For Flange Frame, Add</i>	186.12	
			<i>For Clear Lacquer Finish, Add</i>	372.24	
			<i>For Baked Enamel Standard Colors, Add</i>	558.36	
			<i>For Anodized Finish, Add</i>	744.48	
			<i>For Kynar™ Standard Colors Finish, Add</i>	1,023.66	

08	Openings
08 90	Louvers And Vents
08 91	Louvers



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 91	19 00-0136	EA	60" Wide x 96" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	2,272.21	130.81
			<i>For Flange Frame, Add</i>	201.06	
			<i>For Clear Lacquer Finish, Add</i>	402.12	
			<i>For Baked Enamel Standard Colors, Add</i>	603.18	
			<i>For Anodized Finish, Add</i>	804.24	
			<i>For Kynar™ Standard Colors Finish, Add</i>	1,105.83	
08 91	19 00-0137	EA	66" Wide x 12" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	635.90	56.34
			<i>For Flange Frame, Add</i>	52.32	
			<i>For Clear Lacquer Finish, Add</i>	104.64	
			<i>For Baked Enamel Standard Colors, Add</i>	156.96	
			<i>For Anodized Finish, Add</i>	209.28	
			<i>For Kynar™ Standard Colors Finish, Add</i>	287.76	
08 91	19 00-0138	EA	66" Wide x 18" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	786.04	68.43
			<i>For Flange Frame, Add</i>	64.92	
			<i>For Clear Lacquer Finish, Add</i>	129.84	
			<i>For Baked Enamel Standard Colors, Add</i>	194.76	
			<i>For Anodized Finish, Add</i>	259.68	
			<i>For Kynar™ Standard Colors Finish, Add</i>	357.06	
08 91	19 00-0139	EA	66" Wide x 24" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	916.40	80.50
			<i>For Flange Frame, Add</i>	75.54	
			<i>For Clear Lacquer Finish, Add</i>	151.08	
			<i>For Baked Enamel Standard Colors, Add</i>	226.62	
			<i>For Anodized Finish, Add</i>	302.16	
			<i>For Kynar™ Standard Colors Finish, Add</i>	415.47	
08 91	19 00-0140	EA	66" Wide x 30" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,049.24	84.53
			<i>For Flange Frame, Add</i>	88.02	
			<i>For Clear Lacquer Finish, Add</i>	176.04	
			<i>For Baked Enamel Standard Colors, Add</i>	264.06	
			<i>For Anodized Finish, Add</i>	352.08	
			<i>For Kynar™ Standard Colors Finish, Add</i>	484.11	
08 91	19 00-0141	EA	66" Wide x 36" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,225.30	88.54
			<i>For Flange Frame, Add</i>	104.82	
			<i>For Clear Lacquer Finish, Add</i>	209.64	
			<i>For Baked Enamel Standard Colors, Add</i>	314.46	
			<i>For Anodized Finish, Add</i>	419.28	
			<i>For Kynar™ Standard Colors Finish, Add</i>	576.51	
08 91	19 00-0142	EA	66" Wide x 42" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,348.54	92.57
			<i>For Flange Frame, Add</i>	116.34	
			<i>For Clear Lacquer Finish, Add</i>	232.68	
			<i>For Baked Enamel Standard Colors, Add</i>	349.02	
			<i>For Anodized Finish, Add</i>	465.36	
			<i>For Kynar™ Standard Colors Finish, Add</i>	639.87	
08 91	19 00-0143	EA	66" Wide x 48" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,468.01	98.61
			<i>For Flange Frame, Add</i>	127.08	
			<i>For Clear Lacquer Finish, Add</i>	254.16	
			<i>For Baked Enamel Standard Colors, Add</i>	381.24	
			<i>For Anodized Finish, Add</i>	508.32	
			<i>For Kynar™ Standard Colors Finish, Add</i>	698.94	
08 91	19 00-0144	EA	66" Wide x 54" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,607.90	104.64
			<i>For Flange Frame, Add</i>	139.86	
			<i>For Clear Lacquer Finish, Add</i>	279.72	
			<i>For Baked Enamel Standard Colors, Add</i>	419.58	
			<i>For Anodized Finish, Add</i>	559.44	
			<i>For Kynar™ Standard Colors Finish, Add</i>	769.23	
08 91	19 00-0145	EA	66" Wide x 60" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,726.77	110.68
			<i>For Flange Frame, Add</i>	150.54	
			<i>For Clear Lacquer Finish, Add</i>	301.08	
			<i>For Baked Enamel Standard Colors, Add</i>	451.62	
			<i>For Anodized Finish, Add</i>	602.16	
			<i>For Kynar™ Standard Colors Finish, Add</i>	827.97	
08 91	19 00-0146	EA	66" Wide x 66" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,909.07	118.73
			<i>For Flange Frame, Add</i>	167.16	
			<i>For Clear Lacquer Finish, Add</i>	334.32	
			<i>For Baked Enamel Standard Colors, Add</i>	501.48	
			<i>For Anodized Finish, Add</i>	668.64	
			<i>For Kynar™ Standard Colors Finish, Add</i>	919.38	
08 91	19 00-0147	EA	66" Wide x 72" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	2,023.74	124.77
			<i>For Flange Frame, Add</i>	177.42	
			<i>For Clear Lacquer Finish, Add</i>	354.84	
			<i>For Baked Enamel Standard Colors, Add</i>	532.26	
			<i>For Anodized Finish, Add</i>	709.68	
			<i>For Kynar™ Standard Colors Finish, Add</i>	975.81	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 91	19 00-0148	EA	66" Wide x 78" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	2,144.59	128.80
			<i>For Flange Frame, Add</i>	188.70	
			<i>For Clear Lacquer Finish, Add</i>	377.40	
			<i>For Baked Enamel Standard Colors, Add</i>	566.10	
			<i>For Anodized Finish, Add</i>	754.80	
			<i>For Kynar™ Standard Colors Finish, Add</i>	1,037.85	
08 91	19 00-0149	EA	66" Wide x 84" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	2,267.84	132.82
			<i>For Flange Frame, Add</i>	200.22	
			<i>For Clear Lacquer Finish, Add</i>	400.44	
			<i>For Baked Enamel Standard Colors, Add</i>	600.66	
			<i>For Anodized Finish, Add</i>	800.88	
			<i>For Kynar™ Standard Colors Finish, Add</i>	1,101.21	
08 91	19 00-0150	EA	66" Wide x 90" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	2,374.89	136.84
			<i>For Flange Frame, Add</i>	210.12	
			<i>For Clear Lacquer Finish, Add</i>	420.24	
			<i>For Baked Enamel Standard Colors, Add</i>	630.36	
			<i>For Anodized Finish, Add</i>	840.48	
			<i>For Kynar™ Standard Colors Finish, Add</i>	1,155.66	
08 91	19 00-0151	EA	66" Wide x 96" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	2,550.34	140.87
			<i>For Flange Frame, Add</i>	226.86	
			<i>For Clear Lacquer Finish, Add</i>	453.72	
			<i>For Baked Enamel Standard Colors, Add</i>	680.58	
			<i>For Anodized Finish, Add</i>	907.44	
			<i>For Kynar™ Standard Colors Finish, Add</i>	1,247.73	
08 91	19 00-0152	EA	72" Wide x 12" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	671.54	60.37
			<i>For Flange Frame, Add</i>	55.08	
			<i>For Clear Lacquer Finish, Add</i>	110.16	
			<i>For Baked Enamel Standard Colors, Add</i>	165.24	
			<i>For Anodized Finish, Add</i>	220.32	
			<i>For Kynar™ Standard Colors Finish, Add</i>	302.94	
08 91	19 00-0153	EA	72" Wide x 18" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	828.90	72.44
			<i>For Flange Frame, Add</i>	68.40	
			<i>For Clear Lacquer Finish, Add</i>	136.80	
			<i>For Baked Enamel Standard Colors, Add</i>	205.20	
			<i>For Anodized Finish, Add</i>	273.60	
			<i>For Kynar™ Standard Colors Finish, Add</i>	376.20	
08 91	19 00-0154	EA	72" Wide x 24" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	965.84	84.53
			<i>For Flange Frame, Add</i>	79.68	
			<i>For Clear Lacquer Finish, Add</i>	159.36	
			<i>For Baked Enamel Standard Colors, Add</i>	239.04	
			<i>For Anodized Finish, Add</i>	318.72	
			<i>For Kynar™ Standard Colors Finish, Add</i>	438.24	
08 91	19 00-0155	EA	72" Wide x 30" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,110.51	90.56
			<i>For Flange Frame, Add</i>	92.94	
			<i>For Clear Lacquer Finish, Add</i>	185.88	
			<i>For Baked Enamel Standard Colors, Add</i>	278.82	
			<i>For Anodized Finish, Add</i>	371.76	
			<i>For Kynar™ Standard Colors Finish, Add</i>	511.17	
08 91	19 00-0156	EA	72" Wide x 36" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,299.17	94.58
			<i>For Flange Frame, Add</i>	111.00	
			<i>For Clear Lacquer Finish, Add</i>	222.00	
			<i>For Baked Enamel Standard Colors, Add</i>	333.00	
			<i>For Anodized Finish, Add</i>	444.00	
			<i>For Kynar™ Standard Colors Finish, Add</i>	610.50	
08 91	19 00-0157	EA	72" Wide x 42" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,429.01	98.61
			<i>For Flange Frame, Add</i>	123.18	
			<i>For Clear Lacquer Finish, Add</i>	246.36	
			<i>For Baked Enamel Standard Colors, Add</i>	369.54	
			<i>For Anodized Finish, Add</i>	492.72	
			<i>For Kynar™ Standard Colors Finish, Add</i>	677.49	
08 91	19 00-0158	EA	72" Wide x 48" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,556.30	104.64
			<i>For Flange Frame, Add</i>	134.70	
			<i>For Clear Lacquer Finish, Add</i>	269.40	
			<i>For Baked Enamel Standard Colors, Add</i>	404.10	
			<i>For Anodized Finish, Add</i>	538.80	
			<i>For Kynar™ Standard Colors Finish, Add</i>	740.85	
08 91	19 00-0159	EA	72" Wide x 54" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,699.94	108.67
			<i>For Flange Frame, Add</i>	148.26	
			<i>For Clear Lacquer Finish, Add</i>	296.52	
			<i>For Baked Enamel Standard Colors, Add</i>	444.78	
			<i>For Anodized Finish, Add</i>	593.04	
			<i>For Kynar™ Standard Colors Finish, Add</i>	815.43	

08	Openings
08 90	Louvers And Vents
08 91	Louvers



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 91	19 00-0160	EA	72" Wide x 60" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,824.21	114.71
			<i>For Flange Frame, Add</i>	159.48	
			<i>For Clear Lacquer Finish, Add</i>	318.96	
			<i>For Baked Enamel Standard Colors, Add</i>	478.44	
			<i>For Anodized Finish, Add</i>	637.92	
			<i>For Kynar™ Standard Colors Finish, Add</i>	877.14	
08 91	19 00-0161	EA	72" Wide x 66" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	2,023.74	124.77
			<i>For Flange Frame, Add</i>	177.42	
			<i>For Clear Lacquer Finish, Add</i>	354.84	
			<i>For Baked Enamel Standard Colors, Add</i>	532.26	
			<i>For Anodized Finish, Add</i>	709.68	
			<i>For Kynar™ Standard Colors Finish, Add</i>	975.81	
08 91	19 00-0162	EA	72" Wide x 72" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	2,149.81	130.81
			<i>For Flange Frame, Add</i>	188.82	
			<i>For Clear Lacquer Finish, Add</i>	377.64	
			<i>For Baked Enamel Standard Colors, Add</i>	566.46	
			<i>For Anodized Finish, Add</i>	755.28	
			<i>For Kynar™ Standard Colors Finish, Add</i>	1,038.51	
08 91	19 00-0163	EA	72" Wide x 78" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	2,274.27	134.83
			<i>For Flange Frame, Add</i>	200.46	
			<i>For Clear Lacquer Finish, Add</i>	400.92	
			<i>For Baked Enamel Standard Colors, Add</i>	601.38	
			<i>For Anodized Finish, Add</i>	801.84	
			<i>For Kynar™ Standard Colors Finish, Add</i>	1,102.53	
08 91	19 00-0164	EA	72" Wide x 84" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	2,400.51	138.86
			<i>For Flange Frame, Add</i>	212.28	
			<i>For Clear Lacquer Finish, Add</i>	424.56	
			<i>For Baked Enamel Standard Colors, Add</i>	636.84	
			<i>For Anodized Finish, Add</i>	849.12	
			<i>For Kynar™ Standard Colors Finish, Add</i>	1,167.54	
08 91	19 00-0165	EA	72" Wide x 90" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	2,518.97	142.88
			<i>For Flange Frame, Add</i>	223.32	
			<i>For Clear Lacquer Finish, Add</i>	446.64	
			<i>For Baked Enamel Standard Colors, Add</i>	669.96	
			<i>For Anodized Finish, Add</i>	893.28	
			<i>For Kynar™ Standard Colors Finish, Add</i>	1,228.26	
08 91	19 00-0166	EA	72" Wide x 96" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	2,705.81	146.91
			<i>For Flange Frame, Add</i>	241.20	
			<i>For Clear Lacquer Finish, Add</i>	482.40	
			<i>For Baked Enamel Standard Colors, Add</i>	723.60	
			<i>For Anodized Finish, Add</i>	964.80	
			<i>For Kynar™ Standard Colors Finish, Add</i>	1,326.60	
08 91	19 00-0167	EA	78" Wide x 12" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	714.40	64.40
			<i>For Flange Frame, Add</i>	58.56	
			<i>For Clear Lacquer Finish, Add</i>	117.12	
			<i>For Baked Enamel Standard Colors, Add</i>	175.68	
			<i>For Anodized Finish, Add</i>	234.24	
			<i>For Kynar™ Standard Colors Finish, Add</i>	322.08	
08 91	19 00-0168	EA	78" Wide x 18" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	875.94	76.47
			<i>For Flange Frame, Add</i>	72.30	
			<i>For Clear Lacquer Finish, Add</i>	144.60	
			<i>For Baked Enamel Standard Colors, Add</i>	216.90	
			<i>For Anodized Finish, Add</i>	289.20	
			<i>For Kynar™ Standard Colors Finish, Add</i>	397.65	
08 91	19 00-0169	EA	78" Wide x 24" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,015.90	88.54
			<i>For Flange Frame, Add</i>	83.88	
			<i>For Clear Lacquer Finish, Add</i>	167.76	
			<i>For Baked Enamel Standard Colors, Add</i>	251.64	
			<i>For Anodized Finish, Add</i>	335.52	
			<i>For Kynar™ Standard Colors Finish, Add</i>	461.34	
08 91	19 00-0170	EA	78" Wide x 30" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,170.17	94.58
			<i>For Flange Frame, Add</i>	98.10	
			<i>For Clear Lacquer Finish, Add</i>	196.20	
			<i>For Baked Enamel Standard Colors, Add</i>	294.30	
			<i>For Anodized Finish, Add</i>	392.40	
			<i>For Kynar™ Standard Colors Finish, Add</i>	539.55	
08 91	19 00-0171	EA	78" Wide x 36" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,369.61	98.61
			<i>For Flange Frame, Add</i>	117.24	
			<i>For Clear Lacquer Finish, Add</i>	234.48	
			<i>For Baked Enamel Standard Colors, Add</i>	351.72	
			<i>For Anodized Finish, Add</i>	468.96	
			<i>For Kynar™ Standard Colors Finish, Add</i>	644.82	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 91	19 00-0172	EA		78" Wide x 42" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,504.87	102.63
				<i>For Flange Frame, Add</i>	129.96	
				<i>For Clear Lacquer Finish, Add</i>	259.92	
				<i>For Baked Enamel Standard Colors, Add</i>	389.88	
				<i>For Anodized Finish, Add</i>	519.84	
				<i>For Kynar™ Standard Colors Finish, Add</i>	714.78	
08 91	19 00-0173	EA		78" Wide x 48" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,641.14	108.67
				<i>For Flange Frame, Add</i>	142.38	
				<i>For Clear Lacquer Finish, Add</i>	284.76	
				<i>For Baked Enamel Standard Colors, Add</i>	427.14	
				<i>For Anodized Finish, Add</i>	569.52	
				<i>For Kynar™ Standard Colors Finish, Add</i>	783.09	
08 91	19 00-0174	EA		78" Wide x 54" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,793.20	112.70
				<i>For Flange Frame, Add</i>	156.78	
				<i>For Clear Lacquer Finish, Add</i>	313.56	
				<i>For Baked Enamel Standard Colors, Add</i>	470.34	
				<i>For Anodized Finish, Add</i>	627.12	
				<i>For Kynar™ Standard Colors Finish, Add</i>	862.29	
08 91	19 00-0175	EA		78" Wide x 60" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,926.47	118.73
				<i>For Flange Frame, Add</i>	168.90	
				<i>For Clear Lacquer Finish, Add</i>	337.80	
				<i>For Baked Enamel Standard Colors, Add</i>	506.70	
				<i>For Anodized Finish, Add</i>	675.60	
				<i>For Kynar™ Standard Colors Finish, Add</i>	928.95	
08 91	19 00-0176	EA		78" Wide x 66" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	2,138.59	128.80
				<i>For Flange Frame, Add</i>	188.10	
				<i>For Clear Lacquer Finish, Add</i>	376.20	
				<i>For Baked Enamel Standard Colors, Add</i>	564.30	
				<i>For Anodized Finish, Add</i>	752.40	
				<i>For Kynar™ Standard Colors Finish, Add</i>	1,034.55	
08 91	19 00-0177	EA		78" Wide x 72" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	2,270.67	134.83
				<i>For Flange Frame, Add</i>	200.10	
				<i>For Clear Lacquer Finish, Add</i>	400.20	
				<i>For Baked Enamel Standard Colors, Add</i>	600.30	
				<i>For Anodized Finish, Add</i>	800.40	
				<i>For Kynar™ Standard Colors Finish, Add</i>	1,100.55	
08 91	19 00-0178	EA		78" Wide x 78" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	2,408.74	140.87
				<i>For Flange Frame, Add</i>	212.70	
				<i>For Clear Lacquer Finish, Add</i>	425.40	
				<i>For Baked Enamel Standard Colors, Add</i>	638.10	
				<i>For Anodized Finish, Add</i>	850.80	
				<i>For Kynar™ Standard Colors Finish, Add</i>	1,169.85	
08 91	19 00-0179	EA		78" Wide x 84" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	2,534.99	144.90
				<i>For Flange Frame, Add</i>	224.52	
				<i>For Clear Lacquer Finish, Add</i>	449.04	
				<i>For Baked Enamel Standard Colors, Add</i>	673.56	
				<i>For Anodized Finish, Add</i>	898.08	
				<i>For Kynar™ Standard Colors Finish, Add</i>	1,234.86	
08 91	19 00-0180	EA		78" Wide x 90" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	2,661.24	148.92
				<i>For Flange Frame, Add</i>	236.34	
				<i>For Clear Lacquer Finish, Add</i>	472.68	
				<i>For Baked Enamel Standard Colors, Add</i>	709.02	
				<i>For Anodized Finish, Add</i>	945.36	
				<i>For Kynar™ Standard Colors Finish, Add</i>	1,299.87	
08 91	19 00-0181	EA		78" Wide x 96" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	2,860.09	152.94
				<i>For Flange Frame, Add</i>	255.42	
				<i>For Clear Lacquer Finish, Add</i>	510.84	
				<i>For Baked Enamel Standard Colors, Add</i>	766.26	
				<i>For Anodized Finish, Add</i>	1,021.68	
				<i>For Kynar™ Standard Colors Finish, Add</i>	1,404.81	
08 91	19 00-0182	EA		84" Wide x 12" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	749.44	68.43
				<i>For Flange Frame, Add</i>	61.26	
				<i>For Clear Lacquer Finish, Add</i>	122.52	
				<i>For Baked Enamel Standard Colors, Add</i>	183.78	
				<i>For Anodized Finish, Add</i>	245.04	
				<i>For Kynar™ Standard Colors Finish, Add</i>	336.93	
08 91	19 00-0183	EA		84" Wide x 18" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	917.60	80.50
				<i>For Flange Frame, Add</i>	75.66	
				<i>For Clear Lacquer Finish, Add</i>	151.32	
				<i>For Baked Enamel Standard Colors, Add</i>	226.98	
				<i>For Anodized Finish, Add</i>	302.64	
				<i>For Kynar™ Standard Colors Finish, Add</i>	416.13	

08	Openings
08 90	Louvers And Vents
08 91	Louvers



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 91	19 00-0184	EA	84" Wide x 24" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,071.94	92.57
			<i>For Flange Frame, Add</i>	88.68	
			<i>For Clear Lacquer Finish, Add</i>	177.36	
			<i>For Baked Enamel Standard Colors, Add</i>	266.04	
			<i>For Anodized Finish, Add</i>	354.72	
			<i>For Kynar™ Standard Colors Finish, Add</i>	487.74	
08 91	19 00-0185	EA	84" Wide x 30" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,231.01	98.61
			<i>For Flange Frame, Add</i>	103.38	
			<i>For Clear Lacquer Finish, Add</i>	206.76	
			<i>For Baked Enamel Standard Colors, Add</i>	310.14	
			<i>For Anodized Finish, Add</i>	413.52	
			<i>For Kynar™ Standard Colors Finish, Add</i>	568.59	
08 91	19 00-0186	EA	84" Wide x 36" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,443.07	102.63
			<i>For Flange Frame, Add</i>	123.78	
			<i>For Clear Lacquer Finish, Add</i>	247.56	
			<i>For Baked Enamel Standard Colors, Add</i>	371.34	
			<i>For Anodized Finish, Add</i>	495.12	
			<i>For Kynar™ Standard Colors Finish, Add</i>	680.79	
08 91	19 00-0187	EA	84" Wide x 42" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,586.11	106.66
			<i>For Flange Frame, Add</i>	137.28	
			<i>For Clear Lacquer Finish, Add</i>	274.56	
			<i>For Baked Enamel Standard Colors, Add</i>	411.84	
			<i>For Anodized Finish, Add</i>	549.12	
			<i>For Kynar™ Standard Colors Finish, Add</i>	755.04	
08 91	19 00-0188	EA	84" Wide x 48" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,725.40	112.70
			<i>For Flange Frame, Add</i>	150.00	
			<i>For Clear Lacquer Finish, Add</i>	300.00	
			<i>For Baked Enamel Standard Colors, Add</i>	450.00	
			<i>For Anodized Finish, Add</i>	600.00	
			<i>For Kynar™ Standard Colors Finish, Add</i>	825.00	
08 91	19 00-0189	EA	84" Wide x 54" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,889.44	116.73
			<i>For Flange Frame, Add</i>	165.60	
			<i>For Clear Lacquer Finish, Add</i>	331.20	
			<i>For Baked Enamel Standard Colors, Add</i>	496.80	
			<i>For Anodized Finish, Add</i>	662.40	
			<i>For Kynar™ Standard Colors Finish, Add</i>	910.80	
08 91	19 00-0190	EA	84" Wide x 60" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	2,029.31	122.76
			<i>For Flange Frame, Add</i>	178.38	
			<i>For Clear Lacquer Finish, Add</i>	356.76	
			<i>For Baked Enamel Standard Colors, Add</i>	535.14	
			<i>For Anodized Finish, Add</i>	713.52	
			<i>For Kynar™ Standard Colors Finish, Add</i>	981.09	
08 91	19 00-0191	EA	84" Wide x 66" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	2,254.04	132.82
			<i>For Flange Frame, Add</i>	198.84	
			<i>For Clear Lacquer Finish, Add</i>	397.68	
			<i>For Baked Enamel Standard Colors, Add</i>	596.52	
			<i>For Anodized Finish, Add</i>	795.36	
			<i>For Kynar™ Standard Colors Finish, Add</i>	1,093.62	
08 91	19 00-0192	EA	84" Wide x 72" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	2,390.91	138.86
			<i>For Flange Frame, Add</i>	211.32	
			<i>For Clear Lacquer Finish, Add</i>	422.64	
			<i>For Baked Enamel Standard Colors, Add</i>	633.96	
			<i>For Anodized Finish, Add</i>	845.28	
			<i>For Kynar™ Standard Colors Finish, Add</i>	1,162.26	
08 91	19 00-0193	EA	84" Wide x 78" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	2,540.99	144.90
			<i>For Flange Frame, Add</i>	225.12	
			<i>For Clear Lacquer Finish, Add</i>	450.24	
			<i>For Baked Enamel Standard Colors, Add</i>	675.36	
			<i>For Anodized Finish, Add</i>	900.48	
			<i>For Kynar™ Standard Colors Finish, Add</i>	1,238.16	
08 91	19 00-0194	EA	84" Wide x 84" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	2,700.84	148.92
			<i>For Flange Frame, Add</i>	240.30	
			<i>For Clear Lacquer Finish, Add</i>	480.60	
			<i>For Baked Enamel Standard Colors, Add</i>	720.90	
			<i>For Anodized Finish, Add</i>	961.20	
			<i>For Kynar™ Standard Colors Finish, Add</i>	1,321.65	
08 91	19 00-0195	EA	84" Wide x 90" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	2,845.09	152.94
			<i>For Flange Frame, Add</i>	253.92	
			<i>For Clear Lacquer Finish, Add</i>	507.84	
			<i>For Baked Enamel Standard Colors, Add</i>	761.76	
			<i>For Anodized Finish, Add</i>	1,015.68	
			<i>For Kynar™ Standard Colors Finish, Add</i>	1,396.56	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 91	19 00-0196	EA		84" Wide x 96" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	3,058.94	156.97
				<i>For Flange Frame, Add</i>	274.50	
				<i>For Clear Lacquer Finish, Add</i>	549.00	
				<i>For Baked Enamel Standard Colors, Add</i>	823.50	
				<i>For Anodized Finish, Add</i>	1,098.00	
				<i>For Kynar™ Standard Colors Finish, Add</i>	1,509.75	
08 91	19 00-0197	EA		90" Wide x 12" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	795.72	74.46
				<i>For Flange Frame, Add</i>	64.68	
				<i>For Clear Lacquer Finish, Add</i>	129.36	
				<i>For Baked Enamel Standard Colors, Add</i>	194.04	
				<i>For Anodized Finish, Add</i>	258.72	
				<i>For Kynar™ Standard Colors Finish, Add</i>	355.74	
08 91	19 00-0198	EA		90" Wide x 18" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	966.27	86.53
				<i>For Flange Frame, Add</i>	79.32	
				<i>For Clear Lacquer Finish, Add</i>	158.64	
				<i>For Baked Enamel Standard Colors, Add</i>	237.96	
				<i>For Anodized Finish, Add</i>	317.28	
				<i>For Kynar™ Standard Colors Finish, Add</i>	436.26	
08 91	19 00-0199	EA		90" Wide x 24" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,126.61	98.61
				<i>For Flange Frame, Add</i>	92.94	
				<i>For Clear Lacquer Finish, Add</i>	185.88	
				<i>For Baked Enamel Standard Colors, Add</i>	278.82	
				<i>For Anodized Finish, Add</i>	371.76	
				<i>For Kynar™ Standard Colors Finish, Add</i>	511.17	
08 91	19 00-0200	EA		90" Wide x 30" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,290.50	104.64
				<i>For Flange Frame, Add</i>	108.12	
				<i>For Clear Lacquer Finish, Add</i>	216.24	
				<i>For Baked Enamel Standard Colors, Add</i>	324.36	
				<i>For Anodized Finish, Add</i>	432.48	
				<i>For Kynar™ Standard Colors Finish, Add</i>	594.66	
08 91	19 00-0201	EA		90" Wide x 36" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,516.94	108.67
				<i>For Flange Frame, Add</i>	129.96	
				<i>For Clear Lacquer Finish, Add</i>	259.92	
				<i>For Baked Enamel Standard Colors, Add</i>	389.88	
				<i>For Anodized Finish, Add</i>	519.84	
				<i>For Kynar™ Standard Colors Finish, Add</i>	714.78	
08 91	19 00-0202	EA		90" Wide x 42" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,664.80	112.70
				<i>For Flange Frame, Add</i>	143.94	
				<i>For Clear Lacquer Finish, Add</i>	287.88	
				<i>For Baked Enamel Standard Colors, Add</i>	431.82	
				<i>For Anodized Finish, Add</i>	575.76	
				<i>For Kynar™ Standard Colors Finish, Add</i>	791.67	
08 91	19 00-0203	EA		90" Wide x 48" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,806.04	116.73
				<i>For Flange Frame, Add</i>	157.26	
				<i>For Clear Lacquer Finish, Add</i>	314.52	
				<i>For Baked Enamel Standard Colors, Add</i>	471.78	
				<i>For Anodized Finish, Add</i>	629.04	
				<i>For Kynar™ Standard Colors Finish, Add</i>	864.93	
08 91	19 00-0204	EA		90" Wide x 54" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,979.10	120.74
				<i>For Flange Frame, Add</i>	173.76	
				<i>For Clear Lacquer Finish, Add</i>	347.52	
				<i>For Baked Enamel Standard Colors, Add</i>	521.28	
				<i>For Anodized Finish, Add</i>	695.04	
				<i>For Kynar™ Standard Colors Finish, Add</i>	955.68	
08 91	19 00-0205	EA		90" Wide x 60" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	2,126.17	126.78
				<i>For Flange Frame, Add</i>	187.26	
				<i>For Clear Lacquer Finish, Add</i>	374.52	
				<i>For Baked Enamel Standard Colors, Add</i>	561.78	
				<i>For Anodized Finish, Add</i>	749.04	
				<i>For Kynar™ Standard Colors Finish, Add</i>	1,029.93	
08 91	19 00-0206	EA		90" Wide x 66" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	2,363.49	136.84
				<i>For Flange Frame, Add</i>	208.98	
				<i>For Clear Lacquer Finish, Add</i>	417.96	
				<i>For Baked Enamel Standard Colors, Add</i>	626.94	
				<i>For Anodized Finish, Add</i>	835.92	
				<i>For Kynar™ Standard Colors Finish, Add</i>	1,149.39	
08 91	19 00-0207	EA		90" Wide x 72" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	2,506.37	142.88
				<i>For Flange Frame, Add</i>	222.06	
				<i>For Clear Lacquer Finish, Add</i>	444.12	
				<i>For Baked Enamel Standard Colors, Add</i>	666.18	
				<i>For Anodized Finish, Add</i>	888.24	
				<i>For Kynar™ Standard Colors Finish, Add</i>	1,221.33	

08	Openings
08 90	Louvers And Vents
08 91	Louvers



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 91	19 00-0208	EA	90" Wide x 78" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	2,669.64	148.92
			<i>For Flange Frame, Add</i>	237.18	
			<i>For Clear Lacquer Finish, Add</i>	474.36	
			<i>For Baked Enamel Standard Colors, Add</i>	711.54	
			<i>For Anodized Finish, Add</i>	948.72	
			<i>For Kynar™ Standard Colors Finish, Add</i>	1,304.49	
08 91	19 00-0209	EA	90" Wide x 84" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	2,839.09	152.94
			<i>For Flange Frame, Add</i>	253.32	
			<i>For Clear Lacquer Finish, Add</i>	506.64	
			<i>For Baked Enamel Standard Colors, Add</i>	759.96	
			<i>For Anodized Finish, Add</i>	1,013.28	
			<i>For Kynar™ Standard Colors Finish, Add</i>	1,393.26	
08 91	19 00-0210	EA	90" Wide x 90" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	2,983.77	158.98
			<i>For Flange Frame, Add</i>	266.58	
			<i>For Clear Lacquer Finish, Add</i>	533.16	
			<i>For Baked Enamel Standard Colors, Add</i>	799.74	
			<i>For Anodized Finish, Add</i>	1,066.32	
			<i>For Kynar™ Standard Colors Finish, Add</i>	1,466.19	
08 91	19 00-0211	EA	90" Wide x 96" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	3,210.21	163.01
			<i>For Flange Frame, Add</i>	288.42	
			<i>For Clear Lacquer Finish, Add</i>	576.84	
			<i>For Baked Enamel Standard Colors, Add</i>	865.26	
			<i>For Anodized Finish, Add</i>	1,153.68	
			<i>For Kynar™ Standard Colors Finish, Add</i>	1,586.31	
08 91	19 00-0212	EA	96" Wide x 12" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	836.00	80.50
			<i>For Flange Frame, Add</i>	67.50	
			<i>For Clear Lacquer Finish, Add</i>	135.00	
			<i>For Baked Enamel Standard Colors, Add</i>	202.50	
			<i>For Anodized Finish, Add</i>	270.00	
			<i>For Kynar™ Standard Colors Finish, Add</i>	371.25	
08 91	19 00-0213	EA	96" Wide x 18" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,012.54	92.57
			<i>For Flange Frame, Add</i>	82.74	
			<i>For Clear Lacquer Finish, Add</i>	165.48	
			<i>For Baked Enamel Standard Colors, Add</i>	248.22	
			<i>For Anodized Finish, Add</i>	330.96	
			<i>For Kynar™ Standard Colors Finish, Add</i>	455.07	
08 91	19 00-0214	EA	96" Wide x 24" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,180.70	104.64
			<i>For Flange Frame, Add</i>	97.14	
			<i>For Clear Lacquer Finish, Add</i>	194.28	
			<i>For Baked Enamel Standard Colors, Add</i>	291.42	
			<i>For Anodized Finish, Add</i>	388.56	
			<i>For Kynar™ Standard Colors Finish, Add</i>	534.27	
08 91	19 00-0215	EA	96" Wide x 30" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,353.57	110.68
			<i>For Flange Frame, Add</i>	113.22	
			<i>For Clear Lacquer Finish, Add</i>	226.44	
			<i>For Baked Enamel Standard Colors, Add</i>	339.66	
			<i>For Anodized Finish, Add</i>	452.88	
			<i>For Kynar™ Standard Colors Finish, Add</i>	622.71	
08 91	19 00-0216	EA	96" Wide x 36" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,587.21	114.71
			<i>For Flange Frame, Add</i>	135.78	
			<i>For Clear Lacquer Finish, Add</i>	271.56	
			<i>For Baked Enamel Standard Colors, Add</i>	407.34	
			<i>For Anodized Finish, Add</i>	543.12	
			<i>For Kynar™ Standard Colors Finish, Add</i>	746.79	
08 91	19 00-0217	EA	96" Wide x 42" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,759.67	118.73
			<i>For Flange Frame, Add</i>	152.22	
			<i>For Clear Lacquer Finish, Add</i>	304.44	
			<i>For Baked Enamel Standard Colors, Add</i>	456.66	
			<i>For Anodized Finish, Add</i>	608.88	
			<i>For Kynar™ Standard Colors Finish, Add</i>	837.21	
08 91	19 00-0218	EA	96" Wide x 48" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	1,909.91	122.76
			<i>For Flange Frame, Add</i>	166.44	
			<i>For Clear Lacquer Finish, Add</i>	332.88	
			<i>For Baked Enamel Standard Colors, Add</i>	499.32	
			<i>For Anodized Finish, Add</i>	665.76	
			<i>For Kynar™ Standard Colors Finish, Add</i>	915.42	
08 91	19 00-0219	EA	96" Wide x 54" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen.	2,074.57	126.78
			<i>For Flange Frame, Add</i>	182.10	
			<i>For Clear Lacquer Finish, Add</i>	364.20	
			<i>For Baked Enamel Standard Colors, Add</i>	546.30	
			<i>For Anodized Finish, Add</i>	728.40	
			<i>For Kynar™ Standard Colors Finish, Add</i>	1,001.55	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 91	19 00-0220	EA	96" Wide x 60" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. <i>For Flange Frame, Add</i> <i>For Clear Lacquer Finish, Add</i> <i>For Baked Enamel Standard Colors, Add</i> <i>For Anodized Finish, Add</i> <i>For Kynar™ Standard Colors Finish, Add</i>	2,227.21 196.56 393.12 589.68 786.24 1,081.08	130.81
08 91	19 00-0221	EA	96" Wide x 66" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. <i>For Flange Frame, Add</i> <i>For Clear Lacquer Finish, Add</i> <i>For Baked Enamel Standard Colors, Add</i> <i>For Anodized Finish, Add</i> <i>For Kynar™ Standard Colors Finish, Add</i>	2,481.94 220.02 440.04 660.06 880.08 1,210.11	140.87
08 91	19 00-0222	EA	96" Wide x 72" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. <i>For Flange Frame, Add</i> <i>For Clear Lacquer Finish, Add</i> <i>For Baked Enamel Standard Colors, Add</i> <i>For Anodized Finish, Add</i> <i>For Kynar™ Standard Colors Finish, Add</i>	1,984.01 169.02 338.04 507.06 676.08 929.61	146.91
08 91	19 00-0223	EA	96" Wide x 78" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. <i>For Flange Frame, Add</i> <i>For Clear Lacquer Finish, Add</i> <i>For Baked Enamel Standard Colors, Add</i> <i>For Anodized Finish, Add</i> <i>For Kynar™ Standard Colors Finish, Add</i>	2,796.49 249.06 498.12 747.18 996.24 1,369.83	152.94
08 91	19 00-0224	EA	96" Wide x 84" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. <i>For Flange Frame, Add</i> <i>For Clear Lacquer Finish, Add</i> <i>For Baked Enamel Standard Colors, Add</i> <i>For Anodized Finish, Add</i> <i>For Kynar™ Standard Colors Finish, Add</i>	2,971.94 265.80 531.60 797.40 1,063.20 1,461.90	156.97
08 91	19 00-0225	EA	96" Wide x 90" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. <i>For Flange Frame, Add</i> <i>For Clear Lacquer Finish, Add</i> <i>For Baked Enamel Standard Colors, Add</i> <i>For Anodized Finish, Add</i> <i>For Kynar™ Standard Colors Finish, Add</i>	3,123.81 279.78 559.56 839.34 1,119.12 1,538.79	163.01
08 91	19 00-0226	EA	96" Wide x 96" High Fixed Intake Louver, Galvanized Aluminum..... Note: Includes bird screen. <i>For Flange Frame, Add</i> <i>For Clear Lacquer Finish, Add</i> <i>For Baked Enamel Standard Colors, Add</i> <i>For Anodized Finish, Add</i> <i>For Kynar™ Standard Colors Finish, Add</i>	3,368.09 303.00 606.00 909.00 1,212.00 1,666.50	169.04
08 91	19 00-0227		Gable Louver Vents <small>(08 91 19)</small> Note: 1" deep, residential/light commercial grade louvers.		
08 91	19 00-0228		Aluminum Gable Louver Vents <small>(08 91 19 00-0227)</small> Note: Includes screen.		
08 91	19 00-0229		Rectangular Aluminum Gable Louver Vents <small>(08 91 19 00-0228)</small> Note: Includes screen.		
08 91	19 00-0230	EA	12" x 18" Rectangular Fixed Aluminum Gable Louver Vent.....	138.53	6.83
08 91	19 00-0231	EA	12" x 24" Rectangular Fixed Aluminum Gable Louver Vent.....	151.67	7.84
08 91	19 00-0232	EA	18" x 24" Rectangular Fixed Aluminum Gable Louver Vent.....	174.92	8.86
08 91	19 00-0233	EA	18" x 30" Rectangular Fixed Aluminum Gable Louver Vent.....	191.75	9.42
08 91	19 00-0234	EA	24" x 30" Rectangular Fixed Aluminum Gable Louver Vent.....	218.66	9.97
08 91	19 00-0235	EA	24" x 36" Rectangular Fixed Aluminum Gable Louver Vent.....	244.85	11.96
08 91	19 00-0236	EA	30" x 36" Rectangular Fixed Aluminum Gable Louver Vent.....	284.14	14.95
08 91	19 00-0237	EA	30" x 42" Rectangular Fixed Aluminum Gable Louver Vent.....	316.88	17.44
08 91	19 00-0238	EA	36" x 42" Rectangular Fixed Aluminum Gable Louver Vent.....	362.72	20.94
08 91	19 00-0239	EA	42" x 48" Rectangular Fixed Aluminum Gable Louver Vent.....	454.37	27.91
08 91	19 00-0240		Square Aluminum Gable Louver Vents <small>(08 91 19 00-0228)</small> Note: Includes screen.		
08 91	19 00-0241	EA	12" x 12" Square Fixed Aluminum Gable Louver Vent	126.81	6.29
08 91	19 00-0242	EA	18" x 18" Square Fixed Aluminum Gable Louver Vent	157.11	7.98
08 91	19 00-0243	EA	24" x 24" Square Fixed Aluminum Gable Louver Vent	196.79	9.42
08 91	19 00-0244	EA	30" x 30" Square Fixed Aluminum Gable Louver Vent	251.39	12.46
08 91	19 00-0245	EA	36" x 36" Square Fixed Aluminum Gable Louver Vent	323.43	17.94
08 91	19 00-0246	EA	42" x 42" Square Fixed Aluminum Gable Louver Vent	408.49	24.40
08 91	19 00-0247	EA	48" x 48" Square Fixed Aluminum Gable Louver Vent	506.78	31.89
08 91	19 00-0248		Round Aluminum Gable Louver Vents <small>(08 91 19 00-0228)</small> Note: Includes screen.		
08 91	19 00-0249	EA	12" Diameter Round Fixed Aluminum Gable Louver Vent.....	126.81	6.29
08 91	19 00-0250	EA	18" Diameter Round Fixed Aluminum Gable Louver Vent.....	157.11	7.98

08 Openings
08 90 Louvers And Vents
08 91 Louvers



MINOR				TOTAL DIRECT	DEMOLITION
CSI	UOM	DESCRIPTION		UNIT COST	UNIT COST
08 91 19 00-0251	EA	24" Diameter Round Fixed Aluminum Gable Louver Vent.....		196.79	9.42
08 91 19 00-0252	EA	30" Diameter Round Fixed Aluminum Gable Louver Vent.....		251.39	12.46
08 91 19 00-0253	EA	36" Diameter Round Fixed Aluminum Gable Louver Vent.....		323.43	17.94
08 91 19 00-0254	EA	42" Diameter Round Fixed Aluminum Gable Louver Vent.....		408.54	24.42
08 91 19 00-0255 Octagonal Aluminum Gable Louver Vents (08 91 19 00-0228)					
Note: Includes screen.					
08 91 19 00-0256	EA	12" x 12" Octagonal Fixed Aluminum Gable Louver Vent.....		126.81	6.29
08 91 19 00-0257	EA	12" x 18" Octagonal Fixed Aluminum Gable Louver Vent.....		138.53	6.83
08 91 19 00-0258	EA	12" x 24" Octagonal Fixed Aluminum Gable Louver Vent.....		151.67	7.84
08 91 19 00-0259	EA	18" x 18" Octagonal Fixed Aluminum Gable Louver Vent.....		157.11	7.98
08 91 19 00-0260	EA	18" x 24" Octagonal Fixed Aluminum Gable Louver Vent.....		174.92	8.86
08 91 19 00-0261	EA	18" x 30" Octagonal Fixed Aluminum Gable Louver Vent.....		191.75	9.42
08 91 19 00-0262	EA	24" x 24" Octagonal Fixed Aluminum Gable Louver Vent.....		196.79	9.42
08 91 19 00-0263	EA	24" x 30" Octagonal Fixed Aluminum Gable Louver Vent.....		218.66	9.97
08 91 19 00-0264	EA	24" x 36" Octagonal Fixed Aluminum Gable Louver Vent.....		244.85	11.96
08 91 19 00-0265	EA	30" x 30" Octagonal Fixed Aluminum Gable Louver Vent.....		251.39	12.46
08 91 19 00-0266	EA	30" x 36" Octagonal Fixed Aluminum Gable Louver Vent.....		284.14	14.95
08 91 19 00-0267	EA	30" x 42" Octagonal Fixed Aluminum Gable Louver Vent.....		316.88	17.44
08 91 19 00-0268	EA	36" x 36" Octagonal Fixed Aluminum Gable Louver Vent.....		323.43	17.94
08 91 19 00-0269	EA	36" x 42" Octagonal Fixed Aluminum Gable Louver Vent.....		362.72	20.94
08 91 19 00-0270	EA	36" x 48" Octagonal Fixed Aluminum Gable Louver Vent.....		402.00	23.93
08 91 19 00-0271	EA	42" x 42" Octagonal Fixed Aluminum Gable Louver Vent.....		408.54	24.42
08 91 19 00-0272	EA	42" x 48" Octagonal Fixed Aluminum Gable Louver Vent.....		454.37	27.91
08 91 19 00-0273	EA	48" x 48" Octagonal Fixed Aluminum Gable Louver Vent.....		506.78	31.89
08 91 19 00-0274 Round Top Aluminum Gable Louver Vents (08 91 19 00-0228)					
Note: Includes screen.					
08 91 19 00-0275	EA	12" x 12" Round Top Fixed Aluminum Gable Louver Vent.....		126.81	6.29
08 91 19 00-0276	EA	12" x 18" Round Top Fixed Aluminum Gable Louver Vent.....		138.53	6.83
08 91 19 00-0277	EA	12" x 24" Round Top Fixed Aluminum Gable Louver Vent.....		151.67	7.84
08 91 19 00-0278	EA	18" x 18" Round Top Fixed Aluminum Gable Louver Vent.....		157.11	7.98
08 91 19 00-0279	EA	18" x 24" Round Top Fixed Aluminum Gable Louver Vent.....		174.92	8.86
08 91 19 00-0280	EA	18" x 30" Round Top Fixed Aluminum Gable Louver Vent.....		191.75	9.42
08 91 19 00-0281	EA	24" x 24" Round Top Fixed Aluminum Gable Louver Vent.....		196.79	9.42
08 91 19 00-0282	EA	24" x 30" Round Top Fixed Aluminum Gable Louver Vent.....		218.66	9.97
08 91 19 00-0283	EA	24" x 36" Round Top Fixed Aluminum Gable Louver Vent.....		244.85	11.96
08 91 19 00-0284	EA	30" x 30" Round Top Fixed Aluminum Gable Louver Vent.....		251.39	12.46
08 91 19 00-0285	EA	30" x 36" Round Top Fixed Aluminum Gable Louver Vent.....		284.14	14.95
08 91 19 00-0286	EA	30" x 42" Round Top Fixed Aluminum Gable Louver Vent.....		316.88	17.44
08 91 19 00-0287	EA	36" x 36" Round Top Fixed Aluminum Gable Louver Vent.....		323.43	17.94
08 91 19 00-0288	EA	36" x 42" Round Top Fixed Aluminum Gable Louver Vent.....		362.72	20.94
08 91 19 00-0289	EA	36" x 48" Round Top Fixed Aluminum Gable Louver Vent.....		402.00	23.93
08 91 19 00-0290	EA	42" x 42" Round Top Fixed Aluminum Gable Louver Vent.....		408.54	24.42
08 91 19 00-0291	EA	42" x 48" Round Top Fixed Aluminum Gable Louver Vent.....		454.37	27.91
08 91 19 00-0292	EA	48" x 48" Round Top Fixed Aluminum Gable Louver Vent.....		506.78	31.89
08 91 19 00-0293 Triangle Aluminum Gable Louver Vents (08 91 19 00-0228)					
Note: Includes screen.					
08 91 19 00-0294	EA	36" Base x 30" High Triangle Fixed Aluminum Gable Louver Vent.....		262.80	7.84
08 91 19 00-0295	EA	36" Base x 36" High Triangle Fixed Aluminum Gable Louver Vent.....		297.82	9.42
08 91 19 00-0296	EA	48" Base x 30" High Triangle Fixed Aluminum Gable Louver Vent.....		319.69	9.97
08 91 19 00-0297	EA	48" Base x 36" High Triangle Fixed Aluminum Gable Louver Vent.....		366.08	11.96
08 91 19 00-0298	EA	48" Base x 42" High Triangle Fixed Aluminum Gable Louver Vent.....		407.98	12.46
08 91 19 00-0299	EA	60" Base x 24" High Triangle Fixed Aluminum Gable Louver Vent.....		334.65	14.95
08 91 19 00-0300	EA	60" Base x 30" High Triangle Fixed Aluminum Gable Louver Vent.....		392.65	17.44
08 91 19 00-0301	EA	60" Base x 36" High Triangle Fixed Aluminum Gable Louver Vent.....		444.66	17.94
08 91 19 00-0302	EA	60" Base x 42" High Triangle Fixed Aluminum Gable Louver Vent.....		504.15	20.94
08 91 19 00-0303	EA	72" Base x 24" High Triangle Fixed Aluminum Gable Louver Vent.....		402.00	23.93
08 91 19 00-0304	EA	72" Base x 30" High Triangle Fixed Aluminum Gable Louver Vent.....		464.11	24.42
08 91 19 00-0305	EA	72" Base x 36" High Triangle Fixed Aluminum Gable Louver Vent.....		535.20	27.91
08 91 19 00-0306	EA	72" Base x 42" High Triangle Fixed Aluminum Gable Louver Vent.....		607.80	31.89
08 91 19 00-0307	EA	72" Base x 48" High Triangle Fixed Aluminum Gable Louver Vent.....		682.69	36.66
08 91 19 00-0308 Vinyl Gable Louver Vents (08 91 19 00-0227)					
Note: Includes screen.					
08 91 19 00-0309	EA	12" x 12" Square Fixed Vinyl Gable Louver Vent.....		42.23	6.29
08 91 19 00-0310	EA	12" x 18" Rectangular Fixed Vinyl Gable Louver Vent.....		50.85	6.83
08 91 19 00-0311	EA	18" x 24" Rectangular Fixed Vinyl Gable Louver Vent.....		69.29	8.86
08 91 19 00-0312	EA	24" x 30" Rectangular Fixed Vinyl Gable Louver Vent.....		94.44	9.97
08 91 19 00-0313	EA	18" Diameter Round Fixed Vinyl Gable Louver Vent.....		66.96	7.98
08 91 19 00-0314	EA	22" Diameter Round Fixed Vinyl Gable Louver Vent.....		77.42	9.42
08 91 19 00-0315	EA	30" Diameter Round Fixed Vinyl Gable Louver Vent.....		108.97	12.46
08 91 19 00-0316	EA	36" Diameter Round Fixed Vinyl Gable Louver Vent.....		159.21	17.94
08 91 19 00-0317	EA	18" x 18" Octagonal Fixed Vinyl Gable Louver Vent.....		66.96	7.98
08 91 19 00-0318	EA	22" x 22" Octagonal Fixed Vinyl Gable Louver Vent.....		75.76	8.86
08 91 19 00-0319	EA	27" x 27" Octagonal Fixed Vinyl Gable Louver Vent.....		97.42	9.97



Openings	08	08
Louvers And Vents	08 90	
Louvers	08 91	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
08 91 19 00-0320	EA		32" x 32" Octagonal Fixed Vinyl Gable Louver Vent.....	138.51	14.95
08 91 19 00-0321	EA		40" x 40" Octagonal Fixed Vinyl Gable Louver Vent.....	326.65	23.93
08 91 19 00-0322	EA		14" x 22" Round Top Fixed Vinyl Gable Louver Vent.....	65.62	7.84
08 91 19 00-0323	EA		22" x 32" Round Top Fixed Vinyl Gable Louver Vent.....	91.25	9.97
08 91 19 00-0324	EA		34" x 22" Half Round Fixed Vinyl Gable Louver Vent.....	94.90	11.96
08 91 19 00-0325	EA		52" Base x 26" High Triangle Fixed Vinyl Gable Louver Vent.....	215.02	14.95
08 91 19 00-0326	EA		56" Base x 23" High Triangle Fixed Vinyl Gable Louver Vent.....	215.02	14.95
08 91 19 00-0327	EA		56" Base x 26" High Triangle Fixed Vinyl Gable Louver Vent.....	215.02	14.95
08 91 19 00-0328	EA		62" Base x 23" High Triangle Fixed Vinyl Gable Louver Vent.....	215.02	14.95
08 91 19 00-0329	EA		62-1/2" Base x 21" High Triangle Fixed Vinyl Gable Louver Vent.....	215.02	14.95
08 91 19 00-0330	EA		70-1/2" Base x 17" High Triangle Fixed Vinyl Gable Louver Vent.....	241.96	23.93
08 91 19 00-0331	EA		70-1/2" Base x 20-1/2" High Triangle Fixed Vinyl Gable Louver Vent.....	241.96	23.93
08 91 19 00-0332	EA		72-1/2" Base x 18" High Triangle Fixed Vinyl Gable Louver Vent.....	241.96	23.93
08 91 19 00-0333	EA		74" Base x 14-1/2" High Triangle Fixed Vinyl Gable Louver Vent.....	241.96	23.93
08 95 Vents (08 90)					
08 95 13 Soffit Vents (08 95)					
08 95 13 00-0001 Aluminum Soffit Vents (08 95 13)					
08 95 13 00-0002	LF		2-1/2" Wide Aluminum Soffit Vent.....	4.53	1.85
08 95 13 00-0003	LF		3" Wide Aluminum Soffit Vent.....	8.57	3.62
08 95 13 00-0004	EA		4" x 16" Under Eave Vent, Mill Finish.....	12.69	4.83
08 95 13 00-0005	EA		8" x 16" Under Eave Vent, Mill Finish.....	12.94	4.83
08 95 13 00-0006 Vinyl Soffit Vents (08 95 13)					
08 95 13 00-0007	LF		Up To 2" Vinyl Soffit Vent, Perforated, White.....	4.18	1.80
			<i>For Colors, Add</i>	0.06	
08 95 13 00-0008	LF		3" To 4" Vinyl Soffit Vent, Perforated, White.....	4.26	1.80
			<i>For Colors, Add</i>	0.07	
08 95 16 Wall Vents (08 95)					
08 95 16 00-0001 Foundation Vents (08 95 16)					
08 95 16 00-0002	SI		Galvanized Steel Foundation Vent.....	0.38	0.13
08 95 16 00-0003	SI		Aluminum Foundation Vent.....	0.39	0.13
08 95 16 00-0004	SI		Stainless Steel Foundation Vent.....	0.93	0.13
08 95 16 00-0005	SI		Plastic Foundation Vent.....	0.28	0.13

END OF SECTION 08

08	08	Openings
	08 90	Louvers And Vents
	08 95	Vents



MINOR	TOTAL DIRECT
CSI UOM DESCRIPTION	UNIT COST DEMOLITION
	UNIT COST

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MINOR	CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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09 Finishes

09 01 Maintenance Of Finishes (09)

09 01 20 Maintenance Of Plaster And Gypsum Board (09 01)

09 01 20 00-0001	Cut And Patch Hole In Drywall To Match Existing <small>(09 01 20)</small> <small>Note: Includes cutting of existing gypsum board, cutting new board to fit opening, finishing, and disposal of debris into dumpster. Per location. See CSI section 09 29 00 00-0000 for "Gypsum Board" repairs > 32 SF.</small>		
09 01 20 00-0002	SF Up To 2 SF, Cut And Patch Hole In Drywall To Match Existing <small>Note: Per location.</small>	14.36	
09 01 20 00-0003	SF >2 To 4 SF, Cut And Patch Hole In Drywall To Match Existing <small>Note: Per location.</small>	11.60	
09 01 20 00-0004	SF >4 To 8 SF, Cut And Patch Hole In Drywall To Match Existing <small>Note: Per location.</small>	10.41	
09 01 20 00-0005	SF >8 To 16 SF, Cut And Patch Hole In Drywall To Match Existing <small>Note: Per location.</small>	9.19	
09 01 20 00-0006	SF >16 To 32 SF, Cut And Patch Hole In Drywall To Match Existing <small>Note: Per location. See CSI section 09 29 00 00-0001 for "Gypsum Board" repairs > 32 SF.</small>	8.23	

09 01 20 00-0007 Plaster/Stucco Repair (09 01 20)

Note: Per location.

09 01 20 00-0008 Clean And Repair Crack In Plaster/Stucco (09 01 20 00-0007)

Note: Includes plaster weld.

09 01 20 00-0009	LF Up To 10', Chip, Clean And Repair Crack In Plaster/Stucco		13.92
09 01 20 00-0010	LF >10' To 50', Chip, Clean And Repair Crack In Plaster/Stucco		11.16
09 01 20 00-0011	LF >50' To 100', Chip, Clean And Repair Crack In Plaster/Stucco		9.09
09 01 20 00-0012	LF >100' To 250', Chip, Clean And Repair Crack In Plaster/Stucco		7.02
09 01 20 00-0013	LF >250' To 500', Chip, Clean And Repair Crack In Plaster/Stucco		5.64
09 01 20 00-0014	LF >500', Chip, Clean And Repair Crack In Plaster/Stucco		4.27

09 01 20 00-0015 Cut And Patch Hole In Plaster To Match Existing (09 01 20 00-0007)

Note: Includes plaster weld.

09 01 20 00-0016	SF Up To 10 SF, Cut And Patch Hole In Plaster To Match Existing		13.10
09 01 20 00-0017	SF >10 To 50 SF, Cut And Patch Hole In Plaster To Match Existing		11.56
09 01 20 00-0018	SF >50 To 100 SF, Cut And Patch Hole In Plaster To Match Existing		10.63
09 01 20 00-0019	SF >100 To 250 SF, Cut And Patch Hole In Plaster To Match Existing		9.86
09 01 20 00-0020	SF >250 To 500 SF, Cut And Patch Hole In Plaster To Match Existing		9.20
09 01 20 00-0021	SF >500 SF, Cut And Patch Hole In Plaster To Match Existing		8.45

09 01 20 00-0022 Chip, Clean And Repair Plaster/Stucco (09 01 20 00-0007)

Note: Includes plaster weld.

09 01 20 00-0023	SF Up To 10 SF, Chip, Clean And Repair Plaster/Stucco		24.92
09 01 20 00-0024	SF >10 To 50 SF, Chip, Clean And Repair Plaster/Stucco		18.02
09 01 20 00-0025	SF >50 To 250 SF, Chip, Clean And Repair Plaster/Stucco		13.19
09 01 20 00-0026	SF >250 SF, Chip, Clean And Repair Plaster/Stucco		10.44

09 01 30 Maintenance of Tiling (09 01)

09 01 30 91 Tile Restoration (09 01 30)

09 01 30 91-0001	SF Regrout Floor Tile Including Removal Of Loose Grout		5.01
09 01 30 91-0002	SF Regrout Wall Tile Including Removal Of Loose Grout		6.25
09 01 30 91-0003	SF Up To 1 SF, Cut And Patch Hole In Tile To Match Existing <small>Note: Per location.</small>		32.64

09 01 60 Maintenance Of Flooring (09 01)

09 01 60 00-0001 Grinding, Polishing And Sealing Terrazzo (09 01 60)

09 01 60 00-0002	CSF Grinding, Polishing And Sealing Existing Terrazzo		222.73
09 01 60 00-0003	SF Remove Setting Bed And Clean Area For Terrazzo Repair		3.41
09 01 60 00-0004	SF Repair Existing Terrazzo		15.24
09 01 60 00-0005	LF Repair Cracks In Existing Terrazzo		3.49

09 01 60 00-0006 Prepare Existing Concrete Floor Prior To Installation Of Carpet (09 01 60)

09 01 60 00-0007	SY Grinding Of Existing Concrete Floor Prior To Installation Of Carpet		10.22
09 01 60 00-0008	SY Chemical Prepare Existing Concrete Floor Prior To Installation Of Carpet		6.36

09 01 60 00-0009 Masonry/Tile/Stone/Terrazzo Floor Sealants (09 01 60)

09 01 60 00-0010	SF Water-Based Emulsion Masonry/Tile/Stone/Terrazzo Floor Sealant/Finish, Per Coat <small>Note: For terrazzo, concrete, quarry tile, brick and unglazed ceramic tile.</small>		0.89
09 01 60 00-0011	SF Fluorochemical Acrylate Copolymer Masonry/Tile/Stone/Terrazzo Floor Sealant		0.99

09 Finishes**09 01 Maintenance Of Finishes****09 01 60 Maintenance Of Flooring**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 01 60 00-0012 GAL Masonry/Tile/Stone/Terrazzo Floor Sealant (Extra To Be Provided To Owner).....	36.12	
09 05 Common Work Results For Finishes (09)		
09 05 61 Common Work Results for Flooring Preparation (09 05)		
09 05 61 13 Moisture Vapor Emission Control (09 05 61)		
09 05 61 13-0001 Moisture Vapor Reduction (Koester VAP) (09 05 61 13)		
09 05 61 13-0002 EA Up To 200 SF, Water Vapor Emission Control System (Koester VAP 1-2000).....	1,739.88	
Note: Clear		
09 05 61 13-0003 SF >200 To 500 SF, Water Vapor Emission Control System (Koester VAP 1-2001)	9.21	
Note: Clear		
09 05 61 13-0004 SF >500 To 1,000 SF, Water Vapor Emission Control System (Koester VAP 1-2002)	6.14	
Note: Clear		
09 05 61 13-0005 SF >1,000 To 3,000 SF, Water Vapor Emission Control System (Koester VAP 1-2003)	5.12	
Note: Clear		
09 05 61 13-0006 SF >3,000 SF, Water Vapor Emission Control System (Koester VAP 1-2004)	4.09	
Note: Clear		
09 05 61 13-0007 Moisture Vapor Transmission Control (Dependable Cutdown® II) (09 05 61 13)		
09 05 61 13-0008 SF 8# Two Coats, Moisture Vapor Transmission Control (Dependable Cutdown® II)	2.58	
09 05 61 13-0009 SF 15# Two Coats, Moisture Vapor Transmission Control (Dependable Cutdown® II)	3.48	
09 05 71 Acoustic Underlayment (09 05)		
09 05 71 00-0001 Tile And Stone Acoustical Underlayment (09 05 71)		
09 05 71 00-0002 SF 5 Mil Tile And Stone Acoustical Underlayment (EasyMat)	2.43	
For Chemical Resistant Epoxy Grout, Add	0.34	
09 05 71 00-0003 Resilient Floor Acoustical Underlayment (09 05 71)		
09 05 71 00-0004 SF Vinyl, Linoleum, LVT And Vinyl Strip Flooring Acoustical Underlayment (Impacta, Soundseal VC300)	1.72	
09 05 71 00-0005 SF 2 MM Thick Resilient Plank Floor Acoustical Underlayment (Floormuffler).....	0.99	
09 05 71 00-0006 SF 0.055" Thick High Density Polyurethane Foam Floor Acoustical Underlayment (Silencer LVT)	1.31	
09 20 Plaster And Gypsum Board (09)		
09 22 Supports For Plaster And Gypsum Board (09 20)		
Note: Per SF of wall area measures one side. Do not deduct for opens of less than 25 SF when calculating total wall square footage.		
09 22 13 Metal Furring (09 22)		
09 22 13 00-0001 Hat Furring Channel (09 22 13)		
Note: Includes clips where required.		
09 22 13 00-0002 Installed On Walls, Hat Furring Channel (09 22 13 00-0001)		
09 22 13 00-0003 SF 7/8", 25 Gauge, 16" On Center, Installed On Walls, Hat Furring Channel	2.70	1.11
For Walls >10' High, Add	0.33	
For 24" On Center, Deduct	-0.32	
For 12" On Center, Add	0.43	
For 22 Gauge, Add	0.24	
For 20 Gauge, Add	0.65	
09 22 13 00-0004 SF 1-1/2", 25 Gauge, 16" On Center, Installed On Walls, Hat Furring Channel	2.88	1.11
For Walls >10' High, Add	0.33	
For 24" On Center, Deduct	-0.35	
For 12" On Center, Add	0.47	
For 22 Gauge, Add	0.33	
For 20 Gauge, Add	0.77	
09 22 13 00-0005 Installed On Columns And Beams, Hat Furring Channel (09 22 13 00-0001)		
09 22 13 00-0006 SF 7/8", 25 Gauge, 16" On Center, Installed On Columns And Beams, Hat Furring Channel	3.90	1.71
For Columns And Beams >10' High, Add	0.68	
For 24" On Center, Deduct	-0.44	
For 12" On Center, Add	0.61	
For 22 Gauge, Add	0.24	
For 20 Gauge, Add	0.83	
09 22 13 00-0007 SF 1-1/2", 25 Gauge, 16" On Center, Installed On Columns And Beams, Hat Furring Channel	4.09	1.71
For Columns And Beams >10' High, Add	0.68	
For 24" On Center, Deduct	-0.48	
For 12" On Center, Add	0.65	
For 22 Gauge, Add	0.34	
For 20 Gauge, Add	0.96	
09 22 13 00-0008 Installed On Ceilings, Hat Furring Channel (09 22 13 00-0001)		



Finishes	09	9
Plaster And Gypsum Board	09 20	
Supports For Plaster And Gypsum Board	09 22	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 22 13 00-0009 SF 7/8", 25 Gauge, 16" On Center, Installed On Ceilings, Hat Furring Channel	3.53	1.37
For Ceilings >10' High, Add	0.41	
For 24" On Center, Deduct	-0.43	
For 12" On Center, Add	0.57	
For 22 Gauge, Add	0.40	
For 20 Gauge, Add	0.93	
09 22 13 00-0010 SF 1-1/2", 25 Gauge, 16" On Center, Installed On Ceilings, Hat Furring Channel	3.72	1.37
For Ceilings >10' High, Add	0.41	
For 24" On Center, Deduct	-0.47	
For 12" On Center, Add	0.61	
For 22 Gauge, Add	0.49	
For 20 Gauge, Add	1.06	
09 22 13 00-0011 Z Furring Channel <small>(09 22 13)</small>		
09 22 13 00-0012 Installed On Walls, Z Furring Channel <small>(09 22 13 00-0011)</small>		
09 22 13 00-0013 SF 1", 25 Gauge, 16" On Center, Installed On Walls, Z Furring Channel	2.38	1.11
For Walls >10' High, Add	0.33	
For 24" On Center, Deduct	-0.25	
For 12" On Center, Add	0.37	
For 22 Gauge, Add	0.08	
For 20 Gauge, Add	0.44	
09 22 13 00-0014 SF 1-1/2", 25 Gauge, 16" On Center, Installed On Walls, Z Furring Channel	2.41	1.11
For Walls >10' High, Add	0.33	
For 24" On Center, Deduct	-0.26	
For 12" On Center, Add	0.37	
For 22 Gauge, Add	0.10	
For 20 Gauge, Add	0.46	
09 22 13 00-0015 SF 2", 25 Gauge, 16" On Center, Installed On Walls, Z Furring Channel	2.44	1.11
For Walls >10' High, Add	0.33	
For 24" On Center, Deduct	-0.27	
For 12" On Center, Add	0.38	
For 22 Gauge, Add	0.11	
For 20 Gauge, Add	0.48	
09 22 13 00-0016 SF 2-1/2", 25 Gauge, 16" On Center, Installed On Walls, Z Furring Channel	2.46	1.11
For Walls >10' High, Add	0.33	
For 24" On Center, Deduct	-0.27	
For 12" On Center, Add	0.38	
For 22 Gauge, Add	0.12	
For 20 Gauge, Add	0.49	
09 22 13 00-0017 SF 3", 25 Gauge, 16" On Center, Installed On Walls, Z Furring Channel	2.48	1.11
For Walls >10' High, Add	0.33	
For 24" On Center, Deduct	-0.27	
For 12" On Center, Add	0.39	
For 22 Gauge, Add	0.13	
For 20 Gauge, Add	0.50	
09 22 13 00-0018 Single-Leg Resilient Channel, RC1 Furring Channel <small>(09 22 13)</small>		
Note: Includes clips where required.		
09 22 13 00-0019 Installed On Walls, Single-Leg Resilient Channel, RC1 Furring Channel <small>(09 22 13 00-0018)</small>		
09 22 13 00-0020 SF 25 Gauge, 16" On Center, Installed On Walls, Single-Leg Resilient Channel, RC1 Furring Channel	2.55	1.11
For Walls >10' High, Add	0.33	
For 24" On Center, Deduct	-0.29	
For 12" On Center, Add	0.40	
For 20 Gauge, Add	0.55	
09 22 13 00-0021 Installed On Ceilings, Single-Leg Resilient Channel, RC1 Furring Channel <small>(09 22 13 00-0018)</small>		
09 22 13 00-0022 SF 25 Gauge, 16" On Center, Installed On Ceilings, Single-Leg Resilient Channel, RC1 Furring Channel	3.07	1.37
For Ceilings >10' High, Add	0.41	
For 24" On Center, Deduct	-0.34	
For 12" On Center, Add	0.48	
For 20 Gauge, Add	0.63	
09 22 13 00-0023 Double-Leg Resilient Channel, RC2 Furring Channel <small>(09 22 13)</small>		
Note: Includes clips where required.		
09 22 13 00-0024 Installed On Walls, Double-Leg Resilient Channel, RC2 Furring Channel <small>(09 22 13 00-0023)</small>		
09 22 13 00-0025 SF 25 Gauge, 16" On Center, Installed On Walls, Double-Leg Resilient Channel, RC2 Furring Channel	2.68	1.11
For Walls >10' High, Add	0.33	
For 24" On Center, Deduct	-0.31	
For 12" On Center, Add	0.43	
For 20 Gauge, Add	0.64	
09 22 13 00-0026 Installed On Ceilings, Double-Leg Resilient Channel, RC2 Furring Channel <small>(09 22 13 00-0023)</small>		

09 Finishes

09 20 Plaster And Gypsum Board

09 22 Supports For Plaster And Gypsum Board



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 22 13 00-0027	SF		25 Gauge, 16" On Center, Installed On Ceilings, Double-Leg Resilient Channel, RC2 Furring Channel	3.20	1.37
			<i>For Ceilings >10' High, Add</i>	0.41	
			<i>For 24" On Center, Deduct</i>	-0.37	
			<i>For 12" On Center, Add</i>	0.50	
			<i>For 20 Gauge, Add</i>	0.71	
09 22 16			Non-Structural Metal Framing <small>(09 22)</small>		
			Note: Includes all necessary framing studs, bridging, fasteners necessary to attach to floors, walls, ceilings and a metal stiffener at half height. Per SF of wall area measures one side. Do not deduct for openings of less than 25 SF when calculating total wall square footage.		
09 22 16 13			Non-Structural Metal Stud Framing <small>(09 22 16)</small>		
09 22 16 13-0001			25 Gauge, Non Load Bearing, Non Structural Metal Stud Framing With Tracks And Runners <small>(09 22 16 13)</small>		
09 22 16 13-0002	SF		1-5/8" Width, 16" On Center, 25 Gauge, Non Load Bearing, Non Structural Metal Stud Framing With Tracks And Runners	1.69	0.46
			<i>For Walls >10' High, Add</i>	0.34	
			<i>For Soffit, Columns Or Beams Up To 10' High, Add</i>	1.10	
			<i>For Soffit, Columns Or Beams >10' High, Add</i>	1.45	
			<i>For Horizontal Installation Up To 10' High, Add</i>	0.34	
			<i>For Horizontal Installation >10' High, Add</i>	0.46	
			<i>For Curved Wall, Add</i>	0.35	
			<i>For 12" On Center, Add</i>	0.28	
			<i>For 24" On Center, Deduct</i>	-0.28	
			<i>For Up To 200, Add</i>	0.57	
			<i>For >200 To 500, Add</i>	0.29	
09 22 16 13-0003	SF		2-1/2" Width, 16" On Center, 25 Gauge, Non Load Bearing, Non Structural Metal Stud Framing With Tracks And Runners	1.79	0.48
			<i>For Walls >10' High, Add</i>	0.36	
			<i>For Soffit, Columns Or Beams Up To 10' High, Add</i>	1.15	
			<i>For Soffit, Columns Or Beams >10' High, Add</i>	1.51	
			<i>For Horizontal Installation Up To 10' High, Add</i>	0.36	
			<i>For Horizontal Installation >10' High, Add</i>	0.48	
			<i>For Curved Wall, Add</i>	0.36	
			<i>For 12" On Center, Add</i>	0.30	
			<i>For 24" On Center, Deduct</i>	-0.30	
			<i>For Up To 200, Add</i>	0.60	
			<i>For >200 To 500, Add</i>	0.30	
09 22 16 13-0004	SF		3-5/8" Width, 16" On Center, 25 Gauge, Non Load Bearing, Non Structural Metal Stud Framing With Tracks And Runners	1.95	0.50
			<i>For Walls >10' High, Add</i>	0.39	
			<i>For Soffit, Columns Or Beams Up To 10' High, Add</i>	1.21	
			<i>For Soffit, Columns Or Beams >10' High, Add</i>	1.59	
			<i>For Horizontal Installation Up To 10' High, Add</i>	0.39	
			<i>For Horizontal Installation >10' High, Add</i>	0.51	
			<i>For Curved Wall, Add</i>	0.38	
			<i>For 12" On Center, Add</i>	0.33	
			<i>For 24" On Center, Deduct</i>	-0.33	
			<i>For Up To 200, Add</i>	0.64	
			<i>For >200 To 500, Add</i>	0.32	
09 22 16 13-0005	SF		4" Width, 16" On Center, 25 Gauge, Non Load Bearing, Non Structural Metal Stud Framing With Tracks And Runners	2.08	0.53
			<i>For Walls >10' High, Add</i>	0.42	
			<i>For Soffit, Columns Or Beams Up To 10' High, Add</i>	1.28	
			<i>For Soffit, Columns Or Beams >10' High, Add</i>	1.68	
			<i>For Horizontal Installation Up To 10' High, Add</i>	0.41	
			<i>For Horizontal Installation >10' High, Add</i>	0.54	
			<i>For Curved Wall, Add</i>	0.40	
			<i>For 12" On Center, Add</i>	0.35	
			<i>For 24" On Center, Deduct</i>	-0.35	
			<i>For Up To 200, Add</i>	0.68	
			<i>For >200 To 500, Add</i>	0.34	
09 22 16 13-0006	SF		6" Width, 16" On Center, 25 Gauge, Non Load Bearing, Non Structural Metal Stud Framing With Tracks And Runners	2.31	0.56
			<i>For Walls >10' High, Add</i>	0.46	
			<i>For Soffit, Columns Or Beams Up To 10' High, Add</i>	1.35	
			<i>For Soffit, Columns Or Beams >10' High, Add</i>	1.77	
			<i>For Horizontal Installation Up To 10' High, Add</i>	0.44	
			<i>For Horizontal Installation >10' High, Add</i>	0.58	
			<i>For Curved Wall, Add</i>	0.42	
			<i>For 12" On Center, Add</i>	0.39	
			<i>For 24" On Center, Deduct</i>	-0.39	
			<i>For Up To 200, Add</i>	0.74	
			<i>For >200 To 500, Add</i>	0.37	
09 22 16 13-0007			20 Gauge, Non Load Bearing, Non Structural Metal Stud Framing With Tracks And Runners <small>(09 22 16 13)</small>		



Finishes	09	9
Plaster And Gypsum Board	09 20	
Supports For Plaster And Gypsum Board	09 22	

MINOR	TOTAL DIRECT	DEMOLITION
CSI UOM DESCRIPTION	UNIT COST	UNIT COST
09 22 16 13-0008 SF 1-5/8" Width, 16" On Center, 20 Gauge, Non Load Bearing, Non Structural Metal Stud Framing With Tracks And Runners.....	1.89	0.47
For Walls >10' High, Add	0.38	
For Soffit, Columns Or Beams Up To 10' High, Add	1.14	
For Soffit, Columns Or Beams >10' High, Add	1.50	
For Horizontal Installation Up To 10' High, Add	0.37	
For Horizontal Installation >10' High, Add	0.49	
For Curved Wall, Add	0.36	
For 12" On Center, Add	0.32	
For 24" On Center, Deduct	-0.32	
For Up To 200, Add	0.62	
For >200 To 500, Add	0.31	
09 22 16 13-0009 SF 2-1/2" Width, 16" On Center, 20 Gauge, Non Load Bearing, Non Structural Metal Stud Framing With Tracks And Runners.....	2.07	0.50
For Walls >10' High, Add	0.41	
For Soffit, Columns Or Beams Up To 10' High, Add	1.21	
For Soffit, Columns Or Beams >10' High, Add	1.58	
For Horizontal Installation Up To 10' High, Add	0.39	
For Horizontal Installation >10' High, Add	0.52	
For Curved Wall, Add	0.38	
For 12" On Center, Add	0.35	
For 24" On Center, Deduct	-0.35	
For Up To 200, Add	0.66	
For >200 To 500, Add	0.33	
09 22 16 13-0010 SF 3-5/8" Width, 16" On Center, 20 Gauge, Non Load Bearing, Non Structural Metal Stud Framing With Tracks And Runners.....	2.28	0.52
For Walls >10' High, Add	0.46	
For Soffit, Columns Or Beams Up To 10' High, Add	1.28	
For Soffit, Columns Or Beams >10' High, Add	1.67	
For Horizontal Installation Up To 10' High, Add	0.42	
For Horizontal Installation >10' High, Add	0.56	
For Curved Wall, Add	0.39	
For 12" On Center, Add	0.39	
For 24" On Center, Deduct	-0.39	
For Up To 200, Add	0.72	
For >200 To 500, Add	0.36	
09 22 16 13-0011 SF 4" Width, 16" On Center, 20 Gauge, Non Load Bearing, Non Structural Metal Stud Framing With Tracks And Runners.....	2.42	0.54
For Walls >10' High, Add	0.48	
For Soffit, Columns Or Beams Up To 10' High, Add	1.34	
For Soffit, Columns Or Beams >10' High, Add	1.75	
For Horizontal Installation Up To 10' High, Add	0.45	
For Horizontal Installation >10' High, Add	0.58	
For Curved Wall, Add	0.41	
For 12" On Center, Add	0.42	
For 24" On Center, Deduct	-0.42	
For Up To 200, Add	0.76	
For >200 To 500, Add	0.38	
09 22 16 13-0012 SF 6" Width, 16" On Center, 20 Gauge, Non Load Bearing, Non Structural Metal Stud Framing With Tracks And Runners.....	3.32	0.57
For Walls >10' High, Add	0.66	
For Soffit, Columns Or Beams Up To 10' High, Add	1.48	
For Soffit, Columns Or Beams >10' High, Add	1.92	
For Horizontal Installation Up To 10' High, Add	0.55	
For Horizontal Installation >10' High, Add	0.69	
For Curved Wall, Add	0.43	
For 12" On Center, Add	0.59	
For 24" On Center, Deduct	-0.59	
For Up To 200, Add	0.95	
For >200 To 500, Add	0.48	
09 22 16 13-0013 18 Gauge, Non Load Bearing, Non Structural Metal Stud Framing With Tracks And Runners		
<small>(09 22 16 13)</small>		
09 22 16 13-0014 SF 2-1/2" Width, 16" On Center, 18 Gauge, Non Load Bearing, Non Structural Metal Stud Framing With Tracks And Runners.....	2.40	0.50
For Walls >10' High, Add	0.48	
For Soffit, Columns Or Beams Up To 10' High, Add	1.26	
For Soffit, Columns Or Beams >10' High, Add	1.64	
For Horizontal Installation Up To 10' High, Add	0.43	
For Horizontal Installation >10' High, Add	0.56	
For Curved Wall, Add	0.38	
For 12" On Center, Add	0.42	
For 24" On Center, Deduct	-0.42	
For Up To 200, Add	0.73	
For >200 To 500, Add	0.37	

09 Finishes**09 20 Plaster And Gypsum Board****09 22 Supports For Plaster And Gypsum Board**

MINOR

CSI UOM DESCRIPTION

TOTAL DIRECT
UNIT COSTDEMOLITION
UNIT COST

09 22 16 13-0015	SF	3-5/8" Width, 16" On Center, 18 Gauge, Non Load Bearing, Non Structural Metal Stud Framing With Tracks And Runners.....	3.05	0.53
		For Walls >10' High, Add	0.61	
		For Soffit, Columns Or Beams Up To 10' High, Add	1.38	
		For Soffit, Columns Or Beams >10' High, Add	1.78	
		For Horizontal Installation Up To 10' High, Add	0.51	
		For Horizontal Installation >10' High, Add	0.64	
		For Curved Wall, Add	0.40	
		For 12" On Center, Add	0.54	
		For 24" On Center, Deduct	-0.54	
		For Up To 200, Add	0.88	
		For >200 To 500, Add	0.44	
09 22 16 13-0016	SF	4" Width, 16" On Center, 18 Gauge, Non Load Bearing, Non Structural Metal Stud Framing With Tracks And Runners.....	3.32	0.56
		For Walls >10' High, Add	0.66	
		For Soffit, Columns Or Beams Up To 10' High, Add	1.45	
		For Soffit, Columns Or Beams >10' High, Add	1.87	
		For Horizontal Installation Up To 10' High, Add	0.54	
		For Horizontal Installation >10' High, Add	0.68	
		For Curved Wall, Add	0.42	
		For 12" On Center, Add	0.59	
		For 24" On Center, Deduct	-0.59	
		For Up To 200, Add	0.94	
		For >200 To 500, Add	0.47	
09 22 16 13-0017	SF	6" Width, 16" On Center, 18 Gauge, Non Load Bearing, Non Structural Metal Stud Framing With Tracks And Runners.....	4.30	0.58
		For Walls >10' High, Add	0.86	
		For Soffit, Columns Or Beams Up To 10' High, Add	1.61	
		For Soffit, Columns Or Beams >10' High, Add	2.06	
		For Horizontal Installation Up To 10' High, Add	0.65	
		For Horizontal Installation >10' High, Add	0.80	
		For Curved Wall, Add	0.44	
		For 12" On Center, Add	0.79	
		For 24" On Center, Deduct	-0.79	
		For Up To 200, Add	1.16	
		For >200 To 500, Add	0.58	
09 22 16 13-0018	SF	8" Width, 16" On Center, 18 Gauge, Non Load Bearing, Non Structural Metal Stud Framing With Tracks And Runners.....	4.67	0.62
		For Walls >10' High, Add	0.93	
		For Soffit, Columns Or Beams Up To 10' High, Add	1.71	
		For Soffit, Columns Or Beams >10' High, Add	2.17	
		For Horizontal Installation Up To 10' High, Add	0.70	
		For Horizontal Installation >10' High, Add	0.85	
		For Curved Wall, Add	0.47	
		For 12" On Center, Add	0.86	
		For 24" On Center, Deduct	-0.86	
		For Up To 200, Add	1.24	
		For >200 To 500, Add	0.62	
09 22 16 13-0019		16 Gauge, Non Load Bearing, Non Structural Metal Stud Framing With Tracks And Runners (09 22 16 13)		
09 22 16 13-0020	SF	2-1/2" Width, 16" On Center, 16 Gauge, Non Load Bearing, Non Structural Metal Stud Framing With Tracks And Runners.....	2.98	0.52
		For Walls >10' High, Add	0.60	
		For Soffit, Columns Or Beams Up To 10' High, Add	1.35	
		For Soffit, Columns Or Beams >10' High, Add	1.74	
		For Horizontal Installation Up To 10' High, Add	0.49	
		For Horizontal Installation >10' High, Add	0.63	
		For Curved Wall, Add	0.39	
		For 12" On Center, Add	0.53	
		For 24" On Center, Deduct	-0.53	
		For Up To 200, Add	0.86	
		For >200 To 500, Add	0.43	
09 22 16 13-0021	SF	3-5/8" Width, 16" On Center, 16 Gauge, Non Load Bearing, Non Structural Metal Stud Framing With Tracks And Runners.....	3.48	0.54
		For Walls >10' High, Add	0.70	
		For Soffit, Columns Or Beams Up To 10' High, Add	1.44	
		For Soffit, Columns Or Beams >10' High, Add	1.86	
		For Horizontal Installation Up To 10' High, Add	0.55	
		For Horizontal Installation >10' High, Add	0.69	
		For Curved Wall, Add	0.41	
		For 12" On Center, Add	0.63	
		For 24" On Center, Deduct	-0.63	
		For Up To 200, Add	0.97	
		For >200 To 500, Add	0.49	



Finishes	09	9
Plaster And Gypsum Board	09 20	
Supports For Plaster And Gypsum Board	09 22	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 22 16 13-0022 SF 4" Width, 16" On Center, 16 Gauge, Non Load Bearing, Non Structural Metal Stud Framing With Tracks And Runners.....	3.69	0.57
For Walls >10' High, Add	0.74	
For Soffit, Columns Or Beams Up To 10' High, Add	1.52	
For Soffit, Columns Or Beams >10' High, Add	1.95	
For Horizontal Installation Up To 10' High, Add	0.59	
For Horizontal Installation >10' High, Add	0.73	
For Curved Wall, Add	0.43	
For 12" On Center, Add	0.67	
For 24" On Center, Deduct	-0.67	
For Up To 200, Add	1.03	
For >200 To 500, Add	0.51	
09 22 16 13-0023 SF 6" Width, 16" On Center, 16 Gauge, Non Load Bearing, Non Structural Metal Stud Framing With Tracks And Runners.....	4.62	0.60
For Walls >10' High, Add	0.92	
For Soffit, Columns Or Beams Up To 10' High, Add	1.67	
For Soffit, Columns Or Beams >10' High, Add	2.12	
For Horizontal Installation Up To 10' High, Add	0.69	
For Horizontal Installation >10' High, Add	0.84	
For Curved Wall, Add	0.45	
For 12" On Center, Add	0.85	
For 24" On Center, Deduct	-0.85	
For Up To 200, Add	1.23	
For >200 To 500, Add	0.61	
09 22 16 13-0024 SF 8" Width, 16" On Center, 16 Gauge, Non Load Bearing, Non Structural Metal Stud Framing With Tracks And Runners.....	5.09	0.63
For Walls >10' High, Add	1.02	
For Soffit, Columns Or Beams Up To 10' High, Add	1.78	
For Soffit, Columns Or Beams >10' High, Add	2.26	
For Horizontal Installation Up To 10' High, Add	0.75	
For Horizontal Installation >10' High, Add	0.91	
For Curved Wall, Add	0.48	
For 12" On Center, Add	0.94	
For 24" On Center, Deduct	-0.94	
For Up To 200, Add	1.34	
For >200 To 500, Add	0.67	
09 22 16 13-0025 Galvanized Steel Backing Plates (09 22 16 13)		
Note: Used to attach fixtures, cabinets, shelves or handrails to metal stud walls.		
09 22 16 13-0026 LF 3" Wide, 25 Gauge Galvanized Steel Backing Plate.....	0.86	
09 22 16 13-0027 LF 4" Wide, 25 Gauge Galvanized Steel Backing Plate.....	1.04	
09 22 16 13-0028 LF 6" Wide, 25 Gauge Galvanized Steel Backing Plate.....	1.32	
09 22 16 13-0029 LF 8" Wide, 25 Gauge Galvanized Steel Backing Plate.....	1.61	
09 22 16 13-0030 LF 10" Wide, 25 Gauge Galvanized Steel Backing Plate.....	1.89	
09 22 16 13-0031 LF 12" Wide, 25 Gauge Galvanized Steel Backing Plate.....	2.25	
09 22 16 13-0032 LF 3" Wide, 20 Gauge Galvanized Steel Backing Plate.....	1.08	
09 22 16 13-0033 LF 4" Wide, 20 Gauge Galvanized Steel Backing Plate.....	1.33	
09 22 16 13-0034 LF 6" Wide, 20 Gauge Galvanized Steel Backing Plate.....	1.75	
09 22 16 13-0035 LF 8" Wide, 20 Gauge Galvanized Steel Backing Plate.....	2.17	
09 22 16 13-0036 LF 10" Wide, 20 Gauge Galvanized Steel Backing Plate.....	2.61	
09 22 16 13-0037 LF 12" Wide, 20 Gauge Galvanized Steel Backing Plate.....	3.10	
09 22 16 13-0038 LF 3" Wide, 16 Gauge Galvanized Steel Backing Plate.....	1.45	
09 22 16 13-0039 LF 4" Wide, 16 Gauge Galvanized Steel Backing Plate.....	1.79	
09 22 16 13-0040 LF 6" Wide, 16 Gauge Galvanized Steel Backing Plate.....	2.41	
09 22 16 13-0041 LF 8" Wide, 16 Gauge Galvanized Steel Backing Plate.....	3.03	
09 22 16 13-0042 LF 10" Wide, 16 Gauge Galvanized Steel Backing Plate.....	3.70	
09 22 16 13-0043 LF 12" Wide, 16 Gauge Galvanized Steel Backing Plate.....	4.35	
09 22 36 Lath (09 22)		
09 22 36 13 Gypsum Lath (09 22 36)		
09 22 36 13-0001 Plaster Base Gypsum Panels (09 22 36 13)		
09 22 36 13-0002 SF 3/8" Thick, Installed On Studs Or Furred Walls, Plaster Base Gypsum Panel.....	0.88	0.31
For Walls >10' High, Add	0.08	
For Up To 100, Add	0.31	
For >100 To 500, Add	0.15	
For >5,000, Deduct	-0.06	
09 22 36 13-0003 SF 1/2" Thick, Installed On Studs Or Furred Walls, Plaster Base Gypsum Panel.....	1.21	0.35
For Walls >10' High, Add	0.09	
For Up To 100, Add	0.36	
For >100 To 500, Add	0.18	
For >5,000, Deduct	-0.07	
09 22 36 13-0004 SF 5/8" Thick, Installed On Studs Or Furred Walls, Plaster Base Gypsum Panel.....	1.53	0.41
For Walls >10' High, Add	0.10	
For Up To 100, Add	0.41	
For >100 To 500, Add	0.20	
For >5,000, Deduct	-0.08	
09 22 36 13-0005 SF 3/8" Thick, Installed On Ceiling, Plaster Base Gypsum Panel.....	1.14	0.43
For Ceilings >10' High, Add	0.13	
For Up To 100, Add	0.44	
For >100 To 500, Add	0.22	
For >5,000, Deduct	-0.09	

09 Finishes

09 20 Plaster And Gypsum Board

09 22 Supports For Plaster And Gypsum Board



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 22 36 13-0006	SF		1/2" Thick, Installed On Ceiling, Plaster Base Gypsum Panel <i>For Ceilings >10' High, Add</i> <i>For Up To 100, Add</i> <i>For >100 To 500, Add</i> <i>For >5,000, Deduct</i>	1.50 0.15 0.50 0.25 -0.10	0.50
09 22 36 13-0007	SF		5/8" Thick, Installed On Ceiling, Plaster Base Gypsum Panel <i>For Ceilings >10' High, Add</i> <i>For Up To 100, Add</i> <i>For >100 To 500, Add</i> <i>For >5,000, Deduct</i>	1.86 0.17 0.57 0.29 -0.11	0.57
09 22 36 13-0008	SF		3/8" Thick, Installed On Columns And Beams, Plaster Base Gypsum Panel..... <i>For Columns And Beams >10' High, Add</i> <i>For Up To 100, Add</i> <i>For >100 To 500, Add</i> <i>For >5,000, Deduct</i>	1.38 0.17 0.56 0.28 -0.11	0.55
09 22 36 13-0009	SF		1/2" Thick, Installed On Columns And Beams, Plaster Base Gypsum Panel..... <i>For Columns And Beams >10' High, Add</i> <i>For Up To 100, Add</i> <i>For >100 To 500, Add</i> <i>For >5,000, Deduct</i>	1.78 0.19 0.64 0.32 -0.13	0.64
09 22 36 13-0010	SF		5/8" Thick, Installed On Columns And Beams, Plaster Base Gypsum Panel..... <i>For Columns And Beams >10' High, Add</i> <i>For Up To 100, Add</i> <i>For >100 To 500, Add</i> <i>For >5,000, Deduct</i>	2.19 0.22 0.74 0.37 -0.15	0.73
09 22 36 13-0011 Firestop Plaster Base Gypsum Panels <small>(09 22 36 13)</small>					
09 22 36 13-0012	SF		3/8" Thick, Installed On Studs Or Furred Walls, Firestop Plaster Base Gypsum Panel <i>For Walls >10' High, Add</i> <i>For Up To 100, Add</i> <i>For >100 To 500, Add</i> <i>For >5,000, Deduct</i>	1.21 0.08 0.31 0.15 -0.06	0.31
09 22 36 13-0013	SF		1/2" Thick, Installed On Studs Or Furred Walls, Firestop Plaster Base Gypsum Panel <i>For Walls >10' High, Add</i> <i>For Up To 100, Add</i> <i>For >100 To 500, Add</i> <i>For >5,000, Deduct</i>	1.41 0.09 0.36 0.18 -0.07	0.35
09 22 36 13-0014	SF		3/8" Thick, Installed On Ceilings, Firestop Plaster Base Gypsum Panel..... <i>For Ceilings >10' High, Add</i> <i>For Up To 100, Add</i> <i>For >100 To 500, Add</i> <i>For >5,000, Deduct</i>	1.47 0.13 0.44 0.22 -0.09	0.43
09 22 36 13-0015	SF		1/2" Thick, Installed On Ceilings, Firestop Plaster Base Gypsum Panel..... <i>For Ceilings >10' High, Add</i> <i>For Up To 100, Add</i> <i>For >100 To 500, Add</i> <i>For >5,000, Deduct</i>	1.70 0.15 0.50 0.25 -0.10	0.50
09 22 36 13-0016	SF		3/8" Thick, Installed On Columns And Beams, Firestop Plaster Base Gypsum Panel..... <i>For Columns And Beams >10' High, Add</i> <i>For Up To 100, Add</i> <i>For >100 To 500, Add</i> <i>For >5,000, Deduct</i>	1.71 0.17 0.56 0.28 -0.11	0.55
09 22 36 13-0017	SF		1/2" Thick, Installed On Columns And Beams, Firestop Plaster Base Gypsum Panel..... <i>For Columns And Beams >10' High, Add</i> <i>For Up To 100, Add</i> <i>For >100 To 500, Add</i> <i>For >5,000, Deduct</i>	1.98 0.19 0.64 0.32 -0.13	0.64
09 22 36 13-0018 Foil Back Plaster Base Gypsum Panels <small>(09 22 36 13)</small>					
09 22 36 13-0019	SF		3/8" Thick, Installed On Studs Or Furred Walls, Foil Back Plaster Base Gypsum Panel <i>For Walls >10' High, Add</i> <i>For Up To 100, Add</i> <i>For >100 To 500, Add</i> <i>For >5,000, Deduct</i>	1.21 0.08 0.31 0.15 -0.06	0.31
09 22 36 13-0020	SF		1/2" Thick, Installed On Studs Or Furred Walls, Foil Back Plaster Base Gypsum Panel <i>For Walls >10' High, Add</i> <i>For Up To 100, Add</i> <i>For >100 To 500, Add</i> <i>For >5,000, Deduct</i>	1.41 0.09 0.36 0.18 -0.07	0.35
09 22 36 13-0021	SF		3/8" Thick, Installed On Ceiling, Foil Back Plaster Base Gypsum Panel..... <i>For Ceilings >10' High, Add</i> <i>For Up To 100, Add</i> <i>For >100 To 500, Add</i> <i>For >5,000, Deduct</i>	1.47 0.13 0.44 0.22 -0.09	0.43
09 22 36 13-0022	SF		1/2" Thick, Installed On Ceiling, Foil Back Plaster Base Gypsum Panel..... <i>For Ceilings >10' High, Add</i> <i>For Up To 100, Add</i> <i>For >100 To 500, Add</i> <i>For >5,000, Deduct</i>	1.70 0.15 0.50 0.25 -0.10	0.50
09 22 36 13-0023	SF		3/8" Thick, Installed On Columns And Beams, Foil Back Plaster Base Gypsum Panel <i>For Columns And Beams >10' High, Add</i> <i>For Up To 100, Add</i> <i>For >100 To 500, Add</i> <i>For >5,000, Deduct</i>	1.71 0.17 0.56 0.28 -0.11	0.55



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 22 36 13-0024 SF 1/2" Thick, Installed On Columns And Beams, Foil Back Plaster Base Gypsum Panel.....	1.98	0.64
<i>For Columns And Beams >10' High, Add</i>	0.19	
<i>For Up To 100, Add</i>	0.64	
<i>For >100 To 500, Add</i>	0.32	
<i>For >5,000, Deduct</i>	-0.13	
09 22 36 23 Metal Lath (09 22 36)		
09 22 36 23-0001 Flat Diamond, Expanded Metal Lath (09 22 36 23)		
09 22 36 23-0002 SF 1.75 LB/SY, Installed On Studs Or Furred Walls, Flat Diamond, Expanded Metal Lath.....	1.43	0.42
<i>For Walls >10' High, Add</i>	0.12	
<i>For Paper Backed Lath, Add</i>	0.06	
<i>For Up To 100, Add</i>	0.48	
<i>For >100 To 500, Add</i>	0.24	
<i>For >5,000, Deduct</i>	-0.10	
09 22 36 23-0003 SF 2.0 LB/SY, Installed On Studs Or Furred Walls, Flat Diamond, Expanded Metal Lath.....	1.49	0.42
<i>For Walls >10' High, Add</i>	0.12	
<i>For Paper Backed Lath, Add</i>	0.06	
<i>For Up To 100, Add</i>	0.48	
<i>For >100 To 500, Add</i>	0.24	
<i>For >5,000, Deduct</i>	-0.10	
09 22 36 23-0004 SF 2.5 LB/SY, Installed On Studs Or Furred Walls, Flat Diamond, Expanded Metal Lath.....	1.56	0.42
<i>For Walls >10' High, Add</i>	0.12	
<i>For Paper Backed Lath, Add</i>	0.06	
<i>For Up To 100, Add</i>	0.48	
<i>For >100 To 500, Add</i>	0.24	
<i>For >5,000, Deduct</i>	-0.10	
09 22 36 23-0005 SF 3.4 LB/SY, Installed On Studs Or Furred Walls, Flat Diamond, Expanded Metal Lath.....	1.79	0.45
<i>For Walls >10' High, Add</i>	0.13	
<i>For Paper Backed Lath, Add</i>	0.06	
<i>For Up To 100, Add</i>	0.51	
<i>For >100 To 500, Add</i>	0.26	
<i>For >5,000, Deduct</i>	-0.10	
09 22 36 23-0006 SF 1.75 LB/SY, Installed On Ceiling, Flat Diamond, Expanded Metal Lath.....	1.57	0.48
<i>For Ceilings >10' High, Add</i>	0.16	
<i>For Paper Backed Lath, Add</i>	0.06	
<i>For Up To 100, Add</i>	0.55	
<i>For >100 To 500, Add</i>	0.27	
<i>For >5,000, Deduct</i>	-0.11	
09 22 36 23-0007 SF 2.0 LB/SY, Installed On Ceiling, Flat Diamond, Expanded Metal Lath.....	1.63	0.48
<i>For Ceilings >10' High, Add</i>	0.16	
<i>For Paper Backed Lath, Add</i>	0.06	
<i>For Up To 100, Add</i>	0.55	
<i>For >100 To 500, Add</i>	0.27	
<i>For >5,000, Deduct</i>	-0.11	
09 22 36 23-0008 SF 2.5 LB/SY, Installed On Ceiling, Flat Diamond, Expanded Metal Lath.....	1.70	0.48
<i>For Ceilings >10' High, Add</i>	0.16	
<i>For Paper Backed Lath, Add</i>	0.06	
<i>For Up To 100, Add</i>	0.55	
<i>For >100 To 500, Add</i>	0.27	
<i>For >5,000, Deduct</i>	-0.11	
09 22 36 23-0009 SF 3.4 LB/SY, Installed On Ceiling, Flat Diamond, Expanded Metal Lath.....	1.86	0.48
<i>For Ceilings >10' High, Add</i>	0.16	
<i>For Paper Backed Lath, Add</i>	0.06	
<i>For Up To 100, Add</i>	0.55	
<i>For >100 To 500, Add</i>	0.27	
<i>For >5,000, Deduct</i>	-0.11	
09 22 36 23-0010 SF 1.75 LB/SY, Installed On Columns And Beams, Flat Diamond, Expanded Metal Lath.....	2.06	0.68
<i>For Columns And Beams >10' High, Add</i>	0.23	
<i>For Paper Backed Lath, Add</i>	0.06	
<i>For Up To 100, Add</i>	0.76	
<i>For >100 To 500, Add</i>	0.38	
<i>For >5,000, Deduct</i>	-0.15	
09 22 36 23-0011 SF 2.0 LB/SY, Installed On Columns And Beams, Flat Diamond, Expanded Metal Lath.....	2.13	0.68
<i>For Columns And Beams >10' High, Add</i>	0.23	
<i>For Paper Backed Lath, Add</i>	0.06	
<i>For Up To 100, Add</i>	0.76	
<i>For >100 To 500, Add</i>	0.38	
<i>For >5,000, Deduct</i>	-0.15	
09 22 36 23-0012 SF 2.5 LB/SY, Installed On Columns And Beams, Flat Diamond, Expanded Metal Lath.....	2.19	0.68
<i>For Columns And Beams >10' High, Add</i>	0.23	
<i>For Paper Backed Lath, Add</i>	0.06	
<i>For Up To 100, Add</i>	0.76	
<i>For >100 To 500, Add</i>	0.38	
<i>For >5,000, Deduct</i>	-0.15	
09 22 36 23-0013 SF 3.4 LB/SY, Installed On Columns And Beams, Flat Diamond, Expanded Metal Lath.....	2.74	0.86
<i>For Columns And Beams >10' High, Add</i>	0.29	
<i>For Paper Backed Lath, Add</i>	0.06	
<i>For Up To 100, Add</i>	0.95	
<i>For >100 To 500, Add</i>	0.48	
<i>For >5,000, Deduct</i>	-0.19	

09 22 36 23-0014 Self Furring, Flat Diamond, Expanded Metal Lath (09 22 36 23)

09 Finishes**09 20 Plaster And Gypsum Board****09 22 Supports For Plaster And Gypsum Board**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 22 36 23-0015	SF	1.75 LB/SY, Installed On Solid Surface, Self Furring, Flat Diamond, Expanded Metal Lath.....	1.50	0.45	
		<i>For Walls >10' High, Add</i>	0.13		
		<i>For Paper Backed Lath, Add</i>	0.06		
		<i>For Up To 100, Add</i>	0.51		
		<i>For >100 To 500, Add</i>	0.26		
		<i>For >5,000, Deduct</i>	-0.10		
09 22 36 23-0016	SF	2.0 LB/SY, Installed On Solid Surface, Self Furring, Flat Diamond, Expanded Metal Lath.....	1.56	0.45	
		<i>For Walls >10' High, Add</i>	0.13		
		<i>For Paper Backed Lath, Add</i>	0.06		
		<i>For Up To 100, Add</i>	0.51		
		<i>For >100 To 500, Add</i>	0.26		
		<i>For >5,000, Deduct</i>	-0.10		
09 22 36 23-0017	SF	2.5 LB/SY, Installed On Solid Surface, Self Furring, Flat Diamond, Expanded Metal Lath.....	1.63	0.45	
		<i>For Walls >10' High, Add</i>	0.13		
		<i>For Paper Backed Lath, Add</i>	0.06		
		<i>For Up To 100, Add</i>	0.51		
		<i>For >100 To 500, Add</i>	0.26		
		<i>For >5,000, Deduct</i>	-0.10		
09 22 36 23-0018	SF	3.4 LB/SY, Installed On Solid Surface, Self Furring, Flat Diamond, Expanded Metal Lath.....	1.79	0.45	
		<i>For Walls >10' High, Add</i>	0.13		
		<i>For Paper Backed Lath, Add</i>	0.06		
		<i>For Up To 100, Add</i>	0.51		
		<i>For >100 To 500, Add</i>	0.26		
		<i>For >5,000, Deduct</i>	-0.10		
09 22 36 23-0019	SF	1.75 LB/SY, Installed On Columns And Beams, Self Furring, Flat Diamond, Expanded Metal Lath.....	2.44	0.86	
		<i>For Columns And Beams >10' High, Add</i>	0.29		
		<i>For Paper Backed Lath, Add</i>	0.06		
		<i>For Up To 100, Add</i>	0.95		
		<i>For >100 To 500, Add</i>	0.48		
		<i>For >5,000, Deduct</i>	-0.19		
09 22 36 23-0020	SF	2.0 LB/SY, Installed On Columns And Beams, Self Furring, Flat Diamond, Expanded Metal Lath.....	2.51	0.86	
		<i>For Columns And Beams >10' High, Add</i>	0.29		
		<i>For Paper Backed Lath, Add</i>	0.06		
		<i>For Up To 100, Add</i>	0.95		
		<i>For >100 To 500, Add</i>	0.48		
		<i>For >5,000, Deduct</i>	-0.19		
09 22 36 23-0021	SF	2.5 LB/SY, Installed On Columns And Beams, Self Furring, Flat Diamond, Expanded Metal Lath.....	2.57	0.86	
		<i>For Columns And Beams >10' High, Add</i>	0.29		
		<i>For Paper Backed Lath, Add</i>	0.06		
		<i>For Up To 100, Add</i>	0.95		
		<i>For >100 To 500, Add</i>	0.48		
		<i>For >5,000, Deduct</i>	-0.19		
09 22 36 23-0022	SF	3.4 LB/SY, Installed On Columns And Beams, Self Furring, Flat Diamond, Expanded Metal Lath.....	3.01	0.98	
		<i>For Columns And Beams >10' High, Add</i>	0.33		
		<i>For Paper Backed Lath, Add</i>	0.06		
		<i>For Up To 100, Add</i>	1.09		
		<i>For >100 To 500, Add</i>	0.54		
		<i>For >5,000, Deduct</i>	-0.22		
09 22 36 23-0023		High Rib Metal Lath <small>(09 22 36 23)</small>			
09 22 36 23-0024	SF	2.75 LB/SY, Installed On Ceiling, 1/8" High Rib Metal Lath.....	1.75	0.48	
		<i>For Ceilings >10' High, Add</i>	0.16		
		<i>For Up To 100, Add</i>	0.55		
		<i>For >100 To 500, Add</i>	0.27		
		<i>For >5,000, Deduct</i>	-0.11		
09 22 36 23-0025	SF	3.4 LB/SY, Installed On Ceiling, 1/8" High Rib Metal Lath.....	1.84	0.48	
		<i>For Ceilings >10' High, Add</i>	0.16		
		<i>For Up To 100, Add</i>	0.55		
		<i>For >100 To 500, Add</i>	0.27		
		<i>For >5,000, Deduct</i>	-0.11		
09 22 36 23-0026	SF	3.4 LB/SY, Installed On Ceiling, 3/8" High Rib Metal Lath.....	1.90	0.48	
		<i>For Ceilings >10' High, Add</i>	0.16		
		<i>For Up To 100, Add</i>	0.55		
		<i>For >100 To 500, Add</i>	0.27		
		<i>For >5,000, Deduct</i>	-0.11		
09 22 36 23-0027	SF	4.0 LB/SY, Installed On Ceiling, 3/8" High Rib Metal Lath.....	2.00	0.48	
		<i>For Ceilings >10' High, Add</i>	0.16		
		<i>For Up To 100, Add</i>	0.55		
		<i>For >100 To 500, Add</i>	0.27		
		<i>For >5,000, Deduct</i>	-0.11		
09 22 36 33		Fiberglass Lath <small>(09 22 36)</small>			
09 22 36 33-0001		Non-Metallic, Fiberglass Lath <small>(09 22 36 33)</small>			
09 22 36 33-0002	SF	1/8" Thick, Installed On Ceiling, Non-Metallic, Fiberglass Lath.....	1.89	0.48	
		<i>For Ceilings >10' High, Add</i>	0.16		
		<i>For Up To 100, Add</i>	0.55		
		<i>For >100 To 500, Add</i>	0.27		
		<i>For >5,000, Deduct</i>	-0.11		
09 22 36 33-0003	SF	1/4" Thick, Installed On Ceiling, Non-Metallic, Fiberglass Lath.....	2.02	0.48	
		<i>For Ceilings >10' High, Add</i>	0.16		
		<i>For Up To 100, Add</i>	0.55		
		<i>For >100 To 500, Add</i>	0.27		
		<i>For >5,000, Deduct</i>	-0.11		



Finishes	09	9
Plaster And Gypsum Board	09 20	
Supports For Plaster And Gypsum Board	09 22	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 22 36 33-0004 SF 1/8" Thick, Installed On Solid Surface, Fiberglass Non Metallic Lath..... <i>For Walls >10' High, Add</i> <i>For Up To 100, Add</i> <i>For >100 To 500, Add</i> <i>For >5,000, Deduct</i>	1.82 0.13 0.51 0.26 -0.10	0.45
09 22 36 33-0005 SF 1/4" Thick, Installed On Solid Surface, Fiberglass Non Metallic Lath..... <i>For Walls >10' High, Add</i> <i>For Up To 100, Add</i> <i>For >100 To 500, Add</i> <i>For >5,000, Deduct</i>	1.95 0.13 0.51 0.26 -0.10	0.45
09 23 Gypsum Plastering (09 20)		
09 23 13 Acoustical Gypsum Plastering (09 23)		
Note: All plastering excludes lath, furring or studs except as noted. See CSI section 09 22 00 00-0000 for metal studs and furring, 09 22 36 00-0000 for lath.		
09 23 13 00-0001 Casing And Corner Beads (09 23 13)		
09 23 13 00-0002 LF Galvanized Expanded Flange Casing Bead For Plaster Applications.....	2.79	0.68
09 23 13 00-0003 LF Zinc Expanded Flange Casing Bead For Plaster Applications.....	2.80	0.68
09 23 13 00-0004 LF Vinyl Expanded Flange Casing Bead For Plaster Applications.....	3.38	0.68
09 23 13 00-0005 LF Galvanized Corner Bead For Plaster Applications.....	2.69	0.68
09 23 13 00-0006 LF Vinyl Corner Bead For Plaster Applications.....	2.89	0.68
09 23 13 00-0007 Trim (09 23 13)		
09 23 13 00-0008 LF Galvanized "J" Trim For Plaster Applications..... <i>For Vinyl Instead Of Galvanized, Add</i> <i>For Zinc Instead Of Galvanized, Add</i>	2.88 0.13 0.84	0.68
09 23 13 00-0009 LF Galvanized "L" Trim For Plaster Applications <i>For Vinyl Instead Of Galvanized, Add</i> <i>For Zinc Instead Of Galvanized, Add</i>	2.88 0.13 0.84	0.68
09 23 13 00-0010 LF Galvanized "U" Trim For Plaster Applications..... <i>For Vinyl Instead Of Galvanized, Add</i> <i>For Zinc Instead Of Galvanized, Add</i>	2.88 0.13 0.84	0.68
09 23 13 00-0011 Plaster Forms And Expansion Joints (09 23 13)		
09 23 13 00-0012 SF 1" Architectural Foam Forms To Cover With Plaster	3.25	
09 23 13 00-0013 LF 3/4" Galvanized Expansion Joint For Plaster Applications.....	3.24	0.68
09 23 13 00-0014 One Skim Coat Gypsum Plaster On Walls (09 23 13)		
09 23 13 00-0015 SF Skim Coat One Coat Gypsum Plaster On Walls <i>For Walls >10' High, Add</i> <i>For Horizontal Installation Up To 10' High, Add</i> <i>For Horizontal Installation >10' High, Add</i> <i>For Columns Or Beams Up To 10' High, Add</i> <i>For Columns Or Beams >10' High, Add</i> <i>For <100, Add</i> <i>For >100 To 500, Add</i> <i>For >5,000, Deduct</i>	0.99 0.08 0.12 0.23 0.24 0.35 0.39 0.19 -0.15	
09 23 13 00-0016 SF For Each Additional Coat Over One, Skim Coat Gypsum Plaster On Walls <i>For Walls >10' High, Add</i> <i>For Horizontal Installation Up To 10' High, Add</i> <i>For Horizontal Installation >10' High, Add</i> <i>For Columns Or Beams Up To 10' High, Add</i> <i>For Columns Or Beams >10' High, Add</i> <i>For <100, Add</i> <i>For >100 To 500, Add</i> <i>For >5,000, Deduct</i>	0.72 0.06 0.08 0.17 0.17 0.26 0.28 0.14 -0.11	
09 23 13 00-0017 Two Coats Gypsum Plaster On Walls (09 23 13)		
09 23 13 00-0018 SF Smooth Finish Two Coats Gypsum Plaster On Walls..... <i>For Walls >10' High, Add</i> <i>For Horizontal Installation Up To 10' High, Add</i> <i>For Horizontal Installation >10' High, Add</i> <i>For Columns Or Beams Up To 10' High, Add</i> <i>For Columns Or Beams >10' High, Add</i> <i>For <100, Add</i> <i>For >100 To 500, Add</i> <i>For >5,000, Deduct</i>	4.60 0.42 0.63 1.26 1.30 1.93 2.10 1.05 -0.84	2.55
09 23 13 00-0019 SF Sand Aggregate Two Coats Gypsum Plaster On Walls..... <i>For Walls >10' High, Add</i> <i>For Horizontal Installation Up To 10' High, Add</i> <i>For Horizontal Installation >10' High, Add</i> <i>For Columns Or Beams Up To 10' High, Add</i> <i>For Columns Or Beams >10' High, Add</i> <i>For <100, Add</i> <i>For >100 To 500, Add</i> <i>For >5,000, Deduct</i>	4.68 0.40 0.59 1.19 1.22 1.82 1.98 0.99 -0.79	2.41

09 Finishes

09 20 Plaster And Gypsum Board

09 23 Gypsum Plastering



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 23 13 00-0020	SF		Perlite Or Vermiculite Two Coats Gypsum Plaster On Walls	4.99	2.41
			For Walls >10' High, Add	0.40	
			For Horizontal Installation Up To 10' High, Add	0.59	
			For Horizontal Installation >10' High, Add	1.19	
			For Columns Or Beams Up To 10' High, Add	1.22	
			For Columns Or Beams >10' High, Add	1.82	
			For <100, Add	1.98	
			For >100 To 500, Add	0.99	
			For >5,000, Deduct	-0.79	
09 23 13 00-0021			Three Coats Gypsum Plaster On Walls (09 23 13)		
09 23 13 00-0022	SF		Smooth Finish Three Coats Gypsum Plaster On Walls	5.59	3.11
			For Walls >10' High, Add	0.50	
			For Horizontal Installation Up To 10' High, Add	0.75	
			For Horizontal Installation >10' High, Add	1.51	
			For Columns Or Beams Up To 10' High, Add	1.56	
			For Columns Or Beams >10' High, Add	2.31	
			For <100, Add	2.51	
			For >100 To 500, Add	1.26	
			For >5,000, Deduct	-1.00	
09 23 13 00-0023	SF		Sand Aggregate Three Coats Gypsum Plaster On Walls	5.56	2.82
			For Walls >10' High, Add	0.47	
			For Horizontal Installation Up To 10' High, Add	0.70	
			For Horizontal Installation >10' High, Add	1.40	
			For Columns Or Beams Up To 10' High, Add	1.44	
			For Columns Or Beams >10' High, Add	2.14	
			For <100, Add	2.33	
			For >100 To 500, Add	1.16	
			For >5,000, Deduct	-0.93	
09 23 13 00-0024	SF		Perlite Or Vermiculite Three Coats Gypsum Plaster On Walls	5.30	2.82
			For Walls >10' High, Add	0.46	
			For Horizontal Installation Up To 10' High, Add	0.69	
			For Horizontal Installation >10' High, Add	1.39	
			For Columns Or Beams Up To 10' High, Add	1.44	
			For Columns Or Beams >10' High, Add	2.13	
			For <100, Add	2.32	
			For >100 To 500, Add	1.16	
			For >5,000, Deduct	-0.93	
09 23 13 00-0025			Keene's Cement Plaster, Quick Setting, White Hard Plaster (09 23 13)		
			Note: Used for areas with higher than normal moisture.		
09 23 13 00-0026	SF		1 Coat Keene's Cement Plaster On Walls	3.45	1.72
			For Walls >10' High, Add	0.28	
			For Horizontal Installation Up To 10' High, Add	0.41	
			For Horizontal Installation >10' High, Add	0.83	
			For Columns Or Beams Up To 10' High, Add	0.86	
			For Columns Or Beams >10' High, Add	1.27	
			For <100, Add	1.38	
			For >100 To 500, Add	0.69	
			For >5,000, Deduct	-0.55	
09 23 13 00-0027	SF		2 Coat Keene's Cement Plaster On Walls	5.24	2.69
			For Walls >10' High, Add	0.44	
			For Horizontal Installation Up To 10' High, Add	0.66	
			For Horizontal Installation >10' High, Add	1.31	
			For Columns Or Beams Up To 10' High, Add	1.35	
			For Columns Or Beams >10' High, Add	2.01	
			For <100, Add	2.19	
			For >100 To 500, Add	1.09	
			For >5,000, Deduct	-0.87	
09 23 13 00-0028	SF		3 Coat Keene's Cement Plaster On Walls	5.93	3.03
			For Walls >10' High, Add	0.49	
			For Horizontal Installation Up To 10' High, Add	0.74	
			For Horizontal Installation >10' High, Add	1.48	
			For Columns Or Beams Up To 10' High, Add	1.53	
			For Columns Or Beams >10' High, Add	2.27	
			For <100, Add	2.47	
			For >100 To 500, Add	1.24	
			For >5,000, Deduct	-0.99	
09 23 13 00-0029			Plaster Bonding Agent (09 23 13)		
09 23 13 00-0030	SF		1 Coat, Brush/Roller Plaster Bonding Agent	0.50	
			For Walls >10' High, Add	0.04	
			For Columns Or Beams Up To 10' High, Add	0.12	
			For Columns Or Beams >10' High, Add	0.18	
			For Ceiling Application Up To 10' High, Add	0.05	
			For Ceiling Application >10' High, Add	0.09	

09 24 Cement Plastering (09 20)

09 24 23 Cement Stucco (09 24)

Note: Packaged product reinforced with fibers. All plastering excludes lath, furring or studs except as noted. See CSI section 09 22 00 00-0000 for metal studs and furring.



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
				09 24 23 00-0001 Stucco <small>(09 24 23)</small>		
				Note: Excludes wall scaffolding or lifting equipment.		
				09 24 23 00-0002 SF Three Coat Troweled Stucco, Scratch/Brown/Finish	6.59	2.13
				Note: Excludes lath and felt. Interior or exterior, one side.		
				For Walls >10' High, Add	0.58	
				For Horizontal Installation Up To 10' High, Add	0.88	
				For Horizontal Installation >10' High, Add	1.75	
				For Columns Or Beams Up To 10' High, Add	1.81	
				For Columns Or Beams >10' High, Add	2.69	
				For Color Added To Finish Coat, Add	0.15	
				For Smooth Float Finish, Add	1.23	
				For <100, Add	2.92	
				For >100 To 500, Add	1.46	
				For >5,000, Deduct	-1.17	
				09 24 23 00-0003 SF Two Coat Troweled Stucco, Scratch/Brown.....	2.79	1.03
				Note: Excludes lath and felt. Interior or exterior, one side.		
				For Walls >10' High, Add	0.21	
				For Horizontal Installation Up To 10' High, Add	0.32	
				For Horizontal Installation >10' High, Add	0.64	
				For Columns Or Beams Up To 10' High, Add	0.66	
				For Columns Or Beams >10' High, Add	0.98	
				For <100, Add	1.07	
				For >100 To 500, Add	0.53	
				For >5,000, Deduct	-0.43	
				09 24 23 00-0004 SF Two Coat Troweled Stucco, Scratch/Finish	4.34	1.03
				Note: Excludes lath and felt. Interior or exterior, one side.		
				For Walls >10' High, Add	0.38	
				For Horizontal Installation Up To 10' High, Add	0.57	
				For Horizontal Installation >10' High, Add	1.14	
				For Columns Or Beams Up To 10' High, Add	1.17	
				For Columns Or Beams >10' High, Add	1.74	
				For Color Added To Finish Coat, Add	0.15	
				For Smooth Float Finish, Add	1.04	
				For <100, Add	1.90	
				For >100 To 500, Add	0.95	
				For >5,000, Deduct	-0.76	
				09 24 23 00-0005 SF Finish Coat Troweled Stucco	2.85	0.69
				Note: Excludes lath and felt. Interior or exterior, one side.		
				For Walls >10' High, Add	0.28	
				For Horizontal Installation Up To 10' High, Add	0.41	
				For Horizontal Installation >10' High, Add	0.83	
				For Columns Or Beams Up To 10' High, Add	0.86	
				For Columns Or Beams >10' High, Add	1.27	
				For Color Added To Finish Coat, Add	0.15	
				For Smooth Float Finish, Add	1.04	
				For <100, Add	1.38	
				For >100 To 500, Add	0.69	
				For >5,000, Deduct	-0.55	
				09 24 33 Cement Parging <small>(09 24)</small>		
				09 24 33 00-0001 Cement Parging <small>(09 24 33)</small>		
				09 24 33 00-0002 SF 1/8" Thick Sand And Cement Parging	2.77	
				09 24 33 00-0003 SF 1/4" Thick Sand And Cement Parging	3.53	
				09 24 33 00-0004 SF 1/2" Thick Sand And Cement Parging	4.38	
				09 28 Backing Boards And Underlayments <small>(09 20)</small>		
				09 28 13 Cementitious Backing Boards <small>(09 28)</small>		
				09 28 13 00-0001 Cementitious Backer Units <small>(09 28 13)</small>		
				Note: Installed with mechanical fasteners to floor, wall and ceiling surfaces. Use thin-set from setting methods section for floor installations as applicable.		
				09 28 13 00-0002 SF 1/4" Cementitious Backer Units For Installation On Floors	2.54	0.45
				For Up To 50, Add	1.98	
				For >50 To 250, Add	0.36	
				For >1,000, Deduct	-0.18	
				For Installation On Wall, Add	0.36	
				For Installation On Ceiling, Add	0.90	
				09 28 13 00-0003 SF 1/2" Cementitious Backer Units For Installation On Floors	2.94	0.54
				For Up To 50, Add	2.36	
				For >50 To 250, Add	0.43	
				For >1,000, Deduct	-0.22	
				For Installation On Wall, Add	0.43	
				For Installation On Ceiling, Add	1.08	
				09 28 13 00-0004 SF 5/8" Cementitious Backer Units For Installation On Floors	3.61	0.62
				For Up To 50, Add	2.79	
				For >50 To 250, Add	0.50	
				For >1,000, Deduct	-0.25	
				For Installation On Wall, Add	0.50	
				For Installation On Ceiling, Add	1.26	

09 Finishes

09 20 Plaster And Gypsum Board

09 28 Backing Boards And Underlayments



MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

09 28 16 Glass-Mat Faced Gypsum Backing Boards (09 28)

09 28 16 00-0001	Glass Mat Faced Backer Units, DensShield (09 28 16)		
	Note: Installed with mechanical fasteners to floor, wall and ceiling surfaces. Use thin-set from setting methods section for floor installations as applicable.		
09 28 16 00-0002	SF 1/2" DensShield Tile Backer For Installation On Floors	2.00	0.50
	For Up To 50, Add	1.47	
	For >50 To 250, Add	0.26	
	For >1,000, Deduct	-0.13	
	For Installation On Wall, Add	0.26	
	For Installation On Ceiling, Add	0.65	
09 28 16 00-0003	SF 5/8" DensShield Tile Backer For Installation On Floors	2.79	0.57
	For Up To 50, Add	1.78	
	For >50 To 250, Add	0.29	
	For >1,000, Deduct	-0.14	
	For Installation On Wall, Add	0.29	
	For Installation On Ceiling, Add	0.72	

09 28 23 Bullet Resistant Fiberglass Board (09 28)

09 28 23 00-0001	Laminated Bullet Resistant Fiberglass Panel (09 28 23)		
	Note: Material consisting of multiple layers of woven roving ballistic grade fiberglass cloth impregnated with a thermoset polyester resin and compressed into rigid flat sheets.		
09 28 23 00-0002	SF 1/8" Thick Ballistic Resistant Fiberglass Panel, 1.2 LB/SF	11.76	1.02
09 28 23 00-0003	SF 3/16" Thick Ballistic Resistant Fiberglass Panel, 2 LB/SF	15.86	1.09
09 28 23 00-0004	SF 1/4" Thick Ballistic Resistant Fiberglass Panel, 2.4 To 2.6 LB/SF	17.88	1.16
09 28 23 00-0005	SF 5/16" Thick Ballistic Resistant Fiberglass Panel, 3 To 3.6 LB/SF	19.05	1.23
09 28 23 00-0006	SF 7/16" Thick Ballistic Resistant Fiberglass Panel, 4 To 4.9 LB/SF	22.16	1.37
09 28 23 00-0007	SF 9/16" Thick Ballistic Resistant Fiberglass Panel, 5.5 To 6.6 LB/SF	37.06	1.67
09 28 23 00-0008	SF 1-3/16" Thick Ballistic Resistant Fiberglass Panel, 12 To 13.2 LB/SF	63.05	3.12
09 28 23 00-0009	SF 1-5/16" Thick Ballistic Resistant Fiberglass Panel, 13.4 To 14 LB/SF	76.33	3.41
09 28 23 00-0010	SF 1-7/16" Thick Ballistic Resistant Fiberglass Panel, 15.2 To 16 LB/SF	86.65	3.62

09 29 Gypsum Board (09 20)

09 29 00 00-0001	Standard Gypsum Board Application (09 29)		
	Note: Price includes gypsum board screwed on one face only, without finishing. Installed on walls, ceilings, beams, columns, soffits, recesses and chases, flat or curved surfaces. See CSI section 09 29 00 00-0051 for finishing gypsum board, 09 29 00 00-0069 for casing and corner bead, 09 91 43 00-0011 for small repairs.		
09 29 00 00-0002	Standard Gypsum Board Application (09 29 00 00-0001)		
09 29 00 00-0003	SF 1/4" Gypsum Board	0.91	0.29
	For Curved Surfaces With A 2'-0" Maximum Radius, Add	0.13	
	For Times When The Shortest Distance From Corner to Corner Is <3', Add	0.29	
	For Adhesive Applied Sheets Instead Of Fasteners (Includes Bracing Until Adhesive Is Bonded), Add	0.09	
	For Horizontal Installation Up To 10' High, Add	0.19	
	For Horizontal Installation >10' High, Add	0.29	
	For Walls >10' High, Add	0.05	
	For Up To 128, Add	0.30	
	For >128 To 320, Add	0.18	
09 29 00 00-0004	SF 1/2" Gypsum Board	1.08	0.37
	For Curved Surfaces With A 2'-0" Maximum Radius, Add	0.18	
	For Times When The Shortest Distance From Corner to Corner Is <3', Add	0.38	
	For Adhesive Applied Sheets Instead Of Fasteners (Includes Bracing Until Adhesive Is Bonded), Add	0.10	
	For Foil Back Board, Add	0.10	
	For Horizontal Installation Up To 10' High, Add	0.26	
	For Horizontal Installation >10' High, Add	0.38	
	For Walls >10' High, Add	0.06	
	For Up To 128, Add	0.37	
	For >128 To 320, Add	0.22	
09 29 00 00-0005	SF 5/8" Gypsum Board	1.28	0.42
	For Curved Surfaces With A 2'-0" Maximum Radius, Add	0.20	
	For Times When The Shortest Distance From Corner to Corner Is <3', Add	0.43	
	For Adhesive Applied Sheets Instead Of Fasteners (Includes Bracing Until Adhesive Is Bonded), Add	0.10	
	For Foil Back Board, Add	0.10	
	For Horizontal Installation Up To 10' High, Add	0.29	
	For Horizontal Installation >10' High, Add	0.43	
	For Walls >10' High, Add	0.07	
	For Up To 128, Add	0.43	
	For >128 To 320, Add	0.26	
09 29 00 00-0006	SF 1/4" Gypsum Board, Two Layers	1.71	0.51
	For Curved Surfaces With A 2'-0" Maximum Radius, Add	0.25	
	For Times When The Shortest Distance From Corner to Corner Is <3', Add	0.52	
	For Adhesive Applied Sheets Instead Of Fasteners (Includes Bracing Until Adhesive Is Bonded), Add	0.11	
	For Horizontal Installation Up To 10' High, Add	0.35	
	For Horizontal Installation >10' High, Add	0.52	
	For Walls >10' High, Add	0.08	
	For Up To 128, Add	0.55	
	For >128 To 320, Add	0.33	



Finishes	09	9
Plaster And Gypsum Board	09 20	
Gypsum Board	09 29	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 29 00 00-0007 SF 1/2" Gypsum Board, Two Layers	2.01	0.66
For Curved Surfaces With A 2'-0" Maximum Radius, Add	0.31	
For Times When The Shortest Distance From Corner to Corner Is <3', Add	0.67	
For Adhesive Applied Sheets Instead Of Fasteners (Includes Bracing Until Adhesive Is Bonded), Add	0.13	
For Horizontal Installation Up To 10' High, Add	0.46	
For Horizontal Installation >10' High, Add	0.67	
For Walls >10' High, Add	0.11	
For Up To 128, Add	0.67	
For >128 To 320, Add	0.40	
09 29 00 00-0008 SF 5/8" Gypsum Board, Two Layers	2.37	0.77
For Curved Surfaces With A 2'-0" Maximum Radius, Add	0.36	
For Times When The Shortest Distance From Corner to Corner Is <3', Add	0.77	
For Adhesive Applied Sheets Instead Of Fasteners (Includes Bracing Until Adhesive Is Bonded), Add	0.14	
For Horizontal Installation Up To 10' High, Add	0.52	
For Horizontal Installation >10' High, Add	0.77	
For Walls >10' High, Add	0.12	
For Up To 128, Add	0.78	
For >128 To 320, Add	0.47	
09 29 00 00-0009 Fire Rated Gypsum Board Application (09 29 00 00-0001)		
09 29 00 00-0010 Type X, Fire Rated Gypsum Board (09 29 00 00-0009)		
09 29 00 00-0011 SF 5/8" Type X Fire Rated Gypsum Board	1.35	0.42
For Curved Surfaces With A 2'-0" Maximum Radius, Add	0.22	
For Times When The Shortest Distance From Corner to Corner Is <3', Add	0.47	
For Adhesive Applied Sheets Instead Of Fasteners (Includes Bracing Until Adhesive Is Bonded), Add	0.11	
For Foil Back Board, Add	0.10	
For Horizontal Installation Up To 10' High, Add	0.32	
For Horizontal Installation >10' High, Add	0.47	
For Walls >10' High, Add	0.08	
For Up To 128, Add	0.46	
For >128 To 320, Add	0.28	
09 29 00 00-0012 SF 5/8" Type X Fire Rated Gypsum Board, Two Layers	2.50	0.42
For Curved Surfaces With A 2'-0" Maximum Radius, Add	0.40	
For Times When The Shortest Distance From Corner to Corner Is <3', Add	0.85	
For Adhesive Applied Sheets Instead Of Fasteners (Includes Bracing Until Adhesive Is Bonded), Add	0.14	
For Horizontal Installation Up To 10' High, Add	0.57	
For Horizontal Installation >10' High, Add	0.85	
For Walls >10' High, Add	0.14	
For Up To 128, Add	0.84	
For >128 To 320, Add	0.50	
09 29 00 00-0013 Type C, Fire Rated Gypsum Board (09 29 00 00-0009)		
09 29 00 00-0014 SF 1/2" Type C Fire Rated Gypsum Board	1.25	0.37
For Curved Surfaces With A 2'-0" Maximum Radius, Add	0.19	
For Times When The Shortest Distance From Corner to Corner Is <3', Add	0.41	
For Adhesive Applied Sheets Instead Of Fasteners (Includes Bracing Until Adhesive Is Bonded), Add	0.10	
For Foil Back Board, Add	0.10	
For Horizontal Installation Up To 10' High, Add	0.28	
For Horizontal Installation >10' High, Add	0.41	
For Walls >10' High, Add	0.07	
For Up To 128, Add	0.41	
For >128 To 320, Add	0.25	
09 29 00 00-0015 SF 5/8" Type C Fire Rated Gypsum Board	1.40	0.42
For Curved Surfaces With A 2'-0" Maximum Radius, Add	0.22	
For Times When The Shortest Distance From Corner to Corner Is <3', Add	0.47	
For Adhesive Applied Sheets Instead Of Fasteners (Includes Bracing Until Adhesive Is Bonded), Add	0.11	
For Foil Back Board, Add	0.10	
For Horizontal Installation Up To 10' High, Add	0.32	
For Horizontal Installation >10' High, Add	0.47	
For Walls >10' High, Add	0.08	
For Up To 128, Add	0.47	
For >128 To 320, Add	0.28	
09 29 00 00-0016 SF 1/2" Type C Fire Rated Gypsum Board, Two Layers	2.33	0.37
For Curved Surfaces With A 2'-0" Maximum Radius, Add	0.35	
For Times When The Shortest Distance From Corner to Corner Is <3', Add	0.74	
For Adhesive Applied Sheets Instead Of Fasteners (Includes Bracing Until Adhesive Is Bonded), Add	0.13	
For Horizontal Installation Up To 10' High, Add	0.50	
For Horizontal Installation >10' High, Add	0.74	
For Walls >10' High, Add	0.12	
For Up To 128, Add	0.76	
For >128 To 320, Add	0.45	
09 29 00 00-0017 SF 5/8" Type C Fire Rated Gypsum Board, Two Layers	2.60	0.42
For Curved Surfaces With A 2'-0" Maximum Radius, Add	0.40	
For Times When The Shortest Distance From Corner to Corner Is <3', Add	0.85	
For Adhesive Applied Sheets Instead Of Fasteners (Includes Bracing Until Adhesive Is Bonded), Add	0.14	
For Horizontal Installation Up To 10' High, Add	0.57	
For Horizontal Installation >10' High, Add	0.85	
For Walls >10' High, Add	0.14	
For Up To 128, Add	0.86	
For >128 To 320, Add	0.51	
09 29 00 00-0018 Fire Rated Gypsum Board (Sheetrock® Ultracode®) (09 29 00 00-0009)		

09 Finishes

09 20 Plaster And Gypsum Board

09 29 Gypsum Board



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 29 00 00-0019	SF		3/4" Fire Rated Gypsum Board (Sheetrock® Ultracode®).....	1.98	0.42
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.23	
			<i>For Times When The Shortest Distance From Corner to Corner Is <3', Add</i>	0.47	
			<i>For Adhesive Applied Sheets Instead Of Fasteners (Includes Bracing Until Adhesive Is Bonded), Add</i>	0.11	
			<i>For Horizontal Installation Up To 10' High, Add</i>	0.32	
			<i>For Horizontal Installation >10' High, Add</i>	0.47	
			<i>For Walls >10' High, Add</i>	0.08	
			<i>For Up To 128, Add</i>	0.58	
			<i>For >128 To 320, Add</i>	0.34	
09 29 00 00-0020	SF		3/4" Fire Rated Gypsum Board (Sheetrock® Ultracode®), Two Layers	3.76	0.42
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.41	
			<i>For Times When The Shortest Distance From Corner to Corner Is <3', Add</i>	0.85	
			<i>For Adhesive Applied Sheets Instead Of Fasteners (Includes Bracing Until Adhesive Is Bonded), Add</i>	0.14	
			<i>For Horizontal Installation Up To 10' High, Add</i>	0.57	
			<i>For Horizontal Installation >10' High, Add</i>	0.85	
			<i>For Walls >10' High, Add</i>	0.14	
			<i>For Up To 128, Add</i>	1.09	
			<i>For >128 To 320, Add</i>	0.63	
09 29 00 00-0021			Moisture Resistant Gypsum Board Application (09 29 00 00-0001)		
			Note: Water-resistant gypsum core.		
09 29 00 00-0022	SF		1/2" Moisture Resistant Gypsum Board	1.19	0.37
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.18	
			<i>For Times When The Shortest Distance From Corner to Corner Is <3', Add</i>	0.38	
			<i>For Adhesive Applied Sheets Instead Of Fasteners (Includes Bracing Until Adhesive Is Bonded), Add</i>	0.10	
			<i>For Horizontal Installation Up To 10' High, Add</i>	0.26	
			<i>For Horizontal Installation >10' High, Add</i>	0.38	
			<i>For Walls >10' High, Add</i>	0.06	
			<i>For Up To 128, Add</i>	0.39	
			<i>For >128 To 320, Add</i>	0.23	
09 29 00 00-0023	SF		5/8" Moisture Resistant Gypsum Board	1.56	0.37
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.20	
			<i>For Times When The Shortest Distance From Corner to Corner Is <3', Add</i>	0.43	
			<i>For Adhesive Applied Sheets Instead Of Fasteners (Includes Bracing Until Adhesive Is Bonded), Add</i>	0.10	
			<i>For Horizontal Installation Up To 10' High, Add</i>	0.29	
			<i>For Horizontal Installation >10' High, Add</i>	0.43	
			<i>For Walls >10' High, Add</i>	0.07	
			<i>For Up To 128, Add</i>	0.48	
			<i>For >128 To 320, Add</i>	0.29	
09 29 00 00-0024			Vinyl Faced Gypsum Board Application (09 29 00 00-0001)		
			Note: All prefinished vinyl faced panels include, screws, edge grip clips and adhesive.		
09 29 00 00-0025	SF		1/2" Prefinished, Vinyl Faced Gypsum Board	2.40	0.37
			<i>For Walls >10' High, Add</i>	0.08	
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.19	
			<i>For Times When The Shortest Distance From Corner to Corner Is <3', Add</i>	0.38	
			<i>For Adhesive Applied Sheets Instead Of Fasteners (Includes Bracing Until Adhesive Is Bonded), Add</i>	0.10	
			<i>For Horizontal Installation Up To 10' High, Add</i>	0.26	
			<i>For Horizontal Installation >10' High, Add</i>	0.38	
			<i>For Walls >10' High, Add</i>	0.06	
			<i>For Up To 128, Add</i>	0.63	
			<i>For >128 To 320, Add</i>	0.35	
09 29 00 00-0026	SF		5/8" Prefinished, Vinyl Faced Gypsum Board	2.51	0.42
			<i>For Walls >10' High, Add</i>	0.09	
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.21	
			<i>For Times When The Shortest Distance From Corner to Corner Is <3', Add</i>	0.43	
			<i>For Adhesive Applied Sheets Instead Of Fasteners (Includes Bracing Until Adhesive Is Bonded), Add</i>	0.10	
			<i>For Horizontal Installation Up To 10' High, Add</i>	0.29	
			<i>For Horizontal Installation >10' High, Add</i>	0.43	
			<i>For Walls >10' High, Add</i>	0.07	
			<i>For Up To 128, Add</i>	0.67	
			<i>For >128 To 320, Add</i>	0.38	
09 29 00 00-0027	SF		1/2" Fire Rated, Prefinished Vinyl Faced Gypsum Board.....	2.80	0.37
			<i>For Walls >10' High, Add</i>	0.08	
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.21	
			<i>For Times When The Shortest Distance From Corner to Corner Is <3', Add</i>	0.41	
			<i>For Adhesive Applied Sheets Instead Of Fasteners (Includes Bracing Until Adhesive Is Bonded), Add</i>	0.10	
			<i>For Horizontal Installation Up To 10' High, Add</i>	0.28	
			<i>For Horizontal Installation >10' High, Add</i>	0.41	
			<i>For Walls >10' High, Add</i>	0.07	
			<i>For Up To 128, Add</i>	0.72	
			<i>For >128 To 320, Add</i>	0.40	
09 29 00 00-0028	SF		5/8" Fire Rated, Prefinished Vinyl Faced Gypsum Board.....	4.36	0.42
			<i>For Walls >10' High, Add</i>	0.09	
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.25	
			<i>For Times When The Shortest Distance From Corner to Corner Is <3', Add</i>	0.47	
			<i>For Adhesive Applied Sheets Instead Of Fasteners (Includes Bracing Until Adhesive Is Bonded), Add</i>	0.11	
			<i>For Horizontal Installation Up To 10' High, Add</i>	0.32	
			<i>For Horizontal Installation >10' High, Add</i>	0.47	
			<i>For Walls >10' High, Add</i>	0.08	
			<i>For Up To 128, Add</i>	1.06	
			<i>For >128 To 320, Add</i>	0.58	



Finishes	09	9
Plaster And Gypsum Board	09 20	
Gypsum Board	09 29	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 29 00 00-0029 Moisture And Mold Resistant Gypsum Board Application <small>(09 29 00 00-0001)</small>		
09 29 00 00-0030 SF 1/2", Mesh Reinforced, Moisture And Mold Resistant Gypsum Board.....	1.41	0.36
For Walls >10' High, Add	0.08	
For Curved Surfaces With A 2'-0" Maximum Radius, Add	0.18	
For Times When The Shortest Distance From Corner To Corner Is <3', Add	0.38	
For Adhesive Applied Sheets Instead Of Fasteners (Includes Bracing Until Adhesive Is Bonded), Add	0.10	
For Non-reinforced Board, Deduct	-0.08	
For Horizontal Installation Up To 10' High, Add	0.26	
For Horizontal Installation >10' High, Add	0.38	
For Walls >10' High, Add	0.06	
For Up To 128, Add	0.43	
For >128 To 320, Add	0.25	
09 29 00 00-0031 SF 5/8", Mesh Reinforced, Moisture And Mold Resistant Gypsum Board.....	1.68	0.41
For Walls >10' High, Add	0.09	
For Curved Surfaces With A 2'-0" Maximum Radius, Add	0.21	
For Times When The Shortest Distance From Corner To Corner Is <3', Add	0.43	
For Adhesive Applied Sheets Instead Of Fasteners (Includes Bracing Until Adhesive Is Bonded), Add	0.10	
For Non-reinforced Board, Deduct	-0.08	
For Horizontal Installation Up To 10' High, Add	0.29	
For Horizontal Installation >10' High, Add	0.43	
For Walls >10' High, Add	0.07	
For Up To 128, Add	0.51	
For >128 To 320, Add	0.30	
09 29 00 00-0032 SF 1/2" Fire Rated, Mesh Reinforced, Moisture And Mold Resistant Gypsum Board.....	1.68	0.36
For Walls >10' High, Add	0.08	
For Curved Surfaces With A 2'-0" Maximum Radius, Add	0.20	
For Times When The Shortest Distance From Corner To Corner Is <3', Add	0.41	
For Adhesive Applied Sheets Instead Of Fasteners (Includes Bracing Until Adhesive Is Bonded), Add	0.10	
For Horizontal Installation Up To 10' High, Add	0.28	
For Horizontal Installation >10' High, Add	0.41	
For Walls >10' High, Add	0.07	
For Up To 128, Add	0.50	
For >128 To 320, Add	0.29	
09 29 00 00-0033 SF 5/8" Fire Rated, Mesh Reinforced, Moisture And Mold Resistant Gypsum Board.....	1.88	0.41
For Walls >10' High, Add	0.09	
For Curved Surfaces With A 2'-0" Maximum Radius, Add	0.23	
For Times When The Shortest Distance From Corner To Corner Is <3', Add	0.47	
For Adhesive Applied Sheets Instead Of Fasteners (Includes Bracing Until Adhesive Is Bonded), Add	0.11	
For Horizontal Installation Up To 10' High, Add	0.32	
For Horizontal Installation >10' High, Add	0.47	
For Walls >10' High, Add	0.08	
For Up To 128, Add	0.56	
For >128 To 320, Add	0.33	
09 29 00 00-0034 Hi-Impact Gypsum Board <small>(09 29 00 00-0001)</small>		
Note: Abrasion, impact and penetration resistant.		
09 29 00 00-0035 SF 0.01" Polycarbonate Backed, Fire Rated, 5/8" Hi-Impact Gypsum Board.....	2.19	0.41
For Walls >10' High, Add	0.09	
For Curved Surfaces With A 2'-0" Maximum Radius, Add	0.21	
For Times When The Shortest Distance From Corner To Corner Is <3', Add	0.43	
For Adhesive Applied Sheets Instead Of Fasteners (Includes Bracing Until Adhesive Is Bonded), Add	0.10	
For Horizontal Installation Up To 10' High, Add	0.29	
For Horizontal Installation >10' High, Add	0.43	
For Walls >10' High, Add	0.07	
For Up To 128, Add	0.61	
For >128 To 320, Add	0.35	
09 29 00 00-0036 SF 0.02" Polycarbonate Backed, Fire Rated, 5/8" Hi-Impact Gypsum Board.....	2.58	0.41
For Walls >10' High, Add	0.09	
For Curved Surfaces With A 2'-0" Maximum Radius, Add	0.21	
For Times When The Shortest Distance From Corner To Corner Is <3', Add	0.43	
For Adhesive Applied Sheets Instead Of Fasteners (Includes Bracing Until Adhesive Is Bonded), Add	0.10	
For Horizontal Installation Up To 10' High, Add	0.29	
For Horizontal Installation >10' High, Add	0.43	
For Walls >10' High, Add	0.07	
For Up To 128, Add	0.69	
For >128 To 320, Add	0.39	
09 29 00 00-0037 SF 0.03" Polycarbonate Backed, Fire Rated, 5/8" Hi-Impact Gypsum Board.....	2.97	0.41
For Walls >10' High, Add	0.09	
For Curved Surfaces With A 2'-0" Maximum Radius, Add	0.22	
For Times When The Shortest Distance From Corner To Corner Is <3', Add	0.43	
For Adhesive Applied Sheets Instead Of Fasteners (Includes Bracing Until Adhesive Is Bonded), Add	0.10	
For Horizontal Installation Up To 10' High, Add	0.29	
For Horizontal Installation >10' High, Add	0.43	
For Walls >10' High, Add	0.07	
For Up To 128, Add	0.76	
For >128 To 320, Add	0.42	

09 Finishes**09 20 Plaster And Gypsum Board****09 29 Gypsum Board**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 29 00 00-0038	SF		0.08" Polycarbonate Backed, Fire Rated, 5/8" Hi-Impact Gypsum Board	5.32	0.41
			<i>For Walls >10' High, Add</i>	0.09	
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.24	
			<i>For Times When The Shortest Distance From Corner to Corner Is <3', Add</i>	0.43	
			<i>For Adhesive Applied Sheets Instead Of Fasteners (Includes Bracing Until Adhesive Is Bonded), Add</i>	0.10	
			<i>For Horizontal Installation Up To 10' High, Add</i>	0.29	
			<i>For Horizontal Installation >10' High, Add</i>	0.43	
			<i>For Walls >10' High, Add</i>	0.07	
			<i>For Up To 128, Add</i>	1.23	
			<i>For >128 To 320, Add</i>	0.66	
09 29 00 00-0039			Hi-Abuse Gypsum Board <small>(09 29 00 00-0001)</small>		
			Note: Surface indentation, impact, abrasion and moisture/mold/mildew resistant.		
09 29 00 00-0040	SF		5/8" Fire Rated, Hi-Abuse Gypsum Board	1.72	0.41
			<i>For Walls >10' High, Add</i>	0.09	
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.20	
			<i>For Times When The Shortest Distance From Corner to Corner Is <3', Add</i>	0.43	
			<i>For Adhesive Applied Sheets Instead Of Fasteners (Includes Bracing Until Adhesive Is Bonded), Add</i>	0.10	
			<i>For Horizontal Installation Up To 10' High, Add</i>	0.29	
			<i>For Horizontal Installation >10' High, Add</i>	0.43	
			<i>For Walls >10' High, Add</i>	0.07	
			<i>For Up To 128, Add</i>	0.51	
			<i>For >128 To 320, Add</i>	0.30	
09 29 00 00-0041			Soundproof Gypsum Board <small>(09 29 00 00-0001)</small>		
			Note: Minimum STC rating for 1/2" board is 49 and 5/8" board is 51.		
09 29 00 00-0042	SF		1/2" Soundproof Gypsum Board	3.42	0.43
			<i>For Walls >10' High, Add</i>	0.09	
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.23	
			<i>For Times When The Shortest Distance From Corner to Corner Is <3', Add</i>	0.44	
			<i>For Adhesive Applied Sheets Instead Of Fasteners (Includes Bracing Until Adhesive Is Bonded), Add</i>	0.10	
			<i>For Horizontal Installation Up To 10' High, Add</i>	0.30	
			<i>For Horizontal Installation >10' High, Add</i>	0.44	
			<i>For Walls >10' High, Add</i>	0.07	
			<i>For Up To 128, Add</i>	0.86	
			<i>For >128 To 320, Add</i>	0.47	
09 29 00 00-0043	SF		5/8" Soundproof Gypsum Board	4.20	0.43
			<i>For Walls >10' High, Add</i>	0.09	
			<i>For Curved Surfaces With A 2'-0" Maximum Radius, Add</i>	0.23	
			<i>For Times When The Shortest Distance From Corner to Corner Is <3', Add</i>	0.44	
			<i>For Adhesive Applied Sheets Instead Of Fasteners (Includes Bracing Until Adhesive Is Bonded), Add</i>	0.10	
			<i>For Horizontal Installation Up To 10' High, Add</i>	0.30	
			<i>For Horizontal Installation >10' High, Add</i>	0.44	
			<i>For Walls >10' High, Add</i>	0.07	
			<i>For Up To 128, Add</i>	1.01	
			<i>For >128 To 320, Add</i>	0.55	
09 29 00 00-0044			Shaft Wall <small>(09 29)</small>		
			See CSI section 09 29 00 00-0051 for finishing drywall.		
09 29 00 00-0045	SF		3/4" Fire Rated Shaft Wall Assembly	4.69	1.79
			Note: 1/4" thick fiber-cement board with tapered edges over 1/2" thick type "X" gypsum board. Excludes studs or wall structure.		
			<i>For Times When The Shortest Distance From Corner to Corner Is <3', Add</i>	1.80	
			<i>For Horizontal Installation Up To 10' High, Add</i>	1.22	
			<i>For Horizontal Installation >10' High, Add</i>	1.80	
			<i>For Walls >10' High, Add</i>	0.29	
			<i>For Up To 128, Add</i>	1.66	
			<i>For >128 To 320, Add</i>	1.01	
09 29 00 00-0046	SF		7/8" Fire Rated Shaft Wall Assembly	5.43	2.16
			Note: 1/4" thick fiber-cement board with tapered edges over 5/8" thick type "X" gypsum board. Excludes studs or wall structure.		
			<i>For Times When The Shortest Distance From Corner to Corner Is <3', Add</i>	2.16	
			<i>For Horizontal Installation Up To 10' High, Add</i>	1.47	
			<i>For Horizontal Installation >10' High, Add</i>	2.16	
			<i>For Walls >10' High, Add</i>	0.34	
			<i>For Up To 128, Add</i>	1.95	
			<i>For >128 To 320, Add</i>	1.19	
09 29 00 00-0047	SF		2-1/2", 25 Gauge C-H Stud/J-Runner, 1" Gypsum Liner Panel Shaft Wall Assembly	4.77	1.39
			Note: Includes sealant installed at top of wall and panel gaps. Excludes additional gypsum panels and finishing.		
			<i>For Times When The Shortest Distance From Corner to Corner Is <3', Add</i>	1.39	
			<i>For Horizontal Installation Up To 10' High, Add</i>	0.94	
			<i>For Horizontal Installation >10' High, Add</i>	1.39	
			<i>For Walls >10' High, Add</i>	0.22	
			<i>For Up To 128, Add</i>	1.51	
			<i>For >128 To 320, Add</i>	0.89	
			<i>For Glass Mat Surfaces, Add</i>	0.24	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 29 00 00-0048 SF 4", 25 Gauge C-H Stud/J-Runner, 1" Gypsum Liner Panel Shaft Wall Assembly.....	5.06	1.45
Note: Includes sealant installed at top of wall and panel gaps. Excludes additional gypsum panels and finishing.		
<i>For Times When The Shortest Distance From Corner to Corner Is <3', Add</i>	1.45	
<i>For Horizontal Installation Up To 10' High, Add</i>	0.99	
<i>For Horizontal Installation >10' High, Add</i>	1.45	
<i>For Walls >10' High, Add</i>	0.23	
<i>For Up To 128, Add</i>	1.59	
<i>For >128 To 320, Add</i>	0.94	
<i>For Glass Mat Surfaces, Add</i>	0.24	
09 29 00 00-0049 SF 2-1/2", 20 Gauge C-H Stud/J-Runner, 1" Gypsum Liner Panel Shaft Wall Assembly.....	5.48	1.45
Note: Includes sealant installed at top of wall and panel gaps. Excludes additional gypsum panels and finishing.		
<i>For Times When The Shortest Distance From Corner to Corner Is <3', Add</i>	1.45	
<i>For Horizontal Installation Up To 10' High, Add</i>	0.99	
<i>For Horizontal Installation >10' High, Add</i>	1.45	
<i>For Walls >10' High, Add</i>	0.23	
<i>For Up To 128, Add</i>	1.68	
<i>For >128 To 320, Add</i>	0.98	
<i>For Glass Mat Surfaces, Add</i>	0.24	
09 29 00 00-0050 SF 4", 20 Gauge C-H Stud/J-Runner, 1" Gypsum Liner Panel Shaft Wall Assembly.....	5.79	1.52
Note: Includes sealant installed at top of wall and panel gaps. Excludes additional gypsum panels and finishing.		
<i>For Times When The Shortest Distance From Corner to Corner Is <3', Add</i>	1.52	
<i>For Horizontal Installation Up To 10' High, Add</i>	1.03	
<i>For Horizontal Installation >10' High, Add</i>	1.52	
<i>For Walls >10' High, Add</i>	0.24	
<i>For Up To 128, Add</i>	1.77	
<i>For >128 To 320, Add</i>	1.04	
<i>For Glass Mat Surfaces, Add</i>	0.24	
09 29 00 00-0051 Finishing Gypsum Board Applications (09 29)		
Note: Includes flat or curved walls, columns, soffits, recesses, and chases. Tape, spackle, sand and finish gypsum board to the appropriate level as defined by ASTM C 840. No taping or finishing is required for Level 0. For Level 1, tape is set in compound at joints and interior angles. Ridges and tool marks are acceptable. For Level 2, tape is set in compound and wiped with a joint knife leaving a thin coating of compound over joints, interior angles, fastener heads, and beads. Ridges and tool marks are acceptable. Compound applied over the body of the tape at the time of the tape is set satisfies the conditions for this level. For Level 3, tape is set in compound and one additional coat of compound is applied over all joints and interior angles. Fastener heads and accessories receive two separate coats of joint compound. Ridges and tool marks are not acceptable. For Level 4, tape is set in compound and two separate coats of compound are applied over all flat joints with one separate coat of compound applied over interior angles. Fastener heads and accessories receive three separate coats of compound. Ridges and tool marks are not acceptable. A Level 5 finish is a Level 4 finish plus a thin skim coat of compound applied to the entire drywall surface. All levels of finish require that the surface be free of excess compound. A single modifier may be used to change the level of finish to the appropriate level.		
09 29 00 00-0052 Finish Gypsum Board Walls, ASTM C840 Level 4 (09 29 00 00-0051)		
09 29 00 00-0053 SF Up To 10' High, Walls, Tape, Spackle And Finish Gypsum Board.....	0.54	
<i>For Up To 128, Add</i>	0.20	
<i>For >128 To 320, Add</i>	0.12	
<i>For ASTM C840 Level 1 Finish, Deduct</i>	-0.25	
<i>For ASTM C840 Level 2 Finish, Deduct</i>	-0.12	
<i>For ASTM C840 Level 3 Finish, Deduct</i>	-0.05	
<i>For ASTM C840 Level 5 High Quality Finish, Add</i>	0.39	
09 29 00 00-0054 SF >10' High, Walls, Tape, Spackle And Finish Gypsum Board.....	0.71	
Note: Use this task for the entire wall area when the wall is >10' high.		
<i>For Up To 128, Add</i>	0.27	
<i>For >128 To 320, Add</i>	0.17	
<i>For ASTM C840 Level 1 Finish, Deduct</i>	-0.33	
<i>For ASTM C840 Level 2 Finish, Deduct</i>	-0.17	
<i>For ASTM C840 Level 3 Finish, Deduct</i>	-0.07	
<i>For ASTM C840 Level 5 High Quality Finish, Add</i>	0.52	
09 29 00 00-0055 Finish Gypsum Board Ceilings, ASTM C840 Level 4 (09 29 00 00-0051)		
09 29 00 00-0056 SF Up To 10' High, Ceilings, Tape, Spackle And Finish Gypsum Board.....	0.67	
<i>For Up To 128, Add</i>	0.25	
<i>For >128 To 320, Add</i>	0.16	
<i>For ASTM C840 Level 1 Finish, Deduct</i>	-0.31	
<i>For ASTM C840 Level 2 Finish, Deduct</i>	-0.16	
<i>For ASTM C840 Level 3 Finish, Deduct</i>	-0.06	
<i>For ASTM C840 Level 5 High Quality Finish, Add</i>	0.49	
09 29 00 00-0057 SF >10' High, Ceilings, Tape, Spackle And Finish Gypsum Board.....	0.84	
Note: Use this task for the entire wall area when the wall is >10' high.		
<i>For Up To 128, Add</i>	0.32	
<i>For >128 To 320, Add</i>	0.20	
<i>For ASTM C840 Level 1 Finish, Deduct</i>	-0.40	
<i>For ASTM C840 Level 2 Finish, Deduct</i>	-0.20	
<i>For ASTM C840 Level 3 Finish, Deduct</i>	-0.08	
<i>For ASTM C840 Level 5 High Quality Finish, Add</i>	0.62	
09 29 00 00-0058 Finish Gypsum Board Vertical Corners, ASTM C840 Level 4 (09 29 00 00-0051)		
Note: Inside or outside gypsum board corners.		

09 Finishes

09 20 Plaster And Gypsum Board

09 29 Gypsum Board



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 29 00 00-0059	LF		Up To 10' High, Vertical Corners, Tape, Spackle And Finish Gypsum Board.....	1.10	
			<i>For ASTM C840 Level 1 Finish, Deduct</i>	-0.50	
			<i>For ASTM C840 Level 2 Finish, Deduct</i>	-0.25	
			<i>For ASTM C840 Level 3 Finish, Deduct</i>	-0.10	
			<i>For ASTM C840 Level 5 High Quality Finish, Add</i>	0.80	
09 29 00 00-0060	LF		>10' High, Vertical Corners, Tape, Spackle And Finish Gypsum Board.....	1.30	
			Note: Use this task for the entire wall area when the wall is >10' high.		
			<i>For ASTM C840 Level 1 Finish, Deduct</i>	-0.60	
			<i>For ASTM C840 Level 2 Finish, Deduct</i>	-0.30	
			<i>For ASTM C840 Level 3 Finish, Deduct</i>	-0.12	
			<i>For ASTM C840 Level 5 High Quality Finish, Add</i>	0.95	
09 29 00 00-0061			Finish Gypsum Board Horizontal Corners, ASTM C840 Level 4 <small>(09 29 00 00-0051)</small>		
			Note: Inside or outside gypsum board corners.		
09 29 00 00-0062	LF		Up To 10' High, Horizontal Corners, Tape, Spackle And Finish Gypsum Board.....	1.27	
			<i>For ASTM C840 Level 1 Finish, Deduct</i>	-0.58	
			<i>For ASTM C840 Level 2 Finish, Deduct</i>	-0.29	
			<i>For ASTM C840 Level 3 Finish, Deduct</i>	-0.12	
			<i>For ASTM C840 Level 5 High Quality Finish, Add</i>	0.93	
09 29 00 00-0063	LF		>10' High, Horizontal Corners, Tape, Spackle And Finish Gypsum Board.....	1.51	
			Note: Use this task for the entire wall area when the wall is >10' high.		
			<i>For ASTM C840 Level 1 Finish, Deduct</i>	-0.70	
			<i>For ASTM C840 Level 2 Finish, Deduct</i>	-0.35	
			<i>For ASTM C840 Level 3 Finish, Deduct</i>	-0.14	
			<i>For ASTM C840 Level 5 High Quality Finish, Add</i>	1.11	
09 29 00 00-0064			Textured Finishes For Gypsum Board <small>(09 29 00 00-0051)</small>		
09 29 00 00-0065	SF		"Popcorn" Spray Applied, Finish On Existing Gypsum Board Ceiling.....	0.28	
09 29 00 00-0066	SF		Textured Finish On Existing Gypsum Board Ceiling.....	0.51	
			Note: For non spray applied textures.		
09 29 00 00-0067	SF		Spray Applied Orange Peel Finish On Existing Gypsum Board Wall.....	0.24	
09 29 00 00-0068	SF		Spray Applied Knockdown Or Skip Trowel Finish On Existing Gypsum Board Wall.....	0.32	
09 29 00 00-0069			Casing And Corner Beads <small>(09 29)</small>		
09 29 00 00-0070	LF		Casing, Galvanized Steel J-Bead For Gypsum Board.....	2.58	0.71
09 29 00 00-0071	LF		Corner Bead, Galvanized Steel For Gypsum Board.....	2.50	0.71
09 29 00 00-0072			Architectural Forms <small>(09 29)</small>		
09 29 00 00-0073	SF		1" Architectural Foam Forms For Gypsum Board Cover.....	3.24	
09 29 00 00-0074			Preformed Architectural Profiles <small>(09 29)</small>		
09 29 00 00-0075			Trim Reveals For Gypsum Board <small>(09 29 00 00-0074)</small>		
09 29 00 00-0076	LF		1/8" x 1/2" Aluminum Extrusions, Single Fin Trim Reveal For Gypsum Board.....	2.55	0.87
09 29 00 00-0077	LF		1/4" x 1/2" Aluminum Extrusions, Single Fin Trim Reveal For Gypsum Board.....	2.56	0.87
09 29 00 00-0078	LF		3/8" x 1/2" Aluminum Extrusions, Single Fin Trim Reveal For Gypsum Board.....	2.61	0.87
09 29 00 00-0079	LF		1/2" x 1/2" Aluminum Extrusions, Single Fin Trim Reveal For Gypsum Board.....	2.64	0.87
09 29 00 00-0080	LF		5/8" x 1/2" Aluminum Extrusions, Single Fin Trim Reveal For Gypsum Board.....	2.70	0.87
09 29 00 00-0081	LF		3/4" x 1/2" Aluminum Extrusions, Single Fin Trim Reveal For Gypsum Board.....	2.77	0.87
09 29 00 00-0082	LF		1" x 1/2" Aluminum Extrusions, Single Fin Trim Reveal For Gypsum Board.....	2.83	0.87
09 29 00 00-0083	LF		1-1/2" x 1/2" Aluminum Extrusions, Single Fin Trim Reveal For Gypsum Board.....	3.04	0.87
09 29 00 00-0084	LF		2" x 1/2" Aluminum Extrusions, Single Fin Trim Reveal For Gypsum Board.....	3.24	0.87
09 29 00 00-0085	LF		1/8" x 5/8" Aluminum Extrusions, Single Fin Trim Reveal For Gypsum Board.....	2.67	0.94
09 29 00 00-0086	LF		1/4" x 5/8" Aluminum Extrusions, Single Fin Trim Reveal For Gypsum Board.....	2.67	0.94
09 29 00 00-0087	LF		3/8" x 5/8" Aluminum Extrusions, Single Fin Trim Reveal For Gypsum Board.....	2.81	0.94
09 29 00 00-0088	LF		1/2" x 5/8" Aluminum Extrusions, Single Fin Trim Reveal For Gypsum Board.....	2.84	0.94
09 29 00 00-0089	LF		5/8" x 5/8" Aluminum Extrusions, Single Fin Trim Reveal For Gypsum Board.....	2.93	0.94
09 29 00 00-0090	LF		3/4" x 5/8" Aluminum Extrusions, Single Fin Trim Reveal For Gypsum Board.....	2.97	0.94
09 29 00 00-0091	LF		1" x 5/8" Aluminum Extrusions, Single Fin Trim Reveal For Gypsum Board.....	3.02	0.94
09 29 00 00-0092	LF		1 1/2" x 5/8" Aluminum Extrusions, Single Fin Trim Reveal For Gypsum Board.....	3.25	0.94
09 29 00 00-0093	LF		2" x 5/8" Aluminum Extrusions, Single Fin Trim Reveal For Gypsum Board.....	3.48	0.94
09 29 00 00-0094	LF		3" x 5/8", Aluminum Extrusions, Single Fin Trim Reveal For Gypsum Board.....	4.56	1.08
09 29 00 00-0095	LF		4" x 5/8", Aluminum Extrusions, Single Fin Trim Reveal For Gypsum Board.....	4.94	1.08
09 29 00 00-0096			Edge Trim For Gypsum Board <small>(09 29 00 00-0074)</small>		
09 29 00 00-0097	LF		1/2" Aluminum Extrusions, Edge Trim For Gypsum Board.....	2.45	0.90
09 29 00 00-0098	LF		5/8" Aluminum Extrusions, Edge Trim For Gypsum Board.....	2.56	0.90
09 29 00 00-0099	LF		1" Aluminum Extrusions, Edge Trim For Gypsum Board.....	2.93	0.99
09 29 00 00-0100	LF		1-1/4" Aluminum Extrusions, Edge Trim For Gypsum Board.....	3.10	1.08
09 29 00 00-0101	LF		1/2" Flexible Aluminum Extrusions, Edge Trim For Gypsum Board.....	3.73	0.90
09 29 00 00-0102	LF		5/8" Flexible Aluminum Extrusions, Edge Trim For Gypsum Board.....	3.83	0.90
09 29 00 00-0103	LF		1" Flexible Aluminum Extrusions, Edge Trim For Gypsum Board.....	4.21	0.99
09 29 00 00-0104	LF		1-1/4" Flexible Aluminum Extrusions, Edge Trim For Gypsum Board.....	4.38	1.08
09 29 00 00-0105			Bevel Trim For Gypsum Board <small>(09 29 00 00-0074)</small>		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 29 00 00-0106 LF 5/16" x 1/4" Aluminum Extrusions, Bevel Trim For Gypsum Board.....	2.56	0.90
09 29 00 00-0107 LF 5/8" x 5/8" Aluminum Extrusions, Bevel Trim For Gypsum Board.....	2.90	0.99
09 29 00 00-0108 Trim/Wainscot Caps For Gypsum Board (09 29 00 00-0074)		
09 29 00 00-0109 LF 1-1/2" Wide Aluminum Extrusions, Trim/Wainscot Cap For Gypsum Board.....	3.32	1.08
09 29 00 00-0110 Single Fin Wall/Trim Reveals For Gypsum Board (09 29 00 00-0074)		
09 29 00 00-0111 LF 1/8" x 1/2" Aluminum Extrusions, Single Fin Wall Reveal For Gypsum Board.....	2.15	0.57
09 29 00 00-0112 LF 1/4" x 1/2" Aluminum Extrusions, Single Fin Wall Reveal For Gypsum Board.....	2.26	0.64
09 29 00 00-0113 LF 3/8" x 1/2" Aluminum Extrusions, Single Fin Wall Reveal For Gypsum Board.....	2.62	0.71
09 29 00 00-0114 LF 1/2" x 1/2" Aluminum Extrusions, Single Fin Wall Reveal For Gypsum Board.....	2.80	0.79
09 29 00 00-0115 LF 5/8" x 1/2" Aluminum Extrusions, Single Fin Wall Reveal For Gypsum Board.....	2.96	0.87
09 29 00 00-0116 LF 3/4" x 1/2" Aluminum Extrusions, Single Fin Wall Reveal For Gypsum Board.....	3.00	0.87
09 29 00 00-0117 LF 1" x 1/2" Aluminum Extrusions, Single Fin Wall Reveal For Gypsum Board.....	3.11	0.87
09 29 00 00-0118 LF 1-1/2" x 1/2" Aluminum Extrusions, Single Fin Wall Reveal For Gypsum Board.....	3.33	0.87
09 29 00 00-0119 LF 2" x 1/2" Aluminum Extrusions, Single Fin Wall Reveal For Gypsum Board.....	3.41	0.87
09 29 00 00-0120 LF 1/8" x 5/8" Aluminum Extrusions, Single Fin Wall Reveal For Gypsum Board.....	2.93	0.94
09 29 00 00-0121 LF 1/4" x 5/8" Aluminum Extrusions, Single Fin Wall Reveal For Gypsum Board.....	2.96	0.94
09 29 00 00-0122 LF 3/8" x 5/8" Aluminum Extrusions, Single Fin Wall Reveal For Gypsum Board.....	3.10	0.94
09 29 00 00-0123 LF 1/2" x 5/8" Aluminum Extrusions, Single Fin Wall Reveal For Gypsum Board.....	3.16	0.94
09 29 00 00-0124 LF 5/8" x 5/8" Aluminum Extrusions, Single Fin Wall Reveal For Gypsum Board.....	3.21	0.94
09 29 00 00-0125 LF 3/4" x 5/8" Aluminum Extrusions, Single Fin Wall Reveal For Gypsum Board.....	3.27	0.94
09 29 00 00-0126 LF 1" x 5/8" Aluminum Extrusions, Single Fin Wall Reveal For Gypsum Board.....	3.36	0.94
09 29 00 00-0127 LF 1-1/2" x 5/8" Aluminum Extrusions, Single Fin Wall Reveal For Gypsum Board.....	3.59	0.94
09 29 00 00-0128 LF 2" x 5/8" Aluminum Extrusions, Single Fin Wall Reveal For Gypsum Board.....	3.79	0.94
09 29 00 00-0129 LF 3" x 5/8" Aluminum Extrusions, Single Fin Wall Reveal For Gypsum Board.....	4.40	0.94
09 29 00 00-0130 LF 4" x 5/8" Aluminum Extrusions, Single Fin Wall Reveal For Gypsum Board.....	5.57	0.94
09 29 00 00-0131 LF 3-1/16" x 7/16", Aluminum Extrusions, Single Fin Wall Base For Gypsum Board.....	4.17	0.94
09 29 00 00-0132 LF 3-1/16" x 9/16", Aluminum Extrusions, Single Fin Wall Base For Gypsum Board.....	4.27	0.94
09 29 00 00-0133 LF 4-1/16" x 7/16", Aluminum Extrusions, Single Fin Wall Base For Gypsum Board.....	4.62	0.94
09 29 00 00-0134 LF 4-1/16" x 9/16", Aluminum Extrusions, Single Fin Wall Base For Gypsum Board.....	4.65	0.94
09 29 00 00-0135 LF 9/16" Tall with 1/2" Reveal, Aluminum Extrusions, Single Fin Wall Base With Reveal For Gypsum Board.....	5.15	0.94
09 29 00 00-0136 LF 5/8" Aluminum Extrusions, Single Fin Wall/Trim Reveal Hanging Track For Gypsum Board.....	4.41	0.94
09 29 00 00-0137 'V' Groove Wall Reveals For Gypsum Board (09 29 00 00-0074)		
09 29 00 00-0138 LF 1/4" x 5/8" Aluminum Extrusions, 'V' Groove Wall Reveal For Gypsum Board.....	3.78	1.29
09 29 00 00-0139 LF 3/4" x 1/2" Aluminum Extrusions, 'V' Groove Wall Reveal For Gypsum Board.....	4.36	1.44
09 29 00 00-0140 LF 1" x 1/2" Aluminum Extrusions, 'V' Groove Wall Reveal For Gypsum Board.....	4.99	1.72
09 29 00 00-0141 LF 9/32" x 5/8" Aluminum Extrusions, 'V' Groove Wall Reveal For Gypsum Board.....	5.21	1.86
09 29 00 00-0142 Double Fin Wall Reveals For Gypsum Board (09 29 00 00-0074)		
09 29 00 00-0143 LF 3/8" x 3/8" Aluminum Extrusions, Double Fin Wall Reveal For Gypsum Board.....	3.16	0.87
09 29 00 00-0144 LF 1/8" x 1/2" Aluminum Extrusions, Double Fin Wall Reveal For Gypsum Board.....	3.19	0.87
09 29 00 00-0145 LF 1/4" x 1/2" Aluminum Extrusions, Double Fin Wall Reveal For Gypsum Board.....	3.21	0.87
09 29 00 00-0146 LF 3/8" x 1/2" Aluminum Extrusions, Double Fin Wall Reveal For Gypsum Board.....	3.21	0.87
09 29 00 00-0147 LF 1/2" x 1/2" Aluminum Extrusions, Double Fin Wall Reveal For Gypsum Board.....	3.33	0.87
09 29 00 00-0148 LF 5/8" x 1/2" Aluminum Extrusions, Double Fin Wall Reveal For Gypsum Board.....	3.38	0.86
09 29 00 00-0149 LF 3/4" x 1/2" Aluminum Extrusions, Double Fin Wall Reveal For Gypsum Board.....	3.43	0.87
09 29 00 00-0150 LF 1" x 1/2" Aluminum Extrusions, Double Fin Wall Reveal For Gypsum Board.....	3.55	0.87
09 29 00 00-0151 LF 1-1/2" x 1/2" Aluminum Extrusions, Double Fin Wall Reveal For Gypsum Board.....	3.74	0.87
09 29 00 00-0152 LF 2" x 1/2" Aluminum Extrusions, Double Fin Wall Reveal For Gypsum Board.....	3.94	0.87
09 29 00 00-0153 LF 3/8" x 5/8" Aluminum Extrusions, Double Fin Wall Reveal For Gypsum Board.....	3.38	0.94
09 29 00 00-0154 LF 1/4" x 5/8" Aluminum Extrusions, Double Fin Wall Reveal For Gypsum Board.....	3.40	0.94
09 29 00 00-0155 LF 3/8" x 5/8" Aluminum Extrusions, Double Fin Wall Reveal For Gypsum Board.....	3.45	0.94
09 29 00 00-0156 LF 1/2" x 5/8" Aluminum Extrusions, Double Fin Wall Reveal For Gypsum Board.....	3.57	0.94
09 29 00 00-0157 LF 5/8" x 5/8" Aluminum Extrusions, Double Fin Wall Reveal For Gypsum Board.....	3.62	0.94
09 29 00 00-0158 LF 3/4" x 5/8" Aluminum Extrusions, Double Fin Wall Reveal For Gypsum Board.....	3.66	0.94
09 29 00 00-0159 LF 1" x 5/8" Aluminum Extrusions, Double Fin Wall Reveal For Gypsum Board.....	3.79	0.94
09 29 00 00-0160 LF 1-1/2" x 5/8" Aluminum Extrusions, Double Fin Wall Reveal For Gypsum Board.....	3.99	0.94
09 29 00 00-0161 LF 2" x 5/8" Aluminum Extrusions, Double Fin Wall Reveal For Gypsum Board.....	4.19	0.94
09 29 00 00-0162 LF 3" x 5/8" Aluminum Extrusions, Double Fin Wall Reveal For Gypsum Board.....	4.74	0.94
09 29 00 00-0163 LF 4" x 5/8" Aluminum Extrusions, Double Fin Wall Reveal For Gypsum Board.....	5.89	0.94
09 29 00 00-0164 LF 1-1/2" x 1" Aluminum Extrusions, Double Fin Wall Reveal For Gypsum Board.....	5.49	1.02
09 29 00 00-0165 LF 3/4" x 1 1/2" Aluminum Extrusions, Double Fin Wall Reveal For Gypsum Board.....	6.34	1.25
09 29 00 00-0166 LF 1-1/2" x 1-1/2" Aluminum Extrusions, Double Fin Wall Reveal For Gypsum Board.....	6.51	1.25
09 29 00 00-0167 LF 1/2", Aluminum Extrusions, Double Fin Hanging Track Wall Reveal For Gypsum Board.....	4.91	0.86
09 29 00 00-0168 LF 1 3/16", Aluminum Extrusions, Double Fin Hanging Track Wall Reveal For Gypsum Board.....	5.05	1.25
09 29 00 00-0169 LF 1/4" Aluminum Extrusions, Double Fin Wall Covering Joiner For Gypsum Board.....	3.58	0.86
09 29 00 00-0170 Special Conditions Reveals For Gypsum Board (09 29 00 00-0074)		
09 29 00 00-0171 Radius Conditions (09 29 00 00-0170)		
09 29 00 00-0172 EA 8' Long Inside Radius For Gypsum Board.....	31.92	
Note: Task used in conjunction with "Prefformed Architectural Profiles" tasks.		

09 Finishes

09 20 Plaster And Gypsum Board

09 29 Gypsum Board



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 29 00 00-0173	EA		8' Long Outside Radius For Gypsum Board.....	31.92	
			Note: Task used in conjunction with "Prefomed Architectural Profiles" tasks.		
09 29 00 00-0174	EA		8' Long Circular / Arched Radius For Gypsum Board	31.92	
			Note: Task used in conjunction with "Prefomed Architectural Profiles" tasks.		
09 29 00 00-0175			Knee Brace Kit (09 29 00 00-0170)		
09 29 00 00-0176	EA		46" H, Aluminum Extrusions, Knee Brace Kit For Gypsum Board	79.24	8.98
09 29 00 00-0177			Wall Bumper Rail (09 29 00 00-0170)		
09 29 00 00-0178	LF		2-1/2" x 5/8", Aluminum Extrusions, Wall Bumper Rail For Gypsum Board	13.56	3.59
09 29 00 00-0179			Corners For Gypsum Board (09 29 00 00-0074)		
09 29 00 00-0180	LF		1/2"R, Aluminum Extrusions, Outside Corner For Gypsum Board	3.00	0.87
09 29 00 00-0181	LF		5/8"R, Aluminum Extrusions, Outside Corner For Gypsum Board	3.22	0.94
09 29 00 00-0182	LF		3/4"R, Aluminum Extrusions, Outside Corner For Gypsum Board	3.51	0.98
09 29 00 00-0183	LF		1"R, Aluminum Extrusions, Outside Corner For Gypsum Board	3.84	1.02
09 29 00 00-0184	LF		1-1/2" R, Aluminum Extrusions, Outside Corner For Gypsum Board	4.67	1.25
09 29 00 00-0185	LF		2" R, Aluminum Extrusions, Outside Corner For Gypsum Board	5.36	1.40
09 29 00 00-0186	LF		2-1/2" R, Aluminum Extrusions, Outside Corner For Gypsum Board	6.39	1.60
09 29 00 00-0187	LF		3" R, Aluminum Extrusions, Outside Corner For Gypsum Board	7.70	1.87
09 29 00 00-0188	LF		4" R, Aluminum Extrusions, Outside Corner For Gypsum Board	10.47	2.50
09 29 00 00-0189	LF		90 Degree 3/8" Aluminum Extrusions, Hi-Strength Corner For Gypsum Board	2.96	0.84
09 29 00 00-0190	LF		90 Degree 1-1/4" Aluminum Extrusions, Hi-Strength Corner For Gypsum Board	5.01	1.12
09 29 00 00-0191	LF		90 Degree 1-1/4" Aluminum Extrusions, Fabric Tuck Corner For Gypsum Board	3.95	1.12
09 29 00 00-0192	LF		90 Degree 1-1/4" Aluminum Extrusions, Corner With Vertical Reveal For Gypsum Board	6.13	1.12
09 29 00 00-0193	LF		45 Degree 2" Aluminum Extrusions, Corner For Gypsum Board	8.50	1.40
09 29 00 00-0194	LF		60 Degree 2" Aluminum Extrusions, Corner For Gypsum Board	8.22	1.40
09 29 00 00-0195	LF		3/4" Aluminum Extrusions, Chamfered Corner For Gypsum Board	3.09	0.98
09 29 00 00-0196	LF		5/8" R, Aluminum Extrusions, Corners Return For Gypsum Board	3.06	0.94
09 29 00 00-0197	LF		1/2" x 1/2" Aluminum Extrusions, Double Corner Step For Gypsum Board	2.98	0.87
09 29 00 00-0198	LF		5/8" x 5/8" Aluminum Extrusions, Double Corner Step For Gypsum Board	3.17	0.94
09 29 00 00-0199	LF		1" x 1" Aluminum Extrusions, Double Corner Step For Gypsum Board	4.01	1.02
09 29 00 00-0200	LF		1/2" x 1/2" Aluminum Extrusions, Triple Corner Step For Gypsum Board	3.48	0.87
09 29 00 00-0201	LF		5/8" x 5/8" Aluminum Extrusions, Triple Corner Step For Gypsum Board	3.71	0.94
09 29 00 00-0202	LF		1" x 1" Aluminum Extrusions, Triple Corner Step For Gypsum Board	5.05	1.02
09 29 00 00-0203	LF		1/3" x 1/2" Aluminum Extrusions, Quad Corner Step For Gypsum Board	5.27	0.87
09 29 00 00-0204	LF		3" Aluminum Extrusions, Bullnose For Gypsum Board	9.50	1.87
09 29 00 00-0205	LF		3-7/8" Aluminum Extrusions, Bullnose For Gypsum Board	10.01	1.87
09 29 00 00-0206	LF		5-3/8", Aluminum Extrusions, Bullnose For Gypsum Board	18.13	3.12
09 29 00 00-0207	LF		7-3/8", Aluminum Extrusions, Bullnose For Gypsum Board	29.27	4.42
09 29 00 00-0208	LF		3/4" R, Aluminum Extrusions, Inside Corner For Gypsum Board	3.52	0.96
09 29 00 00-0209	LF		1" R, Aluminum Extrusions, Inside Corner For Gypsum Board	3.92	1.01
09 29 00 00-0210	LF		1-1/2" R, Aluminum Extrusions, Inside Corner For Gypsum Board	4.73	1.23
09 29 00 00-0211	LF		2" R, Aluminum Extrusions, Inside Corner For Gypsum Board	5.67	1.38
09 29 00 00-0212	LF		2-1/2" R, Aluminum Extrusions, Inside Corner For Gypsum Board	7.60	1.58
09 29 00 00-0213	LF		3" R, Aluminum Extrusions, Inside Corner For Gypsum Board	8.38	1.84
09 29 00 00-0214	LF		4" R, Aluminum Extrusions, Inside Corner For Gypsum Board	9.91	2.46
09 29 00 00-0215	LF		3-5/8", Aluminum Extrusions, Aluminum Wall Cap For Gypsum Board	6.62	1.84
09 29 00 00-0216	LF		3-7/8", Aluminum Extrusions, Aluminum Wall Cap For Gypsum Board	6.69	1.84
09 29 00 00-0217	LF		4-3/4", Aluminum Extrusions, Aluminum Wall Cap For Gypsum Board	7.10	1.84
09 29 00 00-0218	LF		5", Aluminum Extrusions, Aluminum Wall Cap For Gypsum Board	7.22	1.84

09 30 Tiling (09)

Note: All tiles are standard grade ANSI 137.1 or higher, mounted and unmounted, cushioned or non-cushioned edge, all tile colors, all grout colors, PEI rating 1 through 4, and include patterns. Glazing shall meet ASTM C484 and C424. Mounted tiles are assembled into sheets to facilitate handling and installation. Perforated paper, fiber mesh, or other suitable bonding material applied to the front, backs or edges of the tile can be used to mount the tiles. Cushioned edge tile has facial edges with a distinct curvature that results in a slightly recessed joint. All floor, wall, ceiling, cove base and trim tile will be installed in accordance with ANSI 108.1 using these setting methods.

09 30 13 Ceramic Tiling (09 30)

Note: Includes grout and sealing. Excludes setting method. See CSI section 09 31 00 00-0000 for thin-set, 09 32 00 00-0000 for mortar-bed, 09 35 00 00-0000 for chemical-resistant.

09 30 13 00-0001 Ceramic Tiling (09 30 13)

09 30 13 00-0002	SF	Less Than 8" x 8" Mounted Floor Tile	7.97	1.93
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Note: Includes glazed porcelain, unglazed porcelain and glazed ceramic tiles. Tiles mounted from back, side or front in 12" x 12", 12" x 24", or similar sized sheets.

For Up To 50, Add	4.89
For >50 To 250, Add	0.77
For >1,000, Deduct	-0.39
For Epoxy Grout, Add	0.86
For Heavy Duty Floors With A PEI 5 Rating, Add	1.00



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 30 13 00-0003 SF 8" x 8" And Larger Unmounted Floor Tile Note: Includes glazed porcelain, unglazed porcelain and glazed ceramic tiles. <i>For Up To 50, Add</i> <i>For >50 To 250, Add</i> <i>For >1,000, Deduct</i> <i>For Epoxy Grout, Add</i> <i>For Heavy Duty Floors With A PEI 5 Rating, Add</i>	8.93 5.85 0.96 -0.48 1.00 1.00	1.20
09 30 13 00-0004 SF Mounted Floor Tile, Residential Grade Note: Includes glazed porcelain, unglazed porcelain and glazed ceramic tiles. Tiles mounted from back, side or front in 12" x 12", 12" x 24", or similar sized sheets. <i>For Up To 50, Add</i> <i>For >50 To 250, Add</i> <i>For >1,000, Deduct</i>	6.45 4.51 0.77 -0.39	1.93
09 30 13 00-0005 SF Less than 8" x 8" Mounted Wall Tile Note: Includes glazed porcelain, unglazed porcelain and glazed ceramic tiles. Tiles mounted from back, side or front in 12" x 12", 12" x 24", or similar sized sheets. <i>For Up To 50, Add</i> <i>For >50 To 250, Add</i> <i>For >1,000, Deduct</i> <i>For Epoxy Grout, Add</i>	8.79 5.71 0.94 -0.47 0.98	2.34
09 30 13 00-0006 SF 8" x 8" And Larger Unmounted Wall Tile Note: Includes glazed porcelain, unglazed porcelain and glazed ceramic tiles. <i>For Up To 50, Add</i> <i>For >50 To 250, Add</i> <i>For >1,000, Deduct</i> <i>For Epoxy Grout, Add</i>	10.02 6.94 1.18 -0.59 1.17	1.49
09 30 13 00-0007 SF Mounted Wall Tile, Residential Grade Note: Includes glazed porcelain, unglazed porcelain and glazed ceramic tiles. Tiles mounted from back, side or front in 12" x 12", 12" x 24", or similar sized sheets. <i>For Up To 50, Add</i> <i>For >50 To 250, Add</i> <i>For >1,000, Deduct</i>	7.27 5.33 0.94 -0.47	2.34
09 30 13 00-0008 SF Less than 8" x 8" Mounted Ceiling Tile Note: Includes glazed porcelain, unglazed porcelain and glazed ceramic tiles. Tiles mounted from back, side or front in 12" x 12", 12" x 24", or similar sized sheets. <i>For Up To 50, Add</i> <i>For >50 To 250, Add</i> <i>For >1,000, Deduct</i> <i>For Chemical Resistant Epoxy Grout, Add</i>	12.21 9.13 1.62 -0.81 1.52	4.06
09 30 13 00-0009 SF 8" x 8" And Larger Unmounted Ceiling Tile Note: Includes glazed porcelain, unglazed porcelain and glazed ceramic tiles. <i>For Up To 50, Add</i> <i>For >50 To 250, Add</i> <i>For >1,000, Deduct</i> <i>For Chemical Resistant Epoxy Grout, Add</i>	13.84 10.76 1.95 -0.97 1.76	2.43
09 30 13 00-0010 LF 4-1/4" To 4-1/2" High Glazed Porcelain, Unglazed Porcelain And Glazed Ceramic Cove Base Or Trim <i>For Chemical Resistant Epoxy Grout, Add</i>	10.85 1.21	1.69
 09 30 16 Quarry Tiling <small>(09 30)</small>		
Note: Includes grout and sealing. Excludes setting method. See CSI section 09 31 00 00-0000 for thin-set, 09 32 00 00-0000 for mortar-bed, 09 35 00 00-0000 for chemical-resistant.		
09 30 16 00-0001 SF Unglazed Quarry Floor Tile Note: With or without embedded abrasive grit. <i>For Up To 50, Add</i> <i>For >50 To 250, Add</i> <i>For >1,000, Deduct</i> <i>For Epoxy Grout, Add</i>	7.26 5.87 1.08 -0.54 1.09	1.36
09 30 16 00-0002 SF Glazed Quarry Floor Tile <i>For Up To 50, Add</i> <i>For >50 To 250, Add</i> <i>For >1,000, Deduct</i> <i>For Epoxy Grout, Add</i>	13.01 7.30 1.08 -0.54 1.09	1.36
09 30 16 00-0003 SF Unglazed Quarry Wall Tile Note: With or without embedded abrasive grit. <i>For Up To 50, Add</i> <i>For >50 To 250, Add</i> <i>For >1,000, Deduct</i> <i>For Epoxy Grout, Add</i>	8.34 6.95 1.30 -0.65 1.25	1.61
09 30 16 00-0004 SF Glazed Quarry Wall Tile <i>For Up To 50, Add</i> <i>For >50 To 250, Add</i> <i>For >1,000, Deduct</i> <i>For Epoxy Grout, Add</i>	14.09 8.38 1.30 -0.65 1.25	1.61
09 30 16 00-0005 LF 6" High Unglazed Quarry Tile Cove Base Or Trim <i>For Chemical Resistant Epoxy Grout, Add</i>	10.04 1.27	1.79
09 30 16 00-0006 LF 6" High Glazed Quarry Tile Cove Base Or Trim <i>For Chemical Resistant Epoxy Grout, Add</i>	19.47 1.27	1.79
 09 31 Thin-Set Tiling <small>(09 30)</small>		
Note: Tile setting methods in this section are used with ceramic or quarry tile materials as applicable, for a complete installation.		
09 31 00 00-0001 SF Thin Set - Latex Portland Cement Mortar <i>For Up To 50, Add</i> <i>For >50 To 250, Add</i> <i>For >1,000, Deduct</i>	1.14 1.01 0.19 -0.10	0.64
09 31 00 00-0002 SF Clean And Scarify Existing Tile For Installation Of New Tile Over Existing	0.61	

09 Finishes**09 30 Tiling****09 31 Thin-Set Tiling**

MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
		<i>For Up To 50, Add</i>	0.61		
		<i>For >50 To 250, Add</i>	0.12		
		<i>For >1,000, Deduct</i>	-0.06		
09 32		Mortar-Bed Tiling <small>(09 30)</small>			
Note: Tile setting methods in this section are used with ceramic or quarry tile materials as applicable, for a complete installation.					
09 32 00 00-0001	SF	3/4" Minimum Thickness Portland Cement Mortar Setting Bed	2.85		1.29
Note: For residential floors. Includes 15# felt and wire reinforcement.					
		<i>For Up To 50, Add</i>	2.16		
		<i>For >50 To 250, Add</i>	0.39		
		<i>For >1,000, Deduct</i>	-0.19		
		<i>For Exterior Installation (Galvanized Reinforcement), Add</i>	0.15		
09 32 00 00-0002	SF	1-1/4" Minimum Thickness Portland Cement Mortar Setting Bed	4.05		1.72
Note: For commercial floors. Includes 15# felt and wire reinforcement.					
		<i>For Up To 50, Add</i>	2.94		
		<i>For >50 To 250, Add</i>	0.51		
		<i>For >1,000, Deduct</i>	-0.26		
		<i>For Exterior Installation (Galvanized Reinforcement), Add</i>	0.15		
09 32 00 00-0003	SF	3/4" Portland Cement Plaster Scratch Coat for Walls	8.92		3.86
Note: Includes 15# felt and expanded metal lath.					
		<i>For Up To 50, Add</i>	8.01		
		<i>For >50 To 250, Add</i>	1.54		
		<i>For >1,000, Deduct</i>	-0.77		
		<i>For Exterior Installation (Galvanized Reinforcement), Add</i>	0.15		
		<i>For Installation Without Felt And Metal Lath, Deduct</i>	-1.74		
09 34		Waterproofing-Membrane Tiling <small>(09 30)</small>			
09 34 00 00-0001		Bonded Waterproofing System for Tiled Showers, Steam Showers, and Bathtub Surrounds <small>(09 34)</small>			
09 34 00 00-0002		Prefabricated Assemblies For Tiled Showers (Schluter® KERDI Shower ST) <small>(09 34 00 00-0001)</small>			
Note: For creating a watertight sloped shower assembly without a mortar bed. Includes a prefabricated polystyrene foam shower tray, 6" x 4-1/2" prefabricated polystyrene foam shower curb, waterproofing membrane for shower tray and surround, and center shower drain. Excludes tile, mortar, grout and shower accessories.					
09 34 00 00-0003	EA	48" x 48", Prefabricated Assembly For Tiled Showers (Schluter® KERDI Shower ST/SC)	747.60		
09 34 00 00-0004	EA	32" x 60", Prefabricated Assembly For Tiled Showers (Schluter® KERDI Shower ST/SC)	859.45		
09 34 00 00-0005	EA	72" x 72", Prefabricated Assembly For Tiled Showers (Schluter® KERDI Shower ST/SC)	1,262.79		
09 34 00 00-0006		Prefabricated Polystyrene Shower Curbs And Ramps <small>(09 34 00 00-0001)</small>			
Note: Prefabricated shower curbs and ramps for tiling over. Excludes tile.					
09 34 00 00-0007	EA	15-7/8" Width, 48" Length, Prefabricated Polystyrene Shower Ramp (Schluter® SR-122)	90.88		
09 34 00 00-0008	EA	4-1/2" Width, 6" Height, 48" Length, Prefabricated Polystyrene Shower Curb (Schluter® SC-122)	85.89		
09 34 00 00-0009		Prefabricated Polystyrene Shower Benches <small>(09 34 00 00-0001)</small>			
Note: Prefabricated shower bench for tiling over. Excludes tile.					
09 34 00 00-0010	EA	16" Width, 16" Depth, 20" Height, Triangular Prefabricated Polystyrene Shower Bench (Schluter® SB41)	178.67		
09 34 00 00-0011	EA	32" Width, 16" Depth, 20" Height, Rectangular Prefabricated Polystyrene Shower Bench (Schluter® SB4181)	355.37		
09 34 00 00-0012	EA	48" Width, 16" Depth, 20" Height, Rectangular Prefabricated Polystyrene Shower Bench (Schluter® SB41122)	437.83		
09 34 00 00-0013	EA	32" Width, 11-1/2" Depth, 20" Height, Rectangular Prefabricated Polystyrene Shower Bench (Schluter® SB2981)	320.03		
09 34 00 00-0014	EA	42" Width, 11-1/2" Depth, 20" Height, Rectangular Prefabricated Polystyrene Shower Bench (Schluter® SB29107)	355.37		
09 34 00 00-0015	EA	48" Width, 11-1/2" Depth, 20" Height, Rectangular Prefabricated Polystyrene Shower Bench (Schluter® SB29122)	378.93		
09 34 00 00-0016		Prefabricated Polystyrene Shower Tray <small>(09 34 00 00-0001)</small>			
Note: Prefabricated shower tray for tiling over. Excludes tile.					
09 34 00 00-0017	EA	32" x 60", Prefabricated Polystyrene Shower Tray (Schluter® ST-81/152)	155.67		
09 34 00 00-0018	EA	48" x 48", Prefabricated Polystyrene Shower Tray (Schluter® ST-122)	155.67		
09 34 00 00-0019	EA	72" x 72", Prefabricated Polystyrene Shower Tray (Schluter® ST-183)	238.13		
09 34 00 00-0020		Waterproofing, Uncoupling And Vapor Management Membranes (Schluter® DITRA) <small>(09 34 00 00-0001)</small>			
09 34 00 00-0021	SF	1/8" Thick, High-Density Polyethylene Membrane With Grid Structure And Underside Anchoring Fleece, Waterproofing, Uncoupling And Vapor Management Membrane (Schluter® DITRA)	2.77		
09 34 00 00-0022	SF	5/16" Thick, High-Density Polyethylene Membrane With Grid Structure And Underside Anchoring Fleece, Waterproofing, Uncoupling And Vapor Management Membrane (Schluter® DITRA-XL)	3.18		
09 34 00 00-0023		Bonded Waterproof Underlayment Membranes (Schluter® KERDI) <small>(09 34 00 00-0001)</small>			
09 34 00 00-0024	SF	0.008" Polyethylene Membrane With Polypropylene Fleece Laminated On Both Sides, Bonded Waterproof Underlayment Membrane (Schluter® KERDI 200/5M)	2.45		

09 35 Chemical-Resistant Tiling (09 30)

Note: Tile setting methods in this section are used with ceramic or quarry tile materials as applicable, for a complete installation.



Finishes	09	09
Tiling	09 30	
Chemical-Resistant Tiling	09 35	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 35 00 00-0001 SF Thin Set - Epoxy Mortar.....	3.23	0.84
Note: Impact and chemical resistant.		
For Up To 50, Add	1.78	
For >50 To 250, Add	0.26	
For >1,000, Deduct	-0.13	
09 39 Tiling Transitions And Accessories (09 30)		
09 39 00 00-0001 Tile Substrate (Schluter® KERDI BOARD) (09 39)		
09 39 00 00-0002 LF 1/2" Tile Substrate And Building Panel (Schluter® KERDI BOARD)	4.94	0.50
09 39 00 00-0003 LF 5/8" Tile Substrate And Building Panel (Schluter® KERDI BOARD)	5.56	0.57
09 39 00 00-0004 Floor Edge Protection And Transition Profiles For Tile (09 39)		
09 39 00 00-0005 LF 1/4" Height, Aluminum Edge Protection Trim For Tile (Schluter® SCHIENE).....	2.26	
09 39 00 00-0006 LF 5/16" Height, Aluminum Edge Protection Trim For Tile (Schluter® SCHIENE).....	2.32	
09 39 00 00-0007 LF 3/8" Height, Aluminum Edge Protection Trim For Tile (Schluter® SCHIENE).....	2.39	
09 39 00 00-0008 LF 1/2" Height, Aluminum Edge Protection Trim For Tile (Schluter® SCHIENE).....	2.50	
09 39 00 00-0009 LF 1/4" Height, Curved Aluminum Edge Protection Trim For Tile (Schluter® SCHIENE-RADIUS).....	2.93	
09 39 00 00-0010 LF 5/16" Height, Curved Aluminum Edge Protection Trim For Tile (Schluter® SCHIENE-RADIUS).....	3.02	
09 39 00 00-0011 LF 3/8" Height, Curved Aluminum Edge Protection Trim For Tile (Schluter® SCHIENE-RADIUS).....	3.08	
09 39 00 00-0012 LF 1/2" Height, Curved Aluminum Edge Protection Trim For Tile (Schluter® SCHIENE-RADIUS).....	3.14	
09 39 00 00-0013 LF 9/16" Height, Aluminum Transition Trim For Tile (Schluter® RENO-T)	2.36	
09 39 00 00-0014 LF 1" Height, Aluminum Transition Trim For Tile (Schluter® RENO-T)	3.14	
09 39 00 00-0015 LF 1/4" Height, Aluminum Transition Trim For Tile (Schluter® RENO-TK)	2.94	
09 39 00 00-0016 LF 5/16" Height, Aluminum Transition Trim For Tile (Schluter® RENO-TK)	3.08	
09 39 00 00-0017 LF 3/8" Height, Aluminum Transition Trim For Tile (Schluter® RENO-TK)	3.22	
09 39 00 00-0018 LF 1/2" Height, Aluminum Transition Trim For Tile (Schluter® RENO-TK)	3.85	
09 39 00 00-0019 LF 5/16" Height, Aluminum Transition Trim For Tile (Schluter® RENO-U)	3.04	
09 39 00 00-0020 LF 3/8" Height, Aluminum Transition Trim For Tile (Schluter® RENO-U)	3.18	
09 39 00 00-0021 LF 1/2" Height, Aluminum Transition Trim For Tile (Schluter® RENO-U).....	3.81	
09 39 00 00-0022 Outside Wall Edge Protection And Transition Profiles For Tile (09 39)		
09 39 00 00-0023 LF 1/4" Height, Aluminum Edge Protection Trim For Tile (Schluter® QUADDEC)	3.02	
09 39 00 00-0024 LF 5/16" Height, Aluminum Edge Protection Trim For Tile (Schluter® QUADDEC)	3.17	
09 39 00 00-0025 LF 3/8" Height, Aluminum Edge Protection Trim For Tile (Schluter® QUADDEC)	3.39	
09 39 00 00-0026 LF 1/2" Height, Aluminum Edge Protection Trim For Tile (Schluter® QUADDEC)	3.61	
09 39 00 00-0027 LF 1/4" Height, Aluminum Edge Protection Trim For Tile (Schluter® RONDEC)	3.32	
09 39 00 00-0028 LF 5/16" Height, Aluminum Edge Protection Trim For Tile (Schluter® RONDEC)	3.60	
09 39 00 00-0029 LF 3/8" Height, Aluminum Edge Protection Trim For Tile (Schluter® RONDEC)	3.88	
09 39 00 00-0030 LF 1/2" Height, Aluminum Edge Protection Trim For Tile (Schluter® RONDEC).....	4.37	
09 50 Ceilings (09)		
Note: Includes cutting for area around columns, speakers, sprinklers, diffusers, etc.		
09 51 Acoustical Ceilings (09 50)		
Note: Excludes suspension system. See CSI section 09 53 00 00-0000 for suspension systems.		
09 51 13 Acoustical Panel Ceilings (09 51)		
Note: Includes cutting around sprinkler heads, speakers, or other penetrations through the ceiling.		
09 51 13 00-0001 Fiberglass Panels (09 51 13)		
09 51 13 00-0002 Fiberglass Acoustical Panels (09 51 13 00-0001)		
09 51 13 00-0003 SF 2' x 2' x 5/8" Fiberglass Acoustical Ceiling Panel.....	1.60	0.36
For Recessed Edge, Add	0.35	
For Fire Rated Panels, Add	0.51	
For Up To 50, Add	0.57	
For >50 To 200, Add	0.32	
For >200 To 500, Add	0.12	
For >2,500 To 4,000, Deduct	-0.04	
For >4,000 To 5,000, Deduct	-0.06	
For >5,000, Deduct	-0.11	
For Individual Room Quantities <495, Add	0.16	
Note: For use with projects >500 SF		
For Acid Resistive, Add	2.50	
For Black Ceiling Tiles, Add	0.43	
For Ceilings >10' High, Add	0.06	
09 51 13 00-0004 SF 2' x 4' x 5/8" Fiberglass Acoustical Ceiling Panel.....	1.58	0.36
For Recessed Edge, Add	0.35	
For Fire Rated Panels, Add	0.51	
For Up To 50, Add	0.56	
For >50 To 200, Add	0.32	
For >200 To 500, Add	0.12	
For >2,500 To 4,000, Deduct	-0.04	
For >4,000 To 5,000, Deduct	-0.06	
For >5,000, Deduct	-0.11	
For Individual Room Quantities <495, Add	0.16	
Note: For use with projects >500 SF		
For Acid Resistive, Add	2.50	
For Black Ceiling Tiles, Add	0.43	
For Ceilings >10' High, Add	0.06	

09 Finishes**09 50 Ceilings****09 51 Acoustical Ceilings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 51 13 00-0005	SF		2' x 2' x 3/4" Fiberglass Acoustical Ceiling Panel.....	3.20	0.36
			For Recessed Edge, Add	0.35	
			For Fire Rated Panels, Add	0.51	
			For Up To 50, Add	0.81	
			For >50 To 200, Add	0.48	
			For >200 To 500, Add	0.20	
			For >2,500 To 4,000, Deduct	-0.07	
			For >4,000 To 5,000, Deduct	-0.11	
			For >5,000, Deduct	-0.18	
			For Individual Room Quantities <495, Add	0.24	
			Note: For use with projects >500 SF		
			For Acid Resistive, Add	2.50	
			For Black Ceiling Tiles, Add	1.31	
			For Ceilings >10' High, Add	0.06	
09 51 13 00-0006	SF		2' x 4' x 3/4" Fiberglass Acoustical Ceiling Panel.....	3.20	0.36
			For Recessed Edge, Add	0.35	
			For Fire Rated Panels, Add	0.51	
			For Up To 50, Add	0.81	
			For >50 To 200, Add	0.48	
			For >200 To 500, Add	0.20	
			For >2,500 To 4,000, Deduct	-0.07	
			For >4,000 To 5,000, Deduct	-0.11	
			For >5,000, Deduct	-0.18	
			For Individual Room Quantities <495, Add	0.24	
			Note: For use with projects >500 SF		
			For Acid Resistive, Add	2.50	
			For Black Ceiling Tiles, Add	1.31	
			For Ceilings >10' High, Add	0.06	
09 51 13 00-0007	SF		2' x 2' x 1" Fiberglass Acoustical Ceiling Panel.....	3.40	0.43
			For Recessed Edge, Add	0.35	
			For Fire Rated Panels, Add	0.51	
			For Up To 50, Add	0.84	
			For >50 To 200, Add	0.50	
			For >200 To 500, Add	0.21	
			For >2,500 To 4,000, Deduct	-0.07	
			For >4,000 To 5,000, Deduct	-0.12	
			For >5,000, Deduct	-0.19	
			For Individual Room Quantities <495, Add	0.25	
			Note: For use with projects >500 SF		
			For Acid Resistive, Add	2.50	
			For Ceilings >10' High, Add	0.06	
09 51 13 00-0008	SF		2' x 4' x 1" Fiberglass Acoustical Ceiling Panel.....	3.40	0.43
			For Recessed Edge, Add	0.35	
			For Fire Rated Panels, Add	0.51	
			For Up To 50, Add	0.84	
			For >50 To 200, Add	0.50	
			For >200 To 500, Add	0.21	
			For >2,500 To 4,000, Deduct	-0.07	
			For >4,000 To 5,000, Deduct	-0.12	
			For >5,000, Deduct	-0.19	
			For Individual Room Quantities <495, Add	0.25	
			Note: For use with projects >500 SF		
			For Acid Resistive, Add	2.50	
			For Ceilings >10' High, Add	0.06	
09 51 13 00-0009			Glass Cloth Faced Fiberglass Panels (09 51 13 00-0001)		
09 51 13 00-0010	SF		3/4" Thick Glass Cloth Faced Fiberglass Acoustical Ceiling Panels.....	2.69	0.43
			For Fire Rated Panels, Add	0.56	
			For Up To 50, Add	0.82	
			For >50 To 200, Add	0.48	
			For >200 To 500, Add	0.19	
			For >2,500 To 4,000, Deduct	-0.06	
			For >4,000 To 5,000, Deduct	-0.10	
			For >5,000, Deduct	-0.17	
			For Individual Room Quantities <495, Add	0.24	
			Note: For use with projects >500 SF		
			For Acid Resistive, Add	2.50	
			For Ceilings >10' High, Add	0.08	
09 51 13 00-0011	SF		1" Thick Glass Cloth Faced Fiberglass Acoustical Ceiling Panels.....	2.90	0.43
			For Fire Rated Panels, Add	0.56	
			For Up To 50, Add	0.85	
			For >50 To 200, Add	0.50	
			For >200 To 500, Add	0.20	
			For >2,500 To 4,000, Deduct	-0.06	
			For >4,000 To 5,000, Deduct	-0.11	
			For >5,000, Deduct	-0.18	
			For Individual Room Quantities <495, Add	0.25	
			Note: For use with projects >500 SF		
			For Acid Resistive, Add	2.50	
			For Ceilings >10' High, Add	0.08	



Finishes	09	09
Ceilings	09 50	
Acoustical Ceilings	09 51	

MINOR	TOTAL DIRECT	DEMOLITION
CSI UOM DESCRIPTION	UNIT COST	UNIT COST
09 51 13 00-0012 SF 1-1/2" Thick Glass Cloth Faced Fiberglass Acoustical Ceiling Panels.....	4.04	0.71
For Fire Rated Panels, Add	0.62	
For Up To 50, Add	1.15	
For >50 To 200, Add	0.67	
For >200 To 500, Add	0.27	
For >2,500 To 4,000, Deduct	-0.09	
For >4,000 To 5,000, Deduct	-0.15	
For >5,000, Deduct	-0.24	
For Individual Room Quantities <495, Add	0.34	
Note: For use with projects >500 SF		
For Acid Resistive, Add	2.50	
For Ceilings >10' High, Add	0.10	
09 51 13 00-0013 SF 2" Thick Glass Cloth Faced Fiberglass Acoustical Ceiling Panels.....	5.04	0.71
For Fire Rated Panels, Add	0.62	
For Up To 50, Add	1.30	
For >50 To 200, Add	0.77	
For >200 To 500, Add	0.32	
For >2,500 To 4,000, Deduct	-0.11	
For >4,000 To 5,000, Deduct	-0.18	
For >5,000, Deduct	-0.28	
For Individual Room Quantities <495, Add	0.39	
Note: For use with projects >500 SF		
For Acid Resistive, Add	2.50	
For Ceilings >10' High, Add	0.10	
09 51 13 00-0014 Mineral Fiber Panels (09 51 13)		
09 51 13 00-0015 Mineral Fiber Acoustical Ceiling Panels (09 51 13 00-0014)		
09 51 13 00-0016 SF 1' x 2' x 3/4" Mineral Fiber Acoustical Ceiling Panels.....	1.90	0.43
For Vinyl Faced Panels, Add	1.07	
For Fire Rated Panels, Add	0.53	
For Moisture Resistant Panels, Add	1.07	
For Up To 50, Add	0.65	
For >50 To 200, Add	0.37	
For >200 To 500, Add	0.14	
For >2,500 To 4,000, Deduct	-0.04	
For >4,000 To 5,000, Deduct	-0.08	
For >5,000, Deduct	-0.13	
For Individual Room Quantities <495, Add	0.19	
Note: For use with projects >500 SF		
For Acid Resistive, Add	2.50	
For Rough Texture, Add	0.13	
For Integrated Wood Trim, Add	7.59	
For Vertical Application, Add	0.41	
For Single Angled Tegular Edge (Reveal), Add	0.54	
For Ceilings >10' High, Add	0.07	
09 51 13 00-0017 SF 2' x 2' x 5/8" Mineral Fiber Acoustical Ceiling Panels.....	1.34	0.43
For Vinyl Faced Panels, Add	1.04	
For Fire Rated Panels, Add	0.51	
For Vinyl-Coated Aluminum Foil Surfaced, Add	1.39	
For Moisture Resistant Panels, Add	1.04	
For Up To 50, Add	0.53	
For >50 To 200, Add	0.30	
For >200 To 500, Add	0.11	
For >2,500 To 4,000, Deduct	-0.03	
For >4,000 To 5,000, Deduct	-0.06	
For >5,000, Deduct	-0.10	
For Individual Room Quantities <495, Add	0.15	
Note: For use with projects >500 SF		
For Acid Resistive, Add	2.50	
For Rough Texture, Add	0.07	
For Integrated Wood Trim, Add	7.54	
For Vertical Application, Add	0.37	
For Single Angled Tegular Edge (Reveal), Add	0.32	
For Black Ceiling Tiles, Add	0.29	
For Ceilings >10' High, Add	0.06	

09 Finishes**09 50 Ceilings****09 51 Acoustical Ceilings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 51 13 00-0018	SF		2' x 2' x 3/4" Mineral Fiber Acoustical Ceiling Panels.....	1.97	0.43
			<i>For Premium Grade (Eclipse Or Cirrus, With Minimum .70 NRC) Ceiling Tile, Add</i>	0.29	
			<i>For Vinyl Faced Panels, Add</i>	1.04	
			<i>For Fire Rated Panels, Add</i>	0.51	
			<i>For Moisture Resistant Panels, Add</i>	1.04	
			<i>For Up To 50, Add</i>	0.62	
			<i>For >50 To 200, Add</i>	0.36	
			<i>For >200 To 500, Add</i>	0.14	
			<i>For >2,500 To 4,000, Deduct</i>	-0.04	
			<i>For >4,000 To 5,000, Deduct</i>	-0.08	
			<i>For >5,000, Deduct</i>	-0.13	
			<i>For Individual Room Quantities <495, Add</i>	0.18	
			<i>Note: For use with projects >500 SF</i>		
			<i>For Integrated Wood Trim, Add</i>	7.79	
			<i>For Acid Resistive, Add</i>	2.50	
			<i>For Rough Texture, Add</i>	0.14	
			<i>For Vertical Application, Add</i>	0.37	
			<i>For Single Angled Tegular Edge (Reveal), Add</i>	0.60	
			<i>For Scored Acoustical Tile, Add</i>	0.25	
			<i>For Black Ceiling Tiles, Add</i>	0.63	
			<i>For Ceilings >10' High, Add</i>	0.06	
09 51 13 00-0019	SF		2' x 4' x 5/8" Mineral Fiber Acoustical Ceiling Panels.....	1.32	0.43
			<i>For Vinyl Faced Panels, Add</i>	1.03	
			<i>For Fire Rated Panels, Add</i>	0.51	
			<i>For Vinyl-Coated Aluminum Foil Surfaced, Add</i>	1.39	
			<i>For Moisture Resistant Panels, Add</i>	1.03	
			<i>For Up To 50, Add</i>	0.52	
			<i>For >50 To 200, Add</i>	0.29	
			<i>For >200 To 500, Add</i>	0.11	
			<i>For >2,500 To 4,000, Deduct</i>	-0.03	
			<i>For >4,000 To 5,000, Deduct</i>	-0.06	
			<i>For >5,000, Deduct</i>	-0.10	
			<i>For Individual Room Quantities <495, Add</i>	0.15	
			<i>Note: For use with projects >500 SF</i>		
			<i>For Integrated Wood Trim, Add</i>	9.03	
			<i>For Acid Resistive, Add</i>	2.50	
			<i>For Rough Texture, Add</i>	0.07	
			<i>For Vertical Application, Add</i>	0.36	
			<i>For Single Angled Tegular Edge (Reveal), Add</i>	0.31	
			<i>For Black Ceiling Tiles, Add</i>	0.29	
			<i>For Ceilings >10' High, Add</i>	0.06	
09 51 13 00-0020	SF		2' x 4' x 3/4" Mineral Fiber Acoustical Ceiling Panels.....	1.95	0.43
			<i>For Premium Grade (Eclipse Or Cirrus, With Minimum .70 NRC) Ceiling Tile, Add</i>	0.29	
			<i>For Vinyl Faced Panels, Add</i>	1.03	
			<i>For Fire Rated Panels, Add</i>	0.51	
			<i>For Moisture Resistant Panels, Add</i>	1.03	
			<i>For Up To 50, Add</i>	0.61	
			<i>For >50 To 200, Add</i>	0.36	
			<i>For >200 To 500, Add</i>	0.14	
			<i>For >2,500 To 4,000, Deduct</i>	-0.04	
			<i>For >4,000 To 5,000, Deduct</i>	-0.07	
			<i>For >5,000, Deduct</i>	-0.13	
			<i>For Individual Room Quantities <495, Add</i>	0.18	
			<i>Note: For use with projects >500 SF</i>		
			<i>For Integrated Wood Trim, Add</i>	9.28	
			<i>For Acid Resistive, Add</i>	2.50	
			<i>For Rough Texture, Add</i>	0.14	
			<i>For Vertical Application, Add</i>	0.36	
			<i>For Single Angled Tegular Edge (Reveal), Add</i>	0.60	
			<i>For Scored Acoustical Tile, Add</i>	0.25	
			<i>For Black Ceiling Tiles, Add</i>	0.63	
			<i>For Ceilings >10' High, Add</i>	0.06	
09 51 13 00-0021	SF		2' x 5' x 5/8" Mineral Fiber Acoustical Ceiling Panels.....	1.31	0.43
			<i>For Vinyl Faced Panels, Add</i>	1.03	
			<i>For Fire Rated Panels, Add</i>	0.51	
			<i>For Moisture Resistant Panels, Add</i>	1.03	
			<i>For Up To 50, Add</i>	0.51	
			<i>For >50 To 200, Add</i>	0.29	
			<i>For >200 To 500, Add</i>	0.11	
			<i>For >2,500 To 4,000, Deduct</i>	-0.03	
			<i>For >4,000 To 5,000, Deduct</i>	-0.06	
			<i>For >5,000, Deduct</i>	-0.10	
			<i>For Individual Room Quantities <495, Add</i>	0.14	
			<i>Note: For use with projects >500 SF</i>		
			<i>For Integrated Wood Trim, Add</i>	9.27	
			<i>For Acid Resistive, Add</i>	2.50	
			<i>For Rough Texture, Add</i>	0.07	
			<i>For Vertical Application, Add</i>	0.36	
			<i>For Single Angled Tegular Edge (Reveal), Add</i>	0.31	
			<i>For Ceilings >10' High, Add</i>	0.06	

09 51 13 00-0022 Wood Fiber Panels (09 51 13)



Finishes	09	09
Ceilings	09 50	
Acoustical Ceilings	09 51	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 51	13 00-0023	SF	2' x 2' x 1/2" Wood Fiber Acoustical Ceiling Panels.....	2.52	0.57
			<i>For Up To 50, Add</i>	0.89	
			<i>For >50 To 200, Add</i>	0.51	
			<i>For >200 To 500, Add</i>	0.19	
			<i>For >2,500 To 4,000, Deduct</i>	-0.06	
			<i>For >4,000 To 5,000, Deduct</i>	-0.10	
			<i>For >5,000, Deduct</i>	-0.18	
			<i>For Individual Room Quantities <495, Add</i>	0.25	
			<i>Note: For use with projects >500 SF</i>		
			<i>For Flameproofing, Add</i>	0.05	
			<i>For Sculptured, 3 Dimensional, Add</i>	0.10	
			<i>For Ceilings >10' High, Add</i>	0.10	
09 51	13 00-0024	SF	2' x 4' x 1/2" Wood Fiber Acoustical Ceiling Panels.....	2.39	0.50
			<i>For Up To 50, Add</i>	0.82	
			<i>For >50 To 200, Add</i>	0.47	
			<i>For >200 To 500, Add</i>	0.18	
			<i>For >2,500 To 4,000, Deduct</i>	-0.05	
			<i>For >4,000 To 5,000, Deduct</i>	-0.09	
			<i>For >5,000, Deduct</i>	-0.16	
			<i>For Individual Room Quantities <495, Add</i>	0.23	
			<i>Note: For use with projects >500 SF</i>		
			<i>For Flameproofing, Add</i>	0.05	
			<i>For Sculptured, 3 Dimensional, Add</i>	0.10	
			<i>For Ceilings >10' High, Add</i>	0.09	
09 51	13 00-0025	SF	2' x 2' x 5/8" Wood Fiber Acoustical Ceiling Panels.....	3.08	0.57
			<i>For Up To 50, Add</i>	0.97	
			<i>For >50 To 200, Add</i>	0.56	
			<i>For >200 To 500, Add</i>	0.22	
			<i>For >2,500 To 4,000, Deduct</i>	-0.07	
			<i>For >4,000 To 5,000, Deduct</i>	-0.12	
			<i>For >5,000, Deduct</i>	-0.20	
			<i>For Individual Room Quantities <495, Add</i>	0.28	
			<i>Note: For use with projects >500 SF</i>		
			<i>For Flameproofing, Add</i>	0.05	
			<i>For Sculptured, 3 Dimensional, Add</i>	0.10	
			<i>For Ceilings >10' High, Add</i>	0.10	
09 51	13 00-0026	SF	2' x 4' x 5/8" Wood Fiber Acoustical Ceiling Panels.....	2.95	0.50
			<i>For Up To 50, Add</i>	0.90	
			<i>For >50 To 200, Add</i>	0.53	
			<i>For >200 To 500, Add</i>	0.21	
			<i>For >2,500 To 4,000, Deduct</i>	-0.06	
			<i>For >4,000 To 5,000, Deduct</i>	-0.11	
			<i>For >5,000, Deduct</i>	-0.19	
			<i>For Individual Room Quantities <495, Add</i>	0.26	
			<i>Note: For use with projects >500 SF</i>		
			<i>For Flameproofing, Add</i>	0.05	
			<i>For Sculptured, 3 Dimensional, Add</i>	0.10	
			<i>For Ceilings >10' High, Add</i>	0.09	
09 51	13 00-0027	SF	2' x 2' x 3/4" Wood Fiber Acoustical Ceiling Panels.....	3.62	0.57
			<i>For Up To 50, Add</i>	1.06	
			<i>For >50 To 200, Add</i>	0.62	
			<i>For >200 To 500, Add</i>	0.25	
			<i>For >2,500 To 4,000, Deduct</i>	-0.08	
			<i>For >4,000 To 5,000, Deduct</i>	-0.13	
			<i>For >5,000, Deduct</i>	-0.22	
			<i>For Individual Room Quantities <495, Add</i>	0.31	
			<i>Note: For use with projects >500 SF</i>		
			<i>For Flameproofing, Add</i>	0.05	
			<i>For Sculptured, 3 Dimensional, Add</i>	0.10	
			<i>For Ceilings >10' High, Add</i>	0.10	
09 51	13 00-0028	SF	2' x 4' x 3/4" Wood Fiber Acoustical Ceiling Panels.....	3.49	0.50
			<i>For Up To 50, Add</i>	0.98	
			<i>For >50 To 200, Add</i>	0.58	
			<i>For >200 To 500, Add</i>	0.23	
			<i>For >2,500 To 4,000, Deduct</i>	-0.08	
			<i>For >4,000 To 5,000, Deduct</i>	-0.13	
			<i>For >5,000, Deduct</i>	-0.21	
			<i>For Individual Room Quantities <495, Add</i>	0.29	
			<i>Note: For use with projects >500 SF</i>		
			<i>For Flameproofing, Add</i>	0.05	
			<i>For Sculptured, 3 Dimensional, Add</i>	0.10	
			<i>For Ceilings >10' High, Add</i>	0.09	
09 51	13 00-0029	SF	2' x 2' x 1" Wood Fiber Acoustical Ceiling Panels.....	2.85	0.57
			<i>For Up To 50, Add</i>	0.94	
			<i>For >50 To 200, Add</i>	0.54	
			<i>For >200 To 500, Add</i>	0.21	
			<i>For >2,500 To 4,000, Deduct</i>	-0.06	
			<i>For >4,000 To 5,000, Deduct</i>	-0.11	
			<i>For >5,000, Deduct</i>	-0.19	
			<i>For Individual Room Quantities <495, Add</i>	0.27	
			<i>Note: For use with projects >500 SF</i>		
			<i>For Flameproofing, Add</i>	0.05	
			<i>For Sculptured, 3 Dimensional, Add</i>	0.10	
			<i>For Ceilings >10' High, Add</i>	0.10	

09 Finishes**09 50 Ceilings****09 51 Acoustical Ceilings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 51 13 00-0030	SF		2' x 4' x 1" Wood Fiber Acoustical Ceiling Panels.....	2.72	0.50
			<i>For Up To 50, Add</i>	0.87	
			<i>For >50 To 200, Add</i>	0.50	
			<i>For >200 To 500, Add</i>	0.19	
			<i>For >2,500 To 4,000, Deduct</i>	-0.06	
			<i>For >4,000 To 5,000, Deduct</i>	-0.10	
			<i>For >5,000, Deduct</i>	-0.18	
			<i>For Individual Room Quantities <495, Add</i>	0.25	
			<i>Note: For use with projects >500 SF</i>		
			<i>For Flameproofing, Add</i>	0.05	
			<i>For Sculptured, 3 Dimensional, Add</i>	0.10	
			<i>For Ceilings >10' High, Add</i>	0.09	
09 51 13 00-0031			Removal And Reinstallation Of Acoustical Ceiling Panels (09 51 13)		
			<i>Note: 2'x2' Or 2'x4'. Includes storage and cleaning.</i>		
09 51 13 00-0032	SF		Remove And Reinstall Acoustical Ceiling Tile And Grid, 2' x 2' Or 2' x 4'	1.06	
			<i>For Ceilings >10' High, Add</i>	0.08	
09 51 13 00-0033	SF		Remove And Reinstall Acoustical Panels Only	0.69	
			<i>For Ceilings >10' High, Add</i>	0.05	
09 51 13 00-0034	SF		Remove And Reinstall Grid System Only	0.64	
			<i>For Ceilings >10' High, Add</i>	0.05	
09 51 23			Acoustical Tile Ceilings (09 51)		
			<i>Note: Includes fastening with staples and/or adhesive.</i>		
09 51 23 00-0001			Mineral Fiber Acoustical Tile Ceilings (09 51 23)		
09 51 23 00-0002	SF		12" x 12" x 1/2" Tongue And Groove Mineral Fiber Acoustical Ceiling Tile.....	3.40	0.79
			<i>For Furring 1 x 3 Strips 12" On Center, Add</i>	0.50	
			<i>For Up To 50, Add</i>	1.23	
			<i>For >50 To 200, Add</i>	0.70	
			<i>For >200 To 500, Add</i>	0.26	
			<i>For >2,500, Deduct</i>	-0.17	
			<i>For Ceilings >10' High, Add</i>	0.13	
09 51 23 00-0003	SF		12" x 12" x 5/8" Spline Mineral Fiber Acoustical Ceiling Tile.....	4.00	0.79
			<i>For Furring 1 x 3 Strips 12" On Center, Add</i>	0.50	
			<i>For Up To 50, Add</i>	1.32	
			<i>For >50 To 200, Add</i>	0.76	
			<i>For >200 To 500, Add</i>	0.29	
			<i>For >2,500, Deduct</i>	-0.20	
			<i>For Placing Tiles In Suspended Ceiling System, Deduct</i>	-0.24	
			<i>For Ceilings >10' High, Add</i>	0.13	
09 51 23 00-0004	SF		12" x 12" x 3/4" Spline Mineral Fiber Acoustical Ceiling Tile.....	4.48	0.79
			<i>For Furring 1 x 3 Strips 12" On Center, Add</i>	0.50	
			<i>For Up To 50, Add</i>	1.39	
			<i>For >50 To 200, Add</i>	0.81	
			<i>For >200 To 500, Add</i>	0.31	
			<i>For >2,500, Deduct</i>	-0.22	
			<i>For Placing Tiles In Suspended Ceiling System, Deduct</i>	-0.24	
			<i>For Ceilings >10' High, Add</i>	0.13	
09 51 23 00-0005			Wood Fiber Acoustical Tile Ceilings (09 51 23)		
09 51 23 00-0006	SF		12" x 12" x 1/2" Staple Flange Wood Fiber Acoustical Ceiling Tile.....	3.14	0.79
			<i>For Furring 1 x 3 Strips 12" On Center, Add</i>	0.50	
			<i>For Up To 50, Add</i>	1.19	
			<i>For >50 To 200, Add</i>	0.67	
			<i>For >200 To 500, Add</i>	0.25	
			<i>For >2,500, Deduct</i>	-0.16	
			<i>For Ceilings >10' High, Add</i>	0.13	
09 51 33			Acoustical Metal Pan Ceilings (09 51)		
09 51 33 13			Acoustical Snap-in Metal Pan Ceilings (09 51 33)		
09 51 33 13-0001			Metal Pan Units, 24 GA Steel (09 51 33 13)		
			<i>Note: Excludes pads.</i>		
09 51 33 13-0002	SF		12" x 12" - 24 Gauge, Acoustical Metal Pan Units	14.21	0.94
			<i>For Up To 50, Add</i>	2.95	
			<i>For >50 To 200, Add</i>	1.83	
			<i>For >200 To 500, Add</i>	0.81	
			<i>For >2,500, Deduct</i>	-0.71	
			<i>For Ceilings >10' High, Add</i>	0.15	
09 51 33 13-0003	SF		12" x 24" - 24 Gauge, Acoustical Metal Pan Units	15.09	0.94
			<i>For Up To 50, Add</i>	3.08	
			<i>For >50 To 200, Add</i>	1.92	
			<i>For >200 To 500, Add</i>	0.86	
			<i>For >2,500, Deduct</i>	-0.75	
			<i>For Ceilings >10' High, Add</i>	0.15	



Finishes	09	09
Ceilings	09 50	
Acoustical Ceilings	09 51	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 51 33 13-0004	SF		12" x 12" - 0.025" Thick, Acoustical Aluminum Pan <i>For Up To 50, Add</i> <i>For >50 To 200, Add</i> <i>For >200 To 500, Add</i> <i>For >2,500, Deduct</i> <i>For Ceilings >10' High, Add</i>	9.11 2.19 1.32 0.56 -0.46 0.15	0.94
09 51 33 13-0005	SF		12" x 24" - 0.025" Thick, Acoustical Aluminum Pan <i>For Up To 50, Add</i> <i>For >50 To 200, Add</i> <i>For >200 To 500, Add</i> <i>For >2,500, Deduct</i> <i>For Ceilings >10' High, Add</i>	9.84 2.30 1.39 0.59 -0.49 0.15	0.94
09 51 33 13-0006	SF		12" x 12" - 0.025" Thick, Acoustical Anodized Aluminum Pan Units <i>For Up To 50, Add</i> <i>For >50 To 200, Add</i> <i>For >200 To 500, Add</i> <i>For >2,500, Deduct</i> <i>For Ceilings >10' High, Add</i>	13.38 2.83 1.75 0.77 -0.67 0.15	0.94
09 51 33 13-0007	SF		12" x 24" - 0.025" Thick, Acoustical Anodized Aluminum Pan Units <i>For Up To 50, Add</i> <i>For >50 To 200, Add</i> <i>For >200 To 500, Add</i> <i>For >2,500, Deduct</i> <i>For Ceilings >10' High, Add</i>	9.66 2.27 1.38 0.59 -0.48 0.15	0.94
09 51 33 13-0008	SF		12" x 12" - 24 Gauge, Stainless Steel Acoustical Pan Units <i>For Up To 50, Add</i> <i>For >50 To 200, Add</i> <i>For >200 To 500, Add</i> <i>For >2,500, Deduct</i> <i>For Ceilings >10' High, Add</i>	34.21 5.95 3.83 1.81 -1.71 0.15	0.94
09 51 33 13-0009	SF		12" x 24" - 24 Gauge, Stainless Steel Acoustical Pan Units <i>For Up To 50, Add</i> <i>For >50 To 200, Add</i> <i>For >200 To 500, Add</i> <i>For >2,500, Deduct</i> <i>For Ceilings >10' High, Add</i>	19.19 3.70 2.33 1.06 -0.96 0.15	0.94
09 51 33 13-0010	Galvanized Steel, Acoustical Snap-In Metal Ceiling Panels <small>(09 51 33 13)</small>				
09 51 33 13-0011	SF		24" x 24", Unperforated, Tamper-Resistant, 18 Gauge, Galvanized Steel, Acoustical Lay-In Metal Ceiling Panel (Armstrong MetalWorks™ SecureLock™)	11.82	0.62
09 51 33 13-0012	SF		24" x 24", Perforated, Tamper-Resistant, 18 Gauge, Galvanized Steel, Acoustical Lay-In Metal Ceiling Panel (Armstrong MetalWorks™ SecureLock™)	12.64	0.62
09 51 33 13-0013	Aluminum, Acoustical Snap-In Metal Ceiling Panels <small>(09 51 33 13)</small>				
09 51 33 13-0014	SF		24" x 24", Unperforated, 0.040" Thick, Painted Aluminum, Acoustical Snap-In Metal Ceiling Panel (Armstrong MetalWorks™)	8.87	0.71
09 51 33 13-0015	SF		24" x 24", Unperforated, 0.040" Thick, Metallic Painted Aluminum, Acoustical Snap-In Metal Ceiling Panel (Armstrong MetalWorks™)	14.94	0.71
09 51 33 13-0016	SF		24" x 24", Unperforated, 0.040" Thick, Wood Tone Painted Aluminum, Acoustical Snap-In Metal Ceiling Panel (Armstrong MetalWorks™)	29.09	0.71
09 51 33 13-0017	SF		24" x 24", Unperforated, 0.040" Thick, Anodized Aluminum, Acoustical Snap-In Metal Ceiling Panel (Armstrong MetalWorks™)	13.26	0.71
09 51 33 13-0018	SF		24" x 24", Perforated, 0.040" Thick, Painted Aluminum, Acoustical Snap-In Metal Ceiling Panel (Armstrong MetalWorks™)	9.36	0.71
09 51 33 13-0019	SF		24" x 24", Perforated, 0.040" Thick, Metallic Painted Aluminum, Acoustical Snap-In Metal Ceiling Panel (Armstrong MetalWorks™)	14.56	0.71
09 51 33 13-0020	SF		24" x 24", Perforated, 0.040" Thick, Wood Tone Painted Aluminum, Acoustical Snap-In Metal Ceiling Panel (Armstrong MetalWorks™)	28.88	0.71
09 51 33 13-0021	SF		24" x 24", Perforated, 0.040" Thick, Anodized Aluminum, Acoustical Snap-In Metal Ceiling Panel (Armstrong MetalWorks™)	13.15	0.71
09 51 33 13-0022	SF		30" x 30", Unperforated, 0.040" Thick, Painted Aluminum, Acoustical Snap-In Metal Ceiling Panel (Armstrong MetalWorks™)	12.01	0.71
09 51 33 13-0023	SF		30" x 30", Unperforated, 0.040" Thick, Metallic Painted Aluminum, Acoustical Snap-In Metal Ceiling Panel (Armstrong MetalWorks™)	15.75	0.71
09 51 33 13-0024	SF		30" x 30", Unperforated, 0.040" Thick, Wood Tone Painted Aluminum, Acoustical Snap-In Metal Ceiling Panel (Armstrong MetalWorks™)	32.08	0.71
09 51 33 13-0025	SF		30" x 30", Unperforated, 0.040" Thick, Anodized Aluminum, Acoustical Snap-In Metal Ceiling Panel (Armstrong MetalWorks™)	15.59	0.71
09 51 33 13-0026	SF		30" x 30", Perforated, 0.040" Thick, Painted Aluminum, Acoustical Snap-In Metal Ceiling Panel (Armstrong MetalWorks™)	12.72	0.71
09 51 33 13-0027	SF		30" x 30", Perforated, 0.040" Thick, Metallic Painted Aluminum, Acoustical Snap-In Metal Ceiling Panel (Armstrong MetalWorks™)	16.13	0.71
09 51 33 13-0028	SF		30" x 30", Perforated, 0.040" Thick, Wood Tone Painted Aluminum, Acoustical Snap-In Metal Ceiling Panel (Armstrong MetalWorks™)	33.16	0.71
09 51 33 13-0029	SF		30" x 30", Perforated, 0.040" Thick, Anodized Aluminum, Acoustical Snap-In Metal Ceiling Panel (Armstrong MetalWorks™)	15.97	0.71
09 51 33 13-0030	SF		12" x 48", Unperforated, 0.040" Thick, Painted Aluminum, Acoustical Snap-In Metal Ceiling Panel (Armstrong MetalWorks™)	10.87	0.71
09 51 33 13-0031	SF		12" x 48", Unperforated, 0.040" Thick, Metallic Painted Aluminum, Acoustical Snap-In Metal Ceiling Panel (Armstrong MetalWorks™)	17.71	0.71
09 51 33 13-0032	SF		12" x 48", Unperforated, 0.040" Thick, Wood Tone Painted Aluminum, Acoustical Snap-In Metal Ceiling Panel (Armstrong MetalWorks™)	31.37	0.71

09 Finishes**09 50 Ceilings****09 51 Acoustical Ceilings**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 51 33 13-0033 SF 12" x 48", Unperforated, 0.040" Thick, Anodized Aluminum, Acoustical Snap-In Metal Ceiling Panel (Armstrong MetalWorks™)	15.21	0.71
09 51 33 13-0034 SF 12" x 48", Perforated, 0.040" Thick, Painted Aluminum, Acoustical Snap-In Metal Ceiling Panel (Armstrong MetalWorks™)	11.69	0.71
09 51 33 13-0035 SF 12" x 48", Perforated, 0.040" Thick, Metallic Painted Aluminum, Acoustical Snap-In Metal Ceiling Panel (Armstrong MetalWorks™)	17.92	0.71
09 51 33 13-0036 SF 12" x 48", Perforated, 0.040" Thick, Wood Tone Painted Aluminum, Acoustical Snap-In Metal Ceiling Panel (Armstrong MetalWorks™)	32.51	0.71
09 51 33 13-0037 SF 12" x 48", Perforated, 0.040" Thick, Anodized Aluminum, Acoustical Snap-In Metal Ceiling Panel (Armstrong MetalWorks™)	15.70	0.71
09 51 33 13-0038 SF 24" x 48", Unperforated, 0.040" Thick, Painted Aluminum, Acoustical Snap-In Metal Ceiling Panel (Armstrong MetalWorks™)	8.64	0.71
09 51 33 13-0039 SF 24" x 48", Unperforated, 0.040" Thick, Metallic Painted Aluminum, Acoustical Snap-In Metal Ceiling Panel (Armstrong MetalWorks™)	13.20	0.71
09 51 33 13-0040 SF 24" x 48", Unperforated, 0.040" Thick, Wood Tone Painted Aluminum, Acoustical Snap-In Metal Ceiling Panel (Armstrong MetalWorks™)	27.29	0.71
09 51 33 13-0041 SF 24" x 48", Unperforated, 0.040" Thick, Anodized Aluminum, Acoustical Snap-In Metal Ceiling Panel (Armstrong MetalWorks™)	12.54	0.71
09 51 33 13-0042 SF 24" x 48", Perforated, 0.040" Thick, Painted Aluminum, Acoustical Snap-In Metal Ceiling Panel (Armstrong MetalWorks™)	9.18	0.71
09 51 33 13-0043 SF 24" x 48", Perforated, 0.040" Thick, Metallic Painted Aluminum, Acoustical Snap-In Metal Ceiling Panel (Armstrong MetalWorks™)	13.09	0.71
09 51 33 13-0044 SF 24" x 48", Perforated, 0.040" Thick, Wood Tone Painted Aluminum, Acoustical Snap-In Metal Ceiling Panel (Armstrong MetalWorks™)	27.35	0.71
09 51 33 13-0045 SF 24" x 48", Perforated, 0.040" Thick, Anodized Aluminum, Acoustical Snap-In Metal Ceiling Panel (Armstrong MetalWorks™)	12.54	0.71
09 51 33 23 Acoustical Lay-in Metal Pan Ceilings (09 51 33)		
09 51 33 23-0001 Acoustical Lay-In Metal Pan Ceilings (09 51 33 23)		
09 51 33 23-0002 Aluminum, Acoustical Lay-In Metal Ceiling Panels (09 51 33 23-0001)		
09 51 33 23-0003 SF 24" x 24", Unperforated, Painted Aluminum, Acoustical Lay-In Metal Ceiling Panel (USG Panz™)	9.21	0.54
09 51 33 23-0004 SF 24" x 24", Unperforated, Metallic Aluminum, Acoustical Lay-In Metal Ceiling Panel (USG Panz™)	10.43	0.54
09 51 33 23-0005 SF 24" x 24", Unperforated, Wood Tone Aluminum, Acoustical Lay-In Metal Ceiling Panel (USG Panz™)	15.31	0.54
09 51 33 23-0006 SF 24" x 24", Perforated, Painted Aluminum, Acoustical Lay-In Metal Ceiling Panel (USG Panz™)	13.01	0.54
09 51 33 23-0007 SF 24" x 24", Perforated, Metallic Aluminum, Acoustical Lay-In Metal Ceiling Panel (USG Panz™)	13.96	0.54
09 51 33 23-0008 SF 24" x 24", Perforated, Wood Tone Aluminum, Acoustical Lay-In Metal Ceiling Panel (USG Panz™)	21.96	0.54
09 51 33 23-0009 SF 30" x 30", Unperforated, Painted Aluminum, Acoustical Lay-In Metal Ceiling Panel (USG Panz™)	13.75	0.54
09 51 33 23-0010 SF 30" x 30", Perforated, Painted Aluminum, Acoustical Lay-In Metal Ceiling Panel (USG Panz™)	17.04	0.54
09 51 33 23-0011 SF 48" x 48", Unperforated, Painted Aluminum, Acoustical Lay-In Metal Ceiling Panel (USG Panz™)	13.82	0.54
09 51 33 23-0012 SF 48" x 48", Perforated, Painted Aluminum, Acoustical Lay-In Metal Ceiling Panel (USG Panz™)	17.14	0.54
09 51 33 23-0013 SF 12" x 48", Unperforated, Painted Aluminum, Acoustical Lay-In Metal Ceiling Panel (USG Panz™)	13.89	0.54
09 51 33 23-0014 SF 12" x 48", Perforated, Painted Aluminum, Acoustical Lay-In Metal Ceiling Panel (USG Panz™)	17.08	0.54
09 51 33 23-0015 SF 24" x 48", Unperforated, Painted Aluminum, Acoustical Lay-In Metal Ceiling Panel (USG Panz™)	13.89	0.54
09 51 33 23-0016 SF 24" x 48", Perforated, Painted Aluminum, Acoustical Lay-In Metal Ceiling Panel (USG Panz™)	17.21	0.54
09 51 33 23-0017 Steel, Acoustical Lay-In Metal Ceiling Panels (09 51 33 23-0001)		
09 51 33 23-0018 SF 24" x 24", Unperforated, 0.021" Thick, Painted Steel, Acoustical Lay-In Metal Ceiling Panel (Armstrong MetalWorks™ Vector®)	11.88	0.54
09 51 33 23-0019 SF 24" x 24", Unperforated, 0.021" Thick, Metallic Painted Steel, Acoustical Lay-In Metal Ceiling Panel (Armstrong MetalWorks™ Vector®)	14.16	0.54
09 51 33 23-0020 SF 24" x 24", Unperforated, 0.021" Thick, Wood Tone Painted Steel, Acoustical Lay-In Metal Ceiling Panel (Armstrong MetalWorks™ Vector®)	15.19	0.54
09 51 33 23-0021 SF 24" x 24", Perforated, 0.021" Thick, Painted Steel, Acoustical Lay-In Metal Ceiling Panel (Armstrong MetalWorks™ Vector®)	14.27	0.54
09 51 33 23-0022 SF 24" x 24", Perforated, 0.021" Thick, Metallic Painted Steel, Acoustical Lay-In Metal Ceiling Panel (Armstrong MetalWorks™ Vector®)	14.65	0.54
09 51 33 23-0023 SF 24" x 24", Perforated, 0.021" Thick, Wood Tone Painted Steel, Acoustical Lay-In Metal Ceiling Panel (Armstrong MetalWorks™ Vector®)	15.51	0.54
09 51 33 33 Acoustical Tegular Lay-in Metal Pan Ceilings (09 51 33)		
09 51 33 33-0001 Acoustical Tegular Lay-In Metal Pan Ceilings (09 51 33 33)		
09 51 33 33-0002 Steel, Acoustical Tegular Lay-In Metal Pan Ceilings (09 51 33 33-0001)		
09 51 33 33-0003 SF 24" x 24", Unperforated, 0.021" Thick, Painted Steel, Acoustical Tegular Lay-In Metal Ceiling Panel (Armstrong MetalWorks™)	8.68	0.54
09 51 33 33-0004 SF 24" x 24", Unperforated, 0.021" Thick, Metallic Painted Steel, Acoustical Tegular Lay-In Metal Ceiling Panel (Armstrong MetalWorks™)	9.77	0.54
09 51 33 33-0005 SF 24" x 24", Unperforated, 0.021" Thick, Wood Tone Painted Steel, Acoustical Tegular Lay-In Metal Ceiling Panel (Armstrong MetalWorks™)	13.78	0.54
09 51 33 33-0006 SF 24" x 24", Perforated, 0.021" Thick, Painted Steel, Acoustical Tegular Lay-In Metal Ceiling Panel (Armstrong MetalWorks™)	9.87	0.54
09 51 33 33-0007 SF 24" x 24", Perforated, 0.021" Thick, Metallic Painted Steel, Acoustical Tegular Lay-In Metal Ceiling Panel (Armstrong MetalWorks™)	11.18	0.54
09 51 33 33-0008 SF 24" x 24", Perforated, 0.021" Thick, Wood Tone Painted Steel, Acoustical Tegular Lay-In Metal Ceiling Panel (Armstrong MetalWorks™)	15.03	0.54



Finishes	09	09
Ceilings	09 50	
Acoustical Ceiling Suspension Assemblies	09 53	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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09 53 Acoustical Ceiling Suspension Assemblies (09 50)

09 53 23 Metal Acoustical Ceiling Suspension Assemblies (09 53)

09 53 23 00-0001 Ceiling Suspension Systems (09 53 23)

Note: Hot-dipped galvanized steel. Includes single 8 gauge wire hangers (between 3' To 4') attached from structural steel, wood or metal deck, wood members or concrete deck above to main members 4' on center. Includes all main tees, cross tees, wall angle, wall anchors, connector clips, hold down clips, double faced tape (where required). All above shall be mechanically installed by minimum 2-1/4" x 3/8" wedge anchors. Excludes chain supports for lights.

09 53 23 00-0002	SF 12" x 12" Ceiling Tile Size, Concealed 15/16" T Bar Ceiling Suspension System	3.42	0.36
	Note: Excludes ceiling tile.		
	For Vertical Application, Add	1.93	
	For Individual Room Quantities <495, Add	0.39	
	Note: For use with projects >500 SF		
	For Compression Struts With Splay Wires, Add	0.39	
	For Up To 50, Add	1.39	
	For >50 To 200, Add	0.78	
	For >200 To 500, Add	0.28	
	For >2,500 To 4,000, Deduct	-0.08	
	For >4,000 To 5,000, Deduct	-0.15	
	For >5,000, Deduct	-0.21	
	For Ceilings >10' High, Add	0.17	
09 53 23 00-0003	SF 1' x 2' Grid, 15/16" T Bar Ceiling Suspension System	2.79	0.36
	For UL Listed (Fire Guard), Add	0.13	
	For 1-1/2" Wide Faced Grid, Add	0.25	
	For Vertical Application, Add	1.66	
	For Chemical Corrosion Resistant, Polyvinyl Chloride (PVC) Coated, Add	2.50	
	For 9/16" Narrow Faced Grid, Add	0.22	
	For Individual Room Quantities <495, Add	0.33	
	Note: For use with projects >500 SF		
	For Aluminum T-Bar System, Add	0.40	
	For Compression Struts With Splay Wires, Add	0.31	
	For Up To 50, Add	1.18	
	For >50 To 200, Add	0.66	
	For >200 To 500, Add	0.23	
	For >2,500 To 4,000, Deduct	-0.07	
	For >4,000 To 5,000, Deduct	-0.12	
	For >5,000, Deduct	-0.18	
	For Ceilings >10' High, Add	0.14	
09 53 23 00-0004	SF 2' x 2' Grid, 15/16" T Bar Ceiling Suspension System	2.28	0.36
	For UL Listed (Fire Guard), Add	0.09	
	For 1-1/2" Wide Faced Grid, Add	0.18	
	For Vertical Application, Add	1.44	
	For Chemical Corrosion Resistant, Polyvinyl Chloride (PVC) Coated, Add	2.50	
	For 9/16" Narrow Faced Grid, Add	0.16	
	For Individual Room Quantities <495, Add	0.28	
	Note: For use with projects >500 SF		
	For Aluminum T-Bar System, Add	0.28	
	For Compression Struts With Splay Wires, Add	0.25	
	For Up To 50, Add	1.00	
	For >50 To 200, Add	0.56	
	For >200 To 500, Add	0.20	
	For >2,500 To 4,000, Deduct	-0.05	
	For >4,000 To 5,000, Deduct	-0.10	
	For >5,000, Deduct	-0.15	
	For Black Grid, Add	0.08	
	For Ceilings >10' High, Add	0.12	
	For Concealed Spline Grid, Add	0.32	
09 53 23 00-0005	SF 2' x 4' Grid, 15/16" T Bar Ceiling Suspension System	1.93	0.36
	For UL Listed (Fire Guard), Add	0.07	
	For 1-1/2" Wide Faced Grid, Add	0.14	
	For Vertical Application, Add	1.44	
	For Chemical Corrosion Resistant, Polyvinyl Chloride (PVC) Coated, Add	2.50	
	For 9/16" Narrow Faced Grid, Add	0.12	
	For Individual Room Quantities <495, Add	0.24	
	Note: For use with projects >500 SF		
	For Aluminum T-Bar System, Add	0.22	
	For Compression Struts With Splay Wires, Add	0.21	
	For Up To 50, Add	0.87	
	For >50 To 200, Add	0.48	
	For >200 To 500, Add	0.17	
	For >2,500 To 4,000, Deduct	-0.05	
	For >4,000 To 5,000, Deduct	-0.09	
	For >5,000, Deduct	-0.13	
	For Black Grid, Add	0.06	
	For Ceilings >10' High, Add	0.11	
	For Concealed Spline Grid, Add	0.27	

09 Finishes**09 50 Ceilings****09 53 Acoustical Ceiling Suspension Assemblies**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 53 23 00-0006	SF		2' x 5' Grid, 15/16" T Bar Ceiling Suspension System	1.86	0.36
			For UL Listed (Fire Guard), Add	0.08	
			For 1-1/2" Wide Faced Grid, Add	0.15	
			For Chemical Corrosion Resistant, Polyvinyl Chloride (PVC) Coated, Add	2.50	
			For 9/16" Narrow Faced Grid, Add	0.14	
			For Individual Room Quantities <495, Add	0.22	
			Note: For use with projects >500 SF		
			For Aluminum T-Bar System, Add	0.25	
			For Compression Struts With Splay Wires, Add	0.21	
			For Up To 50, Add	0.80	
			For >50 To 200, Add	0.45	
			For >200 To 500, Add	0.16	
			For >2,500 To 4,000, Deduct	-0.04	
			For >4,000 To 5,000, Deduct	-0.08	
			For >5,000, Deduct	-0.12	
			For Ceilings >10' High, Add	0.10	
09 53 23 00-0007	SF		2', 15/16" Suspended Ceiling Cross Tee	0.54	0.21
			Note: Can be used to convert an existing 2' x 4' suspension system to a 2' x 2' system or to replace an individual component.		
			For 1-1/2" Wide Faced Grid, Add	0.04	
			For Vertical Application, Add	0.41	
			For Chemical Corrosion Resistant, Polyvinyl Chloride (PVC) Coated, Add	2.50	
			For 9/16" Narrow Faced Grid, Add	0.03	
			For Individual Room Quantities <495, Add	0.07	
			Note: For use with projects >500 SF		
			For Aluminum T-Bar System, Add	0.06	
			For Up To 50, Add	0.25	
			For >50 To 200, Add	0.14	
			For >200 To 500, Add	0.05	
			For >2,500 To 4,000, Deduct	-0.01	
			For >4,000 To 5,000, Deduct	-0.02	
			For >5,000, Deduct	-0.04	
			For Ceilings >10' High, Add	0.03	
09 53 23 00-0008			Ceiling Suspension System Accessories (09 53 23)		
09 53 23 00-0009	LF		For Pencil Rod Support With Accessories And Attachments (Seismic Control Or Where Required).....	0.83	
09 53 23 00-0010	LF		1" x 1/8" Flat Bar Bracing For Suspended Ceiling.....	1.90	1.01
			For 316 Stainless Steel, Add	1.25	
			For Aluminum, Add	0.07	
			For Galvanized Steel, Add	0.24	
			For 304 Stainless Steel, Add	1.11	
09 53 23 00-0011	LF		1" x 3/16" Flat Bar Bracing For Suspended Ceiling.....	2.69	1.08
			For 316 Stainless Steel, Add	1.92	
			For Aluminum, Add	0.11	
			For Galvanized Steel, Add	0.37	
			For 304 Stainless Steel, Add	1.71	
09 53 23 00-0012	LF		1-1/2" x 1/4" Flat Bar Bracing For Suspended Ceiling	3.56	1.15
			For 316 Stainless Steel, Add	3.81	
			For Aluminum, Add	0.21	
			For Galvanized Steel, Add	0.74	
			For 304 Stainless Steel, Add	3.39	
09 54			Specialty Ceilings (09 50)		
09 54 23			Linear Metal Ceilings (09 54)		
09 54 23 00-0001			Linear Ceiling Systems (09 54 23)		
09 54 23 00-0002			0.032" Aluminum, Linear Ceiling Systems (09 54 23 00-0001)		
			Note: For flat ceilings. Includes round or box style panels with KYNAR 500® or HYLAR 5000® PVDF finish. Includes ceiling suspension system and flush or recessed filler strips.		
09 54 23 00-0003	SF		4" Panel Width, 0.032" Aluminum, Linear Ceiling System	11.46	1.50
			For Up To 50, Add	3.16	
			For >50 To 200, Add	1.87	
			For >200 To 500, Add	0.75	
			For >2,500, Deduct	-0.57	
			For Ceilings >10' High, Add	0.27	
			For Linear Ceiling Systems Without Filler Strips, Deduct	-1.95	
			For Curved Ceilings, Add	0.94	
09 54 23 00-0004	SF		8" Panel Width, 0.032" Aluminum, Linear Ceiling System	9.37	1.50
			For Up To 50, Add	2.82	
			For >50 To 200, Add	1.64	
			For >200 To 500, Add	0.65	
			For >2,500, Deduct	-0.47	
			For Ceilings >10' High, Add	0.26	
			For Linear Ceiling Systems Without Filler Strips, Deduct	-0.96	
			For Curved Ceilings, Add	0.93	
09 54 23 00-0005	SF		12" Panel Width, 0.032" Aluminum, Linear Ceiling System.....	8.55	1.50
			For Up To 50, Add	2.66	
			For >50 To 200, Add	1.55	
			For >200 To 500, Add	0.60	
			For >2,500, Deduct	-0.43	
			For Ceilings >10' High, Add	0.26	
			For Linear Ceiling Systems Without Filler Strips, Deduct	-0.65	
			For Curved Ceilings, Add	0.91	



Finishes	09	09
Ceilings	09 50	
Specialty Ceilings	09 54	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 54 23 00-0006 Tin Ceilings (09 54 23)		
09 54 23 00-0007 SF 2' x 2' Tin Ceiling Embossed Panels.....	11.57	2.33
For Up To 50, Add	2.86	
For >50 To 200, Add	1.72	
For >200 To 500, Add	0.72	
For >2,500, Deduct	-0.58	
For Ceilings >10' High, Add	0.21	
09 54 23 00-0008 SF 12" x 12" Tin Ceiling Embossed Plates.....	16.95	1.50
For Up To 50, Add	3.73	
For >50 To 200, Add	2.29	
For >200 To 500, Add	1.00	
For >2,500, Deduct	-0.85	
For Ceilings >10' High, Add	0.22	
09 54 23 00-0009 SF 12" x 24" Tin Ceiling Embossed Plates.....	12.50	1.50
For Up To 50, Add	3.06	
For >50 To 200, Add	1.84	
For >200 To 500, Add	0.77	
For >2,500, Deduct	-0.63	
For Ceilings >10' High, Add	0.22	
09 54 23 00-0010 SF 24" x 24" Tin Ceiling Embossed Plates.....	11.48	1.50
For Up To 50, Add	2.81	
For >50 To 200, Add	1.69	
For >200 To 500, Add	0.71	
For >2,500, Deduct	-0.57	
For Ceilings >10' High, Add	0.20	
09 54 23 00-0011 SF 24" x 48" Tin Ceiling Embossed Plates.....	10.01	1.13
For Up To 50, Add	2.45	
For >50 To 200, Add	1.48	
For >200 To 500, Add	0.62	
For >2,500, Deduct	-0.50	
For Ceilings >10' High, Add	0.18	
09 54 23 00-0012 LF 3" Or 4" Wide Embossed Molding.....	8.26	2.25
09 54 23 00-0013 LF 6" Wide Embossed Molding.....	10.22	2.63
09 54 23 00-0014 LF 12" Wide Embossed Molding.....	13.65	3.07
09 54 23 00-0015 EA 3", 4" Or 6" Wide Embossed Cross, Tee Or Ell.....	24.09	7.13
09 54 23 00-0016 EA 12" Wide Embossed Cross, Tee Or Ell.....	32.98	8.33
09 57 Special Function Ceilings (09 50)		
09 57 00 00-0001 High Impact Ceiling Systems (09 57)		
09 57 00 00-0002 SF Polyvinyl Chloride Face High Impact Ceiling Panels	4.18	0.71
For Ceilings >10' High, Add	0.09	
09 57 00 00-0003 SF High Impact Clips.....	1.69	0.57
For Ceilings >10' High, Add	0.07	
09 60 Flooring (09)		
09 61 Flooring Treatment (09 60)		
09 61 13 Slip-Resistant Flooring Treatment (09 61)		
09 61 13 00-0001 Anti-Slip Tape (09 61 13)		
Note: Grit sandpaper surface with adhesive back.		
09 61 13 00-0002 LF 1" Anti-Slip Tape.....	1.82	1.44
09 61 13 00-0003 LF 2" Anti-Slip Tape.....	2.26	1.58
09 61 13 00-0004 LF 3" Anti-Slip Tape.....	2.70	1.74
09 61 13 00-0005 LF 4" Anti-Slip Tape.....	3.12	1.91
09 61 13 00-0006 LF 6" Anti-Slip Tape.....	3.92	2.10
09 61 13 00-0007 LF 12" Anti-Slip Tape.....	6.77	3.15
09 61 13 00-0008 LF 24" Anti-Slip Tape.....	9.63	4.73
09 64 Wood Flooring (09 60)		
09 64 13 Wood Flooring Underlayment (09 64)		
09 64 13 00-0001 Wood Flooring Underlayment (09 64 13)		
09 64 13 00-0002 SF Regular Weight Red Rosin Paper, Wood Flooring Underlayment	0.34	
09 64 13 00-0003 SF Heavy Weight Red Rosin Paper, Wood Flooring Underlayment.....	0.34	
09 64 13 00-0004 SF 30 LB, Waxed Paper, Wood Flooring Underlayment	0.35	
09 64 13 00-0005 SF 15 LB, Asphalt Saturated Organic Felt, Wood Flooring Underlayment.....	0.37	
09 64 13 00-0006 SF 6 Mil Thick, Polyethylene Film, Wood Flooring Underlayment	0.46	
09 64 13 00-0007 SF 8 Mil Thick, Polyethylene Film, Wood Flooring Underlayment	0.54	
09 64 13 00-0008 SF 1/8" Thick, Natural Cork, Wood Flooring Underlayment	1.31	
09 64 13 00-0009 SF 1/4" Thick, Natural Cork, Wood Flooring Underlayment	1.37	
09 64 13 00-0010 SF 3/32" Thick, Polyethylene Foam, Wood Flooring Underlayment (Roberts® Unison™ 70-025-15)	0.53	
09 64 13 00-0011 SF 2.0mm Thick, Progressive Foam Technology, Wood Flooring Underlayment (Roberts® Quiet Cushion 70-180)	0.63	
09 64 13 00-0012 SF 4.0mm Thick, Compressed Fiber, Wood Flooring Underlayment (Roberts® Super Felt 70-193)	0.68	
09 64 13 00-0013 SF 2.5mm Thick, Closed Cell Foam, Wood Flooring Underlayment (Roberts® Black Jack™ 70-026)	0.81	

09 Finishes**09 60 Flooring****09 64 Wood Flooring**

MINOR				TOTAL DIRECT	DEMOLITION
CSI	UOM	DESCRIPTION		UNIT COST	UNIT COST
09 64 13 00-0014	SF	1/8" Thick, Moisture Barrier, Sound Reduction And Cushioning, Wood Flooring Underlayment (Roberts® AirGuard™ 70-105)		0.82	
09 64 23		Wood Parquet Flooring (09 64)			
		Note: All wood parquet flooring is prefinished at factory.			
09 64 23 00-0001		Hardwood Parquet Flooring (09 64 23)			
09 64 23 00-0002	SF	Oak Parquet Flooring 5/16" Thick		9.15	0.71
		For Up To 20, Add		3.39	
		For >20 To 50, Add		1.81	
		For >50 To 100, Add		0.91	
		For >100 To 300, Add		0.45	
09 64 29		Wood Strip And Plank Flooring (09 64)			
		Note: All wood strip flooring is unfinished, tongue and groove.			
09 64 29 00-0001		Unfinished Fir, Wood Strip Flooring (09 64 29)			
09 64 29 00-0002	SF	3-1/8" Plank Width, 3/4" Thick, Plain Sawn, Clear Vertical Grain (C Or Better) Unfinished Fir, Wood Strip Flooring		8.09	0.71
		For Factory Finish, Add		0.49	
		For Random Width Floor, Add		1.86	
		For Up To 20, Add		2.67	
		For >20 To 50, Add		1.46	
		For >50 To 100, Add		0.73	
		For >100 To 300, Add		0.36	
09 64 29 00-0003		Unfinished Oak, Wood Strip Flooring (09 64 29)			
09 64 29 00-0004		Unfinished White Oak, Wood Strip Flooring (09 64 29 00-0003)			
09 64 29 00-0005	SF	2-1/4" Plank Width, 3/4" Thick, Plain Sawn, #2 Common Unfinished White Oak, Wood Strip Flooring		6.77	0.71
		For Factory Finish, Add		0.25	
		For Random Width Floor, Add		1.48	
		For Up To 20, Add		2.92	
		For >20 To 50, Add		1.52	
		For >50 To 100, Add		0.76	
		For >100 To 300, Add		0.38	
09 64 29 00-0006	SF	2-1/4" Plank Width, 3/4" Thick, Plain Sawn, #1 Common Unfinished White Oak, Wood Strip Flooring		7.10	0.71
		For Factory Finish, Add		0.29	
		For Random Width Floor, Add		1.56	
		For Up To 20, Add		2.97	
		For >20 To 50, Add		1.56	
		For >50 To 100, Add		0.78	
		For >100 To 300, Add		0.39	
09 64 29 00-0007	SF	2-1/4" Plank Width, 3/4" Thick, Plain Sawn, Select Unfinished White Oak, Wood Strip Flooring		7.59	0.71
		For Factory Finish, Add		0.34	
		For Random Width Floor, Add		1.69	
		For Up To 20, Add		3.04	
		For >20 To 50, Add		1.61	
		For >50 To 100, Add		0.80	
		For >100 To 300, Add		0.40	
09 64 29 00-0008	SF	3-1/4" Plank Width, 3/4" Thick, Plain Sawn, #2 Common Unfinished White Oak, Wood Strip Flooring		5.88	0.71
		For Factory Finish, Add		0.27	
		For Random Width Floor, Add		1.31	
		For Up To 20, Add		2.34	
		For >20 To 50, Add		1.23	
		For >50 To 100, Add		0.62	
		For >100 To 300, Add		0.31	
09 64 29 00-0009	SF	3-1/4" Plank Width, 3/4" Thick, Plain Sawn, #1 Common Unfinished White Oak, Wood Strip Flooring		6.14	0.71
		For Factory Finish, Add		0.29	
		For Random Width Floor, Add		1.37	
		For Up To 20, Add		2.37	
		For >20 To 50, Add		1.26	
		For >50 To 100, Add		0.63	
		For >100 To 300, Add		0.32	
09 64 29 00-0010	SF	3-1/4" Plank Width, 3/4" Thick, Plain Sawn, Select Unfinished White Oak, Wood Strip Flooring		6.65	0.71
		For Factory Finish, Add		0.34	
		For Random Width Floor, Add		1.50	
		For Up To 20, Add		2.45	
		For >20 To 50, Add		1.31	
		For >50 To 100, Add		0.66	
		For >100 To 300, Add		0.33	
09 64 29 00-0011		Unfinished Red Oak, Wood Strip Flooring (09 64 29 00-0003)			
09 64 29 00-0012	SF	2-1/4" Plank Width, 3/4" Thick, Plain Sawn, #2 Common Unfinished Red Oak, Wood Strip Flooring		6.82	0.71
		For Factory Finish, Add		0.26	
		For Random Width Floor, Add		1.49	
		For Up To 20, Add		2.93	
		For >20 To 50, Add		1.53	
		For >50 To 100, Add		0.76	
		For >100 To 300, Add		0.38	



Finishes	09	09
Flooring	09 60	
Wood Flooring	09 64	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 64 29 00-0013	SF		2-1/4" Plank Width, 3/4" Thick, Plain Sawn, #1 Common Unfinished Red Oak, Wood Strip Flooring.....	7.15	0.71
			<i>For Factory Finish, Add</i>	0.29	
			<i>For Random Width Floor, Add</i>	1.58	
			<i>For Up To 20, Add</i>	2.98	
			<i>For >20 To 50, Add</i>	1.56	
			<i>For >50 To 100, Add</i>	0.78	
			<i>For >100 To 300, Add</i>	0.39	
09 64 29 00-0014	SF		2-1/4" Plank Width, 3/4" Thick, Plain Sawn, Select Unfinished Red Oak, Wood Strip Flooring	7.65	0.71
			<i>For Factory Finish, Add</i>	0.34	
			<i>For Random Width Floor, Add</i>	1.70	
			<i>For Up To 20, Add</i>	3.05	
			<i>For >20 To 50, Add</i>	1.61	
			<i>For >50 To 100, Add</i>	0.81	
			<i>For >100 To 300, Add</i>	0.40	
09 64 29 00-0015	SF		3-1/4" Plank Width, 3/4" Thick, Plain Sawn, #2 Common Unfinished Red Oak, Wood Strip Flooring.....	5.93	0.71
			<i>For Factory Finish, Add</i>	0.27	
			<i>For Random Width Floor, Add</i>	1.32	
			<i>For Up To 20, Add</i>	2.34	
			<i>For >20 To 50, Add</i>	1.24	
			<i>For >50 To 100, Add</i>	0.62	
			<i>For >100 To 300, Add</i>	0.31	
09 64 29 00-0016	SF		3-1/4" Plank Width, 3/4" Thick, Plain Sawn, #1 Common Unfinished Red Oak, Wood Strip Flooring.....	6.26	0.71
			<i>For Factory Finish, Add</i>	0.30	
			<i>For Random Width Floor, Add</i>	1.40	
			<i>For Up To 20, Add</i>	2.39	
			<i>For >20 To 50, Add</i>	1.27	
			<i>For >50 To 100, Add</i>	0.64	
			<i>For >100 To 300, Add</i>	0.32	
09 64 29 00-0017	SF		3-1/4" Plank Width, 3/4" Thick, Plain Sawn, Select Unfinished Red Oak, Wood Strip Flooring	6.71	0.71
			<i>For Factory Finish, Add</i>	0.35	
			<i>For Random Width Floor, Add</i>	1.52	
			<i>For Up To 20, Add</i>	2.46	
			<i>For >20 To 50, Add</i>	1.32	
			<i>For >50 To 100, Add</i>	0.66	
			<i>For >100 To 300, Add</i>	0.33	
09 64 29 00-0018			Unfinished Maple, Wood Strip Flooring <small>(09 64 29)</small>		
09 64 29 00-0019			25/32" Thick, Unfinished Maple, Wood Strip Flooring <small>(09 64 29 00-0018)</small>		
09 64 29 00-0020	SF		2-1/4" Plank Width, 25/32" Thick, Plain Sawn, First Grade (Select Or Better) Unfinished Maple, Wood Strip Flooring	8.04	0.71
			<i>For Factory Finish, Add</i>	0.38	
			<i>For Random Width Floor, Add</i>	1.80	
			<i>For Up To 20, Add</i>	3.11	
			<i>For >20 To 50, Add</i>	1.65	
			<i>For >50 To 100, Add</i>	0.83	
			<i>For >100 To 300, Add</i>	0.41	
09 64 29 00-0021	SF		2-1/4" Plank Width, 25/32" Thick, Plain Sawn, Second Grade (#1 Common) Unfinished Maple, Wood Strip Flooring	7.48	0.71
			<i>For Factory Finish, Add</i>	0.33	
			<i>For Random Width Floor, Add</i>	1.66	
			<i>For Up To 20, Add</i>	3.03	
			<i>For >20 To 50, Add</i>	1.59	
			<i>For >50 To 100, Add</i>	0.80	
			<i>For >100 To 300, Add</i>	0.40	
09 64 29 00-0022	SF		3" Plank Width, 25/32" Thick, Plain Sawn, First Grade (Select Or Better) Unfinished Maple, Wood Strip Flooring.....	7.26	0.71
			<i>For Factory Finish, Add</i>	0.40	
			<i>For Random Width Floor, Add</i>	1.65	
			<i>For Up To 20, Add</i>	2.54	
			<i>For >20 To 50, Add</i>	1.37	
			<i>For >50 To 100, Add</i>	0.69	
			<i>For >100 To 300, Add</i>	0.34	
09 64 29 00-0023	SF		3" Plank Width, 25/32" Thick, Plain Sawn, Second Grade (#1 Common) Unfinished Maple, Wood Strip Flooring.....	6.71	0.71
			<i>For Factory Finish, Add</i>	0.35	
			<i>For Random Width Floor, Add</i>	1.52	
			<i>For Up To 20, Add</i>	2.46	
			<i>For >20 To 50, Add</i>	1.32	
			<i>For >50 To 100, Add</i>	0.66	
			<i>For >100 To 300, Add</i>	0.33	
09 64 29 00-0024			33/32" Thick, Unfinished Maple, Wood Strip Flooring <small>(09 64 29 00-0018)</small>		
09 64 29 00-0025	SF		2-1/4" Plank Width, 33/32" Thick, Plain Sawn, First Grade (Select Or Better) Unfinished Maple, Wood Strip Flooring	9.23	0.71
			<i>For Factory Finish, Add</i>	0.50	
			<i>For Random Width Floor, Add</i>	2.10	
			<i>For Up To 20, Add</i>	3.29	
			<i>For >20 To 50, Add</i>	1.77	
			<i>For >50 To 100, Add</i>	0.88	
			<i>For >100 To 300, Add</i>	0.44	

09 Finishes**09 60 Flooring****09 64 Wood Flooring**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 64 29 00-0026	SF		2-1/4" Plank Width, 33/32" Thick, Plain Sawn, Second Grade (#1 Common) Unfinished Maple, Wood Strip Flooring.....	8.49	0.71
			<i>For Factory Finish, Add</i>	0.43	
			<i>For Random Width Floor, Add</i>	1.91	
			<i>For Up To 20, Add</i>	3.18	
			<i>For >20 To 50, Add</i>	1.70	
			<i>For >50 To 100, Add</i>	0.85	
			<i>For >100 To 300, Add</i>	0.42	
09 64 29 00-0027	SF		3" Plank Width, 33/32" Thick, Plain Sawn, First Grade (Select Or Better) Unfinished Maple, Wood Strip Flooring.....	8.52	0.71
			<i>For Factory Finish, Add</i>	0.53	
			<i>For Random Width Floor, Add</i>	1.97	
			<i>For Up To 20, Add</i>	2.73	
			<i>For >20 To 50, Add</i>	1.50	
			<i>For >50 To 100, Add</i>	0.75	
			<i>For >100 To 300, Add</i>	0.37	
09 64 29 00-0028	SF		3" Plank Width, 33/32" Thick, Plain Sawn, Second Grade (#1 Common) Unfinished Maple, Wood Strip Flooring.....	7.79	0.71
			<i>For Factory Finish, Add</i>	0.46	
			<i>For Random Width Floor, Add</i>	1.79	
			<i>For Up To 20, Add</i>	2.62	
			<i>For >20 To 50, Add</i>	1.43	
			<i>For >50 To 100, Add</i>	0.71	
			<i>For >100 To 300, Add</i>	0.36	
09 64 29 00-0029			Vented Cove Base (09 64 29)		
09 64 29 00-0030	LF		Vented Cove Base.....	8.24	
09 64 29 00-0031			Prefinished Engineered Wood Flooring (09 64 29)		
			Note: Glued or nailed. Excludes underlayment. See CSI section 09 64 13 00-0001 for wood flooring underlayment.		
09 64 29 00-0032	SF		1/2" Thick, Red Oak, Prefinished Engineered Wood Flooring.....	9.14	0.71
			<i>For Up To 20, Add</i>	2.64	
			<i>For >20 To 50, Add</i>	1.48	
			<i>For >50 To 100, Add</i>	0.74	
			<i>For >100 To 300, Add</i>	0.37	
09 64 29 00-0033	SF		1/2" Thick, White Oak, Prefinished Engineered Wood Flooring.....	9.14	0.71
			<i>For Up To 20, Add</i>	2.64	
			<i>For >20 To 50, Add</i>	1.48	
			<i>For >50 To 100, Add</i>	0.74	
			<i>For >100 To 300, Add</i>	0.37	
09 64 29 00-0034	SF		1/2" Thick, Select Maple, Prefinished Engineered Wood Flooring.....	8.87	0.71
			<i>For Up To 20, Add</i>	2.60	
			<i>For >20 To 50, Add</i>	1.45	
			<i>For >50 To 100, Add</i>	0.73	
			<i>For >100 To 300, Add</i>	0.36	
09 64 29 00-0035	SF		1/2" Thick, Natural Hickory, Prefinished Engineered Wood Flooring.....	9.08	0.71
			<i>For Up To 20, Add</i>	2.63	
			<i>For >20 To 50, Add</i>	1.47	
			<i>For >50 To 100, Add</i>	0.74	
			<i>For >100 To 300, Add</i>	0.37	
09 64 66			Wood Athletic Flooring (09 64)		
			Note: On shims, sleepers and/or screeds. 1-1/2" or 2-1/4" widths. Excludes finish.		
09 64 66 00-0001			Wood Gym/Stage/Dance Floors (09 64 66)		
			Note: Includes sanding and vent cove base. Excludes concrete repairs to subbase, thresholds, and finishing.		
09 64 66 00-0002	SF		25/32" Maple Wood Gym/Stage/Dance Floor.....	9.73	3.59
			<i>For Oak Or Birch, Deduct</i>	-0.20	
			<i>For Pine, Deduct</i>	-0.30	
			<i>For #1 Grade Material, Add</i>	0.50	
09 64 66 00-0003	SF		Floating 25/32" Maple Wood Gym/Stage/Dance Floor System, Two Layers Of Plywood Panel Subfloor With Resilient Pads (Connor DuraCushion).....	12.96	4.67
			Note: Includes 6 mil polyethylene vapor barrier, two layers of 15/32" plywood subfloor and 3/8" resilient pads.		
			<i>For Oak Or Birch, Deduct</i>	-0.20	
			<i>For Pine, Deduct</i>	-0.30	
			<i>For #1 Grade Material, Add</i>	0.50	
09 64 66 00-0004	SF		Floating 25/32" Maple Wood Gym/Stage/Dance Floor System, Two Layers Of Plywood Panel Subfloor With Two Stage Resilient Pads (Connor NeoShok).....	13.68	4.67
			Note: Includes 6 mil polyethylene vapor barrier, two layers of 15/32" plywood subfloor and 3/4" hemispherical two stage polyurethane resilient pads.		
			<i>For Oak Or Birch, Deduct</i>	-0.20	
			<i>For Pine, Deduct</i>	-0.30	
			<i>For #1 Grade Material, Add</i>	0.50	
09 64 66 00-0005	SF		Floating 25/32" Maple Wood Gym/Stage/Dance Floor System, One Layer Of Plywood Subfloor With Continuous Steel Channel Encased Sleepers And Resilient Pads (Connor PermaFlex).....	15.20	4.67
			Note: Includes 6 mil polyethylene vapor barrier, one layer of 15/32" plywood subfloor, a continuous steel channel encasing a 23/32" fixed sleeper, a 7/16" resilient pad and a 23/32" flex sleeper.		
			<i>For Oak Or Birch, Deduct</i>	-0.20	
			<i>For Pine, Deduct</i>	-0.30	
			<i>For #1 Grade Material, Add</i>	0.50	



Finishes	09	09
Flooring	09 60	
Wood Flooring	09 64	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 64 66 00-0006	SF		Fixed Resilient 25/32" Maple Wood Gym/Stage/Dance Floor System, One Layer Of Plywood Panel Subfloor With Resilient Pads (Connor Focus).....	14.50	4.67
			Note: Includes 6 mil polyethylene vapor barrier, one layer of 3/4" subfloor, 9/16" resilient pads and concrete anchors and clips.		
			<i>For Oak Or Birch, Deduct</i>	-0.20	
			<i>For Pine, Deduct</i>	-0.30	
			<i>For #1 Grade Material, Add</i>	0.50	
09 64 66 00-0007	SF		Clip And Channel, Fixed 33/32" Maple Wood Gym/Stage/Dance Floor System (Connor PermaLock).....	16.45	4.67
			Note: Includes 6 mil polyethylene vapor barrier, one layer of 1/2" impregnated fiberboard with channel grooves for 16 gauge steel anchor channel.		
			<i>For Oak Or Birch, Deduct</i>	-0.20	
			<i>For Pine, Deduct</i>	-0.30	
			<i>For #1 Grade Material, Add</i>	0.50	

09 65 Resilient Flooring (09 60)
 See CSI section 03 54 16 00-0001 for self leveling underlayment for uneven floors.

09 65 13 Resilient Base And Accessories (09 65)

09 65 13 13 Resilient Base (09 65 13)

09 65 13 13-0001			Vinyl Plastic Wall Base <small>(09 65 13 13)</small> Note: Includes inside and outside premolded corners.		
09 65 13 13-0002	LF		4" High, 1/8" Vinyl Plastic Base, All Colors	2.18	0.70
09 65 13 13-0003	LF		6" High, 1/8" Vinyl Plastic Base, All Colors	3.00	0.84
09 65 13 13-0004			1/8" Thick Rubber Wall Base <small>(09 65 13 13)</small>		
09 65 13 13-0005	LF		4" High, 1/8" Rubber Base, Group 1 Black, Russet And Umber	2.30	0.84
09 65 13 13-0006	LF		6" High, 1/8" Rubber Base, Group 1 Black, Russet And Umber	2.49	0.84
09 65 13 13-0007	LF		4" High, 1/8" Rubber Base, Group 2 All (Except White).....	2.37	0.84
09 65 13 13-0008	LF		6" High, 1/8" Rubber Base, Group 2 All (Except White).....	2.63	0.84
09 65 13 13-0009	LF		4" High, 1/8" Rubber Base, Group 3 White Only.....	2.25	0.84
09 65 13 13-0010	EA		6" High, 1/8" Rubber Base, Group 3 Only.....	2.51	0.84
09 65 13 13-0011	EA		4" High, 1/8" Rubber Corner	2.85	0.84
09 65 13 13-0012	EA		6" High, 1/8" Rubber Corner	3.14	0.84

09 65 13 23 Resilient Stair Treads And Risers (09 65 13)

Note: All treads have integral nosing. Abrasive strip modifiers include either 1 or 2 strips running the length of the tread. All colors.

09 65 13 23-0001			Rubber Stair Treads and Risers <small>(09 65 13 23)</small>		
09 65 13 23-0002			Raised Disc Or Other Patterned Rubber Stair Tread <small>(09 65 13 23-0001)</small>		
09 65 13 23-0003	LF		3/16" Thick, 9" To 12-1/2" Deep, Rubber Stair Tread	12.47	1.12
			Note: Raised disc or other pattern.		
			<i>For Abrasive Strip, Add</i>	2.75	
			<i>For Photo Luminescent Abrasive Strip, Add</i>	3.75	
09 65 13 23-0004	LF		1/4" Thick, 9" To 12-1/2" Deep, Rubber Stair Tread	13.39	1.21
			Note: Raised disc or other pattern.		
			<i>For Abrasive Strip, Add</i>	2.75	
			<i>For Photo Luminescent Abrasive Strip, Add</i>	3.75	
09 65 13 23-0005	LF		5/16" Thick, 9" To 12-1/2" Deep, Rubber Stair Tread	16.57	1.29
			Note: Raised disc or other pattern.		
			<i>For Abrasive Strip, Add</i>	2.75	
			<i>For Photo Luminescent Abrasive Strip, Add</i>	3.75	
09 65 13 23-0006			Smooth Surface Rubber Stair Tread <small>(09 65 13 23-0001)</small>		
09 65 13 23-0007	LF		3/16" Thick, 9" To 12-1/2" Deep, Rubber Stair Tread	11.63	1.12
			Note: Smooth surface.		
			<i>For Abrasive Strip, Add</i>	2.75	
			<i>For Photo Luminescent Abrasive Strip, Add</i>	3.75	
09 65 13 23-0008	LF		1/4" Thick, 9" To 12-1/2" Deep, Rubber Stair Tread	12.43	1.21
			Note: Smooth surface.		
			<i>For Abrasive Strip, Add</i>	2.75	
			<i>For Photo Luminescent Abrasive Strip, Add</i>	3.75	
09 65 13 23-0009	LF		5/16" Thick, 9" To 12-1/2" Deep, Rubber Stair Tread	15.34	1.30
			Note: Smooth surface.		
			<i>For Abrasive Strip, Add</i>	2.75	
			<i>For Photo Luminescent Abrasive Strip, Add</i>	3.75	
09 65 13 23-0010			Smooth Surface Rubber Stair Riser <small>(09 65 13 23-0001)</small>		
09 65 13 23-0011	LF		1/8" Thick, Smooth Surface Rubber Stair Riser	6.78	0.67
09 65 13 23-0012			Smooth, Raised Disc or Other Patterned Rubber Landing Mats <small>(09 65 13 23-0001)</small>		
09 65 13 23-0013	SF		1/8" Thick, Rubber Landing Mats.....	13.62	1.04
			Note: Smooth, raised disc or other patterned surface.		
09 65 13 23-0014	SF		3/16" Thick, Rubber Landing Mats.....	16.28	1.12
			Note: Smooth, raised disc or other patterned surface.		

09 Finishes**09 60 Flooring****09 65 Resilient Flooring**

MINOR				TOTAL DIRECT	DEMOLITION
CSI	UOM	DESCRIPTION		UNIT COST	UNIT COST
09 65 13 23-0015	SF	7/32" Thick, Rubber Landing Mats Note: Smooth, raised disc or other patterned surface.		17.65	1.26
09 65 13 23-0016		Vinyl Stair Treads and Risers (09 65 13 23)			
09 65 13 23-0017		Ribbed Vinyl Stair Tread (09 65 13 23-0016)			
09 65 13 23-0018	LF	1/8" Thick, 9" To 12-1/2" Deep, Ribbed Vinyl Stair Tread <i>For Abrasive Strip, Add</i>		9.32 2.75	1.02
09 65 13 23-0019	LF	3/16" Thick, 9" To 12-1/2" Deep, Ribbed Vinyl Stair Tread <i>For Abrasive Strip, Add</i>		10.30 2.75	1.12
09 65 13 23-0020	LF	1/4" Thick, 9" To 12-1/2" Deep, Ribbed Vinyl Stair Tread <i>For Abrasive Strip, Add</i>		12.39 2.75	1.21
09 65 13 23-0021		Smooth Surface Vinyl Stair Riser (09 65 13 23-0016)			
09 65 13 23-0022	LF	1/8" Thick, 7" High, Smooth Surface Vinyl Stair Riser		5.18	0.67
09 65 13 33		Resilient Accessories (09 65 13)			
09 65 13 33-0001		Flexible Self Leveling Cementitious Underlayments (09 65 13 33)			
09 65 13 33-0002	SF	1/8" Thick, Flexible Self Leveling Cementitious Underlayment With Liquid Latex Modifiers		0.99	0.56
09 65 13 33-0003	SF	1/4" Thick, Flexible Self Leveling Cementitious Underlayment With Liquid Latex Modifiers		1.53	0.56
09 65 13 33-0004		Concrete Floor Prep (09 65 13 33)			
09 65 13 33-0005	SF	Remove Glue From Concrete Floor Note: For removal of glue from VCT or carpet placement. Not to be used in conjunction with demolition tasks associated with floor tile installation.		0.70	
09 65 13 36		Resilient Carpet Transitions (09 65 13)			
09 65 13 36-0001		Vinyl Transition Strip (09 65 13 36)			
09 65 13 36-0002	LF	Vinyl Transition Strip, Brown Or Black		1.30	0.50
09 65 13 36-0003	LF	Vinyl Floor Tile Reducer Strip, Brown Or Black.....		1.17	0.50
09 65 13 36-0004	LF	Vinyl Floor Tile Feature Strip, Brown Or Black.....		1.02	0.50
09 65 16		Resilient Sheet Flooring (09 65)			
09 65 16 23		Vinyl Sheet Flooring (09 65 16)			
09 65 16 23-0001		Vinyl Sheet Flooring (09 65 16 23)			
		Note: For flash cove application, add additional square foot of material to form cove base.			
09 65 16 23-0002	SF	0.080" Overall Thickness, 0.080" Wear Layer, Homogeneous, Commercial Vinyl Sheet Flooring (Armstrong® Medintech®)		5.69	0.42
		<i>For >40 To 100, Add</i>		1.13	
		<i>For >1,000, Deduct</i>		-0.48	
		<i>For Up To 40, Add</i>		2.26	
09 65 16 23-0003	SF	0.080" Overall Thickness, 0.080" Wear Layer, Homogeneous, Commercial Vinyl Sheet Flooring (Armstrong® Medley™)		4.66	0.42
		<i>For >40 To 100, Add</i>		1.03	
		<i>For >1,000, Deduct</i>		-0.38	
		<i>For Up To 40, Add</i>		2.05	
09 65 16 23-0004	SF	0.080" Overall Thickness, 0.050" Wear Layer, Inlaid With Polyglass Backing, Commercial Vinyl Sheet Flooring (Armstrong® Connection Corlon®).....		3.05	0.42
		<i>For >40 To 100, Add</i>		0.86	
		<i>For >1,000, Deduct</i>		-0.22	
		<i>For Up To 40, Add</i>		1.73	
09 65 16 23-0005	SF	0.080" Overall Thickness, 0.040" Wear Layer, Inlaid With Polyglass Backing, Commercial Vinyl Sheet Flooring (Armstrong® Possibilities® Petit Point™).....		3.95	0.42
		<i>For >40 To 100, Add</i>		0.95	
		<i>For >1,000, Deduct</i>		-0.31	
		<i>For Up To 40, Add</i>		1.91	
09 65 16 23-0006	SF	0.080" Overall Thickness, 0.060" Wear Layer, Inlaid With Felt Backing, Commercial Vinyl Sheet Flooring (Armstrong® Medintech Tandem®).....		5.27	0.42
		<i>For >40 To 100, Add</i>		1.09	
		<i>For >1,000, Deduct</i>		-0.44	
		<i>For Up To 40, Add</i>		2.17	
09 65 16 23-0007	SF	0.080" Overall Thickness, 0.020" Wear Layer, Slip Retardant Surface, Commercial Vinyl Sheet Flooring (Armstrong® Safeguard®).....		7.27	0.42
		<i>For >40 To 100, Add</i>		1.29	
		<i>For >1,000, Deduct</i>		-0.64	
		<i>For Up To 40, Add</i>		2.57	
09 65 16 23-0008		Heat Welding Vinyl Sheet Flooring Seams (09 65 16 23)			
		Note: For areas requiring seamless installations and superior infection control. Includes routing or hand grooving seams, installing welding rod with heat welding gun, trimming the weld rod flush with the floor surface and applying a protective finish to seam.			
09 65 16 23-0009	LF	Heat Weld Non-Patterned Vinyl Sheet Flooring Seams.....		3.93	
09 65 16 23-0010	LF	Heat Weld Patterned Vinyl Sheet Flooring Seams.....		4.15	



Finishes	09	09
Flooring	09 60	
Resilient Flooring	09 65	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 65 16 23-0011 Forming Vinyl Sheet Flooring Inside/Outside Cove Corners <small>(09 65 16 23)</small> Note: Excludes heat welding.		
09 65 16 23-0012 EA Forming Vinyl Sheet Flooring Inside/Outside Cove Corners.....	9.35	
09 65 16 23-0013 Vinyl Sheet Flooring Accessories <small>(09 65 16 23)</small>		
09 65 16 23-0014 LF 1/2" Radius Vinyl Cove Filler Strip.....	2.28	
09 65 16 23-0015 LF 1-1/4" Radius Vinyl Cove Filler Strip.....	2.05	
09 65 16 23-0016 LF 1-1/2" Radius Vinyl Cove Filler Strip.....	3.11	
09 65 16 23-0017 LF 1/8" Aluminum Cove Cap.....	1.63	
09 65 19 Resilient Tile Flooring <small>(09 65)</small> Note: Includes mastic and cleaning floor after installation is complete. Demolition includes removal of the tile and adhesive and cleaning of the surface for a new floor.		
09 65 19 19 Vinyl Composition Tile Flooring <small>(09 65 19)</small>		
09 65 19 19-0001 Vinyl Composition Tile (VCT) <small>(09 65 19 19)</small> Note: The following vinyl composition tiles are certified to ASTM F 1066 Class 1 solid color tile, Class 2 through pattern tile or Class 3 surface pattern tile as listed in the task description.		
09 65 19 19-0002 SF 1/8" Thick, Class 2 Through Pattern, Vinyl Composition Tile (VCT) (Armstrong® Standard Excelon Imperial Texture®).....	2.09	0.84
For Up To 100, Add	0.16	
For >1,000 To 3,000, Deduct	-0.05	
For >3,000 To 6,000, Deduct	-0.12	
For >6,000, Deduct	-0.22	
For 3/32" Thick, Deduct	-0.11	
For Extra Stock, Material Only, Deduct	-0.99	
For Up To 20, Add	0.73	
For >20 To 40, Add	0.42	
09 65 19 19-0003 SF 1/8" Thick, Class 2 Through Pattern, Vinyl Composition Tile (VCT) (Armstrong® Standard Excelon MultiColor™).....	2.09	0.84
For Up To 100, Add	0.16	
For >1,000 To 3,000, Deduct	-0.05	
For >3,000 To 6,000, Deduct	-0.12	
For >6,000, Deduct	-0.22	
For Extra Stock, Material Only, Deduct	-0.99	
For Up To 20, Add	0.73	
For >20 To 40, Add	0.42	
09 65 19 19-0004 SF 1/8" Thick, Class 2 Through Pattern, Vinyl Composition Tile (VCT) (Armstrong® Standard Excelon Rave®).....	2.09	0.84
For Up To 100, Add	0.16	
For >1,000 To 3,000, Deduct	-0.05	
For >3,000 To 6,000, Deduct	-0.12	
For >6,000, Deduct	-0.22	
For Extra Stock, Material Only, Deduct	-0.99	
For Up To 20, Add	0.73	
For >20 To 40, Add	0.42	
09 65 19 19-0005 SF 1/8" Thick, Class 2 Through Pattern, Vinyl Composition Tile (VCT) (Armstrong® ChromaSpin™).....	3.09	0.84
For Up To 100, Add	0.21	
For >1,000 To 3,000, Deduct	-0.07	
For >3,000 To 6,000, Deduct	-0.16	
For >6,000, Deduct	-0.28	
For Extra Stock, Material Only, Deduct	-0.99	
For Up To 20, Add	0.88	
For >20 To 40, Add	0.52	
09 65 19 19-0006 SF 1/8" Thick, Class 2 Through Pattern, Vinyl Composition Tile (VCT) (Armstrong® Excelon Companion Square®).....	3.10	0.84
For Up To 100, Add	0.21	
For >1,000 To 3,000, Deduct	-0.07	
For >3,000 To 6,000, Deduct	-0.16	
For >6,000, Deduct	-0.28	
For Extra Stock, Material Only, Deduct	-0.99	
For Up To 20, Add	0.88	
For >20 To 40, Add	0.52	
09 65 19 19-0007 SF 1/8" Thick, Class 3 Surface Pattern, Vinyl Composition Tile (VCT) (Armstrong® Arteffects®).....	3.29	0.84
For Up To 100, Add	0.22	
For >1,000 To 3,000, Deduct	-0.07	
For >3,000 To 6,000, Deduct	-0.17	
For >6,000, Deduct	-0.29	
For Extra Stock, Material Only, Deduct	-0.99	
For Up To 20, Add	0.91	
For >20 To 40, Add	0.54	
09 65 19 19-0008 SF 1/8" Thick, Class 2 Through Pattern, Vinyl Composition Tile (VCT) (Armstrong® Excelon Stonetex®).....	3.32	0.84
For Up To 100, Add	0.22	
For >1,000 To 3,000, Deduct	-0.07	
For >3,000 To 6,000, Deduct	-0.17	
For >6,000, Deduct	-0.29	
For Extra Stock, Material Only, Deduct	-0.99	
For Up To 20, Add	0.91	
For >20 To 40, Add	0.54	

09 Finishes**09 60 Flooring****09 65 Resilient Flooring**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 65 19 19-0009	SF		1/8" Thick, Class 2 Through Pattern, Vinyl Composition Tile (VCT) (Armstrong® Raffia™)	3.44	0.84
			For Up To 100, Add	0.22	
			For >1,000 To 3,000, Deduct	-0.07	
			For >3,000 To 6,000, Deduct	-0.17	
			For >6,000, Deduct	-0.30	
			For Extra Stock, Material Only, Deduct	-0.99	
			For Up To 20, Add	0.93	
			For >20 To 40, Add	0.55	
09 65 19 19-0010	SF		1/8" Thick, Slip Retardant, Class 2 Through Pattern, Vinyl Composition Tile (VCT) (Armstrong® Safety Zone™).....	4.54	0.84
			For Up To 100, Add	0.28	
			For >1,000 To 3,000, Deduct	-0.10	
			For >3,000 To 6,000, Deduct	-0.22	
			For >6,000, Deduct	-0.37	
			For Extra Stock, Material Only, Deduct	-0.99	
			For Up To 20, Add	1.10	
			For >20 To 40, Add	0.66	
09 65 19 19-0011	SF		1/8" Thick, Class 1 Solid Color, Vinyl Composition Tile (VCT) (Armstrong® Excelon Feature™).....	4.97	0.84
			For Up To 100, Add	0.30	
			For >1,000 To 3,000, Deduct	-0.10	
			For >3,000 To 6,000, Deduct	-0.24	
			For >6,000, Deduct	-0.39	
			For Extra Stock, Material Only, Deduct	-0.99	
			For Up To 20, Add	1.16	
			For >20 To 40, Add	0.71	
09 65 19 19-0012	SF		1/8" Thick, Static Dissipative, Class 2 Through Pattern, Vinyl Composition Tile (VCT) (Armstrong® SDT™)	6.65	0.84
			For Up To 100, Add	0.38	
			For >1,000 To 3,000, Deduct	-0.14	
			For >3,000 To 6,000, Deduct	-0.30	
			For >6,000, Deduct	-0.49	
			For Extra Stock, Material Only, Deduct	-0.99	
			For Up To 20, Add	1.41	
			For >20 To 40, Add	0.87	

09 65 19 23 Vinyl Tile Flooring (09 65 19)

09 65 19 23-0001			Vinyl Tile (09 65 19 23) Note: Any size.		
09 65 19 23-0002			Solid Vinyl Tile (SVT) (09 65 19 23-0001) Note: The following solid vinyl tiles are certified to ASTM F 1700.		
09 65 19 23-0003	SF		1/8" Thick, Class 1 Type A, Homogeneous, Solid Vinyl Tile (SVT) (Tarkett® Azrock® Cortina Grande).....	5.51	0.84
			For Up To 100, Add	0.35	
			For >1,000 To 3,000, Deduct	-0.12	
			For >3,000 To 6,000, Deduct	-0.27	
			For >6,000, Deduct	-0.46	
09 65 19 23-0004	SF		1/8" Thick, Class 1 Type A, Homogeneous, Solid Vinyl Tile (SVT) (Tarkett® Azrock® Karim Kolors).....	5.66	0.84
			For Up To 100, Add	0.36	
			For >1,000 To 3,000, Deduct	-0.12	
			For >3,000 To 6,000, Deduct	-0.28	
			For >6,000, Deduct	-0.47	
			For Up To 20, Add	1.43	
			For >20 To 40, Add	0.85	
09 65 19 23-0005	SF		1/8" Thick, Slip Retardant, Class 1 Type B, Homogeneous, Solid Vinyl Tile (SVT) (Tarkett® Azrock® Cortina Grande SR)	5.76	0.84
			For Up To 100, Add	0.36	
			For >1,000 To 3,000, Deduct	-0.12	
			For >3,000 To 6,000, Deduct	-0.28	
			For >6,000, Deduct	-0.48	
09 65 19 23-0006			Luxury Vinyl Tile (LVT) (09 65 19 23-0001)		
09 65 19 23-0007	SF		2.5mm Thick, Luxury Vinyl Tile (LVT) (Mannington, Amtico)	7.33	0.84
			For Up To 100, Add	0.44	
			For >1,000 To 3,000, Deduct	-0.15	
			For >3,000 To 6,000, Deduct	-0.34	
			For >6,000, Deduct	-0.57	

09 65 19 33 Rubber Tile Flooring (09 65 19)

09 65 19 33-0001			Rubber Tile (09 65 19 33)		
09 65 19 33-0002			Rubber Tile With Raised Discs, Assorted Colors (09 65 19 33-0001)		
09 65 19 33-0003	SF		1/8" Thick Rubber Tile..... Note: Smooth, raised disc or other patterned surface.	11.63	0.50
			For Up To 100, Add	0.63	
09 65 19 33-0004	SF		3/16" Thick Rubber Tile..... Note: Smooth, raised disc or other patterned surface.	14.09	0.56
			For Up To 100, Add	0.76	
09 65 19 33-0005	SF		7/32" Thick Rubber Tile..... Note: Smooth, raised disc or other patterned surface.	15.43	0.56
			For Up To 100, Add	0.83	

09 65 19 43 Polyester Composition Tile Flooring (09 65 19)



Finishes	09	09
Flooring	09 60	
Resilient Flooring	09 65	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 65 19 43-0001 Polyester Composition Floor Tile <small>(09 65 19 43)</small>		
<i>Note: Any size.</i>		
09 65 19 43-0002 SF 1/8" Thick, Polyester Composition Floor Tile (Armstrong® BioBased Tile® Migrations®).....	3.16	0.84
<i>For Up To 100, Add</i>	<i>0.21</i>	
<i>For >1,000 To 3,000, Deduct</i>	<i>-0.07</i>	
<i>For >3,000 To 6,000, Deduct</i>	<i>-0.16</i>	
<i>For >6,000, Deduct</i>	<i>-0.28</i>	
<i>For Extra Stock, Material Only, Deduct</i>	<i>-0.99</i>	
<i>For Up To 20, Add</i>	<i>0.89</i>	
<i>For >20 To 40, Add</i>	<i>0.52</i>	
09 65 19 43-0003 SF 1/8" Thick, Polyester Composition Floor Tile (Armstrong® BioBased Tile® Striations®)	3.61	0.84
<i>For Up To 100, Add</i>	<i>0.23</i>	
<i>For >1,000 To 3,000, Deduct</i>	<i>-0.08</i>	
<i>For >3,000 To 6,000, Deduct</i>	<i>-0.18</i>	
<i>For >6,000, Deduct</i>	<i>-0.31</i>	
<i>For Extra Stock, Material Only, Deduct</i>	<i>-0.99</i>	
<i>For Up To 20, Add</i>	<i>0.96</i>	
<i>For >20 To 40, Add</i>	<i>0.57</i>	
09 65 23 Resilient Plank Flooring <small>(09 65)</small>		
09 65 23 00-0001 Vinyl Plank Flooring <small>(09 65 23)</small>		
09 65 23 00-0002 SF 0.110" Overall Thickness, 0.012" Wear Layer, Vinyl Plank Flooring (Armstrong® Luxe Plank™)	4.28	0.42
<i>For >40 To 100, Add</i>	<i>0.99</i>	
<i>For >1,000, Deduct</i>	<i>-0.34</i>	
<i>For Up To 40, Add</i>	<i>1.97</i>	
09 65 23 00-0003 SF 0.135" Overall Thickness, 0.020" Wear Layer, Vinyl Plank Flooring (Armstrong® Luxe Plank™)	5.39	0.42
<i>For >40 To 100, Add</i>	<i>1.10</i>	
<i>For >1,000, Deduct</i>	<i>-0.45</i>	
<i>For Up To 40, Add</i>	<i>2.20</i>	
09 65 23 00-0004 SF 0.16" Overall Thickness, 0.020" Wear Layer, Vinyl Plank Flooring (Armstrong® Luxe Plank™)	6.07	0.42
<i>For >40 To 100, Add</i>	<i>1.17</i>	
<i>For >1,000, Deduct</i>	<i>-0.52</i>	
<i>For Up To 40, Add</i>	<i>2.33</i>	
09 65 43 Linoleum Flooring <small>(09 65)</small>		
09 65 43 00-0001 Linoleum Flooring <small>(09 65 43)</small>		
09 65 43 00-0002 SF Linoleum Tile (Forbo Marmoleum Composition Tile, MCT).....	3.73	0.84
09 65 43 00-0003 SF 2.5mm, Linoleum Sheet (Forbo Marmoleum)	2.77	0.42
<i>For 3.2mm Thickness, Add</i>	<i>0.38</i>	
<i>For 2mm Thickness, Deduct</i>	<i>-0.18</i>	
09 65 43 00-0004 LF Heat Weld Linoleum Sheet Flooring Seams	3.94	
<i>Note: For areas requiring seamless installations and superior infection control. Includes routing or hand grooving seams, installing welding rod with heat welding gun, trimming the weld rod flush with the floor surface and applying a protective finish to seam.</i>		
09 65 66 Resilient Athletic Flooring <small>(09 65)</small>		
09 65 66 00-0001 Interlocking Rubber Flooring <small>(09 65 66)</small>		
09 65 66 00-0002 SF 3/8" Interlocking Rubber Athletic Flooring (Pawling HL-155)	20.70	0.39
<i>Note: Black with hidden or exposed locks.</i>		
<i>For Colors, Add</i>	<i>2.52</i>	
09 65 66 00-0003 SF 9/16" Interlocking Rubber Athletic Flooring (Pawling HL-100)	31.90	0.39
<i>Note: Black with hidden or exposed locks.</i>		
<i>For Colors, Add</i>	<i>3.92</i>	
09 65 66 00-0004 SF 7/16" Interlocking Rubber Athletic Flooring (Pawling PL-100)	18.45	0.39
<i>Note: Black with hidden or exposed locks.</i>		
<i>For Colors, Add</i>	<i>2.24</i>	
09 65 66 00-0005 SF 9/16" Interlocking Rubber Athletic Flooring (Pawling PL-200)	22.12	0.39
<i>Note: Black with hidden or exposed locks.</i>		
<i>For Colors, Add</i>	<i>2.70</i>	
09 65 66 00-0006 SF 7/16" Interlocking Rubber Athletic Flooring (Pawling FL-150).....	18.45	0.39
<i>Note: Black with hidden or exposed locks.</i>		
<i>For Colors, Add</i>	<i>2.24</i>	
09 66 Terrazzo Flooring <small>(09 60)</small>		
09 66 13 Portland Cement Terrazzo Flooring <small>(09 66)</small>		
<i>Note: Excludes divider strips. See CSI section 09 66 33 00-0000 for conductive terrazzo.</i>		
09 66 13 00-0001 Floors Bonded To Concrete <small>(09 66 13)</small>		
<i>Note: 1-3/4" Thick - 5/8" topping.</i>		
09 66 13 00-0002 SF Terrazzo Floor, Bonded To Concrete, Gray Cement 1-3/4" Thick With 5/8" Topping	17.64	2.04
<i>For Venetian Type Terrazzo, Add</i>	<i>4.63</i>	
<i>For Abrasive Heavy Duty Terrazzo, Add</i>	<i>4.63</i>	
<i>For Colors, Add</i>	<i>2.31</i>	
<i>For Up To 100, Add</i>	<i>4.28</i>	
<i>For >100 To 250, Add</i>	<i>2.14</i>	

09 Finishes**09 60 Flooring****09 66 Terrazzo Flooring**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 66 13 00-0003	SF		Terrazzo Floor, Bonded To Concrete, White Cement 1-3/4" Thick With 5/8" Topping.....	17.75	2.04
			<i>For Venetian Type Terrazzo, Add</i>	4.68	
			<i>For Abrasive Heavy Duty Terrazzo, Add</i>	4.68	
			<i>For Colors, Add</i>	2.34	
			<i>For Up To 100, Add</i>	4.29	
			<i>For >100 To 250, Add</i>	2.15	
09 66 13 00-0004			Floors Not Bonded To Concrete <small>(09 66 13)</small>		
			Note: 3" Thick - 5/8" topping and 1/4" sand cushion.		
09 66 13 00-0005	SF		Terrazzo Floor, Not Bonded, Gray Cement 3" Thick With 5/8" Topping, 1/4" Sand Cushion.....	22.12	2.04
			<i>For Venetian Type Terrazzo, Add</i>	5.61	
			<i>For Abrasive Heavy Duty Terrazzo, Add</i>	5.61	
			<i>For Colors, Add</i>	2.80	
			<i>For Up To 100, Add</i>	5.49	
			<i>For >100 To 250, Add</i>	2.74	
09 66 13 00-0006	SF		Terrazzo Floor, Not Bonded, White Cement 3" Thick With 5/8" Topping, 1/4" Sand Cushion	22.23	2.04
			<i>For Venetian Type Terrazzo, Add</i>	5.66	
			<i>For Abrasive Heavy Duty Terrazzo, Add</i>	5.66	
			<i>For Colors, Add</i>	2.83	
			<i>For Up To 100, Add</i>	5.50	
			<i>For >100 To 250, Add</i>	2.75	
09 66 13 00-0007			Monolithic Terrazzo <small>(09 66 13)</small>		
09 66 13 00-0008	SF		Monolithic Terrazzo, 3-1/2" Base 5/8" Topping, 4'-5" Square Panels Topping (Including Mesh And Felt)	12.12	2.04
			<i>For Venetian Type Terrazzo, Add</i>	4.08	
			<i>For Abrasive Heavy Duty Terrazzo, Add</i>	4.08	
			<i>For Colors, Add</i>	2.04	
			<i>For Up To 100, Add</i>	2.40	
			<i>For >100 To 250, Add</i>	1.20	
09 66 13 00-0009			Terrazzo Wainscot <small>(09 66 13)</small>		
09 66 13 00-0010	SF		Terrazzo Wainscot Cast In Place 1-1/2" Thick Bonded To Concrete Or Masonry 1-1/2" Thick	24.15	2.73
			<i>For Venetian Type Terrazzo, Add</i>	3.00	
09 66 13 00-0011			Terrazzo Base <small>(09 66 13)</small>		
09 66 13 00-0012	SF		Terrazzo Base, Cast In Place, 6" Cove Type.....	22.57	1.71
			<i>For Venetian Type Terrazzo, Add</i>	6.53	
09 66 13 00-0013			Terrazzo Curb <small>(09 66 13)</small>		
09 66 13 00-0014	LF		6" x 6" Terrazzo Curb, Cast In Place, Polished Top And 2 Faces.....	55.46	11.41
			<i>For Venetian Type Terrazzo, Add</i>	8.71	
09 66 13 00-0015			Stairs Cast In Place <small>(09 66 13)</small>		
			Note: Topping applied to concrete or metal.		
09 66 13 00-0016	LF		Cast In Place Terrazzo Stair, 1-1/2" Thick x 12" Wide, Applied To Concrete Or Metal.....	24.72	4.09
			<i>For Each SF Of Abrasive Surface Finish, Add</i>	0.35	
			<i>For Each LF Of Embedded Abrasive Strips, Add</i>	0.56	
			<i>For Each LF Of Abrasive Metal Nosing, Add</i>	3.90	
			<i>For Each SF Of Landings, Add</i>	1.50	
09 66 13 00-0017	LF		Cast In Place Terrazzo Stair Tread And Riser, Applied To Concrete Or Metal.....	62.00	13.62
			<i>For Each SF Of Abrasive Surface Finish, Add</i>	0.35	
			<i>For Each LF Of Embedded Abrasive Strips, Add</i>	0.56	
			<i>For Each LF Of Abrasive Metal Nosing, Add</i>	3.90	
			<i>For Each SF Of Landings, Add</i>	1.50	
09 66 13 00-0018	SF		Cast In Place Terrazzo Stair Stringer And Fascia, Applied To Concrete Or Metal.....	25.05	4.09
			<i>For Each SF Of Abrasive Surface Finish, Add</i>	0.35	
			<i>For Each LF Of Embedded Abrasive Strips, Add</i>	0.56	
			<i>For Each LF Of Abrasive Metal Nosing, Add</i>	3.90	
			<i>For Each SF Of Landings, Add</i>	1.50	
09 66 13 00-0019			Divider Strips <small>(09 66 13)</small>		
09 66 13 00-0020	LF		Divider Strip, 14 Gauge, 1-1/4" Deep, Zinc.....	3.51	0.68
09 66 13 00-0021	LF		Divider Strip, 14 Gauge, 1-1/4" Deep, Brass.....	2.96	0.68
09 66 13 00-0022	LF		Heavy Top Strip, 1/4" Thick, 1-1/4" Deep, Zinc.....	5.38	0.68
09 66 13 00-0023	LF		Heavy Top Strip, 1/4" Thick, 1-1/4" Deep, Galvanized Bottom, Brass	7.82	0.68
09 66 13 00-0024	LF		Divider Strip For Thin Set Floors, 16 Gauge, 1/2" x 1/2" Zinc	3.39	0.68
09 66 13 00-0025	LF		Divider Strip For Thin Set Floors, 16 Gauge, 1/2" x 1/2" Brass.....	4.93	0.68
09 66 13 00-0026	LF		Divider Strip For Floor, Vinyl Plastic.....	3.38	0.68
09 66 16			Terrazzo Floor Tile <small>(09 66)</small>		
09 66 16 00-0001			Flooring Tiles <small>(09 66 16)</small>		
			Note: Gray cement setting bed 3/16" polyester matrix or 1/2" cement matrix 12" x 12".		
09 66 16 00-0002			Terrazzo Tiles With Non Slip Surface <small>(09 66 16 00-0001)</small>		



Finishes	09	9
Flooring	09 60	
Terrazzo Flooring	09 66	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 66 16 00-0003	SF		9" x 9" x 1" Non Slip Precast Terrazzo, Thin Set Floor Tile <i>For White Cement, Add</i> <i>For Venetian Type Terrazzo, Add</i>	19.75 0.36 2.00	1.85
09 66 16 00-0004	SF		12" x 12" x 1" Non Slip Precast Terrazzo, Thin Set Floor Tile..... <i>For White Cement, Add</i> <i>For Venetian Type Terrazzo, Add</i>	20.16 0.36 2.00	1.85
09 66 16 00-0005	SF		12" x 12" x 1-1/2" Non Slip Precast Terrazzo, Thin Set Floor Tile <i>For White Cement, Add</i> <i>For Venetian Type Terrazzo, Add</i>	23.30 0.36 2.00	1.85
09 66 16 00-0006	SF		18" x 18" x 1-1/2" Non Slip Precast Terrazzo, Thin Set Floor Tile <i>For White Cement, Add</i> <i>For Venetian Type Terrazzo, Add</i>	24.89 0.36 2.00	1.85
09 66 16 00-0007	SF		24" x 24" x 1-1/2" Non Slip Precast Terrazzo, Thin Set Floor Tile <i>For White Cement, Add</i> <i>For Venetian Type Terrazzo, Add</i>	25.99 0.36 2.00	1.85
09 66 16 00-0008			Terrazzo Tile Thin Set <small>(09 66 16 00-0001)</small>		
09 66 16 00-0009	SF		Precast Terrazzo, 1/4"-1/2" Chips Floor Tiles, Thin Set Gray Cement Bed <i>For White Cement, Add</i> <i>For Venetian Type Terrazzo, Add</i>	19.54 0.36 2.00	1.85
09 66 16 00-0010	SF		Precast Terrazzo, 3/8"-1" Chips Floor Tiles, Thin Set Gray Cement Bed <i>For White Cement, Add</i> <i>For Venetian Type Terrazzo, Add</i>	20.82 0.36 2.00	1.85
09 66 16 00-0011			Thin Set Terrazzo Wainscot <small>(09 66 16 00-0001)</small>		
09 66 16 00-0012	SF		12" x 12" x 1" Terrazzo Tile Wainscot Thin Set..... <i>For Each LF Of White Cement, Add</i> <i>For Each LF Of Zinc Toe Strip, Add</i>	28.14 0.50 1.00	3.43
09 66 16 00-0013	SF		18" x 18" x 1-1/2" Terrazzo Tile Wainscot Thin Set <i>For Each LF Of White Cement, Add</i> <i>For Each LF Of Zinc Toe Strip, Add</i>	32.04 0.50 1.00	3.43
09 66 16 00-0014			Thin Set Terrazzo Base, Gray Cement <small>(09 66 16 00-0001)</small>		
09 66 16 00-0015	LF		6" High, Straight Terrazzo Base Thin Set, Gray Cement..... <i>For Each LF Of White Cement, Add</i> <i>For Each LF Of Zinc Toe Strip, Add</i>	9.49 0.50 1.00	1.71
09 66 16 00-0016	LF		6" High, Cove Terrazzo Base Thin Set, Gray Cement..... <i>For Each LF Of White Cement, Add</i> <i>For Each LF Of Zinc Toe Strip, Add</i>	10.67 0.50 1.00	1.71
09 66 16 00-0017	LF		8" High, Straight Terrazzo Base Thin Set, Gray Cement..... <i>For Each LF Of White Cement, Add</i> <i>For Each LF Of Zinc Toe Strip, Add</i>	11.10 0.50 1.00	1.71
09 66 16 00-0018	LF		8" High, Cove Terrazzo Base Thin Set, Gray Cement..... <i>For Each LF Of White Cement, Add</i> <i>For Each LF Of Zinc Toe Strip, Add</i>	11.69 0.50 1.00	1.71
09 66 16 00-0019			Terrazzo Curbs <small>(09 66 16 00-0001)</small>		
09 66 16 00-0020	LF		8" x 8" Curb, Terrazzo Tile..... <i>For Each LF Of White Cement, Add</i> <i>For Each LF Of Zinc Toe Strip, Add</i>	18.63 0.50 1.00	2.28
09 66 16 00-0021	LF		6" x 6" Curb, Terrazzo Tile..... <i>For Each LF Of White Cement, Add</i> <i>For Each LF Of Zinc Toe Strip, Add</i>	18.04 0.50 1.00	2.28
09 66 16 00-0022			Precast Terrazzo Stair Treads 12" Wide <small>(09 66 16 00-0001)</small>		
09 66 16 00-0023	LF		1-1/2" Precast Terrazzo Stair Tread 12" Wide x 1-1/2" Thick, Diamond Pattern <i>For Each LF Of White Cement, Add</i>	47.52 0.50	2.28
09 66 16 00-0024	LF		1-1/2" Precast Terrazzo Stair Tread 12" Wide x 1-1/2" Thick, Non Slip Surface <i>For Each LF Of White Cement, Add</i>	40.41 0.50	2.28
09 66 16 00-0025	LF		2" Precast Terrazzo Straight Stair Tread..... <i>For Each LF Of White Cement, Add</i>	35.68 0.50	2.28
09 66 16 00-0026	LF		2" Precast Terrazzo Curved Stair Tread..... <i>For Each LF Of White Cement, Add</i>	41.85 0.50	2.28
09 66 16 00-0027			Stair Risers, 1" Thick To 6" High, Straight <small>(09 66 16 00-0001)</small>		
09 66 16 00-0028	LF		1"-6" High Precast Terrazzo Stair Riser Straight Section, Thin Set..... <i>For Each LF Of White Cement, Add</i>	21.34 0.50	1.71
09 66 16 00-0029	LF		1"-6" High Precast Terrazzo Stair Riser Straight Cove Section, Thin Set..... <i>For Each LF Of White Cement, Add</i>	24.89 0.50	1.71
09 66 16 00-0030			Stair Risers, 1" Thick To 6" High, Curved <small>(09 66 16 00-0001)</small>		
09 66 16 00-0031	LF		1" To 6" High Precast Terrazzo Stair Riser Curved Vertical Section, Thin Set..... <i>For Each LF Of White Cement, Add</i>	31.66 0.50	1.71
09 66 16 00-0032	LF		1" To 6" High Precast Terrazzo Stair Riser Curved Cove Section, Thin Set..... <i>For Each LF Of White Cement, Add</i>	34.02 0.50	1.71
09 66 16 00-0033			Tread And Riser <small>(09 66 16)</small>		
09 66 16 00-0034			Stair Stringers, Notched For Treads And Risers <small>(09 66 16 00-0033)</small>		
09 66 16 00-0035	LF		1" Precast Terrazzo Stair Stringers Notched For Treads And Risers <i>For Each LF Of White Cement, Add</i>	52.77 0.50	4.56
09 66 16 00-0036	LF		2" Precast Terrazzo Stair Stringers Notched For Treads And Risers <i>For Each LF Of White Cement, Add</i>	63.77 0.50	4.56

09 Finishes**09 60 Flooring****09 66 Terrazzo Flooring**

MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
09 66 16 00-0037		Structural Non-Slip Landings (09 66 16 00-0033)			
09 66 16 00-0038	SF	1-1/2" Thick Precast Terrazzo Stair Landing Structural, Non Slip.....	38.10		2.28
09 66 16 00-0039	SF	3" Thick Precast Terrazzo Stair Landing Structural, Non Slip.....	47.06		2.28
09 66 16 00-0040		Combined Tread And Riser (09 66 16 00-0033)			
09 66 16 00-0041		Straight Sections (09 66 16 00-0040)			
09 66 16 00-0042	LF	Precast Terrazzo Stair Tread And Riser 1-1/2" Tread, 3/4" Riser, Straight Section.....	83.85		4.56
09 66 16 00-0043	LF	Precast Terrazzo Stair Tread And Riser 3" Tread, 1" Riser, Straight Section.....	100.43		4.56
09 66 16 00-0044		Curved Sections (09 66 16 00-0040)			
09 66 16 00-0045	LF	Precast Terrazzo Stair Tread And Riser 2" Tread, 1" Riser, Curved Section.....	105.45		4.56
09 66 16 00-0046	LF	Precast Terrazzo Stair Tread And Riser 3" Tread, 1" Riser, Curved Section.....	133.86		4.56
09 66 33		Conductive Terrazzo Flooring (09 66)			
		Note: For anti-static areas.			
09 66 33 13		Conductive Epoxy-Resin Terrazzo (09 66 33)			
09 66 33 13-0001	SF	Terrazzo, Epoxy System, Floor Sparkproof, Conductive, Industrial.....	16.51		2.85
09 66 33 13-0002	SF	Terrazzo, Epoxy System, Base Sparkproof, Conductive, Industrial.....	30.30		2.85
09 66 33 16		Conductive Polyester-Resin Terrazzo Flooring (09 66 33)			
09 66 33 16-0001	SF	Terrazzo, Polyester System, Floor Sparkproof, Conductive, Industrial.....	12.58		2.85
09 66 33 16-0002	SF	Terrazzo, Polyester System, Base Sparkproof, Conductive, Industrial.....	21.93		2.85
09 66 33 19		Conductive Plastic-Matrix Terrazzo Flooring (09 66 33)			
09 66 33 19-0001	SF	Terrazzo, Polyacrylate System, Floor Sparkproof, Conductive, Industrial.....	14.03		2.85
09 66 33 19-0002	SF	Terrazzo, Polyacrylate System, Base Sparkproof, Conductive, Industrial.....	27.22		2.85
09 66 33 19-0003	SF	Terrazzo, Synthetic Latex Mastic System, Floor Sparkproof, Conductive, Industrial.....	20.57		2.85
09 66 33 19-0004	SF	Terrazzo, Synthetic Latex Mastic System, Base Sparkproof, Conductive, Industrial.....	23.23		2.85
09 68		Carpeting (09 68)			
		Note: No VOC carpet and adhesives. Includes tack strips, glue and floor fastenings as required and vacuuming.			
09 68 13		Tile Carpeting (09 68)			
09 68 13 00-0001		Tufted Carpet Tiles (09 68 13)			
		Note: Level-loop pile or textured-loop pile carpet tiles. Includes glue or peel and stick backing.			
09 68 13 00-0002		Non-Patterned Carpet Tiles (09 68 13 00-0001)			
09 68 13 00-0003	SY	18 Ounce, Non Patterned, Nylon Carpet Tile.....	37.94		3.37
		For >200 To 400, Deduct	-0.59		
		For >400 To 600, Deduct	-0.89		
		For >600 To 900, Deduct	-1.61		
		For >900 To 1,500, Deduct	-2.33		
		For >1,500 To 2,200, Deduct	-3.38		
		For >2,200 To 3,500, Deduct	-4.33		
		For >3,500, Deduct	-5.28		
		For Cushion Backed Tile, Add	4.90		
09 68 13 00-0004	SY	20 Ounce, Non Patterned, Nylon Carpet Tile.....	39.74		3.37
		For >200 To 400, Deduct	-0.63		
		For >400 To 600, Deduct	-0.95		
		For >600 To 900, Deduct	-1.70		
		For >900 To 1,500, Deduct	-2.45		
		For >1,500 To 2,200, Deduct	-3.56		
		For >2,200 To 3,500, Deduct	-4.56		
		For >3,500, Deduct	-5.55		
		For Cushion Backed Tile, Add	4.90		
09 68 13 00-0005	SY	22 Ounce, Non Patterned, Nylon Carpet Tile.....	45.46		3.37
		For >200 To 400, Deduct	-0.74		
		For >400 To 600, Deduct	-1.12		
		For >600 To 900, Deduct	-1.98		
		For >900 To 1,500, Deduct	-2.85		
		For >1,500 To 2,200, Deduct	-4.13		
		For >2,200 To 3,500, Deduct	-5.27		
		For >3,500, Deduct	-6.41		
		For Cushion Backed Tile, Add	4.90		
09 68 13 00-0006	SY	24 Ounce, Non Patterned, Nylon Carpet Tile.....	51.03		3.37
		For >200 To 400, Deduct	-0.86		
		For >400 To 600, Deduct	-1.28		
		For >600 To 900, Deduct	-2.26		
		For >900 To 1,500, Deduct	-3.24		
		For >1,500 To 2,200, Deduct	-4.69		
		For >2,200 To 3,500, Deduct	-5.97		
		For >3,500, Deduct	-7.24		
		For Cushion Backed Tile, Add	4.90		



Finishes	09	09
Flooring	09 60	
Carpeting	09 68	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 68 13 00-0007 SY 26 Ounce, Non Patterned, Nylon Carpet Tile.....	54.29	3.37
For >200 To 400, Deduct	-0.92	
For >400 To 600, Deduct	-1.38	
For >600 To 900, Deduct	-2.43	
For >900 To 1,500, Deduct	-3.47	
For >1,500 To 2,200, Deduct	-5.02	
For >2,200 To 3,500, Deduct	-6.37	
For >3,500, Deduct	-7.73	
For Cushion Backed Tile, Add	4.90	
09 68 13 00-0008 SY 28 Ounce, Non Patterned, Nylon Carpet Tile.....	57.63	3.37
For >200 To 400, Deduct	-0.99	
For >400 To 600, Deduct	-1.48	
For >600 To 900, Deduct	-2.59	
For >900 To 1,500, Deduct	-3.70	
For >1,500 To 2,200, Deduct	-5.35	
For >2,200 To 3,500, Deduct	-6.79	
For >3,500, Deduct	-8.23	
For Cushion Backed Tile, Add	4.90	
09 68 13 00-0009 SY 30 Ounce, Non Patterned, Nylon Carpet Tile.....	58.62	3.37
For >200 To 400, Deduct	-1.01	
For >400 To 600, Deduct	-1.51	
For >600 To 900, Deduct	-2.64	
For >900 To 1,500, Deduct	-3.77	
For >1,500 To 2,200, Deduct	-5.45	
For >2,200 To 3,500, Deduct	-6.92	
For >3,500, Deduct	-8.38	
For Cushion Backed Tile, Add	4.90	
09 68 13 00-0010 SY 32 Ounce, Non Patterned, Nylon Carpet Tile.....	59.24	3.37
For >200 To 400, Deduct	-1.02	
For >400 To 600, Deduct	-1.53	
For >600 To 900, Deduct	-2.67	
For >900 To 1,500, Deduct	-3.82	
For >1,500 To 2,200, Deduct	-5.51	
For >2,200 To 3,500, Deduct	-6.99	
For >3,500, Deduct	-8.47	
For Cushion Backed Tile, Add	4.90	
09 68 13 00-0011 SY 34 Ounce, Non Patterned, Nylon Carpet Tile.....	59.76	3.37
For >200 To 400, Deduct	-1.03	
For >400 To 600, Deduct	-1.55	
For >600 To 900, Deduct	-2.70	
For >900 To 1,500, Deduct	-3.85	
For >1,500 To 2,200, Deduct	-5.56	
For >2,200 To 3,500, Deduct	-7.06	
For >3,500, Deduct	-8.55	
For Cushion Backed Tile, Add	4.90	
09 68 13 00-0012 SY 36 Ounce, Non Patterned, Nylon Carpet Tile.....	61.54	3.37
For >200 To 400, Deduct	-1.07	
For >400 To 600, Deduct	-1.60	
For >600 To 900, Deduct	-2.79	
For >900 To 1,500, Deduct	-3.98	
For >1,500 To 2,200, Deduct	-5.74	
For >2,200 To 3,500, Deduct	-7.28	
For >3,500, Deduct	-8.82	
For Cut And Loop Pile Combination Or Tip Shear Carpet, Add	2.00	
For Cushion Backed Tile, Add	4.90	
09 68 13 00-0013 SY 38 Ounce, Non Patterned, Nylon Carpet Tile.....	65.07	3.37
For >200 To 400, Deduct	-1.14	
For >400 To 600, Deduct	-1.70	
For >600 To 900, Deduct	-2.97	
For >900 To 1,500, Deduct	-4.23	
For >1,500 To 2,200, Deduct	-6.10	
For >2,200 To 3,500, Deduct	-7.72	
For >3,500, Deduct	-9.35	
For Cut And Loop Pile Combination Or Tip Shear Carpet, Add	2.00	
For Cushion Backed Tile, Add	4.90	
09 68 13 00-0014 SY 40 Ounce, Non Patterned, Nylon Carpet Tile.....	68.86	3.37
For >200 To 400, Deduct	-1.21	
For >400 To 600, Deduct	-1.82	
For >600 To 900, Deduct	-3.15	
For >900 To 1,500, Deduct	-4.49	
For >1,500 To 2,200, Deduct	-6.47	
For >2,200 To 3,500, Deduct	-8.20	
For >3,500, Deduct	-9.92	
For Cut And Loop Pile Combination Or Tip Shear Carpet, Add	2.00	
For Cushion Backed Tile, Add	4.90	
09 68 13 00-0015 SY 42 Ounce, Non Patterned, Nylon Carpet Tile.....	76.13	3.37
For >200 To 400, Deduct	-1.36	
For >400 To 600, Deduct	-2.04	
For >600 To 900, Deduct	-3.52	
For >900 To 1,500, Deduct	-5.00	
For >1,500 To 2,200, Deduct	-7.20	
For >2,200 To 3,500, Deduct	-9.10	
For >3,500, Deduct	-11.01	
For Cut And Loop Pile Combination Or Tip Shear Carpet, Add	2.00	
For Cushion Backed Tile, Add	4.90	
09 68 13 00-0016 SY Installation Of Owner Provided Non Patterned Carpet Tiles.....	8.44	

09 Finishes**09 60 Flooring**

09 68 Carpeting



MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
09 68 13 00-0017		Patterned Carpet Tiles <small>(09 68 13 00-0001)</small>			
		Note: Patterned carpet has a definitive repeating pattern as defined by the manufacturer.			
09 68 13 00-0018	SY	18 Ounce, Patterned, Nylon Carpet Tile	39.21		3.37
		For >200 To 400, Deduct	-0.60		
		For >400 To 600, Deduct	-0.90		
		For >600 To 900, Deduct	-1.64		
		For >900 To 1,500, Deduct	-2.38		
		For >1,500 To 2,200, Deduct	-3.47		
		For >2,200 To 3,500, Deduct	-4.45		
		For >3,500, Deduct	-5.43		
		For Cushion Backed Tile, Add	4.90		
09 68 13 00-0019	SY	20 Ounce, Patterned, Nylon Carpet Tile	41.04		3.37
		For >200 To 400, Deduct	-0.64		
		For >400 To 600, Deduct	-0.96		
		For >600 To 900, Deduct	-1.73		
		For >900 To 1,500, Deduct	-2.51		
		For >1,500 To 2,200, Deduct	-3.65		
		For >2,200 To 3,500, Deduct	-4.68		
		For >3,500, Deduct	-5.70		
		For Cushion Backed Tile, Add	4.90		
09 68 13 00-0020	SY	22 Ounce, Patterned, Nylon Carpet Tile	46.84		3.37
		For >200 To 400, Deduct	-0.76		
		For >400 To 600, Deduct	-1.13		
		For >600 To 900, Deduct	-2.02		
		For >900 To 1,500, Deduct	-2.92		
		For >1,500 To 2,200, Deduct	-4.23		
		For >2,200 To 3,500, Deduct	-5.40		
		For >3,500, Deduct	-6.57		
		For Cushion Backed Tile, Add	4.90		
09 68 13 00-0021	SY	24 Ounce, Patterned, Nylon Carpet Tile	52.50		3.37
		For >200 To 400, Deduct	-0.87		
		For >400 To 600, Deduct	-1.30		
		For >600 To 900, Deduct	-2.31		
		For >900 To 1,500, Deduct	-3.31		
		For >1,500 To 2,200, Deduct	-4.80		
		For >2,200 To 3,500, Deduct	-6.11		
		For >3,500, Deduct	-7.42		
		For Cushion Backed Tile, Add	4.90		
09 68 13 00-0022	SY	26 Ounce, Patterned, Nylon Carpet Tile	55.80		3.37
		For >200 To 400, Deduct	-0.93		
		For >400 To 600, Deduct	-1.40		
		For >600 To 900, Deduct	-2.47		
		For >900 To 1,500, Deduct	-3.54		
		For >1,500 To 2,200, Deduct	-5.13		
		For >2,200 To 3,500, Deduct	-6.52		
		For >3,500, Deduct	-7.92		
		For Cushion Backed Tile, Add	4.90		
09 68 13 00-0023	SY	28 Ounce, Patterned, Nylon Carpet Tile	59.19		3.37
		For >200 To 400, Deduct	-1.00		
		For >400 To 600, Deduct	-1.50		
		For >600 To 900, Deduct	-2.64		
		For >900 To 1,500, Deduct	-3.78		
		For >1,500 To 2,200, Deduct	-5.47		
		For >2,200 To 3,500, Deduct	-6.95		
		For >3,500, Deduct	-8.43		
		For Cushion Backed Tile, Add	4.90		
09 68 13 00-0024	SY	30 Ounce, Patterned, Nylon Carpet Tile	60.19		3.37
		For >200 To 400, Deduct	-1.02		
		For >400 To 600, Deduct	-1.53		
		For >600 To 900, Deduct	-2.69		
		For >900 To 1,500, Deduct	-3.85		
		For >1,500 To 2,200, Deduct	-5.57		
		For >2,200 To 3,500, Deduct	-7.07		
		For >3,500, Deduct	-8.58		
		For Cushion Backed Tile, Add	4.90		
09 68 13 00-0025	SY	32 Ounce, Patterned, Nylon Carpet Tile	60.83		3.37
		For >200 To 400, Deduct	-1.04		
		For >400 To 600, Deduct	-1.55		
		For >600 To 900, Deduct	-2.72		
		For >900 To 1,500, Deduct	-3.90		
		For >1,500 To 2,200, Deduct	-5.63		
		For >2,200 To 3,500, Deduct	-7.15		
		For >3,500, Deduct	-8.67		
		For Cushion Backed Tile, Add	4.90		
09 68 13 00-0026	SY	34 Ounce, Patterned, Nylon Carpet Tile	61.35		3.37
		For >200 To 400, Deduct	-1.05		
		For >400 To 600, Deduct	-1.57		
		For >600 To 900, Deduct	-2.75		
		For >900 To 1,500, Deduct	-3.93		
		For >1,500 To 2,200, Deduct	-5.68		
		For >2,200 To 3,500, Deduct	-7.22		
		For >3,500, Deduct	-8.75		
		For Cushion Backed Tile, Add	4.90		



Finishes	09	
Flooring	09 60	09
Carpeting	09 68	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 68 13 00-0027	SY		36 Ounce, Patterned, Nylon Carpet Tile	63.16	3.37
			<i>For >200 To 400, Deduct</i>	-1.08	
			<i>For >400 To 600, Deduct</i>	-1.62	
			<i>For >600 To 900, Deduct</i>	-2.84	
			<i>For >900 To 1,500, Deduct</i>	-4.06	
			<i>For >1,500 To 2,200, Deduct</i>	-5.86	
			<i>For >2,200 To 3,500, Deduct</i>	-7.44	
			<i>For >3,500, Deduct</i>	-9.02	
			<i>For Cut And Loop Pile Combination Or Tip Shear Carpet, Add</i>	2.00	
			<i>For Cushion Backed Tile, Add</i>	4.90	
09 68 13 00-0028	SY		38 Ounce, Patterned, Nylon Carpet Tile	66.74	3.37
			<i>For >200 To 400, Deduct</i>	-1.15	
			<i>For >400 To 600, Deduct</i>	-1.73	
			<i>For >600 To 900, Deduct</i>	-3.02	
			<i>For >900 To 1,500, Deduct</i>	-4.31	
			<i>For >1,500 To 2,200, Deduct</i>	-6.22	
			<i>For >2,200 To 3,500, Deduct</i>	-7.89	
			<i>For >3,500, Deduct</i>	-9.56	
			<i>For Cut And Loop Pile Combination Or Tip Shear Carpet, Add</i>	2.00	
			<i>For Cushion Backed Tile, Add</i>	4.90	
09 68 13 00-0029	SY		40 Ounce, Patterned, Nylon Carpet Tile	70.59	3.37
			<i>For >200 To 400, Deduct</i>	-1.23	
			<i>For >400 To 600, Deduct</i>	-1.85	
			<i>For >600 To 900, Deduct</i>	-3.21	
			<i>For >900 To 1,500, Deduct</i>	-4.58	
			<i>For >1,500 To 2,200, Deduct</i>	-6.61	
			<i>For >2,200 To 3,500, Deduct</i>	-8.37	
			<i>For >3,500, Deduct</i>	-10.14	
			<i>For Cut And Loop Pile Combination Or Tip Shear Carpet, Add</i>	2.00	
			<i>For Cushion Backed Tile, Add</i>	4.90	
09 68 13 00-0030	SY		42 Ounce, Patterned, Nylon Carpet Tile	77.97	3.37
			<i>For >200 To 400, Deduct</i>	-1.38	
			<i>For >400 To 600, Deduct</i>	-2.07	
			<i>For >600 To 900, Deduct</i>	-3.58	
			<i>For >900 To 1,500, Deduct</i>	-5.10	
			<i>For >1,500 To 2,200, Deduct</i>	-7.34	
			<i>For >2,200 To 3,500, Deduct</i>	-9.29	
			<i>For >3,500, Deduct</i>	-11.24	
			<i>For Cut And Loop Pile Combination Or Tip Shear Carpet, Add</i>	2.00	
			<i>For Cushion Backed Tile, Add</i>	4.90	
09 68 13 00-0031	SY		Installation Of Owner Provided Patterned Carpet Tiles	9.63	
09 68 13 00-0032			ESD Static Control Carpet Tiles (StaticSmart Mission Critical Discovery ECO Series) <small>(09 68 13 00-0001)</small>		
			Note: Includes conductive ESD releasable adhesive and grounding clips.		
09 68 13 00-0033	SY		24 Ounce, ESD Static Control, Non-Patterned, Nylon Carpet Tile (StaticSmart Mission Critical Discovery ECO Series)	67.60	3.37
			<i>For >200 To 400, Deduct</i>	-1.17	
			<i>For >400 To 600, Deduct</i>	-1.76	
			<i>For >600 To 900, Deduct</i>	-3.06	
			<i>For >900 To 1,500, Deduct</i>	-4.37	
			<i>For >1,500 To 2,200, Deduct</i>	-6.31	
			<i>For >2,200 To 3,500, Deduct</i>	-8.00	
			<i>For >3,500, Deduct</i>	-9.69	
09 68 16			Sheet Carpeting <small>(09 68)</small>		
			Note: Weights shown are face weight excluding backing weight and excludes padding. Demolition of carpet includes removal of glue if required. Residential carpet backing basis is for padding and commercial carpet backing is for glue down.		
09 68 16 00-0001			Carpet Cushion <small>(09 68 16)</small>		
09 68 16 00-0002			Carpet Pads <small>(09 68 16 00-0001)</small>		
09 68 16 00-0003	SY		Foam Rubber Carpet Padding	5.60	1.93
09 68 16 00-0004	SY		Sponge Rubber Carpet Cushion	5.45	1.93
09 68 16 00-0005	SY		Urethane Carpet Cushion 1/4" Thick	5.35	1.93
09 68 16 00-0006	SY		Urethane Carpet Cushion 3/8" Thick	5.91	1.93
09 68 16 00-0007	SY		7/16" Thick, Rebonded, 6 LB/CF	5.45	1.93
09 68 16 00-0008	SY		3/8" Thick, Rebonded, 7 LB/CF	5.71	1.93
09 68 16 00-0009	SY		1/2" Thick, Rebonded, 8 LB/CF	6.08	1.93
09 68 16 00-0010			Commercial Broadloom Carpet <small>(09 68 16)</small>		
			Note: Level-loop pile or textured-loop pile broadloom carpet.		
09 68 16 00-0011			Non-Patterned Broadloom Carpet <small>(09 68 16 00-0010)</small>		
09 68 16 00-0012	SY		22 Ounce, Medium Traffic, Non Patterned, Nylon Broadloom Carpet	33.03	13.80
			<i>For Up To 15, Add</i>	1.84	
			<i>For >15 To 33, Add</i>	0.92	
			<i>For >200 To 400, Deduct</i>	-0.48	
			<i>For >400 To 600, Deduct</i>	-0.71	
			<i>For >600 To 900, Deduct</i>	-1.33	
			<i>For >900, Deduct</i>	-1.94	
			<i>For Moisture Barrier Backing, Add</i>	3.50	
			<i>For Installation On Stairs, Each Riser, Add</i>	6.00	

09 Finishes**09 60 Flooring****09 68 Carpeting**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 68 16 00-0013	SY		24 Ounce, Medium Traffic, Non Patterned, Nylon Broadloom Carpet.....	33.03	13.80
			<i>For Up To 15, Add</i>	1.84	
			<i>For >15 To 33, Add</i>	0.92	
			<i>For >200 To 400, Deduct</i>	-0.48	
			<i>For >400 To 600, Deduct</i>	-0.71	
			<i>For >600 To 900, Deduct</i>	-1.33	
			<i>For >900, Deduct</i>	-1.94	
			<i>For Moisture Barrier Backing, Add</i>	3.50	
			<i>For Installation On Stairs, Each Riser, Add</i>	6.00	
09 68 16 00-0014	SY		26 Ounce, Medium Traffic, Non Patterned, Nylon Broadloom Carpet.....	33.03	13.80
			<i>For Up To 15, Add</i>	1.84	
			<i>For >15 To 33, Add</i>	0.92	
			<i>For >200 To 400, Deduct</i>	-0.48	
			<i>For >400 To 600, Deduct</i>	-0.71	
			<i>For >600 To 900, Deduct</i>	-1.33	
			<i>For >900, Deduct</i>	-1.94	
			<i>For Moisture Barrier Backing, Add</i>	3.50	
			<i>For Installation On Stairs, Each Riser, Add</i>	6.00	
09 68 16 00-0015	SY		28 Ounce, Medium Traffic, Non Patterned, Nylon Broadloom Carpet.....	35.81	14.96
			<i>For Up To 15, Add</i>	1.99	
			<i>For >15 To 33, Add</i>	1.00	
			<i>For >200 To 400, Deduct</i>	-0.52	
			<i>For >400 To 600, Deduct</i>	-0.78	
			<i>For >600 To 900, Deduct</i>	-1.44	
			<i>For >900, Deduct</i>	-2.11	
			<i>For Moisture Barrier Backing, Add</i>	3.50	
			<i>For Installation On Stairs, Each Riser, Add</i>	6.00	
09 68 16 00-0016	SY		30 Ounce, Medium Traffic, Non Patterned, Nylon Broadloom Carpet.....	36.54	14.96
			<i>For Up To 15, Add</i>	1.99	
			<i>For >15 To 33, Add</i>	1.00	
			<i>For >200 To 400, Deduct</i>	-0.53	
			<i>For >400 To 600, Deduct</i>	-0.80	
			<i>For >600 To 900, Deduct</i>	-1.48	
			<i>For >900, Deduct</i>	-2.16	
			<i>For Cut Pile Carpet, Add</i>	1.50	
			<i>For Moisture Barrier Backing, Add</i>	3.50	
			<i>For Installation On Stairs, Each Riser, Add</i>	6.00	
09 68 16 00-0017	SY		32 Ounce, Medium Traffic, Non Patterned, Nylon Broadloom Carpet.....	36.67	14.96
			<i>For Up To 15, Add</i>	1.99	
			<i>For >15 To 33, Add</i>	1.00	
			<i>For >200 To 400, Deduct</i>	-0.53	
			<i>For >400 To 600, Deduct</i>	-0.80	
			<i>For >600 To 900, Deduct</i>	-1.48	
			<i>For >900, Deduct</i>	-2.17	
			<i>For Cut Pile Carpet, Add</i>	1.50	
			<i>For Moisture Barrier Backing, Add</i>	3.50	
			<i>For Installation On Stairs, Each Riser, Add</i>	6.00	
09 68 16 00-0018	SY		34 Ounce, Medium Traffic, Non Patterned, Nylon Broadloom Carpet.....	40.35	16.10
			<i>For Up To 15, Add</i>	2.15	
			<i>For >15 To 33, Add</i>	1.07	
			<i>For >200 To 400, Deduct</i>	-0.59	
			<i>For >400 To 600, Deduct</i>	-0.89	
			<i>For >600 To 900, Deduct</i>	-1.64	
			<i>For >900, Deduct</i>	-2.39	
			<i>For Cut Pile Carpet, Add</i>	1.50	
			<i>For Moisture Barrier Backing, Add</i>	3.50	
			<i>For Installation On Stairs, Each Riser, Add</i>	6.00	
09 68 16 00-0019	SY		36 Ounce, Heavy Traffic, Non Patterned, Nylon Broadloom Carpet.....	40.87	16.10
			<i>For Up To 15, Add</i>	2.15	
			<i>For >15 To 33, Add</i>	1.07	
			<i>For >200 To 400, Deduct</i>	-0.60	
			<i>For >400 To 600, Deduct</i>	-0.90	
			<i>For >600 To 900, Deduct</i>	-1.67	
			<i>For >900, Deduct</i>	-2.43	
			<i>For Cut Pile Carpet, Add</i>	1.50	
			<i>For Cut And Loop Pile Combination Or Tip Shear Carpet, Add</i>	2.00	
			<i>For Moisture Barrier Backing, Add</i>	3.50	
			<i>For Installation On Stairs, Each Riser, Add</i>	6.00	
09 68 16 00-0020	SY		38 Ounce, Heavy Traffic, Non Patterned, Nylon Broadloom Carpet.....	41.51	16.10
			<i>For Up To 15, Add</i>	2.15	
			<i>For >15 To 33, Add</i>	1.07	
			<i>For >200 To 400, Deduct</i>	-0.62	
			<i>For >400 To 600, Deduct</i>	-0.92	
			<i>For >600 To 900, Deduct</i>	-1.70	
			<i>For >900, Deduct</i>	-2.48	
			<i>For Cut Pile Carpet, Add</i>	1.50	
			<i>For Cut And Loop Pile Combination Or Tip Shear Carpet, Add</i>	2.00	
			<i>For Moisture Barrier Backing, Add</i>	3.50	
			<i>For Installation On Stairs, Each Riser, Add</i>	6.00	

09 68 16 00-0021 Patterned Broadloom Carpet (09 68 16 00-0010)

Note: Patterned carpet has a definitive repeating pattern as defined by the manufacturer.



Finishes	09	09
Flooring	09 60	
Carpeting	09 68	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 68 16 00-0022 SY 22 Ounce, Medium Traffic, Patterned, Nylon Broadloom Carpet.....	34.32	13.80
For Up To 15, Add	2.03	
For >15 To 33, Add	1.01	
For >200 To 400, Deduct	-0.48	
For >400 To 600, Deduct	-0.73	
For >600 To 900, Deduct	-1.36	
For >900, Deduct	-2.00	
For Moisture Barrier Backing, Add	3.50	
For Installation On Stairs, Each Riser, Add	6.00	
09 68 16 00-0023 SY 24 Ounce, Medium Traffic, Patterned, Nylon Broadloom Carpet.....	34.32	13.80
For Up To 15, Add	2.03	
For >15 To 33, Add	1.01	
For >200 To 400, Deduct	-0.48	
For >400 To 600, Deduct	-0.73	
For >600 To 900, Deduct	-1.36	
For >900, Deduct	-2.00	
For Moisture Barrier Backing, Add	3.50	
For Installation On Stairs, Each Riser, Add	6.00	
09 68 16 00-0024 SY 26 Ounce, Medium Traffic, Patterned, Nylon Broadloom Carpet.....	34.32	13.80
For Up To 15, Add	2.03	
For >15 To 33, Add	1.01	
For >200 To 400, Deduct	-0.48	
For >400 To 600, Deduct	-0.73	
For >600 To 900, Deduct	-1.36	
For >900, Deduct	-2.00	
For Moisture Barrier Backing, Add	3.50	
For Installation On Stairs, Each Riser, Add	6.00	
09 68 16 00-0025 SY 28 Ounce, Medium Traffic, Patterned, Nylon Broadloom Carpet.....	37.20	14.96
For Up To 15, Add	2.19	
For >15 To 33, Add	1.10	
For >200 To 400, Deduct	-0.52	
For >400 To 600, Deduct	-0.79	
For >600 To 900, Deduct	-1.48	
For >900, Deduct	-2.17	
For Moisture Barrier Backing, Add	3.50	
For Installation On Stairs, Each Riser, Add	6.00	
09 68 16 00-0026 SY 30 Ounce, Medium Traffic, Patterned, Nylon Broadloom Carpet.....	37.94	14.96
For Up To 15, Add	2.19	
For >15 To 33, Add	1.10	
For >200 To 400, Deduct	-0.54	
For >400 To 600, Deduct	-0.81	
For >600 To 900, Deduct	-1.51	
For >900, Deduct	-2.22	
For Cut Pile Carpet, Add	1.50	
For Moisture Barrier Backing, Add	3.50	
For Installation On Stairs, Each Riser, Add	6.00	
09 68 16 00-0027 SY 32 Ounce, Medium Traffic, Patterned, Nylon Broadloom Carpet.....	38.07	14.96
For Up To 15, Add	2.19	
For >15 To 33, Add	1.10	
For >200 To 400, Deduct	-0.54	
For >400 To 600, Deduct	-0.81	
For >600 To 900, Deduct	-1.52	
For >900, Deduct	-2.23	
For Cut Pile Carpet, Add	1.50	
For Moisture Barrier Backing, Add	3.50	
For Installation On Stairs, Each Riser, Add	6.00	
09 68 16 00-0028 SY 34 Ounce, Medium Traffic, Patterned, Nylon Broadloom Carpet.....	41.86	16.10
For Up To 15, Add	2.36	
For >15 To 33, Add	1.18	
For >200 To 400, Deduct	-0.60	
For >400 To 600, Deduct	-0.90	
For >600 To 900, Deduct	-1.68	
For >900, Deduct	-2.46	
For Cut Pile Carpet, Add	1.50	
For Moisture Barrier Backing, Add	3.50	
For Installation On Stairs, Each Riser, Add	6.00	
09 68 16 00-0029 SY 36 Ounce, Heavy Traffic, Patterned, Nylon Broadloom Carpet.....	42.40	16.10
For Up To 15, Add	2.36	
For >15 To 33, Add	1.18	
For >200 To 400, Deduct	-0.61	
For >400 To 600, Deduct	-0.92	
For >600 To 900, Deduct	-1.71	
For >900, Deduct	-2.50	
For Cut Pile Carpet, Add	1.50	
For Cut And Loop Pile Combination Or Tip Shear Carpet, Add	2.00	
For Moisture Barrier Backing, Add	3.50	
For Installation On Stairs, Each Riser, Add	6.00	

09 Finishes**09 60 Flooring****09 68 Carpeting**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 68 16 00-0030	SY		38 Ounce, Heavy Traffic, Patterned, Nylon Broadloom Carpet.....	43.05	16.10
			<i>For Up To 15, Add</i>	2.36	
			<i>For >15 To 33, Add</i>	1.18	
			<i>For >200 To 400, Deduct</i>	-0.62	
			<i>For >400 To 600, Deduct</i>	-0.94	
			<i>For >600 To 900, Deduct</i>	-1.74	
			<i>For >900, Deduct</i>	-2.54	
			<i>For Cut Pile Carpet, Add</i>	1.50	
			<i>For Cut And Loop Pile Combination Or Tip Shear Carpet, Add</i>	2.00	
			<i>For Moisture Barrier Backing, Add</i>	3.50	
			<i>For Installation On Stairs, Each Riser, Add</i>	6.00	
09 68 16 00-0031			Indoor/Outdoor Carpet (09 68 16) Note: Includes waterproof glue.		
09 68 16 00-0032	SY		Nylon Indoor/Outdoor Carpet.....	27.80	3.87
09 68 16 00-0033	SY		Ozite Indoor/Outdoor Carpet.....	22.92	3.87
09 68 16 00-0034			Carpet Accessories (09 68 16)		
09 68 16 00-0035	LF		Metal Carpet Saddle Strip, Up To 4" Wide.....	3.02	0.73
09 68 16 00-0036			Removal And Reinstallation Of Carpet And Pad (09 68 16) Note: Includes storage, cleaning and supply materials.		
09 68 16 00-0037	SY		Remove And Reinstall Carpet And Pad.....	19.43	
09 68 16 00-0038			Carpeting Support Functions (09 68 16)		
09 68 16 00-0039			Relocate Partitions, Modular Work Stations (09 68 16 00-0038) Note: Includes disassembly and reassembly of work station. Excludes electrical disconnection or reconnection.		
09 68 16 00-0040	EA		Relocate Modular Work Station.....	255.73	
09 68 16 00-0041			Installation Of Owner Provided Broadloom Carpet (09 68 16)		
09 68 16 00-0042	SY		Up To 24 Oz, Installation Of Owner Provided Broadloom Carpet.....	8.21	
			Note: Includes adhesive for glue-down or tack strip for padded installations.		
			<i>For Up To 15, Add</i>	1.60	
			<i>For >15 To 33, Add</i>	0.80	
09 68 16 00-0043	SY		>24 To 34 Oz, Installation Of Owner Provided Broadloom Carpet.....	9.54	
			Note: Includes adhesive for glue-down or tack strip for padded installations.		
			<i>For Up To 15, Add</i>	1.87	
			<i>For >15 To 33, Add</i>	0.93	
09 68 16 00-0044	SY		>34 Oz, Installation Of Owner Provided Broadloom Carpet.....	11.41	
			Note: Includes adhesive for glue-down or tack strip for padded installations.		
			<i>For Up To 15, Add</i>	2.24	
			<i>For >15 To 33, Add</i>	1.12	
09 69			Access Flooring (09 69)		
09 69 13			Rigid-Grid Access Flooring (09 69)		
09 69 13 00-0001			Panels, No Covering (09 69 13)		
09 69 13 00-0002	SF		2' x 2' Panels - No Covering Access And Pedestal Floors.....	9.91	0.73
			<i>For Carpet Covering, Add</i>	2.77	
			<i>For Vinyl Floor Covering, Add</i>	1.91	
09 69 13 00-0003	SF		2' x 2' Perforated Panels Access And Pedestal Floors.....	18.39	0.73
			<i>For Carpet Covering, Add</i>	2.77	
			<i>For Vinyl Floor Covering, Add</i>	1.91	
09 69 13 00-0004	SF		Tate 1250AS Panel Cover UTP Designer Plus Color Raf Blue 7153T.....	17.15	0.80
09 69 13 00-0005	SF		Tate 1250AS Panel Cover UTP Designer Plus Color Sage Brown 7777T.....	17.15	0.80
09 69 13 00-0006	SF		Tate 1250AS Panel Cover UTP Designer Plus Color Moodance 6808.....	17.15	0.80
09 69 13 00-0007	SF		Tate 1250AS Panel Cover UTP Designer Plus Color Mosaic 6280.....	17.15	0.80
09 69 13 00-0008	SF		Tate 1250AS Panel Cover HPL 1/8" Nevamar ST2-2 Beige Star/Brown Trim.....	16.24	0.80
09 69 13 00-0009	SF		Tate 1250AS Panel Cover HPL 1/8" Nevamar ST6-1 Gray Star/Black Trim.....	16.24	0.80
09 69 13 00-0010	SF		Tate Concore 1500 Panel Cover UTP Designer Plus Color Raf Blue 7153T.....	18.30	0.80
09 69 13 00-0011	SF		Tate Concore 1500 Panel Cover UTP Designer Plus Color Sage Brown 7777T.....	18.30	0.80
09 69 13 00-0012	SF		Tate Concore 1500 Panel Cover UTP Designer Plus Color Moodance 6808.....	18.30	0.80
09 69 13 00-0013	SF		Tate Concore 1500 Panel Cover UTP Designer Plus Color Mosaic 6280.....	18.30	0.80
09 69 13 00-0014	SF		Tate Concore 1500 Panel Cover HPL 1/8" Nevamar ST-2 Beige Star/Brown Trim.....	17.38	0.80
09 69 13 00-0015	SF		Tate Concore 1500 Panel Cover HPL 1/8" Nevamar ST6-1 Grey Star/Black Trim.....	17.38	0.80
09 69 13 00-0016	SF		Tate 1250AS Perforated 25% O/A Cover 1/8" Nevamar HPL ST2-2 Beige Star Trim.....	21.94	0.80
09 69 13 00-0017	SF		Tate 1250AS Perforated 25% O/A Cover 1/8" Nevamar HPL ST6-1 Gray Star Trim.....	21.94	0.80
09 69 13 00-0018			Pedestals (09 69 13)		
09 69 13 00-0019	EA		Pedestal, 6" To 12" Access And Pedestal Floors.....	23.56	3.65
09 69 13 00-0020	EA		Standard Pedestal Assembly (8" And 12" Finished Floor Height).....	17.40	1.09
09 69 13 00-0021	EA		Tate Standard Pedestal Assembly (18" And 24" Finished Floor Height).....	17.97	1.09
09 69 13 00-0022	EA		Tate Standard Pedestal Assembly (30" And 36" Finished Floor Height).....	20.46	3.65



Finishes	09	09
Flooring	09 60	
Access Flooring	09 69	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 69 13 00-0023 Stringers <small>(09 69 13)</small>		
09 69 13 00-0024 LF 2' Stringers Access And Pedestal Floors.....	6.70	2.20
09 69 13 00-0025 LF 6' Stringers Access And Pedestal Floors.....	6.66	3.07
09 69 13 00-0026 EA Tate Standard 2' Bolted Stringer.....	15.23	4.38
09 69 13 00-0027 EA Tate Standard 4' Bolted Stringer.....	30.45	9.50
09 69 13 00-0028 Understructure <small>(09 69 13)</small>		
09 69 13 00-0029 SF Tate Standard Bolted Stringer Understructure 8" Or 12" Finished Floor Height	3.89	1.09
09 69 13 00-0030 SF Tate Standard Bolted Stringer Understructure 18" Or 24" Finished Floor Height	4.17	1.09
09 69 13 00-0031 SF Tate Standard Bolted Stringer Understructure 30" Or 36" Finished Floor Height	4.98	1.09
09 69 53 Access Flooring Accessories <small>(09 69)</small>		
09 69 53 00-0001 Accessories <small>(09 69 53)</small>		
09 69 53 00-0002 SF Accessories, Ramp Assembly Access And Pedestal Floors.....	23.03	2.92
09 69 53 00-0003 LF Accessories, Handrail Access And Pedestal Floors	37.23	5.12
09 69 53 00-0004 LF Accessories, Fascia Plate Access And Pedestal Floors	16.79	5.12
09 69 53 00-0005 EA Machine Cutouts.....	126.72	
09 69 53 00-0006 SF Tate Tamp, Cover Step Master Slip Retard- Tile, Buckskin Or Slate.....	37.12	
09 69 53 00-0007 LF Tate 2 Or 3 Riser Steps In Raised Floor System.....	87.16	0.36
Note: Includes baffles, fascia plates trim and cover.		
09 69 53 00-0008 LF Tate Handrail	70.10	2.41
09 69 53 00-0009 SF Hammered Aluminum Finish Fascia	27.49	2.41
Note: Includes trim angles and hardware (8", 12", 18", 24").		
09 69 53 00-0010 EA 7" x 17" Tate Lexan Floor Mounted Grille	122.46	9.14
Note: Includes carpet trim to flush mount.		
09 69 53 00-0011 EA Cut Hole In Raised Floor And Trim With Black 1/2" Trim Material	31.55	
09 69 53 00-0012 EA Cut Round Hole In Raised Floor And Trim Carpet Install 4" Plastic Insert (Gromtec#GT003)	31.55	
09 69 53 00-0013 EA Rehab Panel (Any Brand, Weight) Carpet Cover Only - New UTP Carpet.....	34.49	1.46
09 69 53 00-0014 EA Rehab Panel (Any Brand, Weight) Carpet Cover Only - New HPL	41.94	1.46
09 69 53 00-0015 EA Rehab Panel (Any Brand, Weight) HPL Cover Only - With New HPL/WA Edge Trim	32.43	1.46
09 69 53 00-0016 EA Rehab Panel (Any Brand, Weight) HPL Cover Only - With New HPL Top set Trim Edge	41.92	1.46
09 69 53 00-0017 EA Flush Mounted Electrical Box (Including Cutting Hole Trim Carpet) P/N Telo-7018-4.....	121.07	9.14
09 69 53 00-0018 EA Flush Mounted Telephone Box (Grey/Black/Communications).....	88.31	9.14
Note: Includes cut hole.		
09 69 53 00-0019 EA Flush Mounted Electrical Box (In Existing Hole) P/N Telo 7018-4	121.07	9.14
09 69 53 00-0020 EA Flush Mounted Telephone Box (Grey/Black/Communications) (In Existing Hole) P/N Telo-7018-2	59.08	1.46
09 69 53 00-0021 EA Remove Flush Mounted Electrical, Telephone Or Communications Floor Box In Raised Floor	7.30	
09 69 53 00-0022 Final Cleaning For Computer Room Raised Floor System <small>(09 69 53)</small>		
Note: Includes wipe dirt/dust from stringers and raised floor beneath raised floor. For new or existing systems.		
09 69 53 00-0023 SF Vacuum Raised Floor Carpet Panel, Wipe Dirt/Dust From Stringers And Floor Beneath Raised Floor.....	2.45	
09 69 53 00-0024 SF Vacuum/Shampoo Raised Floor Carpet Panel, Wipe Dirt/Dust From Stringers And Floor Beneath.....	2.52	
09 69 53 00-0025 SF Vacuum/Wet Mop Clean Raised Floor HPL Panel Wipe Dirt/Dust Stringers And Raised Floor.....	2.50	
09 70 Wall Finishes <small>(09)</small>		
09 72 Wall Coverings <small>(09 72)</small>		
09 72 13 Cork Wall Coverings <small>(09 72)</small>		
09 72 13 00-0001 Cork Wall Covering <small>(09 72 13)</small>		
09 72 13 00-0002 SF 1/8" Cork Wall Covering.....	3.38	0.55
09 72 13 00-0003 SF 1/4" Cork Wall Covering.....	4.29	0.55
09 72 13 00-0004 SF 1/2" Cork Wall Covering.....	5.02	0.55
09 72 13 00-0005 SF 3/4" Cork Wall Covering.....	7.14	0.55
09 72 16 Vinyl-Coated Fabric Wall Coverings <small>(09 72)</small>		
09 72 16 00-0001 Vinyl Wall Coverings <small>(09 72 16)</small>		
Note: Includes wall preparation adhesive, and sizing compound. Demolition includes the removal of wall covering and adhesive.		
09 72 16 00-0002 SF Vinyl Wall Covering, 7-10 Oz/SY	1.35	0.55
For Owner Furnished Material, Deduct		
	-0.49	
09 72 16 00-0003 SF Vinyl Wall Covering, 11-14 Oz/SY	1.63	0.55
For Owner Furnished Material, Deduct		
	-0.72	
09 72 16 00-0004 SF Vinyl Wall Covering, 20-25 Oz/SY	2.17	0.55
For Owner Furnished Material, Deduct		
	-1.03	
09 72 16 00-0005 SF Vinyl Wall Covering, 26-32 Oz/SY	2.45	0.55
For Owner Furnished Material, Deduct		
	-1.26	
09 72 16 00-0006 SF Vinyl Wall Covering, 33-38 Oz/SY	3.35	0.55
For Owner Furnished Material, Deduct		
	-2.10	
09 72 19 Textile Wall Coverings <small>(09 72)</small>		

09 Finishes**09 70 Wall Finishes****09 72 Wall Coverings**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 72 19 00-0001 Wall Fabrics <small>(09 72 19)</small>		
09 72 19 00-0002 SF Wall Covering, Natural Fabric, Grass Cloth	3.71	0.55
09 72 19 00-0003 SF Wall Covering, Grass Cloth	4.09	0.55
09 72 19 00-0004 SF Wall Covering, Burlap	3.10	0.55
09 72 19 00-0005 SF Flexible Gypsum Coated Wall Fabric, Fire Resistant.....	2.74	0.55
09 72 19 00-0006 SF Acoustical Wall Cover	4.38	0.55
09 72 19 00-0007 Natural Fiber Resilient Wallcovering <small>(09 72 19)</small>		
09 72 19 00-0008 SY Sisal Wall Covering - 48 To 54 Oz/SY With Adhesive (4', 8', 12' Widths)	53.68	5.12
<i>For Fire Rated Adhesive, UBC 42-2, Add</i>	<i>0.11</i>	
09 72 23 Wallpapering <small>(09 72)</small>		
09 72 23 00-0001 Wallpaper Coverings <small>(09 72 23)</small>		
Note: Includes wall preparation adhesive, and sizing compound. Demolition includes the removal of wall covering and adhesive.		
09 72 23 00-0002 SF Average Quality Wallpaper (Standard Grade)	1.67	0.73
09 72 23 00-0003 SF High Quality Wallpaper (Designer Grade)	2.86	0.93
09 72 23 00-0004 SF Ceiling Paper	2.43	1.37
09 73 Wall Carpeting <small>(09 70)</small>		
09 73 00 00-0001 Carpet Wall Covering <small>(09 73)</small>		
09 73 00 00-0002 SY Nylon 28 Oz Carpet Wall Covering	31.99	10.96
09 73 00 00-0003 SY Nylon 32 Oz Carpet Wall Covering	32.60	10.96
09 73 00 00-0004 SY Nylon 34 Oz Carpet Wall Covering	35.39	12.06
09 73 00 00-0005 SY Nylon 35 Oz Carpet Wall Covering	37.47	12.79
09 73 00 00-0006 SY Nylon 36 Oz Carpet Wall Covering	39.58	13.52
09 73 00 00-0007 SY Nylon 38 Oz Carpet Wall Covering	40.32	13.52
09 73 00 00-0008 SY Nylon 40 Oz Carpet Wall Covering	41.86	13.88
09 73 00 00-0009 SY Nylon 42 Oz Carpet Wall Covering	43.52	14.25
09 74 Flexible Wood Sheets <small>(09 70)</small>		
09 74 16 Flexible Wood Veneers <small>(09 74)</small>		
09 74 16 00-0001 Walnut <small>(09 74 16)</small>		
09 74 16 00-0002 SF Walnut 1/32 In Thick Flexible Wood Veneer	6.79	2.20
09 74 16 00-0003 Exotic Wood <small>(09 74 16)</small>		
09 74 16 00-0004 SF Exotic Wood 1/32 Thick, Flexible Wood Veneer	9.47	2.20
09 80 Acoustic Treatment <small>(09)</small>		
09 81 Acoustic Insulation <small>(09 80)</small>		
09 81 16 Acoustic Blanket Insulation <small>(09 81)</small>		
09 81 16 00-0001 Sound Attenuation Fire Blankets (SAFB) <small>(09 81 16)</small>		
09 81 16 00-0002 2.5 PCF Density, Sound Attenuation Fire Blankets (SAFB) <small>(09 81 16 00-0001)</small>		
09 81 16 00-0003 SF 1-1/2" Thick, 2.5 PCF Density, Sound Attenuation Fire Blanket (Thermafiber SAFB)	1.19	0.21
09 81 16 00-0004 SF 2" Thick, 2.5 PCF Density, Sound Attenuation Fire Blanket (Thermafiber SAFB)	1.27	0.21
09 81 16 00-0005 SF 2-1/2" Thick, 2.5 PCF Density, Sound Attenuation Fire Blanket (Thermafiber SAFB)	1.38	0.21
09 81 16 00-0006 SF 3" Thick, 2.5 PCF Density, Sound Attenuation Fire Blanket (Thermafiber SAFB)	1.47	0.21
09 81 16 00-0007 SF 3-1/2" Thick, 2.5 PCF Density, Sound Attenuation Fire Blanket (Thermafiber SAFB)	1.58	0.21
09 81 16 00-0008 SF 4" Thick, 2.5 PCF Density, Sound Attenuation Fire Blanket (Thermafiber SAFB)	1.69	0.21
09 81 16 00-0009 SF 5" Thick, 2.5 PCF Density, Sound Attenuation Fire Blanket (Thermafiber SAFB)	1.84	0.21
09 81 16 00-0010 SF 6" Thick, 2.5 PCF Density, Sound Attenuation Fire Blanket (Thermafiber SAFB)	2.00	0.21
09 81 16 00-0011 4 PCF Density, Sound Attenuation Fire Blankets (SAFB) <small>(09 81 16 00-0001)</small>		
09 81 16 00-0012 SF 1" Thick, 4 PCF Density, Sound Attenuation Fire Blanket (Thermafiber SAFB)	1.17	0.21
09 81 16 00-0013 Sound Attenuation Batts <small>(09 81 16)</small>		
Note: NoiseReducer® by Certainteed, Quitezone® by Owens Corning, Sound-Shield® by Johns Mansville.		
09 81 16 00-0014 SF 2-1/2" Thick, Unfaced Sound Attenuation Batt	0.74	0.29
09 81 16 00-0015 SF 3-1/2" Thick, Unfaced Sound Attenuation Batt	0.79	0.29
09 81 16 00-0016 SF 3-1/2" Thick, Kraft Faced Sound Attenuation Batt	0.81	0.29
09 81 16 00-0017 SF 5-1/2" Thick, Unfaced Sound Attenuation Batt	0.90	0.29
09 81 16 00-0018 SF 5-1/2" Thick, Kraft Faced Sound Attenuation Batt	0.92	0.29
09 81 16 00-0019 SF 6-1/4" Thick, Unfaced Sound Attenuation Batt	0.91	0.29
09 81 16 00-0020 SF 6-1/4" Thick, Kraft Faced Sound Attenuation Batt	0.94	0.29



Finishes	09	
Acoustic Treatment	09 80	9
Acoustic Insulation	09 81	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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09 84 Acoustic Room Components (09 80)

09 84 13 Fixed Sound-Absorptive Panels (09 84)

09 84 13 00-0001 Sound Absorbing Panels And Attenuation Blankets (09 84 13)
 Note: No backs, 3" thick modular, ceiling or wall hung back. Excludes ceiling suspension systems and wall furring system.

09 84 13 00-0002	SF	3" Thick Perforated Steel Sound Absorbing Panel Painted, No Back With Fiberglass Or Mineral Filler.....	6.91	1.44
09 84 13 00-0003	SF	1" Thick Fiberglass Sound Absorbing Panels With Glass Cloth Face For Walls	10.08	1.44

09 84 13 00-0004 Sound Absorbing Acoustical Wall Panel System (09 84 13)

09 84 13 00-0005 Mineral Fiber Substrate, Sound Absorbing Acoustical Wall Panel System (Armstrong® Soundsoak®) (09 84 13 00-0004)

Note: Includes tackable surface, molding and mounting hardware for flush mount.

09 84 13 00-0006	SF	5/8" Panel Thickness, Vinyl Surface, Mineral Fiber Substrate, Sound Absorbing Acoustical Wall Panel System (Armstrong® Soundsoak® 60 Signature Vinyl)	7.95	1.62
09 84 13 00-0007	SF	3/4" Panel Thickness, Composed Fabric Surface (Non-Woven), Mineral Fiber Substrate, Sound Absorbing Acoustical Wall Panel System (Armstrong® Soundsoak® 60 Rhythms®)	7.39	1.62
09 84 13 00-0008	SF	3/4" Panel Thickness, Woven Fabric Surface, Mineral Fiber Substrate, Sound Absorbing Acoustical Wall Panel System (Armstrong® Soundsoak® 60 FR-701)	9.15	1.62
09 84 13 00-0009	SF	3/4" Panel Thickness, Woven Fabric Surface, Mineral Fiber Substrate, Sound Absorbing Acoustical Wall Panel System (Armstrong® Soundsoak® 60 Lido™)	9.17	1.62
09 84 13 00-0010	SF	3/4" Panel Thickness, Woven Fabric Surface, Mineral Fiber Substrate, Sound Absorbing Acoustical Wall Panel System (Armstrong® Soundsoak® 60 Spinel™)	10.06	1.62
09 84 13 00-0011	SF	3/4" Panel Thickness, Woven Fabric Surface, Mineral Fiber Substrate, Sound Absorbing Acoustical Wall Panel System (Armstrong® Soundsoak® 60 Zirconia™)	10.06	1.62

09 84 13 00-0012 Fiberglass Substrate, Sound Absorbing Acoustical Wall Panel System (Armstrong® Soundsoak®) (09 84 13 00-0004)

Note: Includes molding and mounting hardware for flush mount.

09 84 13 00-0013	SF	1" Panel Thickness, Composed Fabric Surface (Non-Woven), Fiberglass Substrate, Sound Absorbing Acoustical Wall Panel System (Armstrong® Soundsoak® 85 Rhythms®).....	9.18	1.62
09 84 13 00-0014	SF	1" Panel Thickness, Woven Fabric Surface, Fiberglass Substrate, Sound Absorbing Acoustical Wall Panel System (Armstrong® Soundsoak® 85 FR-701)	10.63	1.62
09 84 13 00-0015	SF	1" Panel Thickness, Woven Fabric Surface, Fiberglass Substrate, Sound Absorbing Acoustical Wall Panel System (Armstrong® Soundsoak® 85 Lido™)	10.63	1.62
09 84 13 00-0016	SF	1" Panel Thickness, Woven Fabric Surface, Fiberglass Substrate, Sound Absorbing Acoustical Wall Panel System (Armstrong® Soundsoak® 85 Spinel™)	12.08	1.62
09 84 13 00-0017	SF	1" Panel Thickness, Woven Fabric Surface, Fiberglass Substrate, Sound Absorbing Acoustical Wall Panel System (Armstrong® Soundsoak® 85 Zirconia™)	12.08	1.62

09 84 13 00-0018 Sound Absorbing Panel, Eggcrate Style (09 84 13)

Note: Ceiling or wall hung back.

09 84 13 00-0019	SF	2" Thick Polyurethane Sound Wave (Eggcrate Style).....	7.26	
		<i>For Pyramid Style, Add</i>	1.18	
09 84 13 00-0020	SF	3" Thick Polyurethane Sound Wave (Eggcrate Style).....	9.67	
		<i>For Pyramid Style, Add</i>	1.18	
09 84 13 00-0021	SF	4" Thick Polyurethane Sound Wave (Eggcrate Style).....	12.73	
		<i>For Pyramid Style, Add</i>	1.18	
09 84 13 00-0022	SF	2" Thick Melamine Sound Wave (Eggcrate Style)	9.55	
		<i>For Eggcrate Style With Hypalon Coating, Add</i>	1.97	
		<i>For Pyramid Style, Add</i>	2.05	
		<i>For Pyramid Style With Hypalon Coating, Add</i>	4.02	
09 84 13 00-0023	SF	3" Thick Melamine Sound Wave (Eggcrate Style)	19.06	
		<i>For Eggcrate Style With Hypalon Coating, Add</i>	1.97	
		<i>For Pyramid Style, Add</i>	0.42	
		<i>For Pyramid Style With Hypalon Coating, Add</i>	2.40	
09 84 13 00-0024	SF	4" Thick Melamine Sound Wave (Eggcrate Style)	24.46	
		<i>For Eggcrate Style With Hypalon Coating, Add</i>	1.97	
		<i>For Pyramid Style, Add</i>	0.42	
		<i>For Pyramid Style With Hypalon Coating, Add</i>	2.40	

09 85 Acoustic Sound Deadening (09 80)

09 85 00 00-0001 Sound Deadening Fiberboard (09 85)

09 85 00 00-0002	SF	1/2" Sound Deadening Fiberboard.....	1.03	0.36
		<i>For Times When The Shortest Distance From Corner To Corner Is <3', Add</i>	0.33	
		<i>For Horizontal Installation Up To 10' High, Add</i>	0.22	
		<i>For Horizontal Installation >10' High, Add</i>	0.33	
		<i>For Walls >10' High, Add</i>	0.05	
		<i>For Up To 128, Add</i>	0.34	
		<i>For >128 To 320, Add</i>	0.20	

09 90 Painting And Coating (09)

09 Finishes
09 90 Painting And Coating
09 85 Acoustic Sound Deadening



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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Note: Includes masking, safety signs, cleaning of area (dry wiping down walls, floors, doors, etc.), removal of loose paint (paint, caulk, etc.), feathering rough edges, protective work to contain dust and paint splatters (drop cloths), unless otherwise noted, removal and reinstallation of cabinet hardware, switch covers and outlet plates, equipment to place paint and ladders. New construction work additionally includes filling knots, divots, depressions, holes (screw and nail holes in drywall to 1/4" diameter of unlimited quantity). All work designated as "brush/roller" includes brush work for cut and roller work up to cut in. See CSI section 07 92 00 00-0000 for caulking where required, 09 01 20 00-0000 for severely damaged surface preparation in excess of items included above, hand scrape, pressure washing and chemical cleaning where required.

09 91 Painting (09 90)

09 91 13 Exterior Painting (09 91)

Note: Acrylic latex paint unless otherwise stated.

09 91 13 00-0001 Paint Exterior Walls/Siding (09 91 13)

09 91 13 00-0002 Paint Exterior Brick Walls (09 91 13 00-0001)

09 91 13 00-0003	SF	Paint Exterior Brick Walls, 1 Coat Filler, Brush Work.....	0.62	
		For Oil Based Paint, Add	0.04	
		For Work >20', Add	0.12	
		Note: Applied only to work area above 20'.		
		For Up To 100, Add	0.39	
		For >100 To 250, Add	0.18	
		For >250 To 500, Add	0.08	
		For >2,500 To 5,000, Deduct	-0.03	
		For >5,000 To 10,000, Deduct	-0.06	
		For >10,000 To 20,000, Deduct	-0.09	
		For >20,000, Deduct	-0.12	
09 91 13 00-0004	SF	Paint Exterior Brick Walls, 1 Coat Paint, Brush Work.....	0.87	
		For Oil Based Paint, Add	0.05	
		For Work >20', Add	0.18	
		Note: Applied only to work area above 20'.		
		For Up To 100, Add	0.56	
		For >100 To 250, Add	0.27	
		For >250 To 500, Add	0.12	
		For >2,500 To 5,000, Deduct	-0.04	
		For >5,000 To 10,000, Deduct	-0.09	
		For >10,000 To 20,000, Deduct	-0.13	
		For >20,000, Deduct	-0.17	
09 91 13 00-0005	SF	Paint Exterior Brick Walls, 2 Coats Paint, Brush Work.....	1.28	
		For Oil Based Paint, Add	0.08	
		For Work >20', Add	0.25	
		Note: Applied only to work area above 20'.		
		For Up To 100, Add	0.78	
		For >100 To 250, Add	0.37	
		For >250 To 500, Add	0.16	
		For >2,500 To 5,000, Deduct	-0.06	
		For >5,000 To 10,000, Deduct	-0.13	
		For >10,000 To 20,000, Deduct	-0.19	
		For >20,000, Deduct	-0.26	
09 91 13 00-0006	SF	Paint Exterior Brick Walls, 1 Coat Filler, Brush/Roller Work.....	0.42	
		For Oil Based Paint, Add	0.03	
		For Work >20', Add	0.07	
		Note: Applied only to work area above 20'.		
		For Up To 100, Add	0.24	
		For >100 To 250, Add	0.11	
		For >250 To 500, Add	0.05	
		For >2,500 To 5,000, Deduct	-0.02	
		For >5,000 To 10,000, Deduct	-0.04	
		For >10,000 To 20,000, Deduct	-0.06	
		For >20,000, Deduct	-0.08	
09 91 13 00-0007	SF	Paint Exterior Brick Walls, 1 Coat Paint, Brush/Roller Work.....	0.69	
		For Oil Based Paint, Add	0.04	
		For Work >20', Add	0.13	
		Note: Applied only to work area above 20'.		
		For Up To 100, Add	0.40	
		For >100 To 250, Add	0.19	
		For >250 To 500, Add	0.08	
		For >2,500 To 5,000, Deduct	-0.03	
		For >5,000 To 10,000, Deduct	-0.07	
		For >10,000 To 20,000, Deduct	-0.10	
		For >20,000, Deduct	-0.14	
09 91 13 00-0008	SF	Paint Exterior Brick Walls, 2 Coats Paint, Brush/Roller Work.....	1.02	
		For Oil Based Paint, Add	0.07	
		For Work >20', Add	0.17	
		Note: Applied only to work area above 20'.		
		For Up To 100, Add	0.56	
		For >100 To 250, Add	0.27	
		For >250 To 500, Add	0.12	
		For >2,500 To 5,000, Deduct	-0.05	
		For >5,000 To 10,000, Deduct	-0.10	
		For >10,000 To 20,000, Deduct	-0.15	
		For >20,000, Deduct	-0.20	



Finishes	09	9
Painting And Coating	09 90	
Painting	09 91	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 13 00-0009 SF Paint Exterior Brick Walls, 1 Coat Filler, Sprayed.....	0.45	
For Oil Based Paint, Add	0.03	
For Work >20', Add	0.08	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.25	
For >100 To 250, Add	0.12	
For >250 To 500, Add	0.05	
For >2,500 To 5,000, Deduct	-0.02	
For >5,000 To 10,000, Deduct	-0.05	
For >10,000 To 20,000, Deduct	-0.07	
For >20,000, Deduct	-0.09	
09 91 13 00-0010 SF Paint Exterior Brick Walls, 1 Coat Paint, Sprayed.....	0.45	
For Oil Based Paint, Add	0.03	
For Work >20', Add	0.06	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.21	
For >100 To 250, Add	0.11	
For >250 To 500, Add	0.05	
For >2,500 To 5,000, Deduct	-0.02	
For >5,000 To 10,000, Deduct	-0.05	
For >10,000 To 20,000, Deduct	-0.07	
For >20,000, Deduct	-0.09	
09 91 13 00-0011 SF Paint Exterior Brick Walls, 2 Coats Paint, Sprayed.....	0.97	
For Oil Based Paint, Add	0.07	
For Work >20', Add	0.15	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.51	
For >100 To 250, Add	0.25	
For >250 To 500, Add	0.11	
For >2,500 To 5,000, Deduct	-0.05	
For >5,000 To 10,000, Deduct	-0.10	
For >10,000 To 20,000, Deduct	-0.15	
For >20,000, Deduct	-0.19	
09 91 13 00-0012 Paint Exterior Concrete Walls (09 91 13 00-0001)		
09 91 13 00-0013 SF Paint Exterior Concrete Walls, 1 Coat Filler, Brush Work.....	0.53	
For Oil Based Paint, Add	0.03	
For Epoxy Paint, Add	0.06	
For Work >20', Add	0.11	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.33	
For >100 To 250, Add	0.16	
For >250 To 500, Add	0.07	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.05	
For >10,000 To 20,000, Deduct	-0.08	
For >20,000, Deduct	-0.11	
09 91 13 00-0014 SF Paint Exterior Concrete Walls, 1 Coat Paint, Brush Work.....	0.57	
For Oil Based Paint, Add	0.03	
For Epoxy Paint, Add	0.06	
For Work >20', Add	0.12	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.37	
For >100 To 250, Add	0.18	
For >250 To 500, Add	0.08	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.06	
For >10,000 To 20,000, Deduct	-0.09	
For >20,000, Deduct	-0.11	
09 91 13 00-0015 SF Paint Exterior Concrete Walls, 2 Coats Paint, Brush Work.....	1.06	
For Oil Based Paint, Add	0.06	
For Epoxy Paint, Add	0.10	
For Work >20', Add	0.22	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.69	
For >100 To 250, Add	0.33	
For >250 To 500, Add	0.14	
For >2,500 To 5,000, Deduct	-0.05	
For >5,000 To 10,000, Deduct	-0.11	
For >10,000 To 20,000, Deduct	-0.16	
For >20,000, Deduct	-0.21	
09 91 13 00-0016 SF Paint Exterior Concrete Walls, 1 Coat Filler, Brush/Roller Work.....	0.42	
For Oil Based Paint, Add	0.03	
For Epoxy Paint, Add	0.05	
For Work >20', Add	0.08	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.25	
For >100 To 250, Add	0.12	
For >250 To 500, Add	0.05	
For >2,500 To 5,000, Deduct	-0.02	
For >5,000 To 10,000, Deduct	-0.04	
For >10,000 To 20,000, Deduct	-0.06	
For >20,000, Deduct	-0.08	

09 Finishes**09 90 Painting And Coating****09 91 Painting**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 13 00-0017	SF		Paint Exterior Concrete Walls, 1 Coat Paint, Brush/Roller Work.....	0.48	
			<i>For Oil Based Paint, Add</i>	0.03	
			<i>For Epoxy Paint, Add</i>	0.05	
			<i>For Work >20', Add</i>	0.10	
			<i>Note: Applied only to work area above 20'.</i>		
			<i>For Up To 100, Add</i>	0.31	
			<i>For >100 To 250, Add</i>	0.15	
			<i>For >250 To 500, Add</i>	0.06	
			<i>For >2,500 To 5,000, Deduct</i>	-0.02	
			<i>For >5,000 To 10,000, Deduct</i>	-0.05	
			<i>For >10,000 To 20,000, Deduct</i>	-0.07	
			<i>For >20,000, Deduct</i>	-0.10	
09 91 13 00-0018	SF		Paint Exterior Concrete Walls, 2 Coats Paint, Brush/Roller Work.....	0.81	
			<i>For Oil Based Paint, Add</i>	0.05	
			<i>For Epoxy Paint, Add</i>	0.09	
			<i>For Work >20', Add</i>	0.16	
			<i>Note: Applied only to work area above 20'.</i>		
			<i>For Up To 100, Add</i>	0.51	
			<i>For >100 To 250, Add</i>	0.24	
			<i>For >250 To 500, Add</i>	0.10	
			<i>For >2,500 To 5,000, Deduct</i>	-0.04	
			<i>For >5,000 To 10,000, Deduct</i>	-0.08	
			<i>For >10,000 To 20,000, Deduct</i>	-0.12	
			<i>For >20,000, Deduct</i>	-0.16	
09 91 13 00-0019	SF		Paint Exterior Concrete Walls, 1 Coat Filler, Sprayed.....	0.41	
			<i>For Oil Based Paint, Add</i>	0.03	
			<i>For Epoxy Paint, Add</i>	0.06	
			<i>For Work >20', Add</i>	0.07	
			<i>Note: Applied only to work area above 20'.</i>		
			<i>For Up To 100, Add</i>	0.23	
			<i>For >100 To 250, Add</i>	0.11	
			<i>For >250 To 500, Add</i>	0.05	
			<i>For >2,500 To 5,000, Deduct</i>	-0.02	
			<i>For >5,000 To 10,000, Deduct</i>	-0.04	
			<i>For >10,000 To 20,000, Deduct</i>	-0.06	
			<i>For >20,000, Deduct</i>	-0.08	
09 91 13 00-0020	SF		Paint Exterior Concrete Walls, 1 Coat Paint, Sprayed.....	0.38	
			<i>For Oil Based Paint, Add</i>	0.02	
			<i>For Epoxy Paint, Add</i>	0.05	
			<i>For Work >20', Add</i>	0.07	
			<i>Note: Applied only to work area above 20'.</i>		
			<i>For Up To 100, Add</i>	0.22	
			<i>For >100 To 250, Add</i>	0.11	
			<i>For >250 To 500, Add</i>	0.05	
			<i>For >2,500 To 5,000, Deduct</i>	-0.02	
			<i>For >5,000 To 10,000, Deduct</i>	-0.04	
			<i>For >10,000 To 20,000, Deduct</i>	-0.06	
			<i>For >20,000, Deduct</i>	-0.08	
09 91 13 00-0021	SF		Paint Exterior Concrete Walls, 2 Coats Paint, Sprayed.....	0.65	
			<i>For Oil Based Paint, Add</i>	0.04	
			<i>For Epoxy Paint, Add</i>	0.10	
			<i>For Work >20', Add</i>	0.11	
			<i>Note: Applied only to work area above 20'.</i>		
			<i>For Up To 100, Add</i>	0.36	
			<i>For >100 To 250, Add</i>	0.18	
			<i>For >250 To 500, Add</i>	0.08	
			<i>For >2,500 To 5,000, Deduct</i>	-0.03	
			<i>For >5,000 To 10,000, Deduct</i>	-0.07	
			<i>For >10,000 To 20,000, Deduct</i>	-0.10	
			<i>For >20,000, Deduct</i>	-0.13	
09 91 13 00-0022			Paint Exterior Concrete Block Walls (09 91 13 00-0001)		
09 91 13 00-0023			Paint Exterior Concrete Block Walls, Epoxy Paint (09 91 13 00-0022)		
09 91 13 00-0024	SF		Paint Exterior Concrete Block Walls, 1 Coat Filler, Brush Work.....	0.73	
			<i>For Work >20', Add</i>	0.14	
			<i>Note: Applied only to work area above 20'.</i>		
			<i>For Up To 100, Add</i>	0.43	
			<i>For >100 To 250, Add</i>	0.21	
			<i>For >250 To 500, Add</i>	0.09	
			<i>For >2,500 To 5,000, Deduct</i>	-0.04	
			<i>For >5,000 To 10,000, Deduct</i>	-0.07	
			<i>For >10,000 To 20,000, Deduct</i>	-0.11	
			<i>For >20,000, Deduct</i>	-0.15	
09 91 13 00-0025	SF		Paint Exterior Concrete Block Walls, 1 Coat Epoxy Paint, Brush.....	0.84	
			<i>For Work >20', Add</i>	0.16	
			<i>Note: Applied only to work area above 20'.</i>		
			<i>For Up To 100, Add</i>	0.52	
			<i>For >100 To 250, Add</i>	0.25	
			<i>For >250 To 500, Add</i>	0.11	
			<i>For >2,500 To 5,000, Deduct</i>	-0.04	
			<i>For >5,000 To 10,000, Deduct</i>	-0.08	
			<i>For >10,000 To 20,000, Deduct</i>	-0.13	
			<i>For >20,000, Deduct</i>	-0.17	



Finishes	09	09
Painting And Coating	09 90	
Painting	09 91	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 13 00-0026 SF Paint Exterior Concrete Block Walls, 2 Coats Epoxy Paint, Brush Work.....	1.48	
For Work >20', Add	0.27	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.88	
For >100 To 250, Add	0.42	
For >250 To 500, Add	0.18	
For >2,500 To 5,000, Deduct	-0.07	
For >5,000 To 10,000, Deduct	-0.15	
For >10,000 To 20,000, Deduct	-0.22	
For >20,000, Deduct	-0.30	
09 91 13 00-0027 SF Paint Exterior Concrete Block Walls, 1 Coat Filler, Brush/Roller Work.....	0.61	
For Work >20', Add	0.11	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.34	
For >100 To 250, Add	0.17	
For >250 To 500, Add	0.07	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.06	
For >10,000 To 20,000, Deduct	-0.09	
For >20,000, Deduct	-0.12	
09 91 13 00-0028 SF Paint Exterior Concrete Block Walls, 1 Coat Epoxy Paint, Brush/Roller Work.....	0.67	
For Work >20', Add	0.12	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.39	
For >100 To 250, Add	0.19	
For >250 To 500, Add	0.08	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.07	
For >10,000 To 20,000, Deduct	-0.10	
For >20,000, Deduct	-0.13	
09 91 13 00-0029 SF Paint Exterior Concrete Block Walls, 2 Coats Epoxy Paint, Brush/Roller Work.....	1.20	
For Work >20', Add	0.20	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.67	
For >100 To 250, Add	0.32	
For >250 To 500, Add	0.14	
For >2,500 To 5,000, Deduct	-0.06	
For >5,000 To 10,000, Deduct	-0.12	
For >10,000 To 20,000, Deduct	-0.18	
For >20,000, Deduct	-0.24	
09 91 13 00-0030 SF Paint Exterior Concrete Block Walls, 1 Coat Filler, Sprayed.....	0.53	
For Work >20', Add	0.07	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.25	
For >100 To 250, Add	0.13	
For >250 To 500, Add	0.06	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.05	
For >10,000 To 20,000, Deduct	-0.08	
For >20,000, Deduct	-0.11	
09 91 13 00-0031 SF Paint Exterior Concrete Block Walls, 1 Coat Epoxy Paint, Sprayed.....	0.60	
For Work >20', Add	0.09	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.31	
For >100 To 250, Add	0.15	
For >250 To 500, Add	0.07	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.06	
For >10,000 To 20,000, Deduct	-0.09	
For >20,000, Deduct	-0.12	
09 91 13 00-0032 SF Paint Exterior Concrete Block Walls, 2 Coats Epoxy Paint, Sprayed.....	1.14	
For Work >20', Add	0.16	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.56	
For >100 To 250, Add	0.28	
For >250 To 500, Add	0.12	
For >2,500 To 5,000, Deduct	-0.06	
For >5,000 To 10,000, Deduct	-0.11	
For >10,000 To 20,000, Deduct	-0.17	
For >20,000, Deduct	-0.23	
09 91 13 00-0033 Paint Exterior Concrete Block Walls, Acrylic Latex Paint (09 91 13 00-0022)	0.68	
09 91 13 00-0034 SF Paint Exterior Concrete Block Walls, 1 Coat Filler, Brush Work.....	0.68	
For Oil Based Paint, Add	0.04	
For Work >20', Add	0.14	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.43	
For >100 To 250, Add	0.21	
For >250 To 500, Add	0.09	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.07	
For >10,000 To 20,000, Deduct	-0.10	
For >20,000, Deduct	-0.14	

09 Finishes
09 90 Painting And Coating
09 91 Painting



MINOR		TOTAL DIRECT	DEMOLITION
CSI	UOM DESCRIPTION	UNIT COST	UNIT COST
09 91 13 00-0035	SF Paint Exterior Concrete Block Walls, 1 Coat Paint, Brush Work.....	0.80	
	For Oil Based Paint, Add	0.05	
	For Work >20', Add	0.16	
	Note: Applied only to work area above 20'.		
	For Up To 100, Add	0.50	
	For >100 To 250, Add	0.24	
	For >250 To 500, Add	0.10	
	For >2,500 To 5,000, Deduct	-0.04	
	For >5,000 To 10,000, Deduct	-0.08	
	For >10,000 To 20,000, Deduct	-0.12	
	For >20,000, Deduct	-0.16	
09 91 13 00-0036	SF Paint Exterior Concrete Block Walls, 2 Coats Paint, Brush Work.....	1.46	
	For Oil Based Paint, Add	0.09	
	For Work >20', Add	0.28	
	Note: Applied only to work area above 20'.		
	For Up To 100, Add	0.89	
	For >100 To 250, Add	0.43	
	For >250 To 500, Add	0.19	
	For >2,500 To 5,000, Deduct	-0.07	
	For >5,000 To 10,000, Deduct	-0.15	
	For >10,000 To 20,000, Deduct	-0.22	
	For >20,000, Deduct	-0.29	
09 91 13 00-0037	SF Paint Exterior Concrete Block Walls, Texture Coat, Brush Work.....	0.88	
	For Oil Based Paint, Add	0.05	
	For Work >20', Add	0.17	
	Note: Applied only to work area above 20'.		
	For Up To 100, Add	0.55	
	For >100 To 250, Add	0.26	
	For >250 To 500, Add	0.11	
	For >2,500 To 5,000, Deduct	-0.04	
	For >5,000 To 10,000, Deduct	-0.09	
	For >10,000 To 20,000, Deduct	-0.13	
	For >20,000, Deduct	-0.18	
09 91 13 00-0038	SF Paint Exterior Concrete Block Walls, 1 Coat Filler, Brush/Roller Work.....	0.54	
	For Oil Based Paint, Add	0.03	
	For Work >20', Add	0.10	
	Note: Applied only to work area above 20'.		
	For Up To 100, Add	0.33	
	For >100 To 250, Add	0.16	
	For >250 To 500, Add	0.07	
	For >2,500 To 5,000, Deduct	-0.03	
	For >5,000 To 10,000, Deduct	-0.05	
	For >10,000 To 20,000, Deduct	-0.08	
	For >20,000, Deduct	-0.11	
09 91 13 00-0039	SF Paint Exterior Concrete Block Walls, 1 Coat Paint, Brush/Roller Work.....	0.68	
	For Oil Based Paint, Add	0.04	
	For Work >20', Add	0.13	
	Note: Applied only to work area above 20'.		
	For Up To 100, Add	0.41	
	For >100 To 250, Add	0.20	
	For >250 To 500, Add	0.09	
	For >2,500 To 5,000, Deduct	-0.03	
	For >5,000 To 10,000, Deduct	-0.07	
	For >10,000 To 20,000, Deduct	-0.10	
	For >20,000, Deduct	-0.14	
09 91 13 00-0040	SF Paint Exterior Concrete Block Walls, 2 Coats Paint, Brush/Roller Work.....	1.17	
	For Oil Based Paint, Add	0.08	
	For Work >20', Add	0.21	
	Note: Applied only to work area above 20'.		
	For Up To 100, Add	0.67	
	For >100 To 250, Add	0.32	
	For >250 To 500, Add	0.14	
	For >2,500 To 5,000, Deduct	-0.06	
	For >5,000 To 10,000, Deduct	-0.12	
	For >10,000 To 20,000, Deduct	-0.18	
	For >20,000, Deduct	-0.23	
09 91 13 00-0041	SF Paint Exterior Concrete Block Walls, Texture Coat, Brush/Roller Work.....	0.76	
	For Oil Based Paint, Add	0.05	
	For Work >20', Add	0.14	
	Note: Applied only to work area above 20'.		
	For Up To 100, Add	0.46	
	For >100 To 250, Add	0.22	
	For >250 To 500, Add	0.10	
	For >2,500 To 5,000, Deduct	-0.04	
	For >5,000 To 10,000, Deduct	-0.08	
	For >10,000 To 20,000, Deduct	-0.11	
	For >20,000, Deduct	-0.15	



Finishes	09	2
Painting And Coating	09 90	
Painting	09 91	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 13 00-0042 SF Paint Exterior Concrete Block Walls, 1 Coat Filler, Sprayed.....	0.56	
For Oil Based Paint, Add	0.04	
For Work >20', Add	0.10	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.32	
For >100 To 250, Add	0.15	
For >250 To 500, Add	0.07	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.06	
For >10,000 To 20,000, Deduct	-0.08	
For >20,000, Deduct	-0.11	
09 91 13 00-0043 SF Paint Exterior Concrete Block Walls, 1 Coat Paint, Sprayed	0.59	
For Oil Based Paint, Add	0.04	
For Work >20', Add	0.10	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.32	
For >100 To 250, Add	0.15	
For >250 To 500, Add	0.07	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.06	
For >10,000 To 20,000, Deduct	-0.09	
For >20,000, Deduct	-0.12	
09 91 13 00-0044 SF Paint Exterior Concrete Block Walls, 2 Coats Paint, Sprayed.....	0.94	
For Oil Based Paint, Add	0.06	
For Work >20', Add	0.17	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.55	
For >100 To 250, Add	0.26	
For >250 To 500, Add	0.12	
For >2,500 To 5,000, Deduct	-0.05	
For >5,000 To 10,000, Deduct	-0.09	
For >10,000 To 20,000, Deduct	-0.14	
For >20,000, Deduct	-0.19	
09 91 13 00-0045 SF Paint Exterior Concrete Block Walls, Texture Coat, Sprayed	0.77	
For Oil Based Paint, Add	0.05	
For Work >20', Add	0.13	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.42	
For >100 To 250, Add	0.20	
For >250 To 500, Add	0.09	
For >2,500 To 5,000, Deduct	-0.04	
For >5,000 To 10,000, Deduct	-0.08	
For >10,000 To 20,000, Deduct	-0.12	
For >20,000, Deduct	-0.15	
09 91 13 00-0046 Paint Exterior Drywall/Plaster Walls (09 91 13 00-0001)	0.54	
09 91 13 00-0047 SF Paint Exterior Drywall/Plaster Walls, 1 Coat Primer, Brush Work.....	0.54	
For Oil Based Paint, Add	0.03	
For Orange Peel Finish, Add	0.07	
For Work >20', Add	0.11	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.34	
For >100 To 250, Add	0.16	
For >250 To 500, Add	0.07	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.05	
For >10,000 To 20,000, Deduct	-0.08	
For >20,000, Deduct	-0.11	
09 91 13 00-0048 SF Paint Exterior Drywall/Plaster Walls, 1 Coat Paint, Brush Work	0.59	
For Oil Based Paint, Add	0.03	
For Orange Peel Finish, Add	0.08	
For Work >20', Add	0.13	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.39	
For >100 To 250, Add	0.18	
For >250 To 500, Add	0.08	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.06	
For >10,000 To 20,000, Deduct	-0.09	
For >20,000, Deduct	-0.12	
09 91 13 00-0049 SF Paint Exterior Drywall/Plaster Walls, 2 Coats Paint, Brush Work.....	1.06	
For Oil Based Paint, Add	0.06	
For Orange Peel Finish, Add	0.15	
For Work >20', Add	0.22	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.69	
For >100 To 250, Add	0.33	
For >250 To 500, Add	0.14	
For >2,500 To 5,000, Deduct	-0.05	
For >5,000 To 10,000, Deduct	-0.11	
For >10,000 To 20,000, Deduct	-0.16	
For >20,000, Deduct	-0.21	

09 Finishes

09 90 Painting And Coating

09 91 Painting



MINOR		TOTAL DIRECT	DEMOLITION
CSI	UOM DESCRIPTION	UNIT COST	UNIT COST
09 91 13 00-0050	SF Paint Exterior Drywall/Plaster Walls, 1 Coat Primer, Brush/Roller Work.....	0.43	
	<i>For Oil Based Paint, Add</i>	0.03	
	<i>For Orange Peel Finish, Add</i>	0.06	
	<i>For Work >20', Add</i>	0.08	
	<i>Note: Applied only to work area above 20'.</i>		
	<i>For Up To 100, Add</i>	0.26	
	<i>For >100 To 250, Add</i>	0.12	
	<i>For >250 To 500, Add</i>	0.05	
	<i>For >2,500 To 5,000, Deduct</i>	-0.02	
	<i>For >5,000 To 10,000, Deduct</i>	-0.04	
	<i>For >10,000 To 20,000, Deduct</i>	-0.06	
	<i>For >20,000, Deduct</i>	-0.09	
09 91 13 00-0051	SF Paint Exterior Drywall/Plaster Walls, 1 Coat Paint, Brush/Roller Work.....	0.44	
	<i>For Oil Based Paint, Add</i>	0.03	
	<i>For Orange Peel Finish, Add</i>	0.06	
	<i>For Work >20', Add</i>	0.09	
	<i>Note: Applied only to work area above 20'.</i>		
	<i>For Up To 100, Add</i>	0.28	
	<i>For >100 To 250, Add</i>	0.13	
	<i>For >250 To 500, Add</i>	0.06	
	<i>For >2,500 To 5,000, Deduct</i>	-0.02	
	<i>For >5,000 To 10,000, Deduct</i>	-0.04	
	<i>For >10,000 To 20,000, Deduct</i>	-0.07	
	<i>For >20,000, Deduct</i>	-0.09	
09 91 13 00-0052	SF Paint Exterior Drywall/Plaster Walls, 2 Coats Paint, Brush/Roller Work.....	0.79	
	<i>For Oil Based Paint, Add</i>	0.05	
	<i>For Orange Peel Finish, Add</i>	0.11	
	<i>For Work >20', Add</i>	0.16	
	<i>Note: Applied only to work area above 20'.</i>		
	<i>For Up To 100, Add</i>	0.49	
	<i>For >100 To 250, Add</i>	0.23	
	<i>For >250 To 500, Add</i>	0.10	
	<i>For >2,500 To 5,000, Deduct</i>	-0.04	
	<i>For >5,000 To 10,000, Deduct</i>	-0.08	
	<i>For >10,000 To 20,000, Deduct</i>	-0.12	
	<i>For >20,000, Deduct</i>	-0.16	
09 91 13 00-0053	SF Paint Exterior Drywall/Plaster Walls, 1 Coat Primer, Sprayed.....	0.41	
	<i>For Oil Based Paint, Add</i>	0.03	
	<i>For Work >20', Add</i>	0.07	
	<i>Note: Applied only to work area above 20'.</i>		
	<i>For Up To 100, Add</i>	0.23	
	<i>For >100 To 250, Add</i>	0.11	
	<i>For >250 To 500, Add</i>	0.05	
	<i>For >2,500 To 5,000, Deduct</i>	-0.02	
	<i>For >5,000 To 10,000, Deduct</i>	-0.04	
	<i>For >10,000 To 20,000, Deduct</i>	-0.06	
	<i>For >20,000, Deduct</i>	-0.08	
09 91 13 00-0054	SF Paint Exterior Drywall/Plaster Walls, 1 Coat Paint, Sprayed.....	0.45	
	<i>For Oil Based Paint, Add</i>	0.03	
	<i>For Work >20', Add</i>	0.09	
	<i>Note: Applied only to work area above 20'.</i>		
	<i>For Up To 100, Add</i>	0.27	
	<i>For >100 To 250, Add</i>	0.13	
	<i>For >250 To 500, Add</i>	0.06	
	<i>For >2,500 To 5,000, Deduct</i>	-0.02	
	<i>For >5,000 To 10,000, Deduct</i>	-0.05	
	<i>For >10,000 To 20,000, Deduct</i>	-0.07	
	<i>For >20,000, Deduct</i>	-0.09	
09 91 13 00-0055	SF Paint Exterior Drywall/Plaster Walls, 2 Coats Paint, Sprayed.....	0.72	
	<i>For Oil Based Paint, Add</i>	0.05	
	<i>For Work >20', Add</i>	0.13	
	<i>Note: Applied only to work area above 20'.</i>		
	<i>For Up To 100, Add</i>	0.41	
	<i>For >100 To 250, Add</i>	0.20	
	<i>For >250 To 500, Add</i>	0.09	
	<i>For >2,500 To 5,000, Deduct</i>	-0.04	
	<i>For >5,000 To 10,000, Deduct</i>	-0.07	
	<i>For >10,000 To 20,000, Deduct</i>	-0.11	
	<i>For >20,000, Deduct</i>	-0.14	
09 91 13 00-0056	Paint Exterior Metal Walls (09 91 13 00-0001)		
09 91 13 00-0057	Paint Exterior Galvanized Walls (09 91 13 00-0056)		
	<i>Note: Linseed oil or acrylic latex paint.</i>		
09 91 13 00-0058	SF Paint Exterior Galvanized Wall Surfaces, 1 Coat Primer, Brush Work.....	0.64	
	<i>For Work >20', Add</i>	0.12	
	<i>Note: Applied only to work area above 20'.</i>		
	<i>For Up To 100, Add</i>	0.39	
	<i>For >100 To 250, Add</i>	0.19	
	<i>For >250 To 500, Add</i>	0.08	
	<i>For >2,500 To 5,000, Deduct</i>	-0.03	
	<i>For >5,000 To 10,000, Deduct</i>	-0.06	
	<i>For >10,000 To 20,000, Deduct</i>	-0.10	
	<i>For >20,000, Deduct</i>	-0.13	



Finishes	09	9
Painting And Coating	09 90	
Painting	09 91	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 13 00-0059 SF Paint Exterior Galvanized Wall Surfaces, 1 Coat Paint, Brush Work.....	0.71	
For Work >20', Add	0.14	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.44	
For >100 To 250, Add	0.21	
For >250 To 500, Add	0.09	
For >2,500 To 5,000, Deduct	-0.04	
For >5,000 To 10,000, Deduct	-0.07	
For >10,000 To 20,000, Deduct	-0.11	
For >20,000, Deduct	-0.14	
09 91 13 00-0060 SF Paint Exterior Galvanized Wall Surfaces, 2 Coats Paint, Brush Work.....	1.28	
For Work >20', Add	0.25	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.78	
For >100 To 250, Add	0.37	
For >250 To 500, Add	0.16	
For >2,500 To 5,000, Deduct	-0.06	
For >5,000 To 10,000, Deduct	-0.13	
For >10,000 To 20,000, Deduct	-0.19	
For >20,000, Deduct	-0.26	
09 91 13 00-0061 SF Paint Exterior Galvanized Walls, 1 Coat Primer, Brush/Roller Work.....	0.47	
For Work >20', Add	0.09	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.28	
For >100 To 250, Add	0.13	
For >250 To 500, Add	0.06	
For >2,500 To 5,000, Deduct	-0.02	
For >5,000 To 10,000, Deduct	-0.05	
For >10,000 To 20,000, Deduct	-0.07	
For >20,000, Deduct	-0.09	
09 91 13 00-0062 SF Paint Exterior Galvanized Walls, 1 Coat Paint, Brush/Roller Work.....	0.55	
For Work >20', Add	0.11	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.33	
For >100 To 250, Add	0.16	
For >250 To 500, Add	0.07	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.06	
For >10,000 To 20,000, Deduct	-0.08	
For >20,000, Deduct	-0.11	
09 91 13 00-0063 SF Paint Exterior Galvanized Walls, 2 Coats Paint, Brush/Roller Work.....	1.02	
For Work >20', Add	0.19	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.61	
For >100 To 250, Add	0.29	
For >250 To 500, Add	0.13	
For >2,500 To 5,000, Deduct	-0.05	
For >5,000 To 10,000, Deduct	-0.10	
For >10,000 To 20,000, Deduct	-0.15	
For >20,000, Deduct	-0.20	
09 91 13 00-0064 SF Paint Exterior Galvanized Walls, 1 Coat Primer, Sprayed.....	0.42	
For Work >20', Add	0.06	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.21	
For >100 To 250, Add	0.10	
For >250 To 500, Add	0.05	
For >2,500 To 5,000, Deduct	-0.02	
For >5,000 To 10,000, Deduct	-0.04	
For >10,000 To 20,000, Deduct	-0.06	
For >20,000, Deduct	-0.08	
09 91 13 00-0065 SF Paint Exterior Galvanized Walls, 1 Coat Paint, Sprayed.....	0.56	
For Work >20', Add	0.10	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.32	
For >100 To 250, Add	0.15	
For >250 To 500, Add	0.07	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.06	
For >10,000 To 20,000, Deduct	-0.08	
For >20,000, Deduct	-0.11	
09 91 13 00-0066 SF Paint Exterior Galvanized Walls, 2 Coats Paint, Sprayed.....	0.94	
For Work >20', Add	0.15	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.50	
For >100 To 250, Add	0.24	
For >250 To 500, Add	0.11	
For >2,500 To 5,000, Deduct	-0.05	
For >5,000 To 10,000, Deduct	-0.09	
For >10,000 To 20,000, Deduct	-0.14	
For >20,000, Deduct	-0.19	

09 91 13 00-0067 Paint Exterior Aluminum And Aluminum Alloy Walls (09 91 13 00-0056)
 Note: Alkyd enamel paint.

09 Finishes

09 90 Painting And Coating

09 91 Painting



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 13 00-0068	SF		Paint Exterior Aluminum And Aluminum Alloy Wall Surfaces, 1 Coat Primer, Brush Work.....	0.64	
			For Work >20', Add	0.12	
			Note: Applied only to work area above 20'.		
			For Up To 100, Add	0.39	
			For >100 To 250, Add	0.19	
			For >250 To 500, Add	0.08	
			For >2,500 To 5,000, Deduct	-0.03	
			For >5,000 To 10,000, Deduct	-0.06	
			For >10,000 To 20,000, Deduct	-0.10	
			For >20,000, Deduct	-0.13	
09 91 13 00-0069	SF		Paint Exterior Aluminum And Aluminum Alloy Wall Surfaces, 1 Coat Paint, Brush Work	0.71	
			For Work >20', Add	0.14	
			Note: Applied only to work area above 20'.		
			For Up To 100, Add	0.44	
			For >100 To 250, Add	0.21	
			For >250 To 500, Add	0.09	
			For >2,500 To 5,000, Deduct	-0.04	
			For >5,000 To 10,000, Deduct	-0.07	
			For >10,000 To 20,000, Deduct	-0.11	
			For >20,000, Deduct	-0.14	
09 91 13 00-0070	SF		Paint Exterior Aluminum And Aluminum Alloy Wall Surfaces, 2 Coats Paint, Brush Work	1.28	
			For Work >20', Add	0.25	
			Note: Applied only to work area above 20'.		
			For Up To 100, Add	0.78	
			For >100 To 250, Add	0.37	
			For >250 To 500, Add	0.16	
			For >2,500 To 5,000, Deduct	-0.06	
			For >5,000 To 10,000, Deduct	-0.13	
			For >10,000 To 20,000, Deduct	-0.19	
			For >20,000, Deduct	-0.26	
09 91 13 00-0071	SF		Paint Exterior Aluminum And Aluminum Alloy Walls, 1 Coat Primer, Brush/Roller Work.....	0.52	
			For Work >20', Add	0.09	
			Note: Applied only to work area above 20'.		
			For Up To 100, Add	0.29	
			For >100 To 250, Add	0.14	
			For >250 To 500, Add	0.06	
			For >2,500 To 5,000, Deduct	-0.03	
			For >5,000 To 10,000, Deduct	-0.05	
			For >10,000 To 20,000, Deduct	-0.08	
			For >20,000, Deduct	-0.10	
09 91 13 00-0072	SF		Paint Exterior Aluminum And Aluminum Alloy Walls, 1 Coat Paint, Brush/Roller Work	0.59	
			For Work >20', Add	0.11	
			Note: Applied only to work area above 20'.		
			For Up To 100, Add	0.34	
			For >100 To 250, Add	0.16	
			For >250 To 500, Add	0.07	
			For >2,500 To 5,000, Deduct	-0.03	
			For >5,000 To 10,000, Deduct	-0.06	
			For >10,000 To 20,000, Deduct	-0.09	
			For >20,000, Deduct	-0.12	
09 91 13 00-0073	SF		Paint Exterior Aluminum And Aluminum Alloy Walls, 2 Coats Paint, Brush/Roller Work	1.10	
			For Work >20', Add	0.19	
			Note: Applied only to work area above 20'.		
			For Up To 100, Add	0.62	
			For >100 To 250, Add	0.30	
			For >250 To 500, Add	0.13	
			For >2,500 To 5,000, Deduct	-0.06	
			For >5,000 To 10,000, Deduct	-0.11	
			For >10,000 To 20,000, Deduct	-0.17	
			For >20,000, Deduct	-0.22	
09 91 13 00-0074	SF		Paint Exterior Aluminum And Aluminum Alloy Walls, 1 Coat Primer, Sprayed	0.47	
			For Work >20', Add	0.08	
			Note: Applied only to work area above 20'.		
			For Up To 100, Add	0.25	
			For >100 To 250, Add	0.12	
			For >250 To 500, Add	0.05	
			For >2,500 To 5,000, Deduct	-0.02	
			For >5,000 To 10,000, Deduct	-0.05	
			For >10,000 To 20,000, Deduct	-0.07	
			For >20,000, Deduct	-0.09	
09 91 13 00-0075	SF		Paint Exterior Aluminum And Aluminum Alloy Walls, 1 Coat Paint, Sprayed.....	0.56	
			For Work >20', Add	0.10	
			Note: Applied only to work area above 20'.		
			For Up To 100, Add	0.32	
			For >100 To 250, Add	0.15	
			For >250 To 500, Add	0.07	
			For >2,500 To 5,000, Deduct	-0.03	
			For >5,000 To 10,000, Deduct	-0.06	
			For >10,000 To 20,000, Deduct	-0.08	
			For >20,000, Deduct	-0.11	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 13 00-0076 SF Paint Exterior Aluminum And Aluminum Alloy Walls, 2 Coats Paint, Sprayed.....	0.94	
For Work >20', Add	0.15	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.50	
For >100 To 250, Add	0.24	
For >250 To 500, Add	0.11	
For >2,500 To 5,000, Deduct	-0.05	
For >5,000 To 10,000, Deduct	-0.09	
For >10,000 To 20,000, Deduct	-0.14	
For >20,000, Deduct	-0.19	
09 91 13 00-0077 Paint Exterior Aluminum And Aluminum Alloy Roof Stacks (09 91 13 00-0056)		
09 91 13 00-0078 LF Paint Exterior Aluminum And Aluminum Alloy Roof Stack With Heat Resistant Paint, 1 Coat Primer, Per LF Of Stack	9.81	
For Work >20', Add	2.24	
Note: Applied only to work area above 20'.		
For Up To 100, Add	6.84	
For >100 To 250, Add	3.22	
For >250 To 500, Add	1.39	
For >2,500 To 5,000, Deduct	-0.49	
For >5,000 To 10,000, Deduct	-0.98	
For >10,000 To 20,000, Deduct	-1.47	
For >20,000, Deduct	-1.96	
09 91 13 00-0079 LF Paint Exterior Aluminum And Aluminum Alloy Roof Stack With Heat Resistant Paint, 1 Coat Paint, Per LF Of Stack	10.91	
For Work >20', Add	2.49	
Note: Applied only to work area above 20'.		
For Up To 100, Add	7.60	
For >100 To 250, Add	3.58	
For >250 To 500, Add	1.54	
For >2,500 To 5,000, Deduct	-0.55	
For >5,000 To 10,000, Deduct	-1.09	
For >10,000 To 20,000, Deduct	-1.64	
For >20,000, Deduct	-2.18	
09 91 13 00-0080 LF Paint Exterior Aluminum And Aluminum Alloy Roof Stack With Heat Resistant Paint, 2 Coats Paint, Per LF Of Stack	20.41	
For Work >20', Add	4.67	
Note: Applied only to work area above 20'.		
For Up To 100, Add	14.28	
For >100 To 250, Add	6.71	
For >250 To 500, Add	2.89	
For >2,500 To 5,000, Deduct	-1.02	
For >5,000 To 10,000, Deduct	-2.04	
For >10,000 To 20,000, Deduct	-3.06	
For >20,000, Deduct	-4.08	
09 91 13 00-0081 Paint Exterior Corrugated Metal Walls (09 91 13 00-0056)		
09 91 13 00-0082 SF Paint Exterior Corrugated Metal Walls, 1 Coat Primer, Sprayed.....	0.53	
For Work >20', Add	0.08	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.28	
For >100 To 250, Add	0.14	
For >250 To 500, Add	0.06	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.05	
For >10,000 To 20,000, Deduct	-0.08	
For >20,000, Deduct	-0.11	
09 91 13 00-0083 SF Paint Exterior Corrugated Metal Walls, 1 Coat Paint, Sprayed.....	0.73	
For Work >20', Add	0.13	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.43	
For >100 To 250, Add	0.21	
For >250 To 500, Add	0.09	
For >2,500 To 5,000, Deduct	-0.04	
For >5,000 To 10,000, Deduct	-0.07	
For >10,000 To 20,000, Deduct	-0.11	
For >20,000, Deduct	-0.15	
09 91 13 00-0084 SF Paint Exterior Corrugated Metal Walls, 2 Coats Paint, Sprayed	1.19	
For Work >20', Add	0.20	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.66	
For >100 To 250, Add	0.32	
For >250 To 500, Add	0.14	
For >2,500 To 5,000, Deduct	-0.06	
For >5,000 To 10,000, Deduct	-0.12	
For >10,000 To 20,000, Deduct	-0.18	
For >20,000, Deduct	-0.24	
09 91 13 00-0085 Paint Exterior Stucco Walls (09 91 13 00-0001)		

09	Finishes
09 90	Painting And Coating
09 91	Painting



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91	13 00-0086	SF	Paint Exterior Stucco Wall Surfaces 1 Coat Primer, Brush Work.....	0.89	
			For Oil Based Paint, Add	0.05	
			For Work >20', Add	0.19	
			Note: Applied only to work area above 20'.		
			For Up To 100, Add	0.59	
			For >100 To 250, Add	0.28	
			For >250 To 500, Add	0.12	
			For >2,500 To 5,000, Deduct	-0.04	
			For >5,000 To 10,000, Deduct	-0.09	
			For >10,000 To 20,000, Deduct	-0.13	
			For >20,000, Deduct	-0.18	
09 91	13 00-0087	SF	Paint Exterior Stucco Wall Surfaces 1 Coat Paint, Brush Work.....	0.98	
			For Oil Based Paint, Add	0.06	
			For Work >20', Add	0.21	
			Note: Applied only to work area above 20'.		
			For Up To 100, Add	0.65	
			For >100 To 250, Add	0.31	
			For >250 To 500, Add	0.13	
			For >2,500 To 5,000, Deduct	-0.05	
			For >5,000 To 10,000, Deduct	-0.10	
			For >10,000 To 20,000, Deduct	-0.15	
			For >20,000, Deduct	-0.20	
09 91	13 00-0088	SF	Paint Exterior Stucco Wall Surfaces, 2 Coats Paint, Brush Work.....	1.83	
			For Oil Based Paint, Add	0.11	
			For Work >20', Add	0.38	
			Note: Applied only to work area above 20'.		
			For Up To 100, Add	1.19	
			For >100 To 250, Add	0.57	
			For >250 To 500, Add	0.24	
			For >2,500 To 5,000, Deduct	-0.09	
			For >5,000 To 10,000, Deduct	-0.18	
			For >10,000 To 20,000, Deduct	-0.27	
			For >20,000, Deduct	-0.37	
09 91	13 00-0089	SF	Paint Exterior Stucco Walls, 1 Coat Primer, Brush/Roller Work.....	0.68	
			For Oil Based Paint, Add	0.04	
			For Work >20', Add	0.14	
			Note: Applied only to work area above 20'.		
			For Up To 100, Add	0.43	
			For >100 To 250, Add	0.21	
			For >250 To 500, Add	0.09	
			For >2,500 To 5,000, Deduct	-0.03	
			For >5,000 To 10,000, Deduct	-0.07	
			For >10,000 To 20,000, Deduct	-0.10	
			For >20,000, Deduct	-0.14	
09 91	13 00-0090	SF	Paint Exterior Stucco Walls, 1 Coat Paint, Brush/Roller Work.....	0.77	
			For Oil Based Paint, Add	0.05	
			For Work >20', Add	0.16	
			Note: Applied only to work area above 20'.		
			For Up To 100, Add	0.49	
			For >100 To 250, Add	0.23	
			For >250 To 500, Add	0.10	
			For >2,500 To 5,000, Deduct	-0.04	
			For >5,000 To 10,000, Deduct	-0.08	
			For >10,000 To 20,000, Deduct	-0.12	
			For >20,000, Deduct	-0.15	
09 91	13 00-0091	SF	Paint Exterior Stucco Walls, 2 Coats Paint, Brush/Roller Work.....	1.42	
			For Oil Based Paint, Add	0.09	
			For Work >20', Add	0.28	
			Note: Applied only to work area above 20'.		
			For Up To 100, Add	0.89	
			For >100 To 250, Add	0.42	
			For >250 To 500, Add	0.18	
			For >2,500 To 5,000, Deduct	-0.07	
			For >5,000 To 10,000, Deduct	-0.14	
			For >10,000 To 20,000, Deduct	-0.21	
			For >20,000, Deduct	-0.28	
09 91	13 00-0092	SF	Paint Exterior Stucco Walls, 1 Coat Primer, Sprayed.....	0.57	
			For Oil Based Paint, Add	0.04	
			For Work >20', Add	0.11	
			Note: Applied only to work area above 20'.		
			For Up To 100, Add	0.34	
			For >100 To 250, Add	0.16	
			For >250 To 500, Add	0.07	
			For >2,500 To 5,000, Deduct	-0.03	
			For >5,000 To 10,000, Deduct	-0.06	
			For >10,000 To 20,000, Deduct	-0.09	
			For >20,000, Deduct	-0.11	



Finishes	09	2
Painting And Coating	09 90	
Painting	09 91	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 13 00-0093 SF Paint Exterior Stucco Walls, 1 Coat Paint, Sprayed.....	0.69	
For Oil Based Paint, Add	0.04	
For Work >20', Add	0.13	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.40	
For >100 To 250, Add	0.19	
For >250 To 500, Add	0.08	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.07	
For >10,000 To 20,000, Deduct	-0.10	
For >20,000, Deduct	-0.14	
09 91 13 00-0094 SF Paint Exterior Stucco Walls, 2 Coats Paint, Sprayed.....	1.34	
For Oil Based Paint, Add	0.08	
For Work >20', Add	0.25	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.80	
For >100 To 250, Add	0.38	
For >250 To 500, Add	0.17	
For >2,500 To 5,000, Deduct	-0.07	
For >5,000 To 10,000, Deduct	-0.13	
For >10,000 To 20,000, Deduct	-0.20	
For >20,000, Deduct	-0.27	
09 91 13 00-0095 Paint Exterior Wood Siding (09 91 13 00-0001)		
09 91 13 00-0096 Paint Exterior Smooth Wood Siding (09 91 13 00-0095)		
Note: Includes tongue and groove, beveled, drop or board and batten siding.		
09 91 13 00-0097 SF Paint Exterior Wood Smooth Siding, 1 Coat Primer, Brush Work.....	0.66	
For Oil Based Paint, Add	0.04	
For Work >20', Add	0.13	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.41	
For >100 To 250, Add	0.19	
For >250 To 500, Add	0.08	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.07	
For >10,000 To 20,000, Deduct	-0.10	
For >20,000, Deduct	-0.13	
09 91 13 00-0098 SF Paint Exterior Wood Smooth Siding, 1 Coat Paint, Brush Work	0.69	
For Oil Based Paint, Add	0.04	
For Work >20', Add	0.14	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.44	
For >100 To 250, Add	0.21	
For >250 To 500, Add	0.09	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.07	
For >10,000 To 20,000, Deduct	-0.10	
For >20,000, Deduct	-0.14	
09 91 13 00-0099 SF Paint Exterior Wood Smooth Siding, 2 Coats Paint, Brush Work.....	1.24	
For Oil Based Paint, Add	0.08	
For Work >20', Add	0.25	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.77	
For >100 To 250, Add	0.37	
For >250 To 500, Add	0.16	
For >2,500 To 5,000, Deduct	-0.06	
For >5,000 To 10,000, Deduct	-0.12	
For >10,000 To 20,000, Deduct	-0.19	
For >20,000, Deduct	-0.25	
09 91 13 00-0100 SF Paint Exterior Smooth Wood Siding, 1 Coat Primer, Brush/Roller Work.....	0.52	
For Oil Based Paint, Add	0.03	
For Work >20', Add	0.09	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.29	
For >100 To 250, Add	0.14	
For >250 To 500, Add	0.06	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.05	
For >10,000 To 20,000, Deduct	-0.08	
For >20,000, Deduct	-0.10	
09 91 13 00-0101 SF Paint Exterior Smooth Wood Siding, 1 Coat Paint, Brush/Roller Work.....	0.57	
For Oil Based Paint, Add	0.04	
For Work >20', Add	0.11	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.34	
For >100 To 250, Add	0.16	
For >250 To 500, Add	0.07	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.06	
For >10,000 To 20,000, Deduct	-0.09	
For >20,000, Deduct	-0.11	

09 Finishes**09 90 Painting And Coating****09 91 Painting**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 13 00-0102	SF		Paint Exterior Smooth Wood Siding, 2 Coats Paint, Brush/Roller Work	1.06	
			For Oil Based Paint, Add	0.07	
			For Work >20', Add	0.19	
			Note: Applied only to work area above 20'.		
			For Up To 100, Add	0.62	
			For >100 To 250, Add	0.30	
			For >250 To 500, Add	0.13	
			For >2,500 To 5,000, Deduct	-0.05	
			For >5,000 To 10,000, Deduct	-0.11	
			For >10,000 To 20,000, Deduct	-0.16	
			For >20,000, Deduct	-0.21	
09 91 13 00-0103	SF		Paint Exterior Smooth Wood Siding, 1 Coat Primer, Sprayed	0.47	
			For Oil Based Paint, Add	0.03	
			For Work >20', Add	0.08	
			Note: Applied only to work area above 20'.		
			For Up To 100, Add	0.25	
			For >100 To 250, Add	0.12	
			For >250 To 500, Add	0.05	
			For >2,500 To 5,000, Deduct	-0.02	
			For >5,000 To 10,000, Deduct	-0.05	
			For >10,000 To 20,000, Deduct	-0.07	
			For >20,000, Deduct	-0.09	
09 91 13 00-0104	SF		Paint Exterior Smooth Wood Siding, 1 Coat Paint, Sprayed.....	0.56	
			For Oil Based Paint, Add	0.04	
			For Work >20', Add	0.10	
			Note: Applied only to work area above 20'.		
			For Up To 100, Add	0.32	
			For >100 To 250, Add	0.15	
			For >250 To 500, Add	0.07	
			For >2,500 To 5,000, Deduct	-0.03	
			For >5,000 To 10,000, Deduct	-0.06	
			For >10,000 To 20,000, Deduct	-0.08	
			For >20,000, Deduct	-0.11	
09 91 13 00-0105	SF		Paint Exterior Smooth Wood Siding, 2 Coats Paint, Sprayed.....	0.92	
			For Oil Based Paint, Add	0.06	
			For Work >20', Add	0.15	
			Note: Applied only to work area above 20'.		
			For Up To 100, Add	0.50	
			For >100 To 250, Add	0.24	
			For >250 To 500, Add	0.11	
			For >2,500 To 5,000, Deduct	-0.05	
			For >5,000 To 10,000, Deduct	-0.09	
			For >10,000 To 20,000, Deduct	-0.14	
			For >20,000, Deduct	-0.18	
09 91 13 00-0106			Paint Exterior Rough Wood Siding (09 91 13 00-0095)		
			Note: Includes shingles, shakes or rough sawn siding.		
09 91 13 00-0107	SF		Paint Exterior Wood Rough (Shingles, Shakes Or Rough Sawn) Siding, 1 Coat Primer, Brush Work.....	1.01	
			For Oil Based Paint, Add	0.06	
			For Work >20', Add	0.21	
			Note: Applied only to work area above 20'.		
			For Up To 100, Add	0.66	
			For >100 To 250, Add	0.31	
			For >250 To 500, Add	0.13	
			For >2,500 To 5,000, Deduct	-0.05	
			For >5,000 To 10,000, Deduct	-0.10	
			For >10,000 To 20,000, Deduct	-0.15	
			For >20,000, Deduct	-0.20	
09 91 13 00-0108	SF		Paint Exterior Wood Rough (Shingles, Shakes Or Rough Sawn) Siding, 1 Coat Paint, Brush Work.....	1.01	
			For Oil Based Paint, Add	0.06	
			For Work >20', Add	0.22	
			Note: Applied only to work area above 20'.		
			For Up To 100, Add	0.68	
			For >100 To 250, Add	0.32	
			For >250 To 500, Add	0.14	
			For >2,500 To 5,000, Deduct	-0.05	
			For >5,000 To 10,000, Deduct	-0.10	
			For >10,000 To 20,000, Deduct	-0.15	
			For >20,000, Deduct	-0.20	
09 91 13 00-0109	SF		Paint Exterior Wood Rough (Shingles, Shakes Or Rough Sawn) Siding, 2 Coats Paint, Brush Work.....	1.87	
			For Oil Based Paint, Add	0.11	
			For Work >20', Add	0.40	
			Note: Applied only to work area above 20'.		
			For Up To 100, Add	1.25	
			For >100 To 250, Add	0.59	
			For >250 To 500, Add	0.25	
			For >2,500 To 5,000, Deduct	-0.09	
			For >5,000 To 10,000, Deduct	-0.19	
			For >10,000 To 20,000, Deduct	-0.28	
			For >20,000, Deduct	-0.37	



Finishes	09	2
Painting And Coating	09 90	
Painting	09 91	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 13 00-0110 SF Paint Exterior Rough Wood Siding (Shingles, Shakes Or Rough Sawn), 1 Coat Primer, Brush/Roller Work	0.91	
For Oil Based Paint, Add	0.06	
For Work >20', Add	0.16	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.51	
For >100 To 250, Add	0.25	
For >250 To 500, Add	0.11	
For >2,500 To 5,000, Deduct	-0.05	
For >5,000 To 10,000, Deduct	-0.09	
For >10,000 To 20,000, Deduct	-0.14	
For >20,000, Deduct	-0.18	
09 91 13 00-0111 SF Paint Exterior Rough Wood Siding (Shingles, Shakes Or Rough Sawn), 1 Coat Paint, Brush/Roller Work	0.97	
For Oil Based Paint, Add	0.06	
For Work >20', Add	0.17	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.56	
For >100 To 250, Add	0.27	
For >250 To 500, Add	0.12	
For >2,500 To 5,000, Deduct	-0.05	
For >5,000 To 10,000, Deduct	-0.10	
For >10,000 To 20,000, Deduct	-0.15	
For >20,000, Deduct	-0.19	
09 91 13 00-0112 SF Paint Exterior Rough Wood Siding (Shingles, Shakes Or Rough Sawn), 2 Coats Paint, Brush/Roller Work	1.81	
For Oil Based Paint, Add	0.12	
For Work >20', Add	0.31	
Note: Applied only to work area above 20'.		
For Up To 100, Add	1.02	
For >100 To 250, Add	0.49	
For >250 To 500, Add	0.22	
For >2,500 To 5,000, Deduct	-0.09	
For >5,000 To 10,000, Deduct	-0.18	
For >10,000 To 20,000, Deduct	-0.27	
For >20,000, Deduct	-0.36	
09 91 13 00-0113 SF Paint Exterior Rough Wood Siding (Shingles, Shakes Or Rough Sawn), 1 Coat Primer, Sprayed	0.74	
For Oil Based Paint, Add	0.05	
For Work >20', Add	0.13	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.41	
For >100 To 250, Add	0.20	
For >250 To 500, Add	0.09	
For >2,500 To 5,000, Deduct	-0.04	
For >5,000 To 10,000, Deduct	-0.07	
For >10,000 To 20,000, Deduct	-0.11	
For >20,000, Deduct	-0.15	
09 91 13 00-0114 SF Paint Exterior Rough Wood Siding (Shingles, Shakes Or Rough Sawn), 1 Coat Paint, Sprayed	0.84	
For Oil Based Paint, Add	0.05	
For Work >20', Add	0.15	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.49	
For >100 To 250, Add	0.23	
For >250 To 500, Add	0.10	
For >2,500 To 5,000, Deduct	-0.04	
For >5,000 To 10,000, Deduct	-0.08	
For >10,000 To 20,000, Deduct	-0.13	
For >20,000, Deduct	-0.17	
09 91 13 00-0115 SF Paint Exterior Rough Wood Siding (Shingles, Shakes Or Rough Sawn), 2 Coats Paint, Sprayed	1.56	
For Oil Based Paint, Add	0.10	
For Work >20', Add	0.27	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.89	
For >100 To 250, Add	0.43	
For >250 To 500, Add	0.19	
For >2,500 To 5,000, Deduct	-0.08	
For >5,000 To 10,000, Deduct	-0.16	
For >10,000 To 20,000, Deduct	-0.23	
For >20,000, Deduct	-0.31	
09 91 13 00-0116 Paint Exterior Vinyl Siding <small>(09 91 13 00-0001)</small>	0.57	
09 91 13 00-0117 SF Paint Exterior Vinyl Siding, 1 Coat Primer, Brush Work	0.57	
For Oil Based Paint, Add	0.04	
For Work >20', Add	0.11	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.34	
For >100 To 250, Add	0.16	
For >250 To 500, Add	0.07	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.06	
For >10,000 To 20,000, Deduct	-0.09	
For >20,000, Deduct	-0.11	

09 Finishes

09 90 Painting And Coating

09 91 Painting



MINOR		TOTAL DIRECT	DEMOLITION
CSI	UOM DESCRIPTION	UNIT COST	UNIT COST
09 91 13 00-0118	SF Paint Exterior Vinyl Siding, 1 Coat Paint, Brush Work	0.63	
	For Oil Based Paint, Add	0.04	
	For Work >20', Add	0.12	
	Note: Applied only to work area above 20'.		
	For Up To 100, Add	0.38	
	For >100 To 250, Add	0.18	
	For >250 To 500, Add	0.08	
	For >2,500 To 5,000, Deduct	-0.03	
	For >5,000 To 10,000, Deduct	-0.06	
	For >10,000 To 20,000, Deduct	-0.09	
	For >20,000, Deduct	-0.13	
09 91 13 00-0119	SF Paint Exterior Vinyl Siding, 2 Coats Paint, Brush Work.....	1.15	
	For Oil Based Paint, Add	0.07	
	For Work >20', Add	0.21	
	Note: Applied only to work area above 20'.		
	For Up To 100, Add	0.67	
	For >100 To 250, Add	0.32	
	For >250 To 500, Add	0.14	
	For >2,500 To 5,000, Deduct	-0.06	
	For >5,000 To 10,000, Deduct	-0.12	
	For >10,000 To 20,000, Deduct	-0.17	
	For >20,000, Deduct	-0.23	
09 91 13 00-0120	SF Paint Exterior Vinyl Siding, 1 Coat Primer, Brush/Roller Work.....	0.52	
	For Oil Based Paint, Add	0.03	
	For Work >20', Add	0.09	
	Note: Applied only to work area above 20'.		
	For Up To 100, Add	0.29	
	For >100 To 250, Add	0.14	
	For >250 To 500, Add	0.06	
	For >2,500 To 5,000, Deduct	-0.03	
	For >5,000 To 10,000, Deduct	-0.05	
	For >10,000 To 20,000, Deduct	-0.08	
	For >20,000, Deduct	-0.10	
09 91 13 00-0121	SF Paint Exterior Vinyl Siding, 1 Coat Paint, Brush/Roller Work	0.52	
	For Oil Based Paint, Add	0.03	
	For Work >20', Add	0.09	
	Note: Applied only to work area above 20'.		
	For Up To 100, Add	0.29	
	For >100 To 250, Add	0.14	
	For >250 To 500, Add	0.06	
	For >2,500 To 5,000, Deduct	-0.03	
	For >5,000 To 10,000, Deduct	-0.05	
	For >10,000 To 20,000, Deduct	-0.08	
	For >20,000, Deduct	-0.10	
09 91 13 00-0122	SF Paint Exterior Vinyl Siding, 2 Coats Paint, Brush/Roller Work	0.97	
	For Oil Based Paint, Add	0.07	
	For Work >20', Add	0.16	
	Note: Applied only to work area above 20'.		
	For Up To 100, Add	0.52	
	For >100 To 250, Add	0.25	
	For >250 To 500, Add	0.11	
	For >2,500 To 5,000, Deduct	-0.05	
	For >5,000 To 10,000, Deduct	-0.10	
	For >10,000 To 20,000, Deduct	-0.15	
	For >20,000, Deduct	-0.19	
09 91 13 00-0123	SF Paint Exterior Vinyl Siding, 1 Coat Primer, Sprayed	0.51	
	For Oil Based Paint, Add	0.04	
	For Work >20', Add	0.08	
	Note: Applied only to work area above 20'.		
	For Up To 100, Add	0.26	
	For >100 To 250, Add	0.13	
	For >250 To 500, Add	0.06	
	For >2,500 To 5,000, Deduct	-0.03	
	For >5,000 To 10,000, Deduct	-0.05	
	For >10,000 To 20,000, Deduct	-0.08	
	For >20,000, Deduct	-0.10	
09 91 13 00-0124	SF Paint Exterior Vinyl Siding, 1 Coat Paint, Sprayed.....	0.58	
	For Oil Based Paint, Add	0.04	
	For Work >20', Add	0.08	
	Note: Applied only to work area above 20'.		
	For Up To 100, Add	0.27	
	For >100 To 250, Add	0.13	
	For >250 To 500, Add	0.06	
	For >2,500 To 5,000, Deduct	-0.03	
	For >5,000 To 10,000, Deduct	-0.06	
	For >10,000 To 20,000, Deduct	-0.09	
	For >20,000, Deduct	-0.12	



Finishes	09	9
Painting And Coating	09 90	
Painting	09 91	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 13 00-0125 SF Paint Exterior Vinyl Siding, 2 Coats Paint, Sprayed.....	1.14	
For Oil Based Paint, Add	0.08	
For Work >20', Add	0.15	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.53	
For >100 To 250, Add	0.26	
For >250 To 500, Add	0.12	
For >2,500 To 5,000, Deduct	-0.06	
For >5,000 To 10,000, Deduct	-0.11	
For >10,000 To 20,000, Deduct	-0.17	
For >20,000, Deduct	-0.23	
 09 91 13 00-0126 Paint Exterior Ceilings (09 91 13)		
09 91 13 00-0127 Paint Exterior Concrete Ceilings (09 91 13 00-0126)		
09 91 13 00-0128 SF Paint Exterior Concrete Ceiling, 1 Coat Filler, Brush Work.....	0.60	
For Oil Based Paint, Add	0.04	
For Epoxy Paint, Add	0.06	
For Work >20', Add	0.12	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.38	
For >100 To 250, Add	0.18	
For >250 To 500, Add	0.08	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.06	
For >10,000 To 20,000, Deduct	-0.09	
For >20,000, Deduct	-0.12	
09 91 13 00-0129 SF Paint Exterior Concrete Ceiling, 1 Coat Paint, Brush Work.....	0.65	
For Oil Based Paint, Add	0.04	
For Epoxy Paint, Add	0.06	
For Work >20', Add	0.14	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.43	
For >100 To 250, Add	0.21	
For >250 To 500, Add	0.09	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.07	
For >10,000 To 20,000, Deduct	-0.10	
For >20,000, Deduct	-0.13	
09 91 13 00-0130 SF Paint Exterior Concrete Ceiling, 2 Coats Paint, Brush Work.....	1.15	
For Oil Based Paint, Add	0.07	
For Epoxy Paint, Add	0.11	
For Work >20', Add	0.25	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.76	
For >100 To 250, Add	0.36	
For >250 To 500, Add	0.16	
For >2,500 To 5,000, Deduct	-0.06	
For >5,000 To 10,000, Deduct	-0.12	
For >10,000 To 20,000, Deduct	-0.17	
For >20,000, Deduct	-0.23	
09 91 13 00-0131 SF Paint Exterior Concrete Ceiling, 1 Coat Filler, Brush/Roller Work.....	0.46	
For Oil Based Paint, Add	0.03	
For Epoxy Paint, Add	0.06	
For Work >20', Add	0.09	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.28	
For >100 To 250, Add	0.13	
For >250 To 500, Add	0.06	
For >2,500 To 5,000, Deduct	-0.02	
For >5,000 To 10,000, Deduct	-0.05	
For >10,000 To 20,000, Deduct	-0.07	
For >20,000, Deduct	-0.09	
09 91 13 00-0132 SF Paint Exterior Concrete Ceiling, 1 Coat Paint, Brush/Roller Work.....	0.51	
For Oil Based Paint, Add	0.03	
For Epoxy Paint, Add	0.05	
For Work >20', Add	0.11	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.33	
For >100 To 250, Add	0.16	
For >250 To 500, Add	0.07	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.05	
For >10,000 To 20,000, Deduct	-0.08	
For >20,000, Deduct	-0.10	

09	Finishes
09 90	Painting And Coating
09 91	Painting



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 13 00-0133	SF		Paint Exterior Concrete Ceiling, 2 Coats Paint, Brush/Roller Work.....	0.94	
			<i>For Oil Based Paint, Add</i>	0.06	
			<i>For Epoxy Paint, Add</i>	0.10	
			<i>For Work >20', Add</i>	0.19	
			<i>Note: Applied only to work area above 20'.</i>		
			<i>For Up To 100, Add</i>	0.60	
			<i>For >100 To 250, Add</i>	0.29	
			<i>For >250 To 500, Add</i>	0.12	
			<i>For >2,500 To 5,000, Deduct</i>	-0.05	
			<i>For >5,000 To 10,000, Deduct</i>	-0.09	
			<i>For >10,000 To 20,000, Deduct</i>	-0.14	
			<i>For >20,000, Deduct</i>	-0.19	
09 91 13 00-0134	SF		Paint Exterior Concrete Ceiling, 1 Coat Filler, Sprayed	0.43	
			<i>For Oil Based Paint, Add</i>	0.03	
			<i>For Epoxy Paint, Add</i>	0.06	
			<i>For Work >20', Add</i>	0.08	
			<i>Note: Applied only to work area above 20'.</i>		
			<i>For Up To 100, Add</i>	0.24	
			<i>For >100 To 250, Add</i>	0.12	
			<i>For >250 To 500, Add</i>	0.05	
			<i>For >2,500 To 5,000, Deduct</i>	-0.02	
			<i>For >5,000 To 10,000, Deduct</i>	-0.04	
			<i>For >10,000 To 20,000, Deduct</i>	-0.06	
			<i>For >20,000, Deduct</i>	-0.09	
09 91 13 00-0135	SF		Paint Exterior Concrete Ceiling, 1 Coat Paint, Sprayed	0.50	
			<i>For Oil Based Paint, Add</i>	0.03	
			<i>For Epoxy Paint, Add</i>	0.06	
			<i>For Work >20', Add</i>	0.10	
			<i>Note: Applied only to work area above 20'.</i>		
			<i>For Up To 100, Add</i>	0.31	
			<i>For >100 To 250, Add</i>	0.15	
			<i>For >250 To 500, Add</i>	0.06	
			<i>For >2,500 To 5,000, Deduct</i>	-0.03	
			<i>For >5,000 To 10,000, Deduct</i>	-0.05	
			<i>For >10,000 To 20,000, Deduct</i>	-0.08	
			<i>For >20,000, Deduct</i>	-0.10	
09 91 13 00-0136	SF		Paint Exterior Concrete Ceiling, 2 Coats Paint, Sprayed	0.81	
			<i>For Oil Based Paint, Add</i>	0.05	
			<i>For Epoxy Paint, Add</i>	0.10	
			<i>For Work >20', Add</i>	0.15	
			<i>Note: Applied only to work area above 20'.</i>		
			<i>For Up To 100, Add</i>	0.48	
			<i>For >100 To 250, Add</i>	0.23	
			<i>For >250 To 500, Add</i>	0.10	
			<i>For >2,500 To 5,000, Deduct</i>	-0.04	
			<i>For >5,000 To 10,000, Deduct</i>	-0.08	
			<i>For >10,000 To 20,000, Deduct</i>	-0.12	
			<i>For >20,000, Deduct</i>	-0.16	
09 91 13 00-0137			Drywall/Plaster <small>(09 91 13 00-0126)</small>		
09 91 13 00-0138	SF		Paint Exterior Drywall/Plaster Ceiling, 1 Coat Primer, Brush Work.....	0.60	
			<i>For Oil Based Paint, Add</i>	0.04	
			<i>For Orange Peel Finish, Add</i>	0.08	
			<i>For Epoxy Paint, Add</i>	0.06	
			<i>For Work >20', Add</i>	0.12	
			<i>Note: Applied only to work area above 20'.</i>		
			<i>For Up To 100, Add</i>	0.38	
			<i>For >100 To 250, Add</i>	0.18	
			<i>For >250 To 500, Add</i>	0.08	
			<i>For >2,500 To 5,000, Deduct</i>	-0.03	
			<i>For >5,000 To 10,000, Deduct</i>	-0.06	
			<i>For >10,000 To 20,000, Deduct</i>	-0.09	
			<i>For >20,000, Deduct</i>	-0.12	
09 91 13 00-0139	SF		Paint Exterior Drywall/Plaster Ceiling, 1 Coat Paint, Brush Work	0.65	
			<i>For Oil Based Paint, Add</i>	0.04	
			<i>For Orange Peel Finish, Add</i>	0.09	
			<i>For Epoxy Paint, Add</i>	0.06	
			<i>For Work >20', Add</i>	0.14	
			<i>Note: Applied only to work area above 20'.</i>		
			<i>For Up To 100, Add</i>	0.43	
			<i>For >100 To 250, Add</i>	0.21	
			<i>For >250 To 500, Add</i>	0.09	
			<i>For >2,500 To 5,000, Deduct</i>	-0.03	
			<i>For >5,000 To 10,000, Deduct</i>	-0.07	
			<i>For >10,000 To 20,000, Deduct</i>	-0.10	
			<i>For >20,000, Deduct</i>	-0.13	



Finishes	09	2
Painting And Coating	09 90	
Painting	09 91	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 13 00-0140 SF Paint Exterior Drywall/Plaster Ceiling, 2 Coats Paint, Brush Work	1.15	
For Oil Based Paint, Add	0.07	
For Orange Peel Finish, Add	0.16	
For Epoxy Paint, Add	0.11	
For Work >20', Add	0.25	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.76	
For >100 To 250, Add	0.36	
For >250 To 500, Add	0.16	
For >2,500 To 5,000, Deduct	-0.06	
For >5,000 To 10,000, Deduct	-0.12	
For >10,000 To 20,000, Deduct	-0.17	
For >20,000, Deduct	-0.23	
09 91 13 00-0141 SF Paint Exterior Drywall/Plaster Ceiling, 1 Coat Primer, Brush/Roller Work	0.45	
For Oil Based Paint, Add	0.03	
For Orange Peel Finish, Add	0.06	
For Epoxy Paint, Add	0.06	
For Work >20', Add	0.09	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.27	
For >100 To 250, Add	0.13	
For >250 To 500, Add	0.06	
For >2,500 To 5,000, Deduct	-0.02	
For >5,000 To 10,000, Deduct	-0.05	
For >10,000 To 20,000, Deduct	-0.07	
For >20,000, Deduct	-0.09	
09 91 13 00-0142 SF Paint Exterior Drywall/Plaster Ceiling, 1 Coat Paint, Brush/Roller Work.....	0.51	
For Oil Based Paint, Add	0.03	
For Orange Peel Finish, Add	0.07	
For Epoxy Paint, Add	0.05	
For Work >20', Add	0.11	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.33	
For >100 To 250, Add	0.16	
For >250 To 500, Add	0.07	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.05	
For >10,000 To 20,000, Deduct	-0.08	
For >20,000, Deduct	-0.10	
09 91 13 00-0143 SF Paint Exterior Drywall/Plaster Ceiling, 2 Coats Paint, Brush/Roller Work	0.93	
For Oil Based Paint, Add	0.06	
For Orange Peel Finish, Add	0.13	
For Epoxy Paint, Add	0.10	
For Work >20', Add	0.19	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.60	
For >100 To 250, Add	0.28	
For >250 To 500, Add	0.12	
For >2,500 To 5,000, Deduct	-0.05	
For >5,000 To 10,000, Deduct	-0.09	
For >10,000 To 20,000, Deduct	-0.14	
For >20,000, Deduct	-0.19	
09 91 13 00-0144 SF Paint Exterior Drywall/Plaster Ceiling, 1 Coat Primer, Sprayed	0.42	
For Oil Based Paint, Add	0.03	
For Epoxy Paint, Add	0.06	
For Work >20', Add	0.07	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.24	
For >100 To 250, Add	0.11	
For >250 To 500, Add	0.05	
For >2,500 To 5,000, Deduct	-0.02	
For >5,000 To 10,000, Deduct	-0.04	
For >10,000 To 20,000, Deduct	-0.06	
For >20,000, Deduct	-0.08	
09 91 13 00-0145 SF Paint Exterior Drywall/Plaster Ceiling, 1 Coat Paint, Sprayed.....	0.52	
For Oil Based Paint, Add	0.03	
For Epoxy Paint, Add	0.06	
For Work >20', Add	0.10	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.32	
For >100 To 250, Add	0.15	
For >250 To 500, Add	0.07	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.05	
For >10,000 To 20,000, Deduct	-0.08	
For >20,000, Deduct	-0.10	

09 Finishes**09 90 Painting And Coating****09 91 Painting**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 13 00-0146	SF		Paint Exterior Drywall/Plaster Ceiling, 2 Coats Paint, Sprayed.....	0.81	
			<i>For Oil Based Paint, Add</i>	0.05	
			<i>For Epoxy Paint, Add</i>	0.10	
			<i>For Work >20', Add</i>	0.15	
			<i>Note: Applied only to work area above 20'.</i>		
			<i>For Up To 100, Add</i>	0.48	
			<i>For >100 To 250, Add</i>	0.23	
			<i>For >250 To 500, Add</i>	0.10	
			<i>For >2,500 To 5,000, Deduct</i>	-0.04	
			<i>For >5,000 To 10,000, Deduct</i>	-0.08	
			<i>For >10,000 To 20,000, Deduct</i>	-0.12	
			<i>For >20,000, Deduct</i>	-0.16	
09 91 13 00-0147			Paint Exterior Wood Ceilings <small>(09 91 13 00-0126)</small>		
09 91 13 00-0148			Paint Exterior Smooth Wood Ceilings <small>(09 91 13 00-0147)</small>		
09 91 13 00-0149	SF		Paint Exterior Wood Smooth Ceiling, 1 Coat Primer, Brush Work.....	0.73	
			<i>For Oil Based Paint, Add</i>	0.04	
			<i>For Work >20', Add</i>	0.15	
			<i>Note: Applied only to work area above 20'.</i>		
			<i>For Up To 100, Add</i>	0.46	
			<i>For >100 To 250, Add</i>	0.22	
			<i>For >250 To 500, Add</i>	0.09	
			<i>For >2,500 To 5,000, Deduct</i>	-0.04	
			<i>For >5,000 To 10,000, Deduct</i>	-0.07	
			<i>For >10,000 To 20,000, Deduct</i>	-0.11	
			<i>For >20,000, Deduct</i>	-0.15	
09 91 13 00-0150	SF		Paint Exterior Wood Smooth Ceiling, 1 Coat Paint, Brush Work.....	0.76	
			<i>For Oil Based Paint, Add</i>	0.04	
			<i>For Work >20', Add</i>	0.16	
			<i>Note: Applied only to work area above 20'.</i>		
			<i>For Up To 100, Add</i>	0.49	
			<i>For >100 To 250, Add</i>	0.23	
			<i>For >250 To 500, Add</i>	0.10	
			<i>For >2,500 To 5,000, Deduct</i>	-0.04	
			<i>For >5,000 To 10,000, Deduct</i>	-0.08	
			<i>For >10,000 To 20,000, Deduct</i>	-0.11	
			<i>For >20,000, Deduct</i>	-0.15	
09 91 13 00-0151	SF		Paint Exterior Wood Smooth Ceiling, 2 Coats Paint, Brush Work.....	1.38	
			<i>For Oil Based Paint, Add</i>	0.08	
			<i>For Work >20', Add</i>	0.28	
			<i>Note: Applied only to work area above 20'.</i>		
			<i>For Up To 100, Add</i>	0.88	
			<i>For >100 To 250, Add</i>	0.42	
			<i>For >250 To 500, Add</i>	0.18	
			<i>For >2,500 To 5,000, Deduct</i>	-0.07	
			<i>For >5,000 To 10,000, Deduct</i>	-0.14	
			<i>For >10,000 To 20,000, Deduct</i>	-0.21	
			<i>For >20,000, Deduct</i>	-0.28	
09 91 13 00-0152	SF		Paint Exterior Smooth Wood Ceiling, 1 Coat Primer, Brush/Roller Work.....	0.59	
			<i>For Oil Based Paint, Add</i>	0.04	
			<i>For Work >20', Add</i>	0.11	
			<i>Note: Applied only to work area above 20'.</i>		
			<i>For Up To 100, Add</i>	0.34	
			<i>For >100 To 250, Add</i>	0.16	
			<i>For >250 To 500, Add</i>	0.07	
			<i>For >2,500 To 5,000, Deduct</i>	-0.03	
			<i>For >5,000 To 10,000, Deduct</i>	-0.06	
			<i>For >10,000 To 20,000, Deduct</i>	-0.09	
			<i>For >20,000, Deduct</i>	-0.12	
09 91 13 00-0153	SF		Paint Exterior Smooth Wood Ceiling, 1 Coat Paint, Brush/Roller Work.....	0.64	
			<i>For Oil Based Paint, Add</i>	0.04	
			<i>For Work >20', Add</i>	0.12	
			<i>Note: Applied only to work area above 20'.</i>		
			<i>For Up To 100, Add</i>	0.39	
			<i>For >100 To 250, Add</i>	0.19	
			<i>For >250 To 500, Add</i>	0.08	
			<i>For >2,500 To 5,000, Deduct</i>	-0.03	
			<i>For >5,000 To 10,000, Deduct</i>	-0.06	
			<i>For >10,000 To 20,000, Deduct</i>	-0.10	
			<i>For >20,000, Deduct</i>	-0.13	
09 91 13 00-0154	SF		Paint Exterior Smooth Wood Ceiling, 2 Coats Paint, Brush/Roller Work.....	1.13	
			<i>For Oil Based Paint, Add</i>	0.07	
			<i>For Work >20', Add</i>	0.21	
			<i>Note: Applied only to work area above 20'.</i>		
			<i>For Up To 100, Add</i>	0.67	
			<i>For >100 To 250, Add</i>	0.32	
			<i>For >250 To 500, Add</i>	0.14	
			<i>For >2,500 To 5,000, Deduct</i>	-0.06	
			<i>For >5,000 To 10,000, Deduct</i>	-0.11	
			<i>For >10,000 To 20,000, Deduct</i>	-0.17	
			<i>For >20,000, Deduct</i>	-0.23	



Finishes	09	9
Painting And Coating	09 90	
Painting	09 91	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 13 00-0155 SF Paint Exterior Smooth Wood Ceiling, 1 Coat Primer, Sprayed	0.52	
For Oil Based Paint, Add	0.03	
For Work >20', Add	0.10	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.31	
For >100 To 250, Add	0.15	
For >250 To 500, Add	0.07	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.05	
For >10,000 To 20,000, Deduct	-0.08	
For >20,000, Deduct	-0.10	
09 91 13 00-0156 SF Paint Exterior Smooth Wood Ceiling, 1 Coat Paint, Sprayed.....	0.52	
For Oil Based Paint, Add	0.03	
For Work >20', Add	0.10	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.31	
For >100 To 250, Add	0.15	
For >250 To 500, Add	0.07	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.05	
For >10,000 To 20,000, Deduct	-0.08	
For >20,000, Deduct	-0.10	
09 91 13 00-0157 SF Paint Exterior Smooth Wood Ceiling, 2 Coats Paint, Sprayed.....	0.96	
For Oil Based Paint, Add	0.06	
For Work >20', Add	0.18	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.56	
For >100 To 250, Add	0.27	
For >250 To 500, Add	0.12	
For >2,500 To 5,000, Deduct	-0.05	
For >5,000 To 10,000, Deduct	-0.10	
For >10,000 To 20,000, Deduct	-0.14	
For >20,000, Deduct	-0.19	
09 91 13 00-0158 Paint Exterior Rough Wood Ceilings (09 91 13 00-0147)		
09 91 13 00-0159 SF Paint Exterior Wood Rough Ceiling, 1 Coat Primer, Brush Work.....	1.08	
For Oil Based Paint, Add	0.06	
For Work >20', Add	0.22	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.68	
For >100 To 250, Add	0.33	
For >250 To 500, Add	0.14	
For >2,500 To 5,000, Deduct	-0.05	
For >5,000 To 10,000, Deduct	-0.11	
For >10,000 To 20,000, Deduct	-0.16	
For >20,000, Deduct	-0.22	
09 91 13 00-0160 SF Paint Exterior Wood Rough Ceiling, 1 Coat Paint, Brush Work.....	1.11	
For Oil Based Paint, Add	0.06	
For Work >20', Add	0.25	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.75	
For >100 To 250, Add	0.36	
For >250 To 500, Add	0.15	
For >2,500 To 5,000, Deduct	-0.06	
For >5,000 To 10,000, Deduct	-0.11	
For >10,000 To 20,000, Deduct	-0.17	
For >20,000, Deduct	-0.22	
09 91 13 00-0161 SF Paint Exterior Wood Rough Ceiling, 2 Coats Paint, Brush Work	1.94	
For Oil Based Paint, Add	0.11	
For Work >20', Add	0.42	
Note: Applied only to work area above 20'.		
For Up To 100, Add	1.30	
For >100 To 250, Add	0.61	
For >250 To 500, Add	0.27	
For >2,500 To 5,000, Deduct	-0.10	
For >5,000 To 10,000, Deduct	-0.19	
For >10,000 To 20,000, Deduct	-0.29	
For >20,000, Deduct	-0.39	
09 91 13 00-0162 SF Paint Exterior Rough Wood Ceiling, 1 Coat Primer, Brush/Roller Work	0.97	
For Oil Based Paint, Add	0.06	
For Work >20', Add	0.17	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.56	
For >100 To 250, Add	0.27	
For >250 To 500, Add	0.12	
For >2,500 To 5,000, Deduct	-0.05	
For >5,000 To 10,000, Deduct	-0.10	
For >10,000 To 20,000, Deduct	-0.15	
For >20,000, Deduct	-0.19	

09	Finishes
09 90	Painting And Coating
09 91	Painting



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 13 00-0163	SF		Paint Exterior Rough Wood Ceiling, 1 Coat Paint, Brush/Roller Work.....	1.04	
			<i>For Oil Based Paint, Add</i>	0.07	
			<i>For Work >20', Add</i>	0.19	
			<i>Note: Applied only to work area above 20'.</i>		
			<i>For Up To 100, Add</i>	0.61	
			<i>For >100 To 250, Add</i>	0.29	
			<i>For >250 To 500, Add</i>	0.13	
			<i>For >2,500 To 5,000, Deduct</i>	-0.05	
			<i>For >5,000 To 10,000, Deduct</i>	-0.10	
			<i>For >10,000 To 20,000, Deduct</i>	-0.16	
			<i>For >20,000, Deduct</i>	-0.21	
09 91 13 00-0164	SF		Paint Exterior Rough Wood Ceiling, 2 Coats Paint, Brush/Roller Work.....	1.88	
			<i>For Oil Based Paint, Add</i>	0.12	
			<i>For Work >20', Add</i>	0.33	
			<i>Note: Applied only to work area above 20'.</i>		
			<i>For Up To 100, Add</i>	1.07	
			<i>For >100 To 250, Add</i>	0.52	
			<i>For >250 To 500, Add</i>	0.23	
			<i>For >2,500 To 5,000, Deduct</i>	-0.09	
			<i>For >5,000 To 10,000, Deduct</i>	-0.19	
			<i>For >10,000 To 20,000, Deduct</i>	-0.28	
			<i>For >20,000, Deduct</i>	-0.38	
09 91 13 00-0165	SF		Paint Exterior Rough Wood Ceiling, 1 Coat Primer, Sprayed.....	0.84	
			<i>For Oil Based Paint, Add</i>	0.05	
			<i>For Work >20', Add</i>	0.15	
			<i>Note: Applied only to work area above 20'.</i>		
			<i>For Up To 100, Add</i>	0.49	
			<i>For >100 To 250, Add</i>	0.23	
			<i>For >250 To 500, Add</i>	0.10	
			<i>For >2,500 To 5,000, Deduct</i>	-0.04	
			<i>For >5,000 To 10,000, Deduct</i>	-0.08	
			<i>For >10,000 To 20,000, Deduct</i>	-0.13	
			<i>For >20,000, Deduct</i>	-0.17	
09 91 13 00-0166	SF		Paint Exterior Rough Wood Ceiling, 1 Coat Paint, Sprayed.....	0.93	
			<i>For Oil Based Paint, Add</i>	0.06	
			<i>For Work >20', Add</i>	0.17	
			<i>Note: Applied only to work area above 20'.</i>		
			<i>For Up To 100, Add</i>	0.55	
			<i>For >100 To 250, Add</i>	0.27	
			<i>For >250 To 500, Add</i>	0.12	
			<i>For >2,500 To 5,000, Deduct</i>	-0.05	
			<i>For >5,000 To 10,000, Deduct</i>	-0.09	
			<i>For >10,000 To 20,000, Deduct</i>	-0.14	
			<i>For >20,000, Deduct</i>	-0.19	
09 91 13 00-0167	SF		Paint Exterior Rough Wood Ceiling, 2 Coats Paint, Sprayed.....	1.67	
			<i>For Oil Based Paint, Add</i>	0.11	
			<i>For Work >20', Add</i>	0.30	
			<i>Note: Applied only to work area above 20'.</i>		
			<i>For Up To 100, Add</i>	0.97	
			<i>For >100 To 250, Add</i>	0.47	
			<i>For >250 To 500, Add</i>	0.20	
			<i>For >2,500 To 5,000, Deduct</i>	-0.08	
			<i>For >5,000 To 10,000, Deduct</i>	-0.17	
			<i>For >10,000 To 20,000, Deduct</i>	-0.25	
			<i>For >20,000, Deduct</i>	-0.33	
09 91 13 00-0168			Paint Exterior Metal Ceilings <small>(09 91 13 00-0126)</small>		
09 91 13 00-0169			Paint Exterior Galvanized Ceilings <small>(09 91 13 00-0168)</small>		
			<i>Note: Linseed oil or acrylic latex paint.</i>		
09 91 13 00-0170	SF		Paint Exterior Galvanized Ceiling, 1 Coat Primer, Brush Work.....	0.71	
			<i>For Work >20', Add</i>	0.14	
			<i>Note: Applied only to work area above 20'.</i>		
			<i>For Up To 100, Add</i>	0.44	
			<i>For >100 To 250, Add</i>	0.21	
			<i>For >250 To 500, Add</i>	0.09	
			<i>For >2,500 To 5,000, Deduct</i>	-0.04	
			<i>For >5,000 To 10,000, Deduct</i>	-0.07	
			<i>For >10,000 To 20,000, Deduct</i>	-0.11	
			<i>For >20,000, Deduct</i>	-0.14	
09 91 13 00-0171	SF		Paint Exterior Galvanized Ceiling, 1 Coat Paint, Brush Work.....	0.78	
			<i>For Work >20', Add</i>	0.16	
			<i>Note: Applied only to work area above 20'.</i>		
			<i>For Up To 100, Add</i>	0.50	
			<i>For >100 To 250, Add</i>	0.24	
			<i>For >250 To 500, Add</i>	0.10	
			<i>For >2,500 To 5,000, Deduct</i>	-0.04	
			<i>For >5,000 To 10,000, Deduct</i>	-0.08	
			<i>For >10,000 To 20,000, Deduct</i>	-0.12	
			<i>For >20,000, Deduct</i>	-0.16	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 13 00-0172 SF Paint Exterior Galvanized Ceiling, 2 Coats Paint, Brush Work	1.42	
For Work >20', Add	0.28	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.89	
For >100 To 250, Add	0.42	
For >250 To 500, Add	0.18	
For >2,500 To 5,000, Deduct	-0.07	
For >5,000 To 10,000, Deduct	-0.14	
For >10,000 To 20,000, Deduct	-0.21	
For >20,000, Deduct	-0.28	
09 91 13 00-0173 SF Paint Exterior Galvanized Ceiling, 1 Coat Primer, Brush/Roller Work	0.54	
For Work >20', Add	0.11	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.33	
For >100 To 250, Add	0.16	
For >250 To 500, Add	0.07	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.05	
For >10,000 To 20,000, Deduct	-0.08	
For >20,000, Deduct	-0.11	
09 91 13 00-0174 SF Paint Exterior Galvanized Ceiling, 1 Coat Paint, Brush/Roller Work	0.61	
For Work >20', Add	0.12	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.39	
For >100 To 250, Add	0.18	
For >250 To 500, Add	0.08	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.06	
For >10,000 To 20,000, Deduct	-0.09	
For >20,000, Deduct	-0.12	
09 91 13 00-0175 SF Paint Exterior Galvanized Ceiling, 2 Coats Paint, Brush/Roller Work	1.07	
For Work >20', Add	0.21	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.66	
For >100 To 250, Add	0.31	
For >250 To 500, Add	0.14	
For >2,500 To 5,000, Deduct	-0.05	
For >5,000 To 10,000, Deduct	-0.11	
For >10,000 To 20,000, Deduct	-0.16	
For >20,000, Deduct	-0.21	
09 91 13 00-0176 SF Paint Exterior Galvanized Ceiling, 1 Coat Primer, Sprayed	0.56	
For Work >20', Add	0.10	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.32	
For >100 To 250, Add	0.15	
For >250 To 500, Add	0.07	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.06	
For >10,000 To 20,000, Deduct	-0.08	
For >20,000, Deduct	-0.11	
09 91 13 00-0177 SF Paint Exterior Galvanized Ceiling, 1 Coat Paint, Sprayed	0.67	
For Work >20', Add	0.13	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.40	
For >100 To 250, Add	0.19	
For >250 To 500, Add	0.08	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.07	
For >10,000 To 20,000, Deduct	-0.10	
For >20,000, Deduct	-0.13	
09 91 13 00-0178 SF Paint Exterior Galvanized Ceiling, 2 Coats Paint, Sprayed	1.04	
For Work >20', Add	0.18	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.58	
For >100 To 250, Add	0.28	
For >250 To 500, Add	0.12	
For >2,500 To 5,000, Deduct	-0.05	
For >5,000 To 10,000, Deduct	-0.10	
For >10,000 To 20,000, Deduct	-0.16	
For >20,000, Deduct	-0.21	
09 91 13 00-0179 Paint Exterior Aluminum And Aluminum Alloy Ceilings (09 91 13 00-0168)		
Note: Alkyd enamel paint.		
09 91 13 00-0180 SF Paint Exterior Aluminum And Aluminum Alloy Ceiling, 1 Coat Primer, Brush Work	0.71	
For Work >20', Add	0.14	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.44	
For >100 To 250, Add	0.21	
For >250 To 500, Add	0.09	
For >2,500 To 5,000, Deduct	-0.04	
For >5,000 To 10,000, Deduct	-0.07	
For >10,000 To 20,000, Deduct	-0.11	
For >20,000, Deduct	-0.14	

09 Finishes

09 90 Painting And Coating

09 91 Painting



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 13 00-0181	SF		Paint Exterior Aluminum And Aluminum Alloy Ceiling, 1 Coat Paint, Brush Work.....	0.78	
			For Work >20', Add	0.16	
			Note: Applied only to work area above 20'.		
			For Up To 100, Add	0.50	
			For >100 To 250, Add	0.24	
			For >250 To 500, Add	0.10	
			For >2,500 To 5,000, Deduct	-0.04	
			For >5,000 To 10,000, Deduct	-0.08	
			For >10,000 To 20,000, Deduct	-0.12	
			For >20,000, Deduct	-0.16	
09 91 13 00-0182	SF		Paint Exterior Aluminum And Aluminum Alloy Ceiling, 2 Coats Paint, Brush Work.....	1.42	
			For Work >20', Add	0.28	
			Note: Applied only to work area above 20'.		
			For Up To 100, Add	0.89	
			For >100 To 250, Add	0.42	
			For >250 To 500, Add	0.18	
			For >2,500 To 5,000, Deduct	-0.07	
			For >5,000 To 10,000, Deduct	-0.14	
			For >10,000 To 20,000, Deduct	-0.21	
			For >20,000, Deduct	-0.28	
09 91 13 00-0183	SF		Paint Exterior Aluminum And Aluminum Alloy Ceiling, 1 Coat Primer, Brush/Roller Work.....	0.59	
			For Work >20', Add	0.11	
			Note: Applied only to work area above 20'.		
			For Up To 100, Add	0.34	
			For >100 To 250, Add	0.16	
			For >250 To 500, Add	0.07	
			For >2,500 To 5,000, Deduct	-0.03	
			For >5,000 To 10,000, Deduct	-0.06	
			For >10,000 To 20,000, Deduct	-0.09	
			For >20,000, Deduct	-0.12	
09 91 13 00-0184	SF		Paint Exterior Aluminum And Aluminum Alloy Ceiling, 1 Coat Paint, Brush/Roller Work.....	0.66	
			For Work >20', Add	0.12	
			Note: Applied only to work area above 20'.		
			For Up To 100, Add	0.39	
			For >100 To 250, Add	0.19	
			For >250 To 500, Add	0.08	
			For >2,500 To 5,000, Deduct	-0.03	
			For >5,000 To 10,000, Deduct	-0.07	
			For >10,000 To 20,000, Deduct	-0.10	
			For >20,000, Deduct	-0.13	
09 91 13 00-0185	SF		Paint Exterior Aluminum And Aluminum Alloy Ceiling, 2 Coats Paint, Brush/Roller Work.....	1.17	
			For Work >20', Add	0.21	
			Note: Applied only to work area above 20'.		
			For Up To 100, Add	0.67	
			For >100 To 250, Add	0.32	
			For >250 To 500, Add	0.14	
			For >2,500 To 5,000, Deduct	-0.06	
			For >5,000 To 10,000, Deduct	-0.12	
			For >10,000 To 20,000, Deduct	-0.18	
			For >20,000, Deduct	-0.23	
09 91 13 00-0186	SF		Paint Exterior Aluminum And Aluminum Alloy Ceiling, 1 Coat Primer, Sprayed.....	0.56	
			For Work >20', Add	0.10	
			Note: Applied only to work area above 20'.		
			For Up To 100, Add	0.32	
			For >100 To 250, Add	0.15	
			For >250 To 500, Add	0.07	
			For >2,500 To 5,000, Deduct	-0.03	
			For >5,000 To 10,000, Deduct	-0.06	
			For >10,000 To 20,000, Deduct	-0.08	
			For >20,000, Deduct	-0.11	
09 91 13 00-0187	SF		Paint Exterior Aluminum And Aluminum Alloy Ceiling, 1 Coat Paint, Sprayed.....	0.56	
			For Work >20', Add	0.10	
			Note: Applied only to work area above 20'.		
			For Up To 100, Add	0.32	
			For >100 To 250, Add	0.15	
			For >250 To 500, Add	0.07	
			For >2,500 To 5,000, Deduct	-0.03	
			For >5,000 To 10,000, Deduct	-0.06	
			For >10,000 To 20,000, Deduct	-0.08	
			For >20,000, Deduct	-0.11	
09 91 13 00-0188	SF		Paint Exterior Aluminum And Aluminum Alloy Ceiling, 2 Coats Paint, Sprayed.....	1.04	
			For Work >20', Add	0.18	
			Note: Applied only to work area above 20'.		
			For Up To 100, Add	0.58	
			For >100 To 250, Add	0.28	
			For >250 To 500, Add	0.12	
			For >2,500 To 5,000, Deduct	-0.05	
			For >5,000 To 10,000, Deduct	-0.10	
			For >10,000 To 20,000, Deduct	-0.16	
			For >20,000, Deduct	-0.21	

09 91 13 00-0189 Paint Exterior Corrugated Metal Ceilings (09 91 13 00-0188)



Finishes	09	9
Painting And Coating	09 90	
Painting	09 91	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 13 00-0190 SF Paint Exterior Corrugated Metal Ceiling, 1 Coat Primer, Sprayed.....	0.63	
For Work >20', Add	0.11	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.35	
For >100 To 250, Add	0.17	
For >250 To 500, Add	0.07	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.06	
For >10,000 To 20,000, Deduct	-0.09	
For >20,000, Deduct	-0.13	
09 91 13 00-0191 SF Paint Exterior Corrugated Metal Ceiling, 1 Coat Paint, Sprayed.....	0.73	
For Work >20', Add	0.13	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.43	
For >100 To 250, Add	0.21	
For >250 To 500, Add	0.09	
For >2,500 To 5,000, Deduct	-0.04	
For >5,000 To 10,000, Deduct	-0.07	
For >10,000 To 20,000, Deduct	-0.11	
For >20,000, Deduct	-0.15	
09 91 13 00-0192 SF Paint Exterior Corrugated Metal Ceiling, 2 Coats Paint, Sprayed.....	1.31	
For Work >20', Add	0.23	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.75	
For >100 To 250, Add	0.36	
For >250 To 500, Add	0.16	
For >2,500 To 5,000, Deduct	-0.07	
For >5,000 To 10,000, Deduct	-0.13	
For >10,000 To 20,000, Deduct	-0.20	
For >20,000, Deduct	-0.26	
 09 91 13 00-0193 Paint Exterior Floors <small>(09 91 13)</small>		
09 91 13 00-0194 Paint Exterior Concrete Floors <small>(09 91 13 00-0193)</small>		
09 91 13 00-0195 SF Paint Exterior Concrete Floors And Decks, 1 Coat Primer, Brush Work.....	0.46	
For Oil Based Paint, Add	0.03	
For Epoxy Paint, Add	0.06	
For Up To 100, Add	0.28	
For >100 To 250, Add	0.13	
For >250 To 500, Add	0.06	
For >2,500 To 5,000, Deduct	-0.02	
For >5,000 To 10,000, Deduct	-0.05	
For >10,000 To 20,000, Deduct	-0.07	
For >20,000, Deduct	-0.09	
09 91 13 00-0196 SF Paint Exterior Concrete Floors And Decks, 1 Coat Paint, Brush Work.....	0.51	
For Oil Based Paint, Add	0.03	
For Epoxy Paint, Add	0.05	
For Up To 100, Add	0.33	
For >100 To 250, Add	0.16	
For >250 To 500, Add	0.07	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.05	
For >10,000 To 20,000, Deduct	-0.08	
For >20,000, Deduct	-0.10	
09 91 13 00-0197 SF Paint Exterior Concrete Floors And Decks, 2 Coats Paint, Brush Work.....	0.93	
For Oil Based Paint, Add	0.06	
For Epoxy Paint, Add	0.10	
For Up To 100, Add	0.60	
For >100 To 250, Add	0.28	
For >250 To 500, Add	0.12	
For >2,500 To 5,000, Deduct	-0.05	
For >5,000 To 10,000, Deduct	-0.09	
For >10,000 To 20,000, Deduct	-0.14	
For >20,000, Deduct	-0.19	
09 91 13 00-0198 SF Paint Exterior Concrete Floors And Decks, 1 Coat Primer, Brush/Roller Work.....	0.38	
For Oil Based Paint, Add	0.02	
For Epoxy Paint, Add	0.05	
For Up To 100, Add	0.22	
For >100 To 250, Add	0.11	
For >250 To 500, Add	0.05	
For >2,500 To 5,000, Deduct	-0.02	
For >5,000 To 10,000, Deduct	-0.04	
For >10,000 To 20,000, Deduct	-0.06	
For >20,000, Deduct	-0.08	
09 91 13 00-0199 SF Paint Exterior Concrete Floors And Decks, 1 Coat Paint, Brush/Roller Work.....	0.44	
For Oil Based Paint, Add	0.03	
For Epoxy Paint, Add	0.05	
For Up To 100, Add	0.28	
For >100 To 250, Add	0.13	
For >250 To 500, Add	0.06	
For >2,500 To 5,000, Deduct	-0.02	
For >5,000 To 10,000, Deduct	-0.04	
For >10,000 To 20,000, Deduct	-0.07	
For >20,000, Deduct	-0.09	

09 Finishes

09 90 Painting And Coating

09 91 Painting



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 13 00-0200 SF Paint Exterior Concrete Floors And Decks, 2 Coats Paint, Brush/Roller Work	0.72	
For Oil Based Paint, Add	0.04	
For Epoxy Paint, Add	0.09	
For Up To 100, Add	0.44	
For >100 To 250, Add	0.21	
For >250 To 500, Add	0.09	
For >2,500 To 5,000, Deduct	-0.04	
For >5,000 To 10,000, Deduct	-0.07	
For >10,000 To 20,000, Deduct	-0.11	
For >20,000, Deduct	-0.14	
09 91 13 00-0201 SF Paint Exterior Concrete Floors And Decks, 1 Coat Primer, Sprayed	0.33	
For Oil Based Paint, Add	0.02	
For Epoxy Paint, Add	0.06	
For Up To 100, Add	0.17	
For >100 To 250, Add	0.08	
For >250 To 500, Add	0.04	
For >2,500 To 5,000, Deduct	-0.02	
For >5,000 To 10,000, Deduct	-0.03	
For >10,000 To 20,000, Deduct	-0.05	
For >20,000, Deduct	-0.07	
09 91 13 00-0202 SF Paint Exterior Concrete Floors And Decks, 1 Coat Paint, Sprayed.....	0.41	
For Oil Based Paint, Add	0.03	
For Epoxy Paint, Add	0.05	
For Up To 100, Add	0.24	
For >100 To 250, Add	0.12	
For >250 To 500, Add	0.05	
For >2,500 To 5,000, Deduct	-0.02	
For >5,000 To 10,000, Deduct	-0.04	
For >10,000 To 20,000, Deduct	-0.06	
For >20,000, Deduct	-0.08	
09 91 13 00-0203 SF Paint Exterior Concrete Floors And Decks, 2 Coats Paint, Sprayed.....	0.71	
For Oil Based Paint, Add	0.05	
For Epoxy Paint, Add	0.10	
For Up To 100, Add	0.41	
For >100 To 250, Add	0.20	
For >250 To 500, Add	0.09	
For >2,500 To 5,000, Deduct	-0.04	
For >5,000 To 10,000, Deduct	-0.07	
For >10,000 To 20,000, Deduct	-0.11	
For >20,000, Deduct	-0.14	
09 91 13 00-0204 SF Paint Exterior Concrete Floors And Decks, 1 Coat Non Slip Paint, Brush/Roller Work.....	1.15	
For Up To 100, Add	0.38	
For >100 To 250, Add	0.20	
For >250 To 500, Add	0.09	
For >2,500 To 5,000, Deduct	-0.06	
For >5,000 To 10,000, Deduct	-0.12	
For >10,000 To 20,000, Deduct	-0.17	
For >20,000, Deduct	-0.23	
09 91 13 00-0205 SF Paint Exterior Concrete Floors And Decks, 1 Coat Anti-Slip, Single Component Epoxy Coating, Brush/Roller Work	2.67	
For Up To 100, Add	0.61	
For >100 To 250, Add	0.35	
For >250 To 500, Add	0.17	
For >2,500 To 5,000, Deduct	-0.13	
For >5,000 To 10,000, Deduct	-0.27	
For >10,000 To 20,000, Deduct	-0.40	
For >20,000, Deduct	-0.53	
09 91 13 00-0206 SF Paint Exterior Concrete Floors And Decks, 1 Coat Anti-Slip High Performance Epoxy Coating, Brush/Roller Work.....	3.32	
For Up To 100, Add	0.71	
For >100 To 250, Add	0.42	
For >250 To 500, Add	0.20	
For >2,500 To 5,000, Deduct	-0.17	
For >5,000 To 10,000, Deduct	-0.33	
For >10,000 To 20,000, Deduct	-0.50	
For >20,000, Deduct	-0.66	
09 91 13 00-0207 Paint Exterior Wood Floors <small>(09 91 13 00-0193)</small>		
09 91 13 00-0208 SF Paint Exterior Wood Floors And Decks, 1 Coat Primer, Brush Work	0.57	
For Oil Based Paint, Add	0.04	
For Up To 100, Add	0.34	
For >100 To 250, Add	0.16	
For >250 To 500, Add	0.07	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.06	
For >10,000 To 20,000, Deduct	-0.09	
For >20,000, Deduct	-0.11	
09 91 13 00-0209 SF Paint Exterior Wood Floors And Decks, 1 Coat Paint, Brush Work.....	0.62	
For Oil Based Paint, Add	0.04	
For Up To 100, Add	0.39	
For >100 To 250, Add	0.18	
For >250 To 500, Add	0.08	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.06	
For >10,000 To 20,000, Deduct	-0.09	
For >20,000, Deduct	-0.12	



Finishes	09	9
Painting And Coating	09 90	
Painting	09 91	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 13 00-0210 SF Paint Exterior Wood Floors And Decks, 2 Coats Paint, Brush Work.....	1.16	
For Oil Based Paint, Add	0.07	
For Up To 100, Add	0.71	
For >100 To 250, Add	0.34	
For >250 To 500, Add	0.15	
For >2,500 To 5,000, Deduct	-0.06	
For >5,000 To 10,000, Deduct	-0.12	
For >10,000 To 20,000, Deduct	-0.17	
For >20,000, Deduct	-0.23	
09 91 13 00-0211 SF Paint Exterior Wood Floors And Decks, 1 Coat Primer, Brush/Roller Work.....	0.52	
For Oil Based Paint, Add	0.03	
For Up To 100, Add	0.29	
For >100 To 250, Add	0.14	
For >250 To 500, Add	0.06	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.05	
For >10,000 To 20,000, Deduct	-0.08	
For >20,000, Deduct	-0.10	
09 91 13 00-0212 SF Paint Exterior Wood Floors And Decks, 1 Coat Paint, Brush/Roller Work.....	0.57	
For Oil Based Paint, Add	0.04	
For Up To 100, Add	0.34	
For >100 To 250, Add	0.16	
For >250 To 500, Add	0.07	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.06	
For >10,000 To 20,000, Deduct	-0.09	
For >20,000, Deduct	-0.11	
09 91 13 00-0213 SF Paint Exterior Wood Floors And Decks, 2 Coats Paint, Brush/Roller Work.....	0.93	
For Oil Based Paint, Add	0.06	
For Up To 100, Add	0.52	
For >100 To 250, Add	0.25	
For >250 To 500, Add	0.11	
For >2,500 To 5,000, Deduct	-0.05	
For >5,000 To 10,000, Deduct	-0.09	
For >10,000 To 20,000, Deduct	-0.14	
For >20,000, Deduct	-0.19	
09 91 13 00-0214 SF Paint Exterior Wood Floors And Decks, 1 Coat Primer, Sprayed.....	0.43	
For Oil Based Paint, Add	0.03	
For Up To 100, Add	0.24	
For >100 To 250, Add	0.12	
For >250 To 500, Add	0.05	
For >2,500 To 5,000, Deduct	-0.02	
For >5,000 To 10,000, Deduct	-0.04	
For >10,000 To 20,000, Deduct	-0.06	
For >20,000, Deduct	-0.09	
09 91 13 00-0215 SF Paint Exterior Wood Floors And Decks, 1 Coat Paint, Sprayed.....	0.52	
For Oil Based Paint, Add	0.03	
For Up To 100, Add	0.31	
For >100 To 250, Add	0.15	
For >250 To 500, Add	0.07	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.05	
For >10,000 To 20,000, Deduct	-0.08	
For >20,000, Deduct	-0.10	
09 91 13 00-0216 SF Paint Exterior Wood Floors And Decks, 2 Coats Paint, Sprayed.....	0.86	
For Oil Based Paint, Add	0.06	
For Up To 100, Add	0.49	
For >100 To 250, Add	0.24	
For >250 To 500, Add	0.10	
For >2,500 To 5,000, Deduct	-0.04	
For >5,000 To 10,000, Deduct	-0.09	
For >10,000 To 20,000, Deduct	-0.13	
For >20,000, Deduct	-0.17	
09 91 13 00-0217 SF Paint Exterior Wood Floors And Decks, 1 Coat Non Slip Paint, Brush Work.....	1.22	
For Up To 100, Add	0.44	
For >100 To 250, Add	0.23	
For >250 To 500, Add	0.10	
For >2,500 To 5,000, Deduct	-0.06	
For >5,000 To 10,000, Deduct	-0.12	
For >10,000 To 20,000, Deduct	-0.18	
For >20,000, Deduct	-0.24	
09 91 13 00-0218 SF Paint Exterior Wood Floors And Decks, 1 Coat Non Slip Epoxy Coating, Brush Work.....	3.39	
For Up To 100, Add	0.76	
For >100 To 250, Add	0.44	
For >250 To 500, Add	0.21	
For >2,500 To 5,000, Deduct	-0.17	
For >5,000 To 10,000, Deduct	-0.34	
For >10,000 To 20,000, Deduct	-0.51	
For >20,000, Deduct	-0.68	
09 91 13 00-0219 Paint Exterior Doors And Windows (09 91 13)		
09 91 13 00-0220 Paint Exterior Door Frames (09 91 13 00-0219)		
09 91 13 00-0221 LF Paint Exterior Wood Door Frame And Trim, 1 Coat Primer, Brush/Roller Work.....	0.75	
For Painting Either Interior Or Exterior Only, Deduct	-0.20	

09 Finishes**09 90 Painting And Coating****09 91 Painting**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91	13 00-0222	LF	Paint Exterior Wood Door Frame And Trim, 1 Coat Paint, Brush/Roller Work.....	0.97	
			<i>For Painting Either Interior Or Exterior Only, Deduct</i>	-0.25	
09 91	13 00-0223	LF	Paint Exterior Wood Door Frame And Trim, 2 Coats Paint, Brush/Roller Work.....	1.63	
			<i>For Painting Either Interior Or Exterior Only, Deduct</i>	-0.43	
09 91	13 00-0224	LF	Paint Exterior Metal Door Frame And Trim, 1 Coat Primer, Brush/Roller Work.....	0.74	
			<i>For Painting Either Interior Or Exterior Only, Deduct</i>	-0.20	
09 91	13 00-0225	LF	Paint Exterior Metal Door Frame And Trim, 1 Coat Paint, Brush/Roller Work.....	0.96	
			<i>For Painting Either Interior Or Exterior Only, Deduct</i>	-0.25	
09 91	13 00-0226	LF	Paint Exterior Metal Door Frame And Trim, 2 Coats Paint, Brush/Roller Work.....	1.62	
			<i>For Painting Either Interior Or Exterior Only, Deduct</i>	-0.42	
09 91 13 00-0227 Paint Exterior Metal Doors <small>(09 91 13 00-0219)</small>					
09 91	13 00-0228	EA	Paint Exterior Metal Door, One Face, 1 Coat Primer, Brush/Roller Work.....	30.34	
			<i>For Half Louvered Door, Add</i>	3.03	
			<i>For Full Louvered Door, Add</i>	5.05	
			<i>For Electrostatic Painting, Add</i>	4.56	
			<i>For >5 To 10, Deduct</i>	-1.52	
			<i>For >10 To 25, Deduct</i>	-3.03	
			<i>For >25, Deduct</i>	-4.55	
09 91	13 00-0229	EA	Paint Exterior Metal Door, One Face, 1 Coat Paint, Brush/Roller Work.....	30.34	
			<i>For Half Louvered Door, Add</i>	3.03	
			<i>For Full Louvered Door, Add</i>	5.05	
			<i>For Electrostatic Painting, Add</i>	4.56	
			<i>For >5 To 10, Deduct</i>	-1.52	
			<i>For >10 To 25, Deduct</i>	-3.03	
			<i>For >25, Deduct</i>	-4.55	
09 91	13 00-0230	EA	Paint Exterior Metal Door, One Face, 2 Coats Paint, Brush/Roller Work.....	54.26	
			<i>For Half Louvered Door, Add</i>	5.12	
			<i>For Full Louvered Door, Add</i>	8.53	
			<i>For Electrostatic Painting, Add</i>	8.45	
			<i>For >5 To 10, Deduct</i>	-2.71	
			<i>For >10 To 25, Deduct</i>	-5.43	
			<i>For >25, Deduct</i>	-8.14	
09 91	13 00-0231	EA	Paint Exterior Metal Door, Both Faces, 1 Coat Primer, Brush/Roller Work.....	54.44	
			<i>For Half Louvered Door, Add</i>	5.43	
			<i>For Full Louvered Door, Add</i>	9.05	
			<i>For Electrostatic Painting, Add</i>	8.18	
			<i>For >5 To 10, Deduct</i>	-2.72	
			<i>For >10 To 25, Deduct</i>	-5.44	
			<i>For >25, Deduct</i>	-8.17	
09 91	13 00-0232	EA	Paint Exterior Metal Door, Both Faces, 1 Coat Paint, Brush/Roller Work.....	54.44	
			<i>For Half Louvered Door, Add</i>	5.43	
			<i>For Full Louvered Door, Add</i>	9.05	
			<i>For Electrostatic Painting, Add</i>	8.18	
			<i>For >5 To 10, Deduct</i>	-2.72	
			<i>For >10 To 25, Deduct</i>	-5.44	
			<i>For >25, Deduct</i>	-8.17	
09 91	13 00-0233	EA	Paint Exterior Metal Door, Both Faces, 2 Coats Paint, Brush/Roller Work.....	97.73	
			<i>For Half Louvered Door, Add</i>	9.19	
			<i>For Full Louvered Door, Add</i>	15.32	
			<i>For Electrostatic Painting, Add</i>	15.24	
			<i>For >5 To 10, Deduct</i>	-4.89	
			<i>For >10 To 25, Deduct</i>	-9.77	
			<i>For >25, Deduct</i>	-14.66	
09 91	13 00-0234	EA	Paint Exterior Metal Door, One Face, 1 Coat Primer, Sprayed.....	24.62	
			<i>For Half Louvered Door, Add</i>	2.02	
			<i>For Full Louvered Door, Add</i>	3.37	
			<i>For Electrostatic Painting, Add</i>	4.14	
			<i>For >5 To 10, Deduct</i>	-1.23	
			<i>For >10 To 25, Deduct</i>	-2.46	
			<i>For >25, Deduct</i>	-3.69	
09 91	13 00-0235	EA	Paint Exterior Metal Door, One Face, 1 Coat Paint, Sprayed.....	24.62	
			<i>For Half Louvered Door, Add</i>	2.02	
			<i>For Full Louvered Door, Add</i>	3.37	
			<i>For Electrostatic Painting, Add</i>	4.14	
			<i>For >5 To 10, Deduct</i>	-1.23	
			<i>For >10 To 25, Deduct</i>	-2.46	
			<i>For >25, Deduct</i>	-3.69	
09 91	13 00-0236	EA	Paint Exterior Metal Door, One Face, 2 Coats Paint, Sprayed.....	44.91	
			<i>For Half Louvered Door, Add</i>	3.41	
			<i>For Full Louvered Door, Add</i>	5.68	
			<i>For Electrostatic Painting, Add</i>	7.82	
			<i>For >5 To 10, Deduct</i>	-2.25	
			<i>For >10 To 25, Deduct</i>	-4.49	
			<i>For >25, Deduct</i>	-6.74	
09 91	13 00-0237	EA	Paint Exterior Metal Door, Both Faces, 1 Coat Primer, Sprayed.....	44.91	
			<i>For Half Louvered Door, Add</i>	3.62	
			<i>For Full Louvered Door, Add</i>	6.03	
			<i>For Electrostatic Painting, Add</i>	7.43	
			<i>For >5 To 10, Deduct</i>	-2.21	
			<i>For >10 To 25, Deduct</i>	-4.42	
			<i>For >25, Deduct</i>	-6.63	



Finishes	09	2
Painting And Coating	09 90	
Painting	09 91	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91	13 00-0238	EA	Paint Exterior Metal Door, Both Faces, 1 Coat Paint, Sprayed.....	44.19	
			<i>For Half Louvered Door, Add</i>	3.62	
			<i>For Full Louvered Door, Add</i>	6.03	
			<i>For Electrostatic Painting, Add</i>	7.43	
			<i>For >5 To 10, Deduct</i>	-2.21	
			<i>For >10 To 25, Deduct</i>	-4.42	
			<i>For >25, Deduct</i>	-6.63	
09 91	13 00-0239	EA	Paint Exterior Metal Door, Both Faces, 2 Coats Paint, Sprayed.....	80.94	
			<i>For Half Louvered Door, Add</i>	6.12	
			<i>For Full Louvered Door, Add</i>	10.21	
			<i>For Electrostatic Painting, Add</i>	14.11	
			<i>For >5 To 10, Deduct</i>	-4.05	
			<i>For >10 To 25, Deduct</i>	-8.09	
			<i>For >25, Deduct</i>	-12.14	
09 91	13 00-0240	SF	Paint Exterior Metal Overhead, Sectional Door, Or Roll Up Door, 1 Coat Primer, Brush/Roller Work.....	1.55	
			<i>For Electrostatic Painting, Add</i>	0.18	
09 91	13 00-0241	SF	Paint Exterior Metal Overhead, Sectional Door, Or Roll Up Door, 1 Coat Paint, Brush/Roller Work.....	1.62	
			<i>For Electrostatic Painting, Add</i>	0.20	
09 91	13 00-0242	SF	Paint Exterior Metal Overhead, Sectional Door, Or Roll Up Door, 2 Coats Paint, Brush/Roller Work.....	3.34	
			<i>For Electrostatic Painting, Add</i>	0.40	
09 91	13 00-0243	SF	Paint Exterior Metal Overhead, Sectional Door, Or Roll Up Door, 1 Coat Primer, Sprayed.....	1.97	
			<i>For Electrostatic Painting, Add</i>	0.22	
09 91	13 00-0244	SF	Paint Exterior Metal Overhead, Sectional Door, Or Roll Up Door, 1 Coat Paint, Sprayed.....	2.04	
			<i>For Electrostatic Painting, Add</i>	0.24	
09 91	13 00-0245	SF	Paint Exterior Metal Overhead, Sectional Door, Or Roll Up Door, 2 Coats Paint, Sprayed.....	3.97	
			<i>For Electrostatic Painting, Add</i>	0.46	
09 91 13 00-0246 Paint Exterior Wood Doors (09 91 13 00-0219)					
09 91	13 00-0247	EA	Paint Exterior Wood Door, One Face, 1 Coat Primer, Brush/Roller Work.....	30.34	
			<i>For Half Louvered Door, Add</i>	3.03	
			<i>For Full Louvered Door, Add</i>	5.05	
			<i>For >5 To 10, Deduct</i>	-1.52	
			<i>For >10 To 25, Deduct</i>	-3.03	
			<i>For >25, Deduct</i>	-4.55	
09 91	13 00-0248	EA	Paint Exterior Wood Door, One Face, 1 Coat Paint, Brush/Roller Work.....	30.34	
			<i>For Half Louvered Door, Add</i>	3.03	
			<i>For Full Louvered Door, Add</i>	5.05	
			<i>For >5 To 10, Deduct</i>	-1.52	
			<i>For >10 To 25, Deduct</i>	-3.03	
			<i>For >25, Deduct</i>	-4.55	
09 91	13 00-0249	EA	Paint Exterior Wood Door, One Face, 2 Coats Paint, Brush/Roller Work.....	54.26	
			<i>For Half Louvered Door, Add</i>	5.12	
			<i>For Full Louvered Door, Add</i>	8.53	
			<i>For >5 To 10, Deduct</i>	-2.71	
			<i>For >10 To 25, Deduct</i>	-5.43	
			<i>For >25, Deduct</i>	-8.14	
09 91	13 00-0250	EA	Paint Exterior Wood Door, Both Faces, 1 Coat Primer, Brush/Roller Work.....	54.44	
			<i>For Half Louvered Door, Add</i>	5.43	
			<i>For Full Louvered Door, Add</i>	9.05	
			<i>For >5 To 10, Deduct</i>	-2.72	
			<i>For >10 To 25, Deduct</i>	-5.44	
			<i>For >25, Deduct</i>	-8.17	
09 91	13 00-0251	EA	Paint Exterior Wood Door, Both Faces, 1 Coat Paint, Brush/Roller Work.....	54.44	
			<i>For Half Louvered Door, Add</i>	5.43	
			<i>For Full Louvered Door, Add</i>	9.05	
			<i>For >5 To 10, Deduct</i>	-2.72	
			<i>For >10 To 25, Deduct</i>	-5.44	
			<i>For >25, Deduct</i>	-8.17	
09 91	13 00-0252	EA	Paint Exterior Wood Door, Both Faces, 2 Coats Paint, Brush/Roller Work.....	97.73	
			<i>For Half Louvered Door, Add</i>	9.19	
			<i>For Full Louvered Door, Add</i>	15.32	
			<i>For >5 To 10, Deduct</i>	-4.89	
			<i>For >10 To 25, Deduct</i>	-9.77	
			<i>For >25, Deduct</i>	-14.66	
09 91	13 00-0253	EA	Paint Exterior Wood Door, One Face, 1 Coat Primer, Sprayed.....	24.62	
			<i>For Half Louvered Door, Add</i>	2.02	
			<i>For Full Louvered Door, Add</i>	3.37	
			<i>For >5 To 10, Deduct</i>	-1.23	
			<i>For >10 To 25, Deduct</i>	-2.46	
			<i>For >25, Deduct</i>	-3.69	
09 91	13 00-0254	EA	Paint Exterior Wood Door, One Face, 1 Coat Paint, Sprayed.....	24.62	
			<i>For Half Louvered Door, Add</i>	2.02	
			<i>For Full Louvered Door, Add</i>	3.37	
			<i>For >5 To 10, Deduct</i>	-1.23	
			<i>For >10 To 25, Deduct</i>	-2.46	
			<i>For >25, Deduct</i>	-3.69	
09 91	13 00-0255	EA	Paint Exterior Wood Door, One Face, 2 Coats Paint, Sprayed.....	44.92	
			<i>For Half Louvered Door, Add</i>	3.41	
			<i>For Full Louvered Door, Add</i>	5.69	
			<i>For >5 To 10, Deduct</i>	-2.25	
			<i>For >10 To 25, Deduct</i>	-4.49	
			<i>For >25, Deduct</i>	-6.74	

09 Finishes**09 90 Painting And Coating****09 91 Painting**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 13 00-0256	EA		Paint Exterior Wood Door, Both Faces, 1 Coat Primer, Sprayed.....	44.19	
			<i>For Half Louvered Door, Add</i>	3.62	
			<i>For Full Louvered Door, Add</i>	6.03	
			<i>For >5 To 10, Deduct</i>	-2.21	
			<i>For >10 To 25, Deduct</i>	-4.42	
			<i>For >25, Deduct</i>	-6.63	
09 91 13 00-0257	EA		Paint Exterior Wood Door, Both Faces, 1 Coat Paint, Sprayed.....	44.19	
			<i>For Half Louvered Door, Add</i>	3.62	
			<i>For Full Louvered Door, Add</i>	6.03	
			<i>For >5 To 10, Deduct</i>	-2.21	
			<i>For >10 To 25, Deduct</i>	-4.42	
			<i>For >25, Deduct</i>	-6.63	
09 91 13 00-0258	EA		Paint Exterior Wood Door, Both Faces, 2 Coats Paint, Sprayed.....	80.94	
			<i>For Half Louvered Door, Add</i>	6.12	
			<i>For Full Louvered Door, Add</i>	10.21	
			<i>For >5 To 10, Deduct</i>	-4.05	
			<i>For >10 To 25, Deduct</i>	-8.09	
			<i>For >25, Deduct</i>	-12.14	
09 91 13 00-0259	SF		Paint Exterior Wood Overhead, Sectional Door, Or Roll Up Door, 1 Coat Primer, Brush/Roller Work.....	1.56	
09 91 13 00-0260	SF		Paint Exterior Wood Overhead, Sectional Door, Or Roll Up Door, 1 Coat Paint, Brush/Roller Work.....	1.62	
09 91 13 00-0261	SF		Paint Exterior Wood Overhead, Sectional Door, Or Roll Up Door, 2 Coats Paint, Brush/Roller Work.....	3.34	
09 91 13 00-0262	SF		Paint Exterior Wood Overhead, Sectional Door, Or Roll Up Door, 1 Coat Primer, Sprayed.....	1.97	
09 91 13 00-0263	SF		Paint Exterior Wood Overhead, Sectional Door, Or Roll Up Door, 1 Coat Paint, Sprayed.....	2.04	
09 91 13 00-0264	SF		Paint Exterior Wood Overhead, Sectional Door, Or Roll Up Door, 2 Coats Paint, Sprayed.....	3.97	
09 91 13 00-0265			Paint Exterior Metal Windows (09 91 13 00-0219)		
			Note: Two finish coats paint over rust inhibitive primer.		
09 91 13 00-0266	EA		Paint Exterior Metal Window Including Trim, Window Size Up To 8 SF.....	52.01	
			<i>For Electrostatic Painting, Add</i>	6.21	
			<i>For >5 To 10, Deduct</i>	-2.60	
			<i>For >10 To 25, Deduct</i>	-5.20	
			<i>For >25, Deduct</i>	-7.80	
09 91 13 00-0267	EA		Paint Exterior Metal Window Including Trim, Window Size >8 SF To 14 SF.....	62.64	
			<i>For Electrostatic Painting, Add</i>	7.83	
			<i>For >5 To 10, Deduct</i>	-3.13	
			<i>For >10 To 25, Deduct</i>	-6.26	
			<i>For >25, Deduct</i>	-9.40	
09 91 13 00-0268	EA		Paint Exterior Metal Window Including Trim, Window Size >14 SF To 20 SF.....	84.42	
			<i>For Electrostatic Painting, Add</i>	10.66	
			<i>For >5 To 10, Deduct</i>	-4.22	
			<i>For >10 To 25, Deduct</i>	-8.44	
			<i>For >25, Deduct</i>	-12.66	
09 91 13 00-0269	EA		Paint Exterior Metal Window Including Trim, Window Size >20 SF To 26 SF.....	95.06	
			<i>For Electrostatic Painting, Add</i>	12.01	
			<i>For >5 To 10, Deduct</i>	-4.75	
			<i>For >10 To 25, Deduct</i>	-9.51	
			<i>For >25, Deduct</i>	-14.26	
09 91 13 00-0270	EA		Paint Exterior Metal Window Including Trim, Window Size >26 SF To 34 SF.....	105.43	
			<i>For Electrostatic Painting, Add</i>	13.30	
			<i>For >5 To 10, Deduct</i>	-5.27	
			<i>For >10 To 25, Deduct</i>	-10.54	
			<i>For >25, Deduct</i>	-15.81	
09 91 13 00-0271	SF		Paint Exterior Metal Window Including Trim, Window Size >34 SF.....	3.34	
			<i>For Electrostatic Painting, Add</i>	0.42	
09 91 13 00-0272			Paint Exterior Wood Windows (09 91 13 00-0219)		
			Note: Two finish coats paint over primer.		
09 91 13 00-0273	EA		Paint Exterior Wood Window Including Trim, Window Size Up To 8 SF.....	52.01	
			<i>For >5 To 10, Deduct</i>	-2.60	
			<i>For >10 To 25, Deduct</i>	-5.20	
			<i>For >25, Deduct</i>	-7.80	
09 91 13 00-0274	EA		Paint Exterior Wood Window Including Trim, Window Size >8 SF To 14 SF.....	62.64	
			<i>For >5 To 10, Deduct</i>	-3.13	
			<i>For >10 To 25, Deduct</i>	-6.26	
			<i>For >25, Deduct</i>	-9.40	
09 91 13 00-0275	EA		Paint Exterior Wood Window Including Trim, Window Size >14 SF To 20 SF.....	84.42	
			<i>For >5 To 10, Deduct</i>	-4.22	
			<i>For >10 To 25, Deduct</i>	-8.44	
			<i>For >25, Deduct</i>	-12.66	
09 91 13 00-0276	EA		Paint Exterior Wood Window Including Trim, Window Size >20 SF To 26 SF.....	95.06	
			<i>For >5 To 10, Deduct</i>	-4.75	
			<i>For >10 To 25, Deduct</i>	-9.51	
			<i>For >25, Deduct</i>	-14.26	
09 91 13 00-0277	EA		Paint Exterior Wood Window Including Trim, Window Size >26 SF To 34 SF.....	105.43	
			<i>For >5 To 10, Deduct</i>	-5.27	
			<i>For >10 To 25, Deduct</i>	-10.54	
			<i>For >25, Deduct</i>	-15.81	
09 91 13 00-0278	SF		Paint Exterior Wood Window Including Trim, Window Size >34 SF.....	3.53	
09 91 13 00-0279			Paint Exterior Security Screens (09 91 13 00-0219)		
09 91 13 00-0280	SF		Paint Exterior Security Screen, 1 Coat Primer, Brush/Roller Work.....	1.02	
			<i>For Electrostatic Painting, Add</i>	0.12	



Finishes	09	
Painting And Coating	09 90	9
Painting	09 91	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 13 00-0281 SF Paint Exterior Security Screen, 1 Coat Paint, Brush/Roller Work <i>For Electrostatic Painting, Add</i>	1.08 0.12	
09 91 13 00-0282 SF Paint Exterior Security Screen, 2 Coats Paint, Brush/Roller Work <i>For Electrostatic Painting, Add</i>	1.77 0.21	
09 91 13 00-0283 Paint Exterior Window Guards <small>(09 91 13 00-0219)</small>		
09 91 13 00-0284 SF Paint Exterior Metal Window Guards, 1 Coat Primer, Brush/Roller Work	1.02	
09 91 13 00-0285 SF Paint Exterior Metal Window Guards, 1 Coat Paint, Brush/Roller Work	1.08	
09 91 13 00-0286 SF Paint Exterior Metal Window Guards, 2 Coats Paint, Brush/Roller Work	1.77	
09 91 13 00-0287 Paint Exterior Window Trim <small>(09 91 13 00-0219)</small>		
09 91 13 00-0288 LF Paint Exterior Wood Window Frame And Trim, 1 Coat Primer, Brush/Roller Work	0.95	
09 91 13 00-0289 LF Paint Exterior Wood Window Frame And Trim, 1 Coat Paint, Brush/Roller Work	0.95	
09 91 13 00-0290 LF Paint Exterior Wood Window Frame And Trim, 2 Coats Paint, Brush/Roller Work	1.15	
09 91 13 00-0291 LF Paint Exterior Metal Window Frame And Trim, 1 Coat Primer, Brush/Roller Work	1.02	
09 91 13 00-0292 LF Paint Exterior Metal Window Frame And Trim, 1 Coat Paint, Brush/Roller Work	1.02	
09 91 13 00-0293 LF Paint Exterior Metal Window Frame And Trim, 2 Coats Paint, Brush/Roller Work	1.28	
09 91 13 00-0294 Paint Roofing And Trim <small>(09 91 13)</small>		
09 91 13 00-0295 Paint Stain Or Seal Wood Roofing <small>(09 91 13 00-0294)</small>		
09 91 13 00-0296 SF Stain And Seal Shingles/Shake, 1 Coat, Brush/Roller Work	1.32	
<i>For Up To 100, Add</i>	0.72	
<i>For >100 To 250, Add</i>	0.35	
<i>For >250 To 500, Add</i>	0.15	
09 91 13 00-0297 SF Stain And Seal Shingles/Shake, 2 Coats, Brush/Roller Work	2.44	
<i>For Up To 100, Add</i>	1.31	
<i>For >100 To 250, Add</i>	0.64	
<i>For >250 To 500, Add</i>	0.28	
09 91 13 00-0298 Paint Metal Roofing <small>(09 91 13 00-0294)</small>		
09 91 13 00-0299 SF Paint Metal Roofing, 1 Coat Paint, Brush/Roller Work	0.54	
<i>For Up To 100, Add</i>	0.29	
<i>For >100 To 250, Add</i>	0.14	
<i>For >250 To 500, Add</i>	0.06	
09 91 13 00-0300 SF Paint Metal Roofing, 2 Coats Paint, Brush/Roller Work	0.94	
<i>For Up To 100, Add</i>	0.51	
<i>For >100 To 250, Add</i>	0.25	
<i>For >250 To 500, Add</i>	0.11	
09 91 13 00-0301 Paint Fascia Board <small>(09 91 13 00-0294)</small>		
09 91 13 00-0302 LF Paint Fascia Board, 1 Coat Primer, Brush/Roller Work	0.54	
<i>For Up To 100, Add</i>	0.29	
<i>For >100 To 250, Add</i>	0.14	
<i>For >250 To 500, Add</i>	0.06	
09 91 13 00-0303 LF Paint Fascia Board, 1 Coat Paint, Brush/Roller Work	0.54	
<i>For Up To 100, Add</i>	0.29	
<i>For >100 To 250, Add</i>	0.14	
<i>For >250 To 500, Add</i>	0.06	
09 91 13 00-0304 LF Paint Fascia Board, 2 Coats Paint, Brush/Roller Work	0.94	
<i>For Up To 100, Add</i>	0.51	
<i>For >100 To 250, Add</i>	0.25	
<i>For >250 To 500, Add</i>	0.11	
09 91 13 00-0305 Paint Soffit <small>(09 91 13 00-0294)</small>		
09 91 13 00-0306 SF Paint Soffit, 1 Coat Primer, Brush/Roller Work	0.63	
<i>For Up To 100, Add</i>	0.30	
<i>For >100 To 250, Add</i>	0.15	
<i>For >250 To 500, Add</i>	0.07	
09 91 13 00-0307 SF Paint Soffit, 1 Coat Paint, Brush/Roller Work	0.63	
<i>For Up To 100, Add</i>	0.30	
<i>For >100 To 250, Add</i>	0.15	
<i>For >250 To 500, Add</i>	0.07	
09 91 13 00-0308 SF Paint Soffit, 2 Coats Paint, Brush/Roller Work	1.07	
<i>For Up To 100, Add</i>	0.53	
<i>For >100 To 250, Add</i>	0.26	
<i>For >250 To 500, Add</i>	0.12	
09 91 13 00-0309 Paint Site Work <small>(09 91 13)</small>		
<i>Note: Tasks can be used for exterior or interior applications.</i>		
09 91 13 00-0310 Paint Structural Steel <small>(09 91 13 00-0309)</small>		
09 91 13 00-0311 Paint Structural Steel, Brush Work <small>(09 91 13 00-0310)</small>		

09	Finishes
09 90	Painting And Coating
09 91	Painting



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91	13 00-0312	SF	Paint Structural Steel, 1 Field Coat Primer, Brush/Roller Work	0.71	
			For Up To 100, Add	0.47	
			For >100 To 250, Add	0.22	
			For >250 To 500, Add	0.10	
			For Epoxy Paint, Add	0.07	
09 91	13 00-0313	SF	Paint Structural Steel, 1 Field Coat Paint, Brush/Roller Work.....	0.63	
			For Up To 100, Add	0.41	
			For >100 To 250, Add	0.20	
			For >250 To 500, Add	0.08	
			For Epoxy Paint, Add	0.06	
09 91	13 00-0314		Paint Structural Steel, Spray Work (09 91 13 00-0310)		
09 91	13 00-0315	SF	Paint Structural Steel, 1 Field Coat Primer, Spray Work.....	0.51	
			For Electrostatic Painting, Add	0.07	
			For Up To 100, Add	0.32	
			For >100 To 250, Add	0.15	
			For >250 To 500, Add	0.07	
			For Epoxy Paint, Add	0.06	
09 91	13 00-0316	SF	Paint Structural Steel, 1 Field Coat Paint, Spray Work.....	0.42	
			For Electrostatic Painting, Add	0.06	
			For Up To 100, Add	0.26	
			For >100 To 250, Add	0.12	
			For >250 To 500, Add	0.05	
			For Epoxy Paint, Add	0.05	
09 91	13 00-0317		Paint Metal Decking, Beams And Bar Joist (09 91 13 00-0310)		
09 91	13 00-0318	SF	Paint Exposed Metal Decking, 1 Coat Primer, Sprayed.....	0.57	
			For Up To 100, Add	0.37	
			For >100 To 250, Add	0.17	
			For >250 To 500, Add	0.08	
			For Epoxy Paint, Add	0.06	
09 91	13 00-0319	SF	Paint Exposed Metal Decking, 1 Coat Paint, Sprayed	0.57	
			For Up To 100, Add	0.37	
			For >100 To 250, Add	0.17	
			For >250 To 500, Add	0.08	
			For Epoxy Paint, Add	0.06	
09 91	13 00-0320	SF	Paint Exposed Metal Decking, 2 Coats Paint, Sprayed	0.96	
			For Up To 100, Add	0.60	
			For >100 To 250, Add	0.29	
			For >250 To 500, Add	0.12	
			For Epoxy Paint, Add	0.11	
09 91	13 00-0321	SF	Paint Metal Beams And Bar Joists, 1 Coat Primer, Brush/Roller Work.....	0.72	
			For Up To 100, Add	0.43	
			For >100 To 250, Add	0.20	
			For >250 To 500, Add	0.09	
			For Epoxy Paint, Add	0.09	
09 91	13 00-0322	SF	Paint Metal Beams And Bar Joists, 1 Coat Paint, Brush/Roller Work.....	0.71	
			For Up To 100, Add	0.43	
			For >100 To 250, Add	0.21	
			For >250 To 500, Add	0.09	
			For Epoxy Paint, Add	0.09	
09 91	13 00-0323	SF	Paint Metal Beams And Bar Joists, 2 Coats Paint, Brush/Roller Work	1.33	
			For Up To 100, Add	0.80	
			For >100 To 250, Add	0.38	
			For >250 To 500, Add	0.17	
			For Epoxy Paint, Add	0.17	
09 91	13 00-0324	SF	Paint Metal Beams And Bar Joists, 1 Coat Primer, Sprayed	0.69	
			For Up To 100, Add	0.43	
			For >100 To 250, Add	0.21	
			For >250 To 500, Add	0.09	
			For Epoxy Paint, Add	0.08	
09 91	13 00-0325	SF	Paint Metal Beams And Bar Joists, 1 Coat Paint, Sprayed.....	0.69	
			For Up To 100, Add	0.43	
			For >100 To 250, Add	0.21	
			For >250 To 500, Add	0.09	
			For Epoxy Paint, Add	0.08	
09 91	13 00-0326	SF	Paint Metal Beams And Bar Joists, 2 Coats Paint, Sprayed.....	1.16	
			For Up To 100, Add	0.70	
			For >100 To 250, Add	0.33	
			For >250 To 500, Add	0.15	
			For Epoxy Paint, Add	0.15	
09 91	13 00-0327		Paint Steel Pipes (09 91 13 00-0309)		
			Note: Includes pipe, tubes, rails, conduit, etc.		
09 91	13 00-0328	LF	Paint Conduit, Steel Pipe 1/2" To 1-1/2" Diameter, 1 Coat Primer.....	1.02	
			For Electrostatic Painting, Add	0.12	
			For Epoxy Paint, Add	0.10	
09 91	13 00-0329	LF	Paint Conduit, Steel Pipe 2" To 3-1/2" Diameter, 1 Coat Primer.....	1.14	
			For Electrostatic Painting, Add	0.14	
			For Epoxy Paint, Add	0.11	



Finishes	09	9
Painting And Coating	09 90	
Painting	09 91	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 13 00-0330 LF Paint Steel Pipes 4" Diameter, 1 Coat Primer.....	1.29	
For Electrostatic Painting, Add	0.16	
For Epoxy Paint, Add	0.12	
09 91 13 00-0331 LF Paint Steel Pipes 6" To 8" Diameter, 1 Coat Primer	1.61	
For Electrostatic Painting, Add	0.20	
For Epoxy Paint, Add	0.15	
09 91 13 00-0332 LF Paint Steel Pipes 10" To 12" Diameter 1 Coat Primer	2.03	
For Electrostatic Painting, Add	0.25	
For Epoxy Paint, Add	0.19	
09 91 13 00-0333 LF Paint Conduit, Steel Pipe 1/2" To 1-1/2" Diameter, 1 Coat Paint	1.02	
For Electrostatic Painting, Add	0.12	
For Epoxy Paint, Add	0.10	
09 91 13 00-0334 LF Paint Conduit, Steel Pipe 2" To 3-1/2" Diameter, 1 Coat Paint	1.14	
For Electrostatic Painting, Add	0.14	
For Epoxy Paint, Add	0.11	
09 91 13 00-0335 LF Paint Steel Pipes 4" Diameter, 1 Coat Paint	1.29	
For Electrostatic Painting, Add	0.16	
For Epoxy Paint, Add	0.12	
09 91 13 00-0336 LF Paint Steel Pipes 6" To 8" Diameter, 1 Coat Paint.....	1.61	
For Electrostatic Painting, Add	0.20	
For Epoxy Paint, Add	0.15	
09 91 13 00-0337 LF Paint Steel Pipes 10" To 12" Diameter 1 Coat Paint.....	2.03	
For Electrostatic Painting, Add	0.25	
For Epoxy Paint, Add	0.19	
09 91 13 00-0338 LF Paint Conduit, Steel Pipe 1/2" To 1-1/2" Diameter, 2 Coats	2.05	
For Electrostatic Painting, Add	0.26	
For Epoxy Paint, Add	0.22	
09 91 13 00-0339 LF Paint Conduit, Steel Pipe 2" To 3-1/2" Diameter, 2 Coats	2.27	
For Electrostatic Painting, Add	0.28	
For Epoxy Paint, Add	0.22	
09 91 13 00-0340 LF Paint Steel Pipes 4" Diameter, 2 Coats	2.46	
For Electrostatic Painting, Add	0.30	
For Epoxy Paint, Add	0.24	
09 91 13 00-0341 LF Paint Steel Pipes 6" To 8" Diameter, 2 Coats	3.11	
For Electrostatic Painting, Add	0.38	
For Epoxy Paint, Add	0.30	
09 91 13 00-0342 LF Paint Steel Pipes 10" To 12" Diameter, 2 Coats	3.82	
For Electrostatic Painting, Add	0.47	
For Epoxy Paint, Add	0.37	
09 91 13 00-0343 Paint Fencing <small>(09 91 13 00-0309)</small>		
Note: Per side of fence. Based on gross fence area (length of fence x height of fence).		
09 91 13 00-0344 SF Paint Existing Chain Link Fence, 1 Coat Paint, Brush/Roller.....	0.52	
For Epoxy Paint, Add	0.05	
For Up To 100, Add	0.34	
For >100 To 250, Add	0.16	
For >250 To 500, Add	0.07	
09 91 13 00-0345 SF Paint Existing Chain Link Fence, 2 Coats Paint, Brush/Roller	0.94	
For Epoxy Paint, Add	0.10	
For Up To 100, Add	0.60	
For >100 To 250, Add	0.29	
For >250 To 500, Add	0.12	
09 91 13 00-0346 SF Paint Existing Chain Link Fence, 1 Coat Paint, Sprayed	0.50	
For Epoxy Paint, Add	0.06	
For Up To 100, Add	0.31	
For >100 To 250, Add	0.15	
For >250 To 500, Add	0.06	
09 91 13 00-0347 SF Paint Existing Chain Link Fence, 2 Coats Paint, Sprayed	0.93	
For Epoxy Paint, Add	0.11	
For Up To 100, Add	0.57	
For >100 To 250, Add	0.27	
For >250 To 500, Add	0.12	
09 91 13 00-0348 SF Paint Wrought Iron Fence, 1 Coat Primer, Brush/Roller	0.46	
For Up To 100, Add	0.28	
For >100 To 250, Add	0.13	
For >250 To 500, Add	0.06	
09 91 13 00-0349 SF Paint Wrought Iron Fence, 1 Coat, Brush/Roller.....	0.44	
For Up To 100, Add	0.28	
For >100 To 250, Add	0.13	
For >250 To 500, Add	0.06	
09 91 13 00-0350 SF Paint Wrought Iron Fence, Each Additional Coat, Brush/Roller.....	0.31	
For Up To 100, Add	0.18	
For >100 To 250, Add	0.09	
For >250 To 500, Add	0.04	
09 91 13 00-0351 SF Paint Picket Fence, 1 Coat Primer, Brush/Roller	0.65	
For Up To 100, Add	0.43	
For >100 To 250, Add	0.21	
For >250 To 500, Add	0.09	
09 91 13 00-0352 SF Paint Picket Fence, 1 Coat, Brush/Roller.....	0.62	
For Up To 100, Add	0.43	
For >100 To 250, Add	0.20	
For >250 To 500, Add	0.09	

09	Finishes
09 90	Painting And Coating
09 91	Painting



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 13 00-0353	SF		Paint Picket Fence, Each Additional Coat, Brush/Roller	0.44	
			<i>For Up To 100, Add</i>	0.29	
			<i>For >100 To 250, Add</i>	0.14	
			<i>For >250 To 500, Add</i>	0.06	
09 91 13 00-0354	SF		Paint Wood Fences 1 Coat, Brush/Roller	0.46	
			<i>For Up To 100, Add</i>	0.28	
			<i>For >100 To 250, Add</i>	0.13	
			<i>For >250 To 500, Add</i>	0.06	
09 91 13 00-0355	SF		Paint Wood Fences 2 Coats, Brush/Roller.....	0.82	
			<i>For Up To 100, Add</i>	0.49	
			<i>For >100 To 250, Add</i>	0.23	
			<i>For >250 To 500, Add</i>	0.10	
09 91 13 00-0356	SF		Paint Wood Fences 1 Coat, Sprayed.....	0.41	
			<i>For Up To 100, Add</i>	0.24	
			<i>For >100 To 250, Add</i>	0.12	
			<i>For >250 To 500, Add</i>	0.05	
09 91 13 00-0357	SF		Paint Wood Fences 2 Coats, Sprayed.....	0.75	
			<i>For Up To 100, Add</i>	0.44	
			<i>For >100 To 250, Add</i>	0.21	
			<i>For >250 To 500, Add</i>	0.09	
09 91 13 00-0358			Paint Metal Louvers (09 91 13 00-0309)		
09 91 13 00-0359	SF		Paint Ventilation Louver, SF Of Opening Area, 1 Coat Primer, Brush/Roller Work.....	1.08	
			<i>For Electrostatic Painting, Add</i>	0.13	
09 91 13 00-0360	SF		Paint Ventilation Louver, SF Of Opening Area, 1 Coat Alkyd, Brush/Roller Work	1.03	
			<i>For Electrostatic Painting, Add</i>	0.12	
09 91 13 00-0361	SF		Paint Ventilation Louver, SF Of Opening Area, 2 Coats Alkyd, Brush/Roller Work.....	2.09	
			<i>For Electrostatic Painting, Add</i>	0.24	
09 91 13 00-0362			Paint Ladders (09 91 13 00-0309)		
09 91 13 00-0363	LF		Paint Ladders, 1 Coat Alkyd Primer	2.86	
			<i>For Epoxy Paint, Add</i>	0.16	
09 91 13 00-0364	LF		Paint Ladders, 1 Coat Alkyd Enamel	3.19	
			<i>For Epoxy Paint, Add</i>	0.18	
09 91 13 00-0365	LF		Paint Ladders, 2 Coats Alkyd Enamel.....	6.33	
			<i>For Epoxy Paint, Add</i>	0.35	
09 91 13 00-0366			Paint Handrails (09 91 13 00-0309)		
09 91 13 00-0367	LF		Paint Hand Rail And Bracket, 1 Rail, 1 Coat Alkyd Enamel	1.24	
			<i>For Epoxy Paint, Add</i>	0.08	
09 91 13 00-0368	LF		Paint Hand Rail And Bracket, 1 Rail, 2 Coats Alkyd Enamel	2.06	
			<i>For Epoxy Paint, Add</i>	0.12	
09 91 13 00-0369	LF		Paint Pipe Rail And Pickets, 1 Rail, 1 Coat Alkyd Enamel	1.89	
			<i>For Epoxy Paint, Add</i>	0.12	
09 91 13 00-0370	LF		Paint Pipe Rail And Pickets, 1 Rail, 2 Coats Alkyd Enamel	3.32	
			<i>For Epoxy Paint, Add</i>	0.21	
09 91 13 00-0371	LF		Paint Pipe Rail And Pickets, 2 Rails, 1 Coat Alkyd Enamel	2.06	
			<i>For Epoxy Paint, Add</i>	0.13	
09 91 13 00-0372	LF		Paint Pipe Rail And Pickets, 2 Rails, 2 Coats Alkyd Enamel	3.56	
			<i>For Epoxy Paint, Add</i>	0.22	
09 91 13 00-0373	LF		Paint Balustrades, 1 Coat Alkyd Enamel	1.31	
			<i>For Epoxy Paint, Add</i>	0.12	
09 91 13 00-0374	LF		Paint Balustrades, 2 Coats Alkyd Enamel.....	2.36	
			<i>For Epoxy Paint, Add</i>	0.22	
09 91 13 00-0375			Paint Grating (09 91 13 00-0309)		
09 91 13 00-0376	SF		Paint Gratings And Frames, 1 Coat Primer, Brush/Roller Work.....	2.14	
			<i>For Epoxy Paint, Add</i>	0.15	
09 91 13 00-0377	SF		Paint Gratings And Frames, 1 Coat Paint, Brush/Roller Work.....	2.09	
			<i>For Epoxy Paint, Add</i>	0.13	
09 91 13 00-0378	SF		Paint Gratings And Frames, 2 Coats Paint, Brush/Roller Work	3.13	
			<i>For Epoxy Paint, Add</i>	0.22	
09 91 13 00-0379			Equipment And Tanks (09 91 13 00-0309)		
09 91 13 00-0380			Valves, Primer And Finish Coats (09 91 13 00-0379)		
09 91 13 00-0381	EA		Prime And Paint 4" And Smaller Valve	20.41	
09 91 13 00-0382	EA		Prime And Paint 6" To 10" Valve	24.88	
09 91 13 00-0383	EA		Prime And Paint 12" To 18" Valve	32.86	
09 91 13 00-0384	EA		Prime And Paint 20" To 24" Valve	44.34	
09 91 13 00-0385	EA		Prime And Paint >24" To 36" Valve	60.29	
09 91 13 00-0386	EA		Prime And Paint >36" To 48" Valve	81.66	
09 91 13 00-0387			Pumps And Motors. Primer And Finish Coats (09 91 13 00-0379)		
09 91 13 00-0388	EA		Prime And Paint Pump Under 1 HP.....	62.19	
09 91 13 00-0389	EA		Prime And Paint Pump, 1 HP To 5 HP.....	81.01	
09 91 13 00-0390	EA		Prime And Paint Pump, >5 HP To 10 HP.....	96.31	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 13 00-0391 EA Prime And Paint Pump, >10 HP To 20 HP	107.14	
09 91 13 00-0392 EA Prime And Paint Pump, >20 HP To 30 HP	124.99	
09 91 13 00-0393 EA Prime And Paint Pump, >30 HP To 50 HP	142.86	
09 91 13 00-0394 EA Prime And Paint Pump, >50 HP To 75 HP	157.21	
09 91 13 00-0395 EA Prime And Paint Pump, >75 HP	178.57	
09 91 13 00-0396 Storage Tanks (09 91 13 00-0379)		
09 91 13 00-0397 SF Paint Storage Tank, Exterior Surface, 1 Coat Primer, Roller	0.75	
09 91 13 00-0398 SF Paint Storage Tank, Exterior Surface, 1 Coat Primer, Roller	0.97	
09 91 13 00-0399 SF Paint Storage Tank, Exterior Surface, 2 Coats Paint, Roller	1.83	
09 91 13 00-0400 SF Paint Storage Tank, Interior Surface, 1 Coat Primer, Roller	1.04	
09 91 13 00-0401 SF Paint Storage Tank, Interior Surface, 1 Coat Paint, Roller	1.31	
09 91 13 00-0402 SF Paint Storage Tank, Interior Surface, 2 Coats Paint, Roller	2.48	
09 91 13 00-0403 SF Paint Storage Tank, Exterior Surface, 1 Coat Primer, Spray	0.76	
09 91 13 00-0404 SF Paint Storage Tank, Exterior Surface, 1 Coat Paint, Spray	0.83	
09 91 13 00-0405 SF Paint Storage Tank, Exterior Surface, 2 Coats Paint, Spray	1.58	
09 91 13 00-0406 SF Paint Storage Tank, Interior Surface, 1 Coat Primer, Spray	0.81	
09 91 13 00-0407 SF Paint Storage Tank, Interior Surface, 1 Coat Paint, Spray	1.04	
09 91 13 00-0408 SF Paint Storage Tank, Interior Surface, 2 Coats Paint, Spray	2.01	
09 91 13 00-0409 Other Site Work Painting (09 91 13 00-0309)		
09 91 13 00-0410 Paint Shutters Or Blinds, Solid Panel (09 91 13 00-0409)		
09 91 13 00-0411 SF Paint Shutter Or Blinds, Solid Panel, 1 Coat Primer, Brush Work	2.28	
09 91 13 00-0412 SF Paint Shutter Or Blinds, Solid Panel, 1 Coat, Brush Work	2.27	
09 91 13 00-0413 SF Paint Shutter Or Blinds, Solid Panel, 2 Coats, Brush Work	4.03	
09 91 13 00-0414 SF Paint Shutter Or Blinds, Solid Panel, 1 Coat Primer, Sprayed	1.38	
09 91 13 00-0415 SF Paint Shutter Or Blinds, Solid Panel, 1 Coat, Sprayed	1.37	
09 91 13 00-0416 SF Paint Shutter Or Blinds, Solid Panel, 2 Coats, Sprayed	2.51	
09 91 13 00-0417 Paint Shutters Or Blinds, Louvered Panel (09 91 13 00-0409)		
09 91 13 00-0418 SF Paint Shutter Or Blinds, Louvered Panel, 1 Coat Primer, Brush Work	2.82	
09 91 13 00-0419 SF Paint Shutter Or Blinds, Louvered Panel, 1 Coat, Brush Work	2.81	
09 91 13 00-0420 SF Paint Shutter Or Blinds, Louvered Panel, 2 Coats, Brush Work	4.99	
09 91 13 00-0421 SF Paint Shutter Or Blinds, Louvered Panel, 1 Coat Primer, Sprayed	1.67	
09 91 13 00-0422 SF Paint Shutter Or Blinds, Louvered Panel, 1 Coat, Sprayed	1.66	
09 91 13 00-0423 SF Paint Shutter Or Blinds, Louvered Panel, 2 Coats, Sprayed	3.06	
09 91 13 00-0424 Paint Flagpoles (09 91 13 00-0409)		
09 91 13 00-0425 EA Paint Steel Flagpole, 20' High, 1 Coat Paint	156.38	
09 91 13 00-0426 EA Paint Steel Flagpole, 30' High, 1 Coat Paint	209.99	
09 91 13 00-0427 EA Paint Steel Flagpole, 40' High, 1 Coat Paint	263.61	
09 91 13 00-0428 EA Paint Steel Flagpole, 50' High, 1 Coat Paint	317.26	
09 91 13 00-0429 EA Paint Steel Flagpole, 70' High, 1 Coat Paint	414.31	
09 91 13 00-0430 EA Paint Steel Flagpole, 80' High, 1 Coat Paint	466.68	
09 91 13 00-0431 EA Paint Steel Flagpole, 90' High, 1 Coat Paint	519.04	
09 91 13 00-0432 Paint Lattice Or Trellis (09 91 13 00-0409)		
09 91 13 00-0433 SF Paint Wood Lattice Or Trellis 1 Coat, Spray Per Side	1.07	
09 91 13 00-0434 SF Paint Wood Lattice Or Trellis 2 Coats, Spray Per Side	1.97	
For Up To 100, Add	1.35	
For >100 To 250, Add	0.64	
For >250 To 500, Add	0.27	
09 91 13 00-0435 Paint Exterior Stairs (09 91 13)		
09 91 13 00-0436 Paint Exterior Concrete Stairs (09 91 13 00-0435)		
09 91 13 00-0437 RSR Paint Exterior Concrete Stair (To 4' Wide), 1 Coat Primer, Brush/Roller Work	12.49	
09 91 13 00-0438 RSR Paint Exterior Concrete Stair (To 4' Wide), 1 Coat Alkyd Enamel, Brush/Roller Work	12.49	
09 91 13 00-0439 RSR Paint Exterior Concrete Stair (To 4' Wide), 1 Coat Non Slip Paint, Brush/Roller Work	15.48	
09 91 13 00-0440 RSR Paint Exterior Concrete Stair (To 4' Wide), 1 Coat Non Slip Epoxy Coating, Brush/Roller Work	24.17	
09 91 13 00-0441 RSR Paint Exterior Concrete Stair (To 4' Wide), 2 Coats Alkyd Enamel, Brush/Roller Work	24.98	
09 91 13 00-0442 Paint Exterior Metal Stairs (09 91 13 00-0435)		
09 91 13 00-0443 RSR Paint Exterior Metal Stair (To 4' Wide), 1 Coat Primer, Brush/Roller Work	6.42	
For Oil Based Paint, Add	0.34	
09 91 13 00-0444 RSR Paint Exterior Metal Stair (To 4' Wide), 1 Coat Alkyd Enamel, Brush/Roller Work	6.42	
For Oil Based Paint, Add	0.34	
09 91 13 00-0445 RSR Paint Exterior Metal Stair (To 4' Wide), 2 Coats Alkyd Enamel, Brush/Roller Work	12.86	
For Oil Based Paint, Add	0.68	
09 91 13 00-0446 Paint Exterior Wood Stairs (09 91 13 00-0435)		

09 Finishes

09 90 Painting And Coating

09 91 Painting



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91	13 00-0447	RSR	Paint Exterior Wood Stair (To 4' Wide), 1 Coat Primer, Brush/Roller Work	6.42	
09 91	13 00-0448	RSR	Paint Exterior Wood Stair (To 4' Wide), 1 Coat Alkyd Enamel, Brush/Roller Work	6.42	
09 91	13 00-0449	RSR	Paint Exterior Wood Stair (To 4' Wide), 1 Coat Non Slip Paint, Brush/Roller Work	9.41	
09 91	13 00-0450	RSR	Paint Exterior Wood Stair (To 4' Wide), 1 Coat Non Slip Epoxy Coating, Brush/Roller Work	18.10	
09 91	13 00-0451	RSR	Paint Exterior Wood Stair (To 4' Wide), 2 Coats Alkyd Enamel, Brush/Roller Work	12.85	
09 91	13 00-0452		Paint Exterior Stair Nosing (09 91 13 00-0435)		
09 91	13 00-0453	LF	Paint Exterior Yellow Stair Safety Strip, Up To 2", Non Slip, Brush Work	1.01	
09 91	13 00-0454		Paint Exterior Trim (09 91 13)		
09 91	13 00-0455		Paint Exterior Metal Trim And Gutters (09 91 13 00-0454)		
09 91	13 00-0456	SF	Paint Exterior Exposed Metal Trim, 1 Coat Primer, Brush Work	0.88	
09 91	13 00-0457	SF	Paint Exterior Exposed Metal Trim, 1 Coat Paint, Brush Work	0.88	
09 91	13 00-0458	SF	Paint Exterior Exposed Metal Trim, 2 Coats Paint, Brush Work	1.59	
09 91	13 00-0459	SF	Paint Exterior Metal Trim, 1 Coat Primer, Brush/Roller Work	0.71	
09 91	13 00-0460	SF	Paint Exterior Metal Trim, 1 Coat Paint, Brush/Roller Work	0.80	
09 91	13 00-0461	SF	Paint Exterior Metal Trim, 2 Coats Paint, Brush/Roller Work	1.42	
09 91	13 00-0462	LF	Paint Exterior Gutter And Downspout, 1 Coat Paint, Brush Work	1.29	
09 91	13 00-0463	LF	Paint Exterior Gutter And Downspout, 2 Coats Paint, Brush Work	1.71	
09 91	13 00-0464		Paint Exterior Wood Trim (09 91 13 00-0454)		
09 91	13 00-0465	SF	Paint Exterior Wood Trim, 1 Coat Primer, Brush Work	1.01	
			<i>For Oil Based Paint, Add</i>	0.06	
09 91	13 00-0466	SF	Paint Exterior Wood Trim, 1 Coat Paint, Brush Work	1.10	
			<i>For Oil Based Paint, Add</i>	0.07	
09 91	13 00-0467	SF	Paint Exterior Wood Trim, 2 Coats Paint, Brush Work	2.01	
			<i>For Oil Based Paint, Add</i>	0.12	
09 91	13 00-0468	SF	Paint Exterior Wood Trim, 1 Coat Primer, Brush/Roller Work	0.81	
			<i>For Oil Based Paint, Add</i>	0.05	
09 91	13 00-0469	SF	Paint Exterior Wood Trim, 1 Coat Paint, Brush/Roller Work	0.90	
			<i>For Oil Based Paint, Add</i>	0.06	
09 91	13 00-0470	SF	Paint Exterior Wood Trim, 2 Coats Paint, Brush/Roller Work	1.68	
			<i>For Oil Based Paint, Add</i>	0.11	
09 91	13 00-0471		Paint Exterior Miscellaneous Metal Surfaces (09 91 13)		
09 91	13 00-0472	SF	Paint Exterior Miscellaneous Metal Surfaces, 1 Coat Alkyd Primer, Brush/Roller Work	0.94	
			<i>For Epoxy Paint, Add</i>	0.09	
			<i>For Electrostatic Painting, Add</i>	0.12	
09 91	13 00-0473	SF	Paint Exterior Miscellaneous Metal Surfaces, 1 Coat Alkyd Enamel, Brush/Roller Work	0.89	
			<i>For Epoxy Paint, Add</i>	0.07	
			<i>For Electrostatic Painting, Add</i>	0.10	
09 91	13 00-0474	SF	Paint Exterior Miscellaneous Metal Surfaces, 2 Coats Alkyd Enamel, Brush/Roller Work	1.81	
			<i>For Epoxy Paint, Add</i>	0.15	
			<i>For Electrostatic Painting, Add</i>	0.21	
09 91 23	Interior Painting (09 91)				
			Note: Acrylic latex paint unless otherwise stated. VOC compliant in all regulated areas, review specifications for levels.		
09 91	23 00-0001		Paint Interior Walls (09 91 23)		
09 91	23 00-0002		Paint Interior Brick Walls (09 91 23 00-0001)		
09 91	23 00-0003	SF	Paint Interior Brick Walls, 1 Coat Filler, Brush Work	0.67	
			<i>For Oil Based Paint, Add</i>	0.04	
			<i>For Up To 100, Add</i>	0.42	
			<i>For >100 To 250, Add</i>	0.20	
			<i>For >250 To 500, Add</i>	0.09	
			<i>For >2,500 To 5,000, Deduct</i>	-0.03	
			<i>For >5,000 To 10,000, Deduct</i>	-0.07	
			<i>For >10,000 To 20,000, Deduct</i>	-0.10	
			<i>For >20,000, Deduct</i>	-0.13	
09 91	23 00-0004	SF	Paint Interior Brick Walls, 1 Coat Paint, Brush Work	0.78	
			<i>For Oil Based Paint, Add</i>	0.05	
			<i>For Up To 100, Add</i>	0.50	
			<i>For >100 To 250, Add</i>	0.24	
			<i>For >250 To 500, Add</i>	0.10	
			<i>For >2,500 To 5,000, Deduct</i>	-0.04	
			<i>For >5,000 To 10,000, Deduct</i>	-0.08	
			<i>For >10,000 To 20,000, Deduct</i>	-0.12	
			<i>For >20,000, Deduct</i>	-0.16	
09 91	23 00-0005	SF	Paint Interior Brick Walls, 2 Coats Paint, Brush Work	1.39	
			<i>For Oil Based Paint, Add</i>	0.08	
			<i>For Up To 100, Add</i>	0.86	
			<i>For >100 To 250, Add</i>	0.41	
			<i>For >250 To 500, Add</i>	0.18	
			<i>For >2,500 To 5,000, Deduct</i>	-0.07	
			<i>For >5,000 To 10,000, Deduct</i>	-0.14	
			<i>For >10,000 To 20,000, Deduct</i>	-0.21	
			<i>For >20,000, Deduct</i>	-0.28	



Finishes	09	09
Painting And Coating	09 90	
Painting	09 91	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 23 00-0006 SF Paint Interior Brick Walls, 1 Coat Filler, Brush/Roller Work.....	0.55	
For Oil Based Paint, Add	0.03	
For Up To 100, Add	0.33	
For >100 To 250, Add	0.16	
For >250 To 500, Add	0.07	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.06	
For >10,000 To 20,000, Deduct	-0.08	
For >20,000, Deduct	-0.11	
09 91 23 00-0007 SF Paint Interior Brick Walls, 1 Coat Paint, Brush/Roller Work.....	0.68	
For Oil Based Paint, Add	0.04	
For Up To 100, Add	0.40	
For >100 To 250, Add	0.19	
For >250 To 500, Add	0.08	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.07	
For >10,000 To 20,000, Deduct	-0.10	
For >20,000, Deduct	-0.14	
09 91 23 00-0008 SF Paint Interior Brick Walls, 2 Coats Paint, Brush/Roller Work.....	1.17	
For Oil Based Paint, Add	0.08	
For Up To 100, Add	0.67	
For >100 To 250, Add	0.32	
For >250 To 500, Add	0.14	
For >2,500 To 5,000, Deduct	-0.06	
For >5,000 To 10,000, Deduct	-0.12	
For >10,000 To 20,000, Deduct	-0.18	
For >20,000, Deduct	-0.23	
09 91 23 00-0009 SF Paint Interior Brick Walls, 1 Coat Filler, Sprayed.....	0.42	
For Oil Based Paint, Add	0.03	
For Up To 100, Add	0.23	
For >100 To 250, Add	0.11	
For >250 To 500, Add	0.05	
For >2,500 To 5,000, Deduct	-0.02	
For >5,000 To 10,000, Deduct	-0.04	
For >10,000 To 20,000, Deduct	-0.06	
For >20,000, Deduct	-0.08	
For Backroll, Add	0.05	
09 91 23 00-0010 SF Paint Interior Brick Walls, 1 Coat Paint, Sprayed.....	0.48	
For Oil Based Paint, Add	0.03	
For Up To 100, Add	0.23	
For >100 To 250, Add	0.12	
For >250 To 500, Add	0.05	
For >2,500 To 5,000, Deduct	-0.02	
For >5,000 To 10,000, Deduct	-0.05	
For >10,000 To 20,000, Deduct	-0.07	
For >20,000, Deduct	-0.10	
For Backroll, Add	0.05	
09 91 23 00-0011 SF Paint Interior Brick Walls, 2 Coats Paint, Sprayed.....	0.84	
For Oil Based Paint, Add	0.06	
For Up To 100, Add	0.41	
For >100 To 250, Add	0.20	
For >250 To 500, Add	0.09	
For >2,500 To 5,000, Deduct	-0.04	
For >5,000 To 10,000, Deduct	-0.08	
For >10,000 To 20,000, Deduct	-0.13	
For >20,000, Deduct	-0.17	
For Backroll, Add	0.09	
09 91 23 00-0012 SF Paint Interior Brick Walls, 1 Coat Bonding Agent, Brush Work.....	0.69	
For Up To 100, Add	0.43	
For >100 To 250, Add	0.20	
For >250 To 500, Add	0.09	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.07	
For >10,000 To 20,000, Deduct	-0.10	
For >20,000, Deduct	-0.14	
09 91 23 00-0013 SF Paint Interior Brick Walls, 1 Coat Bonding Agent, Brush/Roller Work.....	0.57	
For Up To 100, Add	0.34	
For >100 To 250, Add	0.16	
For >250 To 500, Add	0.07	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.06	
For >10,000 To 20,000, Deduct	-0.09	
For >20,000, Deduct	-0.11	
09 91 23 00-0014 SF Paint Interior Brick Walls, 1 Coat Bonding Agent, Spray.....	0.45	
For Up To 100, Add	0.23	
For >100 To 250, Add	0.11	
For >250 To 500, Add	0.05	
For >2,500 To 5,000, Deduct	-0.02	
For >5,000 To 10,000, Deduct	-0.05	
For >10,000 To 20,000, Deduct	-0.07	
For >20,000, Deduct	-0.09	
For Backroll, Add	0.05	

09 91 23 00-0015 Paint Interior Concrete Walls (09 91 23 00-0001)

09 Finishes**09 90 Painting And Coating****09 91 Painting**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91	23 00-0016	SF	Paint Interior Concrete Walls, 1 Coat Filler, Brush Work	0.58	
			For Oil Based Paint, Add	0.03	
			For Epoxy Paint, Add	0.06	
			For Up To 100, Add	0.37	
			For >100 To 250, Add	0.18	
			For >250 To 500, Add	0.08	
			For >2,500 To 5,000, Deduct	-0.03	
			For >5,000 To 10,000, Deduct	-0.06	
			For >10,000 To 20,000, Deduct	-0.09	
			For >20,000, Deduct	-0.12	
09 91	23 00-0017	SF	Paint Interior Concrete Walls, 1 Coat Paint, Brush Work	0.62	
			For Oil Based Paint, Add	0.04	
			For Epoxy Paint, Add	0.06	
			For Up To 100, Add	0.41	
			For >100 To 250, Add	0.19	
			For >250 To 500, Add	0.08	
			For >2,500 To 5,000, Deduct	-0.03	
			For >5,000 To 10,000, Deduct	-0.06	
			For >10,000 To 20,000, Deduct	-0.09	
			For >20,000, Deduct	-0.12	
09 91	23 00-0018	SF	Paint Interior Concrete Walls, 2 Coats Paint, Brush Work	1.12	
			For Oil Based Paint, Add	0.06	
			For Epoxy Paint, Add	0.09	
			For Up To 100, Add	0.77	
			For >100 To 250, Add	0.36	
			For >250 To 500, Add	0.16	
			For >2,500 To 5,000, Deduct	-0.06	
			For >5,000 To 10,000, Deduct	-0.11	
			For >10,000 To 20,000, Deduct	-0.17	
			For >20,000, Deduct	-0.22	
09 91	23 00-0019	SF	Paint Interior Concrete Walls, 1 Coat Filler, Brush/Roller Work	0.47	
			For Oil Based Paint, Add	0.03	
			For Epoxy Paint, Add	0.06	
			For Up To 100, Add	0.29	
			For >100 To 250, Add	0.14	
			For >250 To 500, Add	0.06	
			For >2,500 To 5,000, Deduct	-0.02	
			For >5,000 To 10,000, Deduct	-0.05	
			For >10,000 To 20,000, Deduct	-0.07	
			For >20,000, Deduct	-0.09	
09 91	23 00-0020	SF	Paint Interior Concrete Walls, 1 Coat Paint, Brush/Roller Work	0.53	
			For Oil Based Paint, Add	0.03	
			For Epoxy Paint, Add	0.05	
			For Up To 100, Add	0.34	
			For >100 To 250, Add	0.16	
			For >250 To 500, Add	0.07	
			For >2,500 To 5,000, Deduct	-0.03	
			For >5,000 To 10,000, Deduct	-0.05	
			For >10,000 To 20,000, Deduct	-0.08	
			For >20,000, Deduct	-0.11	
09 91	23 00-0021	SF	Paint Interior Concrete Walls, 2 Coats Paint, Brush/Roller Work	0.95	
			For Oil Based Paint, Add	0.06	
			For Epoxy Paint, Add	0.10	
			For Up To 100, Add	0.61	
			For >100 To 250, Add	0.29	
			For >250 To 500, Add	0.13	
			For >2,500 To 5,000, Deduct	-0.05	
			For >5,000 To 10,000, Deduct	-0.10	
			For >10,000 To 20,000, Deduct	-0.14	
			For >20,000, Deduct	-0.19	
09 91	23 00-0022	SF	Paint Interior Concrete Walls, 1 Coat Filler, Sprayed	0.34	
			For Oil Based Paint, Add	0.02	
			For Epoxy Paint, Add	0.06	
			For Up To 100, Add	0.18	
			For >100 To 250, Add	0.09	
			For >250 To 500, Add	0.04	
			For >2,500 To 5,000, Deduct	-0.02	
			For >5,000 To 10,000, Deduct	-0.03	
			For >10,000 To 20,000, Deduct	-0.05	
			For >20,000, Deduct	-0.07	
			For Backroll, Add	0.04	
09 91	23 00-0023	SF	Paint Interior Concrete Walls, 1 Coat Paint, Sprayed	0.38	
			For Oil Based Paint, Add	0.02	
			For Epoxy Paint, Add	0.05	
			For Up To 100, Add	0.22	
			For >100 To 250, Add	0.11	
			For >250 To 500, Add	0.05	
			For >2,500 To 5,000, Deduct	-0.02	
			For >5,000 To 10,000, Deduct	-0.04	
			For >10,000 To 20,000, Deduct	-0.06	
			For >20,000, Deduct	-0.08	
			For Backroll, Add	0.05	



Finishes	09	9
Painting And Coating	09 90	
Painting	09 91	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 23 00-0024 SF Paint Interior Concrete Walls, 2 Coats Paint, Sprayed	0.63	
For Oil Based Paint, Add	0.04	
For Epoxy Paint, Add	0.09	
For Up To 100, Add	0.35	
For >100 To 250, Add	0.17	
For >250 To 500, Add	0.07	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.06	
For >10,000 To 20,000, Deduct	-0.09	
For >20,000, Deduct	-0.13	
For Backroll, Add	0.07	
09 91 23 00-0025 SF Paint Interior Concrete Walls, 1 Coat Bonding Agent, Brush Work.....	0.60	
For Up To 100, Add	0.37	
For >100 To 250, Add	0.18	
For >250 To 500, Add	0.08	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.06	
For >10,000 To 20,000, Deduct	-0.09	
For >20,000, Deduct	-0.12	
09 91 23 00-0026 SF Paint Interior Concrete Walls, 1 Coat Bonding Agent, Brush/Roller Work	0.49	
For Up To 100, Add	0.29	
For >100 To 250, Add	0.14	
For >250 To 500, Add	0.06	
For >2,500 To 5,000, Deduct	-0.02	
For >5,000 To 10,000, Deduct	-0.05	
For >10,000 To 20,000, Deduct	-0.07	
For >20,000, Deduct	-0.10	
09 91 23 00-0027 SF Paint Interior Concrete Walls, 1 Coat Bonding Agent, Sprayed.....	0.36	
For Up To 100, Add	0.18	
For >100 To 250, Add	0.09	
For >250 To 500, Add	0.04	
For >2,500 To 5,000, Deduct	-0.02	
For >5,000 To 10,000, Deduct	-0.04	
For >10,000 To 20,000, Deduct	-0.05	
For >20,000, Deduct	-0.07	
For Backroll, Add	0.04	
09 91 23 00-0028 Paint Interior Concrete Block Walls (09 91 23 00-0001)		
09 91 23 00-0029 Paint Interior Concrete Block Walls, Epoxy Paint (09 91 23 00-0028)		
09 91 23 00-0030 SF Paint Interior Concrete Block Walls, 1 Coat Filler, Brush Work.....	0.79	
For Up To 100, Add	0.48	
For >100 To 250, Add	0.23	
For >250 To 500, Add	0.10	
For >2,500 To 5,000, Deduct	-0.04	
For >5,000 To 10,000, Deduct	-0.08	
For >10,000 To 20,000, Deduct	-0.12	
For >20,000, Deduct	-0.16	
09 91 23 00-0031 SF Paint Interior Concrete Block Walls, 1 Coat Epoxy Paint, Brush.....	0.91	
For Up To 100, Add	0.57	
For >100 To 250, Add	0.27	
For >250 To 500, Add	0.12	
For >2,500 To 5,000, Deduct	-0.05	
For >5,000 To 10,000, Deduct	-0.09	
For >10,000 To 20,000, Deduct	-0.14	
For >20,000, Deduct	-0.18	
09 91 23 00-0032 SF Paint Interior Concrete Block Walls, 2 Coats Epoxy Paint, Brush Work	1.64	
For Up To 100, Add	1.00	
For >100 To 250, Add	0.48	
For >250 To 500, Add	0.21	
For >2,500 To 5,000, Deduct	-0.08	
For >5,000 To 10,000, Deduct	-0.16	
For >10,000 To 20,000, Deduct	-0.25	
For >20,000, Deduct	-0.33	
09 91 23 00-0033 SF Paint Interior Concrete Block Walls, 1 Coat Filler, Brush/Roller Work	0.65	
For Up To 100, Add	0.37	
For >100 To 250, Add	0.18	
For >250 To 500, Add	0.08	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.07	
For >10,000 To 20,000, Deduct	-0.10	
For >20,000, Deduct	-0.13	
09 91 23 00-0034 SF Paint Interior Concrete Block Walls, 1 Coat Epoxy Paint, Brush/Roller Work.....	0.72	
For Up To 100, Add	0.43	
For >100 To 250, Add	0.20	
For >250 To 500, Add	0.09	
For >2,500 To 5,000, Deduct	-0.04	
For >5,000 To 10,000, Deduct	-0.07	
For >10,000 To 20,000, Deduct	-0.11	
For >20,000, Deduct	-0.14	

09 Finishes**09 90 Painting And Coating****09 91 Painting**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 23 00-0035	SF		Paint Interior Concrete Block Walls, 2 Coats Epoxy Paint, Brush/Roller Work	1.37	
			For Up To 100, Add	0.79	
			For >100 To 250, Add	0.38	
			For >250 To 500, Add	0.17	
			For >2,500 To 5,000, Deduct	-0.07	
			For >5,000 To 10,000, Deduct	-0.14	
			For >10,000 To 20,000, Deduct	-0.21	
			For >20,000, Deduct	-0.27	
09 91 23 00-0036	SF		Paint Interior Concrete Block Walls, 1 Coat Filler, Sprayed	0.49	
			For Up To 100, Add	0.22	
			For >100 To 250, Add	0.11	
			For >250 To 500, Add	0.05	
			For >2,500 To 5,000, Deduct	-0.02	
			For >5,000 To 10,000, Deduct	-0.05	
			For >10,000 To 20,000, Deduct	-0.07	
			For >20,000, Deduct	-0.10	
			For Backroll, Add	0.05	
09 91 23 00-0037	SF		Paint Interior Concrete Block Walls, 1 Coat Epoxy Paint, Sprayed.....	0.59	
			For Up To 100, Add	0.30	
			For >100 To 250, Add	0.15	
			For >250 To 500, Add	0.06	
			For >2,500 To 5,000, Deduct	-0.03	
			For >5,000 To 10,000, Deduct	-0.06	
			For >10,000 To 20,000, Deduct	-0.09	
			For >20,000, Deduct	-0.12	
			For Backroll, Add	0.06	
09 91 23 00-0038	SF		Paint Interior Concrete Block Walls, 2 Coats Epoxy Paint, Sprayed.....	1.07	
			For Up To 100, Add	0.51	
			For >100 To 250, Add	0.25	
			For >250 To 500, Add	0.11	
			For >2,500 To 5,000, Deduct	-0.05	
			For >5,000 To 10,000, Deduct	-0.11	
			For >10,000 To 20,000, Deduct	-0.16	
			For >20,000, Deduct	-0.21	
			For Backroll, Add	0.11	
09 91 23 00-0039			Paint Interior Concrete Block Walls, Acrylic Latex Paint (09 91 23 00-0028)		
09 91 23 00-0040	SF		Paint Interior Concrete Block Walls, 1 Coat Filler, Brush Work.....	0.74	
			For Oil Based Paint, Add	0.04	
			For Up To 100, Add	0.48	
			For >100 To 250, Add	0.23	
			For >250 To 500, Add	0.10	
			For >2,500 To 5,000, Deduct	-0.04	
			For >5,000 To 10,000, Deduct	-0.07	
			For >10,000 To 20,000, Deduct	-0.11	
			For >20,000, Deduct	-0.15	
09 91 23 00-0041	SF		Paint Interior Concrete Block Walls, 1 Coat Paint, Brush Work	0.87	
			For Oil Based Paint, Add	0.05	
			For Up To 100, Add	0.55	
			For >100 To 250, Add	0.26	
			For >250 To 500, Add	0.11	
			For >2,500 To 5,000, Deduct	-0.04	
			For >5,000 To 10,000, Deduct	-0.09	
			For >10,000 To 20,000, Deduct	-0.13	
			For >20,000, Deduct	-0.17	
09 91 23 00-0042	SF		Paint Interior Concrete Block Walls, 2 Coats Paint, Brush Work	1.58	
			For Oil Based Paint, Add	0.10	
			For Up To 100, Add	0.98	
			For >100 To 250, Add	0.47	
			For >250 To 500, Add	0.20	
			For >2,500 To 5,000, Deduct	-0.08	
			For >5,000 To 10,000, Deduct	-0.16	
			For >10,000 To 20,000, Deduct	-0.24	
			For >20,000, Deduct	-0.32	
09 91 23 00-0043	SF		Paint Interior Concrete Block Walls, Texture Coat, Brush Work	0.96	
			For Oil Based Paint, Add	0.06	
			For Up To 100, Add	0.61	
			For >100 To 250, Add	0.29	
			For >250 To 500, Add	0.13	
			For >2,500 To 5,000, Deduct	-0.05	
			For >5,000 To 10,000, Deduct	-0.10	
			For >10,000 To 20,000, Deduct	-0.14	
			For >20,000, Deduct	-0.19	
09 91 23 00-0044	SF		Paint Interior Concrete Block Walls, 1 Coat Filler, Brush/Roller Work	0.62	
			For Oil Based Paint, Add	0.04	
			For Up To 100, Add	0.39	
			For >100 To 250, Add	0.18	
			For >250 To 500, Add	0.08	
			For >2,500 To 5,000, Deduct	-0.03	
			For >5,000 To 10,000, Deduct	-0.06	
			For >10,000 To 20,000, Deduct	-0.09	
			For >20,000, Deduct	-0.12	



Finishes	09	9
Painting And Coating	09 90	
Painting	09 91	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 23 00-0045 SF Paint Interior Concrete Block Walls, 1 Coat Paint, Brush/Roller Work.....	0.74	
For Oil Based Paint, Add	0.05	
For Up To 100, Add	0.45	
For >100 To 250, Add	0.22	
For >250 To 500, Add	0.09	
For >2,500 To 5,000, Deduct	-0.04	
For >5,000 To 10,000, Deduct	-0.07	
For >10,000 To 20,000, Deduct	-0.11	
For >20,000, Deduct	-0.15	
09 91 23 00-0046 SF Paint Interior Concrete Block Walls, 2 Coats Paint, Brush/Roller Work.....	1.32	
For Oil Based Paint, Add	0.08	
For Up To 100, Add	0.79	
For >100 To 250, Add	0.38	
For >250 To 500, Add	0.16	
For >2,500 To 5,000, Deduct	-0.07	
For >5,000 To 10,000, Deduct	-0.13	
For >10,000 To 20,000, Deduct	-0.20	
For >20,000, Deduct	-0.26	
09 91 23 00-0047 SF Paint Interior Concrete Block Walls, Texture Coat, Brush/Roller Work.....	0.82	
For Oil Based Paint, Add	0.05	
For Up To 100, Add	0.50	
For >100 To 250, Add	0.24	
For >250 To 500, Add	0.10	
For >2,500 To 5,000, Deduct	-0.04	
For >5,000 To 10,000, Deduct	-0.08	
For >10,000 To 20,000, Deduct	-0.12	
For >20,000, Deduct	-0.16	
09 91 23 00-0048 SF Paint Interior Concrete Block Walls, 1 Coat Filler, Sprayed.....	0.48	
For Oil Based Paint, Add	0.03	
For Up To 100, Add	0.26	
For >100 To 250, Add	0.13	
For >250 To 500, Add	0.06	
For >2,500 To 5,000, Deduct	-0.02	
For >5,000 To 10,000, Deduct	-0.05	
For >10,000 To 20,000, Deduct	-0.07	
For >20,000, Deduct	-0.10	
For Backroll, Add	0.06	
09 91 23 00-0049 SF Paint Interior Concrete Block Walls, 1 Coat Paint, Sprayed.....	0.56	
For Oil Based Paint, Add	0.04	
For Up To 100, Add	0.29	
For >100 To 250, Add	0.14	
For >250 To 500, Add	0.06	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.06	
For >10,000 To 20,000, Deduct	-0.08	
For >20,000, Deduct	-0.11	
For Backroll, Add	0.06	
09 91 23 00-0050 SF Paint Interior Concrete Block Walls, 2 Coats Paint, Sprayed.....	0.79	
For Oil Based Paint, Add	0.05	
For Up To 100, Add	0.44	
For >100 To 250, Add	0.21	
For >250 To 500, Add	0.09	
For >2,500 To 5,000, Deduct	-0.04	
For >5,000 To 10,000, Deduct	-0.08	
For >10,000 To 20,000, Deduct	-0.12	
For >20,000, Deduct	-0.16	
For Backroll, Add	0.09	
09 91 23 00-0051 SF Paint Interior Concrete Block Walls, Texture Coat, Sprayed.....	0.66	
For Oil Based Paint, Add	0.05	
For Up To 100, Add	0.34	
For >100 To 250, Add	0.17	
For >250 To 500, Add	0.07	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.07	
For >10,000 To 20,000, Deduct	-0.10	
For >20,000, Deduct	-0.13	
For Backroll, Add	0.07	
09 91 23 00-0052 Paint Interior Concrete Block Walls With Bonding Agent (09 91 23 00-0028)		
09 91 23 00-0053 SF Paint Interior Concrete Block Walls, 1 Coat Bonding Agent, Brush.....	0.76	
For Up To 100, Add	0.48	
For >100 To 250, Add	0.23	
For >250 To 500, Add	0.10	
For >2,500 To 5,000, Deduct	-0.04	
For >5,000 To 10,000, Deduct	-0.08	
For >10,000 To 20,000, Deduct	-0.11	
For >20,000, Deduct	-0.15	
09 91 23 00-0054 SF Paint Interior Concrete Block Walls, 1 Coat Bonding Agent, Brush/Roller Work.....	0.64	
For Up To 100, Add	0.39	
For >100 To 250, Add	0.19	
For >250 To 500, Add	0.08	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.06	
For >10,000 To 20,000, Deduct	-0.10	
For >20,000, Deduct	-0.13	

09 Finishes**09 90 Painting And Coating****09 91 Painting**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 23 00-0055	SF		Paint Interior Concrete Block Walls, 1 Coat Bonding Agent, Sprayed	0.51	
			<i>For Up To 100, Add</i>	0.26	
			<i>For >100 To 250, Add</i>	0.13	
			<i>For >250 To 500, Add</i>	0.06	
			<i>For >2,500 To 5,000, Deduct</i>	-0.03	
			<i>For >5,000 To 10,000, Deduct</i>	-0.05	
			<i>For >10,000 To 20,000, Deduct</i>	-0.08	
			<i>For >20,000, Deduct</i>	-0.10	
			<i>For Backroll, Add</i>	0.06	
09 91 23 00-0056			Paint Interior Plaster/Drywall Walls <i>(09 91 23 00-0001)</i>		
09 91 23 00-0057			Paint Interior Plaster/Drywall Walls <i>(09 91 23 00-0056)</i>		
09 91 23 00-0058	SF		Paint Interior Plaster/Drywall Walls, 1 Coat Primer, Brush Work	0.60	
			<i>For Oil Based Paint, Add</i>	0.04	
			<i>For Orange Peel Finish, Add</i>	0.08	
			<i>For Up To 100, Add</i>	0.38	
			<i>For >100 To 250, Add</i>	0.18	
			<i>For >250 To 500, Add</i>	0.08	
			<i>For >2,500 To 5,000, Deduct</i>	-0.03	
			<i>For >5,000 To 10,000, Deduct</i>	-0.06	
			<i>For >10,000 To 20,000, Deduct</i>	-0.09	
			<i>For >20,000, Deduct</i>	-0.12	
09 91 23 00-0059	SF		Paint Interior Plaster/Drywall Walls, 1 Coat Paint, Brush Work	0.63	
			<i>For Oil Based Paint, Add</i>	0.04	
			<i>For Orange Peel Finish, Add</i>	0.09	
			<i>For Each Coat With Egg Shell Finish, Add</i>	0.01	
			<i>For Up To 100, Add</i>	0.42	
			<i>For >100 To 250, Add</i>	0.20	
			<i>For >250 To 500, Add</i>	0.09	
			<i>For >2,500 To 5,000, Deduct</i>	-0.03	
			<i>For >5,000 To 10,000, Deduct</i>	-0.06	
			<i>For >10,000 To 20,000, Deduct</i>	-0.09	
			<i>For >20,000, Deduct</i>	-0.13	
09 91 23 00-0060	SF		Paint Interior Plaster/Drywall Walls, 2 Coats Paint, Brush Work	1.15	
			<i>For Oil Based Paint, Add</i>	0.07	
			<i>For Orange Peel Finish, Add</i>	0.16	
			<i>For Each Coat With Egg Shell Finish, Add</i>	0.01	
			<i>For Up To 100, Add</i>	0.76	
			<i>For >100 To 250, Add</i>	0.36	
			<i>For >250 To 500, Add</i>	0.16	
			<i>For >2,500 To 5,000, Deduct</i>	-0.06	
			<i>For >5,000 To 10,000, Deduct</i>	-0.12	
			<i>For >10,000 To 20,000, Deduct</i>	-0.17	
			<i>For >20,000, Deduct</i>	-0.23	
09 91 23 00-0061	SF		Paint Interior Plaster/Drywall Walls, 3 Coats Paint, Brush	1.64	
			<i>For Oil Based Paint, Add</i>	0.10	
			<i>For Orange Peel Finish, Add</i>	0.23	
			<i>For Each Coat With Egg Shell Finish, Add</i>	0.01	
			<i>For Up To 100, Add</i>	1.07	
			<i>For >100 To 250, Add</i>	0.51	
			<i>For >250 To 500, Add</i>	0.22	
			<i>For >2,500 To 5,000, Deduct</i>	-0.08	
			<i>For >5,000 To 10,000, Deduct</i>	-0.16	
			<i>For >10,000 To 20,000, Deduct</i>	-0.25	
			<i>For >20,000, Deduct</i>	-0.33	
09 91 23 00-0062	SF		Paint Interior Plaster/Drywall Walls, 1 Coat Primer, Brush/Roller Work	0.48	
			<i>For Oil Based Paint, Add</i>	0.03	
			<i>For Orange Peel Finish, Add</i>	0.06	
			<i>For Up To 100, Add</i>	0.29	
			<i>For >100 To 250, Add</i>	0.14	
			<i>For >250 To 500, Add</i>	0.06	
			<i>For >2,500 To 5,000, Deduct</i>	-0.02	
			<i>For >5,000 To 10,000, Deduct</i>	-0.05	
			<i>For >10,000 To 20,000, Deduct</i>	-0.07	
			<i>For >20,000, Deduct</i>	-0.10	
09 91 23 00-0063	SF		Paint Interior Plaster/Drywall Walls, 1 Coat Paint, Brush/Roller Work	0.54	
			<i>For Oil Based Paint, Add</i>	0.03	
			<i>For Orange Peel Finish, Add</i>	0.07	
			<i>For Each Coat With Egg Shell Finish, Add</i>	0.01	
			<i>For Up To 100, Add</i>	0.35	
			<i>For >100 To 250, Add</i>	0.16	
			<i>For >250 To 500, Add</i>	0.07	
			<i>For >2,500 To 5,000, Deduct</i>	-0.03	
			<i>For >5,000 To 10,000, Deduct</i>	-0.05	
			<i>For >10,000 To 20,000, Deduct</i>	-0.08	
			<i>For >20,000, Deduct</i>	-0.11	



Finishes	09	9
Painting And Coating	09 90	
Painting	09 91	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 23 00-0064 SF Paint Interior Plaster/Drywall Walls, 2 Coats Paint, Brush/Roller Work	0.95	
For Oil Based Paint, Add	0.06	
For Orange Peel Finish, Add	0.13	
For Each Coat With Egg Shell Finish, Add	0.01	
For Up To 100, Add	0.60	
For >100 To 250, Add	0.29	
For >250 To 500, Add	0.12	
For >2,500 To 5,000, Deduct	-0.05	
For >5,000 To 10,000, Deduct	-0.10	
For >10,000 To 20,000, Deduct	-0.14	
For >20,000, Deduct	-0.19	
09 91 23 00-0065 SF Paint Interior Plaster/Drywall Walls, 1 Coat Primer, Sprayed.....	0.34	
For Oil Based Paint, Add	0.02	
For Up To 100, Add	0.18	
For >100 To 250, Add	0.09	
For >250 To 500, Add	0.04	
For >2,500 To 5,000, Deduct	-0.02	
For >5,000 To 10,000, Deduct	-0.03	
For >10,000 To 20,000, Deduct	-0.05	
For >20,000, Deduct	-0.07	
For Backroll, Add	0.04	
09 91 23 00-0066 SF Paint Interior Plaster/Drywall Walls, 1 Coat Paint, Sprayed.....	0.38	
For Oil Based Paint, Add	0.02	
For Each Coat With Egg Shell Finish, Add	0.01	
For Up To 100, Add	0.22	
For >100 To 250, Add	0.11	
For >250 To 500, Add	0.05	
For >2,500 To 5,000, Deduct	-0.02	
For >5,000 To 10,000, Deduct	-0.04	
For >10,000 To 20,000, Deduct	-0.06	
For >20,000, Deduct	-0.08	
For Backroll, Add	0.05	
09 91 23 00-0067 SF Paint Interior Plaster/Drywall Walls, 2 Coats Paint, Sprayed.....	0.63	
For Oil Based Paint, Add	0.04	
For Each Coat With Egg Shell Finish, Add	0.01	
For Up To 100, Add	0.35	
For >100 To 250, Add	0.17	
For >250 To 500, Add	0.07	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.06	
For >10,000 To 20,000, Deduct	-0.09	
For >20,000, Deduct	-0.13	
For Backroll, Add	0.07	
09 91 23 00-0068 Paint Interior Plaster/Drywall Or Masonry Walls With Polymix Multi-Color		
Paint (09 91 23 00-0056)		
09 91 23 00-0069 SF Paint Interior Plaster/Drywall Or Masonry Walls, 2 Tone Polymix With Base Coat, Spray-on	1.34	
For Up To 100, Add	0.62	
For >100 To 250, Add	0.31	
For >250 To 500, Add	0.14	
For >2,500 To 5,000, Deduct	-0.07	
For >5,000 To 10,000, Deduct	-0.13	
For >10,000 To 20,000, Deduct	-0.20	
For >20,000, Deduct	-0.27	
09 91 23 00-0070 SF Paint Interior Plaster/Drywall Or Masonry Walls, 3 Tone Polymix With Base Coat, Spray-on	1.45	
For Up To 100, Add	0.64	
For >100 To 250, Add	0.32	
For >250 To 500, Add	0.14	
For >2,500 To 5,000, Deduct	-0.07	
For >5,000 To 10,000, Deduct	-0.15	
For >10,000 To 20,000, Deduct	-0.22	
For >20,000, Deduct	-0.29	
09 91 23 00-0071 SF Paint Interior Plaster/Drywall Or Masonry Walls, 4 Tone Polymix With Base Coat, Spray-on	1.56	
For Up To 100, Add	0.65	
For >100 To 250, Add	0.33	
For >250 To 500, Add	0.15	
For >2,500 To 5,000, Deduct	-0.08	
For >5,000 To 10,000, Deduct	-0.16	
For >10,000 To 20,000, Deduct	-0.23	
For >20,000, Deduct	-0.31	
09 91 23 00-0072 Paint Interior Plaster/Drywall Walls, Acoustic Texture (09 91 23 00-0056)		
09 91 23 00-0073 SF Paint Interior Plaster/Drywall Walls, Acoustic Texture, 1 Coat Primer, Spray-on.....	0.56	
For Up To 100, Add	0.32	
For >100 To 250, Add	0.15	
For >250 To 500, Add	0.07	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.06	
For >10,000 To 20,000, Deduct	-0.08	
For >20,000, Deduct	-0.11	

09 Finishes**09 90 Painting And Coating****09 91 Painting**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 23 00-0074 SF Paint Interior Plaster/Drywall Walls, Acoustic Texture, 1 Coat Finish, Spray-on.....	0.67	
For Up To 100, Add	0.40	
For >100 To 250, Add	0.19	
For >250 To 500, Add	0.08	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.07	
For >10,000 To 20,000, Deduct	-0.10	
For >20,000, Deduct	-0.13	
09 91 23 00-0075 SF Paint Interior Plaster/Drywall Walls, Acoustic Texture, 2 Coats Finish, Spray-on.....	1.04	
For Up To 100, Add	0.58	
For >100 To 250, Add	0.28	
For >250 To 500, Add	0.12	
For >2,500 To 5,000, Deduct	-0.05	
For >5,000 To 10,000, Deduct	-0.10	
For >10,000 To 20,000, Deduct	-0.16	
For >20,000, Deduct	-0.21	
09 91 23 00-0076 SF Paint Interior Plaster/Drywall Walls, Stipple Finish (Drippowder).....	1.27	
For Up To 100, Add	0.91	
For >100 To 250, Add	0.43	
For >250 To 500, Add	0.18	
For >2,500 To 5,000, Deduct	-0.06	
For >5,000 To 10,000, Deduct	-0.13	
For >10,000 To 20,000, Deduct	-0.19	
For >20,000, Deduct	-0.25	
09 91 23 00-0077 Paint Interior Metal Walls (09 91 23 00-0001)		
09 91 23 00-0078 Paint Interior Galvanized Walls (09 91 23 00-0077)		
Note: Linseed oil or acrylic latex paint.		
09 91 23 00-0079 SF Paint Interior Galvanized Wall Surfaces, 1 Coat Primer, Brush Work.....	0.69	
For Electrostatic Painting, Add	0.09	
For Up To 100, Add	0.43	
For >100 To 250, Add	0.20	
For >250 To 500, Add	0.09	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.07	
For >10,000 To 20,000, Deduct	-0.10	
For >20,000, Deduct	-0.14	
09 91 23 00-0080 SF Paint Interior Galvanized Wall Surfaces, 1 Coat Paint, Brush Work.....	0.77	
For Electrostatic Painting, Add	0.10	
For Up To 100, Add	0.49	
For >100 To 250, Add	0.23	
For >250 To 500, Add	0.10	
For >2,500 To 5,000, Deduct	-0.04	
For >5,000 To 10,000, Deduct	-0.08	
For >10,000 To 20,000, Deduct	-0.12	
For >20,000, Deduct	-0.15	
09 91 23 00-0081 SF Paint Interior Galvanized Wall Surfaces, 2 Coats Paint, Brush Work.....	1.39	
For Electrostatic Painting, Add	0.18	
For Up To 100, Add	0.86	
For >100 To 250, Add	0.41	
For >250 To 500, Add	0.18	
For >2,500 To 5,000, Deduct	-0.07	
For >5,000 To 10,000, Deduct	-0.14	
For >10,000 To 20,000, Deduct	-0.21	
For >20,000, Deduct	-0.28	
09 91 23 00-0082 SF Paint Interior Galvanized Walls, 1 Coat Primer, Brush/Roller Work.....	0.51	
For Electrostatic Painting, Add	0.07	
For Up To 100, Add	0.31	
For >100 To 250, Add	0.15	
For >250 To 500, Add	0.06	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.05	
For >10,000 To 20,000, Deduct	-0.08	
For >20,000, Deduct	-0.10	
09 91 23 00-0083 SF Paint Interior Galvanized Wall , 1 Coat Paint, Brush/Roller Work.....	0.60	
For Electrostatic Painting, Add	0.08	
For Up To 100, Add	0.37	
For >100 To 250, Add	0.18	
For >250 To 500, Add	0.08	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.06	
For >10,000 To 20,000, Deduct	-0.09	
For >20,000, Deduct	-0.12	
09 91 23 00-0084 SF Paint Interior Galvanized Walls, 2 Coats Paint, Brush/Roller Work.....	1.11	
For Electrostatic Painting, Add	0.15	
For Up To 100, Add	0.68	
For >100 To 250, Add	0.32	
For >250 To 500, Add	0.14	
For >2,500 To 5,000, Deduct	-0.06	
For >5,000 To 10,000, Deduct	-0.11	
For >10,000 To 20,000, Deduct	-0.17	
For >20,000, Deduct	-0.22	



Finishes	09	9
Painting And Coating	09 90	
Painting	09 91	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 23 00-0085 SF Paint Interior Galvanized Walls, 1 Coat Primer, Sprayed	0.36	
For Electrostatic Painting, Add	0.06	
For Up To 100, Add	0.17	
For >100 To 250, Add	0.08	
For >250 To 500, Add	0.04	
For >2,500 To 5,000, Deduct	-0.02	
For >5,000 To 10,000, Deduct	-0.04	
For >10,000 To 20,000, Deduct	-0.05	
For >20,000, Deduct	-0.07	
For Backroll, Add	0.04	
09 91 23 00-0086 SF Paint Interior Galvanized Walls, 1 Coat Paint, Sprayed.....	0.48	
For Electrostatic Painting, Add	0.07	
For Up To 100, Add	0.26	
For >100 To 250, Add	0.13	
For >250 To 500, Add	0.06	
For >2,500 To 5,000, Deduct	-0.02	
For >5,000 To 10,000, Deduct	-0.05	
For >10,000 To 20,000, Deduct	-0.07	
For >20,000, Deduct	-0.10	
For Backroll, Add	0.06	
09 91 23 00-0087 SF Paint Interior Galvanized Walls, 2 Coats Paint, Sprayed.....	0.81	
For Electrostatic Painting, Add	0.13	
For Up To 100, Add	0.40	
For >100 To 250, Add	0.20	
For >250 To 500, Add	0.09	
For >2,500 To 5,000, Deduct	-0.04	
For >5,000 To 10,000, Deduct	-0.08	
For >10,000 To 20,000, Deduct	-0.12	
For >20,000, Deduct	-0.16	
For Backroll, Add	0.09	
09 91 23 00-0088 Paint Interior Aluminum And Aluminum Alloy Walls (09 91 23 00-0077)		
Note: Alkyd enamel paint.		
09 91 23 00-0089 SF Paint Interior Aluminum And Aluminum Alloy Wall Surfaces, 1 Coat Primer, Brush Work.....	0.69	
For Electrostatic Painting, Add	0.09	
For Up To 100, Add	0.43	
For >100 To 250, Add	0.20	
For >250 To 500, Add	0.09	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.07	
For >10,000 To 20,000, Deduct	-0.10	
For >20,000, Deduct	-0.14	
09 91 23 00-0090 SF Paint Interior Aluminum And Aluminum Alloy Wall Surfaces, 1 Coat Paint, Brush Work	0.77	
For Electrostatic Painting, Add	0.10	
For Up To 100, Add	0.49	
For >100 To 250, Add	0.23	
For >250 To 500, Add	0.10	
For >2,500 To 5,000, Deduct	-0.04	
For >5,000 To 10,000, Deduct	-0.08	
For >10,000 To 20,000, Deduct	-0.12	
For >20,000, Deduct	-0.15	
09 91 23 00-0091 SF Paint Interior Aluminum And Aluminum Alloy Wall Surfaces, 2 Coats Paint, Brush Work	1.39	
For Electrostatic Painting, Add	0.18	
For Up To 100, Add	0.86	
For >100 To 250, Add	0.41	
For >250 To 500, Add	0.18	
For >2,500 To 5,000, Deduct	-0.07	
For >5,000 To 10,000, Deduct	-0.14	
For >10,000 To 20,000, Deduct	-0.21	
For >20,000, Deduct	-0.28	
09 91 23 00-0092 SF Paint Interior Aluminum And Aluminum Alloy Walls, 1 Coat Primer, Brush/Roller Work.....	0.56	
For Electrostatic Painting, Add	0.08	
For Up To 100, Add	0.32	
For >100 To 250, Add	0.15	
For >250 To 500, Add	0.07	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.06	
For >10,000 To 20,000, Deduct	-0.08	
For >20,000, Deduct	-0.11	
09 91 23 00-0093 SF Paint Interior Aluminum And Aluminum Alloy Walls, 1 Coat Paint, Brush/Roller Work	0.64	
For Electrostatic Painting, Add	0.09	
For Up To 100, Add	0.38	
For >100 To 250, Add	0.18	
For >250 To 500, Add	0.08	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.06	
For >10,000 To 20,000, Deduct	-0.10	
For >20,000, Deduct	-0.13	

09 Finishes**09 90 Painting And Coating****09 91 Painting**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 23 00-0094	SF		Paint Interior Aluminum And Aluminum Alloy Walls, 2 Coats Paint, Brush/Roller Work.....	1.19	
			<i>For Electrostatic Painting, Add</i>	0.17	
			<i>For Up To 100, Add</i>	0.69	
			<i>For >100 To 250, Add</i>	0.33	
			<i>For >250 To 500, Add</i>	0.14	
			<i>For >2,500 To 5,000, Deduct</i>	-0.06	
			<i>For >5,000 To 10,000, Deduct</i>	-0.12	
			<i>For >10,000 To 20,000, Deduct</i>	-0.18	
			<i>For >20,000, Deduct</i>	-0.24	
09 91 23 00-0095	SF		Paint Interior Aluminum And Aluminum Alloy Walls, 1 Coat Primer, Sprayed.....	0.40	
			<i>For Electrostatic Painting, Add</i>	0.07	
			<i>For Up To 100, Add</i>	0.20	
			<i>For >100 To 250, Add</i>	0.10	
			<i>For >250 To 500, Add</i>	0.04	
			<i>For >2,500 To 5,000, Deduct</i>	-0.02	
			<i>For >5,000 To 10,000, Deduct</i>	-0.04	
			<i>For >10,000 To 20,000, Deduct</i>	-0.06	
			<i>For >20,000, Deduct</i>	-0.08	
			<i>For Backroll, Add</i>	0.04	
09 91 23 00-0096	SF		Paint Interior Aluminum And Aluminum Alloy Walls, 1 Coat Paint, Sprayed.....	0.48	
			<i>For Electrostatic Painting, Add</i>	0.07	
			<i>For Up To 100, Add</i>	0.26	
			<i>For >100 To 250, Add</i>	0.13	
			<i>For >250 To 500, Add</i>	0.06	
			<i>For >2,500 To 5,000, Deduct</i>	-0.02	
			<i>For >5,000 To 10,000, Deduct</i>	-0.05	
			<i>For >10,000 To 20,000, Deduct</i>	-0.07	
			<i>For >20,000, Deduct</i>	-0.10	
			<i>For Backroll, Add</i>	0.06	
09 91 23 00-0097	SF		Paint Interior Aluminum And Aluminum Alloy Walls, 2 Coats Paint, Sprayed.....	0.81	
			<i>For Electrostatic Painting, Add</i>	0.13	
			<i>For Up To 100, Add</i>	0.40	
			<i>For >100 To 250, Add</i>	0.20	
			<i>For >250 To 500, Add</i>	0.09	
			<i>For >2,500 To 5,000, Deduct</i>	-0.04	
			<i>For >5,000 To 10,000, Deduct</i>	-0.08	
			<i>For >10,000 To 20,000, Deduct</i>	-0.12	
			<i>For >20,000, Deduct</i>	-0.16	
			<i>For Backroll, Add</i>	0.09	
09 91 23 00-0098			Paint Interior Corrugated Metal Walls <small>(09 91 23 00-0077)</small>		
09 91 23 00-0099	SF		Paint Interior Corrugated Metal Walls, 1 Coat Primer, Sprayed.....	0.45	
			<i>For Electrostatic Painting, Add</i>	0.08	
			<i>For Up To 100, Add</i>	0.22	
			<i>For >100 To 250, Add</i>	0.11	
			<i>For >250 To 500, Add</i>	0.05	
			<i>For >2,500 To 5,000, Deduct</i>	-0.02	
			<i>For >5,000 To 10,000, Deduct</i>	-0.05	
			<i>For >10,000 To 20,000, Deduct</i>	-0.07	
			<i>For >20,000, Deduct</i>	-0.09	
			<i>For Backroll, Add</i>	0.05	
09 91 23 00-0100	SF		Paint Interior Corrugated Metal Walls, 1 Coat Paint, Sprayed.....	0.62	
			<i>For Electrostatic Painting, Add</i>	0.09	
			<i>For Up To 100, Add</i>	0.35	
			<i>For >100 To 250, Add</i>	0.17	
			<i>For >250 To 500, Add</i>	0.07	
			<i>For >2,500 To 5,000, Deduct</i>	-0.03	
			<i>For >5,000 To 10,000, Deduct</i>	-0.06	
			<i>For >10,000 To 20,000, Deduct</i>	-0.09	
			<i>For >20,000, Deduct</i>	-0.12	
			<i>For Backroll, Add</i>	0.07	
09 91 23 00-0101	SF		Paint Interior Corrugated Metal Walls, 2 Coats Paint, Sprayed.....	1.01	
			<i>For Electrostatic Painting, Add</i>	0.16	
			<i>For Up To 100, Add</i>	0.52	
			<i>For >100 To 250, Add</i>	0.26	
			<i>For >250 To 500, Add</i>	0.11	
			<i>For >2,500 To 5,000, Deduct</i>	-0.05	
			<i>For >5,000 To 10,000, Deduct</i>	-0.10	
			<i>For >10,000 To 20,000, Deduct</i>	-0.15	
			<i>For >20,000, Deduct</i>	-0.20	
			<i>For Backroll, Add</i>	0.11	
09 91 23 00-0102			Paint Interior Stucco Walls <small>(09 91 23 00-0001)</small>		
09 91 23 00-0103	SF		Paint Interior Stucco Wall Surfaces, 1 Coat Primer, Brush Work.....	0.98	
			<i>For Oil Based Paint, Add</i>	0.06	
			<i>For Up To 100, Add</i>	0.66	
			<i>For >100 To 250, Add</i>	0.31	
			<i>For >250 To 500, Add</i>	0.13	
			<i>For >2,500 To 5,000, Deduct</i>	-0.05	
			<i>For >5,000 To 10,000, Deduct</i>	-0.10	
			<i>For >10,000 To 20,000, Deduct</i>	-0.15	
			<i>For >20,000, Deduct</i>	-0.20	



Finishes	09	09
Painting And Coating	09 90	
Painting	09 91	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 23 00-0104 SF Paint Interior Stucco Wall Surfaces, 1 Coat Paint, Brush Work	1.07	
For Oil Based Paint, Add	0.06	
For Up To 100, Add	0.71	
For >100 To 250, Add	0.34	
For >250 To 500, Add	0.15	
For >2,500 To 5,000, Deduct	-0.05	
For >5,000 To 10,000, Deduct	-0.11	
For >10,000 To 20,000, Deduct	-0.16	
For >20,000, Deduct	-0.21	
09 91 23 00-0105 SF Paint Interior Stucco Wall Surfaces, 2 Coats Paint, Brush Work	1.91	
For Oil Based Paint, Add	0.11	
For Up To 100, Add	1.25	
For >100 To 250, Add	0.59	
For >250 To 500, Add	0.26	
For >2,500 To 5,000, Deduct	-0.10	
For >5,000 To 10,000, Deduct	-0.19	
For >10,000 To 20,000, Deduct	-0.29	
For >20,000, Deduct	-0.38	
09 91 23 00-0106 SF Paint Interior Stucco Walls, 1 Coat Primer, Brush/Roller Work.....	0.74	
For Oil Based Paint, Add	0.04	
For Up To 100, Add	0.48	
For >100 To 250, Add	0.23	
For >250 To 500, Add	0.10	
For >2,500 To 5,000, Deduct	-0.04	
For >5,000 To 10,000, Deduct	-0.07	
For >10,000 To 20,000, Deduct	-0.11	
For >20,000, Deduct	-0.15	
09 91 23 00-0107 SF Paint Interior Stucco Walls, 1 Coat Paint, Brush/Roller Work	0.84	
For Oil Based Paint, Add	0.05	
For Up To 100, Add	0.54	
For >100 To 250, Add	0.26	
For >250 To 500, Add	0.11	
For >2,500 To 5,000, Deduct	-0.04	
For >5,000 To 10,000, Deduct	-0.08	
For >10,000 To 20,000, Deduct	-0.13	
For >20,000, Deduct	-0.17	
09 91 23 00-0108 SF Paint Interior Stucco Walls, 2 Coats Paint, Brush/Roller Work	1.54	
For Oil Based Paint, Add	0.09	
For Up To 100, Add	0.98	
For >100 To 250, Add	0.46	
For >250 To 500, Add	0.20	
For >2,500 To 5,000, Deduct	-0.08	
For >5,000 To 10,000, Deduct	-0.15	
For >10,000 To 20,000, Deduct	-0.23	
For >20,000, Deduct	-0.31	
09 91 23 00-0109 SF Paint Interior Stucco Walls, 1 Coat Primer, Sprayed	0.48	
For Oil Based Paint, Add	0.03	
For Up To 100, Add	0.27	
For >100 To 250, Add	0.13	
For >250 To 500, Add	0.06	
For >2,500 To 5,000, Deduct	-0.02	
For >5,000 To 10,000, Deduct	-0.05	
For >10,000 To 20,000, Deduct	-0.07	
For >20,000, Deduct	-0.10	
For Backroll, Add	0.06	
09 91 23 00-0110 SF Paint Interior Stucco Walls, 1 Coat Paint, Sprayed.....	0.58	
For Oil Based Paint, Add	0.04	
For Up To 100, Add	0.32	
For >100 To 250, Add	0.16	
For >250 To 500, Add	0.07	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.06	
For >10,000 To 20,000, Deduct	-0.09	
For >20,000, Deduct	-0.12	
For Backroll, Add	0.07	
09 91 23 00-0111 SF Paint Interior Stucco Walls, 2 Coats Paint, Sprayed.....	1.12	
For Oil Based Paint, Add	0.07	
For Up To 100, Add	0.64	
For >100 To 250, Add	0.31	
For >250 To 500, Add	0.13	
For >2,500 To 5,000, Deduct	-0.06	
For >5,000 To 10,000, Deduct	-0.11	
For >10,000 To 20,000, Deduct	-0.17	
For >20,000, Deduct	-0.22	
For Backroll, Add	0.13	

09 91 23 00-0112 Paint Interior Wood Walls (09 91 23 00-0001)

09 91 23 00-0113 Interior Wood Walls (09 91 23 00-0112)

09 Finishes**09 90 Painting And Coating****09 91 Painting**

MINOR

CSI UOM DESCRIPTION

TOTAL DIRECT
UNIT COSTDEMOLITION
UNIT COST

09 91 23 00-0114	SF	Paint Interior Wood Wall Surfaces, 1 Coat Paint, Brush Work.....	0.74	
		<i>For Oil Based Paint, Add</i>	0.04	
		<i>For Up To 100, Add</i>	0.49	
		<i>For >100 To 250, Add</i>	0.23	
		<i>For >250 To 500, Add</i>	0.10	
		<i>For >2,500 To 5,000, Deduct</i>	-0.04	
		<i>For >5,000 To 10,000, Deduct</i>	-0.07	
		<i>For >10,000 To 20,000, Deduct</i>	-0.11	
		<i>For >20,000, Deduct</i>	-0.15	
09 91 23 00-0115	SF	Paint Interior Wood Wall Surfaces, 2 Coats Paint, Brush Work.....	1.34	
		<i>For Oil Based Paint, Add</i>	0.08	
		<i>For Up To 100, Add</i>	0.88	
		<i>For >100 To 250, Add</i>	0.42	
		<i>For >250 To 500, Add</i>	0.18	
		<i>For >2,500 To 5,000, Deduct</i>	-0.07	
		<i>For >5,000 To 10,000, Deduct</i>	-0.13	
		<i>For >10,000 To 20,000, Deduct</i>	-0.20	
		<i>For >20,000, Deduct</i>	-0.27	
09 91 23 00-0116	SF	Paint Interior Wood Wall Surfaces, 3 Coats Paint, Brush Work.....	1.90	
		<i>For Oil Based Paint, Add</i>	0.11	
		<i>For Up To 100, Add</i>	1.23	
		<i>For >100 To 250, Add</i>	0.59	
		<i>For >250 To 500, Add</i>	0.25	
		<i>For >2,500 To 5,000, Deduct</i>	-0.10	
		<i>For >5,000 To 10,000, Deduct</i>	-0.19	
		<i>For >10,000 To 20,000, Deduct</i>	-0.29	
		<i>For >20,000, Deduct</i>	-0.38	
09 91 23 00-0117	SF	Paint Interior Wood Walls, 1 Coat Primer, Brush/Roller Work.....	0.53	
		<i>For Oil Based Paint, Add</i>	0.03	
		<i>For Up To 100, Add</i>	0.33	
		<i>For >100 To 250, Add</i>	0.16	
		<i>For >250 To 500, Add</i>	0.07	
		<i>For >2,500 To 5,000, Deduct</i>	-0.03	
		<i>For >5,000 To 10,000, Deduct</i>	-0.05	
		<i>For >10,000 To 20,000, Deduct</i>	-0.08	
		<i>For >20,000, Deduct</i>	-0.11	
09 91 23 00-0118	SF	Paint Interior Wood Walls, 1 Coat Paint, Brush/Roller Work.....	0.60	
		<i>For Oil Based Paint, Add</i>	0.04	
		<i>For Up To 100, Add</i>	0.38	
		<i>For >100 To 250, Add</i>	0.18	
		<i>For >250 To 500, Add</i>	0.08	
		<i>For >2,500 To 5,000, Deduct</i>	-0.03	
		<i>For >5,000 To 10,000, Deduct</i>	-0.06	
		<i>For >10,000 To 20,000, Deduct</i>	-0.09	
		<i>For >20,000, Deduct</i>	-0.12	
09 91 23 00-0119	SF	Paint Interior Wood Walls, 2 Coats Paint, Brush/Roller Work.....	1.04	
		<i>For Oil Based Paint, Add</i>	0.06	
		<i>For Up To 100, Add</i>	0.65	
		<i>For >100 To 250, Add</i>	0.31	
		<i>For >250 To 500, Add</i>	0.14	
		<i>For >2,500 To 5,000, Deduct</i>	-0.05	
		<i>For >5,000 To 10,000, Deduct</i>	-0.10	
		<i>For >10,000 To 20,000, Deduct</i>	-0.16	
		<i>For >20,000, Deduct</i>	-0.21	
09 91 23 00-0120	SF	Paint Interior Wood Walls, 1 Coat Primer, Sprayed.....	0.34	
		<i>For Oil Based Paint, Add</i>	0.02	
		<i>For Up To 100, Add</i>	0.18	
		<i>For >100 To 250, Add</i>	0.09	
		<i>For >250 To 500, Add</i>	0.04	
		<i>For >2,500 To 5,000, Deduct</i>	-0.02	
		<i>For >5,000 To 10,000, Deduct</i>	-0.03	
		<i>For >10,000 To 20,000, Deduct</i>	-0.05	
		<i>For >20,000, Deduct</i>	-0.07	
		<i>For Backroll, Add</i>	0.04	
09 91 23 00-0121	SF	Paint Interior Wood Walls, 1 Coat Paint, Sprayed.....	0.43	
		<i>For Oil Based Paint, Add</i>	0.03	
		<i>For Up To 100, Add</i>	0.23	
		<i>For >100 To 250, Add</i>	0.11	
		<i>For >250 To 500, Add</i>	0.05	
		<i>For >2,500 To 5,000, Deduct</i>	-0.02	
		<i>For >5,000 To 10,000, Deduct</i>	-0.04	
		<i>For >10,000 To 20,000, Deduct</i>	-0.06	
		<i>For >20,000, Deduct</i>	-0.09	
		<i>For Backroll, Add</i>	0.05	
09 91 23 00-0122	SF	Paint Interior Wood Walls, 2 Coats Paint, Sprayed.....	0.79	
		<i>For Oil Based Paint, Add</i>	0.05	
		<i>For Up To 100, Add</i>	0.41	
		<i>For >100 To 250, Add</i>	0.20	
		<i>For >250 To 500, Add</i>	0.09	
		<i>For >2,500 To 5,000, Deduct</i>	-0.04	
		<i>For >5,000 To 10,000, Deduct</i>	-0.08	
		<i>For >10,000 To 20,000, Deduct</i>	-0.12	
		<i>For >20,000, Deduct</i>	-0.16	
		<i>For Backroll, Add</i>	0.09	

09 91 23 00-0123 Paint Interior Ceilings (09 91 23)



Finishes	09	9
Painting And Coating	09 90	
Painting	09 91	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 23 00-0124 Paint Interior Acoustical Ceilings <small>(09 91 23 00-0123)</small>		
<i>Note: Includes grid.</i>		
09 91 23 00-0125 SF Paint Interior Acoustical Ceiling, 1 Coat Primer, Brush Work	0.65	
<i>For Oil Based Paint, Add</i>	0.04	
<i>For Up To 100, Add</i>	0.42	
<i>For >100 To 250, Add</i>	0.20	
<i>For >250 To 500, Add</i>	0.09	
<i>For >2,500 To 5,000, Deduct</i>	-0.03	
<i>For >5,000 To 10,000, Deduct</i>	-0.07	
<i>For >10,000 To 20,000, Deduct</i>	-0.10	
<i>For >20,000, Deduct</i>	-0.13	
09 91 23 00-0126 SF Paint Interior Acoustical Ceiling, 1 Coat Paint, Brush Work.....	0.71	
<i>For Oil Based Paint, Add</i>	0.04	
<i>For Up To 100, Add</i>	0.48	
<i>For >100 To 250, Add</i>	0.23	
<i>For >250 To 500, Add</i>	0.10	
<i>For >2,500 To 5,000, Deduct</i>	-0.04	
<i>For >5,000 To 10,000, Deduct</i>	-0.07	
<i>For >10,000 To 20,000, Deduct</i>	-0.11	
<i>For >20,000, Deduct</i>	-0.14	
09 91 23 00-0127 SF Paint Interior Acoustical Ceiling, 2 Coats Paint, Brush Work.....	1.26	
<i>For Oil Based Paint, Add</i>	0.07	
<i>For Up To 100, Add</i>	0.84	
<i>For >100 To 250, Add</i>	0.40	
<i>For >250 To 500, Add</i>	0.17	
<i>For >2,500 To 5,000, Deduct</i>	-0.06	
<i>For >5,000 To 10,000, Deduct</i>	-0.13	
<i>For >10,000 To 20,000, Deduct</i>	-0.19	
<i>For >20,000, Deduct</i>	-0.25	
09 91 23 00-0128 SF Paint Interior Acoustical Ceiling, 1 Coat Primer, Brush/Roller Work.....	0.57	
<i>For Oil Based Paint, Add</i>	0.03	
<i>For Up To 100, Add</i>	0.36	
<i>For >100 To 250, Add</i>	0.17	
<i>For >250 To 500, Add</i>	0.07	
<i>For >2,500 To 5,000, Deduct</i>	-0.03	
<i>For >5,000 To 10,000, Deduct</i>	-0.06	
<i>For >10,000 To 20,000, Deduct</i>	-0.09	
<i>For >20,000, Deduct</i>	-0.11	
09 91 23 00-0129 SF Paint Interior Acoustical Ceiling, 1 Coat Paint, Brush/Roller Work.....	0.56	
<i>For Oil Based Paint, Add</i>	0.03	
<i>For Up To 100, Add</i>	0.37	
<i>For >100 To 250, Add</i>	0.17	
<i>For >250 To 500, Add</i>	0.08	
<i>For >2,500 To 5,000, Deduct</i>	-0.03	
<i>For >5,000 To 10,000, Deduct</i>	-0.06	
<i>For >10,000 To 20,000, Deduct</i>	-0.08	
<i>For >20,000, Deduct</i>	-0.11	
09 91 23 00-0130 SF Paint Interior Acoustical Ceiling, 2 Coats Paint, Brush/Roller Work.....	1.02	
<i>For Oil Based Paint, Add</i>	0.06	
<i>For Up To 100, Add</i>	0.66	
<i>For >100 To 250, Add</i>	0.31	
<i>For >250 To 500, Add</i>	0.14	
<i>For >2,500 To 5,000, Deduct</i>	-0.05	
<i>For >5,000 To 10,000, Deduct</i>	-0.10	
<i>For >10,000 To 20,000, Deduct</i>	-0.15	
<i>For >20,000, Deduct</i>	-0.20	
09 91 23 00-0131 SF Paint Interior Acoustical Ceiling, 1 Coat Primer, Sprayed.....	0.43	
<i>For Oil Based Paint, Add</i>	0.03	
<i>For Up To 100, Add</i>	0.24	
<i>For >100 To 250, Add</i>	0.12	
<i>For >250 To 500, Add</i>	0.05	
<i>For >2,500 To 5,000, Deduct</i>	-0.02	
<i>For >5,000 To 10,000, Deduct</i>	-0.04	
<i>For >10,000 To 20,000, Deduct</i>	-0.06	
<i>For >20,000, Deduct</i>	-0.09	
<i>For Backroll, Add</i>	0.05	
09 91 23 00-0132 SF Paint Interior Acoustical Ceiling, 1 Coat Paint, Sprayed.....	0.42	
<i>For Oil Based Paint, Add</i>	0.03	
<i>For Up To 100, Add</i>	0.25	
<i>For >100 To 250, Add</i>	0.12	
<i>For >250 To 500, Add</i>	0.05	
<i>For >2,500 To 5,000, Deduct</i>	-0.02	
<i>For >5,000 To 10,000, Deduct</i>	-0.04	
<i>For >10,000 To 20,000, Deduct</i>	-0.06	
<i>For >20,000, Deduct</i>	-0.08	
<i>For Backroll, Add</i>	0.05	
09 91 23 00-0133 SF Paint Interior Acoustical Ceiling, 2 Coats Paint, Sprayed	0.68	
<i>For Oil Based Paint, Add</i>	0.04	
<i>For Up To 100, Add</i>	0.38	
<i>For >100 To 250, Add</i>	0.19	
<i>For >250 To 500, Add</i>	0.08	
<i>For >2,500 To 5,000, Deduct</i>	-0.03	
<i>For >5,000 To 10,000, Deduct</i>	-0.07	
<i>For >10,000 To 20,000, Deduct</i>	-0.10	
<i>For >20,000, Deduct</i>	-0.14	
<i>For Backroll, Add</i>	0.08	

09 Finishes**09 90 Painting And Coating****09 91 Painting**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 23 00-0134			Paint Interior Concrete Ceilings (09 91 23 00-0123)		
09 91 23 00-0135	SF		Paint Interior Concrete Ceiling, 1 Coat Filler, Brush Work.....	0.65	
			For Oil Based Paint, Add	0.04	
			For Epoxy Paint, Add	0.07	
			For Up To 100, Add	0.42	
			For >100 To 250, Add	0.20	
			For >250 To 500, Add	0.09	
			For >2,500 To 5,000, Deduct	-0.03	
			For >5,000 To 10,000, Deduct	-0.07	
			For >10,000 To 20,000, Deduct	-0.10	
			For >20,000, Deduct	-0.13	
09 91 23 00-0136	SF		Paint Interior Concrete Ceiling, 1 Coat Paint, Brush Work.....	0.71	
			For Oil Based Paint, Add	0.04	
			For Epoxy Paint, Add	0.06	
			For Up To 100, Add	0.48	
			For >100 To 250, Add	0.23	
			For >250 To 500, Add	0.10	
			For >2,500 To 5,000, Deduct	-0.04	
			For >5,000 To 10,000, Deduct	-0.07	
			For >10,000 To 20,000, Deduct	-0.11	
			For >20,000, Deduct	-0.14	
09 91 23 00-0137	SF		Paint Interior Concrete Ceiling, 2 Coats Paint, Brush Work.....	1.26	
			For Oil Based Paint, Add	0.07	
			For Epoxy Paint, Add	0.11	
			For Up To 100, Add	0.84	
			For >100 To 250, Add	0.40	
			For >250 To 500, Add	0.17	
			For >2,500 To 5,000, Deduct	-0.06	
			For >5,000 To 10,000, Deduct	-0.13	
			For >10,000 To 20,000, Deduct	-0.19	
			For >20,000, Deduct	-0.25	
09 91 23 00-0138	SF		Paint Interior Concrete Ceiling, 1 Coat Filler, Brush/Roller Work.....	0.50	
			For Oil Based Paint, Add	0.03	
			For Epoxy Paint, Add	0.06	
			For Up To 100, Add	0.31	
			For >100 To 250, Add	0.15	
			For >250 To 500, Add	0.06	
			For >2,500 To 5,000, Deduct	-0.03	
			For >5,000 To 10,000, Deduct	-0.05	
			For >10,000 To 20,000, Deduct	-0.08	
			For >20,000, Deduct	-0.10	
09 91 23 00-0139	SF		Paint Interior Concrete Ceiling, 1 Coat Paint, Brush/Roller Work.....	0.56	
			For Oil Based Paint, Add	0.03	
			For Epoxy Paint, Add	0.06	
			For Up To 100, Add	0.37	
			For >100 To 250, Add	0.17	
			For >250 To 500, Add	0.08	
			For >2,500 To 5,000, Deduct	-0.03	
			For >5,000 To 10,000, Deduct	-0.06	
			For >10,000 To 20,000, Deduct	-0.08	
			For >20,000, Deduct	-0.11	
09 91 23 00-0140	SF		Paint Interior Concrete Ceiling, 2 Coats Paint, Brush/Roller Work.....	1.02	
			For Oil Based Paint, Add	0.06	
			For Epoxy Paint, Add	0.10	
			For Up To 100, Add	0.66	
			For >100 To 250, Add	0.31	
			For >250 To 500, Add	0.14	
			For >2,500 To 5,000, Deduct	-0.05	
			For >5,000 To 10,000, Deduct	-0.10	
			For >10,000 To 20,000, Deduct	-0.15	
			For >20,000, Deduct	-0.20	
09 91 23 00-0141	SF		Paint Interior Concrete Ceiling, 1 Coat Filler, Sprayed.....	0.41	
			For Oil Based Paint, Add	0.03	
			For Epoxy Paint, Add	0.06	
			For Up To 100, Add	0.23	
			For >100 To 250, Add	0.11	
			For >250 To 500, Add	0.05	
			For >2,500 To 5,000, Deduct	-0.02	
			For >5,000 To 10,000, Deduct	-0.04	
			For >10,000 To 20,000, Deduct	-0.06	
			For >20,000, Deduct	-0.08	
			For Backroll, Add	0.05	
09 91 23 00-0142	SF		Paint Interior Concrete Ceiling, 1 Coat Paint, Sprayed.....	0.42	
			For Oil Based Paint, Add	0.03	
			For Epoxy Paint, Add	0.05	
			For Up To 100, Add	0.25	
			For >100 To 250, Add	0.12	
			For >250 To 500, Add	0.05	
			For >2,500 To 5,000, Deduct	-0.02	
			For >5,000 To 10,000, Deduct	-0.04	
			For >10,000 To 20,000, Deduct	-0.06	
			For >20,000, Deduct	-0.08	
			For Backroll, Add	0.05	



Finishes	09	9
Painting And Coating	09 90	
Painting	09 91	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 23 00-0143 SF Paint Interior Concrete Ceiling, 2 Coats Paint, Sprayed	0.68	
For Oil Based Paint, Add	0.04	
For Epoxy Paint, Add	0.10	
For Up To 100, Add	0.38	
For >100 To 250, Add	0.19	
For >250 To 500, Add	0.08	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.07	
For >10,000 To 20,000, Deduct	-0.10	
For >20,000, Deduct	-0.14	
For Backroll, Add	0.08	
09 91 23 00-0144 SF Paint Interior Concrete Ceiling, 1 Coat Bonding Agent, Brush Work	0.67	
For Up To 100, Add	0.42	
For >100 To 250, Add	0.20	
For >250 To 500, Add	0.09	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.07	
For >10,000 To 20,000, Deduct	-0.10	
For >20,000, Deduct	-0.13	
09 91 23 00-0145 SF Paint Interior Concrete Ceiling, 1 Coat Bonding Agent, Brush/Roller	0.52	
For Up To 100, Add	0.31	
For >100 To 250, Add	0.15	
For >250 To 500, Add	0.07	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.05	
For >10,000 To 20,000, Deduct	-0.08	
For >20,000, Deduct	-0.10	
09 91 23 00-0146 SF Paint Interior Concrete Ceiling, 1 Coat Bonding Agent, Sprayed	0.43	
For Up To 100, Add	0.23	
For >100 To 250, Add	0.11	
For >250 To 500, Add	0.05	
For >2,500 To 5,000, Deduct	-0.02	
For >5,000 To 10,000, Deduct	-0.04	
For >10,000 To 20,000, Deduct	-0.06	
For >20,000, Deduct	-0.09	
For Backroll, Add	0.05	
09 91 23 00-0147 Paint Interior Drywall/Plaster Ceilings (09 91 23 00-0123)		
09 91 23 00-0148 SF Paint Interior Drywall/Plaster Ceiling, 1 Coat Primer, Brush Work	0.65	
For Oil Based Paint, Add	0.04	
For Orange Peel Finish, Add	0.09	
For Up To 100, Add	0.42	
For >100 To 250, Add	0.20	
For >250 To 500, Add	0.09	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.07	
For >10,000 To 20,000, Deduct	-0.10	
For >20,000, Deduct	-0.13	
09 91 23 00-0149 SF Paint Interior Drywall/Plaster Ceiling, 1 Coat Paint, Brush Work	0.71	
For Oil Based Paint, Add	0.04	
For Orange Peel Finish, Add	0.10	
For Up To 100, Add	0.48	
For >100 To 250, Add	0.23	
For >250 To 500, Add	0.10	
For >2,500 To 5,000, Deduct	-0.04	
For >5,000 To 10,000, Deduct	-0.07	
For >10,000 To 20,000, Deduct	-0.11	
For >20,000, Deduct	-0.14	
09 91 23 00-0150 SF Paint Interior Drywall/Plaster Ceiling, 2 Coats Paint, Brush Work	1.26	
For Oil Based Paint, Add	0.07	
For Orange Peel Finish, Add	0.18	
For Up To 100, Add	0.84	
For >100 To 250, Add	0.40	
For >250 To 500, Add	0.17	
For >2,500 To 5,000, Deduct	-0.06	
For >5,000 To 10,000, Deduct	-0.13	
For >10,000 To 20,000, Deduct	-0.19	
For >20,000, Deduct	-0.25	
09 91 23 00-0151 SF Paint Interior Drywall/Plaster Ceiling, 1 Coat Primer, Brush/Roller Work	0.57	
For Oil Based Paint, Add	0.03	
For Orange Peel Finish, Add	0.08	
For Up To 100, Add	0.36	
For >100 To 250, Add	0.17	
For >250 To 500, Add	0.07	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.06	
For >10,000 To 20,000, Deduct	-0.09	
For >20,000, Deduct	-0.11	

09 Finishes**09 90 Painting And Coating****09 91 Painting**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 23 00-0152	SF		Paint Interior Drywall/Plaster Ceiling, 1 Coat Paint, Brush/Roller Work	0.56	
			<i>For Oil Based Paint, Add</i>	0.03	
			<i>For Orange Peel Finish, Add</i>	0.08	
			<i>For Up To 100, Add</i>	0.37	
			<i>For >100 To 250, Add</i>	0.17	
			<i>For >250 To 500, Add</i>	0.08	
			<i>For >2,500 To 5,000, Deduct</i>	-0.03	
			<i>For >5,000 To 10,000, Deduct</i>	-0.06	
			<i>For >10,000 To 20,000, Deduct</i>	-0.08	
			<i>For >20,000, Deduct</i>	-0.11	
09 91 23 00-0153	SF		Paint Interior Drywall/Plaster Ceiling, 2 Coats Paint, Brush/Roller Work	1.02	
			<i>For Oil Based Paint, Add</i>	0.06	
			<i>For Orange Peel Finish, Add</i>	0.14	
			<i>For Up To 100, Add</i>	0.66	
			<i>For >100 To 250, Add</i>	0.31	
			<i>For >250 To 500, Add</i>	0.14	
			<i>For >2,500 To 5,000, Deduct</i>	-0.05	
			<i>For >5,000 To 10,000, Deduct</i>	-0.10	
			<i>For >10,000 To 20,000, Deduct</i>	-0.15	
			<i>For >20,000, Deduct</i>	-0.20	
09 91 23 00-0154	SF		Paint Interior Drywall/Plaster Ceiling, 1 Coat Primer, Sprayed	0.43	
			<i>For Oil Based Paint, Add</i>	0.03	
			<i>For Up To 100, Add</i>	0.24	
			<i>For >100 To 250, Add</i>	0.12	
			<i>For >250 To 500, Add</i>	0.05	
			<i>For >2,500 To 5,000, Deduct</i>	-0.02	
			<i>For >5,000 To 10,000, Deduct</i>	-0.04	
			<i>For >10,000 To 20,000, Deduct</i>	-0.06	
			<i>For >20,000, Deduct</i>	-0.09	
			<i>For Backroll, Add</i>	0.05	
09 91 23 00-0155	SF		Paint Interior Drywall/Plaster Ceiling, 1 Coat Paint, Sprayed	0.42	
			<i>For Oil Based Paint, Add</i>	0.03	
			<i>For Up To 100, Add</i>	0.25	
			<i>For >100 To 250, Add</i>	0.12	
			<i>For >250 To 500, Add</i>	0.05	
			<i>For >2,500 To 5,000, Deduct</i>	-0.02	
			<i>For >5,000 To 10,000, Deduct</i>	-0.04	
			<i>For >10,000 To 20,000, Deduct</i>	-0.06	
			<i>For >20,000, Deduct</i>	-0.08	
			<i>For Backroll, Add</i>	0.05	
09 91 23 00-0156	SF		Paint Interior Drywall/Plaster Ceiling, 2 Coats Paint, Sprayed	0.68	
			<i>For Oil Based Paint, Add</i>	0.04	
			<i>For Up To 100, Add</i>	0.38	
			<i>For >100 To 250, Add</i>	0.19	
			<i>For >250 To 500, Add</i>	0.08	
			<i>For >2,500 To 5,000, Deduct</i>	-0.03	
			<i>For >5,000 To 10,000, Deduct</i>	-0.07	
			<i>For >10,000 To 20,000, Deduct</i>	-0.10	
			<i>For >20,000, Deduct</i>	-0.14	
			<i>For Backroll, Add</i>	0.08	
09 91 23 00-0157			Paint Interior Metal Ceilings <small>(09 91 23 00-0123)</small>		
09 91 23 00-0158			Galvanized Surfaces, Galvanized Primer <small>(09 91 23 00-0157)</small>		
			Note: Linseed oil or acrylic latex paint.		
09 91 23 00-0159	SF		Paint Interior Galvanized Ceiling, 1 Coat Primer, Brush Work	0.77	
			<i>For Electrostatic Painting, Add</i>	0.10	
			<i>For Up To 100, Add</i>	0.49	
			<i>For >100 To 250, Add</i>	0.23	
			<i>For >250 To 500, Add</i>	0.10	
			<i>For >2,500 To 5,000, Deduct</i>	-0.04	
			<i>For >5,000 To 10,000, Deduct</i>	-0.08	
			<i>For >10,000 To 20,000, Deduct</i>	-0.12	
			<i>For >20,000, Deduct</i>	-0.15	
09 91 23 00-0160	SF		Paint Interior Galvanized Ceiling, 1 Coat Paint, Brush Work	0.85	
			<i>For Electrostatic Painting, Add</i>	0.11	
			<i>For Up To 100, Add</i>	0.55	
			<i>For >100 To 250, Add</i>	0.26	
			<i>For >250 To 500, Add</i>	0.11	
			<i>For >2,500 To 5,000, Deduct</i>	-0.04	
			<i>For >5,000 To 10,000, Deduct</i>	-0.09	
			<i>For >10,000 To 20,000, Deduct</i>	-0.13	
			<i>For >20,000, Deduct</i>	-0.17	
09 91 23 00-0161	SF		Paint Interior Galvanized Ceiling, 2 Coats Paint, Brush Work	1.54	
			<i>For Electrostatic Painting, Add</i>	0.20	
			<i>For Up To 100, Add</i>	0.98	
			<i>For >100 To 250, Add</i>	0.46	
			<i>For >250 To 500, Add</i>	0.20	
			<i>For >2,500 To 5,000, Deduct</i>	-0.08	
			<i>For >5,000 To 10,000, Deduct</i>	-0.15	
			<i>For >10,000 To 20,000, Deduct</i>	-0.23	
			<i>For >20,000, Deduct</i>	-0.31	



Finishes	09	9
Painting And Coating	09 90	
Painting	09 91	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 23 00-0162 SF Paint Interior Galvanized Ceiling, 1 Coat Primer, Brush/Roller Work.....	0.59	
For Electrostatic Painting, Add	0.08	
For Up To 100, Add	0.37	
For >100 To 250, Add	0.18	
For >250 To 500, Add	0.08	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.06	
For >10,000 To 20,000, Deduct	-0.09	
For >20,000, Deduct	-0.12	
09 91 23 00-0163 SF Paint Interior Galvanized Ceiling, 1 Coat Paint, Brush/Roller Work.....	0.66	
For Electrostatic Painting, Add	0.08	
For Up To 100, Add	0.42	
For >100 To 250, Add	0.20	
For >250 To 500, Add	0.09	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.07	
For >10,000 To 20,000, Deduct	-0.10	
For >20,000, Deduct	-0.13	
09 91 23 00-0164 SF Paint Interior Galvanized Ceiling, 2 Coats Paint, Brush/Roller Work.....	1.22	
For Electrostatic Painting, Add	0.16	
For Up To 100, Add	0.77	
For >100 To 250, Add	0.37	
For >250 To 500, Add	0.16	
For >2,500 To 5,000, Deduct	-0.06	
For >5,000 To 10,000, Deduct	-0.12	
For >10,000 To 20,000, Deduct	-0.18	
For >20,000, Deduct	-0.24	
09 91 23 00-0165 SF Paint Interior Galvanized Ceiling, 1 Coat Primer, Sprayed.....	0.48	
For Electrostatic Painting, Add	0.07	
For Up To 100, Add	0.26	
For >100 To 250, Add	0.13	
For >250 To 500, Add	0.06	
For >2,500 To 5,000, Deduct	-0.02	
For >5,000 To 10,000, Deduct	-0.05	
For >10,000 To 20,000, Deduct	-0.07	
For >20,000, Deduct	-0.10	
For Backroll, Add	0.06	
09 91 23 00-0166 SF Paint Interior Galvanized Ceiling, 1 Coat Paint, Sprayed.....	0.56	
For Electrostatic Painting, Add	0.08	
For Up To 100, Add	0.32	
For >100 To 250, Add	0.15	
For >250 To 500, Add	0.07	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.06	
For >10,000 To 20,000, Deduct	-0.08	
For >20,000, Deduct	-0.11	
For Backroll, Add	0.07	
09 91 23 00-0167 SF Paint Interior Galvanized Ceiling, 2 Coats Paint, Sprayed.....	0.88	
For Electrostatic Painting, Add	0.14	
For Up To 100, Add	0.46	
For >100 To 250, Add	0.22	
For >250 To 500, Add	0.10	
For >2,500 To 5,000, Deduct	-0.04	
For >5,000 To 10,000, Deduct	-0.09	
For >10,000 To 20,000, Deduct	-0.13	
For >20,000, Deduct	-0.18	
For Backroll, Add	0.10	
09 91 23 00-0168 Aluminum And Aluminum Alloy Surface Pretreatment Primer <small>(09 91 23 00-0157)</small>		
Note: Alkyd enamel paint.		
09 91 23 00-0169 SF Paint Interior Aluminum And Aluminum Alloy Ceiling, 1 Coat Primer, Brush Work.....	0.77	
For Electrostatic Painting, Add	0.10	
For Up To 100, Add	0.49	
For >100 To 250, Add	0.23	
For >250 To 500, Add	0.10	
For >2,500 To 5,000, Deduct	-0.04	
For >5,000 To 10,000, Deduct	-0.08	
For >10,000 To 20,000, Deduct	-0.12	
For >20,000, Deduct	-0.15	
09 91 23 00-0170 SF Paint Interior Aluminum And Aluminum Alloy Ceiling, 1 Coat Paint, Brush Work.....	0.85	
For Electrostatic Painting, Add	0.11	
For Up To 100, Add	0.55	
For >100 To 250, Add	0.26	
For >250 To 500, Add	0.11	
For >2,500 To 5,000, Deduct	-0.04	
For >5,000 To 10,000, Deduct	-0.09	
For >10,000 To 20,000, Deduct	-0.13	
For >20,000, Deduct	-0.17	

09 Finishes**09 90 Painting And Coating****09 91 Painting**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 23 00-0171	SF		Paint Interior Aluminum And Aluminum Alloy Ceiling, 2 Coats Paint, Brush Work.....	1.54	
			<i>For Electrostatic Painting, Add</i>	0.20	
			<i>For Up To 100, Add</i>	0.98	
			<i>For >100 To 250, Add</i>	0.46	
			<i>For >250 To 500, Add</i>	0.20	
			<i>For >2,500 To 5,000, Deduct</i>	-0.08	
			<i>For >5,000 To 10,000, Deduct</i>	-0.15	
			<i>For >10,000 To 20,000, Deduct</i>	-0.23	
			<i>For >20,000, Deduct</i>	-0.31	
09 91 23 00-0172	SF		Paint Interior Aluminum And Aluminum Alloy Ceiling, 1 Coat Primer, Brush/Roller Work.....	0.64	
			<i>For Electrostatic Painting, Add</i>	0.09	
			<i>For Up To 100, Add</i>	0.38	
			<i>For >100 To 250, Add</i>	0.18	
			<i>For >250 To 500, Add</i>	0.08	
			<i>For >2,500 To 5,000, Deduct</i>	-0.03	
			<i>For >5,000 To 10,000, Deduct</i>	-0.06	
			<i>For >10,000 To 20,000, Deduct</i>	-0.10	
			<i>For >20,000, Deduct</i>	-0.13	
09 91 23 00-0173	SF		Paint Interior Aluminum And Aluminum Alloy Ceiling, 1 Coat Paint, Brush/Roller Work.....	0.71	
			<i>For Electrostatic Painting, Add</i>	0.10	
			<i>For Up To 100, Add</i>	0.43	
			<i>For >100 To 250, Add</i>	0.21	
			<i>For >250 To 500, Add</i>	0.09	
			<i>For >2,500 To 5,000, Deduct</i>	-0.04	
			<i>For >5,000 To 10,000, Deduct</i>	-0.07	
			<i>For >10,000 To 20,000, Deduct</i>	-0.11	
			<i>For >20,000, Deduct</i>	-0.14	
09 91 23 00-0174	SF		Paint Interior Aluminum And Aluminum Alloy Ceiling, 2 Coats Paint, Brush/Roller Work.....	1.34	
			<i>For Electrostatic Painting, Add</i>	0.19	
			<i>For Up To 100, Add</i>	0.80	
			<i>For >100 To 250, Add</i>	0.38	
			<i>For >250 To 500, Add</i>	0.17	
			<i>For >2,500 To 5,000, Deduct</i>	-0.07	
			<i>For >5,000 To 10,000, Deduct</i>	-0.13	
			<i>For >10,000 To 20,000, Deduct</i>	-0.20	
			<i>For >20,000, Deduct</i>	-0.27	
09 91 23 00-0175	SF		Paint Interior Aluminum And Aluminum Alloy Ceiling, 1 Coat Primer, Sprayed.....	0.48	
			<i>For Electrostatic Painting, Add</i>	0.07	
			<i>For Up To 100, Add</i>	0.26	
			<i>For >100 To 250, Add</i>	0.13	
			<i>For >250 To 500, Add</i>	0.06	
			<i>For >2,500 To 5,000, Deduct</i>	-0.02	
			<i>For >5,000 To 10,000, Deduct</i>	-0.05	
			<i>For >10,000 To 20,000, Deduct</i>	-0.07	
			<i>For >20,000, Deduct</i>	-0.10	
			<i>For Backroll, Add</i>	0.06	
09 91 23 00-0176	SF		Paint Interior Aluminum And Aluminum Alloy Ceiling, 1 Coat Paint, Sprayed.....	0.56	
			<i>For Electrostatic Painting, Add</i>	0.08	
			<i>For Up To 100, Add</i>	0.32	
			<i>For >100 To 250, Add</i>	0.15	
			<i>For >250 To 500, Add</i>	0.07	
			<i>For >2,500 To 5,000, Deduct</i>	-0.03	
			<i>For >5,000 To 10,000, Deduct</i>	-0.06	
			<i>For >10,000 To 20,000, Deduct</i>	-0.08	
			<i>For >20,000, Deduct</i>	-0.11	
			<i>For Backroll, Add</i>	0.07	
09 91 23 00-0177	SF		Paint Interior Aluminum And Aluminum Alloy Ceiling, 2 Coats Paint, Sprayed.....	0.88	
			<i>For Electrostatic Painting, Add</i>	0.14	
			<i>For Up To 100, Add</i>	0.46	
			<i>For >100 To 250, Add</i>	0.22	
			<i>For >250 To 500, Add</i>	0.10	
			<i>For >2,500 To 5,000, Deduct</i>	-0.04	
			<i>For >5,000 To 10,000, Deduct</i>	-0.09	
			<i>For >10,000 To 20,000, Deduct</i>	-0.13	
			<i>For >20,000, Deduct</i>	-0.18	
			<i>For Backroll, Add</i>	0.10	
09 91 23 00-0178			Paint Interior Ceiling Tile Grid (09 91 23 00-0157)		
			Note: Grid only.		
09 91 23 00-0179	LF		Paint Interior Ceiling Tile Grid, 1 Coat Paint, Brush/Roller Work.....	0.16	
			<i>For Electrostatic Painting, Add</i>	0.02	
			<i>For Up To 100, Add</i>	0.11	
			<i>For >100 To 250, Add</i>	0.05	
			<i>For >250 To 500, Add</i>	0.02	
			<i>For >2,500 To 5,000, Deduct</i>	-0.01	
			<i>For >5,000 To 10,000, Deduct</i>	-0.02	
			<i>For >10,000 To 20,000, Deduct</i>	-0.02	
			<i>For >20,000, Deduct</i>	-0.03	



Finishes	09	9
Painting And Coating	09 90	
Painting	09 91	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 23 00-0180 LF Paint Interior Ceiling Tile Grid, 2 Coats Paint, Brush/Roller Work.....	0.33	
For Electrostatic Painting, Add	0.04	
For Up To 100, Add	0.22	
For >100 To 250, Add	0.11	
For >250 To 500, Add	0.05	
For >2,500 To 5,000, Deduct	-0.02	
For >5,000 To 10,000, Deduct	-0.03	
For >10,000 To 20,000, Deduct	-0.05	
For >20,000, Deduct	-0.07	
09 91 23 00-0181 Paint Interior Corrugated Metal Ceilings (09 91 23 00-0157)	0.65	
09 91 23 00-0182 SF Paint Interior Corrugated Metal Ceiling, 1 Coat Primer, Sprayed.....	0.65	
For Electrostatic Painting, Add	0.10	
For Up To 100, Add	0.35	
For >100 To 250, Add	0.17	
For >250 To 500, Add	0.07	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.07	
For >10,000 To 20,000, Deduct	-0.10	
For >20,000, Deduct	-0.13	
For Backroll, Add	0.07	
09 91 23 00-0183 SF Paint Interior Corrugated Metal Ceiling, 1 Coat Paint, Sprayed.....	0.74	
For Electrostatic Painting, Add	0.11	
For Up To 100, Add	0.42	
For >100 To 250, Add	0.20	
For >250 To 500, Add	0.09	
For >2,500 To 5,000, Deduct	-0.04	
For >5,000 To 10,000, Deduct	-0.07	
For >10,000 To 20,000, Deduct	-0.11	
For >20,000, Deduct	-0.15	
For Backroll, Add	0.09	
09 91 23 00-0184 SF Paint Interior Corrugated Metal Ceiling, 2 Coats Paint, Sprayed.....	1.18	
For Electrostatic Painting, Add	0.19	
For Up To 100, Add	0.61	
For >100 To 250, Add	0.30	
For >250 To 500, Add	0.13	
For >2,500 To 5,000, Deduct	-0.06	
For >5,000 To 10,000, Deduct	-0.12	
For >10,000 To 20,000, Deduct	-0.18	
For >20,000, Deduct	-0.24	
For Backroll, Add	0.13	
09 91 23 00-0185 Paint Interior Wood Ceilings (09 91 23 00-0123)		
09 91 23 00-0186 Paint Interior Smooth Wood Ceilings (09 91 23 00-0185)		
09 91 23 00-0187 SF Paint Interior Wood Smooth Ceiling, 1 Coat Primer, Brush Work.....	0.79	
For Oil Based Paint, Add	0.05	
For Up To 100, Add	0.50	
For >100 To 250, Add	0.24	
For >250 To 500, Add	0.10	
For >2,500 To 5,000, Deduct	-0.04	
For >5,000 To 10,000, Deduct	-0.08	
For >10,000 To 20,000, Deduct	-0.12	
For >20,000, Deduct	-0.16	
09 91 23 00-0188 SF Paint Interior Wood Smooth Ceiling, 1 Coat Paint, Brush Work.....	0.83	
For Oil Based Paint, Add	0.05	
For Up To 100, Add	0.54	
For >100 To 250, Add	0.26	
For >250 To 500, Add	0.11	
For >2,500 To 5,000, Deduct	-0.04	
For >5,000 To 10,000, Deduct	-0.08	
For >10,000 To 20,000, Deduct	-0.12	
For >20,000, Deduct	-0.17	
09 91 23 00-0189 SF Paint Interior Wood Smooth Ceiling, 2 Coats Paint, Brush Work.....	1.50	
For Oil Based Paint, Add	0.09	
For Up To 100, Add	0.97	
For >100 To 250, Add	0.46	
For >250 To 500, Add	0.20	
For >2,500 To 5,000, Deduct	-0.08	
For >5,000 To 10,000, Deduct	-0.15	
For >10,000 To 20,000, Deduct	-0.23	
For >20,000, Deduct	-0.30	
09 91 23 00-0190 SF Paint Interior Smooth Wood Ceiling, 1 Coat Primer, Brush/Roller Work.....	0.64	
For Oil Based Paint, Add	0.04	
For Up To 100, Add	0.38	
For >100 To 250, Add	0.18	
For >250 To 500, Add	0.08	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.06	
For >10,000 To 20,000, Deduct	-0.10	
For >20,000, Deduct	-0.13	

09 Finishes**09 90 Painting And Coating****09 91 Painting**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 23 00-0191	SF		Paint Interior Smooth Wood Ceiling, 1 Coat Paint, Brush/Roller Work	0.69	
			<i>For Oil Based Paint, Add</i>	0.04	
			<i>For Up To 100, Add</i>	0.43	
			<i>For >100 To 250, Add</i>	0.20	
			<i>For >250 To 500, Add</i>	0.09	
			<i>For >2,500 To 5,000, Deduct</i>	-0.03	
			<i>For >5,000 To 10,000, Deduct</i>	-0.07	
			<i>For >10,000 To 20,000, Deduct</i>	-0.10	
			<i>For >20,000, Deduct</i>	-0.14	
09 91 23 00-0192	SF		Paint Interior Smooth Wood Ceiling, 2 Coats Paint, Brush/Roller Work.....	1.30	
			<i>For Oil Based Paint, Add</i>	0.08	
			<i>For Up To 100, Add</i>	0.80	
			<i>For >100 To 250, Add</i>	0.38	
			<i>For >250 To 500, Add</i>	0.17	
			<i>For >2,500 To 5,000, Deduct</i>	-0.07	
			<i>For >5,000 To 10,000, Deduct</i>	-0.13	
			<i>For >10,000 To 20,000, Deduct</i>	-0.20	
			<i>For >20,000, Deduct</i>	-0.26	
09 91 23 00-0193	SF		Paint Interior Smooth Wood Ceiling, 1 Coat Primer, Sprayed.....	0.44	
			<i>For Oil Based Paint, Add</i>	0.03	
			<i>For Up To 100, Add</i>	0.25	
			<i>For >100 To 250, Add</i>	0.12	
			<i>For >250 To 500, Add</i>	0.05	
			<i>For >2,500 To 5,000, Deduct</i>	-0.02	
			<i>For >5,000 To 10,000, Deduct</i>	-0.04	
			<i>For >10,000 To 20,000, Deduct</i>	-0.07	
			<i>For >20,000, Deduct</i>	-0.09	
			<i>For Backroll, Add</i>	0.05	
09 91 23 00-0194	SF		Paint Interior Smooth Wood Ceiling, 1 Coat Paint, Sprayed.....	0.52	
			<i>For Oil Based Paint, Add</i>	0.03	
			<i>For Up To 100, Add</i>	0.31	
			<i>For >100 To 250, Add</i>	0.15	
			<i>For >250 To 500, Add</i>	0.07	
			<i>For >2,500 To 5,000, Deduct</i>	-0.03	
			<i>For >5,000 To 10,000, Deduct</i>	-0.05	
			<i>For >10,000 To 20,000, Deduct</i>	-0.08	
			<i>For >20,000, Deduct</i>	-0.10	
			<i>For Backroll, Add</i>	0.07	
09 91 23 00-0195	SF		Paint Interior Smooth Wood Ceiling, 2 Coats Paint, Sprayed	0.80	
			<i>For Oil Based Paint, Add</i>	0.05	
			<i>For Up To 100, Add</i>	0.44	
			<i>For >100 To 250, Add</i>	0.22	
			<i>For >250 To 500, Add</i>	0.09	
			<i>For >2,500 To 5,000, Deduct</i>	-0.04	
			<i>For >5,000 To 10,000, Deduct</i>	-0.08	
			<i>For >10,000 To 20,000, Deduct</i>	-0.12	
			<i>For >20,000, Deduct</i>	-0.16	
			<i>For Backroll, Add</i>	0.09	
09 91 23 00-0196			Paint Interior Wood Beams <small>(09 91 23 00-0123)</small>		
09 91 23 00-0197	SF		Paint Interior Wood Beams, 1 Coat Primer, Brush Work	0.87	
			<i>For Oil Based Paint, Add</i>	0.05	
			<i>For Up To 100, Add</i>	0.56	
			<i>For >100 To 250, Add</i>	0.27	
			<i>For >250 To 500, Add</i>	0.12	
			<i>For >2,500 To 5,000, Deduct</i>	-0.04	
			<i>For >5,000 To 10,000, Deduct</i>	-0.09	
			<i>For >10,000 To 20,000, Deduct</i>	-0.13	
			<i>For >20,000, Deduct</i>	-0.17	
09 91 23 00-0198	SF		Paint Interior Wood Beams, 1 Coat Paint, Brush Work.....	0.89	
			<i>For Oil Based Paint, Add</i>	0.05	
			<i>For Up To 100, Add</i>	0.59	
			<i>For >100 To 250, Add</i>	0.28	
			<i>For >250 To 500, Add</i>	0.12	
			<i>For >2,500 To 5,000, Deduct</i>	-0.04	
			<i>For >5,000 To 10,000, Deduct</i>	-0.09	
			<i>For >10,000 To 20,000, Deduct</i>	-0.13	
			<i>For >20,000, Deduct</i>	-0.18	
09 91 23 00-0199	SF		Paint Interior Wood Beams, 2 Coats Paint, Brush Work	1.64	
			<i>For Oil Based Paint, Add</i>	0.10	
			<i>For Up To 100, Add</i>	1.07	
			<i>For >100 To 250, Add</i>	0.51	
			<i>For >250 To 500, Add</i>	0.22	
			<i>For >2,500 To 5,000, Deduct</i>	-0.08	
			<i>For >5,000 To 10,000, Deduct</i>	-0.16	
			<i>For >10,000 To 20,000, Deduct</i>	-0.25	
			<i>For >20,000, Deduct</i>	-0.33	
09 91 23 00-0200	SF		Paint Interior Wood Beams, 1 Coat Primer, Brush/Roller Work	0.70	
			<i>For Oil Based Paint, Add</i>	0.04	
			<i>For Up To 100, Add</i>	0.42	
			<i>For >100 To 250, Add</i>	0.20	
			<i>For >250 To 500, Add</i>	0.09	
			<i>For >2,500 To 5,000, Deduct</i>	-0.04	
			<i>For >5,000 To 10,000, Deduct</i>	-0.07	
			<i>For >10,000 To 20,000, Deduct</i>	-0.11	
			<i>For >20,000, Deduct</i>	-0.14	



Finishes	09	09
Painting And Coating	09 90	
Painting	09 91	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 23 00-0201 SF Paint Interior Wood Beams, 1 Coat Paint, Brush/Roller Work	0.69	
For Oil Based Paint, Add	0.04	
For Up To 100, Add	0.43	
For >100 To 250, Add	0.20	
For >250 To 500, Add	0.09	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.07	
For >10,000 To 20,000, Deduct	-0.10	
For >20,000, Deduct	-0.14	
09 91 23 00-0202 SF Paint Interior Wood Beams, 2 Coats Paint, Brush/Roller Work.....	1.30	
For Oil Based Paint, Add	0.08	
For Up To 100, Add	0.80	
For >100 To 250, Add	0.38	
For >250 To 500, Add	0.17	
For >2,500 To 5,000, Deduct	-0.07	
For >5,000 To 10,000, Deduct	-0.13	
For >10,000 To 20,000, Deduct	-0.20	
For >20,000, Deduct	-0.26	
09 91 23 00-0203 SF Paint Interior Wood Beams, 1 Coat Primer, Sprayed.....	0.52	
For Oil Based Paint, Add	0.03	
For Up To 100, Add	0.31	
For >100 To 250, Add	0.15	
For >250 To 500, Add	0.07	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.05	
For >10,000 To 20,000, Deduct	-0.08	
For >20,000, Deduct	-0.10	
For Backroll, Add	0.07	
09 91 23 00-0204 SF Paint Interior Wood Beams, 1 Coat Paint, Sprayed.....	1.08	
For Oil Based Paint, Add	0.06	
For Up To 100, Add	0.73	
For >100 To 250, Add	0.35	
For >250 To 500, Add	0.15	
For >2,500 To 5,000, Deduct	-0.05	
For >5,000 To 10,000, Deduct	-0.11	
For >10,000 To 20,000, Deduct	-0.16	
For >20,000, Deduct	-0.22	
For Backroll, Add	0.15	
09 91 23 00-0205 SF Paint Interior Wood Beams, 2 Coats Paint, Sprayed	0.87	
For Oil Based Paint, Add	0.06	
For Up To 100, Add	0.50	
For >100 To 250, Add	0.24	
For >250 To 500, Add	0.10	
For >2,500 To 5,000, Deduct	-0.04	
For >5,000 To 10,000, Deduct	-0.09	
For >10,000 To 20,000, Deduct	-0.13	
For >20,000, Deduct	-0.17	
For Backroll, Add	0.10	
09 91 23 00-0206 Paint Interior Floors And Decks (09 91 23)		
09 91 23 00-0207 Paint Interior Concrete Floors And Decks (09 91 23 00-0206)		
09 91 23 00-0208 SF Paint Interior Concrete Floors And Decks, 1 Coat Primer, Brush Work	0.50	
For Oil Based Paint, Add	0.03	
For Epoxy Paint, Add	0.06	
For Up To 100, Add	0.31	
For >100 To 250, Add	0.15	
For >250 To 500, Add	0.06	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.05	
For >10,000 To 20,000, Deduct	-0.08	
For >20,000, Deduct	-0.10	
09 91 23 00-0209 SF Paint Interior Concrete Floors And Decks, 1 Coat Paint, Brush Work	0.56	
For Oil Based Paint, Add	0.03	
For Epoxy Paint, Add	0.06	
For Up To 100, Add	0.37	
For >100 To 250, Add	0.17	
For >250 To 500, Add	0.08	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.06	
For >10,000 To 20,000, Deduct	-0.08	
For >20,000, Deduct	-0.11	
09 91 23 00-0210 SF Paint Interior Concrete Floors And Decks, 2 Coats Paint, Brush Work.....	1.07	
For Oil Based Paint, Add	0.06	
For Epoxy Paint, Add	0.10	
For Up To 100, Add	0.70	
For >100 To 250, Add	0.33	
For >250 To 500, Add	0.14	
For >2,500 To 5,000, Deduct	-0.05	
For >5,000 To 10,000, Deduct	-0.11	
For >10,000 To 20,000, Deduct	-0.16	
For >20,000, Deduct	-0.21	

09 Finishes**09 90 Painting And Coating****09 91 Painting**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 23 00-0211	SF		Paint Interior Concrete Floors And Decks, 1 Coat Primer, Brush/Roller Work.....	0.49	
			<i>For Oil Based Paint, Add</i>	0.03	
			<i>For Epoxy Paint, Add</i>	0.06	
			<i>For Up To 100, Add</i>	0.30	
			<i>For >100 To 250, Add</i>	0.14	
			<i>For >250 To 500, Add</i>	0.06	
			<i>For >2,500 To 5,000, Deduct</i>	-0.02	
			<i>For >5,000 To 10,000, Deduct</i>	-0.05	
			<i>For >10,000 To 20,000, Deduct</i>	-0.07	
			<i>For >20,000, Deduct</i>	-0.10	
09 91 23 00-0212	SF		Paint Interior Concrete Floors And Decks, 1 Coat Paint, Brush/Roller Work.....	0.48	
			<i>For Oil Based Paint, Add</i>	0.03	
			<i>For Epoxy Paint, Add</i>	0.05	
			<i>For Up To 100, Add</i>	0.31	
			<i>For >100 To 250, Add</i>	0.15	
			<i>For >250 To 500, Add</i>	0.06	
			<i>For >2,500 To 5,000, Deduct</i>	-0.02	
			<i>For >5,000 To 10,000, Deduct</i>	-0.05	
			<i>For >10,000 To 20,000, Deduct</i>	-0.07	
			<i>For >20,000, Deduct</i>	-0.10	
09 91 23 00-0213	SF		Paint Interior Concrete Floors And Decks, 2 Coats Paint, Brush/Roller Work.....	0.78	
			<i>For Oil Based Paint, Add</i>	0.05	
			<i>For Epoxy Paint, Add</i>	0.09	
			<i>For Up To 100, Add</i>	0.48	
			<i>For >100 To 250, Add</i>	0.23	
			<i>For >250 To 500, Add</i>	0.10	
			<i>For >2,500 To 5,000, Deduct</i>	-0.04	
			<i>For >5,000 To 10,000, Deduct</i>	-0.08	
			<i>For >10,000 To 20,000, Deduct</i>	-0.12	
			<i>For >20,000, Deduct</i>	-0.16	
09 91 23 00-0214	SF		Paint Interior Concrete Floors And Decks, 1 Coat Primer, Sprayed.....	0.34	
			<i>For Oil Based Paint, Add</i>	0.02	
			<i>For Epoxy Paint, Add</i>	0.06	
			<i>For Up To 100, Add</i>	0.18	
			<i>For >100 To 250, Add</i>	0.09	
			<i>For >250 To 500, Add</i>	0.04	
			<i>For >2,500 To 5,000, Deduct</i>	-0.02	
			<i>For >5,000 To 10,000, Deduct</i>	-0.03	
			<i>For >10,000 To 20,000, Deduct</i>	-0.05	
			<i>For >20,000, Deduct</i>	-0.07	
			<i>For Backroll, Add</i>	0.04	
09 91 23 00-0215	SF		Paint Interior Concrete Floors And Decks, 1 Coat Paint, Sprayed.....	0.34	
			<i>For Oil Based Paint, Add</i>	0.02	
			<i>For Epoxy Paint, Add</i>	0.05	
			<i>For Up To 100, Add</i>	0.19	
			<i>For >100 To 250, Add</i>	0.09	
			<i>For >250 To 500, Add</i>	0.04	
			<i>For >2,500 To 5,000, Deduct</i>	-0.02	
			<i>For >5,000 To 10,000, Deduct</i>	-0.03	
			<i>For >10,000 To 20,000, Deduct</i>	-0.05	
			<i>For >20,000, Deduct</i>	-0.07	
			<i>For Backroll, Add</i>	0.04	
09 91 23 00-0216	SF		Paint Interior Concrete Floors And Decks, 2 Coats Paint, Sprayed.....	0.60	
			<i>For Oil Based Paint, Add</i>	0.04	
			<i>For Epoxy Paint, Add</i>	0.09	
			<i>For Up To 100, Add</i>	0.32	
			<i>For >100 To 250, Add</i>	0.16	
			<i>For >250 To 500, Add</i>	0.07	
			<i>For >2,500 To 5,000, Deduct</i>	-0.03	
			<i>For >5,000 To 10,000, Deduct</i>	-0.06	
			<i>For >10,000 To 20,000, Deduct</i>	-0.09	
			<i>For >20,000, Deduct</i>	-0.12	
			<i>For Backroll, Add</i>	0.07	
09 91 23 00-0217	SF		Paint Interior Concrete Floors And Decks, 1 Coat Bonding Agent, Brush.....	0.52	
			<i>For Up To 100, Add</i>	0.31	
			<i>For >100 To 250, Add</i>	0.15	
			<i>For >250 To 500, Add</i>	0.07	
			<i>For >2,500 To 5,000, Deduct</i>	-0.03	
			<i>For >5,000 To 10,000, Deduct</i>	-0.05	
			<i>For >10,000 To 20,000, Deduct</i>	-0.08	
			<i>For >20,000, Deduct</i>	-0.10	
09 91 23 00-0218	SF		Paint Interior Concrete Floors And Decks, 1 Coat Bonding Agent, Brush/Roller Work.....	0.51	
			<i>For Up To 100, Add</i>	0.30	
			<i>For >100 To 250, Add</i>	0.15	
			<i>For >250 To 500, Add</i>	0.06	
			<i>For >2,500 To 5,000, Deduct</i>	-0.03	
			<i>For >5,000 To 10,000, Deduct</i>	-0.05	
			<i>For >10,000 To 20,000, Deduct</i>	-0.08	
			<i>For >20,000, Deduct</i>	-0.10	



Finishes	09	09
Painting And Coating	09 90	
Painting	09 91	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 23 00-0219 SF Paint Interior Concrete Floors And Decks, 1 Coat Bonding Agent, Sprayed	0.36	
For Up To 100, Add	0.18	
For >100 To 250, Add	0.09	
For >250 To 500, Add	0.04	
For >2,500 To 5,000, Deduct	-0.02	
For >5,000 To 10,000, Deduct	-0.04	
For >10,000 To 20,000, Deduct	-0.05	
For >20,000, Deduct	-0.07	
For Backroll, Add	0.04	
09 91 23 00-0220 SF Paint Interior Concrete Floors And Decks, 1 Coat Non Slip Paint, Brush Work.....	1.27	
For Up To 100, Add	0.47	
For >100 To 250, Add	0.24	
For >250 To 500, Add	0.11	
For >2,500 To 5,000, Deduct	-0.06	
For >5,000 To 10,000, Deduct	-0.13	
For >10,000 To 20,000, Deduct	-0.19	
For >20,000, Deduct	-0.25	
09 91 23 00-0221 SF Paint Interior Concrete Floors And Decks, 1 Coat Non Slip Epoxy Coating, Brush Work (Rust-Oleum® AS91864251).....	3.44	
For Up To 100, Add	0.80	
For >100 To 250, Add	0.46	
For >250 To 500, Add	0.22	
For >2,500 To 5,000, Deduct	-0.17	
For >5,000 To 10,000, Deduct	-0.34	
For >10,000 To 20,000, Deduct	-0.52	
For >20,000, Deduct	-0.69	
09 91 23 00-0222 Paint Interior Wood Floors And Decks (09 91 23 00-0206)		
09 91 23 00-0223 SF Paint Interior Wood Floors And Decks, 1 Coat Primer, Brush Work.....	0.62	
For Oil Based Paint, Add	0.04	
For Up To 100, Add	0.38	
For >100 To 250, Add	0.18	
For >250 To 500, Add	0.08	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.06	
For >10,000 To 20,000, Deduct	-0.09	
For >20,000, Deduct	-0.12	
09 91 23 00-0224 SF Paint Interior Wood Floors And Decks, 1 Coat Paint, Brush Work.....	0.67	
For Oil Based Paint, Add	0.04	
For Up To 100, Add	0.42	
For >100 To 250, Add	0.20	
For >250 To 500, Add	0.09	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.07	
For >10,000 To 20,000, Deduct	-0.10	
For >20,000, Deduct	-0.13	
09 91 23 00-0225 SF Paint Interior Wood Floors And Decks, 2 Coats Paint, Brush Work.....	1.27	
For Oil Based Paint, Add	0.08	
For Up To 100, Add	0.80	
For >100 To 250, Add	0.38	
For >250 To 500, Add	0.16	
For >2,500 To 5,000, Deduct	-0.06	
For >5,000 To 10,000, Deduct	-0.13	
For >10,000 To 20,000, Deduct	-0.19	
For >20,000, Deduct	-0.25	
09 91 23 00-0226 SF Paint Interior Wood Floors And Decks, 1 Coat Primer, Brush/Roller Work.....	0.50	
For Oil Based Paint, Add	0.03	
For Up To 100, Add	0.27	
For >100 To 250, Add	0.13	
For >250 To 500, Add	0.06	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.05	
For >10,000 To 20,000, Deduct	-0.08	
For >20,000, Deduct	-0.10	
09 91 23 00-0227 SF Paint Interior Wood Floors And Decks, 1 Coat Paint, Brush/Roller Work	0.54	
For Oil Based Paint, Add	0.03	
For Up To 100, Add	0.32	
For >100 To 250, Add	0.15	
For >250 To 500, Add	0.07	
For >2,500 To 5,000, Deduct	-0.03	
For >5,000 To 10,000, Deduct	-0.05	
For >10,000 To 20,000, Deduct	-0.08	
For >20,000, Deduct	-0.11	
09 91 23 00-0228 SF Paint Interior Wood Floors And Decks, 2 Coats Paint, Brush/Roller Work	1.06	
For Oil Based Paint, Add	0.07	
For Up To 100, Add	0.62	
For >100 To 250, Add	0.30	
For >250 To 500, Add	0.13	
For >2,500 To 5,000, Deduct	-0.05	
For >5,000 To 10,000, Deduct	-0.11	
For >10,000 To 20,000, Deduct	-0.16	
For >20,000, Deduct	-0.21	

09	Finishes
09 90	Painting And Coating
09 91	Painting



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 23 00-0229	SF		Paint Interior Wood Floors And Decks, 1 Coat Primer, Sprayed.....	0.36	
			<i>For Oil Based Paint, Add</i>	0.02	
			<i>For Up To 100, Add</i>	0.19	
			<i>For >100 To 250, Add</i>	0.09	
			<i>For >250 To 500, Add</i>	0.04	
			<i>For >2,500 To 5,000, Deduct</i>	-0.02	
			<i>For >5,000 To 10,000, Deduct</i>	-0.04	
			<i>For >10,000 To 20,000, Deduct</i>	-0.05	
			<i>For >20,000, Deduct</i>	-0.07	
			<i>For Backroll, Add</i>	0.04	
09 91 23 00-0230	SF		Paint Interior Wood Floors And Decks, 1 Coat Paint, Sprayed.....	0.44	
			<i>For Oil Based Paint, Add</i>	0.03	
			<i>For Up To 100, Add</i>	0.25	
			<i>For >100 To 250, Add</i>	0.12	
			<i>For >250 To 500, Add</i>	0.05	
			<i>For >2,500 To 5,000, Deduct</i>	-0.02	
			<i>For >5,000 To 10,000, Deduct</i>	-0.04	
			<i>For >10,000 To 20,000, Deduct</i>	-0.07	
			<i>For >20,000, Deduct</i>	-0.09	
			<i>For Backroll, Add</i>	0.05	
09 91 23 00-0231	SF		Paint Interior Wood Floors And Decks, 2 Coats Paint, Sprayed.....	0.66	
			<i>For Oil Based Paint, Add</i>	0.05	
			<i>For Up To 100, Add</i>	0.34	
			<i>For >100 To 250, Add</i>	0.17	
			<i>For >250 To 500, Add</i>	0.07	
			<i>For >2,500 To 5,000, Deduct</i>	-0.03	
			<i>For >5,000 To 10,000, Deduct</i>	-0.07	
			<i>For >10,000 To 20,000, Deduct</i>	-0.10	
			<i>For >20,000, Deduct</i>	-0.13	
			<i>For Backroll, Add</i>	0.07	
09 91 23 00-0232	SF		Paint Interior Wood Floors And Decks, 1 Coat Non Slip Paint, Brush Work.....	1.27	
			<i>For Up To 100, Add</i>	0.47	
			<i>For >100 To 250, Add</i>	0.24	
			<i>For >250 To 500, Add</i>	0.11	
			<i>For >2,500 To 5,000, Deduct</i>	-0.06	
			<i>For >5,000 To 10,000, Deduct</i>	-0.13	
			<i>For >10,000 To 20,000, Deduct</i>	-0.19	
			<i>For >20,000, Deduct</i>	-0.25	
09 91 23 00-0233	SF		Paint Interior Wood Floors And Decks, 1 Coat Non Slip Epoxy Coating, Brush Work.....	3.44	
			<i>For Up To 100, Add</i>	0.80	
			<i>For >100 To 250, Add</i>	0.46	
			<i>For >250 To 500, Add</i>	0.22	
			<i>For >2,500 To 5,000, Deduct</i>	-0.17	
			<i>For >5,000 To 10,000, Deduct</i>	-0.34	
			<i>For >10,000 To 20,000, Deduct</i>	-0.52	
			<i>For >20,000, Deduct</i>	-0.69	
09 91 23 00-0234			Paint Interior Doors And Windows (09 91 23)		
09 91 23 00-0235			Paint Interior Door Frames (09 91 23 00-0234)		
09 91 23 00-0236	LF		Paint Interior Wood Door Frame And Trim, 1 Coat Primer, Brush/Roller Work.....	0.75	
			<i>For Oil Based Paint, Add</i>	0.04	
			<i>For Painting One Face Of Frame Only, Deduct</i>	-0.20	
09 91 23 00-0237	LF		Paint Interior Wood Door Frame And Trim, 1 Coat Paint, Brush/Roller Work.....	0.97	
			<i>For Oil Based Paint, Add</i>	0.05	
			<i>For Painting One Face Of Frame Only, Deduct</i>	-0.25	
09 91 23 00-0238	LF		Paint Interior Wood Door Frame And Trim, 2 Coats Paint, Brush/Roller Work.....	1.63	
			<i>For Oil Based Paint, Add</i>	0.09	
			<i>For Painting One Face Of Frame Only, Deduct</i>	-0.43	
09 91 23 00-0239	LF		Paint Interior Metal Door Frame And Trim, 1 Coat Primer, Brush/Roller Work.....	0.74	
			<i>For Oil Based Paint, Add</i>	0.04	
			<i>For Painting One Face Of Frame Only, Deduct</i>	-0.20	
09 91 23 00-0240	LF		Paint Interior Metal Door Frame And Trim, 1 Coat Paint, Brush/Roller Work.....	0.96	
			<i>For Oil Based Paint, Add</i>	0.05	
			<i>For Painting One Face Of Frame Only, Deduct</i>	-0.25	
09 91 23 00-0241	LF		Paint Interior Metal Door Frame And Trim, 2 Coats Paint, Brush/Roller Work.....	1.62	
			<i>For Oil Based Paint, Add</i>	0.09	
			<i>For Painting One Face Of Frame Only, Deduct</i>	-0.42	
09 91 23 00-0242			Paint Interior Metal Doors (09 91 23 00-0234)		
09 91 23 00-0243	EA		Paint Interior Metal Door, One Face, 1 Coat Primer, Brush/Roller Work.....	32.58	
			<i>For Electrostatic Painting, Add</i>	4.78	
			<i>For Half Louvered Door, Add</i>	3.36	
			<i>For Full Louvered Door, Add</i>	5.61	
			<i>For Oil Based Paint, Add</i>	2.14	
			<i>For >5 To 10, Deduct</i>	-1.63	
			<i>For >10 To 25, Deduct</i>	-3.26	
			<i>For >25, Deduct</i>	-4.89	



Finishes	09	9
Painting And Coating	09 90	
Painting	09 91	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 23 00-0244 EA Paint Interior Metal Door, One Face, 1 Coat Paint, Brush/Roller Work.....	32.58	
For Electrostatic Painting, Add	4.78	
For Half Louvered Door, Add	3.36	
For Full Louvered Door, Add	5.61	
For Oil Based Paint, Add	2.14	
For >5 To 10, Deduct	-1.63	
For >10 To 25, Deduct	-3.26	
For >25, Deduct	-4.89	
09 91 23 00-0245 EA Paint Interior Metal Door, One Face, 2 Coats Paint, Brush/Roller Work.....	58.05	
For Electrostatic Painting, Add	8.83	
For Half Louvered Door, Add	5.68	
For Full Louvered Door, Add	9.47	
For Oil Based Paint, Add	3.91	
For >5 To 10, Deduct	-2.90	
For >10 To 25, Deduct	-5.81	
For >25, Deduct	-8.71	
09 91 23 00-0246 EA Paint Interior Metal Door, Both Faces, 1 Coat Primer, Brush/Roller Work.....	58.45	
For Electrostatic Painting, Add	8.58	
For Half Louvered Door, Add	6.03	
For Full Louvered Door, Add	10.06	
For Oil Based Paint, Add	3.83	
For >5 To 10, Deduct	-2.92	
For >10 To 25, Deduct	-5.85	
For >25, Deduct	-8.77	
09 91 23 00-0247 EA Paint Interior Metal Door, Both Faces, 1 Coat Paint, Brush/Roller Work.....	58.46	
For Electrostatic Painting, Add	8.58	
For Half Louvered Door, Add	6.03	
For Full Louvered Door, Add	10.06	
For Oil Based Paint, Add	3.83	
For >5 To 10, Deduct	-2.92	
For >10 To 25, Deduct	-5.85	
For >25, Deduct	-8.77	
09 91 23 00-0248 EA Paint Interior Metal Door, Both Faces, 2 Coats Paint, Brush/Roller Work.....	104.53	
For Electrostatic Painting, Add	15.92	
For Half Louvered Door, Add	10.21	
For Full Louvered Door, Add	17.02	
For Oil Based Paint, Add	7.05	
For >5 To 10, Deduct	-5.23	
For >10 To 25, Deduct	-10.45	
For >25, Deduct	-15.68	
09 91 23 00-0249 EA Paint Interior Metal Door, One Face, 1 Coat Primer, Sprayed.....	24.62	
For Electrostatic Painting, Add	4.14	
For Half Louvered Door, Add	2.02	
For Full Louvered Door, Add	3.37	
For Oil Based Paint, Add	1.79	
For >5 To 10, Deduct	-1.23	
For >10 To 25, Deduct	-2.46	
For >25, Deduct	-3.69	
For Backroll, Add	2.58	
09 91 23 00-0250 EA Paint Interior Metal Door, One Face, 1 Coat Paint, Sprayed.....	24.62	
For Electrostatic Painting, Add	4.14	
For Half Louvered Door, Add	2.02	
For Full Louvered Door, Add	3.37	
For Oil Based Paint, Add	1.79	
For >5 To 10, Deduct	-1.23	
For >10 To 25, Deduct	-2.46	
For >25, Deduct	-3.69	
For Backroll, Add	2.58	
09 91 23 00-0251 EA Paint Interior Metal Door, One Face, 2 Coats Paint, Sprayed.....	44.91	
For Electrostatic Painting, Add	7.82	
For Half Louvered Door, Add	3.41	
For Full Louvered Door, Add	5.68	
For Oil Based Paint, Add	3.35	
For >5 To 10, Deduct	-2.25	
For >10 To 25, Deduct	-4.49	
For >25, Deduct	-6.74	
For Backroll, Add	4.52	
09 91 23 00-0252 EA Paint Interior Metal Door, Both Faces, 1 Coat Primer, Sprayed.....	44.19	
For Electrostatic Painting, Add	7.43	
For Half Louvered Door, Add	3.62	
For Full Louvered Door, Add	6.03	
For Oil Based Paint, Add	3.21	
For >5 To 10, Deduct	-2.21	
For >10 To 25, Deduct	-4.42	
For >25, Deduct	-6.63	
For Backroll, Add	4.62	
09 91 23 00-0253 EA Paint Interior Metal Door, Both Faces, 1 Coat Paint, Sprayed.....	44.19	
For Electrostatic Painting, Add	7.43	
For Half Louvered Door, Add	3.62	
For Full Louvered Door, Add	6.03	
For Oil Based Paint, Add	3.21	
For >5 To 10, Deduct	-2.21	
For >10 To 25, Deduct	-4.42	
For >25, Deduct	-6.63	
For Backroll, Add	4.62	

09 Finishes**09 90 Painting And Coating****09 91 Painting**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 23 00-0254	EA		Paint Interior Metal Door, Both Faces, 2 Coats Paint, Sprayed	80.94	
			<i>For Electrostatic Painting, Add</i>	14.11	
			<i>For Half Louvered Door, Add</i>	6.12	
			<i>For Full Louvered Door, Add</i>	10.21	
			<i>For Oil Based Paint, Add</i>	6.05	
			<i>For >5 To 10, Deduct</i>	-4.05	
			<i>For >10 To 25, Deduct</i>	-8.09	
			<i>For >25, Deduct</i>	-12.14	
			<i>For Backroll, Add</i>	8.13	
09 91 23 00-0255			Paint Interior Wood Doors <small>(09 91 23 00-0234)</small>		
09 91 23 00-0256	EA		Paint Interior Wood Door, One Face, 1 Coat Primer, Brush/Roller Work	32.58	
			<i>For Oil Based Paint, Add</i>	2.14	
			<i>For Half Louvered Door, Add</i>	3.36	
			<i>For Full Louvered Door, Add</i>	5.61	
			<i>For >5 To 10, Deduct</i>	-1.63	
			<i>For >10 To 25, Deduct</i>	-3.26	
			<i>For >25, Deduct</i>	-4.89	
09 91 23 00-0257	EA		Paint Interior Wood Door, One Face, 1 Coat Paint, Brush/Roller Work	32.58	
			<i>For Oil Based Paint, Add</i>	2.14	
			<i>For Half Louvered Door, Add</i>	3.36	
			<i>For Full Louvered Door, Add</i>	5.61	
			<i>For >5 To 10, Deduct</i>	-1.63	
			<i>For >10 To 25, Deduct</i>	-3.26	
			<i>For >25, Deduct</i>	-4.89	
09 91 23 00-0258	EA		Paint Interior Wood Door, One Face, 2 Coats Paint, Brush/Roller Work	58.05	
			<i>For Oil Based Paint, Add</i>	3.91	
			<i>For Half Louvered Door, Add</i>	5.68	
			<i>For Full Louvered Door, Add</i>	9.47	
			<i>For >5 To 10, Deduct</i>	-2.90	
			<i>For >10 To 25, Deduct</i>	-5.81	
			<i>For >25, Deduct</i>	-8.71	
09 91 23 00-0259	EA		Paint Interior Wood Door, Both Faces, 1 Coat Primer, Brush/Roller Work	58.46	
			<i>For Oil Based Paint, Add</i>	3.83	
			<i>For Half Louvered Door, Add</i>	6.03	
			<i>For Full Louvered Door, Add</i>	10.06	
			<i>For >5 To 10, Deduct</i>	-2.92	
			<i>For >10 To 25, Deduct</i>	-5.85	
			<i>For >25, Deduct</i>	-8.77	
09 91 23 00-0260	EA		Paint Interior Wood Door, Both Faces, 1 Coat Paint, Brush/Roller Work	58.46	
			<i>For Oil Based Paint, Add</i>	3.83	
			<i>For Half Louvered Door, Add</i>	6.03	
			<i>For Full Louvered Door, Add</i>	10.06	
			<i>For >5 To 10, Deduct</i>	-2.92	
			<i>For >10 To 25, Deduct</i>	-5.85	
			<i>For >25, Deduct</i>	-8.77	
09 91 23 00-0261	EA		Paint Interior Wood Door, Both Faces, 2 Coats Paint, Brush/Roller Work	104.53	
			<i>For Oil Based Paint, Add</i>	7.05	
			<i>For Half Louvered Door, Add</i>	10.21	
			<i>For Full Louvered Door, Add</i>	17.02	
			<i>For >5 To 10, Deduct</i>	-5.23	
			<i>For >10 To 25, Deduct</i>	-10.45	
			<i>For >25, Deduct</i>	-15.68	
09 91 23 00-0262	EA		Paint Interior Wood Door, One Face, 1 Coat Primer, Sprayed	24.62	
			<i>For Oil Based Paint, Add</i>	1.79	
			<i>For Half Louvered Door, Add</i>	2.02	
			<i>For Full Louvered Door, Add</i>	3.37	
			<i>For >5 To 10, Deduct</i>	-1.23	
			<i>For >10 To 25, Deduct</i>	-2.46	
			<i>For >25, Deduct</i>	-3.69	
			<i>For Backroll, Add</i>	2.58	
09 91 23 00-0263	EA		Paint Interior Wood Door, One Face, 1 Coat Paint, Sprayed	24.62	
			<i>For Oil Based Paint, Add</i>	1.79	
			<i>For Half Louvered Door, Add</i>	2.02	
			<i>For Full Louvered Door, Add</i>	3.37	
			<i>For >5 To 10, Deduct</i>	-1.23	
			<i>For >10 To 25, Deduct</i>	-2.46	
			<i>For >25, Deduct</i>	-3.69	
			<i>For Backroll, Add</i>	2.58	
09 91 23 00-0264	EA		Paint Interior Wood Door, One Face, 2 Coats Paint, Sprayed	44.92	
			<i>For Oil Based Paint, Add</i>	3.36	
			<i>For Half Louvered Door, Add</i>	3.41	
			<i>For Full Louvered Door, Add</i>	5.69	
			<i>For >5 To 10, Deduct</i>	-2.25	
			<i>For >10 To 25, Deduct</i>	-4.49	
			<i>For >25, Deduct</i>	-6.74	
			<i>For Backroll, Add</i>	4.52	
09 91 23 00-0265	EA		Paint Interior Wood Door, Both Faces, 1 Coat Primer, Sprayed	44.19	
			<i>For Oil Based Paint, Add</i>	3.21	
			<i>For Half Louvered Door, Add</i>	3.62	
			<i>For Full Louvered Door, Add</i>	6.03	
			<i>For >5 To 10, Deduct</i>	-2.21	
			<i>For >10 To 25, Deduct</i>	-4.42	
			<i>For >25, Deduct</i>	-6.63	
			<i>For Backroll, Add</i>	4.62	



Finishes	09	9
Painting And Coating	09 90	
Painting	09 91	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 23 00-0266 EA Paint Interior Wood Door, Both Faces, 1 Coat Paint, Sprayed	44.19	
For Oil Based Paint, Add	3.21	
For Half Louvered Door, Add	3.62	
For Full Louvered Door, Add	6.03	
For >5 To 10, Deduct	-2.21	
For >10 To 25, Deduct	-4.42	
For >25, Deduct	-6.63	
For Backroll, Add	4.62	
09 91 23 00-0267 EA Paint Interior Wood Door, Both Faces, 2 Coats Paint, Sprayed.....	80.94	
For Oil Based Paint, Add	6.05	
For Half Louvered Door, Add	6.12	
For Full Louvered Door, Add	10.21	
For >5 To 10, Deduct	-4.05	
For >10 To 25, Deduct	-8.09	
For >25, Deduct	-12.14	
For Backroll, Add	8.13	
09 91 23 00-0268 Paint Interior Metal Windows (09 91 23 00-0234)		
Note: Two finish coats paint over rust inhibitive primer.		
09 91 23 00-0269 EA Paint Interior Metal Window Including Trim, Window Size Up To 8 SF.....	57.03	
For Oil Based Paint, Add	3.19	
For Electrostatic Painting, Add	6.71	
For >5 To 10, Deduct	-2.85	
For >10 To 25, Deduct	-5.70	
For >25, Deduct	-8.55	
09 91 23 00-0270 EA Paint Interior Metal Window Including Trim, Window Size >8 SF To 14 SF.....	68.44	
For Oil Based Paint, Add	3.94	
For Electrostatic Painting, Add	8.41	
For >5 To 10, Deduct	-3.42	
For >10 To 25, Deduct	-6.84	
For >25, Deduct	-10.27	
09 91 23 00-0271 EA Paint Interior Metal Window Including Trim, Window Size >14 SF To 20 SF.....	92.16	
For Oil Based Paint, Add	5.35	
For Electrostatic Painting, Add	11.43	
For >5 To 10, Deduct	-4.61	
For >10 To 25, Deduct	-9.22	
For >25, Deduct	-13.82	
09 91 23 00-0272 EA Paint Interior Metal Window Including Trim, Window Size >20 SF To 26 SF.....	103.77	
For Oil Based Paint, Add	6.02	
For Electrostatic Painting, Add	12.89	
For >5 To 10, Deduct	-5.19	
For >10 To 25, Deduct	-10.38	
For >25, Deduct	-15.57	
09 91 23 00-0273 EA Paint Interior Metal Window Including Trim, Window Size >26 SF To 34 SF.....	115.10	
For Oil Based Paint, Add	6.67	
For Electrostatic Painting, Add	14.27	
For >5 To 10, Deduct	-5.76	
For >10 To 25, Deduct	-11.51	
For >25, Deduct	-17.27	
09 91 23 00-0274 SF Paint Interior Metal Window Including Trim, Window Size >34 SF	3.66	
For Oil Based Paint, Add	0.21	
For Electrostatic Painting, Add	0.45	
09 91 23 00-0275 Wood Windows (09 91 23 00-0234)		
Note: Two finish coats paint over primer.		
09 91 23 00-0276 EA Paint Interior Wood Windows Including Trim, Window Size Up To 8 SF	57.03	
For Oil Based Paint, Add	3.19	
For >5 To 10, Deduct	-2.85	
For >10 To 25, Deduct	-5.70	
For >25, Deduct	-8.55	
09 91 23 00-0277 EA Paint Interior Wood Windows Including Trim, Window Size >8 SF To 14 SF	68.44	
For Oil Based Paint, Add	3.94	
For >5 To 10, Deduct	-3.42	
For >10 To 25, Deduct	-6.84	
For >25, Deduct	-10.27	
09 91 23 00-0278 EA Paint Interior Wood Windows Including Trim, Window Size >14 SF To 20 SF	92.16	
For Oil Based Paint, Add	5.35	
For >5 To 10, Deduct	-4.61	
For >10 To 25, Deduct	-9.22	
For >25, Deduct	-13.82	
09 91 23 00-0279 EA Paint Interior Wood Windows Including Trim, Window Size >20 SF To 26 SF	103.77	
For Oil Based Paint, Add	6.02	
For >5 To 10, Deduct	-5.19	
For >10 To 25, Deduct	-10.38	
For >25, Deduct	-15.57	
09 91 23 00-0280 EA Paint Interior Wood Windows Including Trim, Window Size >26 SF To 34 SF	115.10	
For Oil Based Paint, Add	6.67	
For >5 To 10, Deduct	-5.76	
For >10 To 25, Deduct	-11.51	
For >25, Deduct	-17.27	
09 91 23 00-0281 SF Paint Interior Wood Windows Including Trim, Window Size >34 SF	3.85	
For Oil Based Paint, Add	0.22	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 23 00-0282			Paint Interior Security Screens (09 91 23 00-0234)		
09 91 23 00-0283	SF		Paint Interior Security Screen, 1 Coat Primer, Brush/Roller Work	1.02	
			<i>For Oil Based Paint, Add</i>	0.06	
			<i>For Electrostatic Painting, Add</i>	0.12	
09 91 23 00-0284	SF		Paint Interior Security Screen, 1 Coat Paint, Brush/Roller Work.....	1.08	
			<i>For Oil Based Paint, Add</i>	0.06	
			<i>For Electrostatic Painting, Add</i>	0.12	
09 91 23 00-0285	SF		Paint Interior Security Screen, 2 Coats Paint, Brush/Roller Work.....	1.77	
			<i>For Oil Based Paint, Add</i>	0.10	
			<i>For Electrostatic Painting, Add</i>	0.21	
09 91 23 00-0286			Paint Interior Window Guards (09 91 23 00-0234)		
09 91 23 00-0287	SF		Paint Interior Metal Window Guards, 1 Coat Primer, Brush/Roller Work	1.02	
			<i>For Oil Based Paint, Add</i>	0.06	
09 91 23 00-0288	SF		Paint Interior Metal Window Guards, 1 Coat Paint, Brush/Roller Work.....	1.08	
			<i>For Oil Based Paint, Add</i>	0.06	
09 91 23 00-0289	SF		Paint Interior Metal Window Guards, 2 Coats Paint, Brush/Roller Work.....	1.77	
			<i>For Oil Based Paint, Add</i>	0.10	
09 91 23 00-0290			Paint Interior Window Trim (09 91 23 00-0234)		
09 91 23 00-0291	LF		Paint Interior Wood Window Frame And Trim, 1 Coat Primer, Brush/Roller Work.....	1.04	
			<i>For Oil Based Paint, Add</i>	0.06	
			<i>For Painting One Face Of Frame Only, Deduct</i>	-0.29	
09 91 23 00-0292	LF		Paint Interior Wood Window Frame And Trim, 1 Coat Paint, Brush/Roller Work.....	1.04	
			<i>For Oil Based Paint, Add</i>	0.06	
			<i>For Painting One Face Of Frame Only, Deduct</i>	-0.29	
09 91 23 00-0293	LF		Paint Interior Wood Window Frame And Trim, 2 Coats Paint, Brush/Roller Work	1.24	
			<i>For Oil Based Paint, Add</i>	0.08	
			<i>For Painting One Face Of Frame Only, Deduct</i>	-0.37	
09 91 23 00-0294	LF		Paint Interior Metal Window Frame And Trim, 1 Coat Primer, Brush/Roller Work	1.07	
			Note: Brush/roller work.		
			<i>For Painting One Face Of Frame Only, Deduct</i>	-0.30	
09 91 23 00-0295	LF		Paint Interior Metal Window Frame And Trim, 1 Coat Paint, Brush/Roller Work.....	1.07	
			Note: Brush/roller work.		
			<i>For Painting One Face Of Frame Only, Deduct</i>	-0.30	
09 91 23 00-0296	LF		Paint Interior Metal Window Frame And Trim, 2 Coats Paint, Brush/Roller Work.....	1.30	
			Note: Brush/roller work.		
			<i>For Painting One Face Of Frame Only, Deduct</i>	-0.39	
09 91 23 00-0297			Paint Interior Cabinets And Casework (09 91 23)		
09 91 23 00-0298			Paint Interior Wood Cabinets And Casework (09 91 23 00-0297)		
09 91 23 00-0299	SF		Paint Interior Wood Cabinets And Casework, 1 Coat Paint	0.82	
			<i>For >5,000 To 10,000, Deduct</i>	-0.04	
			<i>For >10,000 To 20,000, Deduct</i>	-0.08	
			<i>For >20,000, Deduct</i>	-0.12	
09 91 23 00-0300	SF		Paint Interior Wood Cabinets And Casework, 1 Coat Primer, 1 Coat Paint, Enamel Primer, Alkyd Or Latex Paint.....	1.14	
			<i>For >5,000 To 10,000, Deduct</i>	-0.06	
			<i>For >10,000 To 20,000, Deduct</i>	-0.11	
			<i>For >20,000, Deduct</i>	-0.17	
09 91 23 00-0301	SF		Paint Interior Wood Cabinets And Casework, 1 Coat Primer, 2 Coats Paint, Enamel Primer, Alkyd Or Latex Paint	1.85	
			<i>For >5,000 To 10,000, Deduct</i>	-0.09	
			<i>For >10,000 To 20,000, Deduct</i>	-0.19	
			<i>For >20,000, Deduct</i>	-0.28	
09 91 23 00-0302			Paint Exposed Metal Lockers (09 91 23 00-0297)		
09 91 23 00-0303	SF		Paint Exposed Metal Locker, 1 Coat Primer, Brush/Roller Work	0.94	
			<i>For >5,000 To 10,000, Deduct</i>	-0.05	
			<i>For >10,000 To 20,000, Deduct</i>	-0.09	
			<i>For >20,000, Deduct</i>	-0.14	
09 91 23 00-0304	SF		Paint Exposed Metal Locker, 1 Coat Alkyd Enamel, Brush/Roller Work	0.99	
			<i>For >5,000 To 10,000, Deduct</i>	-0.05	
			<i>For >10,000 To 20,000, Deduct</i>	-0.10	
			<i>For >20,000, Deduct</i>	-0.15	
09 91 23 00-0305	SF		Paint Exposed Metal Locker, 2 Coats Alkyd Enamel, Brush/Roller Work	1.81	
			<i>For >5,000 To 10,000, Deduct</i>	-0.09	
			<i>For >10,000 To 20,000, Deduct</i>	-0.18	
			<i>For >20,000, Deduct</i>	-0.27	
09 91 23 00-0306			Paint Interior Stairs (09 91 23)		
09 91 23 00-0307			Paint Interior Concrete Stairs (09 91 23 00-0306)		
			Note: Includes the riser and tread.		
09 91 23 00-0308	RSR		Paint Interior Concrete Stair (To 4' Wide), 1 Coat Primer, Brush/Roller Work	13.84	
09 91 23 00-0309	RSR		Paint Interior Concrete Stair (To 4' Wide), 1 Coat Alkyd Enamel, Brush/Roller Work.....	13.84	
09 91 23 00-0310	RSR		Paint Interior Concrete Stair (To 4' Wide), 1 Coat Non Slip Paint, Brush/Roller Work	10.10	
			Note: Excludes riser.		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 23 00-0311 RSR Paint Interior Concrete Stair (To 4' Wide), 1 Coat Non Slip Epoxy Coating, Brush/Roller Work.....	18.79	
Note: Excludes riser.		
09 91 23 00-0312 RSR Paint Interior Concrete Stair (To 4' Wide), 2 Coats Alkyd Enamel, Brush/Roller Work.....	27.67	
09 91 23 00-0313 Paint Interior Metal Stairs (09 91 23 00-0306)		
Note: Includes the riser and tread.		
09 91 23 00-0314 RSR Paint Interior Metal Stair (To 4' Wide), 1 Coat Primer, Brush/Roller Work.....	7.39	
09 91 23 00-0315 RSR Paint Interior Metal Stair (To 4' Wide), 1 Coat Alkyd Enamel, Brush/Roller Work.....	7.10	
09 91 23 00-0316 RSR Paint Interior Metal Stair (To 4' Wide), 2 Coats Alkyd Enamel, Brush/Roller Work.....	14.21	
09 91 23 00-0317 Paint Interior Wood Stairs (09 91 23 00-0306)		
Note: Includes the riser and tread.		
09 91 23 00-0318 RSR Paint Interior Wood Stair (To 4' Wide), 1 Coat Primer, Brush/Roller Work.....	7.10	
09 91 23 00-0319 RSR Paint Interior Wood Stair (To 4' Wide), 1 Coat Alkyd Enamel, Brush/Roller Work.....	7.10	
09 91 23 00-0320 RSR Paint Interior Wood Stair (To 4' Wide), 1 Coat Non Slip Paint, Brush/Roller Work.....	6.72	
Note: Excludes riser.		
09 91 23 00-0321 RSR Paint Interior Wood Stair (To 4' Wide), 1 Coat Non Slip Epoxy Coating, Brush/Roller Work.....	15.41	
Note: Excludes riser.		
09 91 23 00-0322 RSR Paint Interior Wood Stair (To 4' Wide), 2 Coats Alkyd Enamel, Brush/Roller Work.....	14.20	
09 91 23 00-0323 Paint Interior Stair Nosing (09 91 23 00-0306)		
09 91 23 00-0324 LF Paint Interior Yellow Stair Safety Strip, Up To 2", Non Slip, Brush Work.....	1.01	
09 91 23 00-0325 Paint Interior Trim (09 91 23)		
09 91 23 00-0326 Paint Interior Metal Trim (09 91 23 00-0325)		
09 91 23 00-0327 SF Paint Interior Exposed Metal Trim, 1 Coat Primer, Brush Work.....	0.97	
09 91 23 00-0328 SF Paint Interior Exposed Metal Trim, 1 Coat Paint, Brush Work.....	0.97	
09 91 23 00-0329 SF Paint Interior Exposed Metal Trim, 2 Coats Paint, Brush Work.....	1.75	
09 91 23 00-0330 SF Paint Interior Metal Trim, 1 Coat Primer, Brush/Roller Work.....	0.97	
09 91 23 00-0331 SF Paint Interior Metal Trim, 1 Coat Paint, Brush/Roller Work.....	0.97	
09 91 23 00-0332 SF Paint Interior Metal Trim, 2 Coats Paint, Brush/Roller Work.....	1.75	
09 91 23 00-0333 Paint Interior Wood Trim (09 91 23 00-0325)		
09 91 23 00-0334 LF Paint Interior Wood Trim To 6" Wide, 1 Coat Primer, Brush Work.....	0.51	
For Oil Based Paint, Add	0.03	
09 91 23 00-0335 LF Paint Interior Wood Trim To 6" Wide, 1 Coat Paint, Brush Work.....	0.57	
For Oil Based Paint, Add	0.03	
09 91 23 00-0336 LF Paint Interior Wood Trim To 6" Wide, 2 Coats Paint.....	1.18	
For Oil Based Paint, Add	0.06	
09 91 23 00-0337 SF Paint Interior Wood Trim, 1 Coat Primer, Brush Work.....	1.57	
For Oil Based Paint, Add	0.09	
09 91 23 00-0338 SF Paint Interior Wood Trim, 1 Coat Paint, Brush Work.....	1.74	
For Oil Based Paint, Add	0.10	
09 91 23 00-0339 SF Paint Interior Wood Trim, 2 Coats Paint, Brush Work.....	3.72	
For Oil Based Paint, Add	0.21	
09 91 23 00-0340 SF Paint Interior Wood Trim, 1 Coat Primer, Brush/Roller Work.....	1.57	
For Oil Based Paint, Add	0.09	
09 91 23 00-0341 SF Paint Interior Wood Trim, 1 Coat Paint, Brush/Roller Work.....	1.74	
For Oil Based Paint, Add	0.10	
09 91 23 00-0342 SF Paint Interior Wood Trim, 2 Coats Paint, Brush/Roller Work.....	3.72	
For Oil Based Paint, Add	0.21	
09 91 23 00-0343 Paint Additives (09 91 23)		
09 91 23 00-0344 SF Mildewcide/Mold Killing Paint Additive Per Each Coat.....	0.02	
09 91 23 00-0345 SF Class "B" Fire Rating, Fire Resistant Paint Additive.....	0.04	
For Class "A" Fire Rating, Add	0.04	
09 91 23 00-0346 Hand Painting Letters/Numbers (09 91 23)		
Note: Painting on walls, floors, poles, signs, etc.		
09 91 23 00-0347 EA Up To 1" High, Hand Paint, Per Letter/Number.....	1.58	
09 91 23 00-0348 EA 1" To 2" High, Hand Paint, Per Letter/Number.....	1.84	
09 91 23 00-0349 EA 2" To 3" High, Hand Paint, Per Letter/Number.....	2.79	
09 91 23 00-0350 EA 3" To 4" High, Hand Paint, Per Letter/Number.....	3.41	
09 91 23 00-0351 EA 4" To 6" High, Hand Paint, Per Letter/Number.....	4.70	
09 91 23 00-0352 EA 6" To 12" High, Hand Paint, Per Letter/Number.....	5.95	
09 91 23 00-0353 EA Over 12" High, Hand Paint, Per Letter/Number.....	6.98	
09 91 23 00-0354 Glove/Mitt Application (09 91 23)		
09 91 23 00-0355 Conduit/Pipe (09 91 23 00-0354)		
09 91 23 00-0356 CSF Acid Wash (Muriatic Acid) Conduit Or Pipe With Glove/Mitt.....	29.88	
09 91 23 00-0357 CSF Metal Primer Conduit Or Pipe With Glove/Mitt.....	49.74	
09 91 23 00-0358 CSF Enamel, Oil Base Paint, First Coat Conduit Or Pipe With Glove/Mitt.....	39.21	

09 Finishes**09 90 Painting And Coating****09 91 Painting**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 23 00-0359	CSF		Enamel, Oil Base Paint, Second Coat Conduit Or Pipe With Glove/Mitt.....	32.16	
09 91 23 00-0360	CSF		Epoxy Coating, First Coat Conduit Or Pipe With Glove/Mitt	61.06	
09 91 23 00-0361	CSF		Epoxy Coating, Second Coat Conduit Or Pipe With Glove/Mitt	56.33	
09 91 23 00-0362			Ductwork <small>(09 91 23 00-0354)</small>		
09 91 23 00-0363	CSF		Acid Wash (Muriatic Acid) Ductwork With Glove/Mitt.....	29.88	
09 91 23 00-0364	CSF		Metal Primer Ductwork With Glove/Mitt	41.04	
09 91 23 00-0365	CSF		Enamel, Oil Base Paint Ductwork With Glove/Mitt.....	35.63	
09 91 23 00-0366	CSF		Epoxy Coating, First Coat Ductwork With Glove/Mitt.....	58.67	
09 91 23 00-0367	CSF		Epoxy Coating, Second Coat Ductwork With Glove/Mitt.....	51.17	
09 91 23 00-0368			Paint Interior Miscellaneous Metal Surfaces <small>(09 91 23)</small>		
09 91 23 00-0369	SF		Paint Interior Miscellaneous Metal Surfaces, 1 Coat Primer, Brush/Roller Work.....	0.51	
			<i>For Electrostatic Painting, Add</i>	0.07	
			<i>For Up To 100, Add</i>	0.32	
			<i>For >100 To 250, Add</i>	0.15	
			<i>For >250 To 500, Add</i>	0.07	
			<i>For >2,500 To 5,000, Deduct</i>	-0.03	
			<i>For >5,000 To 10,000, Deduct</i>	-0.05	
			<i>For >10,000 To 20,000, Deduct</i>	-0.08	
			<i>For >20,000, Deduct</i>	-0.10	
09 91 23 00-0370	SF		Paint Interior Miscellaneous Metal Surfaces, 1 Coat Alkyd Enamel, Brush/Roller Work.....	0.71	
			<i>For Electrostatic Painting, Add</i>	0.09	
			<i>For Up To 100, Add</i>	0.47	
			<i>For >100 To 250, Add</i>	0.22	
			<i>For >250 To 500, Add</i>	0.10	
			<i>For >2,500 To 5,000, Deduct</i>	-0.04	
			<i>For >5,000 To 10,000, Deduct</i>	-0.07	
			<i>For >10,000 To 20,000, Deduct</i>	-0.11	
			<i>For >20,000, Deduct</i>	-0.14	
09 91 23 00-0371	SF		Paint Interior Miscellaneous Metal Surfaces, 2 Coats Alkyd Enamel Paint, Brush/Roller Work.....	1.06	
			<i>For Electrostatic Painting, Add</i>	0.13	
			<i>For Up To 100, Add</i>	0.71	
			<i>For >100 To 250, Add</i>	0.33	
			<i>For >250 To 500, Add</i>	0.14	
			<i>For >2,500 To 5,000, Deduct</i>	-0.05	
			<i>For >5,000 To 10,000, Deduct</i>	-0.11	
			<i>For >10,000 To 20,000, Deduct</i>	-0.16	
			<i>For >20,000, Deduct</i>	-0.21	
09 91 23 00-0372	SF		Paint Interior Miscellaneous Metal Surfaces, 1 Coat Primer, Sprayed.....	0.59	
			<i>For Electrostatic Painting, Add</i>	0.08	
			<i>For Up To 100, Add</i>	0.38	
			<i>For >100 To 250, Add</i>	0.18	
			<i>For >250 To 500, Add</i>	0.08	
			<i>For >2,500 To 5,000, Deduct</i>	-0.03	
			<i>For >5,000 To 10,000, Deduct</i>	-0.06	
			<i>For >10,000 To 20,000, Deduct</i>	-0.09	
			<i>For >20,000, Deduct</i>	-0.12	
			<i>For Backroll, Add</i>	0.08	
09 91 23 00-0373	SF		Paint Interior Miscellaneous Metal Surfaces, 1 Coat Alkyd, Sprayed.....	0.59	
			<i>For Electrostatic Painting, Add</i>	0.08	
			<i>For Up To 100, Add</i>	0.38	
			<i>For >100 To 250, Add</i>	0.18	
			<i>For >250 To 500, Add</i>	0.08	
			<i>For >2,500 To 5,000, Deduct</i>	-0.03	
			<i>For >5,000 To 10,000, Deduct</i>	-0.06	
			<i>For >10,000 To 20,000, Deduct</i>	-0.09	
			<i>For >20,000, Deduct</i>	-0.12	
			<i>For Backroll, Add</i>	0.08	
09 91 23 00-0374	SF		Paint Interior Miscellaneous Metal Surfaces, 2 Coats Alkyd, Sprayed.....	0.91	
			<i>For Electrostatic Painting, Add</i>	0.12	
			<i>For Up To 100, Add</i>	0.58	
			<i>For >100 To 250, Add</i>	0.28	
			<i>For >250 To 500, Add</i>	0.12	
			<i>For >2,500 To 5,000, Deduct</i>	-0.05	
			<i>For >5,000 To 10,000, Deduct</i>	-0.09	
			<i>For >10,000 To 20,000, Deduct</i>	-0.14	
			<i>For >20,000, Deduct</i>	-0.18	
			<i>For Backroll, Add</i>	0.12	
09 91 33			Painting Materials <small>(09 91)</small>		
			Note: Paint per gallon for owners to obtain extra paint. Not to be used in conjunction with other painting tasks.		
09 91 33 00-0001			Primer <small>(09 91 33)</small>		
09 91 33 00-0002	GAL		Alkyd Primer/Sealer, Interior, 500 SF Per Gallon.....	25.10	
09 91 33 00-0003	GAL		Alkyd Wood Primer, Exterior, 400 SF Per Gallon	24.61	
09 91 33 00-0004	GAL		Prime Coat Oil Wood Primer, 310 SF Per Gallon	31.21	
09 91 33 00-0005	GAL		Catalyzed Epoxy Primer, Two Component Type, 425 SF Per Gallon.....	57.43	
09 91 33 00-0006	EA		Cement Base Primer, 25 LB Sack	25.74	
09 91 33 00-0007	GAL		Alkali Resistant Concrete And Masonry Primer, Exterior, 225 SF Per Gallon.....	39.68	
09 91 33 00-0008	GAL		Alkali Resistant Concrete And Masonry Primer, Interior, 225 SF Per Gallon.....	31.85	
09 91 33 00-0009	GAL		Acrylic Latex Primer, Flat Exterior, Fast Drying Wood Undercoat And Back Primer, 400 SF per Gallon.....	24.61	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
	09 91 33 00-0010		GAL	Acrylic (Vinyl Acrylic) Block Filler, 50 SF Per Gallon.....	22.36	
	09 91 33 00-0011		GAL	Acrylic (Vinyl Acrylic) Rust Inhibiting Metal, Primer - 500 SF Per Gallon: Paint - 260 SF Per Gallon	39.42	
	09 91 33 00-0012		GAL	Acrylic Heavy Duty Wall Primer/Sealer, Low Odor Type, Alkali-Resistant, 800 SF Per Gallon	32.82	
	09 91 33 00-0013		GAL	Acrylic (Vinyl Acrylic) Undercoat, All Purpose, Interior/Exterior, 500 SF Per Gallon.....	32.82	
	09 91 33 00-0014		GAL	Latex Wood Primer, Exterior, 300 SF Per Gallon	37.00	
	09 91 33 00-0015		GAL	Linseed (Oil Base) Primer, Exterior/Interior, 300 SF Per Gallon	24.13	
	09 91 33 00-0016		GAL	Red Alkyd Primer, 500 SF Per Gallon	42.95	
	09 91 33 00-0017		GAL	Wood Sealer/Primer, Interior, Clear, 600 SF Per Gallon	25.74	
	09 91 33 00-0018		GAL	Zinc Chromate Primer, 300 SF Per Gallon	20.59	
	09 91 33 00-0019		GAL	Zinc Dust/Zinc Oxide Primer, 300 SF Per Gallon.....	53.25	
	09 91 33 00-0020		GAL	Stain Killer, Alcohol Base.....	33.21	
	09 91 33 00-0021		GAL	Sealer, Primer Kilz, 400 SF Per Gallon.....	37.47	
	09 91 33 00-0022			Paint <small>(09 91 33)</small>		
	09 91 33 00-0023		GAL	Aluminum Fiber Roof Coat On Composition Roof, 50 SF Per Gallon.....	18.02	
	09 91 33 00-0024		GAL	Acrylic Urethane Sealer	89.34	
	09 91 33 00-0025		GAL	Asphalt-Fiber Roof And Foundation Coating, Solvent Type	9.65	
				Note: 75 SF per gallon on roof or concrete, 100 SF per gallon on metal.		
	09 91 33 00-0026		GAL	Concrete Enamel Epoxy, 350 SF Per Gallon.....	55.82	
	09 91 33 00-0027		GAL	Concrete Acrylic Sealer, 400 SF Per Gallon.....	29.28	
	09 91 33 00-0028		GAL	Driveway Coating, Tar Emulsion, 120 SF Per Gallon	9.65	
	09 91 33 00-0029		GAL	Driveway Coating, Acrylic Latex, 250 SF Per Gallon	14.64	
	09 91 33 00-0030		GAL	Exterior, Oil Base, Gloss Enamel, 400 SF Per Gallon	29.60	
	09 91 33 00-0031		GAL	Exterior, Oil Base, Gloss, 400 SF Per Gallon	39.42	
	09 91 33 00-0032		GAL	Exterior, Oil Base, Semi-Gloss, 400 SF Per Gallon	32.18	
	09 91 33 00-0033		GAL	Exterior, Oil Base, Flat.....	29.49	
	09 91 33 00-0034		GAL	Exterior, Latex, Semi-Gloss, 400 SF Per Gallon.....	27.99	
	09 91 33 00-0035		GAL	Exterior, Flat Latex, Trim Paint, 500 SF Per Gallon.....	32.98	
	09 91 33 00-0036		GAL	Exterior, Latex Flat Paint, 300 SF Per Gallon	29.28	
	09 91 33 00-0037		GAL	Exterior, Latex Gloss Enamel, Water Base.....	41.68	
	09 91 33 00-0038		GAL	Cold Galvanizing Paint	175.91	
	09 91 33 00-0039		GAL	High Heat Paint.....	60.81	
	09 91 33 00-0040		GAL	Heat Resistant Paint	40.54	
	09 91 33 00-0041		GAL	Zinc Chromate Paint.....	36.68	
	09 91 33 00-0042		QT	Anti-Rust Enamel, 500 SF Per Quart.....	14.48	
	09 91 33 00-0043		GAL	Rust Inhibitor, Ferrous Metal.....	40.54	
	09 91 33 00-0044		GAL	Masonry Waterproofing, 100 SF Per Gallon	29.28	
	09 91 33 00-0045		GAL	Alkyd Latex, Black	27.35	
	09 91 33 00-0046		GAL	Alkyd Latex, White	27.35	
	09 91 33 00-0047		GAL	Alkyd Latex, Colors.....	32.98	
	09 91 33 00-0048		QT	Wrought Iron Paint, Black.....	37.00	
	09 91 33 00-0049		GAL	Vinyl Paint.....	49.23	
	09 91 33 00-0050		GAL	Silicone Alkyd	59.85	
	09 91 33 00-0051		GAL	2 Component Solvent Based Acrylic Epoxy.....	60.81	
	09 91 33 00-0052		GAL	2 Component Solvent Based Polyester Epoxy	76.26	
	09 91 33 00-0053		GAL	Chlorinated Rubber.....	55.99	
	09 91 33 00-0054		GAL	Polyamide Epoxy Sealer.....	57.92	
	09 91 33 00-0055		GAL	Coal Tar Epoxy	41.51	
	09 91 33 00-0056		GAL	Swimming Pool Enamel, 350 SF Per Gallon.....	51.80	
	09 91 33 00-0057		GAL	Swimming Pool Epoxy Or Urethane Base	67.57	
	09 91 33 00-0058		GAL	Swimming Pool Rubber Base	46.33	
	09 91 33 00-0059		GAL	Interior, Latex Flat Paint, 300 SF Per Gallon	29.44	
	09 91 33 00-0060		GAL	Interior, Latex Eggshell Or Semi-Gloss Enamel, 300 SF Per Gallon	32.98	
	09 91 33 00-0061		GAL	Interior, Fire-Retardant Flat Paint, 200 SF Per Gallon	60.33	
	09 91 33 00-0062		GAL	Interior, Ceiling White Latex Flat, 350 SF Per Gallon	20.43	
	09 91 33 00-0063		GAL	Linseed Oil.....	17.86	
	09 91 33 00-0064		GAL	Latex Floor Paint, 300 SF Per Gallon	29.28	
	09 91 33 00-0065		GAL	Acrylic Floor Paint, 400 SF Per Gallon	32.98	
	09 91 33 00-0066		GAL	Texture Paint, Sand Texture Latex, Armor Coat, 100 SF Per Gallon.....	30.16	
	09 91 33 00-0067		GAL	Acoustic Spray-On Texture, Finish	24.24	
	09 91 33 00-0068			Stain, Varnish <small>(09 91 33)</small>		
	09 91 33 00-0069		GAL	Thompson Water Sealer, 150 SF Per Gallon.....	16.73	
	09 91 33 00-0070		GAL	Latex Redwood Stain, Water Base, 300 SF Per Gallon.....	31.21	
	09 91 33 00-0071		GAL	Redwood Oil Stain, 300 SF Per Gallon.....	27.83	
	09 91 33 00-0072		GAL	Varnish, Clear	19.44	
	09 91 33 00-0073		GAL	Penetrating Water-Repellent Stain	14.12	
	09 91 33 00-0074		GAL	Redwood Hue Or Clear Stain	12.62	
	09 91 33 00-0075		GAL	Polyurethane.....	22.15	
	09 91 33 00-0076		GAL	Lacquer, Semi-Gloss	29.37	
	09 91 33 00-0077		GAL	Shellac, Clear	38.52	
	09 91 33 00-0078		GAL	Acetone.....	12.71	
	09 91 33 00-0079		GAL	Paint Thinner	3.14	
	09 91 33 00-0080		GAL	Shellac Or Lacquer Thinner	12.87	
	09 91 33 00-0081		GAL	Turpentine.....	17.70	
	09 91 33 00-0082		GAL	Wood Filler Paste	30.24	
	09 91 33 00-0083		GAL	Wood Preservative, Pentachlorophenol, General Purpose, 40%, 150 SF Per Gallon	24.13	



MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

09 91 43 Surface Preparation (09 91)

Note: Steel Structure Painting Council, SSPC; Surface Preparation, SP.

09 91 43 00-0001	Cleaning And Preparation Of Painted And Unpainted Surfaces <small>(09 91 43)</small>	
	Note: In excess of surface preparation required. Water blast and pressure washing includes mild detergent and rinsing of surface until detergent free. Sand blast and water blast includes canvas/plastic for protection of existing surfaces as well as for containment.	
09 91 43 00-0002	Concrete And Masonry Surfaces <small>(09 91 43 00-0001)</small>	
09 91 43 00-0003	SF Calcimine Removal/Washing Concrete Or Masonry	0.30
	For Up To 100, Add	0.19
	For >100 To 250, Add	0.09
	For >250 To 500, Add	0.04
	For >5,000 To 10,000, Deduct	-0.01
	For >10,000 To 15,000, Deduct	-0.03
	For >15,000 To 30,000, Deduct	-0.04
	For >30,000, Deduct	-0.06
09 91 43 00-0004	SF Chemical Clean, Brush And Wash Concrete Or Masonry.....	0.48
	For Up To 100, Add	0.29
	For >100 To 250, Add	0.14
	For >250 To 500, Add	0.06
	For >5,000 To 10,000, Deduct	-0.02
	For >10,000 To 15,000, Deduct	-0.04
	For >15,000 To 30,000, Deduct	-0.07
	For >30,000, Deduct	-0.09
09 91 43 00-0005	SF Hand Scrape Concrete Or Masonry.....	0.50
	For Up To 100, Add	0.38
	For >100 To 250, Add	0.18
	For >250 To 500, Add	0.08
	For >5,000 To 10,000, Deduct	-0.03
	For >10,000 To 15,000, Deduct	-0.05
	For >15,000 To 30,000, Deduct	-0.08
	For >30,000, Deduct	-0.10
09 91 43 00-0006	SF Steam Clean Concrete Or Masonry.....	0.64
	For Up To 100, Add	0.42
	For >100 To 250, Add	0.20
	For >250 To 500, Add	0.08
	For >5,000 To 10,000, Deduct	-0.03
	For >10,000 To 15,000, Deduct	-0.06
	For >15,000 To 30,000, Deduct	-0.09
	For >30,000, Deduct	-0.12
09 91 43 00-0007	SF Up To 5,000 PSI, Pressure Wash Concrete Or Masonry.....	0.40
	For Up To 100, Add	0.25
	For >100 To 250, Add	0.12
	For >250 To 500, Add	0.05
	For >5,000 To 10,000, Deduct	-0.02
	For >10,000 To 15,000, Deduct	-0.04
	For >15,000 To 30,000, Deduct	-0.06
	For >30,000, Deduct	-0.08
09 91 43 00-0008	SF 10,000 To 12,000 PSI, Water Blast Concrete Or Masonry	1.17
	For Up To 100, Add	0.80
	For >100 To 250, Add	0.37
	For >250 To 500, Add	0.16
	For >5,000 To 10,000, Deduct	-0.06
	For >10,000 To 15,000, Deduct	-0.11
	For >15,000 To 30,000, Deduct	-0.17
	For >30,000, Deduct	-0.23
09 91 43 00-0009	SF 30,000 To 40,000 PSI, Water Blast Concrete Or Masonry	1.96
	For Up To 100, Add	1.40
	For >100 To 250, Add	0.65
	For >250 To 500, Add	0.28
	For >5,000 To 10,000, Deduct	-0.10
	For >10,000 To 15,000, Deduct	-0.19
	For >15,000 To 30,000, Deduct	-0.29
	For >30,000, Deduct	-0.39
09 91 43 00-0010	SF Sand Blasting Concrete Or Masonry.....	2.02
	For Heavy Condition Where Multiple Pass Is Required, Add	1.01
	For Up To 100, Add	1.39
	For >100 To 250, Add	0.65
	For >250 To 500, Add	0.28
	For >5,000 To 10,000, Deduct	-0.10
	For >10,000 To 15,000, Deduct	-0.20
	For >15,000 To 30,000, Deduct	-0.30
	For >30,000, Deduct	-0.40
09 91 43 00-0011	Drywall <small>(09 91 43 00-0001)</small>	
	Note: Patch holes other than nail/screw holes and greater than 1/2" diameter.	
09 91 43 00-0012	SF Hand Wash Drywall Surfaces With Mild Detergent Or Degreaser (No Sanding, Repairing Or Scraping).....	0.23
	For Up To 100, Add	0.17
	For >100 To 250, Add	0.08
	For >250 To 500, Add	0.03
	For >5,000 To 10,000, Deduct	-0.01
	For >10,000 To 15,000, Deduct	-0.02
	For >15,000 To 30,000, Deduct	-0.03
	For >30,000, Deduct	-0.05



Finishes	09	09
Painting And Coating	09 90	
Painting	09 91	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 43 00-0013 SF Hand Wash, Minor Repair And Light Sanding Drywall Surfaces.....	0.40	
For Up To 100, Add	0.30	
For >100 To 250, Add	0.14	
For >250 To 500, Add	0.06	
For >5,000 To 10,000, Deduct	-0.02	
For >10,000 To 15,000, Deduct	-0.04	
For >15,000 To 30,000, Deduct	-0.06	
For >30,000, Deduct	-0.08	
09 91 43 00-0014 SF Scrape, Repair And Sand Severely Damaged Drywall Surfaces.....	0.77	
For Up To 100, Add	0.53	
For >100 To 250, Add	0.25	
For >250 To 500, Add	0.11	
For >5,000 To 10,000, Deduct	-0.04	
For >10,000 To 15,000, Deduct	-0.07	
For >15,000 To 30,000, Deduct	-0.11	
For >30,000, Deduct	-0.15	
09 91 43 00-0015 Metal Surfaces (09 91 43 00-0001)		
09 91 43 00-0016 SF Chemical Clean, Brush And Wash Metal Surface.....	0.48	
For Up To 100, Add	0.29	
For >100 To 250, Add	0.14	
For >250 To 500, Add	0.06	
For >5,000 To 10,000, Deduct	-0.02	
For >10,000 To 15,000, Deduct	-0.04	
For >15,000 To 30,000, Deduct	-0.07	
For >30,000, Deduct	-0.09	
09 91 43 00-0017 SF Hand Scraping And Sanding, Metal Surface.....	0.50	
For Up To 100, Add	0.38	
For >100 To 250, Add	0.18	
For >250 To 500, Add	0.08	
For >5,000 To 10,000, Deduct	-0.03	
For >10,000 To 15,000, Deduct	-0.05	
For >15,000 To 30,000, Deduct	-0.08	
For >30,000, Deduct	-0.10	
09 91 43 00-0018 SF Up To 5,000 PSI, Pressure Wash Metal Surface.....	0.39	
For Up To 100, Add	0.26	
For >100 To 250, Add	0.12	
For >250 To 500, Add	0.05	
For >5,000 To 10,000, Deduct	-0.02	
For >10,000 To 15,000, Deduct	-0.04	
For >15,000 To 30,000, Deduct	-0.06	
For >30,000, Deduct	-0.08	
09 91 43 00-0019 SF Power Tool Cleaning, Metal Surface.....	1.02	
For Up To 100, Add	0.77	
For >100 To 250, Add	0.36	
For >250 To 500, Add	0.15	
For >5,000 To 10,000, Deduct	-0.05	
For >10,000 To 15,000, Deduct	-0.10	
For >15,000 To 30,000, Deduct	-0.15	
For >30,000, Deduct	-0.20	
09 91 43 00-0020 SF Steam Cleaning, Metal Surface.....	0.39	
For Up To 100, Add	0.23	
For >100 To 250, Add	0.11	
For >250 To 500, Add	0.05	
For >5,000 To 10,000, Deduct	-0.02	
For >10,000 To 15,000, Deduct	-0.04	
For >15,000 To 30,000, Deduct	-0.06	
For >30,000, Deduct	-0.07	
09 91 43 00-0021 SF Loose Mill Scale With Fine Powder, Commercial Blast Metal Surface.....	0.82	
For Up To 100, Add	0.54	
For >100 To 250, Add	0.25	
For >250 To 500, Add	0.11	
For >5,000 To 10,000, Deduct	-0.04	
For >10,000 To 15,000, Deduct	-0.08	
For >15,000 To 30,000, Deduct	-0.12	
For >30,000, Deduct	-0.16	
09 91 43 00-0022 SF Tight Mill Scale With Fine Powder Rust, Commercial Blast Metal Surface.....	1.11	
For Up To 100, Add	0.72	
For >100 To 250, Add	0.34	
For >250 To 500, Add	0.14	
For >5,000 To 10,000, Deduct	-0.05	
For >10,000 To 15,000, Deduct	-0.11	
For >15,000 To 30,000, Deduct	-0.16	
For >30,000, Deduct	-0.21	
09 91 43 00-0023 SF Exterior Coating Blistered Pitted, Rust, Commercial Blast Metal Surface.....	1.64	
For Up To 100, Add	1.07	
For >100 To 250, Add	0.50	
For >250 To 500, Add	0.21	
For >5,000 To 10,000, Deduct	-0.08	
For >10,000 To 15,000, Deduct	-0.16	
For >15,000 To 30,000, Deduct	-0.24	
For >30,000, Deduct	-0.32	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 43 00-0024	SF		Badly Pitted With Rust Nodules, Commercial Blast Metal Surface	2.74	
			For Up To 100, Add	1.79	
			For >100 To 250, Add	0.84	
			For >250 To 500, Add	0.36	
			For >5,000 To 10,000, Deduct	-0.13	
			For >10,000 To 15,000, Deduct	-0.26	
			For >15,000 To 30,000, Deduct	-0.40	
			For >30,000, Deduct	-0.53	
09 91 43 00-0025	SF		Loose Mill Scale With Fine Powder Rust, Near White Blast Metal Surface	2.08	
			For Up To 100, Add	1.35	
			For >100 To 250, Add	0.63	
			For >250 To 500, Add	0.27	
			For >5,000 To 10,000, Deduct	-0.10	
			For >10,000 To 15,000, Deduct	-0.20	
			For >15,000 To 30,000, Deduct	-0.30	
			For >30,000, Deduct	-0.40	
09 91 43 00-0026	SF		Tight Mill Scale Little Rust, Near White Blast Metal Surface	2.57	
			For Up To 100, Add	1.66	
			For >100 To 250, Add	0.77	
			For >250 To 500, Add	0.33	
			For >5,000 To 10,000, Deduct	-0.12	
			For >10,000 To 15,000, Deduct	-0.24	
			For >15,000 To 30,000, Deduct	-0.37	
			For >30,000, Deduct	-0.50	
09 91 43 00-0027	SF		Exterior Coat Blistered Pitted Rust, Near White Blast Metal Surface	3.34	
			For Up To 100, Add	2.16	
			For >100 To 250, Add	1.01	
			For >250 To 500, Add	0.43	
			For >5,000 To 10,000, Deduct	-0.16	
			For >10,000 To 15,000, Deduct	-0.32	
			For >15,000 To 30,000, Deduct	-0.49	
			For >30,000, Deduct	-0.65	
09 91 43 00-0028	SF		Badly Pitted Rust Nodules, Near White Blast Metal Surface	4.17	
			For Up To 100, Add	2.69	
			For >100 To 250, Add	1.26	
			For >250 To 500, Add	0.54	
			For >5,000 To 10,000, Deduct	-0.20	
			For >10,000 To 15,000, Deduct	-0.39	
			For >15,000 To 30,000, Deduct	-0.61	
			For >30,000, Deduct	-0.81	
09 91 43 00-0029			Tile Surfaces (09 91 43 00-0001)		
09 91 43 00-0030	SF		Alkaline Cleaner, Brush And Wash Tile Surface	0.26	
			For Up To 100, Add	0.20	
			For >100 To 250, Add	0.09	
			For >250 To 500, Add	0.04	
			For >5,000 To 10,000, Deduct	-0.01	
			For >10,000 To 15,000, Deduct	-0.03	
			For >15,000 To 30,000, Deduct	-0.04	
			For >30,000, Deduct	-0.05	
09 91 43 00-0031	SF		Up To 5,000 PSI, Pressure Wash Tile Surface	0.28	
			For Up To 100, Add	0.19	
			For >100 To 250, Add	0.09	
			For >250 To 500, Add	0.04	
			For >5,000 To 10,000, Deduct	-0.01	
			For >10,000 To 15,000, Deduct	-0.03	
			For >15,000 To 30,000, Deduct	-0.04	
			For >30,000, Deduct	-0.05	
09 91 43 00-0032			Wood Surfaces (09 91 43 00-0001)		
09 91 43 00-0033	SF		Prepare New Wood Floor For Finish, Multi Grit Sanding/Screening	0.94	
			For Up To 100, Add	0.68	
			For >100 To 250, Add	0.32	
			For >250 To 500, Add	0.14	
			For >5,000 To 10,000, Deduct	-0.05	
			For >10,000 To 15,000, Deduct	-0.09	
			For >15,000 To 30,000, Deduct	-0.14	
			For >30,000, Deduct	-0.19	
			For Up To 100, Add	0.68	
			For >100 To 250, Add	0.32	
			For >250 To 500, Add	0.14	
			For >4,000, Deduct	-0.05	
09 91 43 00-0034	SF		Chemical Clean, Brush And Wash Wood Surface	0.39	
			For Up To 100, Add	0.23	
			For >100 To 250, Add	0.11	
			For >250 To 500, Add	0.05	
			For >5,000 To 10,000, Deduct	-0.02	
			For >10,000 To 15,000, Deduct	-0.04	
			For >15,000 To 30,000, Deduct	-0.06	
			For >30,000, Deduct	-0.07	



Finishes	09	9
Painting And Coating	09 90	
Painting	09 91	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 43 00-0035 SF Hand Scrape Wood Surface	0.70	
For Up To 100, Add	0.53	
For >100 To 250, Add	0.25	
For >250 To 500, Add	0.11	
For >5,000 To 10,000, Deduct	-0.04	
For >10,000 To 15,000, Deduct	-0.07	
For >15,000 To 30,000, Deduct	-0.11	
For >30,000, Deduct	-0.14	
09 91 43 00-0036 SF Steam Clean Wood Surface	0.63	
For Up To 100, Add	0.41	
For >100 To 250, Add	0.19	
For >250 To 500, Add	0.08	
For >5,000 To 10,000, Deduct	-0.03	
For >10,000 To 15,000, Deduct	-0.06	
For >15,000 To 30,000, Deduct	-0.09	
For >30,000, Deduct	-0.12	
09 91 43 00-0037 SF Up To 5,000 PSI, Pressure Wash Wood Surface	0.42	
For Up To 100, Add	0.28	
For >100 To 250, Add	0.13	
For >250 To 500, Add	0.06	
For >5,000 To 10,000, Deduct	-0.02	
For >10,000 To 15,000, Deduct	-0.04	
For >15,000 To 30,000, Deduct	-0.06	
For >30,000, Deduct	-0.08	
09 91 43 00-0038 SF Sanding Wood Paneling, Boards, Doors, Etcetera	0.55	
For Up To 100, Add	0.38	
For >100 To 250, Add	0.18	
For >250 To 500, Add	0.08	
For >5,000 To 10,000, Deduct	-0.03	
For >10,000 To 15,000, Deduct	-0.05	
For >15,000 To 30,000, Deduct	-0.08	
For >30,000, Deduct	-0.11	
09 91 43 00-0039 SF Sanding Wood Trim	0.74	
For Up To 100, Add	0.53	
For >100 To 250, Add	0.25	
For >250 To 500, Add	0.11	
For >5,000 To 10,000, Deduct	-0.04	
For >10,000 To 15,000, Deduct	-0.07	
For >15,000 To 30,000, Deduct	-0.11	
For >30,000, Deduct	-0.15	
09 91 43 00-0040 SF Prime Wood Surfaces With Linseed Oil, 1 Coat	0.49	
For Up To 100, Add	0.32	
For >100 To 250, Add	0.15	
For >250 To 500, Add	0.06	
For >5,000 To 10,000, Deduct	-0.02	
For >10,000 To 15,000, Deduct	-0.05	
For >15,000 To 30,000, Deduct	-0.07	
For >30,000, Deduct	-0.09	
09 91 43 00-0041 SF Paint Wood Surfaces With Linseed Oil, 1 Coat	0.56	
For Up To 100, Add	0.37	
For >100 To 250, Add	0.17	
For >250 To 500, Add	0.07	
For >5,000 To 10,000, Deduct	-0.03	
For >10,000 To 15,000, Deduct	-0.05	
For >15,000 To 30,000, Deduct	-0.08	
For >30,000, Deduct	-0.11	
09 91 43 00-0042 Vinyl Siding Surfaces (09 91 43 00-0001)	0.42	
09 91 43 00-0043 SF Hand Wash Vinyl Siding	0.42	
For Up To 100, Add	0.30	
For >100 To 250, Add	0.14	
For >250 To 500, Add	0.06	
For >5,000 To 10,000, Deduct	-0.02	
For >10,000 To 15,000, Deduct	-0.04	
For >15,000 To 30,000, Deduct	-0.06	
For >30,000, Deduct	-0.08	
09 91 43 00-0044 SF Up To 5,000 PSI, Pressure Wash Vinyl Siding	0.35	
For Up To 100, Add	0.22	
For >100 To 250, Add	0.10	
For >250 To 500, Add	0.04	
For >5,000 To 10,000, Deduct	-0.02	
For >10,000 To 15,000, Deduct	-0.03	
For >15,000 To 30,000, Deduct	-0.05	
For >30,000, Deduct	-0.07	
09 91 43 00-0045 SF Steam Clean Vinyl Siding	0.65	
For Up To 100, Add	0.41	
For >100 To 250, Add	0.19	
For >250 To 500, Add	0.08	
For >5,000 To 10,000, Deduct	-0.03	
For >10,000 To 15,000, Deduct	-0.06	
For >15,000 To 30,000, Deduct	-0.09	
For >30,000, Deduct	-0.13	
09 91 43 00-0046 Prep Work (09 91 43 00-0001)		

09	Finishes
09 90	Painting And Coating
09 91	Painting



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 91 43 00-0047	SF		Citrus Strip, Single Applications.....	0.71	
09 91 43 00-0048			Plaster/Stucco (09 91 43 00-0001) Note: Based on total project quantity.		
09 91 43 00-0049	SF		Up To 5,000 PSI, Pressure Wash Stucco.....	0.46	
			For Up To 100, Add	0.29	
			For >100 To 250, Add	0.14	
			For >250 To 500, Add	0.06	
			For >5,000 To 10,000, Deduct	-0.02	
			For >10,000 To 15,000, Deduct	-0.04	
			For >15,000 To 30,000, Deduct	-0.07	
			For >30,000, Deduct	-0.09	
09 91 43 00-0050			Paint Removal, Strip To Bare Wood (09 91 43 00-0001)		
09 91 43 00-0051	SF		Flat Surfaces, Paint Removal, Strip To Bare Wood.....	4.80	
09 91 43 00-0052	SF		Cornices And Decorative Trim To 12" Wide, Paint Removal, Strip To Bare Wood.....	5.12	
09 91 43 00-0053			"Spot" Painting Of Surfaces (09 91 43 00-0001) Note: For use on individual areas less than 10 SF.		
09 91 43 00-0054	SF		"Spot" Paint Surfaces, Per Coat.....	0.91	
09 93			Staining And Transparent Finishing (09 90) Note: Includes light sanding or screening between coats.		
09 93 23			Interior Staining And Finishing (09 93) Note: VOC compliant in all regulated areas, review specifications for levels.		
09 93 23 53			Interior Finishing (09 93 23)		
09 93 23 53-0001			Concrete Finishes (09 93 23 53)		
09 93 23 53-0002	SF		Finish Concrete Floor, 1 Coat Polyurethane.....	0.51	
			For Up To 100, Add	0.32	
			For >100 To 250, Add	0.15	
			For >250 To 500, Add	0.07	
			For >4,000, Deduct	-0.03	
09 93 23 53-0003			Wood Trim Finishes (09 93 23 53)		
09 93 23 53-0004	SF		Finish Wood Trim, 1 Coat Sealer And 1 Coat Varnish Or Polyurethane.....	0.87	
			For Up To 100, Add	0.59	
			For >100 To 250, Add	0.28	
			For >250 To 500, Add	0.12	
			For >4,000, Deduct	-0.04	
09 93 23 53-0005	SF		Finish Wood Trim, 1 Coat Varnish Or Polyurethane.....	0.59	
			For Up To 100, Add	0.41	
			For >100 To 250, Add	0.19	
			For >250 To 500, Add	0.08	
			For >4,000, Deduct	-0.03	
09 93 23 53-0006	LF		Stain Wood Trim, Up To 6" Wide, 1 Coat Stain, With Brush And Wipe Off.....	0.74	
			For Up To 100, Add	0.53	
			For >100 To 250, Add	0.25	
			For >250 To 500, Add	0.11	
			For >4,000, Deduct	-0.04	
09 93 23 53-0007	SF		Stain Wood Trim, 1 Coat Stain, With Brush And Wipe Off.....	1.09	
			For Up To 100, Add	0.78	
			For >100 To 250, Add	0.37	
			For >250 To 500, Add	0.16	
			For >4,000, Deduct	-0.05	
09 93 23 53-0008			Wood Floor Finishes (09 93 23 53)		
09 93 23 53-0009	SF		Stain Or Varnish Wood Floor, 1 Coat Stain, Brush Work.....	0.32	
			For Up To 100, Add	0.20	
			For >100 To 250, Add	0.10	
			For >250 To 500, Add	0.04	
			For >4,000, Deduct	-0.02	
09 93 23 53-0010	SF		Stain Or Varnish Wood Floor, 1 Coat Stain, Brush/Roller Work.....	0.24	
			For Up To 100, Add	0.14	
			For >100 To 250, Add	0.07	
			For >250 To 500, Add	0.03	
			For >4,000, Deduct	-0.01	
09 93 23 53-0011	SF		Refinish Wood Floor, 2 Coats Polyurethane.....	1.99	
			Note: Includes sanding existing floor.		
			For Up To 100, Add	1.43	
			For >100 To 250, Add	0.67	
			For >250 To 500, Add	0.29	
			For >4,000, Deduct	-0.10	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
	09 93 23 53-0012	SF		Polyurethane Wood Floor, 1 Coat Polyurethane, With Wool Applicator Or Brush Work.....0.44 Note: Includes screening between coats.		
				<i>For Up To 100, Add</i>	0.30	
				<i>For >100 To 250, Add</i>	0.14	
				<i>For >250 To 500, Add</i>	0.06	
				<i>For >4,000, Deduct</i>	-0.02	
	09 93 23 53-0013	SF		Refinish Wood Floor, 1 Coat Sealer And 2 Coats Polyurethane.....2.26 Note: Includes sanding existing floor.		
				<i>For Up To 100, Add</i>	1.61	
				<i>For >100 To 250, Add</i>	0.75	
				<i>For >250 To 500, Add</i>	0.32	
				<i>For >4,000, Deduct</i>	-0.11	
	09 93 23 53-0014			Wood Door And Window Finishes (09 93 23 53) See CSI section 08 14 16 00-0175 for factory finish.		
	09 93 23 53-0015	EA		Stain Wood Door, 1 Coat Stain With Brush And Wipe Off Wood Door (Per Face) .....35.44		
				<i>For Up To 4, Add</i>	26.04	
				<i>For >4 To 10, Add</i>	12.18	
				<i>For >10 To 20, Add</i>	5.23	
				<i>For >160, Deduct</i>	-1.77	
	09 93 23 53-0016	EA		Stain Wood Window, 1 Coat Stain With Brush And Wipe Off Wood Window And Frame (Per Face).....24.99		
				<i>For Up To 4, Add</i>	17.95	
				<i>For >4 To 10, Add</i>	8.42	
				<i>For >10 To 20, Add</i>	3.62	
				<i>For >160, Deduct</i>	-1.25	
	09 93 23 53-0017	EA		Varnish Or Polyurethane Wood Door, 1 Coat Shellac (Per Face) .....25.65		
				<i>For Up To 4, Add</i>	18.77	
				<i>For >4 To 10, Add</i>	8.78	
				<i>For >10 To 20, Add</i>	3.77	
				<i>For >160, Deduct</i>	-1.28	
	09 93 23 53-0018	EA		Varnish Or Polyurethane Wood Door, 3 Coats Shellac, With Light Sanding Between Coats (Per Face) .....77.50		
				<i>For Up To 4, Add</i>	55.98	
				<i>For >4 To 10, Add</i>	26.23	
				<i>For >10 To 20, Add</i>	11.27	
				<i>For >160, Deduct</i>	-3.88	
	09 93 23 53-0019			Cabinet Finishes (09 93 23 53)		
	09 93 23 53-0020	SF		Stain Cabinet, 1 Coat Stain With Brush And Wipe.....0.88		
	09 93 23 53-0021	SF		Stain Cabinet, 1 Coat Shellac, Varnish Or Polyurethane.....0.88		
	09 93 23 53-0022			Gym, Stage And Dance Floor Finishes (09 93 23 53)		
	09 93 23 53-0023	SF		Yearly Maintenance Refinish Of Gym, Stage Or Dance Floor .....1.10 Note: Includes screening, one coat of finish and buffing. Excludes repainting of game lines.		
	09 93 23 53-0024	SF		Finish New Elementary School Wood Gym, Stage Or Dance Floor .....2.58 Note: Includes sanding to level, vacuuming, tack cloth wiping, seal coat, light sanding between coats, painting of all game lines, logos, court markings and solid paint areas, seal and finish coats per manufacturer's instructions, minimum four coats total with not less than two finish coats.		
				<i>For Stage Or Dance Floors, Deduct</i>	-0.05	
	09 93 23 53-0025	SF		Finish New Middle Or Junior School Wood Gym, Stage Or Dance Floor .....2.65 Note: Includes sanding to level, vacuuming, tack cloth wiping, seal coat, light sanding between coats, painting of all game lines, logos, court markings and solid paint areas, seal and finish coats per manufacturer's instructions, minimum four coats total with not less than two finish coats.		
				<i>For Stage Or Dance Floors, Deduct</i>	-0.05	
	09 93 23 53-0026	SF		Finish New High School Wood Gym, Stage Or Dance Floor .....2.70 Note: Includes sanding to level, vacuuming, tack cloth wiping, seal coat, light sanding between coats, painting of all game lines, logos, court markings and solid paint areas, seal and finish coats per manufacturer's instructions, minimum four coats total with not less than two finish coats.		
				<i>For Stage Or Dance Floors, Deduct</i>	-0.05	
	09 93 23 53-0027	SF		Refinish Existing Elementary School Wood Gym, Stage Or Dance Floor.....2.58 Note: Includes removal of existing finish and sanding to level, vacuuming, tack cloth wiping, seal coat, light sanding between coats, painting of all game lines, logos, court markings and solid paint areas, seal and finish coats per manufacturer's instructions, minimum four coats total with not less than two finish coats.		
				<i>For Stage Or Dance Floors, Deduct</i>	-0.05	
	09 93 23 53-0028	SF		Refinish Existing Middle Or Junior School Wood Gym, Stage Or Dance Floor.....2.65 Note: Includes removal of existing finish and sanding to level, vacuuming, tack cloth wiping, seal coat, light sanding between coats, painting of all game lines, logos, court markings and solid paint areas, seal and finish coats per manufacturer's instructions, minimum four coats total with not less than two finish coats.		
				<i>For Stage Or Dance Floors, Deduct</i>	-0.05	
	09 93 23 53-0029	SF		Refinish Existing High School Wood Gym, Stage Or Dance Floor .....2.70 Note: Includes removal of existing finish and sanding to level, vacuuming, tack cloth wiping, seal coat, light sanding between coats, painting of all game lines, logos, court markings and solid paint areas, seal and finish coats per manufacturer's instructions, minimum four coats total with not less than two finish coats.		
				<i>For Stage Or Dance Floors, Deduct</i>	-0.05	
	09 96			High-Performance Coatings (09 96)		
	09 96 23			Graffiti-Resistant Coatings (09 96)		
	09 96 23 00-001			Anti-Graffiti Painting (09 96 23)		

09 Finishes**09 90 Painting And Coating****09 96 High-Performance Coatings**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 96 23 00-0002 SF Anti-Graffiti Coating System, 1 Coat, Concrete Surface	1.35	
For Up To 100, Add	0.62	
For >100 To 250, Add	0.31	
For >250 To 500, Add	0.14	
09 96 23 00-0003 SF Anti-Graffiti Coating System, 1 Coat, Brick Or Block.....	1.39	
For Up To 100, Add	0.63	
For >100 To 250, Add	0.31	
For >250 To 500, Add	0.14	
09 96 23 00-0004 SF Anti-Graffiti Coating System, 1 Coat, Tile	1.12	
For Up To 100, Add	0.59	
For >100 To 250, Add	0.29	
For >250 To 500, Add	0.13	
09 96 23 00-0005 SF Anti-Graffiti Coating System, 1 Coat, Metal Or Steel	1.08	
For Up To 100, Add	0.58	
For >100 To 250, Add	0.28	
For >250 To 500, Add	0.12	
09 96 23 00-0006 SF Anti-Graffiti Coating System, 1 Coat, Wood.....	1.35	
For Up To 100, Add	0.62	
For >100 To 250, Add	0.31	
For >250 To 500, Add	0.14	
09 96 23 00-0007 SF Anti-Graffiti Coating System, 1 Coat, Painted Surface.....	1.20	
For Up To 100, Add	0.60	
For >100 To 250, Add	0.30	
For >250 To 500, Add	0.13	
09 96 23 00-0008 SF Anti-Graffiti Coating System, 2 Coats, Concrete Surface.....	2.57	
For Up To 100, Add	1.13	
For >100 To 250, Add	0.57	
For >250 To 500, Add	0.25	
09 96 23 00-0009 SF Anti-Graffiti Coating System, 2 Coats, Brick Or Block.....	2.65	
For Up To 100, Add	1.14	
For >100 To 250, Add	0.58	
For >250 To 500, Add	0.26	
09 96 23 00-0010 SF Anti-Graffiti Coating System, 2 Coats, Tile.....	2.12	
For Up To 100, Add	1.06	
For >100 To 250, Add	0.52	
For >250 To 500, Add	0.23	
09 96 23 00-0011 SF Anti-Graffiti Coating System, 2 Coats, Metal Or Steel.....	2.04	
For Up To 100, Add	1.05	
For >100 To 250, Add	0.51	
For >250 To 500, Add	0.23	
09 96 23 00-0012 SF Anti-Graffiti Coating System, 2 Coats, Wood	2.54	
For Up To 100, Add	1.13	
For >100 To 250, Add	0.56	
For >250 To 500, Add	0.25	
09 96 23 00-0013 SF Anti-Graffiti Coating System, 2 Coats, Painted Surface.....	2.27	
For Up To 100, Add	1.08	
For >100 To 250, Add	0.54	
For >250 To 500, Add	0.24	
09 96 53 Elastomeric Coatings (09 96)		
09 96 53 00-0001 Elastomeric (09 96 53)		
Note: Per coat.		
09 96 53 00-0002 SF Paint, Brush, Elastomeric, Per Coat.....	1.71	
For Work >20', Add	0.26	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.88	
For >100 To 250, Add	0.43	
For >250 To 500, Add	0.19	
For >2,500 To 5,000, Deduct	-0.09	
For >5,000 To 10,000, Deduct	-0.17	
For >10,000 To 20,000, Deduct	-0.26	
For >20,000, Deduct	-0.34	
09 96 53 00-0003 SF Paint, Roller, Elastomeric, Per Coat.....	1.40	
For Work >20', Add	0.18	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.65	
For >100 To 250, Add	0.32	
For >250 To 500, Add	0.14	
For >2,500 To 5,000, Deduct	-0.07	
For >5,000 To 10,000, Deduct	-0.14	
For >10,000 To 20,000, Deduct	-0.21	
For >20,000, Deduct	-0.28	
09 96 53 00-0004 SF Paint, Conventional Spray, Elastomeric, Per Coat.....	1.47	
For Work >20', Add	0.17	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.63	
For >100 To 250, Add	0.32	
For >250 To 500, Add	0.14	
For >2,500 To 5,000, Deduct	-0.07	
For >5,000 To 10,000, Deduct	-0.15	
For >10,000 To 20,000, Deduct	-0.22	
For >20,000, Deduct	-0.29	



Finishes	09	9
Painting And Coating	09 90	
High-Performance Coatings	09 96	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
09 96 53 00-0005 SF Paint, Airless Spray, Elastomeric, Per Coat.....	1.32	
For Work >20', Add	0.14	
Note: Applied only to work area above 20'.		
For Up To 100, Add	0.52	
For >100 To 250, Add	0.27	
For >250 To 500, Add	0.12	
For >2,500 To 5,000, Deduct	-0.07	
For >5,000 To 10,000, Deduct	-0.13	
For >10,000 To 20,000, Deduct	-0.20	
For >20,000, Deduct	-0.26	
09 97 Special Coatings <small>(09 90)</small>		
09 97 35 Dry Erase Coatings <small>(09 97)</small>		
09 97 35 00-0001 Dry-Erase Paint <small>(09 97 35)</small>		
09 97 35 00-0002 Dry-Erase Paint (IdeaPaint™ PRO) <small>(09 97 35 00-0001)</small>		
09 97 35 00-0003 SF Dry-Erase Paint (IdeaPaint™ PRO), Applied With Roller	6.74	
Note: Includes two coats of primer and white, white sand, light beige or light gray surface.		
09 97 35 00-0004 Low VOC/Odorless, Dry-Erase Paint (IdeaPaint™ CREATE) <small>(09 97 35 00-0001)</small>		
09 97 35 00-0005 SF Clear, Low VOC/Odorless, Dry-Erase Paint (IdeaPaint™ CREATE), Applied With Roller.....	3.65	
Note: For application over existing latex-based top coats.		
09 97 35 00-0006 SF Black Or White, Low VOC/Odorless, Dry-Erase Paint (IdeaPaint™ CREATE), Applied With Roller	7.18	
Note: Includes two coats of primer and white or black surface coat.		

END OF SECTION 09

09	09	Finishes
	09 90	Painting And Coating
	09 97	Special Coatings



MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

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Specialties	10	10
Information Specialties	10 10	
Visual Display Units	10 11	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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10 Specialties

10 10 Information Specialties ⁽¹⁰⁾

10 11 Visual Display Units ^(10 10)

10 11 13 Chalkboards ^(10 11)

10 11 13 13 Fixed Chalkboards ^(10 11 13)

Note: Select task based off the square footage of an individual chalkboard. For example use the >12 To 16 SF range for each 3' x 5' chalkboard.

10 11 13 13-0001	SF	Up To 6 SF, 5/8" Face Aluminum Frame, Porcelain Enamel Steel Chalkboard.....	39.15	6.11
10 11 13 13-0004	SF	>6 To 12 SF, 5/8" Face Aluminum Frame, Porcelain Enamel Steel Chalkboard	25.75	2.87
10 11 13 13-0005	SF	>12 To 16 SF, 5/8" Face Aluminum Frame, Porcelain Enamel Steel Chalkboard	22.27	2.48
10 11 13 13-0006	SF	>16 To 24 SF, 5/8" Face Aluminum Frame, Porcelain Enamel Steel Chalkboard	18.78	1.62
10 11 13 13-0007	SF	>24 SF, 5/8" Face Aluminum Frame, Porcelain Enamel Steel Chalkboard	16.02	0.90
10 11 13 13-0008		1-1/4" Face Aluminum Frame, Porcelain Enamel Steel Chalkboards (Claridge 1300 Series) ^(10 11 13 13-0001)		
		Note: Includes up to 1/2" core material, aluminum backing, full length map rail, map hooks, chalk tray and mounting hardware.		
10 11 13 13-0009	SF	Up To 6 SF, 1-1/4" Face Aluminum Frame, Porcelain Enamel Steel Chalkboard	41.65	6.11
10 11 13 13-0010	SF	>6 To 12 SF, 1-1/4" Face Aluminum Frame, Porcelain Enamel Steel Chalkboard	28.19	2.87
10 11 13 13-0011	SF	>12 To 16 SF, 1-1/4" Face Aluminum Frame, Porcelain Enamel Steel Chalkboard	24.51	2.48
10 11 13 13-0012	SF	>16 To 24 SF, 1-1/4" Face Aluminum Frame, Porcelain Enamel Steel Chalkboard	21.50	1.62
10 11 13 13-0013	SF	>24 SF, 1-1/4" Face Aluminum Frame, Porcelain Enamel Steel Chalkboard	18.69	0.90
10 11 13 13-0014		1-3/4" Face Wood Frame, Porcelain Enamel Steel Chalkboards (Claridge 1600 Series) ^(10 11 13 13-0001)		
		Note: Includes up to 1/2" core material, aluminum backing, chalk tray and mounting hardware.		
10 11 13 13-0015	SF	Up To 6 SF, 1-3/4" Face Wood Frame, Porcelain Enamel Steel Chalkboard	37.61	6.11
10 11 13 13-0016	SF	>6 To 12 SF, 1-3/4" Face Wood Frame, Porcelain Enamel Steel Chalkboard	24.18	2.87
10 11 13 13-0017	SF	>12 To 16 SF, 1-3/4" Face Wood Frame, Porcelain Enamel Steel Chalkboard	20.76	2.48
10 11 13 13-0018	SF	>16 To 24 SF, 1-3/4" Face Wood Frame, Porcelain Enamel Steel Chalkboard	17.52	1.62
10 11 13 13-0019	SF	>24 SF, 1-3/4" Face Wood Frame, Porcelain Enamel Steel Chalkboard	14.61	0.90
10 11 13 13-0020		Remove And Reinstall ^(10 11 13 13)		
10 11 13 13-0021	SF	Remove And Reinstall Chalkboard	7.62	
10 11 13 13-0022		Field Applied Chalkboard And Accessories ^(10 11 13 13)		
10 11 13 13-0023		Chalkboard Face Sheets And Panels ^(10 11 13 13-0022)		
10 11 13 13-0024	SF	Porcelain Enamel Steel Chalkboard Face Sheet (Claridge Vitracite)	12.57	2.87
		Note: Includes porcelain enamel steel chalkboard skin.		
10 11 13 13-0025	SF	Porcelain Enamel Steel Chalkboard Panel (Claridge VIT)	15.35	2.87
		Note: Includes porcelain enamel steel surface mounted on either particle board or hardboard core with an aluminum moisture barrier back.		
10 11 13 13-0026		Chalkboard And Markerboard Accessory Trays And Trim ^(10 11 13 13-0022)		
10 11 13 13-0027	LF	Chalk And Marker Tray, Field Applied	13.72	3.95
10 11 13 13-0028	PR	Chalk And Marker Tray End Closures, Field Applied	18.86	7.18
10 11 13 13-0029	LF	Mullion Trim For Chalkboards And Markerboards, Field Applied	9.79	3.95
10 11 13 13-0030	LF	Screw On Trim For Chalkboards And Markerboards, Field Applied	10.09	3.95
10 11 13 13-0031	LF	1/2" Leg Map Rail For Chalkboards And Markerboards, Field Applied	11.00	3.95
10 11 13 13-0032	LF	1/4" Leg Map Rail For Chalkboards And Markerboards, Field Applied	11.75	3.95
10 11 13 13-0033	LF	No Leg Map Rail For Chalkboards And Markerboards, Field Applied	10.56	3.95
10 11 13 33		Rail-Mounted Chalkboards ^(10 11 13)		
10 11 13 33-0001		Horizontal Sliding, Porcelain Enamel Steel Chalkboards (Claridge HS Series) ^(10 11 13 33)		
10 11 13 33-0002		Two Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Chalkboards ^(10 11 13 33-0001)		
10 11 13 33-0003	EA	4' x 6' Frame, Two Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Chalkboard	1,948.16	71.87
10 11 13 33-0004	EA	4' x 8' Frame, Two Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Chalkboard	2,193.37	71.87



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 11 13 33-0005	EA		4' x 10' Frame, Two Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Chalkboard.....	2,487.61	76.55
10 11 13 33-0006	EA		4' x 12' Frame, Two Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Chalkboard.....	2,772.51	76.55
10 11 13 33-0007	EA		4' x 14' Frame, Two Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Chalkboard.....	3,463.93	82.29
10 11 13 33-0008	EA		4' x 16' Frame, Two Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Chalkboard.....	3,691.18	82.29
10 11 13 33-0009	EA		4' x 20' Frame, Two Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Chalkboard.....	4,175.32	86.25
10 11 13 33-0010	EA		4' x 24' Frame, Two Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Chalkboard.....	4,739.45	86.25
10 11 13 33-0011			Three Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Chalkboards ^(10 11 13 33-0001)		
10 11 13 33-0012	EA		4' x 6' Frame, Three Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Chalkboard.....	2,679.59	71.87
10 11 13 33-0013	EA		4' x 8' Frame, Three Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Chalkboard.....	3,187.51	71.87
10 11 13 33-0014	EA		4' x 10' Frame, Three Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Chalkboard.....	3,651.85	76.55
10 11 13 33-0015	EA		4' x 12' Frame, Three Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Chalkboard.....	4,118.19	76.55
10 11 13 33-0016	EA		4' x 14' Frame, Three Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Chalkboard.....	4,698.10	82.29
10 11 13 33-0017	EA		4' x 16' Frame, Three Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Chalkboard.....	4,903.61	82.29
10 11 13 33-0018	EA		4' x 20' Frame, Three Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Chalkboard.....	5,757.25	86.25
10 11 13 33-0019	EA		4' x 24' Frame, Three Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Chalkboard.....	6,443.28	86.25
10 11 13 33-0020			Four Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Chalkboards ^(10 11 13 33-0001)		
10 11 13 33-0021	EA		4' x 6' Frame, Four Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Chalkboard.....	2,991.44	71.87
10 11 13 33-0022	EA		4' x 8' Frame, Four Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Chalkboard.....	3,406.75	71.87
10 11 13 33-0023	EA		4' x 10' Frame, Four Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Chalkboard.....	3,853.13	76.55
10 11 13 33-0024	EA		4' x 12' Frame, Four Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Chalkboard.....	4,329.87	76.55
10 11 13 33-0025	EA		4' x 14' Frame, Four Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Chalkboard.....	5,249.98	82.29
10 11 13 33-0026	EA		4' x 16' Frame, Four Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Chalkboard.....	5,468.72	82.29
10 11 13 33-0027	EA		4' x 20' Frame, Four Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Chalkboard.....	6,465.06	86.25
10 11 13 33-0028	EA		4' x 24' Frame, Four Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Chalkboard.....	7,224.38	86.25
10 11 13 33-0029			Vertical Sliding, Porcelain Enamel Steel Chalkboards (Claridge TW Series) ^(10 11 13 33)		
10 11 13 33-0030			One Sliding Panel, Vertical Sliding, Porcelain Enamel Steel Chalkboards ^(10 11 13 33-0029)		
10 11 13 33-0031	EA		8' x 4' Frame, One Sliding Panel, Vertical Sliding, Porcelain Enamel Steel Chalkboard.....	2,337.95	71.87
10 11 13 33-0032	EA		8' x 5' Frame, One Sliding Panel, Vertical Sliding, Porcelain Enamel Steel Chalkboard.....	2,585.05	71.87
10 11 13 33-0033	EA		8' x 6' Frame, One Sliding Panel, Vertical Sliding, Porcelain Enamel Steel Chalkboard.....	2,828.26	76.55
10 11 13 33-0034	EA		8' x 8' Frame, One Sliding Panel, Vertical Sliding, Porcelain Enamel Steel Chalkboard.....	3,257.25	76.55
10 11 13 33-0035	EA		8' x 10' Frame, One Sliding Panel, Vertical Sliding, Porcelain Enamel Steel Chalkboard.....	3,569.24	82.29
10 11 13 33-0036	EA		8' x 12' Frame, One Sliding Panel, Vertical Sliding, Porcelain Enamel Steel Chalkboard.....	3,965.15	82.29
10 11 13 33-0037			Two Sliding Panels, Vertical Sliding, Porcelain Enamel Steel Chalkboards ^(10 11 13 33-0029)		
10 11 13 33-0038	EA		8' x 4' Frame, Two Sliding Panels, Vertical Sliding, Porcelain Enamel Steel Chalkboard.....	3,451.09	71.87
10 11 13 33-0039	EA		8' x 5' Frame, Two Sliding Panels, Vertical Sliding, Porcelain Enamel Steel Chalkboard.....	3,834.72	71.87
10 11 13 33-0040	EA		8' x 6' Frame, Two Sliding Panels, Vertical Sliding, Porcelain Enamel Steel Chalkboard.....	4,216.35	76.55
10 11 13 33-0041	EA		8' x 8' Frame, Two Sliding Panels, Vertical Sliding, Porcelain Enamel Steel Chalkboard.....	4,922.19	76.55
10 11 13 33-0042	EA		8' x 10' Frame, Two Sliding Panels, Vertical Sliding, Porcelain Enamel Steel Chalkboard.....	5,357.93	82.29
10 11 13 33-0043	EA		8' x 12' Frame, Two Sliding Panels, Vertical Sliding, Porcelain Enamel Steel Chalkboard.....	5,998.57	82.29
10 11 13 33-0044			Three Sliding Panels, Vertical Sliding, Porcelain Enamel Steel Chalkboards ^(10 11 13 33-0029)		
10 11 13 33-0045	EA		8' x 4' Frame, Three Sliding Panels, Vertical Sliding, Porcelain Enamel Steel Chalkboard.....	4,729.60	71.87
10 11 13 33-0046	EA		8' x 5' Frame, Three Sliding Panels, Vertical Sliding, Porcelain Enamel Steel Chalkboard.....	5,252.60	71.87
10 11 13 33-0047	EA		8' x 6' Frame, Three Sliding Panels, Vertical Sliding, Porcelain Enamel Steel Chalkboard.....	5,773.60	76.55
10 11 13 33-0048	EA		8' x 8' Frame, Three Sliding Panels, Vertical Sliding, Porcelain Enamel Steel Chalkboard.....	6,755.34	76.55
10 11 13 33-0049	EA		8' x 10' Frame, Three Sliding Panels, Vertical Sliding, Porcelain Enamel Steel Chalkboard.....	7,326.18	82.29
10 11 13 33-0050	EA		8' x 12' Frame, Three Sliding Panels, Vertical Sliding, Porcelain Enamel Steel Chalkboard.....	8,228.54	82.29
10 11 13 33-0051			Motor Operated Vertical Sliding, Porcelain Enamel Steel Chalkboards (Claridge MO Series) ^(10 11 13 33)		
			Note: Excludes remotes.		
10 11 13 33-0052			One Sliding Panel, Motor Operated Vertical Sliding, Porcelain Enamel Steel Chalkboards ^(10 11 13 33-0051)		
10 11 13 33-0053	EA		10' x 4' Frame, One Sliding Panel, Motor Operated Vertical Sliding, Porcelain Enamel Steel Chalkboard.....	7,568.15	143.74
10 11 13 33-0054	EA		10' x 5' Frame, One Sliding Panel, Motor Operated Vertical Sliding, Porcelain Enamel Steel Chalkboard.....	7,787.01	143.74
10 11 13 33-0055	EA		10' x 6' Frame, One Sliding Panel, Motor Operated Vertical Sliding, Porcelain Enamel Steel Chalkboard.....	8,028.08	148.24
10 11 13 33-0056	EA		10' x 8' Frame, One Sliding Panel, Motor Operated Vertical Sliding, Porcelain Enamel Steel Chalkboard.....	8,428.95	148.24
10 11 13 33-0057	EA		10' x 10' Frame, One Sliding Panel, Motor Operated Vertical Sliding, Porcelain Enamel Steel Chalkboard.....	8,869.04	152.73
10 11 13 33-0058	EA		10' x 12' Frame, One Sliding Panel, Motor Operated Vertical Sliding, Porcelain Enamel Steel Chalkboard.....	9,255.73	152.73
10 11 13 33-0059	EA		10' x 14' Frame, One Sliding Panel, Motor Operated Vertical Sliding, Porcelain Enamel Steel Chalkboard.....	10,091.33	161.71
10 11 13 33-0060	EA		10' x 16' Frame, One Sliding Panel, Motor Operated Vertical Sliding, Porcelain Enamel Steel Chalkboard.....	10,198.30	161.71



Specialties	10	10
Information Specialties	10 10	
Visual Display Units	10 11	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 11 13 33-0061 Two Sliding Panels, Motor Operated Vertical Sliding, Porcelain Enamel Steel Chalkboards <small>(10 11 13 33-0051)</small>		
10 11 13 33-0062 EA 10' x 4' Frame, Two Sliding Panels, Motor Operated Vertical Sliding, Porcelain Enamel Steel Chalkboard.....	11,959.00	143.74
10 11 13 33-0063 EA 10' x 5' Frame, Two Sliding Panels, Motor Operated Vertical Sliding, Porcelain Enamel Steel Chalkboard.....	12,248.35	143.74
10 11 13 33-0064 EA 10' x 6' Frame, Two Sliding Panels, Motor Operated Vertical Sliding, Porcelain Enamel Steel Chalkboard.....	12,568.43	148.24
10 11 13 33-0065 EA 10' x 8' Frame, Two Sliding Panels, Motor Operated Vertical Sliding, Porcelain Enamel Steel Chalkboard.....	13,157.54	148.24
10 11 13 33-0066 EA 10' x 10' Frame, Two Sliding Panels, Motor Operated Vertical Sliding, Porcelain Enamel Steel Chalkboard.....	13,740.51	152.73
10 11 13 33-0067 EA 10' x 12' Frame, Two Sliding Panels, Motor Operated Vertical Sliding, Porcelain Enamel Steel Chalkboard.....	14,300.33	152.73
10 11 13 33-0068 EA 10' x 14' Frame, Two Sliding Panels, Motor Operated Vertical Sliding, Porcelain Enamel Steel Chalkboard.....	15,430.96	161.71
10 11 13 33-0069 EA 10' x 16' Frame, Two Sliding Panels, Motor Operated Vertical Sliding, Porcelain Enamel Steel Chalkboard.....	15,600.49	161.71
10 11 13 33-0070 Three Sliding Panels, Motor Operated Vertical Sliding, Porcelain Enamel Steel Chalkboards <small>(10 11 13 33-0051)</small>		
10 11 13 33-0071 EA 10' x 4' Frame, Three Sliding Panels, Motor Operated Vertical Sliding, Porcelain Enamel Steel Chalkboard.....	15,564.55	143.74
10 11 13 33-0072 EA 10' x 5' Frame, Three Sliding Panels, Motor Operated Vertical Sliding, Porcelain Enamel Steel Chalkboard.....	16,294.85	143.74
10 11 13 33-0073 EA 10' x 6' Frame, Three Sliding Panels, Motor Operated Vertical Sliding, Porcelain Enamel Steel Chalkboard.....	16,678.80	148.24
10 11 13 33-0074 EA 10' x 8' Frame, Three Sliding Panels, Motor Operated Vertical Sliding, Porcelain Enamel Steel Chalkboard.....	17,444.82	148.24
10 11 13 33-0075 EA 10' x 10' Frame, Three Sliding Panels, Motor Operated Vertical Sliding, Porcelain Enamel Steel Chalkboard.....	18,247.22	152.73
10 11 13 33-0076 EA 10' x 12' Frame, Three Sliding Panels, Motor Operated Vertical Sliding, Porcelain Enamel Steel Chalkboard.....	19,021.74	152.73
10 11 13 33-0077 EA 10' x 14' Frame, Three Sliding Panels, Motor Operated Vertical Sliding, Porcelain Enamel Steel Chalkboard.....	20,543.78	161.71
10 11 13 33-0078 EA 10' x 16' Frame, Three Sliding Panels, Motor Operated Vertical Sliding, Porcelain Enamel Steel Chalkboard.....	20,842.03	161.71
10 11 13 33-0079 Sliding Chalkboard And Markerboard Accessories <small>(10 11 13 33)</small>		
10 11 13 33-0080 EA One Sliding Panel, Remote Control For Motor Operated Sliding Chalkboard Or Markerboard.....	573.24	
10 11 13 33-0081 EA Two Sliding Panel, Remote Control For Motor Operated Sliding Chalkboard Or Markerboard.....	980.53	
10 11 16 Markerboards <small>(10 11)</small>		
10 11 16 13 Fixed Markerboards <small>(10 11 16)</small>		
Note: Select task based off the square footage of an individual markerboard. For example use the >12 To 16 SF range for each 3' x 5' markerboard.		
10 11 16 13-0001 Porcelain Enamel Steel Markerboards <small>(10 11 16 13)</small>		
10 11 16 13-0002 5/8" Face Aluminum Frame, Porcelain Enamel Steel Markerboards (Claridge 800 Series) <small>(10 11 16 13-0001)</small>		
Note: Includes up to 1/2" core material, aluminum backing, full length map rail, map hooks, marker tray and mounting hardware.		
10 11 16 13-0003 SF Up To 6 SF, 5/8" Face Aluminum Frame, Porcelain Enamel Steel Markerboard.....	39.31	6.11
10 11 16 13-0004 SF >6 To 12 SF, 5/8" Face Aluminum Frame, Porcelain Enamel Steel Markerboard.....	26.30	2.87
10 11 16 13-0005 SF >12 To 16 SF, 5/8" Face Aluminum Frame, Porcelain Enamel Steel Markerboard.....	22.27	2.48
10 11 16 13-0006 SF >16 To 24 SF, 5/8" Face Aluminum Frame, Porcelain Enamel Steel Markerboard.....	18.98	1.62
10 11 16 13-0007 SF >24 SF, 5/8" Face Aluminum Frame, Porcelain Enamel Steel Markerboard.....	15.80	0.90
10 11 16 13-0008 1-1/4" Face Aluminum Frame, Porcelain Enamel Steel Markerboards (Claridge 1300 Series) <small>(10 11 16 13-0001)</small>		
Note: Includes up to 1/2" core material, aluminum backing, full length map rail, map hooks, marker tray and mounting hardware.		
10 11 16 13-0009 SF Up To 6 SF, 1-1/4" Face Aluminum Frame, Porcelain Enamel Steel Markerboard.....	41.68	6.11
10 11 16 13-0010 SF >6 To 12 SF, 1-1/4" Face Aluminum Frame, Porcelain Enamel Steel Markerboard.....	27.01	2.87
10 11 16 13-0011 SF >12 To 16 SF, 1-1/4" Face Aluminum Frame, Porcelain Enamel Steel Markerboard.....	23.33	2.48
10 11 16 13-0012 SF >16 To 24 SF, 1-1/4" Face Aluminum Frame, Porcelain Enamel Steel Markerboard.....	20.32	1.62
10 11 16 13-0013 SF >24 SF, 1-1/4" Face Aluminum Frame, Porcelain Enamel Steel Markerboard.....	17.99	0.90
10 11 16 13-0014 1-3/4" Face Wood Frame, Porcelain Enamel Steel Markerboards (Claridge LCS Series) <small>(10 11 16 13-0001)</small>		
Note: Includes up to 1/2" core material, aluminum backing, marker tray and mounting hardware.		
10 11 16 13-0015 SF Up To 6 SF, 1-3/4" Face Wood Frame, Porcelain Enamel Steel Markerboard.....	37.59	6.11
10 11 16 13-0016 SF >6 To 12 SF, 1-3/4" Face Wood Frame, Porcelain Enamel Steel Markerboard.....	24.19	2.87
10 11 16 13-0017 SF >12 To 16 SF, 1-3/4" Face Wood Frame, Porcelain Enamel Steel Markerboard.....	21.91	2.48
10 11 16 13-0018 SF >16 To 24 SF, 1-3/4" Face Wood Frame, Porcelain Enamel Steel Markerboard.....	17.64	1.62
10 11 16 13-0019 SF >24 SF, 1-3/4" Face Wood Frame, Porcelain Enamel Steel Markerboard.....	14.35	0.90
10 11 16 13-0020 Melamine Markerboards <small>(10 11 16 13)</small>		
10 11 16 13-0021 1-1/4" Face Aluminum Frame, Melamine Markerboard (Claridge MLC Series) <small>(10 11 16 13-0020)</small>		
Note: Includes full length map rail, map hooks, marker tray and mounting hardware.		
10 11 16 13-0022 SF Up To 6 SF, 1-1/4" Face Aluminum Frame, Melamine Markerboard.....	30.33	6.11
10 11 16 13-0023 SF >6 To 12 SF, 1-1/4" Face Aluminum Frame, Melamine Markerboard.....	19.18	2.87
10 11 16 13-0024 SF >12 To 16 SF, 1-1/4" Face Aluminum Frame, Melamine Markerboard.....	16.65	2.48
10 11 16 13-0025 SF >16 To 24 SF, 1-1/4" Face Aluminum Frame, Melamine Markerboard.....	12.68	1.62
10 11 16 13-0026 SF >24 SF, 1-1/4" Face Aluminum Frame, Melamine Markerboard.....	10.57	0.90



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 11 16 13-0027			1-3/4" Face Wood Frame, Melamine Markerboard (Claridge MLC Series) ^(10 11 16 13-0020) Note: Includes marker tray and mounting hardware.		
10 11 16 13-0028	SF		Up To 6 SF, 1-3/4" Face Wood Frame, Melamine Markerboard.....	29.53	6.11
10 11 16 13-0029	SF		>6 To 12 SF, 1-3/4" Face Wood Frame, Melamine Markerboard	18.81	2.87
10 11 16 13-0030	SF		>12 To 16 SF, 1-3/4" Face Wood Frame, Melamine Markerboard	16.12	2.48
10 11 16 13-0031	SF		>16 To 24 SF, 1-3/4" Face Wood Frame, Melamine Markerboard	11.73	1.62
10 11 16 13-0032	SF		>24 SF, 1-3/4" Face Wood Frame, Melamine Markerboard	9.70	0.90
10 11 16 13-0033			Nonporous, Non-Staining Markerboards ^(10 11 16 13)		
10 11 16 13-0034			5/8" Face Aluminum Frame, Nonporous, Non-Staining Markerboards (EverWhite Classic Series) ^(10 11 16 13-0033) Note: Includes non-staining permanent marker resistant surface, non-magnetic surface, marker tray and mounting hardware.		
10 11 16 13-0035	SF		Up To 6 SF, 5/8" Face Aluminum Frame, Nonporous, Non-Staining Markerboard.....	29.96	6.11
			<i>For Magnetic Surface, Add</i>	1.77	
10 11 16 13-0036	SF		>6 To 12 SF, 5/8" Face Aluminum Frame, Nonporous, Non-Staining Markerboard	19.25	2.87
			<i>For Magnetic Surface, Add</i>	1.35	
10 11 16 13-0037	SF		>12 To 16 SF, 5/8" Face Aluminum Frame, Nonporous, Non-Staining Markerboard	16.60	2.48
			<i>For Magnetic Surface, Add</i>	1.16	
10 11 16 13-0038	SF		>16 To 24 SF, 5/8" Face Aluminum Frame, Nonporous, Non-Staining Markerboard	14.41	1.62
			<i>For Magnetic Surface, Add</i>	1.12	
10 11 16 13-0039	SF		>24 SF, 5/8" Face Aluminum Frame, Nonporous, Non-Staining Markerboard	12.22	0.90
			<i>For Magnetic Surface, Add</i>	1.04	
10 11 16 13-0040			1-1/8" Face Aluminum Frame, Nonporous, Non-Staining Markerboards (EverWhite Classic Series) ^(10 11 16 13-0033) Note: Includes non-staining permanent marker resistant surface, non-magnetic surface, marker tray and mounting hardware.		
10 11 16 13-0041	SF		Up To 6 SF, 1-1/8" Face Aluminum Frame, Nonporous, Non-Staining Markerboard.....	29.96	6.11
			<i>For Magnetic Surface, Add</i>	1.77	
10 11 16 13-0042	SF		>6 To 12 SF, 1-1/8" Face Aluminum Frame, Nonporous, Non-Staining Markerboard	19.25	2.87
			<i>For Magnetic Surface, Add</i>	1.35	
10 11 16 13-0043	SF		>12 To 16 SF, 1-1/8" Face Aluminum Frame, Nonporous, Non-Staining Markerboard	16.60	2.48
			<i>For Magnetic Surface, Add</i>	1.16	
10 11 16 13-0044	SF		>16 To 24 SF, 1-1/8" Face Aluminum Frame, Nonporous, Non-Staining Markerboard	14.41	1.62
			<i>For Magnetic Surface, Add</i>	1.12	
10 11 16 13-0045	SF		>24 SF, 1-1/8" Face Aluminum Frame, Nonporous, Non-Staining Markerboard	12.22	0.90
			<i>For Magnetic Surface, Add</i>	1.04	
10 11 16 13-0046			1-1/4" Face Wood Frame, Nonporous, Non-Staining Markerboards (EverWhite Classic Series) ^(10 11 16 13-0033) Note: Includes non-staining permanent marker resistant surface, non-magnetic surface, marker tray and mounting hardware.		
10 11 16 13-0047	SF		Up To 6 SF, 1-1/4" Face Wood Frame, Nonporous, Non-Staining Markerboard	51.94	6.11
			<i>For Magnetic Surface, Add</i>	3.97	
10 11 16 13-0048	SF		>6 To 12 SF, 1-1/4" Face Wood Frame, Nonporous, Non-Staining Markerboard.....	32.45	2.87
			<i>For Magnetic Surface, Add</i>	2.67	
10 11 16 13-0049	SF		>12 To 16 SF, 1-1/4" Face Wood Frame, Nonporous, Non-Staining Markerboard.....	27.45	2.48
			<i>For Magnetic Surface, Add</i>	2.25	
10 11 16 13-0050	SF		>16 To 24 SF, 1-1/4" Face Wood Frame, Nonporous, Non-Staining Markerboard.....	22.99	1.62
			<i>For Magnetic Surface, Add</i>	1.98	
10 11 16 13-0051	SF		>24 SF, 1-1/4" Face Wood Frame, Nonporous, Non-Staining Markerboard	17.70	0.90
			<i>For Magnetic Surface, Add</i>	1.59	
10 11 16 13-0052			Nonporous, Non-Staining Markerboard Resurfacing Panels (EverWhite EverEZ Resurfacing Panels) ^(10 11 16 13-0033) Note: Includes non-staining, permanent marker resistant, magnetic dry erase surface. Excludes frame. Resurfacing panel for mounting to existing chalkboard or markerboard consists of dry erase surface, 24-gauge treated steel interlayer and pressure-sensitive adhesive backing.		
10 11 16 13-0053	SF		Up To 16 SF, Nonporous, Non-Staining Markerboard Resurfacing Panel With Pressure-Sensitive Adhesive Backing.....	13.35	2.48
10 11 16 13-0054	SF		>16 To 24 SF, Nonporous, Non-Staining Markerboard Resurfacing Panel With Pressure-Sensitive Adhesive Backing.....	11.18	1.62
10 11 16 13-0055	SF		>24 SF, Nonporous, Non-Staining Markerboard Resurfacing Panel With Pressure-Sensitive Adhesive Backing.....	9.20	0.90
10 11 16 13-0056			Remove And Reinstall Markerboard ^(10 11 16 13)		
10 11 16 13-0057	EA		Up To 6 SF, Remove And Reinstall Markerboard.....	43.12	
10 11 16 13-0058	EA		>6 To 12 SF, Remove And Reinstall Markerboard	50.31	
10 11 16 13-0059	EA		>12 To 16 SF, Remove And Reinstall Markerboard	57.50	
10 11 16 13-0060	EA		>16 To 24 SF, Remove And Reinstall Markerboard	64.69	
10 11 16 13-0061	EA		>24 SF, Remove And Reinstall Markerboard.....	71.87	



Specialties	10	10
Information Specialties	10 10	
Visual Display Units	10 11	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 11 16 13-0062 Field Applied Markerboard And Accessories <small>(10 11 16 13)</small>		
10 11 16 13-0063 Markerboard Face Sheets And Panels <small>(10 11 16 13-0062)</small>		
10 11 16 13-0064 SF Porcelain Enamel Steel Markerboard Face Sheet (Claridge LCS) 12.35	12.35	2.87
10 11 16 13-0065 SF Porcelain Enamel Steel Markerboard Face Sheet With Double Sided Tape (Claridge LCS EZ Stick) 14.84	14.84	2.87
10 11 16 13-0066 SF Porcelain Enamel Steel Markerboard Panel (Claridge LCS)..... 14.78	14.78	2.87
10 11 16 13-0067 SF Melamine Markerboard Panel (Claridge 1032) 7.83	7.83	2.87
10 11 16 13-0068 Chalkboard And Markerboard Accessory Trays And Trim <small>(10 11 16 13-0062)</small> See CSI section 10 11 13 13-0026 for chalkboard and markerboard accessory trays and trim.		
10 11 16 33 Rail-Mounted Markerboards <small>(10 11 16)</small>		
10 11 16 33-0001 Horizontal Sliding, Porcelain Enamel Steel Markerboards (Claridge HS Series) <small>(10 11 16 33)</small>		
10 11 16 33-0002 Two Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Markerboards <small>(10 11 16 33-0001)</small>		
10 11 16 33-0003 EA 4' x 6' Frame, Two Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Markerboard..... 1,924.12	1,924.12	71.87
10 11 16 33-0004 EA 4' x 8' Frame, Two Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Markerboard..... 2,161.32	2,161.32	71.87
10 11 16 33-0005 EA 4' x 10' Frame, Two Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Markerboard..... 2,447.54	2,447.54	76.55
10 11 16 33-0006 EA 4' x 12' Frame, Two Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Markerboard..... 2,724.42	2,724.42	76.55
10 11 16 33-0007 EA 4' x 14' Frame, Two Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Markerboard..... 3,407.83	3,407.83	82.29
10 11 16 33-0008 EA 4' x 16' Frame, Two Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Markerboard..... 3,627.07	3,627.07	82.29
10 11 16 33-0009 EA 4' x 20' Frame, Two Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Markerboard..... 4,095.19	4,095.19	86.25
10 11 16 33-0010 EA 4' x 24' Frame, Two Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Markerboard..... 4,643.29	4,643.29	86.25
10 11 16 33-0011 Three Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Markerboards <small>(10 11 16 33-0001)</small>		
10 11 16 33-0012 EA 4' x 6' Frame, Three Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Markerboard 2,655.55	2,655.55	71.87
10 11 16 33-0013 EA 4' x 8' Frame, Three Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Markerboard 3,155.46	3,155.46	71.87
10 11 16 33-0014 EA 4' x 10' Frame, Three Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Markerboard 3,611.78	3,611.78	76.55
10 11 16 33-0015 EA 4' x 12' Frame, Three Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Markerboard 4,070.10	4,070.10	76.55
10 11 16 33-0016 EA 4' x 14' Frame, Three Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Markerboard 4,642.00	4,642.00	82.29
10 11 16 33-0017 EA 4' x 16' Frame, Three Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Markerboard 4,839.51	4,839.51	82.29
10 11 16 33-0018 EA 4' x 20' Frame, Three Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Markerboard 5,677.11	5,677.11	86.25
10 11 16 33-0019 EA 4' x 24' Frame, Three Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Markerboard 6,347.12	6,347.12	86.25
10 11 16 33-0020 Four Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Markerboards <small>(10 11 16 33-0001)</small>		
10 11 16 33-0021 EA 4' x 6' Frame, Four Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Markerboard 2,967.40	2,967.40	71.87
10 11 16 33-0022 EA 4' x 8' Frame, Four Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Markerboard 3,374.70	3,374.70	71.87
10 11 16 33-0023 EA 4' x 10' Frame, Four Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Markerboard 3,813.06	3,813.06	76.55
10 11 16 33-0024 EA 4' x 12' Frame, Four Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Markerboard 4,281.78	4,281.78	76.55
10 11 16 33-0025 EA 4' x 14' Frame, Four Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Markerboard 5,193.88	5,193.88	82.29
10 11 16 33-0026 EA 4' x 16' Frame, Four Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Markerboard 5,404.61	5,404.61	82.29
10 11 16 33-0027 EA 4' x 20' Frame, Four Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Markerboard 6,384.92	6,384.92	86.25
10 11 16 33-0028 EA 4' x 24' Frame, Four Sliding Panels, Horizontal Sliding, Porcelain Enamel Steel Markerboard 7,152.26	7,152.26	86.25
10 11 16 33-0029 Vertical Sliding, Porcelain Enamel Steel Markerboards (Claridge TW Series) <small>(10 11 16 33)</small>		
10 11 16 33-0030 One Sliding Panel, Vertical Sliding, Porcelain Enamel Steel Markerboards <small>(10 11 16 33-0029)</small>		
10 11 16 33-0031 EA 8' x 4' Frame, One Sliding Panel, Vertical Sliding, Porcelain Enamel Steel Markerboard..... 2,305.90	2,305.90	71.87
10 11 16 33-0032 EA 8' x 5' Frame, One Sliding Panel, Vertical Sliding, Porcelain Enamel Steel Markerboard..... 2,544.98	2,544.98	71.87
10 11 16 33-0033 EA 8' x 6' Frame, One Sliding Panel, Vertical Sliding, Porcelain Enamel Steel Markerboard..... 2,780.18	2,780.18	76.55
10 11 16 33-0034 EA 8' x 8' Frame, One Sliding Panel, Vertical Sliding, Porcelain Enamel Steel Markerboard..... 3,193.14	3,193.14	76.55
10 11 16 33-0035 EA 8' x 10' Frame, One Sliding Panel, Vertical Sliding, Porcelain Enamel Steel Markerboard..... 3,489.10	3,489.10	82.29
10 11 16 33-0036 EA 8' x 12' Frame, One Sliding Panel, Vertical Sliding, Porcelain Enamel Steel Markerboard..... 3,868.99	3,868.99	82.29
10 11 16 33-0037 Two Sliding Panels, Vertical Sliding, Porcelain Enamel Steel Markerboards <small>(10 11 16 33-0029)</small>		
10 11 16 33-0038 EA 8' x 4' Frame, Two Sliding Panels, Vertical Sliding, Porcelain Enamel Steel Markerboard..... 3,386.98	3,386.98	71.87
10 11 16 33-0039 EA 8' x 5' Frame, Two Sliding Panels, Vertical Sliding, Porcelain Enamel Steel Markerboard..... 3,754.58	3,754.58	71.87
10 11 16 33-0040 EA 8' x 6' Frame, Two Sliding Panels, Vertical Sliding, Porcelain Enamel Steel Markerboard..... 4,120.19	4,120.19	76.55
10 11 16 33-0041 EA 8' x 8' Frame, Two Sliding Panels, Vertical Sliding, Porcelain Enamel Steel Markerboard..... 4,793.98	4,793.98	76.55
10 11 16 33-0042 EA 8' x 10' Frame, Two Sliding Panels, Vertical Sliding, Porcelain Enamel Steel Markerboard..... 5,197.66	5,197.66	82.29
10 11 16 33-0043 EA 8' x 12' Frame, Two Sliding Panels, Vertical Sliding, Porcelain Enamel Steel Markerboard..... 5,806.24	5,806.24	82.29



MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

10 11 16 33-0044	Three Sliding Panels, Vertical Sliding, Porcelain Enamel Steel Markerboards <small>(10 11 16 33-0029)</small>			
10 11 16 33-0045	EA	8' x 4' Frame, Three Sliding Panels, Vertical Sliding, Porcelain Enamel Steel Markerboard	4,633.44	71.87
10 11 16 33-0046	EA	8' x 5' Frame, Three Sliding Panels, Vertical Sliding, Porcelain Enamel Steel Markerboard	5,132.40	71.87
10 11 16 33-0047	EA	8' x 6' Frame, Three Sliding Panels, Vertical Sliding, Porcelain Enamel Steel Markerboard	5,629.36	76.55
10 11 16 33-0048	EA	8' x 8' Frame, Three Sliding Panels, Vertical Sliding, Porcelain Enamel Steel Markerboard	6,563.02	76.55
10 11 16 33-0049	EA	8' x 10' Frame, Three Sliding Panels, Vertical Sliding, Porcelain Enamel Steel Markerboard	7,085.77	82.29
10 11 16 33-0050	EA	8' x 12' Frame, Three Sliding Panels, Vertical Sliding, Porcelain Enamel Steel Markerboard	7,940.05	82.29
10 11 16 33-0051	Motor Operated Vertical Sliding, Porcelain Enamel Steel Markerboards (Claridge MO Series) <small>(10 11 16 33)</small> Note: Excludes remotes.			
10 11 16 33-0052	One Sliding Panel, Motor Operated Vertical Sliding, Porcelain Enamel Steel Markerboards <small>(10 11 16 33-0051)</small>			
10 11 16 33-0053	EA	10' x 4' Frame, One Sliding Panel, Motor Operated Vertical Sliding, Porcelain Enamel Steel Markerboard.....	7,528.08	143.74
10 11 16 33-0054	EA	10' x 5' Frame, One Sliding Panel, Motor Operated Vertical Sliding, Porcelain Enamel Steel Markerboard.....	7,736.93	143.74
10 11 16 33-0055	EA	10' x 6' Frame, One Sliding Panel, Motor Operated Vertical Sliding, Porcelain Enamel Steel Markerboard.....	7,967.98	148.24
10 11 16 33-0056	EA	10' x 8' Frame, One Sliding Panel, Motor Operated Vertical Sliding, Porcelain Enamel Steel Markerboard.....	8,348.81	148.24
10 11 16 33-0057	EA	10' x 10' Frame, One Sliding Panel, Motor Operated Vertical Sliding, Porcelain Enamel Steel Markerboard.....	8,768.87	152.73
10 11 16 33-0058	EA	10' x 12' Frame, One Sliding Panel, Motor Operated Vertical Sliding, Porcelain Enamel Steel Markerboard.....	9,135.53	152.73
10 11 16 33-0059	EA	10' x 14' Frame, One Sliding Panel, Motor Operated Vertical Sliding, Porcelain Enamel Steel Markerboard.....	9,951.09	161.71
10 11 16 33-0060	EA	10' x 16' Frame, One Sliding Panel, Motor Operated Vertical Sliding, Porcelain Enamel Steel Markerboard.....	10,038.03	161.71
10 11 16 33-0061	Two Sliding Panels, Motor Operated Vertical Sliding, Porcelain Enamel Steel Markerboards <small>(10 11 16 33-0051)</small>			
10 11 16 33-0062	EA	10' x 4' Frame, Two Sliding Panels, Motor Operated Vertical Sliding, Porcelain Enamel Steel Markerboard.....	11,878.86	143.74
10 11 16 33-0063	EA	10' x 5' Frame, Two Sliding Panels, Motor Operated Vertical Sliding, Porcelain Enamel Steel Markerboard.....	12,148.19	143.74
10 11 16 33-0064	EA	10' x 6' Frame, Two Sliding Panels, Motor Operated Vertical Sliding, Porcelain Enamel Steel Markerboard.....	12,448.23	148.24
10 11 16 33-0065	EA	10' x 8' Frame, Two Sliding Panels, Motor Operated Vertical Sliding, Porcelain Enamel Steel Markerboard.....	12,997.27	148.24
10 11 16 33-0066	EA	10' x 10' Frame, Two Sliding Panels, Motor Operated Vertical Sliding, Porcelain Enamel Steel Markerboard.....	13,540.17	152.73
10 11 16 33-0067	EA	10' x 12' Frame, Two Sliding Panels, Motor Operated Vertical Sliding, Porcelain Enamel Steel Markerboard.....	14,059.93	152.73
10 11 16 33-0068	EA	10' x 14' Frame, Two Sliding Panels, Motor Operated Vertical Sliding, Porcelain Enamel Steel Markerboard.....	15,150.48	161.71
10 11 16 33-0069	EA	10' x 16' Frame, Two Sliding Panels, Motor Operated Vertical Sliding, Porcelain Enamel Steel Markerboard.....	15,279.95	161.71
10 11 16 33-0070	Three Sliding Panels, Motor Operated Vertical Sliding, Porcelain Enamel Steel Markerboards <small>(10 11 16 33-0051)</small>			
10 11 16 33-0071	EA	10' x 4' Frame, Three Sliding Panels, Motor Operated Vertical Sliding, Porcelain Enamel Steel Markerboard	15,444.35	143.74
10 11 16 33-0072	EA	10' x 5' Frame, Three Sliding Panels, Motor Operated Vertical Sliding, Porcelain Enamel Steel Markerboard	16,144.59	143.74
10 11 16 33-0073	EA	10' x 6' Frame, Three Sliding Panels, Motor Operated Vertical Sliding, Porcelain Enamel Steel Markerboard	16,498.49	148.24
10 11 16 33-0074	EA	10' x 8' Frame, Three Sliding Panels, Motor Operated Vertical Sliding, Porcelain Enamel Steel Markerboard	17,204.41	148.24
10 11 16 33-0075	EA	10' x 10' Frame, Three Sliding Panels, Motor Operated Vertical Sliding, Porcelain Enamel Steel Markerboard	17,946.71	152.73
10 11 16 33-0076	EA	10' x 12' Frame, Three Sliding Panels, Motor Operated Vertical Sliding, Porcelain Enamel Steel Markerboard	18,661.13	152.73
10 11 16 33-0077	EA	10' x 14' Frame, Three Sliding Panels, Motor Operated Vertical Sliding, Porcelain Enamel Steel Markerboard	20,123.07	161.71
10 11 16 33-0078	EA	10' x 16' Frame, Three Sliding Panels, Motor Operated Vertical Sliding, Porcelain Enamel Steel Markerboard	20,361.21	161.71
10 11 16 33-0079	Sliding Chalkboard And Markerboard Accessories <small>(10 11 16 33)</small> See CSI section 10 11 13 33-0079 for sliding chalkboard and markerboard accessories.			
10 11 23	Tackboards <small>(10 11)</small>			
10 11 23 13	Fixed Tackboards <small>(10 11 23)</small> Note: Select task based off the square footage of an individual tackboard. For example use the >12 To 16 SF range for each 3' x 5' tackboard.			
10 11 23 13-0001	Fixed Tackboards <small>(10 11 23 13)</small> Note: Select task based off the square footage of an individual tackboard. For example use the >12 To 16 SF range for each 3' x 5' tackboard.			
10 11 23 13-0002	Cork Surface, Fixed Tackboards <small>(10 11 23 13-0001)</small> Note: Includes up to 1/4" cork surface, unmounted or mounted on duracore or hardboard.			
10 11 23 13-0003	5/8" Face Aluminum Frame, Cork Surface, Fixed Tackboards (Claridge 800 Series) <small>(10 11 23 13-0002)</small>			
10 11 23 13-0004	SF	Up To 6 SF, 5/8" Face Aluminum Frame, Cork Surface, Fixed Tackboard.....	24.90	6.11
10 11 23 13-0005	SF	>6 To 12 SF, 5/8" Face Aluminum Frame, Cork Surface, Fixed Tackboard	14.57	2.87
10 11 23 13-0006	SF	>12 To 16 SF, 5/8" Face Aluminum Frame, Cork Surface, Fixed Tackboard	12.64	2.48
10 11 23 13-0007	SF	>16 To 24 SF, 5/8" Face Aluminum Frame, Cork Surface, Fixed Tackboard	10.32	1.62
10 11 23 13-0008	SF	>24 SF, 5/8" Face Aluminum Frame, Cork Surface, Fixed Tackboard	8.70	0.90
10 11 23 13-0009	1-1/4" Face Aluminum Frame, Cork Surface, Fixed Tackboards (Claridge 900A Series) <small>(10 11 23 13-0002)</small>			
10 11 23 13-0010	SF	Up To 6 SF, 1-1/4" Face Aluminum Frame, Cork Surface, Fixed Tackboard.....	26.40	6.11
10 11 23 13-0011	SF	>6 To 12 SF, 1-1/4" Face Aluminum Frame, Cork Surface, Fixed Tackboard	15.26	2.87
10 11 23 13-0012	SF	>12 To 16 SF, 1-1/4" Face Aluminum Frame, Cork Surface, Fixed Tackboard.....	12.28	2.48
10 11 23 13-0013	SF	>16 To 24 SF, 1-1/4" Face Aluminum Frame, Cork Surface, Fixed Tackboard	9.77	1.62



Specialties	10	10
Information Specialties	10 10	
Visual Display Units	10 11	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 11 23 13-0014 SF >24 SF, 1-1/4" Face Aluminum Frame, Cork Surface, Fixed Tackboard.....	7.84	0.90
10 11 23 13-0015 1-3/4" Face Wood Frame, Cork Surface, Fixed Tackboards (Claridge 700 Series) <small>(10 11 23 13-0002)</small>		
10 11 23 13-0016 SF Up To 6 SF, 1-3/4" Face Wood Frame, Cork Surface, Fixed Tackboard.....	26.55	6.11
10 11 23 13-0017 SF >6 To 12 SF, 1-3/4" Face Wood Frame, Cork Surface, Fixed Tackboard	16.72	2.87
10 11 23 13-0018 SF >12 To 16 SF, 1-3/4" Face Wood Frame, Cork Surface, Fixed Tackboard.....	15.59	2.48
10 11 23 13-0019 SF >16 To 24 SF, 1-3/4" Face Wood Frame, Cork Surface, Fixed Tackboard.....	12.17	1.62
10 11 23 13-0020 SF >24 SF, 1-3/4" Face Wood Frame, Cork Surface, Fixed Tackboard.....	9.85	0.90
10 11 23 13-0021 Burlap Backed Cork Surface, Fixed Tackboards <small>(10 11 23 13-0001)</small> Note: Includes burlap backed 1/4" self healing cork surface, unmounted or mounted on hardboard.		
10 11 23 13-0022 5/8" Face Aluminum Frame, Burlap Backed Cork Surface, Fixed Tackboards (Claridge 800 Series) <small>(10 11 23 13-0021)</small>		
10 11 23 13-0023 SF Up To 6 SF, 5/8" Face Aluminum Frame, Burlap Backed Cork Surface, Fixed Tackboard	29.23	6.11
10 11 23 13-0024 SF >6 To 12 SF, 5/8" Face Aluminum Frame, Burlap Backed Cork Surface, Fixed Tackboard.....	19.77	2.87
10 11 23 13-0025 SF >12 To 16 SF, 5/8" Face Aluminum Frame, Burlap Backed Cork Surface, Fixed Tackboard.....	18.13	2.48
10 11 23 13-0026 SF >16 To 24 SF, 5/8" Face Aluminum Frame, Burlap Backed Cork Surface, Fixed Tackboard.....	15.83	1.62
10 11 23 13-0027 SF >24 SF, 5/8" Face Aluminum Frame, Burlap Backed Cork Surface, Fixed Tackboard.....	14.31	0.90
10 11 23 13-0028 1-3/4" Face Wood Frame, Burlap Backed Cork Surface, Fixed Tackboards (Claridge 700 Series) <small>(10 11 23 13-0021)</small>		
10 11 23 13-0029 SF Up To 6 SF, 1-3/4" Face Wood Frame, Burlap Backed Cork Surface, Fixed Tackboard.....	32.85	6.11
10 11 23 13-0030 SF >6 To 12 SF, 1-3/4" Face Wood Frame, Burlap Backed Cork Surface, Fixed Tackboard	23.64	2.87
10 11 23 13-0031 SF >12 To 16 SF, 1-3/4" Face Wood Frame, Burlap Backed Cork Surface, Fixed Tackboard.....	22.03	2.48
10 11 23 13-0032 SF >16 To 24 SF, 1-3/4" Face Wood Frame, Burlap Backed Cork Surface, Fixed Tackboard	18.67	1.62
10 11 23 13-0033 SF >24 SF, 1-3/4" Face Wood Frame, Burlap Backed Cork Surface, Fixed Tackboard	16.38	0.90
10 11 23 13-0034 Polyester Fabric Surface, Fixed Tackboards <small>(10 11 23 13-0001)</small> Note: Includes polyester fabric on cork underlay, unmounted or mounted on duracore. Class A rating.		
10 11 23 13-0035 5/8" Face Aluminum Frame, Polyester Fabric Surface, Fixed Tackboards (Claridge 800 Series) <small>(10 11 23 13-0034)</small>		
10 11 23 13-0036 SF Up To 6 SF, 5/8" Face Aluminum Frame, Polyester Fabric Surface, Fixed Tackboard	25.92	6.11
10 11 23 13-0037 SF >6 To 12 SF, 5/8" Face Aluminum Frame, Polyester Fabric Surface, Fixed Tackboard	15.83	2.87
10 11 23 13-0038 SF >12 To 16 SF, 5/8" Face Aluminum Frame, Polyester Fabric Surface, Fixed Tackboard	14.06	2.48
10 11 23 13-0039 SF >16 To 24 SF, 5/8" Face Aluminum Frame, Polyester Fabric Surface, Fixed Tackboard.....	11.77	1.62
10 11 23 13-0040 SF >24 SF, 5/8" Face Aluminum Frame, Polyester Fabric Surface, Fixed Tackboard.....	10.00	0.90
10 11 23 13-0041 1-3/4" Face Wood Frame, Polyester Fabric Surface, Fixed Tackboards (Claridge 700 Series) <small>(10 11 23 13-0034)</small>		
10 11 23 13-0042 SF Up To 6 SF, 1-3/4" Face Wood Frame, Polyester Fabric Surface, Fixed Tackboard.....	27.97	6.11
10 11 23 13-0043 SF >6 To 12 SF, 1-3/4" Face Wood Frame, Polyester Fabric Surface, Fixed Tackboard	18.49	2.87
10 11 23 13-0044 SF >12 To 16 SF, 1-3/4" Face Wood Frame, Polyester Fabric Surface, Fixed Tackboard	17.24	2.48
10 11 23 13-0045 SF >16 To 24 SF, 1-3/4" Face Wood Frame, Polyester Fabric Surface, Fixed Tackboard	13.98	1.62
10 11 23 13-0046 SF >24 SF, 1-3/4" Face Wood Frame, Polyester Fabric Surface, Fixed Tackboard	11.74	0.90
10 11 23 13-0047 Vinyl Fabric Surface, Fixed Tackboards <small>(10 11 23 13-0001)</small> Note: Includes vinyl fabric on cork underlay, unmounted or mounted on duracore.		
10 11 23 13-0048 5/8" Face Aluminum Frame, Vinyl Fabric Surface, Fixed Tackboards (Claridge 800 Series) <small>(10 11 23 13-0047)</small>		
10 11 23 13-0049 SF Up To 6 SF, 5/8" Face Aluminum Frame, Vinyl Fabric Surface, Fixed Tackboard.....	24.90	6.11
10 11 23 13-0050 SF >6 To 12 SF, 5/8" Face Aluminum Frame, Vinyl Fabric Surface, Fixed Tackboard	14.65	2.87
10 11 23 13-0051 SF >12 To 16 SF, 5/8" Face Aluminum Frame, Vinyl Fabric Surface, Fixed Tackboard	12.76	2.48
10 11 23 13-0052 SF >16 To 24 SF, 5/8" Face Aluminum Frame, Vinyl Fabric Surface, Fixed Tackboard	10.32	1.62
10 11 23 13-0053 SF >24 SF, 5/8" Face Aluminum Frame, Vinyl Fabric Surface, Fixed Tackboard	8.52	0.90
10 11 23 13-0054 1-3/4" Face Wood Frame, Vinyl Fabric Surface, Fixed Tackboards (Claridge 700 Series) <small>(10 11 23 13-0047)</small>		
10 11 23 13-0055 SF Up To 6 SF, 1-3/4" Face Wood Frame, Vinyl Fabric Surface, Fixed Tackboard.....	26.55	6.11
10 11 23 13-0056 SF >6 To 12 SF, 1-3/4" Face Wood Frame, Vinyl Fabric Surface, Fixed Tackboard	17.45	2.87
10 11 23 13-0057 SF >12 To 16 SF, 1-3/4" Face Wood Frame, Vinyl Fabric Surface, Fixed Tackboard	15.59	2.48
10 11 23 13-0058 SF >16 To 24 SF, 1-3/4" Face Wood Frame, Vinyl Fabric Surface, Fixed Tackboard	12.17	1.62
10 11 23 13-0059 SF 4' x 8', 1-3/4" Face Wood Frame, Vinyl Fabric Surface, Fixed Tackboard	9.85	0.90

10 13 Directories (10 10)

10 13 16 Directory And Bulletin Boards (10 13)

Note: Select task based off the square footage of an individual directory or bulletin board. For example use the >12 To 16 SF range for each 3' x 5' directory or bulletin board.



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 13 16 00-0001	Wall Mounted Directories (10 13 16) Note: Includes changeable letters.	
10 13 16 00-0002	Open Face, Wall Mounted Directories (10 13 16 00-0001) Note: Includes vinyl or felt back panel.	
10 13 16 00-0003	Wood Frame, Open Face, Wall Mounted Directories (Claridge 350 Series) (10 13 16 00-0002)	
10 13 16 00-0004	SF Up To 6 SF, Wood Frame, Open Face, Wall Mounted Directory	44.04 6.11
10 13 16 00-0005	SF >6 To 12 SF, Wood Frame, Open Face, Wall Mounted Directory.....	29.61 2.87
10 13 16 00-0006	SF >12 To 16 SF, Wood Frame, Open Face, Wall Mounted Directory.....	27.01 2.48
10 13 16 00-0007	SF >16 To 24 SF, Wood Frame, Open Face, Wall Mounted Directory.....	20.83 1.62
10 13 16 00-0008	SF >24 SF, Wood Frame, Open Face, Wall Mounted Directory.....	16.91 0.90
10 13 16 00-0009	Aluminum Frame, Open Face, Wall Mounted Directories (Claridge 432 Series) (10 13 16 00-0002)	
10 13 16 00-0010	SF Up To 6 SF, Aluminum Frame, Open Face, Wall Mounted Directory.....	44.51 6.11
	For Bronze Anodize Finish, Add	12.00
10 13 16 00-0011	SF >6 To 12 SF, Aluminum Frame, Open Face, Wall Mounted Directory.....	29.93 2.87
	For Bronze Anodize Finish, Add	12.00
10 13 16 00-0012	SF >12 To 16 SF, Aluminum Frame, Open Face, Wall Mounted Directory.....	27.64 2.48
	For Bronze Anodize Finish, Add	12.00
10 13 16 00-0013	SF >16 To 24 SF, Aluminum Frame, Open Face, Wall Mounted Directory.....	19.81 1.62
	For Bronze Anodize Finish, Add	12.00
10 13 16 00-0014	SF >24 SF, Aluminum Frame, Open Face, Wall Mounted Directory.....	17.38 0.90
	For Bronze Anodize Finish, Add	12.00
10 13 16 00-0015	Glass Encased, Wall Mounted Directory Cabinets (10 13 16 00-0001) Note: Includes vinyl or felt back panel, 3/16" tempered glass and flat key tumbler lock. Surface or recess mounted.	
10 13 16 00-0016	Wood Frame, Glass Encased, Wall Mounted Directory Cabinets (10 13 16 00-0015)	
10 13 16 00-0017	Hinged Door, Wood Frame, Glass Encased, Wall Mounted Directory Cabinets (Claridge 3052 Series) (10 13 16 00-0016)	
10 13 16 00-0018	SF Up To 6 SF, Hinged Door, Wood Frame, Glass Encased, Wall Mounted Directory Cabinet	115.07 6.11
	For Fluorescent Lights, Add	15.00
10 13 16 00-0019	SF >6 To 12 SF, Hinged Door, Wood Frame, Glass Encased, Wall Mounted Directory Cabinet.....	93.71 2.87
	For Fluorescent Lights, Add	15.00
10 13 16 00-0020	SF >12 To 16 SF, Hinged Door, Wood Frame, Glass Encased, Wall Mounted Directory Cabinet.....	78.43 2.48
	For Fluorescent Lights, Add	15.00
10 13 16 00-0021	SF >16 To 24 SF, Hinged Door, Wood Frame, Glass Encased, Wall Mounted Directory Cabinet.....	73.12 1.62
	For Fluorescent Lights, Add	15.00
10 13 16 00-0022	SF >24 SF, Hinged Door, Wood Frame, Glass Encased, Wall Mounted Directory Cabinet.....	66.52 0.90
	For Fluorescent Lights, Add	15.00
10 13 16 00-0023	Sliding Door, Wood Frame, Glass Encased, Wall Mounted Directory Cabinets (Claridge 345 Series) (10 13 16 00-0016)	
10 13 16 00-0024	SF Up To 12 SF, Sliding Door, Wood Frame, Glass Encased, Wall Mounted Directory Cabinet.....	98.37 6.11
	For Fluorescent Lights, Add	15.00
10 13 16 00-0025	SF >12 To 16 SF, Sliding Door, Wood Frame, Glass Encased, Wall Mounted Directory Cabinet.....	81.06 2.48
	For Fluorescent Lights, Add	15.00
10 13 16 00-0026	SF >16 To 24 SF, Sliding Door, Wood Frame, Glass Encased, Wall Mounted Directory Cabinet.....	58.24 1.62
	For Fluorescent Lights, Add	15.00
10 13 16 00-0027	SF >24 SF, Sliding Door, Wood Frame, Glass Encased, Wall Mounted Directory Cabinet.....	52.82 0.90
	For Fluorescent Lights, Add	15.00
10 13 16 00-0028	Aluminum Frame, Glass Encased, Wall Mounted Directory Cabinets (10 13 16 00-0015)	
10 13 16 00-0029	Hinged Door, Aluminum Frame, Glass Encased, Wall Mounted Directory Cabinets (Claridge Contemporary Series) (10 13 16 00-0028)	
10 13 16 00-0030	SF Up To 6 SF, Hinged Door, Aluminum Frame, Glass Encased, Wall Mounted Directory Cabinet	102.55 6.11
	For Fluorescent Lights, Add	15.00
	For Bronze Anodize Finish, Add	12.00
	For Header Panel, Add	18.07
10 13 16 00-0031	SF >6 To 12 SF, Hinged Door, Aluminum Frame, Glass Encased, Wall Mounted Directory Cabinet	80.73 2.87
	For Fluorescent Lights, Add	15.00
	For Bronze Anodize Finish, Add	12.00
	For Header Panel, Add	15.00
10 13 16 00-0032	SF >12 To 16 SF, Hinged Door, Aluminum Frame, Glass Encased, Wall Mounted Directory Cabinet	68.29 2.48
	For Fluorescent Lights, Add	15.00
	For Bronze Anodize Finish, Add	12.00
	For Header Panel, Add	12.67
10 13 16 00-0033	SF >16 To 24 SF, Hinged Door, Aluminum Frame, Glass Encased, Wall Mounted Directory Cabinet	50.33 1.62
	For Fluorescent Lights, Add	15.00
	For Bronze Anodize Finish, Add	12.00
	For Header Panel, Add	9.42



Specialties	10	10
Information Specialties	10 10	
Directories	10 13	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 13 16 00-0034 SF >24 SF, Hinged Door, Aluminum Frame, Glass Encased, Wall Mounted Directory Cabinet <i>For Fluorescent Lights, Add</i> <i>For Bronze Anodize Finish, Add</i> <i>For Header Panel, Add</i>	47.39 15.00 12.00 9.12	0.90
10 13 16 00-0035 Sliding Door, Aluminum Frame, Glass Encased, Wall Mounted Directory Cabinets (Claridge Contemporary Series) (10 13 16 00-0028)		
10 13 16 00-0036 SF Up To 6 SF, Sliding Door, Aluminum Frame, Glass Encased, Wall Mounted Directory Cabinet <i>For Fluorescent Lights, Add</i> <i>For Bronze Anodize Finish, Add</i> <i>For Header Panel, Add</i>	160.36 15.00 12.00 29.63	6.11
10 13 16 00-0037 SF >6 To 12 SF, Sliding Door, Aluminum Frame, Glass Encased, Wall Mounted Directory Cabinet <i>For Fluorescent Lights, Add</i> <i>For Bronze Anodize Finish, Add</i> <i>For Header Panel, Add</i>	93.65 15.00 12.00 17.58	2.87
10 13 16 00-0038 SF >12 To 16 SF, Sliding Door, Aluminum Frame, Glass Encased, Wall Mounted Directory Cabinet <i>For Fluorescent Lights, Add</i> <i>For Bronze Anodize Finish, Add</i> <i>For Header Panel, Add</i>	78.86 15.00 12.00 14.78	2.48
10 13 16 00-0039 SF >16 To 24 SF, Sliding Door, Aluminum Frame, Glass Encased, Wall Mounted Directory Cabinet <i>For Fluorescent Lights, Add</i> <i>For Bronze Anodize Finish, Add</i> <i>For Header Panel, Add</i>	61.00 15.00 12.00 11.55	1.62
10 13 16 00-0040 SF >24 SF, Sliding Door, Aluminum Frame, Glass Encased, Wall Mounted Directory Cabinet <i>For Fluorescent Lights, Add</i> <i>For Bronze Anodize Finish, Add</i> <i>For Header Panel, Add</i>	56.84 15.00 12.00 11.01	0.90
10 13 16 00-0041 Outdoor, Glass Encased, Wall Mounted Directory Cabinets (10 13 16 00-0001) Note: Includes vinyl or felt back panel, 3/16" tempered glass and flat key tumbler lock. Surface or recess mounted.		
10 13 16 00-0042 Aluminum Frame, Outdoor, Glass Encased, Wall Mounted Directory Cabinets (10 13 16 00-0041)		
10 13 16 00-0043 Hinged Door, Aluminum Frame, Outdoor, Glass Encased, Wall Mounted Directory Cabinets (Claridge 548 Series) (10 13 16 00-0042)		
10 13 16 00-0044 SF Up To 6 SF, Hinged Door, Outdoor, Glass Encased, Wall Mounted Directory Cabinet <i>For Fluorescent Lights, Add</i> <i>For Bronze Anodize Finish, Add</i>	157.44 15.00 12.00	6.11
10 13 16 00-0045 SF >6 To 12 SF, Hinged Door, Outdoor, Glass Encased, Wall Mounted Directory Cabinet <i>For Fluorescent Lights, Add</i> <i>For Bronze Anodize Finish, Add</i>	106.01 15.00 12.00	2.87
10 13 16 00-0046 SF >12 SF, Hinged Door, Outdoor, Glass Encased, Wall Mounted Directory Cabinet <i>For Fluorescent Lights, Add</i> <i>For Bronze Anodize Finish, Add</i>	103.24 15.00 12.00	2.48
10 13 16 00-0047 Wall Mounted Bulletin Boards (10 13 16)		
10 13 16 00-0048 Glass Encased, Wall Mounted Bulletin Board Cabinets (10 13 16 00-0047) Note: Includes cork, fabric or hook-fab back panel, 3/16" tempered glass and flat key tumbler lock. Surface or recess mounted.		
10 13 16 00-0049 Wood Frame, Glass Encased, Wall Mounted Bulletin Board Cabinets (10 13 16 00-0048)		
10 13 16 00-0050 Hinged Door, Wood Frame, Glass Encased, Wall Mounted Bulletin Board Cabinets (Claridge 3070 Series) (10 13 16 00-0049)		
10 13 16 00-0051 SF Up To 6 SF, Hinged Door, Wood Frame, Glass Encased, Wall Mounted Bulletin Board Cabinet <i>For Fluorescent Lights, Add</i>	112.23 15.00	6.11
10 13 16 00-0052 SF >6 To 12 SF, Hinged Door, Wood Frame, Glass Encased, Wall Mounted Bulletin Board Cabinet <i>For Fluorescent Lights, Add</i>	91.59 15.00	2.87
10 13 16 00-0053 SF >12 To 16 SF, Hinged Door, Wood Frame, Glass Encased, Wall Mounted Bulletin Board Cabinet <i>For Fluorescent Lights, Add</i>	76.31 15.00	2.48
10 13 16 00-0054 SF >16 To 24 SF, Hinged Door, Wood Frame, Glass Encased, Wall Mounted Bulletin Board Cabinet <i>For Fluorescent Lights, Add</i>	71.11 15.00	1.62
10 13 16 00-0055 SF >24 SF, Hinged Door, Wood Frame, Glass Encased, Wall Mounted Bulletin Board Cabinet <i>For Fluorescent Lights, Add</i>	65.58 15.00	0.90
10 13 16 00-0056 Sliding Door, Wood Frame, Glass Encased, Wall Mounted Bulletin Board Cabinets (Claridge 310 Series) (10 13 16 00-0049)		
10 13 16 00-0057 SF Up To 12 SF, Sliding Door, Wood Frame, Glass Encased, Wall Mounted Bulletin Board Cabinet <i>For Fluorescent Lights, Add</i>	93.33 15.00	6.11
10 13 16 00-0058 SF >12 To 16 SF, Sliding Door, Wood Frame, Glass Encased, Wall Mounted Bulletin Board Cabinet <i>For Fluorescent Lights, Add</i>	76.28 15.00	2.48
10 13 16 00-0059 SF >16 To 24 SF, Sliding Door, Wood Frame, Glass Encased, Wall Mounted Bulletin Board Cabinet <i>For Fluorescent Lights, Add</i>	54.54 15.00	1.62
10 13 16 00-0060 SF >24 SF, Sliding Door, Wood Frame, Glass Encased, Wall Mounted Bulletin Board Cabinet <i>For Fluorescent Lights, Add</i>	49.99 15.00	0.90



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 13 16 00-0061 Aluminum Frame, Glass Encased, Wall Mounted Bulletin Board Cabinets ^(10 13 16 00-0048)		
10 13 16 00-0062 Hinged Door, Aluminum Frame, Glass Encased, Wall Mounted Bulletin Board Cabinets (Claridge Contemporary Series) ^(10 13 16 00-0061)		
10 13 16 00-0063 SF Up To 6 SF, Hinged Door, Aluminum Frame, Glass Encased, Wall Mounted Bulletin Board Cabinet.....	105.14	6.11
For Fluorescent Lights, Add	15.00	
For Bronze Anodize Finish, Add	12.00	
For Header Panel, Add	18.58	
10 13 16 00-0064 SF >6 To 12 SF, Hinged Door, Aluminum Frame, Glass Encased, Wall Mounted Bulletin Board Cabinet	83.32	2.87
For Fluorescent Lights, Add	15.00	
For Bronze Anodize Finish, Add	12.00	
For Header Panel, Add	15.51	
10 13 16 00-0065 SF >12 To 16 SF, Hinged Door, Aluminum Frame, Glass Encased, Wall Mounted Bulletin Board Cabinet	70.87	2.48
For Fluorescent Lights, Add	15.00	
For Bronze Anodize Finish, Add	12.00	
For Header Panel, Add	13.18	
10 13 16 00-0066 SF >16 To 24 SF, Hinged Door, Aluminum Frame, Glass Encased, Wall Mounted Bulletin Board Cabinet	52.92	1.62
For Fluorescent Lights, Add	15.00	
For Bronze Anodize Finish, Add	12.00	
For Header Panel, Add	9.94	
10 13 16 00-0067 SF >24 SF, Hinged Door, Aluminum Frame, Glass Encased, Wall Mounted Bulletin Board Cabinet.....	49.99	0.90
For Fluorescent Lights, Add	15.00	
For Bronze Anodize Finish, Add	12.00	
For Header Panel, Add	9.64	
10 13 16 00-0068 Sliding Door, Aluminum Frame, Glass Encased, Wall Mounted Bulletin Board Cabinets (Claridge Contemporary Series) ^(10 13 16 00-0061)		
10 13 16 00-0069 SF Up To 6 SF, Sliding Door, Aluminum Frame, Glass Encased, Wall Mounted Bulletin Board Cabinet.....	162.95	6.11
For Fluorescent Lights, Add	15.00	
For Bronze Anodize Finish, Add	12.00	
For Header Panel, Add	30.15	
10 13 16 00-0070 SF >6 To 12 SF, Sliding Door, Aluminum Frame, Glass Encased, Wall Mounted Bulletin Board Cabinet.....	96.23	2.87
For Fluorescent Lights, Add	15.00	
For Bronze Anodize Finish, Add	12.00	
For Header Panel, Add	18.10	
10 13 16 00-0071 SF >12 To 16 SF, Sliding Door, Aluminum Frame, Glass Encased, Wall Mounted Bulletin Board Cabinet	81.45	2.48
For Fluorescent Lights, Add	15.00	
For Bronze Anodize Finish, Add	12.00	
For Header Panel, Add	15.30	
10 13 16 00-0072 SF >16 To 24 SF, Sliding Door, Aluminum Frame, Glass Encased, Wall Mounted Bulletin Board Cabinet	63.59	1.62
For Fluorescent Lights, Add	15.00	
For Bronze Anodize Finish, Add	12.00	
For Header Panel, Add	12.07	
10 13 16 00-0073 SF >24 SF, Sliding Door, Aluminum Frame, Glass Encased, Wall Mounted Bulletin Board Cabinet	59.43	0.90
For Fluorescent Lights, Add	15.00	
For Bronze Anodize Finish, Add	12.00	
For Header Panel, Add	11.53	
10 13 16 00-0074 Outdoor, Glass Encased, Wall Mounted Bulletin Board Cabinets ^(10 13 16 00-0047)		
Note: Includes cork, fabric or hook-fab back panel, 3/16" tempered glass and flat key tumbler lock. Surface or recess mounted.		
10 13 16 00-0075 Aluminum Frame, Outdoor, Glass Encased, Wall Mounted Bulletin Board Cabinets ^(10 13 16 00-0074)		
10 13 16 00-0076 Hinged Door, Aluminum Frame, Outdoor, Glass Encased, Wall Mounted Bulletin Board Cabinets ^(10 13 16 00-0075)		
10 13 16 00-0077 SF Up To 6 SF, Hinged Door, Outdoor, Glass Encased, Wall Mounted Bulletin Board Cabinet	154.85	6.11
For Fluorescent Lights, Add	15.00	
For Bronze Anodize Finish, Add	12.00	
10 13 16 00-0078 SF >6 To 12 SF, Hinged Door, Outdoor, Glass Encased, Wall Mounted Bulletin Board Cabinet.....	103.42	2.87
For Fluorescent Lights, Add	15.00	
For Bronze Anodize Finish, Add	12.00	
10 13 16 00-0079 SF >12 SF, Hinged Door, Outdoor, Glass Encased, Wall Mounted Bulletin Board Cabinet.....	100.68	2.48
For Fluorescent Lights, Add	15.00	
For Bronze Anodize Finish, Add	12.00	
10 14 Signage ^(10 10)		
10 14 19 Dimensional Letter Signage ^(10 14)		
Note: Mounted on masonry or concrete.		
10 14 19 00-0001 Cast Characters ^(10 14 19)		
10 14 19 00-0002 Satin Finish, Cast Aluminum Characters ^(10 14 19 00-0001)		
10 14 19 00-0003 EA 2" High x 3/8" Deep, Satin Finish, Cast Aluminum Sign Letter/Character, Installed With Studs	33.81	4.49
For Installation With Adhesive, Deduct	-3.49	
For Clear Anodized, Add	1.59	
For Satin Face And Enameled Return, Add	4.76	
For Patina Finish, Add	6.34	
For Color Anodized, Add	7.93	



Specialties	10
Information Specialties	10 10
Signage	10 14

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MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 14 19 00-0004	EA		3" High x 1/2" Deep, Satin Finish, Cast Aluminum Sign Letter/Character, Installed With Studs	40.13	4.85
			<i>For Installation With Adhesive, Deduct</i>	-3.95	
			<i>For Clear Anodized, Add</i>	2.07	
			<i>For Satin Face And Enameled Return, Add</i>	6.22	
			<i>For Patina Finish, Add</i>	8.29	
			<i>For Color Anodized, Add</i>	10.37	
10 14 19 00-0005	EA		4" High x 5/8" Deep, Satin Finish, Cast Aluminum Sign Letter/Character, Installed With Studs	44.00	5.21
			<i>For Installation With Adhesive, Deduct</i>	-4.28	
			<i>For Clear Anodized, Add</i>	2.32	
			<i>For Satin Face And Enameled Return, Add</i>	6.95	
			<i>For Patina Finish, Add</i>	9.27	
			<i>For Color Anodized, Add</i>	11.59	
10 14 19 00-0006	EA		5" High x 3/4" Deep, Satin Finish, Cast Aluminum Sign Letter/Character, Installed With Studs	50.53	5.96
			<i>For Installation With Adhesive, Deduct</i>	-4.90	
			<i>For Clear Anodized, Add</i>	2.68	
			<i>For Satin Face And Enameled Return, Add</i>	8.05	
			<i>For Patina Finish, Add</i>	10.73	
			<i>For Color Anodized, Add</i>	13.42	
10 14 19 00-0007	EA		6" High x 3/4" Deep, Satin Finish, Cast Aluminum Sign Letter/Character, Installed With Studs	55.64	6.28
			<i>For Installation With Adhesive, Deduct</i>	-5.30	
			<i>For Clear Anodized, Add</i>	3.05	
			<i>For Satin Face And Enameled Return, Add</i>	9.15	
			<i>For Patina Finish, Add</i>	12.20	
			<i>For Color Anodized, Add</i>	15.25	
10 14 19 00-0008	EA		8" High x 3/4" Deep, Satin Finish, Cast Aluminum Sign Letter/Character, Installed With Studs	66.55	7.18
			<i>For Installation With Adhesive, Deduct</i>	-6.20	
			<i>For Clear Anodized, Add</i>	3.78	
			<i>For Satin Face And Enameled Return, Add</i>	11.34	
			<i>For Patina Finish, Add</i>	15.12	
			<i>For Color Anodized, Add</i>	18.91	
10 14 19 00-0009	EA		9" High x 3/4" Deep, Satin Finish, Cast Aluminum Sign Letter/Character, Installed With Studs	74.08	7.54
			<i>For Installation With Adhesive, Deduct</i>	-6.72	
			<i>For Clear Anodized, Add</i>	4.39	
			<i>For Satin Face And Enameled Return, Add</i>	13.17	
			<i>For Patina Finish, Add</i>	17.56	
			<i>For Color Anodized, Add</i>	21.96	
10 14 19 00-0010	EA		10" High x 1" Deep, Satin Finish, Cast Aluminum Sign Letter/Character, Installed With Studs	84.77	8.09
			<i>For Installation With Adhesive, Deduct</i>	-7.47	
			<i>For Clear Anodized, Add</i>	5.25	
			<i>For Satin Face And Enameled Return, Add</i>	15.74	
			<i>For Patina Finish, Add</i>	20.98	
			<i>For Color Anodized, Add</i>	26.23	
10 14 19 00-0011	EA		12" High x 1" Deep, Satin Finish, Cast Aluminum Sign Letter/Character, Installed With Studs	103.22	9.33
			<i>For Installation With Adhesive, Deduct</i>	-8.90	
			<i>For Clear Anodized, Add</i>	6.59	
			<i>For Satin Face And Enameled Return, Add</i>	19.76	
			<i>For Patina Finish, Add</i>	26.34	
			<i>For Color Anodized, Add</i>	32.93	
10 14 19 00-0012	EA		14" High x 1" Deep, Satin Finish, Cast Aluminum Sign Letter/Character, Installed With Studs	123.60	10.78
			<i>For Installation With Adhesive, Deduct</i>	-10.49	
			<i>For Clear Anodized, Add</i>	8.05	
			<i>For Satin Face And Enameled Return, Add</i>	24.15	
			<i>For Patina Finish, Add</i>	32.20	
			<i>For Color Anodized, Add</i>	40.25	
10 14 19 00-0013	EA		15" High x 1-1/4" Deep, Satin Finish, Cast Aluminum Sign Letter/Character, Installed With Studs	135.73	11.97
			<i>For Installation With Adhesive, Deduct</i>	-11.58	
			<i>For Clear Anodized, Add</i>	8.78	
			<i>For Satin Face And Enameled Return, Add</i>	26.35	
			<i>For Patina Finish, Add</i>	35.13	
			<i>For Color Anodized, Add</i>	43.91	
10 14 19 00-0014	EA		16" High x 1-1/4" Deep, Satin Finish, Cast Aluminum Sign Letter/Character, Installed With Studs	151.73	12.93
			<i>For Installation With Adhesive, Deduct</i>	-12.76	
			<i>For Clear Anodized, Add</i>	10.00	
			<i>For Satin Face And Enameled Return, Add</i>	30.00	
			<i>For Patina Finish, Add</i>	40.00	
			<i>For Color Anodized, Add</i>	50.01	
10 14 19 00-0015	EA		18" High x 1-1/2" Deep, Satin Finish, Cast Aluminum Sign Letter/Character, Installed With Studs	184.32	14.37
			<i>For Installation With Adhesive, Deduct</i>	-14.96	
			<i>For Clear Anodized, Add</i>	12.69	
			<i>For Satin Face And Enameled Return, Add</i>	38.06	
			<i>For Patina Finish, Add</i>	50.74	
			<i>For Color Anodized, Add</i>	63.43	
10 14 19 00-0016	EA		20" High x 1-1/2" Deep, Satin Finish, Cast Aluminum Sign Letter/Character, Installed With Studs	223.22	16.16
			<i>For Installation With Adhesive, Deduct</i>	-17.63	
			<i>For Clear Anodized, Add</i>	15.86	
			<i>For Satin Face And Enameled Return, Add</i>	47.57	
			<i>For Patina Finish, Add</i>	63.42	
			<i>For Color Anodized, Add</i>	79.28	
10 14 19 00-0017	EA		24" High x 1-1/2" Deep, Satin Finish, Cast Aluminum Sign Letter/Character, Installed With Studs	269.43	17.95
			<i>For Installation With Adhesive, Deduct</i>	-20.66	
			<i>For Clear Anodized, Add</i>	19.76	
			<i>For Satin Face And Enameled Return, Add</i>	59.28	
			<i>For Patina Finish, Add</i>	79.04	
			<i>For Color Anodized, Add</i>	98.80	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 14 19 00-0018			Satin Finish, Cast Bronze Characters <small>(10 14 19 00-0001)</small>		
10 14 19 00-0019	EA		2" High x 3/8" Deep, Satin Finish, Cast Bronze Sign Letter/Character, Installed With Studs.....	43.57	4.94
			<i>For Installation With Adhesive, Deduct</i>	-4.15	
			<i>For Oxidized Finish, Add</i>	3.57	
			<i>For Polished Or Patina Finish, Add</i>	7.14	
10 14 19 00-0020	EA		3" High x 1/2" Deep, Satin Finish, Cast Bronze Sign Letter/Character, Installed With Studs.....	63.51	5.39
			<i>For Installation With Adhesive, Deduct</i>	-5.33	
			<i>For Oxidized Finish, Add</i>	6.29	
			<i>For Polished Or Patina Finish, Add</i>	12.59	
10 14 19 00-0021	EA		4" High x 5/8" Deep, Satin Finish, Cast Bronze Sign Letter/Character, Installed With Studs.....	69.48	5.75
			<i>For Installation With Adhesive, Deduct</i>	-5.77	
			<i>For Oxidized Finish, Add</i>	6.97	
			<i>For Polished Or Patina Finish, Add</i>	13.95	
10 14 19 00-0022	EA		5" High x 3/4" Deep, Satin Finish, Cast Bronze Sign Letter/Character, Installed With Studs.....	84.83	6.46
			<i>For Installation With Adhesive, Deduct</i>	-6.83	
			<i>For Oxidized Finish, Add</i>	8.85	
			<i>For Polished Or Patina Finish, Add</i>	17.69	
10 14 19 00-0023	EA		6" High x 1/2" Deep, Satin Finish, Cast Bronze Sign Letter/Character, Installed With Studs.....	94.57	6.90
			<i>For Installation With Adhesive, Deduct</i>	-7.49	
			<i>For Oxidized Finish, Add</i>	10.04	
			<i>For Polished Or Patina Finish, Add</i>	20.07	
10 14 19 00-0024	EA		8" High x 3/4" Deep, Satin Finish, Cast Bronze Sign Letter/Character, Installed With Studs.....	126.87	7.91
			<i>For Installation With Adhesive, Deduct</i>	-9.50	
			<i>For Oxidized Finish, Add</i>	14.29	
			<i>For Polished Or Patina Finish, Add</i>	28.58	
10 14 19 00-0025	EA		9" High x 3/4" Deep, Satin Finish, Cast Bronze Sign Letter/Character, Installed With Studs.....	145.32	8.26
			<i>For Installation With Adhesive, Deduct</i>	-10.57	
			<i>For Oxidized Finish, Add</i>	16.84	
			<i>For Polished Or Patina Finish, Add</i>	33.68	
10 14 19 00-0026	EA		10" High x 1" Deep, Satin Finish, Cast Bronze Sign Letter/Character, Installed With Studs.....	162.93	8.98
			<i>For Installation With Adhesive, Deduct</i>	-11.74	
			<i>For Oxidized Finish, Add</i>	19.05	
			<i>For Polished Or Patina Finish, Add</i>	38.10	
10 14 19 00-0027	EA		12" High x 1" Deep, Satin Finish, Cast Bronze Sign Letter/Character, Installed With Studs.....	193.63	10.41
			<i>For Installation With Adhesive, Deduct</i>	-13.85	
			<i>For Oxidized Finish, Add</i>	22.79	
			<i>For Polished Or Patina Finish, Add</i>	45.59	
10 14 19 00-0028	EA		14" High x 1" Deep, Satin Finish, Cast Bronze Sign Letter/Character, Installed With Studs.....	227.72	11.85
			<i>For Installation With Adhesive, Deduct</i>	-16.13	
			<i>For Oxidized Finish, Add</i>	27.05	
			<i>For Polished Or Patina Finish, Add</i>	54.09	
10 14 19 00-0029	EA		15" High x 1-1/4" Deep, Satin Finish, Cast Bronze Sign Letter/Character, Installed With Studs.....	269.53	14.37
			<i>For Installation With Adhesive, Deduct</i>	-19.22	
			<i>For Oxidized Finish, Add</i>	31.81	
			<i>For Polished Or Patina Finish, Add</i>	63.62	
10 14 19 00-0030	EA		16" High x 1-1/4" Deep, Satin Finish, Cast Bronze Sign Letter/Character, Installed With Studs.....	279.51	15.45
			<i>For Installation With Adhesive, Deduct</i>	-20.15	
			<i>For Oxidized Finish, Add</i>	32.66	
			<i>For Polished Or Patina Finish, Add</i>	65.32	
10 14 19 00-0031	EA		18" High x 1-1/2" Deep, Satin Finish, Cast Bronze Sign Letter/Character, Installed With Studs.....	399.57	17.95
			<i>For Installation With Adhesive, Deduct</i>	-27.16	
			<i>For Oxidized Finish, Add</i>	49.16	
			<i>For Polished Or Patina Finish, Add</i>	98.32	
10 14 19 00-0032	EA		20" High x 1-1/2" Deep, Satin Finish, Cast Bronze Sign Letter/Character, Installed With Studs.....	482.26	20.21
			<i>For Installation With Adhesive, Deduct</i>	-32.20	
			<i>For Oxidized Finish, Add</i>	60.22	
			<i>For Polished Or Patina Finish, Add</i>	120.43	
10 14 19 00-0033	EA		24" High x 1-1/2" Deep, Satin Finish, Cast Bronze Sign Letter/Character, Installed With Studs.....	615.03	23.35
			<i>For Installation With Adhesive, Deduct</i>	-40.09	
			<i>For Oxidized Finish, Add</i>	78.25	
			<i>For Polished Or Patina Finish, Add</i>	156.49	
10 14 19 00-0034			Molded Characters <small>(10 14 19)</small>		
10 14 19 00-0035			Molded Plastic Characters <small>(10 14 19 00-0034)</small>		
10 14 19 00-0036	EA		4" High x 3/4" Deep, Molded Plastic Sign Letter/Character, Installed With Studs.....	24.00	3.59
			<i>For Installation With Adhesive, Deduct</i>	-2.64	
10 14 19 00-0037	EA		5" High x 3/4" Deep, Molded Plastic Sign Letter/Character, Installed With Studs.....	26.01	3.95
			<i>For Installation With Adhesive, Deduct</i>	-2.88	
10 14 19 00-0038	EA		6" High x 3/4" Deep, Molded Plastic Sign Letter/Character, Installed With Studs.....	28.71	4.31
			<i>For Installation With Adhesive, Deduct</i>	-3.16	
10 14 19 00-0039	EA		8" High x 3/4" Deep, Molded Plastic Sign Letter/Character, Installed With Studs.....	36.30	4.67
			<i>For Installation With Adhesive, Deduct</i>	-3.68	
10 14 19 00-0040	EA		9" High x 3/4" Deep, Molded Plastic Sign Letter/Character, Installed With Studs.....	39.22	5.03
			<i>For Installation With Adhesive, Deduct</i>	-3.97	
10 14 19 00-0041	EA		10" High x 1" Deep, Molded Plastic Sign Letter/Character, Installed With Studs.....	42.44	5.39
			<i>For Installation With Adhesive, Deduct</i>	-4.28	
10 14 19 00-0042	EA		12" High x 1" Deep, Molded Plastic Sign Letter/Character, Installed With Studs.....	49.47	6.28
			<i>For Installation With Adhesive, Deduct</i>	-4.99	
10 14 19 00-0043	EA		15" High x 1" Deep, Molded Plastic Sign Letter/Character, Installed With Studs.....	64.97	7.91
			<i>For Installation With Adhesive, Deduct</i>	-6.41	
10 14 19 00-0044	EA		18" High x 1-1/2" Deep, Molded Plastic Sign Letter/Character, Installed With Studs.....	82.33	9.33
			<i>For Installation With Adhesive, Deduct</i>	-7.85	



Specialties	10
Information Specialties	10 10
Signage	10 14

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MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 14 19 00-0045 EA 24" High x 1-1/2" Deep, Molded Plastic Sign Letter/Character, Installed With Studs..... <i>For Installation With Adhesive, Deduct</i>	120.61 -10.63	11.49
10 14 19 00-0046 EA 30" High x 1-1/2" Deep, Molded Plastic Sign Letter/Character, Installed With Studs..... <i>For Installation With Adhesive, Deduct</i>	177.10 -14.24	13.47
10 14 19 00-0047 EA 36" High x 1-1/2" Deep, Molded Plastic Sign Letter/Character, Installed With Studs..... <i>For Installation With Adhesive, Deduct</i>	231.26 -17.74	15.45
10 14 19 00-0048 EA 48" High x 1-1/2" Deep, Molded Plastic Sign Letter/Character, Installed With Studs..... <i>For Installation With Adhesive, Deduct</i>	428.01 -29.66	20.65
10 14 19 00-0049 Cutout Characters <small>(10 14 19)</small>		
10 14 19 00-0050 Satin Finish, Aluminum Characters <small>(10 14 19 00-0049)</small>		
10 14 19 00-0051 1/4" Deep, Satin Finish, Aluminum Characters <small>(10 14 19 00-0050)</small>		
10 14 19 00-0052 EA 2" High x 1/4" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs <i>For Installation With Adhesive, Deduct</i> <i>For Clear Anodized, Add</i> <i>For Satin Face And Enameled Return, Add</i> <i>For Color Anodized, Add</i> <i>For Polished Or Patina Finish, Add</i> <i>For Polished Anodized Finish, Add</i>	31.37 -3.36 1.34 4.70 6.71 6.71 10.07	4.49
10 14 19 00-0053 EA 4" High x 1/4" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs <i>For Installation With Adhesive, Deduct</i> <i>For Clear Anodized, Add</i> <i>For Satin Face And Enameled Return, Add</i> <i>For Color Anodized, Add</i> <i>For Polished Or Patina Finish, Add</i> <i>For Polished Anodized Finish, Add</i>	44.00 -4.28 2.32 8.11 11.59 11.59 17.38	5.21
10 14 19 00-0054 EA 6" High x 1/4" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs <i>For Installation With Adhesive, Deduct</i> <i>For Clear Anodized, Add</i> <i>For Satin Face And Enameled Return, Add</i> <i>For Color Anodized, Add</i> <i>For Polished Or Patina Finish, Add</i> <i>For Polished Anodized Finish, Add</i>	59.30 -5.48 3.42 11.95 17.08 17.08 25.61	6.28
10 14 19 00-0055 EA 8" High x 1/4" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs <i>For Installation With Adhesive, Deduct</i> <i>For Clear Anodized, Add</i> <i>For Satin Face And Enameled Return, Add</i> <i>For Color Anodized, Add</i> <i>For Polished Or Patina Finish, Add</i> <i>For Polished Anodized Finish, Add</i>	72.65 -6.51 4.39 15.37 21.96 21.96 32.93	7.18
10 14 19 00-0056 EA 10" High x 1/4" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs <i>For Installation With Adhesive, Deduct</i> <i>For Clear Anodized, Add</i> <i>For Satin Face And Enameled Return, Add</i> <i>For Color Anodized, Add</i> <i>For Polished Or Patina Finish, Add</i> <i>For Polished Anodized Finish, Add</i>	83.55 -7.41 5.12 17.93 25.62 25.62 38.42	8.09
10 14 19 00-0057 EA 12" High x 1/4" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs <i>For Installation With Adhesive, Deduct</i> <i>For Clear Anodized, Add</i> <i>For Satin Face And Enameled Return, Add</i> <i>For Color Anodized, Add</i> <i>For Polished Or Patina Finish, Add</i> <i>For Polished Anodized Finish, Add</i>	95.90 -8.53 5.85 20.49 29.27 29.27 43.91	9.33
10 14 19 00-0058 EA 14" High x 1/4" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs <i>For Installation With Adhesive, Deduct</i> <i>For Clear Anodized, Add</i> <i>For Satin Face And Enameled Return, Add</i> <i>For Color Anodized, Add</i> <i>For Polished Or Patina Finish, Add</i> <i>For Polished Anodized Finish, Add</i>	112.62 -9.94 6.95 24.33 34.76 34.76 52.14	10.78
10 14 19 00-0059 EA 16" High x 1/4" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs <i>For Installation With Adhesive, Deduct</i> <i>For Clear Anodized, Add</i> <i>For Satin Face And Enameled Return, Add</i> <i>For Color Anodized, Add</i> <i>For Polished Or Patina Finish, Add</i> <i>For Polished Anodized Finish, Add</i>	133.44 -11.84 8.17 28.60 40.86 40.86 61.29	12.93
10 14 19 00-0060 EA 18" High x 1/4" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs <i>For Installation With Adhesive, Deduct</i> <i>For Clear Anodized, Add</i> <i>For Satin Face And Enameled Return, Add</i> <i>For Color Anodized, Add</i> <i>For Polished Or Patina Finish, Add</i> <i>For Polished Anodized Finish, Add</i>	150.17 -13.26 9.27 32.45 46.35 46.35 69.53	14.37
10 14 19 00-0061 EA 20" High x 1/4" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs <i>For Installation With Adhesive, Deduct</i> <i>For Clear Anodized, Add</i> <i>For Satin Face And Enameled Return, Add</i> <i>For Color Anodized, Add</i> <i>For Polished Or Patina Finish, Add</i> <i>For Polished Anodized Finish, Add</i>	180.53 -15.49 11.59 40.55 57.94 57.94 86.90	16.16

10	Specialties
10 10	Information Specialties
10 14	Signage



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 14 19 00-0062 EA 22" High x 1/4" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs.....	207.29	17.06
For Installation With Adhesive, Deduct	-17.19	
For Clear Anodized, Add	13.90	
For Satin Face And Enameled Return, Add	48.66	
For Color Anodized, Add	69.52	
For Polished Or Patina Finish, Add	69.52	
For Polished Anodized Finish, Add	104.28	
10 14 19 00-0063 EA 24" High x 1/4" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs.....	257.23	17.95
For Installation With Adhesive, Deduct	-20.05	
For Clear Anodized, Add	18.54	
For Satin Face And Enameled Return, Add	64.89	
For Color Anodized, Add	92.70	
For Polished Or Patina Finish, Add	92.70	
For Polished Anodized Finish, Add	139.04	
10 14 19 00-0064 EA 30" High x 1/4" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs.....	368.77	21.55
For Installation With Adhesive, Deduct	-27.06	
For Clear Anodized, Add	28.26	
For Satin Face And Enameled Return, Add	98.90	
For Color Anodized, Add	141.28	
For Polished Or Patina Finish, Add	141.28	
For Polished Anodized Finish, Add	211.92	
10 14 19 00-0065 3/8" Deep, Satin Finish, Aluminum Characters (10 14 19 00-0050)		
10 14 19 00-0066 EA 2" High x 3/8" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs.....	39.95	4.49
For Installation With Adhesive, Deduct	-3.79	
For Clear Anodized, Add	2.20	
For Satin Face And Enameled Return, Add	7.70	
For Color Anodized, Add	11.00	
For Polished Or Patina Finish, Add	11.00	
For Polished Anodized Finish, Add	16.50	
10 14 19 00-0067 EA 4" High x 3/8" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs.....	57.44	5.21
For Installation With Adhesive, Deduct	-4.96	
For Clear Anodized, Add	3.66	
For Satin Face And Enameled Return, Add	12.81	
For Color Anodized, Add	18.31	
For Polished Or Patina Finish, Add	18.31	
For Polished Anodized Finish, Add	27.46	
10 14 19 00-0068 EA 6" High x 3/8" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs.....	72.62	6.28
For Installation With Adhesive, Deduct	-6.15	
For Clear Anodized, Add	4.75	
For Satin Face And Enameled Return, Add	16.61	
For Color Anodized, Add	23.74	
For Polished Or Patina Finish, Add	23.74	
For Polished Anodized Finish, Add	35.60	
10 14 19 00-0069 EA 8" High x 3/8" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs.....	91.09	7.18
For Installation With Adhesive, Deduct	-7.43	
For Clear Anodized, Add	6.24	
For Satin Face And Enameled Return, Add	21.82	
For Color Anodized, Add	31.18	
For Polished Or Patina Finish, Add	31.18	
For Polished Anodized Finish, Add	46.76	
10 14 19 00-0070 EA 10" High x 3/8" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs.....	105.57	8.09
For Installation With Adhesive, Deduct	-8.51	
For Clear Anodized, Add	7.33	
For Satin Face And Enameled Return, Add	25.64	
For Color Anodized, Add	36.63	
For Polished Or Patina Finish, Add	36.63	
For Polished Anodized Finish, Add	54.94	
10 14 19 00-0071 EA 12" High x 3/8" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs.....	124.01	9.33
For Installation With Adhesive, Deduct	-9.94	
For Clear Anodized, Add	8.67	
For Satin Face And Enameled Return, Add	30.33	
For Color Anodized, Add	43.33	
For Polished Or Patina Finish, Add	43.33	
For Polished Anodized Finish, Add	64.99	
10 14 19 00-0072 EA 14" High x 3/8" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs.....	145.30	10.78
For Installation With Adhesive, Deduct	-11.58	
For Clear Anodized, Add	10.22	
For Satin Face And Enameled Return, Add	35.77	
For Color Anodized, Add	51.10	
For Polished Or Patina Finish, Add	51.10	
For Polished Anodized Finish, Add	76.65	
10 14 19 00-0073 EA 16" High x 3/8" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs.....	180.02	12.93
For Installation With Adhesive, Deduct	-14.17	
For Clear Anodized, Add	12.83	
For Satin Face And Enameled Return, Add	44.91	
For Color Anodized, Add	64.15	
For Polished Or Patina Finish, Add	64.15	
For Polished Anodized Finish, Add	96.23	
10 14 19 00-0074 EA 18" High x 3/8" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs.....	208.56	14.37
For Installation With Adhesive, Deduct	-16.18	
For Clear Anodized, Add	15.11	
For Satin Face And Enameled Return, Add	52.88	
For Color Anodized, Add	75.55	
For Polished Or Patina Finish, Add	75.55	
For Polished Anodized Finish, Add	113.32	



Specialties	10
Information Specialties	10 10
Signage	10 14

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MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 14 19 00-0075 EA 20" High x 3/8" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs	241.94	16.16
For Installation With Adhesive, Deduct	-18.56	
For Clear Anodized, Add	17.73	
For Satin Face And Enameled Return, Add	62.05	
For Color Anodized, Add	88.64	
For Polished Or Patina Finish, Add	88.64	
For Polished Anodized Finish, Add	132.96	
10 14 19 00-0076 EA 22" High x 3/8" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs	271.25	17.06
For Installation With Adhesive, Deduct	-20.39	
For Clear Anodized, Add	20.30	
For Satin Face And Enameled Return, Add	71.05	
For Color Anodized, Add	101.50	
For Polished Or Patina Finish, Add	101.50	
For Polished Anodized Finish, Add	152.25	
10 14 19 00-0077 EA 24" High x 3/8" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs	301.73	17.95
For Installation With Adhesive, Deduct	-22.27	
For Clear Anodized, Add	22.99	
For Satin Face And Enameled Return, Add	80.46	
For Color Anodized, Add	114.95	
For Polished Or Patina Finish, Add	114.95	
For Polished Anodized Finish, Add	172.42	
10 14 19 00-0078 EA 30" High x 3/8" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs	415.52	21.55
For Installation With Adhesive, Deduct	-29.40	
For Clear Anodized, Add	32.93	
For Satin Face And Enameled Return, Add	115.26	
For Color Anodized, Add	164.66	
For Polished Or Patina Finish, Add	164.66	
For Polished Anodized Finish, Add	246.98	
10 14 19 00-0079 1/2" Deep, Satin Finish, Aluminum Characters (10 14 19 00-0050)		
10 14 19 00-0080 EA 2" High x 1/2" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs	49.88	4.49
For Installation With Adhesive, Deduct	-4.29	
For Clear Anodized, Add	3.19	
For Satin Face And Enameled Return, Add	11.18	
For Color Anodized, Add	15.97	
For Polished Or Patina Finish, Add	15.97	
For Polished Anodized Finish, Add	23.95	
10 14 19 00-0081 EA 4" High x 1/2" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs	64.63	5.21
For Installation With Adhesive, Deduct	-5.31	
For Clear Anodized, Add	4.38	
For Satin Face And Enameled Return, Add	15.33	
For Color Anodized, Add	21.90	
For Polished Or Patina Finish, Add	21.90	
For Polished Anodized Finish, Add	32.85	
10 14 19 00-0082 EA 6" High x 1/2" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs	81.16	6.28
For Installation With Adhesive, Deduct	-6.57	
For Clear Anodized, Add	5.60	
For Satin Face And Enameled Return, Add	19.60	
For Color Anodized, Add	28.01	
For Polished Or Patina Finish, Add	28.01	
For Polished Anodized Finish, Add	42.01	
10 14 19 00-0083 EA 8" High x 1/2" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs	95.92	7.18
For Installation With Adhesive, Deduct	-7.67	
For Clear Anodized, Add	6.72	
For Satin Face And Enameled Return, Add	23.51	
For Color Anodized, Add	33.59	
For Polished Or Patina Finish, Add	33.59	
For Polished Anodized Finish, Add	50.39	
10 14 19 00-0084 EA 10" High x 1/2" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs	111.72	8.09
For Installation With Adhesive, Deduct	-8.82	
For Clear Anodized, Add	7.94	
For Satin Face And Enameled Return, Add	27.79	
For Color Anodized, Add	39.70	
For Polished Or Patina Finish, Add	39.70	
For Polished Anodized Finish, Add	59.55	
10 14 19 00-0085 EA 12" High x 1/2" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs	137.47	9.33
For Installation With Adhesive, Deduct	-10.61	
For Clear Anodized, Add	10.01	
For Satin Face And Enameled Return, Add	35.04	
For Color Anodized, Add	50.06	
For Polished Or Patina Finish, Add	50.06	
For Polished Anodized Finish, Add	75.08	
10 14 19 00-0086 EA 14" High x 1/2" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs	169.63	10.78
For Installation With Adhesive, Deduct	-12.79	
For Clear Anodized, Add	12.65	
For Satin Face And Enameled Return, Add	44.29	
For Color Anodized, Add	63.27	
For Polished Or Patina Finish, Add	63.27	
For Polished Anodized Finish, Add	94.90	
10 14 19 00-0087 EA 16" High x 1/2" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs	205.35	12.93
For Installation With Adhesive, Deduct	-15.44	
For Clear Anodized, Add	15.36	
For Satin Face And Enameled Return, Add	53.77	
For Color Anodized, Add	76.82	
For Polished Or Patina Finish, Add	76.82	
For Polished Anodized Finish, Add	115.22	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 14 19 00-0088 EA 18" High x 1/2" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs.....	249.35	14.37
For Installation With Adhesive, Deduct	-18.21	
For Clear Anodized, Add	19.19	
For Satin Face And Enameled Return, Add	67.16	
For Color Anodized, Add	95.94	
For Polished Or Patina Finish, Add	95.94	
For Polished Anodized Finish, Add	143.91	
10 14 19 00-0089 EA 20" High x 1/2" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs.....	294.08	16.16
For Installation With Adhesive, Deduct	-21.17	
For Clear Anodized, Add	22.94	
For Satin Face And Enameled Return, Add	80.30	
For Color Anodized, Add	114.71	
For Polished Or Patina Finish, Add	114.71	
For Polished Anodized Finish, Add	172.07	
10 14 19 00-0090 EA 22" High x 1/2" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs.....	337.99	17.06
For Installation With Adhesive, Deduct	-23.72	
For Clear Anodized, Add	26.97	
For Satin Face And Enameled Return, Add	94.41	
For Color Anodized, Add	134.87	
For Polished Or Patina Finish, Add	134.87	
For Polished Anodized Finish, Add	202.31	
10 14 19 00-0091 EA 24" High x 1/2" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs.....	379.59	17.95
For Installation With Adhesive, Deduct	-26.16	
For Clear Anodized, Add	30.78	
For Satin Face And Enameled Return, Add	107.71	
For Color Anodized, Add	153.88	
For Polished Or Patina Finish, Add	153.88	
For Polished Anodized Finish, Add	230.81	
10 14 19 00-0092 EA 30" High x 1/2" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs.....	527.49	21.55
For Installation With Adhesive, Deduct	-35.00	
For Clear Anodized, Add	44.13	
For Satin Face And Enameled Return, Add	154.45	
For Color Anodized, Add	220.64	
For Polished Or Patina Finish, Add	220.64	
For Polished Anodized Finish, Add	330.96	
10 14 19 00-0093 3/4" Deep, Satin Finish, Aluminum Characters (10 14 19 00-0050)		
10 14 19 00-0094 EA 2" High x 3/4" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs.....	52.16	4.49
For Installation With Adhesive, Deduct	-4.40	
For Clear Anodized, Add	3.42	
For Satin Face And Enameled Return, Add	11.97	
For Color Anodized, Add	17.11	
For Polished Or Patina Finish, Add	17.11	
For Polished Anodized Finish, Add	25.66	
10 14 19 00-0095 EA 4" High x 3/4" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs.....	67.18	5.21
For Installation With Adhesive, Deduct	-5.44	
For Clear Anodized, Add	4.64	
For Satin Face And Enameled Return, Add	16.22	
For Color Anodized, Add	23.18	
For Polished Or Patina Finish, Add	23.18	
For Polished Anodized Finish, Add	34.76	
10 14 19 00-0096 EA 6" High x 3/4" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs.....	88.67	6.28
For Installation With Adhesive, Deduct	-6.95	
For Clear Anodized, Add	6.35	
For Satin Face And Enameled Return, Add	22.23	
For Color Anodized, Add	31.76	
For Polished Or Patina Finish, Add	31.76	
For Polished Anodized Finish, Add	47.64	
10 14 19 00-0097 EA 8" High x 3/4" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs.....	117.87	7.18
For Installation With Adhesive, Deduct	-8.77	
For Clear Anodized, Add	8.91	
For Satin Face And Enameled Return, Add	31.20	
For Color Anodized, Add	44.57	
For Polished Or Patina Finish, Add	44.57	
For Polished Anodized Finish, Add	66.85	
10 14 19 00-0098 EA 10" High x 3/4" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs.....	148.09	8.09
For Installation With Adhesive, Deduct	-10.64	
For Clear Anodized, Add	11.58	
For Satin Face And Enameled Return, Add	40.52	
For Color Anodized, Add	57.89	
For Polished Or Patina Finish, Add	57.89	
For Polished Anodized Finish, Add	86.83	
10 14 19 00-0099 EA 12" High x 3/4" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs.....	186.06	9.33
For Installation With Adhesive, Deduct	-13.04	
For Clear Anodized, Add	14.87	
For Satin Face And Enameled Return, Add	52.05	
For Color Anodized, Add	74.35	
For Polished Or Patina Finish, Add	74.35	
For Polished Anodized Finish, Add	111.53	
10 14 19 00-0100 EA 14" High x 3/4" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs.....	232.20	10.78
For Installation With Adhesive, Deduct	-15.92	
For Clear Anodized, Add	18.91	
For Satin Face And Enameled Return, Add	66.19	
For Color Anodized, Add	94.55	
For Polished Or Patina Finish, Add	94.55	
For Polished Anodized Finish, Add	141.83	



Specialties	10	10
Information Specialties	10 10	
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MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 14 19 00-0101	EA		16" High x 3/4" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs 287.07		12.93
			<i>For Installation With Adhesive, Deduct</i>	-19.53	
			<i>For Clear Anodized, Add</i>	23.54	
			<i>For Satin Face And Enameled Return, Add</i>	82.37	
			<i>For Color Anodized, Add</i>	117.68	
			<i>For Polished Or Patina Finish, Add</i>	117.68	
			<i>For Polished Anodized Finish, Add</i>	176.51	
10 14 19 00-0102	EA		18" High x 3/4" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs 351.32		14.37
			<i>For Installation With Adhesive, Deduct</i>	-23.31	
			<i>For Clear Anodized, Add</i>	29.39	
			<i>For Satin Face And Enameled Return, Add</i>	102.85	
			<i>For Color Anodized, Add</i>	146.93	
			<i>For Polished Or Patina Finish, Add</i>	146.93	
			<i>For Polished Anodized Finish, Add</i>	220.39	
10 14 19 00-0103	EA		20" High x 3/4" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs 418.06		16.16
			<i>For Installation With Adhesive, Deduct</i>	-27.37	
			<i>For Clear Anodized, Add</i>	35.34	
			<i>For Satin Face And Enameled Return, Add</i>	123.69	
			<i>For Color Anodized, Add</i>	176.70	
			<i>For Polished Or Patina Finish, Add</i>	176.70	
			<i>For Polished Anodized Finish, Add</i>	265.05	
10 14 19 00-0104	EA		22" High x 3/4" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs 485.38		17.06
			<i>For Installation With Adhesive, Deduct</i>	-31.09	
			<i>For Clear Anodized, Add</i>	41.71	
			<i>For Satin Face And Enameled Return, Add</i>	146.00	
			<i>For Color Anodized, Add</i>	208.57	
			<i>For Polished Or Patina Finish, Add</i>	208.57	
			<i>For Polished Anodized Finish, Add</i>	312.85	
10 14 19 00-0105	EA		24" High x 3/4" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs 555.71		17.95
			<i>For Installation With Adhesive, Deduct</i>	-34.97	
			<i>For Clear Anodized, Add</i>	48.39	
			<i>For Satin Face And Enameled Return, Add</i>	169.35	
			<i>For Color Anodized, Add</i>	241.94	
			<i>For Polished Or Patina Finish, Add</i>	241.94	
			<i>For Polished Anodized Finish, Add</i>	362.90	
10 14 19 00-0106	EA		30" High x 3/4" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs 764.60		21.55
			<i>For Installation With Adhesive, Deduct</i>	-46.85	
			<i>For Clear Anodized, Add</i>	67.84	
			<i>For Satin Face And Enameled Return, Add</i>	237.44	
			<i>For Color Anodized, Add</i>	339.20	
			<i>For Polished Or Patina Finish, Add</i>	339.20	
			<i>For Polished Anodized Finish, Add</i>	508.79	
10 14 19 00-0107			1" Deep, Satin Finish, Aluminum Characters <small>(10 14 19 00-0050)</small>		
10 14 19 00-0108	EA		2" High x 1" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs 58.20		4.49
			<i>For Installation With Adhesive, Deduct</i>	-4.71	
			<i>For Clear Anodized, Add</i>	4.03	
			<i>For Satin Face And Enameled Return, Add</i>	14.09	
			<i>For Color Anodized, Add</i>	20.13	
			<i>For Polished Or Patina Finish, Add</i>	20.13	
			<i>For Polished Anodized Finish, Add</i>	30.19	
10 14 19 00-0109	EA		4" High x 1" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs 72.04		5.21
			<i>For Installation With Adhesive, Deduct</i>	-5.69	
			<i>For Clear Anodized, Add</i>	5.12	
			<i>For Satin Face And Enameled Return, Add</i>	17.92	
			<i>For Color Anodized, Add</i>	25.61	
			<i>For Polished Or Patina Finish, Add</i>	25.61	
			<i>For Polished Anodized Finish, Add</i>	38.41	
10 14 19 00-0110	EA		6" High x 1" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs 94.82		6.28
			<i>For Installation With Adhesive, Deduct</i>	-7.26	
			<i>For Clear Anodized, Add</i>	6.97	
			<i>For Satin Face And Enameled Return, Add</i>	24.38	
			<i>For Color Anodized, Add</i>	34.84	
			<i>For Polished Or Patina Finish, Add</i>	34.84	
			<i>For Polished Anodized Finish, Add</i>	52.25	
10 14 19 00-0111	EA		8" High x 1" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs 130.17		7.18
			<i>For Installation With Adhesive, Deduct</i>	-9.38	
			<i>For Clear Anodized, Add</i>	10.14	
			<i>For Satin Face And Enameled Return, Add</i>	35.50	
			<i>For Color Anodized, Add</i>	50.72	
			<i>For Polished Or Patina Finish, Add</i>	50.72	
			<i>For Polished Anodized Finish, Add</i>	76.07	
10 14 19 00-0112	EA		10" High x 1" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs 177.29		8.09
			<i>For Installation With Adhesive, Deduct</i>	-12.10	
			<i>For Clear Anodized, Add</i>	14.50	
			<i>For Satin Face And Enameled Return, Add</i>	50.74	
			<i>For Color Anodized, Add</i>	72.49	
			<i>For Polished Or Patina Finish, Add</i>	72.49	
			<i>For Polished Anodized Finish, Add</i>	108.73	
10 14 19 00-0113	EA		12" High x 1" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs 232.31		9.33
			<i>For Installation With Adhesive, Deduct</i>	-15.35	
			<i>For Clear Anodized, Add</i>	19.50	
			<i>For Satin Face And Enameled Return, Add</i>	68.23	
			<i>For Color Anodized, Add</i>	97.48	
			<i>For Polished Or Patina Finish, Add</i>	97.48	
			<i>For Polished Anodized Finish, Add</i>	146.21	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 14 19 00-0114	EA		14" High x 1" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs.....	294.07	10.78
			<i>For Installation With Adhesive, Deduct</i>	-19.01	
			<i>For Clear Anodized, Add</i>	25.10	
			<i>For Satin Face And Enameled Return, Add</i>	87.84	
			<i>For Color Anodized, Add</i>	125.49	
			<i>For Polished Or Patina Finish, Add</i>	125.49	
			<i>For Polished Anodized Finish, Add</i>	188.23	
10 14 19 00-0115	EA		16" High x 1" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs.....	365.52	12.93
			<i>For Installation With Adhesive, Deduct</i>	-23.45	
			<i>For Clear Anodized, Add</i>	31.38	
			<i>For Satin Face And Enameled Return, Add</i>	109.83	
			<i>For Color Anodized, Add</i>	156.90	
			<i>For Polished Or Patina Finish, Add</i>	156.90	
			<i>For Polished Anodized Finish, Add</i>	235.35	
10 14 19 00-0116	EA		18" High x 1" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs.....	443.08	14.37
			<i>For Installation With Adhesive, Deduct</i>	-27.90	
			<i>For Clear Anodized, Add</i>	38.56	
			<i>For Satin Face And Enameled Return, Add</i>	134.96	
			<i>For Color Anodized, Add</i>	192.81	
			<i>For Polished Or Patina Finish, Add</i>	192.81	
			<i>For Polished Anodized Finish, Add</i>	289.21	
10 14 19 00-0117	EA		20" High x 1" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs.....	545.52	16.16
			<i>For Installation With Adhesive, Deduct</i>	-33.74	
			<i>For Clear Anodized, Add</i>	48.09	
			<i>For Satin Face And Enameled Return, Add</i>	168.30	
			<i>For Color Anodized, Add</i>	240.43	
			<i>For Polished Or Patina Finish, Add</i>	240.43	
			<i>For Polished Anodized Finish, Add</i>	360.65	
10 14 19 00-0118	EA		22" High x 1" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs.....	650.84	17.06
			<i>For Installation With Adhesive, Deduct</i>	-39.37	
			<i>For Clear Anodized, Add</i>	58.26	
			<i>For Satin Face And Enameled Return, Add</i>	203.91	
			<i>For Color Anodized, Add</i>	291.30	
			<i>For Polished Or Patina Finish, Add</i>	291.30	
			<i>For Polished Anodized Finish, Add</i>	436.94	
10 14 19 00-0119	EA		24" High x 1" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs.....	768.91	17.95
			<i>For Installation With Adhesive, Deduct</i>	-45.63	
			<i>For Clear Anodized, Add</i>	69.71	
			<i>For Satin Face And Enameled Return, Add</i>	243.97	
			<i>For Color Anodized, Add</i>	348.54	
			<i>For Polished Or Patina Finish, Add</i>	348.54	
			<i>For Polished Anodized Finish, Add</i>	522.80	
10 14 19 00-0120	EA		30" High x 1" Deep, Satin Finish, Aluminum Sign Letter/Character, Installed With Studs.....	1,087.32	21.55
			<i>For Installation With Adhesive, Deduct</i>	-62.99	
			<i>For Clear Anodized, Add</i>	100.11	
			<i>For Satin Face And Enameled Return, Add</i>	350.39	
			<i>For Color Anodized, Add</i>	500.56	
			<i>For Polished Or Patina Finish, Add</i>	500.56	
			<i>For Polished Anodized Finish, Add</i>	750.83	
10 14 19 00-0121			Satin Finish, Brass Characters <small>(10 14 19 00-0049)</small>		
10 14 19 00-0122			1/4" Deep, Satin Finish, Brass Characters <small>(10 14 19 00-0121)</small>		
10 14 19 00-0123	EA		2" High x 1/4" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs	46.66	4.49
			<i>For Installation With Adhesive, Deduct</i>	-4.13	
			<i>For Oxidized Finish, Add</i>	4.31	
			<i>For Polished Finish, Add</i>	8.61	
10 14 19 00-0124	EA		4" High x 1/4" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs	60.78	5.21
			<i>For Installation With Adhesive, Deduct</i>	-5.12	
			<i>For Oxidized Finish, Add</i>	5.99	
			<i>For Polished Finish, Add</i>	11.99	
10 14 19 00-0125	EA		6" High x 1/4" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs	84.62	6.28
			<i>For Installation With Adhesive, Deduct</i>	-6.75	
			<i>For Oxidized Finish, Add</i>	8.92	
			<i>For Polished Finish, Add</i>	17.84	
10 14 19 00-0126	EA		8" High x 1/4" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs	111.79	7.18
			<i>For Installation With Adhesive, Deduct</i>	-8.46	
			<i>For Oxidized Finish, Add</i>	12.46	
			<i>For Polished Finish, Add</i>	24.92	
10 14 19 00-0127	EA		10" High x 1/4" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs	144.08	8.09
			<i>For Installation With Adhesive, Deduct</i>	-10.44	
			<i>For Oxidized Finish, Add</i>	16.76	
			<i>For Polished Finish, Add</i>	33.53	
10 14 19 00-0128	EA		12" High x 1/4" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs	182.96	9.33
			<i>For Installation With Adhesive, Deduct</i>	-12.88	
			<i>For Oxidized Finish, Add</i>	21.84	
			<i>For Polished Finish, Add</i>	43.68	
10 14 19 00-0129	EA		14" High x 1/4" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs	229.71	10.78
			<i>For Installation With Adhesive, Deduct</i>	-15.80	
			<i>For Oxidized Finish, Add</i>	27.99	
			<i>For Polished Finish, Add</i>	55.98	
10 14 19 00-0130	EA		16" High x 1/4" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs	280.37	12.93
			<i>For Installation With Adhesive, Deduct</i>	-19.19	
			<i>For Oxidized Finish, Add</i>	34.30	
			<i>For Polished Finish, Add</i>	68.60	



Specialties	10
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MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 14 19 00-0131	EA		18" High x 1/4" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs <i>For Installation With Adhesive, Deduct</i> <i>For Oxidized Finish, Add</i> <i>For Polished Finish, Add</i>	341.63 -22.83 42.62 85.25	14.37
10 14 19 00-0132	EA		20" High x 1/4" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs <i>For Installation With Adhesive, Deduct</i> <i>For Oxidized Finish, Add</i> <i>For Polished Finish, Add</i>	407.12 -26.82 51.37 102.74	16.16
10 14 19 00-0133	EA		22" High x 1/4" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs <i>For Installation With Adhesive, Deduct</i> <i>For Oxidized Finish, Add</i> <i>For Polished Finish, Add</i>	502.99 -31.97 65.21 130.42	17.06
10 14 19 00-0134	EA		24" High x 1/4" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs <i>For Installation With Adhesive, Deduct</i> <i>For Oxidized Finish, Add</i> <i>For Polished Finish, Add</i>	552.28 -34.80 72.07 144.13	17.95
10 14 19 00-0135	EA		30" High x 1/4" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs <i>For Installation With Adhesive, Deduct</i> <i>For Oxidized Finish, Add</i> <i>For Polished Finish, Add</i>	835.33 -50.39 112.37 224.74	21.55
10 14 19 00-0136			3/8" Deep, Satin Finish, Brass Characters <small>(10 14 19 00-0121)</small>		
10 14 19 00-0137	EA		2" High x 3/8" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs <i>For Installation With Adhesive, Deduct</i> <i>For Oxidized Finish, Add</i> <i>For Polished Finish, Add</i>	56.71 -4.63 5.81 11.63	4.49
10 14 19 00-0138	EA		4" High x 3/8" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs <i>For Installation With Adhesive, Deduct</i> <i>For Oxidized Finish, Add</i> <i>For Polished Finish, Add</i>	74.76 -5.82 8.09 16.18	5.21
10 14 19 00-0139	EA		6" High x 3/8" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs <i>For Installation With Adhesive, Deduct</i> <i>For Oxidized Finish, Add</i> <i>For Polished Finish, Add</i>	108.41 -7.94 12.49 24.98	6.28
10 14 19 00-0140	EA		8" High x 3/8" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs <i>For Installation With Adhesive, Deduct</i> <i>For Oxidized Finish, Add</i> <i>For Polished Finish, Add</i>	145.01 -10.12 17.44 34.88	7.18
10 14 19 00-0141	EA		10" High x 3/8" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs <i>For Installation With Adhesive, Deduct</i> <i>For Oxidized Finish, Add</i> <i>For Polished Finish, Add</i>	194.37 -12.95 24.31 48.62	8.09
10 14 19 00-0142	EA		12" High x 3/8" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs <i>For Installation With Adhesive, Deduct</i> <i>For Oxidized Finish, Add</i> <i>For Polished Finish, Add</i>	248.47 -16.16 31.67 63.33	9.33
10 14 19 00-0143	EA		14" High x 3/8" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs <i>For Installation With Adhesive, Deduct</i> <i>For Oxidized Finish, Add</i> <i>For Polished Finish, Add</i>	313.68 -19.99 40.59 81.17	10.78
10 14 19 00-0144	EA		16" High x 3/8" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs <i>For Installation With Adhesive, Deduct</i> <i>For Oxidized Finish, Add</i> <i>For Polished Finish, Add</i>	371.83 -23.76 48.02 96.03	12.93
10 14 19 00-0145	EA		18" High x 3/8" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs <i>For Installation With Adhesive, Deduct</i> <i>For Oxidized Finish, Add</i> <i>For Polished Finish, Add</i>	469.50 -29.22 61.80 123.61	14.37
10 14 19 00-0146	EA		20" High x 3/8" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs <i>For Installation With Adhesive, Deduct</i> <i>For Oxidized Finish, Add</i> <i>For Polished Finish, Add</i>	544.10 -33.67 71.92 143.83	16.16
10 14 19 00-0147	EA		22" High x 3/8" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs <i>For Installation With Adhesive, Deduct</i> <i>For Oxidized Finish, Add</i> <i>For Polished Finish, Add</i>	672.54 -40.45 90.64 181.29	17.06
10 14 19 00-0148	EA		24" High x 3/8" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs <i>For Installation With Adhesive, Deduct</i> <i>For Oxidized Finish, Add</i> <i>For Polished Finish, Add</i>	768.48 -45.61 104.50 208.99	17.95
10 14 19 00-0149	EA		30" High x 3/8" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs <i>For Installation With Adhesive, Deduct</i> <i>For Oxidized Finish, Add</i> <i>For Polished Finish, Add</i>	1,067.56 -62.00 147.20 294.41	21.55
10 14 19 00-0150			1/2" Deep, Satin Finish, Brass Characters <small>(10 14 19 00-0121)</small>		
10 14 19 00-0151	EA		2" High x 1/2" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs <i>For Installation With Adhesive, Deduct</i> <i>For Oxidized Finish, Add</i> <i>For Polished Finish, Add</i>	72.50 -5.42 8.18 16.37	4.49

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10 10	Information Specialties
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MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 14 19 00-0152	EA		4" High x 1/2" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs	94.73	5.21
			<i>For Installation With Adhesive, Deduct</i>	-6.82	
			<i>For Oxidized Finish, Add</i>	11.09	
			<i>For Polished Finish, Add</i>	22.17	
10 14 19 00-0153	EA		6" High x 1/2" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs	138.14	6.28
			<i>For Installation With Adhesive, Deduct</i>	-9.42	
			<i>For Oxidized Finish, Add</i>	16.95	
			<i>For Polished Finish, Add</i>	33.90	
10 14 19 00-0154	EA		8" High x 1/2" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs	190.69	7.18
			<i>For Installation With Adhesive, Deduct</i>	-12.41	
			<i>For Oxidized Finish, Add</i>	24.29	
			<i>For Polished Finish, Add</i>	48.59	
10 14 19 00-0155	EA		10" High x 1/2" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs	267.02	8.09
			<i>For Installation With Adhesive, Deduct</i>	-16.58	
			<i>For Oxidized Finish, Add</i>	35.21	
			<i>For Polished Finish, Add</i>	70.41	
10 14 19 00-0156	EA		12" High x 1/2" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs	357.67	9.33
			<i>For Installation With Adhesive, Deduct</i>	-21.62	
			<i>For Oxidized Finish, Add</i>	48.05	
			<i>For Polished Finish, Add</i>	96.09	
10 14 19 00-0157	EA		14" High x 1/2" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs	444.31	10.78
			<i>For Installation With Adhesive, Deduct</i>	-26.53	
			<i>For Oxidized Finish, Add</i>	60.18	
			<i>For Polished Finish, Add</i>	120.36	
10 14 19 00-0158	EA		16" High x 1/2" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs	529.59	12.93
			<i>For Installation With Adhesive, Deduct</i>	-31.65	
			<i>For Oxidized Finish, Add</i>	71.68	
			<i>For Polished Finish, Add</i>	143.36	
10 14 19 00-0159	EA		18" High x 1/2" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs	725.25	14.37
			<i>For Installation With Adhesive, Deduct</i>	-42.01	
			<i>For Oxidized Finish, Add</i>	100.17	
			<i>For Polished Finish, Add</i>	200.33	
10 14 19 00-0160	EA		20" High x 1/2" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs	818.07	16.16
			<i>For Installation With Adhesive, Deduct</i>	-47.37	
			<i>For Oxidized Finish, Add</i>	113.01	
			<i>For Polished Finish, Add</i>	226.02	
10 14 19 00-0161	EA		22" High x 1/2" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs	1,024.67	17.06
			<i>For Installation With Adhesive, Deduct</i>	-58.06	
			<i>For Oxidized Finish, Add</i>	143.46	
			<i>For Polished Finish, Add</i>	286.93	
10 14 19 00-0162	EA		24" High x 1/2" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs	1,200.87	17.95
			<i>For Installation With Adhesive, Deduct</i>	-67.23	
			<i>For Oxidized Finish, Add</i>	169.35	
			<i>For Polished Finish, Add</i>	338.71	
10 14 19 00-0163	EA		30" High x 1/2" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs	1,816.68	21.55
			<i>For Installation With Adhesive, Deduct</i>	-99.46	
			<i>For Oxidized Finish, Add</i>	259.57	
			<i>For Polished Finish, Add</i>	519.14	
10 14 19 00-0164			3/4" Deep, Satin Finish, Brass Characters <small>(10 14 19 00-0121)</small>		
10 14 19 00-0165	EA		2" High x 3/4" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs	89.72	4.49
			<i>For Installation With Adhesive, Deduct</i>	-6.28	
			<i>For Oxidized Finish, Add</i>	10.77	
			<i>For Polished Finish, Add</i>	21.53	
10 14 19 00-0166	EA		4" High x 3/4" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs	126.69	5.21
			<i>For Installation With Adhesive, Deduct</i>	-8.42	
			<i>For Oxidized Finish, Add</i>	15.88	
			<i>For Polished Finish, Add</i>	31.76	
10 14 19 00-0167	EA		6" High x 3/4" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs	173.82	6.28
			<i>For Installation With Adhesive, Deduct</i>	-11.21	
			<i>For Oxidized Finish, Add</i>	22.30	
			<i>For Polished Finish, Add</i>	44.60	
10 14 19 00-0168	EA		8" High x 3/4" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs	236.37	7.18
			<i>For Installation With Adhesive, Deduct</i>	-14.69	
			<i>For Oxidized Finish, Add</i>	31.14	
			<i>For Polished Finish, Add</i>	62.29	
10 14 19 00-0169	EA		10" High x 3/4" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs	322.90	8.09
			<i>For Installation With Adhesive, Deduct</i>	-19.38	
			<i>For Oxidized Finish, Add</i>	43.59	
			<i>For Polished Finish, Add</i>	87.17	
10 14 19 00-0170	EA		12" High x 3/4" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs	445.03	9.33
			<i>For Installation With Adhesive, Deduct</i>	-25.99	
			<i>For Oxidized Finish, Add</i>	61.15	
			<i>For Polished Finish, Add</i>	122.30	
10 14 19 00-0171	EA		14" High x 3/4" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs	556.28	10.78
			<i>For Installation With Adhesive, Deduct</i>	-32.12	
			<i>For Oxidized Finish, Add</i>	76.98	
			<i>For Polished Finish, Add</i>	153.95	
10 14 19 00-0172	EA		16" High x 3/4" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs	648.49	12.93
			<i>For Installation With Adhesive, Deduct</i>	-37.60	
			<i>For Oxidized Finish, Add</i>	89.52	
			<i>For Polished Finish, Add</i>	179.03	



Specialties	10
Information Specialties	10 10
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MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 14 19 00-0173	EA		18" High x 3/4" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs <i>For Installation With Adhesive, Deduct</i> <i>For Oxidized Finish, Add</i> <i>For Polished Finish, Add</i>	867.33 -49.11 121.48 242.96	14.37
10 14 19 00-0174	EA		20" High x 3/4" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs <i>For Installation With Adhesive, Deduct</i> <i>For Oxidized Finish, Add</i> <i>For Polished Finish, Add</i>	948.20 -53.88 132.53 265.06	16.16
10 14 19 00-0175	EA		22" High x 3/4" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs <i>For Installation With Adhesive, Deduct</i> <i>For Oxidized Finish, Add</i> <i>For Polished Finish, Add</i>	1,207.26 -67.19 170.85 341.70	17.06
10 14 19 00-0176	EA		24" High x 3/4" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs <i>For Installation With Adhesive, Deduct</i> <i>For Oxidized Finish, Add</i> <i>For Polished Finish, Add</i>	1,537.18 -84.04 219.80 439.60	17.95
10 14 19 00-0177	EA		30" High x 3/4" Deep, Satin Finish, Brass Sign Letter/Character, Installed With Studs <i>For Installation With Adhesive, Deduct</i> <i>For Oxidized Finish, Add</i> <i>For Polished Finish, Add</i>	2,326.08 -124.93 335.98 671.96	21.55
10 14 19 00-0178			Satin Finish, Bronze Characters <small>(10 14 19 00-0049)</small>		
10 14 19 00-0179			1/4" Deep, Satin Finish, Bronze Characters <small>(10 14 19 00-0178)</small>		
10 14 19 00-0180	EA		2" High x 1/4" Deep, Satin Finish, Bronze Sign Letter/Character, Installed With Studs <i>For Installation With Adhesive, Deduct</i> <i>For Oxidized Finish, Add</i> <i>For Polished Or Patina Finish, Add</i>	48.82 -4.24 4.63 9.26	4.49
10 14 19 00-0181	EA		4" High x 1/4" Deep, Satin Finish, Bronze Sign Letter/Character, Installed With Studs <i>For Installation With Adhesive, Deduct</i> <i>For Oxidized Finish, Add</i> <i>For Polished Or Patina Finish, Add</i>	63.83 -5.27 6.45 12.90	5.21
10 14 19 00-0182	EA		6" High x 1/4" Deep, Satin Finish, Bronze Sign Letter/Character, Installed With Studs <i>For Installation With Adhesive, Deduct</i> <i>For Oxidized Finish, Add</i> <i>For Polished Or Patina Finish, Add</i>	89.09 -6.97 9.59 19.18	6.28
10 14 19 00-0183	EA		8" High x 1/4" Deep, Satin Finish, Bronze Sign Letter/Character, Installed With Studs <i>For Installation With Adhesive, Deduct</i> <i>For Oxidized Finish, Add</i> <i>For Polished Or Patina Finish, Add</i>	118.04 -8.78 13.40 26.79	7.18
10 14 19 00-0184	EA		10" High x 1/4" Deep, Satin Finish, Bronze Sign Letter/Character, Installed With Studs <i>For Installation With Adhesive, Deduct</i> <i>For Oxidized Finish, Add</i> <i>For Polished Or Patina Finish, Add</i>	152.49 -10.86 18.03 36.05	8.09
10 14 19 00-0185	EA		12" High x 1/4" Deep, Satin Finish, Bronze Sign Letter/Character, Installed With Studs <i>For Installation With Adhesive, Deduct</i> <i>For Oxidized Finish, Add</i> <i>For Polished Or Patina Finish, Add</i>	193.92 -13.43 23.48 46.97	9.33
10 14 19 00-0186	EA		14" High x 1/4" Deep, Satin Finish, Bronze Sign Letter/Character, Installed With Studs <i>For Installation With Adhesive, Deduct</i> <i>For Oxidized Finish, Add</i> <i>For Polished Or Patina Finish, Add</i>	243.76 -16.50 30.10 60.20	10.78
10 14 19 00-0187	EA		16" High x 1/4" Deep, Satin Finish, Bronze Sign Letter/Character, Installed With Studs <i>For Installation With Adhesive, Deduct</i> <i>For Oxidized Finish, Add</i> <i>For Polished Or Patina Finish, Add</i>	303.09 -20.33 37.71 75.41	12.93
10 14 19 00-0188	EA		18" High x 1/4" Deep, Satin Finish, Bronze Sign Letter/Character, Installed With Studs <i>For Installation With Adhesive, Deduct</i> <i>For Oxidized Finish, Add</i> <i>For Polished Or Patina Finish, Add</i>	363.97 -23.95 45.98 91.95	14.37
10 14 19 00-0189	EA		20" High x 1/4" Deep, Satin Finish, Bronze Sign Letter/Character, Installed With Studs <i>For Installation With Adhesive, Deduct</i> <i>For Oxidized Finish, Add</i> <i>For Polished Or Patina Finish, Add</i>	432.90 -28.11 55.24 110.47	16.16
10 14 19 00-0190	EA		22" High x 1/4" Deep, Satin Finish, Bronze Sign Letter/Character, Installed With Studs <i>For Installation With Adhesive, Deduct</i> <i>For Oxidized Finish, Add</i> <i>For Polished Or Patina Finish, Add</i>	507.05 -32.18 65.82 131.64	17.06
10 14 19 00-0191	EA		24" High x 1/4" Deep, Satin Finish, Bronze Sign Letter/Character, Installed With Studs <i>For Installation With Adhesive, Deduct</i> <i>For Oxidized Finish, Add</i> <i>For Polished Or Patina Finish, Add</i>	588.91 -36.63 77.56 155.12	17.95
10 14 19 00-0192	EA		30" High x 1/4" Deep, Satin Finish, Bronze Sign Letter/Character, Installed With Studs <i>For Installation With Adhesive, Deduct</i> <i>For Oxidized Finish, Add</i> <i>For Polished Or Patina Finish, Add</i>	899.85 -53.61 122.05 244.09	21.55
10 14 19 00-0193			3/8" Deep, Satin Finish, Bronze Characters <small>(10 14 19 00-0178)</small>		
10 14 19 00-0194	EA		2" High x 3/8" Deep, Satin Finish, Bronze Sign Letter/Character, Installed With Studs <i>For Installation With Adhesive, Deduct</i> <i>For Oxidized Finish, Add</i> <i>For Polished Or Patina Finish, Add</i>	58.70 -4.73 6.11 12.23	4.49



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 14 19 00-0195	EA		4" High x 3/8" Deep, Satin Finish, Bronze Sign Letter/Character, Installed With Studs	77.16	5.21
			<i>For Installation With Adhesive, Deduct</i>	-5.94	
			<i>For Oxidized Finish, Add</i>	8.45	
			<i>For Polished Or Patina Finish, Add</i>	16.90	
10 14 19 00-0196	EA		6" High x 3/8" Deep, Satin Finish, Bronze Sign Letter/Character, Installed With Studs	113.39	6.28
			<i>For Installation With Adhesive, Deduct</i>	-8.18	
			<i>For Oxidized Finish, Add</i>	13.24	
			<i>For Polished Or Patina Finish, Add</i>	26.47	
10 14 19 00-0197	EA		8" High x 3/8" Deep, Satin Finish, Bronze Sign Letter/Character, Installed With Studs	151.08	7.18
			<i>For Installation With Adhesive, Deduct</i>	-10.43	
			<i>For Oxidized Finish, Add</i>	18.35	
			<i>For Polished Or Patina Finish, Add</i>	36.70	
10 14 19 00-0198	EA		10" High x 3/8" Deep, Satin Finish, Bronze Sign Letter/Character, Installed With Studs	206.57	8.09
			<i>For Installation With Adhesive, Deduct</i>	-13.56	
			<i>For Oxidized Finish, Add</i>	26.14	
			<i>For Polished Or Patina Finish, Add</i>	52.28	
10 14 19 00-0199	EA		12" High x 3/8" Deep, Satin Finish, Bronze Sign Letter/Character, Installed With Studs	262.80	9.33
			<i>For Installation With Adhesive, Deduct</i>	-16.88	
			<i>For Oxidized Finish, Add</i>	33.82	
			<i>For Polished Or Patina Finish, Add</i>	67.63	
10 14 19 00-0200	EA		14" High x 3/8" Deep, Satin Finish, Bronze Sign Letter/Character, Installed With Studs	330.04	10.78
			<i>For Installation With Adhesive, Deduct</i>	-20.81	
			<i>For Oxidized Finish, Add</i>	43.04	
			<i>For Polished Or Patina Finish, Add</i>	86.08	
10 14 19 00-0201	EA		16" High x 3/8" Deep, Satin Finish, Bronze Sign Letter/Character, Installed With Studs	408.67	12.93
			<i>For Installation With Adhesive, Deduct</i>	-25.61	
			<i>For Oxidized Finish, Add</i>	53.54	
			<i>For Polished Or Patina Finish, Add</i>	107.09	
10 14 19 00-0202	EA		18" High x 3/8" Deep, Satin Finish, Bronze Sign Letter/Character, Installed With Studs	495.76	14.37
			<i>For Installation With Adhesive, Deduct</i>	-30.54	
			<i>For Oxidized Finish, Add</i>	65.74	
			<i>For Polished Or Patina Finish, Add</i>	131.49	
10 14 19 00-0203	EA		20" High x 3/8" Deep, Satin Finish, Bronze Sign Letter/Character, Installed With Studs	591.24	16.16
			<i>For Installation With Adhesive, Deduct</i>	-36.03	
			<i>For Oxidized Finish, Add</i>	78.99	
			<i>For Polished Or Patina Finish, Add</i>	157.97	
10 14 19 00-0204	EA		22" High x 3/8" Deep, Satin Finish, Bronze Sign Letter/Character, Installed With Studs	695.73	17.06
			<i>For Installation With Adhesive, Deduct</i>	-41.61	
			<i>For Oxidized Finish, Add</i>	94.12	
			<i>For Polished Or Patina Finish, Add</i>	188.24	
10 14 19 00-0205	EA		24" High x 3/8" Deep, Satin Finish, Bronze Sign Letter/Character, Installed With Studs	790.57	17.95
			<i>For Installation With Adhesive, Deduct</i>	-46.71	
			<i>For Oxidized Finish, Add</i>	107.81	
			<i>For Polished Or Patina Finish, Add</i>	215.62	
10 14 19 00-0206	EA		30" High x 3/8" Deep, Satin Finish, Bronze Sign Letter/Character, Installed With Studs	1,086.99	21.55
			<i>For Installation With Adhesive, Deduct</i>	-62.97	
			<i>For Oxidized Finish, Add</i>	150.12	
			<i>For Polished Or Patina Finish, Add</i>	300.23	
10 14 19 00-0207			1/2" Deep, Satin Finish, Bronze Characters <small>(10 14 19 00-0178)</small>		
10 14 19 00-0208	EA		2" High x 1/2" Deep, Satin Finish, Bronze Sign Letter/Character, Installed With Studs	60.86	4.49
			<i>For Installation With Adhesive, Deduct</i>	-4.84	
			<i>For Oxidized Finish, Add</i>	6.44	
			<i>For Polished Or Patina Finish, Add</i>	12.87	
10 14 19 00-0209	EA		4" High x 1/2" Deep, Satin Finish, Bronze Sign Letter/Character, Installed With Studs	92.64	5.21
			<i>For Installation With Adhesive, Deduct</i>	-6.72	
			<i>For Oxidized Finish, Add</i>	10.77	
			<i>For Polished Or Patina Finish, Add</i>	21.54	
10 14 19 00-0210	EA		6" High x 1/2" Deep, Satin Finish, Bronze Sign Letter/Character, Installed With Studs	133.22	6.28
			<i>For Installation With Adhesive, Deduct</i>	-9.18	
			<i>For Oxidized Finish, Add</i>	16.21	
			<i>For Polished Or Patina Finish, Add</i>	32.42	
10 14 19 00-0211	EA		8" High x 1/2" Deep, Satin Finish, Bronze Sign Letter/Character, Installed With Studs	185.02	7.18
			<i>For Installation With Adhesive, Deduct</i>	-12.13	
			<i>For Oxidized Finish, Add</i>	23.44	
			<i>For Polished Or Patina Finish, Add</i>	46.88	
10 14 19 00-0212	EA		10" High x 1/2" Deep, Satin Finish, Bronze Sign Letter/Character, Installed With Studs	254.64	8.09
			<i>For Installation With Adhesive, Deduct</i>	-15.96	
			<i>For Oxidized Finish, Add</i>	33.35	
			<i>For Polished Or Patina Finish, Add</i>	66.70	
10 14 19 00-0213	EA		12" High x 1/2" Deep, Satin Finish, Bronze Sign Letter/Character, Installed With Studs	348.90	9.33
			<i>For Installation With Adhesive, Deduct</i>	-21.18	
			<i>For Oxidized Finish, Add</i>	46.73	
			<i>For Polished Or Patina Finish, Add</i>	93.46	
10 14 19 00-0214	EA		14" High x 1/2" Deep, Satin Finish, Bronze Sign Letter/Character, Installed With Studs	454.44	10.78
			<i>For Installation With Adhesive, Deduct</i>	-27.03	
			<i>For Oxidized Finish, Add</i>	61.70	
			<i>For Polished Or Patina Finish, Add</i>	123.40	
10 14 19 00-0215	EA		16" High x 1/2" Deep, Satin Finish, Bronze Sign Letter/Character, Installed With Studs	569.54	12.93
			<i>For Installation With Adhesive, Deduct</i>	-33.65	
			<i>For Oxidized Finish, Add</i>	77.67	
			<i>For Polished Or Patina Finish, Add</i>	155.35	



Specialties	10
Information Specialties	10 10
Signage	10 14

10

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 14 19 00-0216	EA		18" High x 1/2" Deep, Satin Finish, Bronze Sign Letter/Character, Installed With Studs.....	701.11	14.37
			<i>For Installation With Adhesive, Deduct</i>	-40.80	
			<i>For Oxidized Finish, Add</i>	96.55	
			<i>For Polished Or Patina Finish, Add</i>	193.09	
10 14 19 00-0217	EA		20" High x 1/2" Deep, Satin Finish, Bronze Sign Letter/Character, Installed With Studs.....	841.64	16.16
			<i>For Installation With Adhesive, Deduct</i>	-48.55	
			<i>For Oxidized Finish, Add</i>	116.55	
			<i>For Polished Or Patina Finish, Add</i>	233.09	
10 14 19 00-0218	EA		22" High x 1/2" Deep, Satin Finish, Bronze Sign Letter/Character, Installed With Studs.....	998.50	17.06
			<i>For Installation With Adhesive, Deduct</i>	-56.75	
			<i>For Oxidized Finish, Add</i>	139.54	
			<i>For Polished Or Patina Finish, Add</i>	279.08	
10 14 19 00-0219	EA		24" High x 1/2" Deep, Satin Finish, Bronze Sign Letter/Character, Installed With Studs.....	1,162.86	17.95
			<i>For Installation With Adhesive, Deduct</i>	-65.33	
			<i>For Oxidized Finish, Add</i>	163.65	
			<i>For Polished Or Patina Finish, Add</i>	327.31	
10 14 19 00-0220	EA		30" High x 1/2" Deep, Satin Finish, Bronze Sign Letter/Character, Installed With Studs.....	1,632.14	21.55
			<i>For Installation With Adhesive, Deduct</i>	-90.23	
			<i>For Oxidized Finish, Add</i>	231.89	
			<i>For Polished Or Patina Finish, Add</i>	463.78	
10 14 19 00-0221			Satin Finish, Copper Characters <small>(10 14 19 00-0049)</small>		
10 14 19 00-0222			1/4" Deep, Satin Finish, Copper Characters <small>(10 14 19 00-0221)</small>		
10 14 19 00-0223	EA		2" High x 1/4" Deep, Satin Finish, Copper Sign Letter/Character, Installed With Studs.....	46.66	4.49
			<i>For Installation With Adhesive, Deduct</i>	-4.13	
			<i>For Polished Finish, Add</i>	8.61	
10 14 19 00-0224	EA		4" High x 1/4" Deep, Satin Finish, Copper Sign Letter/Character, Installed With Studs.....	61.84	5.21
			<i>For Installation With Adhesive, Deduct</i>	-5.18	
			<i>For Polished Finish, Add</i>	12.30	
10 14 19 00-0225	EA		6" High x 1/4" Deep, Satin Finish, Copper Sign Letter/Character, Installed With Studs.....	88.72	6.28
			<i>For Installation With Adhesive, Deduct</i>	-6.95	
			<i>For Polished Finish, Add</i>	19.07	
10 14 19 00-0226	EA		8" High x 1/4" Deep, Satin Finish, Copper Sign Letter/Character, Installed With Studs.....	118.97	7.18
			<i>For Installation With Adhesive, Deduct</i>	-8.82	
			<i>For Polished Finish, Add</i>	27.07	
10 14 19 00-0227	EA		10" High x 1/4" Deep, Satin Finish, Copper Sign Letter/Character, Installed With Studs.....	152.28	8.09
			<i>For Installation With Adhesive, Deduct</i>	-10.85	
			<i>For Polished Finish, Add</i>	35.99	
10 14 19 00-0228	EA		12" High x 1/4" Deep, Satin Finish, Copper Sign Letter/Character, Installed With Studs.....	195.26	9.33
			<i>For Installation With Adhesive, Deduct</i>	-13.50	
			<i>For Polished Finish, Add</i>	47.37	
10 14 19 00-0229	EA		14" High x 1/4" Deep, Satin Finish, Copper Sign Letter/Character, Installed With Studs.....	246.11	10.78
			<i>For Installation With Adhesive, Deduct</i>	-16.62	
			<i>For Polished Finish, Add</i>	60.90	
10 14 19 00-0230	EA		16" High x 1/4" Deep, Satin Finish, Copper Sign Letter/Character, Installed With Studs.....	303.95	12.93
			<i>For Installation With Adhesive, Deduct</i>	-20.37	
			<i>For Polished Finish, Add</i>	75.67	
10 14 19 00-0231	EA		18" High x 1/4" Deep, Satin Finish, Copper Sign Letter/Character, Installed With Studs.....	366.09	14.37
			<i>For Installation With Adhesive, Deduct</i>	-24.05	
			<i>For Polished Finish, Add</i>	92.59	
10 14 19 00-0232	EA		20" High x 1/4" Deep, Satin Finish, Copper Sign Letter/Character, Installed With Studs.....	434.80	16.16
			<i>For Installation With Adhesive, Deduct</i>	-28.21	
			<i>For Polished Finish, Add</i>	111.04	
10 14 19 00-0233	EA		22" High x 1/4" Deep, Satin Finish, Copper Sign Letter/Character, Installed With Studs.....	510.17	17.06
			<i>For Installation With Adhesive, Deduct</i>	-32.33	
			<i>For Polished Finish, Add</i>	132.58	
10 14 19 00-0234	EA		24" High x 1/4" Deep, Satin Finish, Copper Sign Letter/Character, Installed With Studs.....	591.68	17.95
			<i>For Installation With Adhesive, Deduct</i>	-36.77	
			<i>For Polished Finish, Add</i>	155.95	
10 14 19 00-0235	EA		30" High x 1/4" Deep, Satin Finish, Copper Sign Letter/Character, Installed With Studs.....	855.69	21.55
			<i>For Installation With Adhesive, Deduct</i>	-51.41	
			<i>For Polished Finish, Add</i>	230.84	
10 14 19 00-0236			3/8" Deep, Satin Finish, Copper Characters <small>(10 14 19 00-0221)</small>		
10 14 19 00-0237	EA		2" High x 3/8" Deep, Satin Finish, Copper Sign Letter/Character, Installed With Studs.....	53.84	4.49
			<i>For Installation With Adhesive, Deduct</i>	-4.49	
			<i>For Polished Finish, Add</i>	10.77	
10 14 19 00-0238	EA		4" High x 3/8" Deep, Satin Finish, Copper Sign Letter/Character, Installed With Studs.....	74.15	5.21
			<i>For Installation With Adhesive, Deduct</i>	-5.79	
			<i>For Polished Finish, Add</i>	16.00	
10 14 19 00-0239	EA		6" High x 3/8" Deep, Satin Finish, Copper Sign Letter/Character, Installed With Studs.....	110.97	6.28
			<i>For Installation With Adhesive, Deduct</i>	-8.06	
			<i>For Polished Finish, Add</i>	25.75	
10 14 19 00-0240	EA		8" High x 3/8" Deep, Satin Finish, Copper Sign Letter/Character, Installed With Studs.....	155.06	7.18
			<i>For Installation With Adhesive, Deduct</i>	-10.63	
			<i>For Polished Finish, Add</i>	37.90	
10 14 19 00-0241	EA		10" High x 3/8" Deep, Satin Finish, Copper Sign Letter/Character, Installed With Studs.....	212.26	8.09
			<i>For Installation With Adhesive, Deduct</i>	-13.85	
			<i>For Polished Finish, Add</i>	53.98	
10 14 19 00-0242	EA		12" High x 3/8" Deep, Satin Finish, Copper Sign Letter/Character, Installed With Studs.....	266.32	9.33
			<i>For Installation With Adhesive, Deduct</i>	-17.05	
			<i>For Polished Finish, Add</i>	68.69	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 14 19 00-0243	EA		14" High x 3/8" Deep, Satin Finish, Copper Sign Letter/Character, Installed With Studs.....	337.47	10.78
			<i>For Installation With Adhesive, Deduct</i>	-21.18	
			<i>For Polished Finish, Add</i>	88.31	
10 14 19 00-0244	EA		16" High x 3/8" Deep, Satin Finish, Copper Sign Letter/Character, Installed With Studs.....	417.45	12.93
			<i>For Installation With Adhesive, Deduct</i>	-26.04	
			<i>For Polished Finish, Add</i>	109.72	
10 14 19 00-0245	EA		18" High x 3/8" Deep, Satin Finish, Copper Sign Letter/Character, Installed With Studs.....	504.97	14.37
			<i>For Installation With Adhesive, Deduct</i>	-31.00	
			<i>For Polished Finish, Add</i>	134.25	
10 14 19 00-0246	EA		20" High x 3/8" Deep, Satin Finish, Copper Sign Letter/Character, Installed With Studs.....	601.37	16.16
			<i>For Installation With Adhesive, Deduct</i>	-36.53	
			<i>For Polished Finish, Add</i>	161.01	
10 14 19 00-0247	EA		22" High x 3/8" Deep, Satin Finish, Copper Sign Letter/Character, Installed With Studs.....	709.04	17.06
			<i>For Installation With Adhesive, Deduct</i>	-42.28	
			<i>For Polished Finish, Add</i>	192.24	
10 14 19 00-0248	EA		24" High x 3/8" Deep, Satin Finish, Copper Sign Letter/Character, Installed With Studs.....	799.62	17.95
			<i>For Installation With Adhesive, Deduct</i>	-47.17	
			<i>For Polished Finish, Add</i>	218.33	
10 14 19 00-0249	EA		30" High x 3/8" Deep, Satin Finish, Copper Sign Letter/Character, Installed With Studs.....	1,125.01	21.55
			<i>For Installation With Adhesive, Deduct</i>	-64.87	
			<i>For Polished Finish, Add</i>	311.64	
10 14 19 00-0250			Satin Finish, Stainless Steel Characters <small>(10 14 19 00-0049)</small>		
10 14 19 00-0251			1/4" Deep, Satin Finish, Stainless Steel Characters <small>(10 14 19 00-0250)</small>		
10 14 19 00-0252	EA		2" High x 1/4" Deep, Satin Finish, Stainless Steel Sign Letter/Character, Installed With Studs.....	41.47	4.49
			<i>For Installation With Adhesive, Deduct</i>	-3.87	
			<i>For Polished Finish, Add</i>	7.06	
10 14 19 00-0253	EA		4" High x 1/4" Deep, Satin Finish, Stainless Steel Sign Letter/Character, Installed With Studs.....	54.93	5.21
			<i>For Installation With Adhesive, Deduct</i>	-4.83	
			<i>For Polished Finish, Add</i>	10.23	
10 14 19 00-0254	EA		6" High x 1/4" Deep, Satin Finish, Stainless Steel Sign Letter/Character, Installed With Studs.....	71.01	6.28
			<i>For Installation With Adhesive, Deduct</i>	-6.07	
			<i>For Polished Finish, Add</i>	13.76	
10 14 19 00-0255	EA		8" High x 1/4" Deep, Satin Finish, Stainless Steel Sign Letter/Character, Installed With Studs.....	92.24	7.18
			<i>For Installation With Adhesive, Deduct</i>	-7.49	
			<i>For Polished Finish, Add</i>	19.05	
10 14 19 00-0256	EA		10" High x 1/4" Deep, Satin Finish, Stainless Steel Sign Letter/Character, Installed With Studs.....	113.46	8.09
			<i>For Installation With Adhesive, Deduct</i>	-8.91	
			<i>For Polished Finish, Add</i>	24.34	
10 14 19 00-0257	EA		12" High x 1/4" Deep, Satin Finish, Stainless Steel Sign Letter/Character, Installed With Studs.....	139.67	9.33
			<i>For Installation With Adhesive, Deduct</i>	-10.72	
			<i>For Polished Finish, Add</i>	30.69	
10 14 19 00-0258	EA		14" High x 1/4" Deep, Satin Finish, Stainless Steel Sign Letter/Character, Installed With Studs.....	167.76	10.78
			<i>For Installation With Adhesive, Deduct</i>	-12.70	
			<i>For Polished Finish, Add</i>	37.40	
10 14 19 00-0259	EA		16" High x 1/4" Deep, Satin Finish, Stainless Steel Sign Letter/Character, Installed With Studs.....	201.07	12.93
			<i>For Installation With Adhesive, Deduct</i>	-15.23	
			<i>For Polished Finish, Add</i>	44.81	
10 14 19 00-0260	EA		18" High x 1/4" Deep, Satin Finish, Stainless Steel Sign Letter/Character, Installed With Studs.....	235.05	14.37
			<i>For Installation With Adhesive, Deduct</i>	-17.50	
			<i>For Polished Finish, Add</i>	53.27	
10 14 19 00-0261	EA		20" High x 1/4" Deep, Satin Finish, Stainless Steel Sign Letter/Character, Installed With Studs.....	275.16	16.16
			<i>For Installation With Adhesive, Deduct</i>	-20.22	
			<i>For Polished Finish, Add</i>	63.15	
10 14 19 00-0262	EA		22" High x 1/4" Deep, Satin Finish, Stainless Steel Sign Letter/Character, Installed With Studs.....	321.09	17.06
			<i>For Installation With Adhesive, Deduct</i>	-22.88	
			<i>For Polished Finish, Add</i>	75.85	
10 14 19 00-0263	EA		24" High x 1/4" Deep, Satin Finish, Stainless Steel Sign Letter/Character, Installed With Studs.....	368.19	17.95
			<i>For Installation With Adhesive, Deduct</i>	-25.59	
			<i>For Polished Finish, Add</i>	88.91	
10 14 19 00-0264	EA		30" High x 1/4" Deep, Satin Finish, Stainless Steel Sign Letter/Character, Installed With Studs.....	507.22	21.55
			<i>For Installation With Adhesive, Deduct</i>	-33.98	
			<i>For Polished Finish, Add</i>	126.30	
10 14 19 00-0265			3/8" Deep, Satin Finish, Stainless Steel Characters <small>(10 14 19 00-0250)</small>		
10 14 19 00-0266	EA		2" High x 3/8" Deep, Satin Finish, Stainless Steel Sign Letter/Character, Installed With Studs.....	49.70	4.49
			<i>For Installation With Adhesive, Deduct</i>	-4.28	
			<i>For Polished Finish, Add</i>	9.53	
10 14 19 00-0267	EA		4" High x 3/8" Deep, Satin Finish, Stainless Steel Sign Letter/Character, Installed With Studs.....	66.87	5.21
			<i>For Installation With Adhesive, Deduct</i>	-5.43	
			<i>For Polished Finish, Add</i>	13.81	
10 14 19 00-0268	EA		6" High x 3/8" Deep, Satin Finish, Stainless Steel Sign Letter/Character, Installed With Studs.....	86.15	6.28
			<i>For Installation With Adhesive, Deduct</i>	-6.82	
			<i>For Polished Finish, Add</i>	18.30	
10 14 19 00-0269	EA		8" High x 3/8" Deep, Satin Finish, Stainless Steel Sign Letter/Character, Installed With Studs.....	110.66	7.18
			<i>For Installation With Adhesive, Deduct</i>	-8.41	
			<i>For Polished Finish, Add</i>	24.58	
10 14 19 00-0270	EA		10" High x 3/8" Deep, Satin Finish, Stainless Steel Sign Letter/Character, Installed With Studs.....	137.00	8.09
			<i>For Installation With Adhesive, Deduct</i>	-10.08	
			<i>For Polished Finish, Add</i>	31.40	



Specialties	10
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MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 14 19 00-0271	EA		12" High x 3/8" Deep, Satin Finish, Stainless Steel Sign Letter/Character, Installed With Studs..... <i>For Installation With Adhesive, Deduct</i> <i>For Polished Finish, Add</i>	169.34 -12.20 39.59	9.33
10 14 19 00-0272	EA		14" High x 3/8" Deep, Satin Finish, Stainless Steel Sign Letter/Character, Installed With Studs..... <i>For Installation With Adhesive, Deduct</i> <i>For Polished Finish, Add</i>	203.91 -14.51 48.24	10.78
10 14 19 00-0273	EA		16" High x 3/8" Deep, Satin Finish, Stainless Steel Sign Letter/Character, Installed With Studs..... <i>For Installation With Adhesive, Deduct</i> <i>For Polished Finish, Add</i>	244.38 -17.39 57.80	12.93
10 14 19 00-0274	EA		18" High x 3/8" Deep, Satin Finish, Stainless Steel Sign Letter/Character, Installed With Studs..... <i>For Installation With Adhesive, Deduct</i> <i>For Polished Finish, Add</i>	284.77 -19.99 68.19	14.37
10 14 19 00-0275	EA		20" High x 3/8" Deep, Satin Finish, Stainless Steel Sign Letter/Character, Installed With Studs..... <i>For Installation With Adhesive, Deduct</i> <i>For Polished Finish, Add</i>	334.11 -23.17 80.84	16.16
10 14 19 00-0276	EA		22" High x 3/8" Deep, Satin Finish, Stainless Steel Sign Letter/Character, Installed With Studs..... <i>For Installation With Adhesive, Deduct</i> <i>For Polished Finish, Add</i>	376.71 -25.66 92.54	17.06
10 14 19 00-0277	EA		24" High x 3/8" Deep, Satin Finish, Stainless Steel Sign Letter/Character, Installed With Studs..... <i>For Installation With Adhesive, Deduct</i> <i>For Polished Finish, Add</i>	433.39 -28.85 108.47	17.95
10 14 19 00-0278	EA		30" High x 3/8" Deep, Satin Finish, Stainless Steel Sign Letter/Character, Installed With Studs..... <i>For Installation With Adhesive, Deduct</i> <i>For Polished Finish, Add</i>	599.84 -38.61 154.09	21.55
10 14 19 00-0279			1/2" Deep, Satin Finish, Stainless Steel Characters <small>(10 14 19 00-0250)</small>		
10 14 19 00-0280	EA		2" High x 1/2" Deep, Satin Finish, Stainless Steel Sign Letter/Character, Installed With Studs..... <i>For Installation With Adhesive, Deduct</i> <i>For Polished Finish, Add</i>	60.29 -4.81 12.70	4.49
10 14 19 00-0281	EA		4" High x 1/2" Deep, Satin Finish, Stainless Steel Sign Letter/Character, Installed With Studs..... <i>For Installation With Adhesive, Deduct</i> <i>For Polished Finish, Add</i>	82.22 -6.19 18.42	5.21
10 14 19 00-0282	EA		6" High x 1/2" Deep, Satin Finish, Stainless Steel Sign Letter/Character, Installed With Studs..... <i>For Installation With Adhesive, Deduct</i> <i>For Polished Finish, Add</i>	106.33 -7.83 24.35	6.28
10 14 19 00-0283	EA		8" High x 1/2" Deep, Satin Finish, Stainless Steel Sign Letter/Character, Installed With Studs..... <i>For Installation With Adhesive, Deduct</i> <i>For Polished Finish, Add</i>	140.51 -9.90 33.53	7.18
10 14 19 00-0284	EA		10" High x 1/2" Deep, Satin Finish, Stainless Steel Sign Letter/Character, Installed With Studs..... <i>For Installation With Adhesive, Deduct</i> <i>For Polished Finish, Add</i>	175.13 -11.99 42.84	8.09
10 14 19 00-0285	EA		12" High x 1/2" Deep, Satin Finish, Stainless Steel Sign Letter/Character, Installed With Studs..... <i>For Installation With Adhesive, Deduct</i> <i>For Polished Finish, Add</i>	217.43 -14.61 54.02	9.33
10 14 19 00-0286	EA		14" High x 1/2" Deep, Satin Finish, Stainless Steel Sign Letter/Character, Installed With Studs..... <i>For Installation With Adhesive, Deduct</i> <i>For Polished Finish, Add</i>	262.49 -17.43 65.82	10.78
10 14 19 00-0287	EA		16" High x 1/2" Deep, Satin Finish, Stainless Steel Sign Letter/Character, Installed With Studs..... <i>For Installation With Adhesive, Deduct</i> <i>For Polished Finish, Add</i>	314.58 -20.90 78.86	12.93
10 14 19 00-0288	EA		18" High x 1/2" Deep, Satin Finish, Stainless Steel Sign Letter/Character, Installed With Studs..... <i>For Installation With Adhesive, Deduct</i> <i>For Polished Finish, Add</i>	375.33 -24.51 95.36	14.37
10 14 19 00-0289	EA		20" High x 1/2" Deep, Satin Finish, Stainless Steel Sign Letter/Character, Installed With Studs..... <i>For Installation With Adhesive, Deduct</i> <i>For Polished Finish, Add</i>	441.46 -28.54 113.04	16.16
10 14 19 00-0290	EA		22" High x 1/2" Deep, Satin Finish, Stainless Steel Sign Letter/Character, Installed With Studs..... <i>For Installation With Adhesive, Deduct</i> <i>For Polished Finish, Add</i>	495.55 -31.60 128.19	17.06
10 14 19 00-0291	EA		24" High x 1/2" Deep, Satin Finish, Stainless Steel Sign Letter/Character, Installed With Studs..... <i>For Installation With Adhesive, Deduct</i> <i>For Polished Finish, Add</i>	572.67 -35.82 150.25	17.95
10 14 19 00-0292	EA		30" High x 1/2" Deep, Satin Finish, Stainless Steel Sign Letter/Character, Installed With Studs..... <i>For Installation With Adhesive, Deduct</i> <i>For Polished Finish, Add</i>	797.71 -48.51 213.45	21.55
10 14 23			Panel Signage <small>(10 14)</small>		
10 14 23 00-0001			Indoor/Outdoor Signs <small>(10 14 23)</small> Note: Office number signs, conference room signs, restroom signs, stairway signs, fire extinguisher marker, ANSI/OSHA safety signs, entry/exit signs, etc.		
10 14 23 00-0002			Surface Mount, Indoor/Outdoor Signs <small>(10 14 23 00-0001)</small>		
10 14 23 00-0003			Adhesive Backed Vinyl, Surface Mount, Indoor/Outdoor Signs <small>(10 14 23 00-0002)</small> Note: Multi-color with words, symbols and graphics.		
10 14 23 00-0004	EA		Up To 25 Sl, Adhesive Backed Vinyl, Surface Mount, Indoor/Outdoor Sign..... <i>For >25 To 50, Deduct</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i> <i>For Clear Glass Mount, Add</i> <i>For Glow-In-Dark, Add</i> <i>For Reflective Finish, Add</i>	21.94 -0.37 -0.92 -1.10 2.94 7.36 8.28	9.14



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 14 23 00-0005 EA >25 To 50 SI, Adhesive Backed Vinyl, Surface Mount, Indoor/Outdoor Sign.....	24.56	9.14
For >25 To 50, Deduct	-0.63	
For >50 To 100, Deduct	-1.58	
For >100, Deduct	-1.89	
For Clear Glass Mount, Add	5.04	
For Glow-In-Dark, Add	12.60	
For Reflective Finish, Add	14.18	
10 14 23 00-0006 EA >50 To 100 SI, Adhesive Backed Vinyl, Surface Mount, Indoor/Outdoor Sign.....	28.76	9.14
For >25 To 50, Deduct	-1.05	
For >50 To 100, Deduct	-2.63	
For >100, Deduct	-3.15	
For Clear Glass Mount, Add	8.40	
For Glow-In-Dark, Add	21.00	
For Reflective Finish, Add	23.63	
10 14 23 00-0007 EA >100 To 250 SI, Adhesive Backed Vinyl, Surface Mount, Indoor/Outdoor Sign.....	34.01	9.14
For >25 To 50, Deduct	-1.58	
For >50 To 100, Deduct	-3.94	
For >100, Deduct	-4.73	
For Clear Glass Mount, Add	12.60	
For Glow-In-Dark, Add	31.50	
For Reflective Finish, Add	35.44	
10 14 23 00-0008 EA >250 To 500 SI, Adhesive Backed Vinyl, Surface Mount, Indoor/Outdoor Sign.....	43.46	9.14
For >25 To 50, Deduct	-2.52	
For >50 To 100, Deduct	-6.30	
For >100, Deduct	-7.56	
For Clear Glass Mount, Add	20.16	
For Glow-In-Dark, Add	50.40	
For Reflective Finish, Add	56.70	
10 14 23 00-0009 EA >500 To 750 SI, Adhesive Backed Vinyl, Surface Mount, Indoor/Outdoor Sign.....	60.26	9.14
For >25 To 50, Deduct	-4.20	
For >50 To 100, Deduct	-10.50	
For >100, Deduct	-12.60	
For Clear Glass Mount, Add	33.60	
For Glow-In-Dark, Add	84.00	
For Reflective Finish, Add	94.50	
10 14 23 00-0010 EA >750 To 1,000 SI, Adhesive Backed Vinyl, Surface Mount, Indoor/Outdoor Sign.....	81.26	9.14
For >25 To 50, Deduct	-6.30	
For >50 To 100, Deduct	-15.75	
For >100, Deduct	-18.90	
For Clear Glass Mount, Add	50.40	
For Glow-In-Dark, Add	126.00	
For Reflective Finish, Add	141.75	
10 14 23 00-0011 SI >1,000 SI, Adhesive Backed Vinyl, Surface Mount, Indoor/Outdoor Sign.....	0.09	0.01
For Clear Glass Mount, Add	0.06	
For Glow-In-Dark, Add	0.14	
For Reflective Finish, Add	0.16	
10 14 23 00-0012 Semi-Rigid Polyvinyl Chloride (PVC), Surface Mount, Indoor/Outdoor Signs		
<small>(10 14 23 00-0002)</small>		
Note: Multi-color with words, symbols and graphics. Includes adhesive or fasteners for mounting.		
10 14 23 00-0013 EA Up To 25 SI, Semi-Rigid Polyvinyl Chloride (PVC), Surface Mount, Indoor/Outdoor Sign.....	22.98	9.14
For >25 To 50, Deduct	-0.47	
For >50 To 100, Deduct	-1.18	
For >100, Deduct	-1.42	
For Glow-In-Dark, Add	9.44	
For Reflective Finish, Add	10.15	
10 14 23 00-0014 EA >25 To 50 SI, Semi-Rigid Polyvinyl Chloride (PVC), Surface Mount, Indoor/Outdoor Sign.....	25.61	9.14
For >25 To 50, Deduct	-0.74	
For >50 To 100, Deduct	-1.84	
For >100, Deduct	-2.21	
For Glow-In-Dark, Add	14.70	
For Reflective Finish, Add	15.80	
10 14 23 00-0015 EA >50 To 100 SI, Semi-Rigid Polyvinyl Chloride (PVC), Surface Mount, Indoor/Outdoor Sign.....	30.86	9.14
For >25 To 50, Deduct	-1.26	
For >50 To 100, Deduct	-3.15	
For >100, Deduct	-3.78	
For Glow-In-Dark, Add	25.20	
For Reflective Finish, Add	27.09	
10 14 23 00-0016 EA >100 To 250 SI, Semi-Rigid Polyvinyl Chloride (PVC), Surface Mount, Indoor/Outdoor Sign.....	36.11	9.14
For >25 To 50, Deduct	-1.79	
For >50 To 100, Deduct	-4.46	
For >100, Deduct	-5.36	
For Glow-In-Dark, Add	35.70	
For Reflective Finish, Add	38.38	
10 14 23 00-0017 EA >250 To 500 SI, Semi-Rigid Polyvinyl Chloride (PVC), Surface Mount, Indoor/Outdoor Sign.....	43.98	9.14
For >25 To 50, Deduct	-2.57	
For >50 To 100, Deduct	-6.43	
For >100, Deduct	-7.72	
For Glow-In-Dark, Add	51.44	
For Reflective Finish, Add	55.30	
10 14 23 00-0018 EA >500 To 750 SI, Semi-Rigid Polyvinyl Chloride (PVC), Surface Mount, Indoor/Outdoor Sign.....	51.86	9.14
For >25 To 50, Deduct	-3.36	
For >50 To 100, Deduct	-8.40	
For >100, Deduct	-10.08	
For Glow-In-Dark, Add	67.20	
For Reflective Finish, Add	72.24	



Specialties	10
Information Specialties	10 10
Signage	10 14

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MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 14 23 00-0019 EA >750 To 1,000 SI, Semi-Rigid Polyvinyl Chloride (PVC), Surface Mount, Indoor/Outdoor Sign	60.26	9.14
For >25 To 50, Deduct	-4.20	
For >50 To 100, Deduct	-10.50	
For >100, Deduct	-12.60	
For Glow-In-Dark, Add	84.00	
For Reflective Finish, Add	90.30	
10 14 23 00-0020 SI >1,000 SI, Semi-Rigid Polyvinyl Chloride (PVC), Surface Mount, Indoor/Outdoor Sign	0.07	0.01
For Glow-In-Dark, Add	0.10	
For Reflective Finish, Add	0.11	
10 14 23 00-0021 Acrylic, Surface Mount, Indoor/Outdoor Signs With Braille <small>(10 14 23 00-0002)</small>		
Note: Multi-color with words, symbols and graphics. Includes adhesive or fasteners for mounting. Excludes frame.		
10 14 23 00-0022 EA Up To 25 SI, Acrylic, Surface Mount, Indoor/Outdoor Signs With Braille	30.86	9.14
For >25 To 50, Deduct	-1.26	
For >50 To 100, Deduct	-3.15	
For >100, Deduct	-3.78	
For Molded Plastic Frame, Add	15.00	
For Brushed Metal Finish/Faux Metal Finish, Add	23.00	
For 2" Height Slider Channel For Custom Inserts, Add	35.00	
10 14 23 00-0023 EA >25 To 50 SI, Acrylic, Surface Mount, Indoor/Outdoor Signs With Braille	34.01	9.14
For >25 To 50, Deduct	-1.58	
For >50 To 100, Deduct	-3.94	
For >100, Deduct	-4.73	
For Molded Plastic Frame, Add	17.00	
For Brushed Metal Finish/Faux Metal Finish, Add	28.00	
For 2" Height Slider Channel For Custom Inserts, Add	35.00	
10 14 23 00-0024 EA >50 To 75 SI, Acrylic, Surface Mount, Indoor/Outdoor Signs With Braille	39.26	9.14
For >25 To 50, Deduct	-2.10	
For >50 To 100, Deduct	-5.25	
For >100, Deduct	-6.30	
For Molded Plastic Frame, Add	19.00	
For Brushed Metal Finish/Faux Metal Finish, Add	31.00	
10 14 23 00-0025 EA >75 To 100 SI, Acrylic, Surface Mount, Indoor/Outdoor Signs With Braille	44.20	9.14
For >25 To 50, Deduct	-2.59	
For >50 To 100, Deduct	-6.49	
For >100, Deduct	-7.78	
For Molded Plastic Frame, Add	21.00	
For Brushed Metal Finish/Faux Metal Finish, Add	35.00	
10 14 23 00-0026 SI >100 SI, Acrylic, Surface Mount, Indoor/Outdoor Signs With Braille	0.47	0.09
For Molded Plastic Frame, Add	0.20	
For Brushed Metal Finish/Faux Metal Finish, Add	0.31	
10 14 23 00-0027 Engraved Steel, Surface Mount, Indoor/Outdoor Signs <small>(10 14 23 00-0002)</small>		
Note: Multi-color with words, symbols and graphics. Includes adhesive or fasteners for mounting. Excludes frame.		
10 14 23 00-0028 EA Up To 25 SI, Engraved Steel, Surface Mount, Indoor/Outdoor Sign	38.21	9.14
For >25 To 50, Deduct	-2.00	
For >50 To 100, Deduct	-4.99	
For >100, Deduct	-5.99	
For Molded Plastic Frame, Add	15.00	
10 14 23 00-0029 EA >25 To 50 SI, Engraved Steel, Surface Mount, Indoor/Outdoor Sign	44.51	9.14
For >25 To 50, Deduct	-2.63	
For >50 To 100, Deduct	-6.56	
For >100, Deduct	-7.88	
For Molded Plastic Frame, Add	17.00	
10 14 23 00-0030 EA >50 To 75 SI, Engraved Steel, Surface Mount, Indoor/Outdoor Sign	52.91	9.14
For >25 To 50, Deduct	-3.47	
For >50 To 100, Deduct	-8.66	
For >100, Deduct	-10.40	
For Molded Plastic Frame, Add	19.00	
10 14 23 00-0031 EA >75 To 100 SI, Engraved Steel, Surface Mount, Indoor/Outdoor Sign	69.71	9.14
For >25 To 50, Deduct	-5.15	
For >50 To 100, Deduct	-12.86	
For >100, Deduct	-15.44	
For Molded Plastic Frame, Add	21.00	
10 14 23 00-0032 SI >100 SI, Engraved Steel, Surface Mount, Indoor/Outdoor Sign	0.69	0.09
For Molded Plastic Frame, Add	0.20	
10 14 23 00-0033 Enamel Coated Aluminum, Surface Mount, Indoor/Outdoor Signs <small>(10 14 23 00-0002)</small>		
Note: Multi-color with words, symbols and graphics. Includes adhesive or fasteners for mounting.		
10 14 23 00-0034 EA Up To 25 SI, Enamel Coated Aluminum, Surface Mount, Indoor/Outdoor Sign	22.46	9.14
For >25 To 50, Deduct	-0.42	
For >50 To 100, Deduct	-1.05	
For >100, Deduct	-1.26	
For Glow-In-Dark, Add	2.52	
For Reflective Finish, Add	3.15	
10 14 23 00-0035 EA >25 To 50 SI, Enamel Coated Aluminum, Surface Mount, Indoor/Outdoor Sign	25.61	9.14
For >25 To 50, Deduct	-0.74	
For >50 To 100, Deduct	-1.84	
For >100, Deduct	-2.21	
For Glow-In-Dark, Add	4.41	
For Reflective Finish, Add	5.51	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 14 23 00-0036	EA		>50 To 100 SI, Enamel Coated Aluminum, Surface Mount, Indoor/Outdoor Sign	31.91	9.14
			<i>For >25 To 50, Deduct</i>	-1.37	
			<i>For >50 To 100, Deduct</i>	-3.41	
			<i>For >100, Deduct</i>	-4.10	
			<i>For Glow-In-Dark, Add</i>	8.19	
			<i>For Reflective Finish, Add</i>	10.24	
10 14 23 00-0037	EA		>100 To 250 SI, Enamel Coated Aluminum, Surface Mount, Indoor/Outdoor Sign	39.26	9.14
			<i>For >25 To 50, Deduct</i>	-2.10	
			<i>For >50 To 100, Deduct</i>	-5.25	
			<i>For >100, Deduct</i>	-6.30	
			<i>For Glow-In-Dark, Add</i>	12.60	
			<i>For Reflective Finish, Add</i>	15.75	
10 14 23 00-0038	EA		>250 To 500 SI, Enamel Coated Aluminum, Surface Mount, Indoor/Outdoor Sign	61.31	9.14
			<i>For >25 To 50, Deduct</i>	-4.31	
			<i>For >50 To 100, Deduct</i>	-10.76	
			<i>For >100, Deduct</i>	-12.92	
			<i>For Glow-In-Dark, Add</i>	25.83	
			<i>For Reflective Finish, Add</i>	32.29	
10 14 23 00-0039	EA		>500 To 750 SI, Enamel Coated Aluminum, Surface Mount, Indoor/Outdoor Sign	70.76	9.14
			<i>For >25 To 50, Deduct</i>	-5.25	
			<i>For >50 To 100, Deduct</i>	-13.13	
			<i>For >100, Deduct</i>	-15.75	
			<i>For Glow-In-Dark, Add</i>	31.50	
			<i>For Reflective Finish, Add</i>	39.38	
10 14 23 00-0040	EA		>750 To 1,000 SI, Enamel Coated Aluminum, Surface Mount, Indoor/Outdoor Sign	83.36	9.14
			<i>For >25 To 50, Deduct</i>	-6.51	
			<i>For >50 To 100, Deduct</i>	-16.28	
			<i>For >100, Deduct</i>	-19.53	
			<i>For Glow-In-Dark, Add</i>	39.06	
			<i>For Reflective Finish, Add</i>	48.83	
10 14 23 00-0041	SI		>1,000 SI, Enamel Coated Aluminum, Surface Mount, Indoor/Outdoor Sign.....	0.09	0.01
			<i>For Glow-In-Dark, Add</i>	0.04	
			<i>For Reflective Finish, Add</i>	0.05	
10 14 23 00-0042			California Title 24, Surface Mount, Signs (10 14 23 00-0002)		
10 14 23 00-0043			California Title 24, Surface Mount, Geometric Restroom Signs (10 14 23 00-0042)		
			Note: Includes 1/4" thick acrylic or PVC construction, color that contrasts with the door color, and with or without the international symbol of accessibility and staff only designation.		
10 14 23 00-0044	EA		1/4" Thick, Equilateral Triangle With 12" Long Edges, California Title 24, Surface Mount, Geometric Male Restroom Sign.....	56.85	9.14
			<i>For >25 To 50, Deduct</i>	-3.86	
			<i>For >50 To 100, Deduct</i>	-5.79	
			<i>For >100, Deduct</i>	-6.56	
10 14 23 00-0045	EA		1/4" Thick, 12" Diameter, California Title 24, Surface Mount, Geometric Female Restroom Sign	56.85	9.14
			<i>For >25 To 50, Deduct</i>	-3.86	
			<i>For >50 To 100, Deduct</i>	-5.79	
			<i>For >100, Deduct</i>	-6.56	
10 14 23 00-0046	EA		1/4" Thick, 12" Diameter, California Title 24, Surface Mount, Geometric Unisex Restroom Sign	72.28	9.14
			Note: Includes contrasting color equilateral triangle with 12" long edges superimposed on the circle.		
			<i>For >25 To 50, Deduct</i>	-5.40	
			<i>For >50 To 100, Deduct</i>	-8.10	
			<i>For >100, Deduct</i>	-9.18	
10 14 23 00-0047			California Title 24, Surface Mount, Stairwell Signs (10 14 23 00-0042)		
			Note: Includes 1/16" matte finish colored polymer face plate with 1/16" acrylic backer. Includes information on stairway location, roof access availability, floor level number, basement or mezzanine level identification and exit level and direction.		
10 14 23 00-0048	EA		1/8" Thick, 12" x 18", California Title 24, Surface Mount, Stairwell Sign	105.36	9.14
			<i>For >25 To 50, Deduct</i>	-8.71	
			<i>For >50 To 100, Deduct</i>	-13.07	
			<i>For >100, Deduct</i>	-14.81	
10 14 23 00-0049			Ceiling Mount, Indoor/Outdoor Signs (10 14 23 00-0001)		
10 14 23 00-0050			Enamel Coated Aluminum, Ceiling Mount, Indoor/Outdoor Signs (10 14 23 00-0049)		
10 14 23 00-0051	EA		Up To 25 SI, Enamel Coated Aluminum, Ceiling Mount, Indoor/Outdoor Sign.....	31.35	12.79
			<i>For >25 To 50, Deduct</i>	-0.58	
			<i>For >50 To 100, Deduct</i>	-1.45	
			<i>For >100, Deduct</i>	-1.73	
			<i>For Glow-In-Dark, Add</i>	3.47	
			<i>For Reflective Finish, Add</i>	4.34	
10 14 23 00-0052	EA		>25 To 50 SI, Enamel Coated Aluminum, Ceiling Mount, Indoor/Outdoor Sign.....	36.07	12.79
			<i>For >25 To 50, Deduct</i>	-1.05	
			<i>For >50 To 100, Deduct</i>	-2.63	
			<i>For >100, Deduct</i>	-3.15	
			<i>For Glow-In-Dark, Add</i>	6.30	
			<i>For Reflective Finish, Add</i>	7.88	



Specialties	10
Information Specialties	10 10
Signage	10 14

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 14 23 00-0053	EA		>50 To 100 SI, Enamel Coated Aluminum, Ceiling Mount, Indoor/Outdoor Sign.....	42.37	12.79
			<i>For >25 To 50, Deduct</i>	-1.68	
			<i>For >50 To 100, Deduct</i>	-4.20	
			<i>For >100, Deduct</i>	-5.04	
			<i>For Glow-In-Dark, Add</i>	10.08	
			<i>For Reflective Finish, Add</i>	12.60	
10 14 23 00-0054	EA		>100 To 150 SI, Enamel Coated Aluminum, Ceiling Mount, Indoor/Outdoor Sign.....	51.82	12.79
			<i>For >25 To 50, Deduct</i>	-2.63	
			<i>For >50 To 100, Deduct</i>	-6.56	
			<i>For >100, Deduct</i>	-7.88	
			<i>For Glow-In-Dark, Add</i>	15.75	
			<i>For Reflective Finish, Add</i>	19.69	
10 14 23 00-0055			90 Degree, Projection Mount, Indoor/Outdoor Signs <small>(10 14 23 00-0001)</small>		
10 14 23 00-0056			Enamel Coated Aluminum, 90 Degree, Projection Mount, Indoor/Outdoor Signs <small>(10 14 23 00-0055)</small>		
10 14 23 00-0057	EA		Up To 25 SI, Enamel Coated Aluminum, 90 Degree, Projection Mount, Indoor/Outdoor Sign	31.87	12.79
			<i>For >25 To 50, Deduct</i>	-0.63	
			<i>For >50 To 100, Deduct</i>	-1.58	
			<i>For >100, Deduct</i>	-1.89	
			<i>For Glow-In-Dark, Add</i>	3.78	
			<i>For Reflective Finish, Add</i>	4.73	
10 14 23 00-0058	EA		>25 To 50 SI, Enamel Coated Aluminum, 90 Degree, Projection Mount, Indoor/Outdoor Sign	37.12	12.79
			<i>For >25 To 50, Deduct</i>	-1.16	
			<i>For >50 To 100, Deduct</i>	-2.89	
			<i>For >100, Deduct</i>	-3.47	
			<i>For Glow-In-Dark, Add</i>	6.93	
			<i>For Reflective Finish, Add</i>	8.66	
10 14 23 00-0059	EA		>50 To 100 SI, Enamel Coated Aluminum, 90 Degree, Projection Mount, Indoor/Outdoor Sign	48.67	12.79
			<i>For >25 To 50, Deduct</i>	-2.31	
			<i>For >50 To 100, Deduct</i>	-5.78	
			<i>For >100, Deduct</i>	-6.93	
			<i>For Glow-In-Dark, Add</i>	13.86	
			<i>For Reflective Finish, Add</i>	17.33	
10 14 23 00-0060	EA		>100 To 150 SI, Enamel Coated Aluminum, 90 Degree, Projection Mount, Indoor/Outdoor Sign	52.87	12.79
			<i>For >25 To 50, Deduct</i>	-2.73	
			<i>For >50 To 100, Deduct</i>	-6.83	
			<i>For >100, Deduct</i>	-8.19	
			<i>For Glow-In-Dark, Add</i>	16.38	
			<i>For Reflective Finish, Add</i>	20.48	
10 14 23 00-0061			Triangle, Projection Mount, Indoor/Outdoor Signs <small>(10 14 23 00-0001)</small>		
10 14 23 00-0062			Enamel Coated Aluminum, Triangle, Projection Mount, Indoor/Outdoor Signs <small>(10 14 23 00-0061)</small>		
10 14 23 00-0063	EA		Up To 25 SI, Enamel Coated Aluminum, Triangle, Projection Mount, Indoor/Outdoor Sign	33.45	12.79
			<i>For >25 To 50, Deduct</i>	-0.79	
			<i>For >50 To 100, Deduct</i>	-1.97	
			<i>For >100, Deduct</i>	-2.36	
			<i>For Glow-In-Dark, Add</i>	4.73	
			<i>For Reflective Finish, Add</i>	5.91	
10 14 23 00-0064	EA		>25 To 50 SI, Enamel Coated Aluminum, Triangle, Projection Mount, Indoor/Outdoor Sign	41.32	12.79
			<i>For >25 To 50, Deduct</i>	-1.58	
			<i>For >50 To 100, Deduct</i>	-3.94	
			<i>For >100, Deduct</i>	-4.73	
			<i>For Glow-In-Dark, Add</i>	9.45	
			<i>For Reflective Finish, Add</i>	11.81	
10 14 23 00-0065	EA		>50 To 100 SI, Enamel Coated Aluminum, Triangle, Projection Mount, Indoor/Outdoor Sign	44.47	12.79
			<i>For >25 To 50, Deduct</i>	-1.89	
			<i>For >50 To 100, Deduct</i>	-4.73	
			<i>For >100, Deduct</i>	-5.67	
			<i>For Glow-In-Dark, Add</i>	11.34	
			<i>For Reflective Finish, Add</i>	14.18	
10 14 23 00-0066	EA		>100 To 150 SI, Enamel Coated Aluminum, Triangle, Projection Mount, Indoor/Outdoor Sign	48.67	12.79
			<i>For >25 To 50, Deduct</i>	-2.31	
			<i>For >50 To 100, Deduct</i>	-5.78	
			<i>For >100, Deduct</i>	-6.93	
			<i>For Glow-In-Dark, Add</i>	13.86	
			<i>For Reflective Finish, Add</i>	17.33	
10 14 23 00-0067			Adhesive Backed Vinyl Characters <small>(10 14 23)</small>		
			Note: Includes capital or lower case letters in any font or color. Includes numbers, symbols, punctuation marks, etc. Includes adhesive.		
10 14 23 00-0068	EA		1/2" High, 3 Mil, Adhesive Backed Vinyl Sign Letter/Character	2.16	0.73
			<i>For Pressure Sensitive Vinyl Letters, Custom Cut, Add</i>	0.35	
10 14 23 00-0069	EA		3/4" High, 3 Mil, Adhesive Backed Vinyl Sign Letter/Character	2.23	0.84
			<i>For Pressure Sensitive Vinyl Letters, Custom Cut, Add</i>	0.37	
10 14 23 00-0070	EA		1" High, 3 Mil, Adhesive Backed Vinyl Sign Letter/Character	2.29	0.95
			<i>For Pressure Sensitive Vinyl Letters, Custom Cut, Add</i>	0.38	
10 14 23 00-0071	EA		1-1/2" High, 3 Mil, Adhesive Backed Vinyl Sign Letter/Character	3.13	1.09
			<i>For Pressure Sensitive Vinyl Letters, Custom Cut, Add</i>	0.50	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 14 23 00-0072	EA		2" High, 3 Mil, Adhesive Backed Vinyl Sign Letter/Character <i>For Pressure Sensitive Vinyl Letters, Custom Cut, Add</i>	3.22 0.52	1.27
10 14 23 00-0073	EA		3" High, 3 Mil, Adhesive Backed Vinyl Sign Letter/Character <i>For Pressure Sensitive Vinyl Letters, Custom Cut, Add</i>	4.50 0.75	1.46
10 14 23 00-0074	EA		4" High, 3 Mil, Adhesive Backed Vinyl Sign Letter/Character <i>For Pressure Sensitive Vinyl Letters, Custom Cut, Add</i>	4.77 0.81	1.64
10 14 23 00-0075	EA		6" High, 3 Mil, Adhesive Backed Vinyl Sign Letter/Character <i>For Pressure Sensitive Vinyl Letters, Custom Cut, Add</i>	6.33 1.11	1.83
10 14 23 00-0076	EA		8" High, 3 Mil, Adhesive Backed Vinyl Sign Letter/Character <i>For Pressure Sensitive Vinyl Letters, Custom Cut, Add</i>	7.42 1.38	2.01
10 14 23 00-0077	EA		10" High, 3 Mil, Adhesive Backed Vinyl Sign Letter/Character <i>For Pressure Sensitive Vinyl Letters, Custom Cut, Add</i>	9.42 1.79	2.20
10 14 23 00-0078			Removal And Reinstallation Of Building Signage (10 14 23) Note: Includes storage and cleaning.		
10 14 23 00-0079	EA		Remove And Reinstall Building Signage, Exterior Up To 4 SF.....	125.77	
10 14 23 00-0080	EA		Remove And Reinstall Building Signage, Exterior >4 To 12 SF.....	144.87	
10 14 23 00-0081	EA		Remove And Reinstall Building Signage, >12 To 20 SF.....	162.84	
10 14 23 00-0082	EA		Remove And Reinstall Interior Door And Office Signage, Up To 4SF.....	54.80	
10 14 23 00-0083			Building Sign (10 14 23) Note: Includes 4" numbers painted on. Installed on building.		
10 14 23 00-0084	EA		6" x 18" Metal Building Sign With Numbers	151.24	21.93
10 14 23 00-0085	SF		Double Sided, Molding On Two Sides, For Mounting On Aluminum Posts.....	36.64	5.03
10 14 23 00-0086	SF		Single Sided, Molding On One Side, For Mounting On Structure Up To 20'.....	26.95	4.67
10 14 23 00-0087	EA		Aluminum Posts, Formed Prefinished, Ribbed, 4" Square, 6' High, 3' Deep.....	13.57	3.95
10 14 23 00-0088	EA		Aluminum Posts, Formed Prefinished, Ribbed, 4" Square, 8' High, 3' Deep.....	15.44	4.31
10 14 23 00-0089	EA		Aluminum Posts, Formed Prefinished, Ribbed, 6" Square, 10' High, 3' Deep.....	16.88	4.67
10 14 23 00-0090	EA		Aluminum Posts, Formed Prefinished, Ribbed, 6" Square, 15' High, 4' Deep.....	19.49	5.03
10 14 53			Traffic Signage (10 14)		
10 14 53 00-0001			Traffic Signs (10 14 53)		
10 14 53 00-0002			Reflectorized Stop Signs And Other Traffic Signs (10 14 53 00-0001) Note: Excludes posts.		
10 14 53 00-0003			Aluminum Engineer Grade Stop Signs (10 14 53 00-0002)		
10 14 53 00-0004	EA		18" x 18" Aluminum Engineer Grade Stop Sign..... <i>For Hi-Intensity Grade, Add</i> <i>For Diamond Grade, Add</i>	54.33 6.44 12.23	16.44
10 14 53 00-0005	EA		18" x 24" Aluminum Engineer Grade Stop Sign..... <i>For Hi-Intensity Grade, Add</i> <i>For Diamond Grade, Add</i>	62.75 8.42 15.99	17.39
10 14 53 00-0006	EA		24" x 24" Aluminum Engineer Grade Stop Sign..... <i>For Hi-Intensity Grade, Add</i> <i>For Diamond Grade, Add</i>	67.89 12.85 20.38	18.26
10 14 53 00-0007	EA		30" x 30" Aluminum Engineer Grade Stop Sign..... <i>For Hi-Intensity Grade, Add</i> <i>For Diamond Grade, Add</i>	78.51 4.82 26.10	19.22
10 14 53 00-0008	EA		36" x 36" Aluminum Engineer Grade Stop Sign..... <i>For Hi-Intensity Grade, Add</i> <i>For Diamond Grade, Add</i>	104.54 14.16 44.40	20.09
10 14 53 00-0009			Other Reflectorized Traffic Signs (10 14 53 00-0002) Note: Other traffic signs includes reserve, handicap, visitor, no parking, property, speed limit, tow away, ADA, parking time limit, parking exclusive area, school, traffic/caution, etc. Excludes posts.		
10 14 53 00-0010			Aluminum Engineer Grade Traffic Signs (10 14 53 00-0009)		
10 14 53 00-0011	EA		6" x 12" Aluminum Engineer Grade Traffic Sign <i>For Hi-Intensity Grade, Add</i>	34.54 1.59	14.61
10 14 53 00-0012	EA		6" x 18" Aluminum Engineer Grade Traffic Sign <i>For Hi-Intensity Grade, Add</i>	37.20 2.39	14.61
10 14 53 00-0013	EA		9" x 12" Aluminum Engineer Grade Traffic Sign <i>For Hi-Intensity Grade, Add</i>	37.20 2.39	14.61
10 14 53 00-0014	EA		9" x 15" Aluminum Engineer Grade Traffic Sign <i>For Hi-Intensity Grade, Add</i>	39.19 2.99	14.61
10 14 53 00-0015	EA		9" x 18" Aluminum Engineer Grade Traffic Sign <i>For Hi-Intensity Grade, Add</i>	41.19 3.59	14.61
10 14 53 00-0016	EA		9" x 24" Aluminum Engineer Grade Traffic Sign <i>For Hi-Intensity Grade, Add</i>	46.99 4.78	15.53
10 14 53 00-0017	EA		9" x 48" Aluminum Engineer Grade Traffic Sign <i>For Hi-Intensity Grade, Add</i>	62.93 9.56	15.53
10 14 53 00-0018	EA		12" x 12" Aluminum Engineer Grade Traffic Sign <i>For Hi-Intensity Grade, Add</i>	39.86 3.19	14.61
10 14 53 00-0019	EA		12" x 18" Aluminum Engineer Grade Traffic Sign <i>For Hi-Intensity Grade, Add</i>	46.99 4.78	15.53
10 14 53 00-0020	EA		12" x 24" Aluminum Engineer Grade Traffic Sign <i>For Hi-Intensity Grade, Add</i>	52.30 6.38	15.53
10 14 53 00-0021	EA		12" x 30" Aluminum Engineer Grade Traffic Sign <i>For Hi-Intensity Grade, Add</i>	57.62 7.97	15.53



Specialties	10
Information Specialties	10 10
Signage	10 14

10

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 14 53 00-0022	EA		12" x 36" Aluminum Engineer Grade Traffic Sign	62.93	15.53
			<i>For Hi-Intensity Grade, Add</i>	9.56	
10 14 53 00-0023	EA		18" x 18" Aluminum Engineer Grade Traffic Sign	54.96	15.53
			<i>For Hi-Intensity Grade, Add</i>	7.17	
10 14 53 00-0024	EA		18" x 24" Aluminum Engineer Grade Traffic Sign	62.93	15.53
			<i>For Hi-Intensity Grade, Add</i>	9.56	
10 14 53 00-0025	EA		18" x 30" Aluminum Engineer Grade Traffic Sign	72.73	16.44
			<i>For Hi-Intensity Grade, Add</i>	11.96	
10 14 53 00-0026	EA		18" x 36" Aluminum Engineer Grade Traffic Sign	80.70	16.44
			<i>For Hi-Intensity Grade, Add</i>	14.35	
10 14 53 00-0027	EA		18" x 48" Aluminum Engineer Grade Traffic Sign	103.95	20.09
			<i>For Hi-Intensity Grade, Add</i>	19.13	
10 14 53 00-0028	EA		18" x 54" Aluminum Engineer Grade Traffic Sign	111.92	20.09
			<i>For Hi-Intensity Grade, Add</i>	21.52	
10 14 53 00-0029	EA		24" x 24" Aluminum Engineer Grade Traffic Sign	75.39	16.44
			<i>For Hi-Intensity Grade, Add</i>	12.75	
10 14 53 00-0030	EA		24" x 30" Aluminum Engineer Grade Traffic Sign	86.02	16.44
			<i>For Hi-Intensity Grade, Add</i>	15.94	
10 14 53 00-0031	EA		24" x 36" Aluminum Engineer Grade Traffic Sign	96.64	16.44
			<i>For Hi-Intensity Grade, Add</i>	19.13	
10 14 53 00-0032	EA		24" x 42" Aluminum Engineer Grade Traffic Sign	114.58	20.09
			<i>For Hi-Intensity Grade, Add</i>	22.32	
10 14 53 00-0033	EA		24" x 48" Aluminum Engineer Grade Traffic Sign	125.21	20.09
			<i>For Hi-Intensity Grade, Add</i>	25.51	
10 14 53 00-0034	EA		24" x 54" Aluminum Engineer Grade Traffic Sign	135.83	20.09
			<i>For Hi-Intensity Grade, Add</i>	28.69	
10 14 53 00-0035	EA		24" x 60" Aluminum Engineer Grade Traffic Sign	146.46	20.09
			<i>For Hi-Intensity Grade, Add</i>	31.88	
10 14 53 00-0036	EA		30" x 30" Aluminum Engineer Grade Traffic Sign	99.30	16.44
			<i>For Hi-Intensity Grade, Add</i>	19.93	
10 14 53 00-0037	EA		30" x 36" Aluminum Engineer Grade Traffic Sign	119.89	20.09
			<i>For Hi-Intensity Grade, Add</i>	23.91	
10 14 53 00-0038	EA		30" x 42" Aluminum Engineer Grade Traffic Sign	133.18	20.09
			<i>For Hi-Intensity Grade, Add</i>	27.90	
10 14 53 00-0039	EA		30" x 48" Aluminum Engineer Grade Traffic Sign	153.76	23.75
			<i>For Hi-Intensity Grade, Add</i>	31.88	
10 14 53 00-0040	EA		30" x 60" Aluminum Engineer Grade Traffic Sign	187.64	27.40
			<i>For Hi-Intensity Grade, Add</i>	39.85	
10 14 53 00-0041	EA		36" x 36" Aluminum Engineer Grade Traffic Sign	135.83	20.09
			<i>For Hi-Intensity Grade, Add</i>	28.69	
10 14 53 00-0042	EA		36" x 42" Aluminum Engineer Grade Traffic Sign	159.08	23.75
			<i>For Hi-Intensity Grade, Add</i>	33.48	
10 14 53 00-0043	EA		36" x 48" Aluminum Engineer Grade Traffic Sign	182.33	27.40
			<i>For Hi-Intensity Grade, Add</i>	38.26	
10 14 53 00-0044	EA		36" x 54" Aluminum Engineer Grade Traffic Sign	198.27	27.40
			<i>For Hi-Intensity Grade, Add</i>	43.04	
10 14 53 00-0045	EA		36" x 60" Aluminum Engineer Grade Traffic Sign	221.52	31.05
			<i>For Hi-Intensity Grade, Add</i>	47.82	
10 14 53 00-0046	EA		36" x 73" Aluminum Engineer Grade Traffic Sign	263.37	34.70
			<i>For Hi-Intensity Grade, Add</i>	58.19	
10 14 53 00-0047	EA		36" x 78" Aluminum Engineer Grade Traffic Sign	276.65	34.70
			<i>For Hi-Intensity Grade, Add</i>	62.17	
10 14 53 00-0048	EA		36" x 108" Aluminum Engineer Grade Traffic Sign	367.31	40.19
			<i>For Hi-Intensity Grade, Add</i>	86.08	
10 14 53 00-0049	EA		42" x 42" Aluminum Engineer Grade Traffic Sign	184.98	27.40
			<i>For Hi-Intensity Grade, Add</i>	39.05	
10 14 53 00-0050	EA		48" x 48" Aluminum Engineer Grade Traffic Sign	232.15	31.05
			<i>For Hi-Intensity Grade, Add</i>	51.01	
10 14 53 00-0051	EA		48" x 54" Aluminum Engineer Grade Traffic Sign	260.71	34.70
			<i>For Hi-Intensity Grade, Add</i>	57.39	
10 14 53 00-0052	EA		48" x 60" Aluminum Engineer Grade Traffic Sign	281.96	34.70
			<i>For Hi-Intensity Grade, Add</i>	63.76	
10 14 53 00-0053	EA		48" x 66" Aluminum Engineer Grade Traffic Sign	314.18	40.19
			<i>For Hi-Intensity Grade, Add</i>	70.14	
10 14 53 00-0054	EA		48" x 72" Aluminum Engineer Grade Traffic Sign	335.43	40.19
			<i>For Hi-Intensity Grade, Add</i>	76.52	
10 14 53 00-0055	EA		48" x 84" Aluminum Engineer Grade Traffic Sign	385.24	43.84
			<i>For Hi-Intensity Grade, Add</i>	89.27	
10 14 53 00-0056	EA		48" x 96" Aluminum Engineer Grade Traffic Sign	427.75	43.84
			<i>For Hi-Intensity Grade, Add</i>	102.02	
10 14 53 00-0057	EA		48" x 102" Aluminum Engineer Grade Traffic Sign	449.00	43.84
			<i>For Hi-Intensity Grade, Add</i>	108.40	
10 14 53 00-0058	EA		48" x 108" Aluminum Engineer Grade Traffic Sign	473.91	45.67
			<i>For Hi-Intensity Grade, Add</i>	114.77	
10 14 53 00-0059	EA		60" x 72" Aluminum Engineer Grade Traffic Sign	406.50	43.84
			<i>For Hi-Intensity Grade, Add</i>	95.65	
10 14 53 00-0060	EA		72" x 144" Aluminum Engineer Grade Traffic Sign	882.07	58.45
			<i>For Hi-Intensity Grade, Add</i>	229.55	
10 14 53 00-0061	EA		78" x 96" Aluminum Engineer Grade Traffic Sign	643.94	45.67
			<i>For Hi-Intensity Grade, Add</i>	165.78	



MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

MINOR	CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 14 53 00-0062	Non-Reflectorized Traffic Signs <small>(10 14 53 00-0001)</small> Note: Includes reserved parking, handicap parking, visitor parking, no parking, tow away zones, etc. Excludes posts.		
10 14 53 00-0063	Steel Non-Reflectorized Traffic Signs <small>(10 14 53 00-0062)</small>		
10 14 53 00-0064	EA 6" x 12" Steel Non Reflectorized Traffic Sign.....	33.82	14.61
10 14 53 00-0065	EA 6" x 18" Steel Non Reflectorized Traffic Sign.....	36.12	14.61
10 14 53 00-0066	EA 9" x 12" Steel Non Reflectorized Traffic Sign.....	36.12	14.61
10 14 53 00-0067	EA 9" x 15" Steel Non Reflectorized Traffic Sign.....	37.84	14.61
10 14 53 00-0068	EA 9" x 18" Steel Non Reflectorized Traffic Sign.....	39.57	14.61
10 14 53 00-0069	EA 9" x 24" Steel Non Reflectorized Traffic Sign.....	44.83	15.53
10 14 53 00-0070	EA 9" x 48" Steel Non Reflectorized Traffic Sign.....	58.61	15.53
10 14 53 00-0071	EA 12" x 12" Steel Non Reflectorized Traffic Sign.....	38.42	14.61
10 14 53 00-0072	EA 12" x 18" Steel Non Reflectorized Traffic Sign.....	44.83	15.53
10 14 53 00-0073	EA 12" x 24" Steel Non Reflectorized Traffic Sign.....	49.42	15.53
10 14 53 00-0074	EA 12" x 30" Steel Non Reflectorized Traffic Sign.....	54.02	15.53
10 14 53 00-0075	EA 12" x 36" Steel Non Reflectorized Traffic Sign.....	58.61	15.53
10 14 53 00-0076	EA 18" x 18" Steel Non Reflectorized Traffic Sign.....	51.72	15.53
10 14 53 00-0077	EA 18" x 24" Steel Non Reflectorized Traffic Sign.....	58.61	15.53
10 14 53 00-0078	EA 18" x 30" Steel Non Reflectorized Traffic Sign.....	67.33	16.44
10 14 53 00-0079	EA 18" x 36" Steel Non Reflectorized Traffic Sign.....	74.22	16.44
10 14 53 00-0080	EA 18" x 48" Steel Non Reflectorized Traffic Sign.....	95.31	20.09
10 14 53 00-0081	EA 18" x 54" Steel Non Reflectorized Traffic Sign.....	102.20	20.09
10 14 53 00-0082	EA 24" x 24" Steel Non Reflectorized Traffic Sign.....	69.63	16.44
10 14 53 00-0083	EA 24" x 30" Steel Non Reflectorized Traffic Sign.....	78.82	16.44
10 14 53 00-0084	EA 24" x 36" Steel Non Reflectorized Traffic Sign.....	88.00	16.44
10 14 53 00-0085	EA 24" x 42" Steel Non Reflectorized Traffic Sign.....	104.50	20.09
10 14 53 00-0086	EA 24" x 48" Steel Non Reflectorized Traffic Sign.....	113.69	20.09
10 14 53 00-0087	EA 24" x 54" Steel Non Reflectorized Traffic Sign.....	122.87	20.09
10 14 53 00-0088	EA 24" x 60" Steel Non Reflectorized Traffic Sign.....	132.06	20.09
10 14 53 00-0089	EA 30" x 30" Steel Non Reflectorized Traffic Sign.....	90.30	16.44
10 14 53 00-0090	EA 30" x 36" Steel Non Reflectorized Traffic Sign.....	109.09	20.09
10 14 53 00-0091	EA 30" x 42" Steel Non Reflectorized Traffic Sign.....	120.58	20.09
10 14 53 00-0092	EA 30" x 48" Steel Non Reflectorized Traffic Sign.....	139.36	23.75
10 14 53 00-0093	EA 30" x 60" Steel Non Reflectorized Traffic Sign.....	169.64	27.40
10 14 53 00-0094	EA 36" x 36" Steel Non Reflectorized Traffic Sign.....	122.87	20.09
10 14 53 00-0095	EA 36" x 42" Steel Non Reflectorized Traffic Sign.....	143.96	23.75
10 14 53 00-0096	EA 36" x 48" Steel Non Reflectorized Traffic Sign.....	165.05	27.40
10 14 53 00-0097	EA 36" x 54" Steel Non Reflectorized Traffic Sign.....	178.83	27.40
10 14 53 00-0098	EA 36" x 60" Steel Non Reflectorized Traffic Sign.....	199.92	31.05
10 14 53 00-0099	EA 36" x 73" Steel Non Reflectorized Traffic Sign.....	237.09	34.70
10 14 53 00-0100	EA 36" x 78" Steel Non Reflectorized Traffic Sign.....	248.57	34.70
10 14 53 00-0101	EA 36" x 108" Steel Non Reflectorized Traffic Sign.....	328.43	40.19
10 14 53 00-0102	EA 42" x 42" Steel Non Reflectorized Traffic Sign.....	167.34	27.40
10 14 53 00-0103	EA 48" x 48" Steel Non Reflectorized Traffic Sign.....	209.11	31.05
10 14 53 00-0104	EA 48" x 54" Steel Non Reflectorized Traffic Sign.....	234.79	34.70
10 14 53 00-0105	EA 48" x 60" Steel Non Reflectorized Traffic Sign.....	253.16	34.70
10 14 53 00-0106	EA 48" x 66" Steel Non Reflectorized Traffic Sign.....	282.50	40.19
10 14 53 00-0107	EA 48" x 72" Steel Non Reflectorized Traffic Sign.....	300.87	40.19
10 14 53 00-0108	EA 48" x 84" Steel Non Reflectorized Traffic Sign.....	344.92	43.84
10 14 53 00-0109	EA 48" x 96" Steel Non Reflectorized Traffic Sign.....	381.67	43.84
10 14 53 00-0110	EA 48" x 102" Steel Non Reflectorized Traffic Sign.....	400.04	43.84
10 14 53 00-0111	EA 48" x 108" Steel Non Reflectorized Traffic Sign.....	422.07	45.67
10 14 53 00-0112	EA 60" x 72" Steel Non Reflectorized Traffic Sign.....	363.30	43.84
10 14 53 00-0113	EA 72" x 144" Steel Non Reflectorized Traffic Sign.....	778.39	58.45
10 14 53 00-0114	EA 78" x 96" Steel Non Reflectorized Traffic Sign.....	569.06	45.67
10 14 53 00-0115	Aluminum Non-Reflectorized Traffic Signs <small>(10 14 53 00-0062)</small>		
10 14 53 00-0116	EA 6" x 12" Aluminum Non Reflectorized Traffic Sign.....	34.01	14.61
10 14 53 00-0117	EA 6" x 18" Aluminum Non Reflectorized Traffic Sign.....	36.40	14.61
10 14 53 00-0118	EA 9" x 12" Aluminum Non Reflectorized Traffic Sign.....	36.40	14.61
10 14 53 00-0119	EA 9" x 15" Aluminum Non Reflectorized Traffic Sign.....	38.19	14.61
10 14 53 00-0120	EA 9" x 18" Aluminum Non Reflectorized Traffic Sign.....	39.99	14.61
10 14 53 00-0121	EA 9" x 24" Aluminum Non Reflectorized Traffic Sign.....	45.39	15.53
10 14 53 00-0122	EA 9" x 48" Aluminum Non Reflectorized Traffic Sign.....	59.73	15.53
10 14 53 00-0123	EA 12" x 12" Aluminum Non Reflectorized Traffic Sign.....	38.79	14.61
10 14 53 00-0124	EA 12" x 18" Aluminum Non Reflectorized Traffic Sign.....	45.39	15.53
10 14 53 00-0125	EA 12" x 24" Aluminum Non Reflectorized Traffic Sign.....	50.17	15.53
10 14 53 00-0126	EA 12" x 30" Aluminum Non Reflectorized Traffic Sign.....	54.95	15.53
10 14 53 00-0127	EA 12" x 36" Aluminum Non Reflectorized Traffic Sign.....	59.73	15.53
10 14 53 00-0128	EA 18" x 18" Aluminum Non Reflectorized Traffic Sign.....	52.56	15.53
10 14 53 00-0129	EA 18" x 24" Aluminum Non Reflectorized Traffic Sign.....	59.73	15.53
10 14 53 00-0130	EA 18" x 30" Aluminum Non Reflectorized Traffic Sign.....	68.74	16.44
10 14 53 00-0131	EA 18" x 36" Aluminum Non Reflectorized Traffic Sign.....	75.91	16.44
10 14 53 00-0132	EA 18" x 48" Aluminum Non Reflectorized Traffic Sign.....	97.56	20.09
10 14 53 00-0133	EA 18" x 54" Aluminum Non Reflectorized Traffic Sign.....	104.73	20.09
10 14 53 00-0134	EA 24" x 24" Aluminum Non Reflectorized Traffic Sign.....	71.13	16.44
10 14 53 00-0135	EA 24" x 30" Aluminum Non Reflectorized Traffic Sign.....	80.69	16.44
10 14 53 00-0136	EA 24" x 36" Aluminum Non Reflectorized Traffic Sign.....	90.25	16.44
10 14 53 00-0137	EA 24" x 42" Aluminum Non Reflectorized Traffic Sign.....	107.12	20.09



Specialties	10
Information Specialties	10 10
Signage	10 14

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 14 53 00-0138 EA 24" x 48" Aluminum Non ReflectORIZED Traffic Sign.....	116.68	20.09
10 14 53 00-0139 EA 24" x 54" Aluminum Non ReflectORIZED Traffic Sign.....	126.24	20.09
10 14 53 00-0140 EA 24" x 60" Aluminum Non ReflectORIZED Traffic Sign.....	135.81	20.09
10 14 53 00-0141 EA 30" x 30" Aluminum Non ReflectORIZED Traffic Sign.....	92.64	16.44
10 14 53 00-0142 EA 30" x 36" Aluminum Non ReflectORIZED Traffic Sign.....	111.90	20.09
10 14 53 00-0143 EA 30" x 42" Aluminum Non ReflectORIZED Traffic Sign.....	123.85	20.09
10 14 53 00-0144 EA 30" x 48" Aluminum Non ReflectORIZED Traffic Sign.....	143.11	23.75
10 14 53 00-0145 EA 30" x 60" Aluminum Non ReflectORIZED Traffic Sign.....	174.32	27.40
10 14 53 00-0146 EA 36" x 36" Aluminum Non ReflectORIZED Traffic Sign.....	126.24	20.09
10 14 53 00-0147 EA 36" x 42" Aluminum Non ReflectORIZED Traffic Sign.....	147.89	23.75
10 14 53 00-0148 EA 36" x 48" Aluminum Non ReflectORIZED Traffic Sign.....	169.54	27.40
10 14 53 00-0149 EA 36" x 54" Aluminum Non ReflectORIZED Traffic Sign.....	183.88	27.40
10 14 53 00-0150 EA 36" x 60" Aluminum Non ReflectORIZED Traffic Sign.....	205.53	31.05
10 14 53 00-0151 EA 36" x 73" Aluminum Non ReflectORIZED Traffic Sign.....	243.92	34.70
10 14 53 00-0152 EA 36" x 78" Aluminum Non ReflectORIZED Traffic Sign.....	255.87	34.70
10 14 53 00-0153 EA 36" x 108" Aluminum Non ReflectORIZED Traffic Sign.....	338.54	40.19
10 14 53 00-0154 EA 42" x 42" Aluminum Non ReflectORIZED Traffic Sign.....	171.93	27.40
10 14 53 00-0155 EA 48" x 48" Aluminum Non ReflectORIZED Traffic Sign.....	215.10	31.05
10 14 53 00-0156 EA 48" x 54" Aluminum Non ReflectORIZED Traffic Sign.....	241.53	34.70
10 14 53 00-0157 EA 48" x 60" Aluminum Non ReflectORIZED Traffic Sign.....	260.65	34.70
10 14 53 00-0158 EA 48" x 66" Aluminum Non ReflectORIZED Traffic Sign.....	290.74	40.19
10 14 53 00-0159 EA 48" x 72" Aluminum Non ReflectORIZED Traffic Sign.....	309.86	40.19
10 14 53 00-0160 EA 48" x 84" Aluminum Non ReflectORIZED Traffic Sign.....	355.40	43.84
10 14 53 00-0161 EA 48" x 96" Aluminum Non ReflectORIZED Traffic Sign.....	393.65	43.84
10 14 53 00-0162 EA 48" x 102" Aluminum Non ReflectORIZED Traffic Sign.....	412.77	43.84
10 14 53 00-0163 EA 48" x 108" Aluminum Non ReflectORIZED Traffic Sign.....	435.55	45.67
10 14 53 00-0164 EA 60" x 72" Aluminum Non ReflectORIZED Traffic Sign.....	374.53	43.84
10 14 53 00-0165 EA 72" x 144" Aluminum Non ReflectORIZED Traffic Sign.....	805.35	58.45
10 14 53 00-0166 EA 78" x 96" Aluminum Non ReflectORIZED Traffic Sign.....	588.53	45.67
10 14 53 00-0167 Aluminum Street Signs (10 14 53 00-0001)		
Note: Excludes posts.		
10 14 53 00-0168 Aluminum Engineer Grade Street Signs (10 14 53 00-0167)		
10 14 53 00-0169 EA 6" High, Aluminum Engineer Grade Street Sign.....	58.55	7.31
For Hi-Intensity Grade, Add	13.18	
10 14 53 00-0170 EA 8" High, Aluminum Engineer Grade Street Sign.....	66.31	7.31
For Hi-Intensity Grade, Add	15.51	
10 14 53 00-0171 EA 9" High, Aluminum Engineer Grade Street Sign.....	72.09	7.31
For Hi-Intensity Grade, Add	17.24	
10 14 53 00-0172 Street Sign Accessories (10 14 53 00-0167)		
10 14 53 00-0173 EA Post Cap And Single Bracket For Street Sign.....	17.88	3.65
10 14 53 00-0174 EA Post Cap And Double Bracket For Street Sign.....	17.88	3.65
10 14 53 00-0175 Sign Posts (10 14 53 00-0001)		
Note: Excludes sign. See CSI section 32 31 13 00-0001 for auguring of holes and backfill.		
10 14 53 00-0176 U-Channel Sign Posts (10 14 53 00-0175)		
Note: Excludes digging and concrete.		
10 14 53 00-0177 Baked Enamel U-Channel Sign Posts (10 14 53 00-0176)		
10 14 53 00-0178 EA 3' To 4' Baked Enamel U-Channel Sign Post Base.....	48.12	14.89
10 14 53 00-0179 EA 6' Baked Enamel U-Channel Sign Post.....	63.02	18.61
10 14 53 00-0180 EA 7' Baked Enamel U-Channel Sign Post.....	75.26	22.34
10 14 53 00-0181 EA 8' Baked Enamel U-Channel Sign Post.....	88.11	26.06
10 14 53 00-0182 EA 10' Baked Enamel U-Channel Sign Post.....	106.35	31.64
10 14 53 00-0183 EA 12' Baked Enamel U-Channel Sign Post.....	109.29	31.64
10 14 53 00-0184 Galvanized Steel U-Channel Sign Posts (10 14 53 00-0176)		
10 14 53 00-0185 EA 3' To 4' Galvanized Steel U-Channel Sign Post Base.....	51.90	14.89
10 14 53 00-0186 EA 6' Galvanized Steel U-Channel Sign Post.....	69.02	18.61
10 14 53 00-0187 EA 7' Galvanized Steel U-Channel Sign Post.....	88.83	22.34
10 14 53 00-0188 EA 8' Galvanized Steel U-Channel Sign Post.....	103.11	26.06
10 14 53 00-0189 EA 10' Galvanized Steel U-Channel Sign Post.....	117.27	31.64
10 14 53 00-0190 EA 12' Galvanized Steel U-Channel Sign Post.....	118.79	31.64
10 14 53 00-0191 Fiberglass Or Composite Plastic U-Channel Sign Posts (10 14 53 00-0176)		
10 14 53 00-0192 EA 3' To 4' Fiberglass Or Composite Plastic U-Channel Sign Post Base.....	47.23	14.89
10 14 53 00-0193 EA 6' Fiberglass Or Composite Plastic U-Channel Sign Post.....	61.08	18.61
10 14 53 00-0194 EA 7' Fiberglass Or Composite Plastic U-Channel Sign Post.....	72.92	22.34
10 14 53 00-0195 EA 8' Fiberglass Or Composite Plastic U-Channel Sign Post.....	85.32	26.06
10 14 53 00-0196 EA 10' Fiberglass Or Composite Plastic U-Channel Sign Post.....	101.29	31.64
10 14 53 00-0197 EA 12' Fiberglass Or Composite Plastic U-Channel Sign Post.....	106.29	31.64

10	10	Specialties
	10 10	Information Specialties
	10 14	Signage



MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
10 14 53 00-0198		Tubular Sign Posts (10 14 53 00-0175) Note: Excludes digging and concrete.			
10 14 53 00-0199		2-3/8" Diameter, Galvanized Steel Tubular Sign Post (10 14 53 00-0198)			
10 14 53 00-0200	EA	6', 2-3/8" Diameter, Galvanized Steel Tubular Sign Post.....	69.64		18.61
10 14 53 00-0201	EA	7', 2-3/8" Diameter, Galvanized Steel Tubular Sign Post.....	82.67		22.34
10 14 53 00-0202	EA	8', 2-3/8" Diameter, Galvanized Steel Tubular Sign Post.....	97.61		26.06
10 14 53 00-0203	EA	10', 2-3/8" Diameter, Galvanized Steel Tubular Sign Post.....	125.48		31.64
10 14 53 00-0204	EA	12', 2-3/8" Diameter, Galvanized Steel Tubular Sign Post.....	135.78		31.64
10 14 53 00-0205		Square Sign Posts (10 14 53 00-0175) Note: Excludes digging and concrete.			
10 14 53 00-0206		Galvanized Steel Square Sign Posts (10 14 53 00-0205)			
10 14 53 00-0207	EA	3' To 4' Galvanized Steel Square Sign Post Base	52.74		14.89
10 14 53 00-0208	EA	6' Galvanized Steel Square Sign Post	83.23		18.61
10 14 53 00-0209	EA	7' Galvanized Steel Square Sign Post	97.67		22.34
10 14 53 00-0210	EA	8' Galvanized Steel Square Sign Post	113.93		26.06
10 14 53 00-0211	EA	10' Galvanized Steel Square Sign Post	139.10		31.64
10 14 53 00-0212	EA	12' Galvanized Steel Square Sign Post	146.29		31.64
10 14 53 00-0213		Standard Driven Street Sign Posts, Square (10 14 53 00-0205)			
10 14 53 00-0214	EA	12' x 2" Square 12 Gauge Galvanized Steel Sign Post With 1'-6" x 2-1/2" Square Sleeve And 2'-6" x 2-1/4" Square Anchor Driven Into Earth.....	173.79		31.64
10 14 53 00-0215		Sign Post Accessories (10 14 53 00-0001)			
10 14 53 00-0216		Sign Post Brackets (10 14 53 00-0215)			
10 14 53 00-0217	EA	2-3/8" Outside Diameter, Single Sign Bracket Set	23.65		5.48
10 14 53 00-0218	EA	2-3/8" Outside Diameter, Double Sign Bracket Set.....	42.55		9.14
10 14 53 00-0219	EA	10 cm - 37 cm Diameter, Buckle Bracket Set	36.60		7.31
10 14 53 00-0220		Sign Post Caps (10 14 53 00-0215)			
10 14 53 00-0221	EA	Traffic Sign Post Cap	13.20		3.65
10 14 53 00-0222		Sign Post Replacement Bolts (10 14 53 00-0215)			
10 14 53 00-0223	EA	Signage Fasteners, 2 Bolts, 2 Nuts And 4 Washers	9.30		
10 14 53 00-0225		Removal Of Signs (10 14 53) Note: Includes structural supports.			
10 14 53 00-0226	EA	>4 To 10 SF Sign Area, Sign Removal	146.14		
10 14 53 00-0227	EA	>10 To 20 SF Sign Area, Sign Removal	350.74		
10 14 53 00-0228	EA	>20 To 40 SF Sign Area, Sign Removal	526.10		
10 14 53 00-0229	EA	>40 To 100 SF Sign Area, Sign Removal	811.96		
10 14 53 00-0230		Remove And Reinstall Signs (10 14 53) Note: Includes structural supports.			
10 14 53 00-0231	EA	>4 To 10 SF Sign Area, Remove And Reinstall Sign.....	222.50		
10 14 53 00-0232	EA	>10 To 20 SF Sign Area, Remove And Reinstall Sign.....	528.45		
10 14 53 00-0233	EA	>20 SF To 40 SF Sign Area, Remove And Reinstall Sign	791.14		
10 14 53 00-0234	EA	>40 SF To 100 SF Sign Area, Remove And Reinstall Sign	1,219.81		
10 14 53 00-0235	EA	Remove And Reinstall Street Sign On Post.....	84.03		
10 14 53 00-0236	EA	Remove And Relocate Traffic Light	285.73		
		Note: Excludes electrical hookup.			

10 20 Interior Specialties (10)

10 21 Compartments And Cubicles (10 20)

10 21 13 Toilet Compartments (10 21)

10 21 13 13 Metal Toilet Compartments (10 21 13)

10 21 13 13-0001		Enamel Coated Steel Toilet Partitions And Urinal Screens (10 21 13 13) Note: Complete toilet partitions for corner installations. Includes 1" door, 1-1/4" pilaster, 1" separator panel, trim shoes, and standard stainless steel hardware as required. For alcove, recessed or configurations other than corner installations use either: (1) the appropriate corner unit and add individual components or (2) individual components. Individual components include trim shoes and standard stainless steel hardware as required. Constructed of galvanized sheet metal, cleaned, primed and finished with oven baked enamel or epoxy coating.			
10 21 13 13-0002		Enamel Coated Steel Toilet Partitions (10 21 13 13-0001) Note: All colors.			
10 21 13 13-0003		Floor Anchored, Enamel Coated Steel, Complete Toilet Partitions (10 21 13 13-0002)			



Specialties	10
Interior Specialties	10 20
Compartments And Cubicles	10 21

10

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 21 13 13-0004 EA 36" x 60", Floor Anchored, Enamel Coated Steel, One Compartment Corner Unit, Complete Toilet Partition.....	642.07	80.86
For >10, Deduct	-48.04	
For Heavy Gauge Full-Height SS Hinges And Brackets, Add	90.66	
10 21 13 13-0005 EA 60" x 60", Floor Anchored, Enamel Coated Steel, One Compartment Corner Unit, Complete ADA Compliant Toilet Partition.....	776.25	88.04
For Heavy Gauge Full-Height SS Hinges And Brackets, Add	90.66	
10 21 13 13-0006 EA 60" x 78", Floor Anchored, Enamel Coated Steel, One Compartment Corner Unit, Complete ADA Compliant Toilet Partition.....	828.98	91.64
For Heavy Gauge Full-Height SS Hinges And Brackets, Add	90.66	
10 21 13 13-0007 Overhead Braced, Enamel Coated Steel, Complete Toilet Partitions (10 21 13 13-0002) Note: Includes headrail.		
10 21 13 13-0008 EA 36" x 60", Overhead Braced, Enamel Coated Steel, One Compartment Corner Unit, Complete Toilet Partition.....	668.87	98.82
For >10, Deduct	-47.12	
For Heavy Gauge Full-Height SS Hinges And Brackets, Add	90.66	
10 21 13 13-0009 EA 60" x 60", Overhead Braced, Enamel Coated Steel, One Compartment Corner Unit, Complete ADA Compliant Toilet Partition.....	776.82	106.02
For Heavy Gauge Full-Height SS Hinges And Brackets, Add	90.66	
10 21 13 13-0010 EA 60" x 78", Overhead Braced, Enamel Coated Steel, One Compartment Corner Unit, Complete ADA Compliant Toilet Partition.....	821.09	109.60
For Heavy Gauge Full-Height SS Hinges And Brackets, Add	90.66	
10 21 13 13-0011 Floor And Ceiling Anchored, Enamel Coated Steel, Complete Toilet Partitions (10 21 13 13-0002) Note: Excludes above ceiling steel.		
10 21 13 13-0012 EA 36" x 60", Floor And Ceiling Anchored, Enamel Coated Steel, One Compartment Corner Unit, Complete Toilet Partition.....	789.46	116.79
For >10, Deduct	-55.59	
For Heavy Gauge Full-Height SS Hinges And Brackets, Add	90.66	
10 21 13 13-0013 EA 60" x 60", Floor And Ceiling Anchored, Enamel Coated Steel, One Compartment Corner Unit, Complete ADA Compliant Toilet Partition.....	920.10	123.98
For Heavy Gauge Full-Height SS Hinges And Brackets, Add	90.66	
10 21 13 13-0014 EA 60" x 78", Floor And Ceiling Anchored, Enamel Coated Steel, One Compartment Corner Unit, Complete ADA Compliant Toilet Partition.....	966.34	127.57
For Heavy Gauge Full-Height SS Hinges And Brackets, Add	90.66	
10 21 13 13-0015 Ceiling Hung, Enamel Coated Steel, Complete Toilet Partitions (10 21 13 13-0002) Note: Excludes above ceiling steel.		
10 21 13 13-0016 EA 36" x 60", Ceiling Hung, Enamel Coated Steel, One Compartment Corner Unit, Complete Toilet Partition.....	763.57	134.76
For >10, Deduct	-49.41	
For Heavy Gauge Full-Height SS Hinges And Brackets, Add	90.66	
10 21 13 13-0017 EA 60" x 60", Ceiling Hung, Enamel Coated Steel, One Compartment Corner Unit, Complete ADA Compliant Toilet Partition.....	916.00	141.94
For Heavy Gauge Full-Height SS Hinges And Brackets, Add	90.66	
10 21 13 13-0018 EA 60" x 78", Ceiling Hung, Enamel Coated Steel, One Compartment Corner Unit, Complete ADA Compliant Toilet Partition.....	967.42	145.54
For Heavy Gauge Full-Height SS Hinges And Brackets, Add	90.66	
10 21 13 13-0019 Enamel Coated Steel Urinal Screens (10 21 13 13-0001) Note: All colors.		
10 21 13 13-0020 Floor Anchored, Enamel Coated Steel, Urinal Screens (10 21 13 13-0019)		
10 21 13 13-0021 EA 24" x 58" x 1", Floor Anchored, Enamel Coated Steel, Urinal Screen.....	340.18	50.29
For Heavy Gauge Full-Height SS Brackets, Add	25.12	
10 21 13 13-0022 EA 36" x 58" x 1", Floor Anchored, Enamel Coated Steel, Urinal Screen.....	377.04	53.88
For Heavy Gauge Full-Height SS Brackets, Add	25.12	
10 21 13 13-0023 EA 48" x 58" x 1", Floor Anchored, Enamel Coated Steel, Urinal Screen.....	415.02	57.47
For Heavy Gauge Full-Height SS Brackets, Add	25.12	
10 21 13 13-0024 Wall Hung, Enamel Coated Steel, Urinal Screens (10 21 13 13-0019)		
10 21 13 13-0025 EA 18" x 42" x 1", Wall Hung, Enamel Coated Steel, Urinal Screen.....	193.45	43.10
For Heavy Gauge Full-Height SS Brackets, Add	25.12	
10 21 13 13-0026 EA 24" x 42" x 1", Wall Hung, Enamel Coated Steel, Urinal Screen.....	208.63	46.70
For Heavy Gauge Full-Height SS Brackets, Add	25.12	
10 21 13 13-0027 EA 30" x 42" x 1", Wall Hung, Enamel Coated Steel, Urinal Screen.....	220.37	50.29
For Heavy Gauge Full-Height SS Brackets, Add	25.12	
10 21 13 13-0028 Wall Hung, Wedge Shaped, Enamel Coated Steel, Urinal Screens (10 21 13 13-0019)		
10 21 13 13-0029 EA 18" x 30" x 1", Wall Hung, Wedge Shaped, Enamel Coated Steel, Urinal Screen.....	249.66	46.70
For Heavy Gauge Full-Height SS Brackets, Add	25.12	
10 21 13 13-0030 Wall Hung And Post Supported, Enamel Coated Steel, Urinal Screens (10 21 13 13-0019)		
10 21 13 13-0031 EA 18" x 58" x 1", Wall Hung And Post Supported, Enamel Coated Steel, Urinal Screen.....	279.37	46.70
For Heavy Gauge Full-Height SS Brackets, Add	25.12	

10 Specialties**10 20 Interior Specialties****10 21 Compartments And Cubicles**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 21 13 13-0032	EA		24" x 58" x 1", Wall Hung And Post Supported, Enamel Coated Steel, Urinal Screen..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	297.96 25.12	50.29
10 21 13 13-0033	EA		30" x 58" x 1", Wall Hung And Post Supported, Enamel Coated Steel, Urinal Screen..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	316.56 25.12	53.88
10 21 13 13-0034			Wall Hung And Overhead Braced, Enamel Coated Steel, Urinal Screens ^(10 21 13 13-0019)		
10 21 13 13-0035	EA		22" x 58" x 1", Wall Hung And Overhead Braced, Enamel Coated Steel, Urinal Screen <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	315.08 25.12	50.29
10 21 13 13-0036	EA		34" x 58" x 1", Wall Hung And Overhead Braced, Enamel Coated Steel, Urinal Screen <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	338.24 25.12	53.88
10 21 13 13-0037	EA		46" x 58" x 1", Wall Hung And Overhead Braced, Enamel Coated Steel, Urinal Screen <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	373.95 25.12	57.47
10 21 13 13-0038			Enamel Coated Steel Toilet Partition Doors, Panels And Pilasters ^(10 21 13 13-0001) Note: All colors.		
10 21 13 13-0039			Enamel Coated Steel, Toilet Partition Doors ^(10 21 13 13-0038)		
10 21 13 13-0040	EA		24" x 58" x 1", Enamel Coated Steel, Toilet Partition Door <i>For Heavy Gauge Full-Height SS Hinge, Add</i>	202.18 40.42	14.38
10 21 13 13-0041	EA		26" x 58" x 1", Enamel Coated Steel, Toilet Partition Door <i>For Heavy Gauge Full-Height SS Hinge, Add</i>	206.75 40.42	14.38
10 21 13 13-0042	EA		30" x 58" x 1", Enamel Coated Steel, Toilet Partition Door <i>For Heavy Gauge Full-Height SS Hinge, Add</i>	219.17 40.42	15.45
10 21 13 13-0043	EA		34" x 58" x 1", Enamel Coated Steel, ADA Compliant Toilet Partition Door..... <i>For Heavy Gauge Full-Height SS Hinge, Add</i>	239.71 40.42	15.45
10 21 13 13-0044	EA		36" x 58" x 1", Enamel Coated Steel, ADA Compliant Toilet Partition Door..... <i>For Heavy Gauge Full-Height SS Hinge, Add</i>	244.28 40.42	15.45
10 21 13 13-0045			Enamel Coated Steel, Toilet Partition Panels ^(10 21 13 13-0038)		
10 21 13 13-0046	EA		6" x 58" x 1", Enamel Coated Steel, Toilet Partition Panel..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	145.81 25.12	21.56
10 21 13 13-0047	EA		12" x 58" x 1", Enamel Coated Steel, Toilet Partition Panel..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	160.82 25.12	23.36
10 21 13 13-0048	EA		18" x 58" x 1", Enamel Coated Steel, Toilet Partition Panel..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	175.82 25.12	25.16
10 21 13 13-0049	EA		24" x 58" x 1", Enamel Coated Steel, Toilet Partition Panel..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	190.82 25.12	26.95
10 21 13 13-0050	EA		30" x 58" x 1", Enamel Coated Steel, Toilet Partition Panel..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	205.83 25.12	28.75
10 21 13 13-0051	EA		36" x 58" x 1", Enamel Coated Steel, Toilet Partition Panel..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	220.83 25.12	30.55
10 21 13 13-0052	EA		42" x 58" x 1", Enamel Coated Steel, Toilet Partition Panel..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	234.70 25.12	32.34
10 21 13 13-0053	EA		48" x 58" x 1", Enamel Coated Steel, Toilet Partition Panel..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	249.70 25.12	34.14
10 21 13 13-0054	EA		55" x 58" x 1", Enamel Coated Steel, Toilet Partition Panel..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	260.13 25.12	35.94
10 21 13 13-0055	EA		58" x 58" x 1", Enamel Coated Steel, Toilet Partition Panel..... <i>For Panel Reinforced At ADA Grab Bar, Add</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	266.14 42.00 25.12	36.65
10 21 13 13-0056	EA		60" x 58" x 1", Enamel Coated Steel, Toilet Partition Panel..... <i>For Panel Reinforced At ADA Grab Bar, Add</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	273.99 42.00 25.12	37.73
10 21 13 13-0057	EA		70" x 58" x 1", Enamel Coated Steel, Toilet Partition Panel..... <i>For Panel Reinforced At ADA Grab Bar, Add</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	299.27 42.00 25.12	39.53
10 21 13 13-0058	EA		78" x 58" x 1", Enamel Coated Steel, Toilet Partition Panel..... <i>For Panel Reinforced At ADA Grab Bar, Add</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	321.12 42.00 25.12	41.33
10 21 13 13-0059			70" Long, Enamel Coated Steel, Toilet Partition Pilasters ^(10 21 13 13-0038)		
10 21 13 13-0060	EA		Up To 4" x 70" x 1-1/4", Enamel Coated Steel, Toilet Partition Pilaster <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	110.56 25.12	10.78
10 21 13 13-0061	EA		5" x 70" x 1-1/4", Enamel Coated Steel, Toilet Partition Pilaster..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	122.14 25.12	12.57
10 21 13 13-0062	EA		6" x 70" x 1-1/4", Enamel Coated Steel, Toilet Partition Pilaster..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	134.86 25.12	14.38
10 21 13 13-0063	EA		8" x 70" x 1-1/4", Enamel Coated Steel, Toilet Partition Pilaster..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	156.71 25.12	16.17
10 21 13 13-0064	EA		10" x 70" x 1-1/4", Enamel Coated Steel, Toilet Partition Pilaster..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	177.42 25.12	17.96
10 21 13 13-0065	EA		12" x 70" x 1-1/4", Enamel Coated Steel, Toilet Partition Pilaster..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	198.13 25.12	19.77
10 21 13 13-0066	EA		18" x 70" x 1-1/4", Enamel Coated Steel, Toilet Partition Pilaster..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	255.35 25.12	21.56
10 21 13 13-0067	EA		22" x 70" x 1-1/4", Enamel Coated Steel, Toilet Partition Pilaster..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	293.18 25.12	23.36
10 21 13 13-0068	EA		24" x 70" x 1-1/4", Enamel Coated Steel, Toilet Partition Pilaster..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	315.02 25.12	25.16



Specialties	10	10
Interior Specialties	10 20	
Compartments And Cubicles	10 21	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 21 13 13-0069 82" Long, Enamel Coated Steel, Toilet Partition Pilasters <small>(10 21 13 13-0038)</small>		
10 21 13 13-0070 EA Up To 4" x 82" x 1-1/4", Enamel Coated Steel, Toilet Partition Pilaster.....	88.88	10.78
For Heavy Gauge Full-Height SS Brackets, Add	25.12	
10 21 13 13-0071 EA 5" x 82" x 1-1/4", Enamel Coated Steel, Toilet Partition Pilaster.....	97.04	12.57
For Heavy Gauge Full-Height SS Brackets, Add	25.12	
10 21 13 13-0072 EA 6" x 82" x 1-1/4", Enamel Coated Steel, Toilet Partition Pilaster.....	106.34	14.38
For Heavy Gauge Full-Height SS Brackets, Add	25.12	
10 21 13 13-0073 EA 8" x 82" x 1-1/4", Enamel Coated Steel, Toilet Partition Pilaster.....	120.20	16.17
For Heavy Gauge Full-Height SS Brackets, Add	25.12	
10 21 13 13-0074 EA 10" x 82" x 1-1/4", Enamel Coated Steel, Toilet Partition Pilaster.....	132.92	17.96
For Heavy Gauge Full-Height SS Brackets, Add	25.12	
10 21 13 13-0075 EA 12" x 82" x 1-1/4", Enamel Coated Steel, Toilet Partition Pilaster.....	146.78	19.77
For Heavy Gauge Full-Height SS Brackets, Add	25.12	
10 21 13 13-0076 EA 18" x 82" x 1-1/4", Enamel Coated Steel, Toilet Partition Pilaster.....	181.18	21.56
For Heavy Gauge Full-Height SS Brackets, Add	25.12	
10 21 13 13-0077 EA 22" x 82" x 1-1/4", Enamel Coated Steel, Toilet Partition Pilaster.....	204.18	23.36
For Heavy Gauge Full-Height SS Brackets, Add	25.12	
10 21 13 13-0078 EA 24" x 82" x 1-1/4", Enamel Coated Steel, Toilet Partition Pilaster.....	218.04	25.16
For Heavy Gauge Full-Height SS Brackets, Add	25.12	
10 21 13 13-0079 96" To 120" Long, Enamel Coated Steel, Partition Pilasters <small>(10 21 13 13-0038)</small>		
10 21 13 13-0080 EA Up To 4" x 96" To 120" x 1-1/4", Enamel Coated Steel, Toilet Partition Pilaster.....	123.45	14.38
For Heavy Gauge Full-Height SS Brackets, Add	25.12	
10 21 13 13-0081 EA 5" x 96" To 120" x 1-1/4", Enamel Coated Steel, Toilet Partition Pilaster.....	135.03	16.17
For Heavy Gauge Full-Height SS Brackets, Add	25.12	
10 21 13 13-0082 EA 6" x 96" To 120" x 1-1/4", Enamel Coated Steel, Toilet Partition Pilaster.....	147.76	17.96
For Heavy Gauge Full-Height SS Brackets, Add	25.12	
10 21 13 13-0083 EA 8" x 96" To 120" x 1-1/4", Enamel Coated Steel, Toilet Partition Pilaster.....	169.60	19.77
For Heavy Gauge Full-Height SS Brackets, Add	25.12	
10 21 13 13-0084 EA 10" x 96" To 120" x 1-1/4", Enamel Coated Steel, Toilet Partition Pilaster.....	190.31	21.56
For Heavy Gauge Full-Height SS Brackets, Add	25.12	
10 21 13 13-0085 EA 12" x 96" To 120" x 1-1/4", Enamel Coated Steel, Toilet Partition Pilaster.....	211.02	23.36
For Heavy Gauge Full-Height SS Brackets, Add	25.12	
10 21 13 13-0086 EA 18" x 96" To 120" x 1-1/4", Enamel Coated Steel, Toilet Partition Pilaster.....	268.24	25.16
For Heavy Gauge Full-Height SS Brackets, Add	25.12	
10 21 13 13-0087 EA 22" x 96" To 120" x 1-1/4", Enamel Coated Steel, Toilet Partition Pilaster.....	306.06	26.95
For Heavy Gauge Full-Height SS Brackets, Add	25.12	
10 21 13 13-0088 EA 24" x 96" To 120" x 1-1/4", Enamel Coated Steel, Toilet Partition Pilaster.....	327.92	28.75
For Heavy Gauge Full-Height SS Brackets, Add	25.12	
10 21 13 13-0089 Stainless Steel Toilet Partitions And Urinal Screens <small>(10 21 13 13)</small>		
Note: Complete toilet partitions for corner installations. Includes 1" door, 1-1/4" pilaster, 1" separator panel, trim shoes, and standard stainless steel hardware as required. For alcove, recessed or configurations other than corner installations use either: (1) the appropriate corner unit and add individual components or (2) individual components. Individual components include trim shoes and standard stainless steel hardware as required. Constructed of type 304 stainless steel. Includes satin finish.		
10 21 13 13-0090 Stainless Steel Toilet Partitions <small>(10 21 13 13-0089)</small>		
10 21 13 13-0091 Floor Anchored, Stainless Steel, Complete Toilet Partitions <small>(10 21 13 13-0090)</small>		
10 21 13 13-0092 EA 36" x 60", Floor Anchored, Stainless Steel, One Compartment Corner Unit, Complete Toilet Partition.....	1,883.71	80.86
For >10, Deduct	-172.20	
For Heavy Gauge Full-Height SS Hinges And Brackets, Add	90.66	
For Diamond Pattern Finish, Add	602.70	
10 21 13 13-0093 EA 60" x 60", Floor Anchored, Stainless Steel, One Compartment Corner Unit, Complete ADA Compliant Toilet Partition.....	2,279.99	88.04
For Heavy Gauge Full-Height SS Hinges And Brackets, Add	90.66	
For Diamond Pattern Finish, Add	736.37	
10 21 13 13-0094 EA 60" x 78", Floor Anchored, Stainless Steel, One Compartment Corner Unit, Complete ADA Compliant Toilet Partition.....	2,388.39	91.64
For Heavy Gauge Full-Height SS Hinges And Brackets, Add	90.66	
For Diamond Pattern Finish, Add	771.79	
10 21 13 13-0095 Overhead Braced, Stainless Steel, Complete Toilet Partitions <small>(10 21 13 13-0090)</small>		
Note: Includes headrail.		
10 21 13 13-0096 EA 36" x 60", Overhead Braced, Stainless Steel, One Compartment Corner Unit, Complete Toilet Partition.....	1,577.49	98.82
For >10, Deduct	-137.99	
For Heavy Gauge Full-Height SS Hinges And Brackets, Add	90.66	
For Diamond Pattern Finish, Add	482.95	
10 21 13 13-0097 EA 60" x 60", Overhead Braced, Stainless Steel, One Compartment Corner Unit, Complete ADA Compliant Toilet Partition.....	1,928.37	106.02
For Heavy Gauge Full-Height SS Hinges And Brackets, Add	90.66	
For Diamond Pattern Finish, Add	600.72	
10 21 13 13-0098 EA 60" x 78", Overhead Braced, Stainless Steel, One Compartment Corner Unit, Complete ADA Compliant Toilet Partition.....	2,104.74	109.60
For Heavy Gauge Full-Height SS Hinges And Brackets, Add	90.66	
For Diamond Pattern Finish, Add	659.94	

10 Specialties**10 20 Interior Specialties****10 21 Compartments And Cubicles**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 21 13 13-0099			Floor And Ceiling Anchored, Stainless Steel, Complete Toilet Partitions (10 21 13 13-0099) Note: Excludes above ceiling steel.		
10 21 13 13-0100	EA		36" x 60", Floor And Ceiling Anchored, Stainless Steel, One Compartment Corner Unit, Complete Toilet Partition.....	2,196.56	116.79
			For >10, Deduct	-196.30	
			For Heavy Gauge Full-Height SS Hinges And Brackets, Add	90.66	
			For Diamond Pattern Finish, Add	687.04	
10 21 13 13-0101	EA		60" x 60", Floor And Ceiling Anchored, Stainless Steel, One Compartment Corner Unit, Complete ADA Compliant Toilet Partition.....	2,356.64	123.98
			For Heavy Gauge Full-Height SS Hinges And Brackets, Add	90.66	
			For Diamond Pattern Finish, Add	738.04	
10 21 13 13-0102	EA		60" x 78", Floor And Ceiling Anchored, Stainless Steel, One Compartment Corner Unit, Complete ADA Compliant Toilet Partition.....	2,468.26	127.57
			For Heavy Gauge Full-Height SS Hinges And Brackets, Add	90.66	
			For Diamond Pattern Finish, Add	774.59	
10 21 13 13-0103			Ceiling Hung, Stainless Steel, Complete Toilet Partitions (10 21 13 13-0090) Note: Excludes above ceiling steel.		
10 21 13 13-0104	EA		36" x 60", Ceiling Hung, Stainless Steel, One Compartment Corner Unit, Complete Toilet Partition.....	2,188.63	134.76
			For >10, Deduct	-191.91	
			For Heavy Gauge Full-Height SS Hinges And Brackets, Add	90.66	
			For Diamond Pattern Finish, Add	671.69	
10 21 13 13-0105	EA		60" x 60", Ceiling Hung, Stainless Steel, One Compartment Corner Unit, Complete ADA Compliant Toilet Partition.....	2,676.62	141.94
			For Heavy Gauge Full-Height SS Hinges And Brackets, Add	90.66	
			For Diamond Pattern Finish, Add	837.46	
10 21 13 13-0106	EA		60" x 78", Ceiling Hung, Stainless Steel, One Compartment Corner Unit, Complete ADA Compliant Toilet Partition.....	2,816.67	145.54
			For Heavy Gauge Full-Height SS Hinges And Brackets, Add	90.66	
			For Diamond Pattern Finish, Add	883.96	
10 21 13 13-0107			Stainless Steel Urinal Screens (10 21 13 13-0089)		
10 21 13 13-0108			Floor Anchored, Stainless Steel, Urinal Screens (10 21 13 13-0107)		
10 21 13 13-0109	EA		24" x 58" x 1", Floor Anchored, Stainless Steel, Urinal Screen.....	608.23	50.29
			For Heavy Gauge Full-Height SS Brackets, Add	25.12	
			For Diamond Pattern Finish, Add	177.68	
10 21 13 13-0110	EA		36" x 58" x 1", Floor Anchored, Stainless Steel, Urinal Screen.....	690.23	53.88
			For Heavy Gauge Full-Height SS Brackets, Add	25.12	
			For Diamond Pattern Finish, Add	203.86	
10 21 13 13-0111	EA		48" x 58" x 1", Floor Anchored, Stainless Steel, Urinal Screen.....	703.54	57.47
			For Heavy Gauge Full-Height SS Brackets, Add	25.12	
			For Diamond Pattern Finish, Add	206.01	
10 21 13 13-0112			Wall Hung, Stainless Steel, Urinal Screens (10 21 13 13-0107)		
10 21 13 13-0113	EA		18" x 42" x 1", Wall Hung, Stainless Steel, Urinal Screen.....	446.36	43.10
			For Heavy Gauge Full-Height SS Brackets, Add	25.12	
			For Diamond Pattern Finish, Add	126.06	
10 21 13 13-0114	EA		24" x 42" x 1", Wall Hung, Stainless Steel, Urinal Screen.....	482.96	46.70
			For Heavy Gauge Full-Height SS Brackets, Add	25.12	
			For Diamond Pattern Finish, Add	136.35	
10 21 13 13-0115	EA		30" x 42" x 1", Wall Hung, Stainless Steel, Urinal Screen.....	527.65	50.29
			For Heavy Gauge Full-Height SS Brackets, Add	25.12	
			For Diamond Pattern Finish, Add	149.48	
10 21 13 13-0116			Wall Hung And Post Supported, Stainless Steel, Urinal Screens (10 21 13 13-0107)		
10 21 13 13-0117	EA		18" x 58" x 1", Wall Hung And Post Supported, Stainless Steel, Urinal Screen.....	737.94	46.70
			For Heavy Gauge Full-Height SS Brackets, Add	25.12	
			For Diamond Pattern Finish, Add	225.59	
10 21 13 13-0118	EA		24" x 58" x 1", Wall Hung And Post Supported, Stainless Steel, Urinal Screen.....	772.67	50.29
			For Heavy Gauge Full-Height SS Brackets, Add	25.12	
			For Diamond Pattern Finish, Add	235.24	
10 21 13 13-0119	EA		30" x 58" x 1", Wall Hung And Post Supported, Stainless Steel, Urinal Screen.....	807.24	53.88
			For Heavy Gauge Full-Height SS Brackets, Add	25.12	
			For Diamond Pattern Finish, Add	244.82	
10 21 13 13-0120			Wall Hung And Overhead Braced, Stainless Steel, Urinal Screens (10 21 13 13-0107)		
10 21 13 13-0121	EA		22" x 58" x 1", Wall Hung And Overhead Braced, Stainless Steel, Urinal Screen.....	608.23	50.29
			For Heavy Gauge Full-Height SS Brackets, Add	25.12	
			For Diamond Pattern Finish, Add	177.68	
10 21 13 13-0122	EA		34" x 58" x 1", Wall Hung And Overhead Braced, Stainless Steel, Urinal Screen.....	690.23	53.88
			For Heavy Gauge Full-Height SS Brackets, Add	25.12	
			For Diamond Pattern Finish, Add	203.86	
10 21 13 13-0123	EA		46" x 58" x 1", Wall Hung And Overhead Braced, Stainless Steel, Urinal Screen.....	775.73	57.47
			For Heavy Gauge Full-Height SS Brackets, Add	25.12	
			For Diamond Pattern Finish, Add	231.28	
10 21 13 13-0124			Stainless Steel Toilet Partition Doors, Panels And Pilasters (10 21 13 13-0089)		
10 21 13 13-0125			Stainless Steel, Toilet Partition Doors (10 21 13 13-0124)		



Specialties	10	10
Interior Specialties	10 20	
Compartments And Cubicles	10 21	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 21	13	13-0126	EA 24" x 58" x 1", Stainless Steel, Toilet Partition Door <i>For Heavy Gauge Full-Height SS Hinge, Add</i> <i>For Diamond Pattern Finish, Add</i>	412.78 40.42 134.41	14.38
10 21	13	13-0127	EA 26" x 58" x 1", Stainless Steel, Toilet Partition Door <i>For Heavy Gauge Full-Height SS Hinge, Add</i> <i>For Diamond Pattern Finish, Add</i>	473.43 40.42 155.64	14.38
10 21	13	13-0128	EA 30" x 58" x 1", Stainless Steel, Toilet Partition Door <i>For Heavy Gauge Full-Height SS Hinge, Add</i> <i>For Diamond Pattern Finish, Add</i>	485.43 40.42 158.58	16.17
10 21	13	13-0129	EA 34" x 58" x 1", Stainless Steel, ADA Compliant Toilet Partition Door <i>For Heavy Gauge Full-Height SS Hinge, Add</i> <i>For Diamond Pattern Finish, Add</i>	502.93 40.42 164.71	16.17
10 21	13	13-0130	EA 36" x 58" x 1", Stainless Steel, ADA Compliant Toilet Partition Door <i>For Heavy Gauge Full-Height SS Hinge, Add</i> <i>For Diamond Pattern Finish, Add</i>	507.81 40.42 166.41	16.17
10 21 13 13-0131 Stainless Steel, Toilet Partition Panels (10 21 13 13-0124)					
10 21	13	13-0132	EA 6" x 58" x 1", Stainless Steel, Toilet Partition Panel <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For Diamond Pattern Finish, Add</i>	351.27 25.12 107.85	21.56
10 21	13	13-0133	EA 12" x 58" x 1", Stainless Steel, Toilet Partition Panel <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For Diamond Pattern Finish, Add</i>	390.46 25.12 120.31	23.36
10 21	13	13-0134	EA 18" x 58" x 1", Stainless Steel, Toilet Partition Panel <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For Diamond Pattern Finish, Add</i>	406.36 25.12 124.62	25.16
10 21	13	13-0135	EA 24" x 58" x 1", Stainless Steel, Toilet Partition Panel <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For Diamond Pattern Finish, Add</i>	424.58 25.12 129.74	26.95
10 21	13	13-0136	EA 30" x 58" x 1", Stainless Steel, Toilet Partition Panel <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For Diamond Pattern Finish, Add</i>	455.83 25.12 139.42	28.75
10 21	13	13-0137	EA 36" x 58" x 1", Stainless Steel, Toilet Partition Panel <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For Diamond Pattern Finish, Add</i>	492.33 25.12 150.93	30.55
10 21	13	13-0138	EA 42" x 58" x 1", Stainless Steel, Toilet Partition Panel <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For Diamond Pattern Finish, Add</i>	578.01 25.12 179.66	32.34
10 21	13	13-0139	EA 48" x 58" x 1", Stainless Steel, Toilet Partition Panel <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For Diamond Pattern Finish, Add</i>	633.61 25.12 197.87	34.14
10 21	13	13-0140	EA 55" x 58" x 1", Stainless Steel, Toilet Partition Panel <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For Diamond Pattern Finish, Add</i>	649.52 25.12 202.18	35.94
10 21	13	13-0141	EA 58" x 58" x 1", Stainless Steel, Toilet Partition Panel <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For Diamond Pattern Finish, Add</i>	682.44 25.12 213.20	36.65
10 21	13	13-0142	EA 60" x 58" x 1", Stainless Steel, Toilet Partition Panel <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For Diamond Pattern Finish, Add</i>	725.66 25.12 227.57	37.73
10 21	13	13-0143	EA 70" x 58" x 1", Stainless Steel, Toilet Partition Panel <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For Diamond Pattern Finish, Add</i>	760.35 25.12 238.45	39.53
10 21	13	13-0144	EA 78" x 58" x 1", Stainless Steel, Toilet Partition Panel <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For Diamond Pattern Finish, Add</i>	835.51 25.12 263.50	41.33
10 21 13 13-0145 70" Long, Stainless Steel, Toilet Partition Pilasters (10 21 13 13-0124)					
10 21	13	13-0146	EA Up To 4" x 70" x 1-1/4", Stainless Steel, Toilet Partition Pilaster <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For Diamond Pattern Finish, Add</i>	246.05 25.12 78.57	10.78
10 21	13	13-0147	EA 5" x 70" x 1-1/4", Stainless Steel, Toilet Partition Pilaster <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For Diamond Pattern Finish, Add</i>	267.44 25.12 84.80	12.57
10 21	13	13-0148	EA 6" x 70" x 1-1/4", Stainless Steel, Toilet Partition Pilaster <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For Diamond Pattern Finish, Add</i>	290.20 25.12 91.51	14.38
10 21	13	13-0149	EA 8" x 70" x 1-1/4", Stainless Steel, Toilet Partition Pilaster <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For Diamond Pattern Finish, Add</i>	330.75 25.12 104.44	16.17
10 21	13	13-0150	EA 10" x 70" x 1-1/4", Stainless Steel, Toilet Partition Pilaster <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For Diamond Pattern Finish, Add</i>	371.31 25.12 117.38	17.96
10 21	13	13-0151	EA 12" x 70" x 1-1/4", Stainless Steel, Toilet Partition Pilaster <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For Diamond Pattern Finish, Add</i>	411.85 25.12 130.31	19.77
10 21	13	13-0152	EA 18" x 70" x 1-1/4", Stainless Steel, Toilet Partition Pilaster <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For Diamond Pattern Finish, Add</i>	524.95 25.12 168.64	21.56
10 21	13	13-0153	EA 22" x 70" x 1-1/4", Stainless Steel, Toilet Partition Pilaster <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For Diamond Pattern Finish, Add</i>	602.47 25.12 194.51	23.36

10 Specialties**10 20 Interior Specialties****10 21 Compartments And Cubicles**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 21 13 13-0154	EA		24" x 70" x 1-1/4", Stainless Steel, Toilet Partition Pilaster <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For Diamond Pattern Finish, Add</i>	643.02 25.12 207.45	25.16
10 21 13 13-0155			82" Long, Stainless Steel, Toilet Partition Pilasters (10 21 13 13-0124)		
10 21 13 13-0156	EA		Up To 4" x 82" x 1-1/4", Stainless Steel, Toilet Partition Pilaster <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For Diamond Pattern Finish, Add</i>	186.56 25.12 57.75	10.78
10 21 13 13-0157	EA		5" x 82" x 1-1/4", Stainless Steel, Toilet Partition Pilaster <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For Diamond Pattern Finish, Add</i>	201.45 25.12 61.70	12.57
10 21 13 13-0158	EA		6" x 82" x 1-1/4", Stainless Steel, Toilet Partition Pilaster <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For Diamond Pattern Finish, Add</i>	216.91 25.12 65.86	14.38
10 21 13 13-0159	EA		8" x 82" x 1-1/4", Stainless Steel, Toilet Partition Pilaster <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For Diamond Pattern Finish, Add</i>	283.13 25.12 87.78	16.17
10 21 13 13-0160	EA		10" x 82" x 1-1/4", Stainless Steel, Toilet Partition Pilaster <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For Diamond Pattern Finish, Add</i>	319.73 25.12 99.33	17.96
10 21 13 13-0161	EA		12" x 82" x 1-1/4", Stainless Steel, Toilet Partition Pilaster <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For Diamond Pattern Finish, Add</i>	330.16 25.12 101.72	19.77
10 21 13 13-0162	EA		18" x 82" x 1-1/4", Stainless Steel, Toilet Partition Pilaster <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For Diamond Pattern Finish, Add</i>	374.61 25.12 116.02	21.56
10 21 13 13-0163	EA		22" x 82" x 1-1/4", Stainless Steel, Toilet Partition Pilaster <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For Diamond Pattern Finish, Add</i>	423.15 25.12 131.75	23.36
10 21 13 13-0164	EA		24" x 82" x 1-1/4", Stainless Steel, Toilet Partition Pilaster <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For Diamond Pattern Finish, Add</i>	449.03 25.12 139.55	25.16
10 21 13 13-0165			96" To 120" Long, Stainless Steel, Toilet Partition Pilasters (10 21 13 13-0124)		
10 21 13 13-0166	EA		Up To 4" x 96" To 120" x 1-1/4", Stainless Steel, Toilet Partition Pilaster <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For Diamond Pattern Finish, Add</i>	268.30 25.12 83.84	14.38
10 21 13 13-0167	EA		5" x 96" To 120" x 1-1/4", Stainless Steel, Toilet Partition Pilaster <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For Diamond Pattern Finish, Add</i>	293.79 25.12 91.51	16.17
10 21 13 13-0168	EA		6" x 96" To 120" x 1-1/4", Stainless Steel, Toilet Partition Pilaster <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For Diamond Pattern Finish, Add</i>	317.92 25.12 98.69	17.96
10 21 13 13-0169	EA		8" x 96" To 120" x 1-1/4", Stainless Steel, Toilet Partition Pilaster <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For Diamond Pattern Finish, Add</i>	365.31 25.12 114.02	19.77
10 21 13 13-0170	EA		10" x 96" To 120" x 1-1/4", Stainless Steel, Toilet Partition Pilaster <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For Diamond Pattern Finish, Add</i>	411.34 25.12 128.88	21.56
10 21 13 13-0171	EA		12" x 96" To 120" x 1-1/4", Stainless Steel, Toilet Partition Pilaster <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For Diamond Pattern Finish, Add</i>	457.37 25.12 143.73	23.36
10 21 13 13-0172	EA		18" x 96" To 120" x 1-1/4", Stainless Steel, Toilet Partition Pilaster <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For Diamond Pattern Finish, Add</i>	591.00 25.12 189.24	25.16
10 21 13 13-0173	EA		22" x 96" To 120" x 1-1/4", Stainless Steel, Toilet Partition Pilaster <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For Diamond Pattern Finish, Add</i>	679.46 25.12 218.95	26.95
10 21 13 13-0174	EA		24" x 96" To 120" x 1-1/4", Stainless Steel, Toilet Partition Pilaster <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For Diamond Pattern Finish, Add</i>	726.86 25.12 234.28	28.75
10 21 13 16			Plastic-Laminate-Clad Toilet Compartments (10 21 13)		
10 21 13 16-0001			Laminated Plastic Toilet Partitions And Urinal Screens (10 21 13 16) Note: Complete toilet partitions for corner installations. Includes 1" door, 1" pilaster, 1" separator panel, trim shoes, and standard stainless steel hardware as required. For alcove, recessed or configurations other than corner installations use either: (1) the appropriate corner unit and add individual components or (2) individual components. Individual components include trim shoes and standard stainless steel hardware as required. Constructed of a sandwich of high pressure decorative plastic laminate bonded to a solid industrial-grade particle board.		
10 21 13 16-0002			Laminated Plastic Toilet Partitions (10 21 13 16-0001) Note: Includes all standard Bobrick colors.		
10 21 13 16-0003			Floor Anchored, Laminated Plastic, Complete Toilet Partitions (10 21 13 16-0002)		
10 21 13 16-0004	EA		36" x 60", Floor Anchored, Laminated Plastic, One Compartment Corner Unit, Complete Toilet Partition <i>For >10, Deduct</i> <i>For Cast Stainless Steel Hardware, Add</i> <i>For Heavy Gauge Full-Height SS Hinges And Brackets, Add</i>	603.75 -44.20 72.88 90.66	80.86



Specialties	10
Interior Specialties	10 20
Compartments And Cubicles	10 21

10

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 21 13 16-0005 EA 60" x 60", Floor Anchored, Laminated Plastic, One Compartment Corner Unit, Complete ADA Compliant Toilet Partition	731.30	88.04
<i>For Cast Stainless Steel Hardware, Add</i>	72.89	
<i>For Heavy Gauge Full-Height SS Hinges And Brackets, Add</i>	90.66	
10 21 13 16-0006 EA 60" x 78", Floor Anchored, Laminated Plastic, One Compartment Corner Unit, Complete ADA Compliant Toilet Partition	784.97	91.64
<i>For Cast Stainless Steel Hardware, Add</i>	72.90	
<i>For Heavy Gauge Full-Height SS Hinges And Brackets, Add</i>	90.66	
10 21 13 16-0007 Overhead Braced, Laminated Plastic, Complete Toilet Partitions <small>(10 21 13 16-0002)</small>		
Note: Includes headrail.		
10 21 13 16-0008 EA 36" x 60", Overhead Braced, Laminated Plastic, One Compartment Corner Unit, Complete Toilet Partition	661.26	98.82
<i>For >10, Deduct</i>	-46.36	
<i>For Cast Stainless Steel Hardware, Add</i>	72.91	
<i>For Heavy Gauge Full-Height SS Hinges And Brackets, Add</i>	90.66	
10 21 13 16-0009 EA 60" x 60", Overhead Braced, Laminated Plastic, One Compartment Corner Unit, Complete ADA Compliant Toilet Partition	794.21	106.02
<i>For Cast Stainless Steel Hardware, Add</i>	72.92	
<i>For Heavy Gauge Full-Height SS Hinges And Brackets, Add</i>	90.66	
10 21 13 16-0010 EA 60" x 78", Overhead Braced, Laminated Plastic, One Compartment Corner Unit, Complete ADA Compliant Toilet Partition	851.92	109.60
<i>For Cast Stainless Steel Hardware, Add</i>	72.92	
<i>For Heavy Gauge Full-Height SS Hinges And Brackets, Add</i>	90.66	
10 21 13 16-0011 Ceiling Hung, Laminated Plastic, Complete Toilet Partitions <small>(10 21 13 16-0002)</small>		
Note: Excludes above ceiling steel.		
10 21 13 16-0012 EA 36" x 60", Ceiling Hung, Laminated Plastic, One Compartment Corner Unit, Complete Toilet Partition	885.94	134.76
<i>For >10, Deduct</i>	-61.64	
<i>For Cast Stainless Steel Hardware, Add</i>	72.96	
<i>For Heavy Gauge Full-Height SS Hinges And Brackets, Add</i>	90.66	
10 21 13 16-0013 EA 60" x 60", Ceiling Hung, Laminated Plastic, One Compartment Corner Unit, Complete ADA Compliant Toilet Partition	1,023.03	141.94
<i>For Cast Stainless Steel Hardware, Add</i>	72.97	
<i>For Heavy Gauge Full-Height SS Hinges And Brackets, Add</i>	90.66	
10 21 13 16-0014 EA 60" x 78", Ceiling Hung, Laminated Plastic, One Compartment Corner Unit, Complete ADA Compliant Toilet Partition	1,076.70	145.54
<i>For Cast Stainless Steel Hardware, Add</i>	72.98	
<i>For Heavy Gauge Full-Height SS Hinges And Brackets, Add</i>	90.66	
10 21 13 16-0015 Laminated Plastic Urinal Screens <small>(10 21 13 16-0001)</small>		
Note: Includes all standard Bobrick colors.		
10 21 13 16-0016 Floor Anchored, Laminated Plastic, Urinal Screens <small>(10 21 13 16-0015)</small>		
10 21 13 16-0017 EA 24" x 58" x 1", Floor Anchored, Laminated Plastic, Urinal Screen	265.43	50.29
<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
10 21 13 16-0018 EA 36" x 58" x 1", Floor Anchored, Laminated Plastic, Urinal Screen	288.79	53.88
<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
10 21 13 16-0019 EA 48" x 58" x 1", Floor Anchored, Laminated Plastic, Urinal Screen	299.15	57.47
<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
10 21 13 16-0020 Wall Hung, Laminated Plastic, Urinal Screens <small>(10 21 13 16-0015)</small>		
10 21 13 16-0021 EA 18" x 42" x 1", Wall Hung, Laminated Plastic, Urinal Screen	208.91	43.10
<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
10 21 13 16-0022 EA 24" x 42" x 1", Wall Hung, Laminated Plastic, Urinal Screen	220.72	46.70
<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
10 21 13 16-0023 EA 30" x 42" x 1", Wall Hung, Laminated Plastic, Urinal Screen	232.10	50.29
<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
10 21 13 16-0024 Wall Hung And Post Supported, Laminated Plastic, Urinal Screens <small>(10 21 13 16-0015)</small>		
10 21 13 16-0025 EA 18" x 58" x 1", Wall Hung And Post Supported, Laminated Plastic, Urinal Screen	270.15	46.70
<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
10 21 13 16-0026 EA 24" x 58" x 1", Wall Hung And Post Supported, Laminated Plastic, Urinal Screen	295.77	50.29
<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
10 21 13 16-0027 EA 30" x 58" x 1", Wall Hung And Post Supported, Laminated Plastic, Urinal Screen	323.33	53.88
<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
10 21 13 16-0028 Wall Hung And Overhead Braced, Laminated Plastic, Urinal Screens <small>(10 21 13 16-0015)</small>		
10 21 13 16-0029 EA 24" x 58" x 1", Wall Hung And Overhead Braced, Laminated Plastic, Urinal Screen	251.80	46.70
<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
10 21 13 16-0030 EA 36" x 58" x 1", Wall Hung And Overhead Braced, Laminated Plastic, Urinal Screen	275.61	50.29
<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
10 21 13 16-0031 EA 48" x 58" x 1", Wall Hung And Overhead Braced, Laminated Plastic, Urinal Screen	285.71	53.88
<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
10 21 13 16-0032 Laminated Plastic Toilet Partition Doors, Panels And Pilasters <small>(10 21 13 16-0001)</small>		
Note: Includes all standard Bobrick colors.		

10 Specialties**10 20 Interior Specialties****10 21 Compartments And Cubicles**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 21 13 16-0033			Laminated Plastic, Toilet Partition Doors (10 21 13 16-0032)		
10 21 13 16-0034	EA		24" x 58" x 1", Laminated Plastic, Toilet Partition Door.....	192.17	14.38
			<i>For Heavy Gauge Full-Height SS Hinge, Add</i>	40.42	
10 21 13 16-0035	EA		26" x 58" x 1", Laminated Plastic, Toilet Partition Door.....	208.05	14.38
			<i>For Heavy Gauge Full-Height SS Hinge, Add</i>	40.42	
10 21 13 16-0036	EA		30" x 58" x 1", Laminated Plastic, Toilet Partition Door.....	215.97	16.17
			<i>For Heavy Gauge Full-Height SS Hinge, Add</i>	40.42	
10 21 13 16-0037	EA		34" x 58" x 1", Laminated Plastic, ADA Compliant Toilet Partition Door	220.88	16.17
			<i>For Heavy Gauge Full-Height SS Hinge, Add</i>	40.42	
10 21 13 16-0038	EA		36" x 58" x 1", Laminated Plastic, ADA Compliant Toilet Partition Door	225.50	16.17
			<i>For Heavy Gauge Full-Height SS Hinge, Add</i>	40.42	
10 21 13 16-0039			Laminated Plastic, Toilet Partition Panels (10 21 13 16-0032)		
10 21 13 16-0040	EA		6" x 58" x 1", Laminated Plastic, Toilet Partition Panel	107.48	21.56
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
10 21 13 16-0041	EA		12" x 58" x 1", Laminated Plastic, Toilet Partition Panel	118.57	23.36
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
10 21 13 16-0042	EA		18" x 58" x 1", Laminated Plastic, Toilet Partition Panel	129.64	25.16
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
10 21 13 16-0043	EA		24" x 58" x 1", Laminated Plastic, Toilet Partition Panel	141.10	26.95
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
10 21 13 16-0044	EA		30" x 58" x 1", Laminated Plastic, Toilet Partition Panel	151.80	28.75
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
10 21 13 16-0045	EA		36" x 58" x 1", Laminated Plastic, Toilet Partition Panel	163.30	30.55
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
10 21 13 16-0046	EA		42" x 58" x 1", Laminated Plastic, Toilet Partition Panel	167.78	32.34
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
10 21 13 16-0047	EA		48" x 58" x 1", Laminated Plastic, Toilet Partition Panel	172.80	34.14
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
10 21 13 16-0048	EA		55" x 58" x 1", Laminated Plastic, Toilet Partition Panel	181.89	35.94
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
10 21 13 16-0049	EA		58" x 58" x 1", Laminated Plastic, Toilet Partition Panel	188.94	36.65
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
10 21 13 16-0050	EA		60" x 58" x 1", Laminated Plastic, Toilet Partition Panel	197.01	37.73
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
10 21 13 16-0051	EA		70" x 58" x 1", Laminated Plastic, Toilet Partition Panel	222.27	39.53
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
10 21 13 16-0052	EA		78" x 58" x 1", Laminated Plastic, Toilet Partition Panel	250.69	41.33
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
10 21 13 16-0053			69" Long, Laminated Plastic, Toilet Partition Pilasters (10 21 13 16-0032)		
10 21 13 16-0054	EA		Up To 4" x 69" x 1", Laminated Plastic, Toilet Partition Pilaster.....	83.06	10.78
			<i>For 1-1/4" Pilaster, Add</i>	5.07	
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
			<i>For Steel Core Pilaster, Add</i>	61.50	
10 21 13 16-0055	EA		5" x 69" x 1", Laminated Plastic, Toilet Partition Pilaster.....	95.90	12.57
			<i>For 1-1/4" Pilaster, Add</i>	5.84	
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
			<i>For Steel Core Pilaster, Add</i>	70.74	
10 21 13 16-0056	EA		6" x 69" x 1", Laminated Plastic, Toilet Partition Pilaster.....	99.49	14.38
			<i>For 1-1/4" Pilaster, Add</i>	5.84	
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
			<i>For Steel Core Pilaster, Add</i>	70.74	
10 21 13 16-0057	EA		8" x 69" x 1", Laminated Plastic, Toilet Partition Pilaster.....	110.01	16.17
			<i>For 1-1/4" Pilaster, Add</i>	6.41	
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
			<i>For Steel Core Pilaster, Add</i>	77.67	
10 21 13 16-0058	EA		10" x 69" x 1", Laminated Plastic, Toilet Partition Pilaster.....	115.63	17.96
			<i>For 1-1/4" Pilaster, Add</i>	6.57	
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
			<i>For Steel Core Pilaster, Add</i>	79.69	
10 21 13 16-0059	EA		12" x 69" x 1", Laminated Plastic, Toilet Partition Pilaster.....	125.86	19.77
			<i>For 1-1/4" Pilaster, Add</i>	7.12	
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
			<i>For Steel Core Pilaster, Add</i>	86.33	
10 21 13 16-0060	EA		18" x 69" x 1", Laminated Plastic, Toilet Partition Pilaster.....	157.74	21.56
			<i>For 1-1/4" Pilaster, Add</i>	9.46	
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
			<i>For Steel Core Pilaster, Add</i>	114.62	
10 21 13 16-0061	EA		22" x 69" x 1", Laminated Plastic, Toilet Partition Pilaster.....	189.06	23.36
			<i>For 1-1/4" Pilaster, Add</i>	11.74	
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
			<i>For Steel Core Pilaster, Add</i>	142.34	
10 21 13 16-0062	EA		24" x 69" x 1", Laminated Plastic, Toilet Partition Pilaster.....	211.42	25.16
			<i>For 1-1/4" Pilaster, Add</i>	13.29	
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
			<i>For Steel Core Pilaster, Add</i>	161.11	
10 21 13 16-0063			83" Long, Laminated Plastic, Toilet Partition Pilasters (10 21 13 16-0032)		



Specialties	10	10
Interior Specialties	10 20	
Compartments And Cubicles	10 21	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 21	13 16-0064	EA	Up To 4" x 83" x 1", Laminated Plastic, Toilet Partition Pilaster..... <i>For 1-1/4" Pilaster, Add</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For Steel Core Pilaster, Add</i>	155.82 11.08 25.12 134.26	10.78
10 21	13 16-0065	EA	5" x 83" x 1", Laminated Plastic, Toilet Partition Pilaster <i>For 1-1/4" Pilaster, Add</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For Steel Core Pilaster, Add</i>	172.70 12.17 25.12 147.54	12.57
10 21	13 16-0066	EA	6" x 83" x 1", Laminated Plastic, Toilet Partition Pilaster <i>For 1-1/4" Pilaster, Add</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For Steel Core Pilaster, Add</i>	176.29 12.17 25.12 147.54	14.38
10 21	13 16-0067	EA	8" x 83" x 1", Laminated Plastic, Toilet Partition Pilaster <i>For 1-1/4" Pilaster, Add</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For Steel Core Pilaster, Add</i>	191.14 13.10 25.12 158.80	16.17
10 21	13 16-0068	EA	10" x 83" x 1", Laminated Plastic, Toilet Partition Pilaster <i>For 1-1/4" Pilaster, Add</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For Steel Core Pilaster, Add</i>	208.89 14.27 25.12 172.95	17.96
10 21	13 16-0069	EA	12" x 83" x 1", Laminated Plastic, Toilet Partition Pilaster <i>For 1-1/4" Pilaster, Add</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For Steel Core Pilaster, Add</i>	223.45 15.17 25.12 183.92	19.77
10 21	13 16-0070	EA	18" x 83" x 1", Laminated Plastic, Toilet Partition Pilaster <i>For 1-1/4" Pilaster, Add</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For Steel Core Pilaster, Add</i>	275.98 19.21 25.12 232.86	21.56
10 21	13 16-0071	EA	22" x 83" x 1", Laminated Plastic, Toilet Partition Pilaster <i>For 1-1/4" Pilaster, Add</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For Steel Core Pilaster, Add</i>	313.50 22.01 25.12 266.78	23.36
10 21	13 16-0072	EA	24" x 83" x 1", Laminated Plastic, Toilet Partition Pilaster <i>For 1-1/4" Pilaster, Add</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For Steel Core Pilaster, Add</i>	322.58 22.46 25.12 272.27	25.16

10 21 13 19 Plastic Toilet Compartments (10 21 13)

10 21 13 19-0001	Recycled Solid Polymer (HDPE) Toilet Partitions And Urinal Screens (10 21 13 19) Note: Complete toilet partitions for corner installations. Includes 1" door, 1" pilaster, 1" separator panel, trim shoes, and standard stainless steel hardware as required. For alcove, recessed or configurations other than corner installations use either: (1) the appropriate corner unit and add individual components or (2) individual components. Individual components include trim shoes and standard stainless steel hardware as required. Constructed of high density polyethylene (HDPE). Includes Class B fire rating.			
10 21 13 19-0002	Recycled Solid Plastic (HDPE) Toilet Partitions (10 21 13 19-0001) Note: Includes all standard Columbia Partitions colors.			
10 21 13 19-0003	Overhead Braced, Recycled Solid Plastic (HDPE), Complete Toilet Partitions (10 21 13 19-0002) Note: Includes headrail.			
10 21 13 19-0004	EA	36" x 60", Overhead Braced, Recycled Solid Plastic (HDPE), One Compartment Corner Unit, Complete Toilet Partition <i>For >10, Deduct</i> <i>For Heavy Gauge Full-Height SS Hinges And Brackets, Add</i> <i>For NFPA Class A, Add</i>	1,087.07 -88.94 90.66 551.45	98.82
10 21 13 19-0005	EA	60" x 60", Overhead Braced, Recycled Solid Plastic (HDPE), One Compartment Corner Unit, Complete ADA Compliant Toilet Partition <i>For Heavy Gauge Full-Height SS Hinges And Brackets, Add</i> <i>For NFPA Class A, Add</i>	1,335.69 90.66 696.68	106.02
10 21 13 19-0006	EA	60" x 78", Overhead Braced, Recycled Solid Plastic (HDPE), One Compartment Corner Unit, Complete ADA Compliant Toilet Partition <i>For Heavy Gauge Full-Height SS Hinges And Brackets, Add</i> <i>For NFPA Class A, Add</i>	1,478.83 90.66 780.97	109.60
10 21 13 19-0007	Floor And Ceiling Anchored, Recycled Solid Plastic (HDPE), Complete Toilet Partitions (10 21 13 19-0002) Note: Excludes above ceiling steel.			
10 21 13 19-0008	EA	36" x 60", Floor And Ceiling Anchored, Recycled Solid Plastic (HDPE), One Compartment Corner Unit, Complete Toilet Partition..... <i>For >10, Deduct</i> <i>For Heavy Gauge Full-Height SS Hinges And Brackets, Add</i> <i>For NFPA Class A, Add</i>	1,089.31 -85.57 90.66 530.55	116.79
10 21 13 19-0009	EA	60" x 60", Floor And Ceiling Anchored, Recycled Solid Plastic (HDPE), One Compartment Corner Unit, Complete ADA Compliant Toilet Partition <i>For Heavy Gauge Full-Height SS Hinges And Brackets, Add</i> <i>For NFPA Class A, Add</i>	1,359.70 90.66 689.28	123.98
10 21 13 19-0010	EA	60" x 78", Floor And Ceiling Anchored, Recycled Solid Plastic (HDPE), One Compartment Corner Unit, Complete ADA Compliant Toilet Partition <i>For Heavy Gauge Full-Height SS Hinges And Brackets, Add</i> <i>For NFPA Class A, Add</i>	1,502.84 90.66 773.57	127.57

10 Specialties**10 20 Interior Specialties****10 21 Compartments And Cubicles**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 21 13 19-0011			Ceiling Hung, Recycled Solid Plastic (HDPE), Complete Toilet Partitions ^(10 21 13 19-0002) Note: Excludes above ceiling steel.		
10 21 13 19-0012	EA		36" x 60", Ceiling Hung, Recycled Solid Plastic (HDPE), One Compartment Corner Unit, Complete Toilet Partition.....	1,144.66	134.76
			For >10, Deduct	-87.51	
			For Heavy Gauge Full-Height SS Hinges And Brackets, Add	90.66	
			For NFPA Class A, Add	542.59	
10 21 13 19-0013	EA		60" x 60", Ceiling Hung, Recycled Solid Plastic (HDPE), One Compartment Corner Unit, Complete ADA Compliant Toilet Partition.....	1,355.15	141.94
			For Heavy Gauge Full-Height SS Hinges And Brackets, Add	90.66	
			For NFPA Class A, Add	664.18	
10 21 13 19-0014	EA		60" x 78", Ceiling Hung, Recycled Solid Plastic (HDPE), One Compartment Corner Unit, Complete ADA Compliant Toilet Partition.....	1,498.30	145.54
			For Heavy Gauge Full-Height SS Hinges And Brackets, Add	90.66	
			For NFPA Class A, Add	748.48	
10 21 13 19-0015			Recycled Solid Plastic (HDPE) Urinal Screens ^(10 21 13 19-0001) Note: Includes all standard Columbia Partitions colors.		
10 21 13 19-0016			Wall Hung, Recycled Solid Plastic (HDPE), Urinal Screens ^(10 21 13 19-0015)		
10 21 13 19-0017	EA		18" x 42" x 1", Wall Hung, Recycled Solid Plastic (HDPE), Urinal Screen.....	256.59	43.10
			For Heavy Gauge Full-Height SS Brackets, Add	25.12	
			For NFPA Class A, Add	105.64	
10 21 13 19-0018	EA		24" x 42" x 1", Wall Hung, Recycled Solid Plastic (HDPE), Urinal Screen.....	270.49	46.70
			For Heavy Gauge Full-Height SS Brackets, Add	25.12	
			For NFPA Class A, Add	109.80	
10 21 13 19-0019			Wall Hung And Post Supported, Recycled Solid Plastic (HDPE), Urinal Screens ^(10 21 13 19-0015)		
10 21 13 19-0020	EA		18" x 42" x 1", Wall Hung And Post Supported, Recycled Solid Plastic (HDPE), Urinal Screen.....	324.99	46.70
			For Heavy Gauge Full-Height SS Brackets, Add	25.12	
			For NFPA Class A, Add	143.59	
10 21 13 19-0021	EA		24" x 42" x 1", Wall Hung And Post Supported, Recycled Solid Plastic (HDPE), Urinal Screen.....	409.36	50.29
			For Heavy Gauge Full-Height SS Brackets, Add	25.12	
			For NFPA Class A, Add	191.45	
10 21 13 19-0022	EA		30" x 42" x 1", Wall Hung And Post Supported, Recycled Solid Plastic (HDPE), Urinal Screen.....	454.57	53.88
			For Heavy Gauge Full-Height SS Brackets, Add	25.12	
			For NFPA Class A, Add	215.02	
10 21 13 19-0023			Wall Hung And Overhead Braced, Recycled Solid Plastic (HDPE), Urinal Screens ^(10 21 13 19-0015)		
10 21 13 19-0024	EA		24" x 55" x 1", Wall Hung And Overhead Braced, Recycled Solid Plastic (HDPE), Urinal Screen.....	332.17	50.29
			For Heavy Gauge Full-Height SS Brackets, Add	25.12	
			For NFPA Class A, Add	143.59	
10 21 13 19-0025	EA		36" x 55" x 1", Wall Hung And Overhead Braced, Recycled Solid Plastic (HDPE), Urinal Screen.....	416.55	53.88
			For Heavy Gauge Full-Height SS Brackets, Add	25.12	
			For NFPA Class A, Add	191.45	
10 21 13 19-0026	EA		48" x 55" x 1", Wall Hung And Overhead Braced, Recycled Solid Plastic (HDPE), Urinal Screen.....	493.27	57.47
			For Heavy Gauge Full-Height SS Brackets, Add	25.12	
			For NFPA Class A, Add	234.56	
10 21 13 19-0027			Recycled Solid Plastic (HDPE) Toilet Partition Doors, Panels And Pilasters ^(10 21 13 19-0001) Note: Includes all standard Columbia Partitions colors.		
10 21 13 19-0028			Recycled Solid Plastic (HDPE), Toilet Partition Doors ^(10 21 13 19-0027)		
10 21 13 19-0029	EA		24" x 55" x 1", Recycled Solid Plastic (HDPE), Toilet Partition Door.....	257.68	14.38
			For Heavy Gauge Full-Height SS Hinge, Add	40.42	
			For NFPA Class A, Add	141.94	
10 21 13 19-0030	EA		26" x 55" x 1", Recycled Solid Plastic (HDPE), Toilet Partition Door.....	278.52	14.38
			For Heavy Gauge Full-Height SS Hinge, Add	40.42	
			For NFPA Class A, Add	154.86	
10 21 13 19-0031	EA		30" x 55" x 1", Recycled Solid Plastic (HDPE), Toilet Partition Door.....	302.79	16.17
			For Heavy Gauge Full-Height SS Hinge, Add	40.42	
			For NFPA Class A, Add	167.68	
10 21 13 19-0032	EA		34" x 55" x 1", Recycled Solid Plastic (HDPE), ADA Compliant Toilet Partition Door.....	344.95	16.17
			For Heavy Gauge Full-Height SS Hinge, Add	40.42	
			For NFPA Class A, Add	193.82	
10 21 13 19-0033	EA		36" x 55" x 1", Recycled Solid Plastic (HDPE), ADA Compliant Toilet Partition Door.....	354.93	16.17
			For Heavy Gauge Full-Height SS Hinge, Add	40.42	
			For NFPA Class A, Add	200.01	
10 21 13 19-0034			Recycled Solid Plastic (HDPE), Toilet Partition Panels ^(10 21 13 19-0027)		
10 21 13 19-0035	EA		6" x 55" x 1", Recycled Solid Plastic (HDPE), Toilet Partition Panel.....	93.86	21.56
			For Heavy Gauge Full-Height SS Brackets, Add	25.12	
			For NFPA Class A, Add	31.46	
10 21 13 19-0036	EA		12" x 55" x 1", Recycled Solid Plastic (HDPE), Toilet Partition Panel.....	148.21	23.36
			For Heavy Gauge Full-Height SS Brackets, Add	25.12	
			For NFPA Class A, Add	62.92	



Specialties	10
Interior Specialties	10 20
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MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 21 13 19-0037	EA		18" x 55" x 1", Recycled Solid Plastic (HDPE), Toilet Partition Panel..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	202.53 25.12 94.38	25.16
10 21 13 19-0038	EA		24" x 55" x 1", Recycled Solid Plastic (HDPE), Toilet Partition Panel..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	236.05 25.12 112.93	26.95
10 21 13 19-0039	EA		30" x 55" x 1", Recycled Solid Plastic (HDPE), Toilet Partition Panel..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	285.19 25.12 141.17	28.75
10 21 13 19-0040	EA		36" x 55" x 1", Recycled Solid Plastic (HDPE), Toilet Partition Panel..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	304.71 25.12 151.04	30.55
10 21 13 19-0041	EA		42" x 55" x 1", Recycled Solid Plastic (HDPE), Toilet Partition Panel..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	341.77 25.12 171.79	32.34
10 21 13 19-0042	EA		48" x 55" x 1", Recycled Solid Plastic (HDPE), Toilet Partition Panel..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	384.94 25.12 196.33	34.14
10 21 13 19-0043	EA		55" x 55" x 1", Recycled Solid Plastic (HDPE), Toilet Partition Panel..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	420.22 25.12 215.98	35.94
10 21 13 19-0044	EA		58" x 55" x 1", Recycled Solid Plastic (HDPE), Toilet Partition Panel..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	429.34 25.12 220.74	36.65
10 21 13 19-0045	EA		60" x 55" x 1", Recycled Solid Plastic (HDPE), Toilet Partition Panel..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	443.76 25.12 228.35	37.73
10 21 13 19-0046	EA		70" x 55" x 1", Recycled Solid Plastic (HDPE), Toilet Partition Panel..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	501.09 25.12 261.66	39.53
10 21 13 19-0047	EA		78" x 55" x 1", Recycled Solid Plastic (HDPE), Toilet Partition Panel..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	539.85 25.12 283.46	41.33
10 21 13 19-0048			82" Long, Recycled Solid Plastic (HDPE), Toilet Partition Pilasters <small>(10 21 13 19-0027)</small>		
10 21 13 19-0049	EA		Up To 4" x 82" x 1", Recycled Solid Plastic (HDPE), Toilet Partition Pilaster..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	119.31 25.12 60.61	10.78
10 21 13 19-0050	EA		5" x 82" x 1", Recycled Solid Plastic (HDPE), Toilet Partition Pilaster..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	132.71 25.12 66.68	12.57
10 21 13 19-0051	EA		6" x 82" x 1", Recycled Solid Plastic (HDPE), Toilet Partition Pilaster..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	144.38 25.12 71.69	14.38
10 21 13 19-0052	EA		8" x 82" x 1", Recycled Solid Plastic (HDPE), Toilet Partition Pilaster..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	155.20 25.12 76.17	16.17
10 21 13 19-0053	EA		10" x 82" x 1", Recycled Solid Plastic (HDPE), Toilet Partition Pilaster..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	174.23 25.12 85.74	17.96
10 21 13 19-0054	EA		12" x 82" x 1", Recycled Solid Plastic (HDPE), Toilet Partition Pilaster..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	193.24 25.12 95.30	19.77
10 21 13 19-0055	EA		18" x 82" x 1", Recycled Solid Plastic (HDPE), Toilet Partition Pilaster..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	264.54 25.12 137.28	21.56
10 21 13 19-0056	EA		22" x 82" x 1", Recycled Solid Plastic (HDPE), Toilet Partition Pilaster..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	298.93 25.12 156.37	23.36
10 21 13 19-0057	EA		24" x 82" x 1", Recycled Solid Plastic (HDPE), Toilet Partition Pilaster..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	325.44 25.12 170.58	25.16
10 21 13 19-0058			96" To 120", Recycled Solid Plastic (HDPE), Toilet Partition Pilasters <small>(10 21 13 19-0027)</small>		
10 21 13 19-0059	EA		Up To 4" x 96" To 120" x 1", Recycled Solid Plastic (HDPE), Toilet Partition Pilaster..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	145.82 25.12 72.58	14.38
10 21 13 19-0060	EA		5" x 96" To 120" x 1", Recycled Solid Plastic (HDPE), Toilet Partition Pilaster..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	160.56 25.12 79.50	16.17
10 21 13 19-0061	EA		6" x 96" To 120" x 1", Recycled Solid Plastic (HDPE), Toilet Partition Pilaster..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	176.87 25.12 87.38	17.96
10 21 13 19-0062	EA		8" x 96" To 120" x 1", Recycled Solid Plastic (HDPE), Toilet Partition Pilaster..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	200.33 25.12 99.70	19.77
10 21 13 19-0063	EA		10" x 96" To 120" x 1", Recycled Solid Plastic (HDPE), Toilet Partition Pilaster..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	224.00 25.12 112.15	21.56
10 21 13 19-0064	EA		12" x 96" To 120" x 1", Recycled Solid Plastic (HDPE), Toilet Partition Pilaster..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	247.47 25.12 124.47	23.36

10 Specialties**10 20 Interior Specialties****10 21 Compartments And Cubicles**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 21 13 19-0065	EA		18" x 96" To 120" x 1", Recycled Solid Plastic (HDPE), Toilet Partition Pilaster <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	316.54 25.12 165.06	25.16
10 21 13 19-0066	EA		22" x 96" To 120" x 1", Recycled Solid Plastic (HDPE), Toilet Partition Pilaster <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	354.02 25.12 186.07	26.95
10 21 13 19-0067	EA		24 x 96" To 120" x 1", Recycled Solid Plastic (HDPE), Toilet Partition Pilaster <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	384.90 25.12 202.99	28.75
10 21 13 19-0068			Antimicrobial Recycled Solid Polymer (HDPE) Toilet Partitions And Urinal Screens <small>(10 21 13 19)</small> Note: Complete toilet partitions for corner installations. Includes 1" door, 1" pilaster, 1" separator panel, trim shoes, and hardware as required. For alcove, recessed or configurations other than corner installations use either: (1) the appropriate corner unit and add individual components or (2) individual components. Individual components include trim shoes and hardware as required. Constructed of high density polyethylene (HDPE). Includes Class B fire rating.		
10 21 13 19-0069			Antimicrobial Recycled Solid Plastic (HDPE) Toilet Partitions <small>(10 21 13 19-0068)</small> Note: Includes all standard Columbia Partitions colors.		
10 21 13 19-0070			Overhead Braced, Antimicrobial Recycled Solid Plastic (HDPE), Complete Toilet Partitions <small>(10 21 13 19-0069)</small> Note: Includes headrail.		
10 21 13 19-0071	EA		36" x 60", Overhead Braced, Antimicrobial Solid Plastic (HDPE), One Compartment Corner Unit, Complete Toilet Partition <i>For >10, Deduct</i> <i>For Heavy Gauge Full-Height SS Hinges And Brackets, Add</i> <i>For NFPA Class A, Add</i>	1,398.37 -120.07 90.66 744.45	98.82
10 21 13 19-0072	EA		60" x 60", Overhead Braced, Antimicrobial Solid Plastic (HDPE), One Compartment Corner Unit, Complete ADA Compliant Toilet Partition..... <i>For Heavy Gauge Full-Height SS Hinges And Brackets, Add</i> <i>For NFPA Class A, Add</i>	1,728.99 90.66 940.52	106.02
10 21 13 19-0073	EA		60" x 78", Overhead Braced, Antimicrobial Solid Plastic (HDPE), One Compartment Corner Unit, Complete ADA Compliant Toilet Partition..... <i>For Heavy Gauge Full-Height SS Hinges And Brackets, Add</i> <i>For NFPA Class A, Add</i>	1,919.71 90.66 1,054.32	109.60
10 21 13 19-0074			Floor And Ceiling Anchored, Antimicrobial Recycled Solid Plastic (HDPE), Complete Toilet Partitions <small>(10 21 13 19-0069)</small> Note: Excludes above ceiling steel.		
10 21 13 19-0075	EA		36" x 60", Floor And Ceiling Anchored, Antimicrobial Solid Plastic (HDPE), One Compartment Corner Unit, Complete Toilet Partition <i>For >10, Deduct</i> <i>For Heavy Gauge Full-Height SS Hinges And Brackets, Add</i> <i>For NFPA Class A, Add</i>	1,388.82 -115.52 90.66 716.25	116.79
10 21 13 19-0076	EA		60" x 60", Floor And Ceiling Anchored, Antimicrobial Solid Plastic (HDPE), One Compartment Corner Unit, Complete ADA Compliant Toilet Partition <i>For Heavy Gauge Full-Height SS Hinges And Brackets, Add</i> <i>For NFPA Class A, Add</i>	1,748.80 90.66 930.52	123.98
10 21 13 19-0077	EA		60" x 78", Floor And Ceiling Anchored, Antimicrobial Solid Plastic (HDPE), One Compartment Corner Unit, Complete ADA Compliant Toilet Partition <i>For Heavy Gauge Full-Height SS Hinges And Brackets, Add</i> <i>For NFPA Class A, Add</i>	1,939.53 90.66 1,044.32	127.57
10 21 13 19-0078			Ceiling Hung, Antimicrobial Recycled Solid Plastic (HDPE), Complete Toilet Partitions <small>(10 21 13 19-0069)</small> Note: Excludes above ceiling steel.		
10 21 13 19-0079	EA		36" x 60", Ceiling Hung, Antimicrobial Solid Plastic (HDPE), One Compartment Corner Unit, Complete Toilet Partition <i>For >10, Deduct</i> <i>For Heavy Gauge Full-Height SS Hinges And Brackets, Add</i> <i>For NFPA Class A, Add</i>	1,450.96 -118.14 90.66 732.49	134.76
10 21 13 19-0080	EA		60" x 60", Ceiling Hung, Antimicrobial Solid Plastic (HDPE), One Compartment Corner Unit, Complete ADA Compliant Toilet Partition..... <i>For Heavy Gauge Full-Height SS Hinges And Brackets, Add</i> <i>For NFPA Class A, Add</i>	1,730.08 90.66 896.64	141.94
10 21 13 19-0081	EA		60" x 78", Ceiling Hung, Antimicrobial Solid Plastic (HDPE), One Compartment Corner Unit, Complete ADA Compliant Toilet Partition..... <i>For Heavy Gauge Full-Height SS Hinges And Brackets, Add</i> <i>For NFPA Class A, Add</i>	1,920.82 90.66 1,010.44	145.54
10 21 13 19-0082			Antimicrobial Recycled Solid Plastic (HDPE) Urinal Screens <small>(10 21 13 19-0068)</small> Note: Includes all standard Columbia Partitions colors.		
10 21 13 19-0083			Wall Hung, Antimicrobial Recycled Solid Plastic (HDPE), Urinal Screens <small>(10 21 13 19-0082)</small>		
10 21 13 19-0084	EA		18" x 42" x 1", Wall Hung, Antimicrobial Recycled Solid Plastic (HDPE), Urinal Screen..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	316.22 25.12 142.61	43.10



Specialties	10
Interior Specialties	10 20
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MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 21 13 19-0085 EA 24" x 42" x 1", Wall Hung, Antimicrobial Recycled Solid Plastic (HDPE), Urinal Screen <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	330.29 25.12 146.88	46.70
10 21 13 19-0086 Wall Hung And Post Supported, Antimicrobial Recycled Solid Plastic (HDPE), Urinal Screens <small>(10 21 13 19-0082)</small>		
10 21 13 19-0087 EA 18" x 42" x 1", Wall Hung And Post Supported, Antimicrobial Recycled Solid Plastic (HDPE), Urinal Screen <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	510.26 25.12 258.46	46.70
10 21 13 19-0088 EA 24" x 42" x 1", Wall Hung And Post Supported, Antimicrobial Recycled Solid Plastic (HDPE), Urinal Screen <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	580.14 25.12 297.33	50.29
10 21 13 19-0089 EA 30" x 42" x 1", Wall Hung And Post Supported, Antimicrobial Recycled Solid Plastic (HDPE), Urinal Screen <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	618.51 25.12 316.67	53.88
10 21 13 19-0090 Wall Hung And Overhead Braced, Antimicrobial Recycled Solid Plastic (HDPE), Urinal Screens <small>(10 21 13 19-0082)</small>		
10 21 13 19-0091 EA 24" x 55" x 1", Wall Hung And Overhead Braced, Antimicrobial Recycled Solid Plastic (HDPE), Urinal Screen <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	413.22 25.12 193.84	50.29
10 21 13 19-0092 EA 36" x 55" x 1", Wall Hung And Overhead Braced, Antimicrobial Recycled Solid Plastic (HDPE), Urinal Screen <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	524.63 25.12 258.46	53.88
10 21 13 19-0093 EA 48" x 55" x 1", Wall Hung And Overhead Braced, Antimicrobial Recycled Solid Plastic (HDPE), Urinal Screen <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	625.69 25.12 316.67	57.47
10 21 13 19-0094 Antimicrobial Recycled Solid Plastic (HDPE) Toilet Partition Doors, Panels And Pilasters <small>(10 21 13 19-0088)</small>		
Note: Includes all standard Columbia Partitions colors.		
10 21 13 19-0095 Antimicrobial Recycled Solid Plastic (HDPE), Toilet Partition Doors <small>(10 21 13 19-0094)</small>		
10 21 13 19-0096 EA 24" x 55" x 1", Antimicrobial Recycled Solid Plastic (HDPE), Toilet Partition Door <i>For Heavy Gauge Full-Height SS Hinge, Add</i> <i>For NFPA Class A, Add</i>	337.81 40.42 191.62	14.38
10 21 13 19-0097 EA 26" x 55" x 1", Antimicrobial Recycled Solid Plastic (HDPE), Toilet Partition Door <i>For Heavy Gauge Full-Height SS Hinge, Add</i> <i>For NFPA Class A, Add</i>	365.94 40.42 209.06	14.38
10 21 13 19-0098 EA 30" x 55" x 1", Antimicrobial Recycled Solid Plastic (HDPE), Toilet Partition Door <i>For Heavy Gauge Full-Height SS Hinge, Add</i> <i>For NFPA Class A, Add</i>	397.44 40.42 226.36	16.17
10 21 13 19-0099 EA 34" x 55" x 1", Antimicrobial Recycled Solid Plastic (HDPE), ADA Compliant Toilet Partition Door <i>For Heavy Gauge Full-Height SS Hinge, Add</i> <i>For NFPA Class A, Add</i>	454.37 40.42 261.66	16.17
10 21 13 19-0100 EA 36" x 55" x 1", Antimicrobial Recycled Solid Plastic (HDPE), ADA Compliant Toilet Partition Door <i>For Heavy Gauge Full-Height SS Hinge, Add</i> <i>For NFPA Class A, Add</i>	467.83 40.42 270.00	16.17
10 21 13 19-0101 Antimicrobial Recycled Solid Plastic (HDPE), Toilet Partition Panels <small>(10 21 13 19-0094)</small>		
10 21 13 19-0102 EA 6" x 55" x 1", Antimicrobial Recycled Solid Plastic (HDPE), Toilet Partition Panel <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	111.62 25.12 42.47	21.56
10 21 13 19-0103 EA 12" x 55" x 1", Antimicrobial Recycled Solid Plastic (HDPE), Toilet Partition Panel <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	183.72 25.12 84.94	23.36
10 21 13 19-0104 EA 18" x 55" x 1", Antimicrobial Recycled Solid Plastic (HDPE), Toilet Partition Panel <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	255.81 25.12 127.41	25.16
10 21 13 19-0105 EA 24" x 55" x 1", Antimicrobial Recycled Solid Plastic (HDPE), Toilet Partition Panel <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	299.79 25.12 152.45	26.95
10 21 13 19-0106 EA 30" x 55" x 1", Antimicrobial Recycled Solid Plastic (HDPE), Toilet Partition Panel <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	364.87 25.12 190.57	28.75
10 21 13 19-0107 EA 36" x 55" x 1", Antimicrobial Recycled Solid Plastic (HDPE), Toilet Partition Panel <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	389.97 25.12 203.91	30.55
10 21 13 19-0108 EA 42" x 55" x 1", Antimicrobial Recycled Solid Plastic (HDPE), Toilet Partition Panel <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	438.75 25.12 231.92	32.34
10 21 13 19-0109 EA 48" x 55" x 1", Antimicrobial Recycled Solid Plastic (HDPE), Toilet Partition Panel <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	495.77 25.12 265.04	34.14
10 21 13 19-0110 EA 55" x 55" x 1", Antimicrobial Recycled Solid Plastic (HDPE), Toilet Partition Panel <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	542.14 25.12 291.57	35.94

10 Specialties**10 20 Interior Specialties****10 21 Compartments And Cubicles**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 21 13 19-0111	EA		58" x 55" x 1", Antimicrobial Recycled Solid Plastic (HDPE), Toilet Partition Panel.....	553.94	36.65
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
			<i>For NFPA Class A, Add</i>	297.99	
10 21 13 19-0112	EA		60" x 55" x 1", Antimicrobial Recycled Solid Plastic (HDPE), Toilet Partition Panel.....	572.66	37.73
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
			<i>For NFPA Class A, Add</i>	308.26	
10 21 13 19-0113	EA		70" x 55" x 1", Antimicrobial Recycled Solid Plastic (HDPE), Toilet Partition Panel.....	648.80	39.53
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
			<i>For NFPA Class A, Add</i>	353.24	
10 21 13 19-0114	EA		78" x 55" x 1", Antimicrobial Recycled Solid Plastic (HDPE), Toilet Partition Panel.....	699.87	41.33
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
			<i>For NFPA Class A, Add</i>	382.68	
10 21 13 19-0115			82" Long, Antimicrobial Recycled Solid Plastic (HDPE), Toilet Partition		
			Pilasters <small>(10 21 13 19-0094)</small>		
10 21 13 19-0116	EA		Up To 4" x 82" x 1", Antimicrobial Recycled Solid Plastic (HDPE), Toilet Partition Pilaster	153.52	10.78
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
			<i>For NFPA Class A, Add</i>	81.82	
10 21 13 19-0117	EA		5" x 82" x 1", Antimicrobial Recycled Solid Plastic (HDPE), Toilet Partition Pilaster	170.35	12.57
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
			<i>For NFPA Class A, Add</i>	90.02	
10 21 13 19-0118	EA		6" x 82" x 1", Antimicrobial Recycled Solid Plastic (HDPE), Toilet Partition Pilaster	184.85	14.38
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
			<i>For NFPA Class A, Add</i>	96.78	
10 21 13 19-0119	EA		8" x 82" x 1", Antimicrobial Recycled Solid Plastic (HDPE), Toilet Partition Pilaster	213.28	16.17
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
			<i>For NFPA Class A, Add</i>	112.18	
10 21 13 19-0120	EA		10" x 82" x 1", Antimicrobial Recycled Solid Plastic (HDPE), Toilet Partition Pilaster	239.62	17.96
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
			<i>For NFPA Class A, Add</i>	126.28	
10 21 13 19-0121	EA		12" x 82" x 1", Antimicrobial Recycled Solid Plastic (HDPE), Toilet Partition Pilaster	265.91	19.77
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
			<i>For NFPA Class A, Add</i>	140.36	
10 21 13 19-0122	EA		18" x 82" x 1", Antimicrobial Recycled Solid Plastic (HDPE), Toilet Partition Pilaster	342.03	21.56
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
			<i>For NFPA Class A, Add</i>	185.32	
10 21 13 19-0123	EA		22" x 82" x 1", Antimicrobial Recycled Solid Plastic (HDPE), Toilet Partition Pilaster	387.20	23.36
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
			<i>For NFPA Class A, Add</i>	211.10	
10 21 13 19-0124	EA		24" x 82" x 1", Antimicrobial Recycled Solid Plastic (HDPE), Toilet Partition Pilaster	421.74	25.16
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
			<i>For NFPA Class A, Add</i>	230.29	
10 21 13 19-0125			96" To 120", Antimicrobial Recycled Solid Plastic (HDPE), Toilet Partition		
			Pilasters <small>(10 21 13 19-0094)</small>		
10 21 13 19-0126	EA		Up To 4" x 96" To 120" x 1", Antimicrobial Recycled Solid Plastic (HDPE), Toilet Partition Pilaster.....	186.80	14.38
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
			<i>For NFPA Class A, Add</i>	97.99	
10 21 13 19-0127	EA		5" x 96" To 120" x 1", Antimicrobial Recycled Solid Plastic (HDPE), Toilet Partition Pilaster	205.44	16.17
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
			<i>For NFPA Class A, Add</i>	107.32	
10 21 13 19-0128	EA		6" x 96" To 120" x 1", Antimicrobial Recycled Solid Plastic (HDPE), Toilet Partition Pilaster	226.21	17.96
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
			<i>For NFPA Class A, Add</i>	117.97	
10 21 13 19-0129	EA		8" x 96" To 120" x 1", Antimicrobial Recycled Solid Plastic (HDPE), Toilet Partition Pilaster	256.61	19.77
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
			<i>For NFPA Class A, Add</i>	134.59	
10 21 13 19-0130	EA		10" x 96" To 120" x 1", Antimicrobial Recycled Solid Plastic (HDPE), Toilet Partition Pilaster.....	287.32	21.56
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
			<i>For NFPA Class A, Add</i>	151.40	
10 21 13 19-0131	EA		12" x 96" To 120" x 1", Antimicrobial Recycled Solid Plastic (HDPE), Toilet Partition Pilaster.....	317.73	23.36
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
			<i>For NFPA Class A, Add</i>	168.03	
10 21 13 19-0132	EA		18" x 96" To 120" x 1", Antimicrobial Recycled Solid Plastic (HDPE), Toilet Partition Pilaster.....	409.73	25.16
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
			<i>For NFPA Class A, Add</i>	222.84	
10 21 13 19-0133	EA		22" x 96" To 120" x 1", Antimicrobial Recycled Solid Plastic (HDPE), Toilet Partition Pilaster.....	459.06	26.95
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
			<i>For NFPA Class A, Add</i>	251.20	
10 21 13 19-0134	EA		24" x 96" To 120" x 1", Antimicrobial Recycled Solid Plastic (HDPE), Toilet Partition Pilaster.....	499.49	28.75
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
			<i>For NFPA Class A, Add</i>	274.03	
10 21 13 19-0135			Solid Phenolic Toilet Partitions And Urinal Screens <small>(10 21 13 19)</small>		
			Note: Complete toilet partitions for corner installations. Includes 3/4" door, 3/4" pilaster, 1/2" separator panel, trim shoes, and standard stainless steel hardware as required. For alcove, recessed or configurations other than corner installations use either: (1) the appropriate corner unit and add individual components or (2) individual components. Individual components include trim shoes and standard stainless steel hardware as required. Constructed of solid phenolic (resin impregnated kraft paper) core with a high pressure decorative matte surface finish as an integral part of the core material. Includes Class B fire rating.		



Specialties	10
Interior Specialties	10 20
Compartments And Cubicles	10 21

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MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 21 13 19-0136 Solid Phenolic Toilet Partitions <small>(10 21 13 19-0135)</small> Note: Includes all standard Bobrick colors.		
10 21 13 19-0137 Floor Anchored, Solid Phenolic, Complete Toilet Partitions <small>(10 21 13 19-0136)</small>		
10 21 13 19-0138 EA 36" x 60", Floor Anchored, Solid Phenolic, One Compartment Corner Unit, Complete Toilet Partition.....	889.01	80.86
For >10, Deduct	-72.73	
For Heavy Gauge Full-Height SS Hinges And Brackets, Add	90.66	
For NFPA Class A, Add	160.82	
10 21 13 19-0139 EA 60" x 60", Floor Anchored, Solid Phenolic, One Compartment Corner Unit, Complete ADA Compliant Toilet Partition	1,084.70	88.04
For Heavy Gauge Full-Height SS Hinges And Brackets, Add	90.66	
For NFPA Class A, Add	199.61	
10 21 13 19-0140 EA 60" x 78", Floor Anchored, Solid Phenolic, One Compartment Corner Unit, Complete ADA Compliant Toilet Partition	1,206.81	91.64
For Heavy Gauge Full-Height SS Hinges And Brackets, Add	90.66	
For NFPA Class A, Add	224.11	
10 21 13 19-0141 Overhead Braced, Solid Phenolic, Complete Toilet Partitions <small>(10 21 13 19-0136)</small> Note: Includes headrail.		
10 21 13 19-0142 EA 36" x 60", Overhead Braced, Solid Phenolic, One Compartment Corner Unit, Complete Toilet Partition	992.93	98.82
For >10, Deduct	-79.53	
For Heavy Gauge Full-Height SS Hinges And Brackets, Add	90.66	
For NFPA Class A, Add	176.89	
10 21 13 19-0143 EA 60" x 60", Overhead Braced, Solid Phenolic, One Compartment Corner Unit, Complete ADA Compliant Toilet Partition	1,196.21	106.02
For Heavy Gauge Full-Height SS Hinges And Brackets, Add	90.66	
For NFPA Class A, Add	217.28	
10 21 13 19-0144 EA 60" x 78", Overhead Braced, Solid Phenolic, One Compartment Corner Unit, Complete ADA Compliant Toilet Partition	1,324.09	109.60
For Heavy Gauge Full-Height SS Hinges And Brackets, Add	90.66	
For NFPA Class A, Add	242.99	
10 21 13 19-0145 Floor And Ceiling Anchored, Solid Phenolic, Complete Toilet Partitions <small>(10 21 13 19-0136)</small> Note: Excludes above ceiling steel.		
10 21 13 19-0146 EA 36" x 60", Floor And Ceiling Anchored, Solid Phenolic, One Compartment Corner Unit, Complete Toilet Partition	1,035.08	116.79
For >10, Deduct	-80.15	
For Heavy Gauge Full-Height SS Hinges And Brackets, Add	90.66	
For NFPA Class A, Add	179.99	
10 21 13 19-0147 EA 60" x 60", Floor And Ceiling Anchored, Solid Phenolic, One Compartment Corner Unit, Complete ADA Compliant Toilet Partition.....	1,236.96	123.98
For Heavy Gauge Full-Height SS Hinges And Brackets, Add	90.66	
For NFPA Class A, Add	220.09	
10 21 13 19-0148 EA 60" x 78", Floor And Ceiling Anchored, Solid Phenolic, One Compartment Corner Unit, Complete ADA Compliant Toilet Partition.....	1,359.05	127.57
For Heavy Gauge Full-Height SS Hinges And Brackets, Add	90.66	
For NFPA Class A, Add	244.58	
10 21 13 19-0149 Ceiling Hung, Solid Phenolic, Complete Toilet Partitions <small>(10 21 13 19-0136)</small> Note: Excludes above ceiling steel.		
10 21 13 19-0150 EA 36" x 60", Ceiling Hung, Solid Phenolic, One Compartment Corner Unit, Complete Toilet Partition.....	1,033.93	134.76
For >10, Deduct	-76.44	
For Heavy Gauge Full-Height SS Hinges And Brackets, Add	90.66	
For NFPA Class A, Add	174.00	
10 21 13 19-0151 EA 60" x 60", Ceiling Hung, Solid Phenolic, One Compartment Corner Unit, Complete ADA Compliant Toilet Partition	1,229.48	141.94
For Heavy Gauge Full-Height SS Hinges And Brackets, Add	90.66	
For NFPA Class A, Add	212.77	
10 21 13 19-0152 EA 60" x 78", Ceiling Hung, Solid Phenolic, One Compartment Corner Unit, Complete ADA Compliant Toilet Partition	1,351.58	145.54
For Heavy Gauge Full-Height SS Hinges And Brackets, Add	90.66	
For NFPA Class A, Add	237.26	
10 21 13 19-0153 Solid Phenolic Urinal Screens <small>(10 21 13 19-0135)</small> Note: Includes all standard Bobrick colors.		
10 21 13 19-0154 Floor Anchored, Solid Phenolic, Urinal Screens <small>(10 21 13 19-0153)</small>		
10 21 13 19-0155 EA 24" x 58" x 1/2", Floor Anchored, Solid Phenolic, Urinal Screen.....	337.61	50.29
For Heavy Gauge Full-Height SS Brackets, Add	25.12	
For NFPA Class A, Add	54.81	
10 21 13 19-0156 EA 36" x 58" x 1/2", Floor Anchored, Solid Phenolic, Urinal Screen.....	379.74	53.88
For Heavy Gauge Full-Height SS Brackets, Add	25.12	
For NFPA Class A, Add	62.50	
10 21 13 19-0157 EA 48" x 58" x 1/2", Floor Anchored, Solid Phenolic, Urinal Screen.....	450.73	57.47
For Heavy Gauge Full-Height SS Brackets, Add	25.12	
For NFPA Class A, Add	76.26	
10 21 13 19-0158 Wall Hung, Solid Phenolic, Urinal Screens <small>(10 21 13 19-0153)</small>		
10 21 13 19-0159 EA 18" x 42" x 1/2", Wall Hung, Solid Phenolic, Urinal Screen.....	223.07	43.10
For Heavy Gauge Full-Height SS Brackets, Add	25.12	
For NFPA Class A, Add	33.05	

10 Specialties**10 20 Interior Specialties****10 21 Compartments And Cubicles**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 21 13 19-0160	EA		24" x 42" x 1/2", Wall Hung, Solid Phenolic, Urinal Screen..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	256.23 25.12 38.87	46.70
10 21 13 19-0161	EA		30" x 42" x 1/2", Wall Hung, Solid Phenolic, Urinal Screen..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	304.16 25.12 47.78	50.29
10 21 13 19-0162			Wall Hung And Post Supported, Solid Phenolic, Urinal Screens (10 21 13 19-0153)		
10 21 13 19-0163	EA		18" x 58" x 1/2", Wall Hung And Post Supported, Solid Phenolic, Urinal Screen..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	228.47 25.12 33.04	46.70
10 21 13 19-0164	EA		24" x 58" x 1/2", Wall Hung And Post Supported, Solid Phenolic, Urinal Screen..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	280.67 25.12 42.85	50.29
10 21 13 19-0165	EA		30" x 58" x 1/2", Wall Hung And Post Supported, Solid Phenolic, Urinal Screen..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	324.88 25.12 50.98	53.88
10 21 13 19-0166			Wall Hung And Overhead Braced, Solid Phenolic, Urinal Screens (10 21 13 19-0153)		
10 21 13 19-0167	EA		22" x 58" x 1/2", Wall Hung And Overhead Braced, Solid Phenolic, Urinal Screen <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	344.10 25.12 57.32	46.70
10 21 13 19-0168	EA		36" x 58" x 1/2", Wall Hung And Overhead Braced, Solid Phenolic, Urinal Screen <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	386.45 25.12 65.06	50.29
10 21 13 19-0169	EA		48" x 58" x 1/2", Wall Hung And Overhead Braced, Solid Phenolic, Urinal Screen <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	458.76 25.12 79.10	53.88
10 21 13 19-0170			Solid Phenolic Toilet Partition Doors, Panels And Pilasters (10 21 13 19-0135) Note: Includes all standard Bobrick colors.		
10 21 13 19-0171			Solid Phenolic, Toilet Partition Doors (10 21 13 19-0170)		
10 21 13 19-0172	EA		24" x 58" x 3/4", Solid Phenolic, Toilet Partition Door <i>For Heavy Gauge Full-Height SS Hinge, Add</i> <i>For NFPA Class A, Add</i>	236.05 40.42 44.97	14.38
10 21 13 19-0173	EA		26" x 58" x 3/4", Solid Phenolic, Toilet Partition Door <i>For Heavy Gauge Full-Height SS Hinge, Add</i> <i>For NFPA Class A, Add</i>	243.85 40.42 46.61	14.38
10 21 13 19-0174	EA		30" x 58" x 3/4", Solid Phenolic, Toilet Partition Door <i>For Heavy Gauge Full-Height SS Hinge, Add</i> <i>For NFPA Class A, Add</i>	267.44 40.42 50.99	16.17
10 21 13 19-0175	EA		34" x 58" x 3/4", Solid Phenolic, ADA Compliant Toilet Partition Door..... <i>For Heavy Gauge Full-Height SS Hinge, Add</i> <i>For NFPA Class A, Add</i>	287.77 40.42 55.26	16.17
10 21 13 19-0176	EA		36" x 58" x 3/4", Solid Phenolic, ADA Compliant Toilet Partition Door..... <i>For Heavy Gauge Full-Height SS Hinge, Add</i> <i>For NFPA Class A, Add</i>	308.65 40.42 59.64	16.17
10 21 13 19-0177			Solid Phenolic, Toilet Partition Panels (10 21 13 19-0170)		
10 21 13 19-0178	EA		6" x 58" x 1/2", Solid Phenolic, Toilet Partition Panel..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	86.32 25.12 11.23	21.56
10 21 13 19-0179	EA		12" x 58" x 1/2", Solid Phenolic, Toilet Partition Panel..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	111.51 25.12 15.94	23.36
10 21 13 19-0180	EA		18" x 58" x 1/2", Solid Phenolic, Toilet Partition Panel..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	147.48 25.12 22.92	25.16
10 21 13 19-0181	EA		24" x 58" x 1/2", Solid Phenolic, Toilet Partition Panel..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	183.83 25.12 29.98	26.95
10 21 13 19-0182	EA		30" x 58" x 1/2", Solid Phenolic, Toilet Partition Panel..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	204.13 25.12 33.67	28.75
10 21 13 19-0183	EA		36" x 58" x 1/2", Solid Phenolic, Toilet Partition Panel..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	225.37 25.12 37.55	30.55
10 21 13 19-0184	EA		42" x 58" x 1/2", Solid Phenolic, Toilet Partition Panel..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	260.80 25.12 44.42	32.34
10 21 13 19-0185	EA		48" x 58" x 1/2", Solid Phenolic, Toilet Partition Panel..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	297.24 25.12 51.50	34.14
10 21 13 19-0186	EA		55" x 58" x 1/2", Solid Phenolic, Toilet Partition Panel..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	316.71 25.12 55.01	35.94
10 21 13 19-0187	EA		58" x 58" x 1/2", Solid Phenolic, Toilet Partition Panel..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	325.37 25.12 56.60	36.65



Specialties	10	10
Interior Specialties	10 20	
Compartments And Cubicles	10 21	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 21 13 19-0188	EA		60" x 58" x 1/2", Solid Phenolic, Toilet Partition Panel..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	331.86 25.12 57.62	37.73
10 21 13 19-0189	EA		70" x 58" x 1/2", Solid Phenolic, Toilet Partition Panel..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	379.33 25.12 67.01	39.53
10 21 13 19-0190	EA		78" x 58" x 1/2", Solid Phenolic, Toilet Partition Panel..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	453.95 25.12 82.11	41.33
10 21 13 19-0191			69" Long, Solid Phenolic, Toilet Partition Pilasters <small>(10 21 13 19-0170)</small>		
10 21 13 19-0192	EA		Up To 4" x 69" x 3/4", Solid Phenolic, Toilet Partition Pilaster <i>For 1" Pilaster, Add</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	114.82 11.66 25.12 20.66	10.78
10 21 13 19-0193	EA		5" x 69" x 3/4", Solid Phenolic, Toilet Partition Pilaster <i>For 1" Pilaster, Add</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	132.28 13.39 25.12 23.75	12.57
10 21 13 19-0194	EA		6" x 69" x 3/4", Solid Phenolic, Toilet Partition Pilaster <i>For 1" Pilaster, Add</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	135.87 13.39 25.12 23.93	14.38
10 21 13 19-0195	EA		8" x 69" x 3/4", Solid Phenolic, Toilet Partition Pilaster <i>For 1" Pilaster, Add</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	157.07 15.59 25.12 27.81	16.17
10 21 13 19-0196	EA		10" x 69" x 3/4", Solid Phenolic, Toilet Partition Pilaster <i>For 1" Pilaster, Add</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	176.55 17.58 25.12 31.33	17.96
10 21 13 19-0197	EA		12" x 69" x 3/4", Solid Phenolic, Toilet Partition Pilaster <i>For 1" Pilaster, Add</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	196.02 19.56 25.12 34.84	19.77
10 21 13 19-0198	EA		16" x 69" x 3/4", Solid Phenolic, Toilet Partition Pilaster <i>For 1" Pilaster, Add</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	248.40 25.66 25.12 45.26	21.56
10 21 13 19-0199	EA		20" x 69" x 3/4", Solid Phenolic, Toilet Partition Pilaster <i>For 1" Pilaster, Add</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	303.11 32.05 25.12 56.18	23.36
10 21 13 19-0200	EA		24" x 69" x 3/4", Solid Phenolic, Toilet Partition Pilaster <i>For 1" Pilaster, Add</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	318.82 33.56 25.12 58.90	25.16
10 21 13 19-0201			83" Long, Solid Phenolic, Toilet Partition Pilasters <small>(10 21 13 19-0170)</small>		
10 21 13 19-0202	EA		Up To 4" x 83" x 3/4", Solid Phenolic, Toilet Partition Pilaster <i>For 1" Pilaster, Add</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	125.21 12.96 25.12 22.84	10.78
10 21 13 19-0203	EA		5" x 83" x 3/4", Solid Phenolic, Toilet Partition Pilaster <i>For 1" Pilaster, Add</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	146.71 15.19 25.12 26.78	12.57
10 21 13 19-0204	EA		6" x 83" x 3/4", Solid Phenolic, Toilet Partition Pilaster <i>For 1" Pilaster, Add</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	150.30 15.19 25.12 26.96	14.38
10 21 13 19-0205	EA		8" x 83" x 3/4", Solid Phenolic, Toilet Partition Pilaster <i>For 1" Pilaster, Add</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	173.82 17.69 25.12 31.33	16.17
10 21 13 19-0206	EA		10" x 83" x 3/4", Solid Phenolic, Toilet Partition Pilaster <i>For 1" Pilaster, Add</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	196.18 20.03 25.12 35.45	17.96
10 21 13 19-0207	EA		12" x 83" x 3/4", Solid Phenolic, Toilet Partition Pilaster <i>For 1" Pilaster, Add</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	218.69 22.40 25.12 39.60	19.77
10 21 13 19-0208	EA		16" x 83" x 3/4", Solid Phenolic, Toilet Partition Pilaster <i>For 1" Pilaster, Add</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	282.18 29.88 25.12 52.36	21.56
10 21 13 19-0209	EA		20" x 83" x 3/4", Solid Phenolic, Toilet Partition Pilaster <i>For 1" Pilaster, Add</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i> <i>For NFPA Class A, Add</i>	334.73 36.00 25.12 62.82	23.36

10 Specialties**10 20 Interior Specialties****10 21 Compartments And Cubicles**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 21 13 19-0210	EA		24" x 83" x 3/4", Solid Phenolic, Toilet Partition Pilaster	352.47	25.16
			<i>For 1" Pilaster, Add</i>	37.77	
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
			<i>For NFPA Class A, Add</i>	65.97	
10 21 13 19-0211			96" To 120" Long, Solid Phenolic, Toilet Partition Pilasters <small>(10 21 13 19-0170)</small>		
10 21 13 19-0212	EA		Up To 4" x 96" To 120" x 3/4", Solid Phenolic, Toilet Partition Pilaster	142.80	14.38
			<i>For 1" Pilaster, Add</i>	14.26	
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
			<i>For NFPA Class A, Add</i>	25.39	
10 21 13 19-0213	EA		5" x 96" To 120" x 3/4", Solid Phenolic, Toilet Partition Pilaster	168.33	16.17
			<i>For 1" Pilaster, Add</i>	17.00	
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
			<i>For NFPA Class A, Add</i>	30.17	
10 21 13 19-0214	EA		6" x 96" To 120" x 3/4", Solid Phenolic, Toilet Partition Pilaster	171.93	17.96
			<i>For 1" Pilaster, Add</i>	17.00	
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
			<i>For NFPA Class A, Add</i>	30.35	
10 21 13 19-0215	EA		8" x 96" To 120" x 3/4", Solid Phenolic, Toilet Partition Pilaster	197.75	19.77
			<i>For 1" Pilaster, Add</i>	19.78	
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
			<i>For NFPA Class A, Add</i>	35.20	
10 21 13 19-0216	EA		10" x 96" To 120" x 3/4", Solid Phenolic, Toilet Partition Pilaster	223.00	21.56
			<i>For 1" Pilaster, Add</i>	22.49	
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
			<i>For NFPA Class A, Add</i>	39.93	
10 21 13 19-0217	EA		12" x 96" To 120" x 3/4", Solid Phenolic, Toilet Partition Pilaster	248.54	23.36
			<i>For 1" Pilaster, Add</i>	25.23	
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
			<i>For NFPA Class A, Add</i>	44.72	
10 21 13 19-0218	EA		16" x 96" To 120" x 3/4", Solid Phenolic, Toilet Partition Pilaster	323.16	25.16
			<i>For 1" Pilaster, Add</i>	34.11	
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
			<i>For NFPA Class A, Add</i>	59.81	
10 21 13 19-0219	EA		20" x 96" To 120" x 3/4", Solid Phenolic, Toilet Partition Pilaster	373.52	26.95
			<i>For 1" Pilaster, Add</i>	39.95	
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
			<i>For NFPA Class A, Add</i>	69.82	
10 21 13 19-0220	EA		24" x 96" To 120" x 3/4", Solid Phenolic, Toilet Partition Pilaster	393.29	28.75
			<i>For 1" Pilaster, Add</i>	41.97	
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
			<i>For NFPA Class A, Add</i>	73.39	
10 21 13 19-0221			Solid Color Reinforced Composite Toilet Partitions And Urinal Screens <small>(10 21 13 19-0221)</small>		
			Note: Complete toilet partitions for corner installations. Includes 3/4" door, 3/4" pilaster, 1/2" separator panel, trim shoes, and standard stainless steel hardware as required. For alcove, recessed or configurations other than corner installations use either: (1) the appropriate corner unit and add individual components or (2) individual components. Individual components include trim shoes and standard stainless steel hardware as required. Constructed of solid color reinforced composite core with a high pressure decorative matte surface finish as an integral part of the core material.		
10 21 13 19-0222			Solid Color Reinforced Composite Toilet Partitions <small>(10 21 13 19-0221)</small>		
			Note: Includes all standard Bobrick colors.		
10 21 13 19-0223			Floor Anchored, Solid Color Reinforced Composite, Complete Toilet Partitions <small>(10 21 13 19-0222)</small>		
10 21 13 19-0224	EA		36" x 60", Floor Anchored, Solid Color Reinforced Composite, One Compartment Corner Unit, Complete Toilet Partition	976.28	80.86
			<i>For >10, Deduct</i>	-81.46	
			<i>For Heavy Gauge Full-Height SS Hinges And Brackets, Add</i>	90.66	
10 21 13 19-0225	EA		60" x 60", Floor Anchored, Solid Color Reinforced Composite, One Compartment Corner Unit, Complete ADA Compliant Toilet Partition	1,193.73	88.04
			<i>For Heavy Gauge Full-Height SS Hinges And Brackets, Add</i>	90.66	
10 21 13 19-0226	EA		60" x 78", Floor Anchored, Solid Color Reinforced Composite, One Compartment Corner Unit, Complete ADA Compliant Toilet Partition	1,329.63	91.64
			<i>For Heavy Gauge Full-Height SS Hinges And Brackets, Add</i>	90.66	
10 21 13 19-0227			Overhead Braced, Solid Color Reinforced Composite, Complete Toilet Partitions <small>(10 21 13 19-0222)</small>		
			Note: Includes headrail.		
10 21 13 19-0228	EA		36" x 60", Overhead Braced, Solid Color Reinforced Composite, One Compartment Corner Unit, Complete Toilet Partition	1,088.36	98.82
			<i>For >10, Deduct</i>	-89.07	
			<i>For Heavy Gauge Full-Height SS Hinges And Brackets, Add</i>	90.66	
10 21 13 19-0229	EA		60" x 60", Overhead Braced, Solid Color Reinforced Composite, One Compartment Corner Unit, Complete ADA Compliant Toilet Partition	1,314.32	106.02
			<i>For Heavy Gauge Full-Height SS Hinges And Brackets, Add</i>	90.66	
10 21 13 19-0230	EA		60" x 78", Overhead Braced, Solid Color Reinforced Composite, One Compartment Corner Unit, Complete ADA Compliant Toilet Partition	1,456.68	109.60
			<i>For Heavy Gauge Full-Height SS Hinges And Brackets, Add</i>	90.66	



Specialties	10	10
Interior Specialties	10 20	
Compartments And Cubicles	10 21	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 21 13 19-0231 Floor And Ceiling Anchored, Solid Color Reinforced Composite, Complete Toilet Partitions <small>(10 21 13 19-0222)</small>		
Note: Excludes above ceiling steel.		
10 21 13 19-0232 EA 36" x 60", Floor And Ceiling Anchored, Solid Color Reinforced Composite, One Compartment Corner Unit, Complete Toilet Partition	1,131.26	116.79
For >10, Deduct	-89.77	
For Heavy Gauge Full-Height SS Hinges And Brackets, Add	90.66	
10 21 13 19-0233 EA 60" x 60", Floor And Ceiling Anchored, Solid Color Reinforced Composite, One Compartment Corner Unit, Complete ADA Compliant Toilet Partition	1,355.64	123.98
For Heavy Gauge Full-Height SS Hinges And Brackets, Add	90.66	
10 21 13 19-0234 EA 60" x 78", Floor And Ceiling Anchored, Solid Color Reinforced Composite, One Compartment Corner Unit, Complete ADA Compliant Toilet Partition	1,491.52	127.57
For Heavy Gauge Full-Height SS Hinges And Brackets, Add	90.66	
10 21 13 19-0235 Ceiling Hung, Solid Color Reinforced Composite, Complete Toilet Partitions <small>(10 21 13 19-0222)</small>		
Note: Excludes above ceiling steel.		
10 21 13 19-0236 EA 36" x 60", Ceiling Hung, Solid Color Reinforced Composite, One Compartment Corner Unit, Complete Toilet Partition	1,125.65	134.76
For >10, Deduct	-85.61	
For Heavy Gauge Full-Height SS Hinges And Brackets, Add	90.66	
10 21 13 19-0237 EA 60" x 60", Ceiling Hung, Solid Color Reinforced Composite, One Compartment Corner Unit, Complete ADA Compliant Toilet Partition	1,342.95	141.94
For Heavy Gauge Full-Height SS Hinges And Brackets, Add	90.66	
10 21 13 19-0238 EA 60" x 78", Ceiling Hung, Solid Color Reinforced Composite, One Compartment Corner Unit, Complete ADA Compliant Toilet Partition	1,478.84	145.54
For Heavy Gauge Full-Height SS Hinges And Brackets, Add	90.66	
10 21 13 19-0239 Solid Color Reinforced Composite Urinal Screens <small>(10 21 13 19-0221)</small>		
Note: Includes all standard Bobrick colors.		
10 21 13 19-0240 Floor Anchored, Solid Color Reinforced Composite, Toilet Partition Urinal Screens <small>(10 21 13 19-0239)</small>		
10 21 13 19-0241 EA 24" x 58" x 1/2", Floor Anchored, Solid Color Reinforced Composite, Toilet Partition Urinal Screen.....	366.06	50.29
For Heavy Gauge Full-Height SS Brackets, Add	25.12	
10 21 13 19-0242 EA 36" x 58" x 1/2", Floor Anchored, Solid Color Reinforced Composite, Toilet Partition Urinal Screen.....	412.38	53.88
For Heavy Gauge Full-Height SS Brackets, Add	25.12	
10 21 13 19-0243 EA 48" x 58" x 1/2", Floor Anchored, Solid Color Reinforced Composite, Toilet Partition Urinal Screen.....	491.02	57.47
For Heavy Gauge Full-Height SS Brackets, Add	25.12	
10 21 13 19-0244 Wall Hung, Solid Color Reinforced Composite, Toilet Partition Urinal Screens <small>(10 21 13 19-0239)</small>		
10 21 13 19-0245 EA 18" x 42" x 1/2", Wall Hung, Solid Color Reinforced Composite, Toilet Partition Urinal Screen.....	239.49	43.10
For Heavy Gauge Full-Height SS Brackets, Add	25.12	
10 21 13 19-0246 EA 24" x 42" x 1/2", Wall Hung, Solid Color Reinforced Composite, Toilet Partition Urinal Screen.....	275.77	46.70
For Heavy Gauge Full-Height SS Brackets, Add	25.12	
10 21 13 19-0247 EA 30" x 42" x 1/2", Wall Hung, Solid Color Reinforced Composite, Toilet Partition Urinal Screen.....	328.59	50.29
For Heavy Gauge Full-Height SS Brackets, Add	25.12	
10 21 13 19-0248 Wall Hung And Post Supported, Solid Color Reinforced Composite, Toilet Partition Urinal Screens <small>(10 21 13 19-0239)</small>		
10 21 13 19-0249 EA 18" x 58" x 1/2", Wall Hung And Post Supported, Solid Color Reinforced Composite, Toilet Partitiion Urinal Screen.....	244.68	46.70
For Heavy Gauge Full-Height SS Brackets, Add	25.12	
10 21 13 19-0250 EA 24" x 58" x 1/2", Wall Hung And Post Supported, Solid Color Reinforced Composite, Toilet Partition Urinal Screen.....	302.28	50.29
For Heavy Gauge Full-Height SS Brackets, Add	25.12	
10 21 13 19-0251 EA 30" x 58" x 1/2", Wall Hung And Post Supported, Solid Color Reinforced Composite, Toilet Partition Urinal Screen.....	350.94	53.88
For Heavy Gauge Full-Height SS Brackets, Add	25.12	
10 21 13 19-0252 Wall Hung And Overhead Braced, Solid Color Reinforced Composite, Toilet Partition Urinal Screens <small>(10 21 13 19-0239)</small>		
10 21 13 19-0253 EA 22" x 58" x 1/2", Wall Hung And Overhead Braced, Solid Color Reinforced Composite, Toilet Partition Urinal Screen	374.18	46.70
For Heavy Gauge Full-Height SS Brackets, Add	25.12	
10 21 13 19-0254 EA 36" x 58" x 1/2", Wall Hung And Overhead Braced, Solid Color Reinforced Composite, Toilet Partition Urinal Screen	420.76	50.29
For Heavy Gauge Full-Height SS Brackets, Add	25.12	
10 21 13 19-0255 EA 48" x 58" x 1/2", Wall Hung And Overhead Braced, Solid Color Reinforced Composite, Toilet Partition Urinal Screen	500.88	53.88
For Heavy Gauge Full-Height SS Brackets, Add	25.12	
10 21 13 19-0256 Solid Color Reinforced Composite Toilet Partition Doors, Panels And Pilasters <small>(10 21 13 19-0221)</small>		
Note: Includes all standard Bobrick colors. See CSI section 10 21 13 43-0001 for other accessories.		
10 21 13 19-0257 Solid Color Reinforced Composite, Toilet Partition Doors <small>(10 21 13 19-0256)</small>		

10 Specialties**10 20 Interior Specialties****10 21 Compartments And Cubicles**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 21 13 19-0258	EA		24" x 58" x 3/4", Solid Color Reinforced Composite, Toilet Partition Door <i>For Heavy Gauge Full-Height SS Hinge, Add</i>	260.93 40.42	14.38
10 21 13 19-0259	EA		26" x 58" x 3/4", Solid Color Reinforced Composite, Toilet Partition Door <i>For Heavy Gauge Full-Height SS Hinge, Add</i>	269.66 40.42	14.38
10 21 13 19-0260	EA		30" x 58" x 3/4", Solid Color Reinforced Composite, Toilet Partition Door <i>For Heavy Gauge Full-Height SS Hinge, Add</i>	295.66 40.42	16.17
10 21 13 19-0261	EA		34" x 58" x 3/4", Solid Color Reinforced Composite, Toilet Partition Door <i>For Heavy Gauge Full-Height SS Hinge, Add</i>	318.42 40.42	16.17
10 21 13 19-0262	EA		36" x 58" x 3/4", Solid Color Reinforced Composite, Toilet Partition Door <i>For Heavy Gauge Full-Height SS Hinge, Add</i>	341.81 40.42	16.17
10 21 13 19-0263			Solid Color Reinforced Composite, Toilet Partition Panels <small>(10 21 13 19-0266)</small>		
10 21 13 19-0264	EA		6" x 58" x 1/2", Solid Color Reinforced Composite, Toilet Partition Panel..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	91.51 25.12	21.56
10 21 13 19-0265	EA		12" x 58" x 1/2", Solid Color Reinforced Composite, Toilet Partition Panel..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	119.28 25.12	23.36
10 21 13 19-0266	EA		18" x 58" x 1/2", Solid Color Reinforced Composite, Toilet Partition Panel..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	159.14 25.12	25.16
10 21 13 19-0267	EA		24" x 58" x 1/2", Solid Color Reinforced Composite, Toilet Partition Panel..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	199.42 25.12	26.95
10 21 13 19-0268	EA		30" x 58" x 1/2", Solid Color Reinforced Composite, Toilet Partition Panel..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	221.72 25.12	28.75
10 21 13 19-0269	EA		36" x 58" x 1/2", Solid Color Reinforced Composite, Toilet Partition Panel..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	245.09 25.12	30.55
10 21 13 19-0270	EA		42" x 58" x 1/2", Solid Color Reinforced Composite, Toilet Partition Panel..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	284.34 25.12	32.34
10 21 13 19-0271	EA		48" x 58" x 1/2", Solid Color Reinforced Composite, Toilet Partition Panel..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	324.71 25.12	34.14
10 21 13 19-0272	EA		55" x 58" x 1/2", Solid Color Reinforced Composite, Toilet Partition Panel..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	346.09 25.12	35.94
10 21 13 19-0273	EA		58" x 58" x 1/2", Solid Color Reinforced Composite, Toilet Partition Panel..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	355.61 25.12	36.65
10 21 13 19-0274	EA		60" x 58" x 1/2", Solid Color Reinforced Composite, Toilet Partition Panel..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	362.62 25.12	37.73
10 21 13 19-0275	EA		70" x 58" x 1/2", Solid Color Reinforced Composite, Toilet Partition Panel..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	415.37 25.12	39.53
10 21 13 19-0276	EA		78" x 58" x 1/2", Solid Color Reinforced Composite, Toilet Partition Panel..... <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	498.51 25.12	41.33
10 21 13 19-0277			69" Long, Solid Color Reinforced Composite, Toilet Partition Pilasters <small>(10 21 13 19-0256)</small>		
10 21 13 19-0278	EA		Up To 4" x 69" x 3/4", Solid Color Reinforced Composite, Toilet Partition Pilaster <i>For 1" Pilaster, Add</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	126.01 13.06 25.12	10.78
10 21 13 19-0279	EA		5" x 69" x 3/4", Solid Color Reinforced Composite, Toilet Partition Pilaster <i>For 1" Pilaster, Add</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	145.13 15.00 25.12	12.57
10 21 13 19-0280	EA		6" x 69" x 3/4", Solid Color Reinforced Composite, Toilet Partition Pilaster <i>For 1" Pilaster, Add</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	148.72 15.00 25.12	14.38
10 21 13 19-0281	EA		8" x 69" x 3/4", Solid Color Reinforced Composite, Toilet Partition Pilaster <i>For 1" Pilaster, Add</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	172.04 17.46 25.12	16.17
10 21 13 19-0282	EA		10" x 69" x 3/4", Solid Color Reinforced Composite, Toilet Partition Pilaster <i>For 1" Pilaster, Add</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	193.42 19.69 25.12	17.96
10 21 13 19-0283	EA		12" x 69" x 3/4", Solid Color Reinforced Composite, Toilet Partition Pilaster <i>For 1" Pilaster, Add</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	214.80 21.91 25.12	19.77
10 21 13 19-0284	EA		16" x 69" x 3/4", Solid Color Reinforced Composite, Toilet Partition Pilaster <i>For 1" Pilaster, Add</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	273.04 28.74 25.12	21.56
10 21 13 19-0285	EA		20" x 69" x 3/4", Solid Color Reinforced Composite, Toilet Partition Pilaster <i>For 1" Pilaster, Add</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	333.87 35.89 25.12	23.36
10 21 13 19-0286	EA		24" x 69" x 3/4", Solid Color Reinforced Composite, Toilet Partition Pilaster <i>For 1" Pilaster, Add</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	351.05 37.59 25.12	25.16
10 21 13 19-0287			83" Long, Solid Color Reinforced Composite, Toilet Partition Pilasters <small>(10 21 13 19-0256)</small>		
10 21 13 19-0288	EA		Up To 4" x 83" x 3/4", Solid Color Reinforced Composite, Toilet Partition Pilaster <i>For 1" Pilaster, Add</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	137.65 14.51 25.12	10.78
10 21 13 19-0289	EA		5" x 83" x 3/4", Solid Color Reinforced Composite, Toilet Partition Pilaster <i>For 1" Pilaster, Add</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	161.30 17.02 25.12	12.57
10 21 13 19-0290	EA		6" x 83" x 3/4", Solid Color Reinforced Composite, Toilet Partition Pilaster <i>For 1" Pilaster, Add</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	164.89 17.02 25.12	14.38



Specialties	10
Interior Specialties	10 20
Compartments And Cubicles	10 21

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MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 21 13 19-0291	EA		8" x 83" x 3/4", Solid Color Reinforced Composite, Toilet Partition Pilaster..... <i>For 1" Pilaster, Add</i>	190.79 19.81 25.12	16.17
10 21 13 19-0292	EA		10" x 83" x 3/4", Solid Color Reinforced Composite, Toilet Partition Pilaster..... <i>For 1" Pilaster, Add</i>	215.41 22.43 25.12	17.96
10 21 13 19-0293	EA		12" x 83" x 3/4", Solid Color Reinforced Composite, Toilet Partition Pilaster..... <i>For 1" Pilaster, Add</i>	240.19 25.08 25.12	19.77
10 21 13 19-0294	EA		16" x 83" x 3/4", Solid Color Reinforced Composite, Toilet Partition Pilaster..... <i>For 1" Pilaster, Add</i>	310.87 33.47 25.12	21.56
10 21 13 19-0295	EA		20" x 83" x 3/4", Solid Color Reinforced Composite, Toilet Partition Pilaster..... <i>For 1" Pilaster, Add</i>	369.29 40.32 25.12	23.36
10 21 13 19-0296	EA		24" x 83" x 3/4", Solid Color Reinforced Composite, Toilet Partition Pilaster..... <i>For 1" Pilaster, Add</i>	388.73 42.30 25.12	25.16
10 21 13 19-0297			96" To 120" Long, Solid Color Reinforced Composite, Toilet Partition Pilasters <small>(10 21 13 19-0296)</small>		
10 21 13 19-0298	EA		Up To 4" x 96" To 120" x 3/4", Solid Color Reinforced Composite, Toilet Partition Pilaster..... <i>For 1" Pilaster, Add</i>	156.48 15.97 25.12	14.38
10 21 13 19-0299	EA		5" x 96" To 120" x 3/4", Solid Color Reinforced Composite, Toilet Partition Pilaster..... <i>For 1" Pilaster, Add</i>	184.65 19.04 25.12	16.17
10 21 13 19-0300	EA		6" x 96" To 120" x 3/4", Solid Color Reinforced Composite, Toilet Partition Pilaster..... <i>For 1" Pilaster, Add</i>	188.25 19.04 25.12	17.96
10 21 13 19-0301	EA		8" x 96" To 120" x 3/4", Solid Color Reinforced Composite, Toilet Partition Pilaster..... <i>For 1" Pilaster, Add</i>	216.74 22.15 25.12	19.77
10 21 13 19-0302	EA		10" x 96" To 120" x 3/4", Solid Color Reinforced Composite, Toilet Partition Pilaster..... <i>For 1" Pilaster, Add</i>	244.58 25.18 25.12	21.56
10 21 13 19-0303	EA		12" x 96" To 120" x 3/4", Solid Color Reinforced Composite, Toilet Partition Pilaster..... <i>For 1" Pilaster, Add</i>	272.76 28.26 25.12	23.36
10 21 13 19-0304	EA		16" x 96" To 120" x 3/4", Solid Color Reinforced Composite, Toilet Partition Pilaster..... <i>For 1" Pilaster, Add</i>	355.90 38.20 25.12	25.16
10 21 13 19-0305	EA		20" x 96" To 120" x 3/4", Solid Color Reinforced Composite, Toilet Partition Pilaster..... <i>For 1" Pilaster, Add</i>	411.87 44.75 25.12	26.95
10 21 13 19-0306	EA		24" x 96" To 120" x 3/4", Solid Color Reinforced Composite, Toilet Partition Pilaster..... <i>For 1" Pilaster, Add</i>	433.58 47.01 25.12	28.75
10 21 13 19-0307			Solid Polyester (Corian) Toilet Partitions And Urinal Screens <small>(10 21 13 19)</small> Note: Complete toilet partitions for corner installations. Includes 1/2" door (1" at edge), 1" pilaster, 1/2" separator panel, trim shoes, and standard stainless steel hardware as required. For alcove, recessed or configurations other than corner installations use either: (1) the appropriate corner unit and add individual components or (2) individual components. Individual components include trim shoes and standard stainless steel hardware as required. Produced or cast by combining unsaturated polyester resin with a combination of fillers, pigments and catalysts.		
10 21 13 19-0308			Solid Polyester (Corian) Toilet Partitions <small>(10 21 13 19-0307)</small> Note: Small particulate finish.		
10 21 13 19-0309			Floor Anchored, Solid Polyester (Corian), Complete Toilet Partitions <small>(10 21 13 19-0308)</small>		
10 21 13 19-0310	EA		36" x 60", Floor Anchored, Solid Polyester (Corian), One Compartment Corner Unit, Complete Toilet Partition..... <i>For >10, Deduct</i>	2,781.10 -261.94 -602.46 90.66	80.86
10 21 13 19-0311	EA		60" x 60", Floor Anchored, Solid Polyester (Corian), One Compartment Corner Unit, Complete ADA Compliant Toilet Partition..... <i>For Solid Color Material (No Particulate), Deduct</i>	3,358.74 -732.01 90.66	88.04
10 21 13 19-0312	EA		60" x 78", Floor Anchored, Solid Polyester (Corian), One Compartment Corner Unit, Complete ADA Compliant Toilet Partition..... <i>For Solid Color Material (No Particulate), Deduct</i>	3,724.83 -814.56 90.66	91.64
10 21 13 19-0313			Overhead Braced, Solid Polyester (Corian), Complete Toilet Partitions <small>(10 21 13 19-0308)</small>		
10 21 13 19-0314	EA		36" x 60", Overhead Braced, Solid Polyester (Corian), One Compartment Corner Unit, Complete Toilet Partition..... <i>For >10, Deduct</i>	2,888.38 -269.07 -618.87 90.66	98.82

10 Specialties**10 20 Interior Specialties****10 21 Compartments And Cubicles**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 21 13 19-0315	EA		60" x 60", Overhead Braced, Solid Polyester (Corian), One Compartment Corner Unit, Complete ADA Compliant Toilet Partition.....	3,795.07	106.02
			<i>For Solid Color Material (No Particulate), Deduct</i>	-824.10	
			<i>For Heavy Gauge Full-Height SS Hinges And Brackets, Add</i>	90.66	
10 21 13 19-0316	EA		60" x 78", Overhead Braced, Solid Polyester (Corian), One Compartment Corner Unit, Complete ADA Compliant Toilet Partition.....	4,201.33	109.60
			<i>For Solid Color Material (No Particulate), Deduct</i>	-915.89	
			<i>For Heavy Gauge Full-Height SS Hinges And Brackets, Add</i>	90.66	
10 21 13 19-0317			Floor And Ceiling Anchored, Solid Polyester (Corian), Complete Toilet Partitions <small>(10 21 13 19-0308)</small>		
			Note: Excludes above ceiling steel.		
10 21 13 19-0318	EA		36" x 60", Floor And Ceiling Anchored, Solid Polyester (Corian), One Compartment Corner Unit, Complete Toilet Partition.....	3,235.54	116.79
			<i>For >10, Deduct</i>	-300.20	
			<i>For Solid Color Material (No Particulate), Deduct</i>	-690.45	
			<i>For Heavy Gauge Full-Height SS Hinges And Brackets, Add</i>	90.66	
10 21 13 19-0319	EA		60" x 60", Floor And Ceiling Anchored, Solid Polyester (Corian), One Compartment Corner Unit, Complete ADA Compliant Toilet Partition.....	4,345.96	123.98
			<i>For Solid Color Material (No Particulate), Deduct</i>	-942.54	
			<i>For Heavy Gauge Full-Height SS Hinges And Brackets, Add</i>	90.66	
10 21 13 19-0320	EA		60" x 78", Floor And Ceiling Anchored, Solid Polyester (Corian), One Compartment Corner Unit, Complete ADA Compliant Toilet Partition.....	4,751.89	127.57
			<i>For Solid Color Material (No Particulate), Deduct</i>	-1,034.25	
			<i>For Heavy Gauge Full-Height SS Hinges And Brackets, Add</i>	90.66	
10 21 13 19-0321			Ceiling Hung, Solid Polyester (Corian), Complete Toilet Partitions <small>(10 21 13 19-0308)</small>		
			Note: Excludes above ceiling steel.		
10 21 13 19-0322	EA		36" x 60", Ceiling Hung, Solid Polyester (Corian), One Compartment Corner Unit, Complete Toilet Partition.....	3,267.63	134.76
			<i>For >10, Deduct</i>	-299.81	
			<i>For Solid Color Material (No Particulate), Deduct</i>	-689.57	
			<i>For Heavy Gauge Full-Height SS Hinges And Brackets, Add</i>	90.66	
10 21 13 19-0323	EA		60" x 60", Ceiling Hung, Solid Polyester (Corian), One Compartment Corner Unit, Complete ADA Compliant Toilet Partition.....	4,174.64	141.94
			<i>For Solid Color Material (No Particulate), Deduct</i>	-894.87	
			<i>For Heavy Gauge Full-Height SS Hinges And Brackets, Add</i>	90.66	
10 21 13 19-0324	EA		60" x 78", Ceiling Hung, Solid Polyester (Corian), One Compartment Corner Unit, Complete ADA Compliant Toilet Partition.....	4,580.58	145.54
			<i>For Solid Color Material (No Particulate), Deduct</i>	-986.59	
			<i>For Heavy Gauge Full-Height SS Hinges And Brackets, Add</i>	90.66	
10 21 13 19-0325			Solid Polyester (Corian) Urinal Screens <small>(10 21 13 19-0307)</small>		
10 21 13 19-0326			Floor Anchored, Solid Polyester (Corian), Urinal Screens <small>(10 21 13 19-0325)</small>		
10 21 13 19-0327	EA		24" x 58" x 1/2", Floor Anchored, Solid Polyester (Corian), Urinal Screen.....	766.84	50.29
			<i>For Solid Color Material (No Particulate), Deduct</i>	-153.24	
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
10 21 13 19-0328	EA		36" x 58" x 1/2", Floor Anchored, Solid Polyester (Corian), Urinal Screen.....	1,013.30	53.88
			<i>For Solid Color Material (No Particulate), Deduct</i>	-208.27	
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
10 21 13 19-0329	EA		48" x 58" x 1/2", Floor Anchored, Solid Polyester (Corian), Urinal Screen.....	1,259.74	57.47
			<i>For Solid Color Material (No Particulate), Deduct</i>	-263.30	
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
10 21 13 19-0330			Wall Hung, Solid Polyester (Corian), Urinal Screens <small>(10 21 13 19-0325)</small>		
10 21 13 19-0331	EA		18" x 42" x 1/2", Wall Hung, Solid Polyester (Corian), Urinal Screen.....	392.22	43.10
			<i>For Solid Color Material (No Particulate), Deduct</i>	-70.38	
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
10 21 13 19-0332	EA		24" x 42" x 1/2", Wall Hung, Solid Polyester (Corian), Urinal Screen.....	501.41	46.70
			<i>For Solid Color Material (No Particulate), Deduct</i>	-93.84	
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
10 21 13 19-0333	EA		30" x 42" x 1/2", Wall Hung, Solid Polyester (Corian), Urinal Screen.....	610.60	50.29
			<i>For Solid Color Material (No Particulate), Deduct</i>	-117.31	
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
10 21 13 19-0334			Wall Hung And Post Supported, Solid Polyester (Corian), Urinal Screens <small>(10 21 13 19-0325)</small>		
10 21 13 19-0335	EA		18" x 58" x 1/2", Wall Hung And Post Supported, Solid Polyester (Corian), Urinal Screen.....	513.16	46.70
			<i>For Solid Color Material (No Particulate), Deduct</i>	-96.55	
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
10 21 13 19-0336	EA		24" x 58" x 1/2", Wall Hung And Post Supported, Solid Polyester (Corian), Urinal Screen.....	639.97	50.29
			<i>For Solid Color Material (No Particulate), Deduct</i>	-124.06	
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
10 21 13 19-0337	EA		30" x 58" x 1/2", Wall Hung And Post Supported, Solid Polyester (Corian), Urinal Screen.....	766.79	53.88
			<i>For Solid Color Material (No Particulate), Deduct</i>	-151.58	
			<i>For Heavy Gauge Full-Height SS Brackets, Add</i>	25.12	
10 21 13 19-0338			Wall Hung And Overhead Braced, Solid Polyester (Corian), Urinal Screens <small>(10 21 13 19-0325)</small>		



Specialties	10
Interior Specialties	10 20
Compartments And Cubicles	10 21

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MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 21 13 19-0339	EA		22" x 58" x 1/2", Wall Hung And Overhead Braced, Solid Polyester (Corian), Urinal Screen <i>For Solid Color Material (No Particulate), Deduct</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	785.74 -159.24 25.12	46.70
10 21 13 19-0340	EA		34" x 58" x 1/2", Wall Hung And Overhead Braced, Solid Polyester (Corian), Urinal Screen <i>For Solid Color Material (No Particulate), Deduct</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	1,032.18 -214.27 25.12	50.29
10 21 13 19-0341	EA		46" x 58" x 1/2", Wall Hung And Overhead Braced, Solid Polyester (Corian), Urinal Screen <i>For Solid Color Material (No Particulate), Deduct</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	1,278.63 -269.30 25.12	53.88
10 21 13 19-0342			Solid Polyester (Corian) Toilet Partition Doors, Panels And Pilasters <small>(10 21 13 19-0307)</small>		
10 21 13 19-0343			Solid Polyester (Corian), Toilet Partition Doors <small>(10 21 13 19-0342)</small>		
10 21 13 19-0344	EA		24" x 58" x 1/2", Solid Polyester (Corian), Toilet Partition Door <i>For Solid Color Material (No Particulate), Deduct</i> <i>For Heavy Gauge Full-Height SS Hinge, Add</i>	606.96 -132.99 40.42	14.38
10 21 13 19-0345	EA		26" x 58" x 1/2", Solid Polyester (Corian), Toilet Partition Door <i>For Solid Color Material (No Particulate), Deduct</i> <i>For Heavy Gauge Full-Height SS Hinge, Add</i>	648.28 -142.49 40.42	14.38
10 21 13 19-0346	EA		30" x 58" x 1/2", Solid Polyester (Corian), Toilet Partition Door <i>For Solid Color Material (No Particulate), Deduct</i> <i>For Heavy Gauge Full-Height SS Hinge, Add</i>	739.27 -162.59 40.42	16.17
10 21 13 19-0347	EA		34" x 58" x 1/2", Solid Polyester (Corian), Toilet Partition Door <i>For Solid Color Material (No Particulate), Deduct</i> <i>For Heavy Gauge Full-Height SS Hinge, Add</i>	824.55 -182.21 40.42	16.17
10 21 13 19-0348	EA		36" x 58" x 1/2", Solid Polyester (Corian), Toilet Partition Door <i>For Solid Color Material (No Particulate), Deduct</i> <i>For Heavy Gauge Full-Height SS Hinge, Add</i>	861.66 -190.74 40.42	16.17
10 21 13 19-0349			Solid Polyester (Corian), Toilet Partition Panels <small>(10 21 13 19-0342)</small>		
10 21 13 19-0350	EA		6" x 58" x 1/2", Solid Polyester (Corian), Toilet Partition Panel <i>For Solid Color Material (No Particulate), Deduct</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	162.74 -27.51 25.12	21.56
10 21 13 19-0351	EA		12" x 58" x 1/2", Solid Polyester (Corian), Toilet Partition Panel <i>For Solid Color Material (No Particulate), Deduct</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	285.98 -55.03 25.12	23.36
10 21 13 19-0352	EA		18" x 58" x 1/2", Solid Polyester (Corian), Toilet Partition Panel <i>For Solid Color Material (No Particulate), Deduct</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	409.20 -82.54 25.12	25.16
10 21 13 19-0353	EA		24" x 58" x 1/2", Solid Polyester (Corian), Toilet Partition Panel <i>For Solid Color Material (No Particulate), Deduct</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	532.42 -110.06 25.12	26.95
10 21 13 19-0354	EA		30" x 58" x 1/2", Solid Polyester (Corian), Toilet Partition Panel <i>For Solid Color Material (No Particulate), Deduct</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	655.65 -137.57 25.12	28.75
10 21 13 19-0355	EA		36" x 58" x 1/2", Solid Polyester (Corian), Toilet Partition Panel <i>For Solid Color Material (No Particulate), Deduct</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	778.86 -165.09 25.12	30.55
10 21 13 19-0356	EA		42" x 58" x 1/2", Solid Polyester (Corian), Toilet Partition Panel <i>For Solid Color Material (No Particulate), Deduct</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	902.10 -192.60 25.12	32.34
10 21 13 19-0357	EA		48" x 58" x 1/2", Solid Polyester (Corian), Toilet Partition Panel <i>For Solid Color Material (No Particulate), Deduct</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	1,025.31 -220.12 25.12	34.14
10 21 13 19-0358	EA		55" x 58" x 1/2", Solid Polyester (Corian), Toilet Partition Panel <i>For Solid Color Material (No Particulate), Deduct</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	1,168.47 -252.22 25.12	35.94
10 21 13 19-0359	EA		58" x 58" x 1/2", Solid Polyester (Corian), Toilet Partition Panel <i>For Solid Color Material (No Particulate), Deduct</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	1,229.74 -265.98 25.12	36.65
10 21 13 19-0360	EA		60" x 58" x 1/2", Solid Polyester (Corian), Toilet Partition Panel <i>For Solid Color Material (No Particulate), Deduct</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	1,271.76 -275.15 25.12	37.73
10 21 13 19-0361	EA		70" x 58" x 1/2", Solid Polyester (Corian), Toilet Partition Panel <i>For Solid Color Material (No Particulate), Deduct</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	1,474.73 -321.00 25.12	39.53
10 21 13 19-0362	EA		78" x 58" x 1/2", Solid Polyester (Corian), Toilet Partition Panel <i>For Solid Color Material (No Particulate), Deduct</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	1,637.83 -357.69 25.12	41.33
10 21 13 19-0363			72" Long, Solid Polyester (Corian), Toilet Partition Pilasters <small>(10 21 13 19-0342)</small>		
10 21 13 19-0364	EA		Up To 4" x 72" x 1", Solid Polyester (Corian), Toilet Partition Pilaster <i>For Solid Color Material (No Particulate), Deduct</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	209.31 -43.18 25.12	10.78
10 21 13 19-0365	EA		5" x 72" x 1", Solid Polyester (Corian), Toilet Partition Pilaster <i>For Solid Color Material (No Particulate), Deduct</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	259.85 -53.98 25.12	12.57
10 21 13 19-0366	EA		6" x 72" x 1", Solid Polyester (Corian), Toilet Partition Pilaster <i>For Solid Color Material (No Particulate), Deduct</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	310.38 -64.77 25.12	14.38

10 Specialties**10 20 Interior Specialties****10 21 Compartments And Cubicles**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 21 13 19-0367	EA		8" x 72" x 1", Solid Polyester (Corian), Toilet Partition Pilaster <i>For Solid Color Material (No Particulate), Deduct</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	407.86 -86.37 25.12	16.17
10 21 13 19-0368	EA		10" x 72" x 1", Solid Polyester (Corian), Toilet Partition Pilaster <i>For Solid Color Material (No Particulate), Deduct</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	505.33 -107.96 25.12	17.96
10 21 13 19-0369	EA		12" x 72" x 1", Solid Polyester (Corian), Toilet Partition Pilaster <i>For Solid Color Material (No Particulate), Deduct</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	602.80 -129.55 25.12	19.77
10 21 13 19-0370	EA		18" x 72" x 1", Solid Polyester (Corian), Toilet Partition Pilaster <i>For Solid Color Material (No Particulate), Deduct</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	888.01 -194.32 25.12	21.56
10 21 13 19-0371	EA		22" x 72" x 1", Solid Polyester (Corian), Toilet Partition Pilaster <i>For Solid Color Material (No Particulate), Deduct</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	1,079.38 -237.51 25.12	23.36
10 21 13 19-0372	EA		24" x 72" x 1", Solid Polyester (Corian), Toilet Partition Pilaster <i>For Solid Color Material (No Particulate), Deduct</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	1,176.84 -259.10 25.12	25.16
10 21 13 19-0373			82" Long, Solid Polyester (Corian), Toilet Partition Pilasters (10 21 13 19-0342)		
10 21 13 19-0374	EA		Up To 4" x 82" x 1", Solid Polyester (Corian), Toilet Partition Pilaster <i>For Solid Color Material (No Particulate), Deduct</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	235.39 -49.18 25.12	10.78
10 21 13 19-0375	EA		5" x 82" x 1", Solid Polyester (Corian), Toilet Partition Pilaster <i>For Solid Color Material (No Particulate), Deduct</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	292.46 -61.48 25.12	12.57
10 21 13 19-0376	EA		6" x 82" x 1", Solid Polyester (Corian), Toilet Partition Pilaster <i>For Solid Color Material (No Particulate), Deduct</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	343.39 -72.37 25.12	14.38
10 21 13 19-0377	EA		8" x 82" x 1", Solid Polyester (Corian), Toilet Partition Pilaster <i>For Solid Color Material (No Particulate), Deduct</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	468.16 -100.24 25.12	16.17
10 21 13 19-0378	EA		10" x 82" x 1", Solid Polyester (Corian), Toilet Partition Pilaster <i>For Solid Color Material (No Particulate), Deduct</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	570.52 -122.95 25.12	17.96
10 21 13 19-0379	EA		12" x 82" x 1", Solid Polyester (Corian), Toilet Partition Pilaster <i>For Solid Color Material (No Particulate), Deduct</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	681.02 -147.54 25.12	19.77
10 21 13 19-0380	EA		18" x 82" x 1", Solid Polyester (Corian), Toilet Partition Pilaster <i>For Solid Color Material (No Particulate), Deduct</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	1,005.36 -221.32 25.12	21.56
10 21 13 19-0381	EA		22" x 82" x 1", Solid Polyester (Corian), Toilet Partition Pilaster <i>For Solid Color Material (No Particulate), Deduct</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	1,222.81 -270.50 25.12	23.36
10 21 13 19-0382	EA		24" x 82" x 1", Solid Polyester (Corian), Toilet Partition Pilaster <i>For Solid Color Material (No Particulate), Deduct</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	1,333.31 -295.09 25.12	25.16
10 21 13 19-0383			96" To 120" Long, Solid Polyester (Corian), Toilet Partition Pilasters (10 21 13 19-0342)		
10 21 13 19-0384	EA		Up To 4" x 96" To 120" x 1", Solid Polyester (Corian), Toilet Partition Pilaster <i>For Solid Color Material (No Particulate), Deduct</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	310.38 -64.77 25.12	14.38
10 21 13 19-0385	EA		5" x 96" To 120" x 1", Solid Polyester (Corian), Toilet Partition Pilaster <i>For Solid Color Material (No Particulate), Deduct</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	384.38 -80.97 25.12	16.17
10 21 13 19-0386	EA		6" x 96" To 120" x 1", Solid Polyester (Corian), Toilet Partition Pilaster <i>For Solid Color Material (No Particulate), Deduct</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	458.39 -97.16 25.12	17.96
10 21 13 19-0387	EA		8" x 96" To 120" x 1", Solid Polyester (Corian), Toilet Partition Pilaster <i>For Solid Color Material (No Particulate), Deduct</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	602.80 -129.55 25.12	19.77
10 21 13 19-0388	EA		10" x 96" To 120" x 1", Solid Polyester (Corian), Toilet Partition Pilaster <i>For Solid Color Material (No Particulate), Deduct</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	747.20 -161.94 25.12	21.56
10 21 13 19-0389	EA		12" x 96" To 120" x 1", Solid Polyester (Corian), Toilet Partition Pilaster <i>For Solid Color Material (No Particulate), Deduct</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	891.61 -194.32 25.12	23.36
10 21 13 19-0390	EA		18" x 96" To 120" x 1", Solid Polyester (Corian), Toilet Partition Pilaster <i>For Solid Color Material (No Particulate), Deduct</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	1,317.66 -291.49 25.12	25.16
10 21 13 19-0391	EA		22" x 96" To 120" x 1", Solid Polyester (Corian), Toilet Partition Pilaster <i>For Solid Color Material (No Particulate), Deduct</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	1,602.89 -356.27 25.12	26.95
10 21 13 19-0392	EA		24" x 96" To 120" x 1", Solid Polyester (Corian), Toilet Partition Pilaster <i>For Solid Color Material (No Particulate), Deduct</i> <i>For Heavy Gauge Full-Height SS Brackets, Add</i>	1,747.30 -388.65 25.12	28.75
10 21 13 43			Compartments and Cubicles Common Accessories (10 21 13)		
10 21 13 43-0001			Accessories (10 21 13 43)		
10 21 13 43-0002	LF		Extruded Aluminum Headrails For Toilet Partitions And Urinal Screens.....	8.57	1.44



Specialties	10	10
Interior Specialties	10 20	
Compartments And Cubicles	10 21	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 21	13 43-0003	LF	Stainless Steel Headrails For Toilet Partitions And Urinal Screens	12.76	1.44
10 21	13 43-0004	EA	Replacement 1-1/2" x 58" Stainless Steel Wall Posts.....	87.08	
10 21	13 43-0005	EA	Replacement 58" Aluminum Wall U Bracket.....	44.96	
10 21	13 43-0006	EA	Replacement 58" Aluminum Wall Two Ear Bracket	74.87	
10 21	13 43-0007	EA	Replacement 54" Stainless Steel Wall U Bracket	66.27	
10 21	13 43-0008	EA	Replacement 54" Stainless Steel Wall Two Ear Bracket	164.00	
10 21	13 43-0009	EA	Replacement 54" Plastic Wall Two Ear Bracket, All Colors	99.99	
10 21	13 43-0010	EA	Replacement 57-1/2" Stainless Steel Hinge	105.61	

10 21 16 Shower And Dressing Compartments (10 21)

10 21 16 00-0001 Shower Dividers (10 21 16)

10 21 16 00-0002 Solid Phenolic Core Laminated Plastic, Shower Dividers (10 21 16 00-0001)

Note: Cut to height in field. panels 58" high. Posts 1-1/4" square, 304 stainless steel satin finish. 1/2" thick panels.

10 21 16 00-0003	EA	18" Wide, Solid Phenolic Core Laminated Plastic, Shower Divider	635.93	89.84
		<i>For 66" High Panels, Add</i>	68.44	
10 21 16 00-0004	EA	24" Wide, Solid Phenolic Core Laminated Plastic, Shower Divider	802.39	97.03
		<i>For 66" High Panels, Add</i>	91.25	
10 21 16 00-0005	EA	36" Wide, Solid Phenolic Core Laminated Plastic, Shower Divider	1,041.22	107.81
		<i>For 66" High Panels, Add</i>	123.84	
10 21 16 00-0006	EA	48" Wide, Solid Phenolic Core Laminated Plastic, Shower Divider	1,229.21	125.77
		<i>For 66" High Panels, Add</i>	146.65	
10 21 16 00-0007	EA	57" Wide, Solid Phenolic Core Laminated Plastic, Shower Divider	1,417.25	143.74
		<i>For 66" High Panels, Add</i>	169.46	

10 21 16 00-0008 Solid Phenolic Core Laminated Plastic, Shower Dividers With Headrail And Curtain Track (10 21 16 00-0001)

Note: Cut to height in field. Panels 58" high. Posts 1-1/4" square, 304 stainless steel satin finish. 1/2" thick panels. Includes 3/4" stiles, 85" from floor to top of headrail. Headrail 4" wide. All stainless steel shoes and stainless steel fittings. Leveling devices are chromate treated double zinc plated steel. Overhead braced designed with concealed curtain tracks and hooks in headrail.

10 21 16 00-0009	EA	18" Wide, Solid Phenolic Core Laminated Plastic, Shower Divider With Headrail And Curtain Track	1,546.92	157.90
		<i>For 66" High Panels, Add</i>	216.25	
		<i>For 6" Wide Head Rail, Add</i>	40.09	
		<i>For 8" Wide Head Rail, Add</i>	55.56	
		<i>For 10" Wide Head rail, Add</i>	67.87	
		<i>For 12" Wide Head Rail, Add</i>	81.76	
		<i>For 18" Wide, 1/2" Thick Bench, Add</i>	116.58	
		<i>For 24" Wide, 1/2" Thick Bench, Add</i>	156.58	
10 21 16 00-0010	EA	24" Wide, Solid Phenolic Core Laminated Plastic, Shower Divider With Headrail And Curtain Track	1,913.96	172.42
		<i>For 66" High Panels, Add</i>	269.85	
		<i>For 6" Wide Head Rail, Add</i>	50.52	
		<i>For 8" Wide Head Rail, Add</i>	69.66	
		<i>For 10" Wide Head rail, Add</i>	85.35	
		<i>For 12" Wide Head Rail, Add</i>	102.77	
		<i>For 18" Wide, 1/2" Thick Bench, Add</i>	119.49	
		<i>For 24" Wide, 1/2" Thick Bench, Add</i>	159.49	
10 21 16 00-0011	EA	36" Wide, Solid Phenolic Core Laminated Plastic, Shower Divider With Headrail And Curtain Track	2,418.59	183.35
		<i>For 66" High Panels, Add</i>	344.45	
		<i>For 6" Wide Head Rail, Add</i>	65.22	
		<i>For 8" Wide Head Rail, Add</i>	89.41	
		<i>For 10" Wide Head rail, Add</i>	109.93	
		<i>For 12" Wide Head Rail, Add</i>	132.28	
		<i>For 18" Wide, 1/2" Thick Bench, Add</i>	121.67	
		<i>For 24" Wide, 1/2" Thick Bench, Add</i>	161.67	
10 21 16 00-0012	EA	48" Wide, Solid Phenolic Core Laminated Plastic, Shower Divider With Headrail And Curtain Track	2,582.84	205.12
		<i>For 66" High Panels, Add</i>	366.91	
		<i>For 6" Wide Head Rail, Add</i>	69.28	
		<i>For 8" Wide Head Rail, Add</i>	95.11	
		<i>For 10" Wide Head rail, Add</i>	116.84	
		<i>For 12" Wide Head Rail, Add</i>	140.61	
		<i>For 18" Wide, 1/2" Thick Bench, Add</i>	126.02	
		<i>For 24" Wide, 1/2" Thick Bench, Add</i>	166.02	
10 21 16 00-0013	EA	57" Wide, Solid Phenolic Core Laminated Plastic, Shower Divider With Headrail And Curtain Track	2,956.40	222.94
		<i>For 66" High Panels, Add</i>	421.17	
		<i>For 6" Wide Head Rail, Add</i>	79.78	
		<i>For 8" Wide Head Rail, Add</i>	109.34	
		<i>For 10" Wide Head rail, Add</i>	134.44	
		<i>For 12" Wide Head Rail, Add</i>	161.78	
		<i>For 18" Wide, 1/2" Thick Bench, Add</i>	129.59	
		<i>For 24" Wide, 1/2" Thick Bench, Add</i>	169.59	

10 26 Wall And Door Protection (10 20)

10 26 13 Corner Guards (10 26)

10 26 13 00-0001	Vinyl Corner Guards (10 26 13)
10 26 13 00-0002	Rigid Vinyl Corner Guards (10 26 13 00-0001)
10 26 13 00-0003	Surface Mounted, Rigid Vinyl Corner Guards (10 26 13 00-0002)

10 Specialties**10 20 Interior Specialties****10 26 Wall And Door Protection**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 26 13 00-0004			90 Degree Angle, Surface Mounted, Rigid Vinyl Corner Guards <small>(10 26 13 00-0003)</small>		
10 26 13 00-0005	LF		3/4" Wing, 90 Degree Angle, Surface Mounted, Rigid Vinyl Corner Guard (Pawling CG-34)	5.38	2.16
			<i>For >50 To 100 LF, Deduct</i>	-0.90	
			<i>For >100 To 200 LF, Deduct</i>	-1.26	
			<i>For >200 LF, Deduct</i>	-1.71	
10 26 13 00-0006	LF		1-1/2" Wing, 90 Degree Angle, Surface Mounted, Rigid Vinyl Corner Guard (Pawling CG-12)	6.09	2.16
			<i>For >50 To 100 LF, Deduct</i>	-0.90	
			<i>For >100 To 200 LF, Deduct</i>	-1.26	
			<i>For >200 LF, Deduct</i>	-1.74	
10 26 13 00-0007	LF		3" Wing, 90 Degree Angle, Surface Mounted, Rigid Vinyl Corner Guard (Pawling CG-13)	9.26	2.16
			<i>For >50 To 100 LF, Deduct</i>	-0.90	
			<i>For >100 To 200 LF, Deduct</i>	-1.26	
			<i>For >200 LF, Deduct</i>	-1.90	
10 26 13 00-0008	LF		4" Wing, 90 Degree Angle, Surface Mounted, Rigid Vinyl Corner Guard (Pawling CG-14)	10.96	2.16
			<i>For >50 To 100 LF, Deduct</i>	-0.90	
			<i>For >100 To 200 LF, Deduct</i>	-1.26	
			<i>For >200 LF, Deduct</i>	-1.98	
10 26 13 00-0009			135 Degree Angle, Surface Mounted, Rigid Vinyl Corner Guards <small>(10 26 13 00-0003)</small>		
10 26 13 00-0010	LF		1-1/2" Wing, 135 Degree Angle, Surface Mounted, Rigid Vinyl Corner Guard (Pawling CG-1245)	10.37	2.16
			<i>For >50 To 100 LF, Deduct</i>	-0.90	
			<i>For >100 To 200 LF, Deduct</i>	-1.26	
			<i>For >200 LF, Deduct</i>	-1.95	
10 26 13 00-0011			Rigid Vinyl Corner Guards With Aluminum Retainers <small>(10 26 13 00-0001)</small>		
			Note: Includes closure caps.		
10 26 13 00-0012			Surface Mounted, Rigid Vinyl Corner Guards With Aluminum Retainers <small>(10 26 13 00-0011)</small>		
10 26 13 00-0013			90 Degree Angle, Surface Mounted, Rigid Vinyl Corner Guards With Aluminum Retainers <small>(10 26 13 00-0012)</small>		
10 26 13 00-0014	LF		2" Wing, 90 Degree Angle, Surface Mounted, Rigid Vinyl Corner Guard With Aluminum Retainer (Pawling CG-20)	11.62	3.23
			<i>For >50 To 100 LF, Deduct</i>	-1.35	
			<i>For >100 To 200 LF, Deduct</i>	-1.89	
			<i>For >200 LF, Deduct</i>	-2.74	
			<i>For Recycled Vinyl Retainer, Deduct</i>	-1.25	
10 26 13 00-0015	LF		3" Wing, 90 Degree Angle, Surface Mounted, Rigid Vinyl Corner Guard With Aluminum Retainer (Pawling CG-10)	13.70	3.23
			<i>For >50 To 100 LF, Deduct</i>	-1.35	
			<i>For >100 To 200 LF, Deduct</i>	-1.89	
			<i>For >200 LF, Deduct</i>	-2.84	
			<i>For Recycled Vinyl Retainer, Deduct</i>	-1.66	
10 26 13 00-0016	LF		Bullnose 3" Wing, 90 Degree Angle, Surface Mounted, Rigid Vinyl Corner Guard With Aluminum Retainer (Pawling CG-30)	14.53	3.23
			<i>For >50 To 100 LF, Deduct</i>	-1.35	
			<i>For >100 To 200 LF, Deduct</i>	-1.89	
			<i>For >200 LF, Deduct</i>	-2.88	
			<i>For Recycled Vinyl Retainer, Deduct</i>	-1.83	
10 26 13 00-0017			135 Degree Angle, Surface Mounted, Rigid Vinyl Corner Guards With Aluminum Retainers <small>(10 26 13 00-0012)</small>		
10 26 13 00-0018	LF		3" Wing, 135 Degree Angle, Surface Mounted, Rigid Vinyl Corner Guard With Aluminum Retainer (Pawling CG-135)	15.78	3.23
			<i>For >50 To 100 LF, Deduct</i>	-1.35	
			<i>For >100 To 200 LF, Deduct</i>	-1.89	
			<i>For >200 LF, Deduct</i>	-2.95	
			<i>For Recycled Vinyl Retainer, Deduct</i>	-2.08	
10 26 13 00-0019			End Wall Protector, Surface Mounted, Rigid Vinyl Corner Guards With Aluminum Retainers <small>(10 26 13 00-0012)</small>		
			Note: Includes two rigid vinyl corner guards with aluminum retainers and a vinyl wall covering filler strip inserted between guards.		
10 26 13 00-0020	LF		2" Wing, End Wall Protector, Surface Mounted, Rigid Vinyl Corner Guard With Aluminum Retainer (Pawling CG-11)	32.18	4.31
			<i>For >50 To 100 LF, Deduct</i>	-1.80	
			<i>For >100 To 200 LF, Deduct</i>	-2.51	
			<i>For >200 LF, Deduct</i>	-4.48	
			<i>For Recycled Vinyl Retainer, Deduct</i>	-5.00	
10 26 13 00-0021			Flush Mounted, Rigid Vinyl Corner Guards With Aluminum Retainers <small>(10 26 13 00-0011)</small>		
10 26 13 00-0022			90 Degree Angle, Flush Mounted, Rigid Vinyl Corner Guards With Aluminum Retainers <small>(10 26 13 00-0021)</small>		
10 26 13 00-0023	LF		2" Wing, 90 Degree Angle, Flush Mounted, Rigid Vinyl Corner Guard With Aluminum Retainer (Pawling CG-72)	14.21	3.23
			<i>For >50 To 100 LF, Deduct</i>	-1.35	
			<i>For >100 To 200 LF, Deduct</i>	-1.89	
			<i>For >200 LF, Deduct</i>	-2.87	
			<i>For Up To 2 HR Fire Rated, Add</i>	6.17	



Specialties	10
Interior Specialties	10 20
Wall And Door Protection	10 26

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MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 26 13 00-0024 LF 3" Wing, 90 Degree Angle, Flush Mounted, Rigid Vinyl Corner Guard With Aluminum Retainer (Pawling CG-7) <i>For >50 To 100 LF, Deduct</i> <i>For >100 To 200 LF, Deduct</i> <i>For >200 LF, Deduct</i> <i>For Up To 2 HR Fire Rated, Add</i>	16.69 -1.35 -1.89 -2.99 7.91	3.23
10 26 13 00-0025 LF Bullnose 3" Wing, 90 Degree Angle, Flush Mounted, Rigid Vinyl Corner Guard With Aluminum Retainer (Pawling CG-32)..... <i>For >50 To 100 LF, Deduct</i> <i>For >100 To 200 LF, Deduct</i> <i>For >200 LF, Deduct</i> <i>For Up To 2 HR Fire Rated, Add</i>	17.25 -1.35 -1.89 -3.02 8.30	3.23
10 26 13 00-0026 135 Degree Angle, Flush Mounted, Rigid Vinyl Corner Guards With Aluminum Retainers <small>(10 26 13 00-0021)</small>		
10 26 13 00-0027 LF 3" Wing, 135 Degree Angle, Flush Mounted, Rigid Vinyl Corner Guard With Aluminum Retainer (Pawling CG-75) <i>For >50 To 100 LF, Deduct</i> <i>For >100 To 200 LF, Deduct</i> <i>For >200 LF, Deduct</i> <i>For Up To 2 HR Fire Rated, Add</i>	19.40 -1.35 -1.89 -3.13 9.81	3.23
10 26 13 00-0028 End Wall Protector, Flush Mounted, Rigid Vinyl Corner Guards With Aluminum Retainers <small>(10 26 13 00-0021)</small> Note: Includes two rigid vinyl corner guards with aluminum retainers and a vinyl wall covering filler strip inserted between guards.		
10 26 13 00-0029 LF 2" Wing, End Wall Protector, Flush Mounted, Rigid Vinyl Corner Guard With Aluminum Retainer (Pawling CG-888) <i>For >50 To 100 LF, Deduct</i> <i>For >100 To 200 LF, Deduct</i> <i>For >200 LF, Deduct</i> <i>For Up To 2 HR Fire Rated, Add</i>	41.50 -1.80 -2.51 -4.95 24.02	4.31
10 26 13 00-0030 Flexible Vinyl Corner Guards <small>(10 26 13 00-0001)</small> Note: Includes adhesive for installation.		
10 26 13 00-0031 Surface Mounted, Flexible Vinyl Corner Guards <small>(10 26 13 00-0030)</small>		
10 26 13 00-0032 90 Degree Angle, Surface Mounted, Flexible Vinyl Corner Guards <small>(10 26 13 00-0031)</small>		
10 26 13 00-0033 LF 1-3/4" Wing, 90 Degree Angle, Surface Mounted, Flexible Vinyl Corner Guard (Pawling CG-9)..... <i>For >50 To 100 LF, Deduct</i> <i>For >100 To 200 LF, Deduct</i> <i>For >200 LF, Deduct</i> <i>For Bolting To Concrete Or Masonry, Add</i>	7.50 -0.90 -1.26 -1.81 1.66	2.16
10 26 13 00-0034 LF 2-1/2" Wing, 90 Degree Angle, Surface Mounted, Flexible Vinyl Corner Guard (Pawling CG-3)..... <i>For >50 To 100 LF, Deduct</i> <i>For >100 To 200 LF, Deduct</i> <i>For >200 LF, Deduct</i> <i>For Bolting To Concrete Or Masonry, Add</i>	10.38 -0.90 -1.26 -1.96 2.10	2.16
10 26 13 00-0035 LF 4" Wing, 90 Degree Angle, Surface Mounted, Flexible Vinyl Corner Guard (Pawling CG-15)..... <i>For >50 To 100 LF, Deduct</i> <i>For >100 To 200 LF, Deduct</i> <i>For >200 LF, Deduct</i> <i>For Bolting To Concrete Or Masonry, Add</i>	11.61 -0.90 -1.26 -2.02 2.28	2.16
10 26 13 00-0036 Polycarbonate Corner Guards <small>(10 26 13)</small>		
10 26 13 00-0037 Surface Mounted, Polycarbonate Corner Guards <small>(10 26 13 00-0036)</small>		
10 26 13 00-0038 90 Degree Angle, Surface Mounted, Polycarbonate Corner Guards <small>(10 26 13 00-0037)</small>		
10 26 13 00-0039 LF 3/4" Wing, 90 Degree Angle, Surface Mounted, Polycarbonate Corner Guard (Pawling CG-16) <i>For >50 To 100 LF, Deduct</i> <i>For >100 To 200 LF, Deduct</i> <i>For >200 LF, Deduct</i>	4.77 -0.90 -1.26 -1.67	2.16
10 26 13 00-0040 LF 1-1/8" Wing, 90 Degree Angle, Surface Mounted, Polycarbonate Corner Guard (Pawling CG-17) <i>For >50 To 100 LF, Deduct</i> <i>For >100 To 200 LF, Deduct</i> <i>For >200 LF, Deduct</i>	5.88 -0.90 -1.26 -1.73	2.16
10 26 13 00-0041 LF 2" Wing, 90 Degree Angle, Surface Mounted, Polycarbonate Corner Guard (Pawling CG-24) <i>For >50 To 100 LF, Deduct</i> <i>For >100 To 200 LF, Deduct</i> <i>For >200 LF, Deduct</i>	6.90 -0.90 -1.26 -1.78	2.16
10 26 13 00-0042 LF 2-1/2" Wing, 90 Degree Angle, Surface Mounted, Polycarbonate Corner Guard (Pawling CG-18)..... <i>For >50 To 100 LF, Deduct</i> <i>For >100 To 200 LF, Deduct</i> <i>For >200 LF, Deduct</i>	9.22 -0.90 -1.26 -1.90	2.16
10 26 13 00-0043 LF Bullnose 2-1/2" Wing, 90 Degree Angle, Surface Mounted, Polycarbonate Corner Guard (Pawling CG-23) <i>For >50 To 100 LF, Deduct</i> <i>For >100 To 200 LF, Deduct</i> <i>For >200 LF, Deduct</i>	7.85 -0.90 -1.26 -1.83	2.16

10 Specialties**10 20 Interior Specialties****10 26 Wall And Door Protection**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 26 13 00-0044			135 Degree Angle, Surface Mounted, Polycarbonate Corner Guards <small>(10 26 13 00-0037)</small>		
	10 26 13 00-0045	LF	2-1/2" Wing, 135 Degree Angle, Surface Mounted, Polycarbonate Corner Guard (Pawling CG-19)	9.22	2.16
			<i>For >50 To 100 LF, Deduct</i>	-0.90	
			<i>For >100 To 200 LF, Deduct</i>	-1.26	
			<i>For >200 LF, Deduct</i>	-1.90	
10 26 13 00-0046			Aluminum Corner Guards <small>(10 26 13)</small>		
10 26 13 00-0047			Surface Mounted, Aluminum Corner Guards <small>(10 26 13 00-0046)</small>		
10 26 13 00-0048			90 Degree Angle, Surface Mounted, Aluminum Corner Guards <small>(10 26 13 00-0047)</small>		
	10 26 13 00-0049	LF	1" Wing, 90 Degree Angle, Surface Mounted, Aluminum Corner Guard (Pawling CG-400)	7.50	2.16
			<i>For >50 To 100 LF, Deduct</i>	-0.90	
			<i>For >100 To 200 LF, Deduct</i>	-1.26	
			<i>For >200 LF, Deduct</i>	-1.81	
	10 26 13 00-0050	LF	2" Wing, 90 Degree Angle, Surface Mounted, Aluminum Corner Guard (Pawling CG-401)	9.28	2.16
			<i>For >50 To 100 LF, Deduct</i>	-0.90	
			<i>For >100 To 200 LF, Deduct</i>	-1.26	
			<i>For >200 LF, Deduct</i>	-1.90	
	10 26 13 00-0051	LF	3" Wing, 90 Degree Angle, Surface Mounted, Aluminum Corner Guard (Pawling CG-402)	10.46	2.16
			<i>For >50 To 100 LF, Deduct</i>	-0.90	
			<i>For >100 To 200 LF, Deduct</i>	-1.26	
			<i>For >200 LF, Deduct</i>	-1.96	
10 26 13 00-0052			135 Degree Angle, Surface Mounted, Aluminum Corner Guards <small>(10 26 13 00-0047)</small>		
	10 26 13 00-0053	LF	1" Wing, 135 Degree Angle, Surface Mounted, Aluminum Corner Guard (Pawling CG-403)	7.50	2.16
			<i>For >50 To 100 LF, Deduct</i>	-0.90	
			<i>For >100 To 200 LF, Deduct</i>	-1.26	
			<i>For >200 LF, Deduct</i>	-1.81	
	10 26 13 00-0054	LF	2" Wing, 135 Degree Angle, Surface Mounted, Aluminum Corner Guard (Pawling CG-404)	9.28	2.16
			<i>For >50 To 100 LF, Deduct</i>	-0.90	
			<i>For >100 To 200 LF, Deduct</i>	-1.26	
			<i>For >200 LF, Deduct</i>	-1.90	
	10 26 13 00-0055	LF	3" Wing, 135 Degree Angle, Surface Mounted, Aluminum Corner Guard (Pawling CG-405)	9.78	2.16
			<i>For >50 To 100 LF, Deduct</i>	-0.90	
			<i>For >100 To 200 LF, Deduct</i>	-1.26	
			<i>For >200 LF, Deduct</i>	-1.93	
10 26 13 00-0056			Steel Corner Guards <small>(10 26 13)</small>		
10 26 13 00-0057			Steel Angle Iron, Corner Guards <small>(10 26 13 00-0056)</small>		
10 26 13 00-0058			Surface Mounted, Steel Angle Iron, Corner Guards <small>(10 26 13 00-0057)</small>		
10 26 13 00-0059			90 Degree Angle, Surface Mounted, Steel Angle Iron, Corner Guards <small>(10 26 13 00-0058)</small>		
	10 26 13 00-0060	LF	1" x 1" x 1/4", 90 Degree Angle, Surface Mounted, Steel Angle Iron, Corner Guard	9.64	2.59
			<i>For Galvanizing, Add</i>	1.87	
			<i>For >50 To 100 LF, Deduct</i>	-1.08	
			<i>For >100 To 200 LF, Deduct</i>	-1.51	
			<i>For >200 LF, Deduct</i>	-2.21	
	10 26 13 00-0061	LF	2" x 2" x 1/4", 90 Degree Angle, Surface Mounted, Steel Angle Iron, Corner Guard	12.45	2.80
			<i>For Galvanizing, Add</i>	2.72	
			<i>For >50 To 100 LF, Deduct</i>	-1.17	
			<i>For >100 To 200 LF, Deduct</i>	-1.63	
			<i>For >200 LF, Deduct</i>	-2.49	
	10 26 13 00-0062	LF	2" x 3" x 1/4", 90 Degree Angle, Surface Mounted, Steel Angle Iron, Corner Guard	13.27	2.91
			<i>For Galvanizing, Add</i>	2.95	
			<i>For >50 To 100 LF, Deduct</i>	-1.21	
			<i>For >100 To 200 LF, Deduct</i>	-1.70	
			<i>For >200 LF, Deduct</i>	-2.60	
	10 26 13 00-0063	LF	3" x 3" x 1/4", 90 Degree Angle, Surface Mounted, Steel Angle Iron, Corner Guard	13.55	3.02
			<i>For Galvanizing, Add</i>	2.98	
			<i>For >50 To 100 LF, Deduct</i>	-1.26	
			<i>For >100 To 200 LF, Deduct</i>	-1.76	
			<i>For >200 LF, Deduct</i>	-2.69	
	10 26 13 00-0064	LF	3" x 4" x 1/4", 90 Degree Angle, Surface Mounted, Steel Angle Iron, Corner Guard	17.13	3.12
			<i>For Galvanizing, Add</i>	4.17	
			<i>For >50 To 100 LF, Deduct</i>	-1.30	
			<i>For >100 To 200 LF, Deduct</i>	-1.82	
			<i>For >200 LF, Deduct</i>	-2.94	
	10 26 13 00-0065	LF	4" x 4" x 1/4", 90 Degree Angle, Surface Mounted, Steel Angle Iron, Corner Guard	20.72	3.23
			<i>For Galvanizing, Add</i>	5.37	
			<i>For >50 To 100 LF, Deduct</i>	-1.35	
			<i>For >100 To 200 LF, Deduct</i>	-1.89	
			<i>For >200 LF, Deduct</i>	-3.19	
	10 26 13 00-0066	LF	6" x 6" x 1/4", 90 Degree Angle, Surface Mounted, Steel Angle Iron, Corner Guard	35.78	4.31
			<i>For Galvanizing, Add</i>	10.01	
			<i>For >50 To 100 LF, Deduct</i>	-1.80	
			<i>For >100 To 200 LF, Deduct</i>	-2.51	
			<i>For >200 LF, Deduct</i>	-4.66	



Specialties	10
Interior Specialties	10 20
Wall And Door Protection	10 26

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MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 26 13 00-0067 Stainless Steel Corner Guards <small>(10 26 13)</small>		
10 26 13 00-0068 Stainless Steel Corner Guards <small>(10 26 13 00-0067)</small> Note: Includes 16 gauge, type 304 stainless steel corner guards with #4 satin finish.		
10 26 13 00-0069 Surface Mounted, Stainless Steel Corner Guards <small>(10 26 13 00-0068)</small>		
10 26 13 00-0070 90 Degree Angle, Surface Mounted, Stainless Steel Corner Guards <small>(10 26 13 00-0069)</small>		
10 26 13 00-0071 LF 1" Wing, 90 Degree Angle, Surface Mounted, Stainless Steel Corner Guard (Pawling CG-520) For >50 To 100 LF, Deduct For >100 To 200 LF, Deduct For >200 LF, Deduct	9.13 -0.90 -1.26 -1.89	2.16
10 26 13 00-0072 LF 2" Wing, 90 Degree Angle, Surface Mounted, Stainless Steel Corner Guard (Pawling CG-510) For >50 To 100 LF, Deduct For >100 To 200 LF, Deduct For >200 LF, Deduct	12.42 -0.90 -1.26 -2.06	2.16
10 26 13 00-0073 LF 3-1/2" Wing, 90 Degree Angle, Surface Mounted, Stainless Steel Corner Guard (Pawling CG-500) For >50 To 100 LF, Deduct For >100 To 200 LF, Deduct For >200 LF, Deduct	17.03 -0.90 -1.26 -2.29	2.16
10 26 13 00-0074 LF Bullnose 3-1/2" Wing, 90 Degree Angle, Surface Mounted, Stainless Steel Corner Guard (Pawling CG-550)..... For >50 To 100 LF, Deduct For >100 To 200 LF, Deduct For >200 LF, Deduct	17.03 -0.90 -1.26 -2.29	2.16
10 26 13 00-0075 135 Degree Angle, Surface Mounted, Stainless Steel Corner Guards <small>(10 26 13 00-0069)</small>		
10 26 13 00-0076 LF 3-1/2" Wing, 135 Degree Angle, Surface Mounted, Stainless Steel Corner Guard (Pawling CG-600) For >50 To 100 LF, Deduct For >100 To 200 LF, Deduct For >200 LF, Deduct	17.03 -0.90 -1.26 -2.29	2.16
10 26 13 00-0077 LF Bullnose 3-1/2" Wing, 135 Degree Angle, Surface Mounted, Stainless Steel Corner Guard (Pawling CG-650)..... For >50 To 100 LF, Deduct For >100 To 200 LF, Deduct For >200 LF, Deduct	17.03 -0.90 -1.26 -2.29	2.16
10 26 13 00-0078 Stainless Steel Angle Iron, Corner Guards <small>(10 26 13 00-0067)</small>		
10 26 13 00-0079 Surface Mounted, Stainless Steel Angle Iron, Corner Guards <small>(10 26 13 00-0078)</small>		
10 26 13 00-0080 90 Degree Angle, Surface Mounted, Stainless Steel Angle Iron, Corner Guards <small>(10 26 13 00-0079)</small>		
10 26 13 00-0081 LF 1" x 1" x 1/4", 90 Degree Angle, Surface Mounted, Stainless Steel Angle Iron, Corner Guard..... For >50 To 100 LF, Deduct For >100 To 200 LF, Deduct For >200 LF, Deduct	16.63 -1.08 -1.51 -2.56	2.59
10 26 13 00-0082 LF 2" x 2" x 1/4", 90 Degree Angle, Surface Mounted, Stainless Steel Angle Iron, Corner Guard..... For >50 To 100 LF, Deduct For >100 To 200 LF, Deduct For >200 LF, Deduct	28.02 -1.17 -1.63 -3.27	2.80
10 26 13 00-0083 LF 2" x 3" x 1/4", 90 Degree Angle, Surface Mounted, Stainless Steel Angle Iron, Corner Guard..... For >50 To 100 LF, Deduct For >100 To 200 LF, Deduct For >200 LF, Deduct	39.42 -1.21 -1.70 -3.91	2.91
10 26 13 00-0084 LF 3" x 3" x 1/4", 90 Degree Angle, Surface Mounted, Stainless Steel Angle Iron, Corner Guard..... For >50 To 100 LF, Deduct For >100 To 200 LF, Deduct For >200 LF, Deduct	36.73 -1.26 -1.76 -3.85	3.02
10 26 13 00-0085 LF 3" x 4" x 1/4", 90 Degree Angle, Surface Mounted, Stainless Steel Angle Iron, Corner Guard..... For >50 To 100 LF, Deduct For >100 To 200 LF, Deduct For >200 LF, Deduct	52.80 -1.30 -1.82 -4.72	3.12
10 26 13 00-0086 LF 4" x 4" x 1/4", 90 Degree Angle, Surface Mounted, Stainless Steel Angle Iron, Corner Guard..... For >50 To 100 LF, Deduct For >100 To 200 LF, Deduct For >200 LF, Deduct	48.69 -1.35 -1.89 -4.59	3.23
10 26 13 00-0087 Rubber Corner Guards <small>(10 26 13)</small> Note: Includes adhesive for installation.		
10 26 13 00-0088 Natural Rubber Corner Guards <small>(10 26 13 00-0087)</small>		
10 26 13 00-0089 Surface Mounted, Natural Rubber Corner Guards <small>(10 26 13 00-0088)</small>		
10 26 13 00-0090 90 Degree Angle, Surface Mounted, Natural Rubber Corner Guards <small>(10 26 13 00-0089)</small>		
10 26 13 00-0091 LF 4-3/4" Wing, 90 Degree Angle, Surface Mounted, Natural Rubber Corner Guard (Pawling CG-5)..... For >50 To 100 LF, Deduct For >100 To 200 LF, Deduct For >200 LF, Deduct For Bolting To Concrete Or Masonry, Add	37.48 -0.90 -1.26 -3.31 6.16	2.16

10 Specialties**10 20 Interior Specialties****10 26 Wall And Door Protection**

MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
10 26 13 00-0092		Styrene-Butadiene Rubber (SBR) Corner Guards <small>(10 26 13 00-0087)</small>			
10 26 13 00-0093		Surface Mounted, Styrene-Butadiene Rubber (SBR) Corner Guards <small>(10 26 13 00-0092)</small>			
10 26 13 00-0094		90 Degree Angle, Surface Mounted, Styrene-Butadiene Rubber (SBR) Corner Guards <small>(10 26 13 00-0093)</small>			
10 26 13 00-0095	LF	4-5/8" Wing, 90 Degree Angle, Surface Mounted, Styrene-Butadiene Rubber (SBR) Corner Guard (Pawling CG-2).....	23.63		2.16
		<i>For >50 To 100 LF, Deduct</i>	-0.90		
		<i>For >100 To 200 LF, Deduct</i>	-1.26		
		<i>For >200 LF, Deduct</i>	-2.62		
		<i>For Bolting To Concrete Or Masonry, Add</i>	4.08		
10 26 13 00-0096		Ethylene Propylene Diene Monomer (EPDM) Rubber Corner Guards <small>(10 26 13 00-0087)</small>			
10 26 13 00-0097		Surface Mounted, Ethylene Propylene Diene Monomer (EPDM) Rubber Corner Guards <small>(10 26 13 00-0096)</small>			
10 26 13 00-0098		90 Degree Angle, Surface Mounted, Ethylene Propylene Diene Monomer (EPDM) Rubber Corner Guards <small>(10 26 13 00-0097)</small>			
10 26 13 00-0099	LF	4-5/8" Wing, 90 Degree Angle, Surface Mounted, Ethylene Propylene Diene Monomer (EPDM) Rubber Corner Guard (Pawling CG-2E).....	15.61		2.16
		<i>For >50 To 100 LF, Deduct</i>	-0.90		
		<i>For >100 To 200 LF, Deduct</i>	-1.26		
		<i>For >200 LF, Deduct</i>	-2.22		
		<i>For Bolting To Concrete Or Masonry, Add</i>	2.88		
10 26 16		Bumper Guards <small>(10 26)</small>			
10 26 16 13		Bumper Rails <small>(10 26 16)</small>			
10 26 16 13-0001		Crash Rails <small>(10 26 16 13)</small> Note: Includes end caps.			
10 26 16 13-0002		Polycarbonate Crash Rails <small>(10 26 16 13-0001)</small>			
10 26 16 13-0003	LF	3" High, 5/16" Deep, Polycarbonate Crash Rail (Pawling CR-3).....	8.79		2.87
		<i>For >50 To 100 LF, Deduct</i>	-1.44		
		<i>For >100 To 200 LF, Deduct</i>	-2.01		
		<i>For >200 LF, Deduct</i>	-2.74		
10 26 16 13-0004	LF	4" High, 5/16" Deep, Polycarbonate Crash Rail (Pawling CR-4).....	9.50		2.87
		<i>For >50 To 100 LF, Deduct</i>	-1.44		
		<i>For >100 To 200 LF, Deduct</i>	-2.01		
		<i>For >200 LF, Deduct</i>	-2.78		
10 26 16 13-0005		Aluminum Crash Rails <small>(10 26 16 13-0001)</small>			
10 26 16 13-0006	LF	4" High, 3-1/4" Deep, Aluminum Crash Rail (Pawling CRA-100).....	28.63		2.87
		<i>For >50 To 100 LF, Deduct</i>	-1.44		
		<i>For >100 To 200 LF, Deduct</i>	-2.01		
		<i>For >200 LF, Deduct</i>	-3.73		
10 26 16 13-0007		Stainless Steel Crash Rails <small>(10 26 16 13-0001)</small>			
10 26 16 13-0008	LF	4" High, 3-1/4" Deep, Stainless Steel Crash Rail (Pawling CRS-100).....	51.51		2.87
		<i>For >50 To 100 LF, Deduct</i>	-1.44		
		<i>For >100 To 200 LF, Deduct</i>	-2.01		
		<i>For >200 LF, Deduct</i>	-4.88		
10 26 16 13-0009	LF	5-1/2" High, 1-1/2" Deep, Stainless Steel Crash Rail (Pawling CRS-200).....	40.07		2.87
		<i>For >50 To 100 LF, Deduct</i>	-1.44		
		<i>For >100 To 200 LF, Deduct</i>	-2.01		
		<i>For >200 LF, Deduct</i>	-4.30		
10 26 16 13-0010		Wall Guards <small>(10 26 16 13)</small>			
10 26 16 13-0011		Rigid Vinyl Wall Guards With Aluminum Retainers <small>(10 26 16 13-0010)</small> Note: Includes end caps.			
10 26 16 13-0012	LF	1-1/2" High, 1-1/2" Deep, Flat, Rigid Vinyl Wall Guard With Aluminum Retainer (Pawling WG-1).....	9.36		2.52
		<i>For >50 To 100 LF, Deduct</i>	-1.26		
		<i>For >100 To 200 LF, Deduct</i>	-1.76		
		<i>For >200 LF, Deduct</i>	-2.48		
10 26 16 13-0013	LF	3" High, 1" Deep, Flat, Rigid Vinyl Wall Guard With Aluminum Retainer (Pawling WG-3).....	10.94		2.87
		<i>For >50 To 100 LF, Deduct</i>	-1.44		
		<i>For >100 To 200 LF, Deduct</i>	-2.01		
		<i>For >200 LF, Deduct</i>	-2.85		
10 26 16 13-0014	LF	4" High, 3/4" Deep, Flat, Rigid Vinyl Wall Guard With Aluminum Retainer (Pawling WG-4).....	11.90		2.87
		<i>For >50 To 100 LF, Deduct</i>	-1.44		
		<i>For >100 To 200 LF, Deduct</i>	-2.01		
		<i>For >200 LF, Deduct</i>	-2.90		



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MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 26 16 13-0015	LF		5" High, 1-1/16" Deep, Curved, Rigid Vinyl Wall Guard With Aluminum Retainer (Pawling WG-5)..... <i>For >50 To 100 LF, Deduct</i> <i>For >100 To 200 LF, Deduct</i> <i>For >200 LF, Deduct</i>	13.10 -1.44 -2.01 -2.96	2.87
10 26 16 13-0016	LF		6" High, 1" Deep, Flat, Rigid Vinyl Wall Guard With Aluminum Retainer (Pawling WG-6)..... <i>For >50 To 100 LF, Deduct</i> <i>For >100 To 200 LF, Deduct</i> <i>For >200 LF, Deduct</i>	14.84 -1.53 -2.14 -3.18	3.05
10 26 16 13-0017	LF		7-3/4" High, 1" Deep, Flat, Rigid Vinyl Wall Guard With Aluminum Retainer (Pawling WG-8)..... <i>For >50 To 100 LF, Deduct</i> <i>For >100 To 200 LF, Deduct</i> <i>For >200 LF, Deduct</i>	15.42 -1.53 -2.14 -3.21	3.05
10 26 16 13-0018	LF		8" High, 1-1/16" Deep, Curved, Rigid Vinyl Wall Guard With Aluminum Retainer (Pawling WG-7)..... <i>For >50 To 100 LF, Deduct</i> <i>For >100 To 200 LF, Deduct</i> <i>For >200 LF, Deduct</i>	15.92 -1.53 -2.14 -3.24	3.05
10 26 16 13-0019	LF		12" High, 2" Deep, Flat, Rigid Vinyl Wall Guard With Aluminum Retainer (Pawling WG-12)..... <i>For >50 To 100 LF, Deduct</i> <i>For >100 To 200 LF, Deduct</i> <i>For >200 LF, Deduct</i>	20.01 -1.62 -2.26 -3.58	3.23
10 26 16 13-0020			Rubber Wall Guards <small>(10 26 16 13-0010)</small>		
10 26 16 13-0021			D-Shaped, Rubber Wall Guards <small>(10 26 16 13-0020)</small>		
10 26 16 13-0022	LF		2" High, 1-3/4" Deep, D-Shaped, Rubber Wall Guard (Pawling D-2)..... <i>For >50 To 100 LF, Deduct</i> <i>For >100 To 200 LF, Deduct</i> <i>For >200 LF, Deduct</i>	17.39 -1.26 -1.76 -2.88	2.52
10 26 16 13-0023	LF		3" High, 3" Deep, D-Shaped, Rubber Wall Guard (Pawling D-3)..... <i>For >50 To 100 LF, Deduct</i> <i>For >100 To 200 LF, Deduct</i> <i>For >200 LF, Deduct</i>	24.63 -1.44 -2.01 -3.53	2.87
10 26 16 13-0024	LF		4" High, 4-1/4" Deep, D-Shaped, Rubber Wall Guard (Pawling D-4)..... <i>For >50 To 100 LF, Deduct</i> <i>For >100 To 200 LF, Deduct</i> <i>For >200 LF, Deduct</i>	32.18 -1.44 -2.01 -3.91	2.87
10 26 16 13-0025	LF		6" High, 6" Deep, D-Shaped, Rubber Wall Guard (Pawling D-6)..... <i>For >50 To 100 LF, Deduct</i> <i>For >100 To 200 LF, Deduct</i> <i>For >200 LF, Deduct</i>	44.21 -1.44 -2.01 -4.51	2.87
10 26 16 13-0026			U-Shaped, Rubber Wall Guards <small>(10 26 16 13-0020)</small>		
10 26 16 13-0027	LF		3-1/8" High, 3-7/8" Deep, U-Shaped, Rubber Wall Guard (Pawling U-4)..... <i>For >50 To 100 LF, Deduct</i> <i>For >100 To 200 LF, Deduct</i> <i>For >200 LF, Deduct</i>	44.14 -1.53 -2.14 -4.65	3.05
10 26 16 13-0028	LF		4-1/2" High, 3-1/2" Deep, U-Shaped, Rubber Wall Guard (Pawling U-3)..... <i>For >50 To 100 LF, Deduct</i> <i>For >100 To 200 LF, Deduct</i> <i>For >200 LF, Deduct</i>	49.57 -1.53 -2.14 -4.92	3.05
10 26 16 13-0029			Rectangular, Rubber Wall Guards <small>(10 26 16 13-0020)</small>		
10 26 16 13-0030	LF		8" High, 1-1/2" Deep, Rectangular, Rubber Wall Guard (Pawling E-1)..... <i>For >50 To 100 LF, Deduct</i> <i>For >100 To 200 LF, Deduct</i> <i>For >200 LF, Deduct</i>	32.52 -1.53 -2.14 -4.07	3.05
10 26 16 13-0031	LF		9" High, 2" Deep, Rectangular, Rubber Wall Guard (Pawling M-2)..... <i>For >50 To 100 LF, Deduct</i> <i>For >100 To 200 LF, Deduct</i> <i>For >200 LF, Deduct</i>	38.37 -1.62 -2.26 -4.50	3.23
10 26 16 13-0032			Wing Type, Rubber Wall Guards <small>(10 26 16 13-0020)</small>		
10 26 16 13-0033	LF		3-7/8" High, 2-1/2" Deep, Wing Type, Rubber Wall Guard (Pawling WT-25)..... <i>For >50 To 100 LF, Deduct</i> <i>For >100 To 200 LF, Deduct</i> <i>For >200 LF, Deduct</i>	25.03 -1.26 -1.76 -3.26	2.52
10 26 16 13-0034	LF		6" High, 2" Deep, Wing Type, Rubber Wall Guard (Pawling WT-20)..... <i>For >50 To 100 LF, Deduct</i> <i>For >100 To 200 LF, Deduct</i> <i>For >200 LF, Deduct</i>	52.65 -1.44 -2.01 -4.93	2.87
10 26 16 13-0035	LF		6" High, 3" Deep, Wing Type, Rubber Wall Guard (Pawling WT-30)..... <i>For >50 To 100 LF, Deduct</i> <i>For >100 To 200 LF, Deduct</i> <i>For >200 LF, Deduct</i>	56.09 -1.44 -2.01 -5.10	2.87
10 26 16 13-0036			Accent Rails <small>(10 26 16 13)</small> Note: Includes end caps.		
10 26 16 13-0037			Oval, Rigid Vinyl Accent Rails With Aluminum Retainers <small>(10 26 16 13-0036)</small>		

10 Specialties**10 20 Interior Specialties****10 26 Wall And Door Protection**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 26 16 13-0038	LF		1-1/8" High, 1-1/16" Deep, Oval, Rigid Vinyl Accent Rail With Aluminum Retainer (Pawling EB-25).....	10.61	2.52
			<i>For >50 To 100 LF, Deduct</i>	-1.26	
			<i>For >100 To 200 LF, Deduct</i>	-1.76	
			<i>For >200 LF, Deduct</i>	-2.54	
10 26 16 13-0039	LF		2" High, 1-1/8" Deep, Oval, Rigid Vinyl Accent Rail With Aluminum Retainer (Pawling EBR-30).....	13.55	2.52
			<i>For >50 To 100 LF, Deduct</i>	-1.26	
			<i>For >100 To 200 LF, Deduct</i>	-1.76	
			<i>For >200 LF, Deduct</i>	-2.69	
10 26 16 13-0040	LF		2" High, 1-3/4" Deep, Oval, Rigid Vinyl Accent Rail With Aluminum Retainer (Pawling WG-22).....	16.49	2.52
			<i>For >50 To 100 LF, Deduct</i>	-1.26	
			<i>For >100 To 200 LF, Deduct</i>	-1.76	
			<i>For >200 LF, Deduct</i>	-2.84	
10 26 16 16 Protective Corridor Handrails (10 26 16)					
10 26 16 16-0001			Protective Corridor Handrails (10 26 16 16)		
10 26 16 16-0002			Vinyl/Acrylic Protective Corridor Handrails With Aluminum Retainers (10 26 16 16-0001)		
10 26 16 16-0003	LF		1-1/2" Diameter, Vinyl/Acrylic Protective Corridor Handrail With Aluminum Retainer (Acrovyn HR-6CN).....	16.78	5.39
			<i>For >50 To 100 LF, Deduct</i>	-2.70	
			<i>For >100 To 200 LF, Deduct</i>	-3.77	
			<i>For >200 LF, Deduct</i>	-5.15	
10 26 16 16-0004	EA		End Cap For 1-1/2" Diameter, Vinyl/Acrylic Protective Corridor Handrail With Aluminum Retainer (Acrovyn).....	14.78	5.39
			<i>For >25 To 50, Deduct</i>	-2.70	
			<i>For >50 To 100, Deduct</i>	-3.77	
			<i>For >100, Deduct</i>	-5.05	
10 26 16 16-0005	LF		5-1/2" High, Vinyl/Acrylic Protective Corridor Handrail With Aluminum Retainer (Acrovyn HRB-4C).....	22.78	5.39
			<i>For >50 To 100 LF, Deduct</i>	-2.70	
			<i>For >100 To 200 LF, Deduct</i>	-3.77	
			<i>For >200 LF, Deduct</i>	-5.45	
10 26 16 16-0006	EA		End Cap For 5-1/2" High, Vinyl/Acrylic Protective Corridor Handrail With Aluminum Retainer (Acrovyn).....	19.78	5.39
			<i>For >25 To 50, Deduct</i>	-2.70	
			<i>For >50 To 100, Deduct</i>	-3.77	
			<i>For >100, Deduct</i>	-5.30	
10 26 16 16-0007	LF		6-1/4" High, Vinyl/Acrylic Crash And Handrail With Aluminum Retainer (Acrovyn HRB-10CN).....	23.78	5.39
			<i>For >50 To 100 LF, Deduct</i>	-2.70	
			<i>For >100 To 200 LF, Deduct</i>	-3.77	
			<i>For >200 LF, Deduct</i>	-5.50	
10 26 16 16-0008	EA		End Cap For 6-1/4" High, Vinyl/Acrylic Crash And Handrail With Aluminum Retainer (Acrovyn).....	25.78	5.39
			<i>For >25 To 50, Deduct</i>	-2.70	
			<i>For >50 To 100, Deduct</i>	-3.77	
			<i>For >100, Deduct</i>	-5.60	
10 26 16 16-0009	LF		6" High, Vinyl/Acrylic Protective Corridor Handrail With Aluminum Retainer (Acrovyn HR-8CN).....	29.78	5.39
			<i>For >50 To 100 LF, Deduct</i>	-2.70	
			<i>For >100 To 200 LF, Deduct</i>	-3.77	
			<i>For >200 LF, Deduct</i>	-5.80	
10 26 16 16-0010	EA		End Cap For 6" High, Vinyl/Acrylic Protective Corridor Handrail With Aluminum Retainer (Acrovyn).....	33.78	5.39
			<i>For >25 To 50, Deduct</i>	-2.70	
			<i>For >50 To 100, Deduct</i>	-3.77	
			<i>For >100, Deduct</i>	-6.00	
10 26 16 16-0011			Stainless Steel Protective Corridor Handrails (10 26 16 16-0001)		
10 26 16 16-0012	LF		5-7/8" High, Stainless Steel Protective Corridor Handrail (Acrovyn P-RS).....	39.78	5.39
			<i>For >50 To 100 LF, Deduct</i>	-2.70	
			<i>For >100 To 200 LF, Deduct</i>	-3.77	
			<i>For >200 LF, Deduct</i>	-6.30	
10 26 16 16-0013	EA		End Cap For 5-7/8" High, Stainless Steel Protective Corridor Handrail (Acrovyn).....	40.78	5.39
			<i>For >25 To 50, Deduct</i>	-2.70	
			<i>For >50 To 100, Deduct</i>	-3.77	
			<i>For >100, Deduct</i>	-6.35	
10 26 23 Protective Wall Covering (10 26)					
10 26 23 00-0001			Impact Resistant Wall Protection (10 26 23) Note: Includes standard trim.		
10 26 23 00-0002	SF		0.030" Rigid Vinyl, Impact Resistant Wall Covering (Pawling WC-30).....	5.68	1.79
10 26 23 00-0003	SF		0.040" Rigid Vinyl, Impact Resistant Wall Covering (Pawling WC-40).....	6.14	1.79
10 26 23 00-0004	SF		0.060" Rigid Vinyl, Impact Resistant Wall Covering (Pawling WC-60).....	7.38	1.79
10 26 23 00-0005			Interior Polyvinyl Chloride (PVC) Soffit System (10 26 23) Note: DecoShield Systems, Inc. Concealment system for fire sprinkler piping, plumbing lines, HVAC, cable and conduit.		
10 26 23 00-0006			"L" Design (10 26 23 00-0005)		
10 26 23 00-0007			L-Shield (10 26 23 00-0006)		
10 26 23 00-0008	LF		2.38" Depth L-Shield Cover, Duplex Polyvinyl Chloride (PVC), 1" Shield Size For 3/4" And 1" Pipe.....	9.07	1.79
10 26 23 00-0009	LF		3" Depth L-Shield Cover, Duplex Polyvinyl Chloride (PVC), 1-1/4" Shield Size For 1-1/4" And 1-1/2" Pipe.....	10.63	2.52
10 26 23 00-0010	LF		3.75" Depth L-Shield Cover, Duplex Polyvinyl Chloride (PVC), 2" Shield Size For 2" Pipe.....	13.94	3.23
10 26 23 00-0011	LF		5.75" Depth L-Shield Cover, Duplex Polyvinyl Chloride (PVC), 2-1/2" Shield Size For 2-1/2" Pipe.....	18.99	3.95



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MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 26 23 00-0012 "Combo" Hanger <small>(10 26 23 00-0006)</small>		
10 26 23 00-0013 EA Combination "Combo" Hanger, L-Support, For 3/4" Pipe	10.52	3.60
10 26 23 00-0014 EA Combination "Combo" Hanger, L-Support, For 1" Pipe	12.22	4.31
10 26 23 00-0015 EA Combination "Combo" Hanger, L-Support, For 1-1/4" Pipe	14.13	5.03
10 26 23 00-0016 EA Combination "Combo" Hanger, L-Support, For 1-1/2" Pipe	15.77	5.75
10 26 23 00-0017 EA Combination "Combo" Hanger, L-Support, For 2" Pipe	17.68	6.47
10 26 23 00-0018 Snap-2 Pipe Hanger <small>(10 26 23 00-0006)</small>		
10 26 23 00-0019 EA Snap-2 Pipe Hanger, L-Support, For 3/4" Pipe	8.91	3.60
10 26 23 00-0020 EA Snap-2 Pipe Hanger, L-Support, For 1" Pipe	10.82	4.31
10 26 23 00-0021 EA Snap-2 Pipe Hanger, L-Support, For 1-1/4" Pipe	12.60	5.03
10 26 23 00-0022 EA Snap-2 Pipe Hanger, L-Support, For 1-1/2" Pipe	14.64	5.75
10 26 23 00-0023 EA Snap-2 Pipe Hanger, L-Support, For 2" Pipe	16.74	6.47
10 26 23 00-0024 Coupling <small>(10 26 23 00-0006)</small>		
10 26 23 00-0025 EA Coupling, L-Shield, 1" Shield Size	5.67	1.79
10 26 23 00-0026 EA Coupling, L-Shield, 1-1/4" Shield Size	8.17	2.52
10 26 23 00-0027 EA Coupling, L-Shield, 2" Shield Size	11.61	3.23
10 26 23 00-0028 EA Coupling, L-Shield, 2-1/2" Shield Size	14.52	3.95
10 26 23 00-0029 Coupling, Reducer <small>(10 26 23 00-0006)</small>		
10 26 23 00-0030 EA Coupling, Reducing, L-Shield, 1-1/4" x 1" Shield Size	14.99	2.16
10 26 23 00-0031 EA Coupling, Reducing, L-Shield, 2" x 1" Shield Size	18.37	2.52
10 26 23 00-0032 EA Coupling, Reducing, L-Shield, 2" x 1-1/4" Shield Size	21.76	2.87
10 26 23 00-0033 EA Coupling, Reducing, L-Shield, 2-1/2" x 2" Shield Size	82.45	3.60
10 26 23 00-0034 Shield Clips <small>(10 26 23 00-0006)</small>		
10 26 23 00-0035 EA Shield Clips, L-Support, 1" Shield Size	3.43	1.08
10 26 23 00-0036 EA Shield Clips, L-Support, 1-1/4" Shield Size	5.20	1.79
10 26 23 00-0037 EA Shield Clips, L-Support, 2" Shield Size	6.90	2.52
10 26 23 00-0038 EA Shield Clips, L-Support, 2-1/2" Shield Size	7.94	3.23
10 26 23 00-0039 Wall Flange <small>(10 26 23 00-0006)</small>		
10 26 23 00-0040 EA Wall Flange, L-Shield, 1" Shield Size	5.54	1.79
10 26 23 00-0041 EA Wall Flange, L-Shield, 1-1/4" Shield Size	7.90	2.52
10 26 23 00-0042 EA Wall Flange, L-Shield, 2" Shield Size	11.34	3.23
10 26 23 00-0043 EA Wall Flange, L-Shield, 2-1/2" Shield Size	43.71	3.95
10 26 23 00-0044 End Cap <small>(10 26 23 00-0006)</small>		
10 26 23 00-0045 EA End Cap, L-Shield, 1" Shield Size	5.43	1.08
10 26 23 00-0046 EA End Cap, L-Shield, 1-1/4" Shield Size	7.34	1.79
10 26 23 00-0047 EA End Cap, L-Shield, 2" Shield Size	10.17	2.52
10 26 23 00-0048 EA End Cap, L-Shield, 2-1/2" Shield Size	44.24	3.23
10 26 23 00-0049 Inside/Outside Corner <small>(10 26 23 00-0006)</small>		
10 26 23 00-0050 EA Inside/Outside Corner, L-Shield, 1" Shield Size	32.74	3.60
10 26 23 00-0051 EA Inside/Outside Corner, L-Shield, 1-1/4" Shield Size	35.44	4.31
10 26 23 00-0052 EA Inside/Outside Corner, L-Shield, 2" Shield Size	42.87	5.39
10 26 23 00-0053 EA Inside/Outside Corner, L-Shield, 2-1/2" Shield Size	73.99	6.47
10 26 23 00-0054 Joiner <small>(10 26 23 00-0006)</small>		
10 26 23 00-0055 LF Joiner, L-Shield	6.90	1.08
10 26 23 00-0056 "U" Design <small>(10 26 23 00-0005)</small>		
10 26 23 00-0057 U-Shield <small>(10 26 23 00-0005)</small>		
10 26 23 00-0058 LF 2.25" Depth U-Shield Cover, Duplex Polyvinyl Chloride (PVC), 1" Shield Size For 3/4" And 1" Pipe	10.81	1.79
10 26 23 00-0059 LF 2.875" Depth U-Shield Cover, Duplex Polyvinyl Chloride (PVC), 1-1/4" Shield Size For 1-1/4" Pipe	13.57	2.52
10 26 23 00-0060 LF 3.68" Depth U-Shield Cover, Duplex Polyvinyl Chloride (PVC), 2" Shield Size For 1-1/2" And 2" Pipe	17.35	2.52
10 26 23 00-0061 "Combo" Hanger <small>(10 26 23 00-0006)</small>		
10 26 23 00-0062 EA Combination "Combo" Hanger, U-Support For 3/4" Pipe	9.25	3.60
10 26 23 00-0063 EA Combination "Combo" Hanger, U-Support For 1" Pipe	11.02	4.31
10 26 23 00-0064 EA Combination "Combo" Hanger, U-Support For 1-1/4" Pipe	12.73	5.03
10 26 23 00-0065 EA Combination "Combo" Hanger, U-Support For 1-1/2" Pipe	15.57	5.75
10 26 23 00-0066 EA Combination "Combo" Hanger, U-Support For 2" Pipe	17.61	6.47

10 Specialties**10 20 Interior Specialties****10 26 Wall And Door Protection**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 26 23 00-0067			Snap-2 Pipe Hanger <small>(10 26 23 00-0056)</small>		
10 26 23 00-0068	EA		Snap-2 Pipe Hanger, U-Support, For 3/4" Pipe	8.78	3.60
10 26 23 00-0069	EA		Snap-2 Pipe Hanger, U-Support, For 1" Pipe	10.69	4.31
10 26 23 00-0070	EA		Snap-2 Pipe Hanger, U-Support, For 1-1/4" Pipe	12.93	5.03
10 26 23 00-0071	EA		Snap-2 Pipe Hanger, U-Support, For 1-1/2" Pipe	14.50	5.75
10 26 23 00-0072	EA		Snap-2 Pipe Hanger, U-Support, For 2" Pipe	16.68	6.47
10 26 23 00-0073			Coupling <small>(10 26 23 00-0056)</small>		
10 26 23 00-0074	EA		Coupling, U-Shield, 1" Shield Size	6.60	1.79
10 26 23 00-0075	EA		Coupling, U-Shield, 1-1/4" Shield Size	8.37	2.52
10 26 23 00-0076	EA		Coupling, U-Shield, 2" Shield Size	10.27	3.23
10 26 23 00-0077			Coupling, Reducer <small>(10 26 23 00-0056)</small>		
10 26 23 00-0078	EA		Reducing Coupling, U-Shield, 1-1/4" x 1" Shield Size	17.65	2.16
10 26 23 00-0079	EA		Reducing Coupling, U-Shield, 2" x 1" Shield Size	21.04	2.52
10 26 23 00-0080	EA		Reducing Coupling, U-Shield, 2" x 1-1/4" Shield Size	22.43	2.87
10 26 23 00-0081			Shield Clips <small>(10 26 23 00-0056)</small>		
10 26 23 00-0082	EA		Shield Clips, U-Support, 1" Shield Size	3.16	1.08
10 26 23 00-0083	EA		Shield Clips, U-Support, 1-1/4" Shield Size	4.73	1.79
10 26 23 00-0084	EA		Shield Clips, U-Support, 2" Shield Size	6.30	2.52
10 26 23 00-0085			Wall Flange <small>(10 26 23 00-0056)</small>		
10 26 23 00-0086	EA		Wall Flange, U-Shield, 1" Shield Size	6.40	1.79
10 26 23 00-0087	EA		Wall Flange, U-Shield, 1-1/4" Shield Size	8.30	2.52
10 26 23 00-0088	EA		Wall Flange, U-Shield, 2" Shield Size	10.21	3.23
10 26 23 00-0089			End Cap <small>(10 26 23 00-0056)</small>		
10 26 23 00-0090	EA		End Cap, U-Shield, 1" Shield Size	5.76	1.08
10 26 23 00-0091	EA		End Cap, U-Shield, 1-1/4" Shield Size	7.87	1.79
10 26 23 00-0092	EA		End Cap, U-Shield, 2" Shield Size	9.90	2.52
10 26 23 00-0093			Inside/Outside Corner <small>(10 26 23 00-0056)</small>		
10 26 23 00-0094	EA		Inside/Outside Corner, U-Shield, 1" Shield Size	40.81	3.60
10 26 23 00-0095	EA		Inside/Outside Corner, U-Shield, 1-1/4" Shield Size	45.52	4.31
10 26 23 00-0096	EA		Inside/Outside Corner, U-Shield, 2" Shield Size	53.95	5.39
10 26 23 00-0097			Elbow <small>(10 26 23 00-0056)</small>		
10 26 23 00-0098	EA		Elbow, U-Shield, 1" Shield Size	40.08	3.60
10 26 23 00-0099	EA		Elbow, U-Shield, 1-1/4" Shield Size	44.18	4.31
10 26 23 00-0100	EA		Elbow, U-Shield, 2" Shield Size	52.68	5.39
10 26 23 00-0101			Tee <small>(10 26 23 00-0056)</small>		
10 26 23 00-0102	EA		Tee, U-Shield, 1" x 1" x 1" Shield Size	51.02	5.39
10 26 23 00-0103	EA		Tee, U-Shield, 1-1/4" x 1-1/4" x 1-1/4" Shield Size	56.91	6.47
10 26 23 00-0104	EA		Tee, U-Shield, 2" x 2" x 2" Shield Size	66.59	7.91
10 26 23 00-0105	EA		Tee, U-Shield, 1-1/4" x 1-1/4" x 1" Shield Size	66.93	6.11
10 26 23 00-0106	EA		Tee, U-Shield, 2" x 2" x 1-1/4" Shield Size	72.54	7.55
10 26 23 00-0107			Cross <small>(10 26 23 00-0056)</small>		
10 26 23 00-0108	EA		Cross, U-Shield, 1" Shield Size	91.45	7.18
10 26 23 00-0109	EA		Cross, U-Shield, 1-1/4" Shield Size	102.66	8.62
10 26 23 00-0110	EA		Cross, U-Shield, 2" Shield Size	124.85	10.78
10 26 23 00-0111	EA		Cross, U-Shield, 1-1/4" x 1" Shield Size	124.71	7.91
10 26 23 00-0112	EA		Cross, U-Shield, 2" x 1-1/4" Shield Size	137.50	9.70
10 26 23 00-0113			Transition Fittings (L to U Or U to L) <small>(10 26 23 00-0005)</small>		
10 26 23 00-0114			Coupling Transition <small>(10 26 23 00-0113)</small>		
10 26 23 00-0115	EA		Transition Coupling, 1" x 1", LxU or UxL	15.74	1.79
10 26 23 00-0116	EA		Transition Coupling, 1-1/4" x 1-1/4", LxU or UxL	17.97	2.52
10 26 23 00-0117	EA		Transition Coupling, 2" x 2", LxU or UxL	22.42	3.23
10 26 23 00-0118	EA		Transition Coupling, 1" x 1-1/4", LxU or UxL	17.86	2.16
10 26 23 00-0119	EA		Transition Coupling, 1-1/4" x 2", LxU or UxL	22.30	2.87
10 26 23 00-0120	EA		Transition Coupling, 2" x 2-1/2", LxU or UxL	86.25	3.60



Specialties	10
Interior Specialties	10 20
Wall And Door Protection	10 26

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 26 23 00-0121 Elbow Transition <small>(10 26 23 00-0113)</small>		
10 26 23 00-0122 EA Transition Elbow, 1" x 1" (UxL)	53.49	3.60
10 26 23 00-0123 EA Transition Elbow, 1-1/4" x 1-1/4" (UxL)	58.13	4.31
10 26 23 00-0124 EA Transition Elbow, 2" x 2" (UxL)	68.30	5.39
10 26 23 00-0125 EA Transition Elbow, 1" x 1-1/4" (UxL)	82.64	3.95
10 26 23 00-0126 EA Transition Elbow, 1-1/4" x 1" (UxL)	58.89	3.95
10 26 23 00-0127 EA Transition Elbow, 1-1/4" x 2" (UxL)	87.59	5.03
10 26 23 00-0128 EA Transition Elbow, 2" x 1-1/4" (UxL)	68.31	5.03
10 26 23 00-0129 EA Transition Elbow, 2" x 2-1/2" (UxL)	105.18	5.75
10 26 23 00-0130 Tee Transition <small>(10 26 23 00-0113)</small>		
10 26 23 00-0131 EA Transition Tee, 1" x 1" x 1" (LxLxU)	61.76	5.39
10 26 23 00-0132 EA Transition Tee, 1-1/4" x 1-1/4" x 1-1/4" (LxLxU)	71.52	6.47
10 26 23 00-0133 EA Transition Tee, 2" x 2" x 2" (LxLxU)	83.34	7.91
10 26 23 00-0134 EA Transition Tee, 1-1/4" x 1-1/4" x 1" (LxLxU)	65.40	6.11
10 26 23 00-0135 EA Transition Tee, 1-1/4" x 1-1/4" x 2" (LxLxU)	101.73	6.83
10 26 23 00-0136 EA Transition Tee, 2" x 2" x 1-1/4" (LxLxU)	73.14	7.55
10 26 23 00-0137 EA Transition Tee, 2-1/2" x 2-1/2" x 2" (LxLxU)	99.36	8.99
10 26 23 00-0138 Fittings (L Or U) <small>(10 26 23 00-0005)</small>		
10 26 23 00-0139 Hugger Hangers For Steel Pipe <small>(10 26 23 00-0138)</small>		
10 26 23 00-0140 EA Hugger Hanger, For 1/2" Steel Pipe	7.15	2.87
10 26 23 00-0141 EA Hugger Hanger, For 3/4" Steel Pipe	8.91	3.60
10 26 23 00-0142 EA Hugger Hanger, For 1" Steel Pipe	10.49	4.31
10 26 23 00-0143 EA Hugger Hanger, For 1-1/4" Steel Pipe	12.13	5.03
10 26 23 00-0144 EA Hugger Hanger, For 1-1/2" Steel Pipe	13.70	5.75
10 26 23 00-0145 EA Hugger Hanger, For 2" Steel Pipe	15.41	5.75
10 26 23 00-0146 EA Hugger Hanger, For 2-1/2" Steel Pipe	16.98	7.18
10 26 23 00-0147 EA Hugger Hanger, For 3" Steel Pipe	20.88	7.91
10 26 23 00-0148 Hugger Hangers For Copper Pipe <small>(10 26 23 00-0138)</small>		
10 26 23 00-0149 EA Hugger Hanger, For 1/2" Copper Pipe	7.22	2.87
10 26 23 00-0150 EA Hugger Hanger, For 3/4" Copper Pipe	8.98	3.60
10 26 23 00-0151 EA Hugger Hanger, For 1" Copper Pipe	10.56	4.31
10 26 23 00-0152 EA Hugger Hanger, For 1-1/4" Copper Pipe	12.20	5.03
10 26 23 00-0153 EA Hugger Hanger, For 1-1/2" Copper Pipe	13.77	5.75
10 26 23 00-0154 EA Hugger Hanger, For 2" Copper Pipe	15.54	6.47
10 26 23 00-0155 EA Hugger Hanger, For 2-1/2" Copper Pipe	17.12	7.18
10 26 23 00-0156 EA Hugger Hanger, For 3" Copper Pipe	21.08	7.91
10 26 23 00-0157 Shield Extension (L Or U) <small>(10 26 23 00-0138)</small>		
10 26 23 00-0158 LF Shield Extension	8.30	1.08
10 26 23 00-0159 Interior Steel Soffit System <small>(10 26 23)</small>		
Note: Concealment system for fire sprinkler piping, plumbing lines, HVAC, cable and conduit. Includes factory painted finish and field touch-up.		
10 26 23 00-0160 SF 24 Gauge Steel, U-Shield (JG Innovations Soffi-Steel)	16.16	3.23
For 22 Gauge Steel, Add	0.97	
For 20 Gauge Steel, Add	2.07	
For 18 Gauge Steel, Add	4.07	
For 16 Gauge Steel, Add	6.25	
For Stainless Steel, Add	2.42	
10 26 23 00-0161 EA U-Shield Wall Flange (JG Innovations Soffi-Steel)	26.80	8.99
For Stainless Steel, Add	2.21	
10 26 23 00-0162 EA U-Shield Corner (JG Innovations Soffi-Steel)	63.51	10.78
For Stainless Steel, Add	10.31	
10 26 23 00-0163 EA U-Shield End Cap (JG Innovations Soffi-Steel)	20.20	5.39
For Stainless Steel, Add	2.36	
10 26 23 00-0164 EA U-Shield Clip (JG Innovations Soffi-Steel)	4.69	2.16
For Stainless Steel, Add	0.10	
10 26 23 00-0165 SF 24 Gauge Steel, L-Shield (JG Innovations Soffi-Steel)	18.23	3.23
For 22 Gauge Steel, Add	0.88	
For 20 Gauge Steel, Add	1.88	
For 18 Gauge Steel, Add	3.65	
For 16 Gauge Steel, Add	6.12	
For Stainless Steel, Add	2.94	
10 26 23 00-0166 EA L-Shield Wall Flange (JG Innovations Soffi-Steel)	26.80	8.99
For Stainless Steel, Add	2.21	
10 26 23 00-0167 EA L-Shield Corner (JG Innovations Soffi-Steel)	63.51	10.78
For Stainless Steel, Add	10.31	
10 26 23 00-0168 EA L-Shield End Cap (JG Innovations Soffi-Steel)	17.33	3.95
For Stainless Steel, Add	2.36	
10 26 23 00-0169 EA L-Shield Clip (JG Innovations Soffi-Steel)	4.69	2.16
For Stainless Steel, Add	0.10	

10	10	Specialties
	10 20	Interior Specialties
	10 28	Toilet, Bath, And Laundry Accessories



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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10 28	Toilet, Bath, And Laundry Accessories <small>(10 20)</small>		
10 28 13	Toilet Accessories <small>(10 28)</small>		
10 28 13 13	Commercial Toilet Accessories <small>(10 28 13)</small>		
10 28 13 13-0001	Toilet Accessories <small>(10 28 13 13)</small>		
10 28 13 13-0002	Dispensers <small>(10 28 13 13-0001)</small>		
10 28 13 13-0003	Paper Towel Dispensers <small>(10 28 13 13-0002)</small>		
10 28 13 13-0004	Stainless Steel Paper Towel Dispensers <small>(10 28 13 13-0003)</small>		
10 28 13 13-0005	EA Surface Mounted, Stainless Steel Folded Paper Towel Dispenser (Bobrick Classic B-262).....	73.99	16.16
10 28 13 13-0006	EA Surface Mounted, Stainless Steel Folded Paper Towel Dispenser (Bobrick B-2620)	79.24	16.16
10 28 13 13-0007	EA Surface Mounted, Stainless Steel Folded Paper Towel Dispenser (Bobrick B-2621)	80.02	16.16
10 28 13 13-0008	EA Surface Mounted, Stainless Steel Folded Paper Towel Dispenser (Bobrick Classic B-26212).....	81.53	16.16
10 28 13 13-0009	EA Surface Mounted, Stainless Steel Folded Paper Towel Dispenser (Bobrick B-263)	123.05	16.16
10 28 13 13-0010	EA Recessed Mounted, Stainless Steel Folded Paper Towel Dispenser (Bobrick Classic B-359)	132.39	16.16
10 28 13 13-0011	EA Surface Mounted, Stainless Steel Folded Paper Towel Dispenser (Bobrick Contura B-4262)	145.72	16.16
10 28 13 13-0012	EA Countertop Recessed Mounted, Stainless Steel Folded Paper Towel Dispenser (Bobrick TrimLine B-526)	152.05	7.18
10 28 13 13-0013	EA Concealed Cabinet, Recessed Mounted, Stainless Steel Folded Paper Towel Dispenser (Bobrick B-318)	254.08	16.16
10 28 13 13-0014	EA Touch Free, Surface Mounted, Stainless Steel Roll Paper Towel Dispenser (Bobrick B-2860).....	301.20	16.16
10 28 13 13-0015	EA Recessed Mounted, Stainless Steel Folded Paper Towel Dispenser (Bobrick B-4369).....	323.98	16.16
10 28 13 13-0016	EA Recessed Automated Touchless Towel Dispenser, Stainless (Georgia-Pacific enMotion® 59466).....	183.69	16.16
10 28 13 13-0017	EA Stainless Steel Mounting Bracket For Wall Mounting enMotion Recessed Automated Touchless Towel Dispenser (Georgia-Pacific enMotion® 59476)	80.81	8.98
10 28 13 13-0018	Plastic Paper Towel Dispensers <small>(10 28 13 13-0003)</small>		
10 28 13 13-0019	EA Surface Mounted, Acrylonitrile Butadiene Styrene (ABS) Plastic Folded Paper Towel Dispenser (Bobrick Matrix B- 5262)	56.07	16.16
10 28 13 13-0020	EA Surface Mounted, Acrylonitrile Butadiene Styrene (ABS) Plastic Roll Paper Towel Dispenser (Bobrick Matrix B- 52860)	116.43	16.16
10 28 13 13-0021	EA Surface Mounted, Translucent Cover, Acrylonitrile Butadiene Styrene (ABS) Plastic Roll Paper Towel Dispenser (Bobrick B-72860).....	115.62	16.16
10 28 13 13-0022	EA Surface Mounted, Automated Touchless Towel Dispenser, Translucent Plastic (Georgia-Pacific enMotion® 59462)	98.26	16.16
10 28 13 13-0023	Aluminum Paper Towel Dispensers <small>(10 28 13 13-0003)</small>		
10 28 13 13-0024	EA Surface Mounted, Heavy-Duty Aluminum Casting Roll Paper Towel Dispenser (Bobrick B-253).....	61.33	16.16
10 28 13 13-0025	Toilet Tissue Dispensers <small>(10 28 13 13-0002)</small>		
10 28 13 13-0026	Plastic Toilet Tissue Dispensers <small>(10 28 13 13-0025)</small>		
10 28 13 13-0027	EA Two Roll, Surface Mounted, Acrylonitrile Butadiene Styrene (ABS) Plastic Toilet Tissue Dispenser (Bobrick B- 5288)	55.88	16.16
10 28 13 13-0028	EA Two Jumbo Roll, Surface Mounted, Acrylonitrile Butadiene Styrene (ABS) Plastic Toilet Tissue Dispenser (Georgia Pacific 58250).....	85.75	16.16
10 28 13 13-0029	EA Vertical Double Roll, Surface Mounted, Translucent Plastic Steel Coreless Toilet Tissue Dispenser (Georgia- Pacific Compact® 56760).....	48.25	16.16
10 28 13 13-0030	EA Side By Side Double Roll, Surface Mounted, Translucent Plastic Toilet Tissue Dispenser (Georgia-Pacific Compact® 56784)	57.21	16.16
10 28 13 13-0031	Cast Aluminum Toilet Tissue Dispensers <small>(10 28 13 13-0025)</small>		
10 28 13 13-0032	EA Single Roll Without Controlled Delivery, Surface Mounted, Cast Aluminum Toilet Tissue Dispenser (Bobrick B- 2730)	50.43	16.16
10 28 13 13-0033	EA Single Roll With Controlled Delivery, Surface Mounted, Cast Aluminum Toilet Tissue Dispenser (Bobrick B-273).....	50.82	16.16
10 28 13 13-0034	EA Two Roll Without Controlled Delivery, Surface Mounted, Cast Aluminum Toilet Tissue Dispenser (Bobrick B-2740)	53.54	16.16
10 28 13 13-0035	EA Two Roll With Controlled Delivery, Surface Mounted, Cast Aluminum Toilet Tissue Dispenser (Bobrick B-274)	58.60	16.16
10 28 13 13-0036	EA Two Roll Without Controlled Delivery, Surface Mounted, Cast Aluminum Toilet Tissue Dispenser (Bobrick B- 27460)	77.29	16.16
10 28 13 13-0037	Stainless Steel Toilet Tissue Dispensers <small>(10 28 13 13-0025)</small>		
10 28 13 13-0038	EA Single Roll, Surface Mounted, Stainless Steel Toilet Tissue Dispenser (Bobrick Classic B-264)	42.84	16.16
10 28 13 13-0039	EA Single Roll, Recessed Mounted, Stainless Steel Toilet Tissue Dispenser (Bobrick B-663)	68.15	16.16
10 28 13 13-0040	EA Single Jumbo Roll, Surface Mounted, Stainless Steel Toilet Tissue Dispenser (Bobrick B-2890)	68.27	16.16
10 28 13 13-0041	EA Single Fold/Double Fold, Surface Mounted, Stainless Steel Toilet Tissue Cabinet (Bobrick B-272)	80.21	16.16
10 28 13 13-0042	EA Two Roll, Surface Mounted, Stainless Steel Toilet Tissue Dispenser (Bobrick Classic B-265)	50.04	16.16
10 28 13 13-0043	EA Two Roll, Surface Mounted, Stainless Steel Toilet Tissue Dispenser (Bobrick Classic B-2888)	86.25	16.16
10 28 13 13-0044	EA Two Roll, Recessed Mounted, Stainless Steel Toilet Tissue Dispenser (Bobrick Classic B-3888).....	121.68	16.16
10 28 13 13-0045	EA Two Roll, Surface Mounted, Stainless Steel Toilet Tissue Dispenser (Bobrick Contura B-4288)	127.72	16.16
10 28 13 13-0046	EA Two Roll, Recessed Mounted, Stainless Steel Toilet Tissue Dispenser (Bobrick Contura B-4388).....	161.80	16.16
10 28 13 13-0047	EA Two Jumbo Roll, Surface Mounted, Stainless Steel Toilet Tissue Dispenser (Bobrick B-2892)	187.49	16.16
10 28 13 13-0048	EA Four Roll, Partition Mounted, Stainless Steel Toilet Tissue Dispenser (Bobrick B-386).....	231.75	16.16
	Note: Mounts centered through toilet partitions.		
10 28 13 13-0049	EA Stainless Steel Shelf And Double Roll Toilet Tissue Dispenser (Bobrick B-2840)	99.49	16.16



Specialties	10
Interior Specialties	10 20
Toilet, Bath, And Laundry Accessories	10 28

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 28 13 13-0050 EA Vertical Double Roll, Surface Mounted, Stainless Steel Coreless Toilet Tissue Dispenser (Georgia-Pacific Compact® 56782)	91.88	16.16
10 28 13 13-0051 EA Side By Side Double Roll, Surface Mounted, Stainless Steel Toilet Tissue Dispenser (Georgia-Pacific Compact® 56796)	73.82	16.16
10 28 13 13-0052 Soap Dispensers (10 28 13 13-0002)		
10 28 13 13-0053 EA 20 Fluid Ounce, 4" Spout, Top-Filling Lavatory Mounted, Chrome Plated Soap Dispenser (Bobrick B-8221).....	67.17	16.16
For 34 Fluid Ounce (B-822), Add	3.87	
10 28 13 13-0054 EA 20 Fluid Ounce, 6" Spout, Top-Filling Lavatory Mounted, Chrome Plated Soap Dispenser (Bobrick B-82216).....	73.01	16.16
For 34 Fluid Ounce (B-822), Add	3.87	
10 28 13 13-0055 EA 24 Fluid Ounce, Surface Mounted, Translucent Polyethylene Soap Dispenser (Bobrick B-156).....	44.98	16.16
10 28 13 13-0056 EA 24 Fluid Ounce, Surface Mounted, Chrome-Plated, Translucent Polyethylene Soap Dispenser (Bobrick B-155).....	49.06	16.16
10 28 13 13-0057 EA 40 Fluid Ounce, Concealed Surface Mounted, Translucent Soap Dispenser (Bobrick B-40)	59.25	16.16
10 28 13 13-0058 EA 40 Fluid Ounce, Surface Mounted, Translucent Plastic Soap Dispenser (Bobrick Classic B-42)	60.94	16.16
10 28 13 13-0059 EA 40 Fluid Ounce, Surface Mounted, Stainless Steel Soap Dispenser (Bobrick Classic B-2111/2112).....	68.34	16.16
10 28 13 13-0060 EA 40 Fluid Ounce, Surface Mounted, Stainless Steel Soap Dispenser (Bobrick Contura B-4112).....	86.84	16.16
10 28 13 13-0061 EA 45 Fluid Ounce, Recessed Mounted, Stainless Steel Soap Dispenser (Bobrick B-306).....	148.75	16.16
10 28 13 13-0062 EA 50 Fluid Ounce, Recessed Mounted, Stainless Steel Soap Dispenser (Bobrick Contura B-4063)	238.50	16.16
10 28 13 13-0063 EA 800 ml, Lavatory Mounted, Chrome Plated Automatic Soap Dispenser (Bobrick B-826.18)	147.05	16.16
Note: Includes start-up kit.		
10 28 13 13-0064 Facial Tissue Dispensers (10 28 13 13-0002)		
10 28 13 13-0065 EA Surface Mounted, Stainless Steel Facial Tissue Dispenser (Bobrick B-8397).....	77.69	16.16
10 28 13 13-0066 EA Recessed Mounted, Stainless Steel Facial Tissue Dispenser (Gamco 355)	53.88	16.16
10 28 13 13-0067 Sanitary Toilet Seat Cover Dispensers (10 28 13 13-0002)		
10 28 13 13-0068 EA Surface Mounted, Acrylonitrile Butadiene Styrene (ABS) Plastic Sanitary Seat-Cover Dispenser (Bobrick Matrix B-5221)	44.20	16.16
10 28 13 13-0069 EA Surface Mounted, Stainless Steel Sanitary Seat-Cover Dispenser (Bobrick Classic B-221)	59.58	16.16
10 28 13 13-0070 EA Surface Mounted, Stainless Steel Sanitary Seat-Cover Dispenser (Bobrick Contura B-4221).....	108.06	16.16
10 28 13 13-0071 EA Recessed Mounted, Stainless Steel Sanitary Seat-Cover Dispenser (Bobrick Classic B-301).....	113.12	16.16
10 28 13 13-0072 EA Recessed Mounted, Stainless Steel Sanitary Seat-Cover Dispenser (Bobrick TrimLine B-3013)	225.84	16.16
10 28 13 13-0073 Sanitary Toilet Seat Cover/Toilet Tissue Dispensers (10 28 13 13-0002)		
10 28 13 13-0074 EA Surface Mounted, Stainless Steel Seat Cover And Toilet Tissue Dispenser (Bobrick Classic B-3479).....	362.43	16.16
10 28 13 13-0075 EA Recessed Mounted, Stainless Steel Seat Cover And Toilet Tissue Dispenser (Bobrick B-34745).....	219.18	16.16
10 28 13 13-0076 Sanitary Napkin/Tampon Dispensers (10 28 13 13-0002)		
10 28 13 13-0077 EA Surface Mounted, Stainless Steel Sanitary Napkin/Tampon Vendor (Bobrick B-370639C).....	448.01	16.16
10 28 13 13-0078 EA Surface Mounted, Stainless Steel Sanitary Napkin/Tampon Vendor (Gamco B-282 25).....	340.14	16.16
10 28 13 13-0079 EA Surface Mounted, Stainless Steel Sanitary Napkin/Tampon Vending (Bobrick B-2706).....	453.94	16.16
10 28 13 13-0080 EA Recessed Mounted, Stainless Steel Sanitary Napkin/Tampon Vendor (Bobrick Classic B-352 25)	342.47	16.16
10 28 13 13-0081 EA Recessed Mounted, Single Coin Operation, Stainless Steel, Sanitary Napkin/Tampon Vendor (Gamco NV-2-4)	300.75	16.16
10 28 13 13-0082 Toilet Compartment Combination Dispenser/Disposals (10 28 13 13-0002)		
10 28 13 13-0083 EA Side Wall Recessed Mounted, Stainless Steel Toilet Tissue Dispenser With Sanitary Napkin Disposal (Bobrick B-3094)	312.56	35.92
10 28 13 13-0084 EA Side Wall Recessed Mounted, Stainless Steel Seat Cover And Toilet Tissue Dispenser (Bobrick B-3474).....	349.67	35.92
10 28 13 13-0085 EA Side Wall Recessed Mounted, Stainless Steel Seat Cover And Toilet Tissue Dispenser With Sanitary Napkin Disposal (Bobrick B-35745).....	288.97	35.92
10 28 13 13-0086 EA Side Wall Recessed Mounted, Stainless Steel Seat Cover And Toilet Tissue Dispenser With Sanitary Napkin Disposal (Bobrick B-3574).....	409.26	35.92
10 28 13 13-0087 EA Partition Mounted, Stainless Steel Seat Cover And Toilet Tissue Dispenser (Bobrick B-347).....	420.74	35.92
10 28 13 13-0088 EA Partition Mounted, Stainless Steel Seat Cover And Toilet Tissue Dispenser With Sanitary Napkin Disposal (Bobrick B-357).....	484.80	35.92
10 28 13 13-0089 EA Surface Mounted, Stainless Steel Seat Cover And Toilet Tissue Dispenser With Sanitary Napkin Disposal (Bobrick B-3579).....	454.16	35.92
10 28 13 13-0090 Receptacles (10 28 13 13-0001)		
10 28 13 13-0091 Wall Mounted Waste Receptacles (10 28 13 13-0090)		
10 28 13 13-0092 EA 1-1/2 Gallon, Surface Mounted, Stainless Steel Facial Tissue Waste Receptacle (Gamco WR-3)	68.31	16.16
10 28 13 13-0093 EA 6.4 Gallon, Surface Mounted, Stainless Steel Waste Receptacle (Bobrick B-279).....	115.07	16.16
10 28 13 13-0094 EA 12 Gallon, 4" Wall Recess, Stainless Steel Waste Receptacle (Bobrick Classic B-3644)	266.15	35.92
10 28 13 13-0095 EA 12 Gallon, 4" Wall Recess, Stainless Steel Waste Receptacle (Bobrick Contura B-43644)	397.77	35.92
10 28 13 13-0096 EA 20 Gallon, Surface Mounted, Stainless Steel Waste Receptacle (Bobrick B-275).....	313.86	35.92
10 28 13 13-0097 Floor-Standing/Counter Waste Receptacles (10 28 13 13-0090)		
10 28 13 13-0098 EA 5-7/8" Inside Diameter, 3-7/8" Deep, Countertop-Mounted, Stainless Steel Waste Chute (Bobrick B-532)	81.09	16.16
10 28 13 13-0099 EA 5-7/16" Inside Diameter, 5" Deep, Countertop-Mounted, Stainless Steel Waste Chute (Bobrick B-529).....	117.21	16.16
10 28 13 13-0100 EA 13 Gallon, Open Top, Stainless Steel Floor Standing Waste Receptacle (Bobrick B-2260).....	226.82	7.18
10 28 13 13-0101 EA 13 Gallon, Swing-Top, Stainless Steel Floor-Standing Waste Receptacle (Bobrick B-2250)	344.04	7.18
10 28 13 13-0102 EA 18 Gallon, Open Top, Stainless Steel Floor-Standing Waste Receptacle (Bobrick B-2300).....	322.20	7.18

10 Specialties**10 20 Interior Specialties****10 28 Toilet, Bath, And Laundry Accessories**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 28 13 13-0103 EA 21 Gallon, Open Top, Stainless Steel Floor Standing Waste Receptacle (Bobrick B-2280).....	309.77	7.18
10 28 13 13-0104 Combination Paper Towel Dispenser/ Waste Receptacle <small>(10 28 13 13-0090)</small>		
10 28 13 13-0105 EA 2 Gallon, Recessed Mounted, Stainless Steel Combination Folded Paper Towel Dispenser/ Waste Receptacle (Bobrick Classic B-369)	219.43	35.92
10 28 13 13-0106 EA 2.6 Gallon, Recessed Mounted, Stainless Steel Combination Folded Paper Towel Dispenser/ Waste Receptacle (Bobrick Contura B-4369)	356.30	35.92
10 28 13 13-0107 EA 12 Gallon, Recessed Mounted, Stainless Steel Combination Folded Paper Towel Dispenser/ Waste Receptacle (Bobrick Classic B-3944)	350.85	35.92
10 28 13 13-0108 EA 12 Gallon, Recessed Mounted, Stainless Steel Combination Folded Paper Towel Dispenser/ Waste Receptacle (Bobrick Classic B-3900)	512.55	35.92
10 28 13 13-0109 EA 12 Gallon, Semi-Recessed Mounted, Stainless Steel Combination Folded Paper Towel Dispenser/ Waste Receptacle (Bobrick Classic B-3909)	707.77	35.92
10 28 13 13-0110 EA 12 Gallon, Recessed Mounted, Stainless Steel Combination Roll Towel Dispenser / Waste Receptacle (Bobrick Classic B-3961)	597.34	35.92
10 28 13 13-0111 EA 12 Gallon, Surface Mounted, Stainless Steel Combination Folded Paper Towel Dispenser/ Waste Receptacle (Bobrick Classic B-3949)	459.12	35.92
10 28 13 13-0112 EA 12 Gallon, Surface Mounted, Stainless Steel Combination Roll Towel Dispenser / Waste Receptacle (Bobrick Classic B-39619)	747.26	35.92
10 28 13 13-0113 EA 16 Gallon, Semi-Recessed Mounted, Stainless Steel Combination Folded Paper Towel Dispenser/ Waste Receptacle (Bobrick Contura B-43944)	689.99	39.52
10 28 13 13-0114 EA 18 Gallon, Recessed Mounted, Stainless Steel Combination Folded Paper Towel Dispenser/ Waste Receptacle (Bobrick Classic B-3947)	461.80	39.52
10 28 13 13-0115 Sanitary Napkin/Tampon Receptacles <small>(10 28 13 13-0090)</small>		
10 28 13 13-0116 EA Surface Mounted, Stainless Steel Sanitary Napkin/Tampon Disposal (Bobrick Contura B-270)	62.59	17.95
10 28 13 13-0117 EA Surface Mounted, Stainless Steel Sanitary Napkin/Tampon Disposal (Bobrick Classic B-254).....	126.82	17.95
10 28 13 13-0118 EA Recessed Mounted, Stainless Steel Sanitary Napkin/Tampon Disposal (Bobrick Classic B-353)	138.14	17.95
10 28 13 13-0119 EA Recessed Mounted, Stainless Steel Sanitary Napkin/Tampon Disposal (Bobrick Classic B-35303)	325.44	17.95
10 28 13 13-0120 EA Partition Mounted, Stainless Steel Sanitary Napkin/Tampon Disposal (Bobrick Classic B-354)	171.62	17.95
10 28 13 13-0121 EA Partition Mounted, Stainless Steel Sanitary Napkin Disposal (Bobrick Contura B-4354).....	302.27	17.95
10 28 13 13-0122 Grab Bars <small>(10 28 13 13-0001)</small>		
10 28 13 13-0123 1-1/4" Diameter, Stainless Steel Grab Bars <small>(10 28 13 13-0122)</small>		
Note: Includes satin finish and concealed mounting with snap flange.		
10 28 13 13-0124 EA 12" Length, 1-1/4" Diameter, Stainless Steel Grab Bar (Gamco 125x12)	62.99	14.37
For Peened Grip, Add	3.41	
10 28 13 13-0125 EA 18" Length, 1-1/4" Diameter, Stainless Steel Grab Bar (Bobrick B-5806x18)	72.67	14.37
For Peened Grip, Add	4.28	
10 28 13 13-0126 EA 24" Length, 1-1/4" Diameter, Stainless Steel Grab Bar (Bobrick B-5806x24)	73.64	14.37
For Peened Grip, Add	4.36	
10 28 13 13-0127 EA 30" Length, 1-1/4" Diameter, Stainless Steel Grab Bar (Bobrick B-5806x30)	74.10	14.37
For Peened Grip, Add	4.41	
10 28 13 13-0128 EA 36" Length, 1-1/4" Diameter, Stainless Steel Grab Bar (Bobrick B-5806x36)	74.22	14.37
For Peened Grip, Add	4.42	
10 28 13 13-0129 EA 42" Length, 1-1/4" Diameter, Stainless Steel Grab Bar (Bobrick B-5806x42)	76.56	14.37
For Peened Grip, Add	4.63	
10 28 13 13-0130 EA 48" Length, 1-1/4" Diameter, Stainless Steel Grab Bar (Bobrick B-5806x48)	80.25	14.37
For Peened Grip, Add	4.96	
10 28 13 13-0131 1-1/4" Diameter, Two Wall, Stainless Steel Grab Bars <small>(10 28 13 13-0122)</small>		
Note: Includes satin finish and concealed mounting with snap flange.		
10 28 13 13-0132 EA 24" x 36", Two Wall, 1-1/4" Diameter, Stainless Steel Grab Bar (Bobrick B-58616)	122.79	14.37
For Peened Grip, Add	8.46	
10 28 13 13-0133 EA 36" x 54", Two Wall, 1-1/4" Diameter, Stainless Steel Grab Bar (Bobrick B-5837)	125.32	14.37
For Peened Grip, Add	8.69	
10 28 13 13-0134 1-1/2" Diameter, Stainless Steel Grab Bars <small>(10 28 13 13-0122)</small>		
Note: Includes satin finish and concealed mounting with snap flange.		
10 28 13 13-0135 EA 12" Length, 1-1/2" Diameter, Stainless Steel Grab Bar (Bobrick B-6806x12)	71.86	14.37
For Peened Grip, Add	4.20	
10 28 13 13-0136 EA 18" Length, 1-1/2" Diameter, Stainless Steel Grab Bar (Bobrick B-6806x18)	72.67	14.37
For Peened Grip, Add	4.28	
10 28 13 13-0137 EA 24" Length, 1-1/2" Diameter, Stainless Steel Grab Bar (Bobrick B-6806x24)	74.22	14.37
For Peened Grip, Add	4.42	
10 28 13 13-0138 EA 30" Length, 1-1/2" Diameter, Stainless Steel Grab Bar (Bobrick B-6806x30)	75.78	14.37
For Peened Grip, Add	4.56	
10 28 13 13-0139 EA 36" Length, 1-1/2" Diameter, Stainless Steel Grab Bar (Bobrick B-6806x36)	77.73	14.37
For Peened Grip, Add	4.73	
10 28 13 13-0140 EA 42" Length, 1-1/2" Diameter, Stainless Steel Grab Bar (Bobrick B-6806x42)	79.48	14.37
For Peened Grip, Add	4.89	
10 28 13 13-0141 EA 48" Length, 1-1/2" Diameter, Stainless Steel Grab Bar (Bobrick B-6806x48)	83.76	14.37
For Peened Grip, Add	5.27	
10 28 13 13-0142 1-1/2" Diameter, Two Wall, Stainless Steel Grab Bars <small>(10 28 13 13-0122)</small>		
Note: Includes satin finish and concealed mounting with snap flange.		



Specialties	10
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MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 28 13 13-0143 EA 16" x 31", Two Wall, 1-1/2" Diameter, Stainless Steel Grab Bar (Bobrick B-6861).....	112.27	14.37
For Peened Grip, Add	7.52	
10 28 13 13-0144 EA 24" x 36", Two Wall, 1-1/2" Diameter, Stainless Steel Grab Bar (Bobrick B-68616).....	120.65	14.37
For Peened Grip, Add	8.27	
10 28 13 13-0145 EA 36" x 54", Two Wall, 1-1/2" Diameter, Stainless Steel Grab Bar (Bobrick B-68137).....	104.88	14.37
For Peened Grip, Add	6.85	
10 28 13 13-0146 1-1/4" Diameter, Stainless Steel Swing Up Grab Bars (10 28 13 13-0122)		
Note: Includes satin finish.		
10 28 13 13-0147 EA 29" Length, 1-1/4" Diameter, Stainless Steel Swing Up Grab Bar (Bobrick B-4998)	329.67	14.37
For Peened Grip, Add	27.41	
10 28 13 13-0148 Shelves (10 28 13 13-0001)		
10 28 13 13-0149 EA 5" Width x 16" Length, Stainless Steel Shelf (Bobrick B-295).....	82.35	16.16
10 28 13 13-0150 EA 5" Width x 18" Length, Stainless Steel Shelf (Bobrick B-295).....	84.70	16.16
10 28 13 13-0151 EA 5" Width x 24" Length, Stainless Steel Shelf (Bobrick B-295).....	95.40	16.16
10 28 13 13-0152 EA 5" Width x 36" Length, Stainless Steel Shelf (Gamco S-5x36)	98.10	16.16
10 28 13 13-0153 EA 6" Width x 18" Length, Stainless Steel Shelf (Bobrick B-296).....	93.85	16.16
10 28 13 13-0154 EA 6" Width x 24" Length, Stainless Steel Shelf (Gamco S-6x24)	95.12	16.16
10 28 13 13-0155 EA 8" Width x 18" Length, Stainless Steel Shelf (Bobrick B-298).....	101.44	16.16
10 28 13 13-0156 EA 8" Width x 24" Length, Stainless Steel Shelf (Bobrick B-298).....	110.59	16.16
10 28 13 13-0157 EA 8" Width x 36" Length, Stainless Steel Shelf (Gamco S-8x36)	129.92	16.16
10 28 13 13-0158 EA 5-3/4" Width x 14-1/2" Length, Folding Stainless Steel Utility Shelf (Bobrick B-287)	101.63	16.16
10 28 13 13-0159 EA 4-3/4" Width x 24" Length, Stainless Steel Toiletary Shelf (Bobrick B-683).....	103.58	16.16
10 28 13 13-0160 EA 12" Width x 24" Length, Stainless Steel Shelf (Bradley 7512-24)	165.65	16.16
10 28 13 13-0161 EA 12" Width x 30" Length, Stainless Steel Shelf (Bradley 7512-30)	177.30	16.16
10 28 13 13-0162 EA 12" Width x 36" Length, Stainless Steel Shelf (Bradley 7512-36).....	195.28	16.16
10 28 13 13-0163 EA 12" Width x 48" Length, Stainless Steel Shelf (Bradley 7512-48).....	244.20	16.16
10 28 13 13-0164 EA 12" Width x 60" Length, Stainless Steel Shelf (Bradley 7512-60).....	333.32	16.16
10 28 13 13-0165 EA 4-1/4" Width x 16-1/2" Length x 6-1/2" Height, Recessed Stainless Steel Shelf (American Specialties 0412)	137.75	16.16
10 28 13 13-0166 Changing Stations (10 28 13 13-0001)		
10 28 13 13-0167 EA Horizontal, Wall-Mounted, Polyethylene Baby Changing Station (Gamco BCS-1)	309.19	21.55
10 28 13 13-0168 EA Vertical, Wall-Mounted, Polyethylene Baby Changing Station (Bobrick Koala Care KB101-00).....	327.99	21.55
10 28 13 13-0169 EA Horizontal, Wall-Mounted, Polypropylene Baby Changing Station (Bobrick Koala Care KB200-00)	269.78	21.55
10 28 13 13-0170 EA Horizontal, Recessed Mounted, Stainless Steel Baby Changing Station (Bobrick Koala Care KB110-SSRE).....	1,326.41	21.55
10 28 13 13-0171 EA Horizontal, Wall-Mounted, Stainless Steel Baby Changing Station (Bobrick Koala Care KB111-SSWM)	1,554.35	21.55
10 28 13 13-0172 EA Vertical, Recessed Mounted, Stainless Steel Baby Changing Station (Bobrick Koala Care KB111-SSRE)	1,326.41	21.55
10 28 13 13-0173 EA Vertical, Wall-Mounted, Stainless Steel Baby Changing Station (Bobrick Koala Care KB111-SSWM)	1,554.35	21.55
10 28 13 13-0174 Folding Shower Seats (10 28 13 13-0001)		
10 28 13 13-0175 EA 33" Width, Wall-Mounted, Reversible, Folding , Stainless Steel Hardware, Solid Phenolic Shower Seat (Bobrick B-5181)	386.77	28.74
10 28 13 13-0176 EA 33" Width, Wall-Mounted, Foam Padded, Naugahyde® Folding Shower Seat (Bobrick B-517/518).....	509.43	28.74
10 28 13 13-0177 EA 30" Width, Wall-Mounted, Teakwood Folding Shower Seat.....	492.28	28.74
10 28 13 13-0178 Soap/Dish Holders (10 28 13 13-0001)		
10 28 13 13-0179 EA Surface Mounted, Stainless Steel Toothbrush and Tumbler Holder (Gamco 7679)	40.75	16.16
10 28 13 13-0180 EA Surface Mounted, Stainless Steel Soap Dish (Gamco 7680)	42.11	16.16
10 28 13 13-0181 EA Recessed Mounted, Stainless Steel Soap Dish (Bobrick B-4380).....	75.54	16.16
10 28 13 13-0182 EA Recessed Mounted, Stainless Steel Soap Dish And Bar (Bobrick B-4390).....	82.35	16.16
10 28 13 13-0183 Shower Curtains/Curtain Rods (10 28 13 13-0001)		
10 28 13 13-0184 EA Stainless Steel Shower Curtain Hook (Bobrick B-204-1)	2.05	0.71
10 28 13 13-0185 EA 42" Width x 72" Height, Vinyl Shower Curtain (Bobrick B-204-2).....	34.04	7.18
Note: Requires 7 curtain hooks.		
10 28 13 13-0186 EA 70" Width x 72" Height, Vinyl Shower Curtain (Bobrick B-204-3).....	35.70	7.18
Note: Requires 12 curtain hooks.		
10 28 13 13-0187 EA 36" Length, 20 Gauge, 1" Diameter, Stainless Steel Shower Rod With Concealed Mounting (Bobrick B-207)	59.77	16.16
10 28 13 13-0188 EA 48" Length, 20-Gauge, 1" Diameter, Stainless Steel Shower Rod With Concealed Mounting (Bobrick B-207)	64.06	16.16
10 28 13 13-0189 EA 60" Length, 20-Gauge, 1" Diameter, Stainless Steel Shower Rod With Concealed Mounting (Bobrick B-207)	69.31	16.16
10 28 13 13-0190 EA 72" Length, 20-Gauge, 1" Diameter, Stainless Steel Shower Rod With Concealed Mounting (Bobrick B-207)	75.74	16.16
10 28 13 13-0191 EA 36" Length, 20-Gauge, 1" Diameter, Stainless Steel Shower Rod (Bobrick B-6107x36)	52.38	16.16
10 28 13 13-0192 EA 48" Length, 20-Gauge, 1" Diameter, Stainless Steel Shower Rod (Bobrick B-6107x48).....	57.44	16.16
10 28 13 13-0193 EA 60" Length, 20-Gauge, 1" Diameter, Stainless Steel Shower Rod (Bobrick B-6107x60).....	60.36	16.16
10 28 13 13-0194 EA 72" Length, 20-Gauge, 1" Diameter, Stainless Steel Shower Rod (Bobrick B-6107x72).....	64.06	16.16
10 28 13 13-0195 EA 36" Length, 18-Gauge, 1-1/4" Diameter, Stainless Steel Shower Rod (Bobrick B-6047).....	54.52	16.16
10 28 13 13-0196 EA 48" Length, 18-Gauge, 1-1/4" Diameter, Stainless Steel Shower Rod (Bobrick B-6047).....	58.80	16.16
10 28 13 13-0197 EA 60" Length, 18-Gauge, 1-1/4" Diameter, Stainless Steel Shower Rod (Bobrick B-6047).....	63.86	16.16
10 28 13 13-0198 EA 72" Length, 18-Gauge, 1-1/4" Diameter, Stainless Steel Shower Rod (Bobrick B-6047).....	67.37	16.16
10 28 13 13-0199 Hand Dryers (10 28 13 13-0001)		
10 28 13 13-0200 EA Surface Mounted, Automatic Sensor, One Piece Plastic Cover Hand Dryer (Bobrick CompacDryer B-710)	364.92	20.14

10 Specialties**10 20 Interior Specialties****10 28 Toilet, Bath, And Laundry Accessories**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 28 13 13-0201	EA		Surface Mounted, Automatic Sensor, Cast Aluminum Cover Hand Dryer (Bobrick B-7120-115V).....	393.52	20.14
10 28 13 13-0202	EA		Surface Mounted, Automatic Sensor, Cast-Iron Cover Hand Dryer (Bobrick B-7128 230V).....	436.75	20.14
10 28 13 13-0203	EA		Recessed Mounted, Automatic Sensor, Cast-Iron Cover Hand Dryer (Bobrick B-750-115/230).....	621.29	20.14
10 28 13 13-0204	EA		Surface Mounted, Touch-Button, Cast-Iron Cover Hand Dryer (World Dryer A).....	521.24	20.14
10 28 13 13-0205	EA		Surface Mounted, Automatic Sensor, Cast-Iron Cover Hand Dryer (World Dryer A).....	581.68	20.14
10 28 13 13-0206	EA		Surface Mounted, Touch-Button, Cast-Iron Cover Hand/Hair Dryer (American Dryer A60).....	536.67	20.14
10 28 13 13-0207	EA		Surface Mounted, Automatic Sensor, Cast-Iron Cover Hand/Hair Dryer (American Dryer A60T).....	555.96	20.14
10 28 13 13-0208	EA		Recessed Mounted, Automatic Sensor, Cast-Iron Cover Hand/Hair Dryer (American Dryer A60TR).....	576.53	20.14
10 28 13 13-0209	EA		Surface Mounted, Automatic Sensor, Cast-Iron Cover Hand Dryer (Excel Xlerator XL-GR).....	661.88	20.14
10 28 13 13-0210	EA		Surface Mounted, Automatic Sensor, Acrylonitrile Butadiene Styrene (ABS) Polycarbonate Cover Hand Dryer (Dyson Airblade AB12).....	874.28	20.14
10 28 13 13-0211	EA		Surface Mounted, Automatic Sensor, Acrylonitrile Butadiene Styrene (ABS) Polycarbonate Cover Hand Dryer (Dyson Airblade AB14).....	1,493.96	20.14
10 28 13 13-0212	EA		Surface Mounted, Automatic Sensor, White ABS Cover, CPC Technology, Dries Hands In 10 To 12 Seconds, Hand Dryer (American Dryer CPC9).....	668.75	20.14
			Note: CPC technology kills germs naturally with no chemicals. Electronically adjustable sound and speed.		
10 28 13 13-0213	EA		Surface Mounted, Automatic Sensor, White Epoxy Finish Steel Cover, CPC Technology, Dries Hands In 10 To 12 Seconds, Hand Dryer (American Dryer CPC9-M).....	704.90	20.14
			Note: CPC technology kills germs naturally with no chemicals. Electronically adjustable sound and speed.		
10 28 13 13-0214	EA		Surface Mounted, Automatic Sensor, Black Graphite Steel Cover, CPC Technology, Dries Hands In 10 To 12 Seconds, Hand Dryer (American Dryer CPC9-BG).....	725.55	20.14
			Note: CPC technology kills germs naturally with no chemicals. Electronically adjustable sound and speed.		
10 28 13 13-0215	EA		Surface Mounted, Automatic Sensor, Satin Chrome Finish Steel Cover, CPC Technology, Dries Hands In 10 To 12 Seconds, Hand Dryer (American Dryer CPC9-C).....	746.21	20.14
			Note: CPC technology kills germs naturally with no chemicals. Electronically adjustable sound and speed.		
10 28 13 13-0216	EA		Surface Mounted, Automatic Sensor, Stainless Steel Cover, CPC Technology, Dries Hands In 10 To 12 Seconds, Hand Dryer (American Dryer CPC9-SS).....	787.52	20.14
			Note: CPC technology kills germs naturally with no chemicals. Electronically adjustable sound and speed.		
10 28 13 13-0217	EA		Surface Mounted, Automatic Sensor, White ABS Cover, Dries Hands In 10 To 12 Seconds, Hand Dryer (American Dryer GXT9).....	544.81	20.14
			Note: Electronically adjustable sound and speed.		
10 28 13 13-0218	EA		Surface Mounted, Automatic Sensor, White Epoxy Finish Steel Cover, Dries Hands In 10 To 12 Seconds, Hand Dryer (American Dryer GXT9-M).....	580.96	20.14
			Note: Electronically adjustable sound and speed.		
10 28 13 13-0219	EA		Surface Mounted, Automatic Sensor, Black Graphite Steel Cover, Dries Hands In 10 To 12 Seconds, Hand Dryer (American Dryer GXT9-BG).....	601.62	20.14
			Note: Electronically adjustable sound and speed.		
10 28 13 13-0220	EA		Surface Mounted, Automatic Sensor, Satin Chrome Finish Steel Cover, Dries Hands In 10 To 12 Seconds, Hand Dryer (American Dryer GXT9-C).....	622.27	20.14
			Note: Electronically adjustable sound and speed.		
10 28 13 13-0221	EA		Surface Mounted, Automatic Sensor, Stainless Steel Cover, Dries Hands In 10 To 12 Seconds, Hand Dryer (American Dryer GXT9-SS).....	663.59	20.14
			Note: Electronically adjustable sound and speed.		
10 28 13 13-0222	EA		Surface Mounted, Automatic Sensor, White ABS Cover, Dries Hands In 12 To 15 Seconds, Hand Dryer (American Dryer EXT7).....	544.81	20.14
			Note: Electronically adjustable sound and speed.		
10 28 13 13-0223	EA		Surface Mounted, Automatic Sensor, White Epoxy Finish Steel Cover, Dries Hands In 12 To 15 Seconds, Hand Dryer (American Dryer EXT7-M).....	580.96	20.14
			Note: Electronically adjustable sound and speed.		
10 28 13 13-0224	EA		Surface Mounted, Automatic Sensor, Black Graphite Finish Steel Cover, Dries Hands In 12 To 15 Seconds, Hand Dryer (American Dryer EXT7-BG).....	601.62	20.14
			Note: Electronically adjustable sound and speed.		
10 28 13 13-0225	EA		Surface Mounted, Automatic Sensor, Satin Chrome Finish Steel Cover, Dries Hands In 12 To 15 Seconds, Hand Dryer (American Dryer EXT7-C).....	622.27	20.14
			Note: Electronically adjustable sound and speed.		
10 28 13 13-0226	EA		Surface Mounted, Stainless Steel Cover, Dries Hands In 12 To 15 Seconds, Hand Dryer (American Dryer EXT7-SS).....	663.59	20.14
			Note: Electronically adjustable sound and speed.		
10 28 13 13-0227	EA		Surface Mounted, Automatic Sensor, White ABS Cover, Dries Hands In 25 Seconds, Hand Dryer (American Dryer AD90).....	400.22	20.14
10 28 13 13-0228	EA		Surface Mounted, Automatic Sensor, White Epoxy Finish Steel Cover, Dries Hands In 25 Seconds, Hand Dryer (American Dryer AD90-M).....	436.37	20.14
10 28 13 13-0229	EA		Surface Mounted, Automatic Sensor, Black Graphite Finish Steel Cover, Dries Hands In 25 Seconds, Hand Dryer (American Dryer AD90-BG).....	457.03	20.14
10 28 13 13-0230	EA		Surface Mounted, Automatic Sensor, Satin Chrome Finish Steel Cover, Dries Hands In 25 Seconds, Hand Dryer (American Dryer AD90-C).....	477.68	20.14
10 28 13 13-0231	EA		Surface Mounted, Stainless Steel Cover, Dries Hands In 25 Seconds, Hand Dryer (American Dryer AD90-SS).....	518.99	20.14
10 28 13 13-0232	EA		Surface Mounted, Automatic Sensor, White ABS Cover, Stays On For 80 Seconds, Hair Dryer (American Dryer AD90H).....	400.22	20.14
10 28 13 13-0233	EA		Surface Mounted, Automatic Sensor, White Epoxy Finish Steel Cover, Stays On For 80 Seconds, Hair Dryer (American Dryer AD90-MH).....	436.37	20.14
10 28 13 13-0234	EA		Surface Mounted, Automatic Sensor, Black Graphite Finish Steel Cover, Stays On For 80 Seconds, Hair Dryer (American Dryer AD90-BGH).....	457.03	20.14
10 28 13 13-0235	EA		Surface Mounted, Automatic Sensor, Satin Chrome Finish Steel Cover, Stays On For 80 Seconds, Hair Dryer (American Dryer AD90-CH).....	477.68	20.14
10 28 13 13-0236	EA		Surface Mounted, Automatic Sensor, Stainless Steel Cover, Stays On For 80 Seconds, Hair Dryer (American Dryer AD90-SSH).....	518.99	20.14
10 28 13 13-0237	EA		Surface Mounted, Automatic Sensor, ABS Cover, Hand Dryer (American Dryer GX1).....	296.94	20.14
10 28 13 13-0238	EA		Surface Mounted, Automatic Sensor, White Epoxy Finish Steel Cover, Hand Dryer (American Dryer GX1-M).....	333.09	20.14
10 28 13 13-0239	EA		Surface Mounted, Automatic Sensor, Satin Chrome Finish Steel Cover, Hand Dryer (American Dryer GX1-C).....	374.40	20.14

10 28 13 13-0240 Hand Dryers (Excel XLERATOR®) (10 28 13 13-0001)
Note: With or without noise reduction nozzle options.



Specialties	10
Interior Specialties	10 20
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MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 28 13 13-0241	EA		Surface Mounted, Automatic Sensor, White Epoxy Painted Finish, Zinc-Die Cast Cover, Hand Dryer (Excel XLERATOR® XL-W) <i>For ADA-Compliant Recess Kit, Add</i>	558.97 156.21	20.14
10 28 13 13-0242	EA		Surface Mounted, Automatic Sensor, White Epoxy Painted Finish, Zinc-Die Cast Cover, Hand Dryer With HEPA Filtration System (Excel XLERATOR® XL-WH) <i>For ADA-Compliant Recess Kit, Add</i>	777.96 156.21	20.14
10 28 13 13-0243	EA		Surface Mounted, Automatic Sensor, Graphite Textured Painted Finish, Zinc-Die Cast Cover, Hand Dryer (Excel XLERATOR® XL-GR) <i>For ADA-Compliant Recess Kit, Add</i>	651.96 156.21	20.14
10 28 13 13-0244	EA		Surface Mounted, Automatic Sensor, Graphite Textured Painted Finish, Zinc-Die Cast Cover Hand Dryer With HEPA Filtration System (Excel Xlerator XL-GRH) <i>For ADA-Compliant Recess Kit, Add</i>	809.46 156.21	20.14
10 28 13 13-0245	EA		Surface Mounted, Automatic Sensor, Chrome Plated Finish, Zinc-Die Cast Cover, Hand Dryer (Excel XLERATOR® XL-C) <i>For ADA-Compliant Recess Kit, Add</i>	699.21 156.21	20.14
10 28 13 13-0246	EA		Surface Mounted, Automatic Sensor, Chrome Plated Finish, Zinc-Die Cast Cover, Hand Dryer With HEPA Filtration System (Excel XLERATOR® XL-CH) <i>For ADA-Compliant Recess Kit, Add</i>	856.71 156.21	20.14
10 28 13 13-0247	EA		Surface Mounted, Automatic Sensor, Brushed Finish, Stainless Steel Cover, Hand Dryer (Excel XLERATOR® XL-SB) <i>For ADA-Compliant Recess Kit, Add</i>	699.21 156.21	20.14
10 28 13 13-0248	EA		Surface Mounted, Automatic Sensor, Brushed Finish, Stainless Steel Cover, Hand Dryer With HEPA Filtration System (Excel XLERATOR® XL-SBH) <i>For ADA-Compliant Recess Kit, Add</i>	856.71 156.21	20.14
10 28 13 13-0249	EA		Surface Mounted, Automatic Sensor, Custom Color Painted Finish, Zinc-Die Cast Cover, Hand Dryer (Excel XLERATOR® XL-SP) <i>For ADA-Compliant Recess Kit, Add</i>	651.96 156.21	20.14
10 28 13 13-0250	EA		Surface Mounted, Automatic Sensor, Custom Color Painted Finish, Zinc-Die Cast Cover, Hand Dryer With HEPA Filtration System (Excel XLERATOR® XL-SPH) <i>For ADA-Compliant Recess Kit, Add</i>	809.46 156.21	20.14
10 28 13 13-0251	EA		Surface Mounted, Automatic Sensor, White Finish, Polymer Cover (BMC), Hand Dryer (Excel XLERATOR® XL-BW) <i>For ADA-Compliant Recess Kit, Add</i>	588.96 156.21	20.14
10 28 13 13-0252	EA		Surface Mounted, Automatic Sensor, White Finish, Polymer Cover (BMC), Hand Dryer With HEPA Filtration System (Excel XLERATOR® XL-BWH) <i>For ADA-Compliant Recess Kit, Add</i>	746.46 156.21	20.14
10 28 13 13-0253	EA		Surface Mounted, Automatic Sensor, White Epoxy Painted Finish, Zinc-Die Cast Cover, No Heat Hand Dryer (Excel XLERATOReco® XL-W-ECO) <i>For ADA-Compliant Recess Kit, Add</i>	558.97 156.21	20.14
10 28 13 13-0254	EA		Surface Mounted, Automatic Sensor, White Epoxy Painted Finish, Zinc-Die Cast Cover, No Heat Hand Dryer With HEPA Filtration System (Excel XLERATOReco® XL-WH-ECO) <i>For ADA-Compliant Recess Kit, Add</i>	777.96 156.21	20.14
10 28 13 13-0255	EA		Surface Mounted, Automatic Sensor, Graphite Textured Painted Finish, Zinc-Die Cast Cover, No Heat Hand Dryer (Excel XLERATOReco® XL-GR-ECO) <i>For ADA-Compliant Recess Kit, Add</i>	651.96 156.21	20.14
10 28 13 13-0256	EA		Surface Mounted, Automatic Sensor, Graphite Textured Painted Finish, Zinc-Die Cast Cover, No Heat Hand Dryer With HEPA Filtration System (Excel XLERATOReco® XL-GRH-ECO) <i>For ADA-Compliant Recess Kit, Add</i>	809.46 156.21	20.14
10 28 13 13-0257	EA		Surface Mounted, Automatic Sensor, Chrome Plated Finish, Zinc-Die Cast Cover, No Heat Hand Dryer (Excel XLERATOReco® XL-C-ECO) <i>For ADA-Compliant Recess Kit, Add</i>	699.21 156.21	20.14
10 28 13 13-0258	EA		Surface Mounted, Automatic Sensor, Chrome Plated Finish, Zinc-Die Cast Cover, No Heat Hand Dryer With HEPA Filtration System (Excel XLERATOReco® XL-CH-ECO) <i>For ADA-Compliant Recess Kit, Add</i>	856.71 156.21	20.14
10 28 13 13-0259	EA		Surface Mounted, Automatic Sensor, Brushed Finish, Stainless Steel Cover, No Heat Hand Dryer (Excel XLERATOReco® XL-SB-ECO) <i>For ADA-Compliant Recess Kit, Add</i>	699.21 156.21	20.14
10 28 13 13-0260	EA		Surface Mounted, Automatic Sensor, Brushed Finish, Stainless Steel Cover, No Heat Hand Dryer With HEPA Filtration System (Excel XLERATOReco® XL-SBH-ECO) <i>For ADA-Compliant Recess Kit, Add</i>	856.71 156.21	20.14
10 28 13 13-0261	EA		Surface Mounted, Automatic Sensor, Custom Color Painted Finish, Zinc-Die Cast Cover, No Heat Hand Dryer (Excel XLERATOReco® XL-SP-ECO) <i>For ADA-Compliant Recess Kit, Add</i>	651.96 156.21	20.14
10 28 13 13-0262	EA		Surface Mounted, Automatic Sensor, Custom Color Painted Finish, Zinc-Die Cast Cover, No Heat Hand Dryer With HEPA Filtration System (Excel XLERATOReco® XL-SPH-ECO) <i>For ADA-Compliant Recess Kit, Add</i>	809.46 156.21	20.14
10 28 13 13-0263	EA		Surface Mounted, Automatic Sensor, White Finish, Polymer Cover (BMC), No Heat Hand Dryer (Excel XLERATOReco® XL-BW-ECO) <i>For ADA-Compliant Recess Kit, Add</i>	588.96 156.21	20.14
10 28 13 13-0264	EA		Surface Mounted, Automatic Sensor, White Finish, Polymer Cover (BMC), No Heat Hand Dryer With HEPA Filtration System (Excel XLERATOReco® XL-BWH-ECO) <i>For ADA-Compliant Recess Kit, Add</i>	746.46 156.21	20.14
10 28 13 13-0265			Additional Accessories <small>(10 28 13 13-0001)</small>		
10 28 13 13-0266			Hooks <small>(10 28 13 13-0265)</small>		
10 28 13 13-0267	EA		Stainless Steel Clothes Hook And Bumper (Bobrick B-212)	20.80	7.18
10 28 13 13-0268	EA		Single Stainless Steel Robe Hook (Bobrick B-233)	25.08	7.18
10 28 13 13-0269	EA		Single Stainless Steel Robe Hook (Bobrick B-7671)	21.18	7.18
10 28 13 13-0270	EA		Double Stainless Steel Robe Hook (Bobrick B-7672)	23.10	7.18
10 28 13 13-0271	EA		Double Stainless Steel Robe Hook (Bobrick B-672 or B-6727)	39.09	7.18
10 28 13 13-0272	EA		Single Stainless Steel Robe Hook (Bobrick B-6717)	35.20	7.18

10 Specialties**10 20 Interior Specialties****10 28 Toilet, Bath, And Laundry Accessories**

MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
10 28 13 13-0273		Clotheslines <small>(10 28 13 13-0265)</small>			
10 28 13 13-0274	EA	Surface Mounted, Stainless Steel Retractable Clothesline (Gamco 7636).....	36.35		14.37
10 28 13 13-0275		Towel Bars <small>(10 28 13 13-0265)</small>			
10 28 13 13-0276	EA	18" Length, 3/4" Square, Stainless Steel Towel Bar (Gamco 7673x18).....	44.68		16.16
10 28 13 13-0277	EA	24" Length, 3/4" Square, Stainless Steel Towel Bar (Gamco 7673x24).....	44.83		16.16
10 28 13 13-0278	EA	18" Length, 3/4" Diameter, Stainless Steel Towel Bar (Gamco 7674x18).....	50.54		16.16
10 28 13 13-0279	EA	24" Length, 3/4" Diameter, Stainless Steel Towel Bar (Gamco 7674x24).....	51.08		16.16
10 28 13 13-0280	EA	18" Length, 3/4" Square, Stainless Steel Towel Bar (Bobrick B-673).....	76.13		16.16
10 28 13 13-0281	EA	24" Length, 3/4" Square, Stainless Steel Towel Bar (Bobrick B-673).....	79.43		16.16
10 28 13 13-0282	EA	18" Length, 3/4" Diameter, Stainless Steel Towel Bar (Bobrick B-674).....	78.66		16.16
10 28 13 13-0283	EA	24" Length, 3/4" Diameter, Stainless Steel Towel Bar (Bobrick B-674).....	81.38		16.16
10 28 13 13-0284	EA	18" Length, 1" Diameter, Heavy-Duty, Stainless Steel Towel Bar (Bobrick B-205).....	86.26		16.16
10 28 13 13-0285	EA	24" Length, 1" Diameter, Heavy-Duty, Stainless Steel Towel Bar (Bobrick B-205).....	89.15		16.16
10 28 13 13-0286	EA	18" Length, 1" Diameter, Extra-Heavy-Duty, Stainless Steel Towel Bar/Grab Bar (Bobrick B-530).....	65.03		16.16
10 28 13 13-0287	EA	24" Length, 1" Diameter, Extra-Heavy-Duty, Stainless Steel Towel Bar/Grab Bar (Bobrick B-530).....	67.56		16.16
10 28 13 13-0288		Towel Bar With Shelf <small>(10 28 13 13-0265)</small>			
10 28 13 13-0289	EA	24" Length, Stainless Steel Towel Shelf With Towel Bar (Bobrick B-676).....	150.11		16.16
10 28 13 13-0290		Towel Pins <small>(10 28 13 13-0265)</small>			
10 28 13 13-0291	EA	Stainless Steel Towel Pin (Bobrick B-677).....	37.73		7.18
10 28 13 13-0292		Mirrors <small>(10 28 13 13)</small>			
10 28 13 13-0293		Stainless Steel Channel Frame Glass Mirrors <small>(10 28 13 13-0292)</small>			
10 28 13 13-0294	EA	16" x 24", Surface Mounted, Stainless Steel Channel Frame Glass Mirror (Gamco C-16x24).....	76.71		17.95
10 28 13 13-0295	EA	18" x 24", Surface Mounted, Stainless Steel Channel Frame Glass Mirror (Bobrick B-165 1824).....	87.39		17.95
10 28 13 13-0296	EA	18" x 30", Surface Mounted, Stainless Steel Channel Frame Glass Mirror (Bobrick B-165 1830).....	91.10		17.95
		<i>For Tempered Glass (B-1658), Add</i>	31.08		
10 28 13 13-0297	EA	18" x 36", Surface Mounted, Stainless Steel Channel Frame Glass Mirror (Bobrick B-165 1836).....	98.68		17.95
		<i>For Tempered Glass (B-1658), Add</i>	36.39		
10 28 13 13-0298	EA	24" x 30", Surface Mounted, Stainless Steel Channel Frame Glass Mirror (Bobrick B-165 2430).....	108.42		17.95
10 28 13 13-0299	EA	24" x 36", Surface Mounted, Stainless Steel Channel Frame Glass Mirror (Bobrick B-165 2436).....	112.51		17.95
		<i>For Tempered Glass (B-1658), Add</i>	46.07		
10 28 13 13-0300	EA	24" x 48", Surface Mounted, Stainless Steel Channel Frame Glass Mirror (Bobrick B-165 2448).....	139.38		17.95
10 28 13 13-0301	EA	24" x 60", Surface Mounted, Stainless Steel Channel Frame Glass Mirror (Bobrick B-165 2460).....	161.38		17.95
10 28 13 13-0302	EA	36" x 36", Surface Mounted, Stainless Steel Channel Frame Glass Mirror (Gamco C-36x36).....	195.01		17.95
10 28 13 13-0303	EA	48" x 36", Surface Mounted, Stainless Steel Channel Frame Glass Mirror (Bobrick B-165 4836).....	246.08		17.95
10 28 13 13-0304	EA	60" x 36", Surface Mounted, Stainless Steel Channel Frame Glass Mirror (Gamco C-60x36).....	277.10		17.95
10 28 13 13-0305		Stainless Steel Channel Frame Glass Mirror/Shelf Combination <small>(10 28 13 13-0292)</small>			
10 28 13 13-0306	EA	18" x 24", Surface Mounted, Stainless Steel Channel Frame Glass Mirror/Shelf Combination (Bobrick B-166 1824).....	144.44		17.95
10 28 13 13-0307	EA	18" x 30", Surface Mounted, Stainless Steel Channel Frame Glass Mirror/Shelf Combination (Bobrick B-166 1830).....	155.93		17.95
10 28 13 13-0308	EA	18" x 36", Surface Mounted, Stainless Steel Channel Frame Glass Mirror/Shelf Combination (Bobrick B-166 1836).....	163.52		17.95
10 28 13 13-0309	EA	24" x 36", Surface Mounted, Stainless Steel Channel Frame Glass Mirror/Shelf Combination (Bobrick B-166 2436).....	184.94		17.95
10 28 13 13-0310		Stainless Steel Angle Frame Glass Mirrors <small>(10 28 13 13-0292)</small>			
10 28 13 13-0311	EA	18" x 24", Surface Mounted, Stainless Steel Angle Frame Glass Mirror (Bobrick B-290 1824).....	128.26		17.95
10 28 13 13-0312	EA	18" x 30", Surface Mounted, Stainless Steel Angle Frame Glass Mirror (Bobrick B-290 1830).....	140.94		17.95
		<i>For Tempered Glass (B-2908), Add</i>	62.20		
10 28 13 13-0313	EA	18" x 36", Surface Mounted, Stainless Steel Angle Frame Glass Mirror (Bobrick B-290 1836).....	145.22		17.95
		<i>For Tempered Glass (B-2908), Add</i>	65.02		
10 28 13 13-0314	EA	24" x 30", Surface Mounted, Stainless Steel Angle Frame Glass Mirror (Bobrick B-290 2430).....	170.53		17.95
10 28 13 13-0315	EA	24" x 36", Surface Mounted, Stainless Steel Angle Frame Glass Mirror (Bobrick B-290 2436).....	171.50		17.95
		<i>For Tempered Glass (B-2908), Add</i>	82.37		
10 28 13 13-0316	EA	24" x 48", Surface Mounted, Stainless Steel Angle Frame Glass Mirror (Bobrick B-290 2448).....	230.10		17.95
10 28 13 13-0317	EA	24" x 60", Surface Mounted, Stainless Steel Angle Frame Glass Mirror (Bobrick B-290 2460).....	270.99		17.95
10 28 13 13-0318	EA	24" x 72", Surface Mounted, Stainless Steel Angle Frame Glass Mirror (Bobrick B-290 2472).....	309.16		17.95
10 28 13 13-0319	EA	36" x 36", Surface Mounted, Stainless Steel Angle Frame Glass Mirror (Gamco A-36x36).....	205.22		17.95
10 28 13 13-0320	EA	48" x 36", Surface Mounted, Stainless Steel Angle Frame Glass Mirror (Gamco A-48x36).....	250.72		17.95
10 28 13 13-0321	EA	72" x 36", Surface Mounted, Stainless Steel Angle Frame Glass Mirror (Gamco A-72x36).....	385.30		17.95
10 28 13 13-0322		Stainless Steel Angle Frame Glass Mirror/Shelf Combination <small>(10 28 13 13-0292)</small>			
10 28 13 13-0323	EA	18" x 24", Surface Mounted, Stainless Steel Angle Frame Glass Mirror/Shelf Combination (Gamco AS-18x24).....	132.69		17.95
10 28 13 13-0324	EA	18" x 30", Surface Mounted, Stainless Steel Angle Frame Glass Mirror/Shelf Combination (Bobrick B-292-1830).....	264.18		17.95
10 28 13 13-0325	EA	18" x 36", Surface Mounted, Stainless Steel Angle Frame Glass Mirror/Shelf Combination (Bobrick B-292-1836).....	277.03		17.95
10 28 13 13-0326	EA	24" x 36", Surface Mounted, Stainless Steel Angle Frame Glass Mirror/Shelf Combination (Bobrick B-292-2436).....	309.16		17.95



Specialties	10	10
Interior Specialties	10 20	
Toilet, Bath, And Laundry Accessories	10 28	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 28 13 13-0327 Frameless Stainless Steel Mirrors <small>(10 28 13 13-0292)</small>		
10 28 13 13-0328 EA 17-1/2" x 29-1/2", Frameless Stainless Steel Mirror (Bobrick B-1556 1830).....	144.05	17.95
10 28 13 13-0329 EA 23-1/2" x 35-1/2", Frameless Stainless Steel Mirror (Bobrick B-1556 2436).....	187.07	17.95
10 28 13 13-0330 Fixed-Position Tilt, Stainless Steel Frame Glass Mirrors <small>(10 28 13 13-0292)</small>		
10 28 13 13-0331 EA 16" x 30", Surface Mounted, Fixed-Position Tilt, Stainless Steel Frame Glass Mirror (Bobrick B-293 1630).....	196.81	17.95
10 28 13 13-0332 EA 18" x 30", Surface Mounted, Fixed-Position Tilt, Stainless Steel Frame Glass Mirror (Bobrick B-293 1830).....	205.19	17.95
10 28 13 13-0333 EA 18" x 36", Surface Mounted, Fixed-Position Tilt, Stainless Steel Frame Glass Mirror (Bobrick B-293 1836).....	249.00	17.95
10 28 13 13-0334 EA 24" x 36", Surface Mounted, Fixed-Position Tilt, Stainless Steel Frame Glass Mirror (Bobrick B-293 2436).....	306.82	17.95
10 28 13 13-0335 Medicine Cabinets <small>(10 28 13 13)</small>		
10 28 13 13-0336 Metal Medicine Cabinets <small>(10 28 13 13-0335)</small>		
10 28 13 13-0337 EA 20" x 26", Surface Mounted, Aluminum Medicine Cabinet (Kohler K-CB)	214.68	35.92
10 28 13 13-0338 EA 15-1/2" x 25-7/8", Recessed Mounted, All-Steel Medicine Cabinet (Bobrick B-397).....	170.27	35.92
10 28 13 13-0339 EA 14-1/8" x 20-1/4", Surface Mounted, All-Steel Medicine Cabinet (Bobrick B-297)	175.81	35.92
10 28 13 13-0340 EA 15-1/4" x 25-1/2", Recessed Mounted, Stainless Steel Medicine Cabinet (Bobrick B-398)	387.06	35.92
10 28 13 13-0341 EA 17" x 26-7/8", Surface Mounted, Stainless Steel Medicine Cabinet (Bobrick B-299)	532.11	35.92
10 28 13 13-0342 Janitorial Material <small>(10 28 13 13)</small>		
10 28 13 13-0343 EA Stainless Steel Pail And Ladder Utility Hook (Bobrick B-670).....	35.20	7.18
10 28 13 13-0344 EA 24" Length, Stainless Steel Utility Hook Strip (Bobrick B-232x24).....	91.90	16.16
10 28 13 13-0345 EA 24" Length, 3 Handle Capacity, Stainless Steel Mop And Broom Holder (Bobrick B-223x24).....	88.40	16.16
10 28 13 13-0346 EA 30" Length, 3 Handle Capacity, Stainless Steel Mop And Broom Holder (Gamco MS-1).....	100.73	16.16
10 28 13 13-0347 EA 36" Length, 3 Handle Capacity, Stainless Steel Mop And Broom Holder (Bobrick B-223x36).....	112.93	16.16
10 28 13 13-0348 EA 36" Length, Utility Hook Strip (Gamco HCS-2)	74.71	16.16
10 28 13 13-0349 EA 36" Length, Stainless Steel Custodian Utility Shelf With Mop And Broom Holders And Rag Hooks (Bobrick B-224x36)	211.44	16.16
10 28 13 13-0350 EA 34" Length, 3 Handle Capacity, Stainless Steel Mop And Broom Holder With Shelf And Rag Hooks (Bobrick B-239x34)	305.49	16.16
10 28 13 13-0351 Remove And Reinstall Bathroom Accessories <small>(10 28 13 13)</small>		
10 28 13 13-0352 EA Remove And Reinstall Bathroom Accessory	22.45	
10 28 13 63 Detention Toilet Accessories <small>(10 28 13)</small>		
10 28 13 63-0001 1-1/2" Diameter, 18 Gauge, Stainless Steel Suicide Resistant Security Grab Bar <small>(10 28 13 63)</small>		
10 28 13 63-0002 EA 18" Length, 1-1/2" Diameter, 18 Gauge, Stainless Steel Suicide Resistant Security Grab Bar (Bradley SA70-001180).....	105.47	14.37
10 28 13 63-0003 EA 24" Length, 1-1/2" Diameter, 18 Gauge, Stainless Steel Suicide Resistant Security Grab Bar (Bradley SA70-001240).....	109.98	14.37
10 28 13 63-0004 EA 36" Length, 1-1/2" Diameter, 18 Gauge, Stainless Steel Suicide Resistant Security Grab Bar (Bradley SA70-001360).....	112.98	14.37
10 28 13 63-0005 EA 42" Length, 1-1/2" Diameter, 18 Gauge, Stainless Steel Suicide Resistant Security Grab Bar (Bradley SA70-001420).....	124.49	14.37
10 28 13 63-0006 EA 60" Length, 1-1/2" Diameter, 18 Gauge, Stainless Steel Suicide Resistant Security Grab Bar (Bradley SA70-002600).....	246.88	14.37
10 28 16 Bath Accessories <small>(10 28)</small>		
10 28 16 13 Residential Bath Accessories <small>(10 28 16)</small>		
10 28 16 13-0001 Toilet Accessories <small>(10 28 16 13)</small>		
10 28 16 13-0002 Surface Mounted Porcelain Toilet Accessories <small>(10 28 16 13-0001)</small>		
10 28 16 13-0003 EA Surface Mounted Porcelain Wall Soap Holder.....	35.31	9.70
10 28 16 13-0004 EA Surface Mounted Porcelain Bath/Shower Soap Dish.....	39.52	9.70
10 28 16 13-0005 EA Surface Mounted Porcelain 1 Roll Toilet Paper Holder.....	39.18	9.70
10 28 16 13-0006 EA Surface Mounted Porcelain Toothbrush/Tumbler Holder.....	35.31	9.70
10 28 16 13-0007 EA Surface Mounted Porcelain Towel Bar Set With Plastic Bar.....	38.27	9.70
10 28 16 13-0008 Medicine Cabinets With Mirrors <small>(10 28 16 13-0001)</small>		
10 28 16 13-0009 EA 16" x 20" Recessed Molded Medicine Cabinet With Mirror, Nutone 401ADJ.....	90.13	25.15
10 28 16 13-0010 EA 16" x 22" Recessed Molded Medicine Cabinet With Mirror, Nutone 407ADJ.....	89.57	25.15
10 28 16 13-0011 EA 16" x 26" Recessed Molded Medicine Cabinet With Mirror, Nutone 624.....	113.80	25.15
10 28 16 13-0012 EA 16" x 26" Stainless Trim, Plastic Body Medicine Cabinet With Mirror, Nutone B772193.....	108.18	25.15
10 28 16 13-0013 EA 16" x 22" Recessed Steel Medicine Cabinet With Mirror, Nutone 420BC.....	109.86	25.15
10 28 16 13-0014 EA 16" x 22" Recessed Steel Medicine Cabinet With Mirror, Nutone 421BC.....	116.30	25.15

10 Specialties**10 20 Interior Specialties****10 28 Toilet, Bath, And Laundry Accessories**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
	10 28 16 13-0015	EA	18" x 24" Recessed Steel Medicine Cabinet With Mirror, Nutone 490.....	172.01	25.15
	10 28 16 13-0016	EA	16" x 26" Recessed Steel Medicine Cabinet With Mirror, Nutone 458.....	126.23	25.15
	10 28 16 13-0017	EA	20" x 30" Recessed Steel Medicine Cabinet With Mirror, Nutone 495.....	196.04	25.15
	10 28 16 13-0018	EA	16" x 26" Recessed Steel Medicine Cabinet With Mirror, Nutone 470FS.....	142.58	25.15
	10 28 16 13-0019	EA	16-1/8" x 22-1/8" Surface Steel Medicine Cabinet With Mirror, Nutone 472FS.....	135.66	25.15
	10 28 16 13-0020	EA	16" x 22" Recessed Steel Medicine Cabinet With Mirror, Nutone 473FS.....	136.85	25.15
	10 28 16 13-0021	EA	16" x 26" Recessed Steel Medicine Cabinet With Mirror, Nutone 478FS.....	130.47	25.15
	10 28 16 13-0022	EA	14" x 20" Surface Steel Medicine Cabinet With Mirror, Nutone 422SM.....	108.81	25.15
	10 28 16 13-0023	EA	16" x 22" Surface Steel Medicine Cabinet With Mirror, Nutone 452SM.....	126.98	25.15
	10 28 16 13-0024	EA	16-1/4" x 22-1/4" Molded Steel Medicine Cabinet With Mirror, Nutone 614.....	107.00	25.15
	10 28 16 13-0025	EA	20" x 26" Aluminum Medicine Cabinet With Mirror, Kohler K-CB-CLC2026FS.....	189.21	25.15
10 28 16 13-0026			Shower Curtain Rod (10 28 16 13-0001) Note: Includes end brackets. See CSI section 10 28 13 13-0183 for shower curtain rods.		
10 28 16 13-0027			Recessed Chrome Plated Toilet Accessories (10 28 16 13-0001)		
	10 28 16 13-0028	EA	Single Roll, Recessed Mounted, Chrome Plated Toilet Paper Holder.....	52.58	16.16
	10 28 16 13-0029	EA	Recessed Mounted, Chrome Plated Soap Dish.....	65.23	16.16
	10 28 16 13-0030	EA	Recessed Mounted, Chrome Plated Soap Dish And Bar.....	67.80	16.16
	10 28 16 13-0031	EA	Recessed Mounted, Chrome Plated Tumbler Holder.....	53.67	16.16
10 28 16 13-0032			Surface Mounted Chrome Plated Toilet Accessories (10 28 16 13-0001)		
	10 28 16 13-0033	EA	Surface Mounted, Chrome Plated Soap Dish.....	31.83	10.78
	10 28 16 13-0034	EA	Surface Mounted, Chrome Plated Single Clothes Hook.....	34.69	10.78
	10 28 16 13-0035	EA	Surface Mounted, Chrome Plated Double Clothes Hook.....	34.69	10.78
	10 28 16 13-0036	LF	6" Deep, Surface Mounted, Chrome Plated Supports, Glass Shelf.....	57.05	10.78
	10 28 16 13-0037	LF	6" Deep, Surface Mounted, Stainless Steel Shelf.....	49.84	10.78
	10 28 16 13-0038	EA	18" Length, Surface Mounted, Chrome Plated Towel Bar.....	41.59	14.37
	10 28 16 13-0039	EA	24" Length, Surface Mounted, Chrome Plated Towel Bar.....	41.91	14.37
	10 28 16 13-0040	EA	Surface Mounted, Chrome Plated Towel Ring.....	31.12	10.78
	10 28 16 13-0041	EA	Surface Mounted, Chrome Plated Tumbler And Toothbrush Holder.....	21.06	16.16
	10 28 16 13-0042	EA	Single Roll, Surface Mounted, Chrome Plated Toilet Paper Holder.....	31.83	10.78
	10 28 16 13-0043	EA	Two Roll, Surface Mounted, Chrome Plated Toilet Paper Holder.....	51.05	10.78
	10 28 16 13-0044	EA	Surface Mounted, Chrome Plated Globe Soap Dispenser.....	35.68	10.78
	10 28 16 13-0045	EA	Surface Mounted, Chrome Plated Towel Pin.....	36.98	10.78
	10 28 16 13-0046	EA	Surface Mounted, Chrome Plated Towel Ladder And Shelf.....	80.69	10.78
	10 28 16 13-0047	EA	Surface Mounted, Retractable Chrome Plated Bath/Shower Clothesline.....	48.43	10.78
	10 28 16 13-0048	EA	24" Length, Cut To Size Towel Bar, Surface Mounted, Ceramic Base Towel Bar.....	55.20	10.78
10 28 16 13-0049			Ceramic Toilet Accessories (10 28 16 13-0001)		
	10 28 16 13-0050	EA	4-1/8" x 4-1/8" x 2-7/8" Deep Ceramic Recessed Soap Dish.....	71.58	14.87
	10 28 16 13-0051	EA	6" x 4-1/4" x 3-1/8" Deep Ceramic Recessed Soap Dish.....	83.09	14.87
	10 28 16 13-0052	EA	8-1/8" x 15-3/8" x 2-7/8" Deep Ceramic Recessed Soap And Suds.....	140.06	18.68
	10 28 16 13-0053	EA	6" x 6" x 3-1/4" Deep Ceramic Recessed Toilet Paper Holder.....	78.48	14.87
	10 28 16 13-0054	EA	6" x 6" x 4-7/8" Deep Ceramic Recessed Soap And Cloth Holder With Lip Drain.....	96.90	14.87
	10 28 16 13-0055	EA	6-3/8" x 4-3/4" x 1-3/8" Deep Ceramic Semi-Recessed Soap Dish.....	65.82	14.87
	10 28 16 13-0056	EA	6-3/8" x 6-3/8" x 1-3/4" Deep Ceramic Semi-Recessed Soap Dish.....	69.96	14.87
	10 28 16 13-0057	EA	6-5/8" x 5" x 2-3/8" Deep Ceramic Semi-Recessed Toilet Paper Holder.....	63.52	14.87
	10 28 16 13-0058	EA	6-5/8" x 4-7/8" x 2-3/8" Deep Ceramic Semi-Recessed Soap And Cloth Holder.....	66.97	14.87
	10 28 16 13-0059	EA	7-1/4" x 3" Ceramic Surface Mounted Corner Shelf.....	61.41	9.70
	10 28 16 13-0060	EA	4-1/2" x 2-1/4" Ceramic Surface Mounted Corner Shelf.....	55.61	9.70
	10 28 16 13-0061	EA	4" x 6" Ceramic Surface Mounted Toilet Paper Holder.....	44.14	9.70
	10 28 16 13-0062	EA	4" x 6" Ceramic Surface Mounted Tub Soap Dish.....	44.44	9.70
	10 28 16 13-0063	EA	4-1/4" x 4-1/4" Ceramic Surface Mounted Soap Dish.....	41.82	9.70
	10 28 16 13-0064	EA	2-1/8" x 4-1/4" Ceramic Surface Mounted Low Profile Soap Dish.....	38.32	9.70
	10 28 16 13-0065	EA	4" x 6" Ceramic Surface Mounted Tub Soap Dish And Cloth Holder.....	47.10	9.70
	10 28 16 13-0066	EA	4-1/4" x 4-1/4" Ceramic Surface Mounted Toothbrush/Tumbler Holder.....	41.82	9.70
	10 28 16 13-0067	EA	2-1/8" x 4-1/4" Ceramic Surface Mounted Toothbrush/Tumbler Holder.....	38.32	9.70
	10 28 16 13-0068	EA	1-1/2" x 4-1/4" Ceramic Surface Mounted Towel Ring.....	43.69	9.70
10 28 16 13-0069			Solid Oak Medicine Cabinets (10 28 16 13-0001) Note: Surface or recessed mounted, premium quality.		
	10 28 16 13-0070	EA	24" x 30", Unlighted, Solid Oak Medicine Cabinet With Mirror.....	291.77	35.92
	10 28 16 13-0071	EA	24" x 35", Lighted, Solid Oak Medicine Cabinet With Mirror.....	361.99	35.92
	10 28 16 13-0072	EA	30" x 30" Unlighted, Solid Oak Medicine Cabinet With Mirror.....	308.94	35.92
	10 28 16 13-0073	EA	30" x 35", Lighted, Solid Oak Medicine Cabinet With Mirror.....	385.41	35.92
	10 28 16 13-0074	EA	36" x 30", Unlighted, Solid Oak Medicine Cabinet With Mirror.....	319.77	35.92
	10 28 16 13-0075	EA	36" x 35", Lighted, Solid Oak Medicine Cabinet With Mirror.....	405.99	35.92
	10 28 16 13-0076	EA	48" x 30", Unlighted, Solid Oak Medicine Cabinet With Mirror.....	334.64	35.92
	10 28 16 13-0077	EA	48" x 35", Lighted, Solid Oak Medicine Cabinet With Mirror.....	431.13	35.92
10 28 16 13-0078			Toilet Accessories (10 28 16 13-0001)		
	10 28 16 13-0079	EA	Surface Mounted Paper Towel Dispenser, Plastic.....	48.61	16.16
	10 28 16 13-0080	EA	Surface Mounted Napkin Disposal, Plastic.....	45.01	16.16
	10 28 16 13-0081	EA	Soap Dispenser For Soaps And Detergent, 50 Fluid Oz, Plastic.....	46.28	
	10 28 16 13-0082	EA	Soap Dispenser For Antibacterial Soaps, 50 Fluid Oz, Plastic.....	50.09	16.16



Specialties	10
Interior Specialties	10 20
Toilet, Bath, And Laundry Accessories	10 28

10

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 28 16 13-0083 EA Multi Roll (2) Toilet Tissue Dispenser, Plastic.....	48.62	16.16
10 28 16 13-0084 EA Single Jumbo Roll Toilet Tissue Dispenser, Plastic.....	59.54	19.76
10 28 16 13-0085 EA Surface Mounted Toilet Seat Cover Dispenser, Plastic.....	36.79	14.37
10 28 16 13-0086 EA Waste Door For Countertops, 13 Gallon, Plastic.....	102.54	26.94
10 28 19 Tub and Shower Enclosures (10 28)		
10 28 19 16 Shower Doors (10 28 19)		
10 28 19 16-0001 Swinging Shower Doors (10 28 19 16)		
10 28 19 16-0002 Framed, Swinging Shower Doors (10 28 19 16-0001)		
10 28 19 16-0003 EA 24-1/4" To 26" Opening, Silver Finish Frame, Tempered Safety Glass, Swinging Shower Door (American Standard AM00801)	333.24	19.96
10 28 19 16-0004 EA 27-1/4" To 29" Opening, Silver Finish Frame, Tempered Safety Glass, Swinging Shower Door (American Standard AM00802)	337.74	19.96
10 28 19 16-0005 EA 29-5/8" To 31-3/8" Opening, Silver Finish Frame, Tempered Safety Glass, Swinging Shower Door (American Standard AM00803)	343.53	19.96
10 28 19 16-0006 EA 33-1/8" To 34-7/8" Opening, Silver Finish Frame, Tempered Safety Glass, Swinging Shower Door (American Standard AM00804)	348.03	19.96
10 28 19 16-0007 EA 35-1/8" To 36-7/8" Opening, Silver Finish Frame, Tempered Safety Glass, Swinging Shower Door (American Standard AM00805)	357.04	19.96
10 28 19 16-0008 Frameless, Swinging Shower Doors (10 28 19 16-0001)		
10 28 19 16-0009 EA 24-9/16" To 25-7/16" Opening, Frameless, Tempered Safety Glass, Swinging Shower Door (American Standard AM0301D)	488.88	19.96
10 28 19 16-0010 EA 31-1/16" To 31-15/16" Opening, Frameless, Tempered Safety Glass, Swinging Shower Door (American Standard AM0302D)	510.74	19.96
10 28 19 16-0011 EA 32-11/16" To 33-9/16" Opening, Frameless, Tempered Safety Glass, Swinging Shower Door (American Standard AM0303D)	531.32	19.96
10 28 19 16-0012 EA 34-3/16" To 35-1/16" Opening, Frameless, Tempered Safety Glass, Swinging Shower Door (American Standard AM0304D)	553.19	19.96
10 28 19 16-0013 EA 35-3/16" To 36-1/16" Opening, Frameless, Tempered Safety Glass, Swinging Shower Door (American Standard AM0305D)	574.41	19.96
10 28 19 16-0014 Sliding Shower Doors (10 28 19 16)		
10 28 19 16-0015 Framed, Sliding Shower Doors (10 28 19 16-0014)		
10 28 19 16-0016 EA 40" To 42" Opening, Silver Finish Frame, Tempered Safety Glass, By-Pass Sliding Shower Door (American Standard AM00735)	483.73	19.96
10 28 19 16-0017 EA 44" To 46" Opening, Silver Finish Frame, Tempered Safety Glass, By-Pass Sliding Shower Door (American Standard AM00745)	490.67	19.96
10 28 19 16-0018 EA 46" To 48" Opening, Silver Finish Frame, Tempered Safety Glass, By-Pass Sliding Shower Door (American Standard AM00775)	502.59	19.96
10 28 19 16-0019 EA 52" To 54" Opening, Silver Finish Frame, Tempered Safety Glass, By-Pass Sliding Shower Door (American Standard AM00729)	515.27	19.96
10 28 19 16-0020 EA 54" To 56" Opening, Silver Finish Frame, Tempered Safety Glass, By-Pass Sliding Shower Door (American Standard AM00794)	522.34	19.96
10 28 19 16-0021 EA 56" To 60" Opening, Silver Finish Frame, Tempered Safety Glass, By-Pass Sliding Shower Door (American Standard AM00795)	532.81	19.96
10 28 19 16-0022 Frameless, Sliding Shower Doors (10 28 19 16-0014)		
10 28 19 16-0023 EA 40" To 44" Opening, 65-1/2" Height, Frameless, Tempered Safety Glass, By-Pass Sliding Shower Door (American Standard AM00335)	582.79	19.96
10 28 19 16-0024 EA 44" To 48" Opening, 65-1/2" Height, Frameless, Tempered Safety Glass, By-Pass Sliding Shower Door (American Standard AM00345)	698.56	19.96
10 28 19 16-0025 EA 56" To 60" Opening, 65-1/2" Height, Frameless, Tempered Safety Glass, By-Pass Sliding Shower Door (American Standard AM00394)	753.86	19.96
10 28 19 16-0026 EA 40" To 44" Opening, 70" Height, Frameless, Tempered Safety Glass, By-Pass Sliding Shower Door (American Standard AM00330)	646.46	19.96
10 28 19 16-0027 EA 44" To 48" Opening, 70" Height, Frameless, Tempered Safety Glass, By-Pass Sliding Shower Door (American Standard AM00370)	655.33	19.96
10 28 19 16-0028 EA 56" To 60" Opening, 70" Height, Frameless, Tempered Safety Glass, By-Pass Sliding Shower Door (American Standard AM00390)	737.79	19.96
10 28 19 19 Tub Doors (10 28 19)		
10 28 19 19-0001 Sliding Bathtub Doors (10 28 19 19)		
10 28 19 19-0002 Framed, Sliding Bathtub Doors (10 28 19 19-0001)		
10 28 19 19-0003 EA 52" To 54" Opening, Silver Finish Frame, Tempered Safety Glass, By-Pass Sliding Bathtub Door (American Standard AM00725)	477.37	19.96
10 28 19 19-0004 EA 54" To 56" Opening, Silver Finish Frame, Tempered Safety Glass, By-Pass Sliding Bathtub Door (American Standard AM00749)	482.47	19.96
10 28 19 19-0005 EA 56" To 60" Opening, Silver Finish Frame, Tempered Safety Glass, By-Pass Sliding Bathtub Door (American Standard AM00750)	494.00	19.96

10	10	Specialties
	10 40	Safety Specialties
	10 28	Toilet, Bath, And Laundry Accessories



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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10 40 Safety Specialties ⁽¹⁰⁾

10 41 Emergency Access And Information Cabinets ^(10 40)

10 41 13 Fire Department Plan Cabinets ^(10 41)

10 41 13 00-0001 Fire Department Plan Cabinets (Knox) ^(10 41 13)

10 41 13 00-0002	EA	18" High x 14-1/2" Wide x 5" Deep, Light Gray Finish, Surface Mount, Fire Department Emergency Storage Cabinet (Knox 1300).....	860.35	23.35
		<i>For Tamper Switch Connected To Existing Alarm System, Add</i>	40.00	
		<i>For Dual Locks, Add</i>	60.00	
		<i>For Back Key Hook Panel, Add</i>	57.68	
		<i>For Swing Key Hook Panel, Add</i>	156.68	
		<i>For Non-Locking Weather Housing, Add</i>	393.03	
10 41 13 00-0003	EA	18" High x 14-1/2" Wide x 7" Deep, Light Gray Finish, Surface Mount, Fire Department Emergency Storage Cabinet (Knox 1300).....	911.80	23.35
		<i>For Tamper Switch Connected To Existing Alarm System, Add</i>	40.00	
		<i>For Dual Locks, Add</i>	60.00	
		<i>For Back Key Hook Panel, Add</i>	57.68	
		<i>For Swing Key Hook Panel, Add</i>	156.68	
		<i>For Second Swing Key Hook Panel, Add</i>	123.68	
		<i>For Non-Locking Weather Housing, Add</i>	393.03	

10 41 16 Emergency Key Cabinets ^(10 41)

10 41 16 00-0001 Emergency Key Cabinets (Knox) ^(10 41 16)

10 41 16 00-0002	EA	Elevator/Lobby, Deep Red Finish, Surface Mount, Fire Department Emergency Key Storage Box (Knox 1403).....	433.32	23.35
		<i>For Tamper Switch Connected To Existing Alarm System, Add</i>	40.00	
10 41 16 00-0003	EA	5" High x 4" Wide x 3-3/4" Deep, Black Finish, Surface Mount, Fire Department Emergency Storage Box (Knox-Box 3200).....	381.87	23.35
		<i>For Lift-Off Door, Deduct</i>	-40.00	
		<i>For Aluminum Or Dark Bronze Finish, Add</i>	10.00	
		<i>For Tamper Switch Connected To Existing Alarm System, Add</i>	40.00	
		<i>For Recess Mount, Add</i>	53.38	
		<i>For Cast-In-Place Concrete Recess Mounting, Add</i>	119.00	
10 41 16 00-0004	EA	6" High x 6" Wide x 4-1/2" Deep, Black Finish, Surface Mount, Fire Department Emergency Storage Box (Knox-Vault 4100).....	507.92	23.35
		<i>For Aluminum Or Dark Bronze Finish, Add</i>	10.00	
		<i>For Tamper Switch Connected To Existing Alarm System, Add</i>	40.00	
		<i>For Recess Mount, Add</i>	53.38	
		<i>For Dual Locks, Add</i>	60.00	
		<i>For Cast-In-Place Concrete Recess Mounting, Add</i>	130.00	
10 41 16 00-0005	EA	7" High x 7" Wide x 5" Deep, Black Finish, Surface Mount, Fire Department Emergency Storage Box (Knox-Vault 4400).....	540.07	23.35
		<i>For Aluminum Or Dark Bronze Finish, Add</i>	10.00	
		<i>For Tamper Switch Connected To Existing Alarm System, Add</i>	40.00	
		<i>For Recess Mount, Add</i>	53.38	
		<i>For Dual Locks, Add</i>	60.00	
		<i>For Cast-In-Place Concrete Recess Mounting, Add</i>	135.00	

10 44 Fire Protection Specialties ^(10 40)

10 44 13 Fire Protection Cabinets ^(10 44)

10 44 13 00-0001 Fire Extinguisher Cabinets ^(10 44 13)

10 44 13 00-0002 Recessed Fire Extinguisher Cabinets ^(10 44 13 00-0001)

10 44 13 00-0003 Steel Door And Trim, Recessed Fire Extinguisher Cabinets ^(10 44 13 00-0002)

Note: Includes powder-coat finish, full view glass or solid metal door, zinc plated handle and steel tub.

10 44 13 00-0004	EA	9" x 18" x 5-1/2" Inside Dimensions, Recessed Steel Fire Extinguisher Cabinet.....	240.51	29.45
10 44 13 00-0005	EA	10-1/2" x 24" x 5-1/2" Inside Dimensions, Recessed Steel Fire Extinguisher Cabinet.....	244.83	29.45
10 44 13 00-0006	EA	10-1/2" x 24" x 6" Inside Dimensions, Recessed Steel Fire Extinguisher Cabinet.....	245.69	29.45
10 44 13 00-0007	EA	12" x 27" x 7-3/4" Inside Dimensions, Recessed Steel Fire Extinguisher Cabinet.....	272.45	29.45
10 44 13 00-0008	EA	16" x 32" x 7-3/4" Inside Dimensions, Recessed Steel Fire Extinguisher Cabinet.....	342.39	29.45
10 44 13 00-0009	EA	20" x 27" x 7-3/4" Inside Dimensions, Recessed Steel Fire Extinguisher Cabinet.....	351.88	29.45

10 44 13 00-0010 Aluminum Door And Trim, Recessed Fire Extinguisher Cabinets ^(10 44 13 00-0002)

Note: Includes clear anodized finish, full view glass or solid metal door, zinc plated handle and steel tub.

10 44 13 00-0011	EA	9" x 18" x 5-1/2" Inside Dimensions, Recessed Aluminum Fire Extinguisher Cabinet.....	264.76	29.45
10 44 13 00-0012	EA	10-1/2" x 24" x 5-1/2" Inside Dimensions, Recessed Aluminum Fire Extinguisher Cabinet.....	269.73	29.45
10 44 13 00-0013	EA	10-1/2" x 24" x 6" Inside Dimensions, Recessed Aluminum Fire Extinguisher Cabinet.....	278.02	29.45
10 44 13 00-0014	EA	12" x 27" x 7-3/4" Inside Dimensions, Recessed Aluminum Fire Extinguisher Cabinet.....	292.11	29.45
10 44 13 00-0015	EA	16" x 32" x 7-3/4" Inside Dimensions, Recessed Aluminum Fire Extinguisher Cabinet.....	335.76	29.45
10 44 13 00-0016	EA	20" x 27" x 7-3/4" Inside Dimensions, Recessed Aluminum Fire Extinguisher Cabinet.....	349.02	29.45

10 44 13 00-0017 Stainless Steel Door And Trim, Recessed Fire Extinguisher Cabinets ^(10 44 13 00-0002)

Note: Includes stainless steel finish, full view glass or solid metal door, zinc plated handle and steel tub.

10 44 13 00-0018	EA	9" x 18" x 5-1/2" Inside Dimensions, Recessed Stainless Steel Fire Extinguisher Cabinet.....	369.44	29.45
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Specialties	10	10
Safety Specialties	10 40	
Fire Protection Specialties	10 44	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 44 13 00-0019	EA		10-1/2" x 24" x 5-1/2" Inside Dimensions, Recessed Stainless Steel Fire Extinguisher Cabinet	379.60	29.45
10 44 13 00-0020	EA		10-1/2" x 24" x 6" Inside Dimensions, Recessed Stainless Steel Fire Extinguisher Cabinet	384.67	29.45
10 44 13 00-0021	EA		12" x 27" x 7-3/4" Inside Dimensions, Recessed Stainless Steel Fire Extinguisher Cabinet	419.37	29.45
10 44 13 00-0022	EA		16" x 32" x 7-3/4" Inside Dimensions, Recessed Stainless Steel Fire Extinguisher Cabinet	489.33	29.45
10 44 13 00-0023	EA		20" x 27" x 7-3/4" Inside Dimensions, Recessed Stainless Steel Fire Extinguisher Cabinet	510.49	29.45
10 44 13 00-0024			Bronze Door And Trim, Recessed Fire Extinguisher Cabinets <small>(10 44 13 00-0002)</small>		
			Note: Includes satin bronze finish, full view glass or solid metal door, zinc plated handle and steel tub.		
10 44 13 00-0025	EA		10-1/2" x 24" x 5-1/2" Inside Dimensions, Recessed Bronze Fire Extinguisher Cabinet.....	910.47	29.45
10 44 13 00-0026	EA		10-1/2" x 24" x 6" Inside Dimensions, Recessed Bronze Fire Extinguisher Cabinet.....	917.18	29.45
10 44 13 00-0027	EA		12" x 27" x 7-3/4" Inside Dimensions, Recessed Bronze Fire Extinguisher Cabinet.....	1,054.01	29.45
10 44 13 00-0028			Acrylic Bubble Door And Steel Trim, Recessed Fire Extinguisher Cabinets <small>(10 44 13 00-0002)</small>		
			Note: Includes 180 degree visibility acrylic bubble door, zinc plated handle and steel tub.		
10 44 13 00-0029	EA		10-1/2" x 24" x 4" Inside Dimensions, Recessed Steel Fire Extinguisher Cabinet With Acrylic Bubble Door	296.63	29.45
10 44 13 00-0030	EA		14" x 30" x 4" Inside Dimensions, Recessed Steel Fire Extinguisher Cabinet With Acrylic Bubble Door.....	329.44	29.45
10 44 13 00-0031			Semi Recessed Fire Extinguisher Cabinets <small>(10 44 13 00-0001)</small>		
10 44 13 00-0032			Steel Door And Trim, Semi Recessed Fire Extinguisher Cabinets <small>(10 44 13 00-0001)</small>		
			Note: Includes powder-coat finish, full view glass or solid metal door, zinc plated handle and steel tub.		
10 44 13 00-0033	EA		9" x 18" x 5-1/2" Inside Dimensions, Semi Recessed Steel Fire Extinguisher Cabinet.....	263.82	29.45
10 44 13 00-0034	EA		10-1/2" x 24" x 5-1/2" Inside Dimensions, Semi Recessed Steel Fire Extinguisher Cabinet.....	272.45	29.45
10 44 13 00-0035	EA		10-1/2" x 24" x 6" Inside Dimensions, Semi Recessed Steel Fire Extinguisher Cabinet.....	273.32	29.45
10 44 13 00-0036	EA		12" x 27" x 7-3/4" Inside Dimensions, Semi Recessed Steel Fire Extinguisher Cabinet.....	302.67	29.45
10 44 13 00-0037	EA		16" x 32" x 7-3/4" Inside Dimensions, Semi Recessed Steel Fire Extinguisher Cabinet.....	361.38	29.45
10 44 13 00-0038	EA		20" x 27" x 7-3/4" Inside Dimensions, Semi Recessed Steel Fire Extinguisher Cabinet.....	370.88	29.45
10 44 13 00-0039			Aluminum Door And Trim, Semi Recessed Fire Extinguisher Cabinets <small>(10 44 13 00-0031)</small>		
			Note: Includes clear anodized finish, full view glass or solid metal door, zinc plated handle and steel tub.		
10 44 13 00-0040	EA		9" x 18" x 5-1/2" Inside Dimensions, Semi Recessed Aluminum Fire Extinguisher Cabinet.....	301.77	29.45
10 44 13 00-0041	EA		10-1/2" x 24" x 5-1/2" Inside Dimensions, Semi Recessed Aluminum Fire Extinguisher Cabinet.....	314.21	29.45
10 44 13 00-0042	EA		10-1/2" x 24" x 6" Inside Dimensions, Semi Recessed Aluminum Fire Extinguisher Cabinet.....	321.67	29.45
10 44 13 00-0043	EA		12" x 27" x 7-3/4" Inside Dimensions, Semi Recessed Aluminum Fire Extinguisher Cabinet.....	335.76	29.45
10 44 13 00-0044	EA		16" x 32" x 7-3/4" Inside Dimensions, Semi Recessed Aluminum Fire Extinguisher Cabinet.....	384.66	29.45
10 44 13 00-0045	EA		20" x 27" x 7-3/4" Inside Dimensions, Semi Recessed Aluminum Fire Extinguisher Cabinet.....	396.26	29.45
10 44 13 00-0046			Stainless Steel Door And Trim, Semi Recessed Fire Extinguisher Cabinets <small>(10 44 13 00-0031)</small>		
			Note: Includes stainless steel finish, full view glass or solid metal door, zinc plated handle and steel tub.		
10 44 13 00-0047	EA		9" x 18" x 5-1/2" Inside Dimensions, Semi Recessed Stainless Steel Fire Extinguisher Cabinet	414.01	29.45
10 44 13 00-0048	EA		10-1/2" x 24" x 5-1/2" Inside Dimensions, Semi Recessed Stainless Steel Fire Extinguisher Cabinet	425.86	29.45
10 44 13 00-0049	EA		10-1/2" x 24" x 6" Inside Dimensions, Semi Recessed Stainless Steel Fire Extinguisher Cabinet	430.94	29.45
10 44 13 00-0050	EA		12" x 27" x 7-3/4" Inside Dimensions, Semi Recessed Stainless Steel Fire Extinguisher Cabinet	457.17	29.45
10 44 13 00-0051	EA		16" x 32" x 7-3/4" Inside Dimensions, Semi Recessed Stainless Steel Fire Extinguisher Cabinet	522.34	29.45
10 44 13 00-0052	EA		20" x 27" x 7-3/4" Inside Dimensions, Semi Recessed Stainless Steel Fire Extinguisher Cabinet	536.72	29.45
10 44 13 00-0053			Bronze Door And Trim, Semi Recessed Fire Extinguisher Cabinets <small>(10 44 13 00-0031)</small>		
			Note: Includes satin bronze finish, full view glass or solid metal door, zinc plated handle and steel tub.		
10 44 13 00-0054	EA		10-1/2" x 24" x 5-1/2" Inside Dimensions, Semi Recessed Bronze Fire Extinguisher Cabinet	1,149.43	29.45
10 44 13 00-0055	EA		10-1/2" x 24" x 6" Inside Dimensions, Semi Recessed Bronze Fire Extinguisher Cabinet.....	1,155.06	29.45
10 44 13 00-0056	EA		12" x 27" x 7-3/4" Inside Dimensions, Semi Recessed Bronze Fire Extinguisher Cabinet.....	1,325.01	29.45
10 44 13 00-0057			Acrylic Bubble Door And Steel Trim, Semi Recessed Fire Extinguisher Cabinets <small>(10 44 13 00-0031)</small>		
			Note: Includes 180 degree visibility acrylic bubble door, zinc plated handle and steel tub.		
10 44 13 00-0058	EA		10-1/2" x 24" x 4" Inside Dimensions, Semi Recessed Steel Fire Extinguisher Cabinet With Acrylic Bubble Door	327.71	29.45
10 44 13 00-0059	EA		14" x 30" x 4" Inside Dimensions, Semi Recessed Steel Fire Extinguisher Cabinet With Acrylic Bubble Door	358.79	29.45
10 44 13 00-0060			Surface Mounted Fire Extinguisher Cabinets <small>(10 44 13 00-0001)</small>		
10 44 13 00-0061			Steel Door And Trim, Surface Mount Fire Extinguisher Cabinets <small>(10 44 13 00-0060)</small>		
			Note: Includes powder-coat finish, full view glass or solid metal door, zinc plated handle and steel tub.		
10 44 13 00-0062	EA		12-3/16" x 21-3/16" x 6" Inside Dimensions, Surface Mount Steel Fire Extinguisher Cabinet	256.91	29.45
10 44 13 00-0063	EA		13-11/16" x 27-3/16" x 6-1/2" Inside Dimensions, Surface Mount Steel Fire Extinguisher Cabinet	262.09	29.45
10 44 13 00-0064	EA		15-3/16" x 30-3/16" x 8-1/4" Inside Dimensions, Surface Mount Steel Fire Extinguisher Cabinet	303.54	29.45
10 44 13 00-0065	EA		19-3/16" x 35-3/16" x 8-1/4" Inside Dimensions, Surface Mount Steel Fire Extinguisher Cabinet	354.47	29.45
10 44 13 00-0066	EA		23-3/16" x 30-3/16" x 8-1/4" Inside Dimensions, Surface Mount Steel Fire Extinguisher Cabinet	368.29	29.45
10 44 13 00-0067			Aluminum Door And Trim, Surface Mount Fire Extinguisher Cabinets <small>(10 44 13 00-0060)</small>		
			Note: Includes clear anodized finish, full view glass or solid metal door, zinc plated handle and steel tub.		

10 Specialties**10 40 Safety Specialties****10 44 Fire Protection Specialties**

MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
10 44 13 00-0068	EA	12-3/16" x 21-3/16" x 6" Inside Dimensions, Surface Mount Aluminum Fire Extinguisher Cabinet.....	380.51		29.45
10 44 13 00-0069	EA	13-11/16" x 27-3/16" x 6-1/2" Inside Dimensions, Surface Mount Aluminum Fire Extinguisher Cabinet.....	391.29		29.45
10 44 13 00-0070	EA	15-3/16" x 30-3/16" x 8-1/4" Inside Dimensions, Surface Mount Aluminum Fire Extinguisher Cabinet.....	415.32		29.45
10 44 13 00-0071	EA	19-3/16" x 35-3/16" x 8-1/4" Inside Dimensions, Surface Mount Aluminum Fire Extinguisher Cabinet.....	462.57		29.45
10 44 13 00-0072	EA	23-3/16" x 30-3/16" x 8-1/4" Inside Dimensions, Surface Mount Aluminum Fire Extinguisher Cabinet.....	482.46		29.45
10 44 13 00-0073		Stainless Steel Door And Trim, Surface Mount Fire Extinguisher Cabinets ⁽¹⁰			
		<small>^{44 13 00-0060}</small>			
		Note: Includes stainless steel finish, full view glass or solid metal door, zinc plated handle and steel tub.			
10 44 13 00-0074	EA	12-3/16" x 21-3/16" x 6" Inside Dimensions, Surface Mount Stainless Steel Fire Extinguisher Cabinet.....	487.64		29.45
10 44 13 00-0075	EA	13-11/16" x 27-3/16" x 6-1/2" Inside Dimensions, Surface Mount Stainless Steel Fire Extinguisher Cabinet.....	503.72		29.45
10 44 13 00-0076	EA	15-3/16" x 30-3/16" x 8-1/4" Inside Dimensions, Surface Mount Stainless Steel Fire Extinguisher Cabinet.....	543.49		29.45
10 44 13 00-0077	EA	19-3/16" x 35-3/16" x 8-1/4" Inside Dimensions, Surface Mount Stainless Steel Fire Extinguisher Cabinet.....	622.50		29.45
10 44 13 00-0078	EA	23-3/16" x 30-3/16" x 8-1/4" Inside Dimensions, Surface Mount Stainless Steel Fire Extinguisher Cabinet.....	644.20		29.45
10 44 13 00-0079		Bronze Door And Trim, Surface Mount Fire Extinguisher Cabinets ^(10 44 13 00-0060)			
		Note: Includes satin bronze finish, full view glass or solid metal door, zinc plated handle and steel tub.			
10 44 13 00-0080	EA	13-11/16" x 27-3/16" x 6-1/2" Inside Dimensions, Surface Mount Bronze Fire Extinguisher Cabinet.....	1,319.71		29.45
10 44 13 00-0081	EA	15-3/16" x 30-3/16" x 8-1/4" Inside Dimensions, Surface Mount Bronze Fire Extinguisher Cabinet.....	1,488.36		29.45
10 44 13 00-0082		Acrylic Bubble Door And Steel Trim, Surface Mount Fire Extinguisher Cabinets ^(10 44 13 00-0060)			
		Note: Includes 180 degree visibility acrylic bubble door, zinc plated handle and steel tub.			
10 44 13 00-0083	EA	13-11/16" x 27-3/16" x 4-5/8" Inside Dimensions, Surface Mount Steel Fire Extinguisher Cabinet With Acrylic Bubble Door.....	308.72		29.45
10 44 13 00-0084	EA	17-3/16" x 33-3/16" x 4-5/8" Inside Dimensions, Surface Mount Steel Fire Extinguisher Cabinet With Acrylic Bubble Door.....	346.70		29.45
10 44 13 00-0085	EA	31-3/16" x 33-3/16" x 4-5/8" Inside Dimensions, Surface Mount Steel Fire Extinguisher Cabinet With Acrylic Bubble Door.....	479.66		29.45
10 44 13 00-0086		Fire Extinguisher Cabinet Accessories ^(10 44 13 00-0001)			
10 44 13 00-0087	EA	Standard Break Glass Cylinder Lock Mechanism.....	24.58		8.98
10 44 13 00-0088	EA	Breaker Bar And Chain For Break Glass Cabinets.....	22.26		8.98
10 44 13 00-0089	EA	Replacement Standard Pull Handle.....	20.85		8.98
10 44 13 00-0090	EA	Fire Extinguisher Cabinet Battery Operated Alarm.....	65.75		17.95
10 44 13 00-0091	EA	Fire Rated Option For 10-1/2" x 24" x 5-1/2" Or 6" Cabinets.....	115.12		
10 44 13 00-0092	EA	Fire Rated Option For 12" x 27" x 7-3/4" Cabinets.....	126.63		
10 44 13 00-0093	EA	Fire Rated Option For 16" x 32" x 7-3/4" Cabinets.....	172.68		
10 44 13 00-0094	EA	Fire Rated Option For 20" x 27" x 7-3/4" Cabinets.....	236.00		
10 44 13 00-0095	EA	Fire Rated Option For 9" x 18" x 5-1/2" Cabinets.....	276.29		
10 44 13 00-0096	EA	Replace Standard Glass With Wire Glass For 9" x 18" x 5-1/2" Cabinets.....	66.77		
10 44 13 00-0097	EA	Replace Standard Glass With Wire Glass For 10-1/2" x 24" x 5-1/2" Or 6" Cabinets.....	69.07		
10 44 13 00-0098	EA	Replace Standard Glass With Wire Glass For 12" x 27" x 7-3/4" Cabinets.....	92.10		
10 44 13 00-0099	EA	Replace Standard Glass With Wire Glass For 16" x 32" x 7-3/4" Cabinets.....	166.92		
10 44 13 00-0100	EA	Replace Standard Glass With Wire Glass For 20" x 27" x 7-3/4" Cabinets.....	169.23		
10 44 13 00-0101	EA	Replace Standard Glass With Wire Glass For 12-3/16" x 21-3/16" x 6" Cabinets.....	72.45		
10 44 13 00-0102	EA	Replace Standard Glass With Wire Glass For 13-11/16" x 27-3/16" x 6-1/2" Cabinets.....	76.07		
10 44 13 00-0103	EA	Replace Standard Glass With Wire Glass For 15-3/16" x 30-3/16" x 8-1/4" Cabinets.....	102.64		
10 44 13 00-0104	EA	Replace Standard Glass With Wire Glass For 19-3/16" x 35-3/16" x 8-1/4" Cabinets.....	181.12		
10 44 13 00-0105	EA	Replace Standard Glass With Wire Glass For 23-3/16" x 30-3/16" x 8-1/4" Cabinets.....	183.54		
10 44 13 00-0106		Fire Hose Cabinets ^(10 44 13)			
		Note: Excludes hoses, hose rack units, fire extinguishers and valves. See CSI section 21 12 13 00-0001 for fire hoses and nozzles, 21 12 13 00-0015 for fire hose rack units, 21 12 23 00-0014 for fire hose angle valves.			
10 44 13 00-0107		Recessed Fire Hose Cabinets ^(10 44 13 00-0106)			
10 44 13 00-0108		Steel Door And Trim, Recessed Fire Hose Cabinets ^(10 44 13 00-0107)			
		Note: Includes baked enamel finish, steel door, trim and box, full view acrylic door lite, satin finish turn handle, continuous matching hinge and self-adjusting roller catch.			
10 44 13 00-0109	EA	34" x 24" x 8" Inside Dimensions, Recessed Steel Fire Hose Cabinet.....	383.07		107.84
		<i>For Solid Steel Door, Deduct</i>	-8.60		
10 44 13 00-0110	EA	34" x 26" x 8" Inside Dimensions, Recessed Steel Fire Hose Cabinet.....	388.71		107.84
		<i>For Solid Steel Door, Deduct</i>	-8.60		
10 44 13 00-0111	EA	38" x 24" x 8" Inside Dimensions, Recessed Steel Fire Hose Cabinet.....	393.41		107.84
		<i>For Solid Steel Door, Deduct</i>	-8.60		
10 44 13 00-0112	EA	38" x 26" x 8" Inside Dimensions, Recessed Steel Fire Hose Cabinet.....	398.12		107.84
		<i>For Solid Steel Door, Deduct</i>	-8.60		
10 44 13 00-0113	EA	30" x 30" x 8" Inside Dimensions, Recessed Steel Fire Hose Cabinet.....	403.76		107.84
		<i>For Solid Steel Door, Deduct</i>	-8.60		
10 44 13 00-0114	EA	38" x 32" x 8" Inside Dimensions, Recessed Steel Fire Hose Cabinet.....	418.81		107.84
		<i>For Solid Steel Door, Deduct</i>	-8.60		
10 44 13 00-0115	EA	23" x 18" x 8" Inside Dimensions, Recessed Steel Fire Hose Cabinet.....	423.51		107.84
		<i>For Solid Steel Door, Deduct</i>	-8.60		



Specialties	10	10
Safety Specialties	10 40	
Fire Protection Specialties	10 44	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 44 13 00-0116 Aluminum Door And Trim, Recessed Fire Hose Cabinets <small>(10 44 13 00-0107)</small>		
<small>Note: Includes clear satin anodized finish, aluminum door and trim, baked enamel steel box, full view acrylic door lite, satin finish turn handle, continuous matching hinge and self-adjusting roller catch.</small>		
10 44 13 00-0117 EA 34" x 24" x 8" Inside Dimensions, Recessed Aluminum Fire Hose Cabinet.....	412.32	107.84
<i>For Solid Aluminum Door, Add</i>		
	6.50	
10 44 13 00-0118 EA 30" x 30" x 8" Inside Dimensions, Recessed Aluminum Fire Hose Cabinet.....	421.57	107.84
<i>For Solid Aluminum Door, Add</i>		
	6.50	
10 44 13 00-0119 EA 34" x 26" x 8" Inside Dimensions, Recessed Aluminum Fire Hose Cabinet.....	422.77	107.84
<i>For Solid Aluminum Door, Add</i>		
	6.50	
10 44 13 00-0120 EA 38" x 24" x 8" Inside Dimensions, Recessed Aluminum Fire Hose Cabinet.....	426.61	107.84
<i>For Solid Aluminum Door, Add</i>		
	6.50	
10 44 13 00-0121 EA 38" x 26" x 8" Inside Dimensions, Recessed Aluminum Fire Hose Cabinet.....	431.65	107.84
<i>For Solid Aluminum Door, Add</i>		
	6.50	
10 44 13 00-0122 EA 38" x 32" x 8" Inside Dimensions, Recessed Aluminum Fire Hose Cabinet.....	445.94	107.84
<i>For Solid Aluminum Door, Add</i>		
	6.50	
10 44 13 00-0123 EA 23" x 18" x 8" Inside Dimensions, Recessed Aluminum Fire Hose Cabinet.....	460.23	107.84
<i>For Solid Aluminum Door, Add</i>		
	6.50	
10 44 13 00-0124 Stainless Steel Door And Trim, Recessed Fire Hose Cabinets <small>(10 44 13 00-0107)</small>		
<small>Note: Includes #4 finish, stainless steel door and trim, baked enamel steel box, full view acrylic door lite, satin finish turn handle, continuous matching hinge and self-adjusting roller catch.</small>		
10 44 13 00-0125 EA 23" x 18" x 8" Inside Dimensions, Recessed Stainless Steel Fire Hose Cabinet.....	495.52	107.84
<i>For Solid Stainless Steel Door, Deduct</i>		
	-7.70	
10 44 13 00-0126 EA 34" x 24" x 8" Inside Dimensions, Recessed Stainless Steel Fire Hose Cabinet.....	539.22	107.84
<i>For Solid Stainless Steel Door, Deduct</i>		
	-7.70	
10 44 13 00-0127 EA 34" x 26" x 8" Inside Dimensions, Recessed Stainless Steel Fire Hose Cabinet.....	543.43	107.84
<i>For Solid Stainless Steel Door, Deduct</i>		
	-7.70	
10 44 13 00-0128 EA 38" x 24" x 8" Inside Dimensions, Recessed Stainless Steel Fire Hose Cabinet.....	556.87	107.84
<i>For Solid Stainless Steel Door, Deduct</i>		
	-7.70	
10 44 13 00-0129 EA 38" x 26" x 8" Inside Dimensions, Recessed Stainless Steel Fire Hose Cabinet.....	561.07	107.84
<i>For Solid Stainless Steel Door, Deduct</i>		
	-7.70	
10 44 13 00-0130 EA 30" x 30" x 8" Inside Dimensions, Recessed Stainless Steel Fire Hose Cabinet.....	582.92	107.84
<i>For Solid Stainless Steel Door, Deduct</i>		
	-7.70	
10 44 13 00-0131 EA 38" x 32" x 8" Inside Dimensions, Recessed Stainless Steel Fire Hose Cabinet.....	604.77	107.84
<i>For Solid Stainless Steel Door, Deduct</i>		
	-7.70	
10 44 13 00-0132 Semi Recessed Fire Hose Cabinets <small>(10 44 13 00-0106)</small>		
10 44 13 00-0133 Steel Door And Trim, Semi Recessed Fire Hose Cabinets <small>(10 44 13 00-0132)</small>		
<small>Note: Includes baked enamel finish, steel door, trim and box, full view acrylic door lite, satin finish turn handle, continuous matching hinge and self-adjusting roller catch.</small>		
10 44 13 00-0134 EA 34" x 24" x 8" Inside Dimensions, Semi Recessed Steel Fire Hose Cabinet.....	398.12	107.84
<i>For Solid Steel Door, Deduct</i>		
	-8.60	
10 44 13 00-0135 EA 34" x 26" x 8" Inside Dimensions, Semi Recessed Steel Fire Hose Cabinet.....	403.76	107.84
<i>For Solid Steel Door, Deduct</i>		
	-8.60	
10 44 13 00-0136 EA 38" x 24" x 8" Inside Dimensions, Semi Recessed Steel Fire Hose Cabinet.....	408.46	107.84
<i>For Solid Steel Door, Deduct</i>		
	-8.60	
10 44 13 00-0137 EA 38" x 26" x 8" Inside Dimensions, Semi Recessed Steel Fire Hose Cabinet.....	414.10	107.84
<i>For Solid Steel Door, Deduct</i>		
	-8.60	
10 44 13 00-0138 EA 30" x 30" x 8" Inside Dimensions, Semi Recessed Steel Fire Hose Cabinet.....	418.81	107.84
<i>For Solid Steel Door, Deduct</i>		
	-8.60	
10 44 13 00-0139 EA 38" x 32" x 8" Inside Dimensions, Semi Recessed Steel Fire Hose Cabinet.....	433.85	107.84
<i>For Solid Steel Door, Deduct</i>		
	-8.60	
10 44 13 00-0140 EA 23" x 18" x 8" Inside Dimensions, Semi Recessed Steel Fire Hose Cabinet.....	439.49	107.84
<i>For Solid Steel Door, Deduct</i>		
	-8.60	
10 44 13 00-0141 Aluminum Door And Trim, Semi Recessed Fire Hose Cabinets <small>(10 44 13 00-0132)</small>		
<small>Note: Includes clear satin anodized finish, aluminum door and trim, baked enamel steel box, full view acrylic door lite, satin finish turn handle, continuous matching hinge and self-adjusting roller catch.</small>		
10 44 13 00-0142 EA 34" x 24" x 8" Inside Dimensions, Semi Recessed Aluminum Fire Hose Cabinet.....	421.57	107.84
<i>For Solid Aluminum Door, Add</i>		
	6.50	
10 44 13 00-0143 EA 34" x 26" x 8" Inside Dimensions, Semi Recessed Aluminum Fire Hose Cabinet.....	431.65	107.84
<i>For Solid Aluminum Door, Add</i>		
	6.50	
10 44 13 00-0144 EA 30" x 30" x 8" Inside Dimensions, Semi Recessed Aluminum Fire Hose Cabinet.....	433.09	107.84
<i>For Solid Aluminum Door, Add</i>		
	6.50	
10 44 13 00-0145 EA 38" x 24" x 8" Inside Dimensions, Semi Recessed Aluminum Fire Hose Cabinet.....	435.85	107.84
<i>For Solid Aluminum Door, Add</i>		
	6.50	
10 44 13 00-0146 EA 38" x 26" x 8" Inside Dimensions, Semi Recessed Aluminum Fire Hose Cabinet.....	440.90	107.84
<i>For Solid Aluminum Door, Add</i>		
	6.50	
10 44 13 00-0147 EA 38" x 32" x 8" Inside Dimensions, Semi Recessed Aluminum Fire Hose Cabinet.....	455.18	107.84
<i>For Solid Aluminum Door, Add</i>		
	6.50	
10 44 13 00-0148 EA 23" x 18" x 8" Inside Dimensions, Semi Recessed Aluminum Fire Hose Cabinet.....	469.47	107.84
<i>For Solid Aluminum Door, Add</i>		
	6.50	
10 44 13 00-0149 Stainless Steel Door And Trim, Semi Recessed Fire Hose Cabinets <small>(10 44 13 00-0132)</small>		
<small>Note: Includes #4 finish, 304 stainless steel door and trim, baked enamel steel box, full view acrylic door lite, satin finish turn handle, continuous matching hinge and self-adjusting roller catch.</small>		
10 44 13 00-0150 EA 23" x 18" x 8" Inside Dimensions, Semi Recessed Stainless Steel Fire Hose Cabinet.....	521.58	107.84
<i>For Solid Stainless Steel Door, Deduct</i>		
	-7.70	

10 Specialties**10 40 Safety Specialties****10 44 Fire Protection Specialties**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 44 13 00-0151 EA 34" x 24" x 8" Inside Dimensions, Semi Recessed Stainless Steel Fire Hose Cabinet.....	569.48	107.84
<i>For Solid Stainless Steel Door, Deduct</i>	-7.70	
10 44 13 00-0152 EA 34" x 26" x 8" Inside Dimensions, Semi Recessed Stainless Steel Fire Hose Cabinet.....	573.68	107.84
<i>For Solid Stainless Steel Door, Deduct</i>	-7.70	
10 44 13 00-0153 EA 38" x 24" x 8" Inside Dimensions, Semi Recessed Stainless Steel Fire Hose Cabinet.....	587.13	107.84
<i>For Solid Stainless Steel Door, Deduct</i>	-7.70	
10 44 13 00-0154 EA 38" x 26" x 8" Inside Dimensions, Semi Recessed Stainless Steel Fire Hose Cabinet.....	591.33	107.84
<i>For Solid Stainless Steel Door, Deduct</i>	-7.70	
10 44 13 00-0155 EA 30" x 30" x 8" Inside Dimensions, Semi Recessed Stainless Steel Fire Hose Cabinet.....	613.18	107.84
<i>For Solid Stainless Steel Door, Deduct</i>	-7.70	
10 44 13 00-0156 EA 38" x 32" x 8" Inside Dimensions, Semi Recessed Stainless Steel Fire Hose Cabinet.....	635.03	107.84
<i>For Solid Stainless Steel Door, Deduct</i>	-7.70	
10 44 13 00-0157 Surface Mount Fire Hose Cabinets (10 44 13 00-0106)		
10 44 13 00-0158 Steel Door And Trim, Surface Mount Fire Hose Cabinets (10 44 13 00-0157)		
Note: Includes baked enamel finish, steel door and trim, baked enamel steel box, full view acrylic door lite, satin finish turn handle, continuous matching hinge and self-adjusting roller catch.		
10 44 13 00-0159 EA 37-1/2" x 27-1/2" x 8-1/2" Inside Dimensions, Surface Mount Steel Fire Hose Cabinet.....	403.76	107.84
<i>For Solid Steel Door, Deduct</i>	-8.60	
10 44 13 00-0160 EA 37-1/2" x 29-1/2" x 8-1/2" Inside Dimensions, Surface Mount Steel Fire Hose Cabinet.....	408.46	107.84
<i>For Solid Steel Door, Deduct</i>	-8.60	
10 44 13 00-0161 EA 41-1/2" x 27-1/2" x 8-1/2" Inside Dimensions, Surface Mount Steel Fire Hose Cabinet.....	414.10	107.84
<i>For Solid Steel Door, Deduct</i>	-8.60	
10 44 13 00-0162 EA 41-1/2" x 29-1/2" x 8-1/2" Inside Dimensions, Surface Mount Steel Fire Hose Cabinet.....	418.81	107.84
<i>For Solid Steel Door, Deduct</i>	-8.60	
10 44 13 00-0163 EA 33-1/2" x 33-1/2" x 8-1/2" Inside Dimensions, Surface Mount Steel Fire Hose Cabinet.....	423.51	107.84
<i>For Solid Steel Door, Deduct</i>	-8.60	
10 44 13 00-0164 EA 41-1/2" x 35-1/2" x 8-1/2" Inside Dimensions, Surface Mount Steel Fire Hose Cabinet.....	439.49	107.84
<i>For Solid Steel Door, Deduct</i>	-8.60	
10 44 13 00-0165 EA 26-1/2" x 21-1/2" x 8-1/2" Inside Dimensions, Surface Mount Steel Fire Hose Cabinet.....	444.20	107.84
<i>For Solid Steel Door, Deduct</i>	-8.60	
10 44 13 00-0166 Aluminum Door And Trim, Surface Mount Fire Hose Cabinets (10 44 13 00-0157)		
Note: Includes clear satin anodized finish, aluminum door, trim and box, full view acrylic door lite, satin finish turn handle, continuous matching hinge and self-adjusting roller catch.		
10 44 13 00-0167 EA 37-1/2" x 27-1/2" x 8-1/2" Inside Dimensions, Surface Mount Aluminum Fire Hose Cabinet.....	445.94	107.84
<i>For Solid Aluminum Door, Add</i>	6.50	
10 44 13 00-0168 EA 33-1/2" x 33-1/2" x 8-1/2" Inside Dimensions, Surface Mount Aluminum Fire Hose Cabinet.....	455.18	107.84
<i>For Solid Aluminum Door, Add</i>	6.50	
10 44 13 00-0169 EA 37-1/2" x 29-1/2" x 8-1/2" Inside Dimensions, Surface Mount Aluminum Fire Hose Cabinet.....	457.58	107.84
<i>For Solid Aluminum Door, Add</i>	6.50	
10 44 13 00-0170 EA 41-1/2" x 27-1/2" x 8-1/2" Inside Dimensions, Surface Mount Aluminum Fire Hose Cabinet.....	460.23	107.84
<i>For Solid Aluminum Door, Add</i>	6.50	
10 44 13 00-0171 EA 41-1/2" x 29-1/2" x 8-1/2" Inside Dimensions, Surface Mount Aluminum Fire Hose Cabinet.....	464.43	107.84
<i>For Solid Aluminum Door, Add</i>	6.50	
10 44 13 00-0172 EA 41-1/2" x 35-1/2" x 8-1/2" Inside Dimensions, Surface Mount Aluminum Fire Hose Cabinet.....	479.56	107.84
<i>For Solid Aluminum Door, Add</i>	6.50	
10 44 13 00-0173 EA 26-1/2" x 21-1/2" x 8-1/2" Inside Dimensions, Surface Mount Aluminum Fire Hose Cabinet.....	488.80	107.84
<i>For Solid Aluminum Door, Add</i>	6.50	
10 44 13 00-0174 Stainless Steel Door And Trim, Surface Mount Fire Hose Cabinets (10 44 13 00-0157)		
Note: Includes #4 finish, 304 stainless steel door, trim and box, full view acrylic door lite, satin finish turn handle, continuous matching hinge and self-adjusting roller catch.		
10 44 13 00-0175 EA 26-1/2" x 21-1/2" x 8-1/2" Inside Dimensions, Surface Mount Stainless Steel Fire Hose Cabinet.....	556.87	107.84
<i>For Solid Stainless Steel Door, Deduct</i>	-7.70	
10 44 13 00-0176 EA 37-1/2" x 27-1/2" x 8-1/2" Inside Dimensions, Surface Mount Stainless Steel Fire Hose Cabinet.....	696.38	107.84
<i>For Solid Stainless Steel Door, Deduct</i>	-7.70	
10 44 13 00-0177 EA 41-1/2" x 27-1/2" x 8-1/2" Inside Dimensions, Surface Mount Stainless Steel Fire Hose Cabinet.....	731.67	107.84
<i>For Solid Stainless Steel Door, Deduct</i>	-7.70	
10 44 13 00-0178 EA 37-1/2" x 29-1/2" x 8-1/2" Inside Dimensions, Surface Mount Stainless Steel Fire Hose Cabinet.....	740.08	107.84
<i>For Solid Stainless Steel Door, Deduct</i>	-7.70	
10 44 13 00-0179 EA 41-1/2" x 29-1/2" x 8-1/2" Inside Dimensions, Surface Mount Stainless Steel Fire Hose Cabinet.....	748.48	107.84
<i>For Solid Stainless Steel Door, Deduct</i>	-7.70	
10 44 13 00-0180 EA 33-1/2" x 33-1/2" x 8-1/2" Inside Dimensions, Surface Mount Stainless Steel Fire Hose Cabinet.....	783.78	107.84
<i>For Solid Stainless Steel Door, Deduct</i>	-7.70	
10 44 13 00-0181 EA 41-1/2" x 35-1/2" x 8-1/2" Inside Dimensions, Surface Mount Stainless Steel Fire Hose Cabinet.....	827.48	107.84
<i>For Solid Stainless Steel Door, Deduct</i>	-7.70	
10 44 16 Fire Extinguishers (10 44)		
10 44 16 13 Portable Fire Extinguishers (10 44 16)		
Note: Includes filling, certification, bracket, hardware and mounting on wall.		
10 44 16 13-0001 Carbon Dioxide Type, Class BC Portable Fire Extinguisher (10 44 16 13)		
10 44 16 13-0002 EA 2.5 LB Carbon Dioxide, Type BC Portable Fire Extinguisher.....	172.23	9.33
<i>For >5 To 10, Deduct</i>	-6.22	
<i>For >10, Deduct</i>	-12.43	
<i>For Placement In Cabinet, Deduct</i>	-23.95	



Specialties	10	10
Safety Specialties	10 40	
Fire Protection Specialties	10 44	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 44 16 13-0003	EA		5 LB Carbon Dioxide, Type BC Portable Fire Extinguisher.....	260.75	10.78
			<i>For >5 To 10, Deduct</i>	-10.27	
			<i>For >10, Deduct</i>	-20.55	
			<i>For Placement In Cabinet, Deduct</i>	-27.63	
10 44 16 13-0004	EA		10 LB Carbon Dioxide, Type BC Portable Fire Extinguisher.....	339.20	13.65
			<i>For >5 To 10, Deduct</i>	-13.37	
			<i>For >10, Deduct</i>	-26.74	
			<i>For Placement In Cabinet, Deduct</i>	-35.92	
10 44 16 13-0005	EA		15 LB Carbon Dioxide, Type BC Portable Fire Extinguisher.....	416.79	17.24
			<i>For >5 To 10, Deduct</i>	-16.35	
			<i>For >10, Deduct</i>	-32.70	
			<i>For Placement In Cabinet, Deduct</i>	-44.90	
10 44 16 13-0006	EA		20 LB Carbon Dioxide, Type BC Portable Fire Extinguisher.....	464.33	17.24
			<i>For >5 To 10, Deduct</i>	-18.73	
			<i>For >10, Deduct</i>	-37.45	
			<i>For Placement In Cabinet, Deduct</i>	-44.90	
10 44 16 13-0007	EA		50 LB Carbon Dioxide, Type BC Wheeled Fire Extinguisher.....	1,600.74	27.30
			<i>For >5 To 10, Deduct</i>	-72.85	
			<i>For >10, Deduct</i>	-145.71	
10 44 16 13-0008	EA		100 LB Carbon Dioxide, Type BC Wheeled Fire Extinguisher.....	3,135.72	27.30
			<i>For >5 To 10, Deduct</i>	-149.60	
			<i>For >10, Deduct</i>	-299.20	
10 44 16 13-0009			Dry Chemical Type, Class ABC Portable Fire Extinguisher (10 44 16 13)		
10 44 16 13-0010	EA		2.6 LB Dry Chemical, Type ABC Portable Fire Extinguisher.....	94.57	9.33
			<i>For >5 To 10, Deduct</i>	-2.33	
			<i>For >10, Deduct</i>	-4.67	
			<i>For Placement In Cabinet, Deduct</i>	-23.95	
10 44 16 13-0011	EA		5 LB Dry Chemical, Type ABC Portable Fire Extinguisher.....	122.50	10.78
			<i>For >5 To 10, Deduct</i>	-3.36	
			<i>For >10, Deduct</i>	-6.72	
			<i>For Placement In Cabinet, Deduct</i>	-27.63	
10 44 16 13-0012	EA		10 LB Dry Chemical, Type ABC Portable Fire Extinguisher.....	177.23	13.65
			<i>For >5 To 10, Deduct</i>	-5.27	
			<i>For >10, Deduct</i>	-10.54	
			<i>For Placement In Cabinet, Deduct</i>	-35.92	
10 44 16 13-0013	EA		20 LB Dry Chemical, Type ABC Portable Fire Extinguisher.....	255.66	17.24
			<i>For >5 To 10, Deduct</i>	-8.29	
			<i>For >10, Deduct</i>	-16.59	
			<i>For Placement In Cabinet, Deduct</i>	-44.90	
10 44 16 13-0014	EA		50 LB Dry Chemical, Type ABC Wheeled Fire Extinguisher.....	1,884.86	27.30
			<i>For >5 To 10, Deduct</i>	-87.06	
			<i>For >10, Deduct</i>	-174.12	
10 44 16 13-0015	EA		125 LB Dry Chemical, Type ABC Wheeled Fire Extinguisher.....	2,875.71	27.30
			<i>For >5 To 10, Deduct</i>	-136.60	
			<i>For >10, Deduct</i>	-273.20	
10 44 16 13-0016			Other Portable Fire Extinguishers (10 44 16 13)		
10 44 16 13-0017	EA		2.5 Gallon Water, Stored Pressure Portable Fire Extinguisher.....	193.16	10.78
			Note: Stainless steel.		
			<i>For >5 To 10, Deduct</i>	-6.90	
			<i>For >10, Deduct</i>	-13.79	
			<i>For Placement In Cabinet, Deduct</i>	-27.63	
10 44 16 13-0018	EA		1.6 Gallon Wet Chemical, Class K Portable Fire Extinguisher.....	288.83	17.24
			Note: Stainless steel.		
			<i>For >5 To 10, Deduct</i>	-9.95	
			<i>For >10, Deduct</i>	-19.90	
			<i>For Placement In Cabinet, Deduct</i>	-44.90	
10 44 16 13-0019	EA		2.5 Gallon Wet Chemical, Class K Portable Fire Extinguisher.....	304.13	17.24
			Note: Stainless steel.		
			<i>For >5 To 10, Deduct</i>	-10.72	
			<i>For >10, Deduct</i>	-21.43	
			<i>For Placement In Cabinet, Deduct</i>	-44.90	
10 44 16 13-0020	EA		30 LB Dry Powder, Class D Portable Fire Extinguisher.....	460.29	17.24
			Note: Yellow steel.		
			<i>For >5 To 10, Deduct</i>	-18.52	
			<i>For >10, Deduct</i>	-37.05	
10 44 16 13-0021			Recharge Existing Portable Fire Extinguishers (10 44 16 13)		
			Note: Includes removal, filling, testing, certification and reinstallation.		
10 44 16 13-0022			Recharge Carbon Dioxide, Class BC Portable Fire Extinguishers (10 44 16 13-0021)		
10 44 16 13-0023	EA		Recharge 2.5 LB Carbon Dioxide Portable Fire Extinguisher.....	8.94	
10 44 16 13-0024	EA		Recharge 5 LB Carbon Dioxide Portable Fire Extinguisher.....	9.94	
10 44 16 13-0025	EA		Recharge 10 LB Carbon Dioxide Portable Fire Extinguisher.....	10.33	
10 44 16 13-0026	EA		Recharge 15 LB Carbon Dioxide Portable Fire Extinguisher.....	11.70	
10 44 16 13-0027	EA		Recharge 20 LB Carbon Dioxide Portable Fire Extinguisher.....	13.51	
10 44 16 13-0028			Recharge Dry Chemical, Class ABC Portable Fire Extinguishers (10 44 16 13-0021)		
10 44 16 13-0029	EA		Recharge 2.5 LB Dry Chemical Portable Fire Extinguisher.....	10.79	

10 Specialties**10 40 Safety Specialties****10 44 Fire Protection Specialties**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 44 16 13-0030	EA		Recharge 5 LB Dry Chemical Portable Fire Extinguisher	13.06	
10 44 16 13-0031	EA		Recharge 10 LB Dry Chemical Portable Fire Extinguisher	18.45	
10 44 16 13-0032	EA		Recharge 20 LB Dry Chemical Portable Fire Extinguisher	29.13	
10 44 16 13-0033			Recharge Other Portable Fire Extinguishers (10 44 16 13-0021)		
10 44 16 13-0034	EA		Recharge 2.5 Gallon Pressurized Water Portable Fire Extinguisher.....	10.67	
10 44 16 13-0035	EA		Recharge 1.6 Gallon Wet Chemical Class K Fire Extinguisher.....	76.08	
10 44 16 13-0036	EA		Recharge 2.5 Gallon Wet Chemical Class K Fire Extinguisher.....	106.51	
10 44 16 13-0037	EA		Recharge 30 LB Dry Powder Class D Portable Fire Extinguisher.....	43.85	
10 44 16 13-0038			Fire Extinguisher Backboards (10 44 16 13)		
10 44 16 13-0039			Fire Extinguisher Backboards (10 44 16 13-0038)		
			Note: Mounted to any wall. Includes anchors.		
10 44 16 13-0040	EA		Red Painted 1/2" x 12" x 40" Beveled Edge Plywood Fire Extinguisher Backboard	79.68	12.33
10 44 16 13-0041	EA		Relocate Fire Extinguisher Wood Backboard, Any Size	108.81	
			Note: Includes storage and cleaning.		
10 44 16 13-0042			Inspections And Testing (10 44 16 13)		
10 44 16 13-0043	EA		On Site Fire Extinguisher Annual Inspection (Tag)	9.65	
10 44 16 13-0044	EA		On Site Fire Extinguisher Hydrotest.....	14.19	
10 44 19			Fire Blankets (10 44)		
10 44 19 00-0001	EA		Vertical Roller Type Fire Blanket Cabinet (JL Industries 1FB)	306.33	29.45
			Note: Includes a 62" x 84", 3-1/2 pound, processed wool fire blanket.		
10 44 19 00-0002	EA		Drop Type Fire Blanket Cabinet (JL Industries 2FB).....	224.31	29.45
			Note: Includes a 62" x 84", 3-1/2 pound, processed wool fire blanket.		
10 50 Storage Specialties (10)					
10 51 Lockers (10 50)					
10 51 13 Metal Lockers (10 51)					
10 51 13 00-0001			Institutional And Corridor Lockers (10 51 13)		
			Note: Price per frame. Includes baked enamel 24 gauge solid body components and 6" legs. Excludes slope top, base fillers, and locks.		
10 51 13 00-0002			Single Tier Institutional Or Corridor Locker (10 51 13 00-0001)		
			Note: Includes one hat shelf, three single hooks and one double hook.		
10 51 13 00-0003	EA		12" x 12" x 48" Single Tier Institutional Or Corridor Locker.....	164.00	22.28
			For >25 To 50, Deduct	-5.97	
			For >50 To 100, Deduct	-12.61	
			For >100, Deduct	-19.26	
			For 14 Gauge Doors, Add	9.56	
10 51 13 00-0004	EA		12" x 15" x 48" Single Tier Institutional Or Corridor Locker	168.74	22.28
			For >25 To 50, Deduct	-6.21	
			For >50 To 100, Deduct	-13.09	
			For >100, Deduct	-19.97	
			For 14 Gauge Doors, Add	9.94	
10 51 13 00-0005	EA		12" x 18" x 48" Single Tier Institutional Or Corridor Locker	173.46	22.28
			For >25 To 50, Deduct	-6.45	
			For >50 To 100, Deduct	-13.56	
			For >100, Deduct	-20.67	
			For 14 Gauge Doors, Add	10.31	
10 51 13 00-0006	EA		12" x 12" x 60" Single Tier Institutional Or Corridor Locker.....	155.36	22.28
			For >25 To 50, Deduct	-5.54	
			For >50 To 100, Deduct	-11.75	
			For >100, Deduct	-17.96	
			For 14 Gauge Doors, Add	8.87	
10 51 13 00-0007	EA		12" x 15" x 60" Single Tier Institutional Or Corridor Locker.....	161.23	22.28
			For >25 To 50, Deduct	-5.83	
			For >50 To 100, Deduct	-12.34	
			For >100, Deduct	-18.84	
			For 14 Gauge Doors, Add	9.34	
10 51 13 00-0008	EA		12" x 18" x 60" Single Tier Institutional Or Corridor Locker	169.26	22.28
			For >25 To 50, Deduct	-6.24	
			For >50 To 100, Deduct	-13.14	
			For >100, Deduct	-20.04	
			For 14 Gauge Doors, Add	9.98	
10 51 13 00-0009	EA		12" x 12" x 72" Single Tier Institutional Or Corridor Locker.....	168.98	22.99
			For >25 To 50, Deduct	-6.15	
			For >50 To 100, Deduct	-12.99	
			For >100, Deduct	-19.83	
			For 14 Gauge Doors, Add	9.84	



Specialties	10
Storage Specialties	10 50
Lockers	10 51

10

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 51	13 00-0010	EA	12" x 15" x 72" Single Tier Institutional Or Corridor Locker.....	173.85	22.99
			<i>For >25 To 50, Deduct</i>	-6.39	
			<i>For >50 To 100, Deduct</i>	-13.48	
			<i>For >100, Deduct</i>	-20.56	
			<i>For 14 Gauge Doors, Add</i>	10.23	
10 51	13 00-0011	EA	12" x 18" x 72" Single Tier Institutional Or Corridor Locker.....	178.59	22.99
			<i>For >25 To 50, Deduct</i>	-6.63	
			<i>For >50 To 100, Deduct</i>	-13.95	
			<i>For >100, Deduct</i>	-21.27	
			<i>For 14 Gauge Doors, Add</i>	10.61	
10 51	13 00-0012	EA	15" x 15" x 72" Single Tier Institutional Or Corridor Locker.....	186.79	22.99
			<i>For >25 To 50, Deduct</i>	-7.04	
			<i>For >50 To 100, Deduct</i>	-14.77	
			<i>For >100, Deduct</i>	-22.50	
			<i>For 14 Gauge Doors, Add</i>	11.26	
10 51	13 00-0013	EA	15" x 18" x 72" Single Tier Institutional Or Corridor Locker.....	194.89	22.99
			<i>For >25 To 50, Deduct</i>	-7.45	
			<i>For >50 To 100, Deduct</i>	-15.58	
			<i>For >100, Deduct</i>	-23.72	
			<i>For 14 Gauge Doors, Add</i>	11.91	
10 51	13 00-0014	EA	18" x 18" x 72" Single Tier Institutional Or Corridor Locker.....	203.48	22.99
			<i>For >25 To 50, Deduct</i>	-7.88	
			<i>For >50 To 100, Deduct</i>	-16.44	
			<i>For >100, Deduct</i>	-25.00	
			<i>For 14 Gauge Doors, Add</i>	12.60	
10 51	13 00-0015	EA	18" x 21" x 72" Single Tier Institutional Or Corridor Locker.....	211.41	22.99
			<i>For >25 To 50, Deduct</i>	-8.27	
			<i>For >50 To 100, Deduct</i>	-17.23	
			<i>For >100, Deduct</i>	-26.19	
			<i>For 14 Gauge Doors, Add</i>	13.23	
10 51	13 00-0016	EA	24" x 24" x 72" Single Tier Institutional Or Corridor Locker.....	283.86	22.99
			<i>For >25 To 50, Deduct</i>	-11.89	
			<i>For >50 To 100, Deduct</i>	-24.48	
			<i>For >100, Deduct</i>	-37.06	
			<i>For 14 Gauge Doors, Add</i>	19.03	
10 51	13 00-0017		Two Tier Institutional Or Corridor Locker <small>(10 51 13 00-0001)</small>		
			Note: Includes three single hooks and one double hook per tier.		
10 51	13 00-0018	EA	12" x 12" x 60" Two Tier Institutional Or Corridor Locker.....	182.68	22.99
			<i>For >25 To 50, Deduct</i>	-6.84	
			<i>For >50 To 100, Deduct</i>	-14.36	
			<i>For >100, Deduct</i>	-21.88	
			<i>For 14 Gauge Doors, Add</i>	15.04	
10 51	13 00-0019	EA	12" x 15" x 60" Two Tier Institutional Or Corridor Locker.....	186.38	22.99
			<i>For >25 To 50, Deduct</i>	-7.02	
			<i>For >50 To 100, Deduct</i>	-14.73	
			<i>For >100, Deduct</i>	-22.44	
			<i>For 14 Gauge Doors, Add</i>	15.44	
10 51	13 00-0020	EA	12" x 18" x 60" Two Tier Institutional Or Corridor Locker.....	190.11	22.99
			<i>For >25 To 50, Deduct</i>	-7.21	
			<i>For >50 To 100, Deduct</i>	-15.10	
			<i>For >100, Deduct</i>	-23.00	
			<i>For 14 Gauge Doors, Add</i>	15.85	
10 51	13 00-0021	EA	12" x 12" x 72" Two Tier Institutional Or Corridor Locker.....	190.91	23.70
			<i>For >25 To 50, Deduct</i>	-7.18	
			<i>For >50 To 100, Deduct</i>	-15.06	
			<i>For >100, Deduct</i>	-22.95	
			<i>For 14 Gauge Doors, Add</i>	15.79	
10 51	13 00-0022	EA	12" x 15" x 72" Two Tier Institutional Or Corridor Locker.....	198.99	23.70
			<i>For >25 To 50, Deduct</i>	-7.58	
			<i>For >50 To 100, Deduct</i>	-15.87	
			<i>For >100, Deduct</i>	-24.16	
			<i>For 14 Gauge Doors, Add</i>	16.67	
10 51	13 00-0023	EA	12" x 18" x 72" Two Tier Institutional Or Corridor Locker.....	203.87	23.70
			<i>For >25 To 50, Deduct</i>	-7.82	
			<i>For >50 To 100, Deduct</i>	-16.36	
			<i>For >100, Deduct</i>	-24.89	
			<i>For 14 Gauge Doors, Add</i>	17.21	
10 51	13 00-0024	EA	15" x 15" x 72" Two Tier Institutional Or Corridor Locker.....	210.87	23.70
			<i>For >25 To 50, Deduct</i>	-8.17	
			<i>For >50 To 100, Deduct</i>	-17.06	
			<i>For >100, Deduct</i>	-25.94	
			<i>For 14 Gauge Doors, Add</i>	17.98	
10 51	13 00-0025	EA	15" x 18" x 72" Two Tier Institutional Or Corridor Locker.....	217.90	23.70
			<i>For >25 To 50, Deduct</i>	-8.52	
			<i>For >50 To 100, Deduct</i>	-17.76	
			<i>For >100, Deduct</i>	-27.00	
			<i>For 14 Gauge Doors, Add</i>	18.75	
10 51	13 00-0026	EA	18" x 18" x 72" Two Tier Institutional Or Corridor Locker.....	249.70	23.70
			<i>For >25 To 50, Deduct</i>	-10.11	
			<i>For >50 To 100, Deduct</i>	-20.94	
			<i>For >100, Deduct</i>	-31.77	
			<i>For 14 Gauge Doors, Add</i>	22.25	

10 Specialties**10 50 Storage Specialties****10 51 Lockers**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 51 13 00-0027	EA		18" x 21" x 72" Two Tier Institutional Or Corridor Locker	255.47	23.70
			<i>For >25 To 50, Deduct</i>	-10.40	
			<i>For >50 To 100, Deduct</i>	-21.52	
			<i>For >100, Deduct</i>	-32.63	
			<i>For 14 Gauge Doors, Add</i>	22.89	
10 51 13 00-0028			Three Tier Institutional Or Corridor Locker <small>(10 51 13 00-0001)</small>		
			Note: Includes one double hook per tier.		
10 51 13 00-0029	EA		12" x 12" x 72" Three Tier Institutional Or Corridor Locker	213.82	24.43
			<i>For >25 To 50, Deduct</i>	-8.25	
			<i>For >50 To 100, Deduct</i>	-17.23	
			<i>For >100, Deduct</i>	-26.21	
			<i>For 14 Gauge Doors, Add</i>	24.75	
10 51 13 00-0030	EA		12" x 15" x 72" Three Tier Institutional Or Corridor Locker	217.61	24.43
			<i>For >25 To 50, Deduct</i>	-8.44	
			<i>For >50 To 100, Deduct</i>	-17.61	
			<i>For >100, Deduct</i>	-26.78	
			<i>For 14 Gauge Doors, Add</i>	25.31	
10 51 13 00-0031	EA		12" x 18" x 72" Three Tier Institutional Or Corridor Locker	231.11	24.43
			<i>For >25 To 50, Deduct</i>	-9.11	
			<i>For >50 To 100, Deduct</i>	-18.96	
			<i>For >100, Deduct</i>	-28.80	
			<i>For 14 Gauge Doors, Add</i>	27.34	
10 51 13 00-0032	EA		15" x 15" x 72" Three Tier Institutional Or Corridor Locker	244.04	24.43
			<i>For >25 To 50, Deduct</i>	-9.76	
			<i>For >50 To 100, Deduct</i>	-20.25	
			<i>For >100, Deduct</i>	-30.74	
			<i>For 14 Gauge Doors, Add</i>	29.28	
10 51 13 00-0033	EA		15" x 18" x 72" Three Tier Institutional Or Corridor Locker	254.33	24.43
			<i>For >25 To 50, Deduct</i>	-10.27	
			<i>For >50 To 100, Deduct</i>	-21.28	
			<i>For >100, Deduct</i>	-32.29	
			<i>For 14 Gauge Doors, Add</i>	30.82	
10 51 13 00-0034			Four Tier Institutional Or Corridor Locker <small>(10 51 13 00-0001)</small>		
10 51 13 00-0035	EA		12" x 12" x 72" Four Tier Institutional Or Corridor Locker	210.18	25.15
			<i>For >25 To 50, Deduct</i>	-7.99	
			<i>For >50 To 100, Deduct</i>	-16.74	
			<i>For >100, Deduct</i>	-25.49	
10 51 13 00-0036	EA		12" x 15" x 72" Four Tier Institutional Or Corridor Locker	216.81	25.15
			<i>For >25 To 50, Deduct</i>	-8.33	
			<i>For >50 To 100, Deduct</i>	-17.41	
			<i>For >100, Deduct</i>	-26.49	
10 51 13 00-0037	EA		12" x 18" x 72" Four Tier Institutional Or Corridor Locker	227.47	25.15
			<i>For >25 To 50, Deduct</i>	-8.86	
			<i>For >50 To 100, Deduct</i>	-18.47	
			<i>For >100, Deduct</i>	-28.09	
10 51 13 00-0038	EA		15" x 15" x 72" Four Tier Institutional Or Corridor Locker	236.00	25.15
			<i>For >25 To 50, Deduct</i>	-9.29	
			<i>For >50 To 100, Deduct</i>	-19.33	
			<i>For >100, Deduct</i>	-29.37	
10 51 13 00-0039	EA		15" x 18" x 72" Four Tier Institutional Or Corridor Locker	248.29	25.15
			<i>For >25 To 50, Deduct</i>	-9.90	
			<i>For >50 To 100, Deduct</i>	-20.55	
			<i>For >100, Deduct</i>	-31.21	
10 51 13 00-0040			Six Tier Institutional Or Corridor Locker <small>(10 51 13 00-0001)</small>		
10 51 13 00-0041	EA		12" x 12" x 72" Six Tier Institutional Or Corridor Locker	228.28	25.86
			<i>For >25 To 50, Deduct</i>	-8.83	
			<i>For >50 To 100, Deduct</i>	-18.43	
			<i>For >100, Deduct</i>	-28.04	
10 51 13 00-0042	EA		12" x 15" x 72" Six Tier Institutional Or Corridor Locker	233.39	25.86
			<i>For >25 To 50, Deduct</i>	-9.08	
			<i>For >50 To 100, Deduct</i>	-18.94	
			<i>For >100, Deduct</i>	-28.80	
10 51 13 00-0043	EA		12" x 18" x 72" Six Tier Institutional Or Corridor Locker	243.04	25.86
			<i>For >25 To 50, Deduct</i>	-9.57	
			<i>For >50 To 100, Deduct</i>	-19.91	
			<i>For >100, Deduct</i>	-30.25	
10 51 13 00-0044			Locker And Coat Rack Combination <small>(10 51 13 00-0001)</small>		
10 51 13 00-0045	EA		45" x 18" x 12", 4 Person Wall Mount Locker And Coat Rack Combination	414.46	17.24
10 51 13 00-0046	EA		72" x 18" x 78", 16 Person Locker And Coat Rack Combination	664.86	35.92
10 51 13 00-0047			Athletic Lockers <small>(10 51 13)</small>		
			Note: Price per frame. Includes baked enamel paint, diamond perforated doors and sides, 16 gauge solid top, bottom, and shelves and 6" legs. Excludes slope top, base fillers, and locks.		
10 51 13 00-0048			Single Tier Athletic Locker <small>(10 51 13 00-0047)</small>		
			Note: Includes one hat shelf, three single hooks and one double hook.		



Specialties	10
Storage Specialties	10 50
Lockers	10 51

10

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 51 13 00-0049	EA		12" x 15" x 60" Single Tier Athletic Locker	230.40	22.99
			<i>For >25 To 50, Deduct</i>	-9.22	
			<i>For >50 To 100, Deduct</i>	-19.13	
			<i>For >100, Deduct</i>	-29.04	
10 51 13 00-0050	EA		12" x 18" x 60" Single Tier Athletic Locker	238.19	22.99
			<i>For >25 To 50, Deduct</i>	-9.61	
			<i>For >50 To 100, Deduct</i>	-19.91	
			<i>For >100, Deduct</i>	-30.21	
10 51 13 00-0051	EA		15" x 15" x 60" Single Tier Athletic Locker	243.20	22.99
			<i>For >25 To 50, Deduct</i>	-9.86	
			<i>For >50 To 100, Deduct</i>	-20.41	
			<i>For >100, Deduct</i>	-30.96	
10 51 13 00-0052	EA		15" x 18" x 60" Single Tier Athletic Locker	251.51	22.99
			<i>For >25 To 50, Deduct</i>	-10.28	
			<i>For >50 To 100, Deduct</i>	-21.24	
			<i>For >100, Deduct</i>	-32.21	
10 51 13 00-0053	EA		18" x 18" x 60" Single Tier Athletic Locker	287.38	22.99
			<i>For >25 To 50, Deduct</i>	-12.07	
			<i>For >50 To 100, Deduct</i>	-24.83	
			<i>For >100, Deduct</i>	-37.59	
10 51 13 00-0054	EA		18" x 21" x 60" Single Tier Athletic Locker	315.89	22.99
			<i>For >25 To 50, Deduct</i>	-13.50	
			<i>For >50 To 100, Deduct</i>	-27.68	
			<i>For >100, Deduct</i>	-41.87	
10 51 13 00-0055	EA		18" x 24" x 60" Single Tier Athletic Locker	335.40	22.99
			<i>For >25 To 50, Deduct</i>	-14.47	
			<i>For >50 To 100, Deduct</i>	-29.63	
			<i>For >100, Deduct</i>	-44.79	
10 51 13 00-0056	EA		12" x 15" x 72" Single Tier Athletic Locker	239.04	22.99
			<i>For >25 To 50, Deduct</i>	-9.65	
			<i>For >50 To 100, Deduct</i>	-20.00	
			<i>For >100, Deduct</i>	-30.34	
10 51 13 00-0057	EA		12" x 18" x 72" Single Tier Athletic Locker	253.07	22.99
			<i>For >25 To 50, Deduct</i>	-10.35	
			<i>For >50 To 100, Deduct</i>	-21.40	
			<i>For >100, Deduct</i>	-32.44	
10 51 13 00-0058	EA		15" x 15" x 72" Single Tier Athletic Locker	258.00	22.99
			<i>For >25 To 50, Deduct</i>	-10.60	
			<i>For >50 To 100, Deduct</i>	-21.89	
			<i>For >100, Deduct</i>	-33.18	
10 51 13 00-0059	EA		15" x 18" x 72" Single Tier Athletic Locker	267.01	22.99
			<i>For >25 To 50, Deduct</i>	-11.05	
			<i>For >50 To 100, Deduct</i>	-22.79	
			<i>For >100, Deduct</i>	-34.53	
10 51 13 00-0060	EA		18" x 18" x 72" Single Tier Athletic Locker	289.22	22.99
			<i>For >25 To 50, Deduct</i>	-12.16	
			<i>For >50 To 100, Deduct</i>	-25.01	
			<i>For >100, Deduct</i>	-37.87	
10 51 13 00-0061	EA		18" x 21" x 72" Single Tier Athletic Locker	312.49	22.99
			<i>For >25 To 50, Deduct</i>	-13.33	
			<i>For >50 To 100, Deduct</i>	-27.34	
			<i>For >100, Deduct</i>	-41.36	
10 51 13 00-0062			Two Tier Athletic Locker <small>(10 51 13 00-0047)</small>		
			Note: Includes three single hooks and one double hook per tier.		
10 51 13 00-0063	EA		12" x 12" x 60" Two Tier Athletic Locker	257.84	23.70
			<i>For >25 To 50, Deduct</i>	-10.52	
			<i>For >50 To 100, Deduct</i>	-21.75	
			<i>For >100, Deduct</i>	-32.99	
10 51 13 00-0064	EA		12" x 15" x 60" Two Tier Athletic Locker	266.13	23.70
			<i>For >25 To 50, Deduct</i>	-10.94	
			<i>For >50 To 100, Deduct</i>	-22.58	
			<i>For >100, Deduct</i>	-34.23	
10 51 13 00-0065	EA		12" x 18" x 60" Two Tier Athletic Locker	275.46	23.70
			<i>For >25 To 50, Deduct</i>	-11.40	
			<i>For >50 To 100, Deduct</i>	-23.52	
			<i>For >100, Deduct</i>	-35.63	
10 51 13 00-0066	EA		15" x 15" x 60" Two Tier Athletic Locker	276.37	23.70
			<i>For >25 To 50, Deduct</i>	-11.45	
			<i>For >50 To 100, Deduct</i>	-23.61	
			<i>For >100, Deduct</i>	-35.77	
10 51 13 00-0067	EA		15" x 18" x 60" Two Tier Athletic Locker	278.31	23.70
			<i>For >25 To 50, Deduct</i>	-11.55	
			<i>For >50 To 100, Deduct</i>	-23.80	
			<i>For >100, Deduct</i>	-36.06	
10 51 13 00-0068	EA		18" x 18" x 60" Two Tier Athletic Locker	294.71	23.70
			<i>For >25 To 50, Deduct</i>	-12.37	
			<i>For >50 To 100, Deduct</i>	-25.44	
			<i>For >100, Deduct</i>	-38.52	
10 51 13 00-0069	EA		18" x 21" x 60" Two Tier Athletic Locker	306.72	23.70
			<i>For >25 To 50, Deduct</i>	-12.97	
			<i>For >50 To 100, Deduct</i>	-26.64	
			<i>For >100, Deduct</i>	-40.32	

10 Specialties**10 50 Storage Specialties****10 51 Lockers**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 51	13 00-0070	EA	18" x 24" x 60" Two Tier Athletic Locker	360.35	23.70
			<i>For >25 To 50, Deduct</i>	-15.65	
			<i>For >50 To 100, Deduct</i>	-32.01	
			<i>For >100, Deduct</i>	-48.36	
10 51	13 00-0071	EA	12" x 12" x 72" Two Tier Athletic Locker	266.81	23.70
			<i>For >25 To 50, Deduct</i>	-10.97	
			<i>For >50 To 100, Deduct</i>	-22.65	
			<i>For >100, Deduct</i>	-34.33	
10 51	13 00-0072	EA	12" x 15" x 72" Two Tier Athletic Locker	275.30	23.70
			<i>For >25 To 50, Deduct</i>	-11.39	
			<i>For >50 To 100, Deduct</i>	-23.50	
			<i>For >100, Deduct</i>	-35.61	
10 51	13 00-0073	EA	12" x 18" x 72" Two Tier Athletic Locker	286.88	23.70
			<i>For >25 To 50, Deduct</i>	-11.97	
			<i>For >50 To 100, Deduct</i>	-24.66	
			<i>For >100, Deduct</i>	-37.34	
10 51	13 00-0074	EA	15" x 15" x 72" Two Tier Athletic Locker	288.63	23.70
			<i>For >25 To 50, Deduct</i>	-12.06	
			<i>For >50 To 100, Deduct</i>	-24.83	
			<i>For >100, Deduct</i>	-37.61	
10 51	13 00-0075	EA	15" x 18" x 72" Two Tier Athletic Locker	298.15	23.70
			<i>For >25 To 50, Deduct</i>	-12.54	
			<i>For >50 To 100, Deduct</i>	-25.79	
			<i>For >100, Deduct</i>	-39.03	
10 51	13 00-0076	EA	18" x 18" x 72" Two Tier Athletic Locker	309.83	23.70
			<i>For >25 To 50, Deduct</i>	-13.12	
			<i>For >50 To 100, Deduct</i>	-26.95	
			<i>For >100, Deduct</i>	-40.79	
10 51	13 00-0077	EA	18" x 21" x 72" Two Tier Athletic Locker	336.06	23.70
			<i>For >25 To 50, Deduct</i>	-14.43	
			<i>For >50 To 100, Deduct</i>	-29.58	
			<i>For >100, Deduct</i>	-44.72	
10 51	13 00-0078		Three Tier Athletic Locker <small>(10 51 13 00-0047)</small>		
			Note: Includes one double hook per tier.		
10 51	13 00-0079	EA	12" x 12" x 60" Three Tier Athletic Locker	279.24	24.43
			<i>For >25 To 50, Deduct</i>	-11.52	
			<i>For >50 To 100, Deduct</i>	-23.77	
			<i>For >100, Deduct</i>	-36.02	
10 51	13 00-0080	EA	12" x 15" x 60" Three Tier Athletic Locker	292.68	24.43
			<i>For >25 To 50, Deduct</i>	-12.19	
			<i>For >50 To 100, Deduct</i>	-25.12	
			<i>For >100, Deduct</i>	-38.04	
10 51	13 00-0081	EA	12" x 18" x 60" Three Tier Athletic Locker	304.56	24.43
			<i>For >25 To 50, Deduct</i>	-12.79	
			<i>For >50 To 100, Deduct</i>	-26.30	
			<i>For >100, Deduct</i>	-39.82	
10 51	13 00-0082	EA	15" x 15" x 60" Three Tier Athletic Locker	312.63	24.43
			<i>For >25 To 50, Deduct</i>	-13.19	
			<i>For >50 To 100, Deduct</i>	-27.11	
			<i>For >100, Deduct</i>	-41.03	
10 51	13 00-0083	EA	15" x 18" x 60" Three Tier Athletic Locker	326.06	24.43
			<i>For >25 To 50, Deduct</i>	-13.86	
			<i>For >50 To 100, Deduct</i>	-28.45	
			<i>For >100, Deduct</i>	-43.05	
10 51	13 00-0084	EA	12" x 12" x 72" Three Tier Athletic Locker	294.55	24.43
			<i>For >25 To 50, Deduct</i>	-12.29	
			<i>For >50 To 100, Deduct</i>	-25.30	
			<i>For >100, Deduct</i>	-38.32	
10 51	13 00-0085	EA	12" x 15" x 72" Three Tier Athletic Locker	306.69	24.43
			<i>For >25 To 50, Deduct</i>	-12.89	
			<i>For >50 To 100, Deduct</i>	-26.52	
			<i>For >100, Deduct</i>	-40.14	
10 51	13 00-0086	EA	12" x 18" x 72" Three Tier Athletic Locker	323.43	24.43
			<i>For >25 To 50, Deduct</i>	-13.73	
			<i>For >50 To 100, Deduct</i>	-28.19	
			<i>For >100, Deduct</i>	-42.65	
10 51	13 00-0087	EA	15" x 15" x 72" Three Tier Athletic Locker	332.00	24.43
			<i>For >25 To 50, Deduct</i>	-14.16	
			<i>For >50 To 100, Deduct</i>	-29.05	
			<i>For >100, Deduct</i>	-43.94	
10 51	13 00-0088	EA	15" x 18" x 72" Three Tier Athletic Locker	344.86	24.43
			<i>For >25 To 50, Deduct</i>	-14.80	
			<i>For >50 To 100, Deduct</i>	-30.33	
			<i>For >100, Deduct</i>	-45.87	
10 51	13 00-0089		Four Tier Athletic Locker <small>(10 51 13 00-0047)</small>		
10 51	13 00-0090	EA	12" x 12" x 60" Four Tier Athletic Locker	257.77	25.15
			<i>For >25 To 50, Deduct</i>	-10.37	
			<i>For >50 To 100, Deduct</i>	-21.50	
			<i>For >100, Deduct</i>	-32.63	



Specialties	10
Storage Specialties	10 50
Lockers	10 51

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MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 51 13 00-0091 EA 12" x 15" x 60" Four Tier Athletic Locker <i>For >25 To 50, Deduct</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	274.22 -11.20 -23.15 -35.10	25.15
10 51 13 00-0092 EA 12" x 18" x 60" Four Tier Athletic Locker <i>For >25 To 50, Deduct</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	290.68 -12.02 -24.79 -37.57	25.15
10 51 13 00-0093 EA 15" x 15" x 60" Four Tier Athletic Locker <i>For >25 To 50, Deduct</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	297.40 -12.36 -25.47 -38.58	25.15
10 51 13 00-0094 EA 15" x 18" x 60" Four Tier Athletic Locker <i>For >25 To 50, Deduct</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	324.43 -13.71 -28.17 -42.63	25.15
10 51 13 00-0095 EA 12" x 12" x 72" Four Tier Athletic Locker <i>For >25 To 50, Deduct</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	274.51 -11.21 -23.18 -35.14	25.15
10 51 13 00-0096 EA 12" x 15" x 72" Four Tier Athletic Locker <i>For >25 To 50, Deduct</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	291.20 -12.05 -24.85 -37.65	25.15
10 51 13 00-0097 EA 12" x 18" x 72" Four Tier Athletic Locker <i>For >25 To 50, Deduct</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	307.89 -12.88 -26.51 -40.15	25.15
10 51 13 00-0098 EA 15" x 15" x 72" Four Tier Athletic Locker <i>For >25 To 50, Deduct</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	316.44 -13.31 -27.37 -41.43	25.15
10 51 13 00-0099 EA 15" x 18" x 72" Four Tier Athletic Locker <i>For >25 To 50, Deduct</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	322.85 -13.63 -28.01 -42.39	25.15
10 51 13 00-0100 Six Tier Athletic Locker (10 51 13 00-0047)		
10 51 13 00-0101 EA 12" x 12" x 72" Six Tier Athletic Locker <i>For >25 To 50, Deduct</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	304.01 -12.61 -26.00 -39.40	25.86
10 51 13 00-0102 EA 12" x 15" x 72" Six Tier Athletic Locker <i>For >25 To 50, Deduct</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	316.84 -13.26 -27.29 -41.32	25.86
10 51 13 00-0103 EA 12" x 18" x 72" Six Tier Athletic Locker <i>For >25 To 50, Deduct</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	329.63 -13.90 -28.57 -43.24	25.86
10 51 13 00-0104 EA 12" x 21" x 72" Six Tier Athletic Locker <i>For >25 To 50, Deduct</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	376.35 -16.23 -33.24 -50.25	25.86
10 51 13 00-0105 Metal Locker Accessories (10 51 13)		
10 51 13 00-0106 Locker Slope Tops (10 51 13 00-0105)		
10 51 13 00-0107 16 Gauge Continuous Sloping Hood (10 51 13 00-0106)		
10 51 13 00-0108 LF 12" Deep, 16 Gauge Continuous Slope Top.....	19.42	2.87
10 51 13 00-0109 LF 15" Deep, 16 Gauge Continuous Slope Top.....	16.50	2.87
10 51 13 00-0110 LF 18" Deep, 16 Gauge Continuous Slope Top.....	22.41	2.87
10 51 13 00-0111 LF 21" Deep, 16 Gauge Continuous Slope Top.....	24.68	2.87
10 51 13 00-0112 LF 24" Deep, 16 Gauge Continuous Slope Top.....	25.75	2.87
10 51 13 00-0113 16 Gauge Slope Top Corner Fillers (10 51 13 00-0106)		
10 51 13 00-0114 EA 12" Deep, 16 Gauge Slope Top Corner Fillers	78.05	2.87
10 51 13 00-0115 EA 15" Deep, 16 Gauge Slope Top Corner Fillers	79.71	2.87
10 51 13 00-0116 EA 18" Deep, 16 Gauge Slope Top Corner Fillers	81.35	2.87
10 51 13 00-0117 EA 21" Deep, 16 Gauge Slope Top Corner Fillers	83.35	2.87
10 51 13 00-0118 EA 24" Deep, 16 Gauge Slope Top Corner Fillers	85.33	2.87
10 51 13 00-0119 20 Gauge Individual Slope Top (10 51 13 00-0106)		
10 51 13 00-0120 EA 12" Wide x 12" Deep 20 Gauge Individual Slope Top.....	16.79	2.87
10 51 13 00-0121 EA 12" Wide x 15" Deep 20 Gauge Individual Slope Top.....	16.68	2.87
10 51 13 00-0122 EA 12" Wide x 18" Deep 20 Gauge Individual Slope Top.....	18.48	2.87
10 51 13 00-0123 EA 15" Wide x 15" Deep 20 Gauge Individual Slope Top.....	18.48	2.87
10 51 13 00-0124 EA 15" Wide x 18" Deep 20 Gauge Individual Slope Top.....	18.91	2.87
10 51 13 00-0125 EA 15" Wide x 21" Deep 20 Gauge Individual Slope Top.....	20.61	2.87

10	Specialties
10 50	Storage Specialties
10 51	Lockers



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 51 13 00-0126 EA 18" Wide x 18" Deep 20 Gauge Individual Slope Top.....	20.61	2.87
10 51 13 00-0127 EA 18" Wide x 21" Deep 20 Gauge Individual Slope Top.....	22.84	2.87
10 51 13 00-0128 EA 18" Wide x 24" Deep 20 Gauge Individual Slope Top.....	25.50	2.87
10 51 13 00-0129 Continuous Slope Top End Closures (10 51 13 00-0106)		
10 51 13 00-0130 PR 12" Deep, Continuous Slope Top End Closures	17.85	2.87
10 51 13 00-0131 PR 15" Deep, Continuous Slope Top End Closures	15.28	2.87
10 51 13 00-0132 PR 18" Deep, Continuous Slope Top End Closures	19.97	2.87
10 51 13 00-0133 PR 21" Deep, Continuous Slope Top End Closures	21.03	2.87
10 51 13 00-0134 PR 24" Deep, Continuous Slope Top End Closures	21.76	2.87
10 51 13 00-0135 Individual Slope Top End Closures (10 51 13 00-0106)		
10 51 13 00-0136 EA 12" Deep, Individual Slope Top End Closures	11.80	2.87
10 51 13 00-0137 EA 15" Deep, Individual Slope Top End Closures	12.13	2.87
10 51 13 00-0138 EA 18" Deep, Individual Slope Top End Closures	12.87	2.87
10 51 13 00-0139 EA 21" Deep, Individual Slope Top End Closures	13.38	2.87
10 51 13 00-0140 EA 24" Deep, Individual Slope Top End Closures	18.62	2.87
10 51 13 00-0141 Locker Base (10 51 13 00-0105)		
10 51 13 00-0142 Closed Front Base (10 51 13 00-0141)		
10 51 13 00-0143 EA 12" Wide, 6" High Closed Front Base	12.37	2.87
10 51 13 00-0144 EA 15" Wide, 6" High Closed Front Base	12.92	2.87
10 51 13 00-0145 EA 18" Wide, 6" High Closed Front Base	14.08	2.87
10 51 13 00-0146 EA 24" Wide, 6" High Closed Front Base	14.63	2.87
10 51 13 00-0147 Closed End Base (10 51 13 00-0141)		
10 51 13 00-0148 EA 12" Deep, 6" High Closed End Base	13.91	2.87
10 51 13 00-0149 EA 15" Deep, 6" High Closed End Base	14.00	2.87
10 51 13 00-0150 EA 18" Deep, 6" High Closed End Base	14.75	2.87
10 51 13 00-0151 EA 21" Deep, 6" High Closed End Base	15.49	2.87
10 51 13 00-0152 EA 24" Deep, 6" High Closed End Base	16.49	2.87
10 51 13 00-0153 Recessed Continuous Front "Z" Base (10 51 13 00-0141)		
10 51 13 00-0154 LF 4" High Recessed Continuous Front "Z" Base	14.38	2.16
10 51 13 00-0155 "Z" Base Ends Or Splice (10 51 13 00-0141)		
10 51 13 00-0156 EA 12" Wide, 4" High Z-Base Ends Or Splice	14.50	2.87
10 51 13 00-0157 EA 15" Wide, 4" High Z-Base Ends Or Splice	16.68	2.87
10 51 13 00-0158 EA 18" Wide, 4" High Z-Base Ends Or Splice	18.91	2.87
10 51 13 00-0159 EA 21" Wide, 4" High Z-Base Ends Or Splice	21.25	2.87
10 51 13 00-0160 EA 24" Wide, 4" High Z-Base Ends Or Splice	23.58	2.87
10 51 13 00-0161 Locker Front Fillers And End Panels (10 51 13 00-0105)		
10 51 13 00-0162 Locker Front Fillers (10 51 13 00-0161)		
10 51 13 00-0163 EA 6" Wide x 48" High, 16 Gauge Front Filler	18.85	3.59
10 51 13 00-0164 EA 12" Wide x 48" High, 16 Gauge Front Filler	29.99	3.59
10 51 13 00-0165 EA 6" Wide x 60" High, 16 Gauge Front Filler	23.43	3.59
10 51 13 00-0166 EA 12" Wide x 60" High, 16 Gauge Front Filler	35.70	3.59
10 51 13 00-0167 EA 6" Wide x 66" High, 16 Gauge Front Filler	25.43	3.59
10 51 13 00-0168 EA 12" Wide x 66" High, 16 Gauge Front Filler	28.46	3.59
10 51 13 00-0169 EA 6" Wide x 72" High, 16 Gauge Front Filler	27.75	3.59
10 51 13 00-0170 EA 12" Wide x 72" High, 16 Gauge Front Filler	39.01	3.59
10 51 13 00-0171 EA 6" Wide x 78" High, 16 Gauge Front Filler	28.39	3.59
10 51 13 00-0172 EA 12" Wide x 78" High, 16 Gauge Front Filler	32.94	3.59
10 51 13 00-0173 Locker End Panels (10 51 13 00-0161)		
10 51 13 00-0174 EA 12" Deep x 48" High, 16 Gauge End Panel	30.31	2.87
10 51 13 00-0175 EA 15" Deep x 48" High, 16 Gauge End Panel	36.86	2.87
10 51 13 00-0176 EA 18" Deep x 48" High, 16 Gauge End Panel	43.17	2.87
10 51 13 00-0177 EA 12" Deep x 60" High, 16 Gauge End Panel	35.68	2.87
10 51 13 00-0178 EA 15" Deep x 60" High, 16 Gauge End Panel	40.38	2.87
10 51 13 00-0179 EA 18" Deep x 60" High, 16 Gauge End Panel	47.78	2.87
10 51 13 00-0180 EA 12" Deep x 72" High, 16 Gauge End Panel	41.93	2.87
10 51 13 00-0181 EA 15" Deep x 72" High, 16 Gauge End Panel	47.65	2.87
10 51 13 00-0182 EA 18" Deep x 72" High, 16 Gauge End Panel	55.26	2.87
10 51 13 00-0183 EA 21" Deep x 72" High, 16 Gauge End Panel	63.52	2.87
10 51 13 00-0184 Locker Recessed Trim (10 51 13 00-0105)		
10 51 13 00-0185 LF 3" Height, Top Trim For Recessed Lockers	6.43	1.44



Specialties	10	10
Storage Specialties	10 50	
Lockers	10 51	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 51 13 00-0186 EA 3" Height, Inside And Outside Top Corner Trim For Recessed Lockers.....	17.51	2.87
10 51 13 00-0187 EA 60" Height, 3" Wide Side Trim For Recessed Lockers.....	26.33	2.87
10 51 13 00-0188 EA 66" Height, 3" Wide Side Trim For Recessed Lockers.....	27.26	2.87
10 51 13 00-0189 EA 72" Height, 3" Wide Side Trim For Recessed Lockers.....	28.19	2.87
10 51 13 00-0190 EA 78" Height, 3" Wide Side Trim For Recessed Lockers.....	29.00	2.87
10 51 13 00-0191 Locker Interior Accessories (10 51 13 00-0105)		
10 51 13 00-0192 Locker Coat Rods (10 51 13 00-0191)		
10 51 13 00-0193 EA 12" Wide Coat Rod.....	9.75	2.87
10 51 13 00-0194 EA 15" Wide Coat Rod.....	10.62	2.87
10 51 13 00-0195 EA 18" Wide Coat Rod.....	11.39	2.87
10 51 13 00-0196 EA 24" Wide Coat Rod.....	12.07	2.87
10 51 13 00-0197 Locker Hat Shelf (10 51 13 00-0191)		
10 51 13 00-0198 EA 12" Wide Hat Shelf.....	11.58	2.87
10 51 13 00-0199 EA 15" Wide Hat Shelf.....	13.45	2.87
10 51 13 00-0200 EA 18" Wide Hat Shelf.....	14.24	2.87
10 51 13 00-0201 EA 24" Wide Hat Shelf.....	17.36	2.87
10 51 13 00-0202 Locker ADA Compliant Shelf (10 51 13 00-0191)		
10 51 13 00-0203 EA ADA Compliant Shelf For Single Tier Lockers..... Note: Includes an ADA label for locker face.	22.34	3.59
10 51 13 00-0204 Other Interior Locker Accessories (10 51 13 00-0191)		
10 51 13 00-0205 EA 3" x 10" Bent Plate Shoe Rack.....	29.07	2.87
10 51 13 00-0206 EA 8" x 10" Mirror.....	23.24	2.87
10 51 13 00-0207 EA Additional Hook.....	7.21	2.87
10 51 13 00-0208 Locker Locks (10 51 13 00-0105)		
10 51 13 00-0209 EA Built In Combination Lock.....	25.42	2.87
10 51 13 00-0210 Locker Repair And Refinishing (10 51 13)		
10 51 13 00-0211 EA Replace Single Tier Locker Door.....	213.36	
10 51 13 00-0212 EA Replace Two Tier Locker Door.....	167.93	
10 51 13 00-0213 EA Replace Three Tier Locker Door.....	144.32	
10 51 13 00-0214 EA Replace Four Tier Locker Door.....	122.13	
10 51 13 00-0215 EA Replace Six Tier Or Sixteen Person Locker Door.....	69.54	
10 51 13 00-0216 EA Realign Metal Locker Door For Proper Closure.....	36.53	
10 51 13 00-0217 SF Patch Small Drill Holes In Locker.....	7.31	
10 51 13 00-0218 Steel Basket Racks Mounted On Concrete Base (10 51 13)		
Note: Includes electroplated baskets with 3/4" x 1" wire mesh sides and bottom with perforated sheet steel front and backs.		
10 51 13 00-0219 EA 9" x 13" x 8" Baskets, 28 Wire Mesh Baskets And Rack.....	1,168.93	53.88
10 51 13 00-0220 EA 12" x 13" x 8" Baskets, 21 Wire Mesh Baskets And Rack.....	1,001.28	53.88
10 51 13 00-0221 All-Welded Steel Lockers (10 51 13)		
10 51 13 00-0222 All-Welded Steel Lockers (10 51 13 00-0221)		
Note: Price per frame. Includes diamond perforated, standard louvered or solid doors and sides. Includes all-welded construction with 16 gauge solid top, bottom, and shelves, 14 gauge doors and 4" legs. Includes electrostatically applied enamel powder coat paint finish. Excludes slope top, base fillers, and locks.		
10 51 13 00-0223 Single Tier, All-Welded Steel Lockers (10 51 13 00-0222)		
Note: Includes one hat shelf, two single hooks and one double hook.		
10 51 13 00-0224 EA 12" x 12" x 48" Single Tier, All-Welded Steel Locker.....	240.07	12.57
For >25 To 50, Deduct	-11.11	
For >50 To 100, Deduct	-22.48	
For >100, Deduct	-33.86	
10 51 13 00-0225 EA 12" x 15" x 48" Single Tier, All-Welded Steel Locker.....	253.19	12.57
For >25 To 50, Deduct	-11.76	
For >50 To 100, Deduct	-23.79	
For >100, Deduct	-35.82	
10 51 13 00-0226 EA 12" x 18" x 48" Single Tier, All-Welded Steel Locker.....	265.81	12.57
For >25 To 50, Deduct	-12.39	
For >50 To 100, Deduct	-25.06	
For >100, Deduct	-37.72	
10 51 13 00-0227 EA 12" x 12" x 60" Single Tier, All-Welded Steel Locker.....	250.90	12.57
For >25 To 50, Deduct	-11.65	
For >50 To 100, Deduct	-23.56	
For >100, Deduct	-35.48	

10 Specialties**10 50 Storage Specialties****10 51 Lockers**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 51	13 00-0228	EA	12" x 15" x 60" Single Tier, All-Welded Steel Locker	263.52	12.57
			<i>For >25 To 50, Deduct</i>	-12.28	
			<i>For >50 To 100, Deduct</i>	-24.83	
			<i>For >100, Deduct</i>	-37.37	
10 51	13 00-0229	EA	12" x 18" x 60" Single Tier, All-Welded Steel Locker	276.14	12.57
			<i>For >25 To 50, Deduct</i>	-12.91	
			<i>For >50 To 100, Deduct</i>	-26.09	
			<i>For >100, Deduct</i>	-39.27	
10 51	13 00-0230	EA	12" x 12" x 72" Single Tier, All-Welded Steel Locker	264.39	13.83
			<i>For >25 To 50, Deduct</i>	-12.23	
			<i>For >50 To 100, Deduct</i>	-24.76	
			<i>For >100, Deduct</i>	-37.29	
10 51	13 00-0231	EA	12" x 15" x 72" Single Tier, All-Welded Steel Locker	276.07	13.83
			<i>For >25 To 50, Deduct</i>	-12.82	
			<i>For >50 To 100, Deduct</i>	-25.93	
			<i>For >100, Deduct</i>	-39.04	
10 51	13 00-0232	EA	12" x 18" x 72" Single Tier, All-Welded Steel Locker	288.69	13.83
			<i>For >25 To 50, Deduct</i>	-13.45	
			<i>For >50 To 100, Deduct</i>	-27.19	
			<i>For >100, Deduct</i>	-40.93	
10 51	13 00-0233	EA	15" x 15" x 72" Single Tier, All-Welded Steel Locker	300.50	13.83
			<i>For >25 To 50, Deduct</i>	-14.04	
			<i>For >50 To 100, Deduct</i>	-28.37	
			<i>For >100, Deduct</i>	-42.70	
10 51	13 00-0234	EA	15" x 18" x 72" Single Tier, All-Welded Steel Locker	310.22	13.83
			<i>For >25 To 50, Deduct</i>	-14.52	
			<i>For >50 To 100, Deduct</i>	-29.34	
			<i>For >100, Deduct</i>	-44.16	
10 51	13 00-0235	EA	18" x 18" x 72" Single Tier, All-Welded Steel Locker	323.64	13.83
			<i>For >25 To 50, Deduct</i>	-15.19	
			<i>For >50 To 100, Deduct</i>	-30.68	
			<i>For >100, Deduct</i>	-46.17	
10 51	13 00-0236	EA	18" x 21" x 72" Single Tier, All-Welded Steel Locker	338.73	13.83
			<i>For >25 To 50, Deduct</i>	-15.95	
			<i>For >50 To 100, Deduct</i>	-32.19	
			<i>For >100, Deduct</i>	-48.44	
10 51	13 00-0237	EA	24" x 24" x 72" Single Tier, All-Welded Steel Locker	566.04	13.83
			<i>For >25 To 50, Deduct</i>	-27.31	
			<i>For >50 To 100, Deduct</i>	-54.92	
			<i>For >100, Deduct</i>	-82.53	
10 51	13 00-0238		Two Tier, All-Welded Steel Lockers <small>(10 51 13 00-0222)</small>		
			Note: Includes two single hooks and one double hook per tier.		
10 51	13 00-0239	EA	12" x 12" x 60" Two Tier, All-Welded Steel Locker.....	291.82	12.57
			<i>For >25 To 50, Deduct</i>	-13.69	
			<i>For >50 To 100, Deduct</i>	-27.66	
			<i>For >100, Deduct</i>	-41.62	
10 51	13 00-0240	EA	12" x 15" x 60" Two Tier, All-Welded Steel Locker.....	297.61	12.57
			<i>For >25 To 50, Deduct</i>	-13.98	
			<i>For >50 To 100, Deduct</i>	-28.24	
			<i>For >100, Deduct</i>	-42.49	
10 51	13 00-0241	EA	12" x 18" x 60" Two Tier, All-Welded Steel Locker.....	313.16	12.57
			<i>For >25 To 50, Deduct</i>	-14.76	
			<i>For >50 To 100, Deduct</i>	-29.79	
			<i>For >100, Deduct</i>	-44.82	
10 51	13 00-0242	EA	12" x 12" x 72" Two Tier, All-Welded Steel Locker.....	303.30	13.83
			<i>For >25 To 50, Deduct</i>	-14.18	
			<i>For >50 To 100, Deduct</i>	-28.65	
			<i>For >100, Deduct</i>	-43.12	
10 51	13 00-0243	EA	12" x 15" x 72" Two Tier, All-Welded Steel Locker.....	324.73	13.83
			<i>For >25 To 50, Deduct</i>	-15.25	
			<i>For >50 To 100, Deduct</i>	-30.79	
			<i>For >100, Deduct</i>	-46.34	
10 51	13 00-0244	EA	12" x 18" x 72" Two Tier, All-Welded Steel Locker.....	336.41	13.83
			<i>For >25 To 50, Deduct</i>	-15.83	
			<i>For >50 To 100, Deduct</i>	-31.96	
			<i>For >100, Deduct</i>	-48.09	
10 51	13 00-0245	EA	15" x 15" x 72" Two Tier, All-Welded Steel Locker.....	353.06	13.83
			<i>For >25 To 50, Deduct</i>	-16.67	
			<i>For >50 To 100, Deduct</i>	-33.63	
			<i>For >100, Deduct</i>	-50.59	
10 51	13 00-0246	EA	15" x 18" x 72" Two Tier, All-Welded Steel Locker.....	360.90	13.83
			<i>For >25 To 50, Deduct</i>	-17.06	
			<i>For >50 To 100, Deduct</i>	-34.41	
			<i>For >100, Deduct</i>	-51.76	
10 51	13 00-0247	EA	18" x 18" x 72" Two Tier, All-Welded Steel Locker.....	383.49	13.83
			<i>For >25 To 50, Deduct</i>	-18.19	
			<i>For >50 To 100, Deduct</i>	-36.67	
			<i>For >100, Deduct</i>	-55.15	
10 51	13 00-0248	EA	18" x 21" x 72" Two Tier, All-Welded Steel Locker.....	400.99	13.83
			<i>For >25 To 50, Deduct</i>	-19.06	
			<i>For >50 To 100, Deduct</i>	-38.42	
			<i>For >100, Deduct</i>	-57.78	



Specialties	10	10
Storage Specialties	10 50	
Lockers	10 51	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 51 13 00-0249 Three Tier, All-Welded Steel Lockers <small>(10 51 13 00-0222)</small>		
Note: Includes two single hooks and one double hook per tier.		
10 51 13 00-0250 EA 12" x 12" x 72" Three Tier, All-Welded Steel Locker.....	363.67	13.83
For >25 To 50, Deduct	-17.20	
For >50 To 100, Deduct	-34.69	
For >100, Deduct	-52.18	
10 51 13 00-0251 EA 12" x 15" x 72" Three Tier, All-Welded Steel Locker.....	372.45	13.83
For >25 To 50, Deduct	-17.63	
For >50 To 100, Deduct	-35.57	
For >100, Deduct	-53.50	
10 51 13 00-0252 EA 12" x 18" x 72" Three Tier, All-Welded Steel Locker.....	381.17	13.83
For >25 To 50, Deduct	-18.07	
For >50 To 100, Deduct	-36.44	
For >100, Deduct	-54.80	
10 51 13 00-0253 EA 15" x 15" x 72" Three Tier, All-Welded Steel Locker.....	401.82	13.83
For >25 To 50, Deduct	-19.10	
For >50 To 100, Deduct	-38.50	
For >100, Deduct	-57.90	
10 51 13 00-0254 EA 15" x 18" x 72" Three Tier, All-Welded Steel Locker.....	405.63	13.83
For >25 To 50, Deduct	-19.29	
For >50 To 100, Deduct	-38.88	
For >100, Deduct	-58.47	
10 51 13 00-0255 Four Tier, All-Welded Steel Lockers <small>(10 51 13 00-0222)</small>		
10 51 13 00-0256 EA 12" x 12" x 72" Four Tier, All-Welded Steel Locker.....	342.84	13.83
For >25 To 50, Deduct	-16.15	
For >50 To 100, Deduct	-32.60	
For >100, Deduct	-49.05	
10 51 13 00-0257 EA 12" x 15" x 72" Four Tier, All-Welded Steel Locker.....	351.13	13.83
For >25 To 50, Deduct	-16.57	
For >50 To 100, Deduct	-33.43	
For >100, Deduct	-50.30	
10 51 13 00-0258 EA 12" x 18" x 72" Four Tier, All-Welded Steel Locker.....	359.37	13.83
For >25 To 50, Deduct	-16.98	
For >50 To 100, Deduct	-34.26	
For >100, Deduct	-51.53	
10 51 13 00-0259 EA 15" x 15" x 72" Four Tier, All-Welded Steel Locker.....	378.80	13.83
For >25 To 50, Deduct	-17.95	
For >50 To 100, Deduct	-36.20	
For >100, Deduct	-54.45	
10 51 13 00-0260 EA 15" x 18" x 72" Four Tier, All-Welded Steel Locker.....	382.34	13.83
For >25 To 50, Deduct	-18.13	
For >50 To 100, Deduct	-36.55	
For >100, Deduct	-54.98	
10 51 13 00-0261 Six Tier, All-Welded Steel Lockers <small>(10 51 13 00-0222)</small>		
10 51 13 00-0262 EA 12" x 12" x 72" Six Tier, All-Welded Steel Locker.....	355.74	13.83
For >25 To 50, Deduct	-16.80	
For >50 To 100, Deduct	-33.89	
For >100, Deduct	-50.99	
10 51 13 00-0263 EA 12" x 15" x 72" Six Tier, All-Welded Steel Locker.....	367.84	13.83
For >25 To 50, Deduct	-17.40	
For >50 To 100, Deduct	-35.10	
For >100, Deduct	-52.80	
10 51 13 00-0264 EA 12" x 18" x 72" Six Tier, All-Welded Steel Locker.....	376.75	13.83
For >25 To 50, Deduct	-17.85	
For >50 To 100, Deduct	-36.00	
For >100, Deduct	-54.14	
10 51 13 00-0265 All Welded Locker Accessories <small>(10 51 13 00-0221)</small>		
10 51 13 00-0266 EA ADA Requirements For All Welded Lockers.....	63.77	
10 51 13 00-0267 EA Solid Boxed End Panel For 12" Deep All Welded Lockers.....	104.13	2.87
10 51 13 00-0268 EA Solid Boxed End Panel For 15" Deep All Welded Lockers.....	120.53	2.87
10 51 13 00-0269 EA Recessed Trim For All Welded Lockers.....	73.77	2.87
10 51 13 00-0270 EA Built In Combination Lock For All Welded Lockers.....	25.42	2.87
10 51 13 00-0271 EA Pad Lock For All Welded Lockers.....	20.93	2.87
10 51 26 Plastic Lockers <small>(10 51)</small>		
10 51 26 00-0001 Solid Plastic Lockers <small>(10 51 26)</small>		
Note: Price per frame. High density polyethylene with homogeneous color throughout. Includes 1/2" door, 3/8" sides, tops, bottoms, rears and shelves. Excludes slope top, base, and locks.		
10 51 26 00-0002 Single Tier Solid Plastic Lockers <small>(10 51 26 00-0001)</small>		
Note: Includes one double hook per tier.		
10 51 26 00-0003 EA 12" x 12" x 36" Single Tier Solid Plastic Locker (Tufftec Lockers®).....	285.75	22.28
For >50 To 100, Deduct	-24.12	
For >100, Deduct	-37.52	

10	Specialties
10 50	Storage Specialties
10 51	Lockers



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 51	26 00-0004	EA	12" x 15" x 36" Single Tier Solid Plastic Locker (Tufftec Lockers®)	290.59	22.28
			<i>For >50 To 100, Deduct</i>	-24.61	
			<i>For >100, Deduct</i>	-38.24	
10 51	26 00-0005	EA	12" x 18" x 36" Single Tier Solid Plastic Locker (Tufftec Lockers®)	295.43	22.28
			<i>For >50 To 100, Deduct</i>	-25.09	
			<i>For >100, Deduct</i>	-38.97	
10 51	26 00-0006	EA	15" x 15" x 36" Single Tier Solid Plastic Locker (Tufftec Lockers®)	302.68	22.28
			<i>For >50 To 100, Deduct</i>	-25.81	
			<i>For >100, Deduct</i>	-40.06	
10 51	26 00-0007	EA	15" x 18" x 36" Single Tier Solid Plastic Locker (Tufftec Lockers®)	295.01	22.28
			<i>For >50 To 100, Deduct</i>	-25.05	
			<i>For >100, Deduct</i>	-38.91	
10 51	26 00-0008	EA	18" x 12" x 36" Single Tier Solid Plastic Locker (Tufftec Lockers®)	297.04	22.28
			<i>For >50 To 100, Deduct</i>	-25.25	
			<i>For >100, Deduct</i>	-39.21	
10 51	26 00-0009	EA	18" x 15" x 36" Single Tier Solid Plastic Locker (Tufftec Lockers®)	293.46	22.28
			<i>For >50 To 100, Deduct</i>	-24.89	
			<i>For >100, Deduct</i>	-38.67	
10 51	26 00-0010	EA	18" x 18" x 36" Single Tier Solid Plastic Locker (Tufftec Lockers®)	313.44	22.28
			<i>For >50 To 100, Deduct</i>	-26.89	
			<i>For >100, Deduct</i>	-41.67	
10 51	26 00-0011	EA	12" x 12" x 48" Single Tier Solid Plastic Locker (Tufftec Lockers®)	308.84	22.28
			<i>For >50 To 100, Deduct</i>	-26.43	
			<i>For >100, Deduct</i>	-40.98	
10 51	26 00-0012	EA	12" x 15" x 48" Single Tier Solid Plastic Locker (Tufftec Lockers®)	314.21	22.28
			<i>For >50 To 100, Deduct</i>	-26.97	
			<i>For >100, Deduct</i>	-41.79	
10 51	26 00-0013	EA	12" x 18" x 48" Single Tier Solid Plastic Locker (Tufftec Lockers®)	319.59	22.28
			<i>For >50 To 100, Deduct</i>	-27.51	
			<i>For >100, Deduct</i>	-42.59	
10 51	26 00-0014	EA	15" x 15" x 48" Single Tier Solid Plastic Locker (Tufftec Lockers®)	331.88	22.28
			<i>For >50 To 100, Deduct</i>	-28.73	
			<i>For >100, Deduct</i>	-44.44	
10 51	26 00-0015	EA	15" x 18" x 48" Single Tier Solid Plastic Locker (Tufftec Lockers®)	348.79	22.28
			<i>For >50 To 100, Deduct</i>	-30.43	
			<i>For >100, Deduct</i>	-46.97	
10 51	26 00-0016	EA	18" x 15" x 48" Single Tier Solid Plastic Locker (Tufftec Lockers®)	333.42	22.28
			<i>For >50 To 100, Deduct</i>	-28.89	
			<i>For >100, Deduct</i>	-44.67	
10 51	26 00-0017	EA	18" x 18" x 48" Single Tier Solid Plastic Locker (Tufftec Lockers®)	361.07	22.28
			<i>For >50 To 100, Deduct</i>	-31.65	
			<i>For >100, Deduct</i>	-48.82	
10 51	26 00-0018	EA	12" x 12" x 60" Single Tier Solid Plastic Locker (Tufftec Lockers®)	310.98	22.28
			<i>For >50 To 100, Deduct</i>	-26.64	
			<i>For >100, Deduct</i>	-41.30	
10 51	26 00-0019	EA	12" x 15" x 60" Single Tier Solid Plastic Locker (Tufftec Lockers®)	326.74	22.28
			<i>For >50 To 100, Deduct</i>	-28.22	
			<i>For >100, Deduct</i>	-43.67	
10 51	26 00-0020	EA	12" x 18" x 60" Single Tier Solid Plastic Locker (Tufftec Lockers®)	342.51	22.28
			<i>For >50 To 100, Deduct</i>	-29.80	
			<i>For >100, Deduct</i>	-46.03	
10 51	26 00-0021	EA	15" x 12" x 60" Single Tier Solid Plastic Locker (Tufftec Lockers®)	330.96	22.28
			<i>For >50 To 100, Deduct</i>	-28.64	
			<i>For >100, Deduct</i>	-44.30	
10 51	26 00-0022	EA	15" x 15" x 60" Single Tier Solid Plastic Locker (Tufftec Lockers®)	347.66	22.28
			<i>For >50 To 100, Deduct</i>	-30.31	
			<i>For >100, Deduct</i>	-46.80	
10 51	26 00-0023	EA	15" x 18" x 60" Single Tier Solid Plastic Locker (Tufftec Lockers®)	364.38	22.28
			<i>For >50 To 100, Deduct</i>	-31.98	
			<i>For >100, Deduct</i>	-49.31	
10 51	26 00-0024	EA	18" x 12" x 60" Single Tier Solid Plastic Locker (Tufftec Lockers®)	350.94	22.28
			<i>For >50 To 100, Deduct</i>	-30.64	
			<i>For >100, Deduct</i>	-47.30	
10 51	26 00-0025	EA	18" x 15" x 60" Single Tier Solid Plastic Locker (Tufftec Lockers®)	368.60	22.28
			<i>For >50 To 100, Deduct</i>	-32.41	
			<i>For >100, Deduct</i>	-49.95	
10 51	26 00-0026	EA	12" x 12" x 72" Single Tier Solid Plastic Locker (Tufftec Lockers®)	354.28	22.99
			<i>For >50 To 100, Deduct</i>	-30.83	
			<i>For >100, Deduct</i>	-47.62	
10 51	26 00-0027	EA	12" x 15" x 72" Single Tier Solid Plastic Locker (Tufftec Lockers®)	371.95	22.99
			<i>For >50 To 100, Deduct</i>	-32.60	
			<i>For >100, Deduct</i>	-50.27	
10 51	26 00-0028	EA	12" x 18" x 72" Single Tier Solid Plastic Locker (Tufftec Lockers®)	389.60	22.99
			<i>For >50 To 100, Deduct</i>	-34.36	
			<i>For >100, Deduct</i>	-52.92	
10 51	26 00-0029	EA	15" x 12" x 72" Single Tier Solid Plastic Locker (Tufftec Lockers®)	377.21	22.99
			<i>For >50 To 100, Deduct</i>	-33.12	
			<i>For >100, Deduct</i>	-51.06	
10 51	26 00-0030	EA	15" x 15" x 72" Single Tier Solid Plastic Locker (Tufftec Lockers®)	395.85	22.99
			<i>For >50 To 100, Deduct</i>	-34.99	
			<i>For >100, Deduct</i>	-53.86	
10 51	26 00-0031	EA	15" x 18" x 72" Single Tier Solid Plastic Locker (Tufftec Lockers®)	414.47	22.99
			<i>For >50 To 100, Deduct</i>	-36.85	
			<i>For >100, Deduct</i>	-56.65	



Specialties	10
Storage Specialties	10 50
Lockers	10 51

10

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 51 26 00-0032	EA		18" x 12" x 72" Single Tier Solid Plastic Locker (Tufftec Lockers®).....	395.49	22.99
			<i>For >50 To 100, Deduct</i>	-34.95	
			<i>For >100, Deduct</i>	-53.81	
10 51 26 00-0033	EA		18" x 15" x 72" Single Tier Solid Plastic Locker (Tufftec Lockers®).....	419.73	22.99
			<i>For >50 To 100, Deduct</i>	-37.38	
			<i>For >100, Deduct</i>	-57.44	
10 51 26 00-0034	EA		18" x 18" x 72" Single Tier Solid Plastic Locker (Tufftec Lockers®).....	439.30	22.99
			<i>For >50 To 100, Deduct</i>	-39.33	
			<i>For >100, Deduct</i>	-60.38	
10 51 26 00-0035			Double Tier Solid Plastic Lockers (10 51 26 00-0001)		
			Note: Includes one double hook per tier.		
10 51 26 00-0036	EA		12" x 12" x 48" Double Tier Solid Plastic Locker (Tufftec Lockers®).....	319.49	22.99
			<i>For >50 To 100, Deduct</i>	-27.35	
			<i>For >100, Deduct</i>	-42.41	
10 51 26 00-0037	EA		12" x 15" x 48" Double Tier Solid Plastic Locker (Tufftec Lockers®).....	324.10	22.99
			<i>For >50 To 100, Deduct</i>	-27.81	
			<i>For >100, Deduct</i>	-43.10	
10 51 26 00-0038	EA		12" x 18" x 48" Double Tier Solid Plastic Locker (Tufftec Lockers®).....	331.01	22.99
			<i>For >50 To 100, Deduct</i>	-28.50	
			<i>For >100, Deduct</i>	-44.13	
10 51 26 00-0039	EA		15" x 12" x 48" Double Tier Solid Plastic Locker (Tufftec Lockers®).....	328.71	22.99
			<i>For >50 To 100, Deduct</i>	-28.27	
			<i>For >100, Deduct</i>	-43.79	
10 51 26 00-0040	EA		15" x 15" x 48" Double Tier Solid Plastic Locker (Tufftec Lockers®).....	341.01	22.99
			<i>For >50 To 100, Deduct</i>	-29.50	
			<i>For >100, Deduct</i>	-45.63	
10 51 26 00-0041	EA		15" x 18" x 48" Double Tier Solid Plastic Locker (Tufftec Lockers®).....	370.20	22.99
			<i>For >50 To 100, Deduct</i>	-32.42	
			<i>For >100, Deduct</i>	-50.01	
10 51 26 00-0042	EA		18" x 12" x 48" Double Tier Solid Plastic Locker (Tufftec Lockers®).....	331.79	22.99
			<i>For >50 To 100, Deduct</i>	-28.58	
			<i>For >100, Deduct</i>	-44.25	
10 51 26 00-0043	EA		18" x 15" x 48" Double Tier Solid Plastic Locker (Tufftec Lockers®).....	346.66	22.99
			<i>For >50 To 100, Deduct</i>	-30.07	
			<i>For >100, Deduct</i>	-46.48	
10 51 26 00-0044	EA		18" x 18" x 48" Double Tier Solid Plastic Locker (Tufftec Lockers®).....	373.28	22.99
			<i>For >50 To 100, Deduct</i>	-32.73	
			<i>For >100, Deduct</i>	-50.47	
10 51 26 00-0045	EA		12" x 12" x 60" Double Tier Solid Plastic Locker (Tufftec Lockers®).....	330.07	22.99
			<i>For >50 To 100, Deduct</i>	-28.41	
			<i>For >100, Deduct</i>	-43.99	
10 51 26 00-0046	EA		12" x 15" x 60" Double Tier Solid Plastic Locker (Tufftec Lockers®).....	354.13	22.99
			<i>For >50 To 100, Deduct</i>	-30.82	
			<i>For >100, Deduct</i>	-47.60	
10 51 26 00-0047	EA		12" x 18" x 60" Double Tier Solid Plastic Locker (Tufftec Lockers®).....	361.01	22.99
			<i>For >50 To 100, Deduct</i>	-31.50	
			<i>For >100, Deduct</i>	-48.63	
10 51 26 00-0048	EA		15" x 12" x 60" Double Tier Solid Plastic Locker (Tufftec Lockers®).....	358.16	22.99
			<i>For >50 To 100, Deduct</i>	-31.22	
			<i>For >100, Deduct</i>	-48.21	
10 51 26 00-0049	EA		15" x 15" x 60" Double Tier Solid Plastic Locker (Tufftec Lockers®).....	374.10	22.99
			<i>For >50 To 100, Deduct</i>	-32.81	
			<i>For >100, Deduct</i>	-50.60	
10 51 26 00-0050	EA		18" x 12" x 60" Double Tier Solid Plastic Locker (Tufftec Lockers®).....	377.22	22.99
			<i>For >50 To 100, Deduct</i>	-33.12	
			<i>For >100, Deduct</i>	-51.07	
10 51 26 00-0051	EA		18" x 15" x 60" Double Tier Solid Plastic Locker (Tufftec Lockers®).....	394.09	22.99
			<i>For >50 To 100, Deduct</i>	-34.81	
			<i>For >100, Deduct</i>	-53.60	
10 51 26 00-0052	EA		18" x 18" x 60" Double Tier Solid Plastic Locker (Tufftec Lockers®).....	410.95	22.99
			<i>For >50 To 100, Deduct</i>	-36.50	
			<i>For >100, Deduct</i>	-56.12	
10 51 26 00-0053	EA		12" x 12" x 72" Double Tier Solid Plastic Locker (Tufftec Lockers®).....	380.47	23.70
			<i>For >50 To 100, Deduct</i>	-33.31	
			<i>For >100, Deduct</i>	-51.38	
10 51 26 00-0054	EA		12" x 15" x 72" Double Tier Solid Plastic Locker (Tufftec Lockers®).....	397.33	23.70
			<i>For >50 To 100, Deduct</i>	-34.99	
			<i>For >100, Deduct</i>	-53.91	
10 51 26 00-0055	EA		12" x 18" x 72" Double Tier Solid Plastic Locker (Tufftec Lockers®).....	406.12	23.70
			<i>For >50 To 100, Deduct</i>	-35.87	
			<i>For >100, Deduct</i>	-55.23	
10 51 26 00-0056	EA		15" x 12" x 72" Double Tier Solid Plastic Locker (Tufftec Lockers®).....	402.36	23.70
			<i>For >50 To 100, Deduct</i>	-35.50	
			<i>For >100, Deduct</i>	-54.66	
10 51 26 00-0057	EA		15" x 15" x 72" Double Tier Solid Plastic Locker (Tufftec Lockers®).....	420.15	23.70
			<i>For >50 To 100, Deduct</i>	-37.27	
			<i>For >100, Deduct</i>	-57.33	
10 51 26 00-0058	EA		15" x 18" x 72" Double Tier Solid Plastic Locker (Tufftec Lockers®).....	437.93	23.70
			<i>For >50 To 100, Deduct</i>	-39.05	
			<i>For >100, Deduct</i>	-60.00	
10 51 26 00-0059	EA		18" x 12" x 72" Double Tier Solid Plastic Locker (Tufftec Lockers®).....	405.54	23.70
			<i>For >50 To 100, Deduct</i>	-35.81	
			<i>For >100, Deduct</i>	-55.14	

10	Specialties
10 50	Storage Specialties
10 51	Lockers



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 51 26 00-0060	EA		18" x 15" x 72" Double Tier Solid Plastic Locker (Tufftec Lockers®)	442.95	23.70
			<i>For >50 To 100, Deduct</i>	-39.55	
			<i>For >100, Deduct</i>	-60.75	
10 51 26 00-0061	EA		18" x 18" x 72" Double Tier Solid Plastic Locker (Tufftec Lockers®)	461.62	23.70
			<i>For >50 To 100, Deduct</i>	-41.42	
			<i>For >100, Deduct</i>	-63.55	
10 51 26 00-0062			Triple Tier Solid Plastic Lockers <small>(10 51 26 00-0001)</small>		
			Note: Includes one double hook per tier.		
10 51 26 00-0063	EA		12" x 12" x 48" Triple Tier Solid Plastic Locker (Tufftec Lockers®).....	315.16	23.70
			<i>For >50 To 100, Deduct</i>	-26.78	
			<i>For >100, Deduct</i>	-41.58	
10 51 26 00-0064	EA		15" x 15" x 48" Triple Tier Solid Plastic Locker (Tufftec Lockers®).....	327.81	23.70
			<i>For >50 To 100, Deduct</i>	-28.04	
			<i>For >100, Deduct</i>	-43.48	
10 51 26 00-0065	EA		15" x 18" x 48" Triple Tier Solid Plastic Locker (Tufftec Lockers®).....	339.41	23.70
			<i>For >50 To 100, Deduct</i>	-29.20	
			<i>For >100, Deduct</i>	-45.22	
10 51 26 00-0066	EA		12" x 12" x 60" Triple Tier Solid Plastic Locker (Tufftec Lockers®).....	341.66	23.70
			<i>For >50 To 100, Deduct</i>	-29.43	
			<i>For >100, Deduct</i>	-45.56	
10 51 26 00-0067	EA		12" x 15" x 60" Triple Tier Solid Plastic Locker (Tufftec Lockers®).....	368.70	23.70
			<i>For >50 To 100, Deduct</i>	-32.13	
			<i>For >100, Deduct</i>	-49.62	
10 51 26 00-0068	EA		12" x 18" x 60" Triple Tier Solid Plastic Locker (Tufftec Lockers®).....	368.83	23.70
			<i>For >50 To 100, Deduct</i>	-32.14	
			<i>For >100, Deduct</i>	-49.64	
10 51 26 00-0069	EA		15" x 12" x 60" Triple Tier Solid Plastic Locker (Tufftec Lockers®).....	383.58	23.70
			<i>For >50 To 100, Deduct</i>	-33.62	
			<i>For >100, Deduct</i>	-51.85	
10 51 26 00-0070	EA		15" x 15" x 60" Triple Tier Solid Plastic Locker (Tufftec Lockers®).....	398.39	23.70
			<i>For >50 To 100, Deduct</i>	-35.10	
			<i>For >100, Deduct</i>	-54.07	
10 51 26 00-0071	EA		15" x 18" x 60" Triple Tier Solid Plastic Locker (Tufftec Lockers®).....	413.20	23.70
			<i>For >50 To 100, Deduct</i>	-36.58	
			<i>For >100, Deduct</i>	-56.29	
10 51 26 00-0072	EA		18" x 12" x 60" Triple Tier Solid Plastic Locker (Tufftec Lockers®).....	401.29	23.70
			<i>For >50 To 100, Deduct</i>	-35.39	
			<i>For >100, Deduct</i>	-54.50	
10 51 26 00-0073	EA		18" x 15" x 60" Triple Tier Solid Plastic Locker (Tufftec Lockers®).....	416.95	23.70
			<i>For >50 To 100, Deduct</i>	-36.95	
			<i>For >100, Deduct</i>	-56.85	
10 51 26 00-0074	EA		18" x 18" x 60" Triple Tier Solid Plastic Locker (Tufftec Lockers®).....	432.60	23.70
			<i>For >50 To 100, Deduct</i>	-38.52	
			<i>For >100, Deduct</i>	-59.20	
10 51 26 00-0075	EA		12" x 12" x 72" Triple Tier Solid Plastic Locker (Tufftec Lockers®).....	404.41	24.43
			<i>For >50 To 100, Deduct</i>	-35.56	
			<i>For >100, Deduct</i>	-54.80	
10 51 26 00-0076	EA		12" x 15" x 72" Triple Tier Solid Plastic Locker (Tufftec Lockers®).....	420.08	24.43
			<i>For >50 To 100, Deduct</i>	-37.12	
			<i>For >100, Deduct</i>	-57.15	
10 51 26 00-0077	EA		12" x 18" x 72" Triple Tier Solid Plastic Locker (Tufftec Lockers®).....	431.07	24.43
			<i>For >50 To 100, Deduct</i>	-38.22	
			<i>For >100, Deduct</i>	-58.80	
10 51 26 00-0078	EA		15" x 12" x 72" Triple Tier Solid Plastic Locker (Tufftec Lockers®).....	424.74	24.43
			<i>For >50 To 100, Deduct</i>	-37.59	
			<i>For >100, Deduct</i>	-57.85	
10 51 26 00-0079	EA		15" x 15" x 72" Triple Tier Solid Plastic Locker (Tufftec Lockers®).....	429.71	24.43
			<i>For >50 To 100, Deduct</i>	-38.09	
			<i>For >100, Deduct</i>	-58.59	
10 51 26 00-0080	EA		15" x 18" x 72" Triple Tier Solid Plastic Locker (Tufftec Lockers®).....	447.60	24.43
			<i>For >50 To 100, Deduct</i>	-39.88	
			<i>For >100, Deduct</i>	-61.28	
10 51 26 00-0081	EA		18" x 12" x 72" Triple Tier Solid Plastic Locker (Tufftec Lockers®).....	417.63	24.43
			<i>For >50 To 100, Deduct</i>	-36.88	
			<i>For >100, Deduct</i>	-56.78	
10 51 26 00-0082	EA		18" x 15" x 72" Triple Tier Solid Plastic Locker (Tufftec Lockers®).....	454.01	24.43
			<i>For >50 To 100, Deduct</i>	-40.52	
			<i>For >100, Deduct</i>	-62.24	
10 51 26 00-0083	EA		18" x 18" x 72" Triple Tier Solid Plastic Locker (Tufftec Lockers®).....	479.77	24.43
			<i>For >50 To 100, Deduct</i>	-43.09	
			<i>For >100, Deduct</i>	-66.10	
10 51 26 00-0084			Four Tier Solid Plastic Lockers <small>(10 51 26 00-0001)</small>		
10 51 26 00-0085	EA		12" x 12" x 60" Four Tier Solid Plastic Locker (Tufftec Lockers®)	364.62	24.43
			<i>For >50 To 100, Deduct</i>	-31.58	
			<i>For >100, Deduct</i>	-48.83	
10 51 26 00-0086	EA		12" x 15" x 60" Four Tier Solid Plastic Locker (Tufftec Lockers®)	374.89	24.43
			<i>For >50 To 100, Deduct</i>	-32.60	
			<i>For >100, Deduct</i>	-50.37	
10 51 26 00-0087	EA		12" x 18" x 60" Four Tier Solid Plastic Locker (Tufftec Lockers®)	393.82	24.43
			<i>For >50 To 100, Deduct</i>	-34.50	
			<i>For >100, Deduct</i>	-53.21	



Specialties	10
Storage Specialties	10 50
Lockers	10 51

10

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 51 26 00-0088	EA		15" x 12" x 60" Four Tier Solid Plastic Locker (Tufftec Lockers®) <i>For >50 To 100, Deduct</i>	391.51 -34.27	24.43
			<i>For >100, Deduct</i>	-52.86	
10 51 26 00-0089	EA		15" x 15" x 60" Four Tier Solid Plastic Locker (Tufftec Lockers®) <i>For >50 To 100, Deduct</i>	416.03 -36.72	24.43
			<i>For >100, Deduct</i>	-56.54	
10 51 26 00-0090	EA		15" x 18" x 60" Four Tier Solid Plastic Locker (Tufftec Lockers®) <i>For >50 To 100, Deduct</i>	423.77 -37.49	24.43
			<i>For >100, Deduct</i>	-57.70	
10 51 26 00-0091	EA		18" x 12" x 60" Four Tier Solid Plastic Locker (Tufftec Lockers®) <i>For >50 To 100, Deduct</i>	419.93 -37.11	24.43
			<i>For >100, Deduct</i>	-57.13	
10 51 26 00-0092	EA		18" x 15" x 60" Four Tier Solid Plastic Locker (Tufftec Lockers®) <i>For >50 To 100, Deduct</i>	432.99 -38.41	24.43
			<i>For >100, Deduct</i>	-59.09	
10 51 26 00-0093	EA		18" x 18" x 60" Four Tier Solid Plastic Locker (Tufftec Lockers®) <i>For >50 To 100, Deduct</i>	470.65 -42.18	24.43
			<i>For >100, Deduct</i>	-64.74	
10 51 26 00-0094	EA		12" x 12" x 72" Four Tier Solid Plastic Locker (Tufftec Lockers®) <i>For >50 To 100, Deduct</i>	418.26 -36.80	25.15
			<i>For >100, Deduct</i>	-56.70	
10 51 26 00-0095	EA		12" x 15" x 72" Four Tier Solid Plastic Locker (Tufftec Lockers®) <i>For >50 To 100, Deduct</i>	436.47 -38.62	25.15
			<i>For >100, Deduct</i>	-59.44	
10 51 26 00-0096	EA		12" x 18" x 72" Four Tier Solid Plastic Locker (Tufftec Lockers®) <i>For >50 To 100, Deduct</i>	438.84 -38.86	25.15
			<i>For >100, Deduct</i>	-59.79	
10 51 26 00-0097	EA		15" x 12" x 72" Four Tier Solid Plastic Locker (Tufftec Lockers®) <i>For >50 To 100, Deduct</i>	461.79 -41.15	25.15
			<i>For >100, Deduct</i>	-63.23	
10 51 26 00-0098	EA		15" x 15" x 72" Four Tier Solid Plastic Locker (Tufftec Lockers®) <i>For >50 To 100, Deduct</i>	440.55 -39.03	25.15
			<i>For >100, Deduct</i>	-60.05	
10 51 26 00-0099	EA		15" x 18" x 72" Four Tier Solid Plastic Locker (Tufftec Lockers®) <i>For >50 To 100, Deduct</i>	459.79 -40.95	25.15
			<i>For >100, Deduct</i>	-62.93	
10 51 26 00-0100	EA		18" x 12" x 72" Four Tier Solid Plastic Locker (Tufftec Lockers®) <i>For >50 To 100, Deduct</i>	439.82 -38.95	25.15
			<i>For >100, Deduct</i>	-59.94	
10 51 26 00-0101	EA		18" x 15" x 72" Four Tier Solid Plastic Locker (Tufftec Lockers®) <i>For >50 To 100, Deduct</i>	462.87 -41.26	25.15
			<i>For >100, Deduct</i>	-63.40	
10 51 26 00-0102	EA		18" x 18" x 72" Four Tier Solid Plastic Locker (Tufftec Lockers®) <i>For >50 To 100, Deduct</i>	497.40 -44.71	25.15
			<i>For >100, Deduct</i>	-68.58	
10 51 26 00-0103			Five Tier Solid Plastic Lockers <small>(10 51 26 00-0001)</small>		
10 51 26 00-0104	EA		12" x 12" x 60" Five Tier Solid Plastic Locker (Tufftec Lockers®) <i>For >50 To 100, Deduct</i>	395.64 -34.61	24.78
			<i>For >100, Deduct</i>	-53.40	
10 51 26 00-0105	EA		12" x 15" x 60" Five Tier Solid Plastic Locker (Tufftec Lockers®) <i>For >50 To 100, Deduct</i>	408.35 -35.88	24.78
			<i>For >100, Deduct</i>	-55.30	
10 51 26 00-0106	EA		12" x 18" x 60" Five Tier Solid Plastic Locker (Tufftec Lockers®) <i>For >50 To 100, Deduct</i>	421.07 -37.15	24.78
			<i>For >100, Deduct</i>	-57.21	
10 51 26 00-0107	EA		15" x 12" x 60" Five Tier Solid Plastic Locker (Tufftec Lockers®) <i>For >50 To 100, Deduct</i>	412.97 -36.34	24.78
			<i>For >100, Deduct</i>	-56.00	
10 51 26 00-0108	EA		15" x 15" x 60" Five Tier Solid Plastic Locker (Tufftec Lockers®) <i>For >50 To 100, Deduct</i>	435.75 -38.62	24.78
			<i>For >100, Deduct</i>	-59.41	
10 51 26 00-0109	EA		15" x 18" x 60" Five Tier Solid Plastic Locker (Tufftec Lockers®) <i>For >50 To 100, Deduct</i>	446.77 -39.72	24.78
			<i>For >100, Deduct</i>	-61.07	
10 51 26 00-0110	EA		18" x 12" x 60" Five Tier Solid Plastic Locker (Tufftec Lockers®) <i>For >50 To 100, Deduct</i>	442.93 -39.34	24.78
			<i>For >100, Deduct</i>	-60.49	
10 51 26 00-0111	EA		18" x 15" x 60" Five Tier Solid Plastic Locker (Tufftec Lockers®) <i>For >50 To 100, Deduct</i>	455.23 -40.57	24.78
			<i>For >100, Deduct</i>	-62.34	
10 51 26 00-0112	EA		18" x 18" x 60" Five Tier Solid Plastic Locker (Tufftec Lockers®) <i>For >50 To 100, Deduct</i>	495.18 -44.56	24.78
			<i>For >100, Deduct</i>	-68.33	
10 51 26 00-0113	EA		12" x 12" x 72" Five Tier Solid Plastic Locker (Tufftec Lockers®) <i>For >50 To 100, Deduct</i>	430.85 -37.98	25.51
			<i>For >100, Deduct</i>	-58.51	
10 51 26 00-0114	EA		12" x 15" x 72" Five Tier Solid Plastic Locker (Tufftec Lockers®) <i>For >50 To 100, Deduct</i>	445.11 -39.41	25.51
			<i>For >100, Deduct</i>	-60.65	
10 51 26 00-0115	EA		12" x 18" x 72" Five Tier Solid Plastic Locker (Tufftec Lockers®) <i>For >50 To 100, Deduct</i>	459.35 -40.83	25.51
			<i>For >100, Deduct</i>	-62.78	

10 Specialties**10 50 Storage Specialties****10 51 Lockers**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 51 26 00-0116	EA		15" x 12" x 72" Five Tier Solid Plastic Locker (Tufftec Lockers®).....	454.37	25.51
			<i>For >50 To 100, Deduct</i>	-40.34	
			<i>For >100, Deduct</i>	-62.03	
10 51 26 00-0117	EA		15" x 15" x 72" Five Tier Solid Plastic Locker (Tufftec Lockers®).....	464.39	25.51
			<i>For >50 To 100, Deduct</i>	-41.34	
			<i>For >100, Deduct</i>	-63.54	
10 51 26 00-0118	EA		15" x 18" x 72" Five Tier Solid Plastic Locker (Tufftec Lockers®).....	479.41	25.51
			<i>For >50 To 100, Deduct</i>	-42.84	
			<i>For >100, Deduct</i>	-65.79	
10 51 26 00-0119	EA		18" x 12" x 72" Five Tier Solid Plastic Locker (Tufftec Lockers®).....	467.87	25.51
			<i>For >50 To 100, Deduct</i>	-41.69	
			<i>For >100, Deduct</i>	-64.06	
10 51 26 00-0120	EA		18" x 15" x 72" Five Tier Solid Plastic Locker (Tufftec Lockers®).....	485.09	25.51
			<i>For >50 To 100, Deduct</i>	-43.41	
			<i>For >100, Deduct</i>	-66.64	
10 51 26 00-0121	EA		18" x 18" x 72" Five Tier Solid Plastic Locker (Tufftec Lockers®).....	505.07	25.51
			<i>For >50 To 100, Deduct</i>	-45.41	
			<i>For >100, Deduct</i>	-69.64	
10 51 26 00-0122			Six Tier Solid Plastic Lockers <small>(10 51 26 00-0001)</small>		
10 51 26 00-0123	EA		15" x 12" x 60" Six Tier Solid Plastic Locker (Tufftec Lockers®).....	454.47	25.15
			<i>For >50 To 100, Deduct</i>	-40.42	
			<i>For >100, Deduct</i>	-62.14	
10 51 26 00-0124	EA		12" x 12" x 72" Six Tier Solid Plastic Locker (Tufftec Lockers®).....	446.60	25.86
			<i>For >50 To 100, Deduct</i>	-39.49	
			<i>For >100, Deduct</i>	-60.78	
10 51 26 00-0125	EA		12" x 15" x 72" Six Tier Solid Plastic Locker (Tufftec Lockers®).....	460.84	25.86
			<i>For >50 To 100, Deduct</i>	-40.91	
			<i>For >100, Deduct</i>	-62.92	
10 51 26 00-0126	EA		12" x 18" x 72" Six Tier Solid Plastic Locker (Tufftec Lockers®).....	470.34	25.86
			<i>For >50 To 100, Deduct</i>	-41.86	
			<i>For >100, Deduct</i>	-64.34	
10 51 26 00-0127	EA		15" x 12" x 72" Six Tier Solid Plastic Locker (Tufftec Lockers®).....	489.33	25.86
			<i>For >50 To 100, Deduct</i>	-43.76	
			<i>For >100, Deduct</i>	-67.19	
10 51 26 00-0128	EA		15" x 15" x 72" Six Tier Solid Plastic Locker (Tufftec Lockers®).....	494.87	25.86
			<i>For >50 To 100, Deduct</i>	-44.32	
			<i>For >100, Deduct</i>	-68.02	
10 51 26 00-0129	EA		15" x 18" x 72" Six Tier Solid Plastic Locker (Tufftec Lockers®).....	498.83	25.86
			<i>For >50 To 100, Deduct</i>	-44.71	
			<i>For >100, Deduct</i>	-68.62	
10 51 26 00-0130	EA		18" x 12" x 72" Six Tier Solid Plastic Locker (Tufftec Lockers®).....	500.41	25.86
			<i>For >50 To 100, Deduct</i>	-44.87	
			<i>For >100, Deduct</i>	-68.86	
10 51 26 00-0131	EA		18" x 15" x 72" Six Tier Solid Plastic Locker (Tufftec Lockers®).....	517.82	25.86
			<i>For >50 To 100, Deduct</i>	-46.61	
			<i>For >100, Deduct</i>	-71.47	
10 51 26 00-0132	EA		18" x 18" x 72" Six Tier Solid Plastic Locker (Tufftec Lockers®).....	540.77	25.86
			<i>For >50 To 100, Deduct</i>	-48.91	
			<i>For >100, Deduct</i>	-74.91	
10 51 26 00-0133			Solid Plastic Locker Accessories <small>(10 51 26 00-0001)</small>		
10 51 26 00-0134			Slope Tops For Solid Plastic Lockers <small>(10 51 26 00-0133)</small>		
			Note: Price per frame.		
10 51 26 00-0135	EA		Slope Top For Solid Plastic Lockers (Tufftec Lockers®).....	22.19	
10 51 26 00-0136			Recessed Bases For Solid Plastic Lockers <small>(10 51 26 00-0133)</small>		
			Note: Price per frame.		
10 51 26 00-0137	EA		Recessed Base For Solid Plastic Lockers (Tufftec Lockers®).....	24.24	
10 51 26 00-0138			End Panels For Solid Plastic Lockers <small>(10 51 26 00-0133)</small>		
			Note: Price per frame.		
10 51 26 00-0139	EA		End Panel For Solid Plastic Lockers (Tufftec Lockers®).....	54.04	
10 51 26 00-0140			Venting Options For Solid Plastic Locker Doors <small>(10 51 26 00-0133)</small>		
			Note: Price per frame.		
10 51 26 00-0141	EA		Horizontal Venting Option For Solid Plastic Locker Doors.....	20.55	
10 51 26 00-0142			Filler Panels For Solid Plastic Lockers <small>(10 51 26 00-0133)</small>		
			Note: Price per frame.		
10 51 26 00-0143	EA		Up To 6" Width, Filler Panel For Solid Plastic Lockers (Tufftec Lockers®).....	59.05	
			Note: Full locker height. Width and height cut to size in the field.		
10 51 26 00-0144			Locker Accessories For Solid Plastic Lockers <small>(10 51 26 00-0133)</small>		
			Note: Price per frame.		
10 51 26 00-0145	EA		Built In Hasp For Solid Plastic Lockers.....	5.13	
			Note: For removable padlocks. Excludes padlock.		



Specialties	10	10
Storage Specialties	10 50	
Lockers	10 51	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 51 26 00-0146 EA Built In Combination Lock For Solid Plastic Lockers.....	15.41	
10 51 26 00-0147 EA Built In Key Lock For Solid Plastic Lockers.....	20.55	
10 51 53 Locker Room Benches (10 51)		
10 51 53 00-0001 LF Hardwood Bench With Aluminum Pedestals.....	63.98	3.59
10 51 53 00-0002 LF Hardwood Bench With Painted Steel Pedestals.....	51.11	3.59
10 51 53 00-0003 LF Plastic Laminated Bench With Steel Pedestals.....	77.97	3.59
10 51 53 00-0004 LF Solid Plastic Bench With Steel Pedestals.....	74.52	3.59
10 51 53 00-0005 LF Aluminum Bench With Aluminum Pedestals.....	57.94	3.59
10 55 Postal Specialties (10 50)		
10 55 23 Mail Boxes (10 55)		
10 55 23 26 Commercial Mail Boxes (10 55 23)		
10 55 23 26-0001 Commercial Mail Boxes (10 55 23 26)		
10 55 23 26-0002 EA Surface Mounted Aluminum Letter Box With Key Lock.....	162.51	5.75
10 55 23 26-0003 EA Recessed Mounted Aluminum Letter Box With Key Lock.....	200.60	16.16
10 55 23 26-0004 EA 24" x 14" x 15" Deep, Aluminum Pedestal Mounted Group (NDCBU) Mailbox.....	986.06	21.55
Note: Any door combination.		
10 55 23 26-0005 EA 24" x 27" x 15" Deep, Aluminum Pedestal Mounted Group (NDCBU) Mailbox.....	1,247.25	28.74
Note: Any door combination.		
10 55 23 26-0006 BOX 4-1/2" x 5-1/2" x 15-1/2" Private Use Aluminum Horizontal Mailboxes, Per Box.....	45.35	10.78
10 55 23 26-0007 BOX 10-3/4" x 5-1/2" x 15-1/2" Private Use Aluminum Horizontal Mailboxes, Per Box.....	83.54	14.37
10 55 23 26-0008 BOX 6-3/8" x 5" x 17" US Postal Service Approved Aluminum Horizontal Mailboxes, Per Box.....	45.74	8.98
10 55 23 26-0009 BOX 12-7/8" x 5" x 17" US Postal Service Approved Aluminum Horizontal Mailboxes, Per Box.....	90.02	14.37
10 55 26 Parcel Lockers (10 55)		
10 55 26 00-0001 Parcel Lockers (10 55 26)		
10 55 26 00-0002 EA 24" x 14" x 15" Deep, Aluminum Pedestal Mounted Parcel Locker.....	782.99	21.55
Note: Two compartments.		
10 55 26 00-0003 EA 48" x 16" x 18" Deep, Aluminum Pedestal Mounted Parcel Locker.....	931.99	28.74
Note: Two compartments.		
10 56 Storage Assemblies (10 50)		
10 56 16 Fabricated Wood Storage Shelving (10 56)		
10 56 16 00-0001 Shelving (10 56 16)		
10 56 16 00-0002 Built-In Wood Shelving (10 56 16 00-0001)		
Note: Priced by shelf area. Includes hardware and trim.		
10 56 16 00-0003 SF Built-in Wood Storage Shelving Post And Trimmed Plywood.....	13.34	1.81
For Each SF Of Lumber Edge Band, Add	0.69	
For Each SF Of Prefinished Shelves, Add	2.32	
10 56 16 00-0004 SF Built-in Wood Storage Shelving Post And Solid Clear Pine.....	14.38	2.18
For Each SF Of Lumber Edge Band, Add	0.69	
For Each SF Of Prefinished Shelves, Add	2.32	
10 56 16 00-0005 SF Built-in Wood Storage Shelving Closet Shelf Of Pine With Rod.....	14.53	3.63
For Each SF Of Lumber Edge Band, Add	0.69	
For Each SF Of Prefinished Shelves, Add	2.32	
10 56 16 00-0006 Wood Shelving, White Pine, Clear Grade, Wall Mounted (10 56 16 00-0001)		
10 56 16 00-0007 LF 1" x 8" White Pine Clear Grade Wood Shelving.....	11.27	4.35
10 56 16 00-0008 LF 1" x 10" White Pine Clear Grade Wood Shelving.....	12.34	4.65
10 56 16 00-0009 LF 1" x 12" White Pine Clear Grade Wood Shelving.....	13.54	5.00
10 56 16 00-0010 SF Wood Shelving, 2" White Pine Clear Grade.....	17.37	
10 56 16 00-0011 Plywood Shelf With Edge Band (10 56 16 00-0001)		
10 56 16 00-0012 LF 3/4" Plywood Shelf, 12" Wide With Edge Band.....	13.39	4.35
10 56 16 00-0013 LF 3/4" Plywood Shelf, 24" Wide With Edge Band.....	20.32	5.44
10 56 16 00-0014 Adjustable Shelf And Rod (10 56 16 00-0001)		
10 56 16 00-0015 EA 12" Wide Adjustable Shelf, 3' To 6' Long Including Rod.....	109.67	16.32
10 56 16 00-0016 EA 12" Wide Adjustable Shelf, 5' To 8' Long Including Rod.....	130.39	21.76
10 56 16 00-0017 Prefinished Wood Shelves With Brackets And Supports (10 56 16 00-0001)		
10 56 16 00-0018 LF Prefinished Wood Shelves, 8" Wide, With Brackets And Supports.....	11.84	4.35
10 56 16 00-0019 LF Prefinished Wood Shelves, 10" Wide, With Brackets And Supports.....	12.85	4.65
10 56 16 00-0020 SF Adjustable 3/4" Plastic Laminated Wood Shelves, Recessed Metal Standards.....	40.81	7.25

10	10	Specialties
	10 50	Storage Specialties
	10 56	Storage Assemblies



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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10 56 16 00-0021	Wood Shelving, Oak, Clear Grade, Wall Mounted <small>(10 56 16 00-0001)</small>	13.14	6.82
10 56 16 00-0022	LF Wood Shelving, 1" X 8" Oak Clear Grade.....		

10 70 Exterior Specialties (10)

10 73 Protective Covers (10 70)

10 73 13 Awnings (10 73)

10 73 13 00-0001	Metal Awnings <small>(10 73 13)</small> Note: Includes metal cover, frame supports and anchoring.		
10 73 13 00-0002	SF Ribbed Aluminum Window Awnings, Clear Weather Resistant Finish.....	30.09	6.78
10 73 13 00-0003	SF Ribbed Aluminum Window Awning, Baked Enamel Finish.....	26.75	6.07
10 73 13 00-0004	SF Flat Roofed Steel Awning (Per SF Of Covered Area).....	72.45	7.04
10 73 13 00-0005	SF Arched Roofed Steel Awning (Per SF Of Covered Area).....	75.02	7.93

10 73 13 00-0006	Canvas Awnings <small>(10 73 13)</small> Note: Includes minimum 12 oz. canvas, frame supports and anchoring.		
10 73 13 00-0007	SF Canvas Awning, Waterproof Fabric Tubular Metal Framing.....	26.24	5.00
10 73 13 00-0008	SF Side Protection Canvas For Walkways (Per SF Of Wall Area).....	14.15	1.62
10 73 13 00-0009	SF Replacement Canvas For Awnings.....	15.22	
	Note: Includes removal of existing canvas cover. For 18 Oz. Vinyl Laminated Polyester Cover, Add	0.47	

10 73 16 Canopies (10 73)

10 73 16 00-0001	Canopies, Wall Hung, Aluminum Framed And Covered, Prefinished <small>(10 73 16)</small> Note: Includes cover, frame supports and anchoring.		
10 73 16 00-0002	EA 8' x 10' Canopy, Aluminum, Wall Hung.....	2,495.82	325.90
10 73 16 00-0003	EA 8' x 20' Canopy, Aluminum, Wall Hung.....	4,470.74	521.57
10 73 16 00-0004	EA 10' x 10' Canopy, Aluminum, Wall Hung.....	3,084.82	407.77
10 73 16 00-0005	EA 10' x 20' Canopy, Aluminum, Wall Hung.....	5,268.76	545.27

10 73 26 Walkway Coverings (10 73)

Note: Pre-engineered includes all framing and steel supports, integral gutter system. Excludes foundations.

10 73 26 00-0001	Steel Walkway/Parking Covers <small>(10 73 26)</small> Note: Factory applied polyester finish.		
10 73 26 00-0002	SF Flat Roofed Steel Walkway/Parking Cover.....	36.79	4.86
	Note: Includes factory applied polyester finish. For Snow Load (30 PSF), Add	10.82	
	For Wind Load (140 MPH), Add	13.53	
10 73 26 00-0003	SF Arch Roofed Steel Walkway/Parking Cover.....	39.22	5.24
	Note: Includes factory applied polyester finish. For Snow Load (30 PSF), Add	11.50	
	For Wind Load (140 MPH), Add	14.37	

10 73 26 00-0004	Aluminum Walkway/Parking Covers <small>(10 73 26)</small>		
10 73 26 00-0005	SF Flat Roofed Aluminum Walkway/Parking Cover.....	23.78	4.86
	Note: Includes factory applied polyester finish. For Snow Load (30 PSF), Add	5.62	
	For Wind Load (140 MPH), Add	7.02	
10 73 26 00-0006	SF Arch Roofed Aluminum Walkway/Parking Cover.....	25.80	5.24
	Note: Includes factory applied polyester finish. For Snow Load (30 PSF), Add	6.13	
	For Wind Load (140 MPH), Add	7.66	

10 75 Flagpoles (10 70)

Note: Metal bases are installed in a concrete base and fully rigged. Heights indicated are from ground to top of installed flag pole. Uninstalled lengths are longer. Includes top ball (color and material similar to pole), cleats and cleat cover, all caulking and sealants, and hoisting into place. Excludes excavation and concrete. See CSI section 10 75 16 00-0012 for bases.

10 75 16 Ground-Set Flagpoles (10 75)

10 75 16 00-0001	Free Standing Tapered Aluminum Flagpoles <small>(10 75 16)</small> Note: Heavy duty.		
10 75 16 00-0002	EA 20' Exposed Height, Tapered Satin Aluminum Flagpole.....	2,240.03	543.25
	Note: 5" butt diameter, 3" top diameter and 0.188" wall. For Internal Halyard, Winch System, Add	570.00	
	For Clear Anodized Finish, Add	150.00	
	For Bronze Anodized Finish, Add	180.00	
	For Black Anodized Finish, Add	230.00	
	For Rope Lock Box, Add	96.00	



Specialties	10
Exterior Specialties	10 70
Flagpoles	10 75

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 75 16 00-0003 EA 25' Exposed Height, Tapered Satin Aluminum Flagpole..... Note: 5-1/2" butt diameter, 3-1/2" top diameter and 0.188" wall. <i>For Internal Halyard, Winch System, Add</i> <i>For Clear Anodized Finish, Add</i> <i>For Bronze Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For Rope Lock Box, Add</i>	2,686.32 1,100.00 200.00 230.00 320.00 96.00	597.57
10 75 16 00-0004 EA 30' Exposed Height, Tapered Satin Aluminum Flagpole..... Note: 6" butt diameter, 3-1/2" top diameter and 0.188" wall. <i>For Internal Halyard, Winch System, Add</i> <i>For Clear Anodized Finish, Add</i> <i>For Bronze Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For Rope Lock Box, Add</i>	3,015.63 1,390.00 300.00 375.00 450.00 96.00	651.90
10 75 16 00-0005 EA 35' Exposed Height, Tapered Satin Aluminum Flagpole..... Note: 7" butt diameter, 3-1/2" top diameter and 0.188" wall. <i>For Internal Halyard, Winch System, Add</i> <i>For Clear Anodized Finish, Add</i> <i>For Bronze Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For Rope Lock Box, Add</i>	3,861.40 1,340.00 290.00 360.00 480.00 96.00	760.55
10 75 16 00-0006 EA 40' Exposed Height, Tapered Satin Aluminum Flagpole..... Note: 8" butt diameter, 3-1/2" top diameter and 0.188" wall. <i>For Internal Halyard, Winch System, Add</i> <i>For Clear Anodized Finish, Add</i> <i>For Bronze Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For Rope Lock Box, Add</i>	4,917.79 1,490.00 390.00 480.00 660.00 96.00	869.20
10 75 16 00-0007 EA 45' Exposed Height, Tapered Satin Aluminum Flagpole..... Note: 8" butt diameter, 3-1/2" top diameter and 0.188" wall. <i>For Internal Halyard, Winch System, Add</i> <i>For Clear Anodized Finish, Add</i> <i>For Bronze Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For Rope Lock Box, Add</i>	5,422.59 1,340.00 400.00 500.00 700.00 96.00	923.53
10 75 16 00-0008 EA 50' Exposed Height, Tapered Satin Aluminum Flagpole..... Note: 10" butt diameter, 4" top diameter and 0.188" wall. <i>For Internal Halyard, Winch System, Add</i> <i>For Clear Anodized Finish, Add</i> <i>For Bronze Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For Rope Lock Box, Add</i>	6,863.35 1,380.00 700.00 860.00 1,130.00 96.00	977.85
10 75 16 00-0009 EA 60' Exposed Height, Tapered Satin Aluminum Flagpole..... Note: 12" butt diameter, 4" top diameter and 0.250" wall. <i>For Internal Halyard, Winch System, Add</i> <i>For Clear Anodized Finish, Add</i> <i>For Bronze Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For Rope Lock Box, Add</i>	11,850.80 1,800.00 620.00 820.00 1,160.00 96.00	1,086.50
10 75 16 00-0010 EA 70' Exposed Height, Tapered Satin Aluminum Flagpole..... Note: 12" butt diameter, 4" top diameter and 0.250" wall. <i>For Internal Halyard, Winch System, Add</i> <i>For Clear Anodized Finish, Add</i> <i>For Bronze Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For Rope Lock Box, Add</i>	13,304.98 1,720.00 710.00 950.00 1,360.00 96.00	1,195.15
10 75 16 00-0011 EA 80' Exposed Height, Tapered Satin Aluminum Flagpole..... Note: 12" butt diameter, 4" top diameter and 0.375" wall. <i>For Internal Halyard, Winch System, Add</i> <i>For Clear Anodized Finish, Add</i> <i>For Bronze Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For Rope Lock Box, Add</i>	16,326.88 2,600.00 1,100.00 1,380.00 1,840.00 96.00	1,303.79
10 75 16 00-0012 Flagpole Bases (10 75 16)		
10 75 16 00-0013 Flagpole Concrete Base (10 75 16 00-0012) Note: Includes excavation, forms where necessary, steel casing and reinforcing, metal collar installation, base plate, sand fill, ground spike, concrete and finishing of concrete.		
10 75 16 00-0014 EA 30' Or Less Flagpole, Poured Concrete Foundation	1,024.00	
10 75 16 00-0015 EA 35' Flagpole, Poured Concrete Foundation	1,058.13	
10 75 16 00-0016 EA 40' Flagpole, Poured Concrete Foundation	1,218.21	
10 75 16 00-0017 EA 45' Flagpole, Poured Concrete Foundation	1,288.41	
10 75 16 00-0018 EA 50' Flagpole, Poured Concrete Foundation	1,543.79	
10 75 16 00-0019 EA 60' Flagpole, Poured Concrete Foundation	1,870.91	
10 75 16 00-0020 EA 70' Flagpole, Poured Concrete Foundation	2,210.87	
10 75 16 00-0021 EA 80' Flagpole, Poured Concrete Foundation	2,570.77	
10 75 16 00-0022 EA 90' To 100' Flagpole, Poured Concrete Foundation.....	2,996.59	
10 75 16 00-0023 Direct Embedded Flagpole Base (10 75 16 00-0012) Note: Augured in place, no concrete required.		
10 75 16 00-0024 EA 20' To 25' Flagpole, Direct Embedded Pole Base.....	454.29	
10 75 16 00-0025 EA 30' To 40' Flagpole, Direct Embedded Pole Base.....	652.44	
10 75 16 00-0026 EA 45' To 55' Flagpole, Direct Embedded Pole Base.....	727.56	

10	Specialties
10 70	Exterior Specialties
10 75	Flagpoles



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 75 16 00-0027	EA		60' To 70' Flagpole, Direct Embedded Pole Base.....	820.78	
10 75 16 00-0028			Flagpole Accessories (10 75 16)		
10 75 16 00-0029			Flagpole Tops (10 75 16 00-0028)		
			Note: To be used on renovation of existing flagpole. Do not use in conjunction with installation of new flagpoles.		
10 75 16 00-0030	EA		4" Gold Anodized Aluminum Ball For Top Of Flagpole	85.66	30.55
10 75 16 00-0031	EA		5" Gold Anodized Aluminum Ball For Top Of Flagpole	93.93	32.34
10 75 16 00-0032	EA		6" Gold Anodized Aluminum Ball For Top Of Flagpole	103.38	34.14
10 75 16 00-0033	EA		8" Gold Anodized Aluminum Ball For Top Of Flagpole	132.71	35.94
10 75 16 00-0034	EA		10" Gold Anodized Aluminum Ball For Top Of Flagpole	185.44	37.73
10 75 16 00-0035	EA		12" Gold Anodized Aluminum Ball For Top Of Flagpole	207.76	39.53
10 75 16 00-0036	EA		11-1/4" Aluminum Flying Eagle Mounted On A Spindle For Flagpole Top, Gold Finish.....	172.66	39.53
10 75 16 00-0037	EA		15" Aluminum Flying Eagle Mounted On A Spindle For Flagpole Top, Gold Finish.....	206.84	44.92
10 75 16 00-0038			Flagpole Accessories (10 75 16 00-0028)		
			Note: To be used on renovation of existing flagpole. Do not use in conjunction with installation of new flagpoles.		
10 75 16 00-0039	LF		5/16" Diameter, Nylon Halyard (Rope) With Wire Center For Flagpoles.....	0.71	0.05
10 75 16 00-0040	LF		5/16" Diameter, Solid Braided Multifilament Polypropylene Halyard (Rope) For Flagpoles	0.36	0.05
10 75 16 00-0041	LF		5/16" Diameter, Nylon Halyard (Rope) For Flagpoles.....	0.28	0.05
10 75 16 00-0042	LF		3/8" Diameter, Nylon Halyard (Rope) With Wire Center For Flagpoles.....	0.95	0.05
10 75 16 00-0043	EA		Refinish Existing Flagpole Ball.....	237.02	89.80
10 75 16 00-0044	EA		Locking Aluminum Cleat Box For Flagpoles	220.12	53.88
10 75 16 00-0045	EA		Aluminum Cleat For Flagpoles.....	18.29	3.59
10 75 16 00-0046	LF		1/8" Diameter, 7x7 Galvanized Wire Rope For Flagpoles.....	0.49	0.09
10 75 23			Wall-Mounted Flagpoles (10 75)		
10 75 23 00-0001			Vertical, Wall/Roof Mounted Tapered Aluminum Flagpoles (10 75 23)		
			Note: Includes aluminum brackets, 3" butt diameter and 0.125" wall.		
10 75 23 00-0002	EA		14' Height, Vertical Wall/Roof Mounted Tapered Aluminum Flagpole, Satin Finish.....	1,502.95	476.53
			For Rope Lock Box, Add	96.00	
10 75 23 00-0003	EA		17' Height, Vertical Wall/Roof Mounted Tapered Aluminum Flagpole, Satin Finish.....	1,633.36	524.18
			For Rope Lock Box, Add	96.00	
10 75 23 00-0004	EA		20' Height, Vertical Wall/Roof Mounted Tapered Aluminum Flagpole, Satin Finish.....	1,752.07	571.84
			For Rope Lock Box, Add	96.00	
10 75 23 00-0005	EA		25' Height, Vertical Wall/Roof Mounted Tapered Aluminum Flagpole, Satin Finish.....	2,036.28	667.15
			For Rope Lock Box, Add	96.00	
10 75 23 00-0006			Outrigger, Wall Mounted Tapered Aluminum Flagpoles (10 75 23)		
			Note: Includes aluminum base, 3-1/2" butt diameter and 0.125" wall.		
10 75 23 00-0007	EA		10' Aluminum Outrigger Flagpole, Wall Mounted, Including Base	2,191.51	428.89
			For Rope Lock Box, Add	96.00	
10 75 23 00-0008	EA		15' Aluminum Outrigger Flagpole, Wall Mounted, Including Base	2,216.63	476.53
			For Rope Lock Box, Add	96.00	
10 75 23 00-0009	EA		20' Aluminum Outrigger Flagpole, Wall Mounted, Including Base	2,430.65	571.84
			For Rope Lock Box, Add	96.00	
10 80			Other Specialties (10)		
10 81			Pest Control Devices (10 80)		
10 81 13			Bird Control Devices (10 81)		
10 81 13 00-0001			Stainless Steel Spiked Bird Barrier (10 81 13)		
			Note: Stainless steel spikes with flexible polycarbonate base.		
10 81 13 00-0002	LF		2-1/2" To 3" Wide Stainless Steel Spikes And Polycarbonate Base Bird Deterrent System	6.64	0.57
10 81 13 00-0003	LF		4-1/2" To 5" Wide Stainless Steel Spikes And Polycarbonate Base Bird Deterrent System	7.24	0.57
10 81 13 00-0004	LF		8" Wide Stainless Steel Spikes And Polycarbonate Base Bird Deterrent System.....	9.65	0.57
10 81 13 00-0005			Polycarbonate Spiked Bird Barrier (10 81 13)		
			Note: Polycarbonate spikes and base.		
10 81 13 00-0006	LF		3" Wide Polycarbonate Spikes And Base Bird Deterrent System	5.04	0.57
10 81 13 00-0007	LF		5" Wide Polycarbonate Spikes And Base Bird Deterrent System	6.10	0.57
10 81 13 00-0008	LF		8" Wide Polycarbonate Spikes And Base Bird Deterrent System	7.28	0.57
10 81 13 00-0009			Spiked Gutter Or Girder Bird Barrier (10 81 13)		
			Note: Stainless steel spikes with flexible polycarbonate base mounted to gutter or girder. Includes aluminum clamps.		
10 81 13 00-0010	LF		Stainless Steel Spikes And Polycarbonate Base Bird Deterrent System For Gutter Or Girder Application	5.74	0.57
10 81 13 00-0011			Coil Bird Barrier (10 81 13)		
			Note: Stainless steel coil.		
10 81 13 00-0012	LF		4" Diameter Stainless Steel Coil Bird Deterrent System	4.10	0.57
10 81 13 00-0013	LF		5" Diameter Stainless Steel Coil Bird Deterrent System	4.83	0.57



Specialties	10
Other Specialties	10 80
Pest Control Devices	10 81

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 81 13 00-0014 Spider Bird Barrier <small>(10 81 13)</small>		
Note: Stainless steel arms with various bases.		
10 81 13 00-0015 EA 2' Diameter Stainless Steel Spider Bird Deterrent System	73.35	0.57
10 81 13 00-0016 EA 4' Diameter Stainless Steel Spider Bird Deterrent System	90.17	0.57
10 81 13 00-0017 EA 8' Diameter Stainless Steel Spider Bird Deterrent System	105.82	0.57
10 81 13 00-0018 Oriented Flexible Flame Resistant Netting <small>(10 81 13)</small>		
Note: Includes stainless steel rings and plastic ties.		
10 81 13 00-0019 SF 1/8" x 1/8" Mesh Flexible Polypropylene Netting	0.66	0.29
Note: To control bird and marine predators.		
10 81 13 00-0020 SF 1/4" x 1/4" Mesh Flexible Polypropylene Netting	0.65	0.29
Note: To control bird and marine predators.		
10 81 13 00-0021 SF 1/2" x 1/2" Mesh Flexible Polypropylene Netting	0.64	0.29
Note: To control bird and marine predators.		
10 81 13 00-0022 SF 3/4" x 3/4" Mesh Flexible Polypropylene Netting	0.63	0.29
Note: To control bird and marine predators.		
10 81 13 00-0023 SF 1" x 1" Mesh Flexible Polypropylene Netting	0.63	0.29
Note: To control bird and marine predators.		
10 81 13 00-0024 SF 1-1/8" x 1-1/8" Mesh Flexible Polypropylene Netting	0.63	0.29
Note: To control bird and marine predators.		
10 81 13 00-0025 SF 2" x 2" Mesh Flexible Polypropylene Netting	0.62	0.29
Note: To control bird and marine predators.		
10 81 13 00-0026 SF 3" x 3" Mesh Flexible Polypropylene Netting	0.62	0.29
Note: To control bird and marine predators.		
10 81 13 00-0027 SF 4" x 4" Mesh Flexible Polypropylene Netting	0.61	0.29
Note: To control bird and marine predators.		
10 81 13 00-0028 SF 5/8" x 3/4" Mesh Flexible Polypropylene Netting	0.64	0.29
Note: To control bird and marine predators.		
10 81 13 00-0029 SF 1-1/4" x 1-1/2" Mesh Flexible Polypropylene Netting	0.63	0.29
Note: To control bird and marine predators.		
10 81 13 00-0030 EA Poly Clips For Flexible Netting	2.27	
10 81 13 00-0031 Netting Accessories <small>(10 81 13)</small>		
10 81 13 00-0032 EA 2' Zipper For Flexible Netting	4.55	
10 81 13 00-0033 EA 4' Zipper For Flexible Netting	6.85	
10 81 13 00-0034 EA 6' Zipper For Flexible Netting	8.06	
10 81 13 00-0035 EA 8' Zipper For Flexible Netting	11.45	
10 86 Security Mirrors And Domes <small>(10 86)</small>		
10 86 00 00-0001 Dome Mirrors <small>(10 86)</small>		
Note: Includes all mounting hardware. Indoor or outdoor applications.		
10 86 00 00-0002 Steel Dome Mirrors <small>(10 86 00 00-0001)</small>		
10 86 00 00-0003 EA 9" Diameter Full-Dome Steel Dome Mirror	161.14	14.38
10 86 00 00-0004 EA 12" Diameter Full-Dome Steel Dome Mirror	189.05	15.09
10 86 00 00-0005 EA 18" Diameter Full-Dome Steel Dome Mirror	218.40	16.53
10 86 00 00-0006 EA 24" Diameter Full-Dome Steel Dome Mirror	290.36	17.96
10 86 00 00-0007 EA 9" Diameter Half-Dome Steel Dome Mirror	115.50	10.78
10 86 00 00-0008 EA 12" Diameter Half-Dome Steel Dome Mirror	133.05	11.50
10 86 00 00-0009 EA 18" Diameter Half-Dome Steel Dome Mirror	155.25	12.57
10 86 00 00-0010 EA 24" Diameter Half-Dome Steel Dome Mirror	214.96	13.65
10 86 00 00-0011 Plexiglas Dome Mirrors <small>(10 86 00 00-0001)</small>		
10 86 00 00-0012 EA 18" Diameter Full-Dome Plexiglas Dome Mirror	126.88	16.53
10 86 00 00-0013 EA 26" Diameter Full-Dome Plexiglas Dome Mirror	177.54	17.96
10 86 00 00-0014 EA 32" Diameter Full-Dome Plexiglas Dome Mirror	233.94	20.84
10 86 00 00-0015 EA 36" Diameter Full-Dome Plexiglas Dome Mirror	282.85	25.16
10 86 00 00-0016 EA 48" Diameter Full-Dome Plexiglas Dome Mirror	412.63	35.94
10 86 00 00-0017 EA 18" Diameter Half-Dome Plexiglas Dome Mirror	78.46	12.57
10 86 00 00-0018 EA 26" Diameter Half-Dome Plexiglas Dome Mirror	104.79	13.65
10 86 00 00-0019 EA 32" Diameter Half-Dome Plexiglas Dome Mirror	137.42	15.81
10 86 00 00-0020 EA 36" Diameter Half-Dome Plexiglas Dome Mirror	169.33	19.04
10 86 00 00-0021 EA 48" Diameter Half-Dome Plexiglas Dome Mirror	268.02	26.95
10 86 00 00-0022 EA 18" Diameter Quarter-Dome Plexiglas Dome Mirror	51.49	10.78
10 86 00 00-0023 EA 26" Diameter Quarter-Dome Plexiglas Dome Mirror	65.51	11.86
10 86 00 00-0024 EA 32" Diameter Quarter-Dome Plexiglas Dome Mirror	85.43	13.30
10 86 00 00-0025 EA 36" Diameter Quarter-Dome Plexiglas Dome Mirror	106.22	15.81
10 86 00 00-0026 EA 48" Diameter Quarter-Dome Plexiglas Dome Mirror	175.01	22.46
10 86 00 00-0027 Coated Plexiglas Dome Mirrors <small>(10 86 00 00-0001)</small>		
10 86 00 00-0028 EA 18" Diameter Full-Dome Coated Plexiglas Dome Mirror	150.48	16.53
10 86 00 00-0029 EA 26" Diameter Full-Dome Coated Plexiglas Dome Mirror	230.49	17.96
10 86 00 00-0030 EA 36" Diameter Full-Dome Coated Plexiglas Dome Mirror	388.76	25.16
10 86 00 00-0031 EA 48" Diameter Full-Dome Coated Plexiglas Dome Mirror	597.97	35.94

10 Specialties**10 80 Other Specialties****10 86 Security Mirrors And Domes**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
10 86 00 00-0032 EA 18" Diameter Half-Dome Coated Plexiglas Dome Mirror	98.26	12.57
10 86 00 00-0033 EA 26" Diameter Half-Dome Coated Plexiglas Dome Mirror	144.73	13.65
10 86 00 00-0034 EA 36" Diameter Half-Dome Coated Plexiglas Dome Mirror	228.04	19.04
10 86 00 00-0035 EA 48" Diameter Half-Dome Coated Plexiglas Dome Mirror	376.24	26.95
10 86 00 00-0036 EA 18" Diameter Quarter-Dome Coated Plexiglas Dome Mirror.....	71.87	10.78
10 86 00 00-0037 EA 26" Diameter Quarter-Dome Coated Plexiglas Dome Mirror.....	99.81	11.86
10 86 00 00-0038 EA 32" Diameter Quarter-Dome Coated Plexiglas Dome Mirror.....	128.71	13.30
10 86 00 00-0039 EA 36" Diameter Quarter-Dome Coated Plexiglas Dome Mirror.....	165.16	15.81
10 86 00 00-0040 EA 48" Diameter Quarter-Dome Coated Plexiglas Dome Mirror.....	257.89	22.46
10 86 00 00-0041 Circular Convex Security Mirrors (10 86)		
Note: Includes all mounting hardware.		
10 86 00 00-0042 Plexiglas Circular Convex Mirrors (10 86 00 00-0041)		
Note: Indoor models have a tempered hardboard backing. Outdoor models have a waterproof edge and back, rustproof hardware with backed-on enamel finish.		
10 86 00 00-0043 EA 12" Diameter Plexiglas Circular Convex Mirrors, Indoor	55.23	11.50
10 86 00 00-0044 EA 18" Diameter Plexiglas Circular Convex Mirrors, Indoor	71.09	12.57
10 86 00 00-0045 EA 26" Diameter Plexiglas Circular Convex Mirrors, Indoor	106.05	13.65
10 86 00 00-0046 EA 30" Diameter Plexiglas Circular Convex Mirrors, Indoor	132.12	15.81
10 86 00 00-0047 EA 36" Diameter Plexiglas Circular Convex Mirrors, Indoor	175.08	19.04
10 86 00 00-0048 EA 48" Diameter Plexiglas Circular Convex Mirrors, Indoor	307.16	26.95
10 86 00 00-0049 EA 18" Diameter Plexiglas Circular Convex Mirrors, Outdoor	90.55	12.57
10 86 00 00-0050 EA 26" Diameter Plexiglas Circular Convex Mirrors, Outdoor	129.08	13.65
10 86 00 00-0051 EA 36" Diameter Plexiglas Circular Convex Mirrors, Outdoor	184.29	19.04
10 86 00 00-0052 EA 48" Diameter Plexiglas Circular Convex Mirrors, Outdoor	334.79	26.95
10 86 00 00-0053 Coated Plexiglas Circular Convex Mirrors (10 86 00 00-0041)		
Note: Indoor models have a tempered hardboard backing. Outdoor models have a waterproof edge and back, rustproof hardware with backed-on enamel finish.		
10 86 00 00-0054 EA 18" Diameter Coated Plexiglas Circular Convex Mirrors, Indoor.....	108.51	12.57
10 86 00 00-0055 EA 26" Diameter Coated Plexiglas Circular Convex Mirrors, Indoor.....	168.91	13.65
10 86 00 00-0056 EA 30" Diameter Coated Plexiglas Circular Convex Mirrors, Indoor.....	226.17	15.81
10 86 00 00-0057 EA 36" Diameter Coated Plexiglas Circular Convex Mirrors, Indoor.....	282.14	19.04
10 86 00 00-0058 EA 48" Diameter Coated Plexiglas Circular Convex Mirrors, Indoor.....	409.62	26.95
10 86 00 00-0059 EA 18" Diameter Coated Plexiglas Circular Convex Mirrors, Outdoor.....	129.57	12.57
10 86 00 00-0060 EA 26" Diameter Coated Plexiglas Circular Convex Mirrors, Outdoor.....	198.84	13.65
10 86 00 00-0061 EA 30" Diameter Coated Plexiglas Circular Convex Mirrors, Outdoor.....	275.67	15.81
10 86 00 00-0062 EA 36" Diameter Coated Plexiglas Circular Convex Mirrors, Outdoor.....	312.08	19.04
10 86 00 00-0063 EA 48" Diameter Coated Plexiglas Circular Convex Mirrors, Outdoor.....	493.66	26.95
10 89 Baffle Assembly (10 80)		
10 89 00 00-0001 Baffle Assemblies for RSIP Program (10 89)		
10 89 00 00-0002 EA Roof Baffle Assembly for Exhaust (Detail BF-01 of RSIP Specifications).....	116.00	
Note: For Installed assemblies; Includes painting and seals as needed, per specifications.		
10 89 00 00-0003 EA Wall Baffle Assembly for Exhaust(Detail BF-02 of RSIP Specifications).....	168.00	
Note: For Installed assemblies; Includes painting and seals as needed, per specifications.		
10 89 00 00-0004 EA Modified Ducting Assembly for Exhaust(Detail BF-03 of RSIP Specifications).....	68.00	
Note: For Installed assemblies; Includes painting and seals as needed, per specifications.		
10 89 00 00-0005 EA Attic Baffle for Gable Vent Assembly (Detail BF-10 of RSIP Specifications).....	172.00	
Note: For Installed assemblies; Includes painting and seals as needed, per specifications.		
10 89 00 00-0006 EA Attic Baffle for Triangular Gable Vent Assembly (Detail BF-11 of RSIP Specifications).....	168.00	
Note: For Installed assemblies; Includes painting and seals as needed, per specifications.		
10 89 00 00-0007 EA Attic Baffle for Dormer Vent Assembly (Detail BF-12 of RSIP Specifications).....	155.00	
Note: For Installed assemblies; Includes painting and seals as needed, per specifications.		
10 89 00 00-0008 EA Attic Baffle for Turbine Vent Assembly (Detail BF-13 of RSIP Specifications).....	155.00	
Note: For Installed assemblies; Includes painting and seals as needed, per specifications.		
10 89 00 00-0009 EA Attic Baffle for Roof Vent Assembly (Detail BF-14 of RSIP Specifications).....	150.00	
Note: For Installed assemblies; Includes painting and seals as needed, per specifications.		
10 89 00 00-0010 EA Attic Baffle for Coupola Vent Assembly (Detail BF-15 of RSIP Specifications).....	165.00	
Note: For Installed assemblies; Includes painting and seals as needed, per specifications.		
10 89 00 00-0011 EA Baffle for Whole House Fan Assembly (Detail BF-16 of RSIP Specifications).....	354.00	
Note: For Installed assemblies; Includes painting and seals as needed, per specifications.		
10 89 00 00-0012 EA Attic Vent Baffle Assembly (Detail BF-23 of RSIP Specifications).....	80.00	
Note: For Installed assemblies; Includes painting and seals as needed, per specifications.		

END OF SECTION 10



MINOR	CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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11 Equipment

11 01 Operation And Maintenance Of Equipment ⁽¹¹⁾

11 01 10 Operation And Maintenance Of Vehicle And Pedestrian Equipment ^(11 01)

11 01 10 00-0001 Replacement Parking Equipment ^(11 01 10)

11 01 10 00-0002	EA	10' Wood Arm Replacement With Bolts	314.93	
11 01 10 00-0003	EA	12' Wood Arm Replacement With Bolts	330.49	
11 01 10 00-0004	EA	14' Wood Arm Replacement With Bolts	348.10	
11 01 10 00-0005	EA	12' Aluminum Arm Replacement With Bolts	457.66	
11 01 10 00-0006	EA	14' Aluminum Arm Replacement With Bolts	474.26	
11 01 10 00-0007	EA	16' Aluminum Arm Replacement With Bolts	668.88	
11 01 10 00-0008	EA	18' Aluminum Arm Replacement With Bolts	679.62	
11 01 10 00-0009	EA	20' Aluminum Arm Replacement With Bolts	699.14	
11 01 10 00-0010	EA	22' Aluminum Arm Replacement With Bolts	802.77	
11 01 10 00-0011	EA	24' Aluminum Arm Replacement With Bolts	816.89	

11 10 Vehicle And Pedestrian Equipment ⁽¹¹⁾

11 11 Vehicle Service Equipment ^(11 10)

11 11 19 Vehicle Lubrication Equipment ^(11 11)

11 11 19 00-0001 Lube Equipment ^(11 11 19)

11 11 19 00-0002 Hose Reels With Pumps, Not Including Piping ^(11 11 19 00-0001)

11 11 19 00-0003	EA	1 Reel Hose Reel With Pump, Not Including Piping	2,878.61	1,191.46
11 11 19 00-0004	EA	2 Reel Hose Reel With Pump, Not Including Piping	3,493.60	1,389.77
11 11 19 00-0005	EA	3 Reel Hose Reel With Pump, Not Including Piping	4,180.28	1,587.12
11 11 19 00-0006	EA	4 Reel Hose Reel With Pumps, Not Including Piping	4,830.85	1,785.94
11 11 19 00-0007	EA	5 Reel Hose Reel With Pumps, Not Including Piping	5,484.17	1,982.92
11 11 19 00-0008	EA	Diesel Refueling Station, Including Valves, Hose, Nozzle And Stand	3,953.40	955.51
11 11 19 00-0009	EA	Lube Station, Including Valves, Hose, Nozzle And Stand	3,274.17	882.01

11 11 19 00-0010 Wash Reels And Supports ^(11 11 19)

11 11 19 00-0011	EA	Hose Reel With 100' Hose, 1-1/2" High Pressure Hose	1,502.22	87.55
11 11 19 00-0012	EA	Wash Station Support	706.39	175.91

11 11 19 00-0013 Pneumatic Powered Pump ^(11 11 19)

Note: Excludes air compressor.

11 11 19 00-0014	EA	Pumping Unit - Oil/Gear Lube	2,665.74	66.51
11 11 19 00-0015	EA	Pumping Unit - Grease	3,678.80	66.51

11 11 19 00-0016 Pumping Unit Accessories ^(11 11 19)

11 11 19 00-0017	EA	Hose Reel - 1,000 PSI- Oil/Lube	1,825.40	49.90
11 11 19 00-0018	EA	Hose Reel - 5,000 PSI- Grease	2,083.73	49.90
11 11 19 00-0019	EA	Hose Reel - 160 PSI- Air	1,374.59	49.90
11 11 19 00-0020	EA	Control Valve - Oil/Lube	767.49	24.99
11 11 19 00-0021	EA	Control Valve - Grease	412.92	24.99

11 11 26 Vehicle-Washing Equipment ^(11 11)

Note: Complete equipment and installation for system. Excludes earthwork, concrete foundation, walls or housing.

11 11 26 00-0001 Brushless Type ^(11 11 26)

11 11 26 00-0002	EA	30' Vehicle Wash Equipment, Brushless	201,142.16	
11 11 26 00-0003	EA	50' Vehicle Wash Equipment, Brushless	224,452.77	
11 11 26 00-0004	EA	100' Vehicle Wash Equipment, Brushless	290,560.79	
11 11 26 00-0005	EA	130' Vehicle Wash Equipment, Brushless	340,466.41	

11 11 26 00-0006 Brush Type ^(11 11 26)

11 11 26 00-0007	EA	30' Vehicle Wash Equipment, Brush	131,410.39	
11 11 26 00-0008	EA	50' Vehicle Wash Equipment, Brush	160,258.35	
11 11 26 00-0009	EA	100' Vehicle Wash Equipment, Brush	231,713.68	
11 11 26 00-0010	EA	130' Vehicle Wash Equipment, Brush	285,730.59	

11 11 26 00-0011 High Pressure Water System ^(11 11 26)

11 11 26 00-0012	EA	High Pressure Water Equipment	48,273.44	
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11	11 Equipment
	11 10 Vehicle And Pedestrian Equipment
	11 11 Vehicle Service Equipment



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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11 11 26 00-0013 Car Wash Package Water Heater, Gas Fired (11 11 26)
 Note: Continuous duty, high recovery.

11 11 26 00-0014	EA	180 MBH Car Wash Water Heater, 174 GPH.....	5,613.15	
11 11 26 00-0015	EA	280 MBH Car Wash Water Heater, 270 GPH.....	6,035.37	
11 11 26 00-0016	EA	400 MBH Car Wash Water Heater, 386 GPH.....	6,900.11	
11 11 26 00-0017	EA	480 MBH Car Wash Water Heater, 464 GPH.....	7,319.64	
11 11 26 00-0018	EA	605 MBH Car Wash Water Heater, 584 GPH.....	8,415.22	
11 11 26 00-0019	EA	700 MBH Car Wash Water Heater, 676 GPH.....	8,962.81	
11 11 26 00-0020	EA	1,000 MBH Car Wash Water Heater, 966 GPH.....	10,068.31	
11 11 26 00-0021	EA	1,200 MBH Car Wash Water Heater, 1,159 GPH.....	13,516.17	
11 11 26 00-0022	EA	1,400 MBH Car Wash Water Heater, 1,353 GPH.....	14,798.60	

11 12 Parking Control Equipment (11 10)

11 12 16 Parking Ticket Dispensers (11 12)

11 12 16 00-0001 Parking Ticket Dispensers (11 12 16)

11 12 16 00-0002	EA	Standard Parking Ticket Dispenser With Printer.....	5,350.28	145.02
11 12 16 00-0003	EA	Rate Computing Parking Ticket Dispenser With Printer.....	7,140.83	145.02

11 12 23 Parking Meters (11 12)

11 12 23 00-0001 Parking Meters (11 12 23)

11 12 23 00-0002	EA	Remove Parking Meter For Replacement Or Reinstall Existing Meter.....	162.47	
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11 12 26 Parking Fee Collection Equipment (11 12)

11 12 26 00-0001 Parking Fee Collection Equipment (11 12 26)

11 12 26 00-0002	EA	Multiple Station Slot Box For Parking Fee Collection.....	1,289.64	49.15
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11 12 33 Parking Gates (11 12)

11 12 33 13 Lift Arm Parking Gates (11 12 33)

11 12 33 13-0001 Barrier Parking Gate Operators (11 12 33 13)

11 12 33 13-0002 Barrier Parking Gate Operators (11 12 33 13-0001)

Note: Includes operator and barrier arm. Excludes access controls and concrete foundation.

11 12 33 13-0003	EA	12' Plastic Arm, 1/2 HP, 115 Volt AC, Barrier Parking Gate Operator (DKS™ DoorKing® 1601-080).....	2,627.58	201.07
		<i>For 230/460 Volt AC, Add</i>	322.50	
11 12 33 13-0004	EA	14' Wood Arm, 1/2 HP, 115 Volt AC, Barrier Parking Gate Operator (DKS™ DoorKing® 1601-080).....	2,618.58	201.07
		<i>For 230/460 Volt AC, Add</i>	322.50	
11 12 33 13-0005	EA	14' Aluminum Arm, 1/2 HP, 115 Volt AC, Barrier Parking Gate Operator (DKS™ DoorKing® 1601-080).....	2,732.58	201.07
		<i>For 230/460 Volt AC, Add</i>	322.50	
11 12 33 13-0006	EA	20' Three Piece Wood Arm, 1 HP, 115 Volt AC, Barrier Parking Gate Operator (DKS™ DoorKing® 1602-080).....	3,864.06	201.07
		<i>For 230/460 Volt AC, Add</i>	322.50	
11 12 33 13-0007	EA	14' Wood Arm, 1/3 HP, 115 Volt AC, Barrier Parking Gate Operator With Two Built-In Vehicle Detectors (Federal APD G-90 CD).....	4,514.91	201.07
11 12 33 13-0008	EA	14' Aluminum Arm, 1/3 HP, 115 Volt AC, Barrier Parking Gate Operator With Two Built-In Vehicle Detectors (Federal APD G-90 CD).....	4,694.91	201.07

11 12 33 13-0009 Barrier Parking Gate Operators With Tire Shredding Traffic Control Spikes

(11 12 33 13-0001)

Note: Includes operator, barrier arm and tire shredding traffic control spikes. Excludes access controls and concrete foundation.

11 12 33 13-0010	EA	14' Wood Arm, 1/2 HP, 115 Volt AC, Barrier Parking Gate Operator With 6' Section, Surface Mount, Tire Shredding Traffic Control Spikes (DKS™ DoorKing® 1603-080).....	7,921.81	402.16
11 12 33 13-0011	EA	14' Wood Arm, 1/2 HP, 115 Volt AC, Barrier Parking Gate Operator With 9' Section, Surface Mount, Tire Shredding Traffic Control Spikes (DKS™ DoorKing® 1603-080).....	9,262.24	402.16
11 12 33 13-0012	EA	14' Aluminum Arm, 1/2 HP, 115 Volt AC, Barrier Parking Gate Operator With 6' Section, Surface Mount, Tire Shredding Traffic Control Spikes (DKS™ DoorKing® 1603-080).....	7,989.31	402.16
11 12 33 13-0013	EA	14' Aluminum Arm, 1/2 HP, 115 Volt AC, Barrier Parking Gate Operator With 9' Section, Surface Mount, Tire Shredding Traffic Control Spikes (DKS™ DoorKing® 1603-080).....	9,329.74	402.16

11 12 33 13-0014 Barrier Parking Gate Operator Accessories (11 12 33 13-0001)

11 12 33 13-0015	EA	12' Plastic Replacement Arm For Barrier Parking Gate Operators.....	111.54	18.26
11 12 33 13-0016	EA	14' Wood Replacement Arm For Barrier Parking Gate Operators.....	102.54	18.26
11 12 33 13-0017	EA	14' Aluminum Replacement Arm For Barrier Parking Gate Operators.....	216.54	18.26
11 12 33 13-0018	EA	20' Three Piece Wood Replacement Arm For Barrier Parking Gate Operators.....	317.79	18.26
11 12 33 13-0019	EA	Folding Wood Replacement Arm For Barrier Parking Gate Operators.....	291.54	18.26
11 12 33 13-0020	EA	Folding Plastic Replacement Arm For Barrier Parking Gate Operators.....	291.54	18.26
11 12 33 13-0021	EA	Folding Aluminum Replacement Arm For Barrier Parking Gate Operators.....	351.54	18.26
11 12 33 13-0022	EA	Heater Kit For Barrier Parking Gate Operators (DKS™ DoorKing® 1601-092).....	387.95	109.61
11 12 33 13-0023	EA	Fan Kit For Barrier Parking Gate Operators (DKS™ DoorKing® 1601-093).....	387.95	109.61
11 12 33 13-0024	EA	Single Channel Detector Loop For Barrier Parking Gate Operators (DKS™ DoorKing® 9410-010).....	405.36	



Equipment	11	
Vehicle And Pedestrian Equipment	11 10	11
Parking Control Equipment	11 12	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
11 12 33 13-0025 EA Two Channel Detector Loop For Barrier Parking Gate Operators (Federal APD DLD-10B).....	1,017.22	
11 12 33 13-0026 EA 36" Tall, Gooseneck Style, Single Mount, 2' x 2' Steel, Exterior Mounting Post For Gate Operator Access Controls (Federal APD)	564.48	18.26
Note: Includes mounting plate and hardware. Excludes concrete foundation.		
11 12 36 Tire Shredders (11 12)		
11 12 36 00-0001 Tire Shredding Traffic Control Spikes (11 12 36)		
11 12 36 00-0002 Flush Mount, Tire Shredding Traffic Control Spikes (11 12 36 00-0001)		
11 12 36 00-0003 EA 6' Section, Flush Mount, Tire Shredding Traffic Control Spikes (DKS™ DoorKing® 1610-081).....	1,304.77	292.27
11 12 36 00-0004 Surface Mount, Tire Shredding Traffic Control Spikes (11 12 36 00-0001)		
11 12 36 00-0005 EA 3' Section With End Caps, Surface Mount, Tire Shredding Traffic Control Spikes (DKS™ DoorKing® 1610-088).....	2,171.14	146.14
11 12 36 00-0006 EA 3' Add-On Section, Surface Mount, Tire Shredding Traffic Control Spikes (DKS™ DoorKing® 1610-087)	1,571.14	146.14
11 12 36 00-0007 Warning Signs And Signals For Tire Shredding Traffic Control Spikes (11 12 36 00-0001)		
11 12 36 00-0008 EA Warning Sign For Tire Shredding Traffic Control Spikes (DKS™ DoorKing® 1615).....	987.11	54.80
Note: Includes light and mounting post.		
11 12 36 00-0009 EA Traffic Light Assembly For Tire Shredding Traffic Control Spikes (DKS™ DoorKing® 1603).....	828.64	73.07
Note: Includes mounting post and hardware.		
11 13 Loading Dock Equipment (11 10)		
11 13 13 Loading Dock Bumpers (11 13)		
11 13 13 00-0001 Laminated Rubber Dock Bumpers (11 13 13)		
11 13 13 00-0002 4-1/2" Projection, Laminated Rubber Dock Bumpers (11 13 13 00-0001)		
11 13 13 00-0003 EA 14" x 6", 4-1/2" Projection, Laminated Rubber Dock Bumper	97.66	14.37
11 13 13 00-0004 EA 24" x 6", 4-1/2" Projection, Laminated Rubber Dock Bumper	125.16	14.37
11 13 13 00-0005 EA 36" x 6", 4-1/2" Projection, Laminated Rubber Dock Bumper	163.95	14.37
11 13 13 00-0006 EA 12" x 10", 4-1/2" Projection, Laminated Rubber Dock Bumper	109.38	14.37
11 13 13 00-0007 EA 14" x 10", 4-1/2" Projection, Laminated Rubber Dock Bumper	119.10	14.37
11 13 13 00-0008 EA 18" x 10", 4-1/2" Projection, Laminated Rubber Dock Bumper	136.47	14.37
11 13 13 00-0009 EA 24" x 10", 4-1/2" Projection, Laminated Rubber Dock Bumper	163.95	14.37
11 13 13 00-0010 EA 36" x 10", 4-1/2" Projection, Laminated Rubber Dock Bumper	226.02	14.37
11 13 13 00-0011 EA 12" x 12", 4-1/2" Projection, Laminated Rubber Dock Bumper	124.90	14.37
11 13 13 00-0012 EA 12" x 14", 4-1/2" Projection, Laminated Rubber Dock Bumper	136.47	14.37
11 13 13 00-0013 EA 12" x 18", 4-1/2" Projection, Laminated Rubber Dock Bumper	169.48	14.37
11 13 13 00-0014 EA 12" x 24", 4-1/2" Projection, Laminated Rubber Dock Bumper	192.88	14.37
11 13 13 00-0015 EA 12" x 36", 4-1/2" Projection, Laminated Rubber Dock Bumper	268.89	14.37
11 13 13 00-0016 EA 11" x 20", 4-1/2" Projection, Laminated Rubber Dock Bumper	155.80	14.37
11 13 13 00-0017 EA 11" x 24", 4-1/2" Projection, Laminated Rubber Dock Bumper	183.02	14.37
11 13 13 00-0018 EA 11" x 36", 4-1/2" Projection, Laminated Rubber Dock Bumper	241.01	14.37
11 13 13 00-0019 6" Projection, Laminated Rubber Dock Bumpers (11 13 13 00-0001)		
11 13 13 00-0020 EA 12" x 10", 6" Projection, Laminated Rubber Dock Bumper	139.91	14.37
11 13 13 00-0021 EA 14" x 10", 6" Projection, Laminated Rubber Dock Bumper	149.51	14.37
11 13 13 00-0022 EA 18" x 10", 6" Projection, Laminated Rubber Dock Bumper	172.66	14.37
11 13 13 00-0023 EA 24" x 10", 6" Projection, Laminated Rubber Dock Bumper	207.90	14.37
11 13 13 00-0024 EA 36" x 10", 6" Projection, Laminated Rubber Dock Bumper	285.88	14.37
11 13 13 00-0025 EA 12" x 12", 6" Projection, Laminated Rubber Dock Bumper	161.22	14.37
11 13 13 00-0026 EA 14" x 12", 6" Projection, Laminated Rubber Dock Bumper	169.11	14.37
11 13 13 00-0027 EA 18" x 12", 6" Projection, Laminated Rubber Dock Bumper	200.41	14.37
11 13 13 00-0028 EA 24" x 12", 6" Projection, Laminated Rubber Dock Bumper	247.09	14.37
11 13 13 00-0029 EA 36" x 12", 6" Projection, Laminated Rubber Dock Bumper	377.81	14.37
11 13 13 00-0030 EA 11" x 20", 6" Projection, Laminated Rubber Dock Bumper	208.03	14.37
11 13 13 00-0031 EA 11" x 24", 6" Projection, Laminated Rubber Dock Bumper	239.33	14.37
11 13 13 00-0032 EA 11" x 36", 6" Projection, Laminated Rubber Dock Bumper	243.50	14.37
11 13 13 00-0033 Extruded Rubber Dock Bumpers (11 13 13)		
11 13 13 00-0034 1-3/4" Projection, Extruded Rubber Dock Bumpers (11 13 13 00-0033)		
11 13 13 00-0035 EA 12" x 2", 1-3/4" Projection, Extruded Rubber Dock Bumper	49.28	14.37
11 13 13 00-0036 EA 18" x 2", 1-3/4" Projection, Extruded Rubber Dock Bumper	53.15	14.37
11 13 13 00-0037 EA 24" x 2", 1-3/4" Projection, Extruded Rubber Dock Bumper	58.30	14.37
11 13 13 00-0038 EA 36" x 2", 1-3/4" Projection, Extruded Rubber Dock Bumper	63.46	14.37
11 13 13 00-0039 4" Projection, Extruded Rubber Dock Bumpers (11 13 13 00-0033)		
11 13 13 00-0040 EA 12" x 4-1/2", 4" Projection, Extruded Rubber Dock Bumper	69.49	14.37
11 13 13 00-0041 EA 18" x 4-1/2", 4" Projection, Extruded Rubber Dock Bumper	85.75	14.37
11 13 13 00-0042 EA 24" x 4-1/2", 4" Projection, Extruded Rubber Dock Bumper	90.43	14.37
11 13 13 00-0043 EA 36" x 4-1/2", 4" Projection, Extruded Rubber Dock Bumper	101.09	14.37

11	11 Equipment
	11 10 Vehicle And Pedestrian Equipment
	11 13 Loading Dock Equipment



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
11 13 13 00-0044 6" Projection, Extruded Rubber Dock Bumpers <small>(11 13 13 00-0033)</small>		
11 13 13 00-0045 EA 12" x 6", 6" Projection, Extruded Rubber Dock Bumper.....	85.50	14.37
11 13 13 00-0046 EA 18" x 6", 6" Projection, Extruded Rubber Dock Bumper.....	107.41	14.37
11 13 13 00-0047 EA 24" x 6", 6" Projection, Extruded Rubber Dock Bumper.....	125.45	14.37
11 13 13 00-0048 EA 36" x 6", 6" Projection, Extruded Rubber Dock Bumper.....	159.88	14.37
11 13 13 00-0049 Molded Rubber Dock Bumpers <small>(11 13 13)</small>		
11 13 13 00-0050 Rectangular Molded Rubber Dock Bumpers <small>(11 13 13 00-0049)</small>		
11 13 13 00-0051 EA 18" x 8", 2" Projection, Rectangular Molded Rubber Dock Bumper.....	71.64	14.37
11 13 13 00-0052 EA 10" x 4-1/2", 3" Projection, Rectangular Molded Rubber Dock Bumper.....	61.68	14.37
11 13 13 00-0053 EA 20" x 4-1/2", 3" Projection, Rectangular Molded Rubber Dock Bumper.....	84.39	14.37
11 13 13 00-0054 EA 30" x 4-1/2", 3" Projection, Rectangular Molded Rubber Dock Bumper.....	107.30	14.37
11 13 13 00-0055 EA 24" x 12", 3" Projection, Rectangular Molded Rubber Dock Bumper.....	112.70	14.37
11 13 13 00-0056 EA 13" x 10", 4" Projection, Rectangular Molded Rubber Dock Bumper.....	81.79	14.37
11 13 13 00-0057 EA 18" x 10", 4" Projection, Rectangular Molded Rubber Dock Bumper.....	108.21	14.37
11 13 13 00-0058 EA 30" x 10", 4" Projection, Rectangular Molded Rubber Dock Bumper.....	162.60	14.37
11 13 13 00-0059 EA 13" x 12", 4" Projection, Rectangular Molded Rubber Dock Bumper.....	89.69	14.37
11 13 13 00-0060 EA 24" x 12", 4" Projection, Rectangular Molded Rubber Dock Bumper.....	138.01	14.37
11 13 13 00-0061 EA 18" x 18", 4" Projection, Rectangular Molded Rubber Dock Bumper.....	137.53	14.37
11 13 13 00-0062 EA 24" x 12", 6" Projection, Rectangular Molded Rubber Dock Bumper.....	211.36	14.37
11 13 13 00-0063 T And L Shaped Rubber Dock Bumpers <small>(11 13 13 00-0049)</small>		
11 13 13 00-0064 EA 22" x 22", 3" Projection, T Shaped Molded Rubber Dock Bumper.....	130.09	14.37
11 13 13 00-0065 EA 18" x 18", 4" Projection, L Shaped Molded Rubber Dock Bumper.....	121.02	14.37
11 13 16 Loading Dock Seals And Shelters <small>(11 13)</small>		
11 13 16 13 Loading Dock Seals <small>(11 13 16)</small>		
11 13 16 13-0001 Vinyl Loading Dock Seals <small>(11 13 16 13)</small>		
11 13 16 13-0002 LF 10" Projection, Standard Vinyl Dock Seal.....	57.89	14.37
11 13 16 13-0003 LF 11" Projection, Standard Vinyl Dock Seal.....	58.85	14.37
11 13 16 13-0004 LF 12" Projection, Standard Vinyl Dock Seal.....	59.76	14.37
11 13 16 13-0005 LF 13" Projection, Standard Vinyl Dock Seal.....	60.66	14.37
11 13 16 13-0006 LF 14" Projection, Standard Vinyl Dock Seal.....	61.67	14.37
11 13 16 13-0007 LF 15" Projection, Standard Vinyl Dock Seal.....	62.58	14.37
11 13 16 13-0008 LF 16" Projection, Standard Vinyl Dock Seal.....	63.59	14.37
11 13 16 13-0009 LF 17" Projection, Standard Vinyl Dock Seal.....	64.45	14.37
11 13 16 13-0010 LF 18" Projection, Standard Vinyl Dock Seal.....	65.45	14.37
11 13 16 13-0011 LF 19" Projection, Standard Vinyl Dock Seal.....	66.22	14.37
11 13 16 13-0012 LF 20" Projection, Standard Vinyl Dock Seal.....	67.22	14.37
11 13 16 13-0013 Drape Style, Vinyl Loading Dock Seals <small>(11 13 16 13)</small>		
11 13 16 13-0014 LF 10" Projection, Drape Style Vinyl Dock Seal.....	57.00	14.37
11 13 16 13-0015 LF 12" Projection, Drape Style Vinyl Dock Seal.....	58.45	14.37
11 13 16 13-0016 LF 14" Projection, Drape Style Vinyl Dock Seal.....	61.60	14.37
11 13 16 13-0017 LF 16" Projection, Drape Style Vinyl Dock Seal.....	64.80	14.37
11 13 16 13-0018 LF 18" Projection, Drape Style Vinyl Dock Seal.....	67.96	14.37
11 13 16 13-0019 LF 20" Projection, Drape Style Vinyl Dock Seal.....	71.20	14.37
11 13 16 13-0020 LF 22" Projection, Drape Style Vinyl Dock Seal.....	74.40	14.37
11 13 16 23 Loading Dock Shelters <small>(11 13 16)</small>		
11 13 16 23-0001 Retractable Vinyl Loading Dock Shelter <small>(11 13 16 23)</small>		
11 13 16 23-0002 LF Retractable Vinyl Dock Shelters, Scissor Arms.....	109.69	17.95
11 13 16 23-0003 Rigid Loading Dock Shelters <small>(11 13 16 23)</small>		
11 13 16 23-0004 LF 18" Projection, Rigid Loading Dock Shelter.....	80.59	17.24
11 13 16 23-0005 LF 24" Projection, Rigid Loading Dock Shelter.....	84.23	17.24
11 13 16 23-0006 LF 30" Projection, Rigid Loading Dock Shelter.....	87.47	17.95
11 13 16 23-0007 LF 36" Projection, Rigid Loading Dock Shelter.....	89.98	17.95
11 13 19 Stationary Loading Dock Equipment <small>(11 13)</small>		
<small>Note: Includes all anchor bolts and fasteners.</small>		
11 13 19 13 Loading Dock Levelers <small>(11 13 19)</small>		
11 13 19 13-0001 Hydraulic Dock Levelers <small>(11 13 19 13)</small>		
11 13 19 13-0002 20,000 LB Hydraulic Dock Levelers <small>(11 13 19 13-0001)</small>		
11 13 19 13-0003 EA 6' x 6', 20,000 LB Hydraulic Dock Leveler.....	7,143.97	649.82
11 13 19 13-0004 EA 6' x 8', 20,000 LB Hydraulic Dock Leveler.....	7,632.47	722.03



Equipment	11	
Vehicle And Pedestrian Equipment	11 10	11
Loading Dock Equipment	11 13	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
11 13 19 13-0005	EA		6' x 10', 20,000 LB Hydraulic Dock Leveler.....	9,372.06	866.43
11 13 19 13-0006	EA		7' x 6', 20,000 LB Hydraulic Dock Leveler.....	7,602.15	722.03
11 13 19 13-0007	EA		7' x 8', 20,000 LB Hydraulic Dock Leveler.....	8,265.80	794.22
11 13 19 13-0008	EA		7' x 10', 20,000 LB Hydraulic Dock Leveler.....	9,914.82	866.43
11 13 19 13-0009			25,000 LB Hydraulic Dock Levelers (11 13 19 13-0001)		
11 13 19 13-0010	EA		6' x 6', 25,000 LB Hydraulic Dock Leveler.....	7,297.22	649.82
11 13 19 13-0011	EA		6' x 8', 25,000 LB Hydraulic Dock Leveler.....	7,791.87	722.03
11 13 19 13-0012	EA		6' x 10', 25,000 LB Hydraulic Dock Leveler.....	9,521.44	866.43
11 13 19 13-0013	EA		7' x 6', 25,000 LB Hydraulic Dock Leveler.....	7,752.88	722.03
11 13 19 13-0014	EA		7' x 8', 25,000 LB Hydraulic Dock Leveler.....	8,405.80	794.22
11 13 19 13-0015	EA		7' x 10', 25,000 LB Hydraulic Dock Leveler.....	10,207.46	866.43
11 13 19 13-0016			30,000 LB Hydraulic Dock Levelers (11 13 19 13-0001)		
11 13 19 13-0017	EA		6' x 6', 30,000 LB Hydraulic Dock Leveler.....	7,629.68	758.13
11 13 19 13-0018	EA		6' x 8', 30,000 LB Hydraulic Dock Leveler.....	8,112.08	866.43
11 13 19 13-0019	EA		6' x 10', 30,000 LB Hydraulic Dock Leveler.....	9,897.22	1,010.83
11 13 19 13-0020	EA		7' x 6', 30,000 LB Hydraulic Dock Leveler.....	8,112.08	866.43
11 13 19 13-0021	EA		7' x 8', 30,000 LB Hydraulic Dock Leveler.....	8,745.41	974.73
11 13 19 13-0022	EA		7' x 10', 30,000 LB Hydraulic Dock Leveler.....	10,530.55	974.73
11 13 19 13-0023			35,000 LB Hydraulic Dock Levelers (11 13 19 13-0001)		
11 13 19 13-0024	EA		6' x 6', 35,000 LB Hydraulic Dock Leveler.....	7,898.61	722.03
11 13 19 13-0025	EA		6' x 8', 35,000 LB Hydraulic Dock Leveler.....	8,382.07	794.22
11 13 19 13-0026	EA		6' x 10', 35,000 LB Hydraulic Dock Leveler.....	10,563.53	938.64
11 13 19 13-0027	EA		7' x 6', 35,000 LB Hydraulic Dock Leveler.....	8,382.07	794.22
11 13 19 13-0028	EA		7' x 8', 35,000 LB Hydraulic Dock Leveler.....	9,098.08	866.43
11 13 19 13-0029	EA		7' x 10', 35,000 LB Hydraulic Dock Leveler.....	10,914.99	1,010.83
11 13 19 13-0030			40,000 LB Hydraulic Dock Levelers (11 13 19 13-0001)		
11 13 19 13-0031	EA		6' x 6', 40,000 LB Hydraulic Dock Leveler.....	8,384.60	722.03
11 13 19 13-0032	EA		6' x 8', 40,000 LB Hydraulic Dock Leveler.....	8,867.54	794.22
11 13 19 13-0033	EA		6' x 10', 40,000 LB Hydraulic Dock Leveler.....	10,674.92	938.64
11 13 19 13-0034	EA		7' x 6', 40,000 LB Hydraulic Dock Leveler.....	8,867.54	794.22
11 13 19 13-0035	EA		7' x 8', 40,000 LB Hydraulic Dock Leveler.....	9,584.20	866.43
11 13 19 13-0036	EA		7' x 10', 40,000 LB Hydraulic Dock Leveler.....	11,400.88	1,010.83
11 13 19 13-0037			45,000 LB Hydraulic Dock Levelers (11 13 19 13-0001)		
11 13 19 13-0038	EA		6' x 6', 45,000 LB Hydraulic Dock Leveler.....	8,776.01	794.22
11 13 19 13-0039	EA		6' x 8', 45,000 LB Hydraulic Dock Leveler.....	9,265.61	866.43
11 13 19 13-0040	EA		6' x 10', 45,000 LB Hydraulic Dock Leveler.....	11,065.20	1,010.83
11 13 19 13-0041	EA		7' x 6', 45,000 LB Hydraulic Dock Leveler.....	9,266.70	866.43
11 13 19 13-0042	EA		7' x 8', 45,000 LB Hydraulic Dock Leveler.....	9,978.36	938.64
11 13 19 13-0043	EA		7' x 10', 45,000 LB Hydraulic Dock Leveler.....	11,785.17	1,083.04
11 13 19 13-0044			Manual Dock Levelers (11 13 19 13)		
11 13 19 13-0045			20,000 LB Manual Dock Levelers (11 13 19 13-0044)		
11 13 19 13-0046	EA		6' x 6', 20,000 LB Manual Dock Leveler.....	5,561.97	649.82
11 13 19 13-0047	EA		6' x 8', 20,000 LB Manual Dock Leveler.....	6,060.46	722.03
11 13 19 13-0048	EA		6' x 10', 20,000 LB Manual Dock Leveler.....	7,790.06	866.43
11 13 19 13-0049	EA		7' x 6', 20,000 LB Manual Dock Leveler.....	6,021.57	722.03
11 13 19 13-0050	EA		7' x 8', 20,000 LB Manual Dock Leveler.....	6,683.80	794.22
11 13 19 13-0051	EA		7' x 10', 20,000 LB Manual Dock Leveler.....	8,494.16	866.43
11 13 19 13-0052			40,000 LB Manual Dock Levelers (11 13 19 13-0044)		
11 13 19 13-0053	EA		6' x 6', 40,000 LB Manual Dock Leveler.....	6,942.52	722.03
11 13 19 13-0054	EA		6' x 8', 40,000 LB Manual Dock Leveler.....	7,425.46	794.22
11 13 19 13-0055	EA		6' x 10', 40,000 LB Manual Dock Leveler.....	8,007.79	938.64
11 13 19 13-0056	EA		7' x 6', 40,000 LB Manual Dock Leveler.....	7,425.46	794.22
11 13 19 13-0057	EA		7' x 8', 40,000 LB Manual Dock Leveler.....	8,469.09	866.43
11 13 19 13-0058	EA		7' x 10', 40,000 LB Manual Dock Leveler.....	9,958.80	1,010.83
11 13 19 13-0059			Edge-Of-Dock Levelers (11 13 19 13)		
Note: Mounted on face of dock, single torsion bar counter balance, includes bumpers.					
11 13 19 13-0060			Hydraulic Edge-Of-Dock Levelers (11 13 19 13-0059)		
11 13 19 13-0061	EA		66" Usable Width, 20,000 LB Edge-Of-Dock Leveler, Hydraulic.....	3,178.77	216.61
11 13 19 13-0062	EA		72" Usable Width, 20,000 LB Edge-Of-Dock Leveler, Hydraulic.....	3,440.74	216.61
11 13 19 13-0063	EA		66" Usable Width, 25,000 LB Edge-Of-Dock Leveler, Hydraulic.....	3,402.83	216.61
11 13 19 13-0064	EA		72" Usable Width, 25,000 LB Edge-Of-Dock Leveler, Hydraulic.....	3,762.47	216.61

11	11 Equipment
	11 10 Vehicle And Pedestrian Equipment
	11 13 Loading Dock Equipment



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
11 13 19 13-0065 Manual Edge-Of-Dock Levelers <small>(11 13 19 13-0065)</small>		
11 13 19 13-0066 EA 66" Usable Width, 20,000 LB Edge-Of-Dock Leveler, Manual.....	1,575.54	216.61
11 13 19 13-0067 EA 72" Usable Width, 20,000 LB Edge-Of-Dock Leveler, Manual.....	1,666.94	216.61
11 13 19 13-0068 EA 66" Usable Width, 25,000 LB Edge-Of-Dock Leveler, Manual.....	1,715.20	216.61
11 13 19 13-0069 EA 72" Usable Width, 25,000 LB Edge-Of-Dock Leveler, Manual.....	1,833.56	216.61
11 13 19 23 Stationary Loading Dock Lifts <small>(11 13 19)</small>		
11 13 19 23-0001 Top Of Ground, Fixed Platform Lifts <small>(11 13 19 23)</small>		
11 13 19 23-0002 EA 6' x 8', 5,500 LB Top Of Ground, Fixed Platform Lift.....	13,534.69	145.09
11 13 19 23-0003 Pit Mounted, Fixed Platform Lifts <small>(11 13 19 23)</small>		
11 13 19 23-0004 EA 6' x 8', 5,000 LB Fixed Platform Lift, Pit Mounted.....	9,114.76	145.09
11 13 19 23-0005 EA 6' x 8', 8,000 LB Fixed Platform Lift, Pit Mounted.....	16,777.00	217.62
11 13 19 23-0006 EA 7' x 12', 15,000 LB Fixed Platform Lift, Pit Mounted.....	29,584.97	435.26
11 13 19 23-0007 EA 8' x 20', 15,000 LB Fixed Platform Lift, Pit Mounted.....	30,904.20	580.34
11 13 19 26 Loading Dock Truck Lifts <small>(11 13 19)</small>		
11 13 19 26-0001 Hydraulic Truck Lifts <small>(11 13 19 26)</small>		
11 13 19 26-0002 EA 10' x 15', 60,000 LB Platform Truck Lift	27,608.81	1,353.27
11 13 19 26-0003 EA 10' x 20', 60,000 LB Platform Truck Lift	31,569.25	1,623.93
11 13 19 33 Loading Dock Truck Restraints <small>(11 13 19)</small>		
11 13 19 33-0001 Truck Restraint System <small>(11 13 19 33)</small>		
11 13 19 33-0002 EA Truck Restraint System (Poweramp Powerstop AAL).....	6,401.38	270.76
Note: Includes push button controls, warning lights, alarms, 30,000 LB holding force, all mounting plates, bolts, welds, warning signs, gasketed weatherproof box for controls, 120 V UL listed.		
11 13 19 33-0003 EA Rotating Hook Truck Restraint System (Kelley Star 4)	4,432.81	270.76
Note: Includes push button controls, warning lights, alarms, 32,000 LB holding force, all mounting plates, bolts, welds, warning signs, gasketed weatherproof box for controls, 120 V UL listed.		
11 13 23 Portable Dock Equipment <small>(11 13)</small>		
11 13 23 23 Portable Dock Platforms <small>(11 13 23)</small>		
11 13 23 23-0001 EA 6' x 6', 5,000 LB Capacity Portable Platform Lift.....	13,720.81	91.33
11 13 26 Loading Dock Lights <small>(11 13)</small>		
11 13 26 00-0001 Communication Lights <small>(11 13 26)</small>		
11 13 26 00-0002 EA Console Controlled, Dock Communication Light, Stop And Go Red Light Style, 12 Or 24 Volt DC Or 115 Volt AC.....	220.19	60.42
Note: Excludes control console.		
11 13 26 00-0003 EA Toggle Switch Controlled, Dock Communication Light, Stop And Go Red Light Style, With Solid State Flasher, 12 Or 24 Volt DC Or 115 Volt AC	269.38	60.42
11 13 26 00-0004 EA Dock Guide Light For Truck Backing	125.55	48.34
11 13 26 00-0005 Communication Lights Controls <small>(11 13 26)</small>		
11 13 26 00-0006 EA Dock Communication Lights Control Console For Up To Two Docks.....	245.48	80.57
11 13 26 00-0007 Loading Dock Lights <small>(11 13 26)</small>		
11 13 26 00-0008 Incandescent Loading Dock Lights <small>(11 13 26 00-0007)</small>		
11 13 26 00-0009 EA 24" Long, Single Arm Loading Dock Light, 300W Incandescent.....	340.36	80.57
11 13 26 00-0010 EA 40" Long, Dual Arm Loading Dock Light, 300W Incandescent.....	299.30	80.57
11 13 26 00-0011 EA 60" Long, Dual Arm Loading Dock Light, 300W Incandescent.....	402.87	80.57
11 13 26 00-0012 Metal Halide Loading Dock Lights <small>(11 13 26 00-0007)</small>		
11 13 26 00-0013 EA 24" Long, Single Arm Loading Dock Light, 100W Metal Halide	482.26	80.57
11 13 26 00-0014 EA 40" Long, Dual Arm Loading Dock Light, 100W Metal Halide	530.92	80.57
11 13 26 00-0015 EA 60" Long, Dual Arm Loading Dock Light, 100W Metal Halide.....	569.83	80.57
11 13 26 00-0016 Quartz Halogen Loading Dock Lights <small>(11 13 26 00-0007)</small>		
11 13 26 00-0017 EA 24" Long, Single Arm Loading Dock Light, 500W Quartz Halogen	293.83	80.57
11 13 26 00-0018 EA 40" Long, Dual Arm Loading Dock Light, 500W Quartz Halogen.....	324.61	80.57
11 13 26 00-0019 EA 60" Long, Dual Arm Loading Dock Light, 500W Quartz Halogen.....	350.89	80.57

11 14 Pedestrian Control Equipment (11 10)



Equipment	11	
Vehicle And Pedestrian Equipment	11 10	11
Pedestrian Control Equipment	11 14	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
11 14 13 Pedestrian Gates ^(11 14)		
11 14 13 16 Rotary Gates ^(11 14 13)		
11 14 13 16-0001 Access Control Indoor Or Outdoor Impenetrability ^(11 14 13 16)		
11 14 13 16-0002 Mechanical ^(11 14 13 16-0001)		
11 14 13 16-0003 Galvanized Steel ^(11 14 13 16-0002)		
11 14 13 16-0004 EA One-Way, Single 7' High Exit Rotary Gate, 3 Rotor Sections, Galvanized Steel	6,553.85	917.19
11 14 13 16-0005 EA One-Way, Single 7' High Exit Rotary Gate, 4 Rotor Sections, Galvanized Steel	7,369.42	917.19
11 14 13 16-0006 EA One-Way, "Handicapped" 7' High Exit Rotary Gate, 4 Rotor Sections, Galvanized Steel	14,562.68	1,368.41
11 14 13 16-0007 EA One-Way, Double 7' High Exit Rotary Gate, 3 Or 4 Rotor Sections, Galvanized Steel.....	14,112.92	1,368.41
11 14 13 16-0008 Powder Coated Steel ^(11 14 13 16-0002)		
11 14 13 16-0009 EA One-Way, Single 7' High Exit Rotary Gate, 3 Rotor Sections, Powder Coated Steel	7,379.91	917.19
11 14 13 16-0010 EA One-Way, Single 7' High Exit Rotary Gate, 4 Rotor Sections, Powder Coated Steel	8,163.99	917.19
11 14 13 16-0011 EA One-Way, "Handicapped" 7' High Exit Rotary Gate, 3 Rotor Sections, Powder Coated Steel.....	17,127.81	1,368.41
11 14 13 16-0012 EA One-Way, Double 7' High Exit Rotary Gate, 3 Rotor Sections, Powder Coated Steel.....	15,468.20	1,368.41
11 14 13 16-0013 Anodized Aluminum ^(11 14 13 16-0002)		
11 14 13 16-0014 EA One-Way, Single 7' High Exit Rotary Gate, 3 Rotor Sections, Anodized Aluminum With Stainless Steel Arms	7,738.22	917.19
11 14 13 16-0015 EA One-Way, Single 7' High Exit Rotary Gate, 3 Rotor Sections, Complete Anodized Aluminum	13,226.79	917.19
11 14 13 16-0016 EA One-Way, Double 7' High Exit Rotary Gate, 3 Rotor Sections, Anodized Aluminum With Stainless Steel Arms.....	15,402.23	1,368.41
11 14 13 16-0017 EA One-Way, Double 7' High Exit Rotary Gate, 3 Rotor Sections, Complete Anodized Aluminum.....	25,740.71	1,368.41
11 14 13 16-0018 Stainless Steel ^(11 14 13 16-0002)		
11 14 13 16-0019 EA One-Way, Single 7' High Exit Rotary Gate, 3 Rotor Sections, Stainless Steel	12,078.40	917.19
11 14 13 16-0020 EA One-Way, Single 7' High Exit Rotary Gate, 4 Rotor Sections, Stainless Steel	13,526.63	917.19
11 14 13 16-0021 EA One-Way, "Handicapped" 7' High Exit Rotary Gate, 3 Rotor Sections, Stainless Steel.....	19,360.12	1,368.41
11 14 13 16-0022 EA One-Way, Double 7' High Exit Rotary Gate, 3 Rotor Sections, Stainless Steel	24,067.61	1,368.41
11 14 13 16-0023 Transparent ^(11 14 13 16-0002)		
11 14 13 16-0024 EA One-Way, Single 7' High Exit Rotary Gate, 3 Rotor Sections, Transparent.....	23,721.19	917.32
11 14 13 16-0025 Mechanical Options ^(11 14 13 16-0001)		
11 14 13 16-0026 EA Out-of-Use Lock Option, Add.....	127.43	
11 14 13 16-0027 EA Heel Protector (Each Heel Protector), Add	89.95	
11 14 13 16-0028 Electrical, One-Way ^(11 14 13 16-0001)		
11 14 13 16-0029 Galvanized Steel ^(11 14 13 16-0028)		
11 14 13 16-0030 EA One-Way, Single 7' High Exit Rotary Gate, Electric, 3 Rotor Sections, Galvanized Steel	6,915.16	917.19
11 14 13 16-0031 EA One-Way, Single 7' High Exit Rotary Gate, Electric, 4 Rotor Sections, Galvanized Steel	7,732.22	917.19
11 14 13 16-0032 EA One-Way, "Handicapped" 7' High Exit Rotary Gate, Electric, 3 Rotor Sections, Galvanized Steel.....	15,911.96	1,368.41
11 14 13 16-0033 EA One-Way, Double 7' High Exit Rotary Gate, Electric, 3 Rotor Sections, Galvanized Steel	14,696.11	1,368.41
11 14 13 16-0034 EA One-Way, Double 7' High Exit Rotary Gate, Electric, 4 Rotor Sections, Galvanized Steel	15,911.96	1,368.41
11 14 13 16-0035 Powder Coated Steel ^(11 14 13 16-0028)		
11 14 13 16-0036 EA One-Way, Single 7' High Exit Rotary Gate, Electric, 3 Rotor Sections, Powder Coated Steel.....	7,739.72	917.19
11 14 13 16-0037 EA One-Way, Single 7' High Exit Rotary Gate, Electric, 4 Rotor Sections, Powder Coated Steel.....	8,652.73	917.19
11 14 13 16-0038 EA One-Way, "Handicapped" 7' High Exit Rotary Gate, Electric, 3 Rotor Sections, Powder Coated Steel.....	21,172.65	1,368.41
11 14 13 16-0039 EA One-Way, Double 7' High Exit Rotary Gate, Electric, 3 Rotor Sections, Powder Coated Steel	16,058.88	1,368.41
11 14 13 16-0040 EA One-Way, Double 7' High Exit Rotary Gate, Electric, 4 Rotor Sections, Powder Coated Steel	17,277.73	1,368.41
11 14 13 16-0041 Anodized Aluminum ^(11 14 13 16-0028)		
11 14 13 16-0042 EA One-Way, Single 7' High Exit Rotary Gate, Electric, 3 Rotor Sections, Anodized Aluminum With Stainless Steel Arms	7,889.64	917.19
11 14 13 16-0043 EA One-Way, Single 7' High Exit Rotary Gate, Electric, 4 Rotor Sections, Anodized Aluminum With Stainless Steel Arms	8,354.39	917.19
11 14 13 16-0044 EA One-Way, Single 7' High Exit Rotary Gate, Electric, 3 Rotor Sections, Complete Anodized Aluminum	13,676.55	917.19
11 14 13 16-0045 EA One-Way, Double 7' High Exit Rotary Gate, Electric, 3 Rotor Sections, Anodized Aluminum With Stainless Steel Arms	16,228.29	1,368.41
11 14 13 16-0046 EA One-Way, Double 7' High Exit Rotary Gate, Electric, 4 Rotor Sections, Anodized Aluminum With Stainless Steel Arms	18,010.84	1,368.41
11 14 13 16-0047 EA One-Way, Double 7' High Exit Rotary Gate, Electric, 3 Rotor Sections, Complete Anodized Aluminum	26,518.80	1,368.41
11 14 13 16-0048 Stainless Steel ^(11 14 13 16-0028)		
11 14 13 16-0049 EA One-Way, Single 7' High Exit Rotary Gate, Electric, 3 Rotor Sections, Stainless Steel.....	12,835.50	917.19
11 14 13 16-0050 EA One-Way, Single 7' High Exit Rotary Gate, Electric, 4 Rotor Sections, Stainless Steel.....	13,720.03	917.19
11 14 13 16-0051 EA One-Way, "Handicapped" 7' High Exit Rotary Gate, Electric, 3 Rotor Sections, Stainless Steel	22,172.62	1,368.41

11 Equipment**11 10 Vehicle And Pedestrian Equipment****11 14 Pedestrian Control Equipment**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
11 14 13 16-0052 EA One-Way, Double 7' High Exit Rotary Gate, Electric, 3 Rotor Sections, Stainless Steel.....	25,223.49	1,368.41
11 14 13 16-0053 EA One-Way, Double 7' High Exit Rotary Gate, Electric, 4 Rotor Sections, Stainless Steel.....	27,770.63	1,368.41
11 14 13 16-0054 Transparent <small>(11 14 13 16-0028)</small>		
11 14 13 16-0055 EA One-Way, Single 7' High Exit Rotary Gate, Electric, 3 Rotor Sections, Transparent Arms.....	21,656.79	917.32
11 14 13 16-0056 EA One-Way, Single 7' High Exit Rotary Gate, Electric, 4 Rotor Sections, Transparent Arms.....	22,910.12	917.32
11 14 13 16-0057 EA One-Way, Single 7' High Exit Rotary Gate, Electric, 3 Rotor Sections, Transparent Panels.....	23,457.33	917.32
11 14 13 16-0058 EA One-Way, Double 7' High Exit Rotary Gate, Electric, 3 Rotor Sections, Transparent Arms.....	38,549.88	1,368.41
11 14 13 16-0059 EA One-Way, Double 7' High Exit Rotary Gate, Electric, 4 Rotor Sections, Transparent Arms.....	40,963.59	1,368.41
11 14 13 16-0060 Electrical, Two-Way <small>(11 14 13 16-0001)</small>		
11 14 13 16-0061 Galvanized Steel <small>(11 14 13 16-0060)</small>		
11 14 13 16-0062 EA Two-Way, Single 7' High Exit Rotary Gate, Electric, 3 Rotor Sections, Galvanized Steel.....	7,436.88	917.19
11 14 13 16-0063 EA Two-Way, Single 7' High Exit Rotary Gate, Electric, 4 Rotor Sections, Galvanized Steel.....	8,277.93	917.19
11 14 13 16-0064 EA Two-Way, "Handicapped" 7' High Exit Rotary Gate, Electric, 3 Rotor Sections, Galvanized Steel.....	18,778.43	1,368.41
11 14 13 16-0065 EA Two-Way, Double 7' High Exit Rotary Gate, Electric, 3 Rotor Sections, Galvanized Steel.....	15,627.11	1,368.41
11 14 13 16-0066 Powder Coated Steel <small>(11 14 13 16-0060)</small>		
11 14 13 16-0067 EA Two-Way, Single 7' High Exit Rotary Gate, Electric, 3 Rotor Sections, Powder Coated Steel.....	8,196.97	917.19
11 14 13 16-0068 EA Two-Way, Single 7' High Exit Rotary Gate, Electric, 4 Rotor Sections, Powder Coated Steel.....	9,162.46	917.19
11 14 13 16-0069 EA Two-Way, "Handicapped" 7' High Exit Rotary Gate, Electric, 3 Rotor Sections, Powder Coated Steel.....	21,625.41	1,368.41
11 14 13 16-0070 EA Two-Way, Double 7' High Exit Rotary Gate, Electric, 3 Rotor Sections, Powder Coated Steel.....	16,997.38	1,368.41
11 14 13 16-0071 Anodized Aluminum <small>(11 14 13 16-0060)</small>		
11 14 13 16-0072 EA Two-Way, Single 7' High Exit Rotary Gate, Electric, 3 Rotor Sections, Anodized Aluminum With Stainless Steel Arms.....	8,403.86	917.19
11 14 13 16-0073 EA Two-Way, Single 7' High Exit Rotary Gate, Electric, 4 Rotor Sections, Anodized Aluminum With Stainless Steel Arms.....	8,847.63	917.19
11 14 13 16-0074 EA Two-Way, Single 7' High Exit Rotary Gate, Electric, 3 Rotor Sections, Complete Anodized Aluminum.....	14,274.73	917.19
11 14 13 16-0075 EA Two-Way, Double 7' High Exit Rotary Gate, Electric, 3 Rotor Sections, Anodized Aluminum With Stainless Steel Arms.....	17,276.23	1,368.41
11 14 13 16-0076 EA Two-Way, Double 7' High Exit Rotary Gate, Electric, 3 Rotor Sections, Complete Anodized Aluminum.....	27,491.78	1,368.41
11 14 13 16-0077 Stainless Steel <small>(11 14 13 16-0060)</small>		
11 14 13 16-0078 EA Two-Way, Single 7' High Exit Rotary Gate, Electric, 3 Rotor Sections, Stainless Steel.....	13,342.23	917.19
11 14 13 16-0079 EA Two-Way, Single 7' High Exit Rotary Gate, Electric, 4 Rotor Sections, Stainless Steel.....	14,241.75	917.19
11 14 13 16-0080 EA Two-Way, "Handicapped" 7' High Exit Rotary Gate, Electric, 3 Rotor Sections, Stainless Steel.....	22,544.42	1,368.41
11 14 13 16-0081 EA Two-Way, Double 7' High Exit Rotary Gate, Electric, 3 Rotor Sections, Stainless Steel.....	25,973.09	1,368.41
11 14 13 16-0082 EA Two-Way, Double 7' High Exit Rotary Gate, Electric, 4 Rotor Sections, Stainless Steel.....	28,805.08	1,368.41
11 14 13 16-0083 Transparent <small>(11 14 13 16-0060)</small>		
11 14 13 16-0084 EA Two-Way, Single 7' High Exit Rotary Gate, Electric, 3 Rotor Sections, Transparent Arms.....	22,091.56	917.32
11 14 13 16-0085 EA Two-Way, Single 7' High Exit Rotary Gate, Electric, 4 Rotor Sections, Transparent Arms.....	23,269.93	917.32
11 14 13 16-0086 EA Two-Way, Single 7' High Exit Rotary Gate, Electric, 3 Rotor Sections, Transparent Panels.....	23,946.07	917.32
11 14 13 16-0087 EA Two-Way, Double 7' High Exit Rotary Gate, Electric, 3 Rotor Sections, Transparent Arms.....	39,464.39	1,368.41
11 14 13 16-0088 EA One-Way, Double 7' High Exit Rotary Gate, Electric, 4 Rotor Sections, Transparent Arms.....	41,713.19	1,368.41
11 14 13 16-0089 Electrical Options <small>(11 14 13 16-0001)</small>		
11 14 13 16-0090 EA Additional Set Of Electric Controls, Per Rotor, Add.....	499.23	
11 14 13 16-0091 EA Indicator Lights, Set, Red/Green, Per Controlled Direction, Add.....	350.81	
11 14 13 16-0092 EA Time-Out-Relay, Per Controlled Direction.....	115.44	
11 14 13 16-0093 EA Pulse-Relay, Per Controlled Direction.....	115.44	
11 14 13 16-0094 EA Pushbutton, Per Controlled Direction.....	91.45	
11 14 13 16-0095 EA Heel Protectors, (Per Heel Protector), Add.....	89.95	
11 14 13 16-0096 EA Card Reader Mounting Pad, Per Reader.....	82.46	
11 14 13 16-0097 EA Hydraulic Speed Control (Per Rotor), Add.....	2,094.38	
11 14 13 16-0098 Relocate Rotary Gate <small>(11 14 13 16-0001)</small>		
11 14 13 16-0099 EA Relocate Rotary Gate.....	2,694.22	
11 14 13 19 Turnstiles <small>(11 14 13)</small>		
11 14 13 19-0001 Security Turnstiles <small>(11 14 13 19)</small>		
11 14 13 19-0002 EA 7' Security Turnstile With Automatic Control Free Turning..... Note: One direction, Type B.	6,809.94	455.22
11 14 13 19-0003 EA 7' Security Turnstile, Type B Free Turning In Both Directions.....	5,986.47	455.22
11 14 13 19-0004 EA 7' Security Turnstile With Automatic Control Free Turning..... Note: One direction, Type AA.	8,087.51	455.22
11 14 13 19-0005 EA 7' Security Turnstile, Type AA Free Turning In Both Directions.....	7,333.57	455.22



Equipment	11	
Vehicle And Pedestrian Equipment	11 10	11
Pedestrian Control Equipment	11 14	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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11 14 13 19-0006	Turnstiles <small>(11 14 13 19)</small>		
11 14 13 19-0007 EA	24" Diameter Manual Turnstile, Three Arm, Two Way.....	1,464.33	272.04
11 14 13 19-0008 EA	24" Diameter Manual Turnstile, Three Arm, Two Way With Counter.....	1,886.46	272.04

11 20 Commercial Equipment (11)

11 21 Retail and Service Equipment (11 20)

11 21 63 Refrigerated Display Equipment (11 21)

11 21 63 00-0001	Dairy Products <small>(11 21 63)</small>		
11 21 63 00-0002	Refrigerated Dairy Case <small>(11 21 63 00-0001)</small>		
11 21 63 00-0003 LF	Refrigerated Case, Dairy, Multi-Deck <i>For Rear Sliding Doors, Add</i>	1,110.70 19.95	239.63
11 21 63 00-0004	Refrigerated Milk Unit <small>(11 21 63 00-0001)</small>		
11 21 63 00-0005 EA	46" x 32" x 49-1/2" Capacity: 12, 13" x 13" x 11" Refrigerated Milk Unit.....	4,841.85	174.30
11 21 63 00-0006	Refrigerated Ice Cream And Milk Dispenser <small>(11 21 63 00-0001)</small>		
11 21 63 00-0007 EA	63-1/2" x 28-1/2" x 35-3/8" Refrigerated Ice Cream And Milk Dispenser.....	5,367.73	191.42
11 21 63 00-0008	Ice Cream Dispenser <small>(11 21 63 00-0001)</small>		
11 21 63 00-0009 EA	46" x 28-1/2" x 35-3/8" Refrigerated Ice Cream Dispenser.....	4,483.63	161.18
11 21 63 00-0010	Drop-In Ice Cream Freezer <small>(11 21 63 00-0001)</small>		
11 21 63 00-0011 EA	27-7/8" x 16-9/16" x 28-1/4" 6 Gallon Drop-In Ice Cream Freezer.....	1,118.14	40.12
11 21 63 00-0012 EA	30" x 27-7/8" x 28-1/4" 12 Gallon Drop-In Ice Cream Freezer.....	1,461.11	52.45
11 21 63 00-0013	Ice Cream Cabinets <small>(11 21 63 00-0001)</small>		
11 21 63 00-0014 EA	46" x 32" x 42", 24 Gallon Ice Cream Cabinet.....	3,501.87	125.36
11 21 63 00-0015 EA	68" x 32" x 42", 48 Gallon Ice Cream Cabinet.....	4,989.49	180.91
11 21 63 00-0016	Delicatessen Case, Service Deli <small>(11 21 63)</small>		
11 21 63 00-0017 LF	Delicatessen Case, Single-Deck.....	1,075.87	199.69
11 21 63 00-0018 LF	Delicatessen Case, Multi-Deck.....	1,220.26	239.63
11 21 63 00-0019 EA	Delicatessen Case, 3 Shelf, 32" x 23" x 23".....	1,288.93	50.64
11 21 63 00-0020	Meat Case <small>(11 21 63)</small>		
11 21 63 00-0021 LF	Meat Case, Single - Deck.....	835.48	239.63
11 21 63 00-0022 LF	Meat Case, Multi - Deck.....	903.15	239.63
11 21 63 00-0023	Produce Case <small>(11 21 63)</small>		
11 21 63 00-0024 LF	Produce Case, Single - Deck.....	865.86	239.63
11 21 63 00-0025 LF	Produce Case, Multi - Deck.....	951.62	239.63
11 21 63 00-0026	Bottle Coolers <small>(11 21 63)</small>		
11 21 63 00-0027 EA	Bottle Cooler, 6' Long.....	3,172.10	798.78
11 21 63 00-0028 EA	Bottle Cooler, 10' Long.....	4,843.64	1,198.16
11 21 63 00-0029	Cold Pan Units <small>(11 21 63)</small>		
11 21 63 00-0030 EA	5" x 48", Iced, Cold Pan Units.....	1,792.16	63.83
11 21 63 00-0031 EA	5" x 72", Iced, Cold Pan Units.....	2,490.16	89.30
11 21 63 00-0032 EA	8" x 72", Iced, Cold Pan Units.....	2,944.25	105.61
11 21 63 00-0033 EA	5" x 48", Mechanical, Cold Pan Units.....	3,027.03	109.12
11 21 63 00-0034 EA	8" x 48", Mechanical, Cold Pan Units.....	3,294.22	117.80
11 21 63 00-0035 EA	8" x 72", Mechanical, Cold Pan Units.....	3,913.97	139.20
11 21 63 00-0036	Cold Cabinets (Insulated) <small>(11 21 63)</small>		
11 21 63 00-0037 EA	69-3/4" x 32" x 24", Insulated Cold Cabinet.....	1,626.31	55.23

11 22 Banking Equipment (11 20)

11 22 13 Vault Equipment (11 22)

11	Equipment
11 20	Commercial Equipment
11 22	Banking Equipment



MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

11 22 13 16 Safes (11 22 13)

11 22 13 16-0001 In Room Safes (11 22 13 16)

11 22 13 16-0002	EA	8-1/8" x 7-3/16" x 10-3/16" Keypad Operated In Room Electronic Safe (SafeDecisions Sentinel 25)	412.34	7.18
11 22 13 16-0003	EA	8-1/8" x 7-3/16" x 16-5/8" Keypad Operated In Room Electronic Safe (SafeDecisions Sentinel 41)	386.05	7.18
11 22 13 16-0004	EA	8-1/8" x 7-3/16" x 19-13/16" Keypad Operated In Room Electronic Safe (SafeDecisions Sentinel 49)	401.82	7.18
11 22 13 16-0005	EA	8-1/8" x 7-3/16" x 10-3/16" Keypad (Lighted) Operated In Room Electronic Safe (SafeDecisions Infinity 25)	449.15	7.18
		Note: Keypad lights up blue and beeps when buttons pushed. Includes light on inside of safe door.		
11 22 13 16-0006	EA	8-1/8" x 7-3/16" x 16-5/8" Keypad (Lighted) Operated In Room Electronic Safe (SafeDecisions Infinity 41)	464.92	7.18
		Note: Keypad lights up blue and beeps when buttons pushed. Includes light on inside of safe door.		
11 22 13 16-0007	EA	8-1/8" x 7-3/16" x 19-13/16" Keypad (Lighted) Operated In Room Electronic Safe (SafeDecisions Infinity 49)	480.70	7.18
		Note: Keypad lights up blue and beeps when buttons pushed. Includes light on inside of safe door.		
11 22 13 16-0008	EA	7-5/8" x 14" x 10-11/16" Keypad Operated In Drawer Electronic Safe (SafeDecisions X-Tra II-XD 27)	307.66	8.98
		Note: Includes security wire.		
11 22 13 16-0009	EA	7-5/8" x 14" x 17-1/2" Keypad Operated In Drawer Electronic Safe (SafeDecisions X-Tra II-XD 43)	318.18	8.98
		Note: Includes security wire.		
11 22 13 16-0010	EA	7-5/8" x 14" x 20-3/16" Keypad Operated In Drawer Electronic Safe (SafeDecisions X-Tra II-XD 50)	328.69	8.98
		Note: Includes security wire.		

11 26 Compact Kitchens (11 26)

11 26 13 Metal Compact Kitchens (11 26)

Note: Includes electrical hook-up to outlet, supply line connection to service stops, and drain line and p-trap. Excludes garbage disposer and hood exhaust vent piping.

11 26 13 00-0001 30" Compact Kitchen (11 26 13)

11 26 13 00-0002	EA	30" Compact Unit Kitchen With Refrigerator, Range And Sink	1,977.65	399.22
		<i>For Gas Unit, Add</i>	216.80	
11 26 13 00-0003	EA	30" Compact Unit Kitchen With Refrigerator And Sink	1,698.92	279.46
11 26 13 00-0004	EA	30" Compact Unit Kitchen With Refrigerator And Range	1,559.07	239.54
11 26 13 00-0005	EA	30" Compact Unit Kitchen Cabinet For Upper Wall Section	455.52	107.76
		<i>For Range Hood In Upper Section, Add</i>	179.00	
11 26 13 00-0006	EA	30" Compact Unit Kitchen Cabinet With Microwave And Hood Combination For Upper Wall Section	966.36	143.68
		<i>For Range Hood In Upper Section, Add</i>	179.00	
11 26 13 00-0007	EA	30" Compact Unit Kitchen Stainless Steel Shield For Rear Wall	66.61	14.61
11 26 13 00-0008	EA	30" Compact Unit Kitchen Stainless Steel Shield For Side Wall	59.97	14.61

11 26 13 00-0009 42" Compact Kitchen (11 26 13)

11 26 13 00-0010	EA	42" Compact Unit Kitchen With Refrigerator, Range And Sink	2,310.29	439.15
		<i>For Gas Unit, Add</i>	258.71	
11 26 13 00-0011	EA	42" Compact Unit Kitchen With Refrigerator And Sink	2,094.61	359.31
11 26 13 00-0012	EA	42" Compact Unit Kitchen Cabinet For Upper Wall Section	584.25	122.13
		<i>For Range Hood In Upper Section, Add</i>	179.00	
11 26 13 00-0013	EA	42" Compact Unit Kitchen Cabinet With Microwave And Hood Combination For Upper Wall Section	1,123.28	161.64
		<i>For Range Hood In Upper Section, Add</i>	179.00	
11 26 13 00-0014	EA	42" Compact Unit Kitchen Stainless Steel Shield For Rear Wall	79.98	14.61
11 26 13 00-0015	EA	42" Compact Unit Kitchen Stainless Steel Shield For Side Wall	66.90	14.61

11 26 13 00-0016 54" Compact Kitchen (11 26 13)

11 26 13 00-0017	EA	54" Compact Unit Kitchen With Refrigerator, Oven, Range And Sink	3,137.83	558.92
		<i>For Gas Unit, Add</i>	358.89	
11 26 13 00-0018	EA	54" Compact Unit Kitchen Cabinet For Upper Wall Section	727.36	71.84
		<i>For Range Hood In Upper Section, Add</i>	179.00	
11 26 13 00-0019	EA	54" Compact Unit Kitchen Cabinet With Microwave And Hood Combination For Upper Wall Section	1,249.20	179.60
		<i>For Range Hood In Upper Section, Add</i>	179.00	
11 26 13 00-0020	EA	54" Compact Unit Kitchen Stainless Steel Shield For Rear Wall	93.04	14.61
11 26 13 00-0021	EA	54" Compact Unit Kitchen Stainless Steel Shield For Side Wall	69.67	14.61

11 26 13 00-0022 60" Compact Kitchen (11 26 13)

11 26 13 00-0023	EA	60" Compact Unit Kitchen With Refrigerator, Oven, Range, And Sink	3,297.68	598.84
		<i>For Gas Unit, Add</i>	374.88	
11 26 13 00-0024	EA	60" Compact Unit Kitchen Cabinet For Upper Wall Section	859.20	179.60
		<i>For Range Hood In Upper Section, Add</i>	179.00	
11 26 13 00-0025	EA	60" Compact Unit Kitchen Stainless Steel Shield For Rear Wall	98.65	14.61
11 26 13 00-0026	EA	60" Compact Unit Kitchen Stainless Steel Shield For Side Wall	69.67	14.61

11 26 13 00-0027 72" Compact Kitchen (11 26 13)

11 26 13 00-0028	EA	72" Compact Unit Kitchen With Refrigerator, Oven, Range And Sink	3,537.52	638.76
		<i>For Gas Unit, Add</i>	402.88	
11 26 13 00-0029	EA	72" Compact Unit Kitchen Cabinet For Upper Wall Section	1,051.04	215.52
		<i>For Range Hood In Upper Section, Add</i>	179.00	
11 26 13 00-0030	EA	72" Compact Unit Kitchen Stainless Steel Shield For Rear Wall	115.05	18.26
11 26 13 00-0031	EA	72" Compact Unit Kitchen Stainless Steel Shield For Side Wall	72.99	18.26

11 30 Residential Equipment (11)



Equipment	11
Residential Equipment	11 30
Residential Appliances	11 30 13

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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11 30 13 Residential Appliances ^(11 30)

11 30 13 13 Residential Kitchen Appliances ^(11 30 13)

Note: Includes standard colors. Excludes stainless steel.

11 30 13 13-0001 Ranges With Ovens ^(11 30 13 13)
Note: Free standing or slide in.

11 30 13 13-0002 Electric Ranges With Ovens ^(11 30 13 13-0001)

11 30 13 13-0003	EA 20" Electric Range With Oven	495.14	73.07
	<i>For Stainless Steel, Add</i>	87.25	
11 30 13 13-0004	EA 24" Electric Range With Oven	515.14	73.07
	<i>For Stainless Steel, Add</i>	92.25	
11 30 13 13-0005	EA 30" Electric Range With Oven	545.14	73.07
	<i>For Stainless Steel, Add</i>	99.75	

11 30 13 13-0006 Gas Ranges With Ovens ^(11 30 13 13-0001)

11 30 13 13-0007	EA 20" Gas Range With Oven.....	545.14	73.07
	<i>For Stainless Steel, Add</i>	99.75	
11 30 13 13-0008	EA 24" Gas Range With Oven (Hot Point model # RGA724EKWH, White)	571.14	73.07
	<i>For Stainless Steel, Add</i>	106.25	
11 30 13 13-0009	EA 30" Gas Range With Oven (Kenmore Model # 72902 - White).....	595.14	73.07
	<i>For Stainless Steel, Add</i>	112.25	

11 30 13 13-0010 Range Hoods ^(11 30 13 13)

11 30 13 13-0011 Venting Range Hoods ^(11 30 13 13-0010)

11 30 13 13-0012	EA 21" Venting Range Hood (Broan 40000)	188.30	54.80
	<i>For Stainless Steel, Add</i>	11.80	
11 30 13 13-0013	EA 24" Venting Range Hood (Broan 40000)	176.61	54.80
	<i>For Stainless Steel, Add</i>	10.05	
11 30 13 13-0014	EA 30" Venting Range Hood (Broan 40000/42000)	174.56	54.80
	<i>For Stainless Steel, Add</i>	9.74	
11 30 13 13-0015	EA 36" Venting Range Hood (Broan 40000/42000)	176.61	54.80
	<i>For Stainless Steel, Add</i>	10.05	

11 30 13 13-0016 Non-Ducted Range Hoods ^(11 30 13 13-0010)

11 30 13 13-0017	EA 21" Non Ducted Range Hood (Broan 41000).....	189.81	54.80
	<i>For Stainless Steel, Add</i>	12.03	
11 30 13 13-0018	EA 24" Non Ducted Range Hood (Broan 41000).....	178.16	54.80
	<i>For Stainless Steel, Add</i>	10.28	
11 30 13 13-0019	EA 30" Non-Ducted Range Hood (Broan 41000/46000).....	176.10	54.80
	<i>For Stainless Steel, Add</i>	9.97	
11 30 13 13-0020	EA 36" Non-Ducted Range Hood (Broan 41000/46000).....	178.16	54.80
	<i>For Stainless Steel, Add</i>	10.28	

11 30 13 13-0021 Microwaves ^(11 30 13 13)

11 30 13 13-0022 Countertop Microwaves ^(11 30 13 13-0021)

11 30 13 13-0023	EA 1.1 CF Countertop Microwave Oven.....	100.26	9.14
	<i>For Stainless Steel, Add</i>	12.30	
11 30 13 13-0024	EA 1.2 CF Countertop Microwave Oven.....	118.25	9.14
	<i>For Stainless Steel, Add</i>	15.00	
11 30 13 13-0025	EA 1.3 CF Countertop Microwave Oven.....	121.25	9.14
	<i>For Stainless Steel, Add</i>	15.45	
11 30 13 13-0026	EA 1.4 CF Countertop Microwave Oven.....	147.26	9.14
	<i>For Stainless Steel, Add</i>	19.35	
11 30 13 13-0027	EA 1.5 CF Countertop Microwave Oven.....	157.26	9.14
	<i>For Stainless Steel, Add</i>	20.85	
11 30 13 13-0028	EA 1.6 CF Countertop Microwave Oven.....	167.26	9.14
	<i>For Stainless Steel, Add</i>	22.35	
11 30 13 13-0029	EA 1.7 CF Countertop Microwave Oven.....	177.26	9.14
	<i>For Stainless Steel, Add</i>	23.85	
11 30 13 13-0030	EA 1.8 CF Countertop Microwave Oven.....	187.26	9.14
	<i>For Stainless Steel, Add</i>	25.35	
11 30 13 13-0031	EA 2.0 CF Countertop Microwave Oven.....	198.25	9.14
	<i>For Stainless Steel, Add</i>	27.00	

11 30 13 13-0032 Over-The-Range Microwaves ^(11 30 13 13-0021)

11 30 13 13-0033	EA 1.5 CF Over-The Range Microwave	365.18	73.06
	<i>For Stainless Steel, Add</i>	38.34	
11 30 13 13-0034	EA 1.6 CF Over-The Range Microwave	408.59	73.06
	<i>For Stainless Steel, Add</i>	44.85	
11 30 13 13-0035	EA 1.7 CF Over-The Range Microwave	422.58	73.06
	<i>For Stainless Steel, Add</i>	46.95	
11 30 13 13-0036	EA 1.8 CF Over-The Range Microwave	527.58	73.06
	<i>For Stainless Steel, Add</i>	62.70	

11	Equipment
11 30	Residential Equipment
11 30 13	Residential Appliances



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
11 30 13 13-0037	EA		2.0 CF Over-The Range Microwave <i>For Stainless Steel, Add</i>	428.59 47.85	73.06
11 30 13 13-0038			Trash Compactors <small>(11 30 13 13)</small>		
11 30 13 13-0039	EA		15" Built-In Trash Compactor, 4 To 1 Compaction..... <i>For Stainless Steel, Add</i>	795.14 116.82	73.07
11 30 13 13-0040			Refrigerators <small>(11 30 13 13)</small>		
11 30 13 13-0041			Top Freezer Refrigerators <small>(11 30 13 13-0040)</small>		
11 30 13 13-0042	EA		Up To 10 CF Top Freezer Refrigerator..... <i>For Stainless Steel, Add</i>	393.06 48.00	36.54
11 30 13 13-0043	EA		>10 To 12 CF Top Freezer Refrigerator..... <i>For Stainless Steel, Add</i>	472.07 59.85	36.54
11 30 13 13-0044	EA		>12 To 14 CF Top Freezer Refrigerator..... <i>For Stainless Steel, Add</i>	523.06 67.50	36.54
11 30 13 13-0045	EA		>14 To 16 CF Top Freezer Refrigerator..... <i>For Stainless Steel, Add</i>	553.06 72.00	36.54
11 30 13 13-0046	EA		>16 To 18 CF Top Freezer Refrigerator..... <i>For Stainless Steel, Add</i>	633.06 84.00	36.54
11 30 13 13-0047	EA		>18 To 20 CF Top Freezer Refrigerator..... <i>For Stainless Steel, Add</i>	702.07 94.35	36.54
11 30 13 13-0048	EA		>20 To 22 CF Top Freezer Refrigerator..... <i>For Stainless Steel, Add</i>	753.06 102.00	36.54
11 30 13 13-0049			Side-By-Side Refrigerators <small>(11 30 13 13-0040)</small>		
11 30 13 13-0050	EA		Up To 22 CF Side-By-Side Refrigerator..... <i>For Stainless Steel, Add</i>	772.95 104.98	36.54
11 30 13 13-0051	EA		>22 To 24 CF Side-By-Side Refrigerator..... <i>For Stainless Steel, Add</i>	953.06 132.00	36.54
11 30 13 13-0052	EA		>24 To 26 CF Side-By-Side Refrigerator..... <i>For Stainless Steel, Add</i>	1,073.06 150.00	36.54
11 30 13 13-0053			Other Refrigerators <small>(11 30 13 13-0040)</small>		
11 30 13 13-0054	EA		1.7 CF Dormitory Sized Refrigerator..... <i>For Stainless Steel, Add</i>	134.64 14.72	18.26
11 30 13 13-0055	EA		4.4 CF Dormitory Sized Refrigerator..... <i>For Stainless Steel, Add</i>	179.64 21.47	18.26
11 30 13 13-0056			Freezers <small>(11 30 13 13)</small>		
11 30 13 13-0057			Upright Freezers <small>(11 30 13 13-0056)</small>		
11 30 13 13-0058	EA		Up To 10 CF Upright Freezer..... <i>For Stainless Steel, Add</i>	372.07 44.85	36.54
11 30 13 13-0059	EA		>10 To 12 CF Upright Freezer..... <i>For Stainless Steel, Add</i>	472.07 59.85	36.54
11 30 13 13-0060	EA		>12 To 14 CF Upright Freezer..... <i>For Stainless Steel, Add</i>	502.07 64.35	36.54
11 30 13 13-0061	EA		>14 To 16 CF Upright Freezer..... <i>For Stainless Steel, Add</i>	572.07 74.85	36.54
11 30 13 13-0062	EA		>16 To 18 CF Upright Freezer..... <i>For Stainless Steel, Add</i>	653.06 87.00	36.54
11 30 13 13-0063	EA		>18 To 20 CF Upright Freezer..... <i>For Stainless Steel, Add</i>	693.07 93.00	36.54
11 30 13 13-0064	EA		>20 To 22 CF Upright Freezer..... <i>For Stainless Steel, Add</i>	723.06 97.50	36.54
11 30 13 13-0065			Chest Freezers <small>(11 30 13 13-0056)</small>		
11 30 13 13-0066	EA		Up To 8 CF Chest Freezer..... <i>For Stainless Steel, Add</i>	303.06 34.50	36.54
11 30 13 13-0067	EA		>8 To 10 CF Chest Freezer..... <i>For Stainless Steel, Add</i>	373.06 45.00	36.54
11 30 13 13-0068	EA		>10 To 12 CF Chest Freezer..... <i>For Stainless Steel, Add</i>	398.07 48.75	36.54
11 30 13 13-0069	EA		>12 To 14 CF Chest Freezer..... <i>For Stainless Steel, Add</i>	443.06 55.50	36.54
11 30 13 13-0070	EA		>14 To 16 CF Chest Freezer..... <i>For Stainless Steel, Add</i>	472.07 59.85	36.54
11 30 13 13-0071	EA		>16 To 18 CF Chest Freezer..... <i>For Stainless Steel, Add</i>	572.07 74.85	36.54
11 30 13 13-0072	EA		>18 To 20 CF Chest Freezer..... <i>For Stainless Steel, Add</i>	702.07 94.35	36.54
11 30 13 13-0073	EA		>20 To 22 CF Chest Freezer..... <i>For Stainless Steel, Add</i>	723.06 97.50	36.54
11 30 13 13-0074			Automatic Ice Makers <small>(11 30 13 13)</small>		



Equipment	11
Residential Equipment	11 30
Residential Appliances	11 30 13

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
11 30 13 13-0075 EA 15" Wide, 50 LB Per Day, Automatic Ice Maker	1,344.14	73.07
11 30 13 13-0076 EA 18" Wide, 50 LB Per Day, Automatic Ice Maker	1,494.14	73.07
11 30 13 13-0077 Built-In Dishwashers (11 30 13 13)		
11 30 13 13-0078 EA 18" Built-In Dishwasher..... <i>For Stainless Steel, Add</i>	676.13 79.50	73.07
11 30 13 13-0079 EA 24" Built-In Dishwasher..... <i>For Stainless Steel, Add</i>	466.13 48.00	73.07
11 30 13 13-0080 Disposals (11 30 13 13)		
11 30 13 13-0081 EA 1/3 HP Insulated Garbage Disposal (GE GFC320V)	178.61	54.80
11 30 13 13-0082 EA 1/2 HP Insulated Garbage Disposal (GE GFC520V)	198.61	54.80
11 30 13 13-0083 EA 3/4 HP Insulated Garbage Disposal (GE GFC720V)	248.61	54.80
11 30 13 13-0084 EA 1 HP Insulated Garbage Disposal (GE GFC1020V)	298.61	54.80
11 30 13 13-0085 Removal And Reinstallation Of Kitchen Equipment (11 30 13 13)		
Note: Includes storage, cleaning and final connections.		
11 30 13 13-0086 EA Remove And Reinstall Garbage Disposal.....	109.61	
11 30 13 13-0087 EA Remove And Reinstall Stove/Range.....	219.20	
11 30 13 13-0088 EA Remove And Reinstall Dishwasher.....	233.82	
11 30 13 13-0089 EA Remove And Reinstall Range Hood	109.61	
11 30 13 13-0090 EA Remove And Reinstall Washer And Dryer.....	182.67	
11 30 13 13-0091 Appliance Repair (11 30 13 13)		
Note: Includes removal.		
11 30 13 13-0092 EA 8" Burner Replacement.....	20.61	
11 30 13 13-0093 EA 4" Burner Element Replacement.....	35.43	
11 30 13 13-0094 EA 8" Burner Element Replacement.....	40.85	
11 30 13 13-0095 EA Burner Manifold Replacement	143.37	
11 30 13 13-0096 EA Burner Switch Replacement	56.60	
11 30 13 13-0097 EA Burner Tube, 5/8" x 4" Replacement	27.55	
11 30 13 13-0098 EA Oven Control Replacement.....	67.18	
11 30 13 13-0099 EA Oven Door Gasket Replacement	28.25	
11 30 13 13-0100 EA Oven Element Replacement	62.80	
11 30 13 13-0101 EA Oven Igniter Replacement	45.09	
11 30 13 13-0102 EA Oven Knobs Replacement	34.14	
11 30 13 13-0103 Accessories (11 30 13 13)		
11 30 13 13-0104 SF Colored Metal Range Splash Plate.....	11.64	2.92
11 30 13 13-0105 SF Stainless Steel Range Splash Plate	16.30	2.92
11 30 13 13-0106 Automatic Water Softener (11 30 13 13)		
11 30 13 13-0107 EA 30,000 Grain Capacity, Water Softener (Whirlpool WHES30)	713.25	147.00
11 30 13 13-0108 EA 40,000 Grain Capacity, Water Softener (Whirlpool WHES40)	836.09	147.00
11 30 13 23 Residential Laundry Appliances (11 30 13)		
11 30 13 23-0001 Washing Machines And Dryers (11 30 13 23)		
11 30 13 23-0002 Washing Machines (11 30 13 23-0001)		
11 30 13 23-0003 EA Up To 3.5 CF, Top Load Washing Machine.....	519.60	73.07
11 30 13 23-0004 EA >3.5 To 4 CF, Top Load Washing Machine	809.60	73.07
11 30 13 23-0005 EA >4 To 5 CF, Top Load Washing Machine	1,059.60	73.07
11 30 13 23-0006 Dryers (11 30 13 23-0001)		
11 30 13 23-0007 Electric Dryers (11 30 13 23-0006)		
11 30 13 23-0008 EA Up To 6 CF, Electric Dryer.....	408.61	73.07
11 30 13 23-0009 EA >6 To 6.5 CF, Electric Dryer	509.60	73.07
11 30 13 23-0010 EA >6.5 To 7 CF, Electric Dryer	619.60	73.07
11 30 13 23-0011 EA >7 To 7.5 CF, Electric Dryer	699.60	73.07
11 30 13 23-0012 Gas Dryers (11 30 13 23-0006)		
11 30 13 23-0013 EA Up To 6 CF, Gas Dryer.....	479.60	73.07
11 30 13 23-0014 EA >6 To 6.5 CF, Gas Dryer	579.60	73.07
11 30 13 23-0015 EA >6.5 To 7 CF, Gas Dryer	679.49	73.07
11 30 13 23-0016 EA >7 To 7.5 CF, Gas Dryer	769.60	73.07
11 30 13 23-0017 Stacked Washer And Dryers (11 30 13 23-0001)		
11 30 13 23-0018 EA 27" Wide x 75-1/2" High, Stacked Top Load Washing Machine And Electric Dryer (Frigidare GLET 1031FS)	1,135.67	127.87

11 Equipment
11 30 Residential Equipment
11 30 13 Residential Appliances



MINOR	CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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11 30 33 Retractable Stairs (11 30)

11 30 33 00-0001 Disappearing Folding Access Stairs (11 30 33)

11 30 33 00-0002 250 LB Capacity, Wood Folding Access Stairs (11 30 33 00-0001)

11 30 33 00-0003	EA 22-1/2" x 54" Rough Opening, 7' To 8' 9" Ceiling Height, Wood Folding Access Stairs, 250 LB Capacity.....	463.44	143.74
11 30 33 00-0004	EA 22-1/2" x 54" Rough Opening, 8' 9" To 10' 4" Ceiling Height, Wood Folding Access Stairs, 250 LB Capacity	471.90	143.74
11 30 33 00-0005	EA 25-1/2" x 54" Rough Opening, 7' To 8' 9" Ceiling Height, Wood Folding Access Stairs, 250 LB Capacity.....	471.90	143.74
11 30 33 00-0006	EA 25-1/2" x 54" Rough Opening, 8' 9" To 10' 4" Ceiling Height, Wood Folding Access Stairs, 250 LB Capacity	480.15	143.74

11 30 33 00-0007 350 LB Capacity, Wood Folding Access Stairs (11 30 33 00-0001)

11 30 33 00-0008	EA 22-1/2" x 54" Rough Opening, 7' To 8' 9" Ceiling Height, Wood Folding Access Stairs, 350 LB Capacity.....	540.66	143.74
11 30 33 00-0009	EA 22-1/2" x 54" Rough Opening, 8' 9" To 10' 3" Ceiling Height, Wood Folding Access Stairs, 350 LB Capacity	557.76	143.74
11 30 33 00-0010	EA 25-1/2" x 54" Rough Opening, 7' To 8' 9" Ceiling Height, Wood Folding Access Stairs, 350 LB Capacity.....	550.73	143.74
11 30 33 00-0011	EA 25-1/2" x 54" Rough Opening, 8' 9" To 10' 3" Ceiling Height, Wood Folding Access Stairs, 350 LB Capacity	567.07	143.74
11 30 33 00-0012	EA 30" x 54" Rough Opening, 7' To 8' 9" Ceiling Height, Wood Folding Access Stairs, 350 LB Capacity.....	560.50	143.74
11 30 33 00-0013	EA 30" x 54" Rough Opening, 8' 9" To 10' 4" Ceiling Height, Wood Folding Access Stairs, 350 LB Capacity	588.74	143.74

11 30 33 00-0014 350 LB Capacity, Wood Folding Access Stairs (11 30 33 00-0001)

Note: 1 x 6 treads, 1 x 5 stringers. Bessler Stairway Company, Model Space Saver.

11 30 33 00-0015	EA 22-1/2" x 48" Rough Opening, 8' 5" Ceiling Height, Wood Folding Access Stairs, 350 LB Capacity	680.32	143.74
11 30 33 00-0016	EA 22-1/2" x 54" Rough Opening, 8' 9" Ceiling Height, Wood Folding Access Stairs, 350 LB Capacity	704.13	143.74
11 30 33 00-0017	EA 22-1/2" x 54" Rough Opening, 10' Ceiling Height, Wood Folding Access Stairs, 350 LB Capacity.....	727.94	143.74
11 30 33 00-0018	EA 22-1/2" x 60" Rough Opening, 9' 3" Ceiling Height, Wood Folding Access Stairs, 350 LB Capacity	727.94	143.74
11 30 33 00-0019	EA 22-1/2" x 60" Rough Opening, 10' Ceiling Height, Wood Folding Access Stairs, 350 LB Capacity.....	739.84	143.74
11 30 33 00-0020	EA 25-1/2" x 48" Rough Opening, 8' 5" Ceiling Height, Wood Folding Access Stairs, 350 LB Capacity	698.28	143.74
11 30 33 00-0021	EA 25-1/2" x 54" Rough Opening, 8' 9" Ceiling Height, Wood Folding Access Stairs, 350 LB Capacity	722.09	143.74
11 30 33 00-0022	EA 25-1/2" x 54" Rough Opening, 10' Ceiling Height, Wood Folding Access Stairs, 350 LB Capacity.....	745.90	143.74
11 30 33 00-0023	EA 25-1/2" x 60" Rough Opening, 9' 3" Ceiling Height, Wood Folding Access Stairs, 350 LB Capacity	745.90	143.74
11 30 33 00-0024	EA 25-1/2" x 60" Rough Opening, 10' Ceiling Height, Wood Folding Access Stairs, 350 LB Capacity	757.80	143.74
11 30 33 00-0025	EA 30" x 54" Rough Opening, 8' 9" Ceiling Height, Wood Folding Access Stairs, 350 LB Capacity	775.78	143.74
11 30 33 00-0026	EA 30" x 54" Rough Opening, 10' Ceiling Height, Wood Folding Access Stairs, 350 LB Capacity.....	799.59	143.74
11 30 33 00-0027	EA 30" x 60" Rough Opening, 8' 9" Ceiling Height, Wood Folding Access Stairs, 350 LB Capacity	847.21	143.74
11 30 33 00-0028	EA 30" x 60" Rough Opening, 9' 3" Ceiling Height, Wood Folding Access Stairs, 350 LB Capacity	859.11	143.74
11 30 33 00-0029	EA 30" x 60" Rough Opening, 10' Ceiling Height, Wood Folding Access Stairs, 350 LB Capacity.....	871.01	143.74
11 30 33 00-0030	EA 30" x 60" Rough Opening, 10' 6" Ceiling Height, Wood Folding Access Stairs, 350# Capacity.....	882.92	143.74

11 30 33 00-0031 400 LB Capacity, Wood One Piece Pull Down Access Stairs (11 30 33 00-0001)

Note: Ladder width 17 1/16", 1x4 treads, 1x4 stringers. Bessler Stairway Company, Model 20.

11 30 33 00-0032	EA 24" x 48" Rough Opening, 7' 7" To 7' 10" Ceiling Height, Wood One Piece Pull Down Access Stairs, 400 LB Capacity.....	1,061.70	143.74
11 30 33 00-0033	EA 24" x 48" Rough Opening, 7' 11" To 8' 4" Ceiling Height, Wood One Piece Pull Down Access Stairs, 400 LB Capacity.....	1,097.41	143.74
11 30 33 00-0034	EA 24" x 48" Rough Opening, 8' 5" To 8' 10" Ceiling Height, Wood One Piece Pull Down Access Stairs, 400 LB Capacity.....	1,133.12	143.74
11 30 33 00-0035	EA 24" x 48" Rough Opening, 8' 11" To 9' 4" Ceiling Height, Wood One Piece Pull Down Access Stairs, 400 LB Capacity.....	1,156.93	143.74

11 30 33 00-0036 600 LB Capacity, Wood One Piece Pull Down Access Stairs (11 30 33 00-0001)

Note: Ladder width 17 1/16", 1x6 treads, 1x6 stringers. Bessler Stairway Company, Model 40.

11 30 33 00-0037	EA 24" x 66" Rough Opening, 7' 7" To 7' 10" Ceiling Height, Wood One Piece Pull Down Access Stairs, 600 LB Capacity.....	1,240.26	143.74
	<i>For Ladder Width 18 7/8" Wide, Add</i>	132.14	
11 30 33 00-0038	EA 24" x 66" Rough Opening, 7' 11" To 8' 4" Ceiling Height, Wood One Piece Pull Down Access Stairs, 600 LB Capacity.....	1,264.06	143.74
	<i>For Ladder Width 18 7/8" Wide, Add</i>	135.71	
11 30 33 00-0039	EA 24" x 66" Rough Opening, 8' 5" To 8' 10" Ceiling Height, Wood One Piece Pull Down Access Stairs, 600 LB Capacity.....	1,275.97	143.74
	<i>For Ladder Width 18 7/8" Wide, Add</i>	137.49	
11 30 33 00-0040	EA 24" x 66" Rough Opening, 8' 11" To 9' 4" Ceiling Height, Wood One Piece Pull Down Access Stairs, 600 LB Capacity.....	1,311.68	143.74
	<i>For Ladder Width 18 7/8" Wide, Add</i>	142.85	
11 30 33 00-0041	EA 24" x 72" Rough Opening, 9' 5" To 9' 10" Ceiling Height, Wood One Piece Pull Down Access Stairs, 600 LB Capacity.....	1,395.24	143.74
	<i>For Ladder Width 18 7/8" Wide, Add</i>	149.99	
11 30 33 00-0042	EA 24" x 72" Rough Opening, 9' 11" To 10' 4" Ceiling Height, Wood One Piece Pull Down Access Stairs, 600 LB Capacity.....	1,454.76	143.74
	<i>For Ladder Width 18 7/8" Wide, Add</i>	158.92	
11 30 33 00-0043	EA 24" x 72" Rough Opening, 10' 5" To 10' 10" Ceiling Height, Wood One Piece Pull Down Access Stairs, 600 LB Capacity.....	1,514.28	143.74
	<i>For Ladder Width 18 7/8" Wide, Add</i>	167.85	

11 30 33 00-0044 800 LB Capacity, Wood One Piece Pull Down Access Stairs (11 30 33 00-0001)

Note: Ladder width 18 7/8", 1x8 treads, 1x8 stringers. Bessler Stairway Company, Model 100.

11 30 33 00-0045	EA 30" x 70" Rough Opening, 7' 7" To 7' 10" Ceiling Height, Wood One Piece Pull Down Access Stairs, 800 LB Capacity.....	2,276.13	143.74
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Equipment	11
Residential Equipment	11 30
Retractable Stairs	11 30 33

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
11 30 33 00-0046 EA 30" x 70" Rough Opening, 7' 11" To 8' 4" Ceiling Height, Wood One Piece Pull Down Access Stairs, 800 LB Capacity	2,299.94	143.74
11 30 33 00-0047 EA 30" x 70" Rough Opening, 8' 5" To 8' 10" Ceiling Height, Wood One Piece Pull Down Access Stairs, 800 LB Capacity	2,323.75	143.74
11 30 33 00-0048 EA 30" x 72" Rough Opening, 8' 11" To 9' 4" Ceiling Height, Wood One Piece Pull Down Access Stairs, 800 LB Capacity	2,383.27	143.74
11 30 33 00-0049 EA 30" x 76" Rough Opening, 9' 5" To 9' 10" Ceiling Height, Wood One Piece Pull Down Access Stairs, 800 LB Capacity	2,454.91	143.74
11 30 33 00-0050 EA 30" x 80" Rough Opening, 9' 11" To 10' 4" Ceiling Height, Wood One Piece Pull Down Access Stairs, 800 LB Capacity	2,490.62	143.74
11 30 33 00-0051 EA 30" x 84" Rough Opening, 10' 5" To 10' 10" Ceiling Height, Wood One Piece Pull Down Access Stairs, 800 LB Capacity	2,550.14	143.74
11 30 33 00-0052 EA 30" x 87" Rough Opening, 10' 11" To 11' 4" Ceiling Height, Wood One Piece Pull Down Access Stairs, 800 LB Capacity	2,669.40	143.74
11 30 33 00-0053 EA 30" x 90" Rough Opening, 11' 5" To 11' 10" Ceiling Height, Wood One Piece Pull Down Access Stairs, 800 LB Capacity	2,776.54	143.74
11 30 33 00-0054 EA 30" x 93" Rough Opening, 11' 11" To 12' 4" Ceiling Height, Wood One Piece Pull Down Access Stairs, 800 LB Capacity	2,907.48	143.74
11 30 33 00-0055 EA 30" x 96" Rough Opening, 12' 5" To 12' 10" Ceiling Height, Wood One Piece Pull Down Access Stairs, 800 LB Capacity	3,026.52	143.74
11 30 33 00-0056 300 LB Capacity, Aluminum Folding Access Stairs <small>(11 30 33 00-0001)</small>		
11 30 33 00-0057 EA 22-1/2" x 54" Rough Opening, 7' To 8' 9" Ceiling Height, Aluminum Folding Access Stairs, 300 LB Capacity	563.46	143.74
11 30 33 00-0058 EA 22-1/2" x 54" Rough Opening, 8' 9" To 10' 4" Ceiling Height, Aluminum Folding Access Stairs, 300 LB Capacity	589.15	143.74
11 30 33 00-0059 EA 25-1/2" x 54" Rough Opening, 7' To 8' 9" Ceiling Height, Aluminum Folding Access Stairs, 300 LB Capacity	570.62	143.74
11 30 33 00-0060 EA 25-1/2" x 54" Rough Opening, 8' 9" To 10' 4" Ceiling Height, Aluminum Folding Access Stairs, 300 LB Capacity	596.29	143.74
11 30 33 00-0061 EA 25-1/2" x 54" Rough Opening, 10' 5" To 12' Ceiling Height, Aluminum Folding Access Stairs, 300 LB Capacity	739.25	143.74
11 30 33 00-0062 300 LB Capacity, Steel Folding Access Stairs <small>(11 30 33 00-0001)</small>		
11 30 33 00-0063 EA 22-1/2" x 54" Rough Opening, 7' 3" To 8' 4" Ceiling Height, Steel Folding Access Stairs, 300 LB Capacity	514.32	143.74
11 30 33 00-0064 EA 22-1/2" x 54" Rough Opening, 8' 4" To 10' 3" Ceiling Height, Steel Folding Access Stairs, 300 LB Capacity	538.40	143.74

11 40 Foodservice Equipment (11)

11 41 Foodservice Storage Equipment (11 40)

11 41 13 Refrigerated Food Storage Cases (11 41)

11 41 13 00-0001 Frozen Food Cases (11 41 13)

11 41 13 00-0002 LF Chest Type Frozen Food Case	860.49	239.63
11 41 13 00-0003 LF Reach-in Frozen Food Case (Glass Door)	1,558.89	239.63
11 41 13 00-0004 LF Island Type Frozen Food Case	980.99	239.63
11 41 13 00-0005 LF Multi-Deck Frozen Food Case	1,500.58	239.63

11 41 13 00-0006 Reach-In Refrigeration (11 41 13)

11 41 13 00-0007 Reach-In Refrigerators (11 41 13 00-0006)

11 41 13 00-0008 EA Single Section, 24.2 CF, Full Door, Self Contained, Reach-In Refrigerator	2,826.85	121.72
11 41 13 00-0009 EA Two Section, 46.0 CF, Full Door, Self Contained, Reach-In Refrigerator	3,483.90	153.51
11 41 13 00-0010 EA Three Section, 69.1 CF, Full Door, Self Contained, Reach-In Refrigerator	4,635.97	169.60
11 41 13 00-0011 EA Single Section, Glass Door, 24.2 CF, Full Door, Self Contained, Reach-In Refrigerator	3,030.89	121.72
11 41 13 00-0012 EA Two Section, Glass Door, 46.0 CF, Full Door, Self Contained, Reach-In Refrigerator	3,941.42	153.51
11 41 13 00-0013 EA Three Section, Glass Door, 61.1 CF, Full Door, Self Contained, Reach-In Refrigerator	5,229.34	169.60
11 41 13 00-0014 EA Single Section, Pass-Thru, 24.2 CF, Full Door, Self Contained, Reach-In Refrigerator	3,382.82	121.72
11 41 13 00-0015 EA Two Section, Pass-Thru, 46.0 CF, Full Door, Self Contained, Reach-In Refrigerator	4,570.14	153.51
11 41 13 00-0016 EA Single Section, Pass-Thru, Glass Door, 25.6 CF, Full Door, Self Contained, Reach-In Refrigerator	4,098.44	121.72
11 41 13 00-0017 EA Two Section, Pass-Thru, Glass Door, 48.8 CF, Full Door, Self Contained, Reach-In Refrigerator	5,897.34	153.51

11 41 13 00-0018 Reach-In Freezers (11 41 13 00-0006)

11 41 13 00-0019 EA Single Section, 24.2 CF, Full Door, Self Contained, Reach-In Freezer	3,171.68	121.86
11 41 13 00-0020 EA Two Section, 46.0 CF, Full Door, Self Contained, Reach-In Freezer	4,201.31	153.29

11 41 31 Non-Refrigerated Storage Equipment (11 41)

11 41 31 00-0001 Wall Cabinets (11 41 31)

11 41 31 00-0002 EA 48" Wall Cabinet With Sliding Doors	1,703.86	56.11
Note: 15" deep and 24" high.		
11 41 31 00-0003 EA 72" Wall Cabinet With Sliding Doors	2,248.21	74.07
Note: 15" deep and 24" high.		
11 41 31 00-0004 EA 72" Wall Cabinet With Hinged Doors	2,580.49	84.91
Note: 15" deep and 24" high.		
11 41 31 00-0005 EA 72" Wall Cabinet With Open Shelves	1,651.54	54.17
Note: 15" deep and 24" high.		

11 Equipment**11 40 Foodservice Equipment****11 41 Foodservice Storage Equipment**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
11 41 31 00-0006 Mobile Sheet Pan Truck <small>(11 41 31)</small>		
11 41 31 00-0007 EA 2 Level Mobile Sheet Pan Truck.....	159.56	5.01
11 41 31 00-0008 Pot And Utensil Rack <small>(11 41 31)</small>		
11 41 31 00-0009 EA 70" Bench Type Pot And Utensil Rack.....	465.43	15.28
11 41 31 00-0010 EA 94" Bench Type Pot And Utensil Rack.....	539.44	17.28
11 41 31 00-0011 EA 94" Ceiling Type Pot And Utensil Rack.....	641.33	20.69
11 41 31 00-0012 EA 96" Wall Type Pot And Utensil Rack.....	348.77	11.30
11 41 31 00-0013 Tray And Silverware Cart <small>(11 41 31)</small>		
11 41 31 00-0014 EA 33" x 22-1/2" x 42" Tray And Silverware Cart.....	1,609.90	51.58
11 41 31 00-0015 Flat Top Utility Units <small>(11 41 31)</small>		
11 41 31 00-0016 EA 79-1/2" x 28-1/2" x 35-3/8" Flat Top Utility Units.....	1,470.92	47.12
11 41 31 00-0017 EA 39" x 28-1/2" x 35-3/8" Flat Top Utility Units.....	1,097.64	35.25
11 41 33 Foodservice Shelving <small>(11 41)</small>		
11 41 33 00-0001 Shelving/Racks <small>(11 41 33)</small>		
11 41 33 00-0002 Stainless Steel Shelving, Louvered, 4-Tier <small>(11 41 33 00-0001)</small>		
11 41 33 00-0003 EA 20" X 3' Stainless Steel Shelving, Louvered 4-Tier.....	581.23	45.66
11 41 33 00-0004 EA 20" X 4' Stainless Steel Shelving, Louvered 4-Tier.....	665.70	45.66
11 41 33 00-0005 EA 20" X 6' Stainless Steel Shelving, Louvered 4-Tier.....	823.37	45.66
11 41 33 00-0006 EA 24" X 3' Stainless Steel Shelving, Louvered 4-Tier.....	705.12	45.66
11 41 33 00-0007 EA 24" X 4' Stainless Steel Shelving, Louvered 4-Tier.....	767.06	45.66
11 41 33 00-0008 EA 24" X 6' Stainless Steel Shelving, Louvered 4-Tier.....	1,005.82	45.66
11 41 33 00-0009 Stainless Steel Shelving, Flat, 4-Tier <small>(11 41 33 00-0001)</small>		
11 41 33 00-0010 EA 20" X 3' Stainless Steel Shelving, Flat 4-Tier.....	575.60	45.66
11 41 33 00-0011 EA 20" X 4' Stainless Steel Shelving, Flat 4-Tier.....	648.80	45.66
11 41 33 00-0012 EA 20" X 5' Stainless Steel Shelving, Flat 4-Tier.....	750.16	45.66
11 41 33 00-0013 EA 24" X 3' Stainless Steel Shelving, Flat 4-Tier.....	648.80	45.66
11 41 33 00-0014 EA 24" X 4' Stainless Steel Shelving, Flat 4-Tier.....	755.80	45.66
11 41 33 00-0015 EA 24" X 6' Stainless Steel Shelving, Flat 4-Tier.....	834.63	45.66
11 41 33 00-0016 Galvanized Steel Shelving, Louvered, 4-Tier <small>(11 41 33 00-0001)</small>		
11 41 33 00-0017 EA 20" X 3' Galvanized Shelving, Louvered 4-Tier.....	519.75	45.66
11 41 33 00-0018 EA 20" X 4' Galvanized Shelving, Louvered 4-Tier.....	613.69	45.66
11 41 33 00-0019 EA 20" X 6' Galvanized Shelving, Louvered 4-Tier.....	835.92	45.66
11 41 33 00-0020 EA 24" X 3' Galvanized Shelving, Louvered 4-Tier.....	590.78	45.66
11 41 33 00-0021 EA 24" X 4' Galvanized Shelving, Louvered 4-Tier.....	664.09	45.66
11 41 33 00-0022 EA 24" X 6' Galvanized Shelving, Louvered 4-Tier.....	801.56	45.66
11 41 33 00-0023 Galvanized Steel Shelving, Flat, 4-Tier <small>(11 41 33 00-0001)</small>		
11 41 33 00-0024 EA 20" X 3' Galvanized Shelving, Flat 4-Tier.....	519.75	45.66
11 41 33 00-0025 EA 20" X 4' Galvanized Shelving, Flat 4-Tier.....	549.54	45.66
11 41 33 00-0026 EA 20" X 6' Galvanized Shelving, Flat 4-Tier.....	721.37	45.66
11 41 33 00-0027 EA 24" X 3' Galvanized Shelving, Flat 4-Tier.....	549.54	45.66
11 41 33 00-0028 EA 24" X 4' Galvanized Shelving, Flat 4-Tier.....	641.18	45.66
11 41 33 00-0029 EA 24" X 6' Galvanized Shelving, Flat 4-Tier.....	755.74	45.66
11 41 33 00-0030 Stainless Steel Dunnage Rack <small>(11 41 33 00-0001)</small>		
11 41 33 00-0031 EA 24" X 3' Stainless Steel Dunnage Rack.....	410.93	36.53
11 41 33 00-0032 EA 24" X 4' Stainless Steel Dunnage Rack.....	444.72	36.53
11 41 33 00-0033 Galvanized Steel Dunnage Rack <small>(11 41 33 00-0001)</small>		
11 41 33 00-0034 EA 24" X 3' Galvanized Dunnage Rack.....	451.09	36.53
11 41 33 00-0035 EA 24" X 4' Galvanized Dunnage Rack.....	474.00	36.53
11 41 33 00-0036 Mobile Racks <small>(11 41 33 00-0001)</small>		
11 41 33 00-0037 EA Mobile Rack With Pan Slide.....	1,383.54	36.53
11 41 33 00-0038 Can Racks <small>(11 41 33 00-0001)</small>		
11 41 33 00-0039 EA Can Rack.....	2,071.61	36.53



Equipment	11	
Foodservice Equipment	11 40	11
Food Preparation Equipment	11 42	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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11 42 Food Preparation Equipment (11 40)

11 42 13 Food Preparation Appliances (11 42)

11 42 13 00-0001 Vertical Cutter Mixers (11 42 13)

11 42 13 00-0002	EA	Bench Type Mixers, 25 Quart.....	8,120.30	182.75
11 42 13 00-0003	EA	Bench Type Mixers, 40 Quart.....	9,325.96	182.75
11 42 13 00-0004	EA	Bench Type Mixers, 80 Quart.....	11,691.41	314.33
11 42 13 00-0005	EA	Bench Type Mixers, 130 Quart.....	13,236.82	511.71

11 42 13 00-0006 Choppers (11 42 13)

11 42 13 00-0007	EA	Choppers, 5 LB.....	2,040.70	146.20
11 42 13 00-0008	EA	Choppers, 16 LB.....	2,992.95	190.06
11 42 13 00-0009	EA	Choppers, 35 LB - 40 LB.....	5,773.72	233.93
11 42 13 00-0010	EA	Choppers, 35 LB - 40 LB/Min, 2 HP.....	4,789.50	207.82
11 42 13 00-0011	EA	Choppers, 35 LB - 40 LB/Min, 3 HP.....	5,430.70	207.82

11 42 13 00-0012 Floor Model Mixer (11 42 13)

11 42 13 00-0013	EA	Floor Type Mixers, 20 Quart.....	3,870.70	109.66
11 42 13 00-0014	EA	Floor Type Mixers, 60 Quart.....	9,526.14	73.10
11 42 13 00-0015	EA	Floor Type Mixers, 80 Quart.....	15,038.82	73.10
11 42 13 00-0016	EA	Floor Type Mixers, 140 Quart.....	19,059.70	116.96

11 42 13 00-0017 Slicers (11 42 13)

11 42 13 00-0018	EA	Slicer With Table.....	3,232.05	105.56
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11 42 13 00-0019 Peelers (11 42 13)

11 42 13 00-0020	EA	Small Peeler.....	2,218.47	118.79
11 42 13 00-0021	EA	Large Peeler.....	2,350.73	158.41

11 42 13 00-0022 Proof Boxes (11 42 13)

11 42 13 00-0023	EA	30-1/2" x 22-1/2", Stainless Steel Proof Box.....	1,130.43	51.58
11 42 13 00-0024	EA	30-1/2" x 45", Stainless Steel Proof Box.....	1,891.73	86.44
11 42 13 00-0025	EA	30-1/2" x 45", Galvanized Proof Box.....	1,683.79	39.24

11 42 13 00-0026 Non-Insulated Heated Proof Cabinet (11 42 13)

11 42 13 00-0027	EA	Angle Slide 69-3/4", Solid Door Non Insulated Heated Proof Cabinet.....	1,535.64	49.43
11 42 13 00-0028	EA	Angle Slide 69-3/4", Clear Door Non Insulated Heated Proof Cabinet.....	1,647.35	52.85
11 42 13 00-0029	EA	Channel Slide 69-3/4", Solid Door Non Insulated Heated Proof Cabinet.....	1,525.22	49.02
11 42 13 00-0030	EA	Channel Slide 69-3/4", Clear Door Non Insulated Heated Proof Cabinet.....	1,616.53	51.98

11 42 13 00-0031 Insulated Heated Proof Cabinet (11 42 13)

11 42 13 00-0032	EA	3 Spacing, 69-3/4" High Solid Door Insulated Heated Proof Cabinet.....	2,493.55	82.18
11 42 13 00-0033	EA	3 Spacing 69-3/4" High Sliding Door Insulated Heated Proof Cabinet.....	2,605.80	85.92

11 42 13 00-0034 Pass-Thru Hot Food Holding Cabinet (11 42 13)

11 42 13 00-0035	EA	Single Section, Full Door, Pass-Thru Hot Food Holding Cabinet.....	3,835.28	153.51
11 42 13 00-0036	EA	Single Section, Half Door, Pass-Thru Hot Food Holding Cabinet.....	4,075.38	153.51
11 42 13 00-0037	EA	Two Section, Full Door, Pass-Thru Hot Food Holding Cabinet.....	5,185.82	160.82
11 42 13 00-0038	EA	Two Section, Half Door, Pass-Thru Hot Food Holding Cabinet.....	5,676.26	160.82

11 42 16 Food Preparation Surfaces (11 42)

11 42 16 00-0001 Tables (11 42 16)

11 42 16 00-0002 Baker's Table (11 42 16 00-0001)

11 42 16 00-0003	EA	4' Open Base Baker's Table.....	744.61	36.64
11 42 16 00-0004	EA	10' Open Base Baker's Table.....	1,461.42	71.84
11 42 16 00-0005	EA	10' Undershelf Baker's Table.....	1,803.16	88.65
11 42 16 00-0006	EA	10' Three Drawers Baker's Table.....	1,933.92	95.18
11 42 16 00-0007	EA	10' Bins Baker's Table.....	2,845.31	140.09
11 42 16 00-0008	EA	10' Bins And Drawers Baker's Table.....	4,467.98	219.90

11 42 16 00-0009 Preparation Table, Stainless Steel, With Undershelf (11 42 16 00-0001)

11 42 16 00-0010	EA	30" x 72" Square Edge Stainless Steel Preparation Table With Undershelf.....	414.15	19.32
11 42 16 00-0011	EA	30" x 72" Marine Edge Stainless Steel Preparation Table With Undershelf.....	448.05	23.20
11 42 16 00-0012	EA	36" x 96" Marine Edge Stainless Steel Preparation Table With Undershelf.....	674.64	31.54

11	Equipment
11 40	Foodservice Equipment
11 42	Food Preparation Equipment



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
11 42 16 00-0013			Preparation Table, Stainless Steel, With Open Front <small>(11 42 16 00-0001)</small>		
11 42 16 00-0014	EA		30" X 72" Round Edge Stainless Steel Preparation Table With Open Front.....	436.09	20.33
11 42 16 00-0015	EA		36" X 96" Round Edge Stainless Steel Preparation Table With Open Front.....	560.50	26.15
11 42 16 00-0016	EA		36" X 96" Square Edge Stainless Steel Preparation Table With Open Front.....	481.46	22.49
11 42 16 00-0017	EA		36" X 96" Marine Edge Stainless Steel Preparation Table With Open Front.....	579.53	27.08
11 42 16 00-0018	EA		Roller Utility Drawers Stainless Steel Preparation Table With Open Front.....	117.07	5.46
11 42 16 00-0019			Mobile Tables <small>(11 42 16 00-0001)</small>		
11 42 16 00-0020	EA		21-1/4" x 27-1/2" x 41" Galvanized Mobile Table With Galvanized Top.....	1,604.01	17.31
11 42 16 00-0021	EA		32-1/4" x 27-1/2" x 41" Galvanized Mobile Table With Galvanized Top.....	869.93	20.76
11 42 16 00-0022	EA		32-1/4" x 27-1/2" x 41" Stainless Steel Mobile Table With Stainless Steel Top.....	499.06	23.35
11 42 16 00-0023			Hot Food Tables, Stainless Steel, Gas Or Electric <small>(11 42 16 00-0001)</small>		
11 42 16 00-0024	EA		32-1/4" x 27-1/2" x 41" Stainless Steel Hot Food Tables.....	891.30	41.67
11 42 16 00-0025	EA		32-1/4" x 27-1/2" x 21" Stainless Steel Hot Food Tables.....	722.93	33.77
11 42 16 00-0026	EA		Full Size Pan With Cover Stainless Steel Hot Food Tables.....	60.00	2.80
11 42 16 00-0027	EA		Set Of Three 1/3 Size With Cover Stainless Steel Hot Food Tables.....	87.78	4.10
11 42 16 00-0028	EA		58-1/2", 4 Openings Stainless Steel Hot Food Tables.....	1,764.83	80.78
11 42 16 00-0029	EA		114-1/2", 8 Openings Stainless Steel Hot Food Tables.....	3,511.33	161.18
11 42 16 00-0030			Basic Table <small>(11 42 16 00-0001)</small>		
11 42 16 00-0031	LF		Table, Basic.....	255.11	20.31
11 42 16 00-0032			Table With Sink <small>(11 42 16)</small>		
11 42 16 00-0033	LF		Table With Sink.....	307.19	30.65
11 42 23			Food Preparation Scullery Sinks <small>(11 42)</small>		
11 42 23 00-0001			Stainless Steel Scullery Sinks <small>(11 42 23)</small>		
Note: Excludes faucet. See CSI section 22 42 39 00-0075 for service sink faucets.					
11 42 23 00-0002	EA		Stainless Steel Scullery Sink, Single 30" x 24" x 12" Compartment And Drainboard.....	1,926.88	128.63
For Additional Drain Board, Add				179.83	
11 42 23 00-0003	EA		Stainless Steel Scullery Sink, Double 30" x 24" x 12" Compartment And Drainboard.....	2,648.90	147.00
For Additional Drain Board, Add				251.11	
11 42 23 00-0004	EA		Stainless Steel Scullery Sink, Triple 30" x 24" x 12" Compartment And Drainboard.....	3,466.51	147.00
For Additional Drain Board, Add				331.95	
11 42 23 00-0005	EA		Stainless Steel Scullery Sink, Quad 30" x 24" x 12" Compartment And Drainboard.....	4,902.23	147.00
For Additional Drain Board, Add				475.52	
11 42 23 00-0006	EA		Stainless Steel Pot Sink, Double 20" x 20" x 18" Compartment And Drainboard.....	3,163.58	147.00
11 44			Food Cooking Equipment <small>(11 40)</small>		
11 44 13			Commercial Ranges <small>(11 44)</small>		
11 44 13 00-0001			Range <small>(11 44 13)</small>		
11 44 13 00-0002	EA		Heavy Duty Range, With 34" Open Top Oven.....	1,924.00	73.10
11 44 13 00-0003	EA		Range With Fry Top.....	1,924.00	73.10
11 44 13 00-0004	EA		Steel Finish Fry Top.....	4,096.20	97.02
11 44 13 00-0005	EA		Stainless Top Only Fry Top.....	4,094.42	95.91
11 44 13 00-0006	EA		Stainless Top And 2 Sides Fry Top.....	4,731.19	111.67
11 44 13 00-0007	EA		Gas Range, Vulcan #260L.....	4,268.83	99.49
Note: Six 12" burners, open top sections, porcelain on steel aeration plates and grates. 24" griddle/broiler, two 26-1/4" x 22" x 14-1/2" ovens porcelain on steel liner and aluminized steel construction, nickel plated oven racks.					
11 44 16			Commercial Ovens <small>(11 44)</small>		
11 44 16 00-0001			Bake Oven <small>(11 44 16)</small>		
11 44 16 00-0002	EA		Bake Oven - Single Deck.....	3,996.33	109.66
11 44 16 00-0003	EA		Bake Oven - Double Deck.....	8,142.54	146.20
11 44 16 00-0004	EA		Bake Oven - Triple Deck.....	11,842.69	146.20
11 44 16 00-0005	EA		Rotary Oven, Gas, Medium.....	29,714.54	4,751.57
11 44 16 00-0006			Combination Ovens <small>(11 44 16)</small>		
Note: Convection, steam and combination modes.					
11 44 16 00-0007	EA		35.4" x 34" x 26.6" Half Size Electric Boilerless Combination Oven.....	12,210.90	127.93
11 44 16 00-0008	EA		35.4" x 45" x 36.8" Full Size Electric Boilerless Combination Oven.....	19,997.83	146.20
11 44 16 00-0009	EA		35.4" x 34" x 36.8" Half Size Electric Boilerless Combination Oven.....	16,534.27	146.20
11 44 16 00-0010	EA		35.4" x 45" x 70.4" Full Size Electric Boilerless Combination Oven.....	39,811.33	182.75
11 44 16 00-0011	EA		35.4" x 34" x 70.4" Half Size Electric Boilerless Combination Oven.....	30,248.14	182.75
11 44 16 00-0012			Electric Convection Type Oven <small>(11 44 16)</small>		



Equipment	11	
Foodservice Equipment	11 40	11
Food Cooking Equipment	11 44	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
11 44 16 00-0013	EA		40" x 45" x 57" Convection Oven.....	6,253.06	124.27
11 44 16 00-0014	EA		30" x 25" x 29" Half Size Electric Convection Oven.....	3,605.89	127.93
11 44 16 00-0015	EA		30" x 25" x 66-3/4" Half Size Electric Convection Oven.....	7,334.07	137.06
11 44 16 00-0016	EA		40" x 41-1/2" x 56-3/4" Single Deck Electric Convection Oven.....	5,072.14	137.06
11 44 16 00-0017	EA		40" x 41-1/2" x 70" Single Deck Electric Convection Oven.....	9,575.71	146.20
11 44 16 00-0018			Broiler, Without Oven (11 44 16)		
11 44 16 00-0019	EA		69" x 26" x 39" Broiler Without Oven.....	5,343.02	116.96
11 44 16 00-0020	EA		Conveyor Broiler.....	4,749.68	135.75
11 44 19			Other Commercial Cooking Equipment (11 44)		
11 44 19 00-0001			Electric Griddle (11 44 19)		
11 44 19 00-0002	EA		24" Wide x 24" Deep Electric Griddle.....	2,186.64	100.51
11 44 19 00-0003	EA		36" Wide x 24" Deep Electric Griddle.....	3,086.26	100.51
11 44 19 00-0004	EA		48" Wide x 24" Deep Electric Griddle.....	3,529.36	109.66
11 44 19 00-0005	EA		60" Wide x 24" Deep Electric Griddle.....	4,211.22	109.66
11 44 19 00-0006	EA		72" Wide x 24" Deep Electric Griddle.....	5,385.44	118.79
11 44 19 00-0007			Fryer, With Submerger (11 44 19)		
11 44 19 00-0008	EA		Single Fryer With Submerger.....	2,926.79	116.96
11 44 19 00-0009	EA		Double Fryer With Submerger.....	5,925.56	146.20
11 44 19 00-0010	EA		Fryer Battery With Filter Unit (Single 42 LB Capacity).....	8,966.82	190.06
11 44 19 00-0011	EA		Fryer Battery With Filter Unit (Triple 42 LB Capacity).....	21,195.52	237.57
11 44 19 00-0012	EA		50 LB Capacity, 208 Volt, Electric Fryer.....	3,444.68	146.20
11 44 19 00-0013	EA		50 LB Capacity, Single Basket Lift, 208 Volt, Electric Fryer.....	5,035.78	153.51
11 44 19 00-0014	EA		50 LB Capacity, 480 Volt, Electric Fryer.....	3,611.75	146.20
11 44 19 00-0015	EA		50 LB Capacity, Single Basket Lift, 480 Volt, Electric Fryer.....	5,202.85	153.51
11 44 19 00-0016	EA		85 LB Capacity, Single Basket Lift, 208 Volt, Electric Fryer.....	11,384.87	190.06
11 44 19 00-0017	EA		85 LB Capacity, Single Basket Lift, 480 Volt, Electric Fryer.....	11,659.03	190.06
11 44 19 00-0018			Kettles, Steam Jacketed (11 44 19)		
11 44 19 00-0019	EA		5 Gallon Kettle, With Stand.....	3,002.45	79.59
11 44 19 00-0020	EA		20 Gallon Kettle With Steam Jacket.....	3,977.64	79.59
11 44 19 00-0021	EA		40 Gallon Kettle With Steam Jacket.....	7,063.76	79.59
11 44 19 00-0022	EA		60 Gallon Kettle With Steam Jacket.....	11,036.21	79.59
11 44 19 00-0023			Steamers, Electric (11 44 19)		
11 44 19 00-0024			Cooking Equipment/ Steamers (11 44 19 00-0023)		
11 44 19 00-0025	EA		3 Pan, Electric Countertop Convection Steamer.....	4,703.78	153.51
11 44 19 00-0026	EA		5 Pan, Electric Countertop Convection Steamer.....	6,173.52	160.82
11 44 19 00-0027	EA		3 Pan, Electric Countertop Boilerless/Connectionless Steamer.....	4,358.20	153.51
11 44 19 00-0028	EA		5 Pan, Electric Countertop Boilerless/Connectionless Steamer.....	6,322.73	160.82
11 44 19 00-0029			Braising Pans (11 44 19)		
11 44 19 00-0030	EA		24" x 24", 240 Volt, Tilting Braising Pan.....	6,326.57	138.73
11 44 19 00-0031	EA		24" x 31", 240 Volt, Tilting Braising Pan.....	6,676.24	145.89
11 44 19 00-0032	EA		24" x 41", 240 Volt, Tilting Braising Pan.....	7,110.71	155.36
11 44 19 00-0033	EA		24" x 24", 62,000 BTU/Hour, Tilting Braising Pan.....	8,247.45	180.91
11 44 19 00-0034	EA		24" x 31", 90,000 BTU/Hour, Tilting Braising Pan.....	8,528.38	186.48
11 44 19 00-0035	EA		24" x 41", 120,000 BTU/Hour, Tilting Braising Pan.....	8,859.96	191.42
11 44 19 00-0036			Toasters (11 44 19)		
11 44 19 00-0037	EA		Bun Toaster 3.2 KW.....	1,251.07	28.02
11 44 19 00-0038	EA		Bun Toaster 4.3 KW.....	1,365.37	30.53
11 44 19 00-0039	EA		Pop-Up Toaster, 2 Slot.....	422.12	79.16
11 44 19 00-0040	EA		Conveyor Toaster.....	725.72	118.79
11 44 19 00-0041			Microwave Ovens (11 44 19)		
11 44 19 00-0042	EA		1,000 Watt Commercial Grade Microwave Oven, Freestanding Metallic Cabinet With Dial Timer.....	667.89	
11 44 19 00-0043	EA		1,000 Watt Commercial Grade Microwave Oven, Freestanding Stainless Steel Cabinet With Digital Display.....	926.60	
11 44 19 00-0044			Ceramic Broiler On Storage Base With Doors (11 44 19)		
11 44 19 00-0045	EA		Standard Finish Ceramic Boiler On Storage Base With Doors.....	5,212.71	113.74
11 44 19 00-0046	EA		Stainless Steel Front Ceramic Boiler On Storage Base With Doors.....	5,212.71	113.74
11 44 19 00-0047	EA		Stainless Steel Front And Sides Ceramic Boiler On Storage Base With Doors.....	6,478.81	141.99
11 44 19 00-0048			Gas Countertop Hot Plate (11 44 19)		

11	Equipment
11 40	Foodservice Equipment
11 44	Food Cooking Equipment



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
11 44 19 00-0049	EA		2 Burners Gas Countertop Hot Plate	664.57	14.48
11 46			Food Dispensing Equipment <small>(11 40)</small>		
11 46 13			Bar Equipment <small>(11 46)</small>		
11 46 13 00-0001			Soft Serve Machines <small>(11 46 13)</small>		
11 46 13 00-0002	EA		Soft Serve Machines, Medium	9,128.28	86.41
11 46 13 00-0003	EA		Soft Serve Machines, Large	15,398.02	105.56
11 46 13 00-0004			Salad Bars <small>(11 46 13)</small>		
11 46 13 00-0005	EA		96" Refrigerated Salad Bar With Light 54" Height	6,853.41	308.41
11 46 13 00-0006	EA		96" Refrigerated Salad Bar Without Light 54" Height	6,294.86	308.41
11 46 13 00-0007	EA		96" Iced Salad Bar Without Light 54" Height	4,410.47	169.45
11 46 13 00-0008	EA		79" Iced Salad Bar Without Light 54" Height	3,489.81	139.20
11 46 13 00-0009	EA		79" Refrigerated Salad Bar Without Light 54" Height	5,298.94	204.23
11 46 13 00-0010	EA		114" Iced Salad Bar 34" Height	5,822.12	180.91
11 46 13 00-0011	EA		Salad Bar Tray Fixed	1,146.80	30.64
11 46 13 00-0012	EA		Salad Bar Tray Hinged	1,220.43	30.64
11 46 16			Service Line Equipment <small>(11 46)</small>		
11 46 16 00-0001			Food Warmer Holding Station <small>(11 46 16)</small>		
11 46 16 00-0002	EA		Food Warmer Station And Heat Lamp	462.25	10.34
11 46 16 00-0003			Roll And Food Warmers <small>(11 46 16)</small>		
11 46 16 00-0004	EA		One Drawer, 16 Roll Capacity Food Warmer	994.71	22.28
11 46 16 00-0005	EA		Three Drawer, 36 Roll Capacity Food Warmer	2,276.35	51.01
11 46 16 00-0006			Hot Cabinets With Top Wells Electric <small>(11 46 16)</small>		
11 46 16 00-0007	EA		2 Wells, 2 Compartments Hot Cabinet With Top Wells, Electric	5,330.30	113.74
11 46 16 00-0008	EA		3 Wells, 3 Compartments Hot Cabinet With Top Wells, Electric	7,615.60	163.00
11 46 16 00-0009			Portable Hot Food Units <small>(11 46 16)</small>		
11 46 16 00-0010	EA		44-1/2", 3 Opening Portable Hot Food Unit	1,175.77	25.15
11 46 16 00-0011	EA		72-1/2", 5 Opening Portable Hot Food Unit	1,711.91	36.61
11 46 16 00-0012			Stationary Hot Food Units <small>(11 46 16)</small>		
11 46 16 00-0013	EA		44-1/2", 3 Opening Stationary Hot Food Unit	1,057.85	23.16
11 46 16 00-0014	EA		72-1/2", 5 Opening Stationary Hot Food Unit	1,560.91	34.14
11 46 16 00-0015			Serving Counters <small>(11 46 16)</small>		
11 46 16 00-0016	LF		11" Deep, Tray Slide With 3 Raised Reinforced Ribs And Backing Plate, 316 Stainless Steel Solid Surface, Straight Section	92.76	29.82
11 46 16 00-0017	LF		11" Deep, Tray Slide With 3 Raised Reinforced Ribs And Backing Plate, 316 Stainless Steel Solid Surface, Curved Section	117.49	45.69
11 46 16 00-0018			Drop-In Equipment <small>(11 46 16)</small>		
11 46 16 00-0019	EA		Hot Food Well, Rectangular	399.74	95.03
11 46 16 00-0020	EA		Hot Food Well, Circular	366.97	95.03
11 46 16 00-0021	EA		Refrigerated Well, 2 Compartment	978.42	95.03
11 46 16 00-0022	EA		Refrigerated Well, 3 Compartment	1,109.91	105.56
11 46 16 00-0023	EA		Refrigerated Well, 4 Compartment	1,260.19	118.79
11 46 16 00-0024	EA		Frost Cold Plate	1,538.04	105.56
11 46 16 00-0025			Beverage Dispensing <small>(11 46 16)</small>		
11 46 16 00-0026	EA		Coffee Urn, Twin 3 Gallon	2,488.41	142.60
11 46 16 00-0027	EA		Coffee Urn, Twin 6 Gallon	3,544.37	199.61
11 46 16 00-0028	EA		Coffee Brewer, 5 Burner	1,022.31	142.60
11 46 16 00-0029	EA		Hot Chocolate Dispenser	996.56	117.46
11 46 16 00-0030	EA		Iced Tea Brewer	1,463.42	117.46
11 46 16 00-0031	EA		Juice Dispenser (Concentrate)	1,077.23	210.97
11 46 16 00-0032	EA		Jet Spray Dispenser	1,528.08	211.19
11 46 16 00-0033	EA		Milk Dispenser, Bulk, 2 Flavor	1,282.68	118.79
11 46 16 00-0034	EA		Milk Dispenser, Bulk, 3 Flavor	1,749.54	118.79
11 46 16 00-0035			Dish Dispensers <small>(11 46 16)</small>		
11 46 16 00-0036	EA		Dish Dispenser, 12", Drop-in	520.69	26.08



Equipment	11	
Foodservice Equipment	11 40	11
Food Dispensing Equipment	11 46	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
11 46 16 00-0037 EA Dish Dispenser, Mobile.....	1,613.80	30.47
11 46 16 00-0038 EA Cup And Glass Dispenser, Drop-in.....	896.09	81.09
11 46 16 00-0039 EA Disposable Cup Dispenser, Drop-in.....	323.20	18.26
11 46 16 00-0040 Tray And Silver Dispensers (11 46 16)		
11 46 16 00-0041 EA Tray And Silver Dispensers Mobile.....	2,012.08	18.26
11 46 16 00-0042 Condiment Dispensers (11 46 16)		
11 46 16 00-0043 EA Butter Pat Dispenser.....	122.65	22.87
11 46 16 00-0044 EA Bread Dispenser, Counter Top.....	337.24	22.87
11 46 16 00-0045 Sandwich Rack Warmer (11 46 16)		
11 46 16 00-0046 EA 18 Compartment, 2 Tier Sandwich Rack Warmer.....	2,507.95	82.54
11 46 16 00-0047 Mobile Bread Counter (11 46 16)		
11 46 16 00-0048 EA Mobile Bread And Roll Counter.....	5,757.09	185.56
11 46 16 00-0049 Open Service Stand (11 46 16)		
11 46 16 00-0050 EA 6' Open Service Stand.....	2,228.02	71.23
11 46 16 00-0051 LF Each Additional Ft Over 6 Ft Add.....	304.81	9.63
11 46 16 00-0052 Mobile Serving Stand Unit (11 46 16)		
11 46 16 00-0053 EA 36" Mobile Serving Stand Unit.....	1,945.79	68.13
11 46 16 00-0054 EA 96" Mobile Serving Stand Unit.....	3,198.52	102.12
11 46 16 00-0055 Reach-In Heated Cabinets (11 46 16)		
11 46 16 00-0056 EA Heated Cabinet, Reach-in, 1 Compartment.....	3,929.40	121.86
11 46 16 00-0057 EA Heated Cabinet, Reach-in, 2 Compartment.....	5,663.14	153.29
11 46 16 00-0058 EA Heated Cabinet, 1 Compartment, Pass-Through Roll-In.....	4,113.68	121.86
11 46 16 00-0059 EA Heated Cabinet, Pass-Through, Roll-In 2 Compartment.....	5,930.97	153.29
11 46 16 00-0060 Mobile Heated Cabinets (11 46 16)		
11 46 16 00-0061 EA Heated Cabinet, Mobile.....	4,432.29	45.66
11 46 19 Soda Fountain Equipment (11 46)		
11 46 19 00-0001 Carbonated Beverage Dispensing (11 46 19)		
11 46 19 00-0002 EA Carbonated Beverage Dispenser.....	2,738.23	297.01
11 46 19 00-0003 EA Carbonated Beverage Dispenser With 90 LB Ice.....	4,353.05	339.41
11 46 19 00-0004 EA Carbonated Beverage Dispenser With 150 LB Ice.....	8,013.80	475.16
11 46 19 00-0005 Beverage Chilling Systems (11 46 19)		
11 46 19 00-0006 EA Beverage Chiller, Small.....	4,102.96	244.98
11 46 19 00-0007 EA Beverage Chiller, Large.....	7,632.04	367.50
11 46 83 Ice Machines (11 46)		
11 46 83 00-0001 Ice Flakers (11 46 83)		
11 46 83 00-0002 EA Ice Flakers, 300 LB/Day.....	3,231.07	399.38
11 46 83 00-0003 EA Ice Flakers, 600 LB/Day.....	5,821.49	639.02
11 46 83 00-0004 EA Ice Flakers, 1,000 LB/Day.....	7,231.89	878.65
11 46 83 00-0005 EA Ice Flakers, 2,000 LB/Day.....	8,789.04	958.53
11 46 83 00-0006 Ice Cube Maker (11 46 83)		
11 46 83 00-0007 EA 101 LB/Day, Self Contained Ice Maker With Built-In Bin.....	1,771.91	127.93
11 46 83 00-0008 EA 201 LB/Day, Self Contained Ice Maker With Built-In Bin.....	2,097.79	137.06
11 46 83 00-0009 EA 260 LB/Day, Self Contained Ice Maker With Built-In Bin.....	2,401.70	146.20
11 46 83 00-0010 EA 320 LB/Day, Modular Ice Maker Without Bin.....	2,119.76	137.06
11 46 83 00-0011 EA 451 LB/Day, Modular Ice Maker Without Bin.....	2,302.21	146.20
11 46 83 00-0012 EA 600 LB/Day, Modular Ice Maker Without Bin.....	2,625.82	146.20
11 46 83 00-0013 EA 901 LB/Day, Modular Ice Maker Without Bin.....	3,729.01	155.34
11 46 83 00-0014 EA 1301 LB/Day, Modular Ice Maker Without Bin.....	4,221.66	155.34
11 46 83 00-0015 EA 1601 LB/Day, Modular Ice Maker Without Bin.....	5,078.65	164.48
11 46 83 00-0016 EA 1900 LB/Day, Modular Ice Maker Without Bin.....	5,602.19	164.48
11 46 83 00-0017 Ice Storage Bins (11 46 83)		

11	Equipment
11 40	Foodservice Equipment
11 46	Food Dispensing Equipment



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
11 46 83 00-0018	EA		260 LB Stainless Steel Ice Storage Bin	895.93	109.61
11 46 83 00-0019	EA		360 LB Stainless Steel Ice Storage Bin	975.03	109.61
11 46 83 00-0020	EA		550 LB Stainless Steel Ice Storage Bin	1,204.23	118.73
11 46 83 00-0021	EA		660 LB Stainless Steel Ice Storage Bin	1,292.12	118.73
11 46 83 00-0022	EA		1150 LB Stainless Steel Ice Storage Bin	2,408.98	127.87

11 48 Foodservice Cleaning and Disposal Equipment ^(11 40)

11 48 13 Commercial Dishwashers ^(11 48)

11 48 13 00-0001 Rack Type Dishwasher ^(11 48 13)

11 48 13 00-0002	EA		Dishwasher, 1 Tank And 190 Racks/Hour	7,079.00	159.69
11 48 13 00-0003	EA		Dishwasher, 2 Tanks And 234 Racks/Hour	11,818.71	223.57
11 48 13 00-0004	EA		Dishwasher, 2 Tanks And 265 Racks/Hour	14,212.49	239.54
11 48 13 00-0005	EA		Dishwasher, Automatic - 100 Meals/Hour.....	11,365.34	119.77
11 48 13 00-0006	EA		Dishwasher, Machine Rack	13,303.48	332.72
11 48 13 00-0007	EA		Dishwasher, Hobart LX30-H	3,550.69	139.73

11 48 13 00-0008 Exhaust Hood Dishwasher ^(11 48 13)

11 48 13 00-0009	EA		4' x 4' x 2' Dishwasher Exhaust Hood Stainless Steel With Gutter On All Sides.....	1,426.31	150.09
11 48 13 00-0010	EA		4' x 4' x 7' Dishwasher Exhaust Hood Stainless Steel With Gutter On All Sides.....	2,420.36	180.11

11 48 13 00-0011 Dish Tables ^(11 48 13)

11 48 13 00-0012	LF		Clean/Soiled Dish Table, Basic.....	173.05	30.65
11 48 13 00-0013	LF		Clean/Soiled Dish Table With Trough	271.24	45.94
11 48 13 00-0014	LF		Clean/Soiled Dish Table, Maximum	330.54	61.23

11 48 13 00-0015 Sprays And Hoses ^(11 48 13)

11 48 13 00-0016 Sprays, Fillers ^(11 48 13 00-0015)

11 48 13 00-0017	EA		Pre-Rinse Spray.....	321.49	58.34
11 48 13 00-0018	EA		Kettle Fillers	280.54	58.34

11 48 13 00-0019 Hoses ^(11 48 13 00-0015)

11 48 13 00-0020	EA		Hose Reel	385.80	70.04
11 48 13 00-0021	EA		Wash-Down Hose	303.89	70.04
11 48 13 00-0022	EA		Hose Reel And Spray System With Accessories (Chicago 535NF).....	1,183.38	

11 48 16 Food Waste Disposers ^(11 48)

11 48 16 00-0001 Garbage Disposals ^(11 48 16)

Note: Manual switch.

11 48 16 00-0002	EA		Garbage Disposal 1.5 HP At 100 GPH	1,984.61	119.77
11 48 16 00-0003	EA		Garbage Disposal 3 HP At 120 GPH	3,056.28	79.85
11 48 16 00-0004	EA		Garbage Disposal 5 HP At 250 GPH	3,652.79	159.69
11 48 16 00-0005	EA		Garbage Disposal 7-1/2 HP	5,045.40	158.73

11 48 16 00-0006 Pulper/Extractors ^(11 48 16)

11 48 16 00-0007	EA		5 HP, Pulper/Extractor, Close-Coupled.....	4,441.64	166.32
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11 50 Educational And Scientific Equipment ⁽¹¹⁾

11 52 Audio-Visual Equipment ^(11 50)

11 52 13 Projection Screens ^(11 52)

11 52 13 13 Fixed Projection Screens ^(11 52 13)

11 52 13 13-0001 Screens ^(11 52 13 13)

11 52 13 13-0002 Pull Down Project Screen, Matte White Or Glass Beaded (Da-Lite Model B)

11 52 13 13-0003	EA		40" x 40" Pull Down Projection Screen (Da-Lite B)	169.62	50.31
			For High Contrast Matte, Add	40.00	
			For Video Spectra Fabric, Add	40.00	
			For High Power Fabric, Add	120.00	
11 52 13 13-0004	EA		50" x 50" Pull Down Projection Screen (Da-Lite B)	204.77	64.69
			For High Contrast Matte, Add	40.00	
			For Video Spectra Fabric, Add	40.00	
			For High Power Fabric, Add	120.00	
11 52 13 13-0005	EA		60" x 60" Pull Down Projection Screen (Da-Lite B)	268.68	89.84
			For High Contrast Matte, Add	40.00	
			For Video Spectra Fabric, Add	40.00	
			For High Power Fabric, Add	120.00	



Equipment	11
Educational And Scientific Equipment	11 50
Audio-Visual Equipment	11 52

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
11 52 13 13-0006	EA		70" x 70" Pull Down Projection Screen (Da-Lite B).....	314.62	107.81
			<i>For High Contrast Matte, Add</i>	40.00	
			<i>For Video Spectra Fabric, Add</i>	40.00	
			<i>For High Power Fabric, Add</i>	120.00	
11 52 13 13-0007	EA		84" x 84" Pull Down Projection Screen (Da-Lite B).....	482.43	161.71
			<i>For High Contrast Matte, Add</i>	40.00	
			<i>For Video Spectra Fabric, Add</i>	40.00	
			<i>For High Power Fabric, Add</i>	120.00	
11 52 13 13-0008	EA		96" x 96" Pull Down Projection Screen (Da-Lite B).....	558.36	179.68
			<i>For High Contrast Matte, Add</i>	40.00	
			<i>For Video Spectra Fabric, Add</i>	40.00	
			<i>For High Power Fabric, Add</i>	120.00	
11 52 13 13-0009	EA		64" x 84" Pull Down Projection Screen (Da-Lite B).....	388.99	114.99
			<i>For High Contrast Matte, Add</i>	40.00	
			<i>For Video Spectra Fabric, Add</i>	40.00	
			<i>For High Power Fabric, Add</i>	120.00	
11 52 13 13-0010	EA		72" x 96" Pull Down Projection Screen (Da-Lite B).....	456.49	143.74
			<i>For High Contrast Matte, Add</i>	40.00	
			<i>For Video Spectra Fabric, Add</i>	40.00	
			<i>For High Power Fabric, Add</i>	120.00	
11 52 13 13-0011	EA		43" x 57" Pull Down Projection Screen (Da-Lite B).....	231.18	61.09
			<i>For High Contrast Matte, Add</i>	40.00	
			<i>For Video Spectra Fabric, Add</i>	40.00	
			<i>For High Power Fabric, Add</i>	120.00	
11 52 13 13-0012	EA		50" x 67" Pull Down Projection Screen (Da-Lite B).....	321.49	86.25
			<i>For High Contrast Matte, Add</i>	40.00	
			<i>For Video Spectra Fabric, Add</i>	40.00	
			<i>For High Power Fabric, Add</i>	120.00	
11 52 13 13-0013	EA		55" x 77" Pull Down Projection Screen (Da-Lite B).....	353.06	97.03
			<i>For High Contrast Matte, Add</i>	40.00	
			<i>For Video Spectra Fabric, Add</i>	40.00	
			<i>For High Power Fabric, Add</i>	120.00	
11 52 13 13-0014	EA		60" x 80" Pull Down Projection Screen (Da-Lite B).....	377.42	104.21
			<i>For High Contrast Matte, Add</i>	40.00	
			<i>For Video Spectra Fabric, Add</i>	40.00	
			<i>For High Power Fabric, Add</i>	120.00	
11 52 13 13-0015	EA		69" x 92" Pull Down Projection Screen (Da-Lite B).....	440.55	125.77
			<i>For High Contrast Matte, Add</i>	40.00	
			<i>For Video Spectra Fabric, Add</i>	40.00	
			<i>For High Power Fabric, Add</i>	120.00	
11 52 13 13-0016	EA		45" x 80" Pull Down Projection Screen (Da-Lite B).....	348.68	89.84
			<i>For High Contrast Matte, Add</i>	40.00	
			<i>For Video Spectra Fabric, Add</i>	40.00	
			<i>For High Power Fabric, Add</i>	120.00	
11 52 13 13-0017	EA		52" x 92" Pull Down Projection Screen (Da-Lite B).....	397.42	104.21
			<i>For High Contrast Matte, Add</i>	40.00	
			<i>For Video Spectra Fabric, Add</i>	40.00	
			<i>For High Power Fabric, Add</i>	120.00	
11 52 13 13-0018			Heavy Duty Pull Down Project Screen, Matte White Or Glass Beaded (Da-Lite Model C) <small>(11 52 13 13-0001)</small>		
11 52 13 13-0019	EA		50" x 50" Pull Down Projection Screen (Da-Lite C).....	344.77	64.69
			<i>For High Contrast Matte, Add</i>	40.00	
			<i>For Video Spectra Fabric, Add</i>	40.00	
			<i>For High Power Fabric, Add</i>	120.00	
11 52 13 13-0020	EA		60" x 60" Pull Down Projection Screen (Da-Lite C).....	418.68	89.84
			<i>For High Contrast Matte, Add</i>	40.00	
			<i>For Video Spectra Fabric, Add</i>	40.00	
			<i>For High Power Fabric, Add</i>	120.00	
11 52 13 13-0021	EA		70" x 70" Pull Down Projection Screen (Da-Lite C).....	503.36	122.18
			<i>For High Contrast Matte, Add</i>	40.00	
			<i>For Video Spectra Fabric, Add</i>	40.00	
			<i>For High Power Fabric, Add</i>	120.00	
11 52 13 13-0022	EA		84" x 84" Pull Down Projection Screen (Da-Lite C).....	602.43	161.71
			<i>For High Contrast Matte, Add</i>	40.00	
			<i>For Video Spectra Fabric, Add</i>	40.00	
			<i>For High Power Fabric, Add</i>	120.00	
11 52 13 13-0023	EA		6' x 8' Pull Down Projection Screen (Da-Lite C).....	649.61	165.30
			<i>For High Contrast Matte, Add</i>	40.00	
			<i>For Video Spectra Fabric, Add</i>	40.00	
			<i>For High Power Fabric, Add</i>	120.00	
11 52 13 13-0024	EA		8' x 8' Pull Down Projection Screen (Da-Lite C).....	698.36	179.68
			<i>For High Contrast Matte, Add</i>	40.00	
			<i>For Video Spectra Fabric, Add</i>	40.00	
			<i>For High Power Fabric, Add</i>	120.00	
11 52 13 13-0025	EA		7' x 9' Pull Down Projection Screen (Da-Lite C).....	708.36	179.68
			<i>For High Contrast Matte, Add</i>	40.00	
			<i>For Video Spectra Fabric, Add</i>	40.00	
			<i>For High Power Fabric, Add</i>	120.00	
11 52 13 13-0026	EA		9' x 9' Pull Down Projection Screen (Da-Lite C).....	759.92	190.46
			<i>For High Contrast Matte, Add</i>	40.00	
			<i>For Video Spectra Fabric, Add</i>	40.00	
			<i>For High Power Fabric, Add</i>	120.00	

11 Equipment**11 50 Educational And Scientific Equipment****11 52 Audio-Visual Equipment**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
11 52 13 13-0027	EA		8' x 10' Pull Down Projection Screen (Da-Lite C).....	811.48	201.24
			<i>For High Contrast Matte, Add</i>	40.00	
			<i>For Video Spectra Fabric, Add</i>	40.00	
			<i>For High Power Fabric, Add</i>	120.00	
11 52 13 13-0028	EA		10' x 10' Pull Down Projection Screen (Da-Lite C).....	870.22	215.62
			<i>For High Contrast Matte, Add</i>	40.00	
			<i>For Video Spectra Fabric, Add</i>	40.00	
			<i>For High Power Fabric, Add</i>	120.00	
11 52 13 13-0029	EA		9' x 12' Pull Down Projection Screen (Da-Lite C).....	950.22	215.62
			<i>For High Contrast Matte, Add</i>	40.00	
			<i>For Video Spectra Fabric, Add</i>	40.00	
			<i>For High Power Fabric, Add</i>	120.00	
11 52 13 13-0030	EA		12' x 12' Pull Down Projection Screen (Da-Lite C).....	1,133.97	287.49
			<i>For High Contrast Matte, Add</i>	40.00	
			<i>For Video Spectra Fabric, Add</i>	40.00	
			<i>For High Power Fabric, Add</i>	120.00	
11 52 13 13-0031			Heavy Duty Pull Down Project Screen, Matte White Or Glass Beaded (Da-Lite Model C With CSR) <small>(11 52 13 13-0001)</small>		
			Note: With controlled screen return.		
11 52 13 13-0032	EA		60" x 60" Pull Down Projection Screen With CSR (Controlled Screen Return) (Da-Lite C With CSR).....	618.68	89.84
			<i>For High Contrast Matte, Add</i>	40.00	
			<i>For Video Spectra Fabric, Add</i>	40.00	
			<i>For High Power Fabric, Add</i>	120.00	
11 52 13 13-0033	EA		70" x 70" Pull Down Projection Screen With CSR (Controlled Screen Return) (Da-Lite C With CSR).....	713.36	122.18
			<i>For High Contrast Matte, Add</i>	40.00	
			<i>For Video Spectra Fabric, Add</i>	40.00	
			<i>For High Power Fabric, Add</i>	120.00	
11 52 13 13-0034	EA		84" x 84" Pull Down Projection Screen With CSR (Controlled Screen Return) (Da-Lite C With CSR).....	812.43	161.71
			<i>For High Contrast Matte, Add</i>	40.00	
			<i>For Video Spectra Fabric, Add</i>	40.00	
			<i>For High Power Fabric, Add</i>	120.00	
11 52 13 13-0035	EA		6' x 8' Pull Down Projection Screen With CSR (Controlled Screen Return) (Da-Lite C With CSR).....	849.61	165.30
			<i>For High Contrast Matte, Add</i>	40.00	
			<i>For Video Spectra Fabric, Add</i>	40.00	
			<i>For High Power Fabric, Add</i>	120.00	
11 52 13 13-0036	EA		8' x 8' Pull Down Projection Screen With CSR (Controlled Screen Return) (Da-Lite C With CSR).....	908.36	179.68
			<i>For High Contrast Matte, Add</i>	40.00	
			<i>For Video Spectra Fabric, Add</i>	40.00	
			<i>For High Power Fabric, Add</i>	120.00	
11 52 13 13-0037	EA		7' x 9' Pull Down Projection Screen With CSR (Controlled Screen Return) (Da-Lite C With CSR).....	918.36	179.68
			<i>For High Contrast Matte, Add</i>	40.00	
			<i>For Video Spectra Fabric, Add</i>	40.00	
			<i>For High Power Fabric, Add</i>	120.00	
11 52 13 13-0038	EA		9' x 9' Pull Down Projection Screen With CSR (Controlled Screen Return) (Da-Lite C With CSR).....	969.92	190.46
			<i>For High Contrast Matte, Add</i>	40.00	
			<i>For Video Spectra Fabric, Add</i>	40.00	
			<i>For High Power Fabric, Add</i>	120.00	
11 52 13 13-0039	EA		8' x 10' Pull Down Projection Screen With CSR (Controlled Screen Return) (Da-Lite C With CSR).....	994.30	197.64
			<i>For High Contrast Matte, Add</i>	40.00	
			<i>For Video Spectra Fabric, Add</i>	40.00	
			<i>For High Power Fabric, Add</i>	120.00	
11 52 13 13-0040	EA		10' x 10' Pull Down Projection Screen With CSR (Controlled Screen Return) (Da-Lite C With CSR).....	1,110.22	215.62
			<i>For High Contrast Matte, Add</i>	40.00	
			<i>For Video Spectra Fabric, Add</i>	40.00	
			<i>For High Power Fabric, Add</i>	120.00	
11 52 13 13-0041	EA		9' x 12' Pull Down Projection Screen With CSR (Controlled Screen Return) (Da-Lite C With CSR).....	1,200.22	215.62
			<i>For High Contrast Matte, Add</i>	40.00	
			<i>For Video Spectra Fabric, Add</i>	40.00	
			<i>For High Power Fabric, Add</i>	120.00	
11 52 13 13-0042	EA		12' x 12' Pull Down Projection Screen With CSR (Controlled Screen Return) (Da-Lite C With CSR).....	1,403.97	287.49
			<i>For High Contrast Matte, Add</i>	40.00	
			<i>For Video Spectra Fabric, Add</i>	40.00	
			<i>For High Power Fabric, Add</i>	120.00	
11 52 13 13-0043			Electric Project Screen, Matte White Or Glass Beaded (Da-Lite Cosmopolitan Electrol) <small>(11 52 13 13-0001)</small>		
			Note: Heavy-duty screen for exposed installation.		
11 52 13 13-0044	EA		50" x 50" Electric Projection Screen, Wall Or Ceiling Mounted (Da-Lite Cosmopolitan Electrol).....	1,280.02	80.86
11 52 13 13-0045	EA		60" x 60" Electric Projection Screen, Wall Or Ceiling Mounted (Da-Lite Cosmopolitan Electrol).....	1,311.34	89.84
11 52 13 13-0046	EA		70" x 70" Electric Projection Screen, Wall Or Ceiling Mounted (Da-Lite Cosmopolitan Electrol).....	1,372.63	107.81
11 52 13 13-0047	EA		84" x 84" Electric Projection Screen, Wall Or Ceiling Mounted (Da-Lite Cosmopolitan Electrol).....	1,595.21	161.71
11 52 13 13-0048	EA		6' x 8' Electric Projection Screen, Wall Or Ceiling Mounted (Da-Lite Cosmopolitan Electrol).....	1,634.42	165.30
11 52 13 13-0049	EA		8' x 8' Electric Projection Screen, Wall Or Ceiling Mounted (Da-Lite Cosmopolitan Electrol).....	1,736.56	179.68
11 52 13 13-0050	EA		7' x 9' Electric Projection Screen, Wall Or Ceiling Mounted (Da-Lite Cosmopolitan Electrol).....	1,769.93	179.68
11 52 13 13-0051	EA		9' x 9' Electric Projection Screen, Wall Or Ceiling Mounted (Da-Lite Cosmopolitan Electrol).....	1,859.13	192.25
11 52 13 13-0052	EA		8' x 10' Electric Projection Screen, Wall Or Ceiling Mounted (Da-Lite Cosmopolitan Electrol).....	1,966.51	201.24
11 52 13 13-0053	EA		10' x 10' Electric Projection Screen, Wall Or Ceiling Mounted (Da-Lite Cosmopolitan Electrol).....	2,039.29	215.62
11 52 13 13-0054	EA		9' x 12' Electric Projection Screen, Wall Or Ceiling Mounted (Da-Lite Cosmopolitan Electrol).....	2,099.34	215.62
11 52 13 13-0055	EA		12' x 12' Electric Projection Screen, Wall Or Ceiling Mounted (Da-Lite Cosmopolitan Electrol).....	2,347.19	287.49



Equipment	11	
Educational And Scientific Equipment	11 50	11
Audio-Visual Equipment	11 52	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
11 52 13 13-0056 Electric Project Screen, Matte White Or Glass Beaded (Da-Lite Professional Electrol) <small>(11 52 13 13-0001)</small>		
Note: Heavy-duty screen for exposed or recessed installation without doors.		
11 52 13 13-0057 EA 9' x 12' Electric Projection Screen, Ceiling Mounted (Da-Lite Professional Electrol)	2,130.22	215.62
Note: Heavy-duty screen for exposed or recessed installation without doors.		
11 52 13 13-0058 EA 12' x 12' Electric Projection Screen, Ceiling Mounted (Da-Lite Professional Electrol)	2,353.97	287.49
Note: Heavy-duty screen for exposed or recessed installation without doors.		
11 52 13 13-0059 EA 14' x 14' Electric Projection Screen, Ceiling Mounted (Da-Lite Professional Electrol)	2,885.84	323.43
Note: Heavy-duty screen for exposed or recessed installation without doors.		
11 52 13 13-0060 EA 12' x 16' Electric Projection Screen, Ceiling Mounted (Da-Lite Professional Electrol)	3,057.71	359.36
Note: Heavy-duty screen for exposed or recessed installation without doors.		
11 52 13 13-0061 EA 16' x 16' Electric Projection Screen, Ceiling Mounted (Da-Lite Professional Electrol)	3,301.46	431.23
Note: Heavy-duty screen for exposed or recessed installation without doors.		
11 52 13 13-0062 EA 13.5' x 18' Electric Projection Screen, Ceiling Mounted (Da-Lite Professional Electrol)	3,673.33	467.16
Note: Heavy-duty screen for exposed or recessed installation without doors.		
11 52 13 13-0063 EA 18' x 18' Electric Projection Screen, Ceiling Mounted (Da-Lite Professional Electrol)	4,015.20	503.10
Note: Heavy-duty screen for exposed or recessed installation without doors.		
11 52 13 13-0064 EA 15' x 20' Electric Projection Screen, Ceiling Mounted (Da-Lite Professional Electrol)	4,215.20	503.10
Note: Heavy-duty screen for exposed or recessed installation without doors.		
11 52 13 13-0065 EA 20' x 20' Electric Projection Screen, Ceiling Mounted (Da-Lite Professional Electrol)	4,568.95	574.97
Note: Heavy-duty screen for exposed or recessed installation without doors.		
11 52 13 13-0066 EA 11' x 22' Electric Projection Screen, Ceiling Mounted (Da-Lite Professional Electrol)	4,173.33	467.16
Note: Heavy-duty screen for exposed or recessed installation without doors.		
11 52 13 13-0067 EA 16.5' x 22' Electric Projection Screen, Ceiling Mounted (Da-Lite Professional Electrol)	4,488.95	574.97
Note: Heavy-duty screen for exposed or recessed installation without doors.		
11 52 13 13-0068 EA 22' x 22' Electric Projection Screen, Ceiling Mounted (Da-Lite Professional Electrol)	4,732.68	646.84
Note: Heavy-duty screen for exposed or recessed installation without doors.		
11 52 13 13-0069 EA 12' x 24' Electric Projection Screen, Ceiling Mounted (Da-Lite Professional Electrol)	4,445.20	503.10
Note: Heavy-duty screen for exposed or recessed installation without doors.		
11 52 13 13-0070 EA 18' x 24' Electric Projection Screen, Ceiling Mounted (Da-Lite Professional Electrol)	5,732.68	646.84
Note: Heavy-duty screen for exposed or recessed installation without doors.		
11 52 13 13-0071 Electric Project Screen, Matte White Or Glass Beaded (Da-Lite Executive Electrol) <small>(11 52 13 13-0001)</small>		
Note: In-the-ceiling screen with automatically operated door to conceal screen.		
11 52 13 13-0072 EA 50" x 50" Electric Projection Screen, Ceiling Mounted (Da-Lite Executive Electrol)	1,860.71	80.86
Note: In-the-ceiling screen with automatically operated door to conceal screen.		
11 52 13 13-0073 EA 60" x 60" Electric Projection Screen, Ceiling Mounted (Da-Lite Executive Electrol)	1,908.68	89.84
Note: In-the-ceiling screen with automatically operated door to conceal screen.		
11 52 13 13-0074 EA 70" x 70" Electric Projection Screen, Ceiling Mounted (Da-Lite Executive Electrol)	1,964.62	107.81
Note: In-the-ceiling screen with automatically operated door to conceal screen.		
11 52 13 13-0075 EA 84" x 84" Electric Projection Screen, Ceiling Mounted (Da-Lite Executive Electrol)	2,142.43	161.71
Note: In-the-ceiling screen with automatically operated door to conceal screen.		
11 52 13 13-0076 EA 6' x 8' Electric Projection Screen, Ceiling Mounted (Da-Lite Executive Electrol)	2,169.61	165.30
Note: In-the-ceiling screen with automatically operated door to conceal screen.		
11 52 13 13-0077 EA 8' x 8' Electric Projection Screen, Ceiling Mounted (Da-Lite Executive Electrol)	2,258.36	179.68
Note: In-the-ceiling screen with automatically operated door to conceal screen.		
11 52 13 13-0078 EA 7' x 9' Electric Projection Screen, Ceiling Mounted (Da-Lite Executive Electrol)	2,318.36	179.68
Note: In-the-ceiling screen with automatically operated door to conceal screen.		
11 52 13 13-0079 EA 9' x 9' Electric Projection Screen, Ceiling Mounted (Da-Lite Executive Electrol)	2,373.51	192.25
Note: In-the-ceiling screen with automatically operated door to conceal screen.		
11 52 13 13-0080 EA 8' x 10' Electric Projection Screen, Ceiling Mounted (Da-Lite Executive Electrol)	2,441.48	201.24
Note: In-the-ceiling screen with automatically operated door to conceal screen.		
11 52 13 13-0081 EA 10' x 10' Electric Projection Screen, Ceiling Mounted (Da-Lite Executive Electrol)	2,510.22	215.62
Note: In-the-ceiling screen with automatically operated door to conceal screen.		
11 52 13 13-0082 EA 9' x 12' Electric Projection Screen, Ceiling Mounted (Da-Lite Executive Electrol)	2,530.22	215.62
Note: In-the-ceiling screen with automatically operated door to conceal screen.		
11 52 13 13-0083 EA 12' x 12' Electric Projection Screen, Ceiling Mounted (Da-Lite Executive Electrol)	2,773.97	287.49
Note: In-the-ceiling screen with automatically operated door to conceal screen.		
11 52 13 13-0084 EA 10.6' x 14' Electric Projection Screen, Ceiling Mounted (Da-Lite Executive Electrol)	2,969.90	305.45
Note: In-the-ceiling screen with automatically operated door to conceal screen.		
11 52 13 13-0085 EA 14' x 14' Electric Projection Screen, Ceiling Mounted (Da-Lite Executive Electrol)	3,105.84	323.43
Note: In-the-ceiling screen with automatically operated door to conceal screen.		
11 52 13 13-0086 EA 12' x 16' Electric Projection Screen, Ceiling Mounted (Da-Lite Executive Electrol)	3,397.71	359.36
Note: In-the-ceiling screen with automatically operated door to conceal screen.		
11 52 13 13-0087 EA 16' x 16' Electric Projection Screen, Ceiling Mounted (Da-Lite Executive Electrol)	3,591.46	431.23
Note: In-the-ceiling screen with automatically operated door to conceal screen.		
11 52 13 13-0088 Electric Project Screen, Matte White Or Glass Beaded (Da-Lite Senior Electrol) <small>(11 52 13 13-0001)</small>		
Note: In-the-ceiling screen with automatically operated door to conceal screen.		
11 52 13 13-0089 EA 50" x 50" Electric Projection Screen (Da-Lite Senior Electrol)	1,556.71	80.86
Note: Heavy duty screen for recessed or exposed installation.		
11 52 13 13-0090 EA 60" x 60" Electric Projection Screen (Da-Lite Senior Electrol)	1,606.64	98.82
Note: Heavy duty screen for recessed or exposed installation.		
11 52 13 13-0091 EA 70" x 70" Electric Projection Screen (Da-Lite Senior Electrol)	1,633.62	107.81
Note: Heavy duty screen for recessed or exposed installation.		
11 52 13 13-0092 EA 84" x 84" Electric Projection Screen (Da-Lite Senior Electrol)	1,770.43	161.71
Note: Heavy duty screen for recessed or exposed installation.		

11 Equipment**11 50 Educational And Scientific Equipment****11 52 Audio-Visual Equipment**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
11 52 13 13-0093	EA		6' x 8' Electric Projection Screen (Da-Lite Senior Electrol)..... Note: Heavy duty screen for recessed or exposed installation.	1,786.61	165.30
11 52 13 13-0094	EA		8' x 8' Electric Projection Screen (Da-Lite Senior Electrol)..... Note: Heavy duty screen for recessed or exposed installation.	1,853.36	179.68
11 52 13 13-0095	EA		7' x 9' Electric Projection Screen (Da-Lite Senior Electrol)..... Note: Heavy duty screen for recessed or exposed installation.	1,906.36	179.68
11 52 13 13-0096	EA		9' x 9' Electric Projection Screen (Da-Lite Senior Electrol)..... Note: Heavy duty screen for recessed or exposed installation.	2,002.51	192.25
11 52 13 13-0097	EA		8' x 10' Electric Projection Screen (Da-Lite Senior Electrol)..... Note: Heavy duty screen for recessed or exposed installation.	2,034.48	201.24
11 52 13 13-0098	EA		10' x 10' Electric Projection Screen (Da-Lite Senior Electrol)..... Note: Heavy duty screen for recessed or exposed installation.	2,106.23	215.62
11 52 13 13-0099	EA		9' x 12' Electric Projection Screen (Da-Lite Senior Electrol)..... Note: Heavy duty screen for recessed or exposed installation.	2,138.10	251.55
11 52 13 13-0100	EA		12' x 12' Electric Projection Screen (Da-Lite Senior Electrol)..... Note: Heavy duty screen for recessed or exposed installation.	2,349.97	287.49
11 52 13 13-0101	EA		10'-6" x 14' Electric Projection Screen (Da-Lite Senior Electrol)..... Note: Heavy duty screen for recessed or exposed installation.	2,883.90	305.45
11 52 13 13-0102	EA		14' x 14' Electric Projection Screen (Da-Lite Senior Electrol)..... Note: Heavy duty screen for recessed or exposed installation.	3,014.84	323.43
11 52 13 13-0103	EA		12' x 16' Electric Projection Screen (Da-Lite Senior Electrol)..... Note: Heavy duty screen for recessed or exposed installation.	3,271.71	359.36
11 52 13 13-0104	EA		16' x 16' Electric Projection Screen (Da-Lite Senior Electrol)..... Note: Heavy duty screen for recessed or exposed installation.	3,457.46	431.23
11 52 13 13-0105	EA		13'-6" x 18' Electric Projection Screen (Da-Lite Senior Electrol)..... Note: Heavy duty screen for recessed or exposed installation.	3,764.33	467.16
11 52 13 13-0106	EA		18' x 18' Electric Projection Screen (Da-Lite Senior Electrol)..... Note: Heavy duty screen for recessed or exposed installation.	4,003.20	503.10
11 52 13 13-0107	EA		15' x 20' Electric Projection Screen (Da-Lite Senior Electrol)..... Note: Heavy duty screen for recessed or exposed installation.	4,149.20	503.10
11 52 13 13-0108	EA		20' x 20' Electric Projection Screen (Da-Lite Senior Electrol)..... Note: Heavy duty screen for recessed or exposed installation.	4,604.95	574.97
11 52 13 13-0109	EA		50" x 67" Electric Projection Screen (Da-Lite Senior Electrol)..... Note: Heavy duty screen for recessed or exposed installation.	1,633.62	107.81
11 52 13 13-0110	EA		60" x 80" Electric Projection Screen (Da-Lite Senior Electrol)..... Note: Heavy duty screen for recessed or exposed installation.	1,734.49	143.74
11 52 13 13-0111	EA		69" x 92" Electric Projection Screen (Da-Lite Senior Electrol)..... Note: Heavy duty screen for recessed or exposed installation.	1,779.43	161.71
11 52 13 13-0112	EA		87" x 116" Electric Projection Screen (Da-Lite Senior Electrol)..... Note: Heavy duty screen for recessed or exposed installation.	2,044.48	201.24
11 52 13 13-0113	EA		105" x 140" Electric Projection Screen (Da-Lite Senior Electrol)..... Note: Heavy duty screen for recessed or exposed installation.	2,221.10	251.55
11 52 13 13-0114	EA		123" x 164" Electric Projection Screen (Da-Lite Senior Electrol)..... Note: Heavy duty screen for recessed or exposed installation.	2,763.84	323.43
11 52 13 13-0115	EA		141" x 188" Electric Projection Screen (Da-Lite Senior Electrol)..... Note: Heavy duty screen for recessed or exposed installation.	2,983.59	395.30
11 52 13 13-0116	EA		12' x 24' Electric Projection Screen (Da-Lite Senior Electrol)..... Note: Heavy duty screen for recessed or exposed installation.	5,105.07	539.03
11 52 13 13-0117	EA		45" x 80" Electric Projection Screen (Da-Lite Senior Electrol)..... Note: Heavy duty screen for recessed or exposed installation.	1,739.49	143.74
11 52 13 13-0118	EA		52" x 92" Electric Projection Screen (Da-Lite Senior Electrol)..... Note: Heavy duty screen for recessed or exposed installation.	1,794.43	161.71
11 52 13 13-0119	EA		54" x 96" Electric Projection Screen (Da-Lite Senior Electrol)..... Note: Heavy duty screen for recessed or exposed installation.	1,844.99	172.49
11 52 13 13-0120	EA		58" x 104" Electric Projection Screen (Da-Lite Senior Electrol)..... Note: Heavy duty screen for recessed or exposed installation.	1,882.73	186.86
11 52 13 13-0121	EA		65" x 116" Electric Projection Screen (Da-Lite Senior Electrol)..... Note: Heavy duty screen for recessed or exposed installation.	1,996.48	201.24
11 52 13 13-0122	EA		78" x 139" Electric Projection Screen (Da-Lite Senior Electrol)..... Note: Heavy duty screen for recessed or exposed installation.	2,183.10	251.55
11 52 13 13-0123	EA		92" x 164" Electric Projection Screen (Da-Lite Senior Electrol)..... Note: Heavy duty screen for recessed or exposed installation.	2,736.84	323.43
11 52 13 13-0124	EA		106" x 188" Electric Projection Screen (Da-Lite Senior Electrol)..... Note: Heavy duty screen for recessed or exposed installation.	3,182.59	395.30
11 52 13 13-0125	EA		119" x 212" Electric Projection Screen (Da-Lite Senior Electrol)..... Note: Heavy duty screen for recessed or exposed installation.	3,851.33	467.16
11 52 13 13-0126			Electric Project Screen, Matte White Or Glass Beaded (Da-Lite Boardroom Electrol) <small>(11 52 13 13-0001)</small> Note: In-the-ceiling screen with automatically operated door to conceal screen.		
11 52 13 13-0127	EA		50" x 50" Electric Projection Screen, Ceiling Mounted (Da-Lite Boardroom Electrol)..... Note: In-the-ceiling screen with automatically operated door to conceal screen.	2,487.74	80.86
11 52 13 13-0128	EA		60" x 60" Electric Projection Screen, Ceiling Mounted (Da-Lite Boardroom Electrol)..... Note: In-the-ceiling screen with automatically operated door to conceal screen.	2,537.74	89.84
11 52 13 13-0129	EA		70" x 70" Electric Projection Screen, Ceiling Mounted (Da-Lite Boardroom Electrol)..... Note: In-the-ceiling screen with automatically operated door to conceal screen.	2,597.70	107.81
11 52 13 13-0130	EA		84" x 84" Electric Projection Screen, Ceiling Mounted (Da-Lite Boardroom Electrol)..... Note: In-the-ceiling screen with automatically operated door to conceal screen.	2,788.25	161.71
11 52 13 13-0131	EA		6' x 8' Electric Projection Screen, Ceiling Mounted (Da-Lite Boardroom Electrol)..... Note: In-the-ceiling screen with automatically operated door to conceal screen.	2,822.12	165.30
11 52 13 13-0132	EA		8' x 8' Electric Projection Screen, Ceiling Mounted (Da-Lite Boardroom Electrol)..... Note: In-the-ceiling screen with automatically operated door to conceal screen.	2,908.26	179.68



Equipment	11	
Educational And Scientific Equipment	11 50	11
Audio-Visual Equipment	11 52	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
11 52 13 13-0133	EA		7' x 9' Electric Projection Screen, Ceiling Mounted (Da-Lite Boardroom Electrol) Note: In-the-ceiling screen with automatically operated door to conceal screen.	2,997.67	179.68
11 52 13 13-0134	EA		9' x 9' Electric Projection Screen, Ceiling Mounted (Da-Lite Boardroom Electrol) Note: In-the-ceiling screen with automatically operated door to conceal screen.	3,080.20	192.25
11 52 13 13-0135	EA		8' x 10' Electric Projection Screen, Ceiling Mounted (Da-Lite Boardroom Electrol) Note: In-the-ceiling screen with automatically operated door to conceal screen.	3,140.87	201.24
11 52 13 13-0136	EA		10' x 10' Electric Projection Screen, Ceiling Mounted (Da-Lite Boardroom Electrol) Note: In-the-ceiling screen with automatically operated door to conceal screen.	3,237.67	215.62
11 52 13 13-0137	EA		9' x 12' Electric Projection Screen, Ceiling Mounted (Da-Lite Boardroom Electrol) Note: In-the-ceiling screen with automatically operated door to conceal screen.	3,329.75	215.62
11 52 13 13-0138	EA		12' x 12' Electric Projection Screen, Ceiling Mounted (Da-Lite Boardroom Electrol) Note: In-the-ceiling screen with automatically operated door to conceal screen.	3,550.91	287.49
11 52 13 13-0139			Electric Ascending Project Screen, Matte White, Glass Beaded (Da-Lite Ascender Electrol) <small>(11 52 13 13-0001)</small> Note: High contrast matte white, video spectrum or high power. Includes a motorized spring assisted scissors mechanism which raises the screen surface from the housing ensuring smooth operation. A trap door housing keeps the screen and lift mechanism hidden until the screen is activated.		
11 52 13 13-0140	EA		60" x 80" Electric Ascending Projection Screen (Da-Lite Ascender Electrol)..... Note: Includes a motorized spring assisted scissors mechanism and trap door housing.	4,738.36	179.68
11 52 13 13-0141	EA		69" x 92" Electric Ascending Projection Screen (Da-Lite Ascender Electrol)..... Note: Includes a motorized spring assisted scissors mechanism and trap door housing.	5,090.22	215.62
11 52 13 13-0142	EA		87" x 116" Electric Ascending Projection Screen (Da-Lite Ascender Electrol)..... Note: Includes a motorized spring assisted scissors mechanism and trap door housing.	5,985.84	323.43
11 52 13 13-0143	EA		105" x 140" Electric Ascending Projection Screen (Da-Lite Ascender Electrol)..... Note: Includes a motorized spring assisted scissors mechanism and trap door housing.	7,561.46	431.23
11 52 13 13-0144	EA		120" x 160" Electric Ascending Projection Screen (Da-Lite Ascender Electrol)..... Note: Includes a motorized spring assisted scissors mechanism and trap door housing.	8,405.20	503.10
11 52 13 13-0145	EA		52" x 92" Electric Ascending Projection Screen (Da-Lite Ascender Electrol)..... Note: Includes a motorized spring assisted scissors mechanism and trap door housing.	5,018.36	179.68
11 52 13 13-0146	EA		58" x 104" Electric Ascending Projection Screen (Da-Lite Ascender Electrol)..... Note: Includes a motorized spring assisted scissors mechanism and trap door housing.	5,500.22	215.62
11 52 13 13-0147	EA		65" x 116" Electric Ascending Projection Screen (Da-Lite Ascender Electrol)..... Note: Includes a motorized spring assisted scissors mechanism and trap door housing.	5,842.10	251.55
11 52 13 13-0148	EA		78" x 139" Electric Ascending Projection Screen (Da-Lite Ascender Electrol)..... Note: Includes a motorized spring assisted scissors mechanism and trap door housing.	7,345.84	323.43
11 52 13 13-0149			Electric Rear Projection Screen (Da-Lite DA-View) <small>(11 52 13 13-0001)</small> Note: Consists of a single acrylic layer with rear Fensel lens and lenticulated front profile. Un-framed.		
11 52 13 13-0150	EA		60" Diagonal Video Format Rigid Rear Projection Screen (Da-Lite DA-View) Note: Includes a motorized spring assisted scissors mechanism and trap door housing.	2,402.12	179.68
11 52 13 13-0151	EA		67" Diagonal Video Format Rigid Rear Projection Screen (Da-Lite DA-View) Note: Includes a motorized spring assisted scissors mechanism and trap door housing.	3,005.81	197.64
11 52 13 13-0152	EA		72" Diagonal Video Format Rigid Rear Projection Screen (Da-Lite DA-View) Note: Includes a motorized spring assisted scissors mechanism and trap door housing.	3,439.17	215.62
11 52 13 13-0153	EA		84" Diagonal Video Format Rigid Rear Projection Screen (Da-Lite DA-View) Note: Includes a motorized spring assisted scissors mechanism and trap door housing.	6,143.52	233.58
11 52 13 13-0154	EA		90" Diagonal Video Format Rigid Rear Projection Screen (Da-Lite DA-View) Note: Includes a motorized spring assisted scissors mechanism and trap door housing.	6,803.99	6,552.44
11 52 13 13-0155	EA		96" Diagonal Video Format Rigid Rear Projection Screen (Da-Lite DA-View) Note: Includes a motorized spring assisted scissors mechanism and trap door housing.	7,557.16	287.49
11 52 13 13-0156	EA		100" Diagonal Video Format Rigid Rear Projection Screen (Da-Lite DA-View) Note: Includes a motorized spring assisted scissors mechanism and trap door housing.	9,672.93	323.43
11 52 13 13-0157	EA		120" Diagonal Video Format Rigid Rear Projection Screen (Da-Lite DA-View) Note: Includes a motorized spring assisted scissors mechanism and trap door housing.	13,037.75	359.36
11 52 13 13-0158	EA		125" Diagonal Video Format Rigid Rear Projection Screen (Da-Lite DA-View) Note: Includes a motorized spring assisted scissors mechanism and trap door housing.	14,585.78	395.30
11 52 13 13-0159	EA		135" Diagonal Video Format Rigid Rear Projection Screen (Da-Lite DA-View) Note: Includes a motorized spring assisted scissors mechanism and trap door housing.	19,483.52	431.23
11 52 13 13-0160			Screen Accessories <small>(11 52 13 13-0001)</small>		
11 52 13 13-0161			Manual Pull Down Accessories <small>(11 52 13 13-0160)</small>		
11 52 13 13-0162	EA		6" Mounting Bracket (Pair).....	28.78	5.39
11 52 13 13-0163	EA		14" Wall Mounting Bracket (Pair).....	38.78	5.75
11 52 13 13-0164	EA		14-1/2" To 24" Adjustable Wall Mounting Bracket (Pair).....	44.78	6.47
11 52 13 13-0165			Electric Powered Screen Accessories <small>(11 52 13 13-0160)</small>		
11 52 13 13-0166	EA		Single Motor Low Voltage Remote Control System - Infrared.....	256.95	
11 52 13 13-0167	EA		Single Motor Low Voltage Remote Control System - Radio Frequency.....	366.95	
11 52 16			Projectors <small>(11 52)</small>		
11 52 16 26			Video Projectors <small>(11 52 16)</small>		
11 52 16 26-0001			Projectors <small>(11 52 16 26)</small>		
11 52 16 26-0002	EA		2,000 Lumens Output, 800 x 600 Pixels, SVGA Compact 3LCD Panels Projector.....	690.22	35.94
11 52 16 26-0003	EA		2,000 Lumens Output, 1024 x 768 Pixels, XGA Compact 3LCD Panels Projector.....	798.43	35.94

11	Equipment
11 50	Educational And Scientific Equipment
11 52	Audio-Visual Equipment



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
11 52 16 26-0004	EA		2,000 Lumens Output, 1280 x 800 Pixels, WXGA Compact 3LCD Panels Projector.....	1,053.50	35.94
11 52 16 26-0005	EA		3,000 Lumens Output, 1024 x 768 Pixels, XGA 3LCD Panels Projector	1,656.40	35.94
11 52 16 26-0006	EA		3,500 Lumens Output, 1024 x 768 Pixels, XGA 3LCD Panels Projector	1,926.93	35.94
11 52 16 26-0007	EA		3,000 Lumens Output, 1366 x 800 Pixels, WXGA 3LCD Panels Projector	2,444.80	35.94
11 52 16 26-0008	EA		4,000 Lumens Output, 1024 x 768 Pixels, XGA 3LCD Panels Projector	3,882.46	35.94
11 52 16 26-0009	EA		5,200 Lumens Output, 1024 x 768 Pixels, XGA 3LCD Panels Projector	5,258.30	35.94
11 52 16 26-0010	EA		6,000 Lumens Output, 1024 x 768 Pixels, XGA 3LCD Panels Projector	7,801.27	35.94
11 52 16 26-0011			Projector Mounts <small>(11 52 16 26)</small>		
11 52 16 26-0012			Universal Projector Mounts <small>(11 52 16 26-0011)</small> Note: Includes ceiling or wall mounting hardware and hardware for attaching projector. Excludes projector.		
11 52 16 26-0013	EA		Flush Ceiling, Universal Projector Mount (Peerless PPF).....	159.17	39.52
11 52 16 26-0014	EA		Wall Arm, Universal Projector Mount (Peerless PWA-14).....	255.13	39.52
11 52 16 26-0015			Projector Mount Components <small>(11 52 16 26-0011)</small> Note: Complete projector mount system will include ceiling attachment plate, threaded extension column and projector attachment plate. Excludes projector.		
11 52 16 26-0016			Ceiling Attachment Plates For Projector Mounts <small>(11 52 16 26-0015)</small>		
11 52 16 26-0017	EA		Finished Ceiling, Attachment Plate For Projector Mounts (Peerless ACC 570).....	58.74	17.95
11 52 16 26-0018	EA		Truss Ceiling, Attachment Plate For Projector Mounts (Peerless ACC 557).....	78.43	17.95
11 52 16 26-0019	EA		I-Beam Ceiling, Attachment Plate For Projector Mounts (Peerless ACC 558/559).....	107.58	17.95
11 52 16 26-0020	EA		Suspended Ceiling, Attachment Plate For Projector Mounts (Peerless CMJ 455).....	134.10	17.95
11 52 16 26-0021			Projector Attachment Plates For Projector Mounts <small>(11 52 16 26-0015)</small>		
11 52 16 26-0022	EA		Universal Projector Attachment Plate For Projector Mounts (Peerless PRG-UNV).....	193.81	17.95
11 52 16 26-0023	EA		High Security Projector Enclosure For Projector Mounts (Peerless ALB).....	423.38	17.95
11 52 16 26-0024			Threaded Extension Columns For Projector Mounts <small>(11 52 16 26-0015)</small>		
11 52 16 26-0025			Fixed Length, Threaded Extension Column For Projector Mounts <small>(11 52 16 26-0024)</small> Note: Peerless EXT series.		
11 52 16 26-0026	EA		6" Fixed Length, Threaded Extension Column For Projector Mounts	33.86	5.39
11 52 16 26-0027	EA		12" Fixed Length, Threaded Extension Column For Projector Mounts	43.57	5.39
11 52 16 26-0028	EA		18" Fixed Length, Threaded Extension Column For Projector Mounts	47.22	5.39
11 52 16 26-0029	EA		24" Fixed Length, Threaded Extension Column For Projector Mounts	49.65	5.39
11 52 16 26-0030	EA		36" Fixed Length, Threaded Extension Column For Projector Mounts	59.31	7.18
11 52 16 26-0031	EA		48" Fixed Length, Threaded Extension Column For Projector Mounts	71.46	7.18
11 52 16 26-0032	EA		60" Fixed Length, Threaded Extension Column For Projector Mounts	90.89	7.18
11 52 16 26-0033	EA		72" Fixed Length, Threaded Extension Column For Projector Mounts	104.25	7.18
11 52 16 26-0034	EA		84" Fixed Length, Threaded Extension Column For Projector Mounts	122.41	8.98
11 52 16 26-0035	EA		96" Fixed Length, Threaded Extension Column For Projector Mounts	139.41	8.98
11 52 16 26-0036	EA		108" Fixed Length, Threaded Extension Column For Projector Mounts	155.16	10.78
11 52 16 26-0037	EA		120" Fixed Length, Threaded Extension Column For Projector Mounts	162.45	10.78
11 52 16 26-0038			Adjustable Length, Threaded Extension Columns For Projector Mounts <small>(11 52 16 26-0024)</small> Note: Peerless ADJ series. Adjustable at 1" increments.		
11 52 16 26-0039	EA		6" To 9" Adjustable Length, Threaded Extension Column For Projector Mounts.....	68.96	8.98
11 52 16 26-0040	EA		12" To 18" Adjustable Length, Threaded Extension Column For Projector Mounts.....	105.40	8.98
11 52 16 26-0041	EA		18" To 24" Adjustable Length, Threaded Extension Column For Projector Mounts.....	107.83	8.98
11 52 16 26-0042	EA		24" To 36" Adjustable Length, Threaded Extension Column For Projector Mounts.....	111.48	8.98
11 52 16 26-0043	EA		36" To 60" Adjustable Length, Threaded Extension Column For Projector Mounts.....	121.15	10.78
11 52 16 26-0044	EA		48" To 72" Adjustable Length, Threaded Extension Column For Projector Mounts.....	127.22	10.78
11 52 16 26-0045	EA		60" To 84" Adjustable Length, Threaded Extension Column For Projector Mounts.....	140.58	10.78
11 52 16 26-0046	EA		72" To 96" Adjustable Length, Threaded Extension Column For Projector Mounts.....	152.73	10.78
11 52 16 26-0047	EA		84" To 108" Adjustable Length, Threaded Extension Column For Projector Mounts.....	169.69	12.57
11 52 16 26-0048	EA		96" To 120" Adjustable Length, Threaded Extension Column For Projector Mounts.....	181.84	12.57
11 52 16 26-0049	EA		108" To 132" Adjustable Length, Threaded Extension Column For Projector Mounts.....	198.79	14.37
11 52 16 26-0050	EA		120" To 144" Adjustable Length, Threaded Extension Column For Projector Mounts.....	207.29	14.37
11 52 19			Players And Recorders <small>(11 52)</small>		
11 52 19 00-0001			Audio-Visual Equipment <small>(11 52 19)</small> Note: Includes installation of AV components may be subject to further verification of site conditions before engineering sign-off. Custom control software programming (to be verified after client consultation). Project design, integration, training, including manuals and documentation. Shipping and handling. AV project manager site visit travel expenses per trip.		
11 52 19 00-0002			Audio Equipment <small>(11 52 19 00-0001)</small>		
11 52 19 00-0003	EA		TOA Condenser Microphone Preamp with Remote Mute Capability	355.33	
11 52 19 00-0004	EA		Passive Stereo Line Combiner, Combines Stereo to Mono.....	99.42	
11 52 19 00-0005	EA		Power Supply 24 Volt, 400 mA for Stereo Line Amplifier	33.84	
11 52 19 00-0006	EA		TOA 120 Watt Modular Mixer / Amplifier.....	1,573.62	
11 52 19 00-0007	EA		Auxiliary Stereo Input Module with internal summing and muting capabilities	84.61	
11 52 19 00-0008	EA		Rack Mount Kit for Power Amplifier	52.87	



Equipment	11	
Educational And Scientific Equipment	11 50	11
Audio-Visual Equipment	11 52	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
11 52 19 00-0009 EA TOA Equalization Module for Wide Dispersion Speaker.....	156.51	
11 52 19 00-0010 EA TOA Wide Dispersion Speaker with transformer for 70 volt operation.....	298.24	
11 52 19 00-0011 AV Microphones (11 52 19 00-0001)		
11 52 19 00-0012 EA Audio-Technica Miniature Cardioid Condenser Gooseneck Microphone.....	793.15	
11 52 19 00-0013 Control System (11 52 19 00-0001)		
11 52 19 00-0014 EA Digitally Controlled 3-channel Audio Attenuator.....	1,190.79	
Note: Each channel has controls for volume, tone and mute.		
11 52 19 00-0015 EA Crestron Pro2 Integrated Control System.....	5,683.20	
Note: Includes 8-IR, 8-digital I/Os, 8-relays, 6-RS-232, 3 CNX expansion slots and 1 DPA Ethernet-based communication CNX slot included.		
11 52 19 00-0016 EA IR Emitter Cable	80.37	
11 52 19 00-0017 EA IR/S Control Cable.....	158.63	
11 52 19 00-0018 EA Crestron Isys Compact Video Touchpanel, 5" Diagonal Color Active Matrix Desktop Tilt-case Color Touch Control, 64,000 Colors, 320x234 Pixels	2,679.79	
11 52 19 00-0019 Interfaces (11 52 19 00-0001)		
11 52 19 00-0020 EA Extron RGB 109xi Dedicated VGA/S-VGA/XGA2/VESA interface.....	1,254.23	
11 52 19 00-0021 EA VGA Male/BNC Female Adapter cable.....	86.73	
11 52 19 00-0022 EA Rack Shelf (1RU), holds 2 1RU High 1/2 Rack Units.....	264.38	
11 52 19 00-0023 Display Wall Processors (11 52 19 00-0001)		
11 52 19 00-0024 EA Jupiter Fusion 950 High Performance High-availability Display Wall Graphics Server.....	49,745.63	
Note: Includes 4 high resolution display channels; 6 RGB inputs; 6 RGB output window processors; 16 Composite Video Inputs, 8 - S-Video Inputs (4 Displayable Concurrently); 1 4U rackmount main chassis; Dual (2) 300W hot-swap power supplies; 1 Intel Pentium III CPU @ 1 GHz; 512MB Memory; Single removable 20GB disk drive; 52X CD-ROM drive, 1.44MB floppy drive; 2 10/100 Mb/s RJ-45 Ethernet connectors; Ports: 1 parallel, 2 USB, 1 serial; PS/2 104 keyboard, PS/2 mouse, 1 year limited hardware warranty, 90 days installation assistance via phone and email, Galileo Software, Windows 2000 Professional, Jupiter Multiple Channel Software, ControlPoint Software, X server for Unix Connectivity, 1 Year of software support		
11 52 19 00-0025 Projectors (11 52 19 00-0001)		
11 52 19 00-0026 EA Barco Helios 24/7/365 mission critical performance data Projector, 3 panel LCD, 1,280x1,024, 750 ANSI Lumens, high MTBF, 4,000 hour lamp and 1:27:1 lens for Helios.....	39,086.22	
Note: Includes corner focus to match screen size.		
11 52 19 00-0027 Rack Equipment (11 52 19 00-0001)		
11 52 19 00-0028 EA Power Conditioning and Rack Accessories	634.52	
11 52 19 00-0029 EA Stand Alone Rack With Rear Door	2,538.09	
11 52 19 00-0030 Switchers (11 52 19 00-0001)		
11 52 19 00-0031 EA Six-Input, Two-Output 100KHz Stereo Audio Switcher, 1/2 rack width (RS-232 control).....	1,269.04	
11 52 19 00-0032 AV Source Components (11 52 19 00-0001)		
11 52 19 00-0033 EA JVC Professional VCR 4-Head S-VHS Hi-Fi Serial IR control	846.03	
11 52 19 00-0034 EA Marantz Professional DVD Player With 500 TVL Res. S-Video Output, Dolby Digital, Rack-Mount (RS-232 control)	1,269.04	
11 52 19 00-0035 EA Tuner for AM/FM (IR Control).....	662.01	
11 52 19 00-0036 EA Rack Mount for VCR.....	211.51	
11 52 19 00-0037 EA Rack Mount for Tuner	211.51	
11 52 19 00-0038 Visualizers And Custom Items (11 52 19 00-0001)		
11 52 19 00-0039 EA Canon VC-C4 Visualizer With Rotating Camera Head	6,632.88	
Note: 450+ TV Lines resolution, 8x Zoom lens, built-in switcher with a composite, S-Video, Mic, and sync inputs , Y/C and composite outputs, built-in light base for slides with neg/pos, and RS-232 remote control.		
11 52 19 00-0040 Cables (11 52 19 00-0001)		
11 52 19 00-0041 MLF Low Cap Control (22 AWG pair) And Power (18 AWG pair) in Plenum Cable \$/per 1,000 ft. (2 control And 2 power connectors needed).....	2,157.38	
11 52 19 00-0042 MLF Broadcast Audio Cable (22 gauge/4-conductor)	262.28	
11 52 19 00-0043 MLF Broadcast Speaker Cable (22 gauge/2-conductor).....	486.47	
11 52 19 00-0044 MLF Mini High Resolution RGBHV Plenum Cable.....	6,345.23	
11 52 19 00-0045 MLF Miscellaneous Cables Connectors And Hardware (to be verified after on site visit)	1,402.30	
11 52 19 00-0046 Mixers (11 52 19 00-0001)		
11 52 19 00-0047 EA Audio Mixer 4 Input Auto Mixer.....	1,371.68	

11	11 Equipment
	11 50 Educational And Scientific Equipment
	11 52 Audio-Visual Equipment



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
11 52 19 00-0048 AV Wireless Microphone <small>(11 52 19 00-0001)</small>		
11 52 19 00-0049 EA Wireless Microphone, UHF, Multi Channel with Hand Held Microphone, Rack Mount Kit	1,433.85	
11 52 19 00-0050 EA Wireless Microphone, UHF, Multi Channel with Lavalier Microphone, Rack Mount Kit.....	1,494.00	
11 52 19 00-0051 Videoconference Equipment <small>(11 52 19 00-0001)</small>		
11 52 19 00-0052 EA Canon Remote Control Color Camera with pan/tilt zoom control via RS-232	2,945.90	
11 52 19 00-0053 EA Canon Remote Control Color Camera with pan/tilt zoom control via RS-232. LAN Output	3,609.68	
11 52 19 00-0054 Command View Display Wall <small>(11 52 19)</small>		
Note: Includes Installation, Freight, and Shipping. STANDARD FEATURES: Patented "Seamless" Screen Retention System; Heavy Wall Aluminum and Sheet Metal Stackable Structure; Single Element Acrylic Screen (Fresnel Lenticular or Diffusion); Hinged Lower Enclosure Panels for Projector Access; Mobile Universal Projector Cart with Micro Adjustment for Image Fine Tuning (Single and Double High); Durable High Pressure External Panel Finish, per Evans' Standard Offerings; PowerTrak Powered Lift Mechanism for Double High, Triple High, and Quad High Screen Matrices where applicable); Horizontal and Vertical Light Baffles Between All Adjacent Screens; Wilsonart Black laminate 1595-60 internal panel finish.		
11 52 19 00-0055 4/3 Ratio Projection Screen <small>(11 52 19 00-0054)</small>		
Note: Command view fresnel lenticular screens.		
11 52 19 00-0056 EA 110" 4/3 Ratio Fresnel Lenticular Projection Screen (88"W x 66"H)	11,447.14	
11 52 19 00-0057 Mirror Assemblies <small>(11 52 19 00-0054)</small>		
11 52 19 00-0058 EA 90" to 124" 1st Surface Mirror Assembly	3,359.26	
11 52 19 00-0059 Free Standing System <small>(11 52 19 00-0054)</small>		
Note: Includes projector rack, screen rack, upper, lower, top and rear enclosure panels. Command view single high, free standing modules.		
11 52 19 00-0060 EA 110" Single High Free Standing Module	9,575.89	
11 52 19 00-0061 EA Shared Posts Credit For Single High Free Standing Module	-1,088.73	
11 52 19 00-0062 Equipment Support Solutions <small>(11 52 19 00-0054)</small>		
Note: Command view projector support solutions.		
11 52 19 00-0063 EA Single Level Mobile Universal Projector Cart (Folded Optic Applications Only) - One Cart Per Projector	1,156.10	
11 52 19 00-0064 Contractor Furnished Equipment <small>(11 52 19)</small>		
11 52 19 00-0065 EA Cisco Supervisor III Module, pn WS-X5530-E3A	13,492.80	
11 52 19 00-0066 EA Cisco Uplink Module, pn WS-U5538-FEFX-MMF	4,647.52	
11 52 19 00-0067 EA Cisco Switch - 36 Ports 10/100 TX, pn WS-X5239-RJ21-RF.....	6,896.32	

11 60 Entertainment and Recreation Equipment (11)

11 68 Play Field Equipment And Structures (11 60)

11 68 23 Exterior Court Athletic Equipment (11 68)

11 68 23 13 Exterior Basketball Equipment (11 68 23)

11 68 23 13-0001 Basketball Components (11 68 23 13)

11 68 23 13-0002 EA Nylon Cord Basketball Net (Porter Athletic 09608-120)	25.62	7.34
11 68 23 13-0003 EA Chain Basketball Net (Porter Athletic 00161-000).....	40.92	7.34
11 68 23 13-0004 EA Heavy Duty Goal Ring (Porter Athletic 00235-000).....	102.03	36.70
11 68 23 13-0005 EA Goal Ring For Steel Net (Porter Athletic 00251-H00)	189.48	16.52
11 68 23 13-0006 EA 42" x 72" Rectangular Fully Tempered Glass Basketball Backboard With Steel Frame (Porter Athletic 00204-000)	796.34	31.20
Note: Includes perimeter and target markings. Excludes pole and goal.		
11 68 23 13-0007 EA 42" x 72" Rectangular 11 Gauge Perforated Steel Basketball Backboard (Porter Athletic 01207-300)	848.84	31.20
Note: Includes perimeter and target markings. Excludes pole and goal.		
11 68 23 13-0008 EA 54" x 39" Fan Shaped Cast Aluminum Basketball Backboard (Porter Athletic 00234-300)	610.50	27.53
Note: Includes perimeter and target markings. Excludes pole and goal.		
11 68 23 13-0009 EA 54" x 39" Fan Shaped Fiberglass Basketball Backboard (Porter Athletic 00267-000)	463.50	27.53
Note: Includes perimeter and target markings. Excludes pole and goal.		

11 68 23 13-0010 Basketball Systems (11 68 23 13)

See CSI section 32 31 13 00-0001 for auguring holes and concrete.

11 68 23 13-0011 EA 4-1/2" Bent Post Galvanized Steel Pole With 4' Extension, Aluminum Backboard, Double Rim Goal And Steel Net Basketball System (Sportsplay 541-616).....	1,331.37	162.02
11 68 23 13-0012 EA 5-9/16" Bent Post Galvanized Steel Pole With 6' Extension Style, Aluminum Backboard, Double Rim Goal And Nylon Net Basketball System (Porter Athletic 00176-230).....	2,482.55	178.23
<i>For Fan Shaped Fiberglass Backboard, Deduct</i>		
<i>For 42" x 72" Perforated Steel Backboard, Add</i>		
11 68 23 13-0013 EA 4-1/2" Galvanized Steel Pole With 4' Extension, Aluminum Backboard, Double Rim Goal And Nylon Net Basketball System (Porter Athletic 00164-230)	1,774.66	162.02
<i>For Fan Shaped Fiberglass Backboard, Deduct</i>		
<i>For 42" x 72" Perforated Steel Backboard, Add</i>		



Equipment	11
Entertainment and Recreation Equipment	11 60
Play Field Equipment And Structures	11 68

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
11 68 23 13-0014	EA		5-9/16" Galvanized Steel Pole With 6' Extension, Aluminum Backboard, Double Rim Goal And Nylon Net Basketball System (Porter Athletic 00166-230).....	2,194.85	178.23
			<i>For Fan Shaped Fiberglass Backboard, Deduct</i>	-133.00	
			<i>For 42" x 72" Perforated Steel Backboard, Add</i>	350.00	
11 68 23 13-0015	EA		Back To Back 4-1/2" Galvanized Steel Pole With 4' Extensions, Aluminum Backboards, Double Rim Goals And Nylon Net Double Basketball System (Porter Athletic 00184-230).....	2,804.43	238.27
			<i>For Fan Shaped Fiberglass Backboard, Deduct</i>	-498.00	
			<i>For 42" x 72" Perforated Steel Backboard, Add</i>	700.00	
11 68 23 13-0016	EA		Back To Back 5-9/16" Galvanized Steel Pole With 6' Extensions, Aluminum Backboards, Double Rim Goals And Nylon Net Double Basketball System (Porter Athletic 00186-230).....	3,653.29	262.10
			<i>For Fan Shaped Fiberglass Backboard, Deduct</i>	-498.00	
			<i>For 42" x 72" Perforated Steel Backboard, Add</i>	700.00	
11 68 23 33 Tennis Equipment^(11 68 23)					
11 68 23 33-0001 Tennis Court Net Posts^(11 68 23 33)					
11 68 23 33-0002	PR		Round, Powder Coated Steel, Tennis Court Net Posts With External Winder.....	797.33	124.78
11 68 23 33-0003	PR		Round, Powder Coated Steel, Tennis Court Net Posts With Internal Brass Winder.....	951.68	124.78
11 68 23 33-0004	PR		Square, Powder Coated Steel, Tennis Court Net Posts With Internal Brass Winder.....	977.40	124.78
11 68 23 33-0005	PR		Round, Powder Coated Aluminum, Tennis Court Net Posts With External Winder.....	1,021.89	124.78
11 68 23 33-0006	PR		Round, Powder Coated Aluminum, Tennis Court Net Posts With Internal Winder.....	1,180.28	124.78
11 68 23 33-0007	PR		Polyvinyl Chloride (PVC) Ground Sleeves For Tennis Court Net Posts.....	196.96	
11 68 23 33-0008	PR		Galvanized Steel Ground Sleeves For Tennis Court Net Posts.....	216.19	
11 68 23 33-0009 Tennis Court Nets^(11 68 23 33)					
11 68 23 33-0010	EA		42' Length, Single Top, Vinyl Headband, Polyethylene Net Body, Tennis Court Net.....	385.87	123.31
11 68 23 33-0011	EA		42' Length, Double Top, Vinyl Headband, Polyethylene Net Body, Tennis Court Net.....	416.56	123.31
11 68 23 33-0012	EA		42' Length, Anti-Vandal, Aluminum Coated Flexible Steel Mesh, Tennis Court Net.....	855.17	189.74
11 68 23 33-0013	EA		Galvanized Steel Anchor For Tennis Court Net Center Strap.....	52.26	
11 68 33 Athletic Field Equipment^(11 68)					
11 68 33 13 Football Field Equipment^(11 68 33)					
11 68 33 13-0001 Football Goal Posts^(11 68 33 13)					
Note: Includes augering for post(s), set in concrete and backfill.					
11 68 33 13-0002	PR		Double Steel Football Goal Posts, "H Shape".....	3,094.69	330.33
11 68 33 13-0003	PR		Vertical Style Goal Post, Single In Ground Mounting, Steel With 20' Uprights.....	4,117.27	399.25
11 68 33 13-0004	PR		Gooseneck (Offset) Style Goal Post, Single In Ground Mounting, Steel, With 20' Uprights.....	4,919.05	479.10
11 68 33 23 Soccer And Field Hockey Equipment^(11 68 33)					
11 68 33 23-0001 Soccer Goal Posts^(11 68 33 23)					
Note: Includes augering for post(s), set in concrete and backfill.					
11 68 33 23-0002	PR		Regulation Soccer Goal Posts.....	2,826.09	220.20
11 68 33 23-0003	PR		Combination Football/Soccer Goal Post.....	3,423.49	330.33
11 68 33 33 Baseball Field Equipment^(11 68 33)					
11 68 33 33-0001 Bases^(11 68 33 33)					
11 68 33 33-0002	SET		Bases For Baseball Or Softball.....	308.92	
11 80 Facility Maintenance and Operation Equipment⁽¹¹⁾					
11 81 Maintenance Equipment^(11 80)					
11 81 29 Facility Fall Protection^(11 81)					
11 81 29 00-0001 Safety And Tie-Back Anchors^(11 81 29)					
Note: One cut sheet charge required per manufacturer order. Excludes flashing and testing by engineer after installation. See CSI section 01 22 20 00-0043 for engineering testing and inspection.					
11 81 29 00-0002 Roof Mounted, Safety And Tie-Back Anchors^(11 81 29 00-0001)					
Note: Includes up to 10" high, 0.216" thick hollow structural section tube, 1018 steel forged pad eye, 8" x 8" x 1/2" base plate and hot-dipped galvanized finish.					
11 81 29 00-0003	EA		Mechanically Fastened, Roof Mounted, Safety And Tie-Back Anchor (Summit Anchor).....	384.99	53.90
			Note: Includes drilling in concrete, anchor bolts and bottom plate or plates.		
			<i>For Stainless Steel Pad Eye, Add</i>	40.00	
			<i>For Foam Insulation Filled HSS Tube, Add</i>	10.00	
11 81 29 00-0004	EA		Epoxy Fastened, Roof Mounted, Safety And Tie-Back Anchor (Summit Anchor).....	328.01	53.90
			Note: Includes drilling in concrete and adhesive anchor systems.		
			<i>For Stainless Steel Pad Eye, Add</i>	40.00	
			<i>For Foam Insulation Filled HSS Tube, Add</i>	10.00	
11 81 29 00-0005	EA		Welded In Place, Roof Mounted, Safety And Tie-Back Anchor (Summit Anchor).....	292.74	64.39
			<i>For Stainless Steel Pad Eye, Add</i>	40.00	
			<i>For Foam Insulation Filled HSS Tube, Add</i>	10.00	

11	11 Equipment
	11 80 Facility Maintenance and Operation Equipment
	11 81 Maintenance Equipment



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
11 81 29 00-0006 Wall Mounted, Safety And Tie-Back Anchor <small>(11 81 29 00-0001)</small> Note: Includes 1018 steel forged pad eye, 10" x 4" x 1/2" base plate and hot-dipped galvanized finish.		
11 81 29 00-0007 EA Mechanically Fastened, Wall Mounted, Safety And Tie-Back Anchor (Summit Anchor) Note: Includes drilling in concrete, anchor bolts and bottom plate or plates.	298.02	53.90
For Stainless Steel Pad Eye, Add	40.00	
11 81 29 00-0008 EA Epoxy Fastened, Wall Mounted, Safety And Tie-Back Anchor (Summit Anchor) Note: Includes drilling in concrete and adhesive anchor systems.	270.20	53.90
For Stainless Steel Pad Eye, Add	40.00	
11 81 29 00-0009 EA Welded In Place, Wall Mounted, Safety And Tie-Back Anchor (Summit Anchor) For Stainless Steel Pad Eye, Add	262.38 40.00	64.39
11 81 29 00-0010 Safety And Tie-Back Anchor Accessories <small>(11 81 29 00-0001)</small>		
11 81 29 00-0011 EA Mandatory Cut Sheets For Safety And Tie-Back Anchors (Summit Anchor) Note: One cut sheet required per order.	220.84	
11 82 Facility Solid Waste Handling Equipment <small>(11 80)</small>		
11 82 26 Facility Waste Compactors <small>(11 82)</small>		
11 82 26 00-0001 Trash Compactors <small>(11 82 26)</small>		
11 82 26 00-0002 EA Trash Compactor, Small	2,610.90	220.99
11 82 26 00-0003 EA Trash Compactor, Large	3,214.93	250.07
11 90 Other Equipment <small>(11)</small>		
11 98 Detention Equipment <small>(11 90)</small>		
11 98 16 Detention Gun Lockers <small>(11 98)</small>		
11 98 16 00-0001 Hinged Door Gun Lock <small>(11 98 16)</small> Note: Two keys per locker with one master.		
11 98 16 00-0002 EA 8 Compartment Pistol Locker, 20-1/8" High x 15-1/8" Wide x 17-1/4" Deep, Double Welded 20 Gauge Steel Body, 10 Gauge Steel Door	978.36	37.52
11 98 16 00-0003 Hinged-Door Gun Locker <small>(11 98 16)</small> Note: Includes master key for each set of 4 compartments, two keys per compartment.		
11 98 16 00-0004 EA 4 Compartment Pistol Locker, 11-1/4" High x 16-1/4" Wide x 16-3/4" Deep, 16 Gauge, Foam Filled, Painted With Powder Coat Finish	394.89	26.26
11 98 16 00-0005 EA 8 Compartment Pistol Locker, 11-1/2" High x 32-3/4" Wide x 17-1/4" Deep, 16 Gauge, Foam Filled, Painted With Powder Coat Finish	874.16	37.52
11 98 16 00-0006 EA 16 Compartment Pistol Locker, 11-1/2" High x 32-3/4" Wide x 17-1/4" Deep, 16 Gauge, Foam Filled, Painted With Powder Coat Finish	1,574.13	45.03
11 98 16 00-0007 EA 24 Compartment Pistol Locker, 11-1/2" High x 32-3/4" Wide x 17-1/4" Deep, 16 Gauge, Foam Filled, Painted With Powder Coat Finish	2,259.09	45.03

END OF SECTION 11



MINOR	CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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12 Furnishings

12 01 Operation And Maintenance Of Furnishings ⁽¹²⁾

12 01 60 Operation And Maintenance Of Multiple Seating ^(12 01)

12 01 60 00-0001 Repair Fixed Auditorium Seating ^(12 01 60)			
12 01 60 00-0002	EA	Replace Seat Part.....	104.17
12 01 60 00-0003	EA	Replace Center Armrest Part.....	49.80
12 01 60 00-0004	EA	Replace End Armrest Part.....	67.94
12 01 60 00-0005	EA	Replace Kick Plate Part.....	75.33
12 01 60 00-0006	EA	Replace Back Part.....	124.84
12 01 60 00-0007	EA	Replace Standard Part.....	96.92
12 01 60 00-0008	EA	Replace Back Bracket Part.....	42.45
12 01 60 00-0009	EA	Replace Seat Bracket Part.....	44.06
12 01 60 00-0010	EA	Secure Seat To Floor.....	41.02
12 01 60 00-0011	EA	Remove And Reinstall Existing Seat To Floor.....	48.44
		Note: Includes drilling and fasteners.	
		For Epoxy Anchoring, Add	22.99
12 01 60 00-0012	EA	Reupholster Auditorium Seat And Back.....	128.38
		Note: Includes removal of existing upholstery.	

12 20 Window Treatments ⁽¹²⁾

12 21 Window Blinds ^(12 20)

12 21 13 Horizontal Louver Blinds ^(12 21)

Note: Includes headrail, brackets, cords and all hardware.

12 21 13 13 Metal Horizontal Louver Blinds ^(12 21 13)

12 21 13 13-0001 Aluminum Horizontal Louver Blinds ^(12 21 13 13)

12 21 13 13-0002	SF	1/2" x 0.006" Slats, Aluminum Horizontal Louver Blinds.....	8.52		0.68
12 21 13 13-0003	SF	1" x 0.006" Slats, Aluminum Horizontal Louver Blinds.....	6.97		0.68
12 21 13 13-0004	SF	1" x 0.008" Slats, Aluminum Horizontal Louver Blinds.....	7.56		0.68
12 21 13 13-0005	SF	2" x 0.008" Slats, Aluminum Horizontal Louver Blinds.....	8.75		0.68

12 21 13 33 Plastic Horizontal Louver Blinds ^(12 21 13)

12 21 13 33-0001 Vinyl Horizontal Louver Blinds ^(12 21 13 33)

12 21 13 33-0002	SF	1" Slats, Vinyl Horizontal Louver Blinds.....	7.21		0.68
12 21 13 33-0003	SF	2" Slats, Vinyl Horizontal Louver Blinds.....	8.34		0.68

12 21 16 Vertical Louver Blinds ^(12 21)

Note: Includes headrail, brackets, cords and all hardware.

12 21 16 13 Metal Vertical Louver Blinds ^(12 21 16)

12 21 16 13-0001 Aluminum Vertical Louver Blinds ^(12 21 16 13)

12 21 16 13-0002	SF	3-1/2" x 0.008" Slats, Aluminum Vertical Louver Blinds.....	9.90		1.45
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12 21 16 33 Plastic Vertical Louver Blinds ^(12 21 16)

12 21 16 33-0001 Vinyl Vertical Louver Blinds ^(12 21 16 33)

12 21 16 33-0002	SF	2" Slats, Vinyl Vertical Louver Blinds.....	6.38		1.45
12 21 16 33-0003	SF	3-1/2" Slats, Vinyl Vertical Louver Blinds.....	8.94		1.45

12 22 Curtains And Drapes ^(12 20)

12 22 13 Draperies ^(12 22)

12 22 13 00-0001 Lined Draperies ^(12 22 13)

Note: Width dimensions are the panel width at top excluding returns and overlaps.

12 22 13 00-0002 Up To 48" Wide Lined Draperies ^(12 22 13 00-0001)

12 22 13 00-0003	EA	Up To 39" Long, Up To 48" Wide Lined Draperies.....	141.42		8.99
12 22 13 00-0004	EA	>39" To 63" Long, Up To 48" Wide Lined Draperies.....	146.97		8.99
12 22 13 00-0005	EA	>63" To 72" Long, Up To 48" Wide Lined Draperies.....	155.99		8.99
12 22 13 00-0006	EA	>72" To 81" Long, Up To 48" Wide Lined Draperies.....	159.46		8.99
12 22 13 00-0007	EA	>81" To 90" Long, Up To 48" Wide Lined Draperies.....	167.78		8.99
12 22 13 00-0008	EA	>90" To 99" Long, Up To 48" Wide Lined Draperies.....	178.88		8.99
12 22 13 00-0009	EA	>99" To 108" Long, Up To 48" Wide Lined Draperies.....	185.82		8.99
12 22 13 00-0010	EA	>108" To 120" Long, Up To 48" Wide Lined Draperies.....	195.53		8.99
12 22 13 00-0011	EA	>120" To 130" Long, Up To 48" Wide Lined Draperies.....	210.79		8.99

12	Furnishings
12 20	Window Treatments
12 22	Curtains And Drapes



MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

12 22 13 00-0012	>48" To 72" Wide Lined Draperies (12 22 13 00-0001)		
12 22 13 00-0013	EA Up To 39" Long, >48" To 72" Wide Lined Draperies.....	204.78	12.22
12 22 13 00-0014	EA >39" To 63" Long, >48" To 72" Wide Lined Draperies.....	217.27	12.22
12 22 13 00-0015	EA >63" To 72" Long, >48" To 72" Wide Lined Draperies.....	226.98	12.22
12 22 13 00-0016	EA >72" To 81" Long, >48" To 72" Wide Lined Draperies.....	235.30	12.22
12 22 13 00-0017	EA >81" To 90" Long, >48" To 72" Wide Lined Draperies.....	254.72	12.22
12 22 13 00-0018	EA >90" To 99" Long, >48" To 72" Wide Lined Draperies.....	264.43	12.22
12 22 13 00-0019	EA >99" To 108" Long, >48" To 72" Wide Lined Draperies.....	272.76	12.22
12 22 13 00-0020	EA >108" To 120" Long, >48" To 72" Wide Lined Draperies.....	290.79	12.22
12 22 13 00-0021	EA >120" To 130" Long, >48" To 72" Wide Lined Draperies.....	310.21	12.22
12 22 13 00-0022	>72" To 96" Wide Lined Draperies (12 22 13 00-0001)		
12 22 13 00-0023	EA Up To 39" Long, >72" To 96" Wide Lined Draperies.....	270.90	15.45
12 22 13 00-0024	EA >39" To 63" Long, >72" To 96" Wide Lined Draperies.....	288.94	15.45
12 22 13 00-0025	EA >63" To 72" Long, >72" To 96" Wide Lined Draperies.....	297.26	15.45
12 22 13 00-0026	EA >72" To 81" Long, >72" To 96" Wide Lined Draperies.....	316.68	15.45
12 22 13 00-0027	EA >81" To 90" Long, >72" To 96" Wide Lined Draperies.....	334.72	15.45
12 22 13 00-0028	EA >90" To 99" Long, >72" To 96" Wide Lined Draperies.....	352.75	15.45
12 22 13 00-0029	EA >99" To 108" Long, >72" To 96" Wide Lined Draperies.....	362.46	15.45
12 22 13 00-0030	EA >108" To 120" Long, >72" To 96" Wide Lined Draperies.....	381.88	15.45
12 22 13 00-0031	EA >120" To 130" Long, >72" To 96" Wide Lined Draperies.....	408.24	15.45
12 22 13 00-0032	>96" To 120" Wide Lined Draperies (12 22 13 00-0001)		
12 22 13 00-0033	EA Up To 39" Long, >96" To 120" Wide Lined Draperies.....	341.19	18.69
12 22 13 00-0034	EA >39" To 63" Long, >96" To 120" Wide Lined Draperies.....	359.22	18.69
12 22 13 00-0035	EA >63" To 72" Long, >96" To 120" Wide Lined Draperies.....	368.93	18.69
12 22 13 00-0036	EA >72" To 81" Long, >96" To 120" Wide Lined Draperies.....	396.68	18.69
12 22 13 00-0037	EA >81" To 90" Long, >96" To 120" Wide Lined Draperies.....	414.71	18.69
12 22 13 00-0038	EA >90" To 99" Long, >96" To 120" Wide Lined Draperies.....	434.13	18.69
12 22 13 00-0039	EA >99" To 108" Long, >96" To 120" Wide Lined Draperies.....	397.72	18.69
12 22 13 00-0040	EA >108" To 120" Long, >96" To 120" Wide Lined Draperies.....	481.30	18.69
12 22 13 00-0041	EA >120" To 130" Long, >96" To 120" Wide Lined Draperies.....	495.17	18.69
12 22 13 00-0042	>120" To 144" Wide Lined Draperies (12 22 13 00-0001)		
12 22 13 00-0043	EA Up To 39" Long, >120" To 144" Wide Lined Draperies.....	403.14	21.92
12 22 13 00-0044	EA >39" To 63" Long, >120" To 144" Wide Lined Draperies.....	429.49	21.92
12 22 13 00-0045	EA >63" To 72" Long, >120" To 144" Wide Lined Draperies.....	439.20	21.92
12 22 13 00-0046	EA >72" To 81" Long, >120" To 144" Wide Lined Draperies.....	466.95	21.92
12 22 13 00-0047	EA >81" To 90" Long, >120" To 144" Wide Lined Draperies.....	494.69	21.92
12 22 13 00-0048	EA >90" To 99" Long, >120" To 144" Wide Lined Draperies.....	522.44	21.92
12 22 13 00-0049	EA >99" To 108" Long, >120" To 144" Wide Lined Draperies.....	550.18	21.92
12 22 13 00-0050	EA >108" To 120" Long, >120" To 144" Wide Lined Draperies.....	577.93	21.92
12 22 13 00-0051	EA >120" To 130" Long, >120" To 144" Wide Lined Draperies.....	612.61	21.92
12 22 13 00-0052	>144" To 168" Wide Lined Draperies (12 22 13 00-0001)		
12 22 13 00-0053	EA Up To 39" Long, >144" To 168" Wide Lined Draperies.....	473.42	25.16
12 22 13 00-0054	EA >39" To 63" Long, >144" To 168" Wide Lined Draperies.....	501.16	25.16
12 22 13 00-0055	EA >63" To 72" Long, >144" To 168" Wide Lined Draperies.....	521.97	25.16
12 22 13 00-0056	EA >72" To 81" Long, >144" To 168" Wide Lined Draperies.....	549.72	25.16
12 22 13 00-0057	EA >81" To 90" Long, >144" To 168" Wide Lined Draperies.....	577.46	25.16
12 22 13 00-0058	EA >90" To 99" Long, >144" To 168" Wide Lined Draperies.....	612.14	25.16
12 22 13 00-0059	EA >99" To 108" Long, >144" To 168" Wide Lined Draperies.....	639.89	25.16
12 22 13 00-0060	EA >108" To 120" Long, >144" To 168" Wide Lined Draperies.....	667.63	25.16
12 22 13 00-0061	EA >120" To 130" Long, >144" To 168" Wide Lined Draperies.....	716.19	25.16
12 22 13 00-0062	>168" To 192" Wide Lined Draperies (12 22 13 00-0001)		
12 22 13 00-0063	EA Up To 39" Long, >168" To 192" Wide Lined Draperies.....	535.38	28.39
12 22 13 00-0064	EA >39" To 63" Long, >168" To 192" Wide Lined Draperies.....	570.06	28.39
12 22 13 00-0065	EA >63" To 72" Long, >168" To 192" Wide Lined Draperies.....	590.87	28.39
12 22 13 00-0066	EA >72" To 81" Long, >168" To 192" Wide Lined Draperies.....	625.55	28.39
12 22 13 00-0067	EA >81" To 90" Long, >168" To 192" Wide Lined Draperies.....	653.29	28.39
12 22 13 00-0068	EA >90" To 99" Long, >168" To 192" Wide Lined Draperies.....	687.98	28.39
12 22 13 00-0069	EA >99" To 108" Long, >168" To 192" Wide Lined Draperies.....	743.47	28.39
12 22 13 00-0070	EA >108" To 120" Long, >168" To 192" Wide Lined Draperies.....	764.27	28.39
12 22 13 00-0071	EA >120" To 130" Long, >168" To 192" Wide Lined Draperies.....	812.83	28.39
12 22 13 00-0072	>192" To 216" Wide Lined Draperies (12 22 13 00-0001)		
12 22 13 00-0073	EA Up To 39" Long, >192" To 216" Wide Lined Draperies.....	604.27	31.62
12 22 13 00-0074	EA >39" To 63" Long, >192" To 216" Wide Lined Draperies.....	632.02	31.62
12 22 13 00-0075	EA >63" To 72" Long, >192" To 216" Wide Lined Draperies.....	659.76	31.62
12 22 13 00-0076	EA >72" To 81" Long, >192" To 216" Wide Lined Draperies.....	701.38	31.62
12 22 13 00-0077	EA >81" To 90" Long, >192" To 216" Wide Lined Draperies.....	743.00	31.62
12 22 13 00-0078	EA >90" To 99" Long, >192" To 216" Wide Lined Draperies.....	784.62	31.62



Furnishings	12	12
Window Treatments	12 20	
Curtains And Drapes	12 22	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
12 22 13 00-0079 EA >99" To 108" Long, >192" To 216" Wide Lined Draperies.....	819.30	31.62
12 22 13 00-0080 EA >108" To 120" Long, >192" To 216" Wide Lined Draperies.....	853.98	31.62
12 22 13 00-0081 EA >120" To 130" Long, >192" To 216" Wide Lined Draperies.....	916.40	31.62
12 22 13 00-0082 >216" To 240" Wide Lined Draperies (12 22 13 00-0001)		
12 22 13 00-0083 EA Up To 39" Long, >216" To 240" Wide Lined Draperies.....	666.23	34.86
12 22 13 00-0084 EA >39" To 63" Long, >216" To 240" Wide Lined Draperies.....	714.79	34.86
12 22 13 00-0085 EA >63" To 72" Long, >216" To 240" Wide Lined Draperies.....	735.60	34.86
12 22 13 00-0086 EA >72" To 81" Long, >216" To 240" Wide Lined Draperies.....	777.21	34.86
12 22 13 00-0087 EA >81" To 90" Long, >216" To 240" Wide Lined Draperies.....	825.77	34.86
12 22 13 00-0088 EA >90" To 99" Long, >216" To 240" Wide Lined Draperies.....	867.38	34.86
12 22 13 00-0089 EA >99" To 108" Long, >216" To 240" Wide Lined Draperies.....	909.00	34.86
12 22 13 00-0090 EA >108" To 120" Long, >216" To 240" Wide Lined Draperies.....	950.62	34.86
12 22 13 00-0091 EA >120" To 130" Long, >216" To 240" Wide Lined Draperies.....	1,019.98	34.86
12 22 16 Drapery Track And Accessories (12 22)		
12 22 16 00-0001 Metal Wall Or Ceiling Mount Drapery Tracks (12 22 16)		
12 22 16 00-0002 Basic Traverse Rod (12 22 16 00-0001)		
12 22 16 00-0003 EA Traverse Rod, 30" To 50" Extension Metal Wall Or Ceiling Mounted Track.....	78.61	32.50
12 22 16 00-0004 EA Traverse Rod, 50" To 90" Extension Metal Wall Or Ceiling Mounted Track.....	85.78	32.50
12 22 16 00-0005 EA Traverse Rod, 84" To 156" Extension Metal Wall Or Ceiling Mounted Track.....	99.14	36.12
12 22 16 00-0006 EA Traverse Rod, 136" To 250" Extension Metal Wall Or Ceiling Mounted Track.....	121.53	36.12
12 22 16 00-0007 EA Traverse Rod, 165" To 312" Extension Metal Wall Or Ceiling Mounted Track.....	129.67	39.73
12 22 16 00-0008 Traverse Rod With Stationary Curtain Rod (12 22 16 00-0001)		
12 22 16 00-0009 EA Tray And Curtain Rod, 30" To 50" Extension Metal Wall Or Ceiling Mounted Track.....	85.48	32.50
12 22 16 00-0010 EA Tray And Curtain Rod, 50" To 90" Extension Metal Wall Or Ceiling Mounted Track.....	90.12	32.50
12 22 16 00-0011 EA Tray And Curtain Rod, 84" To 156" Extension Metal Wall Or Ceiling Mounted Track.....	110.04	36.12
12 22 16 00-0012 EA Tray And Curtain Rod, 136" To 250" Extension Metal Wall Or Ceiling Mounted Track.....	125.34	39.73
12 22 16 00-0013 Double Traverse Rod (12 22 16 00-0001)		
12 22 16 00-0014 EA Double Traverse Rod, 30" To 50" Extension Metal Wall Or Ceiling Mounted Track.....	97.29	32.50
12 22 16 00-0015 EA Double Traverse Rod, 50" To 90" Extension Metal Wall Or Ceiling Mounted Track.....	111.33	32.50
12 22 16 00-0016 EA Double Traverse Rod, 84" To 156" Extension Metal Wall Or Ceiling Mounted Track.....	134.61	36.12
12 22 16 00-0017 EA Double Traverse Rod, 136" To 250" Extension Metal Wall Or Ceiling Mounted Track.....	147.29	39.73
12 22 16 00-0018 Curtain Rods (12 22 16 00-0001)		
12 22 16 00-0019 LF Standard Metal Curtain Rod, White.....	4.73	1.29
12 22 16 00-0020 Relocate Drapery And Rod (12 22 16 00-0001)		
12 22 16 00-0021 LF Relocate Any Type Of Drapery And Any Type Rod.....	21.67	
Note: Includes storage and cleaning.		
12 24 Window Shades (12 20)		
12 24 13 Roller Window Shades (12 24)		
12 24 13 00-0001 Roller Window Shades (12 24 13)		
12 24 13 00-0002 Vinyl Coated Fiberglass, Roller Window Shades (12 24 13 00-0001)		
Note: Includes roller, brackets, and stainless steel chain operator.		
12 24 13 00-0003 SF 0% Openness, Blackout, Vinyl Coated Fiberglass, Roller Window Shades.....	10.74	0.43
12 24 13 00-0004 SF 1% To 10% Openness, Vinyl Coated Fiberglass, Roller Window Shades.....	10.74	0.43
12 24 13 00-0005 Polyvinyl Chloride (PVC) Free, Acrylic Backed Polyester, Roller Window Shades (12 24 13 00-0001)		
Note: Includes roller, brackets, and stainless steel chain operator.		
12 24 13 00-0006 SF 0% Openness, Blackout, Polyvinyl Chloride (PVC) Free, Acrylic Backed Polyester, Roller Window Shades.....	13.77	0.43
12 24 13 00-0007 Vinyl Coated Polyester, Roller Window Shades (12 24 13 00-0001)		
Note: Includes roller, brackets, and stainless steel chain operator.		
12 24 13 00-0008 SF 1% To 10% Openness, Vinyl Coated Polyester, Roller Window Shades.....	10.74	0.43
12 30 Casework (12)		
12 31 Manufactured Metal Casework (12 30)		
12 31 13 Manufactured Metal Panel Casework (12 31)		

12 Furnishings**12 30 Casework****12 31 Manufactured Metal Casework**

MINOR		TOTAL DIRECT	DEMOLITION
CSI	UOM DESCRIPTION	UNIT COST	UNIT COST
12 31 13 00-0001	Stainless Steel Cabinets <small>(12 31 13)</small>		
12 31 13 00-0002	Stainless Steel Base Cabinets <small>(12 31 13 00-0001)</small>		
12 31 13 00-0003	18" Stainless Steel Base Cabinet <small>(12 31 13 00-0002)</small>		
12 31 13 00-0004	EA 18" Stainless Steel Base Cabinet, No Doors Or Drawers	1,448.77	162.63
	For >5 To 9, Deduct	-58.98	
	For >9, Deduct	-117.96	
12 31 13 00-0005	EA 18" Stainless Steel Base Cabinet, With 4 Drawers	2,402.97	162.63
	For >5 To 9, Deduct	-109.08	
	For >9, Deduct	-218.15	
12 31 13 00-0006	EA 18" Stainless Steel Base Cabinet, With 3 Drawers	2,222.92	162.63
	For >5 To 9, Deduct	-99.62	
	For >9, Deduct	-199.24	
12 31 13 00-0007	EA 18" Stainless Steel Base Cabinet, With 2 Drawers	2,042.87	162.63
	For >5 To 9, Deduct	-90.17	
	For >9, Deduct	-180.34	
12 31 13 00-0008	EA 18" Stainless Steel Base Cabinet, With Doors And Drawers	1,981.77	162.63
	For >5 To 9, Deduct	-86.96	
	For >9, Deduct	-173.92	
12 31 13 00-0009	24" Stainless Steel Base Cabinet <small>(12 31 13 00-0002)</small>		
12 31 13 00-0010	EA 24" Stainless Steel Base Cabinet, With Doors And Locks	2,123.00	175.76
	For >5 To 9, Deduct	-92.99	
	For >9, Deduct	-185.98	
12 31 13 00-0011	EA 24" Stainless Steel Base Cabinet, With Door, No Locks	1,903.30	175.76
	For >5 To 9, Deduct	-81.45	
	For >9, Deduct	-162.91	
12 31 13 00-0012	EA 24" Stainless Steel Base Cabinet, With Two Doors, No Locks	1,951.40	175.76
	For >5 To 9, Deduct	-83.98	
	For >9, Deduct	-167.96	
12 31 13 00-0013	EA 24" Stainless Steel Base Cabinet, No Doors, 2 Drawers	2,175.00	175.76
	For >5 To 9, Deduct	-95.72	
	For >9, Deduct	-191.44	
12 31 13 00-0014	EA 24" Stainless Steel Base Cabinet, With Doors And Drawers, No Locks	2,852.95	175.76
	For >5 To 9, Deduct	-131.31	
	For >9, Deduct	-262.62	
12 31 13 00-0015	EA 24" Stainless Steel Base Cabinet, With Doors And Drawers, With Locks	3,143.50	175.76
	For >5 To 9, Deduct	-146.56	
	For >9, Deduct	-293.13	
12 31 13 00-0016	30" Stainless Steel Base Cabinet <small>(12 31 13 00-0002)</small>		
12 31 13 00-0017	EA 30" Stainless Steel Base Cabinet, No Doors, No Drawers	1,853.75	185.21
	For >5 To 9, Deduct	-77.88	
	For >9, Deduct	-155.76	
12 31 13 00-0018	EA 30" Stainless Steel Base Cabinet, With 4 Full Size Drawers	2,735.15	185.21
	For >5 To 9, Deduct	-124.16	
	For >9, Deduct	-248.31	
12 31 13 00-0019	EA 30" Stainless Steel Base Cabinet, With Doors, Drawers And Locks	3,545.70	185.21
	For >5 To 9, Deduct	-166.71	
	For >9, Deduct	-333.42	
12 31 13 00-0020	EA 30" Stainless Steel Base Cabinet, With Doors And Drawers, No Locks	3,255.15	185.21
	For >5 To 9, Deduct	-151.46	
	For >9, Deduct	-302.91	
12 31 13 00-0021	EA 30" Stainless Steel Base Cabinet, With Doors And One Full Size Drawer	3,075.10	185.21
	For >5 To 9, Deduct	-142.00	
	For >9, Deduct	-284.01	
12 31 13 00-0022	EA 30" Stainless Steel Base Cabinet, With Doors, No Locks	2,344.50	185.21
	For >5 To 9, Deduct	-103.65	
	For >9, Deduct	-207.29	
12 31 13 00-0023	EA 30" Stainless Steel Base Cabinet, With Doors And Locks	2,322.40	185.21
	For >5 To 9, Deduct	-102.49	
	For >9, Deduct	-204.97	
12 31 13 00-0024	36" Stainless Steel Base Cabinet <small>(12 31 13 00-0002)</small>		
12 31 13 00-0025	EA 36" Stainless Steel Base Cabinet, No Doors, No Drawers	2,053.65	192.57
	For >5 To 9, Deduct	-87.58	
	For >9, Deduct	-175.15	
12 31 13 00-0026	EA 36" Stainless Steel Base Cabinet, With Doors And Locks	2,522.95	192.57
	For >5 To 9, Deduct	-112.22	
	For >9, Deduct	-224.43	
12 31 13 00-0027	EA 36" Stainless Steel Base Cabinet, With Door, No Lock	2,350.05	192.57
	For >5 To 9, Deduct	-103.14	
	For >9, Deduct	-206.28	
12 31 13 00-0028	EA 36" Stainless Steel Base Cabinet, With Doors, Drawers And Lock	3,743.65	192.57
	For >5 To 9, Deduct	-176.30	
	For >9, Deduct	-352.60	
12 31 13 00-0029	EA 36" Stainless Steel Base Cabinet, With Doors, Drawers, No Locks	3,453.75	192.57
	For >5 To 9, Deduct	-161.08	
	For >9, Deduct	-322.16	



Furnishings	12
Casework	12 30
Manufactured Metal Casework	12 31

12

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
12 31 13 00-0030 42" Stainless Steel Base Cabinet <small>(12 31 13 00-0002)</small>		
12 31 13 00-0031 EA 42" Stainless Steel Base Cabinet, No Doors, No Drawers	2,154.71	204.65
For >5 To 9, Deduct	-91.63	
For >9, Deduct	-183.26	
12 31 13 00-0032 EA 42" Stainless Steel Base Cabinet, With Doors, Drawers And Lock.....	3,948.06	204.65
For >5 To 9, Deduct	-185.78	
For >9, Deduct	-371.56	
12 31 13 00-0033 EA 42" Stainless Steel Base Cabinet, With Doors, Drawers, No Lock	3,657.51	204.65
For >5 To 9, Deduct	-170.53	
For >9, Deduct	-341.06	
12 31 13 00-0034 EA 42" Stainless Steel Base Cabinet, No Doors, 2 Drawers	3,356.56	204.65
For >5 To 9, Deduct	-154.73	
For >9, Deduct	-309.46	
12 31 13 00-0035 EA 42" Stainless Steel Base Cabinet, With Doors, No Lock.....	2,555.11	204.65
For >5 To 9, Deduct	-112.65	
For >9, Deduct	-225.30	
12 31 13 00-0036 EA 42" Stainless Steel Base Cabinet, With Doors And Lock.....	2,725.41	204.65
For >5 To 9, Deduct	-121.59	
For >9, Deduct	-243.19	
12 31 13 00-0037 48" Stainless Steel Base Cabinet <small>(12 31 13 00-0002)</small>		
12 31 13 00-0038 EA 48" Stainless Steel Base Cabinet, With Doors, Drawers And Lock.....	4,143.26	209.38
For >5 To 9, Deduct	-195.55	
For >9, Deduct	-391.10	
12 31 13 00-0039 EA 48" Stainless Steel Base Cabinet, With Doors, Drawers, No Lock	3,853.36	209.38
For >5 To 9, Deduct	-180.33	
For >9, Deduct	-360.66	
12 31 13 00-0040 EA 48" Stainless Steel Base Cabinet, No Doors, No Drawers	2,349.91	209.38
For >5 To 9, Deduct	-101.40	
For >9, Deduct	-202.80	
12 31 13 00-0041 EA 48" Stainless Steel Base Cabinet, No Doors, 2 Drawers	3,552.41	209.38
For >5 To 9, Deduct	-164.53	
For >9, Deduct	-329.06	
12 31 13 00-0042 EA 48" Stainless Steel Base Cabinet, With Doors, And Lock.....	2,922.56	209.38
For >5 To 9, Deduct	-131.46	
For >9, Deduct	-262.93	
12 31 13 00-0043 EA 48" Stainless Steel Base Cabinet, With Doors, No Locks.....	2,875.76	209.38
For >5 To 9, Deduct	-129.01	
For >9, Deduct	-258.01	
12 31 13 00-0044 60" Stainless Steel Base Cabinet <small>(12 31 13 00-0002)</small>		
12 31 13 00-0045 EA 24" Deep x 60" Wide Stainless Steel Sink Base Cabinet.....	2,841.22	215.76
For >5 To 9, Deduct	-126.52	
For >9, Deduct	-253.04	
12 31 13 00-0046 Stainless Steel Wall Cabinets <small>(12 31 13 00-0001)</small>		
12 31 13 00-0047 12" Wide Stainless Steel Wall Cabinets <small>(12 31 13 00-0046)</small>		
12 31 13 00-0048 EA 12"W x 12"D x 24"H Stainless Steel Wall Cabinet, With Doors And Locks.....	1,153.49	61.92
For >5 To 9, Deduct	-54.06	
For >9, Deduct	-108.11	
12 31 13 00-0049 EA 12"W x 12"D x 36"H Stainless Steel Wall Cabinet, With Doors, No Locks	1,147.12	65.67
For >5 To 9, Deduct	-53.33	
For >9, Deduct	-106.65	
12 31 13 00-0050 18" Wide Stainless Steel Wall Cabinets <small>(12 31 13 00-0046)</small>		
12 31 13 00-0051 EA 18"W x 12"D x 24"H Stainless Steel Wall Cabinet, With Doors And Locks.....	1,208.40	66.57
For >5 To 9, Deduct	-56.45	
For >9, Deduct	-112.89	
12 31 13 00-0052 EA 18"W x 12"D x 24"H Stainless Steel Wall Cabinet, With Doors, No Locks	1,137.55	66.57
For >5 To 9, Deduct	-52.73	
For >9, Deduct	-105.45	
12 31 13 00-0053 EA 18"W x 12"D x 36"H Stainless Steel Wall Cabinet, With Doors And Locks.....	1,337.14	72.42
For >5 To 9, Deduct	-62.59	
For >9, Deduct	-125.19	
12 31 13 00-0054 EA 18"W x 12"D x 36"H Stainless Steel Wall Cabinet, With Doors, No Locks	1,293.59	72.42
For >5 To 9, Deduct	-60.31	
For >9, Deduct	-120.61	
12 31 13 00-0055 24" Wide Stainless Steel Wall Cabinets <small>(12 31 13 00-0046)</small>		
12 31 13 00-0056 EA 24"W x 12"D x 36"H Stainless Steel Wall Cabinet, No Door.....	994.40	73.69
For >5 To 9, Deduct	-44.47	
For >9, Deduct	-88.94	
12 31 13 00-0057 EA 24"W x 12"D x 36"H Stainless Steel Wall Cabinet, With Doors And Locks.....	1,364.90	73.69
For >5 To 9, Deduct	-63.92	
For >9, Deduct	-127.84	

12 Furnishings**12 30 Casework****12 31 Manufactured Metal Casework**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
12 31	13 00-0058	EA	24"W x 12"D x 36"H Stainless Steel Wall Cabinet, With Doors, No Locks.....	1,294.70	73.69
			<i>For >5 To 9, Deduct</i>	-60.24	
			<i>For >9, Deduct</i>	-120.47	
12 31	13 00-0059	EA	24"W x 12"D x 24"H Stainless Steel Wall Cabinet, With Doors And Locks.....	1,285.21	68.81
			<i>For >5 To 9, Deduct</i>	-60.24	
			<i>For >9, Deduct</i>	-120.48	
12 31	13 00-0060	EA	24"W x 12"D x 24"H Stainless Steel Wall Cabinet, With Doors, No Locks.....	1,210.46	68.81
			<i>For >5 To 9, Deduct</i>	-56.32	
			<i>For >9, Deduct</i>	-112.63	
12 31	13 00-0061	EA	24"W x 12"D x 24"H Stainless Steel Wall Cabinet, With Glass Door, No Lock.....	1,560.81	68.81
			<i>For >5 To 9, Deduct</i>	-74.71	
			<i>For >9, Deduct</i>	-149.42	
12 31	13 00-0062	EA	24"W x 12"D x 24"H Stainless Steel Wall Cabinet, No Doors.....	910.16	68.81
			<i>For >5 To 9, Deduct</i>	-40.55	
			<i>For >9, Deduct</i>	-81.10	
12 31	13 00-0063	EA	24"W x 12"D x 18"H Stainless Steel Wall Cabinet, No Doors.....	856.57	65.67
			<i>For >5 To 9, Deduct</i>	-38.07	
			<i>For >9, Deduct</i>	-76.15	
12 31	13 00-0064		30" Wide Stainless Steel Wall Cabinets (12 31 13 00-0046)		
12 31	13 00-0065	EA	30"W x 12"D x 36"H Stainless Steel Wall Cabinet, With Doors And Locks.....	1,779.83	78.27
			<i>For >5 To 9, Deduct</i>	-85.22	
			<i>For >9, Deduct</i>	-170.44	
12 31	13 00-0066	EA	30"W x 12"D x 36"H Stainless Steel Wall Cabinet, With Doors, No Locks.....	1,609.53	78.27
			<i>For >5 To 9, Deduct</i>	-76.28	
			<i>For >9, Deduct</i>	-152.56	
12 31	13 00-0067	EA	30"W x 12"D x 36"H Stainless Steel Wall Cabinet, No Doors.....	1,068.08	78.27
			<i>For >5 To 9, Deduct</i>	-47.85	
			<i>For >9, Deduct</i>	-95.71	
12 31	13 00-0068	EA	30"W x 12"D x 24"H Stainless Steel Wall Cabinet, With Doors And Locks.....	1,694.31	72.04
			<i>For >5 To 9, Deduct</i>	-81.38	
			<i>For >9, Deduct</i>	-162.77	
12 31	13 00-0069	EA	30"W x 12"D x 24"H Stainless Steel Wall Cabinet, With Doors, No Lock.....	1,524.01	72.04
			<i>For >5 To 9, Deduct</i>	-72.44	
			<i>For >9, Deduct</i>	-144.89	
12 31	13 00-0070	EA	30"W x 12"D x 24"H Stainless Steel Wall Cabinet, No Doors.....	982.56	72.04
			<i>For >5 To 9, Deduct</i>	-44.02	
			<i>For >9, Deduct</i>	-88.03	
12 31	13 00-0071	EA	30"W x 12"D x 18"H Stainless Steel Wall Cabinet, No Doors.....	928.79	68.66
			<i>For >5 To 9, Deduct</i>	-41.55	
			<i>For >9, Deduct</i>	-83.11	
12 31	13 00-0072		36" Wide Stainless Steel Wall Cabinets (12 31 13 00-0046)		
12 31	13 00-0073	EA	36"W x 12"D x 36"H Stainless Steel Wall Cabinet, With Doors And Locks.....	1,851.41	80.53
			<i>For >5 To 9, Deduct</i>	-88.74	
			<i>For >9, Deduct</i>	-177.49	
12 31	13 00-0074	EA	36"W x 12"D x 36"H Stainless Steel Wall Cabinet, With Doors, No Locks.....	1,677.21	80.53
			<i>For >5 To 9, Deduct</i>	-79.60	
			<i>For >9, Deduct</i>	-159.20	
12 31	13 00-0075	EA	36"W x 12"D x 36"H Stainless Steel Wall Cabinet, No Doors.....	1,139.66	80.53
			<i>For >5 To 9, Deduct</i>	-51.38	
			<i>For >9, Deduct</i>	-102.75	
12 31	13 00-0076	EA	36"W x 12"D x 24"H Stainless Steel Wall Cabinet, With Doors And Locks.....	1,765.30	73.69
			<i>For >5 To 9, Deduct</i>	-84.94	
			<i>For >9, Deduct</i>	-169.88	
12 31	13 00-0077	EA	36"W x 12"D x 24"H Stainless Steel Wall Cabinet, With Doors, No Locks.....	1,595.65	73.69
			<i>For >5 To 9, Deduct</i>	-76.04	
			<i>For >9, Deduct</i>	-152.07	
12 31	13 00-0078	EA	36"W x 12"D x 24"H Stainless Steel Wall Cabinet, No Doors.....	1,053.55	73.69
			<i>For >5 To 9, Deduct</i>	-47.58	
			<i>For >9, Deduct</i>	-95.15	
12 31	13 00-0079	EA	36"W x 12"D x 18"H Stainless Steel Wall Cabinet, With Doors, No Locks.....	1,001.01	70.17
			<i>For >5 To 9, Deduct</i>	-45.18	
			<i>For >9, Deduct</i>	-90.37	
12 31	13 00-0080		42" Wide Stainless Steel Wall Cabinets (12 31 13 00-0046)		
12 31	13 00-0081	EA	42"W x 12"D x 42"H Stainless Steel Wall Cabinet, With Doors, No Locks.....	1,931.10	101.32
			<i>For >5 To 9, Deduct</i>	-90.75	
			<i>For >9, Deduct</i>	-181.51	
12 31	13 00-0082	EA	42"W x 12"D x 36"H Stainless Steel Wall Cabinet, With Doors And Locks.....	1,937.72	95.61
			<i>For >5 To 9, Deduct</i>	-91.70	
			<i>For >9, Deduct</i>	-183.39	
12 31	13 00-0083	EA	42"W x 12"D x 36"H Stainless Steel Wall Cabinet, With Doors, No Locks.....	1,764.82	95.61
			<i>For >5 To 9, Deduct</i>	-82.62	
			<i>For >9, Deduct</i>	-165.24	
12 31	13 00-0084	EA	42"W x 12"D x 36"H Stainless Steel Wall Cabinet, No Doors.....	1,224.67	95.61
			<i>For >5 To 9, Deduct</i>	-54.26	
			<i>For >9, Deduct</i>	-108.52	
12 31	13 00-0085	EA	42"W x 12"D x 24"H Stainless Steel Wall Cabinet, With Doors And Locks.....	1,832.34	80.30
			<i>For >5 To 9, Deduct</i>	-87.77	
			<i>For >9, Deduct</i>	-175.53	



Furnishings	12
Casework	12 30
Manufactured Metal Casework	12 31

MINOR				TOTAL DIRECT	DEMOLITION
CSI	UOM	DESCRIPTION		UNIT COST	UNIT COST
12 31 13 00-0086	EA	42"W x 12"D x 24"H Stainless Steel Wall Cabinet, With Doors, No Locks <i>For >5 To 9, Deduct</i> <i>For >9, Deduct</i>		1,660.74 -78.76 -157.52	80.30
12 31 13 00-0087	EA	42"W x 12"D x 24"H Stainless Steel Wall Cabinet, No Doors..... <i>For >5 To 9, Deduct</i> <i>For >9, Deduct</i>		1,120.59 -50.40 -100.80	80.30
12 31 13 00-0088		48" Wide Stainless Steel Wall Cabinets (12 31 13 00-0046)			
12 31 13 00-0089	EA	48"W x 12"D x 42"H Stainless Steel Wall Cabinet, No Doors, No Locks..... <i>For >5 To 9, Deduct</i> <i>For >9, Deduct</i>		1,691.79 -77.98 -155.95	101.32
12 31 13 00-0090	EA	48"W x 12"D x 36"H Stainless Steel Wall Cabinet, With Doors And Locks..... <i>For >5 To 9, Deduct</i> <i>For >9, Deduct</i>		2,007.91 -95.15 -190.31	97.71
12 31 13 00-0091	EA	48"W x 12"D x 36"H Stainless Steel Wall Cabinet, With Doors, No Locks <i>For >5 To 9, Deduct</i> <i>For >9, Deduct</i>		1,837.61 -86.21 -172.43	97.71
12 31 13 00-0092	EA	48"W x 12"D x 36"H Stainless Steel Wall Cabinet, No Doors..... <i>For >5 To 9, Deduct</i> <i>For >9, Deduct</i>		1,296.16 -57.79 -115.58	97.71
12 31 13 00-0093	EA	48"W x 12"D x 24"H Stainless Steel Wall Cabinet, With Doors And Locks..... <i>For >5 To 9, Deduct</i> <i>For >9, Deduct</i>		1,902.63 -91.37 -182.74	81.05
12 31 13 00-0094	EA	48"W x 12"D x 24"H Stainless Steel Wall Cabinet, With Doors, No Locks <i>For >5 To 9, Deduct</i> <i>For >9, Deduct</i>		1,732.98 -82.47 -164.93	81.05
12 31 13 00-0095	EA	48"W x 12"D x 24"H Stainless Steel Wall Cabinet, No Doors..... <i>For >5 To 9, Deduct</i> <i>For >9, Deduct</i>		1,190.88 -54.01 -108.01	81.05
12 31 13 00-0096		Accessories (12 31 13 00-0001)			
12 31 13 00-0097		Stainless Steel Countertops (12 31 13 00-0096) Note: 16 gauge countertops without sinks.			
12 31 13 00-0098	SF	Stainless Steel Countertop With Marine Edge and Splash..... Note: 16 gauge.		101.87	4.12
12 31 13 00-0099	SF	Stainless Steel Countertop Without Marine Edge and With Splash..... Note: 16 gauge.		94.72	4.12
12 31 13 00-0100	SF	Stainless Steel Countertop Without Marine Edge or Splash..... Note: 16 gauge.		88.22	4.12
12 31 13 00-0101		Stainless Steel Wall Panels (12 31 13 00-0096)			
12 31 13 00-0102	SF	Stainless Steel Wall Panel, 20 Gauge		26.95	6.15
12 31 13 00-0103		Pedestal Legs (12 31 13 00-0096)			
12 31 13 00-0104	EA	Type #304 Stainless Steel Pedestal Leg		253.64	9.39
12 31 13 00-0105		Stainless Steel Slanted Cabinet Top Enclosure (12 31 13 00-0096)			
12 31 13 00-0106	EA	Stainless Steel Slanted Cabinet Top Enclosure, 5' Sections		274.02	17.96
12 36		Countertops (12 30)			
12 36 23		Plastic Countertops (12 36)			
12 36 23 13		Plastic-Laminate-Clad Countertops (12 36 23)			
12 36 23 13-0001		Plastic Laminate Countertops (12 36 23 13)			
12 36 23 13-0002	EA	Field Cutout Plastic Laminate Counter Top For Sinks And Lavatories		59.87	
12 36 23 13-0003	SF	Plastic Laminate Counter Top..... <i>For Square Edge Instead Of Rolled Drip Edge, Add</i> <i>For Plywood Base Instead Of Particle Board, Add</i>		14.31 2.85 1.07	3.59
12 36 23 13-0004	LF	Plastic Laminate Counter Top With Backsplash, Up To 26" Deep..... <i>For Square Edge Instead Of Rolled Drip Edge, Add</i> <i>For Plywood Base Instead Of Particle Board, Add</i>		31.25 5.89 2.21	7.18
12 36 23 13-0005	LF	Plastic Laminated Counter Top Custom Made With Backsplash..... Note: Up to 26" deep. <i>For Square Edge Instead Of Rolled Drip Edge, Add</i> <i>For Plywood Base Instead Of Particle Board, Add</i>		38.67 5.89 2.21	10.78
12 36 23 13-0006	LF	Plastic Laminated Backsplash..... <i>For Plywood Base Instead Of Particle Board, Add</i>		6.94 0.20	4.31
12 36 23 13-0007	EA	Plastic Laminate End Splash..... <i>For Plywood Base Instead Of Particle Board, Add</i>		30.85 3.33	4.31
12 36 61		Simulated Stone Countertops (12 36)			
12 36 61 16		Solid Surfacing Countertops (12 36 61)			

12 Furnishings**12 30 Casework**

12 36 Countertops



MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
12 36 61 16-0001		Solid Polyester Countertops <small>(12 36 61 16)</small>			
12 36 61 16-0002		Solid Polyester Countertop And Backsplash, Group B Colors <small>(12 36 61 16-0001)</small>			
		Note: May be used for wall applications.			
12 36 61 16-0003	SF	1/4" Solid Polyester (Corian) Backsplash, Group B Colors.....	19.58		4.79
		Note: Quantity based on area of backsplash. Excludes backing material such as cement or water resistant gypsum board.			
		For Group A Color Material, Deduct	-3.69		
		For Group C Color Material, Add	1.47		
		For Group D Color Material, Add	4.05		
12 36 61 16-0004	SF	1/2" Solid Polyester (Corian) Countertop, Group B Colors.....	39.18		7.18
		Note: Quantity based on area of counter, backsplash and apron. Includes drilling holes for fixtures and 1-1/2" drop edge with 1/8" radius edges (when apron not used).			
		For Group A Color Material, Deduct	-7.38		
		For Group C Color Material, Add	2.95		
		For Group D Color Material, Add	8.11		
		For Each LF Of Half Round Edge, Add	8.00		
		For Each LF Of Ogee Or Full Round Edge, Add	12.00		
		For Each LF Of Machining A Cove At Backsplash, Add	10.00		
		For Each Sink, Range Or Vanity Cutout, Add	15.00		
		For 16-7/16" x 13" x 5-1/4" Depth Lavatory Sink (Corian 810), Add	124.80		
		For 20-7/16" x 14-7/16" x 6-1/8" Depth Lavatory Sink (Corian 815), Add	157.80		
		For 17-3/8" x 10-13/16" x 5-1/2" Depth Lavatory Sink (Corian 816), Add	115.20		
		For 14-3/4" x 10-1/2" x 5-1/2" Depth Lavatory Sink (Corian 820), Add	109.80		
		For 18-7/8" x 13-3/4" x 5-7/8" Depth Lavatory Sink (Corian 830), Add	157.80		
		For 20" x 13-3/8" x 6-1/4" Depth Lavatory Sink (Corian 831), Add	157.80		
		For 19-3/4" x 14-1/4" x 5-7/8" Depth Lavatory Sink (Corian 835), Add	157.80		
		For 17" x 14" x 6" Depth Lavatory Sink (Corian 837), Add	157.80		
		For Up To 1.5 SF Integral Single Basin Kitchen Sink, Add	142.20		
		Note: Single or double bowl.			
		For >1.5 To 2.25 SF Integral Single Basin Kitchen Sink, Add	247.20		
		Note: Single or double bowl.			
		For >2.25 To 3 SF Integral Single Basin Kitchen Sink, Add	331.20		
		Note: Single or double bowl.			
		For >3 SF Integral Single Basin Kitchen Sink, Add	358.80		
		Note: Single or double bowl.			
		For >3 SF Integral Double Basin Kitchen Sink, Add	358.80		
12 40		Furnishings And Accessories <small>(12)</small>			
12 41		Office Accessories <small>(12 40)</small>			
12 41 00 00-0001		Wall Mounted Office Accessories <small>(12 41)</small>			
12 41 00 00-0002	EA	Manual Pencil Sharpener, Wall Mounted.....	10.90		2.48
12 41 00 00-0003	EA	Wall Mounted Flag.....	10.35		2.48
12 48		Rugs And Mats <small>(12 40)</small>			
12 48 13		Entrance Floor Mats And Frames <small>(12 48)</small>			
12 48 13 13		Entrance Floor Mats <small>(12 48 13)</small>			
12 48 13 13-0001		Floor Mats <small>(12 48 13 13)</small>			
12 48 13 13-0002	SF	3/8" Thick Solid Recessable Floor Mat.....	12.06		1.81
		For Colors, Add	1.69		
12 48 13 13-0003	SF	1/2" Thick Solid Recessable Floor Mat.....	14.66		1.81
		For Colors, Add	2.21		
12 48 13 13-0004	SF	3/8" Thick Perforated Recessable Floor Mat.....	12.71		1.81
		For Colors, Add	1.82		
12 48 13 13-0005	SF	1/2" Thick Perforated Recessable Floor Mat.....	15.31		1.81
		For Colors, Add	2.34		
12 48 13 13-0006		Link Mats <small>(12 48 13 13)</small>			
		Note: Includes nosing.			
12 48 13 13-0007	SF	3/8" Link Mats, Aluminum.....	14.75		1.81
12 48 13 13-0008	SF	Black Rubber Link Mats With Galvanized Tie Rods.....	12.55		1.81
12 48 13 13-0009	SF	3/8" Thick, Galvanized Steel Link Mats.....	11.74		1.81
12 48 13 13-0010	SF	Vinyl Link Mats, Color.....	13.51		1.81
12 48 13 13-0011	LF	Rubber Nosing.....	3.89		0.79
12 48 13 13-0012		Duckboard <small>(12 48 13 13)</small>			
12 48 13 13-0013	SF	Aluminum Slats.....	20.27		1.86
12 48 13 13-0014	SF	Hardwood Strips On Rubber Base.....	12.36		1.86
12 48 13 13-0015	SF	Assembled With Brass Rods And Vinyl Spacers.....	13.63		1.86
12 48 13 13-0016	SF	Tire Fabric, 3/4" Thick.....	12.43		1.86
12 48 13 13-0017	SF	Vinyl, 36" Wide, Hollow Top And Bottom.....	6.21		1.86
12 48 13 13-0018	SF	Vinyl, 36" Wide, Solid Top And Bottom.....	8.17		1.86



Furnishings	12
Furnishings And Accessories	12 40
Rugs And Mats	12 48

12

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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12 48 13 16 Entrance Floor Mat Frames (12 48 13)

12 48 13 16-0001 Recessed Frames (12 48 13 16)

12 48 13 16-0002	LF	Aluminum Recessed Embedded Frame	11.00	2.87
12 48 13 16-0003	LF	Bronze Recessed Embedded Frame	16.15	2.87

12 50 Furniture (12)

12 56 Institutional Furniture (12 50)

12 56 39 Lecterns (12 56)

12 56 39 00-0001 Lectern (12 56 39)

12 56 39 00-0002	EA	CON 1500-32 Van Oak Lectern	3,098.52	36.53
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12 59 Systems Furniture (12 50)

12 59 13 Panel-Hung Component System Furniture (12 59)

12 59 13 00-0001 Open Office Systems Furniture Components (12 59 13)

Note: Excludes electrical wire and wiring devices.

12 59 13 00-0002	EA	34H 24W Fabric Covered Panel - Component Systems Furniture	169.16	20.09
		<i>For Tackable Acoustical Barrier Panel, Add</i>	27.36	
		<i>For Acoustical Panel, Add</i>	29.74	
		<i>For Enameled Surface, Deduct</i>	-11.90	
12 59 13 00-0003	EA	34H 30W Fabric Covered Panel - Component Systems Furniture	188.01	22.36
		<i>For Tackable Acoustical Barrier Panel, Add</i>	30.41	
		<i>For Acoustical Panel, Add</i>	33.05	
		<i>For Enameled Surface, Deduct</i>	-13.22	
12 59 13 00-0004	EA	34H 36W Fabric Covered Panel - Component Systems Furniture	201.03	23.82
		<i>For Tackable Acoustical Barrier Panel, Add</i>	32.52	
		<i>For Acoustical Panel, Add</i>	35.34	
		<i>For Enameled Surface, Deduct</i>	-14.14	
12 59 13 00-0005	EA	34H 48W Fabric Covered Panel - Component Systems Furniture	225.25	26.74
		<i>For Tackable Acoustical Barrier Panel, Add</i>	36.43	
		<i>For Acoustical Panel, Add</i>	39.60	
		<i>For Enameled Surface, Deduct</i>	-15.84	
12 59 13 00-0006	EA	42H 24W Fabric Covered Panel - Component Systems Furniture	171.85	20.39
		<i>For Tackable Acoustical Barrier Panel, Add</i>	27.80	
		<i>For Acoustical Panel, Add</i>	30.21	
		<i>For Enameled Surface, Deduct</i>	-12.09	
12 59 13 00-0007	EA	42H 30W Fabric Covered Panel - Component Systems Furniture	194.27	23.02
		<i>For Tackable Acoustical Barrier Panel, Add</i>	31.42	
		<i>For Acoustical Panel, Add</i>	34.16	
		<i>For Enameled Surface, Deduct</i>	-13.66	
12 59 13 00-0008	EA	42H 36W Fabric Covered Panel - Component Systems Furniture	217.61	25.87
		<i>For Tackable Acoustical Barrier Panel, Add</i>	35.20	
		<i>For Acoustical Panel, Add</i>	38.26	
		<i>For Enameled Surface, Deduct</i>	-15.30	
12 59 13 00-0009	EA	42H 48W Fabric Covered Panel - Component Systems Furniture	255.77	30.32
		<i>For Tackable Acoustical Barrier Panel, Add</i>	41.37	
		<i>For Acoustical Panel, Add</i>	44.97	
		<i>For Enameled Surface, Deduct</i>	-17.99	
12 59 13 00-0010	EA	62H 12W Fabric Covered Panel - Component Systems Furniture	165.58	19.66
		<i>For Tackable Acoustical Barrier Panel, Add</i>	26.78	
		<i>For Acoustical Panel, Add</i>	29.11	
		<i>For Enameled Surface, Deduct</i>	-11.64	
12 59 13 00-0011	EA	62H 24W Fabric Covered Panel - Component Systems Furniture	203.72	24.18
		<i>For Tackable Acoustical Barrier Panel, Add</i>	32.95	
		<i>For Acoustical Panel, Add</i>	35.82	
		<i>For Enameled Surface, Deduct</i>	-14.33	
12 59 13 00-0012	EA	62H 36W Fabric Covered Panel - Component Systems Furniture	254.89	30.25
		<i>For Tackable Acoustical Barrier Panel, Add</i>	41.23	
		<i>For Acoustical Panel, Add</i>	44.81	
		<i>For Enameled Surface, Deduct</i>	-17.92	
12 59 13 00-0013	EA	62H 48W Fabric Covered Panel - Component Systems Furniture	305.10	36.17
		<i>For Tackable Acoustical Barrier Panel, Add</i>	49.35	
		<i>For Acoustical Panel, Add</i>	53.65	
		<i>For Enameled Surface, Deduct</i>	-21.46	
12 59 13 00-0014	EA	34" Draw Rod Panel Connector Hardware	9.24	1.09
12 59 13 00-0015	EA	42" Draw Rod Panel Connector Hardware	9.24	1.09
12 59 13 00-0016	EA	62" Draw Rod Panel Connector Hardware	9.86	1.17
12 59 13 00-0017	EA	34" Two-Way 90 Degree Panel Connector Hardware	42.50	5.05
12 59 13 00-0018	EA	42" Two-Way 90 Degree Panel Connector Hardware	49.27	5.85
12 59 13 00-0019	EA	62" Two-Way 90 Degree Panel Connector Hardware	56.66	6.72
12 59 13 00-0020	EA	34" Three-Way 90 Degree Panel Connector Hardware	65.90	7.82
12 59 13 00-0021	EA	42" Three-Way 90 Degree Panel Connector Hardware	76.37	9.06
12 59 13 00-0022	EA	62" Three-Way 90 Degree Panel Connector Hardware	88.69	10.52
12 59 13 00-0023	EA	34" Four-Way 90 Degree Panel Connector Hardware	83.14	9.86
12 59 13 00-0024	EA	42" Four-Way 90 Degree Panel Connector Hardware	97.31	11.54
12 59 13 00-0025	EA	62" Four-Way 90 Degree Panel Connector Hardware	117.01	13.88
12 59 13 00-0026	EA	34" Panel End Cap Hardware	14.16	1.68

12 Furnishings**12 50 Furniture****12 59 Systems Furniture**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
12 59 13 00-0027	EA		42" Panel End Cap Hardware	16.01	1.90
12 59 13 00-0028	EA		62" Panel End Cap Hardware	17.25	2.05
12 59 13 00-0029	EA		28" Variable Height Panel End Filler	15.62	1.90
			Note: Field cut to appropriate length.		
12 59 13 00-0030	EA		Two-Way Trim Cover For Cable Management Raceway	8.05	0.95
12 59 13 00-0031	EA		Three-Way Trim Cover For Cable Management Raceway	8.48	1.02
12 59 13 00-0032	EA		Four-Way Trim Cover For Cable Management Raceway	9.82	1.17
12 59 13 00-0033	EA		Finished End Trim Cover For Cable Management Raceway	8.05	0.95
12 59 13 00-0034	EA		12" Cable Management Raceway Assembly	16.52	1.98
			Note: Includes base plate, two side covers, and 2 side cover fillers.		
12 59 13 00-0035	EA		24" Cable Management Raceway Assembly	18.76	2.20
			Note: Includes base plate, two side covers, and 2 side cover fillers.		
12 59 13 00-0036	EA		30" Cable Management Raceway Assembly	19.20	2.27
			Note: Includes base plate, two side covers, and 2 side cover fillers.		
12 59 13 00-0037	EA		36" Cable Management Raceway Assembly	21.43	2.56
			Note: Includes base plate, two side covers, and 2 side cover fillers.		
12 59 13 00-0038	EA		48" Cable Management Raceway Assembly	24.10	2.85
			Note: Includes base plate, two side covers, and 2 side cover fillers.		
12 59 13 00-0039	EA		24" x 36" Radiused Edge Rectangular Hanging Work Surface	129.67	15.35
12 59 13 00-0040	EA		30" x 36" Radiused Edge Rectangular Hanging Work Surface	159.74	18.93
12 59 13 00-0041	EA		24" x 48" Radiused Edge Rectangular Hanging Work Surface	150.77	17.90
12 59 13 00-0042	EA		30" x 48" Radiused Edge Rectangular Hanging Work Surface	188.47	22.36
12 59 13 00-0043	EA		24" x 60" Radiused Edge Rectangular Hanging Work Surface	190.25	22.58
12 59 13 00-0044	EA		30" x 60" Radiused Edge Rectangular Hanging Work Surface	239.61	28.49
12 59 13 00-0045	EA		24" x 72" Radiused Edge Rectangular Hanging Work Surface	231.08	27.40
12 59 13 00-0046	EA		30" x 72" Radiused Edge Rectangular Hanging Work Surface	290.29	34.41
12 59 13 00-0047	EA		30" x 60" Radiused Edge Table	515.69	61.23
12 59 13 00-0048	EA		30" x 72" Radiused Edge Table	563.56	66.93
12 59 13 00-0049	EA		14" x 24" Radiused Edge Transaction Surface	61.92	7.38
12 59 13 00-0050	EA		14" x 36" Radiused Edge Transaction Surface	70.44	8.32
12 59 13 00-0051	EA		14" x 48" Radiused Edge Transaction Surface	78.97	9.35
12 59 13 00-0052	EA		14" x 60" Radiused Edge Transaction Surface	98.26	11.69
12 59 13 00-0053	EA		14" x 72" Radiused Edge Transaction Surface	118.00	14.03
12 59 13 00-0054	EA		14" Right Angle Corner Transaction Surface	206.42	24.48
12 59 13 00-0055	EA		Transaction Surface Support	16.34	1.94
12 59 13 00-0056	EA		Plastic Pencil Drawer	17.69	1.90
12 59 13 00-0057	EA		15-1/2" x 24" Hanging Shelf	60.29	7.16
12 59 13 00-0058	EA		15-1/2" x 36" Hanging Shelf	65.64	7.74
12 59 13 00-0059	EA		15-1/2" x 48" Hanging Shelf	70.10	8.32
12 59 13 00-0060	EA		24" Flipper Door - Top And Front Closure	104.03	12.35
			Note: Used with hanging shelf.		
12 59 13 00-0061	EA		36" Flipper Door - Top And Front Closure	121.45	14.46
			Note: Used with hanging shelf.		
12 59 13 00-0062	EA		48" Flipper Door - Top And Front Closure	139.30	16.51
			Note: Used with hanging shelf.		
12 59 13 00-0063	EA		24" Suspended Lateral File, Lockable	358.53	42.35
12 59 13 00-0064	EA		30" Suspended Lateral File, Lockable	378.67	44.72
12 59 13 00-0065	EA		36" Suspended Lateral File, Lockable	399.55	47.19
12 59 13 00-0066	EA		48" Suspended Lateral File, Lockable	437.00	51.61
12 59 13 00-0067	EA		Fully Adjustable Vinyl Keyboard Tray	162.54	19.29
12 59 13 00-0068	EA		Palm Rest For Vinyl Keyboard Tray	25.44	3.07
12 59 13 00-0069	EA		24" x 36" Radiused Edge Corner Work Surface	205.35	24.40
12 59 13 00-0070	EA		File Drawer Organizer	66.09	7.82
12 59 13 00-0071	EA		Suspended Lateral File Converter Bracket	14.29	1.68
12 59 13 00-0072	EA		Utility Task Light	71.44	8.48

12 59 13 00-0073 Disassemble And Store Systems Furniture Components (12 59 13)

12 59 13 00-0074	EA		Disassemble And Store 34H 24W Fabric Covered Panel	25.10	
12 59 13 00-0075	EA		Disassemble And Store 34H 30W Fabric Covered Panel	27.90	
12 59 13 00-0076	EA		Disassemble And Store 34H 36W Fabric Covered Panel	29.84	
12 59 13 00-0077	EA		Disassemble And Store 34H 48W Fabric Covered Panel	33.44	
12 59 13 00-0078	EA		Disassemble And Store 42H 24W Fabric Covered Panel	25.51	
12 59 13 00-0079	EA		Disassemble And Store 42H 30W Fabric Covered Panel	28.84	
12 59 13 00-0080	EA		Disassemble And Store 42H 36W Fabric Covered Panel	32.31	
12 59 13 00-0081	EA		Disassemble And Store 42H 48W Fabric Covered Panel	37.96	
12 59 13 00-0082	EA		Disassemble And Store 62H 12W Fabric Covered Panel	24.57	
12 59 13 00-0083	EA		Disassemble And Store 62H 24W Fabric Covered Panel	30.24	
12 59 13 00-0084	EA		Disassemble And Store 62H 36W Fabric Covered Panel	37.83	
12 59 13 00-0085	EA		Disassemble And Store 62H 48W Fabric Covered Panel	45.30	
12 59 13 00-0086	EA		Disassemble And Store 34" Draw Rod Panel Connector Hardware	1.37	
12 59 13 00-0087	EA		Disassemble And Store 42" Draw Rod Panel Connector Hardware	1.37	
12 59 13 00-0088	EA		Disassemble And Store 62" Draw Rod Panel Connector Hardware	1.46	
12 59 13 00-0089	EA		Disassemble And Store 34" Two-Way 90 Degree Panel Connector Hardware	6.31	
12 59 13 00-0090	EA		Disassemble And Store 42" Two-Way 90 Degree Panel Connector Hardware	7.31	
12 59 13 00-0091	EA		Disassemble And Store 62" Two-Way 90 Degree Panel Connector Hardware	8.42	
12 59 13 00-0092	EA		Disassemble And Store 34" Three-Way 90 Degree Panel Connector Hardware	9.78	
12 59 13 00-0093	EA		Disassemble And Store 42" Three-Way 90 Degree Panel Connector Hardware	11.33	
12 59 13 00-0094	EA		Disassemble And Store 62" Three-Way 90 Degree Panel Connector Hardware	13.17	
12 59 13 00-0095	EA		Disassemble And Store 34" Four-Way 90 Degree Panel Connector Hardware	12.34	
12 59 13 00-0096	EA		Disassemble And Store 42" Four-Way 90 Degree Panel Connector Hardware	14.44	
12 59 13 00-0097	EA		Disassemble And Store 62" Four-Way 90 Degree Panel Connector Hardware	17.37	



Furnishings	12
Furniture	12 50
Systems Furniture	12 59

12

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
12 59 13 00-0098 EA Disassemble And Store 34" Panel End Cap Hardware.....	2.11	
12 59 13 00-0099 EA Disassemble And Store 42" Panel End Cap Hardware.....	2.38	
12 59 13 00-0100 EA Disassemble And Store 62" Panel End Cap Hardware.....	2.56	
12 59 13 00-0101 EA Disassemble And Store Variable Height Panel End Filler.....	2.32	
12 59 13 00-0102 EA Disassemble And Store Two-Way Trim Cover For Cable Management Raceway	1.19	
12 59 13 00-0103 EA Disassemble And Store Three-Way Trim Cover For Cable Management Raceway	1.26	
12 59 13 00-0104 EA Disassemble And Store Four-Way Trim Cover For Cable Management Raceway	1.45	
12 59 13 00-0105 EA Disassemble And Store Finished End Trim Cover For Cable Management Raceway	1.19	
12 59 13 00-0106 EA Disassemble And Store 12" Cable Management Raceway Assembly.....	2.46	
12 59 13 00-0107 EA Disassemble And Store 24" Cable Management Raceway Assembly.....	2.79	
12 59 13 00-0108 EA Disassemble And Store 30" Cable Management Raceway Assembly.....	2.85	
12 59 13 00-0109 EA Disassemble And Store 36" Cable Management Raceway Assembly.....	3.18	
12 59 13 00-0110 EA Disassemble And Store 48" Cable Management Raceway Assembly.....	3.58	
12 59 13 00-0111 EA Disassemble And Store 24" x 36" Radiused Edge Rectangular Hanging Work Surface	19.25	
12 59 13 00-0112 EA Disassemble And Store 30" x 36" Radiused Edge Rectangular Hanging Work Surface	23.71	
12 59 13 00-0113 EA Disassemble And Store 24" x 48" Radiused Edge Rectangular Hanging Work Surface	22.38	
12 59 13 00-0114 EA Disassemble And Store 30" x 48" Radiused Edge Rectangular Hanging Work Surface	27.97	
12 59 13 00-0115 EA Disassemble And Store 24" x 60" Radiused Edge Rectangular Hanging Work Surface	28.24	
12 59 13 00-0116 EA Disassemble And Store 30" x 60" Radiused Edge Rectangular Hanging Work Surface	35.57	
12 59 13 00-0117 EA Disassemble And Store 24" x 72" Radiused Edge Rectangular Hanging Work Surface	34.30	
12 59 13 00-0118 EA Disassemble And Store 30" x 72" Radiused Edge Rectangular Hanging Work Surface	43.10	
12 59 13 00-0119 EA Disassemble And Store 30" x 60" Radiused Edge Table.....	66.55	
12 59 13 00-0120 EA Disassemble And Store 30" x 72" Radiused Edge Table.....	83.63	
12 59 13 00-0121 EA Disassemble And Store 14" x 24" Radiused Edge Transaction Surface.....	9.19	
12 59 13 00-0122 EA Disassemble And Store 14" x 36" Radiused Edge Transaction Surface.....	10.46	
12 59 13 00-0123 EA Disassemble And Store 14" x 48" Radiused Edge Transaction Surface.....	11.72	
12 59 13 00-0124 EA Disassemble And Store 14" x 60" Radiused Edge Transaction Surface.....	14.58	
12 59 13 00-0125 EA Disassemble And Store 14" x 72" Radiused Edge Transaction Surface.....	17.51	
12 59 13 00-0126 EA Disassemble And Store 14" Right Angle Corner Transaction Surface.....	30.64	
12 59 13 00-0127 EA Disassemble And Store Transaction Surface Support.....	2.42	
12 59 13 00-0128 EA Disassemble And Store Plastic Pencil Drawer.....	2.39	
12 59 13 00-0129 EA Disassemble And Store 15-1/2" x 24" Hanging Shelf	8.95	
12 59 13 00-0130 EA Disassemble And Store 15-1/2" x 36" Hanging Shelf	9.74	
12 59 13 00-0131 EA Disassemble And Store 15-1/2" x 48" Hanging Shelf	10.41	
12 59 13 00-0132 EA Disassemble And Store 24" Flipper Door And Shelf	15.45	
12 59 13 00-0133 EA Disassemble And Store 36" Flipper Door And Shelf	18.03	
12 59 13 00-0134 EA Disassemble And Store 48" Flipper Door And Shelf	20.68	
12 59 13 00-0135 EA Disassemble And Store 24" Suspended Lateral File	52.93	
12 59 13 00-0136 EA Disassemble And Store 30" Suspended Lateral File	55.90	
12 59 13 00-0137 EA Disassemble And Store 36" Suspended Lateral File	58.99	
12 59 13 00-0138 EA Disassemble And Store 48" Suspended Lateral File	64.51	
12 59 13 00-0139 EA Disassemble And Store Fully Adjustable Vinyl Keyboard Tray.....	24.13	
12 59 13 00-0140 EA Disassemble And Store 24" x 36" Radiused Edge Corner Work Surface	30.48	
12 59 13 00-0141 EA Disassemble And Store Utility Task Light.....	10.60	
12 59 13 00-0142 Reconfigure Systems Furniture Components (12 59 13)		
12 59 13 00-0143 EA Reconfigure 34H 24W Fabric Covered Panel.....	26.77	
12 59 13 00-0144 EA Reconfigure 34H 30W Fabric Covered Panel.....	29.76	
12 59 13 00-0145 EA Reconfigure 34H 36W Fabric Covered Panel.....	31.81	
12 59 13 00-0146 EA Reconfigure 34H 48W Fabric Covered Panel.....	35.65	
12 59 13 00-0147 EA Reconfigure 42H 24W Fabric Covered Panel.....	27.19	
12 59 13 00-0148 EA Reconfigure 42H 30W Fabric Covered Panel.....	30.75	
12 59 13 00-0149 EA Reconfigure 42H 36W Fabric Covered Panel.....	34.44	
12 59 13 00-0150 EA Reconfigure 42H 48W Fabric Covered Panel.....	40.48	
12 59 13 00-0151 EA Reconfigure 62H 12W Fabric Covered Panel.....	26.21	
12 59 13 00-0152 EA Reconfigure 62H 24W Fabric Covered Panel.....	32.24	
12 59 13 00-0153 EA Reconfigure 62H 36W Fabric Covered Panel.....	40.33	
12 59 13 00-0154 EA Reconfigure 62H 48W Fabric Covered Panel.....	48.28	
12 59 13 00-0155 EA Reconfigure 34" Draw Rod Panel Connector Hardware	1.46	
12 59 13 00-0156 EA Reconfigure 42" Draw Rod Panel Connector Hardware	1.46	
12 59 13 00-0157 EA Reconfigure 62" Draw Rod Panel Connector Hardware	1.55	
12 59 13 00-0158 EA Reconfigure 34" Two-Way 90 Degree Panel Connector Hardware	6.73	
12 59 13 00-0159 EA Reconfigure 42" Two-Way 90 Degree Panel Connector Hardware	7.79	
12 59 13 00-0160 EA Reconfigure 62" Two-Way 90 Degree Panel Connector Hardware	8.97	
12 59 13 00-0161 EA Reconfigure 34" Three-Way 90 Degree Panel Connector Hardware	10.43	
12 59 13 00-0162 EA Reconfigure 42" Three-Way 90 Degree Panel Connector Hardware.....	12.09	
12 59 13 00-0163 EA Reconfigure 62" Three-Way 90 Degree Panel Connector Hardware.....	14.03	
12 59 13 00-0164 EA Reconfigure 34" Four-Way 90 Degree Panel Connector Hardware.....	13.16	
12 59 13 00-0165 EA Reconfigure 42" Four-Way 90 Degree Panel Connector Hardware.....	15.41	
12 59 13 00-0166 EA Reconfigure 62" Four-Way 90 Degree Panel Connector Hardware.....	18.52	
12 59 13 00-0167 EA Reconfigure 34" Panel End Cap Hardware.....	2.25	
12 59 13 00-0168 EA Reconfigure 42" Panel End Cap Hardware.....	2.54	
12 59 13 00-0169 EA Reconfigure 62" Panel End Cap Hardware.....	2.73	
12 59 13 00-0170 EA Reconfigure Variable Height Panel End Filler.....	2.48	
12 59 13 00-0171 EA Reconfigure Two-Way Trim Cover For Cable Management Raceway	1.27	
12 59 13 00-0172 EA Reconfigure Three-Way Trim Cover For Cable Management Raceway	1.34	
12 59 13 00-0173 EA Reconfigure Four-Way Trim Cover For Cable Management Raceway	1.55	
12 59 13 00-0174 EA Reconfigure Finished End Trim Cover For Cable Management Raceway.....	1.27	
12 59 13 00-0175 EA Reconfigure 12" Cable Management Raceway Assembly.....	2.62	
12 59 13 00-0176 EA Reconfigure 24" Cable Management Raceway Assembly.....	2.97	

12 Furnishings**12 50 Furniture****12 59 Systems Furniture**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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12 59 13 00-0177	EA		Reconfigure 30" Cable Management Raceway Assembly.....	3.04	
12 59 13 00-0178	EA		Reconfigure 36" Cable Management Raceway Assembly.....	3.39	
12 59 13 00-0179	EA		Reconfigure 48" Cable Management Raceway Assembly.....	3.81	
12 59 13 00-0180	EA		Reconfigure 24" x 36" Radiused Edge Rectangular Hanging Work Surface.....	20.52	
12 59 13 00-0181	EA		Reconfigure 30" x 36" Radiused Edge Rectangular Hanging Work Surface.....	25.28	
12 59 13 00-0182	EA		Reconfigure 24" x 48" Radiused Edge Rectangular Hanging Work Surface.....	23.86	
12 59 13 00-0183	EA		Reconfigure 30" x 48" Radiused Edge Rectangular Hanging Work Surface.....	29.83	
12 59 13 00-0184	EA		Reconfigure 24" x 60" Radiused Edge Rectangular Hanging Work Surface.....	30.11	
12 59 13 00-0185	EA		Reconfigure 30" x 60" Radiused Edge Rectangular Hanging Work Surface.....	37.92	
12 59 13 00-0186	EA		Reconfigure 24" x 72" Radiused Edge Rectangular Hanging Work Surface.....	36.57	
12 59 13 00-0187	EA		Reconfigure 30" x 72" Radiused Edge Rectangular Hanging Work Surface.....	45.95	
12 59 13 00-0188	EA		Reconfigure 30" x 60" Radiused Edge Table.....	81.62	
12 59 13 00-0189	EA		Reconfigure 30" x 72" Radiused Edge Table.....	89.20	
12 59 13 00-0190	EA		Reconfigure 14" x 24" Radiused Edge Transaction Surface.....	9.80	
12 59 13 00-0191	EA		Reconfigure 14" x 36" Radiused Edge Transaction Surface.....	11.14	
12 59 13 00-0192	EA		Reconfigure 14" x 48" Radiused Edge Transaction Surface.....	12.50	
12 59 13 00-0193	EA		Reconfigure 14" x 60" Radiused Edge Transaction Surface.....	15.55	
12 59 13 00-0194	EA		Reconfigure 14" x 72" Radiused Edge Transaction Surface.....	18.68	
12 59 13 00-0195	EA		Reconfigure 14" Right Angle Corner Transaction Surface.....	32.67	
12 59 13 00-0196	EA		Reconfigure Transaction Surface Support.....	2.58	
12 59 13 00-0197	EA		Reconfigure 15-1/2" x 24" Hanging Shelf.....	9.54	
12 59 13 00-0198	EA		Reconfigure 15-1/2" x 36" Hanging Shelf.....	10.39	
12 59 13 00-0199	EA		Reconfigure 15-1/2" x 48" Hanging Shelf.....	11.09	
12 59 13 00-0200	EA		Reconfigure 24" Flipper Door And Shelf.....	16.47	
12 59 13 00-0201	EA		Reconfigure 36" Flipper Door And Shelf.....	19.22	
12 59 13 00-0202	EA		Reconfigure 48" Flipper Door And Shelf.....	22.05	
12 59 13 00-0203	EA		Reconfigure 24" Suspended Lateral File.....	56.46	
12 59 13 00-0204	EA		Reconfigure 30" Suspended Lateral File.....	59.63	
12 59 13 00-0205	EA		Reconfigure 36" Suspended Lateral File.....	62.92	
12 59 13 00-0206	EA		Reconfigure 48" Suspended Lateral File.....	68.82	
12 59 13 00-0207	EA		Reconfigure 24" x 36" Radiused Edge Corner Work Surface.....	32.50	

12 60 Multiple Seating ⁽¹²⁾**12 61 Fixed Audience Seating** ^(12 60)**12 61 13 Upholstered Audience Seating** ^(12 61)**12 61 13 00-0001 Fixed Back Upholstered Audience Seating** ^(12 61 13)

12 61 13 00-0002	EA		31" Seat Height, Polypropylene, Fixed Back Upholstered Audience Seating (Irwin Marquee 51.12.10.4).....	388.95	32.03
			Note: Polypropylene surfaced back and seat with plywood backed upholstered panels. Comfort curved wood armrests. Powdered coated steel chair platform.		
			<i>For <25, Add</i>	86.21	
			<i>For >100, Deduct</i>	-51.79	
			<i>For Table Arm Attachment, Add</i>	57.47	
			<i>For Aisle Panel, Add</i>	86.34	
			<i>For Epoxy Anchoring, Add</i>	22.99	
12 61 13 00-0003	EA		36" Seat Height, Polypropylene, Fixed Back Upholstered Audience Seating (Irwin Saturn 22.12.00.4).....	498.93	32.03
			Note: Polypropylene surfaced back and seat with plywood backed upholstered panels. Comfort curved polymer armrests. Powdered coated steel chair platform.		
			<i>For <25, Add</i>	115.91	
			<i>For >100, Deduct</i>	-69.63	
			<i>For Table Arm Attachment, Add</i>	57.47	
			<i>For Aisle Panel, Add</i>	86.34	
			<i>For Epoxy Anchoring, Add</i>	22.99	

12 61 16 Molded-Plastic Audience Seating ^(12 61)**12 61 16 00-0001 Fixed Back Molded-Plastic Audience Seating** ^(12 61 16)

12 61 16 00-0002	EA		Fixed Back Molded-Plastic Audience Seating (Irwin Patriot 30.52.36.30).....	286.38	32.03
			Note: Impact resistant textured polypropylene seat and back. Laminate surfaced armrests. Powder coated steel chair platform.		
			<i>For <25, Add</i>	58.52	
			<i>For >100, Deduct</i>	-35.16	
			<i>For Table Arm Attachment, Add</i>	57.47	
			<i>For Aisle Panel, Add</i>	86.34	
			<i>For Epoxy Anchoring, Add</i>	22.99	

12 61 19 Plywood/Hardwood Audience Seating ^(12 61)**12 61 19 00-0001 Fixed Back Plywood/Hardwood Audience Seating** ^(12 61 19)

12 61 19 00-0002	EA		Fixed Back Plywood/Hardwood Audience Seating (Irwin Crusader 1.14.86.4).....	428.41	32.03
			Note: Stained hardwood armrests, veneered plywood seat, and veneered plywood back. Powder coated steel chair platform.		
			<i>For <25, Add</i>	96.87	
			<i>For >100, Deduct</i>	-58.19	
			<i>For Table Arm Attachment, Add</i>	57.47	
			<i>For Aisle Panel, Add</i>	86.34	
			<i>For Epoxy Anchoring, Add</i>	22.99	



Furnishings	12
Multiple Seating	12 60
Portable-Audience Seating	12 62

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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12 62 Portable-Audience Seating (12 60)

12 62 23 Portable Bleachers (12 62)

12 62 23 00-0001 Metal Bleachers, Outdoor, Portable (12 62 23)

Note: Average seating is 18".

12 62 23 00-0002 Non-Elevated Portable Aluminum Bleacher (12 62 23 00-0001)

12 62 23 00-0003	SEA 2 To 5 Rows, Non Elevated Portable Aluminum Bleacher Price Per Seat.....	51.56	3.44
	For Each "Tip and Roll" Set (Includes Two Fixed Wheels), Add To Total Structure	165.00	
	For Each "Flip and Roll" Set (Includes Four Wheels), Add To Total Structure	335.00	

12 62 23 00-0004 Non-Elevated Portable Aluminum Bleacher (12 62 23 00-0001)

Note: Includes side and back fence.

12 62 23 00-0005	SEA 5 Rows, Non Elevated Portable Aluminum Bleacher	65.03	3.44
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Note: Including side and back fence.

For Elevated Structure (Includes Additional Front Rail, A Front Walkway With Stairways On Either Side, Double Foot Boards Between Rows), Add

12 62 23 00-0006	SEA 6 To 10 Rows, Non Elevated Portable Aluminum Bleacher	73.37	3.61
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Note: Including side and back fence.

For Elevated Structure (Includes Additional Front Rail, A Front Walkway With Stairways On Either Side, Double Foot Boards Between Rows), Add

12 62 23 00-0007	SEA 11 To 15 Rows, Non Elevated Portable Aluminum Bleacher.....	76.61	3.78
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Note: Including side and back fence.

For Elevated Structure (Includes Additional Front Rail, A Front Walkway With Stairways On Either Side, Double Foot Boards Between Rows), Add

12 62 23 00-0008 Non-Elevated Portable Aluminum Bleacher (12 62 23 00-0001)

Note: Includes side and back fence and center aisle with rails.

12 62 23 00-0009	SEA 5 Rows, Non Elevated Portable Aluminum Bleacher	97.21	3.87
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Note: Including side and back fence and center aisle with hand rails.

For Elevated Structure (Includes Additional Front Rail, A Front Walkway With Stairways On Either Side, Double Foot Boards Between Rows), Add

12 62 23 00-0010	SEA 6 To 10 Rows, Non Elevated Portable Aluminum Bleacher	110.31	4.07
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Note: Including side and back fence and center aisle with hand rails.

For Elevated Structure (Includes Additional Front Rail, A Front Walkway With Stairways On Either Side, Double Foot Boards Between Rows), Add

12 62 23 00-0011	SEA 11 To 15 Rows, Non Elevated Portable Aluminum Bleacher.....	119.33	4.31
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Note: Including side and back fence and center aisle with hand rails.

For Elevated Structure (Includes Additional Front Rail, A Front Walkway With Stairways On Either Side, Double Foot Boards Between Rows), Add

12 63 Stadium And Arena Seating (12 60)

12 63 13 Stadium And Arena Bench Seating (12 63)

12 63 13 00-0001 Precast Concrete Park Benches With Backs (12 63 13)

12 63 13 00-0002	EA 4' Precast Concrete Bench With Back	589.57	71.87
12 63 13 00-0003	EA 8' Precast Concrete Bench With Back	801.95	93.43

12 63 13 00-0004 Fiberglass Benches With Backs (12 63 13)

12 63 13 00-0005	EA 4' Fiberglass Bench With Back	353.40	35.94
12 63 13 00-0006	EA 8' Fiberglass Bench With Back	491.82	51.74

12 63 13 00-0007 Wood Benches With Backs And Fiberglass Supports (12 63 13)

12 63 13 00-0008	EA 4' Wood Bench With Back And Fiberglass Supports	730.20	35.94
12 63 13 00-0009	EA 8' Wood Bench With Back And Fiberglass Supports	890.42	51.74
12 63 13 00-0010	EA 6' Permanent Wooden Slat Bench With Back And Fiberglass Supports.....	240.70	34.63
12 63 13 00-0011	EA 6' Permanent Redwood Slat Bench With Back And Fiberglass Supports.....	285.33	34.63
12 63 13 00-0012	EA 6' Redwood Bench With Back And Fiberglass Supports.....	334.12	34.63
12 63 13 00-0013	EA 6' Permanent Redwood Contour Bench With Back And Fiberglass Supports	394.94	34.63
12 63 13 00-0014	EA 8' Heavy Duty Permanent Redwood Bench With Back And Fiberglass Supports.....	367.67	34.63
12 63 13 00-0015	EA 6' Ornate Bench, Exterior With Back And Fiberglass Supports	492.93	34.63

12 63 13 00-0016 Steel Frame Benches (12 63 13)

12 63 13 00-0017	EA 6' All Steel Bench.....	411.96	45.28
12 63 13 00-0018	EA 6' Steel Frame Bench With Hardwood Boards.....	369.73	45.28

12 63 13 00-0019 Aluminum Benches (12 63 13)

12 63 13 00-0020	LF 10' Steel Frame Players Bench Fir Seat With No Back	30.41	3.60
12 63 13 00-0021	EA 6' Permanent Enclosed Slat Bench.....	375.65	34.63
12 63 13 00-0022	EA 6' Portable Anodized Aluminum Bench.....	359.68	34.63
12 63 13 00-0023	EA 6' Portable Colored Aluminum Bench	396.64	34.63

12 Furnishings**12 60 Multiple Seating****12 63 Stadium And Arena Seating**

MINOR			TOTAL DIRECT	DEMOLITION
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST
12 63 13 00-0024		Steel Benches <small>(12 63 13)</small>		
12 63 13 00-0025	EA	6' Portable Super Slat Steel Bench	370.22	34.63
12 63 13 00-0026	EA	6' Permanent One-piece Steel Bench	349.11	34.63
12 63 13 00-0027	EA	6' Portable Perma-glass Park Bench	380.78	34.63
12 63 13 00-0028		Color Coated Square Steel Frames <small>(12 63 13)</small>		
		Note: With flat steel slats, includes intermediate frame with armrest and back.		
12 63 13 00-0029	EA	Bench 8.08' Long	1,007.71	84.45
12 63 13 00-0030	EA	Bench 10.08' Long	2,061.99	84.45
12 63 13 00-0031	EA	Bench 12' Long	2,237.72	84.45

END OF SECTION 12



Special Construction	13
Special Structures	13 30
Fabricated Engineered Structures	13 34

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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13 Special Construction

13 30 Special Structures ⁽¹³⁾

13 34 Fabricated Engineered Structures ^(13 30)

13 34 16 Grandstands And Bleachers ^(13 34)

13 34 16 13 Grandstands ^(13 34 16)

13 34 16 13-0001 Permanent Grandstands, Wood Seat, Steel Frame ^(13 34 16 13)

13 34 16 13-0002 3 To 15 Tiers ^(13 34 16 13-0001)

13 34 16 13-0003 SEA 3-15 Tier Permanent Grandstand Price Per Seat 65.08 6.88

13 34 16 13-0004 16 To 30 Tiers ^(13 34 16 13-0001)

13 34 16 13-0005 SEA 16-30 Tier Permanent Grandstand Price Per Seat 99.25 7.75

13 34 23 Fabricated Structures ^(13 34)

13 34 23 13 Portable And Mobile Buildings ^(13 34 23)

Note: Includes material, delivery to site, factory design analysis and report, shop drawings and assembly of building on site. Tie down with hurricane anchors on approved foundation. Excludes utility hook-ups and foundation.

13 34 23 13-0001 Prefabricated Signal, Communication Or Electrical Building ^(13 34 23 13)

Note: Complete, includes door, roof, lights and wiring, insulation, painted.

13 34 23 13-0002 SF 15 SF To 29 SF Prefabricated Signal, Communication Or Electrical Building 449.65

13 34 23 13-0003 SF 30 SF To 49 SF Prefabricated Signal, Communication Or Electrical Building 385.67

13 34 23 13-0004 SF 50 SF To 79 SF Prefabricated Signal, Communication Or Electrical Building 308.67

13 34 23 13-0005 SF 80 SF To 99 SF Prefabricated Signal, Communication Or Electrical Building 244.26

13 34 23 13-0006 SF 100 SF To 144 SF Prefabricated Signal, Communication Or Electrical Building 218.32

13 34 23 13-0007 Relocate Trailer Within 5 Miles ^(13 34 23 13)

Note: Includes removal of tie-downs and underpins. Set-up tie-downs.

13 34 23 13-0008 EA Relocate Single Trailer Within 5 Miles 896.71

13 34 23 13-0009 SF Install Under-Pinning 2.53

13 34 23 13-0010 Temporary Trailers 1 To 6 Years Life ^(13 34 23 13)

Note: Includes cost to set-up, underpin, tie-downs, HVAC unit, lights, outlets, phone jacks, two wooden landings, stairs, and handrails. Trailers shall have a 12' x 12' office area and 6' x 8' bathroom with sink, mirror, and water closet. Minimum of two pedestrian doors and a tinted/insulated 3' x 4' single hung window per 20 SF of wall area. Excludes connection of utilities.

13 34 23 13-0011 SF Single Trailer Up To 14' x 73' 33.77

For Each Delivery And Set-Up (Block And Level), Add 1,196.46

For Each Knock-Down And Pick-Up, Add 916.46

For Each Anchoring Into Asphalt Or Concrete, Add 110.00

13 34 23 13-0012 SF Modular Trailers, Connected..... 47.28

For Each Anchoring Into Asphalt Or Concrete, Add 110.00

For Each Delivery And Set-Up (Block And Level), Add 2,643.29

For Each Knock-Down And Pick-Up, Add 1,993.29

13 34 23 13-0013 EA Add Per Additional Exterior Door With Frame And Hardware..... 506.53

13 34 23 13-0014 Accessories ^(13 34 23 13)

13 34 23 13-0015 Skirting ^(13 34 23 13-0014)

Note: Includes 2" x 4" wood framing 16" on center.

13 34 23 13-0016 Vinyl Covered, Exterior Only ^(13 34 23 13-0015)

13 34 23 13-0017 SF 1'-8" High Vinyl Covered Skirt..... 3.05 1.23

13 34 23 13-0018 SF 3' High Vinyl Covered Skirt..... 4.54 2.03

13 34 23 13-0019 Fiberglass, Exterior Only ^(13 34 23 13-0015)

13 34 23 13-0020 SF 1'-8" High Fiberglass Skirt..... 5.53 2.32

13 34 23 13-0021 SF 3' High Fiberglass Skirt..... 6.47 2.83

13 34 23 13-0022 Plywood, Exterior Only ^(13 34 23 13-0015)

13 34 23 13-0023 SF 1'-8" High 5/8" Plywood Skirt 5.36 2.46

13 34 23 13-0024 SF 3' High 5/8" Plywood Skirt..... 6.36 2.97

13 34 23 13-0025 Steel, Painted, Exterior Only ^(13 34 23 13-0015)

13 34 23 13-0026 SF 1'-8" High 26 Gauge Steel Skirt 5.99 2.32

13 34 23 13-0027 SF 3' High 26 Ga. Steel Skirt..... 6.99 2.83

13 Special Construction**13 30 Special Structures****13 34 Fabricated Engineered Structures**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
13 34 23 13-0028 14" x 14" Access Hatch <small>(13 34 23 13-0014)</small> Note: Simple design.		
13 34 23 13-0029 EA 14" x 14" Vinyl Covered Access Hatch	150.07	54.40
13 34 23 13-0030 EA 14" x 14" Fiberglass Access Hatch	130.77	54.40
13 34 23 13-0031 EA 14" x 14" Plywood Access Hatch	149.11	54.40
13 34 23 13-0032 EA 14" x 14" 26 Gauge Steel Access Hatch.....	149.89	54.40
13 34 23 13-0033 Aluminum Modular Access Ramp <small>(13 34 23 13-0014)</small> Note: Includes picketed guardrails, inside grabrails, legs and hardware.		
13 34 23 13-0034 EA 72" Long x 52-1/4" Wide Ramp Section, Aluminum Modular Access Ramp	1,854.43	18.13
13 34 23 13-0035 EA 60-1/4" Long x 61-3/4" Wide Door Landing Section, Aluminum Modular Access Ramp	1,876.19	23.58
13 34 23 13-0036 EA 60-1/4" Long x 123-1/2" Wide Switchback Landing Section, Aluminum Modular Access Ramp	3,855.73	36.27
13 34 23 13-0037 EA 110-3/4" Long x 72" Wide Switchback Landing Section, Aluminum Modular Access Ramp	4,153.18	36.27
13 34 23 13-0038 EA 60-1/4" Long x 61-3/4" Wide Intermediate Landing Section, Aluminum Modular Access Ramp	1,950.55	23.58
13 34 23 13-0039 EA 71-3/4" Long x 52-1/4" Wide Intermediate Landing Section, Aluminum Modular Access Ramp	1,928.79	18.13
13 34 23 13-0040 EA 84-1/2" Long x 61-3/4" Wide Intermediate Landing Section, Aluminum Modular Access Ramp	2,692.31	23.58
13 34 23 13-0041 EA 30" High x 82" Long x 52-3/8" Wide Step Section, Aluminum Modular Access Ramp	1,914.30	23.58
13 34 23 13-0042 EA 35" High x 96" Long x 52-3/8" Wide Step Section, Aluminum Modular Access Ramp	1,914.30	23.58
13 34 23 13-0043 EA 42" High x 110" Long x 52-3/8" Wide Step Section, Aluminum Modular Access Ramp	2,177.35	23.58
13 34 23 13-0044 EA 49" High x 124" Long x 52-3/8" Wide Step Section, Aluminum Modular Access Ramp	2,438.55	23.58
13 34 23 14 Fabricated Classroom Buildings <small>(13 34 23)</small>		
13 34 23 14-0001 Semi Permanent Modular Transportable Buildings <small>(13 34 23 14)</small>		
13 34 23 14-0002 SF Portable Classrooms, Complete With Doors, Windows, Fixtures, Toilets And Workroom	50.32	
For Each Anchoring Into Asphalt Or Concrete, Add	110.00	
For Each Delivery And Set-Up (Block And Level), Add	2,643.29	
For Each Knock-Down And Pick-Up, Add	1,993.29	
13 34 23 14-0003 SF Modular Classroom, Connected, Complete With Doors, Windows, Fixtures, Toilets And Teachers Work Room	51.80	
For Each Anchoring Into Asphalt Or Concrete, Add	110.00	
For Each Delivery And Set-Up (Block And Level), Add	2,643.29	
For Each Knock-Down And Pick-Up, Add	1,993.29	
13 34 23 16 Fabricated Control Booths <small>(13 34 23)</small>		
13 34 23 16-0001 Fabricated Parking Attendant Booths <small>(13 34 23 16)</small> Note: Excludes foundations and slab.		
13 34 23 16-0002 EA Parking Booth For Attendant.....	1,053.32	
13 34 23 29 Kiosks <small>(13 34 23)</small>		
13 34 23 29-0001 Customer's Assistant Kiosk <small>(13 34 23 29)</small> Note: Based on SF of kiosks. Complete kiosk modular enclosure, in-place, structurally independent and self contained. Stainless steel.		
13 34 23 29-0002 CF Round Kiosk With 1/4" Fiberglass Wall, (Based On 5' Diameter x 8' High).....	32.83	
13 34 23 29-0003 CF Round Kiosk, With 1" Insulated Fiberglass Double Wall, (Based On 5' Diameter x 8' High).....	36.90	
13 34 23 29-0004 CF Rectangular Kiosk, With 1/4" Fiberglass Wall, (Based On 5' x 9' x 7'-6" High)	22.16	
13 34 23 29-0005 CF Rectangular Kiosk, With 1" Insulated Fiberglass Double Wall	26.63	
Note: Based on 5'x9'x7'-6" high.		
13 34 23 29-0006 CF Octagonal Kiosk, With 1/4" Fiberglass Wall,	25.46	
Note: Based on 9' wide x 8' high.		
13 34 23 29-0007 CF Octagonal Kiosk, With 1" Insulated Fiberglass Double Wall	30.36	
Note: Based on 9' wide x 8' high.		
13 40 Integrated Construction <small>(13)</small>		
13 48 Sound, Vibration, And Seismic Control <small>(13 40)</small>		
13 48 63 Fabricated Seismic Control Assemblies <small>(13 48)</small>		
13 48 63 00-0001 Seismic Bracing Assembly <small>(13 48 63)</small>		
13 48 63 00-0002 EA 4-Bolt Deck Anchor Connection For Seismic Brace	95.69	
Note: Includes drilling into concrete, bolts, anchor plate, seismic bracket attached with bolt, nut and washer.		
13 48 63 00-0003 EA 2 Cable Seismic Brace With Center Threaded Rod Stiffener.....	97.41	
Note: Includes seismic bracket, bolts, and cable for attachment to ceiling anchor. Excludes deck anchors.		
13 48 63 00-0004 EA 3 Cable Seismic Brace With Center Threaded Rod Stiffener.....	146.06	
Note: Includes seismic bracket, bolts, and cable for attachment to ceiling anchor. Excludes deck anchors.		
13 48 63 00-0005 EA 4 Cable Seismic Brace With Center Threaded Rod Stiffener.....	189.26	
Note: Includes seismic bracket, bolts, and cable for attachment to ceiling anchor. Excludes deck anchors.		
13 48 63 00-0006 EA 2 Channel Seismic Brace With Center Threaded Rod Stiffener.....	191.80	
Note: Includes seismic bracket, bolts, and channel for attachment to ceiling anchor. Excludes deck anchors.		
13 48 63 00-0007 EA 3 Channel Seismic Brace With Center Threaded Rod Stiffener.....	284.93	
Note: Includes seismic bracket, bolts, and channel for attachment to ceiling anchor. Excludes deck anchors.		
13 48 63 00-0008 EA 4 Channel Seismic Brace With Center Threaded Rod Stiffener.....	378.04	
Note: Includes seismic bracket, bolts, and channel for attachment to ceiling anchor. Excludes deck anchors.		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
13 48 63 00-0009 EA 2 Rod Seismic Brace With Center Threaded Rod Stiffener Note: Includes seismic bracket, bolts, and rod for attachment to ceiling anchor. Excludes deck anchors.	116.21	
13 48 63 00-0010 EA 3 Rod Seismic Brace With Center Threaded Rod Stiffener Note: Includes seismic bracket, bolts, and rod for attachment to ceiling anchor. Excludes deck anchors.	171.54	
13 48 63 00-0011 EA 4 Rod Seismic Brace With Center Threaded Rod Stiffener Note: Includes seismic bracket, bolts, and rod for attachment to ceiling anchor. Excludes deck anchors.	226.85	
13 48 63 00-0012 Seismic Brace Components <small>(13 48 63)</small>		
13 48 63 00-0013 EA 1/8" Cable Diameter Seismic Cable Brace Swivel Anchor; Mason SCB-1..... Note: To be used with 7x19 stranded cable.	19.34	
13 48 63 00-0014 EA 3/16" Cable Diameter Seismic Cable Brace Swivel Anchor; Mason SCB-2..... Note: To be used with 7x19 stranded cable.	25.92	
13 48 63 00-0015 EA 1/4" Cable Diameter Seismic Cable Brace Swivel Anchor; Mason SCB-3..... Note: To be used with 7x19 stranded cable.	33.83	
13 48 63 00-0016 EA 3/8" Cable Diameter Seismic Cable Brace Swivel Anchor; Mason SCB-4..... Note: To be used with 7x19 stranded cable.	45.67	
13 48 63 00-0017 EA Seismic Solid Brace Swivel Anchor; Mason SSB-1 Note: To be used with angle or channel.	18.26	
13 48 63 00-0018 EA Seismic Solid Brace Swivel Anchor; Mason SSB-2 Note: To be used with angle or channel.	24.06	
13 48 63 00-0019 EA Seismic Solid Brace Swivel Anchor; Mason SSB-3 Note: To be used with angle or channel.	31.10	
13 48 63 00-0020 EA Seismic Solid Brace Swivel Anchor; Mason SSB-4 Note: To be used with angle or channel.	41.45	
13 48 63 00-0021 EA 1/8" Cable Diameter Seismic Cable Brace Hook Anchor; Mason SCBH-1 Note: To be used with 7x19 stranded cable.	21.78	
13 48 63 00-0022 EA 3/16" Cable Diameter Seismic Cable Brace Hook Anchor; Mason SCBH-2..... Note: To be used with 7x19 stranded cable.	28.20	
13 48 63 00-0023 EA 1/4" Cable Diameter Seismic Cable Brace Hook Anchor; Mason SCBH-3..... Note: To be used with 7x19 stranded cable.	38.55	
13 48 63 00-0024 EA 1/8" Cable Diameter Seismic Cable Brace Vise Anchor; Mason SCBV-1..... Note: Can be used with either SCB or SCBH on the other end. To be used with 7x19 stranded cable.	36.89	
13 48 63 00-0025 EA 3/16" Cable Diameter Seismic Cable Brace Vise Anchor; Mason SCBV-2..... Note: Can be used with either SCB or SCBH on the other end. To be used with 7x19 stranded cable.	51.18	
13 48 63 00-0026 EA 1/4" Cable Diameter Seismic Cable Brace Vise Anchor; Mason SCBV-3..... Note: Can be used with either SCB or SCBH on the other end. To be used with 7x19 stranded cable.	69.19	
13 48 63 00-0027 EA Seismic Rod Clamp; Mason SRC-1 Note: To be used on 3/8" through 5/8" rod. 1" x 1" x 1/4" Angle or Stiffener not included.	15.93	
13 48 63 00-0028 EA Seismic Rod Clamp; Mason SRC-1 1/2..... Note: To be used on 3/8" through 1" rod. 1-1/2" x 1-1/2" x 1/4" Angle or Stiffener not included.	19.24	
13 48 63 00-0029 EA Seismic Rod Clamp; Mason SRC-2..... Note: To be used on 3/8" through 1-1/4" rod. 2" x 2" x 1/4" Angle or Stiffener not included.	23.80	

END OF SECTION 13

13 Special Construction

13 40 Integrated Construction

13 48 Sound, Vibration, And Seismic Control



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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14 Conveying Equipment

14 01 Operation And Maintenance Of Conveying Equipment⁽¹⁴⁾

14 01 20 Operation And Maintenance Of Elevators^(14 01)

14 01 20 00-0001 Elevator Maintenance^(14 01 20)

14 01 20 00-0002	EA	Regular Elevator Inspection, Electric Up To 10 Floors (Sufficient For Issue Of Certificate/Permit)	723.80
14 01 20 00-0003	EA	Regular Elevator Inspection, Electric Over 10 Floors (Sufficient For Issue Of Certificate/Permit)	904.75
14 01 20 00-0004	EA	Regular Elevator Inspection, Hydraulic (Sufficient For Issue Of Certificate/Permit)	542.86
14 01 20 00-0005	EA	Regular Elevator Inspection, Roped Hydraulic (Sufficient For Issue Of Certificate/Permit)	588.09
14 01 20 00-0006	EA	Regular Elevator Inspection, Dumbwaiters/Cart Lifts (Sufficient For Issue Of Certificate/Permit)	158.34
14 01 20 00-0007	HR	Elevator Servicing, Labor Only	115.84
14 01 20 00-0008	EA	Full Load Test For Traction And Winding Drum Elevator Up To 10 Floors	640.88
14 01 20 00-0009	EA	Full Load Test For Traction And Winding Drum Elevator Over 10 Floors	731.36
14 01 20 00-0010	EA	Full Load Test For Hydraulic Elevator	459.93
14 01 20 00-0011	EA	Full Load Test For Roped Hydraulic Elevator	573.02
14 01 20 00-0012	EA	Full Load Test For Dumbwaiters/Cart Lifts	527.79
14 01 20 00-0013	EA	Acceptance Test Of Traction And Winding Drum Elevator Up To 10 Floors	2,714.28
14 01 20 00-0014	EA	Acceptance Test Of Traction And Winding Drum Elevator Over 10 Floors	2,985.69
14 01 20 00-0015	EA	Acceptance Test Of Hydraulic Elevator	2,578.56
14 01 20 00-0016	EA	Acceptance Test Of Roped Hydraulic Elevator	2,669.03
14 01 20 00-0017	EA	Acceptance Test Of Dumbwaiters/Cart Lifts	1,583.32

14 01 20 00-0018 Elevator Modernization^(14 01 20)

14 01 20 00-0019	EA	4" Piston (Hydraulic) Unit Up To 3 Stories (2,000 LB x 50 FPM)	18,236.33
		Note: Includes replacing existing piston, hydraulic pump, motor supply lines, hydraulic valves and ports.	
		For Each Additional 50 FPM, Add	3,475.00
		For Each Additional 500 LB, Add	3,475.00
		For Each Additional Stop, Add	3,155.00
		Note: Deduct if <3 stops.	
14 01 20 00-0020	EA	6" Piston (Hydraulic) Unit Up To 3 Stories (2,500 LB x 100 FPM)	22,508.63
		Note: Includes replacing existing piston, hydraulic pump, motor supply lines, hydraulic valves and ports.	
		For Each Additional 50 FPM, Add	3,475.00
		For Each Additional 500 LB, Add	3,475.00
		For Each Additional Stop, Add	3,155.00
		Note: Deduct if <3 stops.	
14 01 20 00-0021	EA	8" Piston (Hydraulic) Unit Up To 3 Stories (3,000 LB x 100 FPM)	34,651.08
		Note: Includes replacing existing piston, hydraulic pump, motor supply lines, hydraulic valves and ports.	
		For Each Additional 50 FPM, Add	3,475.00
		For Each Additional 500 LB, Add	3,475.00
		For Each Additional Stop, Add	3,155.00
		Note: Deduct if <3 stops.	
14 01 20 00-0022	EA	10" Piston (Hydraulic) Unit Up To 3 Stories (4,000 LB x 100 FPM)	47,989.14
		Note: Includes replacing existing piston, hydraulic pump, motor supply lines, hydraulic valves and ports.	
		For Each Additional 50 FPM, Add	3,475.00
		For Each Additional 500 LB, Add	3,475.00
		For Each Additional Stop, Add	3,155.00
		Note: Deduct if <3 stops.	
14 01 20 00-0023	EA	12" Piston (Hydraulic) Unit Up To 3 Stories (6,000 LB x 100 FPM)	57,363.39
		Note: Includes replacing existing piston, hydraulic pump, motor supply lines, hydraulic valves and ports.	
		For Each Additional 50 FPM, Add	3,475.00
		For Each Additional 500 LB, Add	3,475.00
		For Each Additional Stop, Add	3,155.00
		Note: Deduct if <3 stops.	
14 01 20 00-0024	EA	Replace Multi-Port Controller Valve System	8,149.36
14 01 20 00-0025	SET	Car Roller Guide Assembly, Set Of Four	3,694.58
14 01 20 00-0026	EA	New Door Opening, Excluding Buildback	7,202.54
14 01 20 00-0027	SF	Cab Flooring, Epoxy Aggregate Flooring	14.16
14 01 20 00-0028	SF	Cab Flooring, Aluminum Diamond Plate	34.89
14 01 20 00-0029	EA	Car Stop Electronic Leveling Device (Per Car)	3,690.66
14 01 20 00-0030	EA	Electronic Leveling Device At Stop (Per Stop)	814.30
14 01 20 00-0031	EA	Hoistway Door Hangers Set	719.42
14 01 20 00-0032	EA	Hoistway Door Closer Set	317.61
14 01 20 00-0033	EA	Hoistway Door Interlock Set	508.01
14 01 20 00-0034	EA	Fire Service Switch Controller	1,712.37
14 01 20 00-0035	EA	Car Door Operators With ADA Buzzer	6,720.95
14 01 20 00-0036	EA	Car Door Safety Edges (Infrared Proximity Type Edge)	4,859.64
14 01 20 00-0037	EA	Car Operating Panel (ADA, Fire, Position, Chime)	10,712.99
14 01 20 00-0038	EA	Car Position LED Indicator And Cover Plate, Stainless Steel	451.65
14 01 20 00-0039	EA	Car Traveling Lanterns With Audible Signal	3,139.67
14 01 20 00-0040	EA	Hoistway Door Jam Floor Tags (Braille)	102.25
14 01 20 00-0041	EA	Lobby Vandal Resistant Call Station	603.28
14 01 20 00-0042	EA	Car Voice Synthesized Floor Announcement Module	3,202.03
14 01 20 00-0043	LF	Traveling Cable (140 Conductors, #16 AWG Type ETT)	15.53
14 01 20 00-0044	LF	Governor Cable	6.63
14 01 20 00-0045	EA	Cab Walls Coverings (3,500 LB, Rigid Stainless Steel)	9,987.16
14 01 20 00-0046	EA	Remove And Replace Governor	4,717.74
14 01 20 00-0047	EA	Remove And Replace Car Station	6,794.28

14 Conveying Equipment**14 01 Operation And Maintenance Of Conveying Equipment****14 01 20 Operation And Maintenance Of Elevators**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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14 01 20 00-0048	EA	Remove And Replace Telephone	2,846.02	
14 01 20 00-0049	EA	Remove And Replace Lanterns	2,077.39	
14 01 20 00-0050	EA	Hall Call Buttons, Vandal Resistant	434.11	106.20
14 01 20 00-0051	EA	Hall Traveling Lanterns With Audible Signal	814.73	148.68
14 01 20 00-0052	EA	Add Raised Character (Braille) Signage To Control Panel	67.35	
14 01 20 00-0053	EA	Reprogram Existing Controller, Signal Fixtures	18,968.11	
14 01 20 00-0054	EA	New Walls And Platform, Plastic Laminate, For 5' x 7' Cab	6,889.11	424.78
14 01 20 00-0055	EA	New Walls And Platform, Plastic Laminate With Shell, For 5' x 7' Cab	9,804.28	509.74
14 01 20 00-0056	EA	Replace Elevator Or Hoistway Doors, Baked Enamel	8,479.35	594.69
14 01 20 00-0057	EA	Reopening Device, Manual	3,424.73	297.34
14 01 20 00-0058	EA	Reopening Device, Automatic	17,572.48	297.34
14 01 20 00-0059	EA	Elevator Pit Ladder	1,154.76	339.83
14 01 20 00-0060	EA	New Walls And Platform, Partial Cab Plastic Laminate, For 5' x 7' Cab	9,495.34	424.78
14 01 20 00-0061	LF	Replace Lifting Cable, 3/8" - Liftpack; Bethlehem Wire Rope Minimum Breaking Strength (Tons): Traction Steel - 4.5, EHS Traction Steel - 5.5	12.20	6.37
14 01 20 00-0062	LF	Replace Lifting Cable, 1/2" - Liftpack; Bethlehem Wire Rope Minimum Breaking Strength (Tons): Traction Steel - 8.0, EHS Traction Steel - 9.7	13.59	6.37
14 01 20 00-0063	LF	Replace Lifting Cable, 5/8" - Liftpack; Bethlehem Wire Rope Minimum Breaking Strength (Tons): Traction Steel - 12.7, EHS Traction Steel - 15.4	15.40	6.37
14 01 20 00-0064	EA	Hydraulic Leak Detector And Alarm In Elevator Pit (Sensorcomm Inc)	3,839.67	109.88
14 01 20 00-0065	LF	6" Wide Elevator Door Jamb Wrapped With 0.030" Stainless Steel	223.09	18.35
14 01 20 00-0066	LF	8" Wide Elevator Door Jamb Wrapped With 0.030" Stainless Steel	120.35	41.28
14 01 20 00-0067	LF	10" Wide Elevator Door Jamb Wrapped With 0.030" Stainless Steel	129.65	41.39
14 01 20 00-0068	LF	12" Wide Elevator Door Jamb Wrapped With 0.030" Stainless Steel	54.94	41.42
14 01 20 00-0069	EA	"RopeGripper" With Pumping Unit For Use On 4-7/8" Maximum Out To Out Of Cable	4,826.44	659.24
14 01 20 00-0070	EA	"RopeGripper" With Pumping Unit For Use On 6" Maximum Out To Out Of Cable	6,410.62	769.10
14 01 20 00-0071	EA	"RopeGripper" With Pumping Unit For Use On 10" Maximum Out To Out Of Cable	8,503.96	878.98
14 01 20 00-0072	EA	"RopeGripper" With Pumping Unit For Use On 11-1/2" Maximum Out To Out Of Cable	9,513.59	933.92
14 01 20 00-0073	EA	60 Amp Bussmann Power Module Switch, 480 - 120 Volt CPT, Firesafety Interface Relay, Mechanical Interlock	2,708.13	109.88
14 01 20 00-0074	EA	100 Amp Bussmann Power Module Switch, 480 - 120 Volt CPT, Firesafety Interface Relay, Mechanical Interlock	3,110.03	131.85
14 01 20 00-0075	EA	200 Amp Bussmann Power Module Switch, 480 - 120 Volt CPT, Firesafety Interface Relay, Mechanical Interlock	4,152.51	153.82
14 01 20 00-0076	EA	Aluminum Handrail Spacers With Set Screw	22.29	4.53
14 01 20 00-0077	EA	Bronze Handrail Spacers With Set Screw	36.64	4.53
14 01 20 00-0078	LF	1/2" x 2" Obround Stainless Steel Elevator Handrail	48.75	3.39
14 01 20 00-0079	LF	3/8" x 2" Flat Bar Stainless Steel Elevator Handrail, Brushed Finish	67.52	3.39
14 01 20 00-0080	LF	3/8" x 3" Flat Bar Stainless Steel Elevator Handrail, Brushed Finish	91.15	3.62
14 01 20 00-0081	LF	3/8" x 2" Flat Bar Stainless Steel Elevator Handrail, Mirror Finish	106.17	3.39
14 01 20 00-0082	LF	3/8" x 3" Flat Bar Stainless Steel Elevator Handrail, Mirror Finish	128.69	3.62
14 01 20 00-0083	LF	3/8" x 2" Flat Bar Bronze Elevator Handrail, Brushed Finish	82.98	3.39
14 01 20 00-0084	LF	3/8" x 3" Flat Bar Bronze Elevator Handrail, Brushed Finish	106.61	3.62
14 01 20 00-0085	LF	3/8" x 2" Flat Bar Bronze Elevator Handrail, Mirror Finish	113.90	3.39
14 01 20 00-0086	LF	3/8" x 3" Flat Bar Bronze Elevator Handrail, Mirror Finish	137.53	3.62
14 01 20 00-0087	LF	3/8" x 1-1/2" Diameter Tubular Stainless Steel Elevator Handrail, Brushed Finish	71.55	3.39
14 01 20 00-0088	LF	3/8" x 2" Diameter Tubular Stainless Steel Elevator Handrail, Brushed Finish	78.12	3.39
14 01 20 00-0089	LF	3/8" x 2-1/2" Diameter Tubular Stainless Steel Elevator Handrail, Brushed Finish	104.84	3.62
14 01 20 00-0090	LF	3/8" x 3" Diameter Tubular Stainless Steel Elevator Handrail, Brushed Finish	117.98	3.62
14 01 20 00-0091	LF	3/8" x 1-1/2" Diameter Tubular Stainless Steel Elevator Handrail, Mirror Finish	110.03	3.39
14 01 20 00-0092	LF	3/8" x 2" Diameter Tubular Stainless Steel Elevator Handrail, Mirror Finish	117.54	3.39
14 01 20 00-0093	LF	3/8" x 2-1/2" Diameter Tubular Stainless Steel Elevator Handrail, Mirror Finish	136.75	3.62
14 01 20 00-0094	LF	3/8" x 3" Diameter Tubular Stainless Steel Elevator Handrail, Mirror Finish	149.89	3.62
14 01 20 00-0095	LF	3/8" x 1-1/2" Diameter Tubular Bronze Elevator Handrail, Brushed Finish	82.98	3.39
14 01 20 00-0096	LF	3/8" x 2" Diameter Tubular Bronze Elevator Handrail, Brushed Finish	90.71	3.39
14 01 20 00-0097	LF	3/8" x 2-1/2" Diameter Tubular Bronze Elevator Handrail, Brushed Finish	122.07	3.62
14 01 20 00-0098	LF	3/8" x 3" Diameter Tubular Bronze Elevator Handrail, Brushed Finish	137.53	3.62
14 01 20 00-0099	LF	3/8" x 1-1/2" Diameter Tubular Bronze Elevator Handrail, Mirror Finish	128.25	3.39
14 01 20 00-0100	LF	3/8" x 2" Diameter Tubular Bronze Elevator Handrail, Mirror Finish	137.09	3.39
14 01 20 00-0101	LF	3/8" x 2-1/2" Diameter Tubular Bronze Elevator Handrail, Mirror Finish	159.61	3.62
14 01 20 00-0102	LF	3/8" x 3" Diameter Tubular Bronze Elevator Handrail, Mirror Finish	175.07	3.62

14 01 30 Operation And Maintenance Of Escalators And Moving Walks

(14 01)

14 01 30 00-0001 Maintenance (14 01 30)

14 01 30 00-0002	EA	Regular Escalator Inspection (Sufficient For Issue Of Certificate/Permit)	542.86	
14 01 30 00-0003	HR	Escalator Servicing, Labor Only	90.48	
14 01 30 00-0004	EA	Acceptance Test Of Escalators And Moving Walks	2,985.69	

14 01 30 00-0005 Modernization (14 01 30)

14 01 30 00-0006	EA	Replace 28" Wide Escalator Stair Tread	1,687.09	
14 01 30 00-0007	EA	Replace 36" Wide Escalator Stair Tread	1,824.20	
14 01 30 00-0008	EA	Replace 48" Wide Escalator Stair Tread	1,929.51	
14 01 30 00-0009	EA	Replace 54" Wide Escalator Stair Tread	2,089.88	
14 01 30 00-0010	LF	Replace Sliding Handrail	153.18	

14 20 Elevators (14)

Note: Excludes final electrical work or shaft walls.

14 21 Electric Traction Elevators (14 20)



Conveying Equipment	14	14
Elevators	14 20	
Electric Traction Elevators	14 21	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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14 21 13 Electric Traction Freight Elevators ^(14 21)

14 21 13 00-0001 Manual Control Freight Elevators ^(14 21 13)

Note: Automatic leveling, A.C. rheostatic. Painted metal shaft doors and steel painted cab. Unit prices are based on a shaft of 6 stops and 6 openings with power doors.

14 21 13 00-0002	EA Manual Control Freight Elevator, 3,500 LB x 50 FPM.....	284,525.26	11,211.25
	<i>For Elevator With Manual Door, Deduct</i>	-39,315.42	
	<i>For Variable Voltage Control, Add</i>	26,210.28	
	<i>For Each Additional Stop, Add</i>	4,500.00	
	<i>Note: Deduct if <6 stops.</i>		
	<i>For Each Opening With Stainless Steel Doors, Add</i>	1,610.00	
	<i>For Each Opening With Bi-Parting Doors, Add</i>	894.00	
	<i>For Stainless Steel Cab Interior, Add</i>	12,887.00	
	<i>For Class "B" Loading, Add</i>	1,400.00	
	<i>For Class "C-1" Loading, Add</i>	3,350.00	
	<i>For Class "C-2" Loading, Add</i>	3,790.00	
	<i>For Class "C-3" Loading, Add</i>	5,175.00	
	<i>For Each Additional 500 Lb., Add</i>	3,475.00	
	<i>For Each Additional 50 FPM, Add</i>	3,475.00	
	<i>For Each Additional Stop, Add</i>	5,263.00	
	<i>Note: Deduct if <6 stops.</i>		
14 21 13 00-0003	EA Manual Control Freight Elevator, 4,000 LB x 50 FPM.....	285,976.32	11,412.01
	<i>For Elevator With Manual Door, Deduct</i>	-39,472.84	
	<i>For Variable Voltage Control, Add</i>	26,315.22	
	<i>For Each Additional Stop, Add</i>	4,500.00	
	<i>Note: Deduct if <6 stops.</i>		
	<i>For Each Opening With Stainless Steel Doors, Add</i>	1,610.00	
	<i>For Each Opening With Bi-Parting Doors, Add</i>	894.00	
	<i>For Stainless Steel Cab Interior, Add</i>	12,887.00	
	<i>For Class "B" Loading, Add</i>	1,400.00	
	<i>For Class "C-1" Loading, Add</i>	3,350.00	
	<i>For Class "C-2" Loading, Add</i>	3,790.00	
	<i>For Class "C-3" Loading, Add</i>	5,175.00	
	<i>For Each Additional 500 Lb., Add</i>	3,475.00	
	<i>For Each Additional 50 FPM, Add</i>	3,475.00	
	<i>For Each Additional Stop, Add</i>	5,263.00	
	<i>Note: Deduct if <6 stops.</i>		
14 21 13 00-0004	EA Manual Control Freight Elevator, 5,000 LB x 50 FPM.....	290,483.60	12,617.29
	<i>For Elevator With Manual Door, Deduct</i>	-39,787.36	
	<i>For Variable Voltage Control, Add</i>	26,524.91	
	<i>For Each Additional Stop, Add</i>	4,500.00	
	<i>Note: Deduct if <6 stops.</i>		
	<i>For Each Opening With Stainless Steel Doors, Add</i>	1,610.00	
	<i>For Each Opening With Bi-Parting Doors, Add</i>	894.00	
	<i>For Stainless Steel Cab Interior, Add</i>	12,887.00	
	<i>For Class "B" Loading, Add</i>	1,400.00	
	<i>For Class "C-1" Loading, Add</i>	3,350.00	
	<i>For Class "C-2" Loading, Add</i>	3,790.00	
	<i>For Class "C-3" Loading, Add</i>	5,175.00	
	<i>For Each Additional 500 Lb., Add</i>	3,475.00	
	<i>For Each Additional 50 FPM, Add</i>	3,475.00	
	<i>For Each Additional Stop, Add</i>	5,263.00	
	<i>Note: Deduct if <6 stops.</i>		
14 21 13 00-0005	EA Manual Control Freight Elevator, 3,500 LB x 100 FPM.....	295,234.62	12,372.27
	<i>For Elevator With Manual Door, Deduct</i>	-40,573.51	
	<i>For Variable Voltage Control, Add</i>	27,049.91	
	<i>For Each Additional Stop, Add</i>	4,500.00	
	<i>Note: Deduct if <6 stops.</i>		
	<i>For Each Opening With Stainless Steel Doors, Add</i>	1,610.00	
	<i>For Each Opening With Bi-Parting Doors, Add</i>	894.00	
	<i>For Stainless Steel Cab Interior, Add</i>	12,887.00	
	<i>For Class "B" Loading, Add</i>	1,400.00	
	<i>For Class "C-1" Loading, Add</i>	3,350.00	
	<i>For Class "C-2" Loading, Add</i>	3,790.00	
	<i>For Class "C-3" Loading, Add</i>	5,175.00	
	<i>For Each Additional 500 Lb., Add</i>	3,475.00	
	<i>For Each Additional 50 FPM, Add</i>	3,475.00	
	<i>For Each Additional Stop, Add</i>	5,263.00	
	<i>Note: Deduct if <6 stops.</i>		
14 21 13 00-0006	EA Manual Control Freight Elevator, 4,000 LB x 100 FPM.....	297,574.03	12,493.59
	<i>For Elevator With Manual Door, Deduct</i>	-40,888.03	
	<i>For Variable Voltage Control, Add</i>	27,258.69	
	<i>For Each Additional Stop, Add</i>	4,500.00	
	<i>Note: Deduct if <6 stops.</i>		
	<i>For Each Opening With Stainless Steel Doors, Add</i>	1,610.00	
	<i>For Each Opening With Bi-Parting Doors, Add</i>	894.00	
	<i>For Stainless Steel Cab Interior, Add</i>	12,887.00	
	<i>For Class "B" Loading, Add</i>	1,400.00	
	<i>For Class "C-1" Loading, Add</i>	3,350.00	
	<i>For Class "C-2" Loading, Add</i>	3,790.00	
	<i>For Class "C-3" Loading, Add</i>	5,175.00	
	<i>For Each Additional 500 Lb., Add</i>	3,475.00	
	<i>For Each Additional 50 FPM, Add</i>	3,475.00	
	<i>For Each Additional Stop, Add</i>	5,263.00	
	<i>Note: Deduct if <6 stops.</i>		

14 Conveying Equipment**14 20 Elevators****14 21 Electric Traction Elevators**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
14 21	13 00-0007	EA	Manual Control Freight Elevator, 5,000 LB x 100 FPM.....	302,187.55	13,751.87
			<i>For Elevator With Manual Door, Deduct</i>	-41,202.56	
			<i>For Variable Voltage Control, Add</i>	27,468.37	
			<i>For Each Additional Stop, Add</i>	4,500.00	
			<i>Note: Deduct if <6 stops.</i>		
			<i>For Each Opening With Stainless Steel Doors, Add</i>	1,610.00	
			<i>For Each Opening With Bi-Parting Doors, Add</i>	894.00	
			<i>For Stainless Steel Cab Interior, Add</i>	12,887.00	
			<i>For Class "B" Loading, Add</i>	1,400.00	
			<i>For Class "C-1" Loading, Add</i>	3,350.00	
			<i>For Class "C-2" Loading, Add</i>	3,790.00	
			<i>For Class "C-3" Loading, Add</i>	5,175.00	
			<i>For Each Additional 500 Lb., Add</i>	3,475.00	
			<i>For Each Additional 50 FPM, Add</i>	3,475.00	
			<i>For Each Additional Stop, Add</i>	5,263.00	
			<i>Note: Deduct if <6 stops.</i>		
14 21	13 00-0008	EA	Manual Control Freight Elevator, 3,500 LB x 200 FPM.....	298,880.40	13,461.41
			<i>For Elevator With Manual Door, Deduct</i>	-40,793.64	
			<i>For Variable Voltage Control, Add</i>	27,195.76	
			<i>For Each Additional Stop, Add</i>	4,500.00	
			<i>Note: Deduct if <6 stops.</i>		
			<i>For Each Opening With Stainless Steel Doors, Add</i>	1,610.00	
			<i>For Each Opening With Bi-Parting Doors, Add</i>	894.00	
			<i>For Stainless Steel Cab Interior, Add</i>	12,887.00	
			<i>For Class "B" Loading, Add</i>	1,400.00	
			<i>For Class "C-1" Loading, Add</i>	3,350.00	
			<i>For Class "C-2" Loading, Add</i>	3,790.00	
			<i>For Class "C-3" Loading, Add</i>	5,175.00	
			<i>For Each Additional 500 Lb., Add</i>	3,475.00	
			<i>For Each Additional 50 FPM, Add</i>	3,475.00	
			<i>For Each Additional Stop, Add</i>	5,263.00	
			<i>Note: Deduct if <6 stops.</i>		
14 21	13 00-0009	EA	Manual Control Freight Elevator, 4,000 LB x 200 FPM.....	299,509.65	13,461.41
			<i>For Elevator With Manual Door, Deduct</i>	-40,888.03	
			<i>For Variable Voltage Control, Add</i>	27,258.69	
			<i>For Each Additional Stop, Add</i>	4,500.00	
			<i>Note: Deduct if <6 stops.</i>		
			<i>For Each Opening With Stainless Steel Doors, Add</i>	1,610.00	
			<i>For Each Opening With Bi-Parting Doors, Add</i>	894.00	
			<i>For Stainless Steel Cab Interior, Add</i>	12,887.00	
			<i>For Class "B" Loading, Add</i>	1,400.00	
			<i>For Class "C-1" Loading, Add</i>	3,350.00	
			<i>For Class "C-2" Loading, Add</i>	3,790.00	
			<i>For Class "C-3" Loading, Add</i>	5,175.00	
			<i>For Each Additional 500 Lb., Add</i>	3,475.00	
			<i>For Each Additional 50 FPM, Add</i>	3,475.00	
			<i>For Each Additional Stop, Add</i>	5,263.00	
			<i>Note: Deduct if <6 stops.</i>		
14 21	13 00-0010	EA	Manual Control Freight Elevator, 5,000 LB x 200 FPM.....	307,002.14	15,110.83
			<i>For Elevator With Manual Door, Deduct</i>	-41,517.08	
			<i>For Variable Voltage Control, Add</i>	27,678.05	
			<i>For Each Additional Stop, Add</i>	4,500.00	
			<i>Note: Deduct if <6 stops.</i>		
			<i>For Each Opening With Stainless Steel Doors, Add</i>	1,610.00	
			<i>For Each Opening With Bi-Parting Doors, Add</i>	894.00	
			<i>For Stainless Steel Cab Interior, Add</i>	12,887.00	
			<i>For Class "B" Loading, Add</i>	1,400.00	
			<i>For Class "C-1" Loading, Add</i>	3,350.00	
			<i>For Class "C-2" Loading, Add</i>	3,790.00	
			<i>For Class "C-3" Loading, Add</i>	5,175.00	
			<i>For Each Additional 500 Lb., Add</i>	3,475.00	
			<i>For Each Additional 50 FPM, Add</i>	3,475.00	
			<i>For Each Additional Stop, Add</i>	5,263.00	
			<i>Note: Deduct if <6 stops.</i>		

14 24 Hydraulic Elevators (14 20)

Note: Prices are for a complete operating elevator including all standard controls, hydraulic motor and devices based on unit with cab sized 5' by 8' with galvanized primed shaft door with cab allowances as listed below.

14 24 13 Hydraulic Freight Elevators (14 24)**14 24 13 00-0001 Hydraulic Freight Elevators** (14 24 13)

Note: Painted metal shaft doors and steel painted cab. Unit prices are based on a shaft of 3 stops and 3 openings with power doors. See CSI section 14 24 13 00-0011 for drilling piston hole.



Conveying Equipment	14
Elevators	14 20
Hydraulic Elevators	14 24

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
14 24 13 00-0002 EA Hydraulic Freight Elevator, 3,000 LB x 50 FPM	125,450.06	7,159.27
For Each Additional Stop, Add	5,262.00	
Note: Deduct if <3 stops.		
For Each Opening With Bonderized Steel Door, Add	148.00	
For Each Opening With Stainless Steel Doors, Add	1,610.00	
For Each Opening With Two Speed Doors, Add	536.00	
For Each Opening With Two Speed Bi-Parting Doors, Add	636.00	
For Custom Plastic Laminated Cab Interiors, Add	1,611.00	
For Custom Half Plastic Laminate And Half Stainless Steel Interior, Add	10,202.00	
For Stainless Steel Cab Interior, Add	12,887.00	
For Each Additional 50 FPM, Add	3,475.00	
For Each Additional 500 LB, Add	3,475.00	
For Each Additional Stop, Add	5,263.00	
Note: Deduct if <3 stops.		
For Elevator With Manual Door, Deduct	-11,113.16	
For Class "B" Loading, Add	1,235.00	
For Class "C-1" Loading, Add	2,935.00	
For Class "C-2" Loading, Add	3,530.00	
For Class "C-3" Loading, Add	4,800.00	
14 24 13 00-0003 EA Hydraulic Freight Elevator, 4,000 LB x 50 FPM	136,907.83	7,646.07
For Each Additional Stop, Add	5,262.00	
Note: Deduct if <3 stops.		
For Each Opening With Bonderized Steel Door, Add	148.00	
For Each Opening With Stainless Steel Doors, Add	1,610.00	
For Each Opening With Two Speed Doors, Add	536.00	
For Each Opening With Two Speed Bi-Parting Doors, Add	636.00	
For Custom Plastic Laminated Cab Interiors, Add	1,611.00	
For Custom Half Plastic Laminate And Half Stainless Steel Interior, Add	10,202.00	
For Stainless Steel Cab Interior, Add	12,887.00	
For Each Additional 50 FPM, Add	3,475.00	
For Each Additional 500 LB, Add	3,475.00	
For Each Additional Stop, Add	5,263.00	
Note: Deduct if <3 stops.		
For Elevator With Manual Door, Deduct	-12,161.57	
For Class "B" Loading, Add	1,235.00	
For Class "C-1" Loading, Add	2,935.00	
For Class "C-2" Loading, Add	3,530.00	
For Class "C-3" Loading, Add	4,800.00	
14 24 13 00-0004 EA Hydraulic Freight Elevator, 6,000 LB x 50 FPM	158,579.87	7,997.95
For Each Additional Stop, Add	5,262.00	
Note: Deduct if <3 stops.		
For Each Opening With Bonderized Steel Door, Add	148.00	
For Each Opening With Stainless Steel Doors, Add	1,610.00	
For Each Opening With Two Speed Doors, Add	536.00	
For Each Opening With Two Speed Bi-Parting Doors, Add	636.00	
For Custom Plastic Laminated Cab Interiors, Add	1,611.00	
For Custom Half Plastic Laminate And Half Stainless Steel Interior, Add	10,202.00	
For Stainless Steel Cab Interior, Add	12,887.00	
For Each Additional 50 FPM, Add	3,475.00	
For Each Additional 500 LB, Add	3,475.00	
For Each Additional Stop, Add	5,263.00	
Note: Deduct if <3 stops.		
For Elevator With Manual Door, Deduct	-14,258.39	
For Class "B" Loading, Add	1,235.00	
For Class "C-1" Loading, Add	2,935.00	
For Class "C-2" Loading, Add	3,530.00	
For Class "C-3" Loading, Add	4,800.00	
14 24 13 00-0005 EA Hydraulic Freight Elevator, 3,000 LB x 100 FPM	140,290.51	7,240.57
For Each Additional Stop, Add	5,262.00	
Note: Deduct if <3 stops.		
For Each Opening With Bonderized Steel Door, Add	148.00	
For Each Opening With Stainless Steel Doors, Add	1,610.00	
For Each Opening With Two Speed Doors, Add	536.00	
For Each Opening With Two Speed Bi-Parting Doors, Add	636.00	
For Custom Plastic Laminated Cab Interiors, Add	1,611.00	
For Custom Half Plastic Laminate And Half Stainless Steel Interior, Add	10,202.00	
For Stainless Steel Cab Interior, Add	12,887.00	
For Each Additional 50 FPM, Add	3,475.00	
For Each Additional 500 LB, Add	3,475.00	
For Each Additional Stop, Add	5,263.00	
Note: Deduct if <3 stops.		
For Elevator With Manual Door, Deduct	-12,580.93	
For Class "B" Loading, Add	1,235.00	
For Class "C-1" Loading, Add	2,935.00	
For Class "C-2" Loading, Add	3,530.00	
For Class "C-3" Loading, Add	4,800.00	

14 Conveying Equipment**14 20 Elevators****14 24 Hydraulic Elevators**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
14 24	13 00-0006	EA	Hydraulic Freight Elevator, 4,000 LB x 100 FPM.....	149,674.49	7,738.92
			For Each Additional Stop, Add	5,262.00	
			Note: Deduct if <3 stops.		
			For Each Opening With Bonderized Steel Door, Add	148.00	
			For Each Opening With Stainless Steel Doors, Add	1,610.00	
			For Each Opening With Two Speed Doors, Add	536.00	
			For Each Opening With Two Speed Bi-Parting Doors, Add	636.00	
			For Custom Plastic Laminated Cab Interiors, Add	1,611.00	
			For Custom Half Plastic Laminate And Half Stainless Steel Interior, Add	10,202.00	
			For Stainless Steel Cab Interior, Add	12,887.00	
			For Each Additional 50 FPM, Add	3,475.00	
			For Each Additional 500 LB, Add	3,475.00	
			For Each Additional Stop, Add	5,263.00	
			Note: Deduct if <3 stops.		
			For Elevator With Manual Door, Deduct	-13,419.66	
			For Class "B" Loading, Add	1,235.00	
			For Class "C-1" Loading, Add	2,935.00	
			For Class "C-2" Loading, Add	3,530.00	
			For Class "C-3" Loading, Add	4,800.00	
14 24	13 00-0007	EA	Hydraulic Freight Elevator, 6,000 LB x 100 FPM.....	173,669.52	8,203.97
			For Each Additional Stop, Add	5,262.00	
			Note: Deduct if <3 stops.		
			For Each Opening With Bonderized Steel Door, Add	148.00	
			For Each Opening With Stainless Steel Doors, Add	1,610.00	
			For Each Opening With Two Speed Doors, Add	536.00	
			For Each Opening With Two Speed Bi-Parting Doors, Add	636.00	
			For Custom Plastic Laminated Cab Interiors, Add	1,611.00	
			For Custom Half Plastic Laminate And Half Stainless Steel Interior, Add	10,202.00	
			For Stainless Steel Cab Interior, Add	12,887.00	
			For Each Additional 50 FPM, Add	3,475.00	
			For Each Additional 500 LB, Add	3,475.00	
			For Each Additional Stop, Add	5,263.00	
			Note: Deduct if <3 stops.		
			For Elevator With Manual Door, Deduct	-15,726.17	
			For Class "B" Loading, Add	1,235.00	
			For Class "C-1" Loading, Add	2,935.00	
			For Class "C-2" Loading, Add	3,530.00	
			For Class "C-3" Loading, Add	4,800.00	
14 24	13 00-0008	EA	Hydraulic Freight Elevator, 3,000 LB x 150 FPM.....	152,871.44	7,240.57
			For Each Additional Stop, Add	5,262.00	
			Note: Deduct if <3 stops.		
			For Each Opening With Bonderized Steel Door, Add	148.00	
			For Each Opening With Stainless Steel Doors, Add	1,610.00	
			For Each Opening With Two Speed Doors, Add	536.00	
			For Each Opening With Two Speed Bi-Parting Doors, Add	636.00	
			For Custom Plastic Laminated Cab Interiors, Add	1,611.00	
			For Custom Half Plastic Laminate And Half Stainless Steel Interior, Add	10,202.00	
			For Stainless Steel Cab Interior, Add	12,887.00	
			For Each Additional 50 FPM, Add	3,475.00	
			For Each Additional 500 LB, Add	3,475.00	
			For Each Additional Stop, Add	5,263.00	
			Note: Deduct if <3 stops.		
			For Elevator With Manual Door, Deduct	-13,839.03	
			For Class "B" Loading, Add	1,235.00	
			For Class "C-1" Loading, Add	2,935.00	
			For Class "C-2" Loading, Add	3,530.00	
			For Class "C-3" Loading, Add	4,800.00	
14 24	13 00-0009	EA	Hydraulic Freight Elevator, 4,000 LB x 150 FPM.....	164,639.46	7,882.59
			For Each Additional Stop, Add	5,262.00	
			Note: Deduct if <3 stops.		
			For Each Opening With Bonderized Steel Door, Add	148.00	
			For Each Opening With Stainless Steel Doors, Add	1,610.00	
			For Each Opening With Two Speed Doors, Add	536.00	
			For Each Opening With Two Speed Bi-Parting Doors, Add	636.00	
			For Custom Plastic Laminated Cab Interiors, Add	1,611.00	
			For Custom Half Plastic Laminate And Half Stainless Steel Interior, Add	10,202.00	
			For Stainless Steel Cab Interior, Add	12,887.00	
			For Each Additional 50 FPM, Add	3,475.00	
			For Each Additional 500 LB, Add	3,475.00	
			For Each Additional Stop, Add	5,263.00	
			Note: Deduct if <3 stops.		
			For Elevator With Manual Door, Deduct	-14,887.44	
			For Class "B" Loading, Add	1,235.00	
			For Class "C-1" Loading, Add	2,935.00	
			For Class "C-2" Loading, Add	3,530.00	
			For Class "C-3" Loading, Add	4,800.00	



Conveying Equipment	14	14
Elevators	14 20	
Hydraulic Elevators	14 24	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
14 24 13 00-0010 EA Hydraulic Freight Elevator, 6,000 LB x 150 FPM.....	186,573.60	8,365.48
For Each Additional Stop, Add	5,262.00	
Note: Deduct if <3 stops.		
For Each Opening With Bonderized Steel Door, Add	148.00	
For Each Opening With Stainless Steel Doors, Add	1,610.00	
For Each Opening With Two Speed Doors, Add	536.00	
For Each Opening With Two Speed Bi-Parting Doors, Add	636.00	
For Custom Plastic Laminated Cab Interiors, Add	1,611.00	
For Custom Half Plastic Laminate And Half Stainless Steel Interior, Add	10,202.00	
For Stainless Steel Cab Interior, Add	12,887.00	
For Each Additional 50 FPM, Add	3,475.00	
For Each Additional 500 LB, Add	3,475.00	
For Each Additional Stop, Add	5,263.00	
Note: Deduct if <3 stops.		
For Elevator With Manual Door, Deduct	-16,984.26	
For Class "B" Loading, Add	1,235.00	
For Class "C-1" Loading, Add	2,935.00	
For Class "C-2" Loading, Add	3,530.00	
For Class "C-3" Loading, Add	4,800.00	
14 24 13 00-0011 Hydraulic Elevators Piston Drilling (14 24 13)		
14 24 13 00-0012 VLF Up To 6" Diameter Piston Drilling	54.48	
Note: Includes casing.		
14 24 13 00-0013 VLF 8" To 10" Diameter Piston Drilling.....	64.33	
Note: Includes casing.		
14 24 13 00-0014 VLF 12" To 16" Diameter Piston Drilling.....	71.61	
Note: Includes casing.		
14 24 13 00-0015 VLF 18" Diameter Piston Drilling.....	81.16	
Note: Includes casing.		
14 24 23 Hydraulic Passenger Elevators (14 24)		
14 24 23 00-0001 Hydraulic Passenger Elevators (14 24 23)		
Note: Baked enamel shaft doors and plastic laminated trimmed cab, allowance of \$4000. Unit prices are based on a shaft of 3 stops and 3 openings. See CSI section 14 24 13 00-0011 for drilling piston hole.		
14 24 23 00-0002 EA Hydraulic Passenger Elevator, 2,000 LB x 50 FPM.....	103,915.27	6,875.94
For Each Additional 50 FPM, Add	3,475.00	
For Each Additional 500 LB, Add	3,475.00	
For Each Additional Stop, Add	5,262.00	
Note: Deduct if <3 stops.		
For Each Opening With Bonderized Steel Door, Add	148.00	
For Each Opening With Stainless Steel Doors, Add	1,610.00	
For Each Opening With Two Speed Doors, Add	536.00	
For Each Opening With Two Speed Bi-Parting Doors, Add	636.00	
For Custom Plastic Laminated Cab Interiors, Add	1,611.00	
For Custom Half Plastic Laminate And Half Stainless Steel Interior, Add	10,202.00	
For Stainless Steel Cab Interior, Add	12,887.00	
14 24 23 00-0003 EA Hydraulic Passenger Elevator, 2,500 LB x 50 FPM.....	108,675.48	7,159.27
For Each Additional 50 FPM, Add	3,475.00	
For Each Additional 500 LB, Add	3,475.00	
For Each Additional Stop, Add	5,262.00	
Note: Deduct if <3 stops.		
For Each Opening With Bonderized Steel Door, Add	148.00	
For Each Opening With Stainless Steel Doors, Add	1,610.00	
For Each Opening With Two Speed Doors, Add	536.00	
For Each Opening With Two Speed Bi-Parting Doors, Add	636.00	
For Custom Plastic Laminated Cab Interiors, Add	1,611.00	
For Custom Half Plastic Laminate And Half Stainless Steel Interior, Add	10,202.00	
For Stainless Steel Cab Interior, Add	12,887.00	
14 24 23 00-0004 EA Hydraulic Passenger Elevator, 3,000 LB x 50 FPM.....	118,097.83	7,676.73
For Each Additional 50 FPM, Add	3,475.00	
For Each Additional 500 LB, Add	3,475.00	
For Each Additional Stop, Add	5,262.00	
Note: Deduct if <3 stops.		
For Each Opening With Bonderized Steel Door, Add	148.00	
For Each Opening With Stainless Steel Doors, Add	1,610.00	
For Each Opening With Two Speed Doors, Add	536.00	
For Each Opening With Two Speed Bi-Parting Doors, Add	636.00	
For Custom Plastic Laminated Cab Interiors, Add	1,611.00	
For Custom Half Plastic Laminate And Half Stainless Steel Interior, Add	10,202.00	
For Stainless Steel Cab Interior, Add	12,887.00	
14 24 23 00-0005 EA Hydraulic Passenger Elevator, 2,000 LB x 100 FPM.....	113,916.48	7,159.27
For Each Additional 50 FPM, Add	3,475.00	
For Each Additional 500 LB, Add	3,475.00	
For Each Additional Stop, Add	5,262.00	
Note: Deduct if <3 stops.		
For Each Opening With Bonderized Steel Door, Add	148.00	
For Each Opening With Stainless Steel Doors, Add	1,610.00	
For Each Opening With Two Speed Doors, Add	536.00	
For Each Opening With Two Speed Bi-Parting Doors, Add	636.00	
For Custom Plastic Laminated Cab Interiors, Add	1,611.00	
For Custom Half Plastic Laminate And Half Stainless Steel Interior, Add	10,202.00	
For Stainless Steel Cab Interior, Add	12,887.00	

14 Conveying Equipment**14 20 Elevators****14 24 Hydraulic Elevators**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
14 24 23 00-0006 EA Hydraulic Passenger Elevator, 2,500 LB x 100 FPM	120,413.55	7,786.25
For Each Additional 50 FPM, Add	3,475.00	
For Each Additional 500 LB, Add	3,475.00	
For Each Additional Stop, Add	5,262.00	
Note: Deduct if <3 stops.		
For Each Opening With Bonderized Steel Door, Add	148.00	
For Each Opening With Stainless Steel Doors, Add	1,610.00	
For Each Opening With Two Speed Doors, Add	536.00	
For Each Opening With Two Speed Bi-Parting Doors, Add	636.00	
For Custom Plastic Laminated Cab Interiors, Add	1,611.00	
For Custom Half Plastic Laminate And Half Stainless Steel Interior, Add	10,202.00	
For Stainless Steel Cab Interior, Add	12,887.00	
14 24 23 00-0007 EA Hydraulic Passenger Elevator, 3,000 LB x 100 FPM	126,634.15	8,274.99
For Each Additional 50 FPM, Add	3,475.00	
For Each Additional 500 LB, Add	3,475.00	
For Each Additional Stop, Add	5,262.00	
Note: Deduct if <3 stops.		
For Each Opening With Bonderized Steel Door, Add	148.00	
For Each Opening With Stainless Steel Doors, Add	1,610.00	
For Each Opening With Two Speed Doors, Add	536.00	
For Each Opening With Two Speed Bi-Parting Doors, Add	636.00	
For Custom Plastic Laminated Cab Interiors, Add	1,611.00	
For Custom Half Plastic Laminate And Half Stainless Steel Interior, Add	10,202.00	
For Stainless Steel Cab Interior, Add	12,887.00	
14 24 23 00-0008 EA Hydraulic Passenger Elevator, 2,000 LB x 150 FPM	122,468.58	7,240.57
For Each Additional 50 FPM, Add	3,475.00	
For Each Additional 500 LB, Add	3,475.00	
For Each Additional Stop, Add	5,262.00	
Note: Deduct if <3 stops.		
For Each Opening With Bonderized Steel Door, Add	148.00	
For Each Opening With Stainless Steel Doors, Add	1,610.00	
For Each Opening With Two Speed Doors, Add	536.00	
For Each Opening With Two Speed Bi-Parting Doors, Add	636.00	
For Custom Plastic Laminated Cab Interiors, Add	1,611.00	
For Custom Half Plastic Laminate And Half Stainless Steel Interior, Add	10,202.00	
For Stainless Steel Cab Interior, Add	12,887.00	
14 24 23 00-0009 EA Hydraulic Passenger Elevator, 2,500 LB x 150 FPM	133,724.95	8,151.47
For Each Additional 50 FPM, Add	3,475.00	
For Each Additional 500 LB, Add	3,475.00	
For Each Additional Stop, Add	5,262.00	
Note: Deduct if <3 stops.		
For Each Opening With Bonderized Steel Door, Add	148.00	
For Each Opening With Stainless Steel Doors, Add	1,610.00	
For Each Opening With Two Speed Doors, Add	536.00	
For Each Opening With Two Speed Bi-Parting Doors, Add	636.00	
For Custom Plastic Laminated Cab Interiors, Add	1,611.00	
For Custom Half Plastic Laminate And Half Stainless Steel Interior, Add	10,202.00	
For Stainless Steel Cab Interior, Add	12,887.00	
14 24 23 00-0010 EA Hydraulic Passenger Elevator, 3,000 LB x 150 FPM	144,057.70	9,124.22
For Each Additional 50 FPM, Add	3,475.00	
For Each Additional 500 LB, Add	3,475.00	
For Each Additional Stop, Add	5,262.00	
Note: Deduct if <3 stops.		
For Each Opening With Bonderized Steel Door, Add	148.00	
For Each Opening With Stainless Steel Doors, Add	1,610.00	
For Each Opening With Two Speed Doors, Add	536.00	
For Each Opening With Two Speed Bi-Parting Doors, Add	636.00	
For Custom Plastic Laminated Cab Interiors, Add	1,611.00	
For Custom Half Plastic Laminate And Half Stainless Steel Interior, Add	10,202.00	
For Stainless Steel Cab Interior, Add	12,887.00	
14 24 23 00-0011 Twin Jack Holeless Hydraulic Passenger Elevator ^(14 24 23)		
Note: Baked enamel shaft doors and plastic laminated trimmed cab. Excludes flooring, shaft construction/alterations, pit or mechanical room construction. Connect to established utilities.		
14 24 23 00-0012 EA Hydraulic Passenger Elevator, 2,000 LB, 80 FPM, 3 Stops, 3 Openings.....	83,734.86	7,159.27
14 24 23 00-0013 EA Hydraulic Passenger Elevator, 2,000 LB, 80 FPM, 2 Stops, 2 Openings.....	62,714.31	6,116.85

14 30 Escalators And Moving Walks ⁽¹⁴⁾**14 31 Escalators ^(14 30)****14 31 00 00-0001 Escalators Stainless Steel Construction ^(14 31)**

Note: Prices are medians and are based on each moving stairway. Complete, includes all standard accessories and single microprocessor controlled electronic display sign packages, LED.

14 31 00 00-0002 EA Escalators Stainless Steel, 32" Wide x 12' Floor To Floor Height	201,244.57	9,345.19
14 31 00 00-0003 EA Escalators Stainless Steel, 32" Wide x 15' Floor To Floor Height.....	220,868.61	11,044.32
14 31 00 00-0004 EA Escalators Stainless Steel, 32" Wide x 18' Floor To Floor Height.....	240,058.62	12,743.45
14 31 00 00-0005 EA Escalators Stainless Steel, 32" Wide x 22' Floor To Floor Height.....	263,488.92	15,292.14
14 31 00 00-0006 EA Escalators Stainless Steel, 32" Wide x 25' Floor To Floor Height.....	291,483.77	16,991.26
14 31 00 00-0007 EA Escalators Stainless Steel, 36" Wide x 12' Floor To Floor Height.....	213,177.15	9,939.89
14 31 00 00-0008 EA Escalators Stainless Steel, 36" Wide x 15' Floor To Floor Height.....	234,194.22	11,893.88
14 31 00 00-0009 EA Escalators Stainless Steel, 36" Wide x 18' Floor To Floor Height.....	253,267.38	13,593.01
14 31 00 00-0010 EA Escalators Stainless Steel, 36" Wide x 22' Floor To Floor Height.....	282,875.77	17,076.21



Conveying Equipment	14
Escalators And Moving Walks	14 30
Escalators	14 31

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
14 31 00 00-0011 EA Escalators Stainless Steel, 36" Wide x 25' Floor To Floor Height.....	305,906.85	18,350.56
14 31 00 00-0012 EA Escalators Stainless Steel, 48" Wide x 12' Floor To Floor Height.....	225,307.91	10,534.58
14 31 00 00-0013 EA Escalators Stainless Steel, 48" Wide x 15' Floor To Floor Height.....	248,021.75	12,743.45
14 31 00 00-0014 EA Escalators Stainless Steel, 48" Wide x 18' Floor To Floor Height.....	266,127.95	14,442.57
14 31 00 00-0015 EA Escalators Stainless Steel, 48" Wide x 22' Floor To Floor Height.....	303,257.84	18,010.74
14 31 00 00-0016 EA Escalators Stainless Steel, 48" Wide x 25' Floor To Floor Height.....	322,294.33	19,709.86
14 31 00 00-0017 EA Escalator Fire Shutter Fusible Link.....	31,915.96	339.83

14 32 Moving Walks ^(14 30)

14 32 00 00-0001 Moving Sidewalks ^(14 32)

Note: Prices are medians. Includes safety rails.

14 32 00 00-0002 LF Moving Sidewalks, 28" Wide.....	1,914.19	203.89
For Each LF Of Ramp Or Sloped Sections, Add	333.90	
14 32 00 00-0003 LF Moving Sidewalks, 36" Wide.....	2,688.93	208.15
For Each LF Of Ramp Or Sloped Sections, Add	487.84	
14 32 00 00-0004 LF Moving Sidewalks, 48" Wide.....	3,069.41	216.63
For Each LF Of Ramp Or Sloped Sections, Add	561.90	
14 32 00 00-0005 LF Moving Sidewalks, 54" Wide.....	3,558.07	234.99
For Each LF Of Ramp Or Sloped Sections, Add	655.22	

14 40 Lifts ⁽¹⁴⁾

14 42 Wheelchair Lifts ^(14 40)

14 42 13 Inclined Wheelchair Lifts ^(14 42)

14 42 13 00-0001 Chair Lift-Stair Climber ^(14 42 13)

Note: Includes landing, rails, lifting device and gates.

14 42 13 00-0002 EA Chair Lift, Stair Climber Per Story, Single Passenger, Indoor, 300 LB Capacity.....	3,631.33	407.14
Note: Includes top and bottom call button, safety chair, track, and power unit.		

14 42 16 Vertical Wheelchair Lifts ^(14 42)

14 42 16 00-0001 Shorty Wheelchair Lift ^(14 42 16)

14 42 16 00-0002 EA 36" Vertical Travel Wheelchair Platform Scissor Lift.....	5,922.80	271.43
Note: 1000 LB capacity. Includes handrails and manual ramp.		
For Accordion Safety Skirt, Add	998.00	
For Removable Handrails, Add	100.00	
For Power Operated Ramp, Add	885.00	
14 42 16 00-0003 EA 42" Vertical Travel Wheelchair Platform Scissor Lift.....	5,922.80	271.43
Note: 1000 LB capacity. Includes handrails and manual ramp.		
For 2,000 LB Capacity, Add	600.00	
For 3,000 LB Capacity, Add	1,000.00	
For 4,000 LB Capacity, Add	1,500.00	
For Accordion Safety Skirt, Add	998.00	
For Removable Handrails, Add	100.00	
For Power Operated Ramp, Add	885.00	
14 42 16 00-0004 EA 70" Vertical Travel Wheelchair Platform Scissor Lift.....	8,103.67	361.91
Note: 1000 LB capacity. Includes handrails and manual ramp.		
For 2,000 LB Capacity, Add	600.00	
For 3,000 LB Capacity, Add	1,000.00	
For 4,000 LB Capacity, Add	1,500.00	
For Accordion Safety Skirt, Add	998.00	
For Removable Handrails, Add	100.00	
For Power Operated Ramp, Add	885.00	
14 42 16 00-0005 EA 84" Vertical Travel Wheelchair Platform Scissor Lift.....	9,103.67	361.91
Note: 1000 LB capacity. Includes handrails and manual ramp.		
For 2,000 LB Capacity, Add	600.00	
For 3,000 LB Capacity, Add	1,000.00	
For 4,000 LB Capacity, Add	1,500.00	
For Accordion Safety Skirt, Add	998.00	
For Removable Handrails, Add	100.00	
For Power Operated Ramp, Add	885.00	
14 42 16 00-0006 EA 18' Travel Wheelchair Incline Lift.....	11,342.61	723.80
Note: 500 LB capacity, interior installation.		

END OF SECTION 14

14	14	Conveying Equipment
	14 40	Lifts
	14 42	Wheelchair Lifts



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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21 Fire Suppression

21 01 Operation and Maintenance of Fire Suppression ⁽²¹⁾

21 01 10 Operation and Maintenance of Water-Based Fire-Suppression Systems ^(21 01)

See CSI section 23 01 20 00-0000 for purging of pipes and shutdown.

21 01 10 00-0001	EA	Relocate Sprinkler Head And Branch Piping ^(21 01 10) Note: To adjust or swing existing sprinkler heads to different ceiling grid configuration or location.	
21 01 10 00-0002	EA	Relocate Existing Sprinkler Head And Branch Piping.....	46.29
Note: To adjust or swing existing sprinkler heads to different ceiling grid configuration or location.			
21 01 10 00-0003		Sprinkler Upgrades ^(21 01 10)	
21 01 10 00-0004	LF	Bleed Existing Lines Of Water	0.40
21 01 10 00-0005	LF	Refill Existing Lines With Water	0.47

21 01 30 Operation and Maintenance of Fire-Suppression Equipment ^(21 01)

21 01 30 00-0001	EA	Inspection And Recharge ^(21 01 30)	
21 01 30 00-0002	EA	Inspection, CO2, Carbon Dioxide	165.83
21 01 30 00-0003	LB	Refill/Recharge, CO2, Carbon Dioxide	1.45
21 01 30 00-0004	EA	Inspection, Halon 1301	165.83
21 01 30 00-0005	LB	Refill/Recharge, Halon 1301	34.80
21 01 30 00-0006	EA	Inspection, WC, Wet Chemical	100.26
21 01 30 00-0007	GAL	Refill/Recharge, WC, Wet Chemical	32.63
21 01 30 00-0008	EA	Inspection, DC, Dry Chemical.....	100.26
21 01 30 00-0009	LB	Refill/Recharge, DC, Dry Chemical.....	2.90
21 01 30 00-0010	EA	Hydrostatic Testing, All Sizes, All Agents	30.85
See CSI section 23 05 93 00-0046 for testing existing piping systems.			
21 01 30 00-0011	EA	Disarm/Arm System.....	53.99

21 05 Common Work Results for Fire Suppression ⁽²¹⁾

21 05 13 Common Motor Requirements For Fire-Suppression Equipment ^(21 05)

Note: New equipment includes motor, unless otherwise stated. For use when replacing existing motor. See CSI section 23 05 13 00-0000 for motor requirements.

21 05 16 Expansion Fittings And Loops For Fire-Suppression Piping ^(21 05)

See CSI section 23 05 16 00-0000 for expansion fittings and loops.

21 05 19 Meters And Gages For Fire-Suppression Systems ^(21 05)

21 05 19 00-0001	EA	Fire Service Meter Cast Iron Housing ^(21 05 19)	
21 05 19 00-0002	EA	3" Diameter, 0 - 600 GPM Fire Service Meter Flanged, With Cast Iron Housing.....	3,084.85
For >10 To 25, Deduct			-154.24
For >25, Deduct			-410.10
21 05 19 00-0003	EA	4" Diameter, 0 - 1,000 GPM Fire Service Meter Flanged, With Cast Iron Housing.....	5,986.42
For >10 To 25, Deduct			-299.32
For >25, Deduct			-824.96
21 05 19 00-0004	EA	6" Diameter, 0 - 2,000 GPM Fire Service Meter Flanged, With Cast Iron Housing.....	8,311.29
For >10 To 25, Deduct			-415.56
For >25, Deduct			-1,126.24
21 05 19 00-0005	EA	8" Diameter, 0 - 4,000 GPM Fire Service Meter Flanged, With Cast Iron Housing.....	10,569.35
For >10 To 25, Deduct			-528.47
For >25, Deduct			-1,456.34
21 05 19 00-0006	EA	10" Diameter, 0 - 6,200 GPM Fire Service Meter Flanged, With Cast Iron Housing.....	14,650.19
For >10 To 25, Deduct			-732.51
For >25, Deduct			-2,045.59

21 05 23 General-Duty Valves For Water-Based Fire-Suppression Piping ^(21 05)

See CSI section 23 05 23 00-0000 for valves.

21 05 29 Hangers And Supports For Fire-Suppression Piping And Equipment ^(21 05)

See CSI section 23 05 29 00-0000 for hangers and supports.

21 05 48 Vibration And Seismic Controls For Fire-Suppression Piping And Equipment ^(21 05)

21 Fire Suppression**21 05 Common Work Results for Fire Suppression****21 05 48 Vibration And Seismic Controls For Fire-Suppression Piping And Equipment**

MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

See CSI section 23 05 48 00-0000 for vibration and seismic control.

21 05 53 Identification For Fire-Suppression Piping And Equipment (21 05)

See CSI section 23 05 53 00-0000 for identification.

21 07 Fire-Suppression Systems Insulation (21)**21 07 19 Fire-Suppression Piping Insulation (21 07)**

See CSI section 22 07 19 00-0000 for fire-suppression piping insulation.

21 10 Water-Based Fire-Suppression Systems (21)

See CSI section 22 11 16 00-0335 for copper pipe, 22 11 16 00-0873 for CPVC pipe, 23 05 23 00-0044 for OS&Y gate valves, 23 21 13 23-0000 for black steel piping.

21 11 Facility Fire-Suppression Water-Service Piping (21 10)**21 11 19 Fire-Department Connections (21 11)****21 11 19 00-0001 Fire Department Connections (21 11 19)**

21 11 19 00-0002	EA	4" x 2-1/2" x 2-1/2" Siamese Connection, Polished Brass	546.54	231.49
		<i>For Polished Chrome, Add</i>	24.48	
21 11 19 00-0003	EA	6" x 2-1/2" x 2-1/2" Siamese Connection, Polished Brass	738.36	289.37
		<i>For Polished Chrome, Add</i>	37.47	
21 11 19 00-0004	EA	4" x 3" x 3" Siamese Connection, Polished Brass	730.55	231.49
		<i>For Polished Chrome, Add</i>	47.47	
21 11 19 00-0005	EA	6" x 3" x 3" Siamese Connection, Polished Brass	954.19	289.37
		<i>For Polished Chrome, Add</i>	64.45	
21 11 19 00-0006	EA	6" x 2-1/2" x 2-1/2" x 2-1/2" Siamese Connection, Three Way, Polished Brass	1,006.95	289.37
		<i>For Polished Chrome, Add</i>	71.05	
21 11 19 00-0007	EA	Sidewalk Type Connection With Plug And Chain, Polished Brass	902.16	306.26
		<i>For Polished Chrome, Add</i>	54.79	
21 11 19 00-0008	EA	Wall Type Connection With Plug And Chain, Polished Brass	602.20	231.49
		<i>For Polished Chrome, Add</i>	31.44	

21 11 19 00-0009 Wall Type Indicator Post, Wheel Operated (21 11 19)

See CSI section 33 12 16 00-0001 for adjustable indicator post accessory for ground valves.

21 11 19 00-0010	EA	Wall Type Indicator Post With Wall Flange For Valve	566.77	209.48
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Note: The wall flange is tapped for a 4" diameter schedule 40 steel pipe which extends through wall.

21 12 Fire-Suppression Standpipes (21 10)**21 12 13 Fire-Suppression Hoses And Nozzles (21 12)****21 12 13 00-0001 Fire Hose (21 12 13)****21 12 13 00-0002 Fire Hose Without Couplings (21 12 13 00-0001)**

21 12 13 00-0003	LF	1-1/2" Linen Fire Hose With 1-1/2" Rubber Lining Without Couplings	2.05	1.54
21 12 13 00-0004	LF	2-1/2" Linen Fire Hose With 1-1/2" Rubber Lining Without Couplings	2.40	1.54
21 12 13 00-0005	LF	2" Linen Fire Hose With 1-1/2" Rubber Lining Without Couplings	2.17	1.54
21 12 13 00-0006	LF	3" Linen Fire Hose With 1-1/2" Rubber Lining Without Couplings	2.56	1.54
21 12 13 00-0007	LF	1-1/2" Cotton Fire Hose, 300 LB Test With 1-1/2" Rubber Lining Without Couplings	2.35	1.54
21 12 13 00-0008	LF	2-1/2" Cotton Fire Hose, 300 LB Test With 1-1/2" Rubber Lining Without Couplings	2.95	1.54
21 12 13 00-0009	LF	1-1/2" Cotton Fire Hose, 400 LB Test With 1-1/2" Rubber Lining Without Couplings	2.44	1.54
21 12 13 00-0010	LF	2-1/2" Cotton Fire Hose, 400 LB Test With 1-1/2" Rubber Lining Without Couplings	3.14	1.54

21 12 13 00-0011 Fire Hose With Aluminum Couplings (21 12 13 00-0001)

21 12 13 00-0012	LF	1-3/4" Polyester Fire Hose With Rubber Lining With Aluminum Couplings	3.17	0.85
21 12 13 00-0013	LF	2-1/2" Polyester Fire Hose With Rubber Lining With Aluminum Couplings	3.84	1.01
21 12 13 00-0014	LF	3-1/2" Polyester Fire Hose With Rubber Lining With Aluminum Couplings	5.86	1.01

21 12 13 00-0015 Fire Hose Accessories (21 12 13 00-0001)

21 12 13 00-0016	EA	Hose Coupling With 1-1/2" Pin Lug	72.90	25.45
21 12 13 00-0017	EA	Hose Coupling With 2-1/2" Pin Lug	102.16	28.53
21 12 13 00-0018	EA	1-1/2" x 10" Brass Straight Nozzle	48.69	20.05
21 12 13 00-0019	EA	2-1/2" x 12" Brass Straight Nozzle	83.32	20.05
21 12 13 00-0020	EA	1-1/2" Brass Fog Type Nozzle	68.19	20.05
21 12 13 00-0021	EA	2-1/2" Brass Fog Type Nozzle	92.86	20.05
21 12 13 00-0022	EA	1-1/2" Brass 100' Hose Rack	178.34	84.84
21 12 13 00-0023	EA	2-1/2" Brass 100' Hose Rack	223.98	84.84

21 12 23 Fire-Suppression Hose Valves (21 12)**21 12 23 00-0001 Standpipe Valves (21 12 23)**

21 12 23 00-0002	EA	2-1/2" Fire Department Valve, Polished Brass With Plug And Chain	395.93	153.13
		<i>For Polished Chrome, Add</i>	24.60	
21 12 23 00-0003	EA	2-1/2" x 2-1/2" x 4" Fire Department Valve, Flush, Polished Brass	590.08	153.06
		<i>For Polished Chrome, Add</i>	53.73	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
21 12 23 00-0004 EA 2-1/2" x 2-1/2" x 6" Fire Department Valve, Flush, Polished Brass..... <i>For Polished Chrome, Add</i>	744.93 74.10	165.57
21 12 23 00-0005 EA 3" x 3" x 4" Fire Department Valve, Flush, Polished Brass <i>For Polished Chrome, Add</i>	869.87 95.69	153.06
21 12 23 00-0006 EA 3" x 3" x 6" Fire Department Valve, Flush, Polished Brass <i>For Polished Chrome, Add</i>	1,014.57 114.55	165.57
21 12 23 00-0007 EA 2-1/2" x 2-1/2" x 4" Fire Department Valve, Projecting, Polished Brass..... <i>For Polished Chrome, Add</i>	560.35 49.27	153.06
21 12 23 00-0008 EA 2-1/2" x 2-1/2" x 6" Fire Department Valve, Projecting, Polished Brass..... <i>For Polished Chrome, Add</i>	791.56 81.10	165.57
21 12 23 00-0009 EA 2-1/2" x 2-1/2" x 2-1/2" x 4" Fire Department Valve, Flush, Polished Brass..... <i>For Polished Chrome, Add</i>	986.17 89.61	158.02
21 12 23 00-0010 EA 2-1/2" x 2-1/2" x 2-1/2" x 6" Fire Department Valve, Flush, Polished Brass..... <i>For Polished Chrome, Add</i>	1,386.17 134.42	175.56
21 12 23 00-0011 EA 2-1/2" x 2-1/2" x 2-1/2" x 4" Fire Department Valve, Projecting, Polished Brass <i>For Polished Chrome, Add</i>	1,053.07 97.64	158.02
21 12 23 00-0012 EA 2-1/2" x 2-1/2" x 2-1/2" x 6" Fire Department Valve, Projecting, Polished Brass <i>For Polished Chrome, Add</i>	1,486.97 146.51	175.56
21 12 23 00-0013 EA 2-1/2" x 2-1/2" x 2-1/2" x 2-1/2" 6" Fire Department Valve, Square, Flush, Polished Brass..... <i>For Polished Chrome, Add</i>	2,394.35 207.51	210.64
21 12 23 00-0014 Fire Hose Cabinet Angle Valves <small>(21 12 23)</small>		
21 12 23 00-0015 EA 1-1/2" Fire Hose Angle Valve, Cast Brass	129.13	
21 12 23 00-0016 EA 2-1/2" Fire Hose Angle Valve, Cast Brass	217.99	34.71
21 12 29 Fire-Suppression Fire Hose Equipment <small>(21 12)</small>		
21 12 29 00-0001 Standpipe And Fire Hose Equipment <small>(21 12 29)</small>		
21 12 29 00-0002 EA 2-1/2" x 2-1/2" x 2-1/2" x 4" Manifold Roof Type, Vertical, Polished Brass	1,139.74	379.59
21 12 29 00-0003 EA Water Motor Gong	399.59	118.31
21 12 29 00-0004 EA Fire Riser Flow Switch (NFPA 13)	261.68	13.77
21 12 29 00-0005 EA Water Flow Supervisory (Tamper) Switch Mounted On Valve	138.41	23.54
21 12 29 00-0006 EA Pressure-Type Water Flow Detector For Up To 2-1/2" Pipe	237.00	72.46
21 12 29 00-0007 EA Pressure-Type Water Flow Detector For >2-1/2" To 4" Pipe	340.88	96.00
21 12 29 00-0008 EA Pressure-Type Water Flow Detector For >4" To 8" Pipe	506.66	108.68
21 12 29 00-0009 EA Vane-Type Water Flow Switch For Up To 2-1/2" Pipe	286.84	72.46
21 12 29 00-0010 EA Vane-Type Water Flow Switch For >2-1/2" To 4" Pipe	401.93	96.00
21 12 29 00-0011 EA Vane-Type Water Flow Switch For >4" To 8" Pipe	603.43	108.68
21 13 Fire-Suppression Sprinkler Systems <small>(21 10)</small>		
21 13 13 Wet-Pipe Sprinkler Systems <small>(21 13)</small>		
21 13 13 00-0001 Complete Wet-Pipe Sprinkler Systems <small>(21 13 13)</small>		
Note: Includes complete design per NFPA 13, 13D or 13R and stamped shop drawings approved by a registered engineer. Includes all branch line piping (standard weight black steel, less than 2-1/2" diameter pipe, fittings, branch valves, hangers, sprinkler heads, etc) from riser pipe and mains. The coverage of one sprinkler head varies from about 180 SF for light hazard occupancy, about 155 SF for ordinary, 90 to about 130 SF for extra hazard conditions. Excludes outside mains, inside vertical or horizontal pipe mains, greater than 2" diameter. Excludes special alarm valves, gate valves, check valves, flow control devices, water motor gong assembly, Siamese connections, standpipes and fittings, pipe mains and fittings, fire pumps and tanks.		
21 13 13 00-0002 Light Hazard, Complete Wet-Pipe Sprinkler Systems <small>(21 13 13 00-0001)</small>		
21 13 13 00-0003 EA Exposed Piping, Light Hazard, Complete Wet-Pipe Sprinkler System, Per Head.....	290.53	
Note: Includes branch pipe and fittings, supports and sprinkler heads.		
<i>For Copper Pipe, Add</i>	33.69	
<i>For Polyvinyl Chloride (PVC) Pipe, Deduct</i>	-48.21	
<i>For Up To 5, Add</i>	136.00	
<i>For >5 To 10, Add</i>	87.78	
<i>For >10 To 20, Add</i>	58.73	
<i>For >20 To 40, Add</i>	24.42	
<i>For >100 To 150, Deduct</i>	-29.05	
<i>For >150, Deduct</i>	-58.11	
21 13 13 00-0004 EA Concealed Piping, Light Hazard, Complete Wet-Pipe Sprinkler System, Per Head	391.59	
Note: Includes branch pipe and fittings, supports and sprinkler heads with flat or conical escutcheon.		
<i>For Copper Pipe, Add</i>	44.17	
<i>For Polyvinyl Chloride (PVC) Pipe, Deduct</i>	-63.75	
<i>For Up To 5, Add</i>	185.77	
<i>For >5 To 10, Add</i>	122.01	
<i>For >10 To 20, Add</i>	82.86	
<i>For >20 To 40, Add</i>	34.15	
<i>For >100 To 150, Deduct</i>	-39.16	
<i>For >150, Deduct</i>	-78.32	
21 13 13 00-0005 Ordinary Hazard, Complete Wet-Pipe Sprinkler Systems <small>(21 13 13 00-0001)</small>		

21 Fire Suppression**21 10 Water-Based Fire-Suppression Systems****21 13 Fire-Suppression Sprinkler Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
21 13 13 00-0006	EA		Exposed Piping, Ordinary Hazard, Complete Wet-Pipe Sprinkler System, Per Head.....289.01 Note: Includes branch pipe and fittings, supports and sprinkler heads.		
			<i>For Copper Pipe, Add</i>	33.58	
			<i>For Polyvinyl Chloride (PVC) Pipe, Deduct</i>	-48.03	
			<i>For Up To 5, Add</i>	135.15	
			<i>For >5 To 10, Add</i>	87.12	
			<i>For >10 To 20, Add</i>	58.22	
			<i>For >20 To 40, Add</i>	24.22	
			<i>For >100 To 150, Deduct</i>	-26.90	
			<i>For >150, Deduct</i>	-57.80	
21 13 13 00-0007	EA		Concealed Piping, Ordinary Hazard, Complete Wet-Pipe Sprinkler System, Per Head.....387.80 Note: Includes branch pipe and fittings, supports and sprinkler heads with flat or conical escutcheon.		
			<i>For Copper Pipe, Add</i>	43.80	
			<i>For Polyvinyl Chloride (PVC) Pipe, Deduct</i>	-63.19	
			<i>For Up To 5, Add</i>	183.87	
			<i>For >5 To 10, Add</i>	120.68	
			<i>For >10 To 20, Add</i>	81.90	
			<i>For >20 To 40, Add</i>	33.76	
			<i>For >100 To 150, Deduct</i>	-38.78	
			<i>For >150, Deduct</i>	-77.56	
21 13 13 00-0008			Extra Hazard, Complete Wet-Pipe Sprinkler Systems (21 13 13 00-0001)		
21 13 13 00-0009	EA		Exposed Piping, Extra Hazard, Complete Wet-Pipe Sprinkler System, Per Head .....267.72 Note: Includes branch pipe and fittings, supports and sprinkler heads.		
			<i>For Copper Pipe, Add</i>	31.06	
			<i>For Polyvinyl Chloride (PVC) Pipe, Deduct</i>	-44.44	
			<i>For Up To 5, Add</i>	125.29	
			<i>For >5 To 10, Add</i>	80.85	
			<i>For >10 To 20, Add</i>	54.08	
			<i>For >20 To 40, Add</i>	22.49	
			<i>For >100 To 150, Deduct</i>	-26.77	
			<i>For >150, Deduct</i>	-53.54	
21 13 13 00-0010	EA		Concealed Piping, Extra Hazard, Complete Wet-Pipe Sprinkler System, Per Head .....359.84 Note: Includes branch pipe and fittings, supports and sprinkler heads with flat or conical escutcheon.		
			<i>For Copper Pipe, Add</i>	40.59	
			<i>For Polyvinyl Chloride (PVC) Pipe, Deduct</i>	-58.58	
			<i>For Up To 5, Add</i>	170.72	
			<i>For >5 To 10, Add</i>	112.14	
			<i>For >10 To 20, Add</i>	76.15	
			<i>For >20 To 40, Add</i>	31.38	
			<i>For >100 To 150, Deduct</i>	-35.98	
			<i>For >150, Deduct</i>	-71.97	
21 13 13 00-0011			Wet-Pipe Sprinkler Components (21 13 13)		
			Note: Excludes hydraulic calculations.		
21 13 13 00-0012			Wet-Pipe Sprinkler Heads (21 13 13 00-0011)		
21 13 13 00-0013	EA		Pendant Brass Sprinkler Heads, Standard Response .....50.41		19.29
			<i>For Chrome, Add</i>	1.78	
21 13 13 00-0014	EA		Upright Brass Sprinkler Heads.....42.90		19.29
			<i>For Chrome, Add</i>	1.23	
21 13 13 00-0015	EA		Sidewall, Vertical, Brass Sprinkler Heads .....44.75		19.29
			<i>For Chrome, Add</i>	1.51	
21 13 13 00-0016	EA		Sidewall, Horizontal, Brass Sprinkler Heads .....42.82		19.29
			<i>For Chrome, Add</i>	1.22	
21 13 13 00-0017	EA		Nipple, Adjustable, Fire Sprinkler System .....71.72		7.39
21 13 13 00-0018	EA		Institutional Tamper Resistant Pendant Sprinkler (Tyco TFP PH2) .....152.35 Note: Complete assembly including escutcheon, spacers, retaining flange, and centering grommet.		
21 13 13 00-0019	EA		Institutional Tamper Resistant Horizontal Sidewall Sprinkler (Tyco TFP PH5) .....152.35 Note: Complete assembly including escutcheon, spacers, retaining flange, and centering grommet.		
21 13 13 00-0020	EA		Institutional Tamper Resistant Pendant Sprinkler, Quick Response (Tyco Raven).....73.37		
21 13 13 00-0021	EA		Institutional Tamper Resistant Horizontal Sidewall Sprinkler, Quick Response (Tyco Raven) .....80.23		
21 13 13 00-0022			Wet-Pipe Alarm Valves (21 13 13 00-0011)		
21 13 13 00-0023	EA		2" Wet-Pipe Alarm Valve.....1,328.67		616.05
21 13 13 00-0024	EA		3" Wet-Pipe Alarm Valve.....1,788.01		840.95
21 13 13 00-0025	EA		4" Wet-Pipe Alarm Valve.....2,821.60		1,177.33
21 13 13 00-0026	EA		6" Wet-Pipe Alarm Valve.....3,238.45		1,391.06
21 13 13 00-0027	EA		8" Wet-Pipe Alarm Valve.....4,469.81		1,530.17
21 13 13 00-0028			Flexible Sprinkler Piping (21 13 13 00-0011)		
			Note: 1" Diameter stainless steel flexible pipe with either 1/2" or 3/4" outlet.		
21 13 13 00-0029	EA		2' Long Stainless Steel Flexible Sprinkler Piping .....50.74 Note: Includes ceiling mounting bracket.		11.95
21 13 13 00-0030	EA		3' Long Stainless Steel Flexible Sprinkler Piping .....56.07 Note: Includes ceiling mounting bracket.		12.34
21 13 13 00-0031	EA		4' Long Stainless Steel Flexible Sprinkler Piping .....61.52 Note: Includes ceiling mounting bracket.		13.11
21 13 13 00-0032	EA		5' Long Stainless Steel Flexible Sprinkler Piping .....67.15 Note: Includes ceiling mounting bracket.		13.88



Fire Suppression	21	12
Water-Based Fire-Suppression Systems	21 10	
Fire-Suppression Sprinkler Systems	21 13	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
21 13 13 00-0033 EA 6' Long Stainless Steel Flexible Sprinkler Piping Note: Includes ceiling mounting bracket.	72.98	15.43
21 13 16 Dry-Pipe Sprinkler Systems (21 13)		
21 13 16 00-0001 Complete Dry-Pipe Sprinkler Systems (21 13 16) Note: Includes complete design per NFPA 13 and stamped shop drawings approved by a registered engineer. Includes all branch line piping (standard weight black steel, less than 2-1/2" diameter pipe, fittings, branch valves, hangers, sprinkler heads, etc. From riser pipe and mains. Excludes outside mains, inside vertical or horizontal pipe mains, greater than 2" diameter. The coverage of one sprinkler head varies from about 180 SF for light hazard occupancy, about 155 SF for ordinary, 90 to about 130 SF for extra hazard conditions. Excludes special alarm valves, gate valves, check valves, flow control devices, water motor gong assembly, Siamese connections, standpipes and fittings, pipe mains and fittings, fire pumps and tanks.		
21 13 16 00-0002 Light Hazard, Dry-Pipe Sprinkler Systems (21 13 16 00-0001)		
21 13 16 00-0003 EA Exposed Piping, Light Hazard, Dry-Pipe Sprinkler System, Per Head Note: Includes branch pipe and fittings, supports and sprinkler heads.	315.60	
For Up To 5, Add	147.90	
For >5 To 10, Add	85.71	
For >10 To 20, Add	64.05	
For >20 To 40, Add	26.61	
For >100 To 150, Deduct	-31.56	
For >150, Deduct	-63.12	
For Copper Pipe, Add	36.51	
For Polyvinyl Chloride (PVC) Pipe, Deduct	-52.29	
21 13 16 00-0004 EA Concealed Piping, Light Hazard, Dry-Pipe Sprinkler System, Per Head Note: Includes branch pipe and fittings, supports and sprinkler heads with flat or conical escutcheon.	401.67	
For Up To 5, Add	190.05	
For >5 To 10, Add	113.61	
For >10 To 20, Add	84.23	
For >20 To 40, Add	34.77	
For >100 To 150, Deduct	-40.17	
For >150, Deduct	-80.33	
For Copper Pipe, Add	45.56	
For Polyvinyl Chloride (PVC) Pipe, Deduct	-65.65	
21 13 16 00-0005 Ordinary Hazard, Dry-Pipe Sprinkler Systems (21 13 16 00-0001)		
21 13 16 00-0006 EA Exposed Piping, Ordinary Hazard, Dry-Pipe Sprinkler System, Per Head Note: Includes branch pipe and fittings, supports and sprinkler heads.	318.70	
For Up To 5, Add	148.87	
For >5 To 10, Add	85.34	
For >10 To 20, Add	63.95	
For >20 To 40, Add	26.63	
For >100 To 150, Deduct	-31.87	
For >150, Deduct	-63.74	
For Copper Pipe, Add	37.11	
For Polyvinyl Chloride (PVC) Pipe, Deduct	-53.05	
21 13 16 00-0007 EA Concealed Piping, Ordinary Hazard, Dry-Pipe Sprinkler System, Per Head Note: Includes branch pipe and fittings, supports and sprinkler heads with flat or conical escutcheon.	402.92	
For Up To 5, Add	190.19	
For >5 To 10, Add	112.85	
For >10 To 20, Add	83.83	
For >20 To 40, Add	34.66	
For >100 To 150, Deduct	-40.29	
For >150, Deduct	-80.58	
For Copper Pipe, Add	45.93	
For Polyvinyl Chloride (PVC) Pipe, Deduct	-66.07	
21 13 16 00-0008 Extra Hazard, Dry-Pipe Sprinkler Systems (21 13 16 00-0001)		
21 13 16 00-0009 EA Exposed Piping, Extra Hazard, Dry-Pipe Sprinkler System, Per Head Note: Includes branch pipe and fittings, supports and sprinkler heads.	298.62	
For Up To 5, Add	139.38	
For >5 To 10, Add	79.69	
For >10 To 20, Add	59.76	
For >20 To 40, Add	24.90	
For >100 To 150, Deduct	-29.86	
For >150, Deduct	-59.72	
For Copper Pipe, Add	34.83	
For Polyvinyl Chloride (PVC) Pipe, Deduct	-49.76	
21 13 16 00-0010 EA Concealed Piping, Extra Hazard, Dry-Pipe Sprinkler System, Per Head Note: Includes branch pipe and fittings, supports and sprinkler heads with flat or conical escutcheon.	375.12	
For Up To 5, Add	177.08	
For >5 To 10, Add	105.10	
For >10 To 20, Add	78.06	
For >20 To 40, Add	32.27	
For >100 To 150, Deduct	-37.51	
For >150, Deduct	-75.02	
For Copper Pipe, Add	42.75	
For Polyvinyl Chloride (PVC) Pipe, Deduct	-61.51	
21 13 16 00-0011 Dry-Pipe Sprinkler System Equipment (21 13 16 00-0001)		
21 13 16 00-0012 EA Dry System Air Compressor, 3/4 HP With Alarm Valve Flange With Gauge	1,296.08	220.71

21 Fire Suppression**21 10 Water-Based Fire-Suppression Systems****21 13 Fire-Suppression Sprinkler Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
21 13 16 00-0013	EA		Dry System Air Compressor, 1 HP With Alarm Valve Flange With Gauge	1,347.11	220.71
21 13 16 00-0014	EA		Dry System Air Compressor, 1-1/2 HP With Alarm Valve Flange With Gauge	1,390.16	220.71
21 13 16 00-0015	EA		Dry System Air Compressor, 2 HP With Alarm Valve Flange With Gauge	1,557.59	220.71
21 13 16 00-0016			Dry-Pipe Sprinkler System Components (21 13 16) Note: Excludes hydraulic calculations.		
21 13 16 00-0017			Dry Pipe Alarm Valves (21 13 16 00-0016)		
21 13 16 00-0018	EA		2" Dry Pipe Alarm Valve.....	1,364.44	616.05
21 13 16 00-0019	EA		3" Dry Pipe Alarm Valve.....	1,833.02	840.95
21 13 16 00-0020	EA		4" Dry Pipe Alarm Valve.....	3,274.92	1,177.33
21 13 16 00-0021	EA		6" Dry Pipe Alarm Valve.....	4,142.27	1,391.06
21 13 16 00-0022	EA		8" Dry Pipe Alarm Valve.....	5,105.15	1,530.17
21 13 16 00-0023			Dry Sprinkler Heads (21 13 16 00-0016) Note: 3/4" or 1" NPT.		
21 13 16 00-0024	EA		Up To 4-3/4" Length, Dry Pipe Pendant Head	90.37	25.37
21 13 16 00-0025	EA		>4-3/4" To 6-3/4" Length, Dry Pipe Pendant Head	90.37	25.37
21 13 16 00-0026	EA		>6-3/4" To 8-3/4" Length, Dry Pipe Pendant Head	91.97	25.37
21 13 16 00-0027	EA		>8-3/4" To 10-3/4" Length, Dry Pipe Pendant Head	94.38	25.37
21 13 16 00-0028	EA		>10-3/4" To 12-3/4" Length, Dry Pipe Pendant Head	94.38	25.37
21 13 16 00-0029	EA		>12-3/4" To 14-3/4" Length, Dry Pipe Pendant Head	99.99	25.37
21 13 16 00-0030	EA		>14-3/4" To 16-3/4" Length, Dry Pipe Pendant Head	99.99	25.37
21 13 16 00-0031	EA		>16-3/4" To 18-3/4" Length, Dry Pipe Pendant Head	105.60	25.37
21 13 16 00-0032	EA		>18-3/4" To 20-3/4" Length, Dry Pipe Pendant Head	105.60	25.37
21 13 16 00-0033	EA		>20-3/4" To 22-3/4" Length, Dry Pipe Pendant Head	107.20	25.37
21 13 16 00-0034	EA		>22-3/4" To 24-3/4" Length, Dry Pipe Pendant Head	107.20	25.37
21 13 16 00-0035	EA		>24-3/4" To 26-3/4" Length, Dry Pipe Pendant Head	108.80	25.37
21 13 16 00-0036	EA		>26-3/4" To 28-3/4" Length, Dry Pipe Pendant Head	112.01	25.37
21 13 19			Precision Sprinkler Systems (21 13)		
21 13 19 00-0001			Complete Precision Sprinkler Systems (21 13 19) Note: Includes complete design per NFPA 13 and stamped shop drawings approved by a registered engineer. Includes all branch line piping (standard weight black steel, less than 2-1/2" diameter pipe, fittings, branch valves, hangers, sprinkler heads, etc. From riser pipe and mains. Excludes outside mains, inside vertical or horizontal pipe mains, greater than 2" diameter. The coverage of one sprinkler head varies from about 180 SF for light hazard occupancy, about 155 SF for ordinary, 90 to about 130 SF for extra hazard conditions. Excludes special alarm valves, gate valves, check valves, flow control devices, water motor gong assembly, Siamese connections, standpipes and fittings, pipe mains and fittings, fire pumps and tanks.		
21 13 19 00-0002			Ordinary Hazard, Precision Sprinkler Systems (21 13 19 00-0001)		
21 13 19 00-0003	EA		Exposed Piping, Ordinary Hazard, Precision Sprinkler System, Per Head.....	304.08	
			Note: Includes branch pipe and fittings, supports and sprinkler heads.		
			For Up To 5, Add	143.02	
			For >5 To 10, Add	92.90	
			For >10 To 20, Add	62.49	
			For >20 To 40, Add	25.90	
			For >100 To 150, Deduct	-30.41	
			For >150, Deduct	-60.82	
21 13 19 00-0004			Extra Hazard, Precision Sprinkler Systems (21 13 19 00-0001)		
21 13 19 00-0005	EA		Exposed Piping, Extra Hazard, Precision Sprinkler System, Per Head.....	283.17	
			Note: Includes branch pipe and fittings, supports and sprinkler heads.		
			For Up To 5, Add	133.20	
			For >5 To 10, Add	86.53	
			For >10 To 20, Add	58.21	
			For >20 To 40, Add	24.12	
			For >100 To 150, Deduct	-28.32	
			For >150, Deduct	-56.63	
21 13 26			Deluge Fire-Suppression Sprinkler Systems (21 13)		
21 13 26 00-0001			Deluge Fire-Suppression Sprinkler Systems Equipment (21 13 26)		
21 13 26 00-0002			Deluge Fire-Suppression Sprinkler System Nozzles (21 13 26 00-0001)		
21 13 26 00-0003	EA		3/8" Auto Deluge Sprinkler Nozzle.....	72.41	33.09
21 13 26 00-0004	EA		1/2" Pendant Deluge Spring Nozzle With Open Head	72.41	33.09
21 13 26 00-0005	EA		1/2" Pendant Deluge Spring Nozzle Open Head With Canopy.....	72.41	33.09
21 13 26 00-0006			Deluge Valves With Required Trim And Release Equipment (21 13 26 00-0001)		
21 13 26 00-0007	EA		3" Deluge Valve With Trim And Release Equipment	3,982.75	428.53
21 13 26 00-0008	EA		4" Deluge Valve With Trim And Release Equipment	4,562.66	482.05
21 13 26 00-0009	EA		6" Deluge Valve With Trim And Release Equipment	5,703.76	701.17
21 13 39			Foam-Water Systems (21 13)		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
21 13 39 00-0001 Foam Control Valves And Monitors <small>(21 13 39)</small>		
21 13 39 00-0002 Control Valves <small>(21 13 39 00-0001)</small>		
21 13 39 00-0003 EA 3" Foam Control Valve.....	1,991.11	428.53
21 13 39 00-0004 Supply Valves <small>(21 13 39 00-0001)</small>		
21 13 39 00-0005 EA 2-1/2" Foam Supply Valve.....	1,846.20	482.05
21 13 39 00-0006 Proportioners <small>(21 13 39 00-0001)</small>		
21 13 39 00-0007 EA 8" Foam Proportioner.....	1,684.33	701.17
21 13 39 00-0008 Monitors <small>(21 13 39 00-0001)</small>		
21 13 39 00-0009 EA Oscillating Foam Monitor.....	1,881.98	96.41
21 13 41 Fire-Suppression Sprinkler Piping <small>(21 13)</small>		
<small>See CSI section 23 21 13 23-0000 for black steel piping.</small>		
21 13 41 00-0001 Chlorinated Polyvinyl Chloride (CPVC) Fire Sprinkler Pipe <small>(21 13 41)</small>		
<small>Note: SDR 13.5</small>		
21 13 41 00-0002 Schedule 40 Chlorinated Polyvinyl Chloride (CPVC) Fire Sprinkler Pipe <small>(21 13 41 00-0001)</small>		
21 13 41 00-0003 LF 3/4" Schedule 40 Chlorinated Polyvinyl Chloride (CPVC) Fire Sprinkler Pipe.....	3.83	1.23
21 13 41 00-0004 LF 1" Schedule 40 Chlorinated Polyvinyl Chloride (CPVC) Fire Sprinkler Pipe.....	4.46	1.31
21 13 41 00-0005 LF 1-1/4" Schedule 40 Chlorinated Polyvinyl Chloride (CPVC) Fire Sprinkler Pipe.....	5.44	1.46
21 13 41 00-0006 LF 1-1/2" Schedule 40 Chlorinated Polyvinyl Chloride (CPVC) Fire Sprinkler Pipe.....	6.51	1.62
21 13 41 00-0007 LF 2" Schedule 40 Chlorinated Polyvinyl Chloride (CPVC) Fire Sprinkler Pipe.....	8.14	1.77
21 13 41 00-0008 LF 2-1/2" Schedule 40 Chlorinated Polyvinyl Chloride (CPVC) Fire Sprinkler Pipe.....	10.80	2.01
21 13 41 00-0009 LF 3" Schedule 40 Chlorinated Polyvinyl Chloride (CPVC) Fire Sprinkler Pipe.....	14.73	2.39
21 13 41 00-0010 Chlorinated Polyvinyl Chloride (CPVC) 90 Degree Elbows, Fire Sprinkler Piping <small>(21 13 41 00-0001)</small>		
21 13 41 00-0011 EA 3/4" Schedule 40 Chlorinated Polyvinyl Chloride (CPVC) 90 Degree Elbow, Fire Sprinkler Piping.....	19.49	7.41
21 13 41 00-0012 EA 1" Schedule 40 Chlorinated Polyvinyl Chloride (CPVC) 90 Degree Elbow, Fire Sprinkler Piping.....	25.33	9.26
21 13 41 00-0013 EA 1-1/4" Schedule 40 Chlorinated Polyvinyl Chloride (CPVC) 90 Degree Elbow, Fire Sprinkler Piping.....	31.68	11.57
21 13 41 00-0014 EA 1-1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) 90 Degree Elbow, Fire Sprinkler Piping.....	35.87	12.81
21 13 41 00-0015 EA 2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) 90 Degree Elbow, Fire Sprinkler Piping.....	40.52	14.35
21 13 41 00-0016 EA 2-1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) 90 Degree Elbow, Fire Sprinkler Piping.....	49.81	16.27
21 13 41 00-0017 EA 3" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) 90 Degree Elbow, Fire Sprinkler Piping.....	60.49	19.29
21 13 41 00-0018 Chlorinated Polyvinyl Chloride (CPVC) 45 Degree Elbows, Fire Sprinkler Piping <small>(21 13 41 00-0001)</small>		
21 13 41 00-0019 EA 3/4" Schedule 40 Chlorinated Polyvinyl Chloride (CPVC) 45 Degree Elbow, Fire Sprinkler Piping.....	19.83	7.41
21 13 41 00-0020 EA 1" Schedule 40 Chlorinated Polyvinyl Chloride (CPVC) 45 Degree Elbow, Fire Sprinkler Piping.....	24.78	9.26
21 13 41 00-0021 EA 1-1/4" Schedule 40 Chlorinated Polyvinyl Chloride (CPVC) 45 Degree Elbow, Fire Sprinkler Piping.....	31.27	11.57
21 13 41 00-0022 EA 1-1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) 45 Degree Elbow, Fire Sprinkler Piping.....	35.21	12.81
21 13 41 00-0023 EA 2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) 45 Degree Elbow, Fire Sprinkler Piping.....	39.69	14.35
21 13 41 00-0024 EA 2-1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) 45 Degree Elbow, Fire Sprinkler Piping.....	47.72	16.27
21 13 41 00-0025 EA 3" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) 45 Degree Elbow, Fire Sprinkler Piping.....	58.19	19.29
21 13 41 00-0026 Chlorinated Polyvinyl Chloride (CPVC) Tees, Fire Sprinkler Piping <small>(21 13 41 00-0001)</small>		
21 13 41 00-0027 EA 3/4" Schedule 40 Chlorinated Polyvinyl Chloride (CPVC) Tee, Fire Sprinkler Piping.....	29.09	11.10
21 13 41 00-0028 EA 1" Schedule 40 Chlorinated Polyvinyl Chloride (CPVC) Tee, Fire Sprinkler Piping.....	37.47	13.97
21 13 41 00-0029 EA 1-1/4" Schedule 40 Chlorinated Polyvinyl Chloride (CPVC) Tee, Fire Sprinkler Piping.....	47.43	17.43
21 13 41 00-0030 EA 1-1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Tee, Fire Sprinkler Piping.....	53.91	19.29
21 13 41 00-0031 EA 2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Tee, Fire Sprinkler Piping.....	62.24	21.44
21 13 41 00-0032 EA 2-1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Tee, Fire Sprinkler Piping.....	75.00	24.45
21 13 41 00-0033 EA 3" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Tee, Fire Sprinkler Piping.....	88.61	28.85
21 13 41 00-0034 Chlorinated Polyvinyl Chloride (CPVC) Reducing Tees, Fire Sprinkler Piping <small>(21 13 41 00-0001)</small>		
21 13 41 00-0035 EA 1" Schedule 40 Chlorinated Polyvinyl Chloride (CPVC) Reducing Tee, Fire Sprinkler Piping.....	34.69	13.04
21 13 41 00-0036 EA 1-1/4" Schedule 40 Chlorinated Polyvinyl Chloride (CPVC) Reducing Tee, Fire Sprinkler Piping.....	44.64	16.27
21 13 41 00-0037 EA 1-1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Reducing Tee, Fire Sprinkler Piping.....	49.83	17.98
21 13 41 00-0038 EA 2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Reducing Tee, Fire Sprinkler Piping.....	58.01	20.05
21 13 41 00-0039 EA 2-1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Reducing Tee, Fire Sprinkler Piping.....	67.82	22.83
21 13 41 00-0040 EA 3" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Reducing Tee, Fire Sprinkler Piping.....	79.90	26.92
21 13 41 00-0041 Chlorinated Polyvinyl Chloride (CPVC) Crosses, Fire Sprinkler Piping <small>(21 13 41 00-0001)</small>		
21 13 41 00-0042 EA 3/4" Schedule 40 Chlorinated Polyvinyl Chloride (CPVC) Cross, Fire Sprinkler Piping.....	39.11	14.81

21	Fire Suppression
21 10	Water-Based Fire-Suppression Systems
21 13	Fire-Suppression Sprinkler Systems



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
	21 13 41 00-0043	EA	1" Schedule 40 Chlorinated Polyvinyl Chloride (CPVC) Cross, Fire Sprinkler Piping	49.04	18.59
	21 13 41 00-0044	EA	1-1/4" Schedule 40 Chlorinated Polyvinyl Chloride (CPVC) Cross, Fire Sprinkler Piping	61.62	23.21
	21 13 41 00-0045	EA	1-1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Cross, Fire Sprinkler Piping	69.11	25.68
	21 13 41 00-0046	EA	2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Cross, Fire Sprinkler Piping	79.72	28.62
	21 13 41 00-0047	EA	2-1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Cross, Fire Sprinkler Piping	99.18	32.54
21 13 41 00-0048			Chlorinated Polyvinyl Chloride (CPVC) Couplings, Fire Sprinkler Piping <small>(21 13 41 00-0001)</small>		
	21 13 41 00-0049	EA	3/4" Schedule 40 Chlorinated Polyvinyl Chloride (CPVC) Coupling, Fire Sprinkler Piping.....	13.28	4.94
	21 13 41 00-0050	EA	1" Schedule 40 Chlorinated Polyvinyl Chloride (CPVC) Coupling, Fire Sprinkler Piping.....	17.80	6.63
	21 13 41 00-0051	EA	1-1/4" Schedule 40 Chlorinated Polyvinyl Chloride (CPVC) Coupling, Fire Sprinkler Piping	23.53	8.72
	21 13 41 00-0052	EA	1-1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Coupling, Fire Sprinkler Piping	26.60	9.64
	21 13 41 00-0053	EA	2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Coupling, Fire Sprinkler Piping.....	30.28	10.72
	21 13 41 00-0054	EA	2-1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Coupling, Fire Sprinkler Piping	35.80	12.18
	21 13 41 00-0055	EA	3" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Coupling, Fire Sprinkler Piping.....	42.95	14.42
21 13 41 00-0056			Chlorinated Polyvinyl Chloride (CPVC) Caps, Fire Sprinkler Piping <small>(21 13 41 00-0001)</small>		
	21 13 41 00-0057	EA	3/4" Schedule 40 Chlorinated Polyvinyl Chloride (CPVC) Cap, Fire Sprinkler Piping	6.73	2.47
	21 13 41 00-0058	EA	1" Schedule 40 Chlorinated Polyvinyl Chloride (CPVC) Cap, Fire Sprinkler Piping.....	10.74	4.01
	21 13 41 00-0059	EA	1-1/4" Schedule 40 Chlorinated Polyvinyl Chloride (CPVC) Cap, Fire Sprinkler Piping.....	12.16	4.32
	21 13 41 00-0060	EA	1-1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Cap, Fire Sprinkler Piping	13.81	4.79
	21 13 41 00-0061	EA	2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Cap, Fire Sprinkler Piping.....	16.10	5.40
	21 13 41 00-0062	EA	2-1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Cap, Fire Sprinkler Piping.....	19.15	6.10
	21 13 41 00-0063	EA	3" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Cap, Fire Sprinkler Piping.....	24.32	7.25
21 13 41 00-0064			Chlorinated Polyvinyl Chloride (CPVC) Reducer Bushing, Fire Sprinkler Piping <small>(21 13 41 00-0001)</small>		
	21 13 41 00-0065	EA	1" Schedule 40 Chlorinated Polyvinyl Chloride (CPVC) Reducing Bushing, Fire Sprinkler Piping.....	19.01	7.33
	21 13 41 00-0066	EA	1-1/4" Schedule 40 Chlorinated Polyvinyl Chloride (CPVC) Reducing Bushing, Fire Sprinkler Piping	25.09	9.56
	21 13 41 00-0067	EA	1-1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Reducing Bushing, Fire Sprinkler Piping	27.75	10.57
	21 13 41 00-0068	EA	2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Reducing Bushing, Fire Sprinkler Piping.....	31.42	11.80
	21 13 41 00-0069	EA	2-1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Reducing Bushing, Fire Sprinkler Piping	36.85	13.42
	21 13 41 00-0070	EA	3" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Reducing Bushing, Fire Sprinkler Piping.....	44.59	15.89
21 13 41 00-0071			Chlorinated Polyvinyl Chloride (CPVC) Spigot Style Reducing Adapter, Male Slip x Female Pipe Thread, Fire Sprinkler Piping <small>(21 13 41 00-0001)</small>		
	21 13 41 00-0072	EA	3/4" Schedule 40 Chlorinated Polyvinyl Chloride (CPVC) Spigot Style Reducing Adapter, Male Slip X Female Pipe Thread, Fire Sprinkler Piping	16.00	5.40
	21 13 41 00-0073	EA	1" Schedule 40 Chlorinated Polyvinyl Chloride (CPVC) Spigot Style Reducing Adapter, Male Slip X Female Pipe Thread, Fire Sprinkler Piping	20.86	7.33
21 13 41 00-0074			Chlorinated Polyvinyl Chloride (CPVC) Reducing Adapter, Female Slip x Female Pipe Thread, Fire Sprinkler Piping <small>(21 13 41 00-0001)</small>		
	21 13 41 00-0075	EA	3/4" Schedule 40 Chlorinated Polyvinyl Chloride (CPVC) Reducing Adapter, Female Slip x Female Pipe Thread, Fire Sprinkler Piping	16.00	5.40
	21 13 41 00-0076	EA	1" Schedule 40 Chlorinated Polyvinyl Chloride (CPVC) Reducing Adapter, Female Slip x Female Pipe Thread, Fire Sprinkler Piping	20.86	7.33
21 13 41 00-0077			Chlorinated Polyvinyl Chloride (CPVC) Reducing 90 Degree Elbow Adapter, Female Slip x Female Pipe Thread, Fire Sprinkler Piping <small>(21 13 41 00-0001)</small>		
	21 13 41 00-0078	EA	3/4" Schedule 40 Chlorinated Polyvinyl Chloride (CPVC) Reducing 90 Degree Elbow Adapter With 1/2" FPT, Female Slip x Female Pipe Thread, Fire Sprinkler Piping	18.93	6.63
	21 13 41 00-0079	EA	1" Schedule 40 Chlorinated Polyvinyl Chloride (CPVC) Reducing 90 Degree Elbow Adapter With 1/2" FPT, Female Slip x Female Pipe Thread, Fire Sprinkler Piping	24.07	8.33
	21 13 41 00-0080	EA	1" Schedule 40 Chlorinated Polyvinyl Chloride (CPVC) Reducing 90 Degree Elbow Adapter With 3/4" FPT, Female Slip x Female Pipe Thread, Fire Sprinkler Piping	24.77	8.33
21 13 41 00-0081			Chlorinated Polyvinyl Chloride (CPVC) Straight Tee Adapter, Female Slip x Female Pipe Thread, Fire Sprinkler Piping <small>(21 13 41 00-0001)</small>		
	21 13 41 00-0082	EA	3/4" Schedule 40 Chlorinated Polyvinyl Chloride (CPVC) Straight Tee Adapter With 1/2" FPT, Female Slip x Female Pipe Thread, Fire Sprinkler Piping	31.21	11.10
	21 13 41 00-0083	EA	1" Schedule 40 Chlorinated Polyvinyl Chloride (CPVC) Straight Tee Adapter With 1/2" FPT, Female Slip x Female Pipe Thread, Fire Sprinkler Piping.....	38.58	13.97
	21 13 41 00-0084	EA	1-1/4" Schedule 40 Chlorinated Polyvinyl Chloride (CPVC) Straight Tee Adapter With 1/2" FPT, Female Slip x Female Pipe Thread, Fire Sprinkler Piping	49.69	17.43
	21 13 41 00-0085	EA	1-1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Straight Tee Adapter With 1/2" FPT, Female Slip x Female Pipe Thread, Fire Sprinkler Piping.....	56.31	19.29
	21 13 41 00-0086	EA	2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Straight Tee Adapter With 1/2" FPT, Female Slip x Female Pipe Thread, Fire Sprinkler Piping.....	65.16	21.44

21 16 Fire-Suppression Pressure Maintenance Pumps (21 10)



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
21 16 00 00-0001				Jockey Pumps ^(21 16) Note: Includes pump and controller.		
21 16 00 00-0002	EA			Jockey Pump And Controller	4,058.50	376.13
21 20 Fire-Extinguishing Systems ⁽²¹⁾						
21 21 Carbon-Dioxide Fire-Extinguishing Systems ^(21 20)						
21 21 16 Carbon-Dioxide Fire-Extinguishing Equipment ^(21 21)						
21 21 16 00-0001 Carbon Dioxide Cylinders ^(21 21 16)						
21 21 16 00-0002	EA			Carbon Dioxide Simplex Cylinder, 75 LB.....	990.36	161.70
21 21 16 00-0003	EA			Carbon Dioxide Duplex Cylinder, 75 LB (Each)	1,980.72	323.41
21 21 16 00-0004	EA			Carbon Dioxide Cylinder, Heat/Ion Detector, With Bracket.....	184.60	85.40
21 21 16 00-0005	EA			Carbon Dioxide Cylinder, Dispersion Nozzle	76.42	29.55
21 21 16 00-0006	LF			Carbon Dioxide Cylinder, 1/2" Rubber Tubing.....	22.53	11.98
21 22 Clean-Agent Fire-Extinguishing Systems ^(21 20)						
21 22 16 Clean-Agent Fire-Extinguishing Equipment ^(21 22)						
21 22 16 00-0001 Ansul Fire Control Systems ^(21 22 16)						
21 22 16 00-0002 Sapphire® Fire Suppression Systems ^(21 22 16 00-0001) Note: ANSUL® SAPPHIRE® fire suppression systems use 3M™ Novect™ 1230 fire protection fluid for total flooding applications.						
21 22 16 00-0003 Cylinders, Sapphire® Fire Suppression Systems ^(21 22 16 00-0002)						
21 22 16 00-0004	EA			20 LB, Empty Tank And Valve Assembly, Sapphire® Fire Suppression Systems (Ansul 570635)..... Note: 10 to 21 LB tank capacity. Excludes Sapphire agent.	1,187.73	55.13
21 22 16 00-0005	EA			40 LB, Empty Tank And Valve Assembly, Sapphire® Fire Suppression Systems (Ansul 570636)..... Note: 20 to 46 LB tank capacity. Excludes Sapphire agent.	1,355.71	55.13
21 22 16 00-0006	EA			80 LB, Empty Tank And Valve Assembly, Sapphire® Fire Suppression Systems (Ansul 570637)..... Note: 41 to 80 LB tank capacity. Excludes Sapphire agent.	1,377.80	55.13
21 22 16 00-0007	EA			140 LB, Empty Tank And Valve Assembly, Sapphire® Fire Suppression Systems (Ansul 570638)..... Note: 58 to 138 LB tank capacity. Excludes Sapphire agent.	1,956.65	73.50
21 22 16 00-0008	EA			280 LB, Empty Tank And Valve Assembly, Sapphire® Fire Suppression Systems (Ansul 570639)..... Note: 116 to 280 LB tank capacity. Excludes Sapphire agent.	2,067.70	73.50
21 22 16 00-0009	EA			390 LB, Empty Tank And Valve Assembly, Sapphire® Fire Suppression Systems (Ansul 570640)..... Note: 161 to 388 LB tank capacity. Excludes Sapphire agent.	2,207.62	91.88
21 22 16 00-0010	EA			450 LB, Empty Tank And Valve Assembly, Sapphire® Fire Suppression Systems (Ansul 570641)..... Note: 194 to 459 LB tank capacity. Excludes Sapphire agent.	2,343.02	91.88
21 22 16 00-0011	EA			850 LB, Empty Tank And Valve Assembly, Sapphire® Fire Suppression Systems (Ansul 570586)..... Note: 375 to 851 LB tank capacity. Excludes Sapphire agent.	3,539.64	110.25
21 22 16 00-0012	LB			Sapphire Agent. Fire Protection Fluid, Factory Filled (Novect 1230)	30.00	110.25
21 22 16 00-0013 Nozzles, Sapphire® Fire Suppression Systems ^(21 22 16 00-0002)						
21 22 16 00-0014	EA			1/2" Drilled Brass Nozzle, 180 Degree, Sapphire® Fire Suppression System (Ansul 570515)	112.95	9.19
21 22 16 00-0015	EA			3/4" Drilled Brass Nozzle, 180 Degree, Sapphire® Fire Suppression System (Ansul 570516)	115.81	9.19
21 22 16 00-0016	EA			1" Drilled Brass Nozzle, 180 Degree, Sapphire® Fire Suppression System (Ansul 570517)	122.98	9.19
21 22 16 00-0017	EA			1-1/4" Drilled Brass Nozzle, 180 Degree, Sapphire® Fire Suppression System (Ansul 570518)	128.00	9.19
21 22 16 00-0018	EA			1-1/2" Drilled Brass Nozzle, 180 Degree, Sapphire® Fire Suppression System (Ansul 570519)	135.16	9.19
21 22 16 00-0019	EA			2" Drilled Brass Nozzle, 180 Degree, Sapphire® Fire Suppression System (Ansul 570520)	156.64	9.19
21 22 16 00-0020	EA			1/2" Drilled Brass Nozzle, 360 Degree, Sapphire® Fire Suppression System (Ansul 570602)	112.95	9.19
21 22 16 00-0021	EA			3/4" Drilled Brass Nozzle, 360 Degree, Sapphire® Fire Suppression System (Ansul 570603)	115.81	9.19
21 22 16 00-0022	EA			1" Drilled Brass Nozzle, 360 Degree, Sapphire® Fire Suppression System (Ansul 570604)	122.98	9.19
21 22 16 00-0023	EA			1-1/4" Drilled Brass Nozzle, 360 Degree, Sapphire® Fire Suppression System (Ansul 570605)	128.00	9.19
21 22 16 00-0024	EA			1-1/2" Drilled Brass Nozzle, 360 Degree, Sapphire® Fire Suppression System (Ansul 570606)	135.16	9.19
21 22 16 00-0025	EA			2" Drilled Brass Nozzle, 360 Degree, Sapphire® Fire Suppression System (Ansul 570607)	156.64	9.19
21 22 16 00-0026 Actuation Attachments, Sapphire® Fire Suppression System ^(21 22 16 00-0002)						
21 22 16 00-0027	EA			7/16-20 To 1/4" NPT, Male Actuation Elbow, Sapphire® Fire Suppression System (Ansul 31810).....	9.93	2.76
21 22 16 00-0028	EA			7/16-20 To 1/4" NPT, Male Actuation Tee, Sapphire® Fire Suppression System (Ansul 31811)	11.16	2.76
21 22 16 00-0029	EA			1/4" NPT To 7/16-20, Male Actuation Connector, Sapphire® Fire Suppression System (Ansul 32338).....	14.87	6.43
21 22 16 00-0030	EA			16" Actuation Hose, Sapphire® Fire Suppression System (Ansul 73597)	35.93	8.23
21 22 16 00-0031	EA			32" Actuation Hose, Sapphire® Fire Suppression System (Ansul 415142).....	53.72	8.23
21 22 16 00-0032	EA			42" Actuation Hose, Sapphire® Fire Suppression System (Ansul 430815)	65.06	8.23
21 22 16 00-0033	EA			24", Stainless Steel, Swivel, Braided Actuation Hose, Sapphire® Fire Suppression System (Ansul 32336).....	31.84	8.23
21 22 16 00-0034	EA			Pneumatic Actuator Shipping Assembly, Sapphire® Fire Suppression System (Ansul 570537)	219.36	73.50
21 22 16 00-0035	EA			Local Manual Actuator, Sapphire® Fire Suppression System (Ansul 570549)	213.41	55.13
21 22 16 00-0036	EA			Electric Actuator Shipping Assembly, Sapphire® Fire Suppression System (Ansul 570537)	485.87	73.50
21 22 16 00-0037 Nameplates, Sapphire® Fire Suppression Systems ^(21 22 16 00-0002)						
21 22 16 00-0038	EA			Warning Plate For Use Outside Room, Sapphire® Fire Suppression Systems (Ansul 570580).....	35.57	9.19
21 22 16 00-0039	EA			Warning Plate for Use Inside Room, Sapphire® Fire Suppression Systems (Ansul 570581)	38.81	9.19

21	Fire Suppression
21 20	Fire-Extinguishing Systems
21 22	Clean-Agent Fire-Extinguishing Systems



MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
21 22 16 00-0040		Cylinder Bracketing, Sapphire® Fire Suppression Systems (21 22 16 00-0002)			
21 22 16 00-0041	EA	Tank Bracket Assembly For 20 LB, 40 LB, 50 LB, 80 LB And 90 LB Tanks, Sapphire® Fire Suppression Systems (Ansul 570085)	109.58		27.56
21 22 16 00-0042	EA	Tank Bracket Assembly For 140 LB, 280 LB, 390 LB And 450 LB Tanks, Sapphire® Fire Suppression Systems (Ansul 570085)	116.03		27.56
21 22 16 00-0043	EA	Tank Bracket Assembly For 850 LB Tanks, Sapphire® Fire Suppression Systems (Ansul 570336)	124.27		27.56
21 22 16 00-0044		Check Valves, Sapphire® Fire Suppression Systems (21 22 16 00-0002)			
21 22 16 00-0045	EA	1" Manifold Check Valve, Sapphire® Fire Suppression Systems (Ansul 570566)	302.60		29.26
21 22 16 00-0046	EA	2" Manifold Check Valve, Sapphire® Fire Suppression Systems (Ansul 570568)	424.38		50.20
21 22 16 00-0047		Discharge Hose, Sapphire® Fire Suppression Systems (21 22 16 00-0002)			
21 22 16 00-0048	EA	1" Flexible Discharge Hose, Sapphire® Fire Suppression Systems (Ansul 570539)	93.35		18.38
21 22 16 00-0049	EA	2" Flexible Discharge Hose, Sapphire® Fire Suppression Systems (Ansul 570538)	356.99		18.38
21 22 16 00-0050	EA	3" Flexible Discharge Hose, Sapphire® Fire Suppression Systems (Ansul 69990)	300.39		18.38
21 22 16 00-0051	EA	3" Discharge Hose And Check Valve Assembly, Sapphire® Fire Suppression Systems (Ansul 69841)	1,313.32		73.50
21 22 16 00-0052		Swivel Adaptors, Sapphire® Fire Suppression Systems (21 22 16 00-0002)			
21 22 16 00-0053	EA	1" Single-Tank Swivel Adaptor, Sapphire® Fire Suppression Systems (Ansul 570557)	33.14		12.86
21 22 16 00-0054	EA	2" Single-Tank Swivel Adaptor, Sapphire® Fire Suppression Systems (Ansul 570558)	59.93		12.86
21 22 16 00-0055	EA	3" Flare To 3" Grooved, Single-Tank Swivel Adaptor, Sapphire® Fire Suppression Systems (Ansul 69471)	168.83		9.19
21 22 16 00-0056	EA	3" Flare To 3" NPT, Single-Tank Swivel Adaptor, Sapphire® Fire Suppression Systems (Ansul 69470)	217.82		9.19
21 22 16 00-0057		Pressure Switches, Sapphire® Fire Suppression Systems (21 22 16 00-0002)			
21 22 16 00-0058	EA	Cylinder Low Pressure Switch, Sapphire® Fire Suppression Systems (Ansul 570585)	121.14		36.75
21 22 16 00-0059	EA	Pressure Trip, Sapphire® Fire Suppression Systems (Ansul 5156)	124.72		15.43
21 22 16 00-0060	EA	Weather Proof, DPST Pressure Switch, Sapphire® Fire Suppression Systems (Ansul 46250)	381.52		64.31
21 22 16 00-0061		Level Indicators, Sapphire® Fire Suppression Systems (21 22 16 00-0002)			
21 22 16 00-0062	EA	Liquid Level Indicator For 280 LB Tanks, Sapphire® Fire Suppression Systems (Ansul 570277)	454.14		12.86
21 22 16 00-0063	EA	Liquid Level Indicator For 390 LB And 850 LB Tanks, Sapphire® Fire Suppression Systems (Ansul 570278)	475.64		12.86
21 22 16 00-0064	EA	Liquid Level Indicator For 450 LB Tanks, Sapphire® Fire Suppression Systems (Ansul 570589)	508.86		18.38
21 22 16 00-0065		Inspection/Maintenance Devices, Sapphire® Fire Suppression Systems (21 22 16 00-0002)			
21 22 16 00-0066	EA	Master Tank Pilot Port Male Adaptor, Sapphire® Fire Suppression Systems (Ansul 570342)	33.51		11.02
21 22 16 00-0067	EA	Cylinder Valve Pressure Gauge, Sapphire® Fire Suppression Systems (Ansul 570642)	42.13		12.86
21 22 16 00-0068	EA	Recharge Top Adaptor Assembly, Sapphire® Fire Suppression Systems (Ansul 570579)	139.05		55.13
21 22 16 00-0069	EA	1" Recharge Fill Adaptor Assembly, Sapphire® Fire Suppression Systems (Ansul 570576)	163.62		55.13
21 22 16 00-0070	EA	2" Recharge Fill Adaptor Assembly, Sapphire® Fire Suppression Systems (Ansul 570592)	184.04		55.13
21 22 16 00-0071	EA	3" Recharge Fill Adaptor Assembly, Sapphire® Fire Suppression Systems (Ansul 69891)	249.95		55.13
21 22 16 00-0072		Replacement Parts, Sapphire® Fire Suppression Systems (21 22 16 00-0002)			
21 22 16 00-0073	EA	O-Ring Kit, Sapphire® Fire Suppression Systems (Ansul 570559)	39.71		14.70
21 22 16 00-0074	EA	Recoil Cap, Sapphire® Fire Suppression Systems (Ansul 570553)	67.45		9.19
21 22 16 00-0075	EA	Burst Disc Assembly, Sapphire® Fire Suppression Systems (Ansul 570053)	90.13		18.38
21 22 16 00-0076	EA	Bonnet Assembly, Sapphire® Fire Suppression Systems (Ansul 570543)	234.41		73.50
21 22 16 00-0077	EA	Piston Assembly, Sapphire® Fire Suppression Systems (Ansul 570551)	359.77		73.50
21 22 16 00-0078	EA	1" Valve Assembly, Sapphire® Fire Suppression Systems (Ansul 570535)	1,238.80		73.50
21 22 16 00-0079		Inergen® Fire Suppression System (21 22 16 00-0001)			
21 22 16 00-0080		Actuation Attachments, Inergen® Fire Suppression System (21 22 16 00-0079)			
21 22 16 00-0081	EA	Flexible Discharge Bend For CV90 And CV98 (200 Bar), Inergen® Fire Suppression System (Ansul 427082)	131.71		18.21
21 22 16 00-0082	EA	Metron Protractor Replacement Cartridges, Inergen® Fire Suppression System (Ansul 423958)	153.35		19.57
21 22 16 00-0083	EA	Electric Actuator, Lever, CV98, Inergen® Fire Suppression System (Ansul 423309)	274.34		35.43
21 22 16 00-0084	EA	Electric Actuator For CV90 Valve, Inergen® Fire Suppression System (Ansul 426876)	550.42		80.68
21 22 16 00-0085		Check Valves, Inergen® Fire Suppression System (21 22 16 00-0079)			
21 22 16 00-0086	EA	2" Bronze Check Valve, Weld Neck Flange, Inergen® Fire Suppression System (Ansul 840794)	1,380.23		127.65
21 22 16 00-0087		Components, Inergen® Fire Suppression System (21 22 16 00-0079)			
21 22 16 00-0088	EA	1/2" Manifold Relief Valve, Inergen® Fire Suppression System (Ansul 418378)	39.10		5.58
21 22 16 00-0089	EA	Pressure Operated Siren, Inergen® Fire Suppression System (Ansul 419700)	460.68		59.82
21 22 16 00-0090	EA	30 Second Pneumatic Time Delay, Inergen® Fire Suppression System (Ansul 54169)	1,433.98		187.19
21 22 16 00-0091	EA	60 Second Time Delay, Inergen® Fire Suppression System (Ansul 426170)	1,365.05		190.71



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
21 22 16 00-0092 Cylinders, Inergen® Fire Suppression System <small>(21 22 16 00-0079)</small>		
<small>Note: Includes CV98 valve. Factory filled with Inergen agent.</small>		
21 22 16 00-0093 EA 200 CF Cylinder, Standard Paint, Inergen® Fire Suppression System (Ansul 426147)	1,193.73	171.33
21 22 16 00-0094 EA 250 CF Cylinder, Standard Paint, Inergen® Fire Suppression System (Ansul 426148)	1,354.16	194.10
21 22 16 00-0095 EA 350 CF Cylinder, Standard Paint, Inergen® Fire Suppression System (Ansul 426620)	1,941.28	251.54
21 22 16 00-0096 EA 435 CF Cylinder, Standard Paint, Inergen® Fire Suppression System (Ansul 426150)	1,939.27	307.36
21 22 16 00-0097 EA 250 CF Cylinder, Corrosion Resistant Paint, Inergen® Fire Suppression System (Ansul 426257)	1,398.62	216.42
21 22 16 00-0098 EA 350 CF Cylinder, Corrosion Resistant Paint, Inergen® Fire Suppression System (Ansul 426621)	1,986.07	273.94
21 22 16 00-0099 EA 435 CF Cylinder, Corrosion Resistant Paint, Inergen® Fire Suppression System (Ansul 426259)	2,043.56	330.29
21 22 16 00-0100 Inspection/Maintenance Devices, Inergen® Fire Suppression System <small>(21 22 16 00-0079)</small>		
21 22 16 00-0101 EA CV90 Fill Adaptor To CV98 Valve, Conversion Adapter, Inergen® Fire Suppression System (Ansul 423657)	45.09	6.23
21 22 16 00-0102 EA CV98 To CV90 Conversion Adapter, Cylinder Test Gauge, Inergen® Fire Suppression System (Ansul 426181)	45.09	6.23
21 22 16 00-0103 EA CV90 Pressure Test Assembly Venting Kit, Inergen® Fire Suppression System (Ansul 426954)	54.45	6.92
21 22 16 00-0104 EA Pressure Test Gauge, Inergen® Fire Suppression System (Ansul 423923)	858.99	118.88
21 22 16 00-0105 Multiple Cylinder Bracketing, Inergen® Fire Suppression System <small>(21 22 16 00-0079)</small>		
21 22 16 00-0106 EA 13" Carriage Bolt With Nut, Multiple Cylinder Bracketing, Inergen® Fire Suppression System (Ansul 418502)	14.49	1.82
<small>Note: For single row 435 cubic foot cylinders.</small>		
21 22 16 00-0107 EA 27" Carriage Bolt With Nut, Multiple Cylinder Bracketing, Inergen® Fire Suppression System (Ansul 418503)	20.56	2.60
<small>Note: For double row 435 cubic foot cylinders.</small>		
21 22 16 00-0108 Nameplates, Inergen® Fire Suppression System <small>(21 22 16 00-0079)</small>		
21 22 16 00-0109 EA Warning Plate, Nameplate, Inside Room With Alarm, Inergen® Fire Suppression System (Ansul 416265)	15.98	2.03
21 22 16 00-0110 EA Warning Plate, Nameplate, Outside Room Without Alarm, Inergen® Fire Suppression System (Ansul 416266)	14.75	2.03
21 22 16 00-0111 Nozzle Deflector Shields, Inergen® Fire Suppression System <small>(21 22 16 00-0079)</small>		
21 22 16 00-0112 EA 1/2" Nozzle Deflector Shield, Inergen® Fire Suppression System (Ansul 417708)	64.12	8.77
21 22 16 00-0113 EA 3/4" Nozzle Deflector Shield, Inergen® Fire Suppression System (Ansul 417711)	67.27	9.19
21 22 16 00-0114 EA 1" Nozzle Deflector Shield, Inergen® Fire Suppression System (Ansul 417714)	78.18	10.61
21 22 16 00-0115 EA 1-1/4" Nozzle Deflector Shield, Inergen® Fire Suppression System (Ansul 417717)	87.12	11.98
21 22 16 00-0116 EA 1-1/2" Nozzle Deflector Shield, Inergen® Fire Suppression System (Ansul 417720)	99.94	13.78
21 22 16 00-0117 Nozzles, Inergen® Fire Suppression System <small>(21 22 16 00-0079)</small>		
21 22 16 00-0118 EA 1/4" NPT Nozzle, 360 Degree, Inergen® Fire Suppression System (Ansul 417908)	98.18	13.58
21 22 16 00-0119 EA 3/8" NPT Nozzle, 360 Degree, Inergen® Fire Suppression System (Ansul 417723)	101.87	13.98
21 22 16 00-0120 EA 1/2" NPT Nozzle, 360 Degree, Inergen® Fire Suppression System (Ansul 417362)	93.97	12.94
21 22 16 00-0121 EA 3/4" NPT Nozzle, 360 Degree, Inergen® Fire Suppression System (Ansul 417363)	96.14	13.98
21 22 16 00-0122 EA 1" NPT Nozzle, 360 Degree, Inergen® Fire Suppression System (Ansul 417364)	111.71	15.37
21 22 16 00-0123 EA 1-1/4" NPT Nozzle, 360 Degree, Inergen® Fire Suppression System (Ansul 417365)	119.44	16.38
21 22 16 00-0124 EA 1-1/2" NPT Nozzle, 360 Degree, Inergen® Fire Suppression System (Ansul 417366)	128.58	17.58
21 22 16 00-0125 EA 2" NPT Nozzle, Inergen® Fire Suppression System (Ansul 426155)	221.27	30.75
21 22 16 00-0126 EA 2-1/2" NPT Nozzle, Inergen® Fire Suppression System (Ansul 426156)	292.57	40.33
21 22 16 00-0127 EA 3" NPT Nozzle, Inergen® Fire Suppression System (Ansul 426137)	318.92	44.33
21 22 16 00-0128 EA 1/4" NPT Nozzle, 180 Degree Sidewall, Inergen® Fire Suppression System (Ansul 426138)	114.31	15.97
21 22 16 00-0129 EA 3/8" NPT Nozzle, 180 Degree Sidewall, Inergen® Fire Suppression System (Ansul 426139)	134.87	18.70
21 22 16 00-0130 EA 1/2" NPT Nozzle, 180 Degree Sidewall, Inergen® Fire Suppression System (Ansul 426140)	110.98	15.37
21 22 16 00-0131 EA 3/4" NPT Nozzle, 180 Degree Sidewall, Inergen® Fire Suppression System (Ansul 426141)	118.58	16.30
21 22 16 00-0132 EA 1" NPT Nozzle, 180 Degree Sidewall, Inergen® Fire Suppression System (Ansul 426142)	119.61	16.38
21 22 16 00-0133 EA 1-1/4" NPT Nozzle, 180 Degree Sidewall, Inergen® Fire Suppression System (Ansul 426143)	144.38	19.88
21 22 16 00-0134 EA 1-1/2" NPT Nozzle, 180 Degree Sidewall, Inergen® Fire Suppression System (Ansul 426157)	155.60	21.56
21 22 16 00-0135 EA 2" NPT Nozzle, 180 Degree Sidewall, Inergen® Fire Suppression System (Ansul 426144)	238.85	33.09
21 22 16 00-0136 EA 2-1/2" NPT Nozzle, 180 Degree Sidewall, Inergen® Fire Suppression System (Ansul 426145)	278.86	38.74
21 22 16 00-0137 EA 3" NPT Nozzle, 180 Degree Sidewall, Inergen® Fire Suppression System (Ansul 426146)	305.57	42.34
21 22 16 00-0138 Pressure Reducers, Inergen® Fire Suppression System <small>(21 22 16 00-0079)</small>		
21 22 16 00-0139 EA 1/2" NPT, Orifice Union, Pressure Reducer, Inergen® Fire Suppression System (Ansul 416677)	128.58	17.58
21 22 16 00-0140 EA 3/4" NPT, Orifice Union, Pressure Reducer, Inergen® Fire Suppression System (Ansul 416678)	157.72	21.89
21 22 16 00-0141 EA 1" NPT, Orifice Union, Pressure Reducer, Inergen® Fire Suppression System (Ansul 416679)	169.64	23.56
21 22 16 00-0142 EA 1-1/4" NPT, Orifice Union, Pressure Reducer, Inergen® Fire Suppression System (Ansul 416680)	238.85	33.09
21 22 16 00-0143 EA 1-1/2" NPT, Orifice Union, Pressure Reducer, Inergen® Fire Suppression System (Ansul 416681)	260.96	36.26
21 22 16 00-0144 EA 2" NPT, Orifice Union, Pressure Reducer, Inergen® Fire Suppression System (Ansul 416682)	306.60	42.34
21 22 16 00-0145 EA 2-1/2" NPT, Orifice Nipple, Pressure Reducer, Inergen® Fire Suppression System (Ansul 417057)	356.47	49.64
21 22 16 00-0146 EA 3" NPT, Orifice Nipple, Pressure Reducer, Inergen® Fire Suppression System (Ansul 417058)	421.42	58.71
21 22 16 00-0147 EA 2-1/2" NPT, Orifice Flanged, Pressure Reducer, Inergen® Fire Suppression System (Ansul 426823)	545.04	76.20
21 22 16 00-0148 EA 3" NPT, Orifice Flanged, Pressure Reducer, Inergen® Fire Suppression System (Ansul 426824)	726.61	101.45
21 22 16 00-0149 EA 4" NPT, Orifice Flanged, Pressure Reducer, Inergen® Fire Suppression System (Ansul 426825)	828.81	115.66
21 22 16 00-0150 EA 2-1/2" Slip-On, Orifice Flanged, Pressure Reducer, Inergen® Fire Suppression System (Ansul 426847)	525.39	73.21
21 22 16 00-0151 EA 3" Slip-On, Orifice Flanged, Pressure Reducer, Inergen® Fire Suppression System (Ansul 426848)	580.18	80.90
21 22 16 00-0152 EA 4" Slip-On, Orifice Flanged, Pressure Reducer, Inergen® Fire Suppression System (Ansul 426849)	828.81	115.66
21 22 16 00-0153 EA 2-1/2" Weld Neck, Orifice Flanged, Pressure Reducer, Inergen® Fire Suppression System (Ansul 426853)	541.54	75.49
21 22 16 00-0154 EA 3" Weld Neck, Orifice Flanged, Pressure Reducer, Inergen® Fire Suppression System (Ansul 426854)	603.00	84.07
21 22 16 00-0155 EA 4" Weld Neck, Orifice Flanged, Pressure Reducer, Inergen® Fire Suppression System (Ansul 426855)	827.33	123.52

21 Fire Suppression**21 20 Fire-Extinguishing Systems****21 22 Clean-Agent Fire-Extinguishing Systems**

MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
21 22 16 00-0156		Pressure Switches, Inergen® Fire Suppression System (21 22 16 00-0079)			
21 22 16 00-0157	EA	3PST, Pressure Switch, Inergen® Fire Suppression System (Ansul 842344)	603.20		88.26
21 22 16 00-0158		Releasing Device Equipment, Inergen® Fire Suppression System (21 22 16 00-0079)			
21 22 16 00-0159	EA	12 Or 24 Volt DC, Assembly, Automan II-C Releasing Device Equipment, Inergen® Fire Suppression System (Ansul 17728)	990.00		136.94
21 22 16 00-0160	EA	24 Volt DC, Explosion Proof Automan II-C Releasing Device Equipment, Inergen® Fire Suppression System (Ansul 31492)	1,410.77		182.47
21 22 16 00-0161	EA	120 Volt AC, Explosion Proof Automan II-C Releasing Device Equipment, Inergen® Fire Suppression System (Ansul 32525)	1,496.63		185.61
21 22 16 00-0162	EA	Cocking Lever For Automan II-C Releasing Device Equipment, Inergen® Fire Suppression System (Ansul 26310)	69.92		9.44
21 22 16 00-0163	EA	LT-30-R Nitrogen Cartridge, Releasing Device Equipment, Inergen® Fire Suppression System (Ansul 5373)	83.43		12.50
21 22 16 00-0164	EA	Remote Actuator Booster With N2 Cartridge, Releasing Device Equipment, Inergen® Fire Suppression System (Ansul 28939)	801.88		97.69
21 22 16 00-0165		Replacement Orifice Plates, Inergen® Fire Suppression System (21 22 16 00-0079)			
21 22 16 00-0166	EA	1/2" Replacement Orifice Plate, Inergen® Fire Suppression System (Ansul 418095)	87.86		9.27
21 22 16 00-0167	EA	3/4" Replacement Orifice Plate, Inergen® Fire Suppression System (Ansul 418096)	92.08		9.77
21 22 16 00-0168	EA	1" Replacement Orifice Plate, Inergen® Fire Suppression System (Ansul 418097)	96.72		9.93
21 22 16 00-0169	EA	1-1/4" Replacement Orifice Plate, Inergen® Fire Suppression System (Ansul 418098)	103.83		10.26
21 22 16 00-0170	EA	1-1/2" Replacement Orifice Plate, Inergen® Fire Suppression System (Ansul 418099)	107.99		11.26
21 22 16 00-0171	EA	2" Replacement Orifice Plate, Inergen® Fire Suppression System (Ansul 418100)	108.39		12.17
21 22 16 00-0172	EA	2-1/2" Replacement Orifice Plate, Inergen® Fire Suppression System (Ansul 426984)	237.08		32.62
21 22 16 00-0173	EA	3" Replacement Orifice Plate, Inergen® Fire Suppression System (Ansul 426985)	239.18		32.95
21 22 16 00-0174	EA	4" Replacement Orifice Plate, Inergen® Fire Suppression System (Ansul 426986)	306.60		42.23
21 22 16 00-0175		Single Cylinder Bracketing, Inergen® Fire Suppression System (21 22 16 00-0079)			
21 22 16 00-0176	EA	Strap For 435 CF Cylinder, Single Cylinder Bracketing, Inergen® Fire Suppression System (Ansul 427704)	111.71		15.37
21 22 16 00-0177	EA	Channel For 435 CF Cylinder, Single Cylinder Bracketing, Inergen® Fire Suppression System (Ansul 427705)	151.49		35.15
		Note: Includes saddle, padding and fasteners.			
21 22 16 00-0178		Single Mating Flanges, Flanged Manifold Orifices, Inergen® Fire Suppression System (21 22 16 00-0079)			
21 22 16 00-0179	EA	2 1/2" Threaded, Single Mating Flange, Flanged Manifold Orifices, Inergen® Fire Suppression System (Ansul 426856)	293.03		22.73
		Note: Includes gasket and fasteners.			
21 22 16 00-0180	EA	3" Threaded, Single Mating Flange, Flanged Manifold Orifices, Inergen® Fire Suppression System (Ansul 426857)	244.82		33.93
		Note: Includes gasket and fasteners.			
21 22 16 00-0181	EA	4" Threaded, Single Mating Flange, Flanged Manifold Orifices, Inergen® Fire Suppression System (Ansul 426858)	277.85		38.61
		Note: Includes gasket and fasteners.			
21 22 16 00-0182	EA	2-1/2" Slip-On, Single Mating Flange, Flanged Manifold Orifices, Inergen® Fire Suppression System (Ansul 426859)	153.50		21.22
		Note: Includes gasket and fasteners.			
21 22 16 00-0183	EA	3" Slip-On, Single Mating Flange, Flanged Manifold Orifices, Inergen® Fire Suppression System (Ansul 426860)	180.19		24.76
		Note: Includes gasket and fasteners.			
21 22 16 00-0184	EA	4" Slip-On, Single Mating Flange, Flanged Manifold Orifices, Inergen® Fire Suppression System (Ansul 426861)	272.89		37.95
		Note: Includes gasket and fasteners.			
21 22 16 00-0185	EA	2-1/2" Weld Neck, Single Mating Flange, Flanged Manifold Orifices, Inergen® Fire Suppression System (Ansul 426862)	159.80		22.23
		Note: Includes gasket and fasteners.			
21 22 16 00-0186	EA	3" Weld Neck, Single Mating Flange, Flanged Manifold Orifices, Inergen® Fire Suppression System (Ansul 426863)	187.23		25.91
		Note: Includes gasket and fasteners.			
21 22 16 00-0187	EA	4" Weld Neck, Single Mating Flange, Flanged Manifold Orifices, Inergen® Fire Suppression System (Ansul 426864)	297.82		41.45
		Note: Includes gasket and fasteners.			
21 22 16 00-0188	EA	2-1/2" Flange Gasket, Single Mating Flange, Flanged Manifold Orifices, Inergen® Fire Suppression System (Ansul 426828)	31.59		1.68
		Note: Includes a stainless steel inner ring and a carbon steel outer ring.			
21 22 16 00-0189	EA	3" Flange Gasket, Single Mating Flange, Flanged Manifold Orifices, Inergen® Fire Suppression System (Ansul 426829)	31.93		1.85
		Note: Includes a stainless steel inner ring and a carbon steel outer ring.			
21 22 16 00-0190	EA	4" Flange Gasket, Single Mating Flange, Flanged Manifold Orifices, Inergen® Fire Suppression System (Ansul 426830)	34.36		2.20
		Note: Includes a stainless steel inner ring and a carbon steel outer ring.			
21 22 16 00-0191		Upright And Feet, Cylinder Bracketing, Inergen® Fire Suppression System (21 22 16 00-0079)			
21 22 16 00-0192	EA	Center Upright Foot, Inergen® Fire Suppression System (Ansul 418508)	19.56		2.70
21 22 16 00-0193	EA	Double Row, Back-To-Back Rows, Weigh Rail Support, Inergen® Fire Suppression System (Ansul 423027)	161.09		20.53
21 22 16 00-0194	EA	85" High, Cylinder Bracketing For 425 CF And LC100 Cylinders, Inergen® Fire Suppression System (Ansul 426592)	119.55		20.53
		Note: Includes upright, left, right and center.			



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
21 22 16 00-0195				Autopulse® Fire Detection And Control Equipment <small>(21 22 16 00-0001)</small>		
21 22 16 00-0196				Accessory Switches, Autopulse® Fire Detection And Control Equipment <small>(21 22 16 00-0195)</small>		
21 22 16 00-0197	EA			Abort, Flush Mount Switch, Autopulse® Fire Detection And Control Equipment (Ansl 76495).....	126.04	17.72
21 22 16 00-0198	EA			Abort, Surface Mount Switch, Autopulse® Fire Detection And Control Equipment (Ansl 76494).....	143.24	20.20
21 22 16 00-0199	EA			Main/Reserve, Flush Mount Switch, Autopulse® Fire Detection And Control Equipment (Ansl 76497).....	182.20	25.67
21 22 16 00-0200	EA			Main/Reserve, Surface Mount Switch, Autopulse® Fire Detection And Control Equipment (Ansl 76496).....	196.25	27.65
21 22 16 00-0201	EA			Maintenance, Flush Mount Switch, Autopulse® Fire Detection And Control Equipment (Ansl 76499).....	245.72	34.77
21 22 16 00-0202	EA			Maintenance, Surface Mount Switch, Autopulse® Fire Detection And Control Equipment (Ansl 76498).....	261.53	36.93
21 22 16 00-0203	EA			Explosion Proof, Abort Switch, Autopulse® Fire Detection And Control Equipment (Ansl 65956).....	501.24	71.20
21 22 16 00-0204	EA			Single Gang, Surface Mount Back Box For Accessory Switches, Autopulse® Fire Detection And Control Equipment (Ansl 76490).....	40.41	5.30
21 22 16 00-0205				Alarm Devices, Autopulse® Fire Detection And Control Equipment <small>(21 22 16 00-0195)</small>		
21 22 16 00-0206	EA			Selectable Candela Strobe, Alarm Devices, Autopulse® Fire Detection And Control Equipment (Ansl 429698).....	109.18	15.40
21 22 16 00-0207	EA			Sync Module, Alarm Devices, Autopulse® Fire Detection And Control Equipment (Ansl 429699).....	160.09	22.51
21 22 16 00-0208	EA			Back Box Extender Adapter, Alarm Devices, Autopulse® Fire Detection And Control Equipment (Ansl 429702).....	14.61	2.05
21 22 16 00-0209				Annunciators, Autopulse® Fire Detection And Control Equipment <small>(21 22 16 00-0195)</small>		
21 22 16 00-0210	EA			80 Character LCD, Annunciator, LCD-80, Autopulse® Fire Detection And Control Equipment (Ansl 417492).....	1,257.81	178.66
21 22 16 00-0211	EA			16 Zone Alarm/Trouble, Annunciator Control Module, ACM-16AT, Autopulse® Fire Detection And Control Equipment (Ansl 417496).....	1,054.44	149.68
21 22 16 00-0212	EA			16 Zone Alarm/Trouble, Annunciator Expander Module, AEM-16AT, Autopulse® Fire Detection And Control Equipment (Ansl 417497).....	818.54	116.23
21 22 16 00-0213	EA			32 Zone, Alarm Annunciator Expander Module, AEM-32A, Autopulse® Fire Detection And Control Equipment (Ansl 417500).....	712.90	101.17
21 22 16 00-0214	EA			Annunciator Lamp Driver Control Module, LDM-32, Autopulse® Fire Detection And Control Equipment (Ansl 417501).....	712.90	101.17
21 22 16 00-0215	EA			Annunciator Lamp Driver Expander Module, LDM-E32, Autopulse® Fire Detection And Control Equipment (Ansl 417502).....	571.11	80.97
21 22 16 00-0216	EA			Annunciator Lamp Driver Relay Module, LDM-R32, Autopulse® Fire Detection And Control Equipment (Ansl 417650).....	1,054.44	149.68
21 22 16 00-0217	EA			24", Annunciator Lamp Driver Cable, LDM-CBL24, Autopulse® Fire Detection And Control Equipment (Ansl 417651).....	214.48	30.30
21 22 16 00-0218	EA			48", Annunciator Lamp Driver Cable, LDM-CBL48, Autopulse® Fire Detection And Control Equipment (Ansl 417652).....	268.88	38.09
21 22 16 00-0219	EA			8 Relay, Annunciator Control Module, ACM-8R, Autopulse® Fire Detection And Control Equipment (Ansl 417653).....	539.15	76.50
21 22 16 00-0220	EA			Key Switch, AKS-1 Annunciator Accessory, Autopulse® Fire Detection And Control Equipment (Ansl 417660).....	91.11	12.83
21 22 16 00-0221	EA			Low Profile Annunciator Chassis, CHS-4L, Autopulse® Fire Detection And Control Equipment (Ansl 418576).....	123.88	17.72
21 22 16 00-0222	EA			Flush, Single Annunciator Back Box, ABF-1, Autopulse® Fire Detection And Control Equipment (Ansl 417657).....	214.49	30.30
21 22 16 00-0223				Autopulse IQ-396X Cabinets/Accessories, Autopulse® Fire Detection And Control Equipment <small>(21 22 16 00-0195)</small>		
21 22 16 00-0224	EA			CHS-4 Chassis, IQ-396X Cabinets/Accessories, Autopulse® Fire Detection And Control Equipment (Ansl 419586).....	166.59	24.67
21 22 16 00-0225	EA			REL 47K, In Line Supervisory Device, IQ-396X Cabinets/Accessories, Autopulse® Fire Detection And Control Equipment (Ansl 419639).....	10.28	1.69
21 22 16 00-0226	EA			REL 4.7K, In Line Supervisory Device, IQ-396X Cabinets/Accessories, Autopulse® Fire Detection And Control Equipment (Ansl 419640).....	72.93	2.05
21 22 16 00-0227	EA			REL 2.2K, In Line Supervisory Device, IQ-396X Cabinets/Accessories, Autopulse® Fire Detection And Control Equipment (Ansl 407765).....	11.10	2.05
21 22 16 00-0228				Autopulse IQ-396X Modules, Autopulse® Fire Detection And Control Equipment <small>(21 22 16 00-0195)</small>		
21 22 16 00-0229	EA			Indicating Circuit Expander, IQ-396X Modules, ICE-4, Autopulse® Fire Detection And Control Equipment (Ansl 419564).....	370.27	55.30
21 22 16 00-0230	EA			Control Relay Expander, IQ-396X Modules, CRE-4, Autopulse® Fire Detection And Control Equipment (Ansl 419566).....	221.98	32.95
21 22 16 00-0231				Batteries And Power Supplies, Autopulse® Fire Detection And Control Equipment <small>(21 22 16 00-0195)</small>		
21 22 16 00-0232	EA			7 Amp Hours, 24 Volt DC, Battery Pack, Autopulse® Fire Detection And Control Equipment (Ansl 417692).....	163.91	21.19
21 22 16 00-0233	EA			12 Amp Hours, 24 Volt DC, Battery Pack, Autopulse® Fire Detection And Control Equipment (Ansl 417693).....	342.73	44.88
21 22 16 00-0234	EA			18 Amp Hours, 24 Volt DC, Battery Pack, Autopulse® Fire Detection And Control Equipment (Ansl 417694).....	386.76	50.83
21 22 16 00-0235	EA			25 Amp Hours, 24 Volt DC, Battery Pack, Autopulse® Fire Detection And Control Equipment (Ansl 417695).....	505.90	61.93
21 22 16 00-0236	EA			55 Amp Hours, 24 Volt DC, Battery Pack, Autopulse® Fire Detection And Control Equipment (Ansl 417997).....	814.92	107.46
21 22 16 00-0237	EA			BB-17, Red Battery Box, Autopulse® Fire Detection And Control Equipment (Ansl 418578).....	121.84	17.05
21 22 16 00-0238	EA			BB-25, Grey Cabinet, Autopulse® Fire Detection And Control Equipment (Ansl 428079).....	217.64	30.79
21 22 16 00-0239	EA			BB-55, Red Battery Box, Autopulse® Fire Detection And Control Equipment (Ansl 419410).....	442.63	62.76
				Note: Holds six XP5 modules or 25AH battery pack.		
				Note: For mounting in BB-55 battery box.		

21 Fire Suppression**21 20 Fire-Extinguishing Systems****21 22 Clean-Agent Fire-Extinguishing Systems**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
21 22 16 00-0240 EA Battery Charger, CHG-120, Autopulse® Fire Detection And Control Equipment (Ansul 426207).....	1,286.77	182.80
Note: For mounting in BB-55 battery box.		
21 22 16 00-0241 EA 120 Volt AC, FCPS-24F, Red Remote Power Supply, Autopulse® Fire Detection And Control Equipment (Ansul 418563)	941.05	133.62
21 22 16 00-0242 Intelligent Addressable Devices, Autopulse® Fire Detection And Control Equipment <small>(21 22 16 00-0195)</small>		
21 22 16 00-0243 EA Monitor Module, Intelligent Addressable Devices, FMM-1, Autopulse® Fire Detection And Control Equipment (Ansul 428097)	99.14	14.15
21 22 16 00-0244 EA Mini Monitor Module, Intelligent Addressable Devices, FMM-101, Autopulse® Fire Detection And Control Equipment (Ansul 428098)	92.54	14.07
21 22 16 00-0245 EA Isolator Module, Intelligent Addressable Devices, ISO-X, Autopulse® Fire Detection And Control Equipment (Ansul 417480)	125.33	20.20
21 22 16 00-0246 EA 2-Wire Detector Monitor Module, Intelligent Addressable Devices, FZM-1, Autopulse® Fire Detection And Control Equipment (Ansul 428100)	186.41	26.33
21 22 16 00-0247 EA NAC Control Module, Intelligent Addressable Devices, FCM-1, Autopulse® Fire Detection And Control Equipment (Ansul 428101)	144.85	21.36
21 22 16 00-0248 EA Control Relay Module, Intelligent Addressable Devices, FRM-1, Autopulse® Fire Detection And Control Equipment (Ansul 428102)	136.02	20.53
21 22 16 00-0249 EA Flangeless, Analog Addressable Detector Base, Intelligent Addressable Devices, B501, Autopulse® Fire Detection And Control Equipment (Ansul 417487)	21.67	3.27
21 22 16 00-0250 EA Analog Addressable Detector Base With Isolator, Intelligent Addressable Devices, B224BI, Autopulse® Fire Detection And Control Equipment (Ansul 426125)	80.00	11.59
21 22 16 00-0251 EA Harsh Detector, Analog Addressable Detector Base, Intelligent Addressable Devices, B710HD, Autopulse® Fire Detection And Control Equipment (Ansul 427066)	80.05	11.26
21 22 16 00-0252 EA HPX-751 Detector Filter Cover, Intelligent Addressable Devices, FR-FTX, Autopulse® Fire Detection And Control Equipment (Ansul 427067)	27.97	9.27
21 22 16 00-0253 EA Low Profile Trim Ring, Intelligent Addressable Devices, F110, Autopulse® Fire Detection And Control Equipment (Ansul 428138)	7.37	1.03
Note: Converts BX501 to low profile base.		
21 22 16 00-0254 EA Relay Base, Intelligent Addressable Devices, B224RB, Autopulse® Fire Detection And Control Equipment (Ansul 423945)	77.05	10.85
21 22 16 00-0255 EA EOL Power Supervision Relay, Intelligent Addressable Devices, Autopulse® Fire Detection And Control Equipment (Ansul 417699)	45.13	6.39
21 22 16 00-0256 EA XP5 Modules Cabinet, Intelligent Addressable Devices, BB-XP, Autopulse® Fire Detection And Control Equipment (Ansul 428078)	122.21	16.89
21 22 16 00-0257 EA BB-25 Chassis, Intelligent Addressable Devices, CHS-6, Autopulse® Fire Detection And Control Equipment (Ansul 428080)	63.90	8.94
21 22 16 00-0258 Manual Pull Stations, Autopulse® Fire Detection And Control Equipment <small>(21 22 16 00-0195)</small>		
21 22 16 00-0259 EA Break Rod Package For Manual Pull Stations, Autopulse® Fire Detection And Control Equipment (Ansul 428661)	18.41	2.40
21 22 16 00-0260 EA Key Pull Station For Manual Pull Stations, Autopulse® Fire Detection And Control Equipment (Ansul 418336).....	11.43	1.33
21 22 16 00-0261 Transmitter/Relay Modules, Autopulse® Fire Detection And Control Equipment <small>(21 22 16 00-0195)</small>		
21 22 16 00-0262 EA Transmitter Module, 4XTM, Autopulse® Fire Detection And Control Equipment (Ansul 417470).....	160.09	22.51
Note: Includes municipal box and remote station connection.		
21 22 16 00-0263 EA Relay/Transmitter Module With 8 Form C Relay Contacts, RTM-8, Autopulse® Fire Detection And Control Equipment (Ansul 417471)	481.75	64.74
21 22 16 00-0264 EA Universal Digital Alarm COM/XMTR Module, UDACT, Autopulse® Fire Detection And Control Equipment (Ansul 419411)	918.94	130.48
21 22 16 00-0265 EA Ferrite Core For Transmitter/Relay Modules, Autopulse® Fire Detection And Control Equipment (Ansul 419635).....	24.52	3.37
21 22 16 00-0266 Vesda® Aspirating Smoke Detection System <small>(21 22 16 00-0001)</small>		
21 22 16 00-0267 Batteries And Power Supplies, Vesda® Aspirating Smoke Detection System <small>(21 22 16 00-0266)</small>		
21 22 16 00-0268 EA Transformer Only, VSP-TRAN-120, Vesda® Aspirating Smoke Detection System (Ansul 430482).....	124.75	15.90
21 22 16 00-0269 EA Battery Cabinet, VBC-001, Vesda® Aspirating Smoke Detection System (Ansul 430379).....	303.88	23.96
21 22 16 00-0270 EA 120 Volt AC, Single Zone Power Supply With Housing, VPS-100US-120, Vesda® Aspirating Smoke Detection System (Ansul 430374)	693.35	92.72
21 22 16 00-0271 EA 220 Volt AC, Single Zone Power Supply With Housing, VPS-100US-220, Vesda® Aspirating Smoke Detection System (Ansul 430375)	693.35	92.72
21 22 16 00-0272 EA 120 Volt AC, Multi Zone Power Supply, VPS-300US-120, Vesda® Aspirating Smoke Detection System (Ansul 430376)	1,041.79	139.08
Note: Includes housing and battery cab.		
21 22 16 00-0273 EA 220 Volt AC, Multi Zone Power Supply, VPS-300US-220, Vesda® Aspirating Smoke Detection System (Ansul 430377)	1,041.79	139.08
Note: Includes housing and battery cab.		
21 22 16 00-0274 EA 48 Volt DC, Multi Zone Power Supply With Housing, VPS-400US-48, Vesda® Aspirating Smoke Detection System (Ansul 430378)	1,524.98	177.17
21 22 16 00-0275 Blank Plates, Vesda® Aspirating Smoke Detection System <small>(21 22 16 00-0266)</small>		
21 22 16 00-0276 EA Blank Plate Without VESDA Logo, VSP-300, Vesda® Aspirating Smoke Detection System (Ansul 430459)	22.36	2.98
21 22 16 00-0277 EA Blank Plate With VESDA Logo, VSP-000, Vesda® Aspirating Smoke Detection System (Ansul 430458)	33.89	2.98
21 22 16 00-0278 EA Blank Plate, EMC Painted Without Logo, VSP-200, Vesda® Aspirating Smoke Detection System (Ansul 430484)	49.05	5.63



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
21 22 16 00-0279 EA Single Blank Plate, VRE-001, Vesda® Aspirating Smoke Detection System (Ansul 430446)	76.69	6.30
21 22 16 00-0280 EA Double Blank Plate, VRE-002, Vesda® Aspirating Smoke Detection System (Ansul 430447)	95.88	12.58
21 22 16 00-0281 EA Blank Plate Without FOK LED's And Logo, VSP-100, Vesda® Aspirating Smoke Detection System (Ansul 430480)	178.49	15.90
21 22 16 00-0282 Detectors, Vesda® Aspirating Smoke Detection System <small>(21 22 16 00-0266)</small>		
21 22 16 00-0283 EA LaserPLUS, Detector Only, Enclosure, VLP-000, Vesda® Aspirating Smoke Detection System (Ansul 430350)	5,227.18	778.21
Note: Includes 3 blank plates.		
21 22 16 00-0284 EA LaserPLUS Detector, VLP-012, Vesda® Aspirating Smoke Detection System (Ansul 430354)	6,673.14	960.34
Note: Includes centrally mounted LCD programmer module and standard display.		
21 22 16 00-0285 EA LaserPLUS Detector, VLP-010, Vesda® Aspirating Smoke Detection System (Ansul 430356)	6,032.95	877.56
Note: Includes centrally mounted LCD programmer.		
21 22 16 00-0286 EA 7-Relay Version, LaserSCANNER Detector Only, VLS-200, Vesda® Aspirating Smoke Detection System (Ansul 430357)	8,395.92	1,159.04
21 22 16 00-0287 EA 12-Relay Version, LaserSCANNER Detector Only, VLS-300, Vesda® Aspirating Smoke Detection System (Ansul 430358)	8,838.90	1,225.27
21 22 16 00-0288 EA 7-Relay Version, LaserSCANNER Detector Only, VLS-600, Vesda® Aspirating Smoke Detection System (Ansul 430359)	8,487.86	1,175.60
Note: Includes 1 fire alarm (any SCT) and OK/FOK LEDs.		
21 22 16 00-0289 EA 12-Relay Version, LaserSCANNER Detector Only, VLS-700, Vesda® Aspirating Smoke Detection System (Ansul 430360)	8,964.20	1,241.83
Note: Includes 1 fire alarm (any SCT) and OK/FOK LED.		
21 22 16 00-0290 EA 7-Relay, LaserSCANNER Detector Only, VLS-204, Vesda® Aspirating Smoke Detection System (Ansul 430361)	9,218.68	1,291.50
Note: Includes 2 blank plates and scan display module at far right.		
21 22 16 00-0291 EA 12-Relay, LaserSCANNER Detector, VLS-304, Vesda® Aspirating Smoke Detection System (Ansul 430363)	9,617.48	1,357.73
Note: Includes 2 blank plates and scanner display.		
21 22 16 00-0292 EA 7-Relay, LaserSCANNER Detector, VLS-214, Vesda® Aspirating Smoke Detection System (Ansul 430365)	10,109.20	1,423.96
Note: Includes centrally mounted programmer module.		
21 22 16 00-0293 EA 12-Relay, LaserSCANNER Detector, VLS-314, Vesda® Aspirating Smoke Detection System (Ansul 430367)	10,540.24	1,490.19
Note: Includes centrally mounted LCD programmer module and scanner display module.		
21 22 16 00-0294 EA 12-Relay, LaserSCANNER Detector, VLS-310, Vesda® Aspirating Smoke Detection System (Ansul 430369)	9,910.74	1,357.73
Note: Includes centrally mounted LCD programmer.		
21 22 16 00-0295 Displays, Vesda® Aspirating Smoke Detection System <small>(21 22 16 00-0266)</small>		
21 22 16 00-0296 EA VRT-200 Display, Standard Version, Vesda® Aspirating Smoke Detection System (Ansul 430381)	1,596.41	182.13
Note: Includes a remote termination card and 7 relays.		
21 22 16 00-0297 EA VRT-400 Display, Scanner Version, Vesda® Aspirating Smoke Detection System (Ansul 430385)	1,604.30	182.13
Note: Includes a remote termination card and 7 relays.		
21 22 16 00-0298 EA VRT-600 Display, Standard Version, Vesda® Aspirating Smoke Detection System (Ansul 430383)	1,445.69	165.57
Note: Includes a remote termination card without relays.		
21 22 16 00-0299 EA VRT-700 Display, Scanner Version, Vesda® Aspirating Smoke Detection System (Ansul 430387)	1,454.85	165.57
Note: Includes a remote termination card.		
21 22 16 00-0300 EA VRT-800 Display, Scanner Version, Vesda® Aspirating Smoke Detection System (Ansul 430389)	1,798.96	198.69
Note: Includes a remote termination card and 12 relays.		
21 22 16 00-0301 EA VRT-K00 Display, Compact Version Without Relays, Vesda® Aspirating Smoke Detection System (Ansul 430391)	1,528.38	172.20
21 22 16 00-0302 EA VRT-J00 Display, Compact Version With 7 Relays, Vesda® Aspirating Smoke Detection System (Ansul 430393)	1,672.48	193.40
21 22 16 00-0303 Intelligent Addressable Devices, Vesda® Aspirating Smoke Detection System <small>(21 22 16 00-0266)</small>		
21 22 16 00-0304 EA LaserCOMPACT (VN), VESDAnet Version Plus Relay Output, VLC-505, Vesda® Aspirating Smoke Detection System (Ansul 430370)	4,004.65	546.40
21 22 16 00-0305 EA LaserCOMPACT (RO), Relay Only Version, VLC-500, Vesda® Aspirating Smoke Detection System (Ansul 430372)	3,299.55	437.12
21 22 16 00-0306 EA Programmer With Remote Termination Card, VRT-100, Vesda® Aspirating Smoke Detection System (Ansul 430380)	1,165.39	165.57
21 22 16 00-0307 EA VESDAnet Socket, VRT-300, Vesda® Aspirating Smoke Detection System (Ansul 430395)	840.25	107.62
21 22 16 00-0308 EA System Relay Module, VRT-S07, Vesda® Aspirating Smoke Detection System (Ansul 430399)	1,171.22	145.04
21 22 16 00-0309 EA PC-Link High-Level Interface, VHX-0200, Vesda® Aspirating Smoke Detection System (Ansul 430442)	1,419.86	178.82
Note: Interface connects PC and LaserPLUS system.		
21 22 16 00-0310 EA Modem Cable, PC-HLI To Modem Connection, VHX-00090, Vesda® Aspirating Smoke Detection System (Ansul 430443)	220.98	26.83
21 22 16 00-0311 EA Hand-Held Programmer, VHH-1000, Vesda® Aspirating Smoke Detection System (Ansul 430444)	1,479.20	165.57
21 22 16 00-0312 EA Programmer Module, VSP-001, Vesda® Aspirating Smoke Detection System (Ansul 430460)	1,054.44	137.43
21 22 16 00-0313 EA VESDAnet Socket Kit, VSP-003, Vesda® Aspirating Smoke Detection System (Ansul 430463)	828.35	105.97
21 22 16 00-0314 EA Standard Display Module, VSP-002, Vesda® Aspirating Smoke Detection System (Ansul 430461)	1,056.16	137.43
21 22 16 00-0315 EA Scanner Display Module, VSP-004, Vesda® Aspirating Smoke Detection System (Ansul 430464)	1,054.44	137.43
21 22 16 00-0316 EA Remote Display Module, Compact (VN), VSP-502, Vesda® Aspirating Smoke Detection System (Ansul 430487)	1,043.36	129.15
21 22 16 00-0317 EA Filter Cartridge, VSP-005, Vesda® Aspirating Smoke Detection System (Ansul 430466)	124.41	11.59
21 22 16 00-0318 EA Detector Chassis Assembly, VSP-006, Vesda® Aspirating Smoke Detection System (Ansul 430467)	5,039.85	635.81
21 22 16 00-0319 EA Scanner Chassis Assembly, VSP-009, Vesda® Aspirating Smoke Detection System (Ansul 430470)	8,781.46	1,112.68
21 22 16 00-0320 EA Detector Cover Assembly With EMC Shields, VSP-013, Vesda® Aspirating Smoke Detection System (Ansul 430473)	100.29	49.67
21 22 16 00-0321 EA Aspirator For LaserPLUS And Laser Scanner, VSP-015, Vesda® Aspirating Smoke Detection System (Ansul 430475)	686.67	82.79
21 22 16 00-0322 EA Filter Cover, VSP-019, Vesda® Aspirating Smoke Detection System (Ansul 430477)	15.65	1.65
21 22 16 00-0323 EA Cover Screws, 17606, Vesda® Aspirating Smoke Detection System (Ansul 430478)	8.89	0.33
21 22 16 00-0324 EA US Power Supply Circuit Board Only, VSP-100, Vesda® Aspirating Smoke Detection System (Ansul 430481)	378.02	48.02
21 22 16 00-0325 EA Relay Processor Module (DRP), VSP-102, Vesda® Aspirating Smoke Detection System (Ansul 430483)	457.97	58.28
21 22 16 00-0326 EA Aspirator, LaserCOMPACT, VSP-501, Vesda® Aspirating Smoke Detection System (Ansul 430486)	661.08	84.44

21	Fire Suppression
21 20	Fire-Extinguishing Systems
21 22	Clean-Agent Fire-Extinguishing Systems



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
21 22 16 00-0327 EA RO-Cable For LaserCOMPACT Relay Only, (RO) Version, VSP-509, Vesda® Aspirating Smoke Detection System (Ansul 430488)	97.38	12.58
21 22 16 00-0328 EA Miniature Sampling Point, E700-SP, Vesda® Aspirating Smoke Detection System (Ansul 430502).....	15.14	2.65
21 22 16 00-0329 Labels And Decals, Vesda® Aspirating Smoke Detection System (21 22 16 00-0266)		
21 22 16 00-0330 EA Sampling Point Labels, Roll Of 35, E700-SP-DCL-PIPE, Vesda® Aspirating Smoke Detection System (Ansul 430509)	13.80	1.98
21 22 16 00-0331 EA Round Point Label, Roll Of 50, E700-SP-DCL-PNT, Vesda® Aspirating Smoke Detection System (Ansul 430505).....	14.47	2.32
21 22 16 00-0332 EA Red, Round, Miniature Sampling Point Label, Sheet Of 12, E700-SPLR, Vesda® Aspirating Smoke Detection System (Ansul 430506)	22.36	2.98
21 22 16 00-0333 EA Grey, Round, Miniature Sampling Point Label, Sheet Of 12, E700-SPLG, Vesda® Aspirating Smoke Detection System (Ansul 430507)	22.39	2.98
21 22 16 00-0334 EA Sampling Point Decal, Wrap-Around Style, Roll Of 200, E700-SP-DCL, Vesda® Aspirating Smoke Detection System (Ansul 430508)	81.14	11.26
21 22 16 00-0335 Mounting Hardware, Vesda® Aspirating Smoke Detection System (21 22 16 00-0266)		
21 22 16 00-0336 EA Remote Mounting Single Box With Escutcheon Only, VKT-000, Vesda® Aspirating Smoke Detection System (Ansul 430456)	200.76	23.84
21 22 16 00-0337 EA Recessed Mounting Kit For Remote Single Boxes, VSP-012, Vesda® Aspirating Smoke Detection System (Ansul 430472)	270.54	31.79
21 22 16 00-0338 EA Recessed Mounting Kit For VLP Or VLS Detector, VSP-011, Vesda® Aspirating Smoke Detection System (Ansul 430471)	276.55	34.77
21 22 16 00-0339 EA Remote 19 Sub Rack With 4 Blank Plates, VSR-0000, Vesda® Aspirating Smoke Detection System (Ansul 430457)	676.17	49.67
21 22 16 00-0340 EA Sub Rack Enclosure, VRE-100, Vesda® Aspirating Smoke Detection System (Ansul 430445).....	991.55	109.28
21 22 16 00-0341 Pipe And Fittings, Vesda® Aspirating Smoke Detection System (21 22 16 00-0266)		
21 22 16 00-0342 LF 3/4", Orange Chlorinated Polyvinyl Chloride (CPVC) Pipe, Vesda® Aspirating Smoke Detection System (Ansul 430491)	80.62	39.41
21 22 16 00-0343 EA 3/4", End Cap, Chlorinated Polyvinyl Chloride (CPVC) Socket Weld, Vesda® Aspirating Smoke Detection System (Ansul 430497)	9.57	4.30
21 22 16 00-0344 EA 3/4", 45 Degree Elbow, Chlorinated Polyvinyl Chloride (CPVC) Socket Weld, Vesda® Aspirating Smoke Detection System (Ansul 430494)	12.85	5.99
21 22 16 00-0345 EA 3/4", 90 Degree Elbow, Chlorinated Polyvinyl Chloride (CPVC) Socket Weld, Vesda® Aspirating Smoke Detection System (Ansul 430493)	13.50	5.99
21 22 16 00-0346 EA 3/4", Coupling, Chlorinated Polyvinyl Chloride (CPVC) Socket Weld, Vesda® Aspirating Smoke Detection System (Ansul 430495)	13.45	5.99
21 22 16 00-0347 EA 3/4", Union, Chlorinated Polyvinyl Chloride (CPVC) Socket Weld, Vesda® Aspirating Smoke Detection System (Ansul 430496)	18.14	7.12
21 22 16 00-0348 EA 3/4", Tee, Chlorinated Polyvinyl Chloride (CPVC) Socket Weld, Vesda® Aspirating Smoke Detection System (Ansul 430498)	21.99	9.98
21 22 16 00-0349 EA 3/4" x 1/2" FPT, Tee, Chlorinated Polyvinyl Chloride (CPVC), Vesda® Aspirating Smoke Detection System (Ansul 430499)	24.80	9.98
21 22 16 00-0350 LF 1/2" OD x 3/8" ID, Black Polyethylene Tubing, Vesda® Aspirating Smoke Detection System (Ansul 430500).....	3.55	1.20
21 22 16 00-0351 EA Pipe Adapters, Metric-To-Imperial, VSP-021, Vesda® Aspirating Smoke Detection System (Ansul 430479)	14.32	3.65
21 22 16 00-0352 EA Capillary Kit, 1 Male 1/2" TH x 1/2" OD, 1 Female 1/2" OD, Plastic, E700-CAP KIT, Vesda® Aspirating Smoke Detection System (Ansul 430503)	17.66	2.65
21 22 16 00-0353 EA Capillary Kit, 1 Male 1/2" TH x 1/2" OD, 1 Female 1/2" OD, Brass, Vesda® Aspirating Smoke Detection System (Ansul 430504)	25.33	3.65
21 22 16 00-0354 Remote Termination And Relay Cards, Vesda® Aspirating Smoke Detection System (21 22 16 00-0266)		
21 22 16 00-0355 EA VRT-500, Remote Termination And Relay Proc Card With Blank Plates, Vesda® Aspirating Smoke Detection System (Ansul 430396)	1,160.04	127.16
Note: Remote box includes 7 relays for VLP/VLC.		
21 22 16 00-0356 EA VN, Compact Termination Card, VSP-515, Vesda® Aspirating Smoke Detection System (Ansul 430490).....	1,180.90	146.37
21 22 16 00-0357 EA 12-Relay, Remote Termination Card, VSP-208, Vesda® Aspirating Smoke Detection System (Ansul 430485).....	714.70	89.41
21 22 16 00-0358 EA RO, Compact Termination Card, VSP-510, Vesda® Aspirating Smoke Detection System (Ansul 430489)	816.75	101.00
21 22 16 00-0359 EA VRT-501, Remote Termination And Relay Proc Card With Blank Plates, Vesda® Aspirating Smoke Detection System (Ansul 430397)	1,160.04	127.16
Note: Remote box includes 7 relays for VLS.		
21 22 16 00-0360 EA VRT-900 Remote Termination And Relay Proc Card With Blank Plates, Vesda® Aspirating Smoke Detection System (Ansul 430398)	1,400.50	146.37
Note: Remote box includes 12 relays for VLS.		
21 22 16 00-0361 EA Remote Termination Card Without Relay, VSP-007, Vesda® Aspirating Smoke Detection System (Ansul 430468)	396.95	45.04
21 22 16 00-0362 EA Remote Termination Card (RTC7), VSP-008, Vesda® Aspirating Smoke Detection System (Ansul 430469).....	596.95	68.88
21 22 16 00-0363 EA 7-Relay, Head Termination Card, VSP-014, Vesda® Aspirating Smoke Detection System (Ansul 430474)	1,123.13	142.40
21 22 16 00-0364 EA 12-Relay, Head Termination Card, VSP-016, Vesda® Aspirating Smoke Detection System (Ansul 430476)	1,647.67	208.63
21 22 16 00-0365 Preferred® Low Pressure CO2 System (21 22 16 00-0001)		
21 22 16 00-0366 Manual Pull Stations, Preferred® Low Pressure CO2 System (21 22 16 00-0365)		
21 22 16 00-0367 EA Addressable, DPST, Dual Action Pull Station, Preferred® Low Pressure CO2 System (Ansul 428658)	88.92	11.59
Note: Excludes FMM-101.		
21 22 16 00-0368 EA Weatherproof Backbox For Manual Pull Stations, Preferred® Low Pressure CO2 System (Ansul 428659).....	66.53	8.61



Fire Suppression	21	2
Fire-Extinguishing Systems	21 20	
Clean-Agent Fire-Extinguishing Systems	21 22	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
21 22 16 00-0369 Industrial Fire Control System (21 22 16 00-0001)		
21 22 16 00-0370 Alarm Devices, Industrial Fire Control System (21 22 16 00-0369)		
21 22 16 00-0371 EA Explosion Proof Alarm Horn, Alarm Devices, Industrial Fire Control System (Ansul 65947)	2,149.87	305.49
21 22 16 00-0372 EA 6", 115 Volt AC Alarm Bell For Release Systems, Alarm Devices, Industrial Fire Control System (Ansul 24751).....	65.97	7.02
21 22 16 00-0373 EA 24 Volt AC, Multitone Horn, Alarm Devices, Industrial Fire Control System (Ansul 429697).....	64.95	9.11
21 22 16 00-0374 EA Weatherproof Surface Back Box For Horn And Strobe, Alarm Devices, Industrial Fire Control System (Ansul 429700)	38.68	5.46
21 22 16 00-0375 EA Semi-Flush Plate, Alarm Devices, Industrial Fire Control System (Ansul 429701)	15.81	2.22
21 22 16 00-0376 Manual Pull Stations, Industrial Fire Control System (21 22 16 00-0369)		
21 22 16 00-0377 EA SPST, Dual Action Pull Station, Industrial Fire Control System (Ansul 428655).....	73.48	9.60
21 22 16 00-0378 EA DPST, Dual Action Pull Station, Industrial Fire Control System (Ansul 428656).....	103.59	13.58
21 22 16 00-0379 EA Explosion Proof, DPDT, Dual Action Pull Station, Industrial Fire Control System (Ansul 428657)	808.69	106.64
21 22 16 00-0380 EA Surface Mounted Backbox For Manual Pull Stations, Industrial Fire Control System (Ansul 428660).....	23.51	3.08
21 22 16 00-0381 EA Extra Pull Station Labels For Manual Pull Stations, Industrial Fire Control System (Ansul 428654).....	10.54	1.37
21 22 16 00-0382 Marine Fire Control System (21 22 16 00-0001)		
21 22 16 00-0383 Alarm Devices, Marine Fire Control System (21 22 16 00-0382)		
21 22 16 00-0384 EA Weatherproof Surface Mount Back Box For Alarm Accessories, Alarm Devices, Marine Fire Control System (Ansul 24747)	42.61	5.56
21 22 16 00-0385 EA 6", 24 Volt DC, Alarm Bell, Alarm Devices, Marine Fire Control System (Ansul 417805)	78.48	10.76
21 22 16 00-0386 EA 10", 24 Volt DC, Alarm Bell, Alarm Devices, Marine Fire Control System (Ansul 417806)	78.48	10.76
21 22 16 00-0387 FM200 System Equipment (21 22 16)		
21 22 16 00-0388 EA 26 LB Cylinder, Filled, For FM200 Fire Protection system.....	2,270.80	79.88
21 22 16 00-0389 EA 44 LB Cylinder, Filled, For FM200 Fire Protection system.....	3,253.52	91.45
21 22 16 00-0390 EA 63 LB Cylinder, Filled, For FM200 Fire Protection system.....	3,862.01	107.83
21 22 16 00-0391 EA 101 LB Cylinder, Filled, For FM200 Fire Protection system.....	5,117.40	127.80
21 22 16 00-0392 EA 196 LB Cylinder, Filled, For FM200 Fire Protection system.....	7,996.05	159.75
21 22 16 00-0393 EA Electro/Mechanical Release, For FM200 Fire Protection system	473.04	159.75
21 22 16 00-0394 EA Manual Pull Station, For FM200 Fire Protection system	163.79	53.12
21 22 16 00-0395 EA Pneumatic Damper Release, For FM200 Fire Protection system.....	188.63	39.94
21 22 16 00-0396 LB FM200 Gas	14.68	
21 22 16 00-0397 EA Master Cylinder, For FM200 Fire Protection system.....	3,698.93	42.97
21 22 16 00-0398 EA Shuttle Check Valve, For FM200 Fire Protection system	452.28	60.07
21 22 16 00-0399 EA Flex Head Cylinder, For FM200 Fire Protection system	452.84	64.38
21 22 16 00-0400 EA Nozzles, For FM200 Fire Protection system	115.91	22.77
21 22 16 00-0401 EA Cylinder Support, For FM200 Fire Protection system.....	143.31	42.97
21 22 16 00-0402 EA Solenoid Valve, For FM200 Fire Protection system.....	577.93	64.38
21 22 16 00-0403 EA Battery Back-Up, For FM200 Fire Protection system.....	491.37	169.81
21 22 16 00-0404 EA Control Panel, Single Zone, For FM200 Fire Protection system	2,717.06	319.03
21 22 16 00-0405 EA Control Panel, Multi Zone, For FM200 Fire Protection system	4,412.22	638.78
21 22 16 00-0406 EA Smoke Or Heat Detector, For FM200 Fire Protection system.....	202.85	64.38
21 22 16 00-0407 EA Annunciator, For FM200 Fire Protection system.....	2,199.10	241.79
21 22 16 00-0408 EA Pressure Switch, For FM200 Fire Protection system.....	217.60	64.38
21 22 16 00-0409 EA Alarm Horn, For FM200 Fire Protection system.....	201.42	64.38
21 22 16 00-0410 EA Testing, For FM200 Fire Protection system.....	999.46	
21 22 16 00-0411 EA Abort Switch, For FM200 Fire Protection system.....	132.49	29.96
21 23 Wet-Chemical Fire-Extinguishing Systems (21 20)		
21 23 16 Wet-Chemical Fire-Extinguishing Equipment (21 23)		
21 23 16 00-0001 Kidde Fire Systems (21 23 16)		
Note: Kidde or equal.		
21 23 16 00-0002 Cylinders And Hardware (21 23 16 00-0001)		
21 23 16 00-0003 EA 125 Cylinder And Valve Assembly With 1.25 Gallon Of Wet Agent.....	504.12	66.15
21 23 16 00-0004 EA 260 Cylinder And Valve Assembly With 2.6 Gallon Of Wet Agent.....	582.73	82.40
21 23 16 00-0005 EA 400S And M Cylinder And Valve Assembly With 4 Gallon Of Wet Agent	714.47	101.66
21 23 16 00-0006 EA 600 And L Cylinder And Valve Assembly With 6 Gallon Of Wet Agent.....	844.00	120.62
21 23 16 00-0007 EA Discharge Adapter Kit (One Required Per Cylinder).....	28.12	3.46
21 23 16 00-0008 EA System Valve Actuator	101.75	13.74
21 23 16 00-0009 EA Vent Plug.....	19.20	2.79
21 23 16 00-0010 EA Gauge Shield.....	50.85	7.35
21 23 16 00-0011 EA 125 Cylinder Wall Mounting Bracket.....	52.58	7.35
21 23 16 00-0012 EA 260 Cylinder Wall Mounting Bracket.....	55.73	7.79
21 23 16 00-0013 EA 400S And M Cylinder Wall Mounting Bracket	105.88	14.70
21 23 16 00-0014 EA 600 And 400M Cylinder Shelf Bracket	105.30	16.68
21 23 16 00-0015 EA 600 And 400M Cylinder Floor Mounting Kit	148.09	16.72
21 23 16 00-0016 EA 125 And 260 Cylinder Replacement Bracket Strap.....	20.78	
21 23 16 00-0017 EA 400 And 600 Cylinder Replacement Bracket Strap.....	21.81	
21 23 16 00-0018 Nozzles And Accessories (21 23 16 00-0001)		

21 Fire Suppression**21 20 Fire-Extinguishing Systems****21 23 Wet-Chemical Fire-Extinguishing Systems**

MINOR				TOTAL DIRECT	DEMOLITION
CSI	UOM	DESCRIPTION		UNIT COST	UNIT COST
21 23 16 00-0019	EA	ADP, F, GRW Or R Nozzle		47.23	6.76
21 23 16 00-0020	EA	LPF Or DM Nozzle		51.02	6.76
21 23 16 00-0021	EA	LPR Nozzle		58.82	6.76
21 23 16 00-0022	EA	3/8" Swivel Adapter For Nozzles		35.27	4.78
21 23 16 00-0023	EA	Replacement Nozzle Seals		5.57	
21 23 16 00-0024	EA	Chrome Nozzle Disc Cap		3.43	0.44
21 23 16 00-0025	EA	LPR Nozzle Disc Cap		21.71	6.73
21 23 16 00-0026		Control Systems <small>(21 23 16 00-0001)</small>			
21 23 16 00-0027	EA	XV Control System		615.96	44.10
		Note: Includes (1) SVA, (1) system cartridge, (1) test cartridge, (1) EMT connector kit, (1) SPDT microswitch kit, and (1) SPDT microswitch kit.			
21 23 16 00-0028	EA	7-1/2" High Pressure Hose (Required for cylinder mounted XV Control System)		53.95	7.35
21 23 16 00-0029	EA	24" High Pressure Hose		63.24	7.35
21 23 16 00-0030	EA	60" High Pressure Hose		83.90	7.35
21 23 16 00-0031	EA	XV Solenoid Kit (Electric Actuator), 24 VDC		123.38	14.70
21 23 16 00-0032	EA	XV Microswitch Kit, SPDT		41.71	6.91
21 23 16 00-0033	EA	XV Microswitch Kit, SPDT, Terminal Type, For Alarm/Release		44.80	6.91
21 23 16 00-0034	EA	EMT Connector Kit (EMT Connector & O-Ring)		19.28	5.51
21 23 16 00-0035	EA	KRS-50 Control Box Assembly		348.21	28.48
		Note: Includes (1) SVA, (2) CO2 cartridges, (2) set screws, (1) grommet, (1) cover label, and (1) exhaust fan caution label.			
21 23 16 00-0036	EA	SPDT Microswitch For KRS-50		49.39	6.91
21 23 16 00-0037	EA	DPDT Microswitch For KRS-50		89.10	11.98
21 23 16 00-0038	EA	SPDT Pressure Switch (Fire Department Tie-In)		274.46	38.44
21 23 16 00-0039		Mechanical Actuation Components <small>(21 23 16 00-0001)</small>			
21 23 16 00-0040	EA	Universal Detector Link Housing Kit, Mechanical Actuation Systems		34.92	11.02
		Note: Includes (1) bracket (11-3/4"), (2) "S" hook, and (2) cable crimp sleeves.			
21 23 16 00-0041	EA	XV Low Profile Link Detector Housing Kit		48.90	11.02
		Note: Includes (1) bracket, (2) 1/2" EMT connectors, (4) cable crimp sleeves, and (1) S hook.			
21 23 16 00-0042	EA	XV Or KRS-50 Remote Manual Release, Combination Pull-To-Trip/Release-To-Trip		122.11	7.35
21 23 16 00-0043	EA	XV Remote Manual Release, Pull-To-Trip		94.23	7.35
21 23 16 00-0044	EA	Corner Pulley, Mechanical Actuation Systems		13.81	1.98
21 23 16 00-0045	EA	Double Tee Pulley, Mechanical Actuation Systems		182.46	12.13
21 23 16 00-0046	EA	In-Line Tee Pulley, Mechanical Actuation Systems		23.08	3.23
21 23 16 00-0047	EA	Corner Pulley / Quik-Seal Adapter Combination		49.69	3.68
21 23 16 00-0048	LF	1/16" Cable, Mechanical Actuation Systems		1.70	0.74
21 23 16 00-0049	EA	Cable Clamp		6.94	0.36
21 23 16 00-0050	EA	Cable Crimp Sleeve, Mechanical Actuation Systems		1.00	0.29
21 23 16 00-0051	EA	"S" Hook, Mechanical Actuation Systems		0.97	0.29
21 23 16 00-0052	EA	1/2" EMT x 3/8" NPT Adapter, Mechanical Actuation Systems		49.23	6.84
21 23 16 00-0053		Mechanical Detection Links <small>(21 23 16 00-0001)</small>			
21 23 16 00-0054	EA	KGS Standard Response Link		11.74	3.68
21 23 16 00-0055	EA	KGS Rapid Response Link		16.13	3.68
21 23 16 00-0056	EA	KFA Type "A" Fusible Link		14.16	3.68
21 23 16 00-0057	EA	KML Type "ML" Fusible Link		14.58	3.68
21 23 16 00-0058	EA	500 Degreee, KML Type "ML" Fusible Link		20.78	3.68
21 23 16 00-0059		Gas Valves <small>(21 23 16 00-0001)</small>			
21 23 16 00-0060	EA	3/4" NPT Mechanical Cable Operated Gas Shut-off Valve		214.22	15.88
21 23 16 00-0061	EA	1" NPT Mechanical Cable Operated Gas Shut-off Valve		234.48	19.55
21 23 16 00-0062	EA	1-1/4" NPT Mechanical Cable Operated Gas Shut-off Valve		270.54	24.69
21 23 16 00-0063	EA	1-1/2" NPT Mechanical Cable Operated Gas Shut-off Valve		297.62	28.45
21 23 16 00-0064	EA	2" NPT Mechanical Cable Operated Gas Shut-off Valve		323.09	33.59
21 23 16 00-0065	EA	2-1/2" NPT Mechanical Cable Operated Gas Shut-off Valve		532.04	49.10
21 23 16 00-0066	EA	3" NPT Mechanical Cable Operated Gas Shut-off Valve		595.24	56.82
21 23 16 00-0067	EA	Pneumatic Release (Single Unit)		243.27	17.93
21 23 16 00-0068	EA	Replacement Cable Block And Set Screw Assembly For Gas Valve		30.07	3.68
21 23 16 00-0069	EA	1/2" Electric Solenoid Gas Shut-off Valve		222.61	14.78
21 23 16 00-0070	EA	3/4" Electric Solenoid Gas Shut-off Valve		224.82	15.88
21 23 16 00-0071	EA	1" Electric Solenoid Gas Shut-off Valve		344.27	19.55
21 23 16 00-0072	EA	1-1/4" Electric Solenoid Gas Shut-off Valve		366.71	24.69
21 23 16 00-0073	EA	1-1/2" Electric Solenoid Gas Shut-off Valve		421.04	28.45
21 23 16 00-0074	EA	2" Electric Solenoid Gas Shut-off Valve		539.65	33.59
21 23 16 00-0075	EA	2-1/2" Electric Solenoid Gas Shut-off Valve		888.68	49.10
21 23 16 00-0076	EA	3" Electric Solenoid Gas Shut-off Valve		1,113.92	56.82
21 23 16 00-0077	EA	Manual Reset Relay		333.27	73.87
21 23 16 00-0078		Liquid Tight Sealing Adapters <small>(21 23 16 00-0001)</small>			
21 23 16 00-0079	EA	Compression Seal Adapter - 3/8" Tubing		25.10	3.08
21 23 16 00-0080	EA	Compression Seal Adapter - 1/2" Tubing / 1/4" Pipe		24.88	3.38
21 23 16 00-0081	EA	Compression Seal Adapter - 5/8" Tubing / 3/8" Pipe		29.26	4.04
21 23 16 00-0082	EA	Compression Seal Adapter - 3/4" Tubing / 1/2" Pipe		33.60	4.33



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
21 23 16 00-0083 EA Compression Seal Adapter - 1/2" Electrical Metallic Tubing (EMT)	29.26	4.04
21 23 16 00-0084 EA Quik-Seal Adapter - 3/8" NPT Female	24.88	3.38
21 23 16 00-0085 EA Quik-Seal Adapter - 1/2" NPT Female	24.88	3.38
21 23 16 00-0086 EA Quik-Seal Adapter - 3/4" NPT Female	40.97	5.73
21 23 16 00-0087 EA Quik-Seal Adapter - 1" NPT Female	54.53	7.58
21 23 16 00-0088 EA Quik-Patch For Hole Patching Up To 1-1/8" Diameter	24.88	3.38
21 23 16 00-0089 Pressure Operated Releasing Systems (21 23 16 00-0001)		
21 23 16 00-0090 EA KRS-100 Nitrogen Cylinder.....	179.91	22.19
21 23 16 00-0091 EA KRS-100 Actuator Assembly	162.63	22.64
21 23 16 00-0092 EA KRS-100 Mounting Bracket	121.65	5.58
21 23 16 00-0093 EA KRS-700S Nitrogen Cylinder	466.48	64.02
21 23 16 00-0094 EA KRS-700 Mounting Bracket	99.33	13.67
21 23 16 00-0095 EA KRS-700S Discharge Adapter Kit.....	146.91	13.67
21 23 16 00-0096 EA Check Valve, Pressure Operated Releasing Systems	143.56	9.70
21 23 16 00-0097 EA Vent Check, Pressure Operated Releasing Systems	45.73	6.18
21 23 16 00-0098 EA Replacement Receiver Gasket For KRS-100 Actuator Assembly.....	5.97	
21 23 16 00-0099 EA 3 Pole, Double Throw Pressure Switch	373.99	51.45
21 23 16 00-0100 Pyro-Chem Kitchen Fire Suppression Systems (21 23 16)		
21 23 16 00-0101 Cylinders, Kitchen Fire Suppression Systems (21 23 16 00-0100)		
21 23 16 00-0102 EA 3.0 Gallon Agent Cylinder With Valve, Kitchen Fire Suppression Systems (Pyro-Chem 551194).....	477.18	52.18
21 23 16 00-0103 EA 4.6 Gallon Agent Cylinder With Valve, Kitchen Fire Suppression Systems (Pyro-Chem 551193).....	687.38	75.19
21 23 16 00-0104 EA 6.0 Gallon Agent Cylinder With Valve, Kitchen Fire Suppression Systems (Pyro-Chem 551196).....	904.51	102.83
21 23 16 00-0105 EA Cylinder Mounting Bracket, Kitchen Fire Suppression Systems (Pyro-Chem 550053).....	98.49	12.27
21 23 16 00-0106 EA Enclosure With Mechanical Control Unit, Kitchen Fire Suppression Systems (Pyro-Chem 551208).....	648.27	80.26
21 23 16 00-0107 EA Enclosure For Secondary Cylinders, Kitchen Fire Suppression Systems (Pyro-Chem 550966).....	395.80	48.95
21 23 16 00-0108 Fusible Links, Kitchen Fire Suppression Systems (21 23 16 00-0100)		
21 23 16 00-0109 EA 165 Fahrenheit, Fusible Link, Kitchen Fire Suppression Systems (Pyro-Chem 551522).....	12.78	1.62
21 23 16 00-0110 EA 212 Fahrenheit, Fusible Link, Kitchen Fire Suppression Systems (Pyro-Chem 551523).....	12.78	1.62
21 23 16 00-0111 EA 280 Fahrenheit, Fusible Link, Kitchen Fire Suppression Systems (Pyro-Chem 551524).....	13.07	1.62
21 23 16 00-0112 EA 360 Fahrenheit, Fusible Link, Kitchen Fire Suppression Systems (Pyro-Chem 551525).....	12.78	1.62
21 23 16 00-0113 EA 450 Fahrenheit, Fusible Link, Kitchen Fire Suppression Systems (Pyro-Chem 551526).....	12.78	1.62
21 23 16 00-0114 EA 500 Fahrenheit, Fusible Link, Kitchen Fire Suppression Systems (Pyro-Chem 551527).....	13.83	1.62
21 23 16 00-0115 EA Fusible Link Kit With 10" Bracket, Kitchen Fire Suppression Systems (Pyro-Chem 550131).....	22.14	2.72
21 23 16 00-0116 EA Fusible Link Kit With 8" Bracket, Kitchen Fire Suppression Systems (Pyro-Chem 550132).....	28.75	3.61
21 23 16 00-0117 EA Fusible Link Hanger, Kitchen Fire Suppression Systems (Pyro-Chem 550876).....	41.66	18.60
21 23 16 00-0118 EA 225 To 600 Fahrenheit, Electrical Thermal Detector, Kitchen Fire Suppression Systems (Pyro-Chem 13970-6).....	279.76	41.38
21 23 16 00-0119 Gas Valves, Kitchen Fire Suppression Systems (21 23 16 00-0100)		
21 23 16 00-0120 EA 3/4" Mechanical Gas Valve, Direct Cable Hookup, Kitchen Fire Suppression Systems (Pyro-Chem 550593).....	225.17	15.88
21 23 16 00-0121 EA 1" Mechanical Gas Valve, Direct Cable Hookup, Kitchen Fire Suppression Systems (Pyro-Chem 550594).....	257.16	19.55
21 23 16 00-0122 EA 1-1/4" Mechanical Gas Valve, Direct Cable Hookup, Kitchen Fire Suppression Systems (Pyro-Chem 550595).....	279.20	24.69
21 23 16 00-0123 EA 1-1/2" Mechanical Gas Valve, Direct Cable Hookup, Kitchen Fire Suppression Systems (Pyro-Chem 550596).....	307.68	28.37
21 23 16 00-0124 EA 2" Mechanical Gas Valve, Direct Cable Hookup, Kitchen Fire Suppression Systems (Pyro-Chem 551049).....	354.34	33.52
21 23 16 00-0125 EA 2-1/2" Mechanical Gas Valve, Direct Cable Hookup, Kitchen Fire Suppression Systems (Pyro-Chem 550185).....	812.12	49.02
21 23 16 00-0126 EA 3" Mechanical Gas Valve, Direct Cable Hookup, Kitchen Fire Suppression Systems (Pyro-Chem 550186).....	868.62	56.75
21 23 16 00-0127 EA 3/4" Electrical Gas Valve, Kitchen Fire Suppression Systems (Pyro-Chem 550358).....	178.25	15.88
21 23 16 00-0128 EA 1" Electrical Gas Valve, Kitchen Fire Suppression Systems (Pyro-Chem 550359).....	300.55	19.55
21 23 16 00-0129 EA 1-1/4" Electrical Gas Valve, Kitchen Fire Suppression Systems (Pyro-Chem 550360).....	315.55	24.69
21 23 16 00-0130 EA 1-1/2" Electrical Gas Valve, Kitchen Fire Suppression Systems (Pyro-Chem 550361).....	359.27	28.37
21 23 16 00-0131 EA 2" Electrical Gas Valve, Kitchen Fire Suppression Systems (Pyro-Chem 550362).....	495.06	33.52
21 23 16 00-0132 EA 2-1/2" Electrical Gas Valve, Kitchen Fire Suppression Systems (Pyro-Chem 550363).....	950.48	49.02
21 23 16 00-0133 EA 3" Electrical Gas Valve, Kitchen Fire Suppression Systems (Pyro-Chem 17643).....	1,004.65	56.75
21 23 16 00-0134 Nozzles, Kitchen Fire Suppression Systems (21 23 16 00-0100)		
21 23 16 00-0135 EA Nozzle, Kitchen Fire Suppression Systems (Pyro-Chem).....	45.72	5.44
21 23 16 00-0136 EA Swivel Nozzle, Kitchen Fire Suppression Systems (Pyro-Chem).....	64.56	6.91
21 23 16 00-0137 EA Stainless Steel Nozzle, Kitchen Fire Suppression Systems (Pyro-Chem).....	240.40	6.91
21 23 16 00-0138 Actuating Cylinders/Cartridges, Kitchen Fire Suppression Systems (21 23 16 00-0100)		
21 23 16 00-0139 EA Carbon Dioxide Actuation Cartridge, Kitchen Fire Suppression Systems (Pyro-Chem 551059).....	16.92	2.14
21 23 16 00-0140 EA PAC-10, Pneumatic Actuating Cylinder, Kitchen Fire Suppression Systems (Pyro-Chem 550104).....	554.36	69.02
21 23 16 00-0141 EA PAC-200, Pneumatic Actuating Cylinder, Kitchen Fire Suppression Systems (Pyro-Chem 550690).....	706.54	88.28
21 23 16 00-0142 Circuit Monitors, Kitchen Fire Suppression Systems (21 23 16 00-0100)		
21 23 16 00-0143 EA 24 Volt DC, System Circuit Monitor/Gas Valve Reset Relay, Kitchen Fire Suppression Systems (Pyro-Chem 550303).....	362.41	45.20
21 23 16 00-0144 EA 120 Volt AC, System Circuit Monitor/Gas Valve Reset Relay, Kitchen Fire Suppression Systems (Pyro-Chem 550302).....	437.26	54.46

21 Fire Suppression**21 20 Fire-Extinguishing Systems****21 23 Wet-Chemical Fire-Extinguishing Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
21 23 16 00-0145			Control Heads, Kitchen Fire Suppression Systems <small>(21 23 16 00-0100)</small>		
21 23 16 00-0146	EA		Mechanical Control Head, No Local Action, Kitchen Fire Suppression Systems (Pyro-Chem 551203).....	399.84	49.84
21 23 16 00-0147	EA		Mechanical Control Head With Local Action, Kitchen Fire Suppression Systems (Pyro-Chem 551200).....	417.38	52.11
21 23 16 00-0148	EA		24 Volt DC, Electrical Control Head With Local Actuation, Kitchen Fire Suppression Systems (Pyro-Chem 551201).....	543.60	67.77
21 23 16 00-0149	EA		120 Volt AC Electrical Control Head With Local Actuation, Kitchen Fire Suppression Systems (Pyro-Chem 551202).....	623.68	77.91
21 23 16 00-0150	EA		Control Head Mounting Bracket, Kitchen Fire Suppression Systems (Pyro-Chem 550853).....	50.65	6.32
21 23 16 00-0151			Corner Pulleys/Tees, Kitchen Fire Suppression Systems <small>(21 23 16 00-0100)</small>		
21 23 16 00-0152	EA		Set Screw Type, Corner Pulley, Kitchen Fire Suppression Systems (Pyro-Chem 415670).....	12.44	1.03
21 23 16 00-0153	EA		Compression Type, Corner Pulley, Kitchen Fire Suppression Systems (Pyro-Chem 423250).....	12.90	1.32
21 23 16 00-0154	EA		Tee Pulley, Kitchen Fire Suppression Systems (Pyro-Chem 550166).....	40.61	5.07
21 23 16 00-0155	EA		Replacement Screw For Corner Pulley, Kitchen Fire Suppression Systems (Pyro-Chem 550272).....	0.54	
21 23 16 00-0156			Switches, Kitchen Fire Suppression Systems <small>(21 23 16 00-0100)</small>		
21 23 16 00-0157	EA		SPDT Switch, Kitchen Fire Suppression Systems (Pyro-Chem 550227).....	44.16	5.51
21 23 16 00-0158	EA		DPDT Switch, Kitchen Fire Suppression Systems (Pyro-Chem 550237).....	88.45	10.95
21 23 16 00-0159	EA		Four Pole Double Throw Switch, Kitchen Fire Suppression Systems (Pyro-Chem 550978).....	187.17	23.23
21 23 16 00-0160			Wire Rope/Accessories, Kitchen Fire Suppression Systems <small>(21 23 16 00-0100)</small>		
21 23 16 00-0161	LF		1/16" Diameter Stainless Steel Wire Rope, Kitchen Fire Suppression Systems (Pyro-Chem 15821).....	0.93	0.22
21 23 16 00-0162	EA		Crimps For 1/16" Diameter Stainless Steel Wire Rope, Kitchen Fire Suppression Systems (Pyro-Chem 550122).....	0.60	0.22
21 23 16 00-0163	EA		High Temperature Stainless Steel Crimps, Kitchen Fire Suppression Systems (Pyro-Chem 551551).....	2.19	0.29
21 23 16 00-0164	EA		"S" Hooks, Kitchen Fire Suppression Systems (Pyro-Chem 550121).....	0.41	
21 23 16 00-0165			Replacement Parts, Kitchen Fire Suppression Systems <small>(21 23 16 00-0100)</small>		
21 23 16 00-0166	EA		Wet Valve Rebuilding Kit, Kitchen Fire Suppression Systems (Pyro-Chem 550698).....	41.99	5.29
21 23 16 00-0167	EA		Wet Valve Cap With Schrader Valve, Kitchen Fire Suppression Systems (Pyro-Chem 550831).....	43.82	5.51
21 23 16 00-0168	EA		Wet Spring, Kitchen Fire Suppression Systems (Pyro-Chem 550705).....	5.13	0.66
21 23 16 00-0169	EA		225 psi, Wet Gage, Kitchen Fire Suppression Systems (Pyro-Chem 551236).....	60.11	7.20
21 23 16 00-0170	EA		Wet Valve O-ring, Kitchen Fire Suppression Systems (Pyro-Chem 550716).....	8.45	1.03
21 23 16 00-0171	EA		Wet Piston, Kitchen Fire Suppression Systems (Pyro-Chem 550707).....	11.76	1.47
21 23 16 00-0172	EA		Wet Piston O-Ring, Kitchen Fire Suppression Systems (Pyro-Chem 550715).....	5.13	0.66
21 23 16 00-0173	EA		Wet Nozzle Cap, Kitchen Fire Suppression Systems (Pyro-Chem 551528).....	7.23	0.89
21 23 16 00-0174	EA		Wet Nozzle Strainer, Kitchen Fire Suppression Systems (Pyro-Chem 551529).....	7.07	0.89
21 23 16 00-0175	EA		Wet Nozzle Cap O-Ring, Kitchen Fire Suppression Systems (Pyro-Chem 551530).....	2.01	0.22
21 23 16 00-0176	EA		Replacement Teflon Washer For Control Head Actuator, Kitchen Fire Suppression Systems (Pyro-Chem 550257).....	3.43	
21 23 16 00-0177	EA		O-Ring Lubrication, Kitchen Fire Suppression Systems (Pyro-Chem 550063).....	65.48	
21 23 16 00-0178	EA		3.0 Gallon Empty Test Tank, Kitchen Fire Suppression Systems (Pyro-Chem 551024).....	442.65	
21 23 16 00-0179	EA		4.6 Gallon Empty Test Tank, Kitchen Fire Suppression Systems (Pyro-Chem 550902).....	576.31	
21 23 16 00-0180	EA		6.0 Gallon Empty Test Tank, Kitchen Fire Suppression Systems (Pyro-Chem 550901).....	666.46	
21 23 16 00-0181			Accessories, Kitchen Fire Suppression Systems <small>(21 23 16 00-0100)</small>		
21 23 16 00-0182	EA		3/8" Quickseal Adapter, Kitchen Fire Suppression Systems (Pyro-Chem 550857).....	20.54	2.50
21 23 16 00-0183	EA		1/2" Quickseal Adapter, Kitchen Fire Suppression Systems (Pyro-Chem 550859).....	21.28	2.65
21 23 16 00-0184	EA		Wet Valve Tool, Kitchen Fire Suppression Systems (Pyro-Chem 550788).....	40.97	5.07
21 23 16 00-0185	EA		Recharge Adapter Kit, Kitchen Fire Suppression Systems (Pyro-Chem 551240).....	57.99	
21 23 16 00-0186	EA		3.0 Gallon Of Wet Chemical For Recharge, Kitchen Fire Suppression Systems (Pyro-Chem 551188).....	124.63	
21 23 16 00-0187			Pull Stations/Accessories, Kitchen Fire Suppression Systems <small>(21 23 16 00-0100)</small>		
21 23 16 00-0188	EA		Mechanical, Remote Pull Station, Kitchen Fire Suppression Systems (Pyro-Chem 551074).....	82.83	10.37
21 23 16 00-0189	EA		Electric, Remote Pull Station, Kitchen Fire Suppression Systems (Pyro-Chem 551166).....	90.11	14.56
21 23 16 00-0190	EA		Trim Ring For Flush Mounting Remote Pull Station, Kitchen Fire Suppression Systems (Pyro-Chem 550088).....	22.14	2.72
21 23 16 00-0191	EA		Glass Rods For Pull Stations, Kitchen Fire Suppression Systems (Pyro-Chem 428661).....	3.20	0.96
21 23 16 00-0192			Asco Gas Valve Control Panels <small>(21 23 16)</small>		
21 23 16 00-0193	EA		Relay Control Panel For AC Solenoid Valves (Asco 108D90C).....	1,345.08	161.70
21 23 16 00-0194	EA		Relay Control Panel For DC Solenoid Valves (Asco 108D10C).....	1,387.49	161.70
21 23 16 00-0195	EA		Master Control Station For Relay Control Panel For DC Solenoid Valves (Asco 216C89).....	444.52	36.75
21 23 16 00-0196	EA		Emergency Stop Station For Relay Control Panel (Asco 173A19).....	416.81	36.75
21 24			Dry-Chemical Fire-Extinguishing Systems <small>(21 20)</small>		
21 24 16			Dry-Chemical Fire-Extinguishing Equipment <small>(21 24)</small>		
21 24 16 00-0001			Amerex KP Restaurant Fire Suppression Systems <small>(21 24 16)</small>		
			Note: Amerex or equal.		
21 24 16 00-0002	EA		Agent Cylinder Assembly 3.75 Gallon (With Discharge Valve) Charged.....	323.75	57.04
21 24 16 00-0003	EA		Agent Cylinder Assembly 6 Gallon (With Discharge Valve) Charged.....	446.70	71.94
21 24 16 00-0004	EA		Recharge - KP Liquid Agent (3.75 Gallon).....	106.08	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
21 24 16 00-0005 EA Recharge - KP Liquid Agent (6 Gallon).....	186.49	
21 24 16 00-0006 EA Bracket Assembly Agent Cylinder 3.75 Gallon (With Distribution Hose Assembly And Distribution Outlet)	74.25	11.97
21 24 16 00-0007 EA Bracket Assembly Agent Cylinder 6 Gallon	43.26	6.95
21 24 16 00-0008 EA Discharge Adapter Kit 3/4 NPT - Agent Cylinder 6 Gallon.....	18.76	
21 24 16 00-0009 EA Pneumatic Actuator - Agent Cylinder 6 Gallon.....	74.25	11.97
21 24 16 00-0010 EA Actuator - MRM (Less N2 Cylinder And Enclosure).....	186.49	30.03
21 24 16 00-0011 EA Enclosure - MRM, Painted Steel.....	99.39	15.97
21 24 16 00-0012 EA Enclosure - MRM, Stainless Steel	119.08	15.97
21 24 16 00-0013 EA Cabinet, Stainless Steel (Single Cylinder System)	295.94	47.67
21 24 16 00-0014 EA Actuation Hose - (N2 - 1/4" x 16").....	22.33	3.59
21 24 16 00-0015 EA Cylinder, Nitrogen - 10 CU. In. (Use For 1-10 Agent Cylinders)	99.39	15.97
21 24 16 00-0016 EA Vent Check.....	17.87	2.87
21 24 16 00-0017 EA Detector.....	13.40	2.15
Note: Includes bracket, linkage and conduit fittings.		
21 24 16 00-0018 EA Fusible Link - 280 To 450 Degree F	5.03	0.80
21 24 16 00-0019 EA Test Link.....	1.96	
21 24 16 00-0020 EA Corner Pulley.....	6.92	1.12
21 24 16 00-0021 EA Cable, 1/16" - 500 Foot Spool.....	111.67	17.96
21 24 16 00-0022 EA Pulley Tee.....	50.24	8.07
21 24 16 00-0023 EA Manual Pull Station (Standard).....	44.67	7.19
21 24 16 00-0024 EA Adapter Kit - Manual Pull Station (Recess Standard Pull Station)	20.96	3.35
21 24 16 00-0025 EA Manual Pull Station (Oversized)	49.80	7.98
21 24 16 00-0026 EA Conduit Offset.....	9.94	1.60
21 24 16 00-0027 EA Seal - 3/8" Pipe Thread (Quick-Seal).....	13.70	2.24
21 24 16 00-0028 EA Seal - 1/2" Pipe Thread (Quick-Seal).....	11.16	1.83
21 24 16 00-0029 EA 3/8" Pipe Compression Seal	18.65	3.03
21 24 16 00-0030 EA 1/2" Pipe Compression Seal	18.65	3.03
21 24 16 00-0031 EA Cap, Nozzle Blow-Off (Standard).....	6.03	2.07
21 24 16 00-0032 EA Cap, Nozzle Blow-Off (High Temperature)	12.47	2.07
21 24 16 00-0033 EA Nozzle - Fryer, Griddle - 2 Flow Points Each.....	22.33	3.59
21 24 16 00-0034 EA Nozzle - Appliance, Plenum - 1 Flow Points Each	22.33	3.59
21 24 16 00-0035 EA Nozzle - Solid Fuel Charbroiler - 1 To 1-1/2 Flow Points Each.....	22.33	3.59
21 24 16 00-0036 EA Nozzle - Upright Charbroiler - 1/2 Flow Points Each.....	22.33	3.59
21 24 16 00-0037 EA Nozzle - Duct (Only) - 2 Flow Points Each.....	22.33	3.59
21 24 16 00-0038 EA Nozzle - Four Burner Range - 2 Flow Points Each	32.12	5.19
21 24 16 00-0039 EA Gas Valve - Mechanical - 3/4" Or 1"	173.32	21.16
21 24 16 00-0040 EA Gas Valve - Mechanical - 1-1/4" Or 1-1/2"	207.62	30.74
21 24 16 00-0041 EA Gas Valve - Mechanical - 2"	257.42	36.33
21 24 16 00-0042 EA Manual Reset Relay (Required With Every Electric Gas Valve)	281.40	45.27
21 24 16 00-0043 EA SPDT Microswitch With 18" Leads	14.81	2.40
21 24 16 00-0044 EA Kit Gas Valve Actuator For Use With ASCO Mechanical Gas Valve	23.89	3.84
21 24 16 00-0045 EA Gas Valve Trip Assembly.....	50.25	8.07
21 24 16 00-0046	Range Guard Fire Suppression Systems (21 24 16)	
Note: Range Guard or equal.		
21 24 16 00-0047 EA 1-1/4 Gallon Charged Cylinder With Valve	344.40	61.66
21 24 16 00-0048 EA 2-1/2 Gallon Charged Cylinder With Valve	429.91	76.96
21 24 16 00-0049 EA 4 Gallon Charged Cylinder With Valve	530.75	95.04
21 24 16 00-0050 EA 6 Gallon Charged Cylinder With Valve	630.41	112.83
21 24 16 00-0051 EA Vent Plug.....	14.48	2.57
21 24 16 00-0052 EA Discharge Adapter Kit.....	18.63	
21 24 16 00-0053 EA 1-1/4 Gallon Wall Bracket.....	38.33	6.84
21 24 16 00-0054 EA 2-1/2 Gallon Wall Bracket.....	40.58	7.27
21 24 16 00-0055 EA 4 Gallon Wall Bracket	76.62	13.74
21 24 16 00-0056 EA 6 Gallon Wall Bracket	84.92	15.21
21 24 16 00-0057 EA Mechanical Control Head, No Microswitch	299.58	53.65
21 24 16 00-0058 EA Mechanical Control Head, 1 Microswitch.....	312.55	55.93
21 24 16 00-0059 EA Mechanical Control Head, 2 Microswitches	358.55	64.17
21 24 16 00-0060 EA Tandem Control Head	272.45	48.81
21 24 16 00-0061 EA Electric Control Head, 120 Volt AC / 24 Volt DC.....	461.16	82.55
21 24 16 00-0062 EA Mechanical Control Box.....	205.22	36.75
21 24 16 00-0063 EA Tandem Control Box.....	205.22	36.75
21 24 16 00-0064 EA Mechanical Control Box Adapter	60.16	10.81
21 24 16 00-0065 EA A+ Control head With 1 Pressure Operated Actuator	180.77	32.34
21 24 16 00-0066 EA Pressure Operated Actuator	74.31	13.31
21 24 16 00-0067 EA BMCS-1 Nitrogen Cylinder.....	120.30	21.54
21 24 16 00-0068 EA BMCS-1 Actuator Assembly	122.66	21.98
21 24 16 00-0069 EA BMCS-1 Mounting Bracket	30.08	5.37
21 24 16 00-0070 EA BMCS-7 Nitrogen Cylinder.....	347.12	62.11
21 24 16 00-0071 EA BMCS-7 Mounting Bracket	74.31	13.31
21 24 16 00-0072 EA BMCS-7 Discharge Adapter Kit	74.31	13.31
21 24 16 00-0073 EA Check Valve.....	65.24	15.81
21 24 16 00-0074 EA Vent Check For Use With BMCS Systems	33.62	6.02
21 24 16 00-0075 EA Check Valve, (Schrader Flare Fitting) For Pressure Operated Actuator	14.63	2.62
21 24 16 00-0076 EA Replacement Receiver Gasket For BMCS-Actuator Assembly.....	3.85	
21 24 16 00-0077 EA Pneumatic Control Head For Slave Cylinders.....	76.66	13.74
21 24 16 00-0078 EA Nozzles; ADP, F, R And GRW.....	35.14	6.32
21 24 16 00-0079 EA Nozzles; DM And LPF	39.16	6.98
21 24 16 00-0080 EA Swivel Adapter.....	24.77	4.41
21 24 16 00-0081 EA Corner Pulley.....	10.61	1.91

21 Fire Suppression**21 20 Fire-Extinguishing Systems****21 24 Dry-Chemical Fire-Extinguishing Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
21 24 16 00-0082	LF		1/16" Stainless Steel Cable.....	0.53	0.22
21 24 16 00-0083	EA		Cable Crimp Sleeve.....	0.64	0.22
21 24 16 00-0084	EA		"S" Hook.....	0.47	0.15
21 24 16 00-0085	EA		Electrical Metallic Tubing (EMT) Adapter, 1/2" Electrical Metallic Tubing (EMT) x 3/8" NPT.....	36.55	6.54
21 24 16 00-0086	EA		Cable Clamp.....	3.26	0.58
21 24 16 00-0087	EA		Nico Sleeves - 1/16" Cable.....	0.47	0.15
21 24 16 00-0088	EA		3/8" Cable Anchor.....	38.62	6.91
21 24 16 00-0089	EA		1/2" Cable Anchor.....	38.62	6.91
21 24 16 00-0090	EA		Mechanical Remote Manual Release (Pull Cable).....	62.46	11.17
21 24 16 00-0091	EA		Tee Pulley, Use For Mechanical Pull And Gas Valve.....	66.68	11.91
21 24 16 00-0092	EA		Surface Remote Manual Release, End-of-line.....	78.11	13.96
21 24 16 00-0093	EA		Surface Remote Manual Release, In line Conservation Kit.....	24.47	4.41
21 24 16 00-0094	EA		Surface Remote Manual Release, In line And End Of Line.....	102.55	18.30
21 24 16 00-0095	EA		Recessed Remote Manual Release, End-of-line.....	78.11	13.96
21 24 16 00-0096	EA		Recessed Remote Manual Release, In Line Kit.....	93.11	16.68
21 24 16 00-0097	EA		Pulley Tee, Remote In Line Only.....	16.73	3.01
21 24 16 00-0098	EA		Fusible Link Housing Kit With 1 - Bracket, 2 - 1/2" Electrical Metallic Tubing (EMT) Connector, 1 - "S" Hook, 8 - Cable Crimp Sleeve.....	18.59	3.30
21 24 16 00-0099	EA		Fusible Link 165F To 360F.....	6.10	1.10
21 24 16 00-0100	EA		Fusible Link 500F.....	9.24	1.10
21 24 16 00-0101	EA		Standard Detector With 1 - 360F link, 2 - "S" Hooks, 2 - Crimp Sleeves.....	18.59	3.30
21 24 16 00-0102	EA		Standard Detector Kit With 1 - Large Bracket, 2 - "S" Hooks, 2 - Cable Crimp Sleeve.....	14.23	3.30
21 24 16 00-0103	EA		Quartzoid Link 400 F.....	100.18	17.93
21 24 16 00-0104	EA		Quartzoid Link 500 F.....	100.18	17.93
21 24 16 00-0105	EA		SPDT Micro Switch For Use With A Plus Control Box.....	35.91	6.40
21 24 16 00-0106	EA		DPDT Micro Switch For Use With A Plus Control Box.....	62.46	11.17
21 24 16 00-0107	EA		SPDT Micro Switch For Use With A Mechanical Control Box.....	37.13	6.62
21 24 16 00-0108	EA		DPDT Micro Switch For Use With A Mechanical Control Box.....	64.35	11.53
21 24 16 00-0109	EA		SPDT Micro Switch For Use With PRCB.....	47.14	8.45
21 24 16 00-0110	EA		DPDT Micro Switch For Use With PRCB.....	68.01	12.13
21 24 16 00-0111	EA		Pressure Switch, SPDT (Fire Dept. Tie In).....	199.19	35.65
21 24 16 00-0112	EA		Circuit Monitor 12 Or 24 Volt DC.....	89.58	16.03
21 24 16 00-0113	EA		Circuit Monitor 120 Volt AC.....	89.58	16.03
21 24 16 00-0114	EA		Electric Manual Pull Station.....	65.41	11.69
21 24 16 00-0115	EA		6", 24 Volt DC, Motor Bell.....	36.54	6.54
21 24 16 00-0116	EA		10", 115 Volt AC Motor Bell.....	51.87	9.26
21 24 16 00-0117	EA		Fuse, 1.2 For ECH.....	4.21	0.74
21 24 16 00-0118	EA		Indicator Lamp 12 Or 24 Volt DC.....	18.59	3.30
21 24 16 00-0119	EA		Indicator Lamp 120 Volt AC.....	18.59	3.30
21 24 16 00-0120	EA		B-10 Manual Station Dual Action, SPDT.....	68.36	12.20
21 24 16 00-0121	EA		B-11 Manual Station Dual Action, DPDT.....	75.43	13.52
21 24 16 00-0122	EA		Break Rods For B10/B11 Manual Pull Station.....	2.34	0.96
21 24 16 00-0123	EA		Spare Key For B10/B11 Manual Stations.....	9.43	1.69
21 24 16 00-0124	EA		MT-24-LSM-VAR Multitone Signal With 15/75cd Strobe, 24 Volt, Flush Grill.....	101.37	18.15
21 24 16 00-0125	EA		Suppression Abort Station.....	107.26	19.18
21 24 16 00-0126	EA		Suppression Abort Station With Surface Mount Back Box.....	124.94	22.34
21 24 16 00-0127	EA		Surface Mount Back Box.....	41.25	7.35
21 24 16 00-0128	EA		Single Hazard Control Unit, 120 Volt AC IP.....	766.11	136.94
21 24 16 00-0129	EA		Single Hazard Control Unit, 240 Volt AC IP.....	766.11	136.94
21 24 16 00-0130	EA		1 Lead Acid Battery; 24 Volt DC, 1.2 A.H.....	63.65	11.39
21 24 16 00-0131	EA		Accessory Kit - End-of-line Resistors (10K Ohms, 1/2 W).....	2.50	0.51
21 24 16 00-0132	EA		Spare Scorpio Circuit Board.....	553.92	
21 24 16 00-0133	EA		Extra Scorpio Key.....	9.43	
21 24 16 00-0134	EA		Extra Scorpio Manual.....	5.90	
21 24 16 00-0135	EA		Compression Seal Adapter 3/8" Pipe.....	16.03	2.87
21 24 16 00-0136	EA		Compression Seal Adapter 1/2" Tubing/ 1/4" Pipe.....	17.41	3.08
21 24 16 00-0137	EA		Compression Seal Adapter 5/8" Tubing/ 3/8" Pipe.....	20.94	3.75
21 24 16 00-0138	EA		Compression Seal Adapter 3/4" Tubing/ 1/2" Pipe.....	22.40	3.97
21 24 16 00-0139	EA		Quik Seal Adapter 3/8" NPT Female.....	17.41	3.08
21 24 16 00-0140	EA		Quik Seal Adapter 1/2" NPT Female.....	17.41	3.08
21 24 16 00-0141	EA		Quik Seal Adapter 3/4" NPT Female.....	29.78	5.37
21 24 16 00-0142	EA		Quik Seal Adapter 1" NPT Female.....	39.48	7.05
21 24 16 00-0143	EA		Quik Patch (Up To 1-1/8" Diameter).....	17.41	3.08
21 24 16 00-0144	EA		1-1/4 Gallon Karbaloy Charge.....	38.73	
21 24 16 00-0145	EA		2-1/2 Gallon Karbaloy Charge.....	66.59	
21 24 16 00-0146	EA		4 Gallon Karbaloy Charge.....	100.64	
21 24 16 00-0147	EA		6 Gallon Karbaloy Charge.....	147.28	
21 24 16 00-0148	EA		Inlet Flushing Adapter.....	28.88	5.15
21 24 16 00-0149	EA		1/2" Flushing Adapter (Outlet).....	28.88	5.15
21 24 16 00-0150	EA		1/8" Flushing Adapter (Outlet).....	28.88	5.15
21 24 16 00-0151	EA		1/4" Flushing Adapter (Outlet).....	28.88	5.15
21 24 16 00-0152	EA		3/8" Flushing Adapter (Outlet).....	28.88	5.15
21 24 16 00-0153	EA		Recharge Adapter (Old Style Cylinder Valve Assembly Only).....	40.07	
21 24 16 00-0154	EA		Instruction Label (In Case Of Fire) - MCB.....	3.28	
21 24 16 00-0155	EA		Caution Sign (Turn On Fan).....	3.85	
21 24 16 00-0156	EA		Inspection Label (Authorized installers only).....	2.83	
21 24 16 00-0157	EA		Label, Warning, A+ Control Box.....	2.15	
21 24 16 00-0158	EA		Wet Chemical System Kits, RG-1.25G Kit; #23315.....	506.78	90.63
21 24 16 00-0159	EA		Wet Chemical System Kits, RG-2.5G Kit; #23316.....	591.64	105.77
21 24 16 00-0160	EA		Wet Chemical System Kits, RG-4GS Kit; #23317.....	736.62	131.72
21 24 16 00-0161	EA		Wet Chemical System Kits, RG-4GT Kit; #23318.....	736.62	131.72



Fire Suppression	21	12
Fire-Extinguishing Systems	21 20	
Dry-Chemical Fire-Extinguishing Systems	21 24	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
21 24 16 00-0162 EA Wet Chemical System Kits, RG-6G Kit; #23319	926.36	165.60
21 24 16 00-0163 EA Wet Chemical System Kits, RG Mechanical Control HD (MCH) Kit; #23320	439.02	78.50
21 24 16 00-0164 EA Wet Chemical System Kits, RG Mechanical Control Box (MCB) Kit; #23321	412.49	73.72
21 24 16 00-0165 EA Wet Chemical System Kits, A Plus Control Box Kit; #23322	333.54	59.61
21 24 16 00-0166 EA Wet Chemical System Kits, Valve Rebuild Kit; #23210	577.50	103.27
21 24 16 00-0167 EA Wet Chemical System Kits, BMCS-1 Package; #23208	529.16	94.60

21 30 Fire Pumps ⁽²¹⁾

21 31 Centrifugal Fire Pumps ^(21 30)

21 31 13 Electric-Drive, Centrifugal Fire Pumps ^(21 31)

21 31 13 00-0001 Electric-Drive Fire Pumps ^(21 31 13)

Note: Includes fire pump, motor, motor starter, alarm panel, automatic transfer switch, and controller.

21 31 13 00-0002 EA 20 HP Electric Fire Pump.....	30,766.74	1,437.84
For Duplex Pumping System, Add	29,328.90	
21 31 13 00-0003 EA 30 HP Electric Fire Pump.....	35,824.21	1,617.58
For Duplex Pumping System, Add	34,326.46	
21 31 13 00-0004 EA 40 HP Electric Fire Pump.....	48,701.34	1,797.31
For Duplex Pumping System, Add	47,037.17	
21 31 13 00-0005 EA 50 HP Electric Fire Pump.....	60,186.44	2,068.73
For Duplex Pumping System, Add	58,117.72	
21 31 13 00-0006 EA 75 HP Electric Fire Pump.....	67,168.36	2,256.79
For Duplex Pumping System, Add	64,911.57	

21 31 16 Diesel-Drive, Centrifugal Fire Pumps ^(21 31)

21 31 16 00-0001 Diesel-Drive Fire Pumps ^(21 31 16)

Note: Pumps shall be stand alone units meeting NFPA-20 specs. Includes fire pump, motor, motor starter, alarm panel, and controller.

21 31 16 00-0002 EA 30 HP Diesel Driven Fire Pump, NFPA-20 Specific.....	45,232.06	1,692.59
21 31 16 00-0003 EA 40 HP Diesel Driven Fire Pump, NFPA-20 Specific.....	51,155.99	1,880.66
21 31 16 00-0004 EA 50 HP Diesel Driven Fire Pump, NFPA-20 Specific.....	53,781.52	2,068.73
21 31 16 00-0005 EA 75 HP Diesel Driven Fire Pump, NFPA-20 Specific.....	61,169.53	2,256.79
21 31 16 00-0006 EA 150 HP Diesel Driven Fire Pump, NFPA-20 Specific.....	65,007.09	2,632.92
21 31 16 00-0007 EA 175 HP Diesel Driven Fire Pump, NFPA-20 Specific.....	70,157.72	3,385.19
21 31 16 00-0008 EA 200 HP Diesel Driven Fire Pump, NFPA-20 Specific.....	76,182.92	3,761.32
21 31 16 00-0009 EA 250 HP Diesel Driven Fire Pump, NFPA-20 Specific.....	87,108.88	4,287.90
21 31 16 00-0010 EA 300 HP Diesel Driven Fire Pump, NFPA-20 Specific.....	104,165.67	4,626.42
21 31 16 00-0011 EA 350 HP Diesel Driven Fire Pump, NFPA-20 Specific.....	122,160.58	5,265.85
21 31 16 00-0012 EA 400 HP Diesel Driven Fire Pump, NFPA-20 Specific.....	144,790.06	5,641.98
21 31 16 00-0013 EA 500 HP Diesel Driven Fire Pump, NFPA-20 Specific.....	162,931.77	6,018.11

21 31 16 00-0014 Electric Controllers For Fire Pumps ^(21 31 16)

21 31 16 00-0015 Wye-Delta (Star-Delta), Closed Transition Electric Fire Pump Controller ^(21 31 16)

21 31 16 00-0016 EA 30 HP Wye-Delta (Star-Delta), Closed Transition Electric Fire Pump Controller With Automatic Transfer Switch	17,077.27	169.25
21 31 16 00-0017 EA 40 HP Wye-Delta (Star-Delta), Closed Transition Electric Fire Pump Controller With Automatic Transfer Switch	19,334.00	188.06
21 31 16 00-0018 EA 50 HP Wye-Delta (Star-Delta), Closed Transition Electric Fire Pump Controller With Automatic Transfer Switch	20,271.37	206.88
21 31 16 00-0019 EA 75 HP Wye-Delta (Star-Delta), Closed Transition Electric Fire Pump Controller With Automatic Transfer Switch	23,113.74	225.68
21 31 16 00-0020 EA 150 HP Wye-Delta (Star-Delta), Closed Transition Electric Fire Pump Controller With Automatic Transfer Switch	24,423.05	263.30
21 31 16 00-0021 EA 175 HP Wye-Delta (Star-Delta), Closed Transition Electric Fire Pump Controller With Automatic Transfer Switch	26,031.98	338.52
21 31 16 00-0022 EA 200 HP Wye-Delta (Star-Delta), Closed Transition Electric Fire Pump Controller With Automatic Transfer Switch	28,216.37	376.13
21 31 16 00-0023 EA 250 HP Wye-Delta (Star-Delta), Closed Transition Electric Fire Pump Controller With Automatic Transfer Switch	32,270.78	428.79
21 31 16 00-0024 EA 300 HP Wye-Delta (Star-Delta), Closed Transition Electric Fire Pump Controller With Automatic Transfer Switch	38,890.38	462.65
21 31 16 00-0025 EA 350 HP Wye-Delta (Star-Delta), Closed Transition Electric Fire Pump Controller With Automatic Transfer Switch	45,704.79	526.58
21 31 16 00-0026 EA 400 HP Wye-Delta (Star-Delta), Closed Transition Electric Fire Pump Controller With Automatic Transfer Switch	54,530.84	564.20
21 31 16 00-0027 EA 500 HP Wye-Delta (Star-Delta), Closed Transition Electric Fire Pump Controller With Automatic Transfer Switch	61,561.84	601.82

END OF SECTION 21

21	21	Fire Suppression
	21 30	Fire Pumps
	21 31	Centrifugal Fire Pumps



MINOR		TOTAL DIRECT	DEMOLITION
CSI	UOM DESCRIPTION	UNIT COST	UNIT COST

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MINOR	CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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22 Plumbing

Note: Where required, mechanical equipment excludes electrical connection unless title states otherwise.

22 01 Operation and Maintenance of Plumbing⁽²²⁾

22 01 10 Operation And Maintenance Of Plumbing Piping And Pumps^(22 01)

See CSI section 23 01 20 00-0000 for purging of pipes and shutdown.

22 01 10 61 Plumbing Piping Repairs^(22 01 10)

22 01 10 61-0001 Pipe Repair Clamps^(22 01 10 61)

22 01 10 61-0002	EA	1/2" Diameter x 3" Stainless Steel Pipe Repair Clamp, Single Bolt Note: Includes neoprene gasket	25.05
22 01 10 61-0003	EA	3/4" Diameter x 3" Stainless Steel Pipe Repair Clamp, Single Bolt Note: Includes neoprene gasket	26.25
22 01 10 61-0004	EA	1" Diameter x 3" Stainless Steel Pipe Repair Clamp, Single Bolt Note: Includes neoprene gasket	28.88
22 01 10 61-0005	EA	1-1/4" Diameter x 3" Stainless Steel Pipe Repair Clamp, Single Bolt Note: Includes neoprene gasket	30.90
22 01 10 61-0006	EA	1-1/2" Diameter x 3" Stainless Steel Pipe Repair Clamp, Single Bolt Note: Includes neoprene gasket	33.64
22 01 10 61-0007	EA	2" Diameter x 3" Stainless Steel Pipe Repair Clamp, Single Bolt Note: Includes neoprene gasket	43.05
22 01 10 61-0008	EA	2-1/2" Diameter x 3" Stainless Steel Pipe Repair Clamp, Single Bolt Note: Includes neoprene gasket	55.56
22 01 10 61-0009	EA	3" Diameter x 3" Stainless Steel Pipe Repair Clamp, Single Bolt Note: Includes neoprene gasket	65.10
22 01 10 61-0010	EA	4" Diameter x 3" Stainless Steel Pipe Repair Clamp, Single Bolt Note: Includes neoprene gasket	74.78
22 01 10 61-0011	EA	1/2" Diameter x 6" Stainless Steel Pipe Repair Clamp, Double Bolt Note: Includes neoprene gasket	39.49
22 01 10 61-0012	EA	3/4" Diameter x 6" Stainless Steel Pipe Repair Clamp, Double Bolt Note: Includes neoprene gasket	41.34
22 01 10 61-0013	EA	1" Diameter x 6" Stainless Steel Pipe Repair Clamp, Double Bolt Note: Includes neoprene gasket	45.78
22 01 10 61-0014	EA	1-1/4" Diameter x 6" Stainless Steel Pipe Repair Clamp, Double Bolt Note: Includes neoprene gasket	50.32
22 01 10 61-0015	EA	1-1/2" Diameter x 6" Stainless Steel Pipe Repair Clamp, Double Bolt Note: Includes neoprene gasket	55.60
22 01 10 61-0016	EA	2" Diameter x 6" Stainless Steel Pipe Repair Clamp, Double Bolt Note: Includes neoprene gasket	71.94
22 01 10 61-0017	EA	2-1/2" Diameter x 6" Stainless Steel Pipe Repair Clamp, Double Bolt Note: Includes neoprene gasket	88.73
22 01 10 61-0018	EA	3" Diameter x 6" Stainless Steel Pipe Repair Clamp, Double Bolt Note: Includes neoprene gasket	102.01
22 01 10 61-0019	EA	4" Diameter x 6" Stainless Steel Pipe Repair Clamp, Double Bolt Note: Includes neoprene gasket	116.04
22 01 10 61-0020	EA	1/2" Diameter x 9" Stainless Steel Pipe Repair Clamp, Three Bolt Note: Includes Buna rubber gasket	54.98
22 01 10 61-0021	EA	3/4" Diameter x 9" Stainless Steel Pipe Repair Clamp, Three Bolt Note: Includes Buna rubber gasket	57.51
22 01 10 61-0022	EA	1" Diameter x 9" Stainless Steel Pipe Repair Clamp, Three Bolt Note: Includes Buna rubber gasket	63.57
22 01 10 61-0023	EA	1-1/4" Diameter x 9" Stainless Steel Pipe Repair Clamp, Three Bolt Note: Includes Buna rubber gasket	69.75
22 01 10 61-0024	EA	1-1/2" Diameter x 9" Stainless Steel Pipe Repair Clamp, Three Bolt Note: Includes Buna rubber gasket	78.79
22 01 10 61-0025	EA	2" Diameter x 9" Stainless Steel Pipe Repair Clamp, Three Bolt Note: Includes Buna rubber gasket	96.89
22 01 10 61-0026	EA	2-1/2" Diameter x 9" Stainless Steel Pipe Repair Clamp, Three Bolt Note: Includes Buna rubber gasket	115.87
22 01 10 61-0027	EA	3" Diameter x 9" Stainless Steel Pipe Repair Clamp, Three Bolt Note: Includes Buna rubber gasket	140.10
22 01 10 61-0028	EA	4" Diameter x 9" Stainless Steel Pipe Repair Clamp, Three Bolt Note: Includes Buna rubber gasket	171.70
22 01 10 61-0029	EA	5" Diameter x 9" Stainless Steel Pipe Repair Clamp, Three Bolt Note: Includes Buna rubber gasket	176.61
22 01 10 61-0030	EA	6" Diameter x 9" Stainless Steel Pipe Repair Clamp, Three Bolt Note: Includes Buna rubber gasket	189.08

22 01 40 Operation and Maintenance of Plumbing Fixtures^(22 01)

22 01 40 00-0001 Fixture And/Or Trim Replacement^(22 01 40)

Note: Includes removal of existing item(s) and installation of new item(s).

22 01 40 00-0002	EA	3/8" To 1/2" Compression Shut-off Valve Replacement With 15" Polybutylene Supply Tube	43.04
22 01 40 00-0003	EA	3/8" Compression x 1/2" FIP, Braided Stainless Steel, Supply Lines To Sink/Lavatory Replacement	15.56
22 01 40 00-0004	EA	Chrome Supply Lines To Sink/Lavatory Replacement, Pair	21.37
22 01 40 00-0005	EA	Single Bowl Sink/Lavatory Drain Line Replacement	29.35
22 01 40 00-0006	EA	Double Bowl Sink/Lavatory Drain Line Replacement	45.99
22 01 40 00-0007	EA	Shower Head, Polished Chrome, Replacement	32.85

22 Plumbing**22 01 Operation and Maintenance of Plumbing****22 01 40 Operation and Maintenance of Plumbing Fixtures**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
	22 01 40 00-0008	EA	Shower Arm Replacement	26.55	
	22 01 40 00-0009	EA	Shower Head Replacement	26.35	
	22 01 40 00-0010	EA	Shower Knob Replacement	25.25	
	22 01 40 00-0011	EA	Wall Mount, Hand Shower Unit With Hose (Delta 55011).....	112.60	
	22 01 40 00-0012	EA	Shower and Tub Control Trim Replacement..... Note: Excludes balancing valve.	69.41	
	22 01 40 00-0013	EA	Sink Basket Strainer Replacement	16.85	
	22 01 40 00-0014	EA	Sink Drain Without Stopper, 1-1/2" Replacement	9.67	
	22 01 40 00-0015	EA	Sink Drain Without Stopper, 4-1/2" Replacement	10.09	
	22 01 40 00-0016	EA	Sink Drain With Stopper, 1-1/2" Replacement	9.67	
	22 01 40 00-0017	EA	1" Sink Rubber Stopper Replacement	6.85	
	22 01 40 00-0018	EA	Sink Tailpiece Extension 1-1/2" x 8" Replacement	17.72	
	22 01 40 00-0019	EA	Sink Trap, Adjustable, 1-1/2" Replacement	27.67	
	22 01 40 00-0020	EA	Lavatory Pop-Up Rod Replacement	19.67	
	22 01 40 00-0021	EA	Lavatory Pop-up Drain Stopper Replacement	22.45	
	22 01 40 00-0022	EA	Faucet Handle Replacement	23.72	
	22 01 40 00-0023	EA	Faucet O-Ring Replacement	18.29	
	22 01 40 00-0024	EA	1-1/2" Faucet Hole Cover.....	12.51	
	22 01 40 00-0025	EA	Toilet Ballcock Replacement.....	28.46	
	22 01 40 00-0026	EA	Toilet Bowl Ring, Flat Wax, Replacement..... Note: Excludes removal of toilet.	5.38	
	22 01 40 00-0027	EA	Toilet Tank Replacement	118.14	
	22 01 40 00-0028	EA	Toilet Bowl, 10" Replacement	141.76	
	22 01 40 00-0029	EA	Toilet Bowl, 10", Water Saver, Replacement	154.71	
	22 01 40 00-0030	EA	Toilet Bowl, 12", Replacement	167.21	
	22 01 40 00-0031	EA	Toilet Bowl, Elongated, 18", Replacement.....	146.12	
	22 01 40 00-0032	EA	Toilet Closet Bolt, 5/16" x 3" With Nuts And Washers Replacement.....	16.48	
	22 01 40 00-0033	EA	Toilet Flapper With Chain Replacement	13.41	
	22 01 40 00-0034	EA	Toilet Flush Tank Lever Replacement	14.03	
	22 01 40 00-0035	EA	Elongated Toilet Seat With Lid Replacement.....	83.00	
	22 01 40 00-0036	EA	Elongated Toilet Seat Without Lid Replacement.....	51.00	
	22 01 40 00-0037	EA	Handicap Toilet Seat Replacement, Complete With Rails	121.75	
	22 01 40 00-0038	EA	Diverter Tub Spout Replacement.....	37.93	
	22 01 40 00-0039	EA	Tub Spout Replacement	27.49	
	22 01 40 00-0040	EA	2" Tub Stopper, Replacement.....	7.80	
	22 01 40 00-0041	EA	Tub Waste/Overflow Replacement	55.93	
	22 01 40 00-0042	EA	Tub Stem Bonnet Assembly Replacement	27.04	
	22 01 40 00-0043	EA	Faucet Bonnet Replacement	30.57	
	22 01 40 00-0044	EA	Faucet Diverter Stem Replacement.....	18.90	
	22 01 40 00-0045	EA	Faucet Diverter Stem And Bonnet Replacement	25.45	
	22 01 40 00-0046	EA	Faucet Spout Replacement	29.72	
	22 01 40 00-0047	EA	Faucet Stem Replacement	21.46	
	22 01 40 00-0048	EA	Chrome Plated Plastic Drinking Fountain Bubbler Valve With Flexible Bubbler Guard Replacement.....	132.22	
	22 01 40 00-0049	EA	Chrome Plated Brass Drinking Fountain Bubbler Valve Replacement.....	164.98	
	22 01 40 00-0050	EA	Stainless Steel (Lead Free) Drinking Fountain Pushbutton Bubbler Valve Replacement	102.11	

22 05 Common Work Results for Plumbing ⁽²²⁾**22 05 13 Common Motor Requirements For Plumbing Equipment** ^(22 05)

Note: New equipment includes motor, unless otherwise stated. For use when replacing existing motor. See CSI section 23 05 13 00-0000 for motor requirements.

22 05 16 Expansion Fittings And Loops For Plumbing Piping ^(22 05)

See CSI section 23 05 16 00-0000 for expansion fittings and loops.

22 05 19 Meters And Gages For Plumbing Piping ^(22 05)

See CSI section 23 05 19 00-0000 for gages, 33 12 33 00-0000 for water utility service metering.

22 05 23 General-Duty Valves For Plumbing Piping ^(22 05)

See CSI section 23 05 23 00-0000 for valves.

22 05 23 00-0001 Mud Valves (Drain Plug Valves) ^(22 05 23)

Note: For settling basins, waterworks, sewage treatment plants where sedimentateous material must be flushed from system.

22 05 23 00-0002	EA	4" Flanged End, Non Rising Stem Mud Valve.....	821.71	209.48
22 05 23 00-0003	EA	6" Flanged End, Non Rising Stem Mud Valve.....	896.33	220.50
22 05 23 00-0004	EA	8" Flanged End, Non Rising Stem Mud Valve.....	1,232.02	338.02
22 05 23 00-0005	EA	10" Flanged End, Non Rising Stem Mud Valve.....	1,793.48	411.51
22 05 23 00-0006	EA	12" Flanged End, Non Rising Stem Mud Valve.....	2,114.33	499.69
22 05 23 00-0007	EA	14" Flanged End, Non Rising Stem Mud Valve.....	3,561.92	441.01
22 05 23 00-0008	EA	16" Flanged End, Non Rising Stem Mud Valve.....	4,217.45	485.11

22 05 29 Hangers And Supports For Plumbing Piping And Equipment ^(22 05)

See CSI section 23 05 29 00-0000 for hangers and supports.

22 05 48 Vibration And Seismic Controls For Plumbing Piping And Equipment ^(22 05)

See CSI section 23 05 48 00-0000 for vibration and seismic control.



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 05 53 Identification For Plumbing Piping And Equipment <small>(22 05)</small> See CSI section 23 05 53 00-0000 for identification.		
22 05 76 Facility Drainage Piping Cleanouts <small>(22 05)</small>		
22 05 76 00-0001 Cast Iron Cleanout With Plug And Cover <small>(22 05 76)</small> Note: For floor installation.		
22 05 76 00-0002 Cast Iron Cleanout With Plug And Round Or Square Cover <small>(22 05 76 00-0001)</small>		
22 05 76 00-0003 EA 2" Floor Cleanout, Round Or Square Top, Cast Iron With Cast Bronze Screw Plug And Nickel Bronze Cover.....	287.14	42.48
For Vandal Proof, Add	19.50	
For Galvanized Ferrule, Add	45.00	
For Carpet Marker, Add	16.00	
For Satin Bronze Top, Deduct	-24.00	
For Carpet Flange, Add	58.50	
For Wide Flange, Add	97.00	
22 05 76 00-0004 EA 3" Floor Cleanout, Round Or Square Top, Cast Iron With Cast Bronze Screw Plug And Nickel Bronze Cover.....	317.06	53.26
For Vandal Proof, Add	19.50	
For Galvanized Ferrule, Add	45.00	
For Carpet Marker, Add	16.00	
For Satin Bronze Top, Deduct	-24.00	
For Carpet Flange, Add	58.50	
For Wide Flange, Add	97.00	
22 05 76 00-0005 EA 4" Floor Cleanout, Round Or Square Top, Cast Iron With Cast Bronze Screw Plug And Nickel Bronze Cover.....	393.98	64.35
For Vandal Proof, Add	19.50	
For Galvanized Ferrule, Add	45.00	
For Carpet Marker, Add	16.00	
For Satin Bronze Top, Deduct	-24.00	
For Carpet Flange, Add	58.50	
For Wide Flange, Add	97.00	
22 05 76 00-0006 EA 5" Floor Cleanout, Round Or Square Top, Cast Iron With Cast Bronze Screw Plug And Nickel Bronze Cover.....	546.58	72.02
For Vandal Proof, Add	19.50	
For Galvanized Ferrule, Add	45.00	
For Carpet Marker, Add	16.00	
For Satin Bronze Top, Deduct	-24.00	
For Carpet Flange, Add	58.50	
For Wide Flange, Add	97.00	
22 05 76 00-0007 EA 6" Floor Cleanout, Round Or Square Top, Cast Iron With Cast Bronze Screw Plug And Nickel Bronze Cover.....	662.97	78.01
For Vandal Proof, Add	19.50	
For Galvanized Ferrule, Add	45.00	
For Carpet Marker, Add	16.00	
For Satin Bronze Top, Deduct	-24.00	
For Carpet Flange, Add	58.50	
For Wide Flange, Add	97.00	
22 05 76 00-0008 Cast Iron Heavy Duty Cleanout With Plug And Round Cover <small>(22 05 76 00-0001)</small>		
22 05 76 00-0009 EA 2" Heavy Duty Floor Cleanout, Round Top, Cast Iron With Cast Bronze Screw Plug And Nickel Bronze Cover.....	324.94	42.48
For Vandal Proof, Add	19.50	
For Galvanized Ferrule, Add	45.00	
For Carpet Marker, Add	16.00	
For Satin Bronze Top, Deduct	-24.00	
For Carpet Flange, Add	58.50	
For Wide Flange, Add	97.00	
22 05 76 00-0010 EA 3" Heavy Duty Floor Cleanout, Round Top, Cast Iron With Cast Bronze Screw Plug And Nickel Bronze Cover.....	355.40	53.18
For Vandal Proof, Add	19.50	
For Galvanized Ferrule, Add	45.00	
For Carpet Marker, Add	16.00	
For Satin Bronze Top, Deduct	-24.00	
For Carpet Flange, Add	58.50	
For Wide Flange, Add	97.00	
22 05 76 00-0011 EA 4" Heavy Duty Floor Cleanout, Round Top, Cast Iron With Cast Bronze Screw Plug And Nickel Bronze Cover.....	432.38	64.35
For Vandal Proof, Add	19.50	
For Galvanized Ferrule, Add	45.00	
For Carpet Marker, Add	16.00	
For Satin Bronze Top, Deduct	-24.00	
For Carpet Flange, Add	58.50	
For Wide Flange, Add	97.00	
22 05 76 00-0012 EA 5" Heavy Duty Floor Cleanout, Round Top, Cast Iron With Cast Bronze Screw Plug And Nickel Bronze Cover.....	585.02	72.02
For Vandal Proof, Add	19.50	
For Galvanized Ferrule, Add	45.00	
For Carpet Marker, Add	16.00	
For Satin Bronze Top, Deduct	-24.00	
For Carpet Flange, Add	58.50	
For Wide Flange, Add	97.00	
22 05 76 00-0013 EA 6" Heavy Duty Floor Cleanout, Round Top, Cast Iron With Cast Bronze Screw Plug And Nickel Bronze Cover.....	701.35	78.01
For Vandal Proof, Add	19.50	
For Galvanized Ferrule, Add	45.00	
For Carpet Marker, Add	16.00	
For Satin Bronze Top, Deduct	-24.00	
For Carpet Flange, Add	58.50	
For Wide Flange, Add	97.00	
22 05 76 00-0014 Wall Cover For Cleanout <small>(22 05 76)</small> Note: Cover and screw only.		

22 Plumbing**22 05 Common Work Results for Plumbing****22 05 76 Facility Drainage Piping Cleanouts**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 05 76 00-0015 Round Access Cover, Bronze Polished Top (22 05 76 00-0014) Note: Cover and screw only.		
22 05 76 00-0016 EA 4-1/4" Diameter Wall Cover For Cleanout, Screwed.....	49.41	13.33
For Stainless Steel, Add	9.00	
For Vandal Proof Screws, Add	19.50	
22 05 76 00-0017 EA 5-1/2" Diameter Wall Cover For Cleanout, Screwed.....	54.74	15.97
For Stainless Steel, Add	9.00	
For Vandal Proof Screws, Add	19.50	
22 05 76 00-0018 EA 7" Diameter Wall Cover For Cleanout, Screwed.....	67.73	17.96
For Stainless Steel, Add	9.00	
For Vandal Proof Screws, Add	19.50	
22 05 76 00-0019 EA 9-1/4" Diameter Wall Cover For Cleanout, Screwed.....	105.32	19.96
For Stainless Steel, Add	9.00	
For Vandal Proof Screws, Add	19.50	
22 05 76 00-0020 EA 11-1/4" Diameter Wall Cover For Cleanout, Screwed.....	151.31	21.96
For Stainless Steel, Add	9.00	
For Vandal Proof Screws, Add	19.50	
22 05 76 00-0021 Square Wall Access Panel, Bronze Polished Top (22 05 76 00-0014) Note: Cover and screw only.		
22 05 76 00-0022 EA 7" x 7" Bronze Wall Or Floor Access Cover.....	134.61	13.33
For Vandal Proof Screws, Add	19.50	
For Nickel Bronze, Add	22.50	
22 05 76 00-0023 EA 9" x 9" Bronze Wall Or Floor Access Cover.....	186.94	13.98
For Vandal Proof Screws, Add	19.50	
For Nickel Bronze, Add	22.50	
22 05 76 00-0024 EA 10" x 10" Bronze Wall Or Floor Access Cover.....	199.54	14.77
For Vandal Proof Screws, Add	19.50	
For Nickel Bronze, Add	22.50	
22 05 76 00-0025 EA 14" x 14" Bronze Wall Or Floor Access Cover.....	223.53	16.77
For Vandal Proof Screws, Add	19.50	
For Nickel Bronze, Add	22.50	
22 05 76 00-0026 Secured Square Wall Access Panel, Bronze Polished Top (22 05 76 00-0014) Note: Cover and screw only.		
22 05 76 00-0027 EA 6" x 6" Bronze Secured Wall Access Panel.....	134.61	13.33
For Vandal Proof Screws, Add	19.50	
For Nickel Bronze, Add	22.50	
22 05 76 00-0028 EA 8" x 8" Bronze Secured Wall Access Panel.....	186.94	13.98
For Vandal Proof Screws, Add	19.50	
For Nickel Bronze, Add	22.50	
22 05 76 00-0029 EA 10" x 10" Bronze Secured Wall Access Panel.....	199.54	14.77
For Vandal Proof Screws, Add	19.50	
For Nickel Bronze, Add	22.50	
22 05 76 00-0030 EA 12" x 12" Bronze Secured Wall Access Panel.....	223.53	16.77
For Vandal Proof Screws, Add	19.50	
For Nickel Bronze, Add	22.50	
22 05 76 00-0031 Secure Square Hinged Access Panel, Bronze Polished Top, Scoriated (22 05 76 00-0014) Note: Cover and screw only.		
22 05 76 00-0032 EA 6" x 6" Bronze Secured Hinged Access Panel, Scoriated.....	131.11	13.33
For Vandal Proof Screws, Add	19.50	
For Nickel Bronze, Add	22.50	
22 05 76 00-0033 EA 8" x 8" Bronze Secured Hinged Access Panel, Scoriated.....	175.44	13.98
For Vandal Proof Screws, Add	19.50	
For Nickel Bronze, Add	22.50	
22 05 76 00-0034 EA 10" x 10" Bronze Secured Hinged Access Panel, Scoriated.....	242.04	14.77
For Vandal Proof Screws, Add	19.50	
For Nickel Bronze, Add	22.50	
22 05 76 00-0035 EA 12" x 12" Bronze Secured Hinged Access Panel, Scoriated.....	291.53	16.77
For Vandal Proof Screws, Add	19.50	
For Nickel Bronze, Add	22.50	
22 05 76 00-0036 Cast Iron Cleanout Tee (22 05 76)		
22 05 76 00-0037 Cast Iron Cleanout Tee And Round Access Cover (22 05 76 00-0036) Note: Satin smooth secured cover.		
22 05 76 00-0038 EA 2" Cleanout Tee With Bronze Screw Plug And Round Polished Bronze Cover.....	211.54	42.48
For Vandal Proof Screws, Add	18.00	
For Galvanized Cast Iron Parts, Add	45.00	
22 05 76 00-0039 EA 3" Cleanout Tee With Bronze Screw Plug And Round Polished Bronze Cover.....	246.20	53.18
For Vandal Proof Screws, Add	18.00	
For Galvanized Cast Iron Parts, Add	45.00	
22 05 76 00-0040 EA 4" Cleanout Tee With Bronze Screw Plug And Round Polished Bronze Cover.....	316.58	64.35
For Vandal Proof Screws, Add	18.00	
For Galvanized Cast Iron Parts, Add	45.00	
22 05 76 00-0041 EA 6" Cleanout Tee With Bronze Screw Plug And Round Polished Bronze Cover.....	683.35	78.01
For Vandal Proof Screws, Add	18.00	
For Galvanized Cast Iron Parts, Add	45.00	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 05 76 00-0042 Cast Iron Cleanout Tee And Square Access Cover (22 05 76 00-0036)		
Note: Satin smooth secured cover.		
22 05 76 00-0043 EA 2" Cleanout Tee With Cast Bronze Screw Plug And Square Nickel Bronze Cover.....	338.14	42.48
For Vandal Proof Screws, Add	18.00	
For Galvanized Cast Iron Parts, Add	45.00	
22 05 76 00-0044 EA 3" Cleanout Tee With Cast Bronze Screw Plug And Square Nickel Bronze Cover.....	372.80	53.18
For Vandal Proof Screws, Add	18.00	
For Galvanized Cast Iron Parts, Add	45.00	
22 05 76 00-0045 EA 4" Cleanout Tee With Cast Bronze Screw Plug And Square Nickel Bronze Cover.....	434.78	64.35
For Vandal Proof Screws, Add	18.00	
For Galvanized Cast Iron Parts, Add	45.00	
22 05 76 00-0046 EA 6" Cleanout Tee With Cast Bronze Screw Plug And Square Nickel Bronze Cover.....	854.35	78.01
For Vandal Proof Screws, Add	18.00	
For Galvanized Cast Iron Parts, Add	45.00	
22 05 76 00-0047 Cast Iron Cleanout Tee With Brass Plug (22 05 76 00-0036)		
22 05 76 00-0048 EA 2" Cleanout Tee With Cast Bronze Screw Plug	173.27	34.73
22 05 76 00-0049 EA 3" Cleanout Tee With Cast Bronze Screw Plug	192.85	37.93
22 05 76 00-0050 EA 4" Cleanout Tee With Cast Bronze Screw Plug	256.41	49.90
22 05 76 00-0051 EA 5" Cleanout Tee With Cast Bronze Screw Plug	370.17	59.09
22 05 76 00-0052 EA 6" Cleanout Tee With Cast Bronze Screw Plug	601.73	69.86
22 05 76 00-0053 Removable Cleanout Plug (22 05 76)		
22 05 76 00-0054 Threaded Bronze Plugs (22 05 76 00-0053)		
22 05 76 00-0055 EA 1-1/4", 1-1/2" Or 2" Threaded Bronze Plug	31.04	9.98
For Plug Tapped For Center Screw, Add	9.50	
22 05 76 00-0056 EA 2-1/2" Threaded Bronze Plug	35.64	10.85
For Plug Tapped For Center Screw, Add	9.50	
22 05 76 00-0057 EA 3" Threaded Bronze Plug.....	52.50	11.97
For Plug Tapped For Center Screw, Add	9.50	
22 05 76 00-0058 EA 3-1/2" Threaded Bronze Plug	59.50	13.98
For Plug Tapped For Center Screw, Add	9.50	
22 05 76 00-0059 EA 4" Threaded Bronze Plug.....	67.50	15.97
For Plug Tapped For Center Screw, Add	9.50	
22 05 76 00-0060 EA 5" Threaded Bronze Plug.....	89.00	17.96
For Plug Tapped For Center Screw, Add	9.50	
22 05 76 00-0061 EA 6" Threaded Bronze Plug.....	122.48	19.96
For Plug Tapped For Center Screw, Add	9.50	
22 05 76 00-0062 EA 8" Threaded Bronze Plug.....	191.41	21.96
For Plug Tapped For Center Screw, Add	9.50	
22 05 76 00-0063 EA 10" Threaded Bronze Plug.....	265.41	23.95
For Plug Tapped For Center Screw, Add	9.50	
22 05 76 00-0064 Threaded Brass Plugs (22 05 76 00-0053)		
22 05 76 00-0065 EA 1-1/2" Threaded Brass Plug, Raised Head	23.93	9.98
For Plug Tapped For Center Screw, Add	9.50	
22 05 76 00-0066 EA 2" Threaded Brass Plug, Raised Head	24.62	9.98
For Plug Tapped For Center Screw, Add	9.50	
22 05 76 00-0067 EA 2-1/2" Threaded Brass Plug, Raised Head	27.02	10.85
For Plug Tapped For Center Screw, Add	9.50	
22 05 76 00-0068 EA 3" Threaded Brass Plug, Raised Head	30.91	11.97
For Plug Tapped For Center Screw, Add	9.50	
22 05 76 00-0069 EA 3-1/2" Threaded Brass Plug, Raised Head	36.77	13.98
For Plug Tapped For Center Screw, Add	9.50	
22 05 76 00-0070 EA 4" Threaded Brass Plug, Raised Head	43.90	15.97
For Plug Tapped For Center Screw, Add	9.50	
22 05 76 00-0071 EA 4-1/2" Threaded Brass Plug, Raised Head	47.43	16.82
For Plug Tapped For Center Screw, Add	9.50	
22 05 76 00-0072 EA 5" Threaded Brass Plug, Raised Head	51.41	17.96
For Plug Tapped For Center Screw, Add	9.50	
22 05 76 00-0073 EA 6" Threaded Brass Plug, Raised Head	72.16	19.96
For Plug Tapped For Center Screw, Add	9.50	
22 05 76 00-0074 EA 1-1/2" Threaded Brass Plug, Countersunk Head.....	23.39	9.98
For Plug Tapped For Center Screw, Add	9.50	
22 05 76 00-0075 EA 2" Threaded Brass Plug, Countersunk Head.....	24.15	9.98
For Plug Tapped For Center Screw, Add	9.50	
22 05 76 00-0076 EA 2-1/2" Threaded Brass Plug, Countersunk Head.....	28.52	10.85
For Plug Tapped For Center Screw, Add	9.50	
22 05 76 00-0077 EA 3" Threaded Brass Plug, Countersunk Head	31.13	11.97
For Plug Tapped For Center Screw, Add	9.50	
22 05 76 00-0078 EA 3-1/2" Threaded Brass Plug, Countersunk Head.....	36.12	13.98
For Plug Tapped For Center Screw, Add	9.50	
22 05 76 00-0079 EA 4" Threaded Brass Plug, Countersunk Head	42.88	15.97
For Plug Tapped For Center Screw, Add	9.50	
22 05 76 00-0080 EA 5" Threaded Brass Plug, Countersunk Head	50.85	17.96
For Plug Tapped For Center Screw, Add	9.50	

22 Plumbing**22 05 Common Work Results for Plumbing****22 05 76 Facility Drainage Piping Cleanouts**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 05 76 00-0081 EA 6" Threaded Brass Plug, Countersunk Head <i>For Plug Tapped For Center Screw, Add</i>	63.17 9.50	19.96
22 07 Plumbing Insulation⁽²²⁾		
22 07 16 Plumbing Equipment Insulation^(22 07)		
22 07 16 00-0001 Lavatory Insulation ^(22 07 16)		
22 07 16 00-0002 EA Neoprene Insulation Kit For Under Lavatories	171.69	15.51
22 07 16 00-0003 Water Heater Insulation ^(22 07 16)		
22 07 16 00-0004 EA 3" Thick, 48" x 75" Fiberglass Insulation Blanket For Water Heaters.....	58.28	15.51
22 07 19 Plumbing Piping Insulation^(22 07)		
22 07 19 00-0001 Fiberglass Pipe Insulation ^(22 07 19)		
Note: Includes factory applied All Service Jacket (ASJ), Self Sealing Lap (SSL) longitudinal seam, butt strip seals, and adhesive. Excludes insulation for fittings (a location requiring purchase of an insulation fitting or cutting and fitting straight sections, excludes couplings, plugs, etc.). For fittings/valves up to 3" add 2 LF for each fitting/valve or 3 LF for each flanged/grooved joint. For fittings/valves >3" add 3 LF for each fitting/valve or 4 LF for each flanged/grooved joint.		
22 07 19 00-0002 1" Thick Fiberglass Pipe Insulation ^(22 07 19 00-0001)		
22 07 19 00-0003 LF 1/2" Diameter Pipe, 1" Thick, Fiberglass Insulation With All Service Jacket (ASJ)	7.01	2.07
<i>For Work In Restricted Working Space, Add</i>		
<i>For Single Layer Of Felt Finish, Add</i>		
22 07 19 00-0004 LF 3/4" Diameter Pipe, 1" Thick, Fiberglass Insulation With All Service Jacket (ASJ)	7.21	2.07
<i>For Work In Restricted Working Space, Add</i>		
<i>For Single Layer Of Felt Finish, Add</i>		
22 07 19 00-0005 LF 1" Diameter Pipe, 1" Thick, Fiberglass Insulation With All Service Jacket (ASJ)	7.32	2.07
<i>For Work In Restricted Working Space, Add</i>		
<i>For Single Layer Of Felt Finish, Add</i>		
22 07 19 00-0006 LF 1-1/4" Diameter Pipe, 1" Thick, Fiberglass Insulation With All Service Jacket (ASJ)	7.60	2.14
<i>For Work In Restricted Working Space, Add</i>		
<i>For Single Layer Of Felt Finish, Add</i>		
22 07 19 00-0007 LF 1-1/2" Diameter Pipe, 1" Thick, Fiberglass Insulation With All Service Jacket (ASJ)	7.81	2.14
<i>For Work In Restricted Working Space, Add</i>		
<i>For Single Layer Of Felt Finish, Add</i>		
22 07 19 00-0008 LF 2" Diameter Pipe, 1" Thick, Fiberglass Insulation With All Service Jacket (ASJ)	8.15	2.21
<i>For Work In Restricted Working Space, Add</i>		
<i>For Single Layer Of Felt Finish, Add</i>		
22 07 19 00-0009 LF 2-1/2" Diameter Pipe, 1" Thick, Fiberglass Insulation With All Service Jacket (ASJ)	8.61	2.35
<i>For Work In Restricted Working Space, Add</i>		
<i>For Single Layer Of Felt Finish, Add</i>		
22 07 19 00-0010 LF 3" Diameter Pipe, 1" Thick, Fiberglass Insulation With All Service Jacket (ASJ)	9.07	2.41
<i>For Work In Restricted Working Space, Add</i>		
<i>For Single Layer Of Felt Finish, Add</i>		
22 07 19 00-0011 LF 4" Diameter Pipe, 1" Thick, Fiberglass Insulation With All Service Jacket (ASJ)	10.32	2.55
<i>For Work In Restricted Working Space, Add</i>		
<i>For Single Layer Of Felt Finish, Add</i>		
22 07 19 00-0012 LF 6" Diameter Pipe, 1" Thick, Fiberglass Insulation With All Service Jacket (ASJ)	11.96	2.96
<i>For Work In Restricted Working Space, Add</i>		
<i>For Single Layer Of Felt Finish, Add</i>		
22 07 19 00-0013 LF 8" Diameter Pipe, 1" Thick, Fiberglass Insulation With All Service Jacket (ASJ)	14.87	3.31
<i>For Work In Restricted Working Space, Add</i>		
<i>For Single Layer Of Felt Finish, Add</i>		
22 07 19 00-0014 LF 10" Diameter Pipe, 1" Thick, Fiberglass Insulation With All Service Jacket (ASJ)	17.47	3.93
<i>For Work In Restricted Working Space, Add</i>		
<i>For Single Layer Of Felt Finish, Add</i>		
22 07 19 00-0015 LF 12" Diameter Pipe, 1" Thick, Fiberglass Insulation With All Service Jacket (ASJ)	20.04	4.49
<i>For Work In Restricted Working Space, Add</i>		
<i>For Single Layer Of Felt Finish, Add</i>		
22 07 19 00-0016 1-1/2" Thick Fiberglass Pipe Insulation ^(22 07 19 00-0001)		
22 07 19 00-0017 LF 1/2" Diameter Pipe, 1-1/2" Thick, Fiberglass Insulation With All Service Jacket (ASJ)	8.62	2.13
<i>For Work In Restricted Working Space, Add</i>		
<i>For Single Layer Of Felt Finish, Add</i>		
22 07 19 00-0018 LF 3/4" Diameter Pipe, 1-1/2" Thick, Fiberglass Insulation With All Service Jacket (ASJ)	8.75	2.13
<i>For Work In Restricted Working Space, Add</i>		
<i>For Single Layer Of Felt Finish, Add</i>		
22 07 19 00-0019 LF 1" Diameter Pipe, 1-1/2" Thick, Fiberglass Insulation With All Service Jacket (ASJ)	9.24	2.26
<i>For Work In Restricted Working Space, Add</i>		
<i>For Single Layer Of Felt Finish, Add</i>		
22 07 19 00-0020 LF 1-1/4" Diameter Pipe, 1-1/2" Thick, Fiberglass Insulation With All Service Jacket (ASJ)	9.59	2.30
<i>For Work In Restricted Working Space, Add</i>		
<i>For Single Layer Of Felt Finish, Add</i>		
22 07 19 00-0021 LF 1-1/2" Diameter Pipe, 1-1/2" Thick, Fiberglass Insulation With All Service Jacket (ASJ)	9.88	2.35
<i>For Work In Restricted Working Space, Add</i>		
<i>For Single Layer Of Felt Finish, Add</i>		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 07 19 00-0022 LF 2" Diameter Pipe, 1-1/2" Thick, Fiberglass Insulation With All Service Jacket (ASJ).....	10.54	2.47
<i>For Work In Restricted Working Space, Add</i>	2.05	
<i>For Single Layer Of Felt Finish, Add</i>	0.39	
22 07 19 00-0023 LF 2-1/2" Diameter Pipe, 1-1/2" Thick, Fiberglass Insulation With All Service Jacket (ASJ).....	11.03	2.51
<i>For Work In Restricted Working Space, Add</i>	2.09	
<i>For Single Layer Of Felt Finish, Add</i>	0.43	
22 07 19 00-0024 LF 3" Diameter Pipe, 1-1/2" Thick, Fiberglass Insulation With All Service Jacket (ASJ).....	11.39	2.60
<i>For Work In Restricted Working Space, Add</i>	2.16	
<i>For Single Layer Of Felt Finish, Add</i>	0.44	
22 07 19 00-0025 LF 4" Diameter Pipe, 1-1/2" Thick, Fiberglass Insulation With All Service Jacket (ASJ).....	12.58	2.81
<i>For Work In Restricted Working Space, Add</i>	2.33	
<i>For Single Layer Of Felt Finish, Add</i>	0.50	
22 07 19 00-0026 LF 6" Diameter Pipe, 1-1/2" Thick, Fiberglass Insulation With All Service Jacket (ASJ).....	14.56	3.29
<i>For Work In Restricted Working Space, Add</i>	2.72	
<i>For Single Layer Of Felt Finish, Add</i>	0.58	
22 07 19 00-0027 LF 8" Diameter Pipe, 1-1/2" Thick, Fiberglass Insulation With All Service Jacket (ASJ).....	16.45	3.46
<i>For Work In Restricted Working Space, Add</i>	2.88	
<i>For Single Layer Of Felt Finish, Add</i>	0.72	
22 07 19 00-0028 LF 10" Diameter Pipe, 1-1/2" Thick, Fiberglass Insulation With All Service Jacket (ASJ).....	20.13	4.14
<i>For Work In Restricted Working Space, Add</i>	3.44	
<i>For Single Layer Of Felt Finish, Add</i>	0.91	
22 07 19 00-0029 LF 12" Diameter Pipe, 1-1/2" Thick, Fiberglass Insulation With All Service Jacket (ASJ).....	22.79	4.83
<i>For Work In Restricted Working Space, Add</i>	4.01	
<i>For Single Layer Of Felt Finish, Add</i>	0.99	
22 07 19 00-0030 2" Thick Fiberglass Pipe Insulation (22 07 19 00-0001)		
22 07 19 00-0031 LF 1/2" Diameter Pipe, 2" Thick, Fiberglass Insulation With All Service Jacket (ASJ).....	10.75	2.35
<i>For Work In Restricted Working Space, Add</i>	1.94	
<i>For Single Layer Of Felt Finish, Add</i>	0.45	
22 07 19 00-0032 LF 3/4" Diameter Pipe, 2" Thick, Fiberglass Insulation With All Service Jacket (ASJ).....	10.89	2.35
<i>For Work In Restricted Working Space, Add</i>	1.94	
<i>For Single Layer Of Felt Finish, Add</i>	0.46	
22 07 19 00-0033 LF 1" Diameter Pipe, 2" Thick, Fiberglass Insulation With All Service Jacket (ASJ).....	11.28	2.41
<i>For Work In Restricted Working Space, Add</i>	1.97	
<i>For Single Layer Of Felt Finish, Add</i>	0.50	
22 07 19 00-0034 LF 1-1/4" Diameter Pipe, 2" Thick, Fiberglass Insulation With All Service Jacket (ASJ).....	11.63	2.41
<i>For Work In Restricted Working Space, Add</i>	1.99	
<i>For Single Layer Of Felt Finish, Add</i>	0.52	
22 07 19 00-0035 LF 1-1/2" Diameter Pipe, 2" Thick, Fiberglass Insulation With All Service Jacket (ASJ).....	12.00	2.48
<i>For Work In Restricted Working Space, Add</i>	2.02	
<i>For Single Layer Of Felt Finish, Add</i>	0.55	
22 07 19 00-0036 LF 2" Diameter Pipe, 2" Thick, Fiberglass Insulation With All Service Jacket (ASJ).....	12.46	2.55
<i>For Work In Restricted Working Space, Add</i>	2.09	
<i>For Single Layer Of Felt Finish, Add</i>	0.58	
22 07 19 00-0037 LF 2-1/2" Diameter Pipe, 2" Thick, Fiberglass Insulation With All Service Jacket (ASJ).....	13.11	2.62
<i>For Work In Restricted Working Space, Add</i>	2.17	
<i>For Single Layer Of Felt Finish, Add</i>	0.62	
22 07 19 00-0038 LF 3" Diameter Pipe, 2" Thick, Fiberglass Insulation With All Service Jacket (ASJ).....	13.82	2.76
<i>For Work In Restricted Working Space, Add</i>	2.24	
<i>For Single Layer Of Felt Finish, Add</i>	0.67	
22 07 19 00-0039 LF 4" Diameter Pipe, 2" Thick, Fiberglass Insulation With All Service Jacket (ASJ).....	15.15	2.89
<i>For Work In Restricted Working Space, Add</i>	2.36	
<i>For Single Layer Of Felt Finish, Add</i>	0.76	
22 07 19 00-0040 LF 6" Diameter Pipe, 2" Thick, Fiberglass Insulation With All Service Jacket (ASJ).....	17.91	3.40
<i>For Work In Restricted Working Space, Add</i>	2.84	
<i>For Single Layer Of Felt Finish, Add</i>	0.89	
22 07 19 00-0041 LF 8" Diameter Pipe, 2" Thick, Fiberglass Insulation With All Service Jacket (ASJ).....	20.42	3.59
<i>For Work In Restricted Working Space, Add</i>	2.99	
<i>For Single Layer Of Felt Finish, Add</i>	1.10	
22 07 19 00-0042 LF 10" Diameter Pipe, 2" Thick, Fiberglass Insulation With All Service Jacket (ASJ).....	24.43	4.29
<i>For Work In Restricted Working Space, Add</i>	3.58	
<i>For Single Layer Of Felt Finish, Add</i>	1.31	
22 07 19 00-0043 LF 12" Diameter Pipe, 2" Thick, Fiberglass Insulation With All Service Jacket (ASJ).....	28.01	5.15
<i>For Work In Restricted Working Space, Add</i>	4.29	
<i>For Single Layer Of Felt Finish, Add</i>	1.44	
22 07 19 00-0044 Foamglas Pipe Insulation, Rigid, Closed Cell (22 07 19)		
Note: Includes adhesive. Excludes fittings (a location requiring purchase of an insulation fitting or cutting and fitting straight sections, excludes couplings, plugs, etc.). For fittings/valves up to 3" add 2 LF for each fitting/valve or 3 LF for each flanged/grooved joint. For fittings/valves >3" add 3 LF for each fitting/valve or 4 LF for each flanged/grooved joint.		
22 07 19 00-0045 1" Thick Foamglas Pipe Insulation (22 07 19 00-0044)		
22 07 19 00-0046 LF 1/2" Diameter Pipe, 1" Thick Foamglas Insulation.....	12.96	3.37
<i>For Work In Restricted Working Space, Add</i>	3.06	
22 07 19 00-0047 LF 3/4" Diameter Pipe, 1" Thick Foamglas Insulation.....	13.67	3.37
<i>For Work In Restricted Working Space, Add</i>	3.06	
22 07 19 00-0048 LF 1" Diameter Pipe, 1" Thick Foamglas Insulation.....	14.52	3.42
<i>For Work In Restricted Working Space, Add</i>	3.10	
22 07 19 00-0049 LF 1-1/4" Diameter Pipe, 1" Thick Foamglas Insulation.....	14.91	3.46
<i>For Work In Restricted Working Space, Add</i>	3.14	
22 07 19 00-0050 LF 1-1/2" Diameter Pipe, 1" Thick Foamglas Insulation.....	15.53	3.51
<i>For Work In Restricted Working Space, Add</i>	3.19	

22 Plumbing**22 07 Plumbing Insulation****22 07 19 Plumbing Piping Insulation**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 07 19 00-0051	LF		2" Diameter Pipe, 1" Thick Foamglas Insulation	16.73	3.61
			<i>For Work In Restricted Working Space, Add</i>	3.28	
22 07 19 00-0052	LF		2-1/2" Diameter Pipe, 1" Thick Foamglas Insulation	18.18	3.76
			<i>For Work In Restricted Working Space, Add</i>	3.41	
22 07 19 00-0053	LF		3" Diameter Pipe, 1" Thick Foamglas Insulation	19.85	3.85
			<i>For Work In Restricted Working Space, Add</i>	3.50	
22 07 19 00-0054	LF		4" Diameter Pipe, 1" Thick Foamglas Insulation	23.34	4.14
			<i>For Work In Restricted Working Space, Add</i>	3.77	
22 07 19 00-0055	LF		6" Diameter Pipe, 1" Thick Foamglas Insulation	30.47	4.68
			<i>For Work In Restricted Working Space, Add</i>	4.25	
22 07 19 00-0056			1-1/2" Thick Foamglas Pipe Insulation <small>(22 07 19 00-0044)</small>		
22 07 19 00-0057	LF		1/2" Diameter Pipe, 1-1/2" Thick Foamglas Insulation	18.24	4.41
			<i>For Work In Restricted Working Space, Add</i>	4.00	
22 07 19 00-0058	LF		3/4" Diameter Pipe, 1-1/2" Thick Foamglas Insulation	18.68	4.41
			<i>For Work In Restricted Working Space, Add</i>	4.00	
22 07 19 00-0059	LF		1" Diameter Pipe, 1-1/2" Thick Foamglas Insulation	19.13	4.41
			<i>For Work In Restricted Working Space, Add</i>	4.00	
22 07 19 00-0060	LF		1-1/4" Diameter Pipe, 1-1/2" Thick Foamglas Insulation	19.90	4.55
			<i>For Work In Restricted Working Space, Add</i>	4.14	
22 07 19 00-0061	LF		1-1/2" Diameter Pipe, 1-1/2" Thick Foamglas Insulation	20.64	4.71
			<i>For Work In Restricted Working Space, Add</i>	4.28	
22 07 19 00-0062	LF		2" Diameter Pipe, 1-1/2" Thick Foamglas Insulation	22.54	4.87
			<i>For Work In Restricted Working Space, Add</i>	4.43	
22 07 19 00-0063	LF		2-1/2" Diameter Pipe, 1-1/2" Thick Foamglas Insulation	25.69	5.06
			<i>For Work In Restricted Working Space, Add</i>	4.60	
22 07 19 00-0064	LF		3" Diameter Pipe, 1-1/2" Thick Foamglas Insulation	28.65	5.25
			<i>For Work In Restricted Working Space, Add</i>	4.77	
22 07 19 00-0065	LF		4" Diameter Pipe, 1-1/2" Thick Foamglas Insulation	32.18	5.46
			<i>For Work In Restricted Working Space, Add</i>	4.96	
22 07 19 00-0066	LF		6" Diameter Pipe, 1-1/2" Thick Foamglas Insulation	36.80	5.79
			<i>For Work In Restricted Working Space, Add</i>	5.26	
22 07 19 00-0067	LF		8" Diameter Pipe, 1-1/2" Thick Foamglas Insulation	40.24	6.14
			<i>For Work In Restricted Working Space, Add</i>	5.58	
22 07 19 00-0068	LF		10" Diameter Pipe, 1-1/2" Thick Foamglas Insulation	49.55	7.22
			<i>For Work In Restricted Working Space, Add</i>	6.56	
22 07 19 00-0069	LF		12" Diameter Pipe, 1-1/2" Thick Foamglas Insulation	56.70	8.39
			<i>For Work In Restricted Working Space, Add</i>	7.62	
22 07 19 00-0070	LF		14" Diameter Pipe, 1-1/2" Thick Foamglas Insulation	61.90	8.68
			<i>For Work In Restricted Working Space, Add</i>	7.89	
22 07 19 00-0071	LF		16" Diameter Pipe, 2" Thick Foamglas Insulation	67.96	9.70
			<i>For Work In Restricted Working Space, Add</i>	8.81	
22 07 19 00-0072	LF		18" Diameter Pipe, 2" Thick Foamglas Insulation	76.41	11.46
			<i>For Work In Restricted Working Space, Add</i>	10.43	
22 07 19 00-0073	LF		20" Diameter Pipe, 2" Thick Foamglas Insulation	85.51	12.69
			<i>For Work In Restricted Working Space, Add</i>	11.54	
22 07 19 00-0074	LF		24" Diameter Pipe, 2" Thick Fiberglass Insulation	109.09	14.06
			<i>For Work In Restricted Working Space, Add</i>	12.78	
22 07 19 00-0075			2" Thick Foamglas Pipe Insulation <small>(22 07 19 00-0044)</small>		
22 07 19 00-0076	LF		1/2" Diameter Pipe, 2" Thick Foamglas Insulation	18.06	3.85
			<i>For Work In Restricted Working Space, Add</i>	3.50	
22 07 19 00-0077	LF		3/4" Diameter Pipe, 2" Thick Foamglas Insulation	18.75	3.85
			<i>For Work In Restricted Working Space, Add</i>	3.50	
22 07 19 00-0078	LF		1" Diameter Pipe, 2" Thick Foamglas Insulation	19.57	3.89
			<i>For Work In Restricted Working Space, Add</i>	3.54	
22 07 19 00-0079	LF		1-1/4" Diameter Pipe, 2" Thick Foamglas Insulation	20.81	3.95
			<i>For Work In Restricted Working Space, Add</i>	3.59	
22 07 19 00-0080	LF		1-1/2" Diameter Pipe, 2" Thick Foamglas Insulation	22.07	4.00
			<i>For Work In Restricted Working Space, Add</i>	3.64	
22 07 19 00-0081	LF		2" Diameter Pipe, 2" Thick Foamglas Insulation	25.09	4.14
			<i>For Work In Restricted Working Space, Add</i>	3.77	
22 07 19 00-0082	LF		2-1/2" Diameter Pipe, 2" Thick Foamglas Insulation	26.39	4.29
			<i>For Work In Restricted Working Space, Add</i>	3.90	
22 07 19 00-0083	LF		3" Diameter Pipe, 2" Thick Foamglas Insulation	28.54	4.44
			<i>For Work In Restricted Working Space, Add</i>	4.03	
22 07 19 00-0084	LF		4" Diameter Pipe, 2" Thick Foamglas Insulation	32.55	4.68
			<i>For Work In Restricted Working Space, Add</i>	4.25	
22 07 19 00-0085	LF		6" Diameter Pipe, 2" Thick Foamglas Insulation	39.31	5.31
			<i>For Work In Restricted Working Space, Add</i>	4.83	
22 07 19 00-0086	LF		8" Diameter Pipe, 2" Thick Foamglas Insulation	43.73	5.93
			<i>For Work In Restricted Working Space, Add</i>	5.39	
22 07 19 00-0087	LF		10" Diameter Pipe, 2" Thick Foamglas Insulation	53.72	6.83
			<i>For Work In Restricted Working Space, Add</i>	6.21	
22 07 19 00-0088	LF		12" Diameter Pipe, 2" Thick Foamglas Insulation	66.52	8.50
			<i>For Work In Restricted Working Space, Add</i>	7.72	
22 07 19 00-0089	LF		14" Diameter Pipe, 2" Thick Foamglas Insulation	70.81	9.27
			<i>For Work In Restricted Working Space, Add</i>	8.43	
22 07 19 00-0090	LF		16" Diameter Pipe, 2" Thick Foamglas Insulation	82.52	11.85
			<i>For Work In Restricted Working Space, Add</i>	10.77	
22 07 19 00-0091	LF		18" Diameter Pipe, 2" Thick Foamglas Insulation	90.60	12.44
			<i>For Work In Restricted Working Space, Add</i>	11.31	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 07 19 00-0092 LF 20" Diameter Pipe, 2" Thick Foamglas Insulation..... <i>For Work In Restricted Working Space, Add</i>	99.62 12.93	14.22
22 07 19 00-0093 LF 24" Diameter Pipe, 2" Thick Foamglas Insulation..... <i>For Work In Restricted Working Space, Add</i>	125.83 15.62	17.18
22 07 19 00-0094 2-1/2" Thick Foamglas Pipe Insulation (22 07 19 00-0044)		
22 07 19 00-0095 LF 1/2" Diameter Pipe, 2-1/2" Thick Foamglas Insulation..... <i>For Work In Restricted Working Space, Add</i>	22.61 3.80	4.17
22 07 19 00-0096 LF 3/4" Diameter Pipe, 2-1/2" Thick Foamglas Insulation..... <i>For Work In Restricted Working Space, Add</i>	23.78 3.79	4.17
22 07 19 00-0097 LF 1" Diameter Pipe, 2-1/2" Thick Foamglas Insulation..... <i>For Work In Restricted Working Space, Add</i>	25.17 3.86	4.24
22 07 19 00-0098 LF 1-1/4" Diameter Pipe, 2-1/2" Thick Foamglas Insulation..... <i>For Work In Restricted Working Space, Add</i>	26.44 3.88	4.27
22 07 19 00-0099 LF 1-1/2" Diameter Pipe, 2-1/2" Thick Foamglas Insulation..... <i>For Work In Restricted Working Space, Add</i>	27.74 3.92	4.30
22 07 19 00-0100 LF 2" Diameter Pipe, 2-1/2" Thick Foamglas Insulation..... <i>For Work In Restricted Working Space, Add</i>	29.91 4.08	4.49
22 07 19 00-0101 LF 2-1/2" Diameter Pipe, 2-1/2" Thick Foamglas Insulation..... <i>For Work In Restricted Working Space, Add</i>	32.00 4.22	4.64
22 07 19 00-0102 LF 3" Diameter Pipe, 2-1/2" Thick Foamglas Insulation..... <i>For Work In Restricted Working Space, Add</i>	35.08 4.37	4.80
22 07 19 00-0103 LF 4" Diameter Pipe, 2-1/2" Thick Foamglas Insulation..... <i>For Work In Restricted Working Space, Add</i>	39.74 4.60	5.06
22 07 19 00-0104 LF 6" Diameter Pipe, 2-1/2" Thick Foamglas Insulation..... <i>For Work In Restricted Working Space, Add</i>	47.92 5.23	5.76
22 07 19 00-0105 LF 8" Diameter Pipe, 2-1/2" Thick Foamglas Insulation..... <i>For Work In Restricted Working Space, Add</i>	53.39 5.83	6.42
22 07 19 00-0106 LF 10" Diameter Pipe, 2-1/2" Thick Foamglas Insulation..... <i>For Work In Restricted Working Space, Add</i>	60.82 6.73	7.40
22 07 19 00-0107 LF 12" Diameter Pipe, 2-1/2" Thick Foamglas Insulation..... <i>For Work In Restricted Working Space, Add</i>	75.75 8.36	9.19
22 07 19 00-0108 LF 14" Diameter Pipe, 2-1/2" Thick Foamglas Insulation..... <i>For Work In Restricted Working Space, Add</i>	78.37 9.13	10.04
22 07 19 00-0109 LF 16" Diameter Pipe, 2-1/2" Thick Foamglas Insulation..... <i>For Work In Restricted Working Space, Add</i>	91.05 11.66	12.83
22 07 19 00-0110 LF 18" Diameter Pipe, 2-1/2" Thick Foamglas Insulation..... <i>For Work In Restricted Working Space, Add</i>	99.66 12.25	13.47
22 07 19 00-0111 LF 20" Diameter Pipe, 2-1/2" Thick Foamglas Insulation..... <i>For Work In Restricted Working Space, Add</i>	114.71 14.00	15.39
22 07 19 00-0112 LF 24" Diameter Pipe, 2-1/2" Thick Foamglas Insulation..... <i>For Work In Restricted Working Space, Add</i>	144.61 16.91	18.61
22 07 19 00-0113 3" Thick Foamglas Pipe Insulation (22 07 19 00-0044)		
22 07 19 00-0114 LF 1/2" Diameter Pipe, 3" Thick Foamglas Insulation..... <i>For Work In Restricted Working Space, Add</i>	28.16 4.04	4.44
22 07 19 00-0115 LF 3/4" Diameter Pipe, 3" Thick Foamglas Insulation..... <i>For Work In Restricted Working Space, Add</i>	28.86 4.04	4.44
22 07 19 00-0116 LF 1" Diameter Pipe, 3" Thick Foamglas Insulation..... <i>For Work In Restricted Working Space, Add</i>	29.79 4.10	4.52
22 07 19 00-0117 LF 1-1/4" Diameter Pipe, 3" Thick Foamglas Insulation..... <i>For Work In Restricted Working Space, Add</i>	30.58 4.13	4.55
22 07 19 00-0118 LF 1-1/2" Diameter Pipe, 3" Thick Foamglas Insulation..... <i>For Work In Restricted Working Space, Add</i>	31.41 4.16	4.59
22 07 19 00-0119 LF 2" Diameter Pipe, 3" Thick Foamglas Insulation..... <i>For Work In Restricted Working Space, Add</i>	33.98 4.34	4.77
22 07 19 00-0120 LF 2-1/2" Diameter Pipe, 3" Thick Foamglas Insulation..... <i>For Work In Restricted Working Space, Add</i>	36.45 4.49	4.94
22 07 19 00-0121 LF 3" Diameter Pipe, 3" Thick Foamglas Insulation..... <i>For Work In Restricted Working Space, Add</i>	42.10 4.64	5.11
22 07 19 00-0122 LF 4" Diameter Pipe, 3" Thick Foamglas Insulation..... <i>For Work In Restricted Working Space, Add</i>	48.68 4.90	5.38
22 07 19 00-0123 LF 6" Diameter Pipe, 3" Thick Foamglas Insulation..... <i>For Work In Restricted Working Space, Add</i>	52.99 5.57	6.12
22 07 19 00-0124 LF 8" Diameter Pipe, 3" Thick Foamglas Insulation..... <i>For Work In Restricted Working Space, Add</i>	59.96 6.20	6.82
22 07 19 00-0125 LF 10" Diameter Pipe, 3" Thick Foamglas Insulation..... <i>For Work In Restricted Working Space, Add</i>	71.93 7.16	7.87
22 07 19 00-0126 LF 12" Diameter Pipe, 3" Thick Foamglas Insulation..... <i>For Work In Restricted Working Space, Add</i>	82.66 8.90	9.78
22 07 19 00-0127 LF 14" Diameter Pipe, 3" Thick Foamglas Insulation..... <i>For Work In Restricted Working Space, Add</i>	88.21 9.71	10.67
22 07 19 00-0128 LF 16" Diameter Pipe, 3" Thick Foamglas Insulation..... <i>For Work In Restricted Working Space, Add</i>	104.03 12.41	13.65
22 07 19 00-0129 LF 18" Diameter Pipe, 3" Thick Foamglas Insulation..... <i>For Work In Restricted Working Space, Add</i>	111.77 13.03	14.33
22 07 19 00-0130 LF 20" Diameter Pipe, 3" Thick Foamglas Insulation..... <i>For Work In Restricted Working Space, Add</i>	131.57 14.89	16.38
22 07 19 00-0131 LF 24" Diameter Pipe, 3" Thick Foamglas Insulation..... <i>For Work In Restricted Working Space, Add</i>	161.18 17.99	19.79

22 Plumbing
22 07 Plumbing Insulation
22 07 19 Plumbing Piping Insulation



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 07 19 00-0132			3-1/2" Thick Foamglas Pipe Insulation (22 07 19 00-0044)		
22 07 19 00-0133	LF		1/2" Diameter Pipe, 3-1/2" Thick Foamglas Insulation	33.85	5.38
			<i>For Work In Restricted Working Space, Add</i>	4.90	
22 07 19 00-0134	LF		3/4" Diameter Pipe, 3-1/2" Thick Foamglas Insulation	34.74	5.38
			<i>For Work In Restricted Working Space, Add</i>	4.90	
22 07 19 00-0135	LF		1" Diameter Pipe, 3-1/2" Thick Foamglas Insulation	35.74	5.42
			<i>For Work In Restricted Working Space, Add</i>	4.93	
22 07 19 00-0136	LF		1-1/4" Diameter Pipe, 3-1/2" Thick Foamglas Insulation	36.72	5.45
			<i>For Work In Restricted Working Space, Add</i>	4.96	
22 07 19 00-0137	LF		1-1/2" Diameter Pipe, 3-1/2" Thick Foamglas Insulation	37.82	5.52
			<i>For Work In Restricted Working Space, Add</i>	5.02	
22 07 19 00-0138	LF		2" Diameter Pipe, 3-1/2" Thick Foamglas Insulation	42.14	5.72
			<i>For Work In Restricted Working Space, Add</i>	5.19	
22 07 19 00-0139	LF		2-1/2" Diameter Pipe, 3-1/2" Thick Foamglas Insulation	46.47	5.92
			<i>For Work In Restricted Working Space, Add</i>	5.37	
22 07 19 00-0140	LF		3" Diameter Pipe, 3-1/2" Thick Foamglas Insulation	49.28	6.12
			<i>For Work In Restricted Working Space, Add</i>	5.57	
22 07 19 00-0141	LF		4" Diameter Pipe, 3-1/2" Thick Foamglas Insulation	52.90	6.47
			<i>For Work In Restricted Working Space, Add</i>	5.88	
22 07 19 00-0142	LF		6" Diameter Pipe, 3-1/2" Thick Foamglas Insulation	61.04	7.35
			<i>For Work In Restricted Working Space, Add</i>	6.68	
22 07 19 00-0143	LF		8" Diameter Pipe, 3-1/2" Thick Foamglas Insulation	69.66	8.19
			<i>For Work In Restricted Working Space, Add</i>	7.44	
22 07 19 00-0144	LF		10" Diameter Pipe, 3-1/2" Thick Foamglas Insulation	83.82	9.45
			<i>For Work In Restricted Working Space, Add</i>	8.59	
22 07 19 00-0145	LF		12" Diameter Pipe, 3-1/2" Thick Foamglas Insulation	98.19	11.74
			<i>For Work In Restricted Working Space, Add</i>	10.67	
22 07 19 00-0146	LF		14" Diameter Pipe, 3-1/2" Thick Foamglas Insulation	101.60	12.81
			<i>For Work In Restricted Working Space, Add</i>	11.65	
22 07 19 00-0147	LF		16" Diameter Pipe, 3-1/2" Thick Foamglas Insulation	120.31	16.38
			<i>For Work In Restricted Working Space, Add</i>	14.89	
22 07 19 00-0148	LF		18" Diameter Pipe, 3-1/2" Thick Foamglas Insulation	133.41	17.20
			<i>For Work In Restricted Working Space, Add</i>	15.63	
22 07 19 00-0149	LF		20" Diameter Pipe, 3-1/2" Thick Foamglas Insulation	151.75	19.67
			<i>For Work In Restricted Working Space, Add</i>	17.88	
22 07 19 00-0150	LF		24" Diameter Pipe, 3-1/2" Thick Foamglas Insulation	186.95	23.75
			<i>For Work In Restricted Working Space, Add</i>	21.59	
22 07 19 00-0151			4" Thick Foamglas Pipe Insulation (22 07 19 00-0044)		
22 07 19 00-0152	LF		1/2" Diameter Pipe, 4" Thick Foamglas Insulation	41.14	6.62
			<i>For Work In Restricted Working Space, Add</i>	6.02	
22 07 19 00-0153	LF		3/4" Diameter Pipe, 4" Thick Foamglas Insulation	42.28	6.62
			<i>For Work In Restricted Working Space, Add</i>	6.02	
22 07 19 00-0154	LF		1" Diameter Pipe, 4" Thick Foamglas Insulation	43.77	6.72
			<i>For Work In Restricted Working Space, Add</i>	6.12	
22 07 19 00-0155	LF		1-1/4" Diameter Pipe, 4" Thick Foamglas Insulation	45.14	6.81
			<i>For Work In Restricted Working Space, Add</i>	6.19	
22 07 19 00-0156	LF		1-1/2" Diameter Pipe, 4" Thick Foamglas Insulation	46.94	7.03
			<i>For Work In Restricted Working Space, Add</i>	6.38	
22 07 19 00-0157	LF		2" Diameter Pipe, 4" Thick Foamglas Insulation	51.22	7.24
			<i>For Work In Restricted Working Space, Add</i>	6.58	
22 07 19 00-0158	LF		2-1/2" Diameter Pipe, 4" Thick Foamglas Insulation	55.16	7.36
			<i>For Work In Restricted Working Space, Add</i>	6.68	
22 07 19 00-0159	LF		3" Diameter Pipe, 4" Thick Foamglas Insulation	58.05	7.62
			<i>For Work In Restricted Working Space, Add</i>	6.93	
22 07 19 00-0160	LF		4" Diameter Pipe, 4" Thick Foamglas Insulation	63.20	8.50
			<i>For Work In Restricted Working Space, Add</i>	7.73	
22 07 19 00-0161	LF		6" Diameter Pipe, 4" Thick Foamglas Insulation	74.14	9.12
			<i>For Work In Restricted Working Space, Add</i>	8.30	
22 07 19 00-0162	LF		8" Diameter Pipe, 4" Thick Foamglas Insulation	84.32	9.90
			<i>For Work In Restricted Working Space, Add</i>	9.00	
22 07 19 00-0163	LF		10" Diameter Pipe, 4" Thick Foamglas Insulation	95.95	11.76
			<i>For Work In Restricted Working Space, Add</i>	10.69	
22 07 19 00-0164	LF		12" Diameter Pipe, 4" Thick Foamglas Insulation	110.81	14.61
			<i>For Work In Restricted Working Space, Add</i>	13.28	
22 07 19 00-0165	LF		14" Diameter Pipe, 4" Thick Foamglas Insulation	120.38	15.95
			<i>For Work In Restricted Working Space, Add</i>	14.51	
22 07 19 00-0166	LF		16" Diameter Pipe, 4" Thick Foamglas Insulation	140.72	20.40
			<i>For Work In Restricted Working Space, Add</i>	18.54	
22 07 19 00-0167	LF		18" Diameter Pipe, 4" Thick Foamglas Insulation	158.52	21.38
			<i>For Work In Restricted Working Space, Add</i>	19.43	
22 07 19 00-0168	LF		20" Diameter Pipe, 4" Thick Foamglas Insulation	176.95	24.46
			<i>For Work In Restricted Working Space, Add</i>	22.24	
22 07 19 00-0169	LF		24" Diameter Pipe, 4" Thick Foamglas Insulation	226.62	29.56
			<i>For Work In Restricted Working Space, Add</i>	26.87	
22 07 19 00-0170			Flexible Polyethylene Tubing Closed Cell Foam Insulation (22 07 19)		
			Note: UV resistant standard temperature (-90 Degree F To +212 Degree F). No additional linear feet for fittings required.		
22 07 19 00-0171			3/8" Wall Flexible Polyethylene Tubing Foam Insulation (22 07 19 00-0170)		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 07 19 00-0172 LF 1/8" Diameter Pipe, 3/8" Wall Polyethylene Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	4.32 1.24	2.06
22 07 19 00-0173 LF 1/4" Diameter Pipe, 3/8" Wall Polyethylene Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	4.33 1.24	2.06
22 07 19 00-0174 LF 3/8" Diameter Pipe, 3/8" Wall Polyethylene Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	4.33 1.24	2.06
22 07 19 00-0175 LF 1/2" Diameter Pipe, 3/8" Wall Polyethylene Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	4.51 1.28	2.14
22 07 19 00-0176 LF 3/4" Diameter Pipe, 3/8" Wall Polyethylene Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	4.69 1.33	2.21
22 07 19 00-0177 LF 1" Diameter Pipe, 3/8" Wall Polyethylene Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	4.84 1.35	2.25
22 07 19 00-0178 LF 1-1/4" Diameter Pipe, 3/8" Wall Polyethylene Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	5.01 1.37	2.28
22 07 19 00-0179 LF 1-1/2" Diameter Pipe, 3/8" Wall Polyethylene Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	5.08 1.38	2.28
22 07 19 00-0180 LF 2" Diameter Pipe, 3/8" Wall Polyethylene Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	5.25 1.38	2.28
22 07 19 00-0181 LF 2-1/2" Diameter Pipe, 3/8" Wall Polyethylene Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	5.62 1.42	2.35
22 07 19 00-0182 LF 3" Diameter Pipe, 3/8" Wall Polyethylene Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	5.78 1.44	2.39
22 07 19 00-0183 1/2" Wall Flexible Polyethylene Tubing Foam Insulation (22 07 19 00-0170)		
22 07 19 00-0184 LF 1/8" Diameter Pipe, 1/2" Wall Polyethylene Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	4.77 1.35	2.25
22 07 19 00-0185 LF 1/4" Diameter Pipe, 1/2" Wall Polyethylene Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	4.79 1.35	2.25
22 07 19 00-0186 LF 3/8" Diameter Pipe, 1/2" Wall Polyethylene Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	4.84 1.36	2.25
22 07 19 00-0187 LF 1/2" Diameter Pipe, 1/2" Wall Polyethylene Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	4.92 1.37	2.28
22 07 19 00-0188 LF 3/4" Diameter Pipe, 1/2" Wall Polyethylene Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	4.99 1.38	2.28
22 07 19 00-0189 LF 1" Diameter Pipe, 1/2" Wall Polyethylene Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	5.21 1.41	2.35
22 07 19 00-0190 LF 1-1/4" Diameter Pipe, 1/2" Wall Polyethylene Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	5.02 1.32	2.39
22 07 19 00-0191 LF 1-1/2" Diameter Pipe, 1/2" Wall Polyethylene Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	5.59 1.46	2.43
22 07 19 00-0192 LF 2" Diameter Pipe, 1/2" Wall Polyethylene Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	5.83 1.48	2.46
22 07 19 00-0193 LF 2-1/2" Diameter Pipe, 1/2" Wall Polyethylene Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	6.26 1.52	2.54
22 07 19 00-0194 LF 3" Diameter Pipe, 1/2" Wall Polyethylene Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	6.68 1.54	2.57
22 07 19 00-0195 LF 3-1/2" Diameter Pipe, 1/2" Wall Polyethylene Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	7.08 1.56	2.60
22 07 19 00-0196 LF 4" Diameter Pipe, 1/2" Wall Polyethylene Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	7.33 1.59	2.64
22 07 19 00-0197 3/4" Wall Flexible Polyethylene Tubing Foam Insulation (22 07 19 00-0170)		
22 07 19 00-0198 LF 1/8" Diameter Pipe, 3/4" Wall Polyethylene Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	5.26 1.46	2.43
22 07 19 00-0199 LF 1/4" Diameter Pipe, 3/4" Wall Polyethylene Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	5.29 1.46	2.43
22 07 19 00-0200 LF 3/8" Diameter Pipe, 3/4" Wall Polyethylene Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	5.36 1.48	2.46
22 07 19 00-0201 LF 1/2" Diameter Pipe, 3/4" Wall Polyethylene Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	5.67 1.52	2.54
22 07 19 00-0202 LF 3/4" Diameter Pipe, 3/4" Wall Polyethylene Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	5.80 1.54	2.57
22 07 19 00-0203 LF 1" Diameter Pipe, 3/4" Wall Polyethylene Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	6.17 1.59	2.64
22 07 19 00-0204 LF 1-1/4" Diameter Pipe, 3/4" Wall Polyethylene Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	6.51 1.61	2.68
22 07 19 00-0205 LF 1-1/2" Diameter Pipe, 3/4" Wall Polyethylene Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	6.68 1.62	2.68
22 07 19 00-0206 LF 2" Diameter Pipe, 3/4" Wall Polyethylene Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	7.30 1.63	2.71
22 07 19 00-0207 LF 2-1/2" Diameter Pipe, 3/4" Wall Polyethylene Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	8.18 1.67	2.78
22 07 19 00-0208 LF 3" Diameter Pipe, 3/4" Wall Polyethylene Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	8.25 1.69	2.82
22 07 19 00-0209 LF 3-1/2" Diameter Pipe, 3/4" Wall Polyethylene Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	8.89 1.72	2.86
22 07 19 00-0210 LF 4" Diameter Pipe, 3/4" Wall Polyethylene Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	9.15 1.74	2.89
22 07 19 00-0211 1" Wall Flexible Polyethylene Tubing Foam Insulation (22 07 19 00-0170)		

22 Plumbing
22 07 Plumbing Insulation
22 07 19 Plumbing Piping Insulation



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 07 19 00-0212	LF		1/4" Diameter Pipe, 1" Wall Polyethylene Tubing Flexible Closed Cell Foam Insulation .....5.98 <i>For Work In Restricted Working Space, Add</i> 1.61	5.98	2.68
22 07 19 00-0213	LF		3/8" Diameter Pipe, 1" Wall Polyethylene Tubing Flexible Closed Cell Foam Insulation .....6.12 <i>For Work In Restricted Working Space, Add</i> 1.63	6.12	2.71
22 07 19 00-0214	LF		1/2" Diameter Pipe, 1" Wall Polyethylene Tubing Flexible Closed Cell Foam Insulation .....6.53 <i>For Work In Restricted Working Space, Add</i> 1.67	6.53	2.78
22 07 19 00-0215	LF		3/4" Diameter Pipe, 1" Wall Polyethylene Tubing Flexible Closed Cell Foam Insulation .....6.66 <i>For Work In Restricted Working Space, Add</i> 1.69	6.66	2.82
22 07 19 00-0216	LF		1" Diameter Pipe, 1" Wall Polyethylene Tubing Flexible Closed Cell Foam Insulation .....7.27 <i>For Work In Restricted Working Space, Add</i> 1.74	7.27	2.89
22 07 19 00-0217	LF		1-1/4" Diameter Pipe, 1" Wall Polyethylene Tubing Flexible Closed Cell Foam Insulation .....7.59 <i>For Work In Restricted Working Space, Add</i> 1.78	7.59	2.97
22 07 19 00-0218	LF		1-1/2" Diameter Pipe, 1" Wall Polyethylene Tubing Flexible Closed Cell Foam Insulation .....7.72 <i>For Work In Restricted Working Space, Add</i> 1.80	7.72	2.97
22 07 19 00-0219	LF		2" Diameter Pipe, 1" Wall Polyethylene Tubing Flexible Closed Cell Foam Insulation .....8.28 <i>For Work In Restricted Working Space, Add</i> 1.82	8.28	3.04
22 07 19 00-0220	LF		2-1/2" Diameter Pipe, 1" Wall Polyethylene Tubing Flexible Closed Cell Foam Insulation .....8.71 <i>For Work In Restricted Working Space, Add</i> 1.87	8.71	3.11
22 07 19 00-0221	LF		3" Diameter Pipe, 1" Wall Polyethylene Tubing Flexible Closed Cell Foam Insulation .....9.07 <i>For Work In Restricted Working Space, Add</i> 1.89	9.07	3.16
22 07 19 00-0222			Flexible Elastomeric Tubing Closed Cell Foam Insulation (22 07 19) Note: No additional LF for fittings required.		
22 07 19 00-0223			3/8" Wall Flexible Elastomeric Tubing Foam Insulation (22 07 19 00-0222)		
22 07 19 00-0224	LF		1/4" Diameter Pipe, 3/8" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation .....4.37 <i>For Work In Restricted Working Space, Add</i> 1.24	4.37	2.06
22 07 19 00-0225	LF		3/8" Diameter Pipe, 3/8" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation .....4.41 <i>For Work In Restricted Working Space, Add</i> 1.24	4.41	2.06
22 07 19 00-0226	LF		1/2" Diameter Pipe, 3/8" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation .....4.57 <i>For Work In Restricted Working Space, Add</i> 1.28	4.57	2.14
22 07 19 00-0227	LF		5/8" Diameter Pipe, 3/8" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation .....4.63 <i>For Work In Restricted Working Space, Add</i> 1.30	4.63	2.17
22 07 19 00-0228	LF		3/4" Diameter Pipe, 3/8" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation .....4.77 <i>For Work In Restricted Working Space, Add</i> 1.33	4.77	2.21
22 07 19 00-0229	LF		7/8" Diameter Pipe, 3/8" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation .....4.81 <i>For Work In Restricted Working Space, Add</i> 1.34	4.81	2.21
22 07 19 00-0230	LF		1" Diameter Pipe, 3/8" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation .....4.88 <i>For Work In Restricted Working Space, Add</i> 1.35	4.88	2.25
22 07 19 00-0231	LF		1-1/8" Diameter Pipe, 3/8" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation .....4.92 <i>For Work In Restricted Working Space, Add</i> 1.36	4.92	2.25
22 07 19 00-0232	LF		1-1/4" Diameter Pipe, 3/8" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation .....5.05 <i>For Work In Restricted Working Space, Add</i> 1.37	5.05	2.28
22 07 19 00-0233	LF		1-5/8" Diameter Pipe, 3/8" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation .....5.13 <i>For Work In Restricted Working Space, Add</i> 1.38	5.13	2.28
22 07 19 00-0234	LF		2" Diameter Pipe, 3/8" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation .....5.32 <i>For Work In Restricted Working Space, Add</i> 1.38	5.32	2.28
22 07 19 00-0235	LF		2-1/8" Diameter Pipe, 3/8" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation .....5.43 <i>For Work In Restricted Working Space, Add</i> 1.39	5.43	2.32
22 07 19 00-0236	LF		2-3/8" Diameter Pipe, 3/8" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation .....5.58 <i>For Work In Restricted Working Space, Add</i> 1.41	5.58	2.35
22 07 19 00-0237	LF		2-5/8" Diameter Pipe, 3/8" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation .....5.70 <i>For Work In Restricted Working Space, Add</i> 1.42	5.70	2.35
22 07 19 00-0238	LF		2-7/8" Diameter Pipe, 3/8" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation .....5.79 <i>For Work In Restricted Working Space, Add</i> 1.43	5.79	2.39
22 07 19 00-0239	LF		3-1/8" Diameter Pipe, 3/8" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation .....5.91 <i>For Work In Restricted Working Space, Add</i> 1.44	5.91	2.39
22 07 19 00-0240	LF		3-5/8" Diameter Pipe, 3/8" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation .....6.17 <i>For Work In Restricted Working Space, Add</i> 1.46	6.17	2.43
22 07 19 00-0241	LF		4-1/8" Diameter Pipe, 3/8" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation .....6.48 <i>For Work In Restricted Working Space, Add</i> 1.48	6.48	2.46
22 07 19 00-0242	LF		4-1/2" Diameter Pipe, 3/8" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation .....6.81 <i>For Work In Restricted Working Space, Add</i> 1.49	6.81	2.48
22 07 19 00-0243			1/2" Wall Flexible Elastomeric Tubing Foam Insulation (22 07 19 00-0222)		
22 07 19 00-0244	LF		1/4" Diameter Pipe, 1/2" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation .....4.85 <i>For Work In Restricted Working Space, Add</i> 1.35	4.85	2.25
22 07 19 00-0245	LF		3/8" Diameter Pipe, 1/2" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation .....4.93 <i>For Work In Restricted Working Space, Add</i> 1.36	4.93	2.25
22 07 19 00-0246	LF		1/2" Diameter Pipe, 1/2" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation .....5.02 <i>For Work In Restricted Working Space, Add</i> 1.37	5.02	2.28
22 07 19 00-0247	LF		3/4" Diameter Pipe, 1/2" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation .....5.10 <i>For Work In Restricted Working Space, Add</i> 1.38	5.10	2.28
22 07 19 00-0248	LF		1" Diameter Pipe, 1/2" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation .....5.26 <i>For Work In Restricted Working Space, Add</i> 1.41	5.26	2.35
22 07 19 00-0249	LF		1-1/4" Diameter Pipe, 1/2" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation .....5.42 <i>For Work In Restricted Working Space, Add</i> 1.43	5.42	2.39
22 07 19 00-0250	LF		1-1/2" Diameter Pipe, 1/2" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation .....5.63 <i>For Work In Restricted Working Space, Add</i> 1.46	5.63	2.43
22 07 19 00-0251	LF		2" Diameter Pipe, 1/2" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation .....5.91 <i>For Work In Restricted Working Space, Add</i> 1.48	5.91	2.46



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 07 19 00-0252 LF 2-1/2" Diameter Pipe, 1/2" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation..... <i>For Work In Restricted Working Space, Add</i>	6.33 1.52	2.54
22 07 19 00-0253 LF 3" Diameter Pipe, 1/2" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	6.52 1.54	2.57
22 07 19 00-0254 LF 3-1/2" Diameter Pipe, 1/2" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation..... <i>For Work In Restricted Working Space, Add</i>	7.12 1.56	2.60
22 07 19 00-0255 LF 4" Diameter Pipe, 1/2" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	7.34 1.59	2.64
22 07 19 00-0256 LF 5" Diameter Pipe, 1/2" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	8.15 1.61	2.68
22 07 19 00-0257 LF 6" Diameter Pipe, 1/2" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	8.70 1.65	2.75
22 07 19 00-0258 LF 8" Diameter Pipe, 1/2" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	10.20 1.69	2.82
22 07 19 00-0259 3/4" Wall Flexible Elastomeric Tubing Foam Insulation (22 07 19 00-0222)		
22 07 19 00-0260 LF 1/4" Diameter Pipe, 3/4" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	5.42 1.46	2.43
22 07 19 00-0261 LF 3/8" Diameter Pipe, 3/4" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	5.54 1.48	2.46
22 07 19 00-0262 LF 1/2" Diameter Pipe, 3/4" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	5.81 1.52	2.54
22 07 19 00-0263 LF 3/4" Diameter Pipe, 3/4" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	6.04 1.54	2.57
22 07 19 00-0264 LF 1" Diameter Pipe, 3/4" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	6.32 1.59	2.64
22 07 19 00-0265 LF 1-1/4" Diameter Pipe, 3/4" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation..... <i>For Work In Restricted Working Space, Add</i>	6.74 1.61	2.68
22 07 19 00-0266 LF 1-1/2" Diameter Pipe, 3/4" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation..... <i>For Work In Restricted Working Space, Add</i>	7.00 1.63	2.71
22 07 19 00-0267 LF 2" Diameter Pipe, 3/4" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	7.28 1.63	2.71
22 07 19 00-0268 LF 2-1/2" Diameter Pipe, 3/4" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation..... <i>For Work In Restricted Working Space, Add</i>	8.03 1.67	2.78
22 07 19 00-0269 LF 3" Diameter Pipe, 3/4" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	8.44 1.69	2.82
22 07 19 00-0270 LF 3-1/2" Diameter Pipe, 3/4" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation..... <i>For Work In Restricted Working Space, Add</i>	9.03 1.72	2.86
22 07 19 00-0271 LF 4" Diameter Pipe, 3/4" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	9.31 1.74	2.89
22 07 19 00-0272 LF 5" Diameter Pipe, 3/4" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	7.16 0.88	3.45
22 07 19 00-0273 LF 6" Diameter Pipe, 3/4" Flexible Elastomeric Tubing Closed Cell Foam Insulation..... <i>For Work In Restricted Working Space, Add</i>	11.05 1.78	2.97
22 07 19 00-0274 LF 8" Diameter Pipe, 3/4" Flexible Elastomeric Tubing Closed Cell Foam Insulation..... <i>For Work In Restricted Working Space, Add</i>	12.25 1.82	3.04
22 07 19 00-0275 1" Wall Flexible Elastomeric Tubing Foam Insulation (22 07 19 00-0222)		
22 07 19 00-0276 LF 3/8" Diameter Pipe, 1" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	6.78 1.63	2.71
22 07 19 00-0277 LF 1/2" Diameter Pipe, 1" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	7.00 1.67	2.78
22 07 19 00-0278 LF 3/4" Diameter Pipe, 1" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	7.39 1.69	2.82
22 07 19 00-0279 LF 1" Diameter Pipe, 1" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	7.82 1.74	2.89
22 07 19 00-0280 LF 1-1/4" Diameter Pipe, 1" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	8.24 1.78	2.97
22 07 19 00-0281 LF 1-1/2" Diameter Pipe, 1" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	8.67 1.80	2.97
22 07 19 00-0282 LF 2" Diameter Pipe, 1" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	9.65 1.82	3.04
22 07 19 00-0283 LF 2-1/2" Diameter Pipe, 1" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation..... <i>For Work In Restricted Working Space, Add</i>	10.88 1.87	3.11
22 07 19 00-0284 LF 3" Diameter Pipe, 1" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	11.46 1.89	3.16
22 07 19 00-0285 LF 3-1/2" Diameter Pipe, 1" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation..... <i>For Work In Restricted Working Space, Add</i>	11.70 1.91	3.19
22 07 19 00-0286 LF 4" Diameter Pipe, 1" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	13.29 1.95	3.26
22 07 19 00-0287 LF 5" Diameter Pipe, 1" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	14.58 2.00	3.33
22 07 19 00-0288 LF 6" Diameter Pipe, 1" Wall Flexible Elastomeric Tubing Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	15.91 2.04	3.41
22 07 19 00-0289 Flexible Polyolefin Tubing Closed Cell Foam Insulation (22 07 19)		
Note: UV stabilized, work temperature (-110 degree F to +210 degree F) 0 water vapor transmission. No additional LF for fittings required.		
22 07 19 00-0290 3/8" Wall Flexible Polyolefin Tubing Foam Insulation (22 07 19 00-0289)		

22 Plumbing
22 07 Plumbing Insulation
22 07 19 Plumbing Piping Insulation



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 07 19 00-0291	LF		1/8" Diameter Pipe, 3/8" Wall Polyolefin Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	4.39 1.24	2.06
22 07 19 00-0292	LF		1/4" Diameter Pipe, 3/8" Wall Polyolefin Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	4.41 1.24	2.06
22 07 19 00-0293	LF		3/8" Diameter Pipe, 3/8" Wall Polyolefin Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	4.44 1.24	2.06
22 07 19 00-0294	LF		1/2" Diameter Pipe, 3/8" Wall Polyolefin Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	4.61 1.28	2.14
22 07 19 00-0295	LF		3/4" Diameter Pipe, 3/8" Wall Polyolefin Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	4.81 1.33	2.21
22 07 19 00-0296	LF		1" Diameter Pipe, 3/8" Wall Polyolefin Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	4.93 1.35	2.25
22 07 19 00-0297	LF		1-1/4" Diameter Pipe, 3/8" Wall Polyolefin Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	5.14 1.37	2.28
22 07 19 00-0298	LF		1-1/2" Diameter Pipe, 3/8" Wall Polyolefin Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	5.28 1.38	2.28
22 07 19 00-0299	LF		2" Diameter Pipe, 3/8" Wall Polyolefin Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	5.39 1.38	2.35
22 07 19 00-0300	LF		2-1/2" Diameter Pipe, 3/8" Wall Polyolefin Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	5.87 1.42	2.35
22 07 19 00-0301	LF		3" Diameter Pipe, 3/8" Wall Polyolefin Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	6.29 1.44	2.39
22 07 19 00-0302	LF		4" Diameter Pipe, 3/8" Wall Polyolefin Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	7.37 1.48	2.46
22 07 19 00-0303			1/2" Wall Flexible Polyolefin Tubing Foam Insulation (22 07 19 00-0289)		
22 07 19 00-0304	LF		1/8" Diameter Pipe, 1/2" Wall Polyolefin Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	4.89 1.35	2.25
22 07 19 00-0305	LF		1/4" Diameter Pipe, 1/2" Wall Polyolefin Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	4.92 1.35	2.25
22 07 19 00-0306	LF		3/8" Diameter Pipe, 1/2" Wall Polyolefin Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	4.97 1.36	2.25
22 07 19 00-0307	LF		1/2" Diameter Pipe, 1/2" Wall Polyolefin Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	5.06 1.37	2.28
22 07 19 00-0308	LF		3/4" Diameter Pipe, 1/2" Wall Polyolefin Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	5.18 1.38	2.28
22 07 19 00-0309	LF		1" Diameter Pipe, 1/2" Wall Polyolefin Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	5.34 1.41	2.35
22 07 19 00-0310	LF		1-1/4" Diameter Pipe, 1/2" Wall Polyolefin Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	5.56 1.43	2.39
22 07 19 00-0311	LF		1-1/2" Diameter Pipe, 1/2" Wall Polyolefin Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	5.79 1.46	2.43
22 07 19 00-0312	LF		2" Diameter Pipe, 1/2" Wall Polyolefin Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	6.02 1.48	2.46
22 07 19 00-0313	LF		2-1/2" Diameter Pipe, 1/2" Wall Polyolefin Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	6.55 1.52	2.54
22 07 19 00-0314	LF		3" Diameter Pipe, 1/2" Wall Polyolefin Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	7.00 1.54	2.57
22 07 19 00-0315	LF		4" Diameter Pipe, 1/2" Wall Polyolefin Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	7.86 1.59	2.64
22 07 19 00-0316			3/4" Wall Flexible Polyolefin Tubing Foam Insulation (22 07 19 00-0289)		
22 07 19 00-0317	LF		1/8" Diameter Pipe, 3/4" Wall Polyolefin Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	5.45 1.46	2.43
22 07 19 00-0318	LF		1/4" Diameter Pipe, 3/4" Wall Polyolefin Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	5.49 1.46	2.43
22 07 19 00-0319	LF		3/8" Diameter Pipe, 3/4" Wall Polyolefin Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	5.66 1.48	2.46
22 07 19 00-0320	LF		1/2" Diameter Pipe, 3/4" Wall Polyolefin Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	5.89 1.52	2.54
22 07 19 00-0321	LF		3/4" Diameter Pipe, 3/4" Wall Polyolefin Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	6.19 1.54	2.57
22 07 19 00-0322	LF		1" Diameter Pipe, 3/4" Wall Polyolefin Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	6.51 1.59	2.64
22 07 19 00-0323	LF		1-1/4" Diameter Pipe, 3/4" Wall Polyolefin Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	6.99 1.61	2.68
22 07 19 00-0324	LF		1-1/2" Diameter Pipe, 3/4" Wall Polyolefin Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	7.32 1.62	2.68
22 07 19 00-0325	LF		2" Diameter Pipe, 3/4" Wall Polyolefin Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	7.69 1.63	2.71
22 07 19 00-0326	LF		2-1/2" Diameter Pipe, 3/4" Wall Polyolefin Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	8.41 1.67	2.78
22 07 19 00-0327	LF		3" Diameter Pipe, 3/4" Wall Polyolefin Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	9.06 1.69	2.82
22 07 19 00-0328	LF		4" Diameter Pipe, 3/4" Wall Polyolefin Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	10.30 1.74	2.89
22 07 19 00-0329			1" Wall Flexible Polyolefin Tubing Foam Insulation (22 07 19 00-0289)		
22 07 19 00-0330	LF		1/8" Diameter Pipe, 1" Wall Polyolefin Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	6.44 1.61	2.68



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 07 19 00-0331 LF 1/4" Diameter Pipe, 1" Wall Polyolefin Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	6.47 <i>1.61</i>	2.68
22 07 19 00-0332 LF 3/8" Diameter Pipe, 1" Wall Polyolefin Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	6.57 <i>1.63</i>	2.71
22 07 19 00-0333 LF 1/2" Diameter Pipe, 1" Wall Polyolefin Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	6.79 <i>1.67</i>	2.78
22 07 19 00-0334 LF 3/4" Diameter Pipe, 1" Wall Polyolefin Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	7.23 <i>1.89</i>	2.82
22 07 19 00-0335 LF 1" Diameter Pipe, 1" Wall Polyolefin Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	7.62 <i>1.74</i>	2.89
22 07 19 00-0336 LF 1-1/4" Diameter Pipe, 1" Wall Polyolefin Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	8.02 <i>1.78</i>	2.97
22 07 19 00-0337 LF 1-1/2" Diameter Pipe, 1" Wall Polyolefin Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	8.40 <i>1.80</i>	2.97
22 07 19 00-0338 LF 2" Diameter Pipe, 1" Wall Polyolefin Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	9.21 <i>1.82</i>	3.04
22 07 19 00-0339 LF 2-1/2" Diameter Pipe, 1" Wall Polyolefin Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	10.31 <i>1.87</i>	3.11
22 07 19 00-0340 LF 3" Diameter Pipe, 1" Wall Polyolefin Tubing Flexible Closed Cell Foam Insulation <i>For Work In Restricted Working Space, Add</i>	11.08 <i>1.89</i>	3.16
22 07 19 00-0341 Insulation Protective Jacketing <small>(22 07 19)</small> Note: Jacketing only and must be added to insulation prices.		
22 07 19 00-0342 Aluminum Insulation Protective Jacketing With Bands <small>(22 07 19 00-0341)</small>		
22 07 19 00-0343 SF 0.006" Aluminum Insulation Jacket With Bands Fire Retardant.....	10.36	4.42
22 07 19 00-0344 SF 0.010" Aluminum Insulation Jacket With Bands Fire Retardant.....	10.53	4.42
22 07 19 00-0345 SF 0.016" Aluminum Insulation Jacket With Bands Fire Retardant.....	10.69	4.42
22 07 19 00-0346 SF 0.020" Aluminum Insulation Jacket With Bands Fire Retardant.....	10.84	4.42
22 07 19 00-0347 SF 0.024" Aluminum Insulation Jacket With Bands Fire Retardant.....	10.98	4.42
22 07 19 00-0348 Stainless Steel Insulation Protective Jacketing With Bands <small>(22 07 19 00-0341)</small>		
22 07 19 00-0349 SF 0.016" Stainless Steel Insulation Jacket With Bands Fire Retardant.....	16.54	6.20
22 07 19 00-0350 SF 0.010" Stainless Steel Insulation Jacket With Bands Fire Retardant.....	13.39	5.17
22 07 19 00-0351 Polyvinyl Chloride (PVC) Insulation Protective Jacketing <small>(22 07 19 00-0341)</small>		
22 07 19 00-0352 20 Mil Polyvinyl Chloride (PVC) Insulation Protective Jacketing <small>(22 07 19 00-0351)</small>		
22 07 19 00-0353 LF 1-1/2" ID, 0.02" Polyvinyl Chloride (PVC) Insulation Jacketing.....	4.34	1.04
22 07 19 00-0354 LF 2" ID, 0.02" Polyvinyl Chloride (PVC) Insulation Jacketing.....	4.63	1.07
22 07 19 00-0355 LF 2-1/2" ID, 0.02" Polyvinyl Chloride (PVC) Insulation Jacketing.....	4.85	1.10
22 07 19 00-0356 LF 3" ID, 0.02" Polyvinyl Chloride (PVC) Insulation Jacketing.....	5.13	1.17
22 07 19 00-0357 LF 3-1/2" ID, 0.02" Polyvinyl Chloride (PVC) Insulation Jacketing.....	5.42	1.21
22 07 19 00-0358 LF 4" ID, 0.02" Polyvinyl Chloride (PVC) Insulation Jacketing.....	5.68	1.24
22 07 19 00-0359 LF 4-1/2" ID, 0.02" Polyvinyl Chloride (PVC) Insulation Jacketing.....	5.97	1.31
22 07 19 00-0360 LF 5" ID, 0.02" Polyvinyl Chloride (PVC) Insulation Jacketing.....	6.32	1.38
22 07 19 00-0361 LF 5-1/2" ID, 0.02" Polyvinyl Chloride (PVC) Insulation Jacketing.....	6.68	1.45
22 07 19 00-0362 LF 6" ID, 0.02" Polyvinyl Chloride (PVC) Insulation Jacketing.....	7.10	1.51
22 07 19 00-0363 LF 6-1/2" ID, 0.02" Polyvinyl Chloride (PVC) Insulation Jacketing.....	7.31	1.58
22 07 19 00-0364 LF 7" ID, 0.02" Polyvinyl Chloride (PVC) Insulation Jacketing.....	7.60	1.62
22 07 19 00-0365 LF 7-1/2" ID, 0.02" Polyvinyl Chloride (PVC) Insulation Jacketing.....	7.93	1.69
22 07 19 00-0366 LF 8" ID, 0.02" Polyvinyl Chloride (PVC) Insulation Jacketing.....	8.08	1.70
22 07 19 00-0367 LF 8-1/2" ID, 0.02" Polyvinyl Chloride (PVC) Insulation Jacketing.....	8.31	1.74
22 07 19 00-0368 LF 9" ID, 0.02" Polyvinyl Chloride (PVC) Insulation Jacketing.....	8.51	1.77
22 07 19 00-0369 LF 10" ID, 0.02" Polyvinyl Chloride (PVC) Insulation Jacketing.....	8.95	1.72
22 07 19 00-0370 LF 11" ID, 0.02" Polyvinyl Chloride (PVC) Insulation Jacketing.....	9.44	1.93
22 07 19 00-0371 LF 12" ID, 0.02" Polyvinyl Chloride (PVC) Insulation Jacketing.....	9.94	2.02
22 07 19 00-0372 30 Mil Polyvinyl Chloride (PVC) Insulation Protective Jacketing <small>(22 07 19 00-0351)</small>		
22 07 19 00-0373 LF 2" ID, 0.03" Polyvinyl Chloride (PVC) Insulation Jacketing.....	4.80	1.07
22 07 19 00-0374 LF 2-1/2" ID, 0.03" Polyvinyl Chloride (PVC) Insulation Jacketing.....	5.06	1.10
22 07 19 00-0375 LF 3" ID, 0.03" Polyvinyl Chloride (PVC) Insulation Jacketing.....	5.39	1.16
22 07 19 00-0376 LF 3-1/2" ID, 0.03" Polyvinyl Chloride (PVC) Insulation Jacketing.....	5.71	1.21
22 07 19 00-0377 LF 4" ID, 0.03" Polyvinyl Chloride (PVC) Insulation Jacketing.....	6.01	1.26
22 07 19 00-0378 LF 4-1/2" ID, 0.03" Polyvinyl Chloride (PVC) Insulation Jacketing.....	6.34	1.31
22 07 19 00-0379 LF 5" ID, 0.03" Polyvinyl Chloride (PVC) Insulation Jacketing.....	6.72	1.38
22 07 19 00-0380 LF 5-1/2" ID, 0.03" Polyvinyl Chloride (PVC) Insulation Jacketing.....	7.12	1.45
22 07 19 00-0381 LF 6" ID, 0.03" Polyvinyl Chloride (PVC) Insulation Jacketing.....	7.58	1.55
22 07 19 00-0382 LF 6-1/2" ID, 0.03" Polyvinyl Chloride (PVC) Insulation Jacketing.....	7.83	1.57
22 07 19 00-0383 LF 7" ID, 0.03" Polyvinyl Chloride (PVC) Insulation Jacketing.....	8.14	1.62
22 07 19 00-0384 LF 7-1/2" ID, 0.03" Polyvinyl Chloride (PVC) Insulation Jacketing.....	8.53	1.69
22 07 19 00-0385 LF 8" ID, 0.03" Polyvinyl Chloride (PVC) Insulation Jacketing.....	8.72	1.70
22 07 19 00-0386 LF 8-1/2" ID, 0.03" Polyvinyl Chloride (PVC) Insulation Jacketing.....	8.98	1.74
22 07 19 00-0387 LF 9" ID, 0.03" Polyvinyl Chloride (PVC) Insulation Jacketing.....	9.23	1.77
22 07 19 00-0388 LF 10" ID, 0.03" Polyvinyl Chloride (PVC) Insulation Jacketing.....	9.73	1.84
22 07 19 00-0389 LF 11" ID, 0.03" Polyvinyl Chloride (PVC) Insulation Jacketing.....	10.30	1.93
22 07 19 00-0390 LF 12" ID, 0.03" Polyvinyl Chloride (PVC) Insulation Jacketing.....	10.87	2.02



MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

MINOR	CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 07 19 00-0391	Polyvinyl Chloride (PVC) Insulation Protective Jacketing For Fittings (22 07 19 00-0351)		
22 07 19 00-0392	EA 1-1/2" Polyvinyl Chloride (PVC) Elbow Insulation Jacketing	8.74	2.07
22 07 19 00-0393	EA 2" Polyvinyl Chloride (PVC) Elbow Insulation Jacketing	9.12	2.12
22 07 19 00-0394	EA 2-1/2" Polyvinyl Chloride (PVC) Elbow Insulation Jacketing	9.53	2.19
22 07 19 00-0395	EA 3" Polyvinyl Chloride (PVC) Elbow Insulation Jacketing	10.06	2.29
22 07 19 00-0396	EA 3-1/2" Polyvinyl Chloride (PVC) Elbow Insulation Jacketing	10.79	2.24
22 07 19 00-0397	EA 4" Polyvinyl Chloride (PVC) Elbow Insulation Jacketing	11.44	2.50
22 07 19 00-0398	EA 4-1/2" Polyvinyl Chloride (PVC) Elbow Insulation Jacketing	12.20	2.62
22 07 19 00-0399	EA 5" Polyvinyl Chloride (PVC) Elbow Insulation Jacketing	13.05	2.76
22 07 19 00-0400	EA 5-1/2" Polyvinyl Chloride (PVC) Elbow Insulation Jacketing	14.28	2.89
22 07 19 00-0401	EA 6" Polyvinyl Chloride (PVC) Elbow Insulation Jacketing	16.83	3.06
22 07 19 00-0402	EA 6-1/2" Polyvinyl Chloride (PVC) Elbow Insulation Jacketing	17.15	3.18
22 07 19 00-0403	EA 7" Polyvinyl Chloride (PVC) Elbow Insulation Jacketing	19.00	3.24
22 07 19 00-0404	EA 7-1/2" Polyvinyl Chloride (PVC) Elbow Insulation Jacketing	19.55	3.33
22 07 19 00-0405	EA 8" Polyvinyl Chloride (PVC) Elbow Insulation Jacketing	20.83	3.40
22 07 19 00-0406	EA 8-1/2" Polyvinyl Chloride (PVC) Elbow Insulation Jacketing	21.97	3.45
22 07 19 00-0407	EA 9" Polyvinyl Chloride (PVC) Elbow Insulation Jacketing	25.24	3.59
22 07 19 00-0408	EA 10" Polyvinyl Chloride (PVC) Elbow Insulation Jacketing	27.06	3.72
22 07 19 00-0409	EA 11" Polyvinyl Chloride (PVC) Elbow Insulation Jacketing	29.41	3.88
22 07 19 00-0410	EA 12" Polyvinyl Chloride (PVC) Elbow Insulation Jacketing	34.16	4.05
22 07 19 00-0411	EA 1-1/2" Polyvinyl Chloride (PVC) Tee Or Wye Insulation Jacketing.....	12.51	2.88
22 07 19 00-0412	EA 2" Polyvinyl Chloride (PVC) Tee Or Wye Insulation Jacketing.....	12.99	2.96
22 07 19 00-0413	EA 2-1/2" Polyvinyl Chloride (PVC) Tee Or Wye Insulation Jacketing.....	13.91	3.13
22 07 19 00-0414	EA 3" Polyvinyl Chloride (PVC) Tee Or Wye Insulation Jacketing.....	15.06	3.36
22 07 19 00-0415	EA 3-1/2" Polyvinyl Chloride (PVC) Tee Or Wye Insulation Jacketing.....	16.90	3.64
22 07 19 00-0416	EA 4" Polyvinyl Chloride (PVC) Tee Or Wye Insulation Jacketing.....	17.57	3.77
22 07 19 00-0417	EA 4-1/2" Polyvinyl Chloride (PVC) Tee Or Wye Insulation Jacketing.....	18.88	3.95
22 07 19 00-0418	EA 5" Polyvinyl Chloride (PVC) Tee Or Wye Insulation Jacketing.....	20.17	4.12
22 07 19 00-0419	EA 5-1/2" Polyvinyl Chloride (PVC) Tee Or Wye Insulation Jacketing.....	22.43	4.37
22 07 19 00-0420	EA 6" Polyvinyl Chloride (PVC) Tee Or Wye Insulation Jacketing.....	24.87	4.60
22 07 19 00-0421	EA 6-1/2" Polyvinyl Chloride (PVC) Tee Or Wye Insulation Jacketing.....	26.66	4.67
22 07 19 00-0422	EA 7" Polyvinyl Chloride (PVC) Tee Or Wye Insulation Jacketing.....	32.34	4.84
22 07 19 00-0423	EA 7-1/2" Polyvinyl Chloride (PVC) Tee Or Wye Insulation Jacketing.....	34.57	5.10
22 07 19 00-0424	EA 8" Polyvinyl Chloride (PVC) Tee Or Wye Insulation Jacketing.....	36.58	5.20
22 07 19 00-0425	EA 8-1/2" Polyvinyl Chloride (PVC) Tee Or Wye Insulation Jacketing.....	38.52	5.31
22 07 19 00-0426	EA 9" Polyvinyl Chloride (PVC) Tee Or Wye Insulation Jacketing.....	40.60	5.44
22 07 19 00-0427	EA 10" Polyvinyl Chloride (PVC) Tee Or Wye Insulation Jacketing.....	43.57	5.74
22 07 19 00-0428	EA 11" Polyvinyl Chloride (PVC) Tee Or Wye Insulation Jacketing.....	46.32	5.86
22 07 19 00-0429	EA 12" Polyvinyl Chloride (PVC) Tee Or Wye Insulation Jacketing.....	49.13	6.00

22 07 19 00-0430 **Insulation Foam Rubber** (22 07 19)

22 07 19 00-0431 **Covering 4x6 Sheet** (22 07 19 00-0430)

22 07 19 00-0432	SF 1" Thick Foam Rubber Sheet Insulation.....	13.30	4.90
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22 10 **Plumbing Piping** (22)

Note: The demolition price for only the length of pipe (LF) shall be used for lengths (LF) of pipe removal which do include the fittings, valves, and insulation. The demolition price for individual fittings, valves, and insulation shall not be used in conjunction with pipe (LF) demolition tasks.

22 11 **Facility Water Distribution** (22 10)

22 11 16 **Domestic Water Piping** (22 11)

Note: The demolition price for only the length of pipe (LF) shall be used for lengths (LF) of pipe removal which do include the fittings, valves, and insulation. The demolition price for individual fittings, valves, and insulation shall not be used in conjunction with pipe (LF) demolition tasks. See CSI section 23 21 13 00-0000 for black steel piping and fitting.

22 11 16 00-0001 **Galvanized Steel Pipe Assemblies** (22 11 16)

Note: (ASTM A-53) Threaded and coupled. Includes all hangers and all galvanized malleable iron fittings (couplings, elbows, tees and reducer fittings). All hangers are complete assemblies. Not for use where detail is available.

22 11 16 00-0002	LF 1/2" Schedule 40 Threaded Galvanized Steel Pipe With 150 LB Malleable Iron Fitting Assembly	11.96	2.94
	Note: Includes all hangers and all galvanized malleable iron fittings (couplings, elbows, tees and reducer fittings). All hangers are complete assemblies. Not for use where detail is available.		
	For Work In Restricted Working Space, Add	2.93	
	For ASTM 120, Deduct	-0.33	
	For Schedule 80 Pipe With 300 LB Malleable Iron Fittings, Add	2.94	
22 11 16 00-0003	LF 3/4" Schedule 40 Threaded Galvanized Steel Pipe With 150 LB Malleable Iron Fitting Assembly	12.92	3.16
	Note: Includes all hangers and all galvanized malleable iron fittings (couplings, elbows, tees and reducer fittings). All hangers are complete assemblies. Not for use where detail is available.		
	For Work In Restricted Working Space, Add	3.10	
	For ASTM 120, Deduct	-0.39	
	For Schedule 80 Pipe With 300 LB Malleable Iron Fittings, Add	3.23	
22 11 16 00-0004	LF 1" Schedule 40 Threaded Galvanized Steel Pipe With 150 LB Malleable Iron Fitting Assembly	14.25	3.46
	Note: Includes all hangers and all galvanized malleable iron fittings (couplings, elbows, tees and reducer fittings). All hangers are complete assemblies. Not for use where detail is available.		
	For Work In Restricted Working Space, Add	3.31	
	For ASTM 120, Deduct	-0.48	
	For Schedule 80 Pipe With 300 LB Malleable Iron Fittings, Add	3.66	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 16 00-0005	LF			1-1/4" Schedule 40 Threaded Galvanized Steel Pipe With 150 LB Malleable Iron Fitting Assembly..... 16.35 Note: Includes all hangers and all galvanized malleable iron fittings (couplings, elbows, tees and reducer fittings). All hangers are complete assemblies. Not for use where detail is available.		3.61
				<i>For Work In Restricted Working Space, Add</i>	3.52	
				<i>For ASTM 120, Deduct</i>	-0.69	
				<i>For Schedule 80 Pipe With 300 LB Malleable Iron Fittings, Add</i>	4.43	
22 11 16 00-0006	LF			1-1/2" Schedule 40 Threaded Galvanized Steel Pipe With 150 LB Malleable Iron Fitting Assembly..... 17.30 Note: Includes all hangers and all galvanized malleable iron fittings (couplings, elbows, tees and reducer fittings). All hangers are complete assemblies. Not for use where detail is available.		4.26
				<i>For Work In Restricted Working Space, Add</i>	3.66	
				<i>For ASTM 120, Deduct</i>	-0.76	
				<i>For Schedule 80 Pipe With 300 LB Malleable Iron Fittings, Add</i>	4.73	
22 11 16 00-0007	LF			2" Schedule 40 Threaded Galvanized Steel Pipe With 150 LB Malleable Iron Fitting Assembly..... 20.38 Note: Includes all hangers and all galvanized malleable iron fittings (couplings, elbows, tees and reducer fittings). All hangers are complete assemblies. Not for use where detail is available.		5.15
				<i>For Work In Restricted Working Space, Add</i>	4.17	
				<i>For ASTM 120, Deduct</i>	-0.97	
				<i>For Schedule 80 Pipe With 300 LB Malleable Iron Fittings, Add</i>	5.70	
22 11 16 00-0008	LF			2-1/2" Schedule 40 Threaded Galvanized Steel Pipe With 150 LB Malleable Iron Fitting Assembly..... 27.52 Note: Includes all hangers and all galvanized malleable iron fittings (couplings, elbows, tees and reducer fittings). All hangers are complete assemblies. Not for use where detail is available.		6.10
				<i>For Work In Restricted Working Space, Add</i>	4.89	
				<i>For ASTM 120, Deduct</i>	-1.68	
				<i>For Schedule 80 Pipe With 300 LB Malleable Iron Fittings, Add</i>	8.31	
22 11 16 00-0009	LF			3" Schedule 40 Threaded Galvanized Steel Pipe With 150 LB Malleable Iron Fitting Assembly..... 33.94 Note: Includes all hangers and all galvanized malleable iron fittings (couplings, elbows, tees and reducer fittings). All hangers are complete assemblies. Not for use where detail is available.		8.16
				<i>For Work In Restricted Working Space, Add</i>	5.92	
				<i>For ASTM 120, Deduct</i>	-2.13	
				<i>For Schedule 80 Pipe With 300 LB Malleable Iron Fittings, Add</i>	10.34	
22 11 16 00-0010	LF			4" Schedule 40 Threaded Galvanized Steel Pipe With 150 LB Malleable Iron Fitting Assembly..... 47.94 Note: Includes all hangers and all galvanized malleable iron fittings (couplings, elbows, tees and reducer fittings). All hangers are complete assemblies. Not for use where detail is available.		9.78
				<i>For Work In Restricted Working Space, Add</i>	6.85	
				<i>For ASTM 120, Deduct</i>	-3.77	
				<i>For Schedule 80 Pipe With 300 LB Malleable Iron Fittings, Add</i>	15.87	
22 11 16 00-0011	LF			5" Schedule 40 Threaded Galvanized Steel Pipe With 150 LB Malleable Iron Fitting Assembly..... 77.17 Note: Includes all hangers and all galvanized malleable iron fittings (couplings, elbows, tees and reducer fittings). All hangers are complete assemblies. Not for use where detail is available.		12.49
				<i>For Work In Restricted Working Space, Add</i>	8.27	
				<i>For ASTM 120, Deduct</i>	-7.44	
				<i>For Schedule 80 Pipe With 300 LB Malleable Iron Fittings, Add</i>	27.83	
22 11 16 00-0012	LF			6" Schedule 40 Threaded Galvanized Steel Pipe With 150 LB Malleable Iron Fitting Assembly..... 44.71 Note: Includes all hangers and all galvanized malleable iron fittings (couplings, elbows, tees and reducer fittings). All hangers are complete assemblies. Not for use where detail is available.		14.77
				<i>For Work In Restricted Working Space, Add</i>	9.40	
				<i>For ASTM 120, Deduct</i>	-2.01	
				<i>For Schedule 80 Pipe With 300 LB Malleable Iron Fittings, Add</i>	12.28	
22 11 16 00-0013				Galvanized Steel Pipe And Threaded Fittings (22 11 16) Note: (ASTM A-53) Threaded and coupled, schedule 40. Excludes hangers, elbow, tee, or reducer fittings.		
22 11 16 00-0014				Threaded And Coupled, Galvanized Steel Piping (22 11 16 00-0013) Note: ASTM A-53. Includes coupling.		
22 11 16 00-0015	LF			1/2" Schedule 40, Threaded And Coupled, Galvanized Steel Pipe 5.41 <i>For Work In Restricted Working Space, Add</i> <i>For Schedule 80 Pipe, Add</i> <i>For ASTM 120, Deduct</i>	1.34 0.91 -0.14	2.94
22 11 16 00-0016	LF			3/4" Schedule 40, Threaded And Coupled, Galvanized Steel Pipe 6.01 <i>For Work In Restricted Working Space, Add</i> <i>For Schedule 80 Pipe, Add</i> <i>For ASTM 120, Deduct</i>	1.42 1.08 -0.19	3.16
22 11 16 00-0017	LF			1" Schedule 40, Threaded And Coupled, Galvanized Steel Pipe 7.03 <i>For Work In Restricted Working Space, Add</i> <i>For Schedule 80 Pipe, Add</i> <i>For ASTM 120, Deduct</i>	1.54 1.42 -0.28	3.46
22 11 16 00-0018	LF			1-1/4" Schedule 40, Threaded And Coupled, Galvanized Steel Pipe 8.00 <i>For Work In Restricted Working Space, Add</i> <i>For Schedule 80 Pipe, Add</i> <i>For ASTM 120, Deduct</i>	1.63 1.77 -0.38	3.61
22 11 16 00-0019	LF			1-1/2" Schedule 40, Threaded And Coupled, Galvanized Steel Pipe 9.45 <i>For Work In Restricted Working Space, Add</i> <i>For Schedule 80 Pipe, Add</i> <i>For ASTM 120, Deduct</i>	1.92 2.11 -0.46	4.26
22 11 16 00-0020	LF			2" Schedule 40, Threaded And Coupled, Galvanized Steel Pipe 11.85 <i>For Work In Restricted Working Space, Add</i> <i>For Schedule 80 Pipe, Add</i> <i>For ASTM 120, Deduct</i>	2.32 2.75 -0.62	5.15
22 11 16 00-0021	LF			2-1/2" Schedule 40, Threaded And Coupled, Galvanized Steel Pipe 15.71 <i>For Work In Restricted Working Space, Add</i> <i>For Schedule 80 Pipe, Add</i> <i>For ASTM 120, Deduct</i>	2.76 4.05 -0.98	6.10
22 11 16 00-0022	LF			3" Schedule 40, Threaded And Coupled, Galvanized Steel Pipe 20.78 <i>For Work In Restricted Working Space, Add</i> <i>For Schedule 80 Pipe, Add</i> <i>For ASTM 120, Deduct</i>	3.68 5.32 -1.28	8.16

22	Plumbing
22 10	Plumbing Piping
22 11	Facility Water Distribution



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 16 00-0023	LF		4" Schedule 40, Threaded And Coupled, Galvanized Steel Pipe.....	26.85	9.78
			<i>For Work In Restricted Working Space, Add</i>	4.41	
			<i>For Schedule 80 Pipe, Add</i>	7.30	
			<i>For ASTM 120, Deduct</i>	-1.82	
22 11 16 00-0024	LF		5" Schedule 40, Threaded And Coupled, Galvanized Steel Pipe.....	35.00	12.49
			<i>For Work In Restricted Working Space, Add</i>	5.61	
			<i>For Schedule 80 Pipe, Add</i>	9.69	
			<i>For ASTM 120, Deduct</i>	-2.44	
22 11 16 00-0025	LF		6" Schedule 40, Threaded And Coupled, Galvanized Steel Pipe.....	43.27	14.77
			<i>For Work In Restricted Working Space, Add</i>	6.64	
			<i>For Schedule 80 Pipe, Add</i>	12.36	
			<i>For ASTM 120, Deduct</i>	-3.17	
22 11 16 00-0026			Galvanized Malleable Iron 90 Degree Elbows (22 11 16 00-0013)		
22 11 16 00-0027	EA		1/2", 150 LB, Galvanized Malleable Iron 90 Degree Elbow.....	21.22	13.09
			<i>For 300 LB Rating, Add</i>	6.68	
			<i>For Work In Restricted Working Space, Add</i>	5.88	
			<i>For ASTM 120, Deduct</i>	-0.24	
22 11 16 00-0028	EA		3/4", 150 LB, Galvanized Malleable Iron 90 Degree Elbow.....	23.92	14.63
			<i>For 300 LB Rating, Add</i>	8.05	
			<i>For Work In Restricted Working Space, Add</i>	6.58	
			<i>For ASTM 120, Deduct</i>	-0.30	
22 11 16 00-0029	EA		1", 150 LB, Galvanized Malleable Iron 90 Degree Elbow.....	28.18	16.32
			<i>For 300 LB Rating, Add</i>	13.98	
			<i>For Work In Restricted Working Space, Add</i>	7.35	
			<i>For ASTM 120, Deduct</i>	-0.55	
22 11 16 00-0030	EA		1-1/4", 150 LB, Galvanized Malleable Iron 90 Degree Elbow	33.54	18.53
			<i>For 300 LB Rating, Add</i>	21.42	
			<i>For Work In Restricted Working Space, Add</i>	8.32	
			<i>For ASTM 120, Deduct</i>	-0.87	
22 11 16 00-0031	EA		1-1/2", 150 LB, Galvanized Malleable Iron 90 Degree Elbow	38.86	20.87
			<i>For 300 LB Rating, Add</i>	27.65	
			<i>For Work In Restricted Working Space, Add</i>	9.38	
			<i>For ASTM 120, Deduct</i>	-1.14	
22 11 16 00-0032	EA		2", 150 LB, Galvanized Malleable Iron 90 Degree Elbow.....	52.15	26.54
			<i>For 300 LB Rating, Add</i>	44.61	
			<i>For Work In Restricted Working Space, Add</i>	11.92	
			<i>For ASTM 120, Deduct</i>	-1.86	
22 11 16 00-0033	EA		2-1/2", 150 LB, Galvanized Malleable Iron 90 Degree Elbow	91.30	39.25
			<i>For 300 LB Rating, Add</i>	114.03	
			<i>For Work In Restricted Working Space, Add</i>	17.64	
			<i>For ASTM 120, Deduct</i>	-4.88	
22 11 16 00-0034	EA		3", 150 LB, Galvanized Malleable Iron 90 Degree Elbow.....	130.95	51.60
			<i>For 300 LB Rating, Add</i>	186.81	
			<i>For Work In Restricted Working Space, Add</i>	23.21	
			<i>For ASTM 120, Deduct</i>	-8.04	
22 11 16 00-0035	EA		4", 150 LB, Galvanized Malleable Iron 90 Degree Elbow.....	180.23	57.17
			<i>For 300 LB Rating, Add</i>	326.44	
			<i>For Work In Restricted Working Space, Add</i>	25.72	
			<i>For ASTM 120, Deduct</i>	-14.18	
22 11 16 00-0036	EA		5", 150 LB, Galvanized Malleable Iron 90 Degree Elbow.....	497.58	59.67
			<i>For 300 LB Rating, Add</i>	1,392.98	
			<i>For Work In Restricted Working Space, Add</i>	26.84	
			<i>For ASTM 120, Deduct</i>	-61.22	
22 11 16 00-0037	EA		6", 150 LB, Galvanized Malleable Iron 90 Degree Elbow.....	469.76	62.38
			<i>For 300 LB Rating, Add</i>	1,284.83	
			<i>For Work In Restricted Working Space, Add</i>	28.06	
			<i>For ASTM 120, Deduct</i>	-56.44	
22 11 16 00-0038			Galvanized Malleable Iron Reducing 90 Degree Elbows (22 11 16 00-0013)		
22 11 16 00-0039	EA		3/4" x 1/2", 150 LB, Galvanized Malleable Iron Reducing 90 Degree Elbow	24.22	13.82
			<i>For ASTM 120, Deduct</i>	-0.52	
			<i>For Work In Restricted Working Space, Add</i>	6.23	
22 11 16 00-0040	EA		1" x 3/4", 150 LB, Galvanized Malleable Iron Reducing 90 Degree Elbow	27.65	15.50
			<i>For ASTM 120, Deduct</i>	-0.66	
			<i>For Work In Restricted Working Space, Add</i>	6.97	
22 11 16 00-0041	EA		1" x 1/2", 150 LB, Galvanized Malleable Iron Reducing 90 Degree Elbow	26.75	14.70
			<i>For ASTM 120, Deduct</i>	-0.71	
			<i>For Work In Restricted Working Space, Add</i>	6.62	
22 11 16 00-0042	EA		1-1/4" x 1", 150 LB, Galvanized Malleable Iron Reducing 90 Degree Elbow	33.54	17.42
			<i>For ASTM 120, Deduct</i>	-1.11	
			<i>For Work In Restricted Working Space, Add</i>	7.83	
22 11 16 00-0043	EA		1-1/4" x 3/4", 150 LB, Galvanized Malleable Iron Reducing 90 Degree Elbow	33.75	16.54
			<i>For ASTM 120, Deduct</i>	-1.34	
			<i>For Work In Restricted Working Space, Add</i>	7.45	
22 11 16 00-0044	EA		1-1/4" x 1/2", 150 LB, Galvanized Malleable Iron Reducing 90 Degree Elbow	33.11	15.81
			<i>For ASTM 120, Deduct</i>	-1.42	
			<i>For Work In Restricted Working Space, Add</i>	7.10	
22 11 16 00-0045	EA		1-1/2" x 1-1/4", 150 LB, Galvanized Malleable Iron Reducing 90 Degree Elbow	41.38	19.69
			<i>For ASTM 120, Deduct</i>	-1.78	
			<i>For Work In Restricted Working Space, Add</i>	8.85	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 16 00-0046 EA 1-1/2" x 1", 150 LB, Galvanized Malleable Iron Reducing 90 Degree Elbow <i>For ASTM 120, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	39.75 -1.78 8.36	18.60
22 11 16 00-0047 EA 1-1/2" x 3/4", 150 LB, Galvanized Malleable Iron Reducing 90 Degree Elbow <i>For ASTM 120, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	38.48 -1.78 7.98	17.71
22 11 16 00-0048 EA 2" x 1-1/2", 150 LB, Galvanized Malleable Iron Reducing 90 Degree Elbow <i>For ASTM 120, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	49.37 -2.08 10.65	23.66
22 11 16 00-0049 EA 2" x 1-1/4", 150 LB, Galvanized Malleable Iron Reducing 90 Degree Elbow <i>For ASTM 120, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	49.63 -2.39 10.12	22.50
22 11 16 00-0050 EA 2" x 1", 150 LB, Galvanized Malleable Iron Reducing 90 Degree Elbow <i>For ASTM 120, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	48.62 -2.48 9.64	21.39
22 11 16 00-0051 EA 2" x 3/4", 150 LB, Galvanized Malleable Iron Reducing 90 Degree Elbow <i>For ASTM 120, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	43.35 -1.88 9.25	20.58
22 11 16 00-0052 EA 2-1/2" x 2", 150 LB, Galvanized Malleable Iron Reducing 90 Degree Elbow <i>For ASTM 120, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	96.28 -7.05 14.78	32.85
22 11 16 00-0053 EA 2-1/2" x 1-1/2", 150 LB, Galvanized Malleable Iron Reducing 90 Degree Elbow <i>For ASTM 120, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	97.41 -7.86 13.51	30.06
22 11 16 00-0054 EA 3" x 2-1/2", 150 LB, Galvanized Malleable Iron Reducing 90 Degree Elbow <i>For ASTM 120, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	153.52 -12.82 20.42	45.42
22 11 16 00-0055 EA 3" x 2", 150 LB, Galvanized Malleable Iron Reducing 90 Degree Elbow <i>For ASTM 120, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	132.75 -11.13 17.57	39.03
22 11 16 00-0056 EA 4" x 3", 150 LB, Galvanized Malleable Iron Reducing 90 Degree Elbow <i>For ASTM 120, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	274.88 -29.00 24.47	54.38
22 11 16 00-0057 Galvanized Malleable Iron 45 Degree Elbow <small>(22 11 16 00-0013)</small>		
22 11 16 00-0058 EA 1/2", 150 LB, Galvanized Malleable Iron 45 Degree Elbow <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For ASTM 120, Deduct</i>	22.16 9.88 5.88 -0.38	13.09
22 11 16 00-0059 EA 3/4", 150 LB, Galvanized Malleable Iron 45 Degree Elbow <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For ASTM 120, Deduct</i>	25.62 13.83 6.58 -0.55	14.63
22 11 16 00-0060 EA 1", 150 LB, Galvanized Malleable Iron 45 Degree Elbow <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For ASTM 120, Deduct</i>	28.65 15.58 7.35 -0.62	16.32
22 11 16 00-0061 EA 1-1/4", 150 LB, Galvanized Malleable Iron 45 Degree Elbow <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For ASTM 120, Deduct</i>	35.48 28.01 8.32 -1.16	18.53
22 11 16 00-0062 EA 1-1/2", 150 LB, Galvanized Malleable Iron 45 Degree Elbow <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For ASTM 120, Deduct</i>	40.39 32.85 9.38 -1.37	20.87
22 11 16 00-0063 EA 2", 150 LB, Galvanized Malleable Iron 45 Degree Elbow <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For ASTM 120, Deduct</i>	53.21 48.22 11.92 -2.02	26.54
22 11 16 00-0064 EA 2-1/2", 150 LB, Galvanized Malleable Iron 45 Degree Elbow <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For ASTM 120, Deduct</i>	105.69 162.95 17.64 -7.03	39.25
22 11 16 00-0065 EA 3", 150 LB, Galvanized Malleable Iron 45 Degree Elbow <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For ASTM 120, Deduct</i>	145.57 236.52 23.21 -10.23	51.60
22 11 16 00-0066 EA 4", 150 LB, Galvanized Malleable Iron 45 Degree Elbow <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For ASTM 120, Deduct</i>	200.06 393.87 25.72 -17.15	57.17
22 11 16 00-0067 EA 5", 150 LB, Galvanized Malleable Iron 45 Degree Elbow <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For ASTM 120, Deduct</i>	551.45 1,576.13 26.84 -69.30	59.67
22 11 16 00-0068 EA 6", 150 LB, Galvanized Malleable Iron 45 Degree Elbow <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For ASTM 120, Deduct</i>	650.58 1,899.62 28.06 -83.56	62.38
22 11 16 00-0069 Galvanized Malleable Iron Tees <small>(22 11 16 00-0013)</small>		

22	Plumbing
22 10	Plumbing Piping
22 11	Facility Water Distribution



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 16 00-0070	EA	1/2"	150 LB, Galvanized Malleable Iron Tee.....	26.59	16.32
			<i>For 300 LB Rating, Add</i>	8.58	
			<i>For Work In Restricted Working Space, Add</i>	7.35	
			<i>For ASTM 120, Deduct</i>	-0.31	
22 11 16 00-0071	EA	3/4"	150 LB, Galvanized Malleable Iron Tee.....	31.72	18.89
			<i>For 300 LB Rating, Add</i>	13.43	
			<i>For Work In Restricted Working Space, Add</i>	8.48	
			<i>For ASTM 120, Deduct</i>	-0.52	
22 11 16 00-0072	EA	1"	150 LB, Galvanized Malleable Iron Tee.....	38.99	22.27
			<i>For 300 LB Rating, Add</i>	20.98	
			<i>For Work In Restricted Working Space, Add</i>	10.02	
			<i>For ASTM 120, Deduct</i>	-0.84	
22 11 16 00-0073	EA	1-1/4"	150 LB, Galvanized Malleable Iron Tee.....	48.59	26.54
			<i>For 300 LB Rating, Add</i>	32.51	
			<i>For Work In Restricted Working Space, Add</i>	11.92	
			<i>For ASTM 120, Deduct</i>	-1.33	
22 11 16 00-0074	EA	1-1/2"	150 LB, Galvanized Malleable Iron Tee.....	58.43	31.60
			<i>For 300 LB Rating, Add</i>	40.28	
			<i>For Work In Restricted Working Space, Add</i>	14.23	
			<i>For ASTM 120, Deduct</i>	-1.65	
22 11 16 00-0075	EA	2"	150 LB, Galvanized Malleable Iron Tee.....	76.69	39.25
			<i>For 300 LB Rating, Add</i>	64.35	
			<i>For Work In Restricted Working Space, Add</i>	17.64	
			<i>For ASTM 120, Deduct</i>	-2.68	
22 11 16 00-0076	EA	2-1/2"	150 LB, Galvanized Malleable Iron Tee.....	114.28	42.63
			<i>For 300 LB Rating, Add</i>	175.09	
			<i>For Work In Restricted Working Space, Add</i>	19.17	
			<i>For ASTM 120, Deduct</i>	-7.56	
22 11 16 00-0077	EA	3"	150 LB, Galvanized Malleable Iron Tee.....	136.44	51.60
			<i>For 300 LB Rating, Add</i>	205.48	
			<i>For Work In Restricted Working Space, Add</i>	23.21	
			<i>For ASTM 120, Deduct</i>	-8.86	
22 11 16 00-0078	EA	4"	150 LB, Galvanized Malleable Iron Tee.....	248.03	72.23
			<i>For 300 LB Rating, Add</i>	481.61	
			<i>For Work In Restricted Working Space, Add</i>	32.49	
			<i>For ASTM 120, Deduct</i>	-20.96	
22 11 16 00-0079	EA	5"	150 LB, Galvanized Malleable Iron Tee.....	567.87	85.76
			<i>For 300 LB Rating, Add</i>	1,501.23	
			<i>For Work In Restricted Working Space, Add</i>	38.58	
			<i>For ASTM 120, Deduct</i>	-65.89	
22 11 16 00-0080	EA	6"	150 LB, Galvanized Malleable Iron Tee.....	645.19	98.03
			<i>For 300 LB Rating, Add</i>	1,702.80	
			<i>For Work In Restricted Working Space, Add</i>	44.09	
			<i>For ASTM 120, Deduct</i>	-74.73	
22 11 16 00-0081			Galvanized Malleable Iron Reducing Tee (22 11 16 00-0013)		
22 11 16 00-0082	EA	1/2"	150 LB, Galvanized Malleable Iron Reducing Tee.....	29.36	16.32
			<i>For 300 LB Rating, Add</i>	17.99	
			<i>For Work In Restricted Working Space, Add</i>	7.35	
			<i>For ASTM 120, Deduct</i>	-0.73	
22 11 16 00-0083	EA	3/4"	150 LB, Galvanized Malleable Iron Reducing Tee.....	33.07	18.89
			<i>For 300 LB Rating, Add</i>	18.02	
			<i>For Work In Restricted Working Space, Add</i>	8.48	
			<i>For ASTM 120, Deduct</i>	-0.72	
22 11 16 00-0084	EA	1"	150 LB, Galvanized Malleable Iron Reducing Tee.....	40.15	22.27
			<i>For 300 LB Rating, Add</i>	24.92	
			<i>For Work In Restricted Working Space, Add</i>	10.02	
			<i>For ASTM 120, Deduct</i>	-1.01	
22 11 16 00-0085	EA	1-1/4"	150 LB, Galvanized Malleable Iron Reducing Tee.....	50.18	26.54
			<i>For 300 LB Rating, Add</i>	37.91	
			<i>For Work In Restricted Working Space, Add</i>	11.92	
			<i>For ASTM 120, Deduct</i>	-1.57	
22 11 16 00-0086	EA	1-1/2"	150 LB, Galvanized Malleable Iron Reducing Tee.....	60.33	31.60
			<i>For 300 LB Rating, Add</i>	46.74	
			<i>For Work In Restricted Working Space, Add</i>	14.23	
			<i>For ASTM 120, Deduct</i>	-1.94	
22 11 16 00-0087	EA	2"	150 LB, Galvanized Malleable Iron Reducing Tee.....	77.65	39.25
			<i>For 300 LB Rating, Add</i>	67.62	
			<i>For Work In Restricted Working Space, Add</i>	17.64	
			<i>For ASTM 120, Deduct</i>	-2.83	
22 11 16 00-0088	EA	2-1/2"	150 LB, Galvanized Malleable Iron Reducing Tee.....	130.69	42.77
			<i>For 300 LB Rating, Add</i>	230.22	
			<i>For Work In Restricted Working Space, Add</i>	19.23	
			<i>For ASTM 120, Deduct</i>	-9.99	
22 11 16 00-0089	EA	3"	150 LB, Galvanized Malleable Iron Reducing Tee.....	164.95	52.41
			<i>For 300 LB Rating, Add</i>	298.31	
			<i>For Work In Restricted Working Space, Add</i>	23.58	
			<i>For ASTM 120, Deduct</i>	-12.95	
22 11 16 00-0090	EA	4"	150 LB, Galvanized Malleable Iron Reducing Tee.....	358.59	72.23
			<i>For 300 LB Rating, Add</i>	857.52	
			<i>For Work In Restricted Working Space, Add</i>	32.49	
			<i>For ASTM 120, Deduct</i>	-37.55	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 16 00-0091 EA 5", 150 LB, Galvanized Malleable Iron Reducing Tee..... <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For ASTM 120, Deduct</i>	709.18 1,981.69 38.58 -87.09	85.76
22 11 16 00-0092 EA 6", 150 LB, Galvanized Malleable Iron Reducing Tee..... <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For ASTM 120, Deduct</i>	805.47 2,247.75 44.09 -98.78	98.03
22 11 16 00-0093 Galvanized Malleable Iron Couplings (22 11 16 00-0013)		
22 11 16 00-0094 EA 1/2", 150 LB, Galvanized Malleable Iron Coupling..... <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For ASTM 120, Deduct</i>	21.97 9.23 5.88 -0.36	13.09
22 11 16 00-0095 EA 3/4", 150 LB, Galvanized Malleable Iron Coupling..... <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For ASTM 120, Deduct</i>	24.67 10.60 6.58 -0.41	14.63
22 11 16 00-0096 EA 1", 150 LB, Galvanized Malleable Iron Coupling..... <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For ASTM 120, Deduct</i>	28.97 16.67 7.35 -0.67	16.32
22 11 16 00-0097 EA 1-1/4", 150 LB, Galvanized Malleable Iron Coupling..... <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For ASTM 120, Deduct</i>	34.03 23.08 8.32 -0.95	18.53
22 11 16 00-0098 EA 1-1/2", 150 LB, Galvanized Malleable Iron Coupling..... <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For ASTM 120, Deduct</i>	38.44 26.22 9.38 -1.07	20.87
22 11 16 00-0099 EA 2", 150 LB, Galvanized Malleable Iron Coupling..... <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For ASTM 120, Deduct</i>	50.21 38.02 11.92 -1.57	26.54
22 11 16 00-0100 EA 2-1/2", 150 LB, Galvanized Malleable Iron Coupling..... <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For ASTM 120, Deduct</i>	90.87 112.57 17.64 -4.81	39.25
22 11 16 00-0101 EA 3", 150 LB, Galvanized Malleable Iron Coupling..... <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For ASTM 120, Deduct</i>	120.23 150.37 23.21 -6.43	51.60
22 11 16 00-0102 EA 4", 150 LB, Galvanized Malleable Iron Coupling..... <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For ASTM 120, Deduct</i>	176.75 314.61 25.72 -13.65	57.17
22 11 16 00-0103 EA 5", 150 LB, Galvanized Malleable Iron Coupling..... <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For ASTM 120, Deduct</i>	345.76 876.79 26.84 -38.45	59.67
22 11 16 00-0104 EA 6", 150 LB, Galvanized Malleable Iron Coupling..... <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For ASTM 120, Deduct</i>	385.51 998.38 28.06 -43.80	62.38
22 11 16 00-0105 Galvanized Malleable Iron Reducing Couplings (22 11 16 00-0013)		
22 11 16 00-0106 EA 1/2", 150 LB, Galvanized Malleable Iron Reducing Coupling..... <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For ASTM 120, Deduct</i>	22.47 10.93 5.88 -0.43	13.09
22 11 16 00-0107 EA 3/4", 150 LB, Galvanized Malleable Iron Reducing Coupling..... <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For ASTM 120, Deduct</i>	25.01 11.75 6.58 -0.46	14.63
22 11 16 00-0108 EA 1", 150 LB, Galvanized Malleable Iron Reducing Coupling..... <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For ASTM 120, Deduct</i>	29.62 18.88 7.35 -0.77	16.32
22 11 16 00-0109 EA 1-1/4", 150 LB, Galvanized Malleable Iron Reducing Coupling..... <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For ASTM 120, Deduct</i>	34.35 24.17 8.32 -0.99	18.53
22 11 16 00-0110 EA 1-1/2", 150 LB, Galvanized Malleable Iron Reducing Coupling..... <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For ASTM 120, Deduct</i>	39.81 30.88 9.38 -1.28	20.87
22 11 16 00-0111 EA 2", 150 LB, Galvanized Malleable Iron Reducing Coupling..... <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For ASTM 120, Deduct</i>	51.37 41.96 11.92 -1.75	26.54

22	Plumbing
22 10	Plumbing Piping
22 11	Facility Water Distribution



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 16 00-0112	EA		2-1/2", 150 LB, Galvanized Malleable Iron Reducing Coupling.....	91.27	39.25
			<i>For 300 LB Rating, Add</i>	113.93	
			<i>For Work In Restricted Working Space, Add</i>	17.64	
			<i>For ASTM 120, Deduct</i>	-4.87	
22 11 16 00-0113	EA		3", 150 LB, Galvanized Malleable Iron Reducing Coupling.....	119.01	51.60
			<i>For 300 LB Rating, Add</i>	146.22	
			<i>For Work In Restricted Working Space, Add</i>	23.21	
			<i>For ASTM 120, Deduct</i>	-6.25	
22 11 16 00-0114	EA		4", 150 LB, Galvanized Malleable Iron Reducing Coupling.....	179.10	57.17
			<i>For 300 LB Rating, Add</i>	322.60	
			<i>For Work In Restricted Working Space, Add</i>	25.72	
			<i>For ASTM 120, Deduct</i>	-14.01	
22 11 16 00-0115	EA		5", 150 LB, Galvanized Malleable Iron Reducing Coupling.....	359.25	59.67
			<i>For 300 LB Rating, Add</i>	922.65	
			<i>For Work In Restricted Working Space, Add</i>	26.84	
			<i>For ASTM 120, Deduct</i>	-40.47	
22 11 16 00-0116	EA		6", 150 LB, Galvanized Malleable Iron Reducing Coupling.....	400.88	62.38
			<i>For 300 LB Rating, Add</i>	1,050.64	
			<i>For Work In Restricted Working Space, Add</i>	28.06	
			<i>For ASTM 120, Deduct</i>	-46.10	
22 11 16 00-0117			Galvanized Malleable Iron Caps (22 11 16 00-0013)		
22 11 16 00-0118	EA		1/2", 150 LB, Galvanized Malleable Iron Cap.....	10.98	6.10
			<i>For 300 LB Rating, Add</i>	6.64	
			<i>For Work In Restricted Working Space, Add</i>	2.76	
			<i>For ASTM 120, Deduct</i>	-0.27	
22 11 16 00-0119	EA		3/4", 150 LB, Galvanized Malleable Iron Cap.....	12.28	6.54
			<i>For 300 LB Rating, Add</i>	9.02	
			<i>For Work In Restricted Working Space, Add</i>	2.94	
			<i>For ASTM 120, Deduct</i>	-0.37	
22 11 16 00-0120	EA		1", 150 LB, Galvanized Malleable Iron Cap.....	14.37	7.58
			<i>For 300 LB Rating, Add</i>	11.12	
			<i>For Work In Restricted Working Space, Add</i>	3.39	
			<i>For ASTM 120, Deduct</i>	-0.46	
22 11 16 00-0121	EA		1-1/4", 150 LB, Galvanized Malleable Iron Cap.....	15.91	7.94
			<i>For 300 LB Rating, Add</i>	14.48	
			<i>For Work In Restricted Working Space, Add</i>	3.56	
			<i>For ASTM 120, Deduct</i>	-0.61	
22 11 16 00-0122	EA		1-1/2", 150 LB, Galvanized Malleable Iron Cap.....	17.04	7.94
			<i>For 300 LB Rating, Add</i>	18.32	
			<i>For Work In Restricted Working Space, Add</i>	3.56	
			<i>For ASTM 120, Deduct</i>	-0.78	
22 11 16 00-0123	EA		2", 150 LB, Galvanized Malleable Iron Cap.....	23.07	10.51
			<i>For 300 LB Rating, Add</i>	25.63	
			<i>For Work In Restricted Working Space, Add</i>	4.74	
			<i>For ASTM 120, Deduct</i>	-1.09	
22 11 16 00-0124	EA		2-1/2", 150 LB, Galvanized Malleable Iron Cap.....	40.68	13.09
			<i>For 300 LB Rating, Add</i>	72.85	
			<i>For Work In Restricted Working Space, Add</i>	5.88	
			<i>For ASTM 120, Deduct</i>	-3.16	
22 11 16 00-0125	EA		3", 150 LB, Galvanized Malleable Iron Cap.....	49.26	15.81
			<i>For 300 LB Rating, Add</i>	88.29	
			<i>For Work In Restricted Working Space, Add</i>	7.11	
			<i>For ASTM 120, Deduct</i>	-3.83	
22 11 16 00-0126	EA		4", 150 LB, Galvanized Malleable Iron Cap.....	85.84	19.62
			<i>For 300 LB Rating, Add</i>	193.69	
			<i>For Work In Restricted Working Space, Add</i>	8.82	
			<i>For ASTM 120, Deduct</i>	-8.47	
22 11 16 00-0127	EA		5", 150 LB, Galvanized Malleable Iron Cap.....	188.20	24.54
			<i>For 300 LB Rating, Add</i>	517.17	
			<i>For Work In Restricted Working Space, Add</i>	11.02	
			<i>For ASTM 120, Deduct</i>	-22.72	
22 11 16 00-0128	EA		6", 150 LB, Galvanized Malleable Iron Cap.....	235.20	29.17
			<i>For 300 LB Rating, Add</i>	653.45	
			<i>For Work In Restricted Working Space, Add</i>	13.13	
			<i>For ASTM 120, Deduct</i>	-28.71	
22 11 16 00-0129			Galvanized Malleable Iron Unions (22 11 16 00-0013)		
22 11 16 00-0130	EA		1/2", 150 LB, Galvanized Malleable Iron Union.....	31.50	16.32
			<i>For Work In Restricted Working Space, Add</i>	7.35	
22 11 16 00-0131	EA		3/4", 150 LB, Galvanized Malleable Iron Union.....	36.31	18.89
			<i>For Work In Restricted Working Space, Add</i>	8.48	
22 11 16 00-0132	EA		1", 150 LB, Galvanized Malleable Iron Union.....	43.94	22.27
			<i>For Work In Restricted Working Space, Add</i>	10.02	
22 11 16 00-0133	EA		1-1/4", 150 LB, Galvanized Malleable Iron Union.....	54.95	26.54
			<i>For Work In Restricted Working Space, Add</i>	11.92	
22 11 16 00-0134	EA		1-1/2", 150 LB, Galvanized Malleable Iron Union.....	65.87	31.60
			<i>For Work In Restricted Working Space, Add</i>	14.23	
22 11 16 00-0135	EA		2", 150 LB, Galvanized Malleable Iron Union.....	80.00	39.25
			<i>For Work In Restricted Working Space, Add</i>	17.64	
22 11 16 00-0136	EA		2-1/2", 150 LB, Galvanized Malleable Iron Union.....	160.46	57.85
			<i>For Work In Restricted Working Space, Add</i>	26.04	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 16 00-0137 EA 3", 150 LB, Galvanized Malleable Iron Union	217.31	76.07
For Work In Restricted Working Space, Add	34.26	
22 11 16 00-0138 EA 1/2", 250 LB, Galvanized Malleable Iron Union	38.73	16.32
For Work In Restricted Working Space, Add	7.35	
22 11 16 00-0139 EA 3/4", 250 LB, Galvanized Malleable Iron Union	41.20	18.89
For Work In Restricted Working Space, Add	8.48	
22 11 16 00-0140 EA 1", 250 LB, Galvanized Malleable Iron Union	49.44	22.27
For Work In Restricted Working Space, Add	10.02	
22 11 16 00-0141 EA 1-1/4", 250 LB, Galvanized Malleable Iron Union	64.00	26.54
For Work In Restricted Working Space, Add	11.92	
22 11 16 00-0142 EA 1-1/2", 250 LB, Galvanized Malleable Iron Union	75.36	31.60
For Work In Restricted Working Space, Add	14.23	
22 11 16 00-0143 EA 2", 250 LB, Galvanized Malleable Iron Union	98.26	39.25
For Work In Restricted Working Space, Add	17.64	
22 11 16 00-0144 EA 2-1/2", 250 LB, Galvanized Malleable Iron Union	190.63	57.85
For Work In Restricted Working Space, Add	26.04	
22 11 16 00-0145 EA 3", 250 LB, Galvanized Malleable Iron Union	273.49	76.07
For Work In Restricted Working Space, Add	34.26	
22 11 16 00-0146 EA 4", 250 LB, Galvanized Malleable Iron Union	376.41	84.36
For Work In Restricted Working Space, Add	37.97	
22 11 16 00-0147 EA 1/2", 300 LB, Galvanized Malleable Iron Union	40.71	16.32
For Work In Restricted Working Space, Add	7.35	
22 11 16 00-0148 EA 3/4", 300 LB, Galvanized Malleable Iron Union	45.85	18.89
For Work In Restricted Working Space, Add	8.48	
22 11 16 00-0149 EA 1", 300 LB, Galvanized Malleable Iron Union	56.73	22.27
For Work In Restricted Working Space, Add	10.02	
22 11 16 00-0150 EA 1-1/4", 300 LB, Galvanized Malleable Iron Union	72.25	26.54
For Work In Restricted Working Space, Add	11.92	
22 11 16 00-0151 EA 1-1/2", 300 LB, Galvanized Malleable Iron Union	86.58	31.60
For Work In Restricted Working Space, Add	14.23	
22 11 16 00-0152 EA 2", 300 LB, Galvanized Malleable Iron Union	105.80	39.25
For Work In Restricted Working Space, Add	17.64	
22 11 16 00-0153 EA 2-1/2", 300 LB, Galvanized Malleable Iron Union	217.92	57.85
For Work In Restricted Working Space, Add	26.04	
22 11 16 00-0154 EA 3", 300 LB, Galvanized Malleable Iron Union	335.95	76.07
For Work In Restricted Working Space, Add	34.26	
22 11 16 00-0155 EA 4", 300 LB, Galvanized Malleable Iron Union	682.67	84.36
For Work In Restricted Working Space, Add	37.97	
22 11 16 00-0156 Galvanized Steel Nipples (22 11 16 00-0013)		
Note: ASTM A-53.		
22 11 16 00-0157 EA 3/8" x Close, Schedule 40 Galvanized Steel Nipple	11.23	6.98
For ASTM 120, Deduct	-0.11	
For Work In Restricted Working Space, Add	3.15	
For Schedule 80 Nipples, Add	0.83	
22 11 16 00-0158 EA 1/2" x Close, Schedule 40 Galvanized Steel Nipple	11.09	6.98
For ASTM 120, Deduct	-0.09	
For Work In Restricted Working Space, Add	3.15	
For Schedule 80 Nipples, Add	0.67	
22 11 16 00-0159 EA 3/4" x Close, Schedule 40 Galvanized Steel Nipple	11.22	6.98
For ASTM 120, Deduct	-0.11	
For Work In Restricted Working Space, Add	3.15	
For Schedule 80 Nipples, Add	0.82	
22 11 16 00-0160 EA 1" x Close, Schedule 40 Galvanized Steel Nipple	12.28	7.58
For ASTM 120, Deduct	-0.15	
For Work In Restricted Working Space, Add	3.39	
For Schedule 80 Nipples, Add	1.12	
22 11 16 00-0161 EA 1-1/4" x Close, Schedule 40 Galvanized Steel Nipple	13.57	8.16
For ASTM 120, Deduct	-0.20	
For Work In Restricted Working Space, Add	3.68	
For Schedule 80 Nipples, Add	1.50	
22 11 16 00-0162 EA 1-1/2" x Close, Schedule 40 Galvanized Steel Nipple	13.80	8.16
For ASTM 120, Deduct	-0.23	
For Work In Restricted Working Space, Add	3.68	
For Schedule 80 Nipples, Add	1.77	
22 11 16 00-0163 EA 2" x Close, Schedule 40 Galvanized Steel Nipple	18.00	10.51
For ASTM 120, Deduct	-0.33	
For Work In Restricted Working Space, Add	4.74	
For Schedule 80 Nipples, Add	2.50	
22 11 16 00-0164 EA 2-1/2" x Close, Schedule 40 Galvanized Steel Nipple	26.11	13.09
For ASTM 120, Deduct	-0.98	
For Work In Restricted Working Space, Add	5.88	
For Schedule 80 Nipples, Add	7.42	
22 11 16 00-0165 EA 3" x Close, Schedule 40 Galvanized Steel Nipple	31.50	15.81
For ASTM 120, Deduct	-1.17	
For Work In Restricted Working Space, Add	7.11	
For Schedule 80 Nipples, Add	8.88	
22 11 16 00-0166 EA 4" x Close, Schedule 40 Galvanized Steel Nipple	41.07	19.62
For ASTM 120, Deduct	-1.75	
For Work In Restricted Working Space, Add	8.82	
For Schedule 80 Nipples, Add	13.32	

22	Plumbing
22 10	Plumbing Piping
22 11	Facility Water Distribution



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 16 00-0167	EA		3/8" x 1-1/2" Long, Schedule 40 Galvanized Steel Nipple	11.34	6.98
			<i>For ASTM 120, Deduct</i>	-0.13	
			<i>For Work In Restricted Working Space, Add</i>	3.15	
			<i>For Schedule 80 Nipples, Add</i>	0.96	
22 11 16 00-0168	EA		1/2" x 1-1/2" Long, Schedule 40 Galvanized Steel Nipple	11.12	6.98
			<i>For ASTM 120, Deduct</i>	-0.09	
			<i>For Work In Restricted Working Space, Add</i>	3.15	
			<i>For Schedule 80 Nipples, Add</i>	0.71	
22 11 16 00-0169	EA		3/4" x 1-1/2" Long, Schedule 40 Galvanized Steel Nipple	11.28	6.98
			<i>For ASTM 120, Deduct</i>	-0.12	
			<i>For Work In Restricted Working Space, Add</i>	3.15	
			<i>For Schedule 80 Nipples, Add</i>	0.89	
22 11 16 00-0170	EA		3/8" x 2" Long, Schedule 40 Galvanized Steel Nipple.....	11.34	6.98
			<i>For ASTM 120, Deduct</i>	-0.13	
			<i>For Work In Restricted Working Space, Add</i>	3.15	
			<i>For Schedule 80 Nipples, Add</i>	0.96	
22 11 16 00-0171	EA		1/2" x 2" Long, Schedule 40 Galvanized Steel Nipple.....	11.12	6.98
			<i>For ASTM 120, Deduct</i>	-0.09	
			<i>For Work In Restricted Working Space, Add</i>	3.15	
			<i>For Schedule 80 Nipples, Add</i>	0.71	
22 11 16 00-0172	EA		3/4" x 2" Long, Schedule 40 Galvanized Steel Nipple.....	11.28	6.98
			<i>For ASTM 120, Deduct</i>	-0.12	
			<i>For Work In Restricted Working Space, Add</i>	3.15	
			<i>For Schedule 80 Nipples, Add</i>	0.89	
22 11 16 00-0173	EA		1" x 2" Long, Schedule 40 Galvanized Steel Nipple.....	12.46	7.58
			<i>For ASTM 120, Deduct</i>	-0.17	
			<i>For Work In Restricted Working Space, Add</i>	3.39	
			<i>For Schedule 80 Nipples, Add</i>	1.32	
22 11 16 00-0174	EA		1-1/4" x 2" Long, Schedule 40 Galvanized Steel Nipple	13.67	8.16
			<i>For ASTM 120, Deduct</i>	-0.21	
			<i>For Work In Restricted Working Space, Add</i>	3.68	
			<i>For Schedule 80 Nipples, Add</i>	1.62	
22 11 16 00-0175	EA		1-1/2" x 2" Long, Schedule 40 Galvanized Steel Nipple	13.91	8.16
			<i>For ASTM 120, Deduct</i>	-0.25	
			<i>For Work In Restricted Working Space, Add</i>	3.68	
			<i>For Schedule 80 Nipples, Add</i>	1.89	
22 11 16 00-0176	EA		3/8" x 2-1/2" Long, Schedule 40 Galvanized Steel Nipple	11.62	6.98
			<i>For ASTM 120, Deduct</i>	-0.17	
			<i>For Work In Restricted Working Space, Add</i>	3.15	
			<i>For Schedule 80 Nipples, Add</i>	1.28	
22 11 16 00-0177	EA		1/2" x 2-1/2" Long, Schedule 40 Galvanized Steel Nipple	11.23	6.98
			<i>For ASTM 120, Deduct</i>	-0.11	
			<i>For Work In Restricted Working Space, Add</i>	3.15	
			<i>For Schedule 80 Nipples, Add</i>	0.83	
22 11 16 00-0178	EA		3/4" x 2-1/2" Long, Schedule 40 Galvanized Steel Nipple	11.36	6.98
			<i>For ASTM 120, Deduct</i>	-0.13	
			<i>For Work In Restricted Working Space, Add</i>	3.15	
			<i>For Schedule 80 Nipples, Add</i>	0.98	
22 11 16 00-0179	EA		1" x 2-1/2" Long, Schedule 40 Galvanized Steel Nipple	12.56	7.58
			<i>For ASTM 120, Deduct</i>	-0.19	
			<i>For Work In Restricted Working Space, Add</i>	3.39	
			<i>For Schedule 80 Nipples, Add</i>	1.44	
22 11 16 00-0180	EA		1-1/4" x 2-1/2" Long, Schedule 40 Galvanized Steel Nipple	13.81	8.16
			<i>For ASTM 120, Deduct</i>	-0.23	
			<i>For Work In Restricted Working Space, Add</i>	3.68	
			<i>For Schedule 80 Nipples, Add</i>	1.78	
22 11 16 00-0181	EA		1-1/2" x 2-1/2" Long, Schedule 40 Galvanized Steel Nipple	14.11	8.16
			<i>For ASTM 120, Deduct</i>	-0.28	
			<i>For Work In Restricted Working Space, Add</i>	3.68	
			<i>For Schedule 80 Nipples, Add</i>	2.12	
22 11 16 00-0182	EA		2" x 2-1/2" Long, Schedule 40 Galvanized Steel Nipple	18.27	10.51
			<i>For ASTM 120, Deduct</i>	-0.37	
			<i>For Work In Restricted Working Space, Add</i>	4.74	
			<i>For Schedule 80 Nipples, Add</i>	2.80	
22 11 16 00-0183	EA		3/8" x 3" Long, Schedule 40 Galvanized Steel Nipple.....	11.62	6.98
			<i>For ASTM 120, Deduct</i>	-0.17	
			<i>For Work In Restricted Working Space, Add</i>	3.15	
			<i>For Schedule 80 Nipples, Add</i>	1.28	
22 11 16 00-0184	EA		1/2" x 3" Long, Schedule 40 Galvanized Steel Nipple.....	11.23	6.98
			<i>For ASTM 120, Deduct</i>	-0.11	
			<i>For Work In Restricted Working Space, Add</i>	3.15	
			<i>For Schedule 80 Nipples, Add</i>	0.83	
22 11 16 00-0185	EA		3/4" x 3" Long, Schedule 40 Galvanized Steel Nipple.....	11.36	6.98
			<i>For ASTM 120, Deduct</i>	-0.13	
			<i>For Work In Restricted Working Space, Add</i>	3.15	
			<i>For Schedule 80 Nipples, Add</i>	0.98	
22 11 16 00-0186	EA		1" x 3" Long, Schedule 40 Galvanized Steel Nipple.....	12.56	7.58
			<i>For ASTM 120, Deduct</i>	-0.19	
			<i>For Work In Restricted Working Space, Add</i>	3.39	
			<i>For Schedule 80 Nipples, Add</i>	1.44	
22 11 16 00-0187	EA		1-1/4" x 3" Long, Schedule 40 Galvanized Steel Nipple	13.81	8.16
			<i>For ASTM 120, Deduct</i>	-0.23	
			<i>For Work In Restricted Working Space, Add</i>	3.68	
			<i>For Schedule 80 Nipples, Add</i>	1.78	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 16 00-0188 EA 1-1/2" x 3" Long, Schedule 40 Galvanized Steel Nipple <i>For ASTM 120, Deduct</i> <i>For Work In Restricted Working Space, Add</i> <i>For Schedule 80 Nipples, Add</i>	14.11 -0.28 3.68 2.12	8.16
22 11 16 00-0189 EA 2" x 3" Long, Schedule 40 Galvanized Steel Nipple <i>For ASTM 120, Deduct</i> <i>For Work In Restricted Working Space, Add</i> <i>For Schedule 80 Nipples, Add</i>	18.27 -0.37 4.74 2.80	10.51
22 11 16 00-0190 EA 2-1/2" x 3" Long, Schedule 40 Galvanized Steel Nipple <i>For ASTM 120, Deduct</i> <i>For Work In Restricted Working Space, Add</i> <i>For Schedule 80 Nipples, Add</i>	26.35 -1.01 5.88 7.70	13.09
22 11 16 00-0191 EA 3" x 3" Long, Schedule 40 Galvanized Steel Nipple <i>For ASTM 120, Deduct</i> <i>For Work In Restricted Working Space, Add</i> <i>For Schedule 80 Nipples, Add</i>	32.58 -1.33 7.11 10.11	15.81
22 11 16 00-0192 EA 3/8" x 3-1/2" Long, Schedule 40 Galvanized Steel Nipple <i>For ASTM 120, Deduct</i> <i>For Work In Restricted Working Space, Add</i> <i>For Schedule 80 Nipples, Add</i>	11.83 -0.20 3.15 1.52	6.98
22 11 16 00-0193 EA 1/2" x 3-1/2" Long, Schedule 40 Galvanized Steel Nipple <i>For ASTM 120, Deduct</i> <i>For Work In Restricted Working Space, Add</i> <i>For Schedule 80 Nipples, Add</i>	11.40 -0.14 3.15 1.03	6.98
22 11 16 00-0194 EA 3/4" x 3-1/2" Long, Schedule 40 Galvanized Steel Nipple <i>For ASTM 120, Deduct</i> <i>For Work In Restricted Working Space, Add</i> <i>For Schedule 80 Nipples, Add</i>	11.62 -0.17 3.15 1.28	6.98
22 11 16 00-0195 EA 1" x 3-1/2" Long, Schedule 40 Galvanized Steel Nipple <i>For ASTM 120, Deduct</i> <i>For Work In Restricted Working Space, Add</i> <i>For Schedule 80 Nipples, Add</i>	12.81 -0.23 3.39 1.72	7.58
22 11 16 00-0196 EA 1-1/4" x 3-1/2" Long, Schedule 40 Galvanized Steel Nipple <i>For ASTM 120, Deduct</i> <i>For Work In Restricted Working Space, Add</i> <i>For Schedule 80 Nipples, Add</i>	14.11 -0.28 3.68 2.12	8.16
22 11 16 00-0197 EA 1-1/2" x 3-1/2" Long, Schedule 40 Galvanized Steel Nipple <i>For ASTM 120, Deduct</i> <i>For Work In Restricted Working Space, Add</i> <i>For Schedule 80 Nipples, Add</i>	14.59 -0.35 3.68 2.67	8.16
22 11 16 00-0198 EA 2" x 3-1/2" Long, Schedule 40 Galvanized Steel Nipple <i>For ASTM 120, Deduct</i> <i>For Work In Restricted Working Space, Add</i> <i>For Schedule 80 Nipples, Add</i>	18.80 -0.45 4.74 3.41	10.51
22 11 16 00-0199 EA 2-1/2" x 3-1/2" Long, Schedule 40 Galvanized Steel Nipple <i>For ASTM 120, Deduct</i> <i>For Work In Restricted Working Space, Add</i> <i>For Schedule 80 Nipples, Add</i>	27.44 -1.18 5.88 8.94	13.09
22 11 16 00-0200 EA 3" x 3-1/2" Long, Schedule 40 Galvanized Steel Nipple <i>For ASTM 120, Deduct</i> <i>For Work In Restricted Working Space, Add</i> <i>For Schedule 80 Nipples, Add</i>	34.12 -1.56 7.11 11.87	15.81
22 11 16 00-0201 EA 3/8" x 4" Long, Schedule 40 Galvanized Steel Nipple <i>For ASTM 120, Deduct</i> <i>For Work In Restricted Working Space, Add</i> <i>For Schedule 80 Nipples, Add</i>	11.83 -0.20 3.15 1.52	6.98
22 11 16 00-0202 EA 1/2" x 4" Long, Schedule 40 Galvanized Steel Nipple <i>For ASTM 120, Deduct</i> <i>For Work In Restricted Working Space, Add</i> <i>For Schedule 80 Nipples, Add</i>	11.40 -0.14 3.15 1.03	6.98
22 11 16 00-0203 EA 3/4" x 4" Long, Schedule 40 Galvanized Steel Nipple <i>For ASTM 120, Deduct</i> <i>For Work In Restricted Working Space, Add</i> <i>For Schedule 80 Nipples, Add</i>	11.83 -0.20 3.15 1.52	6.98
22 11 16 00-0204 EA 1" x 4" Long, Schedule 40 Galvanized Steel Nipple <i>For ASTM 120, Deduct</i> <i>For Work In Restricted Working Space, Add</i> <i>For Schedule 80 Nipples, Add</i>	12.81 -0.23 3.39 1.72	7.58
22 11 16 00-0205 EA 1-1/4" x 4" Long, Schedule 40 Galvanized Steel Nipple <i>For ASTM 120, Deduct</i> <i>For Work In Restricted Working Space, Add</i> <i>For Schedule 80 Nipples, Add</i>	14.11 -0.28 3.68 2.12	8.16
22 11 16 00-0206 EA 1-1/2" x 4" Long, Schedule 40 Galvanized Steel Nipple <i>For ASTM 120, Deduct</i> <i>For Work In Restricted Working Space, Add</i> <i>For Schedule 80 Nipples, Add</i>	14.59 -0.35 3.68 2.67	8.16
22 11 16 00-0207 EA 2" x 4" Long, Schedule 40 Galvanized Steel Nipple <i>For ASTM 120, Deduct</i> <i>For Work In Restricted Working Space, Add</i> <i>For Schedule 80 Nipples, Add</i>	18.82 -0.45 4.74 3.43	10.51
22 11 16 00-0208 EA 2-1/2" x 4" Long, Schedule 40 Galvanized Steel Nipple <i>For ASTM 120, Deduct</i> <i>For Work In Restricted Working Space, Add</i> <i>For Schedule 80 Nipples, Add</i>	27.44 -1.18 5.88 8.94	13.09

22	Plumbing
22 10	Plumbing Piping
22 11	Facility Water Distribution



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 16 00-0209	EA		3" x 4" Long, Schedule 40 Galvanized Steel Nipple.....	34.12	15.81
			<i>For ASTM 120, Deduct</i>	-1.56	
			<i>For Work In Restricted Working Space, Add</i>	7.11	
			<i>For Schedule 80 Nipples, Add</i>	11.87	
22 11 16 00-0210	EA		4" x 4" Long, Schedule 40 Galvanized Steel Nipple.....	43.36	19.62
			<i>For ASTM 120, Deduct</i>	-2.10	
			<i>For Work In Restricted Working Space, Add</i>	8.82	
			<i>For Schedule 80 Nipples, Add</i>	15.93	
22 11 16 00-0211	EA		3/8" x 4-1/2" Long, Schedule 40 Galvanized Steel Nipple	12.33	6.98
			<i>For ASTM 120, Deduct</i>	-0.27	
			<i>For Work In Restricted Working Space, Add</i>	3.15	
			<i>For Schedule 80 Nipples, Add</i>	2.09	
22 11 16 00-0212	EA		1/2" x 4-1/2" Long, Schedule 40 Galvanized Steel Nipple	11.59	6.98
			<i>For ASTM 120, Deduct</i>	-0.16	
			<i>For Work In Restricted Working Space, Add</i>	3.15	
			<i>For Schedule 80 Nipples, Add</i>	1.24	
22 11 16 00-0213	EA		3/4" x 4-1/2" Long, Schedule 40 Galvanized Steel Nipple	11.83	6.98
			<i>For ASTM 120, Deduct</i>	-0.20	
			<i>For Work In Restricted Working Space, Add</i>	3.15	
			<i>For Schedule 80 Nipples, Add</i>	1.52	
22 11 16 00-0214	EA		1" x 4-1/2" Long, Schedule 40 Galvanized Steel Nipple	13.16	7.58
			<i>For ASTM 120, Deduct</i>	-0.28	
			<i>For Work In Restricted Working Space, Add</i>	3.39	
			<i>For Schedule 80 Nipples, Add</i>	2.12	
22 11 16 00-0215	EA		1-1/4" x 4-1/2" Long, Schedule 40 Galvanized Steel Nipple	14.54	8.16
			<i>For ASTM 120, Deduct</i>	-0.34	
			<i>For Work In Restricted Working Space, Add</i>	3.68	
			<i>For Schedule 80 Nipples, Add</i>	2.61	
22 11 16 00-0216	EA		1-1/2" x 4-1/2" Long, Schedule 40 Galvanized Steel Nipple	15.08	8.16
			<i>For ASTM 120, Deduct</i>	-0.42	
			<i>For Work In Restricted Working Space, Add</i>	3.68	
			<i>For Schedule 80 Nipples, Add</i>	3.23	
22 11 16 00-0217	EA		2" x 4-1/2" Long, Schedule 40 Galvanized Steel Nipple	19.62	10.51
			<i>For ASTM 120, Deduct</i>	-0.57	
			<i>For Work In Restricted Working Space, Add</i>	4.74	
			<i>For Schedule 80 Nipples, Add</i>	4.34	
22 11 16 00-0218	EA		2-1/2" x 4-1/2" Long, Schedule 40 Galvanized Steel Nipple	28.34	13.09
			<i>For ASTM 120, Deduct</i>	-1.31	
			<i>For Work In Restricted Working Space, Add</i>	5.88	
			<i>For Schedule 80 Nipples, Add</i>	9.96	
22 11 16 00-0219	EA		3" x 4-1/2" Long, Schedule 40 Galvanized Steel Nipple	35.84	15.81
			<i>For ASTM 120, Deduct</i>	-1.82	
			<i>For Work In Restricted Working Space, Add</i>	7.11	
			<i>For Schedule 80 Nipples, Add</i>	13.83	
22 11 16 00-0220	EA		4" x 4-1/2" Long, Schedule 40 Galvanized Steel Nipple	45.06	19.62
			<i>For ASTM 120, Deduct</i>	-2.35	
			<i>For Work In Restricted Working Space, Add</i>	8.82	
			<i>For Schedule 80 Nipples, Add</i>	17.86	
22 11 16 00-0221	EA		3/8" x 5" Long, Schedule 40 Galvanized Steel Nipple.....	12.33	6.98
			<i>For ASTM 120, Deduct</i>	-0.27	
			<i>For Work In Restricted Working Space, Add</i>	3.15	
			<i>For Schedule 80 Nipples, Add</i>	2.09	
22 11 16 00-0222	EA		1/2" x 5" Long, Schedule 40 Galvanized Steel Nipple.....	11.59	6.98
			<i>For ASTM 120, Deduct</i>	-0.16	
			<i>For Work In Restricted Working Space, Add</i>	3.15	
			<i>For Schedule 80 Nipples, Add</i>	1.24	
22 11 16 00-0223	EA		3/4" x 5" Long, Schedule 40 Galvanized Steel Nipple.....	11.83	6.98
			<i>For ASTM 120, Deduct</i>	-0.20	
			<i>For Work In Restricted Working Space, Add</i>	3.15	
			<i>For Schedule 80 Nipples, Add</i>	1.52	
22 11 16 00-0224	EA		1" x 5" Long, Schedule 40 Galvanized Steel Nipple.....	13.16	7.58
			<i>For ASTM 120, Deduct</i>	-0.28	
			<i>For Work In Restricted Working Space, Add</i>	3.39	
			<i>For Schedule 80 Nipples, Add</i>	2.12	
22 11 16 00-0225	EA		1-1/4" x 5" Long, Schedule 40 Galvanized Steel Nipple	14.54	8.16
			<i>For ASTM 120, Deduct</i>	-0.34	
			<i>For Work In Restricted Working Space, Add</i>	3.68	
			<i>For Schedule 80 Nipples, Add</i>	2.61	
22 11 16 00-0226	EA		1-1/2" x 5" Long, Schedule 40 Galvanized Steel Nipple	15.08	8.16
			<i>For ASTM 120, Deduct</i>	-0.42	
			<i>For Work In Restricted Working Space, Add</i>	3.68	
			<i>For Schedule 80 Nipples, Add</i>	3.23	
22 11 16 00-0227	EA		2" x 5" Long, Schedule 40 Galvanized Steel Nipple.....	19.62	10.51
			<i>For ASTM 120, Deduct</i>	-0.57	
			<i>For Work In Restricted Working Space, Add</i>	4.74	
			<i>For Schedule 80 Nipples, Add</i>	4.34	
22 11 16 00-0228	EA		2-1/2" x 5" Long, Schedule 40 Galvanized Steel Nipple	28.34	13.09
			<i>For ASTM 120, Deduct</i>	-1.31	
			<i>For Work In Restricted Working Space, Add</i>	5.88	
			<i>For Schedule 80 Nipples, Add</i>	9.96	
22 11 16 00-0229	EA		3" x 5" Long, Schedule 40 Galvanized Steel Nipple.....	35.84	15.81
			<i>For ASTM 120, Deduct</i>	-1.82	
			<i>For Work In Restricted Working Space, Add</i>	7.11	
			<i>For Schedule 80 Nipples, Add</i>	13.83	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 16 00-0230 EA 4" x 5" Long, Schedule 40 Galvanized Steel Nipple	45.06	19.62
For ASTM 120, Deduct	-2.35	
For Work In Restricted Working Space, Add	8.82	
For Schedule 80 Nipples, Add	17.86	
22 11 16 00-0231 EA 3/8" x 6" Long, Schedule 40 Galvanized Steel Nipple	12.53	6.98
For ASTM 120, Deduct	-0.30	
For Work In Restricted Working Space, Add	3.15	
For Schedule 80 Nipples, Add	2.31	
22 11 16 00-0232 EA 1/2" x 6" Long, Schedule 40 Galvanized Steel Nipple	11.73	6.98
For ASTM 120, Deduct	-0.18	
For Work In Restricted Working Space, Add	3.15	
For Schedule 80 Nipples, Add	1.40	
22 11 16 00-0233 EA 3/4" x 6" Long, Schedule 40 Galvanized Steel Nipple	12.10	6.98
For ASTM 120, Deduct	-0.24	
For Work In Restricted Working Space, Add	3.15	
For Schedule 80 Nipples, Add	1.82	
22 11 16 00-0234 EA 1" x 6" Long, Schedule 40 Galvanized Steel Nipple	13.40	7.58
For ASTM 120, Deduct	-0.32	
For Work In Restricted Working Space, Add	3.39	
For Schedule 80 Nipples, Add	2.39	
22 11 16 00-0235 EA 1-1/4" x 6" Long, Schedule 40 Galvanized Steel Nipple	14.91	8.16
For ASTM 120, Deduct	-0.40	
For Work In Restricted Working Space, Add	3.68	
For Schedule 80 Nipples, Add	3.03	
22 11 16 00-0236 EA 1-1/2" x 6" Long, Schedule 40 Galvanized Steel Nipple	15.44	8.16
For ASTM 120, Deduct	-0.48	
For Work In Restricted Working Space, Add	3.68	
For Schedule 80 Nipples, Add	3.64	
22 11 16 00-0237 EA 2" x 6" Long, Schedule 40 Galvanized Steel Nipple	20.24	10.51
For ASTM 120, Deduct	-0.66	
For Work In Restricted Working Space, Add	4.74	
For Schedule 80 Nipples, Add	5.05	
22 11 16 00-0238 EA 2-1/2" x 6" Long, Schedule 40 Galvanized Steel Nipple	29.21	13.09
For ASTM 120, Deduct	-1.44	
For Work In Restricted Working Space, Add	5.88	
For Schedule 80 Nipples, Add	10.96	
22 11 16 00-0239 EA 3" x 6" Long, Schedule 40 Galvanized Steel Nipple	36.54	15.81
For ASTM 120, Deduct	-1.92	
For Work In Restricted Working Space, Add	7.11	
For Schedule 80 Nipples, Add	14.63	
22 11 16 00-0240 EA 4" x 6" Long, Schedule 40 Galvanized Steel Nipple	46.71	19.62
For ASTM 120, Deduct	-2.60	
For Work In Restricted Working Space, Add	8.82	
For Schedule 80 Nipples, Add	19.74	
22 11 16 00-0241 EA 3/8" x 8" Long, Schedule 40 Galvanized Steel Nipple	18.63	6.98
For ASTM 120, Deduct	-1.22	
For Work In Restricted Working Space, Add	3.15	
For Schedule 80 Nipples, Add	9.27	
22 11 16 00-0242 EA 1/2" x 8" Long, Schedule 40 Galvanized Steel Nipple	12.67	6.98
For ASTM 120, Deduct	-0.33	
For Work In Restricted Working Space, Add	3.15	
For Schedule 80 Nipples, Add	2.47	
22 11 16 00-0243 EA 3/4" x 8" Long, Schedule 40 Galvanized Steel Nipple	13.28	6.98
For ASTM 120, Deduct	-0.42	
For Work In Restricted Working Space, Add	3.15	
For Schedule 80 Nipples, Add	3.17	
22 11 16 00-0244 EA 1" x 8" Long, Schedule 40 Galvanized Steel Nipple	14.82	7.58
For ASTM 120, Deduct	-0.53	
For Work In Restricted Working Space, Add	3.39	
For Schedule 80 Nipples, Add	4.01	
22 11 16 00-0245 EA 1-1/4" x 8" Long, Schedule 40 Galvanized Steel Nipple	16.56	8.16
For ASTM 120, Deduct	-0.65	
For Work In Restricted Working Space, Add	3.68	
For Schedule 80 Nipples, Add	4.91	
22 11 16 00-0246 EA 1-1/2" x 8" Long, Schedule 40 Galvanized Steel Nipple	17.20	8.16
For ASTM 120, Deduct	-0.74	
For Work In Restricted Working Space, Add	3.68	
For Schedule 80 Nipples, Add	5.64	
22 11 16 00-0247 EA 2" x 8" Long, Schedule 40 Galvanized Steel Nipple	23.03	10.51
For ASTM 120, Deduct	-1.08	
For Work In Restricted Working Space, Add	4.74	
For Schedule 80 Nipples, Add	8.23	
22 11 16 00-0248 EA 2-1/2" x 8" Long, Schedule 40 Galvanized Steel Nipple	31.96	13.09
For ASTM 120, Deduct	-1.85	
For Work In Restricted Working Space, Add	5.88	
For Schedule 80 Nipples, Add	14.09	
22 11 16 00-0249 EA 3" x 8" Long, Schedule 40 Galvanized Steel Nipple	40.99	15.81
For ASTM 120, Deduct	-2.59	
For Work In Restricted Working Space, Add	7.11	
For Schedule 80 Nipples, Add	19.70	
22 11 16 00-0250 EA 4" x 8" Long, Schedule 40 Galvanized Steel Nipple	50.06	19.62
For ASTM 120, Deduct	-3.10	
For Work In Restricted Working Space, Add	8.82	
For Schedule 80 Nipples, Add	23.56	

22	Plumbing
22 10	Plumbing Piping
22 11	Facility Water Distribution



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 16 00-0251	EA		3/8" x 10" Long, Schedule 40 Galvanized Steel Nipple.....	14.38	6.98
			<i>For ASTM 120, Deduct</i>	-0.58	
			<i>For Work In Restricted Working Space, Add</i>	3.15	
			<i>For Schedule 80 Nipples, Add</i>	4.42	
22 11 16 00-0252	EA		1/2" x 10" Long, Schedule 40 Galvanized Steel Nipple.....	13.08	6.98
			<i>For ASTM 120, Deduct</i>	-0.39	
			<i>For Work In Restricted Working Space, Add</i>	3.15	
			<i>For Schedule 80 Nipples, Add</i>	2.94	
22 11 16 00-0253	EA		3/4" x 10" Long, Schedule 40 Galvanized Steel Nipple.....	13.58	6.98
			<i>For ASTM 120, Deduct</i>	-0.46	
			<i>For Work In Restricted Working Space, Add</i>	3.15	
			<i>For Schedule 80 Nipples, Add</i>	3.51	
22 11 16 00-0254	EA		1" x 10" Long, Schedule 40 Galvanized Steel Nipple.....	15.32	7.58
			<i>For ASTM 120, Deduct</i>	-0.60	
			<i>For Work In Restricted Working Space, Add</i>	3.39	
			<i>For Schedule 80 Nipples, Add</i>	4.58	
22 11 16 00-0255	EA		1-1/4" x 10" Long, Schedule 40 Galvanized Steel Nipple	17.41	8.16
			<i>For ASTM 120, Deduct</i>	-0.77	
			<i>For Work In Restricted Working Space, Add</i>	3.68	
			<i>For Schedule 80 Nipples, Add</i>	5.88	
22 11 16 00-0256	EA		1-1/2" x 10" Long, Schedule 40 Galvanized Steel Nipple	18.02	8.16
			<i>For ASTM 120, Deduct</i>	-0.87	
			<i>For Work In Restricted Working Space, Add</i>	3.68	
			<i>For Schedule 80 Nipples, Add</i>	6.58	
22 11 16 00-0257	EA		2" x 10" Long, Schedule 40 Galvanized Steel Nipple.....	24.25	10.51
			<i>For ASTM 120, Deduct</i>	-1.27	
			<i>For Work In Restricted Working Space, Add</i>	4.74	
			<i>For Schedule 80 Nipples, Add</i>	9.62	
22 11 16 00-0258	EA		2-1/2" x 10" Long, Schedule 40 Galvanized Steel Nipple	33.69	13.09
			<i>For ASTM 120, Deduct</i>	-2.11	
			<i>For Work In Restricted Working Space, Add</i>	5.88	
			<i>For Schedule 80 Nipples, Add</i>	16.06	
22 11 16 00-0259	EA		3" x 10" Long, Schedule 40 Galvanized Steel Nipple.....	43.42	15.81
			<i>For ASTM 120, Deduct</i>	-2.96	
			<i>For Work In Restricted Working Space, Add</i>	7.11	
			<i>For Schedule 80 Nipples, Add</i>	22.47	
22 11 16 00-0260	EA		4" x 10" Long, Schedule 40 Galvanized Steel Nipple.....	53.34	19.62
			<i>For ASTM 120, Deduct</i>	-3.59	
			<i>For Work In Restricted Working Space, Add</i>	8.82	
			<i>For Schedule 80 Nipples, Add</i>	27.30	
22 11 16 00-0261	EA		3/8" x 12" Long, Schedule 40 Galvanized Steel Nipple.....	14.79	6.98
			<i>For ASTM 120, Deduct</i>	-0.64	
			<i>For Work In Restricted Working Space, Add</i>	3.15	
			<i>For Schedule 80 Nipples, Add</i>	4.89	
22 11 16 00-0262	EA		1/2" x 12" Long, Schedule 40 Galvanized Steel Nipple.....	13.44	6.98
			<i>For ASTM 120, Deduct</i>	-0.44	
			<i>For Work In Restricted Working Space, Add</i>	3.15	
			<i>For Schedule 80 Nipples, Add</i>	3.35	
22 11 16 00-0263	EA		3/4" x 12" Long, Schedule 40 Galvanized Steel Nipple.....	13.96	6.98
			<i>For ASTM 120, Deduct</i>	-0.52	
			<i>For Work In Restricted Working Space, Add</i>	3.15	
			<i>For Schedule 80 Nipples, Add</i>	3.94	
22 11 16 00-0264	EA		1" x 12" Long, Schedule 40 Galvanized Steel Nipple.....	15.98	7.58
			<i>For ASTM 120, Deduct</i>	-0.70	
			<i>For Work In Restricted Working Space, Add</i>	3.39	
			<i>For Schedule 80 Nipples, Add</i>	5.34	
22 11 16 00-0265	EA		1-1/4" x 12" Long, Schedule 40 Galvanized Steel Nipple	18.44	8.16
			<i>For ASTM 120, Deduct</i>	-0.93	
			<i>For Work In Restricted Working Space, Add</i>	3.68	
			<i>For Schedule 80 Nipples, Add</i>	7.06	
22 11 16 00-0266	EA		1-1/2" x 12" Long, Schedule 40 Galvanized Steel Nipple	18.85	8.16
			<i>For ASTM 120, Deduct</i>	-0.99	
			<i>For Work In Restricted Working Space, Add</i>	3.68	
			<i>For Schedule 80 Nipples, Add</i>	7.52	
22 11 16 00-0267	EA		2" x 12" Long, Schedule 40 Galvanized Steel Nipple.....	25.50	10.51
			<i>For ASTM 120, Deduct</i>	-1.45	
			<i>For Work In Restricted Working Space, Add</i>	4.74	
			<i>For Schedule 80 Nipples, Add</i>	11.05	
22 11 16 00-0268	EA		2-1/2" x 12" Long, Schedule 40 Galvanized Steel Nipple	35.37	13.09
			<i>For ASTM 120, Deduct</i>	-2.37	
			<i>For Work In Restricted Working Space, Add</i>	5.88	
			<i>For Schedule 80 Nipples, Add</i>	17.98	
22 11 16 00-0269	EA		3" x 12" Long, Schedule 40 Galvanized Steel Nipple.....	45.87	15.81
			<i>For ASTM 120, Deduct</i>	-3.32	
			<i>For Work In Restricted Working Space, Add</i>	7.11	
			<i>For Schedule 80 Nipples, Add</i>	25.26	
22 11 16 00-0270	EA		4" x 12" Long, Schedule 40 Galvanized Steel Nipple.....	56.66	19.62
			<i>For ASTM 120, Deduct</i>	-4.09	
			<i>For Work In Restricted Working Space, Add</i>	8.82	
			<i>For Schedule 80 Nipples, Add</i>	31.09	
22 11 16 00-0271			Galvanized Malleable Iron Square Head Plugs (22 11 16 00-0013)		
22 11 16 00-0272	EA		1/2", 150 LB, Galvanized Malleable Iron Square Head Plug.....	10.72	5.22
			<i>For 300 LB Rating, Add</i>	10.26	
			<i>For Work In Restricted Working Space, Add</i>	2.35	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 16 00-0273 EA 3/4", 150 LB, Galvanized Malleable Iron Square Head Plug..... <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i>	11.65 10.32 2.63	5.88
22 11 16 00-0274 EA 1", 150 LB, Galvanized Malleable Iron Square Head Plug..... <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i>	12.96 11.33 2.94	6.54
22 11 16 00-0275 EA 1-1/4", 150 LB, Galvanized Malleable Iron Square Head Plug..... <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i>	15.95 17.19 3.33	7.42
22 11 16 00-0276 EA 1-1/2", 150 LB, Galvanized Malleable Iron Square Head Plug..... <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i>	19.06 23.02 3.75	8.30
22 11 16 00-0277 EA 2", 150 LB, Galvanized Malleable Iron Square Head Plug..... <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i>	24.22 29.28 4.77	10.59
22 11 16 00-0278 EA 2-1/2", 150 LB, Galvanized Malleable Iron Square Head Plug..... <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i>	39.77 56.66 7.06	15.66
22 11 16 00-0279 EA 3", 150 LB, Galvanized Malleable Iron Square Head Plug..... <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i>	54.00 80.23 9.29	20.65
22 11 16 00-0280 EA 4", 150 LB, Galvanized Malleable Iron Square Head Plug..... <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i>	82.15 164.78 10.29	22.85
22 11 16 00-0281 EA 5", 150 LB, Galvanized Malleable Iron Square Head Plug..... <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i>	123.59 300.70 10.73	23.88
22 11 16 00-0282 EA 6", 150 LB, Galvanized Malleable Iron Square Head Plug..... <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i>	132.34 325.01 11.22	24.91
22 11 16 00-0283 Galvanized Malleable Iron Bushing (22 11 16 00-0013)		
22 11 16 00-0284 EA 3/4" x 1/2", 150 LB, Galvanized Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	24.68 6.23	13.82
22 11 16 00-0285 EA 1" x 1/2", 150 LB, Galvanized Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	26.73 6.62	14.70
22 11 16 00-0286 EA 1" x 3/4", 150 LB, Galvanized Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	27.65 6.97	15.50
22 11 16 00-0287 EA 1-1/4" x 1/2", 150 LB, Galvanized Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	30.21 7.10	15.81
22 11 16 00-0288 EA 1-1/4" x 3/4", 150 LB, Galvanized Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	30.79 7.45	16.54
22 11 16 00-0289 EA 1-1/4" x 1", 150 LB, Galvanized Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	32.07 7.83	17.42
22 11 16 00-0290 EA 1-1/2" x 1/2", 150 LB, Galvanized Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	34.10 7.63	16.97
22 11 16 00-0291 EA 1-1/2" x 3/4", 150 LB, Galvanized Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	35.27 7.98	17.71
22 11 16 00-0292 EA 1-1/2" x 1", 150 LB, Galvanized Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	35.69 8.36	18.60
22 11 16 00-0293 EA 1-1/2" x 1-1/4", 150 LB, Galvanized Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	36.71 8.85	19.69
22 11 16 00-0294 EA 2" x 1/2", 150 LB, Galvanized Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	40.48 8.90	19.78
22 11 16 00-0295 EA 2" x 3/4", 150 LB, Galvanized Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	40.90 9.25	20.58
22 11 16 00-0296 EA 2" x 1", 150 LB, Galvanized Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	41.63 9.64	21.39
22 11 16 00-0297 EA 2" x 1-1/4", 150 LB, Galvanized Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	43.24 10.12	22.50
22 11 16 00-0298 EA 2" x 1-1/2", 150 LB, Galvanized Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	43.84 10.65	23.66
22 11 16 00-0299 EA 2-1/2" x 3/4", 150 LB, Galvanized Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	56.03 12.11	26.90
22 11 16 00-0300 EA 2-1/2" x 1", 150 LB, Galvanized Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	57.31 12.50	27.78
22 11 16 00-0301 EA 2-1/2" x 1-1/4", 150 LB, Galvanized Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	58.92 12.98	28.81
22 11 16 00-0302 EA 2-1/2" x 1-1/2", 150 LB, Galvanized Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	60.40 13.51	30.06
22 11 16 00-0303 EA 2-1/2" x 2", 150 LB, Galvanized Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	62.88 14.78	32.85
22 11 16 00-0304 EA 3" x 3/4", 150 LB, Galvanized Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	70.32 14.90	33.07
22 11 16 00-0305 EA 3" x 1", 150 LB, Galvanized Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	71.59 15.28	33.96
22 11 16 00-0306 EA 3" x 1-1/4", 150 LB, Galvanized Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	73.22 15.77	35.06
22 11 16 00-0307 EA 3" x 1-1/2", 150 LB, Galvanized Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	74.58 16.30	36.24
22 11 16 00-0308 EA 3" x 2", 150 LB, Galvanized Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	76.91 17.57	39.03
22 11 16 00-0309 EA 3" x 2-1/2", 150 LB, Galvanized Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	87.51 20.42	45.42



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 16 00-0310	EA		4" x 3/4", 150 LB, Galvanized Malleable Iron Bushing.....	97.13	35.86
			<i>For Work In Restricted Working Space, Add</i>	16.15	
22 11 16 00-0311	EA		4" x 1", 150 LB, Galvanized Malleable Iron Bushing.....	98.41	36.74
			<i>For Work In Restricted Working Space, Add</i>	16.54	
22 11 16 00-0312	EA		4" x 1-1/4", 150 LB, Galvanized Malleable Iron Bushing.....	100.02	37.84
			<i>For Work In Restricted Working Space, Add</i>	17.02	
22 11 16 00-0313	EA		4" x 1-1/2", 150 LB, Galvanized Malleable Iron Bushing.....	101.79	39.02
			<i>For Work In Restricted Working Space, Add</i>	17.55	
22 11 16 00-0314	EA		4" x 2", 150 LB, Galvanized Malleable Iron Bushing.....	100.92	41.81
			<i>For Work In Restricted Working Space, Add</i>	18.82	
22 11 16 00-0315	EA		4" x 2-1/2", 150 LB, Galvanized Malleable Iron Bushing.....	115.54	48.20
			<i>For Work In Restricted Working Space, Add</i>	21.68	
22 11 16 00-0316	EA		4" x 3", 150 LB, Galvanized Malleable Iron Bushing.....	121.98	54.38
			<i>For Work In Restricted Working Space, Add</i>	24.47	
22 11 16 00-0317			Galvanized Malleable Iron Floor Flange (22 11 16 00-0013)		
22 11 16 00-0318	EA		1/2", 150 LB, Galvanized Malleable Iron Floor Flange.....	46.24	26.86
22 11 16 00-0319	EA		3/4", 150 LB, Galvanized Malleable Iron Floor Flange.....	50.52	29.40
22 11 16 00-0320	EA		1", 150 LB, Galvanized Malleable Iron Floor Flange.....	58.17	33.22
22 11 16 00-0321	EA		1-1/4", 150 LB, Galvanized Malleable Iron Floor Flange.....	60.50	34.40
22 11 16 00-0322	EA		1-1/2", 150 LB, Galvanized Malleable Iron Floor Flange.....	65.84	37.42
22 11 16 00-0323	EA		2", 150 LB, Galvanized Malleable Iron Floor Flange.....	71.25	39.03
22 11 16 00-0324			Galvanized Cast Iron Flanges (22 11 16 00-0013)		
22 11 16 00-0325	EA		3/4", 125 LB, Galvanized Cast Iron Flange.....	94.18	29.40
			<i>For Work In Restricted Working Space, Add</i>	13.23	
22 11 16 00-0326	EA		1", 125 LB, Galvanized Cast Iron Flange.....	88.61	33.22
			<i>For Work In Restricted Working Space, Add</i>	14.95	
22 11 16 00-0327	EA		1-1/4", 125 LB, Galvanized Cast Iron Flange.....	72.07	34.40
			<i>For Work In Restricted Working Space, Add</i>	15.47	
22 11 16 00-0328	EA		1-1/2", 125 LB, Galvanized Cast Iron Flange.....	101.65	37.42
			<i>For Work In Restricted Working Space, Add</i>	16.83	
22 11 16 00-0329	EA		2", 125 LB, Galvanized Cast Iron Flange.....	98.61	39.03
			<i>For Work In Restricted Working Space, Add</i>	17.57	
22 11 16 00-0330	EA		2-1/2", 125 LB, Galvanized Cast Iron Flange.....	114.58	45.20
			<i>For Work In Restricted Working Space, Add</i>	20.32	
22 11 16 00-0331	EA		3", 125 LB, Galvanized Cast Iron Flange.....	212.47	57.33
			<i>For Work In Restricted Working Space, Add</i>	25.78	
22 11 16 00-0332	EA		4", 125 LB, Galvanized Cast Iron Flange.....	195.10	78.41
			<i>For Work In Restricted Working Space, Add</i>	35.27	
22 11 16 00-0333	EA		5", 125 LB, Galvanized Cast Iron Flange.....	261.68	93.32
			<i>For Work In Restricted Working Space, Add</i>	41.98	
22 11 16 00-0334	EA		6", 125 LB, Galvanized Cast Iron Flange.....	290.87	107.21
			<i>For Work In Restricted Working Space, Add</i>	48.22	
22 11 16 00-0335			Copper Pipe And Fittings (22 11 16)		
			Note: Excludes hangers. See CSI section 22 11 16 00-0860 for pipe with fittings assembly.		
22 11 16 00-0336			Copper Tube/Pipe (22 11 16 00-0335)		
			Note: Pipe based on inside diameter size. Excludes hangers and fittings (couplers, tees, elbows, etc).		
22 11 16 00-0337			Hard Drawn Type L Copper Tube/Pipe (22 11 16 00-0336)		
22 11 16 00-0338	LF		1/4" Hard Drawn Type L Copper Tube/Pipe.....	3.58	1.79
			<i>For Work In Restricted Working Space, Add</i>	0.81	
			<i>For Medical/Oxygen Service Tubing, Add</i>	0.07	
22 11 16 00-0339	LF		3/8" Hard Drawn Type L Copper Tube/Pipe.....	4.15	1.87
			<i>For Work In Restricted Working Space, Add</i>	0.84	
			<i>For Medical/Oxygen Service Tubing, Add</i>	0.11	
22 11 16 00-0340	LF		1/2" Hard Drawn Type L Copper Tube/Pipe.....	4.57	1.94
			<i>For Work In Restricted Working Space, Add</i>	0.88	
			<i>For Medical/Oxygen Service Tubing, Add</i>	0.13	
22 11 16 00-0341	LF		3/4" Hard Drawn Type L Copper Tube/Pipe.....	5.64	2.06
			<i>For Work In Restricted Working Space, Add</i>	0.93	
			<i>For Medical/Oxygen Service Tubing, Add</i>	0.20	
22 11 16 00-0342	LF		1" Hard Drawn Type L Copper Tube/Pipe.....	7.13	2.33
			<i>For Work In Restricted Working Space, Add</i>	1.04	
			<i>For Medical/Oxygen Service Tubing, Add</i>	0.29	
22 11 16 00-0343	LF		1-1/4" Hard Drawn Type L Copper Tube/Pipe.....	10.29	3.45
			<i>For Work In Restricted Working Space, Add</i>	1.55	
			<i>For Medical/Oxygen Service Tubing, Add</i>	0.41	
22 11 16 00-0344	LF		1-1/2" Hard Drawn Type L Copper Tube/Pipe.....	12.98	3.86
			<i>For Work In Restricted Working Space, Add</i>	1.73	
			<i>For Medical/Oxygen Service Tubing, Add</i>	0.58	
22 11 16 00-0345	LF		2" Hard Drawn Type L Copper Tube/Pipe.....	22.13	4.76
			<i>For Work In Restricted Working Space, Add</i>	2.14	
			<i>For Medical/Oxygen Service Tubing, Add</i>	1.20	
22 11 16 00-0346	LF		2-1/2" Hard Drawn Type L Copper Tube/Pipe.....	38.56	5.94
			<i>For Work In Restricted Working Space, Add</i>	5.35	
			<i>For Medical/Oxygen Service Tubing, Add</i>	1.66	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 16 00-0347 LF 3" Hard Drawn Type L Copper Tube/Pipe <i>For Work In Restricted Working Space, Add</i> <i>For Medical/Oxygen Service Tubing, Add</i>	45.54 5.93 2.06	6.59
22 11 16 00-0348 LF 4" Hard Drawn Type L Copper Tube/Pipe <i>For Work In Restricted Working Space, Add</i> <i>For Medical/Oxygen Service Tubing, Add</i>	63.59 6.69 3.30	7.43
22 11 16 00-0349 LF 5" Hard Drawn Type L Copper Tube/Pipe <i>For Work In Restricted Working Space, Add</i> <i>For Medical/Oxygen Service Tubing, Add</i>	139.96 7.69 9.15	8.54
22 11 16 00-0350 LF 6" Hard Drawn Type L Copper Tube/Pipe <i>For Work In Restricted Working Space, Add</i> <i>For Medical/Oxygen Service Tubing, Add</i>	169.80 11.91 10.41	13.24
22 11 16 00-0351 LF 8" Hard Drawn Type L Copper Tube/Pipe <i>For Work In Restricted Working Space, Add</i> <i>For Medical/Oxygen Service Tubing, Add</i>	279.38 13.24 18.82	14.72
22 11 16 00-0352 Hard Drawn Type K Copper Tube/Pipe <small>(22 11 16 00-0336)</small>		
22 11 16 00-0353 LF 1/4" Hard Drawn Type K Copper Tube/Pipe <i>For Work In Restricted Working Space, Add</i> <i>For Medical/Oxygen Service Tubing, Add</i>	3.91 0.87 0.08	1.93
22 11 16 00-0354 LF 3/8" Hard Drawn Type K Copper Tube/Pipe <i>For Work In Restricted Working Space, Add</i> <i>For Medical/Oxygen Service Tubing, Add</i>	5.13 0.99 0.15	2.21
22 11 16 00-0355 LF 1/2" Hard Drawn Type K Copper Tube/Pipe <i>For Work In Restricted Working Space, Add</i> <i>For Medical/Oxygen Service Tubing, Add</i>	5.23 0.97 0.16	2.15
22 11 16 00-0356 LF 3/4" Hard Drawn Type K Copper Tube/Pipe <i>For Work In Restricted Working Space, Add</i> <i>For Medical/Oxygen Service Tubing, Add</i>	7.32 1.12 0.29	2.49
22 11 16 00-0357 LF 1" Hard Drawn Type K Copper Tube/Pipe <i>For Work In Restricted Working Space, Add</i> <i>For Medical/Oxygen Service Tubing, Add</i>	8.66 1.19 0.37	2.65
22 11 16 00-0358 LF 1-1/4" Hard Drawn Type K Copper Tube/Pipe <i>For Work In Restricted Working Space, Add</i> <i>For Medical/Oxygen Service Tubing, Add</i>	11.65 1.69 0.48	3.76
22 11 16 00-0359 LF 1-1/2" Hard Drawn Type K Copper Tube/Pipe <i>For Work In Restricted Working Space, Add</i> <i>For Medical/Oxygen Service Tubing, Add</i>	14.92 1.90 0.69	4.23
22 11 16 00-0360 LF 2" Hard Drawn Type K Copper Tube/Pipe <i>For Work In Restricted Working Space, Add</i> <i>For Medical/Oxygen Service Tubing, Add</i>	25.42 2.33 1.41	5.18
22 11 16 00-0361 LF 2-1/2" Hard Drawn Type K Copper Tube/Pipe <i>For Work In Restricted Working Space, Add</i> <i>For Medical/Oxygen Service Tubing, Add</i>	43.95 5.83 1.96	12.97
22 11 16 00-0362 LF 3" Hard Drawn Type K Copper Tube/Pipe <i>For Work In Restricted Working Space, Add</i> <i>For Medical/Oxygen Service Tubing, Add</i>	52.72 6.53 2.48	14.51
22 11 16 00-0363 LF 4" Hard Drawn Type K Copper Tube/Pipe <i>For Work In Restricted Working Space, Add</i> <i>For Medical/Oxygen Service Tubing, Add</i>	74.61 7.39 4.00	16.44
22 11 16 00-0364 LF 5" Hard Drawn Type K Copper Tube/Pipe <i>For Work In Restricted Working Space, Add</i> <i>For Medical/Oxygen Service Tubing, Add</i>	174.38 8.72 11.62	19.40
22 11 16 00-0365 LF 6" Hard Drawn Type K Copper Tube/Pipe <i>For Work In Restricted Working Space, Add</i> <i>For Medical/Oxygen Service Tubing, Add</i>	224.20 14.06 14.19	31.28
22 11 16 00-0366 LF 8" Hard Drawn Type K Copper Tube/Pipe <i>For Work In Restricted Working Space, Add</i> <i>For Medical/Oxygen Service Tubing, Add</i>	367.39 15.50 25.26	34.46
22 11 16 00-0367 Hard Drawn Type M Copper Tube/Pipe <small>(22 11 16 00-0336)</small>		
22 11 16 00-0368 LF 1/4" Hard Drawn Type M Copper Tube/Pipe <i>For Work In Restricted Working Space, Add</i>	3.10 0.70	1.55
22 11 16 00-0369 LF 3/8" Hard Drawn Type M Copper Tube/Pipe <i>For Work In Restricted Working Space, Add</i>	3.22 0.67	1.49
22 11 16 00-0370 LF 1/2" Hard Drawn Type M Copper Tube/Pipe <i>For Work In Restricted Working Space, Add</i>	3.49 0.69	1.54
22 11 16 00-0371 LF 3/4" Hard Drawn Type M Copper Tube/Pipe <i>For Work In Restricted Working Space, Add</i>	4.29 0.74	1.64
22 11 16 00-0372 LF 1" Hard Drawn Type M Copper Tube/Pipe <i>For Work In Restricted Working Space, Add</i>	5.33 0.82	1.83
22 11 16 00-0373 LF 1-1/4" Hard Drawn Type M Copper Tube/Pipe <i>For Work In Restricted Working Space, Add</i>	8.16 1.27	2.82
22 11 16 00-0374 LF 1-1/2" Hard Drawn Type M Copper Tube/Pipe <i>For Work In Restricted Working Space, Add</i>	10.80 1.46	3.23
22 11 16 00-0375 LF 2" Hard Drawn Type M Copper Tube/Pipe <i>For Work In Restricted Working Space, Add</i>	18.54 1.81	4.02
22 11 16 00-0376 LF 2-1/2" Hard Drawn Type M Copper Tube/Pipe <i>For Work In Restricted Working Space, Add</i>	33.19 4.86	10.81
22 11 16 00-0377 LF 3" Hard Drawn Type M Copper Tube/Pipe <i>For Work In Restricted Working Space, Add</i>	38.58 5.35	11.90
22 11 16 00-0378 LF 4" Hard Drawn Type M Copper Tube/Pipe <i>For Work In Restricted Working Space, Add</i>	56.58 6.24	13.88

22	Plumbing
22 10	Plumbing Piping
22 11	Facility Water Distribution



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 16 00-0379	LF		5" Hard Drawn Type M Copper Tube/Pipe.....	124.09	16.02
			<i>For Work In Restricted Working Space, Add</i>	7.21	
22 11 16 00-0380	LF		6" Hard Drawn Type M Copper Tube/Pipe.....	150.99	24.81
			<i>For Work In Restricted Working Space, Add</i>	11.16	
22 11 16 00-0381	LF		8" Hard Drawn Type M Copper Tube/Pipe.....	242.06	27.29
			<i>For Work In Restricted Working Space, Add</i>	12.28	
22 11 16 00-0382			Soft Drawn Type L Copper Tube (22 11 16 00-0336)		
22 11 16 00-0383	LF		1/4" Soft Drawn Type L Copper Tube	3.65	0.20
			<i>For Work In Restricted Working Space, Add</i>	0.81	
22 11 16 00-0384	LF		3/8" Soft Drawn Type L Copper Tube	4.30	1.87
			<i>For Work In Restricted Working Space, Add</i>	0.84	
22 11 16 00-0385	LF		1/2" Soft Drawn Type L Copper Tube	4.87	1.94
			<i>For Work In Restricted Working Space, Add</i>	0.88	
22 11 16 00-0386	LF		5/8" Soft Drawn Type L Copper Tube	5.61	2.01
			<i>For Work In Restricted Working Space, Add</i>	0.90	
22 11 16 00-0387	LF		3/4" Soft Drawn Type L Copper Tube	6.07	2.06
			<i>For Work In Restricted Working Space, Add</i>	0.93	
22 11 16 00-0388	LF		1" Soft Drawn Type L Copper Tube	7.74	2.33
			<i>For Work In Restricted Working Space, Add</i>	1.04	
22 11 16 00-0389	LF		1-1/4" Soft Drawn Type L Copper Tube	11.64	3.45
			<i>For Work In Restricted Working Space, Add</i>	1.55	
22 11 16 00-0390	LF		1-1/2" Soft Drawn Type L Copper Tube	14.07	3.86
			<i>For Work In Restricted Working Space, Add</i>	1.73	
22 11 16 00-0391	LF		2" Soft Drawn Type L Copper Tube	20.69	4.76
			<i>For Work In Restricted Working Space, Add</i>	2.14	
22 11 16 00-0392			Soft Drawn Type K Copper Tube (22 11 16 00-0336)		
22 11 16 00-0393	LF		1/4" Soft Drawn Type K Copper Tube	3.84	0.20
			<i>For Work In Restricted Working Space, Add</i>	0.81	
22 11 16 00-0394	LF		3/8" Soft Drawn Type K Copper Tube	4.87	1.87
			<i>For Work In Restricted Working Space, Add</i>	0.84	
22 11 16 00-0395	LF		1/2" Soft Drawn Type K Copper Tube	5.22	1.94
			<i>For Work In Restricted Working Space, Add</i>	0.88	
22 11 16 00-0396	LF		5/8" Soft Drawn Type K Copper Tube	5.97	2.01
			<i>For Work In Restricted Working Space, Add</i>	0.90	
22 11 16 00-0397	LF		3/4" Soft Drawn Type K Copper Tube	7.17	2.06
			<i>For Work In Restricted Working Space, Add</i>	0.93	
22 11 16 00-0398	LF		1" Soft Drawn Type K Copper Tube	8.91	2.33
			<i>For Work In Restricted Working Space, Add</i>	1.04	
22 11 16 00-0399	LF		1-1/4" Soft Drawn Type K Copper Tube	12.51	3.45
			<i>For Work In Restricted Working Space, Add</i>	1.55	
22 11 16 00-0400	LF		1-1/2" Soft Drawn Type K Copper Tube	15.40	3.86
			<i>For Work In Restricted Working Space, Add</i>	1.73	
22 11 16 00-0401	LF		2" Soft Drawn Type K Copper Tube	22.45	4.76
			<i>For Work In Restricted Working Space, Add</i>	2.14	
22 11 16 00-0402	LF		2-1/2" Soft Drawn Type K Copper Tube	26.96	5.71
			<i>For Work In Restricted Working Space, Add</i>	2.57	
22 11 16 00-0403	LF		3" Soft Drawn Type K Copper Tube	35.82	6.74
			<i>For Work In Restricted Working Space, Add</i>	3.03	
22 11 16 00-0404			Copper And Brass Fittings (22 11 16 00-0335)		
			Note: All fittings are based on 95/5 solder.		
22 11 16 00-0405			90 Degree Copper Elbows (22 11 16 00-0404)		
22 11 16 00-0406	EA		1/4" 90 Degree Copper Elbow	17.07	10.65
			<i>For Street Fitting, Add</i>	0.44	
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	2.40	
			<i>For Work In Restricted Working Space, Add</i>	4.79	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-1.65	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	2.45	
22 11 16 00-0407	EA		3/8" 90 Degree Copper Elbow	20.33	12.78
			<i>For Street Fitting, Add</i>	0.47	
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	2.87	
			<i>For Work In Restricted Working Space, Add</i>	5.75	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-1.97	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	2.93	
22 11 16 00-0408	EA		1/2" 90 Degree Copper Elbow	26.73	17.57
			<i>For Street Fitting, Add</i>	0.15	
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	3.95	
			<i>For Work In Restricted Working Space, Add</i>	7.91	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-2.65	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	3.97	
22 11 16 00-0409	EA		3/4" 90 Degree Copper Elbow	33.58	21.88
			<i>For Street Fitting, Add</i>	0.34	
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	4.91	
			<i>For Work In Restricted Working Space, Add</i>	9.82	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-3.32	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	4.95	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 16 00-0410 EA 1" 90 Degree Copper Elbow	41.21	26.11
For Street Fitting, Add	0.83	
For Brazed Fittings Instead Of 95/5 Solder, Add	5.87	
For Work In Restricted Working Space, Add	11.74	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-4.02	
For Silver Solder Instead Of 95/5 Solder, Add	5.97	
22 11 16 00-0411 EA 1-1/4" 90 Degree Copper Elbow	45.43	28.26
For Street Fitting, Add	1.24	
For Brazed Fittings Instead Of 95/5 Solder, Add	6.35	
For Work In Restricted Working Space, Add	12.70	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-4.39	
For Silver Solder Instead Of 95/5 Solder, Add	6.50	
22 11 16 00-0412 EA 1-1/2" 90 Degree Copper Elbow	51.17	30.90
For Street Fitting, Add	1.94	
For Brazed Fittings Instead Of 95/5 Solder, Add	6.95	
For Work In Restricted Working Space, Add	13.89	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-4.87	
For Silver Solder Instead Of 95/5 Solder, Add	7.19	
22 11 16 00-0413 EA 2" 90 Degree Copper Elbow	60.76	34.65
For Street Fitting, Add	3.54	
For Brazed Fittings Instead Of 95/5 Solder, Add	7.79	
For Work In Restricted Working Space, Add	15.57	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-5.63	
For Silver Solder Instead Of 95/5 Solder, Add	8.23	
22 11 16 00-0414 EA 2-1/2" 90 Degree Copper Elbow	70.30	35.28
For Brazed Fittings Instead Of 95/5 Solder, Add	7.94	
For Work In Restricted Working Space, Add	15.88	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-6.16	
For Silver Solder Instead Of 95/5 Solder, Add	8.81	
22 11 16 00-0415 EA 3" 90 Degree Copper Elbow	87.72	42.19
For Brazed Fittings Instead Of 95/5 Solder, Add	9.48	
For Work In Restricted Working Space, Add	18.96	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-7.55	
For Silver Solder Instead Of 95/5 Solder, Add	10.71	
22 11 16 00-0416 EA 4" 90 Degree Copper Elbow	149.13	59.83
For Brazed Fittings Instead Of 95/5 Solder, Add	13.45	
For Work In Restricted Working Space, Add	26.90	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-11.94	
For Silver Solder Instead Of 95/5 Solder, Add	16.42	
22 11 16 00-0417 EA 5" 90 Degree Copper Elbow	371.84	81.88
For Brazed Fittings Instead Of 95/5 Solder, Add	18.41	
For Work In Restricted Working Space, Add	36.82	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-24.73	
For Silver Solder Instead Of 95/5 Solder, Add	30.87	
22 11 16 00-0418 EA 6" 90 Degree Copper Elbow	510.68	119.15
For Brazed Fittings Instead Of 95/5 Solder, Add	26.79	
For Work In Restricted Working Space, Add	53.58	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-34.46	
For Silver Solder Instead Of 95/5 Solder, Add	43.40	
22 11 16 00-0419 EA 8" 90 Degree Copper Elbow	1,466.64	158.84
For Brazed Fittings Instead Of 95/5 Solder, Add	35.72	
For Work In Restricted Working Space, Add	71.44	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-85.24	
For Silver Solder Instead Of 95/5 Solder, Add	97.15	
22 11 16 00-0420 90 Degree Brass Elbows (22 11 16 00-0404)		
22 11 16 00-0421 EA 1/2" Drop Ear 90 Degree Brass Elbow.....	28.72	17.57
For Brazed Fittings Instead Of 95/5 Solder, Add	3.95	
For Work In Restricted Working Space, Add	7.91	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-2.75	
For Silver Solder Instead Of 95/5 Solder, Add	4.07	
22 11 16 00-0422 EA 3/4" Drop Ear 90 Degree Brass Elbow.....	39.65	21.88
For Brazed Fittings Instead Of 95/5 Solder, Add	4.91	
For Work In Restricted Working Space, Add	9.82	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-3.62	
For Silver Solder Instead Of 95/5 Solder, Add	5.26	
22 11 16 00-0423 EA 1/2" Flanged Sink 90 Degree Brass Elbow	30.68	17.57
For Brazed Fittings Instead Of 95/5 Solder, Add	3.95	
For Work In Restricted Working Space, Add	7.91	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-2.85	
For Silver Solder Instead Of 95/5 Solder, Add	4.17	
22 11 16 00-0424 EA 3/8" Drop Ear 90 Degree Brass Elbow, Solder X Threaded.....	22.71	12.78
For Brazed Fittings Instead Of 95/5 Solder, Add	2.87	
For Work In Restricted Working Space, Add	5.75	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-2.09	
For Silver Solder Instead Of 95/5 Solder, Add	3.05	
22 11 16 00-0425 EA 1/2" Drop Ear 90 Degree Brass Elbow, Solder X Threaded.....	28.89	17.57
For Brazed Fittings Instead Of 95/5 Solder, Add	3.95	
For Work In Restricted Working Space, Add	7.91	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-2.76	
For Silver Solder Instead Of 95/5 Solder, Add	4.08	

22	Plumbing
22 10	Plumbing Piping
22 11	Facility Water Distribution



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 16 00-0426	EA		3/4" Drop Ear 90 Degree Brass Elbow, Solder X Threaded.....	37.20	21.88
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	4.91	
			<i>For Work In Restricted Working Space, Add</i>	9.82	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-3.50	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	5.13	
22 11 16 00-0427	EA		1" Drop Ear 90 Degree Brass Elbow, Solder X Threaded.....	53.41	26.11
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	5.87	
			<i>For Work In Restricted Working Space, Add</i>	11.74	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-4.63	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	6.58	
22 11 16 00-0428			Reducing 90 Degree Copper Elbows (22 11 16 00-0404)		
22 11 16 00-0429	EA		1/2" Reducing 90 Degree Copper Elbow	29.42	17.57
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	3.95	
			<i>For Work In Restricted Working Space, Add</i>	7.91	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-2.79	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	4.11	
22 11 16 00-0430	EA		3/4" Reducing 90 Degree Copper Elbow	34.90	21.88
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	4.91	
			<i>For Work In Restricted Working Space, Add</i>	9.82	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-3.38	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	5.02	
22 11 16 00-0431	EA		1" Reducing 90 Degree Copper Elbow	43.12	26.11
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	5.87	
			<i>For Work In Restricted Working Space, Add</i>	11.74	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-4.11	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	6.07	
22 11 16 00-0432	EA		1-1/4" Reducing 90 Degree Copper Elbow	52.48	28.26
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	6.35	
			<i>For Work In Restricted Working Space, Add</i>	12.70	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-4.74	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	6.86	
22 11 16 00-0433	EA		1-1/2" Reducing 90 Degree Copper Elbow	59.67	30.90
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	6.95	
			<i>For Work In Restricted Working Space, Add</i>	13.89	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-5.30	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	7.61	
22 11 16 00-0434	EA		2" Reducing 90 Degree Copper Elbow	69.88	34.65
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	7.79	
			<i>For Work In Restricted Working Space, Add</i>	15.57	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-6.09	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	8.68	
22 11 16 00-0435			45 Degree Copper Elbows (22 11 16 00-0404)		
22 11 16 00-0436	EA		1/4" 45 Degree Copper Elbow	18.03	10.65
			<i>For Street Fitting, Add</i>	0.82	
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	2.40	
			<i>For Work In Restricted Working Space, Add</i>	4.79	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-1.70	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	2.50	
22 11 16 00-0437	EA		3/8" 45 Degree Copper Elbow	20.92	12.78
			<i>For Street Fitting, Add</i>	0.70	
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	2.87	
			<i>For Work In Restricted Working Space, Add</i>	5.75	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-2.00	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	2.96	
22 11 16 00-0438	EA		1/2" 45 Degree Copper Elbow	27.04	17.57
			<i>For Street Fitting, Add</i>	0.28	
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	3.95	
			<i>For Work In Restricted Working Space, Add</i>	7.91	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-2.67	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	3.99	
22 11 16 00-0439	EA		3/4" 45 Degree Copper Elbow	33.92	21.88
			<i>For Street Fitting, Add</i>	0.48	
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	4.91	
			<i>For Work In Restricted Working Space, Add</i>	9.82	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-3.33	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	4.97	
22 11 16 00-0440	EA		1" 45 Degree Copper Elbow	42.09	26.11
			<i>For Street Fitting, Add</i>	1.18	
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	5.87	
			<i>For Work In Restricted Working Space, Add</i>	11.74	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-4.06	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	6.02	
22 11 16 00-0441	EA		1-1/4" 45 Degree Copper Elbow	46.33	28.26
			<i>For Street Fitting, Add</i>	1.60	
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	6.35	
			<i>For Work In Restricted Working Space, Add</i>	12.70	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-4.43	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	6.55	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 16 00-0442 EA 1-1/2" 45 Degree Copper Elbow	51.23	30.90
For Street Fitting, Add	1.97	
For Brazed Fittings Instead Of 95/5 Solder, Add	6.95	
For Work In Restricted Working Space, Add	13.89	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-4.88	
For Silver Solder Instead Of 95/5 Solder, Add	7.19	
22 11 16 00-0443 EA 2" 45 Degree Copper Elbow	60.11	34.65
For Brazed Fittings Instead Of 95/5 Solder, Add	7.79	
For Work In Restricted Working Space, Add	15.57	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-5.60	
For Silver Solder Instead Of 95/5 Solder, Add	8.20	
22 11 16 00-0444 EA 2-1/2" 45 Degree Copper Elbow	70.09	35.28
For Brazed Fittings Instead Of 95/5 Solder, Add	7.94	
For Work In Restricted Working Space, Add	15.88	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-6.15	
For Silver Solder Instead Of 95/5 Solder, Add	8.80	
22 11 16 00-0445 EA 3" 45 Degree Copper Elbow	88.68	42.19
For Brazed Fittings Instead Of 95/5 Solder, Add	9.48	
For Work In Restricted Working Space, Add	18.96	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-7.59	
For Silver Solder Instead Of 95/5 Solder, Add	10.76	
22 11 16 00-0446 EA 4" 45 Degree Copper Elbow	143.99	59.83
For Brazed Fittings Instead Of 95/5 Solder, Add	13.45	
For Work In Restricted Working Space, Add	26.90	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-11.68	
For Silver Solder Instead Of 95/5 Solder, Add	16.17	
22 11 16 00-0447 EA 5" 45 Degree Copper Elbow	333.10	81.88
For Brazed Fittings Instead Of 95/5 Solder, Add	18.41	
For Work In Restricted Working Space, Add	36.82	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-22.79	
For Silver Solder Instead Of 95/5 Solder, Add	28.93	
22 11 16 00-0448 EA 6" 45 Degree Copper Elbow	510.12	119.15
For Brazed Fittings Instead Of 95/5 Solder, Add	26.79	
For Work In Restricted Working Space, Add	53.58	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-34.44	
For Silver Solder Instead Of 95/5 Solder, Add	43.37	
22 11 16 00-0449 EA 8" 45 Degree Copper Elbow	1,364.58	158.84
For Brazed Fittings Instead Of 95/5 Solder, Add	35.72	
For Work In Restricted Working Space, Add	71.44	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-80.14	
For Silver Solder Instead Of 95/5 Solder, Add	92.04	
22 11 16 00-0450 Straight Copper And Brass Tees (22 11 16 00-0404)		
22 11 16 00-0451 EA 1/4" Straight Copper Tee	26.26	15.97
For Brazed Fittings Instead Of 95/5 Solder, Add	3.59	
For Work In Restricted Working Space, Add	7.19	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-2.51	
For Silver Solder Instead Of 95/5 Solder, Add	3.71	
22 11 16 00-0452 EA 3/8" Straight Copper Tee	30.61	19.16
For Brazed Fittings Instead Of 95/5 Solder, Add	4.31	
For Work In Restricted Working Space, Add	8.63	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-2.97	
For Silver Solder Instead Of 95/5 Solder, Add	4.41	
22 11 16 00-0453 EA 1/2" Straight Copper Tee	40.57	26.67
For Brazed Fittings Instead Of 95/5 Solder, Add	5.99	
For Work In Restricted Working Space, Add	11.98	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-4.02	
For Silver Solder Instead Of 95/5 Solder, Add	6.02	
22 11 16 00-0454 EA 3/4" Straight Copper Tee	51.05	33.06
For Brazed Fittings Instead Of 95/5 Solder, Add	7.43	
For Work In Restricted Working Space, Add	14.85	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-5.03	
For Silver Solder Instead Of 95/5 Solder, Add	7.50	
22 11 16 00-0455 EA 1" Straight Copper Tee	63.76	39.44
For Brazed Fittings Instead Of 95/5 Solder, Add	8.86	
For Work In Restricted Working Space, Add	17.73	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-6.14	
For Silver Solder Instead Of 95/5 Solder, Add	9.10	
22 11 16 00-0456 EA 1-1/4" Straight Copper Tee	70.39	42.63
For Brazed Fittings Instead Of 95/5 Solder, Add	9.58	
For Work In Restricted Working Space, Add	19.16	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-6.71	
For Silver Solder Instead Of 95/5 Solder, Add	9.91	
22 11 16 00-0457 EA 1-1/2" Straight Copper Tee	79.32	46.31
For Brazed Fittings Instead Of 95/5 Solder, Add	10.42	
For Work In Restricted Working Space, Add	20.84	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-7.44	
For Silver Solder Instead Of 95/5 Solder, Add	10.91	
22 11 16 00-0458 EA 2" Straight Copper Tee	93.91	52.22
For Brazed Fittings Instead Of 95/5 Solder, Add	11.74	
For Work In Restricted Working Space, Add	23.48	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-8.61	
For Silver Solder Instead Of 95/5 Solder, Add	12.52	

22	Plumbing
22 10	Plumbing Piping
22 11	Facility Water Distribution



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 16 00-0459	EA		2-1/2" Straight Copper Tee	110.36	52.92
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	11.91	
			<i>For Work In Restricted Working Space, Add</i>	23.81	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-9.49	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	13.46	
22 11 16 00-0460	EA		3" Straight Copper Tee	142.87	63.73
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	14.33	
			<i>For Work In Restricted Working Space, Add</i>	28.67	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-11.92	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	16.70	
22 11 16 00-0461	EA		4" Straight Copper Tee	248.30	89.23
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	20.07	
			<i>For Work In Restricted Working Space, Add</i>	40.13	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-19.10	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	25.79	
22 11 16 00-0462	EA		5" Straight Copper Tee	557.43	122.09
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	27.45	
			<i>For Work In Restricted Working Space, Add</i>	54.91	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-37.02	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	46.17	
22 11 16 00-0463	EA		6" Straight Copper Tee	780.09	178.98
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	40.24	
			<i>For Work In Restricted Working Space, Add</i>	80.48	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-52.42	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	65.83	
22 11 16 00-0464	EA		8" Straight Copper Tee	2,331.51	238.29
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	53.58	
			<i>For Work In Restricted Working Space, Add</i>	107.17	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-134.44	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	152.30	
22 11 16 00-0465	EA		1/2" Cast Bronze Drop Ear Tee	43.92	26.67
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	5.99	
			<i>For Work In Restricted Working Space, Add</i>	11.98	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-4.19	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	6.19	
22 11 16 00-0466			Reducing Copper Tees <small>(22 11 16 00-0404)</small>		
22 11 16 00-0467	EA		3/8" Reducing Copper Tee	29.24	17.01
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	3.83	
			<i>For Work In Restricted Working Space, Add</i>	7.67	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-2.74	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	4.02	
22 11 16 00-0468	EA		1/2" Reducing Copper Tee	39.16	23.95
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	5.39	
			<i>For Work In Restricted Working Space, Add</i>	10.78	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-3.75	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	5.55	
22 11 16 00-0469	EA		3/4" Reducing Copper Tee	47.96	30.90
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	6.95	
			<i>For Work In Restricted Working Space, Add</i>	13.89	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-4.71	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	7.03	
22 11 16 00-0470	EA		1" Reducing Copper Tee	61.13	37.29
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	8.38	
			<i>For Work In Restricted Working Space, Add</i>	16.77	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-5.85	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	8.65	
22 11 16 00-0471	EA		1-1/4" Reducing Copper Tee	68.64	40.48
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	9.10	
			<i>For Work In Restricted Working Space, Add</i>	18.21	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-6.47	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	9.50	
22 11 16 00-0472	EA		1-1/2" Reducing Copper Tee	77.52	44.23
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	9.94	
			<i>For Work In Restricted Working Space, Add</i>	19.88	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-7.19	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	10.50	
22 11 16 00-0473	EA		2" Reducing Copper Tee	90.50	49.50
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	11.14	
			<i>For Work In Restricted Working Space, Add</i>	22.28	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-8.24	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	11.95	
22 11 16 00-0474	EA		2-1/2" Reducing Copper Tee	110.37	51.01
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	11.47	
			<i>For Work In Restricted Working Space, Add</i>	22.93	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-9.34	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	13.16	
22 11 16 00-0475	EA		3" Reducing Copper Tee	143.92	58.80
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	13.23	
			<i>For Work In Restricted Working Space, Add</i>	26.46	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-11.61	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	16.02	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 16 00-0476	EA		4" Reducing Copper Tee <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	226.09 16.32 32.63 -16.74 22.18	72.54
22 11 16 00-0477 Copper Couplings (22 11 16 00-0404)					
22 11 16 00-0478	EA		1/4" Copper Coupling..... <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	16.19 2.40 4.79 -1.61 2.41	10.65
22 11 16 00-0479	EA		3/8" Copper Coupling..... <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	19.45 2.87 5.75 -1.93 2.89	12.78
22 11 16 00-0480	EA		1/2" Copper Coupling..... <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	26.59 3.95 7.91 -2.65 3.96	17.57
22 11 16 00-0481	EA		3/4" Copper Coupling..... <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	33.22 4.91 9.82 -3.30 4.93	21.88
22 11 16 00-0482	EA		1" Copper Coupling..... <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	40.11 5.87 11.74 -3.96 5.92	26.11
22 11 16 00-0483	EA		1-1/4" Copper Coupling <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	44.04 6.35 12.70 -4.32 6.43	28.26
22 11 16 00-0484	EA		1-1/2" Copper Coupling <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	48.59 6.95 13.89 -4.75 7.06	30.90
22 11 16 00-0485	EA		2" Copper Coupling..... <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	55.69 7.79 15.57 -5.38 7.97	34.34
22 11 16 00-0486	EA		2-1/2" Copper Coupling <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	57.77 7.50 14.99 -5.39 7.89	33.37
22 11 16 00-0487	EA		3" Copper Coupling..... <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	70.87 9.04 18.08 -6.56 9.57	40.43
22 11 16 00-0488	EA		4" Copper Coupling..... <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	104.21 12.13 24.26 -9.25 13.30	54.39
22 11 16 00-0489	EA		5" Copper Coupling..... <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	158.94 16.54 33.08 -13.46 18.97	99.23
22 11 16 00-0490	EA		6" Copper Coupling..... <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	242.16 24.26 48.51 -20.19 28.28	107.82
22 11 16 00-0491	EA		8" Copper Coupling..... <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	475.45 32.19 64.39 -34.50 45.24	142.96
22 11 16 00-0492 Reducing Copper Couplings (22 11 16 00-0404)					
22 11 16 00-0493	EA		3/8" Reducing Copper Coupling <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	16.45 2.40 4.79 -1.62 2.42	10.62

22	Plumbing
22 10	Plumbing Piping
22 11	Facility Water Distribution



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 16 00-0494 EA 1/2" Reducing Copper Coupling.....	23.26	15.17
For Brazed Fittings Instead Of 95/5 Solder, Add	3.41	
For Work In Restricted Working Space, Add	6.83	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-2.30	
For Silver Solder Instead Of 95/5 Solder, Add	3.44	
22 11 16 00-0495 EA 3/4" Reducing Copper Coupling.....	30.41	19.73
For Brazed Fittings Instead Of 95/5 Solder, Add	4.43	
For Work In Restricted Working Space, Add	8.86	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-3.00	
For Silver Solder Instead Of 95/5 Solder, Add	4.47	
22 11 16 00-0496 EA 1-1/2" Reducing Copper Coupling.....	37.51	23.95
For Brazed Fittings Instead Of 95/5 Solder, Add	5.39	
For Work In Restricted Working Space, Add	10.78	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-3.67	
For Silver Solder Instead Of 95/5 Solder, Add	5.47	
22 11 16 00-0497 EA 1-1/4" Reducing Copper Coupling.....	42.91	27.15
For Brazed Fittings Instead Of 95/5 Solder, Add	6.11	
For Work In Restricted Working Space, Add	12.22	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-4.18	
For Silver Solder Instead Of 95/5 Solder, Add	6.22	
22 11 16 00-0498 EA 1-1/2" Reducing Copper Coupling.....	47.94	29.54
For Brazed Fittings Instead Of 95/5 Solder, Add	6.65	
For Work In Restricted Working Space, Add	13.29	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-4.61	
For Silver Solder Instead Of 95/5 Solder, Add	6.83	
22 11 16 00-0499 EA 2" Reducing Copper Coupling.....	54.73	32.73
For Brazed Fittings Instead Of 95/5 Solder, Add	7.37	
For Work In Restricted Working Space, Add	14.73	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-5.19	
For Silver Solder Instead Of 95/5 Solder, Add	7.65	
22 11 16 00-0500 EA 2-1/2" Reducing Copper Coupling.....	61.91	33.59
For Brazed Fittings Instead Of 95/5 Solder, Add	7.55	
For Work In Restricted Working Space, Add	15.11	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-5.61	
For Silver Solder Instead Of 95/5 Solder, Add	8.13	
22 11 16 00-0501 EA 3" Reducing Copper Coupling.....	72.36	38.96
For Brazed Fittings Instead Of 95/5 Solder, Add	8.71	
For Work In Restricted Working Space, Add	17.42	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-6.52	
For Silver Solder Instead Of 95/5 Solder, Add	9.43	
22 11 16 00-0502 EA 4" Reducing Copper Coupling.....	104.81	51.01
For Brazed Fittings Instead Of 95/5 Solder, Add	11.47	
For Work In Restricted Working Space, Add	22.93	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-9.06	
For Silver Solder Instead Of 95/5 Solder, Add	12.88	
22 11 16 00-0503 EA 5" Reducing Copper Coupling.....	217.51	71.07
For Brazed Fittings Instead Of 95/5 Solder, Add	15.99	
For Work In Restricted Working Space, Add	31.97	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-16.20	
For Silver Solder Instead Of 95/5 Solder, Add	21.53	
22 11 16 00-0504 EA 6" Reducing Copper Coupling.....	315.12	95.55
For Brazed Fittings Instead Of 95/5 Solder, Add	21.50	
For Work In Restricted Working Space, Add	43.00	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-22.92	
For Silver Solder Instead Of 95/5 Solder, Add	30.09	
22 11 16 00-0505 EA 8" Reducing Copper Coupling.....	572.94	139.23
For Brazed Fittings Instead Of 95/5 Solder, Add	31.31	
For Work In Restricted Working Space, Add	62.62	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-39.08	
For Silver Solder Instead Of 95/5 Solder, Add	49.52	
22 11 16 00-0506 Male Copper Adapters (22 11 16 00-0404)		
22 11 16 00-0507 EA 1/4" Male Copper Adapter.....	19.87	10.38
For Brazed Fittings Instead Of 95/5 Solder, Add	2.40	
For Work In Restricted Working Space, Add	4.79	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-1.79	
For Silver Solder Instead Of 95/5 Solder, Add	2.59	
22 11 16 00-0508 EA 3/8" Male Copper Adapter.....	21.10	12.78
For Brazed Fittings Instead Of 95/5 Solder, Add	2.87	
For Work In Restricted Working Space, Add	5.75	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-2.01	
For Silver Solder Instead Of 95/5 Solder, Add	2.97	
22 11 16 00-0509 EA 1/2" Male Copper Adapter.....	24.74	15.97
For Brazed Fittings Instead Of 95/5 Solder, Add	3.59	
For Work In Restricted Working Space, Add	7.19	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-2.43	
For Silver Solder Instead Of 95/5 Solder, Add	3.63	
22 11 16 00-0510 EA 3/4" Male Copper Adapter.....	30.87	19.96
For Brazed Fittings Instead Of 95/5 Solder, Add	4.43	
For Work In Restricted Working Space, Add	8.86	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-3.02	
For Silver Solder Instead Of 95/5 Solder, Add	4.50	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 16 00-0511 EA 1" Male Copper Adapter <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	37.73 5.15 10.30 -3.60 5.32	23.16
22 11 16 00-0512 EA 1-1/4" Male Copper Adapter <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	44.86 5.99 11.98 -4.24 6.24	26.35
22 11 16 00-0513 EA 1-1/2" Male Copper Adapter <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	51.29 6.83 13.65 -4.84 7.12	30.34
22 11 16 00-0514 EA 2" Male Copper Adapter <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	68.07 8.74 17.49 -6.32 9.23	38.73
22 11 16 00-0515 EA 2-1/2" Male Copper Adapter <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	106.15 11.26 22.52 -9.06 12.81	50.31
22 11 16 00-0516 EA 3" Male Copper Adapter <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	141.12 14.99 29.99 -12.05 17.05	67.07
22 11 16 00-0517 EA 4" Male Copper Adapter <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	206.95 21.17 42.34 -17.40 24.46	94.08
22 11 16 00-0518 Female Copper Adapters <small>(22 11 16 00-0404)</small>		
22 11 16 00-0519 EA 1/4" Female Copper Adapter <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	18.46 2.40 4.79 -1.72 2.52	10.38
22 11 16 00-0520 EA 3/8" Female Copper Adapter <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	21.76 2.87 5.75 -2.05 3.00	12.78
22 11 16 00-0521 EA 1/2" Female Copper Adapter <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	25.21 3.59 7.19 -2.46 3.66	15.97
22 11 16 00-0522 EA 3/4" Female Copper Adapter <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	31.26 4.43 8.86 -3.04 4.52	19.96
22 11 16 00-0523 EA 1" Female Copper Adapter <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	38.28 5.15 10.30 -3.63 5.35	23.16
22 11 16 00-0524 EA 1-1/4" Female Copper Adapter <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	45.70 5.99 11.98 -4.28 6.28	26.35
22 11 16 00-0525 EA 1-1/2" Female Copper Adapter <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	54.55 6.83 13.65 -5.00 7.28	30.34
22 11 16 00-0526 EA 2" Female Copper Adapter <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	70.55 8.74 17.49 -6.44 9.36	38.73
22 11 16 00-0527 EA 2-1/2" Female Copper Adapter <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	112.96 10.36 20.73 -9.10 12.56	46.31

22	Plumbing
22 10	Plumbing Piping
22 11	Facility Water Distribution



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 16 00-0528	EA		3" Female Copper Adapter	173.86	67.07
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	14.99	
			<i>For Work In Restricted Working Space, Add</i>	29.99	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-13.69	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	18.69	
22 11 16 00-0529			Wrot Copper, Solder Union (22 11 16 00-0404)		
22 11 16 00-0530	EA		1/4" Wrot Copper, Solder Union	24.68	12.78
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	2.87	
			<i>For Work In Restricted Working Space, Add</i>	5.75	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-2.19	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	3.15	
22 11 16 00-0531	EA		3/8" Wrot Copper, Solder Union	28.85	15.41
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	3.47	
			<i>For Work In Restricted Working Space, Add</i>	6.95	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-2.60	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	3.76	
22 11 16 00-0532	EA		1/2" Wrot Copper, Solder Union	32.27	19.16
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	4.31	
			<i>For Work In Restricted Working Space, Add</i>	8.63	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-3.05	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	4.49	
22 11 16 00-0533	EA		3/4" Wrot Copper, Solder Union	37.06	21.88
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	4.91	
			<i>For Work In Restricted Working Space, Add</i>	9.82	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-3.49	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	5.13	
22 11 16 00-0534	EA		1" Wrot Copper, Solder Union	46.56	26.11
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	5.87	
			<i>For Work In Restricted Working Space, Add</i>	11.74	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-4.28	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	6.24	
22 11 16 00-0535	EA		1-1/4" Wrot Copper, Solder Union	53.88	28.75
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	6.47	
			<i>For Work In Restricted Working Space, Add</i>	12.94	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-4.85	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	7.01	
22 11 16 00-0536	EA		1-1/2" Wrot Copper, Solder Union	63.09	31.94
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	7.19	
			<i>For Work In Restricted Working Space, Add</i>	14.37	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-5.55	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	7.95	
22 11 16 00-0537	EA		2" Wrot Copper, Solder Union	83.35	38.32
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	8.62	
			<i>For Work In Restricted Working Space, Add</i>	17.24	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-7.04	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	9.92	
22 11 16 00-0538	EA		2-1/2" Wrot Copper, Solder Union	133.76	42.19
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	9.48	
			<i>For Work In Restricted Working Space, Add</i>	18.96	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-9.85	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	13.01	
22 11 16 00-0539	EA		3" Wrot Copper, Solder Union	272.24	59.83
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	13.45	
			<i>For Work In Restricted Working Space, Add</i>	26.90	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-18.10	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	22.58	
22 11 16 00-0540			Cast Bronze, Solder Union (22 11 16 00-0404)		
22 11 16 00-0541	EA		1/4" Cast Bronze, Solder Union	26.72	12.78
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	2.87	
			<i>For Work In Restricted Working Space, Add</i>	5.75	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-2.29	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	3.25	
22 11 16 00-0542	EA		3/8" Cast Bronze, Solder Union	30.77	15.41
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	3.47	
			<i>For Work In Restricted Working Space, Add</i>	6.95	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-2.70	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	3.85	
22 11 16 00-0543	EA		1/2" Cast Bronze, Solder Union	32.80	19.16
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	4.31	
			<i>For Work In Restricted Working Space, Add</i>	8.63	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-3.08	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	4.52	
22 11 16 00-0544	EA		3/4" Cast Bronze, Solder Union	37.81	21.88
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	4.91	
			<i>For Work In Restricted Working Space, Add</i>	9.82	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-3.53	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	5.16	
22 11 16 00-0545	EA		1" Cast Bronze, Solder Union	47.88	26.11
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	5.87	
			<i>For Work In Restricted Working Space, Add</i>	11.74	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-4.35	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	6.31	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 16 00-0546 EA 1-1/4" Cast Bronze, Solder Union..... <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	57.47 6.47 12.94 -5.03 7.19	28.75
22 11 16 00-0547 EA 1-1/2" Cast Bronze, Solder Union..... <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	66.83 7.19 14.37 -5.74 8.13	31.94
22 11 16 00-0548 EA 2" Cast Bronze, Solder Union..... <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	89.73 8.62 17.24 -7.36 10.23	38.32
22 11 16 00-0549 EA 2-1/2" Cast Bronze, Solder Union..... <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	133.76 9.48 18.96 -9.85 13.01	42.19
22 11 16 00-0550 EA 3" Cast Bronze, Solder Union..... <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	272.24 13.45 26.90 -18.10 22.58	59.83
22 11 16 00-0551 Cast Bronze, Solder X Female Threaded Union (22 11 16 00-0404)		
22 11 16 00-0552 EA 1/4" Cast Bronze, Solder X Female Threaded Union..... <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	29.47 2.87 5.75 -2.43 3.39	12.78
22 11 16 00-0553 EA 3/8" Cast Bronze, Solder X Female Threaded Union..... <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	33.83 3.47 6.95 -2.85 4.01	15.41
22 11 16 00-0554 EA 1/2" Cast Bronze, Solder X Female Threaded Union..... <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	37.22 4.31 8.63 -3.30 4.74	19.16
22 11 16 00-0555 EA 3/4" Cast Bronze, Solder X Female Threaded Union..... <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	44.28 4.91 9.82 -3.85 5.49	21.88
22 11 16 00-0556 EA 1" Cast Bronze, Solder X Female Threaded Union..... <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	63.15 5.87 11.74 -5.11 7.07	26.11
22 11 16 00-0557 EA 1-1/4" Cast Bronze, Solder X Female Threaded Union..... <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	87.89 6.47 12.94 -6.55 8.71	28.75
22 11 16 00-0558 EA 1-1/2" Cast Bronze, Solder X Female Threaded Union..... <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	104.63 7.19 14.37 -7.63 10.02	31.94
22 11 16 00-0559 EA 2" Cast Bronze, Solder X Female Threaded Union..... <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	153.49 8.62 17.24 -10.55 13.42	38.32
22 11 16 00-0560 EA 2-1/2" Cast Bronze, Solder X Female Threaded Union..... <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	245.22 9.48 18.96 -15.42 18.58	42.19
22 11 16 00-0561 Cast Bronze, Solder X Male Threaded Union (22 11 16 00-0404)		
22 11 16 00-0562 EA 1/4" Cast Bronze, Solder X Male Threaded Union..... <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	27.01 2.87 5.75 -2.31 3.27	12.78
22 11 16 00-0563 EA 3/8" Cast Bronze, Solder X Male Threaded Union..... <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	32.33 3.47 6.95 -2.77 3.93	15.41

22	Plumbing
22 10	Plumbing Piping
22 11	Facility Water Distribution



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 16 00-0564	EA		1/2" Cast Bronze, Solder X Male Threaded Union.....	35.44	19.16
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	4.31	
			<i>For Work In Restricted Working Space, Add</i>	8.63	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-3.21	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	4.65	
22 11 16 00-0565	EA		3/4" Cast Bronze, Solder X Male Threaded Union.....	42.77	21.88
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	4.91	
			<i>For Work In Restricted Working Space, Add</i>	9.82	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-3.78	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	5.41	
22 11 16 00-0566	EA		1" Cast Bronze, Solder X Male Threaded Union.....	63.85	26.11
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	5.87	
			<i>For Work In Restricted Working Space, Add</i>	11.74	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-5.15	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	7.11	
22 11 16 00-0567	EA		1-1/4" Cast Bronze, Solder X Male Threaded Union.....	73.78	28.75
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	6.47	
			<i>For Work In Restricted Working Space, Add</i>	12.94	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-5.85	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	8.00	
22 11 16 00-0568	EA		1-1/2" Cast Bronze, Solder X Male Threaded Union.....	80.11	31.94
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	7.19	
			<i>For Work In Restricted Working Space, Add</i>	14.37	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-6.40	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	8.80	
22 11 16 00-0569	EA		2" Cast Bronze, Solder X Male Threaded Union.....	106.95	38.32
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	8.62	
			<i>For Work In Restricted Working Space, Add</i>	17.24	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-8.22	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	11.10	
22 11 16 00-0570	EA		2-1/2" Cast Bronze, Solder X Male Threaded Union.....	208.17	42.19
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	9.48	
			<i>For Work In Restricted Working Space, Add</i>	18.96	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-13.57	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	16.73	
22 11 16 00-0571			Copper Caps (22 11 16 00-0404)		
22 11 16 00-0572	EA		1/4" Copper Cap	3.33	2.02
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	0.45	
			<i>For Work In Restricted Working Space, Add</i>	0.90	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-0.32	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	0.47	
22 11 16 00-0573	EA		3/8" Copper Cap	3.73	2.13
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	0.48	
			<i>For Work In Restricted Working Space, Add</i>	0.96	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-0.35	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	0.51	
22 11 16 00-0574	EA		1/2" Copper Cap	3.66	2.29
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	0.51	
			<i>For Work In Restricted Working Space, Add</i>	1.02	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-0.35	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	0.52	
22 11 16 00-0575	EA		3/4" Copper Cap	4.76	2.87
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	0.64	
			<i>For Work In Restricted Working Space, Add</i>	1.28	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-0.45	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	0.66	
22 11 16 00-0576	EA		1" Copper Cap	6.60	3.63
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	0.81	
			<i>For Work In Restricted Working Space, Add</i>	1.62	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-0.60	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	0.87	
22 11 16 00-0577	EA		1-1/4" Copper Cap	9.00	4.98
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	1.11	
			<i>For Work In Restricted Working Space, Add</i>	2.21	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-0.82	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	1.19	
22 11 16 00-0578	EA		1-1/2" Copper Cap	11.03	5.86
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	1.30	
			<i>For Work In Restricted Working Space, Add</i>	2.60	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-0.99	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	1.42	
22 11 16 00-0579	EA		2" Copper Cap	23.68	13.05
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	2.90	
			<i>For Work In Restricted Working Space, Add</i>	5.80	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-2.15	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	3.12	
22 11 16 00-0580	EA		2-1/2" Copper Cap	42.42	19.85
			<i>For Brazed Fittings Instead Of 95/5 Solder, Add</i>	4.41	
			<i>For Work In Restricted Working Space, Add</i>	8.82	
			<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-3.59	
			<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	5.06	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 16 00-0581 EA 3" Copper Cap <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	57.23 5.79 11.57 -4.79 6.72	26.05
22 11 16 00-0582 EA 4" Copper Cap <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	81.14 6.89 13.78 -6.35 8.65	31.01
22 11 16 00-0583 EA 5" Cast Bronze Cap <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	311.20 9.57 19.14 -18.75 21.94	42.55
22 11 16 00-0584 EA 6" Cast Bronze Cap <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	574.57 12.25 24.50 -32.81 36.89	55.13
22 11 16 00-0585 EA 8" Cast Bronze Cap <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	743.18 17.64 35.28 -43.04 48.92	79.38
22 11 16 00-0586 Copper Crosses (22 11 16 00-0404)		
22 11 16 00-0587 EA 1/2" Copper Cross <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	52.84 7.28 14.55 -5.07 7.49	32.34
22 11 16 00-0588 EA 3/4" Copper Cross <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	68.69 9.04 18.08 -6.45 9.46	40.21
22 11 16 00-0589 EA 1" Copper Cross <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	86.33 10.80 21.61 -7.92 11.52	47.99
22 11 16 00-0590 EA 1-1/4" Copper Cross <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	98.46 11.69 23.37 -8.82 12.71	51.96
22 11 16 00-0591 EA 1-1/2" Copper Cross <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	114.56 12.79 25.58 -9.99 14.25	56.82
22 11 16 00-0592 EA 2" Copper Cross <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	150.90 14.33 28.67 -12.32 17.10	63.73
22 11 16 00-0593 EA 2-1/2" Copper Cross <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	233.42 15.88 31.75 -16.96 22.26	70.56
22 11 16 00-0594 Cast Bronze Crosses (22 11 16 00-0404)		
22 11 16 00-0595 EA 3/8" Cast Bronze Cross <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	41.06 5.29 10.58 -3.82 5.58	23.52
22 11 16 00-0596 EA 1/2" Cast Bronze Cross <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	53.71 7.28 14.55 -5.11 7.54	32.34
22 11 16 00-0597 EA 3/4" Cast Bronze Cross <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	70.37 9.04 18.08 -6.53 9.55	40.21
22 11 16 00-0598 EA 1" Cast Bronze Cross <i>For Brazed Fittings Instead Of 95/5 Solder, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i>	89.19 10.80 21.61 -8.06 11.66	47.99



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 16 00-0599 EA 1-1/4" Cast Bronze Cross	102.57	51.96
For Brazed Fittings Instead Of 95/5 Solder, Add	11.69	
For Work In Restricted Working Space, Add	23.37	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-9.02	
For Silver Solder Instead Of 95/5 Solder, Add	12.92	
22 11 16 00-0600 EA 1-1/2" Cast Bronze Cross	120.41	56.82
For Brazed Fittings Instead Of 95/5 Solder, Add	12.79	
For Work In Restricted Working Space, Add	25.58	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-10.28	
For Silver Solder Instead Of 95/5 Solder, Add	14.55	
22 11 16 00-0601 EA 2" Cast Bronze Cross.....	161.96	63.73
For Brazed Fittings Instead Of 95/5 Solder, Add	14.33	
For Work In Restricted Working Space, Add	28.67	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-12.88	
For Silver Solder Instead Of 95/5 Solder, Add	17.65	
22 11 16 00-0602 EA 2-1/2" Cast Bronze Cross	258.93	70.56
For Brazed Fittings Instead Of 95/5 Solder, Add	15.88	
For Work In Restricted Working Space, Add	31.75	
For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct	-18.24	
For Silver Solder Instead Of 95/5 Solder, Add	23.53	
22 11 16 00-0603 Crimped Copper Fittings (22 11 16 00-0335)		
Note: Viega ProPress type. Includes factory installed ethylene propylene diene monomer (EPDM) sealing elements.		
22 11 16 00-0604 Crimped Copper 90 Degree Elbows (22 11 16 00-0603)		
22 11 16 00-0605 EA 1/2" Crimped Copper 90 Degree Elbow	14.99	9.59
22 11 16 00-0606 EA 3/4" Crimped Copper 90 Degree Elbow	17.42	10.94
22 11 16 00-0607 EA 1" Crimped Copper 90 Degree Elbow	21.67	13.02
22 11 16 00-0608 EA 1-1/4" Crimped Copper 90 Degree Elbow	25.82	14.37
22 11 16 00-0609 EA 1-1/2" Crimped Copper 90 Degree Elbow	32.02	15.97
22 11 16 00-0610 EA 2" Crimped Copper 90 Degree Elbow	39.97	19.16
22 11 16 00-0611 EA 2-1/2" Crimped Copper 90 Degree Elbow	66.12	22.35
22 11 16 00-0612 EA 3" Crimped Copper 90 Degree Elbow	80.93	26.59
22 11 16 00-0613 EA 4" Crimped Copper 90 Degree Elbow	103.43	35.13
22 11 16 00-0614 Crimped Copper 45 Degree Elbows (22 11 16 00-0603)		
22 11 16 00-0615 EA 1/2" Crimped Copper 45 Degree Elbow	15.09	9.59
22 11 16 00-0616 EA 3/4" Crimped Copper 45 Degree Elbow	17.26	10.94
22 11 16 00-0617 EA 1" Crimped Copper 45 Degree Elbow	22.42	13.02
22 11 16 00-0618 EA 1-1/4" Crimped Copper 45 Degree Elbow	25.66	14.37
22 11 16 00-0619 EA 1-1/2" Crimped Copper 45 Degree Elbow	30.60	15.97
22 11 16 00-0620 EA 2" Crimped Copper 45 Degree Elbow	38.05	19.16
22 11 16 00-0621 EA 2-1/2" Crimped Copper 45 Degree Elbow	55.06	22.35
22 11 16 00-0622 EA 3" Crimped Copper 45 Degree Elbow	70.68	26.59
22 11 16 00-0623 EA 4" Crimped Copper 45 Degree Elbow	95.42	35.13
22 11 16 00-0624 Crimped Copper Straight Tees (22 11 16 00-0603)		
22 11 16 00-0625 EA 1/2" Crimped Copper Straight Tee	22.51	14.37
22 11 16 00-0626 EA 3/4" Crimped Copper Straight Tee	30.02	18.92
22 11 16 00-0627 EA 1" Crimped Copper Straight Tee	34.56	21.00
22 11 16 00-0628 EA 1-1/4" Crimped Copper Straight Tee	37.45	21.56
22 11 16 00-0629 EA 1-1/2" Crimped Copper Straight Tee	46.67	24.51
22 11 16 00-0630 EA 2" Crimped Copper Straight Tee	55.40	28.75
22 11 16 00-0631 EA 2-1/2" Crimped Copper Straight Tee	90.58	33.53
22 11 16 00-0632 EA 3" Crimped Copper Straight Tee	110.22	39.92
22 11 16 00-0633 EA 4" Crimped Copper Straight Tee	149.67	52.70
22 11 16 00-0634 Crimped Copper Reducing Tees (22 11 16 00-0603)		
22 11 16 00-0635 EA 3/4" Crimped Copper Reducing Tee	23.11	13.65
22 11 16 00-0636 EA 1" Crimped Copper Reducing Tee	31.50	17.96
22 11 16 00-0637 EA 1-1/4" Crimped Copper Reducing Tee	34.63	19.96
22 11 16 00-0638 EA 1-1/2" Crimped Copper Reducing Tee	39.56	20.52
22 11 16 00-0639 EA 2" Crimped Copper Reducing Tee	46.05	23.24
22 11 16 00-0640 EA 2-1/2" Crimped Copper Reducing Tee	87.22	26.35
22 11 16 00-0641 EA 3" Crimped Copper Reducing Tee	105.82	31.94
22 11 16 00-0642 EA 4" Crimped Copper Reducing Tee	129.77	42.56
22 11 16 00-0643 Crimped Copper Couplings (22 11 16 00-0603)		
22 11 16 00-0644 EA 1/2" Crimped Copper Coupling	14.93	9.59
22 11 16 00-0645 EA 3/4" Crimped Copper Coupling	17.22	10.94
22 11 16 00-0646 EA 1" Crimped Copper Coupling	21.28	13.02
22 11 16 00-0647 EA 1-1/4" Crimped Copper Coupling	23.69	14.37
22 11 16 00-0648 EA 1-1/2" Crimped Copper Coupling	27.92	15.97
22 11 16 00-0649 EA 2" Crimped Copper Coupling	33.82	19.16
22 11 16 00-0650 EA 2-1/2" Crimped Copper Coupling	49.76	22.35
22 11 16 00-0651 EA 3" Crimped Copper Coupling	60.59	26.59



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 16 00-0652	EA		4" Crimped Copper Coupling.....	81.41	35.13
22 11 16 00-0653			Crimped Copper Reducing Couplings (22 11 16 00-0603)		
22 11 16 00-0654	EA		3/4" Crimped Copper Reducing Coupling.....	16.20	9.10
22 11 16 00-0655	EA		1" Crimped Copper Reducing Coupling.....	18.49	10.38
22 11 16 00-0656	EA		1-1/4" Crimped Copper Reducing Coupling.....	22.86	12.37
22 11 16 00-0657	EA		1-1/2" Crimped Copper Reducing Coupling.....	26.77	13.65
22 11 16 00-0658	EA		2" Crimped Copper Reducing Coupling.....	29.80	15.17
22 11 16 00-0659	EA		2-1/2" Crimped Copper FTG x C Reducing Coupling.....	46.33	18.12
22 11 16 00-0660	EA		3" Crimped Copper FTG x C Reducing Coupling.....	56.40	21.32
22 11 16 00-0661	EA		4" Crimped Copper FTG x C Reducing Coupling.....	73.88	28.18
22 11 16 00-0662			Crimped Copper Male Adapters (22 11 16 00-0603)		
22 11 16 00-0663	EA		1/2" Crimped Copper Male Adapter.....	15.05	9.59
22 11 16 00-0664	EA		3/4" Crimped Copper Male Adapter.....	17.61	10.94
22 11 16 00-0665	EA		1" Crimped Copper Male Adapter.....	21.84	13.02
22 11 16 00-0666	EA		1-1/4" Crimped Copper Male Adapter.....	26.55	14.37
22 11 16 00-0667	EA		1-1/2" Crimped Copper Male Adapter.....	30.95	15.97
22 11 16 00-0668	EA		2" Crimped Copper Male Adapter.....	42.23	19.16
22 11 16 00-0669	EA		2-1/2" Crimped Copper Male Adapter.....	66.12	22.35
22 11 16 00-0670	EA		3" Crimped Copper Male Adapter.....	80.93	26.59
22 11 16 00-0671	EA		4" Crimped Copper Male Adapter.....	100.17	35.13
22 11 16 00-0672			Crimped Copper Female Adapters (22 11 16 00-0603)		
22 11 16 00-0673	EA		1/2" Crimped Copper Female Adapter.....	15.20	9.59
22 11 16 00-0674	EA		3/4" Crimped Copper Female Adapter.....	17.72	10.94
22 11 16 00-0675	EA		1" Crimped Copper Female Adapter.....	22.04	13.02
22 11 16 00-0676	EA		1-1/4" Crimped Copper Female Adapter.....	27.17	14.37
22 11 16 00-0677	EA		1-1/2" Crimped Copper Female Adapter.....	32.11	15.97
22 11 16 00-0678	EA		2" Crimped Copper Female Adapter.....	42.60	19.16
22 11 16 00-0679			Crimped Copper Caps (22 11 16 00-0603)		
22 11 16 00-0680	EA		1/2" Crimped Copper Cap.....	8.39	4.79
22 11 16 00-0681	EA		3/4" Crimped Copper Cap.....	10.42	5.59
22 11 16 00-0682	EA		1" Crimped Copper Cap.....	12.72	6.38
22 11 16 00-0683	EA		1-1/4" Crimped Copper Cap.....	14.32	7.19
22 11 16 00-0684	EA		1-1/2" Crimped Copper Cap.....	17.86	8.23
22 11 16 00-0685	EA		2" Crimped Copper Cap.....	21.04	9.59
22 11 16 00-0686	EA		2-1/2" Crimped Copper Cap.....	38.08	11.18
22 11 16 00-0687	EA		3" Crimped Copper Cap.....	46.93	13.33
22 11 16 00-0688	EA		4" Crimped Copper Cap.....	62.29	17.57
22 11 16 00-0689			C x F NPT Crimped Bronze Unions (22 11 16 00-0603)		
22 11 16 00-0690	EA		1/2" C x F NPT Crimped Bronze Union.....	23.08	13.02
22 11 16 00-0691	EA		3/4" C x F NPT Crimped Bronze Union.....	28.55	16.05
22 11 16 00-0692	EA		1" C x F NPT Crimped Bronze Union.....	36.33	19.24
22 11 16 00-0693	EA		1-1/4" C x F NPT Crimped Bronze Union.....	42.86	22.19
22 11 16 00-0694	EA		1-1/2" C x F NPT Crimped Bronze Union.....	47.48	21.72
22 11 16 00-0695	EA		2" C x F NPT Crimped Bronze Union.....	66.86	31.46
22 11 16 00-0696			C x C Crimped Bronze Unions (22 11 16 00-0603)		
22 11 16 00-0697	EA		1/2" C x C Bronze Crimped Union.....	18.76	9.59
22 11 16 00-0698	EA		3/4" C x C Bronze Crimped Union.....	22.12	10.94
22 11 16 00-0699	EA		1" C x C Bronze Crimped Union.....	28.75	13.02
22 11 16 00-0700	EA		1-1/4" C x C Bronze Crimped Union.....	34.68	14.37
22 11 16 00-0701	EA		1-1/2" C x C Bronze Crimped Union.....	41.77	15.97
22 11 16 00-0702	EA		2" C x C Bronze Crimped Union.....	57.86	19.16
22 11 16 00-0703			C x Flange Crimped Bronze Flange (22 11 16 00-0603)		
22 11 16 00-0704	EA		2-1/2" C x Flange Crimped Bronze Flange.....	95.85	22.35
22 11 16 00-0705	EA		3" C x Flange Crimped Bronze Flange.....	107.00	26.59
22 11 16 00-0706	EA		4" C x Flange Crimped Bronze Flange.....	127.79	35.13
22 11 16 00-0707			Field Installed FKM Seals (22 11 16 00-0603)		
			Note: For vacuum systems. Includes removing factory installed ethylene propylene diene monomer (EPDM) seal and installing FKM seal.		
22 11 16 00-0708	EA		1/2" Field Installed FKM Seal.....	3.94	
			Note: To be used in conjunction with fittings.		
22 11 16 00-0709	EA		3/4" Field Installed FKM Seal.....	4.73	
			Note: To be used in conjunction with fittings.		
22 11 16 00-0710	EA		1" Field Installed FKM Seal.....	5.41	
			Note: To be used in conjunction with fittings.		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 16 00-0711 EA 1-1/4" Field Installed FKM Seal..... Note: To be used in conjunction with fittings.	6.14	
22 11 16 00-0712 EA 1-1/2" Field Installed FKM Seal..... Note: To be used in conjunction with fittings.	7.60	
22 11 16 00-0713 EA 2" Field Installed FKM Seal..... Note: To be used in conjunction with fittings.	8.68	
22 11 16 00-0714 EA 2-1/2" Field Installed FKM Seal..... Note: To be used in conjunction with fittings.	11.23	
22 11 16 00-0715 EA 3" Field Installed FKM Seal..... Note: To be used in conjunction with fittings.	13.15	
22 11 16 00-0716 EA 4" Field Installed FKM Seal..... Note: To be used in conjunction with fittings.	17.60	
22 11 16 00-0717 Cut And Prepare Existing In-Place Copper Pipe (22 11 16 00-0335)		
22 11 16 00-0718 EA Up To 1/2", Cut And Prepare Existing In Place Copper Pipe.....	7.98	
22 11 16 00-0719 EA 3/4", Cut And Prepare Existing In Place Copper Pipe.....	8.62	
22 11 16 00-0720 EA 1", Cut And Prepare Existing In Place Copper Pipe.....	9.70	
22 11 16 00-0721 EA 1-1/4", Cut And Prepare Existing In Place Copper Pipe.....	10.18	
22 11 16 00-0722 EA 1-1/2", Cut And Prepare Existing In Place Copper Pipe.....	10.77	
22 11 16 00-0723 EA 2", Cut And Prepare Existing In Place Copper Pipe.....	11.86	
22 11 16 00-0724 EA 2-1/2", Cut And Prepare Existing In Place Copper Pipe.....	12.78	
22 11 16 00-0725 EA 3", Cut And Prepare Existing In Place Copper Pipe.....	15.09	
22 11 16 00-0726 EA 4", Cut And Prepare Existing In Place Copper Pipe.....	20.36	
22 11 16 00-0727 EA 6", Cut And Prepare Existing In Place Copper Pipe.....	29.10	
22 11 16 00-0728 EA 8", Cut And Prepare Existing In Place Copper Pipe.....	38.81	
22 11 16 00-0729 Sweat Brass Companion Flanges (22 11 16 00-0335)		
22 11 16 00-0730 EA 1" Sweat Brass Companion Flange.....	30.33	12.27
22 11 16 00-0731 EA 1-1/4" Sweat Brass Companion Flange.....	33.19	13.52
22 11 16 00-0732 EA 1-1/2" Sweat Brass Companion Flange.....	43.68	14.70
22 11 16 00-0733 EA 2" Sweat Brass Companion Flange.....	55.69	16.32
22 11 16 00-0734 EA 2-1/2" Sweat Brass Companion Flange.....	69.55	19.62
22 11 16 00-0735 EA 3" Sweat Brass Companion Flange.....	80.13	25.73
22 11 16 00-0736 EA 4" Sweat Brass Companion Flange.....	103.93	30.65
22 11 16 00-0737 EA 5" Sweat Brass Companion Flange.....	199.75	37.91
22 11 16 00-0738 EA 6" Sweat Brass Companion Flange.....	245.59	55.09
22 11 16 00-0739 EA 8" Copper Companion Flange.....	499.63	78.57
22 11 16 00-0740 Brass Compression Fittings (22 11 16 00-0335)		
22 11 16 00-0741 Brass Compression Unions (22 11 16 00-0740)		
22 11 16 00-0742 EA 1/4" Brass Compression Union.....	13.66	8.62
22 11 16 00-0743 EA 3/8" Brass Compression Union.....	13.86	8.62
22 11 16 00-0744 EA 1/2" Brass Compression Union.....	14.47	8.62
22 11 16 00-0745 EA 5/8" Brass Compression Union.....	14.76	8.62
22 11 16 00-0746 EA 3/4" Brass Compression Union.....	17.16	8.62
22 11 16 00-0747 EA 3/8" x 1/4" Brass Compression Union.....	14.00	8.62
22 11 16 00-0748 EA 1/2" x 3/8" Brass Compression Union.....	14.52	8.62
22 11 16 00-0749 EA 5/8" x 3/8" Brass Compression Union.....	14.88	8.62
22 11 16 00-0750 EA 5/8" x 1/2" Brass Compression Union.....	15.46	8.62
22 11 16 00-0751 Brass Compression Union Elbows (22 11 16 00-0740)		
22 11 16 00-0752 EA 1/4" Brass Compression Union Elbow.....	14.47	8.62
22 11 16 00-0753 EA 3/8" Brass Compression Union Elbow.....	14.80	8.62
22 11 16 00-0754 EA 1/2" Brass Compression Union Elbow.....	15.52	8.62
22 11 16 00-0755 EA 5/8" Brass Compression Union Elbow.....	16.64	8.62
22 11 16 00-0756 EA 3/4" Brass Compression Union Elbow.....	21.00	8.62
22 11 16 00-0757 EA 3/8" x 1/4" Brass Compression Union Elbow.....	14.80	8.62
22 11 16 00-0758 EA 1/2" x 3/8" Brass Compression Union Elbow.....	15.52	8.62
22 11 16 00-0759 EA 5/8" x 3/8" Brass Compression Union Elbow.....	15.72	8.62
22 11 16 00-0760 EA 5/8" x 1/2" Brass Compression Union Elbow.....	19.00	8.62
22 11 16 00-0761 Brass Compression Union Tees (22 11 16 00-0740)		
22 11 16 00-0762 EA 1/4" Brass Compression Union Tee.....	14.72	8.62
22 11 16 00-0763 EA 3/8" Brass Compression Union Tee.....	15.40	8.62
22 11 16 00-0764 EA 1/2" Brass Compression Union Tee.....	16.12	8.62
22 11 16 00-0765 EA 5/8" Brass Compression Union Tee.....	18.40	8.62
22 11 16 00-0766 EA 3/4" Brass Compression Union Tee.....	26.28	8.62
22 11 16 00-0767 EA 3/8" x 3/8" x 1/4" Brass Compression Union Tee.....	15.88	8.62
22 11 16 00-0768 EA 1/2" x 1/2" x 3/8" Brass Compression Union Tee.....	19.58	8.62
22 11 16 00-0769 EA 5/8" x 5/8" x 3/8" Brass Compression Union Tee.....	19.22	8.62
22 11 16 00-0770 EA 5/8" x 5/8" x 1/2" Brass Compression Union Tee.....	19.64	8.62
22 11 16 00-0771 Brass Compression Male Connectors (22 11 16 00-0740)		
22 11 16 00-0772 EA 1/4" Brass Compression Male Connector.....	13.52	8.62



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 16 00-0773	EA		3/8" Brass Compression Male Connector	13.78	8.62
22 11 16 00-0774	EA		1/2" Brass Compression Male Connector	14.24	8.62
22 11 16 00-0775	EA		5/8" Brass Compression Male Connector	14.92	8.62
22 11 16 00-0776	EA		3/4" Brass Compression Male Connector	15.89	8.54
22 11 16 00-0777			Brass Compression Female Connectors (22 11 16 00-0740)		
22 11 16 00-0778	EA		1/4" Brass Compression Female Connector.....	13.81	8.62
22 11 16 00-0779	EA		3/8" Brass Compression Female Connector.....	14.15	8.62
22 11 16 00-0780	EA		1/2" Brass Compression Female Connector.....	14.73	8.62
22 11 16 00-0781	EA		5/8" Brass Compression Female Connector.....	15.12	8.62
22 11 16 00-0782	EA		3/4" Brass Compression Female Connector.....	18.79	8.47
22 11 16 00-0783			Dielectric Fittings (22 11 16 00-0335)		
22 11 16 00-0784			Copper x Female Iron Pipe Thread Dielectric Unions (22 11 16 00-0783)		
22 11 16 00-0785	EA		1/2" Copper x Female Iron Pipe Thread Dielectric Union	34.52	19.16
22 11 16 00-0786	EA		3/4" Copper x Female Iron Pipe Thread Dielectric Union	38.50	21.88
22 11 16 00-0787	EA		1" Copper x Female Iron Pipe Thread Dielectric Union	46.06	24.04
22 11 16 00-0788	EA		1-1/4" Copper x Female Iron Pipe Thread Dielectric Union	56.16	26.46
22 11 16 00-0789	EA		1-1/2" Copper x Female Iron Pipe Thread Dielectric Union	68.24	29.40
22 11 16 00-0790	EA		2" Copper x Female Iron Pipe Thread Dielectric Union	86.94	35.28
22 11 16 00-0791			Female Brass Thread x Iron Pipe Thread Dielectric Unions (22 11 16 00-0783)		
22 11 16 00-0792	EA		1/2" Female Brass Thread x Iron Pipe Thread Dielectric Union.....	38.17	19.16
22 11 16 00-0793	EA		3/4" Female Brass Thread x Iron Pipe Thread Dielectric Union.....	44.51	21.88
22 11 16 00-0794	EA		1" Female Brass Thread x Iron Pipe Thread Dielectric Union.....	53.98	24.04
22 11 16 00-0795	EA		1-1/4" Female Brass Thread x Iron Pipe Thread Dielectric Union	66.67	26.46
22 11 16 00-0796	EA		1-1/2" Female Brass Thread x Iron Pipe Thread Dielectric Union	81.24	29.40
22 11 16 00-0797	EA		2" Female Brass Thread x Iron Pipe Thread Dielectric Union.....	102.19	35.28
22 11 16 00-0798			Female Iron Pipe Thread x Iron Pipe Thread Dielectric Unions (22 11 16 00-0783)		
22 11 16 00-0799	EA		1/2" Female Iron Pipe Thread x Iron Pipe Thread Dielectric Union.....	35.86	19.16
22 11 16 00-0800	EA		3/4" Female Iron Pipe Thread x Iron Pipe Thread Dielectric Union.....	40.70	21.88
22 11 16 00-0801	EA		1" Female Iron Pipe Thread x Iron Pipe Thread Dielectric Union	46.64	24.04
22 11 16 00-0802	EA		1-1/4" Female Iron Pipe Thread x Iron Pipe Thread Dielectric Union	54.13	26.46
22 11 16 00-0803	EA		1-1/2" Female Iron Pipe Thread x Iron Pipe Thread Dielectric Union	66.23	29.40
22 11 16 00-0804	EA		2" Female Iron Pipe Thread x Iron Pipe Thread Dielectric Union	85.32	35.28
22 11 16 00-0805			Copper x Female Iron Pipe Thread Dielectric Flanges (22 11 16 00-0783)		
22 11 16 00-0806	EA		2-1/2" Copper x Female Iron Pipe Thread Dielectric Flange.....	211.03	90.70
22 11 16 00-0807	EA		3" Copper x Female Iron Pipe Thread Dielectric Flange.....	264.11	114.22
22 11 16 00-0808	EA		4" Copper x Female Iron Pipe Thread Dielectric Flange.....	373.11	155.45
22 11 16 00-0809			Copper x Female Iron Pipe Thread x Iron Pipe Thread Dielectric Flanges (22 11 16 00-0783)		
22 11 16 00-0810	EA		2-1/2" Female Iron Pipe Thread x Iron Pipe Thread Dielectric Flange.....	212.54	90.70
22 11 16 00-0811	EA		3" Female Iron Pipe Thread x Iron Pipe Thread Dielectric Flange	276.07	114.22
22 11 16 00-0812	EA		4" Female Iron Pipe Thread x Iron Pipe Thread Dielectric Flange.....	511.07	155.45
22 11 16 00-0813			Brass Push-Fit Fittings (22 11 16)		
22 11 16 00-0814	EA		1/4" x 1/4" Brass Push-Fit Coupling..... Note: (Sharkbite)	16.04	7.98
22 11 16 00-0815	EA		3/8" x 3/8" Brass Push-Fit Coupling..... Note: (Sharkbite)	19.47	8.52
22 11 16 00-0816	EA		1/2" x 1/2" Brass Push-Fit Coupling..... Note: (Sharkbite)	20.42	9.59
22 11 16 00-0817	EA		5/8" x 5/8" Brass Push-Fit Coupling..... Note: (Sharkbite)	23.24	10.22
22 11 16 00-0818	EA		3/4" x 3/4" Brass Push-Fit Coupling..... Note: (Sharkbite)	23.85	10.92
22 11 16 00-0819	EA		1" x 1" Brass Push-Fit Coupling..... Note: (Sharkbite)	32.78	13.04
22 11 16 00-0820	EA		1/2" x 3/8" Brass Push-Fit Reducing Coupling..... Note: (Sharkbite)	19.94	9.04
22 11 16 00-0821	EA		3/4" x 5/8" Brass Push-Fit Reducing Coupling..... Note: (Sharkbite)	22.90	9.90
22 11 16 00-0822	EA		1" x 3/4" Brass Push-Fit Reducing Coupling..... Note: (Sharkbite)	33.21	11.97
22 11 16 00-0823	EA		1/4" x 1/4" Brass Push-Fit Elbow	16.63	7.98
22 11 16 00-0824	EA		3/8" x 3/8" Brass Push-Fit Elbow	21.97	8.52
22 11 16 00-0825	EA		1/2" x 1/2" Brass Push-Fit Elbow	20.74	9.59



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 16 00-0826 EA 5/8" x 5/8" Brass Push-Fit Elbow Note: (Sharkbite)	24.70	10.22
22 11 16 00-0827 EA 3/4" x 3/4" Brass Push-Fit Elbow Note: (Sharkbite)	23.43	10.92
22 11 16 00-0828 EA 1" x 1" Brass Push-Fit Elbow Note: (Sharkbite)	33.10	13.04
22 11 16 00-0829 EA 1/2" x 3/8" Brass Push-Fit Reducing Elbow Note: (Sharkbite)	19.67	9.04
22 11 16 00-0830 EA 3/4" x 1/2" Brass Push-Fit Reducing Elbow Note: (Sharkbite)	21.86	9.90
22 11 16 00-0831 EA 1" x 3/4" Brass Push-Fit Reducing Elbow Note: (Sharkbite)	40.38	11.97
22 11 16 00-0832 EA 1/4" x 1/4" x 1/4" Brass Push-Fit Tee Note: (Sharkbite)	25.18	11.97
22 11 16 00-0833 EA 3/8" x 3/8" x 3/8" Brass Push-Fit Tee Note: (Sharkbite)	31.13	12.78
22 11 16 00-0834 EA 1/2" x 1/2" x 1/2" Brass Push-Fit Tee Note: (Sharkbite)	29.37	14.37
22 11 16 00-0835 EA 5/8" x 5/8" x 5/8" Brass Push-Fit Tee Note: (Sharkbite)	36.43	15.33
22 11 16 00-0836 EA 3/4" x 3/4" x 3/4" Brass Push-Fit Tee Note: (Sharkbite)	34.13	16.37
22 11 16 00-0837 EA 1" x 1" x 1" Brass Push-Fit Tee Note: (Sharkbite)	45.75	19.56
22 11 16 00-0838 EA 1/2" x 1/2" x 1/4" Brass Push-Fit Reducing Tee Note: (Sharkbite)	32.13	13.57
22 11 16 00-0839 EA 1/2" x 1/2" x 3/8" Brass Push-Fit Reducing Tee Note: (Sharkbite)	32.37	13.84
22 11 16 00-0840 EA 3/4" x 3/4" x 1/2" Brass Push-Fit Reducing Tee Note: (Sharkbite)	32.92	15.71
22 11 16 00-0841 EA 1" x 1" x 3/4" Brass Push-Fit Reducing Tee Note: (Sharkbite)	44.23	18.50
22 11 16 00-0842 EA 1/4" x 1/2" Brass Push-Fit Pipe To FNPT Connector Note: (Sharkbite)	18.86	8.78
22 11 16 00-0843 EA 3/8" x 1/2" Brass Push-Fit Pipe To FNPT Connector Note: (Sharkbite)	18.76	9.04
22 11 16 00-0844 EA 1/2" x 1/2" Brass Push-Fit Pipe To FNPT Connector Note: (Sharkbite)	18.75	9.59
22 11 16 00-0845 EA 3/4" x 3/4" Brass Push-Fit Pipe To FNPT Connector Note: (Sharkbite)	21.45	10.92
22 11 16 00-0846 EA 1" x 1" Brass Push-Fit Pipe To FNPT Connector Note: (Sharkbite)	29.41	13.04
22 11 16 00-0847 EA 1/4" x 1/2" Brass Push-Fit Pipe To MNPT Connector Note: (Sharkbite)	16.85	8.78
22 11 16 00-0848 EA 3/8" x 1/2" Brass Push-Fit Pipe To MNPT Connector Note: (Sharkbite)	18.76	9.04
22 11 16 00-0849 EA 1/2" x 1/2" Brass Push-Fit Pipe To MNPT Connector Note: (Sharkbite)	18.79	9.59
22 11 16 00-0850 EA 3/4" x 3/4" Brass Push-Fit Pipe To MNPT Connector Note: (Sharkbite)	21.27	10.92
22 11 16 00-0851 EA 5/8" x 3/4" Brass Push-Fit Pipe To MNPT Connector Note: (Sharkbite)	22.70	10.56
22 11 16 00-0852 EA 1" x 3/4" Brass Push-Fit Pipe To MNPT Connector Note: (Sharkbite)	27.00	11.97
22 11 16 00-0853 EA 1" x 1" Brass Push-Fit Pipe To MNPT Connector Note: (Sharkbite)	29.78	13.04
22 11 16 00-0854 EA 1/2" Brass Push-Fit Ball Valve Note: (Sharkbite)	25.70	9.59
22 11 16 00-0855 EA 3/4" Brass Push-Fit Ball Valve Note: (Sharkbite)	29.96	10.92
22 11 16 00-0856 EA 1" Brass Push-Fit Ball Valve Note: (Sharkbite)	39.14	13.04
22 11 16 00-0857 EA 1/2" Brass Push-Fit Check Valve Note: (Sharkbite)	27.32	9.59
22 11 16 00-0858 EA 3/4" Brass Push-Fit Check Valve Note: (Sharkbite)	32.69	10.92
22 11 16 00-0859 EA 1" Brass Push-Fit Check Valve Note: (Sharkbite)	53.33	13.04
22 11 16 00-0860 Copper Pipe Assemblies <small>(22 11 16)</small> Note: Includes hangers and all coupling, elbow, tee and reducer fittings. All fittings are based on 95/5 solder. All hangers are complete assemblies installed in accordance with MSS SP 58 and 69. Excludes insulation. Not for use where detail is available.		
22 11 16 00-0861 LF 1/2" Inside Diameter Copper Pipe/Tubing Type L Assembly Note: Includes all hangers and couplings, elbow, tee, reducer fittings. All hangers are complete assemblies. Not for use where detail is available.	15.72	2.24
<i>For Type K Tubing Instead Of Type L, Add</i>	1.06	
<i>For Type M Tubing Instead Of Type L, Deduct</i>	-0.89	
<i>For Silver Solder Instead Of 95/5 Solder, Add</i>	2.04	
<i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i>	-1.41	
<i>For Work In Restricted Working Space, Add</i>	3.75	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 16 00-0862 LF 3/4" Inside Diameter Copper Pipe/Tubing Type L Assembly Note: Includes all hangers and couplings, elbow, tee, reducer fittings. All hangers are complete assemblies. Not for use where detail is available. <i>For Type K Tubing Instead Of Type L, Add</i> 1.25 <i>For Type M Tubing Instead Of Type L, Deduct</i> -1.03 <i>For Silver Solder Instead Of 95/5 Solder, Add</i> 2.32 <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> -1.61 <i>For Work In Restricted Working Space, Add</i> 4.25	18.06	2.87
22 11 16 00-0863 LF 1" Inside Diameter Copper Pipe/Tubing Type L Assembly Note: Includes all hangers and couplings, elbow, tee, reducer fittings. All hangers are complete assemblies. Not for use where detail is available. <i>For Type K Tubing Instead Of Type L, Add</i> 1.46 <i>For Type M Tubing Instead Of Type L, Deduct</i> -1.19 <i>For Silver Solder Instead Of 95/5 Solder, Add</i> 2.47 <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> -1.73 <i>For Work In Restricted Working Space, Add</i> 4.45	19.78	3.43
22 11 16 00-0864 LF 1-1/4" Inside Diameter Copper Pipe/Tubing Type L Assembly Note: Includes all hangers and couplings, elbow, tee, reducer fittings. All hangers are complete assemblies. Not for use where detail is available. <i>For Drain-Waste-Vent (DWV) Tubing Instead Of Type L, Deduct</i> -0.69 <i>For Type K Tubing Instead Of Type L, Add</i> 1.82 <i>For Type M Tubing Instead Of Type L, Deduct</i> -1.45 <i>For Silver Solder Instead Of 95/5 Solder, Add</i> 2.66 <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> -1.89 <i>For Work In Restricted Working Space, Add</i> 4.63	22.33	3.99
22 11 16 00-0865 LF 1-1/2" Inside Diameter Copper Pipe/Tubing Type L Assembly Note: Includes all hangers and couplings, elbow, tee, reducer fittings. All hangers are complete assemblies. Not for use where detail is available. <i>For Drain-Waste-Vent (DWV) Tubing Instead Of Type L, Deduct</i> -0.90 <i>For Type K Tubing Instead Of Type L, Add</i> 2.22 <i>For Type M Tubing Instead Of Type L, Deduct</i> -1.73 <i>For Silver Solder Instead Of 95/5 Solder, Add</i> 2.91 <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> -2.09 <i>For Work In Restricted Working Space, Add</i> 4.93	25.40	4.55
22 11 16 00-0866 LF 2" Inside Diameter Copper Pipe/Tubing Type L Assembly Note: Includes all hangers and couplings, elbow, tee, reducer fittings. All hangers are complete assemblies. Not for use where detail is available. <i>For Drain-Waste-Vent (DWV) Tubing Instead Of Type L, Deduct</i> -1.69 <i>For Type K Tubing Instead Of Type L, Add</i> 3.71 <i>For Type M Tubing Instead Of Type L, Deduct</i> -2.79 <i>For Silver Solder Instead Of 95/5 Solder, Add</i> 3.68 <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> -2.74 <i>For Work In Restricted Working Space, Add</i> 5.67	35.82	5.67
22 11 16 00-0867 LF 2-1/2" Inside Diameter Copper Pipe/Tubing Type L Assembly Note: Includes all hangers and couplings, elbow, tee, reducer fittings. All hangers are complete assemblies. Not for use where detail is available. <i>For Drain-Waste-Vent (DWV) Tubing Instead Of Type L, Deduct</i> -2.35 <i>For Type K Tubing Instead Of Type L, Add</i> 4.90 <i>For Type M Tubing Instead Of Type L, Deduct</i> -3.63 <i>For Silver Solder Instead Of 95/5 Solder, Add</i> 4.21 <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> -3.20 <i>For Work In Restricted Working Space, Add</i> 6.08	43.73	6.84
22 11 16 00-0868 LF 3" Inside Diameter Copper Pipe/Tubing Type L Assembly Note: Includes all hangers and couplings, elbow, tee, reducer fittings. All hangers are complete assemblies. Not for use where detail is available. <i>For Drain-Waste-Vent (DWV) Tubing Instead Of Type L, Deduct</i> -2.97 <i>For Type K Tubing Instead Of Type L, Add</i> 6.05 <i>For Type M Tubing Instead Of Type L, Deduct</i> -4.44 <i>For Silver Solder Instead Of 95/5 Solder, Add</i> 4.78 <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> -3.68 <i>For Work In Restricted Working Space, Add</i> 6.59	51.63	7.94
22 11 16 00-0869 LF 4" Inside Diameter Copper Pipe/Tubing Type L Assembly Note: Includes all hangers and couplings, elbow, tee, reducer fittings. All hangers are complete assemblies. Not for use where detail is available. <i>For Drain-Waste-Vent (DWV) Tubing Instead Of Type L, Deduct</i> -4.76 <i>For Type K Tubing Instead Of Type L, Add</i> 9.44 <i>For Type M Tubing Instead Of Type L, Deduct</i> -6.85 <i>For Silver Solder Instead Of 95/5 Solder, Add</i> 6.64 <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> -5.22 <i>For Work In Restricted Working Space, Add</i> 8.52	76.02	10.51
22 11 16 00-0870 LF 5" Inside Diameter Copper Pipe/Tubing Type L Assembly Note: Includes all hangers and couplings, elbow, tee, reducer fittings. All hangers are complete assemblies. Not for use where detail is available. <i>For Drain-Waste-Vent (DWV) Tubing Instead Of Type L, Deduct</i> -13.23 <i>For Type K Tubing Instead Of Type L, Add</i> 24.54 <i>For Type M Tubing Instead Of Type L, Deduct</i> -17.34 <i>For Silver Solder Instead Of 95/5 Solder, Add</i> 12.09 <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> -10.26 <i>For Work In Restricted Working Space, Add</i> 10.94	168.78	13.09



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 16 00-0871	LF		6" Inside Diameter Copper Pipe/Tubing Type L Assembly Note: Includes all hangers and couplings, elbow, tee, reducer fittings. All hangers are complete assemblies. Not for use where detail is available. <i>For Drain-Waste-Vent (DWV) Tubing Instead Of Type L, Deduct</i> <i>For Type K Tubing Instead Of Type L, Add</i> <i>For Type M Tubing Instead Of Type L, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	199.90 -15.36 28.64 -20.28 14.63 -12.31 13.89	15.81
22 11 16 00-0872	LF		8" Inside Diameter Copper Pipe/Tubing Type L Assembly Note: Includes all hangers and couplings, elbow, tee, reducer fittings. All hangers are complete assemblies. Not for use where detail is available. <i>For Drain-Waste-Vent (DWV) Tubing Instead Of Type L, Deduct</i> <i>For Type K Tubing Instead Of Type L, Add</i> <i>For Type M Tubing Instead Of Type L, Deduct</i> <i>For Silver Solder Instead Of 95/5 Solder, Add</i> <i>For 60/40 Or 50/50 Solder Where Applicable Instead Of 95/5 Solder, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	376.05 -31.85 57.85 -40.52 24.56 -21.68 17.26	18.89
22 11 16 00-0873			Chlorinated Polyvinyl Chloride (CPVC) Pressure Pipe And Fittings (22 11 16) Note: Socket weld.		
22 11 16 00-0874			Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Pressure Pipe And Fittings (22 11 16 00-0873)		
22 11 16 00-0875			Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Pipe (22 11 16 00-0874)		
22 11 16 00-0876	LF		1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Pressure Pipe <i>For Work In Restricted Working Space, Add</i>	4.04 0.88	1.18
22 11 16 00-0877	LF		3/4" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Pressure Pipe <i>For Work In Restricted Working Space, Add</i>	4.59 0.92	1.24
22 11 16 00-0878	LF		1" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Pressure Pipe <i>For Work In Restricted Working Space, Add</i>	5.54 1.00	1.33
22 11 16 00-0879	LF		1-1/4" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Pressure Pipe <i>For Work In Restricted Working Space, Add</i>	6.69 1.09	1.45
22 11 16 00-0880	LF		1-1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Pressure Pipe <i>For Work In Restricted Working Space, Add</i>	7.72 1.20	1.60
22 11 16 00-0881	LF		2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Pressure Pipe <i>For Work In Restricted Working Space, Add</i>	9.60 1.34	1.79
22 11 16 00-0882	LF		2-1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Pressure Pipe <i>For Work In Restricted Working Space, Add</i>	12.95 1.53	2.04
22 11 16 00-0883	LF		3" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Pressure Pipe <i>For Work In Restricted Working Space, Add</i>	16.51 1.81	2.41
22 11 16 00-0884	LF		4" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Pressure Pipe <i>For Work In Restricted Working Space, Add</i>	22.78 2.22	2.96
22 11 16 00-0885	LF		6" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Pressure Pipe <i>For Work In Restricted Working Space, Add</i>	39.18 2.83	3.77
22 11 16 00-0886	LF		8" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Pressure Pipe <i>For Work In Restricted Working Space, Add</i>	56.25 3.71	4.94
22 11 16 00-0887			Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) 90 Degree Elbows (22 11 16 00-0874)		
22 11 16 00-0888	EA		1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) 90 Degree Elbow <i>For Work In Restricted Working Space, Add</i>	15.69 4.19	5.58
22 11 16 00-0889	EA		3/4" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) 90 Degree Elbow <i>For Work In Restricted Working Space, Add</i>	20.32 5.29	7.05
22 11 16 00-0890	EA		1" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) 90 Degree Elbow <i>For Work In Restricted Working Space, Add</i>	26.36 6.64	8.82
22 11 16 00-0891	EA		1-1/4" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) 90 Degree Elbow <i>For Work In Restricted Working Space, Add</i>	35.80 8.29	11.02
22 11 16 00-0892	EA		1-1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) 90 Degree Elbow <i>For Work In Restricted Working Space, Add</i>	39.80 9.17	12.20
22 11 16 00-0893	EA		2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) 90 Degree Elbow <i>For Work In Restricted Working Space, Add</i>	46.54 10.23	12.20
22 11 16 00-0894	EA		2-1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) 90 Degree Elbow <i>For Work In Restricted Working Space, Add</i>	71.20 11.64	15.50
22 11 16 00-0895	EA		3" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) 90 Degree Elbow <i>For Work In Restricted Working Space, Add</i>	81.07 13.76	18.38
22 11 16 00-0896	EA		4" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) 90 Degree Elbow <i>For Work In Restricted Working Space, Add</i>	115.15 16.94	22.57
22 11 16 00-0897	EA		6" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) 90 Degree Elbow <i>For Work In Restricted Working Space, Add</i>	145.32 21.52	28.66
22 11 16 00-0898	EA		8" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) 90 Degree Elbow <i>For Work In Restricted Working Space, Add</i>	274.16 28.22	37.64
22 11 16 00-0899			Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) 45 Degree Elbows (22 11 16 00-0874)		
22 11 16 00-0900	EA		1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) 45 Degree Elbow <i>For Work In Restricted Working Space, Add</i>	16.55 4.19	5.58
22 11 16 00-0901	EA		3/4" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) 45 Degree Elbow <i>For Work In Restricted Working Space, Add</i>	21.36 5.29	7.05
22 11 16 00-0902	EA		1" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) 45 Degree Elbow <i>For Work In Restricted Working Space, Add</i>	28.04 6.64	8.82



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 16 00-0903 EA 1-1/4" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) 45 Degree Elbow <i>For Work In Restricted Working Space, Add</i>	38.01 8.29	11.02
22 11 16 00-0904 EA 1-1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) 45 Degree Elbow <i>For Work In Restricted Working Space, Add</i>	42.48 9.17	12.20
22 11 16 00-0905 EA 2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) 45 Degree Elbow <i>For Work In Restricted Working Space, Add</i>	47.45 10.23	13.67
22 11 16 00-0906 EA 2-1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) 45 Degree Elbow <i>For Work In Restricted Working Space, Add</i>	71.78 11.64	15.50
22 11 16 00-0907 EA 3" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) 45 Degree Elbow <i>For Work In Restricted Working Space, Add</i>	80.99 13.76	18.38
22 11 16 00-0908 EA 4" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) 45 Degree Elbow <i>For Work In Restricted Working Space, Add</i>	104.63 16.94	22.57
22 11 16 00-0909 EA 6" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) 45 Degree Elbow <i>For Work In Restricted Working Space, Add</i>	165.04 21.52	28.66
22 11 16 00-0910 EA 8" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) 45 Degree Elbow <i>For Work In Restricted Working Space, Add</i>	288.13 28.22	37.64
22 11 16 00-0911 Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Tees <small>(22 11 16 00-0874)</small>		
22 11 16 00-0912 EA 1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Tee <i>For Work In Restricted Working Space, Add</i>	24.08 6.28	8.38
22 11 16 00-0913 EA 3/4" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Tee <i>For Work In Restricted Working Space, Add</i>	31.47 7.94	10.59
22 11 16 00-0914 EA 1" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Tee <i>For Work In Restricted Working Space, Add</i>	39.38 9.97	13.31
22 11 16 00-0915 EA 1-1/4" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Tee <i>For Work In Restricted Working Space, Add</i>	54.44 12.44	16.61
22 11 16 00-0916 EA 1-1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Tee <i>For Work In Restricted Working Space, Add</i>	60.75 13.76	18.38
22 11 16 00-0917 EA 2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Tee <i>For Work In Restricted Working Space, Add</i>	73.35 15.35	20.43
22 11 16 00-0918 EA 2-1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Tee <i>For Work In Restricted Working Space, Add</i>	94.68 17.47	23.30
22 11 16 00-0919 EA 3" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Tee <i>For Work In Restricted Working Space, Add</i>	108.47 20.64	27.49
22 11 16 00-0920 EA 4" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Tee <i>For Work In Restricted Working Space, Add</i>	131.53 25.40	33.89
22 11 16 00-0921 EA 6" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Tee <i>For Work In Restricted Working Space, Add</i>	199.17 32.28	43.08
22 11 16 00-0922 EA 8" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Tee <i>For Work In Restricted Working Space, Add</i>	403.29 42.34	56.45
22 11 16 00-0923 Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Crosses <small>(22 11 16 00-0874)</small>		
22 11 16 00-0924 EA 1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Cross <i>For Work In Restricted Working Space, Add</i>	30.64 8.38	11.17
22 11 16 00-0925 EA 3/4" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Cross <i>For Work In Restricted Working Space, Add</i>	39.59 10.58	14.11
22 11 16 00-0926 EA 1" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Cross <i>For Work In Restricted Working Space, Add</i>	49.56 13.28	17.71
22 11 16 00-0927 EA 1-1/4" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Cross <i>For Work In Restricted Working Space, Add</i>	66.47 16.58	22.12
22 11 16 00-0928 EA 1-1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Cross <i>For Work In Restricted Working Space, Add</i>	73.97 18.35	24.48
22 11 16 00-0929 EA 2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Cross <i>For Work In Restricted Working Space, Add</i>	87.33 20.46	27.27
22 11 16 00-0930 EA 2-1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Cross <i>For Work In Restricted Working Space, Add</i>	109.02 23.29	31.02
22 11 16 00-0931 EA 3" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Cross <i>For Work In Restricted Working Space, Add</i>	125.90 27.52	36.68
22 11 16 00-0932 EA 4" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Cross <i>For Work In Restricted Working Space, Add</i>	153.26 33.87	45.13
22 11 16 00-0933 EA 6" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Cross <i>For Work In Restricted Working Space, Add</i>	222.34 43.04	57.40
22 11 16 00-0934 EA 8" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Cross <i>For Work In Restricted Working Space, Add</i>	413.97 56.45	75.26
22 11 16 00-0935 Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Socket Weld Reducing Inserts <small>(22 11 16 00-0874)</small>		
22 11 16 00-0936 EA 3/4" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Reducing Insert <i>For Work In Restricted Working Space, Add</i>	13.97 3.88	5.15
22 11 16 00-0937 EA 1" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Reducing Insert <i>For Work In Restricted Working Space, Add</i>	19.43 5.23	6.98
22 11 16 00-0938 EA 1-1/4" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Reducing Insert <i>For Work In Restricted Working Space, Add</i>	31.99 6.84	9.12
22 11 16 00-0939 EA 1-1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Reducing Insert <i>For Work In Restricted Working Space, Add</i>	36.08 7.57	10.07
22 11 16 00-0940 EA 2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Reducing Insert <i>For Work In Restricted Working Space, Add</i>	42.41 8.45	11.24
22 11 16 00-0941 EA 2-1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Reducing Insert <i>For Work In Restricted Working Space, Add</i>	46.31 9.62	12.79

22	Plumbing
22 10	Plumbing Piping
22 11	Facility Water Distribution



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 16 00-0942	EA		3" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Reducing Insert.....	56.11	15.14
			<i>For Work In Restricted Working Space, Add</i>	11.36	
22 11 16 00-0943	EA		4" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Reducing Insert.....	75.86	18.60
			<i>For Work In Restricted Working Space, Add</i>	13.98	
22 11 16 00-0944	EA		6" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Reducing Insert.....	121.49	23.66
			<i>For Work In Restricted Working Space, Add</i>	17.75	
22 11 16 00-0945	EA		8" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Reducing Insert.....	265.13	31.02
			<i>For Work In Restricted Working Space, Add</i>	23.29	
22 11 16 00-0946			Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Socket Weld x Female Or Male Thread Reducing Inserts <small>(22 11 16 00-0874)</small>		
22 11 16 00-0947	EA		1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Socket Weld x Female Or Male Threaded Reducing Insert.....	15.95	3.68
			<i>For Work In Restricted Working Space, Add</i>	2.76	
22 11 16 00-0948	EA		3/4" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Socket Weld x Female Or Male Threaded Reducing Insert.....	20.22	5.15
			<i>For Work In Restricted Working Space, Add</i>	3.88	
22 11 16 00-0949	EA		1" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Socket Weld x Female Or Male Threaded Reducing Insert.....	25.23	6.98
			<i>For Work In Restricted Working Space, Add</i>	5.23	
22 11 16 00-0950	EA		1-1/4" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Socket Weld x Female Or Male Threaded Reducing Insert.....	31.49	9.12
			<i>For Work In Restricted Working Space, Add</i>	6.84	
22 11 16 00-0951	EA		1-1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Socket Weld x Female Or Male Threaded Reducing Insert.....	36.82	10.07
			<i>For Work In Restricted Working Space, Add</i>	7.57	
22 11 16 00-0952	EA		2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Socket Weld x Female Or Male Threaded Reducing Insert.....	46.10	11.24
			<i>For Work In Restricted Working Space, Add</i>	8.45	
22 11 16 00-0953	EA		2-1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Socket Weld x Female Or Male Threaded Reducing Insert.....	70.41	12.79
			<i>For Work In Restricted Working Space, Add</i>	9.62	
22 11 16 00-0954	EA		3" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Socket Weld x Female Or Male Threaded Reducing Insert.....	138.05	15.14
			<i>For Work In Restricted Working Space, Add</i>	11.36	
22 11 16 00-0955	EA		4" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Socket Weld x Female Or Male Threaded Reducing Insert.....	204.52	18.60
			<i>For Work In Restricted Working Space, Add</i>	13.98	
22 11 16 00-0956			Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Socket Weld x Male Thread Male Adapters <small>(22 11 16 00-0874)</small>		
22 11 16 00-0957	EA		1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Socket Weld x Male Thread Male Adapters.....	11.78	3.68
			<i>For Work In Restricted Working Space, Add</i>	2.76	
22 11 16 00-0958	EA		3/4" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Socket Weld x Male Thread Male Adapters.....	16.44	5.15
			<i>For Work In Restricted Working Space, Add</i>	3.88	
22 11 16 00-0959	EA		1" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Socket Weld x Male Thread Male Adapters.....	23.31	6.98
			<i>For Work In Restricted Working Space, Add</i>	5.23	
22 11 16 00-0960	EA		1-1/4" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Socket Weld x Male Thread Male Adapters.....	31.49	9.12
			<i>For Work In Restricted Working Space, Add</i>	6.84	
22 11 16 00-0961	EA		1-1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Socket Weld x Male Thread Male Adapters.....	36.99	10.07
			<i>For Work In Restricted Working Space, Add</i>	7.57	
22 11 16 00-0962	EA		2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Socket Weld x Male Thread Male Adapters.....	44.06	11.24
			<i>For Work In Restricted Working Space, Add</i>	8.45	
22 11 16 00-0963	EA		2-1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Socket Weld x Male Thread Male Adapters.....	62.17	12.79
			<i>For Work In Restricted Working Space, Add</i>	9.62	
22 11 16 00-0964	EA		3" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Socket Weld x Male Thread Male Adapters.....	74.27	15.14
			<i>For Work In Restricted Working Space, Add</i>	11.36	
22 11 16 00-0965	EA		4" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Socket Weld x Male Thread Male Adapters.....	108.18	18.60
			<i>For Work In Restricted Working Space, Add</i>	13.98	
22 11 16 00-0966			Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Socket Weld x Female Thread Female Adapters <small>(22 11 16 00-0874)</small>		
22 11 16 00-0967	EA		1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Socket Weld x Female Thread Female Adapters.....	12.76	3.68
			<i>For Work In Restricted Working Space, Add</i>	2.76	
22 11 16 00-0968	EA		3/4" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Socket Weld x Female Thread Female Adapters.....	16.75	5.15
			<i>For Work In Restricted Working Space, Add</i>	3.88	
22 11 16 00-0969	EA		1" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Socket Weld x Female Thread Female Adapters.....	23.40	6.98
			<i>For Work In Restricted Working Space, Add</i>	5.23	
22 11 16 00-0970	EA		1-1/4" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Socket Weld x Female Thread Female Adapters.....	31.78	9.12
			<i>For Work In Restricted Working Space, Add</i>	6.84	
22 11 16 00-0971	EA		1-1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Socket Weld x Female Thread Female Adapters.....	35.67	10.07
			<i>For Work In Restricted Working Space, Add</i>	7.57	
22 11 16 00-0972	EA		2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Socket Weld x Female Thread Female Adapters.....	42.98	11.24
			<i>For Work In Restricted Working Space, Add</i>	8.45	
22 11 16 00-0973	EA		2-1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Socket Weld x Female Thread Female Adapters.....	62.79	12.79
			<i>For Work In Restricted Working Space, Add</i>	9.62	
22 11 16 00-0974	EA		3" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Socket Weld x Female Thread Female Adapters.....	85.15	15.14
			<i>For Work In Restricted Working Space, Add</i>	11.36	
22 11 16 00-0975	EA		4" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Socket Weld x Female Thread Female Adapters.....	126.67	18.60
			<i>For Work In Restricted Working Space, Add</i>	13.98	
22 11 16 00-0976			Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Couplings <small>(22 11 16 00-0874)</small>		



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 16 00-0977	EA		1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Couplings..... <i>For Work In Restricted Working Space, Add</i>	10.58 2.51	3.38
22 11 16 00-0978	EA		3/4" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Couplings..... <i>For Work In Restricted Working Space, Add</i>	14.87 3.53	4.70
22 11 16 00-0979	EA		1" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Couplings..... <i>For Work In Restricted Working Space, Add</i>	20.00 4.74	6.32
22 11 16 00-0980	EA		1-1/4" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Couplings..... <i>For Work In Restricted Working Space, Add</i>	26.98 6.22	8.30
22 11 16 00-0981	EA		1-1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Couplings..... <i>For Work In Restricted Working Space, Add</i>	30.81 6.88	9.19
22 11 16 00-0982	EA		2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Couplings..... <i>For Work In Restricted Working Space, Add</i>	34.73 7.67	10.22
22 11 16 00-0983	EA		2-1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Couplings..... <i>For Work In Restricted Working Space, Add</i>	51.05 8.73	11.62
22 11 16 00-0984	EA		3" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Couplings..... <i>For Work In Restricted Working Space, Add</i>	56.56 10.32	13.74
22 11 16 00-0985	EA		4" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Couplings..... <i>For Work In Restricted Working Space, Add</i>	71.38 12.70	16.90
22 11 16 00-0986	EA		6" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Couplings..... <i>For Work In Restricted Working Space, Add</i>	111.10 16.14	21.54
22 11 16 00-0987	EA		8" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Couplings..... <i>For Work In Restricted Working Space, Add</i>	186.64 21.17	28.23
22 11 16 00-0988			Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Unions <small>(22 11 16 00-0874)</small>		
22 11 16 00-0989	EA		1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Unions..... <i>For Work In Restricted Working Space, Add</i>	19.46 3.02	4.04
22 11 16 00-0990	EA		3/4" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Unions..... <i>For Work In Restricted Working Space, Add</i>	23.96 4.23	5.66
22 11 16 00-0991	EA		1" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Unions <i>For Work In Restricted Working Space, Add</i>	29.12 5.69	7.58
22 11 16 00-0992	EA		1-1/4" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Unions <i>For Work In Restricted Working Space, Add</i>	48.73 7.45	9.92
22 11 16 00-0993	EA		1-1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Unions <i>For Work In Restricted Working Space, Add</i>	51.81 8.25	11.02
22 11 16 00-0994	EA		2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Unions <i>For Work In Restricted Working Space, Add</i>	71.08 9.22	12.27
22 11 16 00-0995	EA		2-1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Unions <i>For Work In Restricted Working Space, Add</i>	118.59 10.48	13.96
22 11 16 00-0996	EA		3" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Unions <i>For Work In Restricted Working Space, Add</i>	167.74 12.39	16.54
22 11 16 00-0997	EA		4" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Unions <i>For Work In Restricted Working Space, Add</i>	265.73 15.24	20.29
22 11 16 00-0998	EA		6" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Unions <i>For Work In Restricted Working Space, Add</i>	354.82 19.36	25.80
22 11 16 00-0999	EA		8" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Unions <i>For Work In Restricted Working Space, Add</i>	439.27 25.40	33.89
22 11 16 00-1000			Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Caps <small>(22 11 16 00-0874)</small>		
22 11 16 00-1001	EA		1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Cap..... <i>For Work In Restricted Working Space, Add</i>	6.27 0.84	1.10
22 11 16 00-1002	EA		3/4" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Cap..... <i>For Work In Restricted Working Space, Add</i>	10.82 1.76	2.35
22 11 16 00-1003	EA		1" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Cap..... <i>For Work In Restricted Working Space, Add</i>	18.20 2.84	3.82
22 11 16 00-1004	EA		1-1/4" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Cap..... <i>For Work In Restricted Working Space, Add</i>	19.93 3.11	4.12
22 11 16 00-1005	EA		1-1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Cap..... <i>For Work In Restricted Working Space, Add</i>	21.21 3.44	4.55
22 11 16 00-1006	EA		2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Cap..... <i>For Work In Restricted Working Space, Add</i>	28.49 3.84	5.15
22 11 16 00-1007	EA		2-1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Cap..... <i>For Work In Restricted Working Space, Add</i>	42.83 4.37	5.80
22 11 16 00-1008	EA		3" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Cap..... <i>For Work In Restricted Working Space, Add</i>	46.12 5.16	6.91
22 11 16 00-1009	EA		4" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Cap..... <i>For Work In Restricted Working Space, Add</i>	69.95 6.35	8.45
22 11 16 00-1010	EA		6" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Cap..... <i>For Work In Restricted Working Space, Add</i>	148.28 8.07	10.73
22 11 16 00-1011	EA		8" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) Cap..... <i>For Work In Restricted Working Space, Add</i>	191.14 10.58	14.11
22 11 16 00-1012			Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) 150 LB Flanges <small>(22 11 16 00-0874)</small>		
22 11 16 00-1013	EA		1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) 150 LB Flanges..... <i>For Work In Restricted Working Space, Add</i>	15.08 2.01	2.65
22 11 16 00-1014	EA		3/4" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) 150 LB Flanges..... <i>For Work In Restricted Working Space, Add</i>	18.40 2.82	3.75
22 11 16 00-1015	EA		1" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) 150 LB Flanges..... <i>For Work In Restricted Working Space, Add</i>	22.65 3.79	5.07
22 11 16 00-1016	EA		1-1/4" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) 150 LB Flanges <i>For Work In Restricted Working Space, Add</i>	26.91 4.98	6.62

22	Plumbing
22 10	Plumbing Piping
22 11	Facility Water Distribution



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 16 00-1017	EA		1-1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) 150 LB Flanges.....	28.92	7.35
			<i>For Work In Restricted Working Space, Add</i>	5.51	
22 11 16 00-1018	EA		2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) 150 LB Flanges.....	34.45	8.16
			<i>For Work In Restricted Working Space, Add</i>	6.13	
22 11 16 00-1019	EA		2-1/2" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) 150 LB Flanges.....	45.18	9.34
			<i>For Work In Restricted Working Space, Add</i>	6.99	
22 11 16 00-1020	EA		3" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) 150 LB Flanges.....	51.35	11.02
			<i>For Work In Restricted Working Space, Add</i>	8.25	
22 11 16 00-1021	EA		4" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) 150 LB Flanges.....	64.13	13.52
			<i>For Work In Restricted Working Space, Add</i>	10.17	
22 11 16 00-1022	EA		6" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) 150 LB Flanges.....	90.62	17.20
			<i>For Work In Restricted Working Space, Add</i>	12.92	
22 11 16 00-1023	EA		8" Schedule 80 Chlorinated Polyvinyl Chloride (CPVC) 150 LB Flanges.....	163.69	22.57
			<i>For Work In Restricted Working Space, Add</i>	16.94	
22 11 16 00-1024			Cross-Linked Polyethylene Tubing, ASTM F877 (22 11 16) Note: Aboveground, domestic water usage.		
22 11 16 00-1025			Cross-Linked Polyethylene Tubing (22 11 16 00-1024)		
22 11 16 00-1026	LF		3/8" Cross-Linked Polyethylene Tubing.....	2.66	
			<i>For Work In Restricted Working Space, Add</i>	0.69	
22 11 16 00-1027	LF		1/2" Cross-Linked Polyethylene Tubing.....	2.89	
			<i>For Work In Restricted Working Space, Add</i>	0.75	
22 11 16 00-1028	LF		3/4" Cross-Linked Polyethylene Tubing.....	3.41	
			<i>For Work In Restricted Working Space, Add</i>	0.81	
22 11 16 00-1029	LF		1" Cross-Linked Polyethylene Tubing.....	4.07	
			<i>For Work In Restricted Working Space, Add</i>	0.86	
22 11 16 00-1030			Cross-Linked Polyethylene Forged Brass PEX Fittings (22 11 16 00-1024) Note: Aboveground, domestic water usage.		
22 11 16 00-1031			Male Adapters (22 11 16 00-1030)		
22 11 16 00-1032	EA		3/8" x 1/2", (PE x Threaded) Male Adapter For PEX Tubing.....	13.41	
			<i>For Work In Restricted Working Space, Add</i>	3.59	
22 11 16 00-1033	EA		1/2" x 1/2", (PE x Threaded) Male Adapter For PEX Tubing.....	14.39	
			<i>For Work In Restricted Working Space, Add</i>	3.83	
22 11 16 00-1034	EA		1/2" x 3/4", (PE x Threaded) Male Adapter For PEX Tubing.....	15.51	
			<i>For Work In Restricted Working Space, Add</i>	4.07	
22 11 16 00-1035	EA		3/4" x 3/4", (PE x Threaded) Male Adapter For PEX Tubing.....	16.31	
			<i>For Work In Restricted Working Space, Add</i>	4.31	
22 11 16 00-1036	EA		3/4" x 1/2", (PE x Threaded) Male Adapter For PEX Tubing.....	15.51	
			<i>For Work In Restricted Working Space, Add</i>	4.07	
22 11 16 00-1037	EA		1" x 1", (PE x Threaded) Male Adapter For PEX Tubing.....	19.39	
			<i>For Work In Restricted Working Space, Add</i>	4.79	
22 11 16 00-1038			Female Adapters (22 11 16 00-1030)		
22 11 16 00-1039	EA		1/2" x 1/2", (PE x Threaded) Female Adapter For PEX Tubing.....	14.55	
			<i>For Work In Restricted Working Space, Add</i>	3.83	
22 11 16 00-1040	EA		1/2" x 3/4", (PE x Threaded) Female Adapter For PEX Tubing.....	15.97	
			<i>For Work In Restricted Working Space, Add</i>	4.07	
22 11 16 00-1041	EA		3/4" x 3/4", (PE x Threaded) Female Adapter For PEX Tubing.....	16.77	
			<i>For Work In Restricted Working Space, Add</i>	4.31	
22 11 16 00-1042	EA		3/4" x 1/2", (PE x Threaded) Female Adapter For PEX Tubing.....	15.97	
			<i>For Work In Restricted Working Space, Add</i>	4.07	
22 11 16 00-1043	EA		1" x 1", (PE x Threaded) Female Adapter For PEX Tubing.....	19.60	
			<i>For Work In Restricted Working Space, Add</i>	4.79	
22 11 16 00-1044			Tube Adapters (22 11 16 00-1030)		
22 11 16 00-1045	EA		3/8" x 1/2" Tube Adapter For PEX Tubing.....	12.73	
			<i>For Work In Restricted Working Space, Add</i>	3.59	
22 11 16 00-1046	EA		1/2" Tube Adapter For PEX Tubing.....	13.54	
			<i>For Work In Restricted Working Space, Add</i>	3.83	
22 11 16 00-1047	EA		3/4" Tube Adapter For PEX Tubing.....	15.77	
			<i>For Work In Restricted Working Space, Add</i>	4.31	
22 11 16 00-1048	EA		1" Tube Adapter For PEX Tubing.....	18.96	
			<i>For Work In Restricted Working Space, Add</i>	4.79	
22 11 16 00-1049			Plugs (22 11 16 00-1030)		
22 11 16 00-1050	EA		3/8" Plug For PEX Tubing.....	6.18	
			<i>For Work In Restricted Working Space, Add</i>	1.68	
22 11 16 00-1051	EA		1/2" Plug For PEX Tubing.....	6.97	
			<i>For Work In Restricted Working Space, Add</i>	1.91	
22 11 16 00-1052	EA		3/4" Plug For PEX Tubing.....	7.95	
			<i>For Work In Restricted Working Space, Add</i>	2.16	
22 11 16 00-1053	EA		1" Plug For PEX Tubing.....	9.38	
			<i>For Work In Restricted Working Space, Add</i>	2.39	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
				22 11 16 00-1054 Tees <small>(22 11 16 00-1030)</small>		
				EA 3/8" Tee For PEX Tubing.....	18.00	
				<i>For Work In Restricted Working Space, Add</i>	5.03	
				EA 1/2" Tee For PEX Tubing.....	20.39	
				<i>For Work In Restricted Working Space, Add</i>	5.75	
				EA 3/4" Tee For PEX Tubing.....	23.63	
				<i>For Work In Restricted Working Space, Add</i>	6.47	
				EA 1" Tee For PEX Tubing.....	28.38	
				<i>For Work In Restricted Working Space, Add</i>	7.19	
				EA 1/2" Reducing Tee For PEX Tubing.....	19.60	
				<i>For Work In Restricted Working Space, Add</i>	5.51	
				EA 3/4" Reducing Tee For PEX Tubing.....	22.03	
				<i>For Work In Restricted Working Space, Add</i>	5.99	
				EA 1" Reducing Tee For PEX Tubing.....	25.66	
				<i>For Work In Restricted Working Space, Add</i>	6.47	
				22 11 16 00-1062 Couplings <small>(22 11 16 00-1030)</small>		
				EA 3/8" Coupling For PEX Tubing.....	11.81	
				<i>For Work In Restricted Working Space, Add</i>	3.35	
				EA 1/2" Coupling For PEX Tubing.....	13.45	
				<i>For Work In Restricted Working Space, Add</i>	3.83	
				EA 3/4" Coupling For PEX Tubing.....	15.25	
				<i>For Work In Restricted Working Space, Add</i>	4.31	
				EA 1" Coupling For PEX Tubing.....	17.83	
				<i>For Work In Restricted Working Space, Add</i>	4.79	
				EA 3/4" x 1/2" Reducing Coupling For PEX Tubing.....	14.45	
				<i>For Work In Restricted Working Space, Add</i>	4.07	
				EA 1" x 3/4" Reducing Coupling For PEX Tubing.....	17.03	
				<i>For Work In Restricted Working Space, Add</i>	4.55	
				22 11 16 00-1069 Fitting Reducers <small>(22 11 16 00-1030)</small>		
				EA 3/8" x 1/2" Fitting Reducer For PEX Tubing.....	12.85	
				<i>For Work In Restricted Working Space, Add</i>	3.59	
				EA 1/2" Fitting Reducer For PEX Tubing.....	13.66	
				<i>For Work In Restricted Working Space, Add</i>	3.83	
				EA 3/4" Fitting Reducer For PEX Tubing.....	16.02	
				<i>For Work In Restricted Working Space, Add</i>	4.31	
				EA 1" Fitting Reducer For PEX Tubing.....	20.40	
				<i>For Work In Restricted Working Space, Add</i>	4.79	
				22 11 16 00-1074 90 Degree Elbows <small>(22 11 16 00-1030)</small>		
				EA 3/8" 90 Degree Elbow For PEX Tubing.....	12.19	
				<i>For Work In Restricted Working Space, Add</i>	3.35	
				EA 1/2" 90 Degree Elbow For PEX Tubing.....	13.79	
				<i>For Work In Restricted Working Space, Add</i>	3.83	
				EA 3/4" 90 Degree Elbow For PEX Tubing.....	16.02	
				<i>For Work In Restricted Working Space, Add</i>	4.31	
				EA 3/4" x 1/2" 90 Degree Elbow For PEX Tubing.....	15.22	
				<i>For Work In Restricted Working Space, Add</i>	4.07	
				EA 1/2" Drop 90 Degree Elbow For PEX Tubing.....	16.41	
				<i>For Work In Restricted Working Space, Add</i>	3.83	
				EA 3/4" Drop 90 Degree Elbow For PEX Tubing.....	18.38	
				<i>For Work In Restricted Working Space, Add</i>	4.31	
				EA 3/4" x 1/2" Drop 90 Degree Elbow For PEX Tubing.....	17.58	
				<i>For Work In Restricted Working Space, Add</i>	4.07	
				22 11 19 Domestic Water Piping Specialties <small>(22 11)</small>		
				22 11 19 00-0001 Rubber Hose And Clamps <small>(22 11 19)</small>		
				22 11 19 00-0002 General Purpose Hose <small>(22 11 19 00-0001)</small>		
				Note: For medium pressure (up to 200/250 psi) applications requiring excellent resistance to air, oil and heat.		
				LF 3/8" Inside Diameter Ethylene Propylene Diene Monomer (EPDM) Rubber Hose And Clamp.....	7.40	1.59
				LF 1/2" Inside Diameter Ethylene Propylene Diene Monomer (EPDM) Rubber Hose And Clamp.....	7.47	1.59
				LF 5/8" Inside Diameter Ethylene Propylene Diene Monomer (EPDM) Rubber Hose And Clamp.....	7.63	1.59
				LF 3/4" Inside Diameter Ethylene Propylene Diene Monomer (EPDM) Rubber Hose And Clamp.....	7.59	1.59
				LF 1" Inside Diameter Ethylene Propylene Diene Monomer (EPDM) Rubber Hose And Clamp.....	9.57	2.39
				LF 1-1/4" Inside Diameter Ethylene Propylene Diene Monomer (EPDM) Rubber Hose And Clamp.....	10.79	2.39
				LF 1-1/2" Inside Diameter Ethylene Propylene Diene Monomer (EPDM) Rubber Hose And Clamp.....	12.63	3.18
				22 11 19 00-0010 Chemical Resistant Rubber Hoses <small>(22 11 19 00-0001)</small>		
				EA 50' x 6" Brown Gum Rubber, Chemical Resistant Flexible Hose.....	1,042.04	181.66
				EA 50' x 6" Nitrile Rubber, Low pH Resistance, Flexible Hose.....	1,486.73	181.66
				22 11 19 00-0013 Water Pump Hose <small>(22 11 19 00-0001)</small>		
				EA 2" Inside Diameter, 20' Rubber Discharge Hose.....	178.96	48.63



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 19 00-0015	EA		2" Inside Diameter, 20' Rubber Intake Hose	185.28	48.63
22 11 19 00-0016			Serrated Shank Nipple (22 11 19 00-0001) Note: For use as medium pressure coupling.		
22 11 19 00-0017	EA		3/8" Inside Diameter Hose x 1/2" Male Pipe Thread Serrated Shank Nipple	17.34	3.98
22 11 19 00-0018	EA		1/2" Inside Diameter Hose x 5/8" Male Pipe Thread Serrated Shank Nipple	17.25	3.98
22 11 19 00-0019	EA		5/8" Inside Diameter Hose x 3/4" Male Pipe Thread Serrated Shank Nipple	17.25	3.98
22 11 19 00-0020	EA		3/4" Inside Diameter Hose x 1" Male Pipe Thread Serrated Shank Nipple	21.89	5.57
22 11 19 00-0021	EA		1" Inside Diameter Hose x 1-1/4" Male Pipe Thread Serrated Shank Nipple	23.04	5.57
22 11 19 00-0022	EA		1-1/4" Inside Diameter Hose x 1-1/2" Male Pipe Thread Serrated Shank Nipple	43.39	10.35
22 11 19 00-0023	EA		1-1/2" Inside Diameter Hose x 2" Male Pipe Thread Serrated Shank Nipple	53.83	12.74
22 11 19 00-0024			Worm-Drive Hose Clamp (22 11 19 00-0001)		
22 11 19 00-0025	EA		3/8" To 1" Diameter Worm Drive Hose Clamp	8.13	2.39
22 11 19 00-0026	EA		1/2" To 1-1/6" Diameter Worm Drive Hose Clamp	8.60	2.39
22 11 19 00-0027	EA		5/8" To 1-1/2" Diameter Worm Drive Hose Clamp	9.12	2.39
22 11 19 00-0028	EA		3/4" To 2" Diameter Worm Drive Hose Clamp	9.71	2.39
22 11 19 00-0029	EA		1" To 2-1/2" Diameter Worm Drive Hose Clamp	10.39	2.39
22 11 19 00-0030	EA		1-1/4" To 2-3/4" Diameter Worm Drive Hose Clamp	11.23	3.18
22 11 19 00-0031	EA		1-1/2" To 3" Diameter Worm Drive Hose Clamp	12.13	3.18
22 11 19 00-0032			Trap Primer And Accessories (22 11 19)		
22 11 19 00-0033			Trap Primer (22 11 19 00-0032)		
22 11 19 00-0034	EA		1/2" Inlet/Outlet, Flow Through Automatic Trap Primer (JR Smith 2699)	139.62	11.97
22 11 19 00-0035	EA		1/2" Inlet/Outlet, Automatic Trap Primer, Up To Two Floor Drains (PPP PR-500)	86.43	7.98
22 11 19 00-0036	EA		1/2" Inlet/Outlet, Automatic Trap Primer, Up To Four Floor Drains (PPP PO-500)	84.02	7.98
22 11 19 00-0037			Trap Primer Distribution Unit (22 11 19 00-0032)		
22 11 19 00-0038	EA		Molded Plastic Four Opening Trap Primer Distribution Unit (PPP DU-U)	84.06	15.97
			Note: Can be used for two, three or four drains.		
22 11 19 00-0039	EA		Copper Four Opening Trap Primer Distribution Unit (PPP DU-4)	90.55	15.97
			Note: Can be used for two, three or four drains.		
22 11 19 00-0040			Trap Primer Manifold (22 11 19 00-0032)		
22 11 19 00-0041	EA		Two Outlet Manifold	113.67	21.48
22 11 19 00-0042	EA		Four Outlet Manifold	166.92	24.43
22 11 19 00-0043	EA		Six Outlet Manifold	218.06	25.87
22 11 19 00-0044	EA		Eight Outlet Manifold	272.90	30.34
22 11 19 00-0045			Sewage Air Release Valves (22 11 19)		
22 11 19 00-0046			Cast Iron, Sewage Air Release Valves (22 11 19 00-0045) Note: Stainless steel float.		
22 11 19 00-0047	EA		2" x 1/2" NPT, Cast Iron, Sewage Air Release Valve (Apco 400)	681.15	29.15
			For Back Flush Attachment, Add	650.00	
22 11 19 00-0048	EA		3" x 1/2" NPT, Cast Iron, Sewage Air Release Valve (Apco 400)	835.22	48.72
			For Back Flush Attachment, Add	650.00	
22 11 19 00-0049	EA		4" x 1/2" NPT, Cast Iron, Sewage Air Release Valve (Apco 400)	1,059.13	61.51
			For Back Flush Attachment, Add	650.00	
22 11 19 00-0050			Cast Iron, Sewage Air Vacuum Valves (22 11 19 00-0045) Note: Stainless steel float.		
22 11 19 00-0051	EA		2" x 1" NPT, Cast Iron, Sewage Air Vacuum Valve (Apco 401)	695.98	29.15
			For Back Flush Attachment, Add	650.00	
22 11 19 00-0052	EA		2" x 2" NPT, Cast Iron, Sewage Air Vacuum Valve (Apco 402)	1,367.02	29.15
			For Back Flush Attachment, Add	650.00	
22 11 19 00-0053	EA		3" x 2" NPT, Cast Iron, Sewage Air Vacuum Valve (Apco 403)	1,639.73	48.72
			For Back Flush Attachment, Add	650.00	
22 11 19 00-0054	EA		4" NPT x 4" With Hood, Cast Iron, Sewage Air Vacuum Valve (Apco 404)	2,429.01	61.51
22 11 19 00-0055			Cast Iron, Sewage Combination Air Valves (22 11 19 00-0045) Note: Stainless steel float.		
22 11 19 00-0056	EA		2" x 1" NPT, Sewage Combination Air Valve (Apco 443)	1,489.37	29.15
22 11 19 00-0057	EA		2" x 2" NPT, Sewage Combination Air Valve (Apco 445)	2,054.74	29.15
22 11 19 00-0058	EA		3" x 3" NPT, Sewage Combination Air Valve (Apco 447)	2,403.45	48.72
22 11 19 00-0059	EA		4" x 4" NPT, Sewage Combination Air Valve (Apco 449)	2,938.78	61.51
22 11 19 00-0060			Brass, Anti Siphon Vacuum Breakers (22 11 19) Note: Watts 288A		
22 11 19 00-0061	EA		1/2" Brass, Anti Siphon Vacuum Breaker	60.47	19.96
22 11 19 00-0062	EA		3/4" Brass, Anti Siphon Vacuum Breaker	68.88	22.35
22 11 19 00-0063	EA		1" Brass, Anti Siphon Vacuum Breaker	125.20	25.56



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 19 00-0064 EA 1-1/4" Brass, Anti Siphon Vacuum Breaker	190.46	29.54
22 11 19 00-0065 EA 1-1/2" Brass, Anti Siphon Vacuum Breaker	226.88	32.73
22 11 19 00-0066 EA 2" Brass, Anti Siphon Vacuum Breaker	325.23	39.92
22 11 19 00-0067 EA 2-1/2" Brass, Anti Siphon Vacuum Breaker	810.23	49.90
22 11 19 00-0068 Anti Siphon Pressure Vacuum Breakers (22 11 19)		
Note: Watts 800M4QT		
22 11 19 00-0069 EA 1/2" Anti Siphon Pressure Type Vacuum Breaker	147.51	19.96
22 11 19 00-0070 EA 3/4" Anti Siphon Pressure Type Vacuum Breaker	132.63	22.35
22 11 19 00-0071 EA 1" Anti Siphon Pressure Type Vacuum Breaker	184.41	25.56
22 11 19 00-0072 EA 1-1/4" Anti Siphon Pressure Type Vacuum Breaker	320.71	29.54
22 11 19 00-0073 EA 1-1/2" Anti Siphon Pressure Type Vacuum Breaker	389.43	32.73
22 11 19 00-0074 EA 2" Anti Siphon Pressure Type Vacuum Breaker	398.04	39.92
22 11 19 00-0075 Bellows Type Water Hammer Arrestors (22 11 19)		
22 11 19 00-0076 EA Up To 11 Fixture Unit Capacity, 3/4" Nipple, Stainless Steel, Hydrotrol Water Hammer Arrestor (Jay R. Smith® 5005)	128.40	9.55
22 11 19 00-0077 EA >11 To 32 Fixture Unit Capacity, 1" Nipple, Stainless Steel, Hydrotrol Water Hammer Arrestor (Jay R. Smith® 5010)	245.55	11.55
22 11 19 00-0078 EA >32 To 60 Fixture Unit Capacity, 1" Nipple, Stainless Steel, Hydrotrol Water Hammer Arrestor (Jay R. Smith® 5020)	355.82	11.55
22 11 19 00-0079 EA >60 To 113 Fixture Unit Capacity, 1" Nipple, Stainless Steel, Hydrotrol Water Hammer Arrestor (Jay R. Smith® 5030)	857.24	11.55
22 11 19 00-0080 EA >113 To 154 Fixture Unit Capacity, 1" Nipple, Stainless Steel, Hydrotrol Water Hammer Arrestor (Jay R. Smith® 5040)	964.65	11.55
22 11 19 00-0081 EA >154 To 330 Fixture Unit Capacity, 1" Nipple, Stainless Steel, Hydrotrol Water Hammer Arrestor (Jay R. Smith® 5050)	1,180.09	11.55
22 11 19 00-0082 Piston Type Water Hammer Arrestors (22 11 19)		
22 11 19 00-0083 Threaded Piston Type Water Hammer Arrestors (22 11 19 00-0082)		
22 11 19 00-0084 EA Up To 11 Fixture Unit Capacity, 1/2" M.P.T Brass Connection, Copper Body, Piston Type Water Hammer Arrestor (MI Fab MWH-A)	77.19	5.33
22 11 19 00-0085 EA >11 To 32 Fixture Unit Capacity, 3/4" M.P.T Brass Connection, Copper Body, Piston Type Water Hammer Arrestor (MI Fab MWH-B)	145.38	6.14
22 11 19 00-0086 EA >32 To 60 Fixture Unit Capacity, 1" M.P.T Brass Connection, Copper Body, Piston Type Water Hammer Arrestor (MI Fab MWH-C)	214.31	6.66
22 11 19 00-0087 EA >60 To 113 Fixture Unit Capacity, 1-1/4" M.P.T Brass Connection, Copper Body, Piston Type Water Hammer Arrestor (MI Fab MWH-D)	521.69	8.58
22 11 19 00-0088 EA >113 To 154 Fixture Unit Capacity, 1-1/2" M.P.T Brass Connection, Copper Body, Piston Type Water Hammer Arrestor (MI Fab MWH-E)	635.54	10.64
22 11 19 00-0089 EA >154 To 330 Fixture Unit Capacity, 2" M.P.T Brass Connection, Copper Body, Piston Type Water Hammer Arrestor (MI Fab MWH-F)	722.79	11.55
22 11 19 00-0090 Escutcheons (22 11 19)		
22 11 19 00-0091 Brass Escutcheons (22 11 19 00-0090)		
22 11 19 00-0092 Shallow Brass Escutcheons (22 11 19 00-0091)		
22 11 19 00-0093 EA 3/8" IPS, Antique Or Polished Brass Shallow Escutcheon	9.85	1.99
22 11 19 00-0094 EA 1/2" IPS, Antique Or Polished Brass Shallow Escutcheon	10.68	1.99
22 11 19 00-0095 Deep Bell Brass Escutcheons (22 11 19 00-0091)		
22 11 19 00-0096 EA 3/8" IPS, Antique Or Polished Deep Bell Brass Escutcheon	11.76	2.24
22 11 19 00-0097 EA 1/2" IPS, Antique Or Polished Deep Bell Brass Escutcheon	11.78	2.24
22 11 19 00-0098 Chrome Plated Brass Escutcheons With Setscrew (22 11 19 00-0091)		
22 11 19 00-0099 EA 3/8" IPS, Chrome Plated Brass Escutcheon With Setscrew	12.24	1.99
22 11 19 00-0100 EA 1/2" IPS, Chrome Plated Brass Escutcheon With Setscrew	12.36	1.99
22 11 19 00-0101 EA 5/8" IPS, Chrome Plated Brass Escutcheon With Setscrew	12.53	1.99
22 11 19 00-0102 EA 3/4" IPS, Chrome Plated Brass Escutcheon With Setscrew	13.15	1.99
22 11 19 00-0103 EA 7/8" IPS, Chrome Plated Brass Escutcheon With Setscrew	13.40	2.40
22 11 19 00-0104 EA 1" IPS, Chrome Plated Brass Escutcheon With Setscrew	14.00	2.40
22 11 19 00-0105 EA 1-1/4" IPS, Chrome Plated Brass Escutcheon With Setscrew	14.57	2.64
22 11 19 00-0106 EA 1-1/2" IPS, Chrome Plated Brass Escutcheon With Setscrew	15.29	2.80
22 11 19 00-0107 EA 2" IPS, Chrome Plated Brass Escutcheon With Setscrew	21.49	3.19
22 11 19 00-0108 Plastic Escutcheons (22 11 19 00-0090)		
22 11 19 00-0109 Split-Ring White Plastic Escutcheons (22 11 19 00-0108)		
22 11 19 00-0110 EA 3/8" IPS, Split-Ring White Plastic Escutcheon	4.21	1.99
22 11 19 00-0111 EA 1/2" IPS, Split-Ring White Plastic Escutcheon	4.21	1.99
22 11 19 00-0112 EA 3/4" IPS, Split-Ring White Plastic Escutcheon	4.72	2.23
22 11 19 00-0113 EA 1" IPS, Split-Ring White Plastic Escutcheon	5.13	2.39
22 11 19 00-0114 EA 1-1/4" IPS, Split-Ring White Plastic Escutcheon	5.55	2.63



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 19 00-0115	EA		1-1/2" IPS, Split-Ring White Plastic Escutcheon.....	5.97	2.78
22 11 19 00-0116	EA		2" IPS, Split-Ring White Plastic Escutcheon.....	6.80	3.18
22 11 19 00-0117	EA		2-1/2" IPS, Split-Ring White Plastic Escutcheon.....	7.69	3.43
22 11 19 00-0118	EA		3" IPS, Split-Ring White Plastic Escutcheon.....	8.57	3.59
22 11 19 00-0119	EA		4" IPS, Split-Ring White Plastic Escutcheon.....	9.85	3.98
22 11 19 00-0120			Chrome Plate Plastic Escutcheons (22 11 19 00-0108)		
22 11 19 00-0121	EA		1/2" IPS, Chrome Plate Plastic Escutcheon.....	4.62	1.99
22 11 19 00-0122	EA		3/4" IPS, Chrome Plate Plastic Escutcheon.....	5.07	2.23
22 11 19 00-0123	EA		1" IPS, Chrome Plate Plastic Escutcheon.....	5.58	2.39
22 11 19 00-0124	EA		1-1/4" IPS, Chrome Plate Plastic Escutcheon.....	6.10	2.63
22 11 19 00-0125	EA		1-1/2" IPS, Chrome Plate Plastic Escutcheon.....	6.51	2.78
22 11 19 00-0126	EA		2" IPS, Chrome Plate Plastic Escutcheon.....	7.73	3.18
22 11 19 00-0127	EA		2-1/2" IPS, Chrome Plate Plastic Escutcheon.....	9.36	3.43
22 11 19 00-0128	EA		3" IPS, Chrome Plate Plastic Escutcheon.....	9.80	3.59
22 11 19 00-0129	EA		4" IPS, Chrome Plate Plastic Escutcheon.....	10.70	3.98
22 11 19 00-0130			Stainless Steel Escutcheons (22 11 19 00-0090)		
22 11 19 00-0131			Shallow Stainless Steel Escutcheons (22 11 19 00-0130)		
22 11 19 00-0132	EA		3/8" IPS, Shallow Stainless Steel Escutcheon.....	10.49	1.99
22 11 19 00-0133	EA		1/2" IPS, Shallow Stainless Steel Escutcheon.....	10.49	1.99
22 11 19 00-0134	EA		3/4" IPS, Shallow Stainless Steel Escutcheon.....	14.47	2.24
22 11 19 00-0135			Chrome Plated Steel Escutcheons (22 11 19 00-0090)		
22 11 19 00-0136			Split-Ring Chrome Plated Steel Escutcheons (22 11 19 00-0135)		
22 11 19 00-0137	EA		1/2" IPS, Split-Ring Chrome Plated Steel Escutcheon.....	4.33	1.99
22 11 19 00-0138	EA		3/4" IPS, Split-Ring Chrome Plated Steel Escutcheon.....	4.73	2.23
22 11 19 00-0139	EA		1" IPS, Split-Ring Chrome Plated Steel Escutcheon.....	5.19	2.39
22 11 19 00-0140	EA		1-1/4" IPS, Split-Ring Chrome Plated Steel Escutcheon.....	5.59	2.63
22 11 19 00-0141	EA		1-1/2" IPS, Split-Ring Chrome Plated Steel Escutcheon.....	5.99	2.78
22 11 19 00-0142	EA		2" IPS, Split-Ring Chrome Plated Steel Escutcheon.....	6.89	3.18
22 11 19 00-0143	EA		2-1/2" IPS, Split-Ring Chrome Plated Steel Escutcheon.....	9.67	3.43
22 11 19 00-0144	EA		3" IPS, Split-Ring Chrome Plated Steel Escutcheon.....	10.25	3.59
22 11 19 00-0145	EA		3-1/2" IPS, Split-Ring Chrome Plated Steel Escutcheon.....	12.31	3.82
22 11 19 00-0146	EA		4" IPS, Split-Ring Chrome Plated Steel Escutcheon.....	11.21	3.98
22 11 19 00-0147	EA		5" IPS, Split-Ring Chrome Plated Steel Escutcheon.....	14.09	4.38
22 11 19 00-0148	EA		6" IPS, Split-Ring Chrome Plated Steel Escutcheon.....	16.26	4.77
22 11 19 00-0149			Split-Ring/Springs Chrome Plated Steel Escutcheons (22 11 19 00-0135)		
22 11 19 00-0150	EA		3/8" IPS, Split-Ring/Springs Chrome Plated Steel Escutcheon.....	6.32	1.99
22 11 19 00-0151	EA		1/2" IPS, Split-Ring/Springs Chrome Plated Steel Escutcheon.....	6.32	1.99
22 11 19 00-0152	EA		3/4" IPS, Split-Ring/Springs Chrome Plated Steel Escutcheon.....	6.80	2.23
22 11 19 00-0153	EA		1" IPS, Split-Ring/Springs Chrome Plated Steel Escutcheon.....	7.42	2.39
22 11 19 00-0154	EA		1-1/4" IPS, Split-Ring/Springs Chrome Plated Steel Escutcheon.....	8.10	2.63
22 11 19 00-0155	EA		1-1/2" IPS, Split-Ring/Springs Chrome Plated Steel Escutcheon.....	8.60	2.78
22 11 19 00-0156	EA		2" IPS, Split-Ring/Springs Chrome Plated Steel Escutcheon.....	10.14	3.18
22 11 19 00-0157	EA		2-1/2" IPS, Split-Ring/Springs Chrome Plated Steel Escutcheon.....	11.53	3.43
22 11 19 00-0158	EA		3" IPS, Split-Ring/Springs Chrome Plated Steel Escutcheon.....	13.79	3.59
22 11 19 00-0159	EA		3-1/2" IPS, Split-Ring/Springs Chrome Plated Steel Escutcheon.....	16.63	3.82
22 11 19 00-0160	EA		4" IPS, Split-Ring/Springs Chrome Plated Steel Escutcheon.....	16.94	3.98
22 11 19 00-0161	EA		5" IPS, Split-Ring/Springs Chrome Plated Steel Escutcheon.....	26.87	4.38
22 11 19 00-0162	EA		6" IPS, Split-Ring/Springs Chrome Plated Steel Escutcheon.....	28.15	4.77
22 11 19 00-0163			Deep Bell Chrome Plated Steel Escutcheons (22 11 19 00-0135)		
22 11 19 00-0164	EA		3/8" IPS, Deep Bell Chrome Plated Steel Escutcheon.....	5.22	2.24
22 11 19 00-0165	EA		1/2" IPS, Deep Bell Chrome Plated Steel Escutcheon.....	5.16	2.24
22 11 19 00-0166	EA		3/4" IPS, Deep Bell Chrome Plated Steel Escutcheon.....	5.04	2.24
22 11 19 00-0167	EA		1" IPS, Deep Bell Chrome Plated Steel Escutcheon.....	5.53	2.40
22 11 19 00-0168	EA		1-1/4" IPS, Deep Bell Chrome Plated Steel Escutcheon.....	6.00	2.64
22 11 19 00-0169	EA		1-1/2" IPS, Deep Bell Chrome Plated Steel Escutcheon.....	6.57	2.80
22 11 19 00-0170			Shallow Chrome Plated Steel Escutcheons (22 11 19 00-0135)		
22 11 19 00-0171	EA		3/8" IPS, Shallow Chrome Plated Steel Escutcheon.....	4.81	1.99
22 11 19 00-0172	EA		1/2" IPS, Shallow Chrome Plated Steel Escutcheon.....	4.81	1.99
22 11 19 00-0173	EA		3/4" IPS, Shallow Chrome Plated Steel Escutcheon.....	4.86	1.99
22 11 19 00-0174	EA		1" IPS, Shallow Chrome Plated Steel Escutcheon.....	5.18	2.40
22 11 19 00-0175	EA		1-1/4" IPS, Shallow Chrome Plated Steel Escutcheon.....	5.61	2.64
22 11 19 00-0176	EA		1-1/2" IPS, Shallow Chrome Plated Steel Escutcheon.....	6.18	2.80
22 11 19 00-0177	EA		2" IPS, Shallow Chrome Plated Steel Escutcheon.....	7.01	3.19
22 11 19 00-0178			Wall Hydrants (22 11 19)		
			Note: Female inlet connection, 3/4" hose thread outlet.		



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 19 00-0179			Cast Bronze, Non-Freeze, Stainless Steel Box, Integral Vacuum Breaker Wall Hydrants <small>(22 11 19 00-0178)</small> Note: 3/4" HPT outlet. 3/4" NPT female and 1" NPT male inlet connection. Includes wall clamp.		
22 11 19 00-0180	EA		6" Thick Wall, Cast Bronze, Non Freeze, Stainless Steel Box, Integral Vacuum Breaker Wall Hydrant.....	464.09	19.96
			For 1" NPT Outlet, Add	54.31	
			For Cast Bronze Box, Add	23.04	
22 11 19 00-0181	EA		12" Thick Wall, Cast Bronze, Non Freeze, Stainless Steel Box, Integral Vacuum Breaker Wall Hydrant.....	490.98	23.95
			For 1" NPT Outlet, Add	54.31	
			For Cast Bronze Box, Add	23.04	
22 11 19 00-0182	EA		18" Thick Wall, Cast Bronze, Non Freeze, Stainless Steel Box, Integral Vacuum Breaker Wall Hydrant.....	507.33	28.83
			For 1" NPT Outlet, Add	54.31	
			For Cast Bronze Box, Add	23.04	
22 11 19 00-0183			Cast Bronze, Stainless Steel Box, Integral Vacuum Breaker Wall Hydrants <small>(22 11 19 00-0178)</small> Note: 3/4" HPT outlet. 3/4" NPT female and 1" NPT male inlet connection. Includes wall clamp.		
22 11 19 00-0184	EA		Cast Bronze, Stainless Steel Box, Integral Vacuum Breaker Wall Hydrant	479.57	33.53
			For 1" NPT Outlet, Add	54.31	
			For Cast Bronze Box, Add	23.04	
22 11 19 00-0185			Cast Bronze Non-Freezing Wall Hydrant <small>(22 11 19 00-0178)</small> Note: 3/4" HPT outlet. 3/4" NPT female and 1" NPT male inlet connection. Includes wall clamp.		
22 11 19 00-0186	EA		3" Thick Wall, Cast Bronze, Non Freeze, Nikaloy Face, Integral Vacuum Breaker Wall Hydrant	264.14	24.75
			For 1" NPT Outlet, Add	54.31	
22 11 19 00-0187	EA		4" Thick Wall, Cast Bronze, Non Freeze, Nikaloy Face, Integral Vacuum Breaker Wall Hydrant	322.49	24.75
			For 1" NPT Outlet, Add	54.31	
22 11 19 00-0188	EA		6" Thick Wall, Cast Bronze, Non Freeze, Nikaloy Face, Integral Vacuum Breaker Wall Hydrant	322.49	24.75
			For 1" NPT Outlet, Add	54.31	
22 11 19 00-0189	EA		8" Thick Wall, Cast Bronze, Non Freeze, Nikaloy Face, Integral Vacuum Breaker Wall Hydrant	322.49	24.75
			For 1" NPT Outlet, Add	54.31	
22 11 19 00-0190	EA		10" Thick Wall, Cast Bronze, Non Freeze, Nikaloy Face, Integral Vacuum Breaker Wall Hydrant	336.06	49.90
			For 1" NPT Outlet, Add	54.31	
22 11 19 00-0191	EA		12" Thick Wall, Cast Bronze, Non Freeze, Nikaloy Face, Integral Vacuum Breaker Wall Hydrant	336.06	49.90
			For 1" NPT Outlet, Add	54.31	
22 11 19 00-0192	EA		18" Thick Wall, Cast Bronze, Non Freeze, Nikaloy Face, Integral Vacuum Breaker Wall Hydrant	376.68	49.90
			For 1" NPT Outlet, Add	54.31	
22 11 19 00-0193			Stainless Steel Box Type Wall Hydrants <small>(22 11 19 00-0178)</small> Note: With 3/4" NPT female and 3/4" NPT male inlet connection.		
22 11 19 00-0194	EA		Recessed Stainless Steel Hose Box With Wall Flange Less Door (Acorn 8140).....	237.70	19.96
22 11 19 00-0195	EA		Recessed Stainless Steel Hose Box With Vacuum Breaker, Wall Flange Less Door (Acorn 8141)	258.06	19.96
22 11 19 00-0196	EA		Recessed Stainless Steel Hose Box With Wall Flange And Door (Acorn 8150).....	260.83	19.96
22 11 19 00-0197	EA		Recessed Stainless Steel Hose Box With Vacuum Breaker, Wall Flange And Door (Acorn 8151)	291.37	19.96
22 11 19 00-0198	EA		Recessed Stainless Steel Hose Box With Wall Flange Less Door (Acorn 8145).....	407.37	27.94
			Note: Includes hot and cold hose connections.		
22 11 19 00-0199	EA		Recessed Stainless Steel Hose Box With Vacuum Breaker, Wall Flange Less Door (Acorn 8146)	419.40	27.94
			Note: Includes hot and cold hose connections.		
22 11 19 00-0200	EA		Recessed Stainless Steel Hose Box With Wall Flange And Door (Acorn 8155).....	419.40	27.94
			Note: Includes hot and cold hose connections.		
22 11 19 00-0201	EA		Recessed Stainless Steel Hose Box With Vacuum Breaker, Wall Flange And Door (Acorn 8156)	448.08	27.94
			Note: Includes hot and cold hose connections.		
22 11 19 00-0202			Washer Boxes And Dryer Outlets <small>(22 11 19)</small>		
22 11 19 00-0203			Dryer Vent Kit <small>(22 11 19 00-0202)</small> Note: Includes 4" flexible tubing plastic hood clamps and tailpipe.		
22 11 19 00-0204	EA		Dryer Vent Kit With Hood, 4" x 5" Flexible Vent And Clamps	57.01	10.38
22 11 19 00-0205			Washer Boxes And Dryer Vents <small>(22 11 19 00-0202)</small> Note: Includes 1/2" supply valves and mounting brackets.		
22 11 19 00-0206	EA		2" Washing Machine Outlet Box, Plastic, Two 1/2" Supply Valves	184.76	15.97
22 11 19 00-0207			Ice Maker Outlet Box <small>(22 11 19)</small> Note: Includes one 1/2" quarter turn ball valve and connections wall mount.		
22 11 19 00-0208	EA		Plastic Ice Maker Outlet Box, 1/2" Quarter Turn Ball Valve, Wall Mount	100.92	15.97
22 11 19 00-0209	EA		Plastic Ice Maker Outlet Box, 1/2" Quarter Turn Ball Valve With Water Hammer Arrestor, Wall Mount	125.64	15.97
22 11 19 00-0210	EA		Steel Ice Maker Outlet Box, 1/2" Quarter Turn Ball Valve, Wall Mount.....	139.24	15.97
22 11 19 00-0211			Tempering Controllers For Potable Hot Water <small>(22 11 19)</small>		
22 11 19 00-0212			Point-Of-Use Thermostatic Mixing Valves (Bradley) <small>(22 11 19 00-0211)</small> Note: Point-of-Use Water Tempering Valves: ASSE 1016, or 1070, with piston-control mechanism, positive shutoff of hot water when cold water supply is lost, bronze body and cap with replaceable corrosion-resistant components, including stainless steel piston and liner.		
22 11 19 00-0213	EA		1/2" Inlets, 1/2" Outlet Sink/Faucet Point-Of-Use Thermostatic Mixing Valve (Bradley S59-2007)	258.14	19.33
22 11 19 00-0214	EA		1/2" Inlets, 1/2" Outlet Point-Of-Use Thermostatic Mixing Valve (Bradley S59-4004).....	133.08	19.33



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 19 00-0215	EA		1/2" Inlets, 1/2" Outlet Point-Of-Use Thermostatic Mixing Valve (Bradley S59-4008).....	143.01	19.33
22 11 19 00-0216	EA		3/4" Inlets, 3/4" Outlet Point-Of-Use Thermostatic Mixing Valve (Bradley S59-4016).....	221.14	26.04
22 11 19 00-0217			Thermostatic Mixing Valves (Bradley) (22 11 19 00-0211) Note: Standard Thermostatic, Water Mixing Valves: ASSE 1017, liquid-filled motor and piston control mechanism with positive shutoff of hot water when coldwater supply is lost. Water flow is shut off in event of thermostat failure. Bronze valve body and cap with replaceable corrosion-resistant components, including stainless steel piston and liner. Equipped with integral check stops and removable strainers.		
22 11 19 00-0218	EA		3/4" Inlets, 3/4" Outlet, 25 GPM Thermostatic Mixing Valve (Bradley S59-2025)	630.54	27.87
22 11 19 00-0219	EA		3/4" Inlets, 1" Outlet, 45 GPM Thermostatic Mixing Valve (Bradley S59-2045)	710.54	34.34
22 11 19 00-0220	EA		1" Inlets, 1-1/4" Outlet, 80 GPM Thermostatic Mixing Valve (Bradley S59-2080)	852.60	39.94
22 11 19 00-0221	EA		1-1/4" Inlets, 1-1/2" Outlet, 130 GPM Thermostatic Mixing Valve (Bradley S59-2130)	1,099.34	41.98
22 11 19 00-0222	EA		2" Inlets, 2" Outlet, 220 GPM Thermostatic Mixing Valve (Bradley S59-2200)	1,474.64	54.46
22 11 19 00-0223			High Low Temperature Thermostatic Mixing Valves (Bradley) (22 11 19 00-0211) Note: High Low Temperature Thermostatic Mixing Valves: ASSE 1017, liquid-filled thermal motor and piston control mechanism with positive shutoff of hot water when cold water supply is lost, and allowing restricted cold flow in event of loss or interruption of hot water supply. Flow is shut off in the event of thermostat failure. Equipped with integral check stops, thermometer, and removable strainers.		
22 11 19 00-0224	EA		3/4" Inlets, 1" Outlet, 45 GPM High-Low Thermostatic Mixing Valve (Leonard S59-3045)	1,552.15	42.93
22 11 19 00-0225	EA		1" Inlets, 1-1/4" Outlet, 80 GPM High-Low Thermostatic Mixing Valve (Bradley S59-3080)	2,011.28	49.92
22 11 19 00-0226	EA		1-1/4" Inlets, 1-1/2" Outlet, 130 GPM High-Low Thermostatic Mixing Valve (Bradley S59-3130).....	2,341.81	52.47
22 11 19 00-0227	EA		2" Inlets, 2" Outlet, 220 GPM High-Low Thermostatic Mixing Valve (Bradley S59-3200)	2,601.19	68.07
22 11 19 00-0228			Thermostatic Mixing Valves (Leonard) (22 11 19 00-0211) Note: Thermostatic Water Mixing Valve with Integral combination checkstops with strainers, 125 PSI (8.6 BAR) maximum operating pressure, Copper encapsulated thermostatic assembly with Teflon coated brass shuttle, Locking temperature regulating handle, Top or bottom supply/outlet connections, Integral circulation port connection		
22 11 19 00-0229	EA		3/4" In x 3/4" Out Thermostatic Mixing Valve (Leonard LV-981-RF)	581.87	27.87
			Note: For hot water or two pipe low pressure steam.		
22 11 19 00-0230	EA		1" In x 1-1/4" Out Thermostatic Mixing Valve (Leonard LV-982-RF).....	685.49	34.33
			Note: For hot water or two pipe low pressure steam.		
22 11 19 00-0231	EA		1-1/4" In x 1-1/4" Out Thermostatic Mixing Valve (Leonard LV-983-RF).....	841.84	39.94
			Note: For hot water or two pipe low pressure steam.		
22 11 19 00-0232	EA		1-1/4" In x 1-1/2" Out Thermostatic Mixing Valve (Leonard LV-984-RF).....	1,027.32	42.00
			Note: For hot water or two pipe low pressure steam.		
22 11 19 00-0233	EA		2" In x 2" Out Thermostatic Mixing Valve (Leonard LV-985-RF)	1,523.98	54.46
			Note: For hot water or two pipe low pressure steam.		
22 11 19 00-0234			Water Mixing/Self Operating Temperature Regulator (22 11 19 00-0211) Note: Includes high rate spring, temperature adjustment screw, temperature dial and remote bulb with 8' capillary tube.		
22 11 19 00-0235	EA		3/4" Valve Size, Water Mixing/Self Operating Temperature Regulator (Powers #11 Type WM Regulator)	1,256.13	39.92
22 11 19 00-0236	EA		1" Valve Size, Water Mixing/Self Operating Temperature Regulator (Powers #11 Type WM Regulator)	1,344.07	50.31
22 11 19 00-0237	EA		1-1/4" Valve Size, Water Mixing/Self Operating Temperature Regulator (Powers #11 Type WM Regulator).....	1,489.95	60.69
22 11 19 00-0238	EA		1-1/2" Valve Size, Water Mixing/Self Operating Temperature Regulator (Powers #11 Type WM Regulator).....	1,648.23	71.06
22 11 19 00-0239	EA		2" Valve Size, Water Mixing/Self Operating Temperature Regulator (Powers #11 Type WM Regulator)	1,942.81	93.42
22 11 19 00-0240	EA		2-1/2" Valve Size, Water Mixing/Self Operating Temperature Regulator (Powers #11 Type WM Regulator).....	2,267.77	106.50
22 11 19 00-0241			Backflow Preventer Valves (22 11 19)		
22 11 19 00-0242			Double Check Valve Backflow Preventer Assemblies (22 11 19 00-0241)		
22 11 19 00-0243			Threaded Double Check Valve Assemblies (22 11 19 00-0242)		
22 11 19 00-0244			Double Check Valve Assemblies With Quarter Turn Shut-Offs (22 11 19 00-0243) Note: Includes ball type test cocks, two quarter-turn (QT) full port resilient seated bronze body ball valves, and two epoxy coated bronze body check valves (Watts 007 QT or 719 QT series).		
22 11 19 00-0245	EA		1/2" Threaded Double Check Valve Assembly With Quarter Turn Shut-offs (Watts 007 QT or 719 QT series).....	226.85	21.40
			For Owner Furnished Material, Deduct	-173.35	
			For Work In Restricted Working Space, Add	16.05	
22 11 19 00-0246	EA		3/4" Threaded Double Check Valve Assembly With Quarter Turn Shut-offs (Watts 007 QT or 719 QT series).....	271.54	30.34
			For Owner Furnished Material, Deduct	-195.69	
			For Work In Restricted Working Space, Add	22.76	
22 11 19 00-0247	EA		1" Threaded Double Check Valve Assembly With Quarter Turn Shut-offs (Watts 007 QT or 719 QT series).....	314.65	37.04
			For Owner Furnished Material, Deduct	-222.03	
			For Work In Restricted Working Space, Add	27.79	
22 11 19 00-0248	EA		1-1/4" Threaded Double Check Valve Assembly With Quarter Turn Shut-offs (Watts 007 QT or 719 QT series)	433.99	43.12
			For Owner Furnished Material, Deduct	-326.20	
			For Work In Restricted Working Space, Add	32.34	
22 11 19 00-0249	EA		1-1/2" Threaded Double Check Valve Assembly With Quarter Turn Shut-offs (Watts 007 QT or 719 QT series)	534.27	49.50
			For Owner Furnished Material, Deduct	-411.31	
			For Work In Restricted Working Space, Add	36.89	
22 11 19 00-0250	EA		2" Threaded Double Check Valve Assembly With Quarter Turn Shut-offs (Watts 007 QT or 719 QT series).....	620.83	63.88
			For Owner Furnished Material, Deduct	-461.14	
			For Work In Restricted Working Space, Add	47.91	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 19 00-0251			Double Check Valve Assemblies With Quarter Turn Shut-Offs And Strainer <small>(22 11 19 00-0243)</small> Note: Includes ball type test cocks, two quarter-turn (QT) full port resilient seated bronze body ball valves, two epoxy coated bronze body check valves, and bronze strainer (Watts 007 QT-S or 719 QT-S series).		
22 11 19 00-0252	EA		1/2" Threaded Double Check Valve Assembly With Quarter Turn Shut-offs And Strainer (Watts 007 QT-S or 719 QT-S).....	276.45	21.40
			<i>For Owner Furnished Material, Deduct</i>	-222.95	
			<i>For Work In Restricted Working Space, Add</i>	16.05	
22 11 19 00-0253	EA		3/4" Threaded Double Check Valve Assembly With Quarter Turn Shut-offs And Strainer (Watts 007 QT-S or 719 QT-S).....	344.19	30.34
			<i>For Owner Furnished Material, Deduct</i>	-268.34	
			<i>For Work In Restricted Working Space, Add</i>	22.76	
22 11 19 00-0254	EA		1" Threaded Double Check Valve Assembly With Quarter Turn Shut-offs And Strainer (Watts 007 QT-S or 719 QT-S).....	403.72	37.04
			<i>For Owner Furnished Material, Deduct</i>	-311.10	
			<i>For Work In Restricted Working Space, Add</i>	27.79	
22 11 19 00-0255	EA		1-1/4" Threaded Double Check Valve Assembly With Quarter Turn Shut-offs And Strainer (Watts 007 QT-S or 719 QT-S).....	560.89	43.12
			<i>For Owner Furnished Material, Deduct</i>	-453.10	
			<i>For Work In Restricted Working Space, Add</i>	32.34	
22 11 19 00-0256	EA		1-1/2" Threaded Double Check Valve Assembly With Quarter Turn Shut-offs And Strainer (Watts 007 QT-S or 719 QT-S).....	683.74	49.50
			<i>For Owner Furnished Material, Deduct</i>	-560.78	
			<i>For Work In Restricted Working Space, Add</i>	36.89	
22 11 19 00-0257	EA		2" Threaded Double Check Valve Assembly With Quarter Turn Shut-offs And Strainer (Watts 007 QT-S or 719 QT-S).....	827.19	63.88
			<i>For Owner Furnished Material, Deduct</i>	-667.50	
			<i>For Work In Restricted Working Space, Add</i>	47.91	
22 11 19 00-0258			Flanged Double Check Valve Assemblies <small>(22 11 19 00-0242)</small>		
22 11 19 00-0259			Double Check Valve Assemblies With Non-Rising Stem Shut-Offs <small>(22 11 19 00-0258)</small> Note: Includes ball type test cocks, two non-rising stem (NRS) resilient seated iron body gate valves, and two epoxy coated iron body check valves (Watts 007 NRS series).		
22 11 19 00-0260	EA		2-1/2" Flanged Double Check Valve Assembly With NRS Shut-offs (Watts 007 NRS).....	1,673.31	176.41
			<i>For Owner Furnished Material, Deduct</i>	-1,438.10	
			<i>For Work In Restricted Working Space, Add</i>	70.56	
22 11 19 00-0261	EA		3" Flanged Double Check Valve Assembly With NRS Shut-offs (Watts 007 NRS).....	1,840.41	198.45
			<i>For Owner Furnished Material, Deduct</i>	-1,579.48	
			<i>For Work In Restricted Working Space, Add</i>	78.28	
22 11 19 00-0262			Double Check Valve Assemblies With Outside Stem And Yoke Shut-Offs <small>(22 11 19 00-0258)</small> Note: Includes ball type test cocks, two outside stem and yoke resilient seated iron body gate valves, and two epoxy coated iron body check valves (Watts 007 OSY series).		
22 11 19 00-0263	EA		2-1/2" Flanged Double Check Valve Assembly With Outside Stem And Yoke Shut-offs (Watts 007 OSY).....	1,819.49	176.41
			<i>For Owner Furnished Material, Deduct</i>	-1,584.28	
			<i>For Work In Restricted Working Space, Add</i>	70.56	
22 11 19 00-0264	EA		3" Flanged Double Check Valve Assembly With Outside Stem And Yoke Shut-offs (Watts 007 OSY).....	2,084.21	198.45
			<i>For Owner Furnished Material, Deduct</i>	-1,823.28	
			<i>For Work In Restricted Working Space, Add</i>	78.28	
22 11 19 00-0265			Double Check Valve Assemblies With Non-Rising Stem Shut-Offs <small>(22 11 19 00-0258)</small> Note: Includes ball type test cocks, two non-rising stem (NRS) resilient seated iron body gate valves, and two epoxy coated iron body check valves (Watts 709 NRS series).		
22 11 19 00-0266	EA		2-1/2" Flanged Double Check Valve Assembly With NRS Shut-offs (Watts 709 NRS series).....	2,064.49	176.41
			<i>For Owner Furnished Material, Deduct</i>	-1,829.30	
			<i>For Work In Restricted Working Space, Add</i>	70.56	
22 11 19 00-0267	EA		3" Flanged Double Check Valve Assembly With NRS Shut-offs (Watts 709 NRS series).....	2,269.88	198.45
			<i>For Owner Furnished Material, Deduct</i>	-2,008.94	
			<i>For Work In Restricted Working Space, Add</i>	78.28	
22 11 19 00-0268	EA		4" Flanged Double Check Valve Assembly With NRS Shut-offs (Watts 709 NRS series).....	2,615.12	294.00
			<i>For Owner Furnished Material, Deduct</i>	-2,223.32	
			<i>For Work In Restricted Working Space, Add</i>	117.54	
22 11 19 00-0269	EA		6" Flanged Double Check Valve Assembly With NRS Shut-offs (Watts 709 NRS series).....	4,398.27	455.60
			<i>For Owner Furnished Material, Deduct</i>	-3,575.26	
			<i>For Work In Restricted Working Space, Add</i>	246.90	
22 11 19 00-0270	EA		8" Flanged Double Check Valve Assembly With NRS Shut-offs (Watts 709 NRS series).....	8,402.92	683.39
			<i>For Owner Furnished Material, Deduct</i>	-7,168.21	
			<i>For Work In Restricted Working Space, Add</i>	370.41	
22 11 19 00-0271	EA		10" Flanged Double Check Valve Assembly With NRS Shut-offs (Watts 709 NRS series).....	11,009.68	808.31
			<i>For Owner Furnished Material, Deduct</i>	-9,540.02	
			<i>For Work In Restricted Working Space, Add</i>	440.90	
22 11 19 00-0272			Double Check Valve Assemblies With Non-Rising Stem Shut-Offs And Strainer <small>(22 11 19 00-0258)</small> Note: Includes ball type test cocks, two non-rising stem (NRS) resilient seated iron body gate valves, two epoxy coated iron body check valves, and iron body strainer (Watts 709 NRS-S series).		
22 11 19 00-0273	EA		2-1/2" Flanged Double Check Valve Assembly With NRS Shut-offs And Strainer (Watts 709 NRS-S series).....	2,266.78	176.41
			<i>For Owner Furnished Material, Deduct</i>	-2,031.59	
			<i>For Work In Restricted Working Space, Add</i>	70.56	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 19 00-0274 EA 3" Flanged Double Check Valve Assembly With NRS Shut-offs And Strainer (Watts 709 NRS-S series).....	2,511.90	198.45
<i>For Owner Furnished Material, Deduct</i>	-2,250.97	
<i>For Work In Restricted Working Space, Add</i>	78.28	
22 11 19 00-0275 EA 4" Flanged Double Check Valve Assembly With NRS Shut-offs And Strainer (Watts 709 NRS-S series).....	3,153.24	294.00
<i>For Owner Furnished Material, Deduct</i>	-2,761.48	
<i>For Work In Restricted Working Space, Add</i>	117.53	
22 11 19 00-0276 EA 6" Flanged Double Check Valve Assembly With NRS Shut-offs And Strainer (Watts 709 NRS-S series).....	5,419.39	455.60
<i>For Owner Furnished Material, Deduct</i>	-4,596.38	
<i>For Work In Restricted Working Space, Add</i>	246.90	
22 11 19 00-0277 EA 8" Flanged Double Check Valve Assembly With NRS Shut-offs And Strainer (Watts 709 NRS-S series).....	10,123.02	683.39
<i>For Owner Furnished Material, Deduct</i>	-8,888.50	
<i>For Work In Restricted Working Space, Add</i>	370.36	
22 11 19 00-0278 EA 10" Flanged Double Check Valve Assembly With NRS Shut-offs And Strainer (Watts 709 NRS-S series).....	11,009.68	808.31
<i>For Owner Furnished Material, Deduct</i>	-9,540.02	
<i>For Work In Restricted Working Space, Add</i>	440.90	
22 11 19 00-0279 Double Check Valve Assemblies With Outside Stem And Yoke Shut-Offs ^(22 11 19 00-0258)		
Note: Includes ball type test cocks, two outside stem and yoke resilient seated iron body gate valves, and two epoxy coated iron body check valves (Watts 709 OSY series).		
22 11 19 00-0280 EA 2-1/2" Flanged Double Check Valve Assembly With Outside Stem And Yoke Shut-offs (Watts 709 OSY series).....	2,191.62	176.41
<i>For Owner Furnished Material, Deduct</i>	-1,956.43	
<i>For Work In Restricted Working Space, Add</i>	70.56	
22 11 19 00-0281 EA 3" Flanged Double Check Valve Assembly With Outside Stem And Yoke Shut-offs (Watts 709 OSY series).....	2,501.08	198.45
<i>For Owner Furnished Material, Deduct</i>	-2,240.15	
<i>For Work In Restricted Working Space, Add</i>	78.28	
22 11 19 00-0282 EA 4" Flanged Double Check Valve Assembly With Outside Stem And Yoke Shut-offs (Watts 709 OSY series).....	2,884.51	294.00
<i>For Owner Furnished Material, Deduct</i>	-2,492.75	
<i>For Work In Restricted Working Space, Add</i>	117.53	
22 11 19 00-0283 EA 6" Flanged Double Check Valve Assembly With Outside Stem And Yoke Shut-offs (Watts 709 OSY series).....	4,720.73	455.60
<i>For Owner Furnished Material, Deduct</i>	-3,897.72	
<i>For Work In Restricted Working Space, Add</i>	246.90	
22 11 19 00-0284 EA 8" Flanged Double Check Valve Assembly With Outside Stem And Yoke Shut-offs (Watts 709 OSY series).....	8,940.72	683.39
<i>For Owner Furnished Material, Deduct</i>	-7,706.20	
<i>For Work In Restricted Working Space, Add</i>	370.36	
22 11 19 00-0285 EA 10" Flanged Double Check Valve Assembly With Outside Stem And Yoke Shut-offs (Watts 709 OSY series).....	12,084.57	808.31
<i>For Owner Furnished Material, Deduct</i>	-10,614.91	
<i>For Work In Restricted Working Space, Add</i>	440.90	
22 11 19 00-0286 Double Check Valve Assemblies With Outside Stem And Yoke Shut-Offs ^(22 11 19 00-0258)		
Note: Includes ball type test cocks, two outside stem and yoke resilient seated iron body gate valves, and single stainless steel housing and sleeve for two check valves (Watts 757 OSY series).		
22 11 19 00-0287 EA 2-1/2" Flanged Double Check Valve Assembly With Outside Stem And Yoke Shut-offs (Watts 757 OSY series).....	1,888.20	176.41
<i>For Owner Furnished Material, Deduct</i>	-1,653.01	
<i>For Work In Restricted Working Space, Add</i>	70.56	
22 11 19 00-0288 EA 3" Flanged Double Check Valve Assembly With Outside Stem And Yoke Shut-offs (Watts 757 OSY series).....	2,079.34	198.45
<i>For Owner Furnished Material, Deduct</i>	-1,818.41	
<i>For Work In Restricted Working Space, Add</i>	78.28	
22 11 19 00-0289 EA 4" Flanged Double Check Valve Assembly With Outside Stem And Yoke Shut-offs (Watts 757 OSY series).....	2,375.57	294.00
<i>For Owner Furnished Material, Deduct</i>	-1,983.81	
<i>For Work In Restricted Working Space, Add</i>	117.53	
22 11 19 00-0290 EA 6" Flanged Double Check Valve Assembly With Outside Stem And Yoke Shut-offs (Watts 757 OSY series).....	3,924.97	455.60
<i>For Owner Furnished Material, Deduct</i>	-3,101.96	
<i>For Work In Restricted Working Space, Add</i>	246.90	
22 11 19 00-0291 EA 8" Flanged Double Check Valve Assembly With Outside Stem And Yoke Shut-offs (Watts 757 OSY series).....	7,367.36	683.39
<i>For Owner Furnished Material, Deduct</i>	-6,132.84	
<i>For Work In Restricted Working Space, Add</i>	370.36	
22 11 19 00-0292 EA 10" Flanged Double Check Valve Assembly With Outside Stem And Yoke Shut-offs (Watts 757 OSY series).....	8,032.23	808.31
<i>For Owner Furnished Material, Deduct</i>	-6,562.57	
<i>For Work In Restricted Working Space, Add</i>	440.90	
22 11 19 00-0293 N-Pattern Double Check Valve Assemblies With Outside Stem And Yoke Shut-Offs ^(22 11 19 00-0258)		
Note: Includes ball type test cocks, two outside stem and yoke resilient seated iron body gate valves, and single stainless steel housing and sleeve for two check valves (Watts 757N OSY series).		
22 11 19 00-0294 EA 2-1/2" N-Pattern Flanged Double Check Valve Assembly With Outside Stem And Yoke Shutoffs (Watts 757N OSY series).....	2,474.73	176.41
<i>For Owner Furnished Material, Deduct</i>	-2,239.54	
<i>For Work In Restricted Working Space, Add</i>	70.56	
22 11 19 00-0295 EA 3" N-Pattern Flanged Double Check Valve Assembly With Outside Stem And Yoke Shutoffs (Watts 757N OSY series).....	2,665.87	198.45
<i>For Owner Furnished Material, Deduct</i>	-2,404.94	
<i>For Work In Restricted Working Space, Add</i>	78.28	
22 11 19 00-0296 EA 4" N-Pattern Flanged Double Check Valve Assembly With Outside Stem And Yoke Shutoffs (Watts 757 OSY series).....	3,355.67	294.00
<i>For Owner Furnished Material, Deduct</i>	-2,963.91	
<i>For Work In Restricted Working Space, Add</i>	117.53	
22 11 19 00-0297 EA 6" N-Pattern Flanged Double Check Valve Assembly With Outside Stem And Yoke Shutoffs (Watts 757N OSY series).....	5,565.71	455.60
<i>For Owner Furnished Material, Deduct</i>	-4,742.70	
<i>For Work In Restricted Working Space, Add</i>	246.90	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 19 00-0298	EA		8" N-Pattern Flanged Double Check Valve Assembly With Outside Stem And Yoke Shutoffs (Watts 757N OSY series).....	9,799.10	683.39
			<i>For Owner Furnished Material, Deduct</i>	-8,564.58	
			<i>For Work In Restricted Working Space, Add</i>	370.36	
22 11 19 00-0299	EA		10" N-Pattern Flanged Double Check Valve Assembly With Outside Stem And Yoke Shutoffs (Watts 757N OSY series).....	11,661.00	808.31
			<i>For Owner Furnished Material, Deduct</i>	-10,191.34	
			<i>For Work In Restricted Working Space, Add</i>	440.90	
22 11 19 00-0300			Double Check Valve Assemblies With Non-Rising Stem Shut-Off Valves <small>(22 11 19 00-0258)</small>		
			Note: Includes ball type test cocks, two non-rising stem (NRS) resilient seated iron body gate valves, and single stainless steel housing and sleeve for two check valves (Watts 757 NRS series).		
22 11 19 00-0301	EA		2-1/2" Flanged Double Check Valve Assembly With NRS Shut-offs (Watts 757 NRS series).....	1,771.55	176.41
			<i>For Owner Furnished Material, Deduct</i>	-1,536.36	
			<i>For Work In Restricted Working Space, Add</i>	70.56	
22 11 19 00-0302	EA		3" Flanged Double Check Valve Assembly With NRS Shut-offs (Watts 757 NRS series).....	1,967.99	198.45
			<i>For Owner Furnished Material, Deduct</i>	-1,707.06	
			<i>For Work In Restricted Working Space, Add</i>	78.28	
22 11 19 00-0303	EA		4" Flanged Double Check Valve Assembly With NRS Shut-offs (Watts 757 NRS series).....	2,269.45	294.00
			<i>For Owner Furnished Material, Deduct</i>	-1,877.69	
			<i>For Work In Restricted Working Space, Add</i>	117.53	
22 11 19 00-0304	EA		6" Flanged Double Check Valve Assembly With NRS Shut-offs (Watts 757 NRS series).....	3,841.61	455.60
			<i>For Owner Furnished Material, Deduct</i>	-3,018.60	
			<i>For Work In Restricted Working Space, Add</i>	246.90	
22 11 19 00-0305	EA		8" Flanged Double Check Valve Assembly With NRS Shut-offs (Watts 757 NRS series).....	7,287.03	683.39
			<i>For Owner Furnished Material, Deduct</i>	-6,052.51	
			<i>For Work In Restricted Working Space, Add</i>	370.36	
22 11 19 00-0306	EA		10" Flanged Double Check Valve Assembly With NRS Shut-offs (Watts 757 NRS series).....	8,256.54	808.31
			<i>For Owner Furnished Material, Deduct</i>	-6,786.88	
			<i>For Work In Restricted Working Space, Add</i>	440.90	
22 11 19 00-0307			N-Pattern Double Check Valve Assemblies With Non-Rising Stem Shut-Offs <small>(22 11 19 00-0258)</small>		
			Note: Includes ball type test cocks, two non-rising stem (NRS) resilient seated iron body gate valves, and single stainless steel housing and sleeve for two check valves (Watts 757N NRS series).		
22 11 19 00-0308	EA		2-1/2" N-Pattern Flanged Double Check Valve Assembly With NRS Shutoffs (Watts 757 NRS series).....	2,308.89	176.41
			<i>For Owner Furnished Material, Deduct</i>	-2,073.70	
			<i>For Work In Restricted Working Space, Add</i>	70.56	
22 11 19 00-0309	EA		3" N-Pattern Flanged Double Check Valve Assembly With NRS Shutoffs (Watts 757 NRS series).....	2,500.03	198.45
			<i>For Owner Furnished Material, Deduct</i>	-2,239.10	
			<i>For Work In Restricted Working Space, Add</i>	78.28	
22 11 19 00-0310	EA		4" N-Pattern Flanged Double Check Valve Assembly With NRS Shutoffs (Watts 757 NRS series).....	3,190.04	294.00
			<i>For Owner Furnished Material, Deduct</i>	-2,798.28	
			<i>For Work In Restricted Working Space, Add</i>	117.53	
22 11 19 00-0311	EA		6" N-Pattern Flanged Double Check Valve Assembly With NRS Shutoffs (Watts 757 NRS series).....	5,389.29	455.60
			<i>For Owner Furnished Material, Deduct</i>	-4,566.28	
			<i>For Work In Restricted Working Space, Add</i>	246.90	
22 11 19 00-0312	EA		8" N-Pattern Flanged Double Check Valve Assembly With NRS Shutoffs (Watts 757 NRS series).....	9,532.07	683.39
			<i>For Owner Furnished Material, Deduct</i>	-8,297.55	
			<i>For Work In Restricted Working Space, Add</i>	370.36	
22 11 19 00-0313	EA		10" N-Pattern Flanged Double Check Valve Assembly With NRS Shutoffs (Watts 757 NRS series).....	11,393.19	808.31
			<i>For Owner Furnished Material, Deduct</i>	-9,923.53	
			<i>For Work In Restricted Working Space, Add</i>	440.90	
22 11 19 00-0314			Double Check Valve Assemblies With Butterfly Shut-Off Valves <small>(22 11 19 00-0258)</small>		
			Note: Includes ball type test cocks, two resilient seated iron body butterfly valves, and single stainless steel housing and sleeve for two check valves (Watts 757 BFG series).		
22 11 19 00-0315	EA		2-1/2" Flanged Double Check Valve Assembly With Butterfly Valves (Watts 757 BFG series).....	2,047.45	176.41
			<i>For Owner Furnished Material, Deduct</i>	-1,812.26	
			<i>For Work In Restricted Working Space, Add</i>	70.56	
22 11 19 00-0316	EA		3" Flanged Double Check Valve Assembly With Butterfly Valves (Watts 757 BFG series).....	2,238.58	198.45
			<i>For Owner Furnished Material, Deduct</i>	-1,977.65	
			<i>For Work In Restricted Working Space, Add</i>	78.28	
22 11 19 00-0317	EA		4" Flanged Double Check Valve Assembly With Butterfly Valves (Watts 757 BFG series).....	2,534.81	294.00
			<i>For Owner Furnished Material, Deduct</i>	-2,143.05	
			<i>For Work In Restricted Working Space, Add</i>	117.53	
22 11 19 00-0318	EA		6" Flanged Double Check Valve Assembly With Butterfly Valves (Watts 757 BFG series).....	4,088.23	455.60
			<i>For Owner Furnished Material, Deduct</i>	-3,265.22	
			<i>For Work In Restricted Working Space, Add</i>	246.90	
22 11 19 00-0319	EA		8" Flanged Double Check Valve Assembly With Butterfly Valves (Watts 757 BFG series).....	7,530.61	683.39
			<i>For Owner Furnished Material, Deduct</i>	-6,296.09	
			<i>For Work In Restricted Working Space, Add</i>	370.36	
22 11 19 00-0320			N-Pattern Double Check Valve Assemblies With Butterfly Shut-Offs <small>(22 11 19 00-0258)</small>		
			Note: Includes ball type test cocks, two resilient seated iron body butterfly valves, and single stainless steel housing and sleeve for two check valves (Watts 757N BFG series).		
22 11 19 00-0321	EA		2-1/2" N-Pattern Flanged Double Check Assembly With Butterfly Valves (Watts 757 BFG series).....	2,633.97	176.41
			<i>For Owner Furnished Material, Deduct</i>	-2,398.78	
			<i>For Work In Restricted Working Space, Add</i>	70.56	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 19 00-0322 EA 3" N-Pattern Flanged Double Check Valve Assembly With Butterfly Valves (Watts 757 BFG series) <i>For Owner Furnished Material, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	2,825.11 -2,564.18 78.28	198.45
22 11 19 00-0323 EA 4" N-Pattern Flanged Double Check Valve Assembly With Butterfly Valves (Watts 757 BFG series) <i>For Owner Furnished Material, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	3,514.91 -3,123.15 117.53	294.00
22 11 19 00-0324 EA 6" N-Pattern Flanged Double Check Valve Assembly With Butterfly Valves (Watts 757 BFG series) <i>For Owner Furnished Material, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	5,729.00 -4,905.99 246.90	455.60
22 11 19 00-0325 EA 8" N-Pattern Flanged Double Check Valve Assembly With Butterfly Valves (Watts 757 BFG series) <i>For Owner Furnished Material, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	7,530.61 -6,296.09 370.36	683.39
22 11 19 00-0326 Grooved Double Check Valve Assemblies (22 11 19 00-0242)		
22 11 19 00-0327 Double Check Valve Assemblies With Quarter Turn Shut-Offs (22 11 19 00-0326) Note: Includes ball type test cocks, two quarter turn (QT) resilient seated iron body ball valves, and single stainless steel housing and sleeve for two check valves (Watts 757 QT series).		
22 11 19 00-0328 EA 2-1/2" Grooved Double Check Valve Assembly With Quarter Turn Shut-offs (Watts 757 QT series) <i>For Owner Furnished Material, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	1,771.55 -1,536.36 70.56	94.08
22 11 19 00-0329 EA 3" Grooved Double Check Valve Assembly With Quarter Turn Shut-offs (Watts 757 QT series) <i>For Owner Furnished Material, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	1,967.99 -1,707.06 78.28	104.37
22 11 19 00-0330 N-Patten Double Check Valve Assemblies With Quarter Turn Shut-Offs (22 11 19 00-0326) Note: Includes ball type test cocks, two quarter turn (QT) resilient seated iron body ball valves, and single stainless steel housing and sleeve for two check valves (Watts 757N QT series).		
22 11 19 00-0331 EA 2-1/2" N-Pattern Grooved Double Check Valve Assembly With QT Shutoffs (Watts 757 QT series) <i>For Owner Furnished Material, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	2,308.89 -2,073.70 70.56	94.08
22 11 19 00-0332 EA 3" N-Pattern Grooved Double Check Valve Assembly With QT Shutoffs (Watts 757 QT series) <i>For Owner Furnished Material, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	2,500.03 -2,239.10 78.28	104.37
22 11 19 00-0333 Reduced Pressure Zone Backflow Preventer Assemblies (22 11 19 00-0241)		
22 11 19 00-0334 Threaded Reduced Pressure Zone Assemblies (22 11 19 00-0333)		
22 11 19 00-0335 Reduced Pressure Zone Assemblies With Quarter Turn Shut-Offs (22 11 19 00-0334) Note: Includes ball type test cocks, two quarter-turn (QT) full port resilient seated bronze body ball valves, and captured spring assemblies (Watts 009 QT series).		
22 11 19 00-0336 EA 1/4" Threaded Reduced Pressure Zone Assembly With Quarter Turn Shut-offs (Watts 009 QT series) <i>For Owner Furnished Material, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	247.93 -201.62 13.89	18.53
22 11 19 00-0337 EA 3/8" Threaded Reduced Pressure Zone Assembly With Quarter Turn Shut-offs (Watts 009 QT series) <i>For Owner Furnished Material, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	262.51 -211.41 15.33	20.44
22 11 19 00-0338 EA 1/2" Threaded Reduced Pressure Zone Assembly With Quarter Turn Shut-offs (Watts 009 QT series) <i>For Owner Furnished Material, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	303.93 -250.43 16.05	21.40
22 11 19 00-0339 EA 3/4" Threaded Reduced Pressure Zone Assembly With Quarter Turn Shut-offs (Watts 009M3 QT series) <i>For Owner Furnished Material, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	409.38 -333.53 22.76	30.34
22 11 19 00-0340 EA 1" Threaded Reduced Pressure Zone Assembly With Quarter Turn Shut-offs (Watts 009M2 QT series) <i>For Owner Furnished Material, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	486.51 -393.89 27.79	37.04
22 11 19 00-0341 EA 1-1/4" Threaded Reduced Pressure Zone Assembly With Quarter Turn Shut-offs (Watts 009M2 QT series) <i>For Owner Furnished Material, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	725.68 -617.89 32.34	43.12
22 11 19 00-0342 EA 1-1/2" Threaded Reduced Pressure Zone Assembly With Quarter Turn Shut-offs (Watts 009M2 QT series) <i>For Owner Furnished Material, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	769.91 -646.95 36.89	49.50
22 11 19 00-0343 EA 2" Threaded Reduced Pressure Zone Assembly With Quarter Turn Shut-offs (Watts 009M2 QT series) <i>For Owner Furnished Material, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	927.40 -767.71 47.91	63.88
22 11 19 00-0344 Reduced Pressure Zone Assemblies With Quarter Turn Shut-Offs And Strainer (22 11 19 00-0334) Note: Includes ball type test cocks, two quarter-turn (QT) full port resilient seated bronze body ball valves, bronze strainer, and captured spring assemblies (Watts 009 QT-S series).		
22 11 19 00-0345 EA 1/4" Threaded Reduced Pressure Zone Assembly With Quarter Turn Shut-offs And Strainer (Watts 009 QT-S series) <i>For Owner Furnished Material, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	272.34 -226.03 13.89	18.53
22 11 19 00-0346 EA 3/8" Threaded Reduced Pressure Zone Assembly With Quarter Turn Shut-offs And Strainer (Watts 009 QT-S series) <i>For Owner Furnished Material, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	288.23 -237.13 15.33	20.44



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 19 00-0347 EA 1/2" Threaded Reduced Pressure Zone Assembly With Quarter Turn Shut-offs And Strainer (Watts 009 QT-S series).....	339.18	30.34
<i>For Owner Furnished Material, Deduct</i>	-285.68	
<i>For Work In Restricted Working Space, Add</i>	16.05	
22 11 19 00-0348 EA 3/4" Threaded Reduced Pressure Zone Assembly With Quarter Turn Shut-offs And Strainer (Watts 009 QT-S series).....	464.78	30.34
<i>For Owner Furnished Material, Deduct</i>	-388.93	
<i>For Work In Restricted Working Space, Add</i>	22.76	
22 11 19 00-0349 EA 1" Threaded Reduced Pressure Zone Assembly With Quarter Turn Shut-offs And Strainer (Watts 009 QT-S series).....	555.78	37.04
<i>For Owner Furnished Material, Deduct</i>	-463.16	
<i>For Work In Restricted Working Space, Add</i>	27.79	
22 11 19 00-0350 EA 1-1/4" Threaded Reduced Pressure Zone Assembly With Quarter Turn Shut-offs And Strainer (Watts 009 QT-S series).....	820.15	43.12
<i>For Owner Furnished Material, Deduct</i>	-712.36	
<i>For Work In Restricted Working Space, Add</i>	32.34	
22 11 19 00-0351 EA 1-1/2" Threaded Reduced Pressure Zone Assembly With Quarter Turn Shut-offs And Strainer (Watts 009 QT-S series).....	903.23	49.50
<i>For Owner Furnished Material, Deduct</i>	-780.27	
<i>For Work In Restricted Working Space, Add</i>	36.89	
22 11 19 00-0352 EA 2" Threaded Reduced Pressure Zone Assembly With Quarter Turn Shut-offs And Strainer (Watts 009 QT-S series).....	1,090.96	63.88
<i>For Owner Furnished Material, Deduct</i>	-931.27	
<i>For Work In Restricted Working Space, Add</i>	47.91	
22 11 19 00-0353 Reduced Pressure Zone Assemblies With Quarter Turn Shut-Offs <small>(22 11 19 00-0334)</small>		
Note: Includes ball type test cocks, two quarter-turn (QT) full port resilient seated bronze body ball valves, and captured spring assemblies (Watts 919 QT series).		
22 11 19 00-0354 EA 3/4" Threaded Reduced Pressure Zone Assembly With Quarter Turn Shut-offs (Watts 919 QT series)	409.38	30.34
<i>For Owner Furnished Material, Deduct</i>	-333.53	
<i>For Work In Restricted Working Space, Add</i>	22.76	
22 11 19 00-0355 EA 1" Threaded Reduced Pressure Zone Assembly With Quarter Turn Shut-offs (Watts 919 QT series)	486.51	37.04
<i>For Owner Furnished Material, Deduct</i>	-393.89	
<i>For Work In Restricted Working Space, Add</i>	27.79	
22 11 19 00-0356 EA 1-1/4" Threaded Reduced Pressure Zone Assembly With Quarter Turn Shut-offs (Watts 919 QT series)	725.68	43.12
<i>For Owner Furnished Material, Deduct</i>	-617.89	
<i>For Work In Restricted Working Space, Add</i>	32.34	
22 11 19 00-0357 EA 1-1/2" Threaded Reduced Pressure Zone Assembly With Quarter Turn Shut-offs (Watts 919 QT series)	769.91	49.50
<i>For Owner Furnished Material, Deduct</i>	-646.95	
<i>For Work In Restricted Working Space, Add</i>	36.89	
22 11 19 00-0358 EA 2" Threaded Reduced Pressure Zone Assembly With Quarter Turn Shut-offs (Watts 919 QT series)	927.40	63.88
<i>For Owner Furnished Material, Deduct</i>	-767.71	
<i>For Work In Restricted Working Space, Add</i>	47.91	
22 11 19 00-0359 Reduced Pressure Zone Assemblies With Quarter Turn Shut-Offs And Strainer <small>(22 11 19 00-0334)</small>		
Note: Includes ball type test cocks, two quarter-turn (QT) full port resilient seated bronze body ball valves, bronze strainer, and captured spring assemblies (Watts 919 QT-S series).		
22 11 19 00-0360 EA 3/4" Threaded Reduced Pressure Zone Assembly With Quarter Turn Shut-offs And Strainer (Watts 919QT-S series).....	464.78	30.34
<i>For Owner Furnished Material, Deduct</i>	-388.93	
<i>For Work In Restricted Working Space, Add</i>	22.76	
22 11 19 00-0361 EA 1" Threaded Reduced Pressure Zone Assembly With Quarter Turn Shut-offs And Strainer (Watts 919QT-S series).....	555.78	37.04
<i>For Owner Furnished Material, Deduct</i>	-463.16	
<i>For Work In Restricted Working Space, Add</i>	27.79	
22 11 19 00-0362 EA 1-1/4" Threaded Reduced Pressure Zone Assembly With Quarter Turn Shut-offs And Strainer (Watts 919QT-S series).....	820.15	43.12
<i>For Owner Furnished Material, Deduct</i>	-712.36	
<i>For Work In Restricted Working Space, Add</i>	32.34	
22 11 19 00-0363 EA 1-1/2" Threaded Reduced Pressure Zone Assembly With Quarter Turn Shut-offs And Strainer (Watts 919QT-S series).....	903.23	49.50
<i>For Owner Furnished Material, Deduct</i>	-780.27	
<i>For Work In Restricted Working Space, Add</i>	36.89	
22 11 19 00-0364 EA 2" Threaded Reduced Pressure Zone Assembly With Quarter Turn Shut-offs And Strainer (Watts 919QT-S series).....	1,090.96	63.88
<i>For Owner Furnished Material, Deduct</i>	-931.27	
<i>For Work In Restricted Working Space, Add</i>	47.91	
22 11 19 00-0365 Reduced Pressure Zone Assemblies With Quarter Turn Shut-Offs <small>(22 11 19 00-0334)</small>		
Note: Includes ball type test cocks, two quarter-turn (QT) full port resilient seated bronze body ball valves, and captured spring assemblies (Watts 909 QT series).		
22 11 19 00-0366 EA 3/4" Threaded Reduced Pressure Zone Assembly With Quarter Turn Shut-offs (Watts 909QT).....	601.08	30.34
<i>For Owner Furnished Material, Deduct</i>	-525.23	
<i>For Work In Restricted Working Space, Add</i>	22.76	
22 11 19 00-0367 EA 1" Threaded Reduced Pressure Zone Assembly With Quarter Turn Shut-offs (Watts 909QT).....	712.49	37.04
<i>For Owner Furnished Material, Deduct</i>	-619.87	
<i>For Work In Restricted Working Space, Add</i>	27.79	
22 11 19 00-0368 EA 1-1/4" Threaded Reduced Pressure Zone Assembly With Quarter Turn Shut-offs (Watts 909M1QT)	1,080.68	43.12
<i>For Owner Furnished Material, Deduct</i>	-972.89	
<i>For Work In Restricted Working Space, Add</i>	32.34	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 19 00-0369	EA		1-1/2" Threaded Reduced Pressure Zone Assembly With Quarter Turn Shut-offs (Watts 909M1QT).....	1,172.05	49.50
			<i>For Owner Furnished Material, Deduct</i>	-1,049.09	
			<i>For Work In Restricted Working Space, Add</i>	36.89	
22 11 19 00-0370	EA		2" Threaded Reduced Pressure Zone Assembly With Quarter Turn Shut-offs (Watts 909M1QT).....	1,367.91	63.88
			<i>For Owner Furnished Material, Deduct</i>	-1,208.22	
			<i>For Work In Restricted Working Space, Add</i>	47.91	
22 11 19 00-0371			Reduced Pressure Zone Assemblies With Quarter Turn Shut-Offs And Strainer <small>(22 11 19 00-0334)</small>		
			Note: Includes ball type test cocks, two quarter-turn (QT) full port resilient seated bronze body ball valves, bronze strainer, and captured spring assemblies (Watts 909 QT-S series).		
22 11 19 00-0372	EA		3/4" Threaded Reduced Pressure Zone Assembly With Quarter Turn Shut-offs And Strainer (Watts 909QT-S)	675.70	30.34
			<i>For Owner Furnished Material, Deduct</i>	-599.85	
			<i>For Work In Restricted Working Space, Add</i>	22.76	
22 11 19 00-0373	EA		1" Threaded Reduced Pressure Zone Assembly With Quarter Turn Shut-offs And Strainer (Watts 909QT-S)	805.07	37.04
			<i>For Owner Furnished Material, Deduct</i>	-712.45	
			<i>For Work In Restricted Working Space, Add</i>	27.79	
22 11 19 00-0374	EA		1-1/4" Threaded Reduced Pressure Zone Assembly With Quarter Turn Shut-offs And Strainer (Watts 909M1QT-S)	1,209.25	43.12
			<i>For Owner Furnished Material, Deduct</i>	-1,101.46	
			<i>For Work In Restricted Working Space, Add</i>	32.34	
22 11 19 00-0375	EA		1-1/2" Threaded Reduced Pressure Zone Assembly With Quarter Turn Shut-offs And Strainer (Watts 909M1QT-S)	1,323.94	49.50
			<i>For Owner Furnished Material, Deduct</i>	-1,200.98	
			<i>For Work In Restricted Working Space, Add</i>	36.89	
22 11 19 00-0376	EA		2" Threaded Reduced Pressure Zone Assembly With Quarter Turn Shut-offs And Strainer (Watts 909M1QT-S)	1,581.51	63.88
			<i>For Owner Furnished Material, Deduct</i>	-1,421.82	
			<i>For Work In Restricted Working Space, Add</i>	47.91	
22 11 19 00-0377			Flanged Reduced Pressure Zone Assemblies <small>(22 11 19 00-0333)</small>		
22 11 19 00-0378			Reduced Pressure Zone Assemblies With Non-Rising Stem Shut-Offs <small>(22 11 19 00-0377)</small>		
			Note: Includes ball type test cocks, two non-rising stem (NRS) resilient seated iron body gate valves, and captured spring assemblies (Watts 009 NRS series).		
22 11 19 00-0379	EA		2-1/2" Flanged Reduced Pressure Zone Assembly With NRS Shut-offs (Watts 009 NRS series).....	1,995.16	176.41
			<i>For Owner Furnished Material, Deduct</i>	-1,759.95	
			<i>For Work In Restricted Working Space, Add</i>	70.56	
22 11 19 00-0380	EA		3" Flanged Reduced Pressure Zone Assembly With NRS Shut-offs (Watts 009 NRS series).....	2,246.03	198.45
			<i>For Owner Furnished Material, Deduct</i>	-1,985.10	
			<i>For Work In Restricted Working Space, Add</i>	78.28	
22 11 19 00-0381			Reduced Pressure Zone Assemblies With Non-Rising Stem Shut-Off And Strainer <small>(22 11 19 00-0377)</small>		
			Note: Includes ball type test cocks, two non-rising stem (NRS) resilient seated iron body gate valves, iron body strainer, and captured spring assemblies (Watts 009 NRS-S series).		
22 11 19 00-0382	EA		2-1/2" Flanged Reduced Pressure Zone Assembly With NRS Shut-offs And Strainer (Watts 009 NRS-S series)	2,215.72	176.41
			<i>For Owner Furnished Material, Deduct</i>	-1,980.51	
			<i>For Work In Restricted Working Space, Add</i>	70.56	
22 11 19 00-0383	EA		3" Flanged Reduced Pressure Zone Assembly With NRS Shut-offs And Strainer (Watts 009 NRS-S series).....	2,505.16	198.45
			<i>For Owner Furnished Material, Deduct</i>	-2,244.23	
			<i>For Work In Restricted Working Space, Add</i>	78.28	
22 11 19 00-0384			Reduced Pressure Zone Assemblies With Outside Stem And Yoke Shut-Offs <small>(22 11 19 00-0377)</small>		
			Note: Includes ball type test cocks, two outside stem and yoke resilient seated iron body gate valves, and captured spring assemblies (Watts 009 OSY series).		
22 11 19 00-0385	EA		2-1/2" Flanged Reduced Pressure Zone Assembly With Outside Stem And Yoke Shut-offs (Watts 009 OSY series).....	2,132.94	176.41
			<i>For Owner Furnished Material, Deduct</i>	-1,897.73	
			<i>For Work In Restricted Working Space, Add</i>	70.56	
22 11 19 00-0386	EA		3" Flanged Reduced Pressure Zone Assembly With Outside Stem And Yoke Shut-offs (Watts 009 OSY series)	2,475.81	198.45
			<i>For Owner Furnished Material, Deduct</i>	-2,214.88	
			<i>For Work In Restricted Working Space, Add</i>	78.28	
22 11 19 00-0387			Reduced Pressure Zone Assemblies With Quarter Turn Shut-Offs <small>(22 11 19 00-0377)</small>		
			Note: Includes ball type test cocks, two quarter turn (QT) resilient seated iron body ball valves, and captured spring assemblies (Watts 009 QT-FDA series).		
22 11 19 00-0388	EA		2-1/2" Flanged Reduced Pressure Zone Assembly With QT Shut-offs (Watts 009 QT-FDA series).....	2,506.35	176.41
			<i>For Owner Furnished Material, Deduct</i>	-2,271.14	
			<i>For Work In Restricted Working Space, Add</i>	70.56	
22 11 19 00-0389	EA		3" Flanged Reduced Pressure Zone Assembly With QT Shut-offs (Watts 009 QT-FDA series).....	2,864.15	198.45
			<i>For Owner Furnished Material, Deduct</i>	-2,603.22	
			<i>For Work In Restricted Working Space, Add</i>	78.28	
22 11 19 00-0390			Reduced Pressure Zone Assemblies With Quarter Turn Shut-Offs <small>(22 11 19 00-0377)</small>		
			Note: Includes ball type test cocks, two quarter turn (QT) resilient seated iron body ball valves, and captured spring assemblies (Watts FAE 909 QT series).		



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 19 00-0391	EA		1-1/4" Flanged Reduced Pressure Zone Assembly With QT Shut-offs (Watts FAE 909 QT series).....	959.09	110.25
			<i>For Owner Furnished Material, Deduct</i>	-812.09	
			<i>For Work In Restricted Working Space, Add</i>	44.10	
22 11 19 00-0392	EA		1-1/2" Flanged Reduced Pressure Zone Assembly With QT Shut-offs (Watts FAE 909 QT series).....	1,065.19	128.63
			<i>For Owner Furnished Material, Deduct</i>	-892.46	
			<i>For Work In Restricted Working Space, Add</i>	51.82	
22 11 19 00-0393	EA		2" Flanged Reduced Pressure Zone Assembly With QT Shut-offs (Watts FAE 909 QT series).....	1,260.66	150.68
			<i>For Owner Furnished Material, Deduct</i>	-1,058.53	
			<i>For Work In Restricted Working Space, Add</i>	60.64	
22 11 19 00-0394			Reduced Pressure Zone Assemblies With Quarter Turn Shut-Offs And Strainer <small>(22 11 19 00-0377)</small>		
			Note: Includes ball type test cocks, two quarter turn (QT) resilient seated iron body ball valves, iron body strainers, and captured spring assemblies (Watts FAE 909 QT-S series).		
22 11 19 00-0395	EA		1-1/4" Flanged Reduced Pressure Zone Assembly With QT Shut-offs And Strainer (Watts FAE 909 QT-S series).....	1,041.53	110.25
			<i>For Owner Furnished Material, Deduct</i>	-894.53	
			<i>For Work In Restricted Working Space, Add</i>	44.10	
22 11 19 00-0396	EA		1-1/2" Flanged Reduced Pressure Zone Assembly With QT Shut-offs And Strainer (Watts FAE 909 QT-S series).....	1,330.30	128.63
			<i>For Owner Furnished Material, Deduct</i>	-1,157.57	
			<i>For Work In Restricted Working Space, Add</i>	51.82	
22 11 19 00-0397	EA		2" Flanged Reduced Pressure Zone Assembly With QT Shut-offs And Strainer (Watts FAE 909 QT-S series).....	1,403.78	150.68
			<i>For Owner Furnished Material, Deduct</i>	-1,201.65	
			<i>For Work In Restricted Working Space, Add</i>	60.64	
22 11 19 00-0398			Reduced Pressure Zone Assemblies With Non-Rising Stem Shut-Offs <small>(22 11 19 00-0377)</small>		
			Note: Includes ball type test cocks, two non-rising stem (NRS) resilient seated iron body gate valves, and captured spring assemblies (Watts 909 NRS series).		
22 11 19 00-0399	EA		2-1/2" Flanged Reduced Pressure Zone Assembly With NRS Shut-offs (Watts 909 NRS series).....	2,485.37	176.41
			<i>For Owner Furnished Material, Deduct</i>	-2,250.18	
			<i>For Work In Restricted Working Space, Add</i>	70.56	
22 11 19 00-0400	EA		3" Flanged Reduced Pressure Zone Assembly With NRS Shut-offs (Watts 909 NRS series).....	2,801.89	198.45
			<i>For Owner Furnished Material, Deduct</i>	-2,540.95	
			<i>For Work In Restricted Working Space, Add</i>	78.28	
22 11 19 00-0401	EA		4" Flanged Reduced Pressure Zone Assembly With NRS Shut-offs (Watts 909 NRS series).....	3,478.39	294.00
			<i>For Owner Furnished Material, Deduct</i>	-3,086.59	
			<i>For Work In Restricted Working Space, Add</i>	117.54	
22 11 19 00-0402	EA		6" Flanged Reduced Pressure Zone Assembly With NRS Shut-offs (Watts 909 NRS series).....	6,067.25	455.60
			<i>For Owner Furnished Material, Deduct</i>	-4,914.97	
			<i>For Work In Restricted Working Space, Add</i>	345.68	
22 11 19 00-0403	EA		8" Flanged Reduced Pressure Zone Assembly With NRS Shut-offs (Watts 909M1 NRS series).....	10,336.07	683.39
			<i>For Owner Furnished Material, Deduct</i>	-8,607.64	
			<i>For Work In Restricted Working Space, Add</i>	518.53	
22 11 19 00-0404	EA		10" Flanged Reduced Pressure Zone Assembly With NRS Shut-offs (Watts 909M1 NRS series).....	12,909.99	808.31
			<i>For Owner Furnished Material, Deduct</i>	-11,440.33	
			<i>For Work In Restricted Working Space, Add</i>	440.90	
22 11 19 00-0405			Reduced Pressure Zone Assemblies With Non-Rising Stem Shut-Off And Strainer <small>(22 11 19 00-0377)</small>		
			Note: Includes ball type test cocks, two non-rising stem (NRS) resilient seated iron body gate valves, iron body strainer, and captured spring assemblies (Watts 909 NRS-S series).		
22 11 19 00-0406	EA		2-1/2" Flanged Reduced Pressure Zone Assembly With NRS Shut-offs And Strainer (Watts 909 NRS-S series).....	2,688.18	176.41
			<i>For Owner Furnished Material, Deduct</i>	-2,452.99	
			<i>For Work In Restricted Working Space, Add</i>	70.56	
22 11 19 00-0407	EA		3" Flanged Reduced Pressure Zone Assembly With NRS Shut-offs And Strainer (Watts 909 NRS-S series).....	3,040.87	198.45
			<i>For Owner Furnished Material, Deduct</i>	-2,779.94	
			<i>For Work In Restricted Working Space, Add</i>	78.28	
22 11 19 00-0408	EA		4" Flanged Reduced Pressure Zone Assembly With NRS Shut-offs And Strainer (Watts 909 NRS-S series).....	3,939.10	294.00
			<i>For Owner Furnished Material, Deduct</i>	-3,547.34	
			<i>For Work In Restricted Working Space, Add</i>	117.53	
22 11 19 00-0409	EA		6" Flanged Reduced Pressure Zone Assembly With NRS Shut-offs And Strainer (Watts 909 NRS-S series).....	6,613.66	455.60
			<i>For Owner Furnished Material, Deduct</i>	-5,790.65	
			<i>For Work In Restricted Working Space, Add</i>	246.90	
22 11 19 00-0410	EA		8" Flanged Reduced Pressure Zone Assembly With NRS Shut-offs And Strainer (Watts 909 NRS-S series).....	11,315.86	683.39
			<i>For Owner Furnished Material, Deduct</i>	-10,081.34	
			<i>For Work In Restricted Working Space, Add</i>	370.36	
22 11 19 00-0411	EA		10" Flanged Reduced Pressure Zone Assembly With NRS Shut-offs And Strainer (Watts 909 NRS-S series).....	15,443.28	808.31
			<i>For Owner Furnished Material, Deduct</i>	-13,973.62	
			<i>For Work In Restricted Working Space, Add</i>	440.90	
22 11 19 00-0412			Reduced Pressure Zone Assemblies With Outside Stem And Yoke Shut-Offs <small>(22 11 19 00-0377)</small>		
			Note: Includes ball type test cocks, two outside stem and yoke resilient seated iron body gate valves, and captured spring assemblies (Watts 909 OSY series).		
22 11 19 00-0413	EA		2-1/2" Flanged Reduced Pressure Zone Assembly With Outside Stem And Yoke Shut-offs (Watts 909 OSY series).....	2,568.91	176.41
			<i>For Owner Furnished Material, Deduct</i>	-2,333.72	
			<i>For Work In Restricted Working Space, Add</i>	70.56	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 19 00-0414	EA		3" Flanged Reduced Pressure Zone Assembly With Outside Stem And Yoke Shut-offs (Watts 909 OSY series) .....2,976.26 <i>For Owner Furnished Material, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	-2,715.32 78.28	198.45
22 11 19 00-0415	EA		4" Flanged Reduced Pressure Zone Assembly With Outside Stem And Yoke Shut-offs (Watts 909 OSY series) .....3,577.33 <i>For Owner Furnished Material, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	-3,185.53 117.54	294.00
22 11 19 00-0416	EA		6" Flanged Reduced Pressure Zone Assembly With Outside Stem And Yoke Shut-offs (Watts 909 OSY series) .....5,893.07 <i>For Owner Furnished Material, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	-5,070.06 246.90	455.60
22 11 19 00-0417	EA		8" Flanged Reduced Pressure Zone Assembly With Outside Stem And Yoke Shut-offs (Watts 909 OSY series) .....10,088.36 <i>For Owner Furnished Material, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	-8,853.84 370.36	683.39
22 11 19 00-0418	EA		10" Flanged Reduced Pressure Zone Assembly With Outside Stem And Yoke Shut-offs (Watts 909 OSY series) .....14,175.65 <i>For Owner Furnished Material, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	-12,705.99 440.90	808.31
22 11 19 00-0419			Reduced Pressure Zone Assemblies With Non-Rising Stem Shut-Offs (22 11 19 00-0377) Note: Includes ball type test cocks, two non-rising stem (NRS) resilient seated bronze body gate valves, and captured spring assemblies (Watts 909 NRS BB series).		
22 11 19 00-0420	EA		2-1/2" Flanged Reduced Pressure Zone Assembly With NRS Shut-offs (Watts 909 NRS BB series) .....4,169.02 <i>For Owner Furnished Material, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	-3,933.81 70.56	176.41
22 11 19 00-0421	EA		3" Flanged Reduced Pressure Zone Assembly With NRS Shut-offs (Watts 909 NRS BB series) .....4,703.04 <i>For Owner Furnished Material, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	-4,442.11 78.28	198.45
22 11 19 00-0422			Reduced Pressure Zone Assemblies With Outside Stem And Yoke Shut-Offs (22 11 19 00-0377) Note: Includes ball type test cocks, two outside stem and yoke resilient seated bronze body gate valves, and captured spring assemblies (Watts 909 OSY BB series).		
22 11 19 00-0423	EA		2-1/2" Flanged Reduced Pressure Zone Assembly With Outside Stem And Yoke Shut-offs (Watts 909 OSY BB series) .....4,357.48 <i>For Owner Furnished Material, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	-4,122.27 70.56	176.41
22 11 19 00-0424	EA		3" Flanged Reduced Pressure Zone Assembly With Outside Stem And Yoke Shut-offs (Watts 909 OSY BB series) .....5,057.30 <i>For Owner Furnished Material, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	-4,796.37 78.28	198.45
22 11 19 00-0425			Double Check Detector Assemblies (22 11 19 00-0241)		
22 11 19 00-0426			Flanged Double Check Detector Assemblies With Meter (22 11 19 00-0425)		
22 11 19 00-0427			Double Check Detector Assembly With Outside Stem And Yoke Shut-Offs And Meter (22 11 19 00-0426) Note: Includes ball type test cocks, two outside stem and yoke resilient seated iron body gate valves, two epoxy coated iron body check valves, and meter (Watts 709 DCDA OSY series).		
22 11 19 00-0428	EA		3" Flanged Double Check Detector Assembly With Outside Stem And Yoke Shut-offs And Meter (Watts 007 DCDA OSY series) .....3,677.73 <i>For Owner Furnished Material, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	-3,416.80 78.28	198.45
22 11 19 00-0429	EA		4" Flanged Double Check Detector Assembly With Outside Stem And Yoke Shut-offs And Meter (Watts 007 DCDA OSY series) .....3,887.84 <i>For Owner Furnished Material, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	-3,496.08 117.53	294.00
22 11 19 00-0430	EA		6" Flanged Double Check Detector Assembly With Outside Stem And Yoke Shut-offs And Meter (Watts 007 DCDA OSY series) .....5,362.80 <i>For Owner Furnished Material, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	-4,539.79 246.90	455.60
22 11 19 00-0431	EA		8" Flanged Double Check Detector Assembly With Outside Stem And Yoke Shut-offs And Meter (Watts 007 DCDA OSY series) .....9,440.45 <i>For Owner Furnished Material, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	-8,205.93 370.36	683.39
22 11 19 00-0432	EA		10" Flanged Double Check Detector Assembly With Outside Stem And Yoke Shut-offs And Meter (Watts 007 DCDA OSY series) .....12,684.39 <i>For Owner Furnished Material, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	-11,214.73 440.90	808.31
22 11 19 00-0433			Double Check Detector Assembly With Outside Stem And Yoke Shut-Offs And Meter (22 11 19 00-0426) Note: Includes ball type test cocks, two outside stem and yoke resilient seated iron body gate valves, single stainless steel housing and sleeve for two check valves, and meter (Watts 757 DCDA OSY series).		
22 11 19 00-0434	EA		2-1/2" Flanged Double Check Detector Assembly With Outside Stem And Yoke Shut-offs And Meter (Watts 757 DCDA OSY series) .....2,766.50 <i>For Owner Furnished Material, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	-2,531.29 70.56	176.41
22 11 19 00-0435	EA		3" Flanged Double Check Detector Assembly With Outside Stem And Yoke Shut-offs And Meter (Watts 757 DCDA OSY series) .....2,957.44 <i>For Owner Furnished Material, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	-2,696.51 78.28	198.45



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
	22 11 19 00-0436	EA		4" Flanged Double Check Detector Assembly With Outside Stem And Yoke Shut-offs And Meter (Watts 757 DCDA OSY series) 3,257.58		294.00
				<i>For Owner Furnished Material, Deduct</i> -2,865.82		
				<i>For Work In Restricted Working Space, Add</i> 117.53		
	22 11 19 00-0437	EA		6" Flanged Double Check Detector Assembly With Outside Stem And Yoke Shut-offs And Meter (Watts 757 DCDA OSY series) 4,544.25		455.60
				<i>For Owner Furnished Material, Deduct</i> -3,721.24		
				<i>For Work In Restricted Working Space, Add</i> 246.90		
	22 11 19 00-0438	EA		8" Flanged Double Check Detector Assembly With Outside Stem And Yoke Shut-offs And Meter (Watts 757 DCDA OSY series) 7,960.99		683.39
				<i>For Owner Furnished Material, Deduct</i> -6,726.47		
				<i>For Work In Restricted Working Space, Add</i> 370.36		
	22 11 19 00-0439	EA		10" Flanged Double Check Detector Assembly With Outside Stem And Yoke Shut-offs And Meter (Watts 757 DCDA OSY series) 9,392.55		808.31
				<i>For Owner Furnished Material, Deduct</i> -7,922.89		
				<i>For Work In Restricted Working Space, Add</i> 440.90		
	22 11 19 00-0440			Double Check Detector Assembly With Butterfly Valves And Meter <small>(22 11 19 00-0426)</small>		
				Note: Includes ball type test cocks, two resilient seated iron body butterfly valves, single stainless steel housing and sleeve for two check valves, and meter (Watts 757 DCDA BFG series).		
	22 11 19 00-0441	EA		2-1/2" Flanged Double Check Detector Assembly With Butterfly Valves And Meter (Watts 757 DCDA BFG series) 2,925.77		176.41
				<i>For Owner Furnished Material, Deduct</i> -2,690.56		
				<i>For Work In Restricted Working Space, Add</i> 70.56		
	22 11 19 00-0442	EA		3" Flanged Double Check Detector Assembly With Butterfly Valves And Meter (Watts 757 DCDA BFG series) 3,116.72		198.45
				<i>For Owner Furnished Material, Deduct</i> -2,855.79		
				<i>For Work In Restricted Working Space, Add</i> 78.28		
	22 11 19 00-0443	EA		4" Flanged Double Check Detector Assembly With Butterfly Valves And Meter (Watts 757 DCDA BFG series) 3,416.82		294.00
				<i>For Owner Furnished Material, Deduct</i> -3,025.06		
				<i>For Work In Restricted Working Space, Add</i> 117.53		
	22 11 19 00-0444	EA		6" Flanged Double Check Detector Assembly With Butterfly Valves And Meter (Watts 757 DCDA BFG series) 4,707.50		455.60
				<i>For Owner Furnished Material, Deduct</i> -3,884.49		
				<i>For Work In Restricted Working Space, Add</i> 246.90		
	22 11 19 00-0445	EA		8" Flanged Double Check Detector Assembly With Butterfly Valves And Meter (Watts 757 DCDA BFG series) 7,765.12		683.39
				<i>For Owner Furnished Material, Deduct</i> -6,530.60		
				<i>For Work In Restricted Working Space, Add</i> 370.36		
	22 11 19 00-0446			Flanged Double Check Detector Assemblies Without Meter <small>(22 11 19 00-0425)</small>		
	22 11 19 00-0447			Double Check Detector Assembly With Outside Stem And Yoke Shut-Offs Less Meter <small>(22 11 19 00-0446)</small>		
				Note: Includes ball type test cocks, two outside stem and yoke resilient seated iron body gate valves, single stainless steel housing and sleeve for two check valves (Watts 757 DCDA OSY LM series).		
	22 11 19 00-0448	EA		2-1/2" Flanged Double Check Detector Assembly With Outside Stem And Yoke Shut-offs Less Meter (Watts 757 DCDA OSY LM series) 2,716.21		176.41
				<i>For Work In Restricted Working Space, Add</i> 70.56		
	22 11 19 00-0449	EA		3" Flanged Double Check Detector Assembly With Outside Stem And Yoke Shut-offs Less Meter (Watts 757 DCDA OSY LM series) 2,907.18		198.45
				<i>For Work In Restricted Working Space, Add</i> 78.28		
	22 11 19 00-0450	EA		4" Flanged Double Check Detector Assembly With Outside Stem And Yoke Shut-offs Less Meter (Watts 757 DCDA OSY LM series) 3,207.31		294.00
				<i>For Work In Restricted Working Space, Add</i> 117.53		
	22 11 19 00-0451	EA		6" Flanged Double Check Detector Assembly With Outside Stem And Yoke Shut-offs Less Meter (Watts 757 DCDA OSY LM series) 4,493.98		455.60
				<i>For Work In Restricted Working Space, Add</i> 246.90		
	22 11 19 00-0452	EA		8" Flanged Double Check Detector Assembly With Outside Stem And Yoke Shut-offs Less Meter (Watts 757 DCDA OSY LM series) 7,910.76		683.39
				<i>For Work In Restricted Working Space, Add</i> 370.36		
	22 11 19 00-0453	EA		10" Flanged Double Check Detector Assembly With Outside Stem And Yoke Shut-offs Less Meter (Watts 757 DCDA OSY LM series) 9,342.24		808.31
				<i>For Work In Restricted Working Space, Add</i> 440.90		
	22 11 19 00-0454			Double Check Detector Assembly With Butterfly Valves Less Meter <small>(22 11 19 00-0446)</small>		
				Note: Includes ball type test cocks, two butterfly resilient seated iron body butterfly valves, single stainless steel housing and sleeve for two check valves (Watts 757 DCDA BFG LM series).		
	22 11 19 00-0455	EA		2-1/2" Flanged Double Check Detector Assembly With Butterfly Valves Less Meter (Watts 757 DCDA BFG LM series) 2,875.47		176.41
				<i>For Work In Restricted Working Space, Add</i> 70.56		
	22 11 19 00-0456	EA		3" Flanged Double Check Detector Assembly With Butterfly Valves Less Meter (Watts 757 DCDA BFG LM series) 3,066.42		198.45
				<i>For Work In Restricted Working Space, Add</i> 78.28		
	22 11 19 00-0457	EA		4" Flanged Double Check Detector Assembly With Butterfly Valves Less Meter (Watts 757 DCDA BFG LM series) 3,366.55		294.00
				<i>For Work In Restricted Working Space, Add</i> 117.53		
	22 11 19 00-0458	EA		6" Flanged Double Check Detector Assembly With Butterfly Valves Less Meter (Watts 757 DCDA BFG LM series) 4,657.20		455.60
				<i>For Work In Restricted Working Space, Add</i> 246.90		
	22 11 19 00-0459	EA		8" Flanged Double Check Detector Assembly With Butterfly Valves Less Meter (Watts 757 DCDA BFG LM series) 8,074.01		683.39
				<i>For Work In Restricted Working Space, Add</i> 370.36		
	22 11 19 00-0460			Backflow Preventer Accessories <small>(22 11 19 00-0241)</small>		
	22 11 19 00-0461			Air Gap <small>(22 11 19 00-0460)</small>		
	22 11 19 00-0462	EA		Up To 1" Diameter Air Gap For Backflow Preventer 66.09		9.98



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 19 00-0463	EA		1-1/4" To 2" Diameter Air Gap For Backflow Preventer	81.14	11.97
22 11 19 00-0464	EA		2-1/2" To 3" Diameter Air Gap For Backflow Preventer	148.35	15.97
22 11 19 00-0465	EA		4" To 6" Diameter Air Gap For Backflow Preventer	291.20	27.94
22 11 19 00-0466	EA		8" To 10" Diameter Air Gap For Backflow Preventer	315.16	39.92
22 11 19 00-0467			Brass Test Cocks (22 11 19 00-0460)		
22 11 19 00-0468	EA		1/8" Or 1/4" Brass Test Cock.....	21.68	3.99
22 11 19 00-0469			Backflow Valve Enclosures (22 11 19 00-0241)		
22 11 19 00-0470			Flip-Top, Insulated Fiberglass Valve Enclosures (22 11 19 00-0469)		
			Note: Dimensions listed are inside dimensions. Includes anchor kit. Excludes concrete pad.		
22 11 19 00-0471	EA		19" Length x 11" Width x 22" Height, Flip-Top, Insulated Fiberglass Valve Enclosure	613.64	71.86
			For Heated Enclosure, Add	74.08	
22 11 19 00-0472	EA		27" Length x 13" Width x 23" Height, Flip-Top, Insulated Fiberglass Valve Enclosure	751.83	71.86
			For Heated Enclosure, Add	94.81	
22 11 19 00-0473	EA		27" Length x 13" Width x 35" Height, Flip-Top, Insulated Fiberglass Valve Enclosure	948.99	66.15
			For Heated Enclosure, Add	125.81	
22 11 19 00-0474	EA		33" Length x 21" Width x 25" Height, Flip-Top, Insulated Fiberglass Valve Enclosure	989.35	88.20
			For Heated Enclosure, Add	126.35	
22 11 19 00-0475	EA		39" Length x 13" Width x 28" Height, Flip-Top, Insulated Fiberglass Valve Enclosure	1,036.21	88.20
			For Heated Enclosure, Add	133.38	
22 11 19 00-0476	EA		47" Length x 13" Width x 28" Height, Flip-Top, Insulated Fiberglass Valve Enclosure	1,218.86	88.20
			For Heated Enclosure, Add	160.78	
22 11 19 00-0477	EA		39" Length x 13" Width x 36" Height, Flip-Top, Insulated Fiberglass Valve Enclosure	1,223.67	88.20
			For Heated Enclosure, Add	161.50	
22 11 19 00-0478	EA		47" Length x 13" Width x 36" Height, Flip-Top, Insulated Fiberglass Valve Enclosure	1,534.89	88.20
			For Heated Enclosure, Add	208.18	
22 11 19 00-0479	EA		70" Length x 26" Width x 45" Height, Flip-Top, Insulated Fiberglass Valve Enclosure	3,523.81	132.30
			For Heated Enclosure, Add	495.50	
22 11 19 00-0480	EA		83" Length x 26" Width x 45" Height, Flip-Top, Insulated Fiberglass Valve Enclosure	5,094.35	132.30
			For Heated Enclosure, Add	731.08	
22 11 19 00-0481	EA		70" Length x 26" Width x 55" Height, Flip-Top, Insulated Fiberglass Valve Enclosure	4,842.01	132.30
			For Heated Enclosure, Add	693.23	
22 11 19 00-0482	EA		83" Length x 26" Width x 55" Height, Flip-Top, Insulated Fiberglass Valve Enclosure	5,829.25	154.35
			For Heated Enclosure, Add	835.80	
22 11 19 00-0483			One-Piece Drop Over, Insulated Fiberglass Valve Enclosures (22 11 19 00-0469)		
			Note: Dimensions listed are inside dimensions. Includes anchor kit. Excludes concrete pad.		
22 11 19 00-0484	EA		20" Length x 6-1/2" Width x 22" Height, One-Piece Drop Over, Insulated Fiberglass Valve Enclosure.....	332.35	19.16
			For Heated Enclosure, Add	60.08	
22 11 19 00-0485	EA		27" Length x 14" Width x 26" Height, One-Piece Drop Over, Insulated Fiberglass Valve Enclosure	459.72	19.16
			For Heated Enclosure, Add	85.56	
22 11 19 00-0486	EA		38-1/2" Length x 12" Width x 28" Height, One-Piece Drop Over, Insulated Fiberglass Valve Enclosure.....	574.94	17.64
			For Heated Enclosure, Add	109.11	
22 11 19 00-0487	EA		47" Length x 13" Width x 28" Height, One-Piece Drop Over, Insulated Fiberglass Valve Enclosure	865.74	17.64
			For Heated Enclosure, Add	167.27	
22 11 19 00-0488	EA		70" Length x 26" Width x 45" Height, One-Piece Drop Over, Insulated Fiberglass Valve Enclosure	2,237.31	33.07
			For Heated Enclosure, Add	436.44	
22 11 19 00-0489	EA		83" Length x 26" Width x 45" Height, One-Piece Drop Over, Insulated Fiberglass Valve Enclosure	3,050.82	33.07
			For Heated Enclosure, Add	599.14	
22 11 19 00-0490	EA		45" Length x 35" Width x 35" Height, One-Piece Drop Over, Insulated Fiberglass Valve Enclosure	2,035.43	33.07
			For Heated Enclosure, Add	396.06	
22 11 19 00-0491	EA		53" Length x 44" Width x 44" Height, One-Piece Drop Over, Insulated Fiberglass Valve Enclosure	2,302.20	33.07
			For Heated Enclosure, Add	449.41	
22 11 19 00-0492	EA		61" Length x 52" Width x 50" Height, One-Piece Drop Over, Insulated Fiberglass Valve Enclosure	3,596.36	33.07
			For Heated Enclosure, Add	708.25	
22 11 19 00-0493			Sectional, Insulated Aluminum Valve Enclosures (22 11 19 00-0469)		
			Note: Dimensions listed are inside dimensions. Includes anchor kit. Excludes concrete pad.		
22 11 19 00-0494	EA		70" Length x 26" Width x 55" Height, Sectional, Insulated Aluminum Valve Enclosure	4,579.86	143.72
			For Heated Enclosure, Add	651.05	
			For One 24" Fluorescent Light Fixture, Add	412.09	
			For Two 24" Fluorescent Light Fixture, Add	737.42	
22 11 19 00-0495	EA		83" Length x 26" Width x 55" Height, Sectional, Insulated Aluminum Valve Enclosure	5,044.90	143.72
			For Heated Enclosure, Add	720.80	
			For One 24" Fluorescent Light Fixture, Add	412.09	
			For Two 24" Fluorescent Light Fixture, Add	737.42	
22 11 19 00-0496	EA		53" Length x 33" Width x 44" Height, Sectional, Insulated Aluminum Valve Enclosure	3,580.29	132.30
			For Heated Enclosure, Add	503.97	
			For One 24" Fluorescent Light Fixture, Add	412.09	
			For Two 24" Fluorescent Light Fixture, Add	737.42	
22 11 19 00-0497	EA		53" Length x 44" Width x 44" Height, Sectional, Insulated Aluminum Valve Enclosure	3,923.95	132.30
			For Heated Enclosure, Add	555.52	
			For One 24" Fluorescent Light Fixture, Add	412.09	
			For Two 24" Fluorescent Light Fixture, Add	737.42	
22 11 19 00-0498	EA		90" Length x 32" Width x 50-1/2" Height, Sectional, Insulated Aluminum Valve Enclosure	4,570.64	176.41
			For Heated Enclosure, Add	641.50	
			For One 24" Fluorescent Light Fixture, Add	412.09	
			For Two 24" Fluorescent Light Fixture, Add	737.42	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 19 00-0499 EA 102" Length x 32" Width x 50-1/2" Height, Sectional, Insulated Aluminum Valve Enclosure	5,120.99	176.41
For Heated Enclosure, Add	724.05	
For One 24" Fluorescent Light Fixture, Add	412.09	
For Two 24" Fluorescent Light Fixture, Add	737.42	
22 11 19 00-0500 EA 90" Length x 32" Width x 57-1/2" Height, Sectional, Insulated Aluminum Valve Enclosure	5,120.99	176.41
For Heated Enclosure, Add	724.05	
For One 24" Fluorescent Light Fixture, Add	412.09	
For Two 24" Fluorescent Light Fixture, Add	737.42	
22 11 19 00-0501 EA 102" Length x 32" Width x 57-1/2" Height, Sectional, Insulated Aluminum Valve Enclosure	5,654.52	176.41
For Heated Enclosure, Add	804.08	
For One 24" Fluorescent Light Fixture, Add	412.09	
For Two 24" Fluorescent Light Fixture, Add	737.42	
22 11 19 00-0502 EA 62" Length x 39" Width x 46" Height, Sectional, Insulated Aluminum Valve Enclosure	4,250.30	154.35
For Heated Enclosure, Add	598.96	
For One 24" Fluorescent Light Fixture, Add	412.09	
For Two 24" Fluorescent Light Fixture, Add	737.42	
22 11 19 00-0503 EA 62" Length x 53" Width x 46" Height, Sectional, Insulated Aluminum Valve Enclosure	4,975.59	176.41
For Heated Enclosure, Add	702.24	
For One 24" Fluorescent Light Fixture, Add	412.09	
For Two 24" Fluorescent Light Fixture, Add	737.42	
22 11 19 00-0504 EA 105" Length x 36" Width x 53" Height, Sectional, Insulated Aluminum Valve Enclosure	5,808.33	176.41
For Heated Enclosure, Add	827.15	
For One 24" Fluorescent Light Fixture, Add	412.09	
For Two 24" Fluorescent Light Fixture, Add	737.42	
22 11 19 00-0505 EA 125" Length x 36" Width x 53" Height, Sectional, Insulated Aluminum Valve Enclosure	6,374.65	187.43
For Heated Enclosure, Add	909.34	
For One 24" Fluorescent Light Fixture, Add	412.09	
For Two 24" Fluorescent Light Fixture, Add	737.42	
22 11 19 00-0506 EA 105" Length x 36" Width x 64" Height, Sectional, Insulated Aluminum Valve Enclosure	6,539.80	203.61
For Heated Enclosure, Add	930.07	
For One 24" Fluorescent Light Fixture, Add	412.09	
For Two 24" Fluorescent Light Fixture, Add	737.42	
22 11 19 00-0507 EA 125" Length x 36" Width x 64" Height, Sectional, Insulated Aluminum Valve Enclosure	7,247.11	215.58
For Heated Enclosure, Add	1,033.17	
For One 24" Fluorescent Light Fixture, Add	412.09	
For Two 24" Fluorescent Light Fixture, Add	737.42	
22 11 19 00-0508 EA 105" Length x 36" Width x 80" Height, Sectional, Insulated Aluminum Valve Enclosure	7,493.73	198.45
For Heated Enclosure, Add	1,074.45	
For One 24" Fluorescent Light Fixture, Add	412.09	
For Two 24" Fluorescent Light Fixture, Add	737.42	
22 11 19 00-0509 EA 72" Length x 45" Width x 52" Height, Sectional, Insulated Aluminum Valve Enclosure	5,447.83	176.41
For Heated Enclosure, Add	773.07	
For One 24" Fluorescent Light Fixture, Add	412.09	
For Two 24" Fluorescent Light Fixture, Add	737.42	
22 11 19 00-0510 EA 72" Length x 45" Width x 60" Height, Sectional, Insulated Aluminum Valve Enclosure	5,804.72	176.41
For Heated Enclosure, Add	826.61	
For One 24" Fluorescent Light Fixture, Add	412.09	
For Two 24" Fluorescent Light Fixture, Add	737.42	
22 11 19 00-0511 EA 72" Length x 65" Width x 52" Height, Sectional, Insulated Aluminum Valve Enclosure	6,565.71	187.43
For Heated Enclosure, Add	938.00	
For One 24" Fluorescent Light Fixture, Add	412.09	
For Two 24" Fluorescent Light Fixture, Add	737.42	
22 11 19 00-0512 EA 72" Length x 65" Width x 60" Height, Sectional, Insulated Aluminum Valve Enclosure	7,951.55	198.45
For Heated Enclosure, Add	1,143.12	
For One 24" Fluorescent Light Fixture, Add	412.09	
For Two 24" Fluorescent Light Fixture, Add	737.42	
22 11 19 00-0513 EA 118" Length x 40" Width x 58" Height, Sectional, Insulated Aluminum Valve Enclosure	6,943.37	88.20
For Heated Enclosure, Add	991.89	
For One 24" Fluorescent Light Fixture, Add	412.09	
For Two 24" Fluorescent Light Fixture, Add	737.42	
22 11 19 00-0514 EA 142" Length x 40" Width x 58" Height, Sectional, Insulated Aluminum Valve Enclosure	8,337.63	88.20
For Heated Enclosure, Add	1,198.28	
For One 24" Fluorescent Light Fixture, Add	412.09	
For Two 24" Fluorescent Light Fixture, Add	737.42	
22 11 19 00-0515 EA 118" Length x 40" Width x 74" Height, Sectional, Insulated Aluminum Valve Enclosure	8,062.46	132.30
For Heated Enclosure, Add	1,157.00	
For One 24" Fluorescent Light Fixture, Add	412.09	
For Two 24" Fluorescent Light Fixture, Add	737.42	
22 11 19 00-0516 EA 142" Length x 40" Width x 74" Height, Sectional, Insulated Aluminum Valve Enclosure	9,352.53	132.30
For Heated Enclosure, Add	1,345.00	
For One 24" Fluorescent Light Fixture, Add	412.09	
For Two 24" Fluorescent Light Fixture, Add	737.42	
22 11 19 00-0517 EA 142" Length x 42" Width x 65" Height, Sectional, Insulated Aluminum Valve Enclosure	8,631.18	132.30
For Heated Enclosure, Add	1,239.55	
For One 24" Fluorescent Light Fixture, Add	412.09	
For Two 24" Fluorescent Light Fixture, Add	737.42	
22 11 19 00-0518 EA 172" Length x 42" Width x 65" Height, Sectional, Insulated Aluminum Valve Enclosure	10,084.67	154.35
For Heated Enclosure, Add	1,452.06	
For One 24" Fluorescent Light Fixture, Add	412.09	
For Two 24" Fluorescent Light Fixture, Add	737.42	
22 11 19 00-0519 EA 142" Length x 42" Width x 85" Height, Sectional, Insulated Aluminum Valve Enclosure	10,121.42	132.30
For Heated Enclosure, Add	1,452.06	
For One 24" Fluorescent Light Fixture, Add	412.09	
For Two 24" Fluorescent Light Fixture, Add	737.42	

22	Plumbing
22 10	Plumbing Piping
22 11	Facility Water Distribution



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 19 00-0520	EA		172" Length x 42" Width x 85" Height, Sectional, Insulated Aluminum Valve Enclosure <i>For Heated Enclosure, Add</i> <i>For One 24" Fluorescent Light Fixture, Add</i> <i>For Two 24" Fluorescent Light Fixture, Add</i>	12,002.69 1,728.74 412.09 737.42	132.30
22 11 19 00-0521			Faucets (Hose Bibbs) <small>(22 11 19)</small>		
22 11 19 00-0522			Bronze Garden Hose Valves (Hose Bibbs), Screwed Ends <small>(22 11 19 00-0521)</small>		
22 11 19 00-0523	EA		1/2", 125 LB Bronze Garden Hose Valves (Hose Bibbs), Screwed Ends	38.98	7.98
22 11 19 00-0524	EA		3/4" Faucet, Bronze Garden Hose Valve With Screwed Ends, 125#	45.66	8.78
22 11 19 00-0525	EA		3/4" Hose Valve With Screwed Ends And Vacuum Breaker, 125#	13.75	5.99
22 11 19 00-0526			Chrome Plated Brass Hose Valves, Screwed Ends <small>(22 11 19 00-0521)</small>		
22 11 19 00-0527	EA		3/4" Hose Valve With Screwed Ends; Chicago Faucets #387-CP	98.61	24.43
22 11 19 00-0528			Antisiphon Freezeless Wall Faucet <small>(22 11 19 00-0521)</small>		
22 11 19 00-0529	EA		4" Long, 1/2" Antisiphon Freezeless Wall Faucet	95.37	19.96
22 11 19 00-0530	EA		6" Long, 1/2" Antisiphon Freezeless Wall Faucet	103.38	22.12
22 11 19 00-0531	EA		8" Long, 1/2" Antisiphon Freezeless Wall Faucet	109.38	23.39
22 11 19 00-0532	EA		10" Long, 1/2" Antisiphon Freezeless Wall Faucet	115.37	25.07
22 11 19 00-0533	EA		12" Long, 1/2" Antisiphon Freezeless Wall Faucet	121.44	26.59
22 11 19 00-0534			Keyed, Recessed Valve Boxes <small>(22 11 19)</small>		
22 11 19 00-0535	EA		8" x 8" x 4" Painted Steel, Keyed, Recessed Valve Box	194.99	23.87
22 11 19 00-0536	EA		8" x 8" x 6" Painted Steel, Keyed, Recessed Valve Box	216.02	23.87
22 11 19 00-0537	EA		8" x 8" x 8" Painted Steel, Keyed, Recessed Valve Box	247.57	23.87
22 11 19 00-0538	EA		12" x 12" x 4" Painted Steel, Keyed, Recessed Valve Box	242.45	31.84
22 11 19 00-0539	EA		12" x 12" x 6" Painted Steel, Keyed, Recessed Valve Box	274.00	31.84
22 11 19 00-0540	EA		12" x 12" x 8" Painted Steel, Keyed, Recessed Valve Box	283.46	31.84
22 11 19 00-0541	EA		8" x 8" x 4" Stainless Steel, Keyed, Recessed Valve Box	228.64	23.87
22 11 19 00-0542	EA		8" x 8" x 6" Stainless Steel, Keyed, Recessed Valve Box	274.92	23.87
22 11 19 00-0543	EA		8" x 8" x 8" Stainless Steel, Keyed, Recessed Valve Box	315.93	23.87
22 11 19 00-0544	EA		12" x 12" x 4" Stainless Steel, Keyed, Recessed Valve Box	301.34	31.84
22 11 19 00-0545	EA		12" x 12" x 6" Stainless Steel, Keyed, Recessed Valve Box	342.36	31.84
22 11 19 00-0546	EA		12" x 12" x 8" Stainless Steel, Keyed, Recessed Valve Box	358.14	31.84
22 11 23			Domestic Water Pumps <small>(22 11)</small>		
22 11 23 13			Domestic Water Packaged Booster Pumps And Tanks <small>(22 11 23)</small>		
			Note: Includes motor starter and controls.		
22 11 23 13-0001			Simplex Domestic Water Packaged Booster Pumps And Tank <small>(22 11 23 13)</small>		
22 11 23 13-0002	EA		1 HP Simplex Domestic Water Packaged Booster Pump And Tank	8,004.71	235.21
22 11 23 13-0003	EA		1.5 HP Simplex Domestic Water Packaged Booster Pump And Tank	8,320.07	316.05
22 11 23 13-0004	EA		2 HP Simplex Domestic Water Packaged Booster Pump And Tank	8,692.04	396.91
22 11 23 13-0005	EA		3 HP Simplex Domestic Water Packaged Booster Pump And Tank	9,035.72	477.76
22 11 23 13-0006	EA		5 HP Simplex Domestic Water Packaged Booster Pump And Tank	10,002.16	558.61
22 11 23 13-0007	EA		7.5 HP Simplex Domestic Water Packaged Booster Pump And Tank	11,110.14	639.46
22 11 23 13-0008	EA		10 HP Simplex Domestic Water Packaged Booster Pump And Tank	11,878.43	720.32
22 11 23 13-0009			Duplex Domestic Water Packaged Booster Pumps And Hydrocumulator <small>(22 11 23 13)</small>		
22 11 23 13-0010	EA		100 GPM Duplex Domestic Water Packaged Booster Pumps And Hydrocumulator	21,550.87	954.26
22 11 23 13-0011	EA		200 GPM Duplex Domestic Water Packaged Booster Pumps And Hydrocumulator	25,958.91	1,013.90
22 11 23 13-0012	EA		300 GPM Duplex Domestic Water Packaged Booster Pumps And Hydrocumulator	30,385.01	1,073.54
22 11 23 13-0013			Triplex Domestic Water Packaged Booster Pumps And Hydrocumulator <small>(22 11 23 13)</small>		
22 11 23 13-0014	EA		200 GPM Triplex Domestic Water Packaged Booster Pumps And Hydrocumulator	28,372.17	1,013.90
22 11 23 13-0015	EA		300 GPM Triplex Domestic Water Packaged Booster Pumps And Hydrocumulator	35,327.23	1,073.54
22 11 23 13-0016	EA		500 GPM Triplex Domestic Water Packaged Booster Pumps And Hydrocumulator	43,911.18	1,192.83
22 11 23 13-0017	EA		750 GPM Triplex Domestic Water Packaged Booster Pumps And Hydrocumulator	55,632.72	1,312.10
22 11 23 13-0018	EA		1,000 GPM Triplex Domestic Water Packaged Booster Pumps And Hydrocumulator	67,354.28	1,431.39
22 11 23 13-0019	EA		1,750 GPM Triplex Domestic Water Packaged Booster Pumps And Hydrocumulator	78,466.97	1,610.32
22 11 23 13-0020	EA		2,500 GPM Triplex Domestic Water Packaged Booster Pumps And Hydrocumulator	89,579.68	1,789.23
22 11 23 13-0021	EA		3,750 GPM Triplex Domestic Water Packaged Booster Pumps And Hydrocumulator	100,692.39	1,968.16
22 11 23 13-0022	EA		5,000 GPM Triplex Domestic Water Packaged Booster Pumps And Hydrocumulator	111,954.18	2,206.73
22 11 23 13-0023			Variable Speed Duplex Domestic Water Pressure Booster Skid <small>(22 11 23 13)</small>		
			Note: AB1953 compliant, UL listed and labeled. Includes stainless steel headers with check, isolation, thermal relief valves, and start up support. The standard control package is integrated in a NEMA 1 enclosure and is outfitted with an individual VFD's which are controlled through a HOA and internally programmed PID logic for system control.		



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 23 13-0024	EA			40 GPM At 40 To 70 PSI, NEMA 1, Variable Speed Duplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV2-1).....	21,340.62	988.83
22 11 23 13-0025	EA			40 GPM At 80 To 120 PSI, 80 GPM At 50 To 90 PSI, NEMA 1, Variable Speed Duplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV2-2).....	22,309.24	988.83
22 11 23 13-0026	EA			80 GPM At 80 PSI, 120 GPM At 40 To 90 PSI, NEMA 1, Variable Speed Duplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV2-3).....	23,693.27	988.83
22 11 23 13-0027	EA			80 GPM At 130 To 150 PSI, 120 GPM At 100 To 150 PSI, NEMA 1, Variable Speed Duplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV2-4).....	25,688.35	988.83
22 11 23 13-0028	EA			160 GPM At 40 To 50 PSI, 200 GPM At 40 To 50 PSI, NEMA 1, Variable Speed Duplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV2-5).....	24,271.62	1,050.63
22 11 23 13-0029	EA			160 GPM At 60 To 80 PSI, 200 GPM At 60 To 70 PSI, NEMA 1, Variable Speed Duplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV2-6).....	26,013.23	1,050.63
22 11 23 13-0030	EA			160 GPM At 90 To 110 PSI, 200 GPM At 80 To 100 PSI, NEMA 1, Variable Speed Duplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV2-7).....	28,378.51	1,050.63
22 11 23 13-0031	EA			160 To 200 GPM At 120 To 150 PSI, NEMA 1, Variable Speed Duplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV2-8).....	30,301.01	1,050.63
22 11 23 13-0032	EA			240 To 280 GPM At 40 To 50 PSI, NEMA 1, Variable Speed Duplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV2-9).....	26,513.74	1,112.44
22 11 23 13-0033	EA			280 To 320 GPM At 60 To 70 PSI, NEMA 1, Variable Speed Duplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV2-10).....	28,233.27	1,112.44
22 11 23 13-0034	EA			240 To 320 GPM At 90 To 120 PSI, NEMA 1, Variable Speed Duplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV2-11).....	32,078.29	1,112.44
22 11 23 13-0035	EA			240 To 320 GPM At 130 To 150 PSI, NEMA 1, Variable Speed Duplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV2-12).....	38,531.52	1,112.44
22 11 23 13-0036	EA			360 To 400 GPM At 40 PSI, NEMA 1, Variable Speed Duplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV2-13).....	27,991.38	1,112.44
22 11 23 13-0037	EA			360 To 400 GPM At 50 To 80 PSI, NEMA 1, Variable Speed Duplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV2-14).....	31,498.80	1,112.44
22 11 23 13-0038	EA			360 To 400 GPM At 90 To 110 PSI, NEMA 1, Variable Speed Duplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV2-15).....	39,219.33	1,112.44
22 11 23 13-0039	EA			360 To 400 GPM At 120 To 140 PSI, NEMA 1, Variable Speed Duplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV2-16).....	38,996.37	1,112.44
22 11 23 13-0040	EA			440 To 480 GPM At 150 PSI, NEMA 1, Variable Speed Duplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV2-17).....	46,492.70	1,236.04
22 11 23 13-0041	EA			440 To 480 GPM At 40 To 50 PSI, NEMA 1, Variable Speed Duplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV2-18).....	32,031.82	1,236.04
22 11 23 13-0042	EA			440 To 480 GPM At 60 To 90 PSI, 520 To 600 GPM At 40 To 80 PSI, NEMA 1, Variable Speed Duplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV2-19).....	39,062.44	1,236.04
22 11 23 13-0043	EA			440 To 480 GPM At 100 PSI, NEMA 1, Variable Speed Duplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV2-20).....	38,840.53	1,236.04
22 11 23 13-0044	EA			440 To 600 GPM At 100 To 120 PSI, NEMA 1, Variable Speed Duplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV2-21).....	46,837.65	1,236.04
22 11 23 13-0045	EA			440 To 600 GPM At 130 To 150 PSI, NEMA 1, Variable Speed Duplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV2-22).....	56,619.52	1,236.04
22 11 23 13-0046	EA			60 GPM At 40 To 70 PSI, NEMA 1, Variable Speed Triplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV3-1).....	26,927.25	988.83
22 11 23 13-0047				Variable Speed Triplex Domestic Water Pressure Booster Skid <small>(22 11 23 13)</small> Note: AB1953 compliant, UL listed and labeled. Includes stainless steel headers with check, isolation, thermal relief valves, and start up support. The standard control package is integrated in a NEMA 1 enclosure and is outfitted with an individual VFD's which are controlled through a HOA and internally programmed PID logic for system control.		
22 11 23 13-0048	EA			60 GPM At 80 To 130 PSI, 120 GPM At 50 To 90 PSI, NEMA 1, Variable Speed Triplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV3-2).....	26,927.25	988.83
22 11 23 13-0049	EA			120 GPM At 100 To 120 PSI, NEMA 1, Variable Speed Triplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV3-3).....	30,101.28	988.83
22 11 23 13-0050	EA			60 GPM At 140 To 150 PSI, 120 GPM At 130 To 150 PSI, NEMA 1, Variable Speed Triplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV3-4).....	32,839.91	988.83
22 11 23 13-0051	EA			180 GPM At 40 To 90 PSI, NEMA 1, Variable Speed Triplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV3-5).....	30,255.79	1,050.63
22 11 23 13-0052	EA			180 GPM At 100 To 150 PSI, NEMA 1, Variable Speed Triplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV3-6).....	32,975.49	1,050.63
22 11 23 13-0053	EA			240 GPM At 40 To 50 PSI, NEMA 1, Variable Speed Triplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV3-7).....	30,891.02	1,050.63
22 11 23 13-0054	EA			240 GPM At 60 To 80 PSI, NEMA 1, Variable Speed Triplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV3-8).....	33,228.95	1,050.63
22 11 23 13-0055	EA			240 GPM At 90 To 110 PSI, NEMA 1, Variable Speed Triplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV3-9).....	36,443.99	1,050.63
22 11 23 13-0056	EA			240 GPM At 120 To 150 PSI, NEMA 1, Variable Speed Triplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV3-10).....	39,109.00	1,050.63
22 11 23 13-0057	EA			300 GPM At 40 To 50 PSI, NEMA 1, Variable Speed Triplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV3-11).....	31,199.07	1,112.44
22 11 23 13-0058	EA			300 GPM At 60 To 70 PSI, NEMA 1, Variable Speed Triplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV3-12).....	33,536.99	1,112.44
22 11 23 13-0059	EA			300 GPM At 80 To 100 PSI, NEMA 1, Variable Speed Triplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV3-13).....	36,750.99	1,112.44
22 11 23 13-0060	EA			300 GPM At 110 To 150 PSI, NEMA 1, Variable Speed Triplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV3-14).....	39,416.00	1,112.44
22 11 23 13-0061	EA			360 GPM At 40 To 60 PSI, 420 GPM At 40 To 50 PSI, NEMA 1, Variable Speed Triplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV3-15).....	33,828.32	1,112.44
22 11 23 13-0062	EA			360 GPM At 70 To 80 PSI, 420 GPM At 60 To 70 PSI, NEMA 1, Variable Speed Triplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV3-16).....	36,073.70	1,112.44



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 11 23 13-0063 EA 360 GPM At 90 To 130 PSI, 420 GPM At 80 To 120 PSI, NEMA 1, Variable Speed Triplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV3-17)	41,621.41	1,112.44
22 11 23 13-0064 EA 360 GPM At 140 To 150 PSI, 420 GPM At 130 To 150 PSI, NEMA 1, Variable Speed Triplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV3-18)	50,674.45	1,112.44
22 11 23 13-0065 EA 480 GPM At 40 PSI, NEMA 1, Variable Speed Triplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV3-19)	34,595.87	1,236.04
22 11 23 13-0066 EA 480 GPM At 50 To 70 PSI, 520 To 600 GPM At 40 To 80 PSI, NEMA 1, Variable Speed Triplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV3-20)	36,842.30	1,236.04
22 11 23 13-0067 EA 480 GPM At 80 To 110 PSI, NEMA 1, Variable Speed Triplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV3-21)	42,390.02	1,236.04
22 11 23 13-0068 EA 480 GPM At 120 To 150 PSI, NEMA 1, Variable Speed Triplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV3-22)	51,442.00	1,236.04
22 11 23 13-0069 EA 540 GPM At 40 PSI, 600 GPM At 40 PSI, NEMA 1, Variable Speed Triplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV3-23)	36,478.41	1,236.04
22 11 23 13-0070 EA 540 GPM At 50 To 90 PSI, 600 GPM At 50 To 80 PSI, NEMA 1, Variable Speed Triplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV3-24)	41,520.26	1,236.04
22 11 23 13-0071 EA 540 GPM At 100 To 110 PSI, 600 GPM At 90 To 110 PSI, NEMA 1, Variable Speed Triplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV3-25)	52,472.66	1,236.04
22 11 23 13-0072 EA 540 GPM At 120 To 130 PSI, 600 GPM At 120 To 130 PSI, NEMA 1, Variable Speed Triplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV3-26)	53,533.83	1,236.04
22 11 23 13-0073 EA 540 GPM At 140 To 150 PSI, 600 GPM At 140 To 150 PSI, NEMA 1, Variable Speed Triplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV3-27)	66,247.83	1,236.04
22 11 23 13-0074 EA 660 GPM At 40 To 50 PSI, 720 GPM At 40 To 50 PSI, NEMA 1, Variable Speed Triplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV3-28)	41,361.07	1,483.24
22 11 23 13-0075 EA 660 GPM At 60 To 90 PSI, 720,780,840,900 GPM At 60 To 80 PSI, NEMA 1, Variable Speed Triplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV3-29)	49,670.56	1,483.24
22 11 23 13-0076 EA 660, 720, 780 GPM At 100 PSI, 840 To 900 GPM At 90 PSI, NEMA 1, Variable Speed Triplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV3-30)	52,821.45	1,483.24
22 11 23 13-0077 EA 660, 720, 780, 840, 900 GPM At 110 To 120 PSI, NEMA 1, Variable Speed Triplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV3-31)	63,629.77	1,483.24
22 11 23 13-0078 EA 660, 720, 780, 840, 900 GPM At 130 To 150 PSI, NEMA 1, Variable Speed Triplex Domestic Water Pressure Booster Skid (FlowTherm Systems FMV3-32)	78,754.27	1,483.24

22 11 23 39 In-Line Centrifugal Domestic Water Booster Pumps (22 11 23)

22 11 23 39-0001	Bronze In-Line Centrifugal Domestic Water Booster Pumps (22 11 23 39)		
Note: ODP motor.			
22 11 23 39-0002 EA	1/12 HP, 3/4" To 1-1/2" Flanges, Bronze In-Line Centrifugal Domestic Water Booster Pump (B&G PL30B)	594.65	132.30
22 11 23 39-0003 EA	1/6 HP, 3/4" Flanges, Bronze In-Line Centrifugal Domestic Water Booster Pump (B&G PL36B)	608.42	132.30
22 11 23 39-0004 EA	1/6 HP, 1" To 1-1/4" Flanges, Bronze In-Line Centrifugal Domestic Water Booster Pump (B&G PL45B)	634.81	134.87
22 11 23 39-0005 EA	1/6 HP, 1-1/2" Flanges, Bronze In-Line Centrifugal Domestic Water Booster Pump (B&G PL50B)	694.95	140.39
22 11 23 39-0006 EA	1/6 HP, 2" Flanges, Bronze In-Line Centrifugal Domestic Water Booster Pump (B&G PL75B)	1,186.28	145.61
22 11 23 39-0007 EA	1/6 HP, 2" Flanges, Bronze In-Line Centrifugal Domestic Water Booster Pump (B&G 2AB)	1,259.99	145.61
22 11 23 39-0008 EA	1/4 HP, 2-1/2" Flanges, Bronze In-Line Centrifugal Domestic Water Booster Pump (B&G 2-1/2AB)	1,851.07	160.33
22 11 23 39-0009 EA	1/4 HP, 3" Flanges, Bronze In-Line Centrifugal Domestic Water Booster Pump (B&G LD3 AB)	1,935.29	176.13
22 11 23 39-0010 EA	1/3 HP, 3" Flanges, Bronze In-Line Centrifugal Domestic Water Booster Pump (B&G HD3 AB)	2,332.17	193.78
22 11 23 39-0011 EA	1/2 HP, 3" Flanges, Bronze In-Line Centrifugal Domestic Water Booster Pump (B&G PDB35S)	2,392.16	213.27
22 11 23 39-0012 EA	3/4 HP, 3" Flanges, Bronze In-Line Centrifugal Domestic Water Booster Pump (B&G PDB37S)	2,616.63	234.23
22 11 23 39-0013 EA	1 HP, 3" Flanges, Bronze In-Line Centrifugal Domestic Water Booster Pump (B&G PDB38S)	3,706.16	257.77
22 11 23 39-0014 EA	1-1/2 HP, 3" Flanges, Bronze In-Line Centrifugal Domestic Water Booster Pump (B&G PDB40S)	4,254.49	270.26

22 11 23 39-0015 Cast Iron In-Line Centrifugal Domestic Water Booster Pumps (22 11 23 39)

22 11 23 39-0015	Cast Iron In-Line Centrifugal Domestic Water Booster Pumps (22 11 23 39)		
Note: ODP motor.			
22 11 23 39-0016 EA	1/12 HP, 3/4" To 1-1/2" Flanges, Cast Iron In-Line Centrifugal Domestic Water Booster Pump (B&G PL30)	599.65	132.30
22 11 23 39-0017 EA	1/6 HP, 3/4" Flanges, Cast Iron In-Line Centrifugal Domestic Water Booster Pump (B&G PL36)	946.93	132.30
22 11 23 39-0018 EA	1/6 HP, 1" To 1-1/4" Flanges, Cast Iron In-Line Centrifugal Domestic Water Booster Pump (B&G PL45)	952.25	134.87
22 11 23 39-0019 EA	1/6 HP, 1-1/4" Flanges, Cast Iron In-Line Centrifugal Domestic Water Booster Pump (B&G PL45)	969.28	137.81
22 11 23 39-0020 EA	1/6 HP, 1-1/2" Flanges, Cast Iron In-Line Centrifugal Domestic Water Booster Pump (B&G PL50)	974.41	140.39
22 11 23 39-0021 EA	1/6 HP, 2" Flanges, Cast Iron In-Line Centrifugal Domestic Water Booster Pump (B&G PL75)	994.42	145.61
22 11 23 39-0022 EA	1/4 HP, 2-1/2" Flanges, Cast Iron In-Line Centrifugal Domestic Water Booster Pump (B&G 2-1/2)	1,204.06	160.33
22 11 23 39-0023 EA	1/3 HP, 3" Flanges, Cast Iron In-Line Centrifugal Domestic Water Booster Pump (B&G HD30)	1,545.57	193.78
22 11 23 39-0024 EA	1/2 HP, 3" Flanges, Cast Iron In-Line Centrifugal Domestic Water Booster Pump (B&G PD35S)	1,633.71	213.27
22 11 23 39-0025 EA	3/4 HP, 3" Flanges, Cast Iron In-Line Centrifugal Domestic Water Booster Pump (B&G PD37S)	1,898.19	234.23
22 11 23 39-0026 EA	1 HP, 3" Flanges, Cast Iron In-Line Centrifugal Domestic Water Booster Pump (B&G PD38S)	2,524.22	257.77
22 11 23 39-0027 EA	1-1/2 HP, 3" Flanges, Cast Iron In-Line Centrifugal Domestic Water Booster Pump (B&G PD40S)	2,932.68	270.26
22 11 23 39-0028 EA	2 HP, 4" Flanges, Cast Iron In-Line Centrifugal Domestic Water Booster Pump (B&G 80, 4x4x7, BF)	2,762.80	283.87
22 11 23 39-0029 EA	3 HP, 4" Flanges, Cast Iron In-Line Centrifugal Domestic Water Booster Pump (B&G 80, 4x4x7, BF)	2,973.87	312.03

22 12 Facility Potable-Water Storage Tanks (22 10)

22 12 23 Facility Indoor Potable-Water Storage Tanks (22 12)

22 12 23 13 Facility Steel, Indoor Potable-Water Storage Pressure Tanks (22 12 23)

22 12 23 13-0001	Insulated Glass Lined Storage Tank (A.O. Smith TJ, TJV And TJH) (22 12 23 13)		
22 12 23 13-0002 EA	80 Gallon ASME Rated Tank, 150PSI, Jacketed, Insulated, Glass Lined Water Heater Storage Tank (TJ-80A)	2,052.96	294.00
22 12 23 13-0003 EA	119 Gallon ASME Rated Tank, Jacketed, Insulated, Glass Lined Water Heater Storage Tank (TJV-120M)	2,265.46	367.50
22 12 23 13-0004 EA	140 Gallon ASME Rated Tank, 125 PSI, Jacketed, Insulated, Glass Lined Water Heater Storage Tank (TJV-140A)	4,849.56	404.26



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 12 23 13-0005 EA 200 Gallon ASME Rated Tank, 125 PSI, Jacketed, Insulated, Glass Lined Water Heater Storage Tank (TJV-200A).....	5,366.59	441.01
22 12 23 13-0006 EA 250 Gallon ASME Rated Tank, 125 PSI, Jacketed, Insulated, Glass Lined Water Heater Storage Tank (TJV-250A).....	7,128.00	477.76
22 12 23 13-0007 EA 350 Gallon ASME Rated Tank, 125 PSI, Jacketed, Insulated, Glass Lined Water Heater Storage Tank (TJV-350A).....	9,324.90	514.51
22 12 23 13-0008 EA 400 Gallon ASME Rated Tank, 125 PSI, Jacketed, Insulated, Glass Lined Water Heater Storage Tank (TJV-400A).....	10,496.88	551.26
22 12 23 13-0009 EA 500 Gallon ASME Rated Tank, 125 PSI, Jacketed, Insulated, Glass Lined Water Heater Storage Tank (TJV-500A).....	14,882.00	588.01
22 12 23 13-0010 EA 750 Gallon ASME Rated Tank, 125 PSI, Jacketed, Insulated, Glass Lined Water Heater Storage Tank (TJV-750A).....	16,175.20	624.76
22 12 23 13-0011 EA 1,000 Gallon ASME Rated Tank, 125 PSI, Jacketed, Insulated, Glass Lined Water Heater Storage Tank (TJV-1000A).....	19,320.59	661.51
22 12 23 13-0012 Uninsulated Glass Lined Storage Tank (A.O. Smith T) (22 12 23 13)		
22 12 23 13-0013 EA 80 Gallon 150 PSI, Uninsulated, Glass Lined Water Storage Tank (T-80S).....	1,732.27	294.00
22 12 23 13-0014 EA 120 Gallon 150 PSA, Uninsulated, Glass Lined Water Storage Tank (T-120S).....	2,803.06	367.50
22 12 23 13-0015 EA 140 Gallon ASME Rated Tank, 125 PSI, Uninsulated, Glass Lined Water Storage Tank (T-140A).....	4,339.54	404.26
22 12 23 13-0016 EA 200 Gallon 150 PSI, Uninsulated, Glass Lined Water Storage Tank (T-200S).....	4,338.75	441.01
22 12 23 13-0017 EA 200 Gallon ASME Rated Tank, 125 PSI, Uninsulated, Glass Lined Water Storage Tank (T-200A).....	4,546.04	441.01
22 12 23 13-0018 EA 250 Gallon ASME Rated Tank, 125 PSI, Uninsulated, Glass Lined Water Storage Tank (T-250A).....	5,737.44	477.76
22 12 23 13-0019 EA 325 Gallon ASME Rated Tank, 125 PSI, Uninsulated, Glass Lined Water Storage Tank (T-325A).....	6,245.87	514.51
22 12 23 13-0020 EA 350 Gallon 150 PSI, Uninsulated, Glass Lined Water Storage Tank (T-350S).....	5,876.84	514.51
22 12 23 13-0021 EA 350 Gallon ASME Rated Tank, 125 PSI, Uninsulated, Glass Lined Water Storage Tank (T-350A).....	6,682.01	514.51
22 12 23 13-0022 EA 400 Gallon ASME Rated Tank, 125 PSI, Uninsulated, Glass Lined Water Storage Tank (T-400A).....	7,365.33	551.26
22 12 23 13-0023 EA 500 Gallon ASME Rated Tank, 125 PSI, Uninsulated, Glass Lined Water Storage Tank (T-500A).....	10,020.39	588.01
22 12 23 13-0024 EA 750 Gallon ASME Rated Tank, 125 PSI, Uninsulated, Glass Lined Water Storage Tank (T-750A).....	11,667.22	624.76
22 12 23 13-0025 EA 1,000 Gallon ASME Rated Tank, 125 PSI, Uninsulated, Glass Lined Water Storage Tank (T-1000A).....	14,688.28	661.51
22 12 23 26 Facility Plastic, Indoor Potable-Water Storage Non-Pressure Tanks (22 12 23)		
22 12 23 26-0001 Horizontal Non-Pressurized Polyethylene Tanks (22 12 23 26)		
Note: Excludes excavation and backfill.		
22 12 23 26-0002 EA 100 Gallon Horizontal Non-Pressurized Polyethylene Tank.....	408.59	165.38
For Saddle Assembly, Add	449.29	
22 12 23 26-0003 EA 150 Gallon Horizontal Non-Pressurized Polyethylene Tank.....	478.34	192.94
For Saddle Assembly, Add	449.29	
22 12 23 26-0004 EA 200 Gallon Horizontal Non-Pressurized Polyethylene Tank.....	564.59	220.50
For Saddle Assembly, Add	505.39	
22 12 23 26-0005 EA 300 Gallon Horizontal Non-Pressurized Polyethylene Tank.....	680.54	248.06
For Saddle Assembly, Add	724.29	
22 12 23 26-0006 EA 335 Gallon Horizontal Non-Pressurized Polyethylene Tank.....	808.59	275.63
For Two Tie Down Bands, Add	263.58	
22 12 23 26-0007 EA 535 Gallon Horizontal Non-Pressurized Polyethylene Tank.....	1,047.54	372.41
For Two Tie Down Bands, Add	278.98	
22 12 23 26-0008 EA 1,035 Gallon Horizontal Non-Pressurized Polyethylene Tank.....	1,523.29	434.48
For Three Tie Down Bands, Add	467.97	
22 12 23 26-0009 EA 1,335 Gallon Horizontal Non-Pressurized Polyethylene Tank.....	2,152.55	496.55
For Three Tie Down Bands, Add	471.27	
22 12 23 26-0010 EA 1,635 Gallon Horizontal Non-Pressurized Polyethylene Tank.....	2,665.41	558.61
For Four Tie Down Bands, Add	637.16	
22 12 23 26-0011 EA 2,035 Gallon Horizontal Non-Pressurized Polyethylene Tank.....	3,110.57	620.68
For Four Tie Down Bands, Add	861.56	
22 12 23 26-0012 EA 2,635 Gallon Horizontal Non-Pressurized Polyethylene Tank.....	4,375.32	682.75
For Four Tie Down Bands, Add	1,107.96	
22 12 23 26-0013 EA 3,135 Gallon Horizontal Non-Pressurized Polyethylene Tank.....	5,052.08	744.82
For Four Tie Down Bands, Add	1,191.56	
22 12 23 26-0014 EA 4,035 Gallon Horizontal Non-Pressurized Polyethylene Tank.....	7,230.11	993.09
For Four Tie Down Bands, Add	1,336.76	
22 12 23 26-0015 EA 5,025 Gallon Horizontal Non-Pressurized Polyethylene Tank.....	9,251.81	993.09
For Five Tie Down Bands, Add	2,072.44	
22 12 23 26-0016 Vertical Non-Pressurized Polyethylene Tanks (22 12 23 26)		
22 12 23 26-0017 EA 100 Gallon Vertical Non-Pressurized Polyethylene Tank.....	460.09	220.50
22 12 23 26-0018 EA 160 Gallon Vertical Non-Pressurized Polyethylene Tank.....	543.37	234.28
22 12 23 26-0019 EA 210 Gallon Vertical Non-Pressurized Polyethylene Tank.....	593.64	248.06
22 12 23 26-0020 EA 300 Gallon Vertical Non-Pressurized Polyethylene Tank.....	710.69	275.63
22 12 23 26-0021 EA 405 Gallon Vertical Non-Pressurized Polyethylene Tank.....	816.10	330.75
22 12 23 26-0022 EA 500 Gallon Vertical Non-Pressurized Polyethylene Tank.....	962.20	385.89
22 12 23 26-0023 EA 800 Gallon Vertical Non-Pressurized Polyethylene Tank.....	1,326.45	496.55
22 12 23 26-0024 EA 1,000 Gallon Vertical Non-Pressurized Polyethylene Tank.....	1,709.77	620.68
22 12 23 26-0025 EA 2,000 Gallon Vertical Non-Pressurized Polyethylene Tank.....	2,266.88	744.82
22 12 23 26-0026 EA 3,000 Gallon Vertical Non-Pressurized Polyethylene Tank.....	2,927.40	868.96
22 12 23 26-0027 EA 4,000 Gallon Vertical Non-Pressurized Polyethylene Tank.....	4,207.21	993.09
22 12 23 26-0028 EA 5,000 Gallon Vertical Non-Pressurized Polyethylene Tank.....	5,616.83	1,117.23
22 12 23 26-0029 EA 6,250 Gallon Vertical Non-Pressurized Polyethylene Tank.....	6,358.75	1,241.36
22 12 23 26-0030 EA 7,000 Gallon Vertical Non-Pressurized Polyethylene Tank.....	7,006.06	1,365.50
22 12 23 26-0031 EA 8,000 Gallon Vertical Non-Pressurized Polyethylene Tank.....	8,042.78	1,489.64
22 12 23 26-0032 EA 9,150 Gallon Vertical Non-Pressurized Polyethylene Tank.....	9,060.78	1,613.77

22 Plumbing**22 10 Plumbing Piping****22 12 Facility Potable-Water Storage Tanks**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 12 23 26-0033	EA		10,500 Gallon Vertical Non-Pressurized Polyethylene Tank.....	11,123.80	1,737.91
22 12 23 26-0034	EA		12,500 Gallon Vertical Non-Pressurized Polyethylene Tank.....	13,346.83	1,986.19

22 13 Facility Sanitary Sewerage (22 10)**22 13 13 Facility Sanitary Sewers** (22 13)**22 13 13 00-0001****Fixture Rough-In** (22 13 13)

Note: Excludes fixture. Not for use when individual component details are available, on remodeling work where partial pipe and fittings are installed or on residential projects. For use on commercial restrooms with multiple toilets, urinals and lavatories. Includes waste and vent pipe and fittings and domestic water supply pipe and fittings. Waste piping is included from fixture outlet tee to floor, vent piping is included from outlet tee within the wall to the ceiling and domestic water supply from ceiling to fixture and stub out with caps. Based on vertical floor to floor of 12'. Use detailed tasks (i.e. individual pipe and fittings, insulation, hangers, etc.) instead of rough-in assembly where possible.

22 13 13 00-0002**Single Fixture Rough-In, Cast Iron Waste And Vent Pipe** (22 13 13 00-0001)

Note: Single fixtures have one fixture to one pipe riser. Includes cast iron waste and vent pipe and fittings and copper domestic water supply pipe and fittings.

22 13 13 00-0003	EA	Floor Mounted Water Closet, Single Fixture Rough-In, Cast Iron Waste And Vent Pipe.....	641.16		
		Note: Includes cast iron waste and vent pipe and copper domestic supply. Excludes fixture and flush valve.			
22 13 13 00-0004	EA	Wall Mounted Water Closet, Single Fixture Rough-In, Cast Iron Waste And Vent Pipe.....	820.47		
		Note: Includes cast iron waste and vent pipe and copper domestic supply. Excludes fixture, carrier and flush valve.			
22 13 13 00-0005	EA	Tank Type Floor Mounted Water Closet, Single Fixture Rough-In, Cast Iron Waste And Vent Pipe.....	588.88		
		Note: Includes cast iron waste and vent pipe and copper domestic supply. Excludes fixture.			
22 13 13 00-0006	EA	Wall Mounted Urinal, Single Fixture Rough-In, Cast Iron Waste And Vent Pipe.....	375.84		
		Note: Includes cast iron waste and vent pipe and copper domestic supply. Excludes fixture, carrier and flush valve.			
22 13 13 00-0007	EA	Wall Mounted Lavatory, Single Fixture Rough-In, Cast Iron Waste And Vent Pipe.....	442.48		
		Note: Includes cast iron waste and vent pipe and copper domestic supply. Excludes fixture, carrier and faucet.			
22 13 13 00-0008	EA	Countertop Kitchen Sink, Single Fixture Rough-In, Cast Iron Waste And Vent Pipe.....	571.73		
		Note: Includes cast iron waste and vent pipe and copper domestic supply. Excludes fixture and faucet.			
22 13 13 00-0009	EA	Bathub, Single Fixture Rough-In, Cast Iron Waste And Vent Pipe.....	602.26		
		Note: Includes cast iron waste and vent pipe and copper domestic supply. Excludes fixture and faucet.			
22 13 13 00-0010	EA	Free Standing Water Cooler, Single Fixture Rough-In, Cast Iron Waste And Vent Pipe.....	365.04		
		Note: Includes cast iron waste and vent pipe and copper domestic supply. Excludes fixture.			
22 13 13 00-0011	EA	Floor Mounted Service Sink, Single Fixture Rough-In, Cast Iron Waste And Vent Pipe.....	588.88		
		Note: Includes cast iron waste and vent pipe and copper domestic supply. Excludes fixture and faucet.			
22 13 13 00-0012	EA	Wall Mounted Service Sink, Single Fixture Rough-In, Cast Iron Waste And Vent Pipe.....	610.16		
		Note: Includes cast iron waste and vent pipe and copper domestic supply. Excludes fixture, carrier and faucet.			
22 13 13 00-0013	EA	Shower, Single Fixture Rough-In, Cast Iron Waste And Vent Pipe.....	573.40		
		Note: Includes cast iron waste and vent pipe and copper domestic supply. Excludes fixture, shower head and faucet.			
22 13 13 00-0014	EA	Bidet, Single Fixture Rough-In, Cast Iron Waste And Vent Pipe.....	641.16		
		Note: Includes cast iron waste and vent pipe and copper domestic supply. Excludes fixture and faucet.			
22 13 13 00-0015	EA	Floor Mounted Circular Wash Fountain, Single Fixture Rough-In, Cast Iron Waste And Vent Pipe.....	1,001.70		
		Note: Includes cast iron waste and vent pipe and copper domestic supply. Excludes fixture.			
22 13 13 00-0016	EA	Bathub/Shower, Single Fixture Rough-In, Cast Iron Waste And Vent Pipe.....	620.66		
		Note: Includes cast iron waste and vent pipe and copper domestic supply. Excludes fixture, shower head and faucet.			

22 13 13 00-0017**Double Fixture Rough-In, Cast Iron Waste And Vent Pipe** (22 13 13 00-0001)

Note: Double fixtures have two "back-to-back" waste connections to one riser. Includes cast iron waste and vent pipe and fittings and copper domestic water supply pipe and fittings.

22 13 13 00-0018	EA	Floor Mounted Water Closet, Double Fixture Rough-In, Cast Iron Waste And Vent Pipe.....	822.81		
		Note: Includes cast iron waste and vent pipe and copper domestic supply. Excludes fixture and flush valve.			
22 13 13 00-0019	EA	Wall Mounted Water Closet, Double Fixture Rough-In, Cast Iron Waste And Vent Pipe.....	1,099.73		
		Note: Includes cast iron waste and vent pipe and copper domestic supply. Excludes fixture, carrier and flush valve.			
22 13 13 00-0020	EA	Tank Type Floor Mounted Water Closet, Double Fixture Rough-In, Cast Iron Waste And Vent Pipe.....	711.54		
		Note: Includes cast iron waste and vent pipe and copper domestic supply. Excludes fixture.			
22 13 13 00-0021	EA	Wall Mounted Urinal, Double Fixture Rough-In, Cast Iron Waste And Vent Pipe.....	443.08		
		Note: Includes cast iron waste and vent pipe and copper domestic supply. Excludes fixture, carrier and flush valve.			
22 13 13 00-0022	EA	Wall Mounted Lavatory, Double Fixture Rough-In, Cast Iron Waste And Vent Pipe.....	605.70		
		Note: Includes cast iron waste and vent pipe and copper domestic supply. Excludes fixture, carrier and faucet.			
22 13 13 00-0023	EA	Countertop Kitchen Sink, Double Fixture Rough-In, Cast Iron Waste And Vent Pipe.....	639.78		
		Note: Includes cast iron waste and vent pipe and copper domestic supply. Excludes fixture and faucet.			
22 13 13 00-0024	EA	Free Standing Water Cooler, Double Fixture Rough-In, Cast Iron Waste And Vent Pipe.....	421.36		
		Note: Includes cast iron waste and vent pipe and copper domestic supply. Excludes fixture.			
22 13 13 00-0025	EA	Floor Mounted Service Sink, Double Fixture Rough-In, Cast Iron Waste And Vent Pipe.....	718.88		
		Note: Includes cast iron waste and vent pipe and copper domestic supply. Excludes fixture and faucet.			
22 13 13 00-0026	EA	Wall Mounted Service Sink, Double Fixture Rough-In, Cast Iron Waste And Vent Pipe.....	639.45		
		Note: Includes cast iron waste and vent pipe and copper domestic supply. Excludes fixture, carrier and faucet.			
22 13 13 00-0027	EA	Shower, Double Fixture Rough-In, Cast Iron Waste And Vent Pipe.....	621.09		
		Note: Includes cast iron waste and vent pipe and copper domestic supply. Excludes fixture, shower heads and faucets.			
22 13 13 00-0028	EA	Bidet, Double Fixture Rough-In, Cast Iron Waste And Vent Pipe.....	822.81		
		Note: Includes cast iron waste and vent pipe and copper domestic supply. Excludes fixture and faucets.			



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 13 13 00-0029				Gang Fixture Rough-In, Cast Iron Waste And Vent Pipe <small>(22 13 13 00-0001)</small> Note: Gang fixtures include multiple fixtures to one pipe riser. Includes cast iron waste and vent pipe and fittings and copper domestic water supply pipe and fittings.		
22 13 13 00-0030	EA			Floor Mounted Water Closet, Gang Fixture Rough-In, Cast Iron Waste And Vent Pipe 411.06 Note: Includes cast iron waste and vent pipe and copper domestic supply. Excludes fixture and flush valve.	411.06	
22 13 13 00-0031	EA			Wall Mounted Water Closet, Gang Fixture Rough-In, Cast Iron Waste And Vent Pipe 549.86 Note: Includes cast iron waste pipe and vent and copper domestic supply. Excludes fixture, carrier and flush valve.	549.86	
22 13 13 00-0032	EA			Tank Type Floor Mounted Water Closet, Gang Fixture Rough-In, Cast Iron Waste And Vent Pipe 356.13 Note: Includes cast iron waste pipe and vent and copper domestic supply. Excludes fixture.	356.13	
22 13 13 00-0033	EA			Wall Mounted Urinal, Gang Fixture Rough-In, Cast Iron Waste And Vent Pipe..... 221.90 Note: Includes cast iron waste pipe and vent and copper domestic supply. Excludes fixture, carrier and flush valve.	221.90	
22 13 13 00-0034	EA			Wall Mounted Lavatory, Gang Fixture Rough-In, Cast Iron Waste And Vent Pipe 302.86 Note: Includes cast iron waste and vent pipe and copper domestic supply. Excludes fixture, carrier and faucet.	302.86	
22 13 13 00-0035	EA			Countertop Kitchen Sink, Gang Fixture Rough-In, Cast Iron Waste And Vent Pipe 319.88 Note: Includes cast iron waste and vent pipe and copper domestic supply. Excludes fixture and faucet.	319.88	
22 13 13 00-0036	EA			Free Standing Water Cooler, Gang Fixture Rough-In, Cast Iron Waste And Vent Pipe 229.05 Note: Includes cast iron waste and vent pipe and copper domestic supply. Excludes fixture.	229.05	
22 13 13 00-0037	EA			Rough-in Service Sink, Floor Mounted, Gang Mounted Fixture Including Cast Iron Waste Pipe And Vent And Copper Domestic Supply, Not Including Fixture Or Faucet 359.08 Note: Includes cast iron waste and vent pipe and copper domestic supply. Excludes fixture and faucet.	359.08	
22 13 13 00-0038	EA			Wall Mounted Service Sink, Gang Fixture Rough-In, Cast Iron Waste And Vent Pipe 319.73 Note: Includes cast iron waste and vent pipe and copper domestic supply. Excludes fixture, carrier and faucet.	319.73	
22 13 13 00-0039	EA			Shower, Gang Fixture Rough-In, Cast Iron Waste And Vent Pipe..... 310.90 Note: Includes cast iron waste and vent pipe and copper domestic supply. Excludes fixture, shower heads and faucets.	310.90	
22 13 13 00-0040	EA			Bidet, Gang Fixture Rough-In, Cast Iron Waste And Vent Pipe..... 405.91 Note: Includes cast iron waste and vent pipe and copper domestic supply. Excludes fixture and faucet.	405.91	
22 13 13 00-0041				Single Fixture Rough-In, Polyvinyl Chloride (PVC) Waste And Vent Pipe <small>(22 13 13 00-0001)</small> Note: Single fixtures have one fixture to one pipe riser. Includes PVC waste and vent pipe and fittings and copper domestic water supply pipe and fittings.		
22 13 13 00-0042	EA			Floor Mounted Water Closet, Single Fixture Rough-In, Polyvinyl Chloride (PVC) Waste And Vent Pipe 328.46 Note: Includes polyvinyl chloride (PVC) waste and vent pipe and copper domestic supply. Excludes fixture and flush valve.	328.46	
22 13 13 00-0043	EA			Wall Mounted Water Closet, Single Fixture Rough-In, Polyvinyl Chloride (PVC) Waste And Vent Pipe..... 308.86 Note: Includes polyvinyl chloride (PVC) waste and vent pipe and copper domestic supply. Excludes fixture, carrier and flush valve.	308.86	
22 13 13 00-0044	EA			Tank Type Floor Mounted Water Closet, Single Fixture Rough-In, Polyvinyl Chloride (PVC) Waste And Vent Pipe..... 321.36 Note: Includes polyvinyl chloride (PVC) waste and vent pipe and copper domestic supply. Excludes fixture.	321.36	
22 13 13 00-0045	EA			Wall Mounted Urinal, Single Fixture Rough-In, Polyvinyl Chloride (PVC) Waste And Vent Pipe 183.85 Note: Includes polyvinyl chloride (PVC) waste and vent pipe and copper domestic supply. Excludes fixture, carrier and flush valve.	183.85	
22 13 13 00-0046	EA			Wall Mounted Lavatory, Single Fixture Rough-In, Polyvinyl Chloride (PVC) Waste And Vent Pipe..... 214.55 Note: Includes polyvinyl chloride (PVC) waste and vent pipe and copper domestic supply. Excludes fixture, carrier and faucet.	214.55	
22 13 13 00-0047	EA			Countertop Kitchen Sink, Single Fixture Rough-In, Polyvinyl Chloride (PVC) Waste And Vent Pipe..... 305.45 Note: Includes polyvinyl chloride (PVC) waste and vent pipe and copper domestic supply. Excludes fixture and faucet.	305.45	
22 13 13 00-0048	EA			Bathtub, Single Fixture Rough-In, Polyvinyl Chloride (PVC) Waste And Vent Pipe..... 298.66 Note: Includes polyvinyl chloride (PVC) waste and vent pipe and copper domestic supply. Excludes fixture and faucet.	298.66	
22 13 13 00-0049	EA			Free Standing Water Cooler, Single Fixture Rough-In, Polyvinyl Chloride (PVC) Waste And Vent Pipe..... 185.12 Note: Includes polyvinyl chloride (PVC) waste and vent pipe and copper domestic supply. Excludes fixture.	185.12	
22 13 13 00-0050	EA			Floor Mounted Service Sink, Single Fixture Rough-In, Polyvinyl Chloride (PVC) Waste And Vent Pipe 321.36 Note: Includes polyvinyl chloride (PVC) waste and vent pipe and copper domestic supply. Excludes fixture and faucet.	321.36	
22 13 13 00-0051	EA			Wall Mounted Service Sink, Single Fixture Rough-In, Polyvinyl Chloride (PVC) Waste And Vent Pipe 348.75 Note: Includes polyvinyl chloride (PVC) waste and vent pipe and copper domestic supply. Excludes fixture, carrier and faucet.	348.75	
22 13 13 00-0052	EA			Shower, Single Fixture Rough-In, Polyvinyl Chloride (PVC) Waste And Vent Pipe 316.52 Note: Includes polyvinyl chloride (PVC) waste and vent pipe and copper domestic supply. Excludes fixture, shower head and faucet.	316.52	
22 13 13 00-0053	EA			Bidet, Single Fixture Rough-In, Polyvinyl Chloride (PVC) Waste And Vent Pipe 328.38 Note: Includes polyvinyl chloride (PVC) waste and vent pipe and copper domestic supply. Excludes fixture and faucet.	328.38	
22 13 13 00-0054	EA			Floor Mounted Circular Wash Fountain, Single Fixture Rough-In, Polyvinyl Chloride (PVC) Waste And Vent Pipe..... 501.85 Note: Includes polyvinyl chloride (PVC) waste and vent pipe and copper domestic supply. Excludes fixture.	501.85	
22 13 13 00-0055	EA			Bathtub/Shower, Single Fixture Rough-In, Polyvinyl Chloride (PVC) Waste And Vent Pipe..... 314.74 Note: Includes polyvinyl chloride (PVC) waste and vent pipe and copper domestic supply. Excludes fixture, shower head and faucet.	314.74	
22 13 13 00-0056				Double Fixture Rough-In, Polyvinyl Chloride (PVC) Waste And Vent Pipe <small>(22 13 13 00-0001)</small> Note: Double fixtures have two "back-to-back" waste connections to one riser. Includes PVC waste and vent pipe and fittings and copper domestic water supply pipe and fittings.		
22 13 13 00-0057	EA			Floor Mounted Water Closet, Double Fixture Rough-In, Polyvinyl Chloride (PVC) Waste And Vent Pipe 379.96 Note: Includes polyvinyl chloride (PVC) waste and vent pipe and copper domestic supply. Excludes fixture and flush valve.	379.96	

22	Plumbing
22 10	Plumbing Piping
22 13	Facility Sanitary Sewerage



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 13 13 00-0058 EA Wall Mounted Water Closet, Double Fixture Rough-In, Polyvinyl Chloride (PVC) Waste And Vent Pipe .....399.86 Note: Includes polyvinyl chloride (PVC) waste and vent pipe and copper domestic supply. Excludes fixture, carrier and flush valve.	399.86	
22 13 13 00-0059 EA Tank Type Floor Mounted Water Closet, Double Fixture Rough-In, Polyvinyl Chloride (PVC) Waste And Vent Pipe .....332.28 Note: Includes polyvinyl chloride (PVC) waste and vent pipe and copper domestic supply. Excludes fixtures.	332.28	
22 13 13 00-0060 EA Wall Mounted Urinal, Double Fixture Rough-In, Polyvinyl Chloride (PVC) Waste And Vent Pipe.....192.87 Note: Includes polyvinyl chloride (PVC) waste and vent pipe and copper domestic supply. Excludes fixture, carrier and flush valve.	192.87	
22 13 13 00-0061 EA Wall Mounted Lavatory, Double Fixture Rough-In, Polyvinyl Chloride (PVC) Waste And Vent Pipe .....304.49 Note: Includes polyvinyl chloride (PVC) waste and vent pipe and copper domestic supply. Excludes fixtures, carrier and faucets.	304.49	
22 13 13 00-0062 EA Countertop Kitchen Sink, Double Fixture Rough-In, Polyvinyl Chloride (PVC) Waste And Vent Pipe .....314.59 Note: Includes polyvinyl chloride (PVC) waste and vent pipe and copper domestic supply. Excludes fixtures and faucets.	314.59	
22 13 13 00-0063 EA Free Standing Water Cooler, Double Fixture Rough-In, Polyvinyl Chloride (PVC) Waste And Vent Pipe .....192.68 Note: Includes polyvinyl chloride (PVC) waste and vent pipe and copper domestic supply. Excludes fixture.	192.68	
22 13 13 00-0064 EA Floor Mounted Service Sink, Double Fixture Rough-In, Polyvinyl Chloride (PVC) Waste And Vent Pipe .....338.81 Note: Includes polyvinyl chloride (PVC) waste and vent pipe and copper domestic supply. Excludes fixture and faucet.	338.81	
22 13 13 00-0065 EA Wall Mounted Service Sink, Double Fixture Rough-In, Polyvinyl Chloride (PVC) Waste And Vent Pipe .....352.68 Note: Includes polyvinyl chloride (PVC) waste and vent pipe and copper domestic supply. Excludes fixture, carrier and faucet.	352.68	
22 13 13 00-0066 EA Shower, Double Fixture Rough-In, Polyvinyl Chloride (PVC) Waste And Vent Pipe.....336.28 Note: Includes polyvinyl chloride (PVC) waste and vent pipe and copper domestic supply. Excludes fixture, shower head and faucet.	336.28	
22 13 13 00-0067 EA Bidet, Double Fixture Rough-In, Polyvinyl Chloride (PVC) Waste And Vent Pipe.....379.96 Note: Includes polyvinyl chloride (PVC) waste and vent pipe and copper domestic supply. Excludes fixture and faucet.	379.96	
22 13 13 00-0068 Gang Fixture Rough-In, Polyvinyl Chloride (PVC) Waste And Vent Pipe ^(22 13 13 00-0001)		
Note: Gang fixtures include multiple fixtures to one pipe riser. Includes PVC waste and vent pipe and fittings and copper domestic water supply pipe and fittings.		
22 13 13 00-0069 EA Floor Mounted Water Closet, Gang Fixture Rough-In, Polyvinyl Chloride (PVC) Waste And Vent Pipe.....189.69 Note: Includes polyvinyl chloride (PVC) waste and vent pipe and copper domestic supply. Excludes fixture and flush valve.	189.69	
22 13 13 00-0070 EA Wall Mounted Water Closet, Gang Fixture Rough-In, Polyvinyl Chloride (PVC) Waste And Vent Pipe .....199.57 Note: Includes polyvinyl chloride (PVC) waste and vent pipe and copper domestic supply. Excludes fixture, carrier and flush valve.	199.57	
22 13 13 00-0071 EA Tank Type Floor Mounted Water Closet, Gang Fixture Rough-In, Polyvinyl Chloride (PVC) Waste And Vent Pipe.....166.35 Note: Includes polyvinyl chloride (PVC) waste and vent pipe and copper domestic supply. Excludes fixture.	166.35	
22 13 13 00-0072 EA Wall Mounted Urinal, Gang Fixture Rough-In, Polyvinyl Chloride (PVC) Waste And Vent Pipe .....96.47 Note: Includes polyvinyl chloride (PVC) waste and vent pipe and copper domestic supply. Excludes fixture, carrier and flush valve.	96.47	
22 13 13 00-0073 EA Wall Mounted Lavatory, Gang Fixture Rough-In, Polyvinyl Chloride (PVC) Waste And Vent Pipe.....152.23 Note: Includes polyvinyl chloride (PVC) waste and vent pipe and copper domestic supply. Excludes fixture, carrier and faucet.	152.23	
22 13 13 00-0074 EA Countertop Kitchen Sink, Gang Fixture Rough-In, Polyvinyl Chloride (PVC) Waste And Vent Pipe.....157.11 Note: Includes polyvinyl chloride (PVC) waste and vent pipe and copper domestic supply. Excludes fixture and faucet.	157.11	
22 13 13 00-0075 EA Free Standing Water Cooler, Gang Fixture Rough-In, Polyvinyl Chloride (PVC) Waste And Vent Pipe .....96.34 Note: Includes polyvinyl chloride (PVC) waste and vent pipe and copper domestic supply. Excludes fixture.	96.34	
22 13 13 00-0076 EA Floor Mounted Service Sink, Gang Fixture Rough-In, Polyvinyl Chloride (PVC) Waste And Vent Pipe.....169.33 Note: Includes polyvinyl chloride (PVC) waste and vent pipe and copper domestic supply. Excludes fixture and faucet.	169.33	
22 13 13 00-0077 EA Wall Mounted Service Sink, Gang Fixture Rough-In, Polyvinyl Chloride (PVC) Waste And Vent Pipe.....176.36 Note: Includes polyvinyl chloride (PVC) waste and vent pipe and copper domestic supply. Excludes fixture, carrier and faucet.	176.36	
22 13 13 00-0078 EA Shower, Gang Fixture Rough-In, Polyvinyl Chloride (PVC) Waste And Vent Pipe .....168.45 Note: Includes polyvinyl chloride (PVC) waste and vent pipe and copper domestic supply. Excludes fixture, shower head and faucet.	168.45	
22 13 13 00-0079 EA Bidet, Gang Fixture Rough-In, Polyvinyl Chloride (PVC) Waste And Vent Pipe .....184.81 Note: Includes polyvinyl chloride (PVC) waste and vent pipe and copper domestic supply. Excludes fixture and faucet.	184.81	
22 13 16 Sanitary Waste And Vent Piping ^(22 13)		
22 13 16 00-0001 Cast Iron Soil Pipe Assemblies ^(22 13 16)		
22 13 16 00-0002 Underground Bell And Spigot Cast Iron Soil Pipe Assemblies ^(22 13 16 00-0001)		
Note: Includes fittings and gaskets. Fittings are assumed every 10'. Excludes excavation, backfill and compaction. Not for use where detail is available.		
22 13 16 00-0003 LF 2" Underground Bell And Spigot Cast Iron Soil Pipe Assembly .....21.07 Note: Includes all fittings and gaskets. Excludes earthwork excavation, backfill and compaction. Not for use where detail is available.	21.07	4.63
<i>For Work In Restricted Working Space, Add</i>	3.40	
22 13 16 00-0004 LF 3" Underground Bell And Spigot Cast Iron Soil Pipe Assembly .....29.95 Note: Includes all fittings and gaskets. Excludes earthwork excavation, backfill and compaction. Not for use where detail is available.	29.95	6.98
<i>For Work In Restricted Working Space, Add</i>	4.61	
22 13 16 00-0005 LF 4" Underground Bell And Spigot Cast Iron Soil Pipe Assembly .....38.84 Note: Includes all fittings and gaskets. Excludes earthwork excavation, backfill and compaction. Not for use where detail is available.	38.84	8.90
<i>For Work In Restricted Working Space, Add</i>	5.93	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 13 16 00-0006 LF 5" Underground Bell And Spigot Cast Iron Soil Pipe Assembly Note: Includes all fittings and gaskets. Excludes earthwork excavation, backfill and compaction. Not for use where detail is available. <i>For Work In Restricted Working Space, Add</i>	46.09 6.45	11.46
22 13 16 00-0007 LF 6" Underground Bell And Spigot Cast Iron Soil Pipe Assembly Note: Includes all fittings and gaskets. Excludes earthwork excavation, backfill and compaction. Not for use where detail is available. <i>For Work In Restricted Working Space, Add</i>	53.82 7.16	12.49
22 13 16 00-0008 LF 8" Underground Bell And Spigot Cast Iron Soil Pipe Assembly Note: Includes all fittings and gaskets. Excludes earthwork excavation, backfill and compaction. Not for use where detail is available. <i>For Work In Restricted Working Space, Add</i>	84.13 9.98	17.62
22 13 16 00-0009 LF 10" Underground Bell And Spigot Cast Iron Soil Pipe Assembly Note: Includes all fittings and gaskets. Excludes earthwork excavation, backfill and compaction. Not for use where detail is available. <i>For Work In Restricted Working Space, Add</i>	121.10 11.29	17.62
22 13 16 00-0010 Aboveground No Hub Cast Iron Soil Pipe Assemblies (22 13 16 00-0001) Note: Includes fittings, couplings and hangers. Fittings are assumed every 10'. Not for use where detail is available.		
22 13 16 00-0011 LF 1-1/2" Aboveground No Hub Cast Iron Soil Pipe Assembly Note: Includes all fittings, couplings and hangers. Fittings are assumed every 10'. Not for use where detail is available. <i>For Work In Restricted Working Space, Add</i>	17.53 3.68	4.41
22 13 16 00-0012 LF 2" Aboveground No Hub Cast Iron Soil Pipe Assembly Note: Includes all fittings, couplings and hangers. Fittings are assumed every 10'. Not for use where detail is available. <i>For Work In Restricted Working Space, Add</i>	18.66 3.97	4.70
22 13 16 00-0013 LF 3" Aboveground No Hub Cast Iron Soil Pipe Assembly Note: Includes all fittings, couplings and hangers. Fittings are assumed every 10'. Not for use where detail is available. <i>For Work In Restricted Working Space, Add</i>	24.34 5.09	6.84
22 13 16 00-0014 LF 4" Aboveground No Hub Cast Iron Soil Pipe Assembly Note: Includes all fittings, couplings and hangers. Fittings are assumed every 10'. Not for use where detail is available. <i>For Work In Restricted Working Space, Add</i>	30.07 6.28	8.90
22 13 16 00-0015 LF 5" Aboveground No Hub Cast Iron Soil Pipe Assembly Note: Includes all fittings, couplings and hangers. Fittings are assumed every 10'. Not for use where detail is available. <i>For Work In Restricted Working Space, Add</i>	50.54 10.73	11.24
22 13 16 00-0016 LF 6" Aboveground No Hub Cast Iron Soil Pipe Assembly Note: Includes all fittings, couplings and hangers. Fittings are assumed every 10'. Not for use where detail is available. <i>For Work In Restricted Working Space, Add</i>	55.57 11.48	12.27
22 13 16 00-0017 LF 8" Aboveground No Hub Cast Iron Soil Pipe Assembly Note: Includes all fittings, couplings and hangers. Fittings are assumed every 10'. Not for use where detail is available. <i>For Work In Restricted Working Space, Add</i>	89.78 18.19	17.47
22 13 16 00-0018 LF 10" Aboveground No Hub Cast Iron Soil Pipe Assembly Note: Includes all fittings, couplings and hangers. Fittings are assumed every 10'. Not for use where detail is available. <i>For Work In Restricted Working Space, Add</i>	92.00 13.25	19.85
22 13 16 00-0019 Bell And Spigot Cast Iron Soil Pipe And Fittings (22 13 16) Note: Service weight. ASTM A74 and CISPI 301 (Fitting Requirements).		
22 13 16 00-0020 Bell And Spigot Cast Iron Pipe (22 13 16 00-0019) Note: Excludes excavation, hangers, gaskets, and fittings.		
22 13 16 00-0021 LF 2" Bell And Spigot Cast Iron Pipe <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Extra Heavy Pipe, Add</i> <i>For Work In Restricted Working Space, Add</i>	14.80 0.35 3.28 2.10	4.63
22 13 16 00-0022 LF 3" Bell And Spigot Cast Iron Pipe <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Extra Heavy Pipe, Add</i> <i>For Work In Restricted Working Space, Add</i>	21.68 0.53 4.70 3.15	6.98
22 13 16 00-0023 LF 4" Bell And Spigot Cast Iron Pipe <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Extra Heavy Pipe, Add</i> <i>For Work In Restricted Working Space, Add</i>	27.91 0.67 6.11 4.01	8.90
22 13 16 00-0024 LF 5" (12.5 cm) Cast Iron Pipe <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Extra Heavy Pipe, Add</i> <i>For Work In Restricted Working Space, Add</i>	37.67 0.86 8.62 5.15	11.46
22 13 16 00-0025 LF 6" (15 cm) Cast Iron Pipe <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Extra Heavy Pipe, Add</i> <i>For Work In Restricted Working Space, Add</i>	43.70 0.94 10.50 5.61	12.49
22 13 16 00-0026 LF 8" (21 cm) Cast Iron Pipe <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Extra Heavy Pipe, Add</i> <i>For Work In Restricted Working Space, Add</i>	65.30 1.32 16.33 7.93	17.62

22	Plumbing
22 10	Plumbing Piping
22 13	Facility Sanitary Sewerage



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 13 16 00-0027	LF	10"	10" (25 cm) Cast Iron Pipe.....	94.46	19.85
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	1.49	
			<i>For Extra Heavy Pipe, Add</i>	27.18	
			<i>For Work In Restricted Working Space, Add</i>	8.92	
22 13 16 00-0028	LF	12"	12" (31 cm) Cast Iron Pipe.....	133.65	26.47
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	1.98	
			<i>For Extra Heavy Pipe, Add</i>	39.48	
			<i>For Work In Restricted Working Space, Add</i>	11.89	
22 13 16 00-0029			Bell And Spigot Cast Iron Fittings (22 13 16 00-0019)		
22 13 16 00-0030			Bell And Spigot Cast Iron Long Sweeps (22 13 16 00-0029)		
22 13 16 00-0031	EA	2"	2" Bell And Spigot Cast Iron Long Sweep.....	66.82	21.10
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	1.58	
			<i>For Work In Restricted Working Space, Add</i>	9.48	
			<i>For Extra Heavy Fittings, Add</i>	12.32	
22 13 16 00-0032	EA	3"	3" Bell And Spigot Cast Iron Long Sweep.....	111.18	26.54
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	1.99	
			<i>For Work In Restricted Working Space, Add</i>	11.92	
			<i>For Extra Heavy Fittings, Add</i>	25.01	
22 13 16 00-0033	EA	4"	4" Bell And Spigot Cast Iron Long Sweep.....	148.11	35.28
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	2.64	
			<i>For Work In Restricted Working Space, Add</i>	15.86	
			<i>For Extra Heavy Fittings, Add</i>	33.33	
22 13 16 00-0034	EA	6"	6" Bell And Spigot Cast Iron Long Sweep.....	233.04	48.49
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	3.64	
			<i>For Work In Restricted Working Space, Add</i>	21.81	
			<i>For Extra Heavy Fittings, Add</i>	56.12	
22 13 16 00-0035	EA	8"	8" Bell And Spigot Cast Iron Long Sweep.....	450.55	62.00
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	4.65	
			<i>For Work In Restricted Working Space, Add</i>	27.88	
			<i>For Extra Heavy Fittings, Add</i>	125.17	
22 13 16 00-0036	EA	10"	10" Bell And Spigot Cast Iron Long Sweep.....	613.86	76.28
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	5.72	
			<i>For Work In Restricted Working Space, Add</i>	34.31	
			<i>For Extra Heavy Fittings, Add</i>	174.82	
22 13 16 00-0037	EA	12"	12" Bell And Spigot Cast Iron Long Sweep.....	938.37	106.45
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	7.98	
			<i>For Work In Restricted Working Space, Add</i>	47.89	
			<i>For Extra Heavy Fittings, Add</i>	272.56	
22 13 16 00-0038			Bell And Spigot Cast Iron Short Sweeps (22 13 16 00-0029)		
22 13 16 00-0039	EA	2"	2" Bell And Spigot Cast Iron Short Sweep.....	57.53	21.10
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	1.58	
			<i>For Work In Restricted Working Space, Add</i>	9.48	
			<i>For Extra Heavy Fittings, Add</i>	9.07	
22 13 16 00-0040	EA	3"	3" Bell And Spigot Cast Iron Short Sweep.....	95.58	26.54
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	1.99	
			<i>For Work In Restricted Working Space, Add</i>	11.92	
			<i>For Extra Heavy Fittings, Add</i>	19.55	
22 13 16 00-0041	EA	4"	4" Bell And Spigot Cast Iron Short Sweep.....	130.57	35.28
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	2.64	
			<i>For Work In Restricted Working Space, Add</i>	15.86	
			<i>For Extra Heavy Fittings, Add</i>	27.19	
22 13 16 00-0042	EA	5"	5" Bell And Spigot Cast Iron Short Sweep.....	196.11	41.23
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	3.09	
			<i>For Work In Restricted Working Space, Add</i>	18.53	
			<i>For Extra Heavy Fittings, Add</i>	47.02	
22 13 16 00-0043	EA	6"	6" Bell And Spigot Cast Iron Short Sweep.....	236.38	48.49
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	3.64	
			<i>For Work In Restricted Working Space, Add</i>	21.81	
			<i>For Extra Heavy Fittings, Add</i>	57.29	
22 13 16 00-0044	EA	8"	8" Bell And Spigot Cast Iron Short Sweep.....	383.30	62.00
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	4.65	
			<i>For Work In Restricted Working Space, Add</i>	27.88	
			<i>For Extra Heavy Fittings, Add</i>	101.63	
22 13 16 00-0045	EA	10"	10" Bell And Spigot Cast Iron Short Sweep.....	556.49	76.28
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	5.72	
			<i>For Work In Restricted Working Space, Add</i>	34.31	
			<i>For Extra Heavy Fittings, Add</i>	154.74	
22 13 16 00-0046	EA	12"	12" Bell And Spigot Cast Iron Short Sweep.....	916.98	106.45
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	7.98	
			<i>For Work In Restricted Working Space, Add</i>	47.89	
			<i>For Extra Heavy Fittings, Add</i>	265.08	
22 13 16 00-0047			Bell And Spigot Cast Iron 1/4 Bends (22 13 16 00-0029)		
22 13 16 00-0048	EA	2"	2" Bell And Spigot Cast Iron 1/4 Bend.....	52.24	21.02
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	1.58	
			<i>For Work In Restricted Working Space, Add</i>	9.46	
			<i>For Extra Heavy Fittings, Add</i>	7.25	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 13 16 00-0049 EA 3" Bell And Spigot Cast Iron 1/4 Bend <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	76.87 1.78 10.65 14.48	23.66
22 13 16 00-0050 EA 4" Bell And Spigot Cast Iron 1/4 Bend <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	109.35 2.36 14.18 21.73	31.53
22 13 16 00-0051 EA 5" Bell And Spigot Cast Iron 1/4 Bend <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	138.55 2.76 16.55 29.19	36.81
22 13 16 00-0052 EA 6" Bell And Spigot Cast Iron 1/4 Bend <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	166.60 3.31 19.85 35.16	44.09
22 13 16 00-0053 EA 8" Bell And Spigot Cast Iron 1/4 Bend <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	334.84 4.28 25.67 87.24	57.09
22 13 16 00-0054 EA 10" Bell And Spigot Cast Iron 1/4 Bend <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	489.53 5.19 31.16 134.98	69.29
22 13 16 00-0055 EA 12" Bell And Spigot Cast Iron 1/4 Bend <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	642.65 6.13 36.79 182.01	81.78
22 13 16 00-0056 Bell And Spigot Cast Iron 1/8 Bends (22 13 16 00-0029)		
22 13 16 00-0057 EA 2" Bell And Spigot Cast Iron 1/8 Bend <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	48.13 1.58 9.48 5.78	21.10
22 13 16 00-0058 EA 3" Bell And Spigot Cast Iron 1/8 Bend <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	73.83 1.99 11.92 11.94	26.54
22 13 16 00-0059 EA 4" Bell And Spigot Cast Iron 1/8 Bend <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	104.62 2.64 15.86 18.11	35.28
22 13 16 00-0060 EA 5" Bell And Spigot Cast Iron 1/8 Bend <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	134.29 3.45 20.72 22.83	46.07
22 13 16 00-0061 EA 6" Bell And Spigot Cast Iron 1/8 Bend <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	154.74 3.85 23.12 27.19	51.37
22 13 16 00-0062 EA 8" Bell And Spigot Cast Iron 1/8 Bend <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	296.91 5.13 30.76 68.03	68.39
22 13 16 00-0063 EA 10" Bell And Spigot Cast Iron 1/8 Bend <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	412.03 6.33 37.96 99.93	84.38
22 13 16 00-0064 EA 12" Bell And Spigot Cast Iron 1/8 Bend <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	658.02 8.20 49.20 172.90	109.43
22 13 16 00-0065 Bell And Spigot Cast Iron Wyes (22 13 16 00-0029)		
22 13 16 00-0066 EA 2" Bell And Spigot Cast Iron Wye <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	86.57 3.53 21.20 5.57	47.12
22 13 16 00-0067 EA 3" Bell And Spigot Cast Iron Wye <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	107.15 3.87 23.21 10.42	51.60
22 13 16 00-0068 EA 4" Bell And Spigot Cast Iron Wye <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	140.99 5.07 30.41 13.87	67.62
22 13 16 00-0069 EA 5" Bell And Spigot Cast Iron Wye <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	184.93 5.95 35.67 23.11	79.29

22 Plumbing**22 10 Plumbing Piping****22 13 Facility Sanitary Sewerage**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 13 16 00-0070	EA		6" Bell And Spigot Cast Iron Wye	230.39	93.98
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	7.05	
			<i>For Work In Restricted Working Space, Add</i>	42.28	
			<i>For Extra Heavy Fittings, Add</i>	31.31	
22 13 16 00-0071	EA		8" Bell And Spigot Cast Iron Wye	406.64	124.89
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	9.36	
			<i>For Work In Restricted Working Space, Add</i>	56.18	
			<i>For Extra Heavy Fittings, Add</i>	76.78	
22 13 16 00-0072	EA		10" Bell And Spigot Cast Iron Wye	560.61	141.69
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	10.62	
			<i>For Work In Restricted Working Space, Add</i>	63.72	
			<i>For Extra Heavy Fittings, Add</i>	121.87	
22 13 16 00-0073	EA		12" Bell And Spigot Cast Iron Wye	818.75	172.47
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	12.93	
			<i>For Work In Restricted Working Space, Add</i>	77.57	
			<i>For Extra Heavy Fittings, Add</i>	196.06	
22 13 16 00-0074			Bell And Spigot Cast Iron Reducing Wyes <small>(22 13 16 00-0029)</small>		
22 13 16 00-0075	EA		3" x 2" Bell And Spigot Cast Iron Reducing Wye	131.02	49.24
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	3.69	
			<i>For Work In Restricted Working Space, Add</i>	22.16	
			<i>For Extra Heavy Fittings, Add</i>	20.01	
22 13 16 00-0076	EA		4" x 2" Bell And Spigot Cast Iron Reducing Wye	159.69	60.86
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	4.56	
			<i>For Work In Restricted Working Space, Add</i>	27.38	
			<i>For Extra Heavy Fittings, Add</i>	23.94	
22 13 16 00-0077	EA		4" x 3" Bell And Spigot Cast Iron Reducing Wye	176.89	62.40
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	4.68	
			<i>For Work In Restricted Working Space, Add</i>	28.08	
			<i>For Extra Heavy Fittings, Add</i>	29.15	
22 13 16 00-0078	EA		6" x 2" Bell And Spigot Cast Iron Reducing Wye	265.01	84.21
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	6.31	
			<i>For Work In Restricted Working Space, Add</i>	37.86	
			<i>For Extra Heavy Fittings, Add</i>	48.58	
22 13 16 00-0079	EA		6" x 3" Bell And Spigot Cast Iron Reducing Wye	271.70	85.76
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	6.43	
			<i>For Work In Restricted Working Space, Add</i>	38.58	
			<i>For Extra Heavy Fittings, Add</i>	50.09	
22 13 16 00-0080	EA		6" x 4" Bell And Spigot Cast Iron Reducing Wye	284.90	91.48
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	6.86	
			<i>For Work In Restricted Working Space, Add</i>	41.15	
			<i>For Extra Heavy Fittings, Add</i>	51.71	
22 13 16 00-0081	EA		8" x 2" Bell And Spigot Cast Iron Reducing Wye	408.01	100.44
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	7.53	
			<i>For Work In Restricted Working Space, Add</i>	45.17	
			<i>For Extra Heavy Fittings, Add</i>	90.11	
22 13 16 00-0082	EA		8" x 3" Bell And Spigot Cast Iron Reducing Wye	425.76	102.36
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	7.67	
			<i>For Work In Restricted Working Space, Add</i>	46.03	
			<i>For Extra Heavy Fittings, Add</i>	95.31	
22 13 16 00-0083	EA		8" x 4" Bell And Spigot Cast Iron Reducing Wye	436.70	107.20
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	8.04	
			<i>For Work In Restricted Working Space, Add</i>	48.22	
			<i>For Extra Heavy Fittings, Add</i>	96.59	
22 13 16 00-0084	EA		8" x 6" Bell And Spigot Cast Iron Reducing Wye	513.93	119.25
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	8.94	
			<i>For Work In Restricted Working Space, Add</i>	53.64	
			<i>For Extra Heavy Fittings, Add</i>	117.29	
22 13 16 00-0085	EA		10" x 3" Bell And Spigot Cast Iron Reducing Wye	623.94	111.74
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	8.38	
			<i>For Work In Restricted Working Space, Add</i>	50.26	
			<i>For Extra Heavy Fittings, Add</i>	159.74	
22 13 16 00-0086	EA		10" x 4" Bell And Spigot Cast Iron Reducing Wye	649.17	116.64
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	8.75	
			<i>For Work In Restricted Working Space, Add</i>	52.48	
			<i>For Extra Heavy Fittings, Add</i>	165.99	
22 13 16 00-0087	EA		10" x 6" Bell And Spigot Cast Iron Reducing Wye	710.56	128.98
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	9.67	
			<i>For Work In Restricted Working Space, Add</i>	58.00	
			<i>For Extra Heavy Fittings, Add</i>	181.03	
22 13 16 00-0088	EA		10" x 8" Bell And Spigot Cast Iron Reducing Wye	930.17	136.79
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	10.25	
			<i>For Work In Restricted Working Space, Add</i>	61.52	
			<i>For Extra Heavy Fittings, Add</i>	253.78	
22 13 16 00-0089	EA		12" x 4" Bell And Spigot Cast Iron Reducing Wye	956.28	136.79
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	10.25	
			<i>For Work In Restricted Working Space, Add</i>	61.52	
			<i>For Extra Heavy Fittings, Add</i>	262.92	
22 13 16 00-0090	EA		12" x 6" Bell And Spigot Cast Iron Reducing Wye	996.91	148.24
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	11.11	
			<i>For Work In Restricted Working Space, Add</i>	66.67	
			<i>For Extra Heavy Fittings, Add</i>	271.13	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 13 16 00-0091 EA 12" x 8" Bell And Spigot Cast Iron Reducing Wye <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	1,165.53 11.66 69.97 326.31	155.59
22 13 16 00-0092 EA 12" x 10" Bell And Spigot Cast Iron Reducing Wye <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	1,408.81 12.01 72.06 409.01	160.20
22 13 16 00-0093 Bell And Spigot Cast Iron Combination Wye And 1/8 Bends <small>(22 13 16 00-0029)</small>		
22 13 16 00-0094 EA 2" Bell And Spigot Cast Iron Combination Wye And 1/8 Bend..... <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	93.37 3.53 21.20 7.95	47.12
22 13 16 00-0095 EA 3" Bell And Spigot Cast Iron Combination Wye And 1/8 Bend..... <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	111.34 3.87 23.21 11.89	51.60
22 13 16 00-0096 EA 4" Bell And Spigot Cast Iron Combination Wye And 1/8 Bend..... <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	148.29 5.07 30.41 16.43	67.62
22 13 16 00-0097 EA 5" Bell And Spigot Cast Iron Combination Wye And 1/8 Bend..... <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	209.70 6.23 37.40 29.76	83.18
22 13 16 00-0098 EA 6" Bell And Spigot Cast Iron Combination Wye And 1/8 Bend..... <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	262.32 7.73 46.40 37.68	103.17
22 13 16 00-0099 EA 8" Bell And Spigot Cast Iron Combination Wye And 1/8 Bend..... <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	463.71 10.08 60.48 91.74	134.48
22 13 16 00-0100 EA 10" Bell And Spigot Cast Iron Combination Wye And 1/8 Bend..... <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	664.21 13.22 79.30 139.96	176.34
22 13 16 00-0101 EA 12" Bell And Spigot Cast Iron Combination Wye And 1/8 Bend..... <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	887.85 16.99 101.96 191.80	226.67
22 13 16 00-0102 Bell And Spigot Cast Iron Reducing Combination Wye And 1/8 Bends <small>(22 13 16 00-0029)</small>		
22 13 16 00-0103 EA 3" x 2" Bell And Spigot Cast Iron Reducing Combination Wye And 1/8 Bend..... <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	99.33 3.69 22.16 8.92	49.24
22 13 16 00-0104 EA 4" x 2" Bell And Spigot Cast Iron Reducing Combination Wye And 1/8 Bend..... <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	138.08 4.56 27.38 16.38	60.86
22 13 16 00-0105 EA 4" x 3" Bell And Spigot Cast Iron Reducing Combination Wye And 1/8 Bend..... <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	148.37 4.68 28.08 19.17	62.40
22 13 16 00-0106 EA 6" x 2" Bell And Spigot Cast Iron Reducing Combination Wye And 1/8 Bend..... <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	224.11 6.31 37.86 34.27	84.21
22 13 16 00-0107 EA 6" x 3" Bell And Spigot Cast Iron Reducing Combination Wye And 1/8 Bend..... <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	232.87 6.43 38.58 36.49	85.76
22 13 16 00-0108 EA 6" x 4" Bell And Spigot Cast Iron Reducing Combination Wye And 1/8 Bend..... <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	247.01 6.86 41.15 38.44	91.48
22 13 16 00-0109 EA 8" x 2" Bell And Spigot Cast Iron Reducing Combination Wye And 1/8 Bend..... <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	332.04 7.53 45.17 63.52	100.44
22 13 16 00-0110 EA 8" x 4" Bell And Spigot Cast Iron Reducing Combination Wye And 1/8 Bend..... <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	342.22 8.04 48.22 63.52	107.20
22 13 16 00-0111 EA 8" x 6" Bell And Spigot Cast Iron Reducing Combination Wye And 1/8 Bend..... <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	427.95 8.94 53.64 87.20	119.25

22 13 16 00-0112 Bell And Spigot Cast Iron Double Wyes (22 13 16 00-0029)

22	Plumbing
22 10	Plumbing Piping
22 13	Facility Sanitary Sewerage



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 13 16 00-0113 EA 2" Bell And Spigot Cast Iron Double Wye	147.27	56.37
For Above Ground Cast Iron Pipe Installation, Add	4.22	
For Work In Restricted Working Space, Add	25.34	
For Extra Heavy Fittings, Add	21.98	
22 13 16 00-0114 EA 3" Bell And Spigot Cast Iron Double Wye	211.95	71.07
For Above Ground Cast Iron Pipe Installation, Add	5.33	
For Work In Restricted Working Space, Add	31.96	
For Extra Heavy Fittings, Add	36.90	
22 13 16 00-0115 EA 4" Bell And Spigot Cast Iron Double Wye	286.17	89.89
For Above Ground Cast Iron Pipe Installation, Add	6.74	
For Work In Restricted Working Space, Add	40.44	
For Extra Heavy Fittings, Add	52.98	
22 13 16 00-0116 EA 6" Bell And Spigot Cast Iron Double Wye	552.27	144.39
For Above Ground Cast Iron Pipe Installation, Add	10.82	
For Work In Restricted Working Space, Add	64.95	
For Extra Heavy Fittings, Add	117.52	
22 13 16 00-0117 EA 8" Bell And Spigot Cast Iron Double Wye	1,070.38	168.83
For Above Ground Cast Iron Pipe Installation, Add	12.65	
For Work In Restricted Working Space, Add	75.92	
For Extra Heavy Fittings, Add	286.06	
22 13 16 00-0118 EA 10" Bell And Spigot Cast Iron Double Wye	1,409.18	188.90
For Above Ground Cast Iron Pipe Installation, Add	14.16	
For Work In Restricted Working Space, Add	84.96	
For Extra Heavy Fittings, Add	394.09	
22 13 16 00-0119 EA 12" Bell And Spigot Cast Iron Double Wye	1,002.71	226.67
For Above Ground Cast Iron Pipe Installation, Add	16.99	
For Work In Restricted Working Space, Add	101.96	
For Extra Heavy Fittings, Add	232.00	
22 13 16 00-0120 EA 15" Bell And Spigot Cast Iron Double Wye	2,720.13	237.89
For Above Ground Cast Iron Pipe Installation, Add	17.84	
For Work In Restricted Working Space, Add	107.06	
For Extra Heavy Fittings, Add	827.15	
22 13 16 00-0121 Bell And Spigot Cast Iron Reducing Double Wyes (22 13 16 00-0029)		
22 13 16 00-0122 EA 3" x 2" Bell And Spigot Cast Iron Reducing Double Wye	137.03	66.67
For Above Ground Cast Iron Pipe Installation, Add	5.00	
For Work In Restricted Working Space, Add	29.99	
For Extra Heavy Fittings, Add	12.97	
22 13 16 00-0123 EA 4" x 2" Bell And Spigot Cast Iron Reducing Double Wye	159.03	76.59
For Above Ground Cast Iron Pipe Installation, Add	5.74	
For Work In Restricted Working Space, Add	34.45	
For Extra Heavy Fittings, Add	15.47	
22 13 16 00-0124 EA 4" x 3" Bell And Spigot Cast Iron Reducing Double Wye	171.69	80.34
For Above Ground Cast Iron Pipe Installation, Add	6.03	
For Work In Restricted Working Space, Add	36.15	
For Extra Heavy Fittings, Add	17.92	
22 13 16 00-0125 EA 6" x 2" Bell And Spigot Cast Iron Reducing Double Wye	226.55	100.15
For Above Ground Cast Iron Pipe Installation, Add	7.51	
For Work In Restricted Working Space, Add	45.04	
For Extra Heavy Fittings, Add	26.74	
22 13 16 00-0126 EA 6" x 3" Bell And Spigot Cast Iron Reducing Double Wye	239.55	103.98
For Above Ground Cast Iron Pipe Installation, Add	7.79	
For Work In Restricted Working Space, Add	46.76	
For Extra Heavy Fittings, Add	29.29	
22 13 16 00-0127 EA 6" x 4" Bell And Spigot Cast Iron Reducing Double Wye	273.90	113.39
For Above Ground Cast Iron Pipe Installation, Add	8.50	
For Work In Restricted Working Space, Add	51.00	
For Extra Heavy Fittings, Add	36.37	
22 13 16 00-0128 EA 8" x 4" Bell And Spigot Cast Iron Reducing Double Wye	425.70	130.09
For Above Ground Cast Iron Pipe Installation, Add	9.75	
For Work In Restricted Working Space, Add	58.50	
For Extra Heavy Fittings, Add	80.75	
22 13 16 00-0129 EA 8" x 6" Bell And Spigot Cast Iron Reducing Double Wye	466.97	153.96
For Above Ground Cast Iron Pipe Installation, Add	11.54	
For Work In Restricted Working Space, Add	69.26	
For Extra Heavy Fittings, Add	82.64	
22 13 16 00-0130 EA 10" x 4" Bell And Spigot Cast Iron Reducing Double Wye	453.67	139.16
For Above Ground Cast Iron Pipe Installation, Add	10.43	
For Work In Restricted Working Space, Add	62.60	
For Extra Heavy Fittings, Add	85.75	
22 13 16 00-0131 EA 10" x 6" Bell And Spigot Cast Iron Reducing Double Wye	529.06	163.48
For Above Ground Cast Iron Pipe Installation, Add	12.26	
For Work In Restricted Working Space, Add	73.54	
For Extra Heavy Fittings, Add	99.37	
22 13 16 00-0132 EA 10" x 8" Bell And Spigot Cast Iron Reducing Double Wye	645.75	178.19
For Above Ground Cast Iron Pipe Installation, Add	13.36	
For Work In Restricted Working Space, Add	80.15	
For Extra Heavy Fittings, Add	132.50	
22 13 16 00-0133 EA 12" x 6" Bell And Spigot Cast Iron Reducing Double Wye	659.65	182.29
For Above Ground Cast Iron Pipe Installation, Add	13.67	
For Work In Restricted Working Space, Add	81.99	
For Extra Heavy Fittings, Add	135.22	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 13 16 00-0134	EA		12" x 8" Bell And Spigot Cast Iron Reducing Double Wye <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	833.98 14.87 89.21 187.82	198.34
22 13 16 00-0135			Bell And Spigot Cast Iron Double Combination Wye And 1/8 Bends (22 13 16 00-0029)		
22 13 16 00-0136	EA		2" Bell And Spigot Cast Iron Double Combination Wye And 1/8 Bend <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	124.77 4.22 25.34 14.10	56.37
22 13 16 00-0137	EA		3" Bell And Spigot Cast Iron Double Combination Wye And 1/8 Bend <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	167.94 5.65 33.92 19.20	75.41
22 13 16 00-0138	EA		4" Bell And Spigot Cast Iron Double Combination Wye And 1/8 Bend <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	218.55 7.07 42.41 27.02	94.30
22 13 16 00-0139	EA		6" Bell And Spigot Cast Iron Double Combination Wye And 1/8 Bend <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	481.29 12.10 72.59 83.77	161.37
22 13 16 00-0140			Bell And Spigot Cast Iron Reducing Double Combination Wye And 1/8 Bends (22 13 16 00-0029)		
22 13 16 00-0141	EA		3" x 2" Bell And Spigot Cast Iron Reducing Double Combination Wye And 1/8 Bend <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	165.04 5.07 30.41 22.29	67.62
22 13 16 00-0142	EA		4" x 2" Bell And Spigot Cast Iron Reducing Double Combination Wye And 1/8 Bend <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	195.07 5.74 34.45 28.08	76.59
22 13 16 00-0143	EA		4" x 3" Bell And Spigot Cast Iron Reducing Double Combination Wye And 1/8 Bend <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	218.84 6.39 38.33 31.87	85.26
22 13 16 00-0144	EA		6" x 4" Bell And Spigot Cast Iron Reducing Double Combination Wye And 1/8 Bend <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	436.00 9.02 54.15 89.43	120.36
22 13 16 00-0145			Bell And Spigot Cast Iron Sanitary Tees (22 13 16 00-0029)		
22 13 16 00-0146	EA		2" Bell And Spigot Cast Iron Sanitary Tee <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	102.14 3.54 21.22 10.99	47.19
22 13 16 00-0147	EA		3" Bell And Spigot Cast Iron Sanitary Tee <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	115.71 3.87 23.21 13.42	51.60
22 13 16 00-0148	EA		4" Bell And Spigot Cast Iron Sanitary Tee <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	182.07 4.74 28.45 30.54	63.21
22 13 16 00-0149	EA		5" Bell And Spigot Cast Iron Sanitary Tee <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	265.33 5.50 33.00 54.37	73.34
22 13 16 00-0150	EA		6" Bell And Spigot Cast Iron Sanitary Tee <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	318.29 6.59 39.57 65.24	87.96
22 13 16 00-0151	EA		8" Bell And Spigot Cast Iron Sanitary Tee <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	661.88 8.56 51.33 171.77	114.12
22 13 16 00-0152	EA		10" Bell And Spigot Cast Iron Sanitary Tee <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	985.99 10.43 62.60 272.06	139.16
22 13 16 00-0153	EA		12" Bell And Spigot Cast Iron Sanitary Tee <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	1,459.36 12.26 73.54 424.98	163.48
22 13 16 00-0154			Bell And Spigot Cast Iron Reducing Sanitary Tees (22 13 16 00-0029)		

22	Plumbing
22 10	Plumbing Piping
22 13	Facility Sanitary Sewerage



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 13 16 00-0155	EA		3" x 2" Bell And Spigot Cast Iron Reducing Sanitary Tee <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	134.00 3.69 22.16 21.05	49.24
22 13 16 00-0156	EA		4" x 2" Bell And Spigot Cast Iron Reducing Sanitary Tee <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	158.53 4.32 25.94 25.22	57.69
22 13 16 00-0157	EA		4" x 3" Bell And Spigot Cast Iron Reducing Sanitary Tee <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	165.47 4.32 25.94 27.65	57.69
22 13 16 00-0158	EA		6" x 2" Bell And Spigot Cast Iron Reducing Sanitary Tee <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	255.75 6.31 37.86 45.34	84.21
22 13 16 00-0159	EA		6" x 3" Bell And Spigot Cast Iron Reducing Sanitary Tee <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	265.75 6.43 38.58 48.00	85.76
22 13 16 00-0160	EA		6" x 4" Bell And Spigot Cast Iron Reducing Sanitary Tee <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	287.87 6.86 41.15 52.75	91.48
22 13 16 00-0161	EA		8" x 4" Bell And Spigot Cast Iron Reducing Sanitary Tee <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	476.03 8.04 48.22 110.35	107.20
22 13 16 00-0162	EA		8" x 6" Bell And Spigot Cast Iron Reducing Sanitary Tee <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	593.57 8.94 53.64 145.17	119.25
22 13 16 00-0163			Bell And Spigot Cast Iron Vent Tees (22 13 16 00-0029)		
22 13 16 00-0164	EA		2" Bell And Spigot Cast Iron Vent Tee <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	89.01 3.53 21.20 6.42	47.12
22 13 16 00-0165	EA		3" Bell And Spigot Cast Iron Vent Tee <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	109.30 3.87 23.21 11.18	51.60
22 13 16 00-0166	EA		4" Bell And Spigot Cast Iron Vent Tee <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	144.62 5.07 30.41 15.14	67.62
22 13 16 00-0167	EA		5" Bell And Spigot Cast Iron Vent Tee <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	189.21 6.23 37.40 22.59	83.18
22 13 16 00-0168	EA		6" Bell And Spigot Cast Iron Vent Tee <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	237.80 7.73 46.40 29.10	103.17
22 13 16 00-0169	EA		8" Bell And Spigot Cast Iron Vent Tee <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	395.10 10.08 60.48 67.73	134.48
22 13 16 00-0170			Bell And Spigot Cast Iron Tapped Sanitary Tees (22 13 16 00-0029)		
22 13 16 00-0171	EA		2" Bell And Spigot Cast Iron Tapped Sanitary Tee <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	91.16 3.53 21.20 7.17	47.12
22 13 16 00-0172	EA		3" Bell And Spigot Cast Iron Tapped Sanitary Tee <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	100.54 3.87 23.21 8.11	51.60
22 13 16 00-0173	EA		4" Bell And Spigot Cast Iron Tapped Sanitary Tee <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	129.91 5.07 30.41 9.99	67.62
22 13 16 00-0174			Bell And Spigot Cast Iron Tapped Sanitary Crosses (22 13 16 00-0029)		
22 13 16 00-0175	EA		2" Bell And Spigot Cast Iron Tapped Sanitary Cross <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	92.52 3.53 21.20 7.65	47.12
22 13 16 00-0176	EA		3" Bell And Spigot Cast Iron Tapped Sanitary Cross <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	103.11 3.87 23.21 9.01	51.60



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
	22 13 16 00-0177	EA		4" Bell And Spigot Cast Iron Tapped Sanitary Cross <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	136.39 5.07 30.41 12.26	67.62
	22 13 16 00-0178 Bell And Spigot Cast Iron Reducers (22 13 16 00-0029)					
	22 13 16 00-0179	EA		3" x 2" Bell And Spigot Cast Iron Reducer <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	51.33 1.99 11.92 4.06	26.54
	22 13 16 00-0180	EA		4" x 2" Bell And Spigot Cast Iron Reducer <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	64.64 2.63 15.75 4.25	34.99
	22 13 16 00-0181	EA		4" x 3" Bell And Spigot Cast Iron Reducer <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	68.64 2.64 15.86 5.52	35.28
	22 13 16 00-0182	EA		6" x 2" Bell And Spigot Cast Iron Reducer <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	89.70 3.34 20.04 8.02	44.53
	22 13 16 00-0183	EA		6" x 3" Bell And Spigot Cast Iron Reducer <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	93.43 3.38 20.31 9.01	45.12
	22 13 16 00-0184	EA		6" x 4" Bell And Spigot Cast Iron Reducer <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	96.28 3.45 20.72 9.53	46.07
	22 13 16 00-0185	EA		8" x 2" Bell And Spigot Cast Iron Reducer <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	121.45 3.56 21.35 17.59	47.47
	22 13 16 00-0186	EA		8" x 3" Bell And Spigot Cast Iron Reducer <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	137.62 4.34 26.05 17.78	57.91
	22 13 16 00-0187	EA		8" x 4" Bell And Spigot Cast Iron Reducer <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	141.24 4.45 26.73 18.25	59.40
	22 13 16 00-0188	EA		8" x 6" Bell And Spigot Cast Iron Reducer <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	146.04 4.65 27.88 18.59	62.00
	22 13 16 00-0189	EA		10" x 4" Bell And Spigot Cast Iron Reducer <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	180.35 5.22 31.30 26.60	69.58
	22 13 16 00-0190	EA		10" x 6" Bell And Spigot Cast Iron Reducer <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	190.08 5.48 32.88 28.16	73.08
	22 13 16 00-0191	EA		10" x 8" Bell And Spigot Cast Iron Reducer <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	202.11 5.72 34.31 30.71	76.28
	22 13 16 00-0192	EA		12" x 4" Bell And Spigot Cast Iron Reducer <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	248.00 6.20 37.17 43.44	82.67
	22 13 16 00-0193	EA		12" x 6" Bell And Spigot Cast Iron Reducer <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	277.77 7.25 43.52 46.45	96.72
	22 13 16 00-0194	EA		12" x 8" Bell And Spigot Cast Iron Reducer <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	301.86 8.26 49.56 47.83	110.17
	22 13 16 00-0195	EA		12" x 10" Bell And Spigot Cast Iron Reducer <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	332.29 9.51 57.08 49.71	126.90
	22 13 16 00-0196 Bell And Spigot Cast Iron P-Traps (22 13 16 00-0029)					
	22 13 16 00-0197	EA		2" Bell And Spigot Cast Iron P-Trap <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Extra Heavy Fittings, Add</i>	51.44 1.58 9.48 6.94	21.10

22 Plumbing**22 10 Plumbing Piping****22 13 Facility Sanitary Sewerage**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 13 16 00-0198	EA		3" Bell And Spigot Cast Iron P-Trap.....	68.58	26.54
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	1.99	
			<i>For Work In Restricted Working Space, Add</i>	11.92	
			<i>For Extra Heavy Fittings, Add</i>	10.10	
22 13 16 00-0199	EA		4" Bell And Spigot Cast Iron P-Trap.....	93.30	35.28
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	2.64	
			<i>For Work In Restricted Working Space, Add</i>	15.86	
			<i>For Extra Heavy Fittings, Add</i>	14.15	
22 13 16 00-0200	EA		5" Bell And Spigot Cast Iron P-Trap.....	148.43	41.23
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	3.09	
			<i>For Work In Restricted Working Space, Add</i>	18.53	
			<i>For Extra Heavy Fittings, Add</i>	30.33	
22 13 16 00-0201	EA		6" Bell And Spigot Cast Iron P-Trap.....	197.49	48.49
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	3.64	
			<i>For Work In Restricted Working Space, Add</i>	21.81	
			<i>For Extra Heavy Fittings, Add</i>	43.68	
22 13 16 00-0202	EA		8" Bell And Spigot Cast Iron P-Trap.....	426.06	62.00
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	4.65	
			<i>For Work In Restricted Working Space, Add</i>	27.88	
			<i>For Extra Heavy Fittings, Add</i>	116.60	
22 13 16 00-0203	EA		10" Bell And Spigot Cast Iron P-Trap.....	474.27	76.28
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	5.72	
			<i>For Work In Restricted Working Space, Add</i>	34.31	
			<i>For Extra Heavy Fittings, Add</i>	125.97	
22 13 16 00-0204			Bell And Spigot Cast Iron Deep Seal P-Traps (22 13 16 00-0029)		
22 13 16 00-0205	EA		2" Bell And Spigot Cast Iron Deep Seal P-Trap	58.97	21.10
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	1.58	
			<i>For Work In Restricted Working Space, Add</i>	9.48	
			<i>For Extra Heavy Fittings, Add</i>	9.58	
22 13 16 00-0206	EA		3" Bell And Spigot Cast Iron Deep Seal P-Trap	83.39	26.54
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	1.99	
			<i>For Work In Restricted Working Space, Add</i>	11.92	
			<i>For Extra Heavy Fittings, Add</i>	15.28	
22 13 16 00-0207	EA		4" Bell And Spigot Cast Iron Deep Seal P-Trap	120.83	35.28
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	2.64	
			<i>For Work In Restricted Working Space, Add</i>	15.86	
			<i>For Extra Heavy Fittings, Add</i>	23.78	
22 13 16 00-0208	EA		5" Bell And Spigot Cast Iron Deep Seal P-Trap	199.23	46.07
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	3.45	
			<i>For Work In Restricted Working Space, Add</i>	20.72	
			<i>For Extra Heavy Fittings, Add</i>	45.56	
22 13 16 00-0209	EA		6" Bell And Spigot Cast Iron Deep Seal P-Trap	212.09	51.37
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	3.85	
			<i>For Work In Restricted Working Space, Add</i>	23.12	
			<i>For Extra Heavy Fittings, Add</i>	47.26	
22 13 16 00-0210			Bell And Spigot Cast Iron Running Traps With Single Vent (22 13 16 00-0029)		
22 13 16 00-0211	EA		3" x 3" Bell And Spigot Cast Iron Running Trap With Single Vent.....	136.60	50.93
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	3.87	
			<i>For Work In Restricted Working Space, Add</i>	23.21	
22 13 16 00-0212	EA		4" x 4" Bell And Spigot Cast Iron Running Trap With Single Vent.....	181.99	66.96
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	5.07	
			<i>For Work In Restricted Working Space, Add</i>	30.41	
22 13 16 00-0213	EA		5" x 4" Bell And Spigot Cast Iron Running Trap With Single Vent.....	249.35	80.02
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	6.05	
			<i>For Work In Restricted Working Space, Add</i>	36.29	
22 13 16 00-0214	EA		6" x 4" Bell And Spigot Cast Iron Running Trap With Single Vent.....	482.73	90.68
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	6.86	
			<i>For Work In Restricted Working Space, Add</i>	41.15	
22 13 16 00-0215	EA		8" x 4" Bell And Spigot Cast Iron Running Trap With Single Vent.....	1,532.64	106.01
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	8.04	
			<i>For Work In Restricted Working Space, Add</i>	48.22	
22 13 16 00-0216	EA		8" x 6" Bell And Spigot Cast Iron Running Trap With Single Vent.....	1,660.25	118.28
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	8.94	
			<i>For Work In Restricted Working Space, Add</i>	53.64	
22 13 16 00-0217			Bell And Spigot Cast Running Traps With Double Vent (22 13 16 00-0029)		
22 13 16 00-0218	EA		3" x 3" Bell And Spigot Cast Iron Running Trap With Double Vent.....	175.72	70.34
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	5.33	
			<i>For Work In Restricted Working Space, Add</i>	31.96	
22 13 16 00-0219	EA		4" x 4" Bell And Spigot Cast Iron Running Trap With Double Vent.....	238.61	88.79
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	6.74	
			<i>For Work In Restricted Working Space, Add</i>	40.44	
22 13 16 00-0220	EA		6" x 4" Bell And Spigot Cast Iron Running Trap With Double Vent.....	541.07	112.06
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	8.50	
			<i>For Work In Restricted Working Space, Add</i>	51.00	
22 13 16 00-0221	EA		6" x 6" Bell And Spigot Cast Iron Running Trap With Double Vent.....	629.02	135.65
			<i>For Above Ground Cast Iron Pipe Installation, Add</i>	10.28	
			<i>For Work In Restricted Working Space, Add</i>	61.67	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 13 16 00-0222 EA 8" x 4" Bell And Spigot Cast Iron Running Trap With Double Vent..... <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i>	1,654.36 9.75 58.50	128.53
22 13 16 00-0223 EA 8" x 6" Bell And Spigot Cast Iron Running Trap With Double Vent..... <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i>	1,818.17 11.54 69.26	152.62
22 13 16 00-0224 EA 10" x 8" Bell And Spigot Cast Iron Running Trap With Double Vent..... <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i>	2,411.66 13.36 80.15	176.11
22 13 16 00-0225 EA 12" x 10" Bell And Spigot Cast Iron Running Trap With Double Vent..... <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i>	3,327.84 15.42 92.54	203.62
22 13 16 00-0226 EA 15" x 12" Bell And Spigot Cast Iron Running Trap With Double Vent..... <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i>	6,438.07 17.85 107.09	235.51
22 13 16 00-0227 Bell And Spigot Cast Iron Scission Joint Fittings (22 13 16 00-0029)		
22 13 16 00-0228 EA 2" Bell And Spigot Cast Iron Scission Joint Fitting..... <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i>	102.31 1.58 9.46	
22 13 16 00-0229 EA 3" Bell And Spigot Cast Iron Scission Joint Fitting..... <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i>	140.15 1.77 10.63	
22 13 16 00-0230 EA 4" Bell And Spigot Cast Iron Scission Joint Fitting..... <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i>	162.63 2.37 14.24	
22 13 16 00-0231 EA 5" Bell And Spigot Cast Iron Scission Joint Fitting..... <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i>	200.41 2.76 16.54	
22 13 16 00-0232 EA 6" Bell And Spigot Cast Iron Scission Joint Fitting..... <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i>	243.34 3.33 19.98	
22 13 16 00-0233 EA 8" Bell And Spigot Cast Iron Scission Joint Fitting..... <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i>	455.85 4.21 25.25	
22 13 16 00-0234 Cut And Prepare Existing In-Place Cast Iron Pipe (22 13 16 00-0019)		
Note: For use when connecting pipe to an existing in-place system.		
22 13 16 00-0235 EA 2", Cut And Prepare Existing In-Place Cast Iron Pipe..... <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i>	8.78 0.44 2.63	
22 13 16 00-0236 EA 3", Cut And Prepare Existing In-Place Cast Iron Pipe..... <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i>	9.59 0.48 2.88	
22 13 16 00-0237 EA 4", Cut And Prepare Existing In-Place Cast Iron Pipe..... <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i>	11.97 0.60 3.59	
22 13 16 00-0238 EA 6", Cut And Prepare Existing In-Place Cast Iron Pipe..... <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i>	14.37 0.72 4.31	
22 13 16 00-0239 EA 8", Cut And Prepare Existing In-Place Cast Iron Pipe..... <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i>	19.16 0.96 5.75	
22 13 16 00-0240 EA 10", Cut And Prepare Existing In-Place Cast Iron Pipe..... <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i>	22.35 1.12 6.71	
22 13 16 00-0241 EA 12", Cut And Prepare Existing In-Place Cast Iron Pipe..... <i>For Above Ground Cast Iron Pipe Installation, Add</i> <i>For Work In Restricted Working Space, Add</i>	26.35 1.32 7.91	
22 13 16 00-0242 Joint Material (22 13 16 00-0019)		
Note: Labor costs are included in the installation costs for fittings.		
22 13 16 00-0243 LB Lead (1 LB/Diameter Inch) Joint Material	1.55	
22 13 16 00-0244 LB Oakum (1/8 LB/Diameter Inch) Joint Material	6.87	
22 13 16 00-0245 EA 2" Dual Tite Rubber Gasket	0.72	
22 13 16 00-0246 EA 3" Dual Tite Rubber Gasket	0.99	
22 13 16 00-0247 EA 4" Dual Tite Rubber Gasket	1.23	
22 13 16 00-0248 EA 6" Dual Tite Rubber Gasket	2.04	
22 13 16 00-0249 EA 8" Dual Tite Rubber Gasket	4.49	
22 13 16 00-0250 EA 10" Dual Tite Rubber Gasket	6.89	
22 13 16 00-0251 EA 12" Dual Tite Rubber Gasket	8.78	
22 13 16 00-0252 No Hub Cast Iron Soil Pipe And Fittings (22 13 16)		
Note: Service Weight. Excludes hangers.		
22 13 16 00-0253 No Hub Cast Iron Pipe (22 13 16 00-0252)		
Note: Excludes couplings.		
22 13 16 00-0254 LF 1-1/2" No Hub Cast Iron Pipe	9.89	4.41
<i>For Work In Restricted Working Space, Add</i>	1.99	
<i>For Below Ground Installation, Add</i>	0.33	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 13 16 00-0255 LF 2" No Hub Cast Iron Pipe..... <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	10.54 2.13 0.36	4.70
22 13 16 00-0256 LF 3" No Hub Cast Iron Pipe..... <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	15.04 3.08 0.51	6.84
22 13 16 00-0257 LF 4" No Hub Cast Iron Pipe..... <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	19.53 4.01 0.67	8.90
22 13 16 00-0258 LF 5" No Hub Cast Iron Pipe..... <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	25.44 5.06 0.84	11.24
22 13 16 00-0259 LF 6" No Hub Cast Iron Pipe..... <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	29.00 5.51 0.92	12.27
22 13 16 00-0260 LF 8" No Hub Cast Iron Pipe..... <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	43.14 7.84 1.31	17.47
22 13 16 00-0261 LF 10" No Hub Cast Iron Pipe..... <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	57.93 8.92 1.49	19.85
22 13 16 00-0262 No Hub Cast Iron Fittings (22 13 16 00-0252)		
22 13 16 00-0263 No Hub Cast Iron Long Sweeps (22 13 16 00-0262)		
22 13 16 00-0264 EA 1-1/2" No Hub Cast Iron Long Sweep..... <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	39.46 9.38 1.56	20.87
22 13 16 00-0265 EA 2" No Hub Cast Iron Long Sweep..... <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	39.67 9.38 1.56	20.87
22 13 16 00-0266 EA 3" No Hub Cast Iron Long Sweep..... <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	46.36 10.76 1.79	23.89
22 13 16 00-0267 EA 4" No Hub Cast Iron Long Sweep..... <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	63.08 14.23 2.37	31.60
22 13 16 00-0268 EA 5" No Hub Cast Iron Long Sweep..... <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	84.45 16.68 2.78	37.11
22 13 16 00-0269 EA 6" No Hub Cast Iron Long Sweep..... <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	100.38 19.91 3.32	44.24
22 13 16 00-0270 EA 8" No Hub Cast Iron Long Sweep..... <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	177.91 25.49 4.25	56.65
22 13 16 00-0271 No Hub Cast Iron Reducing Long Sweeps (22 13 16 00-0262)		
22 13 16 00-0272 EA 3" x 2" No Hub Cast Iron Reducing Long Sweep..... <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	55.02 10.76 1.79	23.89
22 13 16 00-0273 EA 4" x 3" No Hub Cast Iron Reducing Long Sweep..... <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	79.59 14.23 2.37	31.60
22 13 16 00-0274 No Hub Cast Iron Short Sweeps (22 13 16 00-0262)		
22 13 16 00-0275 EA 2" No Hub Cast Iron Short Sweep..... <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	37.93 9.38 1.56	20.87
22 13 16 00-0276 EA 3" No Hub Cast Iron Short Sweep..... <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	44.98 10.76 1.79	23.89
22 13 16 00-0277 EA 4" No Hub Cast Iron Short Sweep..... <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	62.36 14.23 2.37	31.60
22 13 16 00-0278 EA 5" No Hub Cast Iron Short Sweep..... <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	84.72 16.68 2.78	37.11
22 13 16 00-0279 EA 6" No Hub Cast Iron Short Sweep..... <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	96.15 19.91 3.32	44.24
22 13 16 00-0280 EA 8" No Hub Cast Iron Short Sweep..... <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	165.14 25.49 4.25	56.65
22 13 16 00-0281 EA 10" No Hub Cast Iron Short Sweep..... <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	259.97 35.68 5.95	79.32
22 13 16 00-0282 No Hub Cast Iron 1/4 Bends (22 13 16 00-0262)		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 13 16 00-0283 EA 1-1/2" No Hub Cast Iron 1/4 Bend <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	35.15 9.00 1.50	20.00
22 13 16 00-0284 EA 2" No Hub Cast Iron 1/4 Bend <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	36.73 9.38 1.56	20.87
22 13 16 00-0285 EA 3" No Hub Cast Iron 1/4 Bend <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	43.04 10.76 1.79	23.89
22 13 16 00-0286 EA 4" No Hub Cast Iron 1/4 Bend <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	58.07 14.23 2.37	31.60
22 13 16 00-0287 EA 5" No Hub Cast Iron 1/4 Bend <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	79.39 16.68 2.78	37.11
22 13 16 00-0288 EA 6" No Hub Cast Iron 1/4 Bend <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	92.74 19.91 3.32	44.24
22 13 16 00-0289 EA 8" No Hub Cast Iron 1/4 Bend <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	155.19 25.49 4.25	56.65
 22 13 16 00-0290 No Hub Cast Iron 1/8 Bends (22 13 16 00-0262)		
22 13 16 00-0291 EA 1-1/2" No Hub Cast Iron 1/8 Bend <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	34.05 9.00 1.50	20.00
22 13 16 00-0292 EA 2" No Hub Cast Iron 1/8 Bend <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	35.42 9.38 1.56	20.87
22 13 16 00-0293 EA 3" No Hub Cast Iron 1/8 Bend <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	41.75 10.76 1.79	23.89
22 13 16 00-0294 EA 4" No Hub Cast Iron 1/8 Bend <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	55.17 14.23 2.37	31.60
22 13 16 00-0295 EA 6" No Hub Cast Iron 1/8 Bend <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	87.70 21.00 3.50	46.67
22 13 16 00-0296 EA 8" No Hub Cast Iron 1/8 Bend <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	138.99 27.56 4.59	61.30
22 13 16 00-0297 EA 10" No Hub Cast Iron 1/8 Bend <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	201.94 33.92 5.65	75.41
 22 13 16 00-0298 No Hub Cast Iron Wyes (22 13 16 00-0262)		
22 13 16 00-0299 EA 1-1/2" No Hub Cast Iron Wye <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	54.31 14.14 2.36	31.46
22 13 16 00-0300 EA 2" No Hub Cast Iron Wye <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	71.19 19.17 3.20	42.63
22 13 16 00-0301 EA 3" No Hub Cast Iron Wye <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	79.95 21.00 3.50	46.67
22 13 16 00-0302 EA 4" No Hub Cast Iron Wye <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	108.02 27.56 4.59	61.30
22 13 16 00-0303 EA 5" No Hub Cast Iron Wye <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	143.21 32.49 5.41	72.23
22 13 16 00-0304 EA 6" No Hub Cast Iron Wye <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	169.99 38.58 6.43	85.76
22 13 16 00-0305 EA 8" No Hub Cast Iron Wye <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	267.16 50.98 8.50	113.37
22 13 16 00-0306 EA 10" No Hub Cast Iron Wye <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	399.36 56.64 9.44	125.93
 22 13 16 00-0307 No Hub Cast Iron Reducing Wyes (22 13 16 00-0262)		
22 13 16 00-0308 EA 3" x 1-1/2" No Hub Cast Iron Reducing Wye <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	68.84 18.30 3.05	40.72
22 13 16 00-0309 EA 3" x 2" No Hub Cast Iron Reducing Wye <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	77.84 21.00 3.50	46.67
22 13 16 00-0310 EA 4" x 2" No Hub Cast Iron Reducing Wye <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	87.41 23.21 3.87	51.60

22	Plumbing
22 10	Plumbing Piping
22 13	Facility Sanitary Sewerage



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 13 16 00-0311	EA		4" x 3" No Hub Cast Iron Reducing Wye.....	99.41	57.33
			<i>For Work In Restricted Working Space, Add</i>	25.79	
			<i>For Below Ground Installation, Add</i>	4.30	
22 13 16 00-0312	EA		6" x 2" No Hub Cast Iron Reducing Wye.....	131.76	72.97
			<i>For Work In Restricted Working Space, Add</i>	32.84	
			<i>For Below Ground Installation, Add</i>	5.47	
22 13 16 00-0313	EA		6" x 3" No Hub Cast Iron Reducing Wye.....	139.47	76.27
			<i>For Work In Restricted Working Space, Add</i>	34.29	
			<i>For Below Ground Installation, Add</i>	5.72	
22 13 16 00-0314	EA		6" x 4" No Hub Cast Iron Reducing Wye.....	161.16	89.14
			<i>For Work In Restricted Working Space, Add</i>	40.08	
			<i>For Below Ground Installation, Add</i>	6.68	
22 13 16 00-0315	EA		8" x 4" No Hub Cast Iron Reducing Wye.....	189.32	89.14
			<i>For Work In Restricted Working Space, Add</i>	40.10	
			<i>For Below Ground Installation, Add</i>	6.68	
22 13 16 00-0316	EA		8" x 6" No Hub Cast Iron Reducing Wye.....	215.60	97.98
			<i>For Work In Restricted Working Space, Add</i>	44.05	
			<i>For Below Ground Installation, Add</i>	7.34	
22 13 16 00-0317	EA		10" x 4" No Hub Cast Iron Reducing Wye.....	302.12	104.38
			<i>For Work In Restricted Working Space, Add</i>	46.95	
			<i>For Below Ground Installation, Add</i>	7.83	
22 13 16 00-0318	EA		10" x 6" No Hub Cast Iron Reducing Wye.....	319.88	111.74
			<i>For Work In Restricted Working Space, Add</i>	50.26	
			<i>For Below Ground Installation, Add</i>	8.38	
22 13 16 00-0319	EA		10" x 8" No Hub Cast Iron Reducing Wye.....	361.82	119.32
			<i>For Work In Restricted Working Space, Add</i>	53.66	
			<i>For Below Ground Installation, Add</i>	8.94	
22 13 16 00-0320			No Hub Cast Iron Combination Wye And 1/8 Bends (22 13 16 00-0262)		
22 13 16 00-0321	EA		1-1/2" No Hub Cast Iron Combination Wye And 1/8 Bend.....	62.13	36.60
			<i>For Work In Restricted Working Space, Add</i>	16.46	
			<i>For Below Ground Installation, Add</i>	2.74	
22 13 16 00-0322	EA		2" No Hub Cast Iron Combination Wye And 1/8 Bend.....	71.48	42.63
			<i>For Work In Restricted Working Space, Add</i>	19.17	
			<i>For Below Ground Installation, Add</i>	3.20	
22 13 16 00-0323	EA		3" No Hub Cast Iron Combination Wye And 1/8 Bend.....	82.16	46.67
			<i>For Work In Restricted Working Space, Add</i>	21.00	
			<i>For Below Ground Installation, Add</i>	3.50	
22 13 16 00-0324	EA		4" No Hub Cast Iron Combination Wye And 1/8 Bend.....	114.28	61.30
			<i>For Work In Restricted Working Space, Add</i>	27.56	
			<i>For Below Ground Installation, Add</i>	4.59	
22 13 16 00-0325	EA		6" No Hub Cast Iron Combination Wye And 1/8 Bend.....	197.75	94.30
			<i>For Work In Restricted Working Space, Add</i>	42.41	
			<i>For Below Ground Installation, Add</i>	7.07	
22 13 16 00-0326	EA		8" No Hub Cast Iron Combination Wye And 1/8 Bend.....	322.89	120.98
			<i>For Work In Restricted Working Space, Add</i>	54.42	
			<i>For Below Ground Installation, Add</i>	9.07	
22 13 16 00-0327	EA		10" No Hub Cast Iron Combination Wye And 1/8 Bend.....	381.75	146.27
			<i>For Work In Restricted Working Space, Add</i>	65.78	
			<i>For Below Ground Installation, Add</i>	10.96	
22 13 16 00-0328			No Hub Cast Iron Reducing Combination Wye And 1/8 Bends (22 13 16 00-0262)		
22 13 16 00-0329	EA		2" x 1-1/2" No Hub Cast Iron Reducing Combination Wye And 1/8 Bend.....	71.84	42.63
			<i>For Work In Restricted Working Space, Add</i>	19.17	
			<i>For Below Ground Installation, Add</i>	3.20	
22 13 16 00-0330	EA		3" x 2" No Hub Cast Iron Reducing Combination Wye And 1/8 Bend.....	78.95	46.67
			<i>For Work In Restricted Working Space, Add</i>	21.00	
			<i>For Below Ground Installation, Add</i>	3.50	
22 13 16 00-0331	EA		4" x 2" No Hub Cast Iron Reducing Combination Wye And 1/8 Bend.....	89.62	51.60
			<i>For Work In Restricted Working Space, Add</i>	23.21	
			<i>For Below Ground Installation, Add</i>	3.87	
22 13 16 00-0332	EA		4" x 3" No Hub Cast Iron Reducing Combination Wye And 1/8 Bend.....	101.56	57.33
			<i>For Work In Restricted Working Space, Add</i>	25.79	
			<i>For Below Ground Installation, Add</i>	4.30	
22 13 16 00-0333	EA		6" x 2" No Hub Cast Iron Reducing Combination Wye And 1/8 Bend.....	138.20	72.97
			<i>For Work In Restricted Working Space, Add</i>	32.84	
			<i>For Below Ground Installation, Add</i>	5.47	
22 13 16 00-0334	EA		6" x 3" No Hub Cast Iron Reducing Combination Wye And 1/8 Bend.....	150.73	76.27
			<i>For Work In Restricted Working Space, Add</i>	34.29	
			<i>For Below Ground Installation, Add</i>	5.72	
22 13 16 00-0335	EA		6" x 4" No Hub Cast Iron Reducing Combination Wye And 1/8 Bend.....	171.02	89.14
			<i>For Work In Restricted Working Space, Add</i>	40.08	
			<i>For Below Ground Installation, Add</i>	6.68	
22 13 16 00-0336	EA		8" x 4" No Hub Cast Iron Reducing Combination Wye And 1/8 Bend.....	207.75	89.14
			<i>For Work In Restricted Working Space, Add</i>	40.10	
			<i>For Below Ground Installation, Add</i>	6.68	
22 13 16 00-0337	EA		8" x 6" No Hub Cast Iron Reducing Combination Wye And 1/8 Bend.....	257.71	97.98
			<i>For Work In Restricted Working Space, Add</i>	44.05	
			<i>For Below Ground Installation, Add</i>	7.34	
22 13 16 00-0338			No Hub Cast Iron Double Wyes (22 13 16 00-0262)		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 13 16 00-0339 EA 2" No Hub Cast Iron Double Wye <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	89.61 23.84 3.97	52.99
22 13 16 00-0340 EA 3" No Hub Cast Iron Double Wye <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	115.43 29.01 4.84	64.53
22 13 16 00-0341 EA 4" No Hub Cast Iron Double Wye <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	144.28 31.73 5.29	70.56
22 13 16 00-0342 EA 6" No Hub Cast Iron Double Wye <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	228.38 48.60 8.10	108.10
22 13 16 00-0343 EA 8" No Hub Cast Iron Double Wye <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	396.00 64.88 10.81	144.22
22 13 16 00-0344 No Hub Cast Iron Reducing Double Wyes (22 13 16 00-0262)		
22 13 16 00-0345 EA 3" x 2" No Hub Cast Iron Double Wye <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	104.08 26.41 4.40	58.73
22 13 16 00-0346 EA 4" x 2" No Hub Cast Iron Double Wye <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	122.95 30.42 5.07	67.62
22 13 16 00-0347 EA 4" x 3" No Hub Cast Iron Double Wye <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	134.85 33.16 5.53	73.72
22 13 16 00-0348 EA 6" x 4" No Hub Cast Iron Double Wye <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	196.70 42.86 7.14	95.30
22 13 16 00-0349 No Hub Cast Iron Double Combination Wye And 1/8 Bends (22 13 16 00-0262)		
22 13 16 00-0350 EA 2" No Hub Cast Iron Double Combination Wye And 1/8 Bend..... <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	113.24 28.64 4.77	63.65
22 13 16 00-0351 EA 3" No Hub Cast Iron Double Combination Wye And 1/8 Bend..... <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	133.31 31.73 5.29	70.56
22 13 16 00-0352 EA 4" No Hub Cast Iron Double Combination Wye And 1/8 Bend..... <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	192.62 42.00 7.00	93.42
22 13 16 00-0353 EA 6" No Hub Cast Iron Double Combination Wye And 1/8 Bend..... <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	277.62 64.85 10.81	144.21
22 13 16 00-0354 No Hub Cast Iron Reducing Double Combination Wye And 1/8 Bends (22 13 16 00-0262)		
22 13 16 00-0355 EA 3" x 2" No Hub Cast Iron Reducing Double Combination Wye And 1/8 Bend..... <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	102.76 24.64 4.11	54.76
22 13 16 00-0356 EA 4" x 2" No Hub Cast Iron Reducing Double Combination Wye And 1/8 Bend..... <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	119.23 28.64 4.77	63.65
22 13 16 00-0357 EA 4" x 3" No Hub Cast Iron Reducing Double Combination Wye And 1/8 Bend..... <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	138.82 31.28 5.21	69.53
22 13 16 00-0358 No Hub Cast Iron Sanitary Tees (22 13 16 00-0262)		
22 13 16 00-0359 EA 1-1/2" No Hub Cast Iron Sanitary Tee <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	53.06 13.87 2.31	30.80
22 13 16 00-0360 EA 2" No Hub Cast Iron Sanitary Tee..... <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	71.55 19.17 3.20	42.63
22 13 16 00-0361 EA 3" No Hub Cast Iron Sanitary Tee..... <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	79.13 21.00 3.50	46.67
22 13 16 00-0362 EA 4" No Hub Cast Iron Sanitary Tee..... <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	106.17 27.56 4.59	61.30
22 13 16 00-0363 EA 5" No Hub Cast Iron Sanitary Tee..... <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	143.60 32.49 5.41	72.23
22 13 16 00-0364 EA 6" No Hub Cast Iron Sanitary Tee..... <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	169.72 38.58 6.43	85.76
22 13 16 00-0365 EA 8" No Hub Cast Iron Sanitary Tee..... <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	290.02 50.98 8.50	113.37

22	Plumbing
22 10	Plumbing Piping
22 13	Facility Sanitary Sewerage



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 13 16 00-0366	EA		2" x 1-1/2" No Hub Cast Iron Sanitary Tee <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	59.77 15.64 2.61	34.77
22 13 16 00-0367	EA		3" x 1-1/2" No Hub Cast Iron Sanitary Tee <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	69.48 18.30 3.05	40.72
22 13 16 00-0368			No Hub Cast Iron Reducing Sanitary Tees (22 13 16 00-0262)		
22 13 16 00-0369	EA		3" x 2" No Hub Cast Iron Reducing Sanitary Tee..... <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	72.39 19.17 3.20	42.63
22 13 16 00-0370	EA		3" x 4" No Hub Cast Iron Reducing Sanitary Tee..... <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	81.13 19.17 3.20	42.63
22 13 16 00-0371	EA		4" x 2" No Hub Cast Iron Reducing Sanitary Tee..... <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	97.35 25.94 4.32	57.69
22 13 16 00-0372	EA		4" x 3" No Hub Cast Iron Reducing Sanitary Tee..... <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	99.48 25.94 4.32	57.69
22 13 16 00-0373	EA		5" x 2" No Hub Cast Iron Reducing Sanitary Tee..... <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	128.12 30.86 5.14	68.63
22 13 16 00-0374	EA		5" x 3" No Hub Cast Iron Reducing Sanitary Tee..... <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	131.08 30.86 5.14	68.63
22 13 16 00-0375	EA		5" x 4" No Hub Cast Iron Reducing Sanitary Tee..... <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	131.44 30.86 5.14	68.63
22 13 16 00-0376	EA		6" x 4" No Hub Cast Iron Reducing Sanitary Tee..... <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	136.57 32.15 5.36	71.50
22 13 16 00-0377	EA		8" x 6" No Hub Cast Iron Reducing Sanitary Tee..... <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	232.80 42.99 7.17	95.60
22 13 16 00-0378			No Hub Cast Iron Sanitary Tapped Tees (22 13 16 00-0262)		
22 13 16 00-0379	EA		2" x 1-1/2 Or 1-1/4" No Hub Cast Iron Sanitary Tapped Tee <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	38.94 9.38 1.56	20.87
22 13 16 00-0380	EA		3" x 1-1/2 Or 1-1/4" No Hub Cast Iron Sanitary Tapped Tee <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	45.05 10.76 1.79	23.89
22 13 16 00-0381	EA		4" x 1-1/2 Or 1-1/4" No Hub Cast Iron Sanitary Tapped Tee <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	56.82 14.23 2.37	31.60
22 13 16 00-0382			No Hub Cast Iron Cleanout Tees (22 13 16 00-0262)		
22 13 16 00-0383	EA		2" No Hub Cast Iron Cleanout Tee <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	37.61 9.38 1.56	20.87
22 13 16 00-0384	EA		3" No Hub Cast Iron Cleanout Tee <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	46.02 10.76 1.79	23.89
22 13 16 00-0385	EA		4" No Hub Cast Iron Cleanout Tee <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	65.30 14.23 2.37	31.60
22 13 16 00-0386	EA		6" No Hub Cast Iron Cleanout Tee <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	104.88 21.00 3.50	46.67
22 13 16 00-0387			No Hub Cast Iron Two-Way Cleanout Tees (22 13 16 00-0262)		
22 13 16 00-0388	EA		4" No Hub Cast Iron Single Two-Way Cleanout Tee <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	142.94 27.56 4.59	61.30
22 13 16 00-0389	EA		4" No Hub Cast Iron Double Two-Way Cleanout Tee <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	187.06 41.90 6.98	93.12
22 13 16 00-0390			No Hub Cast Iron Cleanout Plugs (22 13 16 00-0262)		
22 13 16 00-0391	EA		2" No Hub Cast Iron Cleanout Plug <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	33.97 9.38 1.56	20.87
22 13 16 00-0392	EA		3" No Hub Cast Iron Cleanout Plug <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	40.08 10.76 1.79	23.89
22 13 16 00-0393	EA		4" No Hub Cast Iron Cleanout Plug <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	55.44 14.23 2.37	31.60



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 13 16 00-0394	EA		6" No Hub Cast Iron Cleanout Plug <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	84.99 21.00 3.50	46.67
22 13 16 00-0395	EA		8" No Hub Cast Iron Cleanout Plug <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	112.47 27.56 4.59	61.30
22 13 16 00-0396 No Hub Cast Iron Sanitary Crosses <small>(22 13 16 00-0262)</small>					
22 13 16 00-0397	EA		1-1/2" No Hub Cast Iron Sanitary Cross <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	70.98 18.53 3.09	41.16
22 13 16 00-0398	EA		2" No Hub Cast Iron Sanitary Cross <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	75.44 19.17 3.20	42.63
22 13 16 00-0399	EA		3" No Hub Cast Iron Sanitary Cross <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	88.15 21.00 3.50	46.67
22 13 16 00-0400	EA		4" No Hub Cast Iron Sanitary Cross <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	125.99 27.56 4.59	61.30
22 13 16 00-0401 No Hub Cast Iron Reducing Sanitary Crosses <small>(22 13 16 00-0262)</small>					
22 13 16 00-0402	EA		3" x 2" No Hub Cast Iron Sanitary Cross <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	98.42 24.63 4.11	54.76
22 13 16 00-0403	EA		4" x 2" No Hub Cast Iron Sanitary Cross <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	107.58 25.36 4.23	56.37
22 13 16 00-0404	EA		4" x 3" No Hub Cast Iron Sanitary Cross <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	116.05 26.47 4.41	58.87
22 13 16 00-0405 No Hub Cast Iron Reducers <small>(22 13 16 00-0262)</small>					
22 13 16 00-0406	EA		3" x 2" No Hub Cast Iron Reducer <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	67.78 19.17 3.20	42.63
22 13 16 00-0407	EA		4" x 2" No Hub Cast Iron Reducer <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	92.38 25.94 4.32	57.69
22 13 16 00-0408	EA		4" x 3" No Hub Cast Iron Reducer <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	92.56 25.94 4.32	57.69
22 13 16 00-0409	EA		5" x 2" No Hub Cast Iron Reducer <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	111.53 30.86 5.14	68.63
22 13 16 00-0410	EA		5" x 3" No Hub Cast Iron Reducer <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	112.73 30.86 5.14	68.63
22 13 16 00-0411	EA		5" x 4" No Hub Cast Iron Reducer <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	113.20 30.86 5.14	68.63
22 13 16 00-0412	EA		6" x 3" No Hub Cast Iron Reducer <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	129.25 34.29 5.72	76.27
22 13 16 00-0413	EA		6" x 4" No Hub Cast Iron Reducer <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	129.43 34.29 5.72	76.27
22 13 16 00-0414	EA		6" x 5" No Hub Cast Iron Reducer <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	129.97 34.29 5.72	76.27
22 13 16 00-0415	EA		8" x 2" No Hub Cast Iron Reducer <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	178.50 47.58 7.93	105.79
22 13 16 00-0416	EA		8" x 3" No Hub Cast Iron Reducer <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	179.88 47.58 7.93	105.79
22 13 16 00-0417	EA		8" x 4" No Hub Cast Iron Reducer <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	182.10 47.58 7.93	105.79
22 13 16 00-0418	EA		8" x 5" No Hub Cast Iron Reducer <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	184.40 47.58 7.93	105.79
22 13 16 00-0419	EA		8" x 6" No Hub Cast Iron Reducer <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	184.68 47.58 7.93	105.79
22 13 16 00-0420	EA		10" x 4" No Hub Cast Iron Reducer <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	210.04 50.18 8.36	111.59
22 13 16 00-0421	EA		10" x 6" No Hub Cast Iron Reducer <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	222.63 52.41 8.74	116.49



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 13 16 00-0422	EA		10" x 8" No Hub Cast Iron Reducer	246.99	126.45
			<i>For Work In Restricted Working Space, Add</i>	56.87	
			<i>For Below Ground Installation, Add</i>	9.48	
22 13 16 00-0423			No Hub Cast Iron Blind Plugs (22 13 16 00-0262)		
22 13 16 00-0424	EA		1-1/2" No Hub Cast Iron Blind Plug.....	32.22	20.00
			<i>For Work In Restricted Working Space, Add</i>	9.00	
			<i>For Below Ground Installation, Add</i>	1.50	
22 13 16 00-0425	EA		2" No Hub Cast Iron Blind Plug.....	33.40	20.87
			<i>For Work In Restricted Working Space, Add</i>	9.38	
			<i>For Below Ground Installation, Add</i>	1.56	
22 13 16 00-0426	EA		3" No Hub Cast Iron Blind Plug.....	39.63	23.89
			<i>For Work In Restricted Working Space, Add</i>	10.76	
			<i>For Below Ground Installation, Add</i>	1.79	
22 13 16 00-0427	EA		4" No Hub Cast Iron Blind Plug.....	52.48	31.60
			<i>For Work In Restricted Working Space, Add</i>	14.23	
			<i>For Below Ground Installation, Add</i>	2.37	
22 13 16 00-0428	EA		5" No Hub Cast Iron Blind Plug.....	65.98	38.21
			<i>For Work In Restricted Working Space, Add</i>	16.97	
			<i>For Below Ground Installation, Add</i>	2.83	
22 13 16 00-0429	EA		6" No Hub Cast Iron Blind Plug.....	75.87	44.24
			<i>For Work In Restricted Working Space, Add</i>	19.91	
			<i>For Below Ground Installation, Add</i>	3.32	
22 13 16 00-0430	EA		8" No Hub Cast Iron Blind Plug.....	114.91	56.65
			<i>For Work In Restricted Working Space, Add</i>	25.49	
			<i>For Below Ground Installation, Add</i>	4.25	
22 13 16 00-0431	EA		10" No Hub Cast Iron Blind Plug.....	134.56	61.03
			<i>For Work In Restricted Working Space, Add</i>	27.45	
			<i>For Below Ground Installation, Add</i>	4.58	
22 13 16 00-0432			No Hub Cast Iron P-Traps (22 13 16 00-0262)		
22 13 16 00-0433	EA		2" No Hub Cast Iron P-Trap.....	39.12	20.87
			<i>For Work In Restricted Working Space, Add</i>	9.38	
			<i>For Below Ground Installation, Add</i>	1.56	
22 13 16 00-0434	EA		3" No Hub Cast Iron P-Trap.....	53.73	23.89
			<i>For Work In Restricted Working Space, Add</i>	10.76	
			<i>For Below Ground Installation, Add</i>	1.79	
22 13 16 00-0435	EA		4" No Hub Cast Iron P-Trap.....	78.48	31.60
			<i>For Work In Restricted Working Space, Add</i>	14.23	
			<i>For Below Ground Installation, Add</i>	2.37	
22 13 16 00-0436	EA		5" No Hub Cast Iron P-Trap.....	127.11	37.41
			<i>For Work In Restricted Working Space, Add</i>	16.81	
			<i>For Below Ground Installation, Add</i>	2.80	
22 13 16 00-0437	EA		6" No Hub Cast Iron P-Trap.....	138.01	44.60
			<i>For Work In Restricted Working Space, Add</i>	20.06	
			<i>For Below Ground Installation, Add</i>	3.34	
22 13 16 00-0438			No Hub Cast Iron Deep Seal P-Traps (22 13 16 00-0262)		
22 13 16 00-0439	EA		2" No Hub Cast Iron Deep Seal P-Trap	58.45	26.54
			<i>For Work In Restricted Working Space, Add</i>	11.92	
			<i>For Below Ground Installation, Add</i>	1.99	
22 13 16 00-0440	EA		3" No Hub Cast Iron Deep Seal P-Trap	82.74	35.28
			<i>For Work In Restricted Working Space, Add</i>	15.86	
			<i>For Below Ground Installation, Add</i>	2.64	
22 13 16 00-0441	EA		4" No Hub Cast Iron Deep Seal P-Trap	117.74	46.60
			<i>For Work In Restricted Working Space, Add</i>	20.95	
			<i>For Below Ground Installation, Add</i>	3.49	
22 13 16 00-0442			No Hub Cast Iron Closet Flanges (22 13 16 00-0262)		
22 13 16 00-0443	EA		4" No Hub Cast Iron Closet Flange.....	59.85	31.60
			<i>For Work In Restricted Working Space, Add</i>	14.23	
			<i>For Below Ground Installation, Add</i>	2.37	
22 13 16 00-0444	EA		4" x 2-1/2" No Hub Cast Iron Offset Closet Flange	62.43	31.60
			<i>For Work In Restricted Working Space, Add</i>	14.23	
			<i>For Below Ground Installation, Add</i>	2.37	
22 13 16 00-0445			No Hub Cast Iron Closet Bends (22 13 16 00-0262)		
22 13 16 00-0446	EA		4" x 16" No Hub Cast Iron Closet Bend	96.09	31.60
			<i>For Work In Restricted Working Space, Add</i>	14.23	
			<i>For Below Ground Installation, Add</i>	2.37	
22 13 16 00-0447			No Hub Cast Iron Threaded Adapter (22 13 16 00-0262)		
22 13 16 00-0448	EA		1-1/4" No Hub Cast Iron Threaded Adapter.....	46.47	26.54
			<i>For Work In Restricted Working Space, Add</i>	11.92	
			<i>For Below Ground Installation, Add</i>	1.99	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 13 16 00-0449	EA			1-1/2" No Hub Cast Iron Threaded Adapter <i>For Work In Restricted Working Space, Add</i> <i>For Below Ground Installation, Add</i>	48.55 11.92 1.99	26.54
22 13 16 00-0450				No Hub Couplings <small>(22 13 16 00-0262)</small> Note: Includes stainless steel shield/clamps assembly with elastomeric gasket, ASTM C 564. (Ferenco NH).		
22 13 16 00-0451	EA			1-1/2" No Hub Coupling <i>For Medium Duty (Ferenco MD-2000), Add</i> <i>For Heavy Duty (Ferenco HD-4000), Add</i>	5.07 0.66 1.37	
22 13 16 00-0452	EA			2" No Hub Coupling <i>For Medium Duty (Ferenco MD-2000), Add</i> <i>For Heavy Duty (Ferenco HD-4000), Add</i>	5.07 0.66 1.37	
22 13 16 00-0453	EA			3" No Hub Coupling <i>For Medium Duty (Ferenco MD-2000), Add</i> <i>For Heavy Duty (Ferenco HD-4000), Add</i>	6.02 0.78 1.63	
22 13 16 00-0454	EA			4" No Hub Coupling <i>For Medium Duty (Ferenco MD-2000), Add</i> <i>For Heavy Duty (Ferenco HD-4000), Add</i>	7.15 0.93 1.93	
22 13 16 00-0455	EA			5" No Hub Coupling <i>For Medium Duty (Ferenco MD-2000), Add</i> <i>For Heavy Duty (Ferenco HD-4000), Add</i>	16.53 2.15 4.46	
22 13 16 00-0456	EA			6" No Hub Coupling <i>For Medium Duty (Ferenco MD-2000), Add</i> <i>For Heavy Duty (Ferenco HD-4000), Add</i>	18.16 2.36 4.90	
22 13 16 00-0457	EA			8" No Hub Coupling <i>For Medium Duty (Ferenco MD-2000), Add</i> <i>For Heavy Duty (Ferenco HD-4000), Add</i>	34.21 4.45 9.24	
22 13 16 00-0458	EA			10" No Hub Coupling <i>For Medium Duty (Ferenco MD-2000), Add</i> <i>For Heavy Duty (Ferenco HD-4000), Add</i>	47.13 6.13 12.73	
22 13 16 00-0459	EA			2" x 1-1/2" No Hub Reducing Coupling	6.02	
22 13 16 00-0460	EA			3" x 2" No Hub Reducing Coupling	9.34	
22 13 16 00-0461	EA			4" x 2" No Hub Reducing Coupling	13.02	
22 13 16 00-0462	EA			4" x 3" No Hub Reducing Coupling	11.10	
22 13 16 00-0463				Cast Iron Mechanical Joint Couplings With Neoprene Gasket And Bolts <small>(22 13 16 00-0262)</small> Note: For underground connections. See CSI section 22 13 16 00-0845 for additional FERNCO couplings.		
22 13 16 00-0464	EA			1-1/2" Cast Iron Mechanical Joint Coupling With Neoprene Gasket And Bolts	14.89	
22 13 16 00-0465	EA			2" Cast Iron Mechanical Joint Coupling With Neoprene Gasket And Bolts	15.37	
22 13 16 00-0466	EA			3" Cast Iron Mechanical Joint Coupling With Neoprene Gasket And Bolts	16.14	
22 13 16 00-0467	EA			4" Cast Iron Mechanical Joint Coupling With Neoprene Gasket And Bolts	18.83	
22 13 16 00-0468	EA			5" Cast Iron Mechanical Joint Coupling With Neoprene Gasket And Bolts	35.55	
22 13 16 00-0469	EA			6" Cast Iron Mechanical Joint Coupling With Neoprene Gasket And Bolts	48.80	
22 13 16 00-0470	EA			8" Cast Iron Mechanical Joint Coupling With Neoprene Gasket And Bolts	85.50	
22 13 16 00-0471	EA			10" Cast Iron Mechanical Joint Coupling With Neoprene Gasket And Bolts	130.65	
22 13 16 00-0472				Cut And Prepare Existing Pipe In-Place <small>(22 13 16 00-0252)</small> Note: For use when connecting pipe to an existing in-place system.		
22 13 16 00-0473	EA			Cut And Prepare 1-1/2" Cast Iron Pipe, No Hub <i>For Work In Restricted Working Space, Add</i>	7.19 2.16	
22 13 16 00-0474	EA			Cut And Prepare 2" Cast Iron Pipe, No Hub <i>For Work In Restricted Working Space, Add</i>	8.78 2.63	
22 13 16 00-0475	EA			Cut And Prepare 3" Cast Iron Pipe, No Hub <i>For Work In Restricted Working Space, Add</i>	9.59 2.88	
22 13 16 00-0476	EA			Cut And Prepare 4" Cast Iron Pipe, No Hub <i>For Work In Restricted Working Space, Add</i>	11.98 3.59	
22 13 16 00-0477	EA			Cut And Prepare 6" Cast Iron Pipe, No Hub <i>For Work In Restricted Working Space, Add</i>	14.37 4.31	
22 13 16 00-0478	EA			Cut And Prepare 8" Cast Iron Pipe, No Hub <i>For Work In Restricted Working Space, Add</i>	19.16 5.75	
22 13 16 00-0479	EA			Cut And Prepare 10" Cast Iron Pipe, No Hub <i>For Work In Restricted Working Space, Add</i>	22.35 6.71	
22 13 16 00-0480				Copper Drain-Waste-Vent (DWV) Pipe <small>(22 13 16)</small> See CSI section 22 11 16 00-0404 for copper and brass fittings.		
22 13 16 00-0481	LF			1-1/4" Hard Drawn DWV Copper Tube/Pipe	9.55	3.45
22 13 16 00-0482	LF			1-1/2" Hard Drawn DWV Copper Tube/Pipe	11.78	3.86
22 13 16 00-0483	LF			2" Hard Drawn DWV Copper Tube/Pipe	17.97	4.76
22 13 16 00-0484	LF			3" Hard Drawn DWV Copper Tube/Pipe	35.78	6.59
22 13 16 00-0485	LF			4" Hard Drawn DWV Copper Tube/Pipe	47.37	7.43
22 13 16 00-0486	LF			5" Hard Drawn DWV Copper Tube/Pipe	125.28	8.54
22 13 16 00-0487	LF			6" Hard Drawn DWV Copper Tube/Pipe	157.26	13.24
22 13 16 00-0488				Polyvinyl Chloride (PVC) Drain-Waste-Vent (DWV) Pipe And Fittings <small>(22 13 16)</small> Note: Aboveground installation. See CSI section 33 31 00 00-0018 for underground installation.		



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 13 16 00-0489			Schedule 40 Polyvinyl Chloride (PVC) DWV Pipe Assemblies <small>(22 13 16 00-0489)</small> Note: Includes all hangers and couplings, elbow, tee and reducer fittings. All hangers are complete assemblies installed in accordance with uniform plumbing code. Not for use where detail is available.		
22 13 16 00-0490	LF		1-1/2" Schedule 40 Polyvinyl Chloride (PVC) DWV Pipe Assembly Note: Includes all fittings, couplings and hangers. Fittings are assumed every 10'. Not for use where detail is available.	15.34	3.08
			<i>For Work In Restricted Working Space, Add</i>	4.23	
22 13 16 00-0491	LF		2" Schedule 40 Polyvinyl Chloride (PVC) DWV Pipe Assembly..... Note: Includes all fittings, couplings and hangers. Fittings are assumed every 10'. Not for use where detail is available.	17.00	3.68
			<i>For Work In Restricted Working Space, Add</i>	4.68	
22 13 16 00-0492	LF		3" Schedule 40 Polyvinyl Chloride (PVC) DWV Pipe Assembly..... Note: Includes all fittings, couplings and hangers. Fittings are assumed every 10'. Not for use where detail is available.	21.92	5.29
			<i>For Work In Restricted Working Space, Add</i>	5.81	
22 13 16 00-0493	LF		4" Schedule 40 Polyvinyl Chloride (PVC) DWV Pipe Assembly..... Note: Includes all fittings, couplings and hangers. Fittings are assumed every 10'. Not for use where detail is available.	24.73	5.73
			<i>For Work In Restricted Working Space, Add</i>	6.46	
22 13 16 00-0494	LF		6" Schedule 40 Polyvinyl Chloride (PVC) DWV Pipe Assembly..... Note: Includes all fittings, couplings and hangers. Fittings are assumed every 10'. Not for use where detail is available.	36.33	7.35
			<i>For Work In Restricted Working Space, Add</i>	8.59	
22 13 16 00-0495	LF		8" Schedule 40 Polyvinyl Chloride (PVC) DWV Pipe Assembly..... Note: Includes all fittings, couplings and hangers. Fittings are assumed every 10'. Not for use where detail is available.	48.86	9.77
			<i>For Work In Restricted Working Space, Add</i>	10.89	
22 13 16 00-0496	LF		10" Schedule 40 Polyvinyl Chloride (PVC) DWV Pipe Assembly..... Note: Includes all fittings, couplings and hangers. Fittings are assumed every 10'. Not for use where detail is available.	66.92	13.09
			<i>For Work In Restricted Working Space, Add</i>	14.20	
22 13 16 00-0497			Schedule 40 Polyvinyl Chloride (PVC) DWV Pipe <small>(22 13 16 00-0497)</small> Note: Excludes fittings or hangers.		
22 13 16 00-0498			Schedule 40 Polyvinyl Chloride (PVC) DWV Pipe (ASTM D-2665) <small>(22 13 16 00-0497)</small> Note: Excludes fittings or hangers.		
22 13 16 00-0499	LF		1-1/2" Schedule 40 Polyvinyl Chloride (PVC) DWV Pipe..... <i>For Work In Restricted Working Space, Add</i>	5.11 1.38	3.08
22 13 16 00-0500	LF		2" Schedule 40 Polyvinyl Chloride (PVC) DWV Pipe..... <i>For Work In Restricted Working Space, Add</i>	6.20 1.65	3.68
22 13 16 00-0501	LF		3" Schedule 40 Polyvinyl Chloride (PVC) DWV Pipe..... <i>For Work In Restricted Working Space, Add</i>	9.29 2.37	5.29
22 13 16 00-0502	LF		4" Schedule 40 Polyvinyl Chloride (PVC) DWV Pipe..... <i>For Work In Restricted Working Space, Add</i>	10.52 2.57	5.73
22 13 16 00-0503	LF		6" Schedule 40 Polyvinyl Chloride (PVC) DWV Pipe..... <i>For Work In Restricted Working Space, Add</i>	14.46 3.30	7.35
22 13 16 00-0504	LF		8" Schedule 40 Polyvinyl Chloride (PVC) DWV Pipe..... <i>For Work In Restricted Working Space, Add</i>	20.60 4.41	9.78
22 13 16 00-0505	LF		10" Schedule 40 Polyvinyl Chloride (PVC) DWV Pipe..... <i>For Work In Restricted Working Space, Add</i>	28.64 5.88	13.08
22 13 16 00-0506			Schedule 40 Polyvinyl Chloride (PVC) DWV "Foam-Core" Pipe (ASTM F-891) <small>(22 13 16 00-0497)</small> Note: Excludes fittings or hangers.		
22 13 16 00-0507	LF		1-1/2" Schedule 40 Polyvinyl Chloride (PVC) DWV "Foam-Core" Pipe..... <i>For Work In Restricted Working Space, Add</i>	5.00 1.38	3.08
22 13 16 00-0508	LF		2" Schedule 40 Polyvinyl Chloride (PVC) DWV "Foam-Core" Pipe..... <i>For Work In Restricted Working Space, Add</i>	6.07 1.65	3.68
22 13 16 00-0509	LF		3" Schedule 40 Polyvinyl Chloride (PVC) DWV "Foam-Core" Pipe..... <i>For Work In Restricted Working Space, Add</i>	9.06 2.37	5.29
22 13 16 00-0510	LF		4" Schedule 40 Polyvinyl Chloride (PVC) DWV "Foam-Core" Pipe..... <i>For Work In Restricted Working Space, Add</i>	10.23 2.57	5.73
22 13 16 00-0511	LF		6" Schedule 40 Polyvinyl Chloride (PVC) DWV "Foam-Core" Pipe..... <i>For Work In Restricted Working Space, Add</i>	13.91 3.30	7.35
22 13 16 00-0512	LF		8" Schedule 40 Polyvinyl Chloride (PVC) DWV "Foam-Core" Pipe..... <i>For Work In Restricted Working Space, Add</i>	19.22 4.41	9.78
22 13 16 00-0513	LF		10" Schedule 40 Polyvinyl Chloride (PVC) DWV "Foam-Core" Pipe..... <i>For Work In Restricted Working Space, Add</i>	27.14 5.88	13.08
22 13 16 00-0514			Polyvinyl Chloride (PVC) DWV Fittings (ASTM D-2665) <small>(22 13 16 00-0489)</small>		
22 13 16 00-0515			Polyvinyl Chloride (PVC) DWV 1/4 Bends <small>(22 13 16 00-0514)</small>		
22 13 16 00-0516	EA		1-1/2" Polyvinyl Chloride (PVC) DWV 1/4 Bends..... <i>For Work In Restricted Working Space, Add</i>	18.87 5.51	12.27
22 13 16 00-0517	EA		2" Polyvinyl Chloride (PVC) DWV 1/4 Bends..... <i>For Work In Restricted Working Space, Add</i>	24.14 7.06	15.66
22 13 16 00-0518	EA		3" Polyvinyl Chloride (PVC) DWV 1/4 Bends..... <i>For Work In Restricted Working Space, Add</i>	33.53 9.48	21.02
22 13 16 00-0519	EA		4" Polyvinyl Chloride (PVC) DWV 1/4 Bends..... <i>For Work In Restricted Working Space, Add</i>	40.85 11.03	24.48



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 13 16 00-0520	EA		6" Polyvinyl Chloride (PVC) DWV 1/4 Bends..... <i>For Work In Restricted Working Space, Add</i>	72.75 14.33	31.82
22 13 16 00-0521	EA		8" Polyvinyl Chloride (PVC) DWV 1/4 Bends..... <i>For Work In Restricted Working Space, Add</i>	107.09 19.29	42.86
22 13 16 00-0522	EA		10" Polyvinyl Chloride (PVC) DWV 1/4 Bends..... <i>For Work In Restricted Working Space, Add</i>	142.16 25.73	57.11
22 13 16 00-0523			Polyvinyl Chloride (PVC) DWV Long Sweep 1/4 Bends <small>(22 13 16 00-0514)</small>		
22 13 16 00-0524	EA		1-1/2" Polyvinyl Chloride (PVC) DWV Long Sweep 1/4 Bends..... <i>For Work In Restricted Working Space, Add</i>	20.25 5.51	12.27
22 13 16 00-0525	EA		2" Polyvinyl Chloride (PVC) DWV Long Sweep 1/4 Bends..... <i>For Work In Restricted Working Space, Add</i>	24.94 7.06	15.66
22 13 16 00-0526	EA		3" Polyvinyl Chloride (PVC) DWV Long Sweep 1/4 Bends..... <i>For Work In Restricted Working Space, Add</i>	35.57 9.48	21.02
22 13 16 00-0527	EA		4" Polyvinyl Chloride (PVC) DWV Long Sweep 1/4 Bends..... <i>For Work In Restricted Working Space, Add</i>	44.59 11.03	24.48
22 13 16 00-0528	EA		6" Polyvinyl Chloride (PVC) DWV Long Sweep 1/4 Bends..... <i>For Work In Restricted Working Space, Add</i>	65.53 14.33	31.82
22 13 16 00-0529	EA		8" Polyvinyl Chloride (PVC) DWV Long Sweep 1/4 Bends..... <i>For Work In Restricted Working Space, Add</i>	97.61 19.29	42.86
22 13 16 00-0530	EA		10" Polyvinyl Chloride (PVC) DWV Long Sweep 1/4 Bends..... <i>For Work In Restricted Working Space, Add</i>	141.99 25.73	57.11
22 13 16 00-0531			Polyvinyl Chloride (PVC) DWV 1/8 Bends <small>(22 13 16 00-0514)</small>		
22 13 16 00-0532	EA		1-1/2" Polyvinyl Chloride (PVC) DWV 1/8 Bends..... <i>For Work In Restricted Working Space, Add</i>	18.98 5.51	12.27
22 13 16 00-0533	EA		2" Polyvinyl Chloride (PVC) DWV 1/8 Bends..... <i>For Work In Restricted Working Space, Add</i>	24.13 7.06	15.66
22 13 16 00-0534	EA		3" Polyvinyl Chloride (PVC) DWV 1/8 Bends..... <i>For Work In Restricted Working Space, Add</i>	33.36 9.48	21.02
22 13 16 00-0535	EA		4" Polyvinyl Chloride (PVC) DWV 1/8 Bends..... <i>For Work In Restricted Working Space, Add</i>	40.02 11.03	24.48
22 13 16 00-0536	EA		6" Polyvinyl Chloride (PVC) DWV 1/8 Bends..... <i>For Work In Restricted Working Space, Add</i>	70.63 14.33	31.82
22 13 16 00-0537	EA		8" Polyvinyl Chloride (PVC) DWV 1/8 Bends..... <i>For Work In Restricted Working Space, Add</i>	102.18 19.29	42.86
22 13 16 00-0538	EA		10" Polyvinyl Chloride (PVC) DWV 1/8 Bends..... <i>For Work In Restricted Working Space, Add</i>	127.71 25.73	57.11
22 13 16 00-0539			Polyvinyl Chloride (PVC) DWV Sanitary Tees <small>(22 13 16 00-0514)</small>		
22 13 16 00-0540	EA		1-1/2" Polyvinyl Chloride (PVC) DWV Sanitary Tees..... <i>For Work In Restricted Working Space, Add</i>	28.44 8.27	18.38
22 13 16 00-0541	EA		2" Polyvinyl Chloride (PVC) DWV Sanitary Tees..... <i>For Work In Restricted Working Space, Add</i>	36.54 10.58	23.52
22 13 16 00-0542	EA		3" Polyvinyl Chloride (PVC) DWV Sanitary Tees..... <i>For Work In Restricted Working Space, Add</i>	50.75 14.22	31.60
22 13 16 00-0543	EA		4" Polyvinyl Chloride (PVC) DWV Sanitary Tees..... <i>For Work In Restricted Working Space, Add</i>	61.50 16.54	36.75
22 13 16 00-0544	EA		6" Polyvinyl Chloride (PVC) DWV Sanitary Tees..... <i>For Work In Restricted Working Space, Add</i>	108.72 21.50	47.70
22 13 16 00-0545	EA		8" Polyvinyl Chloride (PVC) DWV Sanitary Tees..... <i>For Work In Restricted Working Space, Add</i>	144.36 28.94	64.24
22 13 16 00-0546			Polyvinyl Chloride (PVC) DWV Reducing Sanitary Tees <small>(22 13 16 00-0514)</small>		
22 13 16 00-0547	EA		2" x 1-1/2" x 1-1/2" Polyvinyl Chloride (PVC) DWV Reducing Sanitary Tees..... <i>For Work In Restricted Working Space, Add</i>	31.72 9.04	20.07
22 13 16 00-0548	EA		2" x 1-1/2" x 2" Polyvinyl Chloride (PVC) DWV Reducing Sanitary Tees..... <i>For Work In Restricted Working Space, Add</i>	34.90 9.81	21.76
22 13 16 00-0549	EA		2" x 2" x 1-1/2" Polyvinyl Chloride (PVC) DWV Reducing Sanitary Tees..... <i>For Work In Restricted Working Space, Add</i>	33.97 9.81	21.76
22 13 16 00-0550	EA		3" x 3" x 1-1/2" Polyvinyl Chloride (PVC) DWV Reducing Sanitary Tees..... <i>For Work In Restricted Working Space, Add</i>	43.35 12.24	27.20
22 13 16 00-0551	EA		3" x 3" x 2" Polyvinyl Chloride (PVC) DWV Reducing Sanitary Tees..... <i>For Work In Restricted Working Space, Add</i>	45.80 13.01	28.88
22 13 16 00-0552	EA		4" x 4" x 1-1/2" Polyvinyl Chloride (PVC) DWV Reducing Sanitary Tees..... <i>For Work In Restricted Working Space, Add</i>	49.37 13.78	30.57
22 13 16 00-0553	EA		4" x 4" x 2" Polyvinyl Chloride (PVC) DWV Reducing Sanitary Tees..... <i>For Work In Restricted Working Space, Add</i>	57.14 14.55	32.34
22 13 16 00-0554	EA		4" x 4" x 3" Polyvinyl Chloride (PVC) DWV Reducing Sanitary Tees..... <i>For Work In Restricted Working Space, Add</i>	64.30 15.77	34.99
22 13 16 00-0555	EA		6" x 6" x 4" Polyvinyl Chloride (PVC) DWV Reducing Sanitary Tees..... <i>For Work In Restricted Working Space, Add</i>	101.98 19.85	44.02
22 13 16 00-0556	EA		8" x 8" x 4" Polyvinyl Chloride (PVC) DWV Reducing Sanitary Tees..... <i>For Work In Restricted Working Space, Add</i>	207.40 24.81	55.05
22 13 16 00-0557	EA		8" x 8" x 6" Polyvinyl Chloride (PVC) DWV Reducing Sanitary Tees..... <i>For Work In Restricted Working Space, Add</i>	216.94 26.46	58.73
22 13 16 00-0558			Polyvinyl Chloride (PVC) DWV Double Sanitary Tees <small>(22 13 16 00-0514)</small>		

22	Plumbing
22 10	Plumbing Piping
22 13	Facility Sanitary Sewerage



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 13 16 00-0559	EA		1-1/2" Polyvinyl Chloride (PVC) DWV Double Sanitary Tees..... <i>For Work In Restricted Working Space, Add</i>	39.39 11.03	24.48
22 13 16 00-0560	EA		2" Polyvinyl Chloride (PVC) DWV Double Sanitary Tees..... <i>For Work In Restricted Working Space, Add</i>	50.92 14.12	31.31
22 13 16 00-0561	EA		3" Polyvinyl Chloride (PVC) DWV Double Sanitary Tees..... <i>For Work In Restricted Working Space, Add</i>	74.06 18.96	42.12
22 13 16 00-0562	EA		4" Polyvinyl Chloride (PVC) DWV Double Sanitary Tees..... <i>For Work In Restricted Working Space, Add</i>	90.95 22.05	48.95
22 13 16 00-0563			Polyvinyl Chloride (PVC) DWV Reducing Double Sanitary Tees (22 13 16 00-0514)		
22 13 16 00-0564	EA		2" x 2" x 1-1/2" x 1-1/2 Polyvinyl Chloride (PVC) DWV Double Sanitary Tee <i>For Work In Restricted Working Space, Add</i>	45.40 12.57	27.94
22 13 16 00-0565	EA		3" x 3" x 1-1/2" x 1-1/2 Polyvinyl Chloride (PVC) DWV Double Sanitary Tee <i>For Work In Restricted Working Space, Add</i>	58.19 14.99	33.29
22 13 16 00-0566	EA		3" x 3" x 2" x 2" Polyvinyl Chloride (PVC) DWV Double Sanitary Tee <i>For Work In Restricted Working Space, Add</i>	64.86 16.54	36.75
22 13 16 00-0567	EA		4" x 4" x 2" x 2" Polyvinyl Chloride (PVC) DWV Double Sanitary Tee <i>For Work In Restricted Working Space, Add</i>	81.70 18.08	40.14
22 13 16 00-0568	EA		4" x 4" x 3" x 3" Polyvinyl Chloride (PVC) DWV Double Sanitary Tee <i>For Work In Restricted Working Space, Add</i>	90.37 20.51	45.49
22 13 16 00-0569			Polyvinyl Chloride (PVC) DWV Reducers (22 13 16 00-0514)		
22 13 16 00-0570	EA		2" x 1-1/2" Polyvinyl Chloride (PVC) DWV Reducers..... <i>For Work In Restricted Working Space, Add</i>	21.92 6.28	13.96
22 13 16 00-0571	EA		3" x 1-1/2" Polyvinyl Chloride (PVC) DWV Reducers..... <i>For Work In Restricted Working Space, Add</i>	28.12 7.50	16.61
22 13 16 00-0572	EA		3" x 2" Polyvinyl Chloride (PVC) DWV Reducers..... <i>For Work In Restricted Working Space, Add</i>	30.18 8.27	18.38
22 13 16 00-0573	EA		4" x 2" Polyvinyl Chloride (PVC) DWV Reducers..... <i>For Work In Restricted Working Space, Add</i>	35.32 9.04	20.07
22 13 16 00-0574	EA		4" x 3" Polyvinyl Chloride (PVC) DWV Reducers..... <i>For Work In Restricted Working Space, Add</i>	39.61 10.25	22.79
22 13 16 00-0575	EA		6" x 3" Polyvinyl Chloride (PVC) DWV Reducers..... <i>For Work In Restricted Working Space, Add</i>	67.10 11.91	26.46
22 13 16 00-0576	EA		6" x 4" Polyvinyl Chloride (PVC) DWV Reducers..... <i>For Work In Restricted Working Space, Add</i>	64.27 12.68	28.15
22 13 16 00-0577	EA		8" x 4" Polyvinyl Chloride (PVC) DWV Reducers..... <i>For Work In Restricted Working Space, Add</i>	110.94 15.16	33.67
22 13 16 00-0578	EA		8" x 6" Polyvinyl Chloride (PVC) DWV Reducers..... <i>For Work In Restricted Working Space, Add</i>	105.74 16.81	37.33
22 13 16 00-0579	EA		10" x 6" Polyvinyl Chloride (PVC) DWV Reducers..... <i>For Work In Restricted Working Space, Add</i>	134.41 20.03	44.47
22 13 16 00-0580	EA		10" x 8" Polyvinyl Chloride (PVC) DWV Reducers..... <i>For Work In Restricted Working Space, Add</i>	125.78 22.51	49.98
22 13 16 00-0581			Polyvinyl Chloride (PVC) DWV P-Traps (22 13 16 00-0514)		
22 13 16 00-0582	EA		1-1/2" Polyvinyl Chloride (PVC) DWV P-Traps <i>For Work In Restricted Working Space, Add</i>	29.28 8.27	18.38
22 13 16 00-0583	EA		2" Polyvinyl Chloride (PVC) DWV P-Traps <i>For Work In Restricted Working Space, Add</i>	37.62 10.58	23.52
22 13 16 00-0584	EA		3" Polyvinyl Chloride (PVC) DWV P-Traps <i>For Work In Restricted Working Space, Add</i>	59.06 14.22	31.60
22 13 16 00-0585	EA		4" Polyvinyl Chloride (PVC) DWV P-Traps <i>For Work In Restricted Working Space, Add</i>	82.88 16.54	36.75
22 13 16 00-0586	EA		6" Polyvinyl Chloride (PVC) DWV P-Traps <i>For Work In Restricted Working Space, Add</i>	120.74 21.50	47.70
22 13 16 00-0587			Polyvinyl Chloride (PVC) DWV Closet Flanges (22 13 16 00-0514)		
22 13 16 00-0588	EA		4" Polyvinyl Chloride (PVC) DWV Closet Flanges <i>For Work In Restricted Working Space, Add</i>	40.04 11.03	24.48
22 13 16 00-0589	EA		4" x 3" Polyvinyl Chloride (PVC) DWV Closet Flanges <i>For Work In Restricted Working Space, Add</i>	36.48 10.25	22.79
22 13 16 00-0590			Polyvinyl Chloride (PVC) DWV Wyes (22 13 16 00-0514)		
22 13 16 00-0591	EA		1-1/2" Polyvinyl Chloride (PVC) DWV Wyes <i>For Work In Restricted Working Space, Add</i>	29.32 8.27	18.38
22 13 16 00-0592	EA		2" Polyvinyl Chloride (PVC) DWV Wyes <i>For Work In Restricted Working Space, Add</i>	37.04 10.58	23.52
22 13 16 00-0593	EA		3" Polyvinyl Chloride (PVC) DWV Wyes <i>For Work In Restricted Working Space, Add</i>	51.40 14.22	31.60
22 13 16 00-0594	EA		4" Polyvinyl Chloride (PVC) DWV Wyes <i>For Work In Restricted Working Space, Add</i>	62.57 16.54	36.75
22 13 16 00-0595	EA		6" Polyvinyl Chloride (PVC) DWV Wyes <i>For Work In Restricted Working Space, Add</i>	104.72 21.50	47.70
22 13 16 00-0596	EA		8" Polyvinyl Chloride (PVC) DWV Wyes <i>For Work In Restricted Working Space, Add</i>	136.76 28.94	64.24
22 13 16 00-0597	EA		10" Polyvinyl Chloride (PVC) DWV Wyes <i>For Work In Restricted Working Space, Add</i>	181.49 38.59	85.63



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 13 16 00-0598 Polyvinyl Chloride (PVC) DWV Reducing Wyes (22 13 16 00-0514)		
22 13 16 00-0599 EA 2" x 1-1/2" x 1-1/2" Polyvinyl Chloride (PVC) DWV Reducing Wyes.....	33.26	20.07
For Work In Restricted Working Space, Add	9.04	
22 13 16 00-0600 EA 2" x 2" x 1-1/2" Polyvinyl Chloride (PVC) DWV Reducing Wyes.....	35.81	21.76
For Work In Restricted Working Space, Add	9.81	
22 13 16 00-0601 EA 3" x 3" x 1-1/2" Polyvinyl Chloride (PVC) DWV Reducing Wyes.....	45.67	27.20
For Work In Restricted Working Space, Add	12.24	
22 13 16 00-0602 EA 3" x 3" x 2" Polyvinyl Chloride (PVC) DWV Reducing Wyes.....	46.46	28.88
For Work In Restricted Working Space, Add	13.01	
22 13 16 00-0603 EA 4" x 4" x 1-1/2" Polyvinyl Chloride (PVC) DWV Reducing Wyes.....	53.68	30.57
For Work In Restricted Working Space, Add	13.78	
22 13 16 00-0604 EA 4" x 4" x 2" Polyvinyl Chloride (PVC) DWV Reducing Wyes.....	54.48	32.34
For Work In Restricted Working Space, Add	14.55	
22 13 16 00-0605 EA 4" x 4" x 3" Polyvinyl Chloride (PVC) DWV Reducing Wyes.....	59.53	34.99
For Work In Restricted Working Space, Add	15.77	
22 13 16 00-0606 EA 6" x 6" x 3" Polyvinyl Chloride (PVC) DWV Reducing Wyes.....	93.56	42.34
For Work In Restricted Working Space, Add	19.07	
22 13 16 00-0607 EA 6" x 6" x 4" Polyvinyl Chloride (PVC) DWV Reducing Wyes.....	104.49	44.02
For Work In Restricted Working Space, Add	19.85	
22 13 16 00-0608 EA 8" x 8" x 4" Polyvinyl Chloride (PVC) DWV Reducing Wyes.....	117.22	55.05
For Work In Restricted Working Space, Add	24.81	
22 13 16 00-0609 EA 8" x 8" x 6" Polyvinyl Chloride (PVC) DWV Reducing Wyes.....	133.39	58.73
For Work In Restricted Working Space, Add	26.46	
22 13 16 00-0610 EA 10" x 10" x 4" Polyvinyl Chloride (PVC) DWV Reducing Wyes.....	143.04	69.31
For Work In Restricted Working Space, Add	31.24	
22 13 16 00-0611 EA 10" x 10" x 6" Polyvinyl Chloride (PVC) DWV Reducing Wyes.....	160.12	72.99
For Work In Restricted Working Space, Add	32.89	
22 13 16 00-0612 EA 10" x 10" x 8" Polyvinyl Chloride (PVC) DWV Reducing Wyes.....	177.63	78.50
For Work In Restricted Working Space, Add	35.37	
22 13 16 00-0613 Polyvinyl Chloride (PVC) DWV Double Wyes (22 13 16 00-0514)		
22 13 16 00-0614 EA 1-1/2" Polyvinyl Chloride (PVC) DWV Double Wyes.....	40.49	24.48
For Work In Restricted Working Space, Add	11.03	
22 13 16 00-0615 EA 2" Polyvinyl Chloride (PVC) DWV Double Wyes.....	51.85	31.31
For Work In Restricted Working Space, Add	14.12	
22 13 16 00-0616 EA 3" Polyvinyl Chloride (PVC) DWV Double Wyes.....	75.62	42.12
For Work In Restricted Working Space, Add	18.96	
22 13 16 00-0617 EA 4" Polyvinyl Chloride (PVC) DWV Double Wyes.....	98.66	48.95
For Work In Restricted Working Space, Add	22.05	
22 13 16 00-0618 EA 6" Polyvinyl Chloride (PVC) DWV Double Wyes.....	152.52	63.65
For Work In Restricted Working Space, Add	28.67	
22 13 16 00-0619 EA 8" Polyvinyl Chloride (PVC) DWV Double Wyes.....	192.93	85.70
For Work In Restricted Working Space, Add	38.59	
22 13 16 00-0620 EA 10" Polyvinyl Chloride (PVC) DWV Double Wyes.....	273.95	114.22
For Work In Restricted Working Space, Add	51.45	
22 13 16 00-0621 Polyvinyl Chloride (PVC) DWV Reducing Double Wyes (22 13 16 00-0514)		
22 13 16 00-0622 EA 2" x 2" x 1-1/2" x 1-1/2" Polyvinyl Chloride (PVC) DWV Double Wyes.....	46.29	27.94
For Work In Restricted Working Space, Add	12.57	
22 13 16 00-0623 EA 3" x 3" x 1-1/2" x 1-1/2" Polyvinyl Chloride (PVC) DWV Double Wyes.....	60.87	33.29
For Work In Restricted Working Space, Add	14.99	
22 13 16 00-0624 EA 3" x 3" x 2" x 2" Polyvinyl Chloride (PVC) DWV Double Wyes.....	64.37	36.75
For Work In Restricted Working Space, Add	16.54	
22 13 16 00-0625 EA 4" x 4" x 2" x 2" Polyvinyl Chloride (PVC) DWV Double Wyes.....	75.35	40.14
For Work In Restricted Working Space, Add	18.08	
22 13 16 00-0626 EA 4" x 4" x 3" x 3" Polyvinyl Chloride (PVC) DWV Double Wyes.....	88.27	45.49
For Work In Restricted Working Space, Add	20.51	
22 13 16 00-0627 EA 6" x 6" x 4" x 4" Polyvinyl Chloride (PVC) DWV Double Wyes.....	117.25	56.30
For Work In Restricted Working Space, Add	25.36	
22 13 16 00-0628 EA 8" x 8" x 4" x 4" Polyvinyl Chloride (PVC) DWV Double Wyes.....	139.16	67.33
For Work In Restricted Working Space, Add	30.32	
22 13 16 00-0629 EA 8" x 8" x 6" x 6" Polyvinyl Chloride (PVC) DWV Double Wyes.....	162.17	74.68
For Work In Restricted Working Space, Add	33.63	
22 13 16 00-0630 EA 10" x 10" x 4" x 4" Polyvinyl Chloride (PVC) DWV Double Wyes.....	175.02	81.59
For Work In Restricted Working Space, Add	36.75	
22 13 16 00-0631 EA 10" x 10" x 6" x 6" Polyvinyl Chloride (PVC) DWV Double Wyes.....	204.18	88.93
For Work In Restricted Working Space, Add	40.06	
22 13 16 00-0632 EA 10" x 10" x 8" x 8" Polyvinyl Chloride (PVC) DWV Double Wyes.....	236.61	99.96
For Work In Restricted Working Space, Add	45.02	
22 13 16 00-0633 Polyvinyl Chloride (PVC) DWV Combination Wye And 1/8 Bends (22 13 16 00-0514)		
22 13 16 00-0634 EA 1-1/2" Polyvinyl Chloride (PVC) DWV Combination Wye And 1/8 Bends	30.41	18.38
For Work In Restricted Working Space, Add	8.27	
22 13 16 00-0635 EA 2" Polyvinyl Chloride (PVC) DWV Combination Wye And 1/8 Bends	38.75	23.52
For Work In Restricted Working Space, Add	10.58	
22 13 16 00-0636 EA 3" Polyvinyl Chloride (PVC) DWV Combination Wye And 1/8 Bends	56.53	31.60
For Work In Restricted Working Space, Add	14.22	

22	Plumbing
22 10	Plumbing Piping
22 13	Facility Sanitary Sewerage



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 13 16 00-0637	EA		4" Polyvinyl Chloride (PVC) DWV Combination Wye And 1/8 Bends <i>For Work In Restricted Working Space, Add</i>	74.08 16.54	36.75
22 13 16 00-0638			Polyvinyl Chloride (PVC) DWV Reducing Combination Wye And 1/8 Bends <small>(22 13 16 00-0514)</small>		
22 13 16 00-0639	EA		2" x 2" x 1-1/2" Polyvinyl Chloride (PVC) DWV Combination Wye And 1/8 Bends <i>For Work In Restricted Working Space, Add</i>	39.90 9.81	21.76
22 13 16 00-0640	EA		3" x 3" x 1-1/2" Polyvinyl Chloride (PVC) DWV Combination Wye And 1/8 Bends <i>For Work In Restricted Working Space, Add</i>	53.28 12.24	27.20
22 13 16 00-0641	EA		3" x 3" x 2" Polyvinyl Chloride (PVC) DWV Combination Wye And 1/8 Bends <i>For Work In Restricted Working Space, Add</i>	51.18 13.01	28.88
22 13 16 00-0642	EA		4" x 4" x 2" Polyvinyl Chloride (PVC) DWV Combination Wye And 1/8 Bends <i>For Work In Restricted Working Space, Add</i>	65.88 14.55	32.34
22 13 16 00-0643	EA		4" x 4" x 3" Polyvinyl Chloride (PVC) DWV Combination Wye And 1/8 Bends <i>For Work In Restricted Working Space, Add</i>	71.37 15.77	34.99
22 13 16 00-0644			Polyvinyl Chloride (PVC) DWV Double Combination Wye And 1/8 Bends <small>(22 13 16 00-0514)</small>		
22 13 16 00-0645	EA		1-1/2" Polyvinyl Chloride (PVC) DWV Double Combination Wye And 1/8 Bends..... <i>For Work In Restricted Working Space, Add</i>	41.34 11.03	24.48
22 13 16 00-0646	EA		2" Polyvinyl Chloride (PVC) DWV Double Combination Wye And 1/8 Bends <i>For Work In Restricted Working Space, Add</i>	51.95 14.12	31.31
22 13 16 00-0647	EA		3" Polyvinyl Chloride (PVC) DWV Double Combination Wye And 1/8 Bends <i>For Work In Restricted Working Space, Add</i>	71.72 18.96	42.12
22 13 16 00-0648	EA		4" Polyvinyl Chloride (PVC) DWV Double Combination Wye And 1/8 Bends <i>For Work In Restricted Working Space, Add</i>	118.34 22.05	48.95
22 13 16 00-0649	EA		6" Polyvinyl Chloride (PVC) DWV Double Combination Wye And 1/8 Bends <i>For Work In Restricted Working Space, Add</i>	258.34 28.67	63.65
22 13 16 00-0650			Polyvinyl Chloride (PVC) DWV Reducing Double Combination Wye And 1/8 Bends <small>(22 13 16 00-0514)</small>		
22 13 16 00-0651	EA		2" x 2" x 1-1/2" x 1-1/2" Polyvinyl Chloride (PVC) DWV Double Combination Wye And 1/8 Bends <i>For Work In Restricted Working Space, Add</i>	56.91 12.57	27.94
22 13 16 00-0652	EA		3" x 3" x 2" x 2" Polyvinyl Chloride (PVC) DWV Double Combination Wye And 1/8 Bends <i>For Work In Restricted Working Space, Add</i>	80.55 16.54	36.75
22 13 16 00-0653	EA		4" x 4" x 2" x 2" Polyvinyl Chloride (PVC) DWV Double Combination Wye And 1/8 Bends <i>For Work In Restricted Working Space, Add</i>	107.65 18.08	40.14
22 13 16 00-0654	EA		4" x 4" x 3" x 3" Polyvinyl Chloride (PVC) DWV Double Combination Wye And 1/8 Bends <i>For Work In Restricted Working Space, Add</i>	109.81 20.51	45.49
22 13 16 00-0655	EA		6" x 6" x 4" x 4" Polyvinyl Chloride (PVC) DWV Double Combination Wye And 1/8 Bends <i>For Work In Restricted Working Space, Add</i>	190.88 25.36	56.30
22 13 16 00-0656			Polyvinyl Chloride (PVC) DWV Cleanout Tees With Plug <small>(22 13 16 00-0514)</small>		
22 13 16 00-0657	EA		2" Polyvinyl Chloride (PVC) DWV Cleanout Tees With Plug..... <i>For Work In Restricted Working Space, Add</i>	43.63 10.58	23.52
22 13 16 00-0658	EA		3" Polyvinyl Chloride (PVC) DWV Cleanout Tees With Plug..... <i>For Work In Restricted Working Space, Add</i>	63.37 14.22	31.60
22 13 16 00-0659	EA		4" Polyvinyl Chloride (PVC) DWV Cleanout Tees With Plug..... <i>For Work In Restricted Working Space, Add</i>	82.89 16.54	36.75
22 13 16 00-0660	EA		6" Polyvinyl Chloride (PVC) DWV Cleanout Tees With Plug..... <i>For Work In Restricted Working Space, Add</i>	152.32 21.50	47.70
22 13 16 00-0661	EA		8" Polyvinyl Chloride (PVC) DWV Cleanout Tees With Plug..... <i>For Work In Restricted Working Space, Add</i>	196.89 28.94	64.24
22 13 16 00-0662	EA		10" Polyvinyl Chloride (PVC) DWV Cleanout Tees With Plug..... <i>For Work In Restricted Working Space, Add</i>	261.81 38.59	85.63
22 13 16 00-0663			Polyvinyl Chloride (PVC) DWV Cleanout Adapters With Plug <small>(22 13 16 00-0514)</small>		
22 13 16 00-0664	EA		1-1/2" Polyvinyl Chloride (PVC) DWV Cleanout Adapters With Plug..... <i>For Work In Restricted Working Space, Add</i>	19.82 5.51	12.27
22 13 16 00-0665	EA		2" Polyvinyl Chloride (PVC) DWV Cleanout Adapters With Plug <i>For Work In Restricted Working Space, Add</i>	25.85 7.06	15.66
22 13 16 00-0666	EA		3" Polyvinyl Chloride (PVC) DWV Cleanout Adapters With Plug <i>For Work In Restricted Working Space, Add</i>	35.19 9.48	21.02
22 13 16 00-0667	EA		4" Polyvinyl Chloride (PVC) DWV Cleanout Adapters With Plug <i>For Work In Restricted Working Space, Add</i>	45.18 11.03	24.48
22 13 16 00-0668	EA		6" Polyvinyl Chloride (PVC) DWV Cleanout Adapters With Plug <i>For Work In Restricted Working Space, Add</i>	70.90 14.33	31.82
22 13 16 00-0669	EA		8" Polyvinyl Chloride (PVC) DWV Cleanout Adapters With Plug <i>For Work In Restricted Working Space, Add</i>	120.70 19.29	42.86
22 13 16 00-0670	EA		10" Polyvinyl Chloride (PVC) DWV Cleanout Adapters With Plug <i>For Work In Restricted Working Space, Add</i>	192.98 25.71	57.11
22 13 16 00-0671			Polyvinyl Chloride (PVC) Couplings <small>(22 13 16 00-0514)</small>		
22 13 16 00-0672	EA		1-1/2" Polyvinyl Chloride (PVC) Couplings <i>For Work In Restricted Working Space, Add</i>	18.81 5.51	12.27
22 13 16 00-0673	EA		2" Polyvinyl Chloride (PVC) Couplings..... <i>For Work In Restricted Working Space, Add</i>	24.00 7.06	15.66



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 13 16 00-0674	EA		3" Polyvinyl Chloride (PVC) Couplings <i>For Work In Restricted Working Space, Add</i>	32.83 9.48	21.02
22 13 16 00-0675	EA		4" Polyvinyl Chloride (PVC) Couplings <i>For Work In Restricted Working Space, Add</i>	38.77 11.03	24.48
22 13 16 00-0676	EA		6" Polyvinyl Chloride (PVC) Couplings <i>For Work In Restricted Working Space, Add</i>	58.92 14.33	31.82
22 13 16 00-0677	EA		8" Polyvinyl Chloride (PVC) Couplings <i>For Work In Restricted Working Space, Add</i>	96.53 19.29	42.86
22 13 16 00-0678	EA		10" Polyvinyl Chloride (PVC) Couplings <i>For Work In Restricted Working Space, Add</i>	135.69 25.73	57.11
22 13 16 00-0679			Polyvinyl Chloride (PVC) Male Adapters <small>(22 13 16 00-0514)</small>		
22 13 16 00-0680	EA		1-1/2" Polyvinyl Chloride (PVC) Male Adapters	9.62	6.10
22 13 16 00-0681	EA		2" Polyvinyl Chloride (PVC) Male Adapters	12.83	7.87
22 13 16 00-0682	EA		3" Polyvinyl Chloride (PVC) Male Adapters	18.76	10.51
22 13 16 00-0683	EA		4" Polyvinyl Chloride (PVC) Male Adapters	25.15	12.27
22 13 16 00-0684			Cut And Prepare Existing Polyvinyl Chloride (PVC) DWV Pipe <small>(22 13 16 00-0488)</small>		
			Note: In place piping.		
22 13 16 00-0685	EA		1-1/2", Cut And Prepare Existing Polyvinyl Chloride (PVC) DWV Pipe.....	5.39	
22 13 16 00-0686	EA		2", Cut And Prepare Existing Polyvinyl Chloride (PVC) DWV Pipe.....	5.93	
22 13 16 00-0687	EA		3", Cut And Prepare Existing Polyvinyl Chloride (PVC) DWV Pipe.....	7.54	
22 13 16 00-0688	EA		4", Cut And Prepare Existing Polyvinyl Chloride (PVC) DWV Pipe.....	10.18	
22 13 16 00-0689	EA		6", Cut And Prepare Existing Polyvinyl Chloride (PVC) DWV Pipe.....	14.55	
22 13 16 00-0690	EA		8", Cut And Prepare Existing Polyvinyl Chloride (PVC) DWV Pipe.....	19.40	
22 13 16 00-0691	EA		10", Cut And Prepare Existing Polyvinyl Chloride (PVC) DWV Pipe.....	23.72	
22 13 16 00-0692			Acrylonitrile Butadiene Styrene (ABS) Drain-Waste-Vent (DWV) Pipe And Fittings <small>(22 13 16)</small>		
			Note: Aboveground installation.		
22 13 16 00-0693			Schedule 40 Acrylonitrile Butadiene Styrene (ABS) DWV Pipe Assemblies <small>(22 13 16 00-0692)</small>		
			Note: Includes all hangers and couplings, elbow, tee and reducer fittings. All hangers are complete assemblies installed in accordance with uniform plumbing code. Not for use where detail is available.		
22 13 16 00-0694	LF		1-1/2" Schedule 40 Acrylonitrile Butadiene Styrene (ABS) DWV Pipe Assembly.....	15.34	3.08
			Note: Includes all fittings, couplings and hangers. Fittings are assumed every 10'. Not for use where detail is available.		
			<i>For Work In Restricted Working Space, Add</i>	4.23	
22 13 16 00-0695	LF		2" Schedule 40 Acrylonitrile Butadiene Styrene (ABS) DWV Pipe Assembly	17.00	3.68
			Note: Includes all fittings, couplings and hangers. Fittings are assumed every 10'. Not for use where detail is available.		
			<i>For Work In Restricted Working Space, Add</i>	4.68	
22 13 16 00-0696	LF		3" Schedule 40 Acrylonitrile Butadiene Styrene (ABS) DWV Pipe Assembly	21.92	5.29
			Note: Includes all fittings, couplings and hangers. Fittings are assumed every 10'. Not for use where detail is available.		
			<i>For Work In Restricted Working Space, Add</i>	5.81	
22 13 16 00-0697	LF		4" Schedule 40 Acrylonitrile Butadiene Styrene (ABS) DWV Pipe Assembly	24.73	5.73
			Note: Includes all fittings, couplings and hangers. Fittings are assumed every 10'. Not for use where detail is available.		
			<i>For Work In Restricted Working Space, Add</i>	6.46	
22 13 16 00-0698	LF		6" Schedule 40 Acrylonitrile Butadiene Styrene (ABS) DWV Pipe Assembly	36.33	7.35
			Note: Includes all fittings, couplings and hangers. Fittings are assumed every 10'. Not for use where detail is available.		
			<i>For Work In Restricted Working Space, Add</i>	8.59	
22 13 16 00-0699			Schedule 40 Acrylonitrile Butadiene Styrene (ABS) DWV "Foam-Core" Pipe (ASTM F-628) <small>(22 13 16 00-0692)</small>		
			Note: Excludes fittings or hangers.		
22 13 16 00-0700	LF		1-1/2" Schedule 40 Acrylonitrile Butadiene Styrene (ABS) DWV "Foam-Core" Pipe.....	5.04	3.08
			<i>For Work In Restricted Working Space, Add</i>	1.38	
22 13 16 00-0701	LF		2" Schedule 40 Acrylonitrile Butadiene Styrene (ABS) DWV "Foam-Core" Pipe	6.12	3.68
			<i>For Work In Restricted Working Space, Add</i>	1.65	
22 13 16 00-0702	LF		3" Schedule 40 Acrylonitrile Butadiene Styrene (ABS) DWV "Foam-Core" Pipe	9.17	5.29
			<i>For Work In Restricted Working Space, Add</i>	2.37	
22 13 16 00-0703	LF		4" Schedule 40 Acrylonitrile Butadiene Styrene (ABS) DWV "Foam-Core" Pipe	10.37	5.73
			<i>For Work In Restricted Working Space, Add</i>	2.57	
22 13 16 00-0704	LF		6" Schedule 40 Acrylonitrile Butadiene Styrene (ABS) DWV "Foam-Core" Pipe	14.67	7.35
			<i>For Work In Restricted Working Space, Add</i>	3.30	
22 13 16 00-0705			Acrylonitrile Butadiene Styrene (ABS) DWV Fittings (ASTM D-2661) <small>(22 13 16 00-0692)</small>		
22 13 16 00-0706			Acrylonitrile Butadiene Styrene (ABS) DWV 1/4 Bends <small>(22 13 16 00-0705)</small>		
22 13 16 00-0707	EA		1-1/2" Acrylonitrile Butadiene Styrene (ABS) DWV 1/4 Bends	20.30	12.27
			<i>For Work In Restricted Working Space, Add</i>	5.51	
22 13 16 00-0708	EA		2" Acrylonitrile Butadiene Styrene (ABS) DWV 1/4 Bends.....	26.26	15.66
			<i>For Work In Restricted Working Space, Add</i>	7.06	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 13 16 00-0709	EA		3" Acrylonitrile Butadiene Styrene (ABS) DWV 1/4 Bends..... <i>For Work In Restricted Working Space, Add</i>	40.07 9.48	21.02
22 13 16 00-0710	EA		4" Acrylonitrile Butadiene Styrene (ABS) DWV 1/4 Bends..... <i>For Work In Restricted Working Space, Add</i>	53.34 11.03	24.48
22 13 16 00-0711	EA		6" Acrylonitrile Butadiene Styrene (ABS) DWV 1/4 Bends..... <i>For Work In Restricted Working Space, Add</i>	109.68 14.33	31.82
22 13 16 00-0712			Acrylonitrile Butadiene Styrene (ABS) DWV Long Sweep 1/4 Bends (22 13 16 00-0705)		
22 13 16 00-0713	EA		1-1/2" Acrylonitrile Butadiene Styrene (ABS) DWV Long Sweep 1/4 Bends..... <i>For Work In Restricted Working Space, Add</i>	22.96 5.51	12.27
22 13 16 00-0714	EA		2" Acrylonitrile Butadiene Styrene (ABS) DWV Long Sweep 1/4 Bends..... <i>For Work In Restricted Working Space, Add</i>	28.86 7.06	15.66
22 13 16 00-0715	EA		3" Acrylonitrile Butadiene Styrene (ABS) DWV Long Sweep 1/4 Bends..... <i>For Work In Restricted Working Space, Add</i>	46.52 9.48	21.02
22 13 16 00-0716	EA		4" Acrylonitrile Butadiene Styrene (ABS) DWV Long Sweep 1/4 Bends..... <i>For Work In Restricted Working Space, Add</i>	66.18 11.03	24.48
22 13 16 00-0717			Acrylonitrile Butadiene Styrene (ABS) DWV 1/8 Bends (22 13 16 00-0705)		
22 13 16 00-0718	EA		1-1/2" Acrylonitrile Butadiene Styrene (ABS) DWV 1/8 Bends..... <i>For Work In Restricted Working Space, Add</i>	20.66 5.51	12.27
22 13 16 00-0719	EA		2" Acrylonitrile Butadiene Styrene (ABS) DWV 1/8 Bends..... <i>For Work In Restricted Working Space, Add</i>	26.01 7.06	15.66
22 13 16 00-0720	EA		3" Acrylonitrile Butadiene Styrene (ABS) DWV 1/8 Bends..... <i>For Work In Restricted Working Space, Add</i>	38.74 9.48	21.02
22 13 16 00-0721	EA		4" Acrylonitrile Butadiene Styrene (ABS) DWV 1/8 Bends..... <i>For Work In Restricted Working Space, Add</i>	50.89 11.03	24.48
22 13 16 00-0722	EA		6" Acrylonitrile Butadiene Styrene (ABS) DWV 1/8 Bends..... <i>For Work In Restricted Working Space, Add</i>	112.25 14.33	31.82
22 13 16 00-0723			Acrylonitrile Butadiene Styrene (ABS) DWV Sanitary Tees (22 13 16 00-0705)		
22 13 16 00-0724	EA		1-1/2" Acrylonitrile Butadiene Styrene (ABS) DWV Sanitary Tees..... <i>For Work In Restricted Working Space, Add</i>	30.84 8.27	18.38
22 13 16 00-0725	EA		2" Acrylonitrile Butadiene Styrene (ABS) DWV Sanitary Tees..... <i>For Work In Restricted Working Space, Add</i>	40.20 10.58	23.52
22 13 16 00-0726	EA		3" Acrylonitrile Butadiene Styrene (ABS) DWV Sanitary Tees..... <i>For Work In Restricted Working Space, Add</i>	59.95 14.22	31.60
22 13 16 00-0727	EA		4" Acrylonitrile Butadiene Styrene (ABS) DWV Sanitary Tees..... <i>For Work In Restricted Working Space, Add</i>	79.23 16.54	36.75
22 13 16 00-0728	EA		6" Acrylonitrile Butadiene Styrene (ABS) DWV Sanitary Tees..... <i>For Work In Restricted Working Space, Add</i>	202.31 21.50	47.70
22 13 16 00-0729			Acrylonitrile Butadiene Styrene (ABS) DWV Reducing Sanitary Tees (22 13 16 00-0705)		
22 13 16 00-0730	EA		2" x 1-1/2" x 1-1/2" Acrylonitrile Butadiene Styrene (ABS) DWV Reducing Sanitary Tees..... <i>For Work In Restricted Working Space, Add</i>	35.35 9.04	20.07
22 13 16 00-0731	EA		2" x 1-1/2" x 2" Acrylonitrile Butadiene Styrene (ABS) DWV Reducing Sanitary Tees..... <i>For Work In Restricted Working Space, Add</i>	40.04 9.81	21.76
22 13 16 00-0732	EA		2" x 2" x 1-1/2" Acrylonitrile Butadiene Styrene (ABS) DWV Reducing Sanitary Tees..... <i>For Work In Restricted Working Space, Add</i>	37.43 9.81	21.76
22 13 16 00-0733	EA		3" x 3" x 1-1/2" Acrylonitrile Butadiene Styrene (ABS) DWV Reducing Sanitary Tees..... <i>For Work In Restricted Working Space, Add</i>	50.37 12.24	27.20
22 13 16 00-0734	EA		3" x 3" x 2" Acrylonitrile Butadiene Styrene (ABS) DWV Reducing Sanitary Tees..... <i>For Work In Restricted Working Space, Add</i>	53.04 13.01	28.88
22 13 16 00-0735	EA		4" x 4" x 1-1/2" Acrylonitrile Butadiene Styrene (ABS) DWV Reducing Sanitary Tees..... <i>For Work In Restricted Working Space, Add</i>	80.68 13.78	30.57
22 13 16 00-0736	EA		4" x 4" x 2" Acrylonitrile Butadiene Styrene (ABS) DWV Reducing Sanitary Tees..... <i>For Work In Restricted Working Space, Add</i>	80.94 14.55	32.34
22 13 16 00-0737	EA		4" x 4" x 3" Acrylonitrile Butadiene Styrene (ABS) DWV Reducing Sanitary Tees..... <i>For Work In Restricted Working Space, Add</i>	90.58 15.77	34.99
22 13 16 00-0738	EA		6" x 6" x 4" Acrylonitrile Butadiene Styrene (ABS) DWV Reducing Sanitary Tees..... <i>For Work In Restricted Working Space, Add</i>	212.21 19.85	44.02
22 13 16 00-0739			Acrylonitrile Butadiene Styrene (ABS) DWV Double Sanitary Tees (22 13 16 00-0705)		
22 13 16 00-0740	EA		1-1/2" Acrylonitrile Butadiene Styrene (ABS) DWV Double Sanitary Tees..... <i>For Work In Restricted Working Space, Add</i>	46.70 11.03	24.48
22 13 16 00-0741	EA		2" Acrylonitrile Butadiene Styrene (ABS) DWV Double Sanitary Tees..... <i>For Work In Restricted Working Space, Add</i>	61.57 14.12	31.31
22 13 16 00-0742	EA		3" Acrylonitrile Butadiene Styrene (ABS) DWV Double Sanitary Tees..... <i>For Work In Restricted Working Space, Add</i>	103.99 18.96	42.12
22 13 16 00-0743	EA		4" Acrylonitrile Butadiene Styrene (ABS) DWV Double Sanitary Tees..... <i>For Work In Restricted Working Space, Add</i>	138.85 22.05	48.95
22 13 16 00-0744			Acrylonitrile Butadiene Styrene (ABS) DWV Reducing Double Sanitary Tees (22 13 16 00-0705)		
22 13 16 00-0745	EA		2" x 2" x 1-1/2" x 1-1/2" Acrylonitrile Butadiene Styrene (ABS) DWV Double Sanitary Tees..... <i>For Work In Restricted Working Space, Add</i>	53.18 12.57	27.94



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
	22 13 16 00-0746	EA		3" x 3" x 1-1/2" x 1-1/2" Acrylonitrile Butadiene Styrene (ABS) DWV Double Sanitary Tees..... <i>For Work In Restricted Working Space, Add</i>	70.76 14.99	33.29
	22 13 16 00-0747	EA		3" x 3" x 2" x 2" Acrylonitrile Butadiene Styrene (ABS) DWV Double Sanitary Tees <i>For Work In Restricted Working Space, Add</i>	79.72 16.54	36.75
	22 13 16 00-0748	EA		4" x 4" x 2" x 2" Acrylonitrile Butadiene Styrene (ABS) DWV Double Wyes <i>For Work In Restricted Working Space, Add</i>	114.42 18.08	40.12
	22 13 16 00-0749	EA		4" x 4" x 3" x 3" Acrylonitrile Butadiene Styrene (ABS) DWV Double Sanitary Tees <i>For Work In Restricted Working Space, Add</i>	123.99 20.50	45.49
22 13 16 00-0750	Acrylonitrile Butadiene Styrene (ABS) DWV Wyes (22 13 16 00-0705)					
	22 13 16 00-0751	EA		1-1/2" Acrylonitrile Butadiene Styrene (ABS) DWV Wyes..... <i>For Work In Restricted Working Space, Add</i>	34.15 8.27	18.38
	22 13 16 00-0752	EA		2" Acrylonitrile Butadiene Styrene (ABS) DWV Wyes..... <i>For Work In Restricted Working Space, Add</i>	42.05 10.58	23.52
	22 13 16 00-0753	EA		3" Acrylonitrile Butadiene Styrene (ABS) DWV Wyes..... <i>For Work In Restricted Working Space, Add</i>	62.39 14.22	31.60
	22 13 16 00-0754	EA		4" Acrylonitrile Butadiene Styrene (ABS) DWV Wyes..... <i>For Work In Restricted Working Space, Add</i>	83.05 16.54	36.75
	22 13 16 00-0755	EA		6" Acrylonitrile Butadiene Styrene (ABS) DWV Wyes..... <i>For Work In Restricted Working Space, Add</i>	174.10 21.50	47.70
22 13 16 00-0756	Acrylonitrile Butadiene Styrene (ABS) DWV Reducing Wyes (22 13 16 00-0705)					
	22 13 16 00-0757	EA		2" x 1-1/2" x 1-1/2" Acrylonitrile Butadiene Styrene (ABS) DWV Reducing Wyes <i>For Work In Restricted Working Space, Add</i>	41.89 9.04	20.07
	22 13 16 00-0758	EA		2" x 2" x 1-1/2" Acrylonitrile Butadiene Styrene (ABS) DWV Reducing Wyes..... <i>For Work In Restricted Working Space, Add</i>	44.35 9.81	21.76
	22 13 16 00-0759	EA		3" x 3" x 2" Acrylonitrile Butadiene Styrene (ABS) DWV Reducing Wyes..... <i>For Work In Restricted Working Space, Add</i>	55.01 13.01	28.88
	22 13 16 00-0760	EA		4" x 4" x 2" Acrylonitrile Butadiene Styrene (ABS) DWV Reducing Wyes..... <i>For Work In Restricted Working Space, Add</i>	70.94 14.55	32.34
	22 13 16 00-0761	EA		4" x 4" x 3" Acrylonitrile Butadiene Styrene (ABS) DWV Reducing Wyes..... <i>For Work In Restricted Working Space, Add</i>	78.76 15.77	34.99
	22 13 16 00-0762	EA		6" x 6" x 4" Acrylonitrile Butadiene Styrene (ABS) DWV Reducing Wyes..... <i>For Work In Restricted Working Space, Add</i>	150.78 19.85	44.02
22 13 16 00-0763	Acrylonitrile Butadiene Styrene (ABS) DWV Double Wyes (22 13 16 00-0705)					
	22 13 16 00-0764	EA		1-1/2" Acrylonitrile Butadiene Styrene (ABS) DWV Double Wyes <i>For Work In Restricted Working Space, Add</i>	50.77 11.03	24.48
	22 13 16 00-0765	EA		2" Acrylonitrile Butadiene Styrene (ABS) DWV Double Wyes <i>For Work In Restricted Working Space, Add</i>	65.09 14.12	31.31
	22 13 16 00-0766	EA		3" Acrylonitrile Butadiene Styrene (ABS) DWV Double Wyes <i>For Work In Restricted Working Space, Add</i>	109.84 18.96	42.12
	22 13 16 00-0767	EA		4" Acrylonitrile Butadiene Styrene (ABS) DWV Double Wyes <i>For Work In Restricted Working Space, Add</i>	167.97 22.05	48.95
22 13 16 00-0768	Acrylonitrile Butadiene Styrene (ABS) DWV Reducing Double Wyes (22 13 16 00-0705)					
	22 13 16 00-0769	EA		2" x 2" x 1-1/2" x 1-1/2" Acrylonitrile Butadiene Styrene (ABS) DWV Double Wyes <i>For Work In Restricted Working Space, Add</i>	58.38 12.57	27.94
	22 13 16 00-0770	EA		3" x 3" x 1-1/2" x 1-1/2" Acrylonitrile Butadiene Styrene (ABS) DWV Double Wyes..... <i>For Work In Restricted Working Space, Add</i>	82.87 14.99	33.29
	22 13 16 00-0771	EA		3" x 3" x 2" x 2" Acrylonitrile Butadiene Styrene (ABS) DWV Double Wyes <i>For Work In Restricted Working Space, Add</i>	89.75 16.54	36.75
	22 13 16 00-0772	EA		4" x 4" x 2" x 2" Acrylonitrile Butadiene Styrene (ABS) DWV Double Wyes <i>For Work In Restricted Working Space, Add</i>	116.91 18.08	40.14
	22 13 16 00-0773	EA		4" x 4" x 3" x 3" Acrylonitrile Butadiene Styrene (ABS) DWV Double Wyes <i>For Work In Restricted Working Space, Add</i>	143.16 20.51	45.49
22 13 16 00-0774	Acrylonitrile Butadiene Styrene (ABS) DWV Combination Wye And 1/8 Bend (22 13 16 00-0705)					
	22 13 16 00-0775	EA		1-1/2" Acrylonitrile Butadiene Styrene (ABS) DWV Combination Wye And 1/8 Bends..... <i>For Work In Restricted Working Space, Add</i>	38.09 8.27	18.38
	22 13 16 00-0776	EA		2" Acrylonitrile Butadiene Styrene (ABS) DWV Combination Wye And 1/8 Bends..... <i>For Work In Restricted Working Space, Add</i>	48.97 10.58	23.52
	22 13 16 00-0777	EA		3" Acrylonitrile Butadiene Styrene (ABS) DWV Combination Wye And 1/8 Bends <i>For Work In Restricted Working Space, Add</i>	69.96 14.22	31.60
	22 13 16 00-0778	EA		4" Acrylonitrile Butadiene Styrene (ABS) DWV Combination Wye And 1/8 Bends <i>For Work In Restricted Working Space, Add</i>	99.39 16.54	36.74
22 13 16 00-0779	Acrylonitrile Butadiene Styrene (ABS) DWV Reducing Combination Wye And 1/8 Bend (22 13 16 00-0705)					
	22 13 16 00-0780	EA		2" x 2" x 1-1/2" Acrylonitrile Butadiene Styrene (ABS) DWV Combination Wye And 1/8 Bends..... <i>For Work In Restricted Working Space, Add</i>	43.79 9.81	21.76
	22 13 16 00-0781	EA		3" x 3" x 1-1/2" Acrylonitrile Butadiene Styrene (ABS) DWV Combination Wye And 1/8 Bends..... <i>For Work In Restricted Working Space, Add</i>	67.04 12.24	27.20

22	Plumbing
22 10	Plumbing Piping
22 13	Facility Sanitary Sewerage



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 13 16 00-0782	EA		3" x 3" x 2" Acrylonitrile Butadiene Styrene (ABS) DWV Combination Wye And 1/8 Bends <i>For Work In Restricted Working Space, Add</i>	59.77 13.01	28.88
22 13 16 00-0783	EA		4" x 4" x 2" Acrylonitrile Butadiene Styrene (ABS) DWV Combination Wye And 1/8 Bends <i>For Work In Restricted Working Space, Add</i>	85.05 14.55	32.34
22 13 16 00-0784	EA		4" x 4" x 3" Acrylonitrile Butadiene Styrene (ABS) DWV Combination Wye And 1/8 Bends <i>For Work In Restricted Working Space, Add</i>	92.12 15.77	34.99
22 13 16 00-0785			Acrylonitrile Butadiene Styrene (ABS) DWV Double Combination Wye And 1/8 Bend <small>(22 13 16 00-0705)</small>		
22 13 16 00-0786	EA		2" Acrylonitrile Butadiene Styrene (ABS) DWV Double Combination Wye And 1/8 Bends <i>For Work In Restricted Working Space, Add</i>	71.83 14.12	31.31
22 13 16 00-0787	EA		3" Acrylonitrile Butadiene Styrene (ABS) DWV Double Combination Wye And 1/8 Bends <i>For Work In Restricted Working Space, Add</i>	120.36 18.96	42.12
22 13 16 00-0788			Acrylonitrile Butadiene Styrene (ABS) DWV Reducing Double Combination Wye And 1/8 Bend <small>(22 13 16 00-0705)</small>		
22 13 16 00-0789	EA		2" x 2" x 1-1/2" x 1-1/2" Acrylonitrile Butadiene Styrene (ABS) DWV Double Combination Wye And 1/8 Bends <i>For Work In Restricted Working Space, Add</i>	61.84 12.57	27.94
22 13 16 00-0790	EA		3" x 3" x 2" x 2" Acrylonitrile Butadiene Styrene (ABS) DWV Double Combination Wye And 1/8 Bends <i>For Work In Restricted Working Space, Add</i>	111.31 16.54	36.75
22 13 16 00-0791			Acrylonitrile Butadiene Styrene (ABS) DWV Cleanout Tees With Plug <small>(22 13 16 00-0705)</small>		
22 13 16 00-0792	EA		1-1/2" Acrylonitrile Butadiene Styrene (ABS) DWV Cleanout Tees With Plug <i>For Work In Restricted Working Space, Add</i>	39.95 8.27	18.38
22 13 16 00-0793	EA		2" Acrylonitrile Butadiene Styrene (ABS) DWV Cleanout Tees With Plug <i>For Work In Restricted Working Space, Add</i>	50.82 10.58	23.52
22 13 16 00-0794	EA		3" Acrylonitrile Butadiene Styrene (ABS) DWV Cleanout Tees With Plug <i>For Work In Restricted Working Space, Add</i>	74.11 14.22	31.60
22 13 16 00-0795	EA		4" Acrylonitrile Butadiene Styrene (ABS) DWV Cleanout Tees With Plug <i>For Work In Restricted Working Space, Add</i>	105.04 16.54	36.75
22 13 16 00-0796			Acrylonitrile Butadiene Styrene (ABS) DWV Cleanout Adapters With Plug <small>(22 13 16 00-0705)</small>		
22 13 16 00-0797	EA		1-1/2" Acrylonitrile Butadiene Styrene (ABS) DWV Cleanout Adapters With Plug <i>For Work In Restricted Working Space, Add</i>	22.63 5.51	12.27
22 13 16 00-0798	EA		2" Acrylonitrile Butadiene Styrene (ABS) DWV Cleanout Adapters With Plug <i>For Work In Restricted Working Space, Add</i>	30.37 7.06	15.66
22 13 16 00-0799	EA		3" Acrylonitrile Butadiene Styrene (ABS) DWV Cleanout Adapters With Plug <i>For Work In Restricted Working Space, Add</i>	42.13 9.48	21.02
22 13 16 00-0800	EA		4" Acrylonitrile Butadiene Styrene (ABS) DWV Cleanout Adapters With Plug <i>For Work In Restricted Working Space, Add</i>	61.55 11.03	24.48
22 13 16 00-0801	EA		6" Acrylonitrile Butadiene Styrene (ABS) DWV Cleanout Adapters With Plug <i>For Work In Restricted Working Space, Add</i>	115.85 14.33	31.82
22 13 16 00-0802			Acrylonitrile Butadiene Styrene (ABS) DWV Couplings <small>(22 13 16 00-0705)</small>		
22 13 16 00-0803	EA		1-1/2" Acrylonitrile Butadiene Styrene (ABS) DWV Couplings <i>For Work In Restricted Working Space, Add</i>	19.84 5.51	12.27
22 13 16 00-0804	EA		2" Acrylonitrile Butadiene Styrene (ABS) DWV Couplings <i>For Work In Restricted Working Space, Add</i>	25.06 7.06	15.66
22 13 16 00-0805	EA		3" Acrylonitrile Butadiene Styrene (ABS) DWV Couplings <i>For Work In Restricted Working Space, Add</i>	35.80 9.48	21.02
22 13 16 00-0806	EA		4" Acrylonitrile Butadiene Styrene (ABS) DWV Couplings <i>For Work In Restricted Working Space, Add</i>	43.67 11.03	24.48
22 13 16 00-0807	EA		6" Acrylonitrile Butadiene Styrene (ABS) DWV Couplings <i>For Work In Restricted Working Space, Add</i>	81.98 14.33	31.82
22 13 16 00-0808			Acrylonitrile Butadiene Styrene (ABS) DWV Reducers <small>(22 13 16 00-0705)</small>		
22 13 16 00-0809	EA		2" x 1-1/2" Acrylonitrile Butadiene Styrene (ABS) DWV Reducers <i>For Work In Restricted Working Space, Add</i>	24.65 6.28	13.96
22 13 16 00-0810	EA		3" x 1-1/2" Acrylonitrile Butadiene Styrene (ABS) DWV Reducers <i>For Work In Restricted Working Space, Add</i>	36.75 7.50	16.61
22 13 16 00-0811	EA		3" x 2" Acrylonitrile Butadiene Styrene (ABS) DWV Reducers <i>For Work In Restricted Working Space, Add</i>	37.42 8.27	18.38
22 13 16 00-0812	EA		4" x 2" Acrylonitrile Butadiene Styrene (ABS) DWV Reducers <i>For Work In Restricted Working Space, Add</i>	49.59 9.04	20.07
22 13 16 00-0813	EA		4" x 3" Acrylonitrile Butadiene Styrene (ABS) DWV Reducers <i>For Work In Restricted Working Space, Add</i>	54.54 10.25	22.79
22 13 16 00-0814			Acrylonitrile Butadiene Styrene (ABS) DWV P-Traps <small>(22 13 16 00-0705)</small>		
22 13 16 00-0815	EA		1-1/2" Acrylonitrile Butadiene Styrene (ABS) DWV P-Traps <i>For Work In Restricted Working Space, Add</i>	34.75 8.27	18.38
22 13 16 00-0816	EA		2" Acrylonitrile Butadiene Styrene (ABS) DWV P-Traps <i>For Work In Restricted Working Space, Add</i>	46.92 10.58	23.52



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 13 16 00-0817 EA 3" Acrylonitrile Butadiene Styrene (ABS) DWV P-Traps..... <i>For Work In Restricted Working Space, Add</i>	100.75 14.22	31.60
22 13 16 00-0818 EA 4" Acrylonitrile Butadiene Styrene (ABS) DWV P-Traps..... <i>For Work In Restricted Working Space, Add</i>	164.40 16.54	36.75
22 13 16 00-0819 Acrylonitrile Butadiene Styrene (ABS) DWV Closet Flanges <small>(22 13 16 00-0705)</small>		
22 13 16 00-0820 EA 4" Acrylonitrile Butadiene Styrene (ABS) DWV Closet Flanges..... <i>For Work In Restricted Working Space, Add</i>	46.79 11.03	24.48
22 13 16 00-0821 EA 4" x 3" Acrylonitrile Butadiene Styrene (ABS) DWV Closet Flanges..... <i>For Work In Restricted Working Space, Add</i>	43.60 10.25	22.79
22 13 16 00-0822 Acrylonitrile Butadiene Styrene (ABS) DWV Male Adapters <small>(22 13 16 00-0705)</small>		
22 13 16 00-0823 EA 1-1/2" Acrylonitrile Butadiene Styrene (ABS) DWV Male Adapters <i>For Work In Restricted Working Space, Add</i>	11.06 2.76	6.10
22 13 16 00-0824 EA 2" Acrylonitrile Butadiene Styrene (ABS) DWV Male Adapters..... <i>For Work In Restricted Working Space, Add</i>	15.07 3.53	7.87
22 13 16 00-0825 EA 3" Acrylonitrile Butadiene Styrene (ABS) DWV Male Adapters..... <i>For Work In Restricted Working Space, Add</i>	25.46 4.74	10.51
22 13 16 00-0826 EA 4" Acrylonitrile Butadiene Styrene (ABS) DWV Male Adapters..... <i>For Work In Restricted Working Space, Add</i>	39.72 5.51	12.27
22 13 16 00-0827 Acrylonitrile Butadiene Styrene (ABS) DWV Flush Bushings <small>(22 13 16 00-0705)</small>		
22 13 16 00-0828 EA 2" x 1-1/2" Acrylonitrile Butadiene Styrene (ABS) DWV Flush Bushing..... <i>For Work In Restricted Working Space, Add</i>	22.48 6.28	13.96
22 13 16 00-0829 EA 3" x 1-1/2" Acrylonitrile Butadiene Styrene (ABS) DWV Flush Bushing..... <i>For Work In Restricted Working Space, Add</i>	33.32 7.50	16.61
22 13 16 00-0830 EA 3" x 2" Acrylonitrile Butadiene Styrene (ABS) DWV Flush Bushing..... <i>For Work In Restricted Working Space, Add</i>	32.85 8.27	18.38
22 13 16 00-0831 EA 4" x 2" Acrylonitrile Butadiene Styrene (ABS) DWV Flush Bushing..... <i>For Work In Restricted Working Space, Add</i>	49.32 9.04	20.07
22 13 16 00-0832 EA 4" x 3" Acrylonitrile Butadiene Styrene (ABS) DWV Flush Bushing..... <i>For Work In Restricted Working Space, Add</i>	45.30 10.25	22.79
22 13 16 00-0833 EA 6" x 4" Acrylonitrile Butadiene Styrene (ABS) DWV Flush Bushing..... <i>For Work In Restricted Working Space, Add</i>	85.86 12.68	28.14
22 13 16 00-0834 Acrylonitrile Butadiene Styrene (ABS) To Polyvinyl Chloride (PVC) Flexible Couplings <small>(22 13 16 00-0705)</small>		
22 13 16 00-0835 EA 1-1/2" x 1-1/2" Acrylonitrile Butadiene Styrene (ABS) To Polyvinyl Chloride (PVC) Flexible Coupling..... <i>For Work In Restricted Working Space, Add</i>	25.46 5.51	12.27
22 13 16 00-0836 EA 2" x 2" Acrylonitrile Butadiene Styrene (ABS) To Polyvinyl Chloride (PVC) Flexible Coupling..... <i>For Work In Restricted Working Space, Add</i>	31.07 7.06	15.66
22 13 16 00-0837 EA 3" x 3" Acrylonitrile Butadiene Styrene (ABS) To Polyvinyl Chloride (PVC) Flexible Coupling..... <i>For Work In Restricted Working Space, Add</i>	39.62 9.48	21.02
22 13 16 00-0838 EA 4" x 4" Acrylonitrile Butadiene Styrene (ABS) To Polyvinyl Chloride (PVC) Flexible Coupling..... <i>For Work In Restricted Working Space, Add</i>	45.24 11.03	24.48
22 13 16 00-0839 Cut And Prepare Existing Acrylonitrile Butadiene Styrene (ABS) DWV Pipe <small>(22 13 16 00-0692)</small>		
Note: In place piping.		
22 13 16 00-0840 EA 1-1/2", Cut And Prepare Existing Acrylonitrile Butadiene Styrene (ABS) DWV Pipe.....	5.39	
22 13 16 00-0841 EA 2", Cut And Prepare Existing Acrylonitrile Butadiene Styrene (ABS) DWV Pipe.....	5.93	
22 13 16 00-0842 EA 3", Cut And Prepare Existing Acrylonitrile Butadiene Styrene (ABS) DWV Pipe.....	7.54	
22 13 16 00-0843 EA 4", Cut And Prepare Existing Acrylonitrile Butadiene Styrene (ABS) DWV Pipe.....	10.18	
22 13 16 00-0844 EA 6", Cut And Prepare Existing Acrylonitrile Butadiene Styrene (ABS) DWV Pipe.....	14.55	
22 13 16 00-0845 Elastomeric Polyvinyl Chloride (PVC) Flexible Pipe Couplings <small>(22 13 16)</small>		
22 13 16 00-0846 Cast Iron/Plastic To Cast Iron/Plastic, Elastomeric Polyvinyl Chloride (PVC) Flexible Pipe Couplings <small>(22 13 16 00-0845)</small>		
Note: For cast iron or plastic to cast iron or plastic pipe (Cast Iron/Plastic To Cast Iron/Plastic). Includes stainless steel clamps. Fernco 1056.		
22 13 16 00-0847 EA 1-1/4" Cast Iron/Plastic To Cast Iron/Plastic, Elastomeric Polyvinyl Chloride (PVC) Flexible Pipe Coupling.....	9.71	3.19
22 13 16 00-0848 EA 1-1/2" Cast Iron/Plastic To Cast Iron/Plastic, Elastomeric Polyvinyl Chloride (PVC) Flexible Pipe Coupling.....	9.83	3.39
22 13 16 00-0849 EA 2" Cast Iron/Plastic To Cast Iron/Plastic, Elastomeric Polyvinyl Chloride (PVC) Flexible Pipe Coupling.....	10.35	3.59
22 13 16 00-0850 EA 3" Cast Iron/Plastic To Cast Iron/Plastic, Elastomeric Polyvinyl Chloride (PVC) Flexible Pipe Coupling.....	11.85	3.80
22 13 16 00-0851 EA 4" Cast Iron/Plastic To Cast Iron/Plastic, Elastomeric Polyvinyl Chloride (PVC) Flexible Pipe Coupling.....	13.32	3.99
22 13 16 00-0852 EA 5" Cast Iron/Plastic To Cast Iron/Plastic, Elastomeric Polyvinyl Chloride (PVC) Flexible Pipe Coupling.....	16.76	4.19
22 13 16 00-0853 EA 6" Cast Iron/Plastic To Cast Iron/Plastic, Elastomeric Polyvinyl Chloride (PVC) Flexible Pipe Coupling.....	20.20	4.39
22 13 16 00-0854 EA 8" Cast Iron/Plastic To Cast Iron/Plastic, Elastomeric Polyvinyl Chloride (PVC) Flexible Pipe Coupling.....	27.16	4.79
22 13 16 00-0855 EA 10" Cast Iron/Plastic To Cast Iron/Plastic, Elastomeric Polyvinyl Chloride (PVC) Flexible Pipe Coupling.....	35.61	5.59
22 13 16 00-0856 Cast Iron/Plastic To Cast Iron/Plastic, Elastomeric Polyvinyl Chloride (PVC) Flexible Reducing Pipe Couplings <small>(22 13 16 00-0845)</small>		
Note: For cast iron or plastic to cast iron or plastic pipe (Cast Iron/Plastic To Cast Iron/Plastic). Includes stainless steel clamps. Fernco 1056.		

22	Plumbing
22 10	Plumbing Piping
22 13	Facility Sanitary Sewerage



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 13 16 00-0857 EA 1-1/2" x 1-1/4" Cast Iron/Plastic To Cast Iron/Plastic, Elastomeric Polyvinyl Chloride (PVC) Flexible Reducing Pipe Coupling	10.35	3.39
22 13 16 00-0858 EA 2" x 1-1/2" Cast Iron/Plastic To Cast Iron/Plastic, Elastomeric Polyvinyl Chloride (PVC) Flexible Reducing Pipe Coupling	10.53	3.59
22 13 16 00-0859 EA 3" x 1-1/2" Cast Iron/Plastic To Cast Iron/Plastic, Elastomeric Polyvinyl Chloride (PVC) Flexible Reducing Pipe Coupling	13.82	3.80
22 13 16 00-0860 EA 3" x 2" Cast Iron/Plastic To Cast Iron/Plastic, Elastomeric Polyvinyl Chloride (PVC) Flexible Reducing Pipe Coupling	12.36	3.80
22 13 16 00-0861 EA 4" x 1-1/2" Cast Iron/Plastic To Cast Iron/Plastic, Elastomeric Polyvinyl Chloride (PVC) Flexible Reducing Pipe Coupling	17.08	3.99
22 13 16 00-0862 EA 4" x 2" Cast Iron/Plastic To Cast Iron/Plastic, Elastomeric Polyvinyl Chloride (PVC) Flexible Reducing Pipe Coupling	16.33	3.99
22 13 16 00-0863 EA 4" x 3" Cast Iron/Plastic To Cast Iron/Plastic, Elastomeric Polyvinyl Chloride (PVC) Flexible Reducing Pipe Coupling	14.95	3.99
22 13 16 00-0864 EA 5" x 3" Cast Iron/Plastic To Cast Iron/Plastic, Elastomeric Polyvinyl Chloride (PVC) Flexible Reducing Pipe Coupling	21.78	4.19
22 13 16 00-0865 EA 5" x 4" Cast Iron/Plastic To Cast Iron/Plastic, Elastomeric Polyvinyl Chloride (PVC) Flexible Reducing Pipe Coupling	19.66	4.19
22 13 16 00-0866 EA 6" x 3" Cast Iron/Plastic To Cast Iron/Plastic, Elastomeric Polyvinyl Chloride (PVC) Flexible Reducing Pipe Coupling	26.99	4.39
22 13 16 00-0867 EA 6" x 4" Cast Iron/Plastic To Cast Iron/Plastic, Elastomeric Polyvinyl Chloride (PVC) Flexible Reducing Pipe Coupling	23.83	4.39
22 13 16 00-0868 EA 6" x 5" Cast Iron/Plastic To Cast Iron/Plastic, Elastomeric Polyvinyl Chloride (PVC) Flexible Reducing Pipe Coupling	24.71	4.39
22 13 16 00-0869 EA 8" x 4" Cast Iron/Plastic To Cast Iron/Plastic, Elastomeric Polyvinyl Chloride (PVC) Flexible Reducing Pipe Coupling	48.55	7.98
22 13 16 00-0870 EA 8" x 6" Cast Iron/Plastic To Cast Iron/Plastic, Elastomeric Polyvinyl Chloride (PVC) Flexible Reducing Pipe Coupling	39.77	7.98
22 13 16 00-0871 EA 10" x 8" Cast Iron/Plastic To Cast Iron/Plastic, Elastomeric Polyvinyl Chloride (PVC) Flexible Reducing Pipe Coupling	50.37	8.98
22 13 16 00-0872 Elastomeric Polyvinyl Chloride (PVC) Flexible Pipe Caps (22 13 16) Note: For cast iron, steel, copper or plastic pipe. Includes stainless steel clamp. Fernco QC.		
22 13 16 00-0873 EA 1-1/2" Elastomeric Polyvinyl Chloride (PVC) Flexible Pipe Cap.....	35.70	21.56
22 13 16 00-0874 EA 2" Elastomeric Polyvinyl Chloride (PVC) Flexible Pipe Cap.....	38.34	22.92
22 13 16 00-0875 EA 3" Elastomeric Polyvinyl Chloride (PVC) Flexible Pipe Cap.....	44.46	26.27
22 13 16 00-0876 EA 4" Elastomeric Polyvinyl Chloride (PVC) Flexible Pipe Cap.....	58.64	34.73
22 13 16 00-0877 EA 5" Elastomeric Polyvinyl Chloride (PVC) Flexible Pipe Cap.....	70.32	41.52
22 13 16 00-0878 EA 6" Elastomeric Polyvinyl Chloride (PVC) Flexible Pipe Cap.....	80.93	47.91
22 13 16 00-0879 EA 8" Elastomeric Polyvinyl Chloride (PVC) Flexible Pipe Cap.....	109.36	60.69
22 13 16 00-0880 Cast Iron Vent Stack Flashing Sleeves With Caulking Recess (22 13 16) Note: Josam 26450 Series.		
22 13 16 00-0881 EA 1-1/2" Cast Iron Vent Stack Flashing Sleeves With Caulking Recess	53.39	16.54
22 13 16 00-0882 EA 2" Cast Iron Vent Stack Flashing Sleeves With Caulking Recess.....	57.07	18.38
22 13 16 00-0883 EA 3" Cast Iron Vent Stack Flashing Sleeves With Caulking Recess.....	82.62	23.89
22 13 16 00-0884 EA 4" Cast Iron Vent Stack Flashing Sleeves With Caulking Recess.....	96.50	27.56
22 13 16 00-0885 EA 5" Cast Iron Vent Stack Flashing Sleeves With Caulking Recess.....	111.83	31.24
22 13 16 00-0886 EA 6" Cast Iron Vent Stack Flashing Sleeves With Caulking Recess.....	174.33	34.92
22 13 16 00-0887 Cast Iron Vent Stack Flashing Sleeves With Counterflashing Recess (22 13 16) Note: Josam 26440 Series		
22 13 16 00-0888 EA 1-1/2" Cast Iron Vent Stack Flashing Sleeves With Counterflashing Recess	96.21	16.54
22 13 16 00-0889 EA 2" Cast Iron Vent Stack Flashing Sleeves With Counterflashing Recess	99.89	18.38
22 13 16 00-0890 EA 3" Cast Iron Vent Stack Flashing Sleeves With Counterflashing Recess	120.36	23.89
22 13 16 00-0891 EA 4" Cast Iron Vent Stack Flashing Sleeves With Counterflashing Recess	148.75	27.56
22 13 16 00-0892 EA 5" Cast Iron Vent Stack Flashing Sleeves With Counterflashing Recess	198.20	31.24
22 13 16 00-0893 EA 6" Cast Iron Vent Stack Flashing Sleeves With Counterflashing Recess	205.54	34.92
22 13 16 00-0894 Cast Iron Vandal Proof Hooded Vent Cap (22 13 16) Note: Includes counterflashing collar, deep protective hood and recessed securing screws. Josam 26700 Series.		
22 13 16 00-0895 EA 1-1/2" Cast Iron Vandal Proof Hooded Vent Cap.....	172.41	16.54
22 13 16 00-0896 EA 2" Cast Iron Vandal Proof Hooded Vent Cap.....	176.09	18.38
22 13 16 00-0897 EA 3" Cast Iron Vandal Proof Hooded Vent Cap.....	204.53	23.89
22 13 16 00-0898 EA 4" Cast Iron Vandal Proof Hooded Vent Cap.....	230.76	27.56
22 13 16 00-0899 EA 5" Cast Iron Vandal Proof Hooded Vent Cap.....	268.60	31.24
22 13 16 00-0900 EA 6" Cast Iron Vandal Proof Hooded Vent Cap.....	294.08	34.92
22 13 19 Sanitary Waste Piping Specialties (22 13)		
22 13 19 13 Sanitary Drains (22 13 19)		
22 13 19 13-0001 Round Top Floor Drains (22 13 19 13)		
22 13 19 13-0002 EA 6" Round Top Floor Drain With 1-1/2" Outlet, Bronze Top.....	266.50	79.01
For Vandal Proof Screws, Add	11.00	
For Sediment Bucket, Add	22.50	
For Galvanized Cast Iron Parts, Add	40.00	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 13 19 13-0003 EA 6" Round Top Floor Drain With 2" Outlet, Bronze Top.....	295.31	88.57
<i>For Vandal Proof Screws, Add</i>	11.00	
<i>For Sediment Bucket, Add</i>	22.50	
<i>For Galvanized Cast Iron Parts, Add</i>	40.00	
22 13 19 13-0004 EA 6" Round Top Floor Drain With 3" Outlet, Bronze Top.....	304.50	97.98
<i>For Vandal Proof Screws, Add</i>	11.00	
<i>For Sediment Bucket, Add</i>	22.50	
<i>For Galvanized Cast Iron Parts, Add</i>	40.00	
22 13 19 13-0005 EA 6" Round Top Floor Drain With 4" Outlet, Bronze Top.....	324.68	108.12
<i>For Vandal Proof Screws, Add</i>	11.00	
<i>For Sediment Bucket, Add</i>	22.50	
<i>For Galvanized Cast Iron Parts, Add</i>	40.00	
22 13 19 13-0006 EA 9" Round Top Floor Drain With 2" Outlet, Cast Iron Top.....	280.61	88.57
<i>For Nikaloy Dome Grate, Add</i>	178.50	
<i>For Ductile Iron Grate, Add</i>	48.00	
<i>For Bronze Dome Grate, Add</i>	143.00	
<i>For Vandal Proof Screws, Add</i>	30.50	
<i>For Galvanized Extension Collar, Each 3", Add</i>	117.50	
<i>For Cast Iron Dome Grate, Add</i>	17.00	
<i>For Cast Iron Extension Collar, Each 3" (76 mm), Add</i>	57.50	
<i>For Galvanized Cast Iron Parts, Add</i>	87.50	
22 13 19 13-0007 EA 9" Round Top Floor Drain With 3" Outlet, Cast Iron Top.....	299.50	97.98
<i>For Nikaloy Dome Grate, Add</i>	178.50	
<i>For Ductile Iron Grate, Add</i>	48.00	
<i>For Bronze Dome Grate, Add</i>	143.00	
<i>For Vandal Proof Screws, Add</i>	30.50	
<i>For Galvanized Extension Collar, Each 3", Add</i>	117.50	
<i>For Cast Iron Dome Grate, Add</i>	17.00	
<i>For Cast Iron Extension Collar, Each 3" (76 mm), Add</i>	57.50	
<i>For Galvanized Cast Iron Parts, Add</i>	87.50	
22 13 19 13-0008 EA 9" Round Top Floor Drain With 4" Outlet, Cast Iron Top.....	319.68	108.12
<i>For Nikaloy Dome Grate, Add</i>	178.50	
<i>For Ductile Iron Grate, Add</i>	48.00	
<i>For Bronze Dome Grate, Add</i>	143.00	
<i>For Vandal Proof Screws, Add</i>	30.50	
<i>For Galvanized Extension Collar, Each 3", Add</i>	117.50	
<i>For Cast Iron Dome Grate, Add</i>	17.00	
<i>For Cast Iron Extension Collar, Each 3" (76 mm), Add</i>	57.50	
<i>For Galvanized Cast Iron Parts, Add</i>	87.50	
22 13 19 13-0009 EA 9" Round Top Floor Drain With 2" Outlet, Nikaloy Top.....	383.61	88.57
<i>For Nikaloy Dome Grate, Add</i>	178.50	
<i>For Ductile Iron Grate, Add</i>	48.00	
<i>For Bronze Dome Grate, Add</i>	143.00	
<i>For Vandal Proof Screws, Add</i>	30.50	
<i>For Galvanized Extension Collar, Each 3", Add</i>	117.50	
<i>For Cast Iron Dome Grate, Add</i>	17.00	
<i>For Cast Iron Extension Collar, Each 3" (76 mm), Add</i>	57.50	
<i>For Galvanized Cast Iron Parts, Add</i>	87.50	
22 13 19 13-0010 EA 9" Round Top Floor Drain With 3" Outlet, Nikaloy Top.....	402.50	97.98
<i>For Nikaloy Dome Grate, Add</i>	178.50	
<i>For Ductile Iron Grate, Add</i>	48.00	
<i>For Bronze Dome Grate, Add</i>	143.00	
<i>For Vandal Proof Screws, Add</i>	30.50	
<i>For Galvanized Extension Collar, Each 3", Add</i>	117.50	
<i>For Cast Iron Dome Grate, Add</i>	17.00	
<i>For Cast Iron Extension Collar, Each 3" (76 mm), Add</i>	57.50	
<i>For Galvanized Cast Iron Parts, Add</i>	87.50	
22 13 19 13-0011 EA 9" Round Top Floor Drain With 4" Outlet, Nikaloy Top.....	422.68	108.12
<i>For Nikaloy Dome Grate, Add</i>	178.50	
<i>For Ductile Iron Grate, Add</i>	48.00	
<i>For Bronze Dome Grate, Add</i>	143.00	
<i>For Vandal Proof Screws, Add</i>	30.50	
<i>For Galvanized Extension Collar, Each 3", Add</i>	117.50	
<i>For Cast Iron Dome Grate, Add</i>	17.00	
<i>For Cast Iron Extension Collar, Each 3" (76 mm), Add</i>	57.50	
<i>For Galvanized Cast Iron Parts, Add</i>	87.50	
22 13 19 13-0012 EA 9" Round Top Floor Drain With 2" Outlet, Bronze Top.....	368.61	88.57
<i>For Nikaloy Dome Grate, Add</i>	178.50	
<i>For Ductile Iron Grate, Add</i>	48.00	
<i>For Bronze Dome Grate, Add</i>	143.00	
<i>For Vandal Proof Screws, Add</i>	30.50	
<i>For Galvanized Extension Collar, Each 3", Add</i>	117.50	
<i>For Cast Iron Dome Grate, Add</i>	17.00	
<i>For Cast Iron Extension Collar, Each 3" (76 mm), Add</i>	57.50	
<i>For Galvanized Cast Iron Parts, Add</i>	87.50	
22 13 19 13-0013 EA 9" Round Top Floor Drain With 3" Outlet, Bronze Top.....	387.40	97.98
<i>For Nikaloy Dome Grate, Add</i>	178.50	
<i>For Ductile Iron Grate, Add</i>	48.00	
<i>For Bronze Dome Grate, Add</i>	143.00	
<i>For Vandal Proof Screws, Add</i>	30.50	
<i>For Galvanized Extension Collar, Each 3", Add</i>	117.50	
<i>For Cast Iron Dome Grate, Add</i>	17.00	
<i>For Cast Iron Extension Collar, Each 3" (76 mm), Add</i>	57.50	
<i>For Galvanized Cast Iron Parts, Add</i>	87.50	

22	Plumbing
22 10	Plumbing Piping
22 13	Facility Sanitary Sewerage



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 13 19 13-0014	EA		9" Round Top Floor Drain With 4" Outlet, Bronze Top.....	407.68	108.12
			<i>For Nikaloy Dome Grate, Add</i>	178.50	
			<i>For Ductile Iron Grate, Add</i>	48.00	
			<i>For Bronze Dome Grate, Add</i>	143.00	
			<i>For Vandal Proof Screws, Add</i>	30.50	
			<i>For Galvanized Extension Collar, Each 3", Add</i>	117.50	
			<i>For Cast Iron Dome Grate, Add</i>	17.00	
			<i>For Cast Iron Extension Collar, Each 3" (76 mm), Add</i>	57.50	
			<i>For Galvanized Cast Iron Parts, Add</i>	87.50	
22 13 19 13-0015	EA		12-5/8" Round Top Floor Drain With 2" Outlet, Cast Iron Top	392.52	88.49
			<i>For Galvanized Extension Collar, Each 2", Add</i>	102.50	
			<i>For Nikaloy Dome Grate, Add</i>	255.00	
			<i>For Vandal Proof Screws, Add</i>	30.50	
			<i>For Cast Iron Dome Grate, Add</i>	28.00	
			<i>For Ductile Iron Grate, Add</i>	53.00	
			<i>For Cast Iron Extension Collar, Each 2", Add</i>	51.00	
			<i>For Primer Tap, Add</i>	33.50	
			<i>For Chained Grate, Add</i>	48.50	
22 13 19 13-0016	EA		12-5/8" Round Top Floor Drain With 3" Outlet, Cast Iron Top	411.40	97.98
			<i>For Galvanized Extension Collar, Each 2", Add</i>	102.50	
			<i>For Nikaloy Dome Grate, Add</i>	255.00	
			<i>For Vandal Proof Screws, Add</i>	30.50	
			<i>For Cast Iron Dome Grate, Add</i>	28.00	
			<i>For Ductile Iron Grate, Add</i>	53.00	
			<i>For Cast Iron Extension Collar, Each 2", Add</i>	51.00	
			<i>For Primer Tap, Add</i>	33.50	
			<i>For Chained Grate, Add</i>	48.50	
22 13 19 13-0017	EA		12-5/8" Round Top Floor Drain With 4" Outlet, Cast Iron Top	431.68	108.12
			<i>For Galvanized Extension Collar, Each 2", Add</i>	102.50	
			<i>For Nikaloy Dome Grate, Add</i>	255.00	
			<i>For Vandal Proof Screws, Add</i>	30.50	
			<i>For Cast Iron Dome Grate, Add</i>	28.00	
			<i>For Ductile Iron Grate, Add</i>	53.00	
			<i>For Cast Iron Extension Collar, Each 2", Add</i>	51.00	
			<i>For Primer Tap, Add</i>	33.50	
			<i>For Chained Grate, Add</i>	48.50	
22 13 19 13-0018	EA		12-5/8" Round Top Floor Drain With 2" Outlet, Nikaloy Top	546.52	88.49
			<i>For Galvanized Extension Collar, Each 2", Add</i>	102.50	
			<i>For Nikaloy Dome Grate, Add</i>	255.00	
			<i>For Vandal Proof Screws, Add</i>	30.50	
			<i>For Cast Iron Dome Grate, Add</i>	28.00	
			<i>For Ductile Iron Grate, Add</i>	53.00	
			<i>For Cast Iron Extension Collar, Each 2", Add</i>	51.00	
			<i>For Primer Tap, Add</i>	33.50	
			<i>For Chained Grate, Add</i>	48.50	
22 13 19 13-0019	EA		12-5/8" Round Top Floor Drain With 3" Outlet, Nikaloy Top	565.40	97.98
			<i>For Galvanized Extension Collar, Each 2", Add</i>	102.50	
			<i>For Nikaloy Dome Grate, Add</i>	255.00	
			<i>For Vandal Proof Screws, Add</i>	30.50	
			<i>For Cast Iron Dome Grate, Add</i>	28.00	
			<i>For Ductile Iron Grate, Add</i>	53.00	
			<i>For Cast Iron Extension Collar, Each 2", Add</i>	51.00	
			<i>For Primer Tap, Add</i>	33.50	
			<i>For Chained Grate, Add</i>	48.50	
22 13 19 13-0020	EA		12-5/8" Round Top Floor Drain With 4" Outlet, Nikaloy Top	585.68	108.12
			<i>For Galvanized Extension Collar, Each 2", Add</i>	102.50	
			<i>For Nikaloy Dome Grate, Add</i>	255.00	
			<i>For Vandal Proof Screws, Add</i>	30.50	
			<i>For Cast Iron Dome Grate, Add</i>	28.00	
			<i>For Ductile Iron Grate, Add</i>	53.00	
			<i>For Cast Iron Extension Collar, Each 2", Add</i>	51.00	
			<i>For Primer Tap, Add</i>	33.50	
			<i>For Chained Grate, Add</i>	48.50	
22 13 19 13-0021	EA		12-5/8" Round Top Floor Drain With 2" Outlet, Bronze Top.....	526.02	88.49
			<i>For Galvanized Extension Collar, Each 2", Add</i>	102.50	
			<i>For Nikaloy Dome Grate, Add</i>	255.00	
			<i>For Vandal Proof Screws, Add</i>	30.50	
			<i>For Cast Iron Dome Grate, Add</i>	28.00	
			<i>For Ductile Iron Grate, Add</i>	53.00	
			<i>For Cast Iron Extension Collar, Each 2", Add</i>	51.00	
			<i>For Primer Tap, Add</i>	33.50	
			<i>For Chained Grate, Add</i>	48.50	
22 13 19 13-0022	EA		12-5/8" Round Top Floor Drain With 3" Outlet, Bronze Top.....	544.90	97.98
			<i>For Galvanized Extension Collar, Each 2", Add</i>	102.50	
			<i>For Nikaloy Dome Grate, Add</i>	255.00	
			<i>For Vandal Proof Screws, Add</i>	30.50	
			<i>For Cast Iron Dome Grate, Add</i>	28.00	
			<i>For Ductile Iron Grate, Add</i>	53.00	
			<i>For Cast Iron Extension Collar, Each 2", Add</i>	51.00	
			<i>For Primer Tap, Add</i>	33.50	
			<i>For Chained Grate, Add</i>	48.50	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 13 19 13-0023 EA 12-5/8" Round Top Floor Drain With 4" Outlet, Bronze Top.....	565.18	108.12
For Galvanized Extension Collar, Each 2", Add	102.50	
For Nikaloy Dome Grate, Add	255.00	
For Vandal Proof Screws, Add	30.50	
For Cast Iron Dome Grate, Add	28.00	
For Ductile Iron Grate, Add	53.00	
For Cast Iron Extension Collar, Each 2", Add	51.00	
For Primer Tap, Add	33.50	
For Chained Grate, Add	48.50	
22 13 19 13-0024 Square Or Rectangular Top Drains (22 13 19 13)		
22 13 19 13-0025 EA 5" x 5" Floor Drain With 2" Bottom Outlet, Nikaloy Top.....	309.02	88.49
For Vandal Proof Screws, Add	11.00	
For Sediment Bucket, Add	22.50	
For Galvanized Cast Iron Parts, Add	40.00	
22 13 19 13-0026 EA 5" x 5" Floor Drain With 3" Bottom Outlet, Nikaloy Top.....	328.11	98.05
For Vandal Proof Screws, Add	11.00	
For Sediment Bucket, Add	22.50	
For Galvanized Cast Iron Parts, Add	40.00	
22 13 19 13-0027 EA 5" x 5" Floor Drain With 4" Bottom Outlet, Nikaloy Top.....	348.18	108.12
For Vandal Proof Screws, Add	11.00	
For Sediment Bucket, Add	22.50	
For Galvanized Cast Iron Parts, Add	40.00	
22 13 19 13-0028 EA 6" x 6" Floor Drain With 2" Bottom Outlet, Nikaloy Top.....	324.02	88.49
For Vandal Proof Screws, Add	11.00	
For Sediment Bucket, Add	22.50	
For Galvanized Cast Iron Parts, Add	40.00	
22 13 19 13-0029 EA 6" x 6" Floor Drain With 3" Bottom Outlet, Nikaloy Top.....	343.11	98.05
For Vandal Proof Screws, Add	11.00	
For Sediment Bucket, Add	22.50	
For Galvanized Cast Iron Parts, Add	40.00	
22 13 19 13-0030 EA 6" x 6" Floor Drain With 4" Bottom Outlet, Nikaloy Top.....	363.18	108.12
For Vandal Proof Screws, Add	11.00	
For Sediment Bucket, Add	22.50	
For Galvanized Cast Iron Parts, Add	40.00	
22 13 19 13-0031 EA 8" x 8" Floor Drain With 2" Bottom Outlet, Nikaloy Top.....	390.02	88.49
For Vandal Proof Screws, Add	11.00	
For Sediment Bucket, Add	22.50	
For Galvanized Cast Iron Parts, Add	40.00	
22 13 19 13-0032 EA 8" x 8" Floor Drain With 3" Bottom Outlet, Nikaloy Top.....	409.11	98.05
For Vandal Proof Screws, Add	11.00	
For Sediment Bucket, Add	22.50	
For Galvanized Cast Iron Parts, Add	40.00	
22 13 19 13-0033 EA 8" x 8" Floor Drain With 4" Bottom Outlet, Nikaloy Top.....	429.18	108.12
For Vandal Proof Screws, Add	11.00	
For Sediment Bucket, Add	22.50	
For Galvanized Cast Iron Parts, Add	40.00	
22 13 19 13-0034 EA 5" x 5" Floor Drain With 2" Bottom Outlet, Bronze Top.....	298.02	88.49
For Vandal Proof Screws, Add	11.00	
For Sediment Bucket, Add	22.50	
For Galvanized Cast Iron Parts, Add	40.00	
22 13 19 13-0035 EA 5" x 5" Floor Drain With 3" Bottom Outlet, Bronze Top.....	317.11	98.05
For Vandal Proof Screws, Add	11.00	
For Sediment Bucket, Add	22.50	
For Galvanized Cast Iron Parts, Add	40.00	
22 13 19 13-0036 EA 5" x 5" Floor Drain With 4" Bottom Outlet, Bronze Top.....	337.18	108.12
For Vandal Proof Screws, Add	11.00	
For Sediment Bucket, Add	22.50	
For Galvanized Cast Iron Parts, Add	40.00	
22 13 19 13-0037 EA 6" x 6" Floor Drain With 2" Bottom Outlet, Bronze Top.....	317.02	88.49
For Vandal Proof Screws, Add	11.00	
For Sediment Bucket, Add	22.50	
For Galvanized Cast Iron Parts, Add	40.00	
22 13 19 13-0038 EA 6" x 6" Floor Drain With 3" Bottom Outlet, Bronze Top.....	336.11	98.05
For Vandal Proof Screws, Add	11.00	
For Sediment Bucket, Add	22.50	
For Galvanized Cast Iron Parts, Add	40.00	
22 13 19 13-0039 EA 6" x 6" Floor Drain With 4" Bottom Outlet, Bronze Top.....	356.18	108.12
For Vandal Proof Screws, Add	11.00	
For Sediment Bucket, Add	22.50	
For Galvanized Cast Iron Parts, Add	40.00	
22 13 19 13-0040 EA 8" x 8" Floor Drain With 2" Bottom Outlet, Bronze Top.....	370.52	88.49
For Vandal Proof Screws, Add	11.00	
For Sediment Bucket, Add	22.50	
For Galvanized Cast Iron Parts, Add	40.00	
22 13 19 13-0041 EA 8" x 8" Floor Drain With 3" Bottom Outlet, Bronze Top.....	389.61	98.05
For Vandal Proof Screws, Add	11.00	
For Sediment Bucket, Add	22.50	
For Galvanized Cast Iron Parts, Add	40.00	
22 13 19 13-0042 EA 8" x 8" Floor Drain With 4" Bottom Outlet, Bronze Top.....	409.68	108.12
For Vandal Proof Screws, Add	11.00	
For Sediment Bucket, Add	22.50	
For Galvanized Cast Iron Parts, Add	40.00	

22	Plumbing
22 10	Plumbing Piping
22 13	Facility Sanitary Sewerage



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 13 19 13-0043	EA		12" x 12" Can Wash Drain With 3" Bottom Outlet, Cast Iron Top	775.61	98.05
			<i>For Galvanized Cast Iron Parts, Add</i>	212.00	
			<i>For No-Hub Side Outlet, Add</i>	76.00	
			<i>For Chained Grate, Add</i>	48.50	
22 13 19 13-0044	EA		12" x 12" Can Wash Drain With 4" Bottom Outlet, Cast Iron Top	795.68	108.12
			<i>For Galvanized Cast Iron Parts, Add</i>	212.00	
			<i>For No-Hub Side Outlet, Add</i>	76.00	
			<i>For Chained Grate, Add</i>	48.50	
22 13 19 13-0045	EA		12" x 12" Can Wash Drain With 3" Bottom Outlet, Nikaloy Top	938.61	98.05
			<i>For Galvanized Cast Iron Parts, Add</i>	212.00	
			<i>For No-Hub Side Outlet, Add</i>	76.00	
			<i>For Chained Grate, Add</i>	48.50	
22 13 19 13-0046	EA		12" x 12" Can Wash Drain With 4" Bottom Outlet, Nikaloy Top	958.68	108.12
			<i>For Galvanized Cast Iron Parts, Add</i>	212.00	
			<i>For No-Hub Side Outlet, Add</i>	76.00	
			<i>For Chained Grate, Add</i>	48.50	
22 13 19 13-0047	EA		12" x 12" Can Wash Drain With 3" Bottom Outlet, Bronze Top.....	919.11	98.05
			<i>For Galvanized Cast Iron Parts, Add</i>	212.00	
			<i>For No-Hub Side Outlet, Add</i>	76.00	
			<i>For Chained Grate, Add</i>	48.50	
22 13 19 13-0048	EA		12" x 12" Can Wash Drain With 4" Bottom Outlet, Bronze Top.....	939.18	108.12
			<i>For Galvanized Cast Iron Parts, Add</i>	212.00	
			<i>For No-Hub Side Outlet, Add</i>	76.00	
			<i>For Chained Grate, Add</i>	48.50	
22 13 19 13-0049	EA		5" x 9" Floor Drain With 2" Bottom Outlet, Nikaloy Top.....	394.02	88.49
			<i>For Rough Bronze Body, Add</i>	120.94	
			<i>For Vandal Proof Screws, Add</i>	11.00	
			<i>For Sediment Bucket, Add</i>	22.50	
22 13 19 13-0050	EA		5" x 9" Floor Drain With 3" Bottom Outlet, Nikaloy Top.....	413.11	98.05
			<i>For Rough Bronze Body, Add</i>	120.94	
			<i>For Vandal Proof Screws, Add</i>	11.00	
			<i>For Sediment Bucket, Add</i>	22.50	
22 13 19 13-0051	EA		5" x 9" Floor Drain With 4" Bottom Outlet, Nikaloy Top.....	433.18	108.12
			<i>For Rough Bronze Body, Add</i>	120.94	
			<i>For Vandal Proof Screws, Add</i>	11.00	
			<i>For Sediment Bucket, Add</i>	22.50	
22 13 19 13-0052	EA		5" x 13" Floor Drain With 2" Bottom Outlet, Nikaloy Top.....	471.52	88.49
			<i>For Rough Bronze Body, Add</i>	120.94	
			<i>For Vandal Proof Screws, Add</i>	11.00	
			<i>For Sediment Bucket, Add</i>	22.50	
22 13 19 13-0053	EA		5" x 13" Floor Drain With 3" Bottom Outlet, Nikaloy Top.....	490.61	98.05
			<i>For Rough Bronze Body, Add</i>	120.94	
			<i>For Vandal Proof Screws, Add</i>	11.00	
			<i>For Sediment Bucket, Add</i>	22.50	
22 13 19 13-0054	EA		5" x 13" Floor Drain With 4" Bottom Outlet, Nikaloy Top.....	510.68	108.12
			<i>For Rough Bronze Body, Add</i>	120.94	
			<i>For Vandal Proof Screws, Add</i>	11.00	
			<i>For Sediment Bucket, Add</i>	22.50	
22 13 19 13-0055	EA		5" x 16-3/4" Floor Drain With 2" Bottom Outlet, Nikaloy Top.....	489.52	88.49
			<i>For Rough Bronze Body, Add</i>	120.94	
			<i>For Vandal Proof Screws, Add</i>	11.00	
			<i>For Sediment Bucket, Add</i>	22.50	
22 13 19 13-0056	EA		5" x 16-5/8" Floor Drain With 3" Bottom Outlet, Nikaloy Top.....	508.61	98.05
			<i>For Rough Bronze Body, Add</i>	120.94	
			<i>For Vandal Proof Screws, Add</i>	11.00	
			<i>For Sediment Bucket, Add</i>	22.50	
22 13 19 13-0057	EA		5" x 16-3/4" Floor Drain With 4" Bottom Outlet, Nikaloy Top.....	528.68	108.12
			<i>For Rough Bronze Body, Add</i>	120.94	
			<i>For Vandal Proof Screws, Add</i>	11.00	
			<i>For Sediment Bucket, Add</i>	22.50	
22 13 19 13-0058	EA		5" x 21" Floor Drain With 2" Bottom Outlet, Nikaloy Top.....	629.02	88.49
			<i>For Rough Bronze Body, Add</i>	120.94	
			<i>For Vandal Proof Screws, Add</i>	11.00	
			<i>For Sediment Bucket, Add</i>	22.50	
22 13 19 13-0059	EA		5" x 21" Floor Drain With 3" Bottom Outlet, Nikaloy Top.....	648.11	98.05
			<i>For Rough Bronze Body, Add</i>	120.94	
			<i>For Vandal Proof Screws, Add</i>	11.00	
			<i>For Sediment Bucket, Add</i>	22.50	
22 13 19 13-0060	EA		5" x 21" Floor Drain With 4" Bottom Outlet, Nikaloy Top.....	668.18	108.12
			<i>For Rough Bronze Body, Add</i>	120.94	
			<i>For Vandal Proof Screws, Add</i>	11.00	
			<i>For Sediment Bucket, Add</i>	22.50	
22 13 19 13-0061	EA		5" x 9" Floor Drain With 2" Bottom Outlet, Bronze Top.....	378.02	88.49
			<i>For Rough Bronze Body, Add</i>	120.94	
			<i>For Vandal Proof Screws, Add</i>	11.00	
			<i>For Sediment Bucket, Add</i>	22.50	
22 13 19 13-0062	EA		5" x 9" Floor Drain With 3" Bottom Outlet, Bronze Top.....	397.11	98.05
			<i>For Rough Bronze Body, Add</i>	120.94	
			<i>For Vandal Proof Screws, Add</i>	11.00	
			<i>For Sediment Bucket, Add</i>	22.50	
22 13 19 13-0063	EA		5" x 9" Floor Drain With 4" Bottom Outlet, Bronze Top.....	417.18	108.12
			<i>For Rough Bronze Body, Add</i>	120.94	
			<i>For Vandal Proof Screws, Add</i>	11.00	
			<i>For Sediment Bucket, Add</i>	22.50	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 13 19 13-0064 EA 5" x 13" Floor Drain With 2" Bottom Outlet, Bronze Top	444.02	88.49
<i>For Rough Bronze Body, Add</i>	120.94	
<i>For Vandal Proof Screws, Add</i>	11.00	
<i>For Sediment Bucket, Add</i>	22.50	
22 13 19 13-0065 EA 5" x 13" Floor Drain With 3" Bottom Outlet, Bronze Top	463.11	98.05
<i>For Rough Bronze Body, Add</i>	120.94	
<i>For Vandal Proof Screws, Add</i>	11.00	
<i>For Sediment Bucket, Add</i>	22.50	
22 13 19 13-0066 EA 5" x 13" Floor Drain With 4" Bottom Outlet, Bronze Top	483.18	108.12
<i>For Rough Bronze Body, Add</i>	120.94	
<i>For Vandal Proof Screws, Add</i>	11.00	
<i>For Sediment Bucket, Add</i>	22.50	
22 13 19 13-0067 EA 5" x 16-3/4" Floor Drain With 2" Bottom Outlet, Bronze Top	462.02	88.49
<i>For Rough Bronze Body, Add</i>	120.94	
<i>For Vandal Proof Screws, Add</i>	11.00	
<i>For Sediment Bucket, Add</i>	22.50	
22 13 19 13-0068 EA 5" x 16-5/8" Floor Drain With 3" Bottom Outlet, Bronze Top	481.11	98.05
<i>For Rough Bronze Body, Add</i>	120.94	
<i>For Vandal Proof Screws, Add</i>	11.00	
<i>For Sediment Bucket, Add</i>	22.50	
22 13 19 13-0069 EA 5" x 16-3/4" Floor Drain With 4" Bottom Outlet, Bronze Top	501.18	108.12
<i>For Rough Bronze Body, Add</i>	120.94	
<i>For Vandal Proof Screws, Add</i>	11.00	
<i>For Sediment Bucket, Add</i>	22.50	
22 13 19 13-0070 EA 5" x 21" Floor Drain With 2" Bottom Outlet, Bronze Top	575.52	88.49
<i>For Rough Bronze Body, Add</i>	120.94	
<i>For Vandal Proof Screws, Add</i>	11.00	
<i>For Sediment Bucket, Add</i>	22.50	
22 13 19 13-0071 EA 5" x 21" Floor Drain With 3" Bottom Outlet, Bronze Top	594.61	98.05
<i>For Rough Bronze Body, Add</i>	120.94	
<i>For Vandal Proof Screws, Add</i>	11.00	
<i>For Sediment Bucket, Add</i>	22.50	
22 13 19 13-0072 EA 5" x 21" Floor Drain With 4" Bottom Outlet, Bronze Top	614.68	108.12
<i>For Rough Bronze Body, Add</i>	120.94	
<i>For Vandal Proof Screws, Add</i>	11.00	
<i>For Sediment Bucket, Add</i>	22.50	
22 13 19 13-0073 Funnel Type Floor Drains <small>(22 13 19 13)</small>		
22 13 19 13-0074 EA 7" Diameter Floor Drain With 4" Round Funnel With 1-1/2" Outlet, Bronze Top	365.57	79.01
<i>For Vandal Proof Screws, Add</i>	11.00	
<i>For Galvanized Cast Iron Parts, Add</i>	40.00	
<i>For Satin Finish Bronze Top, Deduct</i>	-19.50	
22 13 19 13-0075 EA 7" Diameter Floor Drain With 4" Round Funnel With 2" Outlet, Bronze Top	384.52	88.49
<i>For Vandal Proof Screws, Add</i>	11.00	
<i>For Galvanized Cast Iron Parts, Add</i>	40.00	
<i>For Satin Finish Bronze Top, Deduct</i>	-19.50	
22 13 19 13-0076 EA 7" Diameter Floor Drain With 4" Round Funnel With 3" Outlet, Bronze Top	403.40	97.98
<i>For Vandal Proof Screws, Add</i>	11.00	
<i>For Galvanized Cast Iron Parts, Add</i>	40.00	
<i>For Satin Finish Bronze Top, Deduct</i>	-19.50	
22 13 19 13-0077 EA 7" Diameter Floor Drain With 4" Round Funnel With 4" Outlet, Bronze Top	423.68	108.12
<i>For Vandal Proof Screws, Add</i>	11.00	
<i>For Galvanized Cast Iron Parts, Add</i>	40.00	
<i>For Satin Finish Bronze Top, Deduct</i>	-19.50	
22 13 19 13-0078 EA 7" Diameter Floor Drain With 9" x 3-1/2" Oval Funnel With 2" Outlet, Nikaloy Top	497.02	88.49
<i>For Vandal Proof Screws, Add</i>	11.00	
<i>For Primer Tap, Add</i>	15.10	
<i>For Galvanized Cast Iron Parts, Add</i>	40.00	
<i>For Satin Finish Bronze Top, Deduct</i>	-19.50	
22 13 19 13-0079 EA 7" Diameter Floor Drain With 9" x 3-1/2" Oval Funnel With 3" Outlet, Nikaloy Top	515.90	97.98
<i>For Vandal Proof Screws, Add</i>	11.00	
<i>For Primer Tap, Add</i>	15.10	
<i>For Galvanized Cast Iron Parts, Add</i>	40.00	
<i>For Satin Finish Bronze Top, Deduct</i>	-19.50	
22 13 19 13-0080 EA 7" Diameter Floor Drain With 9" x 3-1/2" Oval Funnel With 4" Outlet, Nikaloy Top	536.18	108.12
<i>For Vandal Proof Screws, Add</i>	11.00	
<i>For Primer Tap, Add</i>	15.10	
<i>For Galvanized Cast Iron Parts, Add</i>	40.00	
<i>For Satin Finish Bronze Top, Deduct</i>	-19.50	
22 13 19 13-0081 EA 7" Diameter Floor Drain With 9" x 3-1/2" Oval Funnel With 2" Outlet, Bronze Top	477.52	88.49
<i>For Vandal Proof Screws, Add</i>	11.00	
<i>For Primer Tap, Add</i>	15.10	
<i>For Galvanized Cast Iron Parts, Add</i>	40.00	
<i>For Satin Finish Bronze Top, Deduct</i>	-19.50	
22 13 19 13-0082 EA 7" Diameter Floor Drain With 9" x 3-1/2" Oval Funnel With 3" Outlet, Bronze Top	496.40	97.98
<i>For Vandal Proof Screws, Add</i>	11.00	
<i>For Primer Tap, Add</i>	15.10	
<i>For Galvanized Cast Iron Parts, Add</i>	40.00	
<i>For Satin Finish Bronze Top, Deduct</i>	-19.50	
22 13 19 13-0083 EA 7" Diameter Floor Drain With 9" x 3-1/2" Oval Funnel With 4" Outlet, Bronze Top	516.68	108.12
<i>For Vandal Proof Screws, Add</i>	11.00	
<i>For Primer Tap, Add</i>	15.10	
<i>For Galvanized Cast Iron Parts, Add</i>	40.00	
<i>For Satin Finish Bronze Top, Deduct</i>	-19.50	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 13 19 13-0084			Floor Drain With Sediment Bucket Bottom Outlet ^(22 13 19 13)		
22 13 19 13-0085	EA		12-5/8" Round Floor Drain With Sediment Bucket, 2" Bottom Outlet, Satin Bronze Top, Without Trap.....	651.50	79.01
			<i>For Vandal Proof Screws, Add</i>	30.50	
			<i>For Galvanized Cast Iron Parts, Add</i>	247.00	
			<i>For Primer Tap, Add</i>	33.50	
22 13 19 13-0086	EA		12-5/8" Round Floor Drain With Sediment Bucket, 3" Bottom Outlet, Satin Bronze Top, Without Trap.....	670.52	88.49
			<i>For Vandal Proof Screws, Add</i>	30.50	
			<i>For Galvanized Cast Iron Parts, Add</i>	247.00	
			<i>For Primer Tap, Add</i>	33.50	
22 13 19 13-0087	EA		12-5/8" Round Floor Drain With Sediment Bucket, 4" Bottom Outlet, Satin Bronze Top, Without Trap.....	689.40	97.98
			<i>For Vandal Proof Screws, Add</i>	30.50	
			<i>For Galvanized Cast Iron Parts, Add</i>	247.00	
			<i>For Primer Tap, Add</i>	33.50	
22 13 19 13-0088	EA		12-5/8" Round Floor Drain With Sediment Bucket, 5" Bottom Outlet, Satin Bronze Top, Without Trap.....	709.68	108.12
			<i>For Vandal Proof Screws, Add</i>	30.50	
			<i>For Galvanized Cast Iron Parts, Add</i>	247.00	
			<i>For Primer Tap, Add</i>	33.50	
22 13 19 13-0089	EA		12-5/8" Round Floor Drain With Sediment Bucket, 6" Bottom Outlet, Satin Bronze Top, Without Trap.....	730.60	118.56
			<i>For Vandal Proof Screws, Add</i>	30.50	
			<i>For Galvanized Cast Iron Parts, Add</i>	247.00	
			<i>For Primer Tap, Add</i>	33.50	
22 13 19 13-0090	EA		12" x 12" Floor Drain With Sediment Bucket, 2" Bottom Outlet, Nikaloy Top, Heavy Duty Loose-Set Cast Iron Grate.....	708.52	88.49
			<i>For Vandal Proof Screws, Add</i>	29.50	
			<i>For Galvanized Cast Iron Parts, Add</i>	182.50	
			<i>For Aluminum Bucket, Add</i>	77.50	
			<i>For Primer Tap, Add</i>	31.00	
22 13 19 13-0091	EA		12" x 12" Floor Drain With Sediment Bucket, 3" Bottom Outlet, Nikaloy Top, Heavy Duty Loose-Set Cast Iron Grate.....	727.61	98.05
			<i>For Vandal Proof Screws, Add</i>	29.50	
			<i>For Galvanized Cast Iron Parts, Add</i>	182.50	
			<i>For Aluminum Bucket, Add</i>	77.50	
			<i>For Primer Tap, Add</i>	31.00	
22 13 19 13-0092	EA		12" x 12" Floor Drain With Sediment Bucket, 4" Bottom Outlet, Nikaloy Top, Heavy Duty Loose-Set Cast Iron Grate.....	747.68	108.12
			<i>For Vandal Proof Screws, Add</i>	29.50	
			<i>For Galvanized Cast Iron Parts, Add</i>	182.50	
			<i>For Aluminum Bucket, Add</i>	77.50	
			<i>For Primer Tap, Add</i>	31.00	
22 13 19 13-0093	EA		12" x 12" Floor Drain With Sediment Bucket, 6" Bottom Outlet, Nikaloy Top, Heavy Duty Loose-Set Cast Iron Grate.....	768.60	118.56
			<i>For Vandal Proof Screws, Add</i>	29.50	
			<i>For Galvanized Cast Iron Parts, Add</i>	182.50	
			<i>For Aluminum Bucket, Add</i>	77.50	
			<i>For Primer Tap, Add</i>	31.00	
22 13 19 13-0094	EA		12" x 12" Floor Drain With Sediment Bucket, 2" Bottom Outlet, Cast Iron Top, Heavy Duty Loose-Set Cast Iron Grate.....	483.02	88.49
			<i>For Vandal Proof Screws, Add</i>	29.50	
			<i>For Galvanized Cast Iron Parts, Add</i>	182.50	
			<i>For Aluminum Bucket, Add</i>	77.50	
			<i>For Primer Tap, Add</i>	31.00	
22 13 19 13-0095	EA		12" x 12" Floor Drain With Sediment Bucket, 3" Bottom Outlet, Cast Iron Top, Heavy Duty Loose-Set Cast Iron Grate.....	502.11	98.05
			<i>For Vandal Proof Screws, Add</i>	29.50	
			<i>For Galvanized Cast Iron Parts, Add</i>	182.50	
			<i>For Aluminum Bucket, Add</i>	77.50	
			<i>For Primer Tap, Add</i>	31.00	
22 13 19 13-0096	EA		12" x 12" Floor Drain With Sediment Bucket, 4" Bottom Outlet, Cast Iron Top, Heavy Duty Loose-Set Cast Iron Grate.....	522.18	108.12
			<i>For Vandal Proof Screws, Add</i>	29.50	
			<i>For Galvanized Cast Iron Parts, Add</i>	182.50	
			<i>For Aluminum Bucket, Add</i>	77.50	
			<i>For Primer Tap, Add</i>	31.00	
22 13 19 13-0097	EA		12" x 12" Floor Drain With Sediment Bucket, 6" Bottom Outlet, Cast Iron Top, Heavy Duty Loose-Set Cast Iron Grate.....	543.10	118.56
			<i>For Vandal Proof Screws, Add</i>	29.50	
			<i>For Galvanized Cast Iron Parts, Add</i>	182.50	
			<i>For Aluminum Bucket, Add</i>	77.50	
			<i>For Primer Tap, Add</i>	31.00	
22 13 19 13-0098	EA		12" x 12" Floor Drain With Sediment Bucket, 2" Bottom Outlet, Bronze Top, Heavy Duty Loose-Set Cast Iron Grate.....	669.52	88.49
			<i>For Vandal Proof Screws, Add</i>	29.50	
			<i>For Galvanized Cast Iron Parts, Add</i>	182.50	
			<i>For Aluminum Bucket, Add</i>	77.50	
			<i>For Primer Tap, Add</i>	31.00	
22 13 19 13-0099	EA		12" x 12" Floor Drain With Sediment Bucket, 3" Bottom Outlet, Bronze Top, Heavy Duty Loose-Set Cast Iron Grate.....	688.61	98.05
			<i>For Vandal Proof Screws, Add</i>	29.50	
			<i>For Galvanized Cast Iron Parts, Add</i>	182.50	
			<i>For Aluminum Bucket, Add</i>	77.50	
			<i>For Primer Tap, Add</i>	31.00	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 13 19 13-0100 EA 12" x 12" Floor Drain With Sediment Bucket, 4" Bottom Outlet, Bronze Top, Heavy Duty Loose-Set Cast Iron Grate	708.68	108.12
<i>For Vandal Proof Screws, Add</i>	29.50	
<i>For Galvanized Cast Iron Parts, Add</i>	182.50	
<i>For Aluminum Bucket, Add</i>	77.50	
<i>For Primer Tap, Add</i>	31.00	
22 13 19 13-0101 EA 12" x 12" Floor Drain With Sediment Bucket, 6" Bottom Outlet, Bronze Top, Heavy Duty Loose-Set Cast Iron Grate	729.60	118.56
<i>For Vandal Proof Screws, Add</i>	29.50	
<i>For Galvanized Cast Iron Parts, Add</i>	182.50	
<i>For Aluminum Bucket, Add</i>	77.50	
<i>For Primer Tap, Add</i>	31.00	
22 13 19 13-0102 Other Drains <small>(22 13 19 13)</small>		
22 13 19 13-0103 Shower Drains <small>(22 13 19 13-0102)</small>		
22 13 19 13-0104 EA 4-1/4" Stainless Steel Shower Drain Strainer	28.92	7.98
Note: Includes two 2-5/8" screws.		
22 13 19 13-0105 EA 4-1/4" Brass Shower Drain Strainer	31.89	7.98
Note: Includes two 2-5/8" screws.		
22 13 19 13-0106 EA 4" Brass Shower Drain For Polyvinyl Chloride (PVC) Pipe	67.59	15.97
Note: Fits over 2" polyvinyl chloride (PVC) pipe or inside 3" polyvinyl chloride (PVC) pipe.		
22 13 19 13-0107 EA 4" Chrome Finish, Threaded Brass Shower Drain And Gasket	84.63	15.97
Note: For 2" pipe. Kohler K-9132.		
22 13 19 13-0108 Acid Resistant Floor Drains <small>(22 13 19 13-0102)</small>		
22 13 19 13-0109 EA 9" Diameter Floor Drain With 2" Bottom Outlet, Acid Resistant Top	367.50	79.01
<i>For Vandal Proof Screws, Add</i>	30.50	
<i>For Galvanized Cast Iron Parts, Add</i>	87.50	
<i>For Primer Tap, Add</i>	33.50	
22 13 19 13-0110 EA 9" Diameter Floor Drain With 3" Bottom Outlet, Acid Resistant Top	386.52	88.49
<i>For Vandal Proof Screws, Add</i>	30.50	
<i>For Galvanized Cast Iron Parts, Add</i>	87.50	
<i>For Primer Tap, Add</i>	33.50	
22 13 19 13-0111 EA 9" Diameter Floor Drain With 4" Bottom Outlet, Acid Resistant Top	405.40	97.98
<i>For Vandal Proof Screws, Add</i>	30.50	
<i>For Galvanized Cast Iron Parts, Add</i>	87.50	
<i>For Primer Tap, Add</i>	33.50	
22 13 19 13-0112 Rotary And Lever Drains <small>(22 13 19 13-0102)</small>		
22 13 19 13-0113 EA 1-1/2" Drain, 3" Sink Opening Lever Drain	159.52	53.29
22 13 19 13-0114 EA 2" Drain, 3" Sink Opening Lever Drain	170.54	58.80
22 13 19 13-0115 EA 1-1/2" Drain, 3-1/2" Sink Opening Lever Drain	159.52	53.29
22 13 19 13-0116 EA 2" Drain, 3-1/2" Sink Opening Lever Drain	170.54	58.80
22 13 19 13-0117 EA 1-1/2" Drain, 3" Sink Opening Twist Drain	159.52	53.29
22 13 19 13-0118 EA 2" Drain, 3" Sink Opening Twist Drain	170.54	58.80
22 13 19 13-0119 EA 1-1/2" Drain, 3-1/2" Sink Opening Twist Drain	159.52	53.29
22 13 19 13-0120 EA 2" Drain, 3-1/2" Sink Opening Twist Drain	170.54	58.80
22 13 19 13-0121 EA 1-1/2"-2" Drain, 3-1/2" Sink Opening Rotary Twist Drain (Fisher 16100)	211.39	58.80
22 13 19 13-0122 Floor Receptor <small>(22 13 19 13)</small>		
22 13 19 13-0123 9" Diameter Round Shallow Receptor <small>(22 13 19 13-0122)</small>		
Note: With slotted medium duty grate, aluminum secondary strainer and white acid resisting coated interior and top.		
22 13 19 13-0124 EA 9" Diameter x 3" Shallow Cast Iron Floor Receptor, 2" Drain Connection	439.14	88.57
<i>For Flange With Seepage Holes And Clamp Collar, Add</i>	97.00	
<i>For Full Grate With 2" (50 mm) Square Center Opening, Add</i>	36.00	
<i>For Flange With Seepage Holes, Add</i>	58.50	
<i>For White Acid Resistant Bucket, Add</i>	47.00	
<i>For Trap Primer Connection, Add</i>	38.00	
<i>For Vandal Proof Secured Grate, Add</i>	33.50	
<i>For Stainless Steel Liner For Bucket, Add</i>	62.50	
22 13 19 13-0125 EA 9" Diameter x 3" Shallow Cast Iron Floor Receptor, 3" Drain Connection	458.31	98.12
<i>For Flange With Seepage Holes And Clamp Collar, Add</i>	97.00	
<i>For Full Grate With 2" (50 mm) Square Center Opening, Add</i>	36.00	
<i>For Flange With Seepage Holes, Add</i>	58.50	
<i>For White Acid Resistant Bucket, Add</i>	47.00	
<i>For Trap Primer Connection, Add</i>	38.00	
<i>For Vandal Proof Secured Grate, Add</i>	33.50	
<i>For Stainless Steel Liner For Bucket, Add</i>	62.50	
22 13 19 13-0126 EA 9" Diameter x 3" Shallow Cast Iron Floor Receptor, 4" Drain Connection	478.18	108.12
<i>For Flange With Seepage Holes And Clamp Collar, Add</i>	97.00	
<i>For Full Grate With 2" (50 mm) Square Center Opening, Add</i>	36.00	
<i>For Flange With Seepage Holes, Add</i>	58.50	
<i>For White Acid Resistant Bucket, Add</i>	47.00	
<i>For Trap Primer Connection, Add</i>	38.00	
<i>For Vandal Proof Secured Grate, Add</i>	33.50	
<i>For Stainless Steel Liner For Bucket, Add</i>	62.50	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 13 19 13-0127			Square Top Floor Receptors (22 13 19 13-0122) Note: With acid resistant coating.		
22 13 19 13-0128	EA		8" x 8" Floor Drain With 1-1/2" Bottom Outlet, Acid Resistant Top <i>For Flange With Seepage Holes And Clamp Collar, Add</i> <i>For Trap Primer Connection, Add</i> <i>For Full Grate With 2" Square Center Opening, Add</i> <i>For Vandal Proof Secured Grate, Add</i> <i>For Stainless Steel Liner For Bucket, Add</i> <i>For White Acid Resistant Bucket, Add</i> <i>For Flange With Seepage Holes, Add</i>	482.07 69.00 39.50 36.00 15.50 97.00 88.00 37.50	79.01
22 13 19 13-0129	EA		8" x 8" Floor Drain With 2" Bottom Outlet, Acid Resistant Top..... <i>For Flange With Seepage Holes And Clamp Collar, Add</i> <i>For Trap Primer Connection, Add</i> <i>For Full Grate With 2" Square Center Opening, Add</i> <i>For Vandal Proof Secured Grate, Add</i> <i>For Stainless Steel Liner For Bucket, Add</i> <i>For White Acid Resistant Bucket, Add</i> <i>For Flange With Seepage Holes, Add</i>	501.11 69.00 39.50 36.00 15.50 97.00 88.00 37.50	88.57
22 13 19 13-0130	EA		8" x 8" Floor Drain With 3" Bottom Outlet, Acid Resistant Top..... <i>For Flange With Seepage Holes And Clamp Collar, Add</i> <i>For Trap Primer Connection, Add</i> <i>For Full Grate With 2" Square Center Opening, Add</i> <i>For Vandal Proof Secured Grate, Add</i> <i>For Stainless Steel Liner For Bucket, Add</i> <i>For White Acid Resistant Bucket, Add</i> <i>For Flange With Seepage Holes, Add</i>	519.90 69.00 39.50 36.00 15.50 97.00 88.00 37.50	97.98
22 13 19 13-0131	EA		8" x 8" Floor Drain With 4" Bottom Outlet, Acid Resistant Top..... <i>For Flange With Seepage Holes And Clamp Collar, Add</i> <i>For Trap Primer Connection, Add</i> <i>For Full Grate With 2" Square Center Opening, Add</i> <i>For Vandal Proof Secured Grate, Add</i> <i>For Stainless Steel Liner For Bucket, Add</i> <i>For White Acid Resistant Bucket, Add</i> <i>For Flange With Seepage Holes, Add</i>	540.18 69.00 39.50 36.00 15.50 97.00 88.00 37.50	108.12
22 13 19 13-0132			Floor Drain Accessories (22 13 19 13)		
22 13 19 13-0133	EA		3" Trap Guard Floor Drain Insert (ProVent TG3H)..... Note: Prevents emission of sewer gases.	60.45	9.19
22 13 19 13-0134	EA		2" Trap Guard Drain Insert For Cast Iron Or Polyvinyl Chloride (PVC) Pipe (ProVent TG22)..... Note: Prevents emission of sewer gases.	49.93	9.19
22 13 19 13-0135	EA		3" Trap Guard Drain Insert For Cast Iron Or Polyvinyl Chloride (PVC) Pipe (ProVent TG33)..... Note: Prevents emission of sewer gases.	54.14	9.19
22 13 19 13-0136	EA		3" Trap Guard Drain Insert For 4" Cast Iron Or Polyvinyl Chloride (PVC) Pipe (ProVent TG34IP)..... Note: Prevents emission of sewer gases.	64.65	9.19
22 13 19 13-0137	EA		3" Trap Guard Drain Insert For 4" Hub (ProVent TG34TP)..... Note: Prevents emission of sewer gases.	58.34	9.19
22 13 19 13-0138	EA		2" Quad Close Trap Seal, For Drain Body Or Strainer Throat (JRSmith 2692-02) Note: Prevents emission of sewer gases.	81.64	9.19
22 13 19 13-0139	EA		3" Quad Close Trap Seal, For Drain Body Or Strainer Throat (JRSmith 2692-03) Note: Prevents emission of sewer gases.	90.11	9.19
22 13 19 13-0140	EA		4" Quad Close Trap Seal, For Drain Body Or Strainer Throat (JRSmith 2692-04) Note: Prevents emission of sewer gases.	111.13	9.19
22 13 19 26			Grease Removal Devices (22 13 19)		
22 13 19 26-0001			Manual Cleaning Epoxy Coated Steel Grease Interceptor (22 13 19 26) Note: Includes internal air relief, visible double wall trap, removable baffle, gasketed non-skid cover bearing PDI seal of approval and flow control fitting.		
22 13 19 26-0002			Standard Manual Cleaning Epoxy Coated Steel Grease Interceptor (22 13 19 26-0001) Note: Josam 60100H/60210A, Smith 8100/8400, Wade 5100, or Zurn Z1173/Z1170 series.		
22 13 19 26-0003	EA		7 GPM, 14 LB Capacity Manual Cleaning Epoxy Coated Steel Grease Interceptor Note: Josam 60102H.	688.77 1,268.65	55.13
22 13 19 26-0004	EA		10 GPM, 20 LB Capacity Manual Cleaning Epoxy Coated Steel Grease Interceptor Note: Josam 60103H. <i>For Flange And Clamp Device, Add</i> <i>For Steel Enclosure Cabinet With Non Skid Cover, Add</i>	801.99 342.85 1,337.48	124.03
22 13 19 26-0005	EA		15 GPM, 30 LB Capacity Manual Cleaning Epoxy Coated Steel Grease Interceptor Note: Josam 60104H. <i>For Flange And Clamp Device, Add</i> <i>For Steel Enclosure Cabinet With Non Skid Cover, Add</i>	1,126.31 352.04 1,459.73	137.81
22 13 19 26-0006	EA		20 GPM, 40 LB Capacity Manual Cleaning Epoxy Coated Steel Grease Interceptor Note: Josam 60105H. <i>For Flange And Clamp Device, Add</i> <i>For Steel Enclosure Cabinet With Non Skid Cover, Add</i>	1,355.80 361.23 1,576.56	151.59
22 13 19 26-0007	EA		25 GPM, 50 LB Capacity Manual Cleaning Epoxy Coated Steel Grease Interceptor Note: Josam 60106H. <i>For Flange And Clamp Device, Add</i> <i>For Steel Enclosure Cabinet With Non Skid Cover, Add</i>	1,516.61 400.81 1,638.66	165.38



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 13 19 26-0008 EA 35 GPM, 70 LB Capacity Manual Cleaning Epoxy Coated Steel Grease Interceptor Note: Josam 60107H. <i>For Flange And Clamp Device, Add</i>	1,859.30 <i>430.39</i>	192.94
22 13 19 26-0009 EA 50 GPM, 100 LB Capacity Manual Cleaning Epoxy Coated Steel Grease Interceptor Note: Josam 60108H. <i>For Steel Enclosure Cabinet With Non Skid Cover, Add</i>	2,415.66 <i>1,798.70</i>	220.50
22 13 19 26-0010 EA 75 GPM, 150 LB Capacity Manual Cleaning Epoxy Coated Steel Grease Interceptor Note: Josam 60109H. <i>For Flange And Clamp Device, Add</i>	4,691.07 <i>489.72</i>	248.06
22 13 19 26-0011 EA 100 GPM, 200 LB Capacity Manual Cleaning Epoxy Coated Steel Grease Interceptor Note: Josam 60110H. <i>For Steel Enclosure Cabinet With Non Skid Cover, Add</i>	5,291.62 <i>1,911.70</i>	289.70
22 13 19 26-0012 EA 150 GPM, 300 LB Capacity Manual Cleaning Epoxy Coated Steel Grease Interceptor Note: Josam 60213A. <i>For Flange And Clamp Device, Add</i>	6,554.96 <i>801.13</i>	463.51
22 13 19 26-0013 EA 200 GPM, 400 LB Capacity Manual Cleaning Epoxy Coated Steel Grease Interceptor Note: Josam 60214A. <i>For Flange And Clamp Device, Add</i>	9,385.24 <i>1,077.01</i>	579.39
22 13 19 26-0014 EA 250 GPM, 500 LB Capacity Manual Cleaning Epoxy Coated Steel Grease Interceptor Note: Josam 60215A. <i>For Flange And Clamp Device, Add</i>	10,952.85 <i>1,283.54</i>	695.27
22 13 19 26-0015 EA 350 GPM, 700 LB Capacity Manual Cleaning Epoxy Coated Steel Grease Interceptor Note: Josam 60216A. <i>For Flange And Clamp Device, Add</i>	14,209.00 <i>1,673.75</i>	811.15
22 13 19 26-0016 EA 500 GPM, 1,000 LB Capacity Manual Cleaning Epoxy Coated Steel Grease Interceptor Note: Josam 60217A. <i>For Flange And Clamp Device, Add</i>	18,352.84 <i>1,988.77</i>	927.02
22 13 19 26-0017 Low Profile Manual Cleaning Epoxy Coated Steel Grease Interceptor (22 13 19 26-0001) Note: Josam 60110A, Smith 8100, Wade 5100LR, or Zurn Z1171 series.		
22 13 19 26-0018 EA 20 GPM, 40 LB Capacity Low Profile Manual Cleaning Epoxy Coated Steel Grease Interceptor..... Note: Josam 60115A.	1,931.36	151.59
22 13 19 26-0019 EA 35 GPM, 70 LB Capacity Low Profile Manual Cleaning Epoxy Coated Steel Grease Interceptor..... Note: Josam 60117A.	2,483.92	192.94
22 13 19 26-0020 EA 50 GPM, 100 LB Capacity Low Profile Manual Cleaning Epoxy Coated Steel Grease Interceptor..... Note: Smith 8150.	4,066.77	220.50
22 13 19 26-0021 Semi Automatic Cleaning Epoxy Coated Steel Grease Interceptor (22 13 19 26) Note: Includes internal air relief, visible double wall trap, removable baffle, gasketed non-skid cover bearing PDI seal of approval, grease recovery cone, flexible hose, grease draw off valve and flow control fitting.		
22 13 19 26-0022 Standard Semi Automatic Cleaning Epoxy Coated Steel Grease Interceptor (22 13 19 26-0021) Note: Josam 60100-SA, Smith 8300GTX, Wade 5100JCX, or Zurn Z1173-TD series.		
22 13 19 26-0023 EA 7 GPM, 14 LB Capacity Semi Automatic Epoxy Coated Steel Grease Interceptor Note: Josam 60102-SA. <i>For Steel Enclosure Cabinet With Non Skid Cover, Add</i>	1,690.19 <i>1,268.65</i>	55.13
22 13 19 26-0024 EA 10 GPM, 20 LB Capacity Semi Automatic Epoxy Coated Steel Grease Interceptor Note: Josam 60103-SA. <i>For Steel Enclosure Cabinet With Non Skid Cover, Add</i>	1,985.81 <i>1,337.48</i>	124.03
22 13 19 26-0025 EA 15 GPM, 30 LB Capacity Semi Automatic Epoxy Coated Steel Grease Interceptor Note: Josam 60104-SA. <i>For Steel Enclosure Cabinet With Non Skid Cover, Add</i>	2,123.37 <i>1,459.73</i>	137.81
22 13 19 26-0026 EA 20 GPM, 40 LB Capacity Semi Automatic Epoxy Coated Steel Grease Interceptor Note: Josam 60105-SA. <i>For Steel Enclosure Cabinet With Non Skid Cover, Add</i>	2,586.13 <i>1,576.56</i>	151.59
22 13 19 26-0027 EA 25 GPM, 50 LB Capacity Semi Automatic Epoxy Coated Steel Grease Interceptor Note: Josam 60106-SA. <i>For Steel Enclosure Cabinet With Non Skid Cover, Add</i>	3,112.12 <i>1,638.66</i>	165.38
22 13 19 26-0028 EA 35 GPM, 70 LB Capacity Semi Automatic Epoxy Coated Steel Grease Interceptor Note: Josam 60107-SA. <i>For Steel Enclosure Cabinet With Non Skid Cover, Add</i>	3,224.81 <i>1,798.70</i>	192.94
22 13 19 26-0029 EA 50 GPM, 100 LB Capacity Semi Automatic Epoxy Coated Steel Grease Interceptor Note: Josam 60108-SA. <i>For Steel Enclosure Cabinet With Non Skid Cover, Add</i>	3,681.24 <i>1,911.70</i>	220.50
22 13 19 26-0030 Low Profile Semi Automatic Cleaning Epoxy Coated Steel Grease Interceptor (22 13 19 26-0021) Note: Josam 60115A-SA, Smith 8100GTX, or Zurn Z1171-TD series.		
22 13 19 26-0031 EA 35 GPM, 70 LB Capacity Low Profile Semi Automatic Epoxy Coated Steel Grease Interceptor Note: Josam 60115A-SA.	4,311.98	192.94
22 13 19 26-0032 Automatic Cleaning Stainless Steel Grease Interceptor (22 13 19 26) Note: Includes stainless steel screen basket, plastic grease container with lid and control box with digital timer.		
22 13 19 26-0033 EA 20 GPM, 69 LB Capacity Automatic Cleaning Stainless Steel Grease Interceptor Note: Lowe Engineering 20 Greasestopper.	3,709.10	151.59
22 13 19 26-0034 EA 25 GPM, 91 LB Capacity Automatic Cleaning Stainless Steel Grease Interceptor Note: Lowe Engineering 25 Greasestopper.	4,304.11	165.38



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 13 19 26-0035 Precast Concrete Grease Interceptor <small>(22 13 19 26)</small>		
Note: Includes two access manholes, cast iron non-skid surface, lift hole, frame and cover for heavy-traffic.		
22 13 19 26-0036 EA 1,000 Gallon Pre-Cast Grease Interceptor.....	3,420.89	270.51
22 13 19 26-0037 EA 1,250 Gallon Pre-Cast Grease Interceptor.....	3,910.88	270.51
22 13 19 26-0038 EA 1,500 Gallon Pre-Cast Grease Interceptor.....	4,438.94	309.26
22 13 19 26-0039 EA 2,000 Gallon Pre-Cast Grease Interceptor.....	5,058.11	436.75
22 13 19 26-0040 EA 2,500 Gallon Pre-Cast Grease Interceptor.....	5,702.68	587.62
22 13 19 26-0041 EA 4,000 Gallon Pre-Cast Grease Interceptor.....	8,544.84	773.11
22 13 19 26-0042 EA 5,000 Gallon Pre-Cast Grease Interceptor.....	10,991.94	1,267.79
22 13 19 26-0043 Coated Steel Manual Oil Interceptor <small>(22 13 19 26)</small>		
Note: Includes internal air relief, and flow control fitting.		
22 13 19 26-0044 EA 10 GPM, Oil Interceptor, Coated Steel, Manual Draw-Off.....	2,021.09	209.99
22 13 19 26-0045 EA 15 GPM, Oil Interceptor, Coated Steel, Manual Draw-Off.....	2,696.24	249.51
22 13 19 26-0046 EA 20 GPM, Oil Interceptor, Coated Steel, Manual Draw-Off.....	3,268.14	307.01
22 13 19 26-0047 EA 25 GPM, Oil Interceptor, Coated Steel, Manual Draw-Off.....	3,549.48	332.55
22 13 19 26-0048 EA 35 GPM, Oil Interceptor, Coated Steel, Manual Draw-Off.....	4,230.47	362.89
22 13 19 26-0049 EA 50 GPM, Oil Interceptor, Coated Steel, Manual Draw-Off.....	5,514.65	399.22
22 13 19 26-0050 EA 75 GPM, Oil Interceptor, Coated Steel, Manual Draw-Off.....	9,086.86	459.39
22 13 19 26-0051 EA 100 GPM, Oil Interceptor, Coated Steel, Manual Draw-Off.....	9,984.11	565.23
22 13 19 26-0052 EA 150 GPM, Oil Interceptor, Coated Steel, Manual Draw-Off.....	12,194.52	612.63
22 13 19 26-0053 EA 200 GPM, Oil Interceptor, Coated Steel, Manual Draw-Off.....	16,968.21	735.01
22 13 19 26-0054 EA 250 GPM, Oil Interceptor, Coated Steel, Manual Draw-Off.....	19,529.55	790.14
22 13 19 26-0055 EA 350 GPM, Oil Interceptor, Coated Steel, Manual Draw-Off.....	24,556.39	942.29
22 13 19 26-0056 EA 400 GPM, Oil Interceptor, Coated Steel, Manual Draw-Off.....	29,362.59	772.14
22 13 19 26-0057 EA 500 GPM, Oil Interceptor, Coated Steel, Manual Draw-Off.....	34,786.60	918.76
22 13 19 33 Backwater Valves <small>(22 13 19)</small>		
22 13 19 33-0001 Cast Iron Body Terminal Backwater Valves <small>(22 13 19 33)</small>		
22 13 19 33-0002 EA 2" Cast Iron Body Terminal Backwater Valve	222.17	21.10
22 13 19 33-0003 EA 3" Cast Iron Body Terminal Backwater Valve	230.26	26.54
22 13 19 33-0004 EA 4" Cast Iron Body Terminal Backwater Valve	330.67	35.28
22 13 19 33-0005 EA 6" Cast Iron Body Terminal Backwater Valve	870.94	51.37
22 13 19 33-0006 EA 8" Cast Iron Body Terminal Backwater Valve	1,067.56	67.61
22 13 19 33-0007 EA 10" Cast Iron Body Terminal Backwater Valve	3,029.11	83.40
22 13 19 33-0008 EA 12" Cast Iron Body Terminal Backwater Valve	3,438.71	108.17
22 13 19 33-0009 Cast Iron Backwater Sewer Line Valve <small>(22 13 19 33)</small>		
Note: Offset type with bronze swing check assembly, threaded bronze cover, and bell and spigot connections.		
22 13 19 33-0010 EA 2" Backwater Sewer Valve, Cast Iron, Offset Type With Bronze Swing Check Assembly	556.96	50.31
22 13 19 33-0011 EA 3" Backwater Sewer Valve, Cast Iron, Offset Type With Bronze Swing Check Assembly	838.74	61.01
22 13 19 33-0012 EA 4" Backwater Sewer Valve, Cast Iron, Offset Type With Bronze Swing Check Assembly	1,039.72	78.65
22 13 19 33-0013 EA 6" Backwater Sewer Valve, Cast Iron, Offset Type With Bronze Swing Check Assembly	1,453.59	93.32
22 13 19 33-0014 EA 8" Backwater Sewer Valve, Cast Iron, Offset Type With Bronze Swing Check Assembly	2,001.14	110.60
22 13 19 33-0015 Cast Iron, Straight Through Shear Gate, Swing Check Backwater Valve <small>(22 13 19 33)</small>		
Note: Offset type with bronze, manually operated shear gate, non-rising stem, and bell and spigot connections.		
22 13 19 33-0016 EA 3" Cast Iron Body, Straight Through Shear Gate, Swing Check Backwater Valve.....	1,462.04	79.61
22 13 19 33-0017 EA 4" Cast Iron Body, Straight Through Shear Gate, Swing Check Backwater Valve.....	1,501.44	105.84
22 13 19 33-0018 EA 5" Cast Iron Body, Straight Through Shear Gate, Swing Check Backwater Valve.....	2,184.53	138.22
22 13 19 33-0019 EA 6" Cast Iron Body, Straight Through Shear Gate, Swing Check Backwater Valve.....	2,208.56	154.09
22 13 19 33-0020 Polyvinyl Chloride (PVC) Backwater Sewer Line Valve <small>(22 13 19 33)</small>		
Note: Oatey.		
22 13 19 33-0021 EA 3" Polyvinyl Chloride (PVC) Backwater Sewer Valve (Oatey 43900).....	80.87	26.54
22 13 19 33-0022 EA 4" Polyvinyl Chloride (PVC) Backwater Sewer Valve (Oatey 43904).....	98.24	35.28
22 13 19 33-0023 EA 6" Polyvinyl Chloride (PVC) Backwater Sewer Valve (Oatey 43908).....	270.35	51.37
22 13 19 33-0024 Polyvinyl Chloride (PVC) Extendable Backwater Valves <small>(22 13 19 33)</small>		
22 13 19 33-0025 EA 3" Polyvinyl Chloride (PVC) Extendable Backwater Sewer Valve (Rectorseal Clean Check).....	187.14	53.07
Note: Includes valve body, flapper assembly and collar.		
22 13 19 33-0026 EA 4" Polyvinyl Chloride (PVC) Extendable Backwater Sewer Valve (Rectorseal Clean Check).....	249.19	70.56
Note: Includes valve body, flapper assembly and collar.		
22 13 19 33-0027 EA 6" Polyvinyl Chloride (PVC) Extendable Backwater Sewer Valve (Rectorseal Clean Check).....	428.57	102.73
Note: Includes valve body, flapper assembly and collar.		
22 13 19 36 Air-Admittance Valves <small>(22 13 19)</small>		
22 13 19 36-0001 Acrylonitrile Butadiene Styrene (ABS) And Polyvinyl Chloride (PVC) Automatic Drain Vent <small>(22 13 19 36)</small>		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 13 19 36-0002 EA 1-1/4", 1-1/2" And 2" Acrylonitrile Butadiene Styrene (ABS) Or Polyvinyl Chloride (PVC) Automatic Drain Vent, Mini Vent.....	89.68	10.29
22 13 19 36-0003 EA 2", 3" And 4" Acrylonitrile Butadiene Styrene (ABS) Or Polyvinyl Chloride (PVC) Automatic Drain Vent, Maxi Vent.....	105.92	10.29
22 13 23 Sanitary Waste Interceptors (22 13)		
22 13 23 00-0001 Sediment Bucket Solids Interceptors (22 13 23)		
22 13 23 00-0002 EA 1-1/2" Or 2" Top Access, 15 GPM, Composite With Removable PVC Sediment Bucket Solids Interceptor (Zurn 1180).....	669.25	104.08
Note: Replaces P-Trap. Recovers all types of solids from precious metal particles, plaster, clay or similar materials.		
22 13 23 00-0003 EA 1-1/2" Or 2" Bottom Access, 15 GPM, Composite With Removable PVC Sediment Bucket Solids Interceptor (Zurn 1184).....	670.05	104.08
Note: Replaces P-Trap. Recovers all types of solids from precious metal particles, plaster, clay or similar materials.		
22 13 23 00-0004 EA 1-1/2" Or 2" Top Access, Acid Resistant Coated Steel (Inside And Outside), Aluminum Cover, Removable Stainless Steel Sediment Bucket Solids Interceptor (Jay R. Smith 8714 ARIO).....	930.69	104.08
Note: On floor mount. Replaces P-Trap. Recovers all types of solids from precious metal particles, plaster, clay or similar materials.		
22 13 23 00-0005 EA 1-1/2" Or 2" Bottom Access, 15 GPM, Acid Resistant Coated Cast Iron, Aluminum Strainer, Removable Stainless Steel Screens, Sediment Bucket Solids Interceptor (Jay R. Smith 8730-ARIO).....	930.69	104.08
Note: Replaces P-Trap. Recovers all types of solids from precious metal particles, plaster, clay or similar materials.		
22 13 23 00-0006 EA 1-1/2" Or 2" Top Access, Acid Resistant Coated Cast Aluminum (Inside And Outside) Removable Stainless Steel Screen, Sediment Bucket Solids Interceptor (Josam 61030)	989.70	104.08
Note: Replaces P-Trap. Recovers all types of solids from precious metal particles, plaster, clay or similar materials.		
22 13 23 00-0007 Solid Interceptors, Cast Iron With Internal Deep Seal Trap (22 13 23)		
22 13 23 00-0008 EA 1-1/2" Inlet Cast Iron Solid Interceptor, Painted Enamel.....	283.62	35.61
<i>For Stainless Steel Bucket, Add</i>		
	175.00	
22 13 23 00-0009 EA 2" Inlet Cast Iron Solid Interceptor, Painted Enamel	288.18	37.93
<i>For Stainless Steel Bucket, Add</i>		
	175.00	
22 13 23 00-0010 Sediment Strainers (22 13 23)		
22 13 23 00-0011 EA 2" Strainer, Pump Suction Side	110.05	48.63
22 13 29 Sanitary Sewerage Pumps (22 13)		
Note: Includes extra set of gaskets, bearings and seals.		
22 13 29 13 Wet-Pit-Mounted, Vertical Sewerage Pumps (22 13 29)		
22 13 29 13-0001 Vertical Non-Clog Sewage Pumps (22 13 29 13)		
22 13 29 13-0002 1-1/2" Solids 1750 RPM Vertical Sewage Pumps (22 13 29 13-0001)		
22 13 29 13-0003 EA 1/2 HP, Up To 75 GPM Sewage Pump, Vertical Non Clog, 2-1/2" Discharge Pipe, 1,750 RPM	8,376.43	881.72
22 13 29 13-0004 EA 3/4 HP, Up To 125 GPM Sewage Pump, Vertical Non Clog, 2-1/2" Discharge Pipe, 1,750 RPM	8,782.90	881.72
22 13 29 13-0005 EA 1 HP, Up To 150 GPM Sewage Pump, Vertical Non Clog, 2-1/2" Discharge Pipe, 1,750 RPM	9,189.37	881.72
22 13 29 13-0006 EA 1-1/2 HP, Up To 150 GPM Sewage Pump, Vertical Non Clog, 2-1/2" Discharge Pipe, 1,750 RPM	9,577.08	881.72
22 13 29 13-0007 2" Solids 1750 RPM Vertical Sewage Pumps (22 13 29 13-0001)		
22 13 29 13-0008 EA 3/4 HP, Up To 75 GPM Sewage Pump, Vertical Non Clog, 3" Discharge Pipe, 1,750 RPM.....	9,502.04	881.72
22 13 29 13-0009 EA 1 HP, Up To 100 GPM Sewage Pump, Vertical Non Clog, 3" Discharge Pipe, 1,750 RPM.....	9,658.38	881.72
22 13 29 13-0010 EA 2 HP, Up To 200 GPM Sewage Pump, Vertical Non Clog, 3" Discharge Pipe, 1,750 RPM.....	9,767.81	881.72
22 13 29 13-0011 EA 3 HP, Up To 300 GPM Sewage Pump, Vertical Non Clog, 3" Discharge Pipe, 1,750 RPM.....	10,518.22	881.72
22 13 29 13-0012 EA 5 HP, Up To 400 GPM Sewage Pump, Vertical Non Clog, 3" Discharge Pipe, 1,750 RPM.....	11,252.99	881.72
22 13 29 13-0013 EA 7-1/2 HP, Up To 500 GPM Sewage Pump, Vertical Non Clog, 3" Discharge Pipe, 1,750 RPM	12,378.61	881.72
22 13 29 13-0014 EA 10 HP, Up To 600 GPM Sewage Pump, Vertical Non Clog, 3" Discharge Pipe, 1,750 RPM.....	13,504.22	881.72
22 13 29 13-0015 EA 15 HP, Up To 600 GPM Sewage Pump, Vertical Non Clog, 3" Discharge Pipe, 1,750 RPM.....	15,213.15	1,173.38
22 13 29 13-0016 3" Solids 1750 RPM Vertical Sewage Pumps (22 13 29 13-0001)		
22 13 29 13-0017 EA 2 HP, Up To 300 GPM Sewage Pump, Vertical Non Clog, 4" Discharge Pipe, 1,750 RPM.....	10,285.38	881.72
22 13 29 13-0018 EA 3 HP, Up To 400 GPM Sewage Pump, Vertical Non Clog, 4" Discharge Pipe, 1,750 RPM.....	10,285.38	881.72
22 13 29 13-0019 EA 5 HP, Up To 500 GPM Sewage Pump, Vertical Non Clog, 4" Discharge Pipe, 1,750 RPM.....	10,556.24	881.72
22 13 29 13-0020 EA 7-1/2 HP, Up To 700 GPM Sewage Pump, Vertical Non Clog, 4" Discharge Pipe, 1,750 RPM	12,657.88	881.72
22 13 29 13-0021 EA 10 HP, Up To 800 GPM Sewage Pump, Vertical Non Clog, 4" Discharge Pipe, 1,750 RPM.....	13,026.54	881.72
22 13 29 13-0022 EA 15 HP, Up To 900 GPM Sewage Pump, Vertical Non Clog, 4" Discharge Pipe, 1,750 RPM.....	15,342.84	1,173.38
22 13 29 13-0023 EA 20 HP, Up To 900 GPM Sewage Pump, Vertical Non Clog, 4" Discharge Pipe, 1,750 RPM.....	16,280.85	1,173.38
22 13 29 13-0024 Extra Column Assemblies Addition, 5' Or Less (22 13 29 13-0001)		
22 13 29 13-0025 EA 2-1/2" Diameter x 5' Long Extra Column Assembly For vertical sewage pumps.....	519.49	
22 13 29 13-0026 EA 3" Diameter x 5' Long Extra Column Assembly For vertical sewage pumps.....	623.75	
22 13 29 13-0027 EA 4" Diameter x 5' Long Extra Column Assembly For vertical sewage pumps.....	697.18	
22 13 29 13-0028 EA 5" Diameter x 5' Long Extra Column Assembly For vertical sewage pumps.....	709.88	
22 13 29 13-0029 EA 6" Diameter x 5' Long Extra Column Assembly For vertical sewage pumps.....	796.91	

22 Plumbing**22 10 Plumbing Piping****22 13 Facility Sanitary Sewerage**MINOR
CSI UOM DESCRIPTIONTOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 13 29 13-0030			Float Switches (22 13 29 13-0001) Note: Copper coated floats, brass rods and stops and switch brackets.		
22 13 29 13-0031	EA		Float Switch Copper Coated Float, Add, General Purpose For vertical sewage pumps	466.91	
22 13 29 13-0032	EA		Float Switch Copper Coated Float, Add, Weather Proof For vertical sewage pumps	490.48	
22 13 29 13-0033	EA		Float Switch Copper Coated Float, Add, Explosion Proof For vertical sewage pumps	501.36	
22 13 29 13-0034			Square Or Round Steel Sump Covers (22 13 29 13-0001)		
22 13 29 13-0035	EA		24" Steel Sump Covers, Square Or Round.....	444.51	29.40
22 13 29 13-0036	EA		30" Steel Sump Covers, Square Or Round.....	492.22	33.07
22 13 29 13-0037	EA		36" Steel Sump Covers, Square Or Round.....	682.33	44.10
22 13 29 13-0038	EA		40" Steel Sump Covers, Square Or Round.....	985.53	51.45
22 13 29 13-0039	EA		42" Steel Sump Covers, Square Or Round.....	1,055.81	53.29
22 13 29 13-0040	EA		48" Steel Sump Covers, Square Or Round.....	1,128.36	55.13
22 13 29 13-0041	EA		54" Steel Sump Covers, Square Or Round.....	1,435.86	66.15
22 13 29 13-0042	EA		60" Steel Sump Covers, Square Or Round.....	1,938.94	73.50
22 13 29 13-0043	EA		72" Steel Sump Covers, Square Or Round.....	2,458.72	91.88
22 13 29 13-0044	EA		84" Steel Sump Covers, Square Or Round.....	3,119.65	101.06
22 13 29 16			Submersible Sewerage Pumps (22 13 29) Note: Includes 25' of cord with pumps unless otherwise noted.		
22 13 29 16-0001			Submersible Sewage Pumps With Vortex Impeller (22 13 29 16)		
22 13 29 16-0002			Submersible Sewage Pumps With Cast Iron Vortex Impeller (22 13 29 16-0001)		
22 13 29 16-0003	EA		1/2 HP Submersible Sewage Pump, 115 Volt Or 230 Volt, 1 Phase, 2" Threaded Discharge, Epoxy-Coated Cast Steel Housing And Impeller	483.71	53.50
22 13 29 16-0004	EA		1/2 HP Submersible Sewage Pump, 115 Volt Or 230 Volt, 1 Phase, 2" To 3" Flanged Discharge, Epoxy-Coated Cast Steel Housing And Impeller.....	634.14	53.50
22 13 29 16-0005	EA		1 HP Submersible Sewage Pump, 115 Volt Or 230 Volt, 1 Phase, 2" To 3" Flanged Discharge, Epoxy-Coated Cast Steel Housing And Impeller.....	763.58	66.87
22 13 29 16-0006			Submersible Sewage Pumps With Bronze Vortex Impeller (22 13 29 16-0001)		
22 13 29 16-0007	EA		1/2 HP Submersible Sewage Pump, 115 Volt Or 230 Volt, 1 Phase, 2" To 3" Flanged Discharge, Epoxy-Coated Cast Steel Housing And Bronze Impeller.....	724.48	53.50
22 13 29 16-0008	EA		1 HP Submersible Sewage Pump, 230 Volt, 1 Phase, 2" To 3" Flanged Discharge, Epoxy-Coated Cast Steel Housing And Bronze Impeller	886.47	66.87
22 13 29 16-0009	EA		1-1/2 HP Submersible Sewage Pump, 230 Volt, 1 Or 3 Phase, 2" To 3" Flanged Discharge, Epoxy-Coated Cast Steel Housing And Bronze Impeller	1,070.13	107.79
22 13 29 16-0010	EA		2 HP Submersible Sewage Pump, 230 Volt, 1 Or 3 Phase, 2" To 3" Flanged Discharge, Epoxy-Coated Cast Steel Housing And Bronze Impeller	1,173.97	131.74
22 13 29 16-0011			Submersible Sewage Pumps With Semi-Open Impeller (22 13 29 16)		
22 13 29 16-0012	EA		1 HP Submersible Sewage Pump, 230 Volt, 3 Phase, 3" To 4" Flanged Discharge, Epoxy-Coated Cast Steel Housing And Impeller	1,572.92	66.87
22 13 29 16-0013	EA		1.5 HP Submersible Sewage Pump, 230 Volt, 3 Phase, 3" To 4" Flanged Discharge, Epoxy-Coated Cast Steel Housing And Impeller	1,751.88	114.41
22 13 29 16-0014	EA		2 HP Submersible Sewage Pump, 230 Volt, 3 Phase, 3" To 4" Flanged Discharge, Epoxy-Coated Cast Steel Housing And Impeller	2,260.49	139.84
22 13 29 16-0015	EA		3 HP Submersible Sewage Pump, 230 Volt, 3 Phase, 3" To 4" Flanged Discharge, Epoxy-Coated Cast Steel Housing And Impeller	2,628.37	169.50
22 13 29 16-0016	EA		5 HP Submersible Sewage Pump, 230 Volt, 3 Phase, 3" To 4" Flanged Discharge, Epoxy-Coated Cast Steel Housing And Impeller	3,062.96	199.16
22 13 29 16-0017	EA		7.5 HP Submersible Sewage Pump, 230 Volt, 3 Phase, 3" To 4" Flanged Discharge, Epoxy-Coated Cast Steel Housing And Impeller	3,198.56	228.83
22 13 29 16-0018			Submersible Sewage Pumps Accessories (22 13 29 16)		
22 13 29 16-0019	EA		Simplex Single Phase Plug In Controller With NEMA 4X Enclosure For Non-Automatic Submersible Sewage Pump	285.04	60.32
22 13 29 16-0020	EA		Simplex Single Phase Controller With NEMA 4X Enclosure For Non Automatic Submersible Sewage Pump	673.56	80.44
22 13 29 16-0021	EA		Simplex Three Phase Controller With NEMA 4X Enclosure For Non Automatic Submersible Sewage Pump.....	876.68	80.44
22 13 29 16-0022	EA		Duplex Alarm System And Controller With NEMA 4X Enclosure For Non Automatic Submersible Sewage Pump	977.76	100.54
22 13 29 16-0023	EA		High-water Alarm For Submersible Sewage Pump.....	220.07	40.21
22 13 29 16-0024	EA		Float Switch For Submersible Sewage Pump.....	82.28	20.11
22 13 29 16-0025	EA		Rail System With 2" Discharge For Submersible Sewage Pump.....	414.53	60.32
22 13 29 33			Sewerage Pump Basins And Pits (22 13 29)		
22 13 29 33-0001			Sewage Sump Pump Basin (22 13 29 33)		
22 13 29 33-0002			High Density Polyethylene (HDPE) Basin (22 13 29 33-0001)		
22 13 29 33-0003	EA		18" Diameter x 24" High, High Density Polyethylene (HDPE) Basin And Lid With Inlet And Hub.....	97.41	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
				22 13 29 33-0004 EA 18" Diameter x 30" High, High Density Polyethylene (HDPE) Basin And Lid With Inlet And Hub.....	125.84	
				22 13 29 33-0005 EA 24" Diameter x 30" High, High Density Polyethylene (HDPE) Basin And Lid With Inlet And Hub.....	285.44	
				22 13 29 33-0006 EA 24" Diameter x 36" High, High Density Polyethylene (HDPE) Basin And Lid With Inlet And Hub.....	400.49	
				22 13 29 33-0007 EA 30" Diameter x 36" High, High Density Polyethylene (HDPE) Basin And Lid With Inlet And Hub.....	515.54	
				22 13 29 33-0008 EA 36" Diameter x 36" High, High Density Polyethylene (HDPE) Basin And Lid With Inlet And Hub.....	599.66	
				22 13 29 33-0009 Fiberglass Basin <small>(22 13 29 33-0001)</small>		
				22 13 29 33-0010 EA 18" Diameter x 30" High Fiberglass Basin And Lid With Inlet And Hub.....	173.05	
				22 13 29 33-0011 EA 24" Diameter x 30" High Fiberglass Basin And Lid With Inlet And Hub.....	338.15	
				22 13 29 33-0012 EA 30" Diameter x 36" High Fiberglass Basin And Lid With Inlet And Hub.....	597.24	
				22 13 29 33-0013 EA 36" Diameter x 36" High Fiberglass Basin And Lid With Inlet And Hub.....	798.85	
				22 13 29 33-0014 EA 36" Diameter x 48" High Fiberglass Basin And Lid With Inlet And Hub.....	918.78	
				22 13 29 33-0015 EA 36" Diameter x 60" High Fiberglass Basin And Lid With Inlet And Hub.....	970.50	
				22 13 29 33-0016 EA 36" Diameter x 72" High Fiberglass Basin And Lid With Inlet And Hub.....	1,137.52	
				22 13 29 33-0017 EA 48" Diameter x 48" High Fiberglass Basin And Lid With Inlet And Hub.....	1,319.75	
				22 14 Facility Storm Drainage <small>(22 10)</small>		
				22 14 13 Facility Storm Drainage Piping <small>(22 14)</small>		
				See CSI section 22 13 16 00-0000 for storm drainage piping.		
				22 14 26 Facility Storm Drains <small>(22 14)</small>		
				22 14 26 13 Roof Drains <small>(22 14 26)</small>		
				22 14 26 13-0001 Cast Iron Roof Drains <small>(22 14 26 13)</small>		
				22 14 26 13-0002 Cast Iron Roof Drains With Large Polypropylene Dome <small>(22 14 26 13-0001)</small>		
				Note: Dome free area is 124 square inches.		
				22 14 26 13-0003 EA 15" Diameter Cast Iron Roof Drain With 2" Outlet, 124 Square Inch Free Area Polypropylene Dome.....	390.50	122.53
				For 4" (10 cm) Fixed Extension Collar, Cast Iron, Add	136.00	
				For Bronze Dome, Add	170.50	
				For Deck Clamp, Add	50.00	
				For Galvanized Iron Parts, Add	197.00	
				For Drain Receiver, Add	75.50	
				22 14 26 13-0004 EA 15" Diameter Cast Iron Roof Drain With 3" Outlet, 124 Square Inch Free Area Polypropylene Dome.....	451.75	147.00
				For 4" (10 cm) Fixed Extension Collar, Cast Iron, Add	136.00	
				For Bronze Dome, Add	170.50	
				For Deck Clamp, Add	50.00	
				For Galvanized Iron Parts, Add	197.00	
				For Drain Receiver, Add	75.50	
				22 14 26 13-0005 EA 15" Diameter Cast Iron Roof Drain With 4" Outlet, 124 Square Inch Free Area Polypropylene Dome.....	513.00	183.75
				For 4" (10 cm) Fixed Extension Collar, Cast Iron, Add	136.00	
				For Bronze Dome, Add	170.50	
				For Deck Clamp, Add	50.00	
				For Galvanized Iron Parts, Add	197.00	
				For Drain Receiver, Add	75.50	
				22 14 26 13-0006 EA 15" Diameter Cast Iron Roof Drain With 5" Outlet, 124 Square Inch Free Area Polypropylene Dome.....	667.39	220.50
				For 4" (10 cm) Fixed Extension Collar, Cast Iron, Add	136.00	
				For Bronze Dome, Add	170.50	
				For Deck Clamp, Add	50.00	
				For Galvanized Iron Parts, Add	197.00	
				For Drain Receiver, Add	75.50	
				22 14 26 13-0007 EA 15" Diameter Cast Iron Roof Drain With 6" Outlet, 124 Square Inch Free Area Polypropylene Dome.....	698.01	244.98
				For 4" (10 cm) Fixed Extension Collar, Cast Iron, Add	136.00	
				For Bronze Dome, Add	170.50	
				For Deck Clamp, Add	50.00	
				For Galvanized Iron Parts, Add	197.00	
				For Drain Receiver, Add	75.50	
				22 14 26 13-0008 EA 15" Diameter Cast Iron Roof Drain With 8" Outlet, 124 Square Inch Free Area Polypropylene Dome.....	784.57	257.25
				For 4" (10 cm) Fixed Extension Collar, Cast Iron, Add	136.00	
				For Bronze Dome, Add	170.50	
				For Deck Clamp, Add	50.00	
				For Galvanized Iron Parts, Add	197.00	
				For Drain Receiver, Add	75.50	
				22 14 26 13-0009 EA 15" Diameter Cast Iron Roof Drain With 10" Outlet, 124 Square Inch Free Area Polypropylene Dome.....	958.93	266.44
				For 4" (10 cm) Fixed Extension Collar, Cast Iron, Add	136.00	
				For Bronze Dome, Add	170.50	
				For Deck Clamp, Add	50.00	
				For Galvanized Iron Parts, Add	197.00	
				For Drain Receiver, Add	75.50	
				22 14 26 13-0010 Cast Iron Roof Drains With Expansion Joint <small>(22 14 26 13-0001)</small>		
				Note: With polypropylene dome. Dome free area is 124 square inches.		
				22 14 26 13-0011 EA 15" Diameter Cast Iron Roof Drain With Expansion Joint, 2" Outlet, Polypropylene Dome.....	526.50	122.53
				For Deck Clamp, Add	50.00	
				For Drain Receiver, Add	56.00	
				For 4" (10 cm) Fixed Extension Collar, Cast Iron, Add	136.00	
				For Galvanized Iron Parts, Add	197.00	

22	Plumbing
22 10	Plumbing Piping
22 14	Facility Storm Drainage



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 14 26 13-0012	EA		15" Diameter Cast Iron Roof Drain With Expansion Joint, 3" Outlet, Polypropylene Dome	597.25	147.00
			<i>For Deck Clamp, Add</i>	50.00	
			<i>For Drain Receiver, Add</i>	56.00	
			<i>For 4" (10 cm) Fixed Extension Collar, Cast Iron, Add</i>	136.00	
			<i>For Galvanized Iron Parts, Add</i>	197.00	
22 14 26 13-0013	EA		15" Diameter Cast Iron Roof Drain With Expansion Joint, 4" Outlet, Polypropylene Dome	677.00	183.75
			<i>For Deck Clamp, Add</i>	50.00	
			<i>For Drain Receiver, Add</i>	56.00	
			<i>For 4" (10 cm) Fixed Extension Collar, Cast Iron, Add</i>	136.00	
			<i>For Galvanized Iron Parts, Add</i>	197.00	
22 14 26 13-0014	EA		15" Diameter Cast Iron Roof Drain With Expansion Joint, 5" Outlet, Polypropylene Dome	905.89	220.50
			<i>For Deck Clamp, Add</i>	50.00	
			<i>For Drain Receiver, Add</i>	56.00	
			<i>For 4" (10 cm) Fixed Extension Collar, Cast Iron, Add</i>	136.00	
			<i>For Galvanized Iron Parts, Add</i>	197.00	
22 14 26 13-0015	EA		15" Diameter Cast Iron Roof Drain With Expansion Joint, 6" Outlet, Polypropylene Dome	971.01	244.98
			<i>For Deck Clamp, Add</i>	50.00	
			<i>For Drain Receiver, Add</i>	56.00	
			<i>For 4" (10 cm) Fixed Extension Collar, Cast Iron, Add</i>	136.00	
			<i>For Galvanized Iron Parts, Add</i>	197.00	
22 14 26 13-0016			Cast Iron Roof Drains With Flat Bronze Promenade Top <small>(22 14 26 13-0001)</small>		
22 14 26 13-0017	EA		14" x 14" Cast Iron Roof Drain With 2" Outlet, Bronze Promenade Top	660.50	122.53
			<i>For Galvanized Iron Parts, Add</i>	197.00	
			<i>For Deck Clamp, Add</i>	50.00	
			<i>For Drain Receiver, Add</i>	75.50	
			<i>For 4" (10 cm) Fixed Extension Collar, Cast Iron, Add</i>	136.00	
22 14 26 13-0018	EA		14" x 14" Cast Iron Roof Drain With 3" Outlet, Bronze Promenade Top	721.75	147.00
			<i>For Galvanized Iron Parts, Add</i>	197.00	
			<i>For Deck Clamp, Add</i>	50.00	
			<i>For Drain Receiver, Add</i>	75.50	
			<i>For 4" (10 cm) Fixed Extension Collar, Cast Iron, Add</i>	136.00	
22 14 26 13-0019	EA		14" x 14" Cast Iron Roof Drain With 4" Outlet, Bronze Promenade Top	783.00	183.75
			<i>For Galvanized Iron Parts, Add</i>	197.00	
			<i>For Deck Clamp, Add</i>	50.00	
			<i>For Drain Receiver, Add</i>	75.50	
			<i>For 4" (10 cm) Fixed Extension Collar, Cast Iron, Add</i>	136.00	
22 14 26 13-0020	EA		14" x 14" Cast Iron Roof Drain With 5" Outlet, Bronze Promenade Top	933.39	220.50
			<i>For Galvanized Iron Parts, Add</i>	197.00	
			<i>For Deck Clamp, Add</i>	50.00	
			<i>For Drain Receiver, Add</i>	75.50	
			<i>For 4" (10 cm) Fixed Extension Collar, Cast Iron, Add</i>	136.00	
22 14 26 13-0021	EA		14" x 14" Cast Iron Roof Drain With 6" Outlet, Bronze Promenade Top	964.01	244.98
			<i>For Galvanized Iron Parts, Add</i>	197.00	
			<i>For Deck Clamp, Add</i>	50.00	
			<i>For Drain Receiver, Add</i>	75.50	
			<i>For 4" (10 cm) Fixed Extension Collar, Cast Iron, Add</i>	136.00	
22 14 26 13-0022			Cast Iron Scupper Drain With L-Shaped Bronze Grate <small>(22 14 26 13-0001)</small>		
22 14 26 13-0023	EA		Cast Iron Scupper Drain With 2" Outlet, L-Shaped Bronze Grate	389.00	49.02
			<i>For Vandal Proof Grate, Add</i>	11.00	
			<i>For Galvanized Iron Parts, Add</i>	49.00	
22 14 26 13-0024	EA		Cast Iron Scupper Drain With 3" Outlet, L-Shaped Bronze Grate	413.50	61.23
			<i>For Vandal Proof Grate, Add</i>	11.00	
			<i>For Galvanized Iron Parts, Add</i>	49.00	
22 14 26 13-0025	EA		Cast Iron Scupper Drain With 4" Outlet, L-Shaped Bronze Grate	424.64	66.81
			<i>For Vandal Proof Grate, Add</i>	11.00	
			<i>For Galvanized Iron Parts, Add</i>	49.00	
22 14 26 13-0026	EA		Cast Iron Scupper Drain With 5" Outlet, L-Shaped Bronze Grate	590.61	88.57
			<i>For Galvanized Iron Parts, Add</i>	98.00	
			<i>For Vandal Proof Grate, Add</i>	11.00	
22 14 26 13-0027	EA		Cast Iron Scupper Drain With 6" Outlet, L-Shaped Bronze Grate	629.68	108.12
			<i>For Galvanized Iron Parts, Add</i>	98.00	
			<i>For Vandal Proof Grate, Add</i>	11.00	
22 14 26 13-0028			Cast Iron Roof Drain With Flat Cast Iron Grate <small>(22 14 26 13-0001)</small>		
22 14 26 13-0029	EA		9" x 9" Cast Iron Roof Drain With 2" Outlet, Cast Iron Promenade Top	413.50	122.53
			<i>For Galvanized Iron Parts, Add</i>	55.00	
			<i>For Bronze Grate, Add</i>	78.50	
			<i>For Deck Clamp, Add</i>	31.00	
			<i>For 4" (10 cm) Fixed Extension Collar, Cast Iron, Add</i>	72.00	
22 14 26 13-0030	EA		9" x 9" Cast Iron Roof Drain With 3" Outlet, Cast Iron Promenade Top	474.75	147.00
			<i>For Galvanized Iron Parts, Add</i>	55.00	
			<i>For Bronze Grate, Add</i>	78.50	
			<i>For Deck Clamp, Add</i>	31.00	
			<i>For 4" (10 cm) Fixed Extension Collar, Cast Iron, Add</i>	72.00	
22 14 26 13-0031	EA		9" x 9" Cast Iron Roof Drain With 4" Outlet, Cast Iron Promenade Top	536.00	183.75
			<i>For Galvanized Iron Parts, Add</i>	55.00	
			<i>For Bronze Grate, Add</i>	78.50	
			<i>For Deck Clamp, Add</i>	31.00	
			<i>For 4" (10 cm) Fixed Extension Collar, Cast Iron, Add</i>	72.00	



	Plumbing	22
	Plumbing Piping	22 10
	Facility Storm Drainage	22 14

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 14 26 13-0032 Cast Iron Roof Drains With Large Cast Iron Dome <small>(22 14 26 13-0001)</small>		
22 14 26 13-0033 EA 15" Diameter Cast Iron Roof Drain With 2" Outlet, Cast Iron Dome	433.50	122.53
For Galvanized Iron Parts, Add	197.00	
For Deck Clamp, Add	50.00	
For Drain Receiver, Add	56.00	
For 4" (10 cm) Fixed Extension Collar, Cast Iron, Add	136.00	
22 14 26 13-0034 EA 15" Diameter Cast Iron Roof Drain With 3" Outlet, Cast Iron Dome	494.75	147.00
For Galvanized Iron Parts, Add	197.00	
For Deck Clamp, Add	50.00	
For Drain Receiver, Add	56.00	
For 4" (10 cm) Fixed Extension Collar, Cast Iron, Add	136.00	
22 14 26 13-0035 EA 15" Diameter Cast Iron Roof Drain With 4" Outlet, Cast Iron Dome	556.00	183.75
For Galvanized Iron Parts, Add	197.00	
For Deck Clamp, Add	50.00	
For Drain Receiver, Add	56.00	
For 4" (10 cm) Fixed Extension Collar, Cast Iron, Add	136.00	
22 14 26 13-0036 EA 15" Diameter Cast Iron Roof Drain With 5" Outlet, Cast Iron Dome	710.39	220.50
For Galvanized Iron Parts, Add	197.00	
For Deck Clamp, Add	50.00	
For Drain Receiver, Add	56.00	
For 4" (10 cm) Fixed Extension Collar, Cast Iron, Add	136.00	
22 14 26 13-0037 EA 15" Diameter Cast Iron Roof Drain With 6" Outlet, Cast Iron Dome	741.01	244.98
For Galvanized Iron Parts, Add	197.00	
For Deck Clamp, Add	50.00	
For Drain Receiver, Add	56.00	
For 4" (10 cm) Fixed Extension Collar, Cast Iron, Add	136.00	
22 14 26 13-0038 EA 15" Diameter Cast Iron Roof Drain With 8" Outlet, Cast Iron Dome	827.57	257.25
For Galvanized Iron Parts, Add	197.00	
For Deck Clamp, Add	50.00	
For Drain Receiver, Add	56.00	
For 4" (10 cm) Fixed Extension Collar, Cast Iron, Add	136.00	
22 14 26 13-0039 EA 15" Diameter Cast Iron Roof Drain With 10" Outlet, Cast Iron Dome	1,001.93	266.44
For Galvanized Iron Parts, Add	197.00	
For Deck Clamp, Add	50.00	
For Drain Receiver, Add	56.00	
For 4" (10 cm) Fixed Extension Collar, Cast Iron, Add	136.00	
22 14 26 13-0040 Aluminum Roof Drains <small>(22 14 26 13)</small>		
22 14 26 13-0041 Aluminum Dome Roof Drains <small>(22 14 26 13-0040)</small>		
22 14 26 13-0042 EA 15" Diameter Roof Drain With 2" Outlet, Aluminum Dome.....	441.00	122.53
For Galvanized Iron Parts, Add	197.00	
For Deck Clamp, Add	50.00	
For Drain Receiver, Add	56.00	
For 4" (10 cm) Fixed Extension Collar, Cast Iron, Add	136.00	
22 14 26 13-0043 EA 15" Diameter Roof Drain With 3" Outlet, Aluminum Dome.....	502.25	147.00
For Galvanized Iron Parts, Add	197.00	
For Deck Clamp, Add	50.00	
For Drain Receiver, Add	56.00	
For 4" (10 cm) Fixed Extension Collar, Cast Iron, Add	136.00	
22 14 26 13-0044 EA 15" Diameter Roof Drain With 4" Outlet, Aluminum Dome.....	563.50	183.75
For Galvanized Iron Parts, Add	197.00	
For Deck Clamp, Add	50.00	
For Drain Receiver, Add	56.00	
For 4" (10 cm) Fixed Extension Collar, Cast Iron, Add	136.00	
22 14 26 13-0045 EA 15" Diameter Roof Drain With 6" Outlet, Aluminum Dome.....	748.51	244.76
For Galvanized Iron Parts, Add	197.00	
For Deck Clamp, Add	50.00	
For Drain Receiver, Add	56.00	
For 4" (10 cm) Fixed Extension Collar, Cast Iron, Add	136.00	
22 14 26 13-0046 EA 15" Diameter Roof Drain With 8" Outlet, Aluminum Dome.....	835.21	257.25
For Galvanized Iron Parts, Add	197.00	
For Deck Clamp, Add	50.00	
For Drain Receiver, Add	56.00	
For 4" (10 cm) Fixed Extension Collar, Cast Iron, Add	136.00	
22 14 26 13-0047 EA 15" Diameter Roof Drain With 10" Outlet, Aluminum Dome.....	1,009.43	266.44
For Galvanized Iron Parts, Add	197.00	
For Deck Clamp, Add	50.00	
For Drain Receiver, Add	56.00	
For 4" (10 cm) Fixed Extension Collar, Cast Iron, Add	136.00	
22 14 26 13-0048 Retrofit Roof Drains <small>(22 14 26 13)</small>		
22 14 26 13-0049 Copolymer Retrofit Roof Drains With Copolymer Strainer Dome <small>(22 14 26 13-0048)</small>		
22 14 26 13-0050 EA Copolymer Retrofit 3" Roof Drains, With Copolymer Dome	501.15	147.00
22 14 26 13-0051 EA Copolymer Retrofit 4" Roof Drains, With Copolymer Dome	569.89	183.75
22 14 26 13-0052 EA Copolymer Retrofit 5" Roof Drains, With Copolymer Dome	691.77	220.50
22 14 26 13-0053 EA Copolymer Retrofit 6" Roof Drains, With Copolymer Dome	752.37	244.76
22 14 26 13-0054 Copolymer Retrofit Roof Drains With Cast Aluminum Strainer Dome <small>(22 14 26 13-0049)</small>		

22	Plumbing
22 10	Plumbing Piping
22 14	Facility Storm Drainage



MINOR				TOTAL DIRECT	DEMOLITION
CSI	UOM	DESCRIPTION		UNIT COST	UNIT COST
22 14 26 13-0055	EA	Copolymer Retrofit Drain, 3", With Cast Aluminum Dome		568.61	147.00
22 14 26 13-0056	EA	Copolymer Retrofit Drain, 4", With Cast Aluminum Dome		634.36	183.75
22 14 26 13-0057	EA	Copolymer Retrofit Drain, 5", With Cast Aluminum Dome		760.73	220.50
22 14 26 13-0058	EA	Copolymer Retrofit Drain, 6", With Cast Aluminum Dome		800.34	244.76
22 14 26 13-0059		Aluminum Retrofit Roof Drains With Cast Aluminum Strainer Dome <small>(22 14 26 13-0048)</small>			
22 14 26 13-0060	EA	Aluminum Retrofit 3" Roof Drains, With Cast Aluminum Dome		504.14	147.00
		<i>For Copolymer Strainer Dome, Deduct</i>		-24.00	
22 14 26 13-0061	EA	Aluminum Retrofit 4" Roof Drains, With Cast Aluminum Dome		572.89	183.75
		<i>For Copolymer Strainer Dome, Deduct</i>		-24.00	
22 14 26 13-0062	EA	Aluminum Retrofit 5" Roof Drains, With Cast Aluminum Dome		694.76	220.50
		<i>For Copolymer Strainer Dome, Deduct</i>		-24.00	
22 14 26 13-0063	EA	Aluminum Retrofit 6" Roof Drains, With Cast Aluminum Dome		731.38	244.76
		<i>For Copolymer Strainer Dome, Deduct</i>		-24.00	
22 14 26 13-0064		Bronze Downspout Nozzles <small>(22 14 26 13)</small>			
22 14 26 13-0065	EA	2" Outlet, Bronze Roof Drain Downspout Nozzle		293.65	73.50
22 14 26 13-0066	EA	3" Outlet, Bronze Roof Drain Downspout Nozzle		293.65	73.50
22 14 26 13-0067	EA	4" Outlet, Bronze Roof Drain Downspout Nozzle		293.65	73.50
22 14 26 13-0068	EA	5" Outlet, Bronze Roof Drain Downspout Nozzle		447.79	91.88
22 14 26 13-0069	EA	6" Outlet, Bronze Roof Drain Downspout Nozzle		447.79	91.88
22 14 26 13-0070	EA	8" Outlet, Bronze Roof Drain Downspout Nozzle		570.71	91.88
22 14 26 16		Facility Area Drains <small>(22 14 26)</small>			
22 14 26 16-0001		Area Drain <small>(22 14 26 16)</small>			
22 14 26 16-0002	EA	12" x 12" Floor Drain With 2" Bottom Outlet, Nikaloy Top, Medium Duty Loose-Set Cast Iron Grate And Secondary Strainer		708.52	88.49
		<i>For Ductile Iron Grate, Add</i>		123.50	
		<i>For Vandal Proof Screws, Add</i>		29.50	
		<i>For Galvanized Cast Iron Parts, Add</i>		101.50	
		<i>For Primer Tap, Add</i>		36.00	
22 14 26 16-0003	EA	12" x 12" Floor Drain With 3" Bottom Outlet, Nikaloy Top, Medium Duty Loose-Set Cast Iron Grate And Secondary Strainer		727.61	98.05
		<i>For Ductile Iron Grate, Add</i>		123.50	
		<i>For Vandal Proof Screws, Add</i>		29.50	
		<i>For Galvanized Cast Iron Parts, Add</i>		101.50	
		<i>For Primer Tap, Add</i>		36.00	
22 14 26 16-0004	EA	12" x 12" Floor Drain With 4" Bottom Outlet, Nikaloy Top, Medium Duty Loose-Set Cast Iron Grate And Secondary Strainer		747.68	108.12
		<i>For Ductile Iron Grate, Add</i>		123.50	
		<i>For Vandal Proof Screws, Add</i>		29.50	
		<i>For Galvanized Cast Iron Parts, Add</i>		101.50	
		<i>For Primer Tap, Add</i>		36.00	
22 14 26 16-0005	EA	12" x 12" Floor Drain With 6" Bottom Outlet, Nikaloy Top, Medium Duty Loose-Set Cast Iron Grate And Secondary Strainer		768.60	118.56
		<i>For Ductile Iron Grate, Add</i>		123.50	
		<i>For Vandal Proof Screws, Add</i>		29.50	
		<i>For Galvanized Cast Iron Parts, Add</i>		101.50	
		<i>For Primer Tap, Add</i>		36.00	
22 14 26 16-0006	EA	12" x 12" Floor Drain With 2" Bottom Outlet, Cast Iron Top, Medium Duty Loose-Set Cast Iron Grate And Secondary Strainer		483.02	88.49
		<i>For Ductile Iron Grate, Add</i>		123.50	
		<i>For Vandal Proof Screws, Add</i>		29.50	
		<i>For Galvanized Cast Iron Parts, Add</i>		101.50	
		<i>For Primer Tap, Add</i>		36.00	
22 14 26 16-0007	EA	12" x 12" Floor Drain With 3" Bottom Outlet, Cast Iron Top, Medium Duty Loose-Set Cast Iron Grate And Secondary Strainer		502.11	98.05
		<i>For Ductile Iron Grate, Add</i>		123.50	
		<i>For Vandal Proof Screws, Add</i>		29.50	
		<i>For Galvanized Cast Iron Parts, Add</i>		101.50	
		<i>For Primer Tap, Add</i>		36.00	
22 14 26 16-0008	EA	12" x 12" Floor Drain With 4" Bottom Outlet, Cast Iron Top, Medium Duty Loose-Set Cast Iron Grate And Secondary Strainer		522.18	108.12
		<i>For Ductile Iron Grate, Add</i>		123.50	
		<i>For Vandal Proof Screws, Add</i>		29.50	
		<i>For Galvanized Cast Iron Parts, Add</i>		101.50	
		<i>For Primer Tap, Add</i>		36.00	
22 14 26 16-0009	EA	12" x 12" Floor Drain With 6" Bottom Outlet, Cast Iron Top, Medium Duty Loose-Set Cast Iron Grate And Secondary Strainer		543.10	118.56
		<i>For Ductile Iron Grate, Add</i>		123.50	
		<i>For Vandal Proof Screws, Add</i>		29.50	
		<i>For Galvanized Cast Iron Parts, Add</i>		101.50	
		<i>For Primer Tap, Add</i>		36.00	
22 14 26 16-0010	EA	12" x 12" Floor Drain With 2" Bottom Outlet, Bronze Top, Medium Duty Loose-Set Cast Iron Grate And Secondary Strainer		669.52	88.49
		<i>For Ductile Iron Grate, Add</i>		123.50	
		<i>For Vandal Proof Screws, Add</i>		29.50	
		<i>For Galvanized Cast Iron Parts, Add</i>		101.50	
		<i>For Primer Tap, Add</i>		36.00	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22	14	26	16-0011	EA 12" x 12" Floor Drain With 3" Bottom Outlet, Bronze Top, Medium Duty Loose-Set Cast Iron Grate And Secondary Strainer.....	688.61	98.05
				<i>For Ductile Iron Grate, Add</i>	123.50	
				<i>For Vandal Proof Screws, Add</i>	29.50	
				<i>For Galvanized Cast Iron Parts, Add</i>	101.50	
				<i>For Primer Tap, Add</i>	36.00	
22	14	26	16-0012	EA 12" x 12" Floor Drain With 4" Bottom Outlet, Bronze Top, Medium Duty Loose-Set Cast Iron Grate And Secondary Strainer.....	708.68	108.12
				<i>For Ductile Iron Grate, Add</i>	123.50	
				<i>For Vandal Proof Screws, Add</i>	29.50	
				<i>For Galvanized Cast Iron Parts, Add</i>	101.50	
				<i>For Primer Tap, Add</i>	36.00	
22	14	26	16-0013	EA 12" x 12" Floor Drain With 6" Bottom Outlet, Bronze Top, Medium Duty Loose-Set Cast Iron Grate And Secondary Strainer.....	729.60	118.56
				<i>For Ductile Iron Grate, Add</i>	123.50	
				<i>For Vandal Proof Screws, Add</i>	29.50	
				<i>For Galvanized Cast Iron Parts, Add</i>	101.50	
				<i>For Primer Tap, Add</i>	36.00	
22	14	26	16-0014	EA 16" x 16" Floor Drain With 2" Bottom Outlet, Nikaloy Top, Medium Duty Loose-Set Cast Iron Grate And Secondary Strainer.....	1,304.52	88.49
				<i>For Ductile Iron Grate, Add</i>	123.50	
				<i>For Primer Tap, Add</i>	36.00	
				<i>For Galvanized Cast Iron Parts, Add</i>	258.50	
22	14	26	16-0015	EA 16" x 16" Floor Drain With 3" Bottom Outlet, Nikaloy Top, Medium Duty Loose-Set Cast Iron Grate And Secondary Strainer.....	1,323.61	98.05
				<i>For Ductile Iron Grate, Add</i>	123.50	
				<i>For Primer Tap, Add</i>	36.00	
				<i>For Galvanized Cast Iron Parts, Add</i>	258.50	
22	14	26	16-0016	EA 16" x 16" Floor Drain With 4" Bottom Outlet, Nikaloy Top, Medium Duty Loose-Set Cast Iron Grate And Secondary Strainer.....	1,343.68	108.12
				<i>For Ductile Iron Grate, Add</i>	123.50	
				<i>For Primer Tap, Add</i>	36.00	
				<i>For Galvanized Cast Iron Parts, Add</i>	258.50	
22	14	26	16-0017	EA 16" x 16" Floor Drain With 6" Bottom Outlet, Nikaloy Top, Medium Duty Loose-Set Cast Iron Grate And Secondary Strainer.....	1,364.60	118.56
				<i>For Ductile Iron Grate, Add</i>	123.50	
				<i>For Primer Tap, Add</i>	36.00	
				<i>For Galvanized Cast Iron Parts, Add</i>	258.50	
22	14	26	16-0018	EA 16" x 16" Floor Drain With 2" Bottom Outlet, Cast Iron Top, Medium Duty Loose-Set Cast Iron Grate And Secondary Strainer.....	699.52	88.49
				<i>For Ductile Iron Grate, Add</i>	123.50	
				<i>For Primer Tap, Add</i>	36.00	
				<i>For Galvanized Cast Iron Parts, Add</i>	258.50	
22	14	26	16-0019	EA 16" x 16" Floor Drain With 3" Bottom Outlet, Cast Iron Top, Medium Duty Loose-Set Cast Iron Grate And Secondary Strainer.....	718.61	98.05
				<i>For Ductile Iron Grate, Add</i>	123.50	
				<i>For Primer Tap, Add</i>	36.00	
				<i>For Galvanized Cast Iron Parts, Add</i>	258.50	
22	14	26	16-0020	EA 16" x 16" Floor Drain With 4" Bottom Outlet, Cast Iron Top, Medium Duty Loose-Set Cast Iron Grate And Secondary Strainer.....	738.68	108.12
				<i>For Ductile Iron Grate, Add</i>	123.50	
				<i>For Primer Tap, Add</i>	36.00	
				<i>For Galvanized Cast Iron Parts, Add</i>	258.50	
22	14	26	16-0021	EA 16" x 16" Floor Drain With 6" Bottom Outlet, Cast Iron Top, Medium Duty Loose-Set Cast Iron Grate And Secondary Strainer.....	759.60	118.56
				<i>For Ductile Iron Grate, Add</i>	123.50	
				<i>For Primer Tap, Add</i>	36.00	
				<i>For Galvanized Cast Iron Parts, Add</i>	258.50	
22	14	26	16-0022	EA 16" x 16" Floor Drain With 2" Bottom Outlet, Bronze Top, Medium Duty Loose-Set Cast Iron Grate And Secondary Strainer.....	1,243.02	88.49
				<i>For Ductile Iron Grate, Add</i>	123.50	
				<i>For Primer Tap, Add</i>	36.00	
				<i>For Galvanized Cast Iron Parts, Add</i>	258.50	
22	14	26	16-0023	EA 16" x 16" Floor Drain With 3" Bottom Outlet, Bronze Top, Medium Duty Loose-Set Cast Iron Grate And Secondary Strainer.....	1,262.11	98.05
				<i>For Ductile Iron Grate, Add</i>	123.50	
				<i>For Primer Tap, Add</i>	36.00	
				<i>For Galvanized Cast Iron Parts, Add</i>	258.50	
22	14	26	16-0024	EA 16" x 16" Floor Drain With 4" Bottom Outlet, Bronze Top, Medium Duty Loose-Set Cast Iron Grate And Secondary Strainer.....	1,282.18	108.12
				<i>For Ductile Iron Grate, Add</i>	123.50	
				<i>For Primer Tap, Add</i>	36.00	
				<i>For Galvanized Cast Iron Parts, Add</i>	258.50	
22	14	26	16-0025	EA 16" x 16" Floor Drain With 6" Bottom Outlet, Bronze Top, Medium Duty Loose-Set Cast Iron Grate And Secondary Strainer.....	1,303.10	118.56
				<i>For Ductile Iron Grate, Add</i>	123.50	
				<i>For Primer Tap, Add</i>	36.00	
				<i>For Galvanized Cast Iron Parts, Add</i>	258.50	
22	14	26	16-0026	EA 9" Diameter Floor Drain With 2" Bottom Outlet, Nikaloy Top, Medium Duty Anti-Tilting Grate And Perimeter Drainage Slots.....	383.52	88.49
				<i>For Vandal Proof Grate, Add</i>	30.50	
				<i>For Galvanized Cast Iron Parts, Add</i>	87.50	
22	14	26	16-0027	EA 9" Diameter Floor Drain With 3" Bottom Outlet, Nikaloy Top, Medium Duty Anti-Tilting Grate And Perimeter Drainage Slots.....	402.61	98.05
				<i>For Vandal Proof Grate, Add</i>	30.50	
				<i>For Galvanized Cast Iron Parts, Add</i>	87.50	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 14 26 16-0028	EA		9" Diameter Floor Drain With 4" Bottom Outlet, Nikaloy Top, Medium Duty Anti-Tilting Grate And Perimeter Drainage Slots.....	422.68	108.12
			<i>For Vandal Proof Grate, Add</i>	30.50	
			<i>For Galvanized Cast Iron Parts, Add</i>	87.50	
22 14 26 16-0029	EA		9" Diameter Floor Drain With 2" Bottom Outlet, Cast Iron Top, Medium Duty Anti-Tilting Grate And Perimeter Drainage Slots.....	280.52	88.49
			<i>For Vandal Proof Grate, Add</i>	30.50	
			<i>For Galvanized Cast Iron Parts, Add</i>	87.50	
22 14 26 16-0030	EA		9" Diameter Floor Drain With 3" Bottom Outlet, Cast Iron Top, Medium Duty Anti-Tilting Grate And Perimeter Drainage Slots.....	299.61	98.05
			<i>For Vandal Proof Grate, Add</i>	30.50	
			<i>For Galvanized Cast Iron Parts, Add</i>	87.50	
22 14 26 16-0031	EA		9" Diameter Floor Drain With 4" Bottom Outlet, Cast Iron Top, Medium Duty Anti-Tilting Grate And Perimeter Drainage Slots.....	319.68	108.12
			<i>For Vandal Proof Grate, Add</i>	30.50	
			<i>For Galvanized Cast Iron Parts, Add</i>	87.50	
22 14 26 16-0032	EA		9" Diameter Floor Drain With 2" Bottom Outlet, Bronze Top, Medium Duty Anti-Tilting Grate And Perimeter Drainage Slots.....	368.52	88.49
			<i>For Vandal Proof Grate, Add</i>	30.50	
			<i>For Galvanized Cast Iron Parts, Add</i>	87.50	
22 14 26 16-0033	EA		9" Diameter Floor Drain With 3" Bottom Outlet, Bronze Top, Medium Duty Anti-Tilting Grate And Perimeter Drainage Slots.....	387.61	98.05
			<i>For Vandal Proof Grate, Add</i>	30.50	
			<i>For Galvanized Cast Iron Parts, Add</i>	87.50	
22 14 26 16-0034	EA		9" Diameter Floor Drain With 4" Bottom Outlet, Bronze Top, Medium Duty Anti-Tilting Grate And Perimeter Drainage Slots.....	407.68	108.12
			<i>For Vandal Proof Grate, Add</i>	30.50	
			<i>For Galvanized Cast Iron Parts, Add</i>	87.50	
22 14 26 16-0035	EA		12-7/8" x 10-7/8" Floor Drain With 2" Side Outlet, Nikaloy Top, Heavy Duty Hinged Grate And Removable Medium-Deep Sediment Strainer.....	910.02	88.49
			<i>For Ductile Iron Grate, Add</i>	126.00	
			<i>For Vandal Proof Screws, Add</i>	30.50	
			<i>For Galvanized Cast Iron Parts, Add</i>	205.00	
22 14 26 16-0036	EA		12-7/8" x 10-7/8" Floor Drain With 3" Side Outlet, Nikaloy Top, Heavy Duty Hinged Grate And Removable Medium-Deep Sediment Strainer.....	929.11	98.05
			<i>For Ductile Iron Grate, Add</i>	126.00	
			<i>For Vandal Proof Screws, Add</i>	30.50	
			<i>For Galvanized Cast Iron Parts, Add</i>	205.00	
22 14 26 16-0037	EA		12-7/8" x 10-7/8" Floor Drain With 4" Side Outlet, Nikaloy Top, Heavy Duty Hinged Grate And Removable Medium-Deep Sediment Strainer.....	949.18	108.12
			<i>For Ductile Iron Grate, Add</i>	126.00	
			<i>For Vandal Proof Screws, Add</i>	30.50	
			<i>For Galvanized Cast Iron Parts, Add</i>	205.00	
22 14 26 16-0038	EA		12-7/8" x 10-7/8" Floor Drain With 2" Side Outlet, Cast Iron Top, Heavy Duty Hinged Grate And Removable Medium-Deep Sediment Strainer.....	634.52	88.49
			<i>For Ductile Iron Grate, Add</i>	126.00	
			<i>For Vandal Proof Screws, Add</i>	30.50	
			<i>For Galvanized Cast Iron Parts, Add</i>	205.00	
22 14 26 16-0039	EA		12-7/8" x 10-7/8" Floor Drain With 3" Side Outlet, Cast Iron Top, Heavy Duty Hinged Grate And Removable Medium-Deep Sediment Strainer.....	653.61	98.05
			<i>For Ductile Iron Grate, Add</i>	126.00	
			<i>For Vandal Proof Screws, Add</i>	30.50	
			<i>For Galvanized Cast Iron Parts, Add</i>	205.00	
22 14 26 16-0040	EA		12-7/8" x 10-7/8" Floor Drain With 4" Side Outlet, Cast Iron Top, Heavy Duty Hinged Grate And Removable Medium-Deep Sediment Strainer.....	673.68	108.12
			<i>For Ductile Iron Grate, Add</i>	126.00	
			<i>For Vandal Proof Screws, Add</i>	30.50	
			<i>For Galvanized Cast Iron Parts, Add</i>	205.00	
22 14 26 16-0041	EA		12-7/8" x 10-7/8" Floor Drain With 2" Side Outlet, Bronze Top, Heavy Duty Hinged Grate And Removable Medium-Deep Sediment Strainer.....	862.02	88.49
			<i>For Ductile Iron Grate, Add</i>	126.00	
			<i>For Vandal Proof Screws, Add</i>	30.50	
			<i>For Galvanized Cast Iron Parts, Add</i>	205.00	
22 14 26 16-0042	EA		12-7/8" x 10-7/8" Floor Drain With 3" Side Outlet, Bronze Top, Heavy Duty Hinged Grate And Removable Medium-Deep Sediment Strainer.....	881.11	98.05
			<i>For Ductile Iron Grate, Add</i>	126.00	
			<i>For Vandal Proof Screws, Add</i>	30.50	
			<i>For Galvanized Cast Iron Parts, Add</i>	205.00	
22 14 26 16-0043	EA		12-7/8" x 10-7/8" Floor Drain With 4" Side Outlet, Bronze Top, Heavy Duty Hinged Grate And Removable Medium-Deep Sediment Strainer.....	901.18	108.12
			<i>For Ductile Iron Grate, Add</i>	126.00	
			<i>For Vandal Proof Screws, Add</i>	30.50	
			<i>For Galvanized Cast Iron Parts, Add</i>	205.00	
22 14 26 19			Facility Trench Drains (22 14 26)		
22 14 26 19-0001			Trench Drain (22 14 26 19) Note: Each section is 39.4" in length.		
22 14 26 19-0002	EA		6" Wide Trench Drain x 9" Outlet Section With 2" Bottom Outlet, Nikaloy Top, Heavy Duty Body Sections, Heavy Duty Loose Set Grate With Perimeter Drainage Slots.....	595.36	88.49
			<i>For Vandal Proof Screws, Add</i>	48.50	
			<i>For Ductile Iron Grate, Add</i>	66.00	
			<i>For Galvanized Cast Iron Parts, Add</i>	65.50	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 14 26 19-0003	EA			6" Wide Trench Drain x 9" Outlet Section With 3" Bottom Outlet, Nikaloy Top, Heavy Duty Body Sections, Heavy Duty Loose Set Grate With Perimeter Drainage Slots.....	614.45	98.05
				<i>For Vandal Proof Screws, Add</i>	48.50	
				<i>For Ductile Iron Grate, Add</i>	66.00	
				<i>For Galvanized Cast Iron Parts, Add</i>	65.50	
22 14 26 19-0004	EA			6" Wide Trench Drain x 9" Outlet Section With 4" Bottom Outlet, Nikaloy Top, Heavy Duty Body Sections, Heavy Duty Loose Set Grate With Perimeter Drainage Slots.....	634.52	108.12
				<i>For Vandal Proof Screws, Add</i>	48.50	
				<i>For Ductile Iron Grate, Add</i>	66.00	
				<i>For Galvanized Cast Iron Parts, Add</i>	65.50	
22 14 26 19-0005	EA			6" Wide Trench Drain x 9" Outlet Section With 2" Bottom Outlet, Cast Iron Top, Heavy Duty Body Sections, Heavy Duty Loose Set Grate With Perimeter Drainage Slots.....	379.31	88.49
				<i>For Vandal Proof Screws, Add</i>	48.50	
				<i>For Ductile Iron Grate, Add</i>	66.00	
				<i>For Galvanized Cast Iron Parts, Add</i>	65.50	
22 14 26 19-0006	EA			6" Wide Trench Drain x 9" Outlet Section With 3" Bottom Outlet, Cast Iron Top, Heavy Duty Body Sections, Heavy Duty Loose Set Grate With Perimeter Drainage Slots.....	398.40	98.05
				<i>For Vandal Proof Screws, Add</i>	48.50	
				<i>For Ductile Iron Grate, Add</i>	66.00	
				<i>For Galvanized Cast Iron Parts, Add</i>	65.50	
22 14 26 19-0007	EA			6" Wide Trench Drain x 9" Outlet Section With 4" Bottom Outlet, Cast Iron Top, Heavy Duty Body Sections, Heavy Duty Loose Set Grate With Perimeter Drainage Slots.....	418.47	108.12
				<i>For Vandal Proof Screws, Add</i>	48.50	
				<i>For Ductile Iron Grate, Add</i>	66.00	
				<i>For Galvanized Cast Iron Parts, Add</i>	65.50	
22 14 26 19-0008	EA			6" Wide Trench Drain x 9" Outlet Section With 2" Bottom Outlet, Bronze Top, Heavy Duty Body Sections, Heavy Duty Loose Set Grate With Perimeter Drainage Slots.....	565.92	88.49
				<i>For Vandal Proof Screws, Add</i>	48.50	
				<i>For Ductile Iron Grate, Add</i>	66.00	
				<i>For Galvanized Cast Iron Parts, Add</i>	65.50	
22 14 26 19-0009	EA			6" Wide Trench Drain x 9" Outlet Section With 3" Bottom Outlet, Bronze Top, Heavy Duty Body Sections, Heavy Duty Loose Set Grate With Perimeter Drainage Slots.....	585.01	98.05
				<i>For Vandal Proof Screws, Add</i>	48.50	
				<i>For Ductile Iron Grate, Add</i>	66.00	
				<i>For Galvanized Cast Iron Parts, Add</i>	65.50	
22 14 26 19-0010	EA			6" Wide Trench Drain x 9" Outlet Section With 4" Bottom Outlet, Bronze Top, Heavy Duty Body Sections, Heavy Duty Loose Set Grate With Perimeter Drainage Slots.....	605.08	108.12
				<i>For Vandal Proof Screws, Add</i>	48.50	
				<i>For Ductile Iron Grate, Add</i>	66.00	
				<i>For Galvanized Cast Iron Parts, Add</i>	65.50	
22 14 26 19-0011	EA			6" Wide Trench Drain x 15" Extension Section, Nikaloy Top, Heavy Duty Body Sections, Heavy Duty Loose Set Grate With Perimeter Drainage Slots.....	506.49	44.10
				<i>For Vandal Proof Screws, Add</i>	48.50	
				<i>For Ductile Iron Grate, Add</i>	66.00	
				<i>For Galvanized Cast Iron Parts, Add</i>	65.50	
22 14 26 19-0012	EA			6" Wide Trench Drain x 15" Extension Section, Cast Iron Top, Heavy Duty Body Sections, Heavy Duty Loose Set Grate With Perimeter Drainage Slots.....	290.44	44.10
				<i>For Vandal Proof Screws, Add</i>	48.50	
				<i>For Ductile Iron Grate, Add</i>	66.00	
				<i>For Galvanized Cast Iron Parts, Add</i>	65.50	
22 14 26 19-0013	EA			6" Wide Trench Drain x 15" Extension Section, Bronze Top, Heavy Duty Body Sections, Heavy Duty Loose Set Grate With Perimeter Drainage Slots.....	477.05	44.10
				<i>For Vandal Proof Screws, Add</i>	48.50	
				<i>For Ductile Iron Grate, Add</i>	66.00	
				<i>For Galvanized Cast Iron Parts, Add</i>	65.50	
22 14 26 19-0014	EA			12" Wide Trench Drain x 15" Outlet Section With 3" Bottom Outlet, Nikaloy Top, Heavy Duty Body Sections, Heavy Duty Loose Set Grate With Perimeter Drainage Slots.....	918.74	88.49
				<i>For Vandal Proof Screws, Add</i>	48.50	
				<i>For Ductile Iron Grate, Add</i>	181.50	
				<i>For Convex Grate On Cast Iron Or Ductile Price, Add</i>	38.50	
				<i>For Sediment Bucket, Add</i>	116.00	
				<i>For Galvanized Sediment Bucket, Add</i>	188.50	
				<i>For Galvanized Cast Iron Parts, Add</i>	131.50	
22 14 26 19-0015	EA			12" Wide Trench Drain x 15" Outlet Section With 4" Bottom Outlet, Nikaloy Top, Heavy Duty Body Sections, Heavy Duty Loose Set Grate With Perimeter Drainage Slots.....	937.83	98.05
				<i>For Vandal Proof Screws, Add</i>	48.50	
				<i>For Ductile Iron Grate, Add</i>	181.50	
				<i>For Convex Grate On Cast Iron Or Ductile Price, Add</i>	38.50	
				<i>For Sediment Bucket, Add</i>	116.00	
				<i>For Galvanized Sediment Bucket, Add</i>	188.50	
				<i>For Galvanized Cast Iron Parts, Add</i>	131.50	
22 14 26 19-0016	EA			12" Wide Trench Drain x 15" Outlet Section With 6" Bottom Outlet, Nikaloy Top, Heavy Duty Body Sections, Heavy Duty Loose Set Grate With Perimeter Drainage Slots.....	957.90	108.12
				<i>For Vandal Proof Screws, Add</i>	48.50	
				<i>For Ductile Iron Grate, Add</i>	181.50	
				<i>For Convex Grate On Cast Iron Or Ductile Price, Add</i>	38.50	
				<i>For Sediment Bucket, Add</i>	116.00	
				<i>For Galvanized Sediment Bucket, Add</i>	188.50	
				<i>For Galvanized Cast Iron Parts, Add</i>	131.50	
22 14 26 19-0017	EA			12" Wide Trench Drain x 15" Outlet Section With 3" Bottom Outlet, Cast Iron Top, Heavy Duty Body Sections, Heavy Duty Loose Set Grate With Perimeter Drainage Slots.....	651.40	88.49
				<i>For Vandal Proof Screws, Add</i>	48.50	
				<i>For Ductile Iron Grate, Add</i>	181.50	
				<i>For Convex Grate On Cast Iron Or Ductile Price, Add</i>	38.50	
				<i>For Sediment Bucket, Add</i>	116.00	
				<i>For Galvanized Sediment Bucket, Add</i>	188.50	
				<i>For Galvanized Cast Iron Parts, Add</i>	131.50	

22	Plumbing
22 10	Plumbing Piping
22 14	Facility Storm Drainage



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 14 26 19-0018	EA		12" Wide Trench Drain x 15" Outlet Section With 4" Bottom Outlet, Cast Iron Top, Heavy Duty Body Sections, Heavy Duty Loose Set Grate With Perimeter Drainage Slots.....	670.49	98.05
			<i>For Vandal Proof Screws, Add</i>	48.50	
			<i>For Ductile Iron Grate, Add</i>	181.50	
			<i>For Convex Grate On Cast Iron Or Ductile Price, Add</i>	38.50	
			<i>For Sediment Bucket, Add</i>	116.00	
			<i>For Galvanized Sediment Bucket, Add</i>	188.50	
			<i>For Galvanized Cast Iron Parts, Add</i>	131.50	
22 14 26 19-0019	EA		12" Wide Trench Drain x 15" Outlet Section With 6" Bottom Outlet, Cast Iron Top, Heavy Duty Body Sections, Heavy Duty Loose Set Grate With Perimeter Drainage Slots.....	690.56	108.12
			<i>For Vandal Proof Screws, Add</i>	48.50	
			<i>For Ductile Iron Grate, Add</i>	181.50	
			<i>For Convex Grate On Cast Iron Or Ductile Price, Add</i>	38.50	
			<i>For Sediment Bucket, Add</i>	116.00	
			<i>For Galvanized Sediment Bucket, Add</i>	188.50	
			<i>For Galvanized Cast Iron Parts, Add</i>	131.50	
22 14 26 19-0020	EA		12" Wide Trench Drain x 15" Outlet Section With 3" Bottom Outlet, Bronze Top, Heavy Duty Body Sections, Heavy Duty Loose Set Grate With Perimeter Drainage Slots.....	882.17	88.49
			<i>For Vandal Proof Screws, Add</i>	48.50	
			<i>For Ductile Iron Grate, Add</i>	181.50	
			<i>For Convex Grate On Cast Iron Or Ductile Price, Add</i>	38.50	
			<i>For Sediment Bucket, Add</i>	116.00	
			<i>For Galvanized Sediment Bucket, Add</i>	188.50	
			<i>For Galvanized Cast Iron Parts, Add</i>	131.50	
22 14 26 19-0021	EA		12" Wide Trench Drain x 15" Outlet Section With 4" Bottom Outlet, Bronze Top, Heavy Duty Body Sections, Heavy Duty Loose Set Grate With Perimeter Drainage Slots.....	901.26	98.05
			<i>For Vandal Proof Screws, Add</i>	48.50	
			<i>For Ductile Iron Grate, Add</i>	181.50	
			<i>For Convex Grate On Cast Iron Or Ductile Price, Add</i>	38.50	
			<i>For Sediment Bucket, Add</i>	116.00	
			<i>For Galvanized Sediment Bucket, Add</i>	188.50	
			<i>For Galvanized Cast Iron Parts, Add</i>	131.50	
22 14 26 19-0022	EA		12" Wide Trench Drain x 15" Outlet Section With 6" Bottom Outlet, Bronze Top, Heavy Duty Body Sections, Heavy Duty Loose Set Grate With Perimeter Drainage Slots.....	921.33	108.12
			<i>For Vandal Proof Screws, Add</i>	48.50	
			<i>For Ductile Iron Grate, Add</i>	181.50	
			<i>For Convex Grate On Cast Iron Or Ductile Price, Add</i>	38.50	
			<i>For Sediment Bucket, Add</i>	116.00	
			<i>For Galvanized Sediment Bucket, Add</i>	188.50	
			<i>For Galvanized Cast Iron Parts, Add</i>	131.50	
22 14 26 19-0023	EA		12" Wide Trench Drain x 15" Outlet Section With 3" Bottom Outlet, Galvanized Top And Body, Heavy Duty Body Sections, Heavy Duty Loose Set Grate With Perimeter Drainage Slots.....	776.28	88.49
			<i>For Vandal Proof Screws, Add</i>	48.50	
			<i>For Ductile Iron Grate, Add</i>	181.50	
			<i>For Convex Grate On Cast Iron Or Ductile Price, Add</i>	38.50	
			<i>For Sediment Bucket, Add</i>	116.00	
			<i>For Galvanized Sediment Bucket, Add</i>	188.50	
			<i>For Galvanized Cast Iron Parts, Add</i>	131.50	
22 14 26 19-0024	EA		12" Wide Trench Drain x 15" Outlet Section With 4" Bottom Outlet, Galvanized Top And Body, Heavy Duty Body Sections, Heavy Duty Loose Set Grate With Perimeter Drainage Slots.....	795.37	98.05
			<i>For Vandal Proof Screws, Add</i>	48.50	
			<i>For Ductile Iron Grate, Add</i>	181.50	
			<i>For Convex Grate On Cast Iron Or Ductile Price, Add</i>	38.50	
			<i>For Sediment Bucket, Add</i>	116.00	
			<i>For Galvanized Sediment Bucket, Add</i>	188.50	
			<i>For Galvanized Cast Iron Parts, Add</i>	131.50	
22 14 26 19-0025	EA		12" Wide Trench Drain x 15" Outlet Section With 6" Bottom Outlet, Galvanized Top And Body, Heavy Duty Body Sections, Heavy Duty Loose Set Grate With Perimeter Drainage Slots.....	815.44	108.12
			<i>For Vandal Proof Screws, Add</i>	48.50	
			<i>For Ductile Iron Grate, Add</i>	181.50	
			<i>For Convex Grate On Cast Iron Or Ductile Price, Add</i>	38.50	
			<i>For Sediment Bucket, Add</i>	116.00	
			<i>For Galvanized Sediment Bucket, Add</i>	188.50	
			<i>For Galvanized Cast Iron Parts, Add</i>	131.50	
22 14 26 19-0026	EA		12" Wide Trench Drain x 15" Extension Section, Nikaloy Top, Heavy Duty Body Sections, Heavy Duty Loose Set Grate With Perimeter Drainage Slots.....	829.85	44.10
			<i>For Vandal Proof Screws, Add</i>	48.50	
			<i>For Ductile Iron Grate, Add</i>	181.50	
			<i>For Convex Grate On Cast Iron Or Ductile Price, Add</i>	38.50	
22 14 26 19-0027	EA		12" Wide Trench Drain x 15" Extension Section, Cast Iron Top, Heavy Duty Body Sections, Heavy Duty Loose Set Grate With Perimeter Drainage Slots.....	562.51	44.10
			<i>For Vandal Proof Screws, Add</i>	48.50	
			<i>For Ductile Iron Grate, Add</i>	181.50	
			<i>For Convex Grate On Cast Iron Or Ductile Price, Add</i>	38.50	
22 14 26 19-0028	EA		12" Wide Trench Drain x 15" Extension Section, Bronze Top, Heavy Duty Body Sections, Heavy Duty Loose Set Grate With Perimeter Drainage Slots.....	793.28	44.10
			<i>For Vandal Proof Screws, Add</i>	48.50	
			<i>For Ductile Iron Grate, Add</i>	181.50	
			<i>For Convex Grate On Cast Iron Or Ductile Price, Add</i>	38.50	
22 14 26 19-0029	EA		12" Wide Trench Drain x 15" Extension Section, Galvanized Top And Body, Heavy Duty Body Sections, Heavy Duty Loose Set Grate With Perimeter Drainage Slots.....	687.39	44.10
			<i>For Vandal Proof Screws, Add</i>	48.50	
			<i>For Ductile Iron Grate, Add</i>	181.50	
			<i>For Convex Grate On Cast Iron Or Ductile Price, Add</i>	38.50	

22 14 29 Sump Pumps (22 14)



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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See CSI section 22 11 16 00-0000 for pipe extensions into well.

22 14 29 13 Wet-Pit-Mounted, Vertical Sump Pumps (22 14 29)

22 14 29 13-0001 Vertical Mounted Sump Pumps (22 14 29 13)

Note: Mounted on steel support plate and supplied with cast iron strainer, 1750 RPM drip-proof motor, 5' column sections.

22 14 29 13-0002	EA	1 HP Vertical Mounted Cast Iron Sump Pump, 1-1/2" Discharge, Single Stage, 25 GPM 40' Head.....	2,967.91	213.27
22 14 29 13-0003	EA	1-1/2 HP Vertical Mounted Cast Iron Sump Pump, 2" Discharge, Single Stage, 75 GPM 40' Head.....	3,168.93	258.13
22 14 29 13-0004	EA	2 HP Vertical Mounted Cast Iron Sump Pump, 2-1/2" Discharge, Single Stage, 100 GPM 40' Head.....	3,632.07	306.67
22 14 29 13-0005	EA	3 HP Vertical Mounted Cast Iron Sump Pump, 3" Discharge, Single Stage, 150 GPM 40' Head.....	3,922.04	377.27
22 14 29 13-0006	EA	5 HP Vertical Mounted Cast Iron Sump Pump, 3" Discharge, Single Stage, 200 GPM 40' Head.....	4,152.86	408.89
22 14 29 13-0007	EA	10 HP Vertical Mounted Cast Iron Sump Pump, 4" Discharge, Single Stage, 300 GPM 70' Head.....	4,930.20	490.52
22 14 29 13-0008	EA	15 HP Vertical Mounted Cast Iron Sump Pump, 5" Discharge, Single Stage, 500 GPM 70' Head.....	5,762.24	527.81
22 14 29 13-0009	EA	20 HP Vertical Mounted Cast Iron Sump Pump, 6" Discharge, Single Stage, 800 GPM 70' Head.....	7,015.00	642.59
22 14 29 13-0010	EA	30 HP Vertical Mounted Cast Iron Sump Pump, 6" Discharge, Single Stage, 1,000 GPM 70' Head.....	7,635.69	749.41
22 14 29 13-0011	EA	50 HP Vertical Mounted Cast Iron Sump Pump, 8" Discharge, Single Stage, 1,600 GPM 70' Head.....	10,135.04	899.61
22 14 29 13-0012	EA	60 HP Vertical Mounted Cast Iron Sump Pump, 8" Discharge, Single Stage, 2,000 GPM 70' Head.....	13,768.98	999.21

22 14 29 13-0013 Extra Column Assemblies (22 14 29 13)

22 14 29 13-0014	EA	1-1/2" Diameter x 5' Long Extra Column Assembly.....	1,200.19	
22 14 29 13-0015	EA	2" Diameter x 5' Long Extra Column Assembly.....	1,313.28	
22 14 29 13-0016	EA	2-1/2" Diameter x 5' Long Extra Column Assembly.....	519.49	
22 14 29 13-0017	EA	3" Diameter x 5' Long Extra Column Assembly.....	1,725.45	
22 14 29 13-0018	EA	4" Diameter x 5' Long Extra Column Assembly.....	1,928.59	
22 14 29 13-0019	EA	5" Diameter x 5' Long Extra Column Assembly.....	709.88	
22 14 29 13-0020	EA	6" Diameter x 5' Long Extra Column Assembly.....	2,204.46	
22 14 29 13-0021	EA	8" Diameter x 5' Long Extra Column Assembly.....	2,412.20	

22 14 29 13-0022 Float Switch (22 14 29 13)

22 14 29 13-0023	EA	For Float Switch Copper Coated Float, General Purpose.....	1,337.52	23.15
22 14 29 13-0024	EA	For Float Switch Copper Coated Float, Weathertight.....	1,402.73	23.15
22 14 29 13-0025	EA	For Float Switch Copper Coated Float, Explosion Proof.....	1,432.82	23.15

22 14 29 13-0026 Support Plate (22 14 29 13)

22 14 29 13-0027	EA	24" Steel Support Plate, Round Or Square.....	444.51	29.40
22 14 29 13-0028	EA	30" Steel Support Plate, Round Or Square.....	492.22	33.07
22 14 29 13-0029	EA	36" Steel Support Plate, Round Or Square.....	682.33	44.10
22 14 29 13-0030	EA	40" Steel Support Plate, Round Or Square.....	985.53	51.45
22 14 29 13-0031	EA	42" Steel Support Plate, Round Or Square.....	1,055.81	53.29
22 14 29 13-0032	EA	48" Steel Support Plate, Round Or Square.....	1,128.29	55.13
22 14 29 13-0033	EA	54" Steel Support Plate, Round Or Square.....	1,435.86	66.15
22 14 29 13-0034	EA	60" Steel Support Plate, Round Or Square.....	1,938.94	73.50
22 14 29 13-0035	EA	72" Steel Support Plate, Round Or Square.....	2,586.88	91.88
22 14 29 13-0036	EA	84" Steel Support Plate, Round Or Square.....	3,119.65	101.06

22 14 29 16 Submersible Sump Pumps (22 14 29)

Note: Includes 25' of cord with pumps unless otherwise noted.

22 14 29 16-0001 Submersible Sump Pump With Vortex Impeller (22 14 29 16)

22 14 29 16-0002 Submersible Sump Pump With Cast Iron Vortex Impeller (22 14 29 16-0001)

22 14 29 16-0003	EA	1/3 HP Manual Submersible Sump Pump, 115 Volt Or 230 Volt, 1 Phase, 1-1/2" Threaded Discharge, Epoxy-Coated Cast Steel Housing And Impeller.....	273.20	47.91
22 14 29 16-0004	EA	1/3 HP Automatic Submersible Sump Pump, 115 Volt Or 230 Volt, 1 Phase, 1-1/2" Threaded Discharge, Epoxy-Coated Cast Steel Housing And Impeller.....	302.09	47.91
22 14 29 16-0005	EA	1/2 HP Manual Submersible Sump Pump, 115 Volt Or 230 Volt, 1 Phase, 1-1/2" Threaded Discharge, Epoxy-Coated Cast Steel Housing And Impeller.....	436.98	50.70
22 14 29 16-0006	EA	1/2 HP Automatic Submersible Sump Pump, 115 Volt Or 230 Volt, 1 Phase, 1-1/2" Threaded Discharge, Epoxy-Coated Cast Steel Housing And Impeller.....	470.72	50.70

22 14 29 16-0007 Submersible Sump Pump With Bronze Vortex Impeller (22 14 29 16-0001)

22 14 29 16-0008	EA	1/2 HP Manual Submersible Sump Pump, 115 Volt Or 230 Volt, 1 Phase, 1-1/2" Threaded or 2" To 3" Flanged Discharge, Epoxy-Coated Cast Steel Housing And Bronze Impeller.....	690.85	50.70
22 14 29 16-0009	EA	1/2 HP Automatic Submersible Sump Pump, 115 Volt Or 230 Volt, 1 Phase, 1-1/2" Threaded or 2" To 3" Flanged Discharge, Epoxy-Coated Cast Steel Housing And Bronze Impeller.....	749.04	50.70
22 14 29 16-0010	EA	1 HP Manual Submersible Sump Pump, 230 Volt, 1 Phase, 1-1/2" Threaded or 2" To 3" Flanged Discharge, Epoxy-Coated Cast Steel Housing And Bronze Impeller.....	787.80	55.89
22 14 29 16-0011	EA	1 HP Automatic Submersible Sump Pump, 230 Volt, 1 Phase, 1-1/2" Threaded or 2" To 3" Flanged Discharge, Epoxy-Coated Cast Steel Housing And Bronze Impeller.....	848.02	55.89
22 14 29 16-0012	EA	1-1/2 HP Manual Submersible Sump Pump, 230 Volt, 1 Phase, 1-1/2" Threaded or 2" To 3" Flanged Discharge, Epoxy-Coated Cast Steel Housing And Bronze Impeller.....	887.44	63.88
22 14 29 16-0013	EA	1-1/2 HP Automatic Submersible Sump Pump, 230 Volt, 1 Phase, 1-1/2" Threaded or 2" To 3" Flanged Discharge, Epoxy-Coated Cast Steel Housing And Bronze Impeller.....	947.67	63.88
22 14 29 16-0014	EA	2 HP Manual Submersible Sump Pump, 230 Volt, 1 Phase, 1-1/2" Threaded or 2" To 3" Flanged Discharge, Epoxy-Coated Cast Steel Housing And Bronze Impeller.....	959.26	75.85
22 14 29 16-0015	EA	2 HP Automatic Submersible Sump Pump, 230 Volt, 1 Phase, 1-1/2" Threaded or 2" To 3" Flanged Discharge, Epoxy-Coated Cast Steel Housing And Bronze Impeller.....	1,008.90	75.85



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 14 29 16-0016 Submersible Sump Pump With Semi-Open Impeller (22 14 29 16)		
22 14 29 16-0017 EA 1/3 HP Manual Submersible Sump Pump, 115 Volt Or 230 Volt, 1 Phase, 2" Threaded Discharge, Epoxy-Coated Cast Steel Housing And Semi-Open Impeller.....	676.09	47.91
22 14 29 16-0018 EA 1/2 HP Manual Submersible Sump Pump, 115 Volt Or 230 Volt, 1 Phase, 2" Threaded Discharge, Epoxy-Coated Cast Steel Housing And Semi-Open Impeller.....	772.23	50.70
22 14 29 16-0019 EA 3/4 HP Manual Submersible Sump Pump, 230 Volt, 1 Or 3 Phase, 2" Threaded Discharge, Epoxy-Coated Cast Steel Housing And Semi-Open Impeller.....	919.25	53.50
22 14 29 16-0020 EA 1 HP Manual Submersible Sump Pump, 230 Volt, 1 Or 3 Phase, 2" Threaded Discharge, Epoxy-Coated Cast Steel Housing And Semi-Open Impeller.....	971.31	55.89
22 14 29 16-0021 EA 1-1/2 HP Manual Submersible Sump Pump, 230 Volt, 1 Or 3 Phase, 2" Threaded Discharge, Epoxy-Coated Cast Steel Housing And Semi-Open Impeller.....	1,108.02	63.88
22 14 29 16-0022 EA 2 HP Manual Submersible Sump Pump, 230 Volt, 1 Or 3 Phase, 2" Threaded Discharge, Epoxy-Coated Cast Steel Housing And Semi-Open Impeller.....	1,290.86	75.85
22 14 29 19 Sump-Pump Basins and Pits (22 14 29) See CSI section 22 13 29 33-0000 for basins and pits.		
22 15 General Service Compressed-Air Systems (22 15)		
22 15 13 General Service Compressed-Air Piping (22 15)		
22 15 13 00-0001 Quick Disconnect, Air-Service (22 15 13)		
22 15 13 00-0002 Combination Steel And Brass (22 15 13 00-0001)		
22 15 13 00-0003 EA 1/2" Combination Steel And Brass Disconnect Valve, Single Seated With Arm Ball And Bracket.....	34.91	11.18
22 15 13 00-0004 EA 3/4" Combination Steel And Brass Disconnect Valve, Single Seated With Arm Ball And Bracket.....	38.49	13.57
22 15 13 00-0005 Refrigerated Air Dryers With Ambient Air Filters (22 15 13)		
22 15 13 00-0006 EA 3 SCFM Capacity Refrigerated Air Dryers With Ambient Air Filters.....	550.91	66.16
22 15 13 00-0007 EA 5 SCFM Capacity Refrigerated Air Dryers With Ambient Air Filters.....	626.31	67.99
22 15 13 00-0008 EA 7.5 SCFM Capacity Refrigerated Air Dryers With Ambient Air Filters.....	797.34	69.84
22 15 13 00-0009 EA 10 SCFM Capacity Refrigerated Air Dryers With Ambient Air Filters.....	927.94	73.51
22 15 13 00-0010 EA 15 SCFM Capacity Refrigerated Air Dryers With Ambient Air Filters.....	1,032.38	82.70
22 15 13 00-0011 EA 20 SCFM Capacity Refrigerated Air Dryers With Ambient Air Filters.....	1,146.23	94.09
22 15 13 00-0012 EA 30 SCFM Capacity Refrigerated Air Dryers With Ambient Air Filters.....	1,623.74	119.45
22 15 13 00-0013 EA 40 SCFM Capacity Refrigerated Air Dryers With Ambient Air Filters.....	1,826.53	139.67
22 15 13 00-0014 EA 50 SCFM Capacity Refrigerated Air Dryers With Ambient Air Filters.....	1,985.58	149.23
22 15 13 00-0015 EA 60 SCFM Capacity Refrigerated Air Dryers With Ambient Air Filters.....	2,158.14	165.40
22 15 13 00-0016 EA 75 SCFM Capacity Refrigerated Air Dryers With Ambient Air Filters.....	2,430.49	183.78
22 15 13 00-0017 EA 85 SCFM Capacity Refrigerated Air Dryers With Ambient Air Filters.....	2,705.23	202.16
22 15 13 00-0018 EA 100 SCFM Capacity Refrigerated Air Dryers With Ambient Air Filters.....	2,847.88	224.21
22 15 13 00-0019 EA 125 SCFM Capacity Refrigerated Air Dryers With Ambient Air Filters.....	3,320.48	238.91
22 15 13 00-0020 EA 175 SCFM Capacity Refrigerated Air Dryers With Ambient Air Filters.....	3,998.99	248.10
22 15 13 00-0021 EA 200 SCFM Capacity Refrigerated Air Dryers With Ambient Air Filters.....	4,721.76	257.29
22 15 13 00-0022 EA 250 SCFM Capacity Refrigerated Air Dryers With Ambient Air Filters.....	5,246.72	266.48
22 15 13 00-0023 EA 300 SCFM Capacity Refrigerated Air Dryers With Ambient Air Filters.....	5,712.84	275.67
22 15 13 00-0024 EA 400 SCFM Capacity Refrigerated Air Dryers With Ambient Air Filters.....	6,384.63	294.04
22 15 13 00-0025 EA 500 SCFM Capacity Refrigerated Air Dryers With Ambient Air Filters.....	7,462.06	367.56
22 15 13 00-0026 EA 600 SCFM Capacity Refrigerated Air Dryers With Ambient Air Filters.....	9,436.41	441.07
22 15 13 00-0027 EA 800 SCFM Capacity Refrigerated Air Dryers With Ambient Air Filters.....	10,513.84	514.58
22 15 13 00-0028 EA 1,000 SCFM Capacity Refrigerated Air Dryers With Ambient Air Filters.....	12,369.81	588.10
22 15 13 00-0029 Oil And Water Separator For Air Compressor (22 15 13)		
22 15 13 00-0030 EA 0-60 SCFM Oil/Water Separator.....	452.90	25.57
22 15 13 00-0031 EA 85 SCFM Oil/Water Separator.....	684.17	29.96
22 15 13 00-0032 EA 190 SCFM Oil/Water Separator.....	799.78	33.95
22 15 13 00-0033 EA 245 SCFM Oil/Water Separator.....	1,004.31	39.94
22 15 13 00-0034 EA 320 SCFM Oil/Water Separator.....	1,193.70	47.93
22 15 13 00-0035 EA 700 SCFM Oil/Water Separator.....	2,406.13	99.85
22 15 13 00-0036 Heavy Duty Industrial Pressure Regulator (22 15 13)		
22 15 13 00-0037 EA 3/8" Pressure Regulator, Max 300 PSI Input, 2-125 PSI Output.....	88.36	22.05
22 15 13 00-0038 EA 1/2" Pressure Regulator, Max 300 PSI Input, 2-125 PSI Output.....	123.39	29.40
22 15 13 00-0039 EA 3/4" Pressure Regulator, Max 300 PSI Input, 2-125 PSI Output.....	210.80	36.76
22 15 13 00-0040 EA 1" Pressure Regulator, Max 300 PSI Input, 2-125 PSI Output.....	264.30	55.14
22 15 13 00-0041 EA 1-1/4" Pressure Regulator, Max 300 PSI Input, 2-125 PSI Output.....	369.43	64.32
22 15 13 00-0042 EA 1-1/2" Pressure Regulator, Max 300 PSI Input, 2-125 PSI Output.....	387.80	73.51
22 15 13 00-0043 Combination Air System; Filter Regulator Lubricator (22 15 13)		
22 15 13 00-0044 EA 3/8" Filter Regulator Lubricator, Max 150 PSI Input, 150 CFM, 40 Micron Filter.....	335.61	66.16
22 15 13 00-0045 EA 1/2" Filter Regulator Lubricator, Max 150 PSI Input, 150 CFM, 40 Micron Filter.....	415.60	88.21
22 15 13 00-0046 Heatless Desiccant Air Dryers (22 15 13)		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 15 13 00-0047 EA 5 SCFM Heatless Desiccant Air Dryer.....	1,977.23	66.16
22 15 13 00-0048 EA 10 SCFM Heatless Desiccant Air Dryer.....	2,377.37	73.51
22 15 13 00-0049 EA 15 SCFM Heatless Desiccant Air Dryer.....	2,400.44	80.86
22 15 13 00-0050 EA 20 SCFM Heatless Desiccant Air Dryer.....	2,741.85	91.89
22 15 13 00-0051 EA 30 SCFM Heatless Desiccant Air Dryer.....	3,777.14	110.27
22 15 13 00-0052 EA 50 SCFM Heatless Desiccant Air Dryer.....	3,729.86	147.02
22 15 13 00-0053 EA 85 SCFM Heatless Desiccant Air Dryer.....	5,010.04	183.78
22 15 13 00-0054 EA 100 SCFM Heatless Desiccant Air Dryer.....	5,316.52	220.53
22 15 13 00-0055 EA 125 SCFM Heatless Desiccant Air Dryer.....	6,086.52	257.29
22 15 13 00-0056 EA 175 SCFM Heatless Desiccant Air Dryer.....	6,989.15	294.04
22 15 13 00-0057 EA 200 SCFM Heatless Desiccant Air Dryer.....	7,510.53	330.80
22 15 13 00-0058 EA 300 SCFM Heatless Desiccant Air Dryer.....	9,184.15	367.56
22 15 13 00-0059 EA 400 SCFM Heatless Desiccant Air Dryer.....	10,201.79	441.07
22 15 13 00-0060 EA 500 SCFM Heatless Desiccant Air Dryer.....	11,791.06	514.58
22 15 13 00-0061 EA 600 SCFM Heatless Desiccant Air Dryer.....	13,605.18	588.10
22 15 13 00-0062 Air Cooled Aftercoolers (22 15 13)		
22 15 13 00-0063 EA 20 SCFM Air-Cooled Aftercooler.....	498.52	45.94
22 15 13 00-0064 EA 35 SCFM Air-Cooled Aftercooler.....	673.54	55.14
22 15 13 00-0065 EA 43 SCFM Air-Cooled Aftercooler.....	739.75	64.32
22 15 13 00-0066 EA 70 SCFM Air-Cooled Aftercooler.....	904.02	73.51
22 15 13 00-0067 EA 125 SCFM Air-Cooled Aftercooler.....	1,259.64	82.70
22 15 13 00-0068 EA 185 SCFM Air-Cooled Aftercooler.....	1,414.36	91.89
22 15 13 00-0069 EA 260 SCFM Air-Cooled Aftercooler.....	2,739.57	110.27
22 15 13 00-0070 EA 365 SCFM Air-Cooled Aftercooler.....	2,863.87	128.65
22 15 13 00-0071 EA 560 SCFM Air-Cooled Aftercooler.....	2,987.21	147.02
22 15 13 00-0072 EA 650 SCFM Air-Cooled Aftercooler.....	3,503.28	165.40
22 15 13 00-0073 EA 750 SCFM Air-Cooled Aftercooler.....	3,829.93	183.78
22 15 13 00-0074 EA 900 SCFM Air-Cooled Aftercooler.....	4,391.93	202.16
22 15 13 00-0075 EA 1,100 SCFM Air-Cooled Aftercooler.....	5,638.93	220.53
22 15 13 00-0076 EA 1,460 SCFM Air-Cooled Aftercooler.....	6,450.15	238.91
22 15 13 00-0077 EA 1,800 SCFM Air-Cooled Aftercooler.....	6,660.31	257.29
22 15 13 00-0078 EA 2,500 SCFM Air-Cooled Aftercooler.....	7,141.94	275.67
22 15 13 00-0079 Compressed Air Coalescing Filters (22 15 13)		
22 15 13 00-0080 1.0 Micron Filter Rated Compressed Air Coalescing Filters (22 15 13 00-0079)		
22 15 13 00-0081 EA 10 SCFM, 3/8", Coalescing Filter, 1.0 Micron Filter Rating.....	171.51	25.96
22 15 13 00-0082 EA 20 SCFM, 3/8", Coalescing Filter, 1.0 Micron Filter Rating.....	205.00	25.96
22 15 13 00-0083 EA 50 SCFM, 1/2", Coalescing Filter, 1.0 Micron Filter Rating.....	223.75	29.96
22 15 13 00-0084 EA 75 SCFM, 3/4", Coalescing Filter, 1.0 Micron Filter Rating.....	257.65	34.35
22 15 13 00-0085 EA 100 SCFM, 3/4", Coalescing Filter, 1.0 Micron Filter Rating.....	300.71	37.95
22 15 13 00-0086 EA 140 SCFM, 1", Coalescing Filter, 1.0 Micron Filter Rating.....	340.61	45.93
22 15 13 00-0087 EA 175 SCFM, 1-1/4" Coalescing Filter, 1.0 Micron Filter Rating.....	394.18	49.92
22 15 13 00-0088 EA 250 SCFM, 1-1/2" Coalescing Filter, 1.0 Micron Filter Rating.....	445.10	59.91
22 15 13 00-0089 EA 280 SCFM, 2" Coalescing Filter, 1.0 Micron Filter Rating.....	571.14	79.88
22 15 13 00-0090 EA 350 SCFM, 2" Coalescing Filter, 1.0 Micron Filter Rating.....	653.31	89.86
22 15 13 00-0091 0.01 Micron Filter Rated Compressed Air Coalescing Filters (22 15 13 00-0079)		
22 15 13 00-0092 EA 16 SCFM, 3/8" Coalescing Filter, 0.01 Micron Filter Rating.....	209.78	25.96
22 15 13 00-0093 EA 30 SCFM, 1/2" Coalescing Filter, 0.01 Micron Filter Rating.....	227.33	29.96
22 15 13 00-0094 EA 60 SCFM, 3/4" Coalescing Filter, 0.01 Micron Filter Rating.....	261.00	34.35
22 15 13 00-0095 EA 100 SCFM, 1" Coalescing Filter, 0.01 Micron Filter Rating.....	307.41	33.95
22 15 13 00-0096 EA 140 SCFM, 1-1/4" Coalescing Filter, 0.01 Micron Filter Rating.....	348.26	45.93
22 15 13 00-0097 EA 180 SCFM, 1-1/4" Coalescing Filter, 0.01 Micron Filter Rating.....	395.24	49.92
22 15 13 00-0098 EA 250 SCFM, 1-1/2" Coalescing Filter, 0.01 Micron Filter Rating.....	453.72	59.91
22 15 13 00-0099 EA 280 SCFM, 2" Coalescing Filter, 0.01 Micron Filter Rating.....	585.49	79.88
22 15 13 00-0100 EA 350 SCFM, 2" Coalescing Filter, 0.01 Micron Filter Rating.....	672.44	89.86
22 15 13 00-0101 Compressed Air Storage Tanks (22 15 13)		
22 15 13 00-0102 Horizontal Compressed Air Storage Tanks (22 15 13 00-0101)		
22 15 13 00-0103 EA 12 Gallon Horizontal Compressed Air Storage Tank, ASME.....	285.05	58.81
22 15 13 00-0104 EA 15 Gallon Horizontal Compressed Air Storage Tank, ASME.....	374.44	64.32
22 15 13 00-0105 EA 20 Gallon Horizontal Compressed Air Storage Tank, ASME.....	396.41	67.63
22 15 13 00-0106 EA 30 Gallon Horizontal Compressed Air Storage Tank, ASME.....	449.80	73.51
22 15 13 00-0107 EA 60 Gallon Horizontal Compressed Air Storage Tank, ASME.....	589.14	99.24
22 15 13 00-0108 EA 80 Gallon Horizontal Compressed Air Storage Tank, ASME.....	705.51	110.27
22 15 13 00-0109 EA 120 Gallon Horizontal Compressed Air Storage Tank, ASME.....	1,036.30	128.65
22 15 13 00-0110 EA 200 Gallon Horizontal Compressed Air Storage Tank, ASME.....	1,518.54	147.02
22 15 13 00-0111 EA 240 Gallon Horizontal Compressed Air Storage Tank, ASME.....	1,688.41	156.21
22 15 13 00-0112 EA 325 Gallon Horizontal Compressed Air Storage Tank, ASME.....	2,404.67	165.40
22 15 13 00-0113 EA 400 Gallon Horizontal Compressed Air Storage Tank, ASME.....	3,153.23	192.97
22 15 13 00-0114 EA 660 Gallon Horizontal Compressed Air Storage Tank, ASME.....	4,507.34	229.73
22 15 13 00-0115 Vertical Compressed Air Storage Tanks (22 15 13 00-0101)		



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 15	13 00-0116	EA	10 Gallon Vertical Compressed Air Storage Tank, ASME	348.05	58.81
22 15	13 00-0117	EA	15 Gallon Vertical Compressed Air Storage Tank, ASME	366.76	64.32
22 15	13 00-0118	EA	20 Gallon Vertical Compressed Air Storage Tank, ASME	396.41	67.63
22 15	13 00-0119	EA	30 Gallon Vertical Compressed Air Storage Tank, ASME	465.01	73.51
22 15	13 00-0120	EA	60 Gallon Vertical Compressed Air Storage Tank, ASME	634.76	99.24
22 15	13 00-0121	EA	80 Gallon Vertical Compressed Air Storage Tank, ASME	727.48	110.27
22 15	13 00-0122	EA	120 Gallon Vertical Compressed Air Storage Tank, ASME	988.52	128.65
22 15	13 00-0123	EA	200 Gallon Vertical Compressed Air Storage Tank, ASME	1,420.07	147.02
22 15	13 00-0124	EA	240 Gallon Vertical Compressed Air Storage Tank, ASME	1,562.90	156.21
22 15	13 00-0125	EA	325 Gallon Vertical Compressed Air Storage Tank, ASME	2,097.43	165.40
22 15	13 00-0126	EA	400 Gallon Vertical Compressed Air Storage Tank, ASME	2,676.41	192.97
22 15	13 00-0127	EA	500 Gallon Vertical Compressed Air Storage Tank, ASME	3,465.90	211.35
22 15	13 00-0128	EA	660 Gallon Vertical Compressed Air Storage Tank, ASME	5,693.23	238.91

22 15 19 General Service Packaged Air Compressors And Receivers (22 15)

Note: Includes V-belt drive, receiver, motor, starter mounted and wired. Excludes piping, pressure reducing valve station, or air dryer.

22 15 19 13 General Service Packaged Reciprocating Air Compressors (22 15 19)

22 15 19 13-0001	Single Stage Compressor (22 15 19 13)		
Note: Includes receiver, reciprocating air cooled, 140 PSIG working pressure, splash lubricated, tank mounted.			
22 15 19 13-0002	EA	1/2 HP 1-Stage Air Compressor, 1.5 ACFM Air Cooled With 30 Gallon Receiver, 140 PSIG Working Pressure	1,484.13 260.82
22 15 19 13-0003	EA	3/4 HP 1-Stage Air Compressor, 2.0 ACFM Air Cooled With 30 Gallon Receiver, 140 PSIG Working Pressure	1,565.97 301.03
22 15 19 13-0004	EA	1 HP 1-Stage Air Compressor, 2.5 ACFM Air Cooled With 30 Gallon Receiver, 140 PSIG Working Pressure	1,793.40 355.50
22 15 19 13-0005	EA	2 HP 1-Stage Air Compressor, Air Cooled With 30 Gallon Receiver, 140 PSIG Working Pressure	2,036.33 392.26
22 15 19 13-0006	EA	3 HP 1-Stage Air Compressor, Air Cooled With 30 Gallon Receiver, 140 PSIG Working Pressure	2,455.69 414.31
22 15 19 13-0007	EA	3 HP 1-Stage Air Compressor, Air Cooled With 60 Gallon Receiver, 140 PSIG Working Pressure	2,616.46 429.01
22 15 19 13-0008	EA	5 HP 1-Stage Air Compressor, Air Cooled With 60 Gallon Receiver, 140 PSIG Working Pressure	2,942.75 490.32
22 15 19 13-0009	EA	5 HP 1-Stage Air Compressor, Air Cooled With 80 Gallon Receiver, 140 PSIG Working Pressure	3,153.05 519.73
22 15 19 13-0010	EA	7.5 HP 1-Stage Air Compressor, Air Cooled With 80 Gallon Receiver, 140 PSIG Working Pressure.....	3,764.16 588.39

22 15 19 13-0011 Two Stage Compressor (22 15 19 13)

Note: With receiver, reciprocating air cooled, discharge pressure 80-200 PSIG, receiver capacity as noted, splash lubricated, tank mounted.

22 15 19 13-0012	EA	1-1/2 HP 2-Stage Air Compressor, 60 Gallon Receiver, 5.0 ACFM, 80-200 PSIG Discharge Pressure	2,816.09 458.42
22 15 19 13-0013	EA	2 HP 2-Stage Air Compressor, 60 Gallon Receiver, 7.0 ACFM, 80-200 PSIG Discharge Pressure	3,048.51 539.36
22 15 19 13-0014	EA	3 HP 2-Stage Air Compressor, 60 Gallon Receiver, 12 ACFM, 80-200 PSIG Discharge Pressure	3,199.69 588.39
22 15 19 13-0015	EA	5 HP 2-Stage Air Compressor, 80 Gallon Receiver, 15 ACFM, 80-200 PSIG Discharge Pressure	3,714.15 784.52
22 15 19 13-0016	EA	5 HP 2-Stage Air Compressor, 120 Gallon Receiver, 16.5 ACFM, 80-200 PSI Max Discharge Pressure	3,971.27 784.52
22 15 19 13-0017	EA	7.5 HP 2-Stage Air Compressor, 80 Gallon Receiver, 19.8 ACFM, 80-200 PSIG Discharge Pressure	4,338.00 980.65
22 15 19 13-0018	EA	7.5 HP 2-Stage Air Compressor, 120 Gallon Receiver, 25.6 ACFM, 80-200 PSI Max Discharge Pressure	4,571.20 980.65
22 15 19 13-0019	EA	10 HP 2-Stage Air Compressor, 80 Gallon Receiver, 35.0 ACFM, 80-200 PSI Max Discharge Pressure	5,844.06 1,212.95
22 15 19 13-0020	EA	10 HP 2-Stage Air Compressor, 120 Gallon Receiver, 38 ACFM, 80-200 PSIG Discharge Pressure	6,296.24 1,249.70
22 15 19 13-0021	EA	15 HP 2-Stage Air Compressor, 120 Gallon Receiver, 50 ACFM, 80-200 PSIG Discharge Pressure	6,795.12 1,460.53
22 15 19 13-0022	EA	20 HP 2-Stage Air Compressor, 120 Gallon Receiver, 70 ACFM, 80-200 PSIG Discharge Pressure	9,949.51 1,653.27
22 15 19 13-0023	EA	25 HP 2-Stage Air Compressor, 120 Gallon Receiver, 84.4 ACFM, 175 PSI Max Discharge Pressure	10,737.50 1,868.15
22 15 19 13-0024	EA	30 HP 2-Stage Air Compressor, 120 Gallon Receiver, 97.2 ACFM, 175 PSI Max Discharge Pressure	11,957.94 2,064.72
22 15 19 13-0025	EA	30 HP 2-Stage Air Compressor, 250 Gallon Receiver, 101 ACFM, 175 PSI Max Discharge Pressure	13,017.76 2,262.84

22 15 19 19 General Service Packaged Rotary-Screw Air Compressors (22 15 19)

22 15 19 19-0001	Rotary Screw Air Compressor, Base Mounted Without Receiver (22 15 19 19)		
Note: Oil flooded.			
22 15 19 19-0002	EA	3 HP, 8.5 SCFM, Rotary Screw Air Compressor With Enclosure, 150 PSIG Max Discharge Pressure, Lubricated	4,711.26 637.42
22 15 19 19-0003	EA	5 HP, 16.6 SCFM, Rotary Screw Air Compressor With Enclosure, 150 PSIG Max Discharge Pressure, Lubricated	5,323.77 849.90
22 15 19 19-0004	EA	7.5 HP, 27 SCFM, Rotary Screw Air Compressor With Enclosure, 125 PSIG Max Discharge Pressure, Lubricated	6,812.86 1,065.57
22 15 19 19-0005	EA	10 HP, 37 SCFM, Rotary Screw Air Compressor With Enclosure, 125 PSIG Max Discharge Pressure, Lubricated	7,953.46 1,357.91
22 15 19 19-0006	EA	15 HP, 56 SCFM, Rotary Screw Air Compressor With Enclosure, 125 PSIG Max Discharge Pressure, Lubricated	9,106.49 1,597.54
22 15 19 19-0007	EA	20 HP, 79 SCFM, Rotary Screw Air Compressor With Enclosure, 125 PSIG Max Discharge Pressure, Lubricated	10,989.05 1,797.25
22 15 19 19-0008	EA	25 HP, 114 SCFM, Rotary Screw Air Compressor With Enclosure, 125 PSIG Max Discharge Pressure, Lubricated	12,061.97 1,996.94
22 15 19 19-0009	EA	30 HP, 137 SCFM, Rotary Screw Air Compressor With Enclosure, 125 PSIG Max Discharge Pressure, Lubricated	14,413.33 2,236.57
22 15 19 19-0010	EA	40 HP, 183 SCFM, Rotary Screw Air Compressor With Enclosure, 125 PSIG Max Discharge Pressure, Lubricated	15,814.16 2,396.32
22 15 19 19-0011	EA	50 HP, 214 SCFM, Rotary Screw Air Compressor With Enclosure, 125 PSIG Max Discharge Pressure, Lubricated	17,701.09 2,582.43
22 15 19 19-0012	EA	60 HP, 256 SCFM Rotary Screw Air Compressor With Enclosure, 125 PSIG Max Discharge Pressure, Lubricated	22,736.80 2,795.72
22 15 19 19-0013	EA	75 HP, 320 SCFM Rotary Screw Air Compressor With Enclosure, 125 PSIG Max Discharge Pressure, Lubricated	25,160.11 2,955.47
22 15 19 19-0014	EA	100 HP, 494 SCFM Rotary Screw Air Compressor With Enclosure, 100 PSIG Max Discharge Pressure, Lubricated.....	39,674.73 3,195.10
22 15 19 19-0015	EA	125 HP, 592 SCFM Rotary Screw Air Compressor With Enclosure, 100 PSIG Max Discharge Pressure, Lubricated.....	49,251.32 3,454.70
22 15 19 19-0016	EA	150 HP, 695 SCFM Rotary Screw Air Compressor With Enclosure, 100 PSIG Max Discharge Pressure, Lubricated.....	57,073.76 3,718.29
22 15 19 19-0017	EA	220 HP, 996 SCFM Rotary Screw Air Compressor With Enclosure, 100 PSIG Max Discharge Pressure, Lubricated.....	73,858.49 3,993.88
22 15 19 19-0018	EA	250 HP, 1,000 SCFM Rotary Screw Air Compressor With Enclosure, 125 PSIG Max Discharge Pressure, Lubricated.....	83,784.06 4,249.48



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 15 19 19-0019				Rotary Screw Air Compressor, Base Mounted With Receiver ^(22 15 19 19) Note: Includes receiver, motor, starter mounted and wired. Excludes piping, pressure reducing valve station, or air dryer.		
22 15 19 19-0020	EA			5 HP, 18.5 SCFM, 80 Gallon Receiver, Rotary Screw Air Compressor, 150 PSIG Max Discharge Pressure, Lubricated.....	5,906.17	849.90
22 15 19 19-0021	EA			5 HP, 18.5 SCFM, 120 Gallon Receiver, Rotary Screw Air Compressor, 150 PSIG Max Discharge Pressure, Lubricated.....	6,250.59	849.90
22 15 19 19-0022	EA			7.5 HP, 28 SCFM, 80 Gallon Receiver, Rotary Screw Air Compressor, 125 PSIG Max Discharge Pressure, Lubricated.....	7,086.72	1,065.57
22 15 19 19-0023	EA			7.5 HP, 28 SCFM, 120 Gallon Receiver, Rotary Screw Air Compressor, 125 PSIG Max Discharge Pressure, Lubricated.....	7,463.43	1,065.57
22 15 19 19-0024	EA			10 HP, 38 SCFM, 80 Gallon Receiver, Rotary Screw Air Compressor, 125 PSIG Max Discharge Pressure, Lubricated.....	8,104.15	1,357.91
22 15 19 19-0025	EA			10 HP, 38 SCFM, 120 Gallon Receiver, Rotary Screw Air Compressor, 125 PSIG Max Discharge Pressure, Lubricated.....	8,502.38	1,357.91
22 15 19 19-0026	EA			15 HP, 55 SCFM, 80 Gallon Receiver, Rotary Screw Air Compressor, 125 PSIG Max Discharge Pressure, Lubricated.....	9,230.87	1,597.54
22 15 19 19-0027	EA			15 HP, 55 SCFM, 120 Gallon Receiver, Rotary Screw Air Compressor, 125 PSIG Max Discharge Pressure, Lubricated.....	9,661.39	1,597.54
22 15 19 19-0028	EA			20 HP, 75 SCFM, 120 Gallon Receiver, Rotary Screw Air Compressor, 125 PSIG Max Discharge Pressure, Lubricated.....	15,523.90	1,797.25
22 15 19 19-0029	EA			25 HP, 102 SCFM, 120 gallon receiver, Rotary Screw Air Compressor, 125 PSIG Max Discharge Pressure, Lubricated.....	16,758.27	1,996.94
22 15 19 19-0030	EA			30 HP, 125 SCFM, 120 Gallon Receiver, Rotary Screw Air Compressor, 125 PSIG Max Discharge Pressure, Lubricated.....	17,885.02	2,236.57

22 30 Plumbing Equipment ⁽²²⁾

22 31 Domestic Water Softeners ^(22 30)

22 31 13 Residential Domestic Water Softeners ^(22 31)

See CSI section 11 30 13 13-0106 for residential water softener.

22 31 16 Commercial Domestic Water Softeners ^(22 31)

22 31 16 00-0001 Commercial Water Softeners (Watts Pure Water) ^(22 31 16)

22 31 16 00-0002 Commercial Water Softeners (Watts Pure Water) ^(22 31 16 00-0001)

22 31 16 00-0003 1" Pipe Connection, Commercial Water Softeners (Watts Pure Water) ^(22 31 16 00-0002)

Note: Includes corrosion resistant NSF Certified fiberglass mineral and brine tanks and fully automatic metered demand control valve.

22 31 16 00-0004	EA			30,000 Grain Capacity, 1" Pipe Connection, Commercial Water Softener With Fiberglass Tanks (Watts Pure Water PWS10111A11).....	2,665.86	202.13
22 31 16 00-0005	EA			45,000 Grain Capacity, 1" Pipe Connection, Commercial Water Softener With Fiberglass Tanks (Watts Pure Water PWS10111B11).....	2,786.54	211.31
22 31 16 00-0006	EA			60,000 Grain Capacity, 1" Pipe Connection, Commercial Water Softener With Fiberglass Tanks (Watts Pure Water PWS10111C11).....	3,006.21	220.50
22 31 16 00-0007	EA			90,000 Grain Capacity, 1" Pipe Connection, Commercial Water Softener With Fiberglass Tanks (Watts Pure Water PWS10111D11).....	3,455.79	229.69
22 31 16 00-0008	EA			120,000 Grain Capacity, 1" Pipe Connection, Commercial Water Softener With Fiberglass Tanks (Watts Pure Water PWS10111E11).....	3,682.06	238.88

22 31 16 00-0009 1-1/2" Pipe Connection, Commercial Water Softeners (Watts Pure Water) ^(22 31 16 00-0002)

Note: Includes corrosion resistant NSF Certified fiberglass mineral and brine tanks and fully automatic metered demand control valve.

22 31 16 00-0010	EA			60,000 Grain Capacity, 1-1/2" Pipe Connection, Commercial Water Softener With Fiberglass Tanks (Watts Pure Water PWS15121C11).....	3,977.51	220.50
22 31 16 00-0011	EA			90,000 Grain Capacity, 1-1/2" Pipe Connection, Commercial Water Softener With Fiberglass Tanks (Watts Pure Water PWS15121D11).....	4,182.89	229.69
22 31 16 00-0012	EA			120,000 Grain Capacity, 1-1/2" Pipe Connection, Commercial Water Softener With Fiberglass Tanks (Watts Pure Water PWS15121E11).....	4,410.26	238.88
22 31 16 00-0013	EA			150,000 Grain Capacity, 1-1/2" Pipe Connection, Commercial Water Softener With Fiberglass Tanks (Watts Pure Water PWS15121F11).....	5,233.84	248.06
22 31 16 00-0014	EA			210,000 Grain Capacity, 1-1/2" Pipe Connection, Commercial Water Softener With Fiberglass Tanks (Watts Pure Water PWS15121G11).....	5,814.31	257.25
22 31 16 00-0015	EA			300,000 Grain Capacity, 1-1/2" Pipe Connection, Commercial Water Softener With Fiberglass Tanks (Watts Pure Water PWS15121H11).....	7,070.19	266.44

22 31 16 00-0016 2" Pipe Connection, Commercial Water Softeners (Watts Pure Water) ^(22 31 16 00-0002)

Note: Includes corrosion resistant NSF Certified fiberglass mineral and brine tanks and fully automatic metered demand control valve.

22 31 16 00-0017	EA			90,000 Grain Capacity, 2" Pipe Connection, Commercial Water Softener With Fiberglass Tanks (Watts Pure Water PWS20131D11).....	6,019.89	229.69
22 31 16 00-0018	EA			120,000 Grain Capacity, 2" Pipe Connection, Commercial Water Softener With Fiberglass Tanks (Watts Pure Water PWS20131E11).....	6,239.56	238.88
22 31 16 00-0019	EA			150,000 Grain Capacity, 2" Pipe Connection, Commercial Water Softener With Fiberglass Tanks (Watts Pure Water PWS20131F11).....	7,065.34	248.06



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 31 16 00-0020	EA		210,000 Grain Capacity, 2" Pipe Connection, Commercial Water Softener With Fiberglass Tanks (Watts Pure Water PWS20131G11).....	7,645.81	257.25
22 31 16 00-0021	EA		300,000 Grain Capacity, 2" Pipe Connection, Commercial Water Softener With Fiberglass Tanks (Watts Pure Water PWS20131H11).....	8,969.89	266.44
22 31 16 00-0022	EA		450,000 Grain Capacity, 2" Pipe Connection, Commercial Water Softener With Fiberglass Tanks (Watts Pure Water PWS20131I11).....	11,816.36	275.63
22 31 16 00-0023	EA		600,000 Grain Capacity, 2" Pipe Connection, Commercial Water Softener With Fiberglass Tanks (Watts Pure Water PWS20131J11).....	13,815.84	284.81
22 31 16 00-0024			3" Pipe Connection, Commercial Water Softeners (Watts Pure Water) <small>(22 31 16 00-0024)</small>		
			Note: Includes corrosion resistant NSF Certified fiberglass mineral and brine tanks and fully automatic metered demand control valve.		
22 31 16 00-0025	EA		300,000 Grain Capacity, 3" Pipe Connection, Commercial Water Softener With Fiberglass Tanks (Watts Pure Water PWS30151H11).....	14,496.29	266.44
22 31 16 00-0026	EA		450,000 Grain Capacity, 3" Pipe Connection, Commercial Water Softener With Fiberglass Tanks (Watts Pure Water PWS30151I11).....	16,741.06	275.63
22 31 16 00-0027	EA		600,000 Grain Capacity, 3" Pipe Connection, Commercial Water Softener With Fiberglass Tanks (Watts Pure Water PWS30151J11).....	18,714.14	284.81
22 31 16 00-0028	EA		900,000 Grain Capacity, 3" Pipe Connection, Commercial Water Softener With Fiberglass Tanks (Watts Pure Water PWS30151K11).....	23,549.41	294.00
22 31 16 00-0029	EA		1050,000 Grain Capacity, 3" Pipe Connection, Commercial Water Softener With Fiberglass Tanks (Watts Pure Water PWS30151L11).....	26,071.39	303.19
22 31 16 00-0030			Duplex Alternating (Two Valves), Commercial Water Softeners (Watts Pure Water) <small>(22 31 16 00-0030)</small>		
22 31 16 00-0031			2" Pipe Connection, Duplex Alternating (Two Valves), Commercial Water Softeners (Watts Pure Water) <small>(22 31 16 00-0031)</small>		
			Note: Includes corrosion resistant NSF Certified fiberglass mineral and brine tanks and two fully automatic metered demand control valves.		
22 31 16 00-0032	EA		90,000 Grain Capacity, 2" Pipe Connection, Duplex Alternating (Two Valves), Commercial Water Softener With Fiberglass Tanks (Watts Pure Water PWS20131D21).....	9,874.08	344.53
22 31 16 00-0033	EA		120,000 Grain Capacity, 2" Pipe Connection, Duplex Alternating (Two Valves), Commercial Water Softener With Fiberglass Tanks (Watts Pure Water PWS20131E21).....	10,311.94	358.32
22 31 16 00-0034	EA		150,000 Grain Capacity, 2" Pipe Connection, Duplex Alternating (Two Valves), Commercial Water Softener With Fiberglass Tanks (Watts Pure Water PWS20131F21).....	11,735.40	372.11
22 31 16 00-0035	EA		210,000 Grain Capacity, 2" Pipe Connection, Duplex Alternating (Two Valves), Commercial Water Softener With Fiberglass Tanks (Watts Pure Water PWS20131G21).....	12,826.66	385.89
22 31 16 00-0036	EA		300,000 Grain Capacity, 2" Pipe Connection, Duplex Alternating (Two Valves), Commercial Water Softener With Fiberglass Tanks (Watts Pure Water PWS20131H21).....	15,643.83	399.66
22 31 16 00-0037	EA		450,000 Grain Capacity, 2" Pipe Connection, Duplex Alternating (Two Valves), Commercial Water Softener With Fiberglass Tanks (Watts Pure Water PWS20131I21).....	20,702.79	413.45
22 31 16 00-0038	EA		600,000 Grain Capacity, 2" Pipe Connection, Duplex Alternating (Two Valves), Commercial Water Softener With Fiberglass Tanks (Watts Pure Water PWS20131J21).....	24,355.95	427.23
22 31 16 00-0039			3" Pipe Connection, Duplex Alternating (Two Valves), Commercial Water Softeners (Watts Pure Water) <small>(22 31 16 00-0039)</small>		
			Note: Includes corrosion resistant NSF Certified fiberglass mineral and brine tanks and two fully automatic metered demand control valves.		
22 31 16 00-0040	EA		300,000 Grain Capacity, 3" Pipe Connection, Duplex Alternating (Two Valves), Commercial Water Softener With Fiberglass Tanks (Watts Pure Water PWS30151H21).....	26,604.23	399.66
22 31 16 00-0041	EA		450,000 Grain Capacity, 3" Pipe Connection, Duplex Alternating (Two Valves), Commercial Water Softener With Fiberglass Tanks (Watts Pure Water PWS30151I21).....	30,554.39	413.45
22 31 16 00-0042	EA		600,000 Grain Capacity, 3" Pipe Connection, Duplex Alternating (Two Valves), Commercial Water Softener With Fiberglass Tanks (Watts Pure Water PWS30151J21).....	34,329.65	427.23
22 31 16 00-0043	EA		900,000 Grain Capacity, 3" Pipe Connection, Duplex Alternating (Two Valves), Commercial Water Softener With Fiberglass Tanks (Watts Pure Water PWS30151K21).....	43,662.11	441.01
22 31 16 00-0044	EA		1,050,000 Grain Capacity, 3" Pipe Connection, Duplex Alternating (Two Valves), Commercial Water Softener With Fiberglass Tanks (Watts Pure Water PWS30151L21).....	48,741.98	454.79
22 31 16 00-0045			Twin Alternating, Commercial Water Softeners (Watts Pure Water) <small>(22 31 16 00-0045)</small>		
22 31 16 00-0046			1" Pipe Connection, Twin Alternating, Commercial Water Softeners (Watts Pure Water) <small>(22 31 16 00-0046)</small>		
			Note: Includes corrosion resistant NSF Certified fiberglass mineral and brine tanks and fully automatic metered demand control valve.		
22 31 16 00-0047	EA		30,000 Grain Capacity, 1" Pipe Connection, Twin Alternating, Commercial Water Softener With Fiberglass Tanks (Watts Pure Water PWS10T161A21).....	3,512.59	303.19
22 31 16 00-0048	EA		45,000 Grain Capacity, 1" Pipe Connection, Twin Alternating, Commercial Water Softener With Fiberglass Tanks (Watts Pure Water PWS10T161B21).....	3,744.75	316.97
22 31 16 00-0049	EA		60,000 Grain Capacity, 1" Pipe Connection, Twin Alternating, Commercial Water Softener With Fiberglass Tanks (Watts Pure Water PWS10T161C21).....	4,081.41	330.75
22 31 16 00-0050	EA		90,000 Grain Capacity, 1" Pipe Connection, Twin Alternating, Commercial Water Softener With Fiberglass Tanks (Watts Pure Water PWS10T161D21).....	4,887.78	344.53
22 31 16 00-0051	EA		120,000 Grain Capacity, 1" Pipe Connection, Twin Alternating, Commercial Water Softener With Fiberglass Tanks (Watts Pure Water PWS10T161E21).....	5,401.54	358.32



MINOR			TOTAL DIRECT	DEMOLITION
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST
22 31 16 00-0052		1-1/2" Pipe Connection, Twin Alternating, Commercial Water Softeners (Watts Pure Water) <small>(22 31 16 00-0045)</small>		
		Note: Includes corrosion resistant NSF Certified fiberglass mineral and brine tanks and fully automatic metered demand control valve.		
22 31 16 00-0053	EA	60,000 Grain Capacity, 1-1/2" Pipe Connection, Twin Alternating, Commercial Water Softener With Fiberglass Tanks (Watts Pure Water PWS10T161A21).....	6,823.71	330.75
22 31 16 00-0054	EA	90,000 Grain Capacity, 1-1/2" Pipe Connection, Twin Alternating, Commercial Water Softener With Fiberglass Tanks (Watts Pure Water PWS10T161B21).....	7,194.48	344.53
22 31 16 00-0055	EA	120,000 Grain Capacity, 1-1/2" Pipe Connection, Twin Alternating, Commercial Water Softener With Fiberglass Tanks (Watts Pure Water PWS10T161C21).....	7,741.24	358.32
22 31 16 00-0056	EA	150,000 Grain Capacity, 1-1/2" Pipe Connection, Twin Alternating, Commercial Water Softener With Fiberglass Tanks (Watts Pure Water PWS10T161D21).....	8,853.40	372.11
22 31 16 00-0057	EA	210,000 Grain Capacity, 1-1/2" Pipe Connection, Twin Alternating, Commercial Water Softener With Fiberglass Tanks (Watts Pure Water PWS10T161E21).....	9,982.06	385.89
22 31 16 00-0058	EA	300,000 Grain Capacity, 1-1/2" Pipe Connection, Twin Alternating, Commercial Water Softener With Fiberglass Tanks (Watts Pure Water PWS10T161E21).....	12,481.33	399.66
22 32		Domestic Water Filtration Equipment <small>(22 30)</small>		
22 32 16		Domestic-Water Freestanding Cartridge Filters <small>(22 32)</small>		
22 32 16 00-0001		Commercial Water Filters Housings <small>(22 32 16)</small>		
22 32 16 00-0002		Commercial Multi-Cartridge Stainless Steel Water Filter Housings <small>(22 32 16 00-0001)</small>		
22 32 16 00-0003		Commercial Multi-Cartridge Stainless Steel Water Filter Housings <small>(22 32 16 00-0002)</small>		
22 32 16 00-0004	EA	25 GPM Max Flow Rate, 4 Cartridge, Commercial Multi-Cartridge Stainless Steel Water Filter Housing (Watts Pure Water PWHS4X1).....	1,387.10	129.80
22 32 16 00-0005	EA	30 GPM Max Flow Rate, 5 Cartridge, Commercial Multi-Cartridge Stainless Steel Water Filter Housing (Watts Pure Water PWHS5X1).....	1,416.97	139.79
22 32 16 00-0006	EA	60 GPM Max Flow Rate, 4 Cartridge, Commercial Multi-Cartridge Stainless Steel Water Filter Housing (Watts Pure Water PWHS4X2).....	1,508.44	149.77
22 32 16 00-0007	EA	90 GPM Max Flow Rate, 4 Cartridge, Commercial Multi-Cartridge Stainless Steel Water Filter Housing (Watts Pure Water PWHS4X3).....	1,668.11	159.75
22 32 16 00-0008	EA	120 GPM Max Flow Rate, 4 Cartridge, Commercial Multi-Cartridge Stainless Steel Water Filter Housing (Watts Pure Water PWHS4X4).....	1,719.98	169.74
22 32 16 00-0009	EA	150 GPM Max Flow Rate, 5 Cartridge, Commercial Multi-Cartridge Stainless Steel Water Filter Housing (Watts Pure Water PWHS5X4).....	2,076.55	179.73
22 32 16 00-0010	EA	250 GPM Max Flow Rate, 12 Cartridge, Commercial Multi-Cartridge Stainless Steel Water Filter Housing (Watts Pure Water PWHS12X3).....	5,733.12	189.71
22 32 16 00-0011	EA	300 GPM Max Flow Rate, 12 Cartridge, Commercial Multi-Cartridge Stainless Steel Water Filter Housing (Watts Pure Water PWHS12X4).....	6,662.78	199.69
22 32 16 00-0012	EA	500 GPM Max Flow Rate, 22 Cartridge, Commercial Multi-Cartridge Stainless Steel Water Filter Housing (Watts Pure Water PWHS22X3).....	8,444.96	209.67
22 32 16 00-0013	EA	600 GPM Max Flow Rate, 22 Cartridge, Commercial Multi-Cartridge Stainless Steel Water Filter Housing (Watts Pure Water PWHS22X4).....	9,363.62	219.67
22 32 16 00-0014		Commercial Water Filter Cartridges <small>(22 32 16 00-0002)</small>		
22 32 16 00-0015		(Depth) Water Filter Cartridges <small>(22 32 16 00-0014)</small>		
22 32 16 00-0016	EA	50 Micron, 10" Depth, Melt Blown (Depth) Water Filter Cartridge (Watts Pure Water PWMB10M50).....	7.31	1.60
22 32 16 00-0017	EA	20 Micron, 10" Depth, Melt Blown (Depth) Water Filter Cartridge (Watts Pure Water PWMB10M20).....	7.31	1.60
22 32 16 00-0018	EA	10 Micron, 10" Depth, Melt Blown (Depth) Water Filter Cartridge (Watts Pure Water PWMB10M10).....	7.31	1.60
22 32 16 00-0019	EA	5 Micron, 10" Depth, Melt Blown (Depth) Water Filter Cartridge (Watts Pure Water PWMB10M5).....	6.21	1.60
22 32 16 00-0020	EA	1 Micron, 10" Depth, Melt Blown (Depth) Water Filter Cartridge (Watts Pure Water PWMB10M1).....	7.59	1.60
22 32 16 00-0021	EA	50 Micron, 20" Depth, Melt Blown (Depth) Water Filter Cartridge (Watts Pure Water PWMB20M50).....	7.59	1.60
22 32 16 00-0022	EA	20 Micron, 20" Depth, Melt Blown (Depth) Water Filter Cartridge (Watts Pure Water PWMB20M20).....	8.14	1.60
22 32 16 00-0023	EA	5 Micron, 20" Depth, Melt Blown (Depth) Water Filter Cartridge (Watts Big Pure Water PWMB20M5).....	10.07	1.60
22 32 16 00-0024	EA	1 Micron, 20" Depth, Melt Blown (Depth) Water Filter Cartridge (Watts Pure Water PWMB20M1).....	8.14	1.60
22 32 16 00-0025	EA	50 Micron, 30" Depth, Melt Blown (Depth) Water Filter Cartridge (Watts Pure Water PWMB30M50).....	9.51	1.60
22 32 16 00-0026	EA	20 Micron, 30" Depth, Melt Blown (Depth) Water Filter Cartridge (Watts Pure Water PWMB30M20).....	9.51	1.60
22 32 16 00-0027	EA	5 Micron, 30" Depth, Melt Blown (Depth) Water Filter Cartridge (Watts Pure Water PWMB30M5).....	9.51	1.60
22 32 16 00-0028	EA	1 Micron, 30" Depth, Melt Blown (Depth) Water Filter Cartridge (Watts Pure Water PWMB30M1).....	10.34	1.60
22 32 16 00-0029	EA	50 Micron, 40" Length, Melt Blown (Depth) Water Filter Cartridge (Watts Pure Water PWMB40M50).....	13.37	1.60
22 32 16 00-0030	EA	20 Micron, 40" Length, Melt Blown (Depth) Water Filter Cartridge (Watts Pure Water PWMB40M20).....	12.27	1.60
22 32 16 00-0031	EA	5 Micron, 40" Length, Melt Blown (Depth) Water Filter Cartridge (Watts Pure Water PWMB40M5).....	12.27	1.60
22 32 16 00-0032	EA	1 Micron, 40" Length, Melt Blown (Depth) Water Filter Cartridge (Watts Pure Water PWMB40M1).....	13.37	1.60
22 32 16 00-0033		Pleated Water Filter Cartridges <small>(22 32 16 00-0014)</small>		
22 32 16 00-0034	EA	50 Micron, 9-3/4" Length, Pleated Water Filter Cartridge (Watts Pure Water PWPL10M50).....	12.54	1.60
22 32 16 00-0035	EA	20 Micron, 9-3/4" Length, Pleated Water Filter Cartridge (Watts Pure Water PWPL10M20).....	12.54	1.60
22 32 16 00-0036	EA	5 Micron, 9-3/4" Length, Pleated Water Filter Cartridge (Watts Pure Water PWPL10M5).....	12.81	1.60
22 32 16 00-0037	EA	1 Micron, 9-3/4" Length, Pleated Water Filter Cartridge (Watts Pure Water PWPL10M1).....	13.64	1.60
22 32 16 00-0038	EA	1 Micron Absolute, 9-3/4" Length, Pleated Water Filter Cartridge (Watts Pure Water PWPL10M1AB).....	20.24	1.60
22 32 16 00-0039	EA	50 Micron, 20" Length, Pleated Water Filter Cartridge (Watts Pure Water PWPL20M50).....	19.41	1.60
22 32 16 00-0040	EA	20 Micron, 20" Length, Pleated Water Filter Cartridge (Watts Pure Water PWPL20M20).....	19.41	1.60
22 32 16 00-0041	EA	5 Micron, 20" Length, Pleated Water Filter Cartridge (Watts Big Pure Water PWPL20M5).....	19.41	1.60
22 32 16 00-0042	EA	1 Micron, 20" Length, Pleated Water Filter Cartridge (Watts Pure Water PWPL20M1).....	25.47	1.60
22 32 16 00-0043	EA	1 Micron Absolute, 20" Length, Pleated Water Filter Cartridge (Watts Pure Water PWPL20M1AB).....	35.91	1.60

22	Plumbing
22 30	Plumbing Equipment
22 32	Domestic Water Filtration Equipment



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 32 16 00-0044 EA 50 Micron, 40" Length, Pleated Water Filter Cartridge (Watts Pure Water PWPL40M50)	30.14	1.60
22 32 16 00-0045 EA 20 Micron, 40" Length, Pleated Water Filter Cartridge (Watts Pure Water PWPL40M20)	41.69	1.60
22 32 16 00-0046 EA 5 Micron, 40" Length, Pleated Water Filter Cartridge (Watts Pure Water PWPL40M5)	43.34	1.60
22 32 16 00-0047 EA 1 Micron, 40" Length, Pleated Water Filter Cartridge (Watts Pure Water PWPL40M1)	48.84	1.60
22 32 16 00-0048 Commercial Non-Metallic Water Filter Housings (22 32 16 00-0001)		
22 32 16 00-0049 Commercial Non-Metallic Water Filter Housings (22 32 16 00-0048)		
22 32 16 00-0050 EA 150 GPM Max Flow Rate, 1 Cartridge, Commercial Non-Metallic Water Filter Housing (Watts Big Bubba® PWWJCHSG)	1,098.18	119.82
22 32 16 00-0051 Commercial Water Filter Cartridges (22 32 16 00-0048)		
22 32 16 00-0052 Carbon Water Filter Cartridges (22 32 16 00-0051)		
22 32 16 00-0053 EA Activated 26-1/4" Length, Carbon Water Filter Cartridge (Watts Big Bubba® PWWJCAC5)	345.84	1.60
22 32 16 00-0054 (Depth) Water Filter Cartridges (22 32 16 00-0051)		
22 32 16 00-0055 EA 50 Micron, 26-1/4" Length, Melt Blown (Depth) Water Filter Cartridge (Watts Big Bubba® PWWJCMB50)	72.21	1.60
22 32 16 00-0056 EA 20 Micron, 26-1/4" Length, Melt Blown (Depth) Water Filter Cartridge (Watts Big Bubba® PWWJCMB20)	71.67	1.60
22 32 16 00-0057 EA 5 Micron, 26-1/4" Length, Melt Blown (Depth) Water Filter Cartridge (Watts Big Bubba® PWWJCMB5)	71.67	1.60
22 32 16 00-0058 EA 1 Micron, 26-1/4" Length, Melt Blown (Depth) Water Filter Cartridge (Watts Big Bubba® PWWJCMB1)	82.11	1.60
22 32 16 00-0059 Pleated Water Filter Cartridges (22 32 16 00-0051)		
22 32 16 00-0060 EA 150 Micron, 26-1/4" Length, Pleated Water Filter Cartridge (Watts Big Bubba® PWWJCM150)	190.19	1.60
22 32 16 00-0061 EA 50 Micron, 26-1/4" Length, Pleated Water Filter Cartridge (Watts Big Bubba® PWWJCP50)	178.64	1.60
22 32 16 00-0062 EA 20 Micron, 26-1/4" Length, Pleated Water Filter Cartridge (Watts Big Bubba® PWWJCP20)	194.59	1.60
22 32 16 00-0063 EA 5 Micron, 26-1/4" Length, Pleated Water Filter Cartridge (Watts Big Bubba® PWWJCP5)	203.94	1.60
22 32 16 00-0064 EA 1 Micron, 26-1/4" Length, Pleated Water Filter Cartridge (Watts Big Bubba® PWWJCP1)	217.14	1.60
22 32 16 00-0065 EA 1 Absolute, 26-1/4" Length, Pleated Water Filter Cartridge (Watts Big Bubba® PWWJCP1AB)	235.29	1.60
22 33 Electric Domestic Water Heaters (22 30)		
22 33 13 Instantaneous Electric Domestic Water Heaters (22 33)		
22 33 13 13 Flow-Control, Instantaneous Electric Domestic Water Heaters (22 33 13)		
22 33 13 13-0001 Flow Controlled, Instantaneous, Tankless, Electric Domestic Water Heaters (22 33 13 13)		
22 33 13 13-0002 EA 3 To 10 KW Flow Controlled, Instantaneous, Tankless, Electric Domestic Water Heater (Eemax EX3012, EX48, EX65, EX75, EX95)	260.80	39.92
22 33 13 13-0003 EA 7.2 KW, 0.75 GPM, Instantaneous, Tankless, Electric Domestic Water Heater (Bosch RP7P)	326.84	39.92
22 33 13 16 Thermostat-Control, Instantaneous Electric Domestic Water Heaters (22 33 13)		
22 33 13 16-0001 Thermostat Controlled, Instantaneous, Tankless, Electric Domestic Water Heaters (22 33 13 16)		
Note: Temperature rise decreases with increased flow rate.		
22 33 13 16-0002 EA 3 To 10 KW Thermostat-Control, Instantaneous, Tankless, Electric Domestic Water Heater (Eemax EX3012T, EX48T, EX65T, EX75T, EX95T, EX012240T)	350.88	59.88
22 33 13 16-0003 EA 12 KW, 2.0 GPM, Indoor Mount, Instantaneous, Tankless, Electric Domestic Water Heater (Bosch PowerStar AE12)	427.46	79.85
22 33 13 16-0004 EA 17.25 KW, 2.3 GPM At 45 Degree Rise, Indoor Mount, Instantaneous, Tankless, Electric Domestic Water Heater (Bosch PowerStar AE115)	725.98	139.73
22 33 13 16-0005 EA 26.85 KW, 4.0 GPM At 45 Degree Rise, Indoor Mount, Instantaneous, Tankless, Electric Domestic Water Heater (Bosch PowerStar AE125)	1,078.26	159.69
22 33 13 16-0006 EA 12 KW, 1.6 GPM At 45 Degree Rise, Indoor Mount, Instantaneous, Tankless, Electric Domestic Water Heater (Stiebel Eltron Temptra 12 Plus)	683.46	79.85
22 33 13 16-0007 EA 14.4 KW, 2.3 GPM At 45 Degree Rise, Indoor Mount, Instantaneous, Tankless, Electric Domestic Water Heater (Stiebel Eltron Temptra 15 Plus)	940.93	119.77
22 33 13 16-0008 EA 19.2 KW, 2.8 GPM At 45 Degree Rise, Indoor Mount, Instantaneous, Tankless, Electric Domestic Water Heater (Stiebel Eltron Temptra 20 Plus)	1,055.09	159.69
22 33 13 16-0009 EA 24 KW, 3.3 GPM At 45 Degree Rise, Indoor Mount, Instantaneous, Tankless, Electric Domestic Water Heater (Stiebel Eltron Temptra 24 Plus)	1,091.42	159.69
22 33 13 16-0010 EA 28.8 KW, 4.5 GPM At 45 Degree Rise, Indoor Mount, Instantaneous, Tankless, Electric Domestic Water Heater (Stiebel Eltron Temptra 29 Plus)	1,125.73	159.69
22 33 13 16-0011 EA 36 KW, 4.5 GPM At 55 Degree Rise, Indoor Mount, Instantaneous, Tankless, Electric Domestic Water Heater (Stiebel Eltron Temptra 36 Plus)	1,176.19	159.69
22 33 30 Residential, Electric Domestic Water Heaters (22 33)		
22 33 30 13 Residential, Small-Capacity Electric Domestic Water Heaters (22 33 30)		
22 33 30 13-0001 Small-Capacity, Electric Domestic Water Heaters (A.O. Smith ProMax) (22 33 30 13)		
Note: Includes glass lined tank, drain valve and temperature and pressure relief valve. Excludes electrical connections.		
22 33 30 13-0002 EA 2 Gallon, Small-Capacity, Electric Domestic Water Heater	517.88	125.75



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 33 30 13-0003 EA 10 Gallon, Small-Capacity, Electric Domestic Water Heater.....	622.66	133.74
22 33 30 13-0004 EA 20 Gallon, Small-Capacity, Electric Domestic Water Heater.....	723.45	139.73
 22 33 30 16 Residential, Storage Electric Domestic Water Heaters (22 33 30)		
22 33 30 16-0001 Electric Domestic Water Heaters (A.O. Smith ProMax) (22 33 30 16)		
Note: Includes glass lined tank, drain valve and temperature and pressure relief valve. Excludes electrical connections.		
22 33 30 16-0002 EA 30 Gallon, Electric Domestic Water Heater.....	766.86	139.73
22 33 30 16-0003 EA 40 Gallon, Electric Domestic Water Heater.....	729.21	143.72
22 33 30 16-0004 EA 50 Gallon, Electric Domestic Water Heater.....	721.66	147.71
22 33 30 16-0005 EA 55 Gallon, Electric Domestic Water Heater.....	795.87	149.71
22 33 30 16-0006 EA 66 Gallon, Electric Domestic Water Heater.....	1,115.51	153.71
22 33 30 16-0007 EA 80 Gallon, Electric Domestic Water Heater.....	1,138.59	159.69
22 33 30 16-0008 EA 120 Gallon, Electric Domestic Water Heater.....	1,487.32	169.68
 22 33 30 16-0009 Low-Boy, Electric Domestic Water Heaters (A.O. Smith ProMax) (22 33 30 16)		
Note: Includes glass lined tank, drain valve and temperature and pressure relief valve. Excludes electrical connections.		
22 33 30 16-0010 EA 30 Gallon, Low-Boy, Electric Domestic Water Heater.....	816.70	139.73
22 33 30 16-0011 EA 40 Gallon, Low-Boy, Electric Domestic Water Heater.....	784.72	143.72
22 33 30 16-0012 EA 50 Gallon, Low-Boy, Electric Domestic Water Heater.....	828.23	147.71
 22 33 30 16-0013 High Efficiency, Electric Domestic Water Heaters (A.O. Smith Conservationist) (22 33 30 16)		
Note: Includes .95 energy factor glass lined tank, drain valve and temperature and pressure relief valve. Excludes electrical connections.		
22 33 30 16-0014 EA 40 Gallon, High Efficiency, Electric Domestic Water Heater.....	842.94	143.72
22 33 30 16-0015 EA 50 Gallon, High Efficiency, Electric Domestic Water Heater.....	914.82	147.71
22 33 30 16-0016 EA 66 Gallon, High Efficiency, Electric Domestic Water Heater.....	1,107.69	153.71
22 33 30 16-0017 EA 80 Gallon, High Efficiency, Electric Domestic Water Heater.....	1,199.59	159.69
 22 33 30 16-0018 Water Heater Accessories (22 33 30 16)		
22 33 30 16-0019 EA 2 Gallon, Expansion Pressure Tank For Water Heaters.....	62.65	7.98
22 33 30 16-0020 EA 4.4 Gallon, Expansion Pressure Tank For Water Heaters.....	73.06	7.98
22 33 30 16-0021 EA 7.6 Gallon, Expansion Pressure Tank For Water Heaters.....	137.41	7.98
22 33 30 16-0022 EA 14 Gallon, Expansion Pressure Tank For Water Heaters.....	182.69	7.98
22 33 30 16-0023 EA 20" Diameter, 2-1/2" Deep, Aluminum Water Heater Drain Pan.....	40.78	5.99
22 33 30 16-0024 EA 22" Diameter, 2-1/2" Deep, Aluminum Water Heater Drain Pan.....	44.25	5.99
22 33 30 16-0025 EA 24" Diameter, 2-1/2" Deep, Aluminum Water Heater Drain Pan.....	46.56	5.99
22 33 30 16-0026 EA 26" Diameter, 2-1/2" Deep, Aluminum Water Heater Drain Pan.....	54.66	5.99
22 33 30 16-0027 EA 22" Diameter, 2-1/2" Deep, Polyethylene Water Heater Drain Pan.....	23.37	5.99
22 33 30 16-0028 EA 24" Diameter, 2-1/2" Deep, Polyethylene Water Heater Drain Pan.....	25.22	5.99
22 33 30 16-0029 EA 26" Diameter, 2-1/2" Deep, Polyethylene Water Heater Drain Pan.....	27.82	5.99
22 33 30 16-0030 EA 28" Diameter, 2-1/2" Deep, Polyethylene Water Heater Drain Pan.....	31.17	5.99
22 33 30 16-0031 EA Earthquake Straps For Up To 80 Gallon Water Heater.....	34.88	7.98
 22 33 33 Light-Commercial Electric Domestic Water Heaters (22 33)		
22 33 33 00-0001 Removal And Reinstallation Of Water Heater (22 33 33)		
Note: Includes storage and cleaning.		
22 33 33 00-0002 EA Remove And Reinstall Water Heater Electric, Up To 82 Gallon.....	266.15	
22 33 33 00-0003 EA Remove And Reinstall Water Heater Electric, 83 Gallon To 200 Gallon.....	798.45	
 22 34 Fuel-Fired Domestic Water Heaters (22 30)		
22 34 13 Instantaneous, Tankless, Gas Domestic Water Heaters (22 34)		
22 34 13 00-0001 Instantaneous, Tankless, Gas Domestic Water Heaters (22 34 13)		
22 34 13 00-0002 Indoor Mount, Instantaneous, Tankless, Gas Domestic Water Heaters (22 34 13 00-0001)		
Note: Includes vent connection. Excludes vent.		
22 34 13 00-0003 EA 4.2 GPM, Indoor Mount, Instantaneous, Tankless, Gas Domestic Water Heater (Rheem RTG-42PVN).....	1,053.72	159.69
22 34 13 00-0004 EA 5.3 GPM, Indoor Mount, Instantaneous, Tankless, Gas Domestic Water Heater (Rheem RTG-53PVN).....	1,134.65	161.69
22 34 13 00-0005 EA 5.3 GPM, Direct Vent, Indoor Mount, Instantaneous, Tankless, Gas Domestic Water Heater (Rheem RTG-53DVN).....	1,240.55	165.68
22 34 13 00-0006 EA 6.6 GPM, Direct Vent, Indoor Mount, Instantaneous, Tankless, Gas Domestic Water Heater (Rheem RTG-66DVN).....	1,437.25	169.68
22 34 13 00-0007 EA 7.4 GPM, Indoor Mount, Instantaneous, Tankless, Gas Domestic Water Heater (Rheem RTG-74PVN).....	1,731.48	179.65
22 34 13 00-0008 EA 7.4 GPM, Direct Vent, Indoor Mount, Instantaneous, Tankless, Gas Domestic Water Heater (Rheem RTG-74DVN).....	1,766.45	179.65
 22 34 13 00-0009 Outdoor Mount, Instantaneous, Tankless, Gas Domestic Water Heaters (22 34 13 00-0001)		
22 34 13 00-0010 EA 5.3 GPM, Outdoor Mount, Instantaneous, Tankless, Gas Domestic Water Heater (Rheem RTG-53XN).....	1,130.66	159.69

22 Plumbing**22 30 Plumbing Equipment****22 34 Fuel-Fired Domestic Water Heaters**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
			22 34 13 00-0011 EA 7.4 GPM, Outdoor Mount, Instantaneous, Tankless, Gas Domestic Water Heater (Rheem RTG-74XN).....	1,731.48	179.65
22 34 30			Residential Gas Domestic Water Heaters (22 34)		
22 34 30 13			Residential, Atmospheric, Gas Domestic Water Heaters (22 34 30)		
22 34 30 13-0001			Atmospheric, Gas Domestic Water Heaters (A.O. Smith ProMax) (22 34 30 13) Note: Includes glass lined tank, drain valve, temperature and pressure relief valve and vent connection. Excludes vent.		
22 34 30 13-0002	EA		30 Gallon, Atmospheric, Gas Domestic Water Heater	806.90	153.71
22 34 30 13-0003	EA		40 Gallon, Atmospheric, Gas Domestic Water Heater	796.02	157.69
22 34 30 13-0004	EA		50 Gallon, Atmospheric, Gas Domestic Water Heater	1,033.79	161.69
22 34 30 13-0005	EA		65 Gallon, Atmospheric, Gas Domestic Water Heater	1,113.99	165.68
22 34 30 13-0006	EA		75 Gallon, Atmospheric, Gas Domestic Water Heater	1,210.73	169.68
22 34 30 13-0007	EA		100 Gallon, Atmospheric, Gas Domestic Water Heater	1,753.62	179.65
22 34 30 16			Residential, Direct-Vent, Gas Domestic Water Heaters (22 34 30)		
22 34 30 16-0001			Direct-Vent, Gas Domestic Water Heaters (A.O. Smith ProMax) (22 34 30 16) Note: Includes glass lined tank, drain valve, temperature and pressure relief valve and vent connection. Excludes vent.		
22 34 30 16-0002	EA		40 Gallon, Direct-Vent, Gas Domestic Water Heater	1,411.74	157.69
22 34 30 16-0003	EA		50 Gallon, Direct-Vent, Gas Domestic Water Heater	1,599.95	161.69
22 34 30 16-0004	EA		75 Gallon, Direct-Vent, Gas Domestic Water Heater	2,057.82	165.68
22 34 30 19			Residential, Power-Vent, Gas Domestic Water Heaters (22 34 30)		
22 34 30 19-0001			Power-Vent, Gas Domestic Water Heaters (A.O. Smith ProMax) (22 34 30 19) Note: Includes glass lined tank, drain valve, temperature and pressure relief valve and vent connection. Excludes vent.		
22 34 30 19-0002	EA		40 Gallon, Power-Vent, Gas Domestic Water Heater	1,290.02	157.69
22 34 30 19-0003	EA		50 Gallon, Power-Vent, Gas Domestic Water Heater	1,342.40	161.69
22 34 36			Commercial Gas Domestic Water Heaters (22 34)		
22 34 36 00-0001			Gas Fired Commercial Water Heaters (A.O. Smith BTR) (22 34 36) Note: Includes automatic flue damper, glass lined tank, drain valve, temperature and pressure relief valve and vent connection. Excludes vent.		
22 34 36 00-0002	EA		120 MBH Input, 71 Gallon, 80% Efficiency, Gas Fired Commercial Water Heater (A.O. Smith BTR-120)	5,001.36	239.54
22 34 36 00-0003	EA		154 MBH Input, 81 Gallon, 80% Efficiency, Gas Fired Commercial Water Heater (A.O. Smith BTR-154)	6,303.35	279.46
22 34 36 00-0004	EA		180 MBH Input, 81 Gallon, 80% Efficiency, Gas Fired Commercial Water Heater (A.O. Smith BTR-180)	6,574.29	319.38
22 34 36 00-0005	EA		199 MBH Input, 81 Gallon, 80% Efficiency, Gas Fired Commercial Water Heater (A.O. Smith BTR-199)	6,598.86	319.38
22 34 36 00-0006	EA		199 MBH Input, 100 Gallon, 80% Efficiency, Gas Fired Commercial Water Heater (A.O. Smith BTR-200)	6,752.23	319.38
22 34 36 00-0007	EA		199 MBH Input, 100 Gallon, ASME Rated Tank, 80% Efficiency, Gas Fired Commercial Water Heater (A.O. Smith BTR-200A).....	8,383.20	351.32
22 34 36 00-0008	EA		250 MBH Input, 100 Gallon, 80% Efficiency, Gas Fired Commercial Water Heater (A.O. Smith BTR-250)	7,477.50	359.31
22 34 36 00-0009	EA		250 MBH Input, 100 Gallon, ASME Rated Tank, 80% Efficiency, Gas Fired Commercial Water Heater (A.O. Smith BTR-250A).....	9,024.04	395.23
22 34 36 00-0010	EA		251 MBH Input, 65 Gallon, 80% Efficiency, Gas Fired Commercial Water Heater (A.O. Smith BTR-251)	7,071.96	359.31
22 34 36 00-0011	EA		251 MBH Input, 65 Gallon, ASME Rated Tank, 80% Efficiency, Gas Fired Commercial Water Heater (A.O. Smith BTR-251A).....	8,624.52	395.23
22 34 36 00-0012	EA		275 MBH Input, 100 Gallon, 80% Efficiency, Gas Fired Commercial Water Heater (A.O. Smith BTR-275)	7,839.33	439.15
22 34 36 00-0013	EA		275 MBH Input, 100 Gallon, ASME Rated Tank, 80% Efficiency, Gas Fired Commercial Water Heater (A.O. Smith BTR-275A).....	9,439.33	483.07
22 34 36 00-0014	EA		305 MBH Input, 65 Gallon, 80% Efficiency, Gas Fired Commercial Water Heater (A.O. Smith BTR-305)	7,975.13	439.15
22 34 36 00-0015	EA		305 MBH Input, 65 Gallon, ASME Rated Tank, 80% Efficiency, Gas Fired Commercial Water Heater (A.O. Smith BTR-305A).....	9,493.90	483.07
22 34 36 00-0016	EA		365 MBH Input, 85 Gallon, 80% Efficiency, Gas Fired Commercial Water Heater (A.O. Smith BTR-365)	8,927.37	479.07
22 34 36 00-0017	EA		365 MBH Input, 85 Gallon, ASME Rated Tank, 80% Efficiency, Gas Fired Commercial Water Heater (A.O. Smith BTR-365A).....	10,479.56	526.98
22 34 36 00-0018	EA		390 MBH Input, 100 Gallon, 80% Efficiency, Gas Fired Commercial Water Heater (A.O. Smith BTR-400)	10,789.28	479.07
22 34 36 00-0019	EA		390 MBH Input, 100 Gallon, ASME Rated Tank, 80% Efficiency, Gas Fired Commercial Water Heater (A.O. Smith BTR-400A).....	12,482.67	526.98
22 34 36 00-0020	EA		500 MBH Input, 85 Gallon, 80% Efficiency, Gas Fired Commercial Water Heater (A.O. Smith BTR-500)	12,098.03	518.99
22 34 36 00-0021	EA		150 MBH Input, 32 Gallon, Booster Type, 80% Efficiency, Gas Fired Commercial Water Heater (A.O. Smith BTR-151)	6,015.17	279.46
22 34 36 00-0022	EA		150 MBH Input, 32 Gallon, ASME Rated Tank, Booster Type, 80% Efficiency, Gas Fired Commercial Water Heater (A.O. Smith BTR-151A).....	7,250.80	307.40
22 34 36 00-0023	EA		199 MBH Input, 32 Gallon, Booster Type, 80% Efficiency, Gas Fired Commercial Water Heater (A.O. Smith BTR-201)	6,248.63	319.38
22 34 36 00-0024	EA		199 MBH Input, 32 Gallon, ASME Rated Tank, Booster Type, 80% Efficiency, Gas Fired Commercial Water Heater (A.O. Smith BTR-201A).....	7,535.26	351.32
22 34 36 00-0025	EA		Sidewall Power Vent System For BTR-120 through BTR-200	921.44	199.61
22 34 36 00-0026	EA		Sidewall Power Vent System For BTR-250 through BTR-500	1,083.66	199.61
22 34 36 00-0027			Induced Draft Blower Gas Fired Commercial Water Heaters (A.O. Smith BTN) (22 34 36) Note: Includes glass lined tank, drain valve, temperature and pressure relief valve and vent connection. Excludes vent.		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 34 36 00-0028 EA 80 MBH Input, 74 Gallon, 80% Efficiency, Induced Draft Blower, Gas Fired Commercial Water Heater (BTN-80)	3,151.87	239.54
22 34 36 00-0029 EA 90 MBH Input, 98 Gallon, 80% Efficiency, Induced Draft Blower, Gas Fired Commercial Water Heater (BTN-100)	3,643.43	239.54
22 34 36 00-0030 EA 120 MBH Input, 71 Gallon, 80% Efficiency, Induced Draft Blower, Gas Fired Commercial Water Heater (BTN-120)	5,419.19	239.54
22 34 36 00-0031 EA 154 MBH Input, 81 Gallon, 80% Efficiency, Induced Draft Blower, Gas Fired Commercial Water Heater (BTN-154)	6,660.35	279.46
22 34 36 00-0032 EA 180 MBH Input, 99 Gallon, 80% Efficiency, Induced Draft Blower, Gas Fired Commercial Water Heater (BTN-180)	6,918.38	319.38
22 34 36 00-0033 EA 199 MBH Input, 99 Gallon, 80% Efficiency, Induced Draft Blower, Gas Fired Commercial Water Heater (BTN-199)	6,961.39	319.38
22 34 36 00-0034 EA 199 MBH Input, 100 Gallon, 80% Efficiency, Induced Draft Blower, Gas Fired Commercial Water Heater (BTN-200)	7,121.15	319.38
22 34 36 00-0035 EA 199 MBH Input, 100 Gallon, ASME Rated Tank, 80% Efficiency, Induced Draft Blower, Gas Fired Commercial Water Heater (BTN-200A)	8,377.06	351.32
22 34 36 00-0036 EA 250 MBH Input, 100 Gallon, 80% Efficiency, Induced Draft Blower, Gas Fired Commercial Water Heater (BTN-250)	7,864.60	359.31
22 34 36 00-0037 EA 250 MBH Input, 100 Gallon, ASME Rated Tank, 80% Efficiency, Induced Draft Blower, Gas Fired Commercial Water Heater (BTN-250A)	9,687.64	395.23
22 34 36 00-0038 EA 275 MBH Input, 100 Gallon, 80% Efficiency, Induced Draft Blower, Gas Fired Commercial Water Heater (BTN-275)	8,239.34	439.15
22 34 36 00-0039 EA 275 MBH Input, 100 Gallon, ASME Rated Tank, 80% Efficiency, Induced Draft Blower, Gas Fired Commercial Water Heater (BTN-275A)	10,096.80	483.07
22 34 36 00-0040 EA 310 MBH Input, 85 Gallon, 80% Efficiency, Induced Draft Blower, Gas Fired Commercial Water Heater (BTN-310)	8,427.36	439.15
22 34 36 00-0041 EA 310 MBH Input, 85 Gallon, ASME Rated Tank, 80% Efficiency, Induced Draft Blower, Gas Fired Commercial Water Heater (BTN-310A)	10,207.40	483.07
22 34 36 00-0042 EA 366 MBH Input, 85 Gallon, 80% Efficiency, Induced Draft Blower, Gas Fired Commercial Water Heater (BTN-366)	9,468.21	479.07
22 34 36 00-0043 EA 366 MBH Input, 85 Gallon, ASME Rated Tank, 80% Efficiency, Induced Draft Blower, Gas Fired Commercial Water Heater (BTN-366A)	11,103.84	526.98
22 34 36 00-0044 EA 390 MBH Input, 85 Gallon, 80% Efficiency, Induced Draft Blower, Gas Fired Commercial Water Heater (BTN-400)	11,532.76	479.07
22 34 36 00-0045 EA 390 MBH Input, 85 Gallon, ASME Rated Tank, 80% Efficiency, Induced Draft Blower, Gas Fired Commercial Water Heater (BTN-400A)	13,213.86	526.98
22 34 36 00-0046 Condensing Gas Fired Commercial Water Heaters (A.O. Smith BTX And BTH) <small>(22 34 36)</small>		
Note: Includes glass lined tank, drain valve, temperature and pressure relief valve and vent connection. Excludes vent.		
22 34 36 00-0047 EA 76 MBH Input, 50 Gallon, 90% Efficiency, Power-Vent, Condensing Gas Fired Commercial Water Heater (BTX-80)	2,863.07	239.54
22 34 36 00-0048 EA 100 MBH Input, 50 Gallon, 90% Efficiency, Power-Vent, Condensing Gas Fired Commercial Water Heater (BTX-100)	3,919.93	239.54
22 34 36 00-0049 EA 120 MBH Input, 60 Gallon, 95% Efficiency, Power-Vent, Condensing Gas Fired Commercial Water Heater (BTH-120)	5,523.64	239.54
22 34 36 00-0050 EA 120 MBH Input, 60 Gallon, ASME Rated Tank, 95% Efficiency, Power-Vent, Condensing Gas Fired Commercial Water Heater (BTH-120A)	6,997.08	263.49
22 34 36 00-0051 EA 150 MBH Input, 100 Gallon, 95% Efficiency, Power-Vent, Condensing Gas Fired Commercial Water Heater (BTH-150)	7,428.41	279.46
22 34 36 00-0052 EA 150 MBH Input, 100 Gallon, ASME Rated Tank, 95% Efficiency, Power-Vent, Condensing Gas Fired Commercial Water Heater (BTH-150A)	9,069.57	307.40
22 34 36 00-0053 EA 199 MBH Input, 100 Gallon, 95% Efficiency, Power-Vent, Condensing Gas Fired Commercial Water Heater (BTH-199)	7,671.69	319.38
22 34 36 00-0054 EA 199 MBH Input, 100 Gallon, ASME Rated Tank, 95% Efficiency, Power-Vent, Condensing Gas Fired Commercial Water Heater (BTH-199A)	9,335.60	351.32
22 34 36 00-0055 EA 250 MBH Input, 100 Gallon, 95% Efficiency, Power-Vent, Condensing Gas Fired Commercial Water Heater (BTH-250)	8,675.68	359.31
22 34 36 00-0056 EA 250 MBH Input, 100 Gallon, ASME Rated Tank, 95% Efficiency, Power-Vent, Condensing Gas Fired Commercial Water Heater (BTH-250A)	10,246.79	395.23
22 34 36 00-0057 EA 300 MBH Input, 130 Gallon, ASME Rated Tank, 95% Efficiency, Power-Vent, Condensing Gas Fired Commercial Water Heater (BTH-300A)	12,880.25	483.07
22 34 36 00-0058 EA 399.9 MBH Input, 130 Gallon, ASME Rated Tank, 95% Efficiency, Power-Vent, Condensing Gas Fired Commercial Water Heater (BTH-400A)	14,768.42	526.98
22 34 36 00-0059 EA 499.9 MBH Input, 130 Gallon, ASME Rated Tank, 95% Efficiency, Power-Vent, Condensing Gas Fired Commercial Water Heater (BTH-500A)	17,019.11	570.89
22 34 36 00-0060 Laars Rheos+ 90% Efficient, Gas Fired, Copper Fin Tube Condensing Water Heaters <small>(22 34 36)</small>		
22 34 36 00-0061 EA 1,200 MBH 90% Efficient, Gas Fired, Copper Fin Tube Condensing Water Heater (Laars Rheos+)	25,305.92	922.21
22 34 36 00-0062 EA 1,600 MBH 90% Efficient, Gas Fired, Copper Fin Tube Condensing Water Heater (Laars Rheos+)	35,807.30	1,019.29
22 34 36 00-0063 EA 2,000 MBH 90% Efficient, Gas Fired, Copper Fin Tube Condensing Water Heater (Laars Rheos+)	38,862.84	1,067.82
22 34 36 00-0064 EA 2,400 MBH 90% Efficient, Gas Fired, Copper Fin Tube Condensing Water Heater (Laars Rheos+)	42,090.87	1,164.90
22 34 36 00-0065 Laars Rheos 86% Efficient Gas Fired, Copper Fin Tube LoNox Water Heaters <small>(22 34 36)</small>		
22 34 36 00-0066 EA 1,200 MBH 86% Efficient, Gas Fired, Copper Fin Tube LoNox Water Heater (Laars Rheos)	22,418.43	922.21
22 34 36 00-0067 EA 1,600 MBH 86% Efficient, Gas Fired, Copper Fin Tube LoNox Water Heater (Laars Rheos)	24,766.40	1,019.29
22 34 36 00-0068 EA 2,000 MBH 86% Efficient, Gas Fired, Copper Fin Tube LoNox Water Heater (Laars Rheos)	27,085.45	1,067.82
22 34 36 00-0069 EA 2,400 MBH 86% Efficient, Gas Fired, Copper Fin Tube LoNox Water Heater (Laars Rheos)	29,426.80	1,164.90
22 34 36 00-0070 Laars Pennant 85% Efficient, Gas Fired, Copper Fin Tube LoNox Water Heaters <small>(22 34 36)</small>		
22 34 36 00-0071 EA 200 MBH 85% Efficient, Gas Fired, Copper Fin Tube LoNox Water Heater (Laars Pennant)	5,712.95	436.84
22 34 36 00-0072 EA 300 MBH 85% Efficient, Gas Fired, Copper Fin Tube LoNox Water Heater (Laars Pennant)	6,284.04	485.37

22 Plumbing**22 30 Plumbing Equipment****22 34 Fuel-Fired Domestic Water Heaters**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 34 36 00-0073 EA 400 MBH 85% Efficient, Gas Fired, Copper Fin Tube LoNox Water Heater (Laars Pennant)	7,377.65	582.45
22 34 36 00-0074 EA 500 MBH 85% Efficient, Gas Fired, Copper Fin Tube LoNox Water Heater (Laars Pennant)	10,451.30	606.72
22 34 36 00-0075 EA 750 MBH 85% Efficient, Gas Fired, Copper Fin Tube LoNox Water Heater (Laars Pennant)	11,501.41	728.06
22 34 36 00-0076 EA 1,000 MBH 85% Efficient, Gas Fired, Copper Fin Tube LoNox Water Heater (Laars Pennant)	14,189.70	873.68
22 34 36 00-0077 EA 1,250 MBH 85% Efficient, Gas Fired, Copper Fin Tube LoNox Water Heater (Laars Pennant)	16,145.47	922.21
22 34 36 00-0078 EA 1,500 MBH 85% Efficient, Gas Fired, Copper Fin Tube LoNox Water Heater (Laars Pennant)	17,902.03	995.02
22 34 36 00-0079 EA 1,750 MBH 85% Efficient, Gas Fired, Copper Fin Tube LoNox Water Heater (Laars Pennant)	19,550.83	1,043.56
22 34 36 00-0080 EA 2,000 MBH 85% Efficient, Gas Fired, Copper Fin Tube LoNox Water Heater (Laars Pennant)	20,994.68	1,067.82
22 34 36 00-0081 Patterson Kelly Thermific Sealed Combustion, Gas Fired, Copper Fin Tube Water Heaters (22 34 36)		
22 34 36 00-0082 EA 700 MBH 85% Efficient, Sealed Combustion, Gas Fired, Copper Fin Tube Water Heater (Patterson Kelly Thermific).....	18,839.92	728.06
22 34 36 00-0083 EA 1,000 MBH 85% Efficient, Sealed Combustion, Gas Fired, Copper Fin Tube Water Heater (Patterson Kelly Thermific).....	20,725.46	873.68
22 34 36 00-0084 EA 1,500 MBH 85% Efficient, Sealed Combustion, Gas Fired, Copper Fin Tube Water Heater (Patterson Kelly Thermific).....	27,757.02	995.02
22 34 36 00-0085 EA 1,700 MBH 85% Efficient, Sealed Combustion, Gas Fired, Copper Fin Tube Water Heater (Patterson Kelly Thermific).....	28,590.91	1,043.56
22 34 36 00-0086 EA 2,000 MBH 85% Efficient, Sealed Combustion, Gas Fired, Copper Fin Tube Water Heater (Patterson Kelly Thermific).....	29,935.39	1,067.82
22 34 36 00-0087 Patterson Kelly Modufire Forced Draft, Water, Gas Fired, Copper Fin Tube Water Heaters (22 34 36)		
22 34 36 00-0088 EA 1,000 MBH 85% Efficient, Forced Draft, Gas Fired, Copper Fin Tube Water Heater (Patterson Kelly Modufire)	23,911.08	873.68
22 34 36 00-0089 EA 1,500 MBH 85% Efficient, Forced Draft, Gas Fired, Copper Fin Tube Water Heater (Patterson Kelly Modufire)	28,938.51	995.02
22 34 36 00-0090 EA 2,000 MBH 85% Efficient, Forced Draft, Gas Fired, Copper Fin Tube Water Heater (Patterson Kelly Modufire)	30,707.22	1,067.82
22 34 36 00-0091 Laars Mighty Therm Volume Water Heater (22 34 36)		
22 34 36 00-0092 EA 200 MBH Gas Fired Volume Water Heater (Laars MT2V0200)	6,140.69	588.34
22 34 36 00-0093 EA 300 MBH Gas Fired Volume Water Heater (Laars MT2V0300)	6,670.59	661.88
22 34 36 00-0094 EA 400 MBH Gas Fired Volume Water Heater (Laars MT2V0400)	7,738.81	808.96
22 34 36 00-0095 EA 500 MBH Gas Fired Volume Water Heater (Laars MT2V0500)	11,173.51	882.50
22 34 36 00-0096 EA 750 MBH Gas Fired Volume Water Heater (Laars MT2V0750)	12,310.09	1,029.58
22 34 36 00-0097 EA 1,000 MBH Gas Fired Volume Water Heater (Laars MT2V1000)	14,080.84	1,176.67
22 34 36 00-0098 EA 1,250 MBH Gas Fired Volume Water Heater (Laars MT2V1250)	15,563.43	1,323.75
22 34 36 00-0099 EA 1,500 MBH Gas Fired Volume Water Heater (Laars MT2V1500)	18,567.83	1,470.83
22 34 36 00-0100 EA 1,750 MBH Gas Fired Volume Water Heater (Laars MT2V1750)	19,273.36	1,544.37
22 34 36 00-0101 EA 2,000 MBH Gas Fired Volume Water Heater (Laars MT2V2000)	20,662.50	1,617.92
22 34 36 00-0102 Laars Mighty Therm Gas Fired Domestic Hot Water Skid Package (22 34 36)		
Note: Includes (2) Laars Mighty Therm boilers, (2) B&G boiler primary pumps (one per boiler), T&P valve, circuit setter, storage tank (sized for 10 minutes buffer based on 50 degree city water supply, and operating set point for the tank at 130 degrees storage), and all necessary accessories for system monitoring such as gauges and thermometers. UL listed and labeled. Excludes piping insulation or seismic calculations.		
22 34 36 00-0103 EA 400 MBH x 2, Gas Fired Domestic Hot Water Skid Package (FlowTherm Systems FTDW-400)	47,881.32	988.83
22 34 36 00-0104 EA 1,000 MBH x 2, Gas Fired Domestic Hot Water Skid Package (FlowTherm Systems FTDW-1000)	57,870.28	1,050.63
22 34 36 00-0105 EA 2,000 MBH x 2, Gas Fired Domestic Hot Water Skid Package (FlowTherm Systems FTDW-2000)	70,289.70	1,112.44
22 34 36 00-0106 EA 3,000 MBH x 2, Gas Fired Domestic Hot Water Skid Package (FlowTherm Systems FTDW-3000)	84,003.77	1,174.23
22 34 36 00-0107 EA 4,000 MBH x 2, Gas Fired Domestic Hot Water Skid Package (FlowTherm Systems FTDW-4000)	88,050.62	1,236.04
22 34 36 00-0108 Removal And Reinstallation Of Water Heater (22 34 36)		
Note: Includes storage and cleaning.		
22 34 36 00-0109 EA Remove And Reinstall Water Heater Gas Fired, Up To 86 Gallon	362.93	
22 34 36 00-0110 EA Remove And Reinstall Water Heater Gas Fired, 87 Gallon To 200 Gallon.....	959.68	
22 34 36 00-0111 Gas Fired Commercial Water Heaters (Rheem-Ruud) (22 34 36)		
Note: Includes automatic flue damper, glass lined tank, drain valve, temperature and pressure relief valve and vent connection. Excludes vent.		
22 34 36 00-0112 EA 199 MBH Input, 100 Gallon, Universal Gas Fired Commercial Water Heater (Rheem-Ruud G100-200)	5,698.19	319.38
22 34 46 Oil-Fired Domestic Water Heaters (22 34)		
22 34 46 00-0001 Oil-Fired Domestic Water Heaters (Bock) (22 34 46)		
Note: Includes burner, glass lined tank, drain valve, temperature and pressure relief valve and vent connection. Excludes vent.		
22 34 46 00-0002 EA 60 MBH, 20 Gallon, Oil-Fired Domestic Water Heater (Bock 20E)	1,743.61	153.71
22 34 46 00-0003 EA 104 MBH, 32 Gallon, Oil-Fired Domestic Water Heater (Bock 32E)	1,718.38	153.71
22 34 46 00-0004 EA 104 MBH, 33 Gallon, Oil-Fired Domestic Water Heater (Bock 33ES).....	1,845.26	153.71
22 34 46 00-0005 EA 125 MBH, 40 Gallon, Oil-Fired Domestic Water Heater (Bock 40E)	1,904.00	157.69
22 34 46 00-0006 EA 140 MBH, 50 Gallon, Oil-Fired Domestic Water Heater (Bock 50ES).....	2,409.91	161.69
22 34 46 00-0007 EA 152 MBH, 50 Gallon, Oil-Fired Domestic Water Heater (Bock 51E)	2,054.07	161.69



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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22 35 Domestic Water Heat Exchangers (22 30)

22 35 23 Circulating, Domestic Water heat Exchangers (22 35)

22 35 23 00-0001 Steam Driven Water Heaters (22 35 23)

22 35 23 00-0002 Constant Flow (22 35 23 00-0001)

22 35 23 00-0003	EA	30 GPM, 700 LB/Hour Steam Water Heater, Constant Flow	4,217.42	399.22
22 35 23 00-0004	EA	90 GPM, 1,250 LB/Hour Steam Water Heater, Constant Flow	5,266.06	489.21
22 35 23 00-0005	EA	140 GPM, 2,500 LB/Hour Steam Water Heater, Constant Flow	6,749.92	639.79
22 35 23 00-0006	EA	230 GPM, 5,000 LB/Hour Steam Water Heater, Constant Flow	9,137.66	891.15
22 35 23 00-0007	EA	500 GPM, 7,500 LB/Hour Steam Water Heater, Constant Flow	13,506.56	1,467.71
22 35 23 00-0008	EA	900 GPM, 10,000 LB/Hour Steam Water Heater, Constant Flow	14,729.61	1,663.41
22 35 23 00-0009	EA	1,400 GPM, 15,000 LB/Hour Steam Water Heater, Constant Flow	19,288.76	1,919.31
22 35 23 00-0010	EA	2,400 GPM, 20,000 LB/Hour Steam Water Heater, Constant Flow	23,202.39	2,268.32

22 35 23 00-0011 Variable Flow (22 35 23 00-0001)

22 35 23 00-0012	EA	30 GPM, 700 LB/Hour Steam Water Heater, Variable Flow	6,380.56	778.49
22 35 23 00-0013	EA	90 GPM, 1,250 LB/Hour Steam Water Heater, Variable Flow	7,242.06	950.56
22 35 23 00-0014	EA	140 GPM, 2,500 LB/Hour Steam Water Heater, Variable Flow	9,240.78	1,229.13
22 35 23 00-0015	EA	230 GPM, 5,000 LB/Hour Steam Water Heater, Variable Flow	12,134.29	1,714.92
22 35 23 00-0016	EA	500 GPM, 7,500 LB/Hour Steam Water Heater, Variable Flow	18,155.18	2,868.04
22 35 23 00-0017	EA	900 GPM, 10,000 LB/Hour Steam Water Heater, Variable Flow	22,044.12	3,158.43
22 35 23 00-0018	EA	1,400 GPM, 15,000 LB/Hour Steam Water Heater, Variable Flow	25,541.33	3,696.51
22 35 23 00-0019	EA	2,400 GPM, 20,000 LB/Hour Steam Water Heater, Variable Flow	32,303.18	4,416.23

22 40 Plumbing Fixtures (22)

Note: The following Energy Policy Act Flow Rates Requirements superseded flow rates standards listed in section. Plumbing fixtures and trim should not exceed the maximum flow rates set forth in The Energy Policy Act 92. lavatory faucets - 2.5 gal/min, lavatory replacement aerators - 2.5 gal/min, kitchen faucets - 2.5 gal/min, kitchen replacement aerators - 2.5 gal/min, metering faucets - 0.25 gal/cycle, gravity tank-type toilets - 1.6 gal/flush, flushometer tank toilets - 1.6 gal/flush, electromechanical hydraulic toilets - 1.6 gal/flush, blowdown toilets - 3.5 gal/flush, urinals - 1.0 gal/flush.

22 41 Residential Plumbing Fixtures (22 40)

22 41 39 Residential Faucets, Supplies, And Trim (22 41)

22 41 39 00-0001 Kitchen Faucets (22 41 39)

22 41 39 00-0002	EA	Chrome Single Handle Kitchen Faucet (Delta 100WF).....	122.23	36.75
22 41 39 00-0003	EA	Chrome Single Handle Kitchen Faucet With Spray (Delta 400WF)	139.55	36.75
22 41 39 00-0004	EA	Chrome Single Handle Kitchen Faucet With Integrated Spray (Delta 300WF)	139.55	36.75
22 41 39 00-0005	EA	Chrome Two Handle Kitchen Faucet, Three Hole Installation 8"Center (Delta 2102-LHP+H215).....	134.76	36.75
22 41 39 00-0006	EA	Chrome Two Handle Kitchen Faucet With Spray, Three Hole Installation, 8" Center (Delta 2402-LHP+H215)	144.07	36.75

22 41 39 00-0007 Lavatory Faucets (22 41 39)

22 41 39 00-0008	EA	Chrome Single Acrylic Handle Bath Faucet (Delta 502WF).....	109.59	26.46
		<i>For Faucet With Brass Pop-Up, Add</i>	11.00	
22 41 39 00-0009	EA	Chrome Single Lever Handle Bath Faucet (Delta 500WF)	109.59	26.46
		<i>For Faucet With Brass Pop-Up, Add</i>	11.00	
22 41 39 00-0010	EA	Chrome Two Handle Bath Faucet With Acrylic Handles (Delta 2502)	84.14	26.46
		<i>For Faucet With Brass Pop-Up, Add</i>	16.50	
		<i>For Faucet With Plastic Pop-Up, Add</i>	14.00	

22 41 39 00-0011 Bath And Shower Faucets (22 41 39)

22 41 39 00-0012	EA	Single Lever Handle, Chrome Shower Only, Pressure Balanced/Anti-Scald Valve (American Standard T675.501)	134.28	31.90
		<i>For Faucet With Polished Nickel Or Brass Finish, Add</i>	25.00	
22 41 39 00-0013	EA	Single Lever Handle, Chrome Bath And Shower, Pressure Balanced/Anti-Scald Valve (American Standard T675.502)	164.22	31.90
		<i>For Faucet With Polished Nickel Or Brass Finish, Add</i>	25.00	
22 41 39 00-0014	EA	Two-Knob Handle Chrome Shower Only, Ceramic Valving (American Standard 3275.301)	120.02	31.90
		<i>For Faucet With Polished Nickel Or Brass Finish, Add</i>	75.00	
		<i>For Faucet With Lever Handles, Add</i>	8.10	
22 41 39 00-0015	EA	Two-Knob Handle Chrome Shower And Tub Filler, Ceramic Valving (American Standard 3275.302)	134.98	31.90
		<i>For Faucet With Polished Nickel Or Brass Finish, Add</i>	75.00	
		<i>For Faucet With Lever Handles, Add</i>	8.10	
22 41 39 00-0016	EA	Three-Knob Handle Chrome Shower And Tub Filler, Ceramic Valving (American Standard 3375.302).....	148.00	31.90
		<i>For Faucet With Polished Nickel Or Brass Finish, Add</i>	75.00	
		<i>For Faucet With Lever Handles, Add</i>	8.10	
22 41 39 00-0017	EA	Hand Shower With Hose And 25" Slide Bar (American Standard 1662.602).....	158.37	19.96

22 41 39 00-0018 Laundry Faucets (22 41 39)

22 41 39 00-0019	EA	Stream Straightener Nozzle Chrome Laundry Faucet, Lever Handles, 4" Center (Delta 2123).....	95.21	23.47
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22 41 39 00-0020 Laundry/Wash Basin Faucets (22 41 39)

22 41 39 00-0021	EA	Hose Thread Spout Chrome Laundry Faucet, Lever Handles, 4" Center (Delta 2121)	95.92	23.47
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22	Plumbing
22 40	Plumbing Fixtures
22 41	Residential Plumbing Fixtures



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 41 39 00-0022	EA		Hose Thread Spout With Vacuum Breaker Chrome Laundry Faucet, Lever Handles, 4" Center (Delta 2121+RP25695).....	134.28	25.87
22 41 39 00-0023			Other Faucets (22 41 39)		
22 41 39 00-0024	EA		Sillcock, Compact, Brass, IPS Or Copper To Hose	21.68	5.99
22 42			Commercial Plumbing Fixtures (22 40)		
Note: Prices are for commercial grade unless otherwise indicated. Includes final connection and all associated trim (seat, supply stop and line, wax seal, valve). Excludes rough-in within the wall and carrier.					
22 42 13			Commercial Water Closets, Urinals, And Bidets (22 42)		
22 42 13 00-0001			Vitreous China Water Closets (22 42 13)		
Note: With a 2" ball pass.					
22 42 13 00-0002			Floor Mounted Elongated Vitreous China Water Closets (22 42 13 00-0001)		
Note: Includes wax seal and toilet seat. Excludes flush valve.					
22 42 13 00-0003	EA		Flush Valve Type, Siphon Jet, Floor Mounted, Floor Outlet, Elongated Vitreous China Water Closet (American Standard Madera™).....	471.63	76.44
22 42 13 00-0004	EA		Flush Valve Type, Siphon Jet, Floor Mounted, Floor Outlet, Elongated Vitreous China Water Closet (American Standard Colorado).....	465.65	76.44
22 42 13 00-0005	EA		Flush Valve Type, Siphon Jet, Floor Mounted, Wall Outlet, Elongated Vitreous China Water Closet (American Standard Priolo®).....	587.30	76.44
22 42 13 00-0006	EA		2 Piece Tank Type, Pressure Assisted, Siphon Jet, Floor Mounted, Wall Outlet, Elongated Vitreous China Water Closet (American Standard Yorkville™).....	798.04	76.44
22 42 13 00-0007	EA		2 Piece Tank Type, Pressure Assisted, Siphon Jet, Floor Mounted, Floor Outlet, Elongated Vitreous China Water Closet (American Standard Cadet™).....	700.32	76.44
22 42 13 00-0008	EA		1.28 GPF Flush Valve Type, Siphon Jet, Floor Mounted, Floor Outlet, Elongated Vitreous China Water Closet (Toto® CT705E).....	505.75	76.44
22 42 13 00-0009			Wall Hung Elongated Vitreous China Water Closets (22 42 13 00-0001)		
Note: Includes wax seal and toilet seat. Excludes flush valve.					
22 42 13 00-0010	EA		Flush Valve Type, Siphon Jet, Wall Mounted, Wall Outlet, Handicap Accessible, Elongated Vitreous China Water Closet (American Standard AFWall®).....	542.98	94.08
22 42 13 00-0011	EA		Flush Valve Type, Siphon Jet, Wall Mounted, Wall Outlet, Handicap Accessible, Elongated Vitreous China Water Closet (American Standard AFWall® ADA Retrofit).....	709.84	94.08
22 42 13 00-0012	EA		2 Piece Tank Type, Pressure Assisted, Siphon Jet, Wall Mounted, Wall Outlet, Handicap Accessible, Elongated Vitreous China Water Closet (American Standard Glenwall™).....	938.52	94.08
22 42 13 00-0013	EA		Flush Valve Type, Siphon Jet, Wall Mounted, Wall Outlet, Handicap Accessible, Elongated Vitreous China Water Closet (Toto® CT708E Or CT708EV).....	618.55	94.08
22 42 13 00-0014	EA		Flush Valve Type, Siphon Jet, Wall Mounted, Wall Outlet, Handicap Accessible, Elongated Vitreous China Water Closet (Zurn Z5615-BWL).....	499.48	94.08
22 42 13 00-0015	EA		Flush Valve Type, Siphon Jet, Wall Mounted, Wall Outlet, Handicap Accessible, Elongated Vitreous China Water Closet (Sloan ST-2059-A).....	531.73	94.08
22 42 13 00-0016			Floor Mounted Elongated Handicapped Water Closets (22 42 13 00-0001)		
Note: Includes wax seal and toilet seat. Excludes flush valve.					
22 42 13 00-0017	EA		Flush Valve Type, Siphon Jet, Floor Mounted, Floor Outlet, Handicap Accessible, Elongated Vitreous China Water Closet (American Standard Madera™ ADA).....	479.87	76.44
22 42 13 00-0018	EA		Flush Valve Type, Siphon Jet, Floor Mounted, Floor Outlet, Handicap Accessible, Elongated Vitreous China Water Closet (American Standard Colorado Right Height®).....	494.49	76.44
22 42 13 00-0019	EA		Flush Valve Type, Siphon Jet, Floor Mounted, Floor Outlet, Handicap Accessible, Elongated Vitreous China Water Closet (American Standard Right Width™ Right Height®).....	558.98	76.44
22 42 13 00-0020	EA		Flush Valve Type, Siphon Jet, Floor Mounted, Wall Outlet, Handicap Accessible, Elongated Vitreous China Water Closet (American Standard Huron).....	638.75	76.44
22 42 13 00-0021	EA		Flush Valve Type, Siphon Jet, Floor Mounted, Wall Outlet, Handicap Accessible, Elongated Vitreous China Water Closet (American Standard Priolo® ADA).....	635.43	76.44
22 42 13 00-0022	EA		2 Piece Tank Type, Pressure Assisted, Siphon Jet, Floor Mounted, Back Outlet, Handicap Accessible, Elongated Vitreous China Water Closet (American Standard Yorkville™ ADA).....	890.04	76.44
22 42 13 00-0023	EA		2 Piece Tank Type, Pressure Assisted, Siphon Jet, Floor Mounted, Floor Outlet, Handicap Accessible, Elongated Vitreous China Water Closet (American Standard Cadet Right Height™ ADA).....	730.49	76.44
22 42 13 00-0024	EA		Flush Valve Type, Siphon Jet, Floor Mounted, Floor Outlet, Handicap Accessible, Elongated Vitreous China Water Closet (Toto® CT705ELN).....	545.56	76.44
22 42 13 00-0025	EA		Flush Valve Type, Siphon Jet, Floor Mounted, Floor Outlet, Handicap Accessible, Elongated Vitreous China Water Closet (Zurn HET Z5667-BWL).....	512.00	76.44
22 42 13 00-0026			Water Closet Flush Valves (22 42 13 00-0001)		
22 42 13 00-0027	EA		Exposed Manual Water Closet Flush Valve (Sloan Regal-115XL).....	176.06	25.06
22 42 13 00-0028	EA		Exposed Manual Water Closet Flush Valve (Sloan Regal-113-1.6).....	170.95	25.06
22 42 13 00-0029	EA		Exposed Manual Water Closet Flush Valve (Sloan Regal-110 Or 111).....	196.89	25.06
22 42 13 00-0030	EA		Concealed Manual Water Closet Flush Valve, Back Spud (Sloan Royal-140).....	271.23	25.06
22 42 13 00-0031	EA		Concealed Manual Water Closet Flush Valve, Top Spud (Sloan Royal-142).....	300.48	25.06
22 42 13 00-0032	EA		Exposed Infrared Water Closet Flush Valve (Sloan Royal 115-1.6 ES-S).....	540.65	25.06
22 42 13 00-0033	EA		Concealed Infrared Water Closet Flush Valve, Back Spud (Sloan Royal-140 ES-S).....	544.11	25.06
22 42 13 00-0034	EA		Concealed Infrared Water Closet Flush Valve, Top Spud (Sloan Royal-153-1.6-ES-S).....	573.62	25.06
22 42 13 00-0035	EA		Dual Battery Powered Water Closet Flush Valve (Sloan G2 Optima Plus 8113).....	534.00	25.06
22 42 13 00-0036	EA		Exposed Water Closet Flush Valve (Sloan Uppercut WES-115).....	241.39	14.70
Note: "Green", 1.6 Gallons or 1.1 Gallons per flush. Includes instructional placards on proper operation.					



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 42 13 00-0037 EA Exposed Battery Powered Water Closet Flush Valve (Sloan G2 Optima Plus 8110)	458.91	25.06
22 42 13 00-0038 EA Side Mount Battery Powered Water Closet/Urinal Automatic Flush Retrofit Converters (Sloan Optima EBV-89AM)	265.55	25.06
22 42 13 00-0039 EA Side Mount Battery Powered Water Closet/Urinal Automatic Flush Retrofit Converters (Technical Concepts 40118X)	233.92	25.06
22 42 13 00-0040 EA Slide Over Handle Battery Powered Water Closet/Urinal Automatic Flush Retrofit Converters (Sloan Optima Smooth EBV-200A)	233.13	22.05
22 42 13 00-0041 EA Slide Over Handle Battery Powered Water Closet/Urinal Automatic Flush Retrofit Converters (Technical Concepts 40180X)	253.01	22.05
22 42 13 00-0042 EA Exposed Infrared Water Closet Flush Valve 1.28 GPF (Toto EcoPower TET1LN)	548.28	25.06
22 42 13 00-0043 EA Exposed Infrared Water Closet Flush Valve (1-1/2" V.B.) 1.28 GPF (Toto EcoPower TET1LN32)	599.71	25.06
22 42 13 00-0044 EA Concealed Infrared Water Closet Flush Valve, Back Spud 1.28 GPF (Toto EcoPower TET2LN31 Or TET3LN31)	762.68	25.06
22 42 13 00-0045 EA Concealed Infrared Water Closet Flush Valve, Top Spud 1.28 GPF (Toto EcoPower TET2LN32 Or TET3LN32)	762.68	25.06
22 42 13 00-0046 EA Exposed Infrared Water Closet Flush Valve (Zurn ZEMS6000AV-HET-IS)	497.28	25.06
22 42 13 00-0047 EA Exposed Infrared Water Closet Flush Valve (Zurn ZTS6200EV)	492.95	25.06
22 42 13 00-0048 EA Slide Over Handle AC Powered Water Closet/Urinal Automatic Flush Retrofit Converters (Sloan EL-600-A)	244.36	22.05
22 42 13 00-0049 EA 6 Volt DC, 120 Volt AC Hardwired Power Transformer (Sloan EL-451)	76.64	4.03
22 42 13 00-0050 EA Exposed Solar/Battery Powered Water Closet Flush Valve (Sloan Solis 8111-1.28)	501.99	25.06
22 42 13 00-0051 EA Exposed Manual Water Closet Flush Valve (Zurn Z6000AV-HET)	188.80	25.06
22 42 13 00-0052 EA Exposed Battery Powered Water Closet Flush Valve (Zurn ZER6000AV-HET)	509.11	25.06
22 42 13 00-0053 Vitreous China Urinals <small>(22 42 13)</small> Note: Excludes flush valve unless indicated otherwise.		
22 42 13 00-0054 Wall Hung Urinals <small>(22 42 13 00-0053)</small>		
22 42 13 00-0055 EA Washout, Wall Hung, Vitreous China Urinal (American Standard Maybrook™)	444.40	78.65
22 42 13 00-0056 EA Washout, Wall Hung, Vitreous China Urinal (American Standard Decorum™)	465.67	78.65
22 42 13 00-0057 EA Washout, Wall Hung, Vitreous China Urinal With Top Spud (American Standard Washbrook®)	566.72	78.65
22 42 13 00-0058 EA Blowout, Wall Hung, Vitreous China Urinal (American Standard Lynbrook™)	629.87	78.65
22 42 13 00-0059 EA Siphon Jet, Wall Hung, Vitreous China Urinal (American Standard Trimbrook™)	564.72	78.65
22 42 13 00-0060 EA Siphon Jet, Wall Hung, Vitreous China Urinal (American Standard Allbrook™)	461.34	78.65
22 42 13 00-0061 EA Washout, Wall Hung, Vitreous China Urinal (Toto® UT447E Or UT447EV)	582.70	78.65
22 42 13 00-0062 EA Washout, Wall Hung, Vitreous China Urinal (Toto® UT104E Or UT104EV)	483.84	78.65
22 42 13 00-0063 EA Washout, Wall Hung, Vitreous China Urinal (Zurn Z5798)	531.87	78.65
22 42 13 00-0064 EA 0.125 To 0.5 GPF, HEU, Washout, Wall Hung, Vitreous China Urinal (Sloan SU-1009-A)	476.77	78.65
22 42 13 00-0065 EA 1.0 GPF, HEU, Washout, Wall Hung, Vitreous China Urinal (Sloan SU-1006-A)	474.68	78.65
22 42 13 00-0066 Floor Mounted Urinals <small>(22 42 13 00-0053)</small>		
22 42 13 00-0067 EA Washout, Floor Mounted, Vitreous China Urinal (American Standard Stallbrook™)	794.01	99.23
22 42 13 00-0068 Urinal Flush Valves <small>(22 42 13 00-0053)</small>		
22 42 13 00-0069 EA Exposed Manual Urinal Flush Valve, 3/4" Top Spud (Sloan Regal 186 XL)	163.89	25.06
Note: 0.5, 1.0 or 1.5 GPF.		
22 42 13 00-0070 EA Exposed Manual Urinal Flush Valve, 1-1/4" Top Spud (Sloan Regal 180)	150.80	25.06
Note: 1.0, 1.5 or 3.5 GPF.		
22 42 13 00-0071 EA Concealed Manual Urinal Flush Valve, Back Spud (Sloan Royal 195)	211.89	25.06
Note: 1.0 or 1.5 GPF.		
22 42 13 00-0072 EA Concealed Manual Urinal Flush Valve, Top Spud (Sloan Royal 197)	287.14	25.06
Note: 1.0 or 1.5 GPF.		
22 42 13 00-0073 EA Exposed Infrared Urinal Flush Valve (Sloan Royal 186-ES-S)	446.57	25.06
Note: 1.0 or 1.5 GPF.		
22 42 13 00-0074 EA Concealed Infrared Urinal Flush Valve, Back Spud (Sloan Royal 195-WB-ES-S)	598.84	25.06
Note: 0.5, 1.0 or 1.5 GPF.		
22 42 13 00-0075 EA Concealed Infrared Urinal Flush Valve, Top Spud (Sloan Royal 197-WB-ES-S)	641.99	25.06
Note: 0.5, 1.0 or 1.5 GPF.		
22 42 13 00-0076 EA Exposed Battery Powered Urinal Flush Valve, Top Spud (Sloan G2 Opt+8186-1)	422.16	25.06
Note: 1.0 GPF.		
22 42 13 00-0077 EA Exposed Infrared Urinal Flush Valve (Toto EcoPower TEU1LN)	548.28	25.06
Note: 0.5 GPF.		
22 42 13 00-0078 EA Exposed Infrared Urinal Flush Valve (3/4" V.B.) (Toto EcoPower TEU1LN12)	596.39	25.06
Note: 0.5 GPF.		
22 42 13 00-0079 EA Concealed Infrared Urinal Flush Valve, 0.5 GPF (Toto EcoPower TEU2LN21 Or TEU3LN21)	937.15	25.06
Note: 0.5 GPF.		
22 42 13 00-0080 EA Exposed Solar/Battery Powered Urinal Flush Valve, Top Spud (Sloan Solis 8186-0.13)	465.24	25.06
Note: 0.13 GPF.		
22 42 13 00-0081 EA Exposed Manual Urinal Flush Valve, 3/4" Top Spud (Zurn Z6003AV-ULF)	179.92	25.06
Note: 0.125 GPF.		
22 42 13 00-0082 EA Exposed Battery Powered Urinal Flush Valve, Top Spud (Zurn ZTR6203-ULF)	504.51	25.06
Note: 0.125 GPF.		
22 42 13 00-0083 EA Exposed Infrared Urinal Flush Valve (Zurn ZEMS6003AV-ULF-IS)	488.91	25.06
Note: 0.125 GPF.		
22 42 13 00-0084 Waterfree Urinals <small>(22 42 13 00-0053)</small>		
22 42 13 00-0085 EA Waterfree, Wall Hung, Vitreous China Urinal (American Standard Small FloWise® Flush-Free)	457.64	55.13
For >1, Deduct	-31.22	
For Colored Fixtures, Add	66.90	
22 42 13 00-0086 EA Waterfree, Wall Hung, Vitreous China Urinal (American Standard Medium FloWise® Flush-Free)	520.13	55.13
For >1, Deduct	-38.35	
For Colored Fixtures, Add	66.90	

22	Plumbing
22 40	Plumbing Fixtures
22 42	Commercial Plumbing Fixtures



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 42 13 00-0087	EA		Waterfree, Wall Hung, Vitreous China Urinal (American Standard Large FloWise® Flush-Free).....	551.38	55.13
			<i>For >1, Deduct</i>	-41.91	
			<i>For Colored Fixtures, Add</i>	66.90	
22 42 13 00-0088	EA		Waterfree, Wall Hung, Vitreous China Urinal (Falcon F-1000)	620.17	55.13
			<i>For >1, Deduct</i>	-49.75	
			<i>For Colored Fixtures, Add</i>	66.90	
22 42 13 00-0089	EA		Waterfree, Wall Hung, Vitreous China Urinal (Falcon F-2000)	572.21	55.13
			<i>For >1, Deduct</i>	-44.28	
			<i>For Colored Fixtures, Add</i>	66.90	
22 42 13 00-0090	EA		Waterfree, Wall Hung, Vitreous China Urinal (Falcon F-4000)	450.83	55.13
			<i>For >1, Deduct</i>	-30.45	
			<i>For Colored Fixtures, Add</i>	66.90	
22 42 13 00-0091	EA		Waterfree, Wall Hung, Vitreous China Urinal (Falcon F-5000)	450.83	55.13
			<i>For >1, Deduct</i>	-30.45	
			<i>For Colored Fixtures, Add</i>	66.90	
22 42 13 00-0092	EA		Waterfree, Wall Hung, Vitreous China Urinal (Falcon F-7000)	546.17	55.13
			<i>For >1, Deduct</i>	-41.32	
			<i>For Colored Fixtures, Add</i>	66.90	
22 42 13 00-0093	EA		Waterfree, Wall Hung, Stainless Steel Urinal (Falcon F-9000)	801.08	55.13
			<i>For >1, Deduct</i>	-70.38	
22 42 13 00-0094			Removal And Reinstallation Of Fixtures And Trim <small>(22 42 13)</small>		
			Note: Includes storage, cleaning and supply materials for reconnecting pipe to fixture.		
22 42 13 00-0095	EA		Remove And Reinstall Wall Hung Water Closet With Tank	336.23	
22 42 13 00-0096	EA		Remove And Reinstall Wall Hung Water Closet With Flush Valve.....	336.23	
22 42 13 00-0097	EA		Remove And Reinstall Floor Mount Water Closet With Tank.....	258.64	
22 42 13 00-0098	EA		Remove And Reinstall Floor Mount Water Closet With Flush Valve.....	258.64	
22 42 13 00-0099	EA		Remove And Reinstall Wall Hung Urinal With Flush Valve.....	334.84	
22 42 13 00-0100			Stainless Steel Water Closets <small>(22 42 13)</small>		
22 42 13 00-0101	EA		Wall Hung Water Closet, Stainless Steel With Hinged Seat, Siphon Jet (Acorn 2105-T-1-HS).....	2,497.75	165.38
22 42 13 00-0102	EA		Floor Mounted Water Closet, Stainless Steel With Hinged Seat, Siphon Jet (Acorn 2120-T-3-HS)	2,632.05	165.38
22 42 13 00-0103			Stainless Steel Urinals <small>(22 42 13)</small>		
22 42 13 00-0104	EA		Wall Hung Urinal, Stainless Steel, Blowout Jet (Acorn 2160-T-1).....	2,573.29	165.38
22 42 13 00-0105	EA		5' Wall Hung Trough Urinal, Stainless Steel With Strainer And Washdown Pipe (Elkay EU6014C).....	3,336.53	202.13
22 42 13 00-0106			Fixture Carriers <small>(22 42 13)</small>		
22 42 13 00-0107			Water Closet Carriers <small>(22 42 13 00-0106)</small>		
22 42 13 00-0108			Pipe Grip Adaptor Type, Water Closet Carriers <small>(22 42 13 00-0107)</small>		
			Note: Includes coated cast iron construction, plated hardware and adjustable feet. Excludes waste piping and fittings.		
22 42 13 00-0109	EA		Pipe Grip Adaptor Type, Water Closet Carrier.....	362.29	38.81
22 42 13 00-0110			No-Hub, Water Closet Carriers <small>(22 42 13 00-0107)</small>		
			Note: Includes coated cast iron construction, ABS extension with integral test cap, plated hardware and neoprene fixture gasket. Includes buttress feet or pylon feet and anchor foot.		
22 42 13 00-0111	EA		Vertical Close With Offset, No-Hub, Single Water Closet Carrier	553.14	38.81
			<i>For Carrier For Floor Mounted, Back Outlet China Bowls, Deduct</i>	-46.82	
			<i>For Positioning Frame, Add</i>	31.05	
			<i>For Supply Pipe Support, Add</i>	31.75	
			<i>For Vandal Proof Trim, Add</i>	39.85	
			<i>For Auxiliary Inlet, Add</i>	134.68	
			<i>For Special Duty 500 LB Carrier, Add</i>	222.31	
22 42 13 00-0112	EA		Vertical Close On Stack, No-Hub, Single Water Closet Carrier	553.14	38.81
			<i>For Carrier For Floor Mounted, Back Outlet China Bowls, Deduct</i>	-46.82	
			<i>For Positioning Frame, Add</i>	31.05	
			<i>For Supply Pipe Support, Add</i>	31.75	
			<i>For Vandal Proof Trim, Add</i>	39.85	
			<i>For Auxiliary Inlet, Add</i>	134.68	
			<i>For Special Duty 500 LB Carrier, Add</i>	222.31	
22 42 13 00-0113	EA		Horizontal Adjustable, No-Hub, Single Water Closet Carrier	602.78	38.81
			<i>For Carrier For Floor Mounted, Back Outlet China Bowls, Deduct</i>	-46.82	
			<i>For Positioning Frame, Add</i>	31.05	
			<i>For Supply Pipe Support, Add</i>	31.75	
			<i>For Vandal Proof Trim, Add</i>	39.85	
			<i>For Auxiliary Inlet, Add</i>	134.68	
			<i>For Horizontal No Hub Cast Long Barrel, Add</i>	136.90	
			<i>For Carrier For Wide Chase Installations, Add</i>	182.79	
			<i>For Special Duty 1,000 LB Carrier, Add</i>	222.32	



Plumbing	22	22
Plumbing Fixtures	22 40	
Commercial Plumbing Fixtures	22 42	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 42 13 00-0114	EA		Vertical Adjustable On Stack, No-Hub, Single Water Closet Carrier.....	666.40	38.81
			<i>For Carrier For Floor Mounted, Back Outlet China Bowls, Deduct</i>	-46.82	
			<i>For Positioning Frame, Add</i>	31.05	
			<i>For Supply Pipe Support, Add</i>	31.75	
			<i>For Vandal Proof Trim, Add</i>	39.85	
			<i>For 4" Branch, Add</i>	105.44	
			<i>For Auxiliary Inlet, Add</i>	134.68	
			<i>For Carrier For Wide Chase Installations, Add</i>	182.79	
			<i>For Double 4" Branches, Add</i>	211.58	
			<i>For Special Duty 1,000 LB Carrier, Add</i>	222.32	
22 42 13 00-0115	EA		Vertical Close With Offset, No-Hub, Double Water Closet (Back To Back) Carrier	917.97	56.96
			<i>For Carrier For Floor Mounted, Back Outlet China Bowls, Deduct</i>	-93.67	
			<i>For Positioning Frame, Add</i>	67.61	
			<i>For Supply Pipe Support, Add</i>	69.01	
			<i>For Vandal Proof Trim, Add</i>	79.71	
			<i>For Auxiliary Inlet, Add</i>	145.71	
			<i>For Special Duty 500 LB Carrier, Add</i>	444.62	
22 42 13 00-0116	EA		Vertical Close On Stack, No-Hub, Double Water Closet (Back To Back) Carrier	943.14	56.96
			<i>For Carrier For Floor Mounted, Back Outlet China Bowls, Deduct</i>	-93.67	
			<i>For Positioning Frame, Add</i>	67.61	
			<i>For Supply Pipe Support, Add</i>	69.01	
			<i>For Vandal Proof Trim, Add</i>	79.71	
			<i>For Auxiliary Inlet, Add</i>	145.71	
			<i>For Special Duty 500 LB Carrier, Add</i>	444.62	
22 42 13 00-0117	EA		Vertical Adjustable On Stack, No-Hub, Double Water Closet (Back To Back) Carrier.....	1,143.78	56.96
			<i>For Carrier For Floor Mounted, Back Outlet China Bowls, Deduct</i>	-93.67	
			<i>For Positioning Frame, Add</i>	67.61	
			<i>For Supply Pipe Support, Add</i>	69.01	
			<i>For Vandal Proof Trim, Add</i>	79.71	
			<i>For 4" Branch, Add</i>	110.95	
			<i>For Auxiliary Inlet, Add</i>	145.71	
			<i>For Double 4" Branches, Add</i>	222.61	
			<i>For Carrier For Wide Chase Installations, Add</i>	398.67	
			<i>For Special Duty 1,000 LB Carrier, Add</i>	444.63	
22 42 13 00-0118	EA		Horizontal Adjustable, No-Hub, Double Water Closet (Back To Back) Carrier	1,078.06	56.96
			<i>For Carrier For Floor Mounted, Back Outlet China Bowls, Deduct</i>	-93.67	
			<i>For Positioning Frame, Add</i>	67.61	
			<i>For Supply Pipe Support, Add</i>	69.01	
			<i>For Vandal Proof Trim, Add</i>	79.71	
			<i>For Horizontal No Hub Cast Long Barrel, Add</i>	142.41	
			<i>For Carrier For Wide Chase Installations, Add</i>	398.67	
			<i>For Special Duty 1,000 LB Carrier, Add</i>	444.63	
22 42 13 00-0119			Hub And Spigot, Water Closet Carriers (22 42 13 00-0107)		
			Note: Includes coated cast iron construction, ABS extension with integral test cap, plated hardware and neoprene fixture gasket. Includes buttress feet or pylon feet and anchor foot.		
22 42 13 00-0120	EA		Vertical Close With Offset, Hub And Spigot, Single Water Closet Carrier	553.14	38.81
			<i>For Positioning Frame, Add</i>	31.05	
			<i>For Supply Pipe Support, Add</i>	31.75	
			<i>For Vandal Proof Trim, Add</i>	39.85	
			<i>For Hanger Type Closet Adapter, Add</i>	99.97	
			<i>For Auxiliary Inlet, Add</i>	134.68	
22 42 13 00-0121	EA		Vertical Close On Stack, Hub And Spigot, Single Water Closet Carrier	553.14	38.81
			<i>For Positioning Frame, Add</i>	31.05	
			<i>For Supply Pipe Support, Add</i>	31.75	
			<i>For Vandal Proof Trim, Add</i>	39.85	
			<i>For Auxiliary Inlet, Add</i>	134.68	
			<i>For Special Duty 500 LB Carrier, Add</i>	222.31	
22 42 13 00-0122	EA		Vertical Adjustable On Stack, Hub And Spigot, Single Water Closet Carrier.....	690.16	38.81
			<i>For Carrier For Floor Mounted, Back Outlet China Bowls, Deduct</i>	-46.82	
			<i>For Positioning Frame, Add</i>	31.05	
			<i>For Supply Pipe Support, Add</i>	31.75	
			<i>For Vandal Proof Trim, Add</i>	39.85	
			<i>For 4" Branch, Add</i>	105.44	
			<i>For Auxiliary Inlet, Add</i>	134.68	
			<i>For Carrier For Wide Chase Installations, Add</i>	182.79	
			<i>For Double 4" Branches, Add</i>	211.58	
			<i>For Special Duty 1,000 LB Carrier, Add</i>	222.32	
22 42 13 00-0123	EA		Vertical Close With Offset, Hub And Spigot, Double Water Closet (Back To Back) Carrier.....	917.97	56.96
			<i>For Positioning Frame, Add</i>	67.61	
			<i>For Supply Pipe Support, Add</i>	69.01	
			<i>For Vandal Proof Trim, Add</i>	79.71	
			<i>For Auxiliary Inlet, Add</i>	145.71	
			<i>For Hanger Type Closet Adapter, Add</i>	199.94	
22 42 13 00-0124	EA		Vertical Adjustable On Stack, Hub And Spigot, Double Water Closet (Back To Back) Carrier	1,167.55	56.96
			<i>For Carrier For Floor Mounted, Back Outlet China Bowls, Deduct</i>	-93.67	
			<i>For Positioning Frame, Add</i>	67.61	
			<i>For Supply Pipe Support, Add</i>	69.01	
			<i>For Vandal Proof Trim, Add</i>	79.71	
			<i>For 4" Branch, Add</i>	110.95	
			<i>For Auxiliary Inlet, Add</i>	145.71	
			<i>For Double 4" Branches, Add</i>	222.61	
			<i>For Carrier For Wide Chase Installations, Add</i>	398.67	
			<i>For Special Duty 1,000 LB Carrier, Add</i>	444.63	

22 Plumbing**22 40 Plumbing Fixtures****22 42 Commercial Plumbing Fixtures**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 42 13 00-0125			Floor Mount Polyvinyl Chloride (PVC) Adaptor Type, Water Closet Carriers <small>(22 42 13 00-0107)</small> Note: Includes coated cast iron construction, plastic fitting adaptor with extension and plated hardware.		
22 42 13 00-0126	EA		Vertical On Stack, Floor Mount Polyvinyl Chloride (PVC) Adaptor Type, Single Water Closet Carrier	430.80	38.81
			<i>For Positioning Frame, Add</i>	31.05	
			<i>For Supply Pipe Support, Add</i>	31.75	
			<i>For Vandal Proof Trim, Add</i>	39.85	
			<i>For Hanger Type Closet Adapter, Add</i>	99.97	
22 42 13 00-0127			Institutional Water Closet Carriers <small>(22 42 13 00-0107)</small> Note: Includes coated cast iron construction, ABS extension with integral test cap, buttress feet, plated hardware and neoprene fixture gasket.		
22 42 13 00-0128	EA		Vertical On Stack, No-Hub, 90 Degree Institutional, Double Waste Fitting With Vent And Carrier, Water Closet Carrier	1,491.94	56.96
			<i>For Carrier For Floor Mounted, Back Outlet China Bowls, Deduct</i>	-93.67	
			<i>For Positioning Frame, Add</i>	67.61	
			<i>For Supply Pipe Support, Add</i>	69.01	
			<i>For Vandal Proof Trim, Add</i>	79.71	
			<i>For Auxiliary Inlet, Add</i>	145.71	
22 42 13 00-0129			Urinal Carriers <small>(22 42 13 00-0106)</small>		
22 42 13 00-0130			Floor Mounted, Urinal Carriers <small>(22 42 13 00-0129)</small> Note: Includes adjustable supporting rods, structural uprights and welded feet.		
22 42 13 00-0131	EA		Floor Mounted Hanger Plate Type, Single Urinal Carrier	313.87	27.94
			<i>For Up To 4" Extension Sleeves And Hardware, Add</i>	14.68	
22 42 13 00-0132	EA		Floor Mounted Bearing Plate Type, Single Urinal Carrier	340.43	27.94
			<i>For Up To 4" Extension Sleeves And Hardware, Add</i>	14.68	
22 42 13 00-0133			Wall Mounted, Urinal Carriers <small>(22 42 13 00-0129)</small> Note: Includes wall plate and adjustable supporting rods.		
22 42 13 00-0134	EA		Wall Mounted Hanger Plate Type, Single Urinal Carrier	148.18	27.94
			<i>For Up To 6-1/2" Extension Sleeves And Hardware, Add</i>	14.68	
22 42 16 Commercial Lavatories And Sinks			<small>(22 42)</small>		
22 42 16 00-0001			Lavatories <small>(22 42 16)</small> Note: Includes trap, drain and supply valves. Excludes faucets.		
22 42 16 00-0002			Wall Hung Lavatories <small>(22 42 16 00-0001)</small>		
22 42 16 00-0003	EA		19" x 17" Porcelain Enameled Cast Iron Wall Hung Lavatory (American Standard Regalyn™)	441.80	49.24
22 42 16 00-0004	EA		20" x 18" Porcelain Enameled Cast Iron Wall Hung Lavatory (American Standard Regalyn™)	464.41	49.24
22 42 16 00-0005	EA		22" x 19" Porcelain Enameled Cast Iron Wall Hung Lavatory (Kohler® Hampton™)	607.12	49.24
22 42 16 00-0006	EA		18" x 16" Vitreous China Wall Hung Lavatory (American Standard Penlyn™)	400.59	49.24
22 42 16 00-0007	EA		19" x 17" Vitreous China Wall Hung Lavatory (American Standard Declyn™)	337.43	49.24
22 42 16 00-0008	EA		20" x 18" Vitreous China Wall Hung Lavatory (American Standard Roxalyn™)	411.22	49.24
22 42 16 00-0009	EA		20" x 18" Vitreous China Wall Hung Lavatory (Kohler® Soho®)	441.43	49.24
22 42 16 00-0010	EA		27" x 20" Wheelchair Accessible, Vitreous China Wall Hung Lavatory (American Standard Wheel Chair Users)	530.22	49.24
22 42 16 00-0011			Countertop Lavatories <small>(22 42 16 00-0001)</small>		
22 42 16 00-0012	EA		21" x 18" Vitreous China Countertop Lavatory (American Standard Cadet™ Oval)	393.16	59.54
22 42 16 00-0013	EA		19" Diameter Enameled Steel Countertop Lavatory (American Standard Colony Round™)	361.91	59.54
22 42 16 00-0014	EA		19" x 16" Enameled Cast Iron Countertop Lavatory (Kohler® Farmington™)	415.68	59.54
22 42 16 00-0015	EA		19" x 16" Enameled Cast Iron Countertop Lavatory (Kohler® Ellington™)	439.69	59.54
22 42 16 00-0016	EA		24" x 18" Enameled Cast Iron Countertop Lavatory (Kohler® Thoreau®)	572.27	64.31
22 42 16 00-0017			Undercounter Lavatories <small>(22 42 16 00-0001)</small>		
22 42 16 00-0018	EA		15" x 12" Vitreous China Undercounter Lavatory (American Standard Ovalyn™)	396.65	59.54
22 42 16 00-0019	EA		17" x 14" Vitreous China Undercounter Lavatory (American Standard Ovalyn™)	366.74	59.54
22 42 16 00-0020	EA		19" x 16" Vitreous China Undercounter Lavatory (American Standard Ovalyn™)	366.74	59.54
22 42 16 00-0021	EA		21" x 17" Vitreous China Undercounter Lavatory (American Standard Ovalyn™)	402.94	59.54
22 42 16 00-0022	EA		15" x 12" Oval Vitreous China Undercounter Lavatory (Kohler® Caxton®)	379.61	59.54
22 42 16 00-0023	EA		17" x 14" Oval Vitreous China Undercounter Lavatory (Kohler® Caxton®)	374.10	59.54
22 42 16 00-0024	EA		19" x 15" Oval Vitreous China Undercounter Lavatory (Kohler® Caxton®)	379.71	59.54
22 42 16 00-0025	EA		21" x 17" Oval Vitreous China Undercounter Lavatory (Crane Tiara™)	362.81	59.54
22 42 16 00-0026	EA		18" x 12" Rectangular Vitreous China Undercounter Lavatory (Kohler® Ladena®)	503.57	59.54
22 42 16 00-0027	EA		21" x 14" Rectangular Vitreous China Undercounter Lavatory (Kohler® Ladena®)	503.57	59.54
22 42 16 00-0028			Pedestal Lavatories <small>(22 42 16 00-0001)</small>		
22 42 16 00-0029	EA		19" x 21" x 34" High Vitreous China Pedestal Sink (American Standard Colony™)	420.40	141.49
22 42 16 00-0030			Pre-Molded Culture Marble Lavatory Vanity <small>(22 42 16 00-0001)</small> Note: Includes splash. Single sink, center or offset. Bowl is either oval, shell shape or rectangular.		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 42 16 00-0031 EA 17" x 20" Pre-Molded Culture Marble Vanity Top With Lavatory.....	191.60	45.94
For Colored Fixtures, Add	28.92	
22 42 16 00-0032 EA 18" x 24" Pre-Molded Culture Marble Vanity Top With Lavatory.....	232.87	55.13
For Colored Fixtures, Add	35.57	
22 42 16 00-0033 EA 18" x 30" Pre-Molded Culture Marble Vanity Top With Lavatory.....	255.12	58.80
For Colored Fixtures, Add	39.89	
22 42 16 00-0034 EA 18" x 36" Pre-Molded Culture Marble Vanity Top With Lavatory.....	273.94	62.48
For Colored Fixtures, Add	43.21	
22 42 16 00-0035 EA 19" x 25" Pre-Molded Culture Marble Vanity Top With Lavatory.....	238.61	55.13
For Colored Fixtures, Add	37.23	
22 42 16 00-0036 EA 19" x 31" Pre-Molded Culture Marble Vanity Top With Lavatory.....	258.54	58.80
For Colored Fixtures, Add	40.88	
22 42 16 00-0037 EA 19" x 37" Pre-Molded Culture Marble Vanity Top With Lavatory.....	276.22	62.48
For Colored Fixtures, Add	43.88	
22 42 16 00-0038 EA 19" x 43" Pre-Molded Culture Marble Vanity Top With Lavatory.....	308.54	64.31
For Colored Fixtures, Add	52.19	
22 42 16 00-0039 EA 19" x 49" Pre-Molded Culture Marble Vanity Top With Lavatory.....	335.17	66.15
For Colored Fixtures, Add	58.84	
22 42 16 00-0040 EA 22" x 25" Pre-Molded Culture Marble Vanity Top With Lavatory.....	261.53	55.13
For Colored Fixtures, Add	43.88	
22 42 16 00-0041 EA 22" x 31" Pre-Molded Culture Marble Vanity Top With Lavatory.....	297.51	58.80
For Colored Fixtures, Add	52.19	
22 42 16 00-0042 EA 22" x 37" Pre-Molded Culture Marble Vanity Top With Lavatory.....	316.34	62.48
For Colored Fixtures, Add	55.51	
22 42 16 00-0043 EA 22" x 43" Pre-Molded Culture Marble Vanity Top With Lavatory.....	338.34	64.31
For Colored Fixtures, Add	60.83	
22 42 16 00-0044 EA 22" x 49" Pre-Molded Culture Marble Vanity Top With Lavatory.....	358.09	66.15
For Colored Fixtures, Add	65.48	
22 42 16 00-0045 EA 22" x 55" Pre-Molded Culture Marble Vanity Top With Lavatory.....	383.77	69.82
For Colored Fixtures, Add	70.80	
22 42 16 00-0046 Solid Surface Multi-Station Lavatory Systems (22 42 16 00-0001)		
Note: ADA compliant. Includes integral faucets.		
22 42 16 00-0047 EA 2 Station, Solid Surface Multi-Station Lavatory System With Integral Sprayheads And Infrared Controls (Bradley MG-2).....	3,491.46	109.01
For Integral Liquid Soap Dispenser, Add	171.00	
For Integral Photovoltaic Power Panels, Add	563.00	
22 42 16 00-0048 EA 3 Station, Solid Surface Multi-Station Lavatory System With Integral Sprayheads And Infrared Controls (Bradley MG-3).....	5,098.60	109.01
For Integral Liquid Soap Dispenser, Add	171.00	
For Integral Photovoltaic Power Panels, Add	657.00	
22 42 16 00-0049 EA 12" Length, Solid Surface Countertop Extension (Bradley MG-EXT-12).....	247.60	36.34
22 42 16 00-0050 EA 18" Length, Solid Surface Countertop Extension (Bradley MG-EXT-18).....	302.91	36.34
22 42 16 00-0051 EA 36" Length, Solid Surface Countertop Extension (Bradley MG-EXT-36).....	584.59	36.34
22 42 16 00-0052 Stainless Steel Lavatories (22 42 16 00-0001)		
22 42 16 00-0053 EA 18" x 15" Wall Mounted Lavatory, Stainless Steel (Acorn 1950-1).....	1,310.03	128.63
22 42 16 00-0054 Sinks (22 42 16)		
Note: Includes drain, trap and supply valves. Excludes faucets.		
22 42 16 00-0055 Kitchen Sinks (22 42 16 00-0054)		
22 42 16 00-0056 EA 25" x 22" x 8-3/4" Enameled Cast Iron Kitchen Sink, Single Bowl (Kohler® Mayfield®).....	553.85	69.09
22 42 16 00-0057 EA 22" x 33" x 9-5/8" Enameled Cast Iron Kitchen Sink, Double Bowl (Kohler® Brookfield®).....	749.73	78.65
22 42 16 00-0058 EA 15" x 17" x 7-1/4" Stainless Steel Kitchen Sink, Single Bowl, 20 Gauge (Elkay PSR1517).....	679.21	67.62
For 18 Gauge, Add	201.79	
22 42 16 00-0059 EA 17" x 22" x 7-1/4" Stainless Steel Kitchen Sink, Single Bowl, 20 Gauge (Elkay PSR1722).....	697.95	67.62
For 18 Gauge, Add	211.16	
22 42 16 00-0060 EA 22" x 22" x 7-1/4" Stainless Steel Kitchen Sink, Single Bowl, 20 Gauge (Elkay PSR2222).....	740.13	67.62
For 18 Gauge, Add	232.25	
22 42 16 00-0061 EA 25" x 22" x 7-1/2" Stainless Steel Kitchen Sink, Single Bowl, 20 Gauge (Elkay PSR2522).....	777.07	69.09
For 18 Gauge, Add	246.31	
22 42 16 00-0062 EA 31" x 22" x 7-1/4" Stainless Steel Kitchen Sink, Single Bowl, 20 Gauge (Elkay PSR3122).....	989.47	78.65
For 18 Gauge, Add	338.48	
22 42 16 00-0063 EA 33" x 21" x 7-1/2" Stainless Steel Kitchen Sink, Double Bowl, 20 Gauge (Elkay PSR3321).....	1,012.04	78.65
For 18 Gauge, Add	349.64	
22 42 16 00-0064 EA 15" x 17" x 10" Stainless Steel Kitchen Sink, Single Bowl, 18 Gauge (Elkay DLR151710).....	983.05	67.62
22 42 16 00-0065 EA 17" x 22" x 10" Stainless Steel Kitchen Sink, Single Bowl, 18 Gauge (Elkay DLR172210).....	1,004.14	67.62
22 42 16 00-0066 EA 22" x 22" x 10" Stainless Steel Kitchen Sink, Single Bowl, 18 Gauge (Elkay DLR222210).....	1,057.26	67.62
22 42 16 00-0067 EA 25" x 22" x 10" Stainless Steel Kitchen Sink, Single Bowl, 18 Gauge (Elkay DLR252210).....	1,127.78	69.09
22 42 16 00-0068 EA 31" x 22" x 11-1/2" Stainless Steel Kitchen Sink, Single Bowl, 18 Gauge (Elkay DLR312210).....	1,371.43	78.65
22 42 16 00-0069 Undermount Kitchen Sinks (22 42 16 00-0054)		
22 42 16 00-0070 EA 21" x 15" x 7-1/2" Stainless Steel Kitchen Sink, Single Bowl, 18 Gauge (Elkay ELU2115) With Strainer (Elkay LK99).....	870.51	67.62
22 42 16 00-0071 EA 21" x 15" x 10" Stainless Steel Kitchen Sink, Single Bowl, 18 Gauge (Elkay ELU211510) With Strainer (Elkay LK99).....	868.23	67.62
22 42 16 00-0072 EA 21" x 15" x 7-1/2" Stainless Steel Kitchen Sink With Cutting Board, Single Bowl, 18 Gauge (Elkay ELUH2115) With Strainer (Elkay LK99).....	878.32	67.62

22	Plumbing
22 40	Plumbing Fixtures
22 42	Commercial Plumbing Fixtures



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 42 16 00-0073 EA 21" x 15" x 10" Stainless Steel Kitchen Sink With Cutting Board, Single Bowl, 18 Gauge (Elkay ELUH211510) With Strainer (Elkay LK99)	931.44	67.62
22 42 16 00-0074 Multi-Station Wash Sink, Wall Mounted <small>(22 42 16 00-0054)</small>		
Note: Includes concealed wall hanger, soap dish(s), strainer, supply lines and P-Trap. Excludes faucets.		
22 42 16 00-0075 EA 36" Wide, 2 Station Enameled Cast Iron Multi-Station Wash Sink (Kohler® Brockway™)	1,659.16	119.44
Note: Excludes faucets.		
22 42 16 00-0076 EA 48" Wide, 2 Station Enameled Cast Iron Multi-Station Wash Sink (Kohler® Brockway™)	2,251.61	128.63
Note: Excludes faucets.		
22 42 16 00-0077 EA 60" Wide, 3 Station Enameled Cast Iron Multi-Station Wash Sink (Kohler® Brockway™)	2,599.83	137.81
Note: Excludes faucets.		
22 42 16 00-0078 EA 72" Wide, 3 Station Enameled Cast Iron Multi-Station Wash Sink (Kohler® Brockway™)	2,845.31	147.00
Note: Excludes faucets.		
22 42 16 00-0079 EA 48" Wide, 2 Station Stainless Steel Multi-Station Wash Sink (Bradley 6951)	1,840.65	91.88
Note: Excludes faucets.		
22 42 16 00-0080 EA 62" Wide, 3 Station Stainless Steel Multi-Station Wash Sink (Bradley 6951)	2,044.59	101.06
Note: Excludes faucets.		
22 42 16 00-0081 EA 80" Wide, 4 Station Stainless Steel Multi-Station Wash Sink (Bradley 6951)	2,244.32	110.25
Note: Excludes faucets.		
22 42 16 00-0082 EA 102" Wide, 5 Station Stainless Steel Multi-Station Wash Sink (Bradley 6951)	2,489.71	124.03
Note: Excludes faucets.		
22 42 16 00-0083 EA 27" Diameter, 2 Person, Stainless Steel, Sensor Operated Compact Wash Fountain.....	2,415.27	202.13
Note: Includes sensor operated spray heads.		
22 42 16 00-0084 Laundry Sinks <small>(22 42 16 00-0054)</small>		
22 42 16 00-0085 EA 23" x 21" Molded Stone Single Laundry Sink, Floor Mounted With Enamel Steel Legs (Fiat Products FL-1).....	492.64	78.65
22 42 16 00-0086 EA 40" x 24" Molded Stone Double Laundry Sink, Floor Mounted With Enamel Steel Legs (Fiat Products FLTD-II).....	587.70	78.65
22 42 16 00-0087 EA 22" x 17" Molded Stone Single Laundry Sink, Drop-In (Fiat Products DL1).....	490.92	78.65
22 42 16 00-0088 EA 24" x 21" Enameled Cast Iron Single Laundry Sink, Floor Mounted With Metal Stand (Eljer 222-2210)	826.90	78.65
22 42 16 00-0089 EA 48" x 21" Enameled Cast Iron Double Laundry Sink, Floor Mounted With Metal Stand (Eljer 222-2220)	1,225.73	88.20
22 42 16 00-0090 Refinish Sink/Lavatory <small>(22 42 16 00-0054)</small>		
22 42 16 00-0091 EA Refinish Sink/Lavatory	176.43	
22 42 16 00-0092 Service Sinks <small>(22 42 16 00-0054)</small>		
22 42 16 00-0093 EA 22" x 18" Enameled Cast Iron Wall Mount Service Sink With Stainless Steel Rim Guard, Trap Standard (American Standard Lakewell™)	817.26	118.34
22 42 16 00-0094 EA 24" x 20" Enameled Cast Iron Wall Mount Service Sink With Stainless Steel Rim Guard, Trap Standard (American Standard Akron™)	869.12	118.34
22 42 16 00-0095 EA 28" x 28" Enameled Cast Iron Floor Type Corner Service Sink With Removable Vinyl Coated Rim Guard (American Standard Florwell™)	1,133.82	156.56
22 42 16 00-0096 EA 12" x 12" x 10" Cast Iron Floor Sink With Dome Strainer And Full Grate (Zurn FD2377-PO3-F).....	446.19	110.25
22 42 16 00-0097 EA 24" x 24" x 10" Plastic Composite Mop Service Sink With Combination Dome Strainer And Stainless Steel Lint Basket (Fiat Products MSB2424).....	528.96	110.25
22 42 16 00-0098 EA 36" x 24" x 10" Plastic Composite Mop Service Sink With Combination Dome Strainer And Stainless Steel Lint Basket (Fiat Products MSB3624).....	577.73	132.30
22 42 16 00-0099 EA 24" x 24" x 10" Molded Stone Mop Service Sink With Strainer (Swanstone MS-2424-010)	481.53	110.25
22 42 16 00-0100 EA 36" x 24" x 10" Molded Stone Mop Service Sink With Strainer (Swanstone MS-2436-010)	543.70	132.30
22 42 16 00-0101 EA 24" x 24" x 12" Terrazzo Mop Service Sink With Strainer (Acorn TSH-24)	549.89	110.25
22 42 16 00-0102 EA 36" x 24" x 12" Terrazzo Mop Service Sink With Strainer (Acorn TSH-3624)	676.96	132.30
22 42 16 00-0103 Stainless Steel Sink And Drainboard <small>(22 42 16 00-0054)</small>		
22 42 16 00-0104 EA 24" x 24" Stainless Steel Sink With One Compartment And Drainboard , 14 Gauge Stainless Steel With Tubular Adjustable Legs (Advance Tabco 94-41-24-24L).....	2,599.06	183.75
22 42 16 00-0105 Fixture Carriers <small>(22 42 16)</small>		
22 42 16 00-0106 Lavatory Carriers <small>(22 42 16 00-0105)</small>		
22 42 16 00-0107 Floor Mounted, Lavatory Carriers <small>(22 42 16 00-0106)</small>		
22 42 16 00-0108 Floor Mounted Plate Type, Lavatory Carriers <small>(22 42 16 00-0107)</small>		
Note: Includes adjustable supporting rods, structural uprights and welded feet.		
22 42 16 00-0109 EA Floor Mounted Hanger Plate Type, Single Lavatory Carrier	313.87	27.94
For Up To 4" Extension Sleeves And Hardware, Add	14.68	
For Valve Plate For Attaching To Upright, Add	53.27	
For Corner Carrier, Add	103.74	
22 42 16 00-0110 EA Floor Mounted Bearing Plate Type, Single Lavatory Carrier.....	340.43	27.94
For Up To 4" Extension Sleeves And Hardware, Add	14.68	
For Valve Plate For Attaching To Upright, Add	53.27	
22 42 16 00-0111 EA Floor Mounted Hanger Plate Type, Double Lavatory (Back To Back) Carrier.....	387.27	27.94
For Up To 4" Extension Sleeves And Hardware, Add	29.36	
For Valve Plate For Attaching To Upright, Add	106.53	
22 42 16 00-0112 EA Floor Mounted Bearing Plate Type, Double Lavatory (Back To Back) Carrier	441.10	27.94
For Up To 4" Extension Sleeves And Hardware, Add	29.36	
For Valve Plate For Attaching To Upright, Add	106.53	



Plumbing	22	22
Plumbing Fixtures	22 40	
Commercial Plumbing Fixtures	22 42	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 42 16 00-0113 Floor Mounted, Lavatory Carriers With Arms <small>(22 42 16 00-0107)</small>		
<i>Note: Includes leveling and securing screws, structural uprights and welded feet.</i>		
22 42 16 00-0114 EA Floor Mounted, Single Lavatory Carrier With Concealed Arms.....	401.97	33.07
<i>For Up To 6-1/2" Extension Sleeves And Hardware, Add</i>		
<i>For Concealed Arm Carrier For Wheelchair Lavatory, Add</i>		
<i>For Valve Plate For Attaching To Upright, Add</i>		
<i>For 2" Chrome Plated Escutcheons, Add</i>		
<i>For 4" Or 6" Chrome Plated Escutcheons, Add</i>		
22 42 16 00-0115 EA Floor Mounted, Single Lavatory Carrier With Exposed Acid Resistant White Coated Arms	530.61	33.07
<i>For Up To 4-1/2" Extension Sleeves And Hardware, Add</i>		
<i>For Vandal Proof Trim, Add</i>		
<i>For Valve Plate For Attaching To Upright, Add</i>		
<i>For Heavy Duty Carrier, Add</i>		
22 42 16 00-0116 EA Floor Mounted, Double Lavatory (Back To Back) Carrier With Concealed Arms	529.90	33.07
<i>For Up To 6-1/2" Extension Sleeves And Hardware, Add</i>		
<i>For Concealed Arm Carrier For Wheelchair Lavatory, Add</i>		
<i>For Valve Plate For Attaching To Upright, Add</i>		
<i>For 2" Chrome Plated Escutcheons, Add</i>		
<i>For 4" Or 6" Chrome Plated Escutcheons, Add</i>		
22 42 16 00-0117 EA Floor Mounted, Double Lavatory (Back To Back) Carrier With Exposed Acid Resistant White Coated Arms.....	775.99	33.07
<i>For Up To 4-1/2" Extension Sleeves And Hardware, Add</i>		
<i>For Vandal Proof Trim, Add</i>		
<i>For Valve Plate For Attaching To Upright, Add</i>		
<i>For Heavy Duty Carrier, Add</i>		
22 42 16 00-0118 Wall Mounted, Lavatory Carriers <small>(22 42 16 00-0106)</small>		
22 42 16 00-0119 Wall Mounted Plate Type, Lavatory Carriers <small>(22 42 16 00-0118)</small>		
<i>Note: Includes wall plate and adjustable supporting rods.</i>		
22 42 16 00-0120 EA Wall Mounted Hanger Plate Type, Single Lavatory Carrier	148.18	27.94
<i>For Double Plate Carrier, Add</i>		
22 42 16 00-0121 Wall Mounted Plate Type, Lavatory Carriers With Arms <small>(22 42 16 00-0118)</small>		
<i>Note: Includes wall plate and leveling and securing screws.</i>		
22 42 16 00-0122 EA Wall Mounted Fixed Steel Plate Type, Single Lavatory Carrier With Concealed Arms.....	239.08	33.07
<i>For Up To 4" Extension Sleeves And Hardware, Add</i>		
<i>For 2" Chrome Plated Escutcheons, Add</i>		
22 42 16 00-0123 EA Wall Mounted Adjustable Plate Type, Single Lavatory Carrier With Concealed Arms	278.23	33.07
<i>For Movable Mounting Brackets, Deduct</i>		
<i>For Up To 4" Extension Sleeves And Hardware, Add</i>		
<i>For 2" Chrome Plated Escutcheons, Add</i>		
<i>For 4" Or 6" Chrome Plated Escutcheons, Add</i>		
22 42 16 00-0124 EA Wall Mounted Adjustable Plate Type, Single Lavatory Carrier With Exposed Acid Resistant White Coated Arms.....	399.18	33.07
<i>For Up To 4-1/2" Extension Sleeves And Hardware, Add</i>		
<i>For Vandal Proof Trim, Add</i>		
22 42 16 00-0125 Sink Carriers <small>(22 42 16 00-0105)</small>		
22 42 16 00-0126 Floor Mounted, Sink Carriers <small>(22 42 16 00-0125)</small>		
<i>Note: With support plates, adjustable coupling with 4" piping connection, mounting studs, structural uprights, welded feet and chrome plated trim.</i>		
22 42 16 00-0127 EA Floor Mounted Heavy Duty Support Plate Type, Single Sink Carrier With 4" Adjustable Coupling.....	450.19	27.94
<i>For Vandal Proof Trim, Add</i>		
<i>For Valve Plate For Attaching To Upright, Add</i>		
22 42 16 00-0128 EA Floor Mounted Heavy Duty Support Plate Type, Single Sink Carrier With 4" Adjustable Coupling And 4" x 2" Waste Fitting.....	689.98	27.94
<i>For Vandal Proof Trim, Add</i>		
<i>For Auxiliary Vent, Add</i>		
22 42 16 00-0129 EA Floor Mounted Heavy Duty Support Plate Type, Single Sink Carrier With Exposed Acid Resistant White Coated Arms	860.57	27.94
<i>For Up To 4" Extension Sleeves And Hardware, Add</i>		
<i>For Vandal Proof Trim, Add</i>		
22 42 16 00-0130 Removal And Reinstallation Of Fixtures And Trim <small>(22 42 16)</small>		
<i>Note: Includes storage, cleaning and supply materials for reconnecting pipe to fixture.</i>		
22 42 16 00-0131 EA Remove And Reinstall Wall Hung Lavatory With Faucet.....	216.18	
22 42 16 00-0132 EA Remove And Reinstall Wall Hung Service Sink With Faucet.....	296.38	
22 42 19 Commercial Bathtubs <small>(22 42)</small>		
22 42 19 00-0001 Recessed Alcove Bathtubs <small>(22 42 19)</small>		
22 42 19 00-0002 Porcelain Enameled Cast Iron, Recessed Alcove Bathtubs <small>(22 42 19 00-0001)</small>		
22 42 19 00-0003 EA 54" x 30-1/4" x 14", Porcelain Enameled Cast Iron, Recessed Alcove Bathtub (Kohler® Seaforth™)	1,330.22	204.33
22 42 19 00-0004 EA 60" x 30" x 14", Porcelain Enameled Cast Iron, Recessed Alcove Bathtub (Kohler® Villager®).....	674.97	204.33
22 42 19 00-0005 EA 60" x 32" x 16-1/4", Porcelain Enameled Cast Iron, Recessed Alcove Bathtub (Kohler® Mendota®).....	1,126.03	204.33
22 42 19 00-0006 EA 60" x 32" x 16-1/4", Porcelain Enameled Cast Iron, Recessed Alcove Bathtub (Kohler® Dynamic®).....	1,335.35	204.33
22 42 19 00-0007 EA 66" x 32" x 16-1/4", Porcelain Enameled Cast Iron, Recessed Alcove Bathtub (Kohler® Dynamic®).....	1,746.01	204.33
22 42 19 00-0008 EA 66-1/4" x 32" x 16", Porcelain Enameled Cast Iron, Recessed Alcove Bathtub (American Standard Spectra™).....	1,482.13	204.33

22 Plumbing**22 40 Plumbing Fixtures****22 42 Commercial Plumbing Fixtures**

MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
22 42 19 00-0009		Porcelain Enameled Steel, Recessed Alcove Bathtubs (22 42 19 00-0001)			
22 42 19 00-0010	EA	46-1/2" x 27" x 15-1/2", Porcelain Enameled Steel, Recessed Alcove Bathtub (American Standard Huron™).....	662.45		204.33
22 42 19 00-0011	EA	54" x 30" x 15", Porcelain Enameled Steel, Recessed Alcove Bathtub (American Standard Mackenzie™).....	650.48		204.33
22 42 19 00-0012	EA	60" x 30" x 14-1/4", Porcelain Enameled Steel, Recessed Alcove Bathtub (American Standard New Salem®).....	536.14		204.33
22 42 19 00-0013	EA	60" x 30" x 16-5/8", Porcelain Enameled Steel, Recessed Alcove Bathtub (American Standard New Solar®).....	550.76		204.33
22 42 19 00-0014		Porcelain Finished Metal Alloy, Recessed Alcove Bathtubs (22 42 19 00-0001)			
22 42 19 00-0015	EA	60" x 32" x 17-3/4", Porcelain Finished Metal Alloy, Recessed Alcove Bathtub (American Standard Cambridge™).....	838.61		204.33
22 42 19 00-0016		Acrylic, Recessed Alcove Bathtubs (22 42 19 00-0001)			
22 42 19 00-0017	EA	60" x 32" x 19", Acrylic, Recessed Alcove Bathtub (Kohler® Archer®).....	866.27		204.33
22 42 19 00-0018	EA	60" x 36" x 20", Acrylic, Recessed Alcove Bathtub (Kohler® Mariposa®).....	1,043.05		204.33
22 42 19 00-0019	EA	66" x 36" x 20", Acrylic, Recessed Alcove Bathtub (Kohler® Mariposa®).....	1,065.88		204.33
22 42 19 00-0020	EA	72" x 36" x 20", Acrylic, Recessed Alcove Bathtub (Kohler® Mariposa®).....	1,051.85		204.33
22 42 19 00-0021	EA	72" x 42" x 21", Acrylic, Recessed Alcove Bathtub (Kohler® Windward®).....	1,102.33		204.33
22 42 19 00-0022		Bathtub Refinishing (22 42 19 00-0001)			
22 42 19 00-0023	EA	Refinish Porcelain Finished Bathtub With Acrylic Urethane Enamel.....	396.21		
22 42 19 00-0024		Tub And Shower Combinations (22 42 19)			
22 42 19 00-0025		Acrylic Tub And Shower Combination (22 42 19 00-0024)			
22 42 19 00-0026	EA	3 Piece, 62" x 30-1/2" x 88" Domed Acrylic Tub And Shower (Crane Plumbing A 6031.21).....	1,275.43		78.48
		<i>For 2 Piece Enclosure, Deduct</i>	-270.83		
22 42 19 00-0027	EA	1 Piece, 59-7/8" x 34-1/2" x 79-5/8" Acrylic Tub And Shower (Aqua Glass 626036E).....	995.76		78.48
		<i>For 2 Piece Enclosure, Deduct</i>	-214.90		
22 42 19 00-0028		Fiberglass Tub And Shower Combination (22 42 19 00-0024)			
22 42 19 00-0029	EA	1 Piece 60" x 32" x 72" Fiberglass Tub And Shower (Aquatic 2603-SG).....	717.19		78.48
22 42 19 00-0030	EA	2 Piece 60" x 30" x 72" Fiberglass Tub And Shower (Aquatic 2603-2P).....	580.05		52.32
22 42 19 00-0031	EA	4 Piece 60" x 32" x 75-1/2" Fiberglass Tub And Shower (Aquatic 26030-4P).....	1,143.87		118.46
22 42 19 00-0032	EA	3 Piece Tub/Shower Surrounds, 32" x 72" Side Walls, 48" x 72" Back, (Swanstone SK-324872).....	1,813.72		228.12
		<i>For 2 Piece Enclosure, Deduct</i>	-380.03		
22 42 23		Commercial Showers (22 42)			
22 42 23 00-0001		Shower Enclosures (22 42 23)			
		Note: Includes precast concrete receptors. Excludes plumbing hook-up and door or curtain.			
22 42 23 00-0002		Stainless Steel Shower Enclosure (22 42 23 00-0001)			
22 42 23 00-0003	EA	36" x 36" x 82" Stainless Steel Interior And Exterior Shower Enclosure, Single Access Front Opening (Crane Plumbing, Fiat S86 Commander).....	2,803.04		118.56
22 42 23 00-0004	EA	36" x 38" x 82" Stainless Steel Interior And Exterior Shower Enclosure, Double Access Walk Through (Crane Plumbing, Fiat S91 Commander).....	2,803.04		118.56
22 42 23 00-0005	EA	37" x 37" x 82" Stainless Steel Interior And Exterior Shower Enclosure, Double Access Corner Opening (Crane Plumbing, Fiat S92 Commander).....	2,803.04		118.55
22 42 23 00-0006	EA	38"x 38" x 82" Stainless Steel Interior And Exterior Shower Enclosure, Single Access Front Opening Corner (Crane Plumbing, Fiat S101 Commander).....	2,803.04		118.55
22 42 23 00-0007		Powder Coated Or Baked Enamel Steel Shower Enclosure (22 42 23 00-0001)			
22 42 23 00-0008	EA	39" x 39" x 82" Baked Enamel Wonder Wall Steel Shower Enclosure (Crane Plumbing, Fiat S115 Commander).....	3,308.35		118.55
22 42 23 00-0009	EA	39" x 48" x 82" Baked Enamel Wonder Wall Steel Shower Enclosure (Crane Plumbing, Fiat S125 Commander).....	4,325.85		118.55
22 42 23 00-0010	EA	32" x 32" x 82" Baked Enamel Steel Shower Enclosure (General Partitions).....	837.10		118.55
22 42 23 00-0011	EA	36" x 36" x 82" Baked Enamel Steel Shower Enclosure (General Partitions).....	837.10		118.55
22 42 23 00-0012	EA	40" x 40" x 82" Baked Enamel Steel Shower Enclosure (General Partitions).....	1,221.10		118.55
22 42 23 00-0013	EA	40" x 48" x 82" Handicapped, Baked Enamel Steel Shower Enclosure (General Partitions).....	1,335.10		118.55
22 42 23 00-0014		Solid Plastic Core High Density Polymer (HDP) Shower Enclosure (22 42 23 00-0001)			
22 42 23 00-0015	EA	32" x 32" x 82" Single Opening Solid Plastic Shower Enclosure (General Partitions).....	1,323.10		118.55
22 42 23 00-0016	EA	36" x 36" x 82" Single Opening Solid Plastic Shower Enclosure (General Partitions).....	1,323.10		118.55
22 42 23 00-0017	EA	40" x 40" x 82" Single Opening Solid Plastic Shower Enclosure (General Partitions).....	1,863.10		118.55
22 42 23 00-0018	EA	40" x 48" x 82" Handicapped, Solid Plastic Shower Enclosure (General Partitions).....	2,073.10		118.55
22 42 23 00-0019		1 Piece Shower Units (22 42 23)			
22 42 23 00-0020	EA	1 Piece, 32" x 32" x 73" Fiberglass Shower With Drain (Swanstone FS03232).....	653.54		78.48
22 42 23 00-0021	EA	1 Piece, 36" x 36" x 73" Fiberglass Shower With Drain (Swanstone FS03636).....	721.39		78.48
22 42 23 00-0022		Personnel Type Shower Receptors (22 42 23)			



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 42 23 00-0023 Acrylic Shower Receptors <small>(22 42 23 00-0022)</small>						
			EA	36" x 36" Acrylic Shower Receptor.....	340.79	29.95
			EA	42" x 42" Acrylic Shower Receptor.....	360.88	29.95
			EA	48" x 48" Acrylic Shower Receptor.....	401.01	29.95
			EA	60" x 60" Acrylic Shower Receptor.....	487.88	35.93
			EA	48" x 32" Acrylic Shower Receptor.....	341.73	29.95
			EA	48" x 36" Acrylic Shower Receptor.....	368.16	29.95
			EA	48" x 42" Acrylic Shower Receptor.....	417.33	29.95
			EA	60" x 32" Acrylic Shower Receptor.....	462.87	35.93
			EA	60" x 36" Acrylic Shower Receptor.....	466.27	35.93
			EA	60" x 42" Acrylic Shower Receptor.....	469.39	35.93
			EA	60" x 48" Acrylic Shower Receptor.....	518.25	35.93
			EA	36" x 36" Acrylic Corner Shower Receptor.....	501.88	29.95
			EA	42" x 42" Acrylic Corner Shower Receptor.....	577.73	29.95
22 42 23 00-0037 Molded Stone Shower Receptors <small>(22 42 23 00-0022)</small>						
			EA	32" x 32" Molded Stone Shower Receptor (Fiat 32WL).....	223.92	29.95
			EA	34" x 34" Molded Stone Shower Receptor (Fiat 34WL).....	235.26	29.95
			EA	36" x 36" Molded Stone Shower Receptor (Fiat 36WL).....	236.52	29.95
			EA	42" x 42" Molded Stone Shower Receptor (Fiat 4242WL).....	292.59	29.95
			EA	42" x 34" Molded Stone Shower Receptor (Fiat 42WL).....	258.57	29.95
			EA	48" x 32" Molded Stone Shower Receptor (Fiat 4832WL).....	274.32	29.95
			EA	48" x 34" Molded Stone Shower Receptor (Fiat 48WL).....	276.21	29.95
			EA	54" x 34" Molded Stone Shower Receptor (Fiat 54WL).....	319.48	35.93
			EA	60" x 34" Molded Stone Shower Receptor (Fiat 60WL).....	331.45	35.93
			EA	36" x 36" Molded Stone Corner Shower Receptor (Fiat 36WLC).....	261.72	29.95
			EA	38" x 38" Molded Stone Corner Shower Receptor (Fiat 38WLC).....	268.65	29.95
22 42 23 00-0049 Precast Terrazzo Shower Receptors <small>(22 42 23 00-0022)</small>						
			EA	30" x 30" Precast Terrazzo Shower Receptor.....	429.30	29.95
			EA	32" x 32" Precast Terrazzo Shower Receptor.....	446.31	29.95
			EA	34" x 34" Precast Terrazzo Shower Receptor.....	462.06	29.95
			EA	36" x 36" Precast Terrazzo Shower Receptor.....	463.95	29.95
			EA	40" x 40" Precast Terrazzo Shower Receptor.....	508.68	29.95
			EA	42" x 42" Precast Terrazzo Shower Receptor.....	531.36	29.95
			EA	48" x 48" Precast Terrazzo Shower Receptor.....	750.60	29.95
			EA	36" x 32" Precast Terrazzo Shower Receptor.....	458.28	29.95
			EA	42" x 32" Precast Terrazzo Shower Receptor.....	467.31	29.95
			EA	42" x 34" Precast Terrazzo Shower Receptor.....	483.48	29.95
			EA	42" x 36" Precast Terrazzo Shower Receptor.....	503.64	29.95
			EA	32" x 48" Precast Terrazzo Shower Receptor.....	505.53	29.95
			EA	48" x 34" Precast Terrazzo Shower Receptor.....	531.36	29.95
			EA	48" x 36" Precast Terrazzo Shower Receptor.....	550.26	29.95
			EA	54" x 32" Precast Terrazzo Shower Receptor.....	557.19	29.95
			EA	60" x 30" Precast Terrazzo Shower Receptor.....	754.58	35.93
			EA	60" x 32" Precast Terrazzo Shower Receptor.....	826.06	35.93
			EA	60" x 34" Precast Terrazzo Shower Receptor.....	829.57	35.93
			EA	60" x 36" Precast Terrazzo Shower Receptor.....	833.06	35.93
			EA	32" x 32" Precast Terrazzo Corner Shower Receptor.....	466.47	29.95
			EA	34" x 34" Precast Terrazzo Corner Shower Receptor.....	467.31	29.95
			EA	36" x 36" Precast Terrazzo Corner Shower Receptor.....	468.99	29.95
			EA	40" x 40" Precast Terrazzo Corner Shower Receptor.....	564.12	29.95
			EA	36" x 36", ADA Wheelchair Accessible, Precast Terrazzo Shower Receptor.....	1,033.47	29.95
			EA	60" x 30", ADA Wheelchair Accessible, Precast Terrazzo Shower Receptor.....	1,149.82	35.93
			EA	60" x 36", ADA Wheelchair Accessible, Precast Terrazzo Shower Receptor.....	1,198.96	35.93
22 42 23 00-0076 Shower Receptors Accessories <small>(22 42 23 00-0022)</small>						
			SF	Polyvinyl Chloride (PVC) Shower Pan Liner.....	2.77	
22 42 23 00-0078 Removal And Reinstallation Of Fixtures And Trim <small>(22 42 23)</small>						
Note: Includes storage, cleaning and supply materials for reconnecting pipe to fixture.						
			EA	Remove And Reinstall Shower Head.....	35.93	
22 42 33 Wash Fountains <small>(22 42)</small>						
22 42 33 00-0001 Circular Wash Fountain, Deep Bowl <small>(22 42 33)</small>						
Note: Includes trim and trap. 2" IPS waste outlets foot control/hand control operated.						
			EA	36" Stainless Steel Circular Wash Fountain Including Trim, Trap, 2" IPS Outlet And Foot/Hand Controls (Bradley WF2705F-A-LSD).....	6,108.46	127.17
				<i>For Metal Soap Dispenser, Add</i>	100.00	
				<i>For Stainless Steel Pedestal Panels, Add</i>	100.00	
			EA	36" Bradstone® Circular Wash Fountain Including Trim, Trap, 2" IPS Outlet And Foot/Hand Controls (Bradley WF2805F-A-LSD).....	4,664.94	127.17
				<i>For Metal Soap Dispenser, Add</i>	100.00	
				<i>For Stainless Steel Pedestal Panels, Add</i>	100.00	

22 Plumbing**22 40 Plumbing Fixtures****22 42 Commercial Plumbing Fixtures**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 42 33 00-0004 EA 36" Terreon® Circular Wash Fountain Including Trim, Trap, 2" IPS Outlet And Foot/Hand Controls (Bradley TDB3105AIRLSDE).....	8,197.30	127.17
For Metal Soap Dispenser, Add	100.00	
For Stainless Steel Pedestal Panels, Add	100.00	
22 42 33 00-0005 EA 54" Stainless Steel Circular Wash Fountain Including Trim, Trap, 2" IPS Outlet And Foot/Hand Controls (Bradley WF2708F-A-LSD).....	7,781.59	145.34
For Metal Soap Dispenser, Add	100.00	
For Stainless Steel Pedestal Panels, Add	100.00	
22 42 33 00-0006 EA 54" Bradstone® Circular Wash Fountain Including Trim, Trap, 2" IPS Outlet And Foot/Hand Controls (Bradley WF2808F-A-LSD).....	5,384.33	145.34
For Metal Soap Dispenser, Add	100.00	
For Stainless Steel Pedestal Panels, Add	100.00	
22 42 33 00-0007 EA 54" Terreon® Circular Wash Fountain Including Trim, Trap, 2" IPS Outlet And Foot/Hand Controls (Bradley TDB3108AIRLSDE).....	9,830.42	145.34
For Metal Soap Dispenser, Add	100.00	
For Stainless Steel Pedestal Panels, Add	100.00	
22 42 33 00-0008 Semi-Circular Wash Fountain, Deep Bowl <small>(22 42 33)</small>		
Note: Includes trim and trap. 2" IPS waste outlets foot control/hand control operated.		
22 42 33 00-0009 EA 36" Stainless Steel Semi-Circular Wash Fountain Including Trim, Trap, 2" IPS Outlet And Foot/Hand Controls (Bradley WF2703F-A-LSD).....	5,329.11	109.01
For Metal Soap Dispenser, Add	100.00	
For Stainless Steel Pedestal Panels, Add	100.00	
22 42 33 00-0010 EA 36" Bradstone® Semi-Circular Wash Fountain Including Trim, Trap, 2" IPS Outlet And Foot/Hand Controls (Bradley WF2803F-A-LSD).....	4,267.54	109.01
For Metal Soap Dispenser, Add	100.00	
For Stainless Steel Pedestal Panels, Add	100.00	
22 42 33 00-0011 EA 36" Terreon® Semi-Circular Wash Fountain Including Trim, Trap, 2" IPS Outlet And Foot/Hand Controls (Bradley TDB3103AIRLSDE).....	6,200.76	109.01
For Metal Soap Dispenser, Add	100.00	
For Stainless Steel Pedestal Panels, Add	100.00	
22 42 33 00-0012 EA 54" Stainless Steel Semi-Circular Wash Fountain Including Trim, Trap, 2" IPS Outlet And Foot/Hand Controls (Bradley WF2704F-A-LSD).....	6,537.62	127.17
For Metal Soap Dispenser, Add	100.00	
For Stainless Steel Pedestal Panels, Add	100.00	
22 42 33 00-0013 EA 54" Bradstone® Semi-Circular Wash Fountain Including Trim, Trap, 2" IPS Outlet And Foot/Hand Controls (Bradley WF2804F-A-LSD).....	5,154.54	127.17
For Metal Soap Dispenser, Add	100.00	
For Stainless Steel Pedestal Panels, Add	100.00	
22 42 33 00-0014 EA 54" Terreon® Semi-Circular Wash Fountain Including Trim, Trap, 2" IPS Outlet And Foot/Hand Controls (Bradley TDB3104AIRLSDE).....	7,379.22	127.17
For Metal Soap Dispenser, Add	100.00	
For Stainless Steel Pedestal Panels, Add	100.00	
22 42 39 Commercial Faucets, Supplies, And Trim <small>(22 42)</small>		
22 42 39 00-0001 Kitchen Faucets <small>(22 42 39)</small>		
22 42 39 00-0002 EA Top Cast Kitchen Faucet, Single Handle, Chrome Finish (Delta 140-DST).....	133.89	36.75
22 42 39 00-0003 EA Top Cast Kitchen Faucet With Spray, Single Handle, Chrome Finish (Delta 440-DST).....	151.78	36.75
22 42 39 00-0004 EA Top Cast Kitchen Faucet, Single Handle, Stainless Steel Finish (Delta 140-SS-DST).....	159.45	36.75
22 42 39 00-0005 EA Top Cast Kitchen Faucet With Spray, Single Handle, Stainless Steel Finish (Delta 440 -SS-DST).....	181.33	36.75
22 42 39 00-0006 EA Top Cast Kitchen Faucet, Two Handle, Chrome Finish, 8" Center, Lever Handles (Delta 2102LF-LHP+H24).....	122.68	36.75
22 42 39 00-0007 EA Top Cast Kitchen Faucet With Spray, Two Handle, Chrome Finish, 8" Center, Lever Handles (Delta 2402LF-LHP+H24).....	136.26	36.75
22 42 39 00-0008 EA Top Cast Kitchen Faucet, Two Handle, Chrome Finish, Center Gooseneck Faucet, Lever Handles (Delta 21987LF).....	169.77	36.75
22 42 39 00-0009 EA Top Cast Kitchen Faucet With Spray, Two Handle, Chrome Finish, Center Gooseneck Faucet, Lever Handles (Delta 21996LF).....	191.97	36.75
22 42 39 00-0010 EA Bottom Mount Kitchen Faucet, Single Handle, Chrome Finish (Delta 101LF-WF).....	122.43	36.75
22 42 39 00-0011 EA Bottom Mount Kitchen Faucet With Spray, Single Handle, Chrome Finish (Delta 175LF-WF).....	144.45	36.75
22 42 39 00-0012 EA Bottom Mount Kitchen Faucet, Two Handle, Chrome Finish, Gooseneck Faucet, Lever Handles (Delta 2274-LHP+H24).....	236.58	36.75
22 42 39 00-0013 EA Bottom Mount Kitchen Faucet With Spray, Two Handle, Chrome Finish, Gooseneck Faucet, Lever Handles (Delta 2276-LHP+H24).....	258.81	36.75
22 42 39 00-0014 EA Wall Mount Kitchen Faucet, Two Handle, 11" Long Swing Spout (Delta 28T6943).....	205.44	36.75
22 42 39 00-0015 EA Wall Mount Kitchen Faucet, 8" Center, With 14" Double Joint Spout (Delta 28T4433).....	181.49	36.75
22 42 39 00-0016 EA Deck Mount Sink Faucet, 8" Center Set, Lever Handles (Chicago Faucet 1100 ABCP).....	231.23	39.92
22 42 39 00-0017 EA Deck Mount Sink Faucet, 8" Center Set, 4" Wristblade Handles (Chicago Faucet 1100-GN2AE3-317CP).....	235.08	39.92
22 42 39 00-0018 EA Chrome Single Handle Kitchen Faucet With Integrated Spray (Elkay LKGT1041CR).....	443.52	36.75
22 42 39 00-0019 EA Brushed Nickel Single Handle Kitchen Faucet With Integrated Spray (Elkay LKGT1041NK).....	560.26	36.75
22 42 39 00-0020 EA Oil Rubbed Bronze Single Handle Kitchen Faucet With Integrated Spray (Elkay LKGT1041RB).....	599.17	36.75
22 42 39 00-0021 EA Chrome Single Handle Kitchen Faucet With Integrated Spray, 1.5 GPM Aerator (Elkay LKLFGT1041CR).....	522.81	36.75
22 42 39 00-0022 EA Brushed Nickel Single Handle Kitchen Faucet With Integrated Spray, 1.5 GPM Aerator (Elkay LKLFGT1041NK).....	663.04	36.75
22 42 39 00-0023 EA Oil Rubbed Bronze Single Handle Kitchen Faucet With Integrated Spray, 1.5 GPM Aerator (Elkay LKLFGT1041RB).....	710.03	36.75
22 42 39 00-0024 Lavatory Faucets <small>(22 42 39)</small>		
22 42 39 00-0025 EA Single Handle Centerset Lavatory Faucet, Polished Chrome Finish (Delta Lahara 538-MPU-DST).....	150.97	26.46
22 42 39 00-0026 EA 4" Centerset Lavatory Faucet With Chrome Lever Handle (Delta 501-WF).....	109.59	26.46
22 42 39 00-0027 EA 4" Classic Style Centerset Lavatory Faucet With Chrome Lever Handles (Delta 2521-LHP+H25).....	134.71	26.46
22 42 39 00-0028 EA 4" Centerset Lavatory Gooseneck Faucet With Chrome Lever Handles (Delta 2530-LHP+H24).....	147.24	26.46



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 42 39 00-0029 EA Widespread Lavatory Faucet With Chrome Lever Handles (Delta 3543-LHP+H24).....	179.59	26.46
22 42 39 00-0030 EA Widespread Lavatory Gooseneck Faucet With Chrome Lever Handles (Delta 3530-LHP+H24).....	208.32	26.46
22 42 39 00-0031 EA Self Closing/Metered Faucet, Brass, Single Hole, Push Handle (Delta 86T104).....	124.04	26.46
22 42 39 00-0032 EA Self Closing/Metered Faucet, Double Hole, Push Handles (American Standard 1340.225.002).....	173.12	26.46
22 42 39 00-0033 EA Single Inlet, Push Handle Metering Faucet, ADA (Chicago Faucet 333-665).....	156.36	26.46
22 42 39 00-0034 EA Easy-Push Metering Faucet Wash-Up Fitting (Speakman S-4123).....	151.35	26.46
22 42 39 00-0035 EA Easy-Push Metering 4" Centerset Faucet (Speakman S-4141-LD).....	248.45	26.46
22 42 39 00-0036 EA Easy-Push Metering Widespread Faucet (Speakman S-4171-LD).....	316.50	26.46
22 42 39 00-0037 EA 3" Reach, 4-Arm Handle Single Basin Faucet (T&S Brass 0710).....	90.37	26.46
22 42 39 00-0038 EA 3" Reach, Push Handle Self-Closing Valve, Single Basin Metering Faucet (T&S Brass 0712).....	131.33	26.46
22 42 39 00-0039 EA 4" Reach, Push Handle Self-Closing Valve, Single Basin Metering Faucet (T&S Brass 0805).....	129.24	26.46
22 42 39 00-0040 EA 4" Classic Style Centerset Lavatory Faucet With Chrome Lever Handles (Zurn Z81104).....	170.53	26.46
22 42 39 00-0041 Bath And Shower Faucets (22 42 39)		
22 42 39 00-0042 Bath And Shower Faucets With Valve Body (22 42 39 00-0041)		
22 42 39 00-0043 EA Single Lever Handle Chrome Tub Filler, Pressure-Balance (American Standard T480 500).....	138.18	31.90
22 42 39 00-0044 EA Single Lever Handle, Chrome Shower Only, Pressure-Balance (American Standard T480.501).....	155.75	31.90
22 42 39 00-0045 EA Single Lever Handle, Chrome Shower And Tub Filler, Pressure-Balance (American Standard T480.502).....	170.07	31.90
22 42 39 00-0046 EA Two Lever Handle, Chrome Tub Filler (American Standard 3275.505).....	125.87	31.90
For Faucet With Metal Cross Handles, Add	45.75	
22 42 39 00-0047 EA Two Lever Handle, Chrome Shower Only (American Standard 3275.501).....	126.86	31.90
For Faucet With Metal Cross Handles, Add	45.75	
22 42 39 00-0048 EA Two Lever Handle, Chrome Shower And Tub Filler (American Standard 3275.502).....	143.45	31.90
For Faucet With Metal Cross Handles, Add	45.75	
22 42 39 00-0049 EA Three Lever Handle, Chrome Shower And Tub Filler (American Standard 3375.502).....	160.37	31.90
For Faucet With Metal Cross Handles, Add	45.75	
22 42 39 00-0050 Shower Valves And Trim (22 42 39)		
See CSI section 22 41 39 00-0011 for residential shower valves and heads.		
22 42 39 00-0051 EA Removable Hand Held Shower With Rose Wall Hook And Inline Vacuum Breaker (Powers 141-318 with 141-319).....	247.12	49.61
22 42 39 00-0052 EA Concealed Thermostatic/Pressure Balancing Control Valve With Chrome Plated Shower Head (Chicago Faucet 2502-600CP).....	538.21	49.61
22 42 39 00-0053 EA Concealed Pressure Balancing Control Valve With Chrome Plated Shower Head (Chicago Faucet 1762-ISCP).....	357.10	49.61
22 42 39 00-0054 EA Senior Institutional Shower Head (Symmons® 4-150).....	140.83	31.90
22 42 39 00-0055 EA Universal Institutional Shower Head (Symmons® 4-151).....	214.53	31.90
22 42 39 00-0056 EA Fre-Flo Institutional Shower Head (Symmons® 4-295).....	154.33	31.90
22 42 39 00-0057 EA Fre-Flo Institutional Shower Head With Short Arm (Symmons® 4-385).....	119.04	31.90
22 42 39 00-0058 EA Wall Mounted Shower Valve And Slide Bar, Single Lever Concealed Mixer (Symmons® 96-300-B30-V-X).....	407.75	47.77
22 42 39 00-0059 EA Wall Mounted Shower Valve, Tub Faucet, And Slide Bar, Single Lever Concealed Mixer (Symmons® 96-400-B30-V-X).....	425.92	55.13
22 42 39 00-0060 EA Wall Mounted Shower Valve, Slide Bar And Head, Single Lever Concealed Mixer (Symmons® 96-500-B30-V-X).....	527.39	55.13
22 42 39 00-0061 EA Wall Mounted Shower Valve, Tub Faucet, Slide Bar And Head, Single Lever Concealed Mixer (Symmons® 96-600-B30-V-X).....	543.62	58.80
22 42 39 00-0062 EA Stainless Steel Shower System With Thru-Wall Exposed Piping Covering, Adjustable Shower Head, Soap Dish, Metal Top Cap And Thermostatic/Pressure Balancing Control Valve (Symmons® Hydapipe® 1-801S/1-802S).....	667.12	49.61
For Hand Spray, Hose And Wall Hooks, Add	106.44	
For Recessed Soap Dish, Add	108.12	
For Hand Spray, Hose And 30" Slide Bar, Add	165.51	
For Pressure Balance And Metering Combination, Add	291.63	
22 42 39 00-0063 EA Stainless Steel Corner Shower System With Thru-Wall Exposed Piping Covering, Adjustable Shower Head, Soap Dish, Metal Top Cap And Thermostatic/Pressure Balancing Control Valve (Symmons® Hydapipe® 1-807).....	787.55	49.61
For Hand Spray, Hose And Wall Hooks, Add	106.44	
For Recessed Soap Dish, Add	108.12	
For Hand Spray, Hose And 30" Slide Bar, Add	165.51	
For Pressure Balance And Metering Combination, Add	291.63	
22 42 39 00-0064 EA Stainless Steel Institutional Shower System With Thru-Wall Exposed Piping Covering, Vandal Resistant Adjustable Shower Head, Soap Dish, Sloped Metal Top Cap And Thermostatic/Pressure Balancing Control Valve (Symmons® Hydapipe® 1-901S).....	541.98	49.61
For Hand Spray, Hose And Wall Hooks, Add	19.32	
For Hand Spray, Hose And 30" Slide Bar, Add	78.39	
For Pressure Balance And Metering Combination, Add	291.63	
22 42 39 00-0065 EA Stainless Steel Institutional Shower System With Flat Wall Recessed Piping Covering, Vandal Resistant Adjustable Shower Head, Soap Dish And Thermostatic/Pressure Balancing Control Valve (Symmons® Hydapipe® 1-911RS).....	804.99	49.61
For Pressure Balance And Metering Combination, Add	291.63	
22 42 39 00-0066 EA Stainless Steel Double Outlet Institutional Shower System With Thru-Ceiling Exposed Piping Covering, Vandal Resistant Adjustable Shower Head, Soap Dish, Sloped Metal Top Cap And Thermostatic/Pressure Balancing Control Valve (Symmons® Hydapipe® 1-902S-FS).....	823.57	49.61
For Hand Spray, Hose And 30" Slide Bar, Add	59.07	
For Pressure Balance And Metering Combination, Add	291.63	
22 42 39 00-0067 EA Stainless Steel Institutional Triple Shower System With Thru-Wall Exposed Piping Covering, Vandal Resistant Adjustable Shower Heads, Sloped Metal Top Cap And Thermostatic/Pressure Balancing Control Valve (Symmons® Hydapipe® 1-931).....	1,567.84	49.61
For Recessed Soap Dish, Add	83.94	
For Pressure Balance And Metering Combination, Add	227.79	
22 42 39 00-0068 EA Stainless Steel Institutional Double Shower System With Thru-Wall Exposed Piping Covering, Vandal Resistant Adjustable Shower Heads, Metal Top Cap And Thermostatic/Pressure Balancing Control Valve (Symmons® Hydapipe® 1-921).....	1,372.83	49.61
For Recessed Soap Dish, Add	83.94	
For Pressure Balance And Metering Combination, Add	291.63	

22 Plumbing**22 40 Plumbing Fixtures****22 42 Commercial Plumbing Fixtures**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 42 39 00-0069 EA Stainless Steel Tub And Shower System With Thru-Wall Exposed Piping Covering, Adjustable Shower Head, Sloped Metal Top Cap And Thermostatic/Pressure Balancing Control Valve (Symmons® Hydapipe® 1-941-231).....	674.75	49.61
22 42 39 00-0070 EA Stainless Steel Double Outlet Institutional Shower System With Flat Wall Recessed Piping Covering, Vandal Resistant Adjustable Shower Head, Hand Spray, Hose, Wall Hooks, Soap Dish And Thermostatic/Pressure Balancing Control Valve (Symmons® Hydapipe® 1-912RS-FS).....	1,021.23	49.61
For Hand Spray, Hose And 30" Slide Bar, Add	59.07	
For Pressure Balance And Metering Combination, Add	291.63	
22 42 39 00-0071 EA Stainless Steel Single Supply Institutional Shower System With Thru-Wall Exposed Piping Covering, Vandal Resistant Adjustable Shower Head, Soap Dish, Sloped Metal Top Cap And Thermostatic/Pressure Balancing Control Valve (Symmons® Hydapipe® 1-901S-60).....	571.09	49.61
22 42 39 00-0072 EA Stainless Steel Single Supply Single Outlet Institutional Shower System With Thru-Wall Exposed Piping Covering, Vandal Resistant Adjustable Shower Head, Soap Dish, Sloped Metal Top Cap And Thermostatic/Pressure Balancing Control Valve (Symmons® Hydapipe® 1-901S-22-FS).....	605.33	49.61
For Hand Spray, Hose And 30" Slide Bar, Add	59.07	
22 42 39 00-0073 EA Single Lever Handle, Chrome, Pressure-Balance, Shower System (Symmons SafetyMix 1-100-X-3/4).....	516.72	44.10
22 42 39 00-0074 EA Single Lever Handle, Chrome, Pressure-Balance, Shower Valve (Symmons SafetyMix 4-500).....	401.88	31.90
22 42 39 00-0075 Service Sink Faucets (22 42 39)		
22 42 39 00-0076 EA 2-1/4" Spout With Vacuum Breaker, Wall Mount Service Sink Faucet, Lever Handles (Kohler® Knoxford®).....	264.66	61.19
22 42 39 00-0077 EA 4-5/8" Spout With Vacuum Breaker, Wall Mount Service Sink Faucet, Lever Handles (Kohler® Kinlock™).....	316.87	61.19
22 42 39 00-0078 EA 3" Spout, Wall Mount Service Sink Faucet, Lever Handles (American Standard 8340.235).....	218.58	61.19
22 42 39 00-0079 EA 3" Spout With Vacuum Breaker, Wall Mount Service Sink Faucet, Lever Handles (American Standard 8340.243).....	233.62	61.19
22 42 39 00-0080 EA 6" Spout With Vacuum Breaker And Top Brace, Wall Mount Service Sink Faucet, Lever Handles (American Standard 8344.012).....	241.72	61.19
22 42 39 00-0081 EA 6" Spout With Bottom Fork Brace, Wall Mount Service Sink Faucet, Stops In Integral Arm, Wrist Blade Handles (American Standard 8345.101).....	334.95	85.78
22 42 39 00-0082 EA 6" Spout With Vacuum Break And Bottom Fork Brace, Wall Mount Service Sink Faucet, Stops In Integral Arm, Wrist Blade Handles (American Standard 8345.110).....	375.45	97.76
22 42 39 00-0083 EA 12" Spout With Bottom Fork Brace, Wall Mount Service Sink Faucet, Stops In Integral Arm, Wrist Blade Handles (American Standard 8345.115).....	406.18	97.76
22 42 39 00-0084 EA 44" Flexible Stainless Steel Hose With Insulated Handle, 23" Riser, Pre-Rinse Faucet (Chicago Faucet 923-LCP).....	458.52	97.76
22 42 39 00-0085 Laboratory Faucets And Fittings (22 42 39)		
22 42 39 00-0086 EA Cold Faucet, Single Deck Mount, Gooseneck Spout With Serrated Nozzle Outlet, Laboratory Faucet (Chicago Faucet 927).....	125.96	26.02
22 42 39 00-0087 EA Hot And Cold Faucet, Single Deck Mount, Gooseneck Spout With Serrated Nozzle Outlet, Laboratory Faucet (Chicago Faucet 929).....	204.68	36.75
22 42 39 00-0088 EA Hot And Cold Faucet With Vacuum Breaker, Single Deck Mount Gooseneck Spout With Serrated Nozzle Outlet, Laboratory Faucet (Chicago Faucet 930).....	264.79	36.75
22 42 39 00-0089 EA Cold Wall Mount, Gooseneck Spout With Aerator, Laboratory Faucet (Chicago Faucet 933).....	164.40	34.32
22 42 39 00-0090 EA Hot And Cold Wall Mount, 6" Spout With Aerator, Laboratory Faucet (Chicago Faucet 940).....	218.45	48.95
22 42 39 00-0091 EA Hot And Cold Wall Mount, 6" Spout With Aerator And Vacuum Breaker, Laboratory Faucet (Chicago Faucet 940-VBE7-CP).....	299.40	48.95
22 42 39 00-0092 EA Hot And Cold Faucet, Dual Deck Mount, Gooseneck Spout With Serrated Nozzle Outlet, Laboratory Faucet (Chicago Faucet 946).....	238.89	36.75
22 42 39 00-0093 EA Hot And Cold Wall Mount, Gooseneck Spout With Aerator Laboratory Faucet (Chicago Faucet 942).....	237.71	48.95
22 42 39 00-0094 EA Single Control, Single Hole Deck Mount Sink Faucet (Chicago Faucet 350-CP).....	150.56	28.26
22 42 39 00-0095 EA Dual Control, Single Hole Deck Mount Sink Faucet (Chicago Faucet 50-CP).....	212.17	39.92
22 42 39 00-0096 EA Deck Mount Lavatory Faucet, 4" Center Set, Lever Handles (Chicago Faucet 802).....	166.16	39.92
22 42 39 00-0097 EA Deck Mount Gooseneck Sink Faucet, 4" Center Set, Blade Handles (Chicago Faucet 895-317CP).....	200.31	39.92
22 42 39 00-0098 EA Gas Ball Valve, Removable Nozzle, Less Index Button (Chicago Faucet 909-LESS216-28CP).....	59.47	24.55
22 42 39 00-0099 EA Gas Ball Valve, Removable Nozzle, With Index Button (Chicago Faucet 909-AGVCP).....	57.52	24.55
22 42 39 00-0100 EA Dual Service Lab Fitting, Two Gas And One Water Outlet (Chicago Faucet 1332-CP).....	329.08	44.10
22 42 39 00-0101 EA Dual Service Lab Fitting With Wristblade Handle, Two Gas And One Water Outlet (Chicago Faucet 1332-317CP).....	329.08	44.10
22 42 39 00-0102 EA Dual Service Lab Fitting With Metal Cross Handle, Inline Vacuum Breaker, Two Gas And One Water Outlet (Chicago Faucet 1332-E22E7-204CP).....	415.73	44.10
22 42 39 00-0103 EA Dual Service Lab Fitting With Plastic Cross Handle, Two Gas And One Water Outlet (Chicago Faucet 1332-E22E7CP).....	370.14	44.10
22 42 39 00-0104 EA Dual Service Lab Fitting With Chemical Resistant Coating And Plastic Cross Handle, Two Gas And One Water Outlet (Chicago Faucet 1332-E22E7SAM).....	500.27	44.10
22 42 39 00-0105 EA Single, Deck Mounted Laboratory Ball Valve Assembly (Watersaver L4100-131WSA).....	89.12	24.26
22 42 39 00-0106 EA 90 Degree Double, Deck Mounted Laboratory Ball Valve Assembly (Watersaver L4100-132AWSA).....	123.19	29.10
22 42 39 00-0107 EA 180 Degree Double, Deck Mounted Laboratory Ball Valve Assembly (Watersaver L4100-132SWSA).....	123.19	29.10
22 42 39 00-0108 EA Three Way, Deck Mounted Laboratory Ball Valve Assembly (Watersaver L4100-133WSA).....	157.25	33.96
22 42 39 00-0109 EA Four Way, Deck Mounted Laboratory Ball Valve Assembly (Watersaver L4100-134WSA).....	191.31	38.81
22 42 39 00-0110 Gooseneck Faucets With Independent Eyewash (22 42 39)		
22 42 39 00-0111 EA Two Handle Widespread Valves, Gooseneck Faucet With Independent Eyewash (Speakman SEF-1800-CA).....	537.33	27.56
22 42 39 00-0112 EA Single Lever Gooseneck Faucet With Independent Eyewash (Speakman SEF-1800-CA-SL).....	588.13	25.73
22 42 39 00-0113 EA 8" Stem, Two Handle Widespread Valves, Gooseneck Faucet With Independent Eyewash (Speakman SEF-1800-CA-8).....	621.26	27.56
22 42 39 00-0114 EA Serrated Tip With Vacuum Breaker, Two Handle Widespread Valves, Gooseneck Faucet With Independent Eyewash (Speakman SEF-1800-ST).....	646.29	27.56
22 42 39 00-0115 EA Thermostatic Mixing Valve Kit For The SEF-1800 (Speakman SEF-TW).....	873.80	18.38
22 42 39 00-0116 EA Foot Pedal Activation, Two Handle Widespread Valves, Gooseneck Faucet With Independent Eyewash (Speakman SEF-1800-FP).....	1,211.62	45.94
22 42 39 00-0117 EA Thermostatic Mixing Valve Kit, Two Handle Widespread Valves, Gooseneck Faucet With Independent Eyewash (Speakman SEF-1800-CA-TW).....	1,411.13	45.94
22 42 39 00-0118 EA 8" Stem, Thermostatic Mixing Valve Kit, Two Handle Widespread Valves, Gooseneck Faucet With Independent Eyewash (Speakman SEF-1800-CA-8TW).....	1,495.06	45.94



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 42 39 00-0119 EA Adjustable Aerated Outlet Heads, Gooseneck Faucet Mounted Eyewash (WaterSaver EW101)	159.34	27.94
22 42 39 00-0120 EA Gooseneck Faucet Mounted Eyewash With Faucet Control Valve (WaterSaver EW200)	173.59	27.94
22 42 39 00-0121 EA Gooseneck Faucet Mounted Eyewash With Faucet Control Valve (WaterSaver EW201)	186.05	27.94
22 42 39 00-0122 EA 6 Gallon Capacity, Tempering Valve (WaterSaver AP3600)	754.50	18.38
22 42 39 00-0123 Bubblers And Glass Fillers (22 42 39)		
22 42 39 00-0124 EA Self-Closing Bubbler Faucet, Metering Handle (Chicago Faucet 748-665CP).....	211.55	26.02
22 42 39 00-0125 EA Wall Mount Glass Filler, 1/2" Flanged Female Inlet (Chicago Faucet 313-CP).....	128.30	34.32
22 42 39 00-0126 EA 7" Overall Outlet Height, Deck Mount Glass Filler, 1/2" Flanged Female Inlet (Chicago Faucet 709-CP)	147.44	26.02
22 42 39 00-0127 EA Wall Mount, Push Button Single Glass Filler (Chicago Faucet 324-CP).....	141.39	37.29
22 42 39 00-0128 EA Deck Mount, Lever Handle Drinking Faucet (Haws 5054LF)	183.33	28.26
22 42 39 00-0129 EA Self Closing Lever Handle Drinking Bubbler, 1/2" IPS (Haws 5057LF).....	267.94	28.26
22 42 39 00-0130 EA Push Button Bubbler, 1/2" OD (Haws 5017LF).....	183.33	28.26
22 42 39 00-0131 EA Push Button Bubbler, 3/8" NPT (Haws 5010-6427)	193.46	28.26
22 42 39 00-0132 Electronic Infrared Sensor Faucets (22 42 39)		
22 42 39 00-0133 EA Electronic Lavatory Faucet (American Standard 6055.205.002).....	398.43	61.30
For Faucet With Temperature Control, Add	40.00	
22 42 39 00-0134 EA Electronic Lavatory Gooseneck Faucet (American Standard 6055.105.002)	401.68	61.30
For Faucet With Temperature Control, Add	40.00	
22 42 39 00-0135 EA Electronic Gooseneck Faucets (Chicago Faucet 116.103.AB.1)	546.07	66.59
22 42 39 00-0136 EA Electronic Lavatory Faucet (Chicago Faucet 116.112.AB.1)	544.62	61.30
22 42 39 00-0137 EA Electronic Soap Dispenser And Faucet Combination (Sloan Optima ESD-30880)	964.36	66.59
22 42 39 00-0138 EA Electronic Soap Dispenser And Faucet Combination (Sloan Optima ESD-30880-BDT)	1,120.95	66.59
22 42 39 00-0139 EA Electronic Soap Dispenser And Faucet Combination (Sloan Optima ESD-35187).....	968.09	66.59
22 42 39 00-0140 EA Solar Powered, Electronic Lavatory Faucet With Integral Mixing Valve (Sloan Solis EAF-275-ISM).....	636.06	61.30
22 42 39 00-0141 EA Self-Generating EcoPower System, Single Supply Sensor Faucet, Standard Spout (Toto "Eco-Power" TEL3GKCN-60)	948.81	61.30
22 42 39 00-0142 EA Self-Generating EcoPower System, Single Supply Sensor Faucet, Standard Spout (Toto "Eco-Power" TEL5GKCN-60)	1,133.94	61.30
22 42 39 00-0143 Other Trim (22 42 39)		
22 42 39 00-0144 EA Deck Mount Gooseneck Sink Faucet, 4" Center Set, Blade Handles (Chicago Faucet 802-317CP).....	178.12	39.92
22 42 39 00-0145 EA Faucet Aerator, Male Thread 13/16" Male, 2 GPM (Delta RP330)	12.43	3.99
22 42 39 00-0146 EA 1-1/2" Pop-up Tailpiece (Chicago Faucet 226-ACP).....	71.27	11.97
22 42 39 00-0147 EA Basket Strainer Assembly (American Standard 055781-0070A)	31.68	9.98
22 42 39 00-0148 EA 1-1/4" Grid Strainer Tailpiece (Chicago Faucet 327-XCP).....	32.01	9.98
22 42 39 00-0149 EA 1-1/2" Grid Strainer Tailpiece (Chicago Faucet 327-X1-1/2TPCP)	66.42	9.98
22 42 39 00-0150 EA 1-1/4" Chrome Plated Cast P-Trap With Or Without Cleanout.....	87.06	20.87
22 42 39 00-0151 EA 1-1/2" Chrome Plated Cast P-Trap With Or Without Cleanout.....	88.85	22.05
22 42 39 00-0152 EA 1-1/2" Cast Brass P-Trap With Cleanout	144.89	22.05
22 42 39 00-0153 EA Lavatory Drainline Guard And Shutoff Covers (IPS Truebro Lav Guard 102).....	53.31	11.02
22 42 39 00-0154 EA Soft Lavatory Drainline Guard And Shutoff Covers (IPS Truebro Soft-Guard Plus).....	56.09	11.02
22 42 39 00-0155 EA Lavatory Protective Enclosure (IPS Truebro Lav Shield).....	149.03	11.02
22 42 39 00-0156 EA 36" Wide, Undersink Protective Enclosure (IPS Truebro Basin Guard)	184.96	11.02
22 42 39 00-0157 EA 42" Wide, Undersink Protective Enclosure (IPS Truebro Basin Guard)	211.06	11.02
22 42 39 00-0158 Removal And Reinstallation Of Fixtures And Trim (22 42 39)		
Note: Includes storage, cleaning and supply materials for reconnecting pipe to fixture.		
22 42 39 00-0159 EA Remove And Reinstall Faucet	63.88	
22 42 43 Flushometers (22 42)		
22 42 43 00-0001 Removal And Reinstallation Of Fixtures And Trim (22 42 43)		
Note: Includes storage, cleaning and supply materials for reconnecting pipe to fixture.		
22 42 43 00-0002 EA Remove And Reinstall Flush Valve.....	99.81	
22 42 43 00-0003 Plumbing Control Transformers (22 42 43)		
22 42 43 00-0004 EA 6 Volt DC, 120 Volt AC Plug In Style Power Transformer (Zurn P6000-PC6)	35.01	
22 42 46 Chemical Toilets (22 42)		
Note: Includes toilet, urinal, holding tank, and ventilation system. Building to be priced separately.		
22 42 46 00-0001 Standard Chemical Toilets (22 42 46)		
22 42 46 00-0002 Small Tank Chemical Toilets (22 42 46 00-0001)		
22 42 46 00-0003 EA Chemical Toilet, Small Tank 7,000 Uses/Year.....	3,088.17	735.01
For Extra Urinal, Add	103.01	
22 42 46 00-0004 Medium Tank Chemical Toilets (22 42 46 00-0001)		
22 42 46 00-0005 EA Chemical Toilet, Medium Tank 13,000 Uses/Year.....	3,667.92	875.41
For Extra Urinal, Add	121.79	

22	Plumbing
22 40	Plumbing Fixtures
22 42	Commercial Plumbing Fixtures



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 42 46 00-0006 Large Tank Chemical Toilets (22 42 46 00-0001)		
22 42 46 00-0007 EA Chemical Toilet, Large Tank 28,000 Uses/Year For Extra Urinal, Add	4,501.98 172.38	993.00
22 43 Healthcare Plumbing Fixtures (22 40)		
22 43 13 Healthcare Water Closets (22 43)		
22 43 13 00-0001 Healthcare Water Closets (22 43 13)		
22 43 13 00-0002 EA Flush Valve Type, Siphon Jet, Floor Mounted, Wall Outlet, Handicap Accessible, Elongated Vitreous China Healthcare Water Closet With Bedpan Holding Rim (American Standard Priolo® ADA).....	649.39	76.44
22 43 13 00-0003 EA Flush Valve Type, Siphon Jet, Floor Mounted, Floor Outlet, Handicap Accessible, Elongated Vitreous China Healthcare Water Closet With Bedpan Holding Rim (American Standard Madera™ ADA).....	493.83	76.44
22 43 16 Healthcare Sinks (22 43)		
22 43 16 00-0001 Healthcare Sinks (22 43 16) Note: Includes trap, drain and supply valves. Excludes faucets and flush valves.		
22 43 16 00-0002 EA 25" x 21", Wall Mounted, Blow Out Flushing Rim, Vitreous China Clinic Service Sink (American Standard) For Stainless Steel Rim Guards (Three Sides), Add	1,086.64 105.70	49.24
22 43 16 00-0003 EA 29" x 20", Floor Mounted, Siphon Jet Flushing Rim, Vitreous China Clinic Service Sink (American Standard)..... For Stainless Steel Rim Guards (Three Sides), Add For Pedestal Base, Add	1,144.35 105.70 484.63	141.49
22 43 16 00-0004 EA 28" x 22", Wall Mounted, Vitreous China Surgeon's Scrub Sink (American Standard) For Painted Bracket Supports, Add	1,040.11 163.19	49.24
22 43 16 00-0005 EA 20" x 17", Wall Mounted, Vitreous China Intensive Care Unit Sink (American Standard).....	900.50	49.24
22 43 39 Healthcare Faucets (22 43)		
22 43 39 00-0001 Medical Faucet Spouts (22 43 39)		
22 43 39 00-0002 EA Deck Mounted, Rigid Gooseneck Medical Lavatory Spout (American Standard 7522).....	89.45	11.02
22 43 39 00-0003 Electronic Proximity Medical Faucets (22 43 39)		
22 43 39 00-0004 EA DC Or Plug-In AC Powered, Single Inlet, Electronic Proximity Medical Lavatory Faucet (American Standard Selectronic™ ICU)..... For Hard Wired AC Powered, Add	527.86 24.07	53.95
22 43 39 00-0005 Foot And Knee Faucet Controls (22 43 39)		
22 43 39 00-0006 EA Single Supply Metering Pedal Valve (Chicago Faucet 628).....	272.32	98.05
22 43 39 00-0007 EA Double Supply Metering Pedal Valve (Chicago Faucet 625).....	316.29	98.05
22 43 39 00-0008 EA Knee Actuated Metering Mixing Valve (Chicago Faucet 745-VOCP).....	655.27	98.05
22 43 39 00-0009 EA Double Knee Actuated Metering Mixing Valve (American Standard 7676).....	593.32	98.05
22 43 39 00-0010 Centerset Medical Faucets (22 43 39)		
22 43 39 00-0011 EA Rigid Gooseneck Centerset Medical Lavatory Faucet, 8" Centers 6" Wrist Action Handles, Adjustable Centers (T&S B-0865-04).....	262.39	53.95
22 43 39 00-0012 EA Swivel Gooseneck Centerset Medical Lavatory Faucet, 8" Centers, 6" Wrist Action Handles, Adjustable Centers (T&S B-0866-04).....	273.50	53.95
22 43 39 00-0013 EA Swivel Gooseneck Centerset Medical Lavatory Faucet With Aerator 8" Centers, 6" Wrist Action Handles, Adjustable Centers (T&S B-0867-04).....	255.45	53.95
22 43 39 00-0014 EA Surgical Sink Rigid Gooseneck Faucets, 8" Centers, 6" Wrist Action Handles (T&S B-0322-04).....	242.95	53.95
22 43 39 00-0015 EA Surgical Sink Rigid Gooseneck Faucets With Stream Regulator Outlet, 8" Centers, 6" Wrist Action Handles (T&S B-0323-04).....	233.58	53.95
22 43 39 00-0016 Bedpan Washers (22 43 39)		
22 43 39 00-0017 EA Self Closing Pedal Valve Bed Pan Washer, With Volume Control, Vacuum Breaker, Wall Hook Hose Connection, Polyvinyl Chloride Hose (T&S B-0675).....	731.88	98.05
22 43 39 00-0018 EA Pedal Valve Bed Panwasher With Volume Control Valve, Vacuum Breaker, Wall Hook Hose Connection, Extended Spray Polyvinyl Chloride Hose (T&S B-0676).....	696.83	98.05
22 43 39 00-0019 EA Self Closing Single Pedal Valve Bedpan Washer With Volume Control, Vacuum Breaker, Wall Hook Hose Connection Polyvinyl Chloride Hose (T&S B-0685).....	649.97	98.05
22 43 39 00-0020 EA Single Pedal Valve Bedpan Washer With Volume Control, Vacuum Breaker, Wall Hook Hose Connection, Polyvinyl Chloride Hose, Extended Spray (T&S B-0686).....	624.22	98.05
22 43 43 Healthcare Plumbing Fixture Flushometers (22 43)		
22 43 43 00-0001 Healthcare Plumbing Fixture Flushometers (22 43 43)		
22 43 43 00-0002 EA Exposed Manual Service Sink Flush Valve (Sloan Royal-117).....	202.04	25.06
22 43 43 00-0003 EA Exposed Manual Water Closet Flush Valve With Bedpan Washer (Sloan Slimline BPW).....	473.59	25.06
22 43 46 Patient Care Fixtures (22 43)		
22 43 46 00-0001 Modular Patient Care Units (22 43 46)		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 43 46 00-0002 EA 47" Swivel Toilet Modular Sink And Water Closet Patient Care Unit (Willoughby WH-1700-AQCT-WB-BWSEV) <i>For SDB Single Temperature Dialysis Box, Add</i> <i>For DDB Dual Temperature Dialysis Box, Add</i> <i>For BWSEV Bedpan Washer With Elevated Valve, Add</i> <i>For LOCK Flush Valve Lockout Device, Add</i>	10,018.70 722.50 767.38 585.94 407.25	147.00
22 43 46 00-0003 EA 31" Swing Front Cabinet Modular Sink And Water Closet Patient Care Unit (Willoughby WH-2600-SST-DC-AQCT-WB) <i>For SDB Single Temperature Dialysis Box, Add</i> <i>For DDB Dual Temperature Dialysis Box, Add</i> <i>For BWSEV Bedpan Washer With Elevated Valve, Add</i> <i>For LOCK Flush Valve Lockout Device, Add</i>	7,905.59 722.50 767.38 585.94 407.25	128.63
22 43 46 00-0004 Patient Care Plumbing Accessories (22 43 46)		
22 43 46 00-0005 EA One Valve Supply Recessed Stainless Steel Dialysis Box With Locking Door (Bradley 7920)	951.37	19.96
22 43 46 00-0006 EA Two Valve Supply Recessed Stainless Steel Dialysis Box With Locking Door (Bradley 7919)	1,047.18	19.96
22 45 Emergency Plumbing Fixtures (22 45)		
22 45 13 Emergency Showers (22 45)		
22 45 13 00-0001 Emergency Drench Showers (22 45 13)		
22 45 13 00-0002 Emergency Drench Showers (Haws) (22 45 13 00-0001) Note: Includes one pull rod.		
22 45 13 00-0003 EA Horizontal Or Vertical Mounted, Emergency Drench Shower With Axion® MSR ABS Plastic Showerhead (Haws 8122)	485.63	128.63
22 45 13 00-0004 EA Horizontal Or Vertical Mounted, Emergency Drench Shower With Axion® MSR Stainless Steel Showerhead (Haws 8123)	556.50	128.63
22 45 13 00-0005 EA Horizontal Mounted, Barrier-Free, Emergency Drench Shower With Axion® MSR ABS Plastic Showerhead (Haws 8122HWC)	595.87	128.63
22 45 13 00-0006 EA Horizontal Or Vertical Mounted, Corrosion Resistant, Emergency Drench Shower With Axion® MSR ABS Plastic Showerhead (Haws 8130)	714.00	128.63
22 45 13 00-0007 EA Horizontal Mounted, All Stainless Steel, Corrosion Resistant, Emergency Drench Shower With Axion® MSR Stainless Steel Showerhead (Haws 8133H)	958.13	128.63
22 45 13 00-0008 EA Floor Mounted, Emergency Drench Shower With Axion® MSR ABS Plastic Showerhead (Haws 8100)	758.62	147.00
22 45 13 00-0009 EA Wall Mounted, Freeze Protected, Emergency Drench Shower With Axion® MSR ABS Plastic Showerhead And Stainless Steel Push Flag (Haws 8111FP)	830.81	165.38
22 45 13 00-0010 EA Flush To Ceiling, Emergency Drench Shower With Axion® MSR Stainless Steel Showerhead (Haws 8169)	756.00	165.38
22 45 13 00-0011 EA Concealed Ceiling Supply, Emergency Drench Shower With Axion® MSR Stainless Steel Showerhead (Haws 8163)	771.75	165.38
22 45 13 00-0012 EA Flush To Ceiling, Emergency Drench Shower With Axion® MSR Stainless Steel Showerhead And Pull Down Lever Ball Valve Mounted In A Recessed Stainless Steel Cabinet (Haws 8164)	1,067.06	165.38
22 45 13 00-0013 Emergency Drench Showers (Speakman) (22 45 13 00-0001) Note: Includes one pull rod.		
22 45 13 00-0014 EA Vertical Mounted, Lifesaver® Emergency Drench Shower With Plastic Showerhead (Speakman SE-220)	405.93	128.63
22 45 13 00-0015 EA Horizontal Mounted, Lifesaver® Emergency Drench Shower With Plastic Showerhead (Speakman SE-227)	409.65	128.63
22 45 13 00-0016 EA Floor Mounted, Lifesaver® Emergency Drench Shower With Plastic Showerhead (Speakman SE-253)	647.43	147.00
22 45 13 00-0017 Emergency Drench Showers (Guardian) (22 45 13 00-0001) Note: Includes one pull rod.		
22 45 13 00-0018 EA All-Stainless Steel Handicapped Accessible Safety Station With WideArea™ Eye/Face Wash (Guardian GBF1994)	2,844.41	128.63
22 45 13 00-0019 Emergency Drench Showers (WaterSaver) (22 45 13 00-0001) Note: Includes one pull rod.		
22 45 13 00-0020 EA Emergency Shower, Vertically Mounted (WaterSaver ES635)	465.15	128.63
22 45 13 00-0021 EA Emergency Shower, Horizontally Mounted (WaterSaver ES643)	474.24	128.63
22 45 13 00-0022 EA All-Stainless Steel, Emergency Shower, Horizontally Mounted (WaterSaver ES691)	919.47	128.63
22 45 13 00-0023 EA Emergency Shower, Recess Mounted (WaterSaver ES629)	713.01	165.38
22 45 13 00-0024 EA Emergency Shower, Semi-Concealed (WaterSaver ES658)	918.72	165.38
22 45 16 Eyewash Equipment (22 45)		
22 45 16 00-0001 Emergency Eyewash Equipment (22 45 16)		
22 45 16 00-0002 Emergency Eyewash Equipment (Haws) (22 45 16 00-0001)		
22 45 16 00-0003 EA Faucet Mounted, Stainless Steel Emergency Eyewash (Haws Axion® eyePOD® 7620)	212.10	3.68
22 45 16 00-0004 EA Wall Mounted, Freeze Protected, Emergency Eye Wash With Soft-Flo Heads And Stainless Steel Bowl (Haws 7433FP)	1,004.06	165.38
22 45 16 00-0005 Emergency Eyewash Equipment (WaterSaver) (22 45 16 00-0001)		
22 45 16 00-0006 EA Auto Flow, Right Hand Mounting, Emergency Eye Wash, Deck Mounted (WaterSaver EW805)	401.10	36.75
22 45 16 00-0007 EA Auto Flow, Left Hand Mounting, Emergency Eye Wash, Deck Mounted (WaterSaver EW805LH)	401.10	36.75
22 45 16 00-0008 EA Right Hand Mounting, Emergency Eye Wash, Deck Mounted (WaterSaver EW806)	407.99	36.75
22 45 16 00-0009 EA Left Hand Mounting, Emergency Eye Wash, Deck Mounted (WaterSaver EW806LH)	407.99	36.75

22 Plumbing**22 40 Plumbing Fixtures****22 45 Emergency Plumbing Fixtures**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 45 16 00-0010 EA Stainless Steel Bowl, Emergency Eye Wash, Deck Mounted (WaterSaver EW822)	534.45	36.75
22 45 16 00-0011 EA Swing-Down, Auto Flow, Emergency Eye Wash, Wall Mounted (WaterSaver EW848)	605.69	36.75
22 45 16 00-0012 EA Swing-Down, Auto Flow, Emergency Eye Wash, Deck Mounted (WaterSaver EW849)	605.69	36.75
22 45 16 00-0013 EA Right Hand Mounting, All-Stainless Steel, Emergency Eye Wash, Deck Mounted (WaterSaver EW893)	1,102.57	36.75
22 45 16 00-0014 EA Left Hand Mounting, All-Stainless Steel, Emergency Eye Wash, Deck Mounted (WaterSaver EW893LH)	1,102.57	36.75
22 45 16 00-0015 EA Right Hand Mounting, Auto Flow, All-Stainless Steel, Emergency Eye Wash, Deck Mounted (WaterSaver EW895)	1,152.70	36.75
22 45 16 00-0016 EA Left Hand Mounting, Auto Flow, All-Stainless Steel, Emergency Eye Wash, Deck Mounted (WaterSaver EW895LH)	1,152.70	36.75
22 45 16 00-0017 EA Swing-Down, Auto Flow, All-Stainless Steel, Emergency Eye Wash, Wall Mounted (WaterSaver EW898)	1,416.49	36.75
22 45 16 00-0018 EA Swing-Down, Auto Flow, All-Stainless Steel, Emergency Eye Wash, Deck Mounted (WaterSaver EW899)	1,416.49	36.75
22 45 16 00-0019 EA Ball Valve With Flag Handle, Emergency Eye Wash, Recess Deck Mounted (WaterSaver EW808)	777.05	128.63
22 45 16 00-0020 EA Push-Down Valve, Emergency Eye Wash, Recess Deck Mounted (WaterSaver EW810)	767.33	128.63
22 45 16 00-0021 EA Stainless Steel Bowl, Emergency Eye Wash, Wall Mounted (WaterSaver EW814)	575.68	128.63
22 45 16 00-0022 EA Stainless Steel Bowl And Cover, Emergency Eye Wash, Wall Mounted (WaterSaver EW814BC)	777.79	128.63
22 45 16 00-0023 EA Plastic Bowl, Emergency Eye Wash, Wall Mounted (WaterSaver EW814P)	503.53	128.63
22 45 23 Personal Eyewash Equipment (22 45)		
22 45 23 00-0001 Portable Eyewash Equipment (22 45 23)		
22 45 23 00-0002 Portable Eyewash Equipment (Bradley) (22 45 23 00-0001)		
22 45 23 00-0003 EA Portable (Wall Mounted) Heated Gravity-Fed Emergency Eye/Face Wash (Bradley S19-921H)	1,213.38	11.02
22 45 26 Eye/Face Wash Equipment (22 45)		
22 45 26 00-0001 Emergency Eye/Face Wash Equipment (22 45 26)		
22 45 26 00-0002 Emergency Eye/Face Wash Equipment (Haws) (22 45 26 00-0001)		
22 45 26 00-0003 EA Unmounted, Emergency Eye/Face Wash With Axion® MSR Wash Head Assembly And Stainless Steel Bowl (Haws 7460)	526.31	91.88
Note: Excludes p-trap and tailpiece.		
22 45 26 00-0004 EA Wall Mounted, Emergency Eye/Face Wash With Axion® MSR Wash Head Assembly Without Receptor (Haws 7324)	528.94	128.63
22 45 26 00-0005 EA Wall Mounted, Emergency Eye/Face Wash With Axion® MSR Wash Head Assembly And Plastic Bowl (Haws 7260B-7270B)	517.13	128.63
Note: Excludes p-trap and tailpiece.		
22 45 26 00-0006 EA Wall Mounted, Emergency Eye/Face Wash With Axion® MSR Wash Head Assembly And Plastic Bowl (Haws 7260BT-7270BT)	563.59	128.63
Note: Excludes p-trap and tailpiece.		
22 45 26 00-0007 EA Wall Mounted, Emergency Eye/Face Wash With Axion® MSR Wash Head Assembly And Stainless Steel Bowl (Haws 7360B-7460B)	568.31	128.63
Note: Excludes p-trap and tailpiece.		
22 45 26 00-0008 EA Wall Mounted, Emergency Eye/Face Wash With Axion® MSR Wash Head Assembly And Stainless Steel Bowl (Haws 7360BT-7460BT)	624.23	128.63
Note: Excludes p-trap and tailpiece.		
22 45 26 00-0009 EA Wall Mounted, Barrier-Free, Emergency Eye/Face Wash With Axion® MSR Wash Head Assembly And Stainless Steel Bowl (Haws 7360BTWC)	847.87	128.63
22 45 26 00-0010 EA Wall Mounted, All Stainless Steel, Corrosion Resistant, Emergency Eye/Face Wash With Axion® MSR Wash Head Assembly And Stainless Steel Bowl And Dust Cover (Haws 7778B)	1,596.00	128.63
22 45 26 00-0011 EA Pedestal Mounted, Emergency Eye/Face Wash With Axion® MSR Wash Head Assembly And Plastic Bowl (Haws 7261-7271)	648.38	147.00
22 45 26 00-0012 EA Pedestal Mounted, Emergency Eye/Face Wash With Axion® MSR Wash Head Assembly And Stainless Steel Bowl (Haws 7361-7461)	738.94	147.00
22 45 26 00-0013 EA Pedestal Mounted, All Stainless Steel, Corrosion Resistant, Emergency Eye/Face Wash With Axion® MSR Wash Head Assembly And Stainless Steel Bowl (Haws 7777)	1,652.44	147.00
22 45 26 00-0014 EA Sink Mounted, Swing-Away, Emergency Eye/Face Wash With Axion® MSR Wash Head Assembly (Haws 7611)	439.69	36.75
22 45 26 00-0015 EA Right Side Sink Mounted, Swing-Away, Emergency Eye/Face Wash With Stainless Steel Axion® MSR Wash Head Assembly (Haws 7612)	423.94	36.75
22 45 26 00-0016 EA Left Side Sink Mounted, Swing-Away, Emergency Eye/Face Wash With Stainless Steel Axion® MSR Wash Head Assembly (Haws 7612LH)	443.62	36.75
22 45 26 00-0017 EA Wall Or Deck Mounted, Barrier-Free, Swing-Down, Emergency Eye/Face Wash With Axion® MSR Wash Head Assembly (Haws 7610)	557.81	36.75
22 45 26 00-0018 EA Recessed Wall Mounted, Barrier-Free, Pull Down, Emergency Eye/Face Wash With Axion® MSR Wash Head Assembly And Stainless Steel Cabinet (Haws 7655WCC)	1,359.75	183.75
22 45 26 00-0019 EA Surface Wall Mounted, Wheelchair Accessible, Pull Down, Emergency Eye/Face Wash With Axion® MSR Wash Head Assembly And Stainless Steel Cabinet (Haws 7655WCSM)	1,644.56	147.00
22 45 26 00-0020 EA Recessed Wall Mounted, Barrier-Free, Pull Down, Emergency Eye/Face Wash With Axion® MSR Wash Head Assembly And Stainless Steel Cabinet And Drain Pan (Haws 7656WCC)	1,690.50	183.75
22 45 26 00-0021 EA Surface Wall Mounted, Wheelchair Accessible, Pull Down, Emergency Eye/Face Wash With Axion® MSR Wash Head Assembly And Stainless Steel Cabinet And Drain Pan (Haws 7656WCSM)	1,983.19	147.00
22 45 26 00-0022 Emergency Eye/Face Wash Equipment (Speakman) (22 45 26 00-0001)		
22 45 26 00-0023 EA Wall Mounted, Lifesaver® Emergency Eye/Face Wash And Plastic Bowl (Speakman SE-495)	452.55	128.63
22 45 26 00-0024 EA Floor Mounted, DuraJade™ Finish, Lifesaver® Emergency Eye/Face Wash And Plastic Bowl (Speakman SE- 496)	549.15	147.00
22 45 26 00-0025 Emergency Eye/Face Wash Equipment (WaterSaver) (22 45 26 00-0001)		
22 45 26 00-0026 EA Wide Area, Emergency Eye/Face Wash With Stainless Steel Bowl, Wall Mounted (WaterSaver FE724)	702.51	128.63



Plumbing	22	22
Plumbing Fixtures	22 40	
Emergency Plumbing Fixtures	22 45	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 45 26 00-0027	EA		Wide Area, Emergency Eye/Face Wash With Stainless Steel Bowl And Cover, Wall Mounted (WaterSaver FE724BC).....	904.62	128.63
22 45 26 00-0028	EA		Wide Area, Push-Down Valve, Emergency Eye/Face Wash, Recess Deck Mounted (WaterSaver FE727).....	878.92	128.63
22 45 26 00-0029	EA		Push-Down Valve, Emergency Eye/Face Wash, Recess Deck Mounted (WaterSaver FE765).....	817.61	128.63
22 45 26 00-0030	EA		Auto Flow, Right Hand Mounting, Emergency Eye/Face Wash, Deck Mounted (WaterSaver FE774).....	421.16	36.75
22 45 26 00-0031	EA		Auto Flow, Left Hand Mounting, Emergency Eye/Face Wash, Deck Mounted (WaterSaver FE774LH).....	421.16	36.75
22 45 26 00-0032	EA		Right Hand Mounting, Emergency Eye/Face Wash, Deck Mounted (WaterSaver FE775).....	409.20	36.75
22 45 26 00-0033	EA		Left Hand Mounting, Emergency Eye/Face Wash, Deck Mounted (WaterSaver FE775LH).....	409.20	36.75
22 45 26 00-0034	EA		Swing-Down, Auto Flow, Emergency Eye/Face Wash, Wall Mounted (WaterSaver FE778).....	614.68	36.75
22 45 26 00-0035	EA		Swing-Down, Auto Flow, Emergency Eye/Face Wash, Deck Mounted (WaterSaver FE779).....	614.68	36.75
22 45 29 Hand-Held Emergency Drench Hoses (22 45)					
22 45 29 00-0001			Hand-Held Emergency Eye/Face/Body Wash With Hose (22 45 29)		
22 45 29 00-0002			Hand-Held Emergency Eye/Face/Body Wash With Hose (Haws) (22 45 29 00-0001)		
22 45 29 00-0003	EA		Counter Mounted, Hand-Held Emergency Eye/Face/Body Wash With Axion® MSR Wash Head Assembly And 8' Hose (Haws 8904).....	469.88	45.94
22 45 29 00-0004	EA		Wall Mounted, Hand-Held Emergency Eye/Face/Body Wash With Axion® MSR Wash Head Assembly And 12' Recoil Hose (Haws 8905).....	540.76	45.94
22 45 29 00-0005			Hand-Held Emergency Eye/Face/Body Wash With Hose (WaterSaver) (22 45 29 00-0001)		
22 45 29 00-0006	EA		Emergency Drench Hose Unit, Deck Mounted (WaterSaver EW1020).....	332.91	45.94
22 45 29 00-0007	EA		Emergency Drench Hose Unit, Wall Mounted (WaterSaver EW1025).....	308.90	45.94
22 45 29 00-0008	EA		Emergency Eye Wash Drench Hose Unit, Wall Mounted (WaterSaver EW1014).....	450.13	45.94
22 45 29 00-0009	EA		Emergency Eye Wash Drench Hose Unit, Deck Mounted (WaterSaver EW1022).....	423.42	45.94
22 45 29 00-0010	EA		Emergency Eye Wash Drench Hose Unit, Wall Mounted (WaterSaver EW1026).....	432.98	45.94
22 45 29 00-0011	EA		Ball Valve With Flag Handle, Emergency Eye Wash Drench Hose Unit, Deck Mounted (WaterSaver EW1028).....	558.92	45.94
22 45 29 00-0012	EA		Ball Valve With Flag Handle And Vacuum Breaker, Emergency Eye Wash Drench Hose Unit, Deck Mounted (WaterSaver EW1028VB).....	642.68	45.94
22 45 29 00-0013	EA		Emergency Eye Wash Drench Hose Unit, 45 Degree Panel Mounted (WaterSaver EW1041).....	614.28	45.94
22 45 33 Combination Emergency Fixture Units (22 45)					
22 45 33 00-0001			Emergency Shower With Eye/Face Wash (22 45 33)		
22 45 33 00-0002			Emergency Shower With Eye/Face Wash (Haws) (22 45 33 00-0001)		
22 45 33 00-0003	EA		Floor Mounted, All Stainless Steel, Corrosion Resistant, Emergency Drench Shower With Axion® MSR Stainless Steel Showerhead And Eye/Face Wash With Axion® MSR Wash Head Assembly And Stainless Steel Bowl (Haws 8330).....	2,781.20	238.88
22 45 33 00-0004	EA		Floor Mounted, Freeze Protected, Emergency Drench Shower With Axion® MSR ABS Plastic Showerhead And Eyewash With Soft-Flo Heads And Stainless Steel Bowl (Haws 8300FP).....	1,883.45	238.88
			Note: Includes freeze protection bury valve.		
22 45 33 00-0005	EA		Floor Mounted, Emergency Drench Shower With Axion® MSR ABS Plastic Showerhead And Eye/Face Wash With Axion® MSR Wash Head Assembly And Stainless Steel Bowl (Haws 8300-8309).....	1,312.51	238.88
22 45 33 00-0006	EA		Floor Mounted, Freeze Protected, Emergency Drench Shower With Axion® MSR ABS Plastic Showerhead And Eyewash With Soft-Flo Heads And Stainless Steel Bowl (Haws 8300.158).....	2,088.20	238.88
22 45 33 00-0007	EA		Floor Mounted, Corrosion Resistant, Emergency Drench Shower With Axion® MSR ABS Plastic Showerhead And Eye/Face Wash With Axion® MSR Wash Head Assembly And Stainless Steel Bowl (Haws 8300CRP-8309CRP).....	1,533.01	238.88
22 45 33 00-0008	EA		Floor Mounted, Barrier-Free, Emergency Drench Shower With Axion® MSR ABS Plastic Showerhead And Eye/Face Wash With Axion® MSR Wash Head Assembly And Stainless Steel Bowl (Haws 8309WC).....	1,442.45	238.88
22 45 33 00-0009	EA		Floor Mounted, Emergency Drench Shower With Axion® MSR ABS Plastic Showerhead And Eye/Face Wash With Axion® MSR Wash Head Assembly (Haws 8317).....	1,233.76	238.88
22 45 33 00-0010	EA		Floor Mounted, Corrosion Resistant, PVC Plastic, Emergency Drench Shower With Axion® MSR ABS Plastic Showerhead And Eye/Face Wash With Axion® MSR Wash Head Assembly And Plastic Bowl (Haws 8336).....	2,017.32	238.88
22 45 33 00-0011	EA		Recessed Wall Mounted, Barrier-Free, Pull Down, Emergency Eye/Face Wash With Axion® MSR Wash Head Assembly With Stainless Steel Cabinet And Ceiling Mounted Axion® MSR Stainless Steel Showerhead (Haws 8355WCC).....	2,210.26	238.88
22 45 33 00-0012	EA		Recessed Wall Mounted, Barrier-Free, Pull Down, Emergency Eye/Face Wash With Axion® MSR Wash Head Assembly With Stainless Steel Cabinet And Wall Mounted Axion® MSR Stainless Steel Showerhead (Haws 8355WCW).....	2,253.57	238.88
22 45 33 00-0013	EA		Recessed Wall Mounted, Barrier-Free, Pull Down, Emergency Eye/Face Wash With Axion® MSR Wash Head Assembly With Stainless Steel Cabinet And Drain Pan And Ceiling Mounted Axion® MSR Stainless Steel Showerhead (Haws 8356WCC).....	2,517.38	238.88
22 45 33 00-0014	EA		Recessed Wall Mounted, Barrier-Free, Pull Down, Emergency Eye/Face Wash With Axion® MSR Wash Head Assembly With Stainless Steel Cabinet And Drain Pan, Daylight Drain And Wall Mounted Axion® MSR Stainless Steel Showerhead (Haws 8356WCCD).....	2,670.95	238.88
22 45 33 00-0015	EA		Recessed Wall Mounted, Barrier-Free, Pull Down, Emergency Eye/Face Wash With Axion® MSR Wash Head Assembly With Stainless Steel Cabinet And Drain Pan And Wall Mounted Axion® MSR Stainless Steel Showerhead (Haws 8356WCW).....	2,627.64	238.88
22 45 33 00-0016	EA		Floor Mounted, 120 VAC Cable Heated, Freeze Protected, Emergency Drench Shower With Axion® MSR ABS Plastic Showerhead And Eye/Face Wash With Axion® MSR Wash Head Assembly (Haws 8317CTFP).....	3,927.01	238.88
22 45 33 00-0017	EA		Floor Mounted, 220 VAC Cable Heated, Freeze Protected, Emergency Drench Shower With Axion® MSR ABS Plastic Showerhead And Eye/Face Wash With Axion® MSR Wash Head Assembly (Haws 8317CTFP.220V).....	4,139.64	238.88
22 45 33 00-0018	EA		Floor Mounted, C1D1 Rated, 120 VAC Cable Heated, Freeze Protected, Emergency Drench Shower With Axion® MSR ABS Plastic Showerhead And Eye/Face Wash With Axion® MSR Wash Head Assembly (Haws 8317CTFPC1D1).....	8,746.51	238.88
22 45 33 00-0019	EA		Floor Mounted, Emergency Drench Shower With Axion® MSR ABS Plastic Showerhead And Eye/Face Wash With Axion® MSR Wash Head Assembly And Plastic Bowl (Haws 8320-8325).....	1,233.76	238.88
22 45 33 00-0020	EA		Floor Mounted, Corrosion Resistant, Emergency Drench Shower With Axion® MSR ABS Plastic Showerhead And Eye/Face Wash With Axion® MSR Wash Head Assembly And Plastic Bowl (Haws 8320CRP).....	1,395.20	238.88

22	Plumbing
22 40	Plumbing Fixtures
22 45	Emergency Plumbing Fixtures



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 45 33 00-0021 Emergency Shower With Eye/Face Wash (Speakman) <small>(22 45 33 00-0001)</small>		
22 45 33 00-0022 EA Floor Mounted, Emergency Drench Shower With Plastic Showerhead And Eye/Face Wash With Plastic Bowl (Speakman SE-690)	1,047.28	238.88
22 45 33 00-0023 Emergency Shower With Eye/Face Wash (WaterSaver) <small>(22 45 33 00-0001)</small>		
22 45 33 00-0024 EA All-Stainless Steel, Wide Area, Emergency Shower With Eye/Face Wash Station, Floor Mounted (WaterSaver SS994).....	2,902.13	199.61
22 45 33 00-0025 EA Polished Chrome Construction, Wide Area, Emergency Shower With Eye/Face Wash Station, Floor Mounted (WaterSaver SS909PCC).....	2,963.04	199.61
22 45 33 00-0026 EA Emergency Shower With Eye Wash Station And Stainless Steel Bowl, Floor Mounted (WaterSaver SS902)	1,246.45	199.61
22 45 33 00-0027 EA Emergency Shower With Eye Wash Station And Plastic Bowl, Floor Mounted (WaterSaver SS902P)	1,151.69	199.61
22 45 33 00-0028 EA Emergency Shower With Eye Wash Station And Stainless Steel Bowl And Cover, Floor Mounted (WaterSaver SS902BC).....	1,448.56	199.61
22 45 36 Emergency Fixture Water-Tempering Equipment <small>(22 45)</small>		
22 45 36 00-0001 Emergency Fixture Water-Tempering Equipment <small>(22 45 36)</small>		
22 45 36 00-0002 Emergency Fixture Water-Tempering Equipment (Haws) <small>(22 45 36 00-0001)</small>		
22 45 36 00-0003 EA 10 GPM, 1/2" Inlet, 1/2" Outlet, Brass Thermostatic Mixing/Tempering Valve (Haws 9201EW).....	497.44	45.94
22 45 36 00-0004 EA 12 GPM, 1/2" Inlet, 3/4" Outlet, Brass Thermostatic Mixing/Tempering Valve (Haws 9201EFE).....	729.76	45.94
22 45 36 00-0005 EA 31 GPM, 1-1/4" Inlet, 1-1/4" Outlet, Brass Thermostatic Mixing/Tempering Valve (Haws 9201E).....	1,072.32	45.94
22 45 36 00-0006 EA 78 GPM, 1-1/4" Inlet, 1-1/4" Outlet, Brass Thermostatic Mixing/Tempering Valve (Haws 9202E).....	1,265.26	45.94
22 45 36 00-0007 EA 31 GPM, 1" Inlet, 1-1/4" Outlet, Secondary High Temperature Limit Valve, Lead Free, Brass Thermostatic Mixing/Tempering Valve (Haws 9201H)	1,792.88	45.94
22 45 36 00-0008 EA 12 GPM, 1/2" Inlet, 3/4" Outlet, Secondary High Temperature Limit Valve, Brass Thermostatic Mixing/Tempering Valve (Haws TWBS.EWE).....	1,891.32	45.94
22 45 36 00-0009 EA 74 GPM, 1-1/4" Inlet, 1-1/4" Outlet, Secondary High Temperature Limit Valve, Lead Free, Brass Thermostatic Mixing/Tempering Valve (Haws TWBS.SHE)	3,178.88	45.94
22 45 36 00-0010 EA 78 GPM, 2" Inlet, 2" Outlet, Secondary High Temperature Limit Valve, Lead Free, Brass Thermostatic Mixing/Tempering Valve (Haws TWBS.HF).....	3,820.69	45.94
22 45 36 00-0011 EA 1/2" Inlet, 1/2" Outlet, Brass Scald Protection Bleed Valve (Haws SP157B)	556.50	45.94
22 45 39 Emergency Plumbing Fixture Accessories <small>(22 45)</small>		
22 45 39 00-0001 Emergency Plumbing Fixture Accessories <small>(22 45 39)</small>		
22 45 39 00-0002 Emergency Plumbing Fixture Accessories (Haws) <small>(22 45 39 00-0001)</small>		
22 45 39 00-0003 EA Pedestal Mounted, Powder Coated Aluminum Foot Control Assembly For Hands Free Activation Of Emergency Plumbing Fixtures (Haws SP220).....	127.84	14.70
22 45 39 00-0004 EA Wall Mounted, Powder Coated Aluminum Foot Control Assembly For Hands Free Activation Of Emergency Plumbing Fixtures (Haws SP220W).....	179.02	14.70
22 45 39 00-0005 EA Pedestal Mounted, Stainless Steel Foot Control Assembly For Hands Free Activation Of Emergency Plumbing Fixtures (Haws SP220SS)	186.90	14.70
22 45 39 00-0006 EA Axion® MSR Stainless Steel Showerhead For Emergency Drench Showers (Haws SP829SS)	207.90	5.51
22 45 39 00-0007 EA Stainless Steel Dust Cover For Emergency Eye/Face Wash Bowls (Haws 9102).....	212.10	3.68
22 45 39 00-0008 EA 3-Sided ABS Plastic Safety Sign For Emergency Combination Shower And Eyewash Units (Haws 9020).....	231.26	7.35
22 45 39 00-0009 EA Emergency Body Spray Kit With 8' Hose And ABS Plastic Head For Emergency Plumbing Fixtures (Haws 8901RFK).....	405.56	55.13
22 45 39 00-0010 EA Class 1, Div. 1, Group B, C And D, Indicator Light For Emergency Plumbing Fixtures (Haws 8317IDLTEXP)	418.46	24.17
22 45 39 00-0011 EA Vapor Tight And Gasketed, Green Area Light For Emergency Plumbing Fixtures (Haws 8317LT).....	623.22	24.17
22 45 39 00-0012 EA Privacy Curtain For Horizontal Emergency Drench Shower Or Combination Emergency Drench Shower And Eyewash Units (Haws 9037).....	729.76	55.13
22 45 39 00-0013 EA Class 1, Div. 1, Group B, C And D, White Area Light For Emergency Plumbing Fixtures (Haws 8317LTEXP)	1,391.03	24.17
22 45 39 00-0014 EA 1/2" Supply, Emergency Alarm And Light System For Emergency Plumbing Fixtures (Haws 9001.5).....	1,539.26	80.57
22 45 39 00-0015 EA 1-1/4" Supply, Emergency Alarm And Light System For Emergency Plumbing Fixtures (Haws 9001).....	1,570.76	80.57
22 45 39 00-0016 EA 1-1/4" Supply, Class 1, Division 2, Groups B, C, And D Emergency Alarm And Light System For Emergency Plumbing Fixtures (Haws 9001EXP).....	2,917.39	80.57
22 45 39 00-0017 EA 1-1/4" Supply, 90 db, Class 1, Division 1, Groups C And D, Emergency Alarm And Light System For Emergency Plumbing Fixtures (Haws 9001EXPC1D1)	5,555.52	80.57
22 45 39 00-0018 Emergency Plumbing Fixture Accessories (Speakman) <small>(22 45 39 00-0001)</small>		
22 45 39 00-0019 EA Privacy Curtain For Emergency Showers	654.68	55.13
Note: Curtain includes stainless steel curtain rod and mounting accessories.		
22 45 39 00-0020 Emergency Plumbing Fixture Accessories (WaterSaver) <small>(22 45 39 00-0001)</small>		
22 45 39 00-0021 EA Hand And Foot Control For Emergency Eyewash Equipment (WaterSaver HFC).....	88.08	11.97
22 46 Security Plumbing Fixtures <small>(22 40)</small>		
22 46 13 Security Water Closets And Urinals <small>(22 46)</small>		
22 46 13 00-0001 Security Fixtures <small>(22 46 13)</small>		
22 46 13 00-0002 EA Prison Urinal, Back Supply And Flush, Wall Hung, Stainless Steel	2,573.31	165.38



Plumbing	22
Plumbing Fixtures	22 40
Security Plumbing Fixtures	22 46

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 46 13 00-0003	EA		Prison Urinal, Back Supply And Flush, Stall, Stainless Steel.....	4,377.31	234.99
22 46 13 00-0004	EA		Prison Water Closet, Integral Seat, Back Supply And Flush Valve, Wall Hung, Wall Outlet, Cast Aluminum.....	2,165.19	183.75
			<i>For Angled Toilet, Add</i>	18.38	
			<i>For Offset Toilet, Add</i>	198.14	
22 46 13 00-0005	EA		Prison Water Closet, Integral Seat, Back Supply And Flush Valve, Floor Mount, Wall Outlet, Cast Aluminum.....	2,628.25	183.75
			<i>For Angled Toilet, Add</i>	18.38	
			<i>For Offset Toilet, Add</i>	244.45	
22 46 13 00-0006	EA		Prison Water Closet, Integral Seat, Back Supply And Flush Valve, Floor Mount, Floor Outlet, Cast Aluminum.....	2,668.82	183.75
			<i>For Angled Toilet, Add</i>	18.38	
			<i>For Offset Toilet, Add</i>	248.51	
22 46 13 00-0007	EA		For Recessed Tissue Holder For Prison Water Closet, Stainless Steel.....	239.91	36.75
22 46 13 00-0008	EA		15" Wide Combination Prison Water Closet And Lavatory Unit, Soap And Paper Holders, Seat, Wall Mounted, Stainless Steel.....	3,950.36	227.86
			<i>For 15" Mirror/Shelf Module, Add</i>	777.86	
			<i>For Angled Toilet, Add</i>	22.79	
			<i>For Intercom Option, Add</i>	120.57	
			<i>For AC Duplex Outlet Option, Add</i>	75.57	
			<i>For 15" Wide Light/Ventilation Module, Add</i>	771.71	
			<i>For Offset Toilet, Add</i>	372.25	
22 46 13 00-0009	EA		18" Wide Combination Prison Water Closet And Lavatory Unit, Soap And Paper Holders, Seat, Wall Mounted, Stainless Steel.....	4,068.94	238.88
			<i>For Angled Toilet, Add</i>	23.89	
			<i>For 18" Wide Light/Ventilation Module, Add</i>	793.33	
			<i>For Intercom Option, Add</i>	122.78	
			<i>For AC Duplex Outlet Option, Add</i>	77.78	
			<i>For Offset Toilet, Add</i>	383.01	
			<i>For 18" Mirror/Shelf Module, Add</i>	813.88	
22 46 13 00-0010	EA		20" Wide Combination Prison Water Closet And Lavatory Unit, Soap And Paper Holders, Seat, Wall Mounted, Stainless Steel.....	4,158.13	249.91
			<i>For 20" Mirror/Shelf Module, Add</i>	859.90	
			<i>For Angled Toilet, Add</i>	24.99	
			<i>For Intercom Option, Add</i>	124.98	
			<i>For 20" Wide Light/Ventilation Module, Add</i>	824.94	
			<i>For AC Duplex Outlet Option, Add</i>	79.98	
			<i>For Offset Toilet, Add</i>	390.82	
22 46 13 00-0011	EA		26" Wide Combination Prison Water Closet And Lavatory Unit, Soap And Paper Holders, Seat, Wall Mounted, Stainless Steel.....	4,451.59	260.93
			<i>For 26" Wide Light/Ventilation Module, Add</i>	851.56	
			<i>For Angled Toilet, Add</i>	26.09	
			<i>For 26" Mirror/Shelf Module, Add</i>	895.93	
			<i>For Intercom Option, Add</i>	127.19	
			<i>For AC Duplex Outlet Option, Add</i>	82.19	
			<i>For Offset Toilet, Add</i>	419.07	
22 46 13 00-0012	EA		28" Wide Combination Prison Water Closet And Lavatory Unit, Soap And Paper Holders, Seat, Floor Mounted, Stainless Steel.....	7,211.44	271.96
			<i>For Angled Toilet, Add</i>	27.20	
			<i>For 28" Wide Light/Ventilation Module, Add</i>	878.17	
			<i>For Intercom Option, Add</i>	129.39	
			<i>For AC Duplex Outlet Option, Add</i>	84.39	
			<i>For Offset Toilet, Add</i>	693.95	
			<i>For 28" Mirror/Shelf Module, Add</i>	926.96	

22 46 16 Security Lavatories And Sinks (22 46)

22 46 16 00-0001 Security Lavatories And Sinks (22 46 16)

22 46 16 00-0002	EA		Prison Lavatory, Wall Hung, Push Button Filler V, Rectangular Bowl, Stainless Steel.....	1,561.47	128.63
			<i>For Shelf, Add</i>	73.59	
22 46 16 00-0003	EA		Prison Lavatory, Wall Hung, Push Button Filler V, Oval Bowl, Stainless Steel.....	1,588.33	128.63
			<i>For Shelf, Add</i>	73.59	
22 46 16 00-0004	EA		Prison Lavatory, Wall Hung, Push Button Filler V, Oval Bowl, Corner Mount, Stainless Steel.....	1,815.15	128.63
			<i>For Shelf, Add</i>	73.59	
22 46 16 00-0005	EA		Prison Lavatory, Wall Hung, Push Button Filler V, Multi Sided Bowl, Stainless Steel.....	1,588.33	128.63
			<i>For Shelf, Add</i>	73.59	
22 46 16 00-0006	EA		Prison Service Sink, With Soap Dish, 22" x 16" x 10", Stainless Steel.....	3,379.27	195.88

22 46 19 Security Showers (22 46)

22 46 19 00-0001 Prison Showers (22 46 19)

22 46 19 00-0002	EA		Prison Shower Cabinet, Unitized, 36" X 36" X 88", Stainless Steel.....	9,473.17	267.10
			<i>For Door, Add</i>	118.42	
22 46 19 00-0003	EA		Shower Package For Built-in, Hot And Cold Faucets, Mixing Valve, Rectangular Soap Dish, Stainless Steel.....	551.01	98.12
22 46 19 00-0004	EA		Prison Shower Head With Mixing Valves And Piping Assembly In Wall.....	405.84	51.45
22 46 19 00-0005	EA		Prison Drinking Fountain, Wall Hung, Push Button Filler V, Rectangular Bowl, Stainless Steel.....	1,576.67	128.63

22 46 43 Security Plumbing Fixture Flushometers (22 46)

22 46 43 00-0001	EA		Concealed Manual Water Closet Flush Valve, With Pushbutton Control (Sloan 601 AFD ESM).....	402.92	25.06
			Note: Anti-flood device (AFD), solenoid operated with module plug 24V (ESM).		
22 46 43 00-0002	EA		Concealed Manual Urinal Flush Valve, 1-1/2" Backinlet, With Pushbutton Control (Sloan 609 ESM).....	402.47	25.06
			Note: Solenoid operated with module plug 24V (ESM).		
22 46 43 00-0003	EA		Concealed Manual Urinal Flush Valve, 3/4" Backinlet, With Pushbutton Control (Sloan 613 ESM).....	389.50	25.06
			Note: Solenoid operated with module plug 24V (ESM).		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 47 Drinking Fountains And Water Coolers (22 40)		
22 47 13 Drinking Fountains (22 47)		
22 47 13 00-0001 Indoor Drinking Fountains (22 47 13)		
22 47 13 00-0002 Face Mounted Indoor Drinking Fountain (22 47 13 00-0001)		
22 47 13 00-0003 EA Stainless Steel, Standard Length, Semi-Circular Indoor Drinking Fountain With Bubblers, 180 Degree Push Bar (Halsey-Taylor OVL-II-S)	1,440.01	119.44
22 47 13 00-0004 EA Stainless Steel, Standard Length, Semi-Circular With Back Panel Indoor Drinking Fountain With Bubblers, 180 Degree Push Bar (Halsey-Taylor OVL-II-SBP)	1,716.87	128.63
22 47 13 00-0005 EA Stainless Steel, Extended Length, Semi-Circular Indoor Drinking Fountain With Bubblers, 180 Degree Push Bar (Halsey-Taylor OVL-II-E)	1,627.10	119.44
22 47 13 00-0006 EA Stainless Steel, Extended Length, Semi-Circular With Back Panel Indoor Drinking Fountain With Bubblers, 180 Degree Push Bar (Halsey-Taylor OVL-II-EBP)	1,744.88	128.63
22 47 13 00-0007 EA Stainless Steel, Standard Length, Rectangle Indoor/Outdoor Drinking Fountain With Bubblers, Rounded Corners (Halsey-Taylor HRFSS)	953.79	119.44
22 47 13 00-0008 EA Stainless Steel, Standard Length, Rectangle With Back Panel Indoor/Outdoor Drinking Fountain With Bubblers, Rounded Corners With Back Panel (Halsey-Taylor HRFSSBP)	1,133.92	128.63
22 47 13 00-0009 EA Stainless Steel, Extended Length, Rectangle Indoor/Outdoor Drinking Fountain With Bubblers, Rounded Corners (Halsey-Taylor HRFE)	1,032.41	119.44
22 47 13 00-0010 EA Stainless Steel, Extended Length, Rectangle With Back Panel Indoor/Outdoor Drinking Fountain With Bubblers, Rounded Corners (Halsey-Taylor HRFEBP)	1,155.61	128.63
22 47 13 00-0011 Wall Mounted Indoor Drinking Fountain (22 47 13 00-0001)		
22 47 13 00-0012 EA Stainless Steel Wall-Mounted Rectangle Indoor Drinking Fountain With Bubblers, Backsplash, Front And Side Push Bars (Halsey-Taylor 5701).....	980.28	128.63
22 47 13 00-0013 EA Stainless Steel Wall-Mounted Rectangle Indoor Drinking Fountain/Bottle Filling Station With Bubblers, Backsplash, Front And Side Push Bars (Elkay/Halsey-Taylor HTHB-HAC8WF)	1,353.09	128.63
22 47 13 00-0014 EA Bi-Level, Stainless Steel Wall-Mounted Rectangle Indoor Drinking Fountain/Bottle Filling Station With Bubblers, Backsplash, Front And Side Push Bars (Elkay/Halsey-Taylor HTHB-HAC8BLWF).....	1,932.51	128.63
22 47 13 00-0015 Semi-Recessed Indoor Drinking Fountain (22 47 13 00-0001)		
22 47 13 00-0016 EA Stainless Steel Semi-Recessed Indoor Drinking Fountain With Bubblers (Halsey-Taylor 5801)	1,326.72	137.81
22 47 13 00-0017 EA Stainless Steel Semi-Recessed Indoor Drinking Fountain With Bubblers And Cuspidor (Halsey-Taylor 5801C).....	2,891.18	137.81
22 47 13 00-0018 Fully Recessed Indoor Drinking Fountain (22 47 13 00-0001)		
22 47 13 00-0019 EA Stainless Steel Fully-Recessed, With Bubblers, Indoor Drinking Fountain (Halsey-Taylor 8880, Haws 2400).....	1,419.22	147.00
22 47 13 00-0020 EA Stainless Steel Fully-Recessed, With Bubblers And Cuspidor, Indoor Drinking Fountain (Halsey-Taylor 8800 With 10245, Haws 2403).....	2,619.45	147.00
22 47 13 00-0021 Countertop Indoor Drinking Fountain (22 47 13 00-0001)		
22 47 13 00-0022 EA Stainless Steel Countertop Circular Indoor Drinking Fountain Basin With Pushbutton Bubblers (Halsey-Taylor 10000)	580.51	91.88
22 47 13 00-0023 EA Stainless Steel Countertop Rectangular Indoor Drinking Fountain Basin With Pushbutton Bubblers (Halsey-Taylor 6000)	557.92	91.88
22 47 13 00-0024 EA Stainless Steel Countertop Oval Indoor Drinking Fountain Basin With Pushbutton Bubblers (Halsey-Taylor 6028)	681.74	91.88
22 47 13 00-0025 Bowl And Bracket Indoor Drinking Fountain (22 47 13 00-0001)		
22 47 13 00-0026 EA Stainless Steel, Bowl And Bracket With Pushbutton Bubblers, Indoor Drinking Fountain (Halsey-Taylor 2501A).....	406.99	91.88
22 47 13 00-0027 EA Stainless Steel, Bowl And Bracket, Self Closing Lever Handle Stop, Indoor Drinking Fountain (Halsey-Taylor 4540)	530.80	91.88
22 47 13 00-0028 Multi-Station Indoor Drinking Fountain (22 47 13 00-0001)		
22 47 13 00-0029 EA Stainless Steel Two Station Indoor Drinking Fountains With Bubblers And Built In Backsplash, With Bottom Cover Plate (Halsey-Taylor 7020)	2,723.38	147.00
22 47 13 00-0030 EA Stainless Steel Three Station Indoor Drinking Fountains With Bubblers And Built In Backsplash, With Bottom Cover Plate (Halsey-Taylor 7030)	2,971.02	147.00
22 47 13 00-0031 EA Marble, Face-Mounted Two Station Indoor Drinking Fountain With Bubblers (Halsey-Taylor 7120).....	2,276.91	147.00
22 47 13 00-0032 EA White Enameled Iron Two Station Indoor Drinking Fountains With Bubblers (Haws 1430)	1,866.59	147.00
22 47 13 00-0033 EA White Enameled Iron Three Station Indoor Drinking Fountains With Bubblers (Haws 1435).....	2,384.46	147.00
22 47 13 00-0034 EA Stainless Steel, Bi-Level Indoor Drinking Fountain With Bubblers And Back Panel (Halsey-Taylor HRFSEBP, Haws 1119.14 With 6700.4)	2,063.01	187.52
22 47 13 00-0035 EA Cast Aluminum Two Station Indoor Drinking Fountains With Bubblers (Haws 1441)	2,776.67	147.00
22 47 13 00-0036 EA Cast Aluminum Three Station Indoor Drinking Fountains With Bubblers (Haws 1408).....	2,930.21	147.00
22 47 13 00-0037 Outdoor Drinking Fountains (22 47 13)		
22 47 13 00-0038 Face Mounted (22 47 13 00-0037)		
22 47 13 00-0039 EA Stainless Steel Freeze Resistant Face Mounted Outdoor Drinking Fountain With Bubblers (Halsey-Taylor HRFE-FR).....	1,564.73	147.00
22 47 13 00-0040 EA Stainless Steel Freeze Resistant Face Mounted, With Back Panel, Outdoor Drinking Fountain With Bubblers (Halsey-Taylor HRFEFBP-FR).....	1,668.66	147.00



Plumbing	22	22
Plumbing Fixtures	22 40	
Drinking Fountains And Water Coolers	22 47	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 47 13 00-0041 EA Stone Aggregate Weather Resistant Face Mounted Outdoor Drinking Fountain With Bubbler (Halsey-Taylor 4592).....	1,241.17	147.00
22 47 13 00-0042 EA Stone Aggregate Freeze Resistant Face Mounted Outdoor Drinking Fountain With Bubbler (Halsey-Taylor 4592-FR).....	1,702.10	147.00
22 47 13 00-0043 Free Standing (22 47 13 00-0037)		
22 47 13 00-0044 EA Steel Pedestal Outdoor Drinking Fountain With Bubbler (Halsey-Taylor 4715).....	2,255.82	137.81
22 47 13 00-0045 EA Steel Pedestal Freeze Resistant Outdoor Drinking Fountain With Bubbler (Halsey-Taylor 4715-FR).....	3,175.87	137.81
22 47 13 00-0046 EA Steel Barrier-Free Pedestal Outdoor Drinking Fountain With Bubbler (Halsey-Taylor 4710).....	2,379.64	137.81
22 47 13 00-0047 EA Steel Barrier-Free Pedestal Freeze Resistant Outdoor Drinking Fountain With Bubbler (Halsey-Taylor 4710-FR).....	3,299.69	137.81
22 47 13 00-0048 EA Steel Barrier-Free Bi-level Pedestal Outdoor Drinking Fountain With Bubbler (Halsey-Taylor 4720).....	3,421.10	147.00
22 47 13 00-0049 EA Steel Barrier-Free Bi-level Pedestal Freeze Resistant Outdoor Drinking Fountain With Bubbler (Halsey-Taylor 4720-FR).....	4,911.45	147.00
22 47 13 00-0050 EA Stone Aggregate Pedestal Outdoor Drinking Fountain With Bubbler (Halsey-Taylor 4591).....	1,260.75	137.81
22 47 13 00-0051 EA Stone Aggregate Barrier-Free Pedestal Outdoor Drinking Fountain With Bubbler (Halsey-Taylor 4590).....	2,189.84	137.81
22 47 13 00-0052 EA Stone Aggregate Barrier-Free Pedestal Freeze Resistant Outdoor Drinking Fountain With Bubbler (Halsey-Taylor 4590-FR).....	3,110.80	137.81
22 47 13 00-0053 EA Stone Aggregate Barrier-Free Bi-level Pedestal Outdoor Drinking Fountain With Bubbler (Halsey-Taylor 4595).....	3,334.34	147.00
22 47 13 00-0054 EA Stone Aggregate Barrier-Free Bi-level Pedestal Freeze Resistant Outdoor Drinking Fountain With Bubbler (Halsey-Taylor 4595-FR).....	4,733.40	147.00
22 47 16 Pressure Water Coolers (22 47)		
22 47 16 00-0001 Indoor Water Coolers (22 47 16)		
22 47 16 00-0002 Face Mounted Indoor Water Coolers (22 47 16 00-0001)		
22 47 16 00-0003 EA Stainless Steel, Semi-Circular Water Cooler With Bubbler, Face-Mounted, Extended Length, 180 Degree Push Bar, 7.5 GPH (Halsey-Taylor OVL-II ER-Q).....	2,673.67	147.00
22 47 16 00-0004 EA Stainless Steel, Semi-Circular Water Cooler, Electronic Sensor, Face-Mounted, Extended Length, With Bubbler, 7.5 GPH (Halsey-Taylor OVL-II EREE-Q).....	2,852.62	147.00
22 47 16 00-0005 Wall Mounted Indoor Water Coolers (22 47 16 00-0001)		
22 47 16 00-0006 EA Stainless Steel Wall-Mounted Compact Water Cooler, 4 GPH, With Bubbler, (Halsey-Taylor SW4A-Q).....	1,037.82	147.00
22 47 16 00-0007 EA Stainless Steel Wall-Mounted Compact Water Cooler, 8 GPH, With Bubbler (Halsey-Taylor SW8A-Q).....	1,077.58	147.00
22 47 16 00-0008 EA Stainless Steel Wall-Mounted Compact Water Cooler, 14 GPH, With Bubbler (Halsey-Taylor SW14A-Q).....	1,195.98	147.00
22 47 16 00-0009 EA Stainless Steel Wall-Mounted Vandal Resistant Compact Water Cooler With Bubbler, 8 GPH (Halsey-Taylor SW8A-VR-Q-SS).....	1,220.38	147.00
22 47 16 00-0010 EA Stainless Steel Wall-Mounted Vandal Resistant Barrier Free Water Cooler With Bubbler, 8 GPH (Halsey-Taylor HVR8-CHILD ADA).....	902.79	147.00
22 47 16 00-0011 EA Stainless Steel Wall-Mounted Barrier Free Water Cooler With Bubbler, Front And Side Pushbar, 8 GPH (Halsey-Taylor WC8AFS-Q-SS).....	1,101.99	147.00
22 47 16 00-0012 EA Stainless Steel Wall-Mounted Barrier Free Water Cooler With Bubbler, Front And Side Pushbar, 8 GPH (Halsey-Taylor HAC8FS-Q Child SS).....	1,007.99	147.00
22 47 16 00-0013 EA Stainless Steel, Wall Mounted, Barrier Free, Bi-Level Indoor Water Cooler With Bubblers, 8 GPH (Halsey-Taylor HAC8FSBL-Q-SS).....	1,756.02	220.50
22 47 16 00-0014 Simulated Recessed Indoor Water Coolers (22 47 16 00-0001)		
22 47 16 00-0015 EA Stainless Steel Simulated Recessed Water Cooler With Bubbler, 8 GPH (Halsey-Taylor RWM8A-Q).....	1,534.00	147.00
22 47 16 00-0016 Fully Recessed Indoor Water Coolers (22 47 16 00-0001)		
22 47 16 00-0017 EA Stainless Steel Fully-Recessed Water Cooler With Bubbler, 8 GPH (Halsey-Taylor RC8A-Q).....	2,512.47	165.38
22 47 16 00-0018 EA Stainless Steel Fully-Recessed Water Cooler With Bubbler And Cup Dispenser, 8 GPH (Halsey-Taylor RC8AQ + 14762).....	3,696.43	165.38
22 47 16 00-0019 EA Stainless Steel Fully-Recessed Water Cooler With Bubbler And Cup Dispenser And Glass Filler, 8 GPH (Halsey-Taylor RC8A-Q-14700).....	4,335.41	165.38
22 47 16 00-0020 Free Standing Indoor Water Coolers (22 47 16 00-0001)		
22 47 16 00-0021 EA Stainless Steel, Free-Standing Indoor Water Cooler, 4 GPH, With Bubbler (Halsey-Taylor SCWT4A-Q).....	1,030.89	128.63
22 47 16 00-0022 EA Stainless Steel, Free-Standing Indoor Water Cooler, 8 GPH, With Bubbler (Halsey-Taylor SCWT8A-Q).....	1,070.66	128.63
22 47 16 00-0023 EA Stainless Steel, Free-Standing Indoor Water Cooler, 14 GPH, With Bubbler (Halsey-Taylor SCWT14A-Q).....	1,189.96	128.63
22 47 16 00-0024 EA Stainless Steel, Free-Standing Vandal Resistant Water Cooler With Bubbler, 14 GPH (Halsey-Taylor SCWT14A-VR-Q).....	1,385.18	128.63
22 47 16 00-0025 Bottled Water Coolers (22 47 16 00-0001)		
22 47 16 00-0026 EA Free-Standing Bottled Water Cooler With Chilled Or Room Temperature Water.....	419.34	73.50
22 47 16 00-0027 EA Free-Standing Bottled Water Cooler With Chilled Or Hot Water.....	506.10	73.50
22 47 16 00-0028 Multi-Station Indoor Water Coolers (22 47 16 00-0001)		
22 47 16 00-0029 EA Stainless Steel, Wall Mounted, Two Station, Semi-Circular Indoor Water Cooler With Bubblers, 180 Degree Push Bars, 7.5 GPH (Halsey-Taylor OVL-II SER-Q).....	3,713.62	220.50
22 47 16 00-0030 EA Stainless Steel, Wall Mounted, Two Station, Electronic Sensor Semi Circular Indoor Water Cooler With Bubblers, 180 Degree Push Bars, 7.5 GPH (Halsey-Taylor OVL-II-SEREE-Q).....	3,885.34	220.50
22 47 16 00-0031 EA Stainless Steel, Wall Mounted, Barrier Free, Bi-Level, Vandal Resistant Indoor Water Cooler With Bubblers, 8 GPH (Halsey-Taylor HVR8BL-CHILD ADA-SS).....	1,678.30	220.50

22 Plumbing**22 40 Plumbing Fixtures****22 47 Drinking Fountains And Water Coolers**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 47 16 00-0032			Outdoor Water Coolers (22 47 16)		
22 47 16 00-0033			Wall Mounted Outdoor Water Coolers (22 47 16 00-0032)		
22 47 16 00-0034	EA		Stainless Steel, Wall Mounted, Barrier Free, Vandal Resistant, Frost Resistant Outdoor Water Cooler With Bubbler, 8 GPH (Halsey-Taylor HVR8FR-CHILD ADA-SS).....	1,345.12	91.88
22 47 16 00-0035	EA		Stainless Steel, Wall Mounted, Barrier Free, Bi-Level, Vandal Resistant Outdoor Water Cooler With Bubblers, 8 GPH (Halsey-Taylor HVR8BLFR-CHILD ADA-SS).....	2,145.87	91.88
22 47 16 00-0036			Free Standing Outdoor Water Coolers (22 47 16 00-0032)		
22 47 16 00-0037	EA		Stainless Steel Free-Standing Outdoor Water Cooler With Bubbler, 14 GPH (Halsey-Taylor HOF14A-Q).....	1,814.77	137.81
22 47 16 00-0038	EA		Stainless Steel Free-Standing Frost Resistant Outdoor Water Cooler With Bubbler, 14 GPH (Halsey-Taylor HOF14A-FR-Q).....	2,170.86	137.81
22 47 16 00-0039			Removal And Reinstallation Of Fixtures And Trim (22 47 16)		
			Note: Includes storage, cleaning and supply materials for reconnecting pipe to fixture.		
22 47 16 00-0040	EA		Remove And Reinstall Wall Hung Water Cooler.....	358.42	
22 47 16 00-0041	EA		Remove And Reinstall Floor Mount Water Cooler.....	79.85	
22 47 19			Water-Station Water Coolers (22 47)		
22 47 19 00-0001			Bottle Filler (22 47 19)		
22 47 19 00-0002	EA		Outdoor Tubular Bottle Filling Station, Surface Mount (Elkay LK4410BF).....	3,235.08	147.00
			For Stainless Steel Carrier, Add	205.00	
22 47 19 00-0003	EA		Outdoor Tubular Bottle Filling Station, Surface Mount, Freeze Resistant (Elkay LK4410BFFRK).....	4,107.79	147.00
			For Stainless Steel Carrier, Add	205.00	
22 47 19 00-0004	EA		Tri-level Outdoor Tubular Bottle Filling Station With Single Bottle Filler And Two Drinking Fountain Basins, Surface Mount (Elkay LK4430BF1).....	5,281.48	165.38
			For Stainless Steel Carrier, Add	205.00	
22 47 19 00-0005	EA		Tri-level Outdoor Tubular Bottle Filling Station With Two Bottle Fillers And Single Drinking Fountain Basin, Surface Mount (Elkay LK4430BF2).....	5,711.59	165.38
			For Stainless Steel Carrier, Add	205.00	
22 47 19 00-0006	EA		Tri-level Outdoor Tubular Bottle Filling Station With Three Bottle Fillers, Surface Mount (Elkay LK4430BF3).....	6,141.71	165.38
			For Stainless Steel Carrier, Add	205.00	
22 47 23			Remote Water Coolers (22 47)		
22 47 23 00-0001			Remote Chillers (22 47 23)		
22 47 23 00-0002	EA		1.5 GPH Remote Chiller (Halsey-Taylor SJ1-Q).....	723.74	49.61
22 47 23 00-0003	EA		5 GPH Remote Chiller (Halsey-Taylor SJ5-Q).....	1,101.70	55.13
22 47 23 00-0004	EA		8 GPH Remote Chiller (Halsey-Taylor SJ8-Q).....	872.45	64.31
22 47 23 00-0005	EA		10 GPH Remote Chiller (Halsey-Taylor SJ10-Q).....	1,237.87	73.50
22 47 23 00-0006	EA		19 GPH Remote Chiller (Halsey-Taylor SJ19-Q).....	1,756.95	110.25
22 47 23 00-0007	EA		30 GPH Remote Chiller (Halsey-Taylor SJ30-Q).....	2,221.80	119.44
22 47 26			Fixture Carriers (22 47)		
22 47 26 00-0001			Water Cooler Carriers (22 47 26)		
22 47 26 00-0002			Floor Mounted, Water Cooler Carriers (22 47 26 00-0001)		
			Note: Includes adjustable supporting rods, structural uprights and welded feet.		
22 47 26 00-0003	EA		Floor Mounted Hanger Plate Type, Single Water Cooler Carrier.....	313.87	27.94
			For Up To 4" Extension Sleeves And Hardware, Add	14.68	
			For Bi-Level Carrier, Add	171.00	
22 47 26 00-0004	EA		Floor Mounted Bearing Plate Type, Single Water Cooler Carrier.....	340.43	27.94
			For Up To 4" Extension Sleeves And Hardware, Add	14.68	
			For Bi-Level Carrier, Add	171.00	
22 50			Pool And Fountain Plumbing Systems (22)		
22 51			Swimming Pool Plumbing Systems (22 50)		
22 51 13			Swimming Pool Piping (22 51)		
22 51 13 00-0001			Swimming Pool Gutters (22 51 13)		
22 51 13 00-0002	LF		Swimming Pool Gutters, Stainless.....	218.89	16.54
22 51 13 00-0003			Pool Drains (22 51 13)		
22 51 13 00-0004			Cast Iron Pool Drain With Bottom Outlet (22 51 13 00-0003)		
			Note: Large square top and 24" loose set round super-flo grate.		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 51 13 00-0005 EA Cast Iron Pool Drain, 4" - 8" Bottom Outlet, Large Square Top And 24" Super-Flo Grate.....	1,312.79	46.31
<i>For Galvanized Top, Add</i>	276.40	
<i>For Polished Bronze Top, Add</i>	769.60	
<i>For Vandal Proof Construction, Add</i>	57.20	
<i>For Chromium Plated Top, Add</i>	805.00	
22 51 13 00-0006 Cast Iron Pool Drain With Waterproof Flange <small>(22 51 13 00-0003)</small>		
Note: Bottom outlet 14" square top and loose set square flange.		
22 51 13 00-0007 EA Cast Iron Pool Drain, 2" - 4" Bottom Outlet With Waterproof Flange And 14" Square Top.....	418.15	46.31
<i>For Galvanized Top, Add</i>	38.10	
<i>For Supplementary Strainer, Add</i>	7.00	
<i>For Ground Screw, Add</i>	18.30	
<i>For Hinge Grate, Add</i>	28.60	
<i>For Clamp Device, Add</i>	13.80	
<i>For Vandal Proof Construction, Add</i>	17.10	
<i>For Polished Bronze Top, Add</i>	133.50	
<i>For Threaded Outlet, Add</i>	9.50	
<i>For Chromium Plated Top, Add</i>	146.90	
22 51 13 00-0008 Pool Supply Fittings <small>(22 51 13)</small>		
22 51 13 00-0009 Cast Iron Pool Supply Fittings <small>(22 51 13 00-0008)</small>		
Note: Includes polished bronze head and anchor flange and adjustable V-ported valve insert and threaded inlet.		
22 51 13 00-0010 EA Cast Iron Pool Fitting For 2" Pipe.....	520.74	82.69
<i>For Grounding Screw, Add</i>	18.30	
<i>For Galvanized Head, Add</i>	26.30	
<i>For Vandal Proof Construction, Add</i>	11.50	
22 51 13 00-0011 EA Cast Iron Pool Fitting For 3" Pipe.....	520.74	82.69
<i>For Grounding Screw, Add</i>	18.30	
<i>For Galvanized Head, Add</i>	26.30	
<i>For Vandal Proof Construction, Add</i>	11.50	
<i>For Chromium Plated Head, Add</i>	11.50	
22 51 16 Swimming Pool Pumps <small>(22 51)</small>		
22 51 16 00-0001 Variable Speed Pool Pumps <small>(22 51 16)</small>		
22 51 16 00-0002 EA 3 HP, Variable Speed Pool Pump With Vacuum Release (Pentair INTELLIFLO VS+SVRS 11017).....	1,618.61	312.38
22 51 16 00-0003 EA Variable Speed Pool Pump (Hayward EcoStar SVRS SP3400VSP).....	1,759.65	312.38
22 51 16 00-0004 EA Variable Speed Pool Pump With Vacuum Release (Hayward EcoStar SVRS SP3400VSPVR).....	1,948.96	312.38
22 51 16 00-0005 Electric Powered Portable Vacuum Cleaner Pump <small>(22 51 16)</small>		
Note: Includes 75' of 3 wire electric safety cord.		
22 51 16 00-0006 EA 1 HP Electric Portable Vacuum Cleaner Pump With 75' Of 3-Wire Safety Cord.....	296.37	36.75
22 51 16 00-0007 EA 1-1/2 HP Electric Portable Vacuum Cleaner Pump With 75' Of 3-Wire Safety Cord.....	556.82	36.75
22 51 16 00-0008 Gasoline Driven Portable Vacuum Cleaner Pump <small>(22 51 16)</small>		
22 51 16 00-0009 EA 3 HP Gasoline Driven Portable Vacuum Cleaner Pump.....	2,288.26	36.75
22 51 19 Swimming Pool Water Treatment Equipment <small>(22 51)</small>		
22 51 19 00-0001 Condensing Pool Water Heater <small>(22 51 19)</small>		
22 51 19 00-0002 EA 372 MBH, 97% Efficient, Gas Fired, Indirect, Condensing Pool Water Heater (Lochinvar XPN400).....	20,520.40	526.98
22 51 19 00-0003 EA 467 MBH, 97% Efficient, Gas Fired, Indirect, Condensing Pool Water Heater (Lochinvar XPN501).....	22,399.19	632.37
22 51 19 00-0004 EA 567 MBH, 97% Efficient, Gas Fired, Indirect, Condensing Pool Water Heater (Lochinvar XPN601).....	24,556.85	685.08
22 51 19 00-0005 EA 660 MBH, 97% Efficient, Gas Fired, Indirect, Condensing Pool Water Heater (Lochinvar XPN701).....	30,089.68	737.77
22 51 19 00-0006 EA 773 MBH, 97% Efficient, Gas Fired, Indirect, Condensing Pool Water Heater (Lochinvar XPN801).....	31,229.81	790.47
22 51 19 00-0007 EA 967 MBH, 97% Efficient, Gas Fired, Indirect, Condensing Pool Water Heater (Lochinvar XPN1015).....	47,152.30	948.56
22 51 19 00-0008 EA 1,257 MBH, 97% Efficient, Gas Fired, Indirect, Condensing Pool Water Heater (Lochinvar XPN1320).....	60,262.90	1,001.26
22 51 19 00-0009 EA 1,450 MBH, 97% Efficient, Gas Fired, Indirect, Condensing Pool Water Heater (Lochinvar XPN1520).....	62,722.04	1,080.30
22 51 19 00-0010 Non Condensing Pool Water Heater <small>(22 51 19)</small>		
22 51 19 00-0011 EA 500 MBH, 89% Efficient, Gas Fired, Copper Finned Tube, Non Condensing Pool Water Heater (Lochinvar CPN0502).....	11,349.60	685.08
22 51 19 00-0012 EA 650 MBH, 89% Efficient, Gas Fired, Copper Finned Tube, Non Condensing Pool Water Heater (Lochinvar CPN0652).....	12,101.67	737.77
22 51 19 00-0013 EA 750 MBH, 89% Efficient, Gas Fired, Copper Finned Tube, Non Condensing Pool Water Heater (Lochinvar CPN0752).....	13,173.96	790.47
22 51 19 00-0014 EA 990 MBH, 89% Efficient, Gas Fired, Copper Finned Tube, Non Condensing Pool Water Heater (Lochinvar CPN0992).....	17,337.40	948.56
22 51 19 00-0015 EA 1,260 MBH, 89% Efficient, Gas Fired, Copper Finned Tube, Non Condensing Pool Water Heater (Lochinvar CPN1262).....	20,017.23	1,001.26
22 51 19 00-0016 EA 1,440 MBH, 89% Efficient, Gas Fired, Copper Finned Tube, Non Condensing Pool Water Heater (Lochinvar CPN1442).....	21,377.61	1,080.30
22 51 19 00-0017 EA 1,800 MBH, 89% Efficient, Gas Fired, Copper Finned Tube, Non Condensing Pool Water Heater (Lochinvar CPN1802).....	21,228.10	1,133.00

22 Plumbing**22 50 Pool And Fountain Plumbing Systems****22 51 Swimming Pool Plumbing Systems**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 51 19 00-0018 EA 2,070 MBH, 89% Efficient, Gas Fired, Copper Finned Tube, Non Condensing Pool Water Heater (Lochinvar CPN2072).....	27,282.92	1,159.35
22 51 19 00-0019 Swimming Pool Heaters (22 51 19) Note: Excludes wiring, external piping, base or pad. Commercial pools.		
22 51 19 00-0020 Electric Pool Heaters (22 51 19 00-0019)		
22 51 19 00-0021 EA 12 KW Heater (1 Degree/Hour), For 4,800 Gallon Pool.....	2,815.03	147.00
22 51 19 00-0022 EA 18 KW Heater (1 Degree/Hour), For 7,200 Gallon Pool.....	3,145.18	158.03
22 51 19 00-0023 EA 24 KW Heater (1 Degree/Hour), For 9,600 Gallon Pool.....	3,495.46	183.75
22 51 19 00-0024 EA 30 KW Heater (1 Degree/Hour), For 12,000 Gallon Pool.....	3,703.65	220.50
22 51 19 00-0025 EA 36 KW Heater (1 Degree/Hour), For 14,400 Gallon Pool.....	4,083.34	308.71
22 51 19 00-0026 EA 60 KW Heater (1 Degree/Hour), For 24,000 Gallon Pool.....	4,691.92	441.01
22 51 19 00-0027 Gas Fired Pool Heaters (22 51 19 00-0019)		
22 51 19 00-0028 EA 120 MBH Output Gas Fired Pool Heater.....	3,255.12	356.83
22 51 19 00-0029 EA 180 MBH Output Gas Fired Pool Heater.....	3,744.40	423.74
22 51 19 00-0030 EA 240 MBH Output Gas Fired Pool Heater.....	4,876.84	743.40
22 51 19 00-0031 EA 300 MBH Output Gas Fired Pool Heater.....	5,830.03	892.09
22 51 19 00-0032 EA 360 MBH Output Gas Fired Pool Heater.....	6,161.04	990.42
22 51 19 00-0033 EA 400 MBH Output Gas Fired Pool Heater.....	7,192.08	1,204.84
22 51 19 00-0034 EA 500 MBH Output Gas Fired Pool Heater.....	11,571.10	1,445.81
22 51 19 00-0035 EA 600 MBH Output Gas Fired Pool Heater.....	13,418.22	1,606.45
22 51 19 00-0036 EA 750 MBH Output Gas Fired Pool Heater.....	15,131.81	1,734.97
22 51 19 00-0037 EA 1,000 MBH Output Gas Fired Pool Heater.....	19,403.48	2,048.22
22 51 19 00-0038 Surge Tanks (22 51 19) Note: Includes 100 GPM vertical pump with 2 HP motor and electronic float switch. Prices are for 1' To 5' sump depth for pump.		
22 51 19 00-0039 EA 1,000 Gallon Surge Tank, With 2 HP Motor With 100 GPM Vertical Pump And Electric Float Switch.....	10,952.01	595.12
22 51 19 00-0040 EA 1,500 Gallon Surge Tank, With 2 HP Motor With 100 GPM Vertical Pump And Electric Float Switch.....	12,225.06	595.12
22 51 19 00-0041 EA 2,000 Gallon Surge Tank, With 2 HP Motor With 100 GPM Vertical Pump And Electric Float Switch.....	14,776.33	751.14
22 51 19 00-0042 EA 5,000 Gallon Surge Tank, With 2 HP Motor With 100 GPM Vertical Pump And Electric Float Switch.....	19,771.40	1,212.27
22 51 19 00-0043 Diatomite Type Filter System (22 51 19)		
22 51 19 00-0044 EA 35,000 Gallon Filter System, Diatomite.....	9,430.67	1,931.31
22 51 19 00-0045 EA 45,000 Gallon Filter System, Diatomite.....	11,243.53	2,317.57
22 51 19 00-0046 Silver Recovery System, X-Ray Film Processing (22 51 19)		
22 51 19 00-0047 EA 20 Gallon/Day Capacity, Silver Recovery System.....	1,321.53	249.51
22 51 19 00-0048 EA 40 Gallon/Day Capacity, Silver Recovery System.....	1,936.51	332.72
22 51 19 00-0049 Inline Water Filter (22 51 19) Note: 3/8" NPT threaded inlet and outlet, 125 PSI, includes one filter cartridge.		
22 51 19 00-0050 EA 2 GPM Water Filter, 100 Degree Temperature, 8" x 5" Diameter, Plastic Body.....	176.65	73.50
22 51 19 00-0051 EA 6 GPM Water Filter, 250 Degree Temperature, 12" x 5" Diameter, Stainless Steel Body.....	316.86	110.25
22 51 19 00-0052 Swimming Pool Chlorinators (22 51 19)		
22 51 19 00-0053 EA Swimming Pool Chlorinator, 50-100 PPD, Direct Cylinder Mounted Gas Chlorinator.....	917.19	105.10
22 51 23 Swimming Pool Equipment Controls (22 51)		
22 51 23 00-0001 Pentair Acu Drive XS Pool Pump Variable Frequency Drive (22 51 23)		
22 51 23 00-0002 EA 3 HP, 230 Volt AC, NEMA 1, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD030-2303-N01).....	2,546.32	154.69
22 51 23 00-0003 EA 5 HP, 230 Volt AC, NEMA 1, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD050-2303-N01).....	2,736.29	174.03
22 51 23 00-0004 EA 7-1/2 HP, 230 Volt AC, NEMA 1, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD075-2303-N01).....	3,279.98	217.53
22 51 23 00-0005 EA 10 HP, 230 Volt AC, NEMA 1, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD100-2303-N01).....	3,496.25	259.59
22 51 23 00-0006 EA 15 HP, 230 Volt AC, NEMA 1, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD150-2303-N01).....	3,749.11	302.13
22 51 23 00-0007 EA 20 HP, 230 Volt AC, NEMA 1, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD200-2303-N01).....	4,249.89	345.15
22 51 23 00-0008 EA 3 HP, 460 Volt AC, NEMA 1, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD030-4603-N01).....	2,549.47	154.69
22 51 23 00-0009 EA 5 HP, 460 Volt AC, NEMA 1, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD050-4603-N01).....	2,691.07	174.03
22 51 23 00-0010 EA 7-1/2 HP, 460 Volt AC, NEMA 1, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD075-4603-N01).....	2,909.78	217.53
22 51 23 00-0011 EA 10 HP, 460 Volt AC, NEMA 1, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD100-4603-N01).....	3,136.57	259.59



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 51 23 00-0012 EA 15 HP, 460 Volt AC, NEMA 1, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD150-4603-N01).....	3,697.57	302.13
22 51 23 00-0013 EA 20 HP, 460 Volt AC, NEMA 1, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD200-4603-N01).....	4,110.01	345.15
22 51 23 00-0014 EA 3 HP, Fused Bypass, 230 Volt AC, NEMA 1, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD030-2303-N01FB).....	3,276.20	154.69
22 51 23 00-0015 EA 5 HP, Fused Bypass, 230 Volt AC, NEMA 1, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD050-2303-N01FB).....	3,765.91	174.03
22 51 23 00-0016 EA 7-1/2 HP, Fused Bypass, 230 Volt AC, NEMA 1, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD075-2303-N01FB).....	4,192.85	217.53
22 51 23 00-0017 EA 10 HP, Fused Bypass, 230 Volt AC, NEMA 1, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD100-2303-N01FB).....	4,527.97	259.59
22 51 23 00-0018 EA 15 HP, Fused Bypass, 230 Volt AC, NEMA 1, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD150-2303-N01FB).....	5,329.81	302.13
22 51 23 00-0019 EA 20 HP, Fused Bypass, 230 Volt AC, NEMA 1, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD200-2303-N01FB).....	6,010.44	345.15
22 51 23 00-0020 EA 3 HP, Fused Bypass, 460 Volt AC, NEMA 1, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD030-4603-N01FB).....	3,514.93	154.69
22 51 23 00-0021 EA 5 HP, Fused Bypass, 460 Volt AC, NEMA 1, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD050-4603-N01FB).....	3,658.85	174.03
22 51 23 00-0022 EA 7-1/2 HP, Fused Bypass, 460 Volt AC, NEMA 1, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD075-4603-N01FB).....	3,874.19	217.53
22 51 23 00-0023 EA 10 HP, Fused Bypass, 460 Volt AC, NEMA 1, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD100-4603-N01FB).....	4,102.03	259.59
22 51 23 00-0024 EA 15 HP, Fused Bypass, 460 Volt AC, NEMA 1, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD150-4603-N01FB).....	4,683.02	302.13
22 51 23 00-0025 EA 20 HP, Fused Bypass, 460 Volt AC, NEMA 1, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD200-4603-N01FB).....	5,128.06	345.15
22 51 23 00-0026 EA 1/2 HP, 230 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD005-2303-N12).....	2,425.21	154.69
22 51 23 00-0027 EA 3/4 HP, 230 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD007-2303-N12).....	2,464.85	154.69
22 51 23 00-0028 EA 1 HP, 230 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD010-2303-N12).....	2,489.35	154.69
22 51 23 00-0029 EA 1-1/2 HP, 230 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD015-2303-N12).....	2,555.34	154.69
22 51 23 00-0030 EA 2 HP, 230 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD020-2303-N12).....	2,655.03	154.69
22 51 23 00-0031 EA 3 HP, 230 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD030-2303-N12).....	2,732.36	154.69
22 51 23 00-0032 EA 5 HP, 230 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD050-2303-N12).....	2,927.60	174.03
22 51 23 00-0033 EA 7-1/2 HP, 230 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD075-2303-N12).....	3,493.34	217.53
22 51 23 00-0034 EA 10 HP, 230 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD100-2303-N12).....	3,744.42	259.59
22 51 23 00-0035 EA 15 HP, 230 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD150-2303-N12).....	4,004.68	302.13
22 51 23 00-0036 EA 20 HP, 230 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD200-2303-N12).....	4,550.58	345.15
22 51 23 00-0037 EA 25 HP, 230 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD250-2303-N12).....	5,970.49	430.23
22 51 23 00-0038 EA 30 HP, 230 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD300-2303-N12).....	6,590.46	473.74
22 51 23 00-0039 EA 40 HP, 230 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD400-2303-N12).....	7,783.18	517.25
22 51 23 00-0040 EA 50 HP, 230 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD500-2303-N12).....	9,056.56	604.26
22 51 23 00-0041 EA 60 HP, 230 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD600-2303-N12).....	9,916.97	647.77
22 51 23 00-0042 EA 1/2 HP, 460 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD005-4603-N12).....	2,474.61	154.69
22 51 23 00-0043 EA 3/4 HP, 460 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD007-4603-N12).....	2,525.82	154.69
22 51 23 00-0044 EA 1 HP, 460 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD010-4603-N12).....	2,590.25	154.69
22 51 23 00-0045 EA 1-1/2 HP, 460 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD015-4603-N12).....	2,645.63	154.69
22 51 23 00-0046 EA 2 HP, 460 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD020-4603-N12).....	2,702.07	154.69
22 51 23 00-0047 EA 3 HP, 460 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD030-4603-N12).....	2,761.62	154.69
22 51 23 00-0048 EA 5 HP, 460 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD050-4603-N12).....	2,907.74	174.03
22 51 23 00-0049 EA 7-1/2 HP, 460 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD075-4603-N12).....	3,128.65	217.53
22 51 23 00-0050 EA 10 HP, 460 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD100-4603-N12).....	3,360.71	259.59
22 51 23 00-0051 EA 15 HP, 460 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD150-4603-N12).....	4,080.55	302.13
22 51 23 00-0052 EA 20 HP, 460 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD200-4603-N12).....	4,502.30	345.15
22 51 23 00-0053 EA 25 HP, 460 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD250-4603-N12).....	4,976.29	430.23

22 Plumbing**22 50 Pool And Fountain Plumbing Systems****22 51 Swimming Pool Plumbing Systems**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 51 23 00-0054 EA 30 HP, 460 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD300-4603-N12).....	5,625.01	473.74
22 51 23 00-0055 EA 40 HP, 460 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD400-4603-N12).....	6,345.68	517.25
22 51 23 00-0056 EA 50 HP, 460 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD500-4603-N12).....	7,768.32	604.26
22 51 23 00-0057 EA 60 HP, 460 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD600-4603-N12).....	8,530.13	647.77
22 51 23 00-0058 EA 75 HP, 460 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD750-4603-N12).....	9,555.61	691.28
22 51 23 00-0059 EA 100 HP, 460 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS ADC10-4603-N12).....	11,297.60	732.36
22 51 23 00-0060 EA 125 HP, 460 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS ADC13-4603-N12).....	13,009.31	773.46
22 51 23 00-0061 EA 150 HP, 460 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS ADC15-4603-N12).....	14,117.67	865.31
22 51 23 00-0062 EA 200 HP, 460 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS ADC20-4603-N12).....	16,463.86	947.48
22 51 23 00-0063 EA 1/2 HP, Fused Bypass, 230 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD005-2303-N12FB).....	3,482.23	154.69
22 51 23 00-0064 EA 3/4 HP, Fused Bypass, 230 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD007-2303-N12FB).....	3,521.88	154.69
22 51 23 00-0065 EA 1 HP, Fused Bypass, 230 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD010-2303-N12FB).....	3,546.37	154.69
22 51 23 00-0066 EA 1-1/2 HP, Fused Bypass, 230 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD015-2303-N12FB).....	3,612.36	154.69
22 51 23 00-0067 EA 2 HP, Fused Bypass, 230 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD020-2303-N12FB).....	3,712.06	154.69
22 51 23 00-0068 EA 3 HP, Fused Bypass, 230 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD030-2303-N12FB).....	3,789.39	154.69
22 51 23 00-0069 EA 5 HP, Fused Bypass, 230 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD050-2303-N12FB).....	3,984.62	174.03
22 51 23 00-0070 EA 7-1/2 HP, Fused Bypass, 230 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD075-2303-N12FB).....	4,430.70	217.53
22 51 23 00-0071 EA 10 HP, Fused Bypass, 230 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD100-2303-N12FB).....	4,804.00	259.59
22 51 23 00-0072 EA 15 HP, Fused Bypass, 230 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD150-2303-N12FB).....	5,627.02	302.13
22 51 23 00-0073 EA 20 HP, Fused Bypass, 230 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD200-2303-N12FB).....	6,360.21	345.15
22 51 23 00-0074 EA 25 HP, Fused Bypass, 230 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD250-2303-N12FB).....	7,493.50	430.23
22 51 23 00-0075 EA 30 HP, Fused Bypass, 230 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD300-2303-N12FB).....	8,249.86	473.74
22 51 23 00-0076 EA 40 HP, Fused Bypass, 230 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD400-2303-N12FB).....	10,515.22	517.25
22 51 23 00-0077 EA 50 HP, Fused Bypass, 230 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD500-2303-N12FB).....	13,843.92	604.26
22 51 23 00-0078 EA 60 HP, Fused Bypass, 230 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD600-2303-N12FB).....	15,210.38	647.77
22 51 23 00-0079 EA 1/2 HP, Fused Bypass, 460 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD005-4603-N12FB).....	3,467.23	154.69
22 51 23 00-0080 EA 3/4 HP, Fused Bypass, 460 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD007-4603-N12FB).....	3,518.43	154.69
22 51 23 00-0081 EA 1 HP, Fused Bypass, 460 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD010-4603-N12FB).....	3,582.86	154.69
22 51 23 00-0082 EA 1-1/2 HP, Fused Bypass, 460 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD015-4603-N12FB).....	3,638.25	154.69
22 51 23 00-0083 EA 2 HP, Fused Bypass, 460 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD020-4603-N12FB).....	3,694.67	154.69
22 51 23 00-0084 EA 3 HP, Fused Bypass, 460 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD030-4603-N12FB).....	3,754.24	154.69
22 51 23 00-0085 EA 5 HP, Fused Bypass, 460 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD050-4603-N12FB).....	3,900.36	174.03
22 51 23 00-0086 EA 7-1/2 HP, Fused Bypass, 460 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD075-4603-N12FB).....	4,120.19	217.53
22 51 23 00-0087 EA 10 HP, Fused Bypass, 460 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD100-4603-N12FB).....	4,352.25	259.59
22 51 23 00-0088 EA 15 HP, Fused Bypass, 460 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD150-4603-N12FB).....	5,093.62	302.13
22 51 23 00-0089 EA 20 HP, Fused Bypass, 460 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD200-4603-N12FB).....	5,548.69	345.15
22 51 23 00-0090 EA 25 HP, Fused Bypass, 460 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD250-4603-N12FB).....	6,093.60	430.23
22 51 23 00-0091 EA 30 HP, Fused Bypass, 460 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD300-4603-N12FB).....	6,864.67	473.74
22 51 23 00-0092 EA 40 HP, Fused Bypass, 460 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD400-4603-N12FB).....	8,117.26	517.25
22 51 23 00-0093 EA 50 HP, Fused Bypass, 460 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD500-4603-N12FB).....	9,342.79	604.26
22 51 23 00-0094 EA 60 HP, Fused Bypass, 460 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD600-4603-N12FB).....	10,394.76	647.77
22 51 23 00-0095 EA 75 HP, Fused Bypass, 460 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS AD750-4603-N12FB).....	12,054.26	691.28



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 51 23 00-0096 EA 100 HP, Fused Bypass, 460 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS ADC10-4603-N12FB).....	15,848.55	732.36
22 51 23 00-0097 EA 125 HP, Fused Bypass, 460 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS ADC13-4603-N12FB).....	17,522.72	773.46
22 51 23 00-0098 EA 150 HP, Fused Bypass, 460 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS ADC15-4603-N12FB).....	21,985.88	865.31
22 51 23 00-0099 EA 200 HP, Fused Bypass, 460 Volt AC, NEMA 12, 3 Phase, Pool Pump Variable Frequency Drive (Pentair Acu Drive XS ADC20-4603-N12FB).....	25,815.08	947.48
22 51 23 00-0100 EA 380+ Volt AC, Up To 10 HP, 260 Volt AC, Up To 3 HP, 3 Year Extended Warranty (Pentair AD-EWW136).....	234.82	
22 51 23 00-0101 EA 380+ Volt AC, 15 To 40 HP, 260 Volt AC, 5 To 25 HP, 3 Year Extended Warranty (Pentair AD-EWW236).....	374.72	
22 51 23 00-0102 EA 380+ Volt AC, Up To 10 HP, 260 Volt AC, Up To 3 HP, 6 Year Extended Warranty (Pentair AD-EWW172).....	414.69	
22 51 23 00-0103 EA 380+ Volt AC, 15 To 40 HP, 260 Volt AC, 5 To 25 HP, 6 Year Extended Warranty (Pentair AD-EWW272).....	704.47	
22 51 23 00-0104 EA 380+ Volt AC, 50 To 125 HP, 260 Volt AC, 30 To 60 HP, 6 Year Extended Warranty (Pentair AD-EWW372).....	1,343.99	
22 51 23 00-0105 EA 3" Clamp On Saddle Flow Sensor Kit, Integral 4 To 20 mA Output Signal (Pentair 97014-4203KIT).....	849.35	
22 51 23 00-0106 EA 4" Clamp On Saddle Flow Sensor Kit, Integral 4 To 20 mA Output Signal (Pentair 97014-4204KIT).....	888.31	
22 51 23 00-0107 EA 6" Clamp On Saddle Flow Sensor Kit, Integral 4 To 20 mA Output Signal (Pentair 97016-4206KIT).....	969.92	
22 51 23 00-0108 EA 8" Clamp On Saddle Flow Sensor Kit, Integral 4 To 20 mA Output Signal (Pentair 97016-4208KIT).....	1,040.87	
22 51 23 00-0109 EA 3" Clamp On Saddle Flow Sensor Kit, Wall Mounted Display/Transmitter, 4 To 20 mA Output Signal (Pentair 97014BL-03KIT).....	1,211.79	
22 51 23 00-0110 EA 4" Clamp On Saddle Flow Sensor Kit, Wall Mounted Display/Transmitter, 4 To 20 mA Output Signal (Pentair 97014BL-04KIT).....	1,248.42	
22 51 23 00-0111 EA 6" Clamp On Saddle Flow Sensor Kit, Wall Mounted Display/Transmitter, 4 To 20 mA Output Signal (Pentair 97016BL-06KIT).....	1,326.34	
22 51 23 00-0112 EA 8" Clamp On Saddle Flow Sensor Kit, Wall Mounted Display/Transmitter, 4 To 20 mA Output Signal (Pentair 97016BL-08KIT).....	1,395.12	
22 51 23 00-0113 EA 10" Clamp On Saddle Flow Sensor Kit, Wall Mounted Display/Transmitter, 4 To 20 mA Output Signal (Pentair 97020BL-10KIT).....	1,666.65	
22 51 23 00-0114 EA 12" Clamp On Saddle Flow Sensor Kit, Wall Mounted Display/Transmitter, 4 To 20 mA Output Signal (Pentair 97020BL-12KIT).....	1,674.63	
22 51 23 00-0115 Eco-Flow-E Aquatic Variable Frequency Drive And Options (22 51 23)		
22 51 23 00-0116 Eco-Flow-E Aquatic Variable Frequency Drive (22 51 23 00-0115)		
22 51 23 00-0117 EA 2 HP, 480 Volt, 3 Phase, 4 Amps Maximum, NEMA 12, Eco-Flow-E Aquatic Variable Frequency Drive (H2Flow EF-E-04-12-4).....	2,034.77	128.91
<i>For Bypass Panel, Add</i>	486.75	
22 51 23 00-0118 EA 3 HP, 480 Volt, 3 Phase, 6 Amps Maximum, NEMA 12, Eco-Flow-E Aquatic Variable Frequency Drive (H2Flow EF-E-06-12-4).....	2,036.67	128.91
<i>For Bypass Panel, Add</i>	486.75	
22 51 23 00-0119 EA 5 HP, 480 Volt, 3 Phase, 8 Amps Maximum, NEMA 12, Eco-Flow-E Aquatic Variable Frequency Drive (H2Flow EF-E-08-12-4).....	2,078.98	145.02
<i>For Bypass Panel, Add</i>	486.75	
22 51 23 00-0120 EA 7-1/2 HP, 480 Volt, 3 Phase, 12 Amps Maximum, NEMA 12, Eco-Flow-E Aquatic Variable Frequency Drive (H2Flow EF-E-12-12-4).....	2,172.33	181.28
<i>For Bypass Panel, Add</i>	486.75	
22 51 23 00-0121 EA 10 HP, 480 Volt, 3 Phase, 16 Amps Maximum, NEMA 12, Eco-Flow-E Aquatic Variable Frequency Drive (H2Flow EF-E-16-12-4).....	2,359.15	216.33
<i>For Bypass Panel, Add</i>	486.75	
22 51 23 00-0122 EA 15 HP, 480 Volt, 3 Phase, 24 Amps Maximum, NEMA 12, Eco-Flow-E Aquatic Variable Frequency Drive (H2Flow EF-E-24-12-4).....	2,630.73	251.78
<i>For Bypass Panel, Add</i>	572.51	
22 51 23 00-0123 EA 20 HP, 480 Volt, 3 Phase, 30 Amps Maximum, NEMA 12, Eco-Flow-E Aquatic Variable Frequency Drive (H2Flow EF-E-30-12-4).....	3,096.17	287.63
<i>For Bypass Panel, Add</i>	572.51	
22 51 23 00-0124 EA 25 HP, 480 Volt, 3 Phase, 39 Amps Maximum, NEMA 12, Eco-Flow-E Aquatic Variable Frequency Drive (H2Flow EF-E-39-12-4).....	3,251.93	360.14
<i>For Bypass Panel, Add</i>	572.51	
22 51 23 00-0125 EA 30 HP, 480 Volt, 3 Phase, 45 Amps Maximum, NEMA 12, Eco-Flow-E Aquatic Variable Frequency Drive (H2Flow EF-E-45-12-4).....	3,873.26	396.00
<i>For Bypass Panel, Add</i>	572.51	
22 51 23 00-0126 EA 40 HP, 480 Volt, 3 Phase, 61 Amps Maximum, NEMA 12, Eco-Flow-E Aquatic Variable Frequency Drive (H2Flow EF-E-61-12-4).....	4,005.37	431.45
<i>For Bypass Panel, Add</i>	692.35	
22 51 23 00-0127 EA 1/2 HP, 208/230 Volt, 1 Phase (1 HP, 208/230 Volt, 3 Phase) 8 Amps Maximum, NEMA 12, Eco-Flow-E Aquatic Variable Frequency Drive (H2Flow EF-E-08-12-2).....	2,024.04	128.91
<i>For Bypass Panel, Add</i>	486.75	
22 51 23 00-0128 EA 1 HP, 208/230 Volt, 1 Phase (2 HP, 208/230 Volt, 3 Phase) 12 Amps Maximum, NEMA 12, Eco-Flow-E Aquatic Variable Frequency Drive (H2Flow EF-E-12-12-2).....	2,026.57	128.91
<i>For Bypass Panel, Add</i>	486.75	
22 51 23 00-0129 EA 1-1/2 HP, 208/230 Volt, 1 Phase (3 HP, 208/230 Volt, 3 Phase) 16 Amps Maximum, NEMA 12, Eco-Flow-E Aquatic Variable Frequency Drive (H2Flow EF-E-16-12-2).....	2,038.56	128.91
<i>For Bypass Panel, Add</i>	486.75	
22 51 23 00-0130 EA 5 HP, 208/230 Volt, 1 Phase, 24 Amps Maximum, NEMA 12, Eco-Flow-E Aquatic Variable Frequency Drive (H2Flow EF-E-24-12-2).....	2,089.08	145.02
<i>For Bypass Panel, Add</i>	572.51	
22 51 23 00-0131 EA 3 HP, 208/230 Volt, 1 Phase (7-1/2 HP, 208/230 Volt, 3 Phase) 32 Amps Maximum, NEMA 12, Eco-Flow-E Aquatic Variable Frequency Drive (H2Flow EF-E-32-12-2).....	2,280.86	181.28
<i>For Bypass Panel, Add</i>	572.51	
22 51 23 00-0132 EA 5 HP, 208/230 Volt, 1 Phase (10 HP, 208/230 Volt, 3 Phase) 46 Amps Maximum, NEMA 12, Eco-Flow-E Aquatic Variable Frequency Drive (H2Flow EF-E-46-12-2).....	2,549.72	216.33
<i>For Bypass Panel, Add</i>	572.51	
22 51 23 00-0133 EA 7-1/2 HP, 208/230 Volt, 1 Phase (15 HP, 208/230 Volt, 3 Phase) 60 Amps Maximum, NEMA 12, Eco-Flow-E Aquatic Variable Frequency Drive (H2Flow EF-E-60-12-2).....	3,018.81	251.78
<i>For Bypass Panel, Add</i>	692.35	

22 Plumbing**22 50 Pool And Fountain Plumbing Systems****22 51 Swimming Pool Plumbing Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 51 23 00-0134	EA		10 HP, 208/230 Volt, 1 Phase (20 HP, 208/230 Volt, 3 Phase) 74 Amps Maximum, NEMA 12, Eco-Flow-E Aquatic Variable Frequency Drive (H2Flow EF-E-74-12-2)	3,102.49	287.63
			<i>For Bypass Panel, Add</i>	692.35	
22 51 23 00-0135	EA		25 HP, 208/230 Volt, 1 Phase, 88 Amps Maximum, NEMA 12, Eco-Flow-E Aquatic Variable Frequency Drive (H2Flow EF-E-88-12-2)	3,792.72	360.14
			<i>For Bypass Panel, Add</i>	928.31	
22 51 23 00-0136	EA		15 HP, 208/230 Volt, 1 Phase (30 HP, 208/230 Volt, 3 Phase) 124 Amps Maximum, NEMA 12, Eco-Flow-E Aquatic Variable Frequency Drive (H2Flow EF-E-124-12-2)	3,926.27	396.00
			<i>For Bypass Panel, Add</i>	1,263.96	
22 51 23 00-0137			Eco-Flow-E Aquatic Variable Frequency Drive Options <small>(22 51 23 00-0115)</small>		
22 51 23 00-0138	EA		0 To 30 PSI, 1/4" NPT Male Thread, 4 To 20 mA Output, 10' Cable, Pressure Sensor (H2Flow PS-30)	299.01	60.42
22 51 23 00-0139	EA		0 To 100 PSI, 1/4" NPT Male Thread, 4 To 20 mA Output, 10' Cable, Pressure Sensor (H2Flow PS-100)	299.01	60.42
22 51 23 00-0140	EA		Lightning Arrestor (H2Flow LA)	306.48	40.28
22 51 23 00-0141	EA		2 HP, 480 Volt, (3/4 HP, 208/230 Volt) Load Reactor (TCI V1K4A00)	331.58	18.13
22 51 23 00-0142	EA		3 HP, 480 Volt, (1 To 1-1/2 HP, 208/230 Volt) Load Reactor (TCI V1K6A00)	343.17	20.14
22 51 23 00-0143	EA		5 HP, 480 Volt, (2 HP, 208/230 Volt) Load Reactor (TCI V1K8A00)	352.26	22.16
22 51 23 00-0144	EA		7-1/2 HP, 480 Volt, (3 HP, 208/230 Volt) Load Reactor (TCI V1K12A00)	368.27	24.17
22 51 23 00-0145	EA		10 HP, 480 Volt, (5 HP, 208/230 Volt) Load Reactor (TCI V1K16A00)	376.08	26.18
22 51 23 00-0146	EA		15 HP, 480 Volt, (7-1/2 HP, 208/230 Volt) Load Reactor (TCI V1K25A00)	488.02	28.20
22 51 23 00-0147	EA		20 HP, 480 Volt, Load Reactor (TCI V1K27A00)	509.08	30.21
22 51 23 00-0148	EA		25 HP, 480 Volt, (10 HP, 208/230 Volt) Load Reactor (TCI V1K35A00)	532.05	32.23
22 51 23 00-0149	EA		30 HP, 480 Volt, (15 HP, 208/230 Volt) Load Reactor (TCI V1K45A00)	554.37	34.24
22 51 23 00-0150	EA		40 HP, 480 Volt, (20 HP, 208/230 Volt) Load Reactor (TCI V1K55A00)	574.17	36.26
22 51 23 00-0151	EA		25 To 30 HP, 208/230 Volt, Load Reactor (TCI V1K80A00)	783.91	38.27
22 51 23 00-0152	EA		1 HP, 208/230 Volt, Line Reactor (TCI KDRA25L)	107.80	20.14
22 51 23 00-0153	EA		2 HP, 208/230 Volt, Line Reactor (TCI KDRA27L)	115.63	22.16
22 51 23 00-0154	EA		3 HP, 208/230 Volt, Line Reactor (TCI KDRA28L)	129.11	24.17
22 51 23 00-0155	EA		5 HP, 208/230 Volt, Line Reactor (TCI KDRB22L)	167.22	26.18
22 51 23 00-0156	EA		7-1/2 HP, 208/230 Volt, Line Reactor (TCI KDRB23L)	187.02	28.20
22 51 23 00-0157	EA		10 HP, 208/230 Volt, Line Reactor (TCI KDRD25L)	194.20	30.21
22 51 23 00-0158	EA		15 HP, 208/230 Volt, Line Reactor (TCI KDRD24L)	201.39	32.23
22 51 23 00-0159	EA		20 HP, 208/230 Volt, Line Reactor (TCI KDRD26L)	213.61	34.24
22 51 23 00-0160	EA		25 HP, 208/230 Volt, Line Reactor (TCI KDRD22L)	266.86	36.26
22 51 23 00-0161	EA		30 HP, 208/230 Volt, Line Reactor (TCI KDRF24L)	274.68	38.27
22 51 23 00-0162	EA		1 HP, 480 Volt, Line Reactor (TCI KDRA8L)	108.43	20.14
22 51 23 00-0163	EA		2 HP, 480 Volt, Line Reactor (TCI KDRA1L)	119.41	22.16
22 51 23 00-0164	EA		3 HP, 480 Volt, Line Reactor (TCI KDRA2L)	131.00	24.17
22 51 23 00-0165	EA		5 HP, 480 Volt, Line Reactor (TCI KDRA3L)	138.19	26.18
22 51 23 00-0166	EA		7-1/2 HP, 480 Volt, Line Reactor (TCI KDRA4L)	144.74	28.20
22 51 23 00-0167	EA		10 HP, 480 Volt, Line Reactor (TCI KDRA5L)	179.05	30.21
22 51 23 00-0168	EA		15 HP, 480 Volt, Line Reactor (TCI KDRB2L)	186.88	32.23
22 51 23 00-0169	EA		20 HP, 480 Volt, Line Reactor (TCI KDRB1L)	196.58	34.24
22 51 23 00-0170	EA		25 HP, 480 Volt, Line Reactor (TCI KDRD1L)	203.76	36.26
22 51 23 00-0171	EA		30 HP, 480 Volt, Line Reactor (TCI KDRD2L)	243.13	38.27
22 51 23 00-0172	EA		40 HP, 480 Volt, Line Reactor (TCI KDRC1L)	264.20	40.28
22 51 23 00-0173	EA		Models 04 To 30, 304 SS Metric To English Conduit Adaptor Kit	43.18	
22 51 23 00-0174	EA		Models 32 To 46, 304 SS Metric To English Conduit Adaptor Kit	57.86	
22 51 23 00-0175	EA		Models 60 To 74, 304 SS Metric To English Conduit Adaptor Kit	71.29	
22 51 23 00-0176			Pool Flow Meters <small>(22 51 23)</small>		
22 51 23 00-0177	EA		20 To 110 GPM, 1-1/2" Retrofit Kit FlowVis For Existing Jandy Or Praher Valve Flow Meter (H2Flow FVJ-R-15)	78.87	14.70
22 51 23 00-0178	EA		20 To 110 GPM, 2" x 2-1/2" Retrofit Kit FlowVis For Existing Jandy® Or Praher Valve Flow Meter (H2Flow FVJ-R)	78.87	14.70
22 51 23 00-0179	EA		20 To 110 GPM, 1-1/2" Complete FlowVis Including Valve Body Flow Meter (H2Flow FV-C-15)	125.30	27.56
22 51 23 00-0180	EA		20 To 110 GPM, 2" x 2-1/2" Complete FlowVis Including Valve Body Flow Meter (H2Flow FV-C)	108.27	29.40
22 51 23 00-0181			Paddlewheel Flow Sensors <small>(22 51 23)</small>		
22 51 23 00-0182	EA		1/2" To 4" Pipe, Polypropylene Body, Black Polyvinylidene Fluoride (PVDF) Rotor, Paddlewheel Flow Sensor (Signet 3-2536-PO)	514.87	46.53
			Note: Includes 25' of cable (extendable to 200').		
22 51 23 00-0183	EA		1/2" To 4" Pipe, Polypropylene Body, Pulse/Flow Switch DCR Output Paddlewheel Flow Sensor (Signet 3-2537-1C-PO)	671.99	46.53
22 51 23 00-0184	EA		1/2" To 4" Pipe, Polypropylene Body, Pulse/Flow Switch SSR Output Paddlewheel Flow Sensor (Signet 3-2537-2C-PO)	671.99	46.53
22 51 23 00-0185	EA		1/2" To 4" Pipe, Polypropylene Body, Digital Output Paddlewheel Flow Sensor (Signet 3-2537-5C-PO)	696.60	46.53
22 51 23 00-0186	EA		1/2" To 4" Pipe, Polypropylene Body, 4 To 20 mA Output Paddlewheel Flow Sensor (Signet 3-2537-6C-PO)	723.11	46.53
22 51 23 00-0187	EA		1/2" To 4" Pipe, Polyvinylidene Fluoride (PVDF) Body, Pulse/Flow Switch DCR Output Paddlewheel Flow Sensor (Signet 3-2537-1C-TO)	773.27	46.53
22 51 23 00-0188	EA		1/2" To 4" Pipe, Polyvinylidene Fluoride (PVDF) Body, Pulse/Flow Switch SSR Output Paddlewheel Flow Sensor (Signet 3-2537-2C-TO)	773.27	46.53
22 51 23 00-0189	EA		1/2" To 4" Pipe, Polyvinylidene Fluoride (PVDF) Body, Digital Output Paddlewheel Flow Sensor (Signet 3-2537-5C-TO)	804.51	46.53
22 51 23 00-0190	EA		1/2" To 4" Pipe, Polyvinylidene Fluoride (PVDF) Body, 4 To 20 mA Output Paddlewheel Flow Sensor (Signet 3-2537-6C-TO)	834.80	46.53
22 51 23 00-0191	EA		>4" To 8" Pipe, Polypropylene Body, Black Polyvinylidene Fluoride (PVDF) Rotor, Paddlewheel Flow Sensor (Signet 3-2536-P1)	536.64	46.53
			Note: Includes 25' of cable (extendable to 200').		
22 51 23 00-0192	EA		>4" To 8" Pipe, Polypropylene Body, Pulse/Flow Switch DCR Output Paddlewheel Flow Sensor (Signet 3-2537-1C-P1)	696.60	46.53



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 51 23 00-0193 EA >4" To 8" Pipe, Polypropylene Body, Pulse/Flow Switch SSR Output Paddlewheel Flow Sensor (Signet 3-2537-2C-P1).....	696.60	46.53
22 51 23 00-0194 EA >4" To 8" Pipe, Polypropylene Body, Digital Output Paddlewheel Flow Sensor (Signet 3-2537-5C-P1).....	723.11	46.53
22 51 23 00-0195 EA >4" To 8" Pipe, Polypropylene Body, 4 To 20 mA Output Paddlewheel Flow Sensor (Signet 3-2537-6C-P1).....	747.72	46.53
22 51 23 00-0196 EA >8" Pipe, Polypropylene Body, Black Polyvinylidene Fluoride (PVDF) Rotor, Paddlewheel Flow Sensor (Signet 3-2536-P2).....	556.52	46.53
Note: Includes 25' of cable (extendable to 200').		
22 51 23 00-0197 EA 2" Pipe, Polyvinyl Chloride (PVC) Saddle Clamp For Flow Transducers (Signet PV8S020).....	166.67	
22 51 23 00-0198 EA 4" Pipe, Polyvinyl Chloride (PVC) Saddle Clamp For Flow Transducers (Signet PV8S040).....	230.50	
22 51 23 00-0199 EA 6" Pipe, Polyvinyl Chloride (PVC) Saddle Clamp For Flow Transducers (Signet PV8S060).....	283.92	
22 51 23 00-0200 EA 8" Pipe, Polyvinyl Chloride (PVC) Saddle Clamp For Flow Transducers (Signet PV8S080).....	348.69	
22 51 23 00-0201 EA 10" Pipe, Polyvinyl Chloride (PVC) Saddle Clamp For Flow Transducers (Signet PV8S100).....	459.85	
22 51 23 00-0202 EA 12" Pipe, Polyvinyl Chloride (PVC) Saddle Clamp For Flow Transducers (Signet PV8S120).....	467.83	
22 51 23 00-0203 EA 24 Volt DC, Power Supply 7.5 Watt, 300 mA (Signet 7300-7524).....	174.26	12.89
22 51 23 00-0204 EA 24 Volt DC, Power Supply 15 Watt, 600 mA (Signet 7300-1524).....	233.89	12.89
22 51 23 00-0205 EA 24 Volt DC, Power Supply 30 Watt, 1.3 Amp (Signet 7300-3024).....	285.00	12.89
22 51 23 00-0206 EA 24 Volt DC, Power Supply 50 Watt, 2.1 Amp (Signet 7300-5024).....	356.94	12.89
22 51 23 00-0207 EA 24 Volt DC, Power Supply 100 Watt, 4.2 Amp (Signet 7300-1024).....	489.45	12.89

22 60 Gas and Vacuum Systems For Laboratory And Healthcare Facilities ⁽²²⁾

22 66 Chemical-Waste Systems for Laboratory and Healthcare Facilities ^(22 60)

22 66 53 Laboratory Chemical-Waste And Vent Piping ^(22 66)

22 66 53 00-0001	Polypropylene Acid Resistant Drain-Waste-Vent (DWV) Pipe And Fittings ^(22 66 53)		
22 66 53 00-0002	Schedule 40 Polypropylene Acid Resistant DWV Pipe And Fusal Fittings ^(22 66 53 00-0001)		
22 66 53 00-0003	Schedule 40 Polypropylene Acid Resistant DWV Pipe ^(22 66 53 00-0002)		
22 66 53 00-0004	LF 1-1/2" Schedule 40 Polypropylene Acid Resistant DWV Pipe.....	9.90	4.19
	For Work In Restricted Working Space, Add	1.89	
	For Fire Retardant Thermoplastic Pipe (Proxylene), Add	1.60	
	For Schedule 80, Add	1.87	
22 66 53 00-0005	LF 2" Schedule 40 Polypropylene Acid Resistant DWV Pipe.....	11.95	4.70
	For Work In Restricted Working Space, Add	2.13	
	For Fire Retardant Thermoplastic Pipe (Proxylene), Add	2.16	
	For Schedule 80, Add	2.52	
22 66 53 00-0006	LF 3" Schedule 40 Polypropylene Acid Resistant DWV Pipe.....	19.04	6.84
	For Work In Restricted Working Space, Add	3.08	
	For Fire Retardant Thermoplastic Pipe (Proxylene), Add	3.90	
	For Schedule 80, Add	4.56	
22 66 53 00-0007	LF 4" Schedule 40 Polypropylene Acid Resistant DWV Pipe.....	25.80	8.90
	For Work In Restricted Working Space, Add	4.01	
	For Fire Retardant Thermoplastic Pipe (Proxylene), Add	5.53	
	For Schedule 80, Add	6.46	
22 66 53 00-0008	LF 6" Schedule 40 Polypropylene Acid Resistant DWV Pipe.....	42.01	13.09
	For Work In Restricted Working Space, Add	5.88	
	For Fire Retardant Thermoplastic Pipe (Proxylene), Add	9.97	
	For Schedule 80, Add	11.65	
22 66 53 00-0009	Schedule 40 Polypropylene Acid Resistant DWV Fusal 1/4 Bends ^(22 66 53 00-0002)		
22 66 53 00-0010	EA 1-1/2" Schedule 40 Polypropylene Acid Resistant DWV Fusal 1/4 Bend.....	38.17	15.81
	For Work In Restricted Working Space, Add	7.11	
22 66 53 00-0011	EA 2" Schedule 40 Polypropylene Acid Resistant DWV Fusal 1/4 Bend.....	49.24	20.87
	For Work In Restricted Working Space, Add	9.38	
22 66 53 00-0012	EA 3" Schedule 40 Polypropylene Acid Resistant DWV Fusal 1/4 Bend.....	66.34	23.89
	For Work In Restricted Working Space, Add	10.76	
22 66 53 00-0013	EA 4" Schedule 40 Polypropylene Acid Resistant DWV Fusal 1/4 Bend.....	95.96	31.60
	For Work In Restricted Working Space, Add	14.23	
22 66 53 00-0014	EA 6" Schedule 40 Polypropylene Acid Resistant DWV Fusal 1/4 Bend.....	189.30	46.67
	For Work In Restricted Working Space, Add	21.00	
22 66 53 00-0015	Schedule 40 Polypropylene Acid Resistant DWV Fusal 1/8 Bends ^(22 66 53 00-0002)		
22 66 53 00-0016	EA 1-1/2" Schedule 40 Polypropylene Acid Resistant DWV Fusal 1/8 Bend.....	37.93	15.81
	For Work In Restricted Working Space, Add	7.11	
22 66 53 00-0017	EA 2" Schedule 40 Polypropylene Acid Resistant DWV Fusal 1/8 Bend.....	48.59	20.87
	For Work In Restricted Working Space, Add	9.38	
22 66 53 00-0018	EA 3" Schedule 40 Polypropylene Acid Resistant DWV Fusal 1/8 Bend.....	67.59	23.89
	For Work In Restricted Working Space, Add	10.76	
22 66 53 00-0019	EA 4" Schedule 40 Polypropylene Acid Resistant DWV Fusal 1/8 Bend.....	83.42	31.60
	For Work In Restricted Working Space, Add	14.23	
22 66 53 00-0020	EA 6" Schedule 40 Polypropylene Acid Resistant DWV Fusal 1/8 Bend.....	169.86	46.67
	For Work In Restricted Working Space, Add	21.00	

22 Plumbing**22 60 Gas and Vacuum Systems For Laboratory And Healthcare Facilities****22 66 Chemical-Waste Systems for Laboratory and Healthcare Facilities**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 66 53 00-0021			Schedule 40 Polypropylene Acid Resistant DWV Fuseal Sanitary Tees (22 66 53 00-0002)		
22 66 53 00-0022	EA		1-1/2" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Sanitary Tee.....	68.65	33.81
			<i>For Work In Restricted Working Space, Add</i>	15.21	
22 66 53 00-0023	EA		2" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Sanitary Tee.....	85.43	42.63
			<i>For Work In Restricted Working Space, Add</i>	19.17	
22 66 53 00-0024	EA		3" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Sanitary Tee.....	113.05	46.67
			<i>For Work In Restricted Working Space, Add</i>	21.00	
22 66 53 00-0025	EA		4" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Sanitary Tee.....	156.35	61.30
			<i>For Work In Restricted Working Space, Add</i>	27.56	
22 66 53 00-0026	EA		6" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Sanitary Tee.....	275.22	98.05
			<i>For Work In Restricted Working Space, Add</i>	44.10	
22 66 53 00-0027			Schedule 40 Polypropylene Acid Resistant DWV Fuseal Reducing Sanitary Tees (22 66 53 00-0002)		
22 66 53 00-0028	EA		2" x 2" x 1-1/2" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Reducing Sanitary Tee.....	85.40	42.63
			<i>For Work In Restricted Working Space, Add</i>	19.17	
22 66 53 00-0029	EA		3" x 3" x 2" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Reducing Sanitary Tee.....	110.05	46.67
			<i>For Work In Restricted Working Space, Add</i>	21.00	
22 66 53 00-0030	EA		3" x 3" x 1-1/2" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Reducing Sanitary Tee.....	107.38	46.67
			<i>For Work In Restricted Working Space, Add</i>	21.00	
22 66 53 00-0031	EA		4" x 4" x 2" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Reducing Sanitary Tee.....	149.50	61.30
			<i>For Work In Restricted Working Space, Add</i>	27.56	
22 66 53 00-0032	EA		4" x 4" x 3" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Reducing Sanitary Tee.....	152.08	61.30
			<i>For Work In Restricted Working Space, Add</i>	27.56	
22 66 53 00-0033	EA		6" x 6" x 4" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Reducing Sanitary Tee.....	256.14	98.05
			<i>For Work In Restricted Working Space, Add</i>	44.10	
22 66 53 00-0034			Schedule 40 Polypropylene Acid Resistant DWV Fuseal Cleanout Tees With Plug (22 66 53 00-0002)		
22 66 53 00-0035	EA		1-1/2" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Cleanout Tee With Plug.....	77.42	33.81
			<i>For Work In Restricted Working Space, Add</i>	15.21	
22 66 53 00-0036	EA		2" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Cleanout Tee With Plug.....	87.55	42.63
			<i>For Work In Restricted Working Space, Add</i>	19.17	
22 66 53 00-0037	EA		3" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Cleanout Tee With Plug.....	119.55	46.67
			<i>For Work In Restricted Working Space, Add</i>	21.00	
22 66 53 00-0038	EA		4" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Cleanout Tee With Plug.....	159.34	61.30
			<i>For Work In Restricted Working Space, Add</i>	27.56	
22 66 53 00-0039	EA		6" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Cleanout Tee With Plug.....	238.22	98.05
			<i>For Work In Restricted Working Space, Add</i>	44.10	
22 66 53 00-0040			Schedule 40 Polypropylene Acid Resistant DWV Fuseal Wyes (22 66 53 00-0002)		
22 66 53 00-0041	EA		1-1/2" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Wye.....	73.58	33.81
			<i>For Work In Restricted Working Space, Add</i>	15.21	
22 66 53 00-0042	EA		2" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Wye.....	89.99	42.63
			<i>For Work In Restricted Working Space, Add</i>	19.17	
22 66 53 00-0043	EA		3" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Wye.....	115.77	46.67
			<i>For Work In Restricted Working Space, Add</i>	21.00	
22 66 53 00-0044	EA		4" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Wye.....	158.60	61.30
			<i>For Work In Restricted Working Space, Add</i>	27.56	
22 66 53 00-0045	EA		6" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Wye.....	316.39	98.05
			<i>For Work In Restricted Working Space, Add</i>	44.10	
22 66 53 00-0046			Schedule 40 Polypropylene Acid Resistant DWV Fuseal Reducing Wyes (22 66 53 00-0002)		
22 66 53 00-0047	EA		2" x 2" x 1-1/2" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Reducing Wye.....	96.02	42.63
			<i>For Work In Restricted Working Space, Add</i>	19.17	
22 66 53 00-0048	EA		3" x 3" x 1-1/2" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Reducing Wye.....	112.68	46.67
			<i>For Work In Restricted Working Space, Add</i>	21.00	
22 66 53 00-0049	EA		3" x 3" x 2" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Reducing Wye.....	112.68	46.67
			<i>For Work In Restricted Working Space, Add</i>	21.00	
22 66 53 00-0050	EA		4" x 4" x 2" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Reducing Wye.....	155.93	61.30
			<i>For Work In Restricted Working Space, Add</i>	27.56	
22 66 53 00-0051	EA		4" x 4" x 3" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Reducing Wye.....	155.93	61.30
			<i>For Work In Restricted Working Space, Add</i>	27.56	
22 66 53 00-0052	EA		6" x 6" x 2" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Reducing Wye.....	280.93	98.05
			<i>For Work In Restricted Working Space, Add</i>	44.10	
22 66 53 00-0053	EA		6" x 6" x 3" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Reducing Wye.....	283.00	98.05
			<i>For Work In Restricted Working Space, Add</i>	44.10	
22 66 53 00-0054	EA		6" x 6" x 4" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Reducing Wye.....	257.01	98.05
			<i>For Work In Restricted Working Space, Add</i>	44.10	
22 66 53 00-0055			Schedule 40 Polypropylene Acid Resistant DWV Fuseal Sanitary Crosses (22 66 53 00-0002)		
22 66 53 00-0056	EA		1-1/2" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Sanitary Cross.....	91.53	42.26
			<i>For Work In Restricted Working Space, Add</i>	19.01	
22 66 53 00-0057	EA		2" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Sanitary Cross.....	113.64	53.29
			<i>For Work In Restricted Working Space, Add</i>	23.97	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 66 53 00-0058 EA 3" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Sanitary Cross..... <i>For Work In Restricted Working Space, Add</i>	154.99 26.25	58.36
22 66 53 00-0059 EA 4" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Sanitary Cross..... <i>For Work In Restricted Working Space, Add</i>	215.91 34.45	76.59
22 66 53 00-0060 EA 6" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Sanitary Cross..... <i>For Work In Restricted Working Space, Add</i>	384.75 55.13	122.53
22 66 53 00-0061 Schedule 40 Polypropylene Acid Resistant DWV Fuseal Combination Wye And 1/8 Bends <small>(22 66 53 00-0002)</small>		
22 66 53 00-0062 EA 1-1/2" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Combination Wye And 1/8 Bend..... <i>For Work In Restricted Working Space, Add</i>	67.05 15.21	33.81
22 66 53 00-0063 EA 2" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Combination Wye And 1/8 Bend..... <i>For Work In Restricted Working Space, Add</i>	87.81 19.17	42.63
22 66 53 00-0064 EA 3" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Combination Wye And 1/8 Bend..... <i>For Work In Restricted Working Space, Add</i>	100.58 21.00	46.67
22 66 53 00-0065 EA 4" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Combination Wye And 1/8 Bend..... <i>For Work In Restricted Working Space, Add</i>	139.44 27.56	61.30
22 66 53 00-0066 EA 2" x 2" x 1-1/2" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Combination Wye And 1/8 Bend..... <i>For Work In Restricted Working Space, Add</i>	80.70 19.17	42.63
22 66 53 00-0067 EA 3" x 3" x 1-1/2" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Combination Wye And 1/8 Bend..... <i>For Work In Restricted Working Space, Add</i>	97.72 21.00	46.67
22 66 53 00-0068 EA 3" x 3" x 2" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Combination Wye And 1/8 Bend..... <i>For Work In Restricted Working Space, Add</i>	98.87 21.00	46.67
22 66 53 00-0069 EA 4" x 4" x 2" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Combination Wye And 1/8 Bend..... <i>For Work In Restricted Working Space, Add</i>	135.18 27.56	61.30
22 66 53 00-0070 EA 4" x 4" x 3" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Combination Wye And 1/8 Bend..... <i>For Work In Restricted Working Space, Add</i>	135.91 27.56	61.30
22 66 53 00-0071 Schedule 40 Polypropylene Acid Resistant DWV Fuseal P-Traps <small>(22 66 53 00-0002)</small>		
22 66 53 00-0072 EA 1-1/2" Schedule 40 Polypropylene Acid Resistant DWV Fuseal P-Trap..... <i>For Work In Restricted Working Space, Add</i>	79.32 17.64	39.25
22 66 53 00-0073 EA 2" Schedule 40 Polypropylene Acid Resistant DWV Fuseal P-Trap..... <i>For Work In Restricted Working Space, Add</i>	105.60 23.21	51.60
22 66 53 00-0074 EA 3" Schedule 40 Polypropylene Acid Resistant DWV Fuseal P-Trap..... <i>For Work In Restricted Working Space, Add</i>	160.53 31.50	70.05
22 66 53 00-0075 EA 4" Schedule 40 Polypropylene Acid Resistant DWV Fuseal P-Trap..... <i>For Work In Restricted Working Space, Add</i>	226.95 40.09	89.16
22 66 53 00-0076 Schedule 40 Polypropylene Acid Resistant DWV Fuseal Hub Adapters <small>(22 66 53 00-0002)</small>		
22 66 53 00-0077 EA 1-1/2" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Hub Adapter..... <i>For Work In Restricted Working Space, Add</i>	37.49 7.11	15.81
22 66 53 00-0078 EA 2" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Hub Adapter..... <i>For Work In Restricted Working Space, Add</i>	45.64 9.38	20.87
22 66 53 00-0079 EA 3" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Hub Adapter..... <i>For Work In Restricted Working Space, Add</i>	53.62 10.76	23.89
22 66 53 00-0080 EA 4" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Hub Adapter..... <i>For Work In Restricted Working Space, Add</i>	73.04 14.23	31.60
22 66 53 00-0081 EA 6" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Hub Adapter..... <i>For Work In Restricted Working Space, Add</i>	108.36 21.00	46.67
22 66 53 00-0082 Schedule 40 Polypropylene Acid Resistant DWV Fuseal Mechanical Joint Adapters <small>(22 66 53 00-0002)</small>		
22 66 53 00-0083 EA 1-1/2" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Mechanical Joint Adapter..... <i>For Work In Restricted Working Space, Add</i>	35.76 7.11	15.81
22 66 53 00-0084 EA 2" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Mechanical Joint Adapter..... <i>For Work In Restricted Working Space, Add</i>	46.95 9.38	20.87
22 66 53 00-0085 EA 3" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Mechanical Joint Adapter..... <i>For Work In Restricted Working Space, Add</i>	56.02 10.76	23.89
22 66 53 00-0086 EA 4" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Mechanical Joint Adapter..... <i>For Work In Restricted Working Space, Add</i>	75.39 14.23	31.60
22 66 53 00-0087 Schedule 40 Polypropylene Acid Resistant DWV Fuseal Couplings <small>(22 66 53 00-0002)</small>		
22 66 53 00-0088 EA 1-1/2" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Coupling..... <i>For Work In Restricted Working Space, Add</i>	33.61 7.11	15.81
22 66 53 00-0089 EA 2" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Coupling..... <i>For Work In Restricted Working Space, Add</i>	43.09 9.38	20.87
22 66 53 00-0090 EA 3" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Coupling..... <i>For Work In Restricted Working Space, Add</i>	50.18 10.76	23.89
22 66 53 00-0091 EA 4" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Coupling..... <i>For Work In Restricted Working Space, Add</i>	66.37 14.23	31.60
22 66 53 00-0092 EA 6" Schedule 40 Polypropylene Acid Resistant DWV Fuseal Coupling..... <i>For Work In Restricted Working Space, Add</i>	97.55 21.00	46.67

22 Plumbing**22 60 Gas and Vacuum Systems For Laboratory And Healthcare Facilities****22 66 Chemical-Waste Systems for Laboratory and Healthcare Facilities**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 66 53 00-0093	Bell And Spigot High Silicon Iron Alloy Acid Resistant Drain-Waste-Vent (DWV) Pipe And Fittings <small>(22 66 53)</small> Note: Acid resistant. ASTM A518.	
22 66 53 00-0094	Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Pipe <small>(22 66 53 00-0093)</small>	
22 66 53 00-0095 LF	2" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Pipe	62.49 6.54
22 66 53 00-0096 LF	3" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Pipe	87.69 8.16
22 66 53 00-0097 LF	4" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Pipe	118.91 9.41
22 66 53 00-0098 LF	6" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Pipe	195.75 13.96
22 66 53 00-0099 LF	8" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Pipe	343.29 18.51
22 66 53 00-0100 LF	10" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Pipe	604.30 23.35
22 66 53 00-0101 LF	12" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Pipe	1,074.52 31.45
22 66 53 00-0102	Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Fittings <small>(22 66 53 00-0093)</small>	
22 66 53 00-0103	Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Long Sweeps <small>(22 66 53 00-0102)</small>	
22 66 53 00-0104 EA	2" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Long Sweep	256.93 55.71
22 66 53 00-0105 EA	3" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Long Sweep	333.06 61.30
22 66 53 00-0106 EA	4" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Long Sweep	534.59 73.36
22 66 53 00-0107 EA	6" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Long Sweep	798.04 92.22
22 66 53 00-0108 EA	8" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Long Sweep	1,812.25 148.75
22 66 53 00-0109	Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV 1/4 Bends <small>(22 66 53 00-0102)</small>	
22 66 53 00-0110 EA	2" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV 1/4 Bend	155.28 55.71
22 66 53 00-0111 EA	3" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV 1/4 Bend	199.52 61.30
22 66 53 00-0112 EA	4" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV 1/4 Bend	249.56 73.36
22 66 53 00-0113 EA	6" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV 1/4 Bend	640.57 92.22
22 66 53 00-0114 EA	8" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV 1/4 Bend	1,432.94 148.75
22 66 53 00-0115 EA	10" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV 1/4 Bend	2,164.22 185.33
22 66 53 00-0116 EA	12" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV 1/4 Bend	3,163.60 222.87
22 66 53 00-0117	Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV 1/8 Bends <small>(22 66 53 00-0102)</small>	
22 66 53 00-0118 EA	2" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV 1/8 Bend	155.28 55.71
22 66 53 00-0119 EA	3" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV 1/8 Bend	199.52 61.30
22 66 53 00-0120 EA	4" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV 1/8 Bend	249.56 73.36
22 66 53 00-0121 EA	6" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV 1/8 Bend	477.12 92.22
22 66 53 00-0122 EA	8" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV 1/8 Bend	1,221.65 148.75
22 66 53 00-0123 EA	10" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV 1/8 Bend	1,775.83 185.33
22 66 53 00-0124 EA	12" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV 1/8 Bend	2,506.13 222.87
22 66 53 00-0125	Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV 1/16 Bends <small>(22 66 53 00-0102)</small>	
22 66 53 00-0126 EA	2" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV 1/16 Bend	155.28 55.71
22 66 53 00-0127 EA	3" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV 1/16 Bend	199.52 61.30
22 66 53 00-0128 EA	4" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV 1/16 Bend	249.59 73.28
22 66 53 00-0129	Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Short Sweeps <small>(22 66 53 00-0102)</small>	
22 66 53 00-0130 EA	2" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Short Sweep	207.10 55.71
22 66 53 00-0131 EA	3" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Short Sweep	356.98 61.30
22 66 53 00-0132 EA	4" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Short Sweep	401.05 73.36
22 66 53 00-0133	Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Sanitary Tees <small>(22 66 53 00-0102)</small>	
22 66 53 00-0134 EA	2" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Sanitary Tee	220.68 83.35
22 66 53 00-0135 EA	3" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Sanitary Tee	274.07 92.39
22 66 53 00-0136 EA	4" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Sanitary Tee	376.71 110.32
22 66 53 00-0137 EA	6" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Sanitary Tee	626.36 138.59
22 66 53 00-0138 EA	8" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Sanitary Tee	1,851.70 223.32
22 66 53 00-0139 EA	10" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Sanitary Tee	2,617.57 278.85
22 66 53 00-0140	Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Reducing Sanitary Tees <small>(22 66 53 00-0102)</small>	
22 66 53 00-0141 EA	2" x 1-1/2" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Reducing Sanitary Tee	207.51 79.90
22 66 53 00-0142 EA	3" x 1-1/2" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Reducing Sanitary Tee	240.25 85.78
22 66 53 00-0143 EA	3" x 2" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Reducing Sanitary Tee	266.67 88.79
22 66 53 00-0144 EA	4" x 1-1/2" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Reducing Sanitary Tee	304.47 98.05
22 66 53 00-0145 EA	4" x 2" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Reducing Sanitary Tee	325.10 101.13
22 66 53 00-0146 EA	4" x 3" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Reducing Sanitary Tee	355.43 104.16
22 66 53 00-0147 EA	6" x 2" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Reducing Sanitary Tee	449.22 119.92
22 66 53 00-0148 EA	6" x 3" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Reducing Sanitary Tee	495.39 123.01
22 66 53 00-0149 EA	6" x 4" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Reducing Sanitary Tee	551.70 128.67



	MINOR	CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 66 53 00-0150		Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Tees <small>(22 66 53 00-0102)</small>		
	EA	2" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Tee.....	248.54	83.35
	EA	3" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Tee.....	297.62	92.17
	EA	4" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Tee.....	402.60	110.32
22 66 53 00-0154		Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Reducing Tees <small>(22 66 53 00-0102)</small>		
	EA	2" x 1-1/2" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Reducing Tee.....	235.40	79.90
	EA	3" x 2" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Reducing Tee.....	291.20	89.23
	EA	4" x 2" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Reducing Tee.....	349.45	101.44
	EA	4" x 3" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Reducing Tee.....	373.82	104.45
22 66 53 00-0159		Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Wyes <small>(22 66 53 00-0102)</small>		
	EA	2" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Wye.....	218.84	83.49
	EA	3" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Wye.....	296.00	92.39
	EA	4" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Wye.....	376.58	110.25
	EA	6" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Wye.....	629.55	138.07
	EA	8" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Wye.....	2,301.83	223.10
22 66 53 00-0165		Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Reducing Wyes <small>(22 66 53 00-0102)</small>		
	EA	2" x 1-1/2" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Reducing Wye.....	223.44	79.90
	EA	3" x 1-1/2" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Reducing Wye.....	240.21	85.78
	EA	3" x 2" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Reducing Wye.....	253.49	89.31
	EA	4" x 1-1/2" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Reducing Wye.....	282.54	98.05
	EA	4" x 2" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Reducing Wye.....	293.39	101.28
	EA	4" x 3" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Reducing Wye.....	347.91	104.45
	EA	6" x 2" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Reducing Wye.....	471.05	120.07
	EA	6" x 3" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Reducing Wye.....	553.19	123.01
	EA	6" x 4" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Reducing Wye.....	577.61	128.67
	EA	8" x 3" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Reducing Wye.....	1,368.14	179.98
	EA	8" x 4" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Reducing Wye.....	1,474.72	185.93
	EA	8" x 6" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Reducing Wye.....	1,793.88	195.44
22 66 53 00-0178		Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Combination Wye And 1/8 Bends <small>(22 66 53 00-0102)</small>		
	EA	2" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Combination Wye And 1/8 Bend.....	256.47	83.35
	EA	3" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Combination Wye And 1/8 Bend.....	303.60	92.17
	EA	4" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Combination Wye And 1/8 Bend.....	442.46	110.32
	EA	6" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Combination Wye And 1/8 Bend.....	681.63	138.22
22 66 53 00-0183		Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Reducing Combination Wye And 1/8 Bends <small>(22 66 53 00-0102)</small>		
	EA	2" x 1-1/2" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Reducing Combination Wye And 1/8 Bend.....	215.47	79.90
	EA	3" x 1-1/2" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Reducing Combination Wye And 1/8 Bend.....	248.19	85.78
	EA	3" x 2" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Reducing Combination Wye And 1/8 Bend.....	273.26	89.23
	EA	4" x 1-1/2" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Reducing Combination Wye And 1/8 Bend.....	296.49	98.05
	EA	4" x 2" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Reducing Combination Wye And 1/8 Bend.....	339.49	101.44
	EA	4" x 3" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Reducing Combination Wye And 1/8 Bend.....	381.76	104.37
	EA	6" x 2" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Reducing Combination Wye And 1/8 Bend.....	496.91	120.07
	EA	6" x 3" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Reducing Combination Wye And 1/8 Bend.....	611.06	123.08
	EA	6" x 4" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Reducing Combination Wye And 1/8 Bend.....	667.62	128.89
22 66 53 00-0193		Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Reducers <small>(22 66 53 00-0102)</small>		
	EA	2" x 1-1/2" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Reducer.....	134.47	52.48
	EA	3" x 1-1/2" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Reducer.....	146.84	55.42
	EA	3" x 2" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Reducer.....	163.21	58.36
	EA	4" x 2" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Reducer.....	254.49	64.69
	EA	4" x 3" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Reducer.....	266.88	67.70
	EA	6" x 3" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Reducer.....	294.77	76.94
	EA	6" x 4" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Reducer.....	377.32	82.82
	EA	8" x 4" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Reducer.....	543.97	111.59
	EA	8" x 6" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Reducer.....	580.08	121.03
22 66 53 00-0203		Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Sanitary Increases <small>(22 66 53 00-0102)</small>		
	EA	2" x 3" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Sanitary Increaser.....	355.17	122.53
	EA	2" x 4" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Sanitary Increaser.....	458.82	122.53
	EA	3" x 4" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Sanitary Increaser.....	468.12	122.53
	EA	4" x 6" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Sanitary Increaser.....	546.21	171.58

22 Plumbing**22 60 Gas and Vacuum Systems For Laboratory And Healthcare Facilities****22 66 Chemical-Waste Systems for Laboratory and Healthcare Facilities**

MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
22 66 53 00-0208		Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV P-Traps <small>(22 66 53 00-0102)</small>			
22 66 53 00-0209	EA	2" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV P-Trap	374.53		55.71
22 66 53 00-0210	EA	3" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV P-Trap	450.67		61.30
22 66 53 00-0211	EA	4" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV P-Trap	548.55		73.36
22 66 53 00-0212	EA	6" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV P-Trap	1,591.35		92.22
22 66 53 00-0213		Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Double Hubs <small>(22 66 53 00-0102)</small>			
22 66 53 00-0214	EA	2" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Double Hub	193.15		55.71
22 66 53 00-0215	EA	3" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Double Hub	241.37		61.30
22 66 53 00-0216	EA	4" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Double Hub	329.29		73.36
22 66 53 00-0217	EA	6" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Double Hub	428.95		92.22
22 66 53 00-0218	EA	8" Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Double Hub	818.82		128.67
22 66 53 00-0219		Joint Material For Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Pipe And Fittings <small>(22 66 53 00-0093)</small>			
Note: Labor costs for installation of lead and oakum are included in the installation costs for fittings.					
22 66 53 00-0220	LB	Lead (1 LB/Diameter Inch) Joint Material For Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Pipe And Fittings.....	1.55		
22 66 53 00-0221	LB	Seal-Tite Packing (1/8 LB/Diameter Inch) Joint Material For Bell And Spigot High Silicon Iron Alloy Acid Resistant DWV Pipe And Fittings	36.54		
22 66 53 00-0222		Mechanical Joint High Silicon Iron Alloy Acid Resistant Drain-Waste-Vent (DWV) Pipe And Fittings <small>(22 66 53)</small>			
Note: ASTM A518.					
22 66 53 00-0223		Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Pipe <small>(22 66 53 00-0222)</small>			
22 66 53 00-0224	LF	1-1/2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Pipe.....	49.51		4.93
22 66 53 00-0225	LF	2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Pipe.....	56.31		5.44
22 66 53 00-0226	LF	3" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Pipe.....	77.51		6.84
22 66 53 00-0227	LF	4" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Pipe.....	97.57		7.94
22 66 53 00-0228		Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Fittings <small>(22 66 53 00-0222)</small>			
22 66 53 00-0229		Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Long Sweeps <small>(22 66 53 00-0228)</small>			
22 66 53 00-0230	EA	1-1/2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Long Sweep	188.10		39.03
22 66 53 00-0231	EA	2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Long Sweep	203.68		44.10
22 66 53 00-0232	EA	3" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Long Sweep	276.23		48.66
22 66 53 00-0233	EA	4" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Long Sweep	333.37		58.80
22 66 53 00-0234		Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV 1/4 Bends <small>(22 66 53 00-0228)</small>			
22 66 53 00-0235	EA	1-1/2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV 1/4 Bend.....	110.36		39.03
22 66 53 00-0236	EA	2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV 1/4 Bend.....	131.24		43.66
22 66 53 00-0237	EA	3" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV 1/4 Bend.....	166.85		48.81
22 66 53 00-0238	EA	4" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV 1/4 Bend.....	217.10		58.36
22 66 53 00-0239	EA	2" x 1-1/2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV 1/4 Bend.....	127.60		41.23
22 66 53 00-0240		Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV 1/8 Bends <small>(22 66 53 00-0228)</small>			
22 66 53 00-0241	EA	1-1/2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV 1/8 Bend.....	110.36		39.03
22 66 53 00-0242	EA	2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV 1/8 Bend.....	131.24		43.66
22 66 53 00-0243	EA	3" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV 1/8 Bend.....	166.85		48.81
22 66 53 00-0244	EA	4" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV 1/8 Bend.....	217.10		58.36
22 66 53 00-0245		Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV 1/6 Bends <small>(22 66 53 00-0228)</small>			
22 66 53 00-0246	EA	1-1/2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV 1/6 Bend.....	128.30		39.03
22 66 53 00-0247	EA	2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV 1/6 Bend.....	159.14		43.66
22 66 53 00-0248	EA	3" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV 1/6 Bend.....	240.60		48.81
22 66 53 00-0249	EA	4" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV 1/6 Bend.....	270.92		58.36
22 66 53 00-0250		Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV 1/16 Bends <small>(22 66 53 00-0228)</small>			
22 66 53 00-0251	EA	1-1/2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV 1/16 Bend.....	124.32		39.03
22 66 53 00-0252	EA	2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV 1/16 Bend.....	147.18		43.66
22 66 53 00-0253	EA	3" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV 1/16 Bend.....	222.66		48.81
22 66 53 00-0254	EA	4" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV 1/16 Bend.....	252.98		58.36



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 66 53 00-0255				Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Double Branch 1/4 Bends <small>(22 66 53 00-0228)</small>		
22 66 53 00-0256	EA			1-1/2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Double Branch 1/4 Bend.....	187.71	58.73
22 66 53 00-0257				Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Sanitary Straight Tees <small>(22 66 53 00-0228)</small>		
22 66 53 00-0258	EA			1-1/2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Sanitary Straight Tee	155.82	58.73
22 66 53 00-0259	EA			2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Sanitary Straight Tee	190.87	66.15
22 66 53 00-0260	EA			3" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Sanitary Straight Tee	248.06	73.72
22 66 53 00-0261	EA			4" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Sanitary Straight Tee	369.50	88.28
22 66 53 00-0262				Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Sanitary Reducing Tees <small>(22 66 53 00-0228)</small>		
22 66 53 00-0263	EA			2" x 1-1/2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Sanitary Reducing Tee	179.16	63.65
22 66 53 00-0264	EA			3" x 1-1/2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Sanitary Reducing Tee	216.51	68.65
22 66 53 00-0265	EA			3" x 2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Reducing Tee.....	230.10	71.07
22 66 53 00-0266	EA			4" x 1-1/2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Sanitary Reducing Tee	247.10	78.43
22 66 53 00-0267	EA			4" x 2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Sanitary Reducing Tee.....	270.41	80.63
22 66 53 00-0268	EA			4" x 3" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Sanitary Reducing Tee.....	292.01	83.06
22 66 53 00-0269				Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Wyes <small>(22 66 53 00-0228)</small>		
22 66 53 00-0270	EA			1-1/2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Wye.....	156.11	58.94
22 66 53 00-0271	EA			2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Wye.....	182.90	66.15
22 66 53 00-0272	EA			3" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Wye.....	240.09	73.72
22 66 53 00-0273	EA			4" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Wye.....	369.50	88.28
22 66 53 00-0274				Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Reducing Wyes <small>(22 66 53 00-0228)</small>		
22 66 53 00-0275	EA			2" x 1-1/2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Reducing Wye.....	173.68	64.02
22 66 53 00-0276	EA			3" x 1-1/2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Reducing Wye.....	210.51	68.57
22 66 53 00-0277	EA			3" x 2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Reducing Wye.....	220.47	71.29
22 66 53 00-0278	EA			4" x 1-1/2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Reducing Wye.....	247.46	78.65
22 66 53 00-0279	EA			4" x 2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Reducing Wye.....	271.06	81.08
22 66 53 00-0280	EA			4" x 3" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Reducing Wye.....	286.34	83.27
22 66 53 00-0281				Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Double Wyes <small>(22 66 53 00-0228)</small>		
22 66 53 00-0282	EA			1-1/2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Double Wye	231.32	78.50
22 66 53 00-0283	EA			2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Double Wye	291.86	88.35
22 66 53 00-0284	EA			3" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Double Wye	369.78	97.76
22 66 53 00-0285	EA			4" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Double Wye	479.19	117.52
22 66 53 00-0286	EA			2" x 1-1/2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Double Wye	254.24	83.13
22 66 53 00-0287	EA			3" x 1-1/2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Double Wye	283.50	88.06
22 66 53 00-0288	EA			3" x 2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Double Wye	334.68	92.90
22 66 53 00-0289	EA			4" x 2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Double Wye	369.50	102.91
22 66 53 00-0290	EA			4" x 3" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Double Wye	441.11	108.12
22 66 53 00-0291				Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Sanitary Crosses <small>(22 66 53 00-0228)</small>		
22 66 53 00-0292	EA			1-1/2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Sanitary Cross	255.17	78.50
22 66 53 00-0293	EA			2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Sanitary Cross	299.66	88.20
22 66 53 00-0294	EA			3" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Sanitary Cross	422.43	98.27
22 66 53 00-0295	EA			4" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Sanitary Cross	585.02	117.68
22 66 53 00-0296	EA			2" x 1-1/2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Sanitary Cross	274.12	83.13
22 66 53 00-0297	EA			3" x 1-1/2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Sanitary Cross	353.23	88.06
22 66 53 00-0298	EA			3" x 2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Sanitary Cross	372.50	92.90
22 66 53 00-0299	EA			4" x 2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Sanitary Cross	399.36	102.83
22 66 53 00-0300	EA			4" x 3" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Sanitary Cross	502.34	107.68
22 66 53 00-0301				Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Combination Wye And 1/8 Bends <small>(22 66 53 00-0228)</small>		
22 66 53 00-0302	EA			1-1/2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Combination Wye And 1/8 Bend.....	171.49	58.51
22 66 53 00-0303	EA			2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Combination Wye And 1/8 Bend	198.84	66.15
22 66 53 00-0304	EA			3" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Combination Wye And 1/8 Bend	240.09	73.72
22 66 53 00-0305	EA			4" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Combination Wye And 1/8 Bend	391.42	88.28
22 66 53 00-0306				Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Reducing Combination Wye And 1/8 Bends <small>(22 66 53 00-0228)</small>		
22 66 53 00-0307	EA			2" x 1-1/2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Reducing Combination Wye And 1/8 Bend	189.18	63.73

22 Plumbing**22 60 Gas and Vacuum Systems For Laboratory And Healthcare Facilities****22 66 Chemical-Waste Systems for Laboratory and Healthcare Facilities**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 66 53 00-0308	EA		3" x 1-1/2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Reducing Combination Wye And 1/8 Bend.....	210.80	68.80
22 66 53 00-0309	EA		3" x 2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Reducing Combination Wye And 1/8 Bend.....	228.44	71.29
22 66 53 00-0310	EA		4" x 1-1/2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Reducing Combination Wye And 1/8 Bend.....	305.27	78.65
22 66 53 00-0311	EA		4" x 2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Reducing Combination Wye And 1/8 Bend.....	312.92	81.08
22 66 53 00-0312	EA		4" x 3" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Reducing Combination Wye And 1/8 Bend.....	348.13	83.27
22 66 53 00-0313			Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Double Combination Wye And 1/8 Bends <small>(22 66 53 00-0228)</small>		
22 66 53 00-0314	EA		1-1/2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Double Combination Wye And 1/8 Bend.....	268.97	78.36
22 66 53 00-0315	EA		2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Double Combination Wye And 1/8 Bend.....	335.48	88.13
22 66 53 00-0316	EA		3" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Double Combination Wye And 1/8 Bend.....	475.73	97.98
22 66 53 00-0317	EA		4" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Double Combination Wye And 1/8 Bend.....	571.43	117.90
22 66 53 00-0318			Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Reducing Double Combination Wye And 1/8 Bends <small>(22 66 53 00-0228)</small>		
22 66 53 00-0319	EA		2" x 1-1/2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Reducing Double Combination Wye And 1/8 Bend.....	292.06	83.13
22 66 53 00-0320	EA		3" x 1-1/2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Reducing Double Combination Wye And 1/8 Bend.....	347.23	87.98
22 66 53 00-0321	EA		3" x 2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Reducing Double Combination Wye And 1/8 Bend.....	362.53	92.90
22 66 53 00-0322	EA		4" x 2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Reducing Double Combination Wye And 1/8 Bend.....	403.35	102.83
22 66 53 00-0323	EA		4" x 3" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Reducing Double Combination Wye And 1/8 Bend.....	502.34	107.68
22 66 53 00-0324			Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Reducers-Increasers <small>(22 66 53 00-0228)</small>		
22 66 53 00-0325	EA		2" x 1-1/2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Reducer-Increaser.....	128.23	41.68
22 66 53 00-0326	EA		3" x 1-1/2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Reducer-Increaser.....	143.86	44.10
22 66 53 00-0327	EA		3" x 2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Reducer-Increaser.....	168.83	51.45
22 66 53 00-0328	EA		4" x 1-1/2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Reducer-Increaser.....	196.86	48.88
22 66 53 00-0329	EA		4" x 2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Reducer-Increaser.....	208.50	51.31
22 66 53 00-0330	EA		4" x 3" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Reducer-Increaser.....	220.14	53.73
22 66 53 00-0331			Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Combination Cleanout And Test Tees <small>(22 66 53 00-0228)</small>		
22 66 53 00-0332	EA		1-1/2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Combination Cleanout And Test Tee.....	117.23	34.32
22 66 53 00-0333	EA		2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Combination Cleanout And Test Tee.....	135.93	38.81
22 66 53 00-0334	EA		3" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Combination Cleanout And Test Tee.....	159.53	43.95
22 66 53 00-0335	EA		4" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Combination Cleanout And Test Tee.....	283.56	53.51
22 66 53 00-0336			Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Pipe Plugs <small>(22 66 53 00-0228)</small>		
22 66 53 00-0337	EA		1-1/2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Pipe Plug.....	53.19	19.55
22 66 53 00-0338	EA		2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Pipe Plug.....	62.63	21.83
22 66 53 00-0339	EA		3" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Pipe Plug.....	68.48	24.40
22 66 53 00-0340	EA		4" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Pipe Plug.....	87.62	29.18
22 66 53 00-0341			Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV P-Traps <small>(22 66 53 00-0228)</small>		
22 66 53 00-0342	EA		1-1/2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV P-Trap.....	207.68	38.81
22 66 53 00-0343	EA		2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV P-Trap.....	214.95	43.66
22 66 53 00-0344	EA		3" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV P-Trap.....	264.52	48.81
22 66 53 00-0345	EA		4" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV P-Trap.....	336.70	58.36
22 66 53 00-0346	EA		1-1/2" Mechanical Joint High Silicon Iron Alloy Running Acid Resistant DWV P-Trap.....	285.78	41.75
22 66 53 00-0347	EA		2" Mechanical Joint High Silicon Iron Alloy Running Acid Resistant DWV P-Trap.....	390.80	46.60
22 66 53 00-0348	EA		3" Mechanical Joint High Silicon Iron Alloy Running Acid Resistant DWV P-Trap.....	471.78	51.45
22 66 53 00-0349	EA		4" Mechanical Joint High Silicon Iron Alloy Running Acid Resistant DWV P-Trap.....	586.20	61.30
22 66 53 00-0350			Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Swivel Type Centrifugal Drum Traps <small>(22 66 53 00-0228)</small>		
22 66 53 00-0351	EA		1-1/2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Swivel Type Centrifugal Drum P-Trap.....	379.36	44.33
22 66 53 00-0352	EA		2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Swivel Type Centrifugal Drum P-Trap.....	593.74	49.02
22 66 53 00-0353	EA		1-1/2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Swivel Type Centrifugal Drum S-Trap.....	395.05	44.10
22 66 53 00-0354	EA		2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Swivel Type Centrifugal Drum S-Trap.....	593.74	49.02
22 66 53 00-0355			Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Swivel Type Traps <small>(22 66 53 00-0228)</small>		
22 66 53 00-0356	EA		1-1/2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Swivel Type Short P-Trap.....	353.19	44.10



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 66 53 00-0357 EA 2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Swivel Type Short P-Trap	414.35	49.02
22 66 53 00-0358 EA 1-1/2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Swivel Type Long P-Trap.....	407.01	44.10
22 66 53 00-0359 EA 1-1/2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Swivel Type Long S-Trap.....	882.76	49.02
22 66 53 00-0360 EA 2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Swivel Type Long S-Trap.....	529.96	49.02
22 66 53 00-0361 Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Return Bends		
<i>(22 66 53 00-0228)</i>		
22 66 53 00-0362 EA 1-1/2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Return Bend.....	152.48	39.25
22 66 53 00-0363 EA 2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Return Bend.....	197.70	44.10
22 66 53 00-0364 Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Threaded Adapters		
<i>(22 66 53 00-0228)</i>		
22 66 53 00-0365 EA 1-1/2" x 1-1/2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Threaded Adapter.....	79.98	29.40
22 66 53 00-0366 EA 1-1/2" x 2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Threaded Adapter.....	141.45	31.90
22 66 53 00-0367 EA 2" x 2" Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Threaded Adapter.....	106.95	36.75
22 66 53 00-0368 Mechanical Joint High Silicon Iron Alloy Acid Resistant Hub To Mechanical Joint Adapter		
<i>(22 66 53 00-0228)</i>		
22 66 53 00-0369 EA 1-1/2" x 1-1/2" Mechanical Joint High Silicon Iron Alloy Acid Resistant Hub To Mechanical Joint Adapter	146.46	41.82
22 66 53 00-0370 EA 1-1/2" x 2" Mechanical Joint High Silicon Iron Alloy Acid Resistant Hub To Mechanical Joint Adapter	159.80	44.10
22 66 53 00-0371 EA 1-1/2" x 3" Mechanical Joint High Silicon Iron Alloy Acid Resistant Hub To Mechanical Joint Adapter	177.43	46.52
22 66 53 00-0372 EA 1-1/2" x 4" Mechanical Joint High Silicon Iron Alloy Acid Resistant Hub To Mechanical Joint Adapter	190.57	51.31
22 66 53 00-0373 EA 2" x 2" Mechanical Joint High Silicon Iron Alloy Acid Resistant Hub To Mechanical Joint Adapter	177.46	46.60
22 66 53 00-0374 EA 2" x 3" Mechanical Joint High Silicon Iron Alloy Acid Resistant Hub To Mechanical Joint Adapter	187.08	49.02
22 66 53 00-0375 EA 2" x 4" Mechanical Joint High Silicon Iron Alloy Acid Resistant Hub To Mechanical Joint Adapter	202.20	53.73
22 66 53 00-0376 EA 3" x 3" Mechanical Joint High Silicon Iron Alloy Acid Resistant Hub To Mechanical Joint Adapter	226.67	51.45
22 66 53 00-0377 EA 4" x 4" Mechanical Joint High Silicon Iron Alloy Hub To Mechanical Joint Adapter	279.25	61.30
22 66 53 00-0378 Mechanical Joint Couplings For Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Pipe And Fittings		
<i>(22 66 53 00-0228)</i>		
22 66 53 00-0379 EA 1-1/2" Mechanical Joint Couplings For Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Pipe And Fitting.....	47.84	
22 66 53 00-0380 EA 2" Mechanical Joint Couplings For Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Pipe And Fitting.....	55.81	
22 66 53 00-0381 EA 3" Mechanical Joint Couplings For Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Pipe And Fitting.....	59.80	
22 66 53 00-0382 EA 4" Mechanical Joint Couplings For Mechanical Joint High Silicon Iron Alloy Acid Resistant DWV Pipe And Fitting.....	65.78	
22 66 53 00-0383 Mechanical Joint High Silicon Iron Alloy Acid Resistant Sink Fittings		
<i>(22 66 53 00-0228)</i>		
22 66 53 00-0384 EA Mechanical Joint High Silicon Iron Alloy Acid Resistant Sink Outlet.....	358.29	19.62
22 66 53 00-0385 EA Mechanical Joint High Silicon Iron Alloy Acid Resistant Stopper.....	136.29	9.77
22 66 53 00-0386 EA Mechanical Joint High Silicon Iron Alloy Acid Resistant Sink Overflow	251.90	9.77
22 66 53 00-0387 Mechanical Joint High Silicon Iron Alloy Acid Resistant Floor Drains With Stainless Steel Strainer Plates		
<i>(22 66 53 00-0228)</i>		
22 66 53 00-0388 EA Mechanical Joint High Silicon Iron Alloy Acid Resistant Floor Drain With Stainless Steel Strainer.....	1,291.13	98.05
22 66 53 00-0389 EA Mechanical Joint High Silicon Iron Alloy Acid Resistant Sediment Basin Floor Drain With Stainless Steel Strainer.....	1,589.49	102.98
22 66 53 00-0390 EA Stainless Steel Funnel Attachment For Mechanical Joint High Silicon Iron Alloy Acid Resistant Floor Drain	1,055.17	9.77
22 66 83 Chemical-Waste Tanks		
<i>(22 66)</i>		
22 66 83 16 Chemical-Waste Neutralization Tanks		
<i>(22 66 83)</i>		
22 66 83 16-0001 Acid Neutralization Tank		
<i>(22 66 83 16)</i>		
22 66 83 16-0002 Polyethylene Acid Neutralization Tank		
<i>(22 66 83 16-0001)</i>		
22 66 83 16-0003 EA 5 Gallon Capacity Polyethylene Acid Neutralization Tank	336.79	149.71
22 66 83 16-0004 EA 15 Gallon Capacity Polyethylene Acid Neutralization Tank	593.82	207.60
22 66 83 16-0005 EA 30 Gallon Capacity Polyethylene Acid Neutralization Tank	749.03	299.42
22 66 83 16-0006 EA 55 Gallon Capacity Polyethylene Acid Neutralization Tank	965.36	399.22
22 66 83 16-0007 EA 100 Gallon Capacity Polyethylene Acid Neutralization Tank	1,230.91	479.07
22 66 83 16-0008 EA 150 Gallon Capacity Polyethylene Acid Neutralization Tank	1,668.39	598.84
22 66 83 16-0009 EA 200 Gallon Capacity Polyethylene Acid Neutralization Tank	1,941.17	748.55
22 66 83 16-0010 EA 275 Gallon Capacity Polyethylene Acid Neutralization Tank	2,500.87	898.26
22 66 83 16-0011 EA 350 Gallon Capacity Polyethylene Acid Neutralization Tank	2,854.71	1,077.91
22 66 83 16-0012 Polypropylene Acid Neutralization Tank		
<i>(22 66 83 16-0001)</i>		
22 66 83 16-0013 EA 5 Gallon Capacity Polypropylene Acid Neutralization Tank	528.84	149.71
22 66 83 16-0014 EA 15 Gallon Capacity Polypropylene Acid Neutralization Tank	897.90	207.60
22 66 83 16-0015 EA 30 Gallon Capacity Polypropylene Acid Neutralization Tank	1,424.42	299.42
22 66 83 16-0016 EA 55 Gallon Capacity Polypropylene Acid Neutralization Tank	1,878.30	399.22
22 66 83 16-0017 EA 100 Gallon Capacity Polypropylene Acid Neutralization Tank	2,369.85	479.07
22 66 83 16-0018 EA 150 Gallon Capacity Polypropylene Acid Neutralization Tank	2,704.08	598.84
22 66 83 16-0019 EA 200 Gallon Capacity Polypropylene Acid Neutralization Tank	2,972.29	748.55

22 Plumbing**22 60 Gas and Vacuum Systems For Laboratory And Healthcare Facilities****22 66 Chemical-Waste Systems for Laboratory and Healthcare Facilities**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
22 66 83 16-0020 EA 275 Gallon Capacity Polypropylene Acid Neutralization Tank	4,301.33	898.26
22 66 83 16-0021 EA 350 Gallon Capacity Polypropylene Acid Neutralization Tank	4,679.18	1,077.91
22 66 83 16-0022 Chemical Dilution Trap <small>(22 66 83 16)</small>		
22 66 83 16-0023 EA 1 Gallon Capacity Polyethylene Under Bench Chemical Dilution Trap Note: 1-1/2" top inlet and side outlet with anti siphon.	285.42	49.90
22 66 83 16-0024 EA 1-1/2 Gallon Capacity Polyethylene Under Bench Chemical Dilution Trap Note: 1-1/2" top inlet and side outlet with anti siphon.	293.87	49.90
22 66 83 16-0025 EA 2 Gallon Capacity Polyethylene Under Bench Chemical Dilution Trap Note: 1-1/2" top inlet and side outlet with anti siphon.	302.32	49.90
22 66 83 16-0026 EA 5 Gallon Capacity Polyethylene Under Bench Chemical Dilution Trap Note: 1-1/2" top inlet and side outlet with anti siphon.	333.46	59.88

END OF SECTION 22



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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23 Heating, Ventilating, And Air-Conditioning (HVAC)

Note: Where required, mechanical equipment excludes electrical connection unless title states otherwise.

23 01 Operation and Maintenance of HVAC Systems ⁽²³⁾

23 01 10 Operation and Maintenance of Facility Fuel Systems ^(23 01)

23 01 10 00-0001 AQMD Permit Costs ^(23 01 10)

23 01 10 00-0002	EA	Processing Fee - 5 To 20 Million	4,869.19
23 01 10 00-0003	EA	Processing Fee - 5 To 20 Million, Duplicate (Same Model Number)	2,434.60
23 01 10 00-0004	EA	Permit To Operate - 5 To 20 Million, (Annual Fee)	964.23
23 01 10 00-0005	EA	Processing Fee - 2 To 5 Million	1,891.15
23 01 10 00-0006	EA	Processing Fee - 2 To 5 Million, Duplicate (Same Model Number)	945.58
23 01 10 00-0007	EA	Permit To Operate - 2 To 5 Million, (Annual Fee)	286.51

23 01 10 00-0008 Purge Gas Systems ^(23 01 10)

Note: Includes collection and refilling/bleeding of system. For natural gas, flammable gases and other gases that should not be released inside the building. See CSI section 23 01 60 00-0001 for refrigerant.

23 01 10 00-0009	EA	Up To 100', Up To 1-1/2" Diameter Pipe, Purge Gas Systems.....	368.73
23 01 10 00-0010	EA	>100' To 250', Up To 1-1/2" Diameter Pipe, Purge Gas Systems.....	526.59
23 01 10 00-0011	EA	>250' To 500', Up To 1-1/2" Diameter Pipe, Purge Gas Systems.....	552.62
23 01 10 00-0012	EA	>500' To 1,000', Up To 1-1/2" Diameter Pipe, Purge Gas Systems.....	609.10
23 01 10 00-0013	EA	>1,000' To 2,000', Up To 1-1/2" Diameter Pipe, Purge Gas Systems.....	1,102.98
23 01 10 00-0014	EA	Up To 100', >1-1/2" To 4" Diameter Pipe, Purge Gas Systems	495.16
23 01 10 00-0015	EA	>100' To 250', >1-1/2" To 4" Diameter Pipe, Purge Gas Systems.....	710.79
23 01 10 00-0016	EA	>250' To 500', >1-1/2" To 4" Diameter Pipe, Purge Gas Systems.....	750.73
23 01 10 00-0017	EA	>500' To 1,000', >1-1/2" To 4" Diameter Pipe, Purge Gas Systems.....	836.99
23 01 10 00-0018	EA	>1,000' To 2,000', >1-1/2" To 4" Diameter Pipe, Purge Gas Systems	1,520.38
23 01 10 00-0019	EA	Up To 100', >4" To 10" Diameter Pipe, Purge Gas Systems	583.22
23 01 10 00-0020	EA	>100' To 250', >4" To 10" Diameter Pipe, Purge Gas Systems.....	854.21
23 01 10 00-0021	EA	>250' To 500', >4" To 10" Diameter Pipe, Purge Gas Systems.....	2,044.83
23 01 10 00-0022	EA	>500' To 1,000', >4" To 10" Diameter Pipe, Purge Gas Systems	3,183.08
23 01 10 00-0023	EA	>1,000' To 2,000', >4" To 10" Diameter Pipe, Purge Gas Systems.....	5,975.93

23 01 20 Operation and Maintenance of HVAC Piping and Pumps ^(23 01)

23 01 20 00-0001 Lock Out/Tag Out System ^(23 01 20)

23 01 20 00-0002	EA	Up To 1", Lock Out/Tag Out Valve.....	19.96
23 01 20 00-0003	EA	>1" To 3", Lock Out/Tag Out Valve.....	23.95
23 01 20 00-0004	EA	>3" To 6", Lock Out/Tag Out Valve.....	27.95
23 01 20 00-0005	EA	>6" To 10", Lock Out/Tag Out Valve.....	31.94
23 01 20 00-0006	EA	>10" To 14", Lock Out/Tag Out Valve.....	39.92
23 01 20 00-0007	EA	Lock Out/Tag Out Padlock System.....	15.97
23 01 20 00-0008	EA	Lock Out/Tag Out Tag.....	2.66

23 01 20 00-0009 Freeze Pipe Using CO2 Kit ^(23 01 20)

Note: For use on chilled water or cold water piping systems. Excludes cutting existing pipe, and installation of valve or fittings.

23 01 20 00-0010	EA	Up To 2" Freeze Pipe Using CO2 Kit.....	114.43
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23 01 20 00-0011 Freeze Pipe Using Nitrogen ^(23 01 20)

Note: For use on any water piping systems. Excludes cutting existing pipe, and installation of valve or fittings.

23 01 20 00-0012	EA	Up To 4" Pipe Freezing Using Nitrogen	1,048.23
23 01 20 00-0013	EA	>4" To 12" Pipe Freezing Using Nitrogen	2,096.47

Note: For each location. Includes freezing on each side of valve or fitting.

23 01 20 00-0014 Water/Chlorine Pipe Disinfection/Flush/Testing ^(23 01 20)

Note: For existing piping when required. Water/chlorine solution per specification entitled "Water Distribution".

23 01 20 00-0015	LF	Up To 1", Water/Chlorine Pipe Disinfection/Flush/Testing.....	1.32
23 01 20 00-0016	LF	>1" To 2", Water/Chlorine Pipe Disinfection/Flush/Testing.....	1.80
23 01 20 00-0017	LF	>2" To 3", Water/Chlorine Pipe Disinfection/Flush/Testing.....	2.79
23 01 20 00-0018	LF	4", Water/Chlorine Pipe Disinfection/Flush/Testing	3.83
23 01 20 00-0019	LF	6", Water/Chlorine Pipe Disinfection/Flush/Testing	4.72
23 01 20 00-0020	LF	8", Water/Chlorine Pipe Disinfection/Flush/Testing	5.97
23 01 20 00-0021	LF	10", Water/Chlorine Pipe Disinfection/Flush/Testing.....	7.86
23 01 20 00-0022	LF	12", Water/Chlorine Pipe Disinfection/Flush/Testing.....	9.43

23 01 20 00-0023 Shut Down Existing Piping System ^(23 01 20)

23 01 20 00-0024	EA	Shut Down Existing Interior Piping System.....	161.93
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Note: Includes lock out/tag out and average line tracing. Use when valves are greater than 25' from work. When the shut-off valves for multiple lines are located with a 10' radius, the quantity used shall be one.

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 01 Operation and Maintenance of HVAC Systems****23 01 20 Operation and Maintenance of HVAC Piping and Pumps**MINOR
CSI UOM DESCRIPTIONTOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

23 01 20 00-0025	Purge Liquid Systems <small>(23 01 20)</small>	
	Note: Includes collection and refilling/bleeding of system.	
23 01 20 00-0026	EA Up To 100', Up To 1-1/2" Diameter Pipe, Purge Liquid System.....	262.82
23 01 20 00-0027	EA >100 To 250', Up To 1-1/2" Diameter Pipe, Purge Liquid System	375.37
23 01 20 00-0028	EA >250 To 500', Up To 1-1/2" Diameter Pipe, Purge Liquid System	449.76
23 01 20 00-0029	EA >500 To 1,000', Up To 1-1/2" Diameter Pipe, Purge Liquid System	475.46
23 01 20 00-0030	EA >1,000 To 2,000', Up To 1-1/2" Diameter Pipe, Purge Liquid System	907.70
23 01 20 00-0031	EA Up To 100', >1-1/2" To 4" Diameter Pipe, Purge Liquid System.....	349.85
23 01 20 00-0032	EA >100 To 250', 1-1/2" To 4" Diameter Pipe, Purge Liquid System.....	499.23
23 01 20 00-0033	EA >250 To 500', 1-1/2" To 4" Diameter Pipe, Purge Liquid System.....	594.33
23 01 20 00-0034	EA >500 To 1,000', 1-1/2" To 4" Diameter Pipe, Purge Liquid System.....	631.94
23 01 20 00-0035	EA >1,000 To 2,000', 1-1/2" To 4" Diameter Pipe, Purge Liquid System.....	1,217.64
23 01 20 00-0036	EA Up To 100', >4" To 10" Diameter Pipe, Purge Liquid System	431.31
23 01 20 00-0037	EA >100 To 250', >4" To 10" Diameter Pipe, Purge Liquid System.....	616.34
23 01 20 00-0038	EA >250 To 500', >4" To 10" Diameter Pipe, Purge Liquid System.....	1,762.27
23 01 20 00-0039	EA >1,000 To 2,000', >4" To 10" Diameter Pipe, Purge Liquid System.....	2,796.64

23 01 20 00-0040	Add-A-Valve Emergency Shut Off Device <small>(23 01 20)</small>	
23 01 20 00-0041	EA 1/2" Add-A-Valve Emergency Shut Off Device (Jomar 800-103ADD)	204.78
23 01 20 00-0042	EA 3/4" Add-A-Valve Emergency Shut Off Device (Jomar 800-104ADD)	257.41
23 01 20 00-0043	EA 1" Add-A-Valve Emergency Shut Off Device (Jomar 800-105ADD)	354.79
23 01 20 00-0044	EA 1-1/4" Add-A-Valve Emergency Shut Off Device (Jomar 800-106ADD)	538.90
23 01 20 00-0045	EA 1-1/2" Add-A-Valve Emergency Shut Off Device (Jomar 800-107ADD)	664.09
23 01 20 00-0046	EA 2" Add-A-Valve Emergency Shut Off Device (Jomar 800-108ADD)	997.69

23 01 30 Operation and Maintenance of HVAC Air Distribution (23 01)**23 01 30 51 HVAC Air-Distribution System Cleaning** (23 01 30)

23 01 30 51-0001	Special Cleaning Of Ductwork <small>(23 01 30 51)</small>	
	Note: Includes sealing registers, grilles, diffusers as required.	
23 01 30 51-0002	LF Up To 2 SF Cross Section, Clean Supply/Return Ductwork	2.49
	<i>For Exhaust Ductwork, Add</i>	0.62
23 01 30 51-0003	LF >2 SF To 4 SF Cross Section, Clean Supply/Return Ductwork	3.11
	<i>For Exhaust Ductwork, Add</i>	0.78
23 01 30 51-0004	LF >4 SF To 8 SF Cross Section, Clean Supply/Return Ductwork	4.18
	<i>For Exhaust Ductwork, Add</i>	1.05
23 01 30 51-0005	LF >8 SF Cross Section, Clean Supply/Return Ductwork	5.91
	<i>For Exhaust Ductwork, Add</i>	1.48
23 01 30 51-0006	SF Clean Duct Dampers.....	8.39
23 01 30 51-0007	SF Clean Duct Fire Dampers	16.77
23 01 30 51-0008	SF Clean Louver.....	6.71
23 01 30 51-0009	EA Clean Turning Vane Set.....	20.13
23 01 30 51-0010	EA Clean Grille/Diffuser/Register.....	20.13
	Note: Includes removal and reinstallation.	
23 01 30 51-0011	LF Clean Linear Diffuser	5.03
	Note: Includes removal and reinstallation.	
23 01 30 51-0012	EA Cut Access For Cleaning Duct And Install Duct Insulated Access Doors	67.77
	<i>For Stainless Steel, Add</i>	45.00
23 01 30 51-0013	EA Clean Variable Air Volume (VAV) Unit.....	60.37
23 01 30 51-0014	EA Clean Fan Powered Induction Unit (PIU) Unit.....	80.50
23 01 30 51-0015	EA Clean Fan Coil Unit (FCU) Unit.....	80.50
23 01 30 51-0016	EA Clean Supply Or Return Fan.....	161.00
23 01 30 51-0017	EA Clean Exhaust Fan	140.87
23 01 30 51-0018	EA Clean Duct Coil.....	120.74
23 01 30 51-0019	SF Clean Air Handling Unit Interior Housing, HEPA Vacuum.....	4.03
	Note: Excluding fan and coils.	
23 01 30 51-0020	EA Clean Air Handling Unit Fan	161.00
23 01 30 51-0021	EA Clean Air Handling Unit Coil	241.50
23 01 30 51-0022	SF Clean Equipment Surfaces, Rust Reform And Prime.....	2.07
23 01 30 51-0023	SF Clean Interior Equipment Surfaces, Rust Reform And Prime	2.47
23 01 30 51-0024	SF HEPA Vacuuming Of Walls, Ceilings And Floors In Mechanical Rooms	0.48
23 01 30 51-0025	EA Cleaning Of Ductwork Minimum Set-up Charge	598.96
	Note: For projects where the total charges are less than the minimum set-up charge, use this task exclusively. This task should not be used in conjunction with any other tasks in this section.	
23 01 30 51-0026	SF Apply Antimicrobial Agent To Ductwork And Surfaces After Cleaning	0.32

23 01 50 Operation and Maintenance of Central Heating Equipment (23 01)

23 01 50 00-0001	Boiler And Chiller Water Treatment <small>(23 01 50)</small>	
	Note: 3 LB chemical per 50 gallon system water.	
23 01 50 00-0002	LB Boil Out Boiler And System With Caustic Soda	0.84
	Note: Includes disposal after treatment.	
23 01 50 00-0003	LB Boil Out Boiler And System With Trisodium Phosphate.....	1.26
	Note: Includes disposal after treatment.	
23 01 50 00-0004	GAL Corrosion Resistant Chemical Treatment, Based On Gallons Of Chemical Required.....	79.04



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 01 50 00-0005				Boiler Repairs <small>(23 01 50)</small>		
23 01 50 00-0006				Setup And Maintenance <small>(23 01 50 00-0005)</small>		
23 01 50 00-0007	EA			Set-up Charge For Boiler Fire Side Maintenance 1,800.76 Note: Includes removing/relocating doors, plates, portals, and burners required to access fireside.	1,800.76	
23 01 50 00-0008	EA			Close-up Charge For Boiler Fire Side Maintenance 1,918.84 Note: Includes replacement of doors, plates, portals, burners, adhesive, rope, wool, and seals.	1,918.84	
				<i>For Burner Seals, Add</i> 580.08 <i>Note: Used when burner must be removed from door for maintenance.</i>	580.08	
23 01 50 00-0009	EA			Setup Charge For Boiler Water Side Maintenance 2,401.03 Note: Includes closing valves, draining, and positioning equipment needed for tube replacement.	2,401.03	
23 01 50 00-0010	EA			Up To 100 HP, Hydrostatic Test - Boiler Maintenance 1,200.51 Note: Includes close-up charge for water side maintenance, blanking off supply, return, and relief valves for test and reconnection after test.	1,200.51	
23 01 50 00-0011	EA			>100 HP, Hydrostatic Test - Boiler Maintenance 2,401.03 Note: Includes close-up charge for water side maintenance, blanking off supply, return, and relief valves for test and reconnection after test.	2,401.03	
23 01 50 00-0012	EA			Remove And Replace Handhole..... 75.03	75.03	
23 01 50 00-0013	EA			Remove And Replace Manhole 225.09	225.09	
23 01 50 00-0014	SF			Sheet Metal Jacket Patch 9.35	9.35	
23 01 50 00-0015				Boiler Tube Replacement <small>(23 01 50 00-0005)</small>		
23 01 50 00-0016	EA			Remove Up To 2" Boiler Tube 180.08	180.08	
23 01 50 00-0017	EA			Remove >2" To 3" Boiler Tube 225.10	225.10	
23 01 50 00-0018	EA			Remove >3" To 4" Boiler Tube 315.13	315.13	
23 01 50 00-0019	LF			Place 1-1/2" Boiler Tube Into Position For Termination 5.26	5.26	
23 01 50 00-0020	LF			Place 2" Boiler Tube Into Position For Termination 6.07	6.07	
23 01 50 00-0021	LF			Place 2-1/2" Boiler Tube Into Position For Termination 6.91	6.91	
23 01 50 00-0022	LF			Place 3" Boiler Tube Into Position For Termination 9.59	9.59	
23 01 50 00-0023	LF			Place 3-1/2" Boiler Tube Into Position For Termination 11.14	11.14	
23 01 50 00-0024	LF			Place 4" Boiler Tube Into Position For Termination 14.06	14.06	
23 01 50 00-0025	EA			1-1/2" Rolled Boiler Tube Termination (2 Per New Tube)..... 22.51	22.51	
23 01 50 00-0026	EA			2" Rolled Boiler Tube Termination (2 Per New Tube)..... 33.77	33.77	
23 01 50 00-0027	EA			2-1/2" Rolled Boiler Tube Termination (2 Per New Tube)..... 45.02	45.02	
23 01 50 00-0028	EA			3" Rolled Boiler Tube Termination (2 Per New Tube)..... 56.27	56.27	
23 01 50 00-0029	EA			3-1/2" Rolled Boiler Tube Termination (2 Per New Tube)..... 67.53	67.53	
23 01 50 00-0030	EA			4" Rolled Boiler Tube Termination (2 Per New Tube)..... 78.79	78.79	
23 01 50 00-0031	EA			1-1/2" Welded Boiler Tube Termination (2 Per New Tube)..... 67.53	67.53	
23 01 50 00-0032	EA			2" Welded Boiler Tube Termination (2 Per New Tube) 90.04	90.04	
23 01 50 00-0033	EA			2-1/2" Welded Boiler Tube Termination (2 Per New Tube)..... 112.54	112.54	
23 01 50 00-0034	EA			3" Welded Boiler Tube Termination (2 Per New Tube)..... 135.06	135.06	
23 01 50 00-0035	EA			3-1/2" Welded Boiler Tube Termination (2 Per New Tube)..... 157.56	157.56	
23 01 50 00-0036	EA			4" Welded Boiler Tube Termination (2 Per New Tube) 180.08	180.08	
23 01 50 00-0037	EA			Plug Boiler Tube Hole Where Boiler Tube Is Not Replaced..... 215.13	215.13	
23 01 50 00-0038				Cast Iron Boiler Section Replacement <small>(23 01 50 00-0005)</small>		
23 01 50 00-0039	EA			Replace Front Section Of Weil McLain Model 80 Cast Iron Boiler 2,055.21	2,055.21	
23 01 50 00-0040	EA			Replace Rear Section Of Weil McLain Model 80 Cast Iron Boiler 1,431.85	1,431.85	
23 01 50 00-0041	EA			Replace Inside Section Of Weil McLain Model 80 Cast Iron Boiler..... 1,764.15	1,764.15	
23 01 50 00-0042	EA			Replace Front Section Of Weil McLain Model 88 Cast Iron Boiler 3,815.08	3,815.08	
23 01 50 00-0043	EA			Replace Rear Section Of Weil McLain Model 88 Cast Iron Boiler 2,846.57	2,846.57	
23 01 50 00-0044	EA			Replace Inside Section Of Weil McLain Model 88 Cast Iron Boiler..... 3,258.37	3,258.37	
23 01 50 00-0045	EA			Replace Front Section Of Weil McLain Model 94 Cast Iron Boiler 6,228.24	6,228.24	
23 01 50 00-0046	EA			Replace Rear Section Of Weil McLain Model 94 Cast Iron Boiler 4,898.24	4,898.24	
23 01 50 00-0047	EA			Replace Inside Section Of Weil McLain Model 94 Cast Iron Boiler..... 5,170.49	5,170.49	
23 01 50 00-0048				Cast Iron Grate Replacement <small>(23 01 50 00-0005)</small>		
23 01 50 00-0049	SF			Replace Cast Iron Boiler Grates, Prepared From Casting Mold 102.35 Note: Includes support, linkages and removal of existing.	102.35	
23 01 50 00-0050	EA			Prepare Cast Iron Boiler Grate Mold..... 1,544.88 Note: Includes preparing unique size mold for grate casting. Mold to be used for multiple castings.	1,544.88	
23 01 50 00-0051				Replacement Or Conversion Of Boiler Burners <small>(23 01 50 00-0005)</small>		
23 01 50 00-0052	EA			700 MBH Max Input Burner With 2" Boiler Connection, Screwed..... 5,665.19 <i>For 12 PPM Burner, Add</i> 877.02	5,665.19	783.76
23 01 50 00-0053	EA			2100 MBH Max Input Burner With 2-1/2" Boiler Connection, Screwed..... 8,116.69 <i>For 12 PPM Burner, Add</i> 1,306.36	8,116.69	970.35
23 01 50 00-0054	EA			2800 MBH Max Input Burner With 3" Boiler Connection, Screwed 9,597.87 <i>For 12 PPM Burner, Add</i> 1,535.55	9,597.87	1,175.56
23 01 50 00-0055	EA			3800 MBH Max Input Burner With 4" Boiler Connection, Flanged..... 11,277.43 <i>For 12 PPM Burner, Add</i> 1,842.33	11,277.43	1,264.77
23 01 50 00-0056				Video Inspection Of Boiler Tubing <small>(23 01 50 00-0005)</small>		
23 01 50 00-0057	EA			Initial Set Up For Boiler Tubing Video Camera Inspection..... 343.47	343.47	
23 01 50 00-0058	LF			Boiler Tubing Inspection 0.42	0.42	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 01 Operation and Maintenance of HVAC Systems****23 01 50 Operation and Maintenance of Central Heating Equipment**

MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

23 01 60 Operation and Maintenance of Central Cooling Equipment (23 01)**23 01 60 00-0001 Refrigerant Recovery, Reclaim And Recycling (23 01 60)**

23 01 60 00-0002	LB	Recovery Of Refrigerant	6.26
23 01 60 00-0003	LB	Recovery And Recharging Of Refrigerant.....	11.73

Note: Includes cleaning refrigerant gas prior to recharging.

23 05 Common Work Results For HVAC (23)**23 05 13 Common Motor Requirements For HVAC Equipment (23 05)**

Note: New equipment includes motor, unless otherwise stated. For use when replacing existing motor.

23 05 13 00-0001 Premium Efficient, Motors (23 05 13)

Note: New equipment includes motor, unless otherwise stated. For use when replacing existing motor. Excludes installation.

23 05 13 00-0002 Premium Efficient, Open Drip Proof Motors (23 05 13 00-0001)

Note: NEMA premium efficiency, open drip proof, three phase AC motors.

23 05 13 00-0003 Steel Frame, Premium Efficient, Open Drip Proof Motors (23 05 13 00-0002)

23 05 13 00-0004	EA	1 HP, 3,600 RPM, 56 NEMA Steel Frame, Premium Efficient, Open Drip Proof Motor	404.30
23 05 13 00-0005	EA	1 HP, 1,800 RPM, 143T NEMA Steel Frame, Premium Efficient, Open Drip Proof Motor	457.79
23 05 13 00-0006	EA	1 HP, 1,200 RPM, 145T NEMA Steel Frame, Premium Efficient, Open Drip Proof Motor	536.72
23 05 13 00-0007	EA	1-1/2 HP, 3,600 RPM, 143T NEMA Steel Frame, Premium Efficient, Open Drip Proof Motor	450.78
23 05 13 00-0008	EA	1-1/2 HP, 1,800 RPM, 145T NEMA Steel Frame, Premium Efficient, Open Drip Proof Motor	478.84
23 05 13 00-0009	EA	1-1/2 HP, 1,200 RPM, 182T NEMA Steel Frame, Premium Efficient, Open Drip Proof Motor	627.93
23 05 13 00-0010	EA	2 HP, 3,600 RPM, 145T NEMA Steel Frame, Premium Efficient, Open Drip Proof Motor	529.71
23 05 13 00-0011	EA	2 HP, 1,800 RPM, 145T NEMA Steel Frame, Premium Efficient, Open Drip Proof Motor	513.04
23 05 13 00-0012	EA	2 HP, 1,200 RPM, 184T NEMA Steel Frame, Premium Efficient, Open Drip Proof Motor	641.96
23 05 13 00-0013	EA	3 HP, 3,600 RPM, 182T NEMA Steel Frame, Premium Efficient, Open Drip Proof Motor	536.72
23 05 13 00-0014	EA	3 HP, 1,800 RPM, 182T NEMA Steel Frame, Premium Efficient, Open Drip Proof Motor	553.39
23 05 13 00-0015	EA	3 HP, 1,200 RPM, 213T NEMA Steel Frame, Premium Efficient, Open Drip Proof Motor	817.36
23 05 13 00-0016	EA	5 HP, 3,600 RPM, 184T NEMA Steel Frame, Premium Efficient, Open Drip Proof Motor	585.84
23 05 13 00-0017	EA	5 HP, 1,800 RPM, 184T NEMA Steel Frame, Premium Efficient, Open Drip Proof Motor	606.01
23 05 13 00-0018	EA	5 HP, 1,200 RPM, 215T NEMA Steel Frame, Premium Efficient, Open Drip Proof Motor	1,070.82
23 05 13 00-0019	EA	7-1/2 HP, 3,600 RPM, 213T NEMA Steel Frame, Premium Efficient, Open Drip Proof Motor	929.62
23 05 13 00-0020	EA	7-1/2 HP, 1,800 RPM, 213T NEMA Steel Frame, Premium Efficient, Open Drip Proof Motor	891.03
23 05 13 00-0021	EA	7-1/2 HP, 1,200 RPM, 254T NEMA Steel Frame, Premium Efficient, Open Drip Proof Motor	1,283.93
23 05 13 00-0022	EA	10 HP, 3,600 RPM, 215T NEMA Steel Frame, Premium Efficient, Open Drip Proof Motor	1,062.92
23 05 13 00-0023	EA	10 HP, 1,800 RPM, 215T NEMA Steel Frame, Premium Efficient, Open Drip Proof Motor	1,078.71
23 05 13 00-0024	EA	10 HP, 1,200 RPM, 256T NEMA Steel Frame, Premium Efficient, Open Drip Proof Motor	1,670.68
23 05 13 00-0025	EA	15 HP, 3,600 RPM, 254T NEMA Steel Frame, Premium Efficient, Open Drip Proof Motor	1,510.19
23 05 13 00-0026	EA	15 HP, 1,800 RPM, 254T NEMA Steel Frame, Premium Efficient, Open Drip Proof Motor	1,527.73
23 05 13 00-0027	EA	15 HP, 1,200 RPM, 284T NEMA Steel Frame, Premium Efficient, Open Drip Proof Motor	2,253.01
23 05 13 00-0028	EA	20 HP, 3,600 RPM, 256T NEMA Steel Frame, Premium Efficient, Open Drip Proof Motor	1,774.17
23 05 13 00-0029	EA	20 HP, 1,800 RPM, 256T NEMA Steel Frame, Premium Efficient, Open Drip Proof Motor	1,918.00
23 05 13 00-0030	EA	20 HP, 1,200 RPM, 286T NEMA Steel Frame, Premium Efficient, Open Drip Proof Motor	2,742.38
23 05 13 00-0031	EA	25 HP, 3,600 RPM, 284TS NEMA Steel Frame, Premium Efficient, Open Drip Proof Motor	2,130.23
23 05 13 00-0032	EA	25 HP, 1,800 RPM, 284T NEMA Steel Frame, Premium Efficient, Open Drip Proof Motor	2,338.08
23 05 13 00-0033	EA	25 HP, 1,200 RPM, 324T NEMA Steel Frame, Premium Efficient, Open Drip Proof Motor	3,312.43
23 05 13 00-0034	EA	30 HP, 3,600 RPM, 286TS NEMA Steel Frame, Premium Efficient, Open Drip Proof Motor	2,513.48
23 05 13 00-0035	EA	30 HP, 1,800 RPM, 286T NEMA Steel Frame, Premium Efficient, Open Drip Proof Motor	2,556.46
23 05 13 00-0036	EA	30 HP, 1,200 RPM, 326T NEMA Steel Frame, Premium Efficient, Open Drip Proof Motor	3,455.38
23 05 13 00-0037	EA	40 HP, 3,600 RPM, 324TS NEMA Steel Frame, Premium Efficient, Open Drip Proof Motor	3,238.76
23 05 13 00-0038	EA	40 HP, 1,800 RPM, 324T NEMA Steel Frame, Premium Efficient, Open Drip Proof Motor	3,335.23
23 05 13 00-0039	EA	50 HP, 3,600 RPM, 326TS NEMA Steel Frame, Premium Efficient, Open Drip Proof Motor	3,527.29
23 05 13 00-0040	EA	50 HP, 1,800 RPM, 326T NEMA Steel Frame, Premium Efficient, Open Drip Proof Motor	3,680.77
23 05 13 00-0041	EA	60 HP, 3,600 RPM, 364TS NEMA Steel Frame, Premium Efficient, Open Drip Proof Motor	4,463.05
23 05 13 00-0042	EA	60 HP, 1,800 RPM, 364T NEMA Steel Frame, Premium Efficient, Open Drip Proof Motor	4,634.07
23 05 13 00-0043	EA	75 HP, 3,600 RPM, 365TS NEMA Steel Frame, Premium Efficient, Open Drip Proof Motor	5,854.85
23 05 13 00-0044	EA	75 HP, 1,800 RPM, 365T NEMA Steel Frame, Premium Efficient, Open Drip Proof Motor	5,688.22
23 05 13 00-0045	EA	100 HP, 3,600 RPM, 365TS NEMA Steel Frame, Premium Efficient, Open Drip Proof Motor	6,258.27
23 05 13 00-0046	EA	100 HP, 1,800 RPM, 404T NEMA Steel Frame, Premium Efficient, Open Drip Proof Motor	6,617.84
23 05 13 00-0047	EA	125 HP, 3,600 RPM, 404TS NEMA Steel Frame, Premium Efficient, Open Drip Proof Motor	7,854.41
23 05 13 00-0048	EA	125 HP, 1,800 RPM, 405T NEMA Steel Frame, Premium Efficient, Open Drip Proof Motor	8,118.39
23 05 13 00-0049	EA	150 HP, 3,600 RPM, 405TS NEMA Steel Frame, Premium Efficient, Open Drip Proof Motor	9,689.10

23 05 13 00-0050 Cast Iron Frame, Premium Efficient, Open Drip Proof Motors (23 05 13 00-0002)

23 05 13 00-0051	EA	40 HP, 1,200 RPM, 364T NEMA Cast Iron Frame, Premium Efficient, Open Drip Proof Motor	4,922.60
23 05 13 00-0052	EA	50 HP, 1,200 RPM, 365T NEMA Cast Iron Frame, Premium Efficient, Open Drip Proof Motor	5,959.22
23 05 13 00-0053	EA	60 HP, 1,200 RPM, 404T NEMA Cast Iron Frame, Premium Efficient, Open Drip Proof Motor	7,565.88
23 05 13 00-0054	EA	75 HP, 1,200 RPM, 405T NEMA Cast Iron Frame, Premium Efficient, Open Drip Proof Motor	8,423.58
23 05 13 00-0055	EA	100 HP, 1,200 RPM, 444T NEMA Cast Iron Frame, Premium Efficient, Open Drip Proof Motor	9,271.64
23 05 13 00-0056	EA	125 HP, 1,200 RPM, 445T NEMA Cast Iron Frame, Premium Efficient, Open Drip Proof Motor	10,012.71
23 05 13 00-0057	EA	150 HP, 1,800 RPM, 444T NEMA Cast Iron Frame, Premium Efficient, Open Drip Proof Motor	9,018.19
23 05 13 00-0058	EA	150 HP, 1,200 RPM, 445T NEMA Cast Iron Frame, Premium Efficient, Open Drip Proof Motor	11,792.14
23 05 13 00-0059	EA	200 HP, 3,600 RPM, 444TS NEMA Cast Iron Frame, Premium Efficient, Open Drip Proof Motor	10,980.04
23 05 13 00-0060	EA	200 HP, 1,800 RPM, 445T NEMA Cast Iron Frame, Premium Efficient, Open Drip Proof Motor	11,269.45



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
				23 05 13 00-0061 EA 200 HP, 1,200 RPM, 447T NEMA Cast Iron Frame, Premium Efficient, Open Drip Proof Motor.....	15,500.98	
23 05 13 00-0062				Premium Efficient, TEFC Motors <small>(23 05 13 00-0001)</small>		
				Note: NEMA premium efficiency, totally enclosed fan cooled, three phase AC motors.		
23 05 13 00-0063				Steel Frame, Premium Efficient, TEFC Motors <small>(23 05 13 00-0062)</small>		
				23 05 13 00-0064 EA 1 HP, 3,600 RPM, 56 NEMA Steel Frame, Premium Efficient, TEFC Motor.....	472.70	
				23 05 13 00-0065 EA 1 HP, 1,800 RPM, 143T NEMA Steel Frame, Premium Efficient, TEFC Motor.....	520.94	
				23 05 13 00-0066 EA 1 HP, 1,200 RPM, 145T NEMA Steel Frame, Premium Efficient, TEFC Motor.....	620.04	
				23 05 13 00-0067 EA 1-1/2 HP, 3,600 RPM, 143T NEMA Steel Frame, Premium Efficient, TEFC Motor.....	535.85	
				23 05 13 00-0068 EA 1-1/2 HP, 1,800 RPM, 145T NEMA Steel Frame, Premium Efficient, TEFC Motor.....	541.11	
				23 05 13 00-0069 EA 2 HP, 3,600 RPM, 145T NEMA Steel Frame, Premium Efficient, TEFC Motor.....	586.71	
				23 05 13 00-0070 EA 2 HP, 1,800 RPM, 145T NEMA Steel Frame, Premium Efficient, TEFC Motor.....	561.28	
				23 05 13 00-0071 EA 3 HP, 3,600 RPM, 182T NEMA Steel Frame, Premium Efficient, TEFC Motor.....	650.73	
				23 05 13 00-0072 EA 3 HP, 1,800 RPM, 182T NEMA Steel Frame, Premium Efficient, TEFC Motor.....	620.04	
				23 05 13 00-0073 EA 3 HP, 1,200 RPM, 213T NEMA Steel Frame, Premium Efficient, TEFC Motor.....	995.40	
				23 05 13 00-0074 EA 5 HP, 3,600 RPM, 184T NEMA Steel Frame, Premium Efficient, TEFC Motor.....	721.77	
				23 05 13 00-0075 EA 5 HP, 1,800 RPM, 184T NEMA Steel Frame, Premium Efficient, TEFC Motor.....	678.80	
				23 05 13 00-0076 EA 5 HP, 1,200 RPM, 215T NEMA Steel Frame, Premium Efficient, TEFC Motor.....	1,124.31	
				23 05 13 00-0077 EA 7-1/2 HP, 3,600 RPM, 213T NEMA Steel Frame, Premium Efficient, TEFC Motor.....	1,081.34	
				23 05 13 00-0078 EA 7-1/2 HP, 1,800 RPM, 213T NEMA Steel Frame, Premium Efficient, TEFC Motor.....	978.73	
				23 05 13 00-0079 EA 10 HP, 3,600 RPM, 215T NEMA Steel Frame, Premium Efficient, TEFC Motor.....	1,096.25	
				23 05 13 00-0080 EA 10 HP, 1,800 RPM, 215T NEMA Steel Frame, Premium Efficient, TEFC Motor.....	1,105.02	
23 05 13 00-0081				Cast Iron Frame, Premium Efficient, TEFC Motors <small>(23 05 13 00-0062)</small>		
				23 05 13 00-0082 EA 1 HP, 1,800 RPM, 143T NEMA Cast Iron Frame, Premium Efficient, TEFC Motor.....	674.41	
				23 05 13 00-0083 EA 1 HP, 1,200 RPM, 145T NEMA Cast Iron Frame, Premium Efficient, TEFC Motor.....	755.10	
				23 05 13 00-0084 EA 1-1/2 HP, 3,600 RPM, 143T NEMA Cast Iron Frame, Premium Efficient, TEFC Motor.....	712.12	
				23 05 13 00-0085 EA 1-1/2 HP, 1,800 RPM, 145T NEMA Cast Iron Frame, Premium Efficient, TEFC Motor.....	698.97	
				23 05 13 00-0086 EA 1-1/2 HP, 1,200 RPM, 182T NEMA Cast Iron Frame, Premium Efficient, TEFC Motor.....	898.92	
				23 05 13 00-0087 EA 2 HP, 3,600 RPM, 145T NEMA Cast Iron Frame, Premium Efficient, TEFC Motor.....	748.96	
				23 05 13 00-0088 EA 2 HP, 1,800 RPM, 145T NEMA Cast Iron Frame, Premium Efficient, TEFC Motor.....	732.30	
				23 05 13 00-0089 EA 2 HP, 1,200 RPM, 184T NEMA Cast Iron Frame, Premium Efficient, TEFC Motor.....	912.96	
				23 05 13 00-0090 EA 3 HP, 3,600 RPM, 182T NEMA Cast Iron Frame, Premium Efficient, TEFC Motor.....	808.59	
				23 05 13 00-0091 EA 3 HP, 1,800 RPM, 182T NEMA Cast Iron Frame, Premium Efficient, TEFC Motor.....	831.40	
				23 05 13 00-0092 EA 3 HP, 1,200 RPM, 213T NEMA Cast Iron Frame, Premium Efficient, TEFC Motor.....	1,137.47	
				23 05 13 00-0093 EA 5 HP, 3,600 RPM, 184T NEMA Cast Iron Frame, Premium Efficient, TEFC Motor.....	995.40	
				23 05 13 00-0094 EA 5 HP, 1,800 RPM, 184T NEMA Cast Iron Frame, Premium Efficient, TEFC Motor.....	832.27	
				23 05 13 00-0095 EA 5 HP, 1,200 RPM, 215T NEMA Cast Iron Frame, Premium Efficient, TEFC Motor.....	1,319.88	
				23 05 13 00-0096 EA 7-1/2 HP, 3,600 RPM, 213T NEMA Cast Iron Frame, Premium Efficient, TEFC Motor.....	1,152.38	
				23 05 13 00-0097 EA 7-1/2 HP, 1,800 RPM, 213T NEMA Cast Iron Frame, Premium Efficient, TEFC Motor.....	1,110.28	
				23 05 13 00-0098 EA 7-1/2 HP, 1,200 RPM, 254T NEMA Cast Iron Frame, Premium Efficient, TEFC Motor.....	1,882.04	
				23 05 13 00-0099 EA 10 HP, 3,600 RPM, 215T NEMA Cast Iron Frame, Premium Efficient, TEFC Motor.....	1,350.58	
				23 05 13 00-0100 EA 10 HP, 1,800 RPM, 215T NEMA Cast Iron Frame, Premium Efficient, TEFC Motor.....	1,245.34	
				23 05 13 00-0101 EA 10 HP, 1,200 RPM, 256T NEMA Cast Iron Frame, Premium Efficient, TEFC Motor.....	2,148.65	
				23 05 13 00-0102 EA 15 HP, 3,600 RPM, 254T NEMA Cast Iron Frame, Premium Efficient, TEFC Motor.....	1,860.99	
				23 05 13 00-0103 EA 15 HP, 1,800 RPM, 254T NEMA Cast Iron Frame, Premium Efficient, TEFC Motor.....	1,703.13	
				23 05 13 00-0104 EA 15 HP, 1,200 RPM, 284T NEMA Cast Iron Frame, Premium Efficient, TEFC Motor.....	2,866.04	
				23 05 13 00-0105 EA 20 HP, 3,600 RPM, 256T NEMA Cast Iron Frame, Premium Efficient, TEFC Motor.....	2,042.53	
				23 05 13 00-0106 EA 20 HP, 1,800 RPM, 256T NEMA Cast Iron Frame, Premium Efficient, TEFC Motor.....	2,065.34	
				23 05 13 00-0107 EA 20 HP, 1,200 RPM, 286T NEMA Cast Iron Frame, Premium Efficient, TEFC Motor.....	3,815.83	
				23 05 13 00-0108 EA 25 HP, 3,600 RPM, 284TS NEMA Cast Iron Frame, Premium Efficient, TEFC Motor.....	2,665.20	
				23 05 13 00-0109 EA 25 HP, 1,800 RPM, 284T NEMA Cast Iron Frame, Premium Efficient, TEFC Motor.....	2,701.16	
				23 05 13 00-0110 EA 25 HP, 1,200 RPM, 324T NEMA Cast Iron Frame, Premium Efficient, TEFC Motor.....	4,317.47	
				23 05 13 00-0111 EA 30 HP, 3,600 RPM, 286TS NEMA Cast Iron Frame, Premium Efficient, TEFC Motor.....	3,166.85	
				23 05 13 00-0112 EA 30 HP, 1,800 RPM, 286T NEMA Cast Iron Frame, Premium Efficient, TEFC Motor.....	3,204.56	
				23 05 13 00-0113 EA 30 HP, 1,200 RPM, 326T NEMA Cast Iron Frame, Premium Efficient, TEFC Motor.....	4,987.50	
				23 05 13 00-0114 EA 40 HP, 3,600 RPM, 324TS NEMA Cast Iron Frame, Premium Efficient, TEFC Motor.....	4,341.15	
				23 05 13 00-0115 EA 40 HP, 1,800 RPM, 324T NEMA Cast Iron Frame, Premium Efficient, TEFC Motor.....	4,190.31	
				23 05 13 00-0116 EA 40 HP, 1,200 RPM, 364T NEMA Cast Iron Frame, Premium Efficient, TEFC Motor.....	6,215.30	
				23 05 13 00-0117 EA 50 HP, 3,600 RPM, 326TS NEMA Cast Iron Frame, Premium Efficient, TEFC Motor.....	4,748.96	
				23 05 13 00-0118 EA 50 HP, 1,800 RPM, 326T NEMA Cast Iron Frame, Premium Efficient, TEFC Motor.....	4,579.69	
				23 05 13 00-0119 EA 50 HP, 1,200 RPM, 365T NEMA Cast Iron Frame, Premium Efficient, TEFC Motor.....	7,510.63	
				23 05 13 00-0120 EA 60 HP, 3,600 RPM, 364TS NEMA Cast Iron Frame, Premium Efficient, TEFC Motor.....	6,671.34	
				23 05 13 00-0121 EA 60 HP, 1,800 RPM, 364T NEMA Cast Iron Frame, Premium Efficient, TEFC Motor.....	6,589.78	
				23 05 13 00-0122 EA 60 HP, 1,200 RPM, 404T NEMA Cast Iron Frame, Premium Efficient, TEFC Motor.....	9,116.42	
				23 05 13 00-0123 EA 75 HP, 3,600 RPM, 365TS NEMA Cast Iron Frame, Premium Efficient, TEFC Motor.....	7,761.45	
				23 05 13 00-0124 EA 75 HP, 1,800 RPM, 365T NEMA Cast Iron Frame, Premium Efficient, TEFC Motor.....	7,705.32	
				23 05 13 00-0125 EA 75 HP, 1,200 RPM, 405T NEMA Cast Iron Frame, Premium Efficient, TEFC Motor.....	10,616.08	
				23 05 13 00-0126 EA 100 HP, 1,800 RPM, 405T NEMA Cast Iron Frame, Premium Efficient, TEFC Motor.....	9,568.95	
				23 05 13 00-0127 EA 125 HP, 1,800 RPM, 444T NEMA Cast Iron Frame, Premium Efficient, TEFC Motor.....	11,846.52	
				23 05 13 00-0128 EA 150 HP, 1,800 RPM, 445T NEMA Cast Iron Frame, Premium Efficient, TEFC Motor.....	13,626.83	
				23 05 13 00-0129 EA 200 HP, 1,800 RPM, 447T NEMA Cast Iron Frame, Premium Efficient, TEFC Motor.....	17,126.06	
23 05 13 00-0130				Premium Efficient, Severe Duty Motors <small>(23 05 13 00-0001)</small>		
				Note: NEMA premium efficiency, severe duty, three phase AC motors.		
				23 05 13 00-0131 EA 1 HP, 3,600 RPM, 143T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	700.72	
				23 05 13 00-0132 EA 1 HP, 1,800 RPM, 143T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	770.01	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 05 Common Work Results For HVAC****23 05 13 Common Motor Requirements For HVAC Equipment**MINOR
CSI UOM DESCRIPTIONTOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

23 05 13 00-0133	EA	1 HP, 1,200 RPM, 145T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	850.69	
23 05 13 00-0134	EA	1 HP, 900 RPM, L182T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	1,195.35	
23 05 13 00-0135	EA	1-1/2 HP, 3,600 RPM, 143T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	797.19	
23 05 13 00-0136	EA	1-1/2 HP, 1,800 RPM, 145T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	784.92	
23 05 13 00-0137	EA	1-1/2 HP, 1,200 RPM, 182T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	995.40	
23 05 13 00-0138	EA	1-1/2 HP, 900 RPM, L184T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	1,487.39	
23 05 13 00-0139	EA	2 HP, 3,600 RPM, 145T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	834.03	
23 05 13 00-0140	EA	2 HP, 1,800 RPM, 145T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	819.12	
23 05 13 00-0141	EA	2 HP, 1,200 RPM, L184T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	1,008.55	
23 05 13 00-0142	EA	2 HP, 900 RPM, L213T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	1,875.90	
23 05 13 00-0143	EA	3 HP, 3,600 RPM, 182T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	986.62	
23 05 13 00-0144	EA	3 HP, 1,800 RPM, 182T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	1,036.61	
23 05 13 00-0145	EA	3 HP, 1,200 RPM, 213T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	1,455.82	
23 05 13 00-0146	EA	3 HP, 900 RPM, L215T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	2,034.64	
23 05 13 00-0147	EA	5 HP, 3,600 RPM, 184T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	1,213.77	
23 05 13 00-0148	EA	5 HP, 1,800 RPM, L184T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	1,055.03	
23 05 13 00-0149	EA	5 HP, 1,200 RPM, L215T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	1,475.11	
23 05 13 00-0150	EA	5 HP, 900 RPM, 254T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	3,238.76	
23 05 13 00-0151	EA	7-1/2 HP, 3,600 RPM, 213T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	1,583.86	
23 05 13 00-0152	EA	7-1/2 HP, 1,800 RPM, L213T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	1,328.66	
23 05 13 00-0153	EA	7-1/2 HP, 1,200 RPM, 254T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	2,110.94	
23 05 13 00-0154	EA	7-1/2 HP, 900 RPM, 256T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	3,703.57	
23 05 13 00-0155	EA	10 HP, 3,600 RPM, 215T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	1,686.47	
23 05 13 00-0156	EA	10 HP, 1,800 RPM, L215T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	1,590.88	
23 05 13 00-0157	EA	10 HP, 1,200 RPM, 256T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	2,742.38	
23 05 13 00-0158	EA	10 HP, 900 RPM, 284T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	4,320.10	
23 05 13 00-0159	EA	15 HP, 3,600 RPM, 254T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	2,157.42	
23 05 13 00-0160	EA	15 HP, 1,800 RPM, 254T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	2,026.75	
23 05 13 00-0161	EA	15 HP, 1,200 RPM, 284T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	3,144.04	
23 05 13 00-0162	EA	15 HP, 900 RPM, 286T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	5,767.15	
23 05 13 00-0163	EA	20 HP, 3,600 RPM, 256T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	2,516.99	
23 05 13 00-0164	EA	20 HP, 1,800 RPM, 256T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	2,174.08	
23 05 13 00-0165	EA	20 HP, 1,200 RPM, 286T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	4,271.87	
23 05 13 00-0166	EA	20 HP, 900 RPM, 324T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	6,574.87	
23 05 13 00-0167	EA	25 HP, 3,600 RPM, 284TS NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	3,024.77	
23 05 13 00-0168	EA	25 HP, 1,800 RPM, 284T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	2,844.99	
23 05 13 00-0169	EA	25 HP, 1,200 RPM, 324T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	4,463.93	
23 05 13 00-0170	EA	30 HP, 3,600 RPM, 286TS NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	3,687.78	
23 05 13 00-0171	EA	30 HP, 1,800 RPM, 286T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	3,378.20	
23 05 13 00-0172	EA	30 HP, 1,200 RPM, 326T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	5,754.87	
23 05 13 00-0173	EA	40 HP, 3,600 RPM, 324TS NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	5,066.43	
23 05 13 00-0174	EA	40 HP, 1,800 RPM, 324T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	4,420.08	
23 05 13 00-0175	EA	40 HP, 1,200 RPM, 364T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	7,172.98	
23 05 13 00-0176	EA	50 HP, 3,600 RPM, 326TS NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	5,309.36	
23 05 13 00-0177	EA	50 HP, 1,800 RPM, 326T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	5,188.33	
23 05 13 00-0178	EA	50 HP, 1,200 RPM, 365T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	7,640.42	
23 05 13 00-0179	EA	60 HP, 3,600 RPM, 364TS NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	7,705.32	
23 05 13 00-0180	EA	60 HP, 1,800 RPM, 364T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	6,953.73	
23 05 13 00-0181	EA	60 HP, 1,800 RPM, 404T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	10,436.30	
23 05 13 00-0182	EA	75 HP, 3,600 RPM, 365TS NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	8,613.89	
23 05 13 00-0183	EA	75 HP, 1,800 RPM, 365T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	8,125.40	
23 05 13 00-0184	EA	75 HP, 1,200 RPM, 405T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	12,701.59	
23 05 13 00-0185	EA	100 HP, 3,600 RPM, 405TS NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	10,827.44	
23 05 13 00-0186	EA	100 HP, 1,800 RPM, 405T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	10,666.07	
23 05 13 00-0187	EA	100 HP, 1,200 RPM, 444T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	13,970.61	
23 05 13 00-0188	EA	125 HP, 3,600 RPM, 444TS NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	12,722.64	
23 05 13 00-0189	EA	125 HP, 1,800 RPM, 444T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	12,609.51	
23 05 13 00-0190	EA	125 HP, 1,200 RPM, 445T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	15,782.49	
23 05 13 00-0191	EA	150 HP, 3,600 RPM, 445TS NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	14,915.14	
23 05 13 00-0192	EA	150 HP, 1,800 RPM, 445T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	14,772.19	
23 05 13 00-0193	EA	150 HP, 1,200 RPM, 447T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	17,794.33	
23 05 13 00-0194	EA	200 HP, 3,600 RPM, 447TS NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	17,661.90	
23 05 13 00-0195	EA	200 HP, 1,800 RPM, 447T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	17,770.65	
23 05 13 00-0196	EA	200 HP, 1,200 RPM, 449T NEMA Cast Iron Frame, Premium Efficient, Severe Duty Motor.....	23,308.91	

23 05 13 00-0197 Premium Efficient, Explosion Proof Motors (23 05 13 00-0001)

Note: NEMA premium efficiency, explosion proof, three phase AC motors.

23 05 13 00-0198	EA	1 HP, 1,800 RPM, 143T NEMA Cast Iron Frame, Premium Efficient, Explosion Proof Motor.....	934.88	
23 05 13 00-0199	EA	1-1/2 HP, 1,800 RPM, 145T NEMA Cast Iron Frame, Premium Efficient, Explosion Proof Motor.....	968.21	
23 05 13 00-0200	EA	2 HP, 1,800 RPM, 145T NEMA Cast Iron Frame, Premium Efficient, Explosion Proof Motor.....	1,055.91	
23 05 13 00-0201	EA	3 HP, 1,800 RPM, L182T NEMA Cast Iron Frame, Premium Efficient, Explosion Proof Motor.....	1,304.98	
23 05 13 00-0202	EA	5 HP, 1,800 RPM, L184T NEMA Cast Iron Frame, Premium Efficient, Explosion Proof Motor.....	1,447.05	
23 05 13 00-0203	EA	7-1/2 HP, 1,800 RPM, 213T NEMA Cast Iron Frame, Premium Efficient, Explosion Proof Motor.....	1,994.30	
23 05 13 00-0204	EA	10 HP, 1,800 RPM, L215T NEMA Cast Iron Frame, Premium Efficient, Explosion Proof Motor.....	2,035.52	
23 05 13 00-0205	EA	15 HP, 1,800 RPM, 254T NEMA Cast Iron Frame, Premium Efficient, Explosion Proof Motor.....	2,755.53	
23 05 13 00-0206	EA	20 HP, 1,800 RPM, 256T NEMA Cast Iron Frame, Premium Efficient, Explosion Proof Motor.....	3,141.41	
23 05 13 00-0207	EA	25 HP, 1,800 RPM, 284T NEMA Cast Iron Frame, Premium Efficient, Explosion Proof Motor.....	4,127.16	
23 05 13 00-0208	EA	30 HP, 1,800 RPM, 286T NEMA Cast Iron Frame, Premium Efficient, Explosion Proof Motor.....	4,632.31	
23 05 13 00-0209	EA	40 HP, 1,800 RPM, 324T NEMA Cast Iron Frame, Premium Efficient, Explosion Proof Motor.....	6,057.44	
23 05 13 00-0210	EA	50 HP, 1,800 RPM, 326T NEMA Cast Iron Frame, Premium Efficient, Explosion Proof Motor.....	6,822.18	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 13 00-0211 EA 60 HP, 1,800 RPM, 364T NEMA Cast Iron Frame, Premium Efficient, Explosion Proof Motor	9,543.51	
23 05 13 00-0212 EA 75 HP, 1,800 RPM, 365T NEMA Cast Iron Frame, Premium Efficient, Explosion Proof Motor	11,203.68	
23 05 13 00-0213 EA 100 HP, 1,800 RPM, 405T NEMA Cast Iron Frame, Premium Efficient, Explosion Proof Motor	13,647.87	
23 05 13 00-0214 EA 125 HP, 1,800 RPM, 444T NEMA Cast Iron Frame, Premium Efficient, Explosion Proof Motor	17,838.18	
23 05 13 00-0215 EA 150 HP, 1,800 RPM, 445T NEMA Cast Iron Frame, Premium Efficient, Explosion Proof Motor	20,353.42	
 23 05 13 00-0216 Motor Mounting <small>(23 05 13)</small>		
<i>Note: Includes handling and motor installation on mounting base. Excludes mounting base.</i>		
23 05 13 00-0217 EA 1/2 HP Motor Mounting	126.46	64.35
23 05 13 00-0218 EA 3/4 HP Motor Mounting	145.71	80.44
23 05 13 00-0219 EA 1 HP Motor Mounting	155.88	80.44
23 05 13 00-0220 EA 1-1/2 HP Motor Mounting	167.57	80.44
23 05 13 00-0221 EA 2 HP Motor Mounting	181.15	96.51
23 05 13 00-0222 EA 3 HP Motor Mounting	209.45	96.51
23 05 13 00-0223 EA 5 HP Motor Mounting	248.24	160.86
23 05 13 00-0224 EA 7-1/2 HP Motor Mounting	319.18	160.86
23 05 13 00-0225 EA 10 HP Motor Mounting	418.92	281.51
23 05 13 00-0226 EA 15 HP Motor Mounting	515.59	281.51
23 05 13 00-0227 EA 20 HP Motor Mounting	609.33	402.16
23 05 13 00-0228 EA 25 HP Motor Mounting	690.99	402.16
23 05 13 00-0229 EA 30 HP Motor Mounting	837.82	402.16
23 05 13 00-0230 EA 40 HP Motor Mounting	944.03	603.23
23 05 13 00-0231 EA 50 HP Motor Mounting	1,047.29	603.23
23 05 13 00-0232 EA 75 HP Motor Mounting	1,264.65	884.74
23 05 13 00-0233 EA 100 HP Motor Mounting	1,523.32	884.74
23 05 13 00-0234 EA 125 HP Motor Mounting	1,861.83	1,206.47
23 05 13 00-0235 EA 150 HP Motor Mounting	2,162.13	1,206.47
23 05 13 00-0236 EA 200 HP Motor Mounting	2,482.44	1,447.76
 23 05 16 Expansion Fittings And Loops For HVAC Piping <small>(23 05)</small>		
23 05 16 00-0001 Stainless Steel Bellows Type Expansion Joints <small>(23 05 16)</small>		
<i>Note: Includes internal sleeves and external covers.</i>		
23 05 16 00-0002 Threaded, 150 LB, Stainless Steel Bellows Type Expansion Joints <small>(23 05 16 00-0001)</small>		
<i>Note: Carbon steel ends. Includes internal sleeves and external covers.</i>		
23 05 16 00-0003 EA 1/2" Threaded, 150 LB, Stainless Steel Bellows Type Expansion Joint	152.19	64.38
<i>For 300 LB Rating, Add</i>	<i>5.84</i>	
23 05 16 00-0004 EA 3/4" Threaded, 150 LB, Stainless Steel Bellows Type Expansion Joint	170.70	72.61
<i>For 300 LB Rating, Add</i>	<i>6.39</i>	
23 05 16 00-0005 EA 1" Threaded, 150 LB, Stainless Steel Bellows Type Expansion Joint	199.76	83.24
<i>For 300 LB Rating, Add</i>	<i>8.34</i>	
23 05 16 00-0006 EA 1-1/4" Threaded, 150 LB, Stainless Steel Bellows Type Expansion Joint	225.61	92.90
<i>For 300 LB Rating, Add</i>	<i>10.01</i>	
23 05 16 00-0007 EA 1-1/2" Threaded, 150 LB, Stainless Steel Bellows Type Expansion Joint	244.13	99.85
<i>For 300 LB Rating, Add</i>	<i>11.11</i>	
23 05 16 00-0008 EA 2" Threaded, 150 LB, Stainless Steel Bellows Type Expansion Joint	281.60	117.50
<i>For 300 LB Rating, Add</i>	<i>11.67</i>	
 23 05 16 00-0009 Flanged, 150 LB, Stainless Steel Bellows Type Expansion Joints <small>(23 05 16 00-0001)</small>		
<i>Note: Carbon steel ends. Includes internal sleeves and external covers.</i>		
23 05 16 00-0010 EA 1-1/4" Flanged, 150 LB, Stainless Steel Bellows Type Expansion Joint	652.63	58.83
<i>For 300 LB Rating, Add</i>	<i>133.75</i>	
23 05 16 00-0011 EA 1-1/2" Flanged, 150 LB, Stainless Steel Bellows Type Expansion Joint	688.61	59.28
<i>For 300 LB Rating, Add</i>	<i>142.50</i>	
23 05 16 00-0012 EA 2" Flanged, 150 LB, Stainless Steel Bellows Type Expansion Joint	692.66	61.33
<i>For 300 LB Rating, Add</i>	<i>142.52</i>	
23 05 16 00-0013 EA 2-1/2" Flanged, 150 LB, Stainless Steel Bellows Type Expansion Joint	746.04	66.85
<i>For 300 LB Rating, Add</i>	<i>153.08</i>	
23 05 16 00-0014 EA 3" Flanged, 150 LB, Stainless Steel Bellows Type Expansion Joint	818.82	78.62
<i>For 300 LB Rating, Add</i>	<i>165.42</i>	
23 05 16 00-0015 EA 4" Flanged, 150 LB, Stainless Steel Bellows Type Expansion Joint	1,026.41	156.43
<i>For 300 LB Rating, Add</i>	<i>178.43</i>	
23 05 16 00-0016 EA 5" Flanged, 150 LB, Stainless Steel Bellows Type Expansion Joint	1,395.72	165.99
<i>For 300 LB Rating, Add</i>	<i>266.04</i>	
23 05 16 00-0017 EA 6" Flanged, 150 LB, Stainless Steel Bellows Type Expansion Joint	1,278.93	183.78
<i>For 300 LB Rating, Add</i>	<i>227.84</i>	
23 05 16 00-0018 EA 8" Flanged, 150 LB, Stainless Steel Bellows Type Expansion Joint	1,600.34	210.02
<i>For 300 LB Rating, Add</i>	<i>295.33</i>	
23 05 16 00-0019 EA 10" Flanged, 150 LB, Stainless Steel Bellows Type Expansion Joint	2,041.64	257.29
<i>For 300 LB Rating, Add</i>	<i>382.02</i>	
23 05 16 00-0020 EA 12" Flanged, 150 LB, Stainless Steel Bellows Type Expansion Joint	2,697.18	311.84
<i>For 300 LB Rating, Add</i>	<i>518.17</i>	
 23 05 16 00-0021 Butt Weld, 150 LB, Stainless Steel Bellows Type Expansion Joints <small>(23 05 16 00-0001)</small>		
<i>Note: Carbon steel ends. Includes internal sleeves and external covers.</i>		
23 05 16 00-0022 EA 1-1/4" Butt Weld, 150 LB, Stainless Steel Bellows Type Expansion Joint	606.15	88.25
<i>For 300 LB Rating, Add</i>	<i>107.43</i>	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 05 Common Work Results For HVAC****23 05 16 Expansion Fittings And Loops For HVAC Piping**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 16 00-0023	EA		1-1/2" Butt Weld, 150 LB, Stainless Steel Bellows Type Expansion Joint.....	635.80	88.98
			<i>For 300 LB Rating, Add</i>	114.45	
23 05 16 00-0024	EA		2" Butt Weld, 150 LB, Stainless Steel Bellows Type Expansion Joint.....	641.93	91.93
			<i>For 300 LB Rating, Add</i>	114.47	
23 05 16 00-0025	EA		2-1/2" Butt Weld, 150 LB, Stainless Steel Bellows Type Expansion Joint.....	692.52	100.24
			<i>For 300 LB Rating, Add</i>	122.95	
23 05 16 00-0026	EA		3" Butt Weld, 150 LB, Stainless Steel Bellows Type Expansion Joint.....	768.56	117.89
			<i>For 300 LB Rating, Add</i>	133.14	
23 05 16 00-0027	EA		4" Butt Weld, 150 LB, Stainless Steel Bellows Type Expansion Joint.....	1,042.27	234.74
			<i>For 300 LB Rating, Add</i>	143.32	
23 05 16 00-0028	EA		5" Butt Weld, 150 LB, Stainless Steel Bellows Type Expansion Joint.....	1,351.42	248.99
			<i>For 300 LB Rating, Add</i>	213.68	
23 05 16 00-0029	EA		6" Butt Weld, 150 LB, Stainless Steel Bellows Type Expansion Joint.....	1,282.95	275.67
			<i>For 300 LB Rating, Add</i>	183.00	
23 05 16 00-0030	EA		8" Butt Weld, 150 LB, Stainless Steel Bellows Type Expansion Joint.....	1,577.89	315.00
			<i>For 300 LB Rating, Add</i>	237.20	
23 05 16 00-0031	EA		10" Butt Weld, 150 LB, Stainless Steel Bellows Type Expansion Joint.....	1,997.67	385.94
			<i>For 300 LB Rating, Add</i>	306.84	
23 05 16 00-0032	EA		12" Butt Weld, 150 LB, Stainless Steel Bellows Type Expansion Joint.....	2,600.35	467.83
			<i>For 300 LB Rating, Add</i>	416.19	

23 05 19 Meters And Gages For HVAC Piping (23 05)**23 05 19 00-0001 Thermometers (23 05 19)****23 05 19 00-0002 Dial Type, Bi-Metal, 4" To 9" Stem, Steel Case, Brass Stem, Thermometers**

(23 05 19 00-0001)

Note: Various ranges.

23 05 19 00-0003	EA	2" Diameter Dial, Bi-Metal, 4" To 9" Stem, Steel Case, Brass Stem, Thermometer	83.09	25.57
23 05 19 00-0004	EA	2-1/2" Diameter Dial, Bi-Metal, 4" To 9" Stem, Steel Case, Brass Stem, Thermometer	98.96	25.57
23 05 19 00-0005	EA	3-1/2" Diameter Dial, Bi-Metal, 4" To 9" Stem, Steel Case, Brass Stem, Thermometer	98.96	25.57

23 05 19 00-0006 Liquid Filled Industrial Union Connection Type Thermometers (23 05 19 00-0001)

Note: Various ranges.

23 05 19 00-0007	EA	7" Scale, Angle Stem, Liquid Filled Industrial Union Connection Type Thermometer	114.82	25.57
23 05 19 00-0008	EA	9" Scale, Angle Stem, Liquid Filled Industrial Union Connection Type Thermometer	114.82	25.57
23 05 19 00-0009	EA	12" Scale, Angle Stem, Liquid Filled Industrial Union Connection Type Thermometer	147.99	25.57
23 05 19 00-0010	EA	7" Scale, Straight Stem, Liquid Filled Industrial Union Connection Type Thermometer	119.15	25.57
23 05 19 00-0011	EA	9" Scale, Straight Stem, Liquid Filled Industrial Union Connection Type Thermometer	126.36	25.57
23 05 19 00-0012	EA	12" Scale, Straight Stem, Liquid Filled Industrial Union Connection Type Thermometer	152.32	25.57

23 05 19 00-0013 Liquid Filled Industrial Separable Socket Type Thermometers (23 05 19 00-0001)

Note: Various ranges. Socket connection for thermowell.

23 05 19 00-0014	EA	7" Scale, Angle Stem, Liquid Filled Industrial Separable Socket Type Thermometer	114.82	25.57
23 05 19 00-0015	EA	9" Scale, Angle Stem, Liquid Filled Industrial Separable Socket Type Thermometer	114.82	25.57
23 05 19 00-0016	EA	12" Scale, Angle Stem, Liquid Filled Industrial Separable Socket Type Thermometer	147.99	25.57
23 05 19 00-0017	EA	7" Scale, Straight Stem, Liquid Filled Industrial Separable Socket Type Thermometer	133.57	25.57
23 05 19 00-0018	EA	9" Scale, Straight Stem, Liquid Filled Industrial Separable Socket Type Thermometer	147.99	25.57
23 05 19 00-0019	EA	12" Scale, Straight Stem, Liquid Filled Industrial Separable Socket Type Thermometer	151.67	25.57

23 05 19 00-0020 1" NPT, 304 Stainless Steel Thermowells (23 05 19 00-0001)

23 05 19 00-0021	EA	4" Long, 1" NPT, 304 Stainless Steel Thermowell	129.92	47.93
23 05 19 00-0022	EA	8" Long, 1" NPT, 304 Stainless Steel Thermowell	129.86	47.93

23 05 19 00-0023 Pressure Gauges (23 05 19)**23 05 19 00-0024 Steel Case, 0 To 60 PSI Or 0 To 100 PSI, Pressure Gauges (23 05 19 00-0023)**

23 05 19 00-0025	EA	2" Diameter Dial, Steel Case, 0 To 60 PSI Or 0 To 100 PSI, Pressure Gauge.....	29.20	9.98
23 05 19 00-0026	EA	4" Diameter Dial, Steel Case, 0 To 60 PSI Or 0 To 100 PSI, Pressure Gauge.....	37.71	9.98

23 05 19 00-0027 Aluminum Case, 0 To 60 PSI Or 0 To 100 PSI, Pressure Gauges (23 05 19 00-0023)

23 05 19 00-0028	EA	3-1/2" Diameter Dial, Aluminum Case, 0 To 60 PSI Or 0 To 100 PSI, Pressure Gauge.....	92.42	9.98
23 05 19 00-0029	EA	4-1/2" Diameter Dial, Aluminum Case, 0 To 60 PSI Or 0 To 100 PSI, Pressure Gauge.....	92.42	9.98
23 05 19 00-0030	EA	6" Diameter Dial, Aluminum Case, 0 To 60 PSI Or 0 To 100 PSI, Pressure Gauge.....	117.03	9.98
23 05 19 00-0031	EA	8-1/2" Diameter Dial, Aluminum Case, 0 To 60 PSI Or 0 To 100 PSI, Pressure Gauge.....	261.94	9.98

23 05 19 00-0032 Brass Case, 0 To 60 PSI Or 0 To 100 PSI, Pressure Gauges (23 05 19 00-0023)

Note: Liquid filled.

23 05 19 00-0033	EA	2-1/2" Diameter Dial, Brass Case, 0 To 60 PSI Or 0 To 100 PSI, Pressure Gauge.....	78.49	9.98
23 05 19 00-0034	EA	4" Diameter Dial, Brass Case, 0 To 60 PSI Or 0 To 100 PSI, Pressure Gauge.....	172.07	9.98

23 05 19 00-0035 Steel Case, 0 To 10K PSI High Pressure, Pressure Gauges (23 05 19 00-0023)

23 05 19 00-0036	EA	4-1/2" Diameter Dial, Steel Case, 0 To 10K PSI High Pressure, Pressure Gauge	278.13	9.98
23 05 19 00-0037	EA	6-1/2" Diameter Dial, Steel Case, 0 To 10K PSI High Pressure, Pressure Gauge	278.13	9.98



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
				23 05 19 00-0038 EA 8-1/2" Diameter Dial, Steel Case, 0 To 10K PSI High Pressure, Pressure Gauge	278.13	9.98
23 05 19 00-0039				Gauge Accessories <small>(23 05 19 00-0023)</small>		
				23 05 19 00-0040 EA Pete's Plug (Valve Cock For Removable Pressure Gauge Or Thermometer)	46.12	7.99
				23 05 19 00-0041 EA 1/4" Snubber Valve	32.26	7.99
				23 05 19 00-0042 EA 1/4" Female Pipe Thread, Brass Gauge Cock	20.95	11.98
				23 05 19 00-0043 EA 1/4" Male Pipe Thread, Brass Gauge Cock	19.02	11.98
				23 05 19 00-0044 EA 1/4" Pressure Pigtail Steam Siphon	20.54	11.98
				23 05 19 00-0045 EA 1/4" x 3" Long Black Steel Nipple	4.57	3.99
				23 05 19 00-0046 EA 1/4" Steel Thread-O-Let	51.12	19.97
				23 05 19 00-0047 EA 1/4", 300 LB, Black Steel Union	32.39	7.99
				23 05 19 00-0048 EA 1/4", Black Steel Coupling	16.59	7.99
				23 05 19 00-0049 EA 1/4", 300 LB, Black Steel Plug	9.73	4.79
				23 05 19 00-0050 EA 1/4", 150 LB, Black Steel Cap	9.93	4.79
				23 05 19 00-0051 LF 1/4" Schedule 40, Threaded And Coupled, Black Steel Pipe	5.02	
				23 05 19 00-0052 LF 1/4" Schedule 80, Plain End, Black Steel Pipe	4.99	
				23 05 19 00-0053 LF 1/4" Schedule 40, Threaded And Coupled, Galvanized Steel Pipe	5.01	
				23 05 19 00-0054 EA 1/4" Threaded, 800 LB, Forged Steel, Ball Valve	55.24	
23 05 19 00-0055				Valve Lock Covers <small>(23 05 19)</small>		
				23 05 19 00-0056 EA Valve Lock Cover	49.34	12.22
23 05 19 00-0057				Sight Flow Indicator <small>(23 05 19)</small>		
23 05 19 00-0058				Threaded, Single Window, Acrylonitrile Butadiene Styrene (ABS) Plastic Impeller, Bronze Body, Sight Flow Indicator <small>(23 05 19 00-0057)</small>		
				23 05 19 00-0059 EA 1/4" Threaded, Single Window, Acrylonitrile Butadiene Styrene (ABS) Plastic Impeller, Bronze Body, Sight Flow Indicator (Dwyer SFI-100)	92.24	11.63
				23 05 19 00-0060 EA 3/8" Threaded, Single Window, Acrylonitrile Butadiene Styrene (ABS) Plastic Impeller, Bronze Body, Sight Flow Indicator (Dwyer SFI-100)	96.38	12.23
				23 05 19 00-0061 EA 1/2" Threaded, Single Window, Acrylonitrile Butadiene Styrene (ABS) Plastic Impeller, Bronze Body, Sight Flow Indicator (Dwyer SFI-100)	104.10	12.86
				23 05 19 00-0062 EA 3/4" Threaded, Single Window, Acrylonitrile Butadiene Styrene (ABS) Plastic Impeller, Bronze Body, Sight Flow Indicator (Dwyer SFI-100)	117.74	17.33
				23 05 19 00-0063 EA 1" Threaded, Single Window, Acrylonitrile Butadiene Styrene (ABS) Plastic Impeller, Bronze Body, Sight Flow Indicator (Dwyer SFI-100)	140.84	21.00
				23 05 19 00-0064 EA 1-1/4" Threaded, Single Window, Acrylonitrile Butadiene Styrene (ABS) Plastic Impeller, Bronze Body, Sight Flow Indicator (Dwyer SFI-100)	160.81	26.59
				23 05 19 00-0065 EA 1-1/2" Threaded, Single Window, Acrylonitrile Butadiene Styrene (ABS) Plastic Impeller, Bronze Body, Sight Flow Indicator (Dwyer SFI-100)	225.12	30.74
				23 05 19 00-0066 EA 2" Threaded, Single Window, Acrylonitrile Butadiene Styrene (ABS) Plastic Impeller, Bronze Body, Sight Flow Indicator (Dwyer SFI-100)	250.32	36.33
23 05 19 00-0067				Threaded, Double Window, Acrylonitrile Butadiene Styrene (ABS) Plastic Impeller, Bronze Body, Sight Flow Indicator <small>(23 05 19 00-0057)</small>		
				23 05 19 00-0068 EA 1/4" Threaded, Double Window, Acrylonitrile Butadiene Styrene (ABS) Plastic Impeller, Bronze Body, Sight Flow Indicator (Dwyer SFI-300)	118.55	11.63
				23 05 19 00-0069 EA 3/8" Threaded, Double Window, Acrylonitrile Butadiene Styrene (ABS) Plastic Impeller, Bronze Body, Sight Flow Indicator (Dwyer SFI-300)	122.11	12.23
				23 05 19 00-0070 EA 1/2" Threaded, Double Window, Acrylonitrile Butadiene Styrene (ABS) Plastic Impeller, Bronze Body, Sight Flow Indicator (Dwyer SFI-300)	131.58	12.86
				23 05 19 00-0071 EA 3/4" Threaded, Double Window, Acrylonitrile Butadiene Styrene (ABS) Plastic Impeller, Bronze Body, Sight Flow Indicator (Dwyer SFI-300)	141.13	17.33
				23 05 19 00-0072 EA 1" Threaded, Double Window, Acrylonitrile Butadiene Styrene (ABS) Plastic Impeller, Bronze Body, Sight Flow Indicator (Dwyer SFI-300)	150.77	21.00
				23 05 19 00-0073 EA 1-1/4" Threaded, Double Window, Acrylonitrile Butadiene Styrene (ABS) Plastic Impeller, Bronze Body, Sight Flow Indicator (Dwyer SFI-300)	164.90	26.59
				23 05 19 00-0074 EA 1-1/2" Threaded, Double Window, Acrylonitrile Butadiene Styrene (ABS) Plastic Impeller, Bronze Body, Sight Flow Indicator (Dwyer SFI-300)	304.63	30.74
				23 05 19 00-0075 EA 2" Threaded, Double Window, Acrylonitrile Butadiene Styrene (ABS) Plastic Impeller, Bronze Body, Sight Flow Indicator (Dwyer SFI-300)	327.50	36.33
23 05 19 00-0076				Threaded, Double Window, Acrylonitrile Butadiene Styrene (ABS) Plastic Impeller, Stainless Steel Body, Sight Flow Indicator <small>(23 05 19 00-0057)</small>		
				23 05 19 00-0077 EA 1/4" Threaded, Double Window, Acrylonitrile Butadiene Styrene (ABS) Plastic Impeller, Stainless Steel Body, Sight Flow Indicator (Dwyer SFI-300SS)	169.41	11.63
				23 05 19 00-0078 EA 3/8" Threaded, Double Window, Acrylonitrile Butadiene Styrene (ABS) Plastic Impeller, Stainless Steel Body, Sight Flow Indicator (Dwyer SFI-300SS)	178.82	12.23
				23 05 19 00-0079 EA 1/2" Threaded, Double Window, Acrylonitrile Butadiene Styrene (ABS) Plastic Impeller, Stainless Steel Body, Sight Flow Indicator (Dwyer SFI-300SS)	194.14	12.86
				23 05 19 00-0080 EA 3/4" Threaded, Double Window, Acrylonitrile Butadiene Styrene (ABS) Plastic Impeller, Stainless Steel Body, Sight Flow Indicator (Dwyer SFI-300SS)	212.45	17.33
				23 05 19 00-0081 EA 1" Threaded, Double Window, Acrylonitrile Butadiene Styrene (ABS) Plastic Impeller, Stainless Steel Body, Sight Flow Indicator (Dwyer SFI-300SS)	244.32	21.00
				23 05 19 00-0082 EA 1-1/4" Threaded, Double Window, Acrylonitrile Butadiene Styrene (ABS) Plastic Impeller, Stainless Steel Body, Sight Flow Indicator (Dwyer SFI-300SS)	260.20	26.59

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 05 Common Work Results For HVAC****23 05 19 Meters And Gages For HVAC Piping**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 19 00-0083 EA 1-1/2" Threaded, Double Window, Acrylonitrile Butadiene Styrene (ABS) Plastic Impeller, Stainless Steel Body, Sight Flow Indicator (Dwyer SFI-300SS)	515.11	30.74
23 05 19 00-0084 EA 2" Threaded, Double Window, Acrylonitrile Butadiene Styrene (ABS) Plastic Impeller, Stainless Steel Body, Sight Flow Indicator (Dwyer SFI-300SS)	543.82	36.33
23 05 19 00-0085 Threaded, Double Window, 304SS Flapper, Bronze Body, Sight Flow Indicators <small>(23 05 19 00-0057)</small>		
23 05 19 00-0086 EA 1/4" Threaded, Double Window, 304SS Flapper, Bronze Body, Sight Flow Indicator (Dwyer SFI-360)	116.79	11.63
23 05 19 00-0087 EA 3/8" Threaded, Double Window, 304SS Flapper, Bronze Body, Sight Flow Indicator (Dwyer SFI-360)	121.52	12.23
23 05 19 00-0088 EA 1/2" Threaded, Double Window, 304SS Flapper, Bronze Body, Sight Flow Indicator (Dwyer SFI-360)	128.66	12.86
23 05 19 00-0089 EA 3/4" Threaded, Double Window, 304SS Flapper, Bronze Body, Sight Flow Indicator (Dwyer SFI-360)	140.54	17.33
23 05 19 00-0090 EA 1" Threaded, Double Window, 304SS Flapper, Bronze Body, Sight Flow Indicator (Dwyer SFI-360)	150.19	21.00
23 05 19 00-0091 EA 1-1/4" Threaded, Double Window, 304SS Flapper, Bronze Body, Sight Flow Indicator (Dwyer SFI-360)	164.90	26.59
23 05 19 00-0092 EA 1-1/2" Threaded, Double Window, 304SS Flapper, Bronze Body, Sight Flow Indicator (Dwyer SFI-360)	301.13	30.74
23 05 19 00-0093 EA 2" Threaded, Double Window, 304SS Flapper, Bronze Body, Sight Flow Indicator (Dwyer SFI-360)	322.82	36.33
23 05 19 00-0094 Threaded, Double Window, 304SS Flapper, Stainless Steel Body, Sight Flow Indicators <small>(23 05 19 00-0057)</small>		
23 05 19 00-0095 EA 1/4" Threaded, Double Window, 304SS Flapper, Stainless Steel Body, Sight Flow Indicator (Dwyer SFI-360SS)	168.24	11.63
23 05 19 00-0096 EA 3/8" Threaded, Double Window, 304SS Flapper, Stainless Steel Body, Sight Flow Indicator (Dwyer SFI-360SS)	181.16	12.23
23 05 19 00-0097 EA 1/2" Threaded, Double Window, 304SS Flapper, Stainless Steel Body, Sight Flow Indicator (Dwyer SFI-360SS)	197.65	12.86
23 05 19 00-0098 EA 3/4" Threaded, Double Window, 304SS Flapper, Stainless Steel Body, Sight Flow Indicator (Dwyer SFI-360SS)	212.45	17.33
23 05 19 00-0099 EA 1" Threaded, Double Window, 304SS Flapper, Stainless Steel Body, Sight Flow Indicator (Dwyer SFI-360SS)	244.32	21.00
23 05 19 00-0100 EA 1-1/4" Threaded, Double Window, 304SS Flapper, Stainless Steel Body, Sight Flow Indicator (Dwyer SFI-360SS)	262.53	26.59
23 05 19 00-0101 EA 1-1/2" Threaded, Double Window, 304SS Flapper, Stainless Steel Body, Sight Flow Indicator (Dwyer SFI-360SS)	515.11	30.74
23 05 19 00-0102 EA 2" Threaded, Double Window, 304SS Flapper, Stainless Steel Body, Sight Flow Indicator (Dwyer SFI-360SS)	543.82	36.33
23 05 19 00-0103 Threaded, Tube Style, Without Impeller, Cast Iron Body, Sight Flow Indicators <small>(23 05 19 00-0057)</small>		
23 05 19 00-0104 EA 1" Threaded, Tube Style, Without Impeller, Cast Iron Body, Sight Flow Indicator (Dwyer SFI-400)	249.00	21.00
23 05 19 00-0105 EA 1-1/4" Threaded, Tube Style, Without Impeller, Cast Iron Body, Sight Flow Indicator (Dwyer SFI-400)	281.24	26.59
23 05 19 00-0106 EA 1-1/2" Threaded, Tube Style, Without Impeller, Cast Iron Body, Sight Flow Indicator (Dwyer SFI-400)	319.84	30.74
23 05 19 00-0107 EA 2" Threaded, Tube Style, Without Impeller, Cast Iron Body, Sight Flow Indicator (Dwyer SFI-400)	360.24	36.33
23 05 19 00-0108 Flanged, Double Window, 316SS Flapper, Carbon Steel Body, Sight Flow Indicators <small>(23 05 19 00-0057)</small>		
23 05 19 00-0109 EA 1-1/2" Flanged, Double Window, 316SS Flapper, Carbon Steel Body, Sight Flow Indicator (Dwyer SFI-360FCS)	550.86	83.84
23 05 19 00-0110 EA 2" Flanged, Double Window, 316SS Flapper, Carbon Steel Body, Sight Flow Indicator (Dwyer SFI-360FCS)	618.62	106.43
23 05 19 00-0111 EA 3" Flanged, Double Window, 316SS Flapper, Carbon Steel Body, Sight Flow Indicator (Dwyer SFI-360FCS)	902.70	124.95
23 05 19 00-0112 EA 4" Flanged, Double Window, 316SS Flapper, Carbon Steel Body, Sight Flow Indicator (Dwyer SFI-360FCS)	1,367.79	209.48
23 05 19 00-0113 EA 6" Flanged, Double Window, 316SS Flapper, Carbon Steel Body, Sight Flow Indicator (Dwyer SFI-360FCS)	2,240.93	293.93
23 05 19 00-0114 Flanged, Tube Style, Without Impeller, Stainless Steel Body, Sight Flow Indicators <small>(23 05 19 00-0057)</small>		
23 05 19 00-0115 EA 1" Flanged, Tube Style, Without Impeller, Stainless Steel Body, Sight Flow Indicator (Dwyer SFI-400F)	421.44	59.88
23 05 19 00-0116 EA 1-1/4" Flanged, Tube Style, Without Impeller, Stainless Steel Body, Sight Flow Indicator (Dwyer SFI-400F)	497.21	69.86
23 05 19 00-0117 EA 1-1/2" Flanged, Tube Style, Without Impeller, Stainless Steel Body, Sight Flow Indicator (Dwyer SFI-400F)	538.87	83.84
23 05 19 00-0118 EA 2" Flanged, Tube Style, Without Impeller, Stainless Steel Body, Sight Flow Indicator (Dwyer SFI-400F)	675.63	106.43
23 05 19 00-0119 EA 3" Flanged, Tube Style, Without Impeller, Stainless Steel Body, Sight Flow Indicator (Dwyer SFI-400F)	972.56	124.95
23 05 19 00-0120 EA 4" Flanged, Tube Style, Without Impeller, Stainless Steel Body, Sight Flow Indicator (Dwyer SFI-400F)	1,443.50	209.48
23 05 19 00-0121 Venturi Flowmeters <small>(23 05 19)</small>		
23 05 19 00-0122 Threaded, Brass, Venturi Flowmeters <small>(23 05 19 00-0121)</small>		
23 05 19 00-0123 EA 3/4" Threaded, Brass, Venturi Flowmeter	147.73	54.31
For Portable Venturi Flow Meter, Add	995.00	
23 05 19 00-0124 EA 1" Threaded, Brass, Venturi Flowmeter	165.89	65.18
For Portable Venturi Flow Meter, Add	995.00	
23 05 19 00-0125 EA 1-1/4" Threaded, Brass, Venturi Flowmeter	183.25	72.45
For Portable Venturi Flow Meter, Add	995.00	
23 05 19 00-0126 EA 1-1/2" Threaded, Brass, Venturi Flowmeter	206.46	81.47
For Portable Venturi Flow Meter, Add	995.00	
23 05 19 00-0127 EA 2" Threaded, Brass, Venturi Flowmeter	243.74	93.14
For Portable Venturi Flow Meter, Add	995.00	
23 05 19 00-0128 EA 2-1/2" Threaded, Brass, Venturi Flowmeter	341.96	130.93
For Portable Venturi Flow Meter, Add	995.00	
23 05 19 00-0129 Butt Weld, Carbon Steel, Venturi Flowmeters <small>(23 05 19 00-0121)</small>		
23 05 19 00-0130 EA 3" Butt Weld, Carbon Steel, Venturi Flowmeter	586.44	111.89
For Portable Venturi Flow Meter, Add	995.00	
For Flanged Ends, Add	126.93	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 19 00-0131 EA 4" Butt Weld, Carbon Steel, Venturi Flowmeter <i>For Portable Venturi Flow Meter, Add</i> <i>For Flanged Ends, Add</i>	788.36 995.00 181.94	134.27
23 05 19 00-0132 EA 5" Butt Weld, Carbon Steel, Venturi Flowmeter <i>For Portable Venturi Flow Meter, Add</i> <i>For Flanged Ends, Add</i>	1,024.73 995.00 241.17	167.83
23 05 19 00-0133 EA 6" Butt Weld, Carbon Steel, Venturi Flowmeter <i>For Portable Venturi Flow Meter, Add</i> <i>For Flanged Ends, Add</i>	1,245.43 995.00 279.25	223.77
23 05 19 00-0134 EA 8" Butt Weld, Carbon Steel, Venturi Flowmeter <i>For Portable Venturi Flow Meter, Add</i> <i>For Flanged Ends, Add</i>	1,758.05 995.00 427.35	268.53
23 05 19 00-0135 EA 10" Butt Weld, Carbon Steel, Venturi Flowmeter <i>For Portable Venturi Flow Meter, Add</i> <i>For Flanged Ends, Add</i>	2,762.73 995.00 731.99	335.66
23 05 19 00-0136 EA 12" Butt Weld, Carbon Steel, Venturi Flowmeter <i>For Portable Venturi Flow Meter, Add</i> <i>For Flanged Ends, Add</i>	4,138.24 995.00 1,108.56	485.46
23 05 19 00-0137 Turbine Flowmeter <small>(23 05 19)</small>		
23 05 19 00-0138 EA Saddle Mount Turbine Flowmeter	393.96	59.91
 23 05 23 General-Duty Valves For HVAC Piping <small>(23 05)</small>		
23 05 23 00-0001 Gate Valves <small>(23 05 23)</small>		
23 05 23 00-0002 125 LB Threaded, Brazed Or Soldered Bronze Gate Valves <small>(23 05 23 00-0001)</small>		
<small>Note: 125 psi steam, basic rating. 200 psi cold working pressure. Class 125 (threaded).</small>		
23 05 23 00-0003 EA 1/4" 125 LB Threaded, Brazed Or Soldered Bronze Gate Valve <i>For 250 LB Rating, Add</i> <i>For 150 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 200 LB Rating, Add</i> <i>For 300 LB Rating, Add</i>	34.85 2.90 1.16 6.98 1.74 4.06	7.98
23 05 23 00-0004 EA 3/8" 125 LB Threaded, Brazed Or Soldered Bronze Gate Valve <i>For 250 LB Rating, Add</i> <i>For 150 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 200 LB Rating, Add</i> <i>For 300 LB Rating, Add</i>	36.07 2.90 1.16 7.34 1.74 4.06	7.98
23 05 23 00-0005 EA 1/2" 125 LB Threaded, Brazed Or Soldered Bronze Gate Valve <i>For 250 LB Rating, Add</i> <i>For 150 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 200 LB Rating, Add</i> <i>For 300 LB Rating, Add</i>	37.36 2.90 1.16 7.73 1.74 4.06	7.98
23 05 23 00-0006 EA 3/4" 125 LB Threaded, Brazed Or Soldered Bronze Gate Valve <i>For 250 LB Rating, Add</i> <i>For 150 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 200 LB Rating, Add</i> <i>For 300 LB Rating, Add</i>	48.56 3.46 1.38 10.42 2.08 4.84	8.78
23 05 23 00-0007 EA 1" 125 LB Threaded, Brazed Or Soldered Bronze Gate Valve <i>For 250 LB Rating, Add</i> <i>For 150 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 200 LB Rating, Add</i> <i>For 300 LB Rating, Add</i>	62.94 5.23 2.09 12.61 3.14 7.32	9.98
23 05 23 00-0008 EA 1-1/4" 125 LB Threaded, Brazed Or Soldered Bronze Gate Valve <i>For 250 LB Rating, Add</i> <i>For 150 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 200 LB Rating, Add</i> <i>For 300 LB Rating, Add</i>	81.42 7.05 2.82 15.97 4.23 9.87	10.62
23 05 23 00-0009 EA 1-1/2" 125 LB Threaded, Brazed Or Soldered Bronze Gate Valve <i>For 250 LB Rating, Add</i> <i>For 150 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 200 LB Rating, Add</i> <i>For 300 LB Rating, Add</i>	96.95 8.88 3.55 18.43 5.33 12.44	12.29
23 05 23 00-0010 EA 2" 125 LB Threaded, Brazed Or Soldered Bronze Gate Valve <i>For 250 LB Rating, Add</i> <i>For 150 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 200 LB Rating, Add</i> <i>For 300 LB Rating, Add</i>	121.13 12.14 4.85 21.78 7.28 16.99	14.53
23 05 23 00-0011 EA 2-1/2" 125 LB Threaded, Brazed Or Soldered Bronze Gate Valve <i>For 250 LB Rating, Add</i> <i>For 150 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 200 LB Rating, Add</i> <i>For Chain Operated Type, Add</i> <i>For 300 LB Rating, Add</i>	236.44 34.61 13.84 29.40 20.77 62.30 48.45	19.62

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 05 Common Work Results For HVAC****23 05 23 General-Duty Valves For HVAC Piping**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 23 00-0012 EA 3" 125 LB Threaded, Brazed Or Soldered Bronze Gate Valve	278.57	22.79
For 250 LB Rating, Add	41.37	
For 150 LB Rating, Add	16.55	
For Work In Restricted Working Space, Add	33.92	
For 200 LB Rating, Add	24.82	
For Chain Operated Type, Add	74.47	
For 300 LB Rating, Add	57.92	
23 05 23 00-0013 EA 4" 125 LB Threaded, Brazed Or Soldered Bronze Gate Valve	522.87	25.73
For 250 LB Rating, Add	98.56	
For 150 LB Rating, Add	39.42	
For Work In Restricted Working Space, Add	38.59	
For 200 LB Rating, Add	59.14	
For Chain Operated Type, Add	177.41	
For 300 LB Rating, Add	137.98	
23 05 23 00-0014 200 PSI, Non Rising Stem, Crimped Bronze Gate Valves (23 05 23 00-0001)		
Note: 200 psi cold working pressure.		
23 05 23 00-0015 EA 1/2" 200 PSI, Non Rising Stem, Crimped Bronze Gate Valve.....	70.42	7.98
For Work In Restricted Working Space, Add	5.39	
23 05 23 00-0016 EA 3/4" 200 PSI, Non Rising Stem, Crimped Bronze Gate Valve.....	79.37	8.78
For Work In Restricted Working Space, Add	6.14	
23 05 23 00-0017 EA 1" 200 PSI, Non Rising Stem, Crimped Bronze Gate Valve.....	103.78	9.98
For Work In Restricted Working Space, Add	7.34	
23 05 23 00-0018 EA 1-1/4" 200 PSI, Non Rising Stem, Crimped Bronze Gate Valve	140.13	10.62
For Work In Restricted Working Space, Add	8.09	
23 05 23 00-0019 EA 1-1/2" 200 PSI, Non Rising Stem, Crimped Bronze Gate Valve	162.17	12.29
For Work In Restricted Working Space, Add	8.99	
23 05 23 00-0020 EA 2" 200 PSI, Non Rising Stem, Crimped Bronze Gate Valve.....	222.07	14.53
For Work In Restricted Working Space, Add	10.78	
23 05 23 00-0021 Class 125 Non Rising Stem, Threaded, Cast Iron Body, Bronze Trim Gate Valves (23 05 23 00-0001)		
Note: 125 psi steam, basic rating, 200 psi cold working pressure.		
23 05 23 00-0022 EA 1-1/2" Class 125 Non Rising Stem, Threaded, Cast Iron Body, Bronze Trim Gate Valve.....	91.74	12.29
For 250 LB Rating, Add	10.61	
For Work In Restricted Working Space, Add	18.43	
For Chain Operated Type, Add	10.61	
For 150 LB Rating, Add	6.06	
23 05 23 00-0023 EA 2" Class 125 Non Rising Stem, Threaded, Cast Iron Body, Bronze Trim Gate Valve.....	188.38	14.53
For 250 LB Rating, Add	40.53	
For Work In Restricted Working Space, Add	21.78	
For Chain Operated Type, Add	40.53	
For 150 LB Rating, Add	23.16	
23 05 23 00-0024 EA 2-1/2" Class 125 Non Rising Stem, Threaded, Cast Iron Body, Bronze Trim Gate Valve.....	272.14	19.62
For 250 LB Rating, Add	60.95	
For Work In Restricted Working Space, Add	29.40	
For Chain Operated Type, Add	60.95	
For 150 LB Rating, Add	34.83	
23 05 23 00-0025 EA 3" Class 125 Non Rising Stem, Threaded, Cast Iron Body, Bronze Trim Gate Valve.....	341.57	22.79
For 250 LB Rating, Add	79.97	
For Work In Restricted Working Space, Add	33.92	
For Chain Operated Type, Add	79.97	
For 150 LB Rating, Add	45.70	
23 05 23 00-0026 EA 4" 125 LB Non Rising Stem, Threaded, Cast Iron Body, Bronze Trim Gate Valve	743.69	25.73
For 250 LB Rating, Add	215.27	
For Work In Restricted Working Space, Add	38.59	
For Chain Operated Type, Add	215.27	
For 150 LB Rating, Add	123.01	
23 05 23 00-0027 Class 125 Non Rising Stem, Flanged, Cast Iron Body, Bronze Trim Gate Valves (23 05 23 00-0001)		
Note: 125 psi steam, basic rating, 200 psi cold working pressure.		
23 05 23 00-0028 EA 1-1/2" Class 125 Non Rising Stem, Flanged, Cast Iron Body, Bronze Trim Gate Valve	265.72	83.84
For Chain Operated Type, Add	80.33	
For 150 LB Rating, Add	46.59	
For 300 LB Rating, ASTM A182, Add	213.19	
For Work In Restricted Working Space, Add	31.52	
For 250 LB Rating, Add	80.33	
23 05 23 00-0029 EA 2" Class 125 Non Rising Stem, Flanged, Cast Iron Body, Bronze Trim Gate Valve	301.10	106.43
For Chain Operated Type, Add	84.02	
For 150 LB Rating, Add	48.73	
For 300 LB Rating, ASTM A182, Add	234.57	
For Work In Restricted Working Space, Add	39.92	
For 250 LB Rating, Add	84.02	
23 05 23 00-0030 EA 2-1/2" Class 125 Non Rising Stem, Flanged, Cast Iron Body, Bronze Trim Gate Valve	335.24	106.57
For Chain Operated Type, Add	100.80	
For 150 LB Rating, Add	58.46	
For 300 LB Rating, ASTM A182, Add	268.42	
For Work In Restricted Working Space, Add	40.09	
For 250 LB Rating, Add	100.80	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 23 00-0031 EA 3" Class 125 Non Rising Stem, Flanged, Cast Iron Body, Bronze Trim Gate Valve.....	408.38	124.95
<i>For Chain Operated Type, Add</i>	126.00	
<i>For 150 LB Rating, Add</i>	73.08	
<i>For 300 LB Rating, ASTM A182, Add</i>	330.19	
<i>For Work In Restricted Working Space, Add</i>	46.92	
<i>For 250 LB Rating, Add</i>	126.00	
23 05 23 00-0032 EA 4" Class 125 Non Rising Stem, Flanged, Cast Iron Body, Bronze Trim Gate Valve.....	598.52	209.48
<i>For Chain Operated Type, Add</i>	168.01	
<i>For 150 LB Rating, Add</i>	97.44	
<i>For 300 LB Rating, ASTM A182, Add</i>	467.27	
<i>For Work In Restricted Working Space, Add</i>	78.75	
<i>For 250 LB Rating, Add</i>	168.01	
23 05 23 00-0033 EA 5" Class 125 Non Rising Stem, Flanged, Cast Iron Body, Bronze Trim Gate Valve.....	768.63	264.53
<i>For Chain Operated Type, Add</i>	218.39	
<i>For 150 LB Rating, Add</i>	126.66	
<i>For 300 LB Rating, ASTM A182, Add</i>	602.70	
<i>For Work In Restricted Working Space, Add</i>	99.56	
<i>For 250 LB Rating, Add</i>	218.39	
23 05 23 00-0034 EA 6" Class 125 Non Rising Stem, Flanged, Cast Iron Body, Bronze Trim Gate Valve.....	904.92	293.93
<i>For Chain Operated Type, Add</i>	268.75	
<i>For 150 LB Rating, Add</i>	155.88	
<i>For 300 LB Rating, ASTM A182, Add</i>	721.21	
<i>For Work In Restricted Working Space, Add</i>	110.23	
<i>For 250 LB Rating, Add</i>	268.75	
23 05 23 00-0035 EA 8" Class 125 Non Rising Stem, Flanged, Cast Iron Body, Bronze Trim Gate Valve.....	1,310.28	338.02
<i>For Chain Operated Type, Add</i>	445.19	
<i>For 150 LB Rating, Add</i>	258.21	
<i>For 300 LB Rating, ASTM A182, Add</i>	1,100.33	
<i>For Work In Restricted Working Space, Add</i>	125.97	
<i>For 250 LB Rating, Add</i>	445.19	
23 05 23 00-0036 EA 10" Class 125 Non Rising Stem, Flanged, Cast Iron Body, Bronze Trim Gate Valve.....	1,690.27	411.51
<i>For Chain Operated Type, Add</i>	587.95	
<i>For 150 LB Rating, Add</i>	341.01	
<i>For 300 LB Rating, ASTM A182, Add</i>	1,433.08	
<i>For Work In Restricted Working Space, Add</i>	154.31	
<i>For 250 LB Rating, Add</i>	587.95	
23 05 23 00-0037 EA 12" Class 125 Non Rising Stem, Flanged, Cast Iron Body, Bronze Trim Gate Valve.....	2,303.42	499.69
<i>For Chain Operated Type, Add</i>	839.97	
<i>For 150 LB Rating, Add</i>	467.18	
<i>For 300 LB Rating, ASTM A182, Add</i>	1,991.68	
<i>For Work In Restricted Working Space, Add</i>	187.05	
<i>For 250 LB Rating, Add</i>	839.97	
23 05 23 00-0038 Class 125 Outside Stem And Yoke, Threaded, Cast Iron Body, Bronze Trim Gate Valves <small>(23 05 23 00-0001)</small>		
Note: 125 psi steam, basic rating. 200 psi cold working pressure.		
23 05 23 00-0039 EA 1-1/2" 125 LB Outside Stem And Yoke, Threaded, Cast Iron Body, Bronze Trim Gate Valve.....	229.39	12.29
<i>For Work In Restricted Working Space, Add</i>	18.43	
<i>For 175 LB Rating, Add</i>	83.99	
<i>For 250 LB Rating, Add</i>	125.98	
23 05 23 00-0040 EA 2" 125 LB Outside Stem And Yoke, Threaded, Cast Iron Body, Bronze Trim Gate Valve.....	289.73	14.53
<i>For Work In Restricted Working Space, Add</i>	21.78	
<i>For 175 LB Rating, Add</i>	108.57	
<i>For 250 LB Rating, Add</i>	162.86	
23 05 23 00-0041 EA 2-1/2" 125 LB Outside Stem And Yoke, Threaded, Cast Iron Body, Bronze Trim Gate Valve.....	342.85	19.62
<i>For Work In Restricted Working Space, Add</i>	29.40	
<i>For 175 LB Rating, Add</i>	122.43	
<i>For 250 LB Rating, Add</i>	183.64	
23 05 23 00-0042 EA 3" 125 LB Outside Stem And Yoke, Threaded, Cast Iron Body, Bronze Trim Gate Valve.....	383.25	22.79
<i>For Work In Restricted Working Space, Add</i>	33.92	
<i>For 175 LB Rating, Add</i>	135.09	
<i>For 250 LB Rating, Add</i>	202.63	
23 05 23 00-0043 EA 4" 125 LB Outside Stem And Yoke, Threaded, Cast Iron Body, Bronze Trim Gate Valve.....	501.69	25.73
<i>For Work In Restricted Working Space, Add</i>	38.59	
<i>For 175 LB Rating, Add</i>	186.53	
<i>For 250 LB Rating, Add</i>	279.80	
23 05 23 00-0044 Class 125 Outside Stem And Yoke, Flanged, Cast Iron Body, Bronze Trim Gate Valves <small>(23 05 23 00-0001)</small>		
Note: 125 psi steam, basic rating. 200 psi cold working pressure for up to 12". 100 psi steam, basic rating. 150 psi cold working pressure for >12" to 24". 50 psi steam, basic rating. 150 psi cold working pressure for >24".		
23 05 23 00-0045 EA 1-1/2" Class 125 Outside Stem And Yoke, Flanged, Cast Iron Body, Bronze Trim Gate Valve.....	336.67	83.84
<i>For 250 LB Rating, Add</i>	150.55	
<i>For Work In Restricted Working Space, Add</i>	31.52	
<i>For 175 LB Rating, Add</i>	71.80	
<i>For 150 LB Rating, Add</i>	34.74	
<i>For Chain Operated Type, Add</i>	115.81	
23 05 23 00-0046 EA 2" Class 125 Outside Stem And Yoke, Flanged, Cast Iron Body, Bronze Trim Gate Valve.....	371.56	106.43
<i>For 250 LB Rating, Add</i>	155.02	
<i>For Work In Restricted Working Space, Add</i>	39.92	
<i>For 175 LB Rating, Add</i>	73.93	
<i>For 150 LB Rating, Add</i>	35.77	
<i>For Chain Operated Type, Add</i>	119.25	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 05 Common Work Results For HVAC****23 05 23 General-Duty Valves For HVAC Piping**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 23 00-0047	EA		2-1/2" Class 125 Outside Stem And Yoke, Flanged, Cast Iron Body, Bronze Trim Gate Valve.....	379.92	106.57
			<i>For 250 LB Rating, Add</i>	160.08	
			<i>For Work In Restricted Working Space, Add</i>	40.09	
			<i>For 175 LB Rating, Add</i>	76.35	
			<i>For 150 LB Rating, Add</i>	36.94	
			<i>For Chain Operated Type, Add</i>	123.14	
23 05 23 00-0048	EA		3" Class 125 Outside Stem And Yoke, Flanged, Cast Iron Body, Bronze Trim Gate Valve.....	427.36	124.95
			<i>For 250 LB Rating, Add</i>	176.13	
			<i>For Work In Restricted Working Space, Add</i>	46.92	
			<i>For 175 LB Rating, Add</i>	84.00	
			<i>For 150 LB Rating, Add</i>	40.65	
			<i>For Chain Operated Type, Add</i>	135.49	
23 05 23 00-0049	EA		4" Class 125 Outside Stem And Yoke, Flanged, Cast Iron Body, Bronze Trim Gate Valve.....	591.12	209.48
			<i>For 250 LB Rating, Add</i>	213.60	
			<i>For Work In Restricted Working Space, Add</i>	78.75	
			<i>For 175 LB Rating, Add</i>	101.87	
			<i>For 150 LB Rating, Add</i>	49.29	
			<i>For Chain Operated Type, Add</i>	164.31	
23 05 23 00-0050	EA		5" Class 125 Outside Stem And Yoke, Flanged, Cast Iron Body, Bronze Trim Gate Valve.....	790.35	264.53
			<i>For 250 LB Rating, Add</i>	298.02	
			<i>For Work In Restricted Working Space, Add</i>	99.56	
			<i>For 175 LB Rating, Add</i>	142.13	
			<i>For 150 LB Rating, Add</i>	68.77	
			<i>For Chain Operated Type, Add</i>	229.25	
23 05 23 00-0051	EA		6" Class 125 Outside Stem And Yoke, Flanged, Cast Iron Body, Bronze Trim Gate Valve.....	891.03	293.93
			<i>For 250 LB Rating, Add</i>	340.35	
			<i>For Work In Restricted Working Space, Add</i>	110.23	
			<i>For 175 LB Rating, Add</i>	162.32	
			<i>For 150 LB Rating, Add</i>	78.54	
			<i>For Chain Operated Type, Add</i>	261.81	
23 05 23 00-0052	EA		8" Class 125 Outside Stem And Yoke, Flanged, Cast Iron Body, Bronze Trim Gate Valve.....	1,305.47	338.02
			<i>For 250 LB Rating, Add</i>	575.62	
			<i>For Work In Restricted Working Space, Add</i>	125.97	
			<i>For 175 LB Rating, Add</i>	274.53	
			<i>For 150 LB Rating, Add</i>	132.84	
			<i>For Chain Operated Type, Add</i>	442.79	
23 05 23 00-0053	EA		10" Class 125 Outside Stem And Yoke, Flanged, Cast Iron Body, Bronze Trim Gate Valve.....	1,877.27	411.51
			<i>For 250 LB Rating, Add</i>	885.88	
			<i>For Work In Restricted Working Space, Add</i>	154.31	
			<i>For 175 LB Rating, Add</i>	422.50	
			<i>For 150 LB Rating, Add</i>	204.43	
			<i>For Chain Operated Type, Add</i>	681.45	
23 05 23 00-0054	EA		12" Class 125 Outside Stem And Yoke, Flanged, Cast Iron Body, Bronze Trim Gate Valve.....	2,350.83	499.69
			<i>For 250 LB Rating, Add</i>	1,122.77	
			<i>For Work In Restricted Working Space, Add</i>	187.05	
			<i>For 175 LB Rating, Add</i>	535.48	
			<i>For 150 LB Rating, Add</i>	259.10	
			<i>For Chain Operated Type, Add</i>	863.67	
23 05 23 00-0055			Class 800 Outside Stem And Yoke, Threaded, Forged Steel, Chrome Trim, Bolted Bonnet Gate Valves <small>(23 05 23 00-0001)</small>		
			Note: 800 psig at 850 degrees F.		
23 05 23 00-0056	EA		1/4" Class 800 Outside Stem And Yoke, Threaded, Forged Steel, Chrome Trim, Bolted Bonnet Gate Valve.....	71.39	12.86
			<i>For Work In Restricted Working Space, Add</i>	6.98	
23 05 23 00-0057	EA		1/2" Class 800 Outside Stem And Yoke, Threaded, Forged Steel, Chrome Trim, Bolted Bonnet Gate Valve.....	73.90	12.86
			<i>For Work In Restricted Working Space, Add</i>	7.73	
23 05 23 00-0058	EA		3/4" Class 800 Outside Stem And Yoke, Threaded, Forged Steel, Chrome Trim, Bolted Bonnet Gate Valve.....	89.32	17.33
			<i>For Work In Restricted Working Space, Add</i>	10.42	
23 05 23 00-0059	EA		1" Class 800 Outside Stem And Yoke, Threaded, Forged Steel, Chrome Trim, Bolted Bonnet Gate Valve.....	108.37	21.00
			<i>For Work In Restricted Working Space, Add</i>	12.61	
23 05 23 00-0060	EA		1-1/4" Class 800 Outside Stem And Yoke, Threaded, Forged Steel, Chrome Trim, Bolted Bonnet Gate Valve.....	160.26	26.59
			<i>For Work In Restricted Working Space, Add</i>	15.97	
23 05 23 00-0061	EA		1-1/2" Class 800 Outside Stem And Yoke, Threaded, Forged Steel, Chrome Trim, Bolted Bonnet Gate Valve.....	188.81	30.74
			<i>For Work In Restricted Working Space, Add</i>	18.43	
23 05 23 00-0062	EA		2" Class 800 Outside Stem And Yoke, Threaded, Forged Steel, Chrome Trim, Bolted Bonnet Gate Valve.....	235.20	36.33
			<i>For Work In Restricted Working Space, Add</i>	21.78	
23 05 23 00-0063			Ball Valves <small>(23 05 23)</small>		
23 05 23 00-0064			Threaded Or Sweated, 125 LB, Regular Port, Carbon Steel Trim, Brass Body, Ball Valves <small>(23 05 23 00-0063)</small>		
			Note: 125 LB WSP.		
23 05 23 00-0065	EA		1/2" Threaded Or Sweated, 125 LB, Regular Port, Carbon Steel Trim, Brass Body, Ball Valve.....	31.14	7.98
			<i>For Full Port, Add</i>	2.42	
			<i>For Work In Restricted Working Space, Add</i>	7.73	
			<i>For Extension Stems And Sleeves On Insulated Pipe, Add</i>	2.63	
23 05 23 00-0066	EA		3/4" Threaded Or Sweated, 125 LB, Regular Port, Carbon Steel Trim, Brass Body, Ball Valve.....	42.99	8.78
			<i>For Full Port, Add</i>	3.72	
			<i>For Work In Restricted Working Space, Add</i>	10.42	
			<i>For Extension Stems And Sleeves On Insulated Pipe, Add</i>	2.63	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 23 00-0067 EA 1" Threaded Or Sweated, 125 LB, Regular Port, Carbon Steel Trim, Brass Body, Ball Valve.....	53.20	9.98
<i>For Full Port, Add</i>	5.03	
<i>For Work In Restricted Working Space, Add</i>	12.61	
<i>For Extension Stems And Sleeves On Insulated Pipe, Add</i>	2.63	
23 05 23 00-0068 EA 1-1/4" Threaded Or Sweated, 125 LB, Regular Port, Carbon Steel Trim, Brass Body, Ball Valve.....	71.98	10.62
<i>For Full Port, Add</i>	8.44	
<i>For Work In Restricted Working Space, Add</i>	15.97	
<i>For Extension Stems And Sleeves On Insulated Pipe, Add</i>	2.63	
23 05 23 00-0069 EA 1-1/2" Threaded Or Sweated, 125 LB, Regular Port, Carbon Steel Trim, Brass Body, Ball Valve.....	85.37	12.29
<i>For Full Port, Add</i>	10.78	
<i>For Work In Restricted Working Space, Add</i>	18.43	
<i>For Extension Stems And Sleeves On Insulated Pipe, Add</i>	2.63	
23 05 23 00-0070 EA 2" Threaded Or Sweated, 125 LB, Regular Port, Carbon Steel Trim, Brass Body, Ball Valve.....	102.59	14.53
<i>For Full Port, Add</i>	13.50	
<i>For Work In Restricted Working Space, Add</i>	21.78	
<i>For Extension Stems And Sleeves On Insulated Pipe, Add</i>	2.63	
23 05 23 00-0071 EA 2-1/2" Threaded Or Sweated, 125 LB, Regular Port, Carbon Steel Trim, Brass Body, Ball Valve.....	239.58	19.62
<i>For Full Port, Add</i>	63.71	
<i>For Work In Restricted Working Space, Add</i>	29.40	
<i>For Extension Stems And Sleeves On Insulated Pipe, Add</i>	2.63	
23 05 23 00-0072 EA 3" Threaded Or Sweated, 125 LB, Regular Port, Carbon Steel Trim, Brass Body, Ball Valve.....	276.44	22.79
<i>For Full Port, Add</i>	73.51	
<i>For Work In Restricted Working Space, Add</i>	33.92	
<i>For Extension Stems And Sleeves On Insulated Pipe, Add</i>	2.63	
23 05 23 00-0073 EA 4" Threaded Or Sweated, 125 LB, Regular Port, Carbon Steel Trim, Brass Body, Ball Valve.....	351.34	25.73
<i>For Full Port, Add</i>	100.22	
<i>For Work In Restricted Working Space, Add</i>	38.59	
<i>For Extension Stems And Sleeves On Insulated Pipe, Add</i>	2.63	
23 05 23 00-0074 Screwed, 150 LB, Full Port, Carbon Steel Ball Valves <small>(23 05 23 00-0063)</small>		
23 05 23 00-0075 EA 1/4" Screwed, 150 LB, Full Port, Carbon Steel Ball Valve	33.55	7.98
<i>For Work In Restricted Working Space, Add</i>	6.98	
23 05 23 00-0076 EA 1/2" Screwed, 150 LB, Full Port, Carbon Steel Ball Valve	36.94	7.98
<i>For Work In Restricted Working Space, Add</i>	7.73	
23 05 23 00-0077 EA 3/4" Screwed, 150 LB, Full Port, Carbon Steel Ball Valve	50.88	8.78
<i>For Work In Restricted Working Space, Add</i>	10.42	
23 05 23 00-0078 EA 1" Screwed, 150 LB, Full Port, Carbon Steel Ball Valve	63.77	9.98
<i>For Work In Restricted Working Space, Add</i>	12.61	
23 05 23 00-0079 EA 1-1/4" Screwed, 150 LB, Full Port, Carbon Steel Ball Valve	90.38	10.62
<i>For Work In Restricted Working Space, Add</i>	15.97	
23 05 23 00-0080 EA 1-1/2" Screwed, 150 LB, Full Port, Carbon Steel Ball Valve	108.48	12.29
<i>For Work In Restricted Working Space, Add</i>	18.43	
23 05 23 00-0081 EA 2" Screwed, 150 LB, Full Port, Carbon Steel Ball Valve	137.39	14.53
<i>For Work In Restricted Working Space, Add</i>	21.78	
23 05 23 00-0082 Flanged, 150 LB, Full Port, Carbon Steel Ball Valves <small>(23 05 23 00-0063)</small>		
23 05 23 00-0083 EA 4" Flanged, 150 LB, Full Port, Carbon Steel Ball Valve	873.90	209.48
<i>For Work In Restricted Working Space, Add</i>	78.75	
23 05 23 00-0084 EA 6" Flanged, 150 LB, Full Port, Carbon Steel Ball Valve	1,493.08	293.93
<i>For Work In Restricted Working Space, Add</i>	110.23	
23 05 23 00-0085 EA 8" Flanged, 150 LB, Full Port, Carbon Steel Ball Valve	3,069.47	338.02
<i>For Work In Restricted Working Space, Add</i>	125.97	
23 05 23 00-0086 Socket, 150 PSI, Polyvinyl Chloride (PVC), Ball Valves <small>(23 05 23 00-0063)</small>		
23 05 23 00-0087 EA 1/2" Socket, 150 PSI, Polyvinyl Chloride (PVC), Ball Valve.....	28.81	7.98
<i>For True Union Socket Or Thread Type, Add</i>	2.57	
<i>For Work In Restricted Working Space, Add</i>	7.73	
23 05 23 00-0088 EA 3/4" Socket, 150 PSI, Polyvinyl Chloride (PVC), Ball Valve.....	38.23	8.78
<i>For True Union Socket Or Thread Type, Add</i>	3.23	
<i>For Work In Restricted Working Space, Add</i>	10.42	
23 05 23 00-0089 EA 1" Socket, 150 PSI, Polyvinyl Chloride (PVC), Ball Valve.....	46.92	9.98
<i>For True Union Socket Or Thread Type, Add</i>	4.16	
<i>For Work In Restricted Working Space, Add</i>	12.61	
23 05 23 00-0090 EA 1-1/4" Socket, 150 PSI, Polyvinyl Chloride (PVC), Ball Valve.....	59.66	10.62
<i>For True Union Socket Or Thread Type, Add</i>	5.37	
<i>For Work In Restricted Working Space, Add</i>	15.97	
23 05 23 00-0091 EA 1-1/2" Socket, 150 PSI, Polyvinyl Chloride (PVC), Ball Valve.....	72.60	12.29
<i>For True Union Socket Or Thread Type, Add</i>	7.70	
<i>For Work In Restricted Working Space, Add</i>	18.43	
23 05 23 00-0092 EA 2" Socket, 150 PSI, Polyvinyl Chloride (PVC), Ball Valve.....	86.84	14.53
<i>For True Union Socket Or Thread Type, Add</i>	9.51	
<i>For Work In Restricted Working Space, Add</i>	21.78	
23 05 23 00-0093 EA 2-1/2" Socket, 150 PSI, Polyvinyl Chloride (PVC), Ball Valve.....	128.67	19.62
<i>For True Union Socket Or Thread Type, Add</i>	17.41	
<i>For Work In Restricted Working Space, Add</i>	29.40	
23 05 23 00-0094 EA 3" Socket, 150 PSI, Polyvinyl Chloride (PVC), Ball Valve.....	165.23	22.79
<i>For True Union Socket Or Thread Type, Add</i>	26.80	
<i>For Work In Restricted Working Space, Add</i>	33.92	
23 05 23 00-0095 EA 4" Socket, 150 PSI, Polyvinyl Chloride (PVC), Ball Valve.....	228.34	25.73
<i>For True Union Socket Or Thread Type, Add</i>	46.64	
<i>For Work In Restricted Working Space, Add</i>	38.59	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 05 Common Work Results For HVAC****23 05 23 General-Duty Valves For HVAC Piping**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 23 00-0096 Threaded Or Sweated, 3-Way, 125 LB, Regular Port, Carbon Steel Trim, Brass Body, Ball Valves <small>(23 05 23 00-0063)</small>		
23 05 23 00-0097 EA 1/4" Threaded Or Sweated, 3-Way, 125 LB, Regular Port, Carbon Steel Trim, Brass Body, Ball Valve.....	51.06	11.97
For Full Port, Add	7.28	
For Work In Restricted Working Space, Add	10.46	
23 05 23 00-0098 EA 3/8" Threaded Or Sweated, 3-Way, 125 LB, Regular Port, Carbon Steel Trim, Brass Body, Ball Valve.....	52.89	11.97
For Full Port, Add	7.28	
For Work In Restricted Working Space, Add	11.01	
23 05 23 00-0099 EA 1/2" Threaded Or Sweated, 3-Way, 125 LB, Regular Port, Carbon Steel Trim, Brass Body, Ball Valve.....	54.82	11.97
For Full Port, Add	7.28	
For Work In Restricted Working Space, Add	11.59	
23 05 23 00-0100 EA 3/4" Threaded Or Sweated, 3-Way, 125 LB, Regular Port, Carbon Steel Trim, Brass Body, Ball Valve.....	69.23	13.17
For Full Port, Add	7.72	
For Work In Restricted Working Space, Add	15.62	
23 05 23 00-0101 EA 1" Threaded Or Sweated, 3-Way, 125 LB, Regular Port, Carbon Steel Trim, Brass Body, Ball Valve.....	88.44	14.97
For Full Port, Add	11.43	
For Work In Restricted Working Space, Add	18.91	
23 05 23 00-0102 EA 1-1/4" Threaded Or Sweated, 3-Way, 125 LB, Regular Port, Carbon Steel Trim, Brass Body, Ball Valve	114.63	15.93
For Full Port, Add	15.65	
For Work In Restricted Working Space, Add	23.96	
23 05 23 00-0103 EA 1-1/2" Threaded Or Sweated, 3-Way, 125 LB, Regular Port, Carbon Steel Trim, Brass Body, Ball Valve	138.38	18.45
For Full Port, Add	20.81	
For Work In Restricted Working Space, Add	27.64	
23 05 23 00-0104 EA 2" Threaded Or Sweated, 3-Way, 125 LB, Regular Port, Carbon Steel Trim, Brass Body, Ball Valve.....	184.14	21.80
For Full Port, Add	33.87	
For Work In Restricted Working Space, Add	32.66	
23 05 23 00-0105 EA 2-1/2" Threaded Or Sweated, 3-Way, 125 LB, Regular Port, Carbon Steel Trim, Brass Body, Ball Valve	329.65	29.44
For Full Port, Add	82.19	
For Work In Restricted Working Space, Add	44.10	
23 05 23 00-0106 EA 3" Threaded Or Sweated, 3-Way, 125 LB, Regular Port, Carbon Steel Trim, Brass Body, Ball Valve.....	459.66	34.18
For Full Port, Add	130.51	
For Work In Restricted Working Space, Add	50.89	
23 05 23 00-0107 Crimped Bronze, Ball Valves <small>(23 05 23 00-0063)</small>		
23 05 23 00-0108 Crimped Bronze, 250 PSI, Ball Valves <small>(23 05 23 00-0107)</small>		
Note: Nibco®		
23 05 23 00-0109 EA 1/2" Crimped Bronze, 250 PSI, Ball Valve	49.65	7.98
For Work In Restricted Working Space, Add	5.39	
23 05 23 00-0110 EA 3/4" Crimped Bronze, 250 PSI, Ball Valve	63.64	8.78
For Work In Restricted Working Space, Add	6.14	
23 05 23 00-0111 EA 1" Crimped Bronze, 250 PSI, Ball Valve	81.28	9.98
For Work In Restricted Working Space, Add	7.34	
23 05 23 00-0112 EA 1-1/4" Crimped Bronze, 250 PSI, Ball Valve	128.60	10.62
For Work In Restricted Working Space, Add	8.09	
23 05 23 00-0113 EA 1-1/2" Crimped Bronze, 250 PSI, Ball Valve	168.75	12.29
For Work In Restricted Working Space, Add	8.99	
23 05 23 00-0114 EA 2" Crimped Bronze, 250 PSI, Ball Valve	252.33	14.53
For Work In Restricted Working Space, Add	10.78	
23 05 23 00-0115 Crimped Bronze, 200 PSI, Full Port Ball Valves <small>(23 05 23 00-0107)</small>		
23 05 23 00-0116 EA 1/2" Crimped Bronze, 200 PSI, Full Port, Lever Ball Valve.....	48.46	7.98
23 05 23 00-0117 EA 3/4" Crimped Bronze, 200 PSI, Full Port, Lever Ball Valve.....	63.33	8.78
23 05 23 00-0118 EA 1" Crimped Bronze, 200 PSI, Full Port, Lever Ball Valve.....	77.22	9.98
23 05 23 00-0119 EA 1-1/4" Crimped Bronze, 200 PSI, Full Port, Lever Ball Valve.....	112.70	10.62
23 05 23 00-0120 EA 1-1/2" Crimped Bronze, 200 PSI, Full Port, Lever Ball Valve.....	148.67	12.29
23 05 23 00-0121 EA 2" Crimped Bronze, 200 PSI, Full Port, Lever Ball Valve.....	225.56	14.53
23 05 23 00-0122 Crimped Bronze, 250 PSI, Full Port Ball Valves <small>(23 05 23 00-0107)</small>		
23 05 23 00-0123 EA 1/2" Crimped Bronze, 250 PSI, Full Port, Lever Ball Valve.....	57.53	7.98
23 05 23 00-0124 EA 3/4" Crimped Bronze, 250 PSI, Full Port, Lever Ball Valve.....	69.93	8.78
23 05 23 00-0125 EA 1" Crimped Bronze, 250 PSI, Full Port, Lever Ball Valve.....	87.77	9.98
23 05 23 00-0126 EA 1-1/4" Crimped Bronze, 250 PSI, Full Port, Lever Ball Valve.....	145.67	10.62
23 05 23 00-0127 EA 1-1/2" Crimped Bronze, 250 PSI, Full Port, Lever Ball Valve.....	219.58	12.29
23 05 23 00-0128 EA 2" Crimped Bronze, 250 PSI, Full Port, Lever Ball Valve.....	308.00	14.53
23 05 23 00-0129 Crimped x Threaded Bronze, 250 PSI, Full Port Ball Valves <small>(23 05 23 00-0107)</small>		
23 05 23 00-0130 EA 1/2" Crimped x Threaded Bronze, 250 PSI, Full Port, Lever Ball Valve.....	55.06	7.98
23 05 23 00-0131 EA 3/4" Crimped x Threaded Bronze, 250 PSI, Full Port, Lever Ball Valve.....	67.62	8.78
23 05 23 00-0132 EA 1" Crimped x Threaded Bronze, 250 PSI, Full Port, Lever Ball Valve.....	82.49	9.98
23 05 23 00-0133 Globe Valves <small>(23 05 23)</small>		
23 05 23 00-0134 Threaded Or Sweated, 125 LB, Bronze Body, Globe Valves <small>(23 05 23 00-0133)</small>		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 23 00-0135 EA 1/8" Threaded Or Sweated, 125 LB, Bronze Body, Globe Valve	38.97	7.98
<i>For 300 LB Rating, Add</i>	7.27	
<i>For 200 LB Rating, Add</i>	5.02	
<i>For 250 LB Rating, Add</i>	5.94	
<i>For 150 LB Rating, Add</i>	4.10	
<i>For Work In Restricted Working Space, Add</i>	7.73	
23 05 23 00-0136 EA 1/4" Threaded Or Sweated, 125 LB, Bronze Body, Globe Valve	36.46	7.98
<i>For 300 LB Rating, Add</i>	7.27	
<i>For 200 LB Rating, Add</i>	5.02	
<i>For 250 LB Rating, Add</i>	5.94	
<i>For 150 LB Rating, Add</i>	4.10	
<i>For Work In Restricted Working Space, Add</i>	6.98	
23 05 23 00-0137 EA 3/8" Threaded Or Sweated, 125 LB, Bronze Body, Globe Valve	44.18	7.98
<i>For 300 LB Rating, Add</i>	10.84	
<i>For 200 LB Rating, Add</i>	7.49	
<i>For 250 LB Rating, Add</i>	8.87	
<i>For 150 LB Rating, Add</i>	6.11	
<i>For Work In Restricted Working Space, Add</i>	7.34	
23 05 23 00-0138 EA 1/2" Threaded Or Sweated, 125 LB, Bronze Body, Globe Valve	45.47	7.98
<i>For 300 LB Rating, Add</i>	10.84	
<i>For 200 LB Rating, Add</i>	7.49	
<i>For 250 LB Rating, Add</i>	8.87	
<i>For 600 LB Rating, Forged Steel, Bolted Bonnet, Socket Weld, Add</i>	31.99	
<i>For 150 LB Rating, Add</i>	6.11	
<i>For Work In Restricted Working Space, Add</i>	7.73	
23 05 23 00-0139 EA 3/4" Threaded Or Sweated, 125 LB, Bronze Body, Globe Valve	56.09	8.39
<i>For 300 LB Rating, Add</i>	11.75	
<i>For 200 LB Rating, Add</i>	8.12	
<i>For 250 LB Rating, Add</i>	9.62	
<i>For 600 LB Rating, Forged Steel, Bolted Bonnet, Socket Weld, Add</i>	37.40	
<i>For 150 LB Rating, Add</i>	6.62	
<i>For Work In Restricted Working Space, Add</i>	10.42	
23 05 23 00-0140 EA 1" Threaded Or Sweated, 125 LB, Bronze Body, Globe Valve	70.91	8.39
<i>For 300 LB Rating, Add</i>	15.88	
<i>For 200 LB Rating, Add</i>	10.97	
<i>For 250 LB Rating, Add</i>	13.00	
<i>For 600 LB Rating, Forged Steel, Bolted Bonnet, Socket Weld, Add</i>	48.58	
<i>For 150 LB Rating, Add</i>	8.95	
<i>For Work In Restricted Working Space, Add</i>	12.61	
23 05 23 00-0141 EA 1-1/4" Threaded Or Sweated, 125 LB, Bronze Body, Globe Valve.....	103.11	10.62
<i>For 300 LB Rating, Add</i>	27.43	
<i>For 200 LB Rating, Add</i>	18.95	
<i>For 250 LB Rating, Add</i>	22.45	
<i>For 600 LB Rating, Forged Steel, Bolted Bonnet, Socket Weld, Add</i>	76.16	
<i>For 150 LB Rating, Add</i>	15.46	
<i>For Work In Restricted Working Space, Add</i>	15.97	
23 05 23 00-0142 EA 1-1/2" Threaded Or Sweated, 125 LB, Bronze Body, Globe Valve.....	132.70	12.29
<i>For 300 LB Rating, Add</i>	39.20	
<i>For 200 LB Rating, Add</i>	27.09	
<i>For 250 LB Rating, Add</i>	32.08	
<i>For 600 LB Rating, Forged Steel, Bolted Bonnet, Socket Weld, Add</i>	102.98	
<i>For 150 LB Rating, Add</i>	22.10	
<i>For Work In Restricted Working Space, Add</i>	18.43	
23 05 23 00-0143 EA 2" Threaded Or Sweated, 125 LB, Bronze Body, Globe Valve.....	156.39	14.53
<i>For 300 LB Rating, Add</i>	46.09	
<i>For 200 LB Rating, Add</i>	31.84	
<i>For 250 LB Rating, Add</i>	37.71	
<i>For 600 LB Rating, Forged Steel, Bolted Bonnet, Socket Weld, Add</i>	121.22	
<i>For 150 LB Rating, Add</i>	25.98	
<i>For Work In Restricted Working Space, Add</i>	21.78	
23 05 23 00-0144 EA 2-1/2" Threaded Or Sweated, 125 LB, Bronze Body, Globe Valve.....	182.49	19.62
<i>For 300 LB Rating, Add</i>	46.47	
<i>For 200 LB Rating, Add</i>	32.11	
<i>For 250 LB Rating, Add</i>	38.02	
<i>For 150 LB Rating, Add</i>	26.19	
<i>For Work In Restricted Working Space, Add</i>	29.40	
23 05 23 00-0145 EA 3" Globe Valve, Bronze, Threaded Or Soldered, 125 LB.....	302.37	22.79
<i>For 300 LB Rating, Add</i>	104.11	
<i>For 200 LB Rating, Add</i>	71.93	
<i>For 250 LB Rating, Add</i>	85.18	
<i>For 150 LB Rating, Add</i>	58.68	
<i>For Work In Restricted Working Space, Add</i>	33.92	
23 05 23 00-0146 Threaded, 125 LB, Outside Stem And Yoke, Iron Body, Globe Valves <small>(23 05 23 00-0133)</small>		
23 05 23 00-0147 EA 2" Threaded, 125 LB, Outside Stem And Yoke, Iron Body, Globe Valve.....	219.82	14.53
<i>For 300 LB Rating, Add</i>	80.98	
<i>For Chain Operated Type, Add</i>	122.94	
<i>For 200 LB Rating, Add</i>	55.95	
<i>For 250 LB Rating, Add</i>	66.25	
<i>For 150 LB Rating, Add</i>	45.64	
<i>For Work In Restricted Working Space, Add</i>	21.78	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 05 Common Work Results For HVAC****23 05 23 General-Duty Valves For HVAC Piping**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 23 00-0148 EA 2-1/2" Threaded, 125 LB, Outside Stem And Yoke, Iron Body, Globe Valve.....	276.47	19.62
For 300 LB Rating, Add	98.16	
For Chain Operated Type, Add	149.02	
For 200 LB Rating, Add	67.82	
For 250 LB Rating, Add	80.31	
For 150 LB Rating, Add	55.33	
For Work In Restricted Working Space, Add	29.40	
23 05 23 00-0149 EA 3" Threaded, 125 LB, Outside Stem And Yoke, Iron Body, Globe Valve	327.24	22.79
For 300 LB Rating, Add	117.79	
For Chain Operated Type, Add	178.82	
For 200 LB Rating, Add	81.38	
For 250 LB Rating, Add	96.37	
For 150 LB Rating, Add	66.39	
For Work In Restricted Working Space, Add	33.92	
23 05 23 00-0150 EA 4" Threaded, 125 LB, Outside Stem And Yoke, Iron Body, Globe Valve	414.13	25.73
For 300 LB Rating, Add	157.05	
For Chain Operated Type, Add	238.43	
For 200 LB Rating, Add	108.51	
For 250 LB Rating, Add	128.49	
For 150 LB Rating, Add	88.52	
For Work In Restricted Working Space, Add	38.58	
23 05 23 00-0151 Flanged, 125 LB, Outside Stem And Yoke, Iron Body, Globe Valves (23 05 23 00-		
0133)		
23 05 23 00-0152 EA 2" Flanged, 125 LB, Outside Stem And Yoke, Iron Body, Globe Valve	270.71	106.43
For Chain Operated Type, Add	68.82	
For 150 LB Rating, Add	42.67	
For 250 LB Rating, Add	61.94	
For Work In Restricted Working Space, Add	39.92	
23 05 23 00-0153 EA 2-1/2" Flanged, 125 LB, Outside Stem And Yoke, Iron Body, Globe Valve	301.44	106.57
For Chain Operated Type, Add	83.90	
For 150 LB Rating, Add	52.02	
For 250 LB Rating, Add	75.51	
For Work In Restricted Working Space, Add	40.09	
23 05 23 00-0154 EA 3" Flanged, 125 LB, Outside Stem And Yoke, Iron Body, Globe Valve	357.74	124.95
For Chain Operated Type, Add	100.68	
For 150 LB Rating, Add	62.42	
For 250 LB Rating, Add	90.61	
For Work In Restricted Working Space, Add	46.92	
23 05 23 00-0155 EA 4" Flanged, 125 LB, Outside Stem And Yoke, Iron Body, Globe Valve	498.16	209.48
For Chain Operated Type, Add	134.24	
For 150 LB Rating, Add	83.23	
For 250 LB Rating, Add	120.81	
For Work In Restricted Working Space, Add	68.91	
23 05 23 00-0156 EA 5" Flanged, 125 LB, Outside Stem And Yoke, Iron Body, Globe Valve	705.20	264.53
For Chain Operated Type, Add	186.67	
For 150 LB Rating, Add	115.74	
For 250 LB Rating, Add	168.00	
For Work In Restricted Working Space, Add	99.56	
23 05 23 00-0157 EA 6" Flanged, 125 LB, Outside Stem And Yoke, Iron Body, Globe Valve	839.34	293.93
For Chain Operated Type, Add	235.96	
For 150 LB Rating, Add	146.30	
For 250 LB Rating, Add	212.36	
For Work In Restricted Working Space, Add	110.23	
23 05 23 00-0158 EA 8" Flanged, 125 LB, Outside Stem And Yoke, Iron Body, Globe Valve	1,145.61	338.02
For Chain Operated Type, Add	362.86	
For 150 LB Rating, Add	224.97	
For 250 LB Rating, Add	326.57	
For Work In Restricted Working Space, Add	125.97	
23 05 23 00-0159 EA 10" Flanged, 125 LB, Outside Stem And Yoke, Iron Body, Globe Valve	1,619.73	411.51
For Chain Operated Type, Add	552.68	
For 150 LB Rating, Add	342.66	
For 250 LB Rating, Add	497.41	
For Work In Restricted Working Space, Add	154.31	
23 05 23 00-0160 EA 12" Flanged, 125 LB, Outside Stem And Yoke, Iron Body, Globe Valve	2,715.11	499.69
For Chain Operated Type, Add	1,045.81	
For 150 LB Rating, Add	648.40	
For 250 LB Rating, Add	941.23	
For Work In Restricted Working Space, Add	187.05	
23 05 23 00-0161 Threaded Or Sweated, 125 LB, Bronze Body, Angle Globe Valves (23 05 23 00-0133)		
23 05 23 00-0162 EA 1/8" Threaded Or Sweated, 125 LB, Bronze Body, Angle Globe Valve	35.76	7.98
For 200 LB Rating, Add	3.80	
For 150 LB Rating, Add	3.10	
For 300 LB Rating, Add	5.50	
For Work In Restricted Working Space, Add	7.73	
23 05 23 00-0163 EA 1/4" Threaded Or Sweated, 125 LB, Bronze Body, Angle Globe Valve	33.25	7.98
For 200 LB Rating, Add	3.80	
For 150 LB Rating, Add	3.10	
For 300 LB Rating, Add	5.50	
For Work In Restricted Working Space, Add	6.98	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 23 00-0164 EA 3/8" Threaded Or Sweated, 125 LB, Bronze Body, Angle Globe Valve.....	34.47	7.98
<i>For 200 LB Rating, Add</i>	3.80	
<i>For 150 LB Rating, Add</i>	3.10	
<i>For 300 LB Rating, Add</i>	5.50	
<i>For Work In Restricted Working Space, Add</i>	7.34	
23 05 23 00-0165 EA 1/2" Threaded Or Sweated, 125 LB, Bronze Body, Angle Globe Valve.....	36.43	7.98
<i>For 200 LB Rating, Add</i>	4.05	
<i>For 150 LB Rating, Add</i>	3.31	
<i>For 300 LB Rating, Add</i>	5.87	
<i>For Work In Restricted Working Space, Add</i>	7.73	
23 05 23 00-0166 EA 3/4" Threaded Or Sweated, 125 LB, Bronze Body, Angle Globe Valve.....	49.52	8.39
<i>For 200 LB Rating, Add</i>	5.62	
<i>For 150 LB Rating, Add</i>	4.59	
<i>For 300 LB Rating, Add</i>	8.14	
<i>For Work In Restricted Working Space, Add</i>	10.42	
23 05 23 00-0167 EA 1" Threaded Or Sweated, 125 LB, Bronze Body, Angle Globe Valve.....	61.45	8.39
<i>For 200 LB Rating, Add</i>	7.38	
<i>For 150 LB Rating, Add</i>	6.02	
<i>For 300 LB Rating, Add</i>	10.68	
<i>For Work In Restricted Working Space, Add</i>	12.61	
23 05 23 00-0168 EA 1-1/4" Threaded Or Sweated, 125 LB, Bronze Body, Angle Globe Valve.....	82.07	10.62
<i>For 200 LB Rating, Add</i>	10.96	
<i>For 150 LB Rating, Add</i>	8.94	
<i>For 300 LB Rating, Add</i>	15.86	
<i>For Work In Restricted Working Space, Add</i>	15.97	
23 05 23 00-0169 EA 1-1/2" Threaded Or Sweated, 125 LB, Bronze Body, Angle Globe Valve.....	95.05	12.29
<i>For 200 LB Rating, Add</i>	12.78	
<i>For 150 LB Rating, Add</i>	10.43	
<i>For 300 LB Rating, Add</i>	18.50	
<i>For Work In Restricted Working Space, Add</i>	18.43	
23 05 23 00-0170 EA 2" Threaded Or Sweated, 125 LB, Bronze Body, Angle Globe Valve.....	123.24	14.53
<i>For 200 LB Rating, Add</i>	19.25	
<i>For 150 LB Rating, Add</i>	15.70	
<i>For 300 LB Rating, Add</i>	27.86	
<i>For Work In Restricted Working Space, Add</i>	21.78	
23 05 23 00-0171 EA 2-1/2" Threaded Or Sweated, 125 LB, Bronze Body, Angle Globe Valve.....	197.83	21.32
<i>For 200 LB Rating, Add</i>	34.72	
<i>For 150 LB Rating, Add</i>	28.32	
<i>For 300 LB Rating, Add</i>	50.25	
<i>For Work In Restricted Working Space, Add</i>	31.94	
23 05 23 00-0172 EA 3" Threaded Or Sweated, 125 LB, Bronze Body, Angle Globe Valve.....	277.57	24.75
<i>For 200 LB Rating, Add</i>	58.80	
<i>For 150 LB Rating, Add</i>	47.97	
<i>For 300 LB Rating, Add</i>	85.10	
<i>For Work In Restricted Working Space, Add</i>	36.85	
23 05 23 00-0173 Flanged, 125 LB, Iron Body, Angle Globe Valves (23 05 23 00-0133)		
23 05 23 00-0174 EA 2" Flanged, 125 LB, Iron Body, Angle Globe Valve.....	487.21	106.43
<i>For 250 LB Rating, Add</i>	212.48	
<i>For Chain Operated Type, Add</i>	138.11	
<i>For Work In Restricted Working Space, Add</i>	39.92	
23 05 23 00-0175 EA 2-1/2" Flanged, 125 LB, Iron Body, Angle Globe Valve.....	552.47	106.57
<i>For 250 LB Rating, Add</i>	251.30	
<i>For Chain Operated Type, Add</i>	163.34	
<i>For Work In Restricted Working Space, Add</i>	40.09	
23 05 23 00-0176 EA 3" Flanged, 125 LB, Iron Body, Angle Globe Valve.....	649.94	124.95
<i>For 250 LB Rating, Add</i>	296.13	
<i>For Chain Operated Type, Add</i>	192.48	
<i>For Work In Restricted Working Space, Add</i>	46.92	
23 05 23 00-0177 EA 4" Flanged, 125 LB, Iron Body, Angle Globe Valve.....	967.45	209.48
<i>For 250 LB Rating, Add</i>	422.96	
<i>For Chain Operated Type, Add</i>	274.93	
<i>For Work In Restricted Working Space, Add</i>	78.75	
23 05 23 00-0178 EA 5" Flanged, 125 LB, Iron Body, Angle Globe Valve.....	1,595.24	264.53
<i>For 250 LB Rating, Add</i>	758.03	
<i>For Chain Operated Type, Add</i>	492.72	
<i>For Work In Restricted Working Space, Add</i>	99.56	
23 05 23 00-0179 EA 6" Flanged, 125 LB, Iron Body, Angle Globe Valve.....	1,630.80	293.93
<i>For 250 LB Rating, Add</i>	758.03	
<i>For Chain Operated Type, Add</i>	492.72	
<i>For Work In Restricted Working Space, Add</i>	110.23	
23 05 23 00-0180 EA 8" Flanged, 125 LB, Iron Body, Angle Globe Valve.....	2,892.58	338.02
<i>For 250 LB Rating, Add</i>	1,483.61	
<i>For Chain Operated Type, Add</i>	964.35	
<i>For Work In Restricted Working Space, Add</i>	125.97	
23 05 23 00-0181 Class 800 Outside Stem And Yoke, Threaded, Chrome Trim, Bolted Bonnet, Forged Steel, Globe Valves (23 05 23 00-0133)		
Note: 800 PSIG at 850 degrees F.		
23 05 23 00-0182 EA 1/4" Class 800 Outside Stem And Yoke, Threaded, Chrome Trim, Bolted Bonnet, Forged Steel, Globe Valve.....	87.24	12.94
<i>For Work In Restricted Working Space, Add</i>	6.98	
23 05 23 00-0183 EA 1/2" Class 800 Outside Stem And Yoke, Threaded, Chrome Trim, Bolted Bonnet, Forged Steel, Globe Valve.....	89.75	12.94
<i>For Work In Restricted Working Space, Add</i>	7.73	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 05 Common Work Results For HVAC****23 05 23 General-Duty Valves For HVAC Piping**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 23 00-0184 EA 3/4" Class 800 Outside Stem And Yoke, Threaded, Chrome Trim, Bolted Bonnet, Forged Steel, Globe Valve <i>For Work In Restricted Working Space, Add</i>	107.51 10.42	17.41
23 05 23 00-0185 EA 1" Class 800 Outside Stem And Yoke, Threaded, Chrome Trim, Bolted Bonnet, Forged Steel, Globe Valve <i>For Work In Restricted Working Space, Add</i>	132.44 12.61	21.00
23 05 23 00-0186 EA 1-1/4" Class 800 Outside Stem And Yoke, Threaded, Chrome Trim, Bolted Bonnet, Forged Steel, Globe Valve <i>For Work In Restricted Working Space, Add</i>	208.21 15.97	26.59
23 05 23 00-0187 EA 1-1/2" Class 800 Outside Stem And Yoke, Threaded, Chrome Trim, Bolted Bonnet, Forged Steel, Globe Valve <i>For Work In Restricted Working Space, Add</i>	248.69 18.43	30.74
23 05 23 00-0188 EA 2" Class 800 Outside Stem And Yoke, Threaded, Chrome Trim, Bolted Bonnet, Forged Steel, Globe Valve <i>For Work In Restricted Working Space, Add</i>	313.87 21.78	36.33
23 05 23 00-0189 Triple Duty Valves <small>(23 05 23)</small> Note: Valves function as a shut-off, check valve and calibrated balancing valve.		
23 05 23 00-0190 Straight Pattern, Triple Duty Valves <small>(23 05 23 00-0189)</small> Note: Bell & Gossett 3DX and 3DS-S Series.		
23 05 23 00-0191 EA 1" Threaded, Straight Pattern, Triple Duty Valve	200.52	8.39
23 05 23 00-0192 EA 1-1/4" Threaded, Straight Pattern, Triple Duty Valve	232.63	10.62
23 05 23 00-0193 EA 1-1/2" Threaded, Straight Pattern, Triple Duty Valve	252.82	12.29
23 05 23 00-0194 EA 2" Flanged, Straight Pattern, Triple Duty Valve.....	629.29	21.80
23 05 23 00-0195 EA 2-1/2" Flanged, Straight Pattern, Triple Duty Valve	734.81	106.57
23 05 23 00-0196 EA 3" Flanged, Straight Pattern, Triple Duty Valve.....	805.41	124.95
23 05 23 00-0197 EA 4" Flanged, Straight Pattern, Triple Duty Valve.....	1,644.30	209.48
23 05 23 00-0198 EA 5" Flanged, Straight Pattern Triple Duty Valve.....	1,961.89	264.53
23 05 23 00-0199 EA 6" Flanged, Straight Pattern, Triple Duty Valve.....	2,592.63	293.93
23 05 23 00-0200 EA 8" Flanged, Straight Pattern, Triple Duty Valve.....	3,440.69	338.02
23 05 23 00-0201 EA 10" Flanged, Straight Pattern, Triple Duty Valve.....	5,503.17	411.51
23 05 23 00-0202 Flanged, Angle Pattern, Triple Duty Valves <small>(23 05 23 00-0189)</small> Note: Bell & Gossett 3D-S Series.		
23 05 23 00-0203 EA 2" Flanged, Angle Pattern, Triple Duty Valve.....	614.34	21.80
23 05 23 00-0204 EA 2-1/2" Flanged, Angle Pattern, Triple Duty Valve.....	716.86	106.57
23 05 23 00-0205 EA 3" Flanged, Angle Pattern, Triple Duty Valve.....	790.46	124.95
23 05 23 00-0206 EA 4" Flanged, Angle Pattern, Triple Duty Valve.....	1,605.42	209.48
23 05 23 00-0207 EA 5" Flanged, Angle Pattern, Triple Duty Valve.....	1,914.04	264.53
23 05 23 00-0208 EA 6" Flanged, Angle Pattern, Triple Duty Valve.....	2,144.00	293.93
23 05 23 00-0209 EA 8" Flanged, Angle Pattern, Triple Duty Valve.....	3,228.34	338.02
23 05 23 00-0210 EA 10" Flanged, Angle Pattern, Triple Duty Valve.....	4,309.81	411.51
23 05 23 00-0211 Balanced, Straight Pattern, Triple Duty Valves <small>(23 05 23 00-0189)</small> Note: Bell & Gossett 3DS-B Series.		
23 05 23 00-0212 EA 3" Flanged, Balanced, Straight Pattern, Triple Duty Valve.....	739.61	124.95
23 05 23 00-0213 EA 4" Flanged, Balanced, Straight Pattern, Triple Duty Valve.....	1,470.83	209.48
23 05 23 00-0214 EA 5" Flanged, Balanced, Straight Pattern, Triple Duty Valve.....	1,761.50	264.53
23 05 23 00-0215 EA 6" Flanged, Balanced, Straight Pattern, Triple Duty Valve.....	2,320.46	293.93
23 05 23 00-0216 EA 8" Flanged, Balanced, Straight Pattern, Triple Duty Valve.....	3,069.82	338.02
23 05 23 00-0217 EA 10" Flanged, Balanced, Straight Pattern, Triple Duty Valve.....	4,884.06	411.51
23 05 23 00-0218 EA 12" Flanged, Balanced, Straight Pattern, Triple Duty Valve.....	7,335.18	499.69
23 05 23 00-0219 EA 14" Flanged, Balanced, Straight Pattern, Triple Duty Valve.....	8,913.02	551.12
23 05 23 00-0220 EA 16" Flanged, Balanced, Straight Pattern, Triple Duty Valve.....	11,154.37	646.65
23 05 23 00-0221 Grooved Straight Pattern, Triple Duty Valves <small>(23 05 23 00-0189)</small> Note: Bell & Gossett 3DS-G Series.		
23 05 23 00-0222 EA 2" Grooved, Straight Pattern, Triple Duty Valve.....	687.13	19.73
23 05 23 00-0223 EA 2-1/2" Grooved, Straight Pattern, Triple Duty Valve.....	819.11	23.52
23 05 23 00-0224 EA 3" Grooved, Straight Pattern, Triple Duty Valve.....	953.43	25.51
23 05 23 00-0225 EA 4" Grooved, Straight Pattern, Triple Duty Valve.....	1,581.83	27.49
23 05 23 00-0226 EA 5" Grooved, Straight Pattern, Triple Duty Valve.....	1,835.41	37.48
23 05 23 00-0227 EA 6" Grooved, Straight Pattern Triple Duty Valve.....	2,446.77	48.06
23 05 23 00-0228 EA 8" Grooved, Straight Pattern Triple Duty Valve.....	3,327.25	60.99
23 05 23 00-0229 EA 10" Grooved, Straight Pattern Triple Duty Valve.....	5,247.18	68.34
23 05 23 00-0230 EA 12" Grooved, Straight Pattern Triple Duty Valve.....	8,328.03	83.33
23 05 23 00-0231 Plug Valves <small>(23 05 23)</small>		
23 05 23 00-0232 Plug Valves, Lubricated, Semisteel Screwed, Wrench Operated <small>(23 05 23 00-0231)</small> Note: Includes wrench.		
23 05 23 00-0233 EA 1/2" Diameter Plug Valve, Semi-Steel, Screwed Lubricated, 200 PSI, Wrench Operated, With Wrench.....	119.35	7.98
23 05 23 00-0234 EA 3/4" Diameter Plug Valve, Semi-Steel, Screwed Lubricated, 200 PSI, Wrench Operated, With Wrench.....	128.31	8.78
23 05 23 00-0235 EA 1" Diameter Plug Valve, Semi-Steel, Screwed Lubricated, 200 PSI, Wrench Operated, With Wrench.....	161.41	9.98
23 05 23 00-0236 EA 1-1/4" Diameter Plug Valve, Semi-Steel, Screwed Lubricated, 200 PSI, Wrench Operated, With Wrench.....	194.58	10.62
23 05 23 00-0237 EA 1-1/2" Diameter Plug Valve, Semi-Steel, Screwed Lubricated, 200 PSI, Wrench Operated, With Wrench.....	215.18	12.29
23 05 23 00-0238 EA 2" Diameter Plug Valve, Semi-Steel, Screwed Lubricated, 200 PSI, Wrench Operated, With Wrench.....	254.05	14.53
23 05 23 00-0239 EA 2-1/2" Diameter Plug Valve, Semi-Steel, Screwed Lubricated, 200 PSI, Wrench Operated, With Wrench.....	375.92	19.62
23 05 23 00-0240 EA 3" Diameter Plug Valve, Semi-Steel, Screwed Lubricated, 200 PSI, Wrench Operated, With Wrench.....	456.90	22.79



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 23 00-0241				Plug Valves, Lubricated, Semisteel Flanged <small>(23 05 23 00-0231)</small>		
				Note: Wrench operated for 4", gear operated for 6" and 10".		
				23 05 23 00-0242 EA 2" Diameter Plug Valve, Semi-Steel, Flanged, 175 PSI, Wrench Operated, With Wrench	280.06	106.43
				23 05 23 00-0243 EA 2-1/2" Diameter Plug Valve, Semi-Steel, Flanged, 175 PSI, Wrench Operated, With Wrench	327.26	106.57
				23 05 23 00-0244 EA 3" Diameter Plug Valve, Semi-Steel, Flanged, 175 PSI, Wrench Operated, With Wrench	399.68	124.95
				23 05 23 00-0245 EA 4" Diameter Plug Valve, Semi-Steel, Flanged, 175 PSI, Wrench Operated, With Wrench	591.96	209.48
				23 05 23 00-0246 EA 6" Diameter Plug Valve, Semi-Steel, Flanged, 175 PSI, Wrench Operated, With Wrench	1,246.30	293.93
				23 05 23 00-0247 EA 8" Diameter Plug Valve, Semi-Steel, Flanged, 175 PSI, Wrench Operated, With Wrench	2,003.30	338.02
				23 05 23 00-0248 EA 10" Diameter Plug Valve, Semi-Steel, Flanged, 175 PSI, Wrench Operated, With Wrench	3,153.04	411.51
				23 05 23 00-0249 EA 12" Diameter Plug Valve, Semi-Steel, Flanged, 175 PSI, Wrench Operated, With Wrench	4,628.62	499.69
23 05 23 00-0250				Plug Valves, Forged Steel, Screwed <small>(23 05 23 00-0231)</small>		
				23 05 23 00-0251 EA 1/2" Plug Valve, 1,500 LB, Forged Steel, Screwed.....	426.10	7.98
				23 05 23 00-0252 EA 3/4" Plug Valve, 1,500 LB, Forged Steel, Screwed.....	505.40	8.78
				23 05 23 00-0253 EA 1" Plug Valve, 1,500 LB, Forged Steel, Screwed.....	572.63	9.98
				23 05 23 00-0254 EA 1-1/4" Plug Valve, 1,500 LB, Forged Steel, Screwed.....	688.33	10.62
				23 05 23 00-0255 EA 1-1/2" Plug Valve, 1,500 LB, Forged Steel, Screwed.....	801.31	12.29
				23 05 23 00-0256 EA 2" Plug Valve, 1,500 LB, Forged Steel, Screwed.....	1,050.43	14.53
23 05 23 00-0257				Plug Valves, Eccentric, Cast Iron Flanged <small>(23 05 23 00-0231)</small>		
				23 05 23 00-0258 EA 4" Diameter Plug Valve, Eccentric, Cast Iron, Flanged, 175 PSI	655.25	209.48
				23 05 23 00-0259 EA 6" Diameter Plug Valve, Eccentric, Cast Iron, Flanged, 175 PSI	1,005.30	264.53
				23 05 23 00-0260 EA 8" Diameter Plug Valve, Eccentric, Cast Iron, Flanged, 175 PSI	1,358.61	338.02
				23 05 23 00-0261 EA 10" Diameter Plug Valve, Eccentric, Cast Iron, Flanged, 175 PSI	1,903.77	411.51
				23 05 23 00-0262 EA 12" Diameter Plug Valve, Eccentric, Cast Iron, Flanged, 175 PSI	2,446.81	499.69
23 05 23 00-0263				Foot Valves <small>(23 05 23)</small>		
23 05 23 00-0264				Single Poppet Foot Valves, Metal To Metal Seat Construction <small>(23 05 23 00-0263)</small>		
				23 05 23 00-0265 EA 1" Single Poppet Foot Valve, Metal To Metal Seat Construction	53.79	19.97
				23 05 23 00-0266 EA 1-1/4" Single Poppet Foot Valve, Metal To Metal Seat Construction	60.69	22.36
				23 05 23 00-0267 EA 1-1/2" Single Poppet Foot Valve, Metal To Metal Seat Construction	74.61	25.57
				23 05 23 00-0268 EA 2" Single Poppet Foot Valve, Metal To Metal Seat Construction	94.21	28.76
				23 05 23 00-0269 EA 2-1/2" Single Poppet Foot Valve, Metal To Metal Seat Construction	198.28	47.13
				23 05 23 00-0270 EA 3" Single Poppet Foot Valve, Metal To Metal Seat Construction	250.74	57.51
23 05 23 00-0271				Double Poppet Foot Valves, Metal To Metal Seat Construction <small>(23 05 23 00-0263)</small>		
				23 05 23 00-0272 EA 1" Double Poppet Foot Valve, Metal To Metal Seat Construction.....	53.79	19.97
				23 05 23 00-0273 EA 1-1/4" Double Poppet Foot Valve, Metal To Metal Seat Construction.....	96.27	22.36
				23 05 23 00-0274 EA 1-1/2" Double Poppet Foot Valve, Metal To Metal Seat Construction.....	95.14	25.57
				23 05 23 00-0275 EA 2" Double Poppet Foot Valve, Metal To Metal Seat Construction.....	124.31	28.76
				23 05 23 00-0276 EA 3" Double Poppet Foot Valve, Metal To Metal Seat Construction.....	235.59	47.13
				23 05 23 00-0277 EA 4" Double Poppet Foot Valve, Metal To Metal Seat Construction.....	314.06	56.71
23 05 23 00-0278				Float Valves <small>(23 05 23)</small>		
23 05 23 00-0279				Float Valve Assembly For Maintaining Liquid Level In Tanks <small>(23 05 23 00-0278)</small>		
23 05 23 00-0280				Single Seat, Bronze Construction <small>(23 05 23 00-0279)</small>		
				Note: For storage tanks, reservoirs, cooling towers and filtration plants.		
				23 05 23 00-0281 EA Inlet Size 1/2", Maximum PSI 100, Single Seat Float Valve	97.87	16.77
				23 05 23 00-0282 EA Inlet Size 3/4", Maximum PSI 100, Single Seat Float Valve	112.86	19.96
				23 05 23 00-0283 EA Inlet Size 1", Maximum PSI 100, Single Seat Float Valve	142.10	21.56
				23 05 23 00-0284 EA Inlet Size 1-1/4", Maximum PSI 90, Single Seat Float Valve	229.28	27.15
				23 05 23 00-0285 EA Inlet Size 1-1/2", Maximum PSI 90, Single Seat Float Valve	237.26	31.14
23 05 23 00-0286				Double Seat, Bronze Construction <small>(23 05 23 00-0279)</small>		
				Note: For hot or cold water or oil to open tanks.		
				23 05 23 00-0287 EA Pipe Size 1/2" Maximum PSI 150, Double Seat Float Valve.....	458.06	16.77
				23 05 23 00-0288 EA Pipe Size 3/4" Maximum PSI 150, Double Seat Float Valve.....	464.45	19.96
				23 05 23 00-0289 EA Pipe Size 1" Maximum PSI 150, Double Seat Float Valve.....	534.39	21.56
				23 05 23 00-0290 EA Pipe Size 1-1/4" Maximum PSI 150, Double Seat Float Valve	593.81	27.15
				23 05 23 00-0291 EA Pipe Size 1-1/2" Maximum PSI 150, Double Seat Float Valve	678.98	31.14
				23 05 23 00-0292 EA Pipe Size 2" Maximum PSI 150, Double Seat Float Valve.....	886.99	36.73
				23 05 23 00-0293 EA Pipe Size 2-1/2" Maximum PSI 150, Double Seat Float Valve	1,037.52	49.24
				23 05 23 00-0294 EA Pipe Size 3" Maximum PSI 150, Double Seat Float Valve.....	1,245.92	56.60
23 05 23 00-0295				Float Valve Single Seated Balanced For Air Oil Or Water <small>(23 05 23 00-0278)</small>		
				Note: Includes arm, ball and bracket.		
23 05 23 00-0296				Brass Body Threaded Ends <small>(23 05 23 00-0295)</small>		
				23 05 23 00-0297 EA 1/2" Brass Body, Threaded Ends, Float Valve, Single Seated With Arm Ball And Bracket.....	115.60	21.64
				23 05 23 00-0298 EA 3/4" Brass Body, Threaded Ends, Float Valve, Single Seated With Arm Ball And Bracket.....	130.16	24.04
				23 05 23 00-0299 EA 1" Brass Body, Threaded Ends, Float Valve, Single Seated With Arm Ball And Bracket.....	156.91	26.59

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 05 Common Work Results For HVAC****23 05 23 General-Duty Valves For HVAC Piping**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 23 00-0300 EA 1-1/4" Brass Body, Threaded Ends, Float Valve, Single Seated With Arm Ball And Bracket.....	251.42	42.96
23 05 23 00-0301 EA 1-1/2" Brass Body, Threaded Ends, Float Valve, Single Seated With Arm Ball And Bracket.....	268.66	48.95
23 05 23 00-0302 EA 2" Brass Body, Threaded Ends, Float Valve, Single Seated With Arm Ball And Bracket.....	309.88	60.69
23 05 23 00-0303 Cast Iron Body Flanged (23 05 23 00-0295)		
23 05 23 00-0304 EA 2-1/2" Cast Iron Body, Flanged, Float Valve, Single Seated With Arm Ball And Bracket.....	2,881.92	129.36
23 05 23 00-0305 EA 3" Cast Iron Body, Flanged, Float Valve, Single Seated With Arm Ball And Bracket.....	3,471.66	147.00
23 05 23 00-0306 Float Operated Valves (23 05 23 00-0278)		
23 05 23 00-0307 For Condensate Receivers Tanks And Vessels (23 05 23 00-0306)		
Note: Cast iron body, self-contained, float in-line mount.		
23 05 23 00-0308 EA 1" Inlet, Float Operated Valve, Single Seated With Arm Ball And Bracket.....	345.62	37.53
23 05 23 00-0309 For Condensate Receivers Tanks And Vessels (23 05 23 00-0306)		
Note: Cast iron body, external float tank mount, flanged.		
23 05 23 00-0310 EA 3/4" Inlet, Float Operated Valve, Single Seated With Arm Ball And Bracket.....	455.50	69.82
23 05 23 00-0311 Needle Valves (23 05 23)		
23 05 23 00-0312 Bronze Needle Valve (23 05 23 00-0311)		
Note: For heating and cooling applications.		
23 05 23 00-0313 EA 1/4" Needle Valve, Bronze.....	53.66	7.98
23 05 23 00-0314 EA 3/8" Needle Valve, Bronze.....	59.17	7.98
23 05 23 00-0315 EA 1/2" Needle Valve, Bronze.....	64.26	7.98
23 05 23 00-0316 EA 3/4" Needle Valve, Bronze.....	95.52	8.78
23 05 23 00-0317 EA 1" Needle Valve, Bronze.....	141.22	9.98
23 05 23 00-0318 Eccentric Valves With Taps (23 05 23)		
23 05 23 00-0319 Screwed Eccentric Valves With Taps (23 05 23 00-0318)		
23 05 23 00-0320 EA 1/2" Diameter Eccentric Valves With Taps, Screwed.....	116.56	7.98
23 05 23 00-0321 EA 3/4" Diameter Eccentric Valves With Taps, Screwed.....	126.91	8.78
23 05 23 00-0322 EA 1" Diameter Eccentric Valves With Taps, Screwed.....	159.37	9.98
23 05 23 00-0323 EA 1-1/4" Diameter Eccentric Valves With Taps, Screwed.....	194.31	10.62
23 05 23 00-0324 EA 1-1/2" Diameter Eccentric Valves With Taps, Screwed.....	213.68	12.29
23 05 23 00-0325 EA 2" Diameter Eccentric Valves With Taps, Screwed.....	251.39	14.53
23 05 23 00-0326 EA 2-1/2" Diameter Eccentric Valves With Taps, Screwed.....	374.58	19.62
23 05 23 00-0327 EA 3" Diameter Eccentric Valves With Taps, Screwed.....	452.52	22.79
23 05 23 00-0328 Flanged Eccentric Valves With Taps (23 05 23 00-0318)		
23 05 23 00-0329 EA 2-1/2" Diameter Eccentric Valves With Taps, Flanged.....	461.91	106.57
23 05 23 00-0330 EA 3" Diameter Eccentric Valves With Taps, Flanged.....	547.52	124.95
23 05 23 00-0331 EA 4" Diameter Eccentric Valves With Taps, Flanged.....	758.40	209.48
23 05 23 00-0332 EA 5" Diameter Eccentric Valves With Taps, Flanged.....	1,030.30	264.53
23 05 23 00-0333 EA 6" Diameter Eccentric Valves With Taps, Flanged.....	1,275.39	293.93
23 05 23 00-0334 EA 8" Diameter Eccentric Valves With Taps, Flanged.....	2,061.23	338.02
23 05 23 00-0335 EA 10" Diameter Eccentric Valves With Taps, Flanged.....	2,854.15	411.51
23 05 23 00-0336 EA 12" Diameter Eccentric Valves With Taps, Flanged.....	4,779.21	499.69
23 05 23 00-0337 Earthquake-Sensitive Gas Shut-Off Valve (23 05 23)		
23 05 23 00-0338 0.5 PSI Threaded Earthquake Gas Shutoff Valves (23 05 23 00-0337)		
23 05 23 00-0339 EA 3/4" 0.5 PSI Threaded Earthquake Gas Shutoff Valve.....	158.49	8.78
23 05 23 00-0340 EA 1" 0.5 PSI Threaded Earthquake Gas Shutoff Valve.....	178.29	9.98
23 05 23 00-0341 7 PSI Threaded Earthquake Gas Shutoff Valves (23 05 23 00-0337)		
23 05 23 00-0342 EA 1-1/4" 7 PSI Threaded Earthquake Gas Shutoff Valve.....	206.52	10.62
23 05 23 00-0343 EA 1-1/2" 7 PSI Threaded Earthquake Gas Shutoff Valve.....	282.84	12.29
23 05 23 00-0344 60 PSI Threaded Earthquake Gas Shutoff Valves (23 05 23 00-0337)		
23 05 23 00-0345 EA 3/4" 60 PSI Threaded Earthquake Gas Shutoff Valve.....	199.37	8.78
23 05 23 00-0346 EA 1" 60 PSI Threaded Earthquake Gas Shutoff Valve.....	206.68	9.98
23 05 23 00-0347 EA 1-1/4" 60 PSI Threaded Earthquake Gas Shutoff Valve.....	229.23	10.62
23 05 23 00-0348 EA 1-1/2" 60 PSI Threaded Earthquake Gas Shutoff Valve.....	316.91	12.29
23 05 23 00-0349 EA 2" 60 PSI Threaded Earthquake Gas Shutoff Valve.....	753.89	14.53
23 05 23 00-0350 EA 2-1/2" 60 PSI Threaded Earthquake Gas Shutoff Valve.....	892.54	19.56
23 05 23 00-0351 EA 3" 60 PSI Threaded Earthquake Gas Shutoff Valve.....	1,163.42	22.79
23 05 23 00-0352 EA 4" 60 PSI Threaded Earthquake Gas Shutoff Valve.....	1,349.30	25.73
23 05 23 00-0353 60 PSI Flanged Earthquake Gas Shutoff Valves (23 05 23 00-0337)		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 23 00-0354 EA 2" 60 PSI Flanged Earthquake Gas Shutoff Valve.....	1,041.47	106.43
23 05 23 00-0355 EA 3" 60 PSI Flanged Earthquake Gas Shutoff Valve.....	1,286.21	124.95
23 05 23 00-0356 EA 4" 60 PSI Flanged Earthquake Gas Shutoff Valve.....	1,795.43	209.48
23 05 23 00-0357 EA 6" 60 PSI Flanged Earthquake Gas Shutoff Valve.....	3,035.84	293.93
23 05 23 00-0358 EA 8" 60 PSI Flanged Earthquake Gas Shutoff Valve.....	8,254.85	338.02
23 05 23 00-0359 Emergency Shut-Off Valve With Fusible Link (23 05 23)		
23 05 23 00-0360 Threaded Brass, Fusible Gate Valves (Morrison Bros. 939) (23 05 23 00-0359)		
Note: Brass globe/gate valve used to shut off product flow in the event of a fire. Fusible element in the handwheel automatically closes the valve when in contact with 165° F.		
23 05 23 00-0361 EA 1/4" Threaded Brass, Fusible Gate Valve (Morrison Bros. 939 Series)	51.09	12.86
<i>For Work In Restricted Working Space, Add</i>		
	6.98	
23 05 23 00-0362 EA 3/8" Threaded Brass, Fusible Gate Valve (Morrison Bros. 939 Series)	52.35	13.57
<i>For Work In Restricted Working Space, Add</i>		
	7.35	
23 05 23 00-0363 EA 1/2" Threaded Brass, Fusible Gate Valve (Morrison Bros. 939 Series)	83.05	12.86
<i>For Work In Restricted Working Space, Add</i>		
	7.73	
23 05 23 00-0364 EA 3/4" Threaded Brass, Fusible Gate Valve (Morrison Bros. 939 Series)	161.93	17.33
<i>For Work In Restricted Working Space, Add</i>		
	10.42	
23 05 23 00-0365 EA 1" Threaded Brass, Fusible Gate Valve (Morrison Bros. 939 Series)	402.68	21.00
<i>For Work In Restricted Working Space, Add</i>		
	12.61	
23 05 23 00-0366 Threaded Ductile Iron, Emergency Gas Shutoff Valves (Morrison Bros. 346-DI) (23 05 23 00-0359)		
Note: Ductile iron body, cap, seat and swing arm. Viton® encapsulated Teflon® o-ring, Teflon® gasket, and stainless steel spring.		
23 05 23 00-0367 EA 1-1/2" Threaded Ductile Iron, Emergency Gas Shutoff Valves (Morrison Bros. 346-DI).....	310.53	12.29
23 05 23 00-0368 EA 2" Threaded Ductile Iron, Emergency Gas Shutoff Valves (Morrison Bros. 346-DI).....	335.75	14.53
23 05 23 00-0369 EA 3" Threaded Ductile Iron, Emergency Gas Shutoff Valves (Morrison Bros. 346-DI).....	562.85	22.79
23 05 23 00-0370 Flanged Ductile Iron, Emergency Gas Shutoff Valves (Morrison Bros. 346-DI) (23 05 23 00-0359)		
Note: Ductile iron body, cap, seat and swing arm. Viton® encapsulated Teflon® o-ring, Teflon® gasket, and stainless steel spring.		
23 05 23 00-0371 EA 2" Flanged Ductile Iron, Emergency Gas Shutoff Valves (Morrison Bros. 346-DI)	454.41	106.43
23 05 23 00-0372 EA 3" Flanged Ductile Iron, Emergency Gas Shutoff Valves (Morrison Bros. 346-DI)	732.28	124.95
23 05 23 00-0373 EA 4" Flanged Ductile Iron, Emergency Gas Shutoff Valves (Morrison Bros. 346-DI)	1,662.68	209.48
23 05 23 00-0374 Check Valves (23 05 23)		
23 05 23 00-0375 Iron Body Wafer Type Check Valve (23 05 23 00-0374)		
23 05 23 00-0376 Single Disk Type (23 05 23 00-0375)		
23 05 23 00-0377 EA 2" Check Valve, Single Disc Type, Iron Body Wafer Type, 125 LB	250.38	106.47
<i>For 300 LB Rating, Add</i>		
	35.18	
<i>For 300 LB Rating, Cast Steel, Weld End, Wedge, Add</i>		
	79.39	
<i>For 200 LB Rating, Add</i>		
	29.31	
<i>For 150 LB Rating, Add</i>		
	24.62	
23 05 23 00-0378 EA 2-1/2" Check Valve, Single Disc Type, Iron Body Wafer Type, 125 LB	287.34	106.63
<i>For 300 LB Rating, Add</i>		
	46.09	
<i>For 300 LB Rating, Cast Steel, Weld End, Wedge, Add</i>		
	95.87	
<i>For 200 LB Rating, Add</i>		
	38.41	
<i>For 150 LB Rating, Add</i>		
	32.26	
23 05 23 00-0379 EA 3" Check Valve, Single Disc Type, Iron Body Wafer Type, 125 LB	350.66	125.02
<i>For 300 LB Rating, Add</i>		
	58.25	
<i>For 300 LB Rating, Cast Steel, Weld End, Wedge, Add</i>		
	118.68	
<i>For 200 LB Rating, Add</i>		
	48.55	
<i>For 150 LB Rating, Add</i>		
	40.78	
23 05 23 00-0380 EA 4" Check Valve, Single Disc Type, Iron Body Wafer Type, 125 LB	525.65	209.59
<i>For 300 LB Rating, Add</i>		
	78.90	
<i>For 300 LB Rating, Cast Steel, Weld End, Wedge, Add</i>		
	170.88	
<i>For 200 LB Rating, Add</i>		
	65.75	
<i>For 150 LB Rating, Add</i>		
	55.23	
23 05 23 00-0381 EA 6" Check Valve, Single Disc Type, Iron Body Wafer Type, 125 LB	779.65	294.16
<i>For 300 LB Rating, Add</i>		
	123.59	
<i>For 300 LB Rating, Cast Steel, Weld End, Wedge, Add</i>		
	258.92	
<i>For 200 LB Rating, Add</i>		
	102.99	
<i>For 150 LB Rating, Add</i>		
	86.51	
23 05 23 00-0382 EA 8" Check Valve, Single Disc Type, Iron Body Wafer Type, 125 LB	1,053.52	338.29
<i>For 300 LB Rating, Add</i>		
	189.65	
<i>For 300 LB Rating, Cast Steel, Weld End, Wedge, Add</i>		
	368.75	
<i>For 200 LB Rating, Add</i>		
	158.05	
<i>For 150 LB Rating, Add</i>		
	132.76	
23 05 23 00-0383 EA 10" Check Valve, Single Disc Type, Iron Body Wafer Type, 125 LB	1,528.28	411.83
<i>For 300 LB Rating, Add</i>		
	302.92	
<i>For 300 LB Rating, Cast Steel, Weld End, Wedge, Add</i>		
	558.09	
<i>For 200 LB Rating, Add</i>		
	252.43	
<i>For 150 LB Rating, Add</i>		
	212.04	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 05 Common Work Results For HVAC****23 05 23 General-Duty Valves For HVAC Piping**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 23 00-0384 Twin Disc Type <small>(23 05 23 00-0375)</small>		
23 05 23 00-0385 EA 2" Check Valve, Twin Disc Type, Iron Body Wafer Type, 125 LB.....	264.79	106.47
For 300 LB Rating, Add	39.50	
For 300 LB Rating, Cast Steel, Weld End, Wedge, Add	85.87	
For 200 LB Rating, Add	32.92	
For 150 LB Rating, Add	27.65	
23 05 23 00-0386 EA 2-1/2" Check Valve, Twin Disc Type, Iron Body Wafer Type, 125 LB.....	291.73	106.63
For 300 LB Rating, Add	47.40	
For 300 LB Rating, Cast Steel, Weld End, Wedge, Add	97.85	
For 200 LB Rating, Add	39.50	
For 150 LB Rating, Add	33.18	
23 05 23 00-0387 EA 3" Check Valve, Twin Disc Type, Iron Body Wafer Type, 125 LB.....	340.84	125.02
For 300 LB Rating, Add	55.31	
For 300 LB Rating, Cast Steel, Weld End, Wedge, Add	114.26	
For 200 LB Rating, Add	46.09	
For 150 LB Rating, Add	38.72	
23 05 23 00-0388 EA 4" Check Valve, Twin Disc Type, Iron Body Wafer Type, 125 LB.....	496.78	209.59
For 300 LB Rating, Add	70.24	
For 300 LB Rating, Cast Steel, Weld End, Wedge, Add	157.89	
For 200 LB Rating, Add	58.53	
For 150 LB Rating, Add	49.17	
23 05 23 00-0389 EA 6" Check Valve, Twin Disc Type, Iron Body Wafer Type, 125 LB.....	745.24	294.16
For 300 LB Rating, Add	113.26	
For 300 LB Rating, Cast Steel, Weld End, Wedge, Add	243.43	
For 200 LB Rating, Add	94.39	
For 150 LB Rating, Add	79.28	
23 05 23 00-0390 EA 8" Check Valve, Twin Disc Type, Iron Body Wafer Type, 125 LB.....	996.81	338.29
For 300 LB Rating, Add	172.97	
For 300 LB Rating, Cast Steel, Weld End, Wedge, Add	343.50	
For 200 LB Rating, Add	144.14	
For 150 LB Rating, Add	121.08	
23 05 23 00-0391 EA 10" Check Valve, Twin Disc Type, Iron Body Wafer Type, 125 LB.....	1,428.11	36.77
For 300 LB Rating, Add	273.93	
For 300 LB Rating, Cast Steel, Weld End, Wedge, Add	513.90	
For 200 LB Rating, Add	228.28	
For 150 LB Rating, Add	191.75	
23 05 23 00-0392 EA 12" Check Valve, Twin Disc Type, Iron Body Wafer Type, 125 LB.....	1,846.59	500.08
For 300 LB Rating, Add	367.01	
For 300 LB Rating, Cast Steel, Weld End, Wedge, Add	675.16	
For 200 LB Rating, Add	305.84	
For 150 LB Rating, Add	256.91	
23 05 23 00-0393 Lift Check Valves <small>(23 05 23 00-0374)</small>		
23 05 23 00-0394 Bronze Body, Threaded, Vertical Lift Check Valves <small>(23 05 23 00-0393)</small>		
Note: Watts #600 series.		
23 05 23 00-0395 EA 3/8" Lift Check Valve, Bronze, Threaded.....	55.47	7.98
23 05 23 00-0396 EA 1/2" Lift Check Valve, Bronze, Threaded.....	58.63	7.98
23 05 23 00-0397 EA 3/4" Lift Check Valve, Bronze, Threaded.....	75.66	8.39
23 05 23 00-0398 EA 1" Lift Check Valve, Bronze, Threaded.....	97.91	8.39
23 05 23 00-0399 EA 1-1/4" Lift Check Valve, Bronze, Threaded.....	133.32	10.62
23 05 23 00-0400 EA 1-1/2" Lift Check Valve, Bronze, Threaded.....	160.59	12.29
23 05 23 00-0401 EA 2" Lift Check Valve, Bronze, Threaded.....	221.70	14.53
23 05 23 00-0402 Bronze Body, Threaded, 300 LB, Lift Check Valves <small>(23 05 23 00-0393)</small>		
Note: Crane 366E.		
23 05 23 00-0403 EA 1/2" Lift Check Valve, Bronze, Threaded, 300 LB.....	283.24	7.98
23 05 23 00-0404 EA 3/4" Lift Check Valve, Bronze, Threaded, 300 LB.....	345.70	8.39
23 05 23 00-0405 EA 1" Lift Check Valve, Bronze, Threaded, 300 LB.....	610.50	8.39
23 05 23 00-0406 EA 1-1/4" Lift Check Valve, Bronze, Threaded, 300 LB.....	812.30	10.62
23 05 23 00-0407 EA 1-1/2" Lift Check Valve, Bronze, Threaded, 300 LB.....	884.04	12.29
23 05 23 00-0408 EA 2" Lift Check Valve, Bronze, Threaded, 300 LB.....	1,132.61	14.53
23 05 23 00-0409 Iron Body, Flanged, 125 LB Vertical Lift Check Valves <small>(23 05 23 00-0393)</small>		
Note: Mueller 105MAP.		
23 05 23 00-0410 EA 2" Lift Check Valve, Iron Body, Flanged, 125 LB.....	459.47	106.43
23 05 23 00-0411 EA 2-1/2" Lift Check Valve, Iron Body, Flanged, 125 LB.....	642.27	106.57
23 05 23 00-0412 EA 3" Lift Check Valve, Iron Body, Flanged, 125 LB.....	704.82	124.95
23 05 23 00-0413 EA 4" Lift Check Valve, Iron Body, Flanged, 125 LB.....	999.51	209.48
23 05 23 00-0414 EA 5" Lift Check Valve, Iron Body, Flanged, 125 LB.....	1,279.93	264.53
23 05 23 00-0415 EA 6" Lift Check Valve, Iron Body, Flanged, 125 LB.....	1,555.10	293.93
23 05 23 00-0416 EA 8" Lift Check Valve, Iron Body, Flanged, 125 LB.....	2,593.71	338.02
23 05 23 00-0417 EA 10" Lift Check Valve, Iron Body, Flanged, 125 LB.....	3,251.32	411.51
23 05 23 00-0418 EA 12" Lift Check Valve, Iron Body, Flanged, 125 LB.....	5,176.98	499.69
23 05 23 00-0419 EA 14" Lift Check Valve, Iron Body, Flanged, 125 LB.....	7,025.25	615.97
23 05 23 00-0420 EA 16" Lift Check Valve, Iron Body, Flanged, 125 LB.....	7,782.10	722.75
23 05 23 00-0421 Bronze Body Swing Check Valves <small>(23 05 23 00-0374)</small>		



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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23 05 23 00-0422			Bronze Body, Threaded, Brazed Or Soldered Installation, 125 LB, Swing Check Valves <small>(23 05 23 00-0421)</small>		
	23 05 23 00-0423	EA	1/8" Swing Check Valve, Bronze, Threaded, Brazed Or Soldered, 125 LB.....	42.03	7.98
			<i>For 300 LB Rating, Add</i>	6.35	
			<i>For Work In Restricted Working Space, Add</i>	7.73	
	23 05 23 00-0424	EA	1/4" Swing Check Valve, Bronze, Threaded, Brazed Or Soldered, 125 LB.....	39.52	7.98
			<i>For 300 LB Rating, Add</i>	6.35	
			<i>For Work In Restricted Working Space, Add</i>	6.98	
	23 05 23 00-0425	EA	3/8" Swing Check Valve, Bronze, Threaded, Brazed Or Soldered, 125 LB.....	40.74	7.98
			<i>For 300 LB Rating, Add</i>	6.35	
			<i>For Work In Restricted Working Space, Add</i>	7.34	
	23 05 23 00-0426	EA	1/2" Swing Check Valve, Bronze, Threaded, Brazed Or Soldered, 125 LB.....	42.67	7.98
			<i>For 300 LB Rating, Add</i>	6.59	
			<i>For Work In Restricted Working Space, Add</i>	7.73	
	23 05 23 00-0427	EA	3/4" Swing Check Valve, Bronze, Threaded, Brazed Or Soldered, 125 LB.....	55.21	8.39
			<i>For 300 LB Rating, Add</i>	7.99	
			<i>For Work In Restricted Working Space, Add</i>	10.42	
	23 05 23 00-0428	EA	1" Swing Check Valve, Bronze, Threaded, Brazed Or Soldered, 125 LB.....	69.85	8.39
			<i>For 300 LB Rating, Add</i>	10.85	
			<i>For Work In Restricted Working Space, Add</i>	12.61	
	23 05 23 00-0429	EA	1-1/4" Swing Check Valve, Bronze, Threaded, Brazed Or Soldered, 125 LB.....	92.29	10.62
			<i>For 300 LB Rating, Add</i>	15.23	
			<i>For Work In Restricted Working Space, Add</i>	15.97	
	23 05 23 00-0430	EA	1-1/2" Swing Check Valve, Bronze, Threaded, Brazed Or Soldered, 125 LB.....	116.11	12.29
			<i>For 300 LB Rating, Add</i>	21.33	
			<i>For Work In Restricted Working Space, Add</i>	18.43	
	23 05 23 00-0431	EA	2" Swing Check Valve, Bronze, Threaded, Brazed Or Soldered, 125 LB.....	142.91	14.53
			<i>For 300 LB Rating, Add</i>	27.42	
			<i>For Work In Restricted Working Space, Add</i>	21.78	
	23 05 23 00-0432	EA	2-1/2" Swing Check Valve, Bronze, Threaded, Brazed Or Soldered, 125 LB.....	259.65	19.62
			<i>For 300 LB Rating, Add</i>	63.04	
			<i>For Work In Restricted Working Space, Add</i>	29.40	
	23 05 23 00-0433	EA	3" Swing Check Valve, Bronze, Threaded, Brazed Or Soldered, 125 LB.....	342.98	22.79
			<i>For 300 LB Rating, Add</i>	89.66	
			<i>For Work In Restricted Working Space, Add</i>	33.92	
	23 05 23 00-0434	EA	4" Swing Check Valve, Bronze, Threaded, Brazed Or Soldered, 125 LB.....	388.79	25.73
			<i>For 300 LB Rating, Add</i>	101.46	
			<i>For Work In Restricted Working Space, Add</i>	38.59	

23 05 23 00-0435			125 LB Flanged, Iron Body, Bronze Trim, Swing Check Valves <small>(23 05 23 00-0374)</small>		
	23 05 23 00-0436	EA	1" 125 LB Flanged, Iron Body, Bronze Trim, Swing Check Valves.....	220.34	59.88
			<i>For 150 LB Rating, Add</i>	98.61	
			<i>For 250 LB Rating, Add</i>	188.51	
			<i>For Work In Restricted Working Space, Add</i>	22.60	
	23 05 23 00-0437	EA	1-1/4" 125 LB Flanged, Iron Body, Bronze Trim, Swing Check Valves.....	246.55	69.86
			<i>For 150 LB Rating, Add</i>	108.64	
			<i>For 250 LB Rating, Add</i>	207.69	
			<i>For Work In Restricted Working Space, Add</i>	26.04	
	23 05 23 00-0438	EA	1-1/2" 125 LB Flanged, Iron Body, Bronze Trim, Swing Check Valves.....	278.33	83.84
			<i>For 150 LB Rating, Add</i>	117.82	
			<i>For 250 LB Rating, Add</i>	225.25	
			<i>For Work In Restricted Working Space, Add</i>	31.52	
	23 05 23 00-0439	EA	2" 125 LB Flanged, Iron Body, Bronze Trim, Swing Check Valves.....	348.27	106.43
			<i>For 150 LB Rating, Add</i>	146.34	
			<i>For 250 LB Rating, Add</i>	279.76	
			<i>For Work In Restricted Working Space, Add</i>	39.92	
	23 05 23 00-0440	EA	2-1/2" 125 LB Flanged, Iron Body, Bronze Trim, Swing Check Valves.....	384.79	106.57
			<i>For 150 LB Rating, Add</i>	170.78	
			<i>For 250 LB Rating, Add</i>	326.50	
			<i>For Work In Restricted Working Space, Add</i>	40.09	
	23 05 23 00-0441	EA	3" 125 LB Flanged, Iron Body, Bronze Trim, Swing Check Valves.....	429.32	124.95
			<i>For 150 LB Rating, Add</i>	185.59	
			<i>For 250 LB Rating, Add</i>	354.81	
			<i>For Work In Restricted Working Space, Add</i>	46.92	
	23 05 23 00-0442	EA	4" 125 LB Flanged, Iron Body, Bronze Trim, Swing Check Valves.....	684.30	209.48
			<i>For 150 LB Rating, Add</i>	286.82	
			<i>For 250 LB Rating, Add</i>	548.33	
			<i>For Work In Restricted Working Space, Add</i>	78.75	
	23 05 23 00-0443	EA	5" 125 LB Flanged, Iron Body, Bronze Trim, Swing Check Valves.....	951.14	264.53
			<i>For 150 LB Rating, Add</i>	421.11	
			<i>For 250 LB Rating, Add</i>	805.06	
			<i>For Work In Restricted Working Space, Add</i>	99.56	
	23 05 23 00-0444	EA	6" 125 LB Flanged, Iron Body, Bronze Trim, Swing Check Valves.....	1,085.44	293.93
			<i>For 150 LB Rating, Add</i>	488.25	
			<i>For 250 LB Rating, Add</i>	933.43	
			<i>For Work In Restricted Working Space, Add</i>	110.23	
	23 05 23 00-0445	EA	8" 125 LB Flanged, Iron Body, Bronze Trim, Swing Check Valves.....	2,212.54	338.02
			<i>For 150 LB Rating, Add</i>	1,219.00	
			<i>For 250 LB Rating, Add</i>	2,330.43	
			<i>For Work In Restricted Working Space, Add</i>	125.97	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 05 Common Work Results For HVAC****23 05 23 General-Duty Valves For HVAC Piping**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 23 00-0446	EA		10" 125 LB Flanged, Iron Body, Bronze Trim, Swing Check Valves <i>For 150 LB Rating, Add</i> <i>For 250 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i>	2,954.55 1,659.32 3,172.22 154.31	411.51
23 05 23 00-0447	EA		12" 125 LB Flanged, Iron Body, Bronze Trim, Swing Check Valves <i>For 150 LB Rating, Add</i> <i>For 250 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i>	4,428.81 2,587.62 4,946.92 187.05	499.69
23 05 23 00-0448			Swing Check Valves, 150 LB Polyvinyl Chloride (PVC) Socket Weld End Connections <small>(23 05 23 00-0374)</small>		
23 05 23 00-0449	EA		1/2" Check Valve, Duplex Polyvinyl Chloride (PVC), Socket Weld, 150 LB <i>For Work In Restricted Working Space, Add</i>	38.25 7.73	7.98
23 05 23 00-0450	EA		3/4" Check Valve, Duplex Polyvinyl Chloride (PVC), Socket Weld, 150 LB <i>For Work In Restricted Working Space, Add</i>	47.21 10.42	8.78
23 05 23 00-0451	EA		1" Check Valve, Duplex Polyvinyl Chloride (PVC), Socket Weld, 150 LB <i>For Work In Restricted Working Space, Add</i>	55.01 12.61	9.98
23 05 23 00-0452	EA		1-1/4" Check Valve, Duplex Polyvinyl Chloride (PVC), Socket Weld, 150 LB <i>For Work In Restricted Working Space, Add</i>	66.75 15.97	10.62
23 05 23 00-0453	EA		1-1/2" Check Valve, Duplex Polyvinyl Chloride (PVC), Socket Weld, 150 LB <i>For Work In Restricted Working Space, Add</i>	75.72 18.43	12.29
23 05 23 00-0454	EA		2" Check Valve, Duplex Polyvinyl Chloride (PVC), Socket Weld, 150 LB <i>For Work In Restricted Working Space, Add</i>	94.82 21.78	14.53
23 05 23 00-0455	EA		2-1/2" Check Valve, Duplex Polyvinyl Chloride (PVC), Socket Weld, 150 LB <i>For Work In Restricted Working Space, Add</i>	129.65 29.40	19.62
23 05 23 00-0456	EA		3" Check Valve, Duplex Polyvinyl Chloride (PVC), Socket Weld, 150 LB <i>For Work In Restricted Working Space, Add</i>	154.15 33.92	22.79
23 05 23 00-0457			Crimped Bronze, 200 PSI, Y-Pattern, Swing Check Valves <small>(23 05 23 00-0374)</small> Note: Nibco®		
23 05 23 00-0458	EA		1/2" Crimped Bronze, 200 PSI, Y-Pattern Check Valve <i>For Work In Restricted Working Space, Add</i>	91.18 5.39	7.98
23 05 23 00-0459	EA		3/4" Crimped Bronze, 200 PSI, Y-Pattern Check Valve <i>For Work In Restricted Working Space, Add</i>	115.55 6.14	8.78
23 05 23 00-0460	EA		1" Crimped Bronze, 200 PSI, Y-Pattern Check Valve <i>For Work In Restricted Working Space, Add</i>	158.88 7.34	9.98
23 05 23 00-0461	EA		1-1/4" Crimped Bronze, 200 PSI, Y-Pattern Check Valve <i>For Work In Restricted Working Space, Add</i>	210.56 8.09	10.62
23 05 23 00-0462	EA		1-1/2" Crimped Bronze, 200 PSI, Y-Pattern Check Valve <i>For Work In Restricted Working Space, Add</i>	250.72 8.99	12.29
23 05 23 00-0463	EA		2" Crimped Bronze, 200 PSI, Y-Pattern Check Valve <i>For Work In Restricted Working Space, Add</i>	357.25 10.78	14.53
23 05 23 00-0464			Crimped Bronze, 250 PSI, In-Line, Check Valves <small>(23 05 23 00-0374)</small>		
23 05 23 00-0465	EA		1/2" Crimped Bronze, 250 PSI, In-Line Check Valve <i>For Work In Restricted Working Space, Add</i>	41.50 5.39	7.98
23 05 23 00-0466	EA		3/4" Crimped Bronze, 250 PSI, In-Line Check Valve <i>For Work In Restricted Working Space, Add</i>	50.59 6.14	8.78
23 05 23 00-0467	EA		1" Crimped Bronze, 250 PSI, In-Line Check Valve <i>For Work In Restricted Working Space, Add</i>	59.17 7.34	9.98
23 05 23 00-0468	EA		1-1/4" Crimped Bronze, 250 PSI, In-Line Check Valve <i>For Work In Restricted Working Space, Add</i>	77.16 8.09	10.62
23 05 23 00-0469	EA		1-1/2" Crimped Bronze, 250 PSI, In-Line Check Valve <i>For Work In Restricted Working Space, Add</i>	101.23 8.99	12.29
23 05 23 00-0470	EA		2" Crimped Bronze, 250 PSI, In-Line Check Valve <i>For Work In Restricted Working Space, Add</i>	165.65 10.78	14.53
23 05 23 00-0471			Cast Iron Valves <small>(23 05 23)</small>		
23 05 23 00-0472			Polytetrafluoroethylene (PTFE) Or Viton Lined, Threaded Cast Iron Valves <small>(23 05 23 00-0471)</small>		
23 05 23 00-0473	EA		1/2" Diaphragm Valve, Cast Iron, 150 LB, Threaded, Polytetrafluoroethylene (PTFE) or Viton Lined, Hand Wheel Operated.....	125.96	23.89
23 05 23 00-0474	EA		3/4" Diaphragm Valve, Cast Iron, 150 LB, Threaded, Polytetrafluoroethylene (PTFE) or Viton Lined, Hand Wheel Operated.....	157.89	26.46
23 05 23 00-0475	EA		1" Diaphragm Valve, Cast Iron, 150 LB, Threaded, Polytetrafluoroethylene (PTFE) or Viton Lined, Hand Wheel Operated.....	174.67	32.71
23 05 23 00-0476	EA		1-1/2" Diaphragm Valve, Cast Iron, 150 LB, Threaded, Polytetrafluoroethylene (PTFE) or Viton Lined, Hand Wheel Operated.....	274.80	48.88
23 05 23 00-0477	EA		2" Diaphragm Valve, Cast Iron, 150 LB, Threaded, Polytetrafluoroethylene (PTFE) or Viton Lined, Hand Wheel Operated.....	425.16	58.80
23 05 23 00-0478			Polytetrafluoroethylene (PTFE) Or Viton Lined, Flanged Cast Iron Valves <small>(23 05 23 00-0471)</small>		
23 05 23 00-0479	EA		1/2" Diaphragm Valve, Cast Iron, 150 LB, Flanged, Polytetrafluoroethylene (PTFE) or Viton Lined, Hand Wheel Operated.....	157.72	35.93
23 05 23 00-0480	EA		3/4" Diaphragm Valve, Cast Iron, 150 LB, Flanged, Polytetrafluoroethylene (PTFE) or Viton Lined, Hand Wheel Operated.....	182.16	39.92
23 05 23 00-0481	EA		1" Diaphragm Valve, Cast Iron, 150 LB, Flanged, Polytetrafluoroethylene (PTFE) or Viton Lined, Hand Wheel Operated.....	218.67	59.88
23 05 23 00-0482	EA		1-1/2" Diaphragm Valve, Cast Iron, 150 LB, Flanged, Polytetrafluoroethylene (PTFE) or Viton Lined, Hand Wheel Operated.....	328.02	83.84
23 05 23 00-0483	EA		2" Diaphragm Valve, Cast Iron, 150 LB, Flanged, Polytetrafluoroethylene (PTFE) or Viton Lined, Hand Wheel Operated.....	510.75	106.43



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 23 00-0484 EA 2-1/2" Diaphragm Valve, Cast Iron, 150 LB, Flanged, Polytetrafluoroethylene (PTFE) or Viton Lined, Hand Wheel Operated.....	640.45	106.57
23 05 23 00-0485 EA 3" Diaphragm Valve, Cast Iron, 150 LB, Flanged, Polytetrafluoroethylene (PTFE) or Viton Lined, Hand Wheel Operated.....	792.31	124.95
23 05 23 00-0486 EA 4" Diaphragm Valve, Cast Iron, 150 LB, Flanged, Polytetrafluoroethylene (PTFE) or Viton Lined, Hand Wheel Operated.....	1,135.47	209.48
23 05 23 00-0487 EA 6" Diaphragm Valve, Cast Iron, 150 LB, Flanged, Polytetrafluoroethylene (PTFE) or Viton Lined, Hand Wheel Operated.....	2,323.18	293.93
23 05 23 00-0488 EA 8" Diaphragm Valve, Cast Iron, 150 LB, Flanged, Polytetrafluoroethylene (PTFE) or Viton Lined, Hand Wheel Operated.....	3,521.25	338.02
23 05 23 00-0489 Ethylene Propylene Diene Monomer (EPDM) Lined, Threaded Cast Iron Valves (23 05 23 00-0471)		
23 05 23 00-0490 EA 1/2" Diaphragm Valve, Cast Iron, 150 LB, Threaded, Ethylene Propylene Diene Monomer (EPDM) Lined, Hand Wheel Operated	85.24	23.89
23 05 23 00-0491 EA 3/4" Diaphragm Valve, Cast Iron, 150 LB, Threaded, Ethylene Propylene Diene Monomer (EPDM) Lined, Hand Wheel Operated	107.52	26.46
23 05 23 00-0492 EA 1" Diaphragm Valve, Cast Iron, 150 LB, Threaded, Ethylene Propylene Diene Monomer (EPDM) Lined, Hand Wheel Operated	124.30	32.71
23 05 23 00-0493 EA 1-1/2" Diaphragm Valve, Cast Iron, 150 LB, Threaded, Ethylene Propylene Diene Monomer (EPDM) Lined, Hand Wheel Operated	206.20	48.88
23 05 23 00-0494 EA 2" Diaphragm Valve, Cast Iron, 150 LB, Threaded, Ethylene Propylene Diene Monomer (EPDM) Lined, Hand Wheel Operated	265.46	58.80
23 05 23 00-0495 Ethylene Propylene Diene Monomer (EPDM) Lined, Flanged Cast Iron Valves (23 05 23 00-0471)		
23 05 23 00-0496 EA 1/2" Diaphragm Valve, Cast Iron, 150 LB, Flanged, Ethylene Propylene Diene Monomer (EPDM) Lined, Hand Wheel Operated	114.47	35.93
23 05 23 00-0497 EA 3/4" Diaphragm Valve, Cast Iron, 150 LB, Flanged, Ethylene Propylene Diene Monomer (EPDM) Lined, Hand Wheel Operated	128.70	39.92
23 05 23 00-0498 EA 1" Diaphragm Valve, Cast Iron, 150 LB, Flanged, Ethylene Propylene Diene Monomer (EPDM) Lined, Hand Wheel Operated	165.20	59.88
23 05 23 00-0499 EA 1-1/2" Diaphragm Valve, Cast Iron, 150 LB, Flanged, Ethylene Propylene Diene Monomer (EPDM) Lined, Hand Wheel Operated	255.22	83.84
23 05 23 00-0500 EA 2" Diaphragm Valve, Cast Iron, 150 LB, Flanged, Ethylene Propylene Diene Monomer (EPDM) Lined, Hand Wheel Operated	341.25	106.43
23 05 23 00-0501 EA 2-1/2" Diaphragm Valve, Cast Iron, 150 LB, Flanged, Ethylene Propylene Diene Monomer (EPDM) Lined, Hand Wheel Operated	405.06	106.57
23 05 23 00-0502 EA 3" Diaphragm Valve, Cast Iron, 150 LB, Flanged, Ethylene Propylene Diene Monomer (EPDM) Lined, Hand Wheel Operated	490.85	124.95
23 05 23 00-0503 EA 4" Diaphragm Valve, Cast Iron, 150 LB, Flanged, Ethylene Propylene Diene Monomer (EPDM) Lined, Hand Wheel Operated	780.12	209.48
23 05 23 00-0504 EA 6" Diaphragm Valve, Cast Iron, 150 LB, Flanged, Ethylene Propylene Diene Monomer (EPDM) Lined, Hand Wheel Operated	1,527.05	293.93
23 05 23 00-0505 EA 8" Diaphragm Valve, Cast Iron, 150 LB, Flanged, Ethylene Propylene Diene Monomer (EPDM) Lined, Hand Wheel Operated	2,258.53	338.02
23 05 23 00-0506 125 LB, Flanged Cast Iron Diaphragm Valves, Hand Wheel Operated (23 05 23 00-0471)		
23 05 23 00-0507 EA 1" Diaphragm Valve, Cast Iron, 125 LB, Flanged	202.56	59.88
23 05 23 00-0508 EA 1-1/2" Diaphragm Valve, Cast Iron, 125 LB, Flanged	322.11	83.84
23 05 23 00-0509 EA 2" Diaphragm Valve, Cast Iron, 125 LB, Flanged	430.57	106.43
23 05 23 00-0510 EA 2-1/2" Diaphragm Valve, Cast Iron, 125 LB, Flanged	597.66	106.57
23 05 23 00-0511 EA 3" Diaphragm Valve, Cast Iron, 125 LB, Flanged	663.44	124.95
23 05 23 00-0512 EA 4" Diaphragm Valve, Cast Iron, 125 LB, Flanged	1,046.48	209.48
23 05 23 00-0513 EA 6" Diaphragm Valve, Cast Iron, 125 LB, Flanged	2,070.06	293.93
23 05 23 00-0514 EA 8" Diaphragm Valve, Cast Iron, 125 LB, Flanged	4,128.28	338.02
23 05 23 00-0515 Solenoid Valves (23 05 23)		
23 05 23 00-0516 Bronze Body Solenoid Valves, 150 PSI Maximum Water Pressure (23 05 23 00-0515)		
23 05 23 00-0517 EA 1/4" Solenoid Valve, Bronze, 150 PSI, Water	61.47	7.98
23 05 23 00-0518 EA 1/2" Solenoid Valve, Bronze, 150 PSI, Water	70.83	7.98
23 05 23 00-0519 EA 3/4" Solenoid Valve, Bronze, 150 PSI, Water	91.40	8.78
23 05 23 00-0520 EA 1" Solenoid Valve, Bronze, 150 PSI, Water	130.80	9.98
23 05 23 00-0521 EA 1-1/2" Solenoid Valve, Bronze, 150 PSI, Water	225.30	12.29
23 05 23 00-0522 EA 2" Solenoid Valve, Bronze, 150 PSI, Water	342.78	14.53
23 05 23 00-0523 EA 2-1/2" Solenoid Valve, Bronze, 150 PSI, Water	466.50	19.62
23 05 23 00-0524 EA 3" Solenoid Valve, Bronze, 150 PSI, Water	664.40	22.79
23 05 23 00-0525 Flow Control Valves And Meters (23 05 23)		
23 05 23 00-0526 Conditioned Water Balancing Valves (23 05 23 00-0525)		
Note: Working pressures up to 300 PSIG. Iron and bronze body construction (combination balancing, flow measuring and shut-off). Excludes portable read-out meter.		
23 05 23 00-0527 EA 1/2" NPT Flow Control Valve, Iron And Bronze, Water Balancing Valve With Pressures Up To 300 PSIG	87.47	40.74
23 05 23 00-0528 EA 3/4" NPT Flow Control Valve, Iron And Bronze, Water Balancing Valve With Pressures Up To 300 PSIG	107.75	54.31
23 05 23 00-0529 EA 1" NPT Flow Control Valve, Iron And Bronze, Water Balancing Valve With Pressures Up To 300 PSIG	159.05	62.06

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 05 Common Work Results For HVAC****23 05 23 General-Duty Valves For HVAC Piping**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 23 00-0530	EA		1-1/4" NPT Flow Control Valve, Iron And Bronze, Water Balancing Valve With Pressures Up To 300 PSIG	205.90	76.68
23 05 23 00-0531	EA		1-1/2" NPT Flow Control Valve, Iron And Bronze, Water Balancing Valve With Pressures Up To 300 PSIG	234.93	81.47
23 05 23 00-0532	EA		2" NPT Flow Control Valve, Iron And Bronze, Water Balancing Valve With Pressures Up To 300 PSIG	309.02	93.14
23 05 23 00-0533	EA		2-1/2" NPT Flow Control Valve, Iron And Bronze, Water Balancing Valve With Pressures Up To 300 PSIG	580.48	162.09
23 05 23 00-0534	EA		3" NPT Flow Control Valve, Iron And Bronze, Water Balancing Valve With Pressures Up To 300 PSIG	792.69	185.25
23 05 23 00-0535	EA		3" Flanged Flow Control Valve, Iron And Bronze, Water Balancing Valve With Pressures Up To 300 PSIG	1,097.16	216.22
23 05 23 00-0536	EA		4" Flanged Flow Control Valve, Iron And Bronze, Water Balancing Valve With Pressures Up To 300 PSIG	1,247.28	223.94
23 05 23 00-0537	EA		6" Flanged Flow Control Valve, Iron And Bronze, Water Balancing Valve With Pressures Up To 300 PSIG	1,397.84	231.66
23 05 23 00-0538	EA		8" Flanged Flow Control Valve, Iron And Bronze, Water Balancing Valve With Pressures Up To 300 PSIG	2,326.60	264.75
23 05 23 00-0539	EA		10" Flanged Flow Control Valve, Iron And Bronze, Water Balancing Valve With Pressures Up To 300 PSIG	3,925.66	294.16
23 05 23 00-0540			Balancing Valves (23 05 23)		
23 05 23 00-0541			Balancing Valves With Lever (23 05 23 00-0540)		
			Note: DeZurik PEC eccentric, non-lubricated plug valves, cast iron high temperature faced plug, nickel seats, buna vee packing, bronze bearings with integral gage taps and schrader fittings for metering connections.		
23 05 23 00-0542	EA		1/2" Threaded Balancing Valve With Lever.....	144.80	25.16
23 05 23 00-0543	EA		3/4" Threaded Balancing Valve With Lever.....	163.88	33.15
23 05 23 00-0544	EA		1" Threaded Balancing Valve With Lever.....	175.79	37.95
23 05 23 00-0545	EA		1-1/4" Threaded Balancing Valve With Lever	202.19	47.13
23 05 23 00-0546	EA		1-1/2" Threaded Balancing Valve With Lever	216.63	49.92
23 05 23 00-0547	EA		2" Threaded Balancing Valve With Lever.....	240.62	57.12
23 05 23 00-0548	EA		2-1/2" Flanged Balancing Valve With Lever.....	447.96	101.12
23 05 23 00-0549	EA		3" Flanged Balancing Valve With Lever	547.00	134.95
23 05 23 00-0550	EA		4" Flanged Balancing Valve With Lever	715.22	156.27
23 05 23 00-0551	EA		5" Flanged Balancing Valve With Lever.....	1,047.69	183.85
23 05 23 00-0552	EA		6" Flanged Balancing Valve With Lever.....	1,099.54	209.96
23 05 23 00-0553	EA		8" Flanged Balancing Valve With Lever	1,414.63	235.34
23 05 23 00-0554			Balancing Valves With Nut (23 05 23 00-0540)		
			Note: DeZurik PEC eccentric, non-lubricated plug valves, cast iron high temperature faced plug, nickel seats, buna vee packing, bronze bearings with integral gage taps and schrader fittings for metering connections.		
23 05 23 00-0555	EA		4" Flanged Balancing Valve With Nut	683.59	156.27
23 05 23 00-0556	EA		5" Flanged Balancing Valve With Nut	1,007.55	183.85
23 05 23 00-0557	EA		6" Flanged Balancing Valve With Nut	1,059.40	209.96
23 05 23 00-0558	EA		8" Flanged Balancing Valve With Nut	1,358.67	235.34
23 05 23 00-0559			Balancing Valves With Hand Wheel (23 05 23 00-0540)		
			Note: DeZurik PEC eccentric, non-lubricated plug valves, cast iron high temperature faced plug, nickel seats, buna vee packing, bronze bearings with integral gage taps and schrader fittings for metering connections.		
23 05 23 00-0560	EA		4" Flanged Balancing Valve With Hand Wheel	920.80	156.27
23 05 23 00-0561	EA		5" Flanged Balancing Valve With Hand Wheel	1,308.80	209.96
23 05 23 00-0562	EA		6" Flanged Balancing Valve With Hand Wheel	1,256.92	183.85
23 05 23 00-0563	EA		8" Flanged Balancing Valve With Hand Wheel	1,580.06	209.96
23 05 23 00-0564	EA		10" Flanged Balancing Valve With Hand Wheel	2,331.70	257.17
23 05 23 00-0565	EA		12" Flanged Balancing Valve With Hand Wheel	3,042.34	331.53
23 05 23 00-0566	EA		14" Flanged Balancing Valve With Hand Wheel	4,000.72	343.64
23 05 23 00-0567			Balancing Valves With Chain Wheel (23 05 23 00-0540)		
			Note: DeZurik PEC eccentric, non-lubricated plug valves, cast iron high temperature faced plug, nickel seats, buna vee packing, bronze bearings with integral gage taps and schrader fittings for metering connections.		
23 05 23 00-0568	EA		4" Flanged Balancing Valve With Chain Wheel	1,049.74	156.27
23 05 23 00-0569	EA		5" Flanged Balancing Valve With Chain Wheel	1,438.96	209.96
23 05 23 00-0570	EA		6" Flanged Balancing Valve With Chain Wheel	1,387.08	183.85
23 05 23 00-0571	EA		8" Flanged Balancing Valve With Chain Wheel	1,709.01	209.96
23 05 23 00-0572	EA		10" Flanged Balancing Valve With Chain Wheel	2,462.12	257.03
23 05 23 00-0573	EA		12" Flanged Balancing Valve With Chain Wheel	3,201.89	331.29
23 05 23 00-0574	EA		14" Flanged Balancing Valve With Chain Wheel	4,158.21	343.79
23 05 23 00-0575			Calibrated Balancing Valves (23 05 23 00-0540)		
			Note: Bell & Gossett CB Series.		
23 05 23 00-0576	EA		1/2" Brazerd Or Soldered Calibrated Balancing Valve (CB-1/2S)	73.62	7.99
23 05 23 00-0577	EA		3/4" Brazerd Or Soldered Calibrated Balancing Valve (CB-3/4S)	87.37	8.78
23 05 23 00-0578	EA		1" Brazerd Or Soldered Calibrated Balancing Valve (CB-1S)	106.64	9.98
23 05 23 00-0579	EA		1-1/4" Brazerd Or Soldered Calibrated Balancing Valve (CB-1-1/4S).....	142.99	10.63
23 05 23 00-0580	EA		1" Threaded Calibrated Balancing Valve (CB-1)	113.22	9.98
23 05 23 00-0581	EA		1-1/4" Threaded Calibrated Balancing Valve (CB-1-1/4)	154.35	10.63
23 05 23 00-0582	EA		1-1/2" Threaded Calibrated Balancing Valve (CB-1-1/2)	179.29	12.30
23 05 23 00-0583	EA		2" Threaded Calibrated Balancing Valve (CB-2)	240.11	14.54
23 05 23 00-0584	EA		2-1/2" Threaded Calibrated Balancing Valve (CB-2-1/2)	441.45	21.33
23 05 23 00-0585	EA		3" Threaded Calibrated Balancing Valve (CB-3)	616.35	24.76
23 05 23 00-0586	EA		2-1/2" Flanged Calibrated Balancing Valve (CB-2-1/2F).....	587.89	115.82
23 05 23 00-0587	EA		3" Flanged Calibrated Balancing Valve (CB-3F)	842.90	135.79
23 05 23 00-0588	EA		4" Flanged Calibrated Balancing Valve (CB-4F)	1,287.45	227.66
23 05 23 00-0589	EA		5" Flanged Calibrated Balancing Valve (CB-5F)	1,924.95	287.56
23 05 23 00-0590	EA		6" Flanged Calibrated Balancing Valve (CB-6F).....	2,507.95	319.51
23 05 23 00-0591	EA		8" Flanged Calibrated Balancing Valve (CB-8F).....	4,419.34	367.43



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 23 00-0592 EA 10" Flanged Calibrated Balancing Valve (CB-10F).....	6,122.18	437.55
23 05 23 00-0593 EA 12" Flanged Calibrated Balancing Valve (CB-12F).....	12,787.06	531.31
23 05 23 00-0594 EA 4" Grooved Calibrated Balancing Valve (CB-4G).....	1,507.06	27.49
23 05 23 00-0595 EA 5" Grooved Calibrated Balancing Valve (CB-5G).....	1,742.70	37.48
23 05 23 00-0596 EA 6" Grooved Calibrated Balancing Valve (CB-6G).....	2,315.17	48.06
23 05 23 00-0597 EA 8" Grooved Calibrated Balancing Valve (CB-8G).....	4,320.22	60.99
23 05 23 00-0598 EA 10" Grooved Calibrated Balancing Valve (CB-10G).....	5,801.50	68.34
23 05 23 00-0599 EA 12" Grooved Calibrated Balancing Valve (CB-12G).....	11,918.82	83.33
23 05 23 00-0600 Butterfly Valves (23 05 23)		
23 05 23 00-0601 Cast Iron Body, Iron Disc, Butterfly Valves (23 05 23 00-0600)		
Note: With on-off handle, 150 PSI wafer type.		
23 05 23 00-0602 EA 2" Butterfly Valve, Cast Iron, With Iron Disc, On Off Handle, 150 PSI Wafer Type.....	216.76	106.43
<i>For 200 PSI, Add</i>		
	40.17	
<i>For Work In Restricted Working Space, Add</i>		
	39.92	
23 05 23 00-0603 EA 2-1/2" Butterfly Valve, Cast Iron, With Iron Disc, On Off Handle, 150 PSI Wafer Type.....	222.20	106.57
<i>For 200 PSI, Add</i>		
	42.51	
<i>For Work In Restricted Working Space, Add</i>		
	40.09	
23 05 23 00-0604 EA 3" Butterfly Valve, Cast Iron, With Iron Disc, On Off Handle, 150 PSI Wafer Type.....	251.76	124.95
<i>For 200 PSI, Add</i>		
	45.78	
<i>For Work In Restricted Working Space, Add</i>		
	46.92	
23 05 23 00-0605 EA 4" Butterfly Valve, Cast Iron, With Iron Disc, On Off Handle, 150 PSI Wafer Type.....	382.21	209.48
<i>For 200 PSI, Add</i>		
	57.46	
<i>For Work In Restricted Working Space, Add</i>		
	78.75	
23 05 23 00-0606 EA 5" Butterfly Valve, Cast Iron, With Iron Disc, On Off Handle, 150 PSI Wafer Type.....	502.16	264.53
<i>For 200 PSI, Add</i>		
	81.74	
<i>For Work In Restricted Working Space, Add</i>		
	99.56	
23 05 23 00-0607 EA 6" Butterfly Valve, Cast Iron, With Iron Disc, On Off Handle, 150 PSI Wafer Type.....	575.67	293.93
<i>For 200 PSI, Add</i>		
	99.96	
<i>For Work In Restricted Working Space, Add</i>		
	110.23	
23 05 23 00-0608 EA 8" Butterfly Valve, Cast Iron, With Iron Disc, On Off Handle, 150 PSI Wafer Type.....	733.25	338.02
<i>For 200 PSI, Add</i>		
	150.41	
<i>For Work In Restricted Working Space, Add</i>		
	125.97	
23 05 23 00-0609 EA 10" Butterfly Valve, Cast Iron, With Iron Disc, On Off Handle, 150 PSI Wafer Type.....	1,121.63	411.51
<i>For 200 PSI, Add</i>		
	291.48	
<i>For Work In Restricted Working Space, Add</i>		
	154.31	
23 05 23 00-0610 EA 12" Butterfly Valve, Cast Iron, With Iron Disc, On Off Handle, 150 PSI Wafer Type.....	1,397.15	499.69
<i>For 200 PSI, Add</i>		
	371.36	
<i>For Work In Restricted Working Space, Add</i>		
	187.05	
23 05 23 00-0611 Crimped Ductile Iron, 200 PSI, Handle Butterfly Valve (23 05 23 00-0600)		
23 05 23 00-0612 EA 2-1/2" Crimped Ductile Iron, 200 PSI, Handle Butterfly Valve.....	660.65	21.32
<i>For Work In Restricted Working Space, Add</i>		
	12.58	
23 05 23 00-0613 EA 3" Crimped Ductile Iron, 200 PSI, Handle Butterfly Valve.....	716.23	24.75
<i>For Work In Restricted Working Space, Add</i>		
	14.97	
23 05 23 00-0614 EA 4" Crimped Ductile Iron, 200 PSI, Handle Butterfly Valve.....	896.13	27.94
<i>For Work In Restricted Working Space, Add</i>		
	19.76	
23 05 23 00-0615 Cast Iron Body, Bronze Disc, Gear Operated, 200 LB, Butterfly Valves (23 05 23 00-0600)		
23 05 23 00-0616 EA 2" Butterfly Valve, Cast Iron, With Bronze Disc Gear Operated, 200 PSI.....	362.73	106.43
<i>For Work In Restricted Working Space, Add</i>		
	39.92	
23 05 23 00-0617 EA 2-1/2" Butterfly Valve, Cast Iron, With Bronze Disc Gear Operated, 200 PSI.....	365.25	106.57
<i>For Work In Restricted Working Space, Add</i>		
	40.09	
23 05 23 00-0618 EA 3" Butterfly Valve, Cast Iron, With Bronze Disc Gear Operated, 200 PSI.....	399.68	124.95
<i>For Work In Restricted Working Space, Add</i>		
	46.92	
23 05 23 00-0619 EA 4" Butterfly Valve, Cast Iron, With Bronze Disc Gear Operated, 200 PSI.....	536.94	209.48
<i>For Work In Restricted Working Space, Add</i>		
	78.75	
23 05 23 00-0620 EA 5" Butterfly Valve, Cast Iron, With Bronze Disc Gear Operated, 200 PSI.....	673.44	264.53
<i>For Work In Restricted Working Space, Add</i>		
	99.56	
23 05 23 00-0621 EA 6" Butterfly Valve, Cast Iron, With Bronze Disc Gear Operated, 200 PSI.....	745.92	293.93
<i>For Work In Restricted Working Space, Add</i>		
	110.23	
23 05 23 00-0622 EA 8" Butterfly Valve, Cast Iron, With Bronze Disc Gear Operated, 200 PSI.....	910.37	338.02
<i>For Work In Restricted Working Space, Add</i>		
	125.97	
23 05 23 00-0623 EA 10" Butterfly Valve, Cast Iron, With Bronze Disc Gear Operated, 200 PSI.....	1,147.90	411.51
<i>For Work In Restricted Working Space, Add</i>		
	154.31	
23 05 23 00-0624 EA 12" Butterfly Valve, Cast Iron, With Bronze Disc Gear Operated, 200 PSI.....	1,544.09	499.69
<i>For Work In Restricted Working Space, Add</i>		
	187.05	
23 05 29 Hangers And Supports For HVAC Piping And Equipment (23 05)		
23 05 29 00-0001 Hangers And Supports (23 05 29)		
23 05 29 00-0002 Clevis Hangers (23 05 29 00-0001)		
23 05 29 00-0003 Steel Clevis Hanger (Cooper B-Line B3100) (23 05 29 00-0002)		
Note: Type 1.		
23 05 29 00-0004 EA 1/2" Steel Clevis Hanger (Cooper B-Line B3100).....	14.74	6.62
<i>For Work In Restricted Working Space, Add</i>		
	3.97	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 05 Common Work Results For HVAC****23 05 29 Hangers And Supports For HVAC Piping And Equipment**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 29 00-0005	EA		3/4" Steel Clevis Hanger (Cooper B-Line B3100)	16.21	7.35
			<i>For Work In Restricted Working Space, Add</i>	4.41	
23 05 29 00-0006	EA		1" Steel Clevis Hanger (Cooper B-Line B3100)	17.03	7.35
			<i>For Work In Restricted Working Space, Add</i>	4.64	
23 05 29 00-0007	EA		1-1/4" Steel Clevis Hanger (Cooper B-Line B3100)	17.70	7.95
			<i>For Work In Restricted Working Space, Add</i>	4.77	
23 05 29 00-0008	EA		1-1/2" Steel Clevis Hanger (Cooper B-Line B3100)	17.90	7.95
			<i>For Work In Restricted Working Space, Add</i>	4.77	
23 05 29 00-0009	EA		2" Steel Clevis Hanger (Cooper B-Line B3100)	18.71	8.09
			<i>For Work In Restricted Working Space, Add</i>	4.90	
23 05 29 00-0010	EA		2-1/2" Steel Clevis Hanger (Cooper B-Line B3100)	20.67	8.38
			<i>For Work In Restricted Working Space, Add</i>	5.04	
23 05 29 00-0011	EA		3" Steel Clevis Hanger (Cooper B-Line B3100)	22.16	8.82
			<i>For Work In Restricted Working Space, Add</i>	5.19	
23 05 29 00-0012	EA		3-1/2" Steel Clevis Hanger (Cooper B-Line B3100)	23.11	9.69
			<i>For Work In Restricted Working Space, Add</i>	5.54	
23 05 29 00-0013	EA		4" Steel Clevis Hanger (Cooper B-Line B3100)	25.45	10.29
			<i>For Work In Restricted Working Space, Add</i>	5.88	
23 05 29 00-0014	EA		5" Steel Clevis Hanger (Cooper B-Line B3100)	32.71	12.31
			<i>For Work In Restricted Working Space, Add</i>	7.39	
23 05 29 00-0015	EA		6" Steel Clevis Hanger (Cooper B-Line B3100)	39.39	14.70
			<i>For Work In Restricted Working Space, Add</i>	8.82	
23 05 29 00-0016	EA		8" Steel Clevis Hanger (Cooper B-Line B3100)	53.30	18.38
			<i>For Work In Restricted Working Space, Add</i>	11.03	
23 05 29 00-0017	EA		10" Steel Clevis Hanger (Cooper B-Line B3100)	78.50	24.99
			<i>For Work In Restricted Working Space, Add</i>	14.70	
23 05 29 00-0018	EA		12" Steel Clevis Hanger (Cooper B-Line B3100)	92.29	27.56
			<i>For Work In Restricted Working Space, Add</i>	16.54	
23 05 29 00-0019			Steel Clevis Hanger, Plastic Coated (Cooper B-Line B3100C) (23 05 29 00-0002)		
23 05 29 00-0020	EA		1/2" Steel Clevis Hanger, Plastic Coated (Cooper B-Line B3100C)	18.74	6.62
			<i>For Work In Restricted Working Space, Add</i>	3.97	
23 05 29 00-0021	EA		3/4" Steel Clevis Hanger, Plastic Coated (Cooper B-Line B3100C)	20.21	7.35
			<i>For Work In Restricted Working Space, Add</i>	4.41	
23 05 29 00-0022	EA		1" Steel Clevis Hanger, Plastic Coated (Cooper B-Line B3100C)	21.12	7.35
			<i>For Work In Restricted Working Space, Add</i>	4.64	
23 05 29 00-0023	EA		1-1/4" Steel Clevis Hanger, Plastic Coated (Cooper B-Line B3100C)	21.87	7.95
			<i>For Work In Restricted Working Space, Add</i>	4.77	
23 05 29 00-0024	EA		1-1/2" Steel Clevis Hanger, Plastic Coated (Cooper B-Line B3100C)	22.38	7.95
			<i>For Work In Restricted Working Space, Add</i>	4.77	
23 05 29 00-0025	EA		2" Steel Clevis Hanger, Plastic Coated (Cooper B-Line B3100C)	22.95	8.09
			<i>For Work In Restricted Working Space, Add</i>	4.90	
23 05 29 00-0026	EA		2-1/2" Steel Clevis Hanger, Plastic Coated (Cooper B-Line B3100C)	25.84	8.38
			<i>For Work In Restricted Working Space, Add</i>	5.04	
23 05 29 00-0027	EA		3" Steel Clevis Hanger, Plastic Coated (Cooper B-Line B3100C)	27.15	8.82
			<i>For Work In Restricted Working Space, Add</i>	5.19	
23 05 29 00-0028	EA		3-1/2" Steel Clevis Hanger, Plastic Coated (Cooper B-Line B3100C)	30.42	10.29
			<i>For Work In Restricted Working Space, Add</i>	5.88	
23 05 29 00-0029	EA		4" Steel Clevis Hanger, Plastic Coated (Cooper B-Line B3100C)	33.79	10.29
			<i>For Work In Restricted Working Space, Add</i>	5.88	
23 05 29 00-0030	EA		5" Steel Clevis Hanger, Plastic Coated (Cooper B-Line B3100C)	56.24	12.31
			<i>For Work In Restricted Working Space, Add</i>	7.39	
23 05 29 00-0031	EA		6" Steel Clevis Hanger, Plastic Coated (Cooper B-Line B3100C)	69.82	14.70
			<i>For Work In Restricted Working Space, Add</i>	8.82	
23 05 29 00-0032	EA		8" Steel Clevis Hanger, Plastic Coated (Cooper B-Line B3100C)	82.97	18.38
			<i>For Work In Restricted Working Space, Add</i>	11.03	
23 05 29 00-0033			Steel Clevis Hanger, Light Duty (Cooper B-Line B3104) (23 05 29 00-0002)		
23 05 29 00-0034	EA		1/2" Steel Clevis Hanger, Light Duty (Cooper B-Line B3104)	14.59	6.62
			<i>For Work In Restricted Working Space, Add</i>	3.97	
23 05 29 00-0035	EA		3/4" Steel Clevis Hanger, Light Duty (Cooper B-Line B3104)	16.09	7.35
			<i>For Work In Restricted Working Space, Add</i>	4.41	
23 05 29 00-0036	EA		1" Steel Clevis Hanger, Light Duty (Cooper B-Line B3104)	17.00	7.35
			<i>For Work In Restricted Working Space, Add</i>	4.64	
23 05 29 00-0037	EA		1-1/4" Steel Clevis Hanger, Light Duty (Cooper B-Line B3104)	17.47	7.95
			<i>For Work In Restricted Working Space, Add</i>	4.77	
23 05 29 00-0038	EA		1-1/2" Steel Clevis Hanger, Light Duty (Cooper B-Line B3104)	17.59	7.95
			<i>For Work In Restricted Working Space, Add</i>	4.77	
23 05 29 00-0039	EA		2" Steel Clevis Hanger, Light Duty (Cooper B-Line B3104)	18.09	8.09
			<i>For Work In Restricted Working Space, Add</i>	4.90	
23 05 29 00-0040	EA		2-1/2" Steel Clevis Hanger, Light Duty (Cooper B-Line B3104)	19.85	8.38
			<i>For Work In Restricted Working Space, Add</i>	5.04	
23 05 29 00-0041	EA		3" Steel Clevis Hanger, Light Duty (Cooper B-Line B3104)	20.76	8.82
			<i>For Work In Restricted Working Space, Add</i>	5.19	
23 05 29 00-0042	EA		3-1/2" Steel Clevis Hanger, Light Duty (Cooper B-Line B3104)	23.38	10.29
			<i>For Work In Restricted Working Space, Add</i>	5.88	
23 05 29 00-0043	EA		4" Steel Clevis Hanger, Light Duty (Cooper B-Line B3104)	24.17	10.29
			<i>For Work In Restricted Working Space, Add</i>	5.88	
23 05 29 00-0044			Extended Steel Clevis Hanger (Cooper B-Line B3108) (23 05 29 00-0002)		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 29 00-0045 EA 3/4" Steel Extended Clevis Hanger (Cooper B-Line B3108)..... <i>For Work In Restricted Working Space, Add</i>	21.09 4.41	7.35
23 05 29 00-0046 EA 1" Steel Extended Clevis Hanger (Cooper B-Line B3108)..... <i>For Work In Restricted Working Space, Add</i>	21.92 4.64	7.35
23 05 29 00-0047 EA 1-1/4" Steel Extended Clevis Hanger (Cooper B-Line B3108)..... <i>For Work In Restricted Working Space, Add</i>	22.36 4.77	7.95
23 05 29 00-0048 EA 1-1/2" Steel Extended Clevis Hanger (Cooper B-Line B3108)..... <i>For Work In Restricted Working Space, Add</i>	23.15 4.77	7.95
23 05 29 00-0049 EA 2" Steel Extended Clevis Hanger (Cooper B-Line B3108)..... <i>For Work In Restricted Working Space, Add</i>	24.90 4.90	8.09
23 05 29 00-0050 EA 2-1/2" Steel Extended Clevis Hanger (Cooper B-Line B3108)..... <i>For Work In Restricted Working Space, Add</i>	26.78 5.04	8.38
23 05 29 00-0051 EA 3" Steel Extended Clevis Hanger (Cooper B-Line B3108)..... <i>For Work In Restricted Working Space, Add</i>	28.14 5.19	8.82
23 05 29 00-0052 EA 4" Steel Extended Clevis Hanger (Cooper B-Line B3108)..... <i>For Work In Restricted Working Space, Add</i>	33.91 5.88	10.29
23 05 29 00-0053 EA 5" Steel Extended Clevis Hanger (Cooper B-Line B3108)..... <i>For Work In Restricted Working Space, Add</i>	42.79 7.39	12.31
23 05 29 00-0054 EA 6" Steel Extended Clevis Hanger (Cooper B-Line B3108)..... <i>For Work In Restricted Working Space, Add</i>	52.91 8.82	14.70
23 05 29 00-0055 EA 8" Steel Extended Clevis Hanger (Cooper B-Line B3108)..... <i>For Work In Restricted Working Space, Add</i>	75.47 11.03	18.38
23 05 29 00-0056 EA 10" Steel Extended Clevis Hanger (Cooper B-Line B3108)..... <i>For Work In Restricted Working Space, Add</i>	106.26 14.70	24.99
23 05 29 00-0057 EA 12" Steel Extended Clevis Hanger (Cooper B-Line B3108)..... <i>For Work In Restricted Working Space, Add</i>	119.34 16.54	27.56
23 05 29 00-0058 Steel Clevis Hanger, Flat Top (Cooper B-Line B3109) (23 05 29 00-0002)		
23 05 29 00-0059 EA 2" Steel Clevis Hanger, Flat Top (Cooper B-Line B3109)..... <i>For Work In Restricted Working Space, Add</i>	25.84 4.90	8.09
23 05 29 00-0060 EA 2-1/2" Steel Clevis Hanger, Flat Top (Cooper B-Line B3109)..... <i>For Work In Restricted Working Space, Add</i>	27.65 5.04	8.38
23 05 29 00-0061 EA 3" Steel Clevis Hanger, Flat Top (Cooper B-Line B3109)..... <i>For Work In Restricted Working Space, Add</i>	29.14 5.19	8.82
23 05 29 00-0062 EA 3-1/2" Steel Clevis Hanger, Flat Top (Cooper B-Line B3109)..... <i>For Work In Restricted Working Space, Add</i>	32.20 5.88	10.29
23 05 29 00-0063 EA 4" Steel Clevis Hanger, Flat Top (Cooper B-Line B3109)..... <i>For Work In Restricted Working Space, Add</i>	34.19 5.88	10.29
23 05 29 00-0064 EA 5" Steel Clevis Hanger, Flat Top (Cooper B-Line B3109)..... <i>For Work In Restricted Working Space, Add</i>	42.42 7.39	12.31
23 05 29 00-0065 EA 6" Steel Clevis Hanger, Flat Top (Cooper B-Line B3109)..... <i>For Work In Restricted Working Space, Add</i>	49.44 8.82	14.70
23 05 29 00-0066 EA 8" Steel Clevis Hanger, Flat Top (Cooper B-Line B3109)..... <i>For Work In Restricted Working Space, Add</i>	65.88 11.03	18.38
23 05 29 00-0067 Adjustable Hangers (23 05 29 00-0001)		
23 05 29 00-0068 Steel J-Hanger Hanger With Bolt (Cooper B-Line B3690) (23 05 29 00-0067) Note: Type 5.		
23 05 29 00-0069 EA 1/2" Steel J-Hanger Hanger With Bolt (Cooper B-Line B3690)..... <i>For Work In Restricted Working Space, Add</i>	13.55 3.49	5.81
23 05 29 00-0070 EA 3/4" Steel J-Hanger Hanger With Bolt (Cooper B-Line B3690)..... <i>For Work In Restricted Working Space, Add</i>	14.83 3.87	6.45
23 05 29 00-0071 EA 1" Steel J-Hanger Hanger With Bolt (Cooper B-Line B3690)..... <i>For Work In Restricted Working Space, Add</i>	16.23 4.30	7.16
23 05 29 00-0072 EA 1-1/4" Steel J-Hanger Hanger With Bolt (Cooper B-Line B3690)..... <i>For Work In Restricted Working Space, Add</i>	17.91 4.78	7.95
23 05 29 00-0073 EA 1-1/2" Steel J-Hanger Hanger With Bolt (Cooper B-Line B3690)..... <i>For Work In Restricted Working Space, Add</i>	18.81 5.01	8.36
23 05 29 00-0074 EA 2" Steel J-Hanger Hanger With Bolt (Cooper B-Line B3690)..... <i>For Work In Restricted Working Space, Add</i>	20.21 5.25	8.76
23 05 29 00-0075 EA 2-1/2" Steel J-Hanger Hanger With Bolt (Cooper B-Line B3690)..... <i>For Work In Restricted Working Space, Add</i>	23.48 5.49	9.15
23 05 29 00-0076 EA 3" Steel J-Hanger Hanger With Bolt (Cooper B-Line B3690)..... <i>For Work In Restricted Working Space, Add</i>	24.52 5.73	9.55
23 05 29 00-0077 EA 4" Steel J-Hanger Hanger With Bolt (Cooper B-Line B3690)..... <i>For Work In Restricted Working Space, Add</i>	29.38 6.45	10.75
23 05 29 00-0078 Adjustable Swivel Steel Ring (Cooper B-Line B3170) (23 05 29 00-0067) Note: Type 10.		
23 05 29 00-0079 EA 1/2" Adjustable Swivel Steel Ring (Cooper B-Line B3170)..... <i>For Work In Restricted Working Space, Add</i>	15.58 4.41	7.35
23 05 29 00-0080 EA 3/4" Adjustable Swivel Steel Ring (Cooper B-Line B3170)..... <i>For Work In Restricted Working Space, Add</i>	16.44 4.64	7.35
23 05 29 00-0081 EA 1" Adjustable Swivel Steel Ring (Cooper B-Line B3170)..... <i>For Work In Restricted Working Space, Add</i>	17.30 4.90	8.09
23 05 29 00-0082 EA 1-1/4" Adjustable Swivel Steel Ring (Cooper B-Line B3170)..... <i>For Work In Restricted Working Space, Add</i>	18.38 5.19	8.82
23 05 29 00-0083 EA 1-1/2" Adjustable Swivel Steel Ring (Cooper B-Line B3170)..... <i>For Work In Restricted Working Space, Add</i>	20.68 5.88	10.29

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 05 Common Work Results For HVAC****23 05 29 Hangers And Supports For HVAC Piping And Equipment**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 29 00-0084	EA		2" Adjustable Swivel Steel Ring (Cooper B-Line B3170)	22.14	10.29
			<i>For Work In Restricted Working Space, Add</i>	6.30	
23 05 29 00-0085	EA		2-1/2" Adjustable Swivel Steel Ring (Cooper B-Line B3170)	24.47	11.02
			<i>For Work In Restricted Working Space, Add</i>	6.79	
23 05 29 00-0086	EA		3" Adjustable Swivel Steel Ring (Cooper B-Line B3170)	26.43	12.49
			<i>For Work In Restricted Working Space, Add</i>	7.35	
23 05 29 00-0087	EA		3-1/2" Adjustable Swivel Steel Ring (Cooper B-Line B3170)	29.42	13.42
			<i>For 316 Stainless Steel, Add</i>	22.02	
			<i>For Work In Restricted Working Space, Add</i>	8.05	
			<i>For 304 Stainless Steel, Add</i>	17.09	
23 05 29 00-0088	EA		4" Adjustable Swivel Steel Ring (Cooper B-Line B3170)	31.99	14.70
			<i>For Work In Restricted Working Space, Add</i>	8.82	
23 05 29 00-0089	EA		5" Adjustable Swivel Steel Ring (Cooper B-Line B3170)	38.44	16.54
			<i>For 316 Stainless Steel, Add</i>	45.65	
			<i>For Work In Restricted Working Space, Add</i>	9.92	
			<i>For 304 Stainless Steel, Add</i>	35.44	
23 05 29 00-0090	EA		6" Adjustable Swivel Steel Ring (Cooper B-Line B3170)	42.20	18.38
			<i>For 316 Stainless Steel, Add</i>	46.33	
			<i>For Work In Restricted Working Space, Add</i>	11.03	
			<i>For 304 Stainless Steel, Add</i>	35.97	
23 05 29 00-0091	EA		8" Adjustable Swivel Steel Ring (Cooper B-Line B3170)	50.57	22.05
			<i>For 316 Stainless Steel, Add</i>	55.00	
			<i>For Work In Restricted Working Space, Add</i>	13.23	
			<i>For 304 Stainless Steel, Add</i>	42.70	
23 05 29 00-0092			Copper Tubing Adjustable Swivel Ring (Cooper B-Line B3170CT) <small>(23 05 29 00-0067)</small>		
23 05 29 00-0093	EA		1/2" Copper Tubing Adjustable Swivel Ring (Cooper B-Line B3170CT)	15.97	7.35
			<i>For 316 Stainless Steel, Add</i>	10.80	
			<i>For Work In Restricted Working Space, Add</i>	4.41	
			<i>For 304 Stainless Steel, Add</i>	8.38	
23 05 29 00-0094	EA		3/4" Copper Tubing Adjustable Swivel Ring (Cooper B-Line B3170CT)	16.74	7.35
			<i>For 316 Stainless Steel, Add</i>	10.80	
			<i>For Work In Restricted Working Space, Add</i>	4.64	
			<i>For 304 Stainless Steel, Add</i>	8.38	
23 05 29 00-0095	EA		1" Copper Tubing Adjustable Swivel Ring (Cooper B-Line B3170CT)	17.60	8.09
			<i>For 316 Stainless Steel, Add</i>	10.80	
			<i>For Work In Restricted Working Space, Add</i>	4.90	
			<i>For 304 Stainless Steel, Add</i>	8.38	
23 05 29 00-0096	EA		1-1/4" Copper Tubing Adjustable Swivel Ring (Cooper B-Line B3170CT)	18.57	8.82
			<i>For 316 Stainless Steel, Add</i>	10.80	
			<i>For Work In Restricted Working Space, Add</i>	5.19	
			<i>For 304 Stainless Steel, Add</i>	8.38	
23 05 29 00-0097	EA		1-1/2" Copper Tubing Adjustable Swivel Ring (Cooper B-Line B3170CT)	20.98	10.29
			<i>For 316 Stainless Steel, Add</i>	11.73	
			<i>For Work In Restricted Working Space, Add</i>	5.88	
			<i>For 304 Stainless Steel, Add</i>	9.11	
23 05 29 00-0098	EA		2" Copper Tubing Adjustable Swivel Ring (Cooper B-Line B3170CT)	22.38	10.29
			<i>For 316 Stainless Steel, Add</i>	11.73	
			<i>For Work In Restricted Working Space, Add</i>	6.30	
			<i>For 304 Stainless Steel, Add</i>	9.11	
23 05 29 00-0099	EA		2-1/2" Copper Tubing Adjustable Swivel Ring (Cooper B-Line B3170CT)	26.24	11.02
			<i>For 316 Stainless Steel, Add</i>	30.77	
			<i>For Work In Restricted Working Space, Add</i>	6.79	
			<i>For 304 Stainless Steel, Add</i>	23.89	
23 05 29 00-0100	EA		3" Copper Tubing Adjustable Swivel Ring (Cooper B-Line B3170CT)	28.99	12.49
			<i>For 316 Stainless Steel, Add</i>	38.17	
			<i>For Work In Restricted Working Space, Add</i>	7.35	
			<i>For 304 Stainless Steel, Add</i>	29.63	
23 05 29 00-0101	EA		3-1/2" Copper Tubing Adjustable Swivel Ring (Cooper B-Line B3170CT)	31.67	13.42
			<i>For 316 Stainless Steel, Add</i>	41.14	
			<i>For Work In Restricted Working Space, Add</i>	8.05	
			<i>For 304 Stainless Steel, Add</i>	31.94	
23 05 29 00-0102	EA		4" Copper Tubing Adjustable Swivel Ring (Cooper B-Line B3170CT)	35.29	14.70
			<i>For 316 Stainless Steel, Add</i>	50.07	
			<i>For Work In Restricted Working Space, Add</i>	8.82	
			<i>For 304 Stainless Steel, Add</i>	38.87	
23 05 29 00-0103	EA		5" Copper Tubing Adjustable Swivel Ring (Cooper B-Line B3170CT)	39.05	16.54
			<i>For 316 Stainless Steel, Add</i>	50.83	
			<i>For Work In Restricted Working Space, Add</i>	9.92	
			<i>For 304 Stainless Steel, Add</i>	39.47	
23 05 29 00-0104	EA		6" Copper Tubing Adjustable Swivel Ring (Cooper B-Line B3170CT)	45.40	18.38
			<i>For 316 Stainless Steel, Add</i>	73.53	
			<i>For Work In Restricted Working Space, Add</i>	11.03	
			<i>For 304 Stainless Steel, Add</i>	57.09	
23 05 29 00-0105			Roller Hangers <small>(23 05 29 00-0001)</small>		
23 05 29 00-0106			Single Pipe Roll (Cooper B-Line B3114) <small>(23 05 29 00-0105)</small>		
			Note: Excludes rod and nuts. Type 41.		
23 05 29 00-0107	EA		2" Single Pipe Roll (Cooper B-Line B3114)	24.28	5.89
			Note: Excludes rod and nuts.		
			<i>For Work In Restricted Working Space, Add</i>	3.53	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 29 00-0108 EA 2-1/2" Single Pipe Roll (Cooper B-Line B3114) Note: Excludes rod and nuts. <i>For Work In Restricted Working Space, Add</i>	26.69 3.97	6.62
23 05 29 00-0109 EA 3" Single Pipe Roll (Cooper B-Line B3114) Note: Excludes rod and nuts. <i>For Work In Restricted Working Space, Add</i>	29.63 4.63	7.72
23 05 29 00-0110 EA 3-1/2" Single Pipe Roll (Cooper B-Line B3114) Note: Excludes rod and nuts. <i>For Work In Restricted Working Space, Add</i>	34.11 5.30	8.83
23 05 29 00-0111 EA 4" Single Pipe Roll (Cooper B-Line B3114) Note: Excludes rod and nuts. <i>For Work In Restricted Working Space, Add</i>	47.60 5.96	9.93
23 05 29 00-0112 EA 5" Single Pipe Roll (Cooper B-Line B3114) Note: Excludes rod and nuts. <i>For Work In Restricted Working Space, Add</i>	42.04 6.62	11.03
23 05 29 00-0113 EA 6" Single Pipe Roll (Cooper B-Line B3114) Note: Excludes rod and nuts. <i>For Work In Restricted Working Space, Add</i>	52.43 7.94	13.23
23 05 29 00-0114 EA 8" Single Pipe Roll (Cooper B-Line B3114) Note: Excludes rod and nuts. <i>For Work In Restricted Working Space, Add</i>	71.13 9.26	15.44
23 05 29 00-0115 EA 10" Single Pipe Roll (Cooper B-Line B3114) Note: Excludes rod and nuts. <i>For Work In Restricted Working Space, Add</i>	84.32 11.03	18.39
23 05 29 00-0116 Adjustable Clevis Roller Hanger (Cooper B-Line B3110) <small>(23 05 29 00-0105)</small> Note: Type 43.		
23 05 29 00-0117 EA 2" Steel Clevis Roller Hanger (Cooper B-Line B3110) <i>For Work In Restricted Working Space, Add</i>	35.95 5.99	10.39
23 05 29 00-0118 EA 2-1/2" Steel Clevis Roller Hanger (Cooper B-Line B3110) <i>For 316 Stainless Steel, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 304 Stainless Steel, Add</i>	37.39 135.83 6.42 105.47	10.71
23 05 29 00-0119 EA 3" Steel Clevis Roller Hanger (Cooper B-Line B3110) <i>For Work In Restricted Working Space, Add</i>	40.66 6.85	11.18
23 05 29 00-0120 EA 3-1/2" Steel Clevis Roller Hanger (Cooper B-Line B3110) <i>For 316 Stainless Steel, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 304 Stainless Steel, Add</i>	47.69 201.71 7.19 156.62	11.98
23 05 29 00-0121 EA 4" Steel Clevis Roller Hanger (Cooper B-Line B3110) <i>For Work In Restricted Working Space, Add</i>	50.35 7.99	13.58
23 05 29 00-0122 EA 5" Steel Clevis Roller Hanger (Cooper B-Line B3110) <i>For 316 Stainless Steel, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For 304 Stainless Steel, Add</i>	56.94 235.54 8.77 182.89	14.62
23 05 29 00-0123 EA 6" Steel Clevis Roller Hanger (Cooper B-Line B3110) <i>For Work In Restricted Working Space, Add</i>	66.36 9.59	15.98
23 05 29 00-0124 EA 8" Steel Clevis Roller Hanger (Cooper B-Line B3110) <i>For Work In Restricted Working Space, Add</i>	91.44 11.98	19.97
23 05 29 00-0125 EA 10" Steel Clevis Roller Hanger (Cooper B-Line B3110) <i>For Work In Restricted Working Space, Add</i>	114.60 15.98	27.16
23 05 29 00-0126 EA 12" Steel Clevis Roller Hanger (Cooper B-Line B3110) <i>For Work In Restricted Working Space, Add</i>	150.10 17.97	29.96
23 05 29 00-0127 Roller Chair (Cooper B-Line B3120) <small>(23 05 29 00-0105)</small>		
23 05 29 00-0128 EA 2" Steel Roller Chair (Cooper B-Line B3120) <i>For Work In Restricted Working Space, Add</i>	34.90 5.99	10.39
23 05 29 00-0129 EA 2-1/2" Steel Roller Chair (Cooper B-Line B3120) <i>For Work In Restricted Working Space, Add</i>	37.62 6.42	10.71
23 05 29 00-0130 EA 3" Steel Roller Chair (Cooper B-Line B3120) <i>For Work In Restricted Working Space, Add</i>	39.41 6.85	11.18
23 05 29 00-0131 EA 3-1/2" Steel Roller Chair (Cooper B-Line B3120) <i>For Work In Restricted Working Space, Add</i>	45.08 7.19	11.98
23 05 29 00-0132 EA 4" Steel Roller Chair (Cooper B-Line B3120) <i>For Work In Restricted Working Space, Add</i>	50.24 7.99	13.58
23 05 29 00-0133 EA 5" Steel Roller Chair (Cooper B-Line B3120) <i>For Work In Restricted Working Space, Add</i>	54.89 8.77	14.62
23 05 29 00-0134 EA 6" Steel Roller Chair (Cooper B-Line B3120) <i>For Work In Restricted Working Space, Add</i>	67.69 9.59	15.98
23 05 29 00-0135 EA 8" Steel Roller Chair (Cooper B-Line B3120) <i>For Work In Restricted Working Space, Add</i>	88.26 11.98	19.97
23 05 29 00-0136 EA 10" Steel Roller Chair (Cooper B-Line B3120) <i>For Work In Restricted Working Space, Add</i>	113.86 15.98	27.16
23 05 29 00-0137 EA 12" Steel Roller Chair (Cooper B-Line B3120) <i>For Work In Restricted Working Space, Add</i>	148.17 17.97	29.96
23 05 29 00-0138 EA 14" Steel Roller Chair (Cooper B-Line B3120) <i>For Work In Restricted Working Space, Add</i>	161.27 20.61	34.35
23 05 29 00-0139 EA 16" Steel Roller Chair (Cooper B-Line B3120) <i>For Work In Restricted Working Space, Add</i>	194.79 23.96	39.94
23 05 29 00-0140 EA 18" Steel Roller Chair (Cooper B-Line B3120) <i>For Work In Restricted Working Space, Add</i>	263.48 29.96	49.92
23 05 29 00-0141 EA 20" Steel Roller Chair (Cooper B-Line B3120) <i>For Work In Restricted Working Space, Add</i>	326.46 35.95	59.91

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 05 Common Work Results For HVAC****23 05 29 Hangers And Supports For HVAC Piping And Equipment**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 29 00-0142 Adjustable Roller Support (Cooper B-Line B3122) (23 05 29 00-0105)		
23 05 29 00-0143 EA 2" Steel Adjustable Roller Support (Cooper B-Line B3122)	39.82	10.39
For Work In Restricted Working Space, Add	5.99	
23 05 29 00-0144 EA 2-1/2" Steel Adjustable Roller Support (Cooper B-Line B3122)	44.89	10.71
For Work In Restricted Working Space, Add	6.42	
23 05 29 00-0145 EA 3" Steel Adjustable Roller Support (Cooper B-Line B3122)	47.16	11.18
For Work In Restricted Working Space, Add	6.85	
23 05 29 00-0146 EA 3-1/2" Steel Adjustable Roller Support (Cooper B-Line B3122)	49.82	11.98
For Work In Restricted Working Space, Add	7.19	
23 05 29 00-0147 EA 4" Steel Adjustable Roller Support (Cooper B-Line B3122)	60.17	13.58
For Work In Restricted Working Space, Add	7.99	
23 05 29 00-0148 EA 5" Steel Adjustable Roller Support (Cooper B-Line B3122)	68.35	14.62
For Work In Restricted Working Space, Add	8.77	
23 05 29 00-0149 EA 6" Steel Adjustable Roller Support (Cooper B-Line B3122)	79.84	15.98
For Work In Restricted Working Space, Add	9.59	
23 05 29 00-0150 EA 8" Steel Adjustable Roller Support (Cooper B-Line B3122)	113.27	19.97
For Work In Restricted Working Space, Add	11.98	
23 05 29 00-0151 EA 10" Steel Adjustable Roller Support (Cooper B-Line B3122)	140.83	27.16
For Work In Restricted Working Space, Add	15.98	
23 05 29 00-0152 EA 12" Steel Adjustable Roller Support (Cooper B-Line B3122)	163.10	29.96
For Work In Restricted Working Space, Add	17.97	
23 05 29 00-0153 EA 14" Steel Adjustable Roller Support (Cooper B-Line B3122)	232.76	34.35
For Work In Restricted Working Space, Add	20.61	
23 05 29 00-0154 EA 16" Steel Adjustable Roller Support (Cooper B-Line B3122)	279.33	39.94
For Work In Restricted Working Space, Add	23.96	
23 05 29 00-0155 EA 18" Steel Adjustable Roller Support (Cooper B-Line B3122)	316.08	49.92
For Work In Restricted Working Space, Add	29.96	
23 05 29 00-0156 Adjustable Double Roller Support (Cooper B-Line B3122A) (23 05 29 00-0105)		
23 05 29 00-0157 EA 2" Steel Adjustable Double Roller Support (Cooper B-Line B3122A)	40.10	10.39
For Work In Restricted Working Space, Add	5.99	
23 05 29 00-0158 EA 2-1/2" Steel Adjustable Double Roller Support (Cooper B-Line B3122A)	45.14	10.71
For Work In Restricted Working Space, Add	6.42	
23 05 29 00-0159 EA 3" Steel Adjustable Double Roller Support (Cooper B-Line B3122A)	47.58	11.18
For Work In Restricted Working Space, Add	6.85	
23 05 29 00-0160 EA 3-1/2" Steel Adjustable Double Roller Support (Cooper B-Line B3122A)	49.45	11.98
For Work In Restricted Working Space, Add	7.19	
23 05 29 00-0161 EA 4" Steel Adjustable Double Roller Support (Cooper B-Line B3122A)	63.04	13.58
For Work In Restricted Working Space, Add	7.99	
23 05 29 00-0162 EA 5" Steel Adjustable Double Roller Support (Cooper B-Line B3122A)	71.73	14.62
For Work In Restricted Working Space, Add	8.77	
23 05 29 00-0163 EA 6" Steel Adjustable Double Roller Support (Cooper B-Line B3122A)	83.87	15.98
For Work In Restricted Working Space, Add	9.59	
23 05 29 00-0164 EA 8" Steel Adjustable Double Roller Support (Cooper B-Line B3122A)	119.51	19.97
For Work In Restricted Working Space, Add	11.98	
23 05 29 00-0165 EA 10" Steel Adjustable Double Roller Support (Cooper B-Line B3122A)	148.32	27.16
For Work In Restricted Working Space, Add	15.98	
23 05 29 00-0166 EA 12" Steel Adjustable Double Roller Support (Cooper B-Line B3122A)	171.87	29.96
For Work In Restricted Working Space, Add	17.97	
23 05 29 00-0167 EA 14" Steel Adjustable Double Roller Support (Cooper B-Line B3122A)	246.78	34.35
For Work In Restricted Working Space, Add	20.61	
23 05 29 00-0168 Pipe And Riser Clamps (23 05 29 00-0001)		
23 05 29 00-0169 Steel Pipe Clamp (Cooper B-Line B3140) (23 05 29 00-0168)		
Note: Type 4.		
23 05 29 00-0170 EA 1/2" Steel Pipe Clamp (Cooper B-Line B3140)	13.27	4.77
For Work In Restricted Working Space, Add	2.87	
23 05 29 00-0171 EA 3/4" Steel Pipe Clamp (Cooper B-Line B3140)	13.43	4.85
For Work In Restricted Working Space, Add	2.91	
23 05 29 00-0172 EA 1" Steel Pipe Clamp (Cooper B-Line B3140)	13.62	4.93
For Work In Restricted Working Space, Add	2.96	
23 05 29 00-0173 EA 1-1/4" Steel Pipe Clamp (Cooper B-Line B3140)	14.90	5.01
For Work In Restricted Working Space, Add	3.01	
23 05 29 00-0174 EA 1-1/2" Steel Pipe Clamp (Cooper B-Line B3140)	15.06	5.09
For Work In Restricted Working Space, Add	3.05	
23 05 29 00-0175 EA 2" Steel Pipe Clamp (Cooper B-Line B3140)	16.08	5.17
For Work In Restricted Working Space, Add	3.11	
23 05 29 00-0176 EA 2-1/2" Steel Pipe Clamp (Cooper B-Line B3140)	16.75	5.33
For Work In Restricted Working Space, Add	3.20	
23 05 29 00-0177 EA 3" Steel Pipe Clamp (Cooper B-Line B3140)	17.78	5.49
For Work In Restricted Working Space, Add	3.30	
23 05 29 00-0178 EA 3-1/2" Steel Pipe Clamp (Cooper B-Line B3140)	20.74	5.57
For Work In Restricted Working Space, Add	3.34	
23 05 29 00-0179 EA 4" Steel Pipe Clamp (Cooper B-Line B3140)	23.92	7.16
For Work In Restricted Working Space, Add	4.30	
23 05 29 00-0180 EA 5" Steel Pipe Clamp (Cooper B-Line B3140)	34.43	9.55
For Work In Restricted Working Space, Add	5.73	
23 05 29 00-0181 EA 6" Steel Pipe Clamp (Cooper B-Line B3140)	47.38	11.94
For Work In Restricted Working Space, Add	7.16	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 29 00-0182 EA 8" Steel Pipe Clamp (Cooper B-Line B3140).....	55.78	13.93
<i>For Work In Restricted Working Space, Add</i>	8.36	
23 05 29 00-0183 EA 10" Steel Pipe Clamp (Cooper B-Line B3140).....	82.20	15.92
<i>For Work In Restricted Working Space, Add</i>	9.55	
23 05 29 00-0184 EA 12" Steel Pipe Clamp (Cooper B-Line B3140).....	112.92	17.51
<i>For Work In Restricted Working Space, Add</i>	10.51	
23 05 29 00-0185 Steel Heavy Duty Pipe Clamp (Cooper B-Line B3142) (23 05 29 00-0168)		
23 05 29 00-0186 EA 3" Two Bolt Steel Heavy Duty Pipe Clamp (Cooper B-Line B3142).....	28.07	5.15
<i>For Work In Restricted Working Space, Add</i>	3.06	
23 05 29 00-0187 EA 4" Two Bolt Steel Heavy Duty Pipe Clamp (Cooper B-Line B3142).....	37.24	5.15
<i>For Work In Restricted Working Space, Add</i>	3.06	
23 05 29 00-0188 EA 5" Two Bolt Steel Heavy Duty Pipe Clamp (Cooper B-Line B3142).....	40.94	5.33
<i>For Work In Restricted Working Space, Add</i>	3.20	
23 05 29 00-0189 EA 6" Two Bolt Steel Heavy Duty Pipe Clamp (Cooper B-Line B3142).....	66.05	5.51
<i>For Work In Restricted Working Space, Add</i>	3.33	
23 05 29 00-0190 EA 8" Two Bolt Steel Heavy Duty Pipe Clamp (Cooper B-Line B3142).....	71.91	5.88
<i>For Work In Restricted Working Space, Add</i>	3.53	
23 05 29 00-0191 EA 10" Two Bolt Steel Heavy Duty Pipe Clamp (Cooper B-Line B3142).....	124.09	5.88
<i>For Work In Restricted Working Space, Add</i>	3.52	
23 05 29 00-0192 EA 12" Two Bolt Steel Heavy Duty Pipe Clamp (Cooper B-Line B3142).....	201.46	6.62
<i>For Work In Restricted Working Space, Add</i>	3.97	
23 05 29 00-0193 EA 14" Two Bolt Steel Heavy Duty Pipe Clamp (Cooper B-Line B3142).....	255.83	7.35
<i>For Work In Restricted Working Space, Add</i>	4.41	
23 05 29 00-0194 EA 16" Two Bolt Steel Heavy Duty Pipe Clamp (Cooper B-Line B3142).....	277.99	8.82
<i>For Work In Restricted Working Space, Add</i>	5.29	
23 05 29 00-0195 EA 18" Two Bolt Steel Heavy Duty Pipe Clamp (Cooper B-Line B3142).....	868.27	10.29
<i>For Work In Restricted Working Space, Add</i>	6.17	
23 05 29 00-0196 EA 20" Two Bolt Steel Heavy Duty Pipe Clamp (Cooper B-Line B3142).....	998.22	11.02
<i>For Work In Restricted Working Space, Add</i>	6.62	
23 05 29 00-0197 EA 24" Two Bolt Steel Heavy Duty Pipe Clamp (Cooper B-Line B3142).....	1,279.14	11.76
<i>For Work In Restricted Working Space, Add</i>	7.06	
23 05 29 00-0198 Steel Riser Clamp (Cooper B-Line B3373) (23 05 29 00-0168)		
Note: Type 8.		
23 05 29 00-0199 EA 1/2" Steel Riser Clamp (Cooper B-Line B3373).....	13.48	4.41
<i>For Work In Restricted Working Space, Add</i>	2.65	
23 05 29 00-0200 EA 3/4" Steel Riser Clamp (Cooper B-Line B3373).....	14.05	4.48
<i>For Work In Restricted Working Space, Add</i>	2.69	
23 05 29 00-0201 EA 1" Steel Riser Clamp (Cooper B-Line B3373).....	14.26	4.55
<i>For Work In Restricted Working Space, Add</i>	2.74	
23 05 29 00-0202 EA 1-1/4" Steel Riser Clamp (Cooper B-Line B3373).....	15.48	4.63
<i>For Work In Restricted Working Space, Add</i>	2.78	
23 05 29 00-0203 EA 1-1/2" Steel Riser Clamp (Cooper B-Line B3373).....	16.11	4.70
<i>For Work In Restricted Working Space, Add</i>	2.82	
23 05 29 00-0204 EA 2" Steel Riser Clamp (Cooper B-Line B3373).....	16.51	4.78
<i>For Work In Restricted Working Space, Add</i>	2.87	
23 05 29 00-0205 EA 2-1/2" Steel Riser Clamp (Cooper B-Line B3373).....	17.23	4.93
<i>For Work In Restricted Working Space, Add</i>	2.96	
23 05 29 00-0206 EA 3" Steel Riser Clamp (Cooper B-Line B3373).....	18.29	5.07
<i>For Work In Restricted Working Space, Add</i>	3.04	
23 05 29 00-0207 EA 3-1/2" Steel Riser Clamp (Cooper B-Line B3373).....	20.20	5.15
<i>For Work In Restricted Working Space, Add</i>	3.09	
23 05 29 00-0208 EA 4" Steel Riser Clamp (Cooper B-Line B3373).....	24.45	6.62
<i>For Work In Restricted Working Space, Add</i>	3.97	
23 05 29 00-0209 EA 5" Steel Riser Clamp (Cooper B-Line B3373).....	31.55	8.82
<i>For Work In Restricted Working Space, Add</i>	5.29	
23 05 29 00-0210 EA 6" Steel Riser Clamp (Cooper B-Line B3373).....	40.05	11.02
<i>For Work In Restricted Working Space, Add</i>	6.62	
23 05 29 00-0211 EA 8" Steel Riser Clamp (Cooper B-Line B3373).....	55.20	12.86
<i>For Work In Restricted Working Space, Add</i>	7.72	
23 05 29 00-0212 EA 10" Steel Riser Clamp (Cooper B-Line B3373).....	73.00	14.70
<i>For Work In Restricted Working Space, Add</i>	8.82	
23 05 29 00-0213 EA 12" Steel Riser Clamp (Cooper B-Line B3373).....	88.66	16.17
<i>For Work In Restricted Working Space, Add</i>	9.70	
23 05 29 00-0214 EA 14" Steel Riser Clamp (Cooper B-Line B3373).....	120.02	17.64
<i>For Work In Restricted Working Space, Add</i>	10.58	
23 05 29 00-0215 EA 16" Steel Riser Clamp (Cooper B-Line B3373).....	231.65	19.11
<i>For Work In Restricted Working Space, Add</i>	11.47	
23 05 29 00-0216 Steel Riser Clamp, Plastic Coated (Cooper B-Line B3373C) (23 05 29 00-0168)		
23 05 29 00-0217 EA 1/2" Steel Riser Clamp, Plastic Coated (Cooper B-Line B3373C).....	24.55	4.41
<i>For Work In Restricted Working Space, Add</i>	2.65	
23 05 29 00-0218 EA 3/4" Steel Riser Clamp, Plastic Coated (Cooper B-Line B3373C).....	24.92	4.48
<i>For Work In Restricted Working Space, Add</i>	2.69	
23 05 29 00-0219 EA 1" Steel Riser Clamp, Plastic Coated (Cooper B-Line B3373C).....	25.98	4.55
<i>For Work In Restricted Working Space, Add</i>	2.74	
23 05 29 00-0220 EA 1-1/4" Steel Riser Clamp, Plastic Coated (Cooper B-Line B3373C).....	27.83	4.63
<i>For Work In Restricted Working Space, Add</i>	2.78	
23 05 29 00-0221 EA 1-1/2" Steel Riser Clamp, Plastic Coated (Cooper B-Line B3373C).....	31.55	4.70
<i>For Work In Restricted Working Space, Add</i>	2.82	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 05 Common Work Results For HVAC****23 05 29 Hangers And Supports For HVAC Piping And Equipment**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 29 00-0222	EA		2" Steel Riser Clamp, Plastic Coated (Cooper B-Line B3373C)	33.57	4.78
			<i>For Work In Restricted Working Space, Add</i>	2.87	
23 05 29 00-0223	EA		2-1/2" Steel Riser Clamp, Plastic Coated (Cooper B-Line B3373C)	36.39	4.93
			<i>For Work In Restricted Working Space, Add</i>	2.96	
23 05 29 00-0224	EA		3" Steel Riser Clamp, Plastic Coated (Cooper B-Line B3373C)	40.06	5.07
			<i>For Work In Restricted Working Space, Add</i>	3.04	
23 05 29 00-0225	EA		4" Steel Riser Clamp, Plastic Coated (Cooper B-Line B3373C)	54.31	6.62
			<i>For Work In Restricted Working Space, Add</i>	3.97	
23 05 29 00-0226			Two Bolt Steel Underground Clamp (Cooper B-Line B3132) (23 05 29 00-0168)		
			Note: Type 42		
23 05 29 00-0227	EA		4" Two Bolt Steel Underground Clamp (Cooper B-Line B3132).....	56.37	5.15
			<i>For Work In Restricted Working Space, Add</i>	3.06	
23 05 29 00-0228	EA		6" Two Bolt Steel Underground Clamp (Cooper B-Line B3132).....	59.80	5.51
			<i>For Work In Restricted Working Space, Add</i>	3.33	
23 05 29 00-0229	EA		8" Two Bolt Steel Underground Clamp (Cooper B-Line B3132).....	65.73	5.88
			<i>For Work In Restricted Working Space, Add</i>	3.53	
23 05 29 00-0230	EA		10" Two Bolt Steel Underground Clamp (Cooper B-Line B3132).....	70.27	5.88
			<i>For Work In Restricted Working Space, Add</i>	3.52	
23 05 29 00-0231	EA		12" Two Bolt Steel Underground Clamp (Cooper B-Line B3132).....	85.12	6.62
			<i>For Work In Restricted Working Space, Add</i>	3.97	
23 05 29 00-0232			Four Bolt Steel Underground Clamp (Cooper B-Line B3134) (23 05 29 00-0168)		
23 05 29 00-0233	EA		4" Four Bolt Steel Underground Clamp (Cooper B-Line B3134).....	51.94	5.15
			<i>For Work In Restricted Working Space, Add</i>	3.06	
23 05 29 00-0234	EA		6" Four Bolt Steel Underground Clamp (Cooper B-Line B3134).....	56.00	5.51
			<i>For Work In Restricted Working Space, Add</i>	3.33	
23 05 29 00-0235	EA		8" Four Bolt Steel Underground Clamp (Cooper B-Line B3134).....	98.79	5.88
			<i>For Work In Restricted Working Space, Add</i>	3.53	
23 05 29 00-0236	EA		10" Four Bolt Steel Underground Clamp (Cooper B-Line B3134).....	110.01	5.88
			<i>For Work In Restricted Working Space, Add</i>	3.52	
23 05 29 00-0237	EA		12" Four Bolt Steel Underground Clamp (Cooper B-Line B3134).....	158.40	6.62
			<i>For Work In Restricted Working Space, Add</i>	3.97	
23 05 29 00-0238	EA		14" Four Bolt Steel Underground Clamp (Cooper B-Line B3134).....	243.54	7.35
			<i>For Work In Restricted Working Space, Add</i>	4.41	
23 05 29 00-0239	EA		16" Four Bolt Steel Underground Clamp (Cooper B-Line B3134).....	326.93	8.82
			<i>For Work In Restricted Working Space, Add</i>	5.29	
23 05 29 00-0240	EA		18" Four Bolt Steel Underground Clamp (Cooper B-Line B3134).....	389.17	10.29
			<i>For Work In Restricted Working Space, Add</i>	6.17	
23 05 29 00-0241	EA		20" Four Bolt Steel Underground Clamp (Cooper B-Line B3134).....	569.85	11.02
			<i>For Work In Restricted Working Space, Add</i>	6.62	
23 05 29 00-0242	EA		24" Four Bolt Steel Underground Clamp (Cooper B-Line B3134).....	780.77	11.76
			<i>For Work In Restricted Working Space, Add</i>	7.06	
23 05 29 00-0243			Split Pipe Clamps And Rings (23 05 29 00-0001)		
23 05 29 00-0244			Adjustable Split Ring Swivel Hanger (Cooper B-Line B3171) (23 05 29 00-0243)		
			Note: Type 6.		
23 05 29 00-0245	EA		3/4" Adjustable Swivel Ring (Cooper B-Line B3171)	22.47	6.77
			<i>For Work In Restricted Working Space, Add</i>	4.06	
23 05 29 00-0246	EA		1" Adjustable Swivel Ring (Cooper B-Line B3171)	23.80	7.16
			<i>For Work In Restricted Working Space, Add</i>	4.30	
23 05 29 00-0247	EA		1-1/4" Adjustable Swivel Ring (Cooper B-Line B3171)	25.86	7.95
			<i>For Work In Restricted Working Space, Add</i>	4.78	
23 05 29 00-0248	EA		1-1/2" Adjustable Swivel Ring (Cooper B-Line B3171)	27.89	8.36
			<i>For Work In Restricted Working Space, Add</i>	5.01	
23 05 29 00-0249	EA		2" Adjustable Swivel Ring (Cooper B-Line B3171)	30.20	8.76
			<i>For Work In Restricted Working Space, Add</i>	5.25	
23 05 29 00-0250	EA		2-1/2" Adjustable Swivel Ring (Cooper B-Line B3171)	37.64	9.15
			<i>For Work In Restricted Working Space, Add</i>	5.49	
23 05 29 00-0251	EA		3" Adjustable Swivel Ring (Cooper B-Line B3171)	41.41	9.55
			<i>For Work In Restricted Working Space, Add</i>	5.73	
23 05 29 00-0252	EA		4" Adjustable Swivel Ring (Cooper B-Line B3171)	55.53	10.75
			<i>For Work In Restricted Working Space, Add</i>	6.45	
23 05 29 00-0253	EA		5" Adjustable Swivel Ring (Cooper B-Line B3171)	70.64	13.53
			<i>For Work In Restricted Working Space, Add</i>	8.12	
23 05 29 00-0254	EA		6" Adjustable Swivel Ring (Cooper B-Line B3171)	94.92	15.92
			<i>For Work In Restricted Working Space, Add</i>	9.55	
23 05 29 00-0255			Extension Split Pipe Clamp, Malleable Iron (Cooper B-Line B3198R) (23 05 29 00-0243)		
			Note: Type 11.		
23 05 29 00-0256	EA		1/2" Extension Split Pipe Clamp, Malleable Iron (Cooper B-Line B3198R).....	14.31	5.59
			<i>For Work In Restricted Working Space, Add</i>	3.42	
23 05 29 00-0257	EA		3/4" Extension Split Pipe Clamp, Malleable Iron (Cooper B-Line B3198R).....	15.10	5.59
			<i>For Work In Restricted Working Space, Add</i>	3.58	
23 05 29 00-0258	EA		1" Extension Split Pipe Clamp, Malleable Iron (Cooper B-Line B3198R).....	16.60	7.19
			<i>For Work In Restricted Working Space, Add</i>	3.99	
23 05 29 00-0259	EA		1-1/4" Extension Split Pipe Clamp, Malleable Iron (Cooper B-Line B3198R).....	18.10	7.19
			<i>For Work In Restricted Working Space, Add</i>	4.20	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 29 00-0260 EA 1-1/2" Extension Split Pipe Clamp, Malleable Iron (Cooper B-Line B3198R) <i>For Work In Restricted Working Space, Add</i>	20.34 4.36	7.19
23 05 29 00-0261 EA 2" Extension Split Pipe Clamp, Malleable Iron (Cooper B-Line B3198R)..... <i>For Work In Restricted Working Space, Add</i>	23.89 4.79	7.98
23 05 29 00-0262 EA 2-1/2" Extension Split Pipe Clamp, Malleable Iron (Cooper B-Line B3198R) <i>For Work In Restricted Working Space, Add</i>	32.44 4.99	7.98
23 05 29 00-0263 EA 3" Extension Split Pipe Clamp, Malleable Iron (Cooper B-Line B3198R)..... <i>For Work In Restricted Working Space, Add</i>	36.21 5.21	8.78
23 05 29 00-0264 EA 4" Extension Split Pipe Clamp, Malleable Iron (Cooper B-Line B3198R)..... <i>For Work In Restricted Working Space, Add</i>	38.48 5.70	9.59
23 05 29 00-0265 Hinged Extension Split Pipe Clamp (Cooper B-Line B3198H) (23 05 29 00-0243) Note: Type 12.		
23 05 29 00-0266 EA 1/2" Hinged Extension Split Pipe Clamp (Cooper B-Line B3198H)..... <i>For Work In Restricted Working Space, Add</i>	14.31 3.42	5.59
23 05 29 00-0267 EA 3/4" Hinged Extension Split Pipe Clamp (Cooper B-Line B3198H)..... <i>For Work In Restricted Working Space, Add</i>	15.10 3.58	5.99
23 05 29 00-0268 EA 1" Hinged Extension Split Pipe Clamp (Cooper B-Line B3198H)..... <i>For Work In Restricted Working Space, Add</i>	16.60 3.99	6.79
23 05 29 00-0269 EA 1-1/4" Hinged Extension Split Pipe Clamp (Cooper B-Line B3198H) <i>For Work In Restricted Working Space, Add</i>	18.10 4.20	7.19
23 05 29 00-0270 EA 1-1/2" Hinged Extension Split Pipe Clamp (Cooper B-Line B3198H) <i>For Work In Restricted Working Space, Add</i>	20.34 4.36	7.19
23 05 29 00-0271 EA 2" Hinged Extension Split Pipe Clamp (Cooper B-Line B3198H)..... <i>For Work In Restricted Working Space, Add</i>	23.89 4.79	7.98
23 05 29 00-0272 EA 2-1/2" Hinged Extension Split Pipe Clamp (Cooper B-Line B3198H) <i>For Work In Restricted Working Space, Add</i>	32.44 4.99	8.39
23 05 29 00-0273 EA 3" Hinged Extension Split Pipe Clamp (Cooper B-Line B3198H)..... <i>For Work In Restricted Working Space, Add</i>	36.21 5.21	8.78
23 05 29 00-0274 Pipe Straps (23 05 29 00-0001)		
23 05 29 00-0275 Standard Two Hole Pipe Strap, Steel (Cooper B-Line B2400) (23 05 29 00-0274) Note: Type 26.		
23 05 29 00-0276 EA 1/2" Standard Two Hole Pipe Strap, Plain Steel (Cooper B-Line B2400) <i>For Work In Restricted Working Space, Add</i>	10.78 2.39	3.99
23 05 29 00-0277 EA 3/4" Standard Two Hole Pipe Strap, Plain Steel (Cooper B-Line B2400) <i>For Work In Restricted Working Space, Add</i>	11.37 2.52	4.79
23 05 29 00-0278 EA 1" Standard Two Hole Pipe Strap, Plain Steel (Cooper B-Line B2400) <i>For Work In Restricted Working Space, Add</i>	11.90 2.66	4.79
23 05 29 00-0279 EA 1-1/4" Standard Two Hole Pipe Strap, Plain Steel (Cooper B-Line B2400) <i>For Work In Restricted Working Space, Add</i>	12.54 2.82	4.79
23 05 29 00-0280 EA 1-1/2" Standard Two Hole Pipe Strap, Plain Steel (Cooper B-Line B2400) <i>For Work In Restricted Working Space, Add</i>	13.22 2.99	5.59
23 05 29 00-0281 EA 2" Standard Two Hole Pipe Strap, Plain Steel (Cooper B-Line B2400) <i>For Work In Restricted Working Space, Add</i>	14.14 3.19	5.59
23 05 29 00-0282 EA 2-1/2" Standard Two Hole Pipe Strap, Plain Steel (Cooper B-Line B2400) <i>For Work In Restricted Working Space, Add</i>	21.15 3.42	5.59
23 05 29 00-0283 EA 3" Standard Two Hole Pipe Strap, Plain Steel (Cooper B-Line B2400) <i>For Work In Restricted Working Space, Add</i>	23.34 3.68	5.59
23 05 29 00-0284 EA 4" Standard Two Hole Pipe Strap, Plain Steel (Cooper B-Line B2400) <i>For Work In Restricted Working Space, Add</i>	27.67 4.31	7.19
23 05 29 00-0285 EA 6" Standard Two Hole Pipe Strap, Plain Steel (Cooper B-Line B2400) <i>For Work In Restricted Working Space, Add</i>	34.31 4.79	7.98
23 05 29 00-0286 EA 8" Standard Two Hole Pipe Strap, Plain Steel (Cooper B-Line B2400) <i>For Work In Restricted Working Space, Add</i>	39.46 5.27	8.78
23 05 29 00-0287 2-Hole Copper Straps (23 05 29 00-0274)		
23 05 29 00-0288 EA 1/2" 2-Hole Copper Straps..... <i>For Work In Restricted Working Space, Add</i>	4.17 1.20	
23 05 29 00-0289 EA 3/4" 2-Hole Copper Straps..... <i>For Work In Restricted Working Space, Add</i>	4.49 1.26	
23 05 29 00-0290 EA 1" 2-Hole Copper Straps..... <i>For Work In Restricted Working Space, Add</i>	2.16 0.54	
23 05 29 00-0291 Black Malleable Iron Clamps, 1 Hole (23 05 29 00-0274)		
23 05 29 00-0292 EA 1/2" Galvanized Steel Strap, 1 Hole..... <i>For Work In Restricted Working Space, Add</i>	1.95 0.40	
23 05 29 00-0293 EA 3/4" Galvanized Steel Strap, 1 Hole..... <i>For Work In Restricted Working Space, Add</i>	2.16 0.43	
23 05 29 00-0294 EA 1" Galvanized Steel Strap, 1 Hole..... <i>For Work In Restricted Working Space, Add</i>	2.64 0.46	
23 05 29 00-0295 EA 1-1/4" Galvanized Steel Strap, 1 Hole <i>For Work In Restricted Working Space, Add</i>	3.05 0.50	
23 05 29 00-0296 EA 1-1/2" Galvanized Steel Strap, 1 Hole <i>For Work In Restricted Working Space, Add</i>	3.46 0.54	
23 05 29 00-0297 EA 2" Galvanized Steel Strap, 1 Hole..... <i>For Work In Restricted Working Space, Add</i>	4.61 0.60	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 05 Common Work Results For HVAC****23 05 29 Hangers And Supports For HVAC Piping And Equipment**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 29 00-0298 Pipe and Equipment Support Brackets <small>(23 05 29 00-0001)</small>		
23 05 29 00-0299 Pipe and Equipment Supports, Light Duty Welded Steel Bracket (Cooper B-Line B3068) <small>(23 05 29 00-0298)</small> Note: Up to 750# load.		
23 05 29 00-0300 EA 9" x 9" Light Duty Welded Steel Bracket, Wall Mounted (Cooper B-Line B3068)	94.38	8.82
For Galvanized, Add	15.35	
For Work In Restricted Working Space, Add	5.29	
23 05 29 00-0301 EA 13" x 13" Light Duty Welded Steel Bracket, Wall Mounted (Cooper B-Line B3068).....	95.78	8.82
For Galvanized, Add	15.63	
For Work In Restricted Working Space, Add	5.29	
23 05 29 00-0302 EA 19" x 19" Light Duty Welded Steel Bracket, Wall Mounted (Cooper B-Line B3068).....	101.33	8.82
For Galvanized, Add	16.74	
For Work In Restricted Working Space, Add	5.29	
23 05 29 00-0303 Pipe and Equipment Supports, Medium Duty Welded Steel Bracket (Cooper B-Line B3066) <small>(23 05 29 00-0298)</small> Note: Up to 1500# load.		
23 05 29 00-0304 EA 12" Wide x 18" Deep Medium Duty Welded Steel Bracket, Wall Mounted (Cooper B-Line B3066).....	229.97	8.82
For Galvanized, Add	42.47	
For Work In Restricted Working Space, Add	5.29	
23 05 29 00-0305 EA 18" Wide x 24" Deep Medium Duty Welded Steel Bracket, Wall Mounted (Cooper B-Line B3066).....	269.89	8.82
For Galvanized, Add	50.45	
For Work In Restricted Working Space, Add	5.29	
23 05 29 00-0306 EA 24" Wide x 30" Deep Medium Duty Welded Steel Bracket, Wall Mounted (Cooper B-Line B3066).....	351.28	8.82
For Galvanized, Add	66.73	
For Work In Restricted Working Space, Add	5.29	
23 05 29 00-0307 Sway Bracing For No Hub Pipe <small>(23 05 29 00-0001)</small>		
23 05 29 00-0308 EA 1-1/2" Sway Bracing.....	81.86	9.70
For Work In Restricted Working Space, Add	5.80	
23 05 29 00-0309 EA 2" Sway Bracing.....	84.43	10.22
For Work In Restricted Working Space, Add	6.13	
23 05 29 00-0310 EA 3" Sway Bracing.....	87.53	10.81
For Work In Restricted Working Space, Add	6.49	
23 05 29 00-0311 EA 4" Sway Bracing.....	99.35	12.27
For Work In Restricted Working Space, Add	7.35	
23 05 29 00-0312 EA 6" Sway Bracing.....	145.90	18.38
For Work In Restricted Working Space, Add	11.03	
23 05 29 00-0313 EA 8" Sway Bracing.....	162.50	22.93
For Work In Restricted Working Space, Add	13.78	
23 05 29 00-0314 EA 10" Sway Bracing.....	184.78	30.65
For Work In Restricted Working Space, Add	18.38	
23 05 29 00-0315 Pipe Stand With Adjustable Saddle (Cooper B-Line B3088T-18 Base, B3093 Adjustable Pipe Saddle) <small>(23 05 29 00-0001)</small> Note: Heights listed is total for base and adjustable saddle		
23 05 29 00-0316 EA 23" to 28" High Pipe Stand With Adjustable Saddle For 1-1/4" Pipe (Cooper B-Line B3088T-18 Base, With B3093 Adjustable Pipe Saddle)	110.86	7.35
For Work In Restricted Working Space, Add	4.41	
23 05 29 00-0317 EA 24" to 29" High Pipe Stand With Adjustable Saddle For 1-1/2" Pipe (Cooper B-Line B3088T-18 Base, With B3093 Adjustable Pipe Saddle)	113.50	8.09
For Work In Restricted Working Space, Add	4.85	
23 05 29 00-0318 EA 24" to 29" High Pipe Stand With Adjustable Saddle For 2" Pipe (Cooper B-Line B3088T-18 Base, With B3093 Adjustable Pipe Saddle)	189.52	9.19
For Work In Restricted Working Space, Add	5.51	
23 05 29 00-0319 EA 24" to 29" High Pipe Stand With Adjustable Saddle For 2-1/2" Pipe (Cooper B-Line B3088T-18 Base, With B3093 Adjustable Pipe Saddle)	243.81	10.29
For Work In Restricted Working Space, Add	6.17	
23 05 29 00-0320 EA 24" to 29" High Pipe Stand With Adjustable Saddle For 3" Pipe (Cooper B-Line B3088T-18 Base, With B3093 Adjustable Pipe Saddle)	247.62	11.39
For Work In Restricted Working Space, Add	6.84	
23 05 29 00-0321 EA 25" to 29" High Pipe Stand With Adjustable Saddle For 3-1/2" Pipe (Cooper B-Line B3088T-18 Base, With B3093 Adjustable Pipe Saddle)	268.13	12.86
For Work In Restricted Working Space, Add	7.72	
23 05 29 00-0322 EA 25" to 30" High Pipe Stand With Adjustable Saddle For 4" Pipe (Cooper B-Line B3088T-18 Base, With B3093 Adjustable Pipe Saddle)	324.80	13.96
For Work In Restricted Working Space, Add	8.38	
23 05 29 00-0323 EA 25" to 30" High Pipe Stand With Adjustable Saddle For 5" Pipe (Cooper B-Line B3088T-18 Base, With B3093 Adjustable Pipe Saddle)	329.10	15.07
For Work In Restricted Working Space, Add	9.04	
23 05 29 00-0324 EA 26" to 31" High Pipe Stand With Adjustable Saddle For 6" Pipe (Cooper B-Line B3088T-18 Base, With B3093 Adjustable Pipe Saddle)	334.69	16.54
For Work In Restricted Working Space, Add	9.92	
23 05 29 00-0325 EA 28" to 33" High Pipe Stand With Adjustable Saddle For 8" Pipe (Cooper B-Line B3088T-18 Base, With B3093 Adjustable Pipe Saddle)	346.99	18.01
For Work In Restricted Working Space, Add	10.80	
23 05 29 00-0326 EA 29" to 34" High Pipe Stand With Adjustable Saddle For 10" Pipe (Cooper B-Line B3088T-18 Base, With B3093 Adjustable Pipe Saddle)	368.02	19.85
For Work In Restricted Working Space, Add	11.91	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 29 00-0327 EA 30" to 35" High Pipe Stand With Adjustable Saddle For 12" Pipe (Cooper B-Line B3088T-18 Base, With B3093 Adjustable Pipe Saddle).....	379.26	22.05
<i>For Work In Restricted Working Space, Add</i>	13.23	
23 05 29 00-0328 EA 32" to 37" High Pipe Stand With Adjustable Saddle For 14" Pipe (Cooper B-Line B3088T-18 Base, With B3093 Adjustable Pipe Saddle).....	461.72	24.26
<i>For Work In Restricted Working Space, Add</i>	14.55	
23 05 29 00-0329 EA 33" to 38" High Pipe Stand With Adjustable Saddle For 16" Pipe (Cooper B-Line B3088T-18 Base, With B3093 Adjustable Pipe Saddle).....	497.48	27.20
<i>For Work In Restricted Working Space, Add</i>	16.32	
23 05 29 00-0330 EA 35" to 40" High Pipe Stand With Adjustable Saddle For 18" Pipe (Cooper B-Line B3088T-18 Base, With B3093 Adjustable Pipe Saddle).....	708.23	30.13
<i>For Work In Restricted Working Space, Add</i>	18.08	
23 05 29 00-0331 EA 36" to 41" High Pipe Stand With Adjustable Saddle For 20" Pipe (Cooper B-Line B3088T-18 Base, With B3093 Adjustable Pipe Saddle).....	837.85	33.07
<i>For Work In Restricted Working Space, Add</i>	19.85	
23 05 29 00-0332 EA 39" to 44" High Pipe Stand With Adjustable Saddle For 24" Pipe (Cooper B-Line B3088T-18 Base, With B3093 Adjustable Pipe Saddle).....	975.55	36.01
<i>For Work In Restricted Working Space, Add</i>	21.61	
23 05 29 00-0333 Channel Mounted Cushion Clamp (23 05 29 00-0001)		
Note: Includes fastening into channel.		
23 05 29 00-0334 EA 1/2" Channel Mounted Cushion Clamp For 3/8" Pipe.....	10.23	3.30
23 05 29 00-0335 EA 5/8" Channel Mounted Cushion Clamp For 1/2" Pipe.....	10.77	3.68
23 05 29 00-0336 EA 7/8" Channel Mounted Cushion Clamp For 3/4" Pipe.....	11.70	3.86
23 05 29 00-0337 EA 1-1/8" Channel Mounted Cushion Clamp For 1" Pipe.....	12.67	4.04
23 05 29 00-0338 EA 1-3/8" Channel Mounted Cushion Clamp For 1-1/4" Pipe.....	14.32	4.41
23 05 29 00-0339 EA 1-5/8" Channel Mounted Cushion Clamp For 1-1/2" Pipe.....	15.79	4.59
23 05 29 00-0340 EA 2-1/8" Channel Mounted Cushion Clamp For 2" Pipe.....	21.36	4.78
23 05 29 00-0341 EA 2-5/8" Channel Mounted Cushion Clamp For 2-1/2" Pipe.....	24.88	5.15
23 05 29 00-0342 EA 3-1/8" Channel Mounted Cushion Clamp For 3" Pipe.....	31.90	5.88
23 05 29 00-0343 EA 4-1/8" Channel Mounted Cushion Clamp For 4" Pipe.....	45.87	6.62
23 05 29 00-0344 Galvanized Steel Cushion Tube Clamp (23 05 29 00-0001)		
Note: Excludes fastening bolt and drilling if necessary.		
23 05 29 00-0345 EA 1/2" Vinyl Coated Galvanized Cushion Tube Clamp, 1/2" Width For 3/8" Pipe.....	2.66	
Note: 19/32" Center To Center Length, 9/32" Hole Diameter For Screw		
23 05 29 00-0346 EA 1/2" Vinyl Coated Galvanized Cushion Tube Clamp, 3/4" Width For 3/8" Pipe.....	2.73	
Note: 23/32" Center To Center Length, 13/32" Hole Diameter For Screw		
23 05 29 00-0347 EA 5/8" Vinyl Coated Galvanized Cushion Tube Clamp, 1/2" Width For 1/2" Pipe.....	2.78	
Note: 23/32" Center To Center Length, 9/32" Hole Diameter For Screw		
23 05 29 00-0348 EA 5/8" Vinyl Coated Galvanized Cushion Tube Clamp, 3/4" Width For 1/2" Pipe.....	2.89	
Note: 27/32" Center To Center Length, 13/32" Hole Diameter For Screw		
23 05 29 00-0349 EA 7/8" Vinyl Coated Galvanized Cushion Tube Clamp, 1/2" Width For 3/4" Pipe.....	2.75	
Note: 27/32" Center To Center Length, 9/32" Hole Diameter For Screw		
23 05 29 00-0350 EA 7/8" Vinyl Coated Galvanized Cushion Tube Clamp, 3/4" Width For 3/4" Pipe.....	2.96	
Note: 31/32" Center To Center Length, 13/32" Hole Diameter For Screw		
23 05 29 00-0351 EA 1-1/8" Vinyl Coated Galvanized Cushion Tube Clamp, 1/2" Width For 1" Pipe.....	2.83	
Note: 31/32" Center To Center Length, 9/32" Hole Diameter For Screw		
23 05 29 00-0352 EA 1-1/8" Vinyl Coated Galvanized Cushion Tube Clamp, 3/4" Width For 1" Pipe.....	3.08	
Note: 1-1/32" Center To Center Length, 13/32" Hole Diameter For Screw		
23 05 29 00-0353 EA 1-1/8" Vinyl Coated Galvanized Cushion Tube Clamp, 1" Width For 1" Pipe.....	3.09	
Note: 1-5/32" Center To Center Length, 17/32" Hole Diameter For Screw		
23 05 29 00-0354 EA 1-3/8" Vinyl Coated Galvanized Cushion Tube Clamp, 1/2" Width For 1-1/4" Pipe.....	2.94	
Note: 1-3/32" Center To Center Length, 9/32" Hole Diameter For Screw		
23 05 29 00-0355 EA 1-3/8" Vinyl Coated Galvanized Cushion Tube Clamp, 3/4" Width For 1-1/4" Pipe.....	3.06	
Note: 1-7/32" Center To Center Length, 13/32" Hole Diameter For Screw		
23 05 29 00-0356 EA 1-3/8" Vinyl Coated Galvanized Cushion Tube Clamp, 1" Width For 1-1/4" Pipe.....	3.40	
Note: 1-11/16" Center To Center Length, 17/32" Hole Diameter For Screw		
23 05 29 00-0357 EA 1-5/8" Vinyl Coated Galvanized Cushion Tube Clamp, 1/2" Width For 1-1/2" Pipe.....	3.07	
Note: 1-5/16" Center To Center Length, 9/32" Hole Diameter For Screw		
23 05 29 00-0358 EA 1-5/8" Vinyl Coated Galvanized Cushion Tube Clamp, 3/4" Width For 1-1/2" Pipe.....	3.29	
Note: 1-9/16" Center To Center Length, 13/32" Hole Diameter For Screw		
23 05 29 00-0359 EA 1-5/8" Vinyl Coated Galvanized Cushion Tube Clamp, 1" Width For 1-1/2" Pipe.....	3.66	
Note: 1-13/16" Center To Center Length, 17/32" Hole Diameter For Screw		
23 05 29 00-0360 EA 2-1/8" Vinyl Coated Galvanized Cushion Tube Clamp, 1/2" Width For 2" Pipe.....	3.70	
Note: 1-7/16" Center To Center Length, 9/32" Hole Diameter For Screw		
23 05 29 00-0361 EA 2-1/8" Vinyl Coated Galvanized Cushion Tube Clamp, 3/4" Width For 2" Pipe.....	3.90	
Note: 1-9/16" Center To Center Length, 13/32" Hole Diameter For Screw		
23 05 29 00-0362 EA 2-1/8" Vinyl Coated Galvanized Cushion Tube Clamp, 1" Width For 2" Pipe.....	4.30	
Note: 1-11/16" Center To Center Length, 17/32" Hole Diameter For Screw		
23 05 29 00-0363 EA 2-5/8" Vinyl Coated Galvanized Cushion Tube Clamp, 1/2" Width For 2-1/2" Pipe.....	4.43	
Note: 1-11/16" Center To Center Length, 9/32" Hole Diameter For Screw		
23 05 29 00-0364 EA 2-5/8" Vinyl Coated Galvanized Cushion Tube Clamp, 3/4" Width For 2-1/2" Pipe.....	5.03	
Note: 1-13/16" Center To Center Length, 13/32" Hole Diameter For Screw		
23 05 29 00-0365 EA 2-5/8" Vinyl Coated Galvanized Cushion Tube Clamp, 1" Width For 2-1/2" Pipe.....	5.08	
Note: 1-15/16" Center To Center Length, 17/32" Hole Diameter For Screw		
23 05 29 00-0366 EA 3-1/8" Vinyl Coated Galvanized Cushion Tube Clamp, 1/2" Width For 3" Pipe.....	4.55	
Note: 1-15/16" Center To Center Length, 9/32" Hole Diameter For Screw		
23 05 29 00-0367 EA 3-1/8" Vinyl Coated Galvanized Cushion Tube Clamp, 3/4" Width For 3" Pipe.....	5.03	
Note: 2-1/16" Center To Center Length, 13/32" Hole Diameter For Screw		
23 05 29 00-0368 EA 3-1/8" Vinyl Coated Galvanized Cushion Tube Clamp, 1" Width For 3" Pipe.....	5.32	
Note: 2-3/16" Center To Center Length, 17/32" Hole Diameter For Screw		

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 05 Common Work Results For HVAC****23 05 29 Hangers And Supports For HVAC Piping And Equipment**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 29 00-0369 EA 3-5/8" Vinyl Coated Galvanized Cushion Tube Clamp, 1/2" Width For 3-1/2" Pipe .....4.71 Note: 2-3/16" Center To Center Length, 9/32" Hole Diameter For Screw	4.71	
23 05 29 00-0370 EA 3-5/8" Vinyl Coated Galvanized Cushion Tube Clamp, 3/4" Width For 3-1/2" Pipe .....5.00 Note: 2-5/16" Center To Center Length, 13/32" Hole Diameter For Screw	5.00	
23 05 29 00-0371 EA 3-5/8" Vinyl Coated Galvanized Cushion Tube Clamp, 1" Width For 3-1/2" Pipe .....6.13 Note: 2-7/16" Center To Center Length, 17/32" Hole Diameter For Screw	6.13	
23 05 29 00-0372 EA 4" Vinyl Coated Galvanized Cushion Tube Clamp, 1/2" Width For 4" Pipe.....4.67 Note: 2-7/16" Center To Center Length, 9/32" Hole Diameter For Screw	4.67	
23 05 29 00-0373 EA 4" Vinyl Coated Galvanized Cushion Tube Clamp, 3/4" Width For 4" Pipe.....5.10 Note: 2-9/16" Center To Center Length, 13/32" Hole Diameter For Screw	5.10	
23 05 29 00-0374 EA 4" Vinyl Coated Galvanized Cushion Tube Clamp, 1" Width For 4" Pipe.....6.38 Note: 2-11/16" Center To Center Length, 17/32" Hole Diameter For Screw	6.38	
23 05 29 00-0375 Rooftop Pipe Supports (23 05 29 00-0001) Note: Excludes pipe/conduit clamps and straps.		
23 05 29 00-0376 Rooftop Support Base (23 05 29 00-0375)		
23 05 29 00-0377 EA 4" x 6" x 4.8" Rooftop Support Base (Cooper B-Line Dura-Blok DBM) .....25.59	25.59	5.99
23 05 29 00-0378 EA 4" x 6" x 9.6" Rooftop Support Base (Cooper B-Line Dura-Blok DBP).....36.96	36.96	7.98
23 05 29 00-0379 Rooftop Support Base With 14 Gauge Galvanized Channel (23 05 29 00-0375)		
23 05 29 00-0380 EA 5" x 6" x 4.8" Rooftop Support Base With 14 Gauge Galvanized Channel (Cooper B-Line Dura-Blok DB5) .....32.84	32.84	5.99
23 05 29 00-0381 EA 5" x 6" x 9.6" Rooftop Support Base With 14 Gauge Galvanized Channel (Cooper B-Line Dura-Blok DB10) .....47.83	47.83	7.98
23 05 29 00-0382 EA 5" x 6" x 20.2" Rooftop Support Base With 14 Gauge Galvanized Channel (Cooper B-Line Dura-Blok DB20) .....86.78	86.78	9.98
23 05 29 00-0383 EA 5" x 6" x 30.8" Rooftop Support Base With 14 Gauge Galvanized Channel (Cooper B-Line Dura-Blok DB30) .....115.56	115.56	11.97
23 05 29 00-0384 EA 5" x 6" x 41.4" Rooftop Support Base With 14 Gauge Galvanized Channel (Cooper B-Line Dura-Blok DB40) .....136.38	136.38	13.98
23 05 29 00-0385 EA 5" x 6" x 52" Rooftop Support Base With 14 Gauge Galvanized Channel (Cooper B-Line Dura-Blok DB48) .....160.49	160.49	15.97
23 05 29 00-0386 Rooftop Support Base With 12 Gauge Galvanized Channel (23 05 29 00-0375)		
23 05 29 00-0387 EA 6-7/16" x 6" x 9.6" Rooftop Support Base With 12 Gauge Galvanized Channel (Cooper B-Line Dura-Blok DB610) .....56.25	56.25	7.98
23 05 29 00-0388 EA 6-7/16" x 6" x 20.2" Support Base With 14 Gauge Galvanized Channel (Cooper B-Line Dura-Blok DB620).....103.50	103.50	9.98
23 05 29 00-0389 EA 6-7/16" x 6" x 30.8" Rooftop Support Base With 12 Gauge Galvanized Channel (Cooper B-Line Dura-Blok DB630) .....138.47	138.47	11.97
23 05 29 00-0390 EA 6-7/16" x 6" x 41.4" Rooftop Support Base With 12 Gauge Galvanized Channel (Cooper B-Line Dura-Blok DB640) .....214.15	214.15	13.98
23 05 29 00-0391 EA 6-7/16" x 6" x 52" Rooftop Support Base With 12 Gauge Galvanized Channel (Cooper B-Line Dura-Blok DB648) .....244.66	244.66	11.97
23 05 29 00-0392 Rooftop Bridge Support Base With 12 Gauge Galvanized Channel (23 05 29 00-0375)		
23 05 29 00-0393 EA 5-5/8" x 6" x 28" Rooftop Bridge Support Base With 12 Gauge Galvanized Channel (Cooper B-Line Dura-Blok DB10-28) .....108.07	108.07	11.97
23 05 29 00-0394 EA 5-5/8" x 6" x 36" Rooftop Bridge Support Base With 12 Gauge Galvanized Channel (Cooper B-Line Dura-Blok DB10-36) .....121.18	121.18	13.98
23 05 29 00-0395 EA 5-5/8" x 6" x 42" Rooftop Bridge Support Base With 12 Gauge Galvanized Channel (Cooper B-Line Dura-Blok DB10-42) .....126.82	126.82	15.97
23 05 29 00-0396 EA 5-5/8" x 6" x 50" Rooftop Bridge Support Base With 12 Gauge Galvanized Channel (Cooper B-Line Dura-Blok DB10-50) .....137.24	137.24	17.96
23 05 29 00-0397 EA 5-5/8" x 6" x 60" Rooftop Bridge Support Base With 12 Gauge Galvanized Channel (Cooper B-Line Dura-Blok DB10-60) .....150.94	150.94	19.96
23 05 29 00-0398 Rooftop Pipe Support Base And Rod (23 05 29 00-0375)		
23 05 29 00-0399 EA 9.69" To 11.19" Height Rooftop Pipe Support Base And Rod (Cooper B-Line Dura-Blok DBM-1/2CT).....62.68	62.68	7.98
23 05 29 00-0400 EA 9.84" To 11.34" Height Rooftop Pipe Support Base And Rod (Cooper B-Line Dura-Blok DBM-3/4CT).....62.68	62.68	7.98
23 05 29 00-0401 EA 9.95" To 11.45" Height Rooftop Pipe Support Base And Rod (Cooper B-Line Dura-Blok DBM-1CT).....63.15	63.15	7.98
23 05 29 00-0402 EA 10.13" To 11.63" Height Rooftop Pipe Support Base And Rod (Cooper B-Line Dura-Blok DBM-1-1/4CT) .....67.49	67.49	9.98
23 05 29 00-0403 EA 10.28" To 11.78" Height Rooftop Pipe Support Base And Rod (Cooper B-Line Dura-Blok DBM-1-1/2CT) .....67.60	67.60	9.98
23 05 29 00-0404 EA 10.53" To 12.03" Height Rooftop Pipe Support Base And Rod (Cooper B-Line Dura-Blok DBM-2CT).....68.19	68.19	9.98
23 05 29 00-0405 Rooftop Support Base With 14 Gauge Galvanized Channel And Fixed Height Roller Assembly (23 05 29 00-0375)		
23 05 29 00-0406 EA 7.09" x 6" x 9.6" Rooftop Support Base With 14 Gauge Galvanized Channel And Fixed Height Roller Assembly (Cooper B-Line Dura-Blok DBR2-3 1/2).....101.50	101.50	7.98
23 05 29 00-0407 EA 7.09" x 6" x 9.6" Rooftop Support Base With 14 Gauge Galvanized Channel And Fixed Height Roller Assembly (Cooper B-Line Dura-Blok DBR4-6).....114.12	114.12	7.98
23 05 29 00-0408 EA 8.34" x 6" x 20.2" Rooftop Support Base With 14 Gauge Galvanized Channel And Fixed Height Roller Assembly (Cooper B-Line Dura-Blok DBR8-10).....149.92	149.92	9.98
23 05 29 00-0409 EA 9.38" x 6" x 20.2" Rooftop Support Base With 14 Gauge Galvanized Channel And Fixed Height Roller Assembly (Cooper B-Line Dura-Blok DBR12-14).....211.53	211.53	9.98
23 05 29 00-0410 EA 9.78" x 6" x 20.2" Rooftop Support Base With 14 Gauge Galvanized Channel And Fixed Height Roller Assembly (Cooper B-Line Dura-Blok DBR16-20).....275.96	275.96	9.98
23 05 29 00-0411 Rooftop Support Base And Adjustable Height Roller Assembly (23 05 29 00-0375) Note: Includes base, two zinc all threaded rod risers and pipe roller.		
23 05 29 00-0412 EA Up To 12" Height, 6" x 9.6" Rooftop Support Base And Adjustable Height Roller Assembly (Cooper B-Line Dura-Blok DBR10-12).....99.07	99.07	11.97



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 29 00-0413 Rooftop Support Base And Adjustable Height Channel Assembly <small>(23 05 29 00-0375)</small> Note: Includes base, two zinc all threaded rod and 14 gauge slotted channel.		
23 05 29 00-0414 EA Up To 8" Height, 6" x 9.6" Rooftop Support Base And Adjustable Height Channel Assembly (Cooper B-Line Dura-Blok DBE10-8).....	73.45	9.98
23 05 29 00-0415 EA Up To 12" Height, 6" x 9.6" Rooftop Support Base And Adjustable Height Channel Assembly (Cooper B-Line Dura-Blok DBE10-12).....	93.11	11.97
23 05 29 00-0416 EA Up To 16" Height, 6" x 9.6" Rooftop Support Base And Adjustable Height Channel Assembly (Cooper B-Line Dura-Blok DBE10-16).....	105.75	13.98
 23 05 29 00-0417 Rooftop Support Bases With Channel Support And Risers Assembly <small>(23 05 29 00-0375)</small> Note: Includes two support bases, two 12 gauge galvanized channel risers and one 12 gauge galvanized channel support. Dimensions are "overall" (height x width x length).		
23 05 29 00-0418 EA 23" x 25-5/8" x 20.2" Rooftop Support Bases With Channel Support And Risers Assembly (Cooper B-Line Dura-Blok DB2318DS).....	310.15	15.97
23 05 29 00-0419 EA 29" x 25-5/8" x 20.2" Rooftop Support Bases With Channel Support And Risers Assembly (Cooper B-Line Dura-Blok DB2918DS).....	313.66	15.97
23 05 29 00-0420 EA 41" x 25-5/8" x 20.2" Rooftop Support Bases With Channel Support And Risers Assembly (Cooper B-Line Dura-Blok DB4118DS).....	326.40	15.97
23 05 29 00-0421 EA 53" x 25-5/8" x 20.2" Rooftop Support Bases With Channel Support And Risers Assembly (Cooper B-Line Dura-Blok DB5318DS).....	355.17	15.97
23 05 29 00-0422 EA 23" x 31-5/8" x 20.2" Rooftop Support Bases With Channel Support And Risers Assembly (Cooper B-Line Dura-Blok DB2324DS).....	312.26	15.97
23 05 29 00-0423 EA 29" x 31-5/8" x 20.2" Rooftop Support Bases With Channel Support And Risers Assembly (Cooper B-Line Dura-Blok DB2924DS).....	316.00	15.97
23 05 29 00-0424 EA 41" x 31-5/8" x 20.2" Rooftop Support Bases With Channel Support And Risers Assembly (Cooper B-Line Dura-Blok DB4124DS).....	328.39	15.97
23 05 29 00-0425 EA 53" x 31-5/8" x 20.2" Rooftop Support Bases With Channel Support And Risers Assembly (Cooper B-Line Dura-Blok DB5324DS).....	357.27	15.97
23 05 29 00-0426 EA 23" x 43-5/8" x 20.2" Rooftop Support Bases With Channel Support And Risers Assembly (Cooper B-Line Dura-Blok DB2336DS).....	318.22	15.97
23 05 29 00-0427 EA 29" x 43-5/8" x 20.2" Rooftop Support Bases With Channel Support And Risers Assembly (Cooper B-Line Dura-Blok DB2936DS).....	322.19	15.97
23 05 29 00-0428 EA 41" x 43-5/8" x 20.2" Rooftop Support Bases With Channel Support And Risers Assembly (Cooper B-Line Dura-Blok DB4136DS).....	334.70	15.97
23 05 29 00-0429 EA 53" x 43-5/8" x 20.2" Rooftop Support Bases With Channel Support And Risers Assembly (Cooper B-Line Dura-Blok DB5336DS).....	363.47	15.97
23 05 29 00-0430 EA 23" x 55-5/8" x 20.2" Rooftop Support Bases With Channel Support And Risers Assembly (Cooper B-Line Dura-Blok DB2348DS).....	332.72	15.97
23 05 29 00-0431 EA 29" x 55-5/8" x 20.2" Rooftop Support Bases With Channel Support And Risers Assembly (Cooper B-Line Dura-Blok DB2948DS).....	336.58	15.97
23 05 29 00-0432 EA 41" x 55-5/8" x 20.2" Rooftop Support Bases With Channel Support And Risers Assembly (Cooper B-Line Dura-Blok DB4148DS).....	348.73	15.97
23 05 29 00-0433 EA 53" x 55-5/8" x 20.2" Rooftop Support Bases With Channel Support And Risers Assembly (Cooper B-Line Dura-Blok DB5348DS).....	377.73	15.97
 23 05 29 00-0434 Threaded Rod, Accessories And Attachments <small>(23 05 29)</small>		
23 05 29 00-0435 Threaded Rod And Rod Accessories <small>(23 05 29 00-0434)</small>		
23 05 29 00-0436 Threaded Rod <small>(23 05 29 00-0435)</small> Note: Fully threaded.		
23 05 29 00-0437 LF 3/8" Diameter, Plain Finish Steel, Low Carbon Threaded Rod.....	2.29	0.50
<i>For Galvanized, Add</i>	0.52	
<i>For Zinc Plated, Add</i>	0.37	
<i>For Work In Restricted Working Space, Add</i>	0.30	
23 05 29 00-0438 LF 1/2" Diameter, Plain Finish Steel, Low Carbon Threaded Rod.....	3.11	0.53
<i>For Galvanized, Add</i>	0.82	
<i>For Zinc Plated, Add</i>	0.58	
<i>For Work In Restricted Working Space, Add</i>	0.32	
23 05 29 00-0439 LF 5/8" Diameter, Plain Finish Steel, Low Carbon Threaded Rod.....	4.28	0.55
<i>For Galvanized, Add</i>	1.27	
<i>For Zinc Plated, Add</i>	0.91	
<i>For Work In Restricted Working Space, Add</i>	0.33	
23 05 29 00-0440 LF 3/4" Diameter, Plain Finish Steel, Low Carbon Threaded Rod.....	6.92	0.56
<i>For Galvanized, Add</i>	2.31	
<i>For Zinc Plated, Add</i>	1.65	
<i>For Work In Restricted Working Space, Add</i>	0.34	
23 05 29 00-0441 LF 7/8" Diameter, Plain Finish Steel, Low Carbon Threaded Rod.....	7.53	0.58
<i>For Galvanized, Add</i>	2.54	
<i>For Zinc Plated, Add</i>	1.81	
<i>For Work In Restricted Working Space, Add</i>	0.35	
23 05 29 00-0442 LF 1" Diameter, Plain Finish Steel, Low Carbon Threaded Rod.....	10.25	0.66
<i>For Galvanized, Add</i>	3.57	
<i>For Zinc Plated, Add</i>	2.54	
<i>For Work In Restricted Working Space, Add</i>	0.40	
23 05 29 00-0443 LF 1-1/8" Diameter, Plain Finish Steel, Low Carbon Threaded Rod.....	12.73	0.74
<i>For Galvanized, Add</i>	4.50	
<i>For Zinc Plated, Add</i>	3.21	
<i>For Work In Restricted Working Space, Add</i>	0.44	
 23 05 29 00-0444 Rod Couplings <small>(23 05 29 00-0435)</small>		

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 05 Common Work Results For HVAC****23 05 29 Hangers And Supports For HVAC Piping And Equipment**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 29 00-0445	EA		3/8" Diameter, Threaded Rod Coupling Nut.....	5.79	
			<i>For Work In Restricted Working Space, Add</i>	1.47	
23 05 29 00-0446	EA		1/2" Diameter, Threaded Rod Coupling Nut.....	6.56	
			<i>For Work In Restricted Working Space, Add</i>	1.63	
23 05 29 00-0447	EA		5/8" Diameter, Threaded Rod Coupling Nut.....	8.11	
			<i>For Work In Restricted Working Space, Add</i>	1.84	
23 05 29 00-0448	EA		3/4" Diameter, Threaded Rod Coupling Nut.....	9.78	
			<i>For Work In Restricted Working Space, Add</i>	2.00	
23 05 29 00-0449	EA		7/8" Diameter, Threaded Rod Coupling Nut.....	14.02	
			<i>For Work In Restricted Working Space, Add</i>	2.21	
23 05 29 00-0450	EA		1" Diameter, Threaded Rod Coupling Nut.....	16.61	
			<i>For Work In Restricted Working Space, Add</i>	2.60	
23 05 29 00-0451	EA		1-1/8" Diameter, Threaded Rod Coupling Nut	30.88	
			<i>For Work In Restricted Working Space, Add</i>	2.94	
23 05 29 00-0452			Flat Washers (23 05 29 00-0435)		
			Note: Zinc plated.		
23 05 29 00-0453	EA		3/8" Inside Diameter, Zinc Plated Steel, Low Carbon Flat Washer	0.41	0.16
			<i>For Galvanized, Add</i>	0.02	
			<i>For Work In Restricted Working Space, Add</i>	0.10	
23 05 29 00-0454	EA		1/2" Inside Diameter, Zinc Plated Steel, Low Carbon Flat Washer	0.54	0.16
			<i>For Galvanized, Add</i>	0.04	
			<i>For Work In Restricted Working Space, Add</i>	0.11	
23 05 29 00-0455	EA		5/8" Inside Diameter, Zinc Plated Steel, Low Carbon Flat Washer	0.77	0.24
			<i>For Galvanized, Add</i>	0.08	
			<i>For Work In Restricted Working Space, Add</i>	0.13	
23 05 29 00-0456	EA		3/4" Inside Diameter, Zinc Plated Steel, Low Carbon Flat Washer	1.04	0.24
			<i>For Galvanized, Add</i>	0.12	
			<i>For Work In Restricted Working Space, Add</i>	0.17	
23 05 29 00-0457	EA		7/8" Inside Diameter, Zinc Plated Steel, Low Carbon Flat Washer	1.22	0.32
			<i>For Galvanized, Add</i>	0.14	
			<i>For Work In Restricted Working Space, Add</i>	0.20	
23 05 29 00-0458	EA		1" Inside Diameter, Zinc Plated Steel, Low Carbon Flat Washer	1.42	0.32
			<i>For Galvanized, Add</i>	0.17	
			<i>For Work In Restricted Working Space, Add</i>	0.22	
23 05 29 00-0459	EA		1-1/8" Inside Diameter, Zinc Plated Steel, Low Carbon Flat Washer	1.61	0.40
			<i>For Galvanized, Add</i>	0.19	
			<i>For Work In Restricted Working Space, Add</i>	0.25	
23 05 29 00-0460			Hex Nuts (23 05 29 00-0435)		
			Note: Grade 2 and zinc plated.		
23 05 29 00-0461	EA		3/8" Diameter, Zinc Plated Steel, Low Carbon/Grade 2 Hex Nut	0.51	0.20
			<i>For Galvanized, Add</i>	0.02	
			<i>For Work In Restricted Working Space, Add</i>	0.14	
23 05 29 00-0462	EA		1/2" Diameter, Zinc Plated Steel, Low Carbon/Grade 2 Hex Nut	0.64	0.20
			<i>For Galvanized, Add</i>	0.04	
			<i>For Work In Restricted Working Space, Add</i>	0.15	
23 05 29 00-0463	EA		5/8" Diameter, Zinc Plated Steel, Low Carbon/Grade 2 Hex Nut	0.85	0.20
			<i>For Galvanized, Add</i>	0.08	
			<i>For Work In Restricted Working Space, Add</i>	0.16	
23 05 29 00-0464	EA		3/4" Diameter, Zinc Plated Steel, Low Carbon/Grade 2 Hex Nut	0.99	0.40
			<i>For Galvanized, Add</i>	0.11	
			<i>For Work In Restricted Working Space, Add</i>	0.17	
23 05 29 00-0465	EA		7/8" Diameter, Zinc Plated Steel, Low Carbon/Grade 2 Hex Nut	1.40	0.40
			<i>For Galvanized, Add</i>	0.21	
			<i>For Work In Restricted Working Space, Add</i>	0.17	
23 05 29 00-0466	EA		1" Diameter, Zinc Plated Steel, Low Carbon/Grade 2 Hex Nut	1.78	0.40
			<i>For Galvanized, Add</i>	0.28	
			<i>For Work In Restricted Working Space, Add</i>	0.20	
23 05 29 00-0467	EA		1-1/8" Diameter, Zinc Plated Steel, Low Carbon/Grade 2 Hex Nut	2.86	0.40
			<i>For Galvanized, Add</i>	0.53	
			<i>For Work In Restricted Working Space, Add</i>	0.22	
23 05 29 00-0468			Turnbuckle (Cooper B-Line B3202) (23 05 29 00-0435)		
			Note: Type 13.		
23 05 29 00-0469	EA		3/8" Turnbuckle (Cooper B-Line B3202)	20.47	3.99
			<i>For Work In Restricted Working Space, Add</i>	2.39	
23 05 29 00-0470	EA		1/2" Turnbuckle (Cooper B-Line B3202)	24.40	4.39
			<i>For Work In Restricted Working Space, Add</i>	2.66	
23 05 29 00-0471	EA		5/8" Turnbuckle (Cooper B-Line B3202)	26.22	4.79
			<i>For Work In Restricted Working Space, Add</i>	2.99	
23 05 29 00-0472	EA		3/4" Turnbuckle (Cooper B-Line B3202)	33.15	5.59
			<i>For Work In Restricted Working Space, Add</i>	3.42	
23 05 29 00-0473	EA		7/8" Turnbuckle (Cooper B-Line B3202)	43.13	5.99
			<i>For Work In Restricted Working Space, Add</i>	4.00	
23 05 29 00-0474	EA		1" Turnbuckle (Cooper B-Line B3202)	53.60	6.39
			<i>For Work In Restricted Working Space, Add</i>	4.79	
23 05 29 00-0475	EA		1-1/8" Turnbuckle (Cooper B-Line B3202)	74.66	7.19
			<i>For Work In Restricted Working Space, Add</i>	5.99	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 29 00-0476				Swivel Turnbuckle (Cooper B-Line B3224) (23 05 29 00-0435)		
				Note: Type 15.		
23 05 29 00-0477	EA			3/8" Swivel Turnbuckle (Cooper B-Line B3224).....	12.58	3.99
				<i>For Work In Restricted Working Space, Add</i>	2.39	
23 05 29 00-0478	EA			1/2" Swivel Turnbuckle (Cooper B-Line B3224).....	14.60	4.47
				<i>For Work In Restricted Working Space, Add</i>	2.66	
23 05 29 00-0479	EA			5/8" Swivel Turnbuckle (Cooper B-Line B3224).....	19.61	4.96
				<i>For Work In Restricted Working Space, Add</i>	2.99	
23 05 29 00-0480	EA			3/4" Swivel Turnbuckle (Cooper B-Line B3224).....	23.79	5.67
				<i>For Work In Restricted Working Space, Add</i>	3.42	
23 05 29 00-0481				Forged Steel Clevis (Cooper B-Line B3201) (23 05 29 00-0435)		
				Note: Type 14.		
23 05 29 00-0482	EA			3-9/16" Forged Steel Clevis With Pin, 3/8" To 5/8" Rod Size (Cooper B-Line B3201).....	69.83	7.35
				<i>For Work In Restricted Working Space, Add</i>	4.41	
23 05 29 00-0483	EA			4" Forged Steel Clevis With Pin, 3/4" To 7/8" Rod Size (Cooper B-Line B3201).....	103.84	7.72
				<i>For Work In Restricted Working Space, Add</i>	4.64	
23 05 29 00-0484	EA			5-1/16" Forged Steel Clevis With Pin, 1" Rod Size (Cooper B-Line B3201).....	112.37	8.09
				<i>For Work In Restricted Working Space, Add</i>	4.90	
23 05 29 00-0485	EA			5-1/16" Forged Steel Clevis With Pin, 1-1/8" Rod Size (Cooper B-Line B3201).....	116.98	8.82
				<i>For Work In Restricted Working Space, Add</i>	5.19	
23 05 29 00-0486	EA			5-1/16" Forged Steel Clevis With Pin, 1-1/4" Rod Size (Cooper B-Line B3201).....	122.93	9.92
				<i>For Work In Restricted Working Space, Add</i>	5.88	
23 05 29 00-0487	EA			6" Forged Steel Clevis With Pin, 1-1/2" Rod Size (Cooper B-Line B3201).....	205.79	12.86
				<i>For Work In Restricted Working Space, Add</i>	7.72	
23 05 29 00-0488	EA			5-15/16" Forged Steel Clevis With Pin, 1-3/4" Rod Size (Cooper B-Line B3201).....	223.15	14.70
				<i>For Work In Restricted Working Space, Add</i>	8.82	
23 05 29 00-0489	EA			7" Forged Steel Clevis With Pin, 2" Rod Size (Cooper B-Line B3201).....	262.79	18.38
				<i>For Work In Restricted Working Space, Add</i>	11.03	
23 05 29 00-0490				Welded Eye Rod (Cooper B-Line B3211) (23 05 29 00-0435)		
23 05 29 00-0491	EA			3/8" Diameter x 8" Length Shank, Welded Eye Rod.....	20.27	4.31
				<i>For Work In Restricted Working Space, Add</i>	2.60	
23 05 29 00-0492	EA			3/8" Diameter x 10" Length Shank, Welded Eye Rod.....	20.93	4.39
				<i>For Work In Restricted Working Space, Add</i>	2.64	
23 05 29 00-0493	EA			3/8" Diameter x 12" Length Shank, Welded Eye Rod.....	21.59	4.47
				<i>For Work In Restricted Working Space, Add</i>	2.69	
23 05 29 00-0494	EA			3/8" Diameter x 14" Length Shank, Welded Eye Rod.....	21.76	4.55
				<i>For Work In Restricted Working Space, Add</i>	2.75	
23 05 29 00-0495	EA			3/8" Diameter x 18" Length Shank, Welded Eye Rod.....	23.10	4.71
				<i>For Work In Restricted Working Space, Add</i>	2.85	
23 05 29 00-0496	EA			3/8" Diameter x 24" Length Shank, Welded Eye Rod.....	24.62	5.03
				<i>For Work In Restricted Working Space, Add</i>	2.99	
23 05 29 00-0497	EA			3/8" Diameter x 30" Length Shank, Welded Eye Rod.....	25.61	5.27
				<i>For Work In Restricted Working Space, Add</i>	3.14	
23 05 29 00-0498	EA			3/8" Diameter x 36" Length Shank, Welded Eye Rod.....	27.64	5.51
				<i>For Work In Restricted Working Space, Add</i>	3.29	
23 05 29 00-0499	EA			3/8" Diameter x 42" Length Shank, Welded Eye Rod.....	29.14	5.75
				<i>For Work In Restricted Working Space, Add</i>	3.44	
23 05 29 00-0500	EA			3/8" Diameter x 48" Length Shank, Welded Eye Rod.....	30.65	5.99
				<i>For Work In Restricted Working Space, Add</i>	3.59	
23 05 29 00-0501	EA			1/2" Diameter x 8" Length Shank, Welded Eye Rod.....	27.24	4.79
				<i>For Work In Restricted Working Space, Add</i>	2.87	
23 05 29 00-0502	EA			1/2" Diameter x 10" Length Shank, Welded Eye Rod.....	27.90	4.88
				<i>For Work In Restricted Working Space, Add</i>	2.93	
23 05 29 00-0503	EA			1/2" Diameter x 12" Length Shank, Welded Eye Rod.....	28.61	4.96
				<i>For Work In Restricted Working Space, Add</i>	2.98	
23 05 29 00-0504	EA			1/2" Diameter x 14" Length Shank, Welded Eye Rod.....	29.28	5.04
				<i>For Work In Restricted Working Space, Add</i>	3.03	
23 05 29 00-0505	EA			1/2" Diameter x 18" Length Shank, Welded Eye Rod.....	30.65	5.19
				<i>For Work In Restricted Working Space, Add</i>	3.14	
23 05 29 00-0506	EA			1/2" Diameter x 24" Length Shank, Welded Eye Rod.....	33.19	5.51
				<i>For Work In Restricted Working Space, Add</i>	3.30	
23 05 29 00-0507	EA			1/2" Diameter x 30" Length Shank, Welded Eye Rod.....	35.24	5.75
				<i>For Work In Restricted Working Space, Add</i>	3.46	
23 05 29 00-0508	EA			1/2" Diameter x 36" Length Shank, Welded Eye Rod.....	37.80	5.99
				<i>For Work In Restricted Working Space, Add</i>	3.62	
23 05 29 00-0509	EA			1/2" Diameter x 42" Length Shank, Welded Eye Rod.....	39.82	6.31
				<i>For Work In Restricted Working Space, Add</i>	3.78	
23 05 29 00-0510	EA			1/2" Diameter x 48" Length Shank, Welded Eye Rod.....	41.88	6.55
				<i>For Work In Restricted Working Space, Add</i>	3.94	
23 05 29 00-0511	EA			5/8" Diameter x 8" Length Shank, Welded Eye Rod.....	36.96	5.35
				<i>For Work In Restricted Working Space, Add</i>	3.22	
23 05 29 00-0512	EA			5/8" Diameter x 10" Length Shank, Welded Eye Rod.....	38.13	5.43
				<i>For Work In Restricted Working Space, Add</i>	3.27	
23 05 29 00-0513	EA			5/8" Diameter x 12" Length Shank, Welded Eye Rod.....	39.34	5.51
				<i>For Work In Restricted Working Space, Add</i>	3.33	
23 05 29 00-0514	EA			5/8" Diameter x 14" Length Shank, Welded Eye Rod.....	40.03	5.67
				<i>For Work In Restricted Working Space, Add</i>	3.38	
23 05 29 00-0515	EA			5/8" Diameter x 18" Length Shank, Welded Eye Rod.....	41.90	5.83
				<i>For Work In Restricted Working Space, Add</i>	3.49	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 05 Common Work Results For HVAC****23 05 29 Hangers And Supports For HVAC Piping And Equipment**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 29 00-0516	EA		5/8" Diameter x 24" Length Shank, Welded Eye Rod <i>For Work In Restricted Working Space, Add</i>	44.99 3.66	6.07
23 05 29 00-0517	EA		5/8" Diameter x 30" Length Shank, Welded Eye Rod <i>For Work In Restricted Working Space, Add</i>	48.05 3.82	6.39
23 05 29 00-0518	EA		5/8" Diameter x 36" Length Shank, Welded Eye Rod <i>For Work In Restricted Working Space, Add</i>	50.63 3.99	6.63
23 05 29 00-0519	EA		5/8" Diameter x 42" Length Shank, Welded Eye Rod <i>For Work In Restricted Working Space, Add</i>	53.69 4.15	6.95
23 05 29 00-0520	EA		5/8" Diameter x 48" Length Shank, Welded Eye Rod <i>For Work In Restricted Working Space, Add</i>	56.76 4.32	7.19
23 05 29 00-0521	EA		3/4" Diameter x 8" Length Shank, Welded Eye Rod <i>For Work In Restricted Working Space, Add</i>	45.47 3.65	6.07
23 05 29 00-0522	EA		3/4" Diameter x 10" Length Shank, Welded Eye Rod <i>For Work In Restricted Working Space, Add</i>	47.19 3.71	6.15
23 05 29 00-0523	EA		3/4" Diameter x 12" Length Shank, Welded Eye Rod <i>For Work In Restricted Working Space, Add</i>	48.38 3.77	6.31
23 05 29 00-0524	EA		3/4" Diameter x 14" Length Shank, Welded Eye Rod <i>For Work In Restricted Working Space, Add</i>	50.08 3.83	6.39
23 05 29 00-0525	EA		3/4" Diameter x 18" Length Shank, Welded Eye Rod <i>For Work In Restricted Working Space, Add</i>	52.98 3.94	6.55
23 05 29 00-0526	EA		3/4" Diameter x 24" Length Shank, Welded Eye Rod <i>For Work In Restricted Working Space, Add</i>	57.06 4.11	6.87
23 05 29 00-0527	EA		3/4" Diameter x 30" Length Shank, Welded Eye Rod <i>For Work In Restricted Working Space, Add</i>	61.15 4.28	7.11
23 05 29 00-0528	EA		3/4" Diameter x 36" Length Shank, Welded Eye Rod <i>For Work In Restricted Working Space, Add</i>	65.77 4.45	7.42
23 05 29 00-0529	EA		3/4" Diameter x 42" Length Shank, Welded Eye Rod <i>For Work In Restricted Working Space, Add</i>	70.35 4.62	7.67
23 05 29 00-0530	EA		3/4" Diameter x 48" Length Shank, Welded Eye Rod <i>For Work In Restricted Working Space, Add</i>	74.46 4.79	7.99
23 05 29 00-0531	EA		7/8" Diameter x 8" Length Shank, Welded Eye Rod <i>For Work In Restricted Working Space, Add</i>	54.48 4.24	7.03
23 05 29 00-0532	EA		7/8" Diameter x 10" Length Shank, Welded Eye Rod <i>For Work In Restricted Working Space, Add</i>	56.69 4.30	7.19
23 05 29 00-0533	EA		7/8" Diameter x 12" Length Shank, Welded Eye Rod <i>For Work In Restricted Working Space, Add</i>	58.41 4.36	7.27
23 05 29 00-0534	EA		7/8" Diameter x 14" Length Shank, Welded Eye Rod <i>For Work In Restricted Working Space, Add</i>	60.11 4.42	7.35
23 05 29 00-0535	EA		7/8" Diameter x 18" Length Shank, Welded Eye Rod <i>For Work In Restricted Working Space, Add</i>	63.54 4.53	7.59
23 05 29 00-0536	EA		7/8" Diameter x 24" Length Shank, Welded Eye Rod <i>For Work In Restricted Working Space, Add</i>	69.16 4.71	7.83
23 05 29 00-0537	EA		7/8" Diameter x 30" Length Shank, Welded Eye Rod <i>For Work In Restricted Working Space, Add</i>	74.30 4.89	8.15
23 05 29 00-0538	EA		7/8" Diameter x 36" Length Shank, Welded Eye Rod <i>For Work In Restricted Working Space, Add</i>	79.92 5.06	8.47
23 05 29 00-0539	EA		7/8" Diameter x 42" Length Shank, Welded Eye Rod <i>For Work In Restricted Working Space, Add</i>	85.06 5.24	8.70
23 05 29 00-0540	EA		7/8" Diameter x 48" Length Shank, Welded Eye Rod <i>For Work In Restricted Working Space, Add</i>	90.19 5.42	9.03
23 05 29 00-0541	EA		1" Diameter x 8" Length Shank, Welded Eye Rod <i>For Work In Restricted Working Space, Add</i>	68.30 5.06	8.47
23 05 29 00-0542	EA		1" Diameter x 10" Length Shank, Welded Eye Rod <i>For Work In Restricted Working Space, Add</i>	70.54 5.12	8.54
23 05 29 00-0543	EA		1" Diameter x 12" Length Shank, Welded Eye Rod <i>For Work In Restricted Working Space, Add</i>	72.79 5.19	8.62
23 05 29 00-0544	EA		1" Diameter x 14" Length Shank, Welded Eye Rod <i>For Work In Restricted Working Space, Add</i>	75.03 5.26	8.78
23 05 29 00-0545	EA		1" Diameter x 18" Length Shank, Welded Eye Rod <i>For Work In Restricted Working Space, Add</i>	79.49 5.39	9.03
23 05 29 00-0546	EA		1" Diameter x 24" Length Shank, Welded Eye Rod <i>For Work In Restricted Working Space, Add</i>	86.22 5.59	9.35
23 05 29 00-0547	EA		1" Diameter x 30" Length Shank, Welded Eye Rod <i>For Work In Restricted Working Space, Add</i>	92.96 5.79	9.66
23 05 29 00-0548	EA		1" Diameter x 36" Length Shank, Welded Eye Rod <i>For Work In Restricted Working Space, Add</i>	100.14 5.99	9.98
23 05 29 00-0549	EA		1" Diameter x 42" Length Shank, Welded Eye Rod <i>For Work In Restricted Working Space, Add</i>	106.86 6.19	10.30
23 05 29 00-0550	EA		1" Diameter x 48" Length Shank, Welded Eye Rod <i>For Work In Restricted Working Space, Add</i>	113.59 6.39	10.63
23 05 29 00-0551			Welded Linked Eye Rod (Cooper B-Line B3211X) (23 05 29 00-0435)		
23 05 29 00-0552	EA		3/8" Diameter x 16" Length Shank, Linked Welded Eye Rod <i>For Work In Restricted Working Space, Add</i>	42.95 3.51	5.83
23 05 29 00-0553	EA		3/8" Diameter x 20" Length Shank, Linked Welded Eye Rod <i>For Work In Restricted Working Space, Add</i>	44.11 3.61	5.99
23 05 29 00-0554	EA		3/8" Diameter x 24" Length Shank, Linked Welded Eye Rod <i>For Work In Restricted Working Space, Add</i>	45.27 3.71	6.23
23 05 29 00-0555	EA		3/8" Diameter x 30" Length Shank, Linked Welded Eye Rod <i>For Work In Restricted Working Space, Add</i>	45.78 3.86	6.46
23 05 29 00-0556	EA		3/8" Diameter x 36" Length Shank, Linked Welded Eye Rod <i>For Work In Restricted Working Space, Add</i>	47.94 4.01	6.71



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 29 00-0557 EA 3/8" Diameter x 48" Length Shank, Linked Welded Eye Rod..... <i>For Work In Restricted Working Space, Add</i>	50.65 4.31	7.19
23 05 29 00-0558 EA 3/8" Diameter x 60" Length Shank, Linked Welded Eye Rod..... <i>For Work In Restricted Working Space, Add</i>	52.47 4.61	7.66
23 05 29 00-0559 EA 3/8" Diameter x 72" Length Shank, Linked Welded Eye Rod..... <i>For Work In Restricted Working Space, Add</i>	56.01 4.91	8.23
23 05 29 00-0560 EA 1/2" Diameter x 16" Length Shank, Linked Welded Eye Rod..... <i>For Work In Restricted Working Space, Add</i>	55.71 3.88	6.47
23 05 29 00-0561 EA 1/2" Diameter x 20" Length Shank, Linked Welded Eye Rod..... <i>For Work In Restricted Working Space, Add</i>	56.90 3.99	6.63
23 05 29 00-0562 EA 1/2" Diameter x 24" Length Shank, Linked Welded Eye Rod..... <i>For Work In Restricted Working Space, Add</i>	58.12 4.10	6.79
23 05 29 00-0563 EA 1/2" Diameter x 30" Length Shank, Linked Welded Eye Rod..... <i>For Work In Restricted Working Space, Add</i>	59.49 4.25	7.11
23 05 29 00-0564 EA 1/2" Diameter x 36" Length Shank, Linked Welded Eye Rod..... <i>For Work In Restricted Working Space, Add</i>	61.69 4.42	7.35
23 05 29 00-0565 EA 1/2" Diameter x 48" Length Shank, Linked Welded Eye Rod..... <i>For Work In Restricted Working Space, Add</i>	66.11 4.73	7.91
23 05 29 00-0566 EA 1/2" Diameter x 60" Length Shank, Linked Welded Eye Rod..... <i>For Work In Restricted Working Space, Add</i>	69.71 5.05	8.39
23 05 29 00-0567 EA 1/2" Diameter x 72" Length Shank, Linked Welded Eye Rod..... <i>For Work In Restricted Working Space, Add</i>	74.14 5.37	8.94
23 05 29 00-0568 EA 5/8" Diameter x 16" Length Shank, Linked Welded Eye Rod..... <i>For Work In Restricted Working Space, Add</i>	74.84 4.34	7.19
23 05 29 00-0569 EA 5/8" Diameter x 20" Length Shank, Linked Welded Eye Rod..... <i>For Work In Restricted Working Space, Add</i>	76.87 4.45	7.42
23 05 29 00-0570 EA 5/8" Diameter x 24" Length Shank, Linked Welded Eye Rod..... <i>For Work In Restricted Working Space, Add</i>	78.93 4.55	7.59
23 05 29 00-0571 EA 5/8" Diameter x 30" Length Shank, Linked Welded Eye Rod..... <i>For Work In Restricted Working Space, Add</i>	80.33 4.72	7.91
23 05 29 00-0572 EA 5/8" Diameter x 36" Length Shank, Linked Welded Eye Rod..... <i>For Work In Restricted Working Space, Add</i>	83.41 4.89	8.15
23 05 29 00-0573 EA 5/8" Diameter x 48" Length Shank, Linked Welded Eye Rod..... <i>For Work In Restricted Working Space, Add</i>	88.71 5.22	8.70
23 05 29 00-0574 EA 5/8" Diameter x 60" Length Shank, Linked Welded Eye Rod..... <i>For Work In Restricted Working Space, Add</i>	94.00 5.55	9.27
23 05 29 00-0575 EA 5/8" Diameter x 72" Length Shank, Linked Welded Eye Rod..... <i>For Work In Restricted Working Space, Add</i>	98.46 5.88	9.82
23 05 29 00-0576 EA 3/4" Diameter x 16" Length Shank, Linked Welded Eye Rod..... <i>For Work In Restricted Working Space, Add</i>	94.81 4.91	8.15
23 05 29 00-0577 EA 3/4" Diameter x 20" Length Shank, Linked Welded Eye Rod..... <i>For Work In Restricted Working Space, Add</i>	97.73 5.02	8.39
23 05 29 00-0578 EA 3/4" Diameter x 24" Length Shank, Linked Welded Eye Rod..... <i>For Work In Restricted Working Space, Add</i>	99.77 5.13	8.54
23 05 29 00-0579 EA 3/4" Diameter x 30" Length Shank, Linked Welded Eye Rod..... <i>For Work In Restricted Working Space, Add</i>	102.87 5.31	8.86
23 05 29 00-0580 EA 3/4" Diameter x 36" Length Shank, Linked Welded Eye Rod..... <i>For Work In Restricted Working Space, Add</i>	107.64 5.48	9.11
23 05 29 00-0581 EA 3/4" Diameter x 48" Length Shank, Linked Welded Eye Rod..... <i>For Work In Restricted Working Space, Add</i>	114.64 5.82	9.66
23 05 29 00-0582 EA 3/4" Diameter x 60" Length Shank, Linked Welded Eye Rod..... <i>For Work In Restricted Working Space, Add</i>	121.66 6.16	10.22
23 05 29 00-0583 EA 3/4" Diameter x 72" Length Shank, Linked Welded Eye Rod..... <i>For Work In Restricted Working Space, Add</i>	129.54 6.50	10.86
23 05 29 00-0584 EA 7/8" Diameter x 16" Length Shank, Linked Welded Eye Rod..... <i>For Work In Restricted Working Space, Add</i>	113.95 5.68	9.43
23 05 29 00-0585 EA 7/8" Diameter x 20" Length Shank, Linked Welded Eye Rod..... <i>For Work In Restricted Working Space, Add</i>	117.71 5.79	9.66
23 05 29 00-0586 EA 7/8" Diameter x 24" Length Shank, Linked Welded Eye Rod..... <i>For Work In Restricted Working Space, Add</i>	120.63 5.91	9.82
23 05 29 00-0587 EA 7/8" Diameter x 30" Length Shank, Linked Welded Eye Rod..... <i>For Work In Restricted Working Space, Add</i>	123.74 6.09	10.14
23 05 29 00-0588 EA 7/8" Diameter x 36" Length Shank, Linked Welded Eye Rod..... <i>For Work In Restricted Working Space, Add</i>	129.40 6.27	10.47
23 05 29 00-0589 EA 7/8" Diameter x 48" Length Shank, Linked Welded Eye Rod..... <i>For Work In Restricted Working Space, Add</i>	138.97 6.62	11.02
23 05 29 00-0590 EA 7/8" Diameter x 60" Length Shank, Linked Welded Eye Rod..... <i>For Work In Restricted Working Space, Add</i>	147.71 6.98	11.66
23 05 29 00-0591 EA 7/8" Diameter x 72" Length Shank, Linked Welded Eye Rod..... <i>For Work In Restricted Working Space, Add</i>	157.29 7.33	12.22
23 05 29 00-0592 EA 1" Diameter x 16" Length Shank, Linked Welded Eye Rod..... <i>For Work In Restricted Working Space, Add</i>	145.29 6.76	11.26
23 05 29 00-0593 EA 1" Diameter x 20" Length Shank, Linked Welded Eye Rod..... <i>For Work In Restricted Working Space, Add</i>	149.11 6.90	11.50
23 05 29 00-0594 EA 1" Diameter x 24" Length Shank, Linked Welded Eye Rod..... <i>For Work In Restricted Working Space, Add</i>	152.92 7.03	11.75
23 05 29 00-0595 EA 1" Diameter x 30" Length Shank, Linked Welded Eye Rod..... <i>For Work In Restricted Working Space, Add</i>	156.95 7.23	12.06
23 05 29 00-0596 EA 1" Diameter x 36" Length Shank, Linked Welded Eye Rod..... <i>For Work In Restricted Working Space, Add</i>	164.30 7.43	12.38
23 05 29 00-0597 EA 1" Diameter x 48" Length Shank, Linked Welded Eye Rod..... <i>For Work In Restricted Working Space, Add</i>	175.75 7.83	13.02
23 05 29 00-0598 EA 1" Diameter x 60" Length Shank, Linked Welded Eye Rod..... <i>For Work In Restricted Working Space, Add</i>	187.18 8.23	13.74

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 05 Common Work Results For HVAC****23 05 29 Hangers And Supports For HVAC Piping And Equipment**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 29 00-0599	EA		1" Diameter x 72" Length Shank, Linked Welded Eye Rod..... <i>For Work In Restricted Working Space, Add</i>	199.39 8.63	14.37
23 05 29 00-0600			Attachments (23 05 29 00-0434)		
23 05 29 00-0601			Welded Beam Attachments (B-Line B-3083) (23 05 29 00-0600) Note: Type 22.		
23 05 29 00-0602	EA		3/8" Rod Size, Welded Beam Attachment With Pin (B-Line B-3083)..... <i>For Work In Restricted Working Space, Add</i>	33.43 4.47	7.46
23 05 29 00-0603	EA		1/2" Rod Size, Welded Beam Attachment With Pin (B-Line B-3083)..... <i>For Work In Restricted Working Space, Add</i>	35.67 4.71	7.83
23 05 29 00-0604	EA		5/8" Rod Size, Welded Beam Attachment With Pin (B-Line B-3083)..... <i>For Work In Restricted Working Space, Add</i>	37.98 4.97	8.28
23 05 29 00-0605	EA		3/4" Rod Size, Welded Beam Attachment With Pin (B-Line B-3083)..... <i>For Work In Restricted Working Space, Add</i>	48.57 5.27	8.80
23 05 29 00-0606	EA		7/8" Rod Size, Welded Beam Attachment With Pin (B-Line B-3083)..... <i>For Work In Restricted Working Space, Add</i>	58.34 5.60	9.32
23 05 29 00-0607	EA		1" Rod Size, Welded Beam Attachment With Pin (B-Line B-3083)..... <i>For Work In Restricted Working Space, Add</i>	81.91 6.40	10.66
23 05 29 00-0608	EA		1-1/8" Rod Size, Welded Beam Attachment With Pin (B-Line B-3083)..... <i>For Work In Restricted Working Space, Add</i>	116.20 6.71	11.18
23 05 29 00-0609			C-Clamp Style Beam Clamps (B-Line B-3034) (23 05 29 00-0600) Note: Type 23. Top or bottom flange mount.		
23 05 29 00-0610	EA		3/8" Rod Size, C-Clamp Style Beam Clamp (B-Line B-3034)..... <i>For Work In Restricted Working Space, Add</i>	12.25 2.99	4.07
23 05 29 00-0611	EA		1/2" Rod Size, C-Clamp Style Beam Clamp (B-Line B-3034)..... <i>For Work In Restricted Working Space, Add</i>	14.57 3.20	5.19
23 05 29 00-0612	EA		5/8" Rod Size, C-Clamp Style Beam Clamp (B-Line B-3034)..... <i>For Work In Restricted Working Space, Add</i>	16.51 3.42	5.59
23 05 29 00-0613	EA		3/4" Rod Size, C-Clamp Style Beam Clamp (B-Line B-3034)..... <i>For Work In Restricted Working Space, Add</i>	21.14 3.69	5.99
23 05 29 00-0614	EA		7/8" Rod Size, C-Clamp Style Beam Clamp (B-Line B-3034)..... <i>For Work In Restricted Working Space, Add</i>	30.51 4.00	6.39
23 05 29 00-0615			Bottom Mount I-Beam Clamps (B-Line B-3055) (23 05 29 00-0600) Note: Type 21. For attaching threaded rod centered under beam flanges.		
23 05 29 00-0616	EA		3/8" Rod Size, Up To 6" Flange Width, Bottom Mount I-Beam Clamp (B-Line B-3055)..... <i>For Work In Restricted Working Space, Add</i>	33.20 3.99	5.59
23 05 29 00-0617	EA		1/2" Rod Size, Up To 6" Flange Width, Bottom Mount I-Beam Clamp (B-Line B-3055)..... <i>For Work In Restricted Working Space, Add</i>	48.61 4.36	7.19
23 05 29 00-0618	EA		5/8" Rod Size, Up To 6" Flange Width, Bottom Mount I-Beam Clamp (B-Line B-3055)..... <i>For Work In Restricted Working Space, Add</i>	69.26 4.79	7.99
23 05 29 00-0619	EA		3/4" Rod Size, Up To 6" Flange Width, Bottom Mount I-Beam Clamp (B-Line B-3055)..... <i>For Work In Restricted Working Space, Add</i>	82.85 5.33	8.78
23 05 29 00-0620	EA		1" Rod Size, Up To 6" Flange Width, Bottom Mount I-Beam Clamp (B-Line B-3055)..... <i>For Work In Restricted Working Space, Add</i>	199.71 5.99	9.59
23 05 29 00-0621			Steel U-Bolts (B-Line B-3188) (23 05 29 00-0600) Note: Type 24. Includes plate and nuts.		
23 05 29 00-0622	EA		1/2" Pipe Size, Steel U-Bolt (B-Line B-3188)..... <i>For Work In Restricted Working Space, Add</i>	9.97 2.39	1.99
23 05 29 00-0623	EA		3/4" Pipe Size, Steel U-Bolt (B-Line B-3188)..... <i>For Work In Restricted Working Space, Add</i>	10.82 2.52	2.40
23 05 29 00-0624	EA		1" Pipe Size, Steel U-Bolt (B-Line B-3188)..... <i>For Work In Restricted Working Space, Add</i>	11.63 2.66	2.40
23 05 29 00-0625	EA		1-1/4" Pipe Size, Steel U-Bolt (B-Line B-3188)..... <i>For Work In Restricted Working Space, Add</i>	13.20 2.82	2.40
23 05 29 00-0626	EA		1-1/2" Pipe Size, Steel U-Bolt (B-Line B-3188)..... <i>For Work In Restricted Working Space, Add</i>	13.64 2.99	2.80
23 05 29 00-0627	EA		2" Pipe Size, Steel U-Bolt (B-Line B-3188)..... <i>For Work In Restricted Working Space, Add</i>	14.59 3.19	2.80
23 05 29 00-0628	EA		2-1/2" Pipe Size, Steel U-Bolt (B-Line B-3188)..... <i>For Work In Restricted Working Space, Add</i>	20.88 3.42	2.80
23 05 29 00-0629	EA		3" Pipe Size, Steel U-Bolt (B-Line B-3188)..... <i>For Work In Restricted Working Space, Add</i>	23.00 3.68	3.19
23 05 29 00-0630	EA		4" Pipe Size, Steel U-Bolt (B-Line B-3188)..... <i>For Work In Restricted Working Space, Add</i>	27.74 3.99	3.59
23 05 29 00-0631			Copper Standoff Brackets With Flange (23 05 29 00-0600) Note: Installed in wood, concrete, concrete block or steel.		
23 05 29 00-0632	EA		Clamp Size 1/2", Copper Standoff Brackets With Flange..... <i>For Work In Restricted Working Space, Add</i>	24.26 6.85	11.42
23 05 29 00-0633	EA		Clamp Size 3/4", Copper Standoff Brackets With Flange..... <i>For Work In Restricted Working Space, Add</i>	24.35 6.85	11.42
23 05 29 00-0634	EA		Clamp Size 1", Copper Standoff Brackets With Flange..... <i>For Work In Restricted Working Space, Add</i>	24.43 6.85	11.42
23 05 29 00-0635	EA		Clamp Size 1 1/4", Copper Standoff Brackets With Flange..... <i>For Work In Restricted Working Space, Add</i>	25.99 7.26	12.14



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 29 00-0636 EA Clamp Size 1 1/2", Copper Standoff Brackets With Flange <i>For Work In Restricted Working Space, Add</i>	26.16 7.26	12.14
23 05 29 00-0637 Malleable Iron Eye Sockets (B-Line B-3222) (23 05 29 00-0600) Note: Type 16.		
23 05 29 00-0638 EA 3/8" Rod Size, Malleable Iron Eye Socket <i>For Work In Restricted Working Space, Add</i>	7.43 0.73	1.20
23 05 29 00-0639 EA 1/2" Rod Size, Malleable Iron Eye Socket <i>For Work In Restricted Working Space, Add</i>	9.48 0.96	1.60
23 05 29 00-0640 EA 5/8" Rod Size, Malleable Iron Eye Socket <i>For Work In Restricted Working Space, Add</i>	16.13 0.97	1.60
23 05 29 00-0641 EA 3/4" Rod Size, Malleable Iron Eye Socket <i>For Work In Restricted Working Space, Add</i>	22.66 0.96	1.60
23 05 29 00-0642 EA 7/8" Rod Size, Malleable Iron Eye Socket <i>For Work In Restricted Working Space, Add</i>	24.50 1.20	1.99
23 05 29 00-0643 Steel Weldless Eye Nuts (B-Line B-3200) (23 05 29 00-0600) Note: Type 17.		
23 05 29 00-0644 EA 3/8" Rod Size, Steel Weldless Eye Nut..... <i>For Work In Restricted Working Space, Add</i>	23.83 0.73	1.20
23 05 29 00-0645 EA 1/2" Rod Size, Steel Weldless Eye Nut..... <i>For Work In Restricted Working Space, Add</i>	24.60 0.96	1.60
23 05 29 00-0646 EA 5/8" Rod Size, Steel Weldless Eye Nut..... <i>For Work In Restricted Working Space, Add</i>	24.63 0.97	1.60
23 05 29 00-0647 EA 3/4" Rod Size, Steel Weldless Eye Nut..... <i>For Work In Restricted Working Space, Add</i>	24.60 0.96	1.60
23 05 29 00-0648 EA 7/8" Rod Size, Steel Weldless Eye Nut..... <i>For Work In Restricted Working Space, Add</i>	47.79 1.08	1.75
23 05 29 00-0649 EA 1" Rod Size, Steel Weldless Eye Nut..... <i>For Work In Restricted Working Space, Add</i>	48.18 1.20	1.99
23 05 29 00-0650 Top Mount I-Beam Clamps (B-Line B-3042) (23 05 29 00-0600) Note: For attaching threaded rod to either side of an I-beam.		
23 05 29 00-0651 EA 3/8" Rod Size, Up To 6" Flange Width, Top Mount I-Beam Clamp <i>For Work In Restricted Working Space, Add</i>	16.55 2.24	3.73
23 05 29 00-0652 EA 1/2" Rod Size, Up To 6" Flange Width, Top Mount I-Beam Clamp <i>For Work In Restricted Working Space, Add</i>	19.87 2.47	4.10
23 05 29 00-0653 EA 5/8" Rod Size, Up To 6" Flange Width, Top Mount I-Beam Clamp <i>For Work In Restricted Working Space, Add</i>	24.00 2.71	4.48
23 05 29 00-0654 EA 3/4" Rod Size, Up To 6" Flange Width, Top Mount I-Beam Clamp <i>For Work In Restricted Working Space, Add</i>	32.80 2.85	4.85
23 05 29 00-0655 EA 7/8" Rod Size, Up To 6" Flange Width, Top Mount I-Beam Clamp <i>For Work In Restricted Working Space, Add</i>	50.10 3.35	5.59
23 05 29 00-0656 EA 3/8" Rod Size, >6" To 8" Flange Width, Top Mount I-Beam Clamp <i>For Work In Restricted Working Space, Add</i>	17.40 2.24	3.73
23 05 29 00-0657 EA 1/2" Rod Size, >6" To 8" Flange Width, Top Mount I-Beam Clamp <i>For Work In Restricted Working Space, Add</i>	21.06 2.47	4.10
23 05 29 00-0658 EA 5/8" Rod Size, >6" To 8" Flange Width, Top Mount I-Beam Clamp <i>For Work In Restricted Working Space, Add</i>	24.00 2.71	4.48
23 05 29 00-0659 EA 3/4" Rod Size, >6" To 8" Flange Width, Top Mount I-Beam Clamp <i>For Work In Restricted Working Space, Add</i>	35.93 2.85	4.85
23 05 29 00-0660 EA 7/8" Rod Size, >6" To 8" Flange Width, Top Mount I-Beam Clamp <i>For Work In Restricted Working Space, Add</i>	55.46 3.35	5.59
23 05 29 00-0661 EA 3/8" Rod Size, >8" To 12" Flange Width, Top Mount I-Beam Clamp <i>For Work In Restricted Working Space, Add</i>	19.36 2.24	3.73
23 05 29 00-0662 EA 1/2" Rod Size, >8" To 12" Flange Width, Top Mount I-Beam Clamp <i>For Work In Restricted Working Space, Add</i>	23.27 2.47	4.10
23 05 29 00-0663 EA 5/8" Rod Size, >8" To 12" Flange Width, Top Mount I-Beam Clamp <i>For Work In Restricted Working Space, Add</i>	29.17 2.71	4.48
23 05 29 00-0664 EA 3/4" Rod Size, >8" To 12" Flange Width, Top Mount I-Beam Clamp <i>For Work In Restricted Working Space, Add</i>	41.80 2.85	4.85
23 05 29 00-0665 EA 7/8" Rod Size, >8" To 12" Flange Width, Top Mount I-Beam Clamp <i>For Work In Restricted Working Space, Add</i>	66.93 3.35	5.59
23 05 29 00-0666 Side Beam Brackets (B-Line B-3062) (23 05 29 00-0600) Note: Type 34.		
23 05 29 00-0667 EA 3/8" Rod Size, Side Beam Bracket <i>For Work In Restricted Working Space, Add</i>	13.64 2.99	5.19
23 05 29 00-0668 EA 1/2" Rod Size, Side Beam Bracket <i>For Work In Restricted Working Space, Add</i>	16.08 3.20	5.19
23 05 29 00-0669 EA 5/8" Rod Size, Side Beam Bracket <i>For Work In Restricted Working Space, Add</i>	20.68 3.42	5.59
23 05 29 00-0670 EA 3/4" Rod Size, Side Beam Bracket <i>For Work In Restricted Working Space, Add</i>	36.26 3.69	5.99
23 05 29 00-0671 EA 7/8" Rod Size, Side Beam Bracket <i>For Work In Restricted Working Space, Add</i>	42.39 4.00	6.79
23 05 29 00-0672 Hex Lag Bolts (23 05 29 00-0600) Note: Also known as coach screws.		

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 05 Common Work Results For HVAC****23 05 29 Hangers And Supports For HVAC Piping And Equipment**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 29 00-0673	EA		3/8" x 3-1/2" Long, Hex Lag Bolt.....	2.10	
			<i>For Work In Restricted Working Space, Add</i>	0.50	
23 05 29 00-0674	EA		3/8" x 4" Long, Hex Lag Bolt.....	2.13	
			<i>For Work In Restricted Working Space, Add</i>	0.52	
23 05 29 00-0675	EA		3/8" x 6" Long, Hex Lag Bolt.....	2.38	
			<i>For Work In Restricted Working Space, Add</i>	0.53	
23 05 29 00-0676	EA		3/8" x 8" Long, Hex Lag Bolt.....	2.83	
			<i>For Work In Restricted Working Space, Add</i>	0.56	
23 05 29 00-0677	EA		3/8" x 10" Long, Hex Lag Bolt.....	3.01	
			<i>For Work In Restricted Working Space, Add</i>	0.58	
23 05 29 00-0678	EA		3/8" x 12" Long, Hex Lag Bolt.....	3.74	
			<i>For Work In Restricted Working Space, Add</i>	0.60	
23 05 29 00-0679	EA		1/2" x 3-1/2" Long, Hex Lag Bolt.....	2.83	
			<i>For Work In Restricted Working Space, Add</i>	0.60	
23 05 29 00-0680	EA		1/2" x 4" Long, Hex Lag Bolt.....	2.87	
			<i>For Work In Restricted Working Space, Add</i>	0.62	
23 05 29 00-0681	EA		1/2" x 6" Long, Hex Lag Bolt.....	3.31	
			<i>For Work In Restricted Working Space, Add</i>	0.65	
23 05 29 00-0682	EA		1/2" x 8" Long, Hex Lag Bolt.....	3.81	
			<i>For Work In Restricted Working Space, Add</i>	0.68	
23 05 29 00-0683	EA		1/2" x 10" Long, Hex Lag Bolt.....	4.46	
			<i>For Work In Restricted Working Space, Add</i>	0.71	
23 05 29 00-0684	EA		1/2" x 12" Long, Hex Lag Bolt.....	4.77	
			<i>For Work In Restricted Working Space, Add</i>	0.75	
23 05 29 00-0685	EA		5/8" x 4" Long, Hex Lag Bolt.....	3.85	
			<i>For Work In Restricted Working Space, Add</i>	0.67	
23 05 29 00-0686	EA		3/4" x 5" Long, Hex Lag Bolt.....	4.47	
			<i>For Work In Restricted Working Space, Add</i>	0.68	
23 05 29 00-0687			Shields And Saddles (23 05 29)		
23 05 29 00-0688			Insulation Protection Shield (23 05 29 00-0687)		
			Note: Type 40.		
23 05 29 00-0689			Insulation Protection Shield (Cooper B-Line B3151) (23 05 29 00-0688)		
			Note: Type 40.		
23 05 29 00-0690	EA		1-1/2" Outside Diameter, 18 Gauge Insulation Protection Shield, 12" Length.....	11.58	1.91
			<i>For Work In Restricted Working Space, Add</i>	1.92	
23 05 29 00-0691	EA		2" Outside Diameter, 18 Gauge Insulation Protection Shield, 12" Length.....	11.75	1.94
			<i>For Work In Restricted Working Space, Add</i>	1.94	
23 05 29 00-0692	EA		2-1/2" Outside Diameter, 18 Gauge Insulation Protection Shield, 12" Length.....	12.05	1.96
			<i>For Work In Restricted Working Space, Add</i>	1.97	
23 05 29 00-0693	EA		3" Outside Diameter, 18 Gauge Insulation Protection Shield, 12" Length.....	12.62	1.98
			<i>For Work In Restricted Working Space, Add</i>	1.99	
23 05 29 00-0694	EA		4" Outside Diameter, 18 Gauge Insulation Protection Shield, 12" Length.....	14.01	2.03
			<i>For Work In Restricted Working Space, Add</i>	2.04	
23 05 29 00-0695	EA		6" Outside Diameter, 18 Gauge Insulation Protection Shield, 12" Length.....	17.19	2.09
			<i>For Work In Restricted Working Space, Add</i>	2.09	
23 05 29 00-0696	EA		8" Outside Diameter, 16 Gauge Insulation Protection Shield, 18" Length.....	20.06	2.14
			<i>For Work In Restricted Working Space, Add</i>	2.13	
23 05 29 00-0697	EA		10" Outside Diameter, 16 Gauge Insulation Protection Shield, 18" Length.....	24.63	2.18
			<i>For Work In Restricted Working Space, Add</i>	2.18	
23 05 29 00-0698	EA		12" Outside Diameter, 14 Gauge Insulation Protection Shield, 24" Length.....	31.76	2.21
			<i>For Work In Restricted Working Space, Add</i>	2.21	
23 05 29 00-0699	EA		14" Outside Diameter, 14 Gauge Insulation Protection Shield, 24" Length.....	34.63	2.23
			<i>For Work In Restricted Working Space, Add</i>	2.23	
23 05 29 00-0700	EA		16" Outside Diameter, 14 Gauge Insulation Protection Shield, 24" Length.....	47.86	2.26
			<i>For Work In Restricted Working Space, Add</i>	2.25	
23 05 29 00-0701	EA		18" Outside Diameter, 14 Gauge Insulation Protection Shield, 24" Length.....	53.84	2.28
			<i>For Work In Restricted Working Space, Add</i>	2.28	
23 05 29 00-0702	EA		20" Outside Diameter, 12 Gauge Insulation Protection Shield, 24" Length.....	100.35	2.30
			<i>For Work In Restricted Working Space, Add</i>	2.30	
23 05 29 00-0703	EA		24" Outside Diameter, 12 Gauge Insulation Protection Shield, 24" Length.....	109.11	2.35
			<i>For Work In Restricted Working Space, Add</i>	2.35	
23 05 29 00-0704	EA		30" Outside Diameter, 12 Gauge Insulation Protection Shield, 24" Length.....	131.98	2.40
			<i>For Work In Restricted Working Space, Add</i>	2.40	
23 05 29 00-0705			Insulation Protection Shield (Cooper B-Line B3154) (23 05 29 00-0688)		
			Note: Type 40.		
23 05 29 00-0706	EA		1-1/2" Outside Diameter, 18 Gauge Insulation Protection Shield, 8" Length.....	10.15	1.91
			<i>For Work In Restricted Working Space, Add</i>	1.92	
23 05 29 00-0707	EA		2" Outside Diameter, 18 Gauge Insulation Protection Shield, 8" Length.....	10.30	1.94
			<i>For Work In Restricted Working Space, Add</i>	1.94	
23 05 29 00-0708	EA		2-1/2" Outside Diameter, 18 Gauge Insulation Protection Shield, 8" Length.....	10.53	1.96
			<i>For Work In Restricted Working Space, Add</i>	1.97	
23 05 29 00-0709	EA		3" Outside Diameter, 18 Gauge Insulation Protection Shield, 8" Length.....	10.98	1.98
			<i>For Work In Restricted Working Space, Add</i>	1.99	
23 05 29 00-0710	EA		4" Outside Diameter, 18 Gauge Insulation Protection Shield, 8" Length.....	12.02	2.03
			<i>For Work In Restricted Working Space, Add</i>	2.04	
23 05 29 00-0711	EA		6" Outside Diameter, 18 Gauge Insulation Protection Shield, 8" Length.....	14.37	2.09
			<i>For Work In Restricted Working Space, Add</i>	2.09	
23 05 29 00-0712	EA		8" Outside Diameter, 16 Gauge Insulation Protection Shield, 12" Length.....	15.48	2.14
			<i>For Work In Restricted Working Space, Add</i>	2.13	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 29 00-0713 EA 10" Outside Diameter, 16 Gauge Insulation Protection Shield, 12" Length <i>For Work In Restricted Working Space, Add</i>	19.85 2.18	2.18
23 05 29 00-0714 EA 12" Outside Diameter, 14 Gauge Insulation Protection Shield, 12" Length <i>For Work In Restricted Working Space, Add</i>	23.93 2.21	2.21
23 05 29 00-0715 Pipe Covering Protection Saddle (23 05 29 00-0687) Note: Type 39, sizes are pipe sizes.		
23 05 29 00-0716 Saddle, For 1" Insulation (Cooper B-Line B3160) (23 05 29 00-0715) Note: Type 39.		
23 05 29 00-0717 EA 3/4" Pipe Saddle, Type 39 (For 1" Insulation) <i>For Work In Restricted Working Space, Add</i>	17.86 2.64	2.64
23 05 29 00-0718 EA 1" Pipe Saddle, Type 39 (For 1" Insulation) <i>For Work In Restricted Working Space, Add</i>	17.93 2.66	2.66
23 05 29 00-0719 EA 1-1/4" Pipe Saddle, Type 39 (For 1" Insulation) <i>For Work In Restricted Working Space, Add</i>	18.02 2.69	2.69
23 05 29 00-0720 EA 1-1/2" Pipe Saddle, Type 39 (For 1" Insulation) <i>For Work In Restricted Working Space, Add</i>	18.93 2.73	2.73
23 05 29 00-0721 EA 2" Pipe Saddle, Type 39 (For 1" Insulation) <i>For Work In Restricted Working Space, Add</i>	19.00 2.75	2.75
23 05 29 00-0722 EA 2-1/2" Pipe Saddle, Type 39 (For 1" Insulation) <i>For Work In Restricted Working Space, Add</i>	19.64 2.80	2.80
23 05 29 00-0723 EA 3" Pipe Saddle, Type 39 (For 1" Insulation) <i>For Work In Restricted Working Space, Add</i>	21.94 2.84	2.84
23 05 29 00-0724 EA 4" Pipe Saddle, Type 39 (For 1" Insulation) <i>For Work In Restricted Working Space, Add</i>	24.72 2.89	2.88
23 05 29 00-0725 EA 6" Pipe Saddle, Type 39 (For 1" Insulation) <i>For Work In Restricted Working Space, Add</i>	27.89 2.98	2.98
23 05 29 00-0726 EA 8" Pipe Saddle, Type 39 (For 1" Insulation) <i>For Work In Restricted Working Space, Add</i>	34.13 3.09	3.09
23 05 29 00-0727 EA 10" Pipe Saddle, Type 39 (For 1" Insulation) <i>For Work In Restricted Working Space, Add</i>	38.24 3.13	3.13
23 05 29 00-0728 EA 12" Pipe Saddle, Type 39 (For 1" Insulation) <i>For Work In Restricted Working Space, Add</i>	45.50 3.20	3.13
23 05 29 00-0729 EA 14" Pipe Saddle, Type 39 (For 1" Insulation) <i>For Work In Restricted Working Space, Add</i>	49.77 3.25	3.24
23 05 29 00-0730 Saddle, For 1-1/2" Insulation (Cooper B-Line B3161) (23 05 29 00-0715) Note: Type 39.		
23 05 29 00-0731 EA 3/4" Pipe Saddle, Type 39 (For 1-1/2" Insulation) <i>For Work In Restricted Working Space, Add</i>	20.28 2.64	2.64
23 05 29 00-0732 EA 1" Pipe Saddle, Type 39 (For 1-1/2" Insulation) <i>For Work In Restricted Working Space, Add</i>	20.35 2.66	2.66
23 05 29 00-0733 EA 1-1/4" Pipe Saddle, Type 39 (For 1-1/2" Insulation) <i>For Work In Restricted Working Space, Add</i>	20.44 2.69	2.69
23 05 29 00-0734 EA 1-1/2" Pipe Saddle, Type 39 (For 1-1/2" Insulation) <i>For Work In Restricted Working Space, Add</i>	21.18 2.73	2.73
23 05 29 00-0735 EA 2" Pipe Saddle, Type 39 (For 1-1/2" Insulation) <i>For Work In Restricted Working Space, Add</i>	22.93 2.75	2.75
23 05 29 00-0736 EA 2-1/2" Pipe Saddle, Type 39 (For 1-1/2" Insulation) <i>For Work In Restricted Working Space, Add</i>	24.75 2.80	2.80
23 05 29 00-0737 EA 3" Pipe Saddle, Type 39 (For 1-1/2" Insulation) <i>For Work In Restricted Working Space, Add</i>	25.18 2.84	2.84
23 05 29 00-0738 EA 4" Pipe Saddle, Type 39 (For 1-1/2" Insulation) <i>For Work In Restricted Working Space, Add</i>	28.71 2.89	2.84
23 05 29 00-0739 EA 6" Pipe Saddle, Type 39 (For 1-1/2" Insulation) <i>For Work In Restricted Working Space, Add</i>	32.40 2.98	2.98
23 05 29 00-0740 EA 8" Pipe Saddle, Type 39 (For 1-1/2" Insulation) <i>For Work In Restricted Working Space, Add</i>	38.55 3.09	3.09
23 05 29 00-0741 EA 10" Pipe Saddle, Type 39 (For 1-1/2" Insulation) <i>For Work In Restricted Working Space, Add</i>	43.47 3.13	3.13
23 05 29 00-0742 EA 12" Pipe Saddle, Type 39 (For 1-1/2" Insulation) <i>For Work In Restricted Working Space, Add</i>	51.95 3.20	3.20
23 05 29 00-0743 EA 14" Pipe Saddle, Type 39 (For 1-1/2" Insulation) <i>For Work In Restricted Working Space, Add</i>	57.01 3.25	3.24
23 05 29 00-0744 Saddle, For 2" Insulation (Cooper B-Line B3162) (23 05 29 00-0715) Note: Type 39.		
23 05 29 00-0745 EA 3/4" Pipe Saddle, Type 39 (For 2" Insulation) <i>For Work In Restricted Working Space, Add</i>	21.72 2.78	2.77
23 05 29 00-0746 EA 1" Pipe Saddle, Type 39 (For 2" Insulation) <i>For Work In Restricted Working Space, Add</i>	21.79 2.80	2.80
23 05 29 00-0747 EA 1-1/4" Pipe Saddle, Type 39 (For 2" Insulation) <i>For Work In Restricted Working Space, Add</i>	23.00 2.82	2.82
23 05 29 00-0748 EA 1-1/2" Pipe Saddle, Type 39 (For 2" Insulation) <i>For Work In Restricted Working Space, Add</i>	23.71 2.87	2.86
23 05 29 00-0749 EA 2" Pipe Saddle, Type 39 (For 2" Insulation) <i>For Work In Restricted Working Space, Add</i>	24.35 2.89	2.88
23 05 29 00-0750 EA 2-1/2" Pipe Saddle, Type 39 (For 2" Insulation) <i>For Work In Restricted Working Space, Add</i>	24.50 2.93	2.93

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 05 Common Work Results For HVAC****23 05 29 Hangers And Supports For HVAC Piping And Equipment**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 29 00-0751	EA		3" Pipe Saddle, Type 39 (For 2" Insulation)	25.94	2.99
			<i>For Work In Restricted Working Space, Add</i>	2.98	
23 05 29 00-0752	EA		4" Pipe Saddle, Type 39 (For 2" Insulation)	27.39	3.03
			<i>For Work In Restricted Working Space, Add</i>	3.02	
23 05 29 00-0753	EA		6" Pipe Saddle, Type 39 (For 2" Insulation)	35.23	3.13
			<i>For Work In Restricted Working Space, Add</i>	3.13	
23 05 29 00-0754	EA		8" Pipe Saddle, Type 39 (For 2" Insulation)	40.07	3.24
			<i>For Work In Restricted Working Space, Add</i>	3.25	
23 05 29 00-0755	EA		10" Pipe Saddle, Type 39 (For 2" Insulation)	42.13	3.29
			<i>For Work In Restricted Working Space, Add</i>	3.29	
23 05 29 00-0756	EA		12" Pipe Saddle, Type 39 (For 2" Insulation)	57.30	3.35
			<i>For Work In Restricted Working Space, Add</i>	3.35	
23 05 29 00-0757			Saddle, For 2-1/2" Insulation (Cooper B-Line B3163) <small>(23 05 29 00-0715)</small>		
			Note: Type 39.		
23 05 29 00-0758	EA		1-1/4" Pipe Saddle, Type 39 (For 2-1/2" Insulation)	24.43	2.88
			<i>For Work In Restricted Working Space, Add</i>	2.89	
23 05 29 00-0759	EA		1-1/2" Pipe Saddle, Type 39 (For 2-1/2" Insulation)	25.84	2.93
			<i>For Work In Restricted Working Space, Add</i>	2.93	
23 05 29 00-0760	EA		2" Pipe Saddle, Type 39 (For 2-1/2" Insulation)	26.56	2.96
			<i>For Work In Restricted Working Space, Add</i>	2.96	
23 05 29 00-0761	EA		2-1/2" Pipe Saddle, Type 39 (For 2-1/2" Insulation)	27.34	3.01
			<i>For Work In Restricted Working Space, Add</i>	3.00	
23 05 29 00-0762	EA		3" Pipe Saddle, Type 39 (For 2-1/2" Insulation)	27.56	3.06
			<i>For Work In Restricted Working Space, Add</i>	3.07	
23 05 29 00-0763	EA		4" Pipe Saddle, Type 39 (For 2-1/2" Insulation)	32.25	3.11
			<i>For Work In Restricted Working Space, Add</i>	3.11	
23 05 29 00-0764	EA		6" Pipe Saddle, Type 39 (For 2-1/2" Insulation)	37.09	3.20
			<i>For Work In Restricted Working Space, Add</i>	3.20	
23 05 29 00-0765	EA		8" Pipe Saddle, Type 39 (For 2-1/2" Insulation)	43.41	3.32
			<i>For Work In Restricted Working Space, Add</i>	3.31	
23 05 29 00-0766	EA		10" Pipe Saddle, Type 39 (For 2-1/2" Insulation)	46.61	3.37
			<i>For Work In Restricted Working Space, Add</i>	3.38	
23 05 29 00-0767	EA		12" Pipe Saddle, Type 39 (For 2-1/2" Insulation)	58.79	3.44
			<i>For Work In Restricted Working Space, Add</i>	3.45	
23 05 29 00-0768			Adjustable Pipe Saddle Support (Cooper B-Line B3096) <small>(23 05 29 00-0687)</small>		
			Note: Type 38.		
23 05 29 00-0769	EA		2" Adjustable Pipe Saddle Support, Type 38	70.90	9.98
23 05 29 00-0770	EA		3" Adjustable Pipe Saddle Support, Type 38	74.95	11.58
23 05 29 00-0771	EA		4" Adjustable Pipe Saddle Support, Type 38	91.20	13.18
23 05 29 00-0772	EA		5" Adjustable Pipe Saddle Support, Type 38	94.99	14.37
23 05 29 00-0773	EA		6" Adjustable Pipe Saddle Support, Type 38	105.39	15.98
23 05 29 00-0774	EA		8" Adjustable Pipe Saddle Support, Type 38	119.40	19.97
23 05 29 00-0775	EA		10" Adjustable Pipe Saddle Support, Type 38	156.01	26.75
23 05 29 00-0776	EA		12" Adjustable Pipe Saddle Support, Type 38	191.16	39.94
23 05 29 00-0777			Pipe Stanchion Support (Cooper B-Line B3090) <small>(23 05 29 00-0687)</small>		
			Note: Type 37.		
23 05 29 00-0778	EA		2-1/2" Pipe Support With U-Bolt, Type 37	88.30	9.98
23 05 29 00-0779	EA		3" Pipe Support With U-Bolt, Type 37	91.16	11.58
23 05 29 00-0780	EA		3-1/2" Pipe Support With U-Bolt, Type 37	97.63	12.38
23 05 29 00-0781	EA		4" Pipe Support With U-Bolt, Type 37	99.49	13.18
23 05 29 00-0782	EA		5" Pipe Support With U-Bolt, Type 37	104.53	14.37
23 05 29 00-0783	EA		6" Pipe Support With U-Bolt, Type 37	110.64	15.98
23 05 29 00-0784	EA		8" Pipe Support With U-Bolt, Type 37	140.58	19.97
23 05 29 00-0785	EA		10" Pipe Support With U-Bolt, Type 37	189.71	26.75
23 05 29 00-0786	EA		12" Pipe Support With U-Bolt, Type 37	246.94	39.94
23 05 29 00-0787			Pipe Saddle Support (Cooper B-Line B3095) <small>(23 05 29 00-0687)</small>		
			Note: Type 36.		
23 05 29 00-0788	EA		2-1/2" Pipe Saddle Support, Type 36	44.19	9.98
23 05 29 00-0789	EA		3" Pipe Saddle Support, Type 36	47.05	11.58
23 05 29 00-0790	EA		3-1/2" Pipe Saddle Support, Type 36	72.05	12.38
23 05 29 00-0791	EA		4" Pipe Saddle Support, Type 36	73.91	13.18
23 05 29 00-0792	EA		5" Pipe Saddle Support, Type 36	81.33	14.37
23 05 29 00-0793	EA		6" Pipe Saddle Support, Type 36	90.14	15.98
23 05 29 00-0794	EA		8" Pipe Saddle Support, Type 36	103.02	19.97
23 05 29 00-0795	EA		10" Pipe Saddle Support, Type 36	119.39	26.75
23 05 29 00-0796	EA		12" Pipe Saddle Support, Type 36	149.35	39.94
23 05 29 00-0797			360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate <small>(23 05 29 00-0687)</small>		
			Note: Insert is for use as isolated protective insulation at hangers.		
23 05 29 00-0798			1" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate <small>(23 05 29 00-0797)</small>		
23 05 29 00-0799	EA		1/2" Diameter Pipe, 1" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate	10.14	4.49



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 29 00-0800	EA			3/4" Diameter Pipe, 1" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	10.32	4.49
23 05 29 00-0801	EA			1" Diameter Pipe, 1" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	10.37	4.49
23 05 29 00-0802	EA			1-1/4" Diameter Pipe, 1" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	10.56	4.49
23 05 29 00-0803	EA			1-1/2" Diameter Pipe, 1" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	11.30	4.76
23 05 29 00-0804	EA			2" Diameter Pipe, 1" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	11.80	4.90
23 05 29 00-0805	EA			2-1/2" Diameter Pipe, 1" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	12.38	5.10
23 05 29 00-0806	EA			3" Diameter Pipe, 1" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	13.03	5.31
23 05 29 00-0807	EA			4" Diameter Pipe, 1" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	14.16	5.51
23 05 29 00-0808	EA			6" Diameter Pipe, 1" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	15.06	4.76
23 05 29 00-0809				1-1/2" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate <small>(23 05 29 00-0797)</small>		
23 05 29 00-0810	EA			1/2" Diameter Pipe, 1-1/2" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	8.71	3.38
23 05 29 00-0811	EA			3/4" Diameter Pipe, 1-1/2" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	9.64	3.38
23 05 29 00-0812	EA			1" Diameter Pipe, 1-1/2" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	9.86	3.45
23 05 29 00-0813	EA			1-1/4" Diameter Pipe, 1-1/2" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	10.20	3.52
23 05 29 00-0814	EA			1-1/2" Diameter Pipe, 1-1/2" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	10.51	3.52
23 05 29 00-0815	EA			2" Diameter Pipe, 1-1/2" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	11.07	3.65
23 05 29 00-0816	EA			2-1/2" Diameter Pipe, 1-1/2" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	11.69	3.79
23 05 29 00-0817	EA			3" Diameter Pipe, 1-1/2" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	12.03	3.86
23 05 29 00-0818	EA			4" Diameter Pipe, 1-1/2" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	13.24	4.20
23 05 29 00-0819	EA			6" Diameter Pipe, 1-1/2" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	19.71	7.24
23 05 29 00-0820	EA			8" Diameter Pipe, 1-1/2" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	17.87	5.44
23 05 29 00-0821	EA			10" Diameter Pipe, 1-1/2" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	21.63	6.41
23 05 29 00-0822	EA			12" Diameter Pipe, 1-1/2" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	24.56	7.38
23 05 29 00-0823				2" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate <small>(23 05 29 00-0797)</small>		
23 05 29 00-0824	EA			1/2" Diameter Pipe, 2" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	12.13	3.86
23 05 29 00-0825	EA			3/4" Diameter Pipe, 2" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	12.28	3.86
23 05 29 00-0826	EA			1" Diameter Pipe, 2" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	12.70	3.93
23 05 29 00-0827	EA			1-1/4" Diameter Pipe, 2" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	13.06	4.00
23 05 29 00-0828	EA			1-1/2" Diameter Pipe, 2" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	13.45	4.06
23 05 29 00-0829	EA			2" Diameter Pipe, 2" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	13.97	4.20
23 05 29 00-0830	EA			2-1/2" Diameter Pipe, 2" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	14.72	4.34
23 05 29 00-0831	EA			3" Diameter Pipe, 2" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	15.42	4.49
23 05 29 00-0832	EA			4" Diameter Pipe, 2" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	16.98	4.76
23 05 29 00-0833	EA			6" Diameter Pipe, 2" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	19.42	5.37
23 05 29 00-0834	EA			8" Diameter Pipe, 2" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	30.17	9.17
23 05 29 00-0835	EA			10" Diameter Pipe, 2" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	32.99	10.61
23 05 29 00-0836	EA			12" Diameter Pipe, 2" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	38.06	12.55
23 05 29 00-0837				2-1/2" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate <small>(23 05 29 00-0797)</small>		
23 05 29 00-0838	EA			1/2" Diameter Pipe, 2-1/2" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	13.89	4.49
23 05 29 00-0839	EA			3/4" Diameter Pipe, 2-1/2" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	14.06	4.49
23 05 29 00-0840	EA			1" Diameter Pipe, 2-1/2" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	14.57	4.55
23 05 29 00-0841	EA			1-1/4" Diameter Pipe, 2-1/2" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	14.95	4.62
23 05 29 00-0842	EA			1-1/2" Diameter Pipe, 2-1/2" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	15.34	4.62
23 05 29 00-0843	EA			2" Diameter Pipe, 2-1/2" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	15.98	4.83
23 05 29 00-0844	EA			2-1/2" Diameter Pipe, 2-1/2" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	16.83	4.96
23 05 29 00-0845	EA			3" Diameter Pipe, 2-1/2" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	17.62	5.17
23 05 29 00-0846	EA			4" Diameter Pipe, 2-1/2" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	19.37	5.44
23 05 29 00-0847	EA			6" Diameter Pipe, 2-1/2" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	22.20	6.20
23 05 29 00-0848	EA			8" Diameter Pipe, 2-1/2" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	29.08	6.89
23 05 29 00-0849	EA			10" Diameter Pipe, 2-1/2" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	34.61	7.92
23 05 29 00-0850	EA			12" Diameter Pipe, 2-1/2" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	39.68	9.86
23 05 29 00-0851				3" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate <small>(23 05 29 00-0797)</small>		
23 05 29 00-0852	EA			1/2" Diameter Pipe, 3" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	25.99	4.62
23 05 29 00-0853	EA			3/4" Diameter Pipe, 3" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	30.87	4.83
23 05 29 00-0854	EA			1" Diameter Pipe, 3" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	32.04	4.83
23 05 29 00-0855	EA			1-1/4" Diameter Pipe, 3" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	32.80	4.96
23 05 29 00-0856	EA			1-1/2" Diameter Pipe, 3" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	33.70	5.10
23 05 29 00-0857	EA			2" Diameter Pipe, 3" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	34.71	5.17
23 05 29 00-0858	EA			2-1/2" Diameter Pipe, 3" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	36.52	5.31
23 05 29 00-0859	EA			3" Diameter Pipe, 3" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	38.10	5.65
23 05 29 00-0860	EA			4" Diameter Pipe, 3" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	41.94	5.86
23 05 29 00-0861	EA			6" Diameter Pipe, 3" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	47.98	7.17
23 05 29 00-0862	EA			8" Diameter Pipe, 3" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	61.72	7.86
23 05 29 00-0863	EA			10" Diameter Pipe, 3" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	73.36	8.28
23 05 29 00-0864	EA			12" Diameter Pipe, 3" Thick 360 Degree Thermal Hanger Shield, Pre-Insulated With Calcium Silicate.....	84.36	10.68

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 05 Common Work Results For HVAC****23 05 29 Hangers And Supports For HVAC Piping And Equipment**

MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
23 05 29 00-0865		Equipment Housekeeping Pads <small>(23 05 29)</small> See CSI section 03 31 13 00-0108 for Concrete Equipment Pads.			
23 05 29 00-0866		Molded Plastic Condenser Pad <small>(23 05 29 00-0865)</small>			
23 05 29 00-0867	EA	30" Round Molded Plastic Pad	50.53		9.98
23 05 29 00-0868	EA	30" Octagon Molded Plastic Pad	52.54		9.98
23 05 29 00-0869	EA	30" x 30" Molded Plastic Pad.....	50.53		9.98
23 05 29 00-0870	EA	36" x 36" Molded Plastic Pad.....	62.58		9.98
23 05 29 00-0871	EA	36" x 48" Molded Plastic Pad.....	85.13		9.98
23 05 29 00-0872		Inertia Base <small>(23 05 29 00-0865)</small> Note: Includes spring isolators.			
23 05 29 00-0873	EA	Up To 12 SF Inertia Base, 8" Thick With Spring Base	749.32		
23 05 29 00-0874	EA	>12 To 16 SF Inertia Base, 8" Thick With Spring Base.....	903.04		
23 05 29 00-0875	EA	>16 To 20 SF Inertia Base, 8" Thick With Spring Base.....	1,034.18		
23 05 29 00-0876	EA	>20 To 24 SF Inertia Base, 8" Thick With Spring Base.....	1,180.38		
23 05 29 00-0877		Hanger Assemblies <small>(23 05 29)</small> Note: Includes hanger, rod, nuts, washers, clamps, upper attachment, etc. Not for use where detail is available.			
23 05 29 00-0878	EA	1/2" Standard Duty Clevis Pipe Hanger Assembly.....	34.56		12.41
		Note: Includes hanger, rod, nuts, washers and clamp.			
		<i>For Work In Restricted Working Space, Add</i>	7.99		
23 05 29 00-0879	EA	3/4" Standard Duty Clevis Pipe Hanger Assembly.....	36.03		13.15
		Note: Includes hanger, rod, nuts, washers and clamp.			
		<i>For Work In Restricted Working Space, Add</i>	8.43		
23 05 29 00-0880	EA	1" Standard Duty Clevis Pipe Hanger Assembly.....	37.27		13.95
		Note: Includes hanger, rod, nuts, washers and clamp.			
		<i>For Work In Restricted Working Space, Add</i>	8.78		
23 05 29 00-0881	EA	1-1/4" Standard Duty Clevis Pipe Hanger Assembly.....	37.93		13.97
		Note: Includes hanger, rod, nuts, washers and clamp.			
		<i>For Work In Restricted Working Space, Add</i>	8.92		
23 05 29 00-0882	EA	1-1/2" Standard Duty Clevis Pipe Hanger Assembly.....	38.13		13.97
		Note: Includes hanger, rod, nuts, washers and clamp.			
		<i>For Work In Restricted Working Space, Add</i>	8.92		
23 05 29 00-0883	EA	2" Standard Duty Clevis Pipe Hanger Assembly.....	38.96		14.08
		Note: Includes hanger, rod, nuts, washers and clamp.			
		<i>For Work In Restricted Working Space, Add</i>	9.05		
23 05 29 00-0884	EA	2-1/2" Standard Duty Clevis Pipe Hanger Assembly.....	46.03		15.45
		Note: Includes hanger, rod, nuts, washers and clamp.			
		<i>For Work In Restricted Working Space, Add</i>	9.44		
23 05 29 00-0885	EA	3" Standard Duty Clevis Pipe Hanger Assembly.....	47.51		15.90
		Note: Includes hanger, rod, nuts, washers and clamp.			
		<i>For Work In Restricted Working Space, Add</i>	9.59		
23 05 29 00-0886	EA	4" Standard Duty Clevis Pipe Hanger Assembly.....	57.08		17.94
		Note: Includes hanger, rod, nuts, washers and clamp.			
		<i>For Work In Restricted Working Space, Add</i>	10.59		
23 05 29 00-0887	EA	6" Standard Duty Clevis Pipe Hanger Assembly.....	84.35		23.19
		Note: Includes hanger, rod, nuts, washers and clamp.			
		<i>For Work In Restricted Working Space, Add</i>	13.91		
23 05 29 00-0888	EA	8" Standard Duty Clevis Pipe Hanger Assembly.....	98.33		26.89
		Note: Includes hanger, rod, nuts, washers and clamp.			
		<i>For Work In Restricted Working Space, Add</i>	16.13		
23 05 29 00-0889	EA	10" Standard Duty Clevis Pipe Hanger Assembly.....	135.97		34.16
		Note: Includes hanger, rod, nuts, washers and clamp.			
		<i>For Work In Restricted Working Space, Add</i>	20.24		
23 05 29 00-0890	EA	12" Standard Duty Clevis Pipe Hanger Assembly.....	149.81		36.76
		Note: Includes hanger, rod, nuts, washers and clamp.			
		<i>For Work In Restricted Working Space, Add</i>	22.10		
23 05 29 00-0891		Steel Shapes For Hanger Devices <small>(23 05 29)</small>			
23 05 29 00-0892		Angle Iron <small>(23 05 29 00-0891)</small>			
23 05 29 00-0893	LF	1/2" x 1/2" x 1/8" Angle Iron	1.81		1.16
23 05 29 00-0894	LF	3/4" x 3/4" x 1/8" Angle Iron	2.36		1.45
23 05 29 00-0895	LF	1" x 1" x 1/8" Angle Iron	2.89		1.73
23 05 29 00-0896	LF	1-1/4" x 1-1/4" x 3/16" Angle Iron	3.93		2.17
23 05 29 00-0897	LF	1-1/2" x 1-1/2" x 3/16" Angle Iron	4.36		2.32
23 05 29 00-0898	LF	2" x 2" x 1/4" Angle Iron	5.75		2.60
23 05 29 00-0899	LF	2-1/2" x 2-1/2" x 1/4" Angle Iron	7.14		3.16
23 05 29 00-0900	LF	3" x 2" x 3/8" Angle Iron	9.16		3.72
23 05 29 00-0901	LF	3" x 3" x 3/8" Angle Iron	10.92		4.34
23 05 29 00-0902		Channels <small>(23 05 29 00-0891)</small>			
23 05 29 00-0903	LF	C2 X 1.78 - 2" Wide (Channels).....	5.36		3.08
23 05 29 00-0904	LF	C3 X 4.1 - 3" Wide (Channels).....	8.83		4.42
23 05 29 00-0905	LF	C4 X 5.4 - 4" Wide (Channels).....	10.94		5.32
23 05 29 00-0906	LF	C5 X 6.7 - 5" Wide (Channels).....	13.05		6.20
23 05 29 00-0907	LF	C6 X 8.2 - 6" Wide (Channels).....	15.77		7.45
23 05 29 00-0908	LF	C7 X 9.8 - 7" Wide (Channels).....	18.81		8.86



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 29 00-0909 LF C8 X 11.5 - 8" Wide (Channels).....	21.19	9.76
23 05 29 00-0910 Structural Bar Tees (23 05 29 00-0891)		
23 05 29 00-0911 LF 3/4" x 3/4" x 1/8" Structural Bar Tee	6.37	4.33
23 05 29 00-0912 LF 1" x 1" x 1/8" Structural Bar Tee	7.66	5.13
23 05 29 00-0913 LF 1-1/2" x 1-1/2" x 1/4" Structural Bar Tee	10.39	5.91
23 05 29 00-0914 LF 2" x 2" x 1/4" Structural Bar Tee	13.37	7.88
23 05 29 00-0915 LF 2-1/2" x 2-1/2" x 3/8" Structural Bar Tee	17.85	9.46
23 05 29 00-0916 LF 3" x 3" x 3/8" Structural Bar Tee	22.46	12.21
23 05 29 00-0917 Structural Zees (23 05 29 00-0891)		
23 05 29 00-0918 LF 1-1/4" x 1-3/4" x 1-3/4" Structural Zee	10.40	5.91
23 05 29 00-0919 LF 2-11/16" x 3" x 2-11/16" Structural Zee.....	12.00	5.91
23 05 29 00-0920 LF 3-1/16" x 4" x 3-1/16" Structural Zee.....	17.24	5.91
23 05 29 00-0921 LF 3-1/4" x 5" x 3-1/4" Structural Zee.....	21.39	5.91
23 05 29 00-0922 LF 3-1/2" x 6" x 3-1/2" Structural Zee.....	25.54	5.91
23 05 29 00-0923 Junior I-beams (23 05 29 00-0891)		
23 05 29 00-0924 LF 3" I-beam (Junior)	13.40	8.66
23 05 29 00-0925 LF 4" I-beam (Junior)	15.22	9.46
23 05 29 00-0926 LF 5" I-beam (Junior)	17.33	10.24
23 05 29 00-0927 LF 6" I-beam (Junior)	18.91	11.43
23 05 29 00-0928 LF 7" I-beam (Junior)	21.95	12.21
23 05 29 00-0929 LF 8" I-beam (Junior)	23.72	12.99
23 05 48 Vibration And Seismic Controls For HVAC (23 05)		
23 05 48 00-0001 Unhoused Stable Steel Spring Isolators (23 05 48)		
Note: Includes leveling adjustment, cast top, base plate and pad. For use with floor mounted equipment only.		
23 05 48 00-0002 EA 60 LB Unhoused Steel Spring Isolator.....	85.04	22.35
23 05 48 00-0003 EA 115 LB Unhoused Steel Spring Isolator.....	91.55	22.35
23 05 48 00-0004 EA 1130 LB Unhoused Steel Spring Isolator.....	113.15	22.35
23 05 48 00-0005 Vibration Isolators (23 05 48)		
23 05 48 00-0006 Spring And Rubber Hanger For 1" Deflection (23 05 48 00-0005)		
23 05 48 00-0007 EA 50-500 LB Rated Spring And Rubber Hanger For Vibration Isolation With 3/4" Max Rod Size	124.37	14.37
23 05 48 00-0008 EA 600-1,000 LB Rated Spring And Rubber Hanger For Vibration Isolation With 7/8" Max Rod Size	273.02	15.98
23 05 48 00-0009 Rubber-In-Shear Isolator Hanger (23 05 48 00-0005)		
23 05 48 00-0010 EA 45-340 LB Rubber In Shear Hanger 0.38" Deflection With <1/2" Rod Size	65.91	11.98
23 05 48 00-0011 EA 130-700 LB Rubber In Shear Hanger 0.43" Deflection With <3/4" Rod Size	86.38	14.37
23 05 48 00-0012 Spring Hanger For 1" Deflection (23 05 48 00-0005)		
23 05 48 00-0013 EA 50 To 1,000 LB Rubber In Shear Hanger For 1" Deflection With <3/4" Rod Size	74.15	14.37
23 05 48 00-0014 Rubber-In-Shear Vibration Isolator (23 05 48 00-0005)		
23 05 48 00-0015 EA 45-340 LB Rubber In Shear Vibration Isolation With 0.38" Deflection	136.15	27.16
23 05 48 00-0016 EA 130-700 LB Rubber In Shear Vibration Isolation With 0.43" Deflection	193.80	27.16
23 05 48 00-0017 EA 550-1,920 LB Rubber In Shear Vibration Isolation With 0.48" Deflection	391.64	27.16
23 05 48 00-0018 Two-Piece Spring Type Vibration Isolator (23 05 48 00-0005)		
Note: For equipment support aluminum construction 1/2" adjusting and leveling bolt 1" deflection.		
23 05 48 00-0019 EA 50 - 1,000 LB Rated Load 2-Piece Isolator Spring Type Vibration Isolator.....	111.86	27.16
23 05 48 00-0020 EA >1,000 - 1,600 LB Rated Load 2-Piece Isolator Spring Type Vibration Isolator.....	116.15	27.16
23 05 48 00-0021 Open Double Spring Type Vibration Isolator (23 05 48 00-0005)		
Note: For equipment support 1" deflection neoprene pad and 5/8" stud bolt.		
23 05 48 00-0022 EA 150-450 LB Rated Load Open Isolator, Double Spring Type Vibration Isolator	93.20	13.58
23 05 48 00-0023 EA 500-1,000 LB Rated Load Open Isolator, Double Spring Type Vibration Isolator	93.20	13.58
23 05 48 00-0024 EA 1,100-1,600 LB Rated Load Open Isolator, Double Spring Type Vibration Isolator.....	107.52	13.58
23 05 48 00-0025 EA 1,700-2,400 LB Rated Load Open Isolator, Double Spring Type Vibration Isolator	107.52	13.58
23 05 48 00-0026 EA 2,500-3,400 LB Rated Load Open Isolator, Double Spring Type Vibration Isolator	172.29	13.58
23 05 48 00-0027 Isolation Pads (23 05 48 00-0005)		
23 05 48 00-0028 Laminated Neoprene And Cork Isolation Pad (23 05 48 00-0027)		
23 05 48 00-0029 EA 2" x 2", 1" Thick Laminated Neoprene And Cork Isolation Pad.....	5.20	1.99
23 05 48 00-0030 EA 3" x 3", 1" Thick Laminated Neoprene And Cork Isolation Pad.....	7.05	2.08

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 05 Common Work Results For HVAC****23 05 48 Vibration And Seismic Controls For HVAC**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 48 00-0031 EA 4" x 4", 1" Thick Laminated Neoprene And Cork Isolation Pad.....	9.17	2.16
23 05 48 00-0032 EA 12" x 12", 1" Thick Laminated Neoprene And Cork Isolation Pad.....	41.30	2.48
23 05 48 00-0033 EA 18" x 18", 1" Thick Laminated Neoprene And Cork Isolation Pad.....	80.67	2.80
23 05 48 00-0034 Neoprene And Steel Plate Isolation Pad (23 05 48 00-0027)		
23 05 48 00-0035 EA 6" x 4", 5/8" Thick Steel Plate And Ribbed Neoprene Isolation Pad.....	36.14	1.99
23 05 48 00-0036 EA 6" x 4", 7/8" Thick Steel Plate And Ribbed Neoprene Isolation Pad.....	39.68	1.99
23 05 48 00-0037 Neoprene Isolation Pad (23 05 48 00-0027)		
23 05 48 00-0038 EA 2" x 2", 3/8" Thick Ribbed Neoprene Isolation Pad.....	4.74	1.99
23 05 48 00-0039 EA 3" x 3", 3/8" Thick Ribbed Neoprene Isolation Pad.....	5.56	1.99
23 05 48 00-0040 EA 4" x 4", 3/8" Thick Ribbed Neoprene Isolation Pad.....	6.90	1.99
23 05 48 00-0041 EA 12" x 12", 3/8" Thick Ribbed Neoprene Isolation Pad.....	40.60	2.40
23 05 48 00-0042 EA 18" x 18", 3/8" Thick Ribbed Neoprene Isolation Pad.....	75.67	2.80
23 05 48 00-0043 Threaded Flexible Bronze Hose Connectors (23 05 48)		
Note: Includes hex threaded nipple ends.		
23 05 48 00-0044 EA 3/8" Diameter x 9" Flexible Hose Connection, For Vibration Isolation, Bronze Hose With Hex Threaded Nipple Ends.....	62.77	12.78
23 05 48 00-0045 EA 1/2" Diameter x 10" Flexible Hose Connection, For Vibration Isolation, Bronze Hose With Hex Threaded Nipple Ends.....	71.73	17.58
23 05 48 00-0046 EA 3/4" Diameter x 11" Flexible Hose Connection, For Vibration Isolation, Bronze Hose With Hex Threaded Nipple Ends.....	88.29	21.57
23 05 48 00-0047 EA 1" Diameter x 12" Flexible Hose Connection, For Vibration Isolation, Bronze Hose With Hex Threaded Nipple Ends.....	102.33	25.57
23 05 48 00-0048 EA 1-1/4" Diameter x 12" Flexible Hose Connection, For Vibration Isolation, Bronze Hose With Hex Threaded Nipple Ends.....	116.90	33.54
23 05 48 00-0049 EA 1-1/2" Diameter x 14" Flexible Hose Connection, For Vibration Isolation, Bronze Hose With Hex Threaded Nipple Ends.....	131.30	35.71
23 05 48 00-0050 EA 2" Diameter x 14" Flexible Hose Connection, For Vibration Isolation, Bronze Hose With Hex Threaded Nipple Ends.....	177.47	42.34
23 05 48 00-0051 EA 2-1/2" Diameter x 16" Flexible Hose Connection, For Vibration Isolation, Bronze Hose With Hex Threaded Nipple Ends.....	248.74	65.98
23 05 48 00-0052 Flanged Flexible Hose Connectors (23 05 48)		
23 05 48 00-0053 Flanged Flexible Molded Rubber Hose Connectors (23 05 48 00-0052)		
Note: With helical wire reinforcement 150 PSI.		
23 05 48 00-0054 EA 1-1/2" Diameter x 12" Molded Rubber Connectors With Helical Wire Reinforcement 150 PSI.....	189.72	59.91
23 05 48 00-0055 EA 2" Diameter x 12" Molded Rubber Connectors With Helical Wire Reinforcement 150 PSI.....	204.38	66.53
23 05 48 00-0056 EA 3" Diameter x 12" Molded Rubber Connectors With Helical Wire Reinforcement 150 PSI.....	433.93	197.70
23 05 48 00-0057 EA 4" Diameter x 12" Molded Rubber Connectors With Helical Wire Reinforcement 150 PSI.....	567.70	255.21
23 05 48 00-0058 EA 6" Diameter x 18" Molded Rubber Connectors With Helical Wire Reinforcement 150 PSI.....	767.17	275.67
23 05 48 00-0059 EA 8" Diameter x 24" Molded Rubber Connectors With Helical Wire Reinforcement 150 PSI.....	941.96	314.86
23 05 48 00-0060 EA 10" Diameter x 24" Molded Rubber Connectors With Helical Wire Reinforcement 150 PSI.....	1,235.48	374.69
23 05 48 00-0061 EA 12" Diameter x 24" Molded Rubber Connectors With Helical Wire Reinforcement 150 PSI.....	2,804.27	468.63
23 05 48 00-0062 Flanged Flexible Corrugated Stainless Steel Hose Connectors (23 05 48 00-0052)		
Note: With braided metal wire.		
23 05 48 00-0063 EA 1/2" Diameter x 12" Metal Wire Braid Connector, Over Corrugated Stainless Steel, 150 PSI For Vibration Isolation.....	143.53	54.48
23 05 48 00-0064 EA 1" Diameter x 12" Metal Wire Braid Connector, Over Corrugated Stainless Steel, 150 PSI For Vibration Isolation.....	127.60	74.92
23 05 48 00-0065 EA 1-1/2" Diameter x 12" Metal Wire Braid Connector, Over Corrugated Stainless Steel, 150 PSI For Vibration Isolation.....	268.78	99.85
23 05 48 00-0066 EA 2" Diameter x 12" Metal Wire Braid Connector, Over Corrugated Stainless Steel, 150 PSI For Vibration Isolation.....	338.00	149.77
23 05 48 00-0067 EA 2-1/2" Diameter x 12" Metal Wire Braid Connector, Over Corrugated Stainless Steel, 150 PSI For Vibration Isolation.....	361.50	164.79
23 05 48 00-0068 EA 3" Diameter x 12" Metal Wire Braid Connector, Over Corrugated Stainless Steel, 150 PSI For Vibration Isolation.....	415.88	199.53
23 05 48 00-0069 EA 4" Diameter x 12" Metal Wire Braid Connector, Over Corrugated Stainless Steel, 150 PSI For Vibration Isolation.....	532.37	255.45
23 05 48 00-0070 EA 4" Diameter x 30" Metal Wire Braid Connector, Over Corrugated Stainless Steel, 150 PSI For Vibration Isolation.....	1,024.80	352.42
23 05 48 00-0071 EA 4" Diameter x 36" Metal Wire Braid Connector, Over Corrugated Stainless Steel, 150 PSI For Vibration Isolation.....	1,167.46	413.12
23 05 48 00-0072 EA 6" Diameter x 12" Metal Wire Braid Connector, Over Corrugated Stainless Steel, 150 PSI For Vibration Isolation.....	1,034.88	385.94
23 05 48 00-0073 EA 6" Diameter x 36" Metal Wire Braid Connector, Over Corrugated Stainless Steel, 150 PSI For Vibration Isolation.....	1,480.95	413.50
23 05 48 00-0074 EA 8" Diameter x 12" Metal Wire Braid Connector, Over Corrugated Stainless Steel, 150 PSI For Vibration Isolation.....	1,302.80	441.07
23 05 48 00-0075 EA 10" Diameter x 13" Metal Wire Braid Connector, Over Corrugated Stainless Steel, 150 PSI For Vibration Isolation.....	1,537.63	510.03
23 05 48 00-0076 EA 12" Diameter x 14" Metal Wire Braid Connector, Over Corrugated Stainless Steel, 150 PSI For Vibration Isolation.....	2,027.53	551.34
23 05 48 00-0077 Flanged Flexible Molded Teflon Hose Connectors (23 05 48 00-0052)		
Note: 150 PSI.		
23 05 48 00-0078 EA 2-1/2" Diameter x 3-3/16" Molded Teflon Connectors With Stainless Steel Flanges, 150 PSI, For Vibration Isolation.....	983.06	164.79
23 05 48 00-0079 EA 3" Diameter x 3-5/8" Molded Teflon Connectors With Stainless Steel Flanges, 150 PSI, For Vibration Isolation.....	1,112.00	199.30
23 05 48 00-0080 EA 4" Diameter x 3-5/8" Molded Teflon Connectors With Stainless Steel Flanges, 150 PSI, For Vibration Isolation.....	1,584.18	255.45
23 05 48 00-0081 EA 6" Diameter x 4" Molded Teflon Connectors With Stainless Steel Flanges, 150 PSI, For Vibration Isolation.....	1,868.44	275.67
23 05 48 00-0082 EA 8" Diameter x 6" Molded Teflon Connectors With Stainless Steel Flanges, 150 PSI, For Vibration Isolation.....	2,478.41	314.86



	MINOR CSI UOM DESCRIPTION		TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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23 05 48 00-0083 Flexible Hose Connectors Braided Metal Hose Type, Bronze (23 05 48)

23 05 48 00-0084 Braided Metal Hose Type Flexible Bronze Hose Connectors (23 05 48 00-0083)

Note: MPT connection.

23 05 48 00-0085	EA	1/2" Diameter x 12" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, MPT Connection.....	36.86	1.60
23 05 48 00-0086	EA	1/2" Diameter x 18" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, MPT Connection.....	44.33	1.60
23 05 48 00-0087	EA	1/2" Diameter x 24" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, MPT Connection.....	49.01	2.07
23 05 48 00-0088	EA	1/2" Diameter x 36" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, MPT Connection.....	60.03	2.07
23 05 48 00-0089	EA	3/4" Diameter x 12" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, MPT Connection.....	49.53	1.91
23 05 48 00-0090	EA	3/4" Diameter x 18" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, MPT Connection.....	60.20	1.91
23 05 48 00-0091	EA	3/4" Diameter x 24" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, MPT Connection.....	68.56	2.48
23 05 48 00-0092	EA	3/4" Diameter x 36" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, MPT Connection.....	85.18	2.48
23 05 48 00-0093	EA	1" Diameter x 12" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, MPT Connection.....	67.88	2.24
23 05 48 00-0094	EA	1" Diameter x 18" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, MPT Connection.....	74.43	2.24
23 05 48 00-0095	EA	1" Diameter x 24" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, MPT Connection.....	88.15	2.95
23 05 48 00-0096	EA	1" Diameter x 36" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, MPT Connection.....	112.45	2.95
23 05 48 00-0097	EA	1" Diameter x 48" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, MPT Connection.....	136.57	2.95
23 05 48 00-0098	EA	1" Diameter x 60" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, MPT Connection.....	160.76	2.95
23 05 48 00-0099	EA	1-1/4" Or 1-1/2" Diameter x 12" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, MPT Connection.....	96.99	2.87
23 05 48 00-0100	EA	1-1/4" Or 1-1/2" Diameter x 18" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, MPT Connection.....	107.19	2.87
23 05 48 00-0101	EA	1-1/4" Or 1-1/2" Diameter x 24" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, MPT Connection.....	138.28	2.87
23 05 48 00-0102	EA	1-1/4" Or 1-1/2" Diameter x 36" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, MPT Connection.....	192.42	3.82
23 05 48 00-0103	EA	1-1/4" Or 1-1/2" Diameter x 48" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, MPT Connection.....	223.74	3.82
23 05 48 00-0104	EA	1-1/4" Or 1-1/2" Diameter x 60" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, MPT Connection.....	265.43	3.82
23 05 48 00-0105	EA	2" Diameter x 12" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, MPT Connection.....	133.21	3.46
23 05 48 00-0106	EA	2" Diameter x 18" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, MPT Connection.....	154.53	3.46
23 05 48 00-0107	EA	2" Diameter x 24" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, MPT Connection.....	195.81	3.46
23 05 48 00-0108	EA	2" Diameter x 36" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, MPT Connection.....	261.17	4.63
23 05 48 00-0109	EA	2" Diameter x 48" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, MPT Connection.....	324.09	4.63
23 05 48 00-0110	EA	2" Diameter x 60" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, MPT Connection.....	386.95	4.63
23 05 48 00-0111	EA	2-1/2" Diameter x 12" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, MPT Connection.....	185.61	4.33
23 05 48 00-0112	EA	2-1/2" Diameter x 18" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, MPT Connection.....	211.87	4.12
23 05 48 00-0113	EA	2-1/2" Diameter x 24" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, MPT Connection.....	238.39	4.12
23 05 48 00-0114	EA	2-1/2" Diameter x 36" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, MPT Connection.....	293.59	5.51
23 05 48 00-0115	EA	2-1/2" Diameter x 48" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, MPT Connection.....	346.92	5.51
23 05 48 00-0116	EA	2-1/2" Diameter x 60" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, MPT Connection.....	398.59	5.51
23 05 48 00-0117	EA	3" Diameter x 12" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, MPT Connection.....	293.62	5.51
23 05 48 00-0118	EA	3" Diameter x 18" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, MPT Connection.....	329.04	5.51
23 05 48 00-0119	EA	3" Diameter x 24" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, MPT Connection.....	372.65	5.51
23 05 48 00-0120	EA	3" Diameter x 36" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, MPT Connection.....	439.20	7.35
23 05 48 00-0121	EA	3" Diameter x 48" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, MPT Connection.....	510.65	7.35
23 05 48 00-0122	EA	3" Diameter x 60" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, MPT Connection.....	580.36	7.35
23 05 48 00-0123	EA	4" Diameter x 12" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, MPT Connection.....	541.06	6.61
23 05 48 00-0124	EA	4" Diameter x 18" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, MPT Connection.....	582.46	6.61
23 05 48 00-0125	EA	4" Diameter x 24" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, MPT Connection.....	623.85	6.61
23 05 48 00-0126	EA	4" Diameter x 36" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, MPT Connection.....	712.19	8.82
23 05 48 00-0127	EA	4" Diameter x 48" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, MPT Connection.....	794.66	8.82
23 05 48 00-0128	EA	4" Diameter x 60" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, MPT Connection.....	878.89	8.82

23 05 48 00-0129 Braided Stainless Steel Flexible Hose Connectors (23 05 48 00-0083)

Note: Over braided carbon steel connection.

23 05 48 00-0130	EA	2" Diameter x 12" Long, Flexible Hose Connectors, Braided Stainless Steel Over Braided Carbon Steel Connection, Welded.....	159.28	3.51
23 05 48 00-0131	EA	2" Diameter x 18" Long, Flexible Hose Connectors, Braided Stainless Steel Over Braided Carbon Steel Connection, Welded.....	193.15	3.51
23 05 48 00-0132	EA	2" Diameter x 24" Long, Flexible Hose Connectors, Braided Stainless Steel Over Braided Carbon Steel Connection, Welded.....	226.38	3.51
23 05 48 00-0133	EA	2" Diameter x 36" Long, Flexible Hose Connectors, Braided Stainless Steel Over Braided Carbon Steel Connection, Welded.....	296.24	4.70
23 05 48 00-0134	EA	2" Diameter x 48" Long, Flexible Hose Connectors, Braided Stainless Steel Over Braided Carbon Steel Connection, Welded.....	363.59	4.70
23 05 48 00-0135	EA	2" Diameter x 60" Long, Flexible Hose Connectors, Braided Stainless Steel Over Braided Carbon Steel Connection, Welded.....	430.87	4.70
23 05 48 00-0136	EA	2-1/2" Or 3" Diameter x 12" Long, Flexible Hose Connectors, Braided Stainless Steel Over Braided Carbon Steel Connection, Welded.....	180.44	4.12
23 05 48 00-0137	EA	2-1/2" Or 3" Diameter x 18" Long, Flexible Hose Connectors, Braided Stainless Steel Over Braided Carbon Steel Connection, Welded.....	215.83	4.12
23 05 48 00-0138	EA	2-1/2" Or 3" Diameter x 24" Long, Flexible Hose Connectors, Braided Stainless Steel Over Braided Carbon Steel Connection, Welded.....	251.39	4.12
23 05 48 00-0139	EA	2-1/2" Or 3" Diameter x 36" Long, Flexible Hose Connectors, Braided Stainless Steel Over Braided Carbon Steel Connection, Welded.....	325.53	5.51
23 05 48 00-0140	EA	2-1/2" Or 3" Diameter x 48" Long, Flexible Hose Connectors, Braided Stainless Steel Over Braided Carbon Steel Connection, Welded.....	396.35	5.51
23 05 48 00-0141	EA	2-1/2" Or 3" Diameter x 60" Long, Flexible Hose Connectors, Braided Stainless Steel Over Braided Carbon Steel Connection, Welded.....	466.19	5.51
23 05 48 00-0142	EA	4" Diameter x 12" Long, Flexible Hose Connectors, Braided Stainless Steel Over Braided Carbon Steel Connection, Welded.....	190.42	5.51
23 05 48 00-0143	EA	4" Diameter x 18" Long, Flexible Hose Connectors, Braided Stainless Steel Over Braided Carbon Steel Connection, Welded.....	230.96	5.66
23 05 48 00-0144	FT	4" Diameter x 24" Long, Flexible Hose Connectors, Braided Stainless Steel Over Braided Carbon Steel Connection, Welded.....	272.09	5.51

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 05 Common Work Results For HVAC****23 05 48 Vibration And Seismic Controls For HVAC**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 48 00-0145 EA 4" Diameter x 36" Long, Flexible Hose Connectors, Braided Stainless Steel Over Braided Carbon Steel Connection, Welded	360.30	7.35
23 05 48 00-0146 EA 4" Diameter x 48" Long, Flexible Hose Connectors, Braided Stainless Steel Over Braided Carbon Steel Connection, Welded	442.11	7.35
23 05 48 00-0147 EA 4" Diameter x 60" Long, Flexible Hose Connectors, Braided Stainless Steel Over Braided Carbon Steel Connection, Welded	526.24	7.35
23 05 48 00-0148 EA 6" Diameter x 18" Long, Flexible Hose Connectors, Braided Stainless Steel Over Braided Carbon Steel Connection, Welded	384.26	10.74
23 05 48 00-0149 EA 6" Diameter x 24" Long, Flexible Hose Connectors, Braided Stainless Steel Over Braided Carbon Steel Connection, Welded	571.78	10.82
23 05 48 00-0150 EA 6" Diameter x 36" Long, Flexible Hose Connectors, Braided Stainless Steel Over Braided Carbon Steel Connection, Welded	767.02	14.25
23 05 48 00-0151 EA 6" Diameter x 48" Long, Flexible Hose Connectors, Braided Stainless Steel Over Braided Carbon Steel Connection, Welded	954.61	14.25
23 05 48 00-0152 EA 6" Diameter x 60" Long, Flexible Hose Connectors, Braided Stainless Steel Over Braided Carbon Steel Connection, Welded	1,142.16	14.25
23 05 48 00-0153 EA 8" Diameter x 18" Long, Flexible Hose Connectors, Braided Stainless Steel Over Braided Carbon Steel Connection, Welded	672.49	13.44
23 05 48 00-0154 EA 8" Diameter x 24" Long, Flexible Hose Connectors, Braided Stainless Steel Over Braided Carbon Steel Connection, Welded	814.36	13.44
23 05 48 00-0155 EA 8" Diameter x 36" Long, Flexible Hose Connectors, Braided Stainless Steel Over Braided Carbon Steel Connection, Welded	1,104.70	17.48
23 05 48 00-0156 EA 8" Diameter x 48" Long, Flexible Hose Connectors, Braided Stainless Steel Over Braided Carbon Steel Connection, Welded	1,386.14	17.48
23 05 48 00-0157 EA 8" Diameter x 60" Long, Flexible Hose Connectors, Braided Stainless Steel Over Braided Carbon Steel Connection, Welded	1,667.51	17.48
23 05 48 00-0158 EA 10" Diameter x 18" Long, Flexible Hose Connectors, Braided Stainless Steel Over Braided Carbon Steel Connection, Welded	718.39	16.81
23 05 48 00-0159 EA 10" Diameter x 24" Long, Flexible Hose Connectors, Braided Stainless Steel Over Braided Carbon Steel Connection, Welded	1,073.08	16.81
23 05 48 00-0160 EA 10" Diameter x 36" Long, Flexible Hose Connectors, Braided Stainless Steel Over Braided Carbon Steel Connection, Welded	1,437.85	21.88
23 05 48 00-0161 EA 10" Diameter x 48" Long, Flexible Hose Connectors, Braided Stainless Steel Over Braided Carbon Steel Connection, Welded	1,793.79	21.88
23 05 48 00-0162 EA 10" Diameter x 60" Long, Flexible Hose Connectors, Braided Stainless Steel Over Braided Carbon Steel Connection, Welded	2,148.22	21.88
23 05 48 00-0163 EA 12" Diameter x 24" Long, Flexible Hose Connectors, Braided Stainless Steel Over Braided Carbon Steel Connection, Welded	1,436.07	20.32
23 05 48 00-0164 EA 12" Diameter x 36" Long, Flexible Hose Connectors, Braided Stainless Steel Over Braided Carbon Steel Connection, Welded	1,878.72	20.32
23 05 48 00-0165 EA 12" Diameter x 48" Long, Flexible Hose Connectors, Braided Stainless Steel Over Braided Carbon Steel Connection, Welded	2,348.82	27.33
23 05 48 00-0166 EA 12" Diameter x 60" Long, Flexible Hose Connectors, Braided Stainless Steel Over Braided Carbon Steel Connection, Welded	2,795.36	27.33
23 05 48 00-0167 EA 12" Diameter x 72" Long, Flexible Hose Connectors, Braided Stainless Steel Over Braided Carbon Steel Connection, Welded	3,243.99	27.33

23 05 48 00-0168 Braided Metal Hose Type Flexible Bronze Hose Connectors (23 05 48 00-0083)

Note: Flanged end connection (carbon steel ends).

23 05 48 00-0169 EA 2" Diameter x 12" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, Flanged End Connection (Carbon Steel Ends)	122.64	3.46
23 05 48 00-0170 EA 2" Diameter x 24" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, Flanged End Connection (Carbon Steel Ends)	172.32	3.46
23 05 48 00-0171 EA 2" Diameter x 36" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, Flanged End Connection (Carbon Steel Ends)	224.61	4.63
23 05 48 00-0172 EA 2" Diameter x 48" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, Flanged End Connection (Carbon Steel Ends)	274.36	4.63
23 05 48 00-0173 EA 2" Diameter x 60" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, Flanged End Connection (Carbon Steel Ends)	324.12	4.63
23 05 48 00-0174 EA 2-1/2" Or 3" Diameter x 12" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, Flanged End Connection (Carbon Steel Ends)	139.44	4.12
23 05 48 00-0175 EA 2-1/2" Or 3" Diameter x 24" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, Flanged End Connection (Carbon Steel Ends)	191.87	4.12
23 05 48 00-0176 EA 2-1/2" Or 3" Diameter x 36" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, Flanged End Connection (Carbon Steel Ends)	247.37	5.51
23 05 48 00-0177 EA 2-1/2" Or 3" Diameter x 48" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, Flanged End Connection (Carbon Steel Ends)	299.83	5.51
23 05 48 00-0178 EA 2-1/2" Or 3" Diameter x 60" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, Flanged End Connection (Carbon Steel Ends)	351.38	5.51
23 05 48 00-0179 EA 4" Diameter x 12" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, Flanged End Connection (Carbon Steel Ends)	172.71	5.51
23 05 48 00-0180 EA 4" Diameter x 24" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, Flanged End Connection (Carbon Steel Ends)	233.90	5.51
23 05 48 00-0181 EA 4" Diameter x 36" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, Flanged End Connection (Carbon Steel Ends)	300.16	7.35
23 05 48 00-0182 EA 4" Diameter x 48" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, Flanged End Connection (Carbon Steel Ends)	369.69	7.35
23 05 48 00-0183 EA 4" Diameter x 60" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, Flanged End Connection (Carbon Steel Ends)	422.82	7.35
23 05 48 00-0184 EA 6" Diameter x 12" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, Flanged End Connection (Carbon Steel Ends)	306.01	10.82
23 05 48 00-0185 EA 6" Diameter x 24" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, Flanged End Connection (Carbon Steel Ends)	444.66	10.82



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 48 00-0186 EA 6" Diameter x 36" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, Flanged End Connection (Carbon Steel Ends).....	591.05	14.25
23 05 48 00-0187 EA 6" Diameter x 48" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, Flanged End Connection (Carbon Steel Ends).....	729.72	14.25
23 05 48 00-0188 EA 6" Diameter x 60" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, Flanged End Connection (Carbon Steel Ends).....	868.37	14.25
23 05 48 00-0189 EA 8" Diameter x 18" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, Flanged End Connection (Carbon Steel Ends).....	565.36	13.44
23 05 48 00-0190 EA 8" Diameter x 24" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, Flanged End Connection (Carbon Steel Ends).....	670.25	13.44
23 05 48 00-0191 EA 8" Diameter x 36" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, Flanged End Connection (Carbon Steel Ends).....	887.96	17.85
23 05 48 00-0192 EA 8" Diameter x 48" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, Flanged End Connection (Carbon Steel Ends).....	1,096.00	17.85
23 05 48 00-0193 EA 8" Diameter x 60" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, Flanged End Connection (Carbon Steel Ends).....	1,303.94	17.85
23 05 48 00-0194 EA 10" Diameter x 24" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, Flanged End Connection (Carbon Steel Ends).....	991.72	16.81
23 05 48 00-0195 EA 10" Diameter x 36" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, Flanged End Connection (Carbon Steel Ends).....	1,253.04	16.81
23 05 48 00-0196 EA 10" Diameter x 48" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, Flanged End Connection (Carbon Steel Ends).....	1,528.56	22.40
23 05 48 00-0197 EA 10" Diameter x 60" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, Flanged End Connection (Carbon Steel Ends).....	1,791.08	22.40
23 05 48 00-0198 EA 10" Diameter x 72" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, Flanged End Connection (Carbon Steel Ends).....	2,003.24	22.40
23 05 48 00-0199 EA 12" Diameter x 24" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, Flanged End Connection (Carbon Steel Ends).....	1,374.59	20.32
23 05 48 00-0200 EA 12" Diameter x 36" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, Flanged End Connection (Carbon Steel Ends).....	1,706.20	20.32
23 05 48 00-0201 EA 12" Diameter x 48" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, Flanged End Connection (Carbon Steel Ends).....	2,053.32	27.33
23 05 48 00-0202 EA 12" Diameter x 60" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, Flanged End Connection (Carbon Steel Ends).....	2,384.92	27.33
23 05 48 00-0203 EA 12" Diameter x 72" Long, Flexible Hose Connectors, Braided Metal Hose, Bronze, Flanged End Connection (Carbon Steel Ends).....	2,716.53	27.33

23 05 53 Identification For HVAC Piping And Equipment (23 05)

23 05 53 00-0001 Systems Identification (23 05 53)

23 05 53 00-0002 Pipe Marker Snap-On Type Plastic (23 05 53 00-0001)

Note: Outside diameters include insulation where necessary.

23 05 53 00-0003 EA 1/2" Outside Diameter Snap-On Plastic Marker.....	9.16
23 05 53 00-0004 EA 3/4" Outside Diameter Snap-On Plastic Marker.....	9.35
23 05 53 00-0005 EA 1" Outside Diameter Snap-On Plastic Marker.....	9.46
23 05 53 00-0006 EA 1-1/4" Outside Diameter Snap-On Plastic Marker.....	9.62
23 05 53 00-0007 EA 1-1/2" Outside Diameter Snap-On Plastic Marker.....	10.58
23 05 53 00-0008 EA 2" Outside Diameter Snap-On Plastic Marker.....	10.94
23 05 53 00-0009 EA 2-1/2" Outside Diameter Snap-On Plastic Marker.....	14.96
23 05 53 00-0010 EA 3" Outside Diameter Snap-On Plastic Marker.....	15.24
23 05 53 00-0011 EA 3-1/2" Outside Diameter Snap-On Plastic Marker.....	15.55
23 05 53 00-0012 EA 4" Outside Diameter Snap-On Plastic Marker.....	15.72
23 05 53 00-0013 EA 4-1/2" Outside Diameter Snap-On Plastic Marker.....	15.89
23 05 53 00-0014 EA 5" Outside Diameter Snap-On Plastic Marker.....	16.07
23 05 53 00-0015 EA 6" Outside Diameter Snap-On Plastic Marker.....	16.70
23 05 53 00-0016 EA 7" Outside Diameter Snap-On Plastic Marker.....	16.89
23 05 53 00-0017 EA 8" Outside Diameter Snap-On Plastic Marker.....	19.66
23 05 53 00-0018 EA 10" Outside Diameter Snap-On Plastic Marker.....	20.70
23 05 53 00-0019 EA 12" Outside Diameter Snap-On Plastic Marker.....	24.14
23 05 53 00-0020 EA 14" Outside Diameter Snap-On Plastic Marker.....	27.59

23 05 53 00-0021 Pipe Markers Pressure-Sensitive (23 05 53 00-0001)

Note: Stick on include arrow tape. Outside diameter includes insulation where necessary.

23 05 53 00-0022 EA 1/2" Outside Diameter Press-Sensitive Marker Stick-on With Arrow Tape Over Insulation.....	9.00
23 05 53 00-0023 EA 3/4" Outside Diameter Press-Sensitive Marker Stick-on With Arrow Tape Over Insulation.....	9.39
23 05 53 00-0024 EA 1" Outside Diameter Press-Sensitive Marker Stick-on With Arrow Tape Over Insulation.....	10.19
23 05 53 00-0025 EA 1-1/4" Outside Diameter Press-Sensitive Marker Stick-on With Arrow Tape Over Insulation.....	10.36
23 05 53 00-0026 EA 1-1/2" Outside Diameter Press-Sensitive Marker Stick-on With Arrow Tape Over Insulation.....	11.03
23 05 53 00-0027 EA 2" Outside Diameter Press-Sensitive Marker Stick-on With Arrow Tape Over Insulation.....	11.27
23 05 53 00-0028 EA 2-1/2" Outside Diameter Press-Sensitive Marker Stick-on With Arrow Tape Over Insulation.....	12.63
23 05 53 00-0029 EA 3" Outside Diameter Press-Sensitive Marker Stick-on With Arrow Tape Over Insulation.....	12.95
23 05 53 00-0030 EA 3-1/2" Outside Diameter Press-Sensitive Marker Stick-on With Arrow Tape Over Insulation.....	13.18
23 05 53 00-0031 EA 4" Outside Diameter Press-Sensitive Marker Stick-on With Arrow Tape Over Insulation.....	13.44
23 05 53 00-0032 EA 4-1/2" Outside Diameter Press-Sensitive Marker Stick-on With Arrow Tape Over Insulation.....	13.93
23 05 53 00-0033 EA 5" Outside Diameter Press-Sensitive Marker Stick-on With Arrow Tape Over Insulation.....	14.46
23 05 53 00-0034 EA 6" Outside Diameter Press-Sensitive Marker Stick-on With Arrow Tape Over Insulation.....	14.94
23 05 53 00-0035 EA 7" Outside Diameter Press-Sensitive Marker Stick-on With Arrow Tape Over Insulation.....	15.41
23 05 53 00-0036 EA 8" Outside Diameter Press-Sensitive Marker Stick-on With Arrow Tape Over Insulation.....	16.45
23 05 53 00-0037 EA 10" Outside Diameter Press-Sensitive Marker Stick-on With Arrow Tape Over Insulation.....	17.81
23 05 53 00-0038 EA 12" Outside Diameter Press-Sensitive Marker Stick-on.....	20.75

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 05 Common Work Results For HVAC****23 05 53 Identification For HVAC Piping And Equipment**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 53 00-0039 Valve Identification Tag <small>(23 05 53 00-0001)</small> Note: Includes beaded chain and/or "S" hook.		
23 05 53 00-0040 EA 2" Diameter Identification Tag, Brass.....	7.76	
23 05 53 00-0041 EA 1-1/2" Diameter Identification Tag, Plastic.....	7.39	
23 05 53 00-0042 EA 1-1/2" Diameter Identification Tag, Brass.....	7.27	
23 05 93 Testing, Adjusting, And Balancing For HVAC <small>(23 05)</small> Note: New systems include all necessary testing, startup, and checkout. Use these tasks for testing, startup, and checkout of existing systems.		
23 05 93 00-0001 Heating And Ventilating Equipment <small>(23 05 93)</small>		
23 05 93 00-0002 EA Balancing Centrifugal Fans.....	321.99	
<i>For Testing Of Unit Without Balancing, Deduct</i>	-161.00	
23 05 93 00-0003 EA Balancing Heating And Ventilating Units.....	402.32	
<i>For Testing Of Unit Without Balancing, Deduct</i>	-201.16	
23 05 93 00-0004 EA Balancing In Line Fan.....	362.24	
<i>For Testing Of Unit Without Balancing, Deduct</i>	-181.12	
23 05 93 00-0005 EA Balancing Propeller And Wall Fan.....	80.50	
<i>For Testing Of Unit Without Balancing, Deduct</i>	-40.25	
23 05 93 00-0006 EA Balancing Roof Exhaust Fan.....	241.48	
<i>For Testing Of Unit Without Balancing, Deduct</i>	-120.74	
23 05 93 00-0007 EA Balancing Wall Fan.....	60.36	
<i>For Testing Of Unit Without Balancing, Deduct</i>	-30.18	
23 05 93 00-0008 EA Balancing Fan Section Exhaust.....	321.47	
<i>For Testing Of Unit Without Balancing, Deduct</i>	-160.74	
23 05 93 00-0009 Air Conditioning Equipment <small>(23 05 93)</small>		
23 05 93 00-0010 EA Balancing Constant Volume Air Handling Unit.....	588.34	
<i>For Testing Of Unit Without Balancing, Deduct</i>	-294.17	
23 05 93 00-0011 EA Balancing Package A/C Unit.....	220.62	
<i>For Testing Of Unit Without Balancing, Deduct</i>	-110.31	
23 05 93 00-0012 EA Balancing Rooftop Heat And Cool Unit.....	294.16	
<i>For Testing Of Unit Without Balancing, Deduct</i>	-147.08	
23 05 93 00-0013 EA Balancing Variable Volume Air Handling Unit.....	1,029.58	
<i>For Testing Of Unit Without Balancing, Deduct</i>	-514.79	
23 05 93 00-0014 Registers, Diffusers, Terminal Air Units And Dampers <small>(23 05 93)</small>		
23 05 93 00-0015 EA Balancing HVAC Duct System, Ceiling Height To 12' Supply, Return, Exhaust, Register And Diffuser.....	60.37	
<i>For Testing Of Unit Without Balancing, Deduct</i>	-30.19	
23 05 93 00-0016 EA Balancing HVAC Duct System, Ceiling Height >12' Supply, Return, Exhaust, Register And Diffuser.....	100.63	
<i>For Testing Of Unit Without Balancing, Deduct</i>	-50.32	
23 05 93 00-0017 EA Balancing HVAC Duct System, Floor Height Supply, Return, Exhaust, Register And Diffuser.....	52.33	
<i>For Testing Of Unit Without Balancing, Deduct</i>	-26.17	
23 05 93 00-0018 EA Balance Variable Air Volume Box.....	56.69	
<i>For Testing Of Unit Without Balancing, Deduct</i>	-28.35	
23 05 93 00-0019 EA Balance Constant Volume Box.....	56.69	
<i>For Testing Of Unit Without Balancing, Deduct</i>	-28.35	
23 05 93 00-0020 EA Balance Fan Powered Box.....	64.40	
<i>For Testing Of Unit Without Balancing, Deduct</i>	-32.20	
23 05 93 00-0021 EA Balance Lab Fume Hood.....	261.62	
<i>For Testing Of Unit Without Balancing, Deduct</i>	-130.81	
23 05 93 00-0022 EA Balance General Hood.....	201.24	
<i>For Testing Of Unit Without Balancing, Deduct</i>	-100.62	
23 05 93 00-0023 EA Balance Induction Unit.....	120.75	
<i>For Testing Of Unit Without Balancing, Deduct</i>	-60.38	
23 05 93 00-0024 EA Balance Moduline - Master.....	48.28	
<i>For Testing Of Unit Without Balancing, Deduct</i>	-24.14	
23 05 93 00-0025 EA Balance Moduline - Slave.....	24.14	
<i>For Testing Of Unit Without Balancing, Deduct</i>	-12.07	
23 05 93 00-0026 EA Balance Dampers.....	22.42	
<i>For Testing Of Unit Without Balancing, Deduct</i>	-11.21	
23 05 93 00-0027 EA Balance Regenerators.....	321.47	
<i>For Testing Of Unit Without Balancing, Deduct</i>	-160.74	
23 05 93 00-0028 Water Balancing Of Components <small>(23 05 93)</small>		
23 05 93 00-0029 EA Water Balance, Air Cool Condenser.....	404.52	
<i>For Testing Of Unit Without Balancing, Deduct</i>	-202.26	
23 05 93 00-0030 EA Water Balance, Cabinet Heater.....	51.48	
<i>For Testing Of Unit Without Balancing, Deduct</i>	-25.74	
23 05 93 00-0031 EA Water Balance, Chiller, Air Cooled.....	441.21	
<i>For Testing Of Unit Without Balancing, Deduct</i>	-220.61	
23 05 93 00-0032 EA Water Balance, Chiller, Water Cooled.....	588.34	
<i>For Testing Of Unit Without Balancing, Deduct</i>	-294.17	
23 05 93 00-0033 EA Water Balance, Cooling Tower.....	294.16	
<i>For Testing Of Unit Without Balancing, Deduct</i>	-147.08	
23 05 93 00-0034 EA Water Balance, Fan Coil And Vent.....	73.58	
<i>For Testing Of Unit Without Balancing, Deduct</i>	-36.79	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 93 00-0035 EA Water Balance, Fin Tube And Radiant Panel	73.54	
For Testing Of Unit Without Balancing, Deduct	-36.77	
23 05 93 00-0036 EA Water Balance, Main And Duct Re-Heat Coil	80.90	
For Testing Of Unit Without Balancing, Deduct	-40.45	
23 05 93 00-0037 EA Water Balance, Pumps	220.63	
For Testing Of Unit Without Balancing, Deduct	-110.32	
23 05 93 00-0038 EA Water Balance, Unit Heater	51.48	
For Testing Of Unit Without Balancing, Deduct	-25.74	
23 05 93 00-0039 EA Water Balancing, Converter	220.71	
For Testing Of Unit Without Balancing, Deduct	-110.36	
23 05 93 00-0040 EA Water Balancing, Cocks And Valves	36.76	
For Testing Of Unit Without Balancing, Deduct	-18.38	
23 05 93 00-0041 EA Water Balance, Convector	44.12	
For Testing Of Unit Without Balancing, Deduct	-22.06	
23 05 93 00-0042 EA Water Balancing, Backflow Preventer Or Reduced Pressure Zone Valves	55.16	
For Testing Of Unit Without Balancing, Deduct	-27.58	
23 05 93 00-0043 EA Water Balance, Boiler, Up To 500 MBH	478.02	
For Testing Of Unit Without Balancing, Deduct	-239.01	
23 05 93 00-0044 EA >500 To 1,000 MBH, Water Balance, Boiler	882.50	
For Testing Of Unit Without Balancing, Deduct	-441.25	
23 05 93 00-0045 EA >1,000 MBH, Water Balance, Boiler	1,617.93	
For Testing Of Unit Without Balancing, Deduct	-808.97	
23 05 93 00-0046 Non Destructive Testing (23 05 93)		
23 05 93 00-0047 X-Ray Welds, Non-Destructive Testing (23 05 93 00-0046)		
23 05 93 00-0048 X-Ray Welds Minimum Set-Up Charge (23 05 93 00-0047)		
23 05 93 00-0049 EA X-Ray Welds Minimum Set-Up Charge	580.34	
Note: For projects where the total charges are less than the minimum set-up charge, use this task exclusively. This task should not be used in conjunction with any other tasks in this section.		
23 05 93 00-0050 Piping, X-Ray Welds, Non Destructive Testing (23 05 93 00-0047)		
23 05 93 00-0051 EA Up To 3/4" Piping, X-Ray Welds, Non Destructive Testing	60.27	
23 05 93 00-0052 EA 1" Piping, X-Ray Welds, Non Destructive Testing	68.61	
23 05 93 00-0053 EA 1-1/4" - 1-1/2" Piping, X-Ray Welds, Non Destructive Testing	76.97	
23 05 93 00-0054 EA 2" Piping, X-Ray Welds, Non Destructive Testing	81.32	
23 05 93 00-0055 EA 3" Piping, X-Ray Welds, Non Destructive Testing	85.68	
23 05 93 00-0056 EA 4" Piping, X-Ray Welds, Non Destructive Testing	90.40	
23 05 93 00-0057 EA 6" Piping, X-Ray Welds, Non Destructive Testing	99.11	
23 05 93 00-0058 EA 8" Piping, X-Ray Welds, Non Destructive Testing	107.83	
23 05 93 00-0059 EA 10" Piping, X-Ray Welds, Non Destructive Testing	112.54	
23 05 93 00-0060 EA 12" Piping, X-Ray Welds, Non Destructive Testing	117.26	
23 05 93 00-0061 Liquid Penetration Of Welds, Non Destructive Testing (23 05 93 00-0046)		
23 05 93 00-0062 Piping, Liquid Penetration Of Welds, Non Destructive Testing (23 05 93 00-0061)		
23 05 93 00-0063 EA Up To 3/4" Piping, Liquid Penetration Of Welds, Non Destructive Testing	70.04	
23 05 93 00-0064 EA 1" Piping, Liquid Penetration Of Welds, Non Destructive Testing	74.03	
23 05 93 00-0065 EA 1-1/4" - 1-1/2" Piping, Liquid Penetration Of Welds, Non Destructive Testing	78.03	
23 05 93 00-0066 EA 2" Piping, Liquid Penetration Of Welds, Non Destructive Testing	80.02	
23 05 93 00-0067 EA 3" Piping, Liquid Penetration Of Welds, Non Destructive Testing	83.01	
23 05 93 00-0068 EA 4" Piping, Liquid Penetration Of Welds, Non Destructive Testing	86.02	
23 05 93 00-0069 EA 6" Piping, Liquid Penetration Of Welds, Non Destructive Testing	92.01	
23 05 93 00-0070 EA 8" Piping, Liquid Penetration Of Welds, Non Destructive Testing	97.99	
23 05 93 00-0071 EA 10" Piping, Liquid Penetration Of Welds, Non Destructive Testing	103.99	
23 05 93 00-0072 EA 12" Piping, Liquid Penetration Of Welds, Non Destructive Testing	109.98	
23 05 93 00-0073 Hydrostatic Testing (23 05 93 00-0046)		
Note: Includes flushing and restoring of system.		
23 05 93 00-0074 Piping, Hydrostatic Testing (23 05 93 00-0073)		
23 05 93 00-0075 EA Up To 100', Up To 1-1/2" Piping, Hydrostatic Testing	525.51	
23 05 93 00-0076 EA >100' To 250', Up To 1-1/2" Piping, Hydrostatic Testing	750.73	
23 05 93 00-0077 EA >250' To 500', Up To 1-1/2" Piping, Hydrostatic Testing	899.52	
23 05 93 00-0078 EA >500' To 1,000', Up To 1-1/2" Piping, Hydrostatic Testing	1,198.17	
23 05 93 00-0079 EA >1,000' To 2,000', Up To 1-1/2" Piping, Hydrostatic Testing	1,815.40	
23 05 93 00-0080 EA Up To 100', >1-1/2" To 4" Piping, Hydrostatic Testing	698.72	
23 05 93 00-0081 EA >100' To 250', >1-1/2" To 4" Piping, Hydrostatic Testing	998.47	
23 05 93 00-0082 EA >250' To 500', >1-1/2" To 4" Piping, Hydrostatic Testing	1,188.65	
23 05 93 00-0083 EA >500' To 1,000', >1-1/2" To 4" Piping, Hydrostatic Testing	1,557.60	
23 05 93 00-0084 EA >1,000' To 2,000', >1-1/2" To 4" Piping, Hydrostatic Testing	2,356.38	
23 05 93 00-0085 EA Up To 100', >4" To 10" Piping, Hydrostatic Testing	910.60	
23 05 93 00-0086 EA >100' To 250', >4" To 10" Piping, Hydrostatic Testing	1,298.01	
23 05 93 00-0087 EA >250' To 500', >4" To 10" Piping, Hydrostatic Testing	1,422.45	
23 05 93 00-0088 EA >500' To 1,000', >4" To 10" Piping, Hydrostatic Testing	1,863.52	
23 05 93 00-0089 EA >1,000' To 2,000', >4" To 10" Piping, Hydrostatic Testing	2,819.17	
23 05 93 00-0090 EA Up To 100', >10" To 14" Piping, Hydrostatic Testing	1,182.19	
23 05 93 00-0091 EA >100' To 250', >10" To 14" Piping, Hydrostatic Testing	1,685.40	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 05 Common Work Results For HVAC****23 05 93 Testing, Adjusting, And Balancing For HVAC**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 05 93 00-0092 EA >250' To 500', >10" To 14" Piping, Hydrostatic Testing	1,849.55	
23 05 93 00-0093 EA >500' To 1,000', >10" To 14" Piping, Hydrostatic Testing	2,425.88	
23 05 93 00-0094 EA >1,000' To 2,000', >10" To 14" Piping, Hydrostatic Testing	3,675.58	
23 05 93 00-0095 Pneumatic Testing <small>(23 05 93 00-0046)</small> Note: Includes soaping joints flushing and restoring of system. Can be used for gas or smoke test.		
23 05 93 00-0096 Piping, Pneumatic Testing <small>(23 05 93 00-0095)</small>		
23 05 93 00-0097 EA Up To 100', Up To 1-1/2" Piping, Pneumatic Testing	597.64	
Note: Includes soaping joints.		
23 05 93 00-0098 EA >100' To 250', Up To 1-1/2" Piping, Pneumatic Testing	852.76	
Note: Includes soaping joints.		
23 05 93 00-0099 EA >250' To 500', Up To 1-1/2" Piping, Pneumatic Testing	920.92	
Note: Includes soaping joints.		
23 05 93 00-0100 EA >500' To 1,000', Up To 1-1/2" Piping, Pneumatic Testing	1,179.60	
Note: Includes soaping joints.		
23 05 93 00-0101 EA >1,000' To 2,000', Up To 1-1/2" Piping, Pneumatic Testing	1,845.15	
Note: Includes soaping joints.		
23 05 93 00-0102 EA Up To 100', >1-1/2" To 4" Piping, Pneumatic Testing	779.83	
Note: Includes soaping joints.		
23 05 93 00-0103 EA >100' To 250', >1-1/2" To 4" Piping, Pneumatic Testing	1,107.33	
Note: Includes soaping joints.		
23 05 93 00-0104 EA >250' To 500', >1-1/2" To 4" Piping, Pneumatic Testing	1,197.12	
Note: Includes soaping joints.		
23 05 93 00-0105 EA >500' To 1,000', >1-1/2" To 4" Piping, Pneumatic Testing	1,533.79	
Note: Includes soaping joints.		
23 05 93 00-0106 EA >1,000' To 2,000', >1-1/2" To 4" Piping, Pneumatic Testing	2,398.34	
Note: Includes soaping joints.		
23 05 93 00-0107 EA Up To 100', >4" To 10" Piping, Pneumatic Testing	938.88	
Note: Includes soaping joints.		
23 05 93 00-0108 EA >100' To 250', >4" To 10" Piping, Pneumatic Testing	1,324.98	
Note: Includes soaping joints.		
23 05 93 00-0109 EA >250' To 500', >4" To 10" Piping, Pneumatic Testing	1,557.24	
Note: Includes soaping joints.		
23 05 93 00-0110 EA >500' To 1,000', >4" To 10" Piping, Pneumatic Testing	1,989.74	
Note: Includes soaping joints.		
23 05 93 00-0111 EA >1,000' To 2,000', >4" To 10" Piping, Pneumatic Testing	3,115.74	
Note: Includes soaping joints.		
23 05 93 00-0112 EA Up To 100', >10" To 14" Piping, Pneumatic Testing	1,222.53	
Note: Includes soaping joints.		
23 05 93 00-0113 EA >100' To 250', >10" To 14" Piping, Pneumatic Testing	1,722.60	
Note: Includes soaping joints.		
23 05 93 00-0114 EA >250' To 500', >10" To 14" Piping, Pneumatic Testing	2,025.01	
Note: Includes soaping joints.		
23 05 93 00-0115 EA >500' To 1,000', >10" To 14" Piping, Pneumatic Testing	2,587.16	
Note: Includes soaping joints.		
23 05 93 00-0116 EA >1,000' To 2,000', >10" To 14" Piping, Pneumatic Testing	4,056.97	
Note: Includes soaping joints.		
23 05 93 00-0117 EPA Testing Of Sludge <small>(23 05 93)</small>		
23 05 93 00-0118 EA Flashpoint And Lead Test For Lead	557.15	
23 05 93 00-0119 EA Air Test/Combustion Gas Level	61.18	
23 05 93 00-0120 EA Toxicity Test For Heavy Metals	853.82	
23 05 93 00-0121 EA Aboveground Tank Water Settlement Test Including Water	648.75	
23 07 HVAC Insulation <small>(23)</small>		
23 07 13 Duct Insulation <small>(23 07)</small>		
Note: Based on SF surface area of duct to receive insulation.		
23 07 13 00-0001 FSK Fiber Glass Duct Wrap Insulation <small>(23 07 13)</small>		
Note: Foil-scrim kraft (FSK) facing lapped and joints sealed vapor tight.		
23 07 13 00-0002 Type 75 (0.75 LB/CF) FSK Fiber Glass Duct Wrap Insulation <small>(23 07 13 00-0001)</small>		
23 07 13 00-0003 SF 1-1/2" Type 75 (0.75 LB/CF) FSK Fiber Glass Duct Wrap Insulation	2.42	1.38
23 07 13 00-0004 SF 2" Type 75 (0.75 LB/CF) FSK Fiber Glass Duct Wrap Insulation	2.74	2.07
23 07 13 00-0005 SF 3" Type 75 (0.75 LB/CF) FSK Fiber Glass Duct Wrap Insulation	3.23	2.41
For Plain Blanket, With No Facing, Deduct	-0.14	
For Work In Restricted Working Space, Add	0.86	
23 07 13 00-0006 SF 4" Type 75 (0.75 LB/CF) FSK Fiber Glass Duct Wrap Insulation	3.66	2.62
For Plain Blanket, With No Facing, Deduct	-0.22	
For Work In Restricted Working Space, Add	0.93	
23 07 13 00-0007 Type 100 (1.0 LB/CF) FSK Fiber Glass Duct Wrap Insulation <small>(23 07 13 00-0001)</small>		
23 07 13 00-0008 SF 1" Type 100 (1.0 LB/CF) FSK Fiber Glass Duct Wrap Insulation	2.56	2.07
23 07 13 00-0009 SF 1-1/2" Type 100 (1.0 LB/CF) FSK Fiber Glass Duct Wrap Insulation	2.97	2.41
23 07 13 00-0010 SF 2" Type 100 (1.0 LB/CF) Fiber Glass FSK Duct Wrap Insulation	3.51	2.76



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 07 13 00-0011 Type 150 (1.5 LB/CF) FSK Fiber Glass Duct Wrap Insulation <small>(23 07 13 00-0001)</small>		
23 07 13 00-0012 SF 1" Type 150 (1.5 LB/CF) FSK Fiber Glass Duct Wrap Insulation.....	3.21	2.76
23 07 13 00-0013 SF 1-1/2" Type 150 (1.5 LB/CF) FSK Fiber Glass Duct Wrap Insulation.....	3.93	3.10
23 07 13 00-0014 SF 2" Type 150 (1.5 LB/CF) FSK Fiber Glass Duct Wrap Insulation.....	4.59	3.45
 23 07 13 00-0015 3 LB/CF FSK Rigid Fiber Glass Board Insulation <small>(23 07 13)</small>		
<i>Note: Foil-scrim kraft (FSK) facing, sealed vapor tight and attached to ducts with mechanical fasteners.</i>		
23 07 13 00-0016 SF 1", 3 LB/CF FSK Rigid Fiber Glass Board Insulation.....	6.30	3.95
<i>For Non-Metallic Weatherproof Paste, 2 LB, Add</i>		
<i>For Finishing Cement 1/2" Thick Over 1" Wire Mesh, Add</i>		
<i>For 8 Oz Canvas On Duct, Applied Over Deadening Felt And Finished, Add</i>		
23 07 13 00-0017 SF 1-1/2", 3 LB/CF FSK Rigid Fiber Glass Board Insulation.....	7.71	4.81
<i>For Non-Metallic Weatherproof Paste, 2 LB, Add</i>		
<i>For Finishing Cement 1/2" Thick Over 1" Wire Mesh, Add</i>		
<i>For 8 Oz Canvas On Duct, Applied Over Deadening Felt And Finished, Add</i>		
23 07 13 00-0018 SF 2", 3 LB/CF FSK Rigid Fiber Glass Board Insulation.....	9.33	5.80
<i>For Non-Metallic Weatherproof Paste, 2 LB, Add</i>		
<i>For Finishing Cement 1/2" Thick Over 1" Wire Mesh, Add</i>		
<i>For 8 Oz Canvas On Duct, Applied Over Deadening Felt And Finished, Add</i>		
 23 07 13 00-0019 4.253 LB/CF FSK Rigid Fiber Glass Board Insulation <small>(23 07 13)</small>		
<i>Note: Foil-scrim kraft (FSK) facing, sealed vapor tight and attached to ducts with mechanical fastener.</i>		
23 07 13 00-0020 SF 1", 4.253 LB/CF FSK Rigid Fiber Glass Board Insulation.....	7.33	4.34
23 07 13 00-0021 SF 1-1/2", 4.253 LB/CF FSK Rigid Fiber Glass Board Insulation.....	9.53	5.28
23 07 13 00-0022 SF 2", 4.253 LB/CF FSK Rigid Fiber Glass Board Insulation.....	12.24	6.38
 23 07 13 00-0023 Sheet Flexible Elastomeric Insulation <small>(23 07 13)</small>		
23 07 13 00-0024 SF 3/8" Thick Sheet Flexible Elastomeric Insulation.....	5.10	1.86
23 07 13 00-0025 SF 1/2" Thick Sheet Flexible Elastomeric Insulation.....	5.44	1.97
23 07 13 00-0026 SF 3/4" Thick Sheet Flexible Elastomeric Insulation.....	7.04	2.07
23 07 13 00-0027 SF 1" Thick Sheet Flexible Elastomeric Insulation.....	8.07	2.17
23 07 13 00-0028 SF 1-1/2" Thick Sheet Flexible Elastomeric Insulation.....	11.06	2.38
23 07 13 00-0029 SF 2" Thick Sheet Flexible Elastomeric Insulation.....	13.03	2.58
 23 07 13 00-0030 Aluminum Foil/Mylar Film, Multi-Layer Sheet Elastomeric Insulation <small>(23 07 13)</small>		
<i>Note: Jacketing is a 3-ply laminate consisting of a PVC core, 0.012" thick aluminum foil jacketing and UV-protective Mylar film.</i>		
23 07 13 00-0031 SF 1/2" Thick, Aluminum Foil/Mylar Film, Multi-Layer Sheet Elastomeric Insulation.....	7.39	1.97
23 07 13 00-0032 SF 3/4" Thick, Aluminum Foil/Mylar Film, Multi-Layer Sheet Elastomeric Insulation.....	8.11	2.07
23 07 13 00-0033 SF 1" Thick, Aluminum Foil/Mylar Film, Multi-Layer Sheet Elastomeric Insulation.....	9.00	2.17
23 07 13 00-0034 SF 1-1/2" Thick, Aluminum Foil/Mylar Film, Multi-Layer Sheet Elastomeric Insulation.....	13.86	2.38
23 07 13 00-0035 SF 2" Thick, Aluminum Foil/Mylar Film, Multi-Layer Sheet Elastomeric Insulation.....	16.37	2.58
 23 07 13 00-0036 Adhesive Backed, Aluminum Foil/Mylar Film, Multi-Layer Sheet Elastomeric Insulation <small>(23 07 13)</small>		
<i>Note: Jacketing is a 3-ply laminate consisting of a PVC core, 0.012" thick aluminum foil jacketing and UV-protective Mylar film.</i>		
23 07 13 00-0037 SF 1/2" Thick, Adhesive Backed, Aluminum Foil/Mylar Film, Multi-Layer Sheet Elastomeric Insulation.....	8.78	1.97
23 07 13 00-0038 SF 3/4" Thick, Adhesive Backed, Aluminum Foil/Mylar Film, Multi-Layer Sheet Elastomeric Insulation.....	9.50	2.07
23 07 13 00-0039 SF 1" Thick, Adhesive Backed, Aluminum Foil/Mylar Film, Multi-Layer Sheet Elastomeric Insulation.....	10.63	2.17
23 07 13 00-0040 SF 1-1/2" Thick, Adhesive Backed, Aluminum Foil/Mylar Film, Multi-Layer Sheet Elastomeric Insulation.....	15.47	2.38
 23 07 16 HVAC Equipment Insulation <small>(23 07)</small>		
23 07 16 00-0001 Calcium Silicate Block Insulation <small>(23 07 16)</small>		
23 07 16 00-0002 SF 1" Calcium Silicate Block Insulation.....	11.63	4.75
<i>For Work In Restricted Working Space, Add</i>		
23 07 16 00-0003 SF 1-1/2" Calcium Silicate Block Insulation.....	13.87	5.34
<i>For Work In Restricted Working Space, Add</i>		
23 07 16 00-0004 SF 2" Calcium Silicate Block Insulation.....	16.62	6.16
23 07 16 00-0005 SF 2-1/2" Calcium Silicate Block Insulation.....	19.79	7.22
<i>For Work In Restricted Working Space, Add</i>		
23 07 16 00-0006 SF 3" Calcium Silicate Block Insulation.....	24.19	8.90
<i>For Work In Restricted Working Space, Add</i>		
 23 07 19 HVAC Piping Insulation <small>(23 07)</small>		
<i>See CSI section 22 07 19 00-0000 for pipe insulation.</i>		
23 07 19 00-0001 Calcium Silicate Pipe Insulation <small>(23 07 19)</small>		
<i>Note: Includes adhesive. Excludes fittings (a location requiring purchase of an insulation fitting or cutting and fitting straight sections, excludes couplings, plugs, etc.). For fittings/valves up to 3" add 2 LF for each fitting/valve or 3 LF for each flanged/grooved joint. For fittings/valves >3" add 3 LF for each fitting/valve or 4 LF for each flanged/grooved joint. See CSI section 22 07 19 00-00341 for protective jacketing.</i>		

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 07 HVAC Insulation****23 07 19 HVAC Piping Insulation**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 07 19 00-0002 1" Thick Calcium Silicate Pipe Insulation (23 07 19 00-0001)		
23 07 19 00-0003 LF 1/2" Diameter Pipe, 1" Thick Calcium Silicate Insulation	8.58	2.27
<i>For Work In Restricted Working Space, Add</i>	1.70	
23 07 19 00-0004 LF 3/4" Diameter Pipe, 1" Thick Calcium Silicate Insulation	8.58	2.27
<i>For Work In Restricted Working Space, Add</i>	1.70	
23 07 19 00-0005 LF 1" Diameter Pipe, 1" Thick Calcium Silicate Insulation	8.54	2.30
<i>For Work In Restricted Working Space, Add</i>	1.73	
23 07 19 00-0006 LF 1-1/4" Diameter Pipe, 1" Thick Calcium Silicate Insulation	8.67	2.33
<i>For Work In Restricted Working Space, Add</i>	1.75	
23 07 19 00-0007 LF 1-1/2" Diameter Pipe, 1" Thick Calcium Silicate Insulation	8.77	2.36
<i>For Work In Restricted Working Space, Add</i>	1.77	
23 07 19 00-0008 LF 2" Diameter Pipe, 1" Thick Calcium Silicate Insulation	9.37	2.43
<i>For Work In Restricted Working Space, Add</i>	1.82	
23 07 19 00-0009 LF 2-1/2" Diameter Pipe, 1" Thick Calcium Silicate Insulation	9.81	2.53
<i>For Work In Restricted Working Space, Add</i>	1.90	
23 07 19 00-0010 LF 3" Diameter Pipe, 1" Thick Calcium Silicate Insulation	10.23	2.59
<i>For Work In Restricted Working Space, Add</i>	1.94	
23 07 19 00-0011 LF 4" Diameter Pipe, 1" Thick Calcium Silicate Insulation	11.67	2.79
<i>For Work In Restricted Working Space, Add</i>	2.09	
23 07 19 00-0012 LF 6" Diameter Pipe, 1" Thick Calcium Silicate Insulation	12.99	3.14
<i>For Work In Restricted Working Space, Add</i>	2.36	
23 07 19 00-0013 1-1/2" Thick Calcium Silicate Pipe Insulation (23 07 19 00-0001)		
23 07 19 00-0014 LF 1/2" Diameter Pipe, 1-1/2" Thick Calcium Silicate Insulation	8.98	2.36
<i>For Work In Restricted Working Space, Add</i>	1.77	
23 07 19 00-0015 LF 3/4" Diameter Pipe, 1-1/2" Thick Calcium Silicate Insulation	9.02	2.36
<i>For Work In Restricted Working Space, Add</i>	1.77	
23 07 19 00-0016 LF 1" Diameter Pipe, 1-1/2" Thick Calcium Silicate Insulation	9.66	2.50
<i>For Work In Restricted Working Space, Add</i>	1.88	
23 07 19 00-0017 LF 1-1/4" Diameter Pipe, 1-1/2" Thick Calcium Silicate Insulation	10.05	2.55
<i>For Work In Restricted Working Space, Add</i>	1.91	
23 07 19 00-0018 LF 1-1/2" Diameter Pipe, 1-1/2" Thick Calcium Silicate Insulation	10.44	2.59
<i>For Work In Restricted Working Space, Add</i>	1.95	
23 07 19 00-0019 LF 2" Diameter Pipe, 1-1/2" Thick Calcium Silicate Insulation	11.19	2.74
<i>For Work In Restricted Working Space, Add</i>	2.05	
23 07 19 00-0020 LF 2-1/2" Diameter Pipe, 1-1/2" Thick Calcium Silicate Insulation	11.72	2.78
<i>For Work In Restricted Working Space, Add</i>	2.09	
23 07 19 00-0021 LF 3" Diameter Pipe, 1-1/2" Thick Calcium Silicate Insulation	12.16	2.88
<i>For Work In Restricted Working Space, Add</i>	2.16	
23 07 19 00-0022 LF 4" Diameter Pipe, 1-1/2" Thick Calcium Silicate Insulation	13.53	3.11
<i>For Work In Restricted Working Space, Add</i>	2.33	
23 07 19 00-0023 LF 6" Diameter Pipe, 1-1/2" Thick Calcium Silicate Insulation	15.69	3.64
<i>For Work In Restricted Working Space, Add</i>	2.72	
23 07 19 00-0024 LF 8" Diameter Pipe, 1-1/2" Thick Calcium Silicate Insulation	18.35	3.83
<i>For Work In Restricted Working Space, Add</i>	2.88	
23 07 19 00-0025 LF 10" Diameter Pipe, 1-1/2" Thick Calcium Silicate Insulation	23.08	4.59
<i>For Work In Restricted Working Space, Add</i>	3.44	
23 07 19 00-0026 LF 12" Diameter Pipe, 1-1/2" Thick Calcium Silicate Insulation	27.13	5.34
<i>For Work In Restricted Working Space, Add</i>	4.01	
23 07 19 00-0027 LF 14" Diameter Pipe, 1-1/2" Thick Calcium Silicate Insulation	30.20	5.86
<i>For Work In Restricted Working Space, Add</i>	4.40	
23 07 19 00-0028 LF 16" Diameter Pipe, 1-1/2" Thick Calcium Silicate Insulation	36.06	7.46
<i>For Work In Restricted Working Space, Add</i>	5.60	
23 07 19 00-0029 LF 18" Diameter Pipe, 1-1/2" Thick Calcium Silicate Insulation	38.83	7.83
<i>For Work In Restricted Working Space, Add</i>	5.87	
23 07 19 00-0030 2" Thick Calcium Silicate Pipe Insulation (23 07 19 00-0001)		
23 07 19 00-0031 LF 1/2" Diameter Pipe, 2" Thick Calcium Silicate Insulation	11.34	2.59
<i>For Work In Restricted Working Space, Add</i>	1.94	
23 07 19 00-0032 LF 3/4" Diameter Pipe, 2" Thick Calcium Silicate Insulation	11.60	2.59
<i>For Work In Restricted Working Space, Add</i>	1.94	
23 07 19 00-0033 LF 1" Diameter Pipe, 2" Thick Calcium Silicate Insulation	11.96	2.63
<i>For Work In Restricted Working Space, Add</i>	1.97	
23 07 19 00-0034 LF 1-1/4" Diameter Pipe, 2" Thick Calcium Silicate Insulation	12.43	2.66
<i>For Work In Restricted Working Space, Add</i>	1.99	
23 07 19 00-0035 LF 1-1/2" Diameter Pipe, 2" Thick Calcium Silicate Insulation	12.77	2.69
<i>For Work In Restricted Working Space, Add</i>	2.02	
23 07 19 00-0036 LF 2" Diameter Pipe, 2" Thick Calcium Silicate Insulation	13.32	2.79
<i>For Work In Restricted Working Space, Add</i>	2.09	
23 07 19 00-0037 LF 2-1/2" Diameter Pipe, 2" Thick Calcium Silicate Insulation	14.84	2.89
<i>For Work In Restricted Working Space, Add</i>	2.17	
23 07 19 00-0038 LF 3" Diameter Pipe, 2" Thick Calcium Silicate Insulation	15.12	2.98
<i>For Work In Restricted Working Space, Add</i>	2.24	
23 07 19 00-0039 LF 4" Diameter Pipe, 2" Thick Calcium Silicate Insulation	16.73	3.16
<i>For Work In Restricted Working Space, Add</i>	2.36	
23 07 19 00-0040 LF 6" Diameter Pipe, 2" Thick Calcium Silicate Insulation	20.50	3.78
<i>For Work In Restricted Working Space, Add</i>	2.84	
23 07 19 00-0041 LF 8" Diameter Pipe, 2" Thick Calcium Silicate Insulation	23.13	3.99
<i>For Work In Restricted Working Space, Add</i>	2.99	
23 07 19 00-0042 LF 10" Diameter Pipe, 2" Thick Calcium Silicate Insulation	28.45	4.78
<i>For Work In Restricted Working Space, Add</i>	3.58	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 07 19 00-0043 LF 12" Diameter Pipe, 2" Thick Calcium Silicate Insulation <i>For Work In Restricted Working Space, Add</i>	32.64 4.29	5.72
23 07 19 00-0044 LF 14" Diameter Pipe, 2" Thick Calcium Silicate Insulation <i>For Work In Restricted Working Space, Add</i>	40.13 5.99	7.98
23 07 19 00-0045 LF 16" Diameter Pipe, 2" Thick Calcium Silicate Insulation <i>For Work In Restricted Working Space, Add</i>	42.19 5.99	7.98
23 07 19 00-0046 LF 18" Diameter Pipe, 2" Thick Calcium Silicate Insulation <i>For Work In Restricted Working Space, Add</i>	45.21 6.29	8.38
23 07 19 00-0047 LF 20" Diameter Pipe, 2" Thick Calcium Silicate Insulation <i>For Work In Restricted Working Space, Add</i>	53.82 7.18	9.58
23 07 19 00-0048 LF 24" Diameter Pipe, 2" Thick Calcium Silicate Insulation <i>For Work In Restricted Working Space, Add</i>	62.73 8.68	11.57
23 07 19 00-0049 2-1/2" Thick Calcium Silicate Pipe Insulation (23 07 19 00-0001)		
23 07 19 00-0050 LF 1/2" Diameter Pipe, 2-1/2" Thick Calcium Silicate Insulation <i>For Work In Restricted Working Space, Add</i>	13.59 2.24	2.99
23 07 19 00-0051 LF 3/4" Diameter Pipe, 2-1/2" Thick Calcium Silicate Insulation <i>For Work In Restricted Working Space, Add</i>	13.87 2.24	2.99
23 07 19 00-0052 LF 1" Diameter Pipe, 2-1/2" Thick Calcium Silicate Insulation <i>For Work In Restricted Working Space, Add</i>	14.11 2.28	3.03
23 07 19 00-0053 LF 1-1/4" Diameter Pipe, 2-1/2" Thick Calcium Silicate Insulation <i>For Work In Restricted Working Space, Add</i>	14.24 2.30	3.06
23 07 19 00-0054 LF 1-1/2" Diameter Pipe, 2-1/2" Thick Calcium Silicate Insulation <i>For Work In Restricted Working Space, Add</i>	14.60 2.31	3.08
23 07 19 00-0055 LF 2" Diameter Pipe, 2-1/2" Thick Calcium Silicate Insulation <i>For Work In Restricted Working Space, Add</i>	15.22 2.41	3.22
23 07 19 00-0056 LF 2-1/2" Diameter Pipe, 2-1/2" Thick Calcium Silicate Insulation <i>For Work In Restricted Working Space, Add</i>	17.07 2.49	3.33
23 07 19 00-0057 LF 3" Diameter Pipe, 2-1/2" Thick Calcium Silicate Insulation <i>For Work In Restricted Working Space, Add</i>	17.36 2.58	3.44
23 07 19 00-0058 LF 4" Diameter Pipe, 2-1/2" Thick Calcium Silicate Insulation <i>For Work In Restricted Working Space, Add</i>	20.01 2.72	3.63
23 07 19 00-0059 LF 6" Diameter Pipe, 2-1/2" Thick Calcium Silicate Insulation <i>For Work In Restricted Working Space, Add</i>	24.85 3.09	4.12
23 07 19 00-0060 LF 8" Diameter Pipe, 2-1/2" Thick Calcium Silicate Insulation <i>For Work In Restricted Working Space, Add</i>	28.35 3.45	4.60
23 07 19 00-0061 LF 10" Diameter Pipe, 2-1/2" Thick Calcium Silicate Insulation <i>For Work In Restricted Working Space, Add</i>	33.84 3.98	5.30
23 07 19 00-0062 LF 12" Diameter Pipe, 2-1/2" Thick Calcium Silicate Insulation <i>For Work In Restricted Working Space, Add</i>	39.43 4.94	6.58
23 07 19 00-0063 LF 14" Diameter Pipe, 2-1/2" Thick Calcium Silicate Insulation <i>For Work In Restricted Working Space, Add</i>	43.60 5.39	7.19
23 07 19 00-0064 LF 16" Diameter Pipe, 2-1/2" Thick Calcium Silicate Insulation <i>For Work In Restricted Working Space, Add</i>	52.99 6.89	9.19
23 07 19 00-0065 LF 18" Diameter Pipe, 2-1/2" Thick Calcium Silicate Insulation <i>For Work In Restricted Working Space, Add</i>	55.96 7.24	9.65
23 07 19 00-0066 LF 20" Diameter Pipe, 2-1/2" Thick Calcium Silicate Insulation <i>For Work In Restricted Working Space, Add</i>	64.90 8.27	11.03
23 07 19 00-0067 LF 24" Diameter Pipe, 2-1/2" Thick Calcium Silicate Insulation <i>For Work In Restricted Working Space, Add</i>	76.31 10.00	13.33
23 07 19 00-0068 3" Thick Calcium Silicate Pipe Insulation (23 07 19 00-0001)		
23 07 19 00-0069 LF 1/2" Diameter Pipe, 3" Thick Calcium Silicate Insulation <i>For Work In Restricted Working Space, Add</i>	17.09 2.48	3.31
23 07 19 00-0070 LF 3/4" Diameter Pipe, 3" Thick Calcium Silicate Insulation <i>For Work In Restricted Working Space, Add</i>	17.16 2.48	3.31
23 07 19 00-0071 LF 1" Diameter Pipe, 3" Thick Calcium Silicate Insulation <i>For Work In Restricted Working Space, Add</i>	17.31 2.51	3.35
23 07 19 00-0072 LF 1-1/4" Diameter Pipe, 3" Thick Calcium Silicate Insulation <i>For Work In Restricted Working Space, Add</i>	17.48 2.53	3.37
23 07 19 00-0073 LF 1-1/2" Diameter Pipe, 3" Thick Calcium Silicate Insulation <i>For Work In Restricted Working Space, Add</i>	17.65 2.55	3.41
23 07 19 00-0074 LF 2" Diameter Pipe, 3" Thick Calcium Silicate Insulation <i>For Work In Restricted Working Space, Add</i>	18.24 2.65	3.53
23 07 19 00-0075 LF 2-1/2" Diameter Pipe, 3" Thick Calcium Silicate Insulation <i>For Work In Restricted Working Space, Add</i>	20.21 2.74	3.65
23 07 19 00-0076 LF 3" Diameter Pipe, 3" Thick Calcium Silicate Insulation <i>For Work In Restricted Working Space, Add</i>	20.64 2.84	3.78
23 07 19 00-0077 LF 4" Diameter Pipe, 3" Thick Calcium Silicate Insulation <i>For Work In Restricted Working Space, Add</i>	24.26 2.99	3.99
23 07 19 00-0078 LF 6" Diameter Pipe, 3" Thick Calcium Silicate Insulation <i>For Work In Restricted Working Space, Add</i>	28.74 3.40	4.54
23 07 19 00-0079 LF 8" Diameter Pipe, 3" Thick Calcium Silicate Insulation <i>For Work In Restricted Working Space, Add</i>	33.37 3.79	5.05
23 07 19 00-0080 LF 10" Diameter Pipe, 3" Thick Calcium Silicate Insulation <i>For Work In Restricted Working Space, Add</i>	39.62 4.37	5.83
23 07 19 00-0081 LF 12" Diameter Pipe, 3" Thick Calcium Silicate Insulation <i>For Work In Restricted Working Space, Add</i>	45.81 5.43	7.25
23 07 19 00-0082 LF 14" Diameter Pipe, 3" Thick Calcium Silicate Insulation <i>For Work In Restricted Working Space, Add</i>	50.84 5.93	7.91
23 07 19 00-0083 LF 16" Diameter Pipe, 3" Thick Calcium Silicate Insulation <i>For Work In Restricted Working Space, Add</i>	59.59 7.58	10.11

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 07 HVAC Insulation****23 07 19 HVAC Piping Insulation**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 07 19 00-0084	LF		18" Diameter Pipe, 3" Thick Calcium Silicate Insulation	64.23	10.61
			<i>For Work In Restricted Working Space, Add</i>	7.96	
23 07 19 00-0085	LF		20" Diameter Pipe, 3" Thick Calcium Silicate Insulation	75.16	12.14
			<i>For Work In Restricted Working Space, Add</i>	9.10	
23 07 19 00-0086	LF		24" Diameter Pipe, 3" Thick Calcium Silicate Insulation	88.95	14.66
			<i>For Work In Restricted Working Space, Add</i>	11.00	
23 07 19 00-0087			3-1/2" Thick Calcium Silicate Pipe Insulation (23 07 19 00-0001)		
23 07 19 00-0088	LF		1/2" Diameter Pipe, 3-1/2" Thick Calcium Silicate Insulation	21.71	3.63
			<i>For Work In Restricted Working Space, Add</i>	2.72	
23 07 19 00-0089	LF		3/4" Diameter Pipe, 3-1/2" Thick Calcium Silicate Insulation	22.51	3.63
			<i>For Work In Restricted Working Space, Add</i>	2.72	
23 07 19 00-0090	LF		1" Diameter Pipe, 3-1/2" Thick Calcium Silicate Insulation	22.56	3.65
			<i>For Work In Restricted Working Space, Add</i>	2.74	
23 07 19 00-0091	LF		1-1/4" Diameter Pipe, 3-1/2" Thick Calcium Silicate Insulation	22.62	3.67
			<i>For Work In Restricted Working Space, Add</i>	2.75	
23 07 19 00-0092	LF		1-1/2" Diameter Pipe, 3-1/2" Thick Calcium Silicate Insulation	23.32	3.72
			<i>For Work In Restricted Working Space, Add</i>	2.79	
23 07 19 00-0093	LF		2" Diameter Pipe, 3-1/2" Thick Calcium Silicate Insulation	24.74	3.84
			<i>For Work In Restricted Working Space, Add</i>	2.89	
23 07 19 00-0094	LF		2-1/2" Diameter Pipe, 3-1/2" Thick Calcium Silicate Insulation	26.85	3.98
			<i>For Work In Restricted Working Space, Add</i>	2.99	
23 07 19 00-0095	LF		3" Diameter Pipe, 3-1/2" Thick Calcium Silicate Insulation	27.79	4.12
			<i>For Work In Restricted Working Space, Add</i>	3.09	
23 07 19 00-0096	LF		4" Diameter Pipe, 3-1/2" Thick Calcium Silicate Insulation	31.62	4.35
			<i>For Work In Restricted Working Space, Add</i>	3.27	
23 07 19 00-0097	LF		6" Diameter Pipe, 3-1/2" Thick Calcium Silicate Insulation	35.29	4.95
			<i>For Work In Restricted Working Space, Add</i>	3.71	
23 07 19 00-0098	LF		8" Diameter Pipe, 3-1/2" Thick Calcium Silicate Insulation	42.92	5.51
			<i>For Work In Restricted Working Space, Add</i>	4.13	
23 07 19 00-0099	LF		10" Diameter Pipe, 3-1/2" Thick Calcium Silicate Insulation	52.11	6.36
			<i>For Work In Restricted Working Space, Add</i>	4.77	
23 07 19 00-0100	LF		12" Diameter Pipe, 3-1/2" Thick Calcium Silicate Insulation	63.11	7.90
			<i>For Work In Restricted Working Space, Add</i>	5.93	
23 07 19 00-0101	LF		14" Diameter Pipe, 3-1/2" Thick Calcium Silicate Insulation	66.52	8.63
			<i>For Work In Restricted Working Space, Add</i>	6.47	
23 07 19 00-0102	LF		16" Diameter Pipe, 3-1/2" Thick Calcium Silicate Insulation	77.68	11.03
			<i>For Work In Restricted Working Space, Add</i>	8.27	
23 07 19 00-0103	LF		18" Diameter Pipe, 3-1/2" Thick Calcium Silicate Insulation	89.11	11.58
			<i>For Work In Restricted Working Space, Add</i>	8.69	
23 07 19 00-0104	LF		20" Diameter Pipe, 3-1/2" Thick Calcium Silicate Insulation	96.25	13.25
			<i>For Work In Restricted Working Space, Add</i>	9.93	
23 07 19 00-0105			4" Thick Calcium Silicate Pipe Insulation (23 07 19 00-0001)		
23 07 19 00-0106	LF		1/2" Diameter Pipe, 4" Thick Calcium Silicate Insulation	27.05	4.03
			<i>For Work In Restricted Working Space, Add</i>	3.02	
23 07 19 00-0107	LF		3/4" Diameter Pipe, 4" Thick Calcium Silicate Insulation	27.07	4.03
			<i>For Work In Restricted Working Space, Add</i>	3.02	
23 07 19 00-0108	LF		1" Diameter Pipe, 4" Thick Calcium Silicate Insulation	27.24	4.10
			<i>For Work In Restricted Working Space, Add</i>	3.07	
23 07 19 00-0109	LF		1-1/4" Diameter Pipe, 4" Thick Calcium Silicate Insulation	27.98	4.14
			<i>For Work In Restricted Working Space, Add</i>	3.11	
23 07 19 00-0110	LF		1-1/2" Diameter Pipe, 4" Thick Calcium Silicate Insulation	29.64	4.27
			<i>For Work In Restricted Working Space, Add</i>	3.21	
23 07 19 00-0111	LF		2" Diameter Pipe, 4" Thick Calcium Silicate Insulation	30.24	4.41
			<i>For Work In Restricted Working Space, Add</i>	3.31	
23 07 19 00-0112	LF		2-1/2" Diameter Pipe, 4" Thick Calcium Silicate Insulation	32.99	4.48
			<i>For Work In Restricted Working Space, Add</i>	3.36	
23 07 19 00-0113	LF		3" Diameter Pipe, 4" Thick Calcium Silicate Insulation	33.95	4.64
			<i>For Work In Restricted Working Space, Add</i>	3.48	
23 07 19 00-0114	LF		4" Diameter Pipe, 4" Thick Calcium Silicate Insulation	38.50	4.90
			<i>For Work In Restricted Working Space, Add</i>	3.68	
23 07 19 00-0115	LF		6" Diameter Pipe, 4" Thick Calcium Silicate Insulation	44.52	5.55
			<i>For Work In Restricted Working Space, Add</i>	4.17	
23 07 19 00-0116	LF		8" Diameter Pipe, 4" Thick Calcium Silicate Insulation	52.99	6.20
			<i>For Work In Restricted Working Space, Add</i>	4.65	
23 07 19 00-0117	LF		10" Diameter Pipe, 4" Thick Calcium Silicate Insulation	61.02	7.16
			<i>For Work In Restricted Working Space, Add</i>	5.37	
23 07 19 00-0118	LF		12" Diameter Pipe, 4" Thick Calcium Silicate Insulation	69.58	8.89
			<i>For Work In Restricted Working Space, Add</i>	6.67	
23 07 19 00-0119	LF		14" Diameter Pipe, 4" Thick Calcium Silicate Insulation	74.03	9.72
			<i>For Work In Restricted Working Space, Add</i>	7.28	
23 07 19 00-0120	LF		16" Diameter Pipe, 4" Thick Calcium Silicate Insulation	87.77	12.42
			<i>For Work In Restricted Working Space, Add</i>	9.32	
23 07 19 00-0121	LF		18" Diameter Pipe, 4" Thick Calcium Silicate Insulation	93.33	13.01
			<i>For Work In Restricted Working Space, Add</i>	9.76	
23 07 19 00-0122	LF		20" Diameter Pipe, 4" Thick Calcium Silicate Insulation	103.34	14.90
			<i>For Work In Restricted Working Space, Add</i>	11.17	
23 07 19 00-0123			Weather-Protective Coating For Calcium Silicate Pipe Insulation (23 07 19 00-0001)		



MINOR	CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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23 07 19 00-0124	SF 1/4" Thick (Two 1/8" Coats), Weatherproof Coating Over Glass Cloth Mesh (Insulkote ET) <i>For Work In Restricted Working Space, Add</i>	3.32	0.64
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23 08 Commissioning Of HVAC (23)

See CSI section 23 05 93 00-0000 for testing and balancing.

23 09 Instrumentation And Control For HVAC (23)

23 09 13 Instrumentation And Control Devices For HVAC (23 09)

23 09 13 56 Pneumatic Tubing (23 09 13)

23 09 13 56-0001 Polyurethane Pneumatic Tubing (23 09 13 56)

23 09 13 56-0002	LF 1/4" Outside Diameter x 1/32" Thick Wall Polyurethane Pneumatic Tubing	1.59	0.65
23 09 13 56-0003	LF 5/32" Outside Diameter x 1/16" Thick Wall Polyurethane Pneumatic Tubing	1.95	0.67
23 09 13 56-0004	LF 3/8" Outside Diameter x 1/16" Thick Wall Polyurethane Pneumatic Tubing	2.46	0.69
23 09 13 56-0005	LF 1/2" Outside Diameter x 1/16" Thick Wall Polyurethane Pneumatic Tubing	3.03	0.71

23 09 13 56-0006 Fire Resistant Polyethylene Pneumatic Tubing (23 09 13 56)

23 09 13 56-0007	LF 1/4" Outside Diameter x .040" Thick Wall Fire Resistant Polyethylene Pneumatic Tubing	1.46	0.65
23 09 13 56-0008	LF 5/32" Outside Diameter x .030" Thick Wall Fire Resistant Polyethylene Pneumatic Tubing	1.56	0.67
23 09 13 56-0009	LF 3/8" Outside Diameter x .062" Thick Wall Fire Resistant Polyethylene Pneumatic Tubing	1.75	0.69
23 09 13 56-0010	LF 1/2" Outside Diameter x .062" Thick Wall Fire Resistant Polyethylene Pneumatic Tubing	2.10	0.71

23 09 13 56-0011 Nylon Pneumatic Tubing (23 09 13 56)

23 09 13 56-0012	LF 1/8" Outside Diameter x .016" Thick Wall Nylon Pneumatic Tubing	1.66	0.63
23 09 13 56-0013	LF 1/4" Outside Diameter x .035" Thick Wall Nylon Pneumatic Tubing	2.11	0.65
23 09 13 56-0014	LF 3/8" Outside Diameter x .050" Thick Wall Nylon Pneumatic Tubing	3.03	0.69
23 09 13 56-0015	LF 1/2" Outside Diameter x .062" Thick Wall Nylon Pneumatic Tubing	3.80	0.71

23 09 13 56-0016 Flexible Vinyl Pneumatic Tubing (23 09 13 56)

23 09 13 56-0017	LF 1/4" Outside Diameter Flexible Vinyl Pneumatic Tubing	1.64	0.65
23 09 13 56-0018	LF 3/8" Outside Diameter Flexible Vinyl Pneumatic Tubing	2.47	0.69
23 09 13 56-0019	LF 1/2" Outside Diameter Flexible Vinyl Pneumatic Tubing	2.92	0.71
23 09 13 56-0020	LF 5/8" Outside Diameter Flexible Vinyl Pneumatic Tubing	3.48	0.74
23 09 13 56-0021	LF 3/4" Outside Diameter Flexible Vinyl Pneumatic Tubing	3.90	0.76
23 09 13 56-0022	LF 1" Outside Diameter Flexible Vinyl Pneumatic Tubing	5.21	0.78

23 09 13 56-0023 Braided Vinyl Pneumatic Tubing (23 09 13 56)

23 09 13 56-0024	LF 5/8" Outside Diameter Braided Vinyl Pneumatic Tubing	2.15	0.74
23 09 13 56-0025	LF 3/4" Outside Diameter Braided Vinyl Pneumatic Tubing	2.44	0.76
23 09 13 56-0026	LF 1" Outside Diameter Braided Vinyl Pneumatic Tubing	2.97	0.78

23 09 13 56-0027 Copper Pneumatic Tubing (23 09 13 56)

23 09 13 56-0028	LF 1/4" Outside Diameter Copper Pneumatic Tubing	4.16	1.43
23 09 13 56-0029	LF 3/8" Outside Diameter Copper Pneumatic Tubing	4.72	1.64
23 09 13 56-0030	LF 1/2" Outside Diameter Copper Pneumatic Tubing	5.90	1.88
23 09 13 56-0031	LF 5/8" Outside Diameter Copper Pneumatic Tubing	7.05	2.17
23 09 13 56-0032	LF 3/4" Outside Diameter Copper Pneumatic Tubing	8.58	2.49

23 09 13 56-0033 Brass Couplings (23 09 13 56)

23 09 13 56-0034 Straight Brass Couplings (23 09 13 56-0033)

Note: Barb x Barb			
23 09 13 56-0035	EA 1/4" x 1/4" Straight Brass Coupling	7.50	3.59
23 09 13 56-0036	EA 3/8" x 1/4" Straight Brass Coupling	7.55	3.59
23 09 13 56-0037	EA 3/8" x 3/8" Straight Brass Coupling	7.60	3.59

23 09 13 56-0038 Elbow Brass Couplings (23 09 13 56-0033)

Note: Barb x Barb			
23 09 13 56-0039	EA 1/4" x 1/4" Elbow Brass Coupling	7.78	3.59
23 09 13 56-0040	EA 3/8" x 3/8" Elbow Brass Coupling	7.95	3.59

23 09 13 56-0041 Tee Brass Couplings (23 09 13 56-0033)

Note: Barb x Barb			
23 09 13 56-0042	EA 1/4" x 1/4" x 1/4" Tee Brass Coupling	11.96	5.59
23 09 13 56-0043	EA 3/8" x 3/8" x 1/4" Tee Brass Coupling	13.35	5.99
23 09 13 56-0044	EA 3/8" x 3/8" x 3/8" Tee Brass Coupling	13.17	5.99

23 09 23 Direct-Digital Control System For HVAC (23 09)

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 09 Instrumentation And Control For HVAC****23 09 23 Direct-Digital Control System For HVAC**MINOR
CSI UOM DESCRIPTIONTOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 09 23 00-0001			EMCS General Costs <small>(23 09 23)</small>		
23 09 23 00-0002			EMCS System Design Engineering <small>(23 09 23 00-0001)</small>		
			Note: Hourly labor rates are used for engineering projects only. Not used in conjunction with construction tasks.		
23 09 23 00-0003	HR		EMCS Site Inspection Of Existing Facilities.....	199.41	
23 09 23 00-0004	HR		EMCS Engineering Project Management.....	199.41	
23 09 23 00-0005	HR		EMCS System Engineering, Schematic Design And Layout.....	211.50	
23 09 23 00-0006	HR		EMCS System Software Programming And Graphics Programming.....	211.50	
23 09 23 00-0007	HR		EMCS Graphics Picture Creation.....	135.99	
23 09 23 00-0008	HR		EMCS System Controls Training.....	199.41	
23 09 23 00-0009	HR		EMCS On Site System Diagnostics Field Technician.....	199.41	
23 09 23 00-0010	HR		EMCS Remote Technical Support Using Phone Or Internet.....	166.22	
23 09 23 00-0011	HR		EMCS Travel Time (All Personnel).....	172.26	
23 09 23 00-0012			Post Warranty Field Tests, Checkout And Commissioning <small>(23 09 23 00-0001)</small>		
			Note: Tasks used for building commissioning of other contractors' work or post warranty service work. A point is defined as any transmitter, switch, actuator, sensor or device (starter, VFD, controller, fan, electric coil, actuator, valve, etc.) that is monitored or controlled by the EMCS system. Most devices count as 1 point. Actuators, valves and thermostats count as 2 points.		
23 09 23 00-0013	PNT		EMCS Field Test.....	105.78	
			Note: Priced per point. Task used after warranty period only.		
23 09 23 00-0014	PNT		EMCS Field Checkout And Startup.....	105.78	
			Note: Priced per point. Task used after warranty period only.		
23 09 23 00-0015	PNT		EMCS Field Commissioning.....	105.78	
			Note: Priced per point. Used when the owner requires an independent commissioning firm.		
23 09 23 00-0016	EA		EMCS Field Balance Support.....	90.64	
			Note: Priced per controller. Task used after warranty period only.		
23 09 23 00-0017			EMCS System Engineering/Submittal Design And Layout <small>(23 09 23 00-0001)</small>		
			Note: A point is defined as any transmitter, switch, actuator, sensor or device (starter, VFD, controller, fan, electric coil, actuator, valve, etc.) that is monitored or controlled by the EMCS system. Most devices count as 1 point. Actuators, valves and thermostats count as 2 points.		
23 09 23 00-0018	PNT		EMCS System Engineering/Submittal Design And Layout.....	35.29	
			Note: Priced per point.		
23 09 23 00-0019			Install EMCS Field Devices And Controllers (Labor Only) <small>(23 09 23 00-0001)</small>		
			Note: This section is used when equipment or devices are supplied by others, usually in a maintenance or trouble shooting situation. Excludes cable or conduit between panel and device.		
23 09 23 00-0020	EA		Mount An AHU Control Enclosure On Block, Masonry Or Gypsum Wall.....	182.81	30.21
23 09 23 00-0021	EA		Install AHU Power Supply In A Control Enclosure.....	132.94	60.42
23 09 23 00-0022	EA		Install Metal Box And Conduit Stub-Up For Sensor In Masonry Wall.....	182.81	30.21
23 09 23 00-0023	EA		Install And Wire Room Sensor.....	49.87	30.21
23 09 23 00-0024	EA		Install And Wire Duct Sensor.....	66.47	30.21
23 09 23 00-0025	EA		Install And Wire AHU Averaging Sensor.....	216.00	151.06
23 09 23 00-0026	EA		Install And Wire AHU Humidity Sensor.....	116.34	45.36
23 09 23 00-0027	EA		Install And Wire AHU CO2 Sensor.....	166.22	45.36
23 09 23 00-0028	EA		Install And Wire Fan Or Filter DP Switch.....	166.22	45.36
23 09 23 00-0029	EA		Install And Wire Float Switch.....	132.94	30.21
23 09 23 00-0030	EA		Install And Wire Freezestat.....	216.00	151.06
23 09 23 00-0031	EA		Install And Wire Duct Static Pressure Sensor.....	116.34	60.42
23 09 23 00-0032	EA		Install And Wire Duct High Static Sensor.....	66.47	30.21
23 09 23 00-0033	EA		Install And Wire Emergency Stop Switch For AHU Or Other Equipment.....	66.47	30.21
23 09 23 00-0034	EA		Install And Wire Emergency Stop Switch For AHU.....	199.41	60.42
23 09 23 00-0035	EA		Install And Wire AHU Connection To Starter.....	199.41	151.06
23 09 23 00-0036	EA		Install And Wire Connection To VFD.....	365.61	151.06
23 09 23 00-0037	EA		Install And Wire AHU Valve Actuator.....	99.74	30.21
23 09 23 00-0038	EA		Install And Wire AHU Damper Actuator.....	199.41	60.42
23 09 23 00-0039	EA		Install And Wire AHU Smoke Detector Or Fire Alarm Relay.....	116.34	45.36
23 09 23 00-0040	EA		Install And Wire AHU Electropneumatic Transducer.....	83.06	30.21
23 09 23 00-0041	EA		Install And Wire Electric Heat Or Sequencer.....	199.41	60.42
23 09 23 00-0042	EA		Install And Wire Connection To Outdoor Compressor.....	465.28	45.36
23 09 23 00-0043	EA		Install And Wire AHU Magnahelic.....	166.22	30.21
23 09 23 00-0044	EA		Install And Wire AHU Wireway For Control Enclosure.....	199.41	60.42
23 09 23 00-0045	EA		Wire And Assemble AHU Control Enclosure.....	365.61	
			Note: Includes installing all panel devices for a medium size panel.		
23 09 23 00-0046	EA		Field Install And Wire VAV Controller.....	132.94	60.42
			Note: Use when VAV box is previously installed.		
23 09 23 00-0047	EA		Shop Install And Wire VAV Controller.....	116.34	
23 09 23 00-0048	EA		Install And Wire VAV Power Supply.....	49.87	30.21
23 09 23 00-0049	EA		Wire VAV Fan In Parallel Or Series Fan Box.....	66.47	30.21
23 09 23 00-0050	EA		Install And Wire Fan Coil Unit Controller.....	332.34	90.64
23 09 23 00-0051	EA		Mount Fan Coil Unit, Heat Pump, Or Unit Ventilator Controller.....	99.74	
23 09 23 00-0052	EA		Install And Wire Central Plant Controller.....	465.28	271.92
			Note: For programmable DDC controller.		
23 09 23 00-0053	EA		Mount Central Plant Enclosure For DDC Control Enclosure.....	182.81	30.21
			Note: For programmable DDC controller.		
23 09 23 00-0054	EA		Install Central Plant Power Supply For DDC Programmable Controller.....	132.94	60.42
23 09 23 00-0055	EA		Install Central Plant Wireway For Programmable Controller.....	199.41	60.42
23 09 23 00-0056	EA		Install And Wire Chiller Controls For Enable And Setpoint Controls.....	398.82	90.64



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 09 23 00-0057 EA Install And Wire Chiller Flow Switch	398.82	181.28
23 09 23 00-0058 EA Install And Wire Chiller DP Transmitter	1,495.60	90.64
Note: Includes installing copper tubing connection to water piping.		
23 09 23 00-0059 EA Install And Wire Boiler Controls For Enable And Alarm	299.15	90.64
23 09 23 00-0060 EA Install And Wire Boiler Safeties.....	299.15	90.64
Note: For high water, low water and flame safeguard.		
23 09 23 00-0061 EA Install Boiler Control Panel Enclosure On Block, Masonry Or Gypsum Wall	664.69	377.70
23 09 23 00-0062 EA Wire And Terminate Combustion Air Damper.....	830.91	60.42
23 09 23 00-0063 EA Wire Oil Tank Interlock For Oil Boiler.....	415.41	60.42
23 09 23 00-0064 EA Install And Wire Boiler Emergency Stop Switch.....	830.91	181.28
23 09 23 00-0065 EA Wire And Terminate Temperature Well Sensor	83.06	45.36
Note: Excludes well.		
23 09 23 00-0066 EA Install And Wire Strap On Sensor	199.41	45.36
23 09 23 00-0067 EA Install And Wire CO2 Sensor For Room Or Space.....	166.22	45.36
Note: Excludes stub-up.		
23 09 23 00-0068 EA Install And Wire Valve Actuator	166.22	120.85
23 09 23 00-0069 EA Install And Wire Outside Air Temperature Sensor	299.15	90.64
23 09 23 00-0070 EA Install And Wire Outside Air Humidity Sensor.....	149.54	90.64
23 09 23 00-0071 EA Install And Wire Flow Sensor.....	365.61	181.28
23 09 23 00-0072 EA Install And Wire Pressure Sensor For Pump Or Building.....	365.61	181.28
23 09 23 00-0073 EA Install And Wire Pump Starter.....	199.41	45.36
23 09 23 00-0074 EA Install And Wire Pump VFD	365.61	90.64
23 09 23 00-0075 EA Install And Wire Pump DP Switch.....	498.56	181.28
Note: Includes installing copper tubing connection to water piping.		
23 09 23 00-0076 EA Install And Wire System DP Transmitter.....	1,661.80	181.28
Note: Includes installing copper tubing connection to water piping and wiring remote transmitter.		
23 09 23 00-0077 EA Mount Starter Sized Up To 100 HP	132.94	90.64
23 09 23 00-0078 EA Mount VFD Sized Up To 100 HP.....	332.34	302.13
23 09 23 00-0079 EA Install And Wire Cooling Tower Control Enclosure	598.22	181.28
23 09 23 00-0080 EA Install And Wire Vibration Switch For Cooling Tower.....	365.61	181.28
23 09 23 00-0081 EA Install And Wire Cooling Tower Basin Heater.....	199.41	181.28
23 09 23 00-0082 EA Install And Wire Basin Water Temperature Switch.....	199.41	90.64
23 09 23 00-0083 EA Install And Wire Cooling Tower Make-Up Water Valve.....	199.41	181.28
23 09 23 00-0084 EA Install And Wire Cooling Tower Make-Up Water Valve.....	199.41	181.28
23 09 23 00-0085 EA Install And Wire Refrigerant Monitor Panel.....	997.11	377.70
23 09 23 00-0086 EA Install And Wire Break Glass Switch.....	199.41	90.64
23 09 23 00-0087 EA Install And Wire Horn/Strobe For Refrigerant Monitor	149.54	60.42
23 09 23 00-0088 EA Install And Wire Damper Actuator.....	199.41	60.42
23 09 23 00-0089 EA Install And Wire Chemical Feed System.....	1,661.80	377.70
23 09 23 00-0090 EA Wire And Assemble Control Enclosure.....	398.82	181.28
Note: Includes installing all panel devices in large size panel.		
23 09 23 00-0091 EA Install And Wire Exhaust Fan DDC Control	415.41	75.57
Note: Start or stop and status.		
23 09 23 00-0092 EA Install And Wire Exhaust Fan Thermostat Control	132.94	45.36
23 09 23 00-0093 EA Wire Lighting Contactor (Contactor Installed By Others)	415.41	60.42
23 09 23 00-0094 EA Wire And Terminate Unit Heater.....	132.94	45.36
23 09 23 00-0095 EA Wire Domestic Water Heater For Enable Or Disable.....	415.41	60.42
23 09 23 00-0096 EA Wire And Install Current Transformer KWH Meter (With Power Off)	1,329.45	362.56
23 09 23 00-0097 EA Wire Water Meter (Meter Installed By Others).....	1,329.45	90.64
23 09 23 00-0098 EA Wire Gas Meter (Meter Installed By Others).....	1,329.45	90.64
23 09 23 00-0099 EA Install Wireless Receiver And Wire To DDC Controls.....	166.22	60.42
23 09 23 00-0100 EA Install Wireless Sensor	33.27	15.15
23 09 23 00-0101 EA Wire Split System AC Thermostat	664.69	45.36
23 09 23 00-0102 EA Wire Sump Pump Monitor Status Switch	498.56	90.64
23 09 23 00-0103 EA Install Locking Cover/Wire Guard For Thermostat Or Wall Temperature Sensor	24.17	12.09
23 09 23 00-0104 EA Install And Wire Combination Outside Air Temperature/Outside Air Humidity Sensor.....	448.69	181.28
23 09 23 00-0105	Honeywell Controls (23 09 23)	
23 09 23 00-0106	EMCS Central Equipment And Controllers (23 09 23 00-0105)	
23 09 23 00-0107	EMCS Network Area Controllers (BACnet Or Lon) (23 09 23 00-0106)	
Note: Includes loading software, software license, loading data base and mounting on wall.		
23 09 23 00-0108 EA Network Area Java Controller Supporting 126 Devices (Honeywell WC2003B2004).....	6,853.52	392.77
Note: Includes 128 MB RAM / 32 MB Flash, 10/100 MB ethernet port, 1 RS-232 serial ports, 1 minimum RS-485 electrically isolated ports, 1 LonWorks port (supports 126 devices), and web user interface software.		
23 09 23 00-0109 EA Network Area Java Controller Supporting 27 Devices (Honeywell WC2003B1022).....	4,847.67	392.77
Note: Includes 128 MB RAM / 32 MB Flash, 10/100 MB ethernet port, 1 RS-232 port, 1 RS-485 port, 1 LonWorks port with driver, Lon tunnel service, BACnet driver, wind river VxWorks OS with Jeode java virtual machine, Niagara control engine and web user interface software (supports 27 device).		
23 09 23 00-0110 EA Network Area Java Controller Supporting 10 Devices (Honeywell WEB-201).....	3,830.81	392.77
Note: Includes 128 MB RAM / 64 MB Flash, 2 10/100 MB ethernet ports, 1 RS-232 serial port, 1 RS-485 serial port, NDIO port, 2 communication card option slots, BACnet IP Client, and BACnet MS/TP. Supports up to 10 devices.		
23 09 23 00-0111 EA Network Area Java Controller Supporting 10 Devices (Honeywell WEB-201-EZ).....	4,639.99	392.77
Note: Includes 128 MB RAM / 64 MB Flash, 2 10/100 Mb ethernet ports, 1 RS-232 serial port, 1 RS-485 serial port, NDIO port, 2 communication card option slots, BACnet IP Client, and BACnet MS/TP. Includes WEB user interface and Enterprise connectivity pack.		
23 09 23 00-0112 EA Niagara Network Area Java Controller Supporting 10 Devices (Honeywell WEB-201-LN).....	3,802.95	392.77
Note: Includes 128 MB RAM / 64 MB Flash, 2 10/100 Mb ethernet ports, factory installed LON card, NDIO port and MODBus TCP driver. Excludes RS232 and RS485 communications. Includes Niagara network ethernet communication between stations.		

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 09 Instrumentation And Control For HVAC****23 09 23 Direct-Digital Control System For HVAC**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 09 23 00-0113 EA Web UI Network Area Java Controller Supporting 10 Devices (Honeywell WEB-201-LU) Note: Includes 128 MB RAM / 64 MB Flash, 2 10/100 Mb ethernet ports, factory installed LON card, NDIO port and MODBus TCP driver. Excludes RS232 and RS485.	3,802.95	392.77
23 09 23 00-0114 EA 16 Point BACnet IP Network Area Java Controller (Honeywell WEB-216-B) Note: Includes 16 IO point equipment controller consisting of a controller, one IO-16 module and BACnet IP client communications. Includes 64 MB RAM / 64 MB Flash, 2 10/100 MB ethernet ports, NDIO port and 2 communication card option slots. Excludes RS232 and RS485. The LON card is not an option on this controller.	4,082.81	392.77
23 09 23 00-0115 EA 16 Point Web UI And BACnet IP Network Area Java Controller (Honeywell WEB-216-BU) Note: Includes 16 IO point equipment controller consisting of a controller, one IO-16 module and BACnet IP client communications. Includes 64 MB RAM / 64 MB Flash, 2 10/100 MB ethernet ports, NDIO port and 2 communication card option slots. Excludes RS232 and RS485. The LON card is not an option on this controller.	4,376.59	392.77
23 09 23 00-0116 EA 16 Point Niagara Network Area Java Controller (Honeywell WEB-216-N) Note: Includes 16 IO point equipment controller consisting of a controller, one IO-16 module and BACnet IP client communications. Includes 64 MB RAM / 64 MB Flash, 2 10/100 MB ethernet ports, NDIO port and 2 communication card option slots. Excludes RS232 and RS485. The LON card is not an option on this controller.	4,082.81	392.77
23 09 23 00-0117 EA 16 Point Web UI And Niagara Network Area Java Controller (Honeywell WEB-216-NU) Note: Includes 16 IO point equipment controller consisting of a controller, one IO-16 module and BACnet IP client communications. Includes 64 MB RAM / 64 MB Flash, 2 10/100 MB ethernet ports, NDIO port and 2 communication card option slots. Excludes RS232 and RS485. The LON card is not an option on this controller.	4,376.59	392.77
23 09 23 00-0118 EA 34 Point BACnet IP Network Area Java Controller (Honeywell WEB-234-B) Note: Includes 34 IO point equipment controller consisting of a controller, one IO-16 module and BACnet IP client communications. Includes 64 MB RAM / 64 MB Flash, 2 10/100 MB ethernet ports, NDIO port and 2 communication card option slots. Excludes RS232 and RS485. The LON card is not an option on this controller.	4,379.13	392.77
23 09 23 00-0119 EA 34 Point Web UI and BACnet IP Network Area Java Controller (Honeywell WEB-234-BU) Note: Includes 34 IO point equipment controller consisting of a controller, one IO-16 module and BACnet IP client communications. Includes 64 MB RAM / 64 MB Flash, 2 10/100 MB ethernet ports, NDIO port and 2 communication card option slots. Excludes RS232 and RS485. The LON card is not an option on this.	4,672.91	392.77
23 09 23 00-0120 EA 34 Point Niagara Network Area Java Controller (Honeywell WEB-216-N) Note: Includes 34 IO point equipment controller consisting of a controller, one IO-16 module and BACnet IP client communications. Includes 64 MB RAM / 64 MB Flash, 2 10/100 MB ethernet ports, NDIO port and 2 communication card option slots. Excludes RS232 and RS485. The LON card is not an option on this controller.	4,379.13	392.77
23 09 23 00-0121 EA 34 Point Web UI and Niagara Network Area Java Controller (Honeywell WEB-216-NU) Note: Includes 34 IO point equipment controller consisting of a controller, one IO-16 module and BACnet IP client communications. Includes 64 MB RAM / 64 MB Flash, 2 10/100 MB ethernet ports, NDIO port and 2 communication card option slots. Excludes RS232 and RS485. The LON card is not an option on this.	4,672.91	392.77
23 09 23 00-0122 EA Network Area Java Controller Supporting 27 Devices (Controller Only) (Honeywell WEB-403-AX) Note: Includes 128 MB RAM / 32 MB Flash, 10/100 MB ethernet port, 1 RS-485 port, 1 RS-232 port, 1 LonWorks FTT 10 port, 6 universal inputs (analog or contact/pulse input), 4 form C (SPDT) relay outputs. Excludes UI service and Enterprise connectivity service.	4,626.06	392.77
23 09 23 00-0123 EA Unrestricted Network Area Java Controller Supporting 27 Devices (Controller Only) Note: Unrestricted limit on connected devices. Includes 128 MB RAM / 32 MB Flash, 10/100 MB ethernet port, 1 RS-485 port, 1 RS-232 port, 1 LonWorks FTT 10 port, 6 universal inputs (analog or contact/pulse input), 4 form C (SPDT) relay outputs. Excludes UI service and Enterprise connectivity service. Honeywell WEB-403-EXP-AX. As with other WEBs controllers, capacity is limited by the characteristics of the application including size and complexity.	5,607.46	392.77
23 09 23 00-0124 EA Easy Pack Network Area Java Controller Supporting 27 Devices (Honeywell WEB-403-EZ) Note: Includes controller plus User Interface Station Pack and Enterprise Connectivity Station Pack bundled as an "easy-order" bundle. Includes 128 MB RAM / 32 MB Flash, 10/100 MB ethernet port, 1 RS-485 port, 1 RS-232 port, 1 LonWorks FTT 10 port, 6 universal inputs (analog or contact/pulse input), 4 form C (SPDT) relay outputs. Excludes UI service and Enterprise connectivity service.	5,910.11	392.77
23 09 23 00-0125 EA Expanded Easy Pack Network Area Java Controller Supporting 27 Devices (Honeywell WEB-403-EXP-EZ) Note: Unrestricted limit on connected devices. Includes controller plus User Interface Station Pack and Enterprise Connectivity Station Pack bundled as an "easy-order" bundle. Includes 128 MB RAM / 32 MB Flash, 10/100 MB ethernet port, 1 RS-485 port, 1 RS-232 port, 1 LonWorks FTT 10 port, 6 universal inputs (analog or contact/pulse input), 4 form C (SPDT) relay outputs. Excludes UI service and Enterprise connectivity service. As with other WEBs controllers, capacity is limited by the characteristics of the application including size and complexity.	6,891.51	392.77
23 09 23 00-0126 EA Network Area Java Controller Supporting 124 Devices (Controller Only) (Honeywell WEB-545-AX) Note: Includes 128 MB RAM / 32 MB Flash, 10/100 MB ethernet port, 4 RS-485 port, 2 RS-232 port, 1 LonWorks port. As with other WEBs controllers, capacity is limited by the characteristics of the application. Unit is supplied with a steel, wall mountable enclosure, and 120 volt power supply. Excludes UI service and Enterprise connectivity service.	5,924.04	392.77
23 09 23 00-0127 EA Easy Pack Network Area Java Controller Supporting 124 Devices (Honeywell WEB-545-EZ) Note: Includes 128 MB RAM / 32 MB Flash, 10/100 MB ethernet port, 4 RS-485 port, 2 RS-232 port, 1 LonWorks port. As with other JACES, capacity is limited by the characteristics of the application. Unit is supplied with a steel, wall mountable enclosure, and 120 volt power supply. Includes WEB-545-AX plus User Interface Station Pack (UI-SP-5XX) and Enterprise Connectivity Station Pack (EC-SP-5XX) bundled as an "easy-order" bundle.	7,794.39	392.77
23 09 23 00-0128 EMCS Network Interfaces <small>(23 09 23 00-0106)</small> Note: Includes installation, start-up and tech labor.		
23 09 23 00-0129 EA Serial LonTalk Adapter For LonWorks Bus And A PC (Honeywell Q7760A2001) Note: For desktop computer.	953.06	108.77
23 09 23 00-0130 EA Serial LonTalk Card For LonWorks Bus And A PC (Honeywell Q7752B2009) Note: For laptop computer.	816.93	72.51
23 09 23 00-0131 EA FTT-10 To FTT-10 Router (Honeywell Q7751A2010)	1,050.03	135.99
23 09 23 00-0132 EA 4FTT-10 To TP/FTT-1250 Multi Port Router (Honeywell Q7751J2002)	1,576.18	196.43
23 09 23 00-0133 EA Two Way Lon Repeater (Honeywell Q7740A1008)	842.98	196.43
23 09 23 00-0134 EA FTT Termination Module For Network Bus (Honeywell 209541B)	66.25	24.17
23 09 23 00-0135 DDC Application Specific Controller Assemblies <small>(23 09 23 00-0106)</small> Note: Includes submittal generation, installation, field test, checkout and start-up. Includes control enclosure, transformer, terminal strip and ancillary devices. (For example, fan coil unit include valves, actuators with controller and thermostat; VAVs include controller, thermostat and hot water valve if VAV has reheat coil). Excludes graphics and database generation. Excludes discharge air sensor.		
23 09 23 00-0136 EA Up To 10 Factory Installed Cooling Only Or Electric Reheat VAV Or FPB Controller Assemblies	1,609.42	561.96



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 09 23 00-0137 EA >10 Factory Installed Cooling Only Or Electric Reheat VAV Or FPB Controller Assemblies.....	1,307.29	332.74
23 09 23 00-0138 EA Up To 10 Field Installed Cooling Only Or Electric Reheat VAV Or FPB Controller Assemblies.....	1,736.31	561.96
23 09 23 00-0139 EA >10 Field Installed Cooling Only Or Electric Reheat VAV Or FPB Controller Assemblies.....	1,434.18	365.78
23 09 23 00-0140 EA Up To 10 Factory Installed Steam Or Hot Water Heating VAV Or FPB Controller Assemblies.....	1,908.02	625.45
23 09 23 00-0141 EA >10 Factory Installed Steam Or Hot Water Heating VAV Or FPB Controller Assemblies.....	1,681.37	468.91
23 09 23 00-0142 EA Up To 10 Field Installed Steam Or Hot Water Heating VAV Or FPB Controller Assemblies.....	2,352.11	625.45
23 09 23 00-0143 EA >10 Field Installed Steam Or Hot Water Heating VAV Or FPB Controller Assemblies.....	2,034.91	478.58
23 09 23 00-0144 EA Up To 10 Factory Installed Application Specific Heat Pump Or Gas Heat With DX Cooling Controller Assemblies.....	1,442.49	625.45
23 09 23 00-0145 EA >10 Factory Installed Application Specific Heat Pump Or Gas Heat With DX Cooling Controller Assemblies.....	1,140.36	369.81
23 09 23 00-0146 EA Up To 10 Field Installed Application Specific Heat Pump Or Gas Heat With DX Cooling Controller Assemblies.....	1,608.71	625.45
23 09 23 00-0147 EA >10 Field Installed Application Specific Heat Pump Or Gas Heat With DX Cooling Controller Assemblies.....	1,306.49	416.54
23 09 23 00-0148 EA Up To 10 Factory Installed Application Specific Fan Coil Unit Controller Assemblies.....	1,875.91	625.45
23 09 23 00-0149 EA >10 Factory Installed Application Specific Fan Coil Unit Controller Assemblies.....	1,567.74	369.01
23 09 23 00-0150 EA Up To 10 Field Installed Application Specific Fan Coil Unit Controller Assemblies.....	2,042.13	625.45
23 09 23 00-0151 EA >10 Field Installed Application Specific Fan Coil Unit Controller Assemblies.....	1,733.87	415.73
23 09 23 00-0152 EA Up To 10 Factory Installed Application Specific Unit Ventilator Controller Assemblies.....	2,330.46	625.45
23 09 23 00-0153 EA >10 Factory Installed Application Specific Unit Ventilator Controller Assemblies.....	2,055.56	399.62
23 09 23 00-0154 EA Up To 10 Field Installed Application Specific Unit Ventilator Controller Assemblies.....	2,662.89	625.45
23 09 23 00-0155 EA >10 Field Installed Application Specific Unit Ventilator Controller Assemblies.....	2,387.91	468.10
23 09 23 00-0156		
DDC Programmable Controller Assemblies <small>(23 09 23 00-0106)</small>		
<small>Note: Includes installation, field test, checkout and start-up. Includes control enclosure, transformer and terminal strip only. Excludes ancillary devices. Excludes submittal generation/system engineering and database generation. See CSI section 23 09 23 00-0163 for additional components.</small>		
23 09 23 00-0157 EA 3 AO, 6 UI, 8 DO And 4 DI Small Programmable Controller Assemblies.....	1,661.32	480.42
23 09 23 00-0158 EA Oversized Enclosure 3 AO, 6 UI, 8 DO And 4 DI Small Programmable Controller Assemblies.....	1,901.43	480.42
23 09 23 00-0159 EA 6 AO, 8 AI, 8 DO And 8 DI Medium Programmable Controller Assemblies.....	2,507.33	565.02
23 09 23 00-0160 EA Oversized Enclosure 6 AO, 8 AI, 8 DO And 8 DI Medium Programmable Controller Assemblies.....	2,747.44	565.02
23 09 23 00-0161 EA 10 AO, 16 AI, 16 DO And 16 DI Large Programmable Controller Assemblies.....	4,460.39	661.71
23 09 23 00-0162 EA Oversized Enclosure 10 AO, 16 AI, 16 DO And 16 DI Large Programmable Controller Assemblies.....	4,737.95	661.71
23 09 23 00-0163		
EMCS Optional DDC Controller Hardware <small>(23 09 23 00-0106)</small>		
<small>Note: Used to expand the capacity of DDC programmable controller assemblies.</small>		
23 09 23 00-0164 EA 6 DO (Repay), 3 AI, 3 DI AHU Controller (Honeywell W7750A2005).....	288.72	
<small>Note: For constant volume single zone and heat pump AHUs.</small>		
23 09 23 00-0165 EA 6 AI, 5 DI, 8 DO (Triac) AHU Controller (Honeywell W7750B2011).....	333.68	
<small>Note: For constant volume single zone and heat pump AHUs.</small>		
23 09 23 00-0166 EA 3 AO, 6 AI, 5 DI, 5 DO (Triac) AHU Controller (Honeywell W7750C2001).....	349.50	
<small>Note: For constant volume single zone and heat pump AHUs.</small>		
23 09 23 00-0167 EA VAV Controller Compatible Printed Wiring Board (Honeywell W7751B2010).....	329.88	
23 09 23 00-0168 EA VAV Controller With Internally Wired Subbase (Honeywell W7751D2016).....	334.94	
23 09 23 00-0169 EA VAV Controller With Externally Wired Subbase (Honeywell W7751F2011).....	327.34	
23 09 23 00-0170 EA VAV Controller With Premounted ML6161 Actuator (Honeywell W7751H2025).....	281.76	
23 09 23 00-0171 EA VAV Controller With Premounted ML6161 Actuator (Honeywell W7751J2004).....	245.03	
23 09 23 00-0172 EA Fan Coil Unit Controller With Electric Reheat Relay (Honeywell W7752F2002).....	359.00	
23 09 23 00-0173 EA Fan Coil Unit Controller Without Electric Reheat Relay (Honeywell W7752G2000).....	321.01	
23 09 23 00-0174 EA Unit Ventilator Controller With Heating, Cooling, Actuator And Fan Control (Honeywell W7753A2002).....	354.57	
23 09 23 00-0175 EA Building Manager, Monitor And Control HVAC Equipment (Honeywell W7760A2011).....	752.83	
23 09 23 00-0176 EA Plant Controller, Monitor And Control HVAC Equipment (Honeywell W7760C2017).....	936.44	
23 09 23 00-0177 EA Remote IO Device For Ancillary Point Monitoring And Control (Honeywell W7761A2002).....	467.91	
23 09 23 00-0178 EA Remote IO, UUKL-UL 864 Approved (Honeywell W7761A2010).....	460.94	
23 09 23 00-0179 EA Hydronic Controller Without Wall Module (Honeywell W7762B1027).....	226.04	
23 09 23 00-0180 EA Hydronic Controller With Built-in Wall Module (Honeywell W7763C1016).....	257.06	
23 09 23 00-0181 EA IO Module, 24 Volt AC Without Overrides (Honeywell XFC3A06001).....	474.87	
23 09 23 00-0182 EA IO Module, 24 Volt AC With Overrides (Honeywell XFC3D06001).....	507.79	
23 09 23 00-0183 EA AI Module (Honeywell XFL521B).....	317.85	
23 09 23 00-0184 EA AO Module (Honeywell XFL522B).....	317.85	
23 09 23 00-0185 EA DI Module (Honeywell XFL523B).....	317.85	
23 09 23 00-0186 EA DO Module (Honeywell XFL524B).....	317.85	
23 09 23 00-0187 EA Distributed IO, Lonwork Bus Connector Module With Endplate (Honeywell XSL511).....	56.35	
23 09 23 00-0188 EA Distributed IO, Terminal Block For AI, AO And DI Modules (Honeywell XSL513).....	106.37	
23 09 23 00-0189 EA Distributed IO, Terminal Block For DO Modules (Honeywell XSL514).....	104.47	
23 09 23 00-0190 EA Lon Analog IO Module, 24 Volt AC/DC, 10 Digital Inputs (Honeywell XIO-10DI).....	319.75	
23 09 23 00-0191 EA Lon Hub (Honeywell XIO-HUB).....	47.49	
23 09 23 00-0192 EA Lon Analog IO, 24 Volt AC/DC, 4 Analog Outputs (Honeywell XIO-4AO).....	319.75	
23 09 23 00-0193 EA Lon Digital IO, 24 Volt AC/DC, 4 Digital Inputs (Honeywell XIO-4DI).....	294.42	
23 09 23 00-0194 EA Lon Digital IO, 24 Volt AC/DC, 4 Digital Outputs (Honeywell XIO-4DO).....	294.42	
23 09 23 00-0195 EA Lon Analog IO, 24 Volt AC/DC, 4 Analog Inputs (Honeywell XIO-4NTC).....	310.25	
23 09 23 00-0196 EA Lon Analog IO, 24 Volt AC/DC, 4 Analog PT1000 Inputs (Honeywell XIO-4PT1000).....	310.25	
23 09 23 00-0197 EA Lon Analog IO, 24 Volt AC/DC, 8 Analog Inputs (Honeywell XIO-8AI).....	446.38	
23 09 23 00-0198 EA 16 Point IO Module For Network Area Controllers (Honeywell WEB-IO-16).....	526.79	
<small>Note: Includes 8 universal inputs, 4 relay outputs, and 4 analog outputs.</small>		
23 09 23 00-0199 EA 34 Point IO Module For Network Area Controllers (Honeywell W7750A2005).....	1,119.43	
<small>Note: Includes 16 universal inputs, 10 relay outputs, and 8 analog outputs.</small>		
23 09 23 00-0200		
EMCS Software <small>(23 09 23 00-0105)</small>		
23 09 23 00-0201		
Software Packages And License <small>(23 09 23 00-0200)</small>		
<small>Note: Includes installation on equipment.</small>		

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 09 Instrumentation And Control For HVAC****23 09 23 Direct-Digital Control System For HVAC**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 09 23 00-0202	EA		On Board Programming Tool For Network Area Controllers (Honeywell WP-AX-WEB).....	357.10	
			Note: Requires UI services to be installed on NAC.		
23 09 23 00-0203	EA		Software Upgrade To Provide Unrestricted Connected Device Limit (Honeywell WEB-403-EXUP-AX).....	1,399.43	
			Note: Upgrade existing network area controller. As with other WEBS controllers, capacity is limited by the characteristics of the application including size and complexity.		
23 09 23 00-0204	EA		WEBStation-AX Software For Windows (Honeywell WEB-S-AX).....	3,988.91	
			Note: Includes Archon database. WEBS controllers must have Enterprise Connectivity Station Pack (EC-SP). Includes one copy of WP-AX (WEBPro-AX).		
23 09 23 00-0205	EA		Small Building WEBStation-AX Based Software (Honeywell WEB-S-AX-SBS).....	2,374.35	
			Note: For up to 3 NAC controllers. NAC controllers must have Enterprise Connectivity Station Pack (EC-SP). Includes Archon database.		
23 09 23 00-0206	EA		Upgrade Small Building To Large Building Software.....	2,729.07	
			Note: Upgrade WEB-S-AX-SBS to WEB-S-AX.		
23 09 23 00-0207	EA		Additional Copy Of WEBPro-AX (Honeywell WEB-S-AX-W).....	1,934.72	
			Note: One copy is included with WEB-S-AX and WEBStation-AX.		
23 09 23 00-0208	EA		WEBS Energy Suite (WES) Base Software (Honeywell WES-BASE-AX).....	3,419.48	
			Note: Includes license for 10 points of E ² Profiler and 2 licensed meters of Cost Profiler. Limit of one WES-BASE per WEBStation-AX Supervisor. Additional E ² Profiler point requirements or Cost Profiler meter requirements may use one or any combination of point/meter bundles. One WES-BASE required per WES project.		
23 09 23 00-0209	EA		Perpetual License One Meter Point Bundle Of A Cost Profiler Meter And Two E ² Profiler Points (Honeywell WES-CP-AX).....	478.46	
			Note: Can be combined with the required single instance of WES-BASE as well as with any combination of other EP points and CP meters.		
23 09 23 00-0210	EA		Perpetual License For One Point Of E ² Profiler (Honeywell WES-E2-AX).....	329.66	
			Note: Can be combined with the required single instance of WES-BASE as well as with any number of other EP Points and Cost Profiler meters.		
23 09 23 00-0211	EA		Perpetual License For An Unlimited Bundle Of E2 Points And CP Meters.....	18,364.59	
			Note: Sold on a per server basis. Purchase of this product must be accompanied by VES-M1-ENT-AX maintenance. The first year price of maintenance is included with VES-ENT-AX.		
23 09 23 00-0212	EA		Annual Maintenance For Enterprise WEBS-AX Energy Suite (Honeywell WES-M1-ENT-AX).....	16,764.29	
			Note: The first year cost of VES-M1-ENT-AX is included with VES-ENT-AX. After the first year VES-M1-ENT-AX maintenance fee will be invoiced annually.		
23 09 23 00-0213	EA		Standard WEBStation-AX Supervisor Bundled With WES-BASE-AX (Honeywell WES-S-AX).....	6,360.73	
23 09 23 00-0214	EA		Small WEBStation-AX Supervisor Bundled With WES-BASE-AX (Honeywell WES-S-AX-SBS).....	4,746.17	
23 09 23 00-0215	EA		Add 500 Modbus TCP Points To WEBStation With WS-OSD Option (Honeywell WS-MTCP-500).....	1,372.06	
23 09 23 00-0216	EA		Add 500 OPC Points To WEBStation With WS-OSD Option (Honeywell WS-OPC-500).....	1,372.06	
23 09 23 00-0217	EA		Vykon Oracle Driver For Support Of Oracle Database (Honeywell WS-ORCL).....	9,497.40	
			Note: Excludes Oracle.		
23 09 23 00-0218	EA		Open System Driver Option (Honeywell WS-SNMP-500).....	1,266.32	
			Note: Adds 25 points each of BACnet IP, OPC (client), Modbus TCP and SNMP to a standard WEBStation. Can be purchased with the WS or added later. Web Supervisor required to purchase this option.		
23 09 23 00-0219	EA		Add 500 SNMP Points To WEBStation With WS-OSD Option (Honeywell WS-SNMP-500).....	1,372.06	
23 09 23 00-0220	EA		WEBStation Software WS-1 And First Copy Of WEBPro Software (Honeywell ZW2000A1003).....	3,588.12	
			Note: For a single Honeywell WEB NP controller. Excludes software keys for the additional nodes.		
23 09 23 00-0221	EA		WEBStation Additional Node (Honeywell ZW2000B1002).....	1,372.06	
23 09 23 00-0222	EA		WEBStation Software And 20 Pack Of Node Software Keys (Honeywell ZW2000C1001).....	23,005.24	
23 09 23 00-0223	EA		WEBStation Software And 50 Pack Of Node Software Keys (Honeywell ZW2000D1000).....	42,210.88	
23 09 23 00-0224	EA		WEBStation Software And 100 Pack Of Node Software Keys (Honeywell ZW2000E1009).....	73,868.88	
23 09 23 00-0225	EA		Master WEBStation Software For Monitoring Multiple WEBStations (Honeywell ZW2000F1008).....	3,798.96	
23 09 23 00-0226	EA		Additional Master WEBStation Software Licenses (Honeywell ZW200G1007).....	1,899.48	
23 09 23 00-0227	EA		Additional Copies Of Workplace Pro WP-1 (Web Pro) (Honeywell ZW2001A1001).....	1,544.70	
23 09 23 00-0228	EA		Upgrade Existing NAC To Provide Unrestricted Connected Device Limit (Honeywell WC2003B1055).....	1,684.36	
			Note: As with other WEBS, capacity is limited by the characteristics of the application including size and complexity.		
23 09 23 00-0229			Initial Database Generation (23 09 23 00-0200)		
23 09 23 00-0230	PNT		Database Generation For Central Plant.....	54.06	
23 09 23 00-0231	PNT		Database Generation For Programmable Controller.....	54.06	
			Note: For VAV AHU, large CV AHU, or heat exchanger, etc.		
23 09 23 00-0232	EA		Database Generation For Application Specific Controller.....	54.06	
			Note: Price per each VAV box, fan coil unit, unit ventilator or small CV AHU. Task used for the first piece of each equipment.		
23 09 23 00-0233	EA		Replication Of Database Generation For Application Specific Controller.....	37.62	
			Note: Price per copy made.		
23 09 23 00-0234	EA		Database Generation For Remote IO Modules, Sensors, Etcetera.....	37.62	
23 09 23 00-0235			Application Software Programs (23 09 23 00-0200)		
23 09 23 00-0236	EA		Basic Application Program Package.....	2,255.90	
			Note: One per project. Includes program inputs, command priorities, alarms, trends for analog and digital points, energy totalization, schedules, calendars, special events, occupied and unoccupied setpoints, ventilation and recirculation modes, hot water reset program, chilled water reset program, condenser water reset program, and fail-over logic.		
23 09 23 00-0237	EA		Optimum Start/Stop Program.....	75.41	
			Note: Priced per controller requiring optimum start programming.		
23 09 23 00-0238	EA		Duty Cycling Program.....	35.61	
23 09 23 00-0239	EA		Hot Deck/Cold Deck Reset Application Program.....	3,875.56	
23 09 23 00-0240	EA		Boiler Optimization Program.....	5,078.69	
23 09 23 00-0241	EA		Chiller Optimization Program.....	6,879.60	
23 09 23 00-0242	EA		Lighting Control Program.....	3,319.83	
23 09 23 00-0243	EA		Demand Limiting Program.....	66.14	
			Note: Priced per controller requiring optimum start programming.		
23 09 23 00-0244	EA		Email Alarm Server Configuration.....	2,561.11	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 09 23 00-0245	Color Graphics Generation (23 09 23 00-0200)	
Note: Priced per page.		
23 09 23 00-0246 EA Single Site Home Page Graphics Page With HTML Navigation Code	1,351.78	
23 09 23 00-0247 EA Multi Site Home Page Graphics Page With HTML Navigation Code	2,400.04	
23 09 23 00-0248 EA Color Graphics Page For Central Plant	614.17	
23 09 23 00-0249 EA Color Graphics Page For Building Floor Plan	567.12	
23 09 23 00-0250 EA Replication Of Color Graphics Page For Central Plant.....	308.09	
23 09 23 00-0251 EA Color Graphics Page For Programmable Controller	690.95	
Note: For VAV AHU, large CV AHU, or heat exchanger, etc.		
23 09 23 00-0252 EA Replication Of Color Graphics Page For Programmable Controller.....	147.76	
Note: Priced per copy made.		
23 09 23 00-0253 EA Color Graphics Page For Application Specific Controller.....	639.07	
Note: Price per each VAV box, fan coil unit, unit ventilator or small CV AHU. Task used for the first piece of each equipment.		
23 09 23 00-0254 EA Replication Of Color Graphics Page For Application Specific Cont.....	63.89	
Note: Priced per copy made.		
23 09 23 00-0255	Sensors, Actuators And Control Devices (23 09 23 00-0105)	
Note: Includes installation, startup, checkout and miscellaneous parts for installation. Excludes conduit, wire and cable. Excludes engineering and programming labor. Each device is considered one control point. No engineering or programming time required for replacement parts.		
23 09 23 00-0256	Special Sensors (23 09 23 00-0255)	
23 09 23 00-0257 EA Dewpoint Sensor (Honeywell C7232B1014).....	1,161.65	49.87
23 09 23 00-0258 EA Enthalpy Sensor -25 To 125 F.....	1,210.58	49.87
23 09 23 00-0259 EA Outdoor Mounted Temperature And Humidity Transmitter (Honeywell H7635C1002)	593.39	99.74
23 09 23 00-0260 EA Freezestat (Honeywell L482A1004).....	419.13	166.22
23 09 23 00-0261 EA Wall Mounted Occupancy Sensor.....	288.96	49.87
23 09 23 00-0262 EA Ceiling Mounted Occupancy Sensor.....	235.03	49.87
23 09 23 00-0263 EA I/P Positioner With Gauge.....	275.97	49.87
23 09 23 00-0264 EA Non Communicating Duct Mounted Smoke Detector With Sampling Tube	331.01	49.87
23 09 23 00-0265 EA EP Transducer	275.97	33.27
23 09 23 00-0266 EA Electric Heat Sequencer	443.20	66.47
23 09 23 00-0267	Meters (23 09 23 00-0255)	
23 09 23 00-0268 EA KW/KWh Meter/Current Transformer 208 - 480 Volt, Up To 2,400 Amps.....	2,809.68	398.82
23 09 23 00-0269 EA KW/KWh Meter/Current Transformer 208 - 480 Volt, Up To 2,400 Amps With LON interface	4,108.73	465.28
23 09 23 00-0270 EA Current Transformer For KW Meter 1 - 300 Amps	1,009.36	166.22
23 09 23 00-0271 EA Current Transformer For KW Meter 300 - 800 Amps	1,135.41	166.22
23 09 23 00-0272 EA Current Transformer For KW Meter 800 - 2,400 Amp.....	1,377.17	166.22
23 09 23 00-0273	Direct Coupled Actuators (23 09 23 00-0255)	
23 09 23 00-0274 EA 44 IN-LB, 2 Position, 120 Volt AC Spring Return Direct Coupled Damper Actuator (Honeywell MS4105A1002).....	385.18	66.41
23 09 23 00-0275 EA 88 IN-LB, 2 Position, 120 Volt AC Spring Return Direct Coupled Damper Actuator (Honeywell MS4110A1200).....	420.70	66.41
23 09 23 00-0276 EA 175 IN-LB, 2 Position, 120 Volt AC Spring Return Direct Coupled Damper Actuator (Honeywell MS4120A1209).....	481.76	66.41
23 09 23 00-0277 EA 44 IN-LB, 2 Position, 24 Volt AC Spring Return Direct Coupled Damper Actuator (Honeywell MS8105A1008).....	364.40	66.41
23 09 23 00-0278 EA 88 IN-LB, 2 Position, 24 Volt AC Spring Return Direct Coupled Damper Actuator (Honeywell MS8110A1206).....	402.60	66.41
23 09 23 00-0279 EA 175 IN-LB, 2 Position, 24 Volt AC Spring Return Direct Coupled Damper Actuator (Honeywell MS8120A1205).....	440.42	66.41
23 09 23 00-0280 EA 44 IN-LB, 24 Volt AC, 4-20mA, 0-10 Volt DC Or Floating Control, Spring Return Direct Coupled Damper Actuator.....	404.69	66.41
23 09 23 00-0281 EA 88 IN-LB, 24 Volt AC, 4-20mA, 0-10 Volt DC Or Floating Control, Spring Return Direct Coupled Damper Actuator (Honeywell MS7510A2206).....	459.14	66.41
23 09 23 00-0282 EA 175 IN-LB, 24 Volt AC, 4-20mA, 0-10 Volt DC Or Floating Control, Spring Return Direct Coupled Damper Actuator (Honeywell MS7520A2205).....	517.93	66.41
23 09 23 00-0283 EA 44 IN-LB, 24 Volt AC, 4-20mA, 0-10 Volt DC Or Floating Control, Non- Spring Return Direct Coupled Damper Actuator (Honeywell MN7505A2209)	336.07	66.41
23 09 23 00-0284 EA 88 IN-LB, 24 Volt AC, 4-20mA, 0-10 Volt DC Or Floating Control, Non- Spring Return Direct Coupled Damper Actuator (Honeywell MN7510A2209)	365.07	66.41
23 09 23 00-0285 EA 175 IN-LB, 24 Volt AC, 4-20 mA, Floating Control, Non-Spring Return Direct Coupled Damper Actuator (Honeywell MN6120A1200).....	423.33	66.41
23 09 23 00-0286 EA 175 IN-LB, 24 Volt AC, 4-20mA, 0-10 Volt DC, Non-Spring Return Direct Coupled Damper Actuator (Honeywell MN7220A2007)	450.75	66.41
23 09 23 00-0287 EA 300 IN-LB, 24 Volt AC, 4-20 mA, Floating Control, Non-Spring Return Direct Coupled Damper Actuator (Honeywell MN6134A10030).....	450.41	66.41
23 09 23 00-0288 EA 300 IN-LB, 24 Volt AC, 4-20mA, 0-10 Volt DC, Non-Spring Return Direct Coupled Damper Actuator (Honeywell MN7234A2008)	525.61	66.41
23 09 23 00-0289 EA Pneumatic Spring Return Damper Actuator Without Positive Positioner (Honeywell MP909E1018).....	347.95	66.41
23 09 23 00-0290 EA Pneumatic Spring Return Damper Actuator With Positive Positioner (Honeywell MP909H1368).....	595.92	66.41
23 09 23 00-0291 EA Foot Mount Kit With Damper Linkage And Connectors For Direct Coupled Actuator	266.33	66.41
23 09 23 00-0292 EA Direct Coupled Damper Actuator Enclosure For Outdoor Use.....	398.66	66.41
23 09 23 00-0293	Thermostats (23 09 23 00-0105)	
23 09 23 00-0294	Electric And Electronic Thermostats (23 09 23 00-0293)	
Note: Includes installation, startup and checkout labor. Excludes engineering and programming labor. Each thermostat counts as one control point.		
23 09 23 00-0295 EA Line Voltage 120 Volt, Heat/Cool Thermostat (Honeywell T651A3018)	131.52	12.09
23 09 23 00-0296 EA Electronic Non Programmable Heat/Cool Heat Pump Or Conventional Unit Thermostat (Honeywell TH5320)	140.52	12.09

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 09 Instrumentation And Control For HVAC****23 09 23 Direct-Digital Control System For HVAC**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 09 23 00-0297 EA Electronic Programmable Heating/Cooling Heat Pump Or Conventional Unit Thermostat (Honeywell TH6110).....	130.52	12.09
23 09 23 00-0298 EA Electronic Programmable Two Heating/Two Cooling Heat Pump Or Conventional Unit Thermostat (Honeywell TH6220).....	144.22	12.09
23 09 23 00-0299 EA Electronic Programmable Three Heating/Two Cooling Heat Pump Or Conventional Unit Thermostat (Honeywell TH6320).....	154.52	12.09
23 09 23 00-0300 EA Electronic Programmable Two Heating/Two Cooling Heat Pump Or Conventional Unit Thermostat (Honeywell TH8321).....	220.52	12.09
23 09 23 00-0301 EA Humidity Control Electronic Programmable Heat/Cool Heat Pump Or Conventional Unit Thermostat (Honeywell T7351F).....	314.52	12.09
23 09 23 00-0302 EA Lon Communicating Humidity Control Programmable Heat/Cool Heat Pump Or Conventional Unit Thermostat (Honeywell T7350H).....	500.36	12.09
23 09 23 00-0303 EA Modulating Lon Communicating Humidity Control Programmable Heat/Cool Heat Pump Or Conventional Unit Thermostat (Honeywell T7350M).....	532.65	12.09
23 09 23 00-0304 Pneumatic Thermostats <small>(23 09 23 00-0293)</small> Note: Includes installation, startup and checkout labor. Excludes engineering and programming labor. Each thermostat counts as two control point.		
23 09 23 00-0305 EA Pneumatic Thermostat (Honeywell TP970B2182).....	173.43	12.09
23 09 23 00-0306 Thermostats Guards <small>(23 09 23 00-0293)</small>		
23 09 23 00-0307 EA 9-3/4" x 7-1/4" x 3-3/8" Universal Thermostat Guard (Honeywell TG512A1009).....	43.62	12.09
23 09 23 00-0308 EA 7-1/2" x 6-1/2" x 2-15/16" Universal Thermostat Guard (Honeywell TG511).....	51.12	12.09
23 09 23 00-0309 EA 5-7/8" x 5-7/8" x 2-1/2" Deep Universal Thermostat Guard (Honeywell TG510).....	48.42	12.09
23 09 23 00-0310 Delta Controls <small>(23 09 23)</small>		
23 09 23 00-0311 Software <small>(23 09 23 00-0310)</small> Note: Excludes programming, set-up and commissioning of application.		
23 09 23 00-0312 EA Orca Software Unlimited Points License (Delta Controls DOW333-USB).....	1,303.59	
23 09 23 00-0313 EA Orca Graphics Module, Delta Controls Orca View With Graphics Creation Capabilities (Delta Controls DOW333-I-USB).....	2,104.74	
23 09 23 00-0314 EA Orca Historical Module, Delta Controls Historian Package With Unlimited Archiving Trend Logs (Delta Controls DHS330-HL-USB).....	4,560.27	
23 09 23 00-0315 EA Web Server Unlimited Points License, Delta Controls Web Server Front End (Delta Controls DWS330-L-USB).....	7,267.02	
23 09 23 00-0316 EA Web Server Limited Points (Maximum I/O 2500) License, Delta Controls Web Server Front End (Delta Controls DWS330-M-USB).....	3,759.12	
23 09 23 00-0317 EA Web Server Limited Points (Maximum I/O 250) License, Delta Controls Web Server Front End (Delta Controls DWS330-S-USB).....	1,303.59	
23 09 23 00-0318 EA 100 User Energy Portal, Data Collection Controller, Web PC Server Program License (Delta Controls EP-2.01).....	3,057.54	
23 09 23 00-0319 EA 1,000 User Energy Portal, Data Collection Controller, Web PC Server Program License (Delta Controls EP-2.02).....	3,759.12	
23 09 23 00-0320 EA KW Meter With H8163-2400-4-3 Series, With 3, 2,400 Amp CT's And BACnet MS/TP Interface (Delta Controls H8186-CB).....	1,381.66	80.57
23 09 23 00-0321 EA Delta Controls Touch Screen (Delta Controls DHMI-7-I).....	1,435.39	
23 09 23 00-0322 EMCS Central Equipment And Controllers <small>(23 09 23 00-0310)</small>		
23 09 23 00-0323 EA Fully Programmable, Native BACnet Building Controller, 32 Universal Inputs/32 Analog Or Binary Outputs HOA'S, Twisted-Pair Ethernet Port, BACnet IP, BACnet Over Ethernet, Main LAN RS-485 BACnet MS/TP (Maximum Of 99 Devices), SubLAN (Net2) BACnet MS/TP (Maximum 99 Devices) Or Delta LINKnet @ 76800 bps, Serial RS-232 BACnet PTP, Real-Time Clock With Lithium Battery And SRAM Backup (Delta Controls DSC-1616E + DFM1616).....	5,091.59	322.27
23 09 23 00-0324 EA Fully Programmable, Native BACnet Building Controller, 16 Universal Inputs/16 Analog Or Binary Outputs HOA'S, Twisted-Pair Ethernet Port, BACnet IP, BACnet Over Ethernet, Main LAN RS-485 BACnet MS/TP (Maximum Of 99 Devices), Sublan (Net2) BACnet MS/TP (Maximum 99 Devices) Or Delta LINKnet @ 76800 Bps (Maximum 12 Devices On LINKnet, With 2 DFM Devices) Serial RS-232 BACnet PTP, Real-Time Clock With Lithium Battery And SRAM Backup (Delta Controls DSC-1616E).....	3,969.06	322.27
23 09 23 00-0325 EA Fully Programmable, Native BACnet Advanced Application Controller That Communicates On A RS-485 LAN Using The BACnet MS/TP Protocol, 11 Universal Inputs, 4 Analog Output Or 6 Binary (Triac) Outputs (Delta Controls DAC-1146).....	3,034.21	322.27
23 09 23 00-0326 EA Fully Programmable, Native BACnet Advanced Application Controller That Communicates On A RS-485 LAN Using The BACnet MS/TP Protocol, 11 Universal Inputs, 8 Analog Or Binary Outputs (Delta Controls DAC-1180).....	3,034.21	322.27
23 09 23 00-0327 EA Fully Programmable, Native BACnet Advanced Application Controller That Communicates On A RS-485 LAN Using The BACnet MS/TP Protocol, 11 Universal Inputs, 4 Analog Output Or 6 Binary (Triac) Outputs (Delta Controls DAC-1146).....	3,034.21	322.27
23 09 23 00-0328 EA Fully Programmable, Native BACnet Advanced Application Controller That Communicates On A RS-485 LAN Using The BACnet MS/TP Protocol, 6 Universal Inputs, 3 Binary (Triac) Outputs And 3 Analog Outputs (Delta Controls DAC-633 R3).....	2,863.25	322.27
23 09 23 00-0329 EA VAV Controllers Are Native BACnet Application Controllers That Are Fully Programmable, Communicate On A RS-485 LAN Using The MS/TP BACnet Protocol, 3 Universal Inputs, 4 Binary Outputs, Actuator Position Feedback, Supports 4 BACstat Network Sensors On LINKnet For Room Sensing And Control Or 2 Delta Field Modules On LINKnet For I/O Expansion (Delta Controls DVC-304AF).....	955.00	161.14
23 09 23 00-0330 EA Fully Programmable, Native BACnet Advanced Application Controller That Communicates On A RS-485 LAN Using The BACnet MS/TP Protocol, 4 Binary Triac Outputs (24 Volt AC), 3 Binary Relay Outputs For Fan Speed Control, 240 Volt AC, 1 HP (60 LRA/10 FLA) LED Status Indication Of Each Output (Delta Controls DFC-304R3-240).....	879.58	161.14
23 09 23 00-0331 EA Fully Programmable, Native BACnet Advanced Application Controller That Communicates On A RS-485 LAN Using The BACnet MS/TP Protocol, 6 Universal Inputs, 3 Binary (Triac) Outputs And 3 Analog Outputs (Delta Controls DAC-633 R3).....	929.62	161.14



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 09 23 00-0332 EA Fully Programmable, Native BACnet Advanced Application Controller That Communicates On A RS-485 LAN Using The BACnet MS/TP Protocol, 4 Binary Triac Outputs (24 Volt AC), 3 Binary Relay Outputs For Fan Speed Control, 240 Volt AC, 1 HP (60 LRA/10 FLA) LED Status Indication Of Each Output (Delta Controls DFC-304R3-240)	879.58	161.14
23 09 23 00-0333 EA Remotely Expandable I/O To Delta's BACnet Controllers, 16 Universal Inputs, 16 Analog Outputs (Delta Controls DFM-1616)	1,928.22	201.42
23 09 23 00-0334 EA Remotely Expandable I/O To Delta's BACnet Controllers, 4 Universal Inputs, 4 Analog Outputs (Delta Controls DFM-440)	506.17	80.57
23 09 23 00-0335 EA Remotely Expandable I/O To Delta's BACnet™ Controllers, 4 Universal Inputs, 4 Binary Triac Outputs (Delta Controls DFM-404)	537.97	80.57
23 09 23 00-0336 EA Remotely Expandable I/O To Delta's BACnet™ Controllers, 16 Universal Inputs (Delta Controls DFM-1600)	620.44	80.57
23 09 23 00-0337 Network, VAV And Special Sensors <small>(23 09 23 00-0310)</small>		
23 09 23 00-0338 EA BACnet MS/TP VAV Network Room Temperature Sensor With LCD Display (Delta Controls DNS-24)	159.12	25.78
23 09 23 00-0339 EA BACnet MS/TP VAV Network Temperature And Humidity Sensor With LCD Display (Delta Controls DNS-H24)	212.83	29.01
23 09 23 00-0340 EA Programmable BACnet MS/TP Thermostat With 8 Button Keypad And LCD Display For DX Unit, Fan Coils And RTU (Delta Controls DAC-T305-G2B)	402.62	12.09
23 09 23 00-0341 Trane Controls <small>(23 09 23)</small>		
23 09 23 00-0342 Software <small>(23 09 23 00-0341)</small>		
Note: Excludes programming, set-up and commissioning of application.		
23 09 23 00-0343 EA Summit + Building Management Package (Trane 40201152)	2,174.23	
23 09 23 00-0344 EA Summit Current Version Software (Trane 40201111)	2,184.34	
23 09 23 00-0345 EA Summit Customer Upgrade Package, Currently V10-V16 To V17 (Trane 40201113)	513.92	
23 09 23 00-0346 EA Rover Service Software And Hardware, Complete Kit (Trane X1365150001)	1,636.35	
23 09 23 00-0347 EA Tracer SC With -X1365152401 - BACnet (2 Pack) (Trane BMSC000AAA011000)	5,900.71	
23 09 23 00-0348 EMCS Central Equipment And Controllers <small>(23 09 23 00-0341)</small>		
23 09 23 00-0349 EA Summit BTMX Operator Display Upgrade (Trane 40201224)	3,842.04	322.27
23 09 23 00-0350 EA Summit BTMX Retrofit Kit For BMTS And BMTW BCU (Trane 49500531)	8,012.95	322.27
23 09 23 00-0351 EA Summit BTMX Retrofit Kit For Tracer 100 (Trane 49500532)	8,012.95	322.27
23 09 23 00-0352 EA Summit BTMX, 120 Volt, (Trane BMTX-001-A-A-B0-00)	7,107.30	322.27
23 09 23 00-0353 EA Summit BTMX, 120 Volt, With Display (Trane BMTX-001-A-A-B0-10)	8,160.29	322.27
23 09 23 00-0354 EA Summit CCP Upgrade ROM Kit (Trane 40201095)	132.99	20.14
23 09 23 00-0355 EA Summit Comm5 Repeater (Trane 49500457)	1,031.03	161.14
23 09 23 00-0356 EA AHU Controller MP580/581 E Board Only (Trane 40201157)	1,688.59	201.42
23 09 23 00-0357 EA AHU Controller MP581 120 Volt AC With Enclosure And Display (Trane BMTM000AAC01)	2,152.00	241.71
23 09 23 00-0358 EA AHU Controller MP581 120 Volt AC With Enclosure, No Display (Trane BMTM000AAC00)	1,733.51	241.71
23 09 23 00-0359 EA AHU Controller MP581 Operator Door Display (Trane 40201156)	1,497.40	241.71
23 09 23 00-0360 EA AHU Controller MP581 Portable, Rugged, With Case (Trane 49500491)	1,495.58	241.71
23 09 23 00-0361 EA Controller MP503 I/O Module With Metal Enclosure (Trane 49500590)	650.11	80.57
23 09 23 00-0362 EA Controller MP503 I/O Module With Plastic Cover (Trane 49500490)	598.09	80.57
23 09 23 00-0363 EA Controller MP581 EX2 Expansion Module With Metal Enclosure (Trane 49500500)	1,092.20	161.14
23 09 23 00-0364 EA Controller MP581 EX2 Expansion Module With Plastic Cover (Trane 49500499)	1,049.06	161.14
23 09 23 00-0365 EA 2 Position, FCU Controller ZN511 Zone With Metal Enclosure (Trane 49500569)	579.03	80.57
23 09 23 00-0366 EA 2 Position, FCU Controller ZN511 Zone With Plastic Cover (Trane 4950-0469)	516.40	80.57
23 09 23 00-0367 EA 4 Position, FCU Controller ZN517 Zone With Metal Enclosure (Trane 49500596)	733.17	80.57
23 09 23 00-0368 EA 4 Position, FCU Controller ZN517 Zone With Plastic Cover (Trane 49500496)	670.87	80.57
23 09 23 00-0369 EA Modulating FCU Controller ZN520 Zone With Plastic Cover (Trane 4950049)	584.61	80.57
23 09 23 00-0370 EA Modulating FCU Controller ZN520 Zone With Plastic Cover (Trane 49500496)	560.46	80.57
23 09 23 00-0371 EA Modulating Tri ST FCU Controller ZN521 Zone With Metal Cover (Trane 49500570)	634.14	80.57
23 09 23 00-0372 EA Modulating Tri ST FCU Controller ZN521 Zone With Plastic Cover (Trane 49500470)	584.61	80.57
23 09 23 00-0373 EA DDC VAV Retrofit Kit (Trane VRTODD01)	856.48	161.14
23 09 23 00-0374 EA DDC VAV Retrofit Kit With Belimo Actuator (Trane VRTODD01BLMO)	918.09	161.14
23 09 23 00-0375 Network, VAV And Special Sensors <small>(23 09 23 00-0341)</small>		
23 09 23 00-0376 EA Digital Display Zone Sensor (Trane X13790464010)	128.98	25.78
23 09 23 00-0377 EA Single Setpoint Wall Mounted Zone Temperature Sensor (Trane X13511529010)	95.60	25.78
23 09 23 00-0378 EA Wall Mounted Zone Temperature-Only Sensor (Trane X13511528010)	86.12	25.78
23 09 23 00-0379 EA Ceiling Mount Zone Occupancy Sensor (Trane X13790421-01)	155.18	29.01
23 09 23 00-0380 EA Zone LCD O/C Setpoint, 3 Speed Fan (Trane 41901121)	104.39	25.78
23 09 23 00-0381 EA Zone Sensor LCD O/C Setpoint (Trane 41901120)	104.39	25.78
23 09 23 00-0382 EA Duct CO2 Sensor, 0 To 2,000 ppm (Trane X13790423010)	456.23	46.41
23 09 23 00-0383 EA Room CO2 Sensor, 0 To 2,000 ppm (Trane X13790422010)	359.95	25.78
23 09 23 00-0384 EA Transformer 120/24 40 VA (Trane X13550284010)	93.39	25.78
23 09 23 00-0385 EA Transformer 24 Volt AC Wall Plug-In (Trane 35803005)	78.84	25.78
23 09 23 00-0386 EA Transformer UL Listed 120 Volt AC, 40 VA (Trane 35812022)	75.63	25.78
23 09 23 00-0387 EA Controller UC400 VAV Kit With Enclosure, And Belimo (Trane 5189454010)	942.58	320.95
23 09 23 00-0388 EA Controller UC400 VAV Kit With Enclosure, No Actuator (Trane 5189456010)	909.35	320.95
23 09 23 00-0389 EA Controller UC400 XM32 Module (4 Relay) (Trane X13651563010)	801.16	320.95
23 09 23 00-0390 EA Controller UC400 XM70 (8UI,6UI/AO,4R,1P) (Trane X13651568010)	1,360.56	481.40
23 09 23 00-0391 EA Controller UC400 XM30 I/O Module (4 UI/AO) (Trane X13651537010)	801.57	320.95
23 09 23 00-0392 EA Controller UC210 VAV With Belimo Actuator (Trane BMUC210AAA0B00011)	875.17	320.95
23 09 23 00-0393 EA Controller UC210 VAV Without Actuator (Trane BMUC210AAA0100011)	835.37	320.95
23 09 23 00-0394 EA Controller Optional Metal Enclosure, UC210 (Trane 501898)	337.75	160.45
23 09 23 00-0395 EA Controller UC400 PM014 24 Volt AC To 1.4 Amp 24 Volt DC (Trane X1365153801)	430.48	160.45

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 09 Instrumentation And Control For HVAC****23 09 23 Direct-Digital Control System For HVAC**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 09 23 00-0396	EA		Controller Tracer UC600 Controller (Trane BMUC600AAA0100011)	1,474.15	481.40
23 09 23 00-0397	EA		Controller UC600 Tracer TD7 Display (Trane X13651571010)	1,445.97	481.40
23 09 23 00-0398	EA		Controller UC600 TD7 Mounting Bracket (Trane X05010511010)	90.90	32.11
23 09 23 00-0399	EA		Controller UC400 13" DIN Rail Enclosure, 120 Volt (Trane X13651559010)	285.62	57.77
23 09 23 00-0400	EA		SC 24" DIN Rail Enclosure, 120 Volt (Trane X13651552010)	1,489.91	481.40
23 09 23 00-0401	EA		BACnet Term (2 Pack) (Trane X1365152401)	146.27	57.77
23 09 23 00-0402	EA		Tracer ES Add License (Trane X40250125010)	3,135.89	1,283.69
23 09 23 00-0403	EA		Kit - Tracer TU For Controls (Trane X4509151201)	4,425.97	1,283.61
23 09 23 00-0404	EA		Kit - Tracer TU Complete (Trane X4509151301)	5,536.53	1,283.61
23 09 23 00-0405	EA		Tracer TU Adapter Wired/Wireless (Trane X13651529010)	327.81	57.77
23 09 23 00-0406	EA		Sensor Wireless Zone Sensor, Fahrenheit (Trane X13790492010)	186.64	57.77
23 09 23 00-0407	EA		Sensor Wireless Display Sensor (Trane X13790822010)	204.07	57.77
23 09 23 00-0408	EA		Sensor Wireless Receiver, 100mW (Trane X13790854010)	198.56	57.77
23 09 23 00-0409	EA		Sensor Wireless Comm Interface (WCI) Indoor, 100mW (Trane X13790901010)	292.10	57.77
23 09 23 00-0410	EA		Sensor Wireless Comm Interface (WCI) Outdoor, 100mW (Trane X13790941010)	315.91	57.77
23 09 23 00-0411			Johnson Controls (23 09 23)		
23 09 23 00-0412			Software (23 09 23 00-0411)		
			Note: Excludes programming, set-up and commissioning of application.		
23 09 23 00-0413	EA		5 Concurrent User Application And Data Server (Johnson Controls MS-ADS05U-0)	10,223.54	
23 09 23 00-0414	EA		10 Concurrent User External Application And Data Server (Johnson Controls MS-ADX10U-0)	12,081.67	
23 09 23 00-0415	EA		N2 Controllers Commissioning And Download Software (Johnson Controls MW-MTOOL-0)	644.09	
23 09 23 00-0416	EA		N2 Controllers Download Cable Kit (Johnson Controls AS-CBLPRO-2)	950.31	
23 09 23 00-0417	EA		BACnet FEU Controllers Commissioning And Download Software (Johnson Controls MS-CCTSWO-0)	1,644.98	
23 09 23 00-0418	EA		BACnet Controllers Download Bluetooth Converter (Johnson Controls MS-BTCVT-0)	649.27	
23 09 23 00-0419	EA		New User FX Tools Pro CD-Rom (FX Builder, FX Builder Express, FX CommPro N2, FX CommPro LON, FX CommPro BACnet) Software (Johnson Controls LP-FXTPRO-0)	646.20	
23 09 23 00-0420	EA		Upgrade FX Tools Pro CD-Rom (FX Builder, FX Builder Express, FX CommPro N2, FX CommPro LON, FX CommPro BACnet) Software (Johnson Controls LP-FXTPRO-6)	267.06	
23 09 23 00-0421			Supervisory Controllers (23 09 23 00-0411)		
23 09 23 00-0422	EA		NAE With 1 RS-485, Support For 50 Devices (Either N2 Or BACnet MS/TP) Supervisory Controllers (Johnson Controls MS-NAE3510-2)	4,975.22	322.27
23 09 23 00-0423	EA		NAE With 1 RS-485, Support For 100 Devices (Either N2 Or BACnet MS/TP) Supervisory Controllers (Johnson Controls MS-NAE4511-2)	7,425.77	322.27
23 09 23 00-0424	EA		NAE With 2 RS-485, Support For 200 Devices (N2 Or BACnet MS/TP) Supervisory Controllers (Johnson Controls MS-NAE5511-1)	9,881.75	322.27
23 09 23 00-0425	EA		NCE, 33 Points, Network Control Engine, 32 N2 Device Support Supervisory Controllers (Johnson Controls MS-NCE2510-0)	4,031.28	322.27
23 09 23 00-0426			Controllers (23 09 23 00-0411)		
23 09 23 00-0427	EA		10 Point Field Equipment Controller With 2 UI, 1 BI, 3 BO, 4 CO, 24 Volt AC And Sensor Actuator Bus With Mounting Base (Johnson Controls MS-FEU1610-0)	582.68	80.57
23 09 23 00-0428	EA		10 Point Field Equipment Controller With 2 UI, 1 BI, 3 BO, 4 CO, 24 Volt AC And Sensor Actuator Bus, Mounting Base And Integral Display (Johnson Controls MS-FEU1620-0)	746.08	161.14
23 09 23 00-0429	EA		17 Point Field Equipment Controller With 6 UI, 2 BI, 3 BO, 2 AO, 4 CO, 24 Volt AC, Sensor Actuator Bus And Mounting Base (Johnson Controls MS-FEU2610-0)	1,019.55	161.14
23 09 23 00-0430	EA		17 Point Field Equipment Controller With 6 UI, 2 BI, 3 BO, 2 AO, 4 CO, 24 Volt AC, Sensor Actuator Bus And Integral Display (Johnson Controls MS-FEU2620-0)	1,182.94	161.14
23 09 23 00-0431	EA		BACnet MS/TP 4-Point I/O Module With 4 BI, Field Controller Bus And Sensor Actuator Bus Support (Johnson Controls MS-IOM1710-0)	488.94	80.57
23 09 23 00-0432	EA		BACnet MS/TP 6 Point I/O Module With 2 UI, 2 UO, 2 BO, Field Controller Bus And Sensor Actuator Bus Support (Johnson Controls MS-IOM2710-0)	530.60	80.57
23 09 23 00-0433	EA		BACnet MS/TP 12 Point I/O Module With 4 UI, 4 UO, 4 BO, Field Controller Bus And Sensor Actuator Bus Support (Johnson Controls MS-IOM3710-0)	593.10	80.57
23 09 23 00-0434	EA		17 Point I/O Module With 6 UI, 2 BI, 3 BO, 2 AO, 4 CO, 24 Volt AC And Sensor Actuator Bus With Mounting Base (Johnson Controls MS-IOU4710-0)	601.43	80.57
23 09 23 00-0435	EA		BACnet MS/TP Integrated VAV Controller/Actuator/Pressure Sensor (Cooling Only), Field Controller Bus And Sensor Actuator Bus (Johnson Controls MS-VMA1610-0)	577.36	80.57
23 09 23 00-0436	EA		BACnet MS/TP Integrated VAV Controller/Actuator/Pressure Sensor (With Reheat And Fan Control), Field Controller Bus And Sensor Actuator Bus (Johnson Controls MS-VMA1620-0)	601.65	80.57
23 09 23 00-0437	EA		BACnet MS/TP Rooftop Controller For Stand-Alone And Networked Zoning Systems (Johnson Controls TEC2664Z-2)	1,225.46	161.14
23 09 23 00-0438			Master FX Controllers (23 09 23 00-0411)		
23 09 23 00-0439	EA		6 AI, 8 DI, 4 AO, 9 DO, 9 Relays, No Communication Card Without Display, Extended Temperature Range Master Controllers (Johnson Controls LP-FX16X00-000C)	1,512.92	161.14
23 09 23 00-0440	EA		6 AI, 8 DI, 4 AO, 9 DO, 9 Relays, N2 Open Communication Card Without Display, Extended Temperature Range Master Controllers (Johnson Controls LP-FX16X01-000C)	1,611.75	161.14
23 09 23 00-0441	EA		6 AI, 8 DI, 4 AO, 9 DO, 9 Relays, LON Communication Card Without Display, Extended Temperature Range Master Controllers (Johnson Controls LP-FX16X02-000C)	1,660.86	161.14
23 09 23 00-0442	EA		6 AI, 8 DI, 4 AO, 9 DO, 9 Relays, RS-232 Communication Card Without Display, Extended Temperature Range Master Controllers (Johnson Controls LP-FX16X03-000C)	1,631.02	161.14
23 09 23 00-0443	EA		6 AI, 8 DI, 4 AO, 9 DO, 9 Relays, BACnet Communications Card Without Display, Extended Temperature Range Master Controllers (Johnson Controls LP-FX16X04-000C)	1,584.37	161.14
23 09 23 00-0444	EA		6 AI, 8 DI, 4 AO, 9 DO, 4 Relays, 5 Triac, N2 Communication Card Without Display, Extended Temperature Range Master Controllers (Johnson Controls LP-FX16X11-000C)	1,591.85	161.14



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 09 23 00-0445 EA 6 AI, 8 DI, 4 AO, 9 DO, 4 Relays, 5 Triac, BACnet Communications Card Without Display, Extended Temperature Range Master Controllers (Johnson Controls LP-FX16X14-000C)	1,584.37	161.14
23 09 23 00-0446 EA 6 AI, 8 DI, 4 AO, 9 DO, 9 Relays, No Communication Card With Integral Display, Extended Temperature Range Master Controllers (Johnson Controls LP-FX16X50-000C)	1,611.86	161.14
23 09 23 00-0447 EA 6 AI, 8 DI, 4 AO, 9 DO, 9 Relays, N2 Open Communication Card With Integral Display, Extended Temperature Range Master Controllers (Johnson Controls LP-FX16X51-000C)	1,697.21	161.14
23 09 23 00-0448 EA 6 AI, 8 DI, 4 AO, 9 DO, 9 Relays, LON Communication Card With Integral Display, Extended Temperature Range Master Controllers (Johnson Controls LP-FX16X52-000C)	1,754.11	161.14
23 09 23 00-0449 EA 6 AI, 8 DI, 4 AO, 9 DO, 9 Relays, RS-232 Communication Card With Integral Display, Extended Temperature Range Master Controllers (Johnson Controls LP-FX16X53-000C)	1,725.66	161.14
23 09 23 00-0450 EA 6 AI, 8 DI, 4 AO, 9 DO, 9 Relays, BACnet Communications Card With Integral Display, Extended Temperature Range Master Controllers (Johnson Controls LP-FX16X54-000C)	1,667.42	161.14
23 09 23 00-0451 EA 6 AI, 8 DI, 4 AO, 9 DO, 4 Relays, 5 Triac, No Communication Card With Integral Display, Extended Temperature Range Master Controllers (Johnson Controls LP-FX16X60-000C)	1,611.86	161.14
23 09 23 00-0452 EA 6 AI, 8 DI, 4 AO, 9 DO, 4 Relays, 5 Triac, N2 Communication Card With Integral Display, Extended Temperature Range Master Controllers (Johnson Controls LP-FX16X61-000C)	1,697.21	161.14
23 09 23 00-0453 EA 6 AI, 8 DI, 4 AO, 9 DO, 4 Relays, 5 Triac, LON Communication Card With Integral Display, Extended Temperature Range Master Controllers (Johnson Controls LP-FX16X62-000C)	1,754.11	161.14
23 09 23 00-0454 EA 6 AI, 8 DI, 4 AO, 9 DO, 4 Relays, 5 Triac, RS-232 Communication Card With Integral Display, Extended Temperature Range Master Controllers (Johnson Controls LP-FX16X63-000C)	1,725.66	161.14
23 09 23 00-0455 EA 6 AI, 8 DI, 4 AO, 9 DO, 4 Relays, 5 Triac, BACnet Communications Card With Integral Display, Extended Temperature Range Master Controllers (Johnson Controls LP-FX16X64-000C)	1,667.42	161.14
23 09 23 00-0456 EA N2 Open Communication Card For FX16 (Johnson Controls LP-NET151-010C)	181.38	40.28
23 09 23 00-0457 EA LON Communication Card For FX15 and FX16 (Johnson Controls LP-NET152-010C)	251.40	40.28
23 09 23 00-0458 EA RS-232 Communication Card For FX16 (Johnson Controls LP-NET163-000C)	201.04	40.28
23 09 23 00-0459 EA BACnet Communications Card For FX16 (Johnson Controls LP-NET164-000C)	181.38	40.28
23 09 23 00-0460 EA Remote Medium User Interface For FX16 (Johnson Controls LP-DIS60P20-0C)	497.56	40.28
23 09 23 00-0461 EA Facility Explorer Extension I/O Module (Johnson Controls LP-XT91D00-000C)	461.54	40.28
23 09 23 00-0462 EA 5 UI, 4 BI, 3 AO, 6 Relay DO Expansion I/O Module (Johnson Controls LP-XM07X01-000C)	469.97	40.28
23 09 23 00-0463 EA 5 UI, 4 BI, 3 AO, 2 Triac DO, 4 Relay DO Expansion I/O Module (Johnson Controls LP-XM07X11-000C)	469.97	40.28
23 09 23 00-0464 EA 5 UI, 4 BI, 3 AO, 6 Relay DO (Manual Overrides For 2 AO And 4 Relay DO) Expansion I/O Module (Johnson Controls LP-XM07X51-000C)	512.10	40.28
23 09 23 00-0465 EA 5 UI, 4 BI, 3 AO, 2 Triac DO, 4 Relay DO (Manual Overrides For 2 AO, 2 Triac DO, And 2 Relay DO) Expansion I/O Module (Johnson Controls LP-XM07X61-000C)	512.10	40.28
23 09 23 00-0466 EA 6 UI, 12 BI, 4 AO, 9 Relay DO Expansion I/O Module (Johnson Controls LP-XM14X01-000C)	633.21	40.28
23 09 23 00-0467 EA 6 UI, 12 BI, 4 AO, 4 Triac DO Expansion I/O Module (Johnson Controls LP-XM14X11-000C)	633.21	40.28
23 09 23 00-0468 EA 6 UI, 12 BI, 4 AO, 9 Relay DO (Manual Overrides For 3 AO And 7 Relay DO) Expansion I/O Module (Johnson Controls LP-XM14X51-000C)	701.66	40.28
23 09 23 00-0469 EA 6 UI, 12 BI, 4 AO, 4 Triac DO, 5 Relay DO (Manual Overrides For 3 AO, 2 Triac DO, And 5 Relay DO) Expansion I/O Module (Johnson Controls LP-XM14X61-000C)	701.66	40.28
23 09 23 00-0470 VAV, Network And Special Sensors <small>(23 09 23 00-0411)</small>		
23 09 23 00-0471 EA 3" x 4-1/2", Surface Or Box Mounted, LCD RH Display, 3% RH Accuracy, Occupancy Override, Adjustable Temperature Setpoint BACnet Temperature And Humidity Sensor (Johnson Controls NS-BHR7001-0)	324.12	25.78
23 09 23 00-0472 EA 3" x 4-1/2", Surface Or Box Mounted, Addressing Switch BACnet Temperature Sensor (Johnson Controls NS-BTN7003-0)	117.51	25.78
23 09 23 00-0473 EA 3" x 4-1/2", Surface Or Box Mounted, 3% RH Accuracy, BACnet Temperature And Humidity Sensor (Johnson Controls NS-BHN7001-0)	253.93	25.78
23 09 23 00-0474 EA 3" x 4-1/2", Surface Or Box Mounted, LCD Display, 2% RH Accuracy, Occupancy Override, Adjustable Temperature Setpoint Addressing Switch BACnet Temperature And Humidity Sensor (Johnson Controls NS-BPB7003-0)	373.07	25.78
23 09 23 00-0475 EA 3" x 4-1/2", Surface Or Box Mounted, LCD Display, Occupancy Override, Adjustable Temperature Setpoint, BACnet Temperature Sensor (Johnson Controls NS-BTB7001-0)	132.98	25.78
23 09 23 00-0476 EA 3" x 4-1/2", Surface Or Box Mounted CO2 Sensor, 0 To 2,000 ppm (Johnson Controls NS-BCN7004-0)	339.48	25.78
23 09 23 00-0477 Sensors - Hard Wired Type <small>(23 09 23 00-0411)</small>		
23 09 23 00-0478 EA Duct Mount Temperature Sensor, Platinum RT, With Handi-Box (Johnson Controls TFDCR00)	125.34	46.41
23 09 23 00-0479 EA Well Insertion Temperature Sensor, With Stainless 4-1/2" Well (Johnson Controls TIGB1C0)	99.82	25.78
23 09 23 00-0480 EA BACnet MS/TP Networked, Single Stage Thermostat (Johnson Controls TEC2601-2)	255.30	12.09
Note: For fan coil units, unit heaters and single stage packaged heating/cooling equipment.		
23 09 23 00-0481 EA BACnet MS/TP Networked Two Outputs, Dehumidification Capability And Three Speed Fan Control Thermostat (Johnson Controls TEC2616-2)	340.81	12.09
Note: For two or four pipe fan coils, cabinet unit heaters or other equipment using on/off, floating, or proportional 0 to 10 VDC control input, three speeds of fan control, and dehumidification capability.		
23 09 23 00-0482 EA BACnet MS/TP Networked Thermostats With Two Outputs (Johnson Controls TEC2627VVT-2)	255.77	12.09
Note: For VVT systems.		
23 09 23 00-0483 EA BACnet MS/TP Zone Controller For Proportional Zone Damper, On/Off Or Proportional Reheat Control (Johnson Controls TEC2647Z-2)	331.85	25.78
23 09 23 00-0484 EA BACnet Zone Controller With Occupancy Sensor For Proportional Zone Damper, On/Off Or Proportional Reheat Control (Johnson Controls TEC2647Z-2+PIR)	405.85	25.78
23 09 23 00-0485 Automated Logic Controls <small>(23 09 23)</small>		
23 09 23 00-0486 EA Up To 25 Point, High Speed Ethernet Router (Automated Logic LGR25)	2,677.33	257.82
23 09 23 00-0487 EA Up To 250 Point, High Speed Ethernet Router (Automated Logic LGR250)	3,148.50	257.82
23 09 23 00-0488 EA Up To 1,000 Point, High Speed Ethernet Router (Automated Logic LGR1000)	4,717.63	257.82
23 09 23 00-0489 EA Up 25 Point, Router/Gateway/Processor Multi-Purpose Module (Automated Logic ME-LGR25)	3,055.95	257.82
23 09 23 00-0490 EA Up 200 Point, Router/Gateway/Processor Multi-Purpose Module (Automated Logic ME-LGR200)	5,096.24	257.82
23 09 23 00-0491 EA ME812u Controller And Router (Automated Logic ME812u-LGR)	7,037.39	515.63
23 09 23 00-0492 EA 4 Universal Outputs, 8 Universal Inputs I/O Expander (Automated Logic MEx48u)	2,077.87	257.82
23 09 23 00-0493 EA 8 Universal Outputs, 8 Universal Inputs I/O Expander (Automated Logic MEx88u)	2,420.72	257.82

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 09 Instrumentation And Control For HVAC****23 09 23 Direct-Digital Control System For HVAC**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 09 23 00-0494 EA 0 Universal Outputs, 16 Universal Inputs I/O Expander (Automated Logic MEx016u).....	2,225.10	257.82
23 09 23 00-0495 EA 8 Universal Outputs, 16 Universal Inputs I/O Expander (Automated Logic MEx816u).....	4,989.60	644.55
23 09 23 00-0496 EA 0 Digital Outputs, 8 Universal Inputs, 0 Analog Outputs Standalone Control Module (Automated Logic M0100).....	2,060.59	193.36
23 09 23 00-0497 EA 0 Digital Outputs, 32 Universal Inputs, 0 Analog Outputs Standalone Control Module (Automated Logic M0320).....	4,793.52	580.09
23 09 23 00-0498 EA 2 Digital Outputs, 2 Universal Inputs, 0 Analog Outputs Standalone Control Module (Automated Logic M220nx).....	1,496.88	193.36
23 09 23 00-0499 EA 4 Digital Outputs, 10 Universal Inputs, 6 Analog Outputs Standalone Control Module (Automated Logic M4106nx).....	2,971.81	257.82
23 09 23 00-0500 EA 8 Digital Outputs, 10 Universal Inputs, 2 Analog Outputs Standalone Control Module (Automated Logic M8102nx).....	2,929.74	257.82
23 09 23 00-0501 EA 16 Digital Outputs, 16 Universal Inputs, 0 Analog Outputs Standalone Control Module (Automated Logic M16160).....	4,849.85	515.63
23 09 23 00-0502 EA 8 Digital Outputs, 8 Universal Inputs, 0 Analog Outputs Standalone Control Module (Automated Logic M880nx).....	2,656.30	257.82
23 09 23 00-0503 EA 0 Digital Outputs, 32 Universal Inputs, 0 Analog Outputs Expander Control Module (Automated Logic MX0320).....	2,582.23	193.36
23 09 23 00-0504 EA 16 Digital Outputs, 16 Universal Inputs, 0 Analog Outputs Expander Control Module (Automated Logic MX16160).....	4,597.44	515.63
23 09 23 00-0505 EA No Display, Interior Wall Mounted, Standalone Controller For Heat Pumps, Fan Coil Units And Other Packaged HVAC Equipment (Automated Logic RC642).....	932.72	128.91
23 09 23 00-0506 EA With Display, Interior Wall Mounted, Standalone Controller For Heat Pumps, Fan Coil Units And Other Packaged HVAC Equipment (Automated Logic RC642D).....	974.78	128.91
23 09 23 00-0507 EA 6 Digital Outputs, 10 Universal Inputs, 4 Analog Outputs Single Equipment Control Module (Automated Logic SE6104a).....	3,139.34	451.19
23 09 23 00-0508 EA 6 Digital Outputs, 16 Universal Inputs, 6 Analog Outputs Single Equipment Control Module (Automated Logic SE6166).....	3,819.19	515.63
23 09 23 00-0509 EA 2 Digital Outputs, 2 Universal Inputs Zone Controller (Automated Logic ZN220).....	1,128.78	193.36
23 09 23 00-0510 EA 2 Digital Outputs, 5 Universal Inputs, 3 Analog Outputs Zone Controller (Automated Logic ZN253).....	1,290.74	193.36
23 09 23 00-0511 EA 3 Digital Outputs, 4 Universal Inputs, 1 Analog Outputs Controller For Pressure Independent VAV Applications (Automated Logic ZN341+).....	1,000.02	128.91
23 09 23 00-0512 EA 1 Digital Outputs, 4 Universal Inputs, 1 Analog Outputs Controller For Pressure Independent VAV Applications (Automated Logic ZN141+).....	981.09	128.91
23 09 23 00-0513 EA 5 Digital Outputs, 5 Universal Inputs, 1 Analog Outputs Controller For Heat Pumps, Fan Coil Units And Other Packaged HVAC Equipment (Automated Logic ZN551).....	1,238.58	193.36
23 09 23 00-0514 EA Air Flow Sensor And Damper Actuator Accessory For ZN341V+ Or ZN141V+ (Automated Logic ZASF).....	1,135.09	193.36
23 09 23 00-0515 EA Unlimited Points, Front End Software For Building Control (Automated Logic WC).....	7,444.55	
23 09 23 00-0516 EA 500 Point, Front End Software For Building Control (Automated Logic WC500).....	3,111.54	
23 09 23 00-0517 EA Advanced Reporting Option, Front End Software For Building Control (Automated Logic WC-ADV-REP).....	1,485.91	
23 09 23 00-0518 EA Advanced Security Option, Front End Software For Building Control (Automated Logic WC-ADV-SEC).....	1,906.59	
23 09 23 00-0519 EA Advanced Alarming Option, Front End Software For Building Control (Automated Logic WC-ADV-ALARM).....	2,130.45	
23 09 23 00-0520 EA Enterprise Integration Option, Front End Software For Building Control (Automated Logic WC-ENTERPRISE).....	2,747.95	

23 09 23 00-0521 Alerton Controls (23 09 23)

23 09 23 00-0522 EA 50 Devices, 1 WEBtalk VM, Alerton Building Suite 3 (Alerton ABS-3-SMALL).....	4,413.21	
23 09 23 00-0523 EA 150 Devices, 1 WEBtalk VM, Alerton Building Suite 3 (Alerton ABS-3-MEDIUM).....	6,686.16	
23 09 23 00-0524 EA Dashboard Option, 150 Devices, 1 WEBtalk VM, Alerton Building Suite 3 (Alerton ABS-3-D-MEDIUM).....	16,191.20	
23 09 23 00-0525 EA Unlimited Devices, 1 WEBtalk VM, Alerton Building Suite 3 (Alerton ABS-3-LARGE).....	12,265.20	
23 09 23 00-0526 EA Dashboard Option, Unlimited Devices, 1 WEBtalk VM, Alerton Building Suite 3 (Alerton ABS-3-D-LARGE).....	30,862.02	
23 09 23 00-0527 EA Unlimited Devices, SQL Derver Interface, Unlimited WEBtalk VM, Alerton Building Suite 3 (Alerton ABS-3-ENTERPRISE).....	18,464.13	
23 09 23 00-0528 EA Dashboard Option, Unlimited Devices, SQL Derver Interface, Unlimited WEBtalk VM, Alerton Building Suite 3 (Alerton ABS-3-D-ENTERPRISE).....	37,060.95	
23 09 23 00-0529 EA Alerton Building Suite Tech License (Alerton ABS-3-TECH).....	1,077.74	
23 09 23 00-0530 EA Enterprise Edition With SQL Server Support, Envision for BACTalk v2.6 (Alerton ENV-BT-2.6-ENT1).....	14,356.31	
23 09 23 00-0531 EA Unlimited Controllers, Unlimited Workstation, Envision for BACTalk v2.6 (Alerton ENV-BT-2.6-LRG).....	10,630.75	
23 09 23 00-0532 EA 150 Controllers, 3 Workstation, Envision for BACTalk v2.6 (Alerton ENV-BT-2.6-MED).....	6,657.23	
23 09 23 00-0533 EA 50 Controllers, 1 Workstation, Envision for BACTalk v2.6 (Alerton ENV-BT-2.6-SM).....	4,295.43	
23 09 23 00-0534 EA 10 Controllers, 1 Workstation, Envision for BACTalk v2.6 (Alerton ENV-BT-2.6-XS).....	1,712.76	
23 09 23 00-0535 EA 1 Ethernet, 1 MS/TP, BACTalk Control Module (Alerton 715000100).....	2,867.83	193.36
23 09 23 00-0536 EA Foreign Protocol Converter For P1 Systems, BACTalk Control Module (Alerton BCM-FPCS).....	3,789.33	257.82
23 09 23 00-0537 EA Modbus Gateway, BACTalk Control Module (Alerton BCM-MDBS).....	4,148.86	257.82
23 09 23 00-0538 EA V.90/56K Modem, BACTalk Control Module (Alerton BCM-MDM).....	1,648.70	193.36
23 09 23 00-0539 EA 1 MS/TP, BACTalk Control Module (Alerton 715000300).....	1,944.19	193.36
23 09 23 00-0540 EA Power Supply, BACTalk Control Module (Alerton BCM-PWS).....	1,557.78	193.36
23 09 23 00-0541 EA 1 TUX Trunk, BACTalk Control Module (Alerton BCM-TUX).....	1,747.89	193.36
23 09 23 00-0542 EA Web Server And Configurator CD, BACTalk Control Module (Alerton BCM-WEB).....	4,095.22	193.36
23 09 23 00-0543 EA BACTalk Field Level Gateway For Modbus (Alerton FLG-MODBUS).....	2,097.02	257.82
23 09 23 00-0544 EA EXP BACnet Controller (Alerton VLX).....	4,543.24	515.63
23 09 23 00-0545 EA VLX BACnet High Performance Controller (Alerton VLX-PLATINUM).....	5,190.00	515.63
23 09 23 00-0546 EA Multiple Segment MS/TP Repeater (Alerton MSTP-REP).....	603.21	57.41
23 09 23 00-0547 EA 4 Inputs, 2 Flow Transducers, 4 Ground-Switching Binary Triac Outputs, Dual-Duct VAV Controller (Alerton VAV-DD).....	1,390.41	193.36
23 09 23 00-0548 EA 4 Inputs, 2 Flow Transducers, 3 Binary Triac Outputs, 4 Ground-Switching Binary Triac Outputs, Dual-Duct VAV Controller (Alerton VAV-DD7).....	1,458.61	193.36
23 09 23 00-0549 EA 4 Inputs, 1 Flow Transducers, 3 Hot-Switching Binary Triac Outputs, 2 Ground-Switching Binary Triac Outputs, Single-Duct VAV Controller (Alerton VAV-SD).....	1,223.05	193.36
23 09 23 00-0550 EA 4 Universal Inputs, 5 Binary Outputs, 2 Analog Outputs, Single-Duct VAV Controller (Alerton VAV-SD2A).....	1,318.10	193.36
23 09 23 00-0551 EA 5 Universal Inputs, 6 Binary Outputs, Integral Honeywell Actuator, Single-Duct VAV Controller (Alerton VAVIH-SD).....	1,313.97	193.36
23 09 23 00-0552 EA 11 Inputs, 8 Binary Triac Outputs, 8 Analog Outputs, BACTalk Field Controller For Central Plant Systems (Alerton VLC-1188).....	1,787.15	193.36
23 09 23 00-0553 EA 16 Inputs, BACTalk Field Controller (Alerton VLC-1600).....	1,442.07	193.36
23 09 23 00-0554 EA 16 Inputs, 16 Binary Triac Outputs, BACTalk Field Controller (Alerton VLC-16160).....	2,113.55	257.82
23 09 23 00-0555 EA 4 Universal Inputs, 4 Binary Outputs, 4 Analog Outputs, Field Controller (Alerton VLC-444).....	958.63	128.91
23 09 23 00-0556 EA 5 Inputs, 5 Binary Outputs, BACTalk Field Controller (Alerton VLC-550).....	933.83	128.91
23 09 23 00-0557 EA 6 Inputs, 2 Binary Triac Outputs, 3 Isolated Relay Outputs, BACTalk Field Controller (Alerton VLC-651R).....	1,324.29	193.36
23 09 23 00-0558 EA 6 Inputs, 3 Binary Triac Outputs, 3 Isolated Relay Outputs, BACTalk Field Controller (Alerton VLC-660R).....	1,324.29	193.36
23 09 23 00-0559 EA 8 Inputs, 5 Binary Triac Outputs, 3 Analog Outputs, BACTalk Field Controller (Alerton VLC-853).....	1,497.87	193.36



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 09 23 00-0560 EA 16 Universal Inputs, 8 Binary Outputs, 8 Analog Outputs, Field Controller (Alerton VLCA-1688).....	2,778.90	257.82
23 09 23 00-0561 EA 2 Fixed Inputs, 3 Universal Inputs, 6 Binary Outputs, 2 Analog Outputs, VisualLogic Display Controller (Alerton VLD-362).....	1,363.55	193.36
23 09 23 00-0562 EA Wireless Door Contact Sensor (Alerton AL-OC-DS).....	85.27	7.25
23 09 23 00-0563 EA One-Speed BACtalk Microset Wall Sensor (Alerton MS-1010-BT).....	133.37	7.25
23 09 23 00-0564 EA One-Speed BACtalk Microset Wall Sensor With RH Sensor (Alerton MS-1010H-BT).....	257.36	7.25
23 09 23 00-0565 EA Three-Speed BACtalk Microset Wall Sensor (Alerton MS-1030-BT).....	133.37	7.25
23 09 23 00-0566 EA Three-Speed BACtalk Microset Wall Sensor With RH Sensor (Alerton MS-1030H-BT).....	257.36	7.25
23 09 23 00-0567 EA BACnet-Compliant Wall Sensor (Alerton TS-1050-BT).....	85.85	7.25
23 09 23 00-0568 EA Wireless Temperature And Humidity Sensor (Alerton WTS-1000-KIT).....	346.21	7.25
23 09 23 00-0569 EA Wireless Temperature And Humidity Sensor With Temperature Adjustment Knob And Manual Override (Alerton WTS-1050-KIT).....	387.54	7.25
23 09 23 00-0570 EA 10 12-Bit Inputs, 12 Binary Triac Outputs Expansion Module (Alerton EXP-10-12-0).....	1,855.34	193.36
23 09 23 00-0571 EA 10 12-Bit Inputs, 4 Binary Triac Outputs Expansion Module (Alerton EXP-10-4-8).....	1,855.34	193.36
23 09 23 00-0572 EA 22 12-Bit Inputs Expansion Module (Alerton EXP-22-0-0).....	1,776.82	193.36
23 09 23 00-0573 Siemens Controls <small>(23 09 23)</small>		
23 09 23 00-0574 EA Concealed Temperature Set Point Adjustment, Electric Line Voltage Heating/Cooling Thermostat (Siemens 134-1083).....	182.26	12.09
23 09 23 00-0575 EA Exposed Temperature Set Point Adjustment, Electric Line Voltage Heating/Cooling Thermostat (Siemens 134-1085).....	158.26	12.09
23 09 23 00-0576 EA SPST/Manual Reset, 1" To 12" Set Point Range, Differential Static Pressure Airflow Switch (Siemens 141-0575).....	187.78	54.43
23 09 23 00-0577 EA -0.5" To 0.5" WG, Low Differential Pressure Transmitter (Siemens 141-0591).....	286.38	54.43
23 09 23 00-0578 EA Spring Clip Mounting Kit For Thermostat (Siemens 182-685).....	35.35	
23 09 23 00-0579 EA Two Position, Pneumatic Circuit, RL243 Switching Relay (Siemens 243-0001).....	120.12	80.57
23 09 23 00-0580 EA 3/4" Two Way, Normally Closed, 6.3 Cv, FxF, Brass Trim, Floating, Spring Return Actuator, Globe Valve And Actuator Assembly (Siemens 260-02012).....	196.86	13.89
23 09 23 00-0581 EA 1" Three Way, 10 Cv, FxF, Stainless Steel Trim. Floating, Spring Return Actuator, Globe Valve And Actuator Assembly (Siemens 266-02079).....	347.79	25.22
23 09 23 00-0582 EA 1" Three Way, 10 Cv, FxF, Brass Trim, 0 To 10 Volt DC, 4 To 20 mA Electronic Spring Return Actuator, Globe Valve And Actuator Assembly (Siemens 274-03203).....	686.80	25.22
23 09 23 00-0583 EA 1-1/4" Two Way, 16 Cv, FxF, Stainless Steel Trim, 0 To 10 Volt DC Electronic Spring Return Actuator, Globe Valve And Actuator Assembly (Siemens 298-03006).....	579.34	31.95
23 09 23 00-0584 EA 36" Rigid Probe, 4 To 20 mA, 20 To 120 Degree F Range, Duct Averaging Sensor (Siemens 535-490-36).....	186.54	46.41
23 09 23 00-0585 EA -58 To 122 Degree F Range, Outside Air Temperature Sensor (Siemens 536-768).....	159.74	25.78
23 09 23 00-0586 EA Unit Conditioner Controller With Secure Mode (Siemens 540-110C).....	880.90	128.91
23 09 23 00-0587 EA 9-Pin, Female To RJ-11 Cable (Siemens 540-143).....	57.40	
23 09 23 00-0588 EA Terminal Box Controller, Electronic Output, For Trane (Siemens 540-800).....	918.56	128.91
23 09 23 00-0589 EA MMI Extension Cable (Siemens 545-712).....	94.00	
23 09 23 00-0590 EA Remote Pressure Transmitter (Siemens 547-003).....	595.84	25.78
23 09 23 00-0591 EA Cooling Only, GDE, BACnet Actuating Terminal Equipment Controller (Siemens 550-400).....	988.01	128.91
23 09 23 00-0592 EA BACnet Unit Conditioner Fan Coil Controller (Siemens 550-433).....	911.18	128.91
23 09 23 00-0593 EA Insight Advanced Software Package (Siemens 571-010-381-USB).....	7,637.11	
Note: Includes one user license and one sentinel key.		
23 09 23 00-0594 EA BACnet Client Option For Insight Advanced Software Package (Siemens 571-188).....	302.55	
23 09 23 00-0595 EA Soft Controller Option For Insight Advanced Software Package (Siemens 571-620).....	1,277.12	
23 09 23 00-0596 EA 1" Steam, Normally Open, 10 Cv, Stainless Steel Trim, Class 250 Globe Valve (Siemens 599-03059).....	228.62	8.39
23 09 23 00-0597 EA 2" Steam, Normally Open, 40 Cv, Stainless Steel Trim, Class 250 Globe Valve (Siemens 599-03062).....	476.03	14.54
23 09 23 00-0598 EA Firefinder XLS Driver, Modular Equipment Controller With RS-485 BLN, 8 DI, 8 DO, 8 AI, 8 AO, Point Expansion Support, HOA-Ready (Siemens 986-83481C).....	7,493.49	322.27
23 09 23 00-0599 EA SiPass Driver, Modular Equipment Controller With RS-485 ALN, 8 DI, 8 DO, 8 AI, 8 AO, Point Expansion Support, Modem With HOA (Siemens 986-83482F).....	8,380.53	322.27
23 09 23 00-0600 EA License To Enable 4 TX-I/O Modules On The Island Bus And FLN Support On Models PXC36-E.A And PXC36-PE.A (Siemens LSM-36.A).....	2,655.16	
23 09 23 00-0601 EA License To Enable FLN Support On PXC-16 or PXC-24 "F" Models (Siemens LSM-FLN).....	741.12	
23 09 23 00-0602 EA License To Enable FLN Support On Models PXC36-E.A And PXC36-PE.A (Siemens LSM-FLN36.A).....	1,815.47	
23 09 23 00-0603 EA License To Enable BACnet Field Panel Web Server (PXC-36) Or Web Services (PXC-16/24) (Siemens LSM-FPWEB).....	1,340.10	
23 09 23 00-0604 EA License To Enable 4 TX-I/O Modules On The Island Bus On Models PXC36-E.A And PXC36-PE.A (Siemens LSM-IB36.A).....	1,216.00	
23 09 23 00-0605 EA License To Enable SNMP Agent License To Enable SNMP Agent (Siemens LSM-SNMP).....	3,177.61	
23 09 23 00-0606 EA 16-Switch HOA Upgrade Kit (Siemens PXA16-M).....	432.79	
23 09 23 00-0607 EA 16-Switch HOA Upgrade Kit (Extended Temp, UL 916) With HMI Cable (Siemens PXA16-MR).....	482.61	
23 09 23 00-0608 EA 8-Switch HOA Upgrade Kit (Siemens PXA8-M).....	246.16	
23 09 23 00-0609 EA 18" NEMA Type 1 Enclosure (Utility Cabinet) (Siemens PXA-ENC18).....	349.06	40.28
23 09 23 00-0610 EA 19" NEMA Type 1 Enclosure (Utility Cabinet) (Siemens PXA-ENC19).....	543.97	40.28
23 09 23 00-0611 EA 34" NEMA Type 1 Enclosure (Utility Cabinet) (Siemens PXA-ENC34).....	710.40	40.28
23 09 23 00-0612 EA Serial Cable Required For HOA Or PXM10T/S Connection To Non-Rooftop Variants Of The 16-Point And 24-Point Compact Series (Siemens PXA-HMI.CABLEP5).....	24.74	
23 09 23 00-0613 EA 115 Volt, 24 Volt AC, 50/60 Hertz, 192 VA PX Series Service Box (Siemens PXA-SB115V192VA).....	584.98	40.28
23 09 23 00-0614 EA 115 Volt, 24 Volt AC, 50/60 Hertz, 384 VA PX Series Service Box (Siemens PXA-SB115V384VA).....	836.26	40.28
23 09 23 00-0615 EA 230 Volt, 24 Volt AC, 50/60 Hertz, 192 VA PX Series Service Box (Siemens PXA-SB230V192VA).....	677.55	40.28
23 09 23 00-0616 EA 230 Volt, 24 Volt AC, 50/60 Hertz, 384 VA PX Series Service Box (Siemens PXA-SB230V384VA).....	942.07	40.28
23 09 23 00-0617 EA PXC Modular, BACnet/IP Or MS/TP ALN, P1 Or MS/TP FLN, PXX-485.3 Is Also Required As The Connection To The FLN Devices (Siemens PXC00-E96.A).....	4,655.71	451.19
23 09 23 00-0618 EA PXC Modular Series For BACnet Networks, TX-I/O Module, 96 Node (Siemens PXC100-E96.A).....	3,265.43	128.91
23 09 23 00-0619 EA 16 Point, BACnet/IP ALN Compact Programmable Controller (Siemens PXC16.2-E.A).....	2,139.79	241.71
23 09 23 00-0620 EA 16 Point, BACnet/IP ALN, P1 Or MS/TP FLN Compact Programmable Controller (Siemens PXC16.2-EF.A).....	2,291.99	241.71
23 09 23 00-0621 EA 16 Point, MS/TP ALN Compact Programmable Controller (Siemens PXC16.2-M.A).....	2,139.79	241.71
23 09 23 00-0622 EA 24 Point, BACnet/IP ALN Compact Programmable Controller (Siemens PXC24.2-E.A).....	2,679.05	257.82
23 09 23 00-0623 EA 24 Point, BACnet/IP ALN, P1 Or MS/TP FLN Compact Programmable Controller (Siemens PXC24.2-EF.A).....	2,755.13	257.82

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 09 Instrumentation And Control For HVAC****23 09 23 Direct-Digital Control System For HVAC**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 09 23 00-0624 EA 24 Point, BACnet/IP ALN, Rooftop Compact Programmable Controller (Siemens PXC24.2-ER.A)	2,722.86	257.82
23 09 23 00-0625 EA 24 Point, BACnet/IP ALN, Rooftop, P1 Or MS/TP FLN Compact Programmable Controller (Siemens PXC24.2-ERF.A)	2,870.04	257.82
23 09 23 00-0626 EA 24 Point, MS/TP ALN Compact Programmable Controller (Siemens PXC24.2-M.A)	2,679.05	257.82
23 09 23 00-0627 EA 24 Point, MS/TP ALN, Rooftop Compact Programmable Controller (Siemens PXC24.2-MR.A)	2,794.32	257.82
23 09 23 00-0628 EA 36 Point, BACnet/IP Or MS/TP ALN Compact Programmable Controller (Siemens PXC36-E.A)	4,354.05	451.19
23 09 23 00-0629 EA 36 Point, BACnet/IP or MS/TP ALN, Island Bus, P1 Or MS/TP FLN Compact Programmable Controller (Siemens PXC36-EF.A)	6,834.41	515.63
23 09 23 00-0630 EA License To Enable The Island Bus On PXC00-E96.A and PXC00-PE96.A (Siemens PXF-TXIO.A)	985.12	
23 09 23 00-0631 EA Controller Mounted Operator Display Module With Point Monitor And Optional Blue Backlight (Siemens PXM10S)	394.62	32.23
23 09 23 00-0632 EA Controller Mounted Operator Display Module (Siemens PXM10T)	485.49	64.46
23 09 23 00-0633 EA Provides FLN Support For The PXC Modular, Includes Three RS-485 P1 FLN Connections Or One MS/TP FLN Connection, Maximum Of 96 Devices Supported (Siemens PXX-485.3)	492.31	16.11
23 09 23 00-0634 EA Digital Temperature Room Unit for TEC, Sensing, Setpoint, Override, Display, No Logo (Siemens QAA2280.FWNC)	146.72	25.78
23 09 23 00-0635 EA 4" Platinum, 1,000 Ohm, 385 Alpha Probe, Immersion Temperature Sensor (Siemens QAE2012.010)	99.28	25.78
23 09 23 00-0636 EA 8" Platinum, 1,000 Ohm, 385 Alpha Probe, Duct Temperature Sensor (Siemens QAM2012.020)	148.47	46.41
23 09 23 00-0637 EA 2 Meter Flexible Duct Temperature Sensor With Four Mounting Clamps (Siemens QAM2120.200)	199.94	46.41
23 09 23 00-0638 EA 10 HP, 240 Volt, NEMA 2 Variable Frequency Drive (Siemens SED2-7.5/22X)	1,874.02	259.59
23 09 23 00-0639 EA Labels For HOA And TX-I/O Modules (Siemens TXA1.LLT-P100)	0.33	
23 09 23 00-0640 EA 16 Digital Input Module (Siemens TXM1.16D)	917.09	128.91
23 09 23 00-0641 Cypress Envirosystems Controls (23 09 23)		
23 09 23 00-0642 Wireless Pneumatic Thermostat (23 09 23 00-0641)		
Note: Wireless pneumatic thermostats, hub and repeaters must be installed by installers certified by the manufacturer.		
23 09 23 00-0643 EA Two-Pipe Direct Acting Wireless Pneumatic Thermostat (Cypress Envirosystems WPT-800-T2DP)	542.37	8.05
Note: One for every thermostat to be retrofitted.		
For >50 To 200, Deduct	-28.66	
For >200, Deduct	-57.28	
23 09 23 00-0644 EA Two-Pipe Reverse Acting Wireless Pneumatic Thermostat (Cypress Envirosystems WPT-800-T2RP)	542.37	8.05
Note: One for every thermostat to be retrofitted.		
For >50 To 200, Deduct	-28.66	
For >200, Deduct	-57.28	
23 09 23 00-0645 EA Single-Pipe Direct Acting Wireless Pneumatic Thermostat (Cypress Envirosystems WPT-800-T1DP)	542.37	8.05
Note: One for every thermostat to be retrofitted.		
For >50 To 200, Deduct	-28.66	
For >200, Deduct	-57.28	
23 09 23 00-0646 EA Single-Pipe Indirect Acting Wireless Pneumatic Thermostat (Cypress Envirosystems WPT-800-T1RP)	542.37	8.05
Note: One for every thermostat to be retrofitted.		
For >50 To 200, Deduct	-28.66	
For >200, Deduct	-57.28	
23 09 23 00-0647 EA Two-Pipe Direct Acting Deadband Wireless Pneumatic Thermostat (Cypress Envirosystems WPT-800-T2DP-DB)	619.14	8.05
Note: One for every thermostat to be retrofitted.		
For >50 To 200, Deduct	-32.93	
For >200, Deduct	-65.81	
23 09 23 00-0648 EA Two-Pipe Reverse Acting Deadband Wireless Pneumatic Thermostat (Cypress Envirosystems WPT-800-T2RP-DB)	619.14	8.05
Note: One for every thermostat to be retrofitted.		
For >50 To 200, Deduct	-32.93	
For >200, Deduct	-65.81	
23 09 23 00-0649 EA Single-Pipe Direct Acting Deadband Wireless Pneumatic Thermostat (Cypress Envirosystems WPT-800-T1DP-DB)	619.14	8.05
Note: One for every thermostat to be retrofitted.		
For >50 To 200, Deduct	-32.93	
For >200, Deduct	-65.81	
23 09 23 00-0650 EA Single-Pipe Indirect Acting Deadband Wireless Pneumatic Thermostat (Cypress Envirosystems WPT-800-T1RP-DB)	619.14	8.05
Note: One for every thermostat to be retrofitted.		
For >50 To 200, Deduct	-32.93	
For >200, Deduct	-65.81	
23 09 23 00-0651 EA Wireless Pneumatic Thermostat Blank Cover (Cypress Envirosystems WPT-800-MCOV)	40.96	8.05
Note: Optional cover.		
For >50 To 200, Deduct	-1.83	
For >200, Deduct	-3.66	
23 09 23 00-0652 EA Green Box Controller (Cypress Envirosystems GBC-800-001)	3,254.47	8.05
Note: One unit for up to 100 thermostats.		
For 2, Deduct	-163.03	
For >2, Deduct	-325.77	
23 09 23 00-0653 EA WPT USB Hub (Cypress Envirosystems WPT-800-HUSB)	374.35	8.05
Note: One unit for up to 100 thermostats.		
For 2, Deduct	-20.37	
For >2, Deduct	-40.70	
23 09 23 00-0654 EA WPT Repeater (Cypress Envirosystems WPT-800-RWAL)	424.18	8.05
Note: One unit for up to 15 thermostats.		
For >5 To 10, Deduct	-21.34	
For >10, Deduct	-42.65	
23 09 23 00-0655 EA 24 Volt, WPT Repeater (Cypress Envirosystems WPT-800-RWAL24V)	526.99	8.05
Note: One unit for up to 15 thermostats.		
For >5 To 10, Deduct	-24.82	
For >10, Deduct	-49.60	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 09 23 00-0656				Melink Intelli-Hood IH3 Controls (23 09 23)		
23 09 23 00-0657				Kitchen Ventilation Controllers (23 09 23 00-0656)		
23 09 23 00-0658	EA			Fully Programmable Kitchen Ventilation Controller (Melink Intelli-Hood 2SYS-3001).....	5,691.51	322.27
Note: RS-485 communication protocol supports up to 39 Hood Controllers, 10 graphical user interface devices, 10 auxiliary power supplies, and 10 auxiliary light controllers. Modbus VFD communications interface for support of up to 64 variable frequency drives, programmable I/O points include: 3 digital inputs, 4 digital outputs, 1 analog output, and 1 analog input. BACnet over TCP/IP Interface, Real-Time Clock with battery back-up.						
23 09 23 00-0659	EA			Graphical User Interface (Melink Intelli-Hood 2KPD-3001).....	1,017.23	66.47
Note: Full color 2.5" display and programming interface device. RS-485 communication protocol for interface with main controller.						
23 09 23 00-0660	EA			Hood Controller (Melink Intelli-Hood 2SEN-3001)	1,761.78	268.29
Note: 6 point field I/O device, RS-485 communication protocol, supports up to 4 field temperature sensors and 1 optic sensor system.						
23 09 23 00-0661				Kitchen Ventilation Sensors (23 09 23 00-0656)		
23 09 23 00-0662	EA			Duct Mount Stainless Steel RTD (Melink Intelli-Hood 2SEN-3005-Q).....	312.23	46.41
Note: Includes UL listed mounting compression fitting, stainless steel probe protection sleeve, RJ-45 communication connector.						
23 09 23 00-0663	EA			Optic Sensor System For Detection Of Cooking Effluent (Melink Intelli-Hood 2SEN-3004-28)	2,606.42	257.82
Note: Includes air purge unit, infrared emitter/receiver with stainless steel housings. Auto-calibration, 0.2 second response time, conformal-coated circuit boards, purge pipe assembly complete with UL listed compression fittings, communication interface cables and blower box assembly.						
23 09 23 00-0664				Control Sensors, Meters, Relays, Power Supplies, Valves, Dampers And Actuators (23 09 23)		
23 09 23 00-0665				Temperature Sensors (23 09 23 00-0664)		
23 09 23 00-0666	EA			10K Ohm Thermistor Duct Temperature Sensor (Kele ST-D24).....	142.27	46.41
23 09 23 00-0667	EA			10K Ohm Thermistor Duct Temperature Sensor, 1/2" LB Conduit Fitting (Kele ST-D24-XCO)	166.72	46.41
23 09 23 00-0668	EA			10K Ohm Thermistor Duct Temperature Sensor With Greenfield Fitting (Kele ST-D24-XG).....	145.67	46.41
23 09 23 00-0669	EA			10K Ohm Thermistor Duct Temperature Sensor With Handibox Housing (Kele ST-D24-XH).....	144.05	46.41
23 09 23 00-0670	EA			10K Ohm Thermistor Duct Temperature Sensor With Handibox Housing, 18" Probe (Kele ST-D24-XH-XL18).....	189.73	46.41
23 09 23 00-0671	EA			10K Ohm Thermistor Duct Temperature Sensor With Handibox Housing, 6" Probe (Kele ST-D24-XH-XL6).....	153.12	46.41
23 09 23 00-0672	EA			10K Ohm Thermistor Duct Temperature Sensor With Non Metallic Handibox Housing (Kele ST-D24-XHP)	144.80	46.41
23 09 23 00-0673	EA			10K Ohm Thermistor Duct Temperature Sensor With 4" Probe (Kele ST-D24-XL4)	161.45	46.41
23 09 23 00-0674	EA			10K Ohm Thermistor Duct Temperature Sensor With Weatherproof Housing (Kele ST-D24-XW).....	157.37	46.41
23 09 23 00-0675	EA			10K Ohm Thermistor Outdoor Air Temperature Sensor (Kele ST-O24)	201.00	64.46
23 09 23 00-0676	EA			10K Ohm Thermistor Outdoor Air Temperature Sensor With 25' Lead (Kele ST-O24-XC25).....	206.79	64.46
23 09 23 00-0677	EA			Delta Style Surface Mounted 10K Ohm Thermistor Room Temperature Sensor (Kele BA/10K3-R-N-DF).....	83.04	25.78
23 09 23 00-0678	EA			Delta Style Surface Mounted AD592 Room Temperature Sensor (Kele BA/592-10K-R)	85.49	25.78
23 09 23 00-0679	EA			Stainless Steel Plate 1K Ohm Room Temperature Sensor (Kele BA/1K8-SP).....	85.49	25.78
23 09 23 00-0680				Water Temperature Sensors (23 09 23 00-0664)		
23 09 23 00-0681	EA			5" Immersion 20K Ohm Water Temp Sensor (Honeywell C7041D2001).....	106.39	49.87
23 09 23 00-0682	EA			Strap-On 20K Ohm Water Temp Sensor (Honeywell C7041K2005)	250.12	49.87
23 09 23 00-0683				Relative Humidity Sensors (23 09 23 00-0664)		
23 09 23 00-0684	EA			3% Duct Mounted RH Sensor (Kele HD30K).....	302.90	46.41
23 09 23 00-0685	EA			10K Ohm Thermistor 3% Duct Mounted RH Sensor (Kele HD30K-T3)	312.57	46.41
23 09 23 00-0686	EA			3% RH Outdoor Air Sensor (Kele HO30K).....	356.45	64.46
23 09 23 00-0687	EA			2% Surface Mounted RH Transmitter (Kele HW20K)	258.04	25.78
23 09 23 00-0688				Pressure Sensors (23 09 23 00-0664)		
23 09 23 00-0689	EA			Differential Pressure Transmitters With NEMA 1 Case, 0 To .5" W.C. (Kele T30-005).....	379.78	54.43
23 09 23 00-0690	EA			Differential Pressure Transmitters With NEMA 1 Case, 0 To 5" W.C. (Kele T30-050).....	349.10	54.43
23 09 23 00-0691	EA			Adjustable Differential Pressure Switches, .05 To 12" W.C. (Kele AFS-222)	166.03	54.43
23 09 23 00-0692	EA			Adjustable Differential Pressure Switches, .05 To 2" W.C. (Kele AFS-262)	167.55	54.43
23 09 23 00-0693	EA			Manual Reset Adjustable Differential Pressure Switches, .4 To 2" W.C. (Kele AFS-460)	178.44	54.43
23 09 23 00-0694	EA			Adjustable Differential Pressure Switches, .05 To 12" W.C., 1/8" NPT (Kele AFS-145)	165.04	54.43
23 09 23 00-0695	EA			Water Differential Pressure Transmitter, 0 To 100psid, Bypass Valve Assembly Option (Kele 360C-P210D-BVA).....	1,479.70	54.43
Note: Excludes pipe fittings.						
23 09 23 00-0696	EA			Water Differential Pressure Transmitter, 0 To 60psid, Bypass Valve Assembly Option (Kele 360C-P160D-BVA).....	1,479.70	54.43
Note: Excludes pipe fittings.						
23 09 23 00-0697	EA			Magnahelic Gauge.....	429.02	33.27
23 09 23 00-0698				Water Flow Meters (23 09 23 00-0664)		
23 09 23 00-0699	EA			Insertion Electromagnetic Water Flow Meter (Onicon F-3500)	2,691.85	70.56
Note: Excludes pipe fittings.						
23 09 23 00-0700	EA			Dual Turbine Insertion Flow Meter With Analog Output (Onicon F-1210).....	157.80	23.52
Note: Excludes pipe fittings.						
23 09 23 00-0701				Air Flow Monitoring Stations (23 09 23 00-0664)		

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 09 Instrumentation And Control For HVAC****23 09 23 Direct-Digital Control System For HVAC**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 09 23 00-0702	EA		Analog Transmitter, 2 Point, 3 Sensor Air Flow Monitoring Station (Eatron GTA116) Note: 10' cable, 36" x 24" typical duct size.	2,124.73	77.28
23 09 23 00-0703	EA		Analog Transmitter, 3 Point, 4 Sensor Air Flow Monitoring Station (Eatron GTA116) Note: 10' cable, 48" x 36" typical duct size.	3,031.91	77.28
23 09 23 00-0704	EA		Analog Transmitter, 4 Point, 4 Sensor Air Flow Monitoring Station (Eatron GTA116) Note: 10' cable, 60" x 48" typical duct size.	3,763.30	77.28
23 09 23 00-0705			Gas Sensors (23 09 23 00-0664)		
23 09 23 00-0706	EA		6-1/4" x 6-1/8" CO2 Sensor, 0-2,000 ppm (Kele WCO-1B).....	1,121.43	38.67
23 09 23 00-0707	EA		Wall Mounted CO2 Sensor, 0-2,000 ppm With LCD Display (Kele CD-AW-LCD)	416.81	25.78
23 09 23 00-0708	EA		CO Monitor/Transmitter, 0 To 250 ppm (Kele GMT-CO-S2)..... Note: Solid state sensor.	895.52	38.67
23 09 23 00-0709	EA		CO2 Transmitter, Duct Mount, No Display, 0-10 Volt DC Out, 24 Volt AC/Volt DC, 0-10 Or 4-20mA, 0-2,000 ppm Range With CD-AD Duct Probe Assembly (CDE CD-AD-LCD; CD-AD)	499.89	46.41
23 09 23 00-0710			Room Pressure Monitoring (23 09 23 00-0664)		
23 09 23 00-0711	EA		Hospital Room Pressure Monitor With Digital Interface Monitor, Through Wall Sensor Transformer And Plenum Rated Cable (TSI 8640-PM)	1,754.10	40.24
23 09 23 00-0712	EA		Hospital Room Pressure Controller With Digital Interface Monitor, Through Wall Sensor Transformer And Plenum Rated Cable (TSI 8630-PC)..... Note: Excludes dampers and actuators.	2,808.68	40.24
23 09 23 00-0713	EA		Hospital Room Pressure Status Remote Visual Display (TSI 8694-4)	227.80	24.14
23 09 23 00-0714	EA		Hospital Room Pressure Status Remote Negative/Neutral Key Switch (TSI 8694-7)	261.46	24.14
23 09 23 00-0715			Current Switches And Current Sensors (23 09 23 00-0664)		
23 09 23 00-0716	EA		Current Sensor, 0-20 Amp, 0-5 Volt DC (Senva C-1203)	80.62	25.78
23 09 23 00-0717	EA		Current Sensor, 0-20 Amp, 4-20mA (Senva C-1205)	82.64	25.78
23 09 23 00-0718	EA		VFD Current Switch, 0.5-135 Amp Range, Split Core (Senva C-2350VFD-L)	103.86	25.78
23 09 23 00-0719	EA		Current Switch, 0.15-100 Amp Range, Split Core With NC Command Relay (Senva C-2300 And CR4-24)	86.71	25.78
23 09 23 00-0720	EA		DC Current Sensor, Split Core, 0-50/100/200 Amp (Selectable), 4-20mA, 0-5 Volt DC (Veris H970HCA).....	154.76	25.78
23 09 23 00-0721	EA		DC Current Sensor, Split Core, 0-20/40/80 Amp (Selectable), 0-20mA, 0-5 Volt DC (Veris H970LCC)	154.76	25.78
23 09 23 00-0722	EA		Current Switch, 1-135 Amp, N.O. Contact 1A @ 110 Volt (Veris H709)	105.29	25.78
23 09 23 00-0723	EA		Current Switch, 0-10/20/40 Amp, 4-20mA Analog Output, Solid Core, Loop Powered (Veris H721).....	114.23	25.78
23 09 23 00-0724	EA		Energy Meter H8163 Series, With BACnet Output (Veris H8186-CB-BAC).....	2,948.84	128.91
23 09 23 00-0725	EA		Power Transducer, Modbus RTU, 100 Amp (Veris H8035-0100-2)..... Note: 3 phase networked transducer.	459.48	25.78
23 09 23 00-0726	EA		Energy Meter, Three Current Switches, Pulse Output, Phase Loss Alarm Output, 2,400 Amp (Veris H8163-2400- 4-3)	679.91	25.78
23 09 23 00-0727	EA		Current Transducer, 0-20 Amp, 0-5 Volt DC (Kele 4CTV)	152.02	25.78
23 09 23 00-0728	EA		Solid Core Fixed Setpoint Digital Output Current Switch (Veris H-800)	204.76	68.48
23 09 23 00-0729	EA		Solid Core Fixed Setpoint Digital Output Current Switch (Veris H-900)	212.17	68.48
23 09 23 00-0730	EA		Solid Core Adjustable Setpoint Digital Output Current Sensor (Veris H-708)	220.62	68.48
23 09 23 00-0731	EA		Split Core Adjustable Setpoint Digital Output Current Sensor (Veris H-908)	231.20	68.48
23 09 23 00-0732	EA		Solid And Split Core Adjustable Setpoint Digital Output VFD Current Switch (Veris H-904).....	256.54	68.48
23 09 23 00-0733	EA		Toggle Switch	87.96	32.23
23 09 23 00-0734	EA		Maintained Pushbutton Switch.....	92.73	32.23
23 09 23 00-0735	EA		Manual Time Switch.....	137.63	32.23
23 09 23 00-0736	EA		Emergency Stop Switch.....	217.93	32.23
23 09 23 00-0737	EA		Float Switch	228.77	32.23
23 09 23 00-0738	EA		Break Glass Switch.....	685.55	32.23
23 09 23 00-0739	EA		Boiler E-Stop Switch	459.63	32.23
23 09 23 00-0740			Relays (23 09 23 00-0664)		
23 09 23 00-0741	EA		DPDT, 24 Volt AC, Blade, Standard Relay (Kele RH2B-UAC24V).....	74.55	25.78
23 09 23 00-0742	EA		SPDT, 24 Volt AC/Volt DC, 120 Volt AC Multi-Voltage Relay Module (Kele PAM-1).....	83.74	25.78
23 09 23 00-0743	EA		SPDT, 24 Volt AC/Volt DC, 120 Volt AC Power Relay (Kele RIB2401B)..... Note: Box type.	108.96	32.23
23 09 23 00-0744	EA		Motor Starter Interface, 300msec Pulse (Kele PIL-2).....	134.75	25.78
23 09 23 00-0745	EA		DP Relay Socket, DIN Rail Mounted (Kele SH2B-05).....	71.02	25.78
23 09 23 00-0746	EA		SP Relay Socket, DIN Rail Mounted (Kele SH1B-05)	69.35	25.78
23 09 23 00-0747	EA		SPDT, 24 Volt AC, Blade, Standard Relay (Kele RH1B-UAC24V)	73.52	25.78
23 09 23 00-0748	EA		DPDT, 24 Volt AC, Blade, Indicator Light Relay (Kele RH2B-ULAC24V)	69.74	25.78
23 09 23 00-0749	EA		SPDT, 24 Volt AC, Blade, Indicator Light Relay (Kele RH1B-ULAC24V)	76.92	25.78
23 09 23 00-0750	EA		SPDT Pilot Relay, Universal (Kele RIBU1C)..... Note: Box type.	99.71	32.23
23 09 23 00-0751	EA		SPST Pilot Relay With HOA Switch (Kele RIBU1S)..... Note: Box type.	108.01	32.23
23 09 23 00-0752	EA		SPDT 3 Phase Line Voltage Monitor, 1-5 Minute Delay On Break Timer (ICM400)	216.90	32.23
23 09 23 00-0753	EA		SPDT 3-Phase Line Voltage Monitor, 0-10 Minute Delay On Break Timer (ICM450)	257.29	32.23
23 09 23 00-0754			Surge Protectors (23 09 23 00-0664)		
23 09 23 00-0755	EA		Surge Protector, T100's, Summit, BCU, UPCM, PCM, TCM (Transtector TR2255)	180.78	6.45
23 09 23 00-0756	EA		Surge Protector, 1AC Outlet (Transtector TR2251)	137.33	6.45
23 09 23 00-0757	EA		Surge Protector, 2 AC Outlets (Transtector TR2254)	212.09	6.45
23 09 23 00-0758	EA		Surge Protector, DB-15 Connection (Transtector TR2259-DLP15)	116.12	6.45
23 09 23 00-0759	EA		Surge Protector, DB-25 Connection (Transtector TR2259-DLP25)	116.12	6.45



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
				23 09 23 00-0760 EA Surge Protector, DB-9 Connection (Transtector TR2259-DLP9).....	116.12	6.45
				23 09 23 00-0761 EA Surge Protector, Individual Wire Connection (Transtector TR2258).....	166.64	6.45
				23 09 23 00-0762 EA Surge Protector, Trane Communication Links (Transtector TR2257).....	103.99	6.45
23 09 23 00-0763				Transformers (23 09 23 00-0664)		
				23 09 23 00-0764 EA 50 VA, 120/240/277/480-24 Volt AC, CB Foot And Single Hub Control Transformer (Veris X050CBA).....	91.39	25.78
				23 09 23 00-0765 EA 75 VA, 120-24 Volt AC, CB Foot And Dual Hub Control Transformer (Veris X075CAB).....	98.77	25.78
				23 09 23 00-0766 EA 75 VA, 120/208/240/480-24 Volt AC, CB Foot And Single Hub Control Transformer (Veris X075CBA).....	102.05	25.78
				23 09 23 00-0767 EA 100 VA, 120-24 Volt AC, CB Foot And Dual Hub Control Transformer (Veris X100CAB).....	105.49	25.78
				23 09 23 00-0768 EA 100 VA, 120/240/277/480-24 Volt AC, CB Foot And Single Hub Control Transformer (Veris X100CBA).....	113.95	25.78
23 09 23 00-0769				Power Supplies (23 09 23 00-0664)		
				23 09 23 00-0770 EA Solid Core Current Operated Switch, Terminals, Adjustable Trip, 0.5-150A, SPST (Kele RIBXKTA).....	117.06	25.78
				23 09 23 00-0771 EA AC/DC Power Supply, 1.2 Amp @ 24 Volt Output (Kele DCPA-1.2).....	137.29	25.78
				23 09 23 00-0772 EA DC Power Supply, 5 Volt DC And 24 Volt DC Output (Kele DCP-524).....	125.97	25.78
				23 09 23 00-0773 EA DC Power Supply, 24 Volt DC, DIN Rail Mounted (Kele DCP-250-D).....	130.13	25.78
				23 09 23 00-0774 EA DC Power Supply, 24 Volt DC, Hub Mounted (Kele DCP-250-H).....	130.13	25.78
				23 09 23 00-0775 EA DC Power Supply, 24 Volt DC, Panel Mounted (Kele DCP-250-P).....	130.13	25.78
				23 09 23 00-0776 EA DC Power Supply, 24 Volt AC In To Custom DC Out, At 1.5 Amp (Kele DCP-1.5-W-C).....	105.71	25.78
23 09 23 00-0777				Control Damper Actuators (23 09 23 00-0664)		
				23 09 23 00-0778 EA 44 IN-LB, 24 Volt AC, 4-20mA, 2-10 Volt DC, Proportional Control, Non Spring Return Direct Coupled Control Damper Actuator (Belimo LMB24-SR).....	362.77	66.50
				23 09 23 00-0779 EA 90 IN-LB, 24 Volt AC/DC, 4-20mA, 2-10 Volt DC, Proportional Control, Non Spring Return Direct Coupled Control Damper Actuator (Belimo NMB24-SR).....	380.79	66.50
				23 09 23 00-0780 EA 90 IN-LB, 2 Position, 24 To 240 Volt AC Spring Return Direct Coupled Control Damper Actuator (Belimo NFBUP).....	441.26	66.50
				23 09 23 00-0781 EA 175 IN-LB, 24 Volt AC, 4-20mA, 2-10 Volt DC, Proportional Control, Non-Spring Return Direct Coupled Control Damper Actuator (Belimo AMB24-SR).....	452.93	66.50
				23 09 23 00-0782 EA 90 IN-LB, 24 Volt AC, 4-20mA, 2-10 Volt DC, Proportional Control, Spring Return Direct Coupled Control Damper Actuator (Belimo NFB24-SR).....	480.51	66.50
				23 09 23 00-0783 EA 360 IN-LB, 24 Volt AC, 4-20mA, 2-10 Volt DC, Proportional Control, Non-Spring Return Direct Coupled Control Damper Actuator (Belimo GMB24-SR).....	521.87	66.50
23 09 23 00-0784				Valves With Actuator (23 09 23 00-0664)		
				23 09 23 00-0785 EA 1/2" 2-Way Bronze Globe Valve With Actuator (Belimo G215+NV24-MFT US).....	415.05	10.30
				23 09 23 00-0786 EA 3/4" 2-Way Bronze Globe Valve With Actuator (Belimo G220+NV24-MFT US).....	430.40	13.89
				23 09 23 00-0787 EA 1" 2-Way Bronze Globe Valve With Actuator (Belimo B225+NV24-MFT US).....	471.64	16.81
				23 09 23 00-0788 EA 1-1/4" 2-Way Bronze Globe Valve With Actuator (Belimo B232+NV24-MFT US).....	515.72	21.30
				23 09 23 00-0789 EA 1-1/2" 2-Way Bronze Globe Valve With Actuator (Belimo G240+NV24-MFT US).....	587.57	24.58
				23 09 23 00-0790 EA 2" 2-Way Bronze Globe Valve With Actuator (Belimo G250+NV24-MFT US).....	664.52	29.05
				23 09 23 00-0791 EA 2-1/2" 2-Way Bronze Globe Valve With Actuator (Belimo G665+GMX24-MFTX1).....	1,244.15	58.09
				23 09 23 00-0792 EA 3" 2-Way Bronze Globe Valve With Actuator (Belimo G680+GMX24-MFTX1).....	1,350.55	67.98
				23 09 23 00-0793 EA 4" 2-Way Bronze Globe Valve With Actuator (Belimo G6100C+GMX24-MFTX1).....	1,825.85	99.85
				23 09 23 00-0794 EA 5" 2-Way Bronze Globe Valve With Actuator (Belimo G6125C+GMX24-MFTX1).....	2,684.78	144.30
				23 09 23 00-0795 EA 6" 2-Way Bronze Globe Valve With Actuator (Belimo G6150C+GMX24-MFTX1).....	2,973.77	159.75
				23 09 23 00-0796 EA 1/2" 3-Way Bronze Globe Valve With Actuator (Belimo G315+NV24-MFT US).....	448.09	15.46
				23 09 23 00-0797 EA 3/4" 3-Way Bronze Globe Valve With Actuator (Belimo G320+NV24-MFT US).....	463.66	20.84
				23 09 23 00-0798 EA 1" 3-Way Bronze Globe Valve With Actuator (Belimo G325+NV24-MFT US).....	503.26	25.22
				23 09 23 00-0799 EA 1-1/4" 3-Way Bronze Globe Valve With Actuator (Belimo G332+NV24-MFT US).....	559.34	31.95
				23 09 23 00-0800 EA 1-1/2" 3-Way Bronze Globe Valve With Actuator (Belimo G340+NV24-MFT US).....	716.93	36.87
				23 09 23 00-0801 EA 2" 3-Way Bronze Globe Valve With Actuator (Belimo G350+NV24-MFT US).....	796.27	43.57
				23 09 23 00-0802 EA 2-1/2" 3-Way Bronze Globe Valve With Actuator (Belimo G765+GMX24-MFTX1).....	1,410.10	87.14
				23 09 23 00-0803 EA 3" 3-Way Bronze Globe Valve With Actuator (Belimo G780+GMX24-MFTX1).....	1,552.20	101.97
				23 09 23 00-0804 EA 4" 3-Way Bronze Globe Valve With Actuator (Belimo G7100+2"GMX24-MFTX1).....	2,259.28	149.77
				23 09 23 00-0805 EA 5" 3-Way Bronze Globe Valve With Actuator (Belimo G7125+2"GMX24-MFTX1).....	3,276.73	216.44
				23 09 23 00-0806 EA 6" 3-Way Bronze Globe Valve With Actuator (Belimo G7150+2"GMX24-MFTX1).....	3,642.32	239.63
				23 09 23 00-0807 EA 1/2" Two Way Brass Zone Valve With Actuator (Belimo ZONE215N-35+ZONE24NC).....	111.69	10.30
				23 09 23 00-0808 EA 3/4" Two Way Brass Zone Valve With Actuator (Belimo ZONE220N-50+ZONE24NC).....	129.14	13.89
				23 09 23 00-0809 EA 1" Two Way Brass Zone Valve With Actuator (Belimo ZONE225N-80+ZONE24NC).....	164.14	16.81
				23 09 23 00-0810 EA 1/2" Two Way Brass Zone Valve With Actuator (Belimo ZONE315N-35+ZONE24NC).....	133.06	15.46
				23 09 23 00-0811 EA 3/4" Two Way Brass Zone Valve With Actuator (Belimo ZONE320N-50+ZONE24NC).....	153.92	20.84
				23 09 23 00-0812 EA 1" Two Way Brass Zone Valve With Actuator (Belimo ZONE325N-80+ZONE24NC).....	193.53	25.22
				23 09 23 00-0813 EA 1/2" 2-Way Brass Ball Valve With Actuator (Belimo B215B+LRB24-3).....	156.24	10.30
				23 09 23 00-0814 EA 3/4" 2-Way Brass Ball Valve With Actuator (Belimo B220B+LRB24-3).....	201.26	13.89
				23 09 23 00-0815 EA 1" 2-Way Brass Ball Valve With Actuator (Belimo B225+LRB24-3).....	208.58	16.81
				23 09 23 00-0816 EA 1-1/4" 2-Way Brass Ball Valve With Actuator (Belimo B232+ARB24-3).....	272.82	21.30
				23 09 23 00-0817 EA 1-1/2" 2-Way Brass Ball Valve With Actuator (Belimo B240+ARB24-3).....	281.02	24.58
				23 09 23 00-0818 EA 2" 2-Way Brass Ball Valve With Actuator (Belimo B250+ARB24-3).....	357.94	29.05
				23 09 23 00-0819 EA 2-1/2" 2-Way Brass Ball Valve With Actuator (Belimo B265+ARB24-3).....	770.01	58.09
				23 09 23 00-0820 EA 3" 2-Way Brass Ball Valve With Actuator (Belimo B280+ARB24-3).....	903.99	67.98
				23 09 23 00-0821 EA 1/2" 3-Way Brass Ball Valve With Actuator (Belimo B315B+LRB24-3).....	188.22	15.46
				23 09 23 00-0822 EA 3/4" 3-Way Brass Ball Valve With Actuator (Belimo B320B+LRB24-3).....	216.52	20.84
				23 09 23 00-0823 EA 1" 3-Way Brass Ball Valve With Actuator (Belimo B325+LRB24-3).....	279.45	25.22
				23 09 23 00-0824 EA 1-1/4" 3-Way Brass Ball Valve With Actuator (Belimo B331+ARB24-3).....	398.10	31.95
				23 09 23 00-0825 EA 1-1/2" 3-Way Brass Ball Valve With Actuator (Belimo B341+ARB24-3).....	418.87	36.87
				23 09 23 00-0826 EA 2" 3-Way Brass Ball Valve With Actuator (Belimo B352+ARB24-3).....	551.24	43.57
				23 09 23 00-0827 EA 2" 2-Way Butterfly Valve With Actuator (Belimo F650HD+AMB24-3X1).....	455.59	53.25

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 09 Instrumentation And Control For HVAC****23 09 23 Direct-Digital Control System For HVAC**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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23 09 23 00-0828	EA	2-1/2" 2-Way Butterfly Valve With Actuator (Belimo F665HD+AMB24-3X1).....	477.24	58.09
23 09 23 00-0829	EA	3" 2-Way Butterfly Valve With Actuator (Belimo F680HD+GMB24-3X1).....	628.19	67.98
23 09 23 00-0830	EA	4" 2-Way Butterfly Valve With Actuator (Belimo F6100HD+2"GMB24-3X1).....	992.77	114.11
23 09 23 00-0831	EA	5" 2-Way Butterfly Valve With Actuator (Belimo F6125HD+SY2-24).....	1,894.54	144.30
23 09 23 00-0832	EA	6" 2-Way Butterfly Valve With Actuator (Belimo F6150HD+SY3-24).....	2,047.75	159.75
23 09 23 00-0833	EA	8" 2-Way Butterfly Valve With Actuator (Belimo F6200HD+SY4-24).....	2,849.43	182.58
23 09 23 00-0834	EA	10" 2-Way Butterfly Valve With Actuator (Belimo F6250HD+SY4-24).....	3,577.87	223.66
23 09 23 00-0835	EA	12" 2-Way Butterfly Valve With Actuator (Belimo F6300HD+SY4-24).....	4,232.24	271.10
23 09 23 00-0836	EA	14" 2-Way Butterfly Valve With Actuator (Belimo F6350HD+SY5-24).....	4,700.14	319.51
23 09 23 00-0837	EA	16" 2-Way Butterfly Valve With Actuator (Belimo F6400HD+SY6-110).....	6,226.84	351.47
23 09 23 00-0838	EA	18" 2-Way Butterfly Valve With Actuator (Belimo F6450HD+SY8-110).....	7,551.57	390.44
23 09 23 00-0839	EA	2" 3-Way Butterfly Valve With Actuator (Belimo F750HD+AMB24-3X1).....	843.56	79.88
23 09 23 00-0840	EA	2-1/2" 3-Way Butterfly Valve With Actuator (Belimo F765HD+GMB24-3X1).....	994.31	87.14
23 09 23 00-0841	EA	3" 3-Way Butterfly Valve With Actuator (Belimo F780HD+2"GMB24-3X1).....	1,228.68	101.97
23 09 23 00-0842	EA	4" 3-Way Butterfly Valve With Actuator (Belimo F7100HD+2"GMB24-3X1).....	1,636.08	171.16
23 09 23 00-0843	EA	5" 3-Way Butterfly Valve With Actuator (Belimo F7125HD+SY3-24).....	3,046.54	216.44
23 09 23 00-0844	EA	6" 3-Way Butterfly Valve With Actuator (Belimo F7150HD+SY3-24).....	3,487.44	239.63
23 09 23 00-0845	EA	8" 3-Way Butterfly Valve With Actuator (Belimo F7200HD+SY4-24).....	4,313.48	273.89
23 09 23 00-0846	EA	10" 3-Way Butterfly Valve With Actuator (Belimo F7250HD+SY4-24).....	5,715.94	335.49
23 09 23 00-0847	EA	12" 3-Way Butterfly Valve With Actuator (Belimo F7300HD+SY5-24).....	5,352.87	406.65
23 09 23 00-0848	EA	14" 3-Way Butterfly Valve With Actuator (Belimo F7350HD+SY6-110).....	6,697.57	479.26
23 09 23 00-0849	EA	16" 3-Way Butterfly Valve With Actuator (Belimo F7400HD+SY7-110).....	12,232.86	527.19
23 09 23 00-0850	EA	18" 3-Way Butterfly Valve With Actuator (Belimo F7450HD+SY8-110).....	18,294.77	585.67

23 09 23 00-0851 Valve Actuators (23 09 23 00-0864)

23 09 23 00-0852	EA	24 Volt AC/DC Power Supply, On/Off/Floating Point Control Input, Terminal Strip, 90 Seconds Run Time, 45 IN-LB, Direct Coupled, Non-Spring Return, Valve Actuator (Belimo LRX24-3-T).....	308.70	66.00
23 09 23 00-0853	EA	24 Volt AC/DC Power Supply, On/Off/Floating Point Control Input, 95 Seconds Run Time, 45 IN-LB, Direct Coupled, Non-Spring Return, Valve Actuator (Belimo LRX24-3).....	316.33	66.00
23 09 23 00-0854	EA	24 Volt AC/DC Power Supply, 2-10 Volt DC Control Input, Terminal Strip, 90 Seconds Run Time, 45 IN-LB, Direct Coupled, Non-Spring Return, Valve Actuator (Belimo LRX24-SR-T).....	348.95	66.00
23 09 23 00-0855	EA	24 Volt AC/DC Power Supply, On/Off/Floating Point Control Input, Auxiliary Switch, 90 Seconds Run Time, 45 IN-LB, Direct Coupled, Non-Spring Return, Valve Actuator (Belimo LRX24-3-S).....	360.22	66.00
23 09 23 00-0856	EA	24 Volt AC/DC Power Supply, 2-10 Volt DC Control Input, 90 Seconds Run Time, 45 IN-LB, Direct Coupled, Non-Spring Return, Valve Actuator (Belimo LRX24-SR).....	363.07	66.00
23 09 23 00-0857	EA	24 Volt AC/DC Power Supply, Proportional/Multi-Function Control Input, 150 Seconds Run Time, 45 IN-LB, Direct Coupled, Non-Spring Return, Valve Actuator (Belimo LRX24-MFT).....	407.43	66.00
23 09 23 00-0858	EA	24 Volt AC/DC Power Supply, On/Off Control Input, 2.5 Seconds Run Time, 35 IN-LB, Direct Coupled, Non-Spring Return, Valve Actuator (Belimo LRX24-1).....	428.43	66.00
23 09 23 00-0859	EA	24 Volt AC/DC Power Supply, 0-135 Ohms Control Input, 150 Seconds Run Time, 45 IN-LB, Direct Coupled, Non-Spring Return, Valve Actuator (Belimo LRX24-MFT95).....	436.54	66.00
23 09 23 00-0860	EA	24 Volt AC/DC Power Supply, Proportional/Multi-Function Control Input, 2.5 Seconds Run Time, 35 IN-LB, Direct Coupled, Non-Spring Return, Valve Actuator (Belimo LRX24-MFT).....	456.09	66.00
23 09 23 00-0861	EA	120 Volt AC Power Supply, On/Off/Floating Point Control Input, 90 Seconds Run Time, 45 IN-LB, Direct Coupled, Non-Spring Return, Valve Actuator (Belimo LRX120-3).....	340.66	66.00
23 09 23 00-0862	EA	120 Volt AC Power Supply, 2-10 Volt DC Control Input, 90 Seconds Run Time, 45 IN-LB, Direct Coupled, Non-Spring Return, Valve Actuator (Belimo LRX120-SR).....	381.69	66.00
23 09 23 00-0863	EA	24 Volt AC/DC Power Supply, On/Off/Floating Point Control Input, Terminal Strip, 300, 150, Or 90 Seconds Run Time, 180 IN-LB, Direct Coupled, Non-Spring Return, Valve Actuator (Belimo ARX24-3-T).....	381.69	66.00
23 09 23 00-0864	EA	24 Volt AC/DC Power Supply, On/Off/Floating Point Control Input, 300, 150, Or 90 Seconds Run Time, 180 IN-LB, Direct Coupled, Non-Spring Return, Valve Actuator (Belimo ARX24-3).....	387.89	66.00
23 09 23 00-0865	EA	24 Volt AC/DC Power Supply, On/Off/Floating Point Control Input, 90 Seconds Run Time, 180 IN-LB, Direct Coupled, Non-Spring Return, Valve Actuator (Belimo ARB24-3-5-14).....	394.73	66.00
23 09 23 00-0866	EA	24 Volt AC/DC Power Supply, On/Off/Floating Point Control Input, Auxiliary Switch, 300, 150, Or 90 Seconds Run Time, 180 IN-LB, Direct Coupled, Non-Spring Return, Valve Actuator (Belimo ARX24-3-S).....	436.06	66.00
23 09 23 00-0867	EA	24 Volt AC/DC Power Supply, 2-10 Volt DC Control Input, 300, 150, Or 90 Seconds Run Time, 180 IN-LB, Direct Coupled, Non-Spring Return, Valve Actuator (Belimo ARX24-SR-T).....	450.37	66.00
23 09 23 00-0868	EA	24 Volt AC/DC Power Supply, 2-10 Volt DC Control Input, 300, 150, Or 90 Seconds Run Time, 180 IN-LB, Direct Coupled, Non-Spring Return, Valve Actuator (Belimo ARX24-SR).....	456.57	66.00
23 09 23 00-0869	EA	24 Volt AC/DC Power Supply, Proportional/Multi-Function Control Input, Variable Run Time (90 To 350 Seconds), 180 IN-LB, Direct Coupled, Non-Spring Return, Valve Actuator (Belimo ARX24-MFT).....	470.04	66.00
23 09 23 00-0870	EA	24 Volt AC/DC Power Supply, Phasecut Control Input, 95 Seconds Run Time, 180 IN-LB, Direct Coupled, Non-Spring Return, Valve Actuator (Belimo ARX24-PC).....	471.84	66.00
23 09 23 00-0871	EA	24 Volt AC/DC Power Supply, 0-135 Ohms Control Input, 90 Seconds Run Time, 180 IN-LB, Direct Coupled, Non-Spring Return, Valve Actuator (Belimo ARX24-MFT95).....	476.61	66.00
23 09 23 00-0872	EA	24 Volt AC/DC Power Supply, 2-10 Volt DC Control Input, NEMA 4X, 90 Seconds Run Time, 180 IN-LB, Direct Coupled, Non-Spring Return, Valve Actuator (Belimo ARX24-SR-T N4).....	586.31	66.00
23 09 23 00-0873	EA	24 Volt AC/DC Power Supply, Proportional/Multi-Function Control Input, NEMA 4X, Variable Run Time (75 To 350 Seconds), 160 IN-LB, Direct Coupled, Non-Spring Return, Valve Actuator (Belimo ARX24-MFT-T N4).....	626.86	66.00
23 09 23 00-0874	EA	100-240 Volt AC Power Supply, On/Off/Floating Point Control Input, 300, 150, Or 90 Seconds Run Time, 180 IN-LB, Direct Coupled, Non-Spring Return, Valve Actuator (Belimo ARX120-3).....	427.95	66.00
23 09 23 00-0875	EA	100-240 Volt AC Power Supply, 2-10 Volt DC Control Input, 300, 150, Or 90 Seconds Run Time, 180 IN-LB, Direct Coupled, Non-Spring Return, Valve Actuator (Belimo ARX120-SR).....	499.98	66.00
23 09 23 00-0876	EA	24 Volt AC/DC Power Supply, On/Off Control Input, 15 Seconds Run Time, 801 IN-LB, Direct Coupled, Non-Spring Return, Valve Actuator (Belimo SY2-24).....	1,250.79	66.00
23 09 23 00-0877	EA	24 Volt AC/DC Power Supply, On/Off Control Input, 22 Seconds Run Time, 1,335 IN-LB, Direct Coupled, Non-Spring Return, Valve Actuator (Belimo SY3-24).....	1,394.84	66.00
23 09 23 00-0878	EA	24 Volt AC/DC Power Supply, On/Off Control Input, 16 Seconds Run Time, 3,560 IN-LB, Direct Coupled, Non-Spring Return, Valve Actuator (Belimo SY4-24).....	1,704.90	66.00
23 09 23 00-0879	EA	24 Volt AC/DC Power Supply, On/Off Control Input, 22 Seconds Run Time, 4,450 IN-LB, Direct Coupled, Non-Spring Return, Valve Actuator (Belimo SY5-24).....	1,921.93	66.00



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 09 23 00-0880	EA		120 Volt AC Power Supply, On/Off Control Input, 28 Seconds Run Time, 5,785 IN-LB, Direct Coupled, Non-Spring Return, Valve Actuator (Belimo SY6-110).....	2,248.68	66.00
23 09 23 00-0881	EA		120 Volt AC Power Supply, On/Off Control Input, 46 Seconds Run Time, 8,900 IN-LB, Direct Coupled, Non-Spring Return, Valve Actuator (Belimo SY7-110).....	2,647.94	66.00
23 09 23 00-0882	EA		120 Volt AC Power Supply, On/Off Control Input, 46 Seconds Run Time, 13,350 IN-LB, Direct Coupled, Non-Spring Return, Valve Actuator (Belimo SY8-110).....	3,476.02	66.00
23 09 23 00-0883	EA		120 Volt AC Power Supply, On/Off Control Input, 58 Seconds Run Time, 17,800 IN-LB, Direct Coupled, Non-Spring Return, Valve Actuator (Belimo SY9-110).....	4,249.23	66.00
23 09 23 00-0884 Rectangular Volume Control Dampers (23 09 23 00-0664)					
Note: Excludes actuators.					
23 09 23 00-0885	EA		8" x 8" Low Leakage Volume Control Damper (Johnson Controls VOPSN-008X008).....	117.25	24.95
23 09 23 00-0886	EA		10" x 10" Low Leakage Volume Control Damper (Johnson Controls VOPSN-010X010).....	131.91	27.37
23 09 23 00-0887	EA		12" x 12" Low Leakage Volume Control Damper (Johnson Controls VOPSN-012X012).....	147.35	30.19
23 09 23 00-0888	EA		14" x 14" Low Leakage Volume Control Damper (Johnson Controls VOPSN-014X014).....	170.55	35.42
23 09 23 00-0889	EA		16" x 16" Low Leakage Volume Control Damper (Johnson Controls VOPSN-016X016).....	192.93	40.24
23 09 23 00-0890	EA		18" x 18" Low Leakage Volume Control Damper (Johnson Controls VOPSN-018X018).....	196.63	45.28
23 09 23 00-0891	EA		20" x 20" Low Leakage Volume Control Damper (Johnson Controls VOPSN-020X020).....	239.59	50.31
23 09 23 00-0892	EA		24" x 24" Low Leakage Volume Control Damper (Johnson Controls VOPSN-024X024).....	286.22	60.37
23 09 23 00-0893	EA		32" x 32" Low Leakage Volume Control Damper (Johnson Controls VOPSN-032X032).....	365.21	70.44
23 09 23 00-0894	EA		48" x 48" Low Leakage Volume Control Damper (Johnson Controls VOPSN-048X048).....	534.37	80.50
23 09 23 00-0895	EA		60" x 60" Low Leakage Volume Control Damper (Johnson Controls VOPSN-060X060).....	961.27	90.56
23 09 23 00-0896	EA		72" x 72" Low Leakage Volume Control Damper (Johnson Controls VOPSN-072X072).....	1,216.35	100.63
23 09 23 00-0897 Round Control Galvanized Dampers (23 09 23 00-0664)					
Note: Excludes actuators.					
23 09 23 00-0898	EA		6" Diameter Round Low Leakage Volume Control Damper (Johnson Controls RCG06).....	119.24	30.19
23 09 23 00-0899	EA		8" Diameter Round Low Leakage Volume Control Damper (Johnson Controls RCG08).....	119.29	30.19
23 09 23 00-0900	EA		10" Diameter Round Low Leakage Volume Control Damper (Johnson Controls RCG10).....	124.01	30.19
23 09 23 00-0901	EA		12" Diameter Round Low Leakage Volume Control Damper (Johnson Controls RCG12).....	129.85	30.19
23 09 23 00-0902	EA		14" Diameter Round Low Leakage Volume Control Damper (Johnson Controls RCG14).....	147.34	30.19
23 09 23 00-0903	EA		16" Diameter Round Low Leakage Volume Control Damper (Johnson Controls RCG16).....	169.60	40.24
23 09 23 00-0904	EA		18" Diameter Round Low Leakage Volume Control Damper (Johnson Controls RCG18).....	227.48	42.36
23 09 23 00-0905	EA		20" Diameter Round Low Leakage Volume Control Damper (Johnson Controls RCG20).....	237.69	43.91
23 09 23 00-0906	EA		22" Diameter Round Low Leakage Volume Control Damper (Johnson Controls RCG22).....	252.53	47.34
23 09 23 00-0907	EA		24" Diameter Round Low Leakage Volume Control Damper (Johnson Controls RCG24).....	267.64	50.77
23 09 23 00-0908 Peco Thermostats and Sensors (23 09 23 00-0664)					
23 09 23 00-0909	EA		3 Heating Stage, 2 Cooling Stage Programmable Thermostat With Humidification/Dehumidification Control (Peco T12532-IAQ).....	293.71	12.09
23 09 23 00-0910	EA		3 Heating Stage, 2 Cooling Stage Programmable Thermostat (Peco T12532-001).....	375.70	12.09
23 09 23 00-0911	EA		Ceiling Mount Passive Infrared, 24 Volt, Slave Motion Sensor (Peco SA200-001).....	165.45	18.13
23 09 23 00-0912	EA		Wall/Ceiling Mount Passive Infrared, 24 Volt, Slave Motion Sensor (Peco SB200-001).....	140.00	18.13
23 09 23 00-0913	EA		Wall/Ceiling Passive Infrared, 24 Volt, Master Motion Sensor (Peco SD200-001).....	220.53	18.13
23 09 23 00-0914	EA		Wall/Ceiling Mount, Passive Infrared, 24 Volt, Master Time Sensor (Peco SD200-002).....	189.30	18.13
23 09 23 00-0915	EA		Door Switch Occupancy Sensor (Peco SE200-001).....	44.87	18.13
23 09 23 00-0916	EA		Window Switch Occupancy Sensor (Peco SE200-002).....	43.21	18.13
23 09 23 00-0917	EA		Power Pack And Controller (Peco SF200-001).....	82.59	18.13
23 10 Facility Fuel Systems (23)					
23 11 Facility Fuel Piping (23 10)					
23 11 23 Facility Natural-Gas Piping (23 11)					
23 11 23 00-0001			Corrugated Stainless Steel Tubing (CSST), Flexible Gas Piping (23 11 23)		
23 11 23 00-0002			Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe (23 11 23 00-0001)		
Note: Includes UV resistant polyethylene jacket. Excludes fittings and pipe hangers.					
23 11 23 00-0003	LF		3/8" Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe.....	4.41	1.40
23 11 23 00-0004	LF		1/2" Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe.....	4.85	1.51
23 11 23 00-0005	LF		3/4" Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe.....	5.81	1.64
23 11 23 00-0006	LF		1" Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe.....	7.36	1.73
23 11 23 00-0007	LF		1-1/4" Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe.....	8.69	1.82
23 11 23 00-0008	LF		1-1/2" Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe.....	13.29	1.89
23 11 23 00-0009	LF		2" Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe.....	18.05	2.02
23 11 23 00-0010			Fittings And Accessories For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe (23 11 23 00-0001)		
23 11 23 00-0011			Male Adaptors For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe (23 11 23 00-0010)		
23 11 23 00-0012	EA		3/8" x 1/2", (CSST x Threaded) Male Adaptor For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe.....	20.95	
23 11 23 00-0013	EA		3/8" x 3/8", (CSST x Threaded) Male Adaptor For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe.....	20.95	
23 11 23 00-0014	EA		1/2" x 3/8", (CSST x Threaded) Male Adaptor For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe.....	22.47	
23 11 23 00-0015	EA		1/2" x 1/2", (CSST x Threaded) Male Adaptor For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe.....	22.47	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 10 Facility Fuel Systems****23 11 Facility Fuel Piping**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 11 23 00-0016 EA 3/4" x 3/4", (CSST x Threaded) Male Adaptor For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe.....	27.09	
23 11 23 00-0017 EA 1" x 3/4", (CSST x Threaded) Male Adaptor For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe.....	37.47	
23 11 23 00-0018 EA 1" x 1", (CSST x Threaded) Male Adaptor For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe.....	37.47	
23 11 23 00-0019 EA 1-1/4" x 1-1/4", (CSST x Threaded) Male Adaptor For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe	64.03	
23 11 23 00-0020 EA 1-1/2" x 1-1/2", (CSST x Threaded) Male Adaptor For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe	117.70	
23 11 23 00-0021 EA 2" x 2", (CSST x Threaded) Male Adaptor For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe.....	190.97	
23 11 23 00-0022 Female Adaptors For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe <small>(23 11 23 00-0010)</small>		
23 11 23 00-0023 EA 3/8" x 1/2", (CSST x Threaded) Female Adaptor For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe	20.27	
23 11 23 00-0024 EA 1/2" x 1/2", (CSST x Threaded) Female Adaptor For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe	22.47	
23 11 23 00-0025 EA 1/2" x 3/8", (CSST x Threaded) Female Adaptor For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe	22.47	
23 11 23 00-0026 EA 3/4" x 3/4", (CSST x Threaded) Female Adaptor For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe	27.09	
23 11 23 00-0027 EA 3/4" x 1/2", (CSST x Threaded) Female Adaptor For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe	27.09	
23 11 23 00-0028 EA 1" x 3/4", (CSST x Threaded) Female Adaptor For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe	35.80	
23 11 23 00-0029 EA 1" x 1", (CSST x Threaded) Female Adaptor For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe.....	35.80	
23 11 23 00-0030 Reducing Adaptors For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe <small>(23 11 23 00-0010)</small>		
23 11 23 00-0031 EA 3/4" x 1/2", (CSST x Threaded) Reducing Adaptor For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe	27.49	
23 11 23 00-0032 EA 1" x 3/4", (CSST x Threaded) Reducing Adaptor For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe	36.41	
23 11 23 00-0033 Couplings For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe <small>(23 11 23 00-0010)</small>		
23 11 23 00-0034 EA 3/8" Coupling For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe.....	28.34	
23 11 23 00-0035 EA 1/2" Coupling For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe.....	31.47	
23 11 23 00-0036 EA 3/4" Coupling For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe.....	39.61	
23 11 23 00-0037 EA 1" Coupling For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe.....	57.01	
23 11 23 00-0038 EA 1-1/4" Coupling For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe.....	107.23	
23 11 23 00-0039 EA 1-1/2" Coupling For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe.....	209.89	
23 11 23 00-0040 EA 2" Coupling For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe.....	348.93	
23 11 23 00-0041 Tees For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe <small>(23 11 23 00-0010)</small>		
23 11 23 00-0042 EA 1/2" Tee For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe.....	39.14	
23 11 23 00-0043 EA 3/4" Tee For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe.....	63.46	
23 11 23 00-0044 EA 1" Tee For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe.....	100.99	
23 11 23 00-0045 EA 1-1/4" Tee For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe.....	174.36	
23 11 23 00-0046 EA 1-1/2" Tee For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe.....	187.51	
23 11 23 00-0047 EA 2" Tee For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe.....	215.40	
23 11 23 00-0048 Indoor Termination Fittings For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe <small>(23 11 23 00-0010)</small>		
23 11 23 00-0049 EA 3/8" x 1/2", (CSST x Threaded) Indoor Termination Fitting For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe.....	25.38	
23 11 23 00-0050 EA 1/2" x 1/2", (CSST x Threaded) Indoor Termination Fitting For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe.....	26.23	
23 11 23 00-0051 EA 3/4" x 3/4", (CSST x Threaded) Indoor Termination Fitting For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe.....	28.55	
23 11 23 00-0052 EA 1" x 3/4", (CSST x Threaded) Indoor Termination Fitting For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe.....	38.58	
23 11 23 00-0053 EA 1" x 1", (CSST x Threaded) Indoor Termination Fitting For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe.....	39.15	
23 11 23 00-0054 Outdoor Termination Fittings For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe <small>(23 11 23 00-0010)</small>		
23 11 23 00-0055 EA 3/8" x 1/2", (CSST x Threaded) Outdoor Termination Fitting For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe.....	28.03	
23 11 23 00-0056 EA 1/2" x 1/2", (CSST x Threaded) Outdoor Termination Fitting For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe.....	28.77	
23 11 23 00-0057 EA 3/4" x 3/4", (CSST x Threaded) Outdoor Termination Fitting For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe.....	33.93	
23 11 23 00-0058 EA 1" x 3/4", (CSST x Threaded) Outdoor Termination Fitting For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe.....	40.09	
23 11 23 00-0059 EA 1" x 1", (CSST x Threaded) Outdoor Termination Fitting For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe.....	40.09	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 11 23 00-0060				Indoor Floor Flange Termination Assembly For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe <small>(23 11 23 00-0010)</small>		
	23 11 23 00-0061	EA		3/8" Indoor Floor Flange Termination Assembly For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe	43.26	
	23 11 23 00-0062	EA		1/2" Indoor Floor Flange Termination Assembly For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe	44.36	
	23 11 23 00-0063	EA		3/4" Indoor Floor Flange Termination Assembly For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe	46.57	
	23 11 23 00-0064	EA		1" Indoor Floor Flange Termination Assembly For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe	75.03	
	23 11 23 00-0065	EA		1-1/4" Indoor Floor Flange Termination Assembly For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe	77.93	
	23 11 23 00-0066	EA		1-1/2" Indoor Floor Flange Termination Assembly For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe	113.19	
	23 11 23 00-0067	EA		2" Indoor Floor Flange Termination Assembly For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe	141.20	
23 11 23 00-0068				Outdoor Floor Flange Termination Assembly For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe <small>(23 11 23 00-0010)</small>		
	23 11 23 00-0069	EA		3/8" Outdoor Floor Flange Termination Assembly For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe	45.83	
	23 11 23 00-0070	EA		1/2" Outdoor Floor Flange Termination Assembly For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe	46.88	
	23 11 23 00-0071	EA		3/4" Outdoor Floor Flange Termination Assembly For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe	51.86	
	23 11 23 00-0072	EA		1" Outdoor Floor Flange Termination Assembly For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe	95.25	
	23 11 23 00-0073	EA		1-1/4" Outdoor Floor Flange Termination Assembly For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe	98.32	
	23 11 23 00-0074	EA		1-1/2" Outdoor Floor Flange Termination Assembly For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe	135.92	
	23 11 23 00-0075	EA		2" Outdoor Floor Flange Termination Assembly For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe	171.99	
23 11 23 00-0076				Indoor Bracket Termination Assembly For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe <small>(23 11 23 00-0010)</small>		
	23 11 23 00-0077	EA		1/2" Indoor Bracket Termination Assembly For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe	26.80	
	23 11 23 00-0078	EA		3/4" Indoor Bracket Termination Assembly For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe	28.95	
	23 11 23 00-0079	EA		1" Indoor Bracket Termination Assembly For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe	44.37	
	23 11 23 00-0080	EA		1-1/4" Indoor Bracket Termination Assembly For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe	68.68	
	23 11 23 00-0081	EA		1-1/2" Indoor Bracket Termination Assembly For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe	134.17	
	23 11 23 00-0082	EA		2" Indoor Bracket Termination Assembly For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe	214.07	
23 11 23 00-0083				Stub-Outs For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe <small>(23 11 23 00-0010)</small>		
				Note: Includes mounting plate.		
	23 11 23 00-0084	EA		1/2" Appliance Stub-Out For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe	23.11	
	23 11 23 00-0085	EA		3/4" Appliance Stub-Out For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe	25.20	
	23 11 23 00-0086	EA		1/2" Fireplace Stub-Out For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe	23.13	
	23 11 23 00-0087	EA		1/2" Meter Stub-Out For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe	23.21	
	23 11 23 00-0088	EA		3/4" Meter Stub-Out For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe	24.18	
	23 11 23 00-0089	EA		1" Meter Stub-Out For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe	28.84	
	23 11 23 00-0090	EA		1-1/4" Meter Stub-Out For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe	34.81	
23 11 23 00-0091				Flush Mount Gas Valve Kits For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe <small>(23 11 23 00-0010)</small>		
				Note: Includes flush fitting plastic valve box and 90 degree brass shut-off valve.		
	23 11 23 00-0092	EA		1/2" x 1/2", (CSST x Threaded) Flush Mount Gas Valve Kit For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe	65.51	14.70
	23 11 23 00-0093	EA		3/4" x 3/4", (CSST x Threaded) Flush Mount Gas Valve Kit For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe	74.16	15.43
23 11 23 00-0094				Shut-Off Valves For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe <small>(23 11 23 00-0010)</small>		
	23 11 23 00-0095	EA		3/8" x 1/2", (CSST x Threaded) Shut-Off Valve For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe	46.70	12.86
	23 11 23 00-0096	EA		1/2" x 1/2", (CSST x Threaded) Shut-Off Valve For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe	54.28	15.29
	23 11 23 00-0097	EA		3/4" x 3/4", (CSST x Threaded) Shut-Off Valve For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe	66.65	18.38
	23 11 23 00-0098	EA		1" x 3/4", (CSST x Threaded) Shut-Off Valve For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe	83.19	24.55
23 11 23 00-0099				Manifolds For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe <small>(23 11 23 00-0010)</small>		
				Note: Includes mounting hardware.		
	23 11 23 00-0100	EA		1/2" Inlet, Three 1/2" Outlets, Manifold For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe	57.40	15.29
	23 11 23 00-0101	EA		3/4" Inlet, Three 1/2" Outlets, Manifold For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe	65.01	18.38
	23 11 23 00-0102	EA		1/2" Inlet, Four 1/2" Outlets, Manifold For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe	61.63	15.29
	23 11 23 00-0103	EA		3/4" Inlet, Four 1/2" Outlets, Manifold For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe	67.75	18.38
	23 11 23 00-0104	EA		2" x 1-1/2" Inlet, Four 1" Outlets, Manifold For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe	127.75	45.94

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 10 Facility Fuel Systems****23 11 Facility Fuel Piping**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 11 23 00-0105 Pressure Regulators For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe <small>(23 11 23 00-0010)</small>		
23 11 23 00-0106 EA 1/2" Port, 250 MBTU Pressure Regulator For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe.....	60.83	15.29
23 11 23 00-0107 EA 1/2" Port, 355 MBTU Pressure Regulator For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe.....	60.83	15.29
23 11 23 00-0108 EA 1/2" Port, 425 MBTU Pressure Regulator For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe.....	86.13	15.29
23 11 23 00-0109 EA 3/4" Port, 550 MBTU Pressure Regulator For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe.....	92.25	18.38
23 11 23 00-0110 EA 3/4" Port, 810 MBTU Pressure Regulator For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe.....	92.25	18.38
23 11 23 00-0111 EA 1" Port, 550 MBTU Pressure Regulator For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe.....	104.50	24.55
23 11 23 00-0112 EA 1-1/4" Port, 1,000 MBTU Pressure Regulator For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe.....	157.51	27.56
23 11 23 00-0113 EA 1/2" Port, 200 MBTU Pressure Regulator With Over Pressure Protection Device For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe.....	81.65	15.29
23 11 23 00-0114 EA 3/4" Port, 425 MBTU Pressure Regulator With Over Pressure Protection Device For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe.....	206.84	18.38
23 11 23 00-0115 EA 1-1/4" Port, 900 MBTU Pressure Regulator With Over Pressure Protection Device For Corrugated Stainless Steel Tubing (CSST), Flexible Gas Pipe.....	505.30	27.56
23 11 23 00-0116 Gas Stops <small>(23 11 23)</small>		
23 11 23 00-0117 Brass Gas Stops <small>(23 11 23 00-0116)</small>		
Note: Flat or square head		
23 11 23 00-0118 EA 3/8" Brass Gas Stop.....	32.83	7.98
23 11 23 00-0119 EA 1/2" Brass Gas Stop.....	32.08	7.98
23 11 23 00-0120 EA 3/4" Brass Gas Stop.....	42.48	8.78
23 11 23 00-0121 EA 1" Brass Gas Stop.....	56.98	9.98
23 11 23 00-0122 EA 1-1/4" Brass Gas Stop.....	74.71	10.62
23 11 23 00-0123 EA 1-1/2" Brass Gas Stop.....	91.85	12.29
23 11 23 00-0124 EA 2" Brass Gas Stop.....	122.28	14.53
23 11 23 00-0125 Iron Body Gas Stops <small>(23 11 23 00-0116)</small>		
23 11 23 00-0126 EA 1/2" Iron Body Gas Stop.....	39.61	7.98
23 11 23 00-0127 EA 3/4" Iron Body Gas Stop.....	49.89	8.78
23 11 23 00-0128 EA 1" Iron Body Gas Stop.....	61.45	9.98
23 11 23 00-0129 EA 1-1/4" Iron Body Gas Stop.....	79.05	10.62
23 11 23 00-0130 EA 1-1/2" Iron Body Gas Stop.....	97.30	12.29
23 11 23 00-0131 EA 2" Iron Body Gas Stop.....	123.52	14.53
23 11 23 00-0132 EA 2-1/2" Iron Body Gas Stop.....	222.27	19.62
23 11 23 00-0133 EA 3" Iron Body Gas Stop.....	290.86	22.79
23 11 23 00-0134 Bronze Body Solenoid Valves, 150 PSI Gas <small>(23 11 23)</small>		
23 11 23 00-0135 EA 1/4" Solenoid Valve, Bronze, 150 PSI, Gas.....	84.14	7.98
23 11 23 00-0136 EA 1/2" Solenoid Valve, Bronze, 150 PSI, Gas.....	97.55	7.98
23 11 23 00-0137 EA 3/4" Solenoid Valve, Bronze, 150 PSI, Gas.....	125.01	8.78
23 11 23 00-0138 EA 1" Solenoid Valve, Bronze, 150 PSI, Gas.....	183.44	9.98
23 11 23 00-0139 EA 1-1/2" Solenoid Valve, Bronze, 150 PSI, Gas.....	322.49	12.29
23 11 23 00-0140 EA 2" Solenoid Valve, Bronze, 150 PSI, Gas.....	535.94	14.53
23 11 23 00-0141 EA 2-1/2" Solenoid Valve, Bronze, 150 PSI, Gas.....	667.22	19.62
23 11 23 00-0142 EA 3" Solenoid Valve, Bronze, 150 PSI, Gas.....	991.37	22.79
23 12 Facility Fuel Pumps <small>(23 10)</small>		
23 12 13 Facility Fuel-Oil Pumps <small>(23 12)</small>		
23 12 13 00-0001 Cast Iron Internal Gear Rotary Pump <small>(23 12 13)</small>		
Note: Heavy duty type with relief valve, 1150 RPM drip-proof motor, common base plate. For viscosity to 20 centipoise; diesel oil, and light oil.		
23 12 13 00-0002 10 GPM 1" Discharge <small>(23 12 13 00-0001)</small>		
23 12 13 00-0003 EA 10 GPM Cast Iron Rotary Pump, 20 PSI 1/2 HP With 1" Discharge.....	1,790.19	213.27
23 12 13 00-0004 EA 10 GPM Cast Iron Rotary Pump, 40 PSI 3/4 HP With 1" Discharge.....	1,842.31	258.13
23 12 13 00-0005 EA 10 GPM Cast Iron Rotary Pump, 60 PSI 1 HP With 1" Discharge.....	1,990.68	306.67
23 12 13 00-0006 25 GPM 1-1/4" Discharge <small>(23 12 13 00-0001)</small>		
23 12 13 00-0007 EA 25 GPM Cast Iron Rotary Pump, 20 PSI 1 HP With 1-1/4" Discharge.....	1,828.58	213.27
23 12 13 00-0008 EA 25 GPM Cast Iron Rotary Pump, 40 PSI 1.5 HP With 1-1/4" Discharge.....	1,910.57	258.13
23 12 13 00-0009 EA 25 GPM Cast Iron Rotary Pump, 60 PSI 2 HP With 1-1/4" Discharge.....	1,992.46	306.67
23 12 13 00-0010 Pump, Fuel Oil, 2 Stage 3450 RPM 100 PSI <small>(23 12 13)</small>		
23 12 13 00-0011 EA 1/4 HP Pump Fuel Oil/Diesel.....	1,303.43	119.50
23 12 13 00-0012 EA 1/3 HP Pump Fuel Oil/Diesel.....	1,543.38	133.85
23 12 13 00-0013 EA 1/2 HP Pump Fuel Oil/Diesel.....	1,681.41	150.02
23 12 13 00-0014 EA 3/4 HP Pump Fuel Oil/Diesel.....	1,825.32	169.15
23 12 13 00-0015 EA 1 HP Pump Fuel Oil/Diesel.....	2,648.92	188.27
23 12 13 00-0016 EA 1-1/2 HP Pump Fuel Oil/Diesel.....	3,271.87	210.69



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 12 13 00-0017 EA 2 HP Pump Fuel Oil/Diesel	3,621.64	236.06
23 12 13 00-0018 EA 3 HP Pump Fuel Oil/Diesel	4,454.90	264.01
23 12 13 00-0019 EA 5 HP Pump Fuel Oil/Diesel	5,276.32	296.01
23 12 13 00-0020 EA 7.5 HP Pump Fuel Oil/Diesel	5,906.51	332.04
23 12 13 00-0021 EA 10 HP Pump Fuel Oil/Diesel	6,622.55	372.20
 23 12 23 Facility Natural-Gas Pumps (23 12)		
23 12 23 00-0001 Natural Gas Booster Pump (23 12 23)		
23 12 23 00-0002 EA Natural Gas Booster Pump, 3/4" Outlet Size	662.91	110.31
23 12 23 00-0003 EA Natural Gas Booster Pump, 1" Outlet Size	782.93	123.18
23 12 23 00-0004 EA Natural Gas Booster Pump, 1-1/4" Outlet Size	873.68	128.70
23 12 23 00-0005 EA Natural Gas Booster Pump, 1-1/2" Outlet Size	986.20	134.21
23 12 23 00-0006 EA Natural Gas Booster Pump, 2" Outlet Size	1,109.58	137.89
 23 13 Facility Fuel-Storage Tanks (23 10)		
23 13 13 Facility Underground Fuel-Oil, Storage Tanks (23 13)		
23 13 13 13 Double-Wall Steel, Underground Fuel-Oil, Storage Tanks (23 13 13)		
23 13 13 13-0001 Coated Underground Double Wall Storage Tanks (23 13 13 13)		
Note: Includes setting in place with hold down bars and manway and 4" NPT connections as follows: up to 1000 gallon, 4 each: all others 6 each. Excludes excavation, pad, plastic lining, pumps and piping.		
23 13 13 13-0002 EA 250 Gallon Underground Double Wall Steel Storage Tank, Coated, In Place With Hold Down Bars	4,750.93	518.17
23 13 13 13-0003 EA 550 Gallon Underground Double Wall Steel Storage Tank, Coated, In Place With Hold Down Bars	5,097.78	518.17
23 13 13 13-0004 EA 1,000 Gallon Underground Double Wall Steel Storage Tank, Coated, In Place With Hold Down Bars	7,281.31	647.67
23 13 13 13-0005 EA 2,000 Gallon Underground Double Wall Steel Storage Tank, Coated, In Place With Hold Down Bars	10,290.59	1,265.05
23 13 13 13-0006 EA 3,000 Gallon Underground Double Wall Steel Storage Tank, Coated, In Place With Hold Down Bars	16,058.23	1,626.41
23 13 13 13-0007 EA 4,000 Gallon Underground Double Wall Steel Storage Tank, Coated, In Place With Hold Down Bars	17,936.67	1,867.98
23 13 13 13-0008 EA 5,000 Gallon Underground Double Wall Steel Storage Tank, Coated, In Place With Hold Down Bars	19,744.81	2,469.85
23 13 13 13-0009 EA 6,000 Gallon Underground Double Wall Steel Storage Tank, Coated, In Place With Hold Down Bars	20,500.29	2,651.81
23 13 13 13-0010 EA 8,000 Gallon Underground Double Wall Steel Storage Tank, Coated, In Place With Hold Down Bars	24,932.62	3,132.79
23 13 13 13-0011 EA 10,000 Gallon Underground Double Wall Steel Storage Tank, Coated, In Place With Hold Down Bars	28,862.99	3,613.44
23 13 13 13-0012 EA 12,000 Gallon Underground Double Wall Steel Storage Tank, Coated, In Place With Hold Down Bars	36,375.17	3,973.67
23 13 13 13-0013 EA 14,000 Gallon Underground Double Wall Steel Storage Tank, Coated, In Place With Hold Down Bars	43,218.05	4,824.66
23 13 13 13-0014 EA 15,000 Gallon Underground Double Wall Steel Storage Tank, Coated, In Place With Hold Down Bars	44,756.57	5,120.22
23 13 13 13-0015 EA 20,000 Gallon Underground Double Wall Steel Storage Tank, Coated, In Place With Hold Down Bars	56,467.15	8,121.75
23 13 13 13-0016 EA 25,000 Gallon Underground Double Wall Steel Storage Tank, Coated, In Place With Hold Down Bars	69,859.97	10,531.90
23 13 13 13-0017 EA 30,000 Gallon Underground Double Wall Steel Storage Tank, Coated, In Place With Hold Down Bars	82,008.76	12,050.42
23 13 13 13-0018 EA 40,000 Gallon Underground Double Wall Steel Storage Tank, Coated, In Place With Hold Down Bars	103,329.62	12,954.20
23 13 13 13-0019 EA 48,000 Gallon Underground Double Wall Steel Storage Tank, Coated, In Place With Hold Down Bars	136,390.20	13,286.40
 23 13 13 23 Glass-Fiber-Reinforced-Plastic, Underground Fuel-Oil, Storage Tanks (23 13 13)		
23 13 13 23-0001 Underground Fiberglass Storage Tanks (23 13 13 23)		
23 13 13 23-0002 Single Wall Fiberglass Underground Storage Tanks (23 13 13 23-0001)		
Note: Includes setting in place with hold down bars, fittings, bumper pads, flow channels, monitoring fitting, tank bottom deflector gauge plates, manway, anchor straps and 4" NPT tank mounted fitting connections as follows: 550 gallon or 1000 gallon, 4 each: all others 6 each. Excludes excavation and backfill.		
23 13 13 23-0003 EA 550 Gallon Single Wall Fiberglass Tank Including Fittings And Anchor Straps	2,286.23	518.17
23 13 13 23-0004 EA 1,000 Gallon Single Wall Fiberglass Tank Including Fittings And Anchor Straps	2,870.30	647.67
23 13 13 23-0005 EA 2,000 Gallon Single Wall Fiberglass Tank Including Fittings And Anchor Straps	3,730.69	801.35
23 13 13 23-0006 EA 2,500 Gallon Single Wall Fiberglass Tank Including Fittings And Anchor Straps	4,262.69	976.09
23 13 13 23-0007 EA 3,000 Gallon Single Wall Fiberglass Tank Including Fittings And Anchor Straps	4,789.61	1,144.79
23 13 13 23-0008 EA 4,000 Gallon Single Wall Fiberglass Tank Including Fittings And Anchor Straps	5,869.32	1,506.30
23 13 13 23-0009 EA 5,000 Gallon Single Wall Fiberglass Tank Including Fittings And Anchor Straps	7,186.73	2,289.58
23 13 13 23-0010 EA 6,000 Gallon Single Wall Fiberglass Tank Including Fittings And Anchor Straps	8,242.24	2,892.10
23 13 13 23-0011 EA 8,000 Gallon Single Wall Fiberglass Tank Including Fittings And Anchor Straps	9,798.90	3,253.61
23 13 13 23-0012 EA 10,000 Gallon Single Wall Fiberglass Tank Including Fittings And Anchor Straps	11,115.71	3,856.14
23 13 13 23-0013 EA 12,000 Gallon Single Wall Fiberglass Tank Including Fittings And Anchor Straps	14,152.33	4,579.16
23 13 13 23-0014 EA 15,000 Gallon Single Wall Fiberglass Tank Including Fittings And Anchor Straps	17,466.11	5,723.95
23 13 13 23-0015 EA 20,000 Gallon Single Wall Fiberglass Tank Including Fittings And Anchor Straps	22,182.73	7,652.02
23 13 13 23-0016 EA 25,000 Gallon Single Wall Fiberglass Tank Including Fittings And Anchor Straps	32,430.90	9,519.83
23 13 13 23-0017 EA 30,000 Gallon Single Wall Fiberglass Tank Including Fittings And Anchor Straps	39,587.94	11,447.90
23 13 13 23-0018 EA 40,000 Gallon Single Wall Fiberglass Tank Including Fittings And Anchor Straps	56,723.88	16,569.33
23 13 13 23-0019 EA 50,000 Gallon Single Wall Fiberglass Tank Including Fittings And Anchor Straps	79,771.27	21,088.23
 23 13 13 23-0020 Double Wall Fiberglass Underground Storage Tanks (23 13 13 23-0001)		
Note: Includes setting in place with hold down bars, fittings, bumper pads, flow channels, monitoring fitting, tank bottom deflector gauge plates, manway, anchor straps and 4" NPT tank mounted fitting connections as follows: 550 gallon or 1000 gallon, 4 each: all others 6 each. Excludes excavation and backfill.		
23 13 13 23-0021 EA 550 Gallon Double Wall Fiberglass Tank Including Fittings And Anchor Straps	4,243.02	518.17
23 13 13 23-0022 EA 1,000 Gallon Double Wall Fiberglass Tank Including Fittings And Anchor Straps	5,578.78	647.67
23 13 13 23-0023 EA 2,000 Gallon Double Wall Fiberglass Tank Including Fittings And Anchor Straps	6,691.19	783.28
23 13 13 23-0024 EA 3,000 Gallon Double Wall Fiberglass Tank Including Fittings And Anchor Straps	8,749.61	1,144.87
23 13 13 23-0025 EA 4,000 Gallon Double Wall Fiberglass Tank Including Fittings And Anchor Straps	9,911.82	1,506.30
23 13 13 23-0026 EA 5,000 Gallon Double Wall Fiberglass Tank Including Fittings And Anchor Straps	11,630.73	2,289.58

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 10 Facility Fuel Systems****23 13 Facility Fuel-Storage Tanks**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 13 13 23-0027 EA 6,000 Gallon Double Wall Fiberglass Tank Including Fittings And Anchor Straps	13,082.24	2,892.10
23 13 13 23-0028 EA 8,000 Gallon Double Wall Fiberglass Tank Including Fittings And Anchor Straps	15,958.90	3,253.61
23 13 13 23-0029 EA 10,000 Gallon Double Wall Fiberglass Tank Including Fittings And Anchor Straps	17,275.71	3,856.14
23 13 13 23-0030 EA 12,000 Gallon Double Wall Fiberglass Tank Including Fittings And Anchor Straps	20,862.33	4,579.16
23 13 13 23-0031 EA 15,000 Gallon Double Wall Fiberglass Tank Including Fittings And Anchor Straps	28,493.61	5,723.95
23 13 13 23-0032 EA 20,000 Gallon Double Wall Fiberglass Tank Including Fittings And Anchor Straps	35,492.73	7,652.02
23 13 13 23-0033 EA 30,000 Gallon Double Wall Fiberglass Tank Including Fittings And Anchor Straps	54,657.94	11,447.90
23 13 13 23-0034 Underground Storage Tank Pump Enclosures (23 13 13 23)		
23 13 13 23-0035 EA Secondary Containment Collar	649.25	
23 13 13 23-0036 EA Turbine Enclosure With Lid 4' Long x 42" Diameter	649.25	
23 13 13 23-0037 EA Fitting Kit For Turbine Enclosure	129.85	
23 13 13 23-0038 EA Grommet Kits For Plumbing And Electrical	259.70	
23 13 13 23-0039 EA Turbine Electrical Coupling Kit	324.63	
23 13 23 Facility Aboveground Fuel-Oil, Storage Tanks (23 13)		
23 13 23 13 Vertical, Steel, Aboveground Fuel-Oil, Storage Tanks (23 13 23)		
23 13 23 13-0001 Fuel Day Tank (23 13 23 13)		
Note: Includes day tank with standard equipment, pump, pump control, level control, backup level control, level alarms, alarm outputs.		
23 13 23 13-0002 EA 10 Gallon Double Wall Steel Day Tank; Tramont TRX	856.98	95.86
Note: Includes rust-inhibitor coated interior and gray painted exterior.		
23 13 23 13-0003 EA 15 Gallon Double Wall Steel Day Tank; Tramont TRX	920.44	100.64
Note: Includes rust-inhibitor coated interior and gray painted exterior.		
23 13 23 13-0004 EA 25 Gallon Double Wall Steel Day Tank; Tramont TRX	999.26	107.83
Note: Includes rust-inhibitor coated interior and gray painted exterior.		
23 13 23 13-0005 EA 50 Gallon Double Wall Steel Day Tank; Tramont TRX	1,148.65	115.03
Note: Includes rust-inhibitor coated interior and gray painted exterior.		
23 13 23 13-0006 EA 60 Gallon Double Wall Steel Day Tank; Tramont TRX	1,281.47	119.82
Note: Includes rust-inhibitor coated interior and gray painted exterior.		
23 13 23 13-0007 EA 75 Gallon Double Wall Steel Day Tank; Tramont TRX	1,510.53	143.78
Note: Includes rust-inhibitor coated interior and gray painted exterior.		
23 13 23 13-0008 EA 100 Gallon Double Wall Steel Day Tank; Tramont TRX	2,034.62	167.74
Note: Includes rust-inhibitor coated interior and gray painted exterior.		
23 13 23 13-0009 EA 150 Gallon Double Wall Steel Day Tank; Tramont TRX	2,576.36	191.70
Note: Includes rust-inhibitor coated interior and gray painted exterior.		
23 13 23 13-0010 EA 200 Gallon Double Wall Steel Day Tank; Tramont TRX	3,307.22	215.67
Note: Includes rust-inhibitor coated interior and gray painted exterior.		
23 13 23 13-0011 EA 275 Gallon Double Wall Steel Day Tank; Tramont TRX	3,686.31	239.63
Note: Includes rust-inhibitor coated interior and gray painted exterior.		
23 13 23 13-0012 EA 300 Gallon Double Wall Steel Day Tank; Tramont TRX	4,217.56	287.56
Note: Includes rust-inhibitor coated interior and gray painted exterior.		
23 13 23 13-0013 EA 350 Gallon Double Wall Steel Day Tank; Tramont TRX	4,723.60	335.49
Note: Includes rust-inhibitor coated interior and gray painted exterior.		
23 13 23 13-0014 EA 400 Gallon Double Wall Steel Day Tank; Tramont TRX	5,244.76	383.41
Note: Includes rust-inhibitor coated interior and gray painted exterior.		
23 13 23 13-0015 EA 450 Gallon Double Wall Steel Day Tank; Tramont TRX	5,821.80	407.37
Note: Includes rust-inhibitor coated interior and gray painted exterior.		
23 13 23 13-0016 EA 500 Gallon Double Wall Steel Day Tank; Tramont TRX	6,402.63	431.34
Note: Includes rust-inhibitor coated interior and gray painted exterior.		
23 13 23 13-0017 EA 550 Gallon Double Wall Steel Day Tank; Tramont TRX	7,062.89	455.30
Note: Includes rust-inhibitor coated interior and gray painted exterior.		
23 13 23 13-0018 EA 600 Gallon Double Wall Steel Day Tank; Tramont TRX	7,639.94	479.26
Note: Includes rust-inhibitor coated interior and gray painted exterior.		
23 13 23 13-0019 EA 700 Gallon Double Wall Steel Day Tank; Tramont TRX	8,505.74	575.12
Note: Includes rust-inhibitor coated interior and gray painted exterior.		
23 13 23 13-0020 EA 800 Gallon Double Wall Steel Day Tank; Tramont TRX	9,174.42	623.04
Note: Includes rust-inhibitor coated interior and gray painted exterior.		
23 13 23 13-0021 EA 900 Gallon Double Wall Steel Day Tank; Tramont TRX	10,066.70	718.90
Note: Includes rust-inhibitor coated interior and gray painted exterior.		
23 13 23 13-0022 EA 1,000 Gallon Double Wall Steel Day Tank; Tramont TRX	10,962.76	814.75
Note: Includes rust-inhibitor coated interior and gray painted exterior.		
23 13 23 13-0023 EA 10 Gallon Double Wall Steel Day Tank; Tramont UTRX	1,041.06	95.86
Note: Includes rust-inhibitor coated interior and gray painted exterior.		
23 13 23 13-0024 EA 15 Gallon Double Wall Steel Day Tank; Tramont UTRX	1,105.78	100.64
Note: Includes rust-inhibitor coated interior and gray painted exterior.		
23 13 23 13-0025 EA 25 Gallon Double Wall Steel Day Tank; Tramont UTRX	1,184.60	107.83
Note: Includes rust-inhibitor coated interior and gray painted exterior.		
23 13 23 13-0026 EA 50 Gallon Double Wall Steel Day Tank; Tramont UTRX	1,332.73	115.03
Note: Includes rust-inhibitor coated interior and gray painted exterior.		
23 13 23 13-0027 EA 60 Gallon Double Wall Steel Day Tank; Tramont UTRX	1,465.54	119.82
Note: Includes rust-inhibitor coated interior and gray painted exterior.		
23 13 23 13-0028 EA 75 Gallon Double Wall Steel Day Tank; Tramont UTRX	1,695.87	143.78
Note: Includes rust-inhibitor coated interior and gray painted exterior.		
23 13 23 13-0029 EA 100 Gallon Double Wall Steel Day Tank; Tramont UTRX	2,237.61	167.74
Note: Includes rust-inhibitor coated interior and gray painted exterior.		
23 13 23 13-0030 EA 150 Gallon Double Wall Steel Day Tank; Tramont UTRX	2,779.35	191.70
Note: Includes rust-inhibitor coated interior and gray painted exterior.		
23 13 23 13-0031 EA 200 Gallon Double Wall Steel Day Tank; Tramont UTRX	3,510.21	215.67
Note: Includes rust-inhibitor coated interior and gray painted exterior.		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 13 23 13-0032 EA 275 Gallon Double Wall Steel Day Tank; Tramont UTRX..... Note: Includes rust-inhibitor coated interior and gray painted exterior.	3,889.30	239.63
23 13 23 13-0033 EA 300 Gallon Double Wall Steel Day Tank; Tramont UTRX..... Note: Includes rust-inhibitor coated interior and gray painted exterior.	4,420.55	287.56
23 13 23 13-0034 EA 350 Gallon Double Wall Steel Day Tank; Tramont UTRX..... Note: Includes rust-inhibitor coated interior and gray painted exterior.	4,926.59	335.49
23 13 23 13-0035 EA 400 Gallon Double Wall Steel Day Tank; Tramont UTRX..... Note: Includes rust-inhibitor coated interior and gray painted exterior.	5,447.75	383.41
23 13 23 13-0036 EA 450 Gallon Double Wall Steel Day Tank; Tramont UTRX..... Note: Includes rust-inhibitor coated interior and gray painted exterior.	6,024.79	407.37
23 13 23 13-0037 EA 500 Gallon Double Wall Steel Day Tank; Tramont UTRX..... Note: Includes rust-inhibitor coated interior and gray painted exterior.	6,605.62	431.34
23 13 23 13-0038 EA 550 Gallon Double Wall Steel Day Tank; Tramont UTRX..... Note: Includes rust-inhibitor coated interior and gray painted exterior.	7,267.14	455.30
23 13 23 13-0039 EA 600 Gallon Double Wall Steel Day Tank; Tramont UTRX..... Note: Includes rust-inhibitor coated interior and gray painted exterior.	7,844.19	479.26
23 13 23 13-0040 EA 700 Gallon Double Wall Steel Day Tank; Tramont UTRX..... Note: Includes rust-inhibitor coated interior and gray painted exterior.	8,708.73	575.12
23 13 23 13-0041 EA 800 Gallon Double Wall Steel Day Tank; Tramont UTRX..... Note: Includes rust-inhibitor coated interior and gray painted exterior.	9,377.41	623.04
23 13 23 13-0042 EA 900 Gallon Double Wall Steel Day Tank; Tramont UTRX..... Note: Includes rust-inhibitor coated interior and gray painted exterior.	10,269.69	718.90
23 13 23 13-0043 EA 1,000 Gallon Double Wall Steel Day Tank; Tramont UTRX..... Note: Includes rust-inhibitor coated interior and gray painted exterior.	11,165.75	814.75
23 13 23 13-0044 EA 10 Gallon Double Wall Steel Day Tank With Pump; Tramont TRE..... Note: Includes pump, motor control float switch, rust-inhibitor coated interior and gray painted exterior.	1,738.28	95.86
23 13 23 13-0045 EA 15 Gallon Double Wall Steel Day Tank With Pump; Tramont TRE..... Note: Includes pump, motor control float switch, rust-inhibitor coated interior and gray painted exterior.	1,795.45	100.64
23 13 23 13-0046 EA 25 Gallon Double Wall Steel Day Tank With Pump; Tramont TRE..... Note: Includes pump, motor control float switch, rust-inhibitor coated interior and gray painted exterior.	1,846.52	107.83
23 13 23 13-0047 EA 50 Gallon Double Wall Steel Day Tank With Pump; Tramont TRE..... Note: Includes pump, motor control float switch, rust-inhibitor coated interior and gray painted exterior.	2,045.09	115.03
23 13 23 13-0048 EA 60 Gallon Double Wall Steel Day Tank With Pump; Tramont TRE..... Note: Includes pump, motor control float switch, rust-inhibitor coated interior and gray painted exterior.	2,119.90	119.82
23 13 23 13-0049 EA 75 Gallon Double Wall Steel Day Tank With Pump; Tramont TRE..... Note: Includes pump, motor control float switch, rust-inhibitor coated interior and gray painted exterior.	2,341.40	143.78
23 13 23 13-0050 EA 100 Gallon Double Wall Steel Day Tank With Pump; Tramont TRE..... Note: Includes pump, motor control float switch, rust-inhibitor coated interior and gray painted exterior.	2,818.84	167.74
23 13 23 13-0051 EA 150 Gallon Double Wall Steel Day Tank With Pump; Tramont TRE..... Note: Includes pump, motor control float switch, rust-inhibitor coated interior and gray painted exterior.	3,559.79	191.70
23 13 23 13-0052 EA 200 Gallon Double Wall Steel Day Tank With Pump; Tramont TRE..... Note: Includes pump, motor control float switch, rust-inhibitor coated interior and gray painted exterior.	4,003.19	215.67
23 13 23 13-0053 EA 275 Gallon Double Wall Steel Day Tank With Pump; Tramont TRE..... Note: Includes pump, motor control float switch, rust-inhibitor coated interior and gray painted exterior.	5,237.11	239.63
23 13 23 13-0054 EA 300 Gallon Double Wall Steel Day Tank With Pump; Tramont TRE..... Note: Includes pump, motor control float switch, rust-inhibitor coated interior and gray painted exterior.	5,917.13	287.56
23 13 23 13-0055 EA 350 Gallon Double Wall Steel Day Tank With Pump; Tramont TRE..... Note: Includes pump, motor control float switch, rust-inhibitor coated interior and gray painted exterior.	6,324.82	335.49
23 13 23 13-0056 EA 400 Gallon Double Wall Steel Day Tank With Pump; Tramont TRE..... Note: Includes pump, motor control float switch, rust-inhibitor coated interior and gray painted exterior.	6,881.29	383.41
23 13 23 13-0057 EA 450 Gallon Double Wall Steel Day Tank With Pump; Tramont TRE..... Note: Includes pump, motor control float switch, rust-inhibitor coated interior and gray painted exterior.	7,431.86	407.37
23 13 23 13-0058 EA 500 Gallon Double Wall Steel Day Tank With Pump; Tramont TRE..... Note: Includes pump, motor control float switch, rust-inhibitor coated interior and gray painted exterior.	8,158.94	431.34
23 13 23 13-0059 EA 550 Gallon Double Wall Steel Day Tank With Pump; Tramont TRE..... Note: Includes pump, motor control float switch, rust-inhibitor coated interior and gray painted exterior.	8,459.87	455.30
23 13 23 13-0060 EA 600 Gallon Double Wall Steel Day Tank With Pump; Tramont TRE..... Note: Includes pump, motor control float switch, rust-inhibitor coated interior and gray painted exterior.	8,729.27	479.26
23 13 23 13-0061 EA 700 Gallon Double Wall Steel Day Tank With Pump; Tramont TRE..... Note: Includes pump, motor control float switch, rust-inhibitor coated interior and gray painted exterior.	9,982.15	575.12
23 13 23 13-0062 EA 800 Gallon Double Wall Steel Day Tank With Pump; Tramont TRE..... Note: Includes pump, motor control float switch, rust-inhibitor coated interior and gray painted exterior.	11,201.80	623.04
23 13 23 13-0063 EA 900 Gallon Double Wall Steel Day Tank With Pump; Tramont TRE..... Note: Includes pump, motor control float switch, rust-inhibitor coated interior and gray painted exterior.	12,530.32	718.90
23 13 23 13-0064 EA 1,000 Gallon Double Wall Steel Day Tank With Pump; Tramont TRE..... Note: Includes pump, motor control float switch, rust-inhibitor coated interior and gray painted exterior.	13,880.27	814.75
23 13 23 13-0065 EA 10 Gallon Double Wall Steel Day Tank With Pump; Tramont UTRE..... Note: Includes pump, motor control float switch, rust-inhibitor coated interior and gray painted exterior.	2,570.42	95.86
23 13 23 13-0066 EA 15 Gallon Double Wall Steel Day Tank With Pump; Tramont UTRE..... Note: Includes pump, motor control float switch, rust-inhibitor coated interior and gray painted exterior.	2,627.58	100.64
23 13 23 13-0067 EA 25 Gallon Double Wall Steel Day Tank With Pump; Tramont UTRE..... Note: Includes pump, motor control float switch, rust-inhibitor coated interior and gray painted exterior.	2,678.66	107.83
23 13 23 13-0068 EA 50 Gallon Double Wall Steel Day Tank With Pump; Tramont UTRE..... Note: Includes pump, motor control float switch, rust-inhibitor coated interior and gray painted exterior.	2,877.23	115.03
23 13 23 13-0069 EA 60 Gallon Double Wall Steel Day Tank With Pump; Tramont UTRE..... Note: Includes pump, motor control float switch, rust-inhibitor coated interior and gray painted exterior.	2,952.04	119.82
23 13 23 13-0070 EA 75 Gallon Double Wall Steel Day Tank With Pump; Tramont UTRE..... Note: Includes pump, motor control float switch, rust-inhibitor coated interior and gray painted exterior.	3,173.53	143.78
23 13 23 13-0071 EA 100 Gallon Double Wall Steel Day Tank With Pump; Tramont UTRE..... Note: Includes pump, motor control float switch, rust-inhibitor coated interior and gray painted exterior.	3,650.98	167.74
23 13 23 13-0072 EA 150 Gallon Double Wall Steel Day Tank With Pump; Tramont UTRE..... Note: Includes pump, motor control float switch, rust-inhibitor coated interior and gray painted exterior.	4,391.93	191.70
23 13 23 13-0073 EA 200 Gallon Double Wall Steel Day Tank With Pump; Tramont UTRE..... Note: Includes pump, motor control float switch, rust-inhibitor coated interior and gray painted exterior.	4,890.80	215.67

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 10 Facility Fuel Systems****23 13 Facility Fuel-Storage Tanks**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 13 23 13-0074 EA 275 Gallon Double Wall Steel Day Tank With Pump; Tramont UTRE Note: Includes pump, motor control float switch, rust-inhibitor coated interior and gray painted exterior.	5,779.26	239.63
23 13 23 13-0075 EA 300 Gallon Double Wall Steel Day Tank With Pump; Tramont UTRE Note: Includes pump, motor control float switch, rust-inhibitor coated interior and gray painted exterior.	6,459.28	287.56
23 13 23 13-0076 EA 350 Gallon Double Wall Steel Day Tank With Pump; Tramont UTRE Note: Includes pump, motor control float switch, rust-inhibitor coated interior and gray painted exterior.	6,868.23	335.49
23 13 23 13-0077 EA 400 Gallon Double Wall Steel Day Tank With Pump; Tramont UTRE Note: Includes pump, motor control float switch, rust-inhibitor coated interior and gray painted exterior.	7,423.44	383.41
23 13 23 13-0078 EA 450 Gallon Double Wall Steel Day Tank With Pump; Tramont UTRE Note: Includes pump, motor control float switch, rust-inhibitor coated interior and gray painted exterior.	7,975.27	407.37
23 13 23 13-0079 EA 500 Gallon Double Wall Steel Day Tank With Pump; Tramont UTRE Note: Includes pump, motor control float switch, rust-inhibitor coated interior and gray painted exterior.	8,701.09	431.34
23 13 23 13-0080 EA 550 Gallon Double Wall Steel Day Tank With Pump; Tramont UTRE Note: Includes pump, motor control float switch, rust-inhibitor coated interior and gray painted exterior.	9,002.02	455.30
23 13 23 13-0081 EA 600 Gallon Double Wall Steel Day Tank With Pump; Tramont UTRE Note: Includes pump, motor control float switch, rust-inhibitor coated interior and gray painted exterior.	9,271.42	479.26
23 13 23 13-0082 EA 700 Gallon Double Wall Steel Day Tank With Pump; Tramont UTRE Note: Includes pump, motor control float switch, rust-inhibitor coated interior and gray painted exterior.	10,524.30	575.12
23 13 23 13-0083 EA 800 Gallon Double Wall Steel Day Tank With Pump; Tramont UTRE Note: Includes pump, motor control float switch, rust-inhibitor coated interior and gray painted exterior.	11,745.21	623.04
23 13 23 13-0084 EA 900 Gallon Double Wall Steel Day Tank With Pump; Tramont UTRE Note: Includes pump, motor control float switch, rust-inhibitor coated interior and gray painted exterior.	13,072.47	718.90
23 13 23 13-0085 EA 1,000 Gallon Double Wall Steel Day Tank With Pump; Tramont UTRE Note: Includes pump, motor control float switch, rust-inhibitor coated interior and gray painted exterior.	14,422.42	814.75
23 13 23 13-0086 EA 10 Gallon Double Wall Steel Day Tank With Pump And Control Module; Tramont TRS Note: Includes pump, motor control float switch, electronic control module, rust-inhibitor coated interior and gray painted exterior.	3,035.66	95.86
23 13 23 13-0087 EA 15 Gallon Double Wall Steel Day Tank With Pump And Control Module; Tramont TRS Note: Includes pump, motor control float switch, electronic control module, rust-inhibitor coated interior and gray painted exterior.	3,099.12	100.64
23 13 23 13-0088 EA 25 Gallon Double Wall Steel Day Tank With Pump And Control Module; Tramont TRS Note: Includes pump, motor control float switch, electronic control module, rust-inhibitor coated interior and gray painted exterior.	3,151.46	107.83
23 13 23 13-0089 EA 50 Gallon Double Wall Steel Day Tank With Pump And Control Module; Tramont TRS Note: Includes pump, motor control float switch, electronic control module, rust-inhibitor coated interior and gray painted exterior.	3,356.33	115.03
23 13 23 13-0090 EA 60 Gallon Double Wall Steel Day Tank With Pump And Control Module; Tramont TRS Note: Includes pump, motor control float switch, electronic control module, rust-inhibitor coated interior and gray painted exterior.	3,466.45	119.82
23 13 23 13-0091 EA 75 Gallon Double Wall Steel Day Tank With Pump And Control Module; Tramont TRS Note: Includes pump, motor control float switch, electronic control module, rust-inhibitor coated interior and gray painted exterior.	3,667.77	143.78
23 13 23 13-0092 EA 100 Gallon Double Wall Steel Day Tank With Pump And Control Module; Tramont TRS Note: Includes pump, motor control float switch, electronic control module, rust-inhibitor coated interior and gray painted exterior.	4,164.13	167.74
23 13 23 13-0093 EA 150 Gallon Double Wall Steel Day Tank With Pump And Control Module; Tramont TRS Note: Includes pump, motor control float switch, electronic control module, rust-inhibitor coated interior and gray painted exterior.	4,940.38	191.70
23 13 23 13-0094 EA 200 Gallon Double Wall Steel Day Tank With Pump And Control Module; Tramont TRS Note: Includes pump, motor control float switch, electronic control module, rust-inhibitor coated interior and gray painted exterior.	5,400.17	215.67
23 13 23 13-0095 EA 275 Gallon Double Wall Steel Day Tank With Pump And Control Module; Tramont TRS Note: Includes pump, motor control float switch, electronic control module, rust-inhibitor coated interior and gray painted exterior.	6,682.00	239.63
23 13 23 13-0096 EA 300 Gallon Double Wall Steel Day Tank With Pump And Control Module; Tramont TRS Note: Includes pump, motor control float switch, electronic control module, rust-inhibitor coated interior and gray painted exterior.	7,397.32	287.56
23 13 23 13-0097 EA 350 Gallon Double Wall Steel Day Tank With Pump And Control Module; Tramont TRS Note: Includes pump, motor control float switch, electronic control module, rust-inhibitor coated interior and gray painted exterior.	7,765.93	335.49
23 13 23 13-0098 EA 400 Gallon Double Wall Steel Day Tank With Pump And Control Module; Tramont TRS Note: Includes pump, motor control float switch, electronic control module, rust-inhibitor coated interior and gray painted exterior.	8,398.04	383.41
23 13 23 13-0099 EA 450 Gallon Double Wall Steel Day Tank With Pump And Control Module; Tramont TRS Note: Includes pump, motor control float switch, electronic control module, rust-inhibitor coated interior and gray painted exterior.	9,064.61	407.37
23 13 23 13-0100 EA 500 Gallon Double Wall Steel Day Tank With Pump And Control Module; Tramont TRS Note: Includes pump, motor control float switch, electronic control module, rust-inhibitor coated interior and gray painted exterior.	9,734.95	431.34
23 13 23 13-0101 EA 550 Gallon Double Wall Steel Day Tank With Pump And Control Module; Tramont TRS Note: Includes pump, motor control float switch, electronic control module, rust-inhibitor coated interior and gray painted exterior.	10,072.44	455.30
23 13 23 13-0102 EA 600 Gallon Double Wall Steel Day Tank With Pump And Control Module; Tramont TRS Note: Includes pump, motor control float switch, electronic control module, rust-inhibitor coated interior and gray painted exterior.	10,322.94	479.26
23 13 23 13-0103 EA 700 Gallon Double Wall Steel Day Tank With Pump And Control Module; Tramont TRS Note: Includes pump, motor control float switch, electronic control module, rust-inhibitor coated interior and gray painted exterior.	11,632.55	575.12
23 13 23 13-0104 EA 800 Gallon Double Wall Steel Day Tank With Pump And Control Module; Tramont TRS Note: Includes pump, motor control float switch, electronic control module, rust-inhibitor coated interior and gray painted exterior.	12,911.46	623.04
23 13 23 13-0105 EA 900 Gallon Double Wall Steel Day Tank With Pump And Control Module; Tramont TRS Note: Includes pump, motor control float switch, electronic control module, rust-inhibitor coated interior and gray painted exterior.	14,299.24	718.90



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 13 23 13-0106 EA 1,000 Gallon Double Wall Steel Day Tank With Pump And Control Module; Tramont TRS Note: Includes pump, motor control float switch, electronic control module, rust-inhibitor coated interior and gray painted exterior.	15,705.93	814.75
23 13 23 13-0107 EA 10 Gallon Double Wall Steel Day Tank With Pump And Control Module; Tramont UTRS..... Note: Includes pump, motor control float switch, electronic control module, rust-inhibitor coated interior and gray painted exterior.	3,867.79	95.86
23 13 23 13-0108 EA 15 Gallon Double Wall Steel Day Tank With Pump And Control Module; Tramont UTRS..... Note: Includes pump, motor control float switch, electronic control module, rust-inhibitor coated interior and gray painted exterior.	3,931.26	100.64
23 13 23 13-0109 EA 25 Gallon Double Wall Steel Day Tank With Pump And Control Module; Tramont UTRS..... Note: Includes pump, motor control float switch, electronic control module, rust-inhibitor coated interior and gray painted exterior.	3,983.59	107.83
23 13 23 13-0110 EA 50 Gallon Double Wall Steel Day Tank With Pump And Control Module; Tramont UTRS..... Note: Includes pump, motor control float switch, electronic control module, rust-inhibitor coated interior and gray painted exterior.	4,188.47	115.03
23 13 23 13-0111 EA 60 Gallon Double Wall Steel Day Tank With Pump And Control Module; Tramont UTRS..... Note: Includes pump, motor control float switch, electronic control module, rust-inhibitor coated interior and gray painted exterior.	4,298.58	119.82
23 13 23 13-0112 EA 75 Gallon Double Wall Steel Day Tank With Pump And Control Module; Tramont UTRS..... Note: Includes pump, motor control float switch, electronic control module, rust-inhibitor coated interior and gray painted exterior.	4,497.39	143.78
23 13 23 13-0113 EA 100 Gallon Double Wall Steel Day Tank With Pump And Control Module; Tramont UTRS..... Note: Includes pump, motor control float switch, electronic control module, rust-inhibitor coated interior and gray painted exterior.	4,996.26	167.74
23 13 23 13-0114 EA 150 Gallon Double Wall Steel Day Tank With Pump And Control Module; Tramont UTRS..... Note: Includes pump, motor control float switch, electronic control module, rust-inhibitor coated interior and gray painted exterior.	5,772.51	191.70
23 13 23 13-0115 EA 200 Gallon Double Wall Steel Day Tank With Pump And Control Module; Tramont UTRS..... Note: Includes pump, motor control float switch, electronic control module, rust-inhibitor coated interior and gray painted exterior.	6,232.30	215.67
23 13 23 13-0116 EA 275 Gallon Double Wall Steel Day Tank With Pump And Control Module; Tramont UTRS..... Note: Includes pump, motor control float switch, electronic control module, rust-inhibitor coated interior and gray painted exterior.	7,224.14	239.63
23 13 23 13-0117 EA 300 Gallon Double Wall Steel Day Tank With Pump And Control Module; Tramont UTRS..... Note: Includes pump, motor control float switch, electronic control module, rust-inhibitor coated interior and gray painted exterior.	7,939.47	287.56
23 13 23 13-0118 EA 350 Gallon Double Wall Steel Day Tank With Pump And Control Module; Tramont UTRS..... Note: Includes pump, motor control float switch, electronic control module, rust-inhibitor coated interior and gray painted exterior.	8,434.16	335.49
23 13 23 13-0119 EA 400 Gallon Double Wall Steel Day Tank With Pump And Control Module; Tramont UTRS..... Note: Includes pump, motor control float switch, electronic control module, rust-inhibitor coated interior and gray painted exterior.	8,940.19	383.41
23 13 23 13-0120 EA 450 Gallon Double Wall Steel Day Tank With Pump And Control Module; Tramont UTRS..... Note: Includes pump, motor control float switch, electronic control module, rust-inhibitor coated interior and gray painted exterior.	9,606.76	407.37
23 13 23 13-0121 EA 500 Gallon Double Wall Steel Day Tank With Pump And Control Module; Tramont UTRS..... Note: Includes pump, motor control float switch, electronic control module, rust-inhibitor coated interior and gray painted exterior.	10,277.10	431.34
23 13 23 13-0122 EA 550 Gallon Double Wall Steel Day Tank With Pump And Control Module; Tramont UTRS..... Note: Includes pump, motor control float switch, electronic control module, rust-inhibitor coated interior and gray painted exterior.	10,614.59	455.30
23 13 23 13-0123 EA 600 Gallon Double Wall Steel Day Tank With Pump And Control Module; Tramont UTRS..... Note: Includes pump, motor control float switch, electronic control module, rust-inhibitor coated interior and gray painted exterior.	10,866.35	479.26
23 13 23 13-0124 EA 700 Gallon Double Wall Steel Day Tank With Pump And Control Module; Tramont UTRS..... Note: Includes pump, motor control float switch, electronic control module, rust-inhibitor coated interior and gray painted exterior.	12,174.70	575.12
23 13 23 13-0125 EA 800 Gallon Double Wall Steel Day Tank With Pump And Control Module; Tramont UTRS..... Note: Includes pump, motor control float switch, electronic control module, rust-inhibitor coated interior and gray painted exterior.	13,453.61	623.04
23 13 23 13-0126 EA 900 Gallon Double Wall Steel Day Tank With Pump And Control Module; Tramont UTRS..... Note: Includes pump, motor control float switch, electronic control module, rust-inhibitor coated interior and gray painted exterior.	14,841.38	718.90
23 13 23 13-0127 EA 1,000 Gallon Double Wall Steel Day Tank With Pump And Control Module; Tramont UTRS..... Note: Includes pump, motor control float switch, electronic control module, rust-inhibitor coated interior and gray painted exterior.	16,248.08	814.75
23 13 23 13-0128 EA 150% Containment Double Wall Open Top Basin For 10 Gallon Tank.....	848.76	95.86
23 13 23 13-0129 EA 150% Containment Double Wall Open Top Basin For 15 Gallon Tank.....	919.99	100.64
23 13 23 13-0130 EA 150% Containment Double Wall Open Top Basin For 25 Gallon Tank.....	998.55	107.83
23 13 23 13-0131 EA 150% Containment Double Wall Open Top Basin For 50 Gallon Tank.....	1,142.00	115.03
23 13 23 13-0132 EA 150% Containment Double Wall Open Top Basin For 60 Gallon Tank.....	1,521.12	119.82
23 13 23 13-0133 EA 150% Containment Double Wall Open Top Basin For 75 Gallon Tank.....	1,561.06	143.78
23 13 23 13-0134 EA 150% Containment Double Wall Open Top Basin For 100 Gallon Tank.....	1,963.81	167.74
23 13 23 13-0135 EA 150% Containment Double Wall Open Top Basin For 150 Gallon Tank.....	2,431.47	191.70
23 13 23 13-0136 EA 150% Containment Double Wall Open Top Basin For 200 Gallon Tank.....	3,197.03	215.67
23 13 23 13-0137 EA 150% Containment Double Wall Open Top Basin For 275 Gallon Tank.....	4,019.17	239.63
23 13 23 13-0138 EA 150% Containment Double Wall Open Top Basin For 300 Gallon Tank.....	4,824.67	287.56
23 13 23 13-0139 EA 150% Containment Double Wall Open Top Basin For 350 Gallon Tank.....	5,182.48	335.49
23 13 23 13-0140 EA 150% Containment Double Wall Open Top Basin For 400 Gallon Tank.....	5,541.96	383.41
23 13 23 13-0141 EA 150% Containment Double Wall Open Top Basin For 450 Gallon Tank.....	6,086.17	407.37
23 13 23 13-0142 EA 150% Containment Double Wall Open Top Basin For 500 Gallon Tank.....	6,632.05	431.34
23 13 23 13-0143 EA 150% Containment Double Wall Open Top Basin For 550 Gallon Tank.....	7,106.38	455.30
23 13 23 13-0144 EA 150% Containment Double Wall Open Top Basin For 600 Gallon Tank.....	7,585.67	479.26
23 13 23 13-0145 EA 150% Containment Double Wall Open Top Basin For 700 Gallon Tank.....	8,580.88	575.12
23 13 23 13-0146 EA 150% Containment Double Wall Open Top Basin For 800 Gallon Tank.....	9,526.18	623.04

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 10 Facility Fuel Systems****23 13 Facility Fuel-Storage Tanks**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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23 13 23 13-0147	EA	150% Containment Double Wall Open Top Basin For 900 Gallon Tank.....	10,577.98	718.90
23 13 23 13-0148	EA	150% Containment Double Wall Open Top Basin For 1,000 Gallon Tank.....	11,593.17	814.75
23 13 23 13-0149	EA	200% Containment Double Wall Open Top Basin For 10 Gallon Tank.....	895.03	100.64
23 13 23 13-0150	EA	200% Containment Double Wall Open Top Basin For 15 Gallon Tank.....	973.77	107.83
23 13 23 13-0151	EA	200% Containment Double Wall Open Top Basin For 25 Gallon Tank.....	1,056.01	115.03
23 13 23 13-0152	EA	200% Containment Double Wall Open Top Basin For 50 Gallon Tank.....	1,202.78	119.82
23 13 23 13-0153	EA	200% Containment Double Wall Open Top Basin For 60 Gallon Tank.....	1,634.47	143.78
23 13 23 13-0154	EA	200% Containment Double Wall Open Top Basin For 75 Gallon Tank.....	1,674.41	167.74
23 13 23 13-0155	EA	200% Containment Double Wall Open Top Basin For 100 Gallon Tank.....	2,097.32	191.70
23 13 23 13-0156	EA	200% Containment Double Wall Open Top Basin For 150 Gallon Tank.....	2,588.74	215.67
23 13 23 13-0157	EA	200% Containment Double Wall Open Top Basin For 200 Gallon Tank.....	3,394.60	239.63
23 13 23 13-0158	EA	200% Containment Double Wall Open Top Basin For 275 Gallon Tank.....	4,260.20	263.60
23 13 23 13-0159	EA	200% Containment Double Wall Open Top Basin For 300 Gallon Tank.....	5,106.02	311.52
23 13 23 13-0160	EA	200% Containment Double Wall Open Top Basin For 350 Gallon Tank.....	5,479.28	359.45
23 13 23 13-0161	EA	200% Containment Double Wall Open Top Basin For 400 Gallon Tank.....	5,854.28	407.37
23 13 23 13-0162	EA	200% Containment Double Wall Open Top Basin For 450 Gallon Tank.....	6,426.51	431.34
23 13 23 13-0163	EA	200% Containment Double Wall Open Top Basin For 500 Gallon Tank.....	7,000.50	455.30
23 13 23 13-0164	EA	200% Containment Double Wall Open Top Basin For 550 Gallon Tank.....	7,498.96	479.26
23 13 23 13-0165	EA	200% Containment Double Wall Open Top Basin For 600 Gallon Tank.....	8,042.59	527.19
23 13 23 13-0166	EA	200% Containment Double Wall Open Top Basin For 700 Gallon Tank.....	9,084.23	623.04
23 13 23 13-0167	EA	200% Containment Double Wall Open Top Basin For 800 Gallon Tank.....	10,157.48	718.90
23 13 23 13-0168	EA	200% Containment Double Wall Open Top Basin For 900 Gallon Tank.....	11,258.83	814.75
23 13 23 13-0169	EA	200% Containment Double Wall Open Top Basin For 1,000 Gallon Tank.....	12,321.55	910.60
23 13 23 13-0170	EA	150% Containment Double Wall Sealed Top Basin For 10 Gallon Tank.....	980.23	95.86
23 13 23 13-0171	EA	150% Containment Double Wall Sealed Top Basin For 15 Gallon Tank.....	1,068.11	100.64
23 13 23 13-0172	EA	150% Containment Double Wall Sealed Top Basin For 25 Gallon Tank.....	1,156.66	107.83
23 13 23 13-0173	EA	150% Containment Double Wall Sealed Top Basin For 50 Gallon Tank.....	1,333.39	115.03
23 13 23 13-0174	EA	150% Containment Double Wall Sealed Top Basin For 60 Gallon Tank.....	1,784.07	119.82
23 13 23 13-0175	EA	150% Containment Double Wall Sealed Top Basin For 75 Gallon Tank.....	1,824.01	143.78
23 13 23 13-0176	EA	150% Containment Double Wall Sealed Top Basin For 100 Gallon Tank.....	2,286.68	167.74
23 13 23 13-0177	EA	150% Containment Double Wall Sealed Top Basin For 150 Gallon Tank.....	2,832.56	191.70
23 13 23 13-0178	EA	150% Containment Double Wall Sealed Top Basin For 200 Gallon Tank.....	3,734.13	215.67
23 13 23 13-0179	EA	150% Containment Double Wall Sealed Top Basin For 275 Gallon Tank.....	4,744.79	239.63
23 13 23 13-0180	EA	150% Containment Double Wall Sealed Top Basin For 300 Gallon Tank.....	5,698.41	287.56
23 13 23 13-0181	EA	150% Containment Double Wall Sealed Top Basin For 350 Gallon Tank.....	6,107.81	335.49
23 13 23 13-0182	EA	150% Containment Double Wall Sealed Top Basin For 400 Gallon Tank.....	6,520.55	383.41
23 13 23 13-0183	EA	150% Containment Double Wall Sealed Top Basin For 450 Gallon Tank.....	7,169.61	407.37
23 13 23 13-0184	EA	150% Containment Double Wall Sealed Top Basin For 500 Gallon Tank.....	7,820.34	431.34
23 13 23 13-0185	EA	150% Containment Double Wall Sealed Top Basin For 550 Gallon Tank.....	8,372.87	455.30
23 13 23 13-0186	EA	150% Containment Double Wall Sealed Top Basin For 600 Gallon Tank.....	8,938.72	479.26
23 13 23 13-0187	EA	150% Containment Double Wall Sealed Top Basin For 700 Gallon Tank.....	10,108.68	575.12
23 13 23 13-0188	EA	150% Containment Double Wall Sealed Top Basin For 800 Gallon Tank.....	11,230.39	623.04
23 13 23 13-0189	EA	150% Containment Double Wall Sealed Top Basin For 900 Gallon Tank.....	12,456.94	718.90
23 13 23 13-0190	EA	150% Containment Double Wall Sealed Top Basin For 1,000 Gallon Tank.....	13,646.87	814.75
23 13 23 13-0191	EA	200% Containment Double Wall Sealed Top Basin For 10 Gallon Tank.....	1,033.81	100.64
23 13 23 13-0192	EA	200% Containment Double Wall Sealed Top Basin For 15 Gallon Tank.....	1,130.12	107.83
23 13 23 13-0193	EA	200% Containment Double Wall Sealed Top Basin For 25 Gallon Tank.....	1,222.90	115.03
23 13 23 13-0194	EA	200% Containment Double Wall Sealed Top Basin For 50 Gallon Tank.....	1,404.81	119.82
23 13 23 13-0195	EA	200% Containment Double Wall Sealed Top Basin For 60 Gallon Tank.....	1,912.04	143.78
23 13 23 13-0196	EA	200% Containment Double Wall Sealed Top Basin For 75 Gallon Tank.....	1,951.98	167.74
23 13 23 13-0197	EA	200% Containment Double Wall Sealed Top Basin For 100 Gallon Tank.....	2,438.12	191.70
23 13 23 13-0198	EA	200% Containment Double Wall Sealed Top Basin For 150 Gallon Tank.....	3,012.11	215.67
23 13 23 13-0199	EA	200% Containment Double Wall Sealed Top Basin For 200 Gallon Tank.....	3,961.55	239.63
23 13 23 13-0200	EA	200% Containment Double Wall Sealed Top Basin For 275 Gallon Tank.....	5,026.14	263.60
23 13 23 13-0201	EA	200% Containment Double Wall Sealed Top Basin For 300 Gallon Tank.....	6,028.30	311.52
23 13 23 13-0202	EA	200% Containment Double Wall Sealed Top Basin For 350 Gallon Tank.....	6,456.02	359.45
23 13 23 13-0203	EA	200% Containment Double Wall Sealed Top Basin For 400 Gallon Tank.....	6,887.24	407.37
23 13 23 13-0204	EA	200% Containment Double Wall Sealed Top Basin For 450 Gallon Tank.....	7,570.14	431.34
23 13 23 13-0205	EA	200% Containment Double Wall Sealed Top Basin For 500 Gallon Tank.....	8,254.80	455.30
23 13 23 13-0206	EA	200% Containment Double Wall Sealed Top Basin For 550 Gallon Tank.....	8,835.81	479.26
23 13 23 13-0207	EA	200% Containment Double Wall Sealed Top Basin For 600 Gallon Tank.....	9,470.81	527.19
23 13 23 13-0208	EA	200% Containment Double Wall Sealed Top Basin For 700 Gallon Tank.....	10,696.90	623.04
23 13 23 13-0209	EA	200% Containment Double Wall Sealed Top Basin For 800 Gallon Tank.....	11,956.37	718.90
23 13 23 13-0210	EA	200% Containment Double Wall Sealed Top Basin For 900 Gallon Tank.....	13,242.18	814.75
23 13 23 13-0211	EA	200% Containment Double Wall Sealed Top Basin For 1,000 Gallon Tank.....	14,489.35	910.60

23 13 23 16 Horizontal, Steel, Aboveground Fuel-Oil, Storage Tanks (23 13 23)**23 13 23 16-0001 Single Wall Aboveground Storage Tanks (23 13 23 16)**

Note: Includes supports, coating, fittings, and 4" NPT connections as follows: up to 1000 gallon, 4 each; all others 6 each. Excludes pumps, piping, excavation and backfill.

23 13 23 16-0002	EA	275 Gallon, Steel Storage Tank, With 3/16" Shell, Aboveground With Supports, Coating And Fittings.....	1,739.37	520.96
23 13 23 16-0003	EA	550 Gallon, Steel Storage Tank, With 3/16" Shell, Aboveground With Supports, Coating And Fittings.....	2,094.55	630.63
23 13 23 16-0004	EA	1,000 Gallon, Steel Storage Tank, With 3/16" Shell, Aboveground With Supports, Coating And Fittings.....	2,872.34	892.69
23 13 23 16-0005	EA	1,500 Gallon, Steel Storage Tank, With 3/16" Shell, Aboveground With Supports, Coating And Fittings.....	3,681.85	1,115.86
23 13 23 16-0006	EA	2,000 Gallon, Steel Storage Tank, With 3/16" Shell, Aboveground With Supports, Coating And Fittings.....	4,583.70	1,480.52
23 13 23 16-0007	EA	3,000 Gallon, Steel Storage Tank, With 3/16" Shell, Aboveground With Supports, Coating And Fittings.....	6,307.51	1,524.05
23 13 23 16-0008	EA	5,000 Gallon, Steel Storage Tank, With 3/16" Shell, Aboveground With Supports, Coating And Fittings.....	8,887.41	1,884.28
23 13 23 16-0009	EA	8,000 Gallon, Steel Storage Tank, With 3/16" Shell, Aboveground With Supports, Coating And Fittings.....	11,839.11	2,159.03
23 13 23 16-0010	EA	10,000 Gallon, Steel Storage Tank, With 3/16" Shell, Aboveground With Supports, Coating And Fittings.....	13,924.74	2,355.30
23 13 23 16-0011	EA	12,000 Gallon, Steel Storage Tank, With 3/16" Shell, Aboveground With Supports, Coating And Fittings.....	16,041.92	2,590.84



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 13 23 16-0012	EA		15,000 Gallon, Steel Storage Tank, With 3/16" Shell, Aboveground With Supports, Coating And Fittings.....	17,767.56	2,878.69
23 13 23 16-0013	EA		20,000 Gallon, Steel Storage Tank, With 3/16" Shell, Aboveground With Supports, Coating And Fittings.....	22,283.24	3,701.16
23 13 23 16-0014	EA		30,000 Gallon, Steel Storage Tank, With 3/16" Shell, Aboveground With Supports, Coating And Fittings.....	29,810.31	4,318.07
23 13 23 16-0015			Double Wall Aboveground Storage Tanks <small>(23 13 23 16)</small>		
Note: Includes supports, coating, fittings, and 4" NPT connections as follows: up to 1000 gallon, 4 each: all others 6 each. Excludes pumps, piping, excavation and backfill.					
23 13 23 16-0016	EA		275 Gallon, Steel Storage Tank, Double Wall, With 3/16" Shell, Aboveground With Supports, Coating And Fittings.....	2,616.29	650.05
23 13 23 16-0017	EA		550 Gallon, Steel Storage Tank, Double Wall, With 3/16" Shell, Aboveground With Supports, Coating And Fittings.....	3,148.29	786.63
23 13 23 16-0018	EA		1,000 Gallon, Steel Storage Tank, Double Wall, With 3/16" Shell, Aboveground With Supports, Coating And Fittings.....	4,304.62	1,115.86
23 13 23 16-0019	EA		1,500 Gallon, Steel Storage Tank, Double Wall, With 3/16" Shell, Aboveground With Supports, Coating And Fittings.....	5,533.86	1,394.82
23 13 23 16-0020	EA		2,000 Gallon, Steel Storage Tank, Double Wall, With 3/16" Shell, Aboveground With Supports, Coating And Fittings.....	6,798.70	1,850.62
23 13 23 16-0021	EA		3,000 Gallon, Steel Storage Tank, Double Wall, With 3/16" Shell, Aboveground With Supports, Coating And Fittings.....	9,659.58	1,905.01
23 13 23 16-0022	EA		5,000 Gallon, Steel Storage Tank, Double Wall, With 3/16" Shell, Aboveground With Supports, Coating And Fittings.....	13,754.50	2,346.78
23 13 23 16-0023	EA		8,000 Gallon, Steel Storage Tank, Double Wall, With 3/16" Shell, Aboveground With Supports, Coating And Fittings.....	18,546.48	2,698.81
23 13 23 16-0024	EA		10,000 Gallon, Steel Storage Tank, Double Wall, With 3/16" Shell, Aboveground With Supports, Coating And Fittings.....	21,922.77	2,944.15
23 13 23 16-0025	EA		12,000 Gallon, Steel Storage Tank, Double Wall, With 3/16" Shell, Aboveground With Supports, Coating And Fittings.....	25,328.61	3,238.51
23 13 23 16-0026	EA		15,000 Gallon, Steel Storage Tank, Double Wall, With 3/16" Shell, Aboveground With Supports, Coating And Fittings.....	28,047.83	3,598.42
23 13 23 16-0027	EA		20,000 Gallon, Steel Storage Tank, Double Wall, With 3/16" Shell, Aboveground With Supports, Coating And Fittings.....	35,122.41	4,626.48
23 13 23 16-0028	EA		30,000 Gallon, Steel Storage Tank, Double Wall, With 3/16" Shell, Aboveground With Supports, Coating And Fittings.....	47,361.68	5,397.54
23 13 23 26			Concrete-Vaulted, Steel, Aboveground Fuel-Oil, Storage Tanks <small>(23 13 23)</small>		
23 13 23 26-0001			Aboveground Concrete Vaulted Storage Tanks <small>(23 13 23 26)</small>		
Note: Includes setting in place with stand, NPT openings for an emergency vent, regular vent, gauge, fill with an internal 5 gallon minimum overfill containment, supply and return and leak detection. All tanks that are 2000 gallon and larger shall have a ladder for access. Excludes excavation, pad, pumps and piping.					
23 13 23 26-0002	EA		500 Gallon Concrete Vaulted Storage Tank.....	16,585.29	1,120.61
			<i>For Low Profile Tanks, Add</i>	<i>6,008.66</i>	
23 13 23 26-0003	EA		1,000 Gallon Concrete Vaulted Storage Tank.....	20,847.93	1,265.05
			<i>For Low Profile Tanks, Add</i>	<i>7,633.09</i>	
23 13 23 26-0004	EA		2,000 Gallon Concrete Vaulted Storage Tank.....	36,785.08	1,506.30
			<i>For Low Profile Tanks, Add</i>	<i>13,873.30</i>	
23 13 23 26-0005	EA		4,000 Gallon Concrete Vaulted Storage Tank.....	58,540.84	3,313.14
23 13 23 26-0006	EA		5,000 Gallon Concrete Vaulted Storage Tank.....	66,823.99	3,618.51
23 13 23 26-0007	EA		6,000 Gallon Concrete Vaulted Storage Tank.....	75,171.99	3,907.71
23 13 23 26-0008	EA		8,000 Gallon Concrete Vaulted Storage Tank.....	83,502.71	4,240.38
23 13 23 26-0009	EA		10,000 Gallon Concrete Vaulted Storage Tank.....	91,828.10	4,513.68
23 13 33			Facility Fuel-Oil, Storage Tank Accessories <small>(23 13)</small>		
23 13 33 00-0001			EPA Requirements <small>(23 13 33)</small>		
23 13 33 00-0002	EA		Fill Pipe Spill Containment Manhole (5 Gallon).....	395.61	
23 13 33 00-0003	EA		Over-Fill Prevention Valve.....	515.14	
23 13 33 00-0004	EA		Tank Manway With Cover, Fiberglass.....	1,525.76	
23 13 33 00-0005	EA		Tank Manway With Cover, Steel.....	1,431.88	
23 13 33 00-0006	EA		Vent Fill Alarm (Whistle Vent).....	78.86	
23 13 33 00-0007	EA		Reservoir Sensor, Liquid Level.....	190.93	
23 13 33 00-0008	EA		Manhole Spill Containment.....	725.79	186.38
23 13 33 00-0009	EA		Fill Adapter, 4".....	191.05	124.28
23 13 33 00-0010	EA		Fill Cap, 4".....	125.74	46.59
23 13 33 00-0011	EA		Vent Cap, 2".....	78.66	31.08
23 13 33 00-0012	EA		4" X 2" Extractor Fitting.....	206.99	46.59
23 13 33 00-0013	EA		Float Vent Valve.....	237.25	93.19
23 13 33 00-0014	EA		Vapor Hose Adapter.....	215.93	62.10
23 13 33 00-0015	EA		Dust Cap.....	100.33	33.92
23 13 33 00-0016	EA		1" Double Poppet Foot Valve.....	220.17	53.23
23 13 33 00-0017	EA		10' Wood Gage Stick.....	20.90	
23 13 33 00-0018	EA		1-1/4" Tank Filled Breather, NPT.....	69.54	
23 13 33 00-0019	EA		1-1/2" Tank Filled Breather, Bayonet.....	89.62	
23 13 33 00-0020	EA		2" Cast Iron Combination Fill Cap And Vent.....	50.50	
23 13 33 00-0021	EA		3" Cast Iron Combination Fill Cap And Vent.....	66.46	
23 13 33 00-0022	EA		4" Cast Iron Combination Fill Cap And Vent.....	101.23	
23 13 33 00-0023	EA		Pressure And Vacuum Control Vent.....	360.06	
23 13 33 00-0024	EA		1/4 HP Fuel/Diesel Pump Set.....	1,005.45	
23 13 33 00-0025	EA		1/3 HP Fuel/Diesel Pump Set.....	1,186.74	
23 13 33 00-0026	EA		1/2 HP Fuel/Diesel Pump Set.....	1,294.92	
23 13 33 00-0027	EA		3/4 HP Fuel/Diesel Pump Set.....	1,420.59	
23 13 33 00-0028	EA		1 HP Fuel/Diesel Pump Set.....	2,013.96	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 10 Facility Fuel Systems****23 13 Facility Fuel-Storage Tanks**

MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
23 13 33 00-0029	EA	1-1/2 HP Fuel/Diesel Pump Set	2,479.96		
23 13 33 00-0030	EA	2 HP Fuel/Diesel Pump Set	2,746.63		
23 13 33 00-0031	EA	3 HP Fuel/Diesel Pump Set	3,366.63		
23 13 33 00-0032	EA	5 HP Fuel/Diesel Pump Set	3,979.63		
23 13 33 00-0033	EA	7.5 HP Fuel/Diesel Pump Set	4,454.90		
23 13 33 00-0034	EA	10 HP Fuel/Diesel Pump Set	5,141.42		
23 13 33 00-0035		Tank Bulkhead Fittings (23 13 33)			
23 13 33 00-0036		Tank Bulkhead Fittings (23 13 33 00-0035)			
23 13 33 00-0037		Polyvinyl Chloride (PVC) Tank Bulkhead Fittings, Socket x Threaded Connection (23 13 33 00-0036)			
23 13 33 00-0038	EA	1/2" Polyvinyl Chloride (PVC) Bulkhead Fitting, Socket x Thread	27.16		
23 13 33 00-0039	EA	3/4" Polyvinyl Chloride (PVC) Bulkhead Fitting, Socket x Thread	30.29		
23 13 33 00-0040	EA	1" Polyvinyl Chloride (PVC) Bulkhead Fitting, Socket x Thread	33.28		
23 13 33 00-0041	EA	1-1/4" Polyvinyl Chloride (PVC) Bulkhead Fitting, Socket x Thread	39.48		
23 13 33 00-0042	EA	1-1/2" Polyvinyl Chloride (PVC) Bulkhead Fitting, Socket x Thread	41.08		
23 13 33 00-0043	EA	2" Polyvinyl Chloride (PVC) Bulkhead Fitting, Socket x Thread	52.31		
23 13 33 00-0044	EA	3" Polyvinyl Chloride (PVC) Bulkhead Fitting, Socket x Thread	79.24		
23 13 33 00-0045	EA	4" Polyvinyl Chloride (PVC) Bulkhead Fitting, Socket x Thread	133.22		
23 13 33 00-0046		Polyvinyl Chloride (PVC) Tank Bulkhead Fittings, Thread x Threaded Connection (23 13 33 00-0036)			
23 13 33 00-0047	EA	1/2" Polyvinyl Chloride (PVC) Bulkhead Fitting, Thread x Thread	30.79		
23 13 33 00-0048	EA	3/4" Polyvinyl Chloride (PVC) Bulkhead Fitting, Thread x Thread	33.91		
23 13 33 00-0049	EA	1" Polyvinyl Chloride (PVC) Bulkhead Fitting, Thread x Thread	37.05		
23 13 33 00-0050	EA	1-1/4" Polyvinyl Chloride (PVC) Bulkhead Fitting, Thread x Thread	45.34		
23 13 33 00-0051	EA	1-1/2" Polyvinyl Chloride (PVC) Bulkhead Fitting, Thread x Thread	48.47		
23 13 33 00-0052	EA	2" Polyvinyl Chloride (PVC) Bulkhead Fitting, Thread x Thread	59.00		
23 13 33 00-0053	EA	3" Polyvinyl Chloride (PVC) Bulkhead Fitting, Thread x Thread	88.17		
23 13 33 00-0054	EA	4" Polyvinyl Chloride (PVC) Bulkhead Fitting, Thread x Thread	145.90		
23 13 33 00-0055		Chlorinated Polyvinyl Chloride (CPVC) Tank Bulkhead Fittings, Socket x Threaded Connection (23 13 33 00-0036)			
23 13 33 00-0056	EA	1/2" Chlorinated Polyvinyl Chloride (CPVC) Bulkhead Fitting, Socket x Thread	31.62		
23 13 33 00-0057	EA	3/4" Chlorinated Polyvinyl Chloride (CPVC) Bulkhead Fitting, Socket x Thread	36.29		
23 13 33 00-0058	EA	1" Chlorinated Polyvinyl Chloride (CPVC) Bulkhead Fitting, Socket x Thread	40.82		
23 13 33 00-0059	EA	1-1/2" Chlorinated Polyvinyl Chloride (CPVC) Bulkhead Fitting, Socket x Thread	52.10		
23 13 33 00-0060	EA	2" Chlorinated Polyvinyl Chloride (CPVC) Bulkhead Fitting, Socket x Thread	66.52		
23 13 33 00-0061	EA	3" Chlorinated Polyvinyl Chloride (CPVC) Bulkhead Fitting, Socket x Thread	100.30		
23 13 33 00-0062	EA	4" Chlorinated Polyvinyl Chloride (CPVC) Bulkhead Fitting, Socket x Thread	153.44		
23 13 33 00-0063		Polypropylene Tank Bulkhead Fitting Thread x Threaded Connection (23 13 33 00-0036)			
23 13 33 00-0064	EA	1/2" Polypropylene Bulkhead Fitting, Thread x Thread	36.23		
23 13 33 00-0065	EA	3/4" Polypropylene Bulkhead Fitting, Thread x Thread	42.43		
23 13 33 00-0066	EA	1" Polypropylene Bulkhead Fitting, Thread x Thread	51.55		
23 13 33 00-0067	EA	1-1/4" Polypropylene Bulkhead Fitting, Thread x Thread	62.07		
23 13 33 00-0068	EA	1-1/2" Polypropylene Bulkhead Fitting, Thread x Thread	63.67		
23 13 33 00-0069	EA	2" Polypropylene Bulkhead Fitting, Thread x Thread	88.69		
23 13 33 00-0070	EA	3" Polypropylene Bulkhead Fitting, Thread x Thread	153.84		
23 13 33 00-0071	EA	4" Polypropylene Bulkhead Fitting, Thread x Thread	269.16		
23 13 33 00-0072		Polyethylene Tank Bulkhead Fittings Thread x Threaded Connection (23 13 33 00-0036)			
23 13 33 00-0073	EA	3/4" Polyethylene Bulkhead Fitting, Thread x Thread	32.94		
23 13 33 00-0074	EA	1" Polyethylene Bulkhead Fitting, Thread x Thread	41.47		
23 13 33 00-0075	EA	1-1/4" Polyethylene Bulkhead Fitting, Thread x Thread	43.06		
23 13 33 00-0076	EA	1-1/2" Polyethylene Bulkhead Fitting, Thread x Thread	44.66		
23 13 33 00-0077	EA	2" Polyethylene Bulkhead Fitting, Thread x Thread	60.11		
23 13 33 00-0078	EA	3" Polyethylene Bulkhead Fitting, Thread x Thread	74.82		
23 13 33 00-0079		TFE Teflon Tank Bulkhead Fittings, Thread x Threaded Connection (23 13 33 00-0036)			
23 13 33 00-0080	EA	1/8" TFE Teflon Bulkhead Fitting, Thread x Thread	122.70		
23 13 33 00-0081	EA	1/4" TFE Teflon Bulkhead Fitting, Thread x Thread	140.23		
23 13 33 00-0082	EA	3/8" TFE Teflon Bulkhead Fitting, Thread x Thread	171.69		
23 13 33 00-0083	EA	1/2" TFE Teflon Bulkhead Fitting, Thread x Thread	197.54		
23 13 33 00-0084	EA	3/4" TFE Teflon Bulkhead Fitting, Thread x Thread	227.39		
23 13 33 00-0085	EA	1" TFE Teflon Bulkhead Fitting, Thread x Thread	285.56		
23 13 33 00-0086	EA	1-1/2" TFE Teflon Bulkhead Fitting, Thread x Thread	370.22		
23 13 33 00-0087	EA	2" TFE Teflon Bulkhead Fitting, Thread x Thread	408.83		



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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23 13 33 00-0088			Self-Aligning Bulkhead Fittings <small>(23 13 33 00-0035)</small>		
	EA		3/4" Self-Aligning Polyvinyl Chloride (PVC) Bulkhead Fitting.....	127.09	
	EA		1" Self-Aligning Polyvinyl Chloride (PVC) Bulkhead Fitting.....	127.76	
	EA		1-1/2" Self-Aligning Polyvinyl Chloride (PVC) Bulkhead Fitting	184.79	
	EA		2" Self-Aligning Polyvinyl Chloride (PVC) Bulkhead Fitting.....	189.01	
	EA		3" Self-Aligning Polyvinyl Chloride (PVC) Bulkhead Fitting.....	252.92	

23 20 HVAC Piping And Pumps (23)

Note: The demolition price for only the length of pipe (LF) shall be used for lengths (LF) of pipe removal which do include the fittings, valves, and insulation. The demolition price for individual fittings, valves, and insulation shall not be used in conjunction with pipe (LF) demolition tasks.

23 21 Hydronic Piping And Pumps (23 20)

23 21 13 Hydronic Piping (23 21)

Note: The demolition price for only the length of pipe (LF) shall be used for lengths (LF) of pipe removal which do include the fittings, valves, and insulation. The demolition price for individual fittings, valves, and insulation shall not be used in conjunction with pipe (LF) demolition tasks.

23 21 13 23 Aboveground Hydronic Piping (23 21 13)

23 21 13 23-0001 Threaded Black Steel Pipe (23 21 13 23)

23 21 13 23-0002 Threaded Black Steel Pipe Assemblies (23 21 13 23-0001)

Note: ASTM A-53. Threaded and coupled. Includes all hangers and all fittings (couplings, elbows, tees and reducer fittings). All hangers are complete assemblies. Not for use where detail is available.

	LF	1/2" Schedule 40 Threaded Black Steel Pipe With 150 LB Malleable Iron Fitting Assembly		12.39	2.94
			Note: Includes all hangers and all fittings (couplings, elbows, tees and reducer fittings). All hangers are complete assemblies. Not for use where detail is available.		
			<i>For Schedule 80 Pipe With 300 LB Malleable Iron Fittings, Add</i>	2.84	
			<i>For Work In Restricted Working Space, Add</i>	3.04	
	LF	3/4" Schedule 40 Threaded Black Steel Pipe With 150 LB Malleable Iron Fitting Assembly		13.23	3.16
			Note: Includes all hangers and all fittings (couplings, elbows, tees and reducer fittings). All hangers are complete assemblies. Not for use where detail is available.		
			<i>For Schedule 80 Pipe With 300 LB Malleable Iron Fittings, Add</i>	3.07	
			<i>For Work In Restricted Working Space, Add</i>	3.18	
	LF	1" Schedule 40 Threaded Black Steel Pipe With 150 LB Malleable Iron Fitting Assembly		14.20	3.46
			Note: Includes all hangers and all fittings (couplings, elbows, tees and reducer fittings). All hangers are complete assemblies. Not for use where detail is available.		
			<i>For Schedule 80 Pipe With 300 LB Malleable Iron Fittings, Add</i>	3.33	
			<i>For Work In Restricted Working Space, Add</i>	3.35	
	LF	1-1/4" Schedule 40 Threaded Black Steel Pipe With 150 LB Malleable Iron Fitting Assembly		16.43	3.61
			Note: Includes all hangers and all fittings (couplings, elbows, tees and reducer fittings). All hangers are complete assemblies. Not for use where detail is available.		
			<i>For Schedule 80 Pipe With 300 LB Malleable Iron Fittings, Add</i>	3.99	
			<i>For Work In Restricted Working Space, Add</i>	3.61	
	LF	1-1/2" Schedule 40 Threaded Black Steel Pipe With 150 LB Malleable Iron Fitting Assembly		17.02	4.26
			Note: Includes all hangers and all fittings (couplings, elbows, tees and reducer fittings). All hangers are complete assemblies. Not for use where detail is available.		
			<i>For Schedule 80 Pipe With 300 LB Malleable Iron Fittings, Add</i>	4.17	
			<i>For Work In Restricted Working Space, Add</i>	3.66	
	LF	2" Schedule 40 Threaded Black Steel Pipe With 150 LB Malleable Iron Fitting Assembly		19.69	5.15
			Note: Includes all hangers and all fittings (couplings, elbows, tees and reducer fittings). All hangers are complete assemblies. Not for use where detail is available.		
			<i>For Schedule 80 Pipe With 300 LB Malleable Iron Fittings, Add</i>	4.89	
			<i>For Work In Restricted Working Space, Add</i>	4.13	
	LF	2-1/2" Schedule 40 Threaded Black Steel Pipe With 150 LB Malleable Iron Fitting Assembly		26.70	6.10
			Note: Includes all hangers and all fittings (couplings, elbows, tees and reducer fittings). All hangers are complete assemblies. Not for use where detail is available.		
			<i>For Schedule 80 Pipe With 300 LB Malleable Iron Fittings, Add</i>	6.88	
			<i>For Work In Restricted Working Space, Add</i>	5.12	
	LF	3" Schedule 40 Threaded Black Steel Pipe With 150 LB Malleable Iron Fitting Assembly		33.51	8.16
			Note: Includes all hangers and all fittings (couplings, elbows, tees and reducer fittings). All hangers are complete assemblies. Not for use where detail is available.		
			<i>For Schedule 80 Pipe With 300 LB Malleable Iron Fittings, Add</i>	8.72	
			<i>For Work In Restricted Working Space, Add</i>	6.27	
	LF	4" Schedule 40 Threaded Black Steel Pipe With 150 LB Malleable Iron Fitting Assembly		43.67	9.78
			Note: Includes all hangers and all fittings (couplings, elbows, tees and reducer fittings). All hangers are complete assemblies. Not for use where detail is available.		
			<i>For Schedule 80 Pipe With 300 LB Malleable Iron Fittings, Add</i>	11.96	
			<i>For Work In Restricted Working Space, Add</i>	7.06	
	LF	5" Schedule 40 Threaded Black Steel Pipe With 150 LB Malleable Iron Fitting Assembly		62.72	12.49
			Note: Includes all hangers and all fittings (couplings, elbows, tees and reducer fittings). All hangers are complete assemblies. Not for use where detail is available.		
			<i>For Schedule 80 Pipe With 300 LB Malleable Iron Fittings, Add</i>	18.09	
			<i>For Work In Restricted Working Space, Add</i>	8.41	
	LF	6" Schedule 40 Threaded Black Steel Pipe With 150 LB Malleable Iron Fitting Assembly		74.10	14.77
			Note: Includes all hangers and all fittings (couplings, elbows, tees and reducer fittings). All hangers are complete assemblies. Not for use where detail is available.		
			<i>For Schedule 80 Pipe With 300 LB Malleable Iron Fittings, Add</i>	21.59	
			<i>For Work In Restricted Working Space, Add</i>	9.53	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 20 HVAC Piping And Pumps****23 21 Hydronic Piping And Pumps**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21 13 23-0014			Threaded Black Steel Pipe And Fittings <small>(23 21 13 23-0001)</small> Note: (ASTM A-53) Threaded and coupled, schedule 40. Excludes hangers, elbow, tee, or reducer fittings.		
23 21 13 23-0015			Threaded And Coupled, Black Steel Piping <small>(23 21 13 23-0014)</small> Note: ASTM A-53. Includes coupling.		
23 21 13 23-0016	LF		3/8" Schedule 40, Threaded And Coupled, Black Steel Pipe.....	4.34	1.83
			<i>For Work In Restricted Working Space, Add</i>	1.11	
			<i>For Schedule 80 Pipe, Add</i>	0.65	
23 21 13 23-0017	LF		1/2" Schedule 40, Threaded And Coupled, Black Steel Pipe.....	5.51	2.94
			<i>For Work In Restricted Working Space, Add</i>	1.34	
			<i>For Schedule 80 Pipe, Add</i>	0.92	
23 21 13 23-0018	LF		3/4" Schedule 40, Threaded And Coupled, Black Steel Pipe.....	6.11	3.16
			<i>For Work In Restricted Working Space, Add</i>	1.42	
			<i>For Schedule 80 Pipe, Add</i>	1.09	
23 21 13 23-0019	LF		1" Schedule 40, Threaded And Coupled, Black Steel Pipe.....	6.96	3.46
			<i>For Work In Restricted Working Space, Add</i>	1.54	
			<i>For Schedule 80 Pipe, Add</i>	1.33	
23 21 13 23-0020	LF		1-1/4" Schedule 40, Threaded And Coupled, Black Steel Pipe.....	7.88	3.61
			<i>For Work In Restricted Working Space, Add</i>	1.63	
			<i>For Schedule 80 Pipe, Add</i>	1.64	
23 21 13 23-0021	LF		1-1/2" Schedule 40, Threaded And Coupled, Black Steel Pipe.....	9.31	4.26
			<i>For Work In Restricted Working Space, Add</i>	1.92	
			<i>For Schedule 80 Pipe, Add</i>	1.95	
23 21 13 23-0022	LF		2" Schedule 40, Threaded And Coupled, Black Steel Pipe.....	11.56	5.15
			<i>For Work In Restricted Working Space, Add</i>	2.32	
			<i>For Schedule 80 Pipe, Add</i>	2.49	
23 21 13 23-0023	LF		2-1/2" Schedule 40, Threaded And Coupled, Black Steel Pipe.....	15.23	6.10
			<i>For Work In Restricted Working Space, Add</i>	2.76	
			<i>For Schedule 80 Pipe, Add</i>	3.64	
23 21 13 23-0024	LF		3" Schedule 40, Threaded And Coupled, Black Steel Pipe.....	20.16	8.16
			<i>For Work In Restricted Working Space, Add</i>	3.68	
			<i>For Schedule 80 Pipe, Add</i>	4.78	
23 21 13 23-0025	LF		4" Schedule 40, Threaded And Coupled, Black Steel Pipe.....	26.52	9.78
			<i>For Work In Restricted Working Space, Add</i>	4.41	
			<i>For Schedule 80 Pipe, Add</i>	6.79	
23 21 13 23-0026	LF		5" Schedule 40, Threaded And Coupled, Black Steel Pipe.....	34.42	12.49
			<i>For Work In Restricted Working Space, Add</i>	5.61	
			<i>For Schedule 80 Pipe, Add</i>	8.94	
23 21 13 23-0027	LF		6" Schedule 40, Threaded And Coupled, Black Steel Pipe.....	42.85	14.77
			<i>For Work In Restricted Working Space, Add</i>	6.64	
			<i>For Schedule 80 Pipe, Add</i>	11.54	
23 21 13 23-0028	LF		8" Schedule 40, Threaded And Coupled, Black Steel Pipe.....	57.46	17.86
			<i>For Work In Restricted Working Space, Add</i>	8.02	
			<i>For Schedule 80 Pipe, Add</i>	16.51	
23 21 13 23-0029	LF		10" Schedule 40, Threaded And Coupled, Black Steel Pipe.....	76.16	21.75
			<i>For Work In Restricted Working Space, Add</i>	9.80	
			<i>For Schedule 80 Pipe, Add</i>	22.84	
23 21 13 23-0030	LF		12" Schedule 40, Threaded And Coupled, Black Steel Pipe.....	101.36	28.59
			<i>For Work In Restricted Working Space, Add</i>	12.86	
			<i>For Schedule 80 Pipe, Add</i>	30.61	
23 21 13 23-0031			Black Malleable Iron 90 Degree Elbows <small>(23 21 13 23-0014)</small>		
23 21 13 23-0032	EA		3/8", 150 LB, Black Malleable Iron 90 Degree Elbow.....	18.06	8.16
			<i>For Work In Restricted Working Space, Add</i>	4.90	
			<i>For 300 LB Rating, Add</i>	5.13	
			<i>For Standard Weight Cast Iron Fittings, Add</i>	0.03	
23 21 13 23-0033	EA		1/2", 150 LB, Black Malleable Iron 90 Degree Elbow.....	20.80	13.09
			<i>For Work In Restricted Working Space, Add</i>	5.88	
			<i>For 300 LB Rating, Add</i>	4.06	
			<i>For Standard Weight Cast Iron Fittings, Add</i>	0.02	
23 21 13 23-0034	EA		3/4", 150 LB, Black Malleable Iron 90 Degree Elbow.....	23.39	14.63
			<i>For Work In Restricted Working Space, Add</i>	6.58	
			<i>For 300 LB Rating, Add</i>	4.80	
			<i>For Standard Weight Cast Iron Fittings, Add</i>	0.02	
23 21 13 23-0035	EA		1", 150 LB, Black Malleable Iron 90 Degree Elbow.....	27.02	16.32
			<i>For Work In Restricted Working Space, Add</i>	7.35	
			<i>For 300 LB Rating, Add</i>	7.52	
			<i>For Standard Weight Cast Iron Fittings, Add</i>	0.04	
23 21 13 23-0036	EA		1-1/4", 150 LB, Black Malleable Iron 90 Degree Elbow.....	31.88	18.53
			<i>For Work In Restricted Working Space, Add</i>	8.32	
			<i>For 300 LB Rating, Add</i>	11.62	
			<i>For Standard Weight Cast Iron Fittings, Add</i>	0.07	
23 21 13 23-0037	EA		1-1/2", 150 LB, Black Malleable Iron 90 Degree Elbow.....	36.74	20.87
			<i>For Work In Restricted Working Space, Add</i>	9.38	
			<i>For 300 LB Rating, Add</i>	14.98	
			<i>For Standard Weight Cast Iron Fittings, Add</i>	0.09	
23 21 13 23-0038	EA		2", 150 LB, Black Malleable Iron 90 Degree Elbow.....	49.14	26.54
			<i>For Work In Restricted Working Space, Add</i>	11.92	
			<i>For 300 LB Rating, Add</i>	24.97	
			<i>For Standard Weight Cast Iron Fittings, Add</i>	0.15	
23 21 13 23-0039	EA		2-1/2", 150 LB, Black Malleable Iron 90 Degree Elbow.....	79.77	39.25
			<i>For Work In Restricted Working Space, Add</i>	17.64	
			<i>For 300 LB Rating, Add</i>	53.86	
			<i>For Standard Weight Cast Iron Fittings, Add</i>	0.34	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21 13 23-0040 EA 3", 150 LB, Black Malleable Iron 90 Degree Elbow <i>For Work In Restricted Working Space, Add</i> <i>For 300 LB Rating, Add</i> <i>For Standard Weight Cast Iron Fittings, Add</i>	108.06 23.21 78.30 0.49	51.60
23 21 13 23-0041 EA 4", 150 LB, Black Malleable Iron 90 Degree Elbow <i>For Work In Restricted Working Space, Add</i> <i>For 300 LB Rating, Add</i> <i>For Standard Weight Cast Iron Fittings, Add</i>	151.64 25.72 163.33 1.05	57.17
23 21 13 23-0042 EA 5", 150 LB, Black Malleable Iron 90 Degree Elbow <i>For Work In Restricted Working Space, Add</i> <i>For 300 LB Rating, Add</i> <i>For Standard Weight Cast Iron Fittings, Add</i>	282.06 26.84 467.61 3.08	59.67
23 21 13 23-0043 EA 6", 150 LB, Black Malleable Iron 90 Degree Elbow <i>For Work In Restricted Working Space, Add</i> <i>For 300 LB Rating, Add</i> <i>For Standard Weight Cast Iron Fittings, Add</i>	316.00 28.06 539.56 3.56	62.38
23 21 13 23-0044 Black Malleable Iron Reducing 90 Degree Elbows (23 21 13 23-0014)		
23 21 13 23-0045 EA 1/2" x 3/8", 150 LB, Black Malleable Iron Reducing 90 Degree Elbow <i>For Work In Restricted Working Space, Add</i> <i>For 300 LB Rating, Add</i> <i>For Standard Weight Cast Iron Fittings, Add</i>	20.25 5.39 6.57 0.04	11.98
23 21 13 23-0046 EA 3/4" x 1/2", 150 LB, Black Malleable Iron Reducing 90 Degree Elbow <i>For Work In Restricted Working Space, Add</i> <i>For 300 LB Rating, Add</i> <i>For Standard Weight Cast Iron Fittings, Add</i>	23.12 6.23 6.89 0.04	13.82
23 21 13 23-0047 EA 3/4" x 3/8", 150 LB, Black Malleable Iron Reducing 90 Degree Elbow <i>For Work In Restricted Working Space, Add</i> <i>For 300 LB Rating, Add</i> <i>For Standard Weight Cast Iron Fittings, Add</i>	22.43 5.74 9.04 0.05	12.79
23 21 13 23-0048 EA 1" x 3/4", 150 LB, Black Malleable Iron Reducing 90 Degree Elbow <i>For Work In Restricted Working Space, Add</i> <i>For 300 LB Rating, Add</i> <i>For Standard Weight Cast Iron Fittings, Add</i>	26.24 6.97 8.64 0.05	15.50
23 21 13 23-0049 EA 1" x 1/2", 150 LB, Black Malleable Iron Reducing 90 Degree Elbow <i>For Work In Restricted Working Space, Add</i> <i>For 300 LB Rating, Add</i> <i>For Standard Weight Cast Iron Fittings, Add</i>	25.31 6.62 9.15 0.05	14.70
23 21 13 23-0050 EA 1" x 3/8", 150 LB, Black Malleable Iron Reducing 90 Degree Elbow <i>For Work In Restricted Working Space, Add</i> <i>For 300 LB Rating, Add</i> <i>For Standard Weight Cast Iron Fittings, Add</i>	26.84 6.13 16.63 0.10	13.60
23 21 13 23-0051 EA 1-1/4" x 1", 150 LB, Black Malleable Iron Reducing 90 Degree Elbow <i>For Work In Restricted Working Space, Add</i> <i>For 300 LB Rating, Add</i> <i>For Standard Weight Cast Iron Fittings, Add</i>	31.19 7.83 13.76 0.08	17.42
23 21 13 23-0052 EA 1-1/4" x 3/4", 150 LB, Black Malleable Iron Reducing 90 Degree Elbow <i>For Work In Restricted Working Space, Add</i> <i>For 300 LB Rating, Add</i> <i>For Standard Weight Cast Iron Fittings, Add</i>	30.50 7.45 15.10 0.09	16.54
23 21 13 23-0053 EA 1-1/4" x 1/2", 150 LB, Black Malleable Iron Reducing 90 Degree Elbow <i>For Work In Restricted Working Space, Add</i> <i>For 300 LB Rating, Add</i> <i>For Standard Weight Cast Iron Fittings, Add</i>	30.28 7.10 17.31 0.11	15.81
23 21 13 23-0054 EA 1-1/2" x 1-1/4", 150 LB, Black Malleable Iron Reducing 90 Degree Elbow <i>For Work In Restricted Working Space, Add</i> <i>For 300 LB Rating, Add</i> <i>For Standard Weight Cast Iron Fittings, Add</i>	36.68 8.85 18.98 0.11	19.69
23 21 13 23-0055 EA 1-1/2" x 1", 150 LB, Black Malleable Iron Reducing 90 Degree Elbow <i>For Work In Restricted Working Space, Add</i> <i>For 300 LB Rating, Add</i> <i>For Standard Weight Cast Iron Fittings, Add</i>	35.05 8.36 18.88 0.11	18.60
23 21 13 23-0056 EA 1-1/2" x 3/4", 150 LB, Black Malleable Iron Reducing 90 Degree Elbow <i>For Work In Restricted Working Space, Add</i> <i>For 300 LB Rating, Add</i> <i>For Standard Weight Cast Iron Fittings, Add</i>	34.81 7.98 21.28 0.13	17.71
23 21 13 23-0057 EA 2" x 1-1/2", 150 LB, Black Malleable Iron Reducing 90 Degree Elbow <i>For Work In Restricted Working Space, Add</i> <i>For 300 LB Rating, Add</i> <i>For Standard Weight Cast Iron Fittings, Add</i>	45.89 10.65 27.07 0.17	23.66
23 21 13 23-0058 EA 2" x 1-1/4", 150 LB, Black Malleable Iron Reducing 90 Degree Elbow <i>For Work In Restricted Working Space, Add</i> <i>For 300 LB Rating, Add</i> <i>For Standard Weight Cast Iron Fittings, Add</i>	45.53 10.12 30.34 0.19	22.50
23 21 13 23-0059 EA 2" x 1", 150 LB, Black Malleable Iron Reducing 90 Degree Elbow <i>For Work In Restricted Working Space, Add</i> <i>For 300 LB Rating, Add</i> <i>For Standard Weight Cast Iron Fittings, Add</i>	43.92 9.64 30.25 0.19	21.39
23 21 13 23-0060 EA 2" x 3/4", 150 LB, Black Malleable Iron Reducing 90 Degree Elbow <i>For Work In Restricted Working Space, Add</i> <i>For 300 LB Rating, Add</i> <i>For Standard Weight Cast Iron Fittings, Add</i>	43.35 9.25 31.87 0.20	20.58

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 20 HVAC Piping And Pumps****23 21 Hydronic Piping And Pumps**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21	13 23-0061	EA	2-1/2" x 2", 150 LB, Black Malleable Iron Reducing 90 Degree Elbow	77.77	32.85
			<i>For Work In Restricted Working Space, Add</i>	14.78	
			<i>For 300 LB Rating, Add</i>	71.36	
			<i>For Standard Weight Cast Iron Fittings, Add</i>	0.46	
23 21	13 23-0062	EA	2-1/2" x 1-1/2", 150 LB, Black Malleable Iron Reducing 90 Degree Elbow	75.22	30.06
			<i>For Work In Restricted Working Space, Add</i>	13.51	
			<i>For 300 LB Rating, Add</i>	75.13	
			<i>For Standard Weight Cast Iron Fittings, Add</i>	0.48	
23 21	13 23-0063	EA	3" x 2-1/2", 150 LB, Black Malleable Iron Reducing 90 Degree Elbow	121.42	45.42
			<i>For Work In Restricted Working Space, Add</i>	20.42	
			<i>For 300 LB Rating, Add</i>	132.10	
			<i>For Standard Weight Cast Iron Fittings, Add</i>	0.85	
23 21	13 23-0064	EA	3" x 2", 150 LB, Black Malleable Iron Reducing 90 Degree Elbow.....	104.63	39.03
			<i>For Work In Restricted Working Space, Add</i>	17.57	
			<i>For 300 LB Rating, Add</i>	114.11	
			<i>For Standard Weight Cast Iron Fittings, Add</i>	0.74	
23 21	13 23-0065	EA	4" x 3", 150 LB, Black Malleable Iron Reducing 90 Degree Elbow.....	172.72	54.38
			<i>For Work In Restricted Working Space, Add</i>	24.47	
			<i>For 300 LB Rating, Add</i>	223.70	
			<i>For Standard Weight Cast Iron Fittings, Add</i>	1.46	
23 21 13 23-0066 Black Malleable Iron 45 Degree Elbows (23 21 13 23-0014)					
23 21	13 23-0067	EA	3/8", 150 LB, Black Malleable Iron 45 Degree Elbow.....	18.94	8.16
			<i>For Work In Restricted Working Space, Add</i>	4.90	
			<i>For 300 LB Rating, Add</i>	7.24	
			<i>For Standard Weight Cast Iron Fittings, Add</i>	0.04	
23 21	13 23-0068	EA	1/2", 150 LB, Black Malleable Iron 45 Degree Elbow.....	21.58	13.09
			<i>For Work In Restricted Working Space, Add</i>	5.88	
			<i>For 300 LB Rating, Add</i>	5.93	
			<i>For Standard Weight Cast Iron Fittings, Add</i>	0.03	
23 21	13 23-0069	EA	3/4", 150 LB, Black Malleable Iron 45 Degree Elbow.....	24.39	14.63
			<i>For Work In Restricted Working Space, Add</i>	6.58	
			<i>For 300 LB Rating, Add</i>	7.20	
			<i>For Standard Weight Cast Iron Fittings, Add</i>	0.04	
23 21	13 23-0070	EA	1", 150 LB, Black Malleable Iron 45 Degree Elbow.....	27.59	16.32
			<i>For Work In Restricted Working Space, Add</i>	7.35	
			<i>For 300 LB Rating, Add</i>	8.89	
			<i>For Standard Weight Cast Iron Fittings, Add</i>	0.05	
23 21	13 23-0071	EA	1-1/4", 150 LB, Black Malleable Iron 45 Degree Elbow	33.19	18.53
			<i>For Work In Restricted Working Space, Add</i>	8.32	
			<i>For 300 LB Rating, Add</i>	14.77	
			<i>For Standard Weight Cast Iron Fittings, Add</i>	0.09	
23 21	13 23-0072	EA	1-1/2", 150 LB, Black Malleable Iron 45 Degree Elbow	38.04	20.87
			<i>For Work In Restricted Working Space, Add</i>	9.38	
			<i>For 300 LB Rating, Add</i>	18.10	
			<i>For Standard Weight Cast Iron Fittings, Add</i>	0.11	
23 21	13 23-0073	EA	2", 150 LB, Black Malleable Iron 45 Degree Elbow.....	49.95	26.54
			<i>For Work In Restricted Working Space, Add</i>	11.92	
			<i>For 300 LB Rating, Add</i>	26.91	
			<i>For Standard Weight Cast Iron Fittings, Add</i>	0.16	
23 21	13 23-0074	EA	2-1/2", 150 LB, Black Malleable Iron 45 Degree Elbow	88.37	39.25
			<i>For Work In Restricted Working Space, Add</i>	17.64	
			<i>For 300 LB Rating, Add</i>	74.50	
			<i>For Standard Weight Cast Iron Fittings, Add</i>	0.47	
23 21	13 23-0075	EA	3", 150 LB, Black Malleable Iron 45 Degree Elbow.....	115.78	51.60
			<i>For Work In Restricted Working Space, Add</i>	23.21	
			<i>For 300 LB Rating, Add</i>	96.83	
			<i>For Standard Weight Cast Iron Fittings, Add</i>	0.61	
23 21	13 23-0076	EA	4", 150 LB, Black Malleable Iron 45 Degree Elbow.....	161.05	57.17
			<i>For Work In Restricted Working Space, Add</i>	25.72	
			<i>For 300 LB Rating, Add</i>	185.91	
			<i>For Standard Weight Cast Iron Fittings, Add</i>	1.21	
23 21	13 23-0077	EA	5", 150 LB, Black Malleable Iron 45 Degree Elbow.....	386.96	59.67
			<i>For Work In Restricted Working Space, Add</i>	26.84	
			<i>For 300 LB Rating, Add</i>	719.37	
			<i>For Standard Weight Cast Iron Fittings, Add</i>	4.76	
23 21	13 23-0078	EA	6", 150 LB, Black Malleable Iron 45 Degree Elbow.....	397.90	62.38
			<i>For Work In Restricted Working Space, Add</i>	28.06	
			<i>For 300 LB Rating, Add</i>	736.12	
			<i>For Standard Weight Cast Iron Fittings, Add</i>	4.87	
23 21 13 23-0079 Black Malleable Iron Tees (23 21 13 23-0014)					
23 21	13 23-0080	EA	3/8", 150 LB, Black Malleable Iron Tee.....	22.94	10.22
			<i>For Work In Restricted Working Space, Add</i>	6.13	
			<i>For 300 LB Rating, Add</i>	7.27	
			<i>For Standard Weight Cast Iron Fittings, Add</i>	0.04	
23 21	13 23-0081	EA	1/2", 150 LB, Black Malleable Iron Tee.....	26.11	16.32
			<i>For Work In Restricted Working Space, Add</i>	7.35	
			<i>For 300 LB Rating, Add</i>	5.33	
			<i>For Standard Weight Cast Iron Fittings, Add</i>	0.03	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21 13 23-0082 EA 3/4", 150 LB, Black Malleable Iron Tee.....	30.57	18.89
<i>For Work In Restricted Working Space, Add</i>	8.48	
<i>For 300 LB Rating, Add</i>	7.22	
<i>For Standard Weight Cast Iron Fittings, Add</i>	0.04	
23 21 13 23-0083 EA 1", 150 LB, Black Malleable Iron Tee.....	37.36	22.27
<i>For Work In Restricted Working Space, Add</i>	10.02	
<i>For 300 LB Rating, Add</i>	11.48	
<i>For Standard Weight Cast Iron Fittings, Add</i>	0.06	
23 21 13 23-0084 EA 1-1/4", 150 LB, Black Malleable Iron Tee.....	46.12	26.54
<i>For Work In Restricted Working Space, Add</i>	11.92	
<i>For 300 LB Rating, Add</i>	17.72	
<i>For Standard Weight Cast Iron Fittings, Add</i>	0.10	
23 21 13 23-0085 EA 1-1/2", 150 LB, Black Malleable Iron Tee.....	55.37	31.60
<i>For Work In Restricted Working Space, Add</i>	14.23	
<i>For 300 LB Rating, Add</i>	21.93	
<i>For Standard Weight Cast Iron Fittings, Add</i>	0.13	
23 21 13 23-0086 EA 2", 150 LB, Black Malleable Iron Tee.....	72.34	39.25
<i>For Work In Restricted Working Space, Add</i>	17.64	
<i>For 300 LB Rating, Add</i>	36.02	
<i>For Standard Weight Cast Iron Fittings, Add</i>	0.22	
23 21 13 23-0087 EA 2-1/2", 150 LB, Black Malleable Iron Tee.....	106.57	51.60
<i>For Work In Restricted Working Space, Add</i>	23.21	
<i>For 300 LB Rating, Add</i>	74.72	
<i>For Standard Weight Cast Iron Fittings, Add</i>	0.47	
23 21 13 23-0088 EA 3", 150 LB, Black Malleable Iron Tee.....	134.89	61.30
<i>For Work In Restricted Working Space, Add</i>	27.56	
<i>For 300 LB Rating, Add</i>	108.74	
<i>For Standard Weight Cast Iron Fittings, Add</i>	0.69	
23 21 13 23-0089 EA 4", 150 LB, Black Malleable Iron Tee.....	212.25	72.23
<i>For Work In Restricted Working Space, Add</i>	32.49	
<i>For 300 LB Rating, Add</i>	256.00	
<i>For Standard Weight Cast Iron Fittings, Add</i>	1.66	
23 21 13 23-0090 EA 5", 150 LB, Black Malleable Iron Tee.....	443.63	85.76
<i>For Work In Restricted Working Space, Add</i>	38.58	
<i>For 300 LB Rating, Add</i>	763.79	
<i>For Standard Weight Cast Iron Fittings, Add</i>	5.04	
23 21 13 23-0091 EA 6", 150 LB, Black Malleable Iron Tee.....	485.04	98.03
<i>For Work In Restricted Working Space, Add</i>	44.09	
<i>For 300 LB Rating, Add</i>	820.21	
<i>For Standard Weight Cast Iron Fittings, Add</i>	5.41	
23 21 13 23-0092 Black Malleable Iron Reducing Tees (23 21 13 23-0014)		
23 21 13 23-0093 EA 1/2", 150 LB, Black Malleable Iron Reducing Tee.....	27.23	16.32
<i>For Work In Restricted Working Space, Add</i>	7.35	
<i>For 300 LB Rating, Add</i>	8.02	
<i>For Standard Weight Cast Iron Fittings, Add</i>	0.04	
23 21 13 23-0094 EA 3/4", 150 LB, Black Malleable Iron Reducing Tee.....	31.83	18.89
<i>For Work In Restricted Working Space, Add</i>	8.48	
<i>For 300 LB Rating, Add</i>	10.24	
<i>For Standard Weight Cast Iron Fittings, Add</i>	0.06	
23 21 13 23-0095 EA 1", 150 LB, Black Malleable Iron Reducing Tee.....	37.91	22.27
<i>For Work In Restricted Working Space, Add</i>	10.02	
<i>For 300 LB Rating, Add</i>	12.80	
<i>For Standard Weight Cast Iron Fittings, Add</i>	0.07	
23 21 13 23-0096 EA 1-1/4", 150 LB, Black Malleable Iron Reducing Tee.....	48.57	26.54
<i>For Work In Restricted Working Space, Add</i>	11.92	
<i>For 300 LB Rating, Add</i>	23.60	
<i>For Standard Weight Cast Iron Fittings, Add</i>	0.14	
23 21 13 23-0097 EA 1-1/2", 150 LB, Black Malleable Iron Reducing Tee.....	57.21	31.60
<i>For Work In Restricted Working Space, Add</i>	14.23	
<i>For 300 LB Rating, Add</i>	26.34	
<i>For Standard Weight Cast Iron Fittings, Add</i>	0.16	
23 21 13 23-0098 EA 2", 150 LB, Black Malleable Iron Reducing Tee.....	73.02	39.25
<i>For Work In Restricted Working Space, Add</i>	17.64	
<i>For 300 LB Rating, Add</i>	37.66	
<i>For Standard Weight Cast Iron Fittings, Add</i>	0.23	
23 21 13 23-0099 EA 2-1/2", 150 LB, Black Malleable Iron Reducing Tee.....	121.66	51.60
<i>For Work In Restricted Working Space, Add</i>	23.21	
<i>For 300 LB Rating, Add</i>	110.94	
<i>For Standard Weight Cast Iron Fittings, Add</i>	0.71	
23 21 13 23-0100 EA 3", 150 LB, Black Malleable Iron Reducing Tee.....	142.61	61.30
<i>For Work In Restricted Working Space, Add</i>	27.56	
<i>For 300 LB Rating, Add</i>	127.26	
<i>For Standard Weight Cast Iron Fittings, Add</i>	0.81	
23 21 13 23-0101 EA 4", 150 LB, Black Malleable Iron Reducing Tee.....	231.33	72.23
<i>For Work In Restricted Working Space, Add</i>	32.49	
<i>For 300 LB Rating, Add</i>	301.79	
<i>For Standard Weight Cast Iron Fittings, Add</i>	1.97	
23 21 13 23-0102 EA 5", 150 LB, Black Malleable Iron Reducing Tee.....	413.99	85.76
<i>For Work In Restricted Working Space, Add</i>	38.58	
<i>For 300 LB Rating, Add</i>	692.65	
<i>For Standard Weight Cast Iron Fittings, Add</i>	4.57	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 20 HVAC Piping And Pumps****23 21 Hydronic Piping And Pumps**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21	13 23-0103	EA	6", 150 LB, Black Malleable Iron Reducing Tee.....	470.65	98.03
			<i>For Work In Restricted Working Space, Add</i>	44.09	
			<i>For 300 LB Rating, Add</i>	785.67	
			<i>For Standard Weight Cast Iron Fittings, Add</i>	5.18	
23 21	13 23-0104		Black Malleable Iron Couplings (23 21 13 23-0014)		
23 21	13 23-0105	EA	3/8", 150 LB, Black Malleable Iron Coupling.....	18.49	8.16
			<i>For Work In Restricted Working Space, Add</i>	4.90	
			<i>For 300 LB Rating, Add</i>	6.16	
			<i>For Standard Weight Cast Iron Fittings, Add</i>	0.03	
23 21	13 23-0106	EA	1/2", 150 LB, Black Malleable Iron Coupling.....	21.26	13.09
			<i>For Work In Restricted Working Space, Add</i>	5.88	
			<i>For 300 LB Rating, Add</i>	5.16	
			<i>For Standard Weight Cast Iron Fittings, Add</i>	0.03	
23 21	13 23-0107	EA	3/4", 150 LB, Black Malleable Iron Coupling.....	23.88	14.63
			<i>For Work In Restricted Working Space, Add</i>	6.58	
			<i>For 300 LB Rating, Add</i>	5.97	
			<i>For Standard Weight Cast Iron Fittings, Add</i>	0.03	
23 21	13 23-0108	EA	1", 150 LB, Black Malleable Iron Coupling.....	27.41	16.32
			<i>For Work In Restricted Working Space, Add</i>	7.35	
			<i>For 300 LB Rating, Add</i>	8.45	
			<i>For Standard Weight Cast Iron Fittings, Add</i>	0.05	
23 21	13 23-0109	EA	1-1/4", 150 LB, Black Malleable Iron Coupling.....	31.50	18.53
			<i>For Work In Restricted Working Space, Add</i>	8.32	
			<i>For 300 LB Rating, Add</i>	10.71	
			<i>For Standard Weight Cast Iron Fittings, Add</i>	0.06	
23 21	13 23-0110	EA	1-1/2", 150 LB, Black Malleable Iron Coupling.....	36.37	20.87
			<i>For Work In Restricted Working Space, Add</i>	9.38	
			<i>For 300 LB Rating, Add</i>	14.09	
			<i>For Standard Weight Cast Iron Fittings, Add</i>	0.08	
23 21	13 23-0111	EA	2", 150 LB, Black Malleable Iron Coupling.....	47.28	26.54
			<i>For Work In Restricted Working Space, Add</i>	11.92	
			<i>For 300 LB Rating, Add</i>	20.50	
			<i>For Standard Weight Cast Iron Fittings, Add</i>	0.12	
23 21	13 23-0112	EA	2-1/2", 150 LB, Black Malleable Iron Coupling.....	79.64	39.25
			<i>For Work In Restricted Working Space, Add</i>	17.64	
			<i>For 300 LB Rating, Add</i>	53.54	
			<i>For Standard Weight Cast Iron Fittings, Add</i>	0.33	
23 21	13 23-0113	EA	3", 150 LB, Black Malleable Iron Coupling.....	105.54	51.60
			<i>For Work In Restricted Working Space, Add</i>	23.21	
			<i>For 300 LB Rating, Add</i>	72.25	
			<i>For Standard Weight Cast Iron Fittings, Add</i>	0.45	
23 21	13 23-0114	EA	4", 150 LB, Black Malleable Iron Coupling.....	142.46	57.17
			<i>For Work In Restricted Working Space, Add</i>	25.72	
			<i>For 300 LB Rating, Add</i>	141.30	
			<i>For Standard Weight Cast Iron Fittings, Add</i>	0.91	
23 21	13 23-0115	EA	5", 150 LB, Black Malleable Iron Coupling.....	249.21	59.67
			<i>For Work In Restricted Working Space, Add</i>	26.84	
			<i>For 300 LB Rating, Add</i>	388.77	
			<i>For Standard Weight Cast Iron Fittings, Add</i>	2.56	
23 21	13 23-0116	EA	6", 150 LB, Black Malleable Iron Coupling.....	275.51	62.38
			<i>For Work In Restricted Working Space, Add</i>	28.06	
			<i>For 300 LB Rating, Add</i>	442.39	
			<i>For Standard Weight Cast Iron Fittings, Add</i>	2.91	
23 21	13 23-0117		Black Malleable Iron Reducing Couplings (23 21 13 23-0014)		
23 21	13 23-0118	EA	1/2", 150 LB, Black Malleable Iron Reducing Coupling.....	21.66	13.09
			<i>For Work In Restricted Working Space, Add</i>	5.88	
			<i>For 300 LB Rating, Add</i>	6.12	
			<i>For Standard Weight Cast Iron Fittings, Add</i>	0.03	
23 21	13 23-0119	EA	3/4", 150 LB, Black Malleable Iron Reducing Coupling.....	24.12	14.63
			<i>For Work In Restricted Working Space, Add</i>	6.58	
			<i>For 300 LB Rating, Add</i>	6.55	
			<i>For Standard Weight Cast Iron Fittings, Add</i>	0.03	
23 21	13 23-0120	EA	1", 150 LB, Black Malleable Iron Reducing Coupling.....	27.90	16.32
			<i>For Work In Restricted Working Space, Add</i>	7.35	
			<i>For 300 LB Rating, Add</i>	9.63	
			<i>For Standard Weight Cast Iron Fittings, Add</i>	0.05	
23 21	13 23-0121	EA	1-1/4", 150 LB, Black Malleable Iron Reducing Coupling.....	32.10	18.53
			<i>For Work In Restricted Working Space, Add</i>	8.32	
			<i>For 300 LB Rating, Add</i>	12.15	
			<i>For Standard Weight Cast Iron Fittings, Add</i>	0.07	
23 21	13 23-0122	EA	1-1/2", 150 LB, Black Malleable Iron Reducing Coupling.....	36.80	20.87
			<i>For Work In Restricted Working Space, Add</i>	9.38	
			<i>For 300 LB Rating, Add</i>	15.12	
			<i>For Standard Weight Cast Iron Fittings, Add</i>	0.09	
23 21	13 23-0123	EA	2", 150 LB, Black Malleable Iron Reducing Coupling.....	47.73	26.54
			<i>For Work In Restricted Working Space, Add</i>	11.92	
			<i>For 300 LB Rating, Add</i>	21.58	
			<i>For Standard Weight Cast Iron Fittings, Add</i>	0.13	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21 13 23-0124 EA 2-1/2", 150 LB, Black Malleable Iron Reducing Coupling..... <i>For Work In Restricted Working Space, Add</i> <i>For 300 LB Rating, Add</i> <i>For Standard Weight Cast Iron Fittings, Add</i>	82.45 17.64 60.29 0.38	39.25
23 21 13 23-0125 EA 3", 150 LB, Black Malleable Iron Reducing Coupling..... <i>For Work In Restricted Working Space, Add</i> <i>For 300 LB Rating, Add</i> <i>For Standard Weight Cast Iron Fittings, Add</i>	106.12 23.21 73.64 0.46	51.60
23 21 13 23-0126 EA 4", 150 LB, Black Malleable Iron Reducing Coupling..... <i>For Work In Restricted Working Space, Add</i> <i>For 300 LB Rating, Add</i> <i>For Standard Weight Cast Iron Fittings, Add</i>	143.35 25.72 143.43 0.92	57.17
23 21 13 23-0127 EA 5", 150 LB, Black Malleable Iron Reducing Coupling..... <i>For Work In Restricted Working Space, Add</i> <i>For 300 LB Rating, Add</i> <i>For Standard Weight Cast Iron Fittings, Add</i>	218.97 26.84 316.19 2.07	59.67
23 21 13 23-0128 EA 6", 150 LB, Black Malleable Iron Reducing Coupling..... <i>For Work In Restricted Working Space, Add</i> <i>For 300 LB Rating, Add</i> <i>For Standard Weight Cast Iron Fittings, Add</i>	259.86 28.06 404.83 2.66	62.38
23 21 13 23-0129 Black Malleable Iron Caps (23 21 13 23-0014)		
23 21 13 23-0130 EA 1/2", 150 LB, Black Malleable Iron Cap <i>For Work In Restricted Working Space, Add</i> <i>For 300 LB Rating, Add</i> <i>For Standard Weight Cast Iron Fittings, Add</i>	10.41 2.76 3.48 0.02	6.10
23 21 13 23-0131 EA 3/4", 150 LB, Black Malleable Iron Cap <i>For Work In Restricted Working Space, Add</i> <i>For 300 LB Rating, Add</i> <i>For Standard Weight Cast Iron Fittings, Add</i>	11.44 2.94 4.52 0.03	6.54
23 21 13 23-0132 EA 1", 150 LB, Black Malleable Iron Cap <i>For Work In Restricted Working Space, Add</i> <i>For 300 LB Rating, Add</i> <i>For Standard Weight Cast Iron Fittings, Add</i>	13.29 3.39 5.45 0.03	7.58
23 21 13 23-0133 EA 1-1/4", 150 LB, Black Malleable Iron Cap <i>For Work In Restricted Working Space, Add</i> <i>For 300 LB Rating, Add</i> <i>For Standard Weight Cast Iron Fittings, Add</i>	14.87 3.68 7.02 0.04	8.16
23 21 13 23-0134 EA 1-1/2", 150 LB, Black Malleable Iron Cap <i>For Work In Restricted Working Space, Add</i> <i>For 300 LB Rating, Add</i> <i>For Standard Weight Cast Iron Fittings, Add</i>	15.85 3.68 9.38 0.06	8.16
23 21 13 23-0135 EA 2", 150 LB, Black Malleable Iron Cap <i>For Work In Restricted Working Space, Add</i> <i>For 300 LB Rating, Add</i> <i>For Standard Weight Cast Iron Fittings, Add</i>	21.07 4.74 13.57 0.08	10.51
23 21 13 23-0136 EA 2-1/2", 150 LB, Black Malleable Iron Cap <i>For Work In Restricted Working Space, Add</i> <i>For 300 LB Rating, Add</i> <i>For Standard Weight Cast Iron Fittings, Add</i>	31.66 5.88 30.12 0.19	13.09
23 21 13 23-0137 EA 3", 150 LB, Black Malleable Iron Cap <i>For Work In Restricted Working Space, Add</i> <i>For 300 LB Rating, Add</i> <i>For Standard Weight Cast Iron Fittings, Add</i>	41.49 7.11 44.09 0.28	15.81
23 21 13 23-0138 EA 4", 150 LB, Black Malleable Iron Cap <i>For Work In Restricted Working Space, Add</i> <i>For 300 LB Rating, Add</i> <i>For Standard Weight Cast Iron Fittings, Add</i>	59.89 8.82 74.96 0.49	19.62
23 21 13 23-0139 EA 5", 150 LB, Black Malleable Iron Cap <i>For Work In Restricted Working Space, Add</i> <i>For 300 LB Rating, Add</i> <i>For Standard Weight Cast Iron Fittings, Add</i>	109.42 11.02 176.64 1.16	24.54
23 21 13 23-0140 EA 6", 150 LB, Black Malleable Iron Cap <i>For Work In Restricted Working Space, Add</i> <i>For 300 LB Rating, Add</i> <i>For Standard Weight Cast Iron Fittings, Add</i>	177.02 13.13 322.40 2.13	29.17
23 21 13 23-0141 Black Malleable Iron Unions (23 21 13 23-0014)		
23 21 13 23-0142 EA 3/8", 150 LB, Black Malleable Iron Union..... <i>For Work In Restricted Working Space, Add</i>	22.15 4.90	8.16
23 21 13 23-0143 EA 1/2", 150 LB, Black Malleable Iron Union..... <i>For Work In Restricted Working Space, Add</i>	29.77 7.35	16.32
23 21 13 23-0144 EA 3/4", 150 LB, Black Malleable Iron Union..... <i>For Work In Restricted Working Space, Add</i>	34.33 8.48	18.89
23 21 13 23-0145 EA 1", 150 LB, Black Malleable Iron Union..... <i>For Work In Restricted Working Space, Add</i>	41.31 10.02	22.27
23 21 13 23-0146 EA 1-1/4", 150 LB, Black Malleable Iron Union <i>For Work In Restricted Working Space, Add</i>	51.06 11.92	26.54
23 21 13 23-0147 EA 1-1/2", 150 LB, Black Malleable Iron Union <i>For Work In Restricted Working Space, Add</i>	61.54 14.23	31.60
23 21 13 23-0148 EA 2", 150 LB, Black Malleable Iron Union..... <i>For Work In Restricted Working Space, Add</i>	75.22 17.64	39.25

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 20 HVAC Piping And Pumps****23 21 Hydronic Piping And Pumps**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21	13 23-0149	EA	2-1/2", 150 LB, Black Malleable Iron Union..... <i>For Work In Restricted Working Space, Add</i>	135.72 26.04	57.85
23 21	13 23-0150	EA	3", 150 LB, Black Malleable Iron Union..... <i>For Work In Restricted Working Space, Add</i>	185.48 37.98	84.38
23 21	13 23-0151	EA	3/8", 250 LB, Black Malleable Iron Union..... <i>For Work In Restricted Working Space, Add</i>	24.03 4.90	8.16
23 21	13 23-0152	EA	1/2", 250 LB, Black Malleable Iron Union..... <i>For Work In Restricted Working Space, Add</i>	33.33 7.35	16.32
23 21	13 23-0153	EA	3/4", 250 LB, Black Malleable Iron Union..... <i>For Work In Restricted Working Space, Add</i>	36.95 8.48	18.89
23 21	13 23-0154	EA	1", 250 LB, Black Malleable Iron Union..... <i>For Work In Restricted Working Space, Add</i>	44.07 10.02	22.27
23 21	13 23-0155	EA	1-1/4", 250 LB, Black Malleable Iron Union..... <i>For Work In Restricted Working Space, Add</i>	57.61 11.92	26.54
23 21	13 23-0156	EA	1-1/2", 250 LB, Black Malleable Iron Union..... <i>For Work In Restricted Working Space, Add</i>	68.00 14.23	31.60
23 21	13 23-0157	EA	2", 250 LB, Black Malleable Iron Union..... <i>For Work In Restricted Working Space, Add</i>	85.21 17.64	39.25
23 21	13 23-0158	EA	2-1/2", 250 LB, Black Malleable Iron Union..... <i>For Work In Restricted Working Space, Add</i>	169.58 26.04	57.85
23 21	13 23-0159	EA	3", 250 LB, Black Malleable Iron Union..... <i>For Work In Restricted Working Space, Add</i>	211.08 34.26	76.07
23 21	13 23-0160	EA	4", 250 LB, Black Malleable Iron Union..... <i>For Work In Restricted Working Space, Add</i>	298.25 37.97	84.36
23 21	13 23-0161	EA	3/8", 300 LB, Black Malleable Iron Union..... <i>For Work In Restricted Working Space, Add</i>	28.82 4.90	8.16
23 21	13 23-0162	EA	1/2", 300 LB, Black Malleable Iron Union..... <i>For Work In Restricted Working Space, Add</i>	34.60 7.35	16.32
23 21	13 23-0163	EA	3/4", 300 LB, Black Malleable Iron Union..... <i>For Work In Restricted Working Space, Add</i>	39.46 8.48	18.89
23 21	13 23-0164	EA	1", 300 LB, Black Malleable Iron Union..... <i>For Work In Restricted Working Space, Add</i>	48.02 10.02	22.27
23 21	13 23-0165	EA	1-1/4", 300 LB, Black Malleable Iron Union..... <i>For Work In Restricted Working Space, Add</i>	63.55 11.92	26.54
23 21	13 23-0166	EA	1-1/2", 300 LB, Black Malleable Iron Union..... <i>For Work In Restricted Working Space, Add</i>	72.37 14.23	31.60
23 21	13 23-0167	EA	2", 300 LB, Black Malleable Iron Union..... <i>For Work In Restricted Working Space, Add</i>	89.70 17.64	39.25
23 21	13 23-0168	EA	2-1/2", 300 LB, Black Malleable Iron Union..... <i>For Work In Restricted Working Space, Add</i>	186.44 26.04	57.85
23 21	13 23-0169	EA	3", 300 LB, Black Malleable Iron Union..... <i>For Work In Restricted Working Space, Add</i>	243.10 34.26	76.07
23 21	13 23-0170	EA	4", 300 LB, Black Malleable Iron Union..... <i>For Work In Restricted Working Space, Add</i>	535.63 37.97	84.36
23 21	13 23-0171		Black Steel Nipples (23 21 13 23-0014)		
23 21	13 23-0172	EA	3/8" x Close, Schedule 40 Black Steel Nipple..... <i>For Schedule 80 Nipples, Add</i> <i>For Work In Restricted Working Space, Add</i>	11.11 0.31 3.15	6.98
23 21	13 23-0173	EA	1/2" x Close, Schedule 40 Black Steel Nipple..... <i>For Schedule 80 Nipples, Add</i> <i>For Work In Restricted Working Space, Add</i>	11.02 0.26 3.15	6.98
23 21	13 23-0174	EA	3/4" x Close, Schedule 40 Black Steel Nipple..... <i>For Schedule 80 Nipples, Add</i> <i>For Work In Restricted Working Space, Add</i>	11.09 0.30 3.15	6.98
23 21	13 23-0175	EA	1" x Close, Schedule 40 Black Steel Nipple..... <i>For Schedule 80 Nipples, Add</i> <i>For Work In Restricted Working Space, Add</i>	12.16 0.43 3.39	7.58
23 21	13 23-0176	EA	1-1/4" x Close, Schedule 40 Black Steel Nipple..... <i>For Schedule 80 Nipples, Add</i> <i>For Work In Restricted Working Space, Add</i>	13.34 0.55 3.68	8.16
23 21	13 23-0177	EA	1-1/2" x Close, Schedule 40 Black Steel Nipple..... <i>For Schedule 80 Nipples, Add</i> <i>For Work In Restricted Working Space, Add</i>	13.61 0.68 3.68	8.16
23 21	13 23-0178	EA	2" x Close, Schedule 40 Black Steel Nipple..... <i>For Schedule 80 Nipples, Add</i> <i>For Work In Restricted Working Space, Add</i>	17.66 0.93 4.74	10.51
23 21	13 23-0179	EA	2-1/2" x Close, Schedule 40 Black Steel Nipple..... <i>For Schedule 80 Nipples, Add</i> <i>For Work In Restricted Working Space, Add</i>	25.38 2.89 5.88	13.09
23 21	13 23-0180	EA	3" x Close, Schedule 40 Black Steel Nipple..... <i>For Schedule 80 Nipples, Add</i> <i>For Work In Restricted Working Space, Add</i>	30.58 3.44 7.11	15.81
23 21	13 23-0181	EA	4" x Close, Schedule 40 Black Steel Nipple..... <i>For Schedule 80 Nipples, Add</i> <i>For Work In Restricted Working Space, Add</i>	39.74 5.18 8.82	19.62
23 21	13 23-0182	EA	3/8" x 1-1/2" Long, Schedule 40 Black Steel Nipple..... <i>For Schedule 80 Nipples, Add</i> <i>For Work In Restricted Working Space, Add</i>	11.19 0.35 3.15	6.98
23 21	13 23-0183	EA	1/2" x 1-1/2" Long, Schedule 40 Black Steel Nipple..... <i>For Schedule 80 Nipples, Add</i> <i>For Work In Restricted Working Space, Add</i>	11.02 0.26 3.15	6.98



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21 13 23-0184 EA 3/4" x 1-1/2" Long, Schedule 40 Black Steel Nipple	11.14	6.98
<i>For Schedule 80 Nipples, Add</i>	0.32	
<i>For Work In Restricted Working Space, Add</i>	3.15	
23 21 13 23-0185 EA 3/8" x 2" Long, Schedule 40 Black Steel Nipple.....	11.19	6.98
<i>For Schedule 80 Nipples, Add</i>	0.35	
<i>For Work In Restricted Working Space, Add</i>	3.15	
23 21 13 23-0186 EA 1/2" x 2" Long, Schedule 40 Black Steel Nipple.....	11.02	6.98
<i>For Schedule 80 Nipples, Add</i>	0.26	
<i>For Work In Restricted Working Space, Add</i>	3.15	
23 21 13 23-0187 EA 3/4" x 2" Long, Schedule 40 Black Steel Nipple.....	11.14	6.98
<i>For Schedule 80 Nipples, Add</i>	0.32	
<i>For Work In Restricted Working Space, Add</i>	3.15	
23 21 13 23-0188 EA 1" x 2" Long, Schedule 40 Black Steel Nipple.....	12.24	7.58
<i>For Schedule 80 Nipples, Add</i>	0.47	
<i>For Work In Restricted Working Space, Add</i>	3.39	
23 21 13 23-0189 EA 1-1/4" x 2" Long, Schedule 40 Black Steel Nipple	13.49	8.16
<i>For Schedule 80 Nipples, Add</i>	0.62	
<i>For Work In Restricted Working Space, Add</i>	3.68	
23 21 13 23-0190 EA 1-1/2" x 2" Long, Schedule 40 Black Steel Nipple	13.72	8.16
<i>For Schedule 80 Nipples, Add</i>	0.74	
<i>For Work In Restricted Working Space, Add</i>	3.68	
23 21 13 23-0191 EA 3/8" x 2-1/2" Long, Schedule 40 Black Steel Nipple	11.39	6.98
<i>For Schedule 80 Nipples, Add</i>	0.45	
<i>For Work In Restricted Working Space, Add</i>	3.15	
23 21 13 23-0192 EA 1/2" x 2-1/2" Long, Schedule 40 Black Steel Nipple	11.11	6.98
<i>For Schedule 80 Nipples, Add</i>	0.31	
<i>For Work In Restricted Working Space, Add</i>	3.15	
23 21 13 23-0193 EA 3/4" x 2-1/2" Long, Schedule 40 Black Steel Nipple	11.22	6.98
<i>For Schedule 80 Nipples, Add</i>	0.36	
<i>For Work In Restricted Working Space, Add</i>	3.15	
23 21 13 23-0194 EA 1" x 2-1/2" Long, Schedule 40 Black Steel Nipple	12.30	7.58
<i>For Schedule 80 Nipples, Add</i>	0.50	
<i>For Work In Restricted Working Space, Add</i>	3.39	
23 21 13 23-0195 EA 1-1/4" x 2-1/2" Long, Schedule 40 Black Steel Nipple	13.56	8.16
<i>For Schedule 80 Nipples, Add</i>	0.66	
<i>For Work In Restricted Working Space, Add</i>	3.68	
23 21 13 23-0196 EA 1-1/2" x 2-1/2" Long, Schedule 40 Black Steel Nipple	13.89	8.16
<i>For Schedule 80 Nipples, Add</i>	0.82	
<i>For Work In Restricted Working Space, Add</i>	3.68	
23 21 13 23-0197 EA 2" x 2-1/2" Long, Schedule 40 Black Steel Nipple	17.93	10.51
<i>For Schedule 80 Nipples, Add</i>	1.06	
<i>For Work In Restricted Working Space, Add</i>	4.74	
23 21 13 23-0198 EA 3/8" x 3" Long, Schedule 40 Black Steel Nipple.....	11.39	6.98
<i>For Schedule 80 Nipples, Add</i>	0.45	
<i>For Work In Restricted Working Space, Add</i>	3.15	
23 21 13 23-0199 EA 1/2" x 3" Long, Schedule 40 Black Steel Nipple.....	11.11	6.98
<i>For Schedule 80 Nipples, Add</i>	0.31	
<i>For Work In Restricted Working Space, Add</i>	3.15	
23 21 13 23-0200 EA 3/4" x 3" Long, Schedule 40 Black Steel Nipple.....	11.22	6.98
<i>For Schedule 80 Nipples, Add</i>	0.36	
<i>For Work In Restricted Working Space, Add</i>	3.15	
23 21 13 23-0201 EA 1" x 3" Long, Schedule 40 Black Steel Nipple.....	12.30	7.58
<i>For Schedule 80 Nipples, Add</i>	0.50	
<i>For Work In Restricted Working Space, Add</i>	3.39	
23 21 13 23-0202 EA 1-1/4" x 3" Long, Schedule 40 Black Steel Nipple	13.56	8.16
<i>For Schedule 80 Nipples, Add</i>	0.66	
<i>For Work In Restricted Working Space, Add</i>	3.68	
23 21 13 23-0203 EA 1-1/2" x 3" Long, Schedule 40 Black Steel Nipple	13.89	8.16
<i>For Schedule 80 Nipples, Add</i>	0.82	
<i>For Work In Restricted Working Space, Add</i>	3.68	
23 21 13 23-0204 EA 2" x 3" Long, Schedule 40 Black Steel Nipple.....	17.93	10.51
<i>For Schedule 80 Nipples, Add</i>	1.06	
<i>For Work In Restricted Working Space, Add</i>	4.74	
23 21 13 23-0205 EA 2-1/2" x 3" Long, Schedule 40 Black Steel Nipple	25.54	13.09
<i>For Schedule 80 Nipples, Add</i>	2.97	
<i>For Work In Restricted Working Space, Add</i>	5.88	
23 21 13 23-0206 EA 3" x 3" Long, Schedule 40 Black Steel Nipple.....	31.18	15.81
<i>For Schedule 80 Nipples, Add</i>	3.74	
<i>For Work In Restricted Working Space, Add</i>	7.11	
23 21 13 23-0207 EA 3/8" x 3-1/2" Long, Schedule 40 Black Steel Nipple	11.55	6.98
<i>For Schedule 80 Nipples, Add</i>	0.53	
<i>For Work In Restricted Working Space, Add</i>	3.15	
23 21 13 23-0208 EA 1/2" x 3-1/2" Long, Schedule 40 Black Steel Nipple	11.23	6.98
<i>For Schedule 80 Nipples, Add</i>	0.37	
<i>For Work In Restricted Working Space, Add</i>	3.15	
23 21 13 23-0209 EA 3/4" x 3-1/2" Long, Schedule 40 Black Steel Nipple	11.39	6.98
<i>For Schedule 80 Nipples, Add</i>	0.45	
<i>For Work In Restricted Working Space, Add</i>	3.15	
23 21 13 23-0210 EA 1" x 3-1/2" Long, Schedule 40 Black Steel Nipple	12.54	7.58
<i>For Schedule 80 Nipples, Add</i>	0.62	
<i>For Work In Restricted Working Space, Add</i>	3.39	
23 21 13 23-0211 EA 1-1/4" x 3-1/2" Long, Schedule 40 Black Steel Nipple	13.80	8.16
<i>For Schedule 80 Nipples, Add</i>	0.78	
<i>For Work In Restricted Working Space, Add</i>	3.68	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 20 HVAC Piping And Pumps****23 21 Hydronic Piping And Pumps**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21	13 23-0212	EA	1-1/2" x 3-1/2" Long, Schedule 40 Black Steel Nipple	14.08	8.16
			<i>For Schedule 80 Nipples, Add</i>	0.92	
			<i>For Work In Restricted Working Space, Add</i>	3.68	
23 21	13 23-0213	EA	2" x 3-1/2" Long, Schedule 40 Black Steel Nipple.....	18.38	10.51
			<i>For Schedule 80 Nipples, Add</i>	1.29	
			<i>For Work In Restricted Working Space, Add</i>	4.74	
23 21	13 23-0214	EA	2-1/2" x 3-1/2" Long, Schedule 40 Black Steel Nipple	26.58	13.09
			<i>For Schedule 80 Nipples, Add</i>	3.49	
			<i>For Work In Restricted Working Space, Add</i>	5.88	
23 21	13 23-0215	EA	3" x 3-1/2" Long, Schedule 40 Black Steel Nipple.....	32.56	15.81
			<i>For Schedule 80 Nipples, Add</i>	4.43	
			<i>For Work In Restricted Working Space, Add</i>	7.11	
23 21	13 23-0216	EA	3/8" x 4" Long, Schedule 40 Black Steel Nipple.....	11.55	6.98
			<i>For Schedule 80 Nipples, Add</i>	0.53	
			<i>For Work In Restricted Working Space, Add</i>	3.15	
23 21	13 23-0217	EA	1/2" x 4" Long, Schedule 40 Black Steel Nipple.....	11.23	6.98
			<i>For Schedule 80 Nipples, Add</i>	0.37	
			<i>For Work In Restricted Working Space, Add</i>	3.15	
23 21	13 23-0218	EA	3/4" x 4" Long, Schedule 40 Black Steel Nipple.....	11.39	6.98
			<i>For Schedule 80 Nipples, Add</i>	0.45	
			<i>For Work In Restricted Working Space, Add</i>	3.15	
23 21	13 23-0219	EA	1" x 4" Long, Schedule 40 Black Steel Nipple.....	12.54	7.58
			<i>For Schedule 80 Nipples, Add</i>	0.62	
			<i>For Work In Restricted Working Space, Add</i>	3.39	
23 21	13 23-0220	EA	1-1/4" x 4" Long, Schedule 40 Black Steel Nipple.....	13.80	8.16
			<i>For Schedule 80 Nipples, Add</i>	0.78	
			<i>For Work In Restricted Working Space, Add</i>	3.68	
23 21	13 23-0221	EA	1-1/2" x 4" Long, Schedule 40 Black Steel Nipple.....	14.08	8.16
			<i>For Schedule 80 Nipples, Add</i>	0.92	
			<i>For Work In Restricted Working Space, Add</i>	3.68	
23 21	13 23-0222	EA	2" x 4" Long, Schedule 40 Black Steel Nipple.....	18.38	10.51
			<i>For Schedule 80 Nipples, Add</i>	1.29	
			<i>For Work In Restricted Working Space, Add</i>	4.74	
23 21	13 23-0223	EA	2-1/2" x 4" Long, Schedule 40 Black Steel Nipple.....	26.58	13.09
			<i>For Schedule 80 Nipples, Add</i>	3.49	
			<i>For Work In Restricted Working Space, Add</i>	5.88	
23 21	13 23-0224	EA	3" x 4" Long, Schedule 40 Black Steel Nipple.....	32.56	15.81
			<i>For Schedule 80 Nipples, Add</i>	4.43	
			<i>For Work In Restricted Working Space, Add</i>	7.11	
23 21	13 23-0225	EA	4" x 4" Long, Schedule 40 Black Steel Nipple.....	41.37	19.62
			<i>For Schedule 80 Nipples, Add</i>	5.99	
			<i>For Work In Restricted Working Space, Add</i>	8.82	
23 21	13 23-0226	EA	3/8" x 4-1/2" Long, Schedule 40 Black Steel Nipple.....	12.02	6.98
			<i>For Schedule 80 Nipples, Add</i>	0.76	
			<i>For Work In Restricted Working Space, Add</i>	3.15	
23 21	13 23-0227	EA	1/2" x 4-1/2" Long, Schedule 40 Black Steel Nipple.....	11.36	6.98
			<i>For Schedule 80 Nipples, Add</i>	0.43	
			<i>For Work In Restricted Working Space, Add</i>	3.15	
23 21	13 23-0228	EA	3/4" x 4-1/2" Long, Schedule 40 Black Steel Nipple.....	11.62	6.98
			<i>For Schedule 80 Nipples, Add</i>	0.56	
			<i>For Work In Restricted Working Space, Add</i>	3.15	
23 21	13 23-0229	EA	1" x 4-1/2" Long, Schedule 40 Black Steel Nipple.....	12.77	7.58
			<i>For Schedule 80 Nipples, Add</i>	0.74	
			<i>For Work In Restricted Working Space, Add</i>	3.39	
23 21	13 23-0230	EA	1-1/4" x 4-1/2" Long, Schedule 40 Black Steel Nipple	14.11	8.16
			<i>For Schedule 80 Nipples, Add</i>	0.93	
			<i>For Work In Restricted Working Space, Add</i>	3.68	
23 21	13 23-0231	EA	1-1/2" x 4-1/2" Long, Schedule 40 Black Steel Nipple	14.49	8.16
			<i>For Schedule 80 Nipples, Add</i>	1.12	
			<i>For Work In Restricted Working Space, Add</i>	3.68	
23 21	13 23-0232	EA	2" x 4-1/2" Long, Schedule 40 Black Steel Nipple.....	18.77	10.51
			<i>For Schedule 80 Nipples, Add</i>	1.48	
			<i>For Work In Restricted Working Space, Add</i>	4.74	
23 21	13 23-0233	EA	2-1/2" x 4-1/2" Long, Schedule 40 Black Steel Nipple	27.27	13.09
			<i>For Schedule 80 Nipples, Add</i>	3.84	
			<i>For Work In Restricted Working Space, Add</i>	5.88	
23 21	13 23-0234	EA	3" x 4-1/2" Long, Schedule 40 Black Steel Nipple.....	33.47	15.81
			<i>For Schedule 80 Nipples, Add</i>	4.88	
			<i>For Work In Restricted Working Space, Add</i>	7.11	
23 21	13 23-0235	EA	4" x 4-1/2" Long, Schedule 40 Black Steel Nipple.....	43.07	19.62
			<i>For Schedule 80 Nipples, Add</i>	6.84	
			<i>For Work In Restricted Working Space, Add</i>	8.82	
23 21	13 23-0236	EA	3/8" x 5" Long, Schedule 40 Black Steel Nipple.....	12.02	6.98
			<i>For Schedule 80 Nipples, Add</i>	0.76	
			<i>For Work In Restricted Working Space, Add</i>	3.15	
23 21	13 23-0237	EA	1/2" x 5" Long, Schedule 40 Black Steel Nipple.....	11.36	6.98
			<i>For Schedule 80 Nipples, Add</i>	0.43	
			<i>For Work In Restricted Working Space, Add</i>	3.15	
23 21	13 23-0238	EA	3/4" x 5" Long, Schedule 40 Black Steel Nipple.....	11.62	6.98
			<i>For Schedule 80 Nipples, Add</i>	0.56	
			<i>For Work In Restricted Working Space, Add</i>	3.15	
23 21	13 23-0239	EA	1" x 5" Long, Schedule 40 Black Steel Nipple.....	12.77	7.58
			<i>For Schedule 80 Nipples, Add</i>	0.74	
			<i>For Work In Restricted Working Space, Add</i>	3.39	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21 13 23-0240 EA 1-1/4" x 5" Long, Schedule 40 Black Steel Nipple	14.11	8.16
<i>For Schedule 80 Nipples, Add</i>	0.93	
<i>For Work In Restricted Working Space, Add</i>	3.68	
23 21 13 23-0241 EA 1-1/2" x 5" Long, Schedule 40 Black Steel Nipple	14.49	8.16
<i>For Schedule 80 Nipples, Add</i>	1.12	
<i>For Work In Restricted Working Space, Add</i>	3.68	
23 21 13 23-0242 EA 2" x 5" Long, Schedule 40 Black Steel Nipple.....	18.77	10.51
<i>For Schedule 80 Nipples, Add</i>	1.48	
<i>For Work In Restricted Working Space, Add</i>	4.74	
23 21 13 23-0243 EA 2-1/2" x 5" Long, Schedule 40 Black Steel Nipple	27.27	13.09
<i>For Schedule 80 Nipples, Add</i>	3.84	
<i>For Work In Restricted Working Space, Add</i>	5.88	
23 21 13 23-0244 EA 3" x 5" Long, Schedule 40 Black Steel Nipple.....	33.47	15.81
<i>For Schedule 80 Nipples, Add</i>	4.88	
<i>For Work In Restricted Working Space, Add</i>	7.11	
23 21 13 23-0245 EA 4" x 5" Long, Schedule 40 Black Steel Nipple.....	43.07	19.62
<i>For Schedule 80 Nipples, Add</i>	6.84	
<i>For Work In Restricted Working Space, Add</i>	8.82	
23 21 13 23-0246 EA 3/8" x 6" Long, Schedule 40 Black Steel Nipple.....	12.19	6.98
<i>For Schedule 80 Nipples, Add</i>	0.85	
<i>For Work In Restricted Working Space, Add</i>	3.15	
23 21 13 23-0247 EA 1/2" x 6" Long, Schedule 40 Black Steel Nipple.....	11.46	6.98
<i>For Schedule 80 Nipples, Add</i>	0.48	
<i>For Work In Restricted Working Space, Add</i>	3.15	
23 21 13 23-0248 EA 3/4" x 6" Long, Schedule 40 Black Steel Nipple.....	11.77	6.98
<i>For Schedule 80 Nipples, Add</i>	0.64	
<i>For Work In Restricted Working Space, Add</i>	3.15	
23 21 13 23-0249 EA 1" x 6" Long, Schedule 40 Black Steel Nipple.....	13.03	7.58
<i>For Schedule 80 Nipples, Add</i>	0.87	
<i>For Work In Restricted Working Space, Add</i>	3.39	
23 21 13 23-0250 EA 1-1/4" x 6" Long, Schedule 40 Black Steel Nipple	14.45	8.16
<i>For Schedule 80 Nipples, Add</i>	1.10	
<i>For Work In Restricted Working Space, Add</i>	3.68	
23 21 13 23-0251 EA 1-1/2" x 6" Long, Schedule 40 Black Steel Nipple	14.82	8.16
<i>For Schedule 80 Nipples, Add</i>	1.29	
<i>For Work In Restricted Working Space, Add</i>	3.68	
23 21 13 23-0252 EA 2" x 6" Long, Schedule 40 Black Steel Nipple.....	19.28	10.51
<i>For Schedule 80 Nipples, Add</i>	1.74	
<i>For Work In Restricted Working Space, Add</i>	4.74	
23 21 13 23-0253 EA 2-1/2" x 6" Long, Schedule 40 Black Steel Nipple	27.60	13.09
<i>For Schedule 80 Nipples, Add</i>	4.00	
<i>For Work In Restricted Working Space, Add</i>	5.88	
23 21 13 23-0254 EA 3" x 6" Long, Schedule 40 Black Steel Nipple.....	34.32	15.81
<i>For Schedule 80 Nipples, Add</i>	5.31	
<i>For Work In Restricted Working Space, Add</i>	7.11	
23 21 13 23-0255 EA 4" x 6" Long, Schedule 40 Black Steel Nipple.....	44.02	19.62
<i>For Schedule 80 Nipples, Add</i>	7.32	
<i>For Work In Restricted Working Space, Add</i>	8.82	
23 21 13 23-0256 EA 3/8" x 8" Long, Schedule 40 Black Steel Nipple.....	13.46	6.98
<i>For Schedule 80 Nipples, Add</i>	1.48	
<i>For Work In Restricted Working Space, Add</i>	3.15	
23 21 13 23-0257 EA 1/2" x 8" Long, Schedule 40 Black Steel Nipple.....	12.23	6.98
<i>For Schedule 80 Nipples, Add</i>	0.87	
<i>For Work In Restricted Working Space, Add</i>	3.15	
23 21 13 23-0258 EA 3/4" x 8" Long, Schedule 40 Black Steel Nipple.....	12.62	6.98
<i>For Schedule 80 Nipples, Add</i>	1.06	
<i>For Work In Restricted Working Space, Add</i>	3.15	
23 21 13 23-0259 EA 1" x 8" Long, Schedule 40 Black Steel Nipple.....	14.14	7.58
<i>For Schedule 80 Nipples, Add</i>	1.42	
<i>For Work In Restricted Working Space, Add</i>	3.39	
23 21 13 23-0260 EA 1-1/4" x 8" Long, Schedule 40 Black Steel Nipple	15.81	8.16
<i>For Schedule 80 Nipples, Add</i>	1.78	
<i>For Work In Restricted Working Space, Add</i>	3.68	
23 21 13 23-0261 EA 1-1/2" x 8" Long, Schedule 40 Black Steel Nipple	16.33	8.16
<i>For Schedule 80 Nipples, Add</i>	2.04	
<i>For Work In Restricted Working Space, Add</i>	3.68	
23 21 13 23-0262 EA 2" x 8" Long, Schedule 40 Black Steel Nipple.....	21.62	10.51
<i>For Schedule 80 Nipples, Add</i>	2.91	
<i>For Work In Restricted Working Space, Add</i>	4.74	
23 21 13 23-0263 EA 2-1/2" x 8" Long, Schedule 40 Black Steel Nipple	29.77	13.09
<i>For Schedule 80 Nipples, Add</i>	5.09	
<i>For Work In Restricted Working Space, Add</i>	5.88	
23 21 13 23-0264 EA 3" x 8" Long, Schedule 40 Black Steel Nipple.....	38.02	15.81
<i>For Schedule 80 Nipples, Add</i>	7.16	
<i>For Work In Restricted Working Space, Add</i>	7.11	
23 21 13 23-0265 EA 4" x 8" Long, Schedule 40 Black Steel Nipple.....	46.27	19.62
<i>For Schedule 80 Nipples, Add</i>	8.44	
<i>For Work In Restricted Working Space, Add</i>	8.82	
23 21 13 23-0266 EA 3/8" x 10" Long, Schedule 40 Black Steel Nipple.....	13.83	6.98
<i>For Schedule 80 Nipples, Add</i>	1.67	
<i>For Work In Restricted Working Space, Add</i>	3.15	
23 21 13 23-0267 EA 1/2" x 10" Long, Schedule 40 Black Steel Nipple.....	12.58	6.98
<i>For Schedule 80 Nipples, Add</i>	1.04	
<i>For Work In Restricted Working Space, Add</i>	3.15	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 20 HVAC Piping And Pumps****23 21 Hydronic Piping And Pumps**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21	13 23-0268	EA	3/4" x 10" Long, Schedule 40 Black Steel Nipple.....	12.97	6.98
			<i>For Schedule 80 Nipples, Add</i>	1.24	
			<i>For Work In Restricted Working Space, Add</i>	3.15	
23 21	13 23-0269	EA	1" x 10" Long, Schedule 40 Black Steel Nipple.....	14.61	7.58
			<i>For Schedule 80 Nipples, Add</i>	1.66	
			<i>For Work In Restricted Working Space, Add</i>	3.39	
23 21	13 23-0270	EA	1-1/4" x 10" Long, Schedule 40 Black Steel Nipple.....	16.52	8.16
			<i>For Schedule 80 Nipples, Add</i>	2.14	
			<i>For Work In Restricted Working Space, Add</i>	3.68	
23 21	13 23-0271	EA	1-1/2" x 10" Long, Schedule 40 Black Steel Nipple.....	17.03	8.16
			<i>For Schedule 80 Nipples, Add</i>	2.39	
			<i>For Work In Restricted Working Space, Add</i>	3.68	
23 21	13 23-0272	EA	2" x 10" Long, Schedule 40 Black Steel Nipple.....	22.64	10.51
			<i>For Schedule 80 Nipples, Add</i>	3.42	
			<i>For Work In Restricted Working Space, Add</i>	4.74	
23 21	13 23-0273	EA	2-1/2" x 10" Long, Schedule 40 Black Steel Nipple.....	31.03	13.09
			<i>For Schedule 80 Nipples, Add</i>	5.72	
			<i>For Work In Restricted Working Space, Add</i>	5.88	
23 21	13 23-0274	EA	3" x 10" Long, Schedule 40 Black Steel Nipple.....	39.78	15.81
			<i>For Schedule 80 Nipples, Add</i>	8.04	
			<i>For Work In Restricted Working Space, Add</i>	7.11	
23 21	13 23-0275	EA	4" x 10" Long, Schedule 40 Black Steel Nipple.....	48.62	19.62
			<i>For Schedule 80 Nipples, Add</i>	9.62	
			<i>For Work In Restricted Working Space, Add</i>	8.82	
23 21	13 23-0276	EA	3/8" x 12" Long, Schedule 40 Black Steel Nipple.....	14.28	6.98
			<i>For Schedule 80 Nipples, Add</i>	1.89	
			<i>For Work In Restricted Working Space, Add</i>	3.15	
23 21	13 23-0277	EA	1/2" x 12" Long, Schedule 40 Black Steel Nipple.....	12.97	6.98
			<i>For Schedule 80 Nipples, Add</i>	1.24	
			<i>For Work In Restricted Working Space, Add</i>	3.15	
23 21	13 23-0278	EA	3/4" x 12" Long, Schedule 40 Black Steel Nipple.....	13.24	6.98
			<i>For Schedule 80 Nipples, Add</i>	1.37	
			<i>For Work In Restricted Working Space, Add</i>	3.15	
23 21	13 23-0279	EA	1" x 12" Long, Schedule 40 Black Steel Nipple.....	15.10	7.58
			<i>For Schedule 80 Nipples, Add</i>	1.90	
			<i>For Work In Restricted Working Space, Add</i>	3.39	
23 21	13 23-0280	EA	1-1/4" x 12" Long, Schedule 40 Black Steel Nipple.....	17.09	8.16
			<i>For Schedule 80 Nipples, Add</i>	2.42	
			<i>For Work In Restricted Working Space, Add</i>	3.68	
23 21	13 23-0281	EA	1-1/2" x 12" Long, Schedule 40 Black Steel Nipple.....	17.75	8.16
			<i>For Schedule 80 Nipples, Add</i>	2.75	
			<i>For Work In Restricted Working Space, Add</i>	3.68	
23 21	13 23-0282	EA	2" x 12" Long, Schedule 40 Black Steel Nipple.....	23.67	10.51
			<i>For Schedule 80 Nipples, Add</i>	3.93	
			<i>For Work In Restricted Working Space, Add</i>	4.74	
23 21	13 23-0283	EA	2-1/2" x 12" Long, Schedule 40 Black Steel Nipple.....	32.32	13.09
			<i>For Schedule 80 Nipples, Add</i>	6.36	
			<i>For Work In Restricted Working Space, Add</i>	5.88	
23 21	13 23-0284	EA	3" x 12" Long, Schedule 40 Black Steel Nipple.....	41.55	15.81
			<i>For Schedule 80 Nipples, Add</i>	8.92	
			<i>For Work In Restricted Working Space, Add</i>	7.11	
23 21	13 23-0285	EA	4" x 12" Long, Schedule 40 Black Steel Nipple.....	51.93	19.62
			<i>For Schedule 80 Nipples, Add</i>	11.27	
			<i>For Work In Restricted Working Space, Add</i>	8.82	
23 21	13 23-0286		Black Malleable Iron Bushing <small>(2321 13 23-0014)</small>		
23 21	13 23-0287	EA	1/2" x 3/8", 150 LB, Black Malleable Iron Bushing.....	19.80	11.98
			<i>For Work In Restricted Working Space, Add</i>	5.39	
23 21	13 23-0288	EA	3/4" x 3/8", 150 LB, Black Malleable Iron Bushing.....	21.96	12.86
			<i>For Work In Restricted Working Space, Add</i>	5.79	
23 21	13 23-0289	EA	3/4" x 1/2", 150 LB, Black Malleable Iron Bushing.....	23.43	13.82
			<i>For Work In Restricted Working Space, Add</i>	6.23	
23 21	13 23-0290	EA	1" x 3/8", 150 LB, Black Malleable Iron Bushing.....	24.25	13.74
			<i>For Work In Restricted Working Space, Add</i>	6.17	
23 21	13 23-0291	EA	1" x 1/2", 150 LB, Black Malleable Iron Bushing.....	24.79	14.70
			<i>For Work In Restricted Working Space, Add</i>	6.62	
23 21	13 23-0292	EA	1" x 3/4", 150 LB, Black Malleable Iron Bushing.....	25.96	15.50
			<i>For Work In Restricted Working Space, Add</i>	6.97	
23 21	13 23-0293	EA	1-1/4" x 3/8", 150 LB, Black Malleable Iron Bushing.....	26.30	14.78
			<i>For Work In Restricted Working Space, Add</i>	6.66	
23 21	13 23-0294	EA	1-1/4" x 1/2", 150 LB, Black Malleable Iron Bushing.....	27.59	15.81
			<i>For Work In Restricted Working Space, Add</i>	7.10	
23 21	13 23-0295	EA	1-1/4" x 3/4", 150 LB, Black Malleable Iron Bushing.....	28.37	16.54
			<i>For Work In Restricted Working Space, Add</i>	7.45	
23 21	13 23-0296	EA	1-1/4" x 1", 150 LB, Black Malleable Iron Bushing.....	29.65	17.42
			<i>For Work In Restricted Working Space, Add</i>	7.83	
23 21	13 23-0297	EA	1-1/2" x 3/8", 150 LB, Black Malleable Iron Bushing.....	29.40	16.03
			<i>For Work In Restricted Working Space, Add</i>	7.19	
23 21	13 23-0298	EA	1-1/2" x 1/2", 150 LB, Black Malleable Iron Bushing.....	29.91	16.97
			<i>For Work In Restricted Working Space, Add</i>	7.63	
23 21	13 23-0299	EA	1-1/2" x 3/4", 150 LB, Black Malleable Iron Bushing.....	31.08	17.71
			<i>For Work In Restricted Working Space, Add</i>	7.98	
23 21	13 23-0300	EA	1-1/2" x 1", 150 LB, Black Malleable Iron Bushing.....	31.81	18.60
			<i>For Work In Restricted Working Space, Add</i>	8.36	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21 13 23-0301 EA 1-1/2" x 1-1/4", 150 LB, Black Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	34.00 8.85	19.69
23 21 13 23-0302 EA 2" x 3/8", 150 LB, Black Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	35.86 8.46	18.82
23 21 13 23-0303 EA 2" x 1/2", 150 LB, Black Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	36.42 8.90	19.78
23 21 13 23-0304 EA 2" x 3/4", 150 LB, Black Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	36.56 9.25	20.58
23 21 13 23-0305 EA 2" x 1", 150 LB, Black Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	37.48 9.64	21.39
23 21 13 23-0306 EA 2" x 1-1/4", 150 LB, Black Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	39.09 10.12	22.50
23 21 13 23-0307 EA 2" x 1-1/2", 150 LB, Black Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	41.46 10.65	23.66
23 21 13 23-0308 EA 2-1/2" x 3/4", 150 LB, Black Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	50.11 12.11	26.90
23 21 13 23-0309 EA 2-1/2" x 1", 150 LB, Black Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	51.39 12.50	27.78
23 21 13 23-0310 EA 2-1/2" x 1-1/4", 150 LB, Black Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	53.00 12.98	28.81
23 21 13 23-0311 EA 2-1/2" x 1-1/2", 150 LB, Black Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	54.10 13.51	30.06
23 21 13 23-0312 EA 2-1/2" x 2", 150 LB, Black Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	58.26 14.78	32.85
23 21 13 23-0313 EA 3" x 3/4", 150 LB, Black Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	63.12 14.90	33.07
23 21 13 23-0314 EA 3" x 1", 150 LB, Black Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	64.39 15.28	33.96
23 21 13 23-0315 EA 3" x 1-1/4", 150 LB, Black Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	66.02 15.77	35.06
23 21 13 23-0316 EA 3" x 1-1/2", 150 LB, Black Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	67.52 16.30	36.24
23 21 13 23-0317 EA 3" x 2", 150 LB, Black Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	70.88 17.57	39.03
23 21 13 23-0318 EA 3" x 2-1/2", 150 LB, Black Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	80.59 20.42	45.42
23 21 13 23-0319 EA 4" x 3/4", 150 LB, Black Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	79.65 16.15	35.86
23 21 13 23-0320 EA 4" x 1", 150 LB, Black Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	80.93 16.54	36.74
23 21 13 23-0321 EA 4" x 1-1/4", 150 LB, Black Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	82.54 17.02	37.84
23 21 13 23-0322 EA 4" x 1-1/2", 150 LB, Black Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	84.31 17.55	39.02
23 21 13 23-0323 EA 4" x 2", 150 LB, Black Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	87.15 18.82	41.81
23 21 13 23-0324 EA 4" x 2-1/2", 150 LB, Black Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	96.67 21.68	48.20
23 21 13 23-0325 EA 4" x 3", 150 LB, Black Malleable Iron Bushing..... <i>For Work In Restricted Working Space, Add</i>	105.97 24.47	54.38
23 21 13 23-0326 Black Malleable Iron Square Head Plugs (23 21 13 23-0014)		
23 21 13 23-0327 EA 3/8", 150 LB, Black Malleable Iron Square Head Plug..... <i>For Work In Restricted Working Space, Add</i>	7.95 1.96	4.33
23 21 13 23-0328 EA 1/2", 150 LB, Black Malleable Iron Square Head Plug..... <i>For Work In Restricted Working Space, Add</i>	9.34 2.35	5.22
23 21 13 23-0329 EA 3/4", 150 LB, Black Malleable Iron Square Head Plug..... <i>For Work In Restricted Working Space, Add</i>	10.27 2.63	5.88
23 21 13 23-0330 EA 1", 150 LB, Black Malleable Iron Square Head Plug..... <i>For Work In Restricted Working Space, Add</i>	11.69 2.94	6.54
23 21 13 23-0331 EA 1-1/4", 150 LB, Black Malleable Iron Square Head Plug..... <i>For Work In Restricted Working Space, Add</i>	13.47 3.33	7.42
23 21 13 23-0332 EA 1-1/2", 150 LB, Black Malleable Iron Square Head Plug..... <i>For Work In Restricted Working Space, Add</i>	15.83 3.75	8.30
23 21 13 23-0333 EA 2", 150 LB, Black Malleable Iron Square Head Plug..... <i>For Work In Restricted Working Space, Add</i>	20.61 4.77	10.59
23 21 13 23-0334 EA 2-1/2", 150 LB, Black Malleable Iron Square Head Plug..... <i>For Work In Restricted Working Space, Add</i>	32.11 7.06	15.66
23 21 13 23-0335 EA 3", 150 LB, Black Malleable Iron Square Head Plug..... <i>For Work In Restricted Working Space, Add</i>	42.74 9.29	20.65
23 21 13 23-0336 EA 4", 150 LB, Black Malleable Iron Square Head Plug..... <i>For Work In Restricted Working Space, Add</i>	59.03 10.29	22.85
23 21 13 23-0337 EA 5", 150 LB, Black Malleable Iron Square Head Plug..... <i>For Work In Restricted Working Space, Add</i>	88.92 10.73	23.88
23 21 13 23-0338 EA 6", 150 LB, Black Malleable Iron Square Head Plug..... <i>For Work In Restricted Working Space, Add</i>	103.23 11.22	24.91
23 21 13 23-0339 125 LB Black Cast Iron Screwed Flanges (23 21 13 23-0014)		
23 21 13 23-0340 EA 3/4", 125 LB, Black Cast Iron Flange..... <i>For Work In Restricted Working Space, Add</i>	71.04 13.23	29.40
23 21 13 23-0341 EA 1", 125 LB, Black Cast Iron Flange..... <i>For Work In Restricted Working Space, Add</i>	66.97 14.95	33.22

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 20 HVAC Piping And Pumps****23 21 Hydronic Piping And Pumps**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21	13 23-0342	EA	1-1/4", 125 LB, Black Cast Iron Flange..... <i>For Work In Restricted Working Space, Add</i>	72.07 15.47	34.40
23 21	13 23-0343	EA	1-1/2", 125 LB, Black Cast Iron Flange..... <i>For Work In Restricted Working Space, Add</i>	75.05 16.83	37.42
23 21	13 23-0344	EA	2", 125 LB, Black Cast Iron Flange..... <i>For Work In Restricted Working Space, Add</i>	77.47 17.57	39.03
23 21	13 23-0345	EA	2-1/2", 125 LB, Black Cast Iron Flange..... <i>For Work In Restricted Working Space, Add</i>	89.84 20.32	45.20
23 21	13 23-0346	EA	3", 125 LB, Black Cast Iron Flange..... <i>For Work In Restricted Working Space, Add</i>	114.44 25.79	57.33
23 21	13 23-0347	EA	4", 125 LB, Black Cast Iron Flange..... <i>For Work In Restricted Working Space, Add</i>	155.96 35.27	78.41
23 21	13 23-0348	EA	5", 125 LB, Black Cast Iron Flange..... <i>For Work In Restricted Working Space, Add</i>	194.20 41.99	93.40
23 21	13 23-0349	EA	6", 125 LB, Black Cast Iron Flange..... <i>For Work In Restricted Working Space, Add</i>	222.10 48.22	107.21
23 21	13 23-0350		150 LB, Black Malleable Iron Flanges (23 21 13 23-0014)		
23 21	13 23-0351	EA	1/2", 150 LB, Black Malleable Iron Flange..... <i>For Work In Restricted Working Space, Add</i>	46.24 12.08	26.83
23 21	13 23-0352	EA	3/4", 150 LB, Black Malleable Iron Flange..... <i>For Work In Restricted Working Space, Add</i>	50.52 13.23	29.40
23 21	13 23-0353	EA	1", 150 LB, Black Malleable Iron Flange..... <i>For Work In Restricted Working Space, Add</i>	58.17 14.95	33.22
23 21	13 23-0354	EA	1-1/4", 150 LB, Black Malleable Iron Flange..... <i>For Work In Restricted Working Space, Add</i>	60.49 15.47	34.40
23 21	13 23-0355	EA	1-1/2", 150 LB, Black Malleable Iron Flange..... <i>For Work In Restricted Working Space, Add</i>	65.84 16.83	37.42
23 21	13 23-0356	EA	2", 150 LB, Black Malleable Iron Flange..... <i>For Work In Restricted Working Space, Add</i>	71.25 17.57	39.03
23 21	13 23-0357	EA	2-1/2", 150 LB, Black Malleable Iron Flange..... <i>For Work In Restricted Working Space, Add</i>	87.63 20.32	45.20
23 21	13 23-0358	EA	3", 150 LB, Black Malleable Iron Flange..... <i>For Work In Restricted Working Space, Add</i>	111.09 25.78	57.33
23 21	13 23-0359	EA	4", 150 LB, Black Malleable Iron Flange..... <i>For Work In Restricted Working Space, Add</i>	160.27 35.27	78.41
23 21	13 23-0360		Welded Black Steel Pipe (23 21 13 23)		
23 21	13 23-0361		Welded Plain End Black Steel Pipe Assemblies (23 21 13 23-0360) Note: ASTM A-53. Includes all hangers and all fittings (couplings, elbows, tees and reducer fittings). All hangers are complete assemblies. Not for use where detail is available.		
23 21	13 23-0362	LF	3/4" Schedule 40 Welded Plain End Black Steel Pipe And Fitting Assembly..... Note: Includes all hangers and all fittings (couplings, elbows, tees and reducer fittings). All hangers are complete assemblies. Not for use where detail is available. <i>For Work In Restricted Working Space, Add</i>	16.97 4.09	5.59
23 21	13 23-0363	LF	1" Schedule 40 Welded Plain End Black Steel Pipe And Fitting Assembly..... Note: Includes all hangers and all fittings (couplings, elbows, tees and reducer fittings). All hangers are complete assemblies. Not for use where detail is available. <i>For Work In Restricted Working Space, Add</i>	18.85 4.58	5.97
23 21	13 23-0364	LF	1-1/4" Schedule 40 Welded Plain End Black Steel Pipe And Fitting Assembly..... Note: Includes all hangers and all fittings (couplings, elbows, tees and reducer fittings). All hangers are complete assemblies. Not for use where detail is available. <i>For Work In Restricted Working Space, Add</i>	22.48 5.26	6.34
23 21	13 23-0365	LF	1-1/2" Schedule 40 Welded Plain End Black Steel Pipe And Fitting Assembly..... Note: Includes all hangers and all fittings (couplings, elbows, tees and reducer fittings). All hangers are complete assemblies. Not for use where detail is available. <i>For Work In Restricted Working Space, Add</i>	23.88 5.50	6.34
23 21	13 23-0366	LF	2" Schedule 40 Welded Plain End Black Steel Pipe And Fitting Assembly..... Note: Includes all hangers and all fittings (couplings, elbows, tees and reducer fittings). All hangers are complete assemblies. Not for use where detail is available. <i>For Work In Restricted Working Space, Add</i>	27.30 6.36	6.34
23 21	13 23-0367	LF	2-1/2" Schedule 40 Welded Plain End Black Steel Pipe And Fitting Assembly..... Note: Includes all hangers and all fittings (couplings, elbows, tees and reducer fittings). All hangers are complete assemblies. Not for use where detail is available. <i>For Work In Restricted Working Space, Add</i>	31.63 7.38	6.34
23 21	13 23-0368	LF	3" Schedule 40 Welded Plain End Black Steel Pipe And Fitting Assembly..... Note: Includes all hangers and all fittings (couplings, elbows, tees and reducer fittings). All hangers are complete assemblies. Not for use where detail is available. <i>For Work In Restricted Working Space, Add</i>	36.10 7.78	6.20
23 21	13 23-0369	LF	4" Schedule 40 Welded Plain End Black Steel Pipe And Fitting Assembly..... Note: Includes all hangers and all fittings (couplings, elbows, tees and reducer fittings). All hangers are complete assemblies. Not for use where detail is available. <i>For Work In Restricted Working Space, Add</i>	48.41 10.01	8.07
23 21	13 23-0370	LF	6" Schedule 40 Welded Plain End Black Steel Pipe And Fitting Assembly..... Note: Includes all hangers and all fittings (couplings, elbows, tees and reducer fittings). All hangers are complete assemblies. Not for use where detail is available. <i>For Work In Restricted Working Space, Add</i>	63.56 11.52	12.02
23 21	13 23-0371	LF	8" Schedule 40 Welded Plain End Black Steel Pipe And Fitting Assembly..... Note: Includes all hangers and all fittings (couplings, elbows, tees and reducer fittings). All hangers are complete assemblies. Not for use where detail is available. <i>For Work In Restricted Working Space, Add</i>	96.18 17.10	14.94



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21 13 23-0372 LF 10" Schedule 40 Welded Plain End Black Steel Pipe And Fitting Assembly..... Note: Includes all hangers and all fittings (couplings, elbows, tees and reducer fittings). All hangers are complete assemblies. Not for use where detail is available. <i>For Work In Restricted Working Space, Add</i>	126.33 20.39	18.67
23 21 13 23-0373 LF 12" Schedule 40 Welded Plain End Black Steel Pipe And Fitting Assembly..... Note: Includes all hangers and all fittings (couplings, elbows, tees and reducer fittings). All hangers are complete assemblies. Not for use where detail is available. <i>For Work In Restricted Working Space, Add</i>	156.83 23.56	22.55
23 21 13 23-0374 LF 14" Schedule 40 Welded Plain End Black Steel Pipe And Fitting Assembly..... Note: Includes all hangers and all fittings (couplings, elbows, tees and reducer fittings). All hangers are complete assemblies. Not for use where detail is available. <i>For Work In Restricted Working Space, Add</i>	175.38 26.29	29.43
23 21 13 23-0375 LF 16" Schedule 40 Welded Plain End Black Steel Pipe And Fitting Assembly..... Note: Includes all hangers and all fittings (couplings, elbows, tees and reducer fittings). All hangers are complete assemblies. Not for use where detail is available. <i>For Work In Restricted Working Space, Add</i>	203.62 29.38	37.34
23 21 13 23-0376 LF 18" Schedule 40 Welded Plain End Black Steel Pipe And Fitting Assembly..... Note: Includes all hangers and all fittings (couplings, elbows, tees and reducer fittings). All hangers are complete assemblies. Not for use where detail is available. <i>For Work In Restricted Working Space, Add</i>	253.40 32.23	46.22
23 21 13 23-0377 LF 20" Schedule 40 Welded Plain End Black Steel Pipe And Fitting Assembly..... Note: Includes all hangers and all fittings (couplings, elbows, tees and reducer fittings). All hangers are complete assemblies. Not for use where detail is available. <i>For Work In Restricted Working Space, Add</i>	322.33 36.89	57.13
23 21 13 23-0378 LF 24" Schedule 40 Welded Plain End Black Steel Pipe And Fitting Assembly..... Note: Includes all hangers and all fittings (couplings, elbows, tees and reducer fittings). All hangers are complete assemblies. Not for use where detail is available. <i>For Work In Restricted Working Space, Add</i>	394.31 40.56	64.75
23 21 13 23-0379 Welded Black Steel Pipe And Fittings <small>(23 21 13 23-0360)</small> Note: ASTM A-53. Excludes hangers or fittings.		
23 21 13 23-0380 Welded Plain End Black Steel Piping <small>(23 21 13 23-0379)</small> Note: ASTM A-53		
23 21 13 23-0381 LF 3/4" Schedule 40, Welded Plain End Black Steel Pipe <i>For Schedule A-106 Pipe, Add</i> <i>For Schedule 80 Pipe, Add</i> <i>For Work In Restricted Working Space, Add</i>	7.13 0.14 1.13 1.79	2.99
23 21 13 23-0382 LF 1" Schedule 40, Welded Plain End Black Steel Pipe <i>For Schedule A-106 Pipe, Add</i> <i>For Schedule 80 Pipe, Add</i> <i>For Work In Restricted Working Space, Add</i>	9.00 0.18 1.43 2.24	3.73
23 21 13 23-0383 LF 1-1/4" Schedule 40, Welded Plain End Black Steel Pipe <i>For Schedule A-106 Pipe, Add</i> <i>For Schedule 80 Pipe, Add</i> <i>For Work In Restricted Working Space, Add</i>	11.22 0.27 1.80 2.69	4.48
23 21 13 23-0384 LF 1-1/2" Schedule 40, Welded Plain End Black Steel Pipe <i>For Schedule A-106 Pipe, Add</i> <i>For Schedule 80 Pipe, Add</i> <i>For Work In Restricted Working Space, Add</i>	13.45 0.36 2.17 3.13	5.22
23 21 13 23-0385 LF 2" Schedule 40, Welded Plain End Black Steel Pipe <i>For Schedule A-106 Pipe, Add</i> <i>For Schedule 80 Pipe, Add</i> <i>For Work In Restricted Working Space, Add</i>	15.98 0.43 2.58 3.71	6.20
23 21 13 23-0386 LF 2-1/2" Schedule 40, Welded Plain End Black Steel Pipe <i>For Schedule A-106 Pipe, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Schedule 80 Pipe, Add</i>	18.23 0.50 4.21 3.93	7.01
23 21 13 23-0387 LF 3" Schedule 40, Welded Plain End Black Steel Pipe <i>For Schedule A-106 Pipe, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Schedule 80 Pipe, Add</i>	21.73 0.80 4.52 4.97	7.53
23 21 13 23-0388 LF 4" Schedule 40, Welded Plain End Black Steel Pipe <i>For Schedule A-106 Pipe, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Schedule 80 Pipe, Add</i>	29.33 1.28 5.60 7.00	9.32
23 21 13 23-0389 LF 6" Schedule 40, Welded Plain End Black Steel Pipe <i>For Schedule A-106 Pipe, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Schedule 80 Pipe, Add</i>	41.02 2.15 6.94 10.31	15.10
23 21 13 23-0390 LF 8" Schedule 40, Welded Plain End Black Steel Pipe <i>For Schedule A-106 Pipe, Add</i> <i>For Schedule 30 Pipe, Deduct</i> <i>For Work In Restricted Working Space, Add</i> <i>For Schedule 80 Pipe, Add</i>	59.09 3.24 -8.61 9.63 15.06	16.05
23 21 13 23-0391 LF 10" Schedule 40, Welded Plain End Black Steel Pipe <i>For Schedule A-106 Pipe, Add</i> <i>For Schedule 30 Pipe, Deduct</i> <i>For Work In Restricted Working Space, Add</i> <i>For Schedule 80 Pipe, Add</i>	76.87 4.58 -11.51 11.60 20.14	19.35
23 21 13 23-0392 LF 12" Schedule 40, Welded Plain End Black Steel Pipe <i>For Schedule A-106 Pipe, Add</i> <i>For Schedule 30 Pipe, Deduct</i> <i>For Work In Restricted Working Space, Add</i> <i>For Schedule 80 Pipe, Add</i>	97.25 6.06 -14.78 14.03 25.86	23.37

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 20 HVAC Piping And Pumps****23 21 Hydronic Piping And Pumps**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21 13 23-0393			Welded Plain End Black Steel 90 Degree Elbows (23 21 13 23-0379)		
	EA		3/4" Standard Weight, Welded Plain End Black Steel 90 Degree Elbow	83.57	47.35
			<i>For Schedule 80 Fittings, Add</i>	17.62	
			<i>For Work In Restricted Working Space, Add</i>	21.29	
23 21 13 23-0395	EA		1" Standard Weight, Welded Plain End Black Steel 90 Degree Elbow	87.29	49.81
			<i>For Schedule 80 Fittings, Add</i>	18.35	
			<i>For Work In Restricted Working Space, Add</i>	22.40	
23 21 13 23-0396	EA		1-1/4" Standard Weight, Welded Plain End Black Steel 90 Degree Elbow	97.74	56.76
			<i>For Schedule 80 Fittings, Add</i>	20.38	
			<i>For Work In Restricted Working Space, Add</i>	25.54	
23 21 13 23-0397	EA		1-1/2" Standard Weight, Welded Plain End Black Steel 90 Degree Elbow	104.46	61.24
			<i>For Schedule 80 Fittings, Add</i>	21.69	
			<i>For Work In Restricted Working Space, Add</i>	27.55	
23 21 13 23-0398	EA		2" Standard Weight, Welded Plain End Black Steel 90 Degree Elbow	132.09	79.69
			<i>For Schedule 80 Fittings, Add</i>	27.08	
			<i>For Work In Restricted Working Space, Add</i>	35.84	
23 21 13 23-0399	EA		2-1/2" Standard Weight, Welded Plain End Black Steel 90 Degree Elbow	166.16	99.62
			<i>For Schedule 80 Fittings, Add</i>	34.17	
			<i>For Work In Restricted Working Space, Add</i>	44.80	
23 21 13 23-0400	EA		3" Standard Weight, Welded Plain End Black Steel 90 Degree Elbow	171.26	100.84
			<i>For Schedule 80 Fittings, Add</i>	35.51	
			<i>For Work In Restricted Working Space, Add</i>	45.34	
23 21 13 23-0401	EA		4" Standard Weight, Welded Plain End Black Steel 90 Degree Elbow	294.51	174.25
			<i>For Schedule 80 Fittings, Add</i>	60.92	
			<i>For Work In Restricted Working Space, Add</i>	78.38	
23 21 13 23-0402	EA		6" Standard Weight, Welded Plain End Black Steel 90 Degree Elbow	512.96	287.55
			<i>For Schedule 80 Fittings, Add</i>	108.62	
			<i>For Work In Restricted Working Space, Add</i>	129.35	
23 21 13 23-0403	EA		8" Standard Weight, Welded Plain End Black Steel 90 Degree Elbow	758.57	404.69
			<i>For Schedule 80 Fittings, Add</i>	163.86	
			<i>For Work In Restricted Working Space, Add</i>	182.03	
23 21 13 23-0404	EA		10" Standard Weight, Welded Plain End Black Steel 90 Degree Elbow	972.17	462.56
			<i>For Schedule 80 Fittings, Add</i>	218.84	
			<i>For Work In Restricted Working Space, Add</i>	208.04	
23 21 13 23-0405	EA		12" Standard Weight, Welded Plain End Black Steel 90 Degree Elbow	1,311.48	605.20
			<i>For Schedule 80 Fittings, Add</i>	298.18	
			<i>For Work In Restricted Working Space, Add</i>	272.20	
23 21 13 23-0406			Welded Plain End Black Steel Reducing 90 Degree Elbows (23 21 13 23-0379)		
	EA		4" x 3" 90 Standard Weight, Welded Plain End Black Steel Reducing 90 Degree Elbow	398.56	174.55
			<i>For Schedule 80 Fittings, Add</i>	92.09	
			<i>For Work In Restricted Working Space, Add</i>	78.52	
23 21 13 23-0408	EA		6" x 4" Standard Weight, Welded Plain End Black Steel 90 Degree Elbow	693.92	284.27
			<i>For Schedule 80 Fittings, Add</i>	163.42	
			<i>For Work In Restricted Working Space, Add</i>	127.87	
23 21 13 23-0409	EA		6" x 3" Standard Weight, Welded Plain End Black Steel 90 Degree Elbow	739.81	284.27
			<i>For Schedule 80 Fittings, Add</i>	177.19	
			<i>For Work In Restricted Working Space, Add</i>	127.87	
23 21 13 23-0410	EA		8" x 6" Standard Weight, Welded Plain End Black Steel 90 Degree Elbow	1,171.42	404.69
			<i>For Schedule 80 Fittings, Add</i>	287.72	
			<i>For Work In Restricted Working Space, Add</i>	182.03	
23 21 13 23-0411	EA		8" x 4" Standard Weight, Welded Plain End Black Steel 90 Degree Elbow	1,280.85	404.69
			<i>For Schedule 80 Fittings, Add</i>	320.54	
			<i>For Work In Restricted Working Space, Add</i>	182.03	
23 21 13 23-0412	EA		10" x 8" Standard Weight, Welded Plain End Black Steel 90 Degree Elbow	1,596.00	462.56
			<i>For Schedule 80 Fittings, Add</i>	405.99	
			<i>For Work In Restricted Working Space, Add</i>	208.04	
23 21 13 23-0413	EA		10" x 6" Standard Weight, Welded Plain End Black Steel 90 Degree Elbow	1,596.00	462.56
			<i>For Schedule 80 Fittings, Add</i>	405.99	
			<i>For Work In Restricted Working Space, Add</i>	208.04	
23 21 13 23-0414	EA		12" x 10" Standard Weight, Welded Plain End Black Steel 90 Degree Elbow	2,600.31	616.70
			<i>For Schedule 80 Fittings, Add</i>	683.01	
			<i>For Work In Restricted Working Space, Add</i>	277.38	
23 21 13 23-0415	EA		12" x 8" Standard Weight, Welded Plain End Black Steel 90 Degree Elbow	2,600.31	616.70
			<i>For Schedule 80 Fittings, Add</i>	683.01	
			<i>For Work In Restricted Working Space, Add</i>	277.38	
23 21 13 23-0416	EA		12" x 6" Standard Weight, Welded Plain End Black Steel 90 Degree Elbow	2,897.97	616.70
			<i>For Schedule 80 Fittings, Add</i>	772.31	
			<i>For Work In Restricted Working Space, Add</i>	277.38	
23 21 13 23-0417			Welded Plain End Black Steel 45 Degree Elbows (23 21 13 23-0379)		
	EA		3/4" Standard Weight, Welded Plain End Black Steel 45 Degree Elbow	73.43	42.29
			<i>For Schedule 80 Fittings, Add</i>	15.37	
			<i>For Work In Restricted Working Space, Add</i>	19.02	
23 21 13 23-0419	EA		1" Standard Weight, Welded Plain End Black Steel 45 Degree Elbow	75.67	43.79
			<i>For Schedule 80 Fittings, Add</i>	15.81	
			<i>For Work In Restricted Working Space, Add</i>	19.70	
23 21 13 23-0420	EA		1-1/4" Standard Weight, Welded Plain End Black Steel 45 Degree Elbow	85.36	50.28
			<i>For Schedule 80 Fittings, Add</i>	17.70	
			<i>For Work In Restricted Working Space, Add</i>	22.60	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21 13 23-0421 EA 1-1/2" Standard Weight, Welded Plain End Black Steel 45 Degree Elbow <i>For Schedule 80 Fittings, Add</i> <i>For Work In Restricted Working Space, Add</i>	91.33 18.86 24.39	54.23
23 21 13 23-0422 EA 2" Standard Weight, Welded Plain End Black Steel 45 Degree Elbow <i>For Schedule 80 Fittings, Add</i> <i>For Work In Restricted Working Space, Add</i>	115.20 23.52 31.55	70.11
23 21 13 23-0423 EA 2-1/2" Standard Weight, Welded Plain End Black Steel 45 Degree Elbow <i>For Schedule 80 Fittings, Add</i> <i>For Work In Restricted Working Space, Add</i>	143.69 29.24 39.61	88.10
23 21 13 23-0424 EA 3" Standard Weight, Welded Plain End Black Steel 45 Degree Elbow <i>For Schedule 80 Fittings, Add</i> <i>For Work In Restricted Working Space, Add</i>	165.80 33.87 45.33	100.77
23 21 13 23-0425 EA 4" Standard Weight, Welded Plain End Black Steel 45 Degree Elbow <i>For Schedule 80 Fittings, Add</i> <i>For Work In Restricted Working Space, Add</i>	285.47 58.22 78.35	174.17
23 21 13 23-0426 EA 6" Standard Weight, Welded Plain End Black Steel 45 Degree Elbow <i>For Schedule 80 Fittings, Add</i> <i>For Work In Restricted Working Space, Add</i>	490.39 101.90 129.20	287.25
23 21 13 23-0427 EA 8" Standard Weight, Welded Plain End Black Steel 45 Degree Elbow <i>For Schedule 80 Fittings, Add</i> <i>For Work In Restricted Working Space, Add</i>	717.61 151.57 182.03	404.69
23 21 13 23-0428 EA 10" Standard Weight, Welded Plain End Black Steel 45 Degree Elbow <i>For Schedule 80 Fittings, Add</i> <i>For Work In Restricted Working Space, Add</i>	896.96 196.28 208.04	462.56
23 21 13 23-0429 EA 12" Standard Weight, Welded Plain End Black Steel 45 Degree Elbow <i>For Schedule 80 Fittings, Add</i> <i>For Work In Restricted Working Space, Add</i>	1,200.72 265.13 271.69	604.08
23 21 13 23-0430 Welded Plain End Black Steel Tee <small>(23 21 13 23-0379)</small>		
23 21 13 23-0431 EA 3/4" Standard Weight, Welded Plain End Black Steel Tee <i>For Schedule 80 Fittings, Add</i> <i>For Work In Restricted Working Space, Add</i>	149.61 32.35 35.81	79.59
23 21 13 23-0432 EA 1" Standard Weight, Welded Plain End Black Steel Tee <i>For Schedule 80 Fittings, Add</i> <i>For Work In Restricted Working Space, Add</i>	149.57 32.34 35.79	79.59
23 21 13 23-0433 EA 1-1/4" Standard Weight, Welded Plain End Black Steel Tee <i>For Schedule 80 Fittings, Add</i> <i>For Work In Restricted Working Space, Add</i>	169.19 36.82 39.82	88.54
23 21 13 23-0434 EA 1-1/2" Standard Weight, Welded Plain End Black Steel Tee <i>For Schedule 80 Fittings, Add</i> <i>For Work In Restricted Working Space, Add</i>	185.65 40.03 44.75	99.51
23 21 13 23-0435 EA 2" Standard Weight, Welded Plain End Black Steel Tee <i>For Schedule 80 Fittings, Add</i> <i>For Work In Restricted Working Space, Add</i>	231.42 48.51 59.75	132.84
23 21 13 23-0436 EA 2-1/2" Standard Weight, Welded Plain End Black Steel Tee <i>For Schedule 80 Fittings, Add</i> <i>For Work In Restricted Working Space, Add</i>	263.86 55.66 67.13	149.26
23 21 13 23-0437 EA 3" Standard Weight, Welded Plain End Black Steel Tee <i>For Schedule 80 Fittings, Add</i> <i>For Work In Restricted Working Space, Add</i>	315.89 66.26 81.46	181.26
23 21 13 23-0438 EA 4" Standard Weight, Welded Plain End Black Steel Tee <i>For Schedule 80 Fittings, Add</i> <i>For Work In Restricted Working Space, Add</i>	454.31 95.07 117.78	261.90
23 21 13 23-0439 EA 6" Standard Weight, Welded Plain End Black Steel Tee <i>For Schedule 80 Fittings, Add</i> <i>For Work In Restricted Working Space, Add</i>	760.96 160.18 194.59	432.63
23 21 13 23-0440 EA 8" Standard Weight, Welded Plain End Black Steel Tee <i>For Schedule 80 Fittings, Add</i> <i>For Work In Restricted Working Space, Add</i>	1,132.61 242.70 277.38	616.70
23 21 13 23-0441 EA 10" Standard Weight, Welded Plain End Black Steel Tee <i>For Schedule 80 Fittings, Add</i> <i>For Work In Restricted Working Space, Add</i>	1,427.47 314.98 323.61	719.46
23 21 13 23-0442 EA 12" Standard Weight, Welded Plain End Black Steel Tee <i>For Schedule 80 Fittings, Add</i> <i>For Work In Restricted Working Space, Add</i>	1,917.36 429.58 416.07	925.05
23 21 13 23-0443 Welded Plain End Black Steel Reducing Tees <small>(23 21 13 23-0379)</small>		
23 21 13 23-0444 EA 3/4" Standard Weight, Welded Plain End Black Steel Reducing Tee <i>For Schedule 80 Fittings, Add</i> <i>For Work In Restricted Working Space, Add</i>	145.88 31.62 34.69	77.13
23 21 13 23-0445 EA 1" Standard Weight, Welded Plain End Black Steel Reducing Tee <i>For Schedule 80 Fittings, Add</i> <i>For Work In Restricted Working Space, Add</i>	149.57 32.34 35.79	79.59
23 21 13 23-0446 EA 1-1/4" Standard Weight, Welded Plain End Black Steel Reducing Tee <i>For Schedule 80 Fittings, Add</i> <i>For Work In Restricted Working Space, Add</i>	167.26 36.24 39.82	88.54
23 21 13 23-0447 EA 1-1/2" Standard Weight, Welded Plain End Black Steel Reducing Tee <i>For Schedule 80 Fittings, Add</i> <i>For Work In Restricted Working Space, Add</i>	183.72 39.45 44.75	99.51
23 21 13 23-0448 EA 2" Standard Weight, Welded Plain End Black Steel Reducing Tee <i>For Schedule 80 Fittings, Add</i> <i>For Work In Restricted Working Space, Add</i>	235.79 49.82 59.77	132.84

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 20 HVAC Piping And Pumps****23 21 Hydronic Piping And Pumps**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21	13 23-0449	EA	2-1/2" Standard Weight, Welded Plain End Black Steel Reducing Tee <i>For Schedule 80 Fittings, Add</i> <i>For Work In Restricted Working Space, Add</i>	263.94 55.68 67.16	149.33
23 21	13 23-0450	EA	3" Standard Weight, Welded Plain End Black Steel Reducing Tee <i>For Schedule 80 Fittings, Add</i> <i>For Work In Restricted Working Space, Add</i>	316.09 66.32 81.46	181.26
23 21	13 23-0451	EA	4" Standard Weight, Welded Plain End Black Steel Reducing Tee <i>For Schedule 80 Fittings, Add</i> <i>For Work In Restricted Working Space, Add</i>	454.60 95.16 117.78	261.90
23 21	13 23-0452	EA	6" Standard Weight, Welded Plain End Black Steel Reducing Tee <i>For Schedule 80 Fittings, Add</i> <i>For Work In Restricted Working Space, Add</i>	761.45 160.33 194.59	432.63
23 21	13 23-0453	EA	8" Standard Weight, Welded Plain End Black Steel Reducing Tee <i>For Schedule 80 Fittings, Add</i> <i>For Work In Restricted Working Space, Add</i>	1,133.55 242.98 277.38	616.70
23 21	13 23-0454	EA	10" Standard Weight, Welded Plain End Black Steel Reducing Tee <i>For Schedule 80 Fittings, Add</i> <i>For Work In Restricted Working Space, Add</i>	1,429.07 315.46 323.61	719.46
23 21	13 23-0455	EA	12" Standard Weight, Welded Plain End Black Steel Reducing Tee <i>For Schedule 80 Fittings, Add</i> <i>For Work In Restricted Working Space, Add</i>	1,919.76 430.30 416.07	925.05
23 21 13 23-0456 Welded Plain End Black Steel Eccentric Reducers (23 21 13 23-0379)					
23 21	13 23-0457	EA	3" x 2" Standard Weight, Welded Plain End Black Steel Eccentric Reducer <i>For Schedule 80 Fittings, Add</i> <i>For Concentric Reducers, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	177.02 37.28 -8.43 45.21	100.48
23 21	13 23-0458	EA	4" x 3" Standard Weight, Welded Plain End Black Steel Eccentric Reducer <i>For Schedule 80 Fittings, Add</i> <i>For Concentric Reducers, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	293.62 60.61 -10.21 78.52	174.55
23 21	13 23-0459	EA	4" x 2" Standard Weight, Welded Plain End Black Steel Eccentric Reducer <i>For Schedule 80 Fittings, Add</i> <i>For Concentric Reducers, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	302.80 63.36 -13.15 78.52	174.55
23 21	13 23-0460	EA	6" x 4" Standard Weight, Welded Plain End Black Steel Eccentric Reducer <i>For Schedule 80 Fittings, Add</i> <i>For Concentric Reducers, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	490.73 102.46 -20.64 127.87	284.27
23 21	13 23-0461	EA	6" x 3" Standard Weight, Welded Plain End Black Steel Eccentric Reducer <i>For Schedule 80 Fittings, Add</i> <i>For Concentric Reducers, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	537.70 116.55 -35.67 127.87	284.27
23 21	13 23-0462	EA	8" x 6" Standard Weight, Welded Plain End Black Steel Eccentric Reducer <i>For Schedule 80 Fittings, Add</i> <i>For Concentric Reducers, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	745.01 155.40 -30.84 194.59	432.63
23 21	13 23-0463	EA	8" x 4" Standard Weight, Welded Plain End Black Steel Eccentric Reducer <i>For Schedule 80 Fittings, Add</i> <i>For Concentric Reducers, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	815.03 176.40 -53.25 194.59	432.63
23 21	13 23-0464	EA	10" x 8" Standard Weight, Welded Plain End Black Steel Eccentric Reducer <i>For Schedule 80 Fittings, Add</i> <i>For Concentric Reducers, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	859.63 179.57 -36.39 223.78	497.53
23 21	13 23-0465	EA	10" x 6" Standard Weight, Welded Plain End Black Steel Eccentric Reducer <i>For Schedule 80 Fittings, Add</i> <i>For Concentric Reducers, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	947.68 205.98 -64.56 223.78	497.53
23 21	13 23-0466	EA	12" x 10" Standard Weight, Welded Plain End Black Steel Eccentric Reducer..... <i>For Schedule 80 Fittings, Add</i> <i>For Concentric Reducers, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	1,101.74 233.62 -57.24 276.86	615.51
23 21	13 23-0467	EA	12" x 8" Standard Weight, Welded Plain End Black Steel Eccentric Reducer <i>For Schedule 80 Fittings, Add</i> <i>For Concentric Reducers, Deduct</i> <i>For Work In Restricted Working Space, Add</i>	1,203.71 264.21 -89.88 276.86	615.51
23 21 13 23-0468 Welded Plain End Black Steel Caps (23 21 13 23-0379)					
23 21	13 23-0469	EA	1" Standard Weight, Welded Plain End Black Steel Cap <i>For Schedule 80 Fittings, Add</i> <i>For Work In Restricted Working Space, Add</i>	43.71 8.45 11.19	24.91
23 21	13 23-0470	EA	1-1/4" Standard Weight, Welded Plain End Black Steel Cap <i>For Schedule 80 Fittings, Add</i> <i>For Work In Restricted Working Space, Add</i>	47.84 9.22 12.31	27.38
23 21	13 23-0471	EA	1-1/2" Standard Weight, Welded Plain End Black Steel Cap <i>For Schedule 80 Fittings, Add</i> <i>For Work In Restricted Working Space, Add</i>	49.73 9.60 12.76	28.35
23 21	13 23-0472	EA	2" Standard Weight, Welded Plain End Black Steel Cap <i>For Schedule 80 Fittings, Add</i> <i>For Work In Restricted Working Space, Add</i>	61.67 11.69 16.34	36.32



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21 13 23-0473 EA 2-1/2" Standard Weight, Welded Plain End Black Steel Cap..... <i>For Schedule 80 Fittings, Add</i> <i>For Work In Restricted Working Space, Add</i>	72.87 13.65 19.70	43.79
23 21 13 23-0474 EA 3" Standard Weight, Welded Plain End Black Steel Cap..... <i>For Schedule 80 Fittings, Add</i> <i>For Work In Restricted Working Space, Add</i>	86.15 16.38 22.72	50.49
23 21 13 23-0475 EA 4" Standard Weight, Welded Plain End Black Steel Cap..... <i>For Schedule 80 Fittings, Add</i> <i>For Work In Restricted Working Space, Add</i>	144.73 27.06 39.26	87.27
23 21 13 23-0476 EA 6" Standard Weight, Welded Plain End Black Steel Cap..... <i>For Schedule 80 Fittings, Add</i> <i>For Work In Restricted Working Space, Add</i>	242.54 45.74 64.86	144.18
23 21 13 23-0477 EA 8" Standard Weight, Welded Plain End Black Steel Cap..... <i>For Schedule 80 Fittings, Add</i> <i>For Work In Restricted Working Space, Add</i>	403.39 75.53 109.16	242.73
23 21 13 23-0478 EA 10" Standard Weight, Welded Plain End Black Steel Cap..... <i>For Schedule 80 Fittings, Add</i> <i>For Work In Restricted Working Space, Add</i>	451.86 87.74 114.76	255.18
23 21 13 23-0479 EA 12" Standard Weight, Welded Plain End Black Steel Cap..... <i>For Schedule 80 Fittings, Add</i> <i>For Work In Restricted Working Space, Add</i>	538.25 105.03 135.47	301.18
23 21 13 23-0480 150 LB, Welded Plain End Black Steel Neck Flanges (23 21 13 23-0379) Note: 150 LB.		
23 21 13 23-0481 EA 2", 150 LB, Welded Plain End Black Steel Neck Flange..... <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i>	119.77 33.61 25.33	56.31
23 21 13 23-0482 EA 2-1/2", 150 LB, Welded Plain End Black Steel Neck Flange..... <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i>	140.70 35.81 31.61	70.28
23 21 13 23-0483 EA 3", 150 LB, Welded Plain End Black Steel Neck Flange..... <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i>	155.70 37.41 36.09	80.26
23 21 13 23-0484 EA 4", 150 LB, Welded Plain End Black Steel Neck Flange..... <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i>	203.80 48.23 47.61	105.84
23 21 13 23-0485 EA 6", 150 LB, Welded Plain End Black Steel Neck Flange..... <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i>	310.00 73.83 72.19	160.52
23 21 13 23-0486 EA 8", 150 LB, Welded Plain End Black Steel Neck Flange..... <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i>	383.10 112.05 78.71	175.04
23 21 13 23-0487 EA 10", 150 LB, Welded Plain End Black Steel Neck Flange..... <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i>	527.54 173.46 98.73	219.48
23 21 13 23-0488 EA 12", 150 LB, Welded Plain End Black Steel Neck Flange..... <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i>	662.74 241.75 112.02	249.05
23 21 13 23-0489 150 LB, Welded Black Steel Slip-On Flanges (23 21 13 23-0379)		
23 21 13 23-0490 EA 2", 150 LB, Welded Black Steel Slip-On Flanges..... <i>For Work In Restricted Working Space, Add</i> <i>For 300 LB Rating, Add</i>	84.59 20.16 22.70	56.31
23 21 13 23-0491 EA 2-1/2", 150 LB, Welded Black Steel Slip-On Flange..... <i>For Work In Restricted Working Space, Add</i> <i>For 300 LB Rating, Add</i>	104.46 24.65 28.70	70.28
23 21 13 23-0492 EA 3", 150 LB, Welded Black Steel Slip-On Flange..... <i>For Work In Restricted Working Space, Add</i> <i>For 300 LB Rating, Add</i>	123.23 29.09 33.82	80.26
23 21 13 23-0493 EA 4", 150 LB, Welded Black Steel Slip-On Flange..... <i>For Work In Restricted Working Space, Add</i> <i>For 300 LB Rating, Add</i>	162.62 38.04 45.55	105.84
23 21 13 23-0494 EA 6", 150 LB, Welded Black Steel Slip-On Flange..... <i>For Work In Restricted Working Space, Add</i> <i>For 300 LB Rating, Add</i>	241.61 55.94 69.20	160.52
23 21 13 23-0495 EA 8", 150 LB, Welded Black Steel Slip-On Flange..... <i>For Work In Restricted Working Space, Add</i> <i>For 300 LB Rating, Add</i>	322.85 71.69 100.58	175.04
23 21 13 23-0496 EA 10", 150 LB, Welded Black Steel Slip-On Flange..... <i>For Work In Restricted Working Space, Add</i> <i>For 300 LB Rating, Add</i>	443.51 89.61 161.68	219.48
23 21 13 23-0497 EA 12", 150 LB, Welded Black Steel Slip-On Flange..... <i>For Work In Restricted Working Space, Add</i> <i>For 300 LB Rating, Add</i>	586.93 107.54 243.25	249.05
23 21 13 23-0498 EA 14", 150 LB, Welded Black Steel Slip-On Flange..... <i>For Work In Restricted Working Space, Add</i> <i>For 300 LB Rating, Add</i>	752.00 125.46 344.32	301.18
23 21 13 23-0499 EA 16", 150 LB, Welded Black Steel Slip-On Flange..... <i>For Work In Restricted Working Space, Add</i> <i>For 300 LB Rating, Add</i>	912.44 138.91 453.10	350.03
23 21 13 23-0500 EA 18", 150 LB, Welded Black Steel Slip-On Flange..... <i>For Work In Restricted Working Space, Add</i> <i>For 300 LB Rating, Add</i>	1,011.73 152.35 506.84	392.44

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 20 HVAC Piping And Pumps****23 21 Hydronic Piping And Pumps**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21	13 23-0501	EA	20", 150 LB, Welded Black Steel Slip-On Flange <i>For Work In Restricted Working Space, Add</i> <i>For 300 LB Rating, Add</i>	1,125.40 165.79 573.52	498.11
23 21	13 23-0502	EA	24", 150 LB, Welded Black Steel Slip-On Flange <i>For Work In Restricted Working Space, Add</i> <i>For 300 LB Rating, Add</i>	1,285.80 192.67 646.64	539.64
23 21	13 23-0503		150 LB, Forged Steel Blind Flanges (23 21 13 23-0379)		
23 21	13 23-0504	EA	2", 150 LB, Forged Steel Blind Flange <i>For 300 LB Rating, Add</i> <i>For 600 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i>	59.89 20.15 53.87 11.98	19.97
23 21	13 23-0505	EA	2-1/2", 150 LB, Forged Steel Blind Flange <i>For 300 LB Rating, Add</i> <i>For 600 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i>	80.28 30.91 84.83 14.38	23.96
23 21	13 23-0506	EA	3", 150 LB, Forged Steel Blind Flange <i>For 300 LB Rating, Add</i> <i>For 600 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i>	97.37 33.49 89.91 19.17	31.95
23 21	13 23-0507	EA	4", 150 LB, Forged Steel Blind Flange <i>For 300 LB Rating, Add</i> <i>For 600 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i>	126.00 45.28 122.67 23.96	39.94
23 21	13 23-0508	EA	6", 150 LB, Forged Steel Blind Flange <i>For 300 LB Rating, Add</i> <i>For 600 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i>	173.73 66.82 183.31 31.15	51.92
23 21	13 23-0509	EA	8", 150 LB, Forged Steel Blind Flange <i>For 300 LB Rating, Add</i> <i>For 600 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i>	230.68 101.27 284.04 35.95	59.91
23 21	13 23-0510	EA	10", 150 LB, Forged Steel Blind Flange <i>For 300 LB Rating, Add</i> <i>For 600 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i>	360.27 188.29 541.14 43.13	71.89
23 21	13 23-0511	EA	12", 150 LB, Forged Steel Blind Flange <i>For 300 LB Rating, Add</i> <i>For 600 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i>	474.16 262.75 760.57 50.32	83.87
23 21	13 23-0512	EA	14", 150 LB, Forged Steel Blind Flange <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i>	822.60 524.85 57.51	95.86
23 21	13 23-0513	EA	16", 150 LB, Forged Steel Blind Flange <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i>	880.68 554.65 64.70	107.83
23 21	13 23-0514	EA	18", 150 LB, Forged Steel Blind Flange <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i>	985.89 605.51 79.08	131.80
23 21	13 23-0515	EA	20", 150 LB, Forged Steel Blind Flange <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i>	1,276.50 821.35 86.27	143.78
23 21	13 23-0516	EA	24", 150 LB, Forged Steel Blind Flange <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i>	1,751.32 1,167.89 100.65	167.74
23 21	13 23-0517		3,000 LB, Forge Steel Thread-O-Lets (23 21 13 23-0379)		
23 21	13 23-0518	EA	1/2", 3,000 LB, Forge Steel Thread-O-Let <i>For Sock-O-Lets, Add</i> <i>For Weld-O-Lets, Add</i> <i>For Work In Restricted Working Space, Add</i>	58.47 22.66 4.37 14.92	
23 21	13 23-0519	EA	3/4", 3,000 LB, Forge Steel Thread-O-Let <i>For Sock-O-Lets, Add</i> <i>For Weld-O-Lets, Add</i> <i>For Work In Restricted Working Space, Add</i>	69.93 27.09 5.13 17.90	
23 21	13 23-0520	EA	1", 3,000 LB, Forge Steel Thread-O-Let <i>For Sock-O-Lets, Add</i> <i>For Weld-O-Lets, Add</i> <i>For Work In Restricted Working Space, Add</i>	79.31 30.71 5.75 20.34	
23 21	13 23-0521	EA	1-1/4" Or 1-1/2", 3,000 LB, Forge Steel Thread-O-Let <i>For Sock-O-Lets, Add</i> <i>For Weld-O-Lets, Add</i> <i>For Work In Restricted Working Space, Add</i>	90.90 35.36 8.16 22.38	
23 21	13 23-0522	EA	2", 3,000 LB, Forge Steel Thread-O-Let <i>For Sock-O-Lets, Add</i> <i>For Weld-O-Lets, Add</i> <i>For Work In Restricted Working Space, Add</i>	103.28 40.27 10.20 24.86	
23 21	13 23-0523	EA	2-1/2", 3,000 LB, Forge Steel Thread-O-Let <i>For Sock-O-Lets, Add</i> <i>For Weld-O-Lets, Add</i> <i>For Work In Restricted Working Space, Add</i>	180.59 72.33 37.02 31.97	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21 13 23-0524 EA 3", 3,000 LB, Forge Steel Thread-O-Let.....	223.65	
<i>For Sock-O-Lets, Add</i>	88.71	
<i>For Weld-O-Lets, Add</i>	37.24	
<i>For Work In Restricted Working Space, Add</i>	44.75	
23 21 13 23-0525 EA 4", 3,000 LB, Forge Steel Thread-O-Let.....	332.25	
<i>For Sock-O-Lets, Add</i>	133.54	
<i>For Weld-O-Lets, Add</i>	72.89	
<i>For Work In Restricted Working Space, Add</i>	55.94	
23 21 13 23-0526 Bolt, Nut, And 150 LB Rubber Flange Gasket Set <small>(23 21 13 23-0379)</small>		
Note: Used between weld neck or slip-on flanges and valves, or equipment with bolt connections, or between two bolted valves. Flanged equipment, flanged fittings and flanged valves exclude bolt and gasket sets.		
23 21 13 23-0527 EA 3/4" To 1-1/2" Diameter Pipe; Bolt, Nut And 150 LB Rubber Flange Gasket Set.....	7.14	
Note: Includes rubber gasket, and four (4) 1/2" diameter bolts with washer and nut.		
<i>For 300 LB Rating Gasket Set, Add</i>	2.32	
<i>For 150 LB Rating Teflon Gasket Set, Add</i>	9.32	
23 21 13 23-0528 EA 2" Diameter Pipe; Bolt, Nut And 150 LB Rubber Flange Gasket Set.....	12.70	
Note: Includes rubber gasket, and four (4) 5/8" diameter bolts with washer and nut.		
<i>For 300 LB Rating Gasket Set, Add</i>	4.13	
<i>For 150 LB Rating Teflon Gasket Set, Add</i>	16.57	
23 21 13 23-0529 EA 2-1/2" Diameter Pipe; Bolt, Nut And 150 LB Rubber Flange Gasket Set.....	13.62	
Note: Includes rubber gasket, and four (4) 5/8" diameter bolts with washer and nut.		
<i>For 300 LB Rating Gasket Set, Add</i>	4.43	
<i>For 150 LB Rating Teflon Gasket Set, Add</i>	17.77	
23 21 13 23-0530 EA 3" Diameter Pipe; Bolt, Nut And 150 LB Rubber Flange Gasket Set.....	14.33	
Note: Includes rubber gasket, and four (4) 5/8" diameter bolts with washer and nut.		
<i>For 300 LB Rating Gasket Set, Add</i>	4.66	
<i>For 150 LB Rating Teflon Gasket Set, Add</i>	18.70	
23 21 13 23-0531 EA 4" Diameter Pipe; Bolt, Nut And 150 LB Rubber Flange Gasket Set.....	24.93	
Note: Includes rubber gasket, and eight (8) 5/8" diameter bolts with washer and nut.		
<i>For 300 LB Rating Gasket Set, Add</i>	8.10	
<i>For 150 LB Rating Teflon Gasket Set, Add</i>	32.53	
23 21 13 23-0532 EA 5" To 6" Diameter Pipe; Bolt, Nut And 150 LB Rubber Flange Gasket Set.....	39.10	
Note: Includes rubber gasket, and eight (8) 3/4" diameter bolts with washer and nut.		
<i>For 300 LB Rating Gasket Set, Add</i>	12.71	
<i>For 150 LB Rating Teflon Gasket Set, Add</i>	51.03	
23 21 13 23-0533 EA 8" Diameter Pipe; Bolt, Nut And 150 LB Rubber Flange Gasket Set.....	42.06	
Note: Includes rubber gasket, and eight (8) 3/4" diameter bolts with washer and nut.		
<i>For 300 LB Rating Gasket Set, Add</i>	13.67	
<i>For 150 LB Rating Teflon Gasket Set, Add</i>	54.89	
23 21 13 23-0534 EA 10" Diameter Pipe; Bolt, Nut And 150 LB Rubber Flange Gasket Set.....	85.76	
Note: Includes rubber gasket, and twelve (12) 7/8" diameter bolts with washer and nut.		
<i>For 300 LB Rating Gasket Set, Add</i>	27.87	
<i>For 150 LB Rating Teflon Gasket Set, Add</i>	111.92	
23 21 13 23-0535 EA 12" Diameter Pipe; Bolt, Nut And 150 LB Rubber Flange Gasket Set.....	92.82	
Note: Includes rubber gasket, and twelve (12) 7/8" diameter bolts with washer and nut.		
<i>For 300 LB Rating Gasket Set, Add</i>	30.17	
<i>For 150 LB Rating Teflon Gasket Set, Add</i>	121.13	
23 21 13 23-0536 150 LB, Rubber Flange Gasket Replacement <small>(23 21 13 23-0379)</small>		
Note: Includes unbolting, removal of old gaskets, new 150 LB rubber gasket and rebolting.		
23 21 13 23-0537 EA 1/2", 150 LB, Rubber Flange Gasket Replacement.....	22.13	
<i>For 300 LB Rating Gasket Set, Add</i>	0.02	
<i>For 150 LB Rating Teflon Gasket Set, Add</i>	0.54	
<i>For Work In Restricted Working Space, Add</i>	6.62	
<i>For 300 LB Rating Teflon Gasket Set, Add</i>	0.62	
23 21 13 23-0538 EA 3/4", 150 LB, Rubber Flange Gasket Replacement.....	23.64	
<i>For 300 LB Rating Gasket Set, Add</i>	0.04	
<i>For 150 LB Rating Teflon Gasket Set, Add</i>	0.77	
<i>For Work In Restricted Working Space, Add</i>	7.06	
<i>For 300 LB Rating Teflon Gasket Set, Add</i>	0.89	
23 21 13 23-0539 EA 1", 150 LB, Rubber Flange Gasket Replacement.....	25.91	
<i>For 300 LB Rating Gasket Set, Add</i>	0.06	
<i>For 150 LB Rating Teflon Gasket Set, Add</i>	1.31	
<i>For Work In Restricted Working Space, Add</i>	7.72	
<i>For 300 LB Rating Teflon Gasket Set, Add</i>	1.51	
23 21 13 23-0540 EA 1-1/4", 150 LB, Rubber Flange Gasket Replacement.....	28.13	
<i>For 300 LB Rating Gasket Set, Add</i>	0.07	
<i>For 150 LB Rating Teflon Gasket Set, Add</i>	1.47	
<i>For Work In Restricted Working Space, Add</i>	8.38	
<i>For 300 LB Rating Teflon Gasket Set, Add</i>	1.69	
23 21 13 23-0541 EA 1-1/2", 150 LB, Rubber Flange Gasket Replacement.....	31.12	
<i>For 300 LB Rating Gasket Set, Add</i>	0.08	
<i>For 150 LB Rating Teflon Gasket Set, Add</i>	1.86	
<i>For Work In Restricted Working Space, Add</i>	9.26	
<i>For 300 LB Rating Teflon Gasket Set, Add</i>	2.14	
23 21 13 23-0542 EA 2", 150 LB, Rubber Flange Gasket Replacement.....	34.17	
<i>For 300 LB Rating Gasket Set, Add</i>	0.12	
<i>For 150 LB Rating Teflon Gasket Set, Add</i>	2.63	
<i>For Work In Restricted Working Space, Add</i>	10.15	
<i>For 300 LB Rating Teflon Gasket Set, Add</i>	3.03	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 20 HVAC Piping And Pumps****23 21 Hydronic Piping And Pumps**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21	13 23-0543	EA	2-1/2", 150 LB, Rubber Flange Gasket Replacement	40.17	
			<i>For 300 LB Rating Gasket Set, Add</i>	0.16	
			<i>For 150 LB Rating Teflon Gasket Set, Add</i>	3.56	
			<i>For Work In Restricted Working Space, Add</i>	11.91	
			<i>For 300 LB Rating Teflon Gasket Set, Add</i>	4.09	
23 21	13 23-0544	EA	3", 150 LB, Rubber Flange Gasket Replacement	42.45	
			<i>For 300 LB Rating Gasket Set, Add</i>	0.19	
			<i>For 150 LB Rating Teflon Gasket Set, Add</i>	4.10	
			<i>For Work In Restricted Working Space, Add</i>	12.58	
			<i>For 300 LB Rating Teflon Gasket Set, Add</i>	4.72	
23 21	13 23-0545	EA	4", 150 LB, Rubber Flange Gasket Replacement	56.03	
			<i>For 300 LB Rating Gasket Set, Add</i>	0.30	
			<i>For 150 LB Rating Teflon Gasket Set, Add</i>	6.73	
			<i>For Work In Restricted Working Space, Add</i>	16.55	
			<i>For 300 LB Rating Teflon Gasket Set, Add</i>	7.74	
23 21	13 23-0546	EA	5", 150 LB, Rubber Flange Gasket Replacement	64.96	
			<i>For 300 LB Rating Gasket Set, Add</i>	0.34	
			<i>For 150 LB Rating Teflon Gasket Set, Add</i>	7.50	
			<i>For Work In Restricted Working Space, Add</i>	19.20	
			<i>For 300 LB Rating Teflon Gasket Set, Add</i>	8.63	
23 21	13 23-0547	EA	6", 150 LB, Rubber Flange Gasket Replacement	74.06	
			<i>For 300 LB Rating Gasket Set, Add</i>	0.44	
			<i>For 150 LB Rating Teflon Gasket Set, Add</i>	9.74	
			<i>For Work In Restricted Working Space, Add</i>	21.84	
			<i>For 300 LB Rating Teflon Gasket Set, Add</i>	11.21	
23 21	13 23-0548	EA	8", 150 LB, Rubber Flange Gasket Replacement	90.09	
			<i>For 300 LB Rating Gasket Set, Add</i>	0.64	
			<i>For 150 LB Rating Teflon Gasket Set, Add</i>	14.22	
			<i>For Work In Restricted Working Space, Add</i>	26.48	
			<i>For 300 LB Rating Teflon Gasket Set, Add</i>	16.38	
23 21	13 23-0549	EA	10", 150 LB, Rubber Flange Gasket Replacement	96.74	
			<i>For 300 LB Rating Gasket Set, Add</i>	0.91	
			<i>For 150 LB Rating Teflon Gasket Set, Add</i>	20.18	
			<i>For Work In Restricted Working Space, Add</i>	28.24	
			<i>For 300 LB Rating Teflon Gasket Set, Add</i>	23.23	
23 21	13 23-0550	EA	12", 150 LB, Rubber Flange Gasket Replacement	109.98	
			<i>For 300 LB Rating Gasket Set, Add</i>	1.17	
			<i>For 150 LB Rating Teflon Gasket Set, Add</i>	25.82	
			<i>For Work In Restricted Working Space, Add</i>	31.99	
			<i>For 300 LB Rating Teflon Gasket Set, Add</i>	29.73	
23 21	13 23-0551		Cut And Prepare For Welding Existing In-Place Black Steel Pipe (23 21 13 23-0379)		
			Note: For use when connecting pipe to an existing in-place system.		
23 21	13 23-0552	EA	1/2", Cut And Prepare For Welding Existing In Place Black Steel Pipe	15.97	
			<i>For Work In Restricted Working Space, Add</i>	4.79	
23 21	13 23-0553	EA	3/4", Cut And Prepare For Welding Existing In Place Black Steel Pipe	17.25	
			<i>For Work In Restricted Working Space, Add</i>	5.18	
23 21	13 23-0554	EA	1", Cut And Prepare For Welding Existing In Place Black Steel Pipe	19.40	
			<i>For Work In Restricted Working Space, Add</i>	5.82	
23 21	13 23-0555	EA	1-1/4", Cut And Prepare For Welding Existing In Place Black Steel Pipe	20.36	
			<i>For Work In Restricted Working Space, Add</i>	6.11	
23 21	13 23-0556	EA	1-1/2", Cut And Prepare For Welding Existing In Place Black Steel Pipe	21.56	
			<i>For Work In Restricted Working Space, Add</i>	6.47	
23 21	13 23-0557	EA	2", Cut And Prepare For Welding Existing In Place Black Steel Pipe	23.15	
			<i>For Work In Restricted Working Space, Add</i>	6.95	
23 21	13 23-0558	EA	2-1/2", Cut And Prepare For Welding Existing In Place Black Steel Pipe	24.75	
			<i>For Work In Restricted Working Space, Add</i>	7.43	
23 21	13 23-0559	EA	3", Cut And Prepare For Welding Existing In Place Black Steel Pipe	27.15	
			<i>For Work In Restricted Working Space, Add</i>	8.15	
23 21	13 23-0560	EA	4", Cut And Prepare For Welding Existing In Place Black Steel Pipe	29.54	
			<i>For Work In Restricted Working Space, Add</i>	8.86	
23 21	13 23-0561	EA	6", Cut And Prepare For Welding Existing In Place Black Steel Pipe	31.94	
			<i>For Work In Restricted Working Space, Add</i>	9.58	
23 21	13 23-0562	EA	8", Cut And Prepare For Welding Existing In Place Black Steel Pipe	34.34	
			<i>For Work In Restricted Working Space, Add</i>	10.30	
23 21	13 23-0563	EA	10", Cut And Prepare For Welding Existing In Place Black Steel Pipe	37.53	
			<i>For Work In Restricted Working Space, Add</i>	11.26	
23 21	13 23-0564	EA	12", Cut And Prepare For Welding Existing In Place Black Steel Pipe	40.72	
			<i>For Work In Restricted Working Space, Add</i>	12.22	
23 21	13 23-0565		Welded Plain End Electric Resistance Black Steel Pipe (23 21 13 23-0379)		
			Note: ASTM A-135.		
23 21	13 23-0566	LF	2" Electric Resistance Weld Black Pipe, Plain End Schedule 40 ASTM A-135, Not Including Hangers Or Fittings	15.86	8.21
			<i>For Work In Restricted Working Space, Add</i>	4.03	
23 21	13 23-0567	LF	2-1/2" Electric Resistance Weld Black Pipe, Plain End Schedule 40 ASTM A-135, Not Including Hangers Or Fittings	17.17	8.96
			<i>For Work In Restricted Working Space, Add</i>	4.03	
23 21	13 23-0568	LF	3" Electric Resistance Weld Black Pipe, Plain End Schedule 40 ASTM A-135, Not Including Hangers Or Fittings	17.80	8.80
			<i>For Work In Restricted Working Space, Add</i>	3.95	
23 21	13 23-0569	LF	4" Electric Resistance Weld Black Pipe, Plain End Schedule 40 ASTM A-135, Not Including Hangers Or Fittings	22.36	11.18
			<i>For Work In Restricted Working Space, Add</i>	5.03	
23 21	13 23-0570	LF	6" Electric Resistance Weld Black Pipe, Plain End Schedule 40 ASTM A-135, Not Including Hangers Or Fittings	35.64	16.56
			<i>For Work In Restricted Working Space, Add</i>	7.44	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21 13 23-0571 LF 8.322" Electric Resistance Weld Black Pipe, Plain End Schedule 40 ASTM A-135, Not Including Hangers Or Fittings.....	45.90	20.39
<i>For Work In Restricted Working Space, Add</i>	9.19	
23 21 13 23-0572 LF 10.365" Electric Resistance Weld Black Pipe, Plain End Schedule 40 ASTM A-135, Not Including Hangers Or Fittings.....	60.78	25.39
<i>For Work In Restricted Working Space, Add</i>	11.42	
23 21 13 23-0573 LF 12.375" Electric Resistance Weld Black Pipe, Plain End Schedule 40 ASTM A-135, Not Including Hangers Or Fittings.....	73.65	30.62
<i>For Work In Restricted Working Space, Add</i>	13.77	
23 21 13 23-0574 Flanged Steel Fittings <small>(23 21 13 23)</small>		
See CSI section 23 21 13 23-0380 for steel pipe, 23 21 13 23-0480 for welded neck flange ends.		
23 21 13 23-0575 Flanged Steel Fittings, Standard Weight <small>(23 21 13 23-0574)</small>		
Note: Flanged equipment, flanged fittings and flanged valves exclude bolt and gasket sets. See CSI section 23 21 13 23-0526 for gaskets.		
23 21 13 23-0576 Flanged Steel, 90 Degree Elbows <small>(23 21 13 23-0575)</small>		
23 21 13 23-0577 EA 2" Standard Weight, Flanged Steel, 90 Degree Elbow	408.90	34.32
<i>For Galvanized Fittings, Add</i>	285.96	
<i>For Extra Heavy Weight Fittings, Add</i>	428.94	
23 21 13 23-0578 EA 2-1/2" Standard Weight, Flanged Steel, 90 Degree Elbow	456.09	38.22
<i>For Galvanized Fittings, Add</i>	319.01	
<i>For Extra Heavy Weight Fittings, Add</i>	478.51	
23 21 13 23-0579 EA 3" Standard Weight, Flanged Steel, 90 Degree Elbow	451.19	42.19
<i>For Galvanized Fittings, Add</i>	310.38	
<i>For Extra Heavy Weight Fittings, Add</i>	465.58	
23 21 13 23-0580 EA 4" Standard Weight, Flanged Steel, 90 Degree Elbow	574.65	49.02
<i>For Galvanized Fittings, Add</i>	400.92	
<i>For Extra Heavy Weight Fittings, Add</i>	601.38	
23 21 13 23-0581 EA 5" Standard Weight, Flanged Steel, 90 Degree Elbow	809.80	54.90
<i>For Galvanized Fittings, Add</i>	581.98	
<i>For Extra Heavy Weight Fittings, Add</i>	872.96	
23 21 13 23-0582 EA 6" Standard Weight, Flanged Steel, 90 Degree Elbow	853.56	63.73
<i>For Galvanized Fittings, Add</i>	606.41	
<i>For Extra Heavy Weight Fittings, Add</i>	909.61	
23 21 13 23-0583 EA 8" Standard Weight, Flanged Steel, 90 Degree Elbow	1,087.82	70.56
<i>For Galvanized Fittings, Add</i>	785.58	
<i>For Extra Heavy Weight Fittings, Add</i>	1,178.38	
23 21 13 23-0584 Flanged Steel, Reducing 90 Degree Elbows <small>(23 21 13 23-0575)</small>		
23 21 13 23-0585 EA 2-1/2" x 2" Standard Weight, Flanged Steel, Reducing 90 Degree Elbow	776.47	36.31
<i>For Galvanized Fittings, Add</i>	577.66	
<i>For Extra Heavy Weight Fittings, Add</i>	866.50	
23 21 13 23-0586 EA 3" x 2-1/2" Standard Weight, Flanged Steel, Reducing 90 Degree Elbow	807.50	40.21
<i>For Galvanized Fittings, Add</i>	597.78	
<i>For Extra Heavy Weight Fittings, Add</i>	896.68	
23 21 13 23-0587 EA 4" x 3" Standard Weight, Flanged Steel, Reducing 90 Degree Elbow	1,007.78	45.58
<i>For Galvanized Fittings, Add</i>	751.54	
<i>For Extra Heavy Weight Fittings, Add</i>	1,127.32	
23 21 13 23-0588 EA 5" x 3" Standard Weight, Flanged Steel, Reducing 90 Degree Elbow	1,251.08	48.51
<i>For Galvanized Fittings, Add</i>	942.66	
<i>For Extra Heavy Weight Fittings, Add</i>	1,413.98	
23 21 13 23-0589 EA 6" x 4" Standard Weight, Flanged Steel, Reducing 90 Degree Elbow	1,424.51	56.37
<i>For Galvanized Fittings, Add</i>	1,071.98	
<i>For Extra Heavy Weight Fittings, Add</i>	1,607.98	
23 21 13 23-0590 EA 8" x 6" Standard Weight, Flanged Steel, Reducing 90 Degree Elbow	1,992.13	67.18
<i>For Galvanized Fittings, Add</i>	1,513.14	
<i>For Extra Heavy Weight Fittings, Add</i>	2,269.72	
23 21 13 23-0591 Flanged Steel, 45 Degree Elbows <small>(23 21 13 23-0575)</small>		
23 21 13 23-0592 EA 2" Standard Weight, Flanged Steel, 45 Degree Elbow	538.23	34.32
<i>For Galvanized Fittings, Add</i>	389.42	
<i>For Extra Heavy Weight Fittings, Add</i>	584.14	
23 21 13 23-0593 EA 2-1/2" Standard Weight, Flanged Steel, 45 Degree Elbow	560.27	38.22
<i>For Galvanized Fittings, Add</i>	402.35	
<i>For Extra Heavy Weight Fittings, Add</i>	603.53	
23 21 13 23-0594 EA 3" Standard Weight, Flanged Steel, 45 Degree Elbow	580.52	42.19
<i>For Galvanized Fittings, Add</i>	413.85	
<i>For Extra Heavy Weight Fittings, Add</i>	620.77	
23 21 13 23-0595 EA 4" Standard Weight, Flanged Steel, 45 Degree Elbow	725.53	49.02
<i>For Galvanized Fittings, Add</i>	521.62	
<i>For Extra Heavy Weight Fittings, Add</i>	782.44	
23 21 13 23-0596 EA 5" Standard Weight, Flanged Steel, 45 Degree Elbow	1,054.09	54.90
<i>For Galvanized Fittings, Add</i>	777.41	
<i>For Extra Heavy Weight Fittings, Add</i>	1,166.11	
23 21 13 23-0597 EA 6" Standard Weight, Flanged Steel, 45 Degree Elbow	1,022.40	63.73
<i>For Galvanized Fittings, Add</i>	741.48	
<i>For Extra Heavy Weight Fittings, Add</i>	1,112.22	
23 21 13 23-0598 EA 8" Standard Weight, Flanged Steel, 45 Degree Elbow	1,208.07	70.56
<i>For Galvanized Fittings, Add</i>	881.78	
<i>For Extra Heavy Weight Fittings, Add</i>	1,322.68	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 20 HVAC Piping And Pumps****23 21 Hydronic Piping And Pumps**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21 13 23-0599			Flanged Steel, Tees <small>(23 21 13 23-0575)</small>		
23 21 13 23-0600	EA		2" Standard Weight, Flanged Steel, Tee.....	520.85	51.45
			<i>For Galvanized Fittings, Add</i>	354.94	
			<i>For Extra Heavy Weight Fittings, Add</i>	532.40	
23 21 13 23-0601	EA		2-1/2" Standard Weight, Flanged Steel, Tee.....	676.95	57.33
			<i>For Galvanized Fittings, Add</i>	472.77	
			<i>For Extra Heavy Weight Fittings, Add</i>	709.15	
23 21 13 23-0602	EA		3" Standard Weight, Flanged Steel, Tee.....	612.14	63.21
			<i>For Galvanized Fittings, Add</i>	413.86	
			<i>For Extra Heavy Weight Fittings, Add</i>	620.78	
23 21 13 23-0603	EA		4" Standard Weight, Flanged Steel, Tee.....	882.61	73.57
			<i>For Galvanized Fittings, Add</i>	617.89	
			<i>For Extra Heavy Weight Fittings, Add</i>	926.83	
23 21 13 23-0604	EA		5" Standard Weight, Flanged Steel, Tee.....	1,324.02	82.40
			<i>For Galvanized Fittings, Add</i>	960.43	
			<i>For Extra Heavy Weight Fittings, Add</i>	1,440.65	
23 21 13 23-0605	EA		6" Standard Weight, Flanged Steel, Tee.....	1,618.26	95.62
			<i>For Galvanized Fittings, Add</i>	1,179.95	
			<i>For Extra Heavy Weight Fittings, Add</i>	1,769.93	
23 21 13 23-0606	EA		8" Standard Weight, Flanged Steel, Tee.....	1,789.39	110.76
			<i>For Galvanized Fittings, Add</i>	1,298.62	
			<i>For Extra Heavy Weight Fittings, Add</i>	1,947.94	
23 21 13 23-0607			Flanged Steel, Reducing Tees <small>(23 21 13 23-0575)</small>		
23 21 13 23-0608	EA		2-1/2" Standard Weight, Flanged Steel, Reducing Tee.....	835.68	55.42
			<i>For Galvanized Fittings, Add</i>	602.10	
			<i>For Extra Heavy Weight Fittings, Add</i>	903.14	
23 21 13 23-0609	EA		3" Standard Weight, Flanged Steel, Reducing Tee.....	966.64	61.30
			<i>For Galvanized Fittings, Add</i>	699.81	
			<i>For Extra Heavy Weight Fittings, Add</i>	1,049.71	
23 21 13 23-0610	EA		4" Standard Weight, Flanged Steel, Reducing Tee.....	1,680.28	70.12
			<i>For Galvanized Fittings, Add</i>	1,260.14	
			<i>For Extra Heavy Weight Fittings, Add</i>	1,890.22	
23 21 13 23-0611	EA		5" Standard Weight, Flanged Steel, Reducing Tee.....	1,814.50	79.45
			<i>For Galvanized Fittings, Add</i>	1,356.34	
			<i>For Extra Heavy Weight Fittings, Add</i>	2,034.50	
23 21 13 23-0612	EA		6" Standard Weight, Flanged Steel, Reducing Tee.....	2,285.06	91.21
			<i>For Galvanized Fittings, Add</i>	1,718.67	
			<i>For Extra Heavy Weight Fittings, Add</i>	2,578.01	
23 21 13 23-0613	EA		8" Standard Weight, Flanged Steel, Reducing Tee.....	2,858.73	102.46
			<i>For Galvanized Fittings, Add</i>	2,164.10	
			<i>For Extra Heavy Weight Fittings, Add</i>	3,246.14	
23 21 13 23-0614			Flanged Steel, Concentric Reducers <small>(23 21 13 23-0575)</small>		
23 21 13 23-0615	EA		3" x 2-1/2" Standard Weight, Flanged Steel, Concentric Reducer.....	796.72	40.21
			<i>For Galvanized Fittings, Add</i>	589.16	
			<i>For Extra Heavy Weight Fittings, Add</i>	883.74	
23 21 13 23-0616	EA		4" x 3" Standard Weight, Flanged Steel, Concentric Reducer.....	905.39	45.58
			<i>For Galvanized Fittings, Add</i>	669.63	
			<i>For Extra Heavy Weight Fittings, Add</i>	1,004.45	
23 21 13 23-0617	EA		5" x 4" Standard Weight, Flanged Steel, Concentric Reducer.....	1,351.43	51.96
			<i>For Galvanized Fittings, Add</i>	1,018.82	
			<i>For Extra Heavy Weight Fittings, Add</i>	1,528.22	
23 21 13 23-0618	EA		6" x 4" Standard Weight, Flanged Steel, Concentric Reducer.....	1,490.98	56.37
			<i>For Galvanized Fittings, Add</i>	1,125.16	
			<i>For Extra Heavy Weight Fittings, Add</i>	1,687.74	
23 21 13 23-0619	EA		8" x 6" Standard Weight, Flanged Steel, Concentric Reducer.....	1,746.04	67.18
			<i>For Galvanized Fittings, Add</i>	1,316.27	
			<i>For Extra Heavy Weight Fittings, Add</i>	1,974.41	
23 21 13 23-0620			Flanged Steel, Eccentric Reducers <small>(23 21 13 23-0575)</small>		
23 21 13 23-0621	EA		4" x 3" Standard Weight, Flanged Steel, Eccentric Reducer.....	1,058.07	45.58
			<i>For Galvanized Fittings, Add</i>	791.78	
			<i>For Extra Heavy Weight Fittings, Add</i>	1,187.66	
23 21 13 23-0622	EA		5" x 4" Standard Weight, Flanged Steel, Eccentric Reducer.....	1,448.43	51.96
			<i>For Galvanized Fittings, Add</i>	1,096.42	
			<i>For Extra Heavy Weight Fittings, Add</i>	1,644.62	
23 21 13 23-0623			Plain End Couplings And Fittings <small>(23 21 13 23)</small>		
			Note: For use on standard weight steel pipe (Schedule 40), but may be used on lightwall steel or other metallic pipe such as aluminum or stainless steel.		
23 21 13 23-0624			Plain End Piping System Couplings <small>(23 21 13 23-0623)</small>		
23 21 13 23-0625			Plainlock Plain End Piping System Couplings <small>(23 21 13 23-0624)</small>		
			Note: Ductile iron body with gasket, bolts and nuts.		
23 21 13 23-0626	EA		1" Plainlock Plain End Piping System Coupling.....	104.70	4.41
			<i>For Galvanized Fittings, Add</i>	19.62	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21 13 23-0627 EA 1-1/2" Plainlock Plain End Piping System Coupling.....	107.27	6.10
<i>For Galvanized Fittings, Add</i>	19.62	
23 21 13 23-0628 EA 2" Plainlock Plain End Piping System Coupling.....	110.25	8.09
<i>For Galvanized Fittings, Add</i>	19.62	
23 21 13 23-0629 EA 2-1/2" Plainlock Plain End Piping System Coupling.....	112.79	9.77
<i>For Galvanized Fittings, Add</i>	19.62	
23 21 13 23-0630 EA 3" Plainlock Plain End Piping System Coupling.....	133.40	11.76
<i>For Galvanized Fittings, Add</i>	23.15	
23 21 13 23-0631 EA 4" Plainlock Plain End Piping System Coupling.....	183.90	15.66
<i>For Galvanized Fittings, Add</i>	32.08	
23 21 13 23-0632 EA 6" Plainlock Plain End Piping System Coupling.....	309.03	25.51
<i>For Galvanized Fittings, Add</i>	54.16	
23 21 13 23-0633 Roust-A-Bout Plain End Piping System Couplings <small>(23 21 13 23-0624)</small>		
Note: Ductile iron body with gasket, bolts and nuts.		
23 21 13 23-0634 EA 1-1/2" Roust-A-Bout Plain End Piping System Coupling.....	126.32	6.10
<i>For Galvanized Fittings, Add</i>	29.28	
23 21 13 23-0635 EA 2" Roust-A-Bout Plain End Piping System Coupling.....	129.30	8.09
<i>For Galvanized Fittings, Add</i>	29.28	
23 21 13 23-0636 EA 2-1/2" Roust-A-Bout Plain End Piping System Coupling.....	131.85	9.85
<i>For Galvanized Fittings, Add</i>	29.28	
23 21 13 23-0637 EA 3" Roust-A-Bout Plain End Piping System Coupling.....	191.13	11.76
<i>For Galvanized Fittings, Add</i>	43.38	
23 21 13 23-0638 EA 3-1/2" Roust-A-Bout Plain End Piping System Coupling.....	221.39	13.74
<i>For Galvanized Fittings, Add</i>	50.20	
23 21 13 23-0639 EA 4" Roust-A-Bout Plain End Piping System Coupling.....	224.30	15.66
<i>For Galvanized Fittings, Add</i>	50.20	
23 21 13 23-0640 EA 5" Roust-A-Bout Plain End Piping System Coupling.....	316.29	19.62
<i>For Galvanized Fittings, Add</i>	71.72	
23 21 13 23-0641 EA 6" Roust-A-Bout Plain End Piping System Coupling.....	388.58	25.51
<i>For Galvanized Fittings, Add</i>	67.59	
23 21 13 23-0642 EA 8" Roust-A-Bout Plain End Piping System Coupling.....	666.86	30.43
<i>For Galvanized Fittings, Add</i>	155.31	
23 21 13 23-0643 EA 10" Roust-A-Bout Plain End Piping System Coupling.....	862.28	36.01
<i>For Galvanized Fittings, Add</i>	202.06	
23 21 13 23-0644 EA 12" Roust-A-Bout Plain End Piping System Coupling.....	1,078.11	42.63
<i>For Galvanized Fittings, Add</i>	253.54	
23 21 13 23-0645 EA 14" Roust-A-Bout Plain End Piping System Coupling.....	1,510.79	47.12
<i>For Galvanized Fittings, Add</i>	360.03	
23 21 13 23-0646 EA 16" Roust-A-Bout Plain End Piping System Coupling.....	2,052.03	53.29
<i>For Galvanized Fittings, Add</i>	493.03	
23 21 13 23-0647 Plain End Piping System Fittings <small>(23 21 13 23-0623)</small>		
Note: Cast ductile iron bodies.		
23 21 13 23-0648 Plain End Piping System, 90 Degree Elbows <small>(23 21 13 23-0647)</small>		
23 21 13 23-0649 EA 1" Plain End Piping System, 90 Degree Elbow.....	104.60	8.01
<i>For Galvanized Fittings, Add</i>	18.52	
23 21 13 23-0650 EA 1-1/2" Plain End Piping System, 90 Degree Elbow.....	110.78	12.13
<i>For Galvanized Fittings, Add</i>	18.52	
23 21 13 23-0651 EA 2" Plain End Piping System, 90 Degree Elbow.....	116.61	16.03
<i>For Galvanized Fittings, Add</i>	18.52	
23 21 13 23-0652 EA 2-1/2" Plain End Piping System, 90 Degree Elbow.....	121.85	19.55
<i>For Galvanized Fittings, Add</i>	18.52	
23 21 13 23-0653 EA 3" Plain End Piping System, 90 Degree Elbow.....	146.68	23.66
<i>For Galvanized Fittings, Add</i>	22.24	
23 21 13 23-0654 EA 4" Plain End Piping System, 90 Degree Elbow.....	208.93	31.17
<i>For Galvanized Fittings, Add</i>	32.44	
23 21 13 23-0655 EA 5" Plain End Piping System, 90 Degree Elbow.....	619.88	39.03
<i>For Galvanized Fittings, Add</i>	112.27	
23 21 13 23-0656 EA 6" Plain End Piping System, 90 Degree Elbow.....	522.93	51.09
<i>For Galvanized Fittings, Add</i>	89.27	
23 21 13 23-0657 EA 8" Plain End Piping System, 90 Degree Elbow.....	1,033.74	60.64
<i>For Galvanized Fittings, Add</i>	188.55	
23 21 13 23-0658 EA 10" Plain End Piping System, 90 Degree Elbow.....	1,291.14	70.85
<i>For Galvanized Fittings, Add</i>	236.98	
23 21 13 23-0659 EA 12" Plain End Piping System, 90 Degree Elbow.....	1,636.29	85.12
<i>For Galvanized Fittings, Add</i>	301.74	
23 21 13 23-0660 Plain End Piping System, 45 Degree Elbows <small>(23 21 13 23-0647)</small>		
23 21 13 23-0661 EA 1" Plain End Piping System, 45 Degree Elbow.....	104.60	8.01
<i>For Galvanized Fittings, Add</i>	18.52	
23 21 13 23-0662 EA 1-1/2" Plain End Piping System, 45 Degree Elbow.....	110.78	12.13
<i>For Galvanized Fittings, Add</i>	18.52	
23 21 13 23-0663 EA 2" Plain End Piping System, 45 Degree Elbow.....	116.61	16.03
<i>For Galvanized Fittings, Add</i>	18.52	
23 21 13 23-0664 EA 2-1/2" Plain End Piping System, 45 Degree Elbow.....	121.85	19.55
<i>For Galvanized Fittings, Add</i>	18.52	
23 21 13 23-0665 EA 3" Plain End Piping System, 45 Degree Elbow.....	146.68	23.66
<i>For Galvanized Fittings, Add</i>	22.24	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 20 HVAC Piping And Pumps****23 21 Hydronic Piping And Pumps**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21 13 23-0666 EA 4" Plain End Piping System, 45 Degree Elbow	208.93	31.17
For Galvanized Fittings, Add	32.44	
23 21 13 23-0667 EA 5" Plain End Piping System, 45 Degree Elbow	619.88	39.03
For Galvanized Fittings, Add	112.27	
23 21 13 23-0668 EA 6" Plain End Piping System, 45 Degree Elbow	524.65	51.09
For Galvanized Fittings, Add	89.62	
23 21 13 23-0669 EA 8" Plain End Piping System, 45 Degree Elbow	608.99	60.64
For Galvanized Fittings, Add	103.60	
23 21 13 23-0670 EA 10" Plain End Piping System, 45 Degree Elbow	829.15	70.85
For Galvanized Fittings, Add	144.59	
23 21 13 23-0671 EA 12" Plain End Piping System, 45 Degree Elbow	1,061.54	85.12
For Galvanized Fittings, Add	186.79	
23 21 13 23-0672 Plain End Piping System, Tees (23 21 13 23-0647)		
23 21 13 23-0673 EA 1" Plain End Piping System, Tee	142.87	12.13
For Galvanized Fittings, Add	24.94	
23 21 13 23-0674 EA 1-1/2" Plain End Piping System, Tee	151.98	18.22
For Galvanized Fittings, Add	24.94	
23 21 13 23-0675 EA 2" Plain End Piping System, Tee	160.02	23.59
For Galvanized Fittings, Add	24.94	
23 21 13 23-0676 EA 2-1/2" Plain End Piping System, Tee	168.02	28.88
For Galvanized Fittings, Add	24.94	
23 21 13 23-0677 EA 3" Plain End Piping System, Tee	232.68	35.50
For Galvanized Fittings, Add	35.88	
23 21 13 23-0678 EA 4" Plain End Piping System, Tee	318.36	45.94
For Galvanized Fittings, Add	49.91	
23 21 13 23-0679 EA 5" Plain End Piping System, Tee	638.21	60.05
For Galvanized Fittings, Add	109.63	
23 21 13 23-0680 EA 6" Plain End Piping System, Tee	789.24	75.19
For Galvanized Fittings, Add	135.30	
23 21 13 23-0681 EA 8" Plain End Piping System, Tee	1,074.50	91.43
For Galvanized Fittings, Add	187.47	
23 21 13 23-0682 EA 10" Plain End Piping System, Tee	1,591.23	106.57
For Galvanized Fittings, Add	286.29	
23 21 13 23-0683 EA 12" Plain End Piping System, Tee	2,127.84	127.67
For Galvanized Fittings, Add	387.29	
23 21 13 23-0684 Plain End Piping System, Reducing Tees (23 21 13 23-0647)		
23 21 13 23-0685 EA 1-1/2" Plain End Piping System, Reducing Tee	275.74	19.55
For Galvanized Fittings, Add	49.29	
23 21 13 23-0686 EA 2" Plain End Piping System, Reducing Tee	281.78	23.59
For Galvanized Fittings, Add	49.29	
23 21 13 23-0687 EA 2-1/2" Plain End Piping System, Reducing Tee	289.78	28.88
For Galvanized Fittings, Add	49.29	
23 21 13 23-0688 EA 3" Plain End Piping System, Reducing Tee	299.70	35.50
For Galvanized Fittings, Add	49.29	
23 21 13 23-0689 EA 4" Plain End Piping System, Reducing Tee	432.66	45.94
For Galvanized Fittings, Add	72.77	
23 21 13 23-0690 EA 6" Plain End Piping System, Reducing Tee	730.55	75.19
For Galvanized Fittings, Add	123.56	
23 21 13 23-0691 EA 8" Plain End Piping System, Reducing Tee	950.76	91.43
For Galvanized Fittings, Add	162.73	
23 21 13 23-0692 EA 10" Plain End Piping System, Reducing Tee	1,414.12	106.57
For Galvanized Fittings, Add	250.87	
23 21 13 23-0693 EA 12" Plain End Piping System, Reducing Tee	2,077.16	127.67
For Galvanized Fittings, Add	377.15	
23 21 13 23-0694 Plain End Piping System, Wyes (23 21 13 23-0647)		
23 21 13 23-0695 EA 2" Plain End Piping System, Wye	400.54	23.59
For Galvanized Fittings, Add	73.04	
23 21 13 23-0696 EA 2-1/2" Plain End Piping System, Wye	408.54	28.88
For Galvanized Fittings, Add	73.04	
23 21 13 23-0697 EA 3" Plain End Piping System, Wye	463.77	35.50
For Galvanized Fittings, Add	82.10	
23 21 13 23-0698 EA 4" Plain End Piping System, Wye	678.15	45.94
For Galvanized Fittings, Add	121.86	
23 21 13 23-0699 EA 5" Plain End Piping System, Wye	831.54	60.05
For Galvanized Fittings, Add	148.29	
23 21 13 23-0700 EA 6" Plain End Piping System, Wye	1,133.76	75.19
For Galvanized Fittings, Add	204.21	
23 21 13 23-0701 EA 8" Plain End Piping System, Wye	1,459.43	91.43
For Galvanized Fittings, Add	264.46	
23 21 13 23-0702 EA 10" Plain End Piping System, Wye	2,109.68	106.57
For Galvanized Fittings, Add	389.98	
23 21 13 23-0703 EA 12" Plain End Piping System, Wye	3,197.35	127.67
For Galvanized Fittings, Add	601.19	
23 21 13 23-0704 Plain End Piping System, Laterals (23 21 13 23-0647)		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21 13 23-0705 EA 2" Plain End Piping System, Lateral	426.37	23.59
<i>For Galvanized Fittings, Add</i>	78.21	
23 21 13 23-0706 EA 2-1/2" Plain End Piping System, Lateral	434.37	28.88
<i>For Galvanized Fittings, Add</i>	78.21	
23 21 13 23-0707 EA 3" Plain End Piping System, Lateral	489.42	35.50
<i>For Galvanized Fittings, Add</i>	87.23	
23 21 13 23-0708 EA 4" Plain End Piping System, Lateral	727.15	45.94
<i>For Galvanized Fittings, Add</i>	131.66	
23 21 13 23-0709 EA 5" Plain End Piping System, Lateral	948.24	60.05
<i>For Galvanized Fittings, Add</i>	171.63	
23 21 13 23-0710 EA 6" Plain End Piping System, Lateral	1,208.84	75.19
<i>For Galvanized Fittings, Add</i>	219.22	
23 21 13 23-0711 EA 8" Plain End Piping System, Lateral	1,735.22	91.43
<i>For Galvanized Fittings, Add</i>	319.62	
23 21 13 23-0712 EA 10" Plain End Piping System, Lateral	2,415.67	106.57
<i>For Galvanized Fittings, Add</i>	451.18	
23 21 13 23-0713 EA 12" Plain End Piping System, Lateral	3,242.83	127.67
<i>For Galvanized Fittings, Add</i>	610.28	
23 21 13 23-0714 Plain End Piping System, Crosses (23 21 13 23-0647)		
23 21 13 23-0715 EA 2" Plain End Piping System, Cross	477.54	35.35
<i>For Galvanized Fittings, Add</i>	53.07	
23 21 13 23-0716 EA 2-1/2" Plain End Piping System, Cross	489.51	43.29
<i>For Galvanized Fittings, Add</i>	53.07	
23 21 13 23-0717 EA 3" Plain End Piping System, Cross	572.35	53.29
<i>For Galvanized Fittings, Add</i>	61.56	
23 21 13 23-0718 EA 4" Plain End Piping System, Cross	779.74	68.87
<i>For Galvanized Fittings, Add</i>	84.56	
23 21 13 23-0719 EA 5" Plain End Piping System, Cross	1,095.99	90.11
<i>For Galvanized Fittings, Add</i>	120.11	
23 21 13 23-0720 EA 6" Plain End Piping System, Cross	1,437.34	112.46
<i>For Galvanized Fittings, Add</i>	158.60	
23 21 13 23-0721 EA 8" Plain End Piping System, Cross	1,831.86	136.20
<i>For Galvanized Fittings, Add</i>	203.46	
23 21 13 23-0722 EA 10" Plain End Piping System, Cross	2,613.55	159.20
<i>For Galvanized Fittings, Add</i>	296.86	
23 21 13 23-0723 EA 12" Plain End Piping System, Cross	3,711.54	191.55
<i>For Galvanized Fittings, Add</i>	428.05	
23 21 13 23-0724 Plain End Piping System, Adapter Nipples (23 21 13 23-0647)		
Note: Plain to threaded, plain to beveled or plain to grooved.		
23 21 13 23-0725 EA 1" Plain End Piping System, Adapter Nipple	19.30	4.41
<i>For Galvanized Fittings, Add</i>	3.17	
23 21 13 23-0726 EA 1-1/2" Plain End Piping System, Adapter Nipple	22.22	6.10
<i>For Galvanized Fittings, Add</i>	3.26	
23 21 13 23-0727 EA 2" Plain End Piping System, Adapter Nipple	25.12	8.09
<i>For Galvanized Fittings, Add</i>	3.26	
23 21 13 23-0728 EA 2-1/2" Plain End Piping System, Adapter Nipple	29.96	9.77
<i>For Galvanized Fittings, Add</i>	3.82	
23 21 13 23-0729 EA 3" Plain End Piping System, Adapter Nipple	36.50	11.76
<i>For Galvanized Fittings, Add</i>	4.72	
23 21 13 23-0730 EA 4" Plain End Piping System, Adapter Nipple	55.05	15.66
<i>For Galvanized Fittings, Add</i>	7.88	
23 21 13 23-0731 EA 6" Plain End Piping System, Adapter Nipple	114.68	19.62
<i>For Galvanized Fittings, Add</i>	21.32	
23 21 13 23-0732 Plain End Piping System, Reducing (Swaged) Nipples (23 21 13 23-0647)		
23 21 13 23-0733 EA 1-1/2" x 1" Plain End Piping System, Reducing (Swaged) Nipple	58.40	10.51
<i>For Galvanized Fittings, Add</i>	10.65	
23 21 13 23-0734 EA 2" x 1" Plain End Piping System, Reducing (Swaged) Nipple	61.35	12.49
<i>For Galvanized Fittings, Add</i>	10.65	
23 21 13 23-0735 EA 2" x 1-1/2" Plain End Piping System, Reducing (Swaged) Nipple	64.32	14.48
<i>For Galvanized Fittings, Add</i>	10.65	
23 21 13 23-0736 EA 2-1/2" x 1" Plain End Piping System, Reducing (Swaged) Nipple	63.60	14.04
<i>For Galvanized Fittings, Add</i>	10.65	
23 21 13 23-0737 EA 2-1/2" x 1-1/2" Plain End Piping System, Reducing (Swaged) Nipple	66.50	15.95
<i>For Galvanized Fittings, Add</i>	10.65	
23 21 13 23-0738 EA 2-1/2" x 2" Plain End Piping System, Reducing (Swaged) Nipple	69.43	17.86
<i>For Galvanized Fittings, Add</i>	10.65	
23 21 13 23-0739 EA 3" x 1" Plain End Piping System, Reducing (Swaged) Nipple	76.10	16.17
<i>For Galvanized Fittings, Add</i>	12.97	
23 21 13 23-0740 EA 3" x 1-1/2" Plain End Piping System, Reducing (Swaged) Nipple	78.72	17.86
<i>For Galvanized Fittings, Add</i>	12.97	
23 21 13 23-0741 EA 3" x 2" Plain End Piping System, Reducing (Swaged) Nipple	69.69	19.85
<i>For Galvanized Fittings, Add</i>	9.98	
23 21 13 23-0742 EA 3" x 2-1/2" Plain End Piping System, Reducing (Swaged) Nipple	75.38	23.66
<i>For Galvanized Fittings, Add</i>	9.98	
23 21 13 23-0743 EA 3-1/2" x 3" Plain End Piping System, Reducing (Swaged) Nipple	85.92	25.51
<i>For Galvanized Fittings, Add</i>	11.93	
23 21 13 23-0744 EA 4" x 1" Plain End Piping System, Reducing (Swaged) Nipple	103.09	20.07
<i>For Galvanized Fittings, Add</i>	18.24	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 20 HVAC Piping And Pumps****23 21 Hydronic Piping And Pumps**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21 13 23-0745 EA 4" x 1-1/2" Plain End Piping System, Reducing (Swaged) Nipple.....	105.67	21.83
For Galvanized Fittings, Add	18.24	
23 21 13 23-0746 EA 4" x 2" Plain End Piping System, Reducing (Swaged) Nipple.....	90.93	23.82
For Galvanized Fittings, Add	13.81	
23 21 13 23-0747 EA 4" x 2-1/2" Plain End Piping System, Reducing (Swaged) Nipple.....	93.45	25.51
For Galvanized Fittings, Add	13.81	
23 21 13 23-0748 EA 4" x 3" Plain End Piping System, Reducing (Swaged) Nipple.....	96.45	27.49
For Galvanized Fittings, Add	13.81	
23 21 13 23-0749 EA 4" x 3-1/2" Plain End Piping System, Reducing (Swaged) Nipple.....	99.31	29.40
For Galvanized Fittings, Add	13.81	
23 21 13 23-0750 EA 5" x 2" Plain End Piping System, Reducing (Swaged) Nipple.....	244.76	27.71
For Galvanized Fittings, Add	50.80	
23 21 13 23-0751 EA 5" x 3" Plain End Piping System, Reducing (Swaged) Nipple.....	203.83	31.31
For Galvanized Fittings, Add	39.21	
23 21 13 23-0752 EA 5" x 4" Plain End Piping System, Reducing (Swaged) Nipple.....	182.02	35.35
For Galvanized Fittings, Add	32.27	
23 21 13 23-0753 EA 6" x 1" Plain End Piping System, Reducing (Swaged) Nipple.....	431.97	29.92
For Galvanized Fittings, Add	96.79	
23 21 13 23-0754 EA 6" x 1-1/2" Plain End Piping System, Reducing (Swaged) Nipple.....	434.51	31.60
For Galvanized Fittings, Add	96.79	
23 21 13 23-0755 EA 6" x 2" Plain End Piping System, Reducing (Swaged) Nipple.....	336.69	33.59
For Galvanized Fittings, Add	71.59	
23 21 13 23-0756 EA 6" x 2-1/2" Plain End Piping System, Reducing (Swaged) Nipple.....	339.31	35.35
For Galvanized Fittings, Add	71.59	
23 21 13 23-0757 EA 6" x 3" Plain End Piping System, Reducing (Swaged) Nipple.....	241.43	37.26
For Galvanized Fittings, Add	46.40	
23 21 13 23-0758 EA 6" x 3-1/2" Plain End Piping System, Reducing (Swaged) Nipple.....	244.10	39.03
For Galvanized Fittings, Add	46.40	
23 21 13 23-0759 EA 6" x 4" Plain End Piping System, Reducing (Swaged) Nipple.....	202.40	41.16
For Galvanized Fittings, Add	35.19	
23 21 13 23-0760 EA 6" x 5" Plain End Piping System, Reducing (Swaged) Nipple.....	228.93	45.06
For Galvanized Fittings, Add	40.34	
23 21 13 23-0761 EA 8" x 3" Plain End Piping System, Reducing (Swaged) Nipple.....	286.95	42.12
For Galvanized Fittings, Add	55.95	
23 21 13 23-0762 EA 8" x 4" Plain End Piping System, Reducing (Swaged) Nipple.....	292.89	46.09
For Galvanized Fittings, Add	55.95	
23 21 13 23-0763 EA 8" x 5" Plain End Piping System, Reducing (Swaged) Nipple.....	329.61	50.06
For Galvanized Fittings, Add	63.65	
23 21 13 23-0764 EA 8" x 6" Plain End Piping System, Reducing (Swaged) Nipple.....	369.31	55.93
For Galvanized Fittings, Add	71.35	
23 21 13 23-0765 Plain End Piping System, Bull Plugs (23 21 13 23-0647)		
23 21 13 23-0766 EA 1" Plain End Piping System, Bull Plug.....	207.93	4.41
For Galvanized Fittings, Add	60.39	
23 21 13 23-0767 EA 1-1/2" Plain End Piping System, Bull Plug.....	210.50	6.10
For Galvanized Fittings, Add	60.39	
23 21 13 23-0768 EA 2" Plain End Piping System, Bull Plug.....	213.40	8.09
For Galvanized Fittings, Add	60.39	
23 21 13 23-0769 EA 2-1/2" Plain End Piping System, Bull Plug.....	216.01	9.77
For Galvanized Fittings, Add	60.39	
23 21 13 23-0770 EA 3" Plain End Piping System, Bull Plug.....	312.73	11.76
For Galvanized Fittings, Add	88.53	
23 21 13 23-0771 EA 4" Plain End Piping System, Bull Plug.....	404.67	15.66
For Galvanized Fittings, Add	114.35	
23 21 13 23-0772 EA 5" Plain End Piping System, Bull Plug.....	702.99	19.62
For Galvanized Fittings, Add	202.08	
23 21 13 23-0773 EA 6" Plain End Piping System, Bull Plug.....	936.62	25.51
For Galvanized Fittings, Add	269.52	
23 21 13 23-0774 EA 8" Plain End Piping System, Bull Plug.....	1,734.61	30.35
For Galvanized Fittings, Add	506.71	
23 21 13 23-0775 EA 10" Plain End Piping System, Bull Plug.....	3,119.44	35.50
For Galvanized Fittings, Add	919.85	
23 21 13 23-0776 EA 12" Plain End Piping System, Bull Plug.....	4,779.17	42.63
For Galvanized Fittings, Add	1,414.57	
23 21 13 23-0777 Carbon Steel Piping Systems (23 21 13 23)		
23 21 13 23-0778 Class 3,000 LB Carbon Steel Socket Weld Fittings (23 21 13 23-0777)		
Note: ASTM A105		
23 21 13 23-0779 90 Degree Elbows, 3,000 LB Carbon Steel Socket Weld (23 21 13 23-0778)		
23 21 13 23-0780 EA 1/2" 90 Degree Elbow, Carbon Steel, Socket Weld, 3,000 LB.....	26.88	14.56
23 21 13 23-0781 EA 3/4" 90 Degree Elbow, Carbon Steel, Socket Weld, 3,000 LB.....	30.21	16.24
23 21 13 23-0782 EA 1" 90 Degree Elbow, Carbon Steel, Socket Weld, 3,000 LB.....	37.97	18.15
23 21 13 23-0783 EA 1-1/4" 90 Degree Elbow, Carbon Steel, Socket Weld, 3,000 LB.....	50.86	20.58
23 21 13 23-0784 EA 1-1/2" 90 Degree Elbow, Carbon Steel, Socket Weld, 3,000 LB.....	58.08	23.15
23 21 13 23-0785 EA 2" 90 Degree Elbow, Carbon Steel, Socket Weld, 3,000 LB.....	78.39	29.48
23 21 13 23-0786 EA 2-1/2" 90 Degree Elbow, Carbon Steel, Socket Weld, 3,000 LB.....	152.23	43.59
23 21 13 23-0787 EA 3" 90 Degree Elbow, Carbon Steel, Socket Weld, 3,000 LB.....	215.67	57.33
23 21 13 23-0788 EA 4" 90 Degree Elbow, Carbon Steel, Socket Weld, 3,000 LB.....	370.71	63.56



	MINOR CSI UOM DESCRIPTION		TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21 13 23-0789	45 Degree Elbows, 3,000 LB Carbon Steel Socket Weld <small>(23 21 13 23-0778)</small>			
	23 21 13 23-0790 EA 1/2" 45 Degree Elbow, Carbon Steel, Socket Weld, 3,000 LB.....	29.13	14.56	
	23 21 13 23-0791 EA 3/4" 45 Degree Elbow, Carbon Steel, Socket Weld, 3,000 LB.....	33.61	16.24	
	23 21 13 23-0792 EA 1" 45 Degree Elbow, Carbon Steel, Socket Weld, 3,000 LB.....	39.01	18.15	
	23 21 13 23-0793 EA 1-1/4" 45 Degree Elbow, Carbon Steel, Socket Weld, 3,000 LB.....	52.19	20.58	
	23 21 13 23-0794 EA 1-1/2" 45 Degree Elbow, Carbon Steel, Socket Weld, 3,000 LB.....	61.25	23.15	
	23 21 13 23-0795 EA 2" 45 Degree Elbow, Carbon Steel, Socket Weld, 3,000 LB.....	78.32	29.48	
	23 21 13 23-0796 EA 2-1/2" 45 Degree Elbow, Carbon Steel, Socket Weld, 3,000 LB.....	171.64	43.59	
	23 21 13 23-0797 EA 3" 45 Degree Elbow, Carbon Steel, Socket Weld, 3,000 LB.....	232.10	57.33	
	23 21 13 23-0798 EA 4" 45 Degree Elbow, Carbon Steel, Socket Weld, 3,000 LB.....	363.60	63.56	
23 21 13 23-0799	Straight Tees, 3,000 LB Carbon Steel Socket Weld <small>(23 21 13 23-0778)</small>			
	23 21 13 23-0800 EA 1/2" Tee, Straight, Carbon Steel, Socket Weld, 3,000 LB.....	33.02	18.15	
	23 21 13 23-0801 EA 3/4" Tee, Straight, Carbon Steel, Socket Weld, 3,000 LB.....	39.78	20.94	
	23 21 13 23-0802 EA 1" Tee, Straight, Carbon Steel, Socket Weld, 3,000 LB.....	51.93	24.77	
	23 21 13 23-0803 EA 1-1/4" Tee, Straight, Carbon Steel, Socket Weld, 3,000 LB.....	68.29	29.48	
	23 21 13 23-0804 EA 1-1/2" Tee, Straight, Carbon Steel, Socket Weld, 3,000 LB.....	82.63	35.14	
	23 21 13 23-0805 EA 2" Tee, Straight, Carbon Steel, Socket Weld, 3,000 LB.....	108.80	43.59	
	23 21 13 23-0806 EA 2-1/2" Tee, Straight, Carbon Steel, Socket Weld, 3,000 LB.....	190.61	57.33	
	23 21 13 23-0807 EA 3" Tee, Straight, Carbon Steel, Socket Weld, 3,000 LB.....	259.21	68.06	
	23 21 13 23-0808 EA 4" Tee, Straight, Carbon Steel, Socket Weld, 3,000 LB.....	489.48	80.25	
23 21 13 23-0809	Reducing Tees, 3,000 LB Carbon Steel Socket Weld <small>(23 21 13 23-0778)</small>			
	23 21 13 23-0810 EA 1/2" Tee, Reducing, Carbon Steel, Socket Weld, 3,000 LB.....	33.63	18.15	
	23 21 13 23-0811 EA 3/4" Tee, Reducing, Carbon Steel, Socket Weld, 3,000 LB.....	40.42	20.94	
	23 21 13 23-0812 EA 1" Tee, Reducing, Carbon Steel, Socket Weld, 3,000 LB.....	52.69	24.77	
	23 21 13 23-0813 EA 1-1/4" Tee, Reducing, Carbon Steel, Socket Weld, 3,000 LB.....	70.09	29.48	
	23 21 13 23-0814 EA 1-1/2" Tee, Reducing, Carbon Steel, Socket Weld, 3,000 LB.....	84.75	35.14	
	23 21 13 23-0815 EA 2" Tee, Reducing, Carbon Steel, Socket Weld, 3,000 LB.....	112.05	43.59	
	23 21 13 23-0816 EA 2-1/2" Tee, Reducing, Carbon Steel, Socket Weld, 3,000 LB.....	198.33	57.33	
	23 21 13 23-0817 EA 3" Tee, Reducing, Carbon Steel, Socket Weld, 3,000 LB.....	270.32	68.06	
	23 21 13 23-0818 EA 4" Tee, Reducing, Carbon Steel, Socket Weld, 3,000 LB.....	449.93	80.25	
23 21 13 23-0819	Straight Couplings, 3,000 LB Carbon Steel Socket Weld <small>(23 21 13 23-0778)</small>			
	23 21 13 23-0820 EA 1/2" Coupling, Straight, Carbon Steel, Socket Weld, 3,000 LB.....	24.11	14.56	
	23 21 13 23-0821 EA 3/4" Coupling, Straight, Carbon Steel, Socket Weld, 3,000 LB.....	27.14	16.24	
	23 21 13 23-0822 EA 1" Coupling, Straight, Carbon Steel, Socket Weld, 3,000 LB.....	31.45	18.15	
	23 21 13 23-0823 EA 1-1/4" Coupling, Straight, Carbon Steel, Socket Weld, 3,000 LB.....	36.16	20.58	
	23 21 13 23-0824 EA 1-1/2" Coupling, Straight, Carbon Steel, Socket Weld, 3,000 LB.....	41.94	23.15	
	23 21 13 23-0825 EA 2" Coupling, Straight, Carbon Steel, Socket Weld, 3,000 LB.....	54.63	29.48	
	23 21 13 23-0826 EA 2-1/2" Coupling, Straight, Carbon Steel, Socket, Weld, 3,000 LB.....	91.70	43.59	
	23 21 13 23-0827 EA 3" Coupling, Straight, Carbon Steel, Socket Weld, 3,000 LB.....	122.33	57.33	
	23 21 13 23-0828 EA 4" Coupling, Straight, Carbon Steel, Socket Weld, 3,000 LB.....	167.80	63.56	
23 21 13 23-0829	Reducing Couplings, 3,000 LB Carbon Steel Socket Weld <small>(23 21 13 23-0778)</small>			
	23 21 13 23-0830 EA 1/2" Coupling, Reducing, Carbon Steel, Socket Weld, 3,000 LB.....	25.36	14.56	
	23 21 13 23-0831 EA 3/4" Coupling, Reducing, Carbon Steel, Socket Weld, 3,000 LB.....	28.52	16.24	
	23 21 13 23-0832 EA 1" Coupling, Reducing, Carbon Steel, Socket Weld, 3,000 LB.....	33.65	18.15	
	23 21 13 23-0833 EA 1-1/4" Coupling, Reducing, Carbon Steel, Socket Weld, 3,000 LB.....	38.82	20.58	
	23 21 13 23-0834 EA 1-1/2" Coupling, Reducing, Carbon Steel, Socket Weld, 3,000 LB.....	45.88	23.15	
	23 21 13 23-0835 EA 2" Coupling, Reducing, Carbon Steel, Socket Weld, 3,000 LB.....	58.85	29.48	
	23 21 13 23-0836 EA 2-1/2" Coupling, Reducing, Carbon Steel, Socket Weld, 3,000 LB.....	100.99	43.59	
	23 21 13 23-0837 EA 3" Coupling, Reducing, Carbon Steel, Socket Weld, 3,000 LB.....	141.02	57.33	
	23 21 13 23-0838 EA 4" Coupling, Reducing, Carbon Steel, Socket Weld, 3,000 LB.....	206.65	63.56	
23 21 13 23-0839	Caps, 3,000 LB Carbon Steel Socket Weld <small>(23 21 13 23-0778)</small>			
	23 21 13 23-0840 EA 1/2" Cap, Carbon Steel, Socket Weld, 3,000 LB.....	13.89	6.84	
	23 21 13 23-0841 EA 3/4" Cap, Carbon Steel, Socket Weld, 3,000 LB.....	15.72	7.27	
	23 21 13 23-0842 EA 1" Cap, Carbon Steel, Socket Weld, 3,000 LB.....	18.40	8.38	
	23 21 13 23-0843 EA 1-1/4" Cap, Carbon Steel, Socket Weld, 3,000 LB.....	21.23	9.12	
	23 21 13 23-0844 EA 1-1/2" Cap, Carbon Steel, Socket Weld, 3,000 LB.....	24.03	9.12	
	23 21 13 23-0845 EA 2" Cap, Carbon Steel, Socket Weld, 3,000 LB.....	31.15	11.69	
	23 21 13 23-0846 EA 2-1/2" Cap, Carbon Steel, Socket Weld, 3,000 LB.....	53.79	14.56	
	23 21 13 23-0847 EA 3" Cap, Carbon Steel, Socket Weld, 3,000 LB.....	76.77	17.57	
	23 21 13 23-0848 EA 4" Cap, Carbon Steel, Socket Weld, 3,000 LB.....	111.29	21.75	
23 21 13 23-0849	Black Cast Iron Square Head Plug <small>(23 21 13 23-0778)</small>			
	23 21 13 23-0850 EA 1/2" Square Head Plug, Black, Cast Iron.....	9.47	5.80	
	23 21 13 23-0851 EA 3/4" Square Head Plug, Black, Cast Iron.....	10.66	5.80	
	23 21 13 23-0852 EA 1" Square Head Plug, Black, Cast Iron.....	15.40	8.82	
	23 21 13 23-0853 EA 1-1/4" Square Head Plug, Black, Cast Iron.....	15.64	8.82	
	23 21 13 23-0854 EA 1-1/2" Square Head Plug, Black, Cast Iron.....	16.63	8.82	
	23 21 13 23-0855 EA 2" Square Head Plug, Black, Cast Iron.....	22.03	11.69	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 20 HVAC Piping And Pumps****23 21 Hydronic Piping And Pumps**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21	13 23-0856	EA	2-1/2" Square Head Plug, Black, Cast Iron.....	28.27	14.56
23 21	13 23-0857	EA	3" Square Head Plug, Black, Cast Iron.....	36.75	17.57
23 21	13 23-0858	EA	4" Square Head Plug, Black, Cast Iron.....	44.88	21.75
23 21	13 23-0859		Unions, 3,000 LB Carbon Steel Socket Weld (23 21 13 23-0778)		
23 21	13 23-0860	EA	1/2" Union, Carbon Steel, Socket Weld, 3,000 LB.....	40.28	18.15
23 21	13 23-0861	EA	3/4" Union, Carbon Steel, Socket Weld, 3,000 LB.....	44.81	20.94
23 21	13 23-0862	EA	1" Union, Carbon Steel, Socket Weld, 3,000 LB.....	56.71	24.77
23 21	13 23-0863	EA	1-1/4" Union, Carbon Steel, Socket Weld, 3,000 LB.....	71.17	29.48
23 21	13 23-0864	EA	1-1/2" Union, Carbon Steel, Socket Weld, 3,000 LB.....	85.68	35.14
23 21	13 23-0865	EA	2" Union, Carbon Steel, Socket Weld, 3,000 LB.....	107.02	43.59
23 21	13 23-0866	EA	2-1/2" Union, Carbon Steel, Socket Weld, 3,000 LB.....	177.76	47.34
23 21	13 23-0867	EA	3" Union, Carbon Steel, Socket Weld, 3,000 LB.....	237.27	57.33
23 21	13 23-0868		Class 6,000 LB Carbon Steel Socket Weld Fittings (23 21 13 23-0777)		
			Note: ASTM A105		
23 21	13 23-0869		90 Degree Elbow, 6,000 LB Carbon Steel Socket Weld (23 21 13 23-0868)		
23 21	13 23-0870	EA	1/2" 90 Degree Elbow, Carbon Steel, Socket Weld, 6,000 LB.....	29.59	14.56
23 21	13 23-0871	EA	3/4" 90 Degree Elbow, Carbon Steel, Socket Weld, 6,000 LB.....	33.31	16.24
23 21	13 23-0872	EA	1" 90 Degree Elbow, Carbon Steel, Socket Weld, 6,000 LB.....	43.68	18.15
23 21	13 23-0873	EA	1-1/4" 90 Degree Elbow, Carbon Steel, Socket Weld, 6,000 LB.....	61.50	20.58
23 21	13 23-0874	EA	1-1/2" 90 Degree Elbow, Carbon Steel, Socket Weld, 6,000 LB.....	70.46	23.15
23 21	13 23-0875	EA	2" 90 Degree Elbow, Carbon Steel, Socket Weld, 6,000 LB.....	96.58	29.48
23 21	13 23-0876	EA	2-1/2" 90 Degree Elbow, Carbon Steel, Socket Weld, 6,000 LB.....	198.38	43.59
23 21	13 23-0877	EA	3" 90 Degree Elbow, Carbon Steel, Socket Weld, 6,000 LB.....	284.56	57.33
23 21	13 23-0878	EA	4" 90 Degree Elbow, Carbon Steel, Socket Weld, 6,000 LB.....	517.00	63.56
23 21	13 23-0879		45 Degree Elbow, 6,000 LB Carbon Steel Socket Weld (23 21 13 23-0868)		
23 21	13 23-0880	EA	1/2" 45 Degree Elbow, Carbon Steel, Socket Weld, 6,000 LB.....	33.29	14.56
23 21	13 23-0881	EA	3/4" 45 Degree Elbow, Carbon Steel, Socket Weld, 6,000 LB.....	38.84	16.24
23 21	13 23-0882	EA	1" 45 Degree Elbow, Carbon Steel, Socket Weld, 6,000 LB.....	45.69	18.15
23 21	13 23-0883	EA	1-1/4" 45 Degree Elbow, Carbon Steel, Socket Weld, 6,000 LB.....	64.28	20.58
23 21	13 23-0884	EA	1-1/2" 45 Degree Elbow, Carbon Steel, Socket Weld, 6,000 LB.....	76.25	23.15
23 21	13 23-0885	EA	2" 45 Degree Elbow, Carbon Steel, Socket Weld, 6,000 LB.....	97.68	29.48
23 21	13 23-0886	EA	2-1/2" 45 Degree Elbow, Carbon Steel, Socket Weld, 6,000 LB.....	231.84	43.59
23 21	13 23-0887	EA	3" 45 Degree Elbow, Carbon Steel, Socket Weld, 6,000 LB.....	314.84	57.33
23 21	13 23-0888	EA	4" 45 Degree Elbow, Carbon Steel, Socket Weld, 6,000 LB.....	515.54	63.56
23 21	13 23-0889		Straight Tees, 6,000 LB Carbon Steel Socket Weld (23 21 13 23-0868)		
23 21	13 23-0890	EA	1/2" Tee, Straight, Carbon Steel, Socket Weld, 6,000 LB.....	38.38	18.15
23 21	13 23-0891	EA	3/4" Tee, Straight, Carbon Steel, Socket Weld, 6,000 LB.....	47.54	20.94
23 21	13 23-0892	EA	1" Tee, Straight, Carbon Steel, Socket Weld, 6,000 LB.....	65.65	24.77
23 21	13 23-0893	EA	1-1/4" Tee, Straight, Carbon Steel, Socket Weld, 6,000 LB.....	90.66	29.48
23 21	13 23-0894	EA	1-1/2" Tee, Straight, Carbon Steel, Socket Weld, 6,000 LB.....	110.37	35.14
23 21	13 23-0895	EA	2" Tee, Straight, Carbon Steel, Socket Weld, 6,000 LB.....	149.06	43.59
23 21	13 23-0896	EA	2-1/2" Tee, Straight, Carbon Steel, Socket Weld, 6,000 LB.....	287.53	57.33
23 21	13 23-0897	EA	3" Tee, Straight, Carbon Steel, Socket Weld, 6,000 LB.....	404.74	68.06
23 21	13 23-0898	EA	4" Tee, Straight, Carbon Steel, Socket Weld, 6,000 LB.....	831.39	80.25
23 21	13 23-0899		Reducing Tees, 6,000 LB Carbon Steel Socket Weld (23 21 13 23-0868)		
23 21	13 23-0900	EA	1/2" Tee, Reducing, Carbon Steel, Socket Weld, 6,000 LB.....	33.63	18.15
23 21	13 23-0901	EA	3/4" Tee, Reducing, Carbon Steel, Socket Weld, 6,000 LB.....	40.42	20.94
23 21	13 23-0902	EA	1" Tee, Reducing, Carbon Steel, Socket Weld, 6,000 LB.....	52.69	24.77
23 21	13 23-0903	EA	1-1/4" Tee, Reducing, Carbon Steel, Socket Weld, 6,000 LB.....	70.09	29.48
23 21	13 23-0904	EA	1-1/2" Tee, Reducing, Carbon Steel, Socket Weld, 6,000 LB.....	84.75	35.14
23 21	13 23-0905	EA	2" Tee, Reducing, Carbon Steel, Socket Weld, 6,000 LB.....	112.05	43.59
23 21	13 23-0906	EA	2-1/2" Tee, Reducing, Carbon Steel, Socket Weld, 6,000 LB.....	198.33	57.33
23 21	13 23-0907	EA	3" Tee, Reducing, Carbon Steel, Socket Weld, 6,000 LB.....	270.32	68.06
23 21	13 23-0908	EA	4" Tee, Reducing, Carbon Steel, Socket Weld, 6,000 LB.....	449.93	80.25
23 21	13 23-0909		Straight Couplings, 6,000 LB Carbon Steel Socket Weld (23 21 13 23-0868)		
23 21	13 23-0910	EA	1/2" Coupling, Straight, Carbon Steel, Socket Weld, 6,000 LB.....	25.24	14.56
23 21	13 23-0911	EA	3/4" Coupling, Straight, Carbon Steel, Socket Weld, 6,000 LB.....	28.47	16.24
23 21	13 23-0912	EA	1" Coupling, Straight, Carbon Steel, Socket Weld, 6,000 LB.....	33.50	18.15
23 21	13 23-0913	EA	1-1/4" Coupling, Straight, Carbon Steel, Socket Weld, 6,000 LB.....	38.74	20.58
23 21	13 23-0914	EA	1-1/2" Coupling, Straight, Carbon Steel, Socket Weld, 6,000 LB.....	45.41	23.15
23 21	13 23-0915	EA	2" Coupling, Straight, Carbon Steel, Socket Weld, 6,000 LB.....	59.70	29.48
23 21	13 23-0916	EA	2-1/2" Coupling, Straight, Carbon Steel, Socket Weld, 6,000 LB.....	104.46	43.59
23 21	13 23-0917	EA	3" Coupling, Straight, Carbon Steel, Socket Weld, 6,000 LB.....	139.92	57.33
23 21	13 23-0918	EA	4" Coupling, Straight, Carbon Steel, Socket Weld, 6,000 LB.....	202.89	63.56
23 21	13 23-0919		Reducing Couplings, 6,000 LB Carbon Steel Socket Weld (23 21 13 23-0868)		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21 13 23-0920 EA 1/2" Coupling, Reducing, Carbon Steel, Socket Weld, 6,000 LB.....	27.09	14.56
23 21 13 23-0921 EA 3/4" Coupling, Reducing, Carbon Steel, Socket Weld, 6,000 LB.....	30.50	16.24
23 21 13 23-0922 EA 1" Coupling, Reducing, Carbon Steel, Socket Weld, 6,000 LB.....	36.74	18.15
23 21 13 23-0923 EA 1-1/4" Coupling, Reducing, Carbon Steel, Socket Weld, 6,000 LB.....	42.65	20.58
23 21 13 23-0924 EA 1-1/2" Coupling, Reducing, Carbon Steel, Socket Weld, 6,000 LB.....	51.22	23.15
23 21 13 23-0925 EA 2" Coupling, Reducing, Carbon Steel, Socket Weld, 6,000 LB.....	65.90	29.48
23 21 13 23-0926 EA 2-1/2" Coupling, Reducing, Carbon Steel, Socket Weld, 6,000 LB.....	118.11	43.59
23 21 13 23-0927 EA 3" Coupling, Reducing, Carbon Steel, Socket Weld, 6,000 LB.....	167.44	57.33
23 21 13 23-0928 EA 4" Coupling, Reducing, Carbon Steel, Socket Weld, 6,000 LB.....	260.12	63.56
23 21 13 23-0929 Caps, 6,000 LB Carbon Steel Socket Weld (23 21 13 23-0868)		
23 21 13 23-0930 EA 1/2" Cap, Carbon Steel, Socket Weld, 6,000 LB.....	16.37	6.84
23 21 13 23-0931 EA 3/4" Cap, Carbon Steel, Socket Weld, 6,000 LB.....	18.96	7.27
23 21 13 23-0932 EA 1" Cap, Carbon Steel, Socket Weld, 6,000 LB.....	22.32	8.38
23 21 13 23-0933 EA 1-1/4" Cap, Carbon Steel, Socket Weld, 6,000 LB.....	26.35	9.12
23 21 13 23-0934 EA 1-1/2" Cap, Carbon Steel, Socket Weld, 6,000 LB.....	31.02	9.12
23 21 13 23-0935 EA 2" Cap, Carbon Steel, Socket Weld, 6,000 LB.....	40.27	11.69
23 21 13 23-0936 EA 2-1/2" Cap, Carbon Steel, Socket Weld, 6,000 LB.....	75.27	14.56
23 21 13 23-0937 EA 3" Cap, Carbon Steel, Socket Weld, 6,000 LB.....	110.61	17.57
23 21 13 23-0938 EA 4" Cap, Carbon Steel, Socket Weld, 6,000 LB.....	164.05	21.75
23 21 13 23-0939 Black Cast Iron Square Head Plug (23 21 13 23-0868)		
23 21 13 23-0940 EA 1/2" Square Head Plug, Black Cast Iron.....	9.47	5.80
23 21 13 23-0941 EA 3/4" Square Head Plug, Black Cast Iron.....	10.67	5.80
23 21 13 23-0942 EA 1" Square Head Plug, Black Cast Iron.....	15.41	8.82
23 21 13 23-0943 EA 1-1/4" Square Head Plug, Black Cast Iron.....	15.65	8.82
23 21 13 23-0944 EA 1-1/2" Square Head Plug, Black Cast Iron.....	16.64	8.82
23 21 13 23-0945 EA 2" Square Head Plug, Black Cast Iron.....	22.05	11.69
23 21 13 23-0946 EA 2-1/2" Square Head Plug, Black Cast Iron.....	28.30	14.56
23 21 13 23-0947 EA 3" Square Head Plug, Black Cast Iron.....	36.80	17.57
23 21 13 23-0948 EA 4" Square Head Plug, Black Cast Iron.....	44.94	21.75
23 21 13 23-0949 Unions, 6,000 LB Carbon Steel Socket Weld (23 21 13 23-0868)		
23 21 13 23-0950 EA 1/2" Union, Carbon Steel, Socket Weld, 6,000 LB.....	48.26	18.15
23 21 13 23-0951 EA 3/4" Union, Carbon Steel, Socket Weld, 6,000 LB.....	53.01	20.94
23 21 13 23-0952 EA 1" Union, Carbon Steel, Socket Weld, 6,000 LB.....	68.68	24.77
23 21 13 23-0953 EA 1-1/4" Union, Carbon Steel, Socket Weld, 6,000 LB.....	87.70	29.48
23 21 13 23-0954 EA 1-1/2" Union, Carbon Steel, Socket Weld, 6,000 LB.....	105.85	35.14
23 21 13 23-0955 EA 2" Union, Carbon Steel, Socket Weld, 6,000 LB.....	132.52	43.59
23 21 13 23-0956 EA 2-1/2" Union, Carbon Steel, Socket Weld, 6,000 LB.....	243.04	47.34
23 21 13 23-0957 EA 3" Union, Carbon Steel, Socket Weld, 6,000 LB.....	329.80	57.33
23 21 13 23-0958 Carbon Steel Piping System (23 21 13 23-0777)		
Note: ASTM A106 Excludes hangers or fittings. Demolition Note applies to all pipe demolition.		
23 21 13 23-0959 Schedule 40 Carbon Steel Piping (23 21 13 23-0958)		
Note: ASTM A106 Excludes hangers, elbow, tee, or reducer fittings.		
23 21 13 23-0960 LF 1/4" ASTM A106 Carbon Steel Pipe, Schedule 40.....	5.63	2.72
For Schedule 80, Add	0.56	
23 21 13 23-0961 LF 1/2" ASTM A106 Carbon Steel Pipe, Schedule 40.....	5.87	2.94
For Schedule 160, Add	2.13	
For Schedule 80, Add	0.51	
23 21 13 23-0962 LF 3/4" ASTM A106 Carbon Steel Pipe, Schedule 40.....	6.48	3.16
For Schedule 160, Add	2.61	
For Schedule 80, Add	0.63	
23 21 13 23-0963 LF 1" ASTM A106 Carbon Steel Pipe, Schedule 40.....	6.93	3.46
For Schedule 160, Add	2.69	
For Schedule 80, Add	0.64	
23 21 13 23-0964 LF 1-1/2" ASTM A106 Carbon Steel Pipe, Schedule 40.....	9.03	4.26
For Schedule 160, Add	3.96	
For Schedule 80, Add	0.95	
23 21 13 23-0965 LF 2" ASTM A106 Carbon Steel Pipe, Schedule 40.....	11.22	5.15
For Schedule 160, Add	5.22	
For Schedule 80, Add	1.25	
23 21 13 23-0966 90 Degree Elbows, Screwed Carbon Steel (23 21 13 23-0958)		
23 21 13 23-0967 EA 1/4" 90 Degree Elbow, 2,000 LB, Screwed Carbon Steel.....	19.96	11.17
23 21 13 23-0968 EA 1/2" 90 Degree Elbow, 2,000 LB, Screwed Carbon Steel.....	24.01	13.09
23 21 13 23-0969 EA 3/4" 90 Degree Elbow, 2,000 LB, Screwed Carbon Steel.....	26.84	14.63
23 21 13 23-0970 EA 1" 90 Degree Elbow, 2,000 LB, Screwed Carbon Steel.....	30.67	16.32
23 21 13 23-0971 EA 1-1/2" 90 Degree Elbow, 2,000 LB, Screwed Carbon Steel.....	47.22	20.87
23 21 13 23-0972 EA 2" 90 Degree Elbow, 2,000 LB, Screwed Carbon Steel.....	59.85	26.54
23 21 13 23-0973 EA 1/4" 90 Degree Elbow, 3,000 LB, Screwed Carbon Steel.....	20.98	11.17
23 21 13 23-0974 EA 1/2" 90 Degree Elbow, 3,000 LB, Screwed Carbon Steel.....	24.40	13.09
23 21 13 23-0975 EA 3/4" 90 Degree Elbow, 3,000 LB, Screwed Carbon Steel.....	28.11	14.63
23 21 13 23-0976 EA 1" 90 Degree Elbow, 3,000 LB, Screwed Carbon Steel.....	33.43	16.32
23 21 13 23-0977 EA 1-1/2" 90 Degree Elbow, 3,000 LB, Screwed Carbon Steel.....	53.81	20.87

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 20 HVAC Piping And Pumps****23 21 Hydronic Piping And Pumps**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21	13 23-0978	EA	2" 90 Degree Elbow, 3,000 LB, Screwed Carbon Steel	67.13	26.54
23 21	13 23-0979	EA	1/2" 90 Degree Elbow, 6,000 LB, Screwed Carbon Steel	27.98	13.09
23 21	13 23-0980	EA	3/4" 90 Degree Elbow, 6,000 LB, Screwed Carbon Steel	32.62	14.63
23 21	13 23-0981	EA	1" 90 Degree Elbow, 6,000 LB, Screwed Carbon Steel	38.17	16.32
23 21	13 23-0982	EA	1-1/2" 90 Degree Elbow, 6,000 LB, Screwed Carbon Steel	67.13	20.87
23 21	13 23-0983	EA	2" 90 Degree Elbow, 6,000 LB, Screwed Carbon Steel	102.45	26.54
23 21	13 23-0984		45 Degree Elbows, Screwed Carbon Steel (23 21 13 23-0958)		
23 21	13 23-0985	EA	1/4" 45 Degree Elbow, 2,000 LB, Screwed Carbon Steel	22.14	11.17
23 21	13 23-0986	EA	1/2" 45 Degree Elbow, 2,000 LB, Screwed Carbon Steel	24.84	13.09
23 21	13 23-0987	EA	3/4" 45 Degree Elbow, 2,000 LB, Screwed Carbon Steel	27.91	14.63
23 21	13 23-0988	EA	1" 45 Degree Elbow, 2,000 LB, Screwed Carbon Steel	31.49	16.32
23 21	13 23-0989	EA	1-1/2" 45 Degree Elbow, 2,000 LB, Screwed Carbon Steel	44.59	20.87
23 21	13 23-0990	EA	2" 45 Degree Elbow, 2,000 LB, Screwed Carbon Steel	63.91	26.54
23 21	13 23-0991	EA	1/4" 45 Degree Elbow, 3,000 LB, Screwed Carbon Steel	22.31	11.17
23 21	13 23-0992	EA	1/2" 45 Degree Elbow, 3,000 LB, Screwed Carbon Steel	25.78	13.09
23 21	13 23-0993	EA	3/4" 45 Degree Elbow, 3,000 LB, Screwed Carbon Steel	28.99	14.63
23 21	13 23-0994	EA	1" 45 Degree Elbow, 3,000 LB, Screwed Carbon Steel	34.30	16.32
23 21	13 23-0995	EA	1-1/2" 45 Degree Elbow, 3,000 LB, Screwed Carbon Steel	52.79	20.87
23 21	13 23-0996	EA	2" 45 Degree Elbow, 3,000 LB, Screwed Carbon Steel	69.40	26.54
23 21	13 23-0997	EA	1/2" 45 Degree Elbow, 6,000 LB, Screwed Carbon Steel	30.46	13.09
23 21	13 23-0998	EA	3/4" 45 Degree Elbow, 6,000 LB, Screwed Carbon Steel	37.08	14.63
23 21	13 23-0999	EA	1" 45 Degree Elbow, 6,000 LB, Screwed Carbon Steel	39.85	16.32
23 21	13 23-1000	EA	1-1/2" 45 Degree Elbow, 6,000 LB, Screwed Carbon Steel	76.63	20.87
23 21	13 23-1001	EA	2" 45 Degree Elbow, 6,000 LB, Screwed Carbon Steel	103.08	26.54
23 21	13 23-1002		Straight Tees, Screwed Carbon Steel (23 21 13 23-0958)		
23 21	13 23-1003	EA	1/4" Tee, Straight, 2,000 LB, Screwed Carbon Steel	26.58	15.50
23 21	13 23-1004	EA	1/2" Tee, Straight, 2,000 LB, Screwed Carbon Steel	30.22	16.32
23 21	13 23-1005	EA	3/4" Tee, Straight, 2,000 LB, Screwed Carbon Steel	36.07	18.89
23 21	13 23-1006	EA	1" Tee, Straight, 2,000 LB, Screwed Carbon Steel	44.07	22.27
23 21	13 23-1007	EA	1-1/2" Tee, Straight, 2,000 LB, Screwed Carbon Steel	69.85	31.60
23 21	13 23-1008	EA	2" Tee, Straight, 2,000 LB, Screwed Carbon Steel	86.60	39.25
23 21	13 23-1009	EA	1/4" Tee, Straight, 3,000 LB, Screwed Carbon Steel	27.46	15.50
23 21	13 23-1010	EA	1/2" Tee, Straight, 3,000 LB, Screwed Carbon Steel	30.79	16.32
23 21	13 23-1011	EA	3/4" Tee, Straight, 3,000 LB, Screwed Carbon Steel	37.98	18.89
23 21	13 23-1012	EA	1" Tee, Straight, 3,000 LB, Screwed Carbon Steel	45.71	22.27
23 21	13 23-1013	EA	1-1/2" Tee, Straight, 3,000 LB, Screwed Carbon Steel	75.50	31.60
23 21	13 23-1014	EA	2" Tee, Straight, 3,000 LB, Screwed Carbon Steel	95.95	39.25
23 21	13 23-1015	EA	1/2" Tee, Straight, 6,000 LB, Screwed Carbon Steel	35.09	16.32
23 21	13 23-1016	EA	3/4" Tee, Straight, 6,000 LB, Screwed Carbon Steel	42.59	18.89
23 21	13 23-1017	EA	1" Tee, Straight, 6,000 LB, Screwed Carbon Steel	57.13	22.27
23 21	13 23-1018	EA	1-1/2" Tee, Straight, 6,000 LB, Screwed Carbon Steel	88.47	31.60
23 21	13 23-1019	EA	2" Tee, Straight, 6,000 LB, Screwed Carbon Steel	137.31	39.25
23 21	13 23-1020		Straight Couplings, Screwed Carbon Steel (23 21 13 23-0958)		
23 21	13 23-1021	EA	1/4" Coupling, Straight, 3,000 LB, Screwed Carbon Steel	18.68	11.17
23 21	13 23-1022	EA	1/2" Coupling, Straight, 3,000 LB, Screwed Carbon Steel	21.38	13.09
23 21	13 23-1023	EA	3/4" Coupling, Straight, 3,000 LB, Screwed Carbon Steel	24.40	14.63
23 21	13 23-1024	EA	1" Coupling, Straight, 3,000 LB, Screwed Carbon Steel	28.20	16.32
23 21	13 23-1025	EA	1-1/2" Coupling, Straight, 3,000 LB, Screwed Carbon Steel	40.58	20.87
23 21	13 23-1026	EA	2" Coupling, Straight, 3,000 LB, Screwed Carbon Steel	51.51	26.54
23 21	13 23-1027	EA	1/4" Coupling, Straight, 6,000 LB, Screwed Carbon Steel	21.26	11.17
23 21	13 23-1028	EA	1/2" Coupling, Straight, 6,000 LB, Screwed Carbon Steel	23.02	13.09
23 21	13 23-1029	EA	3/4" Coupling, Straight, 6,000 LB, Screwed Carbon Steel	25.65	14.63
23 21	13 23-1030	EA	1" Coupling, Straight, 6,000 LB, Screwed Carbon Steel	29.87	16.32
23 21	13 23-1031	EA	1-1/2" Coupling, Straight, 6,000 LB, Screwed Carbon Steel	43.14	20.87
23 21	13 23-1032	EA	2" Coupling, Straight, 6,000 LB, Screwed Carbon Steel	60.83	26.54
23 21	13 23-1033		Reducing Couplings, Screwed Carbon Steel (23 21 13 23-0958)		
23 21	13 23-1034	EA	1/4" Coupling, Reducing, 3,000 LB, Screwed Carbon Steel	19.04	11.91
23 21	13 23-1035	EA	1/2" Coupling, Reducing, 3,000 LB, Screwed Carbon Steel	22.23	13.09
23 21	13 23-1036	EA	3/4" Coupling, Reducing, 3,000 LB, Screwed Carbon Steel	25.69	14.63
23 21	13 23-1037	EA	1" Coupling, Reducing, 3,000 LB, Screwed Carbon Steel	29.99	16.32
23 21	13 23-1038	EA	1-1/2" Coupling, Reducing, 3,000 LB, Screwed Carbon Steel	41.05	20.87
23 21	13 23-1039	EA	2" Coupling, Reducing, 3,000 LB, Screwed Carbon Steel	54.02	26.54
23 21	13 23-1040	EA	1/2" Coupling, Reducing, 6,000 LB, Screwed Carbon Steel	55.25	13.09
23 21	13 23-1041	EA	3/4" Coupling, Reducing, 6,000 LB, Screwed Carbon Steel	57.59	14.63
23 21	13 23-1042	EA	1" Coupling, Reducing, 6,000 LB, Screwed Carbon Steel	67.18	16.32
23 21	13 23-1043	EA	1-1/2" Coupling, Reducing, 6,000 LB, Screwed Carbon Steel	96.06	20.87
23 21	13 23-1044	EA	2" Coupling, Reducing, 6,000 LB, Screwed Carbon Steel	137.28	26.54
23 21	13 23-1045		Caps, Screwed Carbon Steel (23 21 13 23-0958)		
23 21	13 23-1046	EA	1/4" Cap, 3,000 LB, Screwed Carbon Steel	5.60	2.72
23 21	13 23-1047	EA	1/2" Cap, 3,000 LB, Screwed Carbon Steel	6.23	3.08



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21 13 23-1048 EA 3/4" Cap, 3,000 LB, Screwed Carbon Steel.....	7.55	3.53
23 21 13 23-1049 EA 1" Cap, 3,000 LB, Screwed Carbon Steel.....	9.65	4.12
23 21 13 23-1050 EA 1-1/2" Cap, 3,000 LB, Screwed Carbon Steel.....	12.99	4.93
23 21 13 23-1051 EA 2" Cap, 3,000 LB, Screwed Carbon Steel.....	17.97	6.10
23 21 13 23-1052 EA 1/4" Cap, 6,000 LB, Screwed Carbon Steel.....	8.69	2.72
23 21 13 23-1053 EA 1/2" Cap, 6,000 LB, Screwed Carbon Steel.....	8.22	3.08
23 21 13 23-1054 EA 3/4" Cap, 6,000 LB, Screwed Carbon Steel.....	10.78	3.53
23 21 13 23-1055 EA 1" Cap, 6,000 LB, Screwed Carbon Steel.....	12.01	4.12
23 21 13 23-1056 EA 1-1/2" Cap, 6,000 LB, Screwed Carbon Steel.....	22.61	4.93
23 21 13 23-1057 EA 2" Cap, 6,000 LB, Screwed Carbon Steel.....	27.33	6.10
23 21 13 23-1058 Nipples, Screwed Carbon Steel (23 21 13 23-0958)		
23 21 13 23-1059 EA 1/4" Nipple, 2" Long, Screwed Carbon Steel.....	11.46	6.69
23 21 13 23-1060 EA 1/2" Nipple, 2" Long, Screwed Carbon Steel.....	11.67	6.98
23 21 13 23-1061 EA 3/4" Nipple, 2" Long, Screwed Carbon Steel.....	11.60	6.98
23 21 13 23-1062 EA 1" Nipple, 2" Long, Screwed Carbon Steel.....	12.87	7.58
23 21 13 23-1063 EA 1-1/2" Nipple, 2" Long, Screwed Carbon Steel.....	14.61	8.16
23 21 13 23-1064 EA 2" Nipple, 2" Long, Screwed Carbon Steel.....	17.59	10.51
23 21 13 23-1065 EA 1/4" Nipple, 4" Long, Screwed Carbon Steel.....	12.05	6.69
23 21 13 23-1066 EA 1/2" Nipple, 4" Long, Screwed Carbon Steel.....	12.14	6.98
23 21 13 23-1067 EA 3/4" Nipple, 4" Long, Screwed Carbon Steel.....	12.13	6.98
23 21 13 23-1068 EA 1" Nipple, 4" Long, Screwed Carbon Steel.....	13.58	7.58
23 21 13 23-1069 EA 1-1/2" Nipple, 4" Long, Screwed Carbon Steel.....	15.89	8.16
23 21 13 23-1070 EA 2" Nipple, 4" Long, Screwed Carbon Steel.....	19.46	10.51
23 21 13 23-1071 EA 1/4" Nipple, 6" Long, Screwed Carbon Steel.....	13.47	6.69
23 21 13 23-1072 EA 1/2" Nipple, 6" Long, Screwed Carbon Steel.....	12.89	6.98
23 21 13 23-1073 EA 3/4" Nipple, 6" Long, Screwed Carbon Steel.....	12.96	6.98
23 21 13 23-1074 EA 1" Nipple, 6" Long, Screwed Carbon Steel.....	14.61	7.58
23 21 13 23-1075 EA 1-1/2" Nipple, 6" Long, Screwed Carbon Steel.....	17.63	8.16
23 21 13 23-1076 EA 2" Nipple, 6" Long, Screwed Carbon Steel.....	21.00	10.51
23 21 13 23-1077 Unions, Screwed Carbon Steel (23 21 13 23-0958)		
23 21 13 23-1078 EA 1/4" Union, 3,000 LB, Screwed Carbon Steel.....	24.14	16.24
23 21 13 23-1079 EA 1/2" Union, 3,000 LB, Screwed Carbon Steel.....	25.51	16.32
23 21 13 23-1080 EA 3/4" Union, 3,000 LB, Screwed Carbon Steel.....	29.31	18.89
23 21 13 23-1081 EA 1" Union, 3,000 LB, Screwed Carbon Steel.....	34.93	22.27
23 21 13 23-1082 EA 1-1/2" Union, 3,000 LB, Screwed Carbon Steel.....	49.97	31.60
23 21 13 23-1083 EA 2" Union, 3,000 LB, Screwed Carbon Steel.....	62.03	39.25
23 21 13 23-1084 EA 1/4" Union, 6,000 LB, Screwed Carbon Steel.....	37.84	16.24
23 21 13 23-1085 EA 1/2" Union, 6,000 LB, Screwed Carbon Steel.....	42.07	16.32
23 21 13 23-1086 EA 3/4" Union, 6,000 LB, Screwed Carbon Steel.....	49.36	18.89
23 21 13 23-1087 EA 1" Union, 6,000 LB, Screwed Carbon Steel.....	59.64	22.27
23 21 13 23-1088 EA 1-1/2" Union, 6,000 LB, Screwed Carbon Steel.....	100.51	31.60
23 21 13 23-1089 EA 2" Union, 6,000 LB, Screwed Carbon Steel.....	124.22	39.25
23 21 13 23-1090 Weld Neck Flanges, Screwed Carbon Steel (23 21 13 23-0958)		
23 21 13 23-1091 EA 1/2" Flange, 150 LB, Screwed Carbon Steel.....	52.83	30.35
23 21 13 23-1092 EA 3/4" Flange, 150 LB, Screwed Carbon Steel.....	55.27	31.82
23 21 13 23-1093 EA 1" Flange, 150 LB, Screwed Carbon Steel.....	57.35	33.22
23 21 13 23-1094 EA 1-1/2" Flange, 150 LB, Screwed Carbon Steel.....	63.89	37.42
23 21 13 23-1095 EA 2" Flange, 150 LB, Screwed Carbon Steel.....	66.34	39.03
23 21 13 23-1096 EA 1/2" Flange, 300 LB, Screwed Carbon Steel.....	53.30	30.35
For Blind Flange, Deduct	-19.77	
For Ring Type Joint, Add	7.75	
23 21 13 23-1097 EA 3/4" Flange, 300 LB, Screwed Carbon Steel.....	55.76	31.82
For Blind Flange, Deduct	-20.70	
For Ring Type Joint, Add	8.01	
23 21 13 23-1098 EA 1" Flange, 300 LB, Screwed Carbon Steel.....	58.09	33.22
For Blind Flange, Deduct	-21.58	
For Ring Type Joint, Add	8.26	
23 21 13 23-1099 EA 1-1/2" Flange, 300 LB, Screwed Carbon Steel.....	65.67	37.42
For Blind Flange, Deduct	-24.36	
For Ring Type Joint, Add	9.56	
23 21 13 23-1100 EA 2" Flange, 300 LB, Screwed Carbon Steel.....	68.12	39.03
For Blind Flange, Deduct	-25.34	
For Ring Type Joint, Add	9.56	
23 21 13 23-1101 EA 1/2" Flange, 600 LB, Screwed Carbon Steel.....	56.34	30.35
For Blind Flange, Deduct	-20.38	
For Ring Type Joint, Add	10.79	
23 21 13 23-1102 EA 3/4" Flange, 600 LB, Screwed Carbon Steel.....	58.54	31.82
For Blind Flange, Deduct	-21.26	
For Ring Type Joint, Add	10.79	
23 21 13 23-1103 EA 1" Flange, 600 LB, Screwed Carbon Steel.....	61.12	33.22
For Blind Flange, Deduct	-22.19	
For Ring Type Joint, Add	11.29	
23 21 13 23-1104 EA 1-1/2" Flange, 600 LB, Screwed Carbon Steel.....	69.41	37.42
For Blind Flange, Deduct	-25.10	
For Ring Type Joint, Add	13.30	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 20 HVAC Piping And Pumps****23 21 Hydronic Piping And Pumps**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21 13 23-1105 EA 2" Flange, 600 LB, Screwed Carbon Steel..... <i>For Blind Flange, Deduct</i> <i>For Ring Type Joint, Add</i>	70.94 -25.90 12.38	39.03
23 21 13 23-1106 Square Head Plugs, Screwed Carbon Steel (23 21 13 23-0958)		
23 21 13 23-1107 EA 1/4" Square Head Plug, Screwed Carbon Steel.....	3.76	2.06
23 21 13 23-1108 EA 1/2" Square Head Plug, Screwed Carbon Steel.....	4.51	2.43
23 21 13 23-1109 EA 3/4" Square Head Plug, Screwed Carbon Steel.....	5.22	2.79
23 21 13 23-1110 EA 1" Square Head Plug, Screwed Carbon Steel.....	7.60	4.12
23 21 13 23-1111 EA 1-1/2" Square Head Plug, Screwed Carbon Steel.....	9.40	4.12
23 21 13 23-1112 EA 2" Square Head Plug, Screwed Carbon Steel.....	13.43	5.37
23 21 13 23-1113 Hex Head Plugs, Screwed Carbon Steel (23 21 13 23-0958)		
23 21 13 23-1114 EA 1/4" Hex Head Plug, Screwed Carbon Steel.....	3.58	2.06
23 21 13 23-1115 EA 1/2" Hex Head Plug, Screwed Carbon Steel.....	4.34	2.43
23 21 13 23-1116 EA 3/4" Hex Head Plug, Screwed Carbon Steel.....	5.11	2.79
23 21 13 23-1117 EA 1" Hex Head Plug, Screwed Carbon Steel.....	7.50	4.12
23 21 13 23-1118 EA 1-1/2" Hex Head Plug, Screwed Carbon Steel.....	9.00	4.12
23 21 13 23-1119 EA 2" Hex Head Plug, Screwed Carbon Steel.....	13.72	5.37
23 21 13 23-1120 Round Head Plugs, Screwed Carbon Steel (23 21 13 23-0958)		
23 21 13 23-1121 EA 1/4" Round Head Plug, Screwed Carbon Steel.....	4.16	2.06
23 21 13 23-1122 EA 1/2" Round Head Plug, Screwed Carbon Steel.....	4.53	2.43
23 21 13 23-1123 EA 3/4" Round Head Plug, Screwed Carbon Steel.....	5.14	2.79
23 21 13 23-1124 EA 1" Round Head Plug, Screwed Carbon Steel.....	7.66	4.12
23 21 13 23-1125 EA 1-1/2" Round Head Plug, Screwed Carbon Steel.....	9.89	4.12
23 21 13 23-1126 EA 2" Round Head Plug, Screwed Carbon Steel.....	13.61	5.37
23 21 13 23-1127 Hexagon Bushings, Screwed Carbon Steel (23 21 13 23-0958)		
23 21 13 23-1128 EA 1/4" Hex Bushing, Screwed Carbon Steel.....	3.71	2.06
23 21 13 23-1129 EA 1/2" Hex Bushing, Screwed Carbon Steel.....	4.33	2.43
23 21 13 23-1130 EA 3/4" Hex Bushing, Screwed Carbon Steel.....	5.06	2.79
23 21 13 23-1131 EA 1" Hex Bushing, Screwed Carbon Steel.....	7.63	4.12
23 21 13 23-1132 EA 1-1/2" Hex Bushing, Screwed Carbon Steel.....	8.97	4.12
23 21 13 23-1133 EA 2" Hex Bushing, Screwed Carbon Steel.....	13.30	5.37
23 21 13 23-1134 90 Degree Street Elbows, Screwed Carbon Steel (23 21 13 23-0958)		
23 21 13 23-1135 EA 1/4" 90 Degree Elbow, 3,000 LB, Screwed Carbon Steel.....	23.23	11.17
23 21 13 23-1136 EA 1/2" 90 Degree Elbow, 3,000 LB, Screwed Carbon Steel.....	26.59	13.09
23 21 13 23-1137 EA 3/4" 90 Degree Elbow, 3,000 LB, Screwed Carbon Steel.....	30.92	14.63
23 21 13 23-1138 EA 1" 90 Degree Elbow, 3,000 LB, Screwed Carbon Steel.....	35.99	16.32
23 21 13 23-1139 EA 1-1/2" 90 Degree Elbow, 3,000 LB, Screwed Carbon Steel.....	55.87	20.87
23 21 13 23-1140 EA 2" 90 Degree Elbow, 3,000 LB, Screwed Carbon Steel.....	74.85	26.54
23 21 13 23-1141 EA 1/2" 90 Degree Elbow, 6,000 LB, Screwed Carbon Steel.....	35.95	13.09
23 21 13 23-1142 EA 3/4" 90 Degree Elbow, 6,000 LB, Screwed Carbon Steel.....	49.96	14.63
23 21 13 23-1143 EA 1" 90 Degree Elbow, 6,000 LB, Screwed Carbon Steel.....	67.84	16.32
23 21 13 23-1144 EA 1-1/2" 90 Degree Elbow, 6,000 LB, Screwed Carbon Steel.....	143.48	20.87
23 21 13 23-1145 Screwed Carbon Steel Laterals (23 21 13 23-0958)		
23 21 13 23-1146 EA 1/2" Lateral, Straight, 3,000 LB, Screwed Carbon Steel.....	88.98	16.32
23 21 13 23-1147 EA 3/4" Lateral, Straight, 3,000 LB, Screwed Carbon Steel.....	106.76	18.89
23 21 13 23-1148 EA 1" Lateral, Straight, 3,000 LB, Screwed Carbon Steel.....	130.41	22.27
23 21 13 23-1149 EA 1-1/2" Lateral, Straight, 3,000 LB, Screwed Carbon Steel.....	168.53	31.60
23 21 13 23-1150 EA 2" Lateral, Straight, 3,000 LB, Screwed Carbon Steel.....	210.19	39.25
23 21 13 23-1151 EA 1/2" Lateral, Straight, 3,000 LB, Screwed Carbon Steel.....	110.84	16.32
23 21 13 23-1152 EA 3/4" Lateral, Straight, 6,000 LB, Screwed Carbon Steel.....	139.28	18.89
23 21 13 23-1153 EA 1" Lateral, Straight, 6,000 LB, Screwed Carbon Steel.....	165.18	22.27
23 21 13 23-1154 EA 1-1/2" Lateral, Straight, 6,000 LB, Screwed Carbon Steel.....	232.45	31.60
23 21 13 23-1155 Grooved-Joint Pipe (23 21 13 23) Note: Includes grooving of pipe. Excludes hangers, elbow, tee, reducer fitting or couplings.		
23 21 13 23-1156 Schedule 10 Black Grooved Pipe (23 21 13 23-1155)		
23 21 13 23-1157 LF 2" Black Schedule 10 Grooved Pipe.....	17.66	9.34
23 21 13 23-1158 LF 2-1/2" Black Schedule 10 Grooved Pipe.....	24.00	12.79
23 21 13 23-1159 LF 3" Black Schedule 10 Grooved Pipe.....	26.82	14.18
23 21 13 23-1160 LF 3-1/2" Black Schedule 10 Grooved Pipe.....	29.18	14.70
23 21 13 23-1161 LF 4" Black Schedule 10 Grooved Pipe.....	31.18	15.95
23 21 13 23-1162 LF 5" Black Schedule 10 Grooved Pipe.....	42.07	19.55
23 21 13 23-1163 LF 6" Black Schedule 10 Grooved Pipe.....	55.94	27.78
23 21 13 23-1164 LF 8" Black Schedule 10 Grooved Pipe.....	71.98	31.17
23 21 13 23-1165 LF 10" Black Schedule 10 Grooved Pipe.....	89.26	37.56
23 21 13 23-1166 LF 12" Black Schedule 10 Grooved Pipe.....	102.48	42.55



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21 13 23-1167 Schedule 40 Black Grooved Pipe (23 21 13 23-1155)						
			LF	3/4" Black Schedule 40 Grooved Pipe.....	10.63	5.66
			LF	1" Black Schedule 40 Grooved Pipe.....	12.00	6.40
			LF	1-1/4" Black Schedule 40 Grooved Pipe.....	13.44	6.91
			LF	1-1/2" Black Schedule 40 Grooved Pipe.....	15.29	7.87
			LF	2" Black Schedule 40 Grooved Pipe.....	19.34	9.99
			LF	2-1/2" Black Schedule 40 Grooved Pipe.....	26.76	13.67
			LF	3" Black Schedule 40 Grooved Pipe.....	31.23	15.58
			LF	4" Black Schedule 40 Grooved Pipe.....	37.13	17.35
			LF	5" Black Schedule 40 Grooved Pipe.....	49.29	21.10
			LF	6" Black Schedule 40 Grooved Pipe.....	67.63	30.43
			LF	8" Black Schedule 40 Grooved Pipe.....	85.94	34.47
			LF	10" Black Schedule 40 Grooved Pipe.....	114.28	41.16
			LF	12" Black Schedule 40 Grooved Pipe.....	133.82	47.26
23 21 13 23-1181 Schedule 80 Black Grooved Pipe (23 21 13 23-1155)						
			LF	3/4" Black Schedule 80 Grooved Pipe.....	11.64	6.18
			LF	1" Black Schedule 80 Grooved Pipe.....	12.74	6.54
			LF	1-1/4" Black Schedule 80 Grooved Pipe.....	14.68	7.27
			LF	1-1/2" Black Schedule 80 Grooved Pipe.....	16.63	8.16
			LF	2" Black Schedule 80 Grooved Pipe.....	21.50	10.51
			LF	2-1/2" Black Schedule 80 Grooved Pipe.....	30.02	14.48
			LF	3" Black Schedule 80 Grooved Pipe.....	35.16	16.24
			LF	4" Black Schedule 80 Grooved Pipe.....	42.41	17.71
			LF	5" Black Schedule 80 Grooved Pipe.....	61.63	22.27
			LF	6" Black Schedule 80 Grooved Pipe.....	82.12	31.90
			LF	8" Black Schedule 80 Grooved Pipe.....	115.49	36.46
			LF	10" Black Schedule 80 Grooved Pipe.....	142.84	44.02
			LF	12" Black Schedule 80 Grooved Pipe.....	154.93	53.21
23 21 13 23-1195 Schedule 40 Galvanized Grooved Pipe (23 21 13 23-1155)						
			LF	3/4" Galvanized Schedule 40 Grooved Pipe.....	11.27	5.66
			LF	1" Galvanized Schedule 40 Grooved Pipe.....	12.97	6.40
			LF	1-1/4" Galvanized Schedule 40 Grooved Pipe.....	14.37	6.91
			LF	1-1/2" Galvanized Schedule 40 Grooved Pipe.....	16.36	7.87
			LF	2" Galvanized Schedule 40 Grooved Pipe.....	20.71	9.99
			LF	2-1/2" Galvanized Schedule 40 Grooved Pipe.....	28.85	13.67
			LF	3" Galvanized Schedule 40 Grooved Pipe.....	33.95	15.58
			LF	4" Galvanized Schedule 40 Grooved Pipe.....	40.97	17.35
			LF	5" Galvanized Schedule 40 Grooved Pipe.....	55.99	21.10
			LF	6" Galvanized Schedule 40 Grooved Pipe.....	76.45	30.43
			LF	8" Galvanized Schedule 40 Grooved Pipe.....	98.70	34.47
			LF	10" Galvanized Schedule 40 Grooved Pipe.....	135.55	41.16
			LF	12" Galvanized Schedule 40 Grooved Pipe.....	159.46	47.26
23 21 13 23-1209 Schedule 80 Galvanized Grooved Pipe (23 21 13 23-1155)						
			LF	3/4" Galvanized Schedule 80 Grooved Pipe.....	12.15	6.18
			LF	1" Galvanized Schedule 80 Grooved Pipe.....	15.12	6.54
			LF	1-1/4" Galvanized Schedule 80 Grooved Pipe.....	15.61	7.27
			LF	1-1/2" Galvanized Schedule 80 Grooved Pipe.....	20.02	8.67
			LF	2" Galvanized Schedule 80 Grooved Pipe.....	22.98	10.51
			LF	2-1/2" Galvanized Schedule 80 Grooved Pipe.....	32.29	14.48
			LF	3" Galvanized Schedule 80 Grooved Pipe.....	38.29	16.24
			LF	4" Galvanized Schedule 80 Grooved Pipe.....	46.90	17.71
			LF	5" Galvanized Schedule 80 Grooved Pipe.....	68.49	22.27
			LF	6" Galvanized Schedule 80 Grooved Pipe.....	90.22	31.90
			LF	8" Galvanized Schedule 80 Grooved Pipe.....	129.49	36.46
			LF	10" Galvanized Schedule 80 Grooved Pipe.....	154.41	44.02
			LF	12" Galvanized Schedule 80 Grooved Pipe.....	171.82	53.21
23 21 13 23-1223 Painted Grooved-Joint Pipe Fittings (23 21 13 23)						
Note: Couplings are not included with fittings.						
23 21 13 23-1224 Grooved Elbows (23 21 13 23-1223)						
23 21 13 23-1225 90 Degree Grooved Elbows (23 21 13 23-1224)						
Note: Victaulic No. 10						
			EA	3/4" 90 Degree Elbow, Ductile Iron, Grooved.....	43.11	8.01
				<i>For Galvanized Fittings, Add</i>	10.26	
			EA	1" 90 Degree Elbow, Ductile Iron, Grooved.....	43.11	8.01
				<i>For Galvanized Fittings, Add</i>	10.26	
			EA	1-1/4" 90 Degree Elbow, Ductile Iron, Grooved.....	46.11	9.99
				<i>For Galvanized Fittings, Add</i>	10.26	
			EA	1-1/2" 90 Degree Elbow, Ductile Iron, Grooved.....	49.29	12.13
				<i>For Galvanized Fittings, Add</i>	10.26	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 20 HVAC Piping And Pumps****23 21 Hydronic Piping And Pumps**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21	13 23-1230	EA	2" 90 Degree Elbow, Ductile Iron, Grooved <i>For Galvanized Fittings, Add</i>	55.12 10.26	16.03
23 21	13 23-1231	EA	2-1/2" 90 Degree Elbow, Ductile Iron, Grooved <i>For Galvanized Fittings, Add</i>	60.36 10.26	19.55
23 21	13 23-1232	EA	3" 90 Degree Elbow, Ductile Iron, Grooved <i>For Galvanized Fittings, Add</i>	90.71 18.23	23.66
23 21	13 23-1233	EA	4" 90 Degree Elbow, Ductile Iron, Grooved <i>For Galvanized Fittings, Add</i>	106.98 19.86	31.24
23 21	13 23-1234	EA	5" 90 Degree Elbow, Ductile Iron, Grooved <i>For Galvanized Fittings, Add</i>	204.99 48.34	39.03
23 21	13 23-1235	EA	6" 90 Degree Elbow, Ductile Iron, Grooved <i>For Galvanized Fittings, Add</i>	246.78 56.17	51.09
23 21	13 23-1236	EA	8" 90 Degree Elbow, Ductile Iron, Grooved <i>For Galvanized Fittings, Add</i>	449.40 118.22	60.79
23 21	13 23-1237	EA	10" 90 Degree Elbow, Ductile Iron, Grooved <i>For Galvanized Fittings, Add</i>	664.49 184.19	70.93
23 21	13 23-1238	EA	12" 90 Degree Elbow, Ductile Iron, Grooved <i>For Galvanized Fittings, Add</i>	1,022.24 295.23	85.12
23 21 13 23-1239 45 Degree Grooved Elbows (23 21 13 23-1224)					
Note: Victaulic No. 11					
23 21	13 23-1240	EA	3/4" 45 Degree Elbow, Ductile Iron, Grooved <i>For Galvanized Fittings, Add</i>	43.09 7.46	8.01
23 21	13 23-1241	EA	1" 45 Degree Elbow, Ductile Iron, Grooved <i>For Galvanized Fittings, Add</i>	43.09 7.46	8.01
23 21	13 23-1242	EA	1-1/4" 45 Degree Elbow, Ductile Iron, Grooved <i>For Galvanized Fittings, Add</i>	46.09 7.46	9.99
23 21	13 23-1243	EA	1-1/2" 45 degree Elbow, Ductile Iron, Grooved <i>For Galvanized Fittings, Add</i>	49.27 7.46	12.13
23 21	13 23-1244	EA	2" 45 Degree Elbow, Ductile Iron, Grooved <i>For Galvanized Fittings, Add</i>	55.10 7.46	16.03
23 21	13 23-1245	EA	2-1/2" 45 Degree Elbow, Ductile Iron, Grooved <i>For Galvanized Fittings, Add</i>	60.34 7.46	19.55
23 21	13 23-1246	EA	3" 45 Degree Elbow, Ductile Iron, Grooved <i>For Galvanized Fittings, Add</i>	90.69 13.25	23.66
23 21	13 23-1247	EA	4" 45 Degree Elbow, Ductile Iron, Grooved <i>For Galvanized Fittings, Add</i>	106.98 14.44	31.24
23 21	13 23-1248	EA	5" 45 Degree Elbow, Ductile Iron, Grooved <i>For Galvanized Fittings, Add</i>	204.99 35.15	39.03
23 21	13 23-1249	EA	6" 45 Degree Elbow, Ductile Iron, Grooved <i>For Galvanized Fittings, Add</i>	246.78 40.85	51.09
23 21	13 23-1250	EA	8" 45 Degree Elbow, Ductile Iron, Grooved <i>For Galvanized Fittings, Add</i>	449.40 85.98	60.79
23 21	13 23-1251	EA	10" 45 Degree Elbow, Ductile Iron, Grooved <i>For Galvanized Fittings, Add</i>	664.49 133.96	70.93
23 21	13 23-1252	EA	12" 45 Degree Elbow, Ductile Iron, Grooved <i>For Galvanized Fittings, Add</i>	1,022.24 214.71	85.12
23 21 13 23-1253 22-1/2 Degree Grooved Elbows (23 21 13 23-1224)					
Note: Victaulic No. 12					
23 21	13 23-1254	EA	1" 22-1/2 Degree Elbow, Ductile Iron, Grooved <i>For Galvanized Fittings, Add</i>	45.13 7.95	8.01
23 21	13 23-1255	EA	1-1/4" 22-1/2 Degree Elbow, Ductile Iron, Grooved <i>For Galvanized Fittings, Add</i>	48.13 7.95	9.99
23 21	13 23-1256	EA	1-1/2" 22-1/2 Degree Elbow, Ductile Iron, Grooved <i>For Galvanized Fittings, Add</i>	51.31 7.95	12.13
23 21	13 23-1257	EA	2" 22-1/2 Degree Elbow, Ductile Iron, Grooved <i>For Galvanized Fittings, Add</i>	57.14 7.95	16.03
23 21	13 23-1258	EA	2-1/2" 22-1/2 Degree Elbow, Ductile Iron, Grooved <i>For Galvanized Fittings, Add</i>	62.38 7.95	19.55
23 21	13 23-1259	EA	3" 22-1/2 Degree Elbow, Ductile Iron, Grooved <i>For Galvanized Fittings, Add</i>	83.91 11.63	23.66
23 21	13 23-1260	EA	4" 22-1/2 Degree Elbow, Ductile Iron, Grooved <i>For Galvanized Fittings, Add</i>	111.77 15.59	31.24
23 21	13 23-1261	EA	5" 22-1/2 Degree Elbow, Steel, Grooved <i>For Galvanized Fittings, Add</i>	259.96 48.35	39.03
23 21	13 23-1262	EA	6" 22-1/2 Degree Elbow, Ductile Iron, Grooved <i>For Galvanized Fittings, Add</i>	260.58 44.16	51.09
23 21	13 23-1263	EA	8" 22-1/2 Degree Elbow, Ductile Iron, Grooved <i>For Galvanized Fittings, Add</i>	476.18 92.41	60.79
23 21	13 23-1264	EA	10" 22-1/2 Degree Elbow, Steel, Grooved <i>For Galvanized Fittings, Add</i>	634.94 126.86	70.93
23 21	13 23-1265	EA	12" 22-1/2 Degree Elbow, Steel, Grooved <i>For Galvanized Fittings, Add</i>	842.23 171.51	85.12
23 21 13 23-1266 11-1/4 Degree Grooved Elbows (23 21 13 23-1224)					
Note: Victaulic No. 13					
23 21	13 23-1267	EA	1" 11-1/4 Degree Elbow, Ductile Iron, Grooved <i>For Galvanized Fittings, Add</i>	45.13 7.95	8.01
23 21	13 23-1268	EA	1-1/4" 11-1/4 Degree Elbow, Ductile Iron, Grooved <i>For Galvanized Fittings, Add</i>	48.13 7.95	9.99



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21 13 23-1269 EA 1-1/2" 11-1/4 Degree Elbow, Ductile Iron, Grooved.....	51.31	12.13
For Galvanized Fittings, Add	7.95	
23 21 13 23-1270 EA 2" 11-1/4 Degree Elbow, Ductile Iron, Grooved.....	57.14	16.03
For Galvanized Fittings, Add	7.95	
23 21 13 23-1271 EA 2-1/2" 11-1/4 Degree Elbow, Ductile Iron, Grooved.....	62.38	19.55
For Galvanized Fittings, Add	7.95	
23 21 13 23-1272 EA 3" 11-1/4 Degree Elbow, Ductile Iron, Grooved.....	83.91	23.66
For Galvanized Fittings, Add	11.63	
23 21 13 23-1273 EA 4" 11-1/4 Degree Elbow, Ductile Iron, Grooved.....	111.76	31.24
For Galvanized Fittings, Add	15.59	
23 21 13 23-1274 EA 5" 11-1/4 Degree Elbow, Steel, Grooved.....	259.95	39.03
For Galvanized Fittings, Add	48.34	
23 21 13 23-1275 EA 6" 11-1/4 Degree Elbow, Ductile Iron, Grooved.....	260.57	51.09
For Galvanized Fittings, Add	44.16	
23 21 13 23-1276 EA 8" 11-1/4 Degree Elbow, Ductile Iron, Grooved.....	476.15	60.79
For Galvanized Fittings, Add	92.40	
23 21 13 23-1277 EA 10" 11-1/4 Degree Elbow, Steel, Grooved.....	634.91	70.93
For Galvanized Fittings, Add	126.86	
23 21 13 23-1278 EA 12" 11-1/4 Degree Elbow, Steel, Grooved.....	842.19	85.12
For Galvanized Fittings, Add	171.50	
23 21 13 23-1279 90 Degree Grooved Long Radius Elbows (23 21 13 23-1224)		
Note: Victaulic No. 100		
23 21 13 23-1280 EA 2" 90 Degree Long Radius Elbow, Ductile Iron, Grooved.....	95.11	16.03
For Galvanized Fittings, Add	17.06	
23 21 13 23-1281 EA 2-1/2" 90 Degree Long Radius Elbow, Steel, Grooved.....	235.55	19.55
For Galvanized Fittings, Add	49.51	
23 21 13 23-1282 EA 3" 90 Degree Long Radius Elbow, Ductile Iron, Grooved.....	106.56	23.66
For Galvanized Fittings, Add	17.06	
23 21 13 23-1283 EA 4" 90 Degree Long Radius Elbow, Ductile Iron, Grooved.....	153.31	31.24
For Galvanized Fittings, Add	25.56	
23 21 13 23-1284 EA 5" 90 Degree Long Radius Elbow, Steel Grooved.....	604.38	39.03
For Galvanized Fittings, Add	131.01	
23 21 13 23-1285 EA 6" 90 Degree Long Radius Elbow, Ductile Iron, Grooved.....	388.11	51.09
For Galvanized Fittings, Add	74.77	
23 21 13 23-1286 EA 8" 90 Degree Long Radius Elbow, Ductile Iron, Grooved.....	838.44	60.79
For Galvanized Fittings, Add	179.35	
23 21 13 23-1287 EA 10" 90 Degree Long Radius Elbow, Ductile Iron, Grooved.....	1,655.79	70.93
For Galvanized Fittings, Add	371.87	
23 21 13 23-1288 EA 12" 90 Degree Long Radius Elbow, Ductile Iron, Grooved.....	1,975.33	85.12
For Galvanized Fittings, Add	443.45	
23 21 13 23-1289 Grooved Tees, Wyes And Crosses (23 21 13 23-1223)		
23 21 13 23-1290 Grooved Tees (23 21 13 23-1289)		
Note: Victaulic No. 20		
23 21 13 23-1291 EA 3/4" Tee, Ductile Iron, Grooved.....	63.33	10.51
For Galvanized Fittings, Add	14.26	
23 21 13 23-1292 EA 1" Tee, Ductile Iron, Grooved.....	65.71	12.13
For Galvanized Fittings, Add	14.26	
23 21 13 23-1293 EA 1-1/4" Tee, Ductile Iron, Grooved.....	69.76	14.85
For Galvanized Fittings, Add	14.26	
23 21 13 23-1294 EA 1-1/2" Tee, Ductile Iron, Grooved.....	74.81	18.22
For Galvanized Fittings, Add	14.26	
23 21 13 23-1295 EA 2" Tee, Ductile Iron, Grooved.....	82.84	23.59
For Galvanized Fittings, Add	14.26	
23 21 13 23-1296 EA 2-1/2" Tee, Ductile Iron, Grooved.....	90.87	28.88
For Galvanized Fittings, Add	14.26	
23 21 13 23-1297 EA 3" Tee, Ductile Iron, Grooved.....	119.76	35.50
For Galvanized Fittings, Add	19.97	
23 21 13 23-1298 EA 4" Tee, Ductile Iron, Grooved.....	170.96	45.94
For Galvanized Fittings, Add	30.63	
23 21 13 23-1299 EA 5" Tee, Ductile Iron, Grooved.....	329.58	60.05
For Galvanized Fittings, Add	71.87	
23 21 13 23-1300 EA 6" Tee, Ductile Iron, Grooved.....	389.46	75.12
For Galvanized Fittings, Add	83.06	
23 21 13 23-1301 EA 8" Tee, Ductile Iron, Grooved.....	741.51	91.21
For Galvanized Fittings, Add	181.43	
23 21 13 23-1302 EA 10" Tee, Ductile Iron, Grooved.....	1,239.47	106.35
For Galvanized Fittings, Add	323.99	
23 21 13 23-1303 EA 12" Tee, Ductile Iron, Grooved.....	1,703.35	127.67
For Galvanized Fittings, Add	453.58	
23 21 13 23-1304 Grooved Wyes (90 Degree True Wye) (23 21 13 23-1289)		
Note: Victaulic No. 33		
23 21 13 23-1305 EA 1" Wye, Steel, Grooved.....	218.68	12.13
For Galvanized Fittings, Add	32.08	
23 21 13 23-1306 EA 1-1/4" Wye, Steel, Grooved.....	222.73	14.85
For Galvanized Fittings, Add	32.08	
23 21 13 23-1307 EA 1-1/2" Wye, Steel, Grooved.....	227.78	18.22
For Galvanized Fittings, Add	32.08	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 20 HVAC Piping And Pumps****23 21 Hydronic Piping And Pumps**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21	13 23-1308	EA	2" Wye, Steel, Grooved.....	235.81	23.59
			<i>For Galvanized Fittings, Add</i>	32.08	
23 21	13 23-1309	EA	2-1/2" Wye, Steel, Grooved	243.84	28.88
			<i>For Galvanized Fittings, Add</i>	32.08	
23 21	13 23-1310	EA	3" Wye, Steel, Grooved.....	292.86	35.50
			<i>For Galvanized Fittings, Add</i>	38.35	
23 21	13 23-1311	EA	4" Wye, Steel, Grooved.....	382.76	45.94
			<i>For Galvanized Fittings, Add</i>	50.23	
23 21	13 23-1312	EA	5" Wye, Steel, Grooved.....	539.97	60.05
			<i>For Galvanized Fittings, Add</i>	71.99	
23 21	13 23-1313	EA	6" Wye, Steel, Grooved.....	669.31	75.12
			<i>For Galvanized Fittings, Add</i>	89.07	
23 21	13 23-1314	EA	8" Wye, Steel, Grooved.....	938.54	91.21
			<i>For Galvanized Fittings, Add</i>	128.29	
23 21	13 23-1315	EA	10" Wye, Steel, Grooved.....	1,543.43	106.35
			<i>For Galvanized Fittings, Add</i>	221.43	
23 21	13 23-1316	EA	12" Wye, Steel, Grooved.....	1,720.32	127.67
			<i>For Galvanized Fittings, Add</i>	244.63	
23 21	13 23-1317		Grooved Reducing Tees (23 21 13 23-1289)		
			Note: Victaulic No. 25		
23 21	13 23-1318	EA	1" Reducing Tee, Steel, Grooved	109.88	12.13
			<i>For Galvanized Fittings, Add</i>	18.34	
23 21	13 23-1319	EA	1-1/4" Reducing Tee, Steel, Grooved	116.81	14.85
			<i>For Galvanized Fittings, Add</i>	18.91	
23 21	13 23-1320	EA	1-1/2" Reducing Tee, Steel, Grooved	124.21	18.22
			<i>For Galvanized Fittings, Add</i>	19.38	
23 21	13 23-1321	EA	2" Reducing Tee, Steel, Grooved	148.79	23.59
			<i>For Galvanized Fittings, Add</i>	22.69	
23 21	13 23-1322	EA	2-1/2" Reducing Tee, Steel, Grooved	168.49	28.88
			<i>For Galvanized Fittings, Add</i>	25.03	
23 21	13 23-1323	EA	3" Reducing Tee, Steel, Grooved	190.18	35.50
			<i>For Galvanized Fittings, Add</i>	27.40	
23 21	13 23-1324	EA	4" Reducing Tee, Steel, Grooved	253.58	45.94
			<i>For Galvanized Fittings, Add</i>	36.95	
23 21	13 23-1325	EA	5" Reducing Tee, Steel, Grooved	333.96	60.05
			<i>For Galvanized Fittings, Add</i>	48.79	
23 21	13 23-1326	EA	6" Reducing Tee, Steel, Grooved	455.74	75.12
			<i>For Galvanized Fittings, Add</i>	68.63	
23 21	13 23-1327	EA	8" Reducing Tee, Steel, Grooved	702.92	91.21
			<i>For Galvanized Fittings, Add</i>	113.24	
23 21	13 23-1328	EA	10" Reducing Tee, Steel, Grooved	994.19	106.35
			<i>For Galvanized Fittings, Add</i>	166.94	
23 21	13 23-1329	EA	12" Reducing Tee, Steel, Grooved	1,422.69	127.67
			<i>For Galvanized Fittings, Add</i>	246.26	
23 21	13 23-1330		Grooved 45 Degree Lateral Wyes (23 21 13 23-1289)		
			Note: Victaulic No. 30		
23 21	13 23-1331	EA	3/4" 45 Degree Lateral Wye, Steel, Grooved.....	205.68	10.51
			<i>For Galvanized Fittings, Add</i>	34.18	
23 21	13 23-1332	EA	1" 45 Degree Lateral Wye, Steel, Grooved.....	208.06	12.13
			<i>For Galvanized Fittings, Add</i>	34.18	
23 21	13 23-1333	EA	1-1/4" 45 Degree Lateral Wye, Steel, Grooved.....	212.11	14.85
			<i>For Galvanized Fittings, Add</i>	34.18	
23 21	13 23-1334	EA	1-1/2" 45 Degree Lateral Wye, Steel, Grooved.....	217.16	18.22
			<i>For Galvanized Fittings, Add</i>	34.18	
23 21	13 23-1335	EA	2" 45 Degree Lateral Wye, Steel, Grooved.....	225.19	23.59
			<i>For Galvanized Fittings, Add</i>	34.18	
23 21	13 23-1336	EA	2-1/2" Wye, 45 Degree Lateral, Steel, Grooved.....	233.22	28.88
			<i>For Galvanized Fittings, Add</i>	34.18	
23 21	13 23-1337	EA	3" Wye, 45 Degree Lateral, Steel, Grooved.....	217.23	35.50
			<i>For Galvanized Fittings, Add</i>	29.53	
23 21	13 23-1338	EA	3-1/2" Wye, 45 Degree Lateral, Steel, Grooved.....	339.23	40.94
			<i>For Galvanized Fittings, Add</i>	50.02	
23 21	13 23-1339	EA	4" 45 Degree Lateral Wye, Steel, Grooved.....	392.34	45.94
			<i>For Galvanized Fittings, Add</i>	58.23	
23 21	13 23-1340	EA	5" 45 Degree Lateral Wye, Steel, Grooved.....	562.80	60.05
			<i>For Galvanized Fittings, Add</i>	85.10	
23 21	13 23-1341	EA	6" 45 Degree Lateral Wye, Steel, Grooved.....	874.31	75.12
			<i>For Galvanized Fittings, Add</i>	137.11	
23 21	13 23-1342	EA	8" 45 Degree Lateral Wye, Steel, Grooved.....	1,233.87	91.21
			<i>For Galvanized Fittings, Add</i>	197.49	
23 21	13 23-1343	EA	10" 45 Degree Lateral Wye, Steel, Grooved.....	1,708.10	106.35
			<i>For Galvanized Fittings, Add</i>	278.75	
23 21	13 23-1344	EA	12" 45 Degree Lateral Wye, Steel, Grooved.....	2,063.73	127.67
			<i>For Galvanized Fittings, Add</i>	337.02	
23 21	13 23-1345		Grooved 45 Degree Lateral Reducing Wyes (23 21 13 23-1289)		
			Note: Victaulic No. 30R		
23 21	13 23-1346	EA	3" 45 Degree Lateral Reducing Wye, Steel, Grooved.....	217.23	35.50
			<i>For Galvanized Fittings, Add</i>	21.32	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21 13 23-1347 EA 4" 45 Degree Lateral Reducing Wye, Steel, Grooved.....	392.34	45.94
For Galvanized Fittings, Add	42.05	
23 21 13 23-1348 EA 5" 45 Degree Lateral Reducing Wye, Steel, Grooved.....	562.80	60.05
For Galvanized Fittings, Add	61.46	
23 21 13 23-1349 EA 6" 45 Degree Lateral Reducing Wye, Steel, Grooved.....	723.41	75.12
For Galvanized Fittings, Add	79.41	
23 21 13 23-1350 EA 8" 45 Degree Lateral Reducing Wye, Steel, Grooved.....	1,018.50	91.21
For Galvanized Fittings, Add	114.63	
23 21 13 23-1351 EA 10" 45 Degree Lateral Reducing Wye, Steel, Grooved.....	1,239.43	106.35
For Galvanized Fittings, Add	140.39	
23 21 13 23-1352 EA 12" 45 Degree Lateral Reducing Wye, Steel, Grooved.....	1,503.78	127.67
For Galvanized Fittings, Add	170.61	
23 21 13 23-1353 Mechanical-T Outlet <small>(23 21 13 23-1289)</small>		
Note: Includes making opening in pipe. Grooved or treaded branch outlets. Victaulic Styles 920 or 921.		
23 21 13 23-1354 EA 2" x 3/4" Mechanical-T Outlet With Threaded Branch Outlet.....	84.50	26.46
For Galvanized Fittings, Add	7.83	
23 21 13 23-1355 EA 2" x 1" Mechanical-T Outlet With Threaded Branch Outlet.....	84.50	26.46
For Galvanized Fittings, Add	7.83	
23 21 13 23-1356 EA 2" x 1-1/4" Mechanical-T Outlet With Threaded Branch Outlet.....	89.42	26.46
For Galvanized Fittings, Add	9.05	
23 21 13 23-1357 EA 2" x 1-1/2" Mechanical-T Outlet With Threaded Branch Outlet.....	89.42	26.46
23 21 13 23-1358 EA 2-1/2" x 3/4" Mechanical-T Outlet With Threaded Branch Outlet.....	91.12	29.77
23 21 13 23-1359 EA 2-1/2" x 1" Mechanical-T Outlet With Threaded Branch Outlet.....	91.12	29.77
23 21 13 23-1360 EA 2-1/2" x 1-1/4" Mechanical-T Outlet With Threaded Branch Outlet.....	104.13	29.77
23 21 13 23-1361 EA 3" x 3/4" Mechanical-T Outlet With Threaded Branch Outlet.....	102.51	33.07
23 21 13 23-1362 EA 3" x 1" Mechanical-T Outlet With Threaded Branch Outlet.....	102.51	33.07
23 21 13 23-1363 EA 3" x 1-1/4" Mechanical-T Outlet With Threaded Branch Outlet.....	112.99	33.07
23 21 13 23-1364 EA 3" x 1-1/2" Mechanical-T Outlet With Threaded Branch Outlet.....	112.99	33.07
23 21 13 23-1365 EA 3" x 2" Mechanical-T Outlet With Threaded Branch Outlet.....	120.16	33.07
23 21 13 23-1366 EA 4" x 3/4" Mechanical-T Outlet With Threaded Branch Outlet.....	134.56	44.10
23 21 13 23-1367 EA 4" x 1" Mechanical-T Outlet With Threaded Branch Outlet.....	134.56	44.10
23 21 13 23-1368 EA 4" x 1-1/4" Mechanical-T Outlet With Threaded Branch Outlet.....	142.74	44.10
23 21 13 23-1369 EA 4" x 1-1/2" Mechanical-T Outlet With Threaded Or Grooved Outlet.....	145.04	44.10
23 21 13 23-1370 EA 4" x 2" Mechanical-T Outlet With Threaded Or Grooved Outlet.....	145.04	44.10
23 21 13 23-1371 EA 4" x 2-1/2" Mechanical-T Outlet With Threaded Or Grooved Outlet.....	147.33	44.10
23 21 13 23-1372 EA 4" x 3" Mechanical-T Outlet With Threaded Or Grooved Outlet.....	151.73	44.10
23 21 13 23-1373 EA 5" x 1-1/2" Mechanical-T Outlet With Threaded Or Grooved Outlet.....	191.08	60.64
23 21 13 23-1374 EA 5" x 2" Mechanical-T Outlet With Threaded Or Grooved Outlet.....	191.08	60.64
23 21 13 23-1375 EA 5" x 2-1/2" Mechanical-T Outlet With Threaded Or Grooved Outlet.....	195.05	60.64
23 21 13 23-1376 EA 5" x 3" Mechanical-T Outlet With Threaded Or Grooved Outlet.....	200.03	60.64
23 21 13 23-1377 EA 6" x 1-1/2" Mechanical-T Outlet With Threaded Or Grooved Outlet.....	225.78	77.18
23 21 13 23-1378 EA 6" x 2" Mechanical-T Outlet With Threaded Or Grooved Outlet.....	225.78	77.18
23 21 13 23-1379 EA 6" x 2-1/2" Mechanical-T Outlet With Threaded Or Grooved Outlet.....	231.61	77.18
23 21 13 23-1380 EA 6" x 3" Mechanical-T Outlet With Threaded Or Grooved Outlet.....	236.54	77.18
23 21 13 23-1381 EA 6" x 4" Mechanical-T Outlet With Threaded Or Grooved Outlet.....	245.30	77.18
23 21 13 23-1382 EA 8" x 2" Mechanical-T Outlet With Threaded Or Grooved Outlet.....	330.73	102.17
23 21 13 23-1383 EA 8" x 2-1/2" Mechanical-T Outlet With Threaded Or Grooved Outlet.....	330.73	102.17
23 21 13 23-1384 EA 8" x 3" Mechanical-T Outlet With Threaded Or Grooved Outlet.....	337.76	102.17
23 21 13 23-1385 EA 8" x 4" Mechanical-T Outlet With Threaded Or Grooved Outlet.....	341.92	102.17
23 21 13 23-1386 Grooved Fittings <small>(23 21 13 23-1223)</small>		
23 21 13 23-1387 Flanged Adapter Nipple, Grooved <small>(23 21 13 23-1386)</small>		
Note: Victaulic No. 41 and 45		
23 21 13 23-1388 EA 1" Flanged Adapter Nipples With Groove Gasket, ANSI CL 125 And 150.....	146.85	8.82
For 300 LB Rating, Add	20.04	
For Galvanized Fittings, Add	24.05	
23 21 13 23-1389 EA 1-1/4" Flanged Adapter Nipples With Groove Gasket, ANSI CL 125 And 150.....	148.32	9.77
For 300 LB Rating, Add	20.04	
For Galvanized Fittings, Add	24.05	
23 21 13 23-1390 EA 1-1/2" Flanged Adapter Nipples With Groove Gasket, ANSI CL 125 And 150.....	152.00	12.27
For 300 LB Rating, Add	20.04	
For Galvanized Fittings, Add	24.05	
23 21 13 23-1391 EA 2" Flanged Adapter Nipples With Groove Gasket, ANSI CL 125 And 150.....	159.73	17.42
For 300 LB Rating, Add	20.04	
For Galvanized Fittings, Add	24.05	
23 21 13 23-1392 EA 2-1/2" Flanged Adapter Nipples With Groove Gasket, ANSI CL 125 And 150.....	165.25	21.10
For 300 LB Rating, Add	20.04	
For Galvanized Fittings, Add	24.05	
23 21 13 23-1393 EA 3" Flanged Adapter Nipples With Groove Gasket, ANSI CL 125 And 150.....	208.74	25.22
For 300 LB Rating, Add	25.65	
For Galvanized Fittings, Add	30.78	
23 21 13 23-1394 EA 4" Flanged Adapter Nipples With Groove Gasket, ANSI CL 125 And 150.....	254.79	33.96
For 300 LB Rating, Add	30.59	
For Galvanized Fittings, Add	36.70	
23 21 13 23-1395 EA 5" Flanged Adapter Nipples With Groove Gasket, ANSI CL 125 And 150.....	352.97	41.09
For 300 LB Rating, Add	43.71	
For Galvanized Fittings, Add	52.45	
23 21 13 23-1396 EA 6" Flanged Adapter Nipples With Groove Gasket, ANSI CL 125 And 150.....	415.66	55.50
For 300 LB Rating, Add	49.87	
For Galvanized Fittings, Add	59.84	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 20 HVAC Piping And Pumps****23 21 Hydronic Piping And Pumps**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21	13 23-1397	EA	8" Flanged Adapter Nipples With Groove Gasket, ANSI CL 125 And 150.....	571.47	75.12
			<i>For 300 LB Rating, Add</i>	68.83	
			<i>For Galvanized Fittings, Add</i>	82.60	
23 21	13 23-1398	EA	10" Flanged Adapter Nipples With Groove Gasket, ANSI CL 125 And 150.....	885.54	91.21
			<i>For 300 LB Rating, Add</i>	112.32	
			<i>For Galvanized Fittings, Add</i>	134.79	
23 21	13 23-1399	EA	12" Flanged Adapter Nipples With Groove Gasket, ANSI CL 125 And 150.....	1,183.37	106.35
			<i>For 300 LB Rating, Add</i>	153.58	
			<i>For Galvanized Fittings, Add</i>	184.29	
23 21	13 23-1400		Grooved Concentric Reducers (23 21 13 23-1386)		
			Note: Victaulic No. 50		
23 21	13 23-1401	EA	1-1/4" x 3/4" Concentric Reducer, Grooved.....	155.75	8.82
			<i>For Galvanized Fittings, Add</i>	6.27	
23 21	13 23-1402	EA	1-1/4" x 1" Concentric Reducer, Grooved.....	162.90	9.34
			<i>For Galvanized Fittings, Add</i>	6.55	
23 21	13 23-1403	EA	1-1/2" x 3/4" Concentric Reducer, Grooved.....	183.29	10.07
			<i>For Galvanized Fittings, Add</i>	20.22	
23 21	13 23-1404	EA	1-1/2" x 1" Concentric Reducer, Grooved.....	51.83	10.51
			<i>For Galvanized Fittings, Add</i>	4.33	
23 21	13 23-1405	EA	1-1/2" x 1-1/4" Concentric Reducer, Grooved.....	155.97	11.02
			<i>For Galvanized Fittings, Add</i>	16.76	
23 21	13 23-1406	EA	2" x 3/4" Concentric Reducer, Grooved.....	54.03	11.98
			<i>For Galvanized Fittings, Add</i>	4.33	
23 21	13 23-1407	EA	2" x 1" Concentric Reducer, Grooved.....	54.76	12.49
			<i>For Galvanized Fittings, Add</i>	4.33	
23 21	13 23-1408	EA	2" x 1-1/4" Concentric Reducer, Grooved.....	59.11	13.01
			<i>For Galvanized Fittings, Add</i>	4.76	
23 21	13 23-1409	EA	2" x 1-1/2" Concentric Reducer, Grooved.....	57.75	14.48
			<i>For Galvanized Fittings, Add</i>	4.33	
23 21	13 23-1410	EA	2-1/2" x 3/4" Concentric Reducer, Grooved.....	313.46	13.52
			<i>For Galvanized Fittings, Add</i>	35.24	
23 21	13 23-1411	EA	2-1/2" x 1" Concentric Reducer, Grooved.....	250.98	14.04
			<i>For Galvanized Fittings, Add</i>	27.64	
23 21	13 23-1412	EA	2-1/2" x 1-1/4" Concentric Reducer, Grooved.....	229.92	14.48
			<i>For Galvanized Fittings, Add</i>	25.02	
23 21	13 23-1413	EA	2-1/2" x 1-1/2" Concentric Reducer, Grooved.....	59.91	15.95
			<i>For Galvanized Fittings, Add</i>	4.33	
23 21	13 23-1414	EA	2-1/2" x 2" Concentric Reducer, Grooved.....	62.85	17.86
			<i>For Galvanized Fittings, Add</i>	4.33	
23 21	13 23-1415	EA	3" x 3/4" Concentric Reducer, Grooved.....	318.63	15.73
			<i>For Galvanized Fittings, Add</i>	44.85	
23 21	13 23-1416	EA	3" x 1" Concentric Reducer, Grooved.....	64.00	16.17
			<i>For Galvanized Fittings, Add</i>	6.05	
23 21	13 23-1417	EA	3" x 1-1/4" Concentric Reducer, Grooved.....	253.52	16.68
			<i>For Galvanized Fittings, Add</i>	34.74	
23 21	13 23-1418	EA	3" x 1-1/2" Concentric Reducer, Grooved.....	239.21	17.86
			<i>For Galvanized Fittings, Add</i>	32.28	
23 21	13 23-1419	EA	3" x 2" Concentric Reducer, Grooved.....	61.37	19.85
			<i>For Galvanized Fittings, Add</i>	4.80	
23 21	13 23-1420	EA	3" x 2-1/2" Concentric Reducer, Grooved.....	79.01	23.66
			<i>For Galvanized Fittings, Add</i>	6.62	
23 21	13 23-1421	EA	3-1/2" x 3" Concentric Reducer, Grooved.....	84.62	25.51
			<i>For Galvanized Fittings, Add</i>	7.05	
23 21	13 23-1422	EA	4" x 1" Concentric Reducer, Grooved.....	77.96	20.07
			<i>For Galvanized Fittings, Add</i>	8.20	
23 21	13 23-1423	EA	4" x 1-1/4" Concentric Reducer, Grooved.....	408.95	20.58
			<i>For Galvanized Fittings, Add</i>	64.84	
23 21	13 23-1424	EA	4" x 1-1/2" Concentric Reducer, Grooved.....	321.75	21.83
			<i>For Galvanized Fittings, Add</i>	49.57	
23 21	13 23-1425	EA	4" x 2" Concentric Reducer, Grooved.....	77.72	23.82
			<i>For Galvanized Fittings, Add</i>	7.22	
23 21	13 23-1426	EA	4" x 2-1/2" Concentric Reducer, Grooved.....	90.96	25.51
			<i>For Galvanized Fittings, Add</i>	9.04	
23 21	13 23-1427	EA	4" x 3" Concentric Reducer, Grooved.....	93.89	27.49
			<i>For Galvanized Fittings, Add</i>	9.04	
23 21	13 23-1428	EA	4" x 3-1/2" Concentric Reducer, Grooved.....	96.83	29.40
			<i>For Galvanized Fittings, Add</i>	9.04	
23 21	13 23-1429	EA	5" x 2" Concentric Reducer, Grooved.....	573.60	27.71
			<i>For Galvanized Fittings, Add</i>	91.25	
23 21	13 23-1430	EA	5" x 2-1/2" Concentric Reducer, Grooved.....	456.91	29.40
			<i>For Galvanized Fittings, Add</i>	70.80	
23 21	13 23-1431	EA	5" x 3" Concentric Reducer, Grooved.....	108.77	31.38
			<i>For Galvanized Fittings, Add</i>	10.58	
23 21	13 23-1432	EA	5" x 4" Concentric Reducer, Grooved.....	126.64	35.28
			<i>For Galvanized Fittings, Add</i>	12.64	
23 21	13 23-1433	EA	6" x 1" Concentric Reducer, Grooved.....	142.87	29.92
			<i>For Galvanized Fittings, Add</i>	18.29	
23 21	13 23-1434	EA	6" x 1-1/2" Concentric Reducer, Grooved.....	606.83	31.60
			<i>For Galvanized Fittings, Add</i>	104.39	
23 21	13 23-1435	EA	6" x 2" Concentric Reducer, Grooved.....	148.37	33.59
			<i>For Galvanized Fittings, Add</i>	18.29	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21 13 23-1436 EA 6" x 2-1/2" Concentric Reducer, Grooved.....	615.54	35.28
For Galvanized Fittings, Add	104.98	
23 21 13 23-1437 EA 6" x 3" Concentric Reducer, Grooved.....	153.90	37.26
For Galvanized Fittings, Add	18.29	
23 21 13 23-1438 EA 6" x 4" Concentric Reducer, Grooved.....	147.11	41.16
For Galvanized Fittings, Add	15.93	
23 21 13 23-1439 EA 6" x 5" Concentric Reducer, Grooved.....	193.92	45.13
For Galvanized Fittings, Add	23.57	
23 21 13 23-1440 EA 8" x 3" Concentric Reducer, Grooved.....	238.37	42.19
For Galvanized Fittings, Add	32.68	
23 21 13 23-1441 EA 8" x 4" Concentric Reducer, Grooved.....	244.24	46.09
For Galvanized Fittings, Add	32.68	
23 21 13 23-1442 EA 8" x 5" Concentric Reducer, Grooved.....	250.13	49.98
For Galvanized Fittings, Add	32.68	
23 21 13 23-1443 EA 8" x 6" Concentric Reducer, Grooved.....	307.16	55.86
For Galvanized Fittings, Add	41.68	
23 21 13 23-1444 EA 10" x 4" Concentric Reducer, Grooved.....	493.86	51.23
For Galvanized Fittings, Add	77.82	
23 21 13 23-1445 EA 10" x 5" Concentric Reducer, Grooved.....	1,002.01	55.13
For Galvanized Fittings, Add	171.54	
23 21 13 23-1446 EA 10" x 6" Concentric Reducer, Grooved.....	547.57	61.01
For Galvanized Fittings, Add	85.10	
23 21 13 23-1447 EA 10" x 8" Concentric Reducer, Grooved.....	554.91	65.93
For Galvanized Fittings, Add	85.10	
23 21 13 23-1448 EA 12" x 4" Concentric Reducer, Grooved.....	1,468.03	58.36
For Galvanized Fittings, Add	207.09	
23 21 13 23-1449 EA 12" x 6" Concentric Reducer, Grooved.....	646.10	68.13
For Galvanized Fittings, Add	61.59	
23 21 13 23-1450 EA 12" x 8" Concentric Reducer, Grooved.....	926.61	73.06
For Galvanized Fittings, Add	122.57	
23 21 13 23-1451 EA 12" x 10" Concentric Reducer, Grooved.....	934.36	78.20
For Galvanized Fittings, Add	122.57	

23 21 13 23-1452 Grooved Eccentric Reducers (23 21 13 23-1386)

Note: Victaulic No. 51

23 21 13 23-1453 EA 1-1/2" x 3/4" Eccentric Reducer, Grooved.....	189.09	10.07
For Galvanized Fittings, Add	20.92	
23 21 13 23-1454 EA 1-1/2" x 1" Eccentric Reducer, Grooved.....	172.89	10.51
For Galvanized Fittings, Add	18.88	
23 21 13 23-1455 EA 1-1/2" x 1-1/4" Eccentric Reducer, Grooved.....	170.20	11.02
For Galvanized Fittings, Add	18.47	
23 21 13 23-1456 EA 2" x 3/4" Eccentric Reducer, Grooved.....	356.16	11.98
For Galvanized Fittings, Add	40.65	
23 21 13 23-1457 EA 2" x 1" Eccentric Reducer, Grooved.....	192.19	12.49
For Galvanized Fittings, Add	20.85	
23 21 13 23-1458 EA 2" x 1-1/4" Eccentric Reducer, Grooved.....	209.62	13.01
For Galvanized Fittings, Add	22.86	
23 21 13 23-1459 EA 2" x 1-1/2" Eccentric Reducer, Grooved.....	180.91	14.48
For Galvanized Fittings, Add	19.13	
23 21 13 23-1460 EA 2-1/2" x 3/4" Eccentric Reducer, Grooved.....	461.69	13.52
For Galvanized Fittings, Add	53.06	
23 21 13 23-1461 EA 2-1/2" x 1" Eccentric Reducer, Grooved.....	432.24	14.04
For Galvanized Fittings, Add	49.43	
23 21 13 23-1462 EA 2-1/2" x 1-1/4" Eccentric Reducer, Grooved.....	260.56	14.48
For Galvanized Fittings, Add	28.71	
23 21 13 23-1463 EA 2-1/2" x 1-1/2" Eccentric Reducer, Grooved.....	213.14	15.95
For Galvanized Fittings, Add	22.75	
23 21 13 23-1464 EA 2-1/2" x 2" Eccentric Reducer, Grooved.....	103.06	17.86
For Galvanized Fittings, Add	9.16	
23 21 13 23-1465 EA 3" x 1" Eccentric Reducer, Grooved.....	465.34	16.17
For Galvanized Fittings, Add	53.02	
23 21 13 23-1466 EA 3" x 1-1/4" Eccentric Reducer, Grooved.....	424.30	16.68
For Galvanized Fittings, Add	48.00	
23 21 13 23-1467 EA 3" x 1-1/2" Eccentric Reducer, Grooved.....	245.73	17.86
For Galvanized Fittings, Add	26.31	
23 21 13 23-1468 EA 3" x 2" Eccentric Reducer, Grooved.....	117.38	19.85
For Galvanized Fittings, Add	10.53	
23 21 13 23-1469 EA 3" x 2-1/2" Eccentric Reducer, Grooved.....	123.08	23.66
For Galvanized Fittings, Add	10.53	
23 21 13 23-1470 EA 3-1/2" x 3" Eccentric Reducer, Grooved.....	522.88	25.51
For Galvanized Fittings, Add	58.26	
23 21 13 23-1471 EA 4" x 1" Eccentric Reducer, Grooved.....	924.28	20.07
For Galvanized Fittings, Add	153.35	
23 21 13 23-1472 EA 4" x 1-1/2" Eccentric Reducer, Grooved.....	573.48	21.83
For Galvanized Fittings, Add	92.74	
23 21 13 23-1473 EA 4" x 2" Eccentric Reducer, Grooved.....	142.77	23.82
For Galvanized Fittings, Add	18.37	
23 21 13 23-1474 EA 4" x 2-1/2" Eccentric Reducer, Grooved.....	145.35	25.51
For Galvanized Fittings, Add	18.37	
23 21 13 23-1475 EA 4" x 3" Eccentric Reducer, Grooved.....	148.28	27.49
For Galvanized Fittings, Add	18.37	
23 21 13 23-1476 EA 5" x 2" Eccentric Reducer, Grooved.....	637.84	27.71
For Galvanized Fittings, Add	102.27	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 20 HVAC Piping And Pumps****23 21 Hydronic Piping And Pumps**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21	13 23-1477	EA	5" x 2-1/2" Eccentric Reducer, Grooved <i>For Galvanized Fittings, Add</i>	552.13 87.13	29.40
23 21	13 23-1478	EA	5" x 3" Eccentric Reducer, Grooved <i>For Galvanized Fittings, Add</i>	537.76 84.16	31.38
23 21	13 23-1479	EA	5" x 4" Eccentric Reducer, Grooved <i>For Galvanized Fittings, Add</i>	198.83 25.02	35.28
23 21	13 23-1480	EA	6" x 1" Eccentric Reducer, Grooved <i>For Galvanized Fittings, Add</i>	971.82 172.97	29.92
23 21	13 23-1481	EA	6" x 2" Eccentric Reducer, Grooved <i>For Galvanized Fittings, Add</i>	895.71 157.75	33.59
23 21	13 23-1482	EA	6" x 2-1/2" Eccentric Reducer, Grooved <i>For Galvanized Fittings, Add</i>	1,059.57 187.84	35.28
23 21	13 23-1483	EA	6" x 3" Eccentric Reducer, Grooved <i>For Galvanized Fittings, Add</i>	250.12 36.25	37.26
23 21	13 23-1484	EA	6" x 4" Eccentric Reducer, Grooved <i>For Galvanized Fittings, Add</i>	231.76 31.73	41.16
23 21	13 23-1485	EA	6" x 5" Eccentric Reducer, Grooved <i>For Galvanized Fittings, Add</i>	271.58 38.06	45.13
23 21	13 23-1486	EA	8" x 3" Eccentric Reducer, Grooved <i>For Galvanized Fittings, Add</i>	1,045.43 183.28	42.19
23 21	13 23-1487	EA	8" x 4" Eccentric Reducer, Grooved <i>For Galvanized Fittings, Add</i>	927.48 160.18	46.09
23 21	13 23-1488	EA	8" x 5" Eccentric Reducer, Grooved <i>For Galvanized Fittings, Add</i>	874.18 149.13	49.98
23 21	13 23-1489	EA	8" x 6" Eccentric Reducer, Grooved <i>For Galvanized Fittings, Add</i>	428.55 64.33	55.86
23 21	13 23-1490	EA	10" x 4" Eccentric Reducer, Grooved <i>For Galvanized Fittings, Add</i>	1,652.01 293.93	51.23
23 21	13 23-1491	EA	10" x 5" Eccentric Reducer, Grooved <i>For Galvanized Fittings, Add</i>	1,566.77 276.93	55.13
23 21	13 23-1492	EA	10" x 6" Eccentric Reducer, Grooved <i>For Galvanized Fittings, Add</i>	1,210.64 208.83	61.01
23 21	13 23-1493	EA	10" x 8" Eccentric Reducer, Grooved <i>For Galvanized Fittings, Add</i>	1,046.05 176.75	65.93
23 21	13 23-1494	EA	12" x 4" Eccentric Reducer, Grooved <i>For Galvanized Fittings, Add</i>	1,689.16 241.70	58.36
23 21	13 23-1495	EA	12" x 6" Eccentric Reducer, Grooved <i>For Galvanized Fittings, Add</i>	1,597.20 225.60	68.13
23 21	13 23-1496	EA	12" x 8" Eccentric Reducer, Grooved <i>For Galvanized Fittings, Add</i>	1,566.31 219.83	73.06
23 21	13 23-1497	EA	12" x 10" Eccentric Reducer, Grooved <i>For Galvanized Fittings, Add</i>	1,422.12 196.90	78.20
23 21	13 23-1498		Grooved Couplings (23 21 13 23-1223)		
23 21	13 23-1499		Flexible Grooved Coupling (23 21 13 23-1498) Note: Victaulic Style 77		
23 21	13 23-1500	EA	3/4" Standard Coupling, Grooved <i>For Galvanized Fittings, Add</i>	27.24 5.95	3.97
23 21	13 23-1501	EA	1" Standard Coupling, Grooved <i>For Galvanized Fittings, Add</i>	27.24 5.95	3.97
23 21	13 23-1502	EA	1-1/4" Standard Coupling, Grooved <i>For Galvanized Fittings, Add</i>	35.75 7.91	5.00
23 21	13 23-1503	EA	1-1/2" Standard Coupling, Grooved <i>For Galvanized Fittings, Add</i>	39.84 8.64	5.95
23 21	13 23-1504	EA	2" Standard Coupling, Grooved <i>For Galvanized Fittings, Add</i>	44.63 9.13	8.01
23 21	13 23-1505	EA	2-1/2" Standard Coupling, Grooved <i>For Galvanized Fittings, Add</i>	53.68 10.93	9.77
23 21	13 23-1506	EA	3" Standard Coupling, Grooved <i>For Galvanized Fittings, Add</i>	56.52 10.93	11.69
23 21	13 23-1507	EA	3-1/2" Standard Coupling, Grooved <i>For Galvanized Fittings, Add</i>	83.44 17.61	13.67
23 21	13 23-1508	EA	4" Standard Coupling, Grooved <i>For Galvanized Fittings, Add</i>	86.32 17.61	15.58
23 21	13 23-1509	EA	5" Standard Coupling, Grooved <i>For Galvanized Fittings, Add</i>	125.71 27.01	19.55
23 21	13 23-1510	EA	6" Standard Coupling, Grooved <i>For Galvanized Fittings, Add</i>	152.30 31.93	25.51
23 21	13 23-1511	EA	8" Standard Coupling, Grooved <i>For Galvanized Fittings, Add</i>	231.44 52.04	30.43
23 21	13 23-1512	EA	10" Standard Coupling, Grooved <i>For Galvanized Fittings, Add</i>	363.58 86.49	36.46
23 21	13 23-1513	EA	12" Standard Coupling, Grooved <i>For Galvanized Fittings, Add</i>	411.51 98.47	39.91
23 21	13 23-1514		Zero-Flex® Rigid Coupling (23 21 13 23-1498) Note: Victaulic Style 07		
23 21	13 23-1515	EA	1" Rigid Coupling, Grooved <i>For Galvanized Fittings, Add</i>	35.54 7.24	3.97
23 21	13 23-1516	EA	1-1/4" Rigid Coupling, Grooved <i>For Galvanized Fittings, Add</i>	37.05 7.24	5.00



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21 13 23-1517 EA 1-1/2" Rigid Coupling, Grooved <i>For Galvanized Fittings, Add</i>	38.51 7.24	5.95
23 21 13 23-1518 EA 2" Rigid Coupling, Grooved <i>For Galvanized Fittings, Add</i>	42.30 7.42	8.01
23 21 13 23-1519 EA 2-1/2" Rigid Coupling, Grooved <i>For Galvanized Fittings, Add</i>	49.55 8.56	9.77
23 21 13 23-1520 EA 3" Rigid Coupling, Grooved <i>For Galvanized Fittings, Add</i>	52.39 8.56	11.69
23 21 13 23-1521 EA 3-1/2" Rigid Coupling, Grooved <i>For Galvanized Fittings, Add</i>	61.33 10.00	13.67
23 21 13 23-1522 EA 4" Rigid Coupling, Grooved <i>For Galvanized Fittings, Add</i>	81.23 14.17	15.58
23 21 13 23-1523 EA 5" Rigid Coupling, Grooved <i>For Galvanized Fittings, Add</i>	104.35 18.40	19.55
23 21 13 23-1524 EA 6" Rigid Coupling, Grooved <i>For Galvanized Fittings, Add</i>	138.66 24.59	25.51
23 21 13 23-1525 EA 8" Rigid Coupling, Grooved <i>For Galvanized Fittings, Add</i>	203.72 38.74	30.43
23 21 13 23-1526 EA 10" Rigid Coupling, Grooved <i>For Galvanized Fittings, Add</i>	338.05 69.42	36.46
23 21 13 23-1527 EA 12" Rigid Coupling, Grooved <i>For Galvanized Fittings, Add</i>	376.91 77.69	39.91
 23 21 13 23-1528 Grooved Strainers And Suction Diffusers (23 21 13 23-1223)		
23 21 13 23-1529 Grooved Wye Strainers (23 21 13 23-1528) Note: Victaulic Style 732		
23 21 13 23-1530 EA 2" Wye Strainer, Grooved	577.14	16.17
23 21 13 23-1531 EA 2-1/2" Wye Strainer, Grooved	610.26	19.62
23 21 13 23-1532 EA 3" Wye Strainer, Grooved	688.03	23.52
23 21 13 23-1533 EA 4" Wye Strainer, Grooved	785.46	31.38
23 21 13 23-1534 EA 5" Wye Strainer, Grooved	1,128.51	39.25
23 21 13 23-1535 EA 6" Wye Strainer, Grooved	1,238.17	51.01
23 21 13 23-1536 EA 8" Wye Strainer, Grooved	1,871.95	60.79
23 21 13 23-1537 EA 10" Wye Strainer, Grooved	2,969.06	71.07
23 21 13 23-1538 EA 12" Wye Strainer, Grooved	5,128.55	85.34
 23 21 13 23-1539 Grooved Tee Type Strainers (23 21 13 23-1528) Note: Victaulic Style 730		
23 21 13 23-1540 EA 1-1/2" Tee Type Strainer, Grooved	445.02	12.27
23 21 13 23-1541 EA 2" Tee Type Strainer, Grooved	570.31	16.17
23 21 13 23-1542 EA 2-1/2" Tee Type Strainer, Grooved	603.16	19.62
23 21 13 23-1543 EA 3" Tee Type Strainer, Grooved	680.01	23.52
23 21 13 23-1544 EA 4" Tee Type Strainer, Grooved	776.37	31.38
23 21 13 23-1545 EA 5" Tee Type Strainer, Grooved	1,115.28	39.25
23 21 13 23-1546 EA 6" Tee Type Strainer, Grooved	1,223.90	51.01
23 21 13 23-1547 EA 8" Tee Type Strainer, Grooved	1,849.86	60.79
23 21 13 23-1548 EA 10" Tee Type Strainer, Grooved	2,689.49	71.07
23 21 13 23-1549 EA 12" Tee Type Strainer, Grooved	3,452.83	85.34
 23 21 13 23-1550 Grooved Suction Diffuser (23 21 13 23-1528) Note: Victaulic Style 731		
23 21 13 23-1551 EA 2-1/2" Grooved x 2" Flanged Suction Diffuser	1,161.13	18.15
23 21 13 23-1552 EA 3" Grooved x 2" Flanged Suction Diffuser	1,233.49	20.07
23 21 13 23-1553 EA 3" Grooved x 2-1/2" Flanged Suction Diffuser	900.64	23.52
23 21 13 23-1554 EA 3" Grooved x 3" Flanged Suction Diffuser	914.89	25.51
23 21 13 23-1555 EA 4" Grooved x 2-1/2" Flanged Suction Diffuser	988.88	25.51
23 21 13 23-1556 EA 4" Grooved x 3" Flanged Suction Diffuser	1,066.82	27.49
23 21 13 23-1557 EA 4" Grooved x 4" Flanged Suction Diffuser	1,229.30	27.49
23 21 13 23-1558 EA 5" Grooved x 4" Flanged Suction Diffuser	1,376.99	35.28
23 21 13 23-1559 EA 5" Grooved x 5" Flanged Suction Diffuser	1,447.12	37.26
23 21 13 23-1560 EA 6" Grooved x 4" Flanged Suction Diffuser	1,473.47	41.16
23 21 13 23-1561 EA 6" Grooved x 5" Flanged Suction Diffuser	1,756.39	45.13
23 21 13 23-1562 EA 6" Grooved x 6" Flanged Suction Diffuser	1,825.49	48.07
23 21 13 23-1563 EA 8" Grooved x 5" Flanged Suction Diffuser	1,873.80	49.98
23 21 13 23-1564 EA 8" Grooved x 6" Flanged Suction Diffuser	1,980.64	55.86
23 21 13 23-1565 EA 8" Grooved x 8" Flanged Suction Diffuser	3,355.38	60.79
23 21 13 23-1566 EA 10" Grooved x 8" Flanged Suction Diffuser	3,782.14	65.71
23 21 13 23-1567 EA 10" Grooved x 10" Flanged Suction Diffuser	4,540.53	68.13
23 21 13 23-1568 EA 12" Grooved x 10" Flanged Suction Diffuser	5,370.92	78.43
23 21 13 23-1569 EA 12" Grooved x 12" Flanged Suction Diffuser	7,432.47	83.35
 23 21 13 23-1570 Grooved Steel Valves (23 21 13 23-1223)		
23 21 13 23-1571 Grooved Lug Type Butterfly Valves With Standard Trim (23 21 13 23-1570)		
23 21 13 23-1572 EA 1-1/2" Butterfly Valve, Grooved, With Standard Trim	199.57	8.01
23 21 13 23-1573 EA 2" Butterfly Valve, Grooved, With Standard Trim	203.37	10.51
23 21 13 23-1574 EA 3" Butterfly Valve, Grooved, With Standard Trim	333.77	15.58

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 20 HVAC Piping And Pumps****23 21 Hydronic Piping And Pumps**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21 13 23-1575 EA 4" Butterfly Valve, Grooved, With Standard Trim	448.34	20.51
23 21 13 23-1576 EA 6" Butterfly Valve, Grooved, With Standard Trim	979.23	33.59
23 21 13 23-1577 EA 8" Butterfly Valve, Grooved, With Standard Trim	1,357.01	47.26
23 21 13 23-1578 EA 10" Butterfly Valve, Grooved, With Standard Trim	2,038.27	63.87
23 21 13 23-1579 Grooved Lug Type Butterfly Valves With Stainless Steel Trim (23 21 13 23-1570)		
23 21 13 23-1580 EA 1-1/2" Butterfly Valve, Grooved, With Stainless Steel Trim	300.05	8.01
23 21 13 23-1581 EA 2" Butterfly Valve, Grooved, With Stainless Steel Trim	303.85	10.51
23 21 13 23-1582 EA 3" Butterfly Valve, Grooved, With Stainless Steel Trim	469.98	15.58
23 21 13 23-1583 EA 4" Butterfly Valve, Grooved, With Stainless Steel Trim	597.94	20.51
23 21 13 23-1584 EA 6" Butterfly Valve, Grooved, With Stainless Steel Trim	1,144.46	33.59
23 21 13 23-1585 EA 8" Butterfly Valve, Grooved, With Stainless Steel Trim	1,901.82	47.26
23 21 13 23-1586 EA 10" Butterfly Valve, Grooved, With Stainless Steel Trim	2,998.39	63.87
23 21 13 23-1587 Grooved Ball Valves With Standard Trim And Handle (23 21 13 23-1570)		
23 21 13 23-1588 EA 1-1/2" Ball Valve, Grooved, With Standard Trim	168.34	7.87
23 21 13 23-1589 EA 2" Ball Valve, Grooved, With Standard Trim	192.79	10.81
23 21 13 23-1590 EA 2-1/2" Ball Valve, Grooved, With Standard Trim	440.58	13.23
23 21 13 23-1591 EA 3" Ball Valve, Grooved, With Standard Trim	722.76	15.66
23 21 13 23-1592 EA 4" Ball Valve, Grooved, With Standard Trim	1,125.70	20.58
23 21 13 23-1593 EA 6" Ball Valve, Grooved, With Standard Trim	3,501.50	33.81
23 21 13 23-1594 Grooved Ball Valves With Stainless Steel Trim And Handle (23 21 13 23-1570)		
23 21 13 23-1595 EA 1-1/2" Ball Valve, Grooved, With Stainless Steel Trim	179.34	7.87
23 21 13 23-1596 EA 2" Ball Valve, Grooved, With Stainless Steel Trim	307.02	10.81
23 21 13 23-1597 EA 2-1/2" Ball Valve, Grooved, With Stainless Steel Trim	800.78	13.23
23 21 13 23-1598 EA 3" Ball Valve, Grooved, With Stainless Steel Trim	1,035.62	15.66
23 21 13 23-1599 EA 4" Ball Valve, Grooved, With Stainless Steel Trim	1,414.81	20.58
23 21 13 23-1600 EA 6" Ball Valve, Grooved, With Stainless Steel Trim	3,859.75	33.81
23 21 13 23-1601 Grooved Check Valves (23 21 13 23-1570)		
23 21 13 23-1602 EA 2" Check Valve, Grooved	255.68	10.81
23 21 13 23-1603 EA 2-1/2" Check Valve, Grooved	415.19	13.23
23 21 13 23-1604 EA 3" Check Valve, Grooved	483.75	15.66
23 21 13 23-1605 EA 4" Check Valve, Grooved	685.76	20.58
23 21 13 23-1606 Grooved Vic-Check Check Valves (23 21 13 23-1570)		
23 21 13 23-1607 EA 2-1/2" "Vic-Check" Check Valve, Grooved	331.65	13.23
23 21 13 23-1608 EA 3" "Vic-Check" Check Valve, Grooved	335.22	15.66
23 21 13 23-1609 EA 4" "Vic-Check" Check Valve, Grooved	420.05	20.58
23 21 13 23-1610 EA 6" "Vic-Check" Check Valve, Grooved	819.16	33.81
23 21 13 23-1611 EA 8" "Vic-Check" Check Valve, Grooved	1,120.85	47.05
23 21 13 23-1612 EA 10" "Vic-Check" Check Valve, Grooved	3,135.69	63.73
23 21 13 23-1613 EA 12" "Vic-Check" Check Valve, Grooved	3,713.31	73.57
23 21 13 23-1614 Grooved Plug Valves With Lever Operator (23 21 13 23-1570)		
23 21 13 23-1615 EA 3" Balancing Plug Valve, Grooved, With Lever Handle	378.24	15.66
23 21 13 23-1616 EA 4" Balancing Plug Valve, Grooved, With Lever Handle	421.25	20.58
23 21 13 23-1617 EA 6" Balancing Plug Valve, Grooved, With Lever Handle	750.67	33.81
23 21 13 23-1618 Grooved Plug Valve With Gear Operator (23 21 13 23-1570)		
23 21 13 23-1619 EA 3" Balancing Plug Valve, Grooved, With Gear Operator	664.41	15.66
23 21 13 23-1620 EA 4" Balancing Plug Valve, Grooved, With Gear Operator	707.45	20.58
23 21 13 23-1621 EA 6" Balancing Plug Valve, Grooved, With Gear Operator	1,036.86	33.81
23 21 13 23-1622 EA 8" Balancing Plug Valve, Grooved, With Gear Operator	1,387.82	47.05
23 21 13 23-1623 EA 10" Balancing Plug Valve, Grooved, With Gear Operator	2,172.98	63.73
23 21 13 23-1624 EA 12" Balancing Plug Valve, Grooved, With Gear Operator	3,136.37	73.57
23 21 13 23-1625 Prepare Pipe For Groove (23 21 13 23-1223)		
23 21 13 23-1626 Cut Grooved Pipe (23 21 13 23-1625)		
Note: For use where connecting ungrooved pipe with grooved pipe, coupling to grooved pipe, or for field groove preparation on existing cut pipe.		
23 21 13 23-1627 EA Cut 3/4" Groove	7.70	
23 21 13 23-1628 EA Cut 1" Groove	8.36	
23 21 13 23-1629 EA Cut 1-1/4" Groove	9.44	
23 21 13 23-1630 EA Cut 1-1/2" Groove	10.27	
23 21 13 23-1631 EA Cut 2" Groove	11.25	
23 21 13 23-1632 EA Cut 2-1/2" Groove	12.19	
23 21 13 23-1633 EA Cut 3" Groove	13.30	
23 21 13 23-1634 EA Cut 3-1/2" Groove	14.10	
23 21 13 23-1635 EA Cut 4" Groove	15.00	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
	23 21	13 23-		EA Cut 5" Groove	16.26	
	23 21	13 23-		EA Cut 6" Groove	16.72	
	23 21	13 23-		EA Cut 8" Groove	21.67	
	23 21	13 23-		EA Cut 10" Groove	30.80	
	23 21	13 23-		EA Cut 12" Groove	39.02	
23 21	13 23-	1641		Roll Grooved Pipe <small>(23 21 13 23-1625)</small>		
				Note: For use where connecting ungrooved pipe with grooved pipe, coupling to grooved pipe, or for field groove preparation on existing cut pipe.		
	23 21	13 23-		EA Roll 3/4" Groove.....	4.40	
	23 21	13 23-		EA Roll 1" Groove.....	5.14	
	23 21	13 23-		EA Roll 1-1/4" Groove	5.85	
	23 21	13 23-		EA Roll 1-1/2" Groove	6.58	
	23 21	13 23-		EA Roll 2" Groove.....	10.09	
	23 21	13 23-		EA Roll 2-1/2" Groove	10.64	
	23 21	13 23-		EA Roll 3" Groove.....	11.71	
	23 21	13 23-		EA Roll 3-1/2" Groove	12.45	
	23 21	13 23-		EA Roll 4" Groove.....	13.61	
	23 21	13 23-		EA Roll 5" Groove.....	13.93	
	23 21	13 23-		EA Roll 6" Groove.....	14.63	
	23 21	13 23-		EA Roll 8" Groove.....	17.73	
	23 21	13 23-		EA Roll 10" Groove.....	20.18	
	23 21	13 23-		EA Roll 12" Groove.....	25.45	
23 21	13 23-	1656		Standard Gaskets <small>(23 21 13 23-1625)</small>		
				Note: For use on replacement of existing gaskets.		
	23 21	13 23-		EA 3/4" Grooved Standard Gasket, Ethylene Propylene Diene Monomer (EPDM) "E" Or Nitrile "T"	18.38	
	23 21	13 23-		EA 1" Grooved Standard Gasket, Ethylene Propylene Diene Monomer (EPDM) "E" Or Nitrile "T"	19.00	
	23 21	13 23-		EA 1-1/4" Grooved Standard Gasket, Ethylene Propylene Diene Monomer (EPDM) "E" Or Nitrile "T"	19.83	
	23 21	13 23-		EA 1-1/2" Grooved Standard Gasket, Ethylene Propylene Diene Monomer (EPDM) "E" Or Nitrile "T"	21.72	
	23 21	13 23-		EA 2" Grooved Standard Gasket, Ethylene Propylene Diene Monomer (EPDM) "E" Or Nitrile "T"	22.17	
	23 21	13 23-		EA 2-1/2" Grooved Standard Gasket, Ethylene Propylene Diene Monomer (EPDM) "E" Or Nitrile "T"	26.09	
	23 21	13 23-		EA 3" Grooved Standard Gasket, Ethylene Propylene Diene Monomer (EPDM) "E" Or Nitrile "T"	28.57	
	23 21	13 23-		EA 3-1/2" Grooved Standard Gasket, Ethylene Propylene Diene Monomer (EPDM) "E" Or Nitrile "T"	35.34	
	23 21	13 23-		EA 4" Grooved Standard Gasket, Ethylene Propylene Diene Monomer (EPDM) "E" Or Nitrile "T"	35.70	
	23 21	13 23-		EA 5" Grooved Standard Gasket, Ethylene Propylene Diene Monomer (EPDM) "E" Or Nitrile "T"	44.75	
	23 21	13 23-		EA 6" Grooved Standard Gasket, Ethylene Propylene Diene Monomer (EPDM) "E" Or Nitrile "T"	48.15	
	23 21	13 23-		EA 8" Grooved Standard Gasket, Ethylene Propylene Diene Monomer (EPDM) "E" Or Nitrile "T"	65.53	
	23 21	13 23-		EA 10" Grooved Standard Gasket, Ethylene Propylene Diene Monomer (EPDM) "E" Or Nitrile "T"	82.44	
	23 21	13 23-		EA 12" Grooved Standard Gasket, Ethylene Propylene Diene Monomer (EPDM) "E" Or Nitrile "T"	97.05	
	23 21	13 23-		EA 14" Grooved Standard Gasket, Ethylene Propylene Diene Monomer (EPDM) "E" Or Nitrile "T"	135.35	
	23 21	13 23-		EA 16" Grooved Standard Gasket, Ethylene Propylene Diene Monomer (EPDM) "E" Or Nitrile "T"	181.61	
	23 21	13 23-		EA 18" Grooved Standard Gasket, Ethylene Propylene Diene Monomer (EPDM) "E" Or Nitrile "T"	215.75	
	23 21	13 23-		EA 20" Grooved Standard Gasket, Ethylene Propylene Diene Monomer (EPDM) "E" Or Nitrile "T"	321.64	
	23 21	13 23-		EA 24" Grooved Standard Gasket, Ethylene Propylene Diene Monomer (EPDM) "E" Or Nitrile "T"	441.36	
23 21	13 23-	1676		Copper Grooved-Joint Pipe Fittings <small>(23 21 13 23)</small>		
				Note: Couplings are not included with fittings.		
23 21	13 23-	1677		Grooved Fittings <small>(23 21 13 23-1676)</small>		
23 21	13 23-	1678		Grooved 90 Degree Elbows <small>(23 21 13 23-1677)</small>		
	23 21	13 23-		EA 2" Copper 90 Degree Elbow, Grooved.....	44.62	11.98
	23 21	13 23-		EA 2-1/2" Copper 90 Degree Elbow, Grooved	51.70	14.63
	23 21	13 23-		EA 3" Copper 90 Degree Elbow, Grooved.....	67.24	17.71
	23 21	13 23-		EA 4" Copper 90 Degree Elbow, Grooved.....	121.21	23.37
	23 21	13 23-		EA 5" Copper 90 Degree Elbow, Grooved.....	271.41	29.26
	23 21	13 23-		EA 6" Copper 90 Degree Elbow, Grooved.....	416.96	38.29
	23 21	13 23-		EA 8" Copper 90 Degree Elbow, Grooved.....	730.94	45.58
23 21	13 23-	1686		Grooved 45 Degree Elbows <small>(23 21 13 23-1677)</small>		
	23 21	13 23-		EA 2" Copper 45 Degree Elbow, Grooved.....	44.62	11.98
	23 21	13 23-		EA 2-1/2" Copper 45 Degree Elbow, Grooved	51.70	14.63
	23 21	13 23-		EA 3" Copper 45 Degree Elbow, Grooved.....	67.24	17.71
	23 21	13 23-		EA 4" Copper 45 Degree Elbow, Grooved.....	121.21	23.37
	23 21	13 23-		EA 5" Copper 45 Degree Elbow, Grooved.....	271.41	29.26
	23 21	13 23-		EA 6" Copper 45 Degree Elbow, Grooved.....	416.96	38.29
	23 21	13 23-		EA 8" Copper 45 Degree Elbow, Grooved.....	730.94	45.58
23 21	13 23-	1694		Grooved Tees <small>(23 21 13 23-1677)</small>		
	23 21	13 23-		EA 2" Copper Tee, Grooved.....	69.75	17.64
	23 21	13 23-		EA 2-1/2" Copper Tee, Grooved.....	80.01	21.68
	23 21	13 23-		EA 3" Copper Tee, Grooved.....	108.26	26.61
	23 21	13 23-		EA 4" Copper Tee, Grooved.....	190.63	34.40
	23 21	13 23-		EA 5" Copper Tee, Grooved.....	433.44	44.98
	23 21	13 23-		EA 6" Copper Tee, Grooved.....	537.34	56.30

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 20 HVAC Piping And Pumps****23 21 Hydronic Piping And Pumps**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21 13 23-1701 EA 8" Copper Tee, Grooved.....	895.90	68.35
23 21 13 23-1702 Grooved Reducing Tees (23 21 13 23-1677)		
23 21 13 23-1703 EA 2-1/2" Copper Tee, Reducing, Grooved.....	98.73	21.68
23 21 13 23-1704 EA 3" Copper Tee, Reducing, Grooved.....	118.59	26.61
23 21 13 23-1705 EA 4" Copper Tee, Reducing, Grooved.....	229.56	34.47
23 21 13 23-1706 EA 5" Copper Tee, Reducing, Grooved.....	582.55	45.06
23 21 13 23-1707 EA 6" Copper Tee, Reducing, Grooved.....	714.30	56.30
23 21 13 23-1708 Grooved X Cup Reducing Tees (23 21 13 23-1677)		
23 21 13 23-1709 EA 2" Copper Tee, Reducing, Grooved X Cup.....	79.66	17.64
23 21 13 23-1710 EA 2-1/2" Copper Tee, Reducing, Grooved X Cup.....	98.83	21.68
23 21 13 23-1711 EA 3" Copper Tee, Reducing, Grooved X Cup.....	118.59	26.61
23 21 13 23-1712 EA 4" Copper Tee, Reducing, Grooved X Cup.....	229.56	34.40
23 21 13 23-1713 Grooved Flanged Adapter Nipples (23 21 13 23-1677)		
23 21 13 23-1714 EA 2" Copper Flanged Adapter Nipples With Groove Gasket, ANSI CL 125 And 150.....	134.35	13.01
23 21 13 23-1715 EA 2-1/2" Copper Flanged Adapter Nipples With Groove Gasket, ANSI CL 125 And 150.....	144.57	15.81
23 21 13 23-1716 EA 3" Copper Flanged Adapter Nipples With Groove Gasket, ANSI CL 125 And 150.....	155.91	18.89
23 21 13 23-1717 EA 4" Copper Flanged Adapter Nipples With Groove Gasket, ANSI CL 125 And 150.....	180.53	25.43
23 21 13 23-1718 EA 5" Copper Flanged Adapter Nipples With Groove Gasket, ANSI CL 125 And 150.....	236.14	30.80
23 21 13 23-1719 EA 6" Copper Flanged Adapter Nipples With Groove Gasket, ANSI CL 125 And 150.....	273.56	41.61
23 21 13 23-1720 Grooved Concentric Reducers (23 21 13 23-1677)		
23 21 13 23-1721 EA 2-1/2" x 2" Copper Concentric Reducer, Grooved.....	56.89	13.38
23 21 13 23-1722 EA 3" x 2" Copper Concentric Reducer, Grooved.....	59.83	14.92
23 21 13 23-1723 EA 3" x 2-1/2" Copper Concentric Reducer, Grooved.....	65.53	17.71
23 21 13 23-1724 EA 4" x 2" Copper Concentric Reducer, Grooved.....	98.22	17.86
23 21 13 23-1725 EA 4" x 2-1/2" Copper Concentric Reducer, Grooved.....	100.80	19.11
23 21 13 23-1726 EA 4" x 3" Copper Concentric Reducer, Grooved.....	103.73	20.58
23 21 13 23-1727 EA 5" x 3" Copper Concentric Reducer, Grooved.....	224.96	23.52
23 21 13 23-1728 EA 5" x 4" Copper Concentric Reducer, Grooved.....	230.84	26.46
23 21 13 23-1729 EA 6" x 3" Copper Concentric Reducer, Grooved.....	248.51	27.94
23 21 13 23-1730 EA 6" x 4" Copper Concentric Reducer, Grooved.....	254.38	30.87
23 21 13 23-1731 EA 6" x 5" Copper Concentric Reducer, Grooved.....	260.27	33.81
23 21 13 23-1732 EA 8" x 6" Copper Concentric Reducer, Grooved.....	422.76	41.90
23 21 13 23-1733 Grooved X Cup Concentric Reducers (23 21 13 23-1677)		
23 21 13 23-1734 EA 2" x 1" Copper Concentric Reducer, Grooved X Cup.....	43.71	9.41
23 21 13 23-1735 EA 2" x 1-1/4" Copper Concentric Reducer, Grooved X Cup.....	44.44	9.77
23 21 13 23-1736 EA 2" x 1-1/2" Copper Concentric Reducer, Grooved X Cup.....	46.70	10.88
23 21 13 23-1737 EA 2-1/2" x 1" Copper Concentric Reducer, Grooved X Cup.....	51.61	10.51
23 21 13 23-1738 EA 2-1/2" x 1-1/4" Copper Concentric Reducer, Grooved X Cup.....	52.34	10.88
23 21 13 23-1739 EA 2-1/2" x 1-1/2" Copper Concentric Reducer, Grooved X Cup.....	54.50	11.98
23 21 13 23-1740 EA 2-1/2" x 2" Copper Concentric Reducer, Grooved X Cup.....	57.44	13.38
23 21 13 23-1741 EA 3" x 1-1/2" Copper Concentric Reducer, Grooved X Cup.....	64.89	13.38
23 21 13 23-1742 EA 3" x 2" Copper Concentric Reducer, Grooved X Cup.....	67.83	14.92
23 21 13 23-1743 EA 4" x 2" Copper Concentric Reducer, Grooved X Cup.....	107.36	17.79
23 21 13 23-1744 Grooved Standard Couplings (23 21 13 23-1677)		
23 21 13 23-1745 EA 2" Copper Standard Coupling, Grooved.....	25.26	6.02
23 21 13 23-1746 EA 2-1/2" Copper Standard Coupling, Grooved.....	29.72	7.35
23 21 13 23-1747 EA 3" Copper Standard Coupling, Grooved.....	34.34	8.74
23 21 13 23-1748 EA 4" Copper Standard Coupling, Grooved.....	49.35	11.76
23 21 13 23-1749 EA 5" Copper Standard Coupling, Grooved.....	73.83	14.63
23 21 13 23-1750 EA 6" Copper Standard Coupling, Grooved.....	97.81	19.11
23 21 13 23-1751 EA 8" Copper Standard Coupling, Grooved.....	138.14	22.79
23 21 13 23-1752 Grooved Caps (23 21 13 23-1677)		
23 21 13 23-1753 EA 2" Copper Cap, Grooved.....	26.07	6.02
23 21 13 23-1754 EA 2-1/2" Copper Cap, Grooved.....	30.47	7.35
23 21 13 23-1755 EA 3" Copper Cap, Grooved.....	37.39	8.74
23 21 13 23-1756 EA 4" Copper Cap, Grooved.....	63.57	11.69
23 21 13 23-1757 EA 5" Copper Cap, Grooved.....	216.50	14.63
23 21 13 23-1758 EA 6" Copper Cap, Grooved.....	374.69	19.11
23 21 13 23-1759 Grooved Valves (23 21 13 23-1676)		
23 21 13 23-1760 Grooved Butterfly Valves, Standard Trim, Without Operator (23 21 13 23-1759)		
Note: Copper body.		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21 13 23-1761 EA 2" Butterfly Valve, Grooved, With Standard Trim, Without Operator, Copper Body	329.66	7.87
<i>For Valve Bracket Insulation, Add</i>	38.20	
<i>For Chain Wheel, Add</i>	43.45	
23 21 13 23-1762 EA 3" Butterfly Valve, Grooved, With Standard Trim, Without Operator, Copper Body	374.95	11.69
<i>For Valve Bracket Insulation, Add</i>	38.20	
<i>For Chain Wheel, Add</i>	43.45	
23 21 13 23-1763 EA 4" Butterfly Valve, Grooved, With Standard Trim, Without Operator, Copper Body	495.63	15.36
<i>For Valve Bracket Insulation, Add</i>	38.20	
<i>For Chain Wheel, Add</i>	43.45	
23 21 13 23-1764 EA 6" Butterfly Valve, Grooved, With Standard Trim, Without Operator, Copper Body	661.35	25.22
<i>For Valve Bracket Insulation, Add</i>	38.20	
<i>For Chain Wheel, Add</i>	43.45	
23 21 13 23-1765 EA 8" Butterfly Valve, Grooved, With Standard Trim, Without Operator, Copper Body	729.06	35.43
<i>For Valve Bracket Insulation, Add</i>	38.20	
<i>For Chain Wheel, Add</i>	43.45	
23 21 13 23-1766 Grooved Butterfly Valves, Standard Trim, With Operator <small>(23 21 13 23-1759)</small>		
Note: Copper body.		
23 21 13 23-1767 EA 2" Butterfly Valve, Grooved, With Standard Trim, With Operator, Copper Body	402.74	7.87
<i>For Valve Bracket Insulation, Add</i>	38.20	
<i>For Chain Wheel, Add</i>	43.45	
23 21 13 23-1768 EA 3" Butterfly Valve, Grooved, With Standard Trim, With Operator, Copper Body	448.07	11.69
<i>For Valve Bracket Insulation, Add</i>	38.20	
<i>For Chain Wheel, Add</i>	43.45	
23 21 13 23-1769 EA 4" Butterfly Valve, Grooved, With Standard Trim, With Operator, Copper Body	568.76	15.36
<i>For Valve Bracket Insulation, Add</i>	38.20	
<i>For Chain Wheel, Add</i>	43.45	
23 21 13 23-1770 EA 6" Butterfly Valve, Grooved, With Standard Trim, With Operator, Copper Body	734.53	25.22
<i>For Valve Bracket Insulation, Add</i>	38.20	
<i>For Chain Wheel, Add</i>	43.45	
23 21 13 23-1771 EA 8" Butterfly Valve, Grooved, With Standard Trim, With Operator, Copper Body	802.19	35.43
<i>For Valve Bracket Insulation, Add</i>	38.20	
<i>For Chain Wheel, Add</i>	43.45	
23 21 13 23-1772 Polyvinyl Chloride (PVC) Pressure Pipe And Fittings <small>(23 21 13 23)</small>		
Note: Socket or back weld.		
23 21 13 23-1773 Schedule 40 Polyvinyl Chloride (PVC) Pressure Pipe And Fittings <small>(23 21 13 23-1772)</small>		
Note: ASTM D1785 with D2466 fittings.		
23 21 13 23-1774 Schedule 40 Polyvinyl Chloride (PVC) Pressure Pipe <small>(23 21 13 23-1773)</small>		
23 21 13 23-1775 LF 1/2" Schedule 40 Polyvinyl Chloride (PVC) Pressure Pipe	3.36	2.14
<i>For Work In Restricted Working Space, Add</i>	0.95	
23 21 13 23-1776 LF 3/4" Schedule 40 Polyvinyl Chloride (PVC) Pressure Pipe	4.21	2.65
<i>For Work In Restricted Working Space, Add</i>	1.18	
23 21 13 23-1777 LF 1" Schedule 40 Polyvinyl Chloride (PVC) Pressure Pipe	4.58	2.79
<i>For Work In Restricted Working Space, Add</i>	1.26	
23 21 13 23-1778 LF 1-1/4" Schedule 40 Polyvinyl Chloride (PVC) Pressure Pipe	5.02	3.01
<i>For Work In Restricted Working Space, Add</i>	1.36	
23 21 13 23-1779 LF 1-1/2" Schedule 40 Polyvinyl Chloride (PVC) Pressure Pipe	5.17	3.08
<i>For Work In Restricted Working Space, Add</i>	1.38	
23 21 13 23-1780 LF 2" Schedule 40 Polyvinyl Chloride (PVC) Pressure Pipe	6.29	3.68
<i>For Work In Restricted Working Space, Add</i>	1.65	
23 21 13 23-1781 LF 2-1/2" Schedule 40 Polyvinyl Chloride (PVC) Pressure Pipe	7.78	4.33
<i>For Work In Restricted Working Space, Add</i>	1.96	
23 21 13 23-1782 LF 3" Schedule 40 Polyvinyl Chloride (PVC) Pressure Pipe	9.52	5.29
<i>For Work In Restricted Working Space, Add</i>	2.37	
23 21 13 23-1783 LF 4" Schedule 40 Polyvinyl Chloride (PVC) Pressure Pipe	14.18	7.94
<i>For Work In Restricted Working Space, Add</i>	3.56	
23 21 13 23-1784 LF 6" Schedule 40 Polyvinyl Chloride (PVC) Pressure Pipe	19.86	10.51
<i>For Work In Restricted Working Space, Add</i>	4.74	
23 21 13 23-1785 LF 8" Schedule 40 Polyvinyl Chloride (PVC) Pressure Pipe	25.00	12.57
<i>For Work In Restricted Working Space, Add</i>	5.66	
23 21 13 23-1786 LF 10" Schedule 40 Polyvinyl Chloride (PVC) Pressure Pipe	39.85	14.04
<i>For Work In Restricted Working Space, Add</i>	6.31	
23 21 13 23-1787 Schedule 40 Polyvinyl Chloride (PVC) 90 Degree Elbows <small>(23 21 13 23-1773)</small>		
23 21 13 23-1788 EA 1/2" Schedule 40 Polyvinyl Chloride (PVC) 90 Degree Elbows	12.14	7.94
<i>For Work In Restricted Working Space, Add</i>	3.56	
23 21 13 23-1789 EA 3/4" Schedule 40 Polyvinyl Chloride (PVC) 90 Degree Elbows	16.20	10.51
<i>For Work In Restricted Working Space, Add</i>	4.74	
23 21 13 23-1790 EA 1" Schedule 40 Polyvinyl Chloride (PVC) 90 Degree Elbows	20.29	13.09
<i>For Work In Restricted Working Space, Add</i>	5.88	
23 21 13 23-1791 EA 1-1/4" Schedule 40 Polyvinyl Chloride (PVC) 90 Degree Elbows	29.00	18.53
<i>For Work In Restricted Working Space, Add</i>	8.32	
23 21 13 23-1792 EA 1-1/2" Schedule 40 Polyvinyl Chloride (PVC) 90 Degree Elbows	32.63	20.87
<i>For Work In Restricted Working Space, Add</i>	9.38	
23 21 13 23-1793 EA 2" Schedule 40 Polyvinyl Chloride (PVC) 90 Degree Elbows	41.85	26.54
<i>For Work In Restricted Working Space, Add</i>	11.92	
23 21 13 23-1794 EA 2-1/2" Schedule 40 Polyvinyl Chloride (PVC) 90 Degree Elbows	65.25	39.25
<i>For Work In Restricted Working Space, Add</i>	17.64	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 20 HVAC Piping And Pumps****23 21 Hydronic Piping And Pumps**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21	13 23-1795	EA	3" Schedule 40 Polyvinyl Chloride (PVC) 90 Degree Elbows	85.12	51.60
			<i>For Work In Restricted Working Space, Add</i>	23.21	
23 21	13 23-1796	EA	4" Schedule 40 Polyvinyl Chloride (PVC) 90 Degree Elbows	105.72	61.30
			<i>For Work In Restricted Working Space, Add</i>	27.56	
23 21	13 23-1797	EA	6" Schedule 40 Polyvinyl Chloride (PVC) 90 Degree Elbows	138.14	70.05
			<i>For Work In Restricted Working Space, Add</i>	31.50	
23 21	13 23-1798	EA	8" Schedule 40 Polyvinyl Chloride (PVC) 90 Degree Elbows	207.82	81.73
			<i>For Work In Restricted Working Space, Add</i>	36.75	
23 21	13 23-1799	EA	10" Schedule 40 Polyvinyl Chloride (PVC) 90 Degree Elbows	310.51	121.87
			<i>For Work In Restricted Working Space, Add</i>	54.80	
23 21 13 23-1800 Schedule 40 Polyvinyl Chloride (PVC) 45 Degree Elbows (23 21 13 23-1773)					
23 21	13 23-1801	EA	1/2" Schedule 40 Polyvinyl Chloride (PVC) 45 Degree Elbows	12.27	7.94
			<i>For Work In Restricted Working Space, Add</i>	3.56	
23 21	13 23-1802	EA	3/4" Schedule 40 Polyvinyl Chloride (PVC) 45 Degree Elbows	16.47	10.51
			<i>For Work In Restricted Working Space, Add</i>	4.74	
23 21	13 23-1803	EA	1" Schedule 40 Polyvinyl Chloride (PVC) 45 Degree Elbows	20.68	13.09
			<i>For Work In Restricted Working Space, Add</i>	5.88	
23 21	13 23-1804	EA	1-1/4" Schedule 40 Polyvinyl Chloride (PVC) 45 Degree Elbows	29.25	18.53
			<i>For Work In Restricted Working Space, Add</i>	8.32	
23 21	13 23-1805	EA	1-1/2" Schedule 40 Polyvinyl Chloride (PVC) 45 Degree Elbows	33.18	20.87
			<i>For Work In Restricted Working Space, Add</i>	9.38	
23 21	13 23-1806	EA	2" Schedule 40 Polyvinyl Chloride (PVC) 45 Degree Elbows	42.21	26.54
			<i>For Work In Restricted Working Space, Add</i>	11.92	
23 21	13 23-1807	EA	2-1/2" Schedule 40 Polyvinyl Chloride (PVC) 45 Degree Elbows	65.25	39.25
			<i>For Work In Restricted Working Space, Add</i>	17.64	
23 21	13 23-1808	EA	3" Schedule 40 Polyvinyl Chloride (PVC) 45 Degree Elbows	87.43	51.60
			<i>For Work In Restricted Working Space, Add</i>	23.21	
23 21	13 23-1809	EA	4" Schedule 40 Polyvinyl Chloride (PVC) 45 Degree Elbows	109.94	61.30
			<i>For Work In Restricted Working Space, Add</i>	27.56	
23 21	13 23-1810	EA	6" Schedule 40 Polyvinyl Chloride (PVC) 45 Degree Elbows	138.52	70.05
			<i>For Work In Restricted Working Space, Add</i>	31.50	
23 21	13 23-1811	EA	8" Schedule 40 Polyvinyl Chloride (PVC) 45 Degree Elbows	203.16	81.73
			<i>For Work In Restricted Working Space, Add</i>	36.75	
23 21	13 23-1812	EA	10" Schedule 40 Polyvinyl Chloride (PVC) 45 Degree Elbows	310.51	121.87
			<i>For Work In Restricted Working Space, Add</i>	54.80	
23 21 13 23-1813 Schedule 40 Polyvinyl Chloride (PVC) Tees (23 21 13 23-1773)					
23 21	13 23-1814	EA	1/2" Schedule 40 Polyvinyl Chloride (PVC) Tees	19.93	13.09
			<i>For Work In Restricted Working Space, Add</i>	5.88	
23 21	13 23-1815	EA	3/4" Schedule 40 Polyvinyl Chloride (PVC) Tees	24.07	15.81
			<i>For Work In Restricted Working Space, Add</i>	7.11	
23 21	13 23-1816	EA	1" Schedule 40 Polyvinyl Chloride (PVC) Tees	31.97	20.87
			<i>For Work In Restricted Working Space, Add</i>	9.38	
23 21	13 23-1817	EA	1-1/4" Schedule 40 Polyvinyl Chloride (PVC) Tees	40.83	26.54
			<i>For Work In Restricted Working Space, Add</i>	11.92	
23 21	13 23-1818	EA	1-1/2" Schedule 40 Polyvinyl Chloride (PVC) Tees	48.77	31.60
			<i>For Work In Restricted Working Space, Add</i>	14.23	
23 21	13 23-1819	EA	2" Schedule 40 Polyvinyl Chloride (PVC) Tees	60.76	39.25
			<i>For Work In Restricted Working Space, Add</i>	17.64	
23 21	13 23-1820	EA	2-1/2" Schedule 40 Polyvinyl Chloride (PVC) Tees	83.88	51.60
			<i>For Work In Restricted Working Space, Add</i>	23.21	
23 21	13 23-1821	EA	3" Schedule 40 Polyvinyl Chloride (PVC) Tees	100.40	61.30
			<i>For Work In Restricted Working Space, Add</i>	27.56	
23 21	13 23-1822	EA	4" Schedule 40 Polyvinyl Chloride (PVC) Tees	137.94	81.73
			<i>For Work In Restricted Working Space, Add</i>	36.75	
23 21	13 23-1823	EA	6" Schedule 40 Polyvinyl Chloride (PVC) Tees	210.12	105.40
			<i>For Work In Restricted Working Space, Add</i>	47.42	
23 21	13 23-1824	EA	8" Schedule 40 Polyvinyl Chloride (PVC) Tees	316.74	130.76
			<i>For Work In Restricted Working Space, Add</i>	58.80	
23 21	13 23-1825	EA	10" Schedule 40 Polyvinyl Chloride (PVC) Tees	765.40	195.37
			<i>For Work In Restricted Working Space, Add</i>	87.88	
23 21 13 23-1826 Schedule 40 Polyvinyl Chloride (PVC) Crosses (23 21 13 23-1773)					
23 21	13 23-1827	EA	1/2" Schedule 40 Polyvinyl Chloride (PVC) Crosses	25.02	16.32
			<i>For Work In Restricted Working Space, Add</i>	7.35	
23 21	13 23-1828	EA	3/4" Schedule 40 Polyvinyl Chloride (PVC) Crosses	30.20	19.78
			<i>For Work In Restricted Working Space, Add</i>	8.89	
23 21	13 23-1829	EA	1" Schedule 40 Polyvinyl Chloride (PVC) Crosses	40.18	26.09
			<i>For Work In Restricted Working Space, Add</i>	11.73	
23 21	13 23-1830	EA	1-1/4" Schedule 40 Polyvinyl Chloride (PVC) Crosses	51.40	33.15
			<i>For Work In Restricted Working Space, Add</i>	14.90	
23 21	13 23-1831	EA	1-1/2" Schedule 40 Polyvinyl Chloride (PVC) Crosses	61.40	39.54
			<i>For Work In Restricted Working Space, Add</i>	17.78	
23 21	13 23-1832	EA	2" Schedule 40 Polyvinyl Chloride (PVC) Crosses	76.57	49.02
			<i>For Work In Restricted Working Space, Add</i>	22.05	
23 21	13 23-1833	EA	2-1/2" Schedule 40 Polyvinyl Chloride (PVC) Crosses	106.91	64.53
			<i>For Work In Restricted Working Space, Add</i>	29.01	
23 21	13 23-1834	EA	3" Schedule 40 Polyvinyl Chloride (PVC) Crosses	128.19	76.59
			<i>For Work In Restricted Working Space, Add</i>	34.45	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21 13 23-1835 EA 4" Schedule 40 Polyvinyl Chloride (PVC) Crosses <i>For Work In Restricted Working Space, Add</i>	177.33 45.94	102.17
23 21 13 23-1836 EA 6" Schedule 40 Polyvinyl Chloride (PVC) Crosses <i>For Work In Restricted Working Space, Add</i>	279.09 59.25	131.72
23 21 13 23-1837 EA 8" Schedule 40 Polyvinyl Chloride (PVC) Crosses <i>For Work In Restricted Working Space, Add</i>	434.15 73.46	163.32
23 21 13 23-1838 EA 10" Schedule 40 Polyvinyl Chloride (PVC) Crosses <i>For Work In Restricted Working Space, Add</i>	1,106.99 109.90	244.32
23 21 13 23-1839 Schedule 40 Polyvinyl Chloride (PVC) Reducing Inserts (23 21 13 23-1773)		
23 21 13 23-1840 EA 3/4" Schedule 40 Polyvinyl Chloride (PVC) Reducing Inserts..... <i>For Work In Restricted Working Space, Add</i>	16.06 4.74	10.51
23 21 13 23-1841 EA 1" Schedule 40 Polyvinyl Chloride (PVC) Reducing Inserts..... <i>For Work In Restricted Working Space, Add</i>	20.12 5.88	13.09
23 21 13 23-1842 EA 1-1/4" Schedule 40 Polyvinyl Chloride (PVC) Reducing Inserts <i>For Work In Restricted Working Space, Add</i>	28.42 8.32	18.53
23 21 13 23-1843 EA 1-1/2" Schedule 40 Polyvinyl Chloride (PVC) Reducing Inserts <i>For Work In Restricted Working Space, Add</i>	32.00 9.38	20.87
23 21 13 23-1844 EA 2" Schedule 40 Polyvinyl Chloride (PVC) Reducing Inserts..... <i>For Work In Restricted Working Space, Add</i>	40.94 11.92	26.54
23 21 13 23-1845 EA 2-1/2" Schedule 40 Polyvinyl Chloride (PVC) Reducing Inserts <i>For Work In Restricted Working Space, Add</i>	60.73 17.64	39.25
23 21 13 23-1846 EA 3" Schedule 40 Polyvinyl Chloride (PVC) Reducing Inserts..... <i>For Work In Restricted Working Space, Add</i>	80.26 23.21	51.60
23 21 13 23-1847 EA 4" Schedule 40 Polyvinyl Chloride (PVC) Reducing Inserts..... <i>For Work In Restricted Working Space, Add</i>	98.41 27.56	61.30
23 21 13 23-1848 EA 6" Schedule 40 Polyvinyl Chloride (PVC) Reducing Inserts..... <i>For Work In Restricted Working Space, Add</i>	121.24 31.50	70.05
23 21 13 23-1849 EA 8" Schedule 40 Polyvinyl Chloride (PVC) Reducing Inserts..... <i>For Work In Restricted Working Space, Add</i>	215.86 36.75	81.73
23 21 13 23-1850 EA 10" Schedule 40 Polyvinyl Chloride (PVC) Reducing Inserts..... <i>For Work In Restricted Working Space, Add</i>	245.96 42.70	94.89
23 21 13 23-1851 Schedule 40 Polyvinyl Chloride (PVC) Threaded Reducing Inserts (23 21 13 23-1773)		
23 21 13 23-1852 EA 1/2" Schedule 40 Polyvinyl Chloride (PVC) Threaded Reducing Inserts <i>For Work In Restricted Working Space, Add</i>	12.44 3.56	7.94
23 21 13 23-1853 EA 3/4" Schedule 40 Polyvinyl Chloride (PVC) Threaded Reducing Inserts <i>For Work In Restricted Working Space, Add</i>	16.39 4.74	10.51
23 21 13 23-1854 EA 1" Schedule 40 Polyvinyl Chloride (PVC) Threaded Reducing Inserts <i>For Work In Restricted Working Space, Add</i>	20.32 5.88	13.09
23 21 13 23-1855 EA 1-1/4" Schedule 40 Polyvinyl Chloride (PVC) Threaded Reducing Inserts <i>For Work In Restricted Working Space, Add</i>	28.83 8.32	18.53
23 21 13 23-1856 EA 1-1/2" Schedule 40 Polyvinyl Chloride (PVC) Threaded Reducing Inserts <i>For Work In Restricted Working Space, Add</i>	32.55 9.38	20.87
23 21 13 23-1857 EA 2" Schedule 40 Polyvinyl Chloride (PVC) Threaded Reducing Inserts <i>For Work In Restricted Working Space, Add</i>	41.47 11.92	26.54
23 21 13 23-1858 EA 2-1/2" Schedule 40 Polyvinyl Chloride (PVC) Threaded Reducing Inserts <i>For Work In Restricted Working Space, Add</i>	61.31 17.64	39.25
23 21 13 23-1859 EA 3" Schedule 40 Polyvinyl Chloride (PVC) Threaded Reducing Inserts <i>For Work In Restricted Working Space, Add</i>	80.26 23.21	51.60
23 21 13 23-1860 EA 4" Schedule 40 Polyvinyl Chloride (PVC) Threaded Reducing Inserts <i>For Work In Restricted Working Space, Add</i>	98.41 27.56	61.30
23 21 13 23-1861 Schedule 40 Polyvinyl Chloride (PVC) Socket Weld X Threaded Male Adapters (23 21 13 23-1773)		
23 21 13 23-1862 EA 1/2" Schedule 40 Polyvinyl Chloride (PVC) Socket Weld X Threaded Male Adapters..... <i>For Work In Restricted Working Space, Add</i>	12.63 3.56	7.94
23 21 13 23-1863 EA 3/4" Schedule 40 Polyvinyl Chloride (PVC) Socket Weld X Threaded Male Adapters..... <i>For Work In Restricted Working Space, Add</i>	16.58 4.74	10.51
23 21 13 23-1864 EA 1" Schedule 40 Polyvinyl Chloride (PVC) Socket Weld X Threaded Male Adapters..... <i>For Work In Restricted Working Space, Add</i>	20.70 5.88	13.09
23 21 13 23-1865 EA 1-1/4" Schedule 40 Polyvinyl Chloride (PVC) Socket Weld X Threaded Male Adapters..... <i>For Work In Restricted Working Space, Add</i>	29.05 8.32	18.53
23 21 13 23-1866 EA 1-1/2" Schedule 40 Polyvinyl Chloride (PVC) Socket Weld X Threaded Male Adapters..... <i>For Work In Restricted Working Space, Add</i>	33.04 9.38	20.87
23 21 13 23-1867 EA 2" Schedule 40 Polyvinyl Chloride (PVC) Socket Weld X Threaded Male Adapters..... <i>For Work In Restricted Working Space, Add</i>	41.91 11.92	26.54
23 21 13 23-1868 EA 2-1/2" Schedule 40 Polyvinyl Chloride (PVC) Socket Weld X Threaded Male Adapters..... <i>For Work In Restricted Working Space, Add</i>	61.80 17.64	39.25
23 21 13 23-1869 EA 3" Schedule 40 Polyvinyl Chloride (PVC) Socket Weld X Threaded Male Adapters..... <i>For Work In Restricted Working Space, Add</i>	81.78 23.21	51.60
23 21 13 23-1870 EA 4" Schedule 40 Polyvinyl Chloride (PVC) Socket Weld X Threaded Male Adapters..... <i>For Work In Restricted Working Space, Add</i>	97.53 27.56	61.30
23 21 13 23-1871 Schedule 40 Polyvinyl Chloride (PVC) Socket Weld X Threaded Female Adapters (23 21 13 23-1773)		
23 21 13 23-1872 EA 1/2" Schedule 40 Polyvinyl Chloride (PVC) Socket Weld X Threaded Female Adapters..... <i>For Work In Restricted Working Space, Add</i>	12.14 3.56	7.94

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 20 HVAC Piping And Pumps****23 21 Hydronic Piping And Pumps**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21	13 23-1873	EA	3/4" Schedule 40 Polyvinyl Chloride (PVC) Socket Weld X Threaded Female Adapters..... <i>For Work In Restricted Working Space, Add</i>	16.17 4.74	10.51
23 21	13 23-1874	EA	1" Schedule 40 Polyvinyl Chloride (PVC) Socket Weld X Threaded Female Adapters..... <i>For Work In Restricted Working Space, Add</i>	20.01 5.88	13.09
23 21	13 23-1875	EA	1-1/4" Schedule 40 Polyvinyl Chloride (PVC) Socket Weld X Threaded Female Adapters <i>For Work In Restricted Working Space, Add</i>	28.39 8.32	18.53
23 21	13 23-1876	EA	1-1/2" Schedule 40 Polyvinyl Chloride (PVC) Socket Weld X Threaded Female Adapters <i>For Work In Restricted Working Space, Add</i>	32.05 9.38	20.87
23 21	13 23-1877	EA	2" Schedule 40 Polyvinyl Chloride (PVC) Socket Weld X Threaded Female Adapters..... <i>For Work In Restricted Working Space, Add</i>	40.78 11.92	26.54
23 21	13 23-1878	EA	2-1/2" Schedule 40 Polyvinyl Chloride (PVC) Socket Weld X Threaded Female Adapters <i>For Work In Restricted Working Space, Add</i>	63.35 17.64	39.25
23 21	13 23-1879	EA	3" Schedule 40 Polyvinyl Chloride (PVC) Socket Weld X Threaded Female Adapters..... <i>For Work In Restricted Working Space, Add</i>	83.49 23.21	51.60
23 21	13 23-1880	EA	4" Schedule 40 Polyvinyl Chloride (PVC) Socket Weld X Threaded Female Adapters..... <i>For Work In Restricted Working Space, Add</i>	102.00 27.56	61.30
23 21	13 23-1881		Schedule 40 Polyvinyl Chloride (PVC) P-Traps (23 21 13 23-1773)		
23 21	13 23-1882	EA	3/4" Schedule 40 Polyvinyl Chloride (PVC) P-Traps..... <i>For Work In Restricted Working Space, Add</i>	18.18 4.85	10.81
23 21	13 23-1883		Schedule 40 Polyvinyl Chloride (PVC) Couplings (23 21 13 23-1773)		
23 21	13 23-1884	EA	1/2" Schedule 40 Polyvinyl Chloride (PVC) Couplings..... <i>For Work In Restricted Working Space, Add</i>	12.03 3.56	7.94
23 21	13 23-1885	EA	3/4" Schedule 40 Polyvinyl Chloride (PVC) Couplings..... <i>For Work In Restricted Working Space, Add</i>	16.03 4.74	10.51
23 21	13 23-1886	EA	1" Schedule 40 Polyvinyl Chloride (PVC) Couplings..... <i>For Work In Restricted Working Space, Add</i>	20.01 5.88	13.09
23 21	13 23-1887	EA	1-1/4" Schedule 40 Polyvinyl Chloride (PVC) Couplings..... <i>For Work In Restricted Working Space, Add</i>	28.28 8.32	18.53
23 21	13 23-1888	EA	1-1/2" Schedule 40 Polyvinyl Chloride (PVC) Couplings..... <i>For Work In Restricted Working Space, Add</i>	31.89 9.38	20.87
23 21	13 23-1889	EA	2" Schedule 40 Polyvinyl Chloride (PVC) Couplings..... <i>For Work In Restricted Working Space, Add</i>	40.67 11.92	26.54
23 21	13 23-1890	EA	2-1/2" Schedule 40 Polyvinyl Chloride (PVC) Couplings..... <i>For Work In Restricted Working Space, Add</i>	60.90 17.64	39.25
23 21	13 23-1891	EA	3" Schedule 40 Polyvinyl Chloride (PVC) Couplings..... <i>For Work In Restricted Working Space, Add</i>	80.65 23.21	51.60
23 21	13 23-1892	EA	4" Schedule 40 Polyvinyl Chloride (PVC) Couplings..... <i>For Work In Restricted Working Space, Add</i>	96.65 27.56	61.30
23 21	13 23-1893	EA	6" Schedule 40 Polyvinyl Chloride (PVC) Couplings..... <i>For Work In Restricted Working Space, Add</i>	120.11 31.50	70.05
23 21	13 23-1894	EA	8" Schedule 40 Polyvinyl Chloride (PVC) Couplings..... <i>For Work In Restricted Working Space, Add</i>	150.73 36.75	81.73
23 21	13 23-1895	EA	10" Schedule 40 Polyvinyl Chloride (PVC) Couplings..... <i>For Work In Restricted Working Space, Add</i>	260.87 39.39	87.61
23 21	13 23-1896		Schedule 40 Polyvinyl Chloride (PVC) Unions (23 21 13 23-1773)		
23 21	13 23-1897	EA	1/2" Schedule 40 Polyvinyl Chloride (PVC) Unions <i>For Work In Restricted Working Space, Add</i>	20.99 5.88	13.09
23 21	13 23-1898	EA	3/4" Schedule 40 Polyvinyl Chloride (PVC) Unions <i>For Work In Restricted Working Space, Add</i>	28.37 7.11	15.81
23 21	13 23-1899	EA	1" Schedule 40 Polyvinyl Chloride (PVC) Unions <i>For Work In Restricted Working Space, Add</i>	36.49 9.38	20.87
23 21	13 23-1900	EA	1-1/4" Schedule 40 Polyvinyl Chloride (PVC) Unions <i>For Work In Restricted Working Space, Add</i>	52.41 11.92	26.54
23 21	13 23-1901	EA	1-1/2" Schedule 40 Polyvinyl Chloride (PVC) Unions <i>For Work In Restricted Working Space, Add</i>	60.65 14.23	31.60
23 21	13 23-1902	EA	2" Schedule 40 Polyvinyl Chloride (PVC) Unions <i>For Work In Restricted Working Space, Add</i>	76.64 17.64	39.25
23 21	13 23-1903	EA	2-1/2" Schedule 40 Polyvinyl Chloride (PVC) Unions <i>For Work In Restricted Working Space, Add</i>	109.73 23.21	51.60
23 21	13 23-1904	EA	3" Schedule 40 Polyvinyl Chloride (PVC) Unions <i>For Work In Restricted Working Space, Add</i>	126.17 27.56	61.30
23 21	13 23-1905	EA	4" Schedule 40 Polyvinyl Chloride (PVC) Unions <i>For Work In Restricted Working Space, Add</i>	190.51 36.75	81.73
23 21	13 23-1906	EA	6" Schedule 40 Polyvinyl Chloride (PVC) Unions <i>For Work In Restricted Working Space, Add</i>	249.16 47.40	105.40
23 21	13 23-1907	EA	8" Schedule 40 Polyvinyl Chloride (PVC) Unions <i>For Work In Restricted Working Space, Add</i>	346.30 58.77	130.68
23 21	13 23-1908	EA	10" Schedule 40 Polyvinyl Chloride (PVC) Unions <i>For Work In Restricted Working Space, Add</i>	491.16 72.98	162.21
23 21	13 23-1909		Schedule 40 Polyvinyl Chloride (PVC) Caps (23 21 13 23-1773)		
23 21	13 23-1910	EA	1/2" Schedule 40 Polyvinyl Chloride (PVC) Caps <i>For Work In Restricted Working Space, Add</i>	12.25 3.61	8.05
23 21	13 23-1911	EA	3/4" Schedule 40 Polyvinyl Chloride (PVC) Caps <i>For Work In Restricted Working Space, Add</i>	16.09 4.74	10.51



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21 13 23-1912 EA 1" Schedule 40 Polyvinyl Chloride (PVC) Caps <i>For Work In Restricted Working Space, Add</i>	20.04 5.88	13.09
23 21 13 23-1913 EA 1-1/4" Schedule 40 Polyvinyl Chloride (PVC) Caps <i>For Work In Restricted Working Space, Add</i>	28.74 8.44	18.79
23 21 13 23-1914 EA 1-1/2" Schedule 40 Polyvinyl Chloride (PVC) Caps <i>For Work In Restricted Working Space, Add</i>	31.94 9.38	20.87
23 21 13 23-1915 EA 2" Schedule 40 Polyvinyl Chloride (PVC) Caps <i>For Work In Restricted Working Space, Add</i>	40.53 11.92	26.54
23 21 13 23-1916 EA 2-1/2" Schedule 40 Polyvinyl Chloride (PVC) Caps <i>For Work In Restricted Working Space, Add</i>	61.42 17.64	39.25
23 21 13 23-1917 EA 3" Schedule 40 Polyvinyl Chloride (PVC) Caps <i>For Work In Restricted Working Space, Add</i>	80.21 23.21	51.60
23 21 13 23-1918 EA 4" Schedule 40 Polyvinyl Chloride (PVC) Caps <i>For Work In Restricted Working Space, Add</i>	98.39 27.56	61.30
23 21 13 23-1919 EA 6" Schedule 40 Polyvinyl Chloride (PVC) Caps <i>For Work In Restricted Working Space, Add</i>	120.58 31.50	70.05
23 21 13 23-1920 EA 8" Schedule 40 Polyvinyl Chloride (PVC) Caps <i>For Work In Restricted Working Space, Add</i>	174.60 36.75	81.73
23 21 13 23-1921 EA 10" Schedule 40 Polyvinyl Chloride (PVC) Caps <i>For Work In Restricted Working Space, Add</i>	324.09 39.39	87.61
23 21 13 23-1922 Schedule 40 Polyvinyl Chloride (PVC) 150 LB Flanges (23 21 13 23-1773)		
23 21 13 23-1923 EA 1/2" Schedule 40 Polyvinyl Chloride (PVC) 150 LB Socket Weld Flanges <i>For Work In Restricted Working Space, Add</i>	25.14 5.88	13.09
23 21 13 23-1924 EA 3/4" Schedule 40 Polyvinyl Chloride (PVC) 150 LB Flanges <i>For Work In Restricted Working Space, Add</i>	32.20 7.11	15.81
23 21 13 23-1925 EA 1" Schedule 40 Polyvinyl Chloride (PVC) 150 LB Flanges <i>For Work In Restricted Working Space, Add</i>	40.74 9.38	20.87
23 21 13 23-1926 EA 1-1/4" Schedule 40 Polyvinyl Chloride (PVC) 150 LB Flanges <i>For Work In Restricted Working Space, Add</i>	49.46 11.92	26.54
23 21 13 23-1927 EA 1-1/2" Schedule 40 Polyvinyl Chloride (PVC) 150 LB Flanges <i>For Work In Restricted Working Space, Add</i>	57.37 14.23	31.60
23 21 13 23-1928 EA 2" Schedule 40 Polyvinyl Chloride (PVC) 150 LB Flanges <i>For Work In Restricted Working Space, Add</i>	72.03 17.64	39.25
23 21 13 23-1929 EA 2-1/2" Schedule 40 Polyvinyl Chloride (PVC) 150 LB Flanges <i>For Work In Restricted Working Space, Add</i>	97.80 23.21	51.60
23 21 13 23-1930 EA 3" Schedule 40 Polyvinyl Chloride (PVC) 150 LB Flanges <i>For Work In Restricted Working Space, Add</i>	114.43 27.56	61.30
23 21 13 23-1931 EA 4" Schedule 40 Polyvinyl Chloride (PVC) 150 LB Flanges <i>For Work In Restricted Working Space, Add</i>	151.06 36.75	81.73
23 21 13 23-1932 EA 6" Schedule 40 Polyvinyl Chloride (PVC) 150 LB Flanges <i>For Work In Restricted Working Space, Add</i>	202.91 47.40	105.40
23 21 13 23-1933 EA 8" Schedule 40 Polyvinyl Chloride (PVC) 150 LB Flanges <i>For Work In Restricted Working Space, Add</i>	297.21 58.77	130.68
23 21 13 23-1934 EA 10" Schedule 40 Polyvinyl Chloride (PVC) 150 LB Flanges <i>For Work In Restricted Working Space, Add</i>	471.20 72.86	162.00
23 21 13 23-1935 Schedule 80 Polyvinyl Chloride (PVC) Pressure Pipe And Fittings (23 21 13 23-1772)		
Note: ASTM D1785 with D2467 fittings.		
23 21 13 23-1936 Schedule 80 Polyvinyl Chloride (PVC) Pressure Pipe (23 21 13 23-1935)		
23 21 13 23-1937 LF 1/2" Schedule 80 Polyvinyl Chloride (PVC) Pressure Pipe <i>For Work In Restricted Working Space, Add</i>	3.42 0.95	2.14
23 21 13 23-1938 LF 3/4" Schedule 80 Polyvinyl Chloride (PVC) Pressure Pipe <i>For Work In Restricted Working Space, Add</i>	4.28 1.18	2.65
23 21 13 23-1939 LF 1" Schedule 80 Polyvinyl Chloride (PVC) Pressure Pipe <i>For Work In Restricted Working Space, Add</i>	5.22 1.42	3.16
23 21 13 23-1940 LF 1-1/4" Schedule 80 Polyvinyl Chloride (PVC) Pressure Pipe <i>For Work In Restricted Working Space, Add</i>	6.21 1.66	3.68
23 21 13 23-1941 LF 1-1/2" Schedule 80 Polyvinyl Chloride (PVC) Pressure Pipe <i>For Work In Restricted Working Space, Add</i>	7.12 1.89	4.19
23 21 13 23-1942 LF 2" Schedule 80 Polyvinyl Chloride (PVC) Pressure Pipe <i>For Work In Restricted Working Space, Add</i>	9.09 2.37	5.29
23 21 13 23-1943 LF 2-1/2" Schedule 80 Polyvinyl Chloride (PVC) Pressure Pipe <i>For Work In Restricted Working Space, Add</i>	10.45 2.61	5.80
23 21 13 23-1944 LF 3" Schedule 80 Polyvinyl Chloride (PVC) Pressure Pipe <i>For Work In Restricted Working Space, Add</i>	11.82 2.84	6.32
23 21 13 23-1945 LF 4" Schedule 80 Polyvinyl Chloride (PVC) Pressure Pipe <i>For Work In Restricted Working Space, Add</i>	15.29 3.56	7.94
23 21 13 23-1946 LF 6" Schedule 80 Polyvinyl Chloride (PVC) Pressure Pipe <i>For Work In Restricted Working Space, Add</i>	22.33 4.74	10.51
23 21 13 23-1947 LF 8" Schedule 80 Polyvinyl Chloride (PVC) Pressure Pipe <i>For Work In Restricted Working Space, Add</i>	28.78 5.66	12.57
23 21 13 23-1948 LF 10" Schedule 80 Polyvinyl Chloride (PVC) Pressure Pipe <i>For Work In Restricted Working Space, Add</i>	50.89 6.09	13.52
23 21 13 23-1949 Schedule 80 Polyvinyl Chloride (PVC) 90 Degree Elbows (23 21 13 23-1935)		
23 21 13 23-1950 EA 1/2" Schedule 80 Polyvinyl Chloride (PVC) 90 Degree Elbows <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	12.85 3.56 1.78	7.94

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 20 HVAC Piping And Pumps****23 21 Hydronic Piping And Pumps**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21	13 23-1951	EA	3/4" Schedule 80 Polyvinyl Chloride (PVC) 90 Degree Elbows	17.11	10.51
			<i>For Work In Restricted Working Space, Add</i>	4.74	
			<i>For Threaded Fittings, Add</i>	2.37	
23 21	13 23-1952	EA	1" Schedule 80 Polyvinyl Chloride (PVC) 90 Degree Elbows	21.70	13.09
			<i>For Work In Restricted Working Space, Add</i>	5.88	
			<i>For Threaded Fittings, Add</i>	2.94	
23 21	13 23-1953	EA	1-1/4" Schedule 80 Polyvinyl Chloride (PVC) 90 Degree Elbows	30.51	18.53
			<i>For Work In Restricted Working Space, Add</i>	8.32	
			<i>For Threaded Fittings, Add</i>	4.16	
23 21	13 23-1954	EA	1-1/2" Schedule 80 Polyvinyl Chloride (PVC) 90 Degree Elbows	34.26	20.87
			<i>For Work In Restricted Working Space, Add</i>	9.38	
			<i>For Threaded Fittings, Add</i>	4.69	
23 21	13 23-1955	EA	2" Schedule 80 Polyvinyl Chloride (PVC) 90 Degree Elbows	43.34	26.54
			<i>For Work In Restricted Working Space, Add</i>	11.92	
			<i>For Threaded Fittings, Add</i>	5.96	
23 21	13 23-1956	EA	2-1/2" Schedule 80 Polyvinyl Chloride (PVC) 90 Degree Elbows	67.26	39.25
			<i>For Work In Restricted Working Space, Add</i>	17.64	
			<i>For Threaded Fittings, Add</i>	8.82	
23 21	13 23-1957	EA	3" Schedule 80 Polyvinyl Chloride (PVC) 90 Degree Elbows	86.88	51.60
			<i>For Work In Restricted Working Space, Add</i>	23.21	
			<i>For Threaded Fittings, Add</i>	11.61	
23 21	13 23-1958	EA	4" Schedule 80 Polyvinyl Chloride (PVC) 90 Degree Elbows	106.33	61.30
			<i>For Work In Restricted Working Space, Add</i>	27.56	
			<i>For Threaded Fittings, Add</i>	13.78	
23 21	13 23-1959	EA	6" Schedule 80 Polyvinyl Chloride (PVC) 90 Degree Elbows	157.19	70.05
			<i>For Work In Restricted Working Space, Add</i>	31.50	
			<i>For Threaded Fittings, Add</i>	15.75	
23 21	13 23-1960	EA	8" Schedule 80 Polyvinyl Chloride (PVC) 90 Degree Elbows	235.94	81.73
			<i>For Work In Restricted Working Space, Add</i>	36.75	
			<i>For Threaded Fittings, Add</i>	18.38	
23 21	13 23-1961	EA	10" Schedule 80 Polyvinyl Chloride (PVC) 90 Degree Elbows	333.26	137.01
			<i>For Work In Restricted Working Space, Add</i>	61.62	
			<i>For Threaded Fittings, Add</i>	30.81	
23 21	13 23-1962		Schedule 80 Polyvinyl Chloride (PVC) 45 Degree Elbows <small>(23 21 13 23-1935)</small>		
23 21	13 23-1963	EA	1/2" Schedule 80 Polyvinyl Chloride (PVC) 45 Degree Elbows	13.76	7.94
			<i>For Work In Restricted Working Space, Add</i>	3.56	
			<i>For Threaded Fittings, Add</i>	1.78	
23 21	13 23-1964	EA	3/4" Schedule 80 Polyvinyl Chloride (PVC) 45 Degree Elbows	18.70	10.51
			<i>For Work In Restricted Working Space, Add</i>	4.74	
			<i>For Threaded Fittings, Add</i>	2.37	
23 21	13 23-1965	EA	1" Schedule 80 Polyvinyl Chloride (PVC) 45 Degree Elbows	23.96	13.09
			<i>For Work In Restricted Working Space, Add</i>	5.88	
			<i>For Threaded Fittings, Add</i>	2.94	
23 21	13 23-1966	EA	1-1/4" Schedule 80 Polyvinyl Chloride (PVC) 45 Degree Elbows	33.30	18.53
			<i>For Work In Restricted Working Space, Add</i>	8.32	
			<i>For Threaded Fittings, Add</i>	4.16	
23 21	13 23-1967	EA	1-1/2" Schedule 80 Polyvinyl Chloride (PVC) 45 Degree Elbows	37.84	20.87
			<i>For Work In Restricted Working Space, Add</i>	9.38	
			<i>For Threaded Fittings, Add</i>	4.69	
23 21	13 23-1968	EA	2" Schedule 80 Polyvinyl Chloride (PVC) 45 Degree Elbows	48.25	26.54
			<i>For Work In Restricted Working Space, Add</i>	11.92	
			<i>For Threaded Fittings, Add</i>	5.96	
23 21	13 23-1969	EA	2-1/2" Schedule 80 Polyvinyl Chloride (PVC) 45 Degree Elbows	76.72	39.25
			<i>For Work In Restricted Working Space, Add</i>	17.64	
			<i>For Threaded Fittings, Add</i>	8.82	
23 21	13 23-1970	EA	3" Schedule 80 Polyvinyl Chloride (PVC) 45 Degree Elbows	99.18	51.60
			<i>For Work In Restricted Working Space, Add</i>	23.21	
			<i>For Threaded Fittings, Add</i>	11.61	
23 21	13 23-1971	EA	4" Schedule 80 Polyvinyl Chloride (PVC) 45 Degree Elbows	131.17	61.30
			<i>For Work In Restricted Working Space, Add</i>	27.56	
			<i>For Threaded Fittings, Add</i>	13.78	
23 21	13 23-1972	EA	6" Schedule 80 Polyvinyl Chloride (PVC) 45 Degree Elbows	154.46	70.05
			<i>For Work In Restricted Working Space, Add</i>	31.50	
			<i>For Threaded Fittings, Add</i>	15.75	
23 21	13 23-1973	EA	8" Schedule 80 Polyvinyl Chloride (PVC) 45 Degree Elbows	229.74	81.73
			<i>For Work In Restricted Working Space, Add</i>	36.75	
			<i>For Threaded Fittings, Add</i>	18.38	
23 21	13 23-1974	EA	10" Schedule 80 Polyvinyl Chloride (PVC) 45 Degree Elbows	326.29	137.01
			<i>For Work In Restricted Working Space, Add</i>	61.62	
			<i>For Threaded Fittings, Add</i>	30.81	
23 21	13 23-1975		Schedule 80 Polyvinyl Chloride (PVC) Tees <small>(23 21 13 23-1935)</small>		
23 21	13 23-1976	EA	1/2" Schedule 80 Polyvinyl Chloride (PVC) Tees.....	21.45	12.42
			<i>For Work In Restricted Working Space, Add</i>	5.58	
			<i>For Threaded Fittings, Add</i>	2.79	
23 21	13 23-1977	EA	3/4" Schedule 80 Polyvinyl Chloride (PVC) Tees.....	26.69	15.81
			<i>For Work In Restricted Working Space, Add</i>	7.11	
			<i>For Threaded Fittings, Add</i>	3.56	
23 21	13 23-1978	EA	1" Schedule 80 Polyvinyl Chloride (PVC) Tees.....	35.00	20.87
			<i>For Work In Restricted Working Space, Add</i>	9.38	
			<i>For Threaded Fittings, Add</i>	4.69	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21 13 23-1979 EA 1-1/4" Schedule 80 Polyvinyl Chloride (PVC) Tees <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	50.01 11.92 5.96	26.54
23 21 13 23-1980 EA 1-1/2" Schedule 80 Polyvinyl Chloride (PVC) Tees <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	57.70 14.23 7.11	31.60
23 21 13 23-1981 EA 2" Schedule 80 Polyvinyl Chloride (PVC) Tees <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	71.67 17.64 8.82	39.25
23 21 13 23-1982 EA 2-1/2" Schedule 80 Polyvinyl Chloride (PVC) Tees <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	91.38 23.21 11.61	51.60
23 21 13 23-1983 EA 3" Schedule 80 Polyvinyl Chloride (PVC) Tees <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	109.36 27.56 13.78	61.30
23 21 13 23-1984 EA 4" Schedule 80 Polyvinyl Chloride (PVC) Tees <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	142.76 36.75 18.38	81.73
23 21 13 23-1985 EA 6" Schedule 80 Polyvinyl Chloride (PVC) Tees <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	227.30 47.42 23.71	105.40
23 21 13 23-1986 EA 8" Schedule 80 Polyvinyl Chloride (PVC) Tees <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	356.56 58.80 29.40	130.76
23 21 13 23-1987 EA 10" Schedule 80 Polyvinyl Chloride (PVC) Tees <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	765.43 87.88 43.94	195.37
23 21 13 23-1988 Schedule 80 Polyvinyl Chloride (PVC) Crosses <small>(23 21 13 23-1935)</small>		
23 21 13 23-1989 EA 1/2" Schedule 80 Polyvinyl Chloride (PVC) Crosses <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	27.71 6.98 3.49	15.50
23 21 13 23-1990 EA 3/4" Schedule 80 Polyvinyl Chloride (PVC) Crosses <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	34.31 8.89 4.45	19.78
23 21 13 23-1991 EA 1" Schedule 80 Polyvinyl Chloride (PVC) Crosses <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	44.93 11.73 5.87	26.09
23 21 13 23-1992 EA 1-1/4" Schedule 80 Polyvinyl Chloride (PVC) Crosses <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	65.79 14.90 7.45	33.15
23 21 13 23-1993 EA 1-1/2" Schedule 80 Polyvinyl Chloride (PVC) Crosses <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	75.40 17.78 8.89	39.54
23 21 13 23-1994 EA 2" Schedule 80 Polyvinyl Chloride (PVC) Crosses <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	93.68 22.05 11.03	49.02
23 21 13 23-1995 EA 2-1/2" Schedule 80 Polyvinyl Chloride (PVC) Crosses <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	118.67 29.01 14.51	64.53
23 21 13 23-1996 EA 3" Schedule 80 Polyvinyl Chloride (PVC) Crosses <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	142.24 34.45 17.23	76.59
23 21 13 23-1997 EA 4" Schedule 80 Polyvinyl Chloride (PVC) Crosses <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	184.90 45.94 22.97	102.17
23 21 13 23-1998 EA 6" Schedule 80 Polyvinyl Chloride (PVC) Crosses <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	306.02 59.25 29.63	131.72
23 21 13 23-1999 EA 8" Schedule 80 Polyvinyl Chloride (PVC) Crosses <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	496.57 73.46 36.73	163.32
23 21 13 23-2000 EA 10" Schedule 80 Polyvinyl Chloride (PVC) Crosses <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	1,107.04 109.90 54.95	244.32
23 21 13 23-2001 Schedule 80 Polyvinyl Chloride (PVC) Reducing Inserts <small>(23 21 13 23-1935)</small>		
23 21 13 23-2002 EA 3/4" Schedule 80 Polyvinyl Chloride (PVC) Reducing Inserts <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	16.39 4.74 2.37	10.51
23 21 13 23-2003 EA 1" Schedule 80 Polyvinyl Chloride (PVC) Reducing Inserts <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	21.28 5.88 2.94	13.09
23 21 13 23-2004 EA 1-1/4" Schedule 80 Polyvinyl Chloride (PVC) Reducing Inserts <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	30.38 8.32 4.16	18.53
23 21 13 23-2005 EA 1-1/2" Schedule 80 Polyvinyl Chloride (PVC) Reducing Inserts <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	34.89 9.38 4.69	20.87
23 21 13 23-2006 EA 2" Schedule 80 Polyvinyl Chloride (PVC) Reducing Inserts <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	44.89 11.92 5.96	26.54

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 20 HVAC Piping And Pumps****23 21 Hydronic Piping And Pumps**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21	13 23-2007	EA	2-1/2" Schedule 80 Polyvinyl Chloride (PVC) Reducing Inserts..... <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	67.73 17.64 8.82	39.25
23 21	13 23-2008	EA	3" Schedule 80 Polyvinyl Chloride (PVC) Reducing Inserts..... <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	91.57 23.21 11.61	51.60
23 21	13 23-2009	EA	4" Schedule 80 Polyvinyl Chloride (PVC) Reducing Inserts..... <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	111.56 27.56 13.78	61.30
23 21	13 23-2010	EA	6" Schedule 80 Polyvinyl Chloride (PVC) Reducing Inserts..... <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	126.83 31.50 15.75	70.05
23 21	13 23-2011	EA	8" Schedule 80 Polyvinyl Chloride (PVC) Reducing Inserts..... <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	170.96 36.75 18.38	81.73
23 21	13 23-2012	EA	10" Schedule 80 Polyvinyl Chloride (PVC) Reducing Inserts..... <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	245.97 42.70 21.35	94.89
23 21	13 23-2013		Schedule 80 Polyvinyl Chloride (PVC) Threaded Reducing Inserts (23 21 13 23-1935)		
23 21	13 23-2014	EA	1/2" Schedule 80 Polyvinyl Chloride (PVC) Threaded Reducing Inserts <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	12.05 3.56 1.78	7.94
23 21	13 23-2015	EA	3/4" Schedule 80 Polyvinyl Chloride (PVC) Threaded Reducing Inserts <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	16.89 4.74 2.37	10.51
23 21	13 23-2016	EA	1" Schedule 80 Polyvinyl Chloride (PVC) Threaded Reducing Inserts <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	21.28 5.88 2.94	13.09
23 21	13 23-2017	EA	1-1/4" Schedule 80 Polyvinyl Chloride (PVC) Threaded Reducing Inserts <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	31.15 8.32 4.16	18.53
23 21	13 23-2018	EA	1-1/2" Schedule 80 Polyvinyl Chloride (PVC) Threaded Reducing Inserts <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	35.58 9.38 4.69	20.87
23 21	13 23-2019	EA	2" Schedule 80 Polyvinyl Chloride (PVC) Threaded Reducing Inserts <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	45.00 11.92 5.96	26.54
23 21	13 23-2020	EA	2-1/2" Schedule 80 Polyvinyl Chloride (PVC) Threaded Reducing Inserts <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	69.94 17.64 8.82	39.25
23 21	13 23-2021	EA	3" Schedule 80 Polyvinyl Chloride (PVC) Threaded Reducing Inserts <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	97.99 23.21 11.61	51.60
23 21	13 23-2022	EA	4" Schedule 80 Polyvinyl Chloride (PVC) Threaded Reducing Inserts <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	123.58 27.56 13.78	61.30
23 21	13 23-2023		Schedule 80 Polyvinyl Chloride (PVC) Socket Weld X Threaded Male Adapters (23 21 13 23-1935)		
23 21	13 23-2024	EA	1/2" Schedule 80 Polyvinyl Chloride (PVC) Socket Weld X Threaded Male Adapters..... <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	14.20 3.56 1.78	7.94
23 21	13 23-2025	EA	3/4" Schedule 80 Polyvinyl Chloride (PVC) Socket Weld X Threaded Male Adapters..... <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	18.40 4.74 2.37	10.51
23 21	13 23-2026	EA	1" Schedule 80 Polyvinyl Chloride (PVC) Socket Weld X Threaded Male Adapters..... <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	24.12 5.88 2.94	13.09
23 21	13 23-2027	EA	1-1/4" Schedule 80 Polyvinyl Chloride (PVC) Socket Weld X Threaded Male Adapters..... <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	33.02 8.32 4.16	18.53
23 21	13 23-2028	EA	1-1/2" Schedule 80 Polyvinyl Chloride (PVC) Socket Weld X Threaded Male Adapters..... <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	38.89 9.38 4.69	20.87
23 21	13 23-2029	EA	2" Schedule 80 Polyvinyl Chloride (PVC) Socket Weld X Threaded Male Adapters..... <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	49.65 11.92 5.96	26.54
23 21	13 23-2030	EA	2-1/2" Schedule 80 Polyvinyl Chloride (PVC) Socket Weld X Threaded Male Adapters..... <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	70.10 17.64 8.82	39.25
23 21	13 23-2031	EA	3" Schedule 80 Polyvinyl Chloride (PVC) Socket Weld X Threaded Male Adapters..... <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	89.91 23.21 11.61	51.60
23 21	13 23-2032	EA	4" Schedule 80 Polyvinyl Chloride (PVC) Socket Weld X Threaded Male Adapters..... <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	114.18 27.56 13.78	61.30
23 21	13 23-2033		Schedule 80 Polyvinyl Chloride (PVC) Socket Weld X Threaded Female Adapters (23 21 13 23-1935)		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21 13 23-2034 EA 1/2" Schedule 80 Polyvinyl Chloride (PVC) Socket Weld X Threaded Female Adapters.....	13.57	7.94
<i>For Work In Restricted Working Space, Add</i>	3.56	
<i>For Threaded Fittings, Add</i>	1.78	
23 21 13 23-2035 EA 3/4" Schedule 80 Polyvinyl Chloride (PVC) Socket Weld X Threaded Female Adapters.....	18.35	10.51
<i>For Work In Restricted Working Space, Add</i>	4.74	
<i>For Threaded Fittings, Add</i>	2.37	
23 21 13 23-2036 EA 1" Schedule 80 Polyvinyl Chloride (PVC) Socket Weld X Threaded Female Adapters.....	23.35	13.09
<i>For Work In Restricted Working Space, Add</i>	5.88	
<i>For Threaded Fittings, Add</i>	2.94	
23 21 13 23-2037 EA 1-1/4" Schedule 80 Polyvinyl Chloride (PVC) Socket Weld X Threaded Female Adapters	33.82	18.53
<i>For Work In Restricted Working Space, Add</i>	8.32	
<i>For Threaded Fittings, Add</i>	4.16	
23 21 13 23-2038 EA 1-1/2" Schedule 80 Polyvinyl Chloride (PVC) Socket Weld X Threaded Female Adapters	38.75	20.87
<i>For Work In Restricted Working Space, Add</i>	9.38	
<i>For Threaded Fittings, Add</i>	4.69	
23 21 13 23-2039 EA 2" Schedule 80 Polyvinyl Chloride (PVC) Socket Weld X Threaded Female Adapters.....	52.74	26.54
<i>For Work In Restricted Working Space, Add</i>	11.92	
<i>For Threaded Fittings, Add</i>	5.96	
23 21 13 23-2040 EA 2-1/2" Schedule 80 Polyvinyl Chloride (PVC) Socket Weld X Threaded Female Adapters	79.36	39.25
<i>For Work In Restricted Working Space, Add</i>	17.64	
<i>For Threaded Fittings, Add</i>	8.82	
23 21 13 23-2041 EA 3" Schedule 80 Polyvinyl Chloride (PVC) Socket Weld X Threaded Female Adapters.....	100.53	51.60
<i>For Work In Restricted Working Space, Add</i>	23.21	
<i>For Threaded Fittings, Add</i>	11.61	
23 21 13 23-2042 EA 4" Schedule 80 Polyvinyl Chloride (PVC) Socket Weld X Threaded Female Adapters.....	131.69	61.30
<i>For Work In Restricted Working Space, Add</i>	27.56	
<i>For Threaded Fittings, Add</i>	13.78	
23 21 13 23-2043 Schedule 80 Polyvinyl Chloride (PVC) Couplings (23 21 13 23-1935)		
23 21 13 23-2044 EA 1/2" Schedule 80 Polyvinyl Chloride (PVC) Couplings.....	13.68	7.94
<i>For Work In Restricted Working Space, Add</i>	3.56	
<i>For Threaded Fittings, Add</i>	1.78	
23 21 13 23-2045 EA 3/4" Schedule 80 Polyvinyl Chloride (PVC) Couplings.....	18.26	10.51
<i>For Work In Restricted Working Space, Add</i>	4.74	
<i>For Threaded Fittings, Add</i>	2.37	
23 21 13 23-2046 EA 1" Schedule 80 Polyvinyl Chloride (PVC) Couplings.....	22.14	13.09
<i>For Work In Restricted Working Space, Add</i>	5.88	
<i>For Threaded Fittings, Add</i>	2.94	
23 21 13 23-2047 EA 1-1/4" Schedule 80 Polyvinyl Chloride (PVC) Couplings	31.62	18.53
<i>For Work In Restricted Working Space, Add</i>	8.32	
<i>For Threaded Fittings, Add</i>	4.16	
23 21 13 23-2048 EA 1-1/2" Schedule 80 Polyvinyl Chloride (PVC) Couplings	35.47	20.87
<i>For Work In Restricted Working Space, Add</i>	9.38	
<i>For Threaded Fittings, Add</i>	4.69	
23 21 13 23-2049 EA 2" Schedule 80 Polyvinyl Chloride (PVC) Couplings.....	44.20	26.54
<i>For Work In Restricted Working Space, Add</i>	11.92	
<i>For Threaded Fittings, Add</i>	5.96	
23 21 13 23-2050 EA 2-1/2" Schedule 80 Polyvinyl Chloride (PVC) Couplings	69.85	39.25
<i>For Work In Restricted Working Space, Add</i>	17.64	
<i>For Threaded Fittings, Add</i>	8.82	
23 21 13 23-2051 EA 3" Schedule 80 Polyvinyl Chloride (PVC) Couplings.....	90.08	51.60
<i>For Work In Restricted Working Space, Add</i>	23.21	
<i>For Threaded Fittings, Add</i>	11.61	
23 21 13 23-2052 EA 4" Schedule 80 Polyvinyl Chloride (PVC) Couplings.....	107.81	61.30
<i>For Work In Restricted Working Space, Add</i>	27.56	
<i>For Threaded Fittings, Add</i>	13.78	
23 21 13 23-2053 EA 6" Schedule 80 Polyvinyl Chloride (PVC) Couplings.....	139.27	70.05
<i>For Work In Restricted Working Space, Add</i>	31.50	
<i>For Threaded Fittings, Add</i>	15.75	
23 21 13 23-2054 EA 8" Schedule 80 Polyvinyl Chloride (PVC) Couplings.....	169.14	81.73
<i>For Work In Restricted Working Space, Add</i>	36.75	
<i>For Threaded Fittings, Add</i>	18.38	
23 21 13 23-2055 EA 10" Schedule 80 Polyvinyl Chloride (PVC) Couplings.....	269.14	87.61
<i>For Work In Restricted Working Space, Add</i>	39.39	
<i>For Threaded Fittings, Add</i>	19.70	
23 21 13 23-2056 Schedule 80 Polyvinyl Chloride (PVC) Unions (23 21 13 23-1935)		
23 21 13 23-2057 EA 1/2" Schedule 80 Polyvinyl Chloride (PVC) Unions	23.68	13.09
<i>For Work In Restricted Working Space, Add</i>	5.88	
<i>For Threaded Fittings, Add</i>	2.94	
23 21 13 23-2058 EA 3/4" Schedule 80 Polyvinyl Chloride (PVC) Unions	28.42	15.81
<i>For Work In Restricted Working Space, Add</i>	7.11	
<i>For Threaded Fittings, Add</i>	3.56	
23 21 13 23-2059 EA 1" Schedule 80 Polyvinyl Chloride (PVC) Unions	36.66	20.87
<i>For Work In Restricted Working Space, Add</i>	9.38	
<i>For Threaded Fittings, Add</i>	4.69	
23 21 13 23-2060 EA 1-1/4" Schedule 80 Polyvinyl Chloride (PVC) Unions	53.18	26.54
<i>For Work In Restricted Working Space, Add</i>	11.92	
<i>For Threaded Fittings, Add</i>	5.96	
23 21 13 23-2061 EA 1-1/2" Schedule 80 Polyvinyl Chloride (PVC) Unions	64.73	31.60
<i>For Work In Restricted Working Space, Add</i>	14.23	
<i>For Threaded Fittings, Add</i>	7.11	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 20 HVAC Piping And Pumps****23 21 Hydronic Piping And Pumps**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21	13 23-2062	EA	2" Schedule 80 Polyvinyl Chloride (PVC) Unions <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	82.26 17.64 8.82	39.25
23 21	13 23-2063	EA	2-1/2" Schedule 80 Polyvinyl Chloride (PVC) Unions <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	121.05 23.21 11.61	51.60
23 21	13 23-2064	EA	3" Schedule 80 Polyvinyl Chloride (PVC) Unions <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	148.18 27.56 13.78	61.30
23 21	13 23-2065	EA	4" Schedule 80 Polyvinyl Chloride (PVC) Unions <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	190.67 36.75 18.38	81.73
23 21	13 23-2066	EA	6" Schedule 80 Polyvinyl Chloride (PVC) Unions <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	249.16 47.40 23.70	105.40
23 21	13 23-2067	EA	8" Schedule 80 Polyvinyl Chloride (PVC) Unions <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	346.30 58.77 29.39	130.68
23 21	13 23-2068	EA	10" Schedule 80 Polyvinyl Chloride (PVC) Unions <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	490.78 72.86 36.43	162.00
23 21	13 23-2069		Schedule 80 Polyvinyl Chloride (PVC) Caps (23 21 13 23-1935)		
23 21	13 23-2070	EA	1/2" Schedule 80 Polyvinyl Chloride (PVC) Caps <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	14.42 3.56 1.78	7.94
23 21	13 23-2071	EA	3/4" Schedule 80 Polyvinyl Chloride (PVC) Caps <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	18.51 4.74 2.37	10.51
23 21	13 23-2072	EA	1" Schedule 80 Polyvinyl Chloride (PVC) Caps <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	24.40 5.88 2.94	13.09
23 21	13 23-2073	EA	1-1/4" Schedule 80 Polyvinyl Chloride (PVC) Caps <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	33.52 8.32 4.16	18.53
23 21	13 23-2074	EA	1-1/2" Schedule 80 Polyvinyl Chloride (PVC) Caps <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	37.07 9.38 4.69	20.87
23 21	13 23-2075	EA	2" Schedule 80 Polyvinyl Chloride (PVC) Caps <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	48.41 11.92 5.96	26.54
23 21	13 23-2076	EA	2-1/2" Schedule 80 Polyvinyl Chloride (PVC) Caps <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	76.64 17.64 8.82	39.25
23 21	13 23-2077	EA	3" Schedule 80 Polyvinyl Chloride (PVC) Caps <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	99.18 23.21 11.61	51.60
23 21	13 23-2078	EA	4" Schedule 80 Polyvinyl Chloride (PVC) Caps <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	126.95 27.56 13.78	61.30
23 21	13 23-2079	EA	6" Schedule 80 Polyvinyl Chloride (PVC) Caps <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	192.11 31.50 15.75	70.05
23 21	13 23-2080	EA	8" Schedule 80 Polyvinyl Chloride (PVC) Caps <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	242.17 36.75 18.38	81.73
23 21	13 23-2081	EA	10" Schedule 80 Polyvinyl Chloride (PVC) Caps <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	351.66 39.39 19.70	87.61
23 21	13 23-2082		Schedule 80 Polyvinyl Chloride (PVC) 150 LB Flanges (23 21 13 23-1935)		
23 21	13 23-2083	EA	1/2" Schedule 80 Polyvinyl Chloride (PVC) 150 LB Flanges <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	27.51 5.88 2.94	13.09
23 21	13 23-2084	EA	3/4" Schedule 80 Polyvinyl Chloride (PVC) 150 LB Flanges <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	32.20 7.11 3.56	15.81
23 21	13 23-2085	EA	1" Schedule 80 Polyvinyl Chloride (PVC) 150 LB Flanges <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	40.74 9.38 4.69	20.87
23 21	13 23-2086	EA	1-1/4" Schedule 80 Polyvinyl Chloride (PVC) 150 LB Flanges <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	49.46 11.92 5.96	26.54
23 21	13 23-2087	EA	1-1/2" Schedule 80 Polyvinyl Chloride (PVC) 150 LB Flanges <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	57.37 14.23 7.11	31.60
23 21	13 23-2088	EA	2" Schedule 80 Polyvinyl Chloride (PVC) 150 LB Flanges <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	72.03 17.64 8.82	39.25
23 21	13 23-2089	EA	2-1/2" Schedule 80 Polyvinyl Chloride (PVC) 150 LB Flanges <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	97.80 23.21 11.61	51.60



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21 13 23-2090 EA 3" Schedule 80 Polyvinyl Chloride (PVC) 150 LB Flanges <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	114.43 27.56 13.78	61.30
23 21 13 23-2091 EA 4" Schedule 80 Polyvinyl Chloride (PVC) 150 LB Flanges <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	151.06 36.75 18.38	81.73
23 21 13 23-2092 EA 6" Schedule 80 Polyvinyl Chloride (PVC) 150 LB Flanges <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	202.91 47.40 23.70	105.40
23 21 13 23-2093 EA 8" Schedule 80 Polyvinyl Chloride (PVC) 150 LB Flanges <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	297.21 58.77 29.39	130.68
23 21 13 23-2094 EA 10" Schedule 80 Polyvinyl Chloride (PVC) 150 LB Flanges <i>For Work In Restricted Working Space, Add</i> <i>For Threaded Fittings, Add</i>	471.20 72.86 36.43	162.00
23 21 13 23-2095 Cut And Prepare Existing Polyvinyl Chloride (PVC) Pressure Pipe <small>(23 21 13 23-1772)</small> Note: In place pipe.		
23 21 13 23-2096 EA 1/2", Cut And Prepare Existing Polyvinyl Chloride (PVC) Pressure Pipe..... <i>For Work In Restricted Working Space, Add</i>	3.99 1.20	
23 21 13 23-2097 EA 3/4", Cut And Prepare Existing Polyvinyl Chloride (PVC) Pressure Pipe..... <i>For Work In Restricted Working Space, Add</i>	4.31 1.29	
23 21 13 23-2098 EA 1", Cut And Prepare Existing Polyvinyl Chloride (PVC) Pressure Pipe..... <i>For Work In Restricted Working Space, Add</i>	4.85 1.46	
23 21 13 23-2099 EA 1-1/4", Cut And Prepare Existing Polyvinyl Chloride (PVC) Pressure Pipe..... <i>For Work In Restricted Working Space, Add</i>	5.10 1.53	
23 21 13 23-2100 EA 1-1/2", Cut And Prepare Existing Polyvinyl Chloride (PVC) Pressure Pipe..... <i>For Work In Restricted Working Space, Add</i>	5.39 1.62	
23 21 13 23-2101 EA 2", Cut And Prepare Existing Polyvinyl Chloride (PVC) Pressure Pipe..... <i>For Work In Restricted Working Space, Add</i>	5.93 1.78	
23 21 13 23-2102 EA 2-1/2", Cut And Prepare Existing Polyvinyl Chloride (PVC) Pressure Pipe..... <i>For Work In Restricted Working Space, Add</i>	6.38 1.91	
23 21 13 23-2103 EA 3", Cut And Prepare Existing Polyvinyl Chloride (PVC) Pressure Pipe..... <i>For Work In Restricted Working Space, Add</i>	7.54 2.26	
23 21 13 23-2104 EA 4", Cut And Prepare Existing Polyvinyl Chloride (PVC) Pressure Pipe..... <i>For Work In Restricted Working Space, Add</i>	10.18 3.05	
23 21 13 23-2105 EA 6", Cut And Prepare Existing Polyvinyl Chloride (PVC) Pressure Pipe..... <i>For Work In Restricted Working Space, Add</i>	14.55 4.37	
23 21 13 23-2106 EA 8", Cut And Prepare Existing Polyvinyl Chloride (PVC) Pressure Pipe..... <i>For Work In Restricted Working Space, Add</i>	19.40 5.82	
23 21 13 23-2107 EA 10", Cut And Prepare Existing Polyvinyl Chloride (PVC) Pressure Pipe..... <i>For Work In Restricted Working Space, Add</i>	23.72 7.12	
23 21 13 23-2108 Polyethylene Pipe And Fittings <small>(23 21 13 23)</small>		
23 21 13 23-2109 Small Diameter Tubing <small>(23 21 13 23-2108)</small>		
23 21 13 23-2110 Tubing <small>(23 21 13 23-2109)</small>		
23 21 13 23-2111 LF 1/4" Polyethylene Tubing..... <i>For Work In Restricted Working Space, Add</i>	2.27 0.67	
23 21 13 23-2112 LF 5/16" Polyethylene Tubing..... <i>For Work In Restricted Working Space, Add</i>	2.36 0.68	
23 21 13 23-2113 LF 3/8" Polyethylene Tubing..... <i>For Work In Restricted Working Space, Add</i>	2.42 0.69	
23 21 13 23-2114 LF 1/2" Polyethylene Tubing..... <i>For Work In Restricted Working Space, Add</i>	2.58 0.75	
23 21 16 Hydronic Piping Specialties <small>(23 21)</small>		
23 21 16 00-0001 Air Vents <small>(23 21 16)</small>		
23 21 16 00-0002 Screwed Ends, Cast Iron, Automatic Air Vents <small>(23 21 16 00-0001)</small> Note: With guided free floating lever.		
23 21 16 00-0003 EA 1/2" NPT, Cast Iron, Automatic Air Vent	186.02	23.17
23 21 16 00-0004 EA 3/4" NPT, Cast Iron, Automatic Air Vent	228.50	30.75
23 21 16 00-0005 EA 1" NPT, Cast Iron, Automatic Air Vent	506.08	31.95
23 21 16 00-0006 EA 1-1/4" NPT, Cast Iron, Automatic Air Vent	751.17	49.37
23 21 16 00-0007 EA 1-1/2" NPT, Cast Iron, Automatic Air Vent	1,241.18	53.12
23 21 16 00-0008 EA 2" NPT, Cast Iron, Automatic Air Vent	1,428.69	70.05
23 21 16 00-0009 Forged Steel, Stainless Steel Internals, Automatic Air Vents <small>(23 21 16 00-0001)</small> Note: With guided free floating lever.		
23 21 16 00-0010 EA 1/2" NPT, Forged Steel, Stainless Steel Internals, Automatic Air Vent	1,202.07	26.75
23 21 16 00-0011 EA 3/4" NPT, Forged Steel, Stainless Steel Internals, Automatic Air Vent	1,505.79	30.75
23 21 16 00-0012 EA 1" NPT, Forged Steel, Stainless Steel Internals, Automatic Air Vent	1,795.43	31.95
23 21 16 00-0013 EA 1-1/4" NPT, Forged Steel, Stainless Steel Internals, Automatic Air Vent	2,945.01	49.52
23 21 16 00-0014 EA 1-1/2" NPT, Forged Steel, Stainless Steel Internals, Automatic Air Vent	3,400.32	53.12
23 21 16 00-0015 EA 2" NPT, Forged Steel, Stainless Steel Internals, Automatic Air Vent	4,996.73	69.89

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 20 HVAC Piping And Pumps****23 21 Hydronic Piping And Pumps**

MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
23 21 16 00-0016		Manual Air Vent (23 21 16 00-0001)			
23 21 16 00-0017	EA	Manual Air Vent	56.36		28.84
23 21 16 00-0018		Air Release Valves (23 21 16 00-0001)			
23 21 16 00-0019		Simple Lever, Cast Iron, Clean Water Air Release Valves (Apco 50) (23 21 16 00-0018)			
		Note: Up to 175 psi. Stainless steel float.			
23 21 16 00-0020	EA	1/2" NPT, Simple Lever, Cast Iron, Clean Water Air Release Valves (Apco 50).....	140.74		11.98
23 21 16 00-0021	EA	3/4" NPT, Simple Lever, Cast Iron, Clean Water Air Release Valves (Apco 50).....	143.94		13.58
23 21 16 00-0022	EA	1" NPT, Simple Lever, Cast Iron, Clean Water Air Release Valves (Apco 50).....	150.32		16.77
23 21 16 00-0023		Cast Iron, Compound Lever, Clean Water Air Release Valves (Apco 200) (23 21 16 00-0018)			
		Note: Up to 175 psi. Stainless steel float.			
23 21 16 00-0024	EA	1" NPT, Cast Iron, Compound Lever, Clean Water Air Release Valves (Apco 200A).....	579.27		16.77
23 21 16 00-0025	EA	2" NPT, Cast Iron, Compound Lever, Clean Water Air Release Valves (Apco 200).....	694.13		29.15
23 21 16 00-0026	EA	3" Flanged, Cast Iron, Compound Lever, Clean Water Air Release Valves (Apco 200).....	994.80		84.95
23 21 16 00-0027		Cast Iron, Air/Vacuum Valves (23 21 16 00-0018)			
		Note: Up to 150 psi. Stainless steel float.			
23 21 16 00-0028	EA	1/2" NPT, Cast Iron, Air/Vacuum Valve (Apco 141)	279.77		11.98
23 21 16 00-0029	EA	1" NPT, Cast Iron, Air/Vacuum Valve (Apco 142)	344.96		16.77
23 21 16 00-0030	EA	2" NPT, Cast Iron, Air/Vacuum Valve (Apco 144)	595.88		29.15
23 21 16 00-0031	EA	3" Flanged, Cast Iron, Air/Vacuum Valve (Apco 146)	950.31		84.95
23 21 16 00-0032	EA	4" Flanged, Cast Iron, Air/Vacuum Valve (Apco 152)	1,476.73		133.16
23 21 16 00-0033	EA	6" Flanged, Cast Iron, Air/Vacuum Valve (Apco 153)	2,221.13		169.81
23 21 16 00-0034		Ductile Iron, Combination Air Release And Vacuum Valves, Single Body Double Orifice (23 21 16 00-0018)			
		Note: Up to 150 psi. Stainless Steel float.			
23 21 16 00-0035	EA	1" NPT, Ductile Iron, Combination Air Release And Vacuum Valves, Single Body Double Orifice (Apco 143C).....	500.67		16.77
23 21 16 00-0036	EA	2" NPT, Ductile Iron, Combination Air Release And Vacuum Valves, Single Body Double Orifice (Apco 145C).....	768.28		29.15
23 21 16 00-0037	EA	3" Flanged, Ductile Iron, Combination Air Release And Vacuum Valves, Single Body Double Orifice (Apco 147C).....	1,497.15		101.92
23 21 16 00-0038	EA	4" Flanged, Ductile Iron, Combination Air Release And Vacuum Valves, Single Body Double Orifice (Apco 149C).....	1,953.13		133.16
23 21 16 00-0039		Vent Valves (23 21 16)			
23 21 16 00-0040	EA	1/8", 1.5 PSIG Operating Pressure, Non Vacuum Adjustable Angle Radiator Steam Vent Valve (Hoffman 1A)	47.29		11.98
23 21 16 00-0041	EA	1/2" x 3/4", 35 PSIG Operating Pressure, Straight Steam Unit Heater Air Vent Valve (Hoffman 74).....	106.39		12.88
23 21 16 00-0042	EA	1/2" x 3/4", 3 PSIG Operating Pressure, Non Vacuum Main Steam Air Vent Valve (Hoffman 75).....	101.72		12.88
23 21 16 00-0043	EA	1/2" x 3/4", 10 PSIG Operating Pressure, Non Vacuum Straight Non-Vacuum Main Steam Air Vent Valve (Hoffman 75H)	104.99		12.88
23 21 16 00-0044	EA	3/4", 150 PSIG Operating Pressure, Straight Water Main Vent Valve (Hoffman 78)	133.64		12.88
23 21 16 00-0045	EA	1/2" x 3/4", 75 PSIG Operating Pressure, Straight Water Main Vent Valve (Hoffman 79)	100.43		12.88
23 21 16 00-0046		Threaded Inlet, Drip-Pan Elbow (23 21 16)			
23 21 16 00-0047		Cast Iron, Threaded Inlet, Drip-Pan Elbow (23 21 16 00-0046)			
23 21 16 00-0048	EA	2-1/2" Cast Iron, Threaded Inlet, Drip-Pan Elbow	154.91		20.14
		For Flanged Inlet, Add	51.10		
23 21 16 00-0049	EA	3" Cast Iron, Threaded Inlet, Drip-Pan Elbow	176.91		23.87
		For Flanged Inlet, Add	54.86		
23 21 16 00-0050	EA	3-1/2" Cast Iron, Threaded Inlet, Drip-Pan Elbow	220.16		27.60
		For Flanged Inlet, Add	74.00		
23 21 16 00-0051	EA	4" Cast Iron, Threaded Inlet, Drip-Pan Elbow	317.90		31.32
		For Flanged Inlet, Add	130.21		
23 21 16 00-0052	EA	5" Cast Iron, Threaded Inlet, Drip-Pan Elbow	360.85		37.30
		For Flanged Inlet, Add	143.94		
23 21 16 00-0053	EA	6" Cast Iron, Threaded Inlet, Drip-Pan Elbow	495.81		47.00
		For Flanged Inlet, Add	210.34		
23 21 16 00-0054	EA	8" Cast Iron, Threaded Inlet, Drip-Pan Elbow	1,071.75		61.91
		For Flanged Inlet, Add	559.71		
23 21 16 00-0055		Cast Steel, Threaded Inlet, Drip-Pan Elbow (23 21 16 00-0046)			
23 21 16 00-0056	EA	2-1/2" Cast Steel, Threaded Inlet, Drip-Pan Elbow	273.00		20.14
		For Flanged Inlet, Add	131.40		
23 21 16 00-0057	EA	3" Cast Steel, Threaded Inlet, Drip-Pan Elbow	330.38		23.87
		For Flanged Inlet, Add	159.22		
23 21 16 00-0058	EA	3-1/2" Cast Steel, Threaded Inlet, Drip-Pan Elbow	460.27		27.60
		For Flanged Inlet, Add	237.28		
23 21 16 00-0059	EA	4" Cast Steel, Threaded Inlet, Drip-Pan Elbow	475.36		31.32
		For Flanged Inlet, Add	237.28		
23 21 16 00-0060	EA	5" Cast Steel, Threaded Inlet, Drip-Pan Elbow	669.81		37.30
		For Flanged Inlet, Add	354.03		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21 16 00-0061 EA 6" Cast Steel, Threaded Inlet, Drip-Pan Elbow	707.11	47.00
<i>For Flanged Inlet, Add</i>	354.03	
23 21 16 00-0062 EA 8" Cast Steel, Threaded Inlet, Drip-Pan Elbow	1,142.69	61.91
<i>For Flanged Inlet, Add</i>	607.95	
23 21 16 00-0063 Y-Type Strainers <small>(23 21 16)</small>		
23 21 16 00-0064 Screwed Ends, 250 LB, Iron Body, Y-Type Strainers <small>(23 21 16 00-0063)</small>		
23 21 16 00-0065 EA 1/4" Or 3/8" Screwed Ends, 250 LB, Iron Body, Y-Type Strainer	41.36	8.94
<i>For Galvanized Body, Add</i>	7.90	
<i>For Work In Restricted Working Space, Add</i>	7.67	
23 21 16 00-0066 EA 1/2" Screwed Ends, 250 LB, Iron Body, Y-Type Strainer	41.75	9.11
<i>For Galvanized Body, Add</i>	7.90	
<i>For Work In Restricted Working Space, Add</i>	7.79	
23 21 16 00-0067 EA 3/4" Screwed Ends, 250 LB, Iron Body, Y-Type Strainer	54.00	12.30
<i>For Galvanized Body, Add</i>	9.43	
<i>For Work In Restricted Working Space, Add</i>	10.55	
23 21 16 00-0068 EA 1" Screwed Ends, 250 LB, Iron Body, Y-Type Strainer	67.40	14.70
<i>For Galvanized Body, Add</i>	12.74	
<i>For Work In Restricted Working Space, Add</i>	12.58	
23 21 16 00-0069 EA 1-1/4" Screwed Ends, 250 LB, Iron Body, Y-Type Strainer	86.81	18.17
<i>For Galvanized Body, Add</i>	17.45	
<i>For Work In Restricted Working Space, Add</i>	15.58	
23 21 16 00-0070 EA 1-1/2" Screwed Ends, 250 LB, Iron Body, Y-Type Strainer	97.94	19.57
<i>For Galvanized Body, Add</i>	21.01	
<i>For Work In Restricted Working Space, Add</i>	16.78	
23 21 16 00-0071 EA 2" Screwed Ends, 250 LB, Iron Body, Y-Type Strainer	128.59	22.36
<i>For Galvanized Body, Add</i>	32.35	
<i>For Work In Restricted Working Space, Add</i>	19.17	
23 21 16 00-0072 EA 2-1/2" Screwed Ends, 250 LB, Iron Body, Y-Type Strainer	225.30	27.95
<i>For Galvanized Body, Add</i>	72.71	
<i>For Work In Restricted Working Space, Add</i>	23.96	
23 21 16 00-0073 EA 3" Screwed Ends, 250 LB, Iron Body, Y-Type Strainer	289.84	34.98
<i>For Galvanized Body, Add</i>	95.00	
<i>For Work In Restricted Working Space, Add</i>	29.96	
23 21 16 00-0074 Flanged, 125 LB, Iron Body, Y-Type Strainers <small>(23 21 16 00-0063)</small>		
23 21 16 00-0075 EA 1-1/2" Flanged, 125 LB, Iron Body, Y-Type Strainer	171.71	39.94
<i>For Galvanized Body, Add</i>	45.92	
<i>For Work In Restricted Working Space, Add</i>	23.96	
23 21 16 00-0076 EA 2" Flanged, 125 LB, Iron Body, Y-Type Strainer	199.22	49.92
<i>For Galvanized Body, Add</i>	49.69	
<i>For Work In Restricted Working Space, Add</i>	29.96	
23 21 16 00-0077 EA 3" Flanged, 125 LB, Iron Body, Y-Type Strainer	396.65	79.88
<i>For Galvanized Body, Add</i>	118.45	
<i>For Work In Restricted Working Space, Add</i>	47.93	
23 21 16 00-0078 EA 4" Flanged, 125 LB, Iron Body, Y-Type Strainer	468.52	99.85
<i>For Galvanized Body, Add</i>	134.42	
<i>For Work In Restricted Working Space, Add</i>	59.91	
23 21 16 00-0079 EA 5" Flanged, 125 LB, Iron Body, Y-Type Strainer	594.80	147.02
<i>For Galvanized Body, Add</i>	150.38	
<i>For Work In Restricted Working Space, Add</i>	88.21	
23 21 16 00-0080 EA 6" Flanged, 125 LB, Iron Body, Y-Type Strainer	716.58	171.28
<i>For Galvanized Body, Add</i>	186.77	
<i>For Work In Restricted Working Space, Add</i>	102.92	
23 21 16 00-0081 EA 8" Flanged, 125 LB, Iron Body, Y-Type Strainer	1,147.34	205.83
<i>For Galvanized Body, Add</i>	367.84	
<i>For Work In Restricted Working Space, Add</i>	123.50	
23 21 16 00-0082 EA 10" Flanged, 125 LB, Iron Body, Y-Type Strainer	2,154.25	257.29
<i>For Galvanized Body, Add</i>	819.84	
<i>For Work In Restricted Working Space, Add</i>	154.37	
23 21 16 00-0083 EA 12" Flanged, 125 LB, Iron Body, Y-Type Strainer	2,440.02	367.56
<i>For Galvanized Body, Add</i>	852.45	
<i>For Work In Restricted Working Space, Add</i>	220.54	
23 21 16 00-0084 Screwed Ends, 150 LB, Bronze Body, Y-Type Strainers <small>(23 21 16 00-0063)</small>		
Note: With screwed cap (4" size has bolted cap).		
23 21 16 00-0085 EA 1/2" Screwed Ends, 150 LB, Bronze Body, Y-Type Strainer	38.75	9.11
<i>For 300 LB Rating, Add</i>	21.74	
<i>For Work In Restricted Working Space, Add</i>	7.79	
23 21 16 00-0086 EA 3/4" Screwed Ends, 150 LB, Bronze Body, Y-Type Strainer	51.78	12.30
<i>For 300 LB Rating, Add</i>	28.27	
<i>For Work In Restricted Working Space, Add</i>	10.55	
23 21 16 00-0087 EA 1" Screwed Ends, 150 LB, Bronze Body, Y-Type Strainer	62.87	14.70
<i>For 300 LB Rating, Add</i>	35.60	
<i>For Work In Restricted Working Space, Add</i>	12.58	
23 21 16 00-0088 EA 1-1/4" Screwed Ends, 150 LB, Bronze Body, Y-Type Strainer	78.14	18.17
<i>For 300 LB Rating, Add</i>	44.57	
<i>For Work In Restricted Working Space, Add</i>	15.58	
23 21 16 00-0089 EA 1-1/2" Screwed Ends, 150 LB, Bronze Body, Y-Type Strainer	89.97	19.57
<i>For 300 LB Rating, Add</i>	57.89	
<i>For Work In Restricted Working Space, Add</i>	16.78	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 20 HVAC Piping And Pumps****23 21 Hydronic Piping And Pumps**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21 16 00-0090	EA		2" Screwed Ends, 150 LB, Bronze Body, Y-Type Strainer..... <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i>	119.22 94.04 19.17	22.36
23 21 16 00-0091	EA		2-1/2" Screwed Ends, 150 LB, Bronze Body, Y-Type Strainer..... <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i>	171.17 155.19 23.96	27.95
23 21 16 00-0092	EA		3" Screwed Ends, 150 LB, Bronze Body, Y-Type Strainer..... <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i>	289.13 321.78 29.96	34.98
23 21 16 00-0093	EA		4" Screwed Ends, 150 LB, Bronze Body, Y-Type Strainer..... <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i>	479.05 610.69 35.95	41.93
23 21 16 00-0094			Flanged, 150 LB, Bronze Body, Y-Type Strainers (23 21 16 00-0063) Note: With bolted cap.		
23 21 16 00-0095	EA		2" Flanged, 150 LB, Bronze Body, Y-Type Strainer <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i>	258.74 95.33 29.96	49.92
23 21 16 00-0096	EA		2-1/2" Flanged, 150 LB, Bronze Body, Y-Type Strainer..... <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i>	292.08 97.13 39.06	65.10
23 21 16 00-0097	EA		3" Flanged, 150 LB, Bronze Body, Y-Type Strainer <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i>	345.12 111.22 47.93	79.88
23 21 16 00-0098	EA		4" Flanged, 150 LB, Bronze Body, Y-Type Strainer <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i>	650.11 270.25 59.91	99.85
23 21 16 00-0099	EA		6" Flanged, 150 LB, Bronze Body, Y-Type Strainer <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i>	1,025.81 409.66 102.92	171.28
23 21 16 00-0100	EA		8" Flanged, 150 LB, Bronze Body, Y-Type Strainer <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i>	1,576.86 699.11 123.50	205.83
23 21 16 00-0101	EA		10" Flanged, 150 LB, Bronze Body, Y-Type Strainer..... <i>For 300 LB Rating, Add</i> <i>For Work In Restricted Working Space, Add</i>	4,696.61 2,509.22 154.37	257.29
23 21 16 00-0102			Class 125, Crimped Bronze Body, Y-Type Strainers (23 21 16 00-0063) Note: Nibco®		
23 21 16 00-0103	EA		1/2" Class 125, Crimped Bronze Body, Y-Type Strainer..... <i>For Work In Restricted Working Space, Add</i>	93.61 5.39	7.98
23 21 16 00-0104	EA		3/4" Class 125, Crimped Bronze Body, Y-Type Strainer..... <i>For Work In Restricted Working Space, Add</i>	108.38 6.14	8.78
23 21 16 00-0105	EA		1" Class 125, Crimped Bronze Body, Y-Type Strainer..... <i>For Work In Restricted Working Space, Add</i>	153.51 7.34	9.98
23 21 16 00-0106	EA		1-1/4" Class 125, Crimped Bronze Body, Y-Type Strainer..... <i>For Work In Restricted Working Space, Add</i>	204.85 8.09	10.62
23 21 16 00-0107	EA		1-1/2" Class 125, Crimped Bronze Body, Y-Type Strainer..... <i>For Work In Restricted Working Space, Add</i>	246.22 8.99	12.29
23 21 16 00-0108	EA		2" Class 125, Crimped Bronze Body, Y-Type Strainer..... <i>For Work In Restricted Working Space, Add</i>	363.23 10.78	14.53
23 21 16 00-0109			250 PSI, Crimped Bronze Body, Y-Type Strainers (23 21 16 00-0063)		
23 21 16 00-0110	EA		1/2" 250 PSI, Crimped Bronze Body, Y-Type Strainer.....	71.29	7.98
23 21 16 00-0111	EA		3/4" 250 PSI, Crimped Bronze Body, Y-Type Strainer.....	87.69	8.78
23 21 16 00-0112	EA		1" 250 PSI, Crimped Bronze Body, Y-Type Strainer.....	131.10	9.98
23 21 16 00-0113	EA		1-1/4" 250 PSI, Crimped Bronze Body, Y-Type Strainer.....	161.61	10.62
23 21 16 00-0114	EA		1-1/2" 250 PSI, Crimped Bronze Body, Y-Type Strainer.....	193.89	12.29
23 21 16 00-0115	EA		2" 250 PSI, Crimped Bronze Body, Y-Type Strainer.....	256.19	14.53
23 21 16 00-0116			Cast Iron Body, Suction Diffusers (23 21 16) Note: 175 PSI, steel inlet vanes, steel orifice cylinder and 16 mesh bronze startup strainer.		
23 21 16 00-0117	EA		2" x 1-1/2" Screwed Ends, 175 LB, Cast Iron Body, Suction Diffuser <i>For Work In Restricted Working Space, Add</i>	350.45 15.41	31.47
23 21 16 00-0118	EA		2" x 2" Screwed Ends, 175 LB, Cast Iron Body, Suction Diffuser <i>For Work In Restricted Working Space, Add</i>	368.10 17.12	34.90
23 21 16 00-0119	EA		2-1/2" x 2" Screwed Ends, 175 LB, Cast Iron Body, Suction Diffuser <i>For Work In Restricted Working Space, Add</i>	373.98 17.98	36.67
23 21 16 00-0120	EA		2-1/2" x 2-1/2" Flanged, 175 LB, Cast Iron Body, Suction Diffuser <i>For Work In Restricted Working Space, Add</i>	629.64 20.21	41.22
23 21 16 00-0121	EA		3" x 1-1/2" Screwed Ends, 175 LB, Cast Iron Body, Suction Diffuser <i>For Work In Restricted Working Space, Add</i>	386.64 20.88	42.65
23 21 16 00-0122	EA		3" x 2" Screwed Ends, 175 LB, Cast Iron Body, Suction Diffuser <i>For Work In Restricted Working Space, Add</i>	437.49 20.88	42.65
23 21 16 00-0123	EA		3" x 2-1/2" Flanged, 175 LB, Cast Iron Body, Suction Diffuser <i>For Work In Restricted Working Space, Add</i>	661.38 23.45	47.85
23 21 16 00-0124	EA		3" x 3" Flanged, 175 LB, Cast Iron Body, Suction Diffuser <i>For Work In Restricted Working Space, Add</i>	667.75 24.46	49.92
23 21 16 00-0125	EA		4" x 3" Flanged, 175 LB, Cast Iron Body, Suction Diffuser <i>For Work In Restricted Working Space, Add</i>	810.75 35.96	73.40



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21 16 00-0126 EA 4" x 4" Flanged, 175 LB, Cast Iron Body, Suction Diffuser <i>For Work In Restricted Working Space, Add</i>	938.21 42.79	87.30
23 21 16 00-0127 EA 6" x 4" Flanged, 175 LB, Cast Iron Body, Suction Diffuser <i>For Work In Restricted Working Space, Add</i>	1,174.05 66.89	136.51
23 21 16 00-0128 EA 6" x 6" Flanged, 175 LB, Cast Iron Body, Suction Diffuser <i>For Work In Restricted Working Space, Add</i>	1,420.46 73.51	150.04
23 21 16 00-0129 EA 8" x 6" Flanged, 175 LB, Cast Iron Body, Suction Diffuser <i>For Work In Restricted Working Space, Add</i>	1,548.62 78.76	160.77
23 21 16 00-0130 EA 8" x 8" Flanged, 175 LB, Cast Iron Body, Suction Diffuser <i>For Work In Restricted Working Space, Add</i>	2,504.30 88.21	180.03
23 21 16 00-0131 EA 10" x 8" Flanged, 175 LB, Cast Iron Body, Suction Diffuser <i>For Work In Restricted Working Space, Add</i>	2,822.11 99.21	202.45
23 21 16 00-0132 EA 10" x 10" Flanged, 175 LB, Cast Iron Body, Suction Diffuser <i>For Work In Restricted Working Space, Add</i>	3,364.42 110.27	225.02
23 21 16 00-0133 Duplex Strainers (23 21 16)		
23 21 16 00-0134 Iron Body, Duplex Strainers (23 21 16 00-0133)		
23 21 16 00-0135 Screwed Ends, 125 LB, Bronze Diverter, Iron Body, Duplex Strainers (23 21 16 00-0134)		
Note: With brass or stainless steel basket.		
23 21 16 00-0136 EA 3/4" Screwed Ends, 125 LB, Bronze Diverter, Iron Body, Duplex Strainer <i>For Work In Restricted Working Space, Add</i>	365.96 11.94	19.88
23 21 16 00-0137 EA 1" Screwed Ends, 125 LB, Bronze Diverter, Iron Body, Duplex Strainer <i>For Work In Restricted Working Space, Add</i>	409.09 13.67	22.77
23 21 16 00-0138 EA 1-1/4" Screwed Ends, 125 LB, Bronze Diverter, Iron Body, Duplex Strainer <i>For Work In Restricted Working Space, Add</i>	551.22 16.05	26.75
23 21 16 00-0139 EA 1-1/2" Screwed Ends, 125 LB, Bronze Diverter, Iron Body, Duplex Strainer <i>For Work In Restricted Working Space, Add</i>	690.24 17.49	29.15
23 21 16 00-0140 EA 2" Screwed Ends, 125 LB, Bronze Diverter, Iron Body, Duplex Strainer <i>For Work In Restricted Working Space, Add</i>	922.38 21.40	35.55
23 21 16 00-0141 EA 2-1/2" Screwed Ends, 125 LB, Bronze Diverter, Iron Body, Duplex Strainer <i>For Work In Restricted Working Space, Add</i>	1,161.23 27.31	45.53
23 21 16 00-0142 Flanged, 125 LB, Bronze Diverter, Iron Body, Duplex Strainers (23 21 16 00-0134)		
Note: With brass or stainless steel basket.		
23 21 16 00-0143 EA 2" Flanged, 125 LB, Bronze Diverter, Iron Body, Duplex Strainer..... <i>For Work In Restricted Working Space, Add</i>	1,244.13 31.79	52.95
23 21 16 00-0144 EA 2-1/2" Flanged, 125 LB, Bronze Diverter, Iron Body, Duplex Strainer <i>For Work In Restricted Working Space, Add</i>	1,455.81 85.11	141.86
23 21 16 00-0145 EA 3" Flanged, 125 LB, Bronze Diverter, Iron Body, Duplex Strainer..... <i>For Work In Restricted Working Space, Add</i>	1,876.87 109.50	182.52
23 21 16 00-0146 EA 4" Flanged, 125 LB, Bronze Diverter, Iron Body, Duplex Strainer..... <i>For Work In Restricted Working Space, Add</i>	2,770.61 117.72	195.91
23 21 16 00-0147 EA 6" Flanged, 125 LB, Bronze Diverter, Iron Body, Duplex Strainer..... <i>For Work In Restricted Working Space, Add</i>	5,344.53 176.43	294.04
23 21 16 00-0148 EA 8" Flanged, 125 LB, Bronze Diverter, Iron Body, Duplex Strainer..... <i>For Work In Restricted Working Space, Add</i>	9,878.80 211.70	352.86
23 21 16 00-0149 EA 10" Flanged, 125 LB, Bronze Diverter, Iron Body, Duplex Strainer..... <i>For Work In Restricted Working Space, Add</i>	13,508.49 240.61	401.01
23 21 16 00-0150 EA 12" Flanged, 125 LB, Bronze Diverter, Iron Body, Duplex Strainer..... <i>For Work In Restricted Working Space, Add</i>	15,171.70 311.49	518.99
23 21 16 00-0151 EA 14" Flanged, 125 LB, Bronze Diverter, Iron Body, Duplex Strainer..... <i>For Work In Restricted Working Space, Add</i>	18,383.15 378.00	629.99
23 21 16 00-0152 EA 16" Flanged, 125 LB, Bronze Diverter, Iron Body, Duplex Strainer..... <i>For Work In Restricted Working Space, Add</i>	23,236.57 529.41	882.14
23 21 16 00-0153 Bronze Body, Duplex Strainers (23 21 16 00-0133)		
23 21 16 00-0154 Screwed Ends, 125 LB, Bronze Diverter, Bronze Body Duplex Strainers (23 21 16 00-0153)		
Note: With brass or stainless steel basket.		
23 21 16 00-0155 EA 3/4" Screwed Ends, 125 LB, Bronze Diverter, Bronze Body Duplex Strainer <i>For Work In Restricted Working Space, Add</i>	668.33 11.94	19.97
23 21 16 00-0156 EA 1" Screwed Ends, 125 LB, Bronze Diverter, Bronze Body Duplex Strainer <i>For Work In Restricted Working Space, Add</i>	742.04 13.67	22.77
23 21 16 00-0157 EA 1-1/4" Screwed Ends, 125 LB, Bronze Diverter, Bronze Body Duplex Strainer <i>For Work In Restricted Working Space, Add</i>	1,081.22 16.05	26.75
23 21 16 00-0158 EA 1-1/2" Screwed Ends, 125 LB, Bronze Diverter, Bronze Body Duplex Strainer <i>For Work In Restricted Working Space, Add</i>	1,417.29 17.49	29.15
23 21 16 00-0159 EA 2" Screwed Ends, 125 LB, Bronze Diverter, Bronze Body Duplex Strainer <i>For Work In Restricted Working Space, Add</i>	1,829.50 21.40	35.55
23 21 16 00-0160 EA 2-1/2" Screwed, 125 LB, Bronze Diverter, Bronze Body Duplex Strainer <i>For Work In Restricted Working Space, Add</i>	2,248.41 27.31	45.53
23 21 16 00-0161 Flanged, 125 LB, Bronze Diverter, Bronze Body, Duplex Strainers (23 21 16 00-0153)		
Note: With brass or stainless steel basket.		
23 21 16 00-0162 EA 2" Flanged, 125 LB, Bronze Diverter, Bronze Body, Duplex Strainer <i>For Work In Restricted Working Space, Add</i>	2,552.14 31.79	53.12

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 20 HVAC Piping And Pumps****23 21 Hydronic Piping And Pumps**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21	16 00-0163	EA	2-1/2" Flanged, 125 LB, Bronze Diverter, Bronze Body, Duplex Strainer <i>For Work In Restricted Working Space, Add</i>	2,797.80 85.11	141.78
23 21	16 00-0164	EA	3" Flanged, 125 LB, Bronze Diverter, Bronze Body, Duplex Strainer <i>For Work In Restricted Working Space, Add</i>	3,830.40 109.50	182.52
23 21	16 00-0165	EA	4" Flanged, 125 LB, Bronze Diverter, Bronze Body, Duplex Strainer <i>For Work In Restricted Working Space, Add</i>	5,862.28 117.72	195.91
23 21	16 00-0166	EA	6" Flanged, 125 LB, Bronze Diverter, Bronze Body, Duplex Strainer <i>For Work In Restricted Working Space, Add</i>	12,615.07 176.43	294.04
23 21	16 00-0167		Cast Steel Body, Duplex Strainers (23 21 16 00-0133)		
23 21	16 00-0168		Screwed Ends, 125 LB, Bronze Diverter, Cast Steel Body, Duplex Strainers (23 21 16 00-0167) Note: With brass or stainless steel basket.		
23 21	16 00-0169	EA	1" Screwed Ends, 125 LB, Bronze Diverter, Cast Steel Body, Duplex Strainer <i>For Work In Restricted Working Space, Add</i>	1,034.83 13.67	22.77
23 21	16 00-0170	EA	1-1/4" Screwed Ends, 125 LB, Bronze Diverter, Cast Steel Body, Duplex Strainer <i>For Work In Restricted Working Space, Add</i>	1,273.56 16.04	26.75
23 21	16 00-0171	EA	1-1/2" Screwed Ends, 125 LB, Bronze Diverter, Cast Steel Body, Duplex Strainer <i>For Work In Restricted Working Space, Add</i>	1,509.23 17.50	29.15
23 21	16 00-0172	EA	2" Screwed Ends, 125 LB, Bronze Diverter, Cast Steel Body, Duplex Strainer <i>For Work In Restricted Working Space, Add</i>	2,544.46 21.40	35.55
23 21	16 00-0173		Flanged, 125 LB, Bronze Diverter, Cast Steel Body, Duplex Strainers (23 21 16 00-0167) Note: With brass or stainless steel basket.		
23 21	16 00-0174	EA	2" Flanged, 125 LB, Bronze Diverter, Cast Steel Body, Duplex Strainer <i>For Work In Restricted Working Space, Add</i>	2,595.62 31.80	53.12
23 21	16 00-0175	EA	2-1/2" Flanged, 125 LB, Bronze Diverter, Cast Steel Body, Duplex Strainer <i>For Work In Restricted Working Space, Add</i>	3,020.60 85.10	141.78
23 21	16 00-0176	EA	3" Flanged, 125 LB, Bronze Diverter, Cast Steel Body, Duplex Strainer <i>For Work In Restricted Working Space, Add</i>	3,975.86 109.52	182.52
23 21	16 00-0177	EA	4" Flanged, 125 LB, Bronze Diverter, Cast Steel Body, Duplex Strainer <i>For Work In Restricted Working Space, Add</i>	5,684.74 117.66	195.91
23 21	16 00-0178	EA	6" Flanged, 125 LB, Bronze Diverter, Cast Steel Body, Duplex Strainer <i>For Work In Restricted Working Space, Add</i>	9,688.59 176.23	294.04
23 21	16 00-0179	EA	8" Flanged, 125 LB, Bronze Diverter, Cast Steel Body, Duplex Strainer <i>For Work In Restricted Working Space, Add</i>	18,577.50 211.47	352.86
23 21	16 00-0180		Stainless Steel Body, Duplex Strainers (23 21 16 00-0133)		
23 21	16 00-0181		Screwed Ends, 125 LB, Stainless Steel Diverter, Stainless Steel Body, Duplex Strainers (23 21 16 00-0180) Note: With stainless steel basket.		
23 21	16 00-0182	EA	1" Screwed Ends, 125 LB, Stainless Steel Diverter, Stainless Steel Body, Duplex Strainer <i>For Work In Restricted Working Space, Add</i>	4,342.64 13.67	22.77
23 21	16 00-0183	EA	1-1/4" Screwed Ends, 125 LB, Stainless Steel Diverter, Stainless Steel Body, Duplex Strainer <i>For Work In Restricted Working Space, Add</i>	5,488.48 16.04	26.75
23 21	16 00-0184	EA	1-1/2" Screwed Ends, 125 LB, Stainless Steel Diverter, Stainless Steel Body, Duplex Strainer <i>For Work In Restricted Working Space, Add</i>	6,623.29 17.50	29.15
23 21	16 00-0185	EA	2" Screwed Ends, 125 LB, Stainless Steel Diverter, Stainless Steel Body, Duplex Strainer <i>For Work In Restricted Working Space, Add</i>	10,615.06 21.40	35.55
23 21	16 00-0186		Flanged, 125 LB, Stainless Steel Diverter, Stainless Steel Body, Duplex Strainers (23 21 16 00-0180) Note: With stainless steel basket.		
23 21	16 00-0187	EA	2" Flanged, 125 LB, Stainless Steel Diverter, Stainless Steel Body, Duplex Strainer <i>For Work In Restricted Working Space, Add</i>	11,087.39 31.80	53.12
23 21	16 00-0188	EA	2-1/2" Flanged, 125 LB, Stainless Steel Diverter, Stainless Steel Body, Duplex Strainer <i>For Work In Restricted Working Space, Add</i>	11,822.08 85.10	141.78
23 21	16 00-0189	EA	3" Flanged, 125 LB, Stainless Steel Diverter, Stainless Steel Body, Duplex Strainer <i>For Work In Restricted Working Space, Add</i>	18,508.26 109.52	182.52
23 21	16 00-0190	EA	4" Flanged, 125 LB, Stainless Steel Diverter, Stainless Steel Body, Duplex Strainer <i>For Work In Restricted Working Space, Add</i>	22,514.16 117.66	195.91
23 21	16 00-0191	EA	6" Flanged, 125 LB, Stainless Steel Diverter, Stainless Steel Body, Duplex Strainer <i>For Work In Restricted Working Space, Add</i>	39,579.35 176.23	294.04
23 21	16 00-0192	EA	8" Flanged, 125 LB, Stainless Steel Diverter, Stainless Steel Body, Duplex Strainer <i>For Work In Restricted Working Space, Add</i>	72,959.35 211.47	352.86
23 21	16 00-0193		Wall Seals And Sleeves (23 21 16) Note: Up to 12" walls. Excludes drilling hole.		
23 21	16 00-0194		Ductile Iron Wall Sleeve (23 21 16 00-0193) Note: Includes rubber gasket seal.		
23 21	16 00-0195	EA	3" Ductile Iron Wall Sleeve With Rubber Gasket Seal	86.20	34.99
23 21	16 00-0196	EA	4" Ductile Iron Wall Sleeve With Rubber Gasket Seal	106.32	40.87
23 21	16 00-0197	EA	6" Ductile Iron Wall Sleeve With Rubber Gasket Seal	129.96	49.02
23 21	16 00-0198	EA	8" Ductile Iron Wall Sleeve With Rubber Gasket Seal	184.61	73.50
23 21	16 00-0199	EA	10" Ductile Iron Wall Sleeve With Rubber Gasket Seal	237.48	97.98



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21 16 00-0200 EA 12" Ductile Iron Wall Sleeve With Rubber Gasket Seal	292.80	122.53
23 21 16 00-0201 Steel Pipe Sleeves <small>(23 21 16 00-0193)</small>		
<small>Note: Includes link seals 12" length.</small>		
23 21 16 00-0202 EA 2" Steel Pipe Sleeve With Link Seals.....	87.66	35.51
23 21 16 00-0203 EA 2-1/2" Steel Pipe Sleeve With Link Seals	104.18	38.49
23 21 16 00-0204 EA 3" Steel Pipe Sleeve With Link Seals.....	120.18	41.48
23 21 16 00-0205 EA 4" Steel Pipe Sleeve With Link Seals.....	147.09	49.75
23 21 16 00-0206 EA 6" Steel Pipe Sleeve With Link Seals.....	205.49	62.14
23 21 16 00-0207 EA 10" Steel Pipe Sleeve With Link Seals.....	366.64	74.59
23 21 16 00-0208 EA 13.25" Inside Diameter Steel Pipe Sleeve With Link Seals.....	416.11	93.24
23 21 16 00-0209 EA 17.25" Inside Diameter Steel Pipe Sleeve With Link Seals.....	577.29	114.72
23 21 16 00-0210 EA 23.25" Inside Diameter Steel Pipe Sleeve With Link Seals.....	787.60	149.18
23 21 16 00-0211 EA 29.25" Inside Diameter Steel Pipe Sleeve With Link Seals.....	826.15	186.48
23 21 16 00-0212 Pressure Regulating Valve <small>(23 21 16)</small>		
23 21 16 00-0213 Screwed Ends, Water Pressure Reducing Valves <small>(23 21 16 00-0212)</small>		
<small>Note: For building services, 25 - 75 PSI, up to 300 Lbs. rating, iron construction.</small>		
23 21 16 00-0214 EA 1/2" Screwed Ends, Iron Construction, Water Pressure Reducing Valve	101.55	9.98
<i>For Work In Restricted Working Space, Add</i>	11.98	
23 21 16 00-0215 EA 3/4" Screwed Ends, Iron Construction, Water Pressure Reducing Valve	122.90	11.18
<i>For Work In Restricted Working Space, Add</i>	13.31	
23 21 16 00-0216 EA 1" Screwed Ends, Iron Construction, Water Pressure Reducing Valve	156.49	11.97
<i>For Work In Restricted Working Space, Add</i>	14.09	
23 21 16 00-0217 EA 1-1/4" Screwed Ends, Iron Construction, Water Pressure Reducing Valve	255.67	13.41
<i>For Work In Restricted Working Space, Add</i>	15.97	
23 21 16 00-0218 EA 1-1/2" Screwed Ends, Iron Construction, Water Pressure Reducing Valve	343.14	15.97
<i>For Work In Restricted Working Space, Add</i>	19.16	
23 21 16 00-0219 EA 2" Screwed Ends, Iron Construction, Water Pressure Reducing Valve	494.71	24.48
<i>For Work In Restricted Working Space, Add</i>	29.40	
23 21 16 00-0220 EA 2-1/2" Screwed Ends, Iron Construction, Water Pressure Reducing Valve	539.84	27.56
<i>For Work In Restricted Working Space, Add</i>	33.08	
23 21 16 00-0221 EA 3" Screwed Ends, Iron Construction, Water Pressure Reducing Valve	593.79	79.75
<i>For Work In Restricted Working Space, Add</i>	36.75	
23 21 16 00-0222 Cast Iron Body, Steam Pressure Regulator And Reducer <small>(23 21 16 00-0212)</small>		
<small>Note: Single seated, spring loaded, direct acting diaphragm valve.</small>		
23 21 16 00-0223 Screwed Ends, Cast Iron Body, Steam Pressure Regulator And Reducer <small>(23 21 16 00-0222)</small>		
23 21 16 00-0224 EA 1/2" Screwed Ends, Cast Iron Body, Steam Pressure Regulator Valve And Reducer.....	164.61	13.42
<i>For Work In Restricted Working Space, Add</i>	16.08	
23 21 16 00-0225 EA 3/4" Screwed Ends, Cast Iron Body, Steam Pressure Regulator Valve And Reducer.....	210.35	19.01
<i>For Work In Restricted Working Space, Add</i>	22.82	
23 21 16 00-0226 EA 1" Screwed Ends, Cast Iron Body, Steam Pressure Regulator Valve And Reducer.....	268.08	23.17
<i>For Work In Restricted Working Space, Add</i>	27.87	
23 21 16 00-0227 EA 1-1/4" Screwed Ends, Cast Iron Body, Steam Pressure Regulator Valve And Reducer.....	350.96	28.11
<i>For Work In Restricted Working Space, Add</i>	32.38	
23 21 16 00-0228 EA 1-1/2" Screwed Ends, Cast Iron Body, Steam Pressure Regulator Valve And Reducer.....	460.74	31.95
<i>For Work In Restricted Working Space, Add</i>	36.87	
23 21 16 00-0229 EA 2" Screwed Ends, Cast Iron Body, Steam Pressure Regulator Valve And Reducer.....	541.47	44.76
<i>For Work In Restricted Working Space, Add</i>	44.75	
23 21 16 00-0230 Flanged, Cast Iron Body, Steam Pressure Regulator And Reducer <small>(23 21 16 00-0222)</small>		
<small>Note: Single seated, spring loaded, direct acting diaphragm valve.</small>		
23 21 16 00-0231 EA 2-1/2" Flanged, Cast Iron Body, Steam Pressure Regulator Valve And Reducer.....	1,191.67	52.51
<i>For Work In Restricted Working Space, Add</i>	53.28	
23 21 16 00-0232 EA 3" Flanged, Cast Iron Body, Steam Pressure Regulator Valve And Reducer.....	1,467.76	59.67
<i>For Work In Restricted Working Space, Add</i>	60.48	
23 21 16 00-0233 EA 4" Flanged, Cast Iron Body, Steam Pressure Regulator Valve And Reducer.....	1,978.34	110.69
<i>For Work In Restricted Working Space, Add</i>	114.76	
23 21 16 00-0234 EA 6" Flanged, Cast Iron Body, Steam Pressure Regulator Valve And Reducer.....	4,633.80	137.56
<i>For Work In Restricted Working Space, Add</i>	143.28	
23 21 16 00-0235 Cast Iron Body, Externally Piloted, Steam Pressure Regulating And Reducing Valves <small>(23 21 16 00-0212)</small>		
23 21 16 00-0236 Screwed Ends, Cast Iron Body, Externally Piloted, Steam Pressure Regulating And Reducing Valves <small>(23 21 16 00-0235)</small>		
23 21 16 00-0237 EA 1/2" Screwed Ends, Cast Iron Body, Externally Piloted, Steam Pressure Regulating And Reducing Valve.....	809.70	9.74
<i>For Work In Restricted Working Space, Add</i>	14.62	
23 21 16 00-0238 EA 3/4" Screwed Ends, Cast Iron Body, Externally Piloted, Steam Pressure Regulating And Reducing Valve.....	826.21	9.74
<i>For Work In Restricted Working Space, Add</i>	14.62	
23 21 16 00-0239 EA 1" Screwed Ends, Cast Iron Body, Externally Piloted, Steam Pressure Regulating And Reducing Valve.....	884.84	12.30
<i>For Work In Restricted Working Space, Add</i>	18.45	
23 21 16 00-0240 EA 1-1/4" Screwed Ends, Cast Iron Body, Externally Piloted, Steam Pressure Regulating And Reducing Valve.....	1,042.80	15.65
<i>For Work In Restricted Working Space, Add</i>	23.48	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 20 HVAC Piping And Pumps****23 21 Hydronic Piping And Pumps**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21 16 00-0241 EA 1-1/2" Screwed Ends, Cast Iron Body, Externally Piloted, Steam Pressure Regulating And Reducing Valve <i>For Work In Restricted Working Space, Add</i>	1,194.14 27.08	18.05
23 21 16 00-0242 EA 2" Screwed Ends, Cast Iron Body, Externally Piloted, Steam Pressure Regulating And Reducing Valve <i>For Work In Restricted Working Space, Add</i>	1,477.84 31.87	21.24
23 21 16 00-0243 Flanged, Cast Iron Body, Externally Piloted, Steam Pressure Regulating And Reducing Valves (23 21 16 00-0235)		
23 21 16 00-0244 EA 2-1/2" Flanged, Cast Iron Body, Externally Piloted, Steam Pressure Regulating And Reducing Valve <i>For Work In Restricted Working Space, Add</i>	1,870.78 53.48	35.66
23 21 16 00-0245 EA 3" Flanged, Cast Iron Body, Externally Piloted, Steam Pressure Regulating And Reducing Valve <i>For Work In Restricted Working Space, Add</i>	2,286.20 58.19	38.79
23 21 16 00-0246 EA 4" Flanged, Cast Iron Body, Externally Piloted, Steam Pressure Regulating And Reducing Valve <i>For Work In Restricted Working Space, Add</i>	3,583.98 128.46	85.63
23 21 16 00-0247 EA 6" Flanged, Cast Iron Body, Externally Piloted, Steam Pressure Regulating And Reducing Valve <i>For Work In Restricted Working Space, Add</i>	7,557.50 143.28	137.56
23 21 16 00-0248 Screwed Ends, Cast Iron Body, Air Pressure Reducing Valves (23 21 16 00-0212)		
23 21 16 00-0249 EA 1/2" Screwed Ends, Cast Iron Body, Air Pressure Reducing Valve	111.69	10.38
23 21 16 00-0250 EA 3/4" Screwed Ends, Cast Iron Body, Air Pressure Reducing Valve	135.82	11.50
23 21 16 00-0251 EA 1" Screwed Ends, Cast Iron Body, Air Pressure Reducing Valve	174.50	12.21
23 21 16 00-0252 EA 1-1/4" Screwed Ends, Cast Iron Body, Air Pressure Reducing Valve	288.96	13.90
23 21 16 00-0253 EA 1-1/2" Screwed Ends, Cast Iron Body, Air Pressure Reducing Valve	389.04	16.60
23 21 16 00-0254 EA 2" Screwed Ends, Cast Iron Body, Air Pressure Reducing Valve	559.93	25.43
23 21 16 00-0255 EA 2-1/2" Screwed Ends, Cast Iron Body, Air Pressure Reducing Valve	606.80	27.71
23 21 16 00-0256 EA 3" Screwed Ends, Cast Iron Body, Air Pressure Reducing Valve	671.29	31.90
23 21 16 00-0257 Screwed Ends, Bronze Body, Water Pressure Reducing Valves (23 21 16 00-0212)		
Note: For building services, bronze construction, pressure adjustment, union and strainer, factory set at 45 PSI (Watts 25AUB).		
23 21 16 00-0258 EA 1/2" Screwed Ends, Bronze Body, Water Pressure Reducing Valve	96.52	9.98
23 21 16 00-0259 EA 3/4" Screwed Ends, Bronze Body, Water Pressure Reducing Valve	106.26	11.18
23 21 16 00-0260 EA 1" Screwed Ends, Bronze Body, Water Pressure Reducing Valve	128.80	12.37
23 21 16 00-0261 EA 1-1/4" Screwed Ends, Bronze Body, Water Pressure Reducing Valve	282.08	13.41
23 21 16 00-0262 EA 1-1/2" Screwed Ends, Bronze Body, Water Pressure Reducing Valve	308.21	15.97
23 21 16 00-0263 EA 2" Screwed Ends, Bronze Body, Water Pressure Reducing Valve	483.34	24.48
23 21 16 00-0264 Dual Unit Reducing And Relief Valve (23 21 16)		
23 21 16 00-0265 EA 1/2" Dual Unit Reducing And Relief Valve	110.42	24.37
23 21 16 00-0266 Safety Relief Valve (23 21 16)		
Note: Used in water heater and hot water storage tank applications.		
23 21 16 00-0267 Threaded Inlet, Bronze Body Safety Valves (23 21 16 00-0266)		
Note: Variable set points to 150 psig pressure, 210 Degree F temperature range.		
23 21 16 00-0268 EA 1/2" x 1/2" Threaded Inlet, Bronze Body Safety Valve	49.72	9.98
23 21 16 00-0269 EA 3/4" x 3/4" Threaded Inlet, Bronze Body Safety Valve	64.54	10.98
23 21 16 00-0270 EA 1" x 1" Threaded Inlet, Bronze Body Safety Valve	89.45	13.37
23 21 16 00-0271 EA 1-1/4" x 1-1/4" Threaded Inlet, Bronze Body Safety Valve	110.91	14.18
23 21 16 00-0272 EA 1-1/2" x 1-1/2" Threaded Inlet, Bronze Body Safety Valve	151.88	18.96
23 21 16 00-0273 EA 2" x 2" Threaded Inlet, Bronze Body Safety Valve	199.04	22.35
23 21 16 00-0274 EA 2-1/2" x 2-1/2" Threaded Inlet, Bronze Body Safety Valve	229.66	27.94
23 21 16 00-0275 Threaded, Bronze Body, Temperature And Pressure Relief Valves (23 21 16)		
23 21 16 00-0276 EA 1/2" x 1/2" Threaded, Bronze Body, Temperature And Pressure Relief Valve..... <i>For Cast Iron Body, Add</i>	51.40 22.66	20.36
23 21 16 00-0277 EA 3/4" x 3/4" Threaded, Bronze Body, Temperature And Pressure Relief Valve..... <i>For Cast Iron Body, Add</i>	65.18 31.58	24.43
23 21 16 00-0278 EA 1" x 1" Threaded, Bronze Body, Temperature And Pressure Relief Valve..... <i>For Cast Iron Body, Add</i>	93.46 50.29	32.57
23 21 16 00-0279 EA 1-1/4" x 1-1/4" Threaded, Bronze Body, Temperature And Pressure Relief Valve <i>For Cast Iron Body, Add</i>	142.53 106.88	34.89
23 21 16 00-0280 EA 1-1/2" x 1-1/2" Threaded, Bronze Body, Temperature And Pressure Relief Valve <i>For Cast Iron Body, Add</i>	227.43 204.46	39.13
23 21 16 00-0281 EA 2" x 2" Threaded, Bronze Body, Temperature And Pressure Relief Valve..... <i>For Cast Iron Body, Add</i>	269.99 222.64	56.23
23 21 16 00-0282 Thermostatic Radiator Valves (23 21 16)		
Note: For hot water or two pipe low pressure steam.		
23 21 16 00-0283 EA 1/2" Straight Thermostatic Radiator Valve (Danfoss 013G8015)	45.65	12.88
23 21 16 00-0284 EA 3/4" Straight Thermostatic Radiator Valve (Danfoss 013G8020)	55.43	17.37
23 21 16 00-0285 EA 1" Straight Thermostatic Radiator Valve (Danfoss 013G8025)	74.34	21.02
23 21 16 00-0286 EA 1-1/4" Straight Thermostatic Radiator Valve (Danfoss 013G8032)	108.75	26.63
23 21 16 00-0287 EA 1/2" Angle Thermostatic Radiator Valve (Danfoss 013G8014)	45.65	12.88
23 21 16 00-0288 EA 3/4" Angle Thermostatic Radiator Valve (Danfoss 013G8019)	55.43	17.37
23 21 16 00-0289 EA 1" Angle Thermostatic Radiator Valve (Danfoss 013G8024)	74.34	21.02



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21 16 00-0290 EA 1-1/4" Angle Thermostatic Radiator Valve (Danfoss 013G8031).....	108.75	26.63
23 21 16 00-0291 EA Tamper Resistant Valve Mounted Dial And Sensor Thermostatic Operator (Danfoss 013G8240).....	56.20	9.98
23 21 16 00-0292 EA Tamper Resistant Valve Mounted Dial With Remote Sensor Thermostatic Operator (Danfoss 013G2922).....	82.82	13.98
23 21 16 00-0293 Radiator Trap Repair Kits ^(23 21 16)		
Note: For hot water or two pipe low pressure steam.		
23 21 16 00-0294 EA 1/2" Trap (Spirax-Sarco TH-125), Straight, Radiator Trap Repair Kit (Spirax-Sarco SH1031).....	80.84	
23 21 16 00-0295 EA 3/4" Trap (Spirax-Sarco TH-125), Straight, Radiator Trap Repair Kit (Spirax-Sarco SH1032).....	100.77	
23 21 16 00-0296 EA 1/2" Trap (Spirax-Sarco TH-125), Angle, Radiator Trap Repair Kit (Spirax-Sarco SH1026).....	101.13	
23 21 16 00-0297 EA 3/4" Trap (Spirax-Sarco TH-125), Angle, Radiator Trap Repair Kit (Spirax-Sarco SH1027).....	115.27	
23 21 16 00-0298 EA 1" Trap (Spirax-Sarco TH-125), Angle, Radiator Trap Repair Kit (Spirax-Sarco SH1028).....	265.63	
23 21 16 00-0299 Horizontal Steel Expansion Tanks ^(23 21 16)		
Note: ASME Code Stamp. 150 PSI with glass gauge and cocks.		
23 21 16 00-0300 EA 10 Gallon Horizontal Steel Expansion Tank.....	425.21	79.88
23 21 16 00-0301 EA 15 Gallon Horizontal Steel Expansion Tank.....	597.89	99.85
23 21 16 00-0302 EA 30 Gallon Horizontal Steel Expansion Tank.....	780.53	119.82
23 21 16 00-0303 EA 40 Gallon Horizontal Steel Expansion Tank.....	898.99	139.79
23 21 16 00-0304 EA 60 Gallon Horizontal Steel Expansion Tank.....	1,039.82	147.02
23 21 16 00-0305 Horizontal Diaphragm Type (Bladder) Steel Expansion Tanks ^(23 21 16)		
Note: ASME. Precharged with working pressure 125 psi. Armstrong AX Series.		
23 21 16 00-0306 EA 7.8 Gallon Horizontal Diaphragm Type (Bladder) Steel Expansion Tank.....	1,265.37	59.91
23 21 16 00-0307 EA 10.9 Gallon Horizontal Diaphragm Type (Bladder) Steel Expansion Tank.....	1,318.63	69.89
23 21 16 00-0308 EA 21.7 Gallon Horizontal Diaphragm Type (Bladder) Steel Expansion Tank.....	1,975.00	79.88
23 21 16 00-0309 EA 33.6 Gallon Horizontal Diaphragm Type (Bladder) Steel Expansion Tank.....	2,053.73	89.86
23 21 16 00-0310 EA 44.4 Gallon Horizontal Diaphragm Type (Bladder) Steel Expansion Tank.....	2,792.35	99.85
23 21 16 00-0311 EA 55.7 Gallon Horizontal Diaphragm Type (Bladder) Steel Expansion Tank.....	2,943.53	109.83
23 21 16 00-0312 EA 68.0 Gallon Horizontal Diaphragm Type (Bladder) Steel Expansion Tank.....	3,503.95	119.82
23 21 16 00-0313 EA 77.0 Gallon Horizontal Diaphragm Type (Bladder) Steel Expansion Tank.....	3,749.11	129.80
23 21 16 00-0314 EA 90.0 Gallon Horizontal Diaphragm Type (Bladder) Steel Expansion Tank.....	4,133.31	139.79
23 21 16 00-0315 EA 110.0 Gallon Horizontal Diaphragm Type (Bladder) Steel Expansion Tank.....	4,243.74	159.75
23 21 16 00-0316 EA 132.0 Gallon Horizontal Diaphragm Type (Bladder) Steel Expansion Tank.....	5,331.32	179.73
23 21 16 00-0317 EA 158.0 Gallon Horizontal Diaphragm Type (Bladder) Steel Expansion Tank.....	6,115.37	199.69
23 21 16 00-0318 EA 211.0 Gallon Horizontal Diaphragm Type (Bladder) Steel Expansion Tank.....	7,096.02	239.63
23 21 16 00-0319 Vertical Diaphragm Type (Bladder) Steel Expansion Tanks ^(23 21 16)		
Note: ASME. Precharged with working pressure 125 psi (Armstrong AX)		
23 21 16 00-0320 EA 8.0 Gallon Vertical Diaphragm Type (Bladder) Steel Expansion Tank.....	1,445.52	59.91
23 21 16 00-0321 EA 11.0 Gallon Vertical Diaphragm Type (Bladder) Steel Expansion Tank.....	1,488.99	69.89
23 21 16 00-0322 EA 22.0 Gallon Vertical Diaphragm Type (Bladder) Steel Expansion Tank.....	2,139.49	79.88
23 21 16 00-0323 EA 34.0 Gallon Vertical Diaphragm Type (Bladder) Steel Expansion Tank.....	2,282.84	89.86
23 21 16 00-0324 EA 44.0 Gallon Vertical Diaphragm Type (Bladder) Steel Expansion Tank.....	2,907.88	99.85
23 21 16 00-0325 EA 56.0 Gallon Vertical Diaphragm Type (Bladder) Steel Expansion Tank.....	3,057.10	109.83
23 21 16 00-0326 EA 67.0 Gallon Vertical Diaphragm Type (Bladder) Steel Expansion Tank.....	3,733.06	119.82
23 21 16 00-0327 EA 77.0 Gallon Vertical Diaphragm Type (Bladder) Steel Expansion Tank.....	4,035.01	129.80
23 21 16 00-0328 EA 91.0 Gallon Vertical Diaphragm Type (Bladder) Steel Expansion Tank.....	4,464.24	139.79
23 21 16 00-0329 EA 111.0 Gallon Vertical Diaphragm Type (Bladder) Steel Expansion Tank.....	4,568.80	159.75
23 21 16 00-0330 EA 132.0 Gallon Vertical Diaphragm Type (Bladder) Steel Expansion Tank.....	5,627.01	179.73
23 21 16 00-0331 EA 158.0 Gallon Vertical Diaphragm Type (Bladder) Steel Expansion Tank.....	6,532.46	199.69
23 21 16 00-0332 EA 211.0 Gallon Vertical Diaphragm Type (Bladder) Steel Expansion Tank.....	7,520.95	239.63
23 21 16 00-0333 Diaphragm Type (Residential Style) Steel Expansion Tanks ^(23 21 16)		
23 21 16 00-0334 EA 2.1 Gallon Diaphragm Type (Residential Style) Steel Expansion Tank (Watts DET-5-M1).....	55.62	7.35
23 21 16 00-0335 EA 4.5 Gallon Diaphragm Type (Residential Style) Steel Expansion Tank (Watts DET-12-M1).....	78.18	7.35
23 21 16 00-0336 Vertical Diaphragm Type (Bladder) Fiberglass Reinforced Polyester (FRP) Expansion Tanks ^(23 21 16)		
23 21 16 00-0337 EA 15 Gallon Vertical Diaphragm Type (Bladder) Fiberglass Reinforced Polyester (FRP) Expansion Tank.....	774.34	239.71
23 21 16 00-0338 EA 20 Gallon Vertical Diaphragm Type (Bladder) Fiberglass Reinforced Polyester (FRP) Expansion Tank.....	804.34	239.71
23 21 16 00-0339 EA 30 Gallon Vertical Diaphragm Type (Bladder) Fiberglass Reinforced Polyester (FRP) Expansion Tank.....	834.34	239.71
23 21 16 00-0340 EA 40 Gallon Vertical Diaphragm Type (Bladder) Fiberglass Reinforced Polyester (FRP) Expansion Tank.....	912.33	239.71
23 21 16 00-0341 EA 47 Gallon Vertical Diaphragm Type (Bladder) Fiberglass Reinforced Polyester (FRP) Expansion Tank.....	1,098.79	319.43
23 21 16 00-0342 EA 60 Gallon Vertical Diaphragm Type (Bladder) Fiberglass Reinforced Polyester (FRP) Expansion Tank.....	1,278.45	319.59
23 21 16 00-0343 EA 80 Gallon Vertical Diaphragm Type (Bladder) Fiberglass Reinforced Polyester (FRP) Expansion Tank.....	1,314.09	319.59
23 21 16 00-0344 EA 87 Gallon Vertical Diaphragm Type (Bladder) Fiberglass Reinforced Polyester (FRP) Expansion Tank.....	1,349.72	319.59
23 21 16 00-0345 EA 120 Gallon Vertical Diaphragm Type (Bladder) Fiberglass Reinforced Polyester (FRP) Expansion Tank.....	1,715.50	399.38
23 21 16 00-0346 EA 187 Gallon Vertical Diaphragm Type (Bladder) Fiberglass Reinforced Polyester (FRP) Expansion Tank.....	4,736.69	399.38
23 21 16 00-0347 EA 264 Gallon Vertical Diaphragm Type (Bladder) Fiberglass Reinforced Polyester (FRP) Expansion Tank.....	6,016.95	479.10
23 21 16 00-0348 ASME Construction Compression Tanks ^(23 21 16)		
Note: With gauge glass taps, 125 PSI, 240 degree F tanks below are sized by capacity and diameter and height.		
23 21 16 00-0349 EA 15 Gallon, 13" x 34-1/2" ASME Construction Compression Tank.....	595.48	140.58
<i>For Galvanized Steel Tanks, Add</i>	<i>191.24</i>	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 20 HVAC Piping And Pumps****23 21 Hydronic Piping And Pumps**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21 16 00-0350	EA		24 Gallon, 13" x 51" ASME Construction Compression Tank.....	607.77	144.58
			<i>For Galvanized Steel Tanks, Add</i>	194.05	
23 21 16 00-0351	EA		30 Gallon, 13" x 61-1/2" ASME Construction Compression Tank.....	659.95	149.37
			<i>For Galvanized Steel Tanks, Add</i>	216.55	
23 21 16 00-0352	EA		40 Gallon, 16-1/4" x 53" ASME Construction Compression Tank.....	719.35	154.97
			<i>For Galvanized Steel Tanks, Add</i>	241.86	
23 21 16 00-0353	EA		60 Gallon, 16-1/4" x 76-1/2" ASME Construction Compression Tank.....	832.57	163.75
			<i>For Galvanized Steel Tanks, Add</i>	292.48	
23 21 16 00-0354	EA		80 Gallon, 20-1/4" x 68" ASME Construction Compression Tank.....	865.12	170.14
			<i>For Galvanized Steel Tanks, Add</i>	303.73	
23 21 16 00-0355	EA		100 Gallon, 20-1/4" x 82" ASME Construction Compression Tank.....	1,062.09	185.32
			<i>For Galvanized Steel Tanks, Add</i>	390.91	
23 21 16 00-0356	EA		120 Gallon, 24-1/4" x 71-1/2" ASME Construction Compression Tank.....	1,156.35	198.90
			<i>For Galvanized Steel Tanks, Add</i>	427.47	
23 21 16 00-0357	EA		144 Gallon, 24-1/4" x 83-1/2" ASME Construction Compression Tank.....	1,430.57	224.45
			<i>For Galvanized Steel Tanks, Add</i>	545.34	
23 21 16 00-0358	EA		180 Gallon, 30" x 60" ASME Construction Compression Tank.....	1,807.03	257.21
			<i>For Galvanized Steel Tanks, Add</i>	708.70	
23 21 16 00-0359	EA		202 Gallon, 30" x 72" ASME Construction Compression Tank.....	2,156.40	285.16
			<i>For Galvanized Steel Tanks, Add</i>	862.32	
23 21 16 00-0360	EA		230 Gallon, 30" x 84" ASME Construction Compression Tank.....	2,357.61	309.92
			<i>For Galvanized Steel Tanks, Add</i>	943.87	
23 21 16 00-0361	EA		280 Gallon, 30" x 96" ASME Construction Compression Tank.....	2,959.91	340.27
			<i>For Galvanized Steel Tanks, Add</i>	1,222.29	
23 21 16 00-0362	EA		306 Gallon, 30" x 108" ASME Construction Compression Tank.....	3,058.30	363.44
			<i>For Galvanized Steel Tanks, Add</i>	1,253.72	
23 21 16 00-0363	EA		340 Gallon, 36" x 84" ASME Construction Compression Tank.....	3,913.31	390.60
			<i>For Galvanized Steel Tanks, Add</i>	1,660.82	
23 21 16 00-0364	EA		550 Gallon, 36" x 96" ASME Construction Compression Tank.....	6,449.50	458.49
			<i>For Galvanized Steel Tanks, Add</i>	2,877.46	
23 21 16 00-0365			Compression Tank Air Fittings ^(23 21 16)		
23 21 16 00-0366	EA		9" To 24" Diameter Compression Tank Air Fittings.....	98.47	22.36
23 21 16 00-0367	EA		>100 Gallon Compression Tank Air Fittings.....	286.59	26.36
23 21 16 00-0368			Vortex Air Separators With Strainer ^(23 21 16)		
			Note: Separators are priced by capacity in gallons per minute and by boiler connection sizes and types.		
23 21 16 00-0369	EA		2" Threaded, 56 GPM, 125 PSI, With Strainer, Vortex Air Separator (Rolairtrol R-2N).....	920.04	170.14
			<i>For 300 PSIG, Add</i>	99.36	
23 21 16 00-0370	EA		2-1/2" Threaded, 90 GPM, 125 PSI, With Strainer, Vortex Air Separator (Rolairtrol R-2-1/2N).....	1,134.57	194.90
			<i>For 300 PSIG, Add</i>	125.81	
23 21 16 00-0371	EA		3" Threaded, 190 GPM, 125 PSI, With Strainer, Vortex Air Separator (Rolairtrol R-3N).....	1,726.89	229.25
			<i>For 300 PSIG, Add</i>	206.94	
23 21 16 00-0372	EA		3" Flanged, 190 GPM, 125 PSI, With Strainer, Vortex Air Separator (Rolairtrol R-3F).....	1,845.28	242.69
			<i>For 300 PSIG, Add</i>	221.64	
23 21 16 00-0373	EA		4" Flanged, 300 GPM, 125 PSI, With Strainer, Vortex Air Separator (Rolairtrol R-4F).....	2,383.31	323.59
			<i>For 300 PSIG, Add</i>	283.95	
23 21 16 00-0374	EA		5" Flanged, 500 GPM, 125 PSI, With Strainer, Vortex Air Separator (Rolairtrol R-5F).....	3,023.61	399.90
			<i>For 300 PSIG, Add</i>	362.73	
23 21 16 00-0375	EA		6" Flanged, 700 GPM, 125 PSI, With Strainer, Vortex Air Separator (Rolairtrol R-6F).....	3,582.49	452.83
			<i>For 300 PSIG, Add</i>	434.46	
23 21 16 00-0376	EA		8" Flanged, 1,300 GPM, 125 PSI, With Strainer, Vortex Air Separator (Rolairtrol R-8F).....	5,126.74	543.25
			<i>For 300 PSIG, Add</i>	645.51	
23 21 16 00-0377	EA		10" Flanged, 2,000 GPM, 125 PSI, With Strainer, Vortex Air Separator (Rolairtrol R-10F).....	7,841.44	617.50
			<i>For 300 PSIG, Add</i>	1,035.88	
23 21 16 00-0378	EA		12" Flanged, 2,750 GPM, 125 PSI, With Strainer, Vortex Air Separator (Rolairtrol R-12F).....	10,569.63	799.07
			<i>For 300 PSIG, Add</i>	1,403.83	
23 21 16 00-0379	EA		14" Flanged, 3400 GPM With Strainer, Vortex Air Separator (Rolairtrol R-14F).....	21,860.36	970.35
			<i>For 300 PSIG, Add</i>	3,058.52	
23 21 16 00-0380	EA		16" Flanged, 4400 GPM With Strainer, Vortex Air Separator (Rolairtrol R-16F).....	26,979.80	1,164.42
			<i>For 300 PSIG, Add</i>	3,782.33	
23 21 16 00-0381	EA		18" Flanged, 5200 GPM With Strainer, Vortex Air Separator (Rolairtrol R-18F).....	35,165.09	1,358.49
			<i>For 300 PSIG, Add</i>	4,966.01	
23 21 16 00-0382	EA		20" Flanged, 6300 GPM With Strainer, Vortex Air Separator (Rolairtrol R-20F).....	41,136.04	1,552.57
			<i>For 300 PSIG, Add</i>	5,817.55	
23 21 16 00-0383			Vortex Air Separators ^(23 21 16)		
			Note: Without system strainer.		
23 21 16 00-0384	EA		2" Threaded, 56 GPM, 125 PSI, Vortex Air Separator (Rolairtrol RL-2N).....	790.70	170.14
			<i>For 300 PSIG, Add</i>	79.95	
23 21 16 00-0385	EA		2-1/2" Threaded, 90 GPM, 125 PSI, Vortex Air Separator (Rolairtrol RL-2-1/2N).....	993.48	194.90
			<i>For 300 PSIG, Add</i>	104.65	
23 21 16 00-0386	EA		3" Threaded, 190 GPM, 125 PSI, Vortex Air Separator (Rolairtrol RL-3N).....	1,691.62	229.25
			<i>For 300 PSIG, Add</i>	201.65	
23 21 16 00-0387	EA		3" Flanged, 190 GPM, 125 PSI, Vortex Air Separator (Rolairtrol RL-3F).....	1,535.66	242.69
			<i>For 300 PSIG, Add</i>	175.19	
23 21 16 00-0388	EA		4" Flanged, 300 GPM, 125 PSI, Vortex Air Separator (Rolairtrol RL-4F).....	2,058.01	323.59
			<i>For 300 PSIG, Add</i>	235.16	
23 21 16 00-0389	EA		5" Flanged, 530 GPM, 125 PSI, Vortex Air Separator (Rolairtrol RL-5F).....	2,682.63	399.90
			<i>For 300 PSIG, Add</i>	311.59	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21 16 00-0390 EA 6" Flanged, 850 GPM, 125 PSI, Vortex Air Separator (Rolairtrol RL-6F).....	3,120.01	452.83
<i>For 300 PSIG, Add</i>	365.09	
23 21 16 00-0391 EA 8" Flanged, 1,900 GPM Vortex Air Separator (Rolairtrol RL-8F)	8,442.49	543.25
<i>For 300 PSIG, Add</i>	1,142.87	
23 21 16 00-0392 EA 10" Flanged, 3,600 GPM Vortex Air Separator (Rolairtrol RL-10F)	5,728.93	617.50
<i>For 300 PSIG, Add</i>	719.00	
23 21 16 00-0393 EA 12" Flanged, 4,800 GPM Vortex Air Separator (Rolairtrol RL-12F)	8,794.66	799.07
<i>For 300 PSIG, Add</i>	1,137.58	
23 21 16 00-0394 Grooved, With Strainer, Vortex Air Separators <small>(23 21 16)</small>		
23 21 16 00-0395 EA 3" Grooved, 190 GPM, With Strainer, Vortex Air Separator (Rolairtrol R-3G)	1,614.97	194.15
23 21 16 00-0396 EA 4" Grooved, 300 GPM, With Strainer, Vortex Air Separator (Rolairtrol R-4G)	2,285.01	258.70
23 21 16 00-0397 EA 5" Grooved, 500 GPM, With Strainer, Vortex Air Separator (Rolairtrol R-5G)	2,902.51	319.63
23 21 16 00-0398 EA 6" Grooved, 700 GPM, With Strainer, Vortex Air Separator (Rolairtrol R-6G)	3,445.22	362.27
23 21 16 00-0399 EA 8" Grooved, 1,300 GPM, With Strainer, Vortex Air Separator (Rolairtrol R-8G)	4,954.23	434.72
23 21 16 00-0400 EA 10" Grooved, 2,000 GPM, With Strainer, Vortex Air Separator (Rolairtrol R-10G)	7,960.02	494.00
23 21 16 00-0401 EA 12" Grooved, 2,750 GPM, With Strainer, Vortex Air Separator (Rolairtrol R-12G)	12,093.48	639.33
23 21 16 00-0402 Grooved Vortex Air Separators <small>(23 21 16)</small>		
Note: Without system strainer.		
23 21 16 00-0403 EA 3" Grooved, 190 GPM Vortex Air Separator (Rolairtrol RL-3G)	1,293.59	194.15
23 21 16 00-0404 EA 4" Grooved, 300 GPM Vortex Air Separator (Rolairtrol RL-4G)	1,959.71	258.70
23 21 16 00-0405 EA 5" Grooved, 530 GPM Vortex Air Separator (Rolairtrol RL-5G)	2,561.53	319.63
23 21 16 00-0406 EA 6" Grooved, 850 GPM Vortex Air Separator (Rolairtrol RL-6G)	2,982.74	362.27
23 21 16 00-0407 EA 8" Grooved, 1,900 GPM Vortex Air Separator (Rolairtrol RL-8G)	3,974.40	434.72
23 21 16 00-0408 EA 10" Grooved, 3,600 GPM Vortex Air Separator (Rolairtrol RL-10G)	5,816.15	494.00
23 21 16 00-0409 EA 12" Grooved, 4,800 GPM Vortex Air Separator (Rolairtrol RL-12G)	9,621.11	639.33
23 21 16 00-0410 Basket Strainers <small>(23 21 16)</small>		
23 21 16 00-0411 Bronze Body Basket Strainers <small>(23 21 16 00-0410)</small>		
23 21 16 00-0412 Screwed Ends, Bronze Body Basket Strainers <small>(23 21 16 00-0411)</small>		
23 21 16 00-0413 EA 1/2" Screwed Ends, Bronze Body Basket Strainer.....	135.66	15.98
<i>For Work In Restricted Working Space, Add</i>	9.51	
23 21 16 00-0414 EA 3/4" Screwed Ends, Bronze Body Basket Strainer.....	160.23	18.77
<i>For Work In Restricted Working Space, Add</i>	11.17	
23 21 16 00-0415 EA 1" Screwed Ends, Bronze Body Basket Strainer.....	186.38	22.36
<i>For Work In Restricted Working Space, Add</i>	13.31	
23 21 16 00-0416 EA 1-1/4" Screwed Ends, Bronze Body Basket Strainer	229.54	24.76
<i>For Work In Restricted Working Space, Add</i>	14.84	
23 21 16 00-0417 EA 1-1/2" Screwed Ends, Bronze Body Basket Strainer	269.90	27.95
<i>For Work In Restricted Working Space, Add</i>	16.76	
23 21 16 00-0418 EA 2" Screwed Ends, Bronze Body Basket Strainer.....	393.52	31.95
<i>For Work In Restricted Working Space, Add</i>	19.19	
23 21 16 00-0419 EA 2-1/2" Screwed Ends, Bronze Body Basket Strainer	554.53	42.73
<i>For Work In Restricted Working Space, Add</i>	25.70	
23 21 16 00-0420 EA 3" Screwed Ends, Bronze Body Basket Strainer.....	766.97	45.53
<i>For Work In Restricted Working Space, Add</i>	27.26	
23 21 16 00-0421 Flanged, Bronze Body Basket Strainers <small>(23 21 16 00-0411)</small>		
23 21 16 00-0422 EA 2" Flanged, Bronze Body Basket Strainer.....	685.57	93.06
<i>For Work In Restricted Working Space, Add</i>	55.84	
23 21 16 00-0423 EA 2-1/2" Flanged, Bronze Body Basket Strainer	1,064.98	141.78
<i>For Work In Restricted Working Space, Add</i>	85.07	
23 21 16 00-0424 EA 3" Flanged, Bronze Body Basket Strainer.....	1,248.41	182.52
<i>For Work In Restricted Working Space, Add</i>	109.52	
23 21 16 00-0425 EA 4" Flanged, Bronze Body Basket Strainer.....	1,920.67	212.88
<i>For Work In Restricted Working Space, Add</i>	127.74	
23 21 16 00-0426 EA 6" Flanged, Bronze Body Basket Strainer.....	3,543.88	294.04
<i>For Work In Restricted Working Space, Add</i>	176.43	
23 21 16 00-0427 EA 8" Flanged, Bronze Body Basket Strainer.....	6,192.56	352.86
<i>For Work In Restricted Working Space, Add</i>	211.70	
23 21 16 00-0428 Iron Body Basket Strainers <small>(23 21 16 00-0410)</small>		
23 21 16 00-0429 Screwed Ends, Iron Body Basket Strainers <small>(23 21 16 00-0428)</small>		
23 21 16 00-0430 EA 1/2" Screwed Ends, Iron Body Basket Strainer.....	149.68	15.98
<i>For Work In Restricted Working Space, Add</i>	9.51	
23 21 16 00-0431 EA 3/4" Screwed Ends, Iron Body Basket Strainer.....	169.29	18.77
<i>For Work In Restricted Working Space, Add</i>	11.17	
23 21 16 00-0432 EA 1" Screwed Ends, Iron Body Basket Strainer.....	200.23	22.36
<i>For Work In Restricted Working Space, Add</i>	13.31	
23 21 16 00-0433 EA 1-1/4" Screwed Ends, Iron Body Basket Strainer.....	258.38	24.76
<i>For Work In Restricted Working Space, Add</i>	14.84	
23 21 16 00-0434 EA 1-1/2" Screwed Ends, Iron Body Basket Strainer.....	284.24	27.95
<i>For Work In Restricted Working Space, Add</i>	16.76	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 20 HVAC Piping And Pumps****23 21 Hydronic Piping And Pumps**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21 16 00-0435	EA		2" Screwed Ends, Iron Body Basket Strainer.....	336.73	31.95
			<i>For Work In Restricted Working Space, Add</i>	19.19	
23 21 16 00-0436	EA		2-1/2" Screwed Ends, Iron Body Basket Strainer.....	475.34	42.73
			<i>For Work In Restricted Working Space, Add</i>	25.70	
23 21 16 00-0437	EA		3" Screwed Ends, Iron Body Basket Strainer.....	534.66	45.53
			<i>For Work In Restricted Working Space, Add</i>	27.26	
23 21 16 00-0438			Flanged, Iron Body Basket Strainers (23 21 16 00-0428)		
23 21 16 00-0439	EA		2" Flanged, Iron Body Basket Strainer.....	582.50	93.06
			<i>For Work In Restricted Working Space, Add</i>	55.84	
23 21 16 00-0440	EA		2-1/2" Flanged, Iron Body Basket Strainer.....	817.79	141.78
			<i>For Work In Restricted Working Space, Add</i>	85.07	
23 21 16 00-0441	EA		3" Flanged, Iron Body Basket Strainer.....	933.76	182.52
			<i>For Work In Restricted Working Space, Add</i>	109.52	
23 21 16 00-0442	EA		4" Flanged, Iron Body Basket Strainer.....	1,281.69	212.88
			<i>For Work In Restricted Working Space, Add</i>	127.74	
23 21 16 00-0443	EA		6" Flanged, Iron Body Basket Strainer.....	2,253.95	294.04
			<i>For Work In Restricted Working Space, Add</i>	176.43	
23 21 16 00-0444	EA		8" Flanged, Iron Body Basket Strainer.....	3,778.88	352.86
			<i>For Work In Restricted Working Space, Add</i>	211.70	
23 21 16 00-0445	EA		10" Flanged, Iron Body Basket Strainer.....	5,426.19	401.01
			<i>For Work In Restricted Working Space, Add</i>	240.61	
23 21 16 00-0446	EA		12" Flanged, Iron Body Basket Strainer.....	6,523.69	518.99
			<i>For Work In Restricted Working Space, Add</i>	311.36	
23 21 16 00-0447	EA		14" Flanged, Iron Body Basket Strainer.....	8,181.88	629.99
			<i>For Work In Restricted Working Space, Add</i>	378.00	
23 21 16 00-0448	EA		16" Flanged, Iron Body Basket Strainer.....	9,002.51	882.07
			<i>For Work In Restricted Working Space, Add</i>	529.41	
23 21 16 00-0449			Cast Steel Body Basket Strainers (23 21 16 00-0410)		
23 21 16 00-0450			Screwed Ends, Cast Steel Body Basket Strainers (23 21 16 00-0449)		
23 21 16 00-0451	EA		1" Screwed Ends, Cast Steel Body Basket Strainer	346.01	22.36
			<i>For Work In Restricted Working Space, Add</i>	13.31	
23 21 16 00-0452	EA		1-1/4" Screwed Ends, Cast Steel Body Basket Strainer	452.10	24.76
			<i>For Work In Restricted Working Space, Add</i>	14.84	
23 21 16 00-0453	EA		1-1/2" Screwed Ends, Cast Steel Body Basket Strainer	509.59	27.95
			<i>For Work In Restricted Working Space, Add</i>	16.76	
23 21 16 00-0454	EA		2" Screwed Ends, Cast Steel Body Basket Strainer	709.42	31.95
			<i>For Work In Restricted Working Space, Add</i>	19.19	
23 21 16 00-0455	EA		2-1/2" Screwed Ends, Cast Steel Body Basket Strainer	993.15	42.73
			<i>For Work In Restricted Working Space, Add</i>	25.70	
23 21 16 00-0456	EA		3" Screwed Ends, Cast Steel Body Basket Strainer	1,279.56	45.53
			<i>For Work In Restricted Working Space, Add</i>	27.27	
23 21 16 00-0457			Flanged, Cast Steel Body Basket Strainers (23 21 16 00-0449)		
23 21 16 00-0458	EA		2" Flanged, Cast Steel Body Basket Strainer.....	1,125.58	93.06
			<i>For Work In Restricted Working Space, Add</i>	55.84	
23 21 16 00-0459	EA		2-1/2" Flanged, Cast Steel Body Basket Strainer	1,657.58	141.78
			<i>For Work In Restricted Working Space, Add</i>	85.07	
23 21 16 00-0460	EA		3" Flanged, Cast Steel Body Basket Strainer.....	1,866.89	182.52
			<i>For Work In Restricted Working Space, Add</i>	109.52	
23 21 16 00-0461	EA		4" Flanged, Cast Steel Body Basket Strainer.....	2,534.73	212.88
			<i>For Work In Restricted Working Space, Add</i>	127.74	
23 21 16 00-0462	EA		6" Flanged, Cast Steel Body Basket Strainer.....	4,390.58	294.04
			<i>For Work In Restricted Working Space, Add</i>	176.43	
23 21 16 00-0463	EA		8" Flanged, Cast Steel Body Basket Strainer.....	6,936.64	352.86
			<i>For Work In Restricted Working Space, Add</i>	211.70	
23 21 16 00-0464			Stainless Steel Body Basket Strainers (23 21 16 00-0410)		
23 21 16 00-0465			Screwed Ends, Stainless Steel Body Basket Strainers (23 21 16 00-0464)		
23 21 16 00-0466	EA		1" Screwed Ends, Stainless Steel Body Basket Strainer	294.82	22.36
			<i>For Work In Restricted Working Space, Add</i>	13.31	
23 21 16 00-0467	EA		1-1/4" Screwed Ends, Stainless Steel Body Basket Strainer	420.19	24.76
			<i>For Work In Restricted Working Space, Add</i>	14.84	
23 21 16 00-0468	EA		1-1/2" Screwed Ends, Stainless Steel Body Basket Strainer	435.24	27.95
			<i>For Work In Restricted Working Space, Add</i>	16.76	
23 21 16 00-0469	EA		2" Screwed Ends, Stainless Steel Body Basket Strainer	638.01	31.95
			<i>For Work In Restricted Working Space, Add</i>	19.19	
23 21 16 00-0470	EA		2-1/2" Screwed Ends, Stainless Steel Body Basket Strainer	900.24	42.73
			<i>For Work In Restricted Working Space, Add</i>	25.70	
23 21 16 00-0471	EA		3" Screwed Ends, Stainless Steel Body Basket Strainer	1,262.54	45.53
			<i>For Work In Restricted Working Space, Add</i>	27.27	
23 21 16 00-0472			Flanged, Stainless Steel Body Basket Strainers (23 21 16 00-0464)		
23 21 16 00-0473	EA		2" Flanged, Stainless Steel Body Basket Strainer	1,040.39	93.06
			<i>For Work In Restricted Working Space, Add</i>	55.84	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21 16 00-0474 EA 2-1/2" Flanged, Stainless Steel Body Basket Strainer <i>For Work In Restricted Working Space, Add</i>	1,613.92 85.07	141.78
23 21 16 00-0475 EA 3" Flanged, Stainless Steel Body Basket Strainer <i>For Work In Restricted Working Space, Add</i>	1,867.76 109.52	182.52
23 21 16 00-0476 EA 4" Flanged, Stainless Steel Body Basket Strainer <i>For Work In Restricted Working Space, Add</i>	2,967.46 127.74	212.88
23 21 16 00-0477 EA 6" Flanged, Stainless Steel Body Basket Strainer <i>For Work In Restricted Working Space, Add</i>	4,555.59 176.43	294.04
23 21 16 00-0478 EA 8" Flanged, Stainless Steel Body Basket Strainer <i>For Work In Restricted Working Space, Add</i>	7,698.38 211.70	352.86
 23 21 23 Hydronic Pumps (23 21)		
23 21 23 13 In-Line Centrifugal Hydronic Pumps (23 21 23)		
23 21 23 13-0001 Cast Iron Single Stage In-Line Centrifugal Pump (23 21 23 13)		
Note: For general service, 125 LB flanged, 3550 RPM TEFC motor. Includes packed stuffing boxes and ductile iron case.		
23 21 23 13-0002 EA 50 GPM Cast Iron Centrifugal Pump, Single Stage With 100' Head And 3 HP..... <i>For Mechanical Seal, Add</i> <i>For Cast Steel Case, Add</i>	6,939.41 503.99 1,133.99	213.27
23 21 23 13-0003 EA 75 GPM Cast Iron Centrifugal Pump, Single Stage With 100' Head And 5 HP..... <i>For Mechanical Seal, Add</i> <i>For Cast Steel Case, Add</i>	7,527.77 540.29 1,215.66	258.13
23 21 23 13-0004 EA 100 GPM Cast Iron Centrifugal Pump, Single Stage With 150' Head And 7-1/2 HP <i>For Mechanical Seal, Add</i> <i>For Cast Steel Case, Add</i>	8,685.10 621.27 1,397.85	306.67
23 21 23 13-0005 EA 125 GPM Cast Iron Centrifugal Pump, Single Stage With 150' Head And 10 HP..... <i>For Mechanical Seal, Add</i> <i>For Cast Steel Case, Add</i>	9,200.94 638.02 1,435.54	408.89
23 21 23 13-0006 EA 150 GPM Cast Iron Centrifugal Pump, Single Stage With 200' Head And 15 HP..... <i>For Mechanical Seal, Add</i> <i>For Cast Steel Case, Add</i>	11,049.50 776.99 1,748.23	445.66
23 21 23 13-0007 EA 200 GPM Cast Iron Centrifugal Pump, Single Stage With 300' Head And 30 HP..... <i>For Mechanical Seal, Add</i> <i>For Cast Steel Case, Add</i>	16,862.87 1,231.36 2,770.57	490.52
23 21 23 13-0008 EA 250 GPM Cast Iron Centrifugal Pump, Single Stage With 300' Head And 40 HP..... <i>For Mechanical Seal, Add</i> <i>For Cast Steel Case, Add</i>	19,743.32 1,432.38 3,222.86	612.61
23 21 23 13-0009 EA 300 GPM Cast Iron Centrifugal Pump, Single Stage With 300' Head And 50 HP..... <i>For Mechanical Seal, Add</i> <i>For Cast Steel Case, Add</i>	16,236.74 1,130.84 2,544.40	700.12
23 21 23 13-0010 EA 400 GPM Cast Iron Centrifugal Pump, Single Stage With 400' Head And 75 HP..... <i>For Mechanical Seal, Add</i> <i>For Cast Steel Case, Add</i>	35,706.99 2,673.60 6,015.59	762.31
23 21 23 13-0011 EA 600 GPM Cast Iron Centrifugal Pump, Single Stage With 400' Head And 100 HP..... <i>For Mechanical Seal, Add</i> <i>For Cast Steel Case, Add</i>	38,726.97 2,862.92 6,441.57	979.91
 23 21 23 16 Base-Mounted, Centrifugal Hydronic Pumps (23 21 23)		
23 21 23 16-0001 Single Stage, Cast Iron, Horizontal End Suction, Base Mounted Centrifugal Pump (23 21 23 16)		
Note: 1800 RPM, welded steel baseplate, internally flushed mechanical seal, bronze wear ring, galvanized drip pan, and 3 phase 230/460V premium efficiency motor. Bell & Gossett 1510 Series.		
23 21 23 16-0002 EA 5 HP, 50 GPM At 100' Head Single Stage Cast Iron Centrifugal Pump (B&G 1510, 1-1/4 BC, BF, 184T)	3,108.61	233.13
23 21 23 16-0003 EA 7.5 HP, 100 GPM At 100' Head Single Stage Cast Iron Centrifugal Pump (B&G 1510, 1-1/2 BC, BF, 213T)	3,470.83	233.42
23 21 23 16-0004 EA 10 HP, 225 GPM At 100' Head Single Stage Cast Iron Centrifugal Pump (B&G 1510, 2 E, BF, 215T)	4,559.80	306.67
23 21 23 16-0005 EA 15 HP, 250 GPM At 100' Head Single Stage Cast Iron Centrifugal Pump (B&G 1510, 2 E, BF, 254T)	5,036.45	377.27
23 21 23 16-0006 EA 15 HP, 300 GPM At 100' Head Single Stage Cast Iron Centrifugal Pump (B&G 1510, 3 G, BF, 254T)	5,594.31	377.27
23 21 23 16-0007 EA 20 HP, 350 GPM At 100' Head Single Stage Cast Iron Centrifugal Pump (B&G 1510, 3 E, BF, 256T)	5,481.76	408.89
23 21 23 16-0008 EA 20 HP, 500 GPM At 100' Head Single Stage Cast Iron Centrifugal Pump (B&G 1510, 4 E, BF, 256T)	5,798.92	408.89
23 21 23 16-0009 EA 25 HP, 600 GPM At 100' Head Single Stage Cast Iron Centrifugal Pump (B&G 1510, 4 E, BF, 284T)	6,330.62	428.75
23 21 23 16-0010 EA 30 HP, 750 GPM At 100' Head Single Stage Cast Iron Centrifugal Pump (B&G 1510, 5 E, BF, 286T)	7,098.81	544.94
23 21 23 16-0011 EA 40 HP, 1,050 GPM At 100' Head Single Stage Cast Iron Centrifugal Pump (B&G 1510, 5 E, BF, 324T)	7,547.55	612.61
23 21 23 16-0012 EA 60 HP, 1,500 GPM At 100' Head Single Stage Cast Iron Centrifugal Pump (B&G 1510, 6 E, BF, 364T)	12,332.33	1,499.63
23 21 23 16-0013 EA 75 HP, 2,000 GPM At 100' Head Single Stage Cast Iron Centrifugal Pump (B&G 1510, 8 G, BF, 365T)	17,455.74	1,799.23
23 21 23 16-0014 EA 100 HP, 3,000 GPM At 100' Head Single Stage Cast Iron Centrifugal Pump (B&G 1510, 8 G, BF, 404TS)	20,032.31	2,249.04
 23 21 23 16-0015 Single Stage, Vertical Split Case, Cast Iron, Horizontal End Suction, Base Mounted Centrifugal Pump (23 21 23 16)		
Note: 125 LB flanged, 1750 RPM drip-proof motor, common base plate 100' head. Standard seal and motor. For general service.		
23 21 23 16-0016 EA 40 GPM Cast Iron Centrifugal Pump, Single Stage, Vertical Split Case, 1-1/2 HP	2,801.85 623.21	171.35
23 21 23 16-0017 EA 50 GPM Cast Iron Centrifugal Pump, Single Stage, Vertical Split Case, 2 HP	3,491.50 803.93	183.85
23 21 23 16-0018 EA 90 GPM Cast Iron Centrifugal Pump, Single Stage, Vertical Split Case, 3 HP	4,364.01 1,009.29	196.36
23 21 23 16-0019 EA 100 GPM Cast Iron Centrifugal Pump, Single Stage, Vertical Split Case, 5 HP	5,116.02 1,173.95	233.13

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 20 HVAC Piping And Pumps****23 21 Hydronic Piping And Pumps**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21 23 16-0020	EA		150 GPM Cast Iron Centrifugal Pump, Single Stage, Vertical Split Case, 7.5 HP	5,376.57	233.42
			<i>For 300 LB Flanges, Add</i>	1,233.83	
23 21 23 16-0021	EA		200 GPM Cast Iron Centrifugal Pump, Single Stage, Vertical Split Case, 10 HP	5,797.60	306.67
			<i>For 300 LB Flanges, Add</i>	1,311.51	
23 21 23 16-0022	EA		225 GPM Cast Iron Centrifugal Pump, Single Stage, Vertical Split Case, 10 HP	5,797.60	306.67
			<i>For 300 LB Flanges, Add</i>	1,311.51	
23 21 23 16-0023	EA		250 GPM Cast Iron Centrifugal Pump, Single Stage, Vertical Split Case, 10 HP	5,797.60	306.67
			<i>For 300 LB Flanges, Add</i>	1,311.51	
23 21 23 16-0024	EA		300 GPM Cast Iron Centrifugal Pump, Single Stage, Vertical Split Case, 15 HP	7,060.65	377.27
			<i>For 300 LB Flanges, Add</i>	1,595.45	
23 21 23 16-0025	EA		350 GPM Cast Iron Centrifugal Pump, Single Stage, Vertical Split Case, 15 HP	7,181.24	376.98
			<i>For 300 LB Flanges, Add</i>	1,618.75	
23 21 23 16-0026	EA		500 GPM Cast Iron Centrifugal Pump, Single Stage, Vertical Split Case, 20 HP	7,563.85	408.89
			<i>For 300 LB Flanges, Add</i>	1,707.11	
23 21 23 16-0027	EA		600 GPM Cast Iron Centrifugal Pump, Single Stage, Vertical Split Case, 25 HP	8,291.52	428.75
			<i>For 300 LB Flanges, Add</i>	1,874.33	
23 21 23 16-0028	EA		750 GPM Cast Iron Centrifugal Pump, Single Stage, Vertical Split Case, 30 HP	9,231.87	544.94
			<i>For 300 LB Flanges, Add</i>	2,062.83	
23 21 23 16-0029	EA		1,050 GPM Cast Iron Centrifugal Pump, Single Stage, Vertical Split Case, 40 HP	10,466.61	612.61
			<i>For 300 LB Flanges, Add</i>	2,340.87	
23 21 23 16-0030	EA		1,500 GPM Cast Iron Centrifugal Pump, Single Stage, Vertical Split Case, 60 HP	15,541.06	1,499.63
			<i>For 300 LB Flanges, Add</i>	3,162.36	
23 21 23 16-0031	EA		2,000 GPM Cast Iron Centrifugal Pump, Single Stage, Vertical Split Case, 75 HP	18,508.62	1,799.23
			<i>For 300 LB Flanges, Add</i>	3,759.67	
23 21 23 16-0032	EA		3,000 GPM Cast Iron Centrifugal Pump, Single Stage, Vertical Split Case, 100 HP	22,015.34	2,249.04
			<i>For 300 LB Flanges, Add</i>	4,419.48	
23 21 23 16-0033			Single Stage, Horizontal Split Case, Cast Iron, Horizontal End Suction, Base Mounted Centrifugal Pump <small>(23 21 23 16)</small>		
			Note: 125 LB flanged, 1750 RPM drip-proof motor, common base plate 100' head. Standard seal and motor. For general service.		
23 21 23 16-0034	EA		40 GPM Cast Iron Centrifugal Pump, Single Stage, Horizontal Split Case, 1-1/2" HP	4,334.25	171.35
			<i>For 300 LB Flanges, Add</i>	1,006.31	
23 21 23 16-0035	EA		50 GPM Cast Iron Centrifugal Pump, Single Stage, Horizontal Split Case, 2 HP	4,448.56	183.85
			<i>For 300 LB Flanges, Add</i>	1,029.40	
23 21 23 16-0036	EA		90 GPM Cast Iron Centrifugal Pump, Single Stage, Horizontal Split Case, 3 HP	4,562.98	196.36
			<i>For 300 LB Flanges, Add</i>	1,052.49	
23 21 23 16-0037	EA		100 GPM Cast Iron Centrifugal Pump, Single Stage, Horizontal Split Case, 5 HP	4,957.73	200.77
			<i>For 300 LB Flanges, Add</i>	1,149.01	
23 21 23 16-0038	EA		100 GPM Cast Iron Centrifugal Pump, Single Stage, Horizontal Split Case, 7.5 HP	8,097.64	233.13
			<i>For 300 LB Flanges, Add</i>	1,919.35	
23 21 23 16-0039	EA		250 GPM Cast Iron Centrifugal Pump, Single Stage, Horizontal Split Case, 10 HP	10,813.26	306.67
			<i>For 300 LB Flanges, Add</i>	2,584.08	
23 21 23 16-0040	EA		350 GPM Cast Iron Centrifugal Pump, Single Stage, Horizontal Split Case, 15 HP	11,031.68	330.93
			<i>For 300 LB Flanges, Add</i>	2,620.03	
23 21 23 16-0041	EA		500 GPM Cast Iron Centrifugal Pump, Single Stage, Horizontal Split Case, 20 HP	11,660.92	367.70
			<i>For 300 LB Flanges, Add</i>	2,745.52	
23 21 23 16-0042	EA		750 GPM Cast Iron Centrifugal Pump, Single Stage, Horizontal Split Case, 25 HP	13,034.72	381.53
			<i>For 300 LB Flanges, Add</i>	3,087.15	
23 21 23 16-0043	EA		1,000 GPM Cast Iron Centrifugal Pump, Single Stage, Horizontal Split Case, 40 HP	14,604.52	490.32
			<i>For 300 LB Flanges, Add</i>	3,430.60	
23 21 23 16-0044	EA		1,500 GPM Cast Iron Centrifugal Pump, Single Stage, Horizontal Split Case, 50 HP	18,521.45	600.01
			<i>For 300 LB Flanges, Add</i>	4,341.20	
23 21 23 16-0045	EA		2,000 GPM Cast Iron Centrifugal Pump, Single Stage, Horizontal Split Case, 75 HP	20,872.11	749.41
			<i>For 300 LB Flanges, Add</i>	4,856.58	
23 21 23 16-0046	EA		3,000 GPM Cast Iron Centrifugal Pump, Single Stage, Horizontal Split Case, 100 HP	29,736.76	899.61
			<i>For 300 LB Flanges, Add</i>	7,000.45	
23 21 23 16-0047	EA		3,500 GPM Cast Iron Centrifugal Pump, Single Stage, Horizontal Split Case, 150 HP	56,608.79	999.21
			<i>For 300 LB Flanges, Add</i>	13,670.26	
23 21 23 16-0048	EA		4,000 GPM Cast Iron Centrifugal Pump, Single Stage, Horizontal Split Case, 200 HP	60,164.25	1,285.16
			<i>For 300 LB Flanges, Add</i>	14,421.43	
23 21 23 16-0049			Two Stage, Horizontal Split Case, Cast Iron, Horizontal End Suction, Base Mounted Centrifugal Pump <small>(23 21 23 16)</small>		
			Note: 3500 RPM drip-proof motor, common base plate 500' head. Packed stuffing box and boiler feed water service.		
23 21 23 16-0050	EA		100 GPM Cast Iron Centrifugal Pump, Two Stage, Horizontal Split Case, 40 HP	15,472.00	377.27
			<i>For 300 LB Flanges, Add</i>	3,698.29	
23 21 23 16-0051	EA		200 GPM Cast Iron Centrifugal Pump, Two Stage, Horizontal Split Case, 50 HP	16,760.31	408.89
			<i>For 300 LB Flanges, Add</i>	4,006.22	
23 21 23 16-0052	EA		300 GPM Cast Iron Centrifugal Pump, Two Stage, Horizontal Split Case, 75 HP	20,154.25	544.85
			<i>For 300 LB Flanges, Add</i>	4,789.08	
23 21 23 16-0053	EA		400 GPM Cast Iron Centrifugal Pump, Two Stage, Horizontal Split Case, 100 HP	39,731.08	748.65
			<i>For 300 LB Flanges, Add</i>	9,589.74	
23 21 23 16-0054	EA		800 GPM Cast Iron Centrifugal Pump, Two Stage, Horizontal Split Case, 200 HP	48,655.29	998.21
			<i>For 300 LB Flanges, Add</i>	11,706.44	
23 21 23 16-0055			Cast Iron Close Coupling Pumps <small>(23 21 23 16)</small>		
23 21 23 16-0056			Foot Mounted Cast Iron Close Coupled Pumps <small>(23 21 23 16-0055)</small>		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 21 23 16-0057 EA 3 HP, 90 GPM At 50' Head, Foot Mounted, Close Coupled Cast Iron Centrifugal Pump (B&G 1531, 1-1/2 AC, BF, 182JM)	2,794.30	220.62
23 21 23 16-0058 EA 3 HP, 150 GPM At 40' Head, Foot Mounted, Close Coupled Cast Iron Centrifugal Pump (B&G 1531, 2-1/2 AB, BF, 182JM)	3,022.46	220.62
23 21 23 16-0059 EA 5 HP, 225 GPM At 50' Head, Foot Mounted, Close Coupled Cast Iron Centrifugal Pump (B&G 1531, 2-1/2 BB, BF, 184JM)	3,348.81	232.89
23 21 23 16-0060 EA 5 HP, 350 GPM At 25' Head, Foot Mounted, Close Coupled Cast Iron Centrifugal Pump (B&G 1531, 4 AC, BF, 184JM)	3,550.65	232.89
23 21 23 16-0061 EA 7.5 HP, 350 GPM At 40' Head, Foot Mounted, Close Coupled Cast Iron Centrifugal Pump (B&G 1531, 4 AC, BF, 213JM)	4,058.78	244.89
23 21 23 16-0062 EA 10 HP, 600 GPM At 40' Head, Foot Mounted, Close Coupled Cast Iron Centrifugal Pump (B&G 1531, 5 A, BF, 215JM)	4,849.00	306.30
23 21 23 16-0063 EA 15 HP, 1,000 GPM At 40' Head, Foot Mounted, Close Coupled Cast Iron Centrifugal Pump (B&G 1531, 6 BC, BF, 254JP)	6,339.64	377.33
23 21 23 16-0064 EA 20 HP, 1,350 GPM At 30' Head, Foot Mounted, Close Coupled Cast Iron Centrifugal Pump (B&G 1531, 6 BC, BF, 256JP)	6,791.32	408.40
23 21 23 16-0065 EA 25 HP, 1,550 GPM At 40' Head, Foot Mounted, Close Coupled Cast Iron Centrifugal Pump (B&G 1531, 6 BC, BF, 284JP)	7,832.03	441.07
23 21 23 16-0066 Pumps, Polypropylene Body, Housing And Impeller, 115/230 Volt (23 21 23 16)		
23 21 23 16-0067 EA 1/3 HP, Centrifugal Pump, Polypropylene Body	1,775.68	113.99
23 21 23 16-0068 EA 1/2 HP, Centrifugal Pump, Polypropylene Body	1,895.78	120.86
23 21 23 16-0069 EA 3/4 HP, Centrifugal Pump, Polypropylene Body	2,236.54	128.69
23 21 23 23 Vertical-Turbine Hydronic Pumps (23 21 23)		
23 21 23 23-0001 Cast Iron, Bronze Fitted Vertical Turbine Wet Sump Pumps (23 21 23 23)		
Note: For water supply, cooling towers and process liquids. Multi-stage 1750 RPM drip-proof motor. For 1' to 5' sump depth.		
23 21 23 23-0002 EA 50 GPM Cast Iron Turbine Pump, 3" Discharge 100' Head, 10 Stage, 2 HP	7,945.84	544.94
<i>For Basket Strainer, Galvanized. Steel Pipe Sizes 3" To 8", Add</i>		
	285.15	
<i>For Basket Strainer, Galvanized Steel Pipe Sizes 10" And Larger, Add</i>		
	205.69	
<i>For Each Extra Column Assembly <60", Add</i>		
	668.35	
23 21 23 23-0003 EA 100 GPM Cast Iron Turbine Pump, 4" Discharge 100' Head, 7 Stage, 3 HP	8,319.68	612.61
<i>For Basket Strainer, Galvanized. Steel Pipe Sizes 3" To 8", Add</i>		
	299.84	
<i>For Basket Strainer, Galvanized Steel Pipe Sizes 10" And Larger, Add</i>		
	216.64	
<i>For Each Extra Column Assembly <60", Add</i>		
	698.52	
23 21 23 23-0004 EA 250 GPM Cast Iron Turbine Pump, 6" Discharge 150' Head, 5 Stage, 15 HP	10,086.05	600.01
<i>For Basket Strainer, Galvanized. Steel Pipe Sizes 3" To 8", Add</i>		
	360.41	
<i>For Basket Strainer, Galvanized Steel Pipe Sizes 10" And Larger, Add</i>		
	259.55	
<i>For Each Extra Column Assembly <60", Add</i>		
	849.91	
23 21 23 23-0005 EA 500 GPM Cast Iron Turbine Pump, 6" Discharge 150' Head, 3 Stage, 25 HP	10,880.19	692.38
<i>For Basket Strainer, Galvanized. Steel Pipe Sizes 3" To 8", Add</i>		
	390.72	
<i>For Basket Strainer, Galvanized Steel Pipe Sizes 10" And Larger, Add</i>		
	281.92	
<i>For Each Extra Column Assembly <60", Add</i>		
	914.90	
23 21 23 23-0006 EA 1,000 GPM Cast Iron Turbine Pump, 8" Discharge 150' Head, 2 Stage, 50 HP	13,319.70	749.41
<i>For Basket Strainer, Galvanized. Steel Pipe Sizes 3" To 8", Add</i>		
	484.59	
<i>For Basket Strainer, Galvanized Steel Pipe Sizes 10" And Larger, Add</i>		
	351.40	
<i>For Each Extra Column Assembly <60", Add</i>		
	1,113.77	
23 21 23 23-0007 EA 2,000 GPM Cast Iron Turbine Pump, 10" Discharge 150' Head, 3 Stage, 100 HP	21,084.98	899.61
<i>For Basket Strainer, Galvanized. Steel Pipe Sizes 3" To 8", Add</i>		
	785.57	
<i>For Basket Strainer, Galvanized Steel Pipe Sizes 10" And Larger, Add</i>		
	574.72	
<i>For Each Extra Column Assembly <60", Add</i>		
	1,744.63	
23 21 29 Automatic Condensate Pump Units (23 21)		
23 21 29 00-0001 Automatic Shallow Pan Condensate Pump (23 21 29)		
23 21 29 00-0002 EA 1/150 HP, 205 GPH (Max) Automatic Shallow Pan Condensate Pump (Little Giant 1-ABS)	150.64	23.90
23 21 29 00-0003 EA 1/40 HP, 300 GPH (Max) Automatic Shallow Pan Condensate Pump (Little Giant 2-ABS)	163.51	23.90
23 21 29 00-0004 EA 1/12 HP, 310 GPH (Max) Automatic Shallow Pan Condensate Pump (Little Giant 3-ABS)	255.52	27.58
23 21 29 00-0005 Automatic Condensate Pump With Tank (23 21 29)		
23 21 29 00-0006 EA 1/20 HP Automatic Condensate Pump With Tank (Hartell KT-15-1UL)	82.31	18.39
23 21 29 00-0007 EA 1/30 HP Automatic Condensate Pump With Tank (Little Giant VCMX-20)	87.81	18.39
23 21 29 00-0008 EA 1/50 HP, 200 GPH (Max) Automatic Condensate Removal Pump With Safety Switch (Little Giant VCL-14ULS)	146.43	23.90
23 21 29 00-0009 EA 1/18 HP, 270 GPH (Max) Automatic Condensate Removal Pump With Safety Switch (Little Giant VCL-24ULS)	158.00	27.58
23 21 29 00-0010 EA 1/5 HP, 450 GPH (Max) Automatic Condensate Removal Pump With Safety Switch (Little Giant VCL-45ULS) Condensate Pump	292.80	31.26
23 22 Steam And Condensate Piping And Pumps (23 20)		
23 22 13 Steam and Condensate Heating Piping (23 22)		
23 22 13 00-0001 Ric-Wil System Pipe And Casing (23 22 13)		
Note: Larger pipe size is usually for the condensate return. Perma, Ric-Wil or Thermoac.		
23 22 13 00-0002 Steam Or Condensate Pipe (23 22 13 00-0001)		
Note: Excludes return.		
23 22 13 00-0003 LF 2" Steam Or Condensate Pipe, 6" Case With No Return Line	57.61	6.71

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 20 HVAC Piping And Pumps****23 22 Steam And Condensate Piping And Pumps**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 22 13 00-0004	LF		2" Steam Or Condensate Pipe, 8" Case With No Return Line	61.25	7.46
23 22 13 00-0005	LF		3" Steam Or Condensate Pipe, 8" Case With No Return Line	71.81	8.95
23 22 13 00-0006	LF		4" Steam Or Condensate Pipe, 10" Case With No Return Line	91.72	13.42
23 22 13 00-0007	LF		6" Steam Or Condensate Pipe, 11-1/2" Case With No Return Line	123.92	20.13
23 22 16			Steam And Condensate Heating Piping Specialties (23 22)		
23 22 16 00-0001			High Temperature Safety Relief Valve (23 22 16) Note: Used in steam or water boiler, heating systems and unfired pressure vessel applications.		
23 22 16 00-0002			Cast Iron Body Safety Valve, Steam Or Water (23 22 16 00-0001) Note: Variable set points to 500 psig pressure, 400 Degree F temperature range.		
23 22 16 00-0003			Threaded (23 22 16 00-0002)		
23 22 16 00-0004	EA		3/4" x 1" Threaded Cast Iron Body Safety Relief Valve, Steam or Water	204.35	11.97
23 22 16 00-0005	EA		1" x 1-1/4" Threaded Cast Iron Body Safety Relief Valve, Steam or Water	216.95	14.18
23 22 16 00-0006	EA		1-1/4" x 1-1/2" Threaded Cast Iron Body Safety Relief Valve, Steam or Water	243.71	17.96
23 22 16 00-0007	EA		1-1/2" x 2" Threaded Cast Iron Body Safety Relief Valve, Steam or Water	296.46	19.96
23 22 16 00-0008	EA		2" x 2-1/2" Threaded Cast Iron Body Safety Relief Valve, Steam or Water	377.64	24.55
23 22 16 00-0009	EA		2-1/2" x 2-1/2" Threaded Cast Iron Body Safety Relief Valve, Steam or Water	566.85	27.94
23 22 16 00-0010	EA		3" x 3" Threaded Cast Iron Body Safety Relief Valve, Steam or Water	617.40	32.14
23 22 16 00-0011			Flanged (23 22 16 00-0002)		
23 22 16 00-0012	EA		1-1/2" x 2-1/2" Flanged Cast Iron Body Safety Relief Valve, Steam or Water	1,304.64	19.96
23 22 16 00-0013	EA		2" x 3" Flanged Cast Iron Body Safety Relief Valve, Steam or Water	1,503.05	23.95
23 22 16 00-0014	EA		2-1/2" x 3" Flanged Cast Iron Body Safety Relief Valve, Steam or Water	1,731.83	40.43
23 22 16 00-0015	EA		2-1/2" x 4" Flanged Cast Iron Body Safety Relief Valve, Steam or Water	2,065.77	44.10
23 22 16 00-0016	EA		3" x 3" Flanged Cast Iron Body Safety Relief Valve, Steam or Water	2,243.34	47.77
23 22 16 00-0017	EA		3" x 4" Flanged Cast Iron Body Safety Relief Valve, Steam or Water	2,618.03	55.13
23 22 16 00-0018	EA		4" x 6" Flanged Cast Iron Body Safety Relief Valve, Steam or Water	4,393.60	88.28
23 22 16 00-0019	EA		6" x 8" Flanged Cast Iron Body Safety Relief Valve, Steam or Water	8,542.60	91.88
23 22 16 00-0020			Bronze Body Safety Valve, Threaded, Steam (23 22 16 00-0001) Note: Variable set points to 250 psig pressure, 400 Degree F temperature range. Valve also can be set for Air or Gas with variable set points to 300 psig pressure.		
23 22 16 00-0021	EA		3/4" x 3/4" Threaded Bronze Body Safety Relief Valve, Steam	218.51	10.98
23 22 16 00-0022	EA		3/4" x 1" Threaded Bronze Body Safety Relief Valve, Steam	225.19	11.97
23 22 16 00-0023	EA		1" x 1" Threaded Bronze Body Safety Relief Valve, Steam	262.01	13.17
23 22 16 00-0024	EA		1" x 1-1/4" Threaded Bronze Body Safety Relief Valve, Steam	288.63	14.18
23 22 16 00-0025	EA		1-1/4" x 1-1/4" Threaded Bronze Body Safety Relief Valve, Steam	333.15	15.97
23 22 16 00-0026	EA		1-1/4" x 1-1/2" Threaded Bronze Body Safety Relief Valve, Steam	338.38	17.96
23 22 16 00-0027	EA		1-1/2" x 1-1/2" Threaded Bronze Body Safety Relief Valve, Steam	378.28	18.96
23 22 16 00-0028	EA		1-1/2" x 2" Threaded Bronze Body Safety Relief Valve, Steam	410.94	19.96
23 22 16 00-0029	EA		2" x 2" Threaded Bronze Body Safety Relief Valve, Steam	560.62	22.35
23 22 16 00-0030	EA		2" x 2-1/2" Threaded Bronze Body Safety Relief Valve, Steam	612.92	24.55
23 22 16 00-0031	EA		2-1/2" x 2-1/2" Threaded Bronze Body Safety Relief Valve, Steam	728.83	27.94
23 22 16 00-0032			Bronze Body Safety Valve, Threaded, Water (23 22 16 00-0001) Note: Variable set points to 160 psig pressure, 250 Degree F temperature range.		
23 22 16 00-0033	EA		3/4" x 3/4" Threaded Bronze Body Safety Relief Valve, Water	113.59	10.98
23 22 16 00-0034	EA		3/4" x 1" Threaded Bronze Body Safety Relief Valve, Water	128.47	11.97
23 22 16 00-0035	EA		1" x 1" Threaded Bronze Body Safety Relief Valve, Water	171.64	13.17
23 22 16 00-0036	EA		1" x 1-1/4" Threaded Bronze Body Safety Relief Valve, Water	188.36	14.18
23 22 16 00-0037	EA		1-1/4" x 1-1/4" Threaded Bronze Body Safety Relief Valve, Water	264.08	15.97
23 22 16 00-0038	EA		1-1/2" x 1-1/2" Threaded Bronze Body Safety Relief Valve, Water	351.46	18.96
23 22 16 00-0039	EA		2" x 2" Threaded Bronze Body Safety Relief Valve, Water	502.85	22.35
23 22 16 00-0040			Steam Temperature Regulator, Iron Body (23 22 16)		
23 22 16 00-0041			Single Seated Spring Loaded Direct Acting Diaphragm Valve, Steam Temperature Regulator, Iron Body (23 22 16 00-0040) Note: Up to 150 PSI.		
23 22 16 00-0042	EA		1/2" Single Seated Spring Loaded Direct Acting Diaphragm Valve, Steam Temperature Regulator, Iron Body	500.47	11.50
23 22 16 00-0043	EA		3/4" Single Seated Spring Loaded Direct Acting Diaphragm Valve, Steam Temperature Regulator, Iron Body	530.06	15.49
23 22 16 00-0044	EA		1" Single Seated Spring Loaded Direct Acting Diaphragm Valve, Steam Temperature Regulator, Iron Body	701.93	19.08
23 22 16 00-0045	EA		1-1/4" Single Seated Spring Loaded Direct Acting Diaphragm Valve, Steam Temperature Regulator, Iron Body	778.10	24.12
23 22 16 00-0046	EA		1-1/2" Single Seated Spring Loaded Direct Acting Diaphragm Valve, Steam Temperature Regulator, Iron Body	801.60	27.71
23 22 16 00-0047	EA		2" Single Seated Spring Loaded Direct Acting Diaphragm Valve, Steam Temperature Regulator, Iron Body	944.52	30.13
23 22 16 00-0048	EA		2-1/2" Single Seated Spring Loaded Direct Acting Diaphragm Valve, Steam Temperature Regulator, Iron Body	1,220.07	55.20
23 22 16 00-0049	EA		3" Single Seated Spring Loaded Direct Acting Diaphragm Valve, Steam Temperature Regulator, Iron Body	1,532.86	60.20
23 22 16 00-0050	EA		4" Single Seated Spring Loaded Direct Acting Diaphragm Valve, Steam Temperature Regulator, Iron Body	2,302.22	140.91
23 22 16 00-0051	EA		6" Single Seated Spring Loaded Direct Acting Diaphragm Valve, Steam Temperature Regulator, Iron Body	3,755.93	165.38
23 22 16 00-0052			Single Seated Spring Loaded Reverse Acting Diaphragm Valve, Steam Temperature Regulator, Iron Body (23 22 16 00-0040)		
23 22 16 00-0053	EA		1/2" Single Seated Spring Loaded Reverse Acting Diaphragm Valve, Steam Temperature Regulator, Iron Body	736.17	11.50



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 22 16 00-0054 EA 3/4" Single Seated Spring Loaded Reverse Acting Diaphragm Valve, Steam Temperature Regulator, Iron Body.....	766.12	15.49
23 22 16 00-0055 EA 1" Single Seated Spring Loaded Reverse Acting Diaphragm Valve, Steam Temperature Regulator, Iron Body.....	803.30	19.08
23 22 16 00-0056 EA 1-1/4" Single Seated Spring Loaded Reverse Acting Diaphragm Valve, Steam Temperature Regulator, Iron Body.....	962.79	24.12
23 22 16 00-0057 EA 1-1/2" Single Seated Spring Loaded Reverse Acting Diaphragm Valve, Steam Temperature Regulator, Iron Body.....	1,033.51	27.71
23 22 16 00-0058 EA 2" Single Seated Spring Loaded Reverse Acting Diaphragm Valve, Steam Temperature Regulator, Iron Body.....	1,172.25	30.13
23 22 16 00-0059 EA 2-1/2" Single Seated Spring Loaded Reverse Acting Diaphragm Valve, Steam Temperature Regulator, Iron Body.....	1,806.08	55.20
23 22 16 00-0060 EA 3" Single Seated Spring Loaded Reverse Acting Diaphragm Valve, Steam Temperature Regulator, Iron Body.....	2,097.37	60.20
23 22 16 00-0061 EA 4" Single Seated Spring Loaded Reverse Acting Diaphragm Valve, Steam Temperature Regulator, Iron Body.....	2,963.99	140.91
23 22 16 00-0062 EA 6" Single Seated Spring Loaded Reverse Acting Diaphragm Valve, Steam Temperature Regulator, Iron Body.....	4,721.53	165.38
23 22 16 00-0063 Double Seated Spring Loaded Direct Acting Diaphragm Valve, Steam Temperature Regulator, Iron Body (23 22 16 00-0040)		
23 22 16 00-0064 EA 1/2" Double Seated Spring Loaded Direct Acting Diaphragm Valve, Steam Temperature Regulator, Iron Body	998.98	11.50
23 22 16 00-0065 EA 3/4" Double Seated Spring Loaded Direct Acting Diaphragm Valve, Steam Temperature Regulator, Iron Body	1,017.46	15.49
23 22 16 00-0066 EA 1" Double Seated Spring Loaded Direct Acting Diaphragm Valve, Steam Temperature Regulator, Iron Body	1,115.74	19.08
23 22 16 00-0067 EA 1-1/4" Double Seated Spring Loaded Direct Acting Diaphragm Valve, Steam Temperature Regulator, Iron Body	1,218.30	24.12
23 22 16 00-0068 EA 1-1/2" Double Seated Spring Loaded Direct Acting Diaphragm Valve, Steam Temperature Regulator, Iron Body	1,265.41	27.71
23 22 16 00-0069 EA 2" Double Seated Spring Loaded Direct Acting Diaphragm Valve, Steam Temperature Regulator, Iron Body	1,426.38	30.13
23 22 16 00-0070 EA 2-1/2" Double Seated Spring Loaded Direct Acting Diaphragm Valve, Steam Temperature Regulator, Iron Body	2,639.26	55.20
23 22 16 00-0071 EA 3" Double Seated Spring Loaded Direct Acting Diaphragm Valve, Steam Temperature Regulator, Iron Body	2,943.38	60.20
23 22 16 00-0072 EA 4" Double Seated Spring Loaded Direct Acting Diaphragm Valve, Steam Temperature Regulator, Iron Body	3,792.34	140.91
23 22 16 00-0073 EA 6" Double Seated Spring Loaded Direct Acting Diaphragm Valve, Steam Temperature Regulator, Iron Body	5,284.55	165.38
23 22 16 00-0074 Double Seated Spring Loaded Reverse Acting Diaphragm Valve, Steam Temperature Regulator, Iron Body (23 22 16 00-0040)		
23 22 16 00-0075 EA 1/2" Double Seated Spring Loaded Reverse Acting Diaphragm Valve, Steam Temperature Regulator, Iron Body	1,276.71	11.50
23 22 16 00-0076 EA 3/4" Double Seated Spring Loaded Reverse Acting Diaphragm Valve, Steam Temperature Regulator, Iron Body	1,293.81	15.49
23 22 16 00-0077 EA 1" Double Seated Spring Loaded Reverse Acting Diaphragm Valve, Steam Temperature Regulator, Iron Body	1,407.36	19.08
23 22 16 00-0078 EA 1-1/4" Double Seated Spring Loaded Reverse Acting Diaphragm Valve, Steam Temperature Regulator, Iron Body	1,471.02	24.12
23 22 16 00-0079 EA 1-1/2" Double Seated Spring Loaded Reverse Acting Diaphragm Valve, Steam Temperature Regulator, Iron Body	1,530.63	27.71
23 22 16 00-0080 EA 2" Double Seated Spring Loaded Reverse Acting Diaphragm Valve, Steam Temperature Regulator, Iron Body	1,666.61	30.13
23 22 16 00-0081 EA 2-1/2" Double Seated Spring Loaded Reverse Acting Diaphragm Valve, Steam Temperature Regulator, Iron Body	2,778.13	55.20
23 22 16 00-0082 EA 3" Double Seated Spring Loaded Reverse Acting Diaphragm Valve, Steam Temperature Regulator, Iron Body	3,090.77	60.20
23 22 16 00-0083 EA 4" Double Seated Spring Loaded Reverse Acting Diaphragm Valve, Steam Temperature Regulator, Iron Body	3,939.73	140.91
23 22 16 00-0084 EA 6" Double Seated Spring Loaded Reverse Acting Diaphragm Valve, Steam Temperature Regulator, Iron Body	5,431.94	165.38
23 22 16 00-0085 Steam Traps (23 22 16)		
23 22 16 00-0086 Inverted Bucket Steam Traps (23 22 16 00-0085)		
23 22 16 00-0087 EA 1/2" 250 PSI Inverted Bucket Cast Iron Steam Trap.....	206.43	23.96
<i>For Work In Restricted Working Space, Add</i>	14.38	
23 22 16 00-0088 EA 3/4" 250 PSI Inverted Bucket Cast Iron Steam Trap.....	208.42	24.96
<i>For Work In Restricted Working Space, Add</i>	14.98	
23 22 16 00-0089 EA 1" 250 PSI Inverted Bucket Cast Iron Steam Trap.....	308.40	26.60
<i>For Work In Restricted Working Space, Add</i>	15.98	
23 22 16 00-0090 EA 1-1/4" 250 PSI Inverted Bucket Cast Iron Steam Trap.....	497.86	36.30
<i>For Work In Restricted Working Space, Add</i>	21.79	
23 22 16 00-0091 EA 1-1/2" 250 PSI Inverted Bucket Cast Iron Steam Trap.....	739.77	44.74
<i>For Work In Restricted Working Space, Add</i>	26.63	
23 22 16 00-0092 EA 2" 250 PSI Inverted Bucket Cast Iron Steam Trap.....	945.45	66.56
<i>For Work In Restricted Working Space, Add</i>	39.94	
23 22 16 00-0093 Float And Thermostatic Steam Traps (23 22 16 00-0085)		
23 22 16 00-0094 EA 3/4" 15 PSI Maximum Pressure Float And Thermostatic Steam Trap	218.15	24.96
<i>For Work In Restricted Working Space, Add</i>	14.98	
23 22 16 00-0095 EA 1" 15 PSI Maximum Pressure Float And Thermostatic Steam Trap	286.48	26.62
<i>For Work In Restricted Working Space, Add</i>	15.98	
23 22 16 00-0096 EA 1-1/4" 15 PSI Maximum Pressure Float And Thermostatic Steam Trap	354.83	36.30
<i>For Work In Restricted Working Space, Add</i>	21.79	
23 22 16 00-0097 EA 1-1/2" 15 PSI Maximum Pressure Float And Thermostatic Steam Trap	479.21	44.37
<i>For Work In Restricted Working Space, Add</i>	26.63	
23 22 16 00-0098 EA 2" 15 PSI Maximum Pressure Float And Thermostatic Steam Trap	874.08	66.53
<i>For Work In Restricted Working Space, Add</i>	39.94	
23 22 16 00-0099 EA 3/4" 30 PSI Maximum Pressure Float And Thermostatic Steam Trap	276.71	24.96
<i>For Work In Restricted Working Space, Add</i>	14.98	
23 22 16 00-0100 EA 1" 30 PSI Maximum Pressure Float And Thermostatic Steam Trap	300.66	26.60
<i>For Work In Restricted Working Space, Add</i>	15.98	
23 22 16 00-0101 EA 1-1/4" 30 PSI Maximum Pressure Float And Thermostatic Steam Trap	393.48	36.30
<i>For Work In Restricted Working Space, Add</i>	21.79	
23 22 16 00-0102 EA 1-1/2" 30 PSI Maximum Pressure Float And Thermostatic Steam Trap	564.25	44.33
<i>For Work In Restricted Working Space, Add</i>	26.63	
23 22 16 00-0103 EA 2" 30 PSI Maximum Pressure Float And Thermostatic Steam Trap	960.42	66.56
<i>For Work In Restricted Working Space, Add</i>	39.94	
23 22 16 00-0104 EA 3/4" 75 PSI Maximum Pressure Float And Thermostatic Steam Trap	357.90	24.96
<i>For Work In Restricted Working Space, Add</i>	14.98	
23 22 16 00-0105 EA 1" 75 PSI Maximum Pressure Float And Thermostatic Steam Trap	398.60	26.62
<i>For Work In Restricted Working Space, Add</i>	15.98	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 20 HVAC Piping And Pumps****23 22 Steam And Condensate Piping And Pumps**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 22 16 00-0106	EA		1-1/4" 75 PSI Maximum Pressure Float And Thermostatic Steam Trap <i>For Work In Restricted Working Space, Add</i>	606.11 21.79	36.30
23 22 16 00-0107	EA		1-1/2" 75 PSI Maximum Pressure Float And Thermostatic Steam Trap <i>For Work In Restricted Working Space, Add</i>	622.25 26.63	44.33
23 22 16 00-0108	EA		2" 75 PSI Maximum Pressure Float And Thermostatic Steam Trap <i>For Work In Restricted Working Space, Add</i>	1,203.96 39.94	66.56
23 22 16 00-0109	EA		3/4" 150 PSI Maximum Pressure Float And Thermostatic Steam Trap <i>For Work In Restricted Working Space, Add</i>	363.05 14.98	24.96
23 22 16 00-0110	EA		1" 150 PSI Maximum Pressure Float And Thermostatic Steam Trap <i>For Work In Restricted Working Space, Add</i>	398.60 15.98	26.62
23 22 16 00-0111	EA		1-1/4" 150 PSI Max Pressure Float And Thermostatic Steam Trap <i>For Work In Restricted Working Space, Add</i>	606.11 21.79	36.30
23 22 16 00-0112	EA		1-1/2" 150 PSI Max Pressure Float And Thermostatic Steam Trap <i>For Work In Restricted Working Space, Add</i>	622.25 26.63	44.33
23 22 16 00-0113	EA		2" 150 PSI Maximum Pressure Float And Thermostatic Steam Trap <i>For Work In Restricted Working Space, Add</i>	1,203.96 39.94	66.56
23 22 16 00-0114			Thermostatic Steam Traps <small>(23 22 16 00-0085)</small>		
23 22 16 00-0115	EA		1/2" 25 PSI Maximum Pressure Thermostatic Steam Trap <i>For Work In Restricted Working Space, Add</i>	107.71 14.38	23.96
23 22 16 00-0116	EA		3/4" 25 PSI Maximum Pressure Thermostatic Steam Trap <i>For Work In Restricted Working Space, Add</i>	177.48 14.98	24.96
23 22 16 00-0117	EA		1" 25 PSI Maximum Pressure Thermostatic Steam Trap <i>For Work In Restricted Working Space, Add</i>	218.49 15.98	26.60
23 22 16 00-0118			Thermodynamic Steam Traps <small>(23 22 16 00-0085)</small>		
23 22 16 00-0119	EA		3/8" 600 PSI Maximum Pressure Thermodynamic Steam Trap	232.77	21.57
23 22 16 00-0120	EA		1/2" 600 PSI Maximum Pressure Thermodynamic Steam Trap	328.85	23.96
23 22 16 00-0121	EA		3/4" 600 PSI Maximum Pressure Thermodynamic Steam Trap	406.86	24.96
23 22 16 00-0122	EA		1" 600 PSI Maximum Pressure Thermodynamic Steam Trap	544.20	26.60
23 22 16 00-0123			Steam Moisture Separator <small>(23 22 16 00-0085)</small>		
23 22 16 00-0124	EA		1/2" Steam Moisture Separator, Threaded Spirax Sarco S1	275.09	39.94
23 22 16 00-0125	EA		3/4" Steam Moisture Separator, Threaded Spirax Sarco S1	311.96	53.92
23 22 16 00-0126	EA		1" Steam Moisture Separator, Threaded.....	371.00	60.71
23 22 16 00-0127	EA		1-1/2" Steam Moisture Separator, Threaded	449.70	69.50
23 22 16 00-0128	EA		2" Steam Moisture Separator, Flanged.....	693.10	106.51
23 22 16 00-0129	EA		2-1/2" Steam Moisture Separator, Flanged.....	850.31	127.80
23 22 16 00-0130	EA		3" Steam Moisture Separator, Flanged.....	1,125.06	159.75
23 22 16 00-0131	EA		4" Steam Moisture Separator, Flanged.....	1,748.97	212.88
23 22 16 00-0132	EA		6" Steam Moisture Separator, Flanged.....	3,484.74	281.97
23 22 16 00-0133			Steam/Condensate Meter <small>(23 22 16)</small>		
Note: Meter shall be of the rotary volumetric type and sized on the maximum estimated steam demand.					
23 22 16 00-0134	EA		1" Steam/Condensate Meter..... <i>For Direct Reading Thermometer, Stainless Steel Case With Trim, Add</i> <i>For Contactor Used For Dial Counter, Add</i> <i>For Direct Reading Pressure Gauge, Add</i> <i>For Steam Meter Pressure-Compensated Counter, Add</i> <i>For Wall Or Panel Mounted Remote Totalizer With Contactor, Add</i>	3,454.22 64.52 567.00 79.82 1,220.00 905.00	44.10
23 22 16 00-0135	EA		2" Steam/Condensate Meter..... <i>For Direct Reading Thermometer, Stainless Steel Case With Trim, Add</i> <i>For Contactor Used For Dial Counter, Add</i> <i>For Direct Reading Pressure Gauge, Add</i> <i>For Steam Meter Pressure-Compensated Counter, Add</i> <i>For Wall Or Panel Mounted Remote Totalizer With Contactor, Add</i>	3,897.85 64.52 567.00 79.82 1,220.00 905.00	51.82
23 22 16 00-0136	EA		2-1/2" Steam/Condensate Meter..... <i>For Direct Reading Thermometer, Stainless Steel Case With Trim, Add</i> <i>For Contactor Used For Dial Counter, Add</i> <i>For Direct Reading Pressure Gauge, Add</i> <i>For Steam Meter Pressure-Compensated Counter, Add</i> <i>For Wall Or Panel Mounted Remote Totalizer With Contactor, Add</i>	4,136.94 64.52 567.00 79.82 1,220.00 905.00	64.31
23 22 16 00-0137	EA		3" Steam/Condensate Meter..... <i>For Direct Reading Thermometer, Stainless Steel Case With Trim, Add</i> <i>For Contactor Used For Dial Counter, Add</i> <i>For Direct Reading Pressure Gauge, Add</i> <i>For Steam Meter Pressure-Compensated Counter, Add</i> <i>For Wall Or Panel Mounted Remote Totalizer With Contactor, Add</i>	4,391.46 64.52 567.00 79.82 1,220.00 905.00	84.53
23 22 16 00-0138	EA		4" Steam/Condensate Meter..... <i>For Direct Reading Thermometer, Stainless Steel Case With Trim, Add</i> <i>For Contactor Used For Dial Counter, Add</i> <i>For Direct Reading Pressure Gauge, Add</i> <i>For Steam Meter Pressure-Compensated Counter, Add</i> <i>For Wall Or Panel Mounted Remote Totalizer With Contactor, Add</i>	4,897.35 64.52 567.00 79.82 1,220.00 905.00	99.59
23 22 16 00-0139	EA		6" Steam/Condensate Meter..... <i>For Direct Reading Thermometer, Stainless Steel Case With Trim, Add</i> <i>For Contactor Used For Dial Counter, Add</i> <i>For Direct Reading Pressure Gauge, Add</i> <i>For Steam Meter Pressure-Compensated Counter, Add</i> <i>For Wall Or Panel Mounted Remote Totalizer With Contactor, Add</i>	9,374.91 64.52 567.00 79.82 1,220.00 905.00	613.73



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 22 16 00-0140 EA 8" Steam/Condensate Meter..... <i>For Direct Reading Thermometer, Stainless Steel Case With Trim, Add For Contactor Used For Dial Counter, Add For Direct Reading Pressure Gauge, Add For Steam Meter Pressure-Compensated Counter, Add For Wall Or Panel Mounted Remote Totalizer With Contactor, Add</i>	9,674.80 64.52 567.00 79.82 1,220.00 905.00	650.70
23 22 23 Steam Condensate Pumps (23 22)		
23 22 23 13 Electric-Driven Steam Condensate Pumps (23 22 23)		
23 22 23 13-0001 Simplex Condensate Pumps And Motors (23 22 23 13)		
Note: Cast iron receiver, float switch.		
23 22 23 13-0002 20 PSI Discharge Pressure (23 22 23 13-0001)		
23 22 23 13-0003 EA 3 To 6 GPM Simplex Condensate Pump And 1/3 HP Motor With 6 Gallon Cast Iron Receiver, Float Switch, 20 PSI Discharge Pressure	1,555.74	374.33
23 22 23 13-0004 EA 9 To 12 GPM Simplex Condensate Pump And 1/3 HP Motor With 13.5 Gallon Cast Iron Receiver, Float Switch, 20 PSI Discharge Pressure	2,015.18	384.63
23 22 23 13-0005 EA 15 GPM Simplex Condensate Pump And 1/2 HP Motor With 13.5 Gallon Cast Iron Receiver, Float Switch, 20 PSI Discharge Pressure	2,106.16	410.36
23 22 23 13-0006 EA 22.5 GPM Simplex Condensate Pump And 1/2 HP Motor With 21 Gallon Cast Iron Receiver, Float Switch, 20 PSI Discharge Pressure	2,325.78	414.78
23 22 23 13-0007 EA 30 GPM Simplex Condensate Pump And 3/4 HP Motor With 36 Gallon Cast Iron Receiver, Float Switch, 20 PSI Discharge Pressure	2,600.94	451.55
23 22 23 13-0008 EA 37.5 GPM Simplex Condensate Pump And 3/4 HP Motor With 36 Gallon Cast Iron Receiver, Float Switch, 20 PSI Discharge Pressure	3,859.94	451.55
23 22 23 13-0009 EA 45 GPM Simplex Condensate Pump And 1 HP Motor With 36 Gallon Cast Iron Receiver, Float Switch, 20 PSI Discharge Pressure	3,919.74	482.43
23 22 23 13-0010 EA 60 GPM Simplex Condensate Pump And 1-1/2 HP Motor With 50 Gallon Cast Iron Receiver, Float Switch, 20 PSI Discharge Pressure	4,795.83	504.49
23 22 23 13-0011 EA 75 GPM Simplex Condensate Pump And 2 HP Motor With 50 Gallon Cast Iron Receiver, Float Switch, 20 PSI Discharge Pressure	4,841.93	526.56
23 22 23 13-0012 30 PSI Discharge Pressure (23 22 23 13-0001)		
23 22 23 13-0013 EA 3 To 6 GPM Simplex Condensate Pump And 1/2 HP Motor With 6 Gallon Cast Iron Receiver, Float Switch, 30 PSI Discharge Pressure	1,790.72	400.07
23 22 23 13-0014 EA 9 To 12 GPM Simplex Condensate Pump And 1/2 HP Motor With 13.5 Gallon Cast Iron Receiver, Float Switch, 30 PSI Discharge Pressure	2,352.16	410.36
23 22 23 13-0015 EA 15 GPM Simplex Condensate Pump And 3/4 HP Motor With 13.5 Gallon Cast Iron Receiver, Float Switch, 30 PSI Discharge Pressure	2,440.61	437.58
23 22 23 13-0016 EA 22.5 GPM Simplex Condensate Pump And 1 HP Motor With 21 Gallon Cast Iron Receiver, Float Switch, 30 PSI Discharge Pressure	2,828.03	472.87
23 22 23 13-0017 EA 30 To 37.5 GPM Simplex Condensate Pump And 1 HP Motor With 36 Gallon Cast Iron Receiver, Float Switch, 30 PSI Discharge Pressure	3,919.74	483.17
23 22 23 13-0018 EA 45 GPM Simplex Condensate Pump And 1-1/2 HP Motor With 36 Gallon Cast Iron Receiver, Float Switch, 30 PSI Discharge Pressure	4,027.48	500.08
23 22 23 13-0019 EA 60 GPM Simplex Condensate Pump And 2 HP Motor With 50 Gallon Cast Iron Receiver, Float Switch, 30 PSI Discharge Pressure	4,147.93	526.56
23 22 23 13-0020 EA 75 GPM Simplex Condensate Pump And 3 HP Motor With 50 Gallon Cast Iron Receiver, Float Switch, 30 PSI Discharge Pressure	4,820.41	560.38
23 22 23 13-0021 40 PSI Discharge Pressure (23 22 23 13-0001)		
23 22 23 13-0022 EA 3 To 6 GPM Simplex Condensate Pump And 1 HP Motor With 6 Gallon Cast Iron Receiver, Float Switch, 40 PSI Discharge Pressure	1,993.97	458.90
23 22 23 13-0023 EA 9 To 15 GPM Simplex Condensate Pump And 1 HP Motor With 13.5 Gallon Cast Iron Receiver, Float Switch, 40 PSI Discharge Pressure	2,540.41	495.67
23 22 23 13-0024 EA 22.5 GPM Simplex Condensate Pump And 1-1/2 HP Motor With 21 Gallon Cast Iron Receiver, Float Switch, 40 PSI Discharge Pressure	2,985.77	489.79
23 22 23 13-0025 EA 30 To 37.5 GPM Simplex Condensate Pump And 1-1/2 HP Motor With 36 Gallon Cast Iron Receiver, Float Switch, 40 PSI Discharge Pressure	4,007.48	500.08
23 22 23 13-0026 EA 45 GPM Simplex Condensate Pump And 2 HP Motor With 36 Gallon Cast Iron Receiver, Float Switch, 40 PSI Discharge Pressure	4,090.57	521.41
23 22 23 13-0027 EA 60 GPM Simplex Condensate Pump And 2 HP Motor With 50 Gallon Cast Iron Receiver, Float Switch, 40 PSI Discharge Pressure	4,841.93	526.56
23 22 23 13-0028 EA 75 GPM Simplex Condensate Pump And 3 HP Motor With 50 Gallon Cast Iron Receiver, Float Switch, 40 PSI Discharge Pressure	4,905.41	560.38
23 22 23 13-0029 50 PSI Discharge Pressure (23 22 23 13-0001)		
23 22 23 13-0030 EA 3 To 6 GPM Simplex Condensate Pump And 2 HP Motor With 6 Gallon Cast Iron Receiver, Float Switch, 50 PSI Discharge Pressure	3,818.80	497.15
23 22 23 13-0031 EA 9 To 15 GPM Simplex Condensate Pump And 2 HP Motor With 13.6 Gallon Cast Iron Receiver, Float Switch, 50 PSI Discharge Pressure	2,741.24	507.44
23 22 23 13-0032 EA 22.5 GPM Simplex Condensate Pump And 2 HP Motor With 21 Gallon Cast Iron Receiver, Float Switch, 50 PSI Discharge Pressure	3,161.87	511.12
23 22 23 13-0033 EA 30 To 45 GPM Simplex Condensate Pump And 3 HP Motor With 36 Gallon Cast Iron Receiver, Float Switch, 50 PSI Discharge Pressure	4,153.05	555.98
23 22 23 13-0034 EA 60 To 75 GPM Simplex Condensate Pump And 5 HP Motor With 50 Gallon Cast Iron Receiver, Float Switch, 50 PSI Discharge Pressure	6,598.24	599.36

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 20 HVAC Piping And Pumps****23 22 Steam And Condensate Piping And Pumps**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 22 23 13-0035 Duplex Condensate Pumps And Motors <small>(23 22 23 13)</small> Note: Cast iron receiver, float switch, alternator assembly.		
23 22 23 13-0036 20 PSI Discharge Pressure <small>(23 22 23 13-0035)</small>		
23 22 23 13-0037 EA 9 To 12 GPM Duplex Condensate Pump And 1/3 HP Motor With 13.5 Gallon Cast Iron Receiver, Float Switch, 20 PSI Discharge Pressure	2,586.16	502.29
23 22 23 13-0038 EA 15 GPM Duplex Condensate Pump And 1/2 HP Motor With 13.5 Gallon Cast Iron Receiver, Float Switch, 20 PSI Discharge Pressure	2,737.44	551.57
23 22 23 13-0039 EA 22.5 GPM Duplex Condensate Pump And 1/2 HP Motor With 21 Gallon Cast Iron Receiver, Float Switch, 20 PSI Discharge Pressure	2,999.05	555.98
23 22 23 13-0040 EA 30 GPM Duplex Condensate Pump And 3/4 HP Motor With 36 Gallon Cast Iron Receiver, Float Switch, 20 PSI Discharge Pressure	3,353.80	605.98
23 22 23 13-0041 EA 37.5 GPM Duplex Condensate Pump And 3/4 HP Motor With 36 Gallon Cast Iron Receiver, Float Switch, 20 PSI Discharge Pressure	4,712.80	605.98
23 22 23 13-0042 EA 45 GPM Duplex Condensate Pump And 1 HP Motor With 36 Gallon Cast Iron Receiver, Float Switch, 20 PSI Discharge Pressure	4,797.13	653.05
23 22 23 13-0043 EA 60 GPM Duplex Condensate Pump And 1-1/2 HP Motor With 50 Gallon Cast Iron Receiver, Float Switch, 20 PSI Discharge Pressure	5,697.26	681.73
23 22 23 13-0044 EA 75 GPM Duplex Condensate Pump And 2 HP Motor With 50 Gallon Cast Iron Receiver, Float Switch, 20 PSI Discharge Pressure	5,835.73	715.56
23 22 23 13-0045 30 PSI Discharge Pressure <small>(23 22 23 13-0035)</small>		
23 22 23 13-0046 EA 9 To 12 GPM Duplex Condensate Pump And 1/2 HP Motor With 13.5 Gallon Cast Iron Receiver, Float Switch, 30 PSI Discharge Pressure	3,368.99	541.26
23 22 23 13-0047 EA 15 GPM Duplex Condensate Pump And 3/4 HP Motor With 13.5 Gallon Cast Iron Receiver, Float Switch, 30 PSI Discharge Pressure	3,523.48	591.28
23 22 23 13-0048 EA 22.5 GPM Duplex Condensate Pump And 1 HP Motor With 21 Gallon Cast Iron Receiver, Float Switch, 30 PSI Discharge Pressure	3,901.42	576.56
23 22 23 13-0049 EA 30 To 37.5 GPM Duplex Condensate Pump And 1 HP Motor With 36 Gallon Cast Iron Receiver, Float Switch, 30 PSI Discharge Pressure	4,797.13	653.05
23 22 23 13-0050 EA 45 GPM Duplex Condensate Pump And 1-1/2 HP Motor With 36 Gallon Cast Iron Receiver, Float Switch, 30 PSI Discharge Pressure	4,932.91	677.32
23 22 23 13-0051 EA 60 GPM Duplex Condensate Pump And 2 HP Motor With 50 Gallon Cast Iron Receiver, Float Switch, 30 PSI Discharge Pressure	5,635.73	715.56
23 22 23 13-0052 EA 75 GPM Duplex Condensate Pump And 3 HP Motor With 50 Gallon Cast Iron Receiver, Float Switch, 30 PSI Discharge Pressure	5,912.95	767.04
23 22 23 13-0053 40 PSI Discharge Pressure <small>(23 22 23 13-0035)</small>		
23 22 23 13-0054 EA 9 To 15 GPM Duplex Condensate Pump And 1 HP Motor With 13.5 Gallon Cast Iron Receiver, Float Switch, 40 PSI Discharge Pressure	3,647.80	638.34
23 22 23 13-0055 EA 22.5 GPM Duplex Condensate Pump And 1-1/2 HP Motor With 21 Gallon Cast Iron Receiver, Float Switch, 40 PSI Discharge Pressure	4,035.19	667.03
23 22 23 13-0056 EA 30 To 37.5 GPM Duplex Condensate Pump And 1-1/2 HP Motor With 36 Gallon Cast Iron Receiver, Float Switch, 40 PSI Discharge Pressure	4,944.91	677.32
23 22 23 13-0057 EA 45 GPM Duplex Condensate Pump And 2 HP Motor With 36 Gallon Cast Iron Receiver, Float Switch, 40 PSI Discharge Pressure	5,084.39	711.15
23 22 23 13-0058 EA 60 GPM Duplex Condensate Pump And 2 HP Motor With 50 Gallon Cast Iron Receiver, Float Switch, 40 PSI Discharge Pressure	5,836.73	715.56
23 22 23 13-0059 EA 75 GPM Duplex Condensate Pump And 3 HP Motor With 50 Gallon Cast Iron Receiver, Float Switch, 40 PSI Discharge Pressure	5,936.95	767.04
23 22 23 13-0060 50 PSI Discharge Pressure <small>(23 22 23 13-0035)</small>		
23 22 23 13-0061 EA 9 To 15 GPM Duplex Condensate Pump And 2 HP Motor With 13.5 Gallon Cast Iron Receiver, Float Switch, 50 PSI Discharge Pressure	3,813.80	638.34
23 22 23 13-0062 EA 22.5 GPM Duplex Condensate Pump And 2 HP Motor With 21 Gallon Cast Iron Receiver, Float Switch, 50 PSI Discharge Pressure	4,114.68	701.59
23 22 23 13-0063 EA 30 To 45 GPM Duplex Condensate Pump And 3 HP Motor With 36 Gallon Cast Iron Receiver, Float Switch, 50 PSI Discharge Pressure	5,185.61	761.90
23 22 23 13-0064 EA 60 To 75 GPM Duplex Condensate Pump And 5 HP Motor With 50 Gallon Cast Iron Receiver, Float Switch, 50 PSI Discharge Pressure	9,096.21	825.14
23 23 Refrigerant Piping <small>(23 20)</small>		
23 23 13 Refrigerant Piping Valves <small>(23 23)</small>		
23 23 13 00-0001 Ball Valves <small>(23 23 13)</small>		
23 23 13 00-0002 Refrigeration Ball Valves, Sweat, 1400 Series <small>(23 23 13 00-0001)</small>		
23 23 13 00-0003 EA 3/8" Refrigeration Ball Valve, Sweated	28.90	7.98
23 23 13 00-0004 EA 1/2" Refrigeration Ball Valve, Sweated	30.19	7.98
23 23 13 00-0005 EA 5/8" Refrigeration Ball Valve, Sweated	36.68	7.98
23 23 13 00-0006 EA 7/8" Refrigeration Ball Valve, Sweated	49.21	8.78
23 23 13 00-0007 EA 1-1/8" Refrigeration Ball Valve, Sweated	66.06	9.98
23 23 13 00-0008 EA 1-5/8" Refrigeration Ball Valve, Sweated	104.53	12.29
23 23 13 00-0009 Shut-Off Valves <small>(23 23 13)</small>		
23 23 13 00-0010 Packless <small>(23 23 13 00-0009)</small>		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 23 13 00-0011 EA 1/2" Refrigeration Valve, Packless.....	31.58	8.31
23 23 13 00-0012 EA 5/8" Refrigeration Valve, Packless.....	38.32	9.11
23 23 13 00-0013 EA 7/8" Refrigeration Valve, Packless.....	73.24	12.46
23 23 13 00-0014 Packed <small>(23 23 13 00-0009)</small>		
23 23 13 00-0015 EA 1-1/8" Refrigeration Valve, Packed.....	126.61	18.13
23 23 13 00-0016 EA 1 3/8" Refrigeration Valve, Packed.....	167.46	22.20
23 23 13 00-0017 EA 1-5/8" Refrigeration Valve, Packed.....	202.20	25.00
23 23 13 00-0018 EA 2-1/8" Refrigeration Valve, Packed.....	282.69	28.52
23 23 13 00-0019 EA 2-5/8" Refrigeration Valve, Packed.....	497.39	79.88
23 23 13 00-0020 EA 3-1/8" Refrigeration Valve, Packed.....	648.36	99.85
23 23 13 00-0021 EA 4-1/8" Refrigeration Valve, Packed.....	914.27	133.16
23 23 13 00-0022 Check Valves <small>(23 23 13)</small>		
23 23 13 00-0023 EA 5/8" Check Valve, Refrigeration.....	41.98	7.99
23 23 13 00-0024 EA 7/8" Check Valve, Refrigeration.....	112.21	8.78
23 23 13 00-0025 EA 1-1/8" Check Valve, Refrigeration.....	130.91	9.98
23 23 13 00-0026 EA 1 3/8" Check Valve, Refrigeration.....	174.82	10.63
23 23 13 00-0027 EA 1-5/8" Check Valve, Refrigeration.....	226.39	12.30
23 23 13 00-0028 EA 2-1/8" Check Valve, Refrigeration.....	327.64	14.54
23 23 13 00-0029 EA 2-5/8" Check Valve, Refrigeration.....	459.53	21.33
23 23 13 00-0030 EA 3-1/8" Check Valve, Refrigeration.....	600.29	27.95
23 23 13 00-0031 Solenoid Valves <small>(23 23 13)</small>		
23 23 13 00-0032 Solenoid Valve, 24 Volt Coil <small>(23 23 13 00-0031)</small>		
23 23 13 00-0033 EA 1/2" Solenoid Valve, Refrigeration.....	91.75	7.99
23 23 13 00-0034 EA 5/8" Solenoid Valve, Refrigeration.....	93.67	7.99
23 23 13 00-0035 EA 3/4" Solenoid Valve, Refrigeration.....	117.14	8.78
23 23 13 00-0036 EA 7/8" Solenoid Valve, Refrigeration.....	117.14	8.78
23 23 13 00-0037 EA 1-1/8" Solenoid Valve, Refrigeration.....	160.96	9.98
23 23 13 00-0038 EA 1 3/8" Solenoid Valve, Refrigeration.....	251.74	10.63
23 23 13 00-0039 EA 1-5/8" Solenoid Valve, Refrigeration.....	446.45	12.30
23 23 13 00-0040 EA 2-1/8" Solenoid Valve, Refrigeration.....	457.62	14.54
23 23 16 Refrigerant Piping Specialties <small>(23 23)</small>		
23 23 16 00-0001 Soft Refrigeration Copper Tubing <small>(23 23 16)</small>		
<i>Note: Based on outside diameter. Nitrogenized.</i>		
23 23 16 00-0002 LF 1/8" Outside Diameter Soft Refrigeration Copper Tubing.....	3.53	2.16
23 23 16 00-0003 LF 3/16" Outside Diameter Soft Refrigeration Copper Tubing.....	3.58	2.16
23 23 16 00-0004 LF 1/4" Outside Diameter Soft Refrigeration Copper Tubing.....	3.64	2.16
23 23 16 00-0005 LF 5/16" Outside Diameter Soft Refrigeration Copper Tubing.....	3.87	2.16
23 23 16 00-0006 LF 3/8" Outside Diameter Soft Refrigeration Copper Tubing.....	3.98	2.24
23 23 16 00-0007 LF 1/2" Outside Diameter Soft Refrigeration Copper Tubing.....	4.51	2.40
23 23 16 00-0008 LF 5/8" Outside Diameter Soft Refrigeration Copper Tubing.....	4.82	2.40
23 23 16 00-0009 LF 3/4" Outside Diameter Soft Refrigeration Copper Tubing.....	5.62	2.80
23 23 16 00-0010 LF 7/8" Outside Diameter Soft Refrigeration Copper Tubing.....	6.66	2.95
23 23 16 00-0011 LF 1-1/8" Outside Diameter Soft Refrigeration Copper Tubing.....	8.54	3.60
23 23 16 00-0012 LF 1-3/8" Outside Diameter Soft Refrigeration Copper Tubing.....	11.73	4.15
23 23 16 00-0013 LF 1-5/8" Outside Diameter Soft Refrigeration Copper Tubing.....	13.61	4.47
23 23 16 00-0014 Type L Drawn, ACR Copper Tubing <small>(23 23 16)</small>		
<i>Note: Nitrogenized.</i>		
23 23 16 00-0015 LF 3/8" Outside Diameter Type L Drawn, ACR Copper Tubing.....	4.18	2.24
<i>For Medical Applications "Oxygen Clean", Add</i>		0.38
23 23 16 00-0016 LF 1/2" Outside Diameter Type L Drawn, ACR Copper Tubing.....	4.58	2.24
<i>For Medical Applications "Oxygen Clean", Add</i>		0.40
23 23 16 00-0017 LF 5/8" Outside Diameter Type L Drawn, ACR Copper Tubing.....	4.83	2.24
<i>For Medical Applications "Oxygen Clean", Add</i>		0.41
23 23 16 00-0018 LF 3/4" Outside Diameter Type L Drawn, ACR Copper Tubing.....	7.01	3.35
<i>For Medical Applications "Oxygen Clean", Add</i>		0.60
23 23 16 00-0019 LF 7/8" Outside Diameter Type L Drawn, ACR Copper Tubing.....	7.63	3.60
<i>For Medical Applications "Oxygen Clean", Add</i>		0.65
23 23 16 00-0020 LF 1-1/8" Outside Diameter Type L Drawn, ACR Copper Tubing.....	8.64	3.60
<i>For Medical Applications "Oxygen Clean", Add</i>		0.70
23 23 16 00-0021 LF 1-3/8" Outside Diameter Type L Drawn, ACR Copper Tubing.....	10.63	4.15
<i>For Medical Applications "Oxygen Clean", Add</i>		0.85
23 23 16 00-0022 LF 1-5/8" Outside Diameter Type L Drawn, ACR Copper Tubing.....	12.75	4.79
<i>For Medical Applications "Oxygen Clean", Add</i>		1.00
23 23 16 00-0023 LF 2-1/8" Outside Diameter Type L Drawn, ACR Copper Tubing.....	17.73	5.99
<i>For Medical Applications "Oxygen Clean", Add</i>		1.34
23 23 16 00-0024 LF 2-5/8" Outside Diameter Type L Drawn, ACR Copper Tubing.....	26.63	9.03
<i>For Medical Applications "Oxygen Clean", Add</i>		2.01
23 23 16 00-0025 LF 3-1/8" Outside Diameter Type L Drawn, ACR Copper Tubing.....	34.22	11.18
<i>For Medical Applications "Oxygen Clean", Add</i>		2.55

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 20 HVAC Piping And Pumps****23 23 Refrigerant Piping**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 23 16 00-0026 LF 3-5/8" Outside Diameter Type L Drawn, ACR Copper Tubing <i>For Medical Applications "Oxygen Clean", Add</i>	42.74 3.13	13.25
23 23 16 00-0027 LF 4-1/8" Outside Diameter Type L Drawn, ACR Copper Tubing <i>For Medical Applications "Oxygen Clean", Add</i>	52.65 3.83	15.98
23 23 16 00-0028 Refrigeration Fittings (23 23 16)		
23 23 16 00-0029 Brass Flare Fittings (23 23 16 00-0028)		
23 23 16 00-0030 Brass Flare Unions (23 23 16 00-0029)		
23 23 16 00-0031 EA 3/8" Brass Flare Union.....	14.54	8.62
23 23 16 00-0032 EA 1/2" Brass Flare Union.....	14.54	8.62
23 23 16 00-0033 EA 5/8" Brass Flare Union.....	14.97	8.62
23 23 16 00-0034 90 Degree Elbow Brass Flare Unions (23 23 16 00-0029)		
23 23 16 00-0035 EA 3/8" 90 Degree Brass Flare Elbow Union.....	14.80	8.62
23 23 16 00-0036 EA 1/2" 90 Degree Brass Flare Elbow Union.....	14.80	8.62
23 23 16 00-0037 EA 5/8" 90 Degree Brass Flare Elbow Union.....	16.23	8.62
23 23 16 00-0038 Brass Flare Tees (23 23 16 00-0029)		
23 23 16 00-0039 EA 3/8" Brass Flare Tee.....	24.02	14.37
23 23 16 00-0040 EA 1/2" Brass Flare Tee.....	24.66	14.37
23 23 16 00-0041 EA 5/8" Brass Flare Tee.....	28.14	14.37
23 23 16 00-0042 Male Connector, Half Brass Flare Unions (23 23 16 00-0029)		
23 23 16 00-0043 EA 3/8" Brass Flare Male Connector, Half Union.....	13.37	8.62
23 23 16 00-0044 EA 1/2" Brass Flare Male Connector, Half Union.....	13.79	8.62
23 23 16 00-0045 EA 5/8" Brass Flare Male Connector, Half Union.....	14.40	8.62
23 23 16 00-0046 Female Connector, Half Brass Flare Unions (23 23 16 00-0029)		
23 23 16 00-0047 EA 3/8" Brass Flare Female Connector, Half Union.....	13.92	8.62
23 23 16 00-0048 EA 1/2" Brass Flare Female Connector, Half Union.....	14.50	8.62
23 23 16 00-0049 EA 5/8" Brass Flare Female Connector, Half Union.....	14.50	8.62
23 23 16 00-0050 Long Forged Nuts (23 23 16 00-0029)		
23 23 16 00-0051 EA 3/8" Brass Long Forged Nut.....	13.63	8.62
23 23 16 00-0052 EA 1/2" Brass Long Forged Nut.....	13.79	8.62
23 23 16 00-0053 EA 5/8" Brass Long Forged Nut.....	15.65	8.62
23 23 16 00-0054 Short Forged Nuts (23 23 16 00-0029)		
23 23 16 00-0055 EA 3/8" Brass Short Forged Nut.....	13.39	8.62
23 23 16 00-0056 EA 1/2" Brass Short Forged Nut.....	13.77	8.62
23 23 16 00-0057 EA 5/8" Brass Short Forged Nut.....	13.85	8.62
23 23 16 00-0058 ACR Wrought Copper Fittings (23 23 16 00-0028) Note: Soldered.		
23 23 16 00-0059 ACR Wrought Copper Coupling (23 23 16 00-0058) Note: C x C		
23 23 16 00-0060 EA 1/4" ACR Wrought Copper Coupling.....	13.27	8.62
23 23 16 00-0061 EA 3/8" ACR Wrought Copper Coupling.....	13.20	8.62
23 23 16 00-0062 EA 1/2" ACR Wrought Copper Coupling.....	13.30	8.62
23 23 16 00-0063 EA 5/8" ACR Wrought Copper Coupling.....	13.91	9.03
23 23 16 00-0064 EA 3/4" ACR Wrought Copper Coupling.....	18.81	11.91
23 23 16 00-0065 EA 7/8" ACR Wrought Copper Coupling.....	19.00	12.22
23 23 16 00-0066 EA 1-1/8" ACR Wrought Copper Coupling.....	24.13	15.18
23 23 16 00-0067 EA 1-3/8" ACR Wrought Copper Coupling.....	33.60	20.77
23 23 16 00-0068 EA 1-5/8" ACR Wrought Copper Coupling.....	39.80	24.37
23 23 16 00-0069 EA 2-1/8" ACR Wrought Copper Coupling.....	49.66	29.55
23 23 16 00-0070 EA 2-5/8" ACR Wrought Copper Coupling.....	79.45	44.89
23 23 16 00-0071 EA 3-1/8" ACR Wrought Copper Coupling.....	105.11	59.03
23 23 16 00-0072 EA 4-1/8" ACR Wrought Copper Coupling.....	142.85	70.13
23 23 16 00-0073 ACR Wrought Copper Short Radius 90 Degree Elbows (23 23 16 00-0058) Note: C x C		
23 23 16 00-0074 EA 1/4" ACR Wrought Copper Short Radius 90 Degree Elbow.....	14.19	8.62
23 23 16 00-0075 EA 3/8" ACR Wrought Copper Short Radius 90 Degree Elbow.....	14.26	8.62
23 23 16 00-0076 EA 1/2" ACR Wrought Copper Short Radius 90 Degree Elbow.....	14.19	8.62
23 23 16 00-0077 ACR Wrought Copper Long Radius 90 Degree Elbows (23 23 16 00-0058) Note: C x C		



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 23 16 00-0078	EA			1/4" ACR Wrought Copper Long Radius 90 Degree Elbow	15.33	8.62
23 23 16 00-0079	EA			3/8" ACR Wrought Copper Long Radius 90 Degree Elbow	14.73	8.62
23 23 16 00-0080	EA			1/2" ACR Wrought Copper Long Radius 90 Degree Elbow	15.21	8.62
23 23 16 00-0081	EA			5/8" ACR Wrought Copper Long Radius 90 Degree Elbow	15.65	9.03
23 23 16 00-0082	EA			3/4" ACR Wrought Copper Long Radius 90 Degree Elbow	20.01	11.91
23 23 16 00-0083	EA			7/8" ACR Wrought Copper Long Radius 90 Degree Elbow	21.01	12.22
23 23 16 00-0084	EA			1-1/8" ACR Wrought Copper Long Radius 90 Degree Elbow	27.08	15.18
23 23 16 00-0085	EA			1-3/8" ACR Wrought Copper Long Radius 90 Degree Elbow	38.21	20.77
23 23 16 00-0086	EA			1-5/8" ACR Wrought Copper Long Radius 90 Degree Elbow	46.04	24.37
23 23 16 00-0087	EA			2-1/8" ACR Wrought Copper Long Radius 90 Degree Elbow	69.21	29.55
23 23 16 00-0088	EA			2-5/8" ACR Wrought Copper Long Radius 90 Degree Elbow	106.75	44.89
23 23 16 00-0089	EA			3-1/8" ACR Wrought Copper Long Radius 90 Degree Elbow	140.80	59.03
23 23 16 00-0090	EA			4-1/8" ACR Wrought Copper Long Radius 90 Degree Elbow	245.17	70.13
23 23 16 00-0091	ACR Wrought Copper 45 Degree Elbow (23 23 16 00-0058)					
	Note: C x C					
23 23 16 00-0092	EA			1/4" ACR Wrought Copper 45 Degree Elbow	16.17	8.62
23 23 16 00-0093	EA			3/8" ACR Wrought Copper 45 Degree Elbow	15.33	8.62
23 23 16 00-0094	EA			1/2" ACR Wrought Copper 45 Degree Elbow	14.98	8.62
23 23 16 00-0095	EA			5/8" ACR Wrought Copper 45 Degree Elbow	14.41	9.03
23 23 16 00-0096	EA			3/4" ACR Wrought Copper 45 Degree Elbow	21.57	11.91
23 23 16 00-0097	EA			7/8" ACR Wrought Copper 45 Degree Elbow	19.78	12.22
23 23 16 00-0098	EA			1-1/8" ACR Wrought Copper 45 Degree Elbow	26.44	15.18
23 23 16 00-0099	EA			1-3/8" ACR Wrought Copper 45 Degree Elbow	36.12	20.77
23 23 16 00-0100	EA			1-5/8" ACR Wrought Copper 45 Degree Elbow	42.54	24.37
23 23 16 00-0101	EA			2-1/8" ACR Wrought Copper 45 Degree Elbow	54.25	29.55
23 23 16 00-0102	EA			2-5/8" ACR Wrought Copper 45 Degree Elbow	88.55	44.89
23 23 16 00-0103	EA			3-1/8" ACR Wrought Copper 45 Degree Elbow	118.21	59.03
23 23 16 00-0104	EA			4-1/8" ACR Wrought Copper 45 Degree Elbow	168.38	70.13
23 23 16 00-0105	ACR Wrought Copper Tee (23 23 16 00-0058)					
	Note: C x C x C					
23 23 16 00-0106	EA			1/4" ACR Wrought Copper Tee	24.18	14.37
23 23 16 00-0107	EA			3/8" ACR Wrought Copper Tee	24.33	14.37
23 23 16 00-0108	EA			1/2" ACR Wrought Copper Tee	23.79	14.37
23 23 16 00-0109	EA			5/8" ACR Wrought Copper Tee	27.91	18.13
23 23 16 00-0110	EA			3/4" ACR Wrought Copper Tee	32.18	18.13
23 23 16 00-0111	EA			7/8" ACR Wrought Copper Tee	29.43	18.37
23 23 16 00-0112	EA			1-1/8" ACR Wrought Copper Tee	42.41	24.37
23 23 16 00-0113	EA			1-3/8" ACR Wrought Copper Tee	52.17	29.55
23 23 16 00-0114	EA			1-5/8" ACR Wrought Copper Tee	64.76	35.06
23 23 16 00-0115	EA			2-1/8" ACR Wrought Copper Tee	89.10	46.73
23 23 16 00-0116	EA			2-5/8" ACR Wrought Copper Tee	191.28	102.00
23 23 16 00-0117	EA			3-1/8" ACR Wrought Copper Tee	223.25	112.15
23 23 16 00-0118	EA			4-1/8" ACR Wrought Copper Tee	320.20	124.61
23 23 16 00-0119	ACR Wrought Copper Male Adapter (23 23 16 00-0058)					
	Note: C x M					
23 23 16 00-0120	EA			1/4" ACR Wrought Copper Male Adapter	17.00	8.62
23 23 16 00-0121	EA			3/8" ACR Wrought Copper Male Adapter	18.33	8.62
23 23 16 00-0122	EA			1/2" ACR Wrought Copper Male Adapter	16.12	8.62
23 23 16 00-0123	ACR Wrought Copper Female Adapter (23 23 16 00-0058)					
	Note: C x F					
23 23 16 00-0124	EA			1/4" ACR Wrought Copper Female Adapter	16.47	8.62
23 23 16 00-0125	EA			3/8" ACR Wrought Copper Female Adapter	15.71	8.62
23 23 16 00-0126	EA			1/2" ACR Wrought Copper Female Adapter	16.00	8.62
23 23 16 00-0127	ACR Wrought Copper Cap (23 23 16 00-0058)					
	Note: C					
23 23 16 00-0128	EA			1/4" ACR Wrought Copper Cap	9.23	5.75
23 23 16 00-0129	EA			3/8" ACR Wrought Copper Cap	8.99	5.75
23 23 16 00-0130	EA			1/2" ACR Wrought Copper Cap	9.23	5.75
23 23 16 00-0131	ACR Wrought Copper P-Trap (23 23 16 00-0058)					
23 23 16 00-0132	EA			5/8" ACR Wrought Copper P-Trap	41.10	7.36
23 23 16 00-0133	EA			3/4" ACR Wrought Copper P-Trap	52.63	8.09
23 23 16 00-0134	EA			7/8" ACR Wrought Copper P-Trap	50.44	8.09
23 23 16 00-0135	EA			1-1/8" ACR Wrought Copper P-Trap	64.28	8.83
23 23 16 00-0136	EA			1-3/8" ACR Wrought Copper P-Trap	109.03	8.83
23 23 16 00-0137	EA			1-5/8" ACR Wrought Copper P-Trap	145.75	9.56
23 23 16 00-0138	EA			2-1/8" ACR Wrought Copper P-Trap	236.14	10.29
23 23 16 00-0139	Sight Glass With Moisture And Liquid Indicator, Solder Connection (23 23 16)					

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 20 HVAC Piping And Pumps****23 23 Refrigerant Piping**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 23 16 00-0140 EA 1/4" Outside Diameter Sight Glass With Moisture And Liquid Indicator, Solder Connection.....	36.15	11.03
23 23 16 00-0141 EA 3/8" Outside Diameter Sight Glass With Moisture And Liquid Indicator, Solder Connection.....	43.71	13.23
23 23 16 00-0142 EA 1/2" Outside Diameter Sight Glass With Moisture And Liquid Indicator, Solder Connection.....	52.57	16.18
23 23 16 00-0143 EA 5/8" Outside Diameter Sight Glass With Moisture And Liquid Indicator, Solder Connection.....	58.20	18.39
23 23 16 00-0144 EA 7/8" Outside Diameter Sight Glass With Moisture And Liquid Indicator, Solder Connection.....	77.62	23.54
23 23 16 00-0145 EA 1-1/8" Outside Diameter Sight Glass With Moisture And Liquid Indicator, Solder Connection.....	90.60	28.68
23 23 16 00-0146 EA 1-3/8" Outside Diameter Sight Glass With Moisture And Liquid Indicator, Solder Connection.....	134.87	33.83
23 23 16 00-0147 EA 1-5/8" Outside Diameter Sight Glass With Moisture And Liquid Indicator, Solder Connection.....	168.62	46.34
23 23 16 00-0148 EA 2-1/8" Outside Diameter Sight Glass With Moisture And Liquid Indicator, Solder Connection.....	207.50	57.36
23 23 16 00-0149 Filter Driers, Solder Connections (23 23 16)		
23 23 16 00-0150 Replaceable Core Type Filter Driers, Solder Connections (23 23 16 00-0149)		
23 23 16 00-0151 EA 5/8" Outside Diameter Replaceable Core Type Filter Drier, Solder Connections.....	289.84	6.62
23 23 16 00-0152 EA 7/8" Outside Diameter Replaceable Core Type Filter Drier, Solder Connections.....	297.77	8.09
23 23 16 00-0153 EA 1-1/8" Outside Diameter Replaceable Core Type Filter Drier, Solder Connections.....	381.70	8.09
23 23 16 00-0154 EA 1-3/8" Outside Diameter Replaceable Core Type Filter Drier, Solder Connections.....	386.59	8.83
23 23 16 00-0155 EA 1-5/8" Outside Diameter Replaceable Core Type Filter Drier, Solder Connections.....	435.75	9.56
23 23 16 00-0156 EA 2-1/8" Outside Diameter Replaceable Core Type Filter Drier, Solder Connections.....	500.14	10.29
23 23 16 00-0157 EA 2-5/8" Outside Diameter Replaceable Core Type Filter Drier, Solder Connections.....	586.34	11.03
23 23 16 00-0158 EA 3-1/8" Outside Diameter Replaceable Core Type Filter Drier, Solder Connections.....	732.12	11.03
23 23 16 00-0159 Sealed In-Line Filter Driers, Solder Connections (23 23 16 00-0149)		
23 23 16 00-0160 EA 1/4" Outside Diameter, 1/4 To 1 Ton, Sealed In-Line Filter Drier, Solder Connections.....	55.93	6.62
23 23 16 00-0161 EA 3/8" Outside Diameter, 1/2 To 2 Ton, Sealed In-Line Filter Drier, Solder Connections.....	71.48	6.62
23 23 16 00-0162 EA 1/2" Outside Diameter, 1 To 7 Ton, Sealed In-Line Filter Drier, Solder Connections.....	90.84	7.36
23 23 16 00-0163 EA 1/2" Outside Diameter, 2 To 7-1/2 Ton, Sealed In-Line Filter Drier, Solder Connections.....	104.29	7.36
23 23 16 00-0164 EA 5/8" Outside Diameter, 2 To 10 Ton, Sealed In-Line Filter Drier, Solder Connections.....	115.22	7.36
23 23 16 00-0165 EA 5/8" Outside Diameter, 4 To 8 Ton, Sealed In-Line Filter Drier, Solder Connections.....	129.37	7.36
23 23 16 00-0166 EA 7/8" Outside Diameter, 5 To 20 Ton, Sealed In-Line Filter Drier, Solder Connections.....	146.01	8.09
23 23 16 00-0167 EA 7/8" Outside Diameter, 7-1/2 To 20 Ton, Sealed In-Line Filter Drier, Solder Connections.....	202.09	8.09
23 23 16 00-0168 EA 1-1/8" Outside Diameter, 15 To 25 Ton, Sealed In-Line Filter Drier, Solder Connections.....	222.08	8.09
23 23 16 00-0169 Bi-Flow Filter Driers, Solder Connections (23 23 16 00-0149)		
23 23 16 00-0170 EA 1/4" Outside Diameter, 1 To 3-1/2 Ton, Bi-Flow Filter Drier, Solder Connections.....	73.48	6.62
23 23 16 00-0171 EA 3/8" Outside Diameter, 1 To 3-1/2 Ton, Bi-Flow Filter Drier, Solder Connections.....	83.98	6.62
23 23 16 00-0172 EA 1/2" Outside Diameter, 1 To 3-1/2 Ton, Bi-Flow Filter Drier, Solder Connections.....	101.06	7.36
23 23 16 00-0173 EA 3/8" Outside Diameter, 1 To 8 Ton, Bi-Flow Filter Drier, Solder Connections.....	88.94	6.62
23 23 16 00-0174 EA 1/2" Outside Diameter, 1 To 8 Ton, Bi-Flow Filter Drier, Solder Connections.....	111.29	7.36
23 23 16 00-0175 EA 5/8" Outside Diameter, 1 To 8 Ton, Bi-Flow Filter Drier, Solder Connections.....	131.12	7.36
23 23 16 00-0176 Refrigerant Compressor Discharge Mufflers (23 23 16)		
23 23 16 00-0177 EA 3/8" Outside Diameter, 2 Ton, Refrigerant Compressor Discharge Muffler.....	68.81	6.62
23 23 16 00-0178 EA 1/2" Outside Diameter, 3 Ton, Refrigerant Compressor Discharge Muffler.....	76.07	6.62
23 23 16 00-0179 EA 5/8" Outside Diameter, 5 Ton, Refrigerant Compressor Discharge Muffler.....	91.35	6.62
23 23 16 00-0180 EA 7/8" Outside Diameter, 7-1/2 To 10 Ton, Refrigerant Compressor Discharge Muffler.....	123.06	8.09
23 23 16 00-0181 EA 1-1/8" Outside Diameter, 10 To 15 Ton, Refrigerant Compressor Discharge Muffler.....	161.27	8.09
23 23 16 00-0182 EA 1-3/8" Outside Diameter, 15 To 25 Ton, Refrigerant Compressor Discharge Muffler.....	191.98	8.83
23 23 16 00-0183 EA 1-5/8" Outside Diameter, 25 To 50 Ton, Refrigerant Compressor Discharge Muffler.....	242.62	9.56
23 23 16 00-0184 EA 2-1/8" Outside Diameter, 50 To 75 Ton, Refrigerant Compressor Discharge Muffler.....	422.50	10.29
23 23 16 00-0185 EA 2-5/8" Outside Diameter, 75 To 100 Ton, Refrigerant Compressor Discharge Muffler.....	477.55	11.03
23 23 16 00-0186 EA 3-1/8" Outside Diameter, 100 To 125 Ton, Refrigerant Compressor Discharge Muffler.....	591.97	11.03
23 23 16 00-0187 Expansion Valves And Vibration Absorbers (23 23 16)		
23 23 16 00-0188 Thermostatic Expansion Valves (23 23 16 00-0187)		
Note: Outside diameter pipe sizes. Sporlan TP-S.		
23 23 16 00-0189 EA 3/8" In x 5/8" Out, 1/2 To 3 Ton, Thermostatic Expansion Valve.....	136.21	6.62
23 23 16 00-0190 EA 1/2" In x 7/8" Out, 4 To 5 Ton, Thermostatic Expansion Valve.....	189.37	7.36
23 23 16 00-0191 EA 5/8" In x 7/8" Out, 6 To 8 Ton, Thermostatic Expansion Valve.....	313.59	7.36
23 23 16 00-0192 EA 7/8" In x 1-1/8" Out, 7 To 12 Ton, Thermostatic Expansion Valve.....	372.18	8.09
23 23 16 00-0193 EA 7/8" In x 1-3/8" Out, 15 To 20 Ton, Thermostatic Expansion Valve.....	408.95	8.09
23 23 16 00-0194 Electric Expansion Valves (23 23 16 00-0187)		
Note: Sporlan SEI or SEH.		
23 23 16 00-0195 EA 1/2 To 11 Ton Electric Expansion Valve.....	266.46	9.19
Note: Sporlan SEI.		
23 23 16 00-0196 EA 25 Ton Electric Expansion Valve.....	304.85	9.56
Note: Sporlan SEI.		
23 23 16 00-0197 EA 50 Ton Electric Expansion Valve.....	343.41	9.93
Note: Sporlan SEI.		
23 23 16 00-0198 EA 100 Ton Electric Expansion Valve.....	410.53	9.93
Note: Sporlan SEH.		
23 23 16 00-0199 EA 175 Ton Electric Expansion Valve.....	460.10	10.29
Note: Sporlan SEH.		



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 23 16 00-0200 Braided Stainless Steel Over Copper Vibration Absorber <small>(23 23 16 00-0187)</small>						
	23 23 16 00-0201	EA		1/4" Outside Diameter Braided Stainless Steel Over Copper Vibration Absorber.....	36.31	9.56
	23 23 16 00-0202	EA		3/8" Outside Diameter Braided Stainless Steel Over Copper Vibration Absorber.....	37.70	11.03
	23 23 16 00-0203	EA		1/2" Outside Diameter Braided Stainless Steel Over Copper Vibration Absorber.....	48.47	13.97
	23 23 16 00-0204	EA		5/8" Outside Diameter Braided Stainless Steel Over Copper Vibration Absorber.....	52.99	16.91
	23 23 16 00-0205	EA		3/4" Outside Diameter Braided Stainless Steel Over Copper Vibration Absorber.....	62.80	20.59
	23 23 16 00-0206	EA		7/8" Outside Diameter Braided Stainless Steel Over Copper Vibration Absorber.....	72.35	23.54
	23 23 16 00-0207	EA		1-1/8" Outside Diameter Braided Stainless Steel Over Copper Vibration Absorber.....	103.16	8.83
	23 23 16 00-0208	EA		1-3/8" Outside Diameter Braided Stainless Steel Over Copper Vibration Absorber.....	142.19	9.56
	23 23 16 00-0209	EA		1-5/8" Outside Diameter Braided Stainless Steel Over Copper Vibration Absorber.....	175.33	9.56
	23 23 16 00-0210	EA		2-1/8" Outside Diameter Braided Stainless Steel Over Copper Vibration Absorber.....	234.62	10.29
	23 23 16 00-0211	EA		2-5/8" Outside Diameter Braided Stainless Steel Over Copper Vibration Absorber.....	391.80	11.03
	23 23 16 00-0212	EA		3-1/8" Outside Diameter Braided Stainless Steel Over Copper Vibration Absorber.....	511.20	11.03
23 23 16 00-0213 Accumulator, Refrigerant Suction Line <small>(23 23 16)</small>						
	23 23 16 00-0214	EA		3/4" Accumulator, Refrigeration Suction Line.....	117.74	33.46
	23 23 16 00-0215	EA		7/8" Accumulator, Refrigeration Suction Line.....	159.88	45.96
	23 23 16 00-0216	EA		1-1/8" Accumulator, Refrigeration Suction Line.....	193.69	61.26
	23 23 16 00-0217	EA		1 3/8" Accumulator, Refrigeration Suction Line.....	266.91	73.54
	23 23 16 00-0218	EA		1-5/8" Accumulator, Refrigeration Suction Line.....	363.44	91.93
	23 23 16 00-0219	EA		2-1/8" Accumulator, Refrigeration Suction Line.....	544.63	122.60
23 23 16 00-0220 Special Chemicals/Component <small>(23 23 16)</small>						
	23 23 16 00-0221	GAL		Special Chemical, Inhibited Propylene Glycol, 100%.....	21.08	
	23 23 16 00-0222	GAL		Remove/Store For Reuse Inhibited Propylene Glycol.....	5.70	
	23 23 16 00-0223	GAL		Special Chemical, Inhibited Ethylene Glycol, 100%.....	14.48	
	23 23 16 00-0224	EA		Internal Coil/Refrigerant Piping Flush.....	193.43	
Note: Up to 10 ton AC system.						
23 23 23 Refrigerants <small>(23 23)</small>						
23 23 23 00-0001 Refrigerant <small>(23 23 23)</small>						
	23 23 23 00-0002	LB		Refrigerant R-113.....	28.31	
	23 23 23 00-0003	LB		Refrigerant R-123.....	26.38	
	23 23 23 00-0004	LB		Refrigerant R-134A.....	9.94	
	23 23 23 00-0005	LB		Refrigerant R-404A.....	12.85	
	23 23 23 00-0006	LB		Refrigerant R-407C.....	12.34	
	23 23 23 00-0007	LB		Refrigerant R-408A.....	37.97	
	23 23 23 00-0008	LB		Refrigerant R-409A.....	41.60	
	23 23 23 00-0009	LB		Refrigerant R-410A.....	10.23	
	23 23 23 00-0010	LB		Refrigerant R-500.....	32.47	
	23 23 23 00-0011	LB		Refrigerant R-502.....	37.20	
	23 23 23 00-0012	LB		Refrigerant R-507.....	12.34	
23 25 HVAC Water Treatment <small>(23 25)</small>						
23 25 13 Water Treatment For Closed-Loop Hydronic Systems <small>(23 25)</small>						
23 25 13 00-0001 Polyethylene Chemical Storage Tanks <small>(23 25 13)</small>						
	23 25 13 00-0002	EA		15 Gallon Chemical Storage Tank, Polyethylene.....	177.39	61.43
23 25 13 00-0003 Gas Chlorinator <small>(23 25 13)</small>						
	23 25 13 00-0004	EA		Gas Chlorinator, Wall Or Cylinder Mounted (10 PPD) With Metering Tube And Rate Valve Metering Tube Supply Indicator, Rate Valve, And Diffuser-Ejector Unit.....	893.21	279.46
				<i>For Booster Pump, Add</i>	326.23	
	23 25 13 00-0005	EA		Gas Chlorinator, Wall Or Cylinder Mounted (25 PPD) With Metering Tube And Rate Valve Metering Tube Supply Indicator, Rate Valve, And Diffuser-Ejector Unit.....	1,020.28	319.38
				<i>For Booster Pump, Add</i>	372.87	
	23 25 13 00-0006	EA		Gas Chlorinator, Wall Or Cylinder Mounted (50 PPD) With Metering Tube And Rate Valve Metering Tube Supply Indicator, Rate Valve, And Diffuser-Ejector Unit.....	1,463.86	241.93
				<i>For Booster Pump, Add</i>	466.25	
23 25 13 00-0007 Bypass Shot Feeders <small>(23 25 13)</small>						
Note: Includes up to 4 ports (in, out, fill and drain). Excludes valves.						
23 25 13 00-0008 In Line Mount, 125 PSIG <small>(23 25 13 00-0007)</small>						
	23 25 13 00-0009	EA		1.7 Gallon Bypass Shot Chemical Feeder In Line Mount, 125 PSIG.....	769.60	208.12
23 25 13 00-0010 Floor Mount, 175 PSIG <small>(23 25 13 00-0007)</small>						
	23 25 13 00-0011	EA		5 Gallon Bypass Shot Chemical Feeder, Floor Mount, 175 PSIG.....	1,124.67	313.28
	23 25 13 00-0012	EA		12 Gallon Bypass Shot Chemical Feeder, Floor Mount, 175 PSIG.....	1,480.79	414.78

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 20 HVAC Piping And Pumps****23 25 HVAC Water Treatment**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 25 13 00-0013			Floor Mount, 150 LB ASME Code <small>(23 25 13 00-0007)</small>		
23 25 13 00-0014	EA		5 Gallon Bypass Shot Chemical Feeder, Floor Mount, 150 LB ASME Code	1,124.67	313.28
23 25 13 00-0015	EA		10 Gallon Bypass Shot Chemical Feeder, Floor Mount, 150 LB ASME Code	1,480.79	414.78
23 25 13 00-0016			Floor Mount, 300 LB ASME Code <small>(23 25 13 00-0007)</small>		
23 25 13 00-0017	EA		5 Gallon Bypass Shot Chemical Feeder, Floor Mount, 300 LB ASME Code	1,491.91	313.28
23 25 13 00-0018	EA		10 Gallon Bypass Shot Chemical Feeder, Floor Mount, 300 LB ASME Code	1,862.10	414.78

23 30 HVAC Air Distribution (23)**23 31 HVAC Ducts And Casings** (23 30)

Note: Excludes angle iron, threaded rod, anchor bolts or other external supporting devices other than normal sheet metal straps. See CSI section 05 12 23 00-0120 for angle iron, 23 05 29 00-0001 for threaded rod.

23 31 13 Metal Ducts (23 31)**23 31 13 13 Rectangular Metal Ducts** (23 31 13)**23 31 13 13-0001 Steel Sheet Metal Duct** (23 31 13 13)

Note: All field fabricated duct is assembled from flat duct sheets on site to fit to exact field conditions. Ductwork which is fabricated off site or snap-fitting duct is considered as shop fabricated.

23 31 13 13-0002 Galvanized Steel Sheet Metal Ductwork (23 31 13 13-0001)

Note: Ductwork poundage includes all fittings, transitions, collars, straps, support straps, etc. Pressure class 2" w.g. and less are considered low pressure/seal class C; pressure class 3" w.g. and less are considered medium pressure/seal class B; pressure class 4" w.g. and larger are considered high pressure/seal class A. Shop fabricated ductwork is designed and fabricated in shop with machines, delivered to site and installed. Field fabricated ductwork is fabricated by hand to fit unique designs and installed on site. SMACNA weight for ductwork LB/SF (surface areas) by gauge: 30 gauge - 0.656 LB/SF; 28 gauge - 0.781 LB/SF; 26 gauge - 0.906 LB/SF; 24 gauge - 1.156 LB/SF; 22 gauge - 1.406 LB/SF; 20 gauge - 1.656 LB/SF; 18 gauge - 2.156 LB/SF; 16 gauge - 2.656 LB/SF; Add 10% additional material for lappage. The gauge of sheet metal is determined by the dimensional opening. Use the following to determine the minimum gauge of low pressure rectangular sheet metal ductwork unless otherwise stated by owner or drawings. The largest dimension of duct governs the gauge: up to 12" - 26 gauge, 13" to 30" - 24 gauge, 31" to 54" - 22 gauge, 55" to 84" - 20 gauge, 85" and larger - 18 gauge. For fittings add the following equivalent lengths: 0.75' for duct end cap; 1.5' for tap-in; 2.5' for 45 degree elbows; 3' for 90 degree elbows, transition, taper, register box; 4' for 45 degree reducing elbow, offset, turning vanes installed in elbows; 5' for 90 degree reducing elbow, 135 degree angle gooseneck, boots; and 6' for transition/reducer.

23 31 13 13-0003	LB		Sheet Metal Ductwork, Low Pressure, Field Fabricated, Galvanized, Field Assemble And Install	8.37	2.22
			<i>For Flat Oval, Add</i>	0.17	
			<i>For Up To 200, Add</i>	2.84	
			<i>For >200 To 500, Add</i>	1.78	
			<i>For >500 To 1,000, Add</i>	1.25	
			<i>For >1,000 To 2,000, Add</i>	0.70	
			<i>For >2,000 To 5,000, Add</i>	0.32	
			<i>For Work In Restricted Working Space, Add</i>	2.18	
23 31 13 13-0004	LB		Sheet Metal Ductwork, Medium Pressure, Field Fabricated, Galvanized, Field Assemble And Install	9.53	2.59
			<i>For Flat Oval, Add</i>	0.18	
			<i>For Up To 200, Add</i>	3.21	
			<i>For >200 To 500, Add</i>	2.01	
			<i>For >500 To 1,000, Add</i>	1.42	
			<i>For >1,000 To 2,000, Add</i>	0.80	
			<i>For >2,000 To 5,000, Add</i>	0.37	
			<i>For Work In Restricted Working Space, Add</i>	2.51	
23 31 13 13-0005	LB		Sheet Metal Ductwork, High Pressure, Field Fabricated, Galvanized, Field Assemble And Install	11.41	2.95
			<i>For Flat Oval, Add</i>	0.19	
			<i>For Up To 200, Add</i>	3.80	
			<i>For >200 To 500, Add</i>	2.37	
			<i>For >500 To 1,000, Add</i>	1.69	
			<i>For >1,000 To 2,000, Add</i>	0.95	
			<i>For >2,000 To 5,000, Add</i>	0.44	
			<i>For Work In Restricted Working Space, Add</i>	3.04	
23 31 13 13-0006	LB		Sheet Metal Ductwork, Low Pressure, Shop Fabricated, Galvanized, Field Assemble And Install	5.43	2.22
			<i>For Polyvinyl Chloride (PVC) Coated, Add</i>	0.35	
			<i>For Flat Oval, Add</i>	0.26	
			<i>For Up To 200, Add</i>	2.15	
			<i>For >200 To 500, Add</i>	1.41	
			<i>For >500 To 1,000, Add</i>	0.88	
			<i>For >1,000 To 2,000, Add</i>	0.49	
			<i>For >2,000 To 5,000, Add</i>	0.20	
			<i>For Work In Restricted Working Space, Add</i>	1.11	
23 31 13 13-0007	LB		Sheet Metal Ductwork, Medium Pressure, Shop Fabricated, Galvanized, Field Assemble And Install	6.30	2.59
			<i>For Polyvinyl Chloride (PVC) Coated, Add</i>	0.43	
			<i>For Flat Oval, Add</i>	0.32	
			<i>For Up To 200, Add</i>	2.53	
			<i>For >200 To 500, Add</i>	1.67	
			<i>For >500 To 1,000, Add</i>	1.03	
			<i>For >1,000 To 2,000, Add</i>	0.57	
			<i>For >2,000 To 5,000, Add</i>	0.23	
			<i>For Work In Restricted Working Space, Add</i>	1.25	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31 13 13-0008 LB Sheet Metal Ductwork, High Pressure, Shop Fabricated, Galvanized, Field Assemble And Install.....	7.66	2.95
<i>For Polyvinyl Chloride (PVC) Coated, Add</i>	0.52	
<i>For Flat Oval, Add</i>	0.39	
<i>For Up To 200, Add</i>	3.08	
<i>For >200 To 500, Add</i>	2.03	
<i>For >500 To 1,000, Add</i>	1.26	
<i>For >1,000 To 2,000, Add</i>	0.69	
<i>For >2,000 To 5,000, Add</i>	0.28	
<i>For Work In Restricted Working Space, Add</i>	1.52	
23 31 13 13-0009 Galvanized Steel Sheet Metal Ductwork By LF <small>(23 31 13 13-0001)</small>		
Note: Ductwork includes collars, straps, support straps, etc. Shop fabricated ductwork is designed and fabricated in shop with machines, delivered to site and installed. For fittings add the following equivalent lengths: 0.75' for duct end cap; 1.5' for tap-in; 2.5' for 45 degree elbows; 3' for 90 degree elbows, transition, taper, register box; 4' for 45 degree reducing elbow, offset, turning vanes installed in elbows; 5' for 90 degree reducing elbow, 135 degree angle gooseneck, boots; and 6' for transition/reducer.		
23 31 13 13-0010 30 Gauge Galvanized Steel Duct <small>(23 31 13 13-0009)</small>		
23 31 13 13-0011 LF 4" x 4", 30 Gauge Galvanized Steel Duct	5.23	2.14
<i>For Flat Oval, Add</i>	0.25	
<i>For Work In Restricted Working Space, Add</i>	1.07	
23 31 13 13-0012 LF 4" x 6", 30 Gauge Galvanized Steel Duct	6.53	2.67
<i>For Flat Oval, Add</i>	0.31	
<i>For Work In Restricted Working Space, Add</i>	1.34	
23 31 13 13-0013 LF 4" x 8", 30 Gauge Galvanized Steel Duct	7.83	3.20
<i>For Flat Oval, Add</i>	0.38	
<i>For Work In Restricted Working Space, Add</i>	1.60	
23 31 13 13-0014 LF 4" x 10", 30 Gauge Galvanized Steel Duct	9.13	3.73
<i>For Flat Oval, Add</i>	0.44	
<i>For Work In Restricted Working Space, Add</i>	1.87	
23 31 13 13-0015 LF 4" x 12", 30 Gauge Galvanized Steel Duct	10.46	4.26
<i>For Flat Oval, Add</i>	0.50	
<i>For Work In Restricted Working Space, Add</i>	2.14	
23 31 13 13-0016 LF 4" x 14", 30 Gauge Galvanized Steel Duct	11.74	4.80
<i>For Flat Oval, Add</i>	0.56	
<i>For Work In Restricted Working Space, Add</i>	2.40	
23 31 13 13-0017 LF 4" x 16", 30 Gauge Galvanized Steel Duct	13.04	5.33
<i>For Flat Oval, Add</i>	0.62	
<i>For Work In Restricted Working Space, Add</i>	2.67	
23 31 13 13-0018 LF 6" x 6", 30 Gauge Galvanized Steel Duct	7.83	3.20
<i>For Flat Oval, Add</i>	0.38	
<i>For Work In Restricted Working Space, Add</i>	1.60	
23 31 13 13-0019 LF 6" x 8", 30 Gauge Galvanized Steel Duct	9.13	3.73
<i>For Flat Oval, Add</i>	0.44	
<i>For Work In Restricted Working Space, Add</i>	1.87	
23 31 13 13-0020 LF 6" x 10", 30 Gauge Galvanized Steel Duct	10.46	4.26
<i>For Flat Oval, Add</i>	0.50	
<i>For Work In Restricted Working Space, Add</i>	2.14	
23 31 13 13-0021 LF 6" x 12", 30 Gauge Galvanized Steel Duct	11.74	4.80
<i>For Flat Oval, Add</i>	0.56	
<i>For Work In Restricted Working Space, Add</i>	2.40	
23 31 13 13-0022 LF 6" x 14", 30 Gauge Galvanized Steel Duct	13.04	5.33
<i>For Flat Oval, Add</i>	0.62	
<i>For Work In Restricted Working Space, Add</i>	2.67	
23 31 13 13-0023 LF 6" x 16", 30 Gauge Galvanized Steel Duct	14.36	5.87
<i>For Flat Oval, Add</i>	0.69	
<i>For Work In Restricted Working Space, Add</i>	2.93	
23 31 13 13-0024 LF 8" x 8", 30 Gauge Galvanized Steel Duct	10.46	4.26
<i>For Flat Oval, Add</i>	0.50	
<i>For Work In Restricted Working Space, Add</i>	2.14	
23 31 13 13-0025 LF 8" x 10", 30 Gauge Galvanized Steel Duct	11.74	4.80
<i>For Flat Oval, Add</i>	0.56	
<i>For Work In Restricted Working Space, Add</i>	2.40	
23 31 13 13-0026 LF 8" x 12", 30 Gauge Galvanized Steel Duct	13.04	5.33
<i>For Flat Oval, Add</i>	0.62	
<i>For Work In Restricted Working Space, Add</i>	2.67	
23 31 13 13-0027 LF 8" x 14", 30 Gauge Galvanized Steel Duct	14.36	5.87
<i>For Flat Oval, Add</i>	0.69	
<i>For Work In Restricted Working Space, Add</i>	2.93	
23 31 13 13-0028 LF 8" x 16", 30 Gauge Galvanized Steel Duct	15.65	6.40
<i>For Flat Oval, Add</i>	0.75	
<i>For Work In Restricted Working Space, Add</i>	3.20	
23 31 13 13-0029 LF 8" x 18", 30 Gauge Galvanized Steel Duct	16.96	6.94
<i>For Flat Oval, Add</i>	0.81	
<i>For Work In Restricted Working Space, Add</i>	3.47	
23 31 13 13-0030 LF 8" x 20", 30 Gauge Galvanized Steel Duct	18.27	7.47
<i>For Flat Oval, Add</i>	0.87	
<i>For Work In Restricted Working Space, Add</i>	3.74	
23 31 13 13-0031 LF 8" x 22", 30 Gauge Galvanized Steel Duct	19.59	8.00
<i>For Flat Oval, Add</i>	0.94	
<i>For Work In Restricted Working Space, Add</i>	4.00	
23 31 13 13-0032 LF 8" x 24", 30 Gauge Galvanized Steel Duct	20.87	8.54
<i>For Flat Oval, Add</i>	1.00	
<i>For Work In Restricted Working Space, Add</i>	4.27	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 31 HVAC Ducts And Casings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31 13	13-0033	LF	10" x 10", 30 Gauge Galvanized Steel Duct	13.04	5.33
			<i>For Flat Oval, Add</i>	0.62	
			<i>For Work In Restricted Working Space, Add</i>	2.67	
23 31 13	13-0034	LF	10" x 12", 30 Gauge Galvanized Steel Duct	14.36	5.87
			<i>For Flat Oval, Add</i>	0.69	
			<i>For Work In Restricted Working Space, Add</i>	2.93	
23 31 13	13-0035	LF	10" x 14", 30 Gauge Galvanized Steel Duct	15.65	6.40
			<i>For Flat Oval, Add</i>	0.75	
			<i>For Work In Restricted Working Space, Add</i>	3.20	
23 31 13	13-0036	LF	10" x 16", 30 Gauge Galvanized Steel Duct	16.96	6.94
			<i>For Flat Oval, Add</i>	0.81	
			<i>For Work In Restricted Working Space, Add</i>	3.47	
23 31 13	13-0037	LF	10" x 18", 30 Gauge Galvanized Steel Duct	18.27	7.47
			<i>For Flat Oval, Add</i>	0.87	
			<i>For Work In Restricted Working Space, Add</i>	3.74	
23 31 13	13-0038	LF	10" x 20", 30 Gauge Galvanized Steel Duct	19.59	8.00
			<i>For Flat Oval, Add</i>	0.94	
			<i>For Work In Restricted Working Space, Add</i>	4.00	
23 31 13	13-0039	LF	10" x 22", 30 Gauge Galvanized Steel Duct	20.87	8.54
			<i>For Flat Oval, Add</i>	1.00	
			<i>For Work In Restricted Working Space, Add</i>	4.27	
23 31 13	13-0040	LF	10" x 24", 30 Gauge Galvanized Steel Duct	22.19	9.07
			<i>For Flat Oval, Add</i>	1.06	
			<i>For Work In Restricted Working Space, Add</i>	4.53	
23 31 13	13-0041	LF	12" x 12", 30 Gauge Galvanized Steel Duct	15.65	6.40
			<i>For Flat Oval, Add</i>	0.75	
			<i>For Work In Restricted Working Space, Add</i>	3.20	
23 31 13	13-0042	LF	12" x 14", 30 Gauge Galvanized Steel Duct	16.96	6.94
			<i>For Flat Oval, Add</i>	0.81	
			<i>For Work In Restricted Working Space, Add</i>	3.47	
23 31 13	13-0043	LF	12" x 16", 30 Gauge Galvanized Steel Duct	18.27	7.47
			<i>For Flat Oval, Add</i>	0.87	
			<i>For Work In Restricted Working Space, Add</i>	3.74	
23 31 13	13-0044	LF	12" x 18", 30 Gauge Galvanized Steel Duct	19.59	8.00
			<i>For Flat Oval, Add</i>	0.94	
			<i>For Work In Restricted Working Space, Add</i>	4.00	
23 31 13	13-0045	LF	12" x 20", 30 Gauge Galvanized Steel Duct	20.87	8.54
			<i>For Flat Oval, Add</i>	1.00	
			<i>For Work In Restricted Working Space, Add</i>	4.27	
23 31 13	13-0046	LF	12" x 22", 30 Gauge Galvanized Steel Duct	22.19	9.07
			<i>For Flat Oval, Add</i>	1.06	
			<i>For Work In Restricted Working Space, Add</i>	4.53	
23 31 13	13-0047	LF	12" x 24", 30 Gauge Galvanized Steel Duct	23.49	9.60
			<i>For Flat Oval, Add</i>	1.12	
			<i>For Work In Restricted Working Space, Add</i>	4.80	
23 31 13	13-0048	LF	14" x 14", 30 Gauge Galvanized Steel Duct	18.27	7.47
			<i>For Flat Oval, Add</i>	0.87	
			<i>For Work In Restricted Working Space, Add</i>	3.74	
23 31 13	13-0049	LF	14" x 16", 30 Gauge Galvanized Steel Duct	19.59	8.00
			<i>For Flat Oval, Add</i>	0.94	
			<i>For Work In Restricted Working Space, Add</i>	4.00	
23 31 13	13-0050	LF	14" x 18", 30 Gauge Galvanized Steel Duct	20.87	8.54
			<i>For Flat Oval, Add</i>	1.00	
			<i>For Work In Restricted Working Space, Add</i>	4.27	
23 31 13	13-0051	LF	14" x 20", 30 Gauge Galvanized Steel Duct	22.19	9.07
			<i>For Flat Oval, Add</i>	1.06	
			<i>For Work In Restricted Working Space, Add</i>	4.53	
23 31 13	13-0052	LF	14" x 22", 30 Gauge Galvanized Steel Duct	23.49	9.60
			<i>For Flat Oval, Add</i>	1.12	
			<i>For Work In Restricted Working Space, Add</i>	4.80	
23 31 13	13-0053	LF	14" x 24", 30 Gauge Galvanized Steel Duct	24.81	10.13
			<i>For Flat Oval, Add</i>	1.19	
			<i>For Work In Restricted Working Space, Add</i>	5.07	
23 31 13	13-0054	LF	16" x 16", 30 Gauge Galvanized Steel Duct	20.87	8.54
			<i>For Flat Oval, Add</i>	1.00	
			<i>For Work In Restricted Working Space, Add</i>	4.27	
23 31 13	13-0055	LF	16" x 18", 30 Gauge Galvanized Steel Duct	22.19	9.07
			<i>For Flat Oval, Add</i>	1.06	
			<i>For Work In Restricted Working Space, Add</i>	4.53	
23 31 13	13-0056	LF	16" x 20", 30 Gauge Galvanized Steel Duct	23.49	9.60
			<i>For Flat Oval, Add</i>	1.12	
			<i>For Work In Restricted Working Space, Add</i>	4.80	
23 31 13	13-0057	LF	16" x 22", 30 Gauge Galvanized Steel Duct	24.81	10.13
			<i>For Flat Oval, Add</i>	1.19	
			<i>For Work In Restricted Working Space, Add</i>	5.07	
23 31 13	13-0058	LF	16" x 24", 30 Gauge Galvanized Steel Duct	26.10	10.67
			<i>For Flat Oval, Add</i>	1.25	
			<i>For Work In Restricted Working Space, Add</i>	5.33	
23 31 13	13-0059	LF	18" x 18", 30 Gauge Galvanized Steel Duct	23.49	9.60
			<i>For Flat Oval, Add</i>	1.12	
			<i>For Work In Restricted Working Space, Add</i>	4.80	
23 31 13	13-0060	LF	18" x 20", 30 Gauge Galvanized Steel Duct	24.81	10.13
			<i>For Flat Oval, Add</i>	1.19	
			<i>For Work In Restricted Working Space, Add</i>	5.07	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31 13 13-0061 LF 18" x 22", 30 Gauge Galvanized Steel Duct	26.10	10.67
For Flat Oval, Add	1.25	
For Work In Restricted Working Space, Add	5.33	
23 31 13 13-0062 LF 18" x 24", 30 Gauge Galvanized Steel Duct	27.40	11.20
For Flat Oval, Add	1.31	
For Work In Restricted Working Space, Add	5.60	
23 31 13 13-0063 LF 20" x 20", 30 Gauge Galvanized Steel Duct	26.10	10.67
For Flat Oval, Add	1.25	
For Work In Restricted Working Space, Add	5.33	
23 31 13 13-0064 LF 20" x 22", 30 Gauge Galvanized Steel Duct	27.40	11.20
For Flat Oval, Add	1.31	
For Work In Restricted Working Space, Add	5.60	
23 31 13 13-0065 LF 20" x 24", 30 Gauge Galvanized Steel Duct	28.71	11.73
For Flat Oval, Add	1.37	
For Work In Restricted Working Space, Add	5.87	
23 31 13 13-0066 LF 22" x 22", 30 Gauge Galvanized Steel Duct	28.71	11.73
For Flat Oval, Add	1.37	
For Work In Restricted Working Space, Add	5.87	
23 31 13 13-0067 LF 22" x 24", 30 Gauge Galvanized Steel Duct	30.00	12.27
For Flat Oval, Add	1.43	
For Work In Restricted Working Space, Add	6.13	
23 31 13 13-0068 LF 24" x 24", 30 Gauge Galvanized Steel Duct	31.33	12.80
For Flat Oval, Add	1.50	
For Work In Restricted Working Space, Add	6.40	
23 31 13 13-0069 28 Gauge Galvanized Steel Duct <small>(23 31 13 13-0009)</small>		
23 31 13 13-0070 LF 4" x 4", 28 Gauge Galvanized Steel Duct	6.20	2.54
For Flat Oval, Add	0.30	
For Work In Restricted Working Space, Add	1.27	
23 31 13 13-0071 LF 4" x 6", 28 Gauge Galvanized Steel Duct	7.77	3.18
For Flat Oval, Add	0.37	
For Work In Restricted Working Space, Add	1.59	
23 31 13 13-0072 LF 4" x 8", 28 Gauge Galvanized Steel Duct	9.32	3.81
For Flat Oval, Add	0.45	
For Work In Restricted Working Space, Add	1.91	
23 31 13 13-0073 LF 4" x 10", 28 Gauge Galvanized Steel Duct	10.87	4.45
For Flat Oval, Add	0.52	
For Work In Restricted Working Space, Add	2.22	
23 31 13 13-0074 LF 4" x 12", 28 Gauge Galvanized Steel Duct	12.44	5.08
For Flat Oval, Add	0.60	
For Work In Restricted Working Space, Add	2.54	
23 31 13 13-0075 LF 4" x 14", 28 Gauge Galvanized Steel Duct	13.99	5.72
For Flat Oval, Add	0.67	
For Work In Restricted Working Space, Add	2.86	
23 31 13 13-0076 LF 4" x 16", 28 Gauge Galvanized Steel Duct	15.52	6.35
For Flat Oval, Add	0.74	
For Work In Restricted Working Space, Add	3.17	
23 31 13 13-0077 LF 6" x 6", 28 Gauge Galvanized Steel Duct	9.32	3.81
For Flat Oval, Add	0.45	
For Work In Restricted Working Space, Add	1.91	
23 31 13 13-0078 LF 6" x 8", 28 Gauge Galvanized Steel Duct	10.87	4.45
For Flat Oval, Add	0.52	
For Work In Restricted Working Space, Add	2.22	
23 31 13 13-0079 LF 6" x 10", 28 Gauge Galvanized Steel Duct	12.44	5.08
For Flat Oval, Add	0.60	
For Work In Restricted Working Space, Add	2.54	
23 31 13 13-0080 LF 6" x 12", 28 Gauge Galvanized Steel Duct	13.99	5.72
For Flat Oval, Add	0.67	
For Work In Restricted Working Space, Add	2.86	
23 31 13 13-0081 LF 6" x 14", 28 Gauge Galvanized Steel Duct	15.52	6.35
For Flat Oval, Add	0.74	
For Work In Restricted Working Space, Add	3.17	
23 31 13 13-0082 LF 6" x 16", 28 Gauge Galvanized Steel Duct	17.09	6.99
For Flat Oval, Add	0.82	
For Work In Restricted Working Space, Add	3.49	
23 31 13 13-0083 LF 8" x 8", 28 Gauge Galvanized Steel Duct	12.44	5.08
For Flat Oval, Add	0.60	
For Work In Restricted Working Space, Add	2.54	
23 31 13 13-0084 LF 8" x 10", 28 Gauge Galvanized Steel Duct	13.99	5.72
For Flat Oval, Add	0.67	
For Work In Restricted Working Space, Add	2.86	
23 31 13 13-0085 LF 8" x 12", 28 Gauge Galvanized Steel Duct	15.52	6.35
For Flat Oval, Add	0.74	
For Work In Restricted Working Space, Add	3.17	
23 31 13 13-0086 LF 8" x 14", 28 Gauge Galvanized Steel Duct	17.09	6.99
For Flat Oval, Add	0.82	
For Work In Restricted Working Space, Add	3.49	
23 31 13 13-0087 LF 8" x 16", 28 Gauge Galvanized Steel Duct	18.64	7.62
For Flat Oval, Add	0.89	
For Work In Restricted Working Space, Add	3.81	
23 31 13 13-0088 LF 8" x 18", 28 Gauge Galvanized Steel Duct	20.19	8.26
For Flat Oval, Add	0.96	
For Work In Restricted Working Space, Add	4.13	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 31 HVAC Ducts And Casings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31 13 13-0089	LF		8" x 20", 28 Gauge Galvanized Steel Duct	21.76	8.89
			<i>For Flat Oval, Add</i>	1.04	
			<i>For Work In Restricted Working Space, Add</i>	4.45	
23 31 13 13-0090	LF		8" x 22", 28 Gauge Galvanized Steel Duct	23.31	9.53
			<i>For Flat Oval, Add</i>	1.11	
			<i>For Work In Restricted Working Space, Add</i>	4.76	
23 31 13 13-0091	LF		8" x 24", 28 Gauge Galvanized Steel Duct	24.87	10.16
			<i>For Flat Oval, Add</i>	1.19	
			<i>For Work In Restricted Working Space, Add</i>	5.08	
23 31 13 13-0092	LF		10" x 10", 28 Gauge Galvanized Steel Duct	15.52	6.35
			<i>For Flat Oval, Add</i>	0.74	
			<i>For Work In Restricted Working Space, Add</i>	3.17	
23 31 13 13-0093	LF		10" x 12", 28 Gauge Galvanized Steel Duct	17.09	6.99
			<i>For Flat Oval, Add</i>	0.82	
			<i>For Work In Restricted Working Space, Add</i>	3.49	
23 31 13 13-0094	LF		10" x 14", 28 Gauge Galvanized Steel Duct	18.64	7.62
			<i>For Flat Oval, Add</i>	0.89	
			<i>For Work In Restricted Working Space, Add</i>	3.81	
23 31 13 13-0095	LF		10" x 16", 28 Gauge Galvanized Steel Duct	20.19	8.26
			<i>For Flat Oval, Add</i>	0.96	
			<i>For Work In Restricted Working Space, Add</i>	4.13	
23 31 13 13-0096	LF		10" x 18", 28 Gauge Galvanized Steel Duct	21.76	8.89
			<i>For Flat Oval, Add</i>	1.04	
			<i>For Work In Restricted Working Space, Add</i>	4.45	
23 31 13 13-0097	LF		10" x 20", 28 Gauge Galvanized Steel Duct	23.31	9.53
			<i>For Flat Oval, Add</i>	1.11	
			<i>For Work In Restricted Working Space, Add</i>	4.76	
23 31 13 13-0098	LF		10" x 22", 28 Gauge Galvanized Steel Duct	24.87	10.16
			<i>For Flat Oval, Add</i>	1.19	
			<i>For Work In Restricted Working Space, Add</i>	5.08	
23 31 13 13-0099	LF		10" x 24", 28 Gauge Galvanized Steel Duct	26.41	10.80
			<i>For Flat Oval, Add</i>	1.26	
			<i>For Work In Restricted Working Space, Add</i>	5.40	
23 31 13 13-0100	LF		12" x 12", 28 Gauge Galvanized Steel Duct	18.64	7.62
			<i>For Flat Oval, Add</i>	0.89	
			<i>For Work In Restricted Working Space, Add</i>	3.81	
23 31 13 13-0101	LF		12" x 14", 28 Gauge Galvanized Steel Duct	20.19	8.26
			<i>For Flat Oval, Add</i>	0.96	
			<i>For Work In Restricted Working Space, Add</i>	4.13	
23 31 13 13-0102	LF		12" x 16", 28 Gauge Galvanized Steel Duct	21.76	8.89
			<i>For Flat Oval, Add</i>	1.04	
			<i>For Work In Restricted Working Space, Add</i>	4.45	
23 31 13 13-0103	LF		12" x 18", 28 Gauge Galvanized Steel Duct	23.31	9.53
			<i>For Flat Oval, Add</i>	1.11	
			<i>For Work In Restricted Working Space, Add</i>	4.76	
23 31 13 13-0104	LF		12" x 20", 28 Gauge Galvanized Steel Duct	24.87	10.16
			<i>For Flat Oval, Add</i>	1.19	
			<i>For Work In Restricted Working Space, Add</i>	5.08	
23 31 13 13-0105	LF		12" x 22", 28 Gauge Galvanized Steel Duct	26.41	10.80
			<i>For Flat Oval, Add</i>	1.26	
			<i>For Work In Restricted Working Space, Add</i>	5.40	
23 31 13 13-0106	LF		12" x 24", 28 Gauge Galvanized Steel Duct	27.96	11.43
			<i>For Flat Oval, Add</i>	1.34	
			<i>For Work In Restricted Working Space, Add</i>	5.72	
23 31 13 13-0107	LF		14" x 14", 28 Gauge Galvanized Steel Duct	21.76	8.89
			<i>For Flat Oval, Add</i>	1.04	
			<i>For Work In Restricted Working Space, Add</i>	4.45	
23 31 13 13-0108	LF		14" x 16", 28 Gauge Galvanized Steel Duct	23.31	9.53
			<i>For Flat Oval, Add</i>	1.11	
			<i>For Work In Restricted Working Space, Add</i>	4.76	
23 31 13 13-0109	LF		14" x 18", 28 Gauge Galvanized Steel Duct	24.87	10.16
			<i>For Flat Oval, Add</i>	1.19	
			<i>For Work In Restricted Working Space, Add</i>	5.08	
23 31 13 13-0110	LF		14" x 20", 28 Gauge Galvanized Steel Duct	26.41	10.80
			<i>For Flat Oval, Add</i>	1.26	
			<i>For Work In Restricted Working Space, Add</i>	5.40	
23 31 13 13-0111	LF		14" x 22", 28 Gauge Galvanized Steel Duct	27.96	11.43
			<i>For Flat Oval, Add</i>	1.34	
			<i>For Work In Restricted Working Space, Add</i>	5.72	
23 31 13 13-0112	LF		14" x 24", 28 Gauge Galvanized Steel Duct	29.53	12.07
			<i>For Flat Oval, Add</i>	1.41	
			<i>For Work In Restricted Working Space, Add</i>	6.03	
23 31 13 13-0113	LF		16" x 16", 28 Gauge Galvanized Steel Duct	24.87	10.16
			<i>For Flat Oval, Add</i>	1.19	
			<i>For Work In Restricted Working Space, Add</i>	5.08	
23 31 13 13-0114	LF		16" x 18", 28 Gauge Galvanized Steel Duct	26.41	10.80
			<i>For Flat Oval, Add</i>	1.26	
			<i>For Work In Restricted Working Space, Add</i>	5.40	
23 31 13 13-0115	LF		16" x 20", 28 Gauge Galvanized Steel Duct	27.96	11.43
			<i>For Flat Oval, Add</i>	1.34	
			<i>For Work In Restricted Working Space, Add</i>	5.72	
23 31 13 13-0116	LF		16" x 22", 28 Gauge Galvanized Steel Duct	29.53	12.07
			<i>For Flat Oval, Add</i>	1.41	
			<i>For Work In Restricted Working Space, Add</i>	6.03	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31 13 13-0117 LF 16" x 24", 28 Gauge Galvanized Steel Duct	31.08	12.70
<i>For Flat Oval, Add</i>	1.49	
<i>For Work In Restricted Working Space, Add</i>	6.35	
23 31 13 13-0118 LF 18" x 18", 28 Gauge Galvanized Steel Duct	27.96	11.43
<i>For Flat Oval, Add</i>	1.34	
<i>For Work In Restricted Working Space, Add</i>	5.72	
23 31 13 13-0119 LF 18" x 20", 28 Gauge Galvanized Steel Duct	29.53	12.07
<i>For Flat Oval, Add</i>	1.41	
<i>For Work In Restricted Working Space, Add</i>	6.03	
23 31 13 13-0120 LF 18" x 22", 28 Gauge Galvanized Steel Duct	31.08	12.70
<i>For Flat Oval, Add</i>	1.49	
<i>For Work In Restricted Working Space, Add</i>	6.35	
23 31 13 13-0121 LF 18" x 24", 28 Gauge Galvanized Steel Duct	32.63	13.34
<i>For Flat Oval, Add</i>	1.56	
<i>For Work In Restricted Working Space, Add</i>	6.67	
23 31 13 13-0122 LF 20" x 20", 28 Gauge Galvanized Steel Duct	31.08	12.70
<i>For Flat Oval, Add</i>	1.49	
<i>For Work In Restricted Working Space, Add</i>	6.35	
23 31 13 13-0123 LF 20" x 22", 28 Gauge Galvanized Steel Duct	32.63	13.34
<i>For Flat Oval, Add</i>	1.56	
<i>For Work In Restricted Working Space, Add</i>	6.67	
23 31 13 13-0124 LF 20" x 24", 28 Gauge Galvanized Steel Duct	34.19	13.97
<i>For Flat Oval, Add</i>	1.64	
<i>For Work In Restricted Working Space, Add</i>	6.99	
23 31 13 13-0125 LF 22" x 22", 28 Gauge Galvanized Steel Duct	34.19	13.97
<i>For Flat Oval, Add</i>	1.64	
<i>For Work In Restricted Working Space, Add</i>	6.99	
23 31 13 13-0126 LF 22" x 24", 28 Gauge Galvanized Steel Duct	35.74	14.61
<i>For Flat Oval, Add</i>	1.71	
<i>For Work In Restricted Working Space, Add</i>	7.31	
23 31 13 13-0127 LF 24" x 24", 28 Gauge Galvanized Steel Duct	37.28	15.24
<i>For Flat Oval, Add</i>	1.78	
<i>For Work In Restricted Working Space, Add</i>	7.62	
23 31 13 13-0128 26 Gauge Galvanized Steel Duct (23 31 13 13-0009)		
23 31 13 13-0129 LF 4" x 4", 26 Gauge Galvanized Steel Duct	7.21	2.95
<i>For Flat Oval, Add</i>	0.35	
<i>For Work In Restricted Working Space, Add</i>	1.47	
23 31 13 13-0130 LF 4" x 6", 26 Gauge Galvanized Steel Duct	9.01	3.68
<i>For Flat Oval, Add</i>	0.43	
<i>For Work In Restricted Working Space, Add</i>	1.84	
23 31 13 13-0131 LF 4" x 8", 26 Gauge Galvanized Steel Duct	10.82	4.43
<i>For Flat Oval, Add</i>	0.52	
<i>For Work In Restricted Working Space, Add</i>	2.21	
23 31 13 13-0132 LF 4" x 10", 26 Gauge Galvanized Steel Duct	12.62	5.16
<i>For Flat Oval, Add</i>	0.60	
<i>For Work In Restricted Working Space, Add</i>	2.58	
23 31 13 13-0133 LF 4" x 12", 26 Gauge Galvanized Steel Duct	14.43	5.89
<i>For Flat Oval, Add</i>	0.69	
<i>For Work In Restricted Working Space, Add</i>	2.95	
23 31 13 13-0134 LF 4" x 14", 26 Gauge Galvanized Steel Duct	16.22	6.63
<i>For Flat Oval, Add</i>	0.78	
<i>For Work In Restricted Working Space, Add</i>	3.32	
23 31 13 13-0135 LF 4" x 16", 26 Gauge Galvanized Steel Duct	18.02	7.37
<i>For Flat Oval, Add</i>	0.86	
<i>For Work In Restricted Working Space, Add</i>	3.68	
23 31 13 13-0136 LF 6" x 6", 26 Gauge Galvanized Steel Duct	10.82	4.43
<i>For Flat Oval, Add</i>	0.52	
<i>For Work In Restricted Working Space, Add</i>	2.21	
23 31 13 13-0137 LF 6" x 8", 26 Gauge Galvanized Steel Duct	12.62	5.16
<i>For Flat Oval, Add</i>	0.60	
<i>For Work In Restricted Working Space, Add</i>	2.58	
23 31 13 13-0138 LF 6" x 10", 26 Gauge Galvanized Steel Duct	14.43	5.89
<i>For Flat Oval, Add</i>	0.69	
<i>For Work In Restricted Working Space, Add</i>	2.95	
23 31 13 13-0139 LF 6" x 12", 26 Gauge Galvanized Steel Duct	16.22	6.63
<i>For Flat Oval, Add</i>	0.78	
<i>For Work In Restricted Working Space, Add</i>	3.32	
23 31 13 13-0140 LF 6" x 14", 26 Gauge Galvanized Steel Duct	18.02	7.37
<i>For Flat Oval, Add</i>	0.86	
<i>For Work In Restricted Working Space, Add</i>	3.68	
23 31 13 13-0141 LF 6" x 16", 26 Gauge Galvanized Steel Duct	19.84	8.10
<i>For Flat Oval, Add</i>	0.95	
<i>For Work In Restricted Working Space, Add</i>	4.05	
23 31 13 13-0142 LF 8" x 8", 26 Gauge Galvanized Steel Duct	14.43	5.89
<i>For Flat Oval, Add</i>	0.69	
<i>For Work In Restricted Working Space, Add</i>	2.95	
23 31 13 13-0143 LF 8" x 10", 26 Gauge Galvanized Steel Duct	16.22	6.63
<i>For Flat Oval, Add</i>	0.78	
<i>For Work In Restricted Working Space, Add</i>	3.32	
23 31 13 13-0144 LF 8" x 12", 26 Gauge Galvanized Steel Duct	18.02	7.37
<i>For Flat Oval, Add</i>	0.86	
<i>For Work In Restricted Working Space, Add</i>	3.68	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 31 HVAC Ducts And Casings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31 13	13-0145	LF	8" x 14", 26 Gauge Galvanized Steel Duct	19.84	8.10
			<i>For Flat Oval, Add</i>	0.95	
			<i>For Work In Restricted Working Space, Add</i>	4.05	
23 31 13	13-0146	LF	8" x 16", 26 Gauge Galvanized Steel Duct	21.64	8.84
			<i>For Flat Oval, Add</i>	1.04	
			<i>For Work In Restricted Working Space, Add</i>	4.42	
23 31 13	13-0147	LF	8" x 18", 26 Gauge Galvanized Steel Duct	23.43	9.58
			<i>For Flat Oval, Add</i>	1.12	
			<i>For Work In Restricted Working Space, Add</i>	4.79	
23 31 13	13-0148	LF	8" x 20", 26 Gauge Galvanized Steel Duct	25.23	10.31
			<i>For Flat Oval, Add</i>	1.21	
			<i>For Work In Restricted Working Space, Add</i>	5.16	
23 31 13	13-0149	LF	8" x 22", 26 Gauge Galvanized Steel Duct	27.05	11.05
			<i>For Flat Oval, Add</i>	1.29	
			<i>For Work In Restricted Working Space, Add</i>	5.53	
23 31 13	13-0150	LF	8" x 24", 26 Gauge Galvanized Steel Duct	28.85	11.78
			<i>For Flat Oval, Add</i>	1.38	
			<i>For Work In Restricted Working Space, Add</i>	5.90	
23 31 13	13-0151	LF	10" x 10", 26 Gauge Galvanized Steel Duct	18.02	7.37
			<i>For Flat Oval, Add</i>	0.86	
			<i>For Work In Restricted Working Space, Add</i>	3.68	
23 31 13	13-0152	LF	10" x 12", 26 Gauge Galvanized Steel Duct	19.83	8.10
			<i>For Flat Oval, Add</i>	0.95	
			<i>For Work In Restricted Working Space, Add</i>	4.05	
23 31 13	13-0153	LF	10" x 14", 26 Gauge Galvanized Steel Duct	21.64	8.84
			<i>For Flat Oval, Add</i>	1.04	
			<i>For Work In Restricted Working Space, Add</i>	4.42	
23 31 13	13-0154	LF	10" x 16", 26 Gauge Galvanized Steel Duct	23.43	9.58
			<i>For Flat Oval, Add</i>	1.12	
			<i>For Work In Restricted Working Space, Add</i>	4.79	
23 31 13	13-0155	LF	10" x 18", 26 Gauge Galvanized Steel Duct	25.23	10.31
			<i>For Flat Oval, Add</i>	1.21	
			<i>For Work In Restricted Working Space, Add</i>	5.16	
23 31 13	13-0156	LF	10" x 20", 26 Gauge Galvanized Steel Duct	27.05	11.05
			<i>For Flat Oval, Add</i>	1.29	
			<i>For Work In Restricted Working Space, Add</i>	5.53	
23 31 13	13-0157	LF	10" x 22", 26 Gauge Galvanized Steel Duct	28.85	11.78
			<i>For Flat Oval, Add</i>	1.38	
			<i>For Work In Restricted Working Space, Add</i>	5.90	
23 31 13	13-0158	LF	10" x 24", 26 Gauge Galvanized Steel Duct	30.64	12.52
			<i>For Flat Oval, Add</i>	1.46	
			<i>For Work In Restricted Working Space, Add</i>	6.26	
23 31 13	13-0159	LF	12" x 12", 26 Gauge Galvanized Steel Duct	21.62	8.84
			<i>For Flat Oval, Add</i>	1.03	
			<i>For Work In Restricted Working Space, Add</i>	4.42	
23 31 13	13-0160	LF	12" x 14", 26 Gauge Galvanized Steel Duct	23.43	9.58
			<i>For Flat Oval, Add</i>	1.12	
			<i>For Work In Restricted Working Space, Add</i>	4.79	
23 31 13	13-0161	LF	12" x 16", 26 Gauge Galvanized Steel Duct	25.23	10.31
			<i>For Flat Oval, Add</i>	1.21	
			<i>For Work In Restricted Working Space, Add</i>	5.16	
23 31 13	13-0162	LF	12" x 18", 26 Gauge Galvanized Steel Duct	27.05	11.05
			<i>For Flat Oval, Add</i>	1.29	
			<i>For Work In Restricted Working Space, Add</i>	5.53	
23 31 13	13-0163	LF	12" x 20", 26 Gauge Galvanized Steel Duct	28.85	11.78
			<i>For Flat Oval, Add</i>	1.38	
			<i>For Work In Restricted Working Space, Add</i>	5.90	
23 31 13	13-0164	LF	12" x 22", 26 Gauge Galvanized Steel Duct	30.64	12.52
			<i>For Flat Oval, Add</i>	1.46	
			<i>For Work In Restricted Working Space, Add</i>	6.26	
23 31 13	13-0165	LF	12" x 24", 26 Gauge Galvanized Steel Duct	32.43	13.26
			<i>For Flat Oval, Add</i>	1.55	
			<i>For Work In Restricted Working Space, Add</i>	6.63	
23 31 13	13-0166	LF	14" x 14", 26 Gauge Galvanized Steel Duct	25.23	10.31
			<i>For Flat Oval, Add</i>	1.21	
			<i>For Work In Restricted Working Space, Add</i>	5.16	
23 31 13	13-0167	LF	14" x 16", 26 Gauge Galvanized Steel Duct	27.05	11.05
			<i>For Flat Oval, Add</i>	1.29	
			<i>For Work In Restricted Working Space, Add</i>	5.53	
23 31 13	13-0168	LF	14" x 18", 26 Gauge Galvanized Steel Duct	28.85	11.78
			<i>For Flat Oval, Add</i>	1.38	
			<i>For Work In Restricted Working Space, Add</i>	5.90	
23 31 13	13-0169	LF	14" x 20", 26 Gauge Galvanized Steel Duct	30.64	12.52
			<i>For Flat Oval, Add</i>	1.46	
			<i>For Work In Restricted Working Space, Add</i>	6.26	
23 31 13	13-0170	LF	14" x 22", 26 Gauge Galvanized Steel Duct	32.43	13.26
			<i>For Flat Oval, Add</i>	1.55	
			<i>For Work In Restricted Working Space, Add</i>	6.63	
23 31 13	13-0171	LF	14" x 24", 26 Gauge Galvanized Steel Duct	34.25	14.00
			<i>For Flat Oval, Add</i>	1.64	
			<i>For Work In Restricted Working Space, Add</i>	7.00	
23 31 13	13-0172	LF	16" x 16", 26 Gauge Galvanized Steel Duct	28.85	11.78
			<i>For Flat Oval, Add</i>	1.38	
			<i>For Work In Restricted Working Space, Add</i>	5.90	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31 13 13-0173 LF 16" x 18", 26 Gauge Galvanized Steel Duct	30.64	12.52
For Flat Oval, Add	1.46	
For Work In Restricted Working Space, Add	6.26	
23 31 13 13-0174 LF 16" x 20", 26 Gauge Galvanized Steel Duct	32.43	13.26
For Flat Oval, Add	1.55	
For Work In Restricted Working Space, Add	6.63	
23 31 13 13-0175 LF 16" x 22", 26 Gauge Galvanized Steel Duct	34.25	14.00
For Flat Oval, Add	1.64	
For Work In Restricted Working Space, Add	7.00	
23 31 13 13-0176 LF 16" x 24", 26 Gauge Galvanized Steel Duct	36.05	14.74
For Flat Oval, Add	1.72	
For Work In Restricted Working Space, Add	7.37	
23 31 13 13-0177 LF 18" x 18", 26 Gauge Galvanized Steel Duct	32.43	13.26
For Flat Oval, Add	1.55	
For Work In Restricted Working Space, Add	6.63	
23 31 13 13-0178 LF 18" x 20", 26 Gauge Galvanized Steel Duct	34.25	14.00
For Flat Oval, Add	1.64	
For Work In Restricted Working Space, Add	7.00	
23 31 13 13-0179 LF 18" x 22", 26 Gauge Galvanized Steel Duct	36.05	14.74
For Flat Oval, Add	1.72	
For Work In Restricted Working Space, Add	7.37	
23 31 13 13-0180 LF 18" x 24", 26 Gauge Galvanized Steel Duct	37.85	15.47
For Flat Oval, Add	1.81	
For Work In Restricted Working Space, Add	7.74	
23 31 13 13-0181 LF 20" x 20", 26 Gauge Galvanized Steel Duct	36.05	14.74
For Flat Oval, Add	1.72	
For Work In Restricted Working Space, Add	7.37	
23 31 13 13-0182 LF 20" x 22", 26 Gauge Galvanized Steel Duct	37.85	15.47
For Flat Oval, Add	1.81	
For Work In Restricted Working Space, Add	7.74	
23 31 13 13-0183 LF 20" x 24", 26 Gauge Galvanized Steel Duct	39.65	16.21
For Flat Oval, Add	1.89	
For Work In Restricted Working Space, Add	8.11	
23 31 13 13-0184 LF 22" x 22", 26 Gauge Galvanized Steel Duct	39.65	16.21
For Flat Oval, Add	1.89	
For Work In Restricted Working Space, Add	8.11	
23 31 13 13-0185 LF 22" x 24", 26 Gauge Galvanized Steel Duct	41.46	16.95
For Flat Oval, Add	1.98	
For Work In Restricted Working Space, Add	8.47	
23 31 13 13-0186 LF 24" x 24", 26 Gauge Galvanized Steel Duct	43.26	17.68
For Flat Oval, Add	2.07	
For Work In Restricted Working Space, Add	8.84	
23 31 13 13-0187 24 Gauge Galvanized Steel Duct (23 31 13 13-0009)		
23 31 13 13-0188 LF 4" x 4", 24 Gauge Galvanized Steel Duct	9.20	3.76
For Flat Oval, Add	0.44	
For Work In Restricted Working Space, Add	1.88	
23 31 13 13-0189 LF 4" x 6", 24 Gauge Galvanized Steel Duct	11.49	4.70
For Flat Oval, Add	0.55	
For Work In Restricted Working Space, Add	2.35	
23 31 13 13-0190 LF 4" x 8", 24 Gauge Galvanized Steel Duct	13.81	5.65
For Flat Oval, Add	0.66	
For Work In Restricted Working Space, Add	2.82	
23 31 13 13-0191 LF 4" x 10", 24 Gauge Galvanized Steel Duct	16.10	6.58
For Flat Oval, Add	0.77	
For Work In Restricted Working Space, Add	3.29	
23 31 13 13-0192 LF 4" x 12", 24 Gauge Galvanized Steel Duct	18.39	7.52
For Flat Oval, Add	0.88	
For Work In Restricted Working Space, Add	3.76	
23 31 13 13-0193 LF 4" x 14", 24 Gauge Galvanized Steel Duct	20.69	8.46
For Flat Oval, Add	0.99	
For Work In Restricted Working Space, Add	4.23	
23 31 13 13-0194 LF 4" x 16", 24 Gauge Galvanized Steel Duct	23.00	9.41
For Flat Oval, Add	1.10	
For Work In Restricted Working Space, Add	4.70	
23 31 13 13-0195 LF 6" x 6", 24 Gauge Galvanized Steel Duct	13.81	5.65
For Flat Oval, Add	0.66	
For Work In Restricted Working Space, Add	2.82	
23 31 13 13-0196 LF 6" x 8", 24 Gauge Galvanized Steel Duct	16.10	6.58
For Flat Oval, Add	0.77	
For Work In Restricted Working Space, Add	3.29	
23 31 13 13-0197 LF 6" x 10", 24 Gauge Galvanized Steel Duct	18.39	7.52
For Flat Oval, Add	0.88	
For Work In Restricted Working Space, Add	3.76	
23 31 13 13-0198 LF 6" x 12", 24 Gauge Galvanized Steel Duct	20.69	8.46
For Flat Oval, Add	0.99	
For Work In Restricted Working Space, Add	4.23	
23 31 13 13-0199 LF 6" x 14", 24 Gauge Galvanized Steel Duct	23.00	9.41
For Flat Oval, Add	1.10	
For Work In Restricted Working Space, Add	4.70	
23 31 13 13-0200 LF 6" x 16", 24 Gauge Galvanized Steel Duct	25.29	10.34
For Flat Oval, Add	1.21	
For Work In Restricted Working Space, Add	5.17	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 31 HVAC Ducts And Casings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31 13	13-0201	LF	8" x 8", 24 Gauge Galvanized Steel Duct	18.39	7.52
			<i>For Flat Oval, Add</i>	0.88	
			<i>For Work In Restricted Working Space, Add</i>	3.76	
23 31 13	13-0202	LF	8" x 10", 24 Gauge Galvanized Steel Duct	20.69	8.46
			<i>For Flat Oval, Add</i>	0.99	
			<i>For Work In Restricted Working Space, Add</i>	4.23	
23 31 13	13-0203	LF	8" x 12", 24 Gauge Galvanized Steel Duct	23.00	9.41
			<i>For Flat Oval, Add</i>	1.10	
			<i>For Work In Restricted Working Space, Add</i>	4.70	
23 31 13	13-0204	LF	8" x 14", 24 Gauge Galvanized Steel Duct	25.29	10.34
			<i>For Flat Oval, Add</i>	1.21	
			<i>For Work In Restricted Working Space, Add</i>	5.17	
23 31 13	13-0205	LF	8" x 16", 24 Gauge Galvanized Steel Duct	27.60	11.28
			<i>For Flat Oval, Add</i>	1.32	
			<i>For Work In Restricted Working Space, Add</i>	5.64	
23 31 13	13-0206	LF	8" x 18", 24 Gauge Galvanized Steel Duct	29.89	12.22
			<i>For Flat Oval, Add</i>	1.43	
			<i>For Work In Restricted Working Space, Add</i>	6.11	
23 31 13	13-0207	LF	8" x 20", 24 Gauge Galvanized Steel Duct	32.20	13.16
			<i>For Flat Oval, Add</i>	1.54	
			<i>For Work In Restricted Working Space, Add</i>	6.58	
23 31 13	13-0208	LF	8" x 22", 24 Gauge Galvanized Steel Duct	34.50	14.09
			<i>For Flat Oval, Add</i>	1.65	
			<i>For Work In Restricted Working Space, Add</i>	7.05	
23 31 13	13-0209	LF	8" x 24", 24 Gauge Galvanized Steel Duct	36.80	15.04
			<i>For Flat Oval, Add</i>	1.76	
			<i>For Work In Restricted Working Space, Add</i>	7.52	
23 31 13	13-0210	LF	10" x 10", 24 Gauge Galvanized Steel Duct	23.00	9.41
			<i>For Flat Oval, Add</i>	1.10	
			<i>For Work In Restricted Working Space, Add</i>	4.70	
23 31 13	13-0211	LF	10" x 12", 24 Gauge Galvanized Steel Duct	25.29	10.34
			<i>For Flat Oval, Add</i>	1.21	
			<i>For Work In Restricted Working Space, Add</i>	5.17	
23 31 13	13-0212	LF	10" x 14", 24 Gauge Galvanized Steel Duct	27.60	11.28
			<i>For Flat Oval, Add</i>	1.32	
			<i>For Work In Restricted Working Space, Add</i>	5.64	
23 31 13	13-0213	LF	10" x 16", 24 Gauge Galvanized Steel Duct	29.89	12.22
			<i>For Flat Oval, Add</i>	1.43	
			<i>For Work In Restricted Working Space, Add</i>	6.11	
23 31 13	13-0214	LF	10" x 18", 24 Gauge Galvanized Steel Duct	32.20	13.16
			<i>For Flat Oval, Add</i>	1.54	
			<i>For Work In Restricted Working Space, Add</i>	6.58	
23 31 13	13-0215	LF	10" x 20", 24 Gauge Galvanized Steel Duct	34.50	14.09
			<i>For Flat Oval, Add</i>	1.65	
			<i>For Work In Restricted Working Space, Add</i>	7.05	
23 31 13	13-0216	LF	10" x 22", 24 Gauge Galvanized Steel Duct	36.80	15.04
			<i>For Flat Oval, Add</i>	1.76	
			<i>For Work In Restricted Working Space, Add</i>	7.52	
23 31 13	13-0217	LF	10" x 24", 24 Gauge Galvanized Steel Duct	39.09	15.98
			<i>For Flat Oval, Add</i>	1.87	
			<i>For Work In Restricted Working Space, Add</i>	7.99	
23 31 13	13-0218	LF	10" x 26", 24 Gauge Galvanized Steel Duct	41.40	16.93
			<i>For Flat Oval, Add</i>	1.98	
			<i>For Work In Restricted Working Space, Add</i>	8.46	
23 31 13	13-0219	LF	10" x 28", 24 Gauge Galvanized Steel Duct	43.70	17.86
			<i>For Flat Oval, Add</i>	2.09	
			<i>For Work In Restricted Working Space, Add</i>	8.93	
23 31 13	13-0220	LF	10" x 30", 24 Gauge Galvanized Steel Duct	45.99	18.80
			<i>For Flat Oval, Add</i>	2.20	
			<i>For Work In Restricted Working Space, Add</i>	9.40	
23 31 13	13-0221	LF	12" x 12", 24 Gauge Galvanized Steel Duct	27.60	11.28
			<i>For Flat Oval, Add</i>	1.32	
			<i>For Work In Restricted Working Space, Add</i>	5.64	
23 31 13	13-0222	LF	12" x 14", 24 Gauge Galvanized Steel Duct	29.89	12.22
			<i>For Flat Oval, Add</i>	1.43	
			<i>For Work In Restricted Working Space, Add</i>	6.11	
23 31 13	13-0223	LF	12" x 16", 24 Gauge Galvanized Steel Duct	32.20	13.16
			<i>For Flat Oval, Add</i>	1.54	
			<i>For Work In Restricted Working Space, Add</i>	6.58	
23 31 13	13-0224	LF	12" x 18", 24 Gauge Galvanized Steel Duct	34.50	14.09
			<i>For Flat Oval, Add</i>	1.65	
			<i>For Work In Restricted Working Space, Add</i>	7.05	
23 31 13	13-0225	LF	12" x 20", 24 Gauge Galvanized Steel Duct	36.80	15.04
			<i>For Flat Oval, Add</i>	1.76	
			<i>For Work In Restricted Working Space, Add</i>	7.52	
23 31 13	13-0226	LF	12" x 22", 24 Gauge Galvanized Steel Duct	39.09	15.98
			<i>For Flat Oval, Add</i>	1.87	
			<i>For Work In Restricted Working Space, Add</i>	7.99	
23 31 13	13-0227	LF	12" x 24", 24 Gauge Galvanized Steel Duct	41.40	16.93
			<i>For Flat Oval, Add</i>	1.98	
			<i>For Work In Restricted Working Space, Add</i>	8.46	
23 31 13	13-0228	LF	12" x 26", 24 Gauge Galvanized Steel Duct	43.70	17.86
			<i>For Flat Oval, Add</i>	2.09	
			<i>For Work In Restricted Working Space, Add</i>	8.93	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31 13 13-0229 LF 12" x 28", 24 Gauge Galvanized Steel Duct	45.99	18.80
<i>For Flat Oval, Add</i>	2.20	
<i>For Work In Restricted Working Space, Add</i>	9.40	
23 31 13 13-0230 LF 12" x 30", 24 Gauge Galvanized Steel Duct	48.29	19.74
<i>For Flat Oval, Add</i>	2.31	
<i>For Work In Restricted Working Space, Add</i>	9.87	
23 31 13 13-0231 LF 14" x 14", 24 Gauge Galvanized Steel Duct	32.20	13.16
<i>For Flat Oval, Add</i>	1.54	
<i>For Work In Restricted Working Space, Add</i>	6.58	
23 31 13 13-0232 LF 14" x 16", 24 Gauge Galvanized Steel Duct	34.50	14.09
<i>For Flat Oval, Add</i>	1.65	
<i>For Work In Restricted Working Space, Add</i>	7.05	
23 31 13 13-0233 LF 14" x 18", 24 Gauge Galvanized Steel Duct	36.80	15.04
<i>For Flat Oval, Add</i>	1.76	
<i>For Work In Restricted Working Space, Add</i>	7.52	
23 31 13 13-0234 LF 14" x 20", 24 Gauge Galvanized Steel Duct	39.09	15.98
<i>For Flat Oval, Add</i>	1.87	
<i>For Work In Restricted Working Space, Add</i>	7.99	
23 31 13 13-0235 LF 14" x 22", 24 Gauge Galvanized Steel Duct	41.40	16.93
<i>For Flat Oval, Add</i>	1.98	
<i>For Work In Restricted Working Space, Add</i>	8.46	
23 31 13 13-0236 LF 14" x 24", 24 Gauge Galvanized Steel Duct	43.70	17.86
<i>For Flat Oval, Add</i>	2.09	
<i>For Work In Restricted Working Space, Add</i>	8.93	
23 31 13 13-0237 LF 14" x 26", 24 Gauge Galvanized Steel Duct	45.99	18.80
<i>For Flat Oval, Add</i>	2.20	
<i>For Work In Restricted Working Space, Add</i>	9.40	
23 31 13 13-0238 LF 14" x 28", 24 Gauge Galvanized Steel Duct	48.29	19.74
<i>For Flat Oval, Add</i>	2.31	
<i>For Work In Restricted Working Space, Add</i>	9.87	
23 31 13 13-0239 LF 14" x 30", 24 Gauge Galvanized Steel Duct	50.60	20.69
<i>For Flat Oval, Add</i>	2.42	
<i>For Work In Restricted Working Space, Add</i>	10.34	
23 31 13 13-0240 LF 16" x 16", 24 Gauge Galvanized Steel Duct	36.80	15.04
<i>For Flat Oval, Add</i>	1.76	
<i>For Work In Restricted Working Space, Add</i>	7.52	
23 31 13 13-0241 LF 16" x 18", 24 Gauge Galvanized Steel Duct	39.09	15.98
<i>For Flat Oval, Add</i>	1.87	
<i>For Work In Restricted Working Space, Add</i>	7.99	
23 31 13 13-0242 LF 16" x 20", 24 Gauge Galvanized Steel Duct	41.40	16.93
<i>For Flat Oval, Add</i>	1.98	
<i>For Work In Restricted Working Space, Add</i>	8.46	
23 31 13 13-0243 LF 16" x 22", 24 Gauge Galvanized Steel Duct	43.70	17.86
<i>For Flat Oval, Add</i>	2.09	
<i>For Work In Restricted Working Space, Add</i>	8.93	
23 31 13 13-0244 LF 16" x 24", 24 Gauge Galvanized Steel Duct	45.99	18.80
<i>For Flat Oval, Add</i>	2.20	
<i>For Work In Restricted Working Space, Add</i>	9.40	
23 31 13 13-0245 LF 16" x 26", 24 Gauge Galvanized Steel Duct	48.29	19.74
<i>For Flat Oval, Add</i>	2.31	
<i>For Work In Restricted Working Space, Add</i>	9.87	
23 31 13 13-0246 LF 16" x 28", 24 Gauge Galvanized Steel Duct	50.60	20.69
<i>For Flat Oval, Add</i>	2.42	
<i>For Work In Restricted Working Space, Add</i>	10.34	
23 31 13 13-0247 LF 16" x 30", 24 Gauge Galvanized Steel Duct	52.89	21.62
<i>For Flat Oval, Add</i>	2.53	
<i>For Work In Restricted Working Space, Add</i>	10.81	
23 31 13 13-0248 LF 18" x 18", 24 Gauge Galvanized Steel Duct	41.40	16.93
<i>For Flat Oval, Add</i>	1.98	
<i>For Work In Restricted Working Space, Add</i>	8.46	
23 31 13 13-0249 LF 18" x 20", 24 Gauge Galvanized Steel Duct	43.70	17.86
<i>For Flat Oval, Add</i>	2.09	
<i>For Work In Restricted Working Space, Add</i>	8.93	
23 31 13 13-0250 LF 18" x 22", 24 Gauge Galvanized Steel Duct	45.99	18.80
<i>For Flat Oval, Add</i>	2.20	
<i>For Work In Restricted Working Space, Add</i>	9.40	
23 31 13 13-0251 LF 18" x 24", 24 Gauge Galvanized Steel Duct	48.29	19.74
<i>For Flat Oval, Add</i>	2.31	
<i>For Work In Restricted Working Space, Add</i>	9.87	
23 31 13 13-0252 LF 18" x 26", 24 Gauge Galvanized Steel Duct	50.60	20.69
<i>For Flat Oval, Add</i>	2.42	
<i>For Work In Restricted Working Space, Add</i>	10.34	
23 31 13 13-0253 LF 18" x 28", 24 Gauge Galvanized Steel Duct	52.89	21.62
<i>For Flat Oval, Add</i>	2.53	
<i>For Work In Restricted Working Space, Add</i>	10.81	
23 31 13 13-0254 LF 18" x 30", 24 Gauge Galvanized Steel Duct	55.19	22.56
<i>For Flat Oval, Add</i>	2.64	
<i>For Work In Restricted Working Space, Add</i>	11.28	
23 31 13 13-0255 LF 20" x 20", 24 Gauge Galvanized Steel Duct	45.99	18.80
<i>For Flat Oval, Add</i>	2.20	
<i>For Work In Restricted Working Space, Add</i>	9.40	
23 31 13 13-0256 LF 20" x 22", 24 Gauge Galvanized Steel Duct	48.29	19.74
<i>For Flat Oval, Add</i>	2.31	
<i>For Work In Restricted Working Space, Add</i>	9.87	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 31 HVAC Ducts And Casings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31 13 13-0257	LF		20" x 24", 24 Gauge Galvanized Steel Duct	50.60	20.69
			<i>For Flat Oval, Add</i>	2.42	
			<i>For Work In Restricted Working Space, Add</i>	10.34	
23 31 13 13-0258	LF		20" x 26", 24 Gauge Galvanized Steel Duct	52.89	21.62
			<i>For Flat Oval, Add</i>	2.53	
			<i>For Work In Restricted Working Space, Add</i>	10.81	
23 31 13 13-0259	LF		20" x 28", 24 Gauge Galvanized Steel Duct	55.19	22.56
			<i>For Flat Oval, Add</i>	2.64	
			<i>For Work In Restricted Working Space, Add</i>	11.28	
23 31 13 13-0260	LF		20" x 30", 24 Gauge Galvanized Steel Duct	57.49	23.50
			<i>For Flat Oval, Add</i>	2.75	
			<i>For Work In Restricted Working Space, Add</i>	11.75	
23 31 13 13-0261	LF		22" x 22", 24 Gauge Galvanized Steel Duct	50.60	20.69
			<i>For Flat Oval, Add</i>	2.42	
			<i>For Work In Restricted Working Space, Add</i>	10.34	
23 31 13 13-0262	LF		22" x 24", 24 Gauge Galvanized Steel Duct	52.89	21.62
			<i>For Flat Oval, Add</i>	2.53	
			<i>For Work In Restricted Working Space, Add</i>	10.81	
23 31 13 13-0263	LF		22" x 26", 24 Gauge Galvanized Steel Duct	55.19	22.56
			<i>For Flat Oval, Add</i>	2.64	
			<i>For Work In Restricted Working Space, Add</i>	11.28	
23 31 13 13-0264	LF		22" x 28", 24 Gauge Galvanized Steel Duct	57.49	23.50
			<i>For Flat Oval, Add</i>	2.75	
			<i>For Work In Restricted Working Space, Add</i>	11.75	
23 31 13 13-0265	LF		22" x 30", 24 Gauge Galvanized Steel Duct	59.79	24.44
			<i>For Flat Oval, Add</i>	2.86	
			<i>For Work In Restricted Working Space, Add</i>	12.22	
23 31 13 13-0266	LF		24" x 24", 24 Gauge Galvanized Steel Duct	55.19	22.56
			<i>For Flat Oval, Add</i>	2.64	
			<i>For Work In Restricted Working Space, Add</i>	11.28	
23 31 13 13-0267	LF		24" x 26", 24 Gauge Galvanized Steel Duct	57.49	23.50
			<i>For Flat Oval, Add</i>	2.75	
			<i>For Work In Restricted Working Space, Add</i>	11.75	
23 31 13 13-0268	LF		24" x 28", 24 Gauge Galvanized Steel Duct	59.79	24.44
			<i>For Flat Oval, Add</i>	2.86	
			<i>For Work In Restricted Working Space, Add</i>	12.22	
23 31 13 13-0269	LF		24" x 30", 24 Gauge Galvanized Steel Duct	62.09	25.37
			<i>For Flat Oval, Add</i>	2.97	
			<i>For Work In Restricted Working Space, Add</i>	12.69	
23 31 13 13-0270	LF		26" x 26", 24 Gauge Galvanized Steel Duct	59.79	24.44
			<i>For Flat Oval, Add</i>	2.86	
			<i>For Work In Restricted Working Space, Add</i>	12.22	
23 31 13 13-0271	LF		26" x 28", 24 Gauge Galvanized Steel Duct	62.09	25.37
			<i>For Flat Oval, Add</i>	2.97	
			<i>For Work In Restricted Working Space, Add</i>	12.69	
23 31 13 13-0272	LF		26" x 30", 24 Gauge Galvanized Steel Duct	64.38	26.32
			<i>For Flat Oval, Add</i>	3.08	
			<i>For Work In Restricted Working Space, Add</i>	13.16	
23 31 13 13-0273	LF		28" x 28", 24 Gauge Galvanized Steel Duct	64.38	26.32
			<i>For Flat Oval, Add</i>	3.08	
			<i>For Work In Restricted Working Space, Add</i>	13.16	
23 31 13 13-0274	LF		28" x 30", 24 Gauge Galvanized Steel Duct	66.69	27.26
			<i>For Flat Oval, Add</i>	3.19	
			<i>For Work In Restricted Working Space, Add</i>	13.63	
23 31 13 13-0275	LF		30" x 30", 24 Gauge Galvanized Steel Duct	68.99	28.21
			<i>For Flat Oval, Add</i>	3.30	
			<i>For Work In Restricted Working Space, Add</i>	14.10	
23 31 13 13-0276			22 Gauge Galvanized Steel Duct <small>(23 31 13 13-0009)</small>		
23 31 13 13-0277	LF		4" x 4", 22 Gauge Galvanized Steel Duct	11.19	4.58
			<i>For Flat Oval, Add</i>	0.54	
			<i>For Work In Restricted Working Space, Add</i>	2.29	
23 31 13 13-0278	LF		4" x 6", 22 Gauge Galvanized Steel Duct	13.99	5.72
			<i>For Flat Oval, Add</i>	0.67	
			<i>For Work In Restricted Working Space, Add</i>	2.86	
23 31 13 13-0279	LF		4" x 8", 22 Gauge Galvanized Steel Duct	16.78	6.86
			<i>For Flat Oval, Add</i>	0.80	
			<i>For Work In Restricted Working Space, Add</i>	3.43	
23 31 13 13-0280	LF		4" x 10", 22 Gauge Galvanized Steel Duct	19.58	8.00
			<i>For Flat Oval, Add</i>	0.94	
			<i>For Work In Restricted Working Space, Add</i>	4.00	
23 31 13 13-0281	LF		4" x 12", 22 Gauge Galvanized Steel Duct	22.37	9.14
			<i>For Flat Oval, Add</i>	1.07	
			<i>For Work In Restricted Working Space, Add</i>	4.57	
23 31 13 13-0282	LF		4" x 14", 22 Gauge Galvanized Steel Duct	25.17	10.29
			<i>For Flat Oval, Add</i>	1.20	
			<i>For Work In Restricted Working Space, Add</i>	5.15	
23 31 13 13-0283	LF		4" x 16", 22 Gauge Galvanized Steel Duct	27.97	11.43
			<i>For Flat Oval, Add</i>	1.34	
			<i>For Work In Restricted Working Space, Add</i>	5.72	
23 31 13 13-0284	LF		6" x 6", 22 Gauge Galvanized Steel Duct	16.78	6.86
			<i>For Flat Oval, Add</i>	0.80	
			<i>For Work In Restricted Working Space, Add</i>	3.43	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31 13 13-0285 LF 6" x 8", 22 Gauge Galvanized Steel Duct	19.58	8.00
For Flat Oval, Add	0.94	
For Work In Restricted Working Space, Add	4.00	
23 31 13 13-0286 LF 6" x 10", 22 Gauge Galvanized Steel Duct	22.37	9.14
For Flat Oval, Add	1.07	
For Work In Restricted Working Space, Add	4.57	
23 31 13 13-0287 LF 6" x 12", 22 Gauge Galvanized Steel Duct	25.17	10.29
For Flat Oval, Add	1.20	
For Work In Restricted Working Space, Add	5.15	
23 31 13 13-0288 LF 6" x 14", 22 Gauge Galvanized Steel Duct	27.97	11.43
For Flat Oval, Add	1.34	
For Work In Restricted Working Space, Add	5.72	
23 31 13 13-0289 LF 6" x 16", 22 Gauge Galvanized Steel Duct	30.77	12.57
For Flat Oval, Add	1.47	
For Work In Restricted Working Space, Add	6.29	
23 31 13 13-0290 LF 8" x 8", 22 Gauge Galvanized Steel Duct	22.37	9.14
For Flat Oval, Add	1.07	
For Work In Restricted Working Space, Add	4.57	
23 31 13 13-0291 LF 8" x 10", 22 Gauge Galvanized Steel Duct	25.17	10.29
For Flat Oval, Add	1.20	
For Work In Restricted Working Space, Add	5.15	
23 31 13 13-0292 LF 8" x 12", 22 Gauge Galvanized Steel Duct	27.97	11.43
For Flat Oval, Add	1.34	
For Work In Restricted Working Space, Add	5.72	
23 31 13 13-0293 LF 8" x 14", 22 Gauge Galvanized Steel Duct	30.77	12.57
For Flat Oval, Add	1.47	
For Work In Restricted Working Space, Add	6.29	
23 31 13 13-0294 LF 8" x 16", 22 Gauge Galvanized Steel Duct	33.56	13.72
For Flat Oval, Add	1.61	
For Work In Restricted Working Space, Add	6.86	
23 31 13 13-0295 LF 8" x 18", 22 Gauge Galvanized Steel Duct	36.36	14.87
For Flat Oval, Add	1.74	
For Work In Restricted Working Space, Add	7.43	
23 31 13 13-0296 LF 8" x 20", 22 Gauge Galvanized Steel Duct	39.15	16.01
For Flat Oval, Add	1.87	
For Work In Restricted Working Space, Add	8.00	
23 31 13 13-0297 LF 8" x 22", 22 Gauge Galvanized Steel Duct	41.96	17.15
For Flat Oval, Add	2.01	
For Work In Restricted Working Space, Add	8.58	
23 31 13 13-0298 LF 8" x 24", 22 Gauge Galvanized Steel Duct	44.74	18.30
For Flat Oval, Add	2.14	
For Work In Restricted Working Space, Add	9.14	
23 31 13 13-0299 LF 10" x 10", 22 Gauge Galvanized Steel Duct	27.97	11.43
For Flat Oval, Add	1.34	
For Work In Restricted Working Space, Add	5.72	
23 31 13 13-0300 LF 10" x 12", 22 Gauge Galvanized Steel Duct	30.77	12.57
For Flat Oval, Add	1.47	
For Work In Restricted Working Space, Add	6.29	
23 31 13 13-0301 LF 10" x 14", 22 Gauge Galvanized Steel Duct	33.56	13.72
For Flat Oval, Add	1.61	
For Work In Restricted Working Space, Add	6.86	
23 31 13 13-0302 LF 10" x 16", 22 Gauge Galvanized Steel Duct	36.36	14.87
For Flat Oval, Add	1.74	
For Work In Restricted Working Space, Add	7.43	
23 31 13 13-0303 LF 10" x 18", 22 Gauge Galvanized Steel Duct	39.15	16.01
For Flat Oval, Add	1.87	
For Work In Restricted Working Space, Add	8.00	
23 31 13 13-0304 LF 10" x 20", 22 Gauge Galvanized Steel Duct	41.96	17.15
For Flat Oval, Add	2.01	
For Work In Restricted Working Space, Add	8.58	
23 31 13 13-0305 LF 10" x 22", 22 Gauge Galvanized Steel Duct	44.74	18.30
For Flat Oval, Add	2.14	
For Work In Restricted Working Space, Add	9.14	
23 31 13 13-0306 LF 10" x 24", 22 Gauge Galvanized Steel Duct	47.55	19.44
For Flat Oval, Add	2.27	
For Work In Restricted Working Space, Add	9.72	
23 31 13 13-0307 LF 10" x 26", 22 Gauge Galvanized Steel Duct	50.35	20.59
For Flat Oval, Add	2.41	
For Work In Restricted Working Space, Add	10.29	
23 31 13 13-0308 LF 10" x 28", 22 Gauge Galvanized Steel Duct	53.15	21.72
For Flat Oval, Add	2.54	
For Work In Restricted Working Space, Add	10.86	
23 31 13 13-0309 LF 10" x 30", 22 Gauge Galvanized Steel Duct	55.94	22.86
For Flat Oval, Add	2.67	
For Work In Restricted Working Space, Add	11.43	
23 31 13 13-0310 LF 10" x 32", 22 Gauge Galvanized Steel Duct	58.73	24.01
For Flat Oval, Add	2.81	
For Work In Restricted Working Space, Add	12.00	
23 31 13 13-0311 LF 12" x 12", 22 Gauge Galvanized Steel Duct	33.56	13.72
For Flat Oval, Add	1.61	
For Work In Restricted Working Space, Add	6.86	
23 31 13 13-0312 LF 12" x 14", 22 Gauge Galvanized Steel Duct	36.36	14.87
For Flat Oval, Add	1.74	
For Work In Restricted Working Space, Add	7.43	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 31 HVAC Ducts And Casings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31 13 13-0313	LF		12" x 16", 22 Gauge Galvanized Steel Duct	39.15	16.01
			<i>For Flat Oval, Add</i>	1.87	
			<i>For Work In Restricted Working Space, Add</i>	8.00	
23 31 13 13-0314	LF		12" x 18", 22 Gauge Galvanized Steel Duct	41.96	17.15
			<i>For Flat Oval, Add</i>	2.01	
			<i>For Work In Restricted Working Space, Add</i>	8.58	
23 31 13 13-0315	LF		12" x 20", 22 Gauge Galvanized Steel Duct	44.74	18.30
			<i>For Flat Oval, Add</i>	2.14	
			<i>For Work In Restricted Working Space, Add</i>	9.14	
23 31 13 13-0316	LF		12" x 22", 22 Gauge Galvanized Steel Duct	47.55	19.44
			<i>For Flat Oval, Add</i>	2.27	
			<i>For Work In Restricted Working Space, Add</i>	9.72	
23 31 13 13-0317	LF		12" x 24", 22 Gauge Galvanized Steel Duct	50.35	20.59
			<i>For Flat Oval, Add</i>	2.41	
			<i>For Work In Restricted Working Space, Add</i>	10.29	
23 31 13 13-0318	LF		12" x 26", 22 Gauge Galvanized Steel Duct	53.15	21.72
			<i>For Flat Oval, Add</i>	2.54	
			<i>For Work In Restricted Working Space, Add</i>	10.86	
23 31 13 13-0319	LF		12" x 28", 22 Gauge Galvanized Steel Duct	55.94	22.86
			<i>For Flat Oval, Add</i>	2.67	
			<i>For Work In Restricted Working Space, Add</i>	11.43	
23 31 13 13-0320	LF		12" x 30", 22 Gauge Galvanized Steel Duct	58.73	24.01
			<i>For Flat Oval, Add</i>	2.81	
			<i>For Work In Restricted Working Space, Add</i>	12.00	
23 31 13 13-0321	LF		12" x 32", 22 Gauge Galvanized Steel Duct	61.54	25.15
			<i>For Flat Oval, Add</i>	2.94	
			<i>For Work In Restricted Working Space, Add</i>	12.58	
23 31 13 13-0322	LF		12" x 34", 22 Gauge Galvanized Steel Duct	64.34	26.29
			<i>For Flat Oval, Add</i>	3.08	
			<i>For Work In Restricted Working Space, Add</i>	13.15	
23 31 13 13-0323	LF		12" x 36", 22 Gauge Galvanized Steel Duct	67.13	27.44
			<i>For Flat Oval, Add</i>	3.21	
			<i>For Work In Restricted Working Space, Add</i>	13.72	
23 31 13 13-0324	LF		14" x 14", 22 Gauge Galvanized Steel Duct	39.15	16.01
			<i>For Flat Oval, Add</i>	1.87	
			<i>For Work In Restricted Working Space, Add</i>	8.00	
23 31 13 13-0325	LF		14" x 16", 22 Gauge Galvanized Steel Duct	41.96	17.15
			<i>For Flat Oval, Add</i>	2.01	
			<i>For Work In Restricted Working Space, Add</i>	8.58	
23 31 13 13-0326	LF		14" x 18", 22 Gauge Galvanized Steel Duct	44.74	18.30
			<i>For Flat Oval, Add</i>	2.14	
			<i>For Work In Restricted Working Space, Add</i>	9.14	
23 31 13 13-0327	LF		14" x 20", 22 Gauge Galvanized Steel Duct	47.55	19.44
			<i>For Flat Oval, Add</i>	2.27	
			<i>For Work In Restricted Working Space, Add</i>	9.72	
23 31 13 13-0328	LF		14" x 22", 22 Gauge Galvanized Steel Duct	50.35	20.59
			<i>For Flat Oval, Add</i>	2.41	
			<i>For Work In Restricted Working Space, Add</i>	10.29	
23 31 13 13-0329	LF		14" x 24", 22 Gauge Galvanized Steel Duct	53.15	21.72
			<i>For Flat Oval, Add</i>	2.54	
			<i>For Work In Restricted Working Space, Add</i>	10.86	
23 31 13 13-0330	LF		14" x 26", 22 Gauge Galvanized Steel Duct	55.94	22.86
			<i>For Flat Oval, Add</i>	2.67	
			<i>For Work In Restricted Working Space, Add</i>	11.43	
23 31 13 13-0331	LF		14" x 28", 22 Gauge Galvanized Steel Duct	58.73	24.01
			<i>For Flat Oval, Add</i>	2.81	
			<i>For Work In Restricted Working Space, Add</i>	12.00	
23 31 13 13-0332	LF		14" x 30", 22 Gauge Galvanized Steel Duct	61.54	25.15
			<i>For Flat Oval, Add</i>	2.94	
			<i>For Work In Restricted Working Space, Add</i>	12.58	
23 31 13 13-0333	LF		14" x 32", 22 Gauge Galvanized Steel Duct	64.34	26.29
			<i>For Flat Oval, Add</i>	3.08	
			<i>For Work In Restricted Working Space, Add</i>	13.15	
23 31 13 13-0334	LF		14" x 34", 22 Gauge Galvanized Steel Duct	67.13	27.44
			<i>For Flat Oval, Add</i>	3.21	
			<i>For Work In Restricted Working Space, Add</i>	13.72	
23 31 13 13-0335	LF		14" x 36", 22 Gauge Galvanized Steel Duct	69.92	28.59
			<i>For Flat Oval, Add</i>	3.34	
			<i>For Work In Restricted Working Space, Add</i>	14.29	
23 31 13 13-0336	LF		16" x 16", 22 Gauge Galvanized Steel Duct	44.74	18.30
			<i>For Flat Oval, Add</i>	2.14	
			<i>For Work In Restricted Working Space, Add</i>	9.14	
23 31 13 13-0337	LF		16" x 18", 22 Gauge Galvanized Steel Duct	47.55	19.44
			<i>For Flat Oval, Add</i>	2.27	
			<i>For Work In Restricted Working Space, Add</i>	9.72	
23 31 13 13-0338	LF		16" x 20", 22 Gauge Galvanized Steel Duct	50.35	20.59
			<i>For Flat Oval, Add</i>	2.41	
			<i>For Work In Restricted Working Space, Add</i>	10.29	
23 31 13 13-0339	LF		16" x 22", 22 Gauge Galvanized Steel Duct	53.15	21.72
			<i>For Flat Oval, Add</i>	2.54	
			<i>For Work In Restricted Working Space, Add</i>	10.86	
23 31 13 13-0340	LF		16" x 24", 22 Gauge Galvanized Steel Duct	55.94	22.86
			<i>For Flat Oval, Add</i>	2.67	
			<i>For Work In Restricted Working Space, Add</i>	11.43	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31 13 13-0341 LF 16" x 26", 22 Gauge Galvanized Steel Duct	58.73	24.01
For Flat Oval, Add	2.81	
For Work In Restricted Working Space, Add	12.00	
23 31 13 13-0342 LF 16" x 28", 22 Gauge Galvanized Steel Duct	61.54	25.15
For Flat Oval, Add	2.94	
For Work In Restricted Working Space, Add	12.58	
23 31 13 13-0343 LF 16" x 30", 22 Gauge Galvanized Steel Duct	64.34	26.29
For Flat Oval, Add	3.08	
For Work In Restricted Working Space, Add	13.15	
23 31 13 13-0344 LF 16" x 32", 22 Gauge Galvanized Steel Duct	67.13	27.44
For Flat Oval, Add	3.21	
For Work In Restricted Working Space, Add	13.72	
23 31 13 13-0345 LF 16" x 34", 22 Gauge Galvanized Steel Duct	69.92	28.59
For Flat Oval, Add	3.34	
For Work In Restricted Working Space, Add	14.29	
23 31 13 13-0346 LF 16" x 36", 22 Gauge Galvanized Steel Duct	72.73	29.73
For Flat Oval, Add	3.48	
For Work In Restricted Working Space, Add	14.87	
23 31 13 13-0347 LF 16" x 38", 22 Gauge Galvanized Steel Duct	75.52	30.87
For Flat Oval, Add	3.61	
For Work In Restricted Working Space, Add	15.44	
23 31 13 13-0348 LF 16" x 40", 22 Gauge Galvanized Steel Duct	78.31	32.01
For Flat Oval, Add	3.74	
For Work In Restricted Working Space, Add	16.01	
23 31 13 13-0349 LF 16" x 42", 22 Gauge Galvanized Steel Duct	81.10	33.16
For Flat Oval, Add	3.88	
For Work In Restricted Working Space, Add	16.58	
23 31 13 13-0350 LF 16" x 44", 22 Gauge Galvanized Steel Duct	83.92	34.30
For Flat Oval, Add	4.01	
For Work In Restricted Working Space, Add	17.15	
23 31 13 13-0351 LF 18" x 18", 22 Gauge Galvanized Steel Duct	50.35	20.59
For Flat Oval, Add	2.41	
For Work In Restricted Working Space, Add	10.29	
23 31 13 13-0352 LF 18" x 20", 22 Gauge Galvanized Steel Duct	53.15	21.72
For Flat Oval, Add	2.54	
For Work In Restricted Working Space, Add	10.86	
23 31 13 13-0353 LF 18" x 22", 22 Gauge Galvanized Steel Duct	55.94	22.86
For Flat Oval, Add	2.67	
For Work In Restricted Working Space, Add	11.43	
23 31 13 13-0354 LF 18" x 24", 22 Gauge Galvanized Steel Duct	58.73	24.01
For Flat Oval, Add	2.81	
For Work In Restricted Working Space, Add	12.00	
23 31 13 13-0355 LF 18" x 26", 22 Gauge Galvanized Steel Duct	61.54	25.15
For Flat Oval, Add	2.94	
For Work In Restricted Working Space, Add	12.58	
23 31 13 13-0356 LF 18" x 28", 22 Gauge Galvanized Steel Duct	64.34	26.29
For Flat Oval, Add	3.08	
For Work In Restricted Working Space, Add	13.15	
23 31 13 13-0357 LF 18" x 30", 22 Gauge Galvanized Steel Duct	67.13	27.44
For Flat Oval, Add	3.21	
For Work In Restricted Working Space, Add	13.72	
23 31 13 13-0358 LF 18" x 32", 22 Gauge Galvanized Steel Duct	69.92	28.59
For Flat Oval, Add	3.34	
For Work In Restricted Working Space, Add	14.29	
23 31 13 13-0359 LF 18" x 34", 22 Gauge Galvanized Steel Duct	72.73	29.73
For Flat Oval, Add	3.48	
For Work In Restricted Working Space, Add	14.87	
23 31 13 13-0360 LF 18" x 36", 22 Gauge Galvanized Steel Duct	75.52	30.87
For Flat Oval, Add	3.61	
For Work In Restricted Working Space, Add	15.44	
23 31 13 13-0361 LF 18" x 38", 22 Gauge Galvanized Steel Duct	78.31	32.01
For Flat Oval, Add	3.74	
For Work In Restricted Working Space, Add	16.01	
23 31 13 13-0362 LF 18" x 40", 22 Gauge Galvanized Steel Duct	81.10	33.16
For Flat Oval, Add	3.88	
For Work In Restricted Working Space, Add	16.58	
23 31 13 13-0363 LF 18" x 42", 22 Gauge Galvanized Steel Duct	83.92	34.30
For Flat Oval, Add	4.01	
For Work In Restricted Working Space, Add	17.15	
23 31 13 13-0364 LF 18" x 44", 22 Gauge Galvanized Steel Duct	86.71	35.43
For Flat Oval, Add	4.15	
For Work In Restricted Working Space, Add	17.72	
23 31 13 13-0365 LF 18" x 46", 22 Gauge Galvanized Steel Duct	89.51	36.58
For Flat Oval, Add	4.28	
For Work In Restricted Working Space, Add	18.29	
23 31 13 13-0366 LF 20" x 20", 22 Gauge Galvanized Steel Duct	55.94	22.86
For Flat Oval, Add	2.67	
For Work In Restricted Working Space, Add	11.43	
23 31 13 13-0367 LF 20" x 22", 22 Gauge Galvanized Steel Duct	58.73	24.01
For Flat Oval, Add	2.81	
For Work In Restricted Working Space, Add	12.00	
23 31 13 13-0368 LF 20" x 24", 22 Gauge Galvanized Steel Duct	61.54	25.15
For Flat Oval, Add	2.94	
For Work In Restricted Working Space, Add	12.58	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 31 HVAC Ducts And Casings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31 13	13-0369	LF	20" x 26", 22 Gauge Galvanized Steel Duct	64.34	26.29
			<i>For Flat Oval, Add</i>	3.08	
			<i>For Work In Restricted Working Space, Add</i>	13.15	
23 31 13	13-0370	LF	20" x 28", 22 Gauge Galvanized Steel Duct	67.13	27.44
			<i>For Flat Oval, Add</i>	3.21	
			<i>For Work In Restricted Working Space, Add</i>	13.72	
23 31 13	13-0371	LF	20" x 30", 22 Gauge Galvanized Steel Duct	69.92	28.59
			<i>For Flat Oval, Add</i>	3.34	
			<i>For Work In Restricted Working Space, Add</i>	14.29	
23 31 13	13-0372	LF	20" x 32", 22 Gauge Galvanized Steel Duct	72.73	29.73
			<i>For Flat Oval, Add</i>	3.48	
			<i>For Work In Restricted Working Space, Add</i>	14.87	
23 31 13	13-0373	LF	20" x 34", 22 Gauge Galvanized Steel Duct	75.52	30.87
			<i>For Flat Oval, Add</i>	3.61	
			<i>For Work In Restricted Working Space, Add</i>	15.44	
23 31 13	13-0374	LF	20" x 36", 22 Gauge Galvanized Steel Duct	78.31	32.01
			<i>For Flat Oval, Add</i>	3.74	
			<i>For Work In Restricted Working Space, Add</i>	16.01	
23 31 13	13-0375	LF	20" x 38", 22 Gauge Galvanized Steel Duct	81.10	33.16
			<i>For Flat Oval, Add</i>	3.88	
			<i>For Work In Restricted Working Space, Add</i>	16.58	
23 31 13	13-0376	LF	20" x 40", 22 Gauge Galvanized Steel Duct	83.92	34.30
			<i>For Flat Oval, Add</i>	4.01	
			<i>For Work In Restricted Working Space, Add</i>	17.15	
23 31 13	13-0377	LF	20" x 42", 22 Gauge Galvanized Steel Duct	86.71	35.43
			<i>For Flat Oval, Add</i>	4.15	
			<i>For Work In Restricted Working Space, Add</i>	17.72	
23 31 13	13-0378	LF	20" x 44", 22 Gauge Galvanized Steel Duct	89.51	36.58
			<i>For Flat Oval, Add</i>	4.28	
			<i>For Work In Restricted Working Space, Add</i>	18.29	
23 31 13	13-0379	LF	20" x 46", 22 Gauge Galvanized Steel Duct	92.29	37.73
			<i>For Flat Oval, Add</i>	4.41	
			<i>For Work In Restricted Working Space, Add</i>	18.86	
23 31 13	13-0380	LF	20" x 48", 22 Gauge Galvanized Steel Duct	95.10	38.87
			<i>For Flat Oval, Add</i>	4.55	
			<i>For Work In Restricted Working Space, Add</i>	19.44	
23 31 13	13-0381	LF	22" x 22", 22 Gauge Galvanized Steel Duct	61.54	25.15
			<i>For Flat Oval, Add</i>	2.94	
			<i>For Work In Restricted Working Space, Add</i>	12.58	
23 31 13	13-0382	LF	22" x 24", 22 Gauge Galvanized Steel Duct	64.34	26.29
			<i>For Flat Oval, Add</i>	3.08	
			<i>For Work In Restricted Working Space, Add</i>	13.15	
23 31 13	13-0383	LF	22" x 26", 22 Gauge Galvanized Steel Duct	67.13	27.44
			<i>For Flat Oval, Add</i>	3.21	
			<i>For Work In Restricted Working Space, Add</i>	13.72	
23 31 13	13-0384	LF	22" x 28", 22 Gauge Galvanized Steel Duct	69.92	28.59
			<i>For Flat Oval, Add</i>	3.34	
			<i>For Work In Restricted Working Space, Add</i>	14.29	
23 31 13	13-0385	LF	22" x 30", 22 Gauge Galvanized Steel Duct	72.73	29.73
			<i>For Flat Oval, Add</i>	3.48	
			<i>For Work In Restricted Working Space, Add</i>	14.87	
23 31 13	13-0386	LF	22" x 32", 22 Gauge Galvanized Steel Duct	75.52	30.87
			<i>For Flat Oval, Add</i>	3.61	
			<i>For Work In Restricted Working Space, Add</i>	15.44	
23 31 13	13-0387	LF	22" x 34", 22 Gauge Galvanized Steel Duct	78.31	32.01
			<i>For Flat Oval, Add</i>	3.74	
			<i>For Work In Restricted Working Space, Add</i>	16.01	
23 31 13	13-0388	LF	22" x 36", 22 Gauge Galvanized Steel Duct	81.10	33.16
			<i>For Flat Oval, Add</i>	3.88	
			<i>For Work In Restricted Working Space, Add</i>	16.58	
23 31 13	13-0389	LF	22" x 38", 22 Gauge Galvanized Steel Duct	83.92	34.30
			<i>For Flat Oval, Add</i>	4.01	
			<i>For Work In Restricted Working Space, Add</i>	17.15	
23 31 13	13-0390	LF	22" x 40", 22 Gauge Galvanized Steel Duct	86.71	35.43
			<i>For Flat Oval, Add</i>	4.15	
			<i>For Work In Restricted Working Space, Add</i>	17.72	
23 31 13	13-0391	LF	22" x 42", 22 Gauge Galvanized Steel Duct	89.51	36.58
			<i>For Flat Oval, Add</i>	4.28	
			<i>For Work In Restricted Working Space, Add</i>	18.29	
23 31 13	13-0392	LF	22" x 44", 22 Gauge Galvanized Steel Duct	92.29	37.73
			<i>For Flat Oval, Add</i>	4.41	
			<i>For Work In Restricted Working Space, Add</i>	18.86	
23 31 13	13-0393	LF	22" x 46", 22 Gauge Galvanized Steel Duct	95.10	38.87
			<i>For Flat Oval, Add</i>	4.55	
			<i>For Work In Restricted Working Space, Add</i>	19.44	
23 31 13	13-0394	LF	22" x 48", 22 Gauge Galvanized Steel Duct	97.90	40.01
			<i>For Flat Oval, Add</i>	4.68	
			<i>For Work In Restricted Working Space, Add</i>	20.01	
23 31 13	13-0395	LF	24" x 24", 22 Gauge Galvanized Steel Duct	67.13	27.44
			<i>For Flat Oval, Add</i>	3.21	
			<i>For Work In Restricted Working Space, Add</i>	13.72	
23 31 13	13-0396	LF	24" x 26", 22 Gauge Galvanized Steel Duct	69.92	28.59
			<i>For Flat Oval, Add</i>	3.34	
			<i>For Work In Restricted Working Space, Add</i>	14.29	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31 13 13-0397 LF 24" x 28", 22 Gauge Galvanized Steel Duct	72.73	29.73
For Flat Oval, Add	3.48	
For Work In Restricted Working Space, Add	14.87	
23 31 13 13-0398 LF 24" x 30", 22 Gauge Galvanized Steel Duct	75.52	30.87
For Flat Oval, Add	3.61	
For Work In Restricted Working Space, Add	15.44	
23 31 13 13-0399 LF 24" x 32", 22 Gauge Galvanized Steel Duct	78.31	32.01
For Flat Oval, Add	3.74	
For Work In Restricted Working Space, Add	16.01	
23 31 13 13-0400 LF 24" x 34", 22 Gauge Galvanized Steel Duct	81.10	33.16
For Flat Oval, Add	3.88	
For Work In Restricted Working Space, Add	16.58	
23 31 13 13-0401 LF 24" x 36", 22 Gauge Galvanized Steel Duct	83.92	34.30
For Flat Oval, Add	4.01	
For Work In Restricted Working Space, Add	17.15	
23 31 13 13-0402 LF 24" x 38", 22 Gauge Galvanized Steel Duct	86.71	35.43
For Flat Oval, Add	4.15	
For Work In Restricted Working Space, Add	17.72	
23 31 13 13-0403 LF 24" x 40", 22 Gauge Galvanized Steel Duct	89.51	36.58
For Flat Oval, Add	4.28	
For Work In Restricted Working Space, Add	18.29	
23 31 13 13-0404 LF 24" x 42", 22 Gauge Galvanized Steel Duct	92.29	37.73
For Flat Oval, Add	4.41	
For Work In Restricted Working Space, Add	18.86	
23 31 13 13-0405 LF 24" x 44", 22 Gauge Galvanized Steel Duct	95.10	38.87
For Flat Oval, Add	4.55	
For Work In Restricted Working Space, Add	19.44	
23 31 13 13-0406 LF 24" x 46", 22 Gauge Galvanized Steel Duct	97.90	40.01
For Flat Oval, Add	4.68	
For Work In Restricted Working Space, Add	20.01	
23 31 13 13-0407 LF 24" x 48", 22 Gauge Galvanized Steel Duct	100.70	41.16
For Flat Oval, Add	4.82	
For Work In Restricted Working Space, Add	20.58	
23 31 13 13-0408 LF 26" x 26", 22 Gauge Galvanized Steel Duct	72.73	29.73
For Flat Oval, Add	3.48	
For Work In Restricted Working Space, Add	14.87	
23 31 13 13-0409 LF 26" x 28", 22 Gauge Galvanized Steel Duct	75.52	30.87
For Flat Oval, Add	3.61	
For Work In Restricted Working Space, Add	15.44	
23 31 13 13-0410 LF 26" x 30", 22 Gauge Galvanized Steel Duct	78.31	32.01
For Flat Oval, Add	3.74	
For Work In Restricted Working Space, Add	16.01	
23 31 13 13-0411 LF 26" x 32", 22 Gauge Galvanized Steel Duct	81.10	33.16
For Flat Oval, Add	3.88	
For Work In Restricted Working Space, Add	16.58	
23 31 13 13-0412 LF 26" x 34", 22 Gauge Galvanized Steel Duct	83.92	34.30
For Flat Oval, Add	4.01	
For Work In Restricted Working Space, Add	17.15	
23 31 13 13-0413 LF 26" x 36", 22 Gauge Galvanized Steel Duct	86.71	35.43
For Flat Oval, Add	4.15	
For Work In Restricted Working Space, Add	17.72	
23 31 13 13-0414 LF 26" x 38", 22 Gauge Galvanized Steel Duct	89.51	36.58
For Flat Oval, Add	4.28	
For Work In Restricted Working Space, Add	18.29	
23 31 13 13-0415 LF 26" x 40", 22 Gauge Galvanized Steel Duct	92.29	37.73
For Flat Oval, Add	4.41	
For Work In Restricted Working Space, Add	18.86	
23 31 13 13-0416 LF 26" x 42", 22 Gauge Galvanized Steel Duct	95.10	38.87
For Flat Oval, Add	4.55	
For Work In Restricted Working Space, Add	19.44	
23 31 13 13-0417 LF 26" x 44", 22 Gauge Galvanized Steel Duct	97.90	40.01
For Flat Oval, Add	4.68	
For Work In Restricted Working Space, Add	20.01	
23 31 13 13-0418 LF 26" x 46", 22 Gauge Galvanized Steel Duct	100.70	41.16
For Flat Oval, Add	4.82	
For Work In Restricted Working Space, Add	20.58	
23 31 13 13-0419 LF 26" x 48", 22 Gauge Galvanized Steel Duct	103.49	42.30
For Flat Oval, Add	4.95	
For Work In Restricted Working Space, Add	21.15	
23 31 13 13-0420 LF 28" x 28", 22 Gauge Galvanized Steel Duct	78.31	32.01
For Flat Oval, Add	3.74	
For Work In Restricted Working Space, Add	16.01	
23 31 13 13-0421 LF 28" x 30", 22 Gauge Galvanized Steel Duct	81.10	33.16
For Flat Oval, Add	3.88	
For Work In Restricted Working Space, Add	16.58	
23 31 13 13-0422 LF 28" x 32", 22 Gauge Galvanized Steel Duct	83.92	34.30
For Flat Oval, Add	4.01	
For Work In Restricted Working Space, Add	17.15	
23 31 13 13-0423 LF 28" x 34", 22 Gauge Galvanized Steel Duct	86.71	35.43
For Flat Oval, Add	4.15	
For Work In Restricted Working Space, Add	17.72	
23 31 13 13-0424 LF 28" x 36", 22 Gauge Galvanized Steel Duct	89.51	36.58
For Flat Oval, Add	4.28	
For Work In Restricted Working Space, Add	18.29	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 31 HVAC Ducts And Casings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31 13 13-0425	LF		28" x 38", 22 Gauge Galvanized Steel Duct	92.29	37.73
			<i>For Flat Oval, Add</i>	4.41	
			<i>For Work In Restricted Working Space, Add</i>	18.86	
23 31 13 13-0426	LF		28" x 40", 22 Gauge Galvanized Steel Duct	95.10	38.87
			<i>For Flat Oval, Add</i>	4.55	
			<i>For Work In Restricted Working Space, Add</i>	19.44	
23 31 13 13-0427	LF		28" x 42", 22 Gauge Galvanized Steel Duct	97.90	40.01
			<i>For Flat Oval, Add</i>	4.68	
			<i>For Work In Restricted Working Space, Add</i>	20.01	
23 31 13 13-0428	LF		28" x 44", 22 Gauge Galvanized Steel Duct	100.70	41.16
			<i>For Flat Oval, Add</i>	4.82	
			<i>For Work In Restricted Working Space, Add</i>	20.58	
23 31 13 13-0429	LF		28" x 46", 22 Gauge Galvanized Steel Duct	103.49	42.30
			<i>For Flat Oval, Add</i>	4.95	
			<i>For Work In Restricted Working Space, Add</i>	21.15	
23 31 13 13-0430	LF		28" x 48", 22 Gauge Galvanized Steel Duct	106.29	43.45
			<i>For Flat Oval, Add</i>	5.08	
			<i>For Work In Restricted Working Space, Add</i>	21.72	
23 31 13 13-0431	LF		30" x 30", 22 Gauge Galvanized Steel Duct	83.92	34.30
			<i>For Flat Oval, Add</i>	4.01	
			<i>For Work In Restricted Working Space, Add</i>	17.15	
23 31 13 13-0432	LF		30" x 32", 22 Gauge Galvanized Steel Duct	86.71	35.43
			<i>For Flat Oval, Add</i>	4.15	
			<i>For Work In Restricted Working Space, Add</i>	17.72	
23 31 13 13-0433	LF		30" x 34", 22 Gauge Galvanized Steel Duct	89.51	36.58
			<i>For Flat Oval, Add</i>	4.28	
			<i>For Work In Restricted Working Space, Add</i>	18.29	
23 31 13 13-0434	LF		30" x 36", 22 Gauge Galvanized Steel Duct	92.29	37.73
			<i>For Flat Oval, Add</i>	4.41	
			<i>For Work In Restricted Working Space, Add</i>	18.86	
23 31 13 13-0435	LF		30" x 38", 22 Gauge Galvanized Steel Duct	95.10	38.87
			<i>For Flat Oval, Add</i>	4.55	
			<i>For Work In Restricted Working Space, Add</i>	19.44	
23 31 13 13-0436	LF		30" x 40", 22 Gauge Galvanized Steel Duct	97.90	40.01
			<i>For Flat Oval, Add</i>	4.68	
			<i>For Work In Restricted Working Space, Add</i>	20.01	
23 31 13 13-0437	LF		30" x 42", 22 Gauge Galvanized Steel Duct	100.70	41.16
			<i>For Flat Oval, Add</i>	4.82	
			<i>For Work In Restricted Working Space, Add</i>	20.58	
23 31 13 13-0438	LF		30" x 44", 22 Gauge Galvanized Steel Duct	103.49	42.30
			<i>For Flat Oval, Add</i>	4.95	
			<i>For Work In Restricted Working Space, Add</i>	21.15	
23 31 13 13-0439	LF		30" x 46", 22 Gauge Galvanized Steel Duct	106.29	43.45
			<i>For Flat Oval, Add</i>	5.08	
			<i>For Work In Restricted Working Space, Add</i>	21.72	
23 31 13 13-0440	LF		30" x 48", 22 Gauge Galvanized Steel Duct	109.09	44.59
			<i>For Flat Oval, Add</i>	5.22	
			<i>For Work In Restricted Working Space, Add</i>	22.30	
23 31 13 13-0441	LF		32" x 32", 22 Gauge Galvanized Steel Duct	89.51	36.58
			<i>For Flat Oval, Add</i>	4.28	
			<i>For Work In Restricted Working Space, Add</i>	18.29	
23 31 13 13-0442	LF		32" x 34", 22 Gauge Galvanized Steel Duct	92.29	37.73
			<i>For Flat Oval, Add</i>	4.41	
			<i>For Work In Restricted Working Space, Add</i>	18.86	
23 31 13 13-0443	LF		32" x 36", 22 Gauge Galvanized Steel Duct	95.10	38.87
			<i>For Flat Oval, Add</i>	4.55	
			<i>For Work In Restricted Working Space, Add</i>	19.44	
23 31 13 13-0444	LF		32" x 38", 22 Gauge Galvanized Steel Duct	97.90	40.01
			<i>For Flat Oval, Add</i>	4.68	
			<i>For Work In Restricted Working Space, Add</i>	20.01	
23 31 13 13-0445	LF		32" x 40", 22 Gauge Galvanized Steel Duct	100.70	41.16
			<i>For Flat Oval, Add</i>	4.82	
			<i>For Work In Restricted Working Space, Add</i>	20.58	
23 31 13 13-0446	LF		32" x 42", 22 Gauge Galvanized Steel Duct	103.49	42.30
			<i>For Flat Oval, Add</i>	4.95	
			<i>For Work In Restricted Working Space, Add</i>	21.15	
23 31 13 13-0447	LF		32" x 44", 22 Gauge Galvanized Steel Duct	106.29	43.45
			<i>For Flat Oval, Add</i>	5.08	
			<i>For Work In Restricted Working Space, Add</i>	21.72	
23 31 13 13-0448	LF		32" x 46", 22 Gauge Galvanized Steel Duct	109.09	44.59
			<i>For Flat Oval, Add</i>	5.22	
			<i>For Work In Restricted Working Space, Add</i>	22.30	
23 31 13 13-0449	LF		32" x 48", 22 Gauge Galvanized Steel Duct	111.88	45.73
			<i>For Flat Oval, Add</i>	5.35	
			<i>For Work In Restricted Working Space, Add</i>	22.87	
23 31 13 13-0450	LF		34" x 34", 22 Gauge Galvanized Steel Duct	95.10	38.87
			<i>For Flat Oval, Add</i>	4.55	
			<i>For Work In Restricted Working Space, Add</i>	19.44	
23 31 13 13-0451	LF		34" x 36", 22 Gauge Galvanized Steel Duct	97.90	40.01
			<i>For Flat Oval, Add</i>	4.68	
			<i>For Work In Restricted Working Space, Add</i>	20.01	
23 31 13 13-0452	LF		34" x 38", 22 Gauge Galvanized Steel Duct	100.70	41.16
			<i>For Flat Oval, Add</i>	4.82	
			<i>For Work In Restricted Working Space, Add</i>	20.58	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31 13 13-0453 LF 34" x 40", 22 Gauge Galvanized Steel Duct	103.49	42.30
For Flat Oval, Add	4.95	
For Work In Restricted Working Space, Add	21.15	
23 31 13 13-0454 LF 34" x 42", 22 Gauge Galvanized Steel Duct	106.29	43.45
For Flat Oval, Add	5.08	
For Work In Restricted Working Space, Add	21.72	
23 31 13 13-0455 LF 34" x 44", 22 Gauge Galvanized Steel Duct	109.09	44.59
For Flat Oval, Add	5.22	
For Work In Restricted Working Space, Add	22.30	
23 31 13 13-0456 LF 34" x 46", 22 Gauge Galvanized Steel Duct	111.88	45.73
For Flat Oval, Add	5.35	
For Work In Restricted Working Space, Add	22.87	
23 31 13 13-0457 LF 34" x 48", 22 Gauge Galvanized Steel Duct	114.67	46.88
For Flat Oval, Add	5.48	
For Work In Restricted Working Space, Add	23.44	
23 31 13 13-0458 LF 36" x 36", 22 Gauge Galvanized Steel Duct	100.70	41.16
For Flat Oval, Add	4.82	
For Work In Restricted Working Space, Add	20.58	
23 31 13 13-0459 LF 36" x 38", 22 Gauge Galvanized Steel Duct	103.49	42.30
For Flat Oval, Add	4.95	
For Work In Restricted Working Space, Add	21.15	
23 31 13 13-0460 LF 36" x 40", 22 Gauge Galvanized Steel Duct	106.29	43.45
For Flat Oval, Add	5.08	
For Work In Restricted Working Space, Add	21.72	
23 31 13 13-0461 LF 36" x 42", 22 Gauge Galvanized Steel Duct	109.09	44.59
For Flat Oval, Add	5.22	
For Work In Restricted Working Space, Add	22.30	
23 31 13 13-0462 LF 36" x 44", 22 Gauge Galvanized Steel Duct	111.88	45.73
For Flat Oval, Add	5.35	
For Work In Restricted Working Space, Add	22.87	
23 31 13 13-0463 LF 36" x 46", 22 Gauge Galvanized Steel Duct	114.67	46.88
For Flat Oval, Add	5.48	
For Work In Restricted Working Space, Add	23.44	
23 31 13 13-0464 LF 36" x 48", 22 Gauge Galvanized Steel Duct	117.47	48.02
For Flat Oval, Add	5.62	
For Work In Restricted Working Space, Add	24.01	
23 31 13 13-0465 LF 38" x 38", 22 Gauge Galvanized Steel Duct	106.29	43.45
For Flat Oval, Add	5.08	
For Work In Restricted Working Space, Add	21.72	
23 31 13 13-0466 LF 38" x 40", 22 Gauge Galvanized Steel Duct	109.09	44.59
For Flat Oval, Add	5.22	
For Work In Restricted Working Space, Add	22.30	
23 31 13 13-0467 LF 38" x 42", 22 Gauge Galvanized Steel Duct	111.88	45.73
For Flat Oval, Add	5.35	
For Work In Restricted Working Space, Add	22.87	
23 31 13 13-0468 LF 38" x 44", 22 Gauge Galvanized Steel Duct	114.67	46.88
For Flat Oval, Add	5.48	
For Work In Restricted Working Space, Add	23.44	
23 31 13 13-0469 LF 38" x 46", 22 Gauge Galvanized Steel Duct	117.47	48.02
For Flat Oval, Add	5.62	
For Work In Restricted Working Space, Add	24.01	
23 31 13 13-0470 LF 38" x 48", 22 Gauge Galvanized Steel Duct	120.28	49.15
For Flat Oval, Add	5.75	
For Work In Restricted Working Space, Add	24.58	
23 31 13 13-0471 LF 38" x 50", 22 Gauge Galvanized Steel Duct	123.07	50.30
For Flat Oval, Add	5.88	
For Work In Restricted Working Space, Add	25.15	
23 31 13 13-0472 LF 40" x 40", 22 Gauge Galvanized Steel Duct	111.88	45.73
For Flat Oval, Add	5.35	
For Work In Restricted Working Space, Add	22.87	
23 31 13 13-0473 LF 40" x 42", 22 Gauge Galvanized Steel Duct	114.67	46.88
For Flat Oval, Add	5.48	
For Work In Restricted Working Space, Add	23.44	
23 31 13 13-0474 LF 40" x 44", 22 Gauge Galvanized Steel Duct	117.47	48.02
For Flat Oval, Add	5.62	
For Work In Restricted Working Space, Add	24.01	
23 31 13 13-0475 LF 40" x 46", 22 Gauge Galvanized Steel Duct	120.28	49.15
For Flat Oval, Add	5.75	
For Work In Restricted Working Space, Add	24.58	
23 31 13 13-0476 LF 40" x 48", 22 Gauge Galvanized Steel Duct	123.07	50.30
For Flat Oval, Add	5.88	
For Work In Restricted Working Space, Add	25.15	
23 31 13 13-0477 LF 40" x 50", 22 Gauge Galvanized Steel Duct	125.87	51.45
For Flat Oval, Add	6.02	
For Work In Restricted Working Space, Add	25.73	
23 31 13 13-0478 LF 40" x 52", 22 Gauge Galvanized Steel Duct	128.66	52.59
For Flat Oval, Add	6.15	
For Work In Restricted Working Space, Add	26.30	
23 31 13 13-0479 LF 40" x 54", 22 Gauge Galvanized Steel Duct	131.46	53.73
For Flat Oval, Add	6.29	
For Work In Restricted Working Space, Add	26.87	
23 31 13 13-0480 LF 42" x 42", 22 Gauge Galvanized Steel Duct	117.47	48.02
For Flat Oval, Add	5.62	
For Work In Restricted Working Space, Add	24.01	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 31 HVAC Ducts And Casings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31 13 13-0481	LF		42" x 44", 22 Gauge Galvanized Steel Duct	120.28	49.15
			<i>For Flat Oval, Add</i>	5.75	
			<i>For Work In Restricted Working Space, Add</i>	24.58	
23 31 13 13-0482	LF		42" x 46", 22 Gauge Galvanized Steel Duct	123.07	50.30
			<i>For Flat Oval, Add</i>	5.88	
			<i>For Work In Restricted Working Space, Add</i>	25.15	
23 31 13 13-0483	LF		42" x 48", 22 Gauge Galvanized Steel Duct	125.87	51.45
			<i>For Flat Oval, Add</i>	6.02	
			<i>For Work In Restricted Working Space, Add</i>	25.73	
23 31 13 13-0484	LF		42" x 50", 22 Gauge Galvanized Steel Duct	128.66	52.59
			<i>For Flat Oval, Add</i>	6.15	
			<i>For Work In Restricted Working Space, Add</i>	26.30	
23 31 13 13-0485	LF		42" x 52", 22 Gauge Galvanized Steel Duct	131.46	53.73
			<i>For Flat Oval, Add</i>	6.29	
			<i>For Work In Restricted Working Space, Add</i>	26.87	
23 31 13 13-0486	LF		42" x 54", 22 Gauge Galvanized Steel Duct	134.25	54.88
			<i>For Flat Oval, Add</i>	6.42	
			<i>For Work In Restricted Working Space, Add</i>	27.44	
23 31 13 13-0487	LF		44" x 44", 22 Gauge Galvanized Steel Duct	123.07	50.30
			<i>For Flat Oval, Add</i>	5.88	
			<i>For Work In Restricted Working Space, Add</i>	25.15	
23 31 13 13-0488	LF		44" x 46", 22 Gauge Galvanized Steel Duct	125.87	51.45
			<i>For Flat Oval, Add</i>	6.02	
			<i>For Work In Restricted Working Space, Add</i>	25.73	
23 31 13 13-0489	LF		44" x 48", 22 Gauge Galvanized Steel Duct	128.66	52.59
			<i>For Flat Oval, Add</i>	6.15	
			<i>For Work In Restricted Working Space, Add</i>	26.30	
23 31 13 13-0490	LF		44" x 50", 22 Gauge Galvanized Steel Duct	131.46	53.73
			<i>For Flat Oval, Add</i>	6.29	
			<i>For Work In Restricted Working Space, Add</i>	26.87	
23 31 13 13-0491	LF		44" x 52", 22 Gauge Galvanized Steel Duct	134.25	54.88
			<i>For Flat Oval, Add</i>	6.42	
			<i>For Work In Restricted Working Space, Add</i>	27.44	
23 31 13 13-0492	LF		44" x 54", 22 Gauge Galvanized Steel Duct	137.06	56.02
			<i>For Flat Oval, Add</i>	6.55	
			<i>For Work In Restricted Working Space, Add</i>	28.01	
23 31 13 13-0493	LF		46" x 46", 22 Gauge Galvanized Steel Duct	128.66	52.59
			<i>For Flat Oval, Add</i>	6.15	
			<i>For Work In Restricted Working Space, Add</i>	26.30	
23 31 13 13-0494	LF		46" x 48", 22 Gauge Galvanized Steel Duct	131.46	53.73
			<i>For Flat Oval, Add</i>	6.29	
			<i>For Work In Restricted Working Space, Add</i>	26.87	
23 31 13 13-0495	LF		46" x 50", 22 Gauge Galvanized Steel Duct	134.25	54.88
			<i>For Flat Oval, Add</i>	6.42	
			<i>For Work In Restricted Working Space, Add</i>	27.44	
23 31 13 13-0496	LF		46" x 52", 22 Gauge Galvanized Steel Duct	137.06	56.02
			<i>For Flat Oval, Add</i>	6.55	
			<i>For Work In Restricted Working Space, Add</i>	28.01	
23 31 13 13-0497	LF		46" x 54", 22 Gauge Galvanized Steel Duct	139.85	57.17
			<i>For Flat Oval, Add</i>	6.69	
			<i>For Work In Restricted Working Space, Add</i>	28.58	
23 31 13 13-0498	LF		48" x 48", 22 Gauge Galvanized Steel Duct	134.25	54.88
			<i>For Flat Oval, Add</i>	6.42	
			<i>For Work In Restricted Working Space, Add</i>	27.44	
23 31 13 13-0499	LF		48" x 50", 22 Gauge Galvanized Steel Duct	137.06	56.02
			<i>For Flat Oval, Add</i>	6.55	
			<i>For Work In Restricted Working Space, Add</i>	28.01	
23 31 13 13-0500	LF		48" x 52", 22 Gauge Galvanized Steel Duct	139.85	57.17
			<i>For Flat Oval, Add</i>	6.69	
			<i>For Work In Restricted Working Space, Add</i>	28.58	
23 31 13 13-0501	LF		48" x 54", 22 Gauge Galvanized Steel Duct	142.65	58.31
			<i>For Flat Oval, Add</i>	6.82	
			<i>For Work In Restricted Working Space, Add</i>	29.15	
23 31 13 13-0502	LF		50" x 50", 22 Gauge Galvanized Steel Duct	139.85	57.17
			<i>For Flat Oval, Add</i>	6.69	
			<i>For Work In Restricted Working Space, Add</i>	28.58	
23 31 13 13-0503	LF		50" x 52", 22 Gauge Galvanized Steel Duct	142.65	58.31
			<i>For Flat Oval, Add</i>	6.82	
			<i>For Work In Restricted Working Space, Add</i>	29.15	
23 31 13 13-0504	LF		50" x 54", 22 Gauge Galvanized Steel Duct	145.45	59.45
			<i>For Flat Oval, Add</i>	6.95	
			<i>For Work In Restricted Working Space, Add</i>	29.73	
23 31 13 13-0505	LF		52" x 52", 22 Gauge Galvanized Steel Duct	145.45	59.45
			<i>For Flat Oval, Add</i>	6.95	
			<i>For Work In Restricted Working Space, Add</i>	29.73	
23 31 13 13-0506	LF		52" x 54", 22 Gauge Galvanized Steel Duct	148.24	60.60
			<i>For Flat Oval, Add</i>	7.09	
			<i>For Work In Restricted Working Space, Add</i>	30.30	
23 31 13 13-0507	LF		54" x 54", 22 Gauge Galvanized Steel Duct	151.04	61.74
			<i>For Flat Oval, Add</i>	7.22	
			<i>For Work In Restricted Working Space, Add</i>	30.87	

23 31 13 13-0508 20 Gauge Galvanized Steel Duct (23 31 13 13-0009)



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31 13 13-0509 LF 4" x 4", 20 Gauge Galvanized Steel Duct	13.17	5.38
<i>For Flat Oval, Add</i>	0.63	
<i>For Work In Restricted Working Space, Add</i>	2.69	
23 31 13 13-0510 LF 4" x 6", 20 Gauge Galvanized Steel Duct	16.47	6.73
<i>For Flat Oval, Add</i>	0.79	
<i>For Work In Restricted Working Space, Add</i>	3.37	
23 31 13 13-0511 LF 4" x 8", 20 Gauge Galvanized Steel Duct	19.78	8.07
<i>For Flat Oval, Add</i>	0.95	
<i>For Work In Restricted Working Space, Add</i>	4.04	
23 31 13 13-0512 LF 4" x 10", 20 Gauge Galvanized Steel Duct	23.05	9.43
<i>For Flat Oval, Add</i>	1.10	
<i>For Work In Restricted Working Space, Add</i>	4.71	
23 31 13 13-0513 LF 4" x 12", 20 Gauge Galvanized Steel Duct	26.35	10.78
<i>For Flat Oval, Add</i>	1.26	
<i>For Work In Restricted Working Space, Add</i>	5.39	
23 31 13 13-0514 LF 4" x 14", 20 Gauge Galvanized Steel Duct	29.66	12.12
<i>For Flat Oval, Add</i>	1.42	
<i>For Work In Restricted Working Space, Add</i>	6.06	
23 31 13 13-0515 LF 4" x 16", 20 Gauge Galvanized Steel Duct	32.94	13.47
<i>For Flat Oval, Add</i>	1.58	
<i>For Work In Restricted Working Space, Add</i>	6.73	
23 31 13 13-0516 LF 6" x 6", 20 Gauge Galvanized Steel Duct	19.78	8.07
<i>For Flat Oval, Add</i>	0.95	
<i>For Work In Restricted Working Space, Add</i>	4.04	
23 31 13 13-0517 LF 6" x 8", 20 Gauge Galvanized Steel Duct	23.05	9.43
<i>For Flat Oval, Add</i>	1.10	
<i>For Work In Restricted Working Space, Add</i>	4.71	
23 31 13 13-0518 LF 6" x 10", 20 Gauge Galvanized Steel Duct	26.35	10.78
<i>For Flat Oval, Add</i>	1.26	
<i>For Work In Restricted Working Space, Add</i>	5.39	
23 31 13 13-0519 LF 6" x 12", 20 Gauge Galvanized Steel Duct	29.66	12.12
<i>For Flat Oval, Add</i>	1.42	
<i>For Work In Restricted Working Space, Add</i>	6.06	
23 31 13 13-0520 LF 6" x 14", 20 Gauge Galvanized Steel Duct	32.94	13.47
<i>For Flat Oval, Add</i>	1.58	
<i>For Work In Restricted Working Space, Add</i>	6.73	
23 31 13 13-0521 LF 6" x 16", 20 Gauge Galvanized Steel Duct	36.24	14.81
<i>For Flat Oval, Add</i>	1.73	
<i>For Work In Restricted Working Space, Add</i>	7.41	
23 31 13 13-0522 LF 8" x 8", 20 Gauge Galvanized Steel Duct	26.35	10.78
<i>For Flat Oval, Add</i>	1.26	
<i>For Work In Restricted Working Space, Add</i>	5.39	
23 31 13 13-0523 LF 8" x 10", 20 Gauge Galvanized Steel Duct	29.66	12.12
<i>For Flat Oval, Add</i>	1.42	
<i>For Work In Restricted Working Space, Add</i>	6.06	
23 31 13 13-0524 LF 8" x 12", 20 Gauge Galvanized Steel Duct	32.94	13.47
<i>For Flat Oval, Add</i>	1.58	
<i>For Work In Restricted Working Space, Add</i>	6.73	
23 31 13 13-0525 LF 8" x 14", 20 Gauge Galvanized Steel Duct	36.24	14.81
<i>For Flat Oval, Add</i>	1.73	
<i>For Work In Restricted Working Space, Add</i>	7.41	
23 31 13 13-0526 LF 8" x 16", 20 Gauge Galvanized Steel Duct	39.53	16.16
<i>For Flat Oval, Add</i>	1.89	
<i>For Work In Restricted Working Space, Add</i>	8.08	
23 31 13 13-0527 LF 8" x 18", 20 Gauge Galvanized Steel Duct	42.82	17.50
<i>For Flat Oval, Add</i>	2.05	
<i>For Work In Restricted Working Space, Add</i>	8.75	
23 31 13 13-0528 LF 8" x 20", 20 Gauge Galvanized Steel Duct	46.13	18.85
<i>For Flat Oval, Add</i>	2.21	
<i>For Work In Restricted Working Space, Add</i>	9.43	
23 31 13 13-0529 LF 8" x 22", 20 Gauge Galvanized Steel Duct	49.41	20.20
<i>For Flat Oval, Add</i>	2.36	
<i>For Work In Restricted Working Space, Add</i>	10.10	
23 31 13 13-0530 LF 8" x 24", 20 Gauge Galvanized Steel Duct	52.71	21.54
<i>For Flat Oval, Add</i>	2.52	
<i>For Work In Restricted Working Space, Add</i>	10.77	
23 31 13 13-0531 LF 10" x 10", 20 Gauge Galvanized Steel Duct	32.94	13.47
<i>For Flat Oval, Add</i>	1.58	
<i>For Work In Restricted Working Space, Add</i>	6.73	
23 31 13 13-0532 LF 10" x 12", 20 Gauge Galvanized Steel Duct	36.24	14.81
<i>For Flat Oval, Add</i>	1.73	
<i>For Work In Restricted Working Space, Add</i>	7.41	
23 31 13 13-0533 LF 10" x 14", 20 Gauge Galvanized Steel Duct	39.53	16.16
<i>For Flat Oval, Add</i>	1.89	
<i>For Work In Restricted Working Space, Add</i>	8.08	
23 31 13 13-0534 LF 10" x 16", 20 Gauge Galvanized Steel Duct	42.82	17.50
<i>For Flat Oval, Add</i>	2.05	
<i>For Work In Restricted Working Space, Add</i>	8.75	
23 31 13 13-0535 LF 10" x 18", 20 Gauge Galvanized Steel Duct	46.13	18.85
<i>For Flat Oval, Add</i>	2.21	
<i>For Work In Restricted Working Space, Add</i>	9.43	
23 31 13 13-0536 LF 10" x 20", 20 Gauge Galvanized Steel Duct	49.41	20.20
<i>For Flat Oval, Add</i>	2.36	
<i>For Work In Restricted Working Space, Add</i>	10.10	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 31 HVAC Ducts And Casings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31	13 13-0537	LF	10" x 22", 20 Gauge Galvanized Steel Duct	52.71	21.54
			<i>For Flat Oval, Add</i>	2.52	
			<i>For Work In Restricted Working Space, Add</i>	10.77	
23 31	13 13-0538	LF	10" x 24", 20 Gauge Galvanized Steel Duct	56.02	22.89
			<i>For Flat Oval, Add</i>	2.68	
			<i>For Work In Restricted Working Space, Add</i>	11.45	
23 31	13 13-0539	LF	10" x 26", 20 Gauge Galvanized Steel Duct	59.29	24.23
			<i>For Flat Oval, Add</i>	2.84	
			<i>For Work In Restricted Working Space, Add</i>	12.12	
23 31	13 13-0540	LF	10" x 28", 20 Gauge Galvanized Steel Duct	62.60	25.59
			<i>For Flat Oval, Add</i>	2.99	
			<i>For Work In Restricted Working Space, Add</i>	12.79	
23 31	13 13-0541	LF	10" x 30", 20 Gauge Galvanized Steel Duct	65.88	26.94
			<i>For Flat Oval, Add</i>	3.15	
			<i>For Work In Restricted Working Space, Add</i>	13.47	
23 31	13 13-0542	LF	10" x 32", 20 Gauge Galvanized Steel Duct	69.18	28.28
			<i>For Flat Oval, Add</i>	3.31	
			<i>For Work In Restricted Working Space, Add</i>	14.14	
23 31	13 13-0543	LF	12" x 12", 20 Gauge Galvanized Steel Duct	39.53	16.16
			<i>For Flat Oval, Add</i>	1.89	
			<i>For Work In Restricted Working Space, Add</i>	8.08	
23 31	13 13-0544	LF	12" x 14", 20 Gauge Galvanized Steel Duct	42.82	17.50
			<i>For Flat Oval, Add</i>	2.05	
			<i>For Work In Restricted Working Space, Add</i>	8.75	
23 31	13 13-0545	LF	12" x 16", 20 Gauge Galvanized Steel Duct	46.13	18.85
			<i>For Flat Oval, Add</i>	2.21	
			<i>For Work In Restricted Working Space, Add</i>	9.43	
23 31	13 13-0546	LF	12" x 18", 20 Gauge Galvanized Steel Duct	49.41	20.20
			<i>For Flat Oval, Add</i>	2.36	
			<i>For Work In Restricted Working Space, Add</i>	10.10	
23 31	13 13-0547	LF	12" x 20", 20 Gauge Galvanized Steel Duct	52.71	21.54
			<i>For Flat Oval, Add</i>	2.52	
			<i>For Work In Restricted Working Space, Add</i>	10.77	
23 31	13 13-0548	LF	12" x 22", 20 Gauge Galvanized Steel Duct	56.02	22.89
			<i>For Flat Oval, Add</i>	2.68	
			<i>For Work In Restricted Working Space, Add</i>	11.45	
23 31	13 13-0549	LF	12" x 24", 20 Gauge Galvanized Steel Duct	59.29	24.23
			<i>For Flat Oval, Add</i>	2.84	
			<i>For Work In Restricted Working Space, Add</i>	12.12	
23 31	13 13-0550	LF	12" x 26", 20 Gauge Galvanized Steel Duct	62.60	25.59
			<i>For Flat Oval, Add</i>	2.99	
			<i>For Work In Restricted Working Space, Add</i>	12.79	
23 31	13 13-0551	LF	12" x 28", 20 Gauge Galvanized Steel Duct	65.88	26.94
			<i>For Flat Oval, Add</i>	3.15	
			<i>For Work In Restricted Working Space, Add</i>	13.47	
23 31	13 13-0552	LF	12" x 30", 20 Gauge Galvanized Steel Duct	69.18	28.28
			<i>For Flat Oval, Add</i>	3.31	
			<i>For Work In Restricted Working Space, Add</i>	14.14	
23 31	13 13-0553	LF	12" x 32", 20 Gauge Galvanized Steel Duct	72.49	29.63
			<i>For Flat Oval, Add</i>	3.47	
			<i>For Work In Restricted Working Space, Add</i>	14.81	
23 31	13 13-0554	LF	12" x 34", 20 Gauge Galvanized Steel Duct	75.76	30.97
			<i>For Flat Oval, Add</i>	3.62	
			<i>For Work In Restricted Working Space, Add</i>	15.48	
23 31	13 13-0555	LF	12" x 36", 20 Gauge Galvanized Steel Duct	79.06	32.32
			<i>For Flat Oval, Add</i>	3.78	
			<i>For Work In Restricted Working Space, Add</i>	16.16	
23 31	13 13-0556	LF	14" x 14", 20 Gauge Galvanized Steel Duct	46.13	18.85
			<i>For Flat Oval, Add</i>	2.21	
			<i>For Work In Restricted Working Space, Add</i>	9.43	
23 31	13 13-0557	LF	14" x 16", 20 Gauge Galvanized Steel Duct	49.41	20.20
			<i>For Flat Oval, Add</i>	2.36	
			<i>For Work In Restricted Working Space, Add</i>	10.10	
23 31	13 13-0558	LF	14" x 18", 20 Gauge Galvanized Steel Duct	52.71	21.54
			<i>For Flat Oval, Add</i>	2.52	
			<i>For Work In Restricted Working Space, Add</i>	10.77	
23 31	13 13-0559	LF	14" x 20", 20 Gauge Galvanized Steel Duct	56.02	22.89
			<i>For Flat Oval, Add</i>	2.68	
			<i>For Work In Restricted Working Space, Add</i>	11.45	
23 31	13 13-0560	LF	14" x 22", 20 Gauge Galvanized Steel Duct	59.29	24.23
			<i>For Flat Oval, Add</i>	2.84	
			<i>For Work In Restricted Working Space, Add</i>	12.12	
23 31	13 13-0561	LF	14" x 24", 20 Gauge Galvanized Steel Duct	62.60	25.59
			<i>For Flat Oval, Add</i>	2.99	
			<i>For Work In Restricted Working Space, Add</i>	12.79	
23 31	13 13-0562	LF	14" x 26", 20 Gauge Galvanized Steel Duct	65.88	26.94
			<i>For Flat Oval, Add</i>	3.15	
			<i>For Work In Restricted Working Space, Add</i>	13.47	
23 31	13 13-0563	LF	14" x 28", 20 Gauge Galvanized Steel Duct	69.18	28.28
			<i>For Flat Oval, Add</i>	3.31	
			<i>For Work In Restricted Working Space, Add</i>	14.14	
23 31	13 13-0564	LF	14" x 30", 20 Gauge Galvanized Steel Duct	72.49	29.63
			<i>For Flat Oval, Add</i>	3.47	
			<i>For Work In Restricted Working Space, Add</i>	14.81	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31 13 13-0565 LF 14" x 32", 20 Gauge Galvanized Steel Duct	75.76	30.97
For Flat Oval, Add	3.62	
For Work In Restricted Working Space, Add	15.48	
23 31 13 13-0566 LF 14" x 34", 20 Gauge Galvanized Steel Duct	79.06	32.32
For Flat Oval, Add	3.78	
For Work In Restricted Working Space, Add	16.16	
23 31 13 13-0567 LF 14" x 36", 20 Gauge Galvanized Steel Duct	82.35	33.66
For Flat Oval, Add	3.94	
For Work In Restricted Working Space, Add	16.83	
23 31 13 13-0568 LF 16" x 16", 20 Gauge Galvanized Steel Duct	52.71	21.54
For Flat Oval, Add	2.52	
For Work In Restricted Working Space, Add	10.77	
23 31 13 13-0569 LF 16" x 18", 20 Gauge Galvanized Steel Duct	56.02	22.89
For Flat Oval, Add	2.68	
For Work In Restricted Working Space, Add	11.45	
23 31 13 13-0570 LF 16" x 20", 20 Gauge Galvanized Steel Duct	59.29	24.23
For Flat Oval, Add	2.84	
For Work In Restricted Working Space, Add	12.12	
23 31 13 13-0571 LF 16" x 22", 20 Gauge Galvanized Steel Duct	62.60	25.59
For Flat Oval, Add	2.99	
For Work In Restricted Working Space, Add	12.79	
23 31 13 13-0572 LF 16" x 24", 20 Gauge Galvanized Steel Duct	65.88	26.94
For Flat Oval, Add	3.15	
For Work In Restricted Working Space, Add	13.47	
23 31 13 13-0573 LF 16" x 26", 20 Gauge Galvanized Steel Duct	69.18	28.28
For Flat Oval, Add	3.31	
For Work In Restricted Working Space, Add	14.14	
23 31 13 13-0574 LF 16" x 28", 20 Gauge Galvanized Steel Duct	72.49	29.63
For Flat Oval, Add	3.47	
For Work In Restricted Working Space, Add	14.81	
23 31 13 13-0575 LF 16" x 30", 20 Gauge Galvanized Steel Duct	75.76	30.97
For Flat Oval, Add	3.62	
For Work In Restricted Working Space, Add	15.48	
23 31 13 13-0576 LF 16" x 32", 20 Gauge Galvanized Steel Duct	79.06	32.32
For Flat Oval, Add	3.78	
For Work In Restricted Working Space, Add	16.16	
23 31 13 13-0577 LF 16" x 34", 20 Gauge Galvanized Steel Duct	82.35	33.66
For Flat Oval, Add	3.94	
For Work In Restricted Working Space, Add	16.83	
23 31 13 13-0578 LF 16" x 36", 20 Gauge Galvanized Steel Duct	85.65	35.01
For Flat Oval, Add	4.10	
For Work In Restricted Working Space, Add	17.51	
23 31 13 13-0579 LF 16" x 38", 20 Gauge Galvanized Steel Duct	88.96	36.36
For Flat Oval, Add	4.25	
For Work In Restricted Working Space, Add	18.18	
23 31 13 13-0580 LF 16" x 40", 20 Gauge Galvanized Steel Duct	92.24	37.70
For Flat Oval, Add	4.41	
For Work In Restricted Working Space, Add	18.85	
23 31 13 13-0581 LF 16" x 42", 20 Gauge Galvanized Steel Duct	95.53	39.05
For Flat Oval, Add	4.57	
For Work In Restricted Working Space, Add	19.52	
23 31 13 13-0582 LF 16" x 44", 20 Gauge Galvanized Steel Duct	98.84	40.39
For Flat Oval, Add	4.73	
For Work In Restricted Working Space, Add	20.20	
23 31 13 13-0583 LF 18" x 18", 20 Gauge Galvanized Steel Duct	59.29	24.23
For Flat Oval, Add	2.84	
For Work In Restricted Working Space, Add	12.12	
23 31 13 13-0584 LF 18" x 20", 20 Gauge Galvanized Steel Duct	62.60	25.59
For Flat Oval, Add	2.99	
For Work In Restricted Working Space, Add	12.79	
23 31 13 13-0585 LF 18" x 22", 20 Gauge Galvanized Steel Duct	65.88	26.94
For Flat Oval, Add	3.15	
For Work In Restricted Working Space, Add	13.47	
23 31 13 13-0586 LF 18" x 24", 20 Gauge Galvanized Steel Duct	69.18	28.28
For Flat Oval, Add	3.31	
For Work In Restricted Working Space, Add	14.14	
23 31 13 13-0587 LF 18" x 26", 20 Gauge Galvanized Steel Duct	72.49	29.63
For Flat Oval, Add	3.47	
For Work In Restricted Working Space, Add	14.81	
23 31 13 13-0588 LF 18" x 28", 20 Gauge Galvanized Steel Duct	75.76	30.97
For Flat Oval, Add	3.62	
For Work In Restricted Working Space, Add	15.48	
23 31 13 13-0589 LF 18" x 30", 20 Gauge Galvanized Steel Duct	79.06	32.32
For Flat Oval, Add	3.78	
For Work In Restricted Working Space, Add	16.16	
23 31 13 13-0590 LF 18" x 32", 20 Gauge Galvanized Steel Duct	82.35	33.66
For Flat Oval, Add	3.94	
For Work In Restricted Working Space, Add	16.83	
23 31 13 13-0591 LF 18" x 34", 20 Gauge Galvanized Steel Duct	85.65	35.01
For Flat Oval, Add	4.10	
For Work In Restricted Working Space, Add	17.51	
23 31 13 13-0592 LF 18" x 36", 20 Gauge Galvanized Steel Duct	88.96	36.36
For Flat Oval, Add	4.25	
For Work In Restricted Working Space, Add	18.18	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 31 HVAC Ducts And Casings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31 13	13	0593	LF 18" x 38", 20 Gauge Galvanized Steel Duct	92.24	37.70
			<i>For Flat Oval, Add</i>	4.41	
			<i>For Work In Restricted Working Space, Add</i>	18.85	
23 31 13	13	0594	LF 18" x 40", 20 Gauge Galvanized Steel Duct	95.53	39.05
			<i>For Flat Oval, Add</i>	4.57	
			<i>For Work In Restricted Working Space, Add</i>	19.52	
23 31 13	13	0595	LF 18" x 42", 20 Gauge Galvanized Steel Duct	98.84	40.39
			<i>For Flat Oval, Add</i>	4.73	
			<i>For Work In Restricted Working Space, Add</i>	20.20	
23 31 13	13	0596	LF 18" x 44", 20 Gauge Galvanized Steel Duct	102.12	41.75
			<i>For Flat Oval, Add</i>	4.88	
			<i>For Work In Restricted Working Space, Add</i>	20.87	
23 31 13	13	0597	LF 18" x 46", 20 Gauge Galvanized Steel Duct	105.43	43.09
			<i>For Flat Oval, Add</i>	5.04	
			<i>For Work In Restricted Working Space, Add</i>	21.55	
23 31 13	13	0598	LF 20" x 20", 20 Gauge Galvanized Steel Duct	65.88	26.94
			<i>For Flat Oval, Add</i>	3.15	
			<i>For Work In Restricted Working Space, Add</i>	13.47	
23 31 13	13	0599	LF 20" x 22", 20 Gauge Galvanized Steel Duct	69.18	28.28
			<i>For Flat Oval, Add</i>	3.31	
			<i>For Work In Restricted Working Space, Add</i>	14.14	
23 31 13	13	0600	LF 20" x 24", 20 Gauge Galvanized Steel Duct	72.49	29.63
			<i>For Flat Oval, Add</i>	3.47	
			<i>For Work In Restricted Working Space, Add</i>	14.81	
23 31 13	13	0601	LF 20" x 26", 20 Gauge Galvanized Steel Duct	75.76	30.97
			<i>For Flat Oval, Add</i>	3.62	
			<i>For Work In Restricted Working Space, Add</i>	15.48	
23 31 13	13	0602	LF 20" x 28", 20 Gauge Galvanized Steel Duct	79.06	32.32
			<i>For Flat Oval, Add</i>	3.78	
			<i>For Work In Restricted Working Space, Add</i>	16.16	
23 31 13	13	0603	LF 20" x 30", 20 Gauge Galvanized Steel Duct	82.35	33.66
			<i>For Flat Oval, Add</i>	3.94	
			<i>For Work In Restricted Working Space, Add</i>	16.83	
23 31 13	13	0604	LF 20" x 32", 20 Gauge Galvanized Steel Duct	85.65	35.01
			<i>For Flat Oval, Add</i>	4.10	
			<i>For Work In Restricted Working Space, Add</i>	17.51	
23 31 13	13	0605	LF 20" x 34", 20 Gauge Galvanized Steel Duct	88.96	36.36
			<i>For Flat Oval, Add</i>	4.25	
			<i>For Work In Restricted Working Space, Add</i>	18.18	
23 31 13	13	0606	LF 20" x 36", 20 Gauge Galvanized Steel Duct	92.24	37.70
			<i>For Flat Oval, Add</i>	4.41	
			<i>For Work In Restricted Working Space, Add</i>	18.85	
23 31 13	13	0607	LF 20" x 38", 20 Gauge Galvanized Steel Duct	95.53	39.05
			<i>For Flat Oval, Add</i>	4.57	
			<i>For Work In Restricted Working Space, Add</i>	19.52	
23 31 13	13	0608	LF 20" x 40", 20 Gauge Galvanized Steel Duct	98.84	40.39
			<i>For Flat Oval, Add</i>	4.73	
			<i>For Work In Restricted Working Space, Add</i>	20.20	
23 31 13	13	0609	LF 20" x 42", 20 Gauge Galvanized Steel Duct	102.12	41.75
			<i>For Flat Oval, Add</i>	4.88	
			<i>For Work In Restricted Working Space, Add</i>	20.87	
23 31 13	13	0610	LF 20" x 44", 20 Gauge Galvanized Steel Duct	105.43	43.09
			<i>For Flat Oval, Add</i>	5.04	
			<i>For Work In Restricted Working Space, Add</i>	21.55	
23 31 13	13	0611	LF 20" x 46", 20 Gauge Galvanized Steel Duct	108.70	44.44
			<i>For Flat Oval, Add</i>	5.20	
			<i>For Work In Restricted Working Space, Add</i>	22.22	
23 31 13	13	0612	LF 20" x 48", 20 Gauge Galvanized Steel Duct	112.00	45.79
			<i>For Flat Oval, Add</i>	5.36	
			<i>For Work In Restricted Working Space, Add</i>	22.89	
23 31 13	13	0613	LF 22" x 22", 20 Gauge Galvanized Steel Duct	72.49	29.63
			<i>For Flat Oval, Add</i>	3.47	
			<i>For Work In Restricted Working Space, Add</i>	14.81	
23 31 13	13	0614	LF 22" x 24", 20 Gauge Galvanized Steel Duct	75.76	30.97
			<i>For Flat Oval, Add</i>	3.62	
			<i>For Work In Restricted Working Space, Add</i>	15.48	
23 31 13	13	0615	LF 22" x 26", 20 Gauge Galvanized Steel Duct	79.06	32.32
			<i>For Flat Oval, Add</i>	3.78	
			<i>For Work In Restricted Working Space, Add</i>	16.16	
23 31 13	13	0616	LF 22" x 28", 20 Gauge Galvanized Steel Duct	82.35	33.66
			<i>For Flat Oval, Add</i>	3.94	
			<i>For Work In Restricted Working Space, Add</i>	16.83	
23 31 13	13	0617	LF 22" x 30", 20 Gauge Galvanized Steel Duct	85.65	35.01
			<i>For Flat Oval, Add</i>	4.10	
			<i>For Work In Restricted Working Space, Add</i>	17.51	
23 31 13	13	0618	LF 22" x 32", 20 Gauge Galvanized Steel Duct	88.96	36.36
			<i>For Flat Oval, Add</i>	4.25	
			<i>For Work In Restricted Working Space, Add</i>	18.18	
23 31 13	13	0619	LF 22" x 34", 20 Gauge Galvanized Steel Duct	92.24	37.70
			<i>For Flat Oval, Add</i>	4.41	
			<i>For Work In Restricted Working Space, Add</i>	18.85	
23 31 13	13	0620	LF 22" x 36", 20 Gauge Galvanized Steel Duct	95.53	39.05
			<i>For Flat Oval, Add</i>	4.57	
			<i>For Work In Restricted Working Space, Add</i>	19.52	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31 13 13-0621 LF 22" x 38", 20 Gauge Galvanized Steel Duct	98.84	40.39
For Flat Oval, Add	4.73	
For Work In Restricted Working Space, Add	20.20	
23 31 13 13-0622 LF 22" x 40", 20 Gauge Galvanized Steel Duct	102.12	41.75
For Flat Oval, Add	4.88	
For Work In Restricted Working Space, Add	20.87	
23 31 13 13-0623 LF 22" x 42", 20 Gauge Galvanized Steel Duct	105.43	43.09
For Flat Oval, Add	5.04	
For Work In Restricted Working Space, Add	21.55	
23 31 13 13-0624 LF 22" x 44", 20 Gauge Galvanized Steel Duct	108.70	44.44
For Flat Oval, Add	5.20	
For Work In Restricted Working Space, Add	22.22	
23 31 13 13-0625 LF 22" x 46", 20 Gauge Galvanized Steel Duct	112.00	45.79
For Flat Oval, Add	5.36	
For Work In Restricted Working Space, Add	22.89	
23 31 13 13-0626 LF 22" x 48", 20 Gauge Galvanized Steel Duct	115.31	47.13
For Flat Oval, Add	5.51	
For Work In Restricted Working Space, Add	23.57	
23 31 13 13-0627 LF 24" x 24", 20 Gauge Galvanized Steel Duct	79.06	32.32
For Flat Oval, Add	3.78	
For Work In Restricted Working Space, Add	16.16	
23 31 13 13-0628 LF 24" x 26", 20 Gauge Galvanized Steel Duct	82.35	33.66
For Flat Oval, Add	3.94	
For Work In Restricted Working Space, Add	16.83	
23 31 13 13-0629 LF 24" x 28", 20 Gauge Galvanized Steel Duct	85.65	35.01
For Flat Oval, Add	4.10	
For Work In Restricted Working Space, Add	17.51	
23 31 13 13-0630 LF 24" x 30", 20 Gauge Galvanized Steel Duct	88.96	36.36
For Flat Oval, Add	4.25	
For Work In Restricted Working Space, Add	18.18	
23 31 13 13-0631 LF 24" x 32", 20 Gauge Galvanized Steel Duct	92.24	37.70
For Flat Oval, Add	4.41	
For Work In Restricted Working Space, Add	18.85	
23 31 13 13-0632 LF 24" x 34", 20 Gauge Galvanized Steel Duct	95.53	39.05
For Flat Oval, Add	4.57	
For Work In Restricted Working Space, Add	19.52	
23 31 13 13-0633 LF 24" x 36", 20 Gauge Galvanized Steel Duct	98.84	40.39
For Flat Oval, Add	4.73	
For Work In Restricted Working Space, Add	20.20	
23 31 13 13-0634 LF 24" x 38", 20 Gauge Galvanized Steel Duct	102.12	41.75
For Flat Oval, Add	4.88	
For Work In Restricted Working Space, Add	20.87	
23 31 13 13-0635 LF 24" x 40", 20 Gauge Galvanized Steel Duct	105.43	43.09
For Flat Oval, Add	5.04	
For Work In Restricted Working Space, Add	21.55	
23 31 13 13-0636 LF 24" x 42", 20 Gauge Galvanized Steel Duct	108.70	44.44
For Flat Oval, Add	5.20	
For Work In Restricted Working Space, Add	22.22	
23 31 13 13-0637 LF 24" x 44", 20 Gauge Galvanized Steel Duct	112.00	45.79
For Flat Oval, Add	5.36	
For Work In Restricted Working Space, Add	22.89	
23 31 13 13-0638 LF 24" x 46", 20 Gauge Galvanized Steel Duct	115.31	47.13
For Flat Oval, Add	5.51	
For Work In Restricted Working Space, Add	23.57	
23 31 13 13-0639 LF 24" x 48", 20 Gauge Galvanized Steel Duct	118.60	48.48
For Flat Oval, Add	5.67	
For Work In Restricted Working Space, Add	24.24	
23 31 13 13-0640 LF 26" x 26", 20 Gauge Galvanized Steel Duct	85.65	35.01
For Flat Oval, Add	4.10	
For Work In Restricted Working Space, Add	17.51	
23 31 13 13-0641 LF 26" x 28", 20 Gauge Galvanized Steel Duct	88.96	36.36
For Flat Oval, Add	4.25	
For Work In Restricted Working Space, Add	18.18	
23 31 13 13-0642 LF 26" x 30", 20 Gauge Galvanized Steel Duct	92.24	37.70
For Flat Oval, Add	4.41	
For Work In Restricted Working Space, Add	18.85	
23 31 13 13-0643 LF 26" x 32", 20 Gauge Galvanized Steel Duct	95.53	39.05
For Flat Oval, Add	4.57	
For Work In Restricted Working Space, Add	19.52	
23 31 13 13-0644 LF 26" x 34", 20 Gauge Galvanized Steel Duct	98.84	40.39
For Flat Oval, Add	4.73	
For Work In Restricted Working Space, Add	20.20	
23 31 13 13-0645 LF 26" x 36", 20 Gauge Galvanized Steel Duct	102.12	41.75
For Flat Oval, Add	4.88	
For Work In Restricted Working Space, Add	20.87	
23 31 13 13-0646 LF 26" x 38", 20 Gauge Galvanized Steel Duct	105.43	43.09
For Flat Oval, Add	5.04	
For Work In Restricted Working Space, Add	21.55	
23 31 13 13-0647 LF 26" x 40", 20 Gauge Galvanized Steel Duct	108.70	44.44
For Flat Oval, Add	5.20	
For Work In Restricted Working Space, Add	22.22	
23 31 13 13-0648 LF 26" x 42", 20 Gauge Galvanized Steel Duct	112.00	45.79
For Flat Oval, Add	5.36	
For Work In Restricted Working Space, Add	22.89	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 31 HVAC Ducts And Casings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31 13	13-0649	LF	26" x 44", 20 Gauge Galvanized Steel Duct	115.31	47.13
			<i>For Flat Oval, Add</i>	5.51	
			<i>For Work In Restricted Working Space, Add</i>	23.57	
23 31 13	13-0650	LF	26" x 46", 20 Gauge Galvanized Steel Duct	118.60	48.48
			<i>For Flat Oval, Add</i>	5.67	
			<i>For Work In Restricted Working Space, Add</i>	24.24	
23 31 13	13-0651	LF	26" x 48", 20 Gauge Galvanized Steel Duct	121.90	49.82
			<i>For Flat Oval, Add</i>	5.83	
			<i>For Work In Restricted Working Space, Add</i>	24.91	
23 31 13	13-0652	LF	28" x 28", 20 Gauge Galvanized Steel Duct	92.24	37.70
			<i>For Flat Oval, Add</i>	4.41	
			<i>For Work In Restricted Working Space, Add</i>	18.85	
23 31 13	13-0653	LF	28" x 30", 20 Gauge Galvanized Steel Duct	95.53	39.05
			<i>For Flat Oval, Add</i>	4.57	
			<i>For Work In Restricted Working Space, Add</i>	19.52	
23 31 13	13-0654	LF	28" x 32", 20 Gauge Galvanized Steel Duct	98.84	40.39
			<i>For Flat Oval, Add</i>	4.73	
			<i>For Work In Restricted Working Space, Add</i>	20.20	
23 31 13	13-0655	LF	28" x 34", 20 Gauge Galvanized Steel Duct	102.12	41.75
			<i>For Flat Oval, Add</i>	4.88	
			<i>For Work In Restricted Working Space, Add</i>	20.87	
23 31 13	13-0656	LF	28" x 36", 20 Gauge Galvanized Steel Duct	105.43	43.09
			<i>For Flat Oval, Add</i>	5.04	
			<i>For Work In Restricted Working Space, Add</i>	21.55	
23 31 13	13-0657	LF	28" x 38", 20 Gauge Galvanized Steel Duct	108.70	44.44
			<i>For Flat Oval, Add</i>	5.20	
			<i>For Work In Restricted Working Space, Add</i>	22.22	
23 31 13	13-0658	LF	28" x 40", 20 Gauge Galvanized Steel Duct	112.00	45.79
			<i>For Flat Oval, Add</i>	5.36	
			<i>For Work In Restricted Working Space, Add</i>	22.89	
23 31 13	13-0659	LF	28" x 42", 20 Gauge Galvanized Steel Duct	115.31	47.13
			<i>For Flat Oval, Add</i>	5.51	
			<i>For Work In Restricted Working Space, Add</i>	23.57	
23 31 13	13-0660	LF	28" x 44", 20 Gauge Galvanized Steel Duct	118.60	48.48
			<i>For Flat Oval, Add</i>	5.67	
			<i>For Work In Restricted Working Space, Add</i>	24.24	
23 31 13	13-0661	LF	28" x 46", 20 Gauge Galvanized Steel Duct	121.90	49.82
			<i>For Flat Oval, Add</i>	5.83	
			<i>For Work In Restricted Working Space, Add</i>	24.91	
23 31 13	13-0662	LF	28" x 48", 20 Gauge Galvanized Steel Duct	125.17	51.17
			<i>For Flat Oval, Add</i>	5.98	
			<i>For Work In Restricted Working Space, Add</i>	25.58	
23 31 13	13-0663	LF	30" x 30", 20 Gauge Galvanized Steel Duct	98.84	40.39
			<i>For Flat Oval, Add</i>	4.73	
			<i>For Work In Restricted Working Space, Add</i>	20.20	
23 31 13	13-0664	LF	30" x 32", 20 Gauge Galvanized Steel Duct	102.12	41.75
			<i>For Flat Oval, Add</i>	4.88	
			<i>For Work In Restricted Working Space, Add</i>	20.87	
23 31 13	13-0665	LF	30" x 34", 20 Gauge Galvanized Steel Duct	105.43	43.09
			<i>For Flat Oval, Add</i>	5.04	
			<i>For Work In Restricted Working Space, Add</i>	21.55	
23 31 13	13-0666	LF	30" x 36", 20 Gauge Galvanized Steel Duct	108.70	44.44
			<i>For Flat Oval, Add</i>	5.20	
			<i>For Work In Restricted Working Space, Add</i>	22.22	
23 31 13	13-0667	LF	30" x 38", 20 Gauge Galvanized Steel Duct	112.00	45.79
			<i>For Flat Oval, Add</i>	5.36	
			<i>For Work In Restricted Working Space, Add</i>	22.89	
23 31 13	13-0668	LF	30" x 40", 20 Gauge Galvanized Steel Duct	115.31	47.13
			<i>For Flat Oval, Add</i>	5.51	
			<i>For Work In Restricted Working Space, Add</i>	23.57	
23 31 13	13-0669	LF	30" x 42", 20 Gauge Galvanized Steel Duct	118.60	48.48
			<i>For Flat Oval, Add</i>	5.67	
			<i>For Work In Restricted Working Space, Add</i>	24.24	
23 31 13	13-0670	LF	30" x 44", 20 Gauge Galvanized Steel Duct	121.90	49.82
			<i>For Flat Oval, Add</i>	5.83	
			<i>For Work In Restricted Working Space, Add</i>	24.91	
23 31 13	13-0671	LF	30" x 46", 20 Gauge Galvanized Steel Duct	125.17	51.17
			<i>For Flat Oval, Add</i>	5.98	
			<i>For Work In Restricted Working Space, Add</i>	25.58	
23 31 13	13-0672	LF	30" x 48", 20 Gauge Galvanized Steel Duct	128.48	52.52
			<i>For Flat Oval, Add</i>	6.14	
			<i>For Work In Restricted Working Space, Add</i>	26.26	
23 31 13	13-0673	LF	32" x 32", 20 Gauge Galvanized Steel Duct	105.43	43.09
			<i>For Flat Oval, Add</i>	5.04	
			<i>For Work In Restricted Working Space, Add</i>	21.55	
23 31 13	13-0674	LF	32" x 34", 20 Gauge Galvanized Steel Duct	108.70	44.44
			<i>For Flat Oval, Add</i>	5.20	
			<i>For Work In Restricted Working Space, Add</i>	22.22	
23 31 13	13-0675	LF	32" x 36", 20 Gauge Galvanized Steel Duct	112.00	45.79
			<i>For Flat Oval, Add</i>	5.36	
			<i>For Work In Restricted Working Space, Add</i>	22.89	
23 31 13	13-0676	LF	32" x 38", 20 Gauge Galvanized Steel Duct	115.31	47.13
			<i>For Flat Oval, Add</i>	5.51	
			<i>For Work In Restricted Working Space, Add</i>	23.57	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31 13 13-0677 LF 32" x 40", 20 Gauge Galvanized Steel Duct	118.60	48.48
For Flat Oval, Add	5.67	
For Work In Restricted Working Space, Add	24.24	
23 31 13 13-0678 LF 32" x 42", 20 Gauge Galvanized Steel Duct	121.90	49.82
For Flat Oval, Add	5.83	
For Work In Restricted Working Space, Add	24.91	
23 31 13 13-0679 LF 32" x 44", 20 Gauge Galvanized Steel Duct	125.17	51.17
For Flat Oval, Add	5.98	
For Work In Restricted Working Space, Add	25.58	
23 31 13 13-0680 LF 32" x 46", 20 Gauge Galvanized Steel Duct	128.48	52.52
For Flat Oval, Add	6.14	
For Work In Restricted Working Space, Add	26.26	
23 31 13 13-0681 LF 32" x 48", 20 Gauge Galvanized Steel Duct	131.78	53.86
For Flat Oval, Add	6.30	
For Work In Restricted Working Space, Add	26.93	
23 31 13 13-0682 LF 34" x 34", 20 Gauge Galvanized Steel Duct	112.00	45.79
For Flat Oval, Add	5.36	
For Work In Restricted Working Space, Add	22.89	
23 31 13 13-0683 LF 34" x 36", 20 Gauge Galvanized Steel Duct	115.31	47.13
For Flat Oval, Add	5.51	
For Work In Restricted Working Space, Add	23.57	
23 31 13 13-0684 LF 34" x 38", 20 Gauge Galvanized Steel Duct	118.60	48.48
For Flat Oval, Add	5.67	
For Work In Restricted Working Space, Add	24.24	
23 31 13 13-0685 LF 34" x 40", 20 Gauge Galvanized Steel Duct	121.90	49.82
For Flat Oval, Add	5.83	
For Work In Restricted Working Space, Add	24.91	
23 31 13 13-0686 LF 34" x 42", 20 Gauge Galvanized Steel Duct	125.17	51.17
For Flat Oval, Add	5.98	
For Work In Restricted Working Space, Add	25.58	
23 31 13 13-0687 LF 34" x 44", 20 Gauge Galvanized Steel Duct	128.48	52.52
For Flat Oval, Add	6.14	
For Work In Restricted Working Space, Add	26.26	
23 31 13 13-0688 LF 34" x 46", 20 Gauge Galvanized Steel Duct	131.78	53.86
For Flat Oval, Add	6.30	
For Work In Restricted Working Space, Add	26.93	
23 31 13 13-0689 LF 34" x 48", 20 Gauge Galvanized Steel Duct	135.07	55.21
For Flat Oval, Add	6.46	
For Work In Restricted Working Space, Add	27.61	
23 31 13 13-0690 LF 36" x 36", 20 Gauge Galvanized Steel Duct	118.60	48.48
For Flat Oval, Add	5.67	
For Work In Restricted Working Space, Add	24.24	
23 31 13 13-0691 LF 36" x 38", 20 Gauge Galvanized Steel Duct	121.90	49.82
For Flat Oval, Add	5.83	
For Work In Restricted Working Space, Add	24.91	
23 31 13 13-0692 LF 36" x 40", 20 Gauge Galvanized Steel Duct	125.17	51.17
For Flat Oval, Add	5.98	
For Work In Restricted Working Space, Add	25.58	
23 31 13 13-0693 LF 36" x 42", 20 Gauge Galvanized Steel Duct	128.48	52.52
For Flat Oval, Add	6.14	
For Work In Restricted Working Space, Add	26.26	
23 31 13 13-0694 LF 36" x 44", 20 Gauge Galvanized Steel Duct	131.78	53.86
For Flat Oval, Add	6.30	
For Work In Restricted Working Space, Add	26.93	
23 31 13 13-0695 LF 36" x 46", 20 Gauge Galvanized Steel Duct	135.07	55.21
For Flat Oval, Add	6.46	
For Work In Restricted Working Space, Add	27.61	
23 31 13 13-0696 LF 36" x 48", 20 Gauge Galvanized Steel Duct	138.36	56.55
For Flat Oval, Add	6.62	
For Work In Restricted Working Space, Add	28.28	
23 31 13 13-0697 LF 38" x 38", 20 Gauge Galvanized Steel Duct	125.17	51.17
For Flat Oval, Add	5.98	
For Work In Restricted Working Space, Add	25.58	
23 31 13 13-0698 LF 38" x 40", 20 Gauge Galvanized Steel Duct	128.48	52.52
For Flat Oval, Add	6.14	
For Work In Restricted Working Space, Add	26.26	
23 31 13 13-0699 LF 38" x 42", 20 Gauge Galvanized Steel Duct	131.78	53.86
For Flat Oval, Add	6.30	
For Work In Restricted Working Space, Add	26.93	
23 31 13 13-0700 LF 38" x 44", 20 Gauge Galvanized Steel Duct	135.07	55.21
For Flat Oval, Add	6.46	
For Work In Restricted Working Space, Add	27.61	
23 31 13 13-0701 LF 38" x 46", 20 Gauge Galvanized Steel Duct	138.36	56.55
For Flat Oval, Add	6.62	
For Work In Restricted Working Space, Add	28.28	
23 31 13 13-0702 LF 38" x 48", 20 Gauge Galvanized Steel Duct	141.66	57.90
For Flat Oval, Add	6.77	
For Work In Restricted Working Space, Add	28.95	
23 31 13 13-0703 LF 38" x 50", 20 Gauge Galvanized Steel Duct	144.95	59.25
For Flat Oval, Add	6.93	
For Work In Restricted Working Space, Add	29.63	
23 31 13 13-0704 LF 40" x 40", 20 Gauge Galvanized Steel Duct	131.78	53.86
For Flat Oval, Add	6.30	
For Work In Restricted Working Space, Add	26.93	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 31 HVAC Ducts And Casings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31 13 13-0705	LF		40" x 42", 20 Gauge Galvanized Steel Duct	135.07	55.21
			<i>For Flat Oval, Add</i>	6.46	
			<i>For Work In Restricted Working Space, Add</i>	27.61	
23 31 13 13-0706	LF		40" x 44", 20 Gauge Galvanized Steel Duct	138.36	56.55
			<i>For Flat Oval, Add</i>	6.62	
			<i>For Work In Restricted Working Space, Add</i>	28.28	
23 31 13 13-0707	LF		40" x 46", 20 Gauge Galvanized Steel Duct	141.66	57.90
			<i>For Flat Oval, Add</i>	6.77	
			<i>For Work In Restricted Working Space, Add</i>	28.95	
23 31 13 13-0708	LF		40" x 48", 20 Gauge Galvanized Steel Duct	144.95	59.25
			<i>For Flat Oval, Add</i>	6.93	
			<i>For Work In Restricted Working Space, Add</i>	29.63	
23 31 13 13-0709	LF		40" x 50", 20 Gauge Galvanized Steel Duct	148.25	60.60
			<i>For Flat Oval, Add</i>	7.09	
			<i>For Work In Restricted Working Space, Add</i>	30.30	
23 31 13 13-0710	LF		40" x 52", 20 Gauge Galvanized Steel Duct	151.53	61.95
			<i>For Flat Oval, Add</i>	7.24	
			<i>For Work In Restricted Working Space, Add</i>	30.97	
23 31 13 13-0711	LF		40" x 54", 20 Gauge Galvanized Steel Duct	154.84	63.29
			<i>For Flat Oval, Add</i>	7.40	
			<i>For Work In Restricted Working Space, Add</i>	31.65	
23 31 13 13-0712	LF		40" x 56", 20 Gauge Galvanized Steel Duct	158.13	64.64
			<i>For Flat Oval, Add</i>	7.56	
			<i>For Work In Restricted Working Space, Add</i>	32.32	
23 31 13 13-0713	LF		42" x 42", 20 Gauge Galvanized Steel Duct	138.36	56.55
			<i>For Flat Oval, Add</i>	6.62	
			<i>For Work In Restricted Working Space, Add</i>	28.28	
23 31 13 13-0714	LF		42" x 44", 20 Gauge Galvanized Steel Duct	141.66	57.90
			<i>For Flat Oval, Add</i>	6.77	
			<i>For Work In Restricted Working Space, Add</i>	28.95	
23 31 13 13-0715	LF		42" x 46", 20 Gauge Galvanized Steel Duct	144.95	59.25
			<i>For Flat Oval, Add</i>	6.93	
			<i>For Work In Restricted Working Space, Add</i>	29.63	
23 31 13 13-0716	LF		42" x 48", 20 Gauge Galvanized Steel Duct	148.25	60.60
			<i>For Flat Oval, Add</i>	7.09	
			<i>For Work In Restricted Working Space, Add</i>	30.30	
23 31 13 13-0717	LF		42" x 50", 20 Gauge Galvanized Steel Duct	151.53	61.95
			<i>For Flat Oval, Add</i>	7.24	
			<i>For Work In Restricted Working Space, Add</i>	30.97	
23 31 13 13-0718	LF		42" x 52", 20 Gauge Galvanized Steel Duct	154.84	63.29
			<i>For Flat Oval, Add</i>	7.40	
			<i>For Work In Restricted Working Space, Add</i>	31.65	
23 31 13 13-0719	LF		42" x 54", 20 Gauge Galvanized Steel Duct	158.13	64.64
			<i>For Flat Oval, Add</i>	7.56	
			<i>For Work In Restricted Working Space, Add</i>	32.32	
23 31 13 13-0720	LF		42" x 56", 20 Gauge Galvanized Steel Duct	161.42	65.98
			<i>For Flat Oval, Add</i>	7.72	
			<i>For Work In Restricted Working Space, Add</i>	32.99	
23 31 13 13-0721	LF		44" x 44", 20 Gauge Galvanized Steel Duct	144.95	59.25
			<i>For Flat Oval, Add</i>	6.93	
			<i>For Work In Restricted Working Space, Add</i>	29.63	
23 31 13 13-0722	LF		44" x 46", 20 Gauge Galvanized Steel Duct	148.25	60.60
			<i>For Flat Oval, Add</i>	7.09	
			<i>For Work In Restricted Working Space, Add</i>	30.30	
23 31 13 13-0723	LF		44" x 48", 20 Gauge Galvanized Steel Duct	151.53	61.95
			<i>For Flat Oval, Add</i>	7.24	
			<i>For Work In Restricted Working Space, Add</i>	30.97	
23 31 13 13-0724	LF		44" x 50", 20 Gauge Galvanized Steel Duct	154.84	63.29
			<i>For Flat Oval, Add</i>	7.40	
			<i>For Work In Restricted Working Space, Add</i>	31.65	
23 31 13 13-0725	LF		44" x 52", 20 Gauge Galvanized Steel Duct	158.13	64.64
			<i>For Flat Oval, Add</i>	7.56	
			<i>For Work In Restricted Working Space, Add</i>	32.32	
23 31 13 13-0726	LF		44" x 54", 20 Gauge Galvanized Steel Duct	161.42	65.98
			<i>For Flat Oval, Add</i>	7.72	
			<i>For Work In Restricted Working Space, Add</i>	32.99	
23 31 13 13-0727	LF		44" x 56", 20 Gauge Galvanized Steel Duct	164.72	67.33
			<i>For Flat Oval, Add</i>	7.88	
			<i>For Work In Restricted Working Space, Add</i>	33.66	
23 31 13 13-0728	LF		46" x 46", 20 Gauge Galvanized Steel Duct	151.53	61.95
			<i>For Flat Oval, Add</i>	7.24	
			<i>For Work In Restricted Working Space, Add</i>	30.97	
23 31 13 13-0729	LF		46" x 48", 20 Gauge Galvanized Steel Duct	154.84	63.29
			<i>For Flat Oval, Add</i>	7.40	
			<i>For Work In Restricted Working Space, Add</i>	31.65	
23 31 13 13-0730	LF		46" x 50", 20 Gauge Galvanized Steel Duct	158.13	64.64
			<i>For Flat Oval, Add</i>	7.56	
			<i>For Work In Restricted Working Space, Add</i>	32.32	
23 31 13 13-0731	LF		46" x 52", 20 Gauge Galvanized Steel Duct	161.42	65.98
			<i>For Flat Oval, Add</i>	7.72	
			<i>For Work In Restricted Working Space, Add</i>	32.99	
23 31 13 13-0732	LF		46" x 54", 20 Gauge Galvanized Steel Duct	164.72	67.33
			<i>For Flat Oval, Add</i>	7.88	
			<i>For Work In Restricted Working Space, Add</i>	33.66	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31 13 13-0733 LF 46" x 56", 20 Gauge Galvanized Steel Duct	168.02	68.67
For Flat Oval, Add	8.03	
For Work In Restricted Working Space, Add	34.34	
23 31 13 13-0734 LF 46" x 58", 20 Gauge Galvanized Steel Duct	171.31	70.02
For Flat Oval, Add	8.19	
For Work In Restricted Working Space, Add	35.01	
23 31 13 13-0735 LF 48" x 48", 20 Gauge Galvanized Steel Duct	158.13	64.64
For Flat Oval, Add	7.56	
For Work In Restricted Working Space, Add	32.32	
23 31 13 13-0736 LF 48" x 50", 20 Gauge Galvanized Steel Duct	161.42	65.98
For Flat Oval, Add	7.72	
For Work In Restricted Working Space, Add	32.99	
23 31 13 13-0737 LF 48" x 52", 20 Gauge Galvanized Steel Duct	164.72	67.33
For Flat Oval, Add	7.88	
For Work In Restricted Working Space, Add	33.66	
23 31 13 13-0738 LF 48" x 54", 20 Gauge Galvanized Steel Duct	168.02	68.67
For Flat Oval, Add	8.03	
For Work In Restricted Working Space, Add	34.34	
23 31 13 13-0739 LF 48" x 56", 20 Gauge Galvanized Steel Duct	171.31	70.02
For Flat Oval, Add	8.19	
For Work In Restricted Working Space, Add	35.01	
23 31 13 13-0740 LF 48" x 58", 20 Gauge Galvanized Steel Duct	174.60	71.37
For Flat Oval, Add	8.35	
For Work In Restricted Working Space, Add	35.68	
23 31 13 13-0741 LF 48" x 60", 20 Gauge Galvanized Steel Duct	177.89	72.71
For Flat Oval, Add	8.51	
For Work In Restricted Working Space, Add	36.36	
23 31 13 13-0742 LF 50" x 50", 20 Gauge Galvanized Steel Duct	164.72	67.33
For Flat Oval, Add	7.88	
For Work In Restricted Working Space, Add	33.66	
23 31 13 13-0743 LF 50" x 52", 20 Gauge Galvanized Steel Duct	168.02	68.67
For Flat Oval, Add	8.03	
For Work In Restricted Working Space, Add	34.34	
23 31 13 13-0744 LF 50" x 54", 20 Gauge Galvanized Steel Duct	171.31	70.02
For Flat Oval, Add	8.19	
For Work In Restricted Working Space, Add	35.01	
23 31 13 13-0745 LF 50" x 56", 20 Gauge Galvanized Steel Duct	174.60	71.37
For Flat Oval, Add	8.35	
For Work In Restricted Working Space, Add	35.68	
23 31 13 13-0746 LF 50" x 58", 20 Gauge Galvanized Steel Duct	177.89	72.71
For Flat Oval, Add	8.51	
For Work In Restricted Working Space, Add	36.36	
23 31 13 13-0747 LF 50" x 60", 20 Gauge Galvanized Steel Duct	181.19	74.06
For Flat Oval, Add	8.66	
For Work In Restricted Working Space, Add	37.03	
23 31 13 13-0748 LF 52" x 52", 20 Gauge Galvanized Steel Duct	171.31	70.02
For Flat Oval, Add	8.19	
For Work In Restricted Working Space, Add	35.01	
23 31 13 13-0749 LF 52" x 54", 20 Gauge Galvanized Steel Duct	174.60	71.37
For Flat Oval, Add	8.35	
For Work In Restricted Working Space, Add	35.68	
23 31 13 13-0750 LF 52" x 56", 20 Gauge Galvanized Steel Duct	177.89	72.71
For Flat Oval, Add	8.51	
For Work In Restricted Working Space, Add	36.36	
23 31 13 13-0751 LF 52" x 58", 20 Gauge Galvanized Steel Duct	181.19	74.06
For Flat Oval, Add	8.66	
For Work In Restricted Working Space, Add	37.03	
23 31 13 13-0752 LF 52" x 60", 20 Gauge Galvanized Steel Duct	184.49	75.41
For Flat Oval, Add	8.82	
For Work In Restricted Working Space, Add	37.70	
23 31 13 13-0753 LF 54" x 54", 20 Gauge Galvanized Steel Duct	177.89	72.71
For Flat Oval, Add	8.51	
For Work In Restricted Working Space, Add	36.36	
23 31 13 13-0754 LF 54" x 56", 20 Gauge Galvanized Steel Duct	181.19	74.06
For Flat Oval, Add	8.66	
For Work In Restricted Working Space, Add	37.03	
23 31 13 13-0755 LF 54" x 58", 20 Gauge Galvanized Steel Duct	184.49	75.41
For Flat Oval, Add	8.82	
For Work In Restricted Working Space, Add	37.70	
23 31 13 13-0756 LF 54" x 60", 20 Gauge Galvanized Steel Duct	187.78	76.76
For Flat Oval, Add	8.98	
For Work In Restricted Working Space, Add	38.38	
23 31 13 13-0757 LF 54" x 62", 20 Gauge Galvanized Steel Duct	191.07	78.10
For Flat Oval, Add	9.14	
For Work In Restricted Working Space, Add	39.05	
23 31 13 13-0758 LF 54" x 64", 20 Gauge Galvanized Steel Duct	194.35	79.45
For Flat Oval, Add	9.29	
For Work In Restricted Working Space, Add	39.72	
23 31 13 13-0759 LF 56" x 56", 20 Gauge Galvanized Steel Duct	184.49	75.41
For Flat Oval, Add	8.82	
For Work In Restricted Working Space, Add	37.70	
23 31 13 13-0760 LF 56" x 58", 20 Gauge Galvanized Steel Duct	187.78	76.76
For Flat Oval, Add	8.98	
For Work In Restricted Working Space, Add	38.38	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 31 HVAC Ducts And Casings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31 13	13-0761	LF	56" x 60", 20 Gauge Galvanized Steel Duct	191.07	78.10
			<i>For Flat Oval, Add</i>	9.14	
			<i>For Work In Restricted Working Space, Add</i>	39.05	
23 31 13	13-0762	LF	56" x 62", 20 Gauge Galvanized Steel Duct	194.35	79.45
			<i>For Flat Oval, Add</i>	9.29	
			<i>For Work In Restricted Working Space, Add</i>	39.72	
23 31 13	13-0763	LF	56" x 64", 20 Gauge Galvanized Steel Duct	197.66	80.80
			<i>For Flat Oval, Add</i>	9.45	
			<i>For Work In Restricted Working Space, Add</i>	40.40	
23 31 13	13-0764	LF	58" x 58", 20 Gauge Galvanized Steel Duct	191.07	78.10
			<i>For Flat Oval, Add</i>	9.14	
			<i>For Work In Restricted Working Space, Add</i>	39.05	
23 31 13	13-0765	LF	58" x 60", 20 Gauge Galvanized Steel Duct	194.35	79.45
			<i>For Flat Oval, Add</i>	9.29	
			<i>For Work In Restricted Working Space, Add</i>	39.72	
23 31 13	13-0766	LF	58" x 62", 20 Gauge Galvanized Steel Duct	197.66	80.80
			<i>For Flat Oval, Add</i>	9.45	
			<i>For Work In Restricted Working Space, Add</i>	40.40	
23 31 13	13-0767	LF	58" x 64", 20 Gauge Galvanized Steel Duct	200.96	82.14
			<i>For Flat Oval, Add</i>	9.61	
			<i>For Work In Restricted Working Space, Add</i>	41.07	
23 31 13	13-0768	LF	58" x 66", 20 Gauge Galvanized Steel Duct	204.25	83.49
			<i>For Flat Oval, Add</i>	9.77	
			<i>For Work In Restricted Working Space, Add</i>	41.75	
23 31 13	13-0769	LF	60" x 60", 20 Gauge Galvanized Steel Duct	197.66	80.80
			<i>For Flat Oval, Add</i>	9.45	
			<i>For Work In Restricted Working Space, Add</i>	40.40	
23 31 13	13-0770	LF	60" x 62", 20 Gauge Galvanized Steel Duct	200.96	82.14
			<i>For Flat Oval, Add</i>	9.61	
			<i>For Work In Restricted Working Space, Add</i>	41.07	
23 31 13	13-0771	LF	60" x 64", 20 Gauge Galvanized Steel Duct	204.25	83.49
			<i>For Flat Oval, Add</i>	9.77	
			<i>For Work In Restricted Working Space, Add</i>	41.75	
23 31 13	13-0772	LF	60" x 66", 20 Gauge Galvanized Steel Duct	207.55	84.83
			<i>For Flat Oval, Add</i>	9.92	
			<i>For Work In Restricted Working Space, Add</i>	42.42	
23 31 13	13-0773	LF	60" x 68", 20 Gauge Galvanized Steel Duct	210.84	86.18
			<i>For Flat Oval, Add</i>	10.08	
			<i>For Work In Restricted Working Space, Add</i>	43.09	
23 31 13	13-0774	LF	62" x 62", 20 Gauge Galvanized Steel Duct	204.25	83.49
			<i>For Flat Oval, Add</i>	9.77	
			<i>For Work In Restricted Working Space, Add</i>	41.75	
23 31 13	13-0775	LF	62" x 64", 20 Gauge Galvanized Steel Duct	207.55	84.83
			<i>For Flat Oval, Add</i>	9.92	
			<i>For Work In Restricted Working Space, Add</i>	42.42	
23 31 13	13-0776	LF	62" x 66", 20 Gauge Galvanized Steel Duct	210.84	86.18
			<i>For Flat Oval, Add</i>	10.08	
			<i>For Work In Restricted Working Space, Add</i>	43.09	
23 31 13	13-0777	LF	62" x 68", 20 Gauge Galvanized Steel Duct	214.13	87.53
			<i>For Flat Oval, Add</i>	10.24	
			<i>For Work In Restricted Working Space, Add</i>	43.76	
23 31 13	13-0778	LF	62" x 70", 20 Gauge Galvanized Steel Duct	217.44	88.87
			<i>For Flat Oval, Add</i>	10.40	
			<i>For Work In Restricted Working Space, Add</i>	44.44	
23 31 13	13-0779	LF	64" x 64", 20 Gauge Galvanized Steel Duct	210.84	86.18
			<i>For Flat Oval, Add</i>	10.08	
			<i>For Work In Restricted Working Space, Add</i>	43.09	
23 31 13	13-0780	LF	64" x 66", 20 Gauge Galvanized Steel Duct	214.13	87.53
			<i>For Flat Oval, Add</i>	10.24	
			<i>For Work In Restricted Working Space, Add</i>	43.76	
23 31 13	13-0781	LF	64" x 68", 20 Gauge Galvanized Steel Duct	217.44	88.87
			<i>For Flat Oval, Add</i>	10.40	
			<i>For Work In Restricted Working Space, Add</i>	44.44	
23 31 13	13-0782	LF	64" x 70", 20 Gauge Galvanized Steel Duct	220.72	90.22
			<i>For Flat Oval, Add</i>	10.55	
			<i>For Work In Restricted Working Space, Add</i>	45.11	
23 31 13	13-0783	LF	66" x 66", 20 Gauge Galvanized Steel Duct	217.44	88.87
			<i>For Flat Oval, Add</i>	10.40	
			<i>For Work In Restricted Working Space, Add</i>	44.44	
23 31 13	13-0784	LF	66" x 68", 20 Gauge Galvanized Steel Duct	220.72	90.22
			<i>For Flat Oval, Add</i>	10.55	
			<i>For Work In Restricted Working Space, Add</i>	45.11	
23 31 13	13-0785	LF	66" x 70", 20 Gauge Galvanized Steel Duct	224.01	91.57
			<i>For Flat Oval, Add</i>	10.71	
			<i>For Work In Restricted Working Space, Add</i>	45.78	
23 31 13	13-0786	LF	66" x 72", 20 Gauge Galvanized Steel Duct	227.31	92.92
			<i>For Flat Oval, Add</i>	10.87	
			<i>For Work In Restricted Working Space, Add</i>	46.46	
23 31 13	13-0787	LF	68" x 68", 20 Gauge Galvanized Steel Duct	224.01	91.57
			<i>For Flat Oval, Add</i>	10.71	
			<i>For Work In Restricted Working Space, Add</i>	45.78	
23 31 13	13-0788	LF	68" x 70", 20 Gauge Galvanized Steel Duct	227.31	92.92
			<i>For Flat Oval, Add</i>	10.87	
			<i>For Work In Restricted Working Space, Add</i>	46.46	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31 13 13-0789 LF 68" x 72", 20 Gauge Galvanized Steel Duct	230.60	94.26
For Flat Oval, Add	11.03	
For Work In Restricted Working Space, Add	47.13	
23 31 13 13-0790 LF 68" x 74", 20 Gauge Galvanized Steel Duct	233.91	95.61
For Flat Oval, Add	11.18	
For Work In Restricted Working Space, Add	47.81	
23 31 13 13-0791 LF 70" x 70", 20 Gauge Galvanized Steel Duct	230.60	94.26
For Flat Oval, Add	11.03	
For Work In Restricted Working Space, Add	47.13	
23 31 13 13-0792 LF 70" x 72", 20 Gauge Galvanized Steel Duct	233.91	95.61
For Flat Oval, Add	11.18	
For Work In Restricted Working Space, Add	47.81	
23 31 13 13-0793 LF 70" x 74", 20 Gauge Galvanized Steel Duct	237.20	96.96
For Flat Oval, Add	11.34	
For Work In Restricted Working Space, Add	48.48	
23 31 13 13-0794 LF 70" x 76", 20 Gauge Galvanized Steel Duct	240.49	98.30
For Flat Oval, Add	11.50	
For Work In Restricted Working Space, Add	49.15	
23 31 13 13-0795 LF 70" x 78", 20 Gauge Galvanized Steel Duct	243.79	99.65
For Flat Oval, Add	11.66	
For Work In Restricted Working Space, Add	49.82	
23 31 13 13-0796 LF 70" x 80", 20 Gauge Galvanized Steel Duct	247.07	100.99
For Flat Oval, Add	11.81	
For Work In Restricted Working Space, Add	50.50	
23 31 13 13-0797 LF 70" x 82", 20 Gauge Galvanized Steel Duct	250.38	102.34
For Flat Oval, Add	11.97	
For Work In Restricted Working Space, Add	51.17	
23 31 13 13-0798 LF 70" x 84", 20 Gauge Galvanized Steel Duct	253.67	103.68
For Flat Oval, Add	12.13	
For Work In Restricted Working Space, Add	51.84	
23 31 13 13-0799 LF 72" x 72", 20 Gauge Galvanized Steel Duct	237.20	96.96
For Flat Oval, Add	11.34	
For Work In Restricted Working Space, Add	48.48	
23 31 13 13-0800 LF 72" x 74", 20 Gauge Galvanized Steel Duct	240.49	98.30
For Flat Oval, Add	11.50	
For Work In Restricted Working Space, Add	49.15	
23 31 13 13-0801 LF 72" x 76", 20 Gauge Galvanized Steel Duct	243.79	99.65
For Flat Oval, Add	11.66	
For Work In Restricted Working Space, Add	49.82	
23 31 13 13-0802 LF 72" x 78", 20 Gauge Galvanized Steel Duct	247.07	100.99
For Flat Oval, Add	11.81	
For Work In Restricted Working Space, Add	50.50	
23 31 13 13-0803 LF 72" x 80", 20 Gauge Galvanized Steel Duct	250.38	102.34
For Flat Oval, Add	11.97	
For Work In Restricted Working Space, Add	51.17	
23 31 13 13-0804 LF 72" x 82", 20 Gauge Galvanized Steel Duct	253.67	103.68
For Flat Oval, Add	12.13	
For Work In Restricted Working Space, Add	51.84	
23 31 13 13-0805 LF 72" x 84", 20 Gauge Galvanized Steel Duct	256.96	105.03
For Flat Oval, Add	12.29	
For Work In Restricted Working Space, Add	52.52	
23 31 13 13-0806 LF 74" x 74", 20 Gauge Galvanized Steel Duct	243.79	99.65
For Flat Oval, Add	11.66	
For Work In Restricted Working Space, Add	49.82	
23 31 13 13-0807 LF 74" x 76", 20 Gauge Galvanized Steel Duct	247.07	100.99
For Flat Oval, Add	11.81	
For Work In Restricted Working Space, Add	50.50	
23 31 13 13-0808 LF 74" x 78", 20 Gauge Galvanized Steel Duct	250.38	102.34
For Flat Oval, Add	11.97	
For Work In Restricted Working Space, Add	51.17	
23 31 13 13-0809 LF 74" x 80", 20 Gauge Galvanized Steel Duct	253.67	103.68
For Flat Oval, Add	12.13	
For Work In Restricted Working Space, Add	51.84	
23 31 13 13-0810 LF 74" x 82", 20 Gauge Galvanized Steel Duct	256.96	105.03
For Flat Oval, Add	12.29	
For Work In Restricted Working Space, Add	52.52	
23 31 13 13-0811 LF 74" x 84", 20 Gauge Galvanized Steel Duct	260.26	106.38
For Flat Oval, Add	12.44	
For Work In Restricted Working Space, Add	53.19	
23 31 13 13-0812 LF 76" x 76", 20 Gauge Galvanized Steel Duct	250.38	102.34
For Flat Oval, Add	11.97	
For Work In Restricted Working Space, Add	51.17	
23 31 13 13-0813 LF 76" x 78", 20 Gauge Galvanized Steel Duct	253.67	103.68
For Flat Oval, Add	12.13	
For Work In Restricted Working Space, Add	51.84	
23 31 13 13-0814 LF 76" x 80", 20 Gauge Galvanized Steel Duct	256.96	105.03
For Flat Oval, Add	12.29	
For Work In Restricted Working Space, Add	52.52	
23 31 13 13-0815 LF 76" x 82", 20 Gauge Galvanized Steel Duct	260.26	106.38
For Flat Oval, Add	12.44	
For Work In Restricted Working Space, Add	53.19	
23 31 13 13-0816 LF 76" x 84", 20 Gauge Galvanized Steel Duct	263.54	107.72
For Flat Oval, Add	12.60	
For Work In Restricted Working Space, Add	53.86	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 31 HVAC Ducts And Casings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31 13 13-0817	LF		78" x 78", 20 Gauge Galvanized Steel Duct	256.96	105.03
			<i>For Flat Oval, Add</i>	12.29	
			<i>For Work In Restricted Working Space, Add</i>	52.52	
23 31 13 13-0818	LF		78" x 80", 20 Gauge Galvanized Steel Duct	260.26	106.38
			<i>For Flat Oval, Add</i>	12.44	
			<i>For Work In Restricted Working Space, Add</i>	53.19	
23 31 13 13-0819	LF		78" x 82", 20 Gauge Galvanized Steel Duct	263.54	107.72
			<i>For Flat Oval, Add</i>	12.60	
			<i>For Work In Restricted Working Space, Add</i>	53.86	
23 31 13 13-0820	LF		78" x 84", 20 Gauge Galvanized Steel Duct	266.84	109.08
			<i>For Flat Oval, Add</i>	12.76	
			<i>For Work In Restricted Working Space, Add</i>	54.54	
23 31 13 13-0821	LF		80" x 80", 20 Gauge Galvanized Steel Duct	263.54	107.72
			<i>For Flat Oval, Add</i>	12.60	
			<i>For Work In Restricted Working Space, Add</i>	53.86	
23 31 13 13-0822	LF		80" x 82", 20 Gauge Galvanized Steel Duct	266.84	109.08
			<i>For Flat Oval, Add</i>	12.76	
			<i>For Work In Restricted Working Space, Add</i>	54.54	
23 31 13 13-0823	LF		80" x 84", 20 Gauge Galvanized Steel Duct	270.15	110.42
			<i>For Flat Oval, Add</i>	12.92	
			<i>For Work In Restricted Working Space, Add</i>	55.21	
23 31 13 13-0824	LF		82" x 82", 20 Gauge Galvanized Steel Duct	270.15	110.42
			<i>For Flat Oval, Add</i>	12.92	
			<i>For Work In Restricted Working Space, Add</i>	55.21	
23 31 13 13-0825	LF		82" x 84", 20 Gauge Galvanized Steel Duct	273.43	111.77
			<i>For Flat Oval, Add</i>	13.07	
			<i>For Work In Restricted Working Space, Add</i>	55.88	
23 31 13 13-0826	LF		84" x 84", 20 Gauge Galvanized Steel Duct	276.73	113.11
			<i>For Flat Oval, Add</i>	13.23	
			<i>For Work In Restricted Working Space, Add</i>	56.56	
23 31 13 13-0827			18 Gauge Galvanized Steel Duct <small>(23 31 13 13-0009)</small>		
23 31 13 13-0828	LF		4" x 4", 18 Gauge Galvanized Steel Duct	17.15	7.02
			<i>For Flat Oval, Add</i>	0.82	
			<i>For Work In Restricted Working Space, Add</i>	3.50	
23 31 13 13-0829	LF		4" x 6", 18 Gauge Galvanized Steel Duct	21.45	8.77
			<i>For Flat Oval, Add</i>	1.03	
			<i>For Work In Restricted Working Space, Add</i>	4.38	
23 31 13 13-0830	LF		4" x 8", 18 Gauge Galvanized Steel Duct	25.73	10.51
			<i>For Flat Oval, Add</i>	1.23	
			<i>For Work In Restricted Working Space, Add</i>	5.26	
23 31 13 13-0831	LF		4" x 10", 18 Gauge Galvanized Steel Duct	30.01	12.27
			<i>For Flat Oval, Add</i>	1.43	
			<i>For Work In Restricted Working Space, Add</i>	6.14	
23 31 13 13-0832	LF		4" x 12", 18 Gauge Galvanized Steel Duct	34.32	14.02
			<i>For Flat Oval, Add</i>	1.64	
			<i>For Work In Restricted Working Space, Add</i>	7.01	
23 31 13 13-0833	LF		4" x 14", 18 Gauge Galvanized Steel Duct	38.61	15.78
			<i>For Flat Oval, Add</i>	1.85	
			<i>For Work In Restricted Working Space, Add</i>	7.89	
23 31 13 13-0834	LF		4" x 16", 18 Gauge Galvanized Steel Duct	42.88	17.53
			<i>For Flat Oval, Add</i>	2.05	
			<i>For Work In Restricted Working Space, Add</i>	8.76	
23 31 13 13-0835	LF		6" x 6", 18 Gauge Galvanized Steel Duct	25.73	10.51
			<i>For Flat Oval, Add</i>	1.23	
			<i>For Work In Restricted Working Space, Add</i>	5.26	
23 31 13 13-0836	LF		6" x 8", 18 Gauge Galvanized Steel Duct	30.01	12.27
			<i>For Flat Oval, Add</i>	1.43	
			<i>For Work In Restricted Working Space, Add</i>	6.14	
23 31 13 13-0837	LF		6" x 10", 18 Gauge Galvanized Steel Duct	34.32	14.02
			<i>For Flat Oval, Add</i>	1.64	
			<i>For Work In Restricted Working Space, Add</i>	7.01	
23 31 13 13-0838	LF		6" x 12", 18 Gauge Galvanized Steel Duct	38.61	15.78
			<i>For Flat Oval, Add</i>	1.85	
			<i>For Work In Restricted Working Space, Add</i>	7.89	
23 31 13 13-0839	LF		6" x 14", 18 Gauge Galvanized Steel Duct	42.88	17.53
			<i>For Flat Oval, Add</i>	2.05	
			<i>For Work In Restricted Working Space, Add</i>	8.76	
23 31 13 13-0840	LF		6" x 16", 18 Gauge Galvanized Steel Duct	47.17	19.28
			<i>For Flat Oval, Add</i>	2.25	
			<i>For Work In Restricted Working Space, Add</i>	9.64	
23 31 13 13-0841	LF		8" x 8", 18 Gauge Galvanized Steel Duct	34.32	14.02
			<i>For Flat Oval, Add</i>	1.64	
			<i>For Work In Restricted Working Space, Add</i>	7.01	
23 31 13 13-0842	LF		8" x 10", 18 Gauge Galvanized Steel Duct	38.61	15.78
			<i>For Flat Oval, Add</i>	1.85	
			<i>For Work In Restricted Working Space, Add</i>	7.89	
23 31 13 13-0843	LF		8" x 12", 18 Gauge Galvanized Steel Duct	42.88	17.53
			<i>For Flat Oval, Add</i>	2.05	
			<i>For Work In Restricted Working Space, Add</i>	8.76	
23 31 13 13-0844	LF		8" x 14", 18 Gauge Galvanized Steel Duct	47.17	19.28
			<i>For Flat Oval, Add</i>	2.25	
			<i>For Work In Restricted Working Space, Add</i>	9.64	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31 13 13-0845 LF 8" x 16", 18 Gauge Galvanized Steel Duct	51.46	21.04
<i>For Flat Oval, Add</i>	2.46	
<i>For Work In Restricted Working Space, Add</i>	10.52	
23 31 13 13-0846 LF 8" x 18", 18 Gauge Galvanized Steel Duct	55.76	22.79
<i>For Flat Oval, Add</i>	2.67	
<i>For Work In Restricted Working Space, Add</i>	11.39	
23 31 13 13-0847 LF 8" x 20", 18 Gauge Galvanized Steel Duct	60.05	24.55
<i>For Flat Oval, Add</i>	2.87	
<i>For Work In Restricted Working Space, Add</i>	12.27	
23 31 13 13-0848 LF 8" x 22", 18 Gauge Galvanized Steel Duct	64.34	26.30
<i>For Flat Oval, Add</i>	3.08	
<i>For Work In Restricted Working Space, Add</i>	13.15	
23 31 13 13-0849 LF 8" x 24", 18 Gauge Galvanized Steel Duct	68.63	28.06
<i>For Flat Oval, Add</i>	3.28	
<i>For Work In Restricted Working Space, Add</i>	14.03	
23 31 13 13-0850 LF 10" x 10", 18 Gauge Galvanized Steel Duct	42.88	17.53
<i>For Flat Oval, Add</i>	2.05	
<i>For Work In Restricted Working Space, Add</i>	8.76	
23 31 13 13-0851 LF 10" x 12", 18 Gauge Galvanized Steel Duct	47.17	19.28
<i>For Flat Oval, Add</i>	2.25	
<i>For Work In Restricted Working Space, Add</i>	9.64	
23 31 13 13-0852 LF 10" x 14", 18 Gauge Galvanized Steel Duct	51.46	21.04
<i>For Flat Oval, Add</i>	2.46	
<i>For Work In Restricted Working Space, Add</i>	10.52	
23 31 13 13-0853 LF 10" x 16", 18 Gauge Galvanized Steel Duct	55.76	22.79
<i>For Flat Oval, Add</i>	2.67	
<i>For Work In Restricted Working Space, Add</i>	11.39	
23 31 13 13-0854 LF 10" x 18", 18 Gauge Galvanized Steel Duct	60.05	24.55
<i>For Flat Oval, Add</i>	2.87	
<i>For Work In Restricted Working Space, Add</i>	12.27	
23 31 13 13-0855 LF 10" x 20", 18 Gauge Galvanized Steel Duct	64.34	26.30
<i>For Flat Oval, Add</i>	3.08	
<i>For Work In Restricted Working Space, Add</i>	13.15	
23 31 13 13-0856 LF 10" x 22", 18 Gauge Galvanized Steel Duct	68.63	28.06
<i>For Flat Oval, Add</i>	3.28	
<i>For Work In Restricted Working Space, Add</i>	14.03	
23 31 13 13-0857 LF 10" x 24", 18 Gauge Galvanized Steel Duct	72.90	29.80
<i>For Flat Oval, Add</i>	3.48	
<i>For Work In Restricted Working Space, Add</i>	14.90	
23 31 13 13-0858 LF 10" x 26", 18 Gauge Galvanized Steel Duct	77.21	31.55
<i>For Flat Oval, Add</i>	3.69	
<i>For Work In Restricted Working Space, Add</i>	15.78	
23 31 13 13-0859 LF 10" x 28", 18 Gauge Galvanized Steel Duct	81.50	33.31
<i>For Flat Oval, Add</i>	3.90	
<i>For Work In Restricted Working Space, Add</i>	16.66	
23 31 13 13-0860 LF 10" x 30", 18 Gauge Galvanized Steel Duct	85.78	35.06
<i>For Flat Oval, Add</i>	4.10	
<i>For Work In Restricted Working Space, Add</i>	17.53	
23 31 13 13-0861 LF 10" x 32", 18 Gauge Galvanized Steel Duct	90.06	36.82
<i>For Flat Oval, Add</i>	4.31	
<i>For Work In Restricted Working Space, Add</i>	18.41	
23 31 13 13-0862 LF 12" x 12", 18 Gauge Galvanized Steel Duct	51.46	21.04
<i>For Flat Oval, Add</i>	2.46	
<i>For Work In Restricted Working Space, Add</i>	10.52	
23 31 13 13-0863 LF 12" x 14", 18 Gauge Galvanized Steel Duct	55.76	22.79
<i>For Flat Oval, Add</i>	2.67	
<i>For Work In Restricted Working Space, Add</i>	11.39	
23 31 13 13-0864 LF 12" x 16", 18 Gauge Galvanized Steel Duct	60.05	24.55
<i>For Flat Oval, Add</i>	2.87	
<i>For Work In Restricted Working Space, Add</i>	12.27	
23 31 13 13-0865 LF 12" x 18", 18 Gauge Galvanized Steel Duct	64.34	26.30
<i>For Flat Oval, Add</i>	3.08	
<i>For Work In Restricted Working Space, Add</i>	13.15	
23 31 13 13-0866 LF 12" x 20", 18 Gauge Galvanized Steel Duct	68.63	28.06
<i>For Flat Oval, Add</i>	3.28	
<i>For Work In Restricted Working Space, Add</i>	14.03	
23 31 13 13-0867 LF 12" x 22", 18 Gauge Galvanized Steel Duct	72.90	29.80
<i>For Flat Oval, Add</i>	3.48	
<i>For Work In Restricted Working Space, Add</i>	14.90	
23 31 13 13-0868 LF 12" x 24", 18 Gauge Galvanized Steel Duct	77.21	31.55
<i>For Flat Oval, Add</i>	3.69	
<i>For Work In Restricted Working Space, Add</i>	15.78	
23 31 13 13-0869 LF 12" x 26", 18 Gauge Galvanized Steel Duct	81.50	33.31
<i>For Flat Oval, Add</i>	3.90	
<i>For Work In Restricted Working Space, Add</i>	16.66	
23 31 13 13-0870 LF 12" x 28", 18 Gauge Galvanized Steel Duct	85.78	35.06
<i>For Flat Oval, Add</i>	4.10	
<i>For Work In Restricted Working Space, Add</i>	17.53	
23 31 13 13-0871 LF 12" x 30", 18 Gauge Galvanized Steel Duct	90.06	36.82
<i>For Flat Oval, Add</i>	4.31	
<i>For Work In Restricted Working Space, Add</i>	18.41	
23 31 13 13-0872 LF 12" x 32", 18 Gauge Galvanized Steel Duct	94.36	38.57
<i>For Flat Oval, Add</i>	4.51	
<i>For Work In Restricted Working Space, Add</i>	19.29	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 31 HVAC Ducts And Casings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31 13	13-0873	LF	12" x 34", 18 Gauge Galvanized Steel Duct	98.65	40.32
			<i>For Flat Oval, Add</i>	4.72	
			<i>For Work In Restricted Working Space, Add</i>	20.16	
23 31 13	13-0874	LF	12" x 36", 18 Gauge Galvanized Steel Duct	102.93	42.08
			<i>For Flat Oval, Add</i>	4.92	
			<i>For Work In Restricted Working Space, Add</i>	21.04	
23 31 13	13-0875	LF	14" x 14", 18 Gauge Galvanized Steel Duct	60.05	24.55
			<i>For Flat Oval, Add</i>	2.87	
			<i>For Work In Restricted Working Space, Add</i>	12.27	
23 31 13	13-0876	LF	14" x 16", 18 Gauge Galvanized Steel Duct	64.34	26.30
			<i>For Flat Oval, Add</i>	3.08	
			<i>For Work In Restricted Working Space, Add</i>	13.15	
23 31 13	13-0877	LF	14" x 18", 18 Gauge Galvanized Steel Duct	68.63	28.06
			<i>For Flat Oval, Add</i>	3.28	
			<i>For Work In Restricted Working Space, Add</i>	14.03	
23 31 13	13-0878	LF	14" x 20", 18 Gauge Galvanized Steel Duct	72.90	29.80
			<i>For Flat Oval, Add</i>	3.48	
			<i>For Work In Restricted Working Space, Add</i>	14.90	
23 31 13	13-0879	LF	14" x 22", 18 Gauge Galvanized Steel Duct	77.21	31.55
			<i>For Flat Oval, Add</i>	3.69	
			<i>For Work In Restricted Working Space, Add</i>	15.78	
23 31 13	13-0880	LF	14" x 24", 18 Gauge Galvanized Steel Duct	81.50	33.31
			<i>For Flat Oval, Add</i>	3.90	
			<i>For Work In Restricted Working Space, Add</i>	16.66	
23 31 13	13-0881	LF	14" x 26", 18 Gauge Galvanized Steel Duct	85.78	35.06
			<i>For Flat Oval, Add</i>	4.10	
			<i>For Work In Restricted Working Space, Add</i>	17.53	
23 31 13	13-0882	LF	14" x 28", 18 Gauge Galvanized Steel Duct	90.06	36.82
			<i>For Flat Oval, Add</i>	4.31	
			<i>For Work In Restricted Working Space, Add</i>	18.41	
23 31 13	13-0883	LF	14" x 30", 18 Gauge Galvanized Steel Duct	94.36	38.57
			<i>For Flat Oval, Add</i>	4.51	
			<i>For Work In Restricted Working Space, Add</i>	19.29	
23 31 13	13-0884	LF	14" x 32", 18 Gauge Galvanized Steel Duct	98.65	40.32
			<i>For Flat Oval, Add</i>	4.72	
			<i>For Work In Restricted Working Space, Add</i>	20.16	
23 31 13	13-0885	LF	14" x 34", 18 Gauge Galvanized Steel Duct	102.93	42.08
			<i>For Flat Oval, Add</i>	4.92	
			<i>For Work In Restricted Working Space, Add</i>	21.04	
23 31 13	13-0886	LF	14" x 36", 18 Gauge Galvanized Steel Duct	107.23	43.83
			<i>For Flat Oval, Add</i>	5.13	
			<i>For Work In Restricted Working Space, Add</i>	21.92	
23 31 13	13-0887	LF	16" x 16", 18 Gauge Galvanized Steel Duct	68.63	28.06
			<i>For Flat Oval, Add</i>	3.28	
			<i>For Work In Restricted Working Space, Add</i>	14.03	
23 31 13	13-0888	LF	16" x 18", 18 Gauge Galvanized Steel Duct	72.90	29.80
			<i>For Flat Oval, Add</i>	3.48	
			<i>For Work In Restricted Working Space, Add</i>	14.90	
23 31 13	13-0889	LF	16" x 20", 18 Gauge Galvanized Steel Duct	77.21	31.55
			<i>For Flat Oval, Add</i>	3.69	
			<i>For Work In Restricted Working Space, Add</i>	15.78	
23 31 13	13-0890	LF	16" x 22", 18 Gauge Galvanized Steel Duct	81.50	33.31
			<i>For Flat Oval, Add</i>	3.90	
			<i>For Work In Restricted Working Space, Add</i>	16.66	
23 31 13	13-0891	LF	16" x 24", 18 Gauge Galvanized Steel Duct	85.78	35.06
			<i>For Flat Oval, Add</i>	4.10	
			<i>For Work In Restricted Working Space, Add</i>	17.53	
23 31 13	13-0892	LF	16" x 26", 18 Gauge Galvanized Steel Duct	90.06	36.82
			<i>For Flat Oval, Add</i>	4.31	
			<i>For Work In Restricted Working Space, Add</i>	18.41	
23 31 13	13-0893	LF	16" x 28", 18 Gauge Galvanized Steel Duct	94.36	38.57
			<i>For Flat Oval, Add</i>	4.51	
			<i>For Work In Restricted Working Space, Add</i>	19.29	
23 31 13	13-0894	LF	16" x 30", 18 Gauge Galvanized Steel Duct	98.65	40.32
			<i>For Flat Oval, Add</i>	4.72	
			<i>For Work In Restricted Working Space, Add</i>	20.16	
23 31 13	13-0895	LF	16" x 32", 18 Gauge Galvanized Steel Duct	102.93	42.08
			<i>For Flat Oval, Add</i>	4.92	
			<i>For Work In Restricted Working Space, Add</i>	21.04	
23 31 13	13-0896	LF	16" x 34", 18 Gauge Galvanized Steel Duct	107.23	43.83
			<i>For Flat Oval, Add</i>	5.13	
			<i>For Work In Restricted Working Space, Add</i>	21.92	
23 31 13	13-0897	LF	16" x 36", 18 Gauge Galvanized Steel Duct	111.51	45.59
			<i>For Flat Oval, Add</i>	5.33	
			<i>For Work In Restricted Working Space, Add</i>	22.79	
23 31 13	13-0898	LF	16" x 38", 18 Gauge Galvanized Steel Duct	115.79	47.34
			<i>For Flat Oval, Add</i>	5.54	
			<i>For Work In Restricted Working Space, Add</i>	23.67	
23 31 13	13-0899	LF	16" x 40", 18 Gauge Galvanized Steel Duct	120.11	49.08
			<i>For Flat Oval, Add</i>	5.74	
			<i>For Work In Restricted Working Space, Add</i>	24.55	
23 31 13	13-0900	LF	16" x 42", 18 Gauge Galvanized Steel Duct	124.39	50.84
			<i>For Flat Oval, Add</i>	5.95	
			<i>For Work In Restricted Working Space, Add</i>	25.42	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31 13 13-0901 LF 16" x 44", 18 Gauge Galvanized Steel Duct	128.66	52.59
For Flat Oval, Add	6.15	
For Work In Restricted Working Space, Add	26.30	
23 31 13 13-0902 LF 18" x 18", 18 Gauge Galvanized Steel Duct	77.21	31.55
For Flat Oval, Add	3.69	
For Work In Restricted Working Space, Add	15.78	
23 31 13 13-0903 LF 18" x 20", 18 Gauge Galvanized Steel Duct	81.50	33.31
For Flat Oval, Add	3.90	
For Work In Restricted Working Space, Add	16.66	
23 31 13 13-0904 LF 18" x 22", 18 Gauge Galvanized Steel Duct	85.78	35.06
For Flat Oval, Add	4.10	
For Work In Restricted Working Space, Add	17.53	
23 31 13 13-0905 LF 18" x 24", 18 Gauge Galvanized Steel Duct	90.06	36.82
For Flat Oval, Add	4.31	
For Work In Restricted Working Space, Add	18.41	
23 31 13 13-0906 LF 18" x 26", 18 Gauge Galvanized Steel Duct	94.36	38.57
For Flat Oval, Add	4.51	
For Work In Restricted Working Space, Add	19.29	
23 31 13 13-0907 LF 18" x 28", 18 Gauge Galvanized Steel Duct	98.65	40.32
For Flat Oval, Add	4.72	
For Work In Restricted Working Space, Add	20.16	
23 31 13 13-0908 LF 18" x 30", 18 Gauge Galvanized Steel Duct	102.93	42.08
For Flat Oval, Add	4.92	
For Work In Restricted Working Space, Add	21.04	
23 31 13 13-0909 LF 18" x 32", 18 Gauge Galvanized Steel Duct	107.23	43.83
For Flat Oval, Add	5.13	
For Work In Restricted Working Space, Add	21.92	
23 31 13 13-0910 LF 18" x 34", 18 Gauge Galvanized Steel Duct	111.51	45.59
For Flat Oval, Add	5.33	
For Work In Restricted Working Space, Add	22.79	
23 31 13 13-0911 LF 18" x 36", 18 Gauge Galvanized Steel Duct	115.79	47.34
For Flat Oval, Add	5.54	
For Work In Restricted Working Space, Add	23.67	
23 31 13 13-0912 LF 18" x 38", 18 Gauge Galvanized Steel Duct	120.11	49.08
For Flat Oval, Add	5.74	
For Work In Restricted Working Space, Add	24.55	
23 31 13 13-0913 LF 18" x 40", 18 Gauge Galvanized Steel Duct	124.39	50.84
For Flat Oval, Add	5.95	
For Work In Restricted Working Space, Add	25.42	
23 31 13 13-0914 LF 18" x 42", 18 Gauge Galvanized Steel Duct	128.66	52.59
For Flat Oval, Add	6.15	
For Work In Restricted Working Space, Add	26.30	
23 31 13 13-0915 LF 18" x 44", 18 Gauge Galvanized Steel Duct	132.95	54.35
For Flat Oval, Add	6.36	
For Work In Restricted Working Space, Add	27.17	
23 31 13 13-0916 LF 18" x 46", 18 Gauge Galvanized Steel Duct	137.26	56.10
For Flat Oval, Add	6.56	
For Work In Restricted Working Space, Add	28.05	
23 31 13 13-0917 LF 20" x 20", 18 Gauge Galvanized Steel Duct	85.78	35.06
For Flat Oval, Add	4.10	
For Work In Restricted Working Space, Add	17.53	
23 31 13 13-0918 LF 20" x 22", 18 Gauge Galvanized Steel Duct	90.06	36.82
For Flat Oval, Add	4.31	
For Work In Restricted Working Space, Add	18.41	
23 31 13 13-0919 LF 20" x 24", 18 Gauge Galvanized Steel Duct	94.36	38.57
For Flat Oval, Add	4.51	
For Work In Restricted Working Space, Add	19.29	
23 31 13 13-0920 LF 20" x 26", 18 Gauge Galvanized Steel Duct	98.65	40.32
For Flat Oval, Add	4.72	
For Work In Restricted Working Space, Add	20.16	
23 31 13 13-0921 LF 20" x 28", 18 Gauge Galvanized Steel Duct	102.93	42.08
For Flat Oval, Add	4.92	
For Work In Restricted Working Space, Add	21.04	
23 31 13 13-0922 LF 20" x 30", 18 Gauge Galvanized Steel Duct	107.23	43.83
For Flat Oval, Add	5.13	
For Work In Restricted Working Space, Add	21.92	
23 31 13 13-0923 LF 20" x 32", 18 Gauge Galvanized Steel Duct	111.51	45.59
For Flat Oval, Add	5.33	
For Work In Restricted Working Space, Add	22.79	
23 31 13 13-0924 LF 20" x 34", 18 Gauge Galvanized Steel Duct	115.79	47.34
For Flat Oval, Add	5.54	
For Work In Restricted Working Space, Add	23.67	
23 31 13 13-0925 LF 20" x 36", 18 Gauge Galvanized Steel Duct	120.11	49.08
For Flat Oval, Add	5.74	
For Work In Restricted Working Space, Add	24.55	
23 31 13 13-0926 LF 20" x 38", 18 Gauge Galvanized Steel Duct	124.39	50.84
For Flat Oval, Add	5.95	
For Work In Restricted Working Space, Add	25.42	
23 31 13 13-0927 LF 20" x 40", 18 Gauge Galvanized Steel Duct	128.66	52.59
For Flat Oval, Add	6.15	
For Work In Restricted Working Space, Add	26.30	
23 31 13 13-0928 LF 20" x 42", 18 Gauge Galvanized Steel Duct	132.95	54.35
For Flat Oval, Add	6.36	
For Work In Restricted Working Space, Add	27.17	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 31 HVAC Ducts And Casings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31 13	13-0929	LF	20" x 44", 18 Gauge Galvanized Steel Duct	137.26	56.10
			<i>For Flat Oval, Add</i>	6.56	
			<i>For Work In Restricted Working Space, Add</i>	28.05	
23 31 13	13-0930	LF	20" x 46", 18 Gauge Galvanized Steel Duct	141.54	57.85
			<i>For Flat Oval, Add</i>	6.77	
			<i>For Work In Restricted Working Space, Add</i>	28.93	
23 31 13	13-0931	LF	20" x 48", 18 Gauge Galvanized Steel Duct	145.83	59.61
			<i>For Flat Oval, Add</i>	6.97	
			<i>For Work In Restricted Working Space, Add</i>	29.81	
23 31 13	13-0932	LF	22" x 22", 18 Gauge Galvanized Steel Duct	94.36	38.57
			<i>For Flat Oval, Add</i>	4.51	
			<i>For Work In Restricted Working Space, Add</i>	19.29	
23 31 13	13-0933	LF	22" x 24", 18 Gauge Galvanized Steel Duct	98.65	40.32
			<i>For Flat Oval, Add</i>	4.72	
			<i>For Work In Restricted Working Space, Add</i>	20.16	
23 31 13	13-0934	LF	22" x 26", 18 Gauge Galvanized Steel Duct	102.93	42.08
			<i>For Flat Oval, Add</i>	4.92	
			<i>For Work In Restricted Working Space, Add</i>	21.04	
23 31 13	13-0935	LF	22" x 28", 18 Gauge Galvanized Steel Duct	107.23	43.83
			<i>For Flat Oval, Add</i>	5.13	
			<i>For Work In Restricted Working Space, Add</i>	21.92	
23 31 13	13-0936	LF	22" x 30", 18 Gauge Galvanized Steel Duct	111.51	45.59
			<i>For Flat Oval, Add</i>	5.33	
			<i>For Work In Restricted Working Space, Add</i>	22.79	
23 31 13	13-0937	LF	22" x 32", 18 Gauge Galvanized Steel Duct	115.79	47.34
			<i>For Flat Oval, Add</i>	5.54	
			<i>For Work In Restricted Working Space, Add</i>	23.67	
23 31 13	13-0938	LF	22" x 34", 18 Gauge Galvanized Steel Duct	120.11	49.08
			<i>For Flat Oval, Add</i>	5.74	
			<i>For Work In Restricted Working Space, Add</i>	24.55	
23 31 13	13-0939	LF	22" x 36", 18 Gauge Galvanized Steel Duct	124.39	50.84
			<i>For Flat Oval, Add</i>	5.95	
			<i>For Work In Restricted Working Space, Add</i>	25.42	
23 31 13	13-0940	LF	22" x 38", 18 Gauge Galvanized Steel Duct	128.66	52.59
			<i>For Flat Oval, Add</i>	6.15	
			<i>For Work In Restricted Working Space, Add</i>	26.30	
23 31 13	13-0941	LF	22" x 40", 18 Gauge Galvanized Steel Duct	132.95	54.35
			<i>For Flat Oval, Add</i>	6.36	
			<i>For Work In Restricted Working Space, Add</i>	27.17	
23 31 13	13-0942	LF	22" x 42", 18 Gauge Galvanized Steel Duct	137.26	56.10
			<i>For Flat Oval, Add</i>	6.56	
			<i>For Work In Restricted Working Space, Add</i>	28.05	
23 31 13	13-0943	LF	22" x 44", 18 Gauge Galvanized Steel Duct	141.54	57.85
			<i>For Flat Oval, Add</i>	6.77	
			<i>For Work In Restricted Working Space, Add</i>	28.93	
23 31 13	13-0944	LF	22" x 46", 18 Gauge Galvanized Steel Duct	145.83	59.61
			<i>For Flat Oval, Add</i>	6.97	
			<i>For Work In Restricted Working Space, Add</i>	29.81	
23 31 13	13-0945	LF	22" x 48", 18 Gauge Galvanized Steel Duct	150.12	61.36
			<i>For Flat Oval, Add</i>	7.18	
			<i>For Work In Restricted Working Space, Add</i>	30.68	
23 31 13	13-0946	LF	24" x 24", 18 Gauge Galvanized Steel Duct	102.93	42.08
			<i>For Flat Oval, Add</i>	4.92	
			<i>For Work In Restricted Working Space, Add</i>	21.04	
23 31 13	13-0947	LF	24" x 26", 18 Gauge Galvanized Steel Duct	107.23	43.83
			<i>For Flat Oval, Add</i>	5.13	
			<i>For Work In Restricted Working Space, Add</i>	21.92	
23 31 13	13-0948	LF	24" x 28", 18 Gauge Galvanized Steel Duct	111.51	45.59
			<i>For Flat Oval, Add</i>	5.33	
			<i>For Work In Restricted Working Space, Add</i>	22.79	
23 31 13	13-0949	LF	24" x 30", 18 Gauge Galvanized Steel Duct	115.79	47.34
			<i>For Flat Oval, Add</i>	5.54	
			<i>For Work In Restricted Working Space, Add</i>	23.67	
23 31 13	13-0950	LF	24" x 32", 18 Gauge Galvanized Steel Duct	120.11	49.08
			<i>For Flat Oval, Add</i>	5.74	
			<i>For Work In Restricted Working Space, Add</i>	24.55	
23 31 13	13-0951	LF	24" x 34", 18 Gauge Galvanized Steel Duct	124.39	50.84
			<i>For Flat Oval, Add</i>	5.95	
			<i>For Work In Restricted Working Space, Add</i>	25.42	
23 31 13	13-0952	LF	24" x 36", 18 Gauge Galvanized Steel Duct	128.66	52.59
			<i>For Flat Oval, Add</i>	6.15	
			<i>For Work In Restricted Working Space, Add</i>	26.30	
23 31 13	13-0953	LF	24" x 38", 18 Gauge Galvanized Steel Duct	132.95	54.35
			<i>For Flat Oval, Add</i>	6.36	
			<i>For Work In Restricted Working Space, Add</i>	27.17	
23 31 13	13-0954	LF	24" x 40", 18 Gauge Galvanized Steel Duct	137.26	56.10
			<i>For Flat Oval, Add</i>	6.56	
			<i>For Work In Restricted Working Space, Add</i>	28.05	
23 31 13	13-0955	LF	24" x 42", 18 Gauge Galvanized Steel Duct	141.54	57.85
			<i>For Flat Oval, Add</i>	6.77	
			<i>For Work In Restricted Working Space, Add</i>	28.93	
23 31 13	13-0956	LF	24" x 44", 18 Gauge Galvanized Steel Duct	145.83	59.61
			<i>For Flat Oval, Add</i>	6.97	
			<i>For Work In Restricted Working Space, Add</i>	29.81	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31 13 13-0957 LF 24" x 46", 18 Gauge Galvanized Steel Duct	150.12	61.36
For Flat Oval, Add	7.18	
For Work In Restricted Working Space, Add	30.68	
23 31 13 13-0958 LF 24" x 48", 18 Gauge Galvanized Steel Duct	154.40	63.12
For Flat Oval, Add	7.38	
For Work In Restricted Working Space, Add	31.56	
23 31 13 13-0959 LF 26" x 26", 18 Gauge Galvanized Steel Duct	111.51	45.59
For Flat Oval, Add	5.33	
For Work In Restricted Working Space, Add	22.79	
23 31 13 13-0960 LF 26" x 28", 18 Gauge Galvanized Steel Duct	115.79	47.34
For Flat Oval, Add	5.54	
For Work In Restricted Working Space, Add	23.67	
23 31 13 13-0961 LF 26" x 30", 18 Gauge Galvanized Steel Duct	120.11	49.08
For Flat Oval, Add	5.74	
For Work In Restricted Working Space, Add	24.55	
23 31 13 13-0962 LF 26" x 32", 18 Gauge Galvanized Steel Duct	124.39	50.84
For Flat Oval, Add	5.95	
For Work In Restricted Working Space, Add	25.42	
23 31 13 13-0963 LF 26" x 34", 18 Gauge Galvanized Steel Duct	128.66	52.59
For Flat Oval, Add	6.15	
For Work In Restricted Working Space, Add	26.30	
23 31 13 13-0964 LF 26" x 36", 18 Gauge Galvanized Steel Duct	132.95	54.35
For Flat Oval, Add	6.36	
For Work In Restricted Working Space, Add	27.17	
23 31 13 13-0965 LF 26" x 38", 18 Gauge Galvanized Steel Duct	137.26	56.10
For Flat Oval, Add	6.56	
For Work In Restricted Working Space, Add	28.05	
23 31 13 13-0966 LF 26" x 40", 18 Gauge Galvanized Steel Duct	141.54	57.85
For Flat Oval, Add	6.77	
For Work In Restricted Working Space, Add	28.93	
23 31 13 13-0967 LF 26" x 42", 18 Gauge Galvanized Steel Duct	145.83	59.61
For Flat Oval, Add	6.97	
For Work In Restricted Working Space, Add	29.81	
23 31 13 13-0968 LF 26" x 44", 18 Gauge Galvanized Steel Duct	150.12	61.36
For Flat Oval, Add	7.18	
For Work In Restricted Working Space, Add	30.68	
23 31 13 13-0969 LF 26" x 46", 18 Gauge Galvanized Steel Duct	154.40	63.12
For Flat Oval, Add	7.38	
For Work In Restricted Working Space, Add	31.56	
23 31 13 13-0970 LF 26" x 48", 18 Gauge Galvanized Steel Duct	158.70	64.87
For Flat Oval, Add	7.59	
For Work In Restricted Working Space, Add	32.43	
23 31 13 13-0971 LF 28" x 28", 18 Gauge Galvanized Steel Duct	120.11	49.08
For Flat Oval, Add	5.74	
For Work In Restricted Working Space, Add	24.55	
23 31 13 13-0972 LF 28" x 30", 18 Gauge Galvanized Steel Duct	124.39	50.84
For Flat Oval, Add	5.95	
For Work In Restricted Working Space, Add	25.42	
23 31 13 13-0973 LF 28" x 32", 18 Gauge Galvanized Steel Duct	128.66	52.59
For Flat Oval, Add	6.15	
For Work In Restricted Working Space, Add	26.30	
23 31 13 13-0974 LF 28" x 34", 18 Gauge Galvanized Steel Duct	132.95	54.35
For Flat Oval, Add	6.36	
For Work In Restricted Working Space, Add	27.17	
23 31 13 13-0975 LF 28" x 36", 18 Gauge Galvanized Steel Duct	137.26	56.10
For Flat Oval, Add	6.56	
For Work In Restricted Working Space, Add	28.05	
23 31 13 13-0976 LF 28" x 38", 18 Gauge Galvanized Steel Duct	141.54	57.85
For Flat Oval, Add	6.77	
For Work In Restricted Working Space, Add	28.93	
23 31 13 13-0977 LF 28" x 40", 18 Gauge Galvanized Steel Duct	145.83	59.61
For Flat Oval, Add	6.97	
For Work In Restricted Working Space, Add	29.81	
23 31 13 13-0978 LF 28" x 42", 18 Gauge Galvanized Steel Duct	150.12	61.36
For Flat Oval, Add	7.18	
For Work In Restricted Working Space, Add	30.68	
23 31 13 13-0979 LF 28" x 44", 18 Gauge Galvanized Steel Duct	154.40	63.12
For Flat Oval, Add	7.38	
For Work In Restricted Working Space, Add	31.56	
23 31 13 13-0980 LF 28" x 46", 18 Gauge Galvanized Steel Duct	158.70	64.87
For Flat Oval, Add	7.59	
For Work In Restricted Working Space, Add	32.43	
23 31 13 13-0981 LF 28" x 48", 18 Gauge Galvanized Steel Duct	162.99	66.62
For Flat Oval, Add	7.79	
For Work In Restricted Working Space, Add	33.31	
23 31 13 13-0982 LF 30" x 30", 18 Gauge Galvanized Steel Duct	128.66	52.59
For Flat Oval, Add	6.15	
For Work In Restricted Working Space, Add	26.30	
23 31 13 13-0983 LF 30" x 32", 18 Gauge Galvanized Steel Duct	132.95	54.35
For Flat Oval, Add	6.36	
For Work In Restricted Working Space, Add	27.17	
23 31 13 13-0984 LF 30" x 34", 18 Gauge Galvanized Steel Duct	137.26	56.10
For Flat Oval, Add	6.56	
For Work In Restricted Working Space, Add	28.05	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 31 HVAC Ducts And Casings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31 13 13-0985	LF		30" x 36", 18 Gauge Galvanized Steel Duct	141.54	57.85
			<i>For Flat Oval, Add</i>	6.77	
			<i>For Work In Restricted Working Space, Add</i>	28.93	
23 31 13 13-0986	LF		30" x 38", 18 Gauge Galvanized Steel Duct	145.83	59.61
			<i>For Flat Oval, Add</i>	6.97	
			<i>For Work In Restricted Working Space, Add</i>	29.81	
23 31 13 13-0987	LF		30" x 40", 18 Gauge Galvanized Steel Duct	150.12	61.36
			<i>For Flat Oval, Add</i>	7.18	
			<i>For Work In Restricted Working Space, Add</i>	30.68	
23 31 13 13-0988	LF		30" x 42", 18 Gauge Galvanized Steel Duct	154.40	63.12
			<i>For Flat Oval, Add</i>	7.38	
			<i>For Work In Restricted Working Space, Add</i>	31.56	
23 31 13 13-0989	LF		30" x 44", 18 Gauge Galvanized Steel Duct	158.70	64.87
			<i>For Flat Oval, Add</i>	7.59	
			<i>For Work In Restricted Working Space, Add</i>	32.43	
23 31 13 13-0990	LF		30" x 46", 18 Gauge Galvanized Steel Duct	162.99	66.62
			<i>For Flat Oval, Add</i>	7.79	
			<i>For Work In Restricted Working Space, Add</i>	33.31	
23 31 13 13-0991	LF		30" x 48", 18 Gauge Galvanized Steel Duct	167.27	68.37
			<i>For Flat Oval, Add</i>	8.00	
			<i>For Work In Restricted Working Space, Add</i>	34.19	
23 31 13 13-0992	LF		32" x 32", 18 Gauge Galvanized Steel Duct	137.26	56.10
			<i>For Flat Oval, Add</i>	6.56	
			<i>For Work In Restricted Working Space, Add</i>	28.05	
23 31 13 13-0993	LF		32" x 34", 18 Gauge Galvanized Steel Duct	141.54	57.85
			<i>For Flat Oval, Add</i>	6.77	
			<i>For Work In Restricted Working Space, Add</i>	28.93	
23 31 13 13-0994	LF		32" x 36", 18 Gauge Galvanized Steel Duct	145.83	59.61
			<i>For Flat Oval, Add</i>	6.97	
			<i>For Work In Restricted Working Space, Add</i>	29.81	
23 31 13 13-0995	LF		32" x 38", 18 Gauge Galvanized Steel Duct	150.12	61.36
			<i>For Flat Oval, Add</i>	7.18	
			<i>For Work In Restricted Working Space, Add</i>	30.68	
23 31 13 13-0996	LF		32" x 40", 18 Gauge Galvanized Steel Duct	154.40	63.12
			<i>For Flat Oval, Add</i>	7.38	
			<i>For Work In Restricted Working Space, Add</i>	31.56	
23 31 13 13-0997	LF		32" x 42", 18 Gauge Galvanized Steel Duct	158.70	64.87
			<i>For Flat Oval, Add</i>	7.59	
			<i>For Work In Restricted Working Space, Add</i>	32.43	
23 31 13 13-0998	LF		32" x 44", 18 Gauge Galvanized Steel Duct	162.99	66.62
			<i>For Flat Oval, Add</i>	7.79	
			<i>For Work In Restricted Working Space, Add</i>	33.31	
23 31 13 13-0999	LF		32" x 46", 18 Gauge Galvanized Steel Duct	167.27	68.37
			<i>For Flat Oval, Add</i>	8.00	
			<i>For Work In Restricted Working Space, Add</i>	34.19	
23 31 13 13-1000	LF		32" x 48", 18 Gauge Galvanized Steel Duct	171.56	70.12
			<i>For Flat Oval, Add</i>	8.20	
			<i>For Work In Restricted Working Space, Add</i>	35.06	
23 31 13 13-1001	LF		34" x 34", 18 Gauge Galvanized Steel Duct	145.83	59.61
			<i>For Flat Oval, Add</i>	6.97	
			<i>For Work In Restricted Working Space, Add</i>	29.81	
23 31 13 13-1002	LF		34" x 36", 18 Gauge Galvanized Steel Duct	150.12	61.36
			<i>For Flat Oval, Add</i>	7.18	
			<i>For Work In Restricted Working Space, Add</i>	30.68	
23 31 13 13-1003	LF		34" x 38", 18 Gauge Galvanized Steel Duct	154.40	63.12
			<i>For Flat Oval, Add</i>	7.38	
			<i>For Work In Restricted Working Space, Add</i>	31.56	
23 31 13 13-1004	LF		34" x 40", 18 Gauge Galvanized Steel Duct	158.70	64.87
			<i>For Flat Oval, Add</i>	7.59	
			<i>For Work In Restricted Working Space, Add</i>	32.43	
23 31 13 13-1005	LF		34" x 42", 18 Gauge Galvanized Steel Duct	162.99	66.62
			<i>For Flat Oval, Add</i>	7.79	
			<i>For Work In Restricted Working Space, Add</i>	33.31	
23 31 13 13-1006	LF		34" x 44", 18 Gauge Galvanized Steel Duct	167.27	68.37
			<i>For Flat Oval, Add</i>	8.00	
			<i>For Work In Restricted Working Space, Add</i>	34.19	
23 31 13 13-1007	LF		34" x 46", 18 Gauge Galvanized Steel Duct	171.56	70.12
			<i>For Flat Oval, Add</i>	8.20	
			<i>For Work In Restricted Working Space, Add</i>	35.06	
23 31 13 13-1008	LF		34" x 48", 18 Gauge Galvanized Steel Duct	175.84	71.88
			<i>For Flat Oval, Add</i>	8.41	
			<i>For Work In Restricted Working Space, Add</i>	35.94	
23 31 13 13-1009	LF		36" x 36", 18 Gauge Galvanized Steel Duct	154.40	63.12
			<i>For Flat Oval, Add</i>	7.38	
			<i>For Work In Restricted Working Space, Add</i>	31.56	
23 31 13 13-1010	LF		36" x 38", 18 Gauge Galvanized Steel Duct	158.70	64.87
			<i>For Flat Oval, Add</i>	7.59	
			<i>For Work In Restricted Working Space, Add</i>	32.43	
23 31 13 13-1011	LF		36" x 40", 18 Gauge Galvanized Steel Duct	162.99	66.62
			<i>For Flat Oval, Add</i>	7.79	
			<i>For Work In Restricted Working Space, Add</i>	33.31	
23 31 13 13-1012	LF		36" x 42", 18 Gauge Galvanized Steel Duct	167.27	68.37
			<i>For Flat Oval, Add</i>	8.00	
			<i>For Work In Restricted Working Space, Add</i>	34.19	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31 13 13-1013 LF 36" x 44", 18 Gauge Galvanized Steel Duct	171.56	70.12
For Flat Oval, Add	8.20	
For Work In Restricted Working Space, Add	35.06	
23 31 13 13-1014 LF 36" x 46", 18 Gauge Galvanized Steel Duct	175.84	71.88
For Flat Oval, Add	8.41	
For Work In Restricted Working Space, Add	35.94	
23 31 13 13-1015 LF 36" x 48", 18 Gauge Galvanized Steel Duct	180.16	73.63
For Flat Oval, Add	8.61	
For Work In Restricted Working Space, Add	36.82	
23 31 13 13-1016 LF 38" x 38", 18 Gauge Galvanized Steel Duct	162.99	66.62
For Flat Oval, Add	7.79	
For Work In Restricted Working Space, Add	33.31	
23 31 13 13-1017 LF 38" x 40", 18 Gauge Galvanized Steel Duct	167.27	68.37
For Flat Oval, Add	8.00	
For Work In Restricted Working Space, Add	34.19	
23 31 13 13-1018 LF 38" x 42", 18 Gauge Galvanized Steel Duct	171.56	70.12
For Flat Oval, Add	8.20	
For Work In Restricted Working Space, Add	35.06	
23 31 13 13-1019 LF 38" x 44", 18 Gauge Galvanized Steel Duct	175.84	71.88
For Flat Oval, Add	8.41	
For Work In Restricted Working Space, Add	35.94	
23 31 13 13-1020 LF 38" x 46", 18 Gauge Galvanized Steel Duct	180.16	73.63
For Flat Oval, Add	8.61	
For Work In Restricted Working Space, Add	36.82	
23 31 13 13-1021 LF 38" x 48", 18 Gauge Galvanized Steel Duct	184.43	75.39
For Flat Oval, Add	8.82	
For Work In Restricted Working Space, Add	37.69	
23 31 13 13-1022 LF 38" x 50", 18 Gauge Galvanized Steel Duct	188.71	77.14
For Flat Oval, Add	9.02	
For Work In Restricted Working Space, Add	38.57	
23 31 13 13-1023 LF 40" x 40", 18 Gauge Galvanized Steel Duct	171.56	70.12
For Flat Oval, Add	8.20	
For Work In Restricted Working Space, Add	35.06	
23 31 13 13-1024 LF 40" x 42", 18 Gauge Galvanized Steel Duct	175.84	71.88
For Flat Oval, Add	8.41	
For Work In Restricted Working Space, Add	35.94	
23 31 13 13-1025 LF 40" x 44", 18 Gauge Galvanized Steel Duct	180.16	73.63
For Flat Oval, Add	8.61	
For Work In Restricted Working Space, Add	36.82	
23 31 13 13-1026 LF 40" x 46", 18 Gauge Galvanized Steel Duct	184.43	75.39
For Flat Oval, Add	8.82	
For Work In Restricted Working Space, Add	37.69	
23 31 13 13-1027 LF 40" x 48", 18 Gauge Galvanized Steel Duct	188.71	77.14
For Flat Oval, Add	9.02	
For Work In Restricted Working Space, Add	38.57	
23 31 13 13-1028 LF 40" x 50", 18 Gauge Galvanized Steel Duct	193.01	78.89
For Flat Oval, Add	9.23	
For Work In Restricted Working Space, Add	39.45	
23 31 13 13-1029 LF 40" x 52", 18 Gauge Galvanized Steel Duct	197.29	80.65
For Flat Oval, Add	9.43	
For Work In Restricted Working Space, Add	40.32	
23 31 13 13-1030 LF 40" x 54", 18 Gauge Galvanized Steel Duct	201.59	82.40
For Flat Oval, Add	9.64	
For Work In Restricted Working Space, Add	41.20	
23 31 13 13-1031 LF 40" x 56", 18 Gauge Galvanized Steel Duct	205.89	84.16
For Flat Oval, Add	9.84	
For Work In Restricted Working Space, Add	42.08	
23 31 13 13-1032 LF 42" x 42", 18 Gauge Galvanized Steel Duct	180.16	73.63
For Flat Oval, Add	8.61	
For Work In Restricted Working Space, Add	36.82	
23 31 13 13-1033 LF 42" x 44", 18 Gauge Galvanized Steel Duct	184.43	75.39
For Flat Oval, Add	8.82	
For Work In Restricted Working Space, Add	37.69	
23 31 13 13-1034 LF 42" x 46", 18 Gauge Galvanized Steel Duct	188.71	77.14
For Flat Oval, Add	9.02	
For Work In Restricted Working Space, Add	38.57	
23 31 13 13-1035 LF 42" x 48", 18 Gauge Galvanized Steel Duct	193.01	78.89
For Flat Oval, Add	9.23	
For Work In Restricted Working Space, Add	39.45	
23 31 13 13-1036 LF 42" x 50", 18 Gauge Galvanized Steel Duct	197.29	80.65
For Flat Oval, Add	9.43	
For Work In Restricted Working Space, Add	40.32	
23 31 13 13-1037 LF 42" x 52", 18 Gauge Galvanized Steel Duct	201.59	82.40
For Flat Oval, Add	9.64	
For Work In Restricted Working Space, Add	41.20	
23 31 13 13-1038 LF 42" x 54", 18 Gauge Galvanized Steel Duct	205.89	84.16
For Flat Oval, Add	9.84	
For Work In Restricted Working Space, Add	42.08	
23 31 13 13-1039 LF 42" x 56", 18 Gauge Galvanized Steel Duct	210.17	85.91
For Flat Oval, Add	10.05	
For Work In Restricted Working Space, Add	42.95	
23 31 13 13-1040 LF 44" x 44", 18 Gauge Galvanized Steel Duct	188.71	77.14
For Flat Oval, Add	9.02	
For Work In Restricted Working Space, Add	38.57	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 31 HVAC Ducts And Casings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31	13 13-1041	LF	44" x 46", 18 Gauge Galvanized Steel Duct	193.01	78.89
			<i>For Flat Oval, Add</i>	9.23	
			<i>For Work In Restricted Working Space, Add</i>	39.45	
23 31	13 13-1042	LF	44" x 48", 18 Gauge Galvanized Steel Duct	197.29	80.65
			<i>For Flat Oval, Add</i>	9.43	
			<i>For Work In Restricted Working Space, Add</i>	40.32	
23 31	13 13-1043	LF	44" x 50", 18 Gauge Galvanized Steel Duct	201.59	82.40
			<i>For Flat Oval, Add</i>	9.64	
			<i>For Work In Restricted Working Space, Add</i>	41.20	
23 31	13 13-1044	LF	44" x 52", 18 Gauge Galvanized Steel Duct	205.89	84.16
			<i>For Flat Oval, Add</i>	9.84	
			<i>For Work In Restricted Working Space, Add</i>	42.08	
23 31	13 13-1045	LF	44" x 54", 18 Gauge Galvanized Steel Duct	210.17	85.91
			<i>For Flat Oval, Add</i>	10.05	
			<i>For Work In Restricted Working Space, Add</i>	42.95	
23 31	13 13-1046	LF	44" x 56", 18 Gauge Galvanized Steel Duct	214.44	87.65
			<i>For Flat Oval, Add</i>	10.25	
			<i>For Work In Restricted Working Space, Add</i>	43.83	
23 31	13 13-1047	LF	46" x 46", 18 Gauge Galvanized Steel Duct	197.29	80.65
			<i>For Flat Oval, Add</i>	9.43	
			<i>For Work In Restricted Working Space, Add</i>	40.32	
23 31	13 13-1048	LF	46" x 48", 18 Gauge Galvanized Steel Duct	201.59	82.40
			<i>For Flat Oval, Add</i>	9.64	
			<i>For Work In Restricted Working Space, Add</i>	41.20	
23 31	13 13-1049	LF	46" x 50", 18 Gauge Galvanized Steel Duct	205.89	84.16
			<i>For Flat Oval, Add</i>	9.84	
			<i>For Work In Restricted Working Space, Add</i>	42.08	
23 31	13 13-1050	LF	46" x 52", 18 Gauge Galvanized Steel Duct	210.17	85.91
			<i>For Flat Oval, Add</i>	10.05	
			<i>For Work In Restricted Working Space, Add</i>	42.95	
23 31	13 13-1051	LF	46" x 54", 18 Gauge Galvanized Steel Duct	214.44	87.65
			<i>For Flat Oval, Add</i>	10.25	
			<i>For Work In Restricted Working Space, Add</i>	43.83	
23 31	13 13-1052	LF	46" x 56", 18 Gauge Galvanized Steel Duct	218.74	89.41
			<i>For Flat Oval, Add</i>	10.46	
			<i>For Work In Restricted Working Space, Add</i>	44.71	
23 31	13 13-1053	LF	46" x 58", 18 Gauge Galvanized Steel Duct	223.04	91.16
			<i>For Flat Oval, Add</i>	10.67	
			<i>For Work In Restricted Working Space, Add</i>	45.58	
23 31	13 13-1054	LF	48" x 48", 18 Gauge Galvanized Steel Duct	205.89	84.16
			<i>For Flat Oval, Add</i>	9.84	
			<i>For Work In Restricted Working Space, Add</i>	42.08	
23 31	13 13-1055	LF	48" x 50", 18 Gauge Galvanized Steel Duct	210.17	85.91
			<i>For Flat Oval, Add</i>	10.05	
			<i>For Work In Restricted Working Space, Add</i>	42.95	
23 31	13 13-1056	LF	48" x 52", 18 Gauge Galvanized Steel Duct	214.44	87.65
			<i>For Flat Oval, Add</i>	10.25	
			<i>For Work In Restricted Working Space, Add</i>	43.83	
23 31	13 13-1057	LF	48" x 54", 18 Gauge Galvanized Steel Duct	218.74	89.41
			<i>For Flat Oval, Add</i>	10.46	
			<i>For Work In Restricted Working Space, Add</i>	44.71	
23 31	13 13-1058	LF	48" x 56", 18 Gauge Galvanized Steel Duct	223.04	91.16
			<i>For Flat Oval, Add</i>	10.67	
			<i>For Work In Restricted Working Space, Add</i>	45.58	
23 31	13 13-1059	LF	48" x 58", 18 Gauge Galvanized Steel Duct	227.32	92.92
			<i>For Flat Oval, Add</i>	10.87	
			<i>For Work In Restricted Working Space, Add</i>	46.46	
23 31	13 13-1060	LF	48" x 60", 18 Gauge Galvanized Steel Duct	231.61	94.67
			<i>For Flat Oval, Add</i>	11.07	
			<i>For Work In Restricted Working Space, Add</i>	47.34	
23 31	13 13-1061	LF	50" x 50", 18 Gauge Galvanized Steel Duct	214.44	87.65
			<i>For Flat Oval, Add</i>	10.25	
			<i>For Work In Restricted Working Space, Add</i>	43.83	
23 31	13 13-1062	LF	50" x 52", 18 Gauge Galvanized Steel Duct	218.74	89.41
			<i>For Flat Oval, Add</i>	10.46	
			<i>For Work In Restricted Working Space, Add</i>	44.71	
23 31	13 13-1063	LF	50" x 54", 18 Gauge Galvanized Steel Duct	223.04	91.16
			<i>For Flat Oval, Add</i>	10.67	
			<i>For Work In Restricted Working Space, Add</i>	45.58	
23 31	13 13-1064	LF	50" x 56", 18 Gauge Galvanized Steel Duct	227.32	92.92
			<i>For Flat Oval, Add</i>	10.87	
			<i>For Work In Restricted Working Space, Add</i>	46.46	
23 31	13 13-1065	LF	50" x 58", 18 Gauge Galvanized Steel Duct	231.61	94.67
			<i>For Flat Oval, Add</i>	11.07	
			<i>For Work In Restricted Working Space, Add</i>	47.34	
23 31	13 13-1066	LF	50" x 60", 18 Gauge Galvanized Steel Duct	235.90	96.42
			<i>For Flat Oval, Add</i>	11.28	
			<i>For Work In Restricted Working Space, Add</i>	48.21	
23 31	13 13-1067	LF	52" x 52", 18 Gauge Galvanized Steel Duct	223.04	91.16
			<i>For Flat Oval, Add</i>	10.67	
			<i>For Work In Restricted Working Space, Add</i>	45.58	
23 31	13 13-1068	LF	52" x 54", 18 Gauge Galvanized Steel Duct	227.32	92.92
			<i>For Flat Oval, Add</i>	10.87	
			<i>For Work In Restricted Working Space, Add</i>	46.46	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31 13 13-1069 LF 52" x 56", 18 Gauge Galvanized Steel Duct	231.61	94.67
For Flat Oval, Add	11.07	
For Work In Restricted Working Space, Add	47.34	
23 31 13 13-1070 LF 52" x 58", 18 Gauge Galvanized Steel Duct	235.90	96.42
For Flat Oval, Add	11.28	
For Work In Restricted Working Space, Add	48.21	
23 31 13 13-1071 LF 52" x 60", 18 Gauge Galvanized Steel Duct	240.17	98.18
For Flat Oval, Add	11.48	
For Work In Restricted Working Space, Add	49.09	
23 31 13 13-1072 LF 54" x 54", 18 Gauge Galvanized Steel Duct	231.61	94.67
For Flat Oval, Add	11.07	
For Work In Restricted Working Space, Add	47.34	
23 31 13 13-1073 LF 54" x 56", 18 Gauge Galvanized Steel Duct	235.90	96.42
For Flat Oval, Add	11.28	
For Work In Restricted Working Space, Add	48.21	
23 31 13 13-1074 LF 54" x 58", 18 Gauge Galvanized Steel Duct	240.17	98.18
For Flat Oval, Add	11.48	
For Work In Restricted Working Space, Add	49.09	
23 31 13 13-1075 LF 54" x 60", 18 Gauge Galvanized Steel Duct	244.48	99.93
For Flat Oval, Add	11.69	
For Work In Restricted Working Space, Add	49.97	
23 31 13 13-1076 LF 54" x 62", 18 Gauge Galvanized Steel Duct	248.77	101.69
For Flat Oval, Add	11.90	
For Work In Restricted Working Space, Add	50.84	
23 31 13 13-1077 LF 54" x 64", 18 Gauge Galvanized Steel Duct	253.05	103.44
For Flat Oval, Add	12.10	
For Work In Restricted Working Space, Add	51.72	
23 31 13 13-1078 LF 56" x 56", 18 Gauge Galvanized Steel Duct	240.17	98.18
For Flat Oval, Add	11.48	
For Work In Restricted Working Space, Add	49.09	
23 31 13 13-1079 LF 56" x 58", 18 Gauge Galvanized Steel Duct	244.48	99.93
For Flat Oval, Add	11.69	
For Work In Restricted Working Space, Add	49.97	
23 31 13 13-1080 LF 56" x 60", 18 Gauge Galvanized Steel Duct	248.77	101.69
For Flat Oval, Add	11.90	
For Work In Restricted Working Space, Add	50.84	
23 31 13 13-1081 LF 56" x 62", 18 Gauge Galvanized Steel Duct	253.05	103.44
For Flat Oval, Add	12.10	
For Work In Restricted Working Space, Add	51.72	
23 31 13 13-1082 LF 56" x 64", 18 Gauge Galvanized Steel Duct	257.34	105.19
For Flat Oval, Add	12.30	
For Work In Restricted Working Space, Add	52.60	
23 31 13 13-1083 LF 58" x 58", 18 Gauge Galvanized Steel Duct	248.77	101.69
For Flat Oval, Add	11.90	
For Work In Restricted Working Space, Add	50.84	
23 31 13 13-1084 LF 58" x 60", 18 Gauge Galvanized Steel Duct	253.05	103.44
For Flat Oval, Add	12.10	
For Work In Restricted Working Space, Add	51.72	
23 31 13 13-1085 LF 58" x 62", 18 Gauge Galvanized Steel Duct	257.34	105.19
For Flat Oval, Add	12.30	
For Work In Restricted Working Space, Add	52.60	
23 31 13 13-1086 LF 58" x 64", 18 Gauge Galvanized Steel Duct	261.63	106.94
For Flat Oval, Add	12.51	
For Work In Restricted Working Space, Add	53.47	
23 31 13 13-1087 LF 58" x 66", 18 Gauge Galvanized Steel Duct	265.93	108.69
For Flat Oval, Add	12.72	
For Work In Restricted Working Space, Add	54.35	
23 31 13 13-1088 LF 60" x 60", 18 Gauge Galvanized Steel Duct	257.34	105.19
For Flat Oval, Add	12.30	
For Work In Restricted Working Space, Add	52.60	
23 31 13 13-1089 LF 60" x 62", 18 Gauge Galvanized Steel Duct	261.63	106.94
For Flat Oval, Add	12.51	
For Work In Restricted Working Space, Add	53.47	
23 31 13 13-1090 LF 60" x 64", 18 Gauge Galvanized Steel Duct	265.93	108.69
For Flat Oval, Add	12.72	
For Work In Restricted Working Space, Add	54.35	
23 31 13 13-1091 LF 60" x 66", 18 Gauge Galvanized Steel Duct	270.21	110.45
For Flat Oval, Add	12.92	
For Work In Restricted Working Space, Add	55.22	
23 31 13 13-1092 LF 60" x 68", 18 Gauge Galvanized Steel Duct	274.50	112.20
For Flat Oval, Add	13.13	
For Work In Restricted Working Space, Add	56.10	
23 31 13 13-1093 LF 62" x 62", 18 Gauge Galvanized Steel Duct	265.93	108.69
For Flat Oval, Add	12.72	
For Work In Restricted Working Space, Add	54.35	
23 31 13 13-1094 LF 62" x 64", 18 Gauge Galvanized Steel Duct	270.21	110.45
For Flat Oval, Add	12.92	
For Work In Restricted Working Space, Add	55.22	
23 31 13 13-1095 LF 62" x 66", 18 Gauge Galvanized Steel Duct	274.50	112.20
For Flat Oval, Add	13.13	
For Work In Restricted Working Space, Add	56.10	
23 31 13 13-1096 LF 62" x 68", 18 Gauge Galvanized Steel Duct	278.78	113.95
For Flat Oval, Add	13.33	
For Work In Restricted Working Space, Add	56.98	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 31 HVAC Ducts And Casings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31	13 13-1097	LF	62" x 70", 18 Gauge Galvanized Steel Duct	283.07	115.71
			<i>For Flat Oval, Add</i>	13.53	
			<i>For Work In Restricted Working Space, Add</i>	57.86	
23 31	13 13-1098	LF	64" x 64", 18 Gauge Galvanized Steel Duct	274.50	112.20
			<i>For Flat Oval, Add</i>	13.13	
			<i>For Work In Restricted Working Space, Add</i>	56.10	
23 31	13 13-1099	LF	64" x 66", 18 Gauge Galvanized Steel Duct	278.78	113.95
			<i>For Flat Oval, Add</i>	13.33	
			<i>For Work In Restricted Working Space, Add</i>	56.98	
23 31	13 13-1100	LF	64" x 68", 18 Gauge Galvanized Steel Duct	283.07	115.71
			<i>For Flat Oval, Add</i>	13.53	
			<i>For Work In Restricted Working Space, Add</i>	57.86	
23 31	13 13-1101	LF	64" x 70", 18 Gauge Galvanized Steel Duct	287.37	117.46
			<i>For Flat Oval, Add</i>	13.74	
			<i>For Work In Restricted Working Space, Add</i>	58.73	
23 31	13 13-1102	LF	66" x 66", 18 Gauge Galvanized Steel Duct	283.07	115.71
			<i>For Flat Oval, Add</i>	13.53	
			<i>For Work In Restricted Working Space, Add</i>	57.86	
23 31	13 13-1103	LF	66" x 68", 18 Gauge Galvanized Steel Duct	287.37	117.46
			<i>For Flat Oval, Add</i>	13.74	
			<i>For Work In Restricted Working Space, Add</i>	58.73	
23 31	13 13-1104	LF	66" x 70", 18 Gauge Galvanized Steel Duct	291.66	119.22
			<i>For Flat Oval, Add</i>	13.95	
			<i>For Work In Restricted Working Space, Add</i>	59.61	
23 31	13 13-1105	LF	66" x 72", 18 Gauge Galvanized Steel Duct	295.94	120.97
			<i>For Flat Oval, Add</i>	14.15	
			<i>For Work In Restricted Working Space, Add</i>	60.48	
23 31	13 13-1106	LF	68" x 68", 18 Gauge Galvanized Steel Duct	291.66	119.22
			<i>For Flat Oval, Add</i>	13.95	
			<i>For Work In Restricted Working Space, Add</i>	59.61	
23 31	13 13-1107	LF	68" x 70", 18 Gauge Galvanized Steel Duct	295.94	120.97
			<i>For Flat Oval, Add</i>	14.15	
			<i>For Work In Restricted Working Space, Add</i>	60.48	
23 31	13 13-1108	LF	68" x 72", 18 Gauge Galvanized Steel Duct	300.22	122.73
			<i>For Flat Oval, Add</i>	14.35	
			<i>For Work In Restricted Working Space, Add</i>	61.36	
23 31	13 13-1109	LF	68" x 74", 18 Gauge Galvanized Steel Duct	304.52	124.48
			<i>For Flat Oval, Add</i>	14.56	
			<i>For Work In Restricted Working Space, Add</i>	62.24	
23 31	13 13-1110	LF	70" x 70", 18 Gauge Galvanized Steel Duct	300.22	122.73
			<i>For Flat Oval, Add</i>	14.35	
			<i>For Work In Restricted Working Space, Add</i>	61.36	
23 31	13 13-1111	LF	70" x 72", 18 Gauge Galvanized Steel Duct	304.52	124.48
			<i>For Flat Oval, Add</i>	14.56	
			<i>For Work In Restricted Working Space, Add</i>	62.24	
23 31	13 13-1112	LF	70" x 74", 18 Gauge Galvanized Steel Duct	308.82	126.22
			<i>For Flat Oval, Add</i>	14.77	
			<i>For Work In Restricted Working Space, Add</i>	63.11	
23 31	13 13-1113	LF	70" x 76", 18 Gauge Galvanized Steel Duct	313.10	127.98
			<i>For Flat Oval, Add</i>	14.97	
			<i>For Work In Restricted Working Space, Add</i>	63.99	
23 31	13 13-1114	LF	70" x 78", 18 Gauge Galvanized Steel Duct	317.40	129.73
			<i>For Flat Oval, Add</i>	15.18	
			<i>For Work In Restricted Working Space, Add</i>	64.87	
23 31	13 13-1115	LF	70" x 80", 18 Gauge Galvanized Steel Duct	321.68	131.49
			<i>For Flat Oval, Add</i>	15.38	
			<i>For Work In Restricted Working Space, Add</i>	65.75	
23 31	13 13-1116	LF	70" x 82", 18 Gauge Galvanized Steel Duct	325.95	133.24
			<i>For Flat Oval, Add</i>	15.58	
			<i>For Work In Restricted Working Space, Add</i>	66.62	
23 31	13 13-1117	LF	70" x 84", 18 Gauge Galvanized Steel Duct	330.27	134.99
			<i>For Flat Oval, Add</i>	15.79	
			<i>For Work In Restricted Working Space, Add</i>	67.50	
23 31	13 13-1118	LF	70" x 86", 18 Gauge Galvanized Steel Duct	334.55	136.75
			<i>For Flat Oval, Add</i>	16.00	
			<i>For Work In Restricted Working Space, Add</i>	68.37	
23 31	13 13-1119	LF	72" x 72", 18 Gauge Galvanized Steel Duct	308.82	126.22
			<i>For Flat Oval, Add</i>	14.77	
			<i>For Work In Restricted Working Space, Add</i>	63.11	
23 31	13 13-1120	LF	72" x 74", 18 Gauge Galvanized Steel Duct	313.10	127.98
			<i>For Flat Oval, Add</i>	14.97	
			<i>For Work In Restricted Working Space, Add</i>	63.99	
23 31	13 13-1121	LF	72" x 76", 18 Gauge Galvanized Steel Duct	317.40	129.73
			<i>For Flat Oval, Add</i>	15.18	
			<i>For Work In Restricted Working Space, Add</i>	64.87	
23 31	13 13-1122	LF	72" x 78", 18 Gauge Galvanized Steel Duct	321.68	131.49
			<i>For Flat Oval, Add</i>	15.38	
			<i>For Work In Restricted Working Space, Add</i>	65.75	
23 31	13 13-1123	LF	72" x 80", 18 Gauge Galvanized Steel Duct	325.95	133.24
			<i>For Flat Oval, Add</i>	15.58	
			<i>For Work In Restricted Working Space, Add</i>	66.62	
23 31	13 13-1124	LF	72" x 82", 18 Gauge Galvanized Steel Duct	330.27	134.99
			<i>For Flat Oval, Add</i>	15.79	
			<i>For Work In Restricted Working Space, Add</i>	67.50	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31 13 13-1125 LF 72" x 84", 18 Gauge Galvanized Steel Duct	334.55	136.75
For Flat Oval, Add	16.00	
For Work In Restricted Working Space, Add	68.37	
23 31 13 13-1126 LF 72" x 86", 18 Gauge Galvanized Steel Duct	338.83	138.50
For Flat Oval, Add	16.20	
For Work In Restricted Working Space, Add	69.25	
23 31 13 13-1127 LF 74" x 74", 18 Gauge Galvanized Steel Duct	317.40	129.73
For Flat Oval, Add	15.18	
For Work In Restricted Working Space, Add	64.87	
23 31 13 13-1128 LF 74" x 76", 18 Gauge Galvanized Steel Duct	321.68	131.49
For Flat Oval, Add	15.38	
For Work In Restricted Working Space, Add	65.75	
23 31 13 13-1129 LF 74" x 78", 18 Gauge Galvanized Steel Duct	325.95	133.24
For Flat Oval, Add	15.58	
For Work In Restricted Working Space, Add	66.62	
23 31 13 13-1130 LF 74" x 80", 18 Gauge Galvanized Steel Duct	330.27	134.99
For Flat Oval, Add	15.79	
For Work In Restricted Working Space, Add	67.50	
23 31 13 13-1131 LF 74" x 82", 18 Gauge Galvanized Steel Duct	334.55	136.75
For Flat Oval, Add	16.00	
For Work In Restricted Working Space, Add	68.37	
23 31 13 13-1132 LF 74" x 84", 18 Gauge Galvanized Steel Duct	338.83	138.50
For Flat Oval, Add	16.20	
For Work In Restricted Working Space, Add	69.25	
23 31 13 13-1133 LF 74" x 86", 18 Gauge Galvanized Steel Duct	343.12	140.26
For Flat Oval, Add	16.40	
For Work In Restricted Working Space, Add	70.13	
23 31 13 13-1134 LF 76" x 76", 18 Gauge Galvanized Steel Duct	325.95	133.24
For Flat Oval, Add	15.58	
For Work In Restricted Working Space, Add	66.62	
23 31 13 13-1135 LF 76" x 78", 18 Gauge Galvanized Steel Duct	330.27	134.99
For Flat Oval, Add	15.79	
For Work In Restricted Working Space, Add	67.50	
23 31 13 13-1136 LF 76" x 80", 18 Gauge Galvanized Steel Duct	334.55	136.75
For Flat Oval, Add	16.00	
For Work In Restricted Working Space, Add	68.37	
23 31 13 13-1137 LF 76" x 82", 18 Gauge Galvanized Steel Duct	338.83	138.50
For Flat Oval, Add	16.20	
For Work In Restricted Working Space, Add	69.25	
23 31 13 13-1138 LF 76" x 84", 18 Gauge Galvanized Steel Duct	343.12	140.26
For Flat Oval, Add	16.40	
For Work In Restricted Working Space, Add	70.13	
23 31 13 13-1139 LF 76" x 86", 18 Gauge Galvanized Steel Duct	347.41	142.01
For Flat Oval, Add	16.61	
For Work In Restricted Working Space, Add	71.00	
23 31 13 13-1140 LF 78" x 78", 18 Gauge Galvanized Steel Duct	334.55	136.75
For Flat Oval, Add	16.00	
For Work In Restricted Working Space, Add	68.37	
23 31 13 13-1141 LF 78" x 80", 18 Gauge Galvanized Steel Duct	338.83	138.50
For Flat Oval, Add	16.20	
For Work In Restricted Working Space, Add	69.25	
23 31 13 13-1142 LF 78" x 82", 18 Gauge Galvanized Steel Duct	343.12	140.26
For Flat Oval, Add	16.40	
For Work In Restricted Working Space, Add	70.13	
23 31 13 13-1143 LF 78" x 84", 18 Gauge Galvanized Steel Duct	347.41	142.01
For Flat Oval, Add	16.61	
For Work In Restricted Working Space, Add	71.00	
23 31 13 13-1144 LF 78" x 86", 18 Gauge Galvanized Steel Duct	351.71	143.75
For Flat Oval, Add	16.82	
For Work In Restricted Working Space, Add	71.88	
23 31 13 13-1145 LF 80" x 80", 18 Gauge Galvanized Steel Duct	343.12	140.26
For Flat Oval, Add	16.40	
For Work In Restricted Working Space, Add	70.13	
23 31 13 13-1146 LF 80" x 82", 18 Gauge Galvanized Steel Duct	347.41	142.01
For Flat Oval, Add	16.61	
For Work In Restricted Working Space, Add	71.00	
23 31 13 13-1147 LF 80" x 84", 18 Gauge Galvanized Steel Duct	351.71	143.75
For Flat Oval, Add	16.82	
For Work In Restricted Working Space, Add	71.88	
23 31 13 13-1148 LF 80" x 86", 18 Gauge Galvanized Steel Duct	355.99	145.51
For Flat Oval, Add	17.02	
For Work In Restricted Working Space, Add	72.76	
23 31 13 13-1149 LF 82" x 82", 18 Gauge Galvanized Steel Duct	351.71	143.75
For Flat Oval, Add	16.82	
For Work In Restricted Working Space, Add	71.88	
23 31 13 13-1150 LF 82" x 84", 18 Gauge Galvanized Steel Duct	355.99	145.51
For Flat Oval, Add	17.02	
For Work In Restricted Working Space, Add	72.76	
23 31 13 13-1151 LF 82" x 86", 18 Gauge Galvanized Steel Duct	360.28	147.26
For Flat Oval, Add	17.23	
For Work In Restricted Working Space, Add	73.63	
23 31 13 13-1152 LF 84" x 84", 18 Gauge Galvanized Steel Duct	360.28	147.26
For Flat Oval, Add	17.23	
For Work In Restricted Working Space, Add	73.63	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 31 HVAC Ducts And Casings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31 13 13-1153	LF		84" x 86", 18 Gauge Galvanized Steel Duct <i>For Flat Oval, Add</i> <i>For Work In Restricted Working Space, Add</i>	364.56 17.43 74.51	149.02
23 31 13 13-1154	LF		86" x 86", 18 Gauge Galvanized Steel Duct <i>For Flat Oval, Add</i> <i>For Work In Restricted Working Space, Add</i>	368.85 17.63 75.39	150.77
23 31 13 13-1155			Aluminum Sheet Metal Duct Alloy 3003-H14 <small>(23 31 13 13)</small> Note: Ductwork poundage includes all fittings, transitions, collars, straps, support straps, etc.		
23 31 13 13-1156	LB		Aluminum Sheet Metal Ductwork, Low Pressure, Alloy 3003-H14..... <i>For Work In Restricted Working Space, Add</i> <i>For Up To 200 LB, Add</i> <i>For >200 To 500, Add</i> <i>For >500 To 1,000, Add</i> <i>For >1,000 To 2,000, Add</i> <i>For >2,000 To 5,000, Add</i>	13.87 3.77 4.55 2.82 2.03 1.15 0.54	2.22
23 31 13 13-1157			Stainless Steel Sheet Metal Duct Type 304 <small>(23 31 13 13)</small> Note: Ductwork poundage includes all fittings, transitions, collars, straps, support straps, etc.		
23 31 13 13-1158	LB		Stainless Steel Sheet Metal Ductwork, Low Pressure, Type 304..... <i>For Type 316 Stainless Steel, Add</i> <i>For Welded Seams, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Up To 200 LB, Add</i> <i>For >200 To 500, Add</i> <i>For >500 To 1,000, Add</i> <i>For >1,000 To 2,000, Add</i> <i>For >2,000 To 5,000, Add</i>	14.20 0.42 5.23 3.02 5.51 3.59 2.28 1.26 0.53	2.95
23 31 13 13-1159	LB		Stainless Steel Sheet Metal Ductwork, Medium Pressure, Type 304..... <i>For Type 316 Stainless Steel, Add</i> <i>For Welded Seams, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Up To 200 LB, Add</i> <i>For >200 To 500, Add</i> <i>For >500 To 1,000, Add</i> <i>For >1,000 To 2,000, Add</i> <i>For >2,000 To 5,000, Add</i>	16.27 0.48 5.98 3.45 6.32 4.12 2.61 1.45 0.60	3.70
23 31 13 13-1160	LB		Stainless Steel Sheet Metal Ductwork, High Pressure, Type 304..... <i>For Type 316 Stainless Steel, Add</i> <i>For Welded Seams, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For Up To 200 LB, Add</i> <i>For >200 To 500, Add</i> <i>For >500 To 1,000, Add</i> <i>For >1,000 To 2,000, Add</i> <i>For >2,000 To 5,000, Add</i>	19.84 0.58 7.31 4.21 7.69 5.02 3.18 1.76 0.74	4.44
23 31 13 13-1161			Rework Sheet Metal Ductwork <small>(23 31 13 13)</small> Note: Includes removal of existing ductwork and reinstallation of ductwork. Excludes new ductwork.		
23 31 13 13-1162	LF		Up To 1 SF Cross Section, Rework Existing Ductwork.....	22.18	
23 31 13 13-1163	LF		>1 To 2 SF Cross Section, Rework Existing Ductwork.....	43.25	
23 31 13 13-1164	LF		>2 To 4 SF Cross Section, Rework Existing Ductwork.....	57.14	
23 31 13 13-1165	LF		>4 To 6 SF Cross Section, Rework Existing Ductwork.....	71.55	
23 31 13 13-1166	LF		>6 To 8 SF Cross Section, Rework Existing Ductwork.....	99.79	
23 31 13 13-1167	LF		>8 To 10 SF Cross Section, Rework Existing Ductwork.....	116.43	
23 31 13 13-1168	LF		>10 To 12 SF Cross Section, Rework Existing Ductwork.....	133.07	
23 31 13 13-1169	LF		>12 To 14 SF Cross Section, Rework Existing Ductwork.....	149.69	
23 31 13 16			Round and Flat-Oval Spiral Ducts <small>(23 31 13)</small>		
23 31 13 16-0001			Factory Fabricated Field Installed Low Pressure Round Duct <small>(23 31 13 16)</small> Note: Based on 26 gauge.		
23 31 13 16-0002			26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round Ducts <small>(23 31 13 16-0001)</small> Note: Includes straps and supports.		
23 31 13 16-0003	LF		4", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round Duct..... <i>For 28 Gauge, Deduct</i> <i>For 24 Gauge, Add</i> <i>For 22 Gauge, Add</i> <i>For 20 Gauge, Add</i> <i>For 18 Gauge, Add</i> <i>For 16 Gauge, Add</i> <i>For Polyvinyl Chloride (PVC) Coated, Inside And Outside, Add</i> <i>For Acid Resistant Asphaltum Coating, Add</i> <i>For Work In Restricted Working Space, Add</i>	5.09 -0.20 0.20 0.40 0.60 0.80 0.99 1.08 3.76 1.09	1.77



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31 13 16-0004 LF 5", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round Duct	5.90	2.01
For 28 Gauge, Deduct	-0.26	
For 24 Gauge, Add	0.26	
For 22 Gauge, Add	0.52	
For 20 Gauge, Add	0.77	
For 18 Gauge, Add	1.03	
For 16 Gauge, Add	1.26	
For Polyvinyl Chloride (PVC) Coated, Inside And Outside, Add	1.38	
For Acid Resistant Asphaltum Coating, Add	4.20	
For Work In Restricted Working Space, Add	1.21	
23 31 13 16-0005 LF 6", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round Duct	6.66	2.42
For 28 Gauge, Deduct	-0.30	
For 24 Gauge, Add	0.30	
For 22 Gauge, Add	0.59	
For 20 Gauge, Add	0.89	
For 18 Gauge, Add	1.18	
For 16 Gauge, Add	1.44	
For Polyvinyl Chloride (PVC) Coated, Inside And Outside, Add	1.58	
For Acid Resistant Asphaltum Coating, Add	4.64	
For Work In Restricted Working Space, Add	1.36	
23 31 13 16-0006 LF 7", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round Duct	7.70	2.82
For 28 Gauge, Deduct	-0.35	
For 24 Gauge, Add	0.35	
For 22 Gauge, Add	0.69	
For 20 Gauge, Add	1.04	
For 18 Gauge, Add	1.39	
For 16 Gauge, Add	1.70	
For Polyvinyl Chloride (PVC) Coated, Inside And Outside, Add	1.86	
For Acid Resistant Asphaltum Coating, Add	5.08	
For Work In Restricted Working Space, Add	1.55	
23 31 13 16-0007 LF 8", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round Duct	8.84	3.22
For 28 Gauge, Deduct	-0.39	
For 24 Gauge, Add	0.39	
For 22 Gauge, Add	0.77	
For 20 Gauge, Add	1.16	
For 18 Gauge, Add	1.55	
For 16 Gauge, Add	1.90	
For Polyvinyl Chloride (PVC) Coated, Inside And Outside, Add	2.08	
For Acid Resistant Asphaltum Coating, Add	5.52	
For Work In Restricted Working Space, Add	1.81	
23 31 13 16-0008 LF 10", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round Duct	10.70	4.03
For 28 Gauge, Deduct	-0.48	
For 24 Gauge, Add	0.48	
For 22 Gauge, Add	0.95	
For 20 Gauge, Add	1.43	
For 18 Gauge, Add	1.90	
For 16 Gauge, Add	2.34	
For Polyvinyl Chloride (PVC) Coated, Inside And Outside, Add	2.56	
For Acid Resistant Asphaltum Coating, Add	6.40	
For Work In Restricted Working Space, Add	2.17	
23 31 13 16-0009 LF 12", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round Duct	13.30	5.39
For 28 Gauge, Deduct	-0.59	
For 24 Gauge, Add	0.59	
For 22 Gauge, Add	1.17	
For 20 Gauge, Add	1.76	
For 18 Gauge, Add	2.34	
For 16 Gauge, Add	2.87	
For Polyvinyl Chloride (PVC) Coated, Inside And Outside, Add	3.15	
For Acid Resistant Asphaltum Coating, Add	6.90	
For Work In Restricted Working Space, Add	2.72	
23 31 13 16-0010 LF 14", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round Duct	16.26	8.05
For 28 Gauge, Deduct	-0.68	
For 24 Gauge, Add	0.68	
For 22 Gauge, Add	1.36	
For 20 Gauge, Add	2.05	
For 18 Gauge, Add	2.72	
For 16 Gauge, Add	3.33	
For Polyvinyl Chloride (PVC) Coated, Inside And Outside, Add	3.66	
For Acid Resistant Asphaltum Coating, Add	7.26	
For Work In Restricted Working Space, Add	3.40	
23 31 13 16-0011 LF 16", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round Duct	22.41	10.79
For 28 Gauge, Deduct	-1.01	
For 24 Gauge, Add	1.01	
For 22 Gauge, Add	2.02	
For 20 Gauge, Add	3.03	
For 18 Gauge, Add	4.03	
For 16 Gauge, Add	4.94	
For Polyvinyl Chloride (PVC) Coated, Inside And Outside, Add	5.42	
For Acid Resistant Asphaltum Coating, Add	7.58	
For Work In Restricted Working Space, Add	4.53	

23 31 13 16-0012 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round Adjustable Elbows (23 31 13 16-0001)
 Note: Up to 90 degree.

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 31 HVAC Ducts And Casings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31 13 16-0013	EA		4", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round Adjustable		
			Elbow.....	28.38	10.75
			For 28 Gauge, Deduct	-0.96	
			For 24 Gauge, Add	0.95	
			For 22 Gauge, Add	1.90	
			For 20 Gauge, Add	2.86	
			For 18 Gauge, Add	3.80	
			For 16 Gauge, Add	4.66	
			For Polyvinyl Chloride (PVC) Coated, Inside And Outside, Add	5.11	
			For Work In Restricted Working Space, Add	6.44	
23 31 13 16-0014	EA		5", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round Adjustable		
			Elbow.....	32.30	12.40
			For 28 Gauge, Deduct	-1.04	
			For 24 Gauge, Add	1.04	
			For 22 Gauge, Add	2.07	
			For 20 Gauge, Add	3.11	
			For 18 Gauge, Add	4.13	
			For 16 Gauge, Add	5.07	
			For Polyvinyl Chloride (PVC) Coated, Inside And Outside, Add	5.56	
			For Work In Restricted Working Space, Add	7.44	
23 31 13 16-0015	EA		6", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round Adjustable		
			Elbow.....	37.74	14.64
			For 28 Gauge, Deduct	-1.17	
			For 24 Gauge, Add	1.16	
			For 22 Gauge, Add	2.33	
			For 20 Gauge, Add	3.49	
			For 18 Gauge, Add	4.64	
			For 16 Gauge, Add	5.70	
			For Polyvinyl Chloride (PVC) Coated, Inside And Outside, Add	6.25	
			For Work In Restricted Working Space, Add	8.79	
23 31 13 16-0016	EA		7", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round Adjustable		
			Elbow.....	48.04	18.83
			For 28 Gauge, Deduct	-1.44	
			For 24 Gauge, Add	1.43	
			For 22 Gauge, Add	2.86	
			For 20 Gauge, Add	4.29	
			For 18 Gauge, Add	5.70	
			For 16 Gauge, Add	7.00	
			For Polyvinyl Chloride (PVC) Coated, Inside And Outside, Add	7.67	
			For Work In Restricted Working Space, Add	11.30	
23 31 13 16-0017	EA		8", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round Adjustable		
			Elbow.....	57.09	22.93
			For 28 Gauge, Deduct	-1.55	
			For 24 Gauge, Add	1.55	
			For 22 Gauge, Add	3.09	
			For 20 Gauge, Add	4.64	
			For 18 Gauge, Add	6.17	
			For 16 Gauge, Add	7.57	
			For Polyvinyl Chloride (PVC) Coated, Inside And Outside, Add	8.30	
			For Work In Restricted Working Space, Add	13.76	
23 31 13 16-0018	EA		10", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round Adjustable		
			Elbow.....	86.42	35.82
			For 28 Gauge, Deduct	-2.05	
			For 24 Gauge, Add	2.04	
			For 22 Gauge, Add	4.07	
			For 20 Gauge, Add	6.12	
			For 18 Gauge, Add	8.13	
			For 16 Gauge, Add	9.98	
			For Polyvinyl Chloride (PVC) Coated, Inside And Outside, Add	10.94	
			For Work In Restricted Working Space, Add	21.49	
23 31 13 16-0019	EA		12", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round Adjustable		
			Elbow.....	119.03	49.49
			For 28 Gauge, Deduct	-2.78	
			For 24 Gauge, Add	2.77	
			For 22 Gauge, Add	5.52	
			For 20 Gauge, Add	8.30	
			For 18 Gauge, Add	11.02	
			For 16 Gauge, Add	13.53	
			For Polyvinyl Chloride (PVC) Coated, Inside And Outside, Add	14.83	
			For Work In Restricted Working Space, Add	29.70	
23 31 13 16-0020	EA		14", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round Adjustable		
			Elbow.....	147.81	58.55
			For 28 Gauge, Deduct	-4.25	
			For 24 Gauge, Add	4.24	
			For 22 Gauge, Add	8.46	
			For 20 Gauge, Add	12.72	
			For 18 Gauge, Add	16.90	
			For 16 Gauge, Add	20.74	
			For Polyvinyl Chloride (PVC) Coated, Inside And Outside, Add	22.73	
			For Work In Restricted Working Space, Add	35.13	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31 13 16-0021 EA 16", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round Adjustable Elbow.....	172.79	64.38
<i>For 28 Gauge, Deduct</i>	-6.10	
<i>For 24 Gauge, Add</i>	6.07	
<i>For 22 Gauge, Add</i>	12.13	
<i>For 20 Gauge, Add</i>	18.22	
<i>For 18 Gauge, Add</i>	24.21	
<i>For 16 Gauge, Add</i>	29.71	
<i>For Polyvinyl Chloride (PVC) Coated, Inside And Outside, Add</i>	32.57	
<i>For Work In Restricted Working Space, Add</i>	38.63	
23 31 13 16-0022 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round 90 Degree Elbows <small>(23 31 13 16-0001)</small>		
23 31 13 16-0023 EA 4", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round 90 Degree Elbow.....	23.91	7.24
<i>For 28 Gauge, Deduct</i>	-0.80	
<i>For 24 Gauge, Add</i>	0.80	
<i>For 22 Gauge, Add</i>	1.60	
<i>For 20 Gauge, Add</i>	2.40	
<i>For 18 Gauge, Add</i>	3.19	
<i>For 16 Gauge, Add</i>	3.92	
<i>For Polyvinyl Chloride (PVC) Coated, Inside And Outside, Add</i>	4.29	
<i>For Work In Restricted Working Space, Add</i>	5.43	
23 31 13 16-0024 EA 5", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round 90 Degree Elbow.....	27.31	8.29
<i>For 28 Gauge, Deduct</i>	-0.92	
<i>For 24 Gauge, Add</i>	0.91	
<i>For 22 Gauge, Add</i>	1.82	
<i>For 20 Gauge, Add</i>	2.74	
<i>For 18 Gauge, Add</i>	3.64	
<i>For 16 Gauge, Add</i>	4.46	
<i>For Polyvinyl Chloride (PVC) Coated, Inside And Outside, Add</i>	4.89	
<i>For Work In Restricted Working Space, Add</i>	6.21	
23 31 13 16-0025 EA 6", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round 90 Degree Elbow.....	31.67	9.66
<i>For 28 Gauge, Deduct</i>	-1.04	
<i>For 24 Gauge, Add</i>	1.04	
<i>For 22 Gauge, Add</i>	2.07	
<i>For 20 Gauge, Add</i>	3.12	
<i>For 18 Gauge, Add</i>	4.14	
<i>For 16 Gauge, Add</i>	5.08	
<i>For Polyvinyl Chloride (PVC) Coated, Inside And Outside, Add</i>	5.57	
<i>For Work In Restricted Working Space, Add</i>	7.24	
23 31 13 16-0026 EA 7", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round 90 Degree Elbow.....	36.95	11.59
<i>For 28 Gauge, Deduct</i>	-1.10	
<i>For 24 Gauge, Add</i>	1.10	
<i>For 22 Gauge, Add</i>	2.20	
<i>For 20 Gauge, Add</i>	3.30	
<i>For 18 Gauge, Add</i>	4.38	
<i>For 16 Gauge, Add</i>	5.38	
<i>For Polyvinyl Chloride (PVC) Coated, Inside And Outside, Add</i>	5.90	
<i>For Work In Restricted Working Space, Add</i>	8.69	
23 31 13 16-0027 EA 8", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round 90 Degree Elbow.....	45.48	14.48
<i>For 28 Gauge, Deduct</i>	-1.28	
<i>For 24 Gauge, Add</i>	1.28	
<i>For 22 Gauge, Add</i>	2.55	
<i>For 20 Gauge, Add</i>	3.83	
<i>For 18 Gauge, Add</i>	5.09	
<i>For 16 Gauge, Add</i>	6.25	
<i>For Polyvinyl Chloride (PVC) Coated, Inside And Outside, Add</i>	6.85	
<i>For Work In Restricted Working Space, Add</i>	10.87	
23 31 13 16-0028 EA 10", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round 90 Degree Elbow.....	61.50	19.32
<i>For 28 Gauge, Deduct</i>	-1.83	
<i>For 24 Gauge, Add</i>	1.82	
<i>For 22 Gauge, Add</i>	3.64	
<i>For 20 Gauge, Add</i>	5.47	
<i>For 18 Gauge, Add</i>	7.27	
<i>For 16 Gauge, Add</i>	8.92	
<i>For Polyvinyl Chloride (PVC) Coated, Inside And Outside, Add</i>	9.78	
<i>For Work In Restricted Working Space, Add</i>	14.48	
23 31 13 16-0029 EA 12", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round 90 Degree Elbow.....	89.93	28.98
<i>For 28 Gauge, Deduct</i>	-2.42	
<i>For 24 Gauge, Add</i>	2.42	
<i>For 22 Gauge, Add</i>	4.82	
<i>For 20 Gauge, Add</i>	7.25	
<i>For 18 Gauge, Add</i>	9.63	
<i>For 16 Gauge, Add</i>	11.81	
<i>For Polyvinyl Chloride (PVC) Coated, Inside And Outside, Add</i>	12.95	
<i>For Work In Restricted Working Space, Add</i>	21.73	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 31 HVAC Ducts And Casings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31 13 16-0030	EA		14", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round 90 Degree Elbow.....	125.30	37.02
			<i>For 28 Gauge, Deduct</i>	-4.54	
			<i>For 24 Gauge, Add</i>	4.52	
			<i>For 22 Gauge, Add</i>	9.02	
			<i>For 20 Gauge, Add</i>	13.56	
			<i>For 18 Gauge, Add</i>	18.01	
			<i>For 16 Gauge, Add</i>	22.11	
			<i>For Polyvinyl Chloride (PVC) Coated, Inside And Outside, Add</i>	24.24	
			<i>For Work In Restricted Working Space, Add</i>	27.77	
23 31 13 16-0031	EA		16", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round 90 Degree Elbow.....	156.77	46.67
			<i>For 28 Gauge, Deduct</i>	-5.55	
			<i>For 24 Gauge, Add</i>	5.53	
			<i>For 22 Gauge, Add</i>	11.04	
			<i>For 20 Gauge, Add</i>	16.59	
			<i>For 18 Gauge, Add</i>	22.04	
			<i>For 16 Gauge, Add</i>	27.05	
			<i>For Polyvinyl Chloride (PVC) Coated, Inside And Outside, Add</i>	29.66	
			<i>For Work In Restricted Working Space, Add</i>	35.01	
23 31 13 16-0032			26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round 45 Degree Elbows <small>(23 31 13 16-0001)</small>		
23 31 13 16-0033	EA		4", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round 45 Degree Elbow.....	21.75	7.24
			<i>For 28 Gauge, Deduct</i>	-0.50	
			<i>For 24 Gauge, Add</i>	0.50	
			<i>For 22 Gauge, Add</i>	1.00	
			<i>For 20 Gauge, Add</i>	1.51	
			<i>For 18 Gauge, Add</i>	2.00	
			<i>For 16 Gauge, Add</i>	2.46	
			<i>For Polyvinyl Chloride (PVC) Coated, Inside And Outside, Add</i>	2.69	
			<i>For Work In Restricted Working Space, Add</i>	5.43	
23 31 13 16-0034	EA		5", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round 45 Degree Elbow.....	25.38	8.29
			<i>For 28 Gauge, Deduct</i>	-0.65	
			<i>For 24 Gauge, Add</i>	0.65	
			<i>For 22 Gauge, Add</i>	1.29	
			<i>For 20 Gauge, Add</i>	1.94	
			<i>For 18 Gauge, Add</i>	2.57	
			<i>For 16 Gauge, Add</i>	3.16	
			<i>For Polyvinyl Chloride (PVC) Coated, Inside And Outside, Add</i>	3.46	
			<i>For Work In Restricted Working Space, Add</i>	6.21	
23 31 13 16-0035	EA		6", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round 45 Degree Elbow.....	29.25	9.66
			<i>For 28 Gauge, Deduct</i>	-0.71	
			<i>For 24 Gauge, Add</i>	0.71	
			<i>For 22 Gauge, Add</i>	1.41	
			<i>For 20 Gauge, Add</i>	2.12	
			<i>For 18 Gauge, Add</i>	2.81	
			<i>For 16 Gauge, Add</i>	3.45	
			<i>For Polyvinyl Chloride (PVC) Coated, Inside And Outside, Add</i>	3.78	
			<i>For Work In Restricted Working Space, Add</i>	7.24	
23 31 13 16-0036	EA		7", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round 45 Degree Elbow.....	34.90	11.59
			<i>For 28 Gauge, Deduct</i>	-0.82	
			<i>For 24 Gauge, Add</i>	0.82	
			<i>For 22 Gauge, Add</i>	1.63	
			<i>For 20 Gauge, Add</i>	2.45	
			<i>For 18 Gauge, Add</i>	3.26	
			<i>For 16 Gauge, Add</i>	4.00	
			<i>For Polyvinyl Chloride (PVC) Coated, Inside And Outside, Add</i>	4.38	
			<i>For Work In Restricted Working Space, Add</i>	8.69	
23 31 13 16-0037	EA		8", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round 45 Degree Elbow.....	42.95	14.48
			<i>For 28 Gauge, Deduct</i>	-0.93	
			<i>For 24 Gauge, Add</i>	0.93	
			<i>For 22 Gauge, Add</i>	1.85	
			<i>For 20 Gauge, Add</i>	2.79	
			<i>For 18 Gauge, Add</i>	3.70	
			<i>For 16 Gauge, Add</i>	4.54	
			<i>For Polyvinyl Chloride (PVC) Coated, Inside And Outside, Add</i>	4.98	
			<i>For Work In Restricted Working Space, Add</i>	10.87	
23 31 13 16-0038	EA		10", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round 45 Degree Elbow.....	58.55	19.32
			<i>For 28 Gauge, Deduct</i>	-1.42	
			<i>For 24 Gauge, Add</i>	1.42	
			<i>For 22 Gauge, Add</i>	2.83	
			<i>For 20 Gauge, Add</i>	4.25	
			<i>For 18 Gauge, Add</i>	5.65	
			<i>For 16 Gauge, Add</i>	6.93	
			<i>For Polyvinyl Chloride (PVC) Coated, Inside And Outside, Add</i>	7.60	
			<i>For Work In Restricted Working Space, Add</i>	14.48	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31 13 16-0039 EA 12", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round 45 Degree Elbow.....	85.65	28.98
<i>For 28 Gauge, Deduct</i>	-1.83	
<i>For 24 Gauge, Add</i>	1.82	
<i>For 22 Gauge, Add</i>	3.64	
<i>For 20 Gauge, Add</i>	5.47	
<i>For 18 Gauge, Add</i>	7.27	
<i>For 16 Gauge, Add</i>	8.92	
<i>For Polyvinyl Chloride (PVC) Coated, Inside And Outside, Add</i>	9.78	
<i>For Work In Restricted Working Space, Add</i>	21.73	
23 31 13 16-0040 EA 14", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round 45 Degree Elbow.....	115.44	37.02
<i>For 28 Gauge, Deduct</i>	-3.17	
<i>For 24 Gauge, Add</i>	3.16	
<i>For 22 Gauge, Add</i>	6.31	
<i>For 20 Gauge, Add</i>	9.48	
<i>For 18 Gauge, Add</i>	12.59	
<i>For 16 Gauge, Add</i>	15.45	
<i>For Polyvinyl Chloride (PVC) Coated, Inside And Outside, Add</i>	16.94	
<i>For Work In Restricted Working Space, Add</i>	27.77	
23 31 13 16-0041 EA 16", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round 45 Degree Elbow.....	154.22	46.67
<i>For 28 Gauge, Deduct</i>	-5.20	
<i>For 24 Gauge, Add</i>	5.18	
<i>For 22 Gauge, Add</i>	10.34	
<i>For 20 Gauge, Add</i>	15.54	
<i>For 18 Gauge, Add</i>	20.64	
<i>For 16 Gauge, Add</i>	25.33	
<i>For Polyvinyl Chloride (PVC) Coated, Inside And Outside, Add</i>	27.77	
<i>For Work In Restricted Working Space, Add</i>	35.01	
23 31 13 16-0042 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round Tees <small>(23 31 13 16-0001)</small>		
23 31 13 16-0043 EA 4", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round Tee.....	35.28	10.87
<i>For 28 Gauge, Deduct</i>	-1.12	
<i>For 24 Gauge, Add</i>	1.12	
<i>For 22 Gauge, Add</i>	2.24	
<i>For 20 Gauge, Add</i>	3.36	
<i>For 18 Gauge, Add</i>	4.47	
<i>For 16 Gauge, Add</i>	5.48	
<i>For Polyvinyl Chloride (PVC) Coated, Inside And Outside, Add</i>	6.01	
<i>For Work In Restricted Working Space, Add</i>	8.15	
23 31 13 16-0044 EA 5", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round Tee.....	41.82	12.40
<i>For 28 Gauge, Deduct</i>	-1.49	
<i>For 24 Gauge, Add</i>	1.49	
<i>For 22 Gauge, Add</i>	2.97	
<i>For 20 Gauge, Add</i>	4.46	
<i>For 18 Gauge, Add</i>	5.93	
<i>For 16 Gauge, Add</i>	7.28	
<i>For Polyvinyl Chloride (PVC) Coated, Inside And Outside, Add</i>	7.98	
<i>For Work In Restricted Working Space, Add</i>	9.31	
23 31 13 16-0045 EA 6", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round Tee.....	47.92	14.48
<i>For 28 Gauge, Deduct</i>	-1.62	
<i>For 24 Gauge, Add</i>	1.61	
<i>For 22 Gauge, Add</i>	3.22	
<i>For 20 Gauge, Add</i>	4.84	
<i>For 18 Gauge, Add</i>	6.44	
<i>For 16 Gauge, Add</i>	7.90	
<i>For Polyvinyl Chloride (PVC) Coated, Inside And Outside, Add</i>	8.66	
<i>For Work In Restricted Working Space, Add</i>	10.87	
23 31 13 16-0046 EA 7", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round Tee.....	56.92	17.38
<i>For 28 Gauge, Deduct</i>	-1.87	
<i>For 24 Gauge, Add</i>	1.86	
<i>For 22 Gauge, Add</i>	3.71	
<i>For 20 Gauge, Add</i>	5.58	
<i>For 18 Gauge, Add</i>	7.41	
<i>For 16 Gauge, Add</i>	9.09	
<i>For Polyvinyl Chloride (PVC) Coated, Inside And Outside, Add</i>	9.97	
<i>For Work In Restricted Working Space, Add</i>	13.04	
23 31 13 16-0047 EA 8", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round Tee.....	76.10	21.72
<i>For 28 Gauge, Deduct</i>	-3.02	
<i>For 24 Gauge, Add</i>	3.00	
<i>For 22 Gauge, Add</i>	6.00	
<i>For 20 Gauge, Add</i>	9.01	
<i>For 18 Gauge, Add</i>	11.97	
<i>For 16 Gauge, Add</i>	14.69	
<i>For Polyvinyl Chloride (PVC) Coated, Inside And Outside, Add</i>	16.11	
<i>For Work In Restricted Working Space, Add</i>	16.30	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 31 HVAC Ducts And Casings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31 13 16-0048	EA		10", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round Tee.....	100.20	28.98
			<i>For 28 Gauge, Deduct</i>	-3.85	
			<i>For 24 Gauge, Add</i>	3.83	
			<i>For 22 Gauge, Add</i>	7.65	
			<i>For 20 Gauge, Add</i>	11.50	
			<i>For 18 Gauge, Add</i>	15.27	
			<i>For 16 Gauge, Add</i>	18.74	
			<i>For Polyvinyl Chloride (PVC) Coated, Inside And Outside, Add</i>	20.55	
			<i>For Work In Restricted Working Space, Add</i>	21.73	
23 31 13 16-0049	EA		12", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round Tee.....	136.39	43.46
			<i>For 28 Gauge, Deduct</i>	-3.85	
			<i>For 24 Gauge, Add</i>	3.83	
			<i>For 22 Gauge, Add</i>	7.65	
			<i>For 20 Gauge, Add</i>	11.50	
			<i>For 18 Gauge, Add</i>	15.27	
			<i>For 16 Gauge, Add</i>	18.74	
			<i>For Polyvinyl Chloride (PVC) Coated, Inside And Outside, Add</i>	20.55	
			<i>For Work In Restricted Working Space, Add</i>	32.59	
23 31 13 16-0050	EA		14", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round Tee.....	191.65	55.36
			<i>For 28 Gauge, Deduct</i>	-7.33	
			<i>For 24 Gauge, Add</i>	7.30	
			<i>For 22 Gauge, Add</i>	14.57	
			<i>For 20 Gauge, Add</i>	21.90	
			<i>For 18 Gauge, Add</i>	29.09	
			<i>For 16 Gauge, Add</i>	35.70	
			<i>For Polyvinyl Chloride (PVC) Coated, Inside And Outside, Add</i>	39.14	
			<i>For Work In Restricted Working Space, Add</i>	41.63	
23 31 13 16-0051	EA		16", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round Tee.....	249.21	70.18
			<i>For 28 Gauge, Deduct</i>	-10.28	
			<i>For 24 Gauge, Add</i>	10.25	
			<i>For 22 Gauge, Add</i>	20.46	
			<i>For 20 Gauge, Add</i>	30.74	
			<i>For 18 Gauge, Add</i>	40.84	
			<i>For 16 Gauge, Add</i>	50.12	
			<i>For Polyvinyl Chloride (PVC) Coated, Inside And Outside, Add</i>	54.95	
			<i>For Work In Restricted Working Space, Add</i>	52.49	
23 31 13 16-0052			26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round Connectors <small>(23 31 13 16-0001)</small>		
23 31 13 16-0053	EA		4", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round Connector	15.60	
			<i>For Work In Restricted Working Space, Add</i>	3.86	
23 31 13 16-0054	EA		5", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round Connector	16.46	
			<i>For Work In Restricted Working Space, Add</i>	4.06	
23 31 13 16-0055	EA		6", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round Connector	17.63	
			<i>For Work In Restricted Working Space, Add</i>	4.34	
23 31 13 16-0056	EA		7", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round Connector	18.89	
			<i>For Work In Restricted Working Space, Add</i>	4.59	
23 31 13 16-0057	EA		8", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round Connector	20.57	
			<i>For Work In Restricted Working Space, Add</i>	4.95	
23 31 13 16-0058	EA		10", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round Connector	24.84	
			<i>For Work In Restricted Working Space, Add</i>	5.53	
23 31 13 16-0059	EA		12", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round Connector	33.48	
			<i>For Work In Restricted Working Space, Add</i>	7.73	
23 31 13 16-0060	EA		14", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round Connector	38.30	
			<i>For Work In Restricted Working Space, Add</i>	8.79	
23 31 13 16-0061	EA		16", 26 Gauge, Factory Fabricated, Field Installed, Low Pressure, Galvanized Sheet Metal Round Connector	42.19	
			<i>For Work In Restricted Working Space, Add</i>	9.64	
23 31 13 19			Metal Duct Fittings <small>(23 31 13)</small>		
23 31 13 19-0001			Sheet Metal Baffles <small>(23 31 13 19)</small>		
23 31 13 19-0002	LF		Sheet Metal Baffles Under Raised Floor.....	29.83	23.66
			<i>For Work In Restricted Working Space, Add</i>	8.65	
23 31 13 23			Galvanized Steel Welded Duct <small>(23 31 13)</small>		
			Note: All field fabricated duct is assembled from flat duct sheets on site to fit to exact field conditions. Ductwork which is fabricated off site or snap-fitting duct is considered as shop fabricated.		
23 31 13 23-0001			Welded Steel Ductwork <small>(23 31 13 23)</small>		
			Note: Ductwork poundage includes all fittings, transitions, collars, straps, support straps, etc.		
23 31 13 23-0002			Galvanized Steel Welded Duct, For Kitchen <small>(23 31 13 23-0001)</small>		
			Note: Also includes special exhaust systems and waste.		
23 31 13 23-0003	LB		Galvanized Steel Welded Duct	18.46	7.17
			<i>For Polyvinyl Chloride (PVC) Coated, Inside And Outside, Add</i>	3.02	
			<i>For Work In Restricted Working Space, Add</i>	4.31	
23 31 13 23-0004			Black Steel Ductwork <small>(23 31 13 23-0001)</small>		
23 31 13 23-0005	LB		Black Steel Ductwork	15.71	7.39
			<i>For Polyvinyl Chloride (PVC) Coated, Inside And Outside, Add</i>	0.68	
			<i>For Work In Restricted Working Space, Add</i>	4.44	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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23 31 13 33 Duct Boots (23 31 13)

23 31 13 33-0001 Duct Register Boots (23 31 13 33)

23 31 13 33-0002	EA		10" x 2-1/4" x 5" Register Boot, 90 Degree, Galvanized Steel.....	29.73	10.06
			<i>For Stainless Steel, Add</i>	12.49	
23 31 13 33-0003	EA		10" x 2-1/4" x 6" Register Boot, 90 Degree, Galvanized Steel.....	29.73	10.06
			<i>For Stainless Steel, Add</i>	12.49	
23 31 13 33-0004	EA		12" x 2-1/4" x 5" Register Boot, 90 Degree, Galvanized Steel.....	31.55	10.87
			<i>For Stainless Steel, Add</i>	12.78	
23 31 13 33-0005	EA		12" x 2-1/4" x 6" Register Boot, 90 Degree, Galvanized Steel.....	31.55	10.87
			<i>For Stainless Steel, Add</i>	12.78	
23 31 13 33-0006	EA		12" x 2-1/4" x 7" Register Boot, 90 Degree, Galvanized Steel.....	33.92	10.87
			<i>For Stainless Steel, Add</i>	15.86	
23 31 13 33-0007	EA		14" x 2-1/4" x 5" Register Boot, 90 Degree, Galvanized Steel.....	34.34	11.67
			<i>For Stainless Steel, Add</i>	14.30	
23 31 13 33-0008	EA		14" x 2-1/4" x 6" Register Boot, 90 Degree, Galvanized Steel.....	34.34	11.67
			<i>For Stainless Steel, Add</i>	14.30	
23 31 13 33-0009	EA		14" x 2-1/4" x 7" Register Boot, 90 Degree, Galvanized Steel.....	35.81	11.67
			<i>For Stainless Steel, Add</i>	16.21	
23 31 13 33-0010	EA		10" x 4" x 6" Register Boot, 90 Degree, Galvanized Steel.....	33.60	12.48
			<i>For Stainless Steel, Add</i>	11.25	
23 31 13 33-0011	EA		12" x 4" x 6" Register Boot, 90 Degree, Galvanized Steel.....	35.47	13.27
			<i>For Stainless Steel, Add</i>	11.58	
23 31 13 33-0012	EA		12" x 4" x 7" Register Boot, 90 Degree, Galvanized Steel.....	41.51	13.27
			<i>For Stainless Steel, Add</i>	19.44	
23 31 13 33-0013	EA		14" x 4" x 6" Register Boot, 90 Degree, Galvanized Steel.....	37.61	14.08
			<i>For Stainless Steel, Add</i>	12.27	
23 31 13 33-0014	EA		14" x 4" x 7" Register Boot, 90 Degree, Galvanized Steel.....	43.53	14.08
			<i>For Stainless Steel, Add</i>	19.97	
23 31 13 33-0015	EA		12" x 2-1/4" x 5" Register Boot, Center, Galvanized Steel.....	30.11	10.87
			<i>For Stainless Steel, Add</i>	10.91	
23 31 13 33-0016	EA		12" x 2-1/4" x 6" Register Boot, Center, Galvanized Steel.....	30.11	10.87
			<i>For Stainless Steel, Add</i>	10.91	
23 31 13 33-0017	EA		14" x 2-1/4" x 6" Register Boot, Center, Galvanized Steel.....	32.70	11.67
			<i>For Stainless Steel, Add</i>	12.17	
23 31 13 33-0018	EA		14" x 2-1/4" x 7" Register Boot, Center, Galvanized Steel.....	34.11	11.67
			<i>For Stainless Steel, Add</i>	14.00	
23 31 13 33-0019	EA		10" x 4" x 6" Register Boot, Center, Galvanized Steel.....	33.79	12.48
			<i>For Stainless Steel, Add</i>	11.49	
23 31 13 33-0020	EA		12" x 4" x 6" Register Boot, Center, Galvanized Steel.....	35.64	13.27
			<i>For Stainless Steel, Add</i>	11.80	
23 31 13 33-0021	EA		12" x 2-1/4" x 6" Register Boot, End, Galvanized Steel.....	31.08	10.87
			<i>For Stainless Steel, Add</i>	12.17	
23 31 13 33-0022	EA		14" x 2-1/4" x 6" Register Boot, End, Galvanized Steel.....	33.27	11.67
			<i>For Stainless Steel, Add</i>	12.91	
23 31 13 33-0023	EA		10" x 2-1/4" x 6" Register Boot, Universal, Galvanized Steel.....	29.73	10.06
			<i>For Stainless Steel, Add</i>	12.49	
23 31 13 33-0024	EA		12" x 2-1/4" x 6" Register Boot, Universal, Galvanized Steel.....	31.55	10.87
			<i>For Stainless Steel, Add</i>	12.78	
23 31 13 33-0025	EA		14" x 2-1/4" x 5" Register Boot, Universal, Galvanized Steel.....	34.34	11.67
			<i>For Stainless Steel, Add</i>	14.30	
23 31 13 33-0026	EA		14" x 2-1/4" x 6" Register Boot, Universal, Galvanized Steel.....	34.34	11.67
			<i>For Stainless Steel, Add</i>	14.30	
23 31 13 33-0027	EA		10" x 4" x 6" Register Boot, Universal, Galvanized Steel.....	33.60	12.48
			<i>For Stainless Steel, Add</i>	11.25	
23 31 13 33-0028	EA		12" x 4" x 6" Register Boot, Universal, Galvanized Steel.....	35.47	13.27
			<i>For Stainless Steel, Add</i>	11.58	
23 31 13 33-0029	EA		12" x 4" x 7" Register Boot, Universal, Galvanized Steel.....	41.51	13.27
			<i>For Stainless Steel, Add</i>	19.44	
23 31 13 33-0030	EA		14" x 4" x 7" Register Boot, Universal, Galvanized Steel.....	43.12	14.08
			<i>For Stainless Steel, Add</i>	19.44	

23 31 16 Nonmetal Ducts (23 31)

23 31 16 13 Fibrous-Glass Ducts (23 31 16)

23 31 16 13-0001 Glass Fiber Duct Board (23 31 16 13)

Note: Rigid, rectangular boards faced on one side with a fire-resistant foil-scrim-kraft (FSK) vapor retarder and a lightweight fiber glass mat on the airstream surface.

23 31 16 13-0002	SF		1" Glass Fiber Duct Board (EI-475)	7.06	1.48
23 31 16 13-0003	SF		1-1/2" Glass Fiber Duct Board (EI-800)	8.22	1.62
23 31 16 13-0004	SF		2" Glass Fiber Duct Board (EI-800)	9.45	1.78

23 31 16 16 Thermoset Fiberglass-Reinforced Plastic Ducts (23 31 16)

23 31 16 16-0001 Round Fiber Reinforced Plastic Duct (23 31 16 16)

23 31 16 16-0002 Round Fiber Reinforced Plastic Duct (23 31 16 16-0001)

23 31 16 16-0003	LF		2" Fiber Reinforced Plastic Duct.....	10.93	3.90
23 31 16 16-0004	LF		3" Fiber Reinforced Plastic Duct.....	13.59	4.55
23 31 16 16-0005	LF		4" Fiber Reinforced Plastic Duct.....	18.59	6.69

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 31 HVAC Ducts And Casings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31 16 16-0006	LF		6" Fiber Reinforced Plastic Duct.....	24.51	8.45
23 31 16 16-0007	LF		8" Fiber Reinforced Plastic Duct.....	31.00	10.59
23 31 16 16-0008	LF		10" Fiber Reinforced Plastic Duct.....	37.37	12.71
23 31 16 16-0009	LF		12" Fiber Reinforced Plastic Duct.....	42.25	14.85
23 31 16 16-0010	LF		14" Fiber Reinforced Plastic Duct.....	47.97	16.24
23 31 16 16-0011	LF		16" Fiber Reinforced Plastic Duct.....	51.76	17.28
23 31 16 16-0012	LF		18" Fiber Reinforced Plastic Duct.....	63.66	19.40
23 31 16 16-0013	LF		20" Fiber Reinforced Plastic Duct.....	67.10	20.80
23 31 16 16-0014	LF		24" Fiber Reinforced Plastic Duct.....	81.59	22.19
23 31 16 16-0015	LF		30" Fiber Reinforced Plastic Duct.....	93.55	25.73
23 31 16 16-0016	LF		36" Fiber Reinforced Plastic Duct.....	108.45	31.02
23 31 16 16-0017	LF		42" Fiber Reinforced Plastic Duct.....	142.67	34.54
23 31 16 16-0018	LF		48" Fiber Reinforced Plastic Duct.....	159.87	38.81
23 31 16 16-0019	LF		54" Fiber Reinforced Plastic Duct.....	178.04	44.47
23 31 16 16-0020	LF		60" Fiber Reinforced Plastic Duct.....	202.54	51.89
23 31 16 16-0021	LF		66" Fiber Reinforced Plastic Duct.....	219.92	63.51
23 31 16 16-0022	LF		72" Fiber Reinforced Plastic Duct.....	268.41	77.62
23 31 16 16-0023 Fiber Reinforced Plastic Bell (23 31 16 16-0001)					
23 31 16 16-0024	EA		2" Fiber Reinforced Plastic Bell.....	46.00	15.81
23 31 16 16-0025	EA		3" Fiber Reinforced Plastic Bell.....	55.49	18.75
23 31 16 16-0026	EA		4" Fiber Reinforced Plastic Bell.....	63.90	22.05
23 31 16 16-0027	EA		6" Fiber Reinforced Plastic Bell.....	84.00	29.40
23 31 16 16-0028	EA		8" Fiber Reinforced Plastic Bell.....	102.30	36.75
23 31 16 16-0029	EA		10" Fiber Reinforced Plastic Bell.....	118.80	44.10
23 31 16 16-0030	EA		12" Fiber Reinforced Plastic Bell.....	147.32	54.76
23 31 16 16-0031	EA		14" Fiber Reinforced Plastic Bell.....	157.53	58.80
23 31 16 16-0032	EA		16" Fiber Reinforced Plastic Bell.....	170.68	62.84
23 31 16 16-0033	EA		18" Fiber Reinforced Plastic Bell.....	183.84	67.62
23 31 16 16-0034	EA		20" Fiber Reinforced Plastic Bell.....	201.00	73.50
23 31 16 16-0035	EA		24" Fiber Reinforced Plastic Bell.....	233.70	80.85
23 31 16 16-0036	EA		30" Fiber Reinforced Plastic Bell.....	271.80	88.20
23 31 16 16-0037	EA		36" Fiber Reinforced Plastic Bell.....	308.26	99.23
23 31 16 16-0038	EA		42" Fiber Reinforced Plastic Bell.....	344.71	110.25
23 31 16 16-0039	EA		48" Fiber Reinforced Plastic Bell.....	381.14	121.28
23 31 16 16-0040	EA		54" Fiber Reinforced Plastic Bell.....	474.00	147.00
23 31 16 16-0041	EA		60" Fiber Reinforced Plastic Bell.....	565.50	183.75
23 31 16 16-0042	EA		66" Fiber Reinforced Plastic Bell.....	678.57	220.50
23 31 16 16-0043	EA		72" Fiber Reinforced Plastic Bell.....	777.07	249.91
23 31 16 16-0044 Fiber Reinforced Plastic Flange (23 31 16 16-0001)					
23 31 16 16-0045	EA		2" Fiber Reinforced Plastic Flange.....	74.80	15.81
23 31 16 16-0046	EA		3" Fiber Reinforced Plastic Flange.....	86.09	18.75
23 31 16 16-0047	EA		4" Fiber Reinforced Plastic Flange.....	98.10	22.05
23 31 16 16-0048	EA		6" Fiber Reinforced Plastic Flange.....	127.20	29.40
23 31 16 16-0049	EA		8" Fiber Reinforced Plastic Flange.....	154.50	36.75
23 31 16 16-0050	EA		10" Fiber Reinforced Plastic Flange.....	181.80	44.10
23 31 16 16-0051	EA		12" Fiber Reinforced Plastic Flange.....	213.92	54.76
23 31 16 16-0052	EA		14" Fiber Reinforced Plastic Flange.....	238.53	58.80
23 31 16 16-0053	EA		16" Fiber Reinforced Plastic Flange.....	260.68	62.84
23 31 16 16-0054	EA		18" Fiber Reinforced Plastic Flange.....	277.44	67.62
23 31 16 16-0055	EA		20" Fiber Reinforced Plastic Flange.....	291.00	73.50
23 31 16 16-0056	EA		24" Fiber Reinforced Plastic Flange.....	341.70	80.85
23 31 16 16-0057	EA		30" Fiber Reinforced Plastic Flange.....	376.20	88.20
23 31 16 16-0058	EA		36" Fiber Reinforced Plastic Flange.....	464.86	99.23
23 31 16 16-0059	EA		42" Fiber Reinforced Plastic Flange.....	517.51	110.25
23 31 16 16-0060	EA		48" Fiber Reinforced Plastic Flange.....	588.14	121.28
23 31 16 16-0061	EA		54" Fiber Reinforced Plastic Flange.....	690.00	147.00
23 31 16 16-0062	EA		60" Fiber Reinforced Plastic Flange.....	822.90	183.75
23 31 16 16-0063	EA		66" Fiber Reinforced Plastic Flange.....	955.77	220.50
23 31 16 16-0064	EA		72" Fiber Reinforced Plastic Flange.....	1,093.87	249.91
23 31 16 16-0065 Fiber Reinforced Plastic 90 Degree Elbow (23 31 16 16-0001)					
23 31 16 16-0066	EA		2" Fiber Reinforced Plastic 90 Degree Elbow.....	122.91	38.07
23 31 16 16-0067	EA		3" Fiber Reinforced Plastic 90 Degree Elbow.....	144.26	45.49
23 31 16 16-0068	EA		4" Fiber Reinforced Plastic 90 Degree Elbow.....	167.40	52.92
23 31 16 16-0069	EA		6" Fiber Reinforced Plastic 90 Degree Elbow.....	216.60	70.56
23 31 16 16-0070	EA		8" Fiber Reinforced Plastic 90 Degree Elbow.....	265.80	88.20
23 31 16 16-0071	EA		10" Fiber Reinforced Plastic 90 Degree Elbow.....	315.02	105.84
23 31 16 16-0072	EA		12" Fiber Reinforced Plastic 90 Degree Elbow.....	386.75	131.64
23 31 16 16-0073	EA		14" Fiber Reinforced Plastic 90 Degree Elbow.....	439.28	139.35
23 31 16 16-0074	EA		16" Fiber Reinforced Plastic 90 Degree Elbow.....	500.67	151.34
23 31 16 16-0075	EA		18" Fiber Reinforced Plastic 90 Degree Elbow.....	598.11	162.29
23 31 16 16-0076	EA		20" Fiber Reinforced Plastic 90 Degree Elbow.....	690.05	176.41
23 31 16 16-0077	EA		24" Fiber Reinforced Plastic 90 Degree Elbow.....	800.45	194.05
23 31 16 16-0078	EA		30" Fiber Reinforced Plastic 90 Degree Elbow.....	1,081.83	211.69
23 31 16 16-0079	EA		36" Fiber Reinforced Plastic 90 Degree Elbow.....	1,386.96	238.14
23 31 16 16-0080	EA		42" Fiber Reinforced Plastic 90 Degree Elbow.....	1,827.08	264.68



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31 16 16-0081 EA 48" Fiber Reinforced Plastic 90 Degree Elbow	2,168.22	291.14
23 31 16 16-0082 EA 54" Fiber Reinforced Plastic 90 Degree Elbow	2,568.01	352.80
23 31 16 16-0083 EA 60" Fiber Reinforced Plastic 90 Degree Elbow	3,111.01	441.01
23 31 16 16-0084 EA 66" Fiber Reinforced Plastic 90 Degree Elbow	3,653.73	529.06
23 31 16 16-0085 EA 72" Fiber Reinforced Plastic 90 Degree Elbow	4,167.21	599.55
23 31 16 16-0086 Fiber Reinforced Plastic 45 Degree Elbow (23 31 16 16-0001)		
23 31 16 16-0087 EA 2" Fiber Reinforced Plastic 45 Degree Elbow	103.10	38.07
23 31 16 16-0088 EA 3" Fiber Reinforced Plastic 45 Degree Elbow	120.86	45.49
23 31 16 16-0089 EA 4" Fiber Reinforced Plastic 45 Degree Elbow	140.38	52.92
23 31 16 16-0090 EA 6" Fiber Reinforced Plastic 45 Degree Elbow	177.00	70.56
23 31 16 16-0091 EA 8" Fiber Reinforced Plastic 45 Degree Elbow	213.60	88.20
23 31 16 16-0092 EA 10" Fiber Reinforced Plastic 45 Degree Elbow	253.87	105.84
23 31 16 16-0093 EA 12" Fiber Reinforced Plastic 45 Degree Elbow	313.00	131.64
23 31 16 16-0094 EA 14" Fiber Reinforced Plastic 45 Degree Elbow	340.22	139.35
23 31 16 16-0095 EA 16" Fiber Reinforced Plastic 45 Degree Elbow	406.93	151.26
23 31 16 16-0096 EA 18" Fiber Reinforced Plastic 45 Degree Elbow	468.70	162.43
23 31 16 16-0097 EA 20" Fiber Reinforced Plastic 45 Degree Elbow	542.40	176.41
23 31 16 16-0098 EA 24" Fiber Reinforced Plastic 45 Degree Elbow	625.52	193.90
23 31 16 16-0099 EA 30" Fiber Reinforced Plastic 45 Degree Elbow	793.56	211.54
23 31 16 16-0100 EA 36" Fiber Reinforced Plastic 45 Degree Elbow	971.50	238.36
23 31 16 16-0101 EA 42" Fiber Reinforced Plastic 45 Degree Elbow	1,238.79	264.83
23 31 16 16-0102 EA 48" Fiber Reinforced Plastic 45 Degree Elbow	1,457.22	291.14
23 31 16 16-0103 EA 54" Fiber Reinforced Plastic 45 Degree Elbow	1,736.41	352.80
23 31 16 16-0104 EA 60" Fiber Reinforced Plastic 45 Degree Elbow	2,081.41	441.01
23 31 16 16-0105 EA 66" Fiber Reinforced Plastic 45 Degree Elbow	2,446.05	528.03
23 31 16 16-0106 EA 72" Fiber Reinforced Plastic 45 Degree Elbow	2,764.29	600.14
23 31 16 16-0107 Fiber Reinforced Plastic Tee (23 31 16 16-0001)		
23 31 16 16-0108 EA 2" Fiber Reinforced Plastic Tee	157.67	56.82
23 31 16 16-0109 EA 3" Fiber Reinforced Plastic Tee	186.07	68.43
23 31 16 16-0110 EA 4" Fiber Reinforced Plastic Tee	213.30	79.38
23 31 16 16-0111 EA 6" Fiber Reinforced Plastic Tee	275.42	105.84
23 31 16 16-0112 EA 8" Fiber Reinforced Plastic Tee	336.35	131.64
23 31 16 16-0113 EA 10" Fiber Reinforced Plastic Tee	400.77	159.50
23 31 16 16-0114 EA 12" Fiber Reinforced Plastic Tee	484.21	193.31
23 31 16 16-0115 EA 14" Fiber Reinforced Plastic Tee	528.67	209.19
23 31 16 16-0116 EA 16" Fiber Reinforced Plastic Tee	612.71	227.27
23 31 16 16-0117 EA 18" Fiber Reinforced Plastic Tee	693.72	243.44
23 31 16 16-0118 EA 20" Fiber Reinforced Plastic Tee	801.08	264.68
23 31 16 16-0119 EA 24" Fiber Reinforced Plastic Tee	917.22	291.14
23 31 16 16-0120 EA 30" Fiber Reinforced Plastic Tee	1,096.09	317.45
23 31 16 16-0121 EA 36" Fiber Reinforced Plastic Tee	1,315.64	357.37
23 31 16 16-0122 EA 42" Fiber Reinforced Plastic Tee	1,741.69	397.06
23 31 16 16-0123 EA 48" Fiber Reinforced Plastic Tee	2,078.02	436.82
23 31 16 16-0124 EA 54" Fiber Reinforced Plastic Tee	2,502.58	529.57
23 31 16 16-0125 EA 60" Fiber Reinforced Plastic Tee	2,992.96	661.81
23 31 16 16-0126 EA 66" Fiber Reinforced Plastic Tee	3,482.92	793.75
23 31 16 16-0127 EA 72" Fiber Reinforced Plastic Tee	3,930.03	900.03
23 31 16 16-0128 Fiber Reinforced Plastic Lateral Joint (23 31 16 16-0001)		
23 31 16 16-0129 EA 2" Fiber Reinforced Plastic Lateral Joint	130.66	56.82
23 31 16 16-0130 EA 3" Fiber Reinforced Plastic Lateral Joint	153.65	68.43
23 31 16 16-0131 EA 4" Fiber Reinforced Plastic Lateral Joint	175.52	79.38
23 31 16 16-0132 EA 6" Fiber Reinforced Plastic Lateral Joint	223.27	105.84
23 31 16 16-0133 EA 8" Fiber Reinforced Plastic Lateral Joint	269.80	131.64
23 31 16 16-0134 EA 10" Fiber Reinforced Plastic Lateral Joint	323.40	159.50
23 31 16 16-0135 EA 12" Fiber Reinforced Plastic Lateral Joint	387.17	193.45
23 31 16 16-0136 EA 14" Fiber Reinforced Plastic Lateral Joint	420.35	209.04
23 31 16 16-0137 EA 16" Fiber Reinforced Plastic Lateral Joint	461.68	227.34
23 31 16 16-0138 EA 18" Fiber Reinforced Plastic Lateral Joint	499.69	243.66
23 31 16 16-0139 EA 20" Fiber Reinforced Plastic Lateral Joint	545.79	264.83
23 31 16 16-0140 EA 24" Fiber Reinforced Plastic Lateral Joint	604.02	291.14
23 31 16 16-0141 EA 30" Fiber Reinforced Plastic Lateral Joint	667.39	317.30
23 31 16 16-0142 EA 36" Fiber Reinforced Plastic Lateral Joint	753.65	357.15
23 31 16 16-0143 EA 42" Fiber Reinforced Plastic Lateral Joint	842.18	397.27
23 31 16 16-0144 EA 48" Fiber Reinforced Plastic Lateral Joint	925.74	436.67
23 31 16 16-0145 EA 54" Fiber Reinforced Plastic Lateral Joint	1,105.05	528.03
23 31 16 16-0146 EA 60" Fiber Reinforced Plastic Lateral Joint	1,347.95	662.98
23 31 16 16-0147 EA 66" Fiber Reinforced Plastic Lateral Joint	1,629.87	794.33
23 31 16 16-0148 EA 72" Fiber Reinforced Plastic Lateral Joint	1,824.03	900.03
23 31 16 16-0149 Fiber Reinforced Plastic One Piece Reducer (23 31 16 16-0001)		
23 31 16 16-0150 EA 2" Fiber Reinforced Plastic One Piece Reducer	110.33	38.15
23 31 16 16-0151 EA 3" Fiber Reinforced Plastic One Piece Reducer	129.89	45.58
23 31 16 16-0152 EA 4" Fiber Reinforced Plastic One Piece Reducer	153.04	52.92

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 31 HVAC Ducts And Casings**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 31 16 16-0153 EA 6" Fiber Reinforced Plastic One Piece Reducer	196.80	70.56
23 31 16 16-0154 EA 8" Fiber Reinforced Plastic One Piece Reducer	237.00	88.20
23 31 16 16-0155 EA 10" Fiber Reinforced Plastic One Piece Reducer	285.11	106.28
23 31 16 16-0156 EA 12" Fiber Reinforced Plastic One Piece Reducer	338.20	131.64
23 31 16 16-0157 EA 14" Fiber Reinforced Plastic One Piece Reducer	361.82	139.35
23 31 16 16-0158 EA 16" Fiber Reinforced Plastic One Piece Reducer	399.73	151.26
23 31 16 16-0159 EA 18" Fiber Reinforced Plastic One Piece Reducer	439.90	162.43
23 31 16 16-0160 EA 20" Fiber Reinforced Plastic One Piece Reducer	492.00	176.41
23 31 16 16-0161 EA 24" Fiber Reinforced Plastic One Piece Reducer	561.39	194.27
23 31 16 16-0162 EA 30" Fiber Reinforced Plastic One Piece Reducer	630.57	212.05
23 31 16 16-0163 EA 36" Fiber Reinforced Plastic One Piece Reducer	714.10	238.36
23 31 16 16-0164 EA 42" Fiber Reinforced Plastic One Piece Reducer	797.79	264.83
23 31 16 16-0165 EA 48" Fiber Reinforced Plastic One Piece Reducer	899.22	291.14
23 31 16 16-0166 EA 54" Fiber Reinforced Plastic One Piece Reducer	1,065.01	352.80
23 31 16 16-0167 EA 60" Fiber Reinforced Plastic One Piece Reducer	1,269.61	441.01
23 31 16 16-0168 EA 66" Fiber Reinforced Plastic One Piece Reducer	1,420.05	528.03
23 31 16 16-0169 EA 72" Fiber Reinforced Plastic One Piece Reducer	1,594.29	600.14

23 31 16 16-0170 Fiber Reinforced Plastic Two Piece Reducer (23 31 16 16-0001)

23 31 16 16-0171 EA 2" Fiber Reinforced Plastic Two Piece Reducer	131.93	38.15
23 31 16 16-0172 EA 3" Fiber Reinforced Plastic Two Piece Reducer	144.29	45.58
23 31 16 16-0173 EA 4" Fiber Reinforced Plastic Two Piece Reducer	167.44	52.92
23 31 16 16-0174 EA 6" Fiber Reinforced Plastic Two Piece Reducer	216.60	70.56
23 31 16 16-0175 EA 8" Fiber Reinforced Plastic Two Piece Reducer	265.80	88.20
23 31 16 16-0176 EA 10" Fiber Reinforced Plastic Two Piece Reducer	315.71	106.28
23 31 16 16-0177 EA 12" Fiber Reinforced Plastic Two Piece Reducer	377.80	131.64
23 31 16 16-0178 EA 14" Fiber Reinforced Plastic Two Piece Reducer	412.22	139.35
23 31 16 16-0179 EA 16" Fiber Reinforced Plastic Two Piece Reducer	450.13	151.26
23 31 16 16-0180 EA 18" Fiber Reinforced Plastic Two Piece Reducer	508.30	162.43
23 31 16 16-0181 EA 20" Fiber Reinforced Plastic Two Piece Reducer	643.20	176.41
23 31 16 16-0182 EA 24" Fiber Reinforced Plastic Two Piece Reducer	782.79	194.27
23 31 16 16-0183 EA 30" Fiber Reinforced Plastic Two Piece Reducer	839.37	212.05
23 31 16 16-0184 EA 36" Fiber Reinforced Plastic Two Piece Reducer	955.30	238.36
23 31 16 16-0185 EA 42" Fiber Reinforced Plastic Two Piece Reducer	1,035.39	264.83
23 31 16 16-0186 EA 48" Fiber Reinforced Plastic Two Piece Reducer	1,133.22	291.14
23 31 16 16-0187 EA 54" Fiber Reinforced Plastic Two Piece Reducer	1,254.01	352.80
23 31 16 16-0188 EA 60" Fiber Reinforced Plastic Two Piece Reducer	1,447.81	441.01
23 31 16 16-0189 EA 66" Fiber Reinforced Plastic Two Piece Reducer	1,618.05	528.03
23 31 16 16-0190 EA 72" Fiber Reinforced Plastic Two Piece Reducer	1,774.29	600.14

23 31 16 16-0191 Fiber Reinforced Plastic Butterfly Dampers (23 31 16 16-0001)

23 31 16 16-0192 EA 2" Fiber Reinforced Plastic Damper	234.50	38.07
23 31 16 16-0193 EA 3" Fiber Reinforced Plastic Damper	264.86	45.49
23 31 16 16-0194 EA 4" Fiber Reinforced Plastic Damper	295.20	52.92
23 31 16 16-0195 EA 6" Fiber Reinforced Plastic Damper	351.60	70.56
23 31 16 16-0196 EA 8" Fiber Reinforced Plastic Damper	417.00	88.20
23 31 16 16-0197 EA 10" Fiber Reinforced Plastic Damper	473.42	105.84
23 31 16 16-0198 EA 12" Fiber Reinforced Plastic Damper	543.35	131.64
23 31 16 16-0199 EA 14" Fiber Reinforced Plastic Damper	601.28	139.35
23 31 16 16-0200 EA 16" Fiber Reinforced Plastic Damper	666.27	151.34
23 31 16 16-0201 EA 18" Fiber Reinforced Plastic Damper	729.51	162.29
23 31 16 16-0202 EA 20" Fiber Reinforced Plastic Damper	780.05	176.41
23 31 16 16-0203 EA 24" Fiber Reinforced Plastic Damper	881.45	194.05
23 31 16 16-0204 EA 30" Fiber Reinforced Plastic Damper	1,018.83	211.69
23 31 16 16-0205 EA 36" Fiber Reinforced Plastic Damper	1,170.96	238.14
23 31 16 16-0206 EA 42" Fiber Reinforced Plastic Damper	1,341.08	264.68
23 31 16 16-0207 EA 48" Fiber Reinforced Plastic Damper	1,493.22	291.14
23 31 16 16-0208 EA 54" Fiber Reinforced Plastic Damper	1,758.01	352.80
23 31 16 16-0209 EA 60" Fiber Reinforced Plastic Damper	2,067.01	441.01
23 31 16 16-0210 EA 66" Fiber Reinforced Plastic Damper	2,357.73	529.06
23 31 16 16-0211 EA 72" Fiber Reinforced Plastic Damper	2,709.21	599.55

23 33 Air Duct Accessories (23 30)**23 33 13 Dampers (23 33)****23 33 13 13 Volume-Control Dampers (23 33 13)****23 33 13 13-0001 Radial Opposed Blade Damper Steel Construction (23 33 13 13)**

23 33 13 13-0002 EA 6" Diameter Radial Opposed Blade Damper Round, Steel Construction, Manual Operated	38.89	6.44
For Stainless Steel, Add	18.08	
For Parallel Blade Damper, Add	5.56	
23 33 13 13-0003 EA 7" Diameter Radial Opposed Blade Damper Round, Steel Construction, Manual Operated	43.10	7.24
For Stainless Steel, Add	18.36	
For Parallel Blade Damper, Add	5.65	
23 33 13 13-0004 EA 8" Diameter Radial Opposed Blade Damper Round, Steel Construction, Manual Operated	47.95	8.05
For Stainless Steel, Add	18.54	
For Parallel Blade Damper, Add	5.70	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 33 13 13-0005 EA 10" Diameter Radial Opposed Blade Damper Round, Steel Construction, Manual Operated	52.30	9.66
<i>For Stainless Steel, Add</i>	19.71	
<i>For Parallel Blade Damper, Add</i>	6.06	
23 33 13 13-0006 EA 12" Diameter Radial Opposed Blade Damper Round, Steel Construction, Manual Operated	57.43	10.46
<i>For Stainless Steel, Add</i>	20.87	
<i>For Parallel Blade Damper, Add</i>	6.42	
23 33 13 13-0007 EA 14" Diameter Radial Opposed Blade Damper Round, Steel Construction, Manual Operated	65.78	11.27
<i>For Stainless Steel, Add</i>	26.66	
<i>For Parallel Blade Damper, Add</i>	8.20	
23 33 13 13-0008 EA 15" Diameter Radial Opposed Blade Damper Round, Steel Construction, Manual Operated	72.25	12.08
<i>For Stainless Steel, Add</i>	28.98	
<i>For Parallel Blade Damper, Add</i>	8.92	
23 33 13 13-0009 EA 16" Diameter Radial Opposed Blade Damper Round, Steel Construction, Manual Operated	76.83	13.68
<i>For Stainless Steel, Add</i>	30.13	
<i>For Parallel Blade Damper, Add</i>	9.27	
23 33 13 13-0010 EA 18" Diameter Radial Opposed Blade Damper Round, Steel Construction, Manual Operated	83.79	14.48
<i>For Stainless Steel, Add</i>	33.61	
<i>For Parallel Blade Damper, Add</i>	10.34	
23 33 13 13-0011 EA 20" Diameter Radial Opposed Blade Damper Round, Steel Construction, Manual Operated	95.08	16.09
<i>For Stainless Steel, Add</i>	41.73	
<i>For Parallel Blade Damper, Add</i>	12.84	
23 33 13 13-0012 EA 24" Diameter Radial Opposed Blade Damper Round, Steel Construction, Manual Operated	102.40	16.09
<i>For Stainless Steel, Add</i>	47.52	
<i>For Parallel Blade Damper, Add</i>	14.62	
23 33 13 13-0013 Rectangular Opposed Blade Damper <small>(23 33 13 13)</small>		
23 33 13 13-0014 EA 6" x 6" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	55.55	8.93
<i>For Stainless Steel, Add</i>	37.38	
<i>For Parallel Blade Damper, Add</i>	11.50	
23 33 13 13-0015 EA 8" x 6" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	58.80	9.33
<i>For Stainless Steel, Add</i>	40.03	
<i>For Parallel Blade Damper, Add</i>	12.32	
23 33 13 13-0016 EA 8" x 8" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	61.01	9.41
<i>For Stainless Steel, Add</i>	42.69	
<i>For Parallel Blade Damper, Add</i>	13.14	
23 33 13 13-0017 EA 10" x 6" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	61.01	9.41
<i>For Stainless Steel, Add</i>	42.69	
<i>For Parallel Blade Damper, Add</i>	13.14	
23 33 13 13-0018 EA 10" x 8" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	63.88	9.66
<i>For Stainless Steel, Add</i>	45.37	
<i>For Parallel Blade Damper, Add</i>	13.96	
23 33 13 13-0019 EA 10" x 10" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	71.19	10.70
<i>For Stainless Steel, Add</i>	50.69	
<i>For Parallel Blade Damper, Add</i>	15.60	
23 33 13 13-0020 EA 12" x 6" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	63.88	9.66
<i>For Stainless Steel, Add</i>	45.37	
<i>For Parallel Blade Damper, Add</i>	13.96	
23 33 13 13-0021 EA 12" x 8" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	69.58	10.22
<i>For Stainless Steel, Add</i>	50.69	
<i>For Parallel Blade Damper, Add</i>	15.60	
23 33 13 13-0022 EA 12" x 10" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	73.26	10.70
<i>For Stainless Steel, Add</i>	53.38	
<i>For Parallel Blade Damper, Add</i>	16.42	
23 33 13 13-0023 EA 12" x 12" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	79.35	12.07
<i>For Stainless Steel, Add</i>	56.06	
<i>For Parallel Blade Damper, Add</i>	17.25	
23 33 13 13-0024 EA 14" x 6" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	68.57	10.22
<i>For Stainless Steel, Add</i>	49.37	
<i>For Parallel Blade Damper, Add</i>	15.19	
23 33 13 13-0025 EA 14" x 8" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	73.26	10.70
<i>For Stainless Steel, Add</i>	53.38	
<i>For Parallel Blade Damper, Add</i>	16.42	
23 33 13 13-0026 EA 14" x 10" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	76.93	11.27
<i>For Stainless Steel, Add</i>	56.06	
<i>For Parallel Blade Damper, Add</i>	17.25	
23 33 13 13-0027 EA 14" x 12" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	81.40	12.07
<i>For Stainless Steel, Add</i>	58.72	
<i>For Parallel Blade Damper, Add</i>	18.07	
23 33 13 13-0028 EA 14" x 14" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	90.54	13.44
<i>For Stainless Steel, Add</i>	65.39	
<i>For Parallel Blade Damper, Add</i>	20.12	
23 33 13 13-0029 EA 16" x 6" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	73.26	10.70
<i>For Stainless Steel, Add</i>	53.38	
<i>For Parallel Blade Damper, Add</i>	16.42	
23 33 13 13-0030 EA 16" x 8" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	77.74	11.51
<i>For Stainless Steel, Add</i>	56.06	
<i>For Parallel Blade Damper, Add</i>	17.25	
23 33 13 13-0031 EA 16" x 10" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	83.01	12.64
<i>For Stainless Steel, Add</i>	58.72	
<i>For Parallel Blade Damper, Add</i>	18.07	
23 33 13 13-0032 EA 16" x 12" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	87.46	13.44
<i>For Stainless Steel, Add</i>	61.39	
<i>For Parallel Blade Damper, Add</i>	18.89	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 33 Air Duct Accessories**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 33 13 13-0033	EA		16" x 14" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	96.64	14.73
			<i>For Stainless Steel, Add</i>	68.08	
			<i>For Parallel Blade Damper, Add</i>	20.95	
23 33 13 13-0034	EA		16" x 16" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	105.79	16.10
			<i>For Stainless Steel, Add</i>	74.74	
			<i>For Parallel Blade Damper, Add</i>	23.00	
23 33 13 13-0035	EA		18" x 6" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	76.93	11.27
			<i>For Stainless Steel, Add</i>	56.06	
			<i>For Parallel Blade Damper, Add</i>	17.25	
23 33 13 13-0036	EA		18" x 8" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	82.42	12.07
			<i>For Stainless Steel, Add</i>	60.05	
			<i>For Parallel Blade Damper, Add</i>	18.48	
23 33 13 13-0037	EA		18" x 10" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	89.52	13.44
			<i>For Stainless Steel, Add</i>	64.06	
			<i>For Parallel Blade Damper, Add</i>	19.71	
23 33 13 13-0038	EA		18" x 12" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	98.69	14.73
			<i>For Stainless Steel, Add</i>	70.75	
			<i>For Parallel Blade Damper, Add</i>	21.77	
23 33 13 13-0039	EA		18" x 14" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	106.82	16.10
			<i>For Stainless Steel, Add</i>	76.08	
			<i>For Parallel Blade Damper, Add</i>	23.41	
23 33 13 13-0040	EA		18" x 16" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	115.97	17.39
			<i>For Stainless Steel, Add</i>	82.73	
			<i>For Parallel Blade Damper, Add</i>	25.46	
23 33 13 13-0041	EA		18" x 18" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	123.07	18.76
			<i>For Stainless Steel, Add</i>	86.75	
			<i>For Parallel Blade Damper, Add</i>	26.69	
23 33 13 13-0042	EA		20" x 6" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	81.40	12.07
			<i>For Stainless Steel, Add</i>	58.72	
			<i>For Parallel Blade Damper, Add</i>	18.07	
23 33 13 13-0043	EA		20" x 8" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	89.51	13.44
			<i>For Stainless Steel, Add</i>	64.05	
			<i>For Parallel Blade Damper, Add</i>	19.71	
23 33 13 13-0044	EA		20" x 10" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	97.65	14.73
			<i>For Stainless Steel, Add</i>	69.39	
			<i>For Parallel Blade Damper, Add</i>	21.35	
23 33 13 13-0045	EA		20" x 12" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	109.90	16.10
			<i>For Stainless Steel, Add</i>	80.08	
			<i>For Parallel Blade Damper, Add</i>	24.64	
23 33 13 13-0046	EA		20" x 14" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	117.02	17.39
			<i>For Stainless Steel, Add</i>	84.10	
			<i>For Parallel Blade Damper, Add</i>	25.88	
23 33 13 13-0047	EA		20" x 16" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	124.11	18.76
			<i>For Stainless Steel, Add</i>	88.10	
			<i>For Parallel Blade Damper, Add</i>	27.11	
23 33 13 13-0048	EA		20" x 18" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	132.23	20.13
			<i>For Stainless Steel, Add</i>	93.42	
			<i>For Parallel Blade Damper, Add</i>	28.74	
23 33 13 13-0049	EA		20" x 20" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	140.36	21.42
			<i>For Stainless Steel, Add</i>	98.75	
			<i>For Parallel Blade Damper, Add</i>	30.38	
23 33 13 13-0050	EA		24" x 6" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	91.57	13.44
			<i>For Stainless Steel, Add</i>	66.73	
			<i>For Parallel Blade Damper, Add</i>	20.53	
23 33 13 13-0051	EA		24" x 8" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	101.76	14.73
			<i>For Stainless Steel, Add</i>	74.74	
			<i>For Parallel Blade Damper, Add</i>	23.00	
23 33 13 13-0052	EA		24" x 10" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	109.90	16.10
			<i>For Stainless Steel, Add</i>	80.08	
			<i>For Parallel Blade Damper, Add</i>	24.64	
23 33 13 13-0053	EA		24" x 12" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	120.10	17.39
			<i>For Stainless Steel, Add</i>	88.10	
			<i>For Parallel Blade Damper, Add</i>	27.11	
23 33 13 13-0054	EA		24" x 14" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	127.18	18.76
			<i>For Stainless Steel, Add</i>	92.09	
			<i>For Parallel Blade Damper, Add</i>	28.34	
23 33 13 13-0055	EA		24" x 16" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	134.29	20.13
			<i>For Stainless Steel, Add</i>	96.10	
			<i>For Parallel Blade Damper, Add</i>	29.57	
23 33 13 13-0056	EA		24" x 18" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	144.47	21.42
			<i>For Stainless Steel, Add</i>	104.09	
			<i>For Parallel Blade Damper, Add</i>	32.03	
23 33 13 13-0057	EA		24" x 20" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	158.66	24.14
			<i>For Stainless Steel, Add</i>	112.09	
			<i>For Parallel Blade Damper, Add</i>	34.49	
23 33 13 13-0058	EA		24" x 24" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	174.96	26.80
			<i>For Stainless Steel, Add</i>	122.80	
			<i>For Parallel Blade Damper, Add</i>	37.78	
23 33 13 13-0059	EA		28" x 6" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	101.76	14.73
			<i>For Stainless Steel, Add</i>	74.74	
			<i>For Parallel Blade Damper, Add</i>	23.00	
23 33 13 13-0060	EA		28" x 8" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	109.90	16.10
			<i>For Stainless Steel, Add</i>	80.08	
			<i>For Parallel Blade Damper, Add</i>	24.64	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 33 13 13-0061 EA 28" x 10" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	120.10	17.39
<i>For Stainless Steel, Add</i>	88.10	
<i>For Parallel Blade Damper, Add</i>	27.11	
23 33 13 13-0062 EA 28" x 12" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	128.20	18.76
<i>For Stainless Steel, Add</i>	93.42	
<i>For Parallel Blade Damper, Add</i>	28.74	
23 33 13 13-0063 EA 28" x 14" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	137.36	20.13
<i>For Stainless Steel, Add</i>	100.09	
<i>For Parallel Blade Damper, Add</i>	30.80	
23 33 13 13-0064 EA 28" x 16" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	146.51	21.42
<i>For Stainless Steel, Add</i>	106.74	
<i>For Parallel Blade Damper, Add</i>	32.84	
23 33 13 13-0065 EA 28" x 18" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	160.72	24.14
<i>For Stainless Steel, Add</i>	114.76	
<i>For Parallel Blade Damper, Add</i>	35.31	
23 33 13 13-0066 EA 28" x 20" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	174.96	26.80
<i>For Stainless Steel, Add</i>	122.80	
<i>For Parallel Blade Damper, Add</i>	37.78	
23 33 13 13-0067 EA 28" x 24" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	191.29	28.17
<i>For Stainless Steel, Add</i>	138.79	
<i>For Parallel Blade Damper, Add</i>	42.70	
23 33 13 13-0068 EA 28" x 28" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	209.59	30.83
<i>For Stainless Steel, Add</i>	152.13	
<i>For Parallel Blade Damper, Add</i>	46.81	
23 33 13 13-0069 EA 32" x 6" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	116.07	16.10
<i>For Stainless Steel, Add</i>	88.10	
<i>For Parallel Blade Damper, Add</i>	27.11	
23 33 13 13-0070 EA 32" x 8" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	122.14	17.39
<i>For Stainless Steel, Add</i>	90.75	
<i>For Parallel Blade Damper, Add</i>	27.92	
23 33 13 13-0071 EA 32" x 10" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	128.20	18.76
<i>For Stainless Steel, Add</i>	93.42	
<i>For Parallel Blade Damper, Add</i>	28.74	
23 33 13 13-0072 EA 32" x 12" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	136.33	20.13
<i>For Stainless Steel, Add</i>	98.75	
<i>For Parallel Blade Damper, Add</i>	30.38	
23 33 13 13-0073 EA 32" x 14" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	146.91	21.42
<i>For Stainless Steel, Add</i>	107.26	
<i>For Parallel Blade Damper, Add</i>	33.00	
23 33 13 13-0074 EA 32" x 16" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	160.72	24.14
<i>For Stainless Steel, Add</i>	114.76	
<i>For Parallel Blade Damper, Add</i>	35.31	
23 33 13 13-0075 EA 32" x 18" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	177.01	26.80
<i>For Stainless Steel, Add</i>	125.46	
<i>For Parallel Blade Damper, Add</i>	38.60	
23 33 13 13-0076 EA 32" x 20" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	193.26	29.46
<i>For Stainless Steel, Add</i>	136.14	
<i>For Parallel Blade Damper, Add</i>	41.89	
23 33 13 13-0077 EA 32" x 24" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	209.59	30.83
<i>For Stainless Steel, Add</i>	152.13	
<i>For Parallel Blade Damper, Add</i>	46.81	
23 33 13 13-0078 EA 32" x 28" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	230.42	33.00
<i>For Stainless Steel, Add</i>	170.83	
<i>For Parallel Blade Damper, Add</i>	52.56	
23 33 13 13-0079 EA 32" x 32" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	252.48	34.86
<i>For Stainless Steel, Add</i>	192.19	
<i>For Parallel Blade Damper, Add</i>	59.14	
23 33 13 13-0080 EA 36" x 6" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	126.25	17.39
<i>For Stainless Steel, Add</i>	96.10	
<i>For Parallel Blade Damper, Add</i>	29.57	
23 33 13 13-0081 EA 36" x 8" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	134.36	18.76
<i>For Stainless Steel, Add</i>	101.43	
<i>For Parallel Blade Damper, Add</i>	31.21	
23 33 13 13-0082 EA 36" x 10" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	142.48	20.13
<i>For Stainless Steel, Add</i>	106.74	
<i>For Parallel Blade Damper, Add</i>	32.84	
23 33 13 13-0083 EA 36" x 12" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	152.68	21.42
<i>For Stainless Steel, Add</i>	114.76	
<i>For Parallel Blade Damper, Add</i>	35.31	
23 33 13 13-0084 EA 36" x 14" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	163.82	24.14
<i>For Stainless Steel, Add</i>	118.79	
<i>For Parallel Blade Damper, Add</i>	36.55	
23 33 13 13-0085 EA 36" x 16" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	170.93	25.43
<i>For Stainless Steel, Add</i>	122.80	
<i>For Parallel Blade Damper, Add</i>	37.78	
23 33 13 13-0086 EA 36" x 18" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	193.26	29.46
<i>For Stainless Steel, Add</i>	136.14	
<i>For Parallel Blade Damper, Add</i>	41.89	
23 33 13 13-0087 EA 36" x 20" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	211.57	32.20
<i>For Stainless Steel, Add</i>	149.46	
<i>For Parallel Blade Damper, Add</i>	45.99	
23 33 13 13-0088 EA 36" x 24" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	227.12	33.25
<i>For Stainless Steel, Add</i>	165.49	
<i>For Parallel Blade Damper, Add</i>	50.92	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 33 Air Duct Accessories**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 33 13 13-0089 EA 36" x 28" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	250.77	35.66
For Stainless Steel, Add	186.82	
For Parallel Blade Damper, Add	57.48	
23 33 13 13-0090 EA 36" x 32" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	270.79	37.52
For Stainless Steel, Add	205.52	
For Parallel Blade Damper, Add	63.24	
23 33 13 13-0091 EA 36" x 36" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	291.25	38.88
For Stainless Steel, Add	226.88	
For Parallel Blade Damper, Add	69.81	
23 33 13 13-0092 EA 40" x 6" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	132.30	20.13
For Stainless Steel, Add	98.75	
For Parallel Blade Damper, Add	30.38	
23 33 13 13-0093 EA 40" x 8" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	144.54	21.42
For Stainless Steel, Add	109.42	
For Parallel Blade Damper, Add	33.67	
23 33 13 13-0094 EA 40" x 10" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	150.62	22.79
For Stainless Steel, Add	112.09	
For Parallel Blade Damper, Add	34.49	
23 33 13 13-0095 EA 40" x 12" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	156.71	24.14
For Stainless Steel, Add	114.76	
For Parallel Blade Damper, Add	35.31	
23 33 13 13-0096 EA 40" x 14" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	171.94	25.43
For Stainless Steel, Add	124.11	
For Parallel Blade Damper, Add	38.19	
23 33 13 13-0097 EA 40" x 16" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	183.17	26.80
For Stainless Steel, Add	133.47	
For Parallel Blade Damper, Add	41.07	
23 33 13 13-0098 EA 40" x 18" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	203.44	30.83
For Stainless Steel, Add	144.13	
For Parallel Blade Damper, Add	44.35	
23 33 13 13-0099 EA 40" x 20" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	219.72	33.49
For Stainless Steel, Add	154.82	
For Parallel Blade Damper, Add	47.64	
23 33 13 13-0100 EA 40" x 24" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	238.47	35.66
For Stainless Steel, Add	170.83	
For Parallel Blade Damper, Add	52.56	
23 33 13 13-0101 EA 40" x 28" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	266.69	37.52
For Stainless Steel, Add	200.19	
For Parallel Blade Damper, Add	61.60	
23 33 13 13-0102 EA 40" x 32" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	285.42	39.68
For Stainless Steel, Add	216.18	
For Parallel Blade Damper, Add	66.52	
23 33 13 13-0103 EA 40" x 36" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	311.24	40.73
For Stainless Steel, Add	245.56	
For Parallel Blade Damper, Add	75.56	
23 33 13 13-0104 EA 40" x 40" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	338.23	42.90
For Stainless Steel, Add	272.26	
For Parallel Blade Damper, Add	83.77	
23 33 13 13-0105 EA 44" x 6" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	140.44	20.13
For Stainless Steel, Add	104.09	
For Parallel Blade Damper, Add	32.03	
23 33 13 13-0106 EA 44" x 8" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	152.68	21.42
For Stainless Steel, Add	114.76	
For Parallel Blade Damper, Add	35.31	
23 33 13 13-0107 EA 44" x 10" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	162.89	22.79
For Stainless Steel, Add	122.80	
For Parallel Blade Damper, Add	37.78	
23 33 13 13-0108 EA 44" x 12" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	168.95	24.14
For Stainless Steel, Add	125.46	
For Parallel Blade Damper, Add	38.60	
23 33 13 13-0109 EA 44" x 14" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	181.19	25.43
For Stainless Steel, Add	136.14	
For Parallel Blade Damper, Add	41.89	
23 33 13 13-0110 EA 44" x 16" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	193.43	26.80
For Stainless Steel, Add	146.81	
For Parallel Blade Damper, Add	45.17	
23 33 13 13-0111 EA 44" x 18" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	219.80	32.20
For Stainless Steel, Add	160.16	
For Parallel Blade Damper, Add	49.28	
23 33 13 13-0112 EA 44" x 20" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	238.09	34.86
For Stainless Steel, Add	173.49	
For Parallel Blade Damper, Add	53.38	
23 33 13 13-0113 EA 44" x 24" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	266.69	37.52
For Stainless Steel, Add	200.19	
For Parallel Blade Damper, Add	61.60	
23 33 13 13-0114 EA 44" x 28" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	293.21	40.24
For Stainless Steel, Add	224.21	
For Parallel Blade Damper, Add	68.99	
23 33 13 13-0115 EA 44" x 32" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	321.79	42.90
For Stainless Steel, Add	250.89	
For Parallel Blade Damper, Add	77.20	
23 33 13 13-0116 EA 44" x 36" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	344.29	44.19
For Stainless Steel, Add	274.91	
For Parallel Blade Damper, Add	84.59	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 33 13 13-0117 EA 44" x 40" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	366.79	45.56
For Stainless Steel, Add	298.94	
For Parallel Blade Damper, Add	91.98	
23 33 13 13-0118 EA 44" x 44" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	389.31	46.93
For Stainless Steel, Add	322.97	
For Parallel Blade Damper, Add	99.38	
23 33 13 13-0119 EA 48" x 6" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	150.62	21.42
For Stainless Steel, Add	112.09	
For Parallel Blade Damper, Add	34.49	
23 33 13 13-0120 EA 48" x 8" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	162.89	22.79
For Stainless Steel, Add	122.80	
For Parallel Blade Damper, Add	37.78	
23 33 13 13-0121 EA 48" x 10" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	168.95	24.14
For Stainless Steel, Add	125.46	
For Parallel Blade Damper, Add	38.60	
23 33 13 13-0122 EA 48" x 12" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	183.17	26.80
For Stainless Steel, Add	133.47	
For Parallel Blade Damper, Add	41.07	
23 33 13 13-0123 EA 48" x 14" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	199.41	29.46
For Stainless Steel, Add	144.13	
For Parallel Blade Damper, Add	44.35	
23 33 13 13-0124 EA 48" x 16" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	215.69	32.20
For Stainless Steel, Add	154.82	
For Parallel Blade Damper, Add	47.64	
23 33 13 13-0125 EA 48" x 18" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	236.05	34.86
For Stainless Steel, Add	170.83	
For Parallel Blade Damper, Add	52.56	
23 33 13 13-0126 EA 48" x 20" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	256.41	37.52
For Stainless Steel, Add	186.82	
For Parallel Blade Damper, Add	57.48	
23 33 13 13-0127 EA 48" x 24" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	282.94	40.24
For Stainless Steel, Add	210.86	
For Parallel Blade Damper, Add	64.88	
23 33 13 13-0128 EA 48" x 28" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	313.58	42.90
For Stainless Steel, Add	240.21	
For Parallel Blade Damper, Add	73.91	
23 33 13 13-0129 EA 48" x 32" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	336.10	44.19
For Stainless Steel, Add	264.26	
For Parallel Blade Damper, Add	81.31	
23 33 13 13-0130 EA 48" x 36" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	364.74	45.56
For Stainless Steel, Add	296.27	
For Parallel Blade Damper, Add	91.16	
23 33 13 13-0131 EA 48" x 40" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	391.28	48.22
For Stainless Steel, Add	320.29	
For Parallel Blade Damper, Add	98.55	
23 33 13 13-0132 EA 48" x 44" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	419.94	49.59
For Stainless Steel, Add	352.33	
For Parallel Blade Damper, Add	108.41	
23 33 13 13-0133 EA 48" x 48" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	448.44	53.62
For Stainless Steel, Add	373.67	
For Parallel Blade Damper, Add	114.98	
23 33 13 13-0134 EA 52" x 6" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	160.83	22.79
For Stainless Steel, Add	120.12	
For Parallel Blade Damper, Add	36.96	
23 33 13 13-0135 EA 52" x 8" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	173.05	24.14
For Stainless Steel, Add	130.79	
For Parallel Blade Damper, Add	40.24	
23 33 13 13-0136 EA 52" x 10" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	189.32	26.80
For Stainless Steel, Add	141.47	
For Parallel Blade Damper, Add	43.53	
23 33 13 13-0137 EA 52" x 12" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	199.41	29.46
For Stainless Steel, Add	144.13	
For Parallel Blade Damper, Add	44.35	
23 33 13 13-0138 EA 52" x 14" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	216.72	32.20
For Stainless Steel, Add	156.16	
For Parallel Blade Damper, Add	48.05	
23 33 13 13-0139 EA 52" x 16" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	234.00	34.86
For Stainless Steel, Add	168.17	
For Parallel Blade Damper, Add	51.74	
23 33 13 13-0140 EA 52" x 18" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	254.37	37.52
For Stainless Steel, Add	184.17	
For Parallel Blade Damper, Add	56.67	
23 33 13 13-0141 EA 52" x 20" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	274.73	40.24
For Stainless Steel, Add	200.19	
For Parallel Blade Damper, Add	61.60	
23 33 13 13-0142 EA 52" x 24" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	301.27	42.90
For Stainless Steel, Add	224.21	
For Parallel Blade Damper, Add	68.99	
23 33 13 13-0143 EA 52" x 28" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	333.94	45.56
For Stainless Steel, Add	256.23	
For Parallel Blade Damper, Add	78.84	
23 33 13 13-0144 EA 52" x 32" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	358.49	46.93
For Stainless Steel, Add	282.91	
For Parallel Blade Damper, Add	87.05	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 33 Air Duct Accessories**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 33 13	13-0145	EA	52" x 36" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	389.23	48.22
			<i>For Stainless Steel, Add</i>	317.63	
			<i>For Parallel Blade Damper, Add</i>	97.73	
23 33 13	13-0146	EA	52" x 40" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	421.89	50.96
			<i>For Stainless Steel, Add</i>	349.64	
			<i>For Parallel Blade Damper, Add</i>	107.58	
23 33 13	13-0147	EA	52" x 44" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	448.44	53.62
			<i>For Stainless Steel, Add</i>	373.67	
			<i>For Parallel Blade Damper, Add</i>	114.98	
23 33 13	13-0148	EA	52" x 48" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	485.15	57.63
			<i>For Stainless Steel, Add</i>	405.70	
			<i>For Parallel Blade Damper, Add</i>	124.83	
23 33 13	13-0149	EA	52" x 52" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	513.73	60.29
			<i>For Stainless Steel, Add</i>	432.41	
			<i>For Parallel Blade Damper, Add</i>	133.05	
23 33 13	13-0150	EA	56" x 6" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	168.95	24.14
			<i>For Stainless Steel, Add</i>	125.46	
			<i>For Parallel Blade Damper, Add</i>	38.60	
23 33 13	13-0151	EA	56" x 8" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	187.26	26.80
			<i>For Stainless Steel, Add</i>	138.79	
			<i>For Parallel Blade Damper, Add</i>	42.70	
23 33 13	13-0152	EA	56" x 10" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	201.47	29.46
			<i>For Stainless Steel, Add</i>	146.81	
			<i>For Parallel Blade Damper, Add</i>	45.17	
23 33 13	13-0153	EA	56" x 12" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	211.57	32.20
			<i>For Stainless Steel, Add</i>	149.46	
			<i>For Parallel Blade Damper, Add</i>	45.99	
23 33 13	13-0154	EA	56" x 14" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	230.91	34.86
			<i>For Stainless Steel, Add</i>	164.15	
			<i>For Parallel Blade Damper, Add</i>	50.51	
23 33 13	13-0155	EA	56" x 16" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	250.26	37.52
			<i>For Stainless Steel, Add</i>	178.83	
			<i>For Parallel Blade Damper, Add</i>	55.02	
23 33 13	13-0156	EA	56" x 18" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	269.59	40.24
			<i>For Stainless Steel, Add</i>	193.51	
			<i>For Parallel Blade Damper, Add</i>	59.54	
23 33 13	13-0157	EA	56" x 20" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	288.94	42.90
			<i>For Stainless Steel, Add</i>	208.18	
			<i>For Parallel Blade Damper, Add</i>	64.06	
23 33 13	13-0158	EA	56" x 24" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	321.62	45.56
			<i>For Stainless Steel, Add</i>	240.21	
			<i>For Parallel Blade Damper, Add</i>	73.91	
23 33 13	13-0159	EA	56" x 28" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	350.30	46.93
			<i>For Stainless Steel, Add</i>	272.26	
			<i>For Parallel Blade Damper, Add</i>	83.77	
23 33 13	13-0160	EA	56" x 32" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	376.91	48.22
			<i>For Stainless Steel, Add</i>	301.61	
			<i>For Parallel Blade Damper, Add</i>	92.80	
23 33 13	13-0161	EA	56" x 36" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	413.69	50.96
			<i>For Stainless Steel, Add</i>	338.98	
			<i>For Parallel Blade Damper, Add</i>	104.30	
23 33 13	13-0162	EA	56" x 40" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	446.39	53.62
			<i>For Stainless Steel, Add</i>	371.01	
			<i>For Parallel Blade Damper, Add</i>	114.16	
23 33 13	13-0163	EA	56" x 44" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	481.12	56.26
			<i>For Stainless Steel, Add</i>	405.70	
			<i>For Parallel Blade Damper, Add</i>	124.83	
23 33 13	13-0164	EA	56" x 48" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	509.72	59.00
			<i>For Stainless Steel, Add</i>	432.41	
			<i>For Parallel Blade Damper, Add</i>	133.05	
23 33 13	13-0165	EA	56" x 52" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	544.45	61.66
			<i>For Stainless Steel, Add</i>	467.10	
			<i>For Parallel Blade Damper, Add</i>	143.72	
23 33 13	13-0166	EA	56" x 56" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	579.20	64.32
			<i>For Stainless Steel, Add</i>	501.80	
			<i>For Parallel Blade Damper, Add</i>	154.40	
23 33 13	13-0167	EA	60" x 6" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	183.17	26.80
			<i>For Stainless Steel, Add</i>	133.47	
			<i>For Parallel Blade Damper, Add</i>	41.07	
23 33 13	13-0168	EA	60" x 8" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	201.47	29.46
			<i>For Stainless Steel, Add</i>	146.81	
			<i>For Parallel Blade Damper, Add</i>	45.17	
23 33 13	13-0169	EA	60" x 10" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	213.62	32.20
			<i>For Stainless Steel, Add</i>	152.13	
			<i>For Parallel Blade Damper, Add</i>	46.81	
23 33 13	13-0170	EA	60" x 12" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	223.73	34.86
			<i>For Stainless Steel, Add</i>	154.82	
			<i>For Parallel Blade Damper, Add</i>	47.64	
23 33 13	13-0171	EA	60" x 14" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	244.11	37.52
			<i>For Stainless Steel, Add</i>	170.83	
			<i>For Parallel Blade Damper, Add</i>	52.56	
23 33 13	13-0172	EA	60" x 16" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	264.45	40.24
			<i>For Stainless Steel, Add</i>	186.82	
			<i>For Parallel Blade Damper, Add</i>	57.48	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 33 13 13-0173 EA 60" x 18" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	285.86	42.90
For Stainless Steel, Add	204.18	
For Parallel Blade Damper, Add	62.82	
23 33 13 13-0174 EA 60" x 20" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	307.25	45.56
For Stainless Steel, Add	221.53	
For Parallel Blade Damper, Add	68.16	
23 33 13 13-0175 EA 60" x 24" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	337.97	46.93
For Stainless Steel, Add	256.23	
For Parallel Blade Damper, Add	78.84	
23 33 13 13-0176 EA 60" x 28" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	366.63	48.22
For Stainless Steel, Add	288.25	
For Parallel Blade Damper, Add	88.69	
23 33 13 13-0177 EA 60" x 32" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	401.38	50.96
For Stainless Steel, Add	322.97	
For Parallel Blade Damper, Add	99.38	
23 33 13 13-0178 EA 60" x 36" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	436.13	53.62
For Stainless Steel, Add	357.67	
For Parallel Blade Damper, Add	110.05	
23 33 13 13-0179 EA 60" x 40" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	464.69	56.26
For Stainless Steel, Add	384.35	
For Parallel Blade Damper, Add	118.26	
23 33 13 13-0180 EA 60" x 44" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	505.59	59.00
For Stainless Steel, Add	427.04	
For Parallel Blade Damper, Add	131.40	
23 33 13 13-0181 EA 60" x 48" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	542.38	61.66
For Stainless Steel, Add	464.41	
For Parallel Blade Damper, Add	142.90	
23 33 13 13-0182 EA 60" x 52" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	579.20	64.32
For Stainless Steel, Add	501.80	
For Parallel Blade Damper, Add	154.40	
23 33 13 13-0183 EA 60" x 56" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	611.85	67.06
For Stainless Steel, Add	533.79	
For Parallel Blade Damper, Add	164.24	
23 33 13 13-0184 EA 60" x 60" Rectangular Opposed Blade Damper, Steel Construction, Manual Operation	644.57	69.71
For Stainless Steel, Add	565.85	
For Parallel Blade Damper, Add	174.11	

23 33 13 16 Fire Dampers (23 33 13)

23 33 13 16-0001 Fire Dampers (23 33 13 16)

23 33 13 16-0002 SF Fire Damper, Vertical Curtain Type	47.54	8.69
For Horizontal, Add	3.21	
For Dynamic Damper, Add	4.81	
For 3 Hour Rated, Add	4.28	
For Smoke Damper, Add	18.17	
23 33 13 16-0003 SF Fire Damper, Vertical Louver Type	59.21	8.69
For Horizontal, Add	4.96	
For Dynamic Damper, Add	7.44	
For 3 Hour Rated, Add	6.61	
For Smoke Damper, Add	28.09	

23 33 13 16-0004 Folding Curtain Fire Dampers (23 33 13 16)

Note: UL Listed. Air stream galvanized steel construction with fusible link 160 F spring actuated for horizontal mount gravity actuated for vertical mount 1-1/2 hour fire rating. Damper blades and damper frame are in the air stream.

23 33 13 16-0005 EA 6" x 6" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	43.20	8.93
For Horizontal, Add	2.46	
For Dynamic Damper, Add	3.69	
For 3 Hour Rated, Add	3.28	
For Damper Blades Outside Air Stream, Add	4.92	
23 33 13 16-0006 EA 8" x 6" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	45.57	9.33
For Horizontal, Add	2.63	
For Dynamic Damper, Add	3.95	
For 3 Hour Rated, Add	3.51	
For Damper Blades Outside Air Stream, Add	5.27	
23 33 13 16-0007 EA 8" x 8" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	46.91	9.41
For Horizontal, Add	2.81	
For Dynamic Damper, Add	4.22	
For 3 Hour Rated, Add	3.75	
For Damper Blades Outside Air Stream, Add	5.62	
23 33 13 16-0008 EA 10" x 6" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	46.91	9.41
For Horizontal, Add	2.81	
For Dynamic Damper, Add	4.22	
For 3 Hour Rated, Add	3.75	
For Damper Blades Outside Air Stream, Add	5.62	
23 33 13 16-0009 EA 10" x 8" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	48.89	9.66
For Horizontal, Add	2.99	
For Dynamic Damper, Add	4.48	
For 3 Hour Rated, Add	3.98	
For Damper Blades Outside Air Stream, Add	5.97	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 33 Air Duct Accessories**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 33 13 16-0010	EA		10" x 10" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	54.45	10.70
			<i>For Horizontal, Add</i>	3.34	
			<i>For Dynamic Damper, Add</i>	5.01	
			<i>For 3 Hour Rated, Add</i>	4.45	
			<i>For Damper Blades Outside Air Stream, Add</i>	6.68	
23 33 13 16-0011	EA		12" x 6" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	48.89	9.66
			<i>For Horizontal, Add</i>	2.99	
			<i>For Dynamic Damper, Add</i>	4.48	
			<i>For 3 Hour Rated, Add</i>	3.98	
			<i>For Damper Blades Outside Air Stream, Add</i>	5.97	
23 33 13 16-0012	EA		12" x 6" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	52.84	10.22
			<i>For Horizontal, Add</i>	3.34	
			<i>For Dynamic Damper, Add</i>	5.01	
			<i>For 3 Hour Rated, Add</i>	4.45	
			<i>For Damper Blades Outside Air Stream, Add</i>	6.68	
23 33 13 16-0013	EA		12" x 10" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	55.62	10.70
			<i>For Horizontal, Add</i>	3.51	
			<i>For Dynamic Damper, Add</i>	5.27	
			<i>For 3 Hour Rated, Add</i>	4.68	
			<i>For Damper Blades Outside Air Stream, Add</i>	7.03	
23 33 13 16-0014	EA		12" x 12" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	60.83	12.07
			<i>For Horizontal, Add</i>	3.69	
			<i>For Dynamic Damper, Add</i>	5.54	
			<i>For 3 Hour Rated, Add</i>	4.92	
			<i>For Damper Blades Outside Air Stream, Add</i>	7.38	
23 33 13 16-0015	EA		14" x 6" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	52.26	10.22
			<i>For Horizontal, Add</i>	3.25	
			<i>For Dynamic Damper, Add</i>	4.88	
			<i>For 3 Hour Rated, Add</i>	4.33	
			<i>For Damper Blades Outside Air Stream, Add</i>	6.50	
23 33 13 16-0016	EA		14" x 8" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	55.62	10.70
			<i>For Horizontal, Add</i>	3.51	
			<i>For Dynamic Damper, Add</i>	5.27	
			<i>For 3 Hour Rated, Add</i>	4.68	
			<i>For Damper Blades Outside Air Stream, Add</i>	7.03	
23 33 13 16-0017	EA		14" x 10" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	58.41	11.27
			<i>For Horizontal, Add</i>	3.69	
			<i>For Dynamic Damper, Add</i>	5.54	
			<i>For 3 Hour Rated, Add</i>	4.92	
			<i>For Damper Blades Outside Air Stream, Add</i>	7.38	
23 33 13 16-0018	EA		14" x 12" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	62.00	12.07
			<i>For Horizontal, Add</i>	3.87	
			<i>For Dynamic Damper, Add</i>	5.80	
			<i>For 3 Hour Rated, Add</i>	5.15	
			<i>For Damper Blades Outside Air Stream, Add</i>	7.73	
23 33 13 16-0019	EA		14" x 14" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	68.94	13.44
			<i>For Horizontal, Add</i>	4.31	
			<i>For Dynamic Damper, Add</i>	6.46	
			<i>For 3 Hour Rated, Add</i>	5.74	
			<i>For Damper Blades Outside Air Stream, Add</i>	8.61	
23 33 13 16-0020	EA		16" x 6" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	55.62	10.70
			<i>For Horizontal, Add</i>	3.51	
			<i>For Dynamic Damper, Add</i>	5.27	
			<i>For 3 Hour Rated, Add</i>	4.68	
			<i>For Damper Blades Outside Air Stream, Add</i>	7.03	
23 33 13 16-0021	EA		16" x 8" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	59.22	11.51
			<i>For Horizontal, Add</i>	3.69	
			<i>For Dynamic Damper, Add</i>	5.54	
			<i>For 3 Hour Rated, Add</i>	4.92	
			<i>For Damper Blades Outside Air Stream, Add</i>	7.38	
23 33 13 16-0022	EA		16" x 10" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	63.61	12.64
			<i>For Horizontal, Add</i>	3.87	
			<i>For Dynamic Damper, Add</i>	5.80	
			<i>For 3 Hour Rated, Add</i>	5.15	
			<i>For Damper Blades Outside Air Stream, Add</i>	7.73	
23 33 13 16-0023	EA		16" x 12" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	67.17	13.44
			<i>For Horizontal, Add</i>	4.04	
			<i>For Dynamic Damper, Add</i>	6.06	
			<i>For 3 Hour Rated, Add</i>	5.39	
			<i>For Damper Blades Outside Air Stream, Add</i>	8.08	
23 33 13 16-0024	EA		16" x 14" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	74.14	14.73
			<i>For Horizontal, Add</i>	4.48	
			<i>For Dynamic Damper, Add</i>	6.72	
			<i>For 3 Hour Rated, Add</i>	5.97	
			<i>For Damper Blades Outside Air Stream, Add</i>	8.96	
23 33 13 16-0025	EA		16" x 16" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	81.10	16.10
			<i>For Horizontal, Add</i>	4.92	
			<i>For Dynamic Damper, Add</i>	7.38	
			<i>For 3 Hour Rated, Add</i>	6.56	
			<i>For Damper Blades Outside Air Stream, Add</i>	9.84	
23 33 13 16-0026	EA		18" x 6" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	58.41	11.27
			<i>For Horizontal, Add</i>	3.69	
			<i>For Dynamic Damper, Add</i>	5.54	
			<i>For 3 Hour Rated, Add</i>	4.92	
			<i>For Damper Blades Outside Air Stream, Add</i>	7.38	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 33 13 16-0027 EA 18" x 8" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	62.58	12.07
<i>For Horizontal, Add</i>	3.95	
<i>For Dynamic Damper, Add</i>	5.93	
<i>For 3 Hour Rated, Add</i>	5.27	
<i>For Damper Blades Outside Air Stream, Add</i>	7.91	
23 33 13 16-0028 EA 18" x 10" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	68.36	13.44
<i>For Horizontal, Add</i>	4.22	
<i>For Dynamic Damper, Add</i>	6.33	
<i>For 3 Hour Rated, Add</i>	5.62	
<i>For Damper Blades Outside Air Stream, Add</i>	8.44	
23 33 13 16-0029 EA 18" x 12" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	75.31	14.73
<i>For Horizontal, Add</i>	4.66	
<i>For Dynamic Damper, Add</i>	6.98	
<i>For 3 Hour Rated, Add</i>	6.21	
<i>For Damper Blades Outside Air Stream, Add</i>	9.31	
23 33 13 16-0030 EA 18" x 14" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	81.68	16.10
<i>For Horizontal, Add</i>	5.01	
<i>For Dynamic Damper, Add</i>	7.51	
<i>For 3 Hour Rated, Add</i>	6.68	
<i>For Damper Blades Outside Air Stream, Add</i>	10.01	
23 33 13 16-0031 EA 18" x 16" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	88.64	17.39
<i>For Horizontal, Add</i>	5.45	
<i>For Dynamic Damper, Add</i>	8.17	
<i>For 3 Hour Rated, Add</i>	7.26	
<i>For Damper Blades Outside Air Stream, Add</i>	10.89	
23 33 13 16-0032 EA 18" x 18" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	94.41	18.76
<i>For Horizontal, Add</i>	5.71	
<i>For Dynamic Damper, Add</i>	8.57	
<i>For 3 Hour Rated, Add</i>	7.61	
<i>For Damper Blades Outside Air Stream, Add</i>	11.42	
23 33 13 16-0033 EA 20" x 6" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	62.00	12.07
<i>For Horizontal, Add</i>	3.87	
<i>For Dynamic Damper, Add</i>	5.80	
<i>For 3 Hour Rated, Add</i>	5.15	
<i>For Damper Blades Outside Air Stream, Add</i>	7.73	
23 33 13 16-0034 EA 20" x 8" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	68.35	13.44
<i>For Horizontal, Add</i>	4.22	
<i>For Dynamic Damper, Add</i>	6.32	
<i>For 3 Hour Rated, Add</i>	5.62	
<i>For Damper Blades Outside Air Stream, Add</i>	8.43	
23 33 13 16-0035 EA 20" x 10" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	74.72	14.73
<i>For Horizontal, Add</i>	4.57	
<i>For Dynamic Damper, Add</i>	6.85	
<i>For 3 Hour Rated, Add</i>	6.09	
<i>For Damper Blades Outside Air Stream, Add</i>	9.14	
23 33 13 16-0036 EA 20" x 12" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	83.45	16.10
<i>For Horizontal, Add</i>	5.27	
<i>For Dynamic Damper, Add</i>	7.91	
<i>For 3 Hour Rated, Add</i>	7.03	
<i>For Damper Blades Outside Air Stream, Add</i>	10.55	
23 33 13 16-0037 EA 20" x 14" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	89.23	17.39
<i>For Horizontal, Add</i>	5.54	
<i>For Dynamic Damper, Add</i>	8.30	
<i>For 3 Hour Rated, Add</i>	7.38	
<i>For Damper Blades Outside Air Stream, Add</i>	11.07	
23 33 13 16-0038 EA 20" x 16" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	95.00	18.76
<i>For Horizontal, Add</i>	5.80	
<i>For Dynamic Damper, Add</i>	8.70	
<i>For 3 Hour Rated, Add</i>	7.73	
<i>For Damper Blades Outside Air Stream, Add</i>	11.60	
23 33 13 16-0039 EA 20" x 18" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	101.37	20.13
<i>For Horizontal, Add</i>	6.15	
<i>For Dynamic Damper, Add</i>	9.23	
<i>For 3 Hour Rated, Add</i>	8.20	
<i>For Damper Blades Outside Air Stream, Add</i>	12.30	
23 33 13 16-0040 EA 20" x 20" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	107.73	21.42
<i>For Horizontal, Add</i>	6.50	
<i>For Dynamic Damper, Add</i>	9.75	
<i>For 3 Hour Rated, Add</i>	8.67	
<i>For Damper Blades Outside Air Stream, Add</i>	13.00	
23 33 13 16-0041 EA 24" x 6" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	69.52	13.44
<i>For Horizontal, Add</i>	4.39	
<i>For Dynamic Damper, Add</i>	6.59	
<i>For 3 Hour Rated, Add</i>	5.86	
<i>For Damper Blades Outside Air Stream, Add</i>	8.78	
23 33 13 16-0042 EA 24" x 8" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	77.07	14.73
<i>For Horizontal, Add</i>	4.92	
<i>For Dynamic Damper, Add</i>	7.38	
<i>For 3 Hour Rated, Add</i>	6.56	
<i>For Damper Blades Outside Air Stream, Add</i>	9.84	
23 33 13 16-0043 EA 24" x 10" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	83.45	16.10
<i>For Horizontal, Add</i>	5.27	
<i>For Dynamic Damper, Add</i>	7.91	
<i>For 3 Hour Rated, Add</i>	7.03	
<i>For Damper Blades Outside Air Stream, Add</i>	10.55	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 33 Air Duct Accessories**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 33 13 16-0044 EA 24" x 12" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	90.99	17.39
For Horizontal, Add	5.80	
For Dynamic Damper, Add	8.70	
For 3 Hour Rated, Add	7.73	
For Damper Blades Outside Air Stream, Add	11.60	
23 33 13 16-0045 EA 24" x 14" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	96.75	18.76
For Horizontal, Add	6.06	
For Dynamic Damper, Add	9.09	
For 3 Hour Rated, Add	8.08	
For Damper Blades Outside Air Stream, Add	12.12	
23 33 13 16-0046 EA 24" x 16" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	102.54	20.13
For Horizontal, Add	6.33	
For Dynamic Damper, Add	9.49	
For 3 Hour Rated, Add	8.43	
For Damper Blades Outside Air Stream, Add	12.65	
23 33 13 16-0047 EA 24" x 18" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	110.08	21.42
For Horizontal, Add	6.85	
For Dynamic Damper, Add	10.28	
For 3 Hour Rated, Add	9.14	
For Damper Blades Outside Air Stream, Add	13.70	
23 33 13 16-0048 EA 24" x 20" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	121.63	24.14
For Horizontal, Add	7.38	
For Dynamic Damper, Add	11.07	
For 3 Hour Rated, Add	9.84	
For Damper Blades Outside Air Stream, Add	14.76	
23 33 13 16-0049 EA 24" x 24" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	134.39	26.80
For Horizontal, Add	8.08	
For Dynamic Damper, Add	12.13	
For 3 Hour Rated, Add	10.78	
For Damper Blades Outside Air Stream, Add	16.17	
23 33 13 16-0050 EA 28" x 6" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	77.07	14.73
For Horizontal, Add	4.92	
For Dynamic Damper, Add	7.38	
For 3 Hour Rated, Add	6.56	
For Damper Blades Outside Air Stream, Add	9.84	
23 33 13 16-0051 EA 28" x 8" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	83.45	16.10
For Horizontal, Add	5.27	
For Dynamic Damper, Add	7.91	
For 3 Hour Rated, Add	7.03	
For Damper Blades Outside Air Stream, Add	10.55	
23 33 13 16-0052 EA 28" x 10" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	90.99	17.39
For Horizontal, Add	5.80	
For Dynamic Damper, Add	8.70	
For 3 Hour Rated, Add	7.73	
For Damper Blades Outside Air Stream, Add	11.60	
23 33 13 16-0053 EA 28" x 12" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	97.34	18.76
For Horizontal, Add	6.15	
For Dynamic Damper, Add	9.23	
For 3 Hour Rated, Add	8.20	
For Damper Blades Outside Air Stream, Add	12.30	
23 33 13 16-0054 EA 28" x 14" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	104.30	20.13
For Horizontal, Add	6.59	
For Dynamic Damper, Add	9.88	
For 3 Hour Rated, Add	8.79	
For Damper Blades Outside Air Stream, Add	13.18	
23 33 13 16-0055 EA 28" x 16" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	111.25	21.42
For Horizontal, Add	7.03	
For Dynamic Damper, Add	10.54	
For 3 Hour Rated, Add	9.37	
For Damper Blades Outside Air Stream, Add	14.06	
23 33 13 16-0056 EA 28" x 18" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	122.81	24.14
For Horizontal, Add	7.56	
For Dynamic Damper, Add	11.33	
For 3 Hour Rated, Add	10.07	
For Damper Blades Outside Air Stream, Add	15.11	
23 33 13 16-0057 EA 28" x 20" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	134.39	26.80
For Horizontal, Add	8.08	
For Dynamic Damper, Add	12.13	
For 3 Hour Rated, Add	10.78	
For Damper Blades Outside Air Stream, Add	16.17	
23 33 13 16-0058 EA 28" x 24" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	145.44	28.17
For Horizontal, Add	9.14	
For Dynamic Damper, Add	13.70	
For 3 Hour Rated, Add	12.18	
For Damper Blades Outside Air Stream, Add	18.27	
23 33 13 16-0059 EA 28" x 28" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	159.34	30.83
For Horizontal, Add	10.02	
For Dynamic Damper, Add	15.02	
For 3 Hour Rated, Add	13.35	
For Damper Blades Outside Air Stream, Add	20.03	
23 33 13 16-0060 EA 32" x 6" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	86.96	16.10
For Horizontal, Add	5.80	
For Dynamic Damper, Add	8.70	
For 3 Hour Rated, Add	7.73	
For Damper Blades Outside Air Stream, Add	11.60	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 33 13 16-0061 EA 32" x 8" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	92.15	17.39
<i>For Horizontal, Add</i>	5.97	
<i>For Dynamic Damper, Add</i>	8.96	
<i>For 3 Hour Rated, Add</i>	7.96	
<i>For Damper Blades Outside Air Stream, Add</i>	11.95	
23 33 13 16-0062 EA 32" x 10" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	97.34	18.76
<i>For Horizontal, Add</i>	6.15	
<i>For Dynamic Damper, Add</i>	9.23	
<i>For 3 Hour Rated, Add</i>	8.20	
<i>For Damper Blades Outside Air Stream, Add</i>	12.30	
23 33 13 16-0063 EA 32" x 12" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	103.70	20.13
<i>For Horizontal, Add</i>	6.50	
<i>For Dynamic Damper, Add</i>	9.75	
<i>For 3 Hour Rated, Add</i>	8.67	
<i>For Damper Blades Outside Air Stream, Add</i>	13.00	
23 33 13 16-0064 EA 32" x 14" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	111.47	21.42
<i>For Horizontal, Add</i>	7.06	
<i>For Dynamic Damper, Add</i>	10.59	
<i>For 3 Hour Rated, Add</i>	9.41	
<i>For Damper Blades Outside Air Stream, Add</i>	14.12	
23 33 13 16-0065 EA 32" x 16" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	122.81	24.14
<i>For Horizontal, Add</i>	7.56	
<i>For Dynamic Damper, Add</i>	11.33	
<i>For 3 Hour Rated, Add</i>	10.07	
<i>For Damper Blades Outside Air Stream, Add</i>	15.11	
23 33 13 16-0066 EA 32" x 18" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	135.56	26.80
<i>For Horizontal, Add</i>	8.26	
<i>For Dynamic Damper, Add</i>	12.39	
<i>For 3 Hour Rated, Add</i>	11.01	
<i>For Damper Blades Outside Air Stream, Add</i>	16.52	
23 33 13 16-0067 EA 32" x 20" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	148.28	29.46
<i>For Horizontal, Add</i>	8.96	
<i>For Dynamic Damper, Add</i>	13.44	
<i>For 3 Hour Rated, Add</i>	11.95	
<i>For Damper Blades Outside Air Stream, Add</i>	17.92	
23 33 13 16-0068 EA 32" x 24" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	159.34	30.83
<i>For Horizontal, Add</i>	10.02	
<i>For Dynamic Damper, Add</i>	15.02	
<i>For 3 Hour Rated, Add</i>	13.35	
<i>For Damper Blades Outside Air Stream, Add</i>	20.03	
23 33 13 16-0069 EA 32" x 28" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	173.98	33.00
<i>For Horizontal, Add</i>	11.25	
<i>For Dynamic Damper, Add</i>	16.87	
<i>For 3 Hour Rated, Add</i>	14.99	
<i>For Damper Blades Outside Air Stream, Add</i>	22.49	
23 33 13 16-0070 EA 32" x 32" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	188.98	34.86
<i>For Horizontal, Add</i>	12.65	
<i>For Dynamic Damper, Add</i>	18.98	
<i>For 3 Hour Rated, Add</i>	16.87	
<i>For Damper Blades Outside Air Stream, Add</i>	25.30	
23 33 13 16-0071 EA 36" x 6" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	94.50	17.39
<i>For Horizontal, Add</i>	6.33	
<i>For Dynamic Damper, Add</i>	9.49	
<i>For 3 Hour Rated, Add</i>	8.43	
<i>For Damper Blades Outside Air Stream, Add</i>	12.65	
23 33 13 16-0072 EA 36" x 8" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	100.85	18.76
<i>For Horizontal, Add</i>	6.68	
<i>For Dynamic Damper, Add</i>	10.01	
<i>For 3 Hour Rated, Add</i>	8.90	
<i>For Damper Blades Outside Air Stream, Add</i>	13.35	
23 33 13 16-0073 EA 36" x 10" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	107.22	20.13
<i>For Horizontal, Add</i>	7.03	
<i>For Dynamic Damper, Add</i>	10.54	
<i>For 3 Hour Rated, Add</i>	9.37	
<i>For Damper Blades Outside Air Stream, Add</i>	14.06	
23 33 13 16-0074 EA 36" x 12" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	114.77	21.42
<i>For Horizontal, Add</i>	7.56	
<i>For Dynamic Damper, Add</i>	11.33	
<i>For 3 Hour Rated, Add</i>	10.07	
<i>For Damper Blades Outside Air Stream, Add</i>	15.11	
23 33 13 16-0075 EA 36" x 14" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	124.57	24.14
<i>For Horizontal, Add</i>	7.82	
<i>For Dynamic Damper, Add</i>	11.73	
<i>For 3 Hour Rated, Add</i>	10.43	
<i>For Damper Blades Outside Air Stream, Add</i>	15.64	
23 33 13 16-0076 EA 36" x 16" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	130.36	25.43
<i>For Horizontal, Add</i>	8.08	
<i>For Dynamic Damper, Add</i>	12.13	
<i>For 3 Hour Rated, Add</i>	10.78	
<i>For Damper Blades Outside Air Stream, Add</i>	16.17	
23 33 13 16-0077 EA 36" x 18" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	148.28	29.46
<i>For Horizontal, Add</i>	8.96	
<i>For Dynamic Damper, Add</i>	13.44	
<i>For 3 Hour Rated, Add</i>	11.95	
<i>For Damper Blades Outside Air Stream, Add</i>	17.92	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 33 Air Duct Accessories**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 33 13 16-0078	EA		36" x 20" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	162.19	32.20
			<i>For Horizontal, Add</i>	9.84	
			<i>For Dynamic Damper, Add</i>	14.76	
			<i>For 3 Hour Rated, Add</i>	13.12	
			<i>For Damper Blades Outside Air Stream, Add</i>	19.68	
23 33 13 16-0079	EA		36" x 24" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	141.32	33.25
			<i>For Horizontal, Add</i>	6.23	
			<i>For Dynamic Damper, Add</i>	9.34	
			<i>For 3 Hour Rated, Add</i>	8.30	
			<i>For Damper Blades Outside Air Stream, Add</i>	12.45	
23 33 13 16-0080	EA		36" x 28" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	189.05	35.66
			<i>For Horizontal, Add</i>	12.30	
			<i>For Dynamic Damper, Add</i>	18.45	
			<i>For 3 Hour Rated, Add</i>	16.40	
			<i>For Damper Blades Outside Air Stream, Add</i>	24.60	
23 33 13 16-0081	EA		36" x 32" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	202.89	37.52
			<i>For Horizontal, Add</i>	13.53	
			<i>For Dynamic Damper, Add</i>	20.29	
			<i>For 3 Hour Rated, Add</i>	18.04	
			<i>For Damper Blades Outside Air Stream, Add</i>	27.06	
23 33 13 16-0082	EA		36" x 36" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	216.29	38.88
			<i>For Horizontal, Add</i>	14.93	
			<i>For Dynamic Damper, Add</i>	22.40	
			<i>For 3 Hour Rated, Add</i>	19.91	
			<i>For Damper Blades Outside Air Stream, Add</i>	29.87	
23 33 13 16-0083	EA		40" x 6" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	99.67	20.13
			<i>For Horizontal, Add</i>	6.50	
			<i>For Dynamic Damper, Add</i>	9.75	
			<i>For 3 Hour Rated, Add</i>	8.67	
			<i>For Damper Blades Outside Air Stream, Add</i>	13.00	
23 33 13 16-0084	EA		40" x 8" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	108.39	21.42
			<i>For Horizontal, Add</i>	7.20	
			<i>For Dynamic Damper, Add</i>	10.80	
			<i>For 3 Hour Rated, Add</i>	9.60	
			<i>For Damper Blades Outside Air Stream, Add</i>	14.41	
23 33 13 16-0085	EA		40" x 10" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	113.59	22.79
			<i>For Horizontal, Add</i>	7.38	
			<i>For Dynamic Damper, Add</i>	11.07	
			<i>For 3 Hour Rated, Add</i>	9.84	
			<i>For Damper Blades Outside Air Stream, Add</i>	14.76	
23 33 13 16-0086	EA		40" x 12" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	118.80	24.14
			<i>For Horizontal, Add</i>	7.56	
			<i>For Dynamic Damper, Add</i>	11.33	
			<i>For 3 Hour Rated, Add</i>	10.07	
			<i>For Damper Blades Outside Air Stream, Add</i>	15.11	
23 33 13 16-0087	EA		40" x 14" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	130.94	25.43
			<i>For Horizontal, Add</i>	8.17	
			<i>For Dynamic Damper, Add</i>	12.26	
			<i>For 3 Hour Rated, Add</i>	10.89	
			<i>For Damper Blades Outside Air Stream, Add</i>	16.34	
23 33 13 16-0088	EA		40" x 16" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	139.07	26.80
			<i>For Horizontal, Add</i>	8.79	
			<i>For Dynamic Damper, Add</i>	13.18	
			<i>For 3 Hour Rated, Add</i>	11.71	
			<i>For Damper Blades Outside Air Stream, Add</i>	17.57	
23 33 13 16-0089	EA		40" x 18" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	155.82	30.83
			<i>For Horizontal, Add</i>	9.49	
			<i>For Dynamic Damper, Add</i>	14.23	
			<i>For 3 Hour Rated, Add</i>	12.65	
			<i>For Damper Blades Outside Air Stream, Add</i>	18.98	
23 33 13 16-0090	EA		40" x 20" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	168.57	33.49
			<i>For Horizontal, Add</i>	10.19	
			<i>For Dynamic Damper, Add</i>	15.29	
			<i>For 3 Hour Rated, Add</i>	13.59	
			<i>For Damper Blades Outside Air Stream, Add</i>	20.38	
23 33 13 16-0091	EA		40" x 24" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	182.03	35.66
			<i>For Horizontal, Add</i>	11.25	
			<i>For Dynamic Damper, Add</i>	16.87	
			<i>For 3 Hour Rated, Add</i>	14.99	
			<i>For Damper Blades Outside Air Stream, Add</i>	22.49	
23 33 13 16-0092	EA		40" x 28" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	200.55	37.52
			<i>For Horizontal, Add</i>	13.18	
			<i>For Dynamic Damper, Add</i>	19.77	
			<i>For 3 Hour Rated, Add</i>	17.57	
			<i>For Damper Blades Outside Air Stream, Add</i>	26.36	
23 33 13 16-0093	EA		40" x 32" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	214.00	39.68
			<i>For Horizontal, Add</i>	14.23	
			<i>For Dynamic Damper, Add</i>	21.35	
			<i>For 3 Hour Rated, Add</i>	18.97	
			<i>For Damper Blades Outside Air Stream, Add</i>	28.46	
23 33 13 16-0094	EA		40" x 36" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	230.11	40.73
			<i>For Horizontal, Add</i>	16.16	
			<i>For Dynamic Damper, Add</i>	24.25	
			<i>For 3 Hour Rated, Add</i>	21.55	
			<i>For Damper Blades Outside Air Stream, Add</i>	32.33	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 33 13 16-0095 EA 40" x 40" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	248.28	42.90
<i>For Horizontal, Add</i>	17.92	
<i>For Dynamic Damper, Add</i>	26.88	
<i>For 3 Hour Rated, Add</i>	23.90	
<i>For Damper Blades Outside Air Stream, Add</i>	35.84	
23 33 13 16-0096 EA 44" x 6" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	106.05	20.13
<i>For Horizontal, Add</i>	6.85	
<i>For Dynamic Damper, Add</i>	10.28	
<i>For 3 Hour Rated, Add</i>	9.14	
<i>For Damper Blades Outside Air Stream, Add</i>	13.70	
23 33 13 16-0097 EA 44" x 8" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	114.77	21.42
<i>For Horizontal, Add</i>	7.56	
<i>For Dynamic Damper, Add</i>	11.33	
<i>For 3 Hour Rated, Add</i>	10.07	
<i>For Damper Blades Outside Air Stream, Add</i>	15.11	
23 33 13 16-0098 EA 44" x 10" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	122.32	22.79
<i>For Horizontal, Add</i>	8.08	
<i>For Dynamic Damper, Add</i>	12.13	
<i>For 3 Hour Rated, Add</i>	10.78	
<i>For Damper Blades Outside Air Stream, Add</i>	16.17	
23 33 13 16-0099 EA 44" x 12" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	127.50	24.14
<i>For Horizontal, Add</i>	8.26	
<i>For Dynamic Damper, Add</i>	12.39	
<i>For 3 Hour Rated, Add</i>	11.01	
<i>For Damper Blades Outside Air Stream, Add</i>	16.52	
23 33 13 16-0100 EA 44" x 14" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	136.21	25.43
<i>For Horizontal, Add</i>	8.96	
<i>For Dynamic Damper, Add</i>	13.44	
<i>For 3 Hour Rated, Add</i>	11.95	
<i>For Damper Blades Outside Air Stream, Add</i>	17.92	
23 33 13 16-0101 EA 44" x 16" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	144.93	26.80
<i>For Horizontal, Add</i>	9.66	
<i>For Dynamic Damper, Add</i>	14.50	
<i>For 3 Hour Rated, Add</i>	12.89	
<i>For Damper Blades Outside Air Stream, Add</i>	19.33	
23 33 13 16-0102 EA 44" x 18" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	166.89	32.20
<i>For Horizontal, Add</i>	10.54	
<i>For Dynamic Damper, Add</i>	15.82	
<i>For 3 Hour Rated, Add</i>	14.06	
<i>For Damper Blades Outside Air Stream, Add</i>	21.09	
23 33 13 16-0103 EA 44" x 20" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	180.77	34.86
<i>For Horizontal, Add</i>	11.42	
<i>For Dynamic Damper, Add</i>	17.13	
<i>For 3 Hour Rated, Add</i>	15.23	
<i>For Damper Blades Outside Air Stream, Add</i>	22.84	
23 33 13 16-0104 EA 44" x 24" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	200.55	37.52
<i>For Horizontal, Add</i>	13.18	
<i>For Dynamic Damper, Add</i>	19.77	
<i>For 3 Hour Rated, Add</i>	17.57	
<i>For Damper Blades Outside Air Stream, Add</i>	26.36	
23 33 13 16-0105 EA 44" x 28" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	219.13	40.24
<i>For Horizontal, Add</i>	14.76	
<i>For Dynamic Damper, Add</i>	22.14	
<i>For 3 Hour Rated, Add</i>	19.68	
<i>For Damper Blades Outside Air Stream, Add</i>	29.52	
23 33 13 16-0106 EA 44" x 32" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	238.90	42.90
<i>For Horizontal, Add</i>	16.52	
<i>For Dynamic Damper, Add</i>	24.77	
<i>For 3 Hour Rated, Add</i>	22.02	
<i>For Damper Blades Outside Air Stream, Add</i>	33.03	
23 33 13 16-0107 EA 44" x 36" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	253.46	44.19
<i>For Horizontal, Add</i>	18.10	
<i>For Dynamic Damper, Add</i>	27.14	
<i>For 3 Hour Rated, Add</i>	24.13	
<i>For Damper Blades Outside Air Stream, Add</i>	36.19	
23 33 13 16-0108 EA 44" x 40" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	268.02	45.56
<i>For Horizontal, Add</i>	19.68	
<i>For Dynamic Damper, Add</i>	29.52	
<i>For 3 Hour Rated, Add</i>	26.24	
<i>For Damper Blades Outside Air Stream, Add</i>	39.35	
23 33 13 16-0109 EA 44" x 44" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	282.61	46.93
<i>For Horizontal, Add</i>	21.26	
<i>For Dynamic Damper, Add</i>	31.89	
<i>For 3 Hour Rated, Add</i>	28.35	
<i>For Damper Blades Outside Air Stream, Add</i>	42.52	
23 33 13 16-0110 EA 48" x 6" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	113.59	21.42
<i>For Horizontal, Add</i>	7.38	
<i>For Dynamic Damper, Add</i>	11.07	
<i>For 3 Hour Rated, Add</i>	9.84	
<i>For Damper Blades Outside Air Stream, Add</i>	14.76	
23 33 13 16-0111 EA 48" x 8" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	122.32	22.79
<i>For Horizontal, Add</i>	8.08	
<i>For Dynamic Damper, Add</i>	12.13	
<i>For 3 Hour Rated, Add</i>	10.78	
<i>For Damper Blades Outside Air Stream, Add</i>	16.17	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 33 Air Duct Accessories**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 33 13 16-0112	EA		48" x 10" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	127.50	24.14
			<i>For Horizontal, Add</i>	8.26	
			<i>For Dynamic Damper, Add</i>	12.39	
			<i>For 3 Hour Rated, Add</i>	11.01	
			<i>For Damper Blades Outside Air Stream, Add</i>	16.52	
23 33 13 16-0113	EA		48" x 12" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	139.07	26.80
			<i>For Horizontal, Add</i>	8.79	
			<i>For Dynamic Damper, Add</i>	13.18	
			<i>For 3 Hour Rated, Add</i>	11.71	
			<i>For Damper Blades Outside Air Stream, Add</i>	17.57	
23 33 13 16-0114	EA		48" x 14" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	151.79	29.46
			<i>For Horizontal, Add</i>	9.49	
			<i>For Dynamic Damper, Add</i>	14.23	
			<i>For 3 Hour Rated, Add</i>	12.65	
			<i>For Damper Blades Outside Air Stream, Add</i>	18.98	
23 33 13 16-0115	EA		48" x 16" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	164.54	32.20
			<i>For Horizontal, Add</i>	10.19	
			<i>For Dynamic Damper, Add</i>	15.29	
			<i>For 3 Hour Rated, Add</i>	13.59	
			<i>For Damper Blades Outside Air Stream, Add</i>	20.38	
23 33 13 16-0116	EA		48" x 18" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	179.61	34.86
			<i>For Horizontal, Add</i>	11.25	
			<i>For Dynamic Damper, Add</i>	16.87	
			<i>For 3 Hour Rated, Add</i>	14.99	
			<i>For Damper Blades Outside Air Stream, Add</i>	22.49	
23 33 13 16-0117	EA		48" x 20" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	194.69	37.52
			<i>For Horizontal, Add</i>	12.30	
			<i>For Dynamic Damper, Add</i>	18.45	
			<i>For 3 Hour Rated, Add</i>	16.40	
			<i>For Damper Blades Outside Air Stream, Add</i>	24.60	
23 33 13 16-0118	EA		48" x 24" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	213.27	40.24
			<i>For Horizontal, Add</i>	13.88	
			<i>For Dynamic Damper, Add</i>	20.82	
			<i>For 3 Hour Rated, Add</i>	18.51	
			<i>For Damper Blades Outside Air Stream, Add</i>	27.76	
23 33 13 16-0119	EA		48" x 28" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	234.21	42.90
			<i>For Horizontal, Add</i>	15.81	
			<i>For Dynamic Damper, Add</i>	23.72	
			<i>For 3 Hour Rated, Add</i>	21.08	
			<i>For Damper Blades Outside Air Stream, Add</i>	31.62	
23 33 13 16-0120	EA		48" x 32" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	248.79	44.19
			<i>For Horizontal, Add</i>	17.40	
			<i>For Dynamic Damper, Add</i>	26.09	
			<i>For 3 Hour Rated, Add</i>	23.19	
			<i>For Damper Blades Outside Air Stream, Add</i>	34.79	
23 33 13 16-0121	EA		48" x 36" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	266.85	45.56
			<i>For Horizontal, Add</i>	19.50	
			<i>For Dynamic Damper, Add</i>	29.25	
			<i>For 3 Hour Rated, Add</i>	26.00	
			<i>For Damper Blades Outside Air Stream, Add</i>	39.00	
23 33 13 16-0122	EA		48" x 40" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	285.46	48.22
			<i>For Horizontal, Add</i>	21.08	
			<i>For Dynamic Damper, Add</i>	31.63	
			<i>For 3 Hour Rated, Add</i>	28.11	
			<i>For Damper Blades Outside Air Stream, Add</i>	42.17	
23 33 13 16-0123	EA		48" x 44" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	303.54	49.59
			<i>For Horizontal, Add</i>	23.19	
			<i>For Dynamic Damper, Add</i>	34.79	
			<i>For 3 Hour Rated, Add</i>	30.92	
			<i>For Damper Blades Outside Air Stream, Add</i>	46.39	
23 33 13 16-0124	EA		48" x 48" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	324.98	53.62
			<i>For Horizontal, Add</i>	24.60	
			<i>For Dynamic Damper, Add</i>	36.90	
			<i>For 3 Hour Rated, Add</i>	32.80	
			<i>For Damper Blades Outside Air Stream, Add</i>	49.19	
23 33 13 16-0125	EA		52" x 6" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	121.14	22.79
			<i>For Horizontal, Add</i>	7.91	
			<i>For Dynamic Damper, Add</i>	11.86	
			<i>For 3 Hour Rated, Add</i>	10.54	
			<i>For Damper Blades Outside Air Stream, Add</i>	15.81	
23 33 13 16-0126	EA		52" x 8" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	129.84	24.14
			<i>For Horizontal, Add</i>	8.61	
			<i>For Dynamic Damper, Add</i>	12.92	
			<i>For 3 Hour Rated, Add</i>	11.48	
			<i>For Damper Blades Outside Air Stream, Add</i>	17.22	
23 33 13 16-0127	EA		52" x 10" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	142.58	26.80
			<i>For Horizontal, Add</i>	9.31	
			<i>For Dynamic Damper, Add</i>	13.97	
			<i>For 3 Hour Rated, Add</i>	12.42	
			<i>For Damper Blades Outside Air Stream, Add</i>	18.62	
23 33 13 16-0128	EA		52" x 12" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	151.79	29.46
			<i>For Horizontal, Add</i>	9.49	
			<i>For Dynamic Damper, Add</i>	14.23	
			<i>For 3 Hour Rated, Add</i>	12.65	
			<i>For Damper Blades Outside Air Stream, Add</i>	18.98	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 33 13 16-0129 EA 52" x 14" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	165.13	32.20
<i>For Horizontal, Add</i>	10.28	
<i>For Dynamic Damper, Add</i>	15.42	
<i>For 3 Hour Rated, Add</i>	13.71	
<i>For Damper Blades Outside Air Stream, Add</i>	20.56	
23 33 13 16-0130 EA 52" x 16" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	178.44	34.86
<i>For Horizontal, Add</i>	11.07	
<i>For Dynamic Damper, Add</i>	16.61	
<i>For 3 Hour Rated, Add</i>	14.76	
<i>For Damper Blades Outside Air Stream, Add</i>	22.14	
23 33 13 16-0131 EA 52" x 18" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	193.53	37.52
<i>For Horizontal, Add</i>	12.12	
<i>For Dynamic Damper, Add</i>	18.19	
<i>For 3 Hour Rated, Add</i>	16.17	
<i>For Damper Blades Outside Air Stream, Add</i>	24.25	
23 33 13 16-0132 EA 52" x 20" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	208.59	40.24
<i>For Horizontal, Add</i>	13.18	
<i>For Dynamic Damper, Add</i>	19.77	
<i>For 3 Hour Rated, Add</i>	17.57	
<i>For Damper Blades Outside Air Stream, Add</i>	26.36	
23 33 13 16-0133 EA 52" x 24" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	227.19	42.90
<i>For Horizontal, Add</i>	14.76	
<i>For Dynamic Damper, Add</i>	22.14	
<i>For 3 Hour Rated, Add</i>	19.68	
<i>For Damper Blades Outside Air Stream, Add</i>	29.52	
23 33 13 16-0134 EA 52" x 28" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	249.29	45.56
<i>For Horizontal, Add</i>	16.87	
<i>For Dynamic Damper, Add</i>	25.30	
<i>For 3 Hour Rated, Add</i>	22.49	
<i>For Damper Blades Outside Air Stream, Add</i>	33.74	
23 33 13 16-0135 EA 52" x 32" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	265.02	46.93
<i>For Horizontal, Add</i>	18.62	
<i>For Dynamic Damper, Add</i>	27.93	
<i>For 3 Hour Rated, Add</i>	24.83	
<i>For Damper Blades Outside Air Stream, Add</i>	37.25	
23 33 13 16-0136 EA 52" x 36" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	284.29	48.22
<i>For Horizontal, Add</i>	20.91	
<i>For Dynamic Damper, Add</i>	31.36	
<i>For 3 Hour Rated, Add</i>	27.88	
<i>For Damper Blades Outside Air Stream, Add</i>	41.82	
23 33 13 16-0137 EA 52" x 40" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	306.37	50.96
<i>For Horizontal, Add</i>	23.01	
<i>For Dynamic Damper, Add</i>	34.52	
<i>For 3 Hour Rated, Add</i>	30.69	
<i>For Damper Blades Outside Air Stream, Add</i>	46.03	
23 33 13 16-0138 EA 52" x 44" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	324.98	53.62
<i>For Horizontal, Add</i>	24.60	
<i>For Dynamic Damper, Add</i>	36.90	
<i>For 3 Hour Rated, Add</i>	32.80	
<i>For Damper Blades Outside Air Stream, Add</i>	49.19	
23 33 13 16-0139 EA 52" x 48" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	351.11	57.63
<i>For Horizontal, Add</i>	26.71	
<i>For Dynamic Damper, Add</i>	40.06	
<i>For 3 Hour Rated, Add</i>	35.61	
<i>For Damper Blades Outside Air Stream, Add</i>	53.41	
23 33 13 16-0140 EA 52" x 52" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	370.86	60.29
<i>For Horizontal, Add</i>	28.46	
<i>For Dynamic Damper, Add</i>	42.69	
<i>For 3 Hour Rated, Add</i>	37.95	
<i>For Damper Blades Outside Air Stream, Add</i>	56.93	
23 33 13 16-0141 EA 56" x 6" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	127.50	24.14
<i>For Horizontal, Add</i>	8.26	
<i>For Dynamic Damper, Add</i>	12.39	
<i>For 3 Hour Rated, Add</i>	11.01	
<i>For Damper Blades Outside Air Stream, Add</i>	16.52	
23 33 13 16-0142 EA 56" x 8" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	141.41	26.80
<i>For Horizontal, Add</i>	9.14	
<i>For Dynamic Damper, Add</i>	13.70	
<i>For 3 Hour Rated, Add</i>	12.18	
<i>For Damper Blades Outside Air Stream, Add</i>	18.27	
23 33 13 16-0143 EA 56" x 10" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	152.97	29.46
<i>For Horizontal, Add</i>	9.66	
<i>For Dynamic Damper, Add</i>	14.50	
<i>For 3 Hour Rated, Add</i>	12.89	
<i>For Damper Blades Outside Air Stream, Add</i>	19.33	
23 33 13 16-0144 EA 56" x 12" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	162.19	32.20
<i>For Horizontal, Add</i>	9.84	
<i>For Dynamic Damper, Add</i>	14.76	
<i>For 3 Hour Rated, Add</i>	13.12	
<i>For Damper Blades Outside Air Stream, Add</i>	19.68	
23 33 13 16-0145 EA 56" x 14" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	176.68	34.86
<i>For Horizontal, Add</i>	10.81	
<i>For Dynamic Damper, Add</i>	16.21	
<i>For 3 Hour Rated, Add</i>	14.41	
<i>For Damper Blades Outside Air Stream, Add</i>	21.61	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 33 Air Duct Accessories**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 33 13 16-0146	EA		56" x 16" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	191.18	37.52
			<i>For Horizontal, Add</i>	11.77	
			<i>For Dynamic Damper, Add</i>	17.66	
			<i>For 3 Hour Rated, Add</i>	15.70	
			<i>For Damper Blades Outside Air Stream, Add</i>	23.54	
23 33 13 16-0147	EA		56" x 18" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	205.66	40.24
			<i>For Horizontal, Add</i>	12.74	
			<i>For Dynamic Damper, Add</i>	19.11	
			<i>For 3 Hour Rated, Add</i>	16.98	
			<i>For Damper Blades Outside Air Stream, Add</i>	25.48	
23 33 13 16-0148	EA		56" x 20" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	220.16	42.90
			<i>For Horizontal, Add</i>	13.70	
			<i>For Dynamic Damper, Add</i>	20.56	
			<i>For 3 Hour Rated, Add</i>	18.27	
			<i>For Damper Blades Outside Air Stream, Add</i>	27.41	
23 33 13 16-0149	EA		56" x 24" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	242.25	45.56
			<i>For Horizontal, Add</i>	15.81	
			<i>For Dynamic Damper, Add</i>	23.72	
			<i>For 3 Hour Rated, Add</i>	21.08	
			<i>For Damper Blades Outside Air Stream, Add</i>	31.62	
23 33 13 16-0150	EA		56" x 28" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	260.35	46.93
			<i>For Horizontal, Add</i>	17.92	
			<i>For Dynamic Damper, Add</i>	26.88	
			<i>For 3 Hour Rated, Add</i>	23.90	
			<i>For Damper Blades Outside Air Stream, Add</i>	35.84	
23 33 13 16-0151	EA		56" x 32" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	277.26	48.22
			<i>For Horizontal, Add</i>	19.85	
			<i>For Dynamic Damper, Add</i>	29.78	
			<i>For 3 Hour Rated, Add</i>	26.47	
			<i>For Damper Blades Outside Air Stream, Add</i>	39.71	
23 33 13 16-0152	EA		56" x 36" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	301.70	50.96
			<i>For Horizontal, Add</i>	22.31	
			<i>For Dynamic Damper, Add</i>	33.47	
			<i>For 3 Hour Rated, Add</i>	29.75	
			<i>For Damper Blades Outside Air Stream, Add</i>	44.63	
23 33 13 16-0153	EA		56" x 40" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	323.81	53.62
			<i>For Horizontal, Add</i>	24.42	
			<i>For Dynamic Damper, Add</i>	36.63	
			<i>For 3 Hour Rated, Add</i>	32.56	
			<i>For Damper Blades Outside Air Stream, Add</i>	48.84	
23 33 13 16-0154	EA		56" x 44" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	347.08	56.26
			<i>For Horizontal, Add</i>	26.71	
			<i>For Dynamic Damper, Add</i>	40.06	
			<i>For 3 Hour Rated, Add</i>	35.61	
			<i>For Damper Blades Outside Air Stream, Add</i>	53.41	
23 33 13 16-0155	EA		56" x 48" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	366.85	59.00
			<i>For Horizontal, Add</i>	28.46	
			<i>For Dynamic Damper, Add</i>	42.69	
			<i>For 3 Hour Rated, Add</i>	37.95	
			<i>For Damper Blades Outside Air Stream, Add</i>	56.93	
23 33 13 16-0156	EA		56" x 52" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	390.12	61.66
			<i>For Horizontal, Add</i>	30.75	
			<i>For Dynamic Damper, Add</i>	46.12	
			<i>For 3 Hour Rated, Add</i>	41.00	
			<i>For Damper Blades Outside Air Stream, Add</i>	61.49	
23 33 13 16-0157	EA		56" x 56" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	413.41	64.32
			<i>For Horizontal, Add</i>	33.03	
			<i>For Dynamic Damper, Add</i>	49.55	
			<i>For 3 Hour Rated, Add</i>	44.04	
			<i>For Damper Blades Outside Air Stream, Add</i>	66.06	
23 33 13 16-0158	EA		60" x 6" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	139.07	26.80
			<i>For Horizontal, Add</i>	8.79	
			<i>For Dynamic Damper, Add</i>	13.18	
			<i>For 3 Hour Rated, Add</i>	11.71	
			<i>For Damper Blades Outside Air Stream, Add</i>	17.57	
23 33 13 16-0159	EA		60" x 8" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	152.97	29.46
			<i>For Horizontal, Add</i>	9.66	
			<i>For Dynamic Damper, Add</i>	14.50	
			<i>For 3 Hour Rated, Add</i>	12.89	
			<i>For Damper Blades Outside Air Stream, Add</i>	19.33	
23 33 13 16-0160	EA		60" x 10" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	163.37	32.20
			<i>For Horizontal, Add</i>	10.02	
			<i>For Dynamic Damper, Add</i>	15.02	
			<i>For 3 Hour Rated, Add</i>	13.35	
			<i>For Damper Blades Outside Air Stream, Add</i>	20.03	
23 33 13 16-0161	EA		60" x 12" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	172.58	34.86
			<i>For Horizontal, Add</i>	10.19	
			<i>For Dynamic Damper, Add</i>	15.29	
			<i>For 3 Hour Rated, Add</i>	13.59	
			<i>For Damper Blades Outside Air Stream, Add</i>	20.38	
23 33 13 16-0162	EA		60" x 14" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	187.67	37.52
			<i>For Horizontal, Add</i>	11.25	
			<i>For Dynamic Damper, Add</i>	16.87	
			<i>For 3 Hour Rated, Add</i>	14.99	
			<i>For Damper Blades Outside Air Stream, Add</i>	22.49	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 33 13 16-0163 EA 60" x 16" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	202.73	40.24
<i>For Horizontal, Add</i>	12.30	
<i>For Dynamic Damper, Add</i>	18.45	
<i>For 3 Hour Rated, Add</i>	16.40	
<i>For Damper Blades Outside Air Stream, Add</i>	24.60	
23 33 13 16-0164 EA 60" x 18" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	218.41	42.90
<i>For Horizontal, Add</i>	13.44	
<i>For Dynamic Damper, Add</i>	20.16	
<i>For 3 Hour Rated, Add</i>	17.92	
<i>For Damper Blades Outside Air Stream, Add</i>	26.88	
23 33 13 16-0165 EA 60" x 20" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	234.06	45.56
<i>For Horizontal, Add</i>	14.58	
<i>For Dynamic Damper, Add</i>	21.87	
<i>For 3 Hour Rated, Add</i>	19.44	
<i>For Damper Blades Outside Air Stream, Add</i>	29.17	
23 33 13 16-0166 EA 60" x 24" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	253.32	46.93
<i>For Horizontal, Add</i>	16.87	
<i>For Dynamic Damper, Add</i>	25.30	
<i>For 3 Hour Rated, Add</i>	22.49	
<i>For Damper Blades Outside Air Stream, Add</i>	33.74	
23 33 13 16-0167 EA 60" x 28" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	271.40	48.22
<i>For Horizontal, Add</i>	18.98	
<i>For Dynamic Damper, Add</i>	28.46	
<i>For 3 Hour Rated, Add</i>	25.30	
<i>For Damper Blades Outside Air Stream, Add</i>	37.95	
23 33 13 16-0168 EA 60" x 32" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	294.68	50.96
<i>For Horizontal, Add</i>	21.26	
<i>For Dynamic Damper, Add</i>	31.89	
<i>For 3 Hour Rated, Add</i>	28.35	
<i>For Damper Blades Outside Air Stream, Add</i>	42.52	
23 33 13 16-0169 EA 60" x 36" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	317.96	53.62
<i>For Horizontal, Add</i>	23.54	
<i>For Dynamic Damper, Add</i>	35.32	
<i>For 3 Hour Rated, Add</i>	31.39	
<i>For Damper Blades Outside Air Stream, Add</i>	47.09	
23 33 13 16-0170 EA 60" x 40" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	337.71	56.26
<i>For Horizontal, Add</i>	25.30	
<i>For Dynamic Damper, Add</i>	37.95	
<i>For 3 Hour Rated, Add</i>	33.73	
<i>For Damper Blades Outside Air Stream, Add</i>	50.60	
23 33 13 16-0171 EA 60" x 44" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	364.51	59.00
<i>For Horizontal, Add</i>	28.11	
<i>For Dynamic Damper, Add</i>	42.17	
<i>For 3 Hour Rated, Add</i>	37.48	
<i>For Damper Blades Outside Air Stream, Add</i>	56.22	
23 33 13 16-0172 EA 60" x 48" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	388.95	61.66
<i>For Horizontal, Add</i>	30.57	
<i>For Dynamic Damper, Add</i>	45.86	
<i>For 3 Hour Rated, Add</i>	40.76	
<i>For Damper Blades Outside Air Stream, Add</i>	61.14	
23 33 13 16-0173 EA 60" x 52" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	413.41	64.32
<i>For Horizontal, Add</i>	33.03	
<i>For Dynamic Damper, Add</i>	49.55	
<i>For 3 Hour Rated, Add</i>	44.04	
<i>For Damper Blades Outside Air Stream, Add</i>	66.06	
23 33 13 16-0174 EA 60" x 56" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	435.49	67.06
<i>For Horizontal, Add</i>	35.14	
<i>For Dynamic Damper, Add</i>	52.71	
<i>For 3 Hour Rated, Add</i>	46.85	
<i>For Damper Blades Outside Air Stream, Add</i>	70.28	
23 33 13 16-0175 EA 60" x 60" Folding Curtain Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	457.62	69.71
<i>For Horizontal, Add</i>	37.25	
<i>For Dynamic Damper, Add</i>	55.87	
<i>For 3 Hour Rated, Add</i>	49.66	
<i>For Damper Blades Outside Air Stream, Add</i>	74.50	
23 33 13 16-0176 Parallel Blade Louver Fire Damper <small>(23 33 13 16)</small>		
<small>Note: UL listed. Galvanized steel construction with fusible link 160 F spring actuated 1-1/2 hour fire rating.</small>		
23 33 13 16-0177 EA 6" x 6" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	60.74	8.93
<i>For Horizontal, Add</i>	5.09	
<i>For Dynamic Damper, Add</i>	7.64	
<i>For 3 Hour Rated, Add</i>	6.79	
23 33 13 16-0178 EA 8" x 6" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	63.40	9.33
<i>For Horizontal, Add</i>	5.31	
<i>For Dynamic Damper, Add</i>	7.96	
<i>For 3 Hour Rated, Add</i>	7.08	
23 33 13 16-0179 EA 8" x 8" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	65.03	9.41
<i>For Horizontal, Add</i>	5.53	
<i>For Dynamic Damper, Add</i>	8.29	
<i>For 3 Hour Rated, Add</i>	7.37	
23 33 13 16-0180 EA 10" x 6" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	65.03	9.41
<i>For Horizontal, Add</i>	5.53	
<i>For Dynamic Damper, Add</i>	8.29	
<i>For 3 Hour Rated, Add</i>	7.37	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 33 Air Duct Accessories**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 33 13 16-0181	EA		10" x 8" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	67.31	9.66
			<i>For Horizontal, Add</i>	5.75	
			<i>For Dynamic Damper, Add</i>	8.62	
			<i>For 3 Hour Rated, Add</i>	7.67	
23 33 13 16-0182	EA		10" x 10" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	73.45	10.70
			<i>For Horizontal, Add</i>	6.19	
			<i>For Dynamic Damper, Add</i>	9.28	
			<i>For 3 Hour Rated, Add</i>	8.25	
23 33 13 16-0183	EA		12" x 6" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	67.31	9.66
			<i>For Horizontal, Add</i>	5.75	
			<i>For Dynamic Damper, Add</i>	8.62	
			<i>For 3 Hour Rated, Add</i>	7.67	
23 33 13 16-0184	EA		12" x 8" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	71.84	10.22
			<i>For Horizontal, Add</i>	6.19	
			<i>For Dynamic Damper, Add</i>	9.28	
			<i>For 3 Hour Rated, Add</i>	8.25	
23 33 13 16-0185	EA		12" x 10" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	74.92	10.70
			<i>For Horizontal, Add</i>	6.41	
			<i>For Dynamic Damper, Add</i>	9.61	
			<i>For 3 Hour Rated, Add</i>	8.54	
23 33 13 16-0186	EA		12" x 12" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	80.41	12.07
			<i>For Horizontal, Add</i>	6.63	
			<i>For Dynamic Damper, Add</i>	9.94	
			<i>For 3 Hour Rated, Add</i>	8.84	
23 33 13 16-0187	EA		14" x 6" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	71.11	10.22
			<i>For Horizontal, Add</i>	6.08	
			<i>For Dynamic Damper, Add</i>	9.12	
			<i>For 3 Hour Rated, Add</i>	8.10	
23 33 13 16-0188	EA		14" x 8" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	74.92	10.70
			<i>For Horizontal, Add</i>	6.41	
			<i>For Dynamic Damper, Add</i>	9.61	
			<i>For 3 Hour Rated, Add</i>	8.54	
23 33 13 16-0189	EA		14" x 10" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	77.99	11.27
			<i>For Horizontal, Add</i>	6.63	
			<i>For Dynamic Damper, Add</i>	9.94	
			<i>For 3 Hour Rated, Add</i>	8.84	
23 33 13 16-0190	EA		14" x 12" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	81.87	12.07
			<i>For Horizontal, Add</i>	6.85	
			<i>For Dynamic Damper, Add</i>	10.27	
			<i>For 3 Hour Rated, Add</i>	9.13	
23 33 13 16-0191	EA		14" x 14" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	89.55	13.44
			<i>For Horizontal, Add</i>	7.40	
			<i>For Dynamic Damper, Add</i>	11.09	
			<i>For 3 Hour Rated, Add</i>	9.86	
23 33 13 16-0192	EA		16" x 6" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	91.86	10.70
			<i>For Horizontal, Add</i>	8.95	
			<i>For Dynamic Damper, Add</i>	13.42	
			<i>For 3 Hour Rated, Add</i>	11.93	
23 33 13 16-0193	EA		16" x 8" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	95.92	11.51
			<i>For Horizontal, Add</i>	9.20	
			<i>For Dynamic Damper, Add</i>	13.79	
			<i>For 3 Hour Rated, Add</i>	12.26	
23 33 13 16-0194	EA		16" x 10" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	100.79	12.64
			<i>For Horizontal, Add</i>	9.44	
			<i>For Dynamic Damper, Add</i>	14.16	
			<i>For 3 Hour Rated, Add</i>	12.59	
23 33 13 16-0195	EA		16" x 12" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	104.82	13.44
			<i>For Horizontal, Add</i>	9.69	
			<i>For Dynamic Damper, Add</i>	14.53	
			<i>For 3 Hour Rated, Add</i>	12.92	
23 33 13 16-0196	EA		16" x 14" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	112.96	14.73
			<i>For Horizontal, Add</i>	10.30	
			<i>For Dynamic Damper, Add</i>	15.46	
			<i>For 3 Hour Rated, Add</i>	13.74	
23 33 13 16-0197	EA		16" x 16" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	121.09	16.10
			<i>For Horizontal, Add</i>	10.92	
			<i>For Dynamic Damper, Add</i>	16.38	
			<i>For 3 Hour Rated, Add</i>	14.56	
23 33 13 16-0198	EA		18" x 6" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	95.11	11.27
			<i>For Horizontal, Add</i>	9.20	
			<i>For Dynamic Damper, Add</i>	13.79	
			<i>For 3 Hour Rated, Add</i>	12.26	
23 33 13 16-0199	EA		18" x 8" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	99.99	12.07
			<i>For Horizontal, Add</i>	9.56	
			<i>For Dynamic Damper, Add</i>	14.35	
			<i>For 3 Hour Rated, Add</i>	12.75	
23 33 13 16-0200	EA		18" x 10" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	106.48	13.44
			<i>For Horizontal, Add</i>	9.94	
			<i>For Dynamic Damper, Add</i>	14.90	
			<i>For 3 Hour Rated, Add</i>	13.25	
23 33 13 16-0201	EA		18" x 12" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	114.60	14.73
			<i>For Horizontal, Add</i>	10.55	
			<i>For Dynamic Damper, Add</i>	15.82	
			<i>For 3 Hour Rated, Add</i>	14.07	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 33 13 16-0202 EA 18" x 14" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	121.91	16.10
<i>For Horizontal, Add</i>	11.04	
<i>For Dynamic Damper, Add</i>	16.56	
<i>For 3 Hour Rated, Add</i>	14.72	
23 33 13 16-0203 EA 18" x 16" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	130.04	17.39
<i>For Horizontal, Add</i>	11.66	
<i>For Dynamic Damper, Add</i>	17.48	
<i>For 3 Hour Rated, Add</i>	15.54	
23 33 13 16-0204 EA 18" x 18" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	136.51	18.76
<i>For Horizontal, Add</i>	12.03	
<i>For Dynamic Damper, Add</i>	18.04	
<i>For 3 Hour Rated, Add</i>	16.03	
23 33 13 16-0205 EA 20" x 6" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	99.18	12.07
<i>For Horizontal, Add</i>	9.44	
<i>For Dynamic Damper, Add</i>	14.16	
<i>For 3 Hour Rated, Add</i>	12.59	
23 33 13 16-0206 EA 20" x 8" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	106.46	13.44
<i>For Horizontal, Add</i>	9.93	
<i>For Dynamic Damper, Add</i>	14.90	
<i>For 3 Hour Rated, Add</i>	13.24	
23 33 13 16-0207 EA 20" x 10" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	113.78	14.73
<i>For Horizontal, Add</i>	10.43	
<i>For Dynamic Damper, Add</i>	15.64	
<i>For 3 Hour Rated, Add</i>	13.90	
23 33 13 16-0208 EA 20" x 12" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	124.38	16.10
<i>For Horizontal, Add</i>	11.41	
<i>For Dynamic Damper, Add</i>	17.12	
<i>For 3 Hour Rated, Add</i>	15.22	
23 33 13 16-0209 EA 20" x 14" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	130.87	17.39
<i>For Horizontal, Add</i>	11.78	
<i>For Dynamic Damper, Add</i>	17.67	
<i>For 3 Hour Rated, Add</i>	15.71	
23 33 13 16-0210 EA 20" x 16" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	137.33	18.76
<i>For Horizontal, Add</i>	12.15	
<i>For Dynamic Damper, Add</i>	18.22	
<i>For 3 Hour Rated, Add</i>	16.20	
23 33 13 16-0211 EA 20" x 18" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	144.64	20.13
<i>For Horizontal, Add</i>	12.64	
<i>For Dynamic Damper, Add</i>	18.96	
<i>For 3 Hour Rated, Add</i>	16.85	
23 33 13 16-0212 EA 20" x 20" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	151.94	21.42
<i>For Horizontal, Add</i>	13.13	
<i>For Dynamic Damper, Add</i>	19.70	
<i>For 3 Hour Rated, Add</i>	17.51	
23 33 13 16-0213 EA 24" x 6" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	121.54	13.44
<i>For Horizontal, Add</i>	12.20	
<i>For Dynamic Damper, Add</i>	18.29	
<i>For 3 Hour Rated, Add</i>	16.26	
23 33 13 16-0214 EA 24" x 8" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	130.50	14.73
<i>For Horizontal, Add</i>	12.93	
<i>For Dynamic Damper, Add</i>	19.40	
<i>For 3 Hour Rated, Add</i>	17.25	
23 33 13 16-0215 EA 24" x 10" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	137.82	16.10
<i>For Horizontal, Add</i>	13.43	
<i>For Dynamic Damper, Add</i>	20.14	
<i>For 3 Hour Rated, Add</i>	17.90	
23 33 13 16-0216 EA 24" x 12" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	146.75	17.39
<i>For Horizontal, Add</i>	14.16	
<i>For Dynamic Damper, Add</i>	21.24	
<i>For 3 Hour Rated, Add</i>	18.88	
23 33 13 16-0217 EA 24" x 14" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	153.23	18.76
<i>For Horizontal, Add</i>	14.53	
<i>For Dynamic Damper, Add</i>	21.80	
<i>For 3 Hour Rated, Add</i>	19.38	
23 33 13 16-0218 EA 24" x 16" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	159.71	20.13
<i>For Horizontal, Add</i>	14.90	
<i>For Dynamic Damper, Add</i>	22.35	
<i>For 3 Hour Rated, Add</i>	19.87	
23 33 13 16-0219 EA 24" x 18" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	168.66	21.42
<i>For Horizontal, Add</i>	15.64	
<i>For Dynamic Damper, Add</i>	23.46	
<i>For 3 Hour Rated, Add</i>	20.85	
23 33 13 16-0220 EA 24" x 20" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	181.62	24.14
<i>For Horizontal, Add</i>	16.38	
<i>For Dynamic Damper, Add</i>	24.57	
<i>For 3 Hour Rated, Add</i>	21.84	
23 33 13 16-0221 EA 24" x 24" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	196.24	26.80
<i>For Horizontal, Add</i>	17.36	
<i>For Dynamic Damper, Add</i>	26.04	
<i>For 3 Hour Rated, Add</i>	23.15	
23 33 13 16-0222 EA 28" x 6" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	130.50	14.73
<i>For Horizontal, Add</i>	12.93	
<i>For Dynamic Damper, Add</i>	19.40	
<i>For 3 Hour Rated, Add</i>	17.25	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 33 Air Duct Accessories**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 33 13 16-0223	EA		28" x 8" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	137.82	16.10
			<i>For Horizontal, Add</i>	13.43	
			<i>For Dynamic Damper, Add</i>	20.14	
			<i>For 3 Hour Rated, Add</i>	17.90	
23 33 13 16-0224	EA		28" x 10" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	146.75	17.39
			<i>For Horizontal, Add</i>	14.16	
			<i>For Dynamic Damper, Add</i>	21.24	
			<i>For 3 Hour Rated, Add</i>	18.88	
23 33 13 16-0225	EA		28" x 12" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	154.04	18.76
			<i>For Horizontal, Add</i>	14.66	
			<i>For Dynamic Damper, Add</i>	21.98	
			<i>For 3 Hour Rated, Add</i>	19.54	
23 33 13 16-0226	EA		28" x 14" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	162.18	20.13
			<i>For Horizontal, Add</i>	15.27	
			<i>For Dynamic Damper, Add</i>	22.91	
			<i>For 3 Hour Rated, Add</i>	20.36	
23 33 13 16-0227	EA		28" x 16" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	170.29	21.42
			<i>For Horizontal, Add</i>	15.88	
			<i>For Dynamic Damper, Add</i>	23.83	
			<i>For 3 Hour Rated, Add</i>	21.18	
23 33 13 16-0228	EA		28" x 18" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	183.26	24.14
			<i>For Horizontal, Add</i>	16.62	
			<i>For Dynamic Damper, Add</i>	24.93	
			<i>For 3 Hour Rated, Add</i>	22.16	
23 33 13 16-0229	EA		28" x 20" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	196.24	26.80
			<i>For Horizontal, Add</i>	17.36	
			<i>For Dynamic Damper, Add</i>	26.04	
			<i>For 3 Hour Rated, Add</i>	23.15	
23 33 13 16-0230	EA		28" x 24" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	210.11	28.17
			<i>For Horizontal, Add</i>	18.84	
			<i>For Dynamic Damper, Add</i>	28.26	
			<i>For 3 Hour Rated, Add</i>	25.12	
23 33 13 16-0231	EA		28" x 28" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	226.35	30.83
			<i>For Horizontal, Add</i>	20.07	
			<i>For Dynamic Damper, Add</i>	30.10	
			<i>For 3 Hour Rated, Add</i>	26.76	
23 33 13 16-0232	EA		32" x 6" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	142.72	16.10
			<i>For Horizontal, Add</i>	14.16	
			<i>For Dynamic Damper, Add</i>	21.24	
			<i>For 3 Hour Rated, Add</i>	18.88	
23 33 13 16-0233	EA		32" x 8" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	148.38	17.39
			<i>For Horizontal, Add</i>	14.41	
			<i>For Dynamic Damper, Add</i>	21.61	
			<i>For 3 Hour Rated, Add</i>	19.21	
23 33 13 16-0234	EA		32" x 10" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	154.04	18.76
			<i>For Horizontal, Add</i>	14.66	
			<i>For Dynamic Damper, Add</i>	21.98	
			<i>For 3 Hour Rated, Add</i>	19.54	
23 33 13 16-0235	EA		32" x 12" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	161.34	20.13
			<i>For Horizontal, Add</i>	15.15	
			<i>For Dynamic Damper, Add</i>	22.72	
			<i>For 3 Hour Rated, Add</i>	20.19	
23 33 13 16-0236	EA		32" x 14" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	170.60	21.42
			<i>For Horizontal, Add</i>	15.93	
			<i>For Dynamic Damper, Add</i>	23.90	
			<i>For 3 Hour Rated, Add</i>	21.24	
23 33 13 16-0237	EA		32" x 16" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	183.26	24.14
			<i>For Horizontal, Add</i>	16.62	
			<i>For Dynamic Damper, Add</i>	24.93	
			<i>For 3 Hour Rated, Add</i>	22.16	
23 33 13 16-0238	EA		32" x 18" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	197.89	26.80
			<i>For Horizontal, Add</i>	17.61	
			<i>For Dynamic Damper, Add</i>	26.41	
			<i>For 3 Hour Rated, Add</i>	23.48	
23 33 13 16-0239	EA		32" x 20" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	212.49	29.46
			<i>For Horizontal, Add</i>	18.59	
			<i>For Dynamic Damper, Add</i>	27.89	
			<i>For 3 Hour Rated, Add</i>	24.79	
23 33 13 16-0240	EA		32" x 24" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	226.35	30.83
			<i>For Horizontal, Add</i>	20.07	
			<i>For Dynamic Damper, Add</i>	30.10	
			<i>For 3 Hour Rated, Add</i>	26.76	
23 33 13 16-0241	EA		32" x 28" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	244.27	33.00
			<i>For Horizontal, Add</i>	21.79	
			<i>For Dynamic Damper, Add</i>	32.68	
			<i>For 3 Hour Rated, Add</i>	29.05	
23 33 13 16-0242	EA		32" x 32" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	263.02	34.86
			<i>For Horizontal, Add</i>	23.76	
			<i>For Dynamic Damper, Add</i>	35.64	
			<i>For 3 Hour Rated, Add</i>	31.68	
23 33 13 16-0243	EA		36" x 6" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	160.11	17.39
			<i>For Horizontal, Add</i>	16.17	
			<i>For Dynamic Damper, Add</i>	24.25	
			<i>For 3 Hour Rated, Add</i>	21.56	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 33 13 16-0244 EA 36" x 8" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	167.85	18.76
<i>For Horizontal, Add</i>	16.73	
<i>For Dynamic Damper, Add</i>	25.09	
<i>For 3 Hour Rated, Add</i>	22.30	
23 33 13 16-0245 EA 36" x 10" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	175.63	20.13
<i>For Horizontal, Add</i>	17.29	
<i>For Dynamic Damper, Add</i>	25.93	
<i>For 3 Hour Rated, Add</i>	23.05	
23 33 13 16-0246 EA 36" x 12" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	185.29	21.42
<i>For Horizontal, Add</i>	18.13	
<i>For Dynamic Damper, Add</i>	27.20	
<i>For 3 Hour Rated, Add</i>	24.18	
23 33 13 16-0247 EA 36" x 14" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	196.15	24.14
<i>For Horizontal, Add</i>	18.56	
<i>For Dynamic Damper, Add</i>	27.83	
<i>For 3 Hour Rated, Add</i>	24.74	
23 33 13 16-0248 EA 36" x 16" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	203.00	25.43
<i>For Horizontal, Add</i>	18.98	
<i>For Dynamic Damper, Add</i>	28.47	
<i>For 3 Hour Rated, Add</i>	25.31	
23 33 13 16-0249 EA 36" x 18" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	224.44	29.46
<i>For Horizontal, Add</i>	20.39	
<i>For Dynamic Damper, Add</i>	30.58	
<i>For 3 Hour Rated, Add</i>	27.18	
23 33 13 16-0250 EA 36" x 20" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	241.86	32.20
<i>For Horizontal, Add</i>	21.79	
<i>For Dynamic Damper, Add</i>	32.68	
<i>For 3 Hour Rated, Add</i>	29.05	
23 33 13 16-0251 EA 36" x 24" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	256.33	33.25
<i>For Horizontal, Add</i>	23.48	
<i>For Dynamic Damper, Add</i>	35.21	
<i>For 3 Hour Rated, Add</i>	31.30	
23 33 13 16-0252 EA 36" x 28" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	278.55	35.66
<i>For Horizontal, Add</i>	25.72	
<i>For Dynamic Damper, Add</i>	38.59	
<i>For 3 Hour Rated, Add</i>	34.30	
23 33 13 16-0253 EA 36" x 32" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	297.30	37.52
<i>For Horizontal, Add</i>	27.69	
<i>For Dynamic Damper, Add</i>	41.54	
<i>For 3 Hour Rated, Add</i>	36.92	
23 33 13 16-0254 EA 36" x 36" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	316.33	38.88
<i>For Horizontal, Add</i>	29.94	
<i>For Dynamic Damper, Add</i>	44.91	
<i>For 3 Hour Rated, Add</i>	39.92	
23 33 13 16-0255 EA 40" x 6" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	179.42	20.13
<i>For Horizontal, Add</i>	18.46	
<i>For Dynamic Damper, Add</i>	27.69	
<i>For 3 Hour Rated, Add</i>	24.62	
23 33 13 16-0256 EA 40" x 8" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	190.95	21.42
<i>For Horizontal, Add</i>	19.59	
<i>For Dynamic Damper, Add</i>	29.38	
<i>For 3 Hour Rated, Add</i>	26.12	
23 33 13 16-0257 EA 40" x 10" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	196.85	22.79
<i>For Horizontal, Add</i>	19.87	
<i>For Dynamic Damper, Add</i>	29.80	
<i>For 3 Hour Rated, Add</i>	26.49	
23 33 13 16-0258 EA 40" x 12" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	202.76	24.14
<i>For Horizontal, Add</i>	20.15	
<i>For Dynamic Damper, Add</i>	30.22	
<i>For 3 Hour Rated, Add</i>	26.87	
23 33 13 16-0259 EA 40" x 14" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	217.36	25.43
<i>For Horizontal, Add</i>	21.13	
<i>For Dynamic Damper, Add</i>	31.70	
<i>For 3 Hour Rated, Add</i>	28.18	
23 33 13 16-0260 EA 40" x 16" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	227.95	26.80
<i>For Horizontal, Add</i>	22.12	
<i>For Dynamic Damper, Add</i>	33.18	
<i>For 3 Hour Rated, Add</i>	29.49	
23 33 13 16-0261 EA 40" x 18" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	247.52	30.83
<i>For Horizontal, Add</i>	23.24	
<i>For Dynamic Damper, Add</i>	34.86	
<i>For 3 Hour Rated, Add</i>	30.99	
23 33 13 16-0262 EA 40" x 20" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	263.07	33.49
<i>For Horizontal, Add</i>	24.37	
<i>For Dynamic Damper, Add</i>	36.55	
<i>For 3 Hour Rated, Add</i>	32.49	
23 33 13 16-0263 EA 40" x 24" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	280.75	35.66
<i>For Horizontal, Add</i>	26.05	
<i>For Dynamic Damper, Add</i>	39.08	
<i>For 3 Hour Rated, Add</i>	34.74	
23 33 13 16-0264 EA 40" x 28" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	307.00	37.52
<i>For Horizontal, Add</i>	29.15	
<i>For Dynamic Damper, Add</i>	43.72	
<i>For 3 Hour Rated, Add</i>	38.86	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 33 Air Duct Accessories**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 33 13 16-0265	EA		40" x 32" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	324.67	39.68
			<i>For Horizontal, Add</i>	30.83	
			<i>For Dynamic Damper, Add</i>	46.25	
			<i>For 3 Hour Rated, Add</i>	41.11	
23 33 13 16-0266	EA		40" x 36" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	348.51	40.73
			<i>For Horizontal, Add</i>	33.92	
			<i>For Dynamic Damper, Add</i>	50.89	
			<i>For 3 Hour Rated, Add</i>	45.23	
23 33 13 16-0267	EA		40" x 40" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	373.70	42.90
			<i>For Horizontal, Add</i>	36.74	
			<i>For Dynamic Damper, Add</i>	55.10	
			<i>For 3 Hour Rated, Add</i>	48.98	
23 33 13 16-0268	EA		44" x 6" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	187.20	20.13
			<i>For Horizontal, Add</i>	19.02	
			<i>For Dynamic Damper, Add</i>	28.54	
			<i>For 3 Hour Rated, Add</i>	25.37	
23 33 13 16-0269	EA		44" x 8" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	198.73	21.42
			<i>For Horizontal, Add</i>	20.15	
			<i>For Dynamic Damper, Add</i>	30.22	
			<i>For 3 Hour Rated, Add</i>	26.87	
23 33 13 16-0270	EA		44" x 10" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	208.39	22.79
			<i>For Horizontal, Add</i>	20.99	
			<i>For Dynamic Damper, Add</i>	31.49	
			<i>For 3 Hour Rated, Add</i>	27.99	
23 33 13 16-0271	EA		44" x 12" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	214.27	24.14
			<i>For Horizontal, Add</i>	21.27	
			<i>For Dynamic Damper, Add</i>	31.91	
			<i>For 3 Hour Rated, Add</i>	28.37	
23 33 13 16-0272	EA		44" x 14" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	225.80	25.43
			<i>For Horizontal, Add</i>	22.40	
			<i>For Dynamic Damper, Add</i>	33.60	
			<i>For 3 Hour Rated, Add</i>	29.87	
23 33 13 16-0273	EA		44" x 16" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	237.33	26.80
			<i>For Horizontal, Add</i>	23.52	
			<i>For Dynamic Damper, Add</i>	35.29	
			<i>For 3 Hour Rated, Add</i>	31.37	
23 33 13 16-0274	EA		44" x 18" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	262.80	32.20
			<i>For Horizontal, Add</i>	24.93	
			<i>For Dynamic Damper, Add</i>	37.40	
			<i>For 3 Hour Rated, Add</i>	33.24	
23 33 13 16-0275	EA		44" x 20" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	280.20	34.86
			<i>For Horizontal, Add</i>	26.33	
			<i>For Dynamic Damper, Add</i>	39.50	
			<i>For 3 Hour Rated, Add</i>	35.11	
23 33 13 16-0276	EA		44" x 24" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	307.00	37.52
			<i>For Horizontal, Add</i>	29.15	
			<i>For Dynamic Damper, Add</i>	43.72	
			<i>For 3 Hour Rated, Add</i>	38.86	
23 33 13 16-0277	EA		44" x 28" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	331.91	40.24
			<i>For Horizontal, Add</i>	31.68	
			<i>For Dynamic Damper, Add</i>	47.51	
			<i>For 3 Hour Rated, Add</i>	42.23	
23 33 13 16-0278	EA		44" x 32" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	358.70	42.90
			<i>For Horizontal, Add</i>	34.49	
			<i>For Dynamic Damper, Add</i>	51.73	
			<i>For 3 Hour Rated, Add</i>	45.98	
23 33 13 16-0279	EA		44" x 36" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	379.59	44.19
			<i>For Horizontal, Add</i>	37.02	
			<i>For Dynamic Damper, Add</i>	55.52	
			<i>For 3 Hour Rated, Add</i>	49.35	
23 33 13 16-0280	EA		44" x 40" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	400.48	45.56
			<i>For Horizontal, Add</i>	39.55	
			<i>For Dynamic Damper, Add</i>	59.32	
			<i>For 3 Hour Rated, Add</i>	52.73	
23 33 13 16-0281	EA		44" x 44" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	421.39	46.93
			<i>For Horizontal, Add</i>	42.08	
			<i>For Dynamic Damper, Add</i>	63.12	
			<i>For 3 Hour Rated, Add</i>	56.10	
23 33 13 16-0282	EA		48" x 6" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	196.85	21.42
			<i>For Horizontal, Add</i>	19.87	
			<i>For Dynamic Damper, Add</i>	29.80	
			<i>For 3 Hour Rated, Add</i>	26.49	
23 33 13 16-0283	EA		48" x 8" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	208.39	22.79
			<i>For Horizontal, Add</i>	20.99	
			<i>For Dynamic Damper, Add</i>	31.49	
			<i>For 3 Hour Rated, Add</i>	27.99	
23 33 13 16-0284	EA		48" x 10" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	214.27	24.14
			<i>For Horizontal, Add</i>	21.27	
			<i>For Dynamic Damper, Add</i>	31.91	
			<i>For 3 Hour Rated, Add</i>	28.37	
23 33 13 16-0285	EA		48" x 12" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	227.95	26.80
			<i>For Horizontal, Add</i>	22.12	
			<i>For Dynamic Damper, Add</i>	33.18	
			<i>For 3 Hour Rated, Add</i>	29.49	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 33 13 16-0286 EA 48" x 14" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	243.49	29.46
<i>For Horizontal, Add</i>	23.24	
<i>For Dynamic Damper, Add</i>	34.86	
<i>For 3 Hour Rated, Add</i>	30.99	
23 33 13 16-0287 EA 48" x 16" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	259.04	32.20
<i>For Horizontal, Add</i>	24.37	
<i>For Dynamic Damper, Add</i>	36.55	
<i>For 3 Hour Rated, Add</i>	32.49	
23 33 13 16-0288 EA 48" x 18" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	278.33	34.86
<i>For Horizontal, Add</i>	26.05	
<i>For Dynamic Damper, Add</i>	39.08	
<i>For 3 Hour Rated, Add</i>	34.74	
23 33 13 16-0289 EA 48" x 20" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	297.63	37.52
<i>For Horizontal, Add</i>	27.74	
<i>For Dynamic Damper, Add</i>	41.61	
<i>For 3 Hour Rated, Add</i>	36.99	
23 33 13 16-0290 EA 48" x 24" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	322.54	40.24
<i>For Horizontal, Add</i>	30.27	
<i>For Dynamic Damper, Add</i>	45.41	
<i>For 3 Hour Rated, Add</i>	40.36	
23 33 13 16-0291 EA 48" x 28" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	351.20	42.90
<i>For Horizontal, Add</i>	33.36	
<i>For Dynamic Damper, Add</i>	50.04	
<i>For 3 Hour Rated, Add</i>	44.48	
23 33 13 16-0292 EA 48" x 32" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	372.11	44.19
<i>For Horizontal, Add</i>	35.89	
<i>For Dynamic Damper, Add</i>	53.84	
<i>For 3 Hour Rated, Add</i>	47.86	
23 33 13 16-0293 EA 48" x 36" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	398.60	45.56
<i>For Horizontal, Add</i>	39.26	
<i>For Dynamic Damper, Add</i>	58.90	
<i>For 3 Hour Rated, Add</i>	52.35	
23 33 13 16-0294 EA 48" x 40" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	423.54	48.22
<i>For Horizontal, Add</i>	41.80	
<i>For Dynamic Damper, Add</i>	62.69	
<i>For 3 Hour Rated, Add</i>	55.73	
23 33 13 16-0295 EA 48" x 44" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	450.05	49.59
<i>For Horizontal, Add</i>	45.17	
<i>For Dynamic Damper, Add</i>	67.75	
<i>For 3 Hour Rated, Add</i>	60.23	
23 33 13 16-0296 EA 48" x 48" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	477.12	53.62
<i>For Horizontal, Add</i>	47.42	
<i>For Dynamic Damper, Add</i>	71.13	
<i>For 3 Hour Rated, Add</i>	63.22	
23 33 13 16-0297 EA 52" x 6" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	206.51	22.79
<i>For Horizontal, Add</i>	20.71	
<i>For Dynamic Damper, Add</i>	31.07	
<i>For 3 Hour Rated, Add</i>	27.62	
23 33 13 16-0298 EA 52" x 8" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	218.02	24.14
<i>For Horizontal, Add</i>	21.84	
<i>For Dynamic Damper, Add</i>	32.76	
<i>For 3 Hour Rated, Add</i>	29.12	
23 33 13 16-0299 EA 52" x 10" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	233.58	26.80
<i>For Horizontal, Add</i>	22.96	
<i>For Dynamic Damper, Add</i>	34.44	
<i>For 3 Hour Rated, Add</i>	30.62	
23 33 13 16-0300 EA 52" x 12" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	243.49	29.46
<i>For Horizontal, Add</i>	23.24	
<i>For Dynamic Damper, Add</i>	34.86	
<i>For 3 Hour Rated, Add</i>	30.99	
23 33 13 16-0301 EA 52" x 14" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	259.99	32.20
<i>For Horizontal, Add</i>	24.51	
<i>For Dynamic Damper, Add</i>	36.76	
<i>For 3 Hour Rated, Add</i>	32.68	
23 33 13 16-0302 EA 52" x 16" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	276.45	34.86
<i>For Horizontal, Add</i>	25.77	
<i>For Dynamic Damper, Add</i>	38.66	
<i>For 3 Hour Rated, Add</i>	34.36	
23 33 13 16-0303 EA 52" x 18" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	295.76	37.52
<i>For Horizontal, Add</i>	27.46	
<i>For Dynamic Damper, Add</i>	41.19	
<i>For 3 Hour Rated, Add</i>	36.61	
23 33 13 16-0304 EA 52" x 20" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	315.04	40.24
<i>For Horizontal, Add</i>	29.15	
<i>For Dynamic Damper, Add</i>	43.72	
<i>For 3 Hour Rated, Add</i>	38.86	
23 33 13 16-0305 EA 52" x 24" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	339.97	42.90
<i>For Horizontal, Add</i>	31.68	
<i>For Dynamic Damper, Add</i>	47.51	
<i>For 3 Hour Rated, Add</i>	42.23	
23 33 13 16-0306 EA 52" x 28" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	370.49	45.56
<i>For Horizontal, Add</i>	35.05	
<i>For Dynamic Damper, Add</i>	52.57	
<i>For 3 Hour Rated, Add</i>	46.73	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 33 Air Duct Accessories**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 33 13 16-0307	EA		52" x 32" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	393.26	46.93
			<i>For Horizontal, Add</i>	37.86	
			<i>For Dynamic Damper, Add</i>	56.79	
			<i>For 3 Hour Rated, Add</i>	50.48	
23 33 13 16-0308	EA		52" x 36" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	421.66	48.22
			<i>For Horizontal, Add</i>	41.51	
			<i>For Dynamic Damper, Add</i>	62.27	
			<i>For 3 Hour Rated, Add</i>	55.35	
23 33 13 16-0309	EA		52" x 40" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	452.18	50.96
			<i>For Horizontal, Add</i>	44.89	
			<i>For Dynamic Damper, Add</i>	67.33	
			<i>For 3 Hour Rated, Add</i>	59.85	
23 33 13 16-0310	EA		52" x 44" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	477.12	53.62
			<i>For Horizontal, Add</i>	47.42	
			<i>For Dynamic Damper, Add</i>	71.13	
			<i>For 3 Hour Rated, Add</i>	63.22	
23 33 13 16-0311	EA		52" x 48" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	511.67	57.63
			<i>For Horizontal, Add</i>	50.79	
			<i>For Dynamic Damper, Add</i>	76.19	
			<i>For 3 Hour Rated, Add</i>	67.72	
23 33 13 16-0312	EA		52" x 52" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	538.46	60.29
			<i>For Horizontal, Add</i>	53.60	
			<i>For Dynamic Damper, Add</i>	80.40	
			<i>For 3 Hour Rated, Add</i>	71.47	
23 33 13 16-0313	EA		56" x 6" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	214.27	24.14
			<i>For Horizontal, Add</i>	21.27	
			<i>For Dynamic Damper, Add</i>	31.91	
			<i>For 3 Hour Rated, Add</i>	28.37	
23 33 13 16-0314	EA		56" x 8" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	231.69	26.80
			<i>For Horizontal, Add</i>	22.68	
			<i>For Dynamic Damper, Add</i>	34.02	
			<i>For 3 Hour Rated, Add</i>	30.24	
23 33 13 16-0315	EA		56" x 10" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	245.37	29.46
			<i>For Horizontal, Add</i>	23.52	
			<i>For Dynamic Damper, Add</i>	35.29	
			<i>For 3 Hour Rated, Add</i>	31.37	
23 33 13 16-0316	EA		56" x 12" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	255.29	32.20
			<i>For Horizontal, Add</i>	23.80	
			<i>For Dynamic Damper, Add</i>	35.71	
			<i>For 3 Hour Rated, Add</i>	31.74	
23 33 13 16-0317	EA		56" x 14" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	273.65	34.86
			<i>For Horizontal, Add</i>	25.35	
			<i>For Dynamic Damper, Add</i>	38.03	
			<i>For 3 Hour Rated, Add</i>	33.80	
23 33 13 16-0318	EA		56" x 16" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	292.01	37.52
			<i>For Horizontal, Add</i>	26.90	
			<i>For Dynamic Damper, Add</i>	40.34	
			<i>For 3 Hour Rated, Add</i>	35.86	
23 33 13 16-0319	EA		56" x 18" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	310.36	40.24
			<i>For Horizontal, Add</i>	28.44	
			<i>For Dynamic Damper, Add</i>	42.66	
			<i>For 3 Hour Rated, Add</i>	37.92	
23 33 13 16-0320	EA		56" x 20" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	328.72	42.90
			<i>For Horizontal, Add</i>	29.99	
			<i>For Dynamic Damper, Add</i>	44.98	
			<i>For 3 Hour Rated, Add</i>	39.98	
23 33 13 16-0321	EA		56" x 24" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	359.24	45.56
			<i>For Horizontal, Add</i>	33.36	
			<i>For Dynamic Damper, Add</i>	50.04	
			<i>For 3 Hour Rated, Add</i>	44.48	
23 33 13 16-0322	EA		56" x 28" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	385.77	46.93
			<i>For Horizontal, Add</i>	36.74	
			<i>For Dynamic Damper, Add</i>	55.10	
			<i>For 3 Hour Rated, Add</i>	48.98	
23 33 13 16-0323	EA		56" x 32" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	410.41	48.22
			<i>For Horizontal, Add</i>	39.83	
			<i>For Dynamic Damper, Add</i>	59.74	
			<i>For 3 Hour Rated, Add</i>	53.10	
23 33 13 16-0324	EA		56" x 36" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	444.70	50.96
			<i>For Horizontal, Add</i>	43.76	
			<i>For Dynamic Damper, Add</i>	65.65	
			<i>For 3 Hour Rated, Add</i>	58.35	
23 33 13 16-0325	EA		56" x 40" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	475.24	53.62
			<i>For Horizontal, Add</i>	47.14	
			<i>For Dynamic Damper, Add</i>	70.70	
			<i>For 3 Hour Rated, Add</i>	62.85	
23 33 13 16-0326	EA		56" x 44" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	507.64	56.26
			<i>For Horizontal, Add</i>	50.79	
			<i>For Dynamic Damper, Add</i>	76.19	
			<i>For 3 Hour Rated, Add</i>	67.72	
23 33 13 16-0327	EA		56" x 48" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	534.45	59.00
			<i>For Horizontal, Add</i>	53.60	
			<i>For Dynamic Damper, Add</i>	80.40	
			<i>For 3 Hour Rated, Add</i>	71.47	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 33 13 16-0328 EA 56" x 52" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	566.85	61.66
<i>For Horizontal, Add</i>	57.26	
<i>For Dynamic Damper, Add</i>	85.88	
<i>For 3 Hour Rated, Add</i>	76.34	
23 33 13 16-0329 EA 56" x 56" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	599.27	64.32
<i>For Horizontal, Add</i>	60.91	
<i>For Dynamic Damper, Add</i>	91.37	
<i>For 3 Hour Rated, Add</i>	81.21	
23 33 13 16-0330 EA 60" x 6" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	227.95	26.80
<i>For Horizontal, Add</i>	22.12	
<i>For Dynamic Damper, Add</i>	33.18	
<i>For 3 Hour Rated, Add</i>	29.49	
23 33 13 16-0331 EA 60" x 8" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	245.37	29.46
<i>For Horizontal, Add</i>	23.52	
<i>For Dynamic Damper, Add</i>	35.29	
<i>For 3 Hour Rated, Add</i>	31.37	
23 33 13 16-0332 EA 60" x 10" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	257.16	32.20
<i>For Horizontal, Add</i>	24.08	
<i>For Dynamic Damper, Add</i>	36.13	
<i>For 3 Hour Rated, Add</i>	32.11	
23 33 13 16-0333 EA 60" x 12" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	267.08	34.86
<i>For Horizontal, Add</i>	24.37	
<i>For Dynamic Damper, Add</i>	36.55	
<i>For 3 Hour Rated, Add</i>	32.49	
23 33 13 16-0334 EA 60" x 14" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	286.39	37.52
<i>For Horizontal, Add</i>	26.05	
<i>For Dynamic Damper, Add</i>	39.08	
<i>For 3 Hour Rated, Add</i>	34.74	
23 33 13 16-0335 EA 60" x 16" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	305.67	40.24
<i>For Horizontal, Add</i>	27.74	
<i>For Dynamic Damper, Add</i>	41.61	
<i>For 3 Hour Rated, Add</i>	36.99	
23 33 13 16-0336 EA 60" x 18" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	325.91	42.90
<i>For Horizontal, Add</i>	29.57	
<i>For Dynamic Damper, Add</i>	44.35	
<i>For 3 Hour Rated, Add</i>	39.42	
23 33 13 16-0337 EA 60" x 20" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	346.13	45.56
<i>For Horizontal, Add</i>	31.39	
<i>For Dynamic Damper, Add</i>	47.09	
<i>For 3 Hour Rated, Add</i>	41.86	
23 33 13 16-0338 EA 60" x 24" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	374.52	46.93
<i>For Horizontal, Add</i>	35.05	
<i>For Dynamic Damper, Add</i>	52.57	
<i>For 3 Hour Rated, Add</i>	46.73	
23 33 13 16-0339 EA 60" x 28" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	401.04	48.22
<i>For Horizontal, Add</i>	38.42	
<i>For Dynamic Damper, Add</i>	57.63	
<i>For 3 Hour Rated, Add</i>	51.23	
23 33 13 16-0340 EA 60" x 32" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	433.46	50.96
<i>For Horizontal, Add</i>	42.08	
<i>For Dynamic Damper, Add</i>	63.12	
<i>For 3 Hour Rated, Add</i>	56.10	
23 33 13 16-0341 EA 60" x 36" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	465.88	53.62
<i>For Horizontal, Add</i>	45.73	
<i>For Dynamic Damper, Add</i>	68.60	
<i>For 3 Hour Rated, Add</i>	60.98	
23 33 13 16-0342 EA 60" x 40" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	492.66	56.26
<i>For Horizontal, Add</i>	48.54	
<i>For Dynamic Damper, Add</i>	72.81	
<i>For 3 Hour Rated, Add</i>	64.72	
23 33 13 16-0343 EA 60" x 44" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	530.70	59.00
<i>For Horizontal, Add</i>	53.04	
<i>For Dynamic Damper, Add</i>	79.56	
<i>For 3 Hour Rated, Add</i>	70.72	
23 33 13 16-0344 EA 60" x 48" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	564.97	61.66
<i>For Horizontal, Add</i>	56.97	
<i>For Dynamic Damper, Add</i>	85.46	
<i>For 3 Hour Rated, Add</i>	75.97	
23 33 13 16-0345 EA 60" x 52" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	599.27	64.32
<i>For Horizontal, Add</i>	60.91	
<i>For Dynamic Damper, Add</i>	91.37	
<i>For 3 Hour Rated, Add</i>	81.21	
23 33 13 16-0346 EA 60" x 56" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	629.79	67.06
<i>For Horizontal, Add</i>	64.28	
<i>For Dynamic Damper, Add</i>	96.42	
<i>For 3 Hour Rated, Add</i>	85.71	
23 33 13 16-0347 EA 60" x 60" Louver Type Fire Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	660.36	69.71
<i>For Horizontal, Add</i>	67.66	
<i>For Dynamic Damper, Add</i>	101.49	
<i>For 3 Hour Rated, Add</i>	90.21	
23 33 13 16-0348 Round 2 Hour Fire Damper <small>(23 33 13 16)</small>		
23 33 13 16-0349 EA 4" Round 2 Hour Fire Damper.....	48.15	16.10
23 33 13 16-0350 EA 5" Round 2 Hour Fire Damper.....	49.29	16.10
23 33 13 16-0351 EA 6" Round 2 Hour Fire Damper.....	57.11	18.27

23 Heating, Ventilating, And Air-Conditioning (HVAC)

23 30 HVAC Air Distribution

23 33 Air Duct Accessories



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 33 13 16-0352	EA		7" Round 2 Hour Fire Damper	58.35	18.27
23 33 13 16-0353	EA		8" Round 2 Hour Fire Damper	67.59	20.13
23 33 13 16-0354	EA		9" Round 2 Hour Fire Damper	71.01	20.13
23 33 13 16-0355	EA		10" Round 2 Hour Fire Damper	78.92	22.38
23 33 13 16-0356	EA		12" Round 2 Hour Fire Damper	88.70	25.19
23 33 13 16-0357	EA		14" Round 2 Hour Fire Damper	101.02	28.74
23 33 13 16-0358			Round 4 Hour Fire Damper (23 33 13 16)		
23 33 13 16-0359	EA		4" Round 4 Hour Fire Damper	54.46	18.27
23 33 13 16-0360	EA		5" Round 4 Hour Fire Damper	57.57	18.27
23 33 13 16-0361	EA		6" Round 4 Hour Fire Damper	64.37	20.13
23 33 13 16-0362	EA		7" Round 4 Hour Fire Damper	68.39	20.13
23 33 13 16-0363	EA		8" Round 4 Hour Fire Damper	76.89	22.38
23 33 13 16-0364	EA		9" Round 4 Hour Fire Damper	79.34	22.38
23 33 13 16-0365	EA		10" Round 4 Hour Fire Damper	88.77	25.19
23 33 13 16-0366	EA		12" Round 4 Hour Fire Damper	99.47	28.74
23 33 13 16-0367	EA		14" Round 4 Hour Fire Damper	116.04	33.57
23 33 13 19			Smoke-Control Dampers (23 33 13)		
23 33 13 19-0001			Combination Smoke/Fire Damper (23 33 13 19)		
Note: Leakage class I with Firestat UL 555S air foil blades.					
23 33 13 19-0002	EA		6" x 6" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	94.89	13.40
			<i>For 3 Hour Rated, Add</i>	10.94	
23 33 13 19-0003	EA		8" x 6" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	98.05	14.01
			<i>For 3 Hour Rated, Add</i>	11.21	
23 33 13 19-0004	EA		8" x 8" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	99.64	14.13
			<i>For 3 Hour Rated, Add</i>	11.48	
23 33 13 19-0005	EA		10" x 6" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	99.64	14.13
			<i>For 3 Hour Rated, Add</i>	11.48	
23 33 13 19-0006	EA		10" x 8" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	102.19	14.49
			<i>For 3 Hour Rated, Add</i>	11.74	
23 33 13 19-0007	EA		10" x 10" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	109.72	16.06
			<i>For 3 Hour Rated, Add</i>	12.28	
23 33 13 19-0008	EA		12" x 6" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	102.19	14.49
			<i>For 3 Hour Rated, Add</i>	11.74	
23 33 13 19-0009	EA		12" x 8" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	107.30	15.33
			<i>For 3 Hour Rated, Add</i>	12.28	
23 33 13 19-0010	EA		12" x 10" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	111.06	16.06
			<i>For 3 Hour Rated, Add</i>	12.55	
23 33 13 19-0011	EA		12" x 12" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	118.45	18.11
			<i>For 3 Hour Rated, Add</i>	12.82	
23 33 13 19-0012	EA		14" x 6" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	106.63	15.33
			<i>For 3 Hour Rated, Add</i>	12.15	
23 33 13 19-0013	EA		14" x 8" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	111.06	16.06
			<i>For 3 Hour Rated, Add</i>	12.55	
23 33 13 19-0014	EA		14" x 10" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	114.83	16.91
			<i>For 3 Hour Rated, Add</i>	12.82	
23 33 13 19-0015	EA		14" x 12" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	119.81	18.11
			<i>For 3 Hour Rated, Add</i>	13.09	
23 33 13 19-0016	EA		14" x 14" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	129.20	20.17
			<i>For 3 Hour Rated, Add</i>	13.77	
23 33 13 19-0017	EA		16" x 6" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	160.33	16.06
			<i>For 3 Hour Rated, Add</i>	22.41	
23 33 13 19-0018	EA		16" x 8" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	165.30	17.27
			<i>For 3 Hour Rated, Add</i>	22.68	
23 33 13 19-0019	EA		16" x 10" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	171.48	18.96
			<i>For 3 Hour Rated, Add</i>	22.95	
23 33 13 19-0020	EA		16" x 12" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	176.43	20.17
			<i>For 3 Hour Rated, Add</i>	23.21	
23 33 13 19-0021	EA		16" x 14" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	185.85	22.10
			<i>For 3 Hour Rated, Add</i>	23.89	
23 33 13 19-0022	EA		16" x 16" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	195.25	24.14
			<i>For 3 Hour Rated, Add</i>	24.56	
23 33 13 19-0023	EA		18" x 6" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	164.10	16.91
			<i>For 3 Hour Rated, Add</i>	22.68	
23 33 13 19-0024	EA		18" x 8" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	169.73	18.11
			<i>For 3 Hour Rated, Add</i>	23.08	
23 33 13 19-0025	EA		18" x 10" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	177.80	20.17
			<i>For 3 Hour Rated, Add</i>	23.49	
23 33 13 19-0026	EA		18" x 12" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	187.20	22.10
			<i>For 3 Hour Rated, Add</i>	24.16	
23 33 13 19-0027	EA		18" x 14" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	195.92	24.14
			<i>For 3 Hour Rated, Add</i>	24.70	
23 33 13 19-0028	EA		18" x 16" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	205.33	26.08
			<i>For 3 Hour Rated, Add</i>	25.37	
23 33 13 19-0029	EA		18" x 18" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	213.40	28.13
			<i>For 3 Hour Rated, Add</i>	25.77	
23 33 13 19-0030	EA		20" x 6" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	169.07	18.11
			<i>For 3 Hour Rated, Add</i>	22.95	
23 33 13 19-0031	EA		20" x 8" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	177.79	20.17
			<i>For 3 Hour Rated, Add</i>	23.48	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 33 13 19-0032 EA 20" x 10" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	186.52 24.02	22.10
23 33 13 19-0033 EA 20" x 12" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	197.95 25.10	24.14
23 33 13 19-0034 EA 20" x 14" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	206.01 25.51	26.08
23 33 13 19-0035 EA 20" x 16" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	214.08 25.91	28.13
23 33 13 19-0036 EA 20" x 18" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	222.80 26.45	30.19
23 33 13 19-0037 EA 20" x 20" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	231.53 26.99	32.12
23 33 13 19-0038 EA 24" x 6" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	232.87 34.50	20.17
23 33 13 19-0039 EA 24" x 8" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	242.96 35.31	22.10
23 33 13 19-0040 EA 24" x 10" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	251.70 35.85	24.14
23 33 13 19-0041 EA 24" x 12" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	261.77 36.66	26.08
23 33 13 19-0042 EA 24" x 14" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	269.84 37.06	28.13
23 33 13 19-0043 EA 24" x 16" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	277.89 37.47	30.19
23 33 13 19-0044 EA 24" x 18" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	287.97 38.27	32.12
23 33 13 19-0045 EA 24" x 20" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	304.08 39.08	36.23
23 33 13 19-0046 EA 24" x 24" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	321.54 40.16	40.20
23 33 13 19-0047 EA 28" x 6" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	242.96 35.31	22.10
23 33 13 19-0048 EA 28" x 8" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	251.70 35.85	24.14
23 33 13 19-0049 EA 28" x 10" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	261.77 36.66	26.08
23 33 13 19-0050 EA 28" x 12" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	270.51 37.20	28.13
23 33 13 19-0051 EA 28" x 14" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	279.91 37.87	30.19
23 33 13 19-0052 EA 28" x 16" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	289.31 38.54	32.12
23 33 13 19-0053 EA 28" x 18" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	305.42 39.35	36.23
23 33 13 19-0054 EA 28" x 20" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	321.54 40.16	40.20
23 33 13 19-0055 EA 28" x 24" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	335.66 41.78	42.26
23 33 13 19-0056 EA 28" x 28" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	354.47 43.12	46.25
23 33 13 19-0057 EA 32" x 6" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	255.73 36.66	24.14
23 33 13 19-0058 EA 32" x 8" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	263.11 36.93	26.08
23 33 13 19-0059 EA 32" x 10" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	270.51 37.20	28.13
23 33 13 19-0060 EA 32" x 12" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	279.23 37.73	30.19
23 33 13 19-0061 EA 32" x 14" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	289.56 38.59	32.12
23 33 13 19-0062 EA 32" x 16" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	305.42 39.35	36.23
23 33 13 19-0063 EA 32" x 18" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	322.89 40.43	40.20
23 33 13 19-0064 EA 32" x 20" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	340.36 41.51	44.19
23 33 13 19-0065 EA 32" x 24" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	354.47 43.12	46.25
23 33 13 19-0066 EA 32" x 28" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	373.57 45.01	49.51
23 33 13 19-0067 EA 32" x 32" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	392.79 47.16	52.29
23 33 13 19-0068 EA 36" x 6" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	270.03 38.31	26.08
23 33 13 19-0069 EA 36" x 8" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	279.00 38.89	28.13
23 33 13 19-0070 EA 36" x 10" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	287.95 39.48	30.19
23 33 13 19-0071 EA 36" x 12" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	298.39 40.36	32.12
23 33 13 19-0072 EA 36" x 14" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	312.67 40.80	36.23
23 33 13 19-0073 EA 36" x 16" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	320.90 41.24	38.16

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 33 Air Duct Accessories**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 33 13 19-0074	EA		36" x 18" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	346.34	44.19
			<i>For 3 Hour Rated, Add</i>	42.70	
23 33 13 19-0075	EA		36" x 20" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	365.73	48.30
			<i>For 3 Hour Rated, Add</i>	44.17	
23 33 13 19-0076	EA		36" x 24" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	379.33	49.87
			<i>For 3 Hour Rated, Add</i>	45.92	
23 33 13 19-0077	EA		36" x 28" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	401.92	53.49
			<i>For 3 Hour Rated, Add</i>	48.27	
23 33 13 19-0078	EA		36" x 32" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	420.61	56.26
			<i>For 3 Hour Rated, Add</i>	50.31	
23 33 13 19-0079	EA		36" x 36" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	438.36	58.32
			<i>For 3 Hour Rated, Add</i>	52.66	
23 33 13 19-0080	EA		40" x 6" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	326.80	30.19
			<i>For 3 Hour Rated, Add</i>	48.45	
23 33 13 19-0081	EA		40" x 8" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	338.68	32.12
			<i>For 3 Hour Rated, Add</i>	49.62	
23 33 13 19-0082	EA		40" x 10" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	346.19	34.17
			<i>For 3 Hour Rated, Add</i>	49.92	
23 33 13 19-0083	EA		40" x 12" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	353.69	36.23
			<i>For 3 Hour Rated, Add</i>	50.21	
23 33 13 19-0084	EA		40" x 14" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	370.89	38.16
			<i>For 3 Hour Rated, Add</i>	51.24	
23 33 13 19-0085	EA		40" x 16" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	382.05	40.20
			<i>For 3 Hour Rated, Add</i>	52.26	
23 33 13 19-0086	EA		40" x 18" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	406.03	46.25
			<i>For 3 Hour Rated, Add</i>	53.43	
23 33 13 19-0087	EA		40" x 20" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	423.95	50.23
			<i>For 3 Hour Rated, Add</i>	54.60	
23 33 13 19-0088	EA		40" x 24" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	442.40	53.49
			<i>For 3 Hour Rated, Add</i>	56.36	
23 33 13 19-0089	EA		40" x 28" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	466.95	56.26
			<i>For 3 Hour Rated, Add</i>	59.58	
23 33 13 19-0090	EA		40" x 32" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	485.40	59.53
			<i>For 3 Hour Rated, Add</i>	61.34	
23 33 13 19-0091	EA		40" x 36" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	506.33	61.10
			<i>For 3 Hour Rated, Add</i>	64.56	
23 33 13 19-0092	EA		40" x 40" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	530.65	64.36
			<i>For 3 Hour Rated, Add</i>	67.49	
23 33 13 19-0093	EA		44" x 6" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	335.76	30.19
			<i>For 3 Hour Rated, Add</i>	49.04	
23 33 13 19-0094	EA		44" x 8" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	347.66	32.12
			<i>For 3 Hour Rated, Add</i>	50.21	
23 33 13 19-0095	EA		44" x 10" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	358.08	34.17
			<i>For 3 Hour Rated, Add</i>	51.09	
23 33 13 19-0096	EA		44" x 12" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	365.59	36.23
			<i>For 3 Hour Rated, Add</i>	51.38	
23 33 13 19-0097	EA		44" x 14" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	377.49	38.16
			<i>For 3 Hour Rated, Add</i>	52.56	
23 33 13 19-0098	EA		44" x 16" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	389.37	40.20
			<i>For 3 Hour Rated, Add</i>	53.73	
23 33 13 19-0099	EA		44" x 18" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	420.86	48.30
			<i>For 3 Hour Rated, Add</i>	55.19	
23 33 13 19-0100	EA		44" x 20" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	440.24	52.29
			<i>For 3 Hour Rated, Add</i>	56.65	
23 33 13 19-0101	EA		44" x 24" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	466.95	56.26
			<i>For 3 Hour Rated, Add</i>	59.58	
23 33 13 19-0102	EA		44" x 28" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	492.20	60.37
			<i>For 3 Hour Rated, Add</i>	62.22	
23 33 13 19-0103	EA		44" x 32" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	518.92	64.36
			<i>For 3 Hour Rated, Add</i>	65.14	
23 33 13 19-0104	EA		44" x 36" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	538.13	66.29
			<i>For 3 Hour Rated, Add</i>	67.78	
23 33 13 19-0105	EA		44" x 40" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	557.35	68.35
			<i>For 3 Hour Rated, Add</i>	70.42	
23 33 13 19-0106	EA		44" x 44" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	576.58	70.40
			<i>For 3 Hour Rated, Add</i>	73.05	
23 33 13 19-0107	EA		48" x 6" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	346.19	32.12
			<i>For 3 Hour Rated, Add</i>	49.92	
23 33 13 19-0108	EA		48" x 8" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	358.08	34.17
			<i>For 3 Hour Rated, Add</i>	51.09	
23 33 13 19-0109	EA		48" x 10" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	365.59	36.23
			<i>For 3 Hour Rated, Add</i>	51.38	
23 33 13 19-0110	EA		48" x 12" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	382.05	40.20
			<i>For 3 Hour Rated, Add</i>	52.26	
23 33 13 19-0111	EA		48" x 14" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	399.99	44.19
			<i>For 3 Hour Rated, Add</i>	53.43	
23 33 13 19-0112	EA		48" x 16" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	417.92	48.30
			<i>For 3 Hour Rated, Add</i>	54.60	
23 33 13 19-0113	EA		48" x 18" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	438.78	52.29
			<i>For 3 Hour Rated, Add</i>	56.36	
23 33 13 19-0114	EA		48" x 20" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	459.63	56.26
			<i>For 3 Hour Rated, Add</i>	58.12	
23 33 13 19-0115	EA		48" x 24" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated.....	484.88	60.37
			<i>For 3 Hour Rated, Add</i>	60.75	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 33 13 19-0116 EA 48" x 28" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	513.06 63.97	64.36
23 33 13 19-0117 EA 48" x 32" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	532.29 66.61	66.29
23 33 13 19-0118 EA 48" x 36" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	555.88 70.12	68.35
23 33 13 19-0119 EA 48" x 40" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	581.14 72.76	72.32
23 33 13 19-0120 EA 48" x 44" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	604.75 76.27	74.38
23 33 13 19-0121 EA 48" x 48" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	634.58 78.62	80.42
23 33 13 19-0122 EA 52" x 6" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	356.61 50.80	34.17
23 33 13 19-0123 EA 52" x 8" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	368.51 51.97	36.23
23 33 13 19-0124 EA 52" x 10" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	386.44 53.14	40.20
23 33 13 19-0125 EA 52" x 12" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	399.99 53.43	44.19
23 33 13 19-0126 EA 52" x 14" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	418.66 54.75	48.30
23 33 13 19-0127 EA 52" x 16" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	437.32 56.07	52.29
23 33 13 19-0128 EA 52" x 18" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	458.17 57.83	56.26
23 33 13 19-0129 EA 52" x 20" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	479.02 59.58	60.37
23 33 13 19-0130 EA 52" x 24" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	504.29 62.22	64.36
23 33 13 19-0131 EA 52" x 28" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	533.93 65.73	68.35
23 33 13 19-0132 EA 52" x 32" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	554.60 68.66	70.40
23 33 13 19-0133 EA 52" x 36" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	579.68 72.47	72.32
23 33 13 19-0134 EA 52" x 40" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	609.30 75.98	76.43
23 33 13 19-0135 EA 52" x 44" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	634.58 78.62	80.42
23 33 13 19-0136 EA 52" x 48" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	670.25 82.13	86.46
23 33 13 19-0137 EA 52" x 52" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	696.97 85.06	90.44
23 33 13 19-0138 EA 56" x 6" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	365.59 51.38	36.23
23 33 13 19-0139 EA 56" x 8" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	384.97 52.85	40.20
23 33 13 19-0140 EA 56" x 10" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	401.45 53.73	44.19
23 33 13 19-0141 EA 56" x 12" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	414.99 54.02	48.30
23 33 13 19-0142 EA 56" x 14" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	435.12 55.63	52.29
23 33 13 19-0143 EA 56" x 16" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	455.24 57.24	56.26
23 33 13 19-0144 EA 56" x 18" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	475.36 58.85	60.37
23 33 13 19-0145 EA 56" x 20" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	495.50 60.46	64.36
23 33 13 19-0146 EA 56" x 24" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	525.13 63.97	68.35
23 33 13 19-0147 EA 56" x 28" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	548.76 67.49	70.40
23 33 13 19-0148 EA 56" x 32" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	570.88 70.71	72.32
23 33 13 19-0149 EA 56" x 36" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	603.45 74.81	76.43
23 33 13 19-0150 EA 56" x 40" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	633.11 78.32	80.42
23 33 13 19-0151 EA 56" x 44" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	664.21 82.13	84.41
23 33 13 19-0152 EA 56" x 48" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	690.93 85.06	88.50
23 33 13 19-0153 EA 56" x 52" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	722.03 88.86	92.49
23 33 13 19-0154 EA 56" x 56" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	753.14 92.67	96.48
23 33 13 19-0155 EA 60" x 6" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	382.05 52.26	40.20
23 33 13 19-0156 EA 60" x 8" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	401.45 53.73	44.19
23 33 13 19-0157 EA 60" x 10" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated..... <i>For 3 Hour Rated, Add</i>	416.46 54.31	48.30

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 33 Air Duct Accessories**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 33 13 19-0158	EA		60" x 12" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	429.99	52.29
			<i>For 3 Hour Rated, Add</i>	54.60	
23 33 13 19-0159	EA		60" x 14" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	450.85	56.26
			<i>For 3 Hour Rated, Add</i>	56.36	
23 33 13 19-0160	EA		60" x 16" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	471.70	60.37
			<i>For 3 Hour Rated, Add</i>	58.12	
23 33 13 19-0161	EA		60" x 18" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	493.30	64.36
			<i>For 3 Hour Rated, Add</i>	60.02	
23 33 13 19-0162	EA		60" x 20" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	514.90	68.35
			<i>For 3 Hour Rated, Add</i>	61.93	
23 33 13 19-0163	EA		60" x 24" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	539.97	70.40
			<i>For 3 Hour Rated, Add</i>	65.73	
23 33 13 19-0164	EA		60" x 28" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	563.56	72.32
			<i>For 3 Hour Rated, Add</i>	69.24	
23 33 13 19-0165	EA		60" x 32" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	594.68	76.43
			<i>For 3 Hour Rated, Add</i>	73.05	
23 33 13 19-0166	EA		60" x 36" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	625.80	80.42
			<i>For 3 Hour Rated, Add</i>	76.86	
23 33 13 19-0167	EA		60" x 40" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	652.51	84.41
			<i>For 3 Hour Rated, Add</i>	79.79	
23 33 13 19-0168	EA		60" x 44" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	688.00	88.50
			<i>For 3 Hour Rated, Add</i>	84.47	
23 33 13 19-0169	EA		60" x 48" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	720.57	92.49
			<i>For 3 Hour Rated, Add</i>	88.57	
23 33 13 19-0170	EA		60" x 52" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	753.14	96.48
			<i>For 3 Hour Rated, Add</i>	92.67	
23 33 13 19-0171	EA		60" x 56" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	782.78	100.59
			<i>For 3 Hour Rated, Add</i>	96.18	
23 33 13 19-0172	EA		60" x 60" Louver Type Combination Fire/Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	812.44	104.56
			<i>For 3 Hour Rated, Add</i>	99.70	
23 33 13 19-0173			Smoke Damper <small>(23 33 13 19)</small>		
			Note: Leakage class I with Firestat UL 555S air foil blades.		
23 33 13 19-0174	EA		6" x 6" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	75.37	8.93
			<i>For Dynamic Damper, Add</i>	10.93	
			<i>For 3 Hour Rated, Add</i>	9.71	
23 33 13 19-0175	EA		8" x 6" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	77.80	9.33
			<i>For Dynamic Damper, Add</i>	11.20	
			<i>For 3 Hour Rated, Add</i>	9.96	
23 33 13 19-0176	EA		8" x 8" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	79.20	9.41
			<i>For Dynamic Damper, Add</i>	11.48	
			<i>For 3 Hour Rated, Add</i>	10.21	
23 33 13 19-0177	EA		10" x 6" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	79.20	9.41
			<i>For Dynamic Damper, Add</i>	11.48	
			<i>For 3 Hour Rated, Add</i>	10.21	
23 33 13 19-0178	EA		10" x 8" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	81.24	9.66
			<i>For Dynamic Damper, Add</i>	11.76	
			<i>For 3 Hour Rated, Add</i>	10.45	
23 33 13 19-0179	EA		10" x 10" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	86.91	10.70
			<i>For Dynamic Damper, Add</i>	12.31	
			<i>For 3 Hour Rated, Add</i>	10.94	
23 33 13 19-0180	EA		12" x 6" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	81.24	9.66
			<i>For Dynamic Damper, Add</i>	11.76	
			<i>For 3 Hour Rated, Add</i>	10.45	
23 33 13 19-0181	EA		12" x 8" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	85.30	10.22
			<i>For Dynamic Damper, Add</i>	12.31	
			<i>For 3 Hour Rated, Add</i>	10.94	
23 33 13 19-0182	EA		12" x 10" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	88.15	10.70
			<i>For Dynamic Damper, Add</i>	12.59	
			<i>For 3 Hour Rated, Add</i>	11.19	
23 33 13 19-0183	EA		12" x 12" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	93.40	12.07
			<i>For Dynamic Damper, Add</i>	12.86	
			<i>For 3 Hour Rated, Add</i>	11.43	
23 33 13 19-0184	EA		14" x 6" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	84.69	10.22
			<i>For Dynamic Damper, Add</i>	12.17	
			<i>For 3 Hour Rated, Add</i>	10.82	
23 33 13 19-0185	EA		14" x 8" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	88.15	10.70
			<i>For Dynamic Damper, Add</i>	12.59	
			<i>For 3 Hour Rated, Add</i>	11.19	
23 33 13 19-0186	EA		14" x 10" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	90.98	11.27
			<i>For Dynamic Damper, Add</i>	12.86	
			<i>For 3 Hour Rated, Add</i>	11.43	
23 33 13 19-0187	EA		14" x 12" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	94.64	12.07
			<i>For Dynamic Damper, Add</i>	13.14	
			<i>For 3 Hour Rated, Add</i>	11.68	
23 33 13 19-0188	EA		14" x 14" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	101.72	13.44
			<i>For Dynamic Damper, Add</i>	13.83	
			<i>For 3 Hour Rated, Add</i>	12.30	
23 33 13 19-0189	EA		16" x 6" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	132.93	10.70
			<i>For Dynamic Damper, Add</i>	22.66	
			<i>For 3 Hour Rated, Add</i>	20.15	
23 33 13 19-0190	EA		16" x 8" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	136.58	11.51
			<i>For Dynamic Damper, Add</i>	22.94	
			<i>For 3 Hour Rated, Add</i>	20.39	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 33 13 19-0191 EA 16" x 10" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	141.03 23.22 20.64	12.64
23 33 13 19-0192 EA 16" x 12" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	144.65 23.49 20.88	13.44
23 33 13 19-0193 EA 16" x 14" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	151.77 24.19 21.50	14.73
23 33 13 19-0194 EA 16" x 16" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	158.87 24.88 22.11	16.10
23 33 13 19-0195 EA 18" x 6" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	135.77 22.94 20.39	11.27
23 33 13 19-0196 EA 18" x 8" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	140.03 23.36 20.76	12.07
23 33 13 19-0197 EA 18" x 10" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	145.90 23.77 21.13	13.44
23 33 13 19-0198 EA 18" x 12" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	153.00 24.46 21.75	14.73
23 33 13 19-0199 EA 18" x 14" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	159.48 25.02 22.24	16.10
23 33 13 19-0200 EA 18" x 16" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	166.59 25.71 22.85	17.39
23 33 13 19-0201 EA 18" x 18" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	172.45 26.12 23.22	18.76
23 33 13 19-0202 EA 20" x 6" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	139.42 23.22 20.64	12.07
23 33 13 19-0203 EA 20" x 8" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	145.89 23.77 21.13	13.44
23 33 13 19-0204 EA 20" x 10" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	152.38 24.32 21.62	14.73
23 33 13 19-0205 EA 20" x 12" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	161.34 25.43 22.61	16.10
23 33 13 19-0206 EA 20" x 14" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	167.21 25.85 22.98	17.39
23 33 13 19-0207 EA 20" x 16" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	173.07 26.26 23.35	18.76
23 33 13 19-0208 EA 20" x 18" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	179.55 26.82 23.84	20.13
23 33 13 19-0209 EA 20" x 20" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	186.04 27.37 24.33	21.42
23 33 13 19-0210 EA 24" x 6" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	182.94 32.11 28.54	13.44
23 33 13 19-0211 EA 24" x 8" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	190.67 32.94 29.28	14.73
23 33 13 19-0212 EA 24" x 10" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	197.17 33.50 29.77	16.10
23 33 13 19-0213 EA 24" x 12" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	204.89 34.33 30.51	17.39
23 33 13 19-0214 EA 24" x 14" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	210.74 34.74 30.88	18.76
23 33 13 19-0215 EA 24" x 16" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	216.61 35.15 31.25	20.13
23 33 13 19-0216 EA 24" x 18" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	224.33 35.98 31.99	21.42
23 33 13 19-0217 EA 24" x 20" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	236.06 36.81 32.72	24.14
23 33 13 19-0218 EA 24" x 24" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	249.04 37.92 33.71	26.80

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 33 Air Duct Accessories**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 33 13 19-0219	EA		28" x 6" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	190.67	14.73
			<i>For Dynamic Damper, Add</i>	32.94	
			<i>For 3 Hour Rated, Add</i>	29.28	
23 33 13 19-0220	EA		28" x 8" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	197.17	16.10
			<i>For Dynamic Damper, Add</i>	33.50	
			<i>For 3 Hour Rated, Add</i>	29.77	
23 33 13 19-0221	EA		28" x 10" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	204.89	17.39
			<i>For Dynamic Damper, Add</i>	34.33	
			<i>For 3 Hour Rated, Add</i>	30.51	
23 33 13 19-0222	EA		28" x 12" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	211.35	18.76
			<i>For Dynamic Damper, Add</i>	34.88	
			<i>For 3 Hour Rated, Add</i>	31.00	
23 33 13 19-0223	EA		28" x 14" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	218.45	20.13
			<i>For Dynamic Damper, Add</i>	35.57	
			<i>For 3 Hour Rated, Add</i>	31.62	
23 33 13 19-0224	EA		28" x 16" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	225.55	21.42
			<i>For Dynamic Damper, Add</i>	36.26	
			<i>For 3 Hour Rated, Add</i>	32.23	
23 33 13 19-0225	EA		28" x 18" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	237.28	24.14
			<i>For Dynamic Damper, Add</i>	37.09	
			<i>For 3 Hour Rated, Add</i>	32.97	
23 33 13 19-0226	EA		28" x 20" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	249.04	26.80
			<i>For Dynamic Damper, Add</i>	37.92	
			<i>For 3 Hour Rated, Add</i>	33.71	
23 33 13 19-0227	EA		28" x 24" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	260.45	28.17
			<i>For Dynamic Damper, Add</i>	39.58	
			<i>For 3 Hour Rated, Add</i>	35.18	
23 33 13 19-0228	EA		28" x 28" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	274.64	30.83
			<i>For Dynamic Damper, Add</i>	40.97	
			<i>For 3 Hour Rated, Add</i>	36.41	
23 33 13 19-0229	EA		32" x 6" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	200.86	16.10
			<i>For Dynamic Damper, Add</i>	34.33	
			<i>For 3 Hour Rated, Add</i>	30.51	
23 33 13 19-0230	EA		32" x 8" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	206.10	17.39
			<i>For Dynamic Damper, Add</i>	34.60	
			<i>For 3 Hour Rated, Add</i>	30.75	
23 33 13 19-0231	EA		32" x 10" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	211.35	18.76
			<i>For Dynamic Damper, Add</i>	34.88	
			<i>For 3 Hour Rated, Add</i>	31.00	
23 33 13 19-0232	EA		32" x 12" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	217.83	20.13
			<i>For Dynamic Damper, Add</i>	35.43	
			<i>For 3 Hour Rated, Add</i>	31.49	
23 33 13 19-0233	EA		32" x 14" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	225.79	21.42
			<i>For Dynamic Damper, Add</i>	36.31	
			<i>For 3 Hour Rated, Add</i>	32.28	
23 33 13 19-0234	EA		32" x 16" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	237.28	24.14
			<i>For Dynamic Damper, Add</i>	37.09	
			<i>For 3 Hour Rated, Add</i>	32.97	
23 33 13 19-0235	EA		32" x 18" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	250.27	26.80
			<i>For Dynamic Damper, Add</i>	38.20	
			<i>For 3 Hour Rated, Add</i>	33.95	
23 33 13 19-0236	EA		32" x 20" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	263.24	29.46
			<i>For Dynamic Damper, Add</i>	39.31	
			<i>For 3 Hour Rated, Add</i>	34.94	
23 33 13 19-0237	EA		32" x 24" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	274.64	30.83
			<i>For Dynamic Damper, Add</i>	40.97	
			<i>For 3 Hour Rated, Add</i>	36.41	
23 33 13 19-0238	EA		32" x 28" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	289.70	33.00
			<i>For Dynamic Damper, Add</i>	42.91	
			<i>For 3 Hour Rated, Add</i>	38.14	
23 33 13 19-0239	EA		32" x 32" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	305.16	34.86
			<i>For Dynamic Damper, Add</i>	45.12	
			<i>For 3 Hour Rated, Add</i>	40.10	
23 33 13 19-0240	EA		36" x 6" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	210.68	17.39
			<i>For Dynamic Damper, Add</i>	35.63	
			<i>For 3 Hour Rated, Add</i>	31.67	
23 33 13 19-0241	EA		36" x 8" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	217.26	18.76
			<i>For Dynamic Damper, Add</i>	36.21	
			<i>For 3 Hour Rated, Add</i>	32.18	
23 33 13 19-0242	EA		36" x 10" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	223.86	20.13
			<i>For Dynamic Damper, Add</i>	36.79	
			<i>For 3 Hour Rated, Add</i>	32.70	
23 33 13 19-0243	EA		36" x 12" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	231.76	21.42
			<i>For Dynamic Damper, Add</i>	37.66	
			<i>For 3 Hour Rated, Add</i>	33.47	
23 33 13 19-0244	EA		36" x 14" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	241.75	24.14
			<i>For Dynamic Damper, Add</i>	38.09	
			<i>For 3 Hour Rated, Add</i>	33.86	
23 33 13 19-0245	EA		36" x 16" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	247.71	25.43
			<i>For Dynamic Damper, Add</i>	38.53	
			<i>For 3 Hour Rated, Add</i>	34.25	
23 33 13 19-0246	EA		36" x 18" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	266.22	29.46
			<i>For Dynamic Damper, Add</i>	39.98	
			<i>For 3 Hour Rated, Add</i>	35.54	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 33 13 19-0247 EA 36" x 20" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	280.71 41.42 36.82	32.20
23 33 13 19-0248 EA 36" x 24" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	291.67 43.17 38.37	33.25
23 33 13 19-0249 EA 36" x 28" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	309.21 45.48 40.43	35.66
23 33 13 19-0250 EA 36" x 32" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	323.87 47.51 42.23	37.52
23 33 13 19-0251 EA 36" x 36" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	338.21 49.83 44.30	38.88
23 33 13 19-0252 EA 40" x 6" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	242.84 41.96 37.30	20.13
23 33 13 19-0253 EA 40" x 8" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	252.02 43.12 38.33	21.42
23 33 13 19-0254 EA 40" x 10" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	257.34 43.41 38.59	22.79
23 33 13 19-0255 EA 40" x 12" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	262.66 43.70 38.85	24.14
23 33 13 19-0256 EA 40" x 14" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	275.22 44.72 39.75	25.43
23 33 13 19-0257 EA 40" x 16" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	283.76 45.73 40.65	26.80
23 33 13 19-0258 EA 40" x 18" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	300.98 46.89 41.68	30.83
23 33 13 19-0259 EA 40" x 20" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	314.20 48.05 42.71	33.49
23 33 13 19-0260 EA 40" x 24" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	328.36 49.79 44.26	35.66
23 33 13 19-0261 EA 40" x 28" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	348.17 52.98 47.09	37.52
23 33 13 19-0262 EA 40" x 32" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	362.32 54.72 48.64	39.68
23 33 13 19-0263 EA 40" x 36" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	379.72 57.91 51.47	40.73
23 33 13 19-0264 EA 40" x 40" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	399.06 60.81 54.05	42.90
23 33 13 19-0265 EA 44" x 6" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	249.45 42.54 37.82	20.13
23 33 13 19-0266 EA 44" x 8" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	258.63 43.70 38.85	21.42
23 33 13 19-0267 EA 44" x 10" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	266.54 44.57 39.62	22.79
23 33 13 19-0268 EA 44" x 12" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	271.84 44.87 39.88	24.14
23 33 13 19-0269 EA 44" x 14" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	281.02 46.02 40.91	25.43
23 33 13 19-0270 EA 44" x 16" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	290.20 47.18 41.94	26.80
23 33 13 19-0271 EA 44" x 18" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	312.75 48.63 43.23	32.20
23 33 13 19-0272 EA 44" x 20" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	327.22 50.08 44.52	34.86
23 33 13 19-0273 EA 44" x 24" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	348.17 52.98 47.09	37.52
23 33 13 19-0274 EA 44" x 28" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	367.81 55.59 49.41	40.24

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 33 Air Duct Accessories**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 33 13 19-0275	EA		44" x 32" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	388.74	42.90
			<i>For Dynamic Damper, Add</i>	58.49	
			<i>For 3 Hour Rated, Add</i>	51.99	
23 33 13 19-0276	EA		44" x 36" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	404.36	44.19
			<i>For Dynamic Damper, Add</i>	61.10	
			<i>For 3 Hour Rated, Add</i>	54.31	
23 33 13 19-0277	EA		44" x 40" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	419.98	45.56
			<i>For Dynamic Damper, Add</i>	63.71	
			<i>For 3 Hour Rated, Add</i>	56.63	
23 33 13 19-0278	EA		44" x 44" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	435.61	46.93
			<i>For Dynamic Damper, Add</i>	66.32	
			<i>For 3 Hour Rated, Add</i>	58.95	
23 33 13 19-0279	EA		48" x 6" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	257.34	21.42
			<i>For Dynamic Damper, Add</i>	43.41	
			<i>For 3 Hour Rated, Add</i>	38.59	
23 33 13 19-0280	EA		48" x 8" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	266.54	22.79
			<i>For Dynamic Damper, Add</i>	44.57	
			<i>For 3 Hour Rated, Add</i>	39.62	
23 33 13 19-0281	EA		48" x 10" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	271.84	24.14
			<i>For Dynamic Damper, Add</i>	44.87	
			<i>For 3 Hour Rated, Add</i>	39.88	
23 33 13 19-0282	EA		48" x 12" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	283.76	26.80
			<i>For Dynamic Damper, Add</i>	45.73	
			<i>For 3 Hour Rated, Add</i>	40.65	
23 33 13 19-0283	EA		48" x 14" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	296.95	29.46
			<i>For Dynamic Damper, Add</i>	46.89	
			<i>For 3 Hour Rated, Add</i>	41.68	
23 33 13 19-0284	EA		48" x 16" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	310.17	32.20
			<i>For Dynamic Damper, Add</i>	48.05	
			<i>For 3 Hour Rated, Add</i>	42.71	
23 33 13 19-0285	EA		48" x 18" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	325.94	34.86
			<i>For Dynamic Damper, Add</i>	49.79	
			<i>For 3 Hour Rated, Add</i>	44.26	
23 33 13 19-0286	EA		48" x 20" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	341.72	37.52
			<i>For Dynamic Damper, Add</i>	51.53	
			<i>For 3 Hour Rated, Add</i>	45.80	
23 33 13 19-0287	EA		48" x 24" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	361.36	40.24
			<i>For Dynamic Damper, Add</i>	54.14	
			<i>For 3 Hour Rated, Add</i>	48.12	
23 33 13 19-0288	EA		48" x 28" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	383.59	42.90
			<i>For Dynamic Damper, Add</i>	57.33	
			<i>For 3 Hour Rated, Add</i>	50.96	
23 33 13 19-0289	EA		48" x 32" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	399.22	44.19
			<i>For Dynamic Damper, Add</i>	59.94	
			<i>For 3 Hour Rated, Add</i>	53.28	
23 33 13 19-0290	EA		48" x 36" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	418.69	45.56
			<i>For Dynamic Damper, Add</i>	63.42	
			<i>For 3 Hour Rated, Add</i>	56.37	
23 33 13 19-0291	EA		48" x 40" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	438.35	48.22
			<i>For Dynamic Damper, Add</i>	66.03	
			<i>For 3 Hour Rated, Add</i>	58.69	
23 33 13 19-0292	EA		48" x 44" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	457.83	49.59
			<i>For Dynamic Damper, Add</i>	69.50	
			<i>For 3 Hour Rated, Add</i>	61.78	
23 33 13 19-0293	EA		48" x 48" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	480.22	53.62
			<i>For Dynamic Damper, Add</i>	71.82	
			<i>For 3 Hour Rated, Add</i>	63.84	
23 33 13 19-0294	EA		52" x 6" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	265.25	22.79
			<i>For Dynamic Damper, Add</i>	44.28	
			<i>For 3 Hour Rated, Add</i>	39.36	
23 33 13 19-0295	EA		52" x 8" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	274.41	24.14
			<i>For Dynamic Damper, Add</i>	45.44	
			<i>For 3 Hour Rated, Add</i>	40.39	
23 33 13 19-0296	EA		52" x 10" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	287.62	26.80
			<i>For Dynamic Damper, Add</i>	46.60	
			<i>For 3 Hour Rated, Add</i>	41.42	
23 33 13 19-0297	EA		52" x 12" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	296.95	29.46
			<i>For Dynamic Damper, Add</i>	46.89	
			<i>For 3 Hour Rated, Add</i>	41.68	
23 33 13 19-0298	EA		52" x 14" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	310.82	32.20
			<i>For Dynamic Damper, Add</i>	48.20	
			<i>For 3 Hour Rated, Add</i>	42.84	
23 33 13 19-0299	EA		52" x 16" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	324.65	34.86
			<i>For Dynamic Damper, Add</i>	49.50	
			<i>For 3 Hour Rated, Add</i>	44.00	
23 33 13 19-0300	EA		52" x 18" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	340.44	37.52
			<i>For Dynamic Damper, Add</i>	51.24	
			<i>For 3 Hour Rated, Add</i>	45.55	
23 33 13 19-0301	EA		52" x 20" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	356.21	40.24
			<i>For Dynamic Damper, Add</i>	52.98	
			<i>For 3 Hour Rated, Add</i>	47.09	
23 33 13 19-0302	EA		52" x 24" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	375.87	42.90
			<i>For Dynamic Damper, Add</i>	55.59	
			<i>For 3 Hour Rated, Add</i>	49.41	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 33 13 19-0303 EA 52" x 28" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	399.36 59.07 52.50	45.56
23 33 13 19-0304 EA 52" x 32" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	416.27 61.97 55.08	46.93
23 33 13 19-0305 EA 52" x 36" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	437.06 65.74 58.43	48.22
23 33 13 19-0306 EA 52" x 40" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	460.55 69.21 61.52	50.96
23 33 13 19-0307 EA 52" x 44" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	480.22 71.82 63.84	53.62
23 33 13 19-0308 EA 52" x 48" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	507.75 75.30 66.94	57.63
23 33 13 19-0309 EA 52" x 52" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	528.68 78.20 69.51	60.29
23 33 13 19-0310 EA 56" x 6" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	271.84 44.87 39.88	24.14
23 33 13 19-0311 EA 56" x 8" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	286.33 46.31 41.17	26.80
23 33 13 19-0312 EA 56" x 10" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	298.24 47.18 41.94	29.46
23 33 13 19-0313 EA 56" x 12" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	307.58 47.47 42.20	32.20
23 33 13 19-0314 EA 56" x 14" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	322.72 49.07 43.62	34.86
23 33 13 19-0315 EA 56" x 16" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	337.86 50.66 45.03	37.52
23 33 13 19-0316 EA 56" x 18" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	352.99 52.26 46.45	40.24
23 33 13 19-0317 EA 56" x 20" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	368.13 53.85 47.87	42.90
23 33 13 19-0318 EA 56" x 24" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	391.63 57.33 50.96	45.56
23 33 13 19-0319 EA 56" x 28" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	411.13 60.81 54.05	46.93
23 33 13 19-0320 EA 56" x 32" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	429.33 64.00 56.89	48.22
23 33 13 19-0321 EA 56" x 36" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	455.41 68.06 60.49	50.96
23 33 13 19-0322 EA 56" x 40" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	478.93 71.53 63.59	53.62
23 33 13 19-0323 EA 56" x 44" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	503.72 75.30 66.94	56.26
23 33 13 19-0324 EA 56" x 48" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	524.67 78.20 69.51	59.00
23 33 13 19-0325 EA 56" x 52" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	549.46 81.97 72.86	61.66
23 33 13 19-0326 EA 56" x 56" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	574.27 85.74 76.21	64.32
23 33 13 19-0327 EA 60" x 6" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	283.76 45.73 40.65	26.80
23 33 13 19-0328 EA 60" x 8" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	298.24 47.18 41.94	29.46
23 33 13 19-0329 EA 60" x 10" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	308.87 47.76 42.45	32.20
23 33 13 19-0330 EA 60" x 12" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated <i>For Dynamic Damper, Add</i> <i>For 3 Hour Rated, Add</i>	318.21 48.05 42.71	34.86

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 33 Air Duct Accessories**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 33 13 19-0331 EA 60" x 14" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	334.00	37.52
For Dynamic Damper, Add	49.79	
For 3 Hour Rated, Add	44.26	
23 33 13 19-0332 EA 60" x 16" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	349.76	40.24
For Dynamic Damper, Add	51.53	
For 3 Hour Rated, Add	45.80	
23 33 13 19-0333 EA 60" x 18" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	366.20	42.90
For Dynamic Damper, Add	53.42	
For 3 Hour Rated, Add	47.48	
23 33 13 19-0334 EA 60" x 20" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	382.61	45.56
For Dynamic Damper, Add	55.30	
For 3 Hour Rated, Add	49.15	
23 33 13 19-0335 EA 60" x 24" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	403.39	46.93
For Dynamic Damper, Add	59.07	
For 3 Hour Rated, Add	52.50	
23 33 13 19-0336 EA 60" x 28" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	422.88	48.22
For Dynamic Damper, Add	62.55	
For 3 Hour Rated, Add	55.60	
23 33 13 19-0337 EA 60" x 32" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	447.68	50.96
For Dynamic Damper, Add	66.32	
For 3 Hour Rated, Add	58.95	
23 33 13 19-0338 EA 60" x 36" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	472.49	53.62
For Dynamic Damper, Add	70.09	
For 3 Hour Rated, Add	62.30	
23 33 13 19-0339 EA 60" x 40" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	493.41	56.26
For Dynamic Damper, Add	72.98	
For 3 Hour Rated, Add	64.87	
23 33 13 19-0340 EA 60" x 44" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	522.08	59.00
For Dynamic Damper, Add	77.62	
For 3 Hour Rated, Add	69.00	
23 33 13 19-0341 EA 60" x 48" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	548.16	61.66
For Dynamic Damper, Add	81.68	
For 3 Hour Rated, Add	72.60	
23 33 13 19-0342 EA 60" x 52" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	574.27	64.32
For Dynamic Damper, Add	85.74	
For 3 Hour Rated, Add	76.21	
23 33 13 19-0343 EA 60" x 56" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	597.75	67.06
For Dynamic Damper, Add	89.21	
For 3 Hour Rated, Add	79.30	
23 33 13 19-0344 EA 60" x 60" Louver Type Smoke Damper, Steel Construction, UL Listed, 1-1/2 Hour Rated	621.29	69.71
For Dynamic Damper, Add	92.70	
For 3 Hour Rated, Add	82.40	

23 33 13 23 Backdraft Dampers (23 33 13)**23 33 13 23-0001 Horizontally Mounted Backdraft Damper (23 33 13 23)**

Note: Galvanized steel frame, aluminum blades. Exclude motor pack.

23 33 13 23-0002 EA 6" x 6" Horizontally Mounted Backdraft Damper	49.25	8.93
23 33 13 23-0003 EA 8" x 6" Horizontally Mounted Backdraft Damper	57.93	9.33
23 33 13 23-0004 EA 8" x 8" Horizontally Mounted Backdraft Damper	68.07	9.41
23 33 13 23-0005 EA 10" x 6" Horizontally Mounted Backdraft Damper	65.58	9.41
23 33 13 23-0006 EA 10" x 8" Horizontally Mounted Backdraft Damper	63.42	9.66
23 33 13 23-0007 EA 10" x 10" Horizontally Mounted Backdraft Damper	75.25	10.70
23 33 13 23-0008 EA 12" x 6" Horizontally Mounted Backdraft Damper	59.98	9.66
23 33 13 23-0009 EA 12" x 8" Horizontally Mounted Backdraft Damper	73.53	10.70
23 33 13 23-0010 EA 12" x 10" Horizontally Mounted Backdraft Damper	71.43	11.27
23 33 13 23-0011 EA 12" x 12" Horizontally Mounted Backdraft Damper	81.38	12.07
23 33 13 23-0012 EA 14" x 6" Horizontally Mounted Backdraft Damper	66.75	10.22
23 33 13 23-0013 EA 14" x 8" Horizontally Mounted Backdraft Damper	68.92	11.27
23 33 13 23-0014 EA 14" x 10" Horizontally Mounted Backdraft Damper	80.13	12.07
23 33 13 23-0015 EA 14" x 12" Horizontally Mounted Backdraft Damper	74.01	13.44
23 33 13 23-0016 EA 14" x 14" Horizontally Mounted Backdraft Damper	83.67	14.73
23 33 13 23-0017 EA 16" x 6" Horizontally Mounted Backdraft Damper	73.53	10.70
23 33 13 23-0018 EA 16" x 8" Horizontally Mounted Backdraft Damper	76.36	12.07
23 33 13 23-0019 EA 16" x 10" Horizontally Mounted Backdraft Damper	72.40	13.44
23 33 13 23-0020 EA 16" x 12" Horizontally Mounted Backdraft Damper	78.83	13.44
23 33 13 23-0021 EA 16" x 14" Horizontally Mounted Backdraft Damper	89.29	14.73
23 33 13 23-0022 EA 16" x 16" Horizontally Mounted Backdraft Damper	99.75	16.10
23 33 13 23-0023 EA 18" x 6" Horizontally Mounted Backdraft Damper	67.67	11.27
23 33 13 23-0024 EA 18" x 8" Horizontally Mounted Backdraft Damper	65.17	12.07
23 33 13 23-0025 EA 18" x 10" Horizontally Mounted Backdraft Damper	76.41	13.44
23 33 13 23-0026 EA 18" x 12" Horizontally Mounted Backdraft Damper	87.68	14.73
23 33 13 23-0027 EA 18" x 14" Horizontally Mounted Backdraft Damper	98.94	16.10
23 33 13 23-0028 EA 18" x 16" Horizontally Mounted Backdraft Damper	112.06	17.39
23 33 13 23-0029 EA 18" x 18" Horizontally Mounted Backdraft Damper	127.57	20.13
23 33 13 23-0030 EA 18" x 20" Horizontally Mounted Backdraft Damper	109.69	21.42
23 33 13 23-0031 EA 18" x 24" Horizontally Mounted Backdraft Damper	126.78	24.14
23 33 13 23-0032 EA 20" x 6" Horizontally Mounted Backdraft Damper	73.85	12.07
23 33 13 23-0033 EA 20" x 8" Horizontally Mounted Backdraft Damper	72.40	13.44
23 33 13 23-0034 EA 20" x 10" Horizontally Mounted Backdraft Damper	84.46	14.73
23 33 13 23-0035 EA 20" x 12" Horizontally Mounted Backdraft Damper	96.54	16.10
23 33 13 23-0036 EA 20" x 14" Horizontally Mounted Backdraft Damper	110.41	17.39
23 33 13 23-0037 EA 20" x 16" Horizontally Mounted Backdraft Damper	122.71	18.76



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 33 13 23-0038 EA 20" x 18" Horizontally Mounted Backdraft Damper.....	109.69	21.42
23 33 13 23-0039 EA 20" x 20" Horizontally Mounted Backdraft Damper.....	114.72	21.42
23 33 13 23-0040 EA 20" x 24" Horizontally Mounted Backdraft Damper.....	132.82	24.14
23 33 13 23-0041 EA 20" x 28" Horizontally Mounted Backdraft Damper.....	150.93	26.80
23 33 13 23-0042 EA 20" x 32" Horizontally Mounted Backdraft Damper.....	146.04	29.46
23 33 13 23-0043 EA 20" x 36" Horizontally Mounted Backdraft Damper.....	161.28	32.20
23 33 13 23-0044 EA 24" x 6" Horizontally Mounted Backdraft Damper.....	69.18	13.44
23 33 13 23-0045 EA 24" x 8" Horizontally Mounted Backdraft Damper.....	82.86	14.73
23 33 13 23-0046 EA 24" x 10" Horizontally Mounted Backdraft Damper.....	96.54	16.10
23 33 13 23-0047 EA 24" x 12" Horizontally Mounted Backdraft Damper.....	112.06	17.39
23 33 13 23-0048 EA 24" x 14" Horizontally Mounted Backdraft Damper.....	102.63	20.13
23 33 13 23-0049 EA 24" x 16" Horizontally Mounted Backdraft Damper.....	112.70	21.42
23 33 13 23-0050 EA 24" x 18" Horizontally Mounted Backdraft Damper.....	126.78	24.14
23 33 13 23-0051 EA 24" x 20" Horizontally Mounted Backdraft Damper.....	132.82	24.14
23 33 13 23-0052 EA 24" x 24" Horizontally Mounted Backdraft Damper.....	152.95	26.80
23 33 13 23-0053 EA 24" x 28" Horizontally Mounted Backdraft Damper.....	148.90	29.46
23 33 13 23-0054 EA 24" x 32" Horizontally Mounted Backdraft Damper.....	165.60	32.20
23 33 13 23-0055 EA 24" x 36" Horizontally Mounted Backdraft Damper.....	182.26	34.86
23 33 13 23-0056 EA 24" x 40" Horizontally Mounted Backdraft Damper.....	181.70	37.52
23 33 13 23-0057 EA 24" x 44" Horizontally Mounted Backdraft Damper.....	196.63	40.24
23 33 13 23-0058 EA 24" x 48" Horizontally Mounted Backdraft Damper.....	203.53	40.24
23 33 13 23-0059 EA 28" x 6" Horizontally Mounted Backdraft Damper.....	74.01	13.44
23 33 13 23-0060 EA 28" x 8" Horizontally Mounted Backdraft Damper.....	89.29	14.73
23 33 13 23-0061 EA 28" x 10" Horizontally Mounted Backdraft Damper.....	110.41	17.39
23 33 13 23-0062 EA 28" x 12" Horizontally Mounted Backdraft Damper.....	102.63	20.13
23 33 13 23-0063 EA 28" x 14" Horizontally Mounted Backdraft Damper.....	113.71	21.42
23 33 13 23-0064 EA 28" x 16" Horizontally Mounted Backdraft Damper.....	128.79	24.14
23 33 13 23-0065 EA 28" x 18" Horizontally Mounted Backdraft Damper.....	143.90	26.80
23 33 13 23-0066 EA 28" x 20" Horizontally Mounted Backdraft Damper.....	150.93	26.80
23 33 13 23-0067 EA 28" x 24" Horizontally Mounted Backdraft Damper.....	148.90	29.46
23 33 13 23-0068 EA 28" x 28" Horizontally Mounted Backdraft Damper.....	167.03	32.20
23 33 13 23-0069 EA 28" x 32" Horizontally Mounted Backdraft Damper.....	185.13	34.86
23 33 13 23-0070 EA 28" x 36" Horizontally Mounted Backdraft Damper.....	193.18	40.24
23 33 13 23-0071 EA 28" x 40" Horizontally Mounted Backdraft Damper.....	201.23	40.24
23 33 13 23-0072 EA 28" x 44" Horizontally Mounted Backdraft Damper.....	217.34	42.90
23 33 13 23-0073 EA 28" x 48" Horizontally Mounted Backdraft Damper.....	233.43	45.56
23 33 13 23-0074 EA 28" x 52" Horizontally Mounted Backdraft Damper.....	241.48	45.56
23 33 13 23-0075 EA 28" x 56" Horizontally Mounted Backdraft Damper.....	243.51	48.22
23 33 13 23-0076 EA 28" x 60" Horizontally Mounted Backdraft Damper.....	250.54	48.22
23 33 13 23-0077 EA 32" x 6" Horizontally Mounted Backdraft Damper.....	82.86	14.73
23 33 13 23-0078 EA 32" x 8" Horizontally Mounted Backdraft Damper.....	105.43	17.39
23 33 13 23-0079 EA 32" x 10" Horizontally Mounted Backdraft Damper.....	122.71	18.76
23 33 13 23-0080 EA 32" x 12" Horizontally Mounted Backdraft Damper.....	112.70	21.42
23 33 13 23-0081 EA 32" x 14" Horizontally Mounted Backdraft Damper.....	128.79	24.14
23 33 13 23-0082 EA 32" x 16" Horizontally Mounted Backdraft Damper.....	144.90	26.80
23 33 13 23-0083 EA 32" x 18" Horizontally Mounted Backdraft Damper.....	132.24	26.80
23 33 13 23-0084 EA 32" x 20" Horizontally Mounted Backdraft Damper.....	146.04	29.46
23 33 13 23-0085 EA 32" x 24" Horizontally Mounted Backdraft Damper.....	165.60	32.20
23 33 13 23-0086 EA 32" x 28" Horizontally Mounted Backdraft Damper.....	185.13	34.86
23 33 13 23-0087 EA 32" x 32" Horizontally Mounted Backdraft Damper.....	194.33	40.24
23 33 13 23-0088 EA 32" x 36" Horizontally Mounted Backdraft Damper.....	203.53	40.24
23 33 13 23-0089 EA 32" x 40" Horizontally Mounted Backdraft Damper.....	220.79	42.90
23 33 13 23-0090 EA 32" x 44" Horizontally Mounted Backdraft Damper.....	238.03	45.56
23 33 13 23-0091 EA 32" x 48" Horizontally Mounted Backdraft Damper.....	241.49	48.22
23 33 13 23-0092 EA 32" x 52" Horizontally Mounted Backdraft Damper.....	249.54	48.22
23 33 13 23-0093 EA 32" x 56" Horizontally Mounted Backdraft Damper.....	265.63	50.96
23 33 13 23-0094 EA 32" x 60" Horizontally Mounted Backdraft Damper.....	273.68	50.96
23 33 13 23-0095 EA 32" x 64" Horizontally Mounted Backdraft Damper.....	271.39	53.62
23 33 13 23-0096 EA 32" x 68" Horizontally Mounted Backdraft Damper.....	278.28	53.62
23 33 13 23-0097 EA 32" x 72" Horizontally Mounted Backdraft Damper.....	293.22	56.26
23 33 13 23-0098 EA 36" x 6" Horizontally Mounted Backdraft Damper.....	87.68	14.73
23 33 13 23-0099 EA 36" x 8" Horizontally Mounted Backdraft Damper.....	116.07	18.76
23 33 13 23-0100 EA 36" x 10" Horizontally Mounted Backdraft Damper.....	109.69	21.42
23 33 13 23-0101 EA 36" x 12" Horizontally Mounted Backdraft Damper.....	126.78	24.14
23 33 13 23-0102 EA 36" x 14" Horizontally Mounted Backdraft Damper.....	143.90	26.80
23 33 13 23-0103 EA 36" x 16" Horizontally Mounted Backdraft Damper.....	132.24	26.80
23 33 13 23-0104 EA 36" x 18" Horizontally Mounted Backdraft Damper.....	146.75	29.46
23 33 13 23-0105 EA 36" x 20" Horizontally Mounted Backdraft Damper.....	161.28	32.20
23 33 13 23-0106 EA 36" x 24" Horizontally Mounted Backdraft Damper.....	182.26	34.86
23 33 13 23-0107 EA 36" x 28" Horizontally Mounted Backdraft Damper.....	193.18	40.24
23 33 13 23-0108 EA 36" x 32" Horizontally Mounted Backdraft Damper.....	203.53	40.24
23 33 13 23-0109 EA 36" x 36" Horizontally Mounted Backdraft Damper.....	221.94	42.90
23 33 13 23-0110 EA 36" x 40" Horizontally Mounted Backdraft Damper.....	240.33	45.56
23 33 13 23-0111 EA 36" x 44" Horizontally Mounted Backdraft Damper.....	244.50	48.22
23 33 13 23-0112 EA 36" x 48" Horizontally Mounted Backdraft Damper.....	261.60	50.96
23 33 13 23-0113 EA 36" x 52" Horizontally Mounted Backdraft Damper.....	270.66	50.96
23 33 13 23-0114 EA 36" x 56" Horizontally Mounted Backdraft Damper.....	269.66	53.62
23 33 13 23-0115 EA 36" x 60" Horizontally Mounted Backdraft Damper.....	277.42	53.62
23 33 13 23-0116 EA 36" x 64" Horizontally Mounted Backdraft Damper.....	293.22	56.26
23 33 13 23-0117 EA 36" x 68" Horizontally Mounted Backdraft Damper.....	300.98	56.26
23 33 13 23-0118 EA 36" x 72" Horizontally Mounted Backdraft Damper.....	308.75	56.26

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 33 Air Duct Accessories**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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23 33 13 23-0119	EA	40" x 6" Horizontally Mounted Backdraft Damper	96.54	16.10
23 33 13 23-0120	EA	40" x 8" Horizontally Mounted Backdraft Damper	126.74	20.13
23 33 13 23-0121	EA	40" x 10" Horizontally Mounted Backdraft Damper	114.72	21.42
23 33 13 23-0122	EA	40" x 12" Horizontally Mounted Backdraft Damper	132.82	24.14
23 33 13 23-0123	EA	40" x 14" Horizontally Mounted Backdraft Damper	150.93	26.80
23 33 13 23-0124	EA	40" x 16" Horizontally Mounted Backdraft Damper	146.04	29.46
23 33 13 23-0125	EA	40" x 18" Horizontally Mounted Backdraft Damper	161.28	32.20
23 33 13 23-0126	EA	40" x 20" Horizontally Mounted Backdraft Damper	176.50	34.86
23 33 13 23-0127	EA	40" x 24" Horizontally Mounted Backdraft Damper	181.70	37.52
23 33 13 23-0128	EA	40" x 28" Horizontally Mounted Backdraft Damper	201.23	40.24
23 33 13 23-0129	EA	40" x 32" Horizontally Mounted Backdraft Damper	220.79	42.90
23 33 13 23-0130	EA	40" x 36" Horizontally Mounted Backdraft Damper	240.33	45.56
23 33 13 23-0131	EA	40" x 40" Horizontally Mounted Backdraft Damper	245.51	48.22
23 33 13 23-0132	EA	40" x 44" Horizontally Mounted Backdraft Damper	263.61	50.96
23 33 13 23-0133	EA	40" x 48" Horizontally Mounted Backdraft Damper	273.68	50.96
23 33 13 23-0134	EA	40" x 50" Horizontally Mounted Backdraft Damper	268.80	53.62
23 33 13 23-0135	EA	44" x 6" Horizontally Mounted Backdraft Damper	107.09	17.39
23 33 13 23-0136	EA	44" x 8" Horizontally Mounted Backdraft Damper	108.68	21.42
23 33 13 23-0137	EA	44" x 10" Horizontally Mounted Backdraft Damper	127.79	24.14
23 33 13 23-0138	EA	44" x 12" Horizontally Mounted Backdraft Damper	146.91	26.80
23 33 13 23-0139	EA	44" x 14" Horizontally Mounted Backdraft Damper	143.88	29.46
23 33 13 23-0140	EA	44" x 16" Horizontally Mounted Backdraft Damper	159.84	32.20
23 33 13 23-0141	EA	44" x 18" Horizontally Mounted Backdraft Damper	167.75	32.20
23 33 13 23-0142	EA	44" x 20" Horizontally Mounted Backdraft Damper	183.69	34.86
23 33 13 23-0143	EA	44" x 24" Horizontally Mounted Backdraft Damper	196.63	40.24
23 33 13 23-0144	EA	44" x 28" Horizontally Mounted Backdraft Damper	217.34	42.90
23 33 13 23-0145	EA	44" x 32" Horizontally Mounted Backdraft Damper	238.03	45.56
23 33 13 23-0146	EA	44" x 36" Horizontally Mounted Backdraft Damper	244.50	48.22
23 33 13 23-0147	EA	44" x 40" Horizontally Mounted Backdraft Damper	263.61	50.96
23 33 13 23-0148	EA	44" x 44" Horizontally Mounted Backdraft Damper	274.68	50.96
23 33 13 23-0149	EA	44" x 48" Horizontally Mounted Backdraft Damper	274.84	53.62
23 33 13 23-0150	EA	44" x 50" Horizontally Mounted Backdraft Damper	279.58	53.62
23 33 13 23-0151	EA	48" x 6" Horizontally Mounted Backdraft Damper	116.07	18.76
23 33 13 23-0152	EA	48" x 8" Horizontally Mounted Backdraft Damper	112.70	21.42
23 33 13 23-0153	EA	48" x 10" Horizontally Mounted Backdraft Damper	132.82	24.14
23 33 13 23-0154	EA	48" x 12" Horizontally Mounted Backdraft Damper	132.24	26.80
23 33 13 23-0155	EA	48" x 14" Horizontally Mounted Backdraft Damper	148.90	29.46
23 33 13 23-0156	EA	48" x 16" Horizontally Mounted Backdraft Damper	165.60	32.20
23 33 13 23-0157	EA	48" x 18" Horizontally Mounted Backdraft Damper	182.26	34.86
23 33 13 23-0158	EA	48" x 20" Horizontally Mounted Backdraft Damper	181.70	37.52
23 33 13 23-0159	EA	48" x 24" Horizontally Mounted Backdraft Damper	203.53	40.24
23 33 13 23-0160	EA	48" x 28" Horizontally Mounted Backdraft Damper	233.43	45.56
23 33 13 23-0161	EA	48" x 32" Horizontally Mounted Backdraft Damper	241.49	48.22
23 33 13 23-0162	EA	48" x 36" Horizontally Mounted Backdraft Damper	261.60	50.96
23 33 13 23-0163	EA	48" x 40" Horizontally Mounted Backdraft Damper	273.68	50.96
23 33 13 23-0164	EA	48" x 44" Horizontally Mounted Backdraft Damper	274.84	53.62
23 33 13 23-0165	EA	48" x 48" Horizontally Mounted Backdraft Damper	293.22	56.26
23 33 13 23-0166	EA	48" x 50" Horizontally Mounted Backdraft Damper	298.40	56.26
23 33 13 23-0167	EA	50" x 6" Horizontally Mounted Backdraft Damper	118.56	18.76
23 33 13 23-0168	EA	50" x 8" Horizontally Mounted Backdraft Damper	122.76	24.14
23 33 13 23-0169	EA	50" x 10" Horizontally Mounted Backdraft Damper	143.40	26.80
23 33 13 23-0170	EA	50" x 12" Horizontally Mounted Backdraft Damper	142.44	29.46
23 33 13 23-0171	EA	50" x 14" Horizontally Mounted Backdraft Damper	159.48	32.20
23 33 13 23-0172	EA	50" x 16" Horizontally Mounted Backdraft Damper	176.50	34.86
23 33 13 23-0173	EA	50" x 18" Horizontally Mounted Backdraft Damper	193.55	37.52
23 33 13 23-0174	EA	50" x 20" Horizontally Mounted Backdraft Damper	192.60	40.24
23 33 13 23-0175	EA	50" x 24" Horizontally Mounted Backdraft Damper	215.04	42.90
23 33 13 23-0176	EA	50" x 28" Horizontally Mounted Backdraft Damper	237.45	45.56
23 33 13 23-0177	EA	50" x 32" Horizontally Mounted Backdraft Damper	245.51	48.22
23 33 13 23-0178	EA	50" x 36" Horizontally Mounted Backdraft Damper	266.13	50.96
23 33 13 23-0179	EA	50" x 40" Horizontally Mounted Backdraft Damper	268.80	53.62
23 33 13 23-0180	EA	50" x 44" Horizontally Mounted Backdraft Damper	279.58	53.62
23 33 13 23-0181	EA	50" x 48" Horizontally Mounted Backdraft Damper	298.40	56.26
23 33 13 23-0182	EA	50" x 50" Horizontally Mounted Backdraft Damper	303.79	56.26

23 33 13 23-0183 Vertically Mounted Backdraft Damper (23 33 13 23)

Note: Galvanized steel frame, aluminum blades. Excludes motor pack.

23 33 13 23-0184	EA	6" x 6" Vertically Mounted Backdraft Damper	52.65	8.93
23 33 13 23-0185	EA	8" x 6" Vertically Mounted Backdraft Damper	62.48	9.33
23 33 13 23-0186	EA	10" x 6" Vertically Mounted Backdraft Damper	64.08	9.41
23 33 13 23-0187	EA	8" x 8" Vertically Mounted Backdraft Damper	66.47	9.41
23 33 13 23-0188	EA	12" x 6" Vertically Mounted Backdraft Damper	72.07	9.66
23 33 13 23-0189	EA	10" x 8" Vertically Mounted Backdraft Damper	80.08	10.70
23 33 13 23-0190	EA	14" x 6" Vertically Mounted Backdraft Damper	79.25	9.66
23 33 13 23-0191	EA	12" x 8" Vertically Mounted Backdraft Damper	89.66	10.70
23 33 13 23-0192	EA	16" x 6" Vertically Mounted Backdraft Damper	91.27	11.27
23 33 13 23-0193	EA	10" x 10" Vertically Mounted Backdraft Damper	96.08	12.07
23 33 13 23-0194	EA	18" x 6" Vertically Mounted Backdraft Damper	77.84	10.22
23 33 13 23-0195	EA	14" x 8" Vertically Mounted Backdraft Damper	82.81	11.27
23 33 13 23-0196	EA	12" x 10" Vertically Mounted Backdraft Damper	88.73	12.07



MINOR			TOTAL DIRECT	DEMOLITION
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST
23 33 13 23-0197	EA	20" x 6" Vertically Mounted Backdraft Damper	92.74	13.44
23 33 13 23-0198	EA	16" x 8" Vertically Mounted Backdraft Damper	100.27	14.73
23 33 13 23-0199	EA	14" x 10" Vertically Mounted Backdraft Damper	93.45	10.70
23 33 13 23-0200	EA	12" x 12" Vertically Mounted Backdraft Damper	99.23	12.07
23 33 13 23-0201	EA	18" x 8" Vertically Mounted Backdraft Damper	90.39	13.44
23 33 13 23-0202	EA	24" x 6" Vertically Mounted Backdraft Damper	90.39	13.44
23 33 13 23-0203	EA	16" x 10" Vertically Mounted Backdraft Damper	99.98	14.73
23 33 13 23-0204	EA	20" x 8" Vertically Mounted Backdraft Damper	104.01	16.10
23 33 13 23-0205	EA	14" x 12" Vertically Mounted Backdraft Damper	92.31	11.27
23 33 13 23-0206	EA	28" x 6" Vertically Mounted Backdraft Damper	94.73	12.07
23 33 13 23-0207	EA	18" x 10" Vertically Mounted Backdraft Damper	102.91	13.44
23 33 13 23-0208	EA	16" x 12" Vertically Mounted Backdraft Damper	111.12	14.73
23 33 13 23-0209	EA	24" x 8" Vertically Mounted Backdraft Damper	115.15	16.10
23 33 13 23-0210	EA	32" x 6" Vertically Mounted Backdraft Damper	119.18	17.39
23 33 13 23-0211	EA	14" x 14" Vertically Mounted Backdraft Damper	128.62	20.13
23 33 13 23-0212	EA	20" x 10" Vertically Mounted Backdraft Damper	129.21	21.42
23 33 13 23-0213	EA	18" x 12" Vertically Mounted Backdraft Damper	142.43	24.14
23 33 13 23-0214	EA	36" x 6" Vertically Mounted Backdraft Damper	106.22	12.07
23 33 13 23-0215	EA	16" x 14" Vertically Mounted Backdraft Damper	112.83	13.44
23 33 13 23-0216	EA	28" x 8" Vertically Mounted Backdraft Damper	116.86	14.73
23 33 13 23-0217	EA	20" x 12" Vertically Mounted Backdraft Damper	126.06	16.10
23 33 13 23-0218	EA	24" x 10" Vertically Mounted Backdraft Damper	130.09	17.39
23 33 13 23-0219	EA	40" x 6" Vertically Mounted Backdraft Damper	134.10	18.76
23 33 13 23-0220	EA	18" x 14" Vertically Mounted Backdraft Damper	146.06	21.42
23 33 13 23-0221	EA	16" x 16" Vertically Mounted Backdraft Damper	147.35	21.42
23 33 13 23-0222	EA	32" x 8" Vertically Mounted Backdraft Damper	155.39	24.14
23 33 13 23-0223	EA	44" x 6" Vertically Mounted Backdraft Damper	166.04	26.80
23 33 13 23-0224	EA	20" x 14" Vertically Mounted Backdraft Damper	179.27	29.46
23 33 13 23-0225	EA	28" x 10" Vertically Mounted Backdraft Damper	187.33	32.20
23 33 13 23-0226	EA	18" x 16" Vertically Mounted Backdraft Damper	133.56	13.44
23 33 13 23-0227	EA	24" x 12" Vertically Mounted Backdraft Damper	137.59	14.73
23 33 13 23-0228	EA	36" x 8" Vertically Mounted Backdraft Damper	141.62	16.10
23 33 13 23-0229	EA	48" x 6" Vertically Mounted Backdraft Damper	145.65	17.39
23 33 13 23-0230	EA	50" x 6" Vertically Mounted Backdraft Damper	157.58	20.13
23 33 13 23-0231	EA	20" x 16" Vertically Mounted Backdraft Damper	168.09	21.42
23 33 13 23-0232	EA	32" x 10" Vertically Mounted Backdraft Damper	176.13	24.14
23 33 13 23-0233	EA	40" x 8" Vertically Mounted Backdraft Damper	176.13	24.14
23 33 13 23-0234	EA	18" x 18" Vertically Mounted Backdraft Damper	163.45	26.80
23 33 13 23-0235	EA	24" x 14" Vertically Mounted Backdraft Damper	159.97	29.46
23 33 13 23-0236	EA	28" x 12" Vertically Mounted Backdraft Damper	168.03	32.20
23 33 13 23-0237	EA	44" x 8" Vertically Mounted Backdraft Damper	179.47	34.86
23 33 13 23-0238	EA	18" x 20" Vertically Mounted Backdraft Damper	189.23	37.52
23 33 13 23-0239	EA	20" x 18" Vertically Mounted Backdraft Damper	197.27	40.24
23 33 13 23-0240	EA	36" x 10" Vertically Mounted Backdraft Damper	197.27	40.24
23 33 13 23-0241	EA	24" x 16" Vertically Mounted Backdraft Damper	121.88	13.44
23 33 13 23-0242	EA	32" x 12" Vertically Mounted Backdraft Damper	125.91	14.73
23 33 13 23-0243	EA	48" x 8" Vertically Mounted Backdraft Damper	133.97	17.39
23 33 13 23-0244	EA	28" x 14" Vertically Mounted Backdraft Damper	143.71	20.13
23 33 13 23-0245	EA	20" x 20" Vertically Mounted Backdraft Damper	149.44	21.42
23 33 13 23-0246	EA	40" x 10" Vertically Mounted Backdraft Damper	157.48	24.14
23 33 13 23-0247	EA	50" x 8" Vertically Mounted Backdraft Damper	165.54	26.80
23 33 13 23-0248	EA	18" x 24" Vertically Mounted Backdraft Damper	172.34	26.80
23 33 13 23-0249	EA	24" x 18" Vertically Mounted Backdraft Damper	180.38	29.46
23 33 13 23-0250	EA	36" x 12" Vertically Mounted Backdraft Damper	188.44	32.20
23 33 13 23-0251	EA	44" x 10" Vertically Mounted Backdraft Damper	198.18	34.86
23 33 13 23-0252	EA	28" x 16" Vertically Mounted Backdraft Damper	215.99	40.24
23 33 13 23-0253	EA	32" x 14" Vertically Mounted Backdraft Damper	215.99	40.24
23 33 13 23-0254	EA	20" x 24" Vertically Mounted Backdraft Damper	231.70	42.90
23 33 13 23-0255	EA	24" x 20" Vertically Mounted Backdraft Damper	224.07	45.56
23 33 13 23-0256	EA	40" x 12" Vertically Mounted Backdraft Damper	224.07	45.56
23 33 13 23-0257	EA	48" x 10" Vertically Mounted Backdraft Damper	232.13	48.22
23 33 13 23-0258	EA	50" x 10" Vertically Mounted Backdraft Damper	235.77	48.22
23 33 13 23-0259	EA	28" x 18" Vertically Mounted Backdraft Damper	135.86	14.73
23 33 13 23-0260	EA	36" x 14" Vertically Mounted Backdraft Damper	143.92	17.39
23 33 13 23-0261	EA	32" x 16" Vertically Mounted Backdraft Damper	149.39	18.76
23 33 13 23-0262	EA	44" x 12" Vertically Mounted Backdraft Damper	160.35	21.42
23 33 13 23-0263	EA	20" x 28" Vertically Mounted Backdraft Damper	174.21	24.14
23 33 13 23-0264	EA	28" x 20" Vertically Mounted Backdraft Damper	182.27	26.80
23 33 13 23-0265	EA	40" x 14" Vertically Mounted Backdraft Damper	182.27	26.80
23 33 13 23-0266	EA	24" x 24" Vertically Mounted Backdraft Damper	193.21	29.46
23 33 13 23-0267	EA	32" x 18" Vertically Mounted Backdraft Damper	201.27	32.20
23 33 13 23-0268	EA	36" x 16" Vertically Mounted Backdraft Damper	209.31	34.86
23 33 13 23-0269	EA	48" x 12" Vertically Mounted Backdraft Damper	225.41	40.24
23 33 13 23-0270	EA	50" x 12" Vertically Mounted Backdraft Damper	229.78	40.24
23 33 13 23-0271	EA	44" x 14" Vertically Mounted Backdraft Damper	240.75	42.90
23 33 13 23-0272	EA	20" x 32" Vertically Mounted Backdraft Damper	253.15	45.56
23 33 13 23-0273	EA	32" x 20" Vertically Mounted Backdraft Damper	261.21	48.22
23 33 13 23-0274	EA	40" x 16" Vertically Mounted Backdraft Damper	261.21	48.22
23 33 13 23-0275	EA	36" x 18" Vertically Mounted Backdraft Damper	270.70	50.96
23 33 13 23-0276	EA	24" x 28" Vertically Mounted Backdraft Damper	275.79	50.96
23 33 13 23-0277	EA	28" x 24" Vertically Mounted Backdraft Damper	273.32	53.62

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 33 Air Duct Accessories**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 33	13 23	0278	EA 48" x 14" Vertically Mounted Backdraft Damper	273.32	53.62
23 33	13 23	0279	EA 50" x 14" Vertically Mounted Backdraft Damper	286.04	56.26
23 33	13 23	0280	EA 44" x 16" Vertically Mounted Backdraft Damper	161.93	14.73
23 33	13 23	0281	EA 20" x 36" Vertically Mounted Backdraft Damper	176.68	18.76
23 33	13 23	0282	EA 36" x 20" Vertically Mounted Backdraft Damper	184.74	21.42
23 33	13 23	0283	EA 40" x 18" Vertically Mounted Backdraft Damper	192.78	24.14
23 33	13 23	0284	EA 24" x 32" Vertically Mounted Backdraft Damper	208.86	26.80
23 33	13 23	0285	EA 32" x 24" Vertically Mounted Backdraft Damper	208.86	26.80
23 33	13 23	0286	EA 48" x 16" Vertically Mounted Backdraft Damper	216.90	29.46
23 33	13 23	0287	EA 28" x 28" Vertically Mounted Backdraft Damper	227.64	32.20
23 33	13 23	0288	EA 44" x 18" Vertically Mounted Backdraft Damper	237.01	34.86
23 33	13 23	0289	EA 40" x 20" Vertically Mounted Backdraft Damper	254.45	40.24
23 33	13 23	0290	EA 50" x 16" Vertically Mounted Backdraft Damper	254.45	40.24
23 33	13 23	0291	EA 24" x 36" Vertically Mounted Backdraft Damper	273.21	42.90
23 33	13 23	0292	EA 36" x 24" Vertically Mounted Backdraft Damper	281.25	45.56
23 33	13 23	0293	EA 48" x 18" Vertically Mounted Backdraft Damper	289.31	48.22
23 33	13 23	0294	EA 44" x 20" Vertically Mounted Backdraft Damper	300.02	50.96
23 33	13 23	0295	EA 28" x 32" Vertically Mounted Backdraft Damper	302.70	50.96
23 33	13 23	0296	EA 32" x 28" Vertically Mounted Backdraft Damper	310.76	53.62
23 33	13 23	0297	EA 50" x 18" Vertically Mounted Backdraft Damper	311.42	53.62
23 33	13 23	0298	EA 24" x 40" Vertically Mounted Backdraft Damper	329.49	56.26
23 33	13 23	0299	EA 40" x 24" Vertically Mounted Backdraft Damper	329.49	56.26
23 33	13 23	0300	EA 48" x 20" Vertically Mounted Backdraft Damper	329.49	56.26
23 33	13 23	0301	EA 50" x 20" Vertically Mounted Backdraft Damper	215.44	16.10
23 33	13 23	0302	EA 28" x 36" Vertically Mounted Backdraft Damper	228.84	20.13
23 33	13 23	0303	EA 36" x 28" Vertically Mounted Backdraft Damper	232.87	21.42
23 33	13 23	0304	EA 32" x 32" Vertically Mounted Backdraft Damper	243.59	24.14
23 33	13 23	0305	EA 24" x 44" Vertically Mounted Backdraft Damper	237.92	26.80
23 33	13 23	0306	EA 44" x 24" Vertically Mounted Backdraft Damper	245.96	29.46
23 33	13 23	0307	EA 28" x 40" Vertically Mounted Backdraft Damper	263.55	32.20
23 33	13 23	0308	EA 40" x 28" Vertically Mounted Backdraft Damper	271.59	34.86
23 33	13 23	0309	EA 24" x 48" Vertically Mounted Backdraft Damper	284.43	37.52
23 33	13 23	0310	EA 32" x 36" Vertically Mounted Backdraft Damper	292.47	40.24
23 33	13 23	0311	EA 36" x 32" Vertically Mounted Backdraft Damper	300.53	42.90
23 33	13 23	0312	EA 48" x 24" Vertically Mounted Backdraft Damper	308.57	45.56
23 33	13 23	0313	EA 50" x 24" Vertically Mounted Backdraft Damper	323.78	48.22
23 33	13 23	0314	EA 28" x 44" Vertically Mounted Backdraft Damper	336.58	50.96
23 33	13 23	0315	EA 44" x 28" Vertically Mounted Backdraft Damper	336.58	50.96
23 33	13 23	0316	EA 32" x 40" Vertically Mounted Backdraft Damper	351.81	53.62
23 33	13 23	0317	EA 40" x 32" Vertically Mounted Backdraft Damper	243.14	17.39
23 33	13 23	0318	EA 36" x 36" Vertically Mounted Backdraft Damper	257.59	21.42
23 33	13 23	0319	EA 28" x 48" Vertically Mounted Backdraft Damper	272.78	24.14
23 33	13 23	0320	EA 48" x 28" Vertically Mounted Backdraft Damper	280.84	26.80
23 33	13 23	0321	EA 50" x 28" Vertically Mounted Backdraft Damper	297.23	29.46
23 33	13 23	0322	EA 32" x 44" Vertically Mounted Backdraft Damper	306.48	32.20
23 33	13 23	0323	EA 44" x 32" Vertically Mounted Backdraft Damper	306.48	32.20
23 33	13 23	0324	EA 36" x 40" Vertically Mounted Backdraft Damper	319.89	34.86
23 33	13 23	0325	EA 40" x 36" Vertically Mounted Backdraft Damper	313.93	40.24
23 33	13 23	0326	EA 28" x 52" Vertically Mounted Backdraft Damper	324.13	42.90
23 33	13 23	0327	EA 32" x 48" Vertically Mounted Backdraft Damper	342.90	45.56
23 33	13 23	0328	EA 48" x 32" Vertically Mounted Backdraft Damper	350.96	48.22
23 33	13 23	0329	EA 28" x 56" Vertically Mounted Backdraft Damper	363.30	50.96
23 33	13 23	0330	EA 36" x 44" Vertically Mounted Backdraft Damper	365.45	50.96
23 33	13 23	0331	EA 44" x 36" Vertically Mounted Backdraft Damper	373.51	53.62
23 33	13 23	0332	EA 40" x 40" Vertically Mounted Backdraft Damper	375.65	53.62
23 33	13 23	0333	EA 50" x 32" Vertically Mounted Backdraft Damper	270.99	18.76
23 33	13 23	0334	EA 32" x 52" Vertically Mounted Backdraft Damper	287.64	21.42
23 33	13 23	0335	EA 28" x 60" Vertically Mounted Backdraft Damper	297.82	24.14
23 33	13 23	0336	EA 36" x 48" Vertically Mounted Backdraft Damper	312.33	26.80
23 33	13 23	0337	EA 48" x 36" Vertically Mounted Backdraft Damper	320.37	29.46
23 33	13 23	0338	EA 40" x 44" Vertically Mounted Backdraft Damper	332.72	32.20
23 33	13 23	0339	EA 44" x 40" Vertically Mounted Backdraft Damper	340.76	34.86
23 33	13 23	0340	EA 32" x 56" Vertically Mounted Backdraft Damper	353.11	37.52
23 33	13 23	0341	EA 50" x 36" Vertically Mounted Backdraft Damper	335.39	40.24
23 33	13 23	0342	EA 36" x 52" Vertically Mounted Backdraft Damper	360.08	45.56
23 33	13 23	0343	EA 32" x 60" Vertically Mounted Backdraft Damper	373.86	48.22
23 33	13 23	0344	EA 40" x 48" Vertically Mounted Backdraft Damper	381.90	50.96
23 33	13 23	0345	EA 48" x 40" Vertically Mounted Backdraft Damper	381.90	50.96
23 33	13 23	0346	EA 44" x 44" Vertically Mounted Backdraft Damper	391.87	53.62
23 33	13 23	0347	EA 40" x 50" Vertically Mounted Backdraft Damper	407.55	56.26
23 33	13 23	0348	EA 50" x 40" Vertically Mounted Backdraft Damper	407.55	56.26
23 33	13 23	0349	EA 36" x 56" Vertically Mounted Backdraft Damper	296.75	18.76
23 33	13 23	0350	EA 32" x 64" Vertically Mounted Backdraft Damper	316.67	24.14
23 33	13 23	0351	EA 44" x 48" Vertically Mounted Backdraft Damper	332.36	26.80
23 33	13 23	0352	EA 48" x 44" Vertically Mounted Backdraft Damper	340.40	29.46
23 33	13 23	0353	EA 36" x 60" Vertically Mounted Backdraft Damper	354.19	32.20
23 33	13 23	0354	EA 32" x 68" Vertically Mounted Backdraft Damper	364.14	34.86
23 33	13 23	0355	EA 44" x 50" Vertically Mounted Backdraft Damper	342.26	37.52
23 33	13 23	0356	EA 50" x 44" Vertically Mounted Backdraft Damper	350.30	40.24
23 33	13 23	0357	EA 32" x 72" Vertically Mounted Backdraft Damper	369.21	42.90
23 33	13 23	0358	EA 36" x 64" Vertically Mounted Backdraft Damper	377.25	45.56



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 33 13 23-0359 EA 48" x 48" Vertically Mounted Backdraft Damper	385.31	48.22
23 33 13 23-0360 EA 48" x 50" Vertically Mounted Backdraft Damper	403.36	50.96
23 33 13 23-0361 EA 50" x 48" Vertically Mounted Backdraft Damper	411.42	53.62
23 33 13 23-0362 EA 36" x 68" Vertically Mounted Backdraft Damper	416.43	53.62
23 33 13 23-0363 EA 50" x 50" Vertically Mounted Backdraft Damper	429.90	56.26
23 33 13 23-0364 EA 36" x 72" Vertically Mounted Backdraft Damper	439.50	56.26
23 33 13 23-0365 Backdraft Damper Accessories (23 33 13 23)		
23 33 13 23-0366 EA For Motor Pack For Horizontally Mounted Backdraft Damper	116.93	20.14
23 33 13 23-0367 EA For Motor Pack For Vertically Mounted Backdraft Damper	187.28	20.14
23 33 13 29 Barometric Dampers (23 33 13)		
23 33 13 29-0001 EA 6" x 6" Barometric Damper	114.81	6.44
23 33 13 29-0002 EA 12" x 12" Barometric Damper	164.56	8.85
23 33 13 29-0003 EA 18" x 18" Barometric Damper	226.29	13.68
23 33 13 29-0004 EA 24" x 24" Barometric Damper	296.99	25.75
23 33 13 29-0005 EA 6" Diameter Barometric Damper	64.86	6.44
For Stainless Steel, Add	51.84	
23 33 13 29-0006 EA 7" Diameter Barometric Damper	76.36	7.24
For Stainless Steel, Add	61.59	
23 33 13 29-0007 EA 8" Diameter Barometric Damper	88.63	8.05
For Stainless Steel, Add	71.42	
23 33 13 29-0008 EA 9" Diameter Barometric Damper	105.01	8.05
For Stainless Steel, Add	90.48	
23 33 13 29-0009 EA 10" Diameter Barometric Damper	131.96	9.66
For Stainless Steel, Add	123.27	
23 33 13 29-0010 EA 12" Diameter Barometric Damper	163.68	10.46
For Stainless Steel, Add	158.99	
23 33 13 29-0011 EA 14" Diameter Barometric Damper	201.24	11.27
For Stainless Steel, Add	202.76	
23 33 13 29-0012 EA 15" Diameter Barometric Damper	237.43	12.08
For Stainless Steel, Add	243.71	
23 33 13 29-0013 EA 16" Diameter Barometric Damper	272.54	13.68
For Stainless Steel, Add	284.56	
23 33 13 29-0014 EA 18" Diameter Barometric Damper	350.39	14.48
For Stainless Steel, Add	380.19	
23 33 13 29-0015 EA 20" Diameter Barometric Damper	413.03	16.09
For Stainless Steel, Add	455.07	
23 33 13 29-0016 EA 24" Diameter Barometric Damper	491.23	16.09
For Stainless Steel, Add	552.99	
23 33 13 29-0017 EA 30" Diameter Barometric Damper	599.73	18.51
For Stainless Steel, Add	685.49	
23 33 13 29-0018 EA 36" Diameter Barometric Damper	754.19	19.32
For Stainless Steel, Add	881.34	
23 33 13 33 Splitter Damper Hardware (23 33 13)		
23 33 13 33-0001 EA Splitter Damper, Hardware	24.60	5.63
23 33 13 43 Blower Check Valve (23 33 13)		
23 33 13 43-0001 Blower Check Valves With Silicone Seals (23 33 13 43)		
23 33 13 43-0002 EA 2-1/2" Blower Check Valves, Silicone Seals	280.80	20.77
23 33 13 43-0003 EA 3" Blower Check Valves, Silicone Seals	313.00	23.66
23 33 13 43-0004 EA 4" Blower Check Valves, Silicone Seals	400.95	31.39
23 33 13 43-0005 EA 5" Blower Check Valves, Silicone Seals	561.85	36.23
23 33 13 43-0006 EA 6" Blower Check Valves, Silicone Seals	626.35	43.47
23 33 13 43-0007 EA 8" Blower Check Valves, Silicone Seals	944.30	55.06
23 33 13 43-0008 Blower Check Valves With Viton Seats (23 33 13 43)		
23 33 13 43-0009 EA 2-1/2" Blower Check Valves, Viton Seats	397.04	20.77
23 33 13 43-0010 EA 3" Blower Check Valves, Viton Seats	451.16	23.66
23 33 13 43-0011 EA 4" Blower Check Valves, Viton Seats	497.14	31.39
23 33 13 43-0012 EA 5" Blower Check Valves, Viton Seats	705.86	36.23
23 33 13 43-0013 EA 6" Blower Check Valves, Viton Seats	785.33	43.47
23 33 13 43-0014 EA 8" Blower Check Valves, Viton Seats	1,225.52	55.06
23 33 19 Duct Sound Trap (23 33)		
23 33 19 00-0001 36" Long Packaged Duct Sound Trap (23 33 19)		
23 33 19 00-0002 EA 12" x 12" x 36" Long, Packaged Duct Sound Trap, Sound Attenuator	207.45	33.00
23 33 19 00-0003 EA 12" x 18" x 36" Long, Packaged Duct Sound Trap, Sound Attenuator	247.54	37.83
23 33 19 00-0004 EA 12" x 24" x 36" Long, Packaged Duct Sound Trap, Sound Attenuator	313.67	43.46
23 33 19 00-0005 EA 12" x 36" x 36" Long, Packaged Duct Sound Trap, Sound Attenuator	376.21	49.09
23 33 19 00-0006 EA 24" x 18" x 36" Long, Packaged Duct Sound Trap, Sound Attenuator	352.81	49.09
23 33 19 00-0007 EA 24" x 24" x 36" Long, Packaged Duct Sound Trap, Sound Attenuator	436.99	51.51
23 33 19 00-0008 EA 24" x 30" x 36" Long, Packaged Duct Sound Trap, Sound Attenuator	479.83	54.73

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 33 Air Duct Accessories**

MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
23 33 19 00-0009	EA	24" x 36" x 36" Long, Packaged Duct Sound Trap, Sound Attenuator.....	524.30		57.94
23 33 19 00-0010	EA	24" x 48" x 36" Long, Packaged Duct Sound Trap, Sound Attenuator.....	673.89		65.99
23 33 19 00-0011	EA	36" x 18" x 36" Long, Packaged Duct Sound Trap, Sound Attenuator.....	438.51		54.73
23 33 19 00-0012	EA	36" x 36" x 36" Long, Packaged Duct Sound Trap, Sound Attenuator.....	581.60		65.99
23 33 19 00-0013	EA	36" x 48" x 36" Long, Packaged Duct Sound Trap, Sound Attenuator.....	993.87		88.52
23 33 19 00-0014	EA	36" x 60" x 36" Long, Packaged Duct Sound Trap, Sound Attenuator.....	1,093.26		93.36
23 33 19 00-0015	EA	48" x 48" x 36" Long, Packaged Duct Sound Trap, Sound Attenuator.....	1,216.51		100.60
23 33 19 00-0016	EA	48" x 60" x 36" Long, Packaged Duct Sound Trap, Sound Attenuator.....	1,361.91		109.45
23 33 19 00-0017		60" Long Packaged Duct Sound Trap <small>(23 33 19)</small>			
23 33 19 00-0018	EA	12" x 12" x 60" Long, Packaged Duct Sound Trap, Sound Attenuator.....	230.96		72.43
23 33 19 00-0019	EA	12" x 18" x 60" Long, Packaged Duct Sound Trap, Sound Attenuator.....	276.45		83.70
23 33 19 00-0020	EA	12" x 24" x 60" Long, Packaged Duct Sound Trap, Sound Attenuator.....	351.25		96.58
23 33 19 00-0021	EA	12" x 36" x 60" Long, Packaged Duct Sound Trap, Sound Attenuator.....	421.27		108.64
23 33 19 00-0022	EA	24" x 18" x 60" Long, Packaged Duct Sound Trap, Sound Attenuator.....	394.66		108.64
23 33 19 00-0023	EA	24" x 24" x 60" Long, Packaged Duct Sound Trap, Sound Attenuator.....	491.36		115.08
23 33 19 00-0024	EA	24" x 30" x 60" Long, Packaged Duct Sound Trap, Sound Attenuator.....	537.28		120.72
23 33 19 00-0025	EA	24" x 36" x 60" Long, Packaged Duct Sound Trap, Sound Attenuator.....	584.43		127.16
23 33 19 00-0026	EA	24" x 48" x 60" Long, Packaged Duct Sound Trap, Sound Attenuator.....	756.20		144.86
23 33 19 00-0027	EA	36" x 18" x 60" Long, Packaged Duct Sound Trap, Sound Attenuator.....	490.32		120.72
23 33 19 00-0028	EA	36" x 36" x 60" Long, Packaged Duct Sound Trap, Sound Attenuator.....	651.32		144.86
23 33 19 00-0029	EA	36" x 48" x 60" Long, Packaged Duct Sound Trap, Sound Attenuator.....	1,109.11		190.73
23 33 19 00-0030	EA	36" x 60" x 60" Long, Packaged Duct Sound Trap, Sound Attenuator.....	1,234.14		206.82
23 33 19 00-0031	EA	48" x 48" x 60" Long, Packaged Duct Sound Trap, Sound Attenuator.....	1,364.10		219.71
23 33 19 00-0032	EA	48" x 60" x 60" Long, Packaged Duct Sound Trap, Sound Attenuator.....	1,531.67		241.43
23 33 19 00-0033		84" Long Packaged Duct Sound Trap <small>(23 33 19)</small>			
23 33 19 00-0034	EA	6" x 12" x 84" Long, Packaged Duct Sound Trap, Sound Attenuator.....	197.42		60.36
23 33 19 00-0035	EA	6" x 24" x 84" Long, Packaged Duct Sound Trap, Sound Attenuator.....	329.78		90.13
23 33 19 00-0036	EA	6" x 36" x 84" Long, Packaged Duct Sound Trap, Sound Attenuator.....	463.76		131.98
23 33 19 00-0037	EA	12" x 12" x 84" Long, Packaged Duct Sound Trap, Sound Attenuator.....	260.70		72.43
23 33 19 00-0038	EA	12" x 18" x 84" Long, Packaged Duct Sound Trap, Sound Attenuator.....	320.28		83.70
23 33 19 00-0039	EA	12" x 24" x 84" Long, Packaged Duct Sound Trap, Sound Attenuator.....	423.26		96.58
23 33 19 00-0040	EA	12" x 30" x 84" Long, Packaged Duct Sound Trap, Sound Attenuator.....	493.40		103.82
23 33 19 00-0041	EA	12" x 36" x 84" Long, Packaged Duct Sound Trap, Sound Attenuator.....	537.50		111.87
23 33 19 00-0042	EA	12" x 42" x 84" Long, Packaged Duct Sound Trap, Sound Attenuator.....	664.08		120.72
23 33 19 00-0043	EA	12" x 48" x 84" Long, Packaged Duct Sound Trap, Sound Attenuator.....	778.40		131.98
23 33 19 00-0044	EA	24" x 18" x 84" Long, Packaged Duct Sound Trap, Sound Attenuator.....	471.75		111.87
23 33 19 00-0045	EA	24" x 24" x 84" Long, Packaged Duct Sound Trap, Sound Attenuator.....	645.33		116.69
23 33 19 00-0046	EA	24" x 30" x 84" Long, Packaged Duct Sound Trap, Sound Attenuator.....	700.08		120.72
23 33 19 00-0047	EA	24" x 36" x 84" Long, Packaged Duct Sound Trap, Sound Attenuator.....	759.75		127.16
23 33 19 00-0048	EA	24" x 42" x 84" Long, Packaged Duct Sound Trap, Sound Attenuator.....	938.60		136.82
23 33 19 00-0049	EA	24" x 48" x 84" Long, Packaged Duct Sound Trap, Sound Attenuator.....	1,016.05		144.86
23 33 23		Duct Turning Vanes <small>(23 33)</small>			
23 33 23 00-0001		Duct Turning Vane Components <small>(23 33 23)</small>			
23 33 23 00-0002	LF	Duct Turning Vane Rail.....	5.66		2.01
		<i>For Stainless Steel, Add</i>	1.94		
23 33 23 00-0003	LF	Double Thick Factory Fabricated, Duct Turning Vane.....	3.91		0.81
		<i>For Stainless Steel, Add</i>	2.91		
23 33 23 00-0004		Duct Turning Vane Sets <small>(23 33 23)</small>			
		Note: Measured from inside corner to outside corner of ductwork.			
23 33 23 00-0005	LF	12" High Duct Turning Vanes, Sets.....	14.06		3.02
		<i>For Stainless Steel, Add</i>	13.36		
23 33 23 00-0006	LF	14" High Duct Turning Vanes, Sets.....	17.03		3.22
		<i>For Stainless Steel, Add</i>	16.90		
23 33 23 00-0007	LF	16" High Duct Turning Vanes, Sets.....	22.46		3.38
		<i>For Stainless Steel, Add</i>	23.66		
23 33 23 00-0008	LF	18" High Duct Turning Vanes, Sets.....	27.92		3.63
		<i>For Stainless Steel, Add</i>	30.42		
23 33 23 00-0009	LF	20" High Duct Turning Vanes, Sets.....	30.82		3.87
		<i>For Stainless Steel, Add</i>	33.80		
23 33 23 00-0010	LF	22" High Duct Turning Vanes, Sets.....	38.33		3.63
		<i>For Stainless Steel, Add</i>	43.95		
23 33 23 00-0011	LF	24" High Duct Turning Vanes, Sets.....	46.98		4.26
		<i>For Stainless Steel, Add</i>	54.09		
23 33 23 00-0012	LF	26" High Duct Turning Vanes, Sets.....	50.31		4.46
		<i>For Stainless Steel, Add</i>	58.16		
23 33 23 00-0013	LF	30" High Duct Turning Vanes, Sets.....	55.89		4.63
		<i>For Stainless Steel, Add</i>	65.13		
23 33 33		Duct-Mounting Access Doors <small>(23 33)</small>			
23 33 33 00-0001		Duct Access Doors, Insulated Factory Fabrication <small>(23 33 33)</small>			



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 33 33 00-0002 EA 6" x 6" Duct Access Doors Insulated Factory Fabrication	62.41	11.27
<i>For Stainless Steel, Add</i>	34.28	
23 33 33 00-0003 EA 10" x 10" Duct Access Doors Insulated Factory Fabrication	66.01	11.27
<i>For Stainless Steel, Add</i>	41.48	
23 33 33 00-0004 EA 12" x 12" Duct Access Doors Insulated Factory Fabrication	67.77	11.27
<i>For Stainless Steel, Add</i>	45.00	
23 33 33 00-0005 EA 12" x 18" Duct Access Doors Insulated Factory Fabrication	87.44	13.68
<i>For Stainless Steel, Add</i>	63.44	
23 33 33 00-0006 EA 16" x 12" Duct Access Doors Insulated Factory Fabrication	88.16	13.68
<i>For Stainless Steel, Add</i>	64.88	
23 33 33 00-0007 EA 18" x 18" Duct Access Doors Insulated Factory Fabrication	109.76	18.51
<i>For Stainless Steel, Add</i>	74.66	
23 33 33 00-0008 EA 24" x 18" Duct Access Doors Insulated Factory Fabrication	130.74	22.53
<i>For Stainless Steel, Add</i>	80.40	
23 33 33 00-0009 EA 24" x 24" Duct Access Doors Insulated Factory Fabrication	170.08	30.58
<i>For Stainless Steel, Add</i>	98.72	
23 33 43 Flexible Duct Connectors (23 33)		
23 33 43 00-0001 LF Flex Duct Connector, Fabric/Sheet Metal	9.42	2.42
23 33 43 00-0002 LF Flex Duct Connector, Rubber Vinyl	9.17	2.18
23 33 46 Flexible Ducts (23 33)		
23 33 46 00-0001 Flexible Duct, R4.2 Insulated With Metallized Outer Jacket (23 33 46)		
Note: Polyester inner liner encapsulating a corrosion resistant steel wire helix, supporting a blanket of fiberglass insulation over a fiberglass scrim and a bi-directional reinforced metallized outer vapor barrier jacket.		
23 33 46 00-0002 LF 4" Diameter Flexible Duct, R4.2 Insulated With Polyester Inner Liner And Metallized Outer Jacket	4.59	0.81
23 33 46 00-0003 LF 5" Diameter Flexible Duct, R4.2 Insulated With Polyester Inner Liner And Metallized Outer Jacket	5.14	1.61
23 33 46 00-0004 LF 6" Diameter Flexible Duct, R4.2 Insulated With Polyester Inner Liner And Metallized Outer Jacket	6.00	1.61
23 33 46 00-0005 LF 7" Diameter Flexible Duct, R4.2 Insulated With Polyester Inner Liner And Metallized Outer Jacket	7.01	1.61
23 33 46 00-0006 LF 8" Diameter Flexible Duct, R4.2 Insulated With Polyester Inner Liner And Metallized Outer Jacket	8.50	2.42
23 33 46 00-0007 LF 10" Diameter Flexible Duct, R4.2 Insulated With Polyester Inner Liner And Metallized Outer Jacket	10.82	2.42
23 33 46 00-0008 LF 12" Diameter Flexible Duct, R4.2 Insulated With Polyester Inner Liner And Metallized Outer Jacket	14.78	3.22
23 33 46 00-0009 LF 14" Diameter Flexible Duct, R4.2 Insulated With Polyester Inner Liner And Metallized Outer Jacket	18.26	3.22
23 33 46 00-0010 LF 16" Diameter Flexible Duct, R4.2 Insulated With Polyester Inner Liner And Metallized Outer Jacket	23.89	4.03
23 33 46 00-0011 Collars, Sheet Metal Spin-In Type With Damper (23 33 46)		
23 33 46 00-0012 EA Up To 4" Diameter Flexible Duct Collar, Spin In Type, Sheet Metal, With Damper	29.69	4.82
<i>For Stainless Steel, Add</i>	15.05	
23 33 46 00-0013 EA 5" Diameter Flexible Duct Collar, Spin In Type, Sheet Metal, With Damper	32.43	5.63
<i>For Stainless Steel, Add</i>	15.25	
23 33 46 00-0014 EA 6" Diameter Flexible Duct Collar, Spin In Type, Sheet Metal, With Damper	37.08	5.63
<i>For Stainless Steel, Add</i>	16.82	
23 33 46 00-0015 EA 7" Diameter Flexible Duct Collar, Spin In Type, Sheet Metal, With Damper	42.33	7.24
<i>For Stainless Steel, Add</i>	17.36	
23 33 46 00-0016 EA 8" Diameter Flexible Duct Collar, Spin In Type, Sheet Metal, With Damper	51.30	8.85
<i>For Stainless Steel, Add</i>	19.60	
23 33 46 00-0017 EA 10" Diameter Flexible Duct Collar, Spin In Type, Sheet Metal, With Damper	59.97	10.46
<i>For Stainless Steel, Add</i>	24.17	
23 33 46 00-0018 EA 12" Diameter Flexible Duct Collar, Spin In Type, Sheet Metal, With Damper	68.31	12.08
<i>For Stainless Steel, Add</i>	26.04	
23 33 46 00-0019 EA 14" Diameter Flexible Duct Collar, Spin In Type, Sheet Metal, With Damper	80.61	13.68
<i>For Stainless Steel, Add</i>	32.60	
23 33 46 00-0020 EA 16" Diameter Flexible Duct Collar, Spin In Type, Sheet Metal, With Damper	87.80	15.29
<i>For Stainless Steel, Add</i>	35.67	
23 33 53 Duct Liners (23 33)		
23 33 53 00-0001 Fiberglass Duct Liner Board, Rigid, Acoustical Insulation (23 33 53)		
23 33 53 00-0002 SF 1/2" Field Installed, 3 LB/CF, Fiberglass Duct Liner Board	7.88	2.07
23 33 53 00-0003 SF 3/4" Field Installed, 3 LB/CF, Fiberglass Duct Liner Board	8.61	2.07
23 33 53 00-0004 SF 1" Field Installed, 3 LB/CF, Fiberglass Duct Liner Board	9.57	2.76
23 33 53 00-0005 SF 1-1/2" Field Installed, 3 LB/CF, Fiberglass Duct Liner Board	11.73	2.76
23 33 53 00-0006 SF 2" Field Installed, 3 LB/CF, Fiberglass Duct Liner Board	14.16	3.10
23 33 53 00-0007 SF 1/2" Shop Installed, 3 LB/CF, Fiberglass Duct Liner Board	7.98	2.42
23 33 53 00-0008 SF 3/4" Shop Installed, 3 LB/CF, Fiberglass Duct Liner Board	8.72	2.42
23 33 53 00-0009 SF 1" Shop Installed, 3 LB/CF, Fiberglass Duct Liner Board	9.73	3.22
23 33 53 00-0010 SF 1-1/2" Shop Installed, 3 LB/CF, Fiberglass Duct Liner Board	11.85	3.22
23 33 53 00-0011 SF 2" Shop Installed, 3 LB/CF, Fiberglass Duct Liner Board	14.35	3.63
23 33 53 00-0012 Fiberglass Duct Liner Blanket, Flexible, Acoustical Insulation (23 33 53)		
23 33 53 00-0013 SF 1", R3.8, 1.5 LB/CF, T150, Fiberglass Duct Liner Blanket	1.94	2.18
23 33 53 00-0014 SF 1", R4.1, 2 LB/CF, T200, Fiberglass Duct Liner Blanket	2.52	2.18
23 33 53 00-0015 SF 1", R4.3, 3 LB/CF, T300, Fiberglass Duct Liner Blanket	3.28	2.18
23 33 53 00-0016 SF 1-1/2", T150, 1.5 LB/CF, Fiberglass Duct Liner Blanket	2.72	2.42
23 33 53 00-0017 SF 2", R7.7, 1.5 LB/CF, T150 Fiberglass Duct Liner Blanket	2.89	2.66
23 33 53 00-0018 SF 2", R8, 2 LB/CF, T200 Fiberglass Duct Liner Blanket	4.52	2.66

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 33 Air Duct Accessories**MINOR
CSI UOM DESCRIPTIONTOTAL DIRECT DEMOLITION
UNIT COST UNIT COST**23 33 56 Duct Air Extractors** (23 33)

23 33 56 00-0001	EA 12" x 4" Duct Air Extractor.....	48.80	13.27
	<i>For Stainless Steel, Add</i>	28.91	
23 33 56 00-0002	EA 8" x 6" Duct Air Extractor	51.22	14.48
	<i>For Stainless Steel, Add</i>	28.91	
23 33 56 00-0003	EA 12" x 6" Duct Air Extractor.....	61.35	15.29
	<i>For Stainless Steel, Add</i>	40.00	
23 33 56 00-0004	EA 16" x 6" Duct Air Extractor.....	71.23	16.09
	<i>For Stainless Steel, Add</i>	50.75	
23 33 56 00-0005	EA 24" x 6" Duct Air Extractor.....	99.86	17.71
	<i>For Stainless Steel, Add</i>	83.79	
23 33 56 00-0006	EA 12" x 8" Duct Air Extractor.....	66.69	16.09
	<i>For Stainless Steel, Add</i>	44.85	
23 33 56 00-0007	EA 20" x 8" Duct Air Extractor.....	90.17	20.12
	<i>For Stainless Steel, Add</i>	64.91	
23 33 56 00-0008	EA 18" x 10" Duct Air Extractor.....	94.90	22.93
	<i>For Stainless Steel, Add</i>	63.73	
23 33 56 00-0009	EA 24" x 10" Duct Air Extractor.....	117.46	26.95
	<i>For Stainless Steel, Add</i>	82.62	
23 33 56 00-0010	EA 24" x 12" Duct Air Extractor.....	132.47	32.19
	<i>For Stainless Steel, Add</i>	88.52	
23 33 56 00-0011	EA 30" x 12" Duct Air Extractor.....	165.80	40.24
	<i>For Stainless Steel, Add</i>	110.93	

23 33 59 Duct Pressure Relief Doors (23 33)**23 33 59 00-0001 Duct Pressure Relief Doors** (23 34 59)

23 33 59 00-0002	EA 18" x 18" Duct Pressure Relief Door (Ruskin PRD18)	643.46	24.14
23 33 59 00-0003	EA 24" x 10" Duct Pressure Relief Door (Ruskin PRD18)	528.91	20.12
23 33 59 00-0004	EA 24" x 12" Duct Pressure Relief Door (Ruskin PRD18)	526.03	22.13

23 34 HVAC Fans (23 30)**23 34 13 Axial HVAC Fans** (23 34)**23 34 13 00-0001 Tube-Axial Fans** (23 34 13)**23 34 13 00-0002 Direct Drive Tube-Axial Duct Fans** (23 34 13 00-0001)

23 34 13 00-0003	EA 12" Direct Drive Axial Flow Fan, 1/6 HP 1,060 CFM Constant Speed, 1/8" Static Pressure.....	1,104.53	246.81
	<i>For 1/4" Static Pressure, Add</i>	48.83	
	<i>For 3/8" Static Pressure, Add</i>	97.67	
	<i>For 1/2" Static Pressure, Add</i>	134.29	
23 34 13 00-0004	EA 12" Direct Drive Axial Flow Fan, 1/2 HP 2,095 CFM Constant Speed, 1/8" Static Pressure.....	1,148.13	247.55
	<i>For 1/4" Static Pressure, Add</i>	52.32	
	<i>For 3/8" Static Pressure, Add</i>	104.64	
	<i>For 1/2" Static Pressure, Add</i>	143.88	
23 34 13 00-0005	EA 16" Direct Drive Axial Flow Fan, 1/3 HP 2,490 CFM Constant Speed, 1/8" Static Pressure.....	1,235.33	246.81
	<i>For 1/4" Static Pressure, Add</i>	59.30	
	<i>For 3/8" Static Pressure, Add</i>	118.59	
	<i>For 1/2" Static Pressure, Add</i>	163.07	
23 34 13 00-0006	EA 20" Direct Drive Axial Flow Fan, 3/4 HP 4,130 CFM Constant Speed, 1/8" Static Pressure.....	1,322.53	247.55
	<i>For 1/4" Static Pressure, Add</i>	66.27	
	<i>For 3/8" Static Pressure, Add</i>	132.55	
	<i>For 1/2" Static Pressure, Add</i>	182.25	
23 34 13 00-0007	EA 22" Direct Drive Axial Flow Fan, 3/4 HP 4,700 CFM Constant Speed, 1/8" Static Pressure.....	1,552.16	296.47
	<i>For 1/4" Static Pressure, Add</i>	76.74	
	<i>For 3/8" Static Pressure, Add</i>	153.48	
	<i>For 1/2" Static Pressure, Add</i>	211.03	
23 34 13 00-0008	EA 24" Direct Drive Axial Flow Fan, 1 HP 5,850 CFM Constant Speed, 1/8" Static Pressure.....	1,778.12	322.41
	<i>For 1/4" Static Pressure, Add</i>	90.69	
	<i>For 3/8" Static Pressure, Add</i>	181.38	
	<i>For 1/2" Static Pressure, Add</i>	249.40	
23 34 13 00-0009	EA 24" Direct Drive Axial Flow Fan, 1-1/2 HP 7,925 CFM Constant Speed, 1/8" Static Pressure.....	1,883.10	352.80
	<i>For 1/4" Static Pressure, Add</i>	94.18	
	<i>For 3/8" Static Pressure, Add</i>	188.36	
	<i>For 1/2" Static Pressure, Add</i>	258.99	
23 34 13 00-0010	EA 30" Direct Drive Axial Flow Fan, 1 HP 10,640 CFM Constant Speed, 1/8" Static Pressure.....	2,136.39	370.58
	<i>For 1/4" Static Pressure, Add</i>	111.62	
	<i>For 3/8" Static Pressure, Add</i>	223.24	
	<i>For 1/2" Static Pressure, Add</i>	306.95	
23 34 13 00-0011	EA 30" Direct Drive Axial Flow Fan, 2-1/2 HP 14,765 CFM Constant Speed, 1/8" Static Pressure.....	2,583.30	463.24
	<i>For 1/4" Static Pressure, Add</i>	132.55	
	<i>For 3/8" Static Pressure, Add</i>	265.09	
	<i>For 1/2" Static Pressure, Add</i>	364.50	
23 34 13 00-0012	EA 36" Direct Drive Axial Flow Fan, 2 HP 16,780 CFM Constant Speed, 1/8" Static Pressure.....	2,906.66	494.36
	<i>For 1/4" Static Pressure, Add</i>	153.47	
	<i>For 3/8" Static Pressure, Add</i>	306.95	
	<i>For 1/2" Static Pressure, Add</i>	422.05	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 34 13 00-0013 EA 36" Direct Drive Axial Flow Fan, 5 HP 22,920 CFM Constant Speed, 1/8" Static Pressure.....	3,407.51	569.96
For 1/4" Static Pressure, Add	181.38	
For 3/8" Static Pressure, Add	362.76	
For 1/2" Static Pressure, Add	498.79	
23 34 13 00-0014 Belt Drive Tube-Axial Duct Fans (23 34 13 00-0001)		
23 34 13 00-0015 EA 15" Belt Drive Axial Flow Fan, 1/3 HP 2,800 CFM Constant Speed, 1/8" Static Pressure.....	1,049.24	239.40
For 1/4" Static Pressure, Add	45.68	
For 3/8" Static Pressure, Add	91.37	
For 1/2" Static Pressure, Add	125.63	
23 34 13 00-0016 EA 15" Belt Drive Axial Flow Fan, 1/2 HP 3,400 CFM Constant Speed, 1/8" Static Pressure.....	1,110.27	247.55
For 1/4" Static Pressure, Add	49.29	
For 3/8" Static Pressure, Add	98.58	
For 1/2" Static Pressure, Add	135.55	
23 34 13 00-0017 EA 18" Belt Drive Axial Flow Fan, 1/3 HP 3,280 CFM Constant Speed, 1/8" Static Pressure.....	1,147.34	255.71
For 1/4" Static Pressure, Add	50.89	
For 3/8" Static Pressure, Add	101.79	
For 1/2" Static Pressure, Add	139.96	
23 34 13 00-0018 EA 18" Belt Drive Axial Flow Fan, 1/2 HP 3,900 CFM Constant Speed, 1/8" Static Pressure.....	1,212.35	264.60
For 1/4" Static Pressure, Add	54.64	
For 3/8" Static Pressure, Add	109.27	
For 1/2" Static Pressure, Add	150.25	
23 34 13 00-0019 EA 18" Belt Drive Axial Flow Fan, 1 HP 5,250 CFM Constant Speed, 1/8" Static Pressure.....	1,358.86	274.97
For 1/4" Static Pressure, Add	64.79	
For 3/8" Static Pressure, Add	129.57	
For 1/2" Static Pressure, Add	178.16	
23 34 13 00-0020 EA 24" Belt Drive Axial Flow Fan, 1/2 HP 4,800 CFM Constant Speed, 1/8" Static Pressure.....	1,431.73	285.35
For 1/4" Static Pressure, Add	68.93	
For 3/8" Static Pressure, Add	137.86	
For 1/2" Static Pressure, Add	189.55	
23 34 13 00-0021 EA 24" Belt Drive Axial Flow Fan, 1 HP 6,430 CFM Constant Speed, 1/8" Static Pressure.....	1,594.80	296.47
For 1/4" Static Pressure, Add	80.15	
For 3/8" Static Pressure, Add	160.30	
For 1/2" Static Pressure, Add	220.41	
23 34 13 00-0022 EA 24" Belt Drive Axial Flow Fan, 2 HP 8,860 CFM Constant Speed, 1/8" Static Pressure.....	1,785.68	296.47
For 1/4" Static Pressure, Add	95.50	
For 3/8" Static Pressure, Add	190.99	
For 1/2" Static Pressure, Add	262.61	
23 34 13 00-0023 EA 30" Belt Drive Axial Flow Fan, 1 HP 9,250 CFM Constant Speed, 1/8" Static Pressure.....	2,062.68	322.41
For 1/4" Static Pressure, Add	113.54	
For 3/8" Static Pressure, Add	227.09	
For 1/2" Static Pressure, Add	312.25	
23 34 13 00-0024 EA 30" Belt Drive Axial Flow Fan, 5 HP 16,900 CFM Constant Speed, 1/8" Static Pressure.....	2,448.32	390.60
For 1/4" Static Pressure, Add	133.58	
For 3/8" Static Pressure, Add	267.16	
For 1/2" Static Pressure, Add	367.35	
23 34 13 00-0025 EA 30" Belt Drive Axial Flow Fan, 5 HP 16,150 CFM Constant Speed, 1/8" Static Pressure.....	2,771.31	390.60
For 1/4" Static Pressure, Add	159.16	
For 3/8" Static Pressure, Add	318.32	
For 1/2" Static Pressure, Add	437.69	
23 34 13 00-0026 EA 36" Belt Drive Axial Flow Fan, 3/4 HP 8,090 CFM Constant Speed, 1/8" Static Pressure.....	3,044.92	412.09
For 1/4" Static Pressure, Add	177.71	
For 3/8" Static Pressure, Add	355.42	
For 1/2" Static Pressure, Add	488.71	
23 34 13 00-0027 EA 36" Belt Drive Axial Flow Fan, 2 HP 14,475 CFM Constant Speed, 1/8" Static Pressure.....	3,321.12	435.81
For 1/4" Static Pressure, Add	196.10	
For 3/8" Static Pressure, Add	392.19	
For 1/2" Static Pressure, Add	539.26	
23 34 13 00-0028 EA 36" Belt Drive Axial Flow Fan, 7-1/2 HP 14,475 CFM Constant Speed, 1/8" Static Pressure.....	3,808.41	569.96
For 1/4" Static Pressure, Add	213.73	
For 3/8" Static Pressure, Add	427.46	
For 1/2" Static Pressure, Add	587.76	
23 34 13 00-0029 EA 36" Belt Drive Axial Flow Fan, 5 HP 20,080 CFM Constant Speed, 1/8" Static Pressure.....	4,319.95	570.70
For 1/4" Static Pressure, Add	254.65	
For 3/8" Static Pressure, Add	509.31	
For 1/2" Static Pressure, Add	700.30	
23 34 13 00-0030 EA 42" Belt Drive Axial Flow Fan, 7-1/2 HP 29,000 CFM Constant Speed, 1/8" Static Pressure.....	4,889.41	673.58
For 1/4" Static Pressure, Add	283.74	
For 3/8" Static Pressure, Add	567.47	
For 1/2" Static Pressure, Add	780.27	
23 34 16 Centrifugal HVAC Fans (23 34)		
23 34 16 00-0001 Centrifugal Fans (23 34 16)		
Note: All belt fans to be supplied with belt guard.		
23 34 16 00-0002 Utility Backward Inclined Steel Wheel Centrifugal Fans (23 34 16 00-0001)		
Note: V-belt driven.		
23 34 16 00-0003 Industrial Type Utility Backward Centrifugal Fans (23 34 16 00-0002)		
Note: Under 30" diameter wheel.		
23 34 16 00-0004 12-1/4" Diameter Wheel 650 To 2,950 CFM At 1/8" Static Pressure (23 34 16 00-0003)		
23 34 16 00-0005 EA 1/6 HP Centrifugal Fan, 12-1/4" Wheel, 450 - 1,750 CFM At 1/8" Static Pressure	1,149.92	162.83

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 34 HVAC Fans**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 34 16 00-0006 EA 1/4 HP Centrifugal Fan, 12-1/4" Wheel, 650 - 2,950 CFM At 1/8" Static Pressure	1,701.64	168.99
23 34 16 00-0007 EA 1/3 HP Centrifugal Fan, 12-1/4" Wheel, 650 - 2,950 CFM At 1/8" Static Pressure	1,747.60	134.67
23 34 16 00-0008 EA 1/2 HP Centrifugal Fan, 12-1/4" Wheel, 650 - 2,950 CFM At 1/8" Static Pressure	1,826.00	184.56
23 34 16 00-0009 EA 3/4 HP Centrifugal Fan, 12-1/4" Wheel, 650 - 2,950 CFM At 1/8" Static Pressure	1,865.40	195.67
23 34 16 00-0010 EA 1 HP Centrifugal Fan, 12-1/4" Wheel, 650 - 2,950 CFM At 1/8" Static Pressure	1,923.56	203.82
23 34 16 00-0011 EA 1-1/2 HP Centrifugal Fan, 12-1/4" Wheel, 650 - 2,950 CFM At 1/8" Static Pressure	1,977.96	217.16
23 34 16 00-0012 13-1/2" Diameter Wheel 734 To 3,343 CFM At 1/8" Static Pressure (23 34 16 00-0003)		
23 34 16 00-0013 EA 1/4 HP Centrifugal Fan, 13-1/2" Wheel, 734 - 3,343 CFM At 1/8" Static Pressure	1,975.23	177.89
23 34 16 00-0014 EA 1/3 HP Centrifugal Fan, 13-1/2" Wheel, 734 - 3,343 CFM At 1/8" Static Pressure	2,008.15	184.56
23 34 16 00-0015 EA 1/2 HP Centrifugal Fan, 13-1/2" Wheel, 734 - 3,343 CFM At 1/8" Static Pressure	2,070.41	195.67
23 34 16 00-0016 EA 3/4 HP Centrifugal Fan, 13-1/2" Wheel, 734 - 3,343 CFM At 1/8" Static Pressure	2,105.50	203.82
23 34 16 00-0017 EA 1 HP Centrifugal Fan, 13-1/2" Wheel, 734 - 3,343 CFM At 1/8" Static Pressure	2,171.59	217.16
23 34 16 00-0018 EA 1-1/2 HP Centrifugal Fan, 13-1/2" Wheel, 734 - 3,343 CFM At 1/8" Static Pressure	2,239.97	227.54
23 34 16 00-0019 15" Diameter Wheel 1,258 To 4,146 CFM At 1/8" Static Pressure (23 34 16 00-0003)		
23 34 16 00-0020 EA 1/4 HP Centrifugal Fan, 15" Wheel, 1,258 - 4,146 CFM At 1/8" Static Pressure.....	1,985.41	184.56
23 34 16 00-0021 EA 1/3 HP Centrifugal Fan, 15" Wheel, 1,258 - 4,146 CFM At 1/8" Static Pressure.....	2,024.93	195.67
23 34 16 00-0022 EA 1/2 HP Centrifugal Fan, 15" Wheel, 1,258 - 4,146 CFM At 1/8" Static Pressure.....	2,082.76	203.82
23 34 16 00-0023 EA 3/4 HP Centrifugal Fan, 15" Wheel, 1,258 - 4,146 CFM At 1/8" Static Pressure.....	2,126.09	217.16
23 34 16 00-0024 EA 1 HP Centrifugal Fan, 15" Wheel, 1,258 - 4,146 CFM At 1/8" Static Pressure.....	2,186.91	227.54
23 34 16 00-0025 EA 1-1/2 HP Centrifugal Fan, 15" Wheel, 1,258 - 4,146 CFM At 1/8" Static Pressure	2,269.60	244.59
23 34 16 00-0026 EA 2 HP Centrifugal Fan, 15" Wheel, 1,258 - 4,146 CFM At 1/8" Static Pressure.....	2,334.59	257.19
23 34 16 00-0027 16-1/2" Diameter Wheel 977 To 4,711 CFM At 1/8" Static Pressure (23 34 16 00-0003)		
23 34 16 00-0028 EA 1/4 HP Centrifugal Fan, 16-1/2" Wheel, 977 - 4,711 CFM At 1/8" Static Pressure	2,286.47	195.67
23 34 16 00-0029 EA 1/3 HP Centrifugal Fan, 16-1/2" Wheel, 977 - 4,711 CFM At 1/8" Static Pressure	2,367.92	203.82
23 34 16 00-0030 EA 1/2 HP Centrifugal Fan, 16-1/2" Wheel, 977 - 4,711 CFM At 1/8" Static Pressure	2,454.47	217.16
23 34 16 00-0031 EA 3/4 HP Centrifugal Fan, 16-1/2" Wheel, 977 - 4,711 CFM At 1/8" Static Pressure	2,497.63	227.54
23 34 16 00-0032 EA 1 HP Centrifugal Fan, 16-1/2" Wheel, 977 - 4,711 CFM At 1/8" Static Pressure	2,551.31	244.59
23 34 16 00-0033 EA 1-1/2 HP Centrifugal Fan, 16-1/2" Wheel, 977 - 4,711 CFM At 1/8" Static Pressure	2,598.65	257.19
23 34 16 00-0034 EA 2 HP Centrifugal Fan, 16-1/2" Wheel, 977 - 4,711 CFM At 1/8" Static Pressure	2,891.13	279.42
23 34 16 00-0035 18-1/4" Diameter Wheel 2,193 To 6,498 CFM At 1/8" Static Pressure (23 34 16 00-0003)		
23 34 16 00-0036 EA 1/4 HP Centrifugal Fan, 18-1/4" Wheel, 2,193 - 6,498 CFM At 1/8" Static Pressure	2,361.36	203.82
23 34 16 00-0037 EA 1/3 HP Centrifugal Fan, 18-1/4" Wheel, 2,193 - 6,498 CFM At 1/8" Static Pressure	2,410.37	217.16
23 34 16 00-0038 EA 1/2 HP Centrifugal Fan, 18-1/4" Wheel, 2,193 - 6,498 CFM At 1/8" Static Pressure	2,482.57	227.54
23 34 16 00-0039 EA 3/4 HP Centrifugal Fan, 18-1/4" Wheel, 2,193 - 6,498 CFM At 1/8" Static Pressure	2,531.16	244.59
23 34 16 00-0040 EA 1 HP Centrifugal Fan, 18-1/4" Wheel, 2,193 - 6,498 CFM At 1/8" Static Pressure	2,607.51	257.19
23 34 16 00-0041 EA 1-1/2 HP Centrifugal Fan, 18-1/4" Wheel, 2,193 - 6,498 CFM At 1/8" Static Pressure	2,720.56	279.42
23 34 16 00-0042 EA 2 HP Centrifugal Fan, 18-1/4" Wheel, 2,193 - 6,498 CFM At 1/8" Static Pressure	2,791.71	296.47
23 34 16 00-0043 EA 3 HP Centrifugal Fan, 18-1/4" Wheel, 2,193 - 6,498 CFM At 1/8" Static Pressure	2,894.14	326.12
23 34 16 00-0044 20" Diameter Wheel 2,412 To 7,364 CFM At 1/8" Static Pressure (23 34 16 00-0003)		
23 34 16 00-0045 EA 1/4 HP Centrifugal Fan, 20" Wheel, 2,412 - 7,364 CFM At 1/8" Static Pressure.....	2,376.27	217.16
23 34 16 00-0046 EA 1/3 HP Centrifugal Fan, 20" Wheel, 2,412 - 7,364 CFM At 1/8" Static Pressure.....	2,448.43	227.54
23 34 16 00-0047 EA 1/2 HP Centrifugal Fan, 20" Wheel, 2,412 - 7,364 CFM At 1/8" Static Pressure.....	2,531.16	244.59
23 34 16 00-0048 EA 3/4 HP Centrifugal Fan, 20" Wheel, 2,412 - 7,364 CFM At 1/8" Static Pressure.....	2,607.51	257.19
23 34 16 00-0049 EA 1 HP Centrifugal Fan, 20" Wheel, 2,412 - 7,364 CFM At 1/8" Static Pressure.....	2,754.67	279.42
23 34 16 00-0050 EA 1-1/2 HP Centrifugal Fan, 20" Wheel, 2,412 - 7,364 CFM At 1/8" Static Pressure	2,972.01	296.47
23 34 16 00-0051 EA 2 HP Centrifugal Fan, 20" Wheel, 2,412 - 7,364 CFM At 1/8" Static Pressure.....	3,109.55	326.12
23 34 16 00-0052 EA 3 HP Centrifugal Fan, 20" Wheel, 2,412 - 7,364 CFM At 1/8" Static Pressure.....	3,258.56	349.09
23 34 16 00-0053 22-1/4" Diameter Wheel 2,265 To 8,483 CFM At 1/8" Static Pressure (23 34 16 00-0003)		
23 34 16 00-0054 EA 1/4 HP Centrifugal Fan, 22-1/4" Wheel, 2,265 - 8,483 CFM At 1/8" Static Pressure	2,884.35	227.54
23 34 16 00-0055 EA 1/3 HP Centrifugal Fan, 22-1/4" Wheel, 2,265 - 8,483 CFM At 1/8" Static Pressure	2,927.60	244.59
23 34 16 00-0056 EA 1/2 HP Centrifugal Fan, 22-1/4" Wheel, 2,265 - 8,483 CFM At 1/8" Static Pressure	2,996.03	257.19
23 34 16 00-0057 EA 3/4 HP Centrifugal Fan, 22-1/4" Wheel, 2,265 - 8,483 CFM At 1/8" Static Pressure	3,076.87	279.42
23 34 16 00-0058 EA 1 HP Centrifugal Fan, 22-1/4" Wheel, 2,265 - 8,483 CFM At 1/8" Static Pressure	3,194.42	296.47
23 34 16 00-0059 EA 1-1/2 HP Centrifugal Fan, 22-1/4" Wheel, 2,265 - 8,483 CFM At 1/8" Static Pressure	3,213.78	326.12
23 34 16 00-0060 EA 2 HP Centrifugal Fan, 22-1/4" Wheel, 2,265 - 8,483 CFM At 1/8" Static Pressure	3,281.30	349.09
23 34 16 00-0061 EA 3 HP Centrifugal Fan, 22-1/4" Wheel, 2,265 - 8,483 CFM At 1/8" Static Pressure	3,401.68	391.34
23 34 16 00-0062 24-1/2" Diameter Wheel 3,055 To 11,380 CFM At 1/8" Static Pressure (23 34 16 00-0003)		
23 34 16 00-0063 EA 1/4 HP Centrifugal Fan, 24-1/2" Wheel, 3,055 - 11,380 CFM At 1/8" Static Pressure	3,493.93	244.59
23 34 16 00-0064 EA 1/2 HP Centrifugal Fan, 24-1/2" Wheel, 3,055 - 11,380 CFM At 1/8" Static Pressure	3,584.79	279.42
23 34 16 00-0065 EA 3/4 HP Centrifugal Fan, 24-1/2" Wheel, 3,055 - 11,380 CFM At 1/8" Static Pressure	3,690.05	296.47
23 34 16 00-0066 EA 1 HP Centrifugal Fan, 24-1/2" Wheel, 3,055 - 11,380 CFM At 1/8" Static Pressure	3,791.83	326.12
23 34 16 00-0067 EA 1-1/2 HP Centrifugal Fan, 24-1/2" Wheel, 3,055 - 11,380 CFM At 1/8" Static Pressure	3,883.98	349.09
23 34 16 00-0068 EA 2 HP Centrifugal Fan, 24-1/2" Wheel, 3,055 - 11,380 CFM At 1/8" Static Pressure	3,947.51	391.34



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
				23 34 16 00-0069 EA 3 HP Centrifugal Fan, 24-1/2" Wheel, 3,055 - 11,380 CFM At 1/8" Static Pressure	4,055.93	425.43
				23 34 16 00-0070 EA 5 HP Centrifugal Fan, 24-1/2" Wheel, 3,055 - 11,380 CFM At 1/8" Static Pressure	4,323.17	489.17
23 34 16 00-0071				27" Diameter Wheel 2,734 To 13,266 CFM At 1/8" Static Pressure (23 34 16 00-0003)		
				23 34 16 00-0072 EA 1/4 HP Centrifugal Fan, 27" Wheel, 2,734 - 13,266 CFM At 1/8" Static Pressure	3,883.01	257.19
				23 34 16 00-0073 EA 1/2 HP Centrifugal Fan, 27" Wheel, 2,734 - 13,266 CFM At 1/8" Static Pressure	3,974.34	296.47
				23 34 16 00-0074 EA 3/4 HP Centrifugal Fan, 27" Wheel, 2,734 - 13,266 CFM At 1/8" Static Pressure	4,076.12	326.12
				23 34 16 00-0075 EA 1 HP Centrifugal Fan, 27" Wheel, 2,734 - 13,266 CFM At 1/8" Static Pressure	4,168.28	349.09
				23 34 16 00-0076 EA 1-1/2 HP Centrifugal Fan, 27" Wheel, 2,734 - 13,266 CFM At 1/8" Static Pressure	4,288.65	391.34
				23 34 16 00-0077 EA 2 HP Centrifugal Fan, 27" Wheel, 2,734 - 13,266 CFM At 1/8" Static Pressure	4,396.73	425.43
				23 34 16 00-0078 EA 3 HP Centrifugal Fan, 27" Wheel, 2,734 - 13,266 CFM At 1/8" Static Pressure	4,688.13	489.17
				23 34 16 00-0079 EA 5 HP Centrifugal Fan, 27" Wheel, 2,734 - 13,266 CFM At 1/8" Static Pressure	4,689.81	543.28
23 34 16 00-0080				Large Industrial Type Utility Backward Centrifugal Fans (23 34 16 00-0002) Note: Over 30" diameter wheel.		
23 34 16 00-0081				30" Diameter Wheel 4,926 To 17,456 CFM At 1/8" Static Pressure (23 34 16 00-0080)		
				23 34 16 00-0082 EA 1/2 HP Centrifugal Fan, 30" Wheel, 4,926 - 17,456 CFM At 1/8" Static Pressure	5,469.13	326.12
				23 34 16 00-0083 EA 3/4 HP Centrifugal Fan, 30" Wheel, 4,926 - 17,456 CFM At 1/8" Static Pressure	5,566.81	349.09
				23 34 16 00-0084 EA 1 HP Centrifugal Fan, 30" Wheel, 4,926 - 17,456 CFM At 1/8" Static Pressure	5,687.35	391.34
				23 34 16 00-0085 EA 1-1/2 HP Centrifugal Fan, 30" Wheel, 4,926 - 17,456 CFM At 1/8" Static Pressure	5,806.79	425.43
				23 34 16 00-0086 EA 2 HP Centrifugal Fan, 30" Wheel, 4,926 - 17,456 CFM At 1/8" Static Pressure	5,972.04	489.17
				23 34 16 00-0087 EA 3 HP Centrifugal Fan, 30" Wheel, 4,926 - 17,456 CFM At 1/8" Static Pressure	6,122.61	543.28
				23 34 16 00-0088 EA 5 HP Centrifugal Fan, 30" Wheel, 4,926 - 17,456 CFM At 1/8" Static Pressure	6,355.56	652.24
				23 34 16 00-0089 EA 7-1/2 HP Centrifugal Fan, 30" Wheel, 4,926 - 17,456 CFM At 1/8" Static Pressure	6,572.33	752.29
23 34 16 00-0090				33" Diameter Wheel 5,734 To 19,799 CFM At 1/8" Static Pressure (23 34 16 00-0090)		
				23 34 16 00-0091 EA 1/2 HP Centrifugal Fan, 33" Wheel, 5,734 - 19,799 CFM At 1/8" Static Pressure	6,442.57	349.09
				23 34 16 00-0092 EA 3/4 HP Centrifugal Fan, 33" Wheel, 5,734 - 19,799 CFM At 1/8" Static Pressure	6,619.81	391.34
				23 34 16 00-0093 EA 1 HP Centrifugal Fan, 33" Wheel, 5,734 - 19,799 CFM At 1/8" Static Pressure	6,785.09	425.43
				23 34 16 00-0094 EA 1-1/2 HP Centrifugal Fan, 33" Wheel, 5,734 - 19,799 CFM At 1/8" Static Pressure	6,995.48	489.17
				23 34 16 00-0095 EA 2 HP Centrifugal Fan, 33" Wheel, 5,734 - 19,799 CFM At 1/8" Static Pressure	7,191.54	543.28
				23 34 16 00-0096 EA 3 HP Centrifugal Fan, 33" Wheel, 5,734 - 19,799 CFM At 1/8" Static Pressure	7,469.96	652.24
				23 34 16 00-0097 EA 5 HP Centrifugal Fan, 33" Wheel, 5,734 - 19,799 CFM At 1/8" Static Pressure	7,798.53	752.29
				23 34 16 00-0098 EA 7-1/2 HP Centrifugal Fan, 33" Wheel, 5,734 - 19,799 CFM At 1/8" Static Pressure	8,191.51	978.36
23 34 16 00-0099				36-1/2" Diameter Wheel 5,388 To 22,500 CFM At 1/8" Static Pressure (23 34 16 00-0090)		
				23 34 16 00-0100 EA 1/2 HP Centrifugal Fan, 36-1/2" Wheel, 5,388 - 22,500 CFM At 1/8" Static Pressure	5,252.37	391.34
				23 34 16 00-0101 EA 3/4 HP Centrifugal Fan, 36-1/2" Wheel, 5,388 - 22,500 CFM At 1/8" Static Pressure	5,303.93	425.43
				23 34 16 00-0102 EA 1 HP Centrifugal Fan, 36-1/2" Wheel, 5,388 - 22,500 CFM At 1/8" Static Pressure	5,400.60	489.17
				23 34 16 00-0103 EA 1-1/2 HP Centrifugal Fan, 36-1/2" Wheel, 5,388 - 22,500 CFM At 1/8" Static Pressure	5,505.87	543.28
				23 34 16 00-0104 EA 2 HP Centrifugal Fan, 36-1/2" Wheel, 5,388 - 22,500 CFM At 1/8" Static Pressure	6,228.86	652.24
				23 34 16 00-0105 EA 3 HP Centrifugal Fan, 36-1/2" Wheel, 5,388 - 22,500 CFM At 1/8" Static Pressure	6,477.49	752.29
				23 34 16 00-0106 EA 5 HP Centrifugal Fan, 36-1/2" Wheel, 5,388 - 22,500 CFM At 1/8" Static Pressure	6,919.44	978.36
				23 34 16 00-0107 EA 7-1/2 HP Centrifugal Fan, 36-1/2" Wheel, 5,388 - 22,500 CFM At 1/8" Static Pressure	7,389.89	1,222.94
23 34 16 00-0108				Kitchen System Fans (23 34 16 00-0001)		
23 34 16 00-0109				Upblast Kitchen Exhaust Fans (23 34 16 00-0108)		
23 34 16 00-0110				Direct Drive Kitchen Upblast Exhaust Fans (23 34 16 00-0109) Note: Greenheck CUE.		
				23 34 16 00-0111 EA Up To 12" Wheel Diameter, 1/6 HP Direct Drive, Kitchen Upblast Exhaust Fan	757.36	96.35
				Note: 115V. For roof or wall installations. Includes disconnect switch.		
				For Bird Screen, Add	31.99	
				For Backdraft Damper, Add	72.64	
				For Damper Motor, Add	113.71	
				23 34 16 00-0112 EA 14" Wheel Diameter, 1/4 HP Direct Drive, Kitchen Upblast Exhaust Fan	884.46	96.35
				Note: 115V. For roof or wall installations. Includes disconnect switch.		
				For Bird Screen, Add	31.99	
				For Backdraft Damper, Add	72.64	
				For Damper Motor, Add	113.71	
23 34 16 00-0113				Belt Drive Kitchen Upblast Exhaust Fans (23 34 16 00-0109) Note: Greenheck CUBE.		
				23 34 16 00-0114 EA 10" Diameter Wheel, Up To 1/3 HP, 1,458 CFM At 1/4" Static Pressure, Belt Drive, Kitchen Upblast Exhaust Fan	1,285.98	96.35
				Note: 115/208-230/60/1. Includes heat baffle, grease baffle and disconnect switch.		
				For Bird Screen, Add	31.99	
				For Wall Mounted Fan, Add	51.44	
				For 3 Phase Motor, Deduct	-50.00	
				For Totally Enclosed Motor, Add	85.00	
				For Grease Trap Kit, Add	76.41	
				For Hinged Curb Kit, Add	92.93	
				For Backdraft Damper, Add	72.64	
				For Damper Motor, Add	113.71	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 34 HVAC Fans**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 34 16 00-0115 EA 12" Diameter Wheel, 1/2 HP, 1,923 CFM At 1/4" Static Pressure, Belt Drive, Kitchen Upblast Exhaust Fan.....	1,341.14	96.35
Note: 115/208-230/60/1. Includes heat baffle, grease baffle and disconnect switch.		
For Bird Screen, Add	31.99	
For Wall Mounted Fan, Add	53.65	
For 3 Phase Motor, Deduct	-50.00	
For Totally Enclosed Motor, Add	85.00	
For Grease Trap Kit, Add	76.41	
For Hinged Curb Kit, Add	97.62	
For Backdraft Damper, Add	72.64	
For Damper Motor, Add	113.71	
23 34 16 00-0116 EA 14" Diameter Wheel, 1/3 HP, 2,006 CFM At 1/4" Static Pressure, Belt Drive, Kitchen Upblast Exhaust Fan.....	1,157.86	111.17
Note: 115/208-230/60/1. Includes heat baffle, grease baffle and disconnect switch.		
For Bird Screen, Add	36.41	
For Wall Mounted Fan, Add	46.31	
For 3 Phase Motor, Deduct	-50.00	
For Totally Enclosed Motor, Add	85.00	
For Grease Trap Kit, Add	76.41	
For Hinged Curb Kit, Add	79.52	
For Backdraft Damper, Add	82.35	
For Damper Motor, Add	113.71	
23 34 16 00-0117 EA 14" Diameter Wheel, 1 HP, 2,757 CFM At 1/4" Static Pressure, Belt Drive, Kitchen Upblast Exhaust Fan.....	1,237.29	111.17
Note: 115/208-230/60/1. Includes heat baffle, grease baffle and disconnect switch.		
For Bird Screen, Add	36.41	
For Wall Mounted Fan, Add	49.49	
For 3 Phase Motor, Deduct	-50.00	
For Totally Enclosed Motor, Add	85.00	
For Grease Trap Kit, Add	76.41	
For Hinged Curb Kit, Add	86.27	
For Backdraft Damper, Add	82.35	
For Damper Motor, Add	113.71	
23 34 16 00-0118 EA 16" Diameter Wheel, 1/2 HP, 2,940 CFM At 1/4" Static Pressure, Belt Drive, Kitchen Upblast Exhaust Fan.....	1,570.01	129.70
Note: 115/208-230/60/1. Includes heat baffle, grease baffle and disconnect switch.		
For Bird Screen, Add	36.41	
For Wall Mounted Fan, Add	62.80	
For 3 Phase Motor, Deduct	-50.00	
For Totally Enclosed Motor, Add	85.00	
For Grease Trap Kit, Add	76.41	
For Hinged Curb Kit, Add	111.40	
For Backdraft Damper, Add	82.35	
For Damper Motor, Add	113.71	
23 34 16 00-0119 EA 16" Diameter Wheel, 1 HP, 3,129 CFM At 1/4" Static Pressure, Belt Drive, Kitchen Upblast Exhaust Fan.....	1,654.96	129.70
Note: 115/208-230/60/1. Includes heat baffle, grease baffle and disconnect switch.		
For Bird Screen, Add	36.41	
For Wall Mounted Fan, Add	66.20	
For 3 Phase Motor, Deduct	-50.00	
For Totally Enclosed Motor, Add	85.00	
For Grease Trap Kit, Add	76.41	
For Hinged Curb Kit, Add	118.62	
For Backdraft Damper, Add	82.35	
For Damper Motor, Add	113.71	
23 34 16 00-0120 EA 18" Diameter Wheel, 1/2 HP, 3,243 CFM At 1/4" Static Pressure, Belt Drive, Kitchen Upblast Exhaust Fan.....	1,802.56	138.97
Note: 115/208-230/60/1. Includes heat baffle, grease baffle and disconnect switch.		
For Bird Screen, Add	60.68	
For Wall Mounted Fan, Add	72.10	
For 3 Phase Motor, Deduct	-50.00	
For Totally Enclosed Motor, Add	85.00	
For Grease Trap Kit, Add	76.41	
For Hinged Curb Kit, Add	129.59	
For Backdraft Damper, Add	101.06	
For Damper Motor, Add	113.71	
23 34 16 00-0121 EA 18" Diameter Wheel, 1 HP, 4,223 CFM At 1/4" Static Pressure, Belt Drive, Kitchen Upblast Exhaust Fan.....	1,934.95	138.97
Note: 115/208-230/60/1. Includes heat baffle, grease baffle and disconnect switch.		
For Bird Screen, Add	60.68	
For Wall Mounted Fan, Add	77.40	
For 3 Phase Motor, Deduct	-50.00	
For Totally Enclosed Motor, Add	85.00	
For Grease Trap Kit, Add	76.41	
For Hinged Curb Kit, Add	140.85	
For Backdraft Damper, Add	101.06	
For Damper Motor, Add	113.71	
23 34 16 00-0122 EA 20" Diameter Wheel, 3/4 HP, 4,438 CFM At 1/4" Static Pressure, Belt Drive, Kitchen Upblast Exhaust Fan.....	1,968.92	148.23
Note: 115/208-230/60/1. Includes heat baffle, grease baffle and disconnect switch.		
For Bird Screen, Add	60.68	
For Wall Mounted Fan, Add	78.76	
For 3 Phase Motor, Deduct	-50.00	
For Totally Enclosed Motor, Add	85.00	
For Grease Trap Kit, Add	76.41	
For Hinged Curb Kit, Add	142.16	
For Backdraft Damper, Add	101.06	
For Damper Motor, Add	113.71	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 34 16 00-0123 EA 20" Diameter Wheel, 2 HP, 6,450 CFM At 1/4" Static Pressure, Belt Drive, Kitchen Upblast Exhaust Fan.....	2,155.36	148.23
Note: 115/208-230/60/1. Includes heat baffle, grease baffle and disconnect switch.		
<i>For Bird Screen, Add</i>	60.68	
<i>For Wall Mounted Fan, Add</i>	86.21	
<i>For 3 Phase Motor, Deduct</i>	-50.00	
<i>For Totally Enclosed Motor, Add</i>	85.00	
<i>For Grease Trap Kit, Add</i>	76.41	
<i>For Hinged Curb Kit, Add</i>	158.01	
<i>For Backdraft Damper, Add</i>	101.06	
<i>For Damper Motor, Add</i>	113.71	
23 34 16 00-0124 EA 24" Diameter Wheel, 3/4 HP, 5,460 CFM At 1/4" Static Pressure, Belt Drive, Kitchen Upblast Exhaust Fan.....	2,481.45	166.76
Note: 115/208-230/60/1. Includes heat baffle, grease baffle and disconnect switch.		
<i>For Bird Screen, Add</i>	71.71	
<i>For Wall Mounted Fan, Add</i>	99.26	
<i>For 3 Phase Motor, Deduct</i>	-50.00	
<i>For Totally Enclosed Motor, Add</i>	85.00	
<i>For Grease Trap Kit, Add</i>	76.41	
<i>For Hinged Curb Kit, Add</i>	182.57	
<i>For Backdraft Damper, Add</i>	109.77	
<i>For Damper Motor, Add</i>	113.71	
23 34 16 00-0125 EA 24" Diameter Wheel, 2 HP, 7,985 CFM At 1/4" Static Pressure, Belt Drive, Kitchen Upblast Exhaust Fan.....	2,652.45	166.76
Note: 115/208-230/60/1. Includes heat baffle, grease baffle and disconnect switch.		
<i>For Bird Screen, Add</i>	71.71	
<i>For Wall Mounted Fan, Add</i>	106.10	
<i>For 3 Phase Motor, Deduct</i>	-50.00	
<i>For Totally Enclosed Motor, Add</i>	85.00	
<i>For Grease Trap Kit, Add</i>	76.41	
<i>For Hinged Curb Kit, Add</i>	197.11	
<i>For Backdraft Damper, Add</i>	109.77	
<i>For Damper Motor, Add</i>	113.71	
23 34 16 00-0126 EA 30" Diameter Wheel, 3/4 HP, 7,771 CFM At 1/4" Static Pressure, Belt Drive, Kitchen Upblast Exhaust Fan.....	3,140.72	185.29
Note: 115/208-230/60/3. Includes heat baffle, grease baffle and disconnect switch.		
<i>For Bird Screen, Add</i>	77.22	
<i>For Wall Mounted Fan, Add</i>	125.63	
<i>For Totally Enclosed Motor, Add</i>	85.00	
<i>For Grease Trap Kit, Add</i>	76.41	
<i>For Hinged Curb Kit, Add</i>	235.46	
<i>For Backdraft Damper, Add</i>	121.47	
<i>For Damper Motor, Add</i>	113.71	
23 34 16 00-0127 EA 30" Diameter Wheel, 2 HP, 10,192 CFM At 1/4" Static Pressure, Belt Drive, Kitchen Upblast Exhaust Fan.....	3,196.98	185.29
Note: 115/208-230/60/3. Includes heat baffle, grease baffle and disconnect switch.		
<i>For Bird Screen, Add</i>	77.22	
<i>For Wall Mounted Fan, Add</i>	127.88	
<i>For Totally Enclosed Motor, Add</i>	85.00	
<i>For Grease Trap Kit, Add</i>	76.41	
<i>For Hinged Curb Kit, Add</i>	240.24	
<i>For Backdraft Damper, Add</i>	121.47	
<i>For Damper Motor, Add</i>	113.71	
23 34 16 00-0128 EA 30" Diameter Wheel, 3 HP, 11,903 CFM At 1/4" Static Pressure, Belt Drive, Kitchen Upblast Exhaust Fan.....	3,482.71	185.29
Note: 115/208-230/60/3. Includes heat baffle, grease baffle and disconnect switch.		
<i>For Bird Screen, Add</i>	77.22	
<i>For Wall Mounted Fan, Add</i>	139.31	
<i>For Totally Enclosed Motor, Add</i>	85.00	
<i>For Grease Trap Kit, Add</i>	76.41	
<i>For Hinged Curb Kit, Add</i>	264.53	
<i>For Backdraft Damper, Add</i>	121.47	
<i>For Damper Motor, Add</i>	113.71	
23 34 16 00-0129 EA 30" Diameter Wheel, 5 HP, 14,266 CFM At 1/4" Static Pressure, Belt Drive, Kitchen Upblast Exhaust Fan.....	3,620.61	185.29
Note: 115/208-230/60/3. Includes heat baffle, grease baffle and disconnect switch.		
<i>For Bird Screen, Add</i>	77.22	
<i>For Wall Mounted Fan, Add</i>	144.82	
<i>For Totally Enclosed Motor, Add</i>	85.00	
<i>For Grease Trap Kit, Add</i>	76.41	
<i>For Hinged Curb Kit, Add</i>	276.25	
<i>For Backdraft Damper, Add</i>	121.47	
<i>For Damper Motor, Add</i>	113.71	
23 34 16 00-0130 EA 36" Diameter Wheel, 3 HP, 14,769 CFM At 1/4" Static Pressure, Belt Drive, Kitchen Upblast Exhaust Fan.....	3,986.60	203.82
Note: 115/208-230/60/3. Includes heat baffle, grease baffle and disconnect switch.		
<i>For Bird Screen, Add</i>	88.26	
<i>For Wall Mounted Fan, Add</i>	159.46	
<i>For Totally Enclosed Motor, Add</i>	85.00	
<i>For Grease Trap Kit, Add</i>	76.41	
<i>For Hinged Curb Kit, Add</i>	304.21	
<i>For Damper Motor, Add</i>	113.71	
<i>For Backdraft Damper, Add</i>	141.31	
23 34 16 00-0131 EA 36" Diameter Wheel, 5 HP, 17,884 CFM At 1/4" Static Pressure, Belt Drive, Kitchen Upblast Exhaust Fan.....	4,145.18	203.82
Note: 115/208-230/60/3. Includes heat baffle, grease baffle and disconnect switch.		
<i>For Bird Screen, Add</i>	88.26	
<i>For Wall Mounted Fan, Add</i>	165.81	
<i>For Totally Enclosed Motor, Add</i>	85.00	
<i>For Grease Trap Kit, Add</i>	76.41	
<i>For Hinged Curb Kit, Add</i>	317.69	
<i>For Damper Motor, Add</i>	113.71	
<i>For Backdraft Damper, Add</i>	141.31	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 34 HVAC Fans**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 34 16 00-0132 EA 42" Diameter Wheel, 3 HP , 17,316 CFM At 1/4" Static Pressure, Belt Drive, Kitchen Upblast Exhaust Fan.....	4,186.68	222.35
Note: 230/460/60/3. Includes birdscreen, heat baffle, grease baffle and disconnect switch.		
For Bird Screen, Add	88.26	
For Totally Enclosed Motor, Add	85.00	
For Grease Trap Kit, Add	76.41	
For Hinged Curb Kit, Add	318.07	
For Damper Motor, Add	113.71	
For Backdraft Damper, Add	162.55	
23 34 16 00-0133 EA 42" Diameter Wheel, 7-1/2 HP , 24,604 CFM At 1/4" Static Pressure, Belt Drive, Kitchen Upblast Exhaust Fan.....	4,534.85	222.35
Note: 230/460/60/3. Includes birdscreen, heat baffle, grease baffle and disconnect switch.		
For Bird Screen, Add	88.26	
For Totally Enclosed Motor, Add	85.00	
For Grease Trap Kit, Add	76.41	
For Hinged Curb Kit, Add	347.67	
For Damper Motor, Add	113.71	
For Backdraft Damper, Add	162.55	
23 34 16 00-0134 Untempered Kitchen Make-Up Air Fans (23 34 16 00-0108)		
Note: Roof mounted with downblast discharge, weatherhood and filter.		
23 34 16 00-0135 Direct Drive Kitchen Make-Up Air Fans (23 34 16 00-0134)		
23 34 16 00-0136 EA 7" Diameter Wheel, 1/2 HP Direct Drive, Kitchen Make-Up Air Fan	810.87	96.35
Note: 115V. For roof installations. Includes downblast discharge, weatherhood, filter and disconnect switch.		
For Extended Weatherhood, Add	140.88	
23 34 16 00-0137 EA 8" Diameter Wheel, 1 HP Direct Drive, Kitchen Make-Up Air Fan	850.01	96.35
Note: 115V. For roof installations. Includes downblast discharge, weatherhood, filter and disconnect switch.		
For Extended Weatherhood, Add	146.75	
23 34 16 00-0138 EA 9" Diameter Wheel, 1 HP Direct Drive, Kitchen Make-Up Air Fan	898.04	96.35
Note: 115V. For roof installations. Includes downblast discharge, weatherhood, filter and disconnect switch.		
For Extended Weatherhood, Add	153.96	
23 34 16 00-0139 Belt Drive Kitchen Make-Up Air Fans (23 34 16 00-0134)		
23 34 16 00-0140 EA 9" Diameter Wheel, 1/2 HP Belt Drive, Kitchen Make-Up Air Fan.....	916.67	96.35
Note: 115/208-230/60/1. For roof installations. Includes downblast discharge, weatherhood, filter and disconnect switch.		
For Extended Weatherhood, Add	156.75	
23 34 16 00-0141 EA 10" Diameter Wheel, 1-1/2 HP Belt Drive, Kitchen Make-Up Air Fan	1,036.79	129.70
Note: 115/208-230/60/1. For roof installations. Includes downblast discharge, weatherhood, filter and disconnect switch.		
For Extended Weatherhood, Add	181.46	
23 34 16 00-0142 EA 12" Diameter Wheel, 2 HP Belt Drive, Kitchen Make-Up Air Fan.....	1,246.47	148.23
Note: 115/208-230/60/1. For roof installations. Includes downblast discharge, weatherhood, filter and disconnect switch.		
For Extended Weatherhood, Add	216.62	
23 34 16 00-0143 EA 15" Diameter Wheel, 3 HP Belt Drive, Kitchen Make-Up Air Fan.....	1,450.58	185.29
Note: 230/460/60/3. For roof installations. Includes downblast discharge, weatherhood, filter and disconnect switch.		
For Extended Weatherhood, Add	254.65	
23 34 16 00-0144 EA 18" Diameter Wheel, 5 HP Belt Drive, Kitchen Make-Up Air Fan.....	1,754.67	222.35
Note: 230/460/60/3. For roof installations. Includes downblast discharge, weatherhood, filter and disconnect switch.		
For Extended Weatherhood, Add	307.67	
23 34 16 00-0145 Replacement Parts (23 34 16 00-0001)		
23 34 16 00-0146 Replace Belts And Accessories (23 34 16 00-0145)		
23 34 16 00-0147 EA Fan Shaft Bearing, Replacement.....	575.67	262.47
23 34 16 00-0148 EA Fan Belt, Replacement	91.54	35.61
23 34 16 00-0149 Corrosive Fume Resistant Plastic (23 34 16 00-0001)		
23 34 16 00-0150 Centrifugal Roof Ventilators, Belt Drive, 1/4" Static Pressure (23 34 16 00-0149)		
23 34 16 00-0151 EA 250 CFM, 1/4 HP Roof Ventilator, Centrifugal, Belt Drive, Corrosive Fume Resistant Plastic.....	3,374.85	133.99
For Explosion Proof Motor, Add	466.03	
23 34 16 00-0152 EA 895 CFM, 1/3 HP Roof Ventilator, Centrifugal, Belt Drive, Corrosive Fume Resistant Plastic.....	3,670.87	160.96
For Explosion Proof Motor, Add	502.34	
23 34 16 00-0153 EA 1,630 CFM, 1/2 HP Roof Ventilator, Centrifugal, Belt Drive, Corrosive Fume Resistant Plastic.....	4,356.59	201.19
For Explosion Proof Motor, Add	593.13	
23 34 16 00-0154 EA 2,240 CFM, 1 HP Roof Ventilator, Centrifugal, Belt Drive, Corrosive Fume Resistant Plastic.....	4,692.78	268.39
For Explosion Proof Motor, Add	623.39	
23 34 16 00-0155 EA 3,810 CFM, 2 HP Roof Ventilator, Centrifugal, Belt Drive, Corrosive Fume Resistant Plastic.....	5,404.56	402.39
For Explosion Proof Motor, Add	689.97	
23 34 16 00-0156 EA 11,760 CFM, 5 HP Roof Ventilator, Centrifugal, Belt Drive, Corrosive Fume Resistant Plastic.....	9,356.56	804.78
For Explosion Proof Motor, Add	1,162.05	
23 34 16 00-0157 EA 18,810 CFM, 10 HP Roof Ventilator, Centrifugal, Belt Drive, Corrosive Fume Resistant Plastic.....	13,638.88	1,150.43
For Explosion Proof Motor, Add	1,700.71	
23 34 16 00-0158 Utility Set, Centrifugal, Belt Drive (23 34 16 00-0149)		
23 34 16 00-0159 EA 1,200 CFM, 1/4 HP Utility Set, Centrifugal, Belt Drive, 1/4 Static Pressure, Corrosive Fume Resistant Plastic.....	3,374.85	133.99
For Explosion Proof Motor, Add	466.03	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 34 16 00-0160 EA 1,520 CFM, 1/3 HP Utility Set, Centrifugal, Belt Drive, 1/4 Static Pressure, Corrosive Fume Resistant Plastic <i>For Explosion Proof Motor, Add</i>	3,469.13 472.08	160.96
23 34 16 00-0161 EA 1,850 CFM, 1/2 HP Utility Set, Centrifugal, Belt Drive, 1/4 Static Pressure, Corrosive Fume Resistant Plastic <i>For Explosion Proof Motor, Add</i>	3,549.61 472.08	201.19
23 34 16 00-0162 EA 2,180 CFM, 3/4 HP Utility Set, Centrifugal, Belt Drive, 1/4 Static Pressure, Corrosive Fume Resistant Plastic <i>For Explosion Proof Motor, Add</i>	3,684.06 472.08	268.39
23 34 16 00-0163 EA 3,600 CFM, 1 HP Utility Set, Centrifugal, Belt Drive, 1/4 Static Pressure, Corrosive Fume Resistant Plastic <i>For Explosion Proof Motor, Add</i>	5,081.77 641.55	402.39
23 34 16 00-0164 EA 4,250 CFM, 1-1/2 HP Utility Set, Centrifugal, Belt Drive, 1/4 Static Pressure, Corrosive Fume Resistant Plastic <i>For Explosion Proof Motor, Add</i>	5,282.97 641.55	502.98
23 34 16 00-0165 EA 4,800 CFM, 2 HP Utility Set, Centrifugal, Belt Drive, 1/4 Static Pressure, Corrosive Fume Resistant Plastic <i>For Explosion Proof Motor, Add</i>	5,428.13 641.55	575.58
23 34 16 00-0166 EA 6,920 CFM, 5 HP Utility Set, Centrifugal, Belt Drive, 1/4 Static Pressure, Corrosive Fume Resistant Plastic <i>For Explosion Proof Motor, Add</i>	5,564.86 653.65	603.58
23 34 16 00-0167 EA 7,700 CFM, 7-1/2 HP Utility Set, Centrifugal, Belt Drive, 1/4 Static Pressure, Corrosive Fume Resistant Plastic <i>For Explosion Proof Motor, Add</i>	5,739.34 659.71	670.62
23 34 16 00-0168 In-Line Duct Fans (23 34 16 00-0001)		
23 34 16 00-0169 Direct Drive In-Line Duct Fans (23 34 16 00-0168) Note: Greenheck SQ.		
23 34 16 00-0170 EA Up To 10" Wheel Diameter, 1/16 HP Direct Drive, In Line Duct Fan Note: 115V. Includes disconnect switch.	1,002.93	96.35
23 34 16 00-0171 EA 13" Wheel Diameter, 1/6 HP Direct Drive, In Line Duct Fan Note: 115V. Includes disconnect switch.	1,281.68	103.77
23 34 16 00-0172 EA 14" Wheel Diameter, 1/3 HP Direct Drive, In Line Duct Fan Note: 115V. Includes disconnect switch.	1,405.43	111.17
23 34 16 00-0173 Belt Drive In-Line Duct Fans (23 34 16 00-0168) Note: Greenheck BSQ.		
23 34 16 00-0174 EA Up To 12" Wheel Diameter, 1/4 HP Belt Drive, In Line Duct Fan Note: 115/208-230/60/1. Includes disconnect switch. <i>For 3 Phase Motor, Deduct</i>	1,468.45 -50.00	111.17
<i>For Totally Enclosed Motor, Add</i>	85.00	
23 34 16 00-0175 EA 13" Or 14" Wheel Diameter, 1/4 HP Belt Drive, In Line Duct Fan Note: 115/208-230/60/1. Includes disconnect switch. <i>For 3 Phase Motor, Deduct</i>	1,687.74 -50.00	129.70
<i>For Totally Enclosed Motor, Add</i>	85.00	
23 34 16 00-0176 EA 13" Or 14" Wheel Diameter, 3/4 HP Belt Drive, In Line Duct Fan Note: 115/208-230/60/1. Includes disconnect switch. <i>For 3 Phase Motor, Deduct</i>	1,898.05 -50.00	129.70
<i>For Totally Enclosed Motor, Add</i>	85.00	
23 34 16 00-0177 EA 13" Or 14" Wheel Diameter, 1-1/2 HP Belt Drive, In Line Duct Fan Note: 115/208-230/60/1. Includes disconnect switch. <i>For 3 Phase Motor, Deduct</i>	2,076.84 -50.00	129.70
<i>For Totally Enclosed Motor, Add</i>	85.00	
23 34 16 00-0178 EA 16" Or 18" Wheel Diameter, 1/3 HP Belt Drive, In Line Duct Fan Note: 115/208-230/60/1. Includes disconnect switch. <i>For 3 Phase Motor, Deduct</i>	2,022.79 -50.00	148.23
<i>For Totally Enclosed Motor, Add</i>	85.00	
23 34 16 00-0179 EA 16" Or 18" Wheel Diameter, 1-1/2 HP Belt Drive, In Line Duct Fan Note: 115/208-230/60/1. Includes disconnect switch. <i>For 3 Phase Motor, Deduct</i>	2,325.58 -50.00	148.23
<i>For Totally Enclosed Motor, Add</i>	85.00	
23 34 16 00-0180 EA 24" Wheel Diameter, 1 HP Belt Drive, In Line Duct Fan Note: 115/208-230/60/1. Includes disconnect switch. <i>For 3 Phase Motor, Deduct</i>	2,959.37 -50.00	185.29
<i>For Totally Enclosed Motor, Add</i>	85.00	
23 34 16 00-0181 EA 24" Wheel Diameter, 3 HP Belt Drive, In Line Duct Fan Note: 230/460/60/3. Includes disconnect switch. <i>For Totally Enclosed Motor, Add</i>	3,126.52 85.00	185.29
23 34 16 00-0182 EA 24" Wheel Diameter, 5 HP Belt Drive, In Line Duct Fan Note: Belt drive. 230/460/60/3. Includes disconnect switch. <i>For Totally Enclosed Motor, Add</i>	3,244.35 85.00	185.29
23 34 16 00-0183 EA 30 Or 36" Wheel Diameter, 3 HP Belt Drive, In Line Duct Fan Note: 230/460/60/3. Includes disconnect switch. <i>For Totally Enclosed Motor, Add</i>	3,752.18 85.00	222.35
23 34 16 00-0184 EA 30 Or 36" Wheel Diameter, 5 HP Belt Drive, In Line Duct Fan Note: 230/460/60/3. Includes disconnect switch. <i>For Totally Enclosed Motor, Add</i>	3,892.81 85.00	222.35
23 34 16 00-0185 EA 30 Or 36" Wheel Diameter, 7-1/2 HP Belt Drive, In Line Duct Fan Note: 230/460/60/3. Includes disconnect switch. <i>For Totally Enclosed Motor, Add</i>	4,065.64 85.00	222.35
23 34 16 00-0186 In-Line Cabinet Fans (23 34 16 00-0001)		
23 34 16 00-0187 EA 950 CFM, 80 Watts, Direct Drive In-Line Cabinet Fan.....	276.05	64.86
23 34 16 00-0188 EA 1,050 CFM, 129 Watts, Direct Drive In-Line Cabinet Fan.....	291.46	64.86
23 34 16 00-0189 EA 1,100 CFM, 173 Watts, Direct Drive In-Line Cabinet Fan.....	312.37	64.86
23 34 16 00-0190 EA 950 CFM, 48.7 Watts, Direct Drive In-Line Cabinet Fan.....	311.27	64.86
23 34 16 00-0191 EA 1,100 CFM, 52.5 Watts, Direct Drive In-Line Cabinet Fan.....	311.27	64.86
23 34 16 00-0192 EA 1,400 CFM, 100 Watts, Direct Drive In-Line Cabinet Fan.....	344.28	64.86
23 34 16 00-0193 EA 900 CFM, 48.2 Watts, Direct Drive In-Line Cabinet Fan.....	411.12	68.55

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 34 HVAC Fans**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 34 16 00-0194	EA		1,000 CFM, 82.7 Watts, Direct Drive In-Line Cabinet Fan.....	352.80	68.55
23 34 16 00-0195	EA		1,050 CFM, 80.7 Watts, Direct Drive In-Line Cabinet Fan.....	374.81	68.55
23 34 16 00-0196	EA		1,350 CFM, 140 Watts, Direct Drive In-Line Cabinet Fan.....	389.11	68.55
23 34 16 00-0197	EA		1,000 CFM, 135 Watts, Direct Drive In-Line Cabinet Fan.....	405.62	68.55
23 34 16 00-0198	EA		1,070 CFM, 217 Watts, Direct Drive In-Line Cabinet Fan.....	405.62	68.55
23 34 16 00-0199	EA		1,100 CFM, 350 Watts, Direct Drive In-Line Cabinet Fan.....	651.81	72.26
23 34 16 00-0200	EA		1,080 CFM, 325 Watts, Direct Drive In-Line Cabinet Fan.....	551.68	72.26
23 34 16 00-0201	EA		1,600 CFM, 405 Watts, Direct Drive In-Line Cabinet Fan.....	551.68	72.26
23 34 16 00-0202	EA		950 CFM, 328 Watts, Direct Drive In-Line Cabinet Fan.....	739.85	72.26
23 34 16 00-0203	EA		1,095 CFM, 455 Watts, Direct Drive In-Line Cabinet Fan.....	739.85	72.26
23 34 16 00-0204	EA		1,450 CFM, 822 Watts, Direct Drive In-Line Cabinet Fan.....	739.85	72.26
23 34 16 00-0205	EA		1,610 CFM, 830 Watts, Direct Drive In-Line Cabinet Fan.....	802.57	72.26
23 34 16 00-0206			Propeller And Ceiling Fans (23 34 16)		
23 34 16 00-0207			Direct Drive, Sidewall Propeller Exhaust Fan (23 34 16 00-0206)		
			Note: Greenheck SE1.		
23 34 16 00-0208	EA		1/25 HP, 307 CFM At 1/8" Static Pressure, 8" Diameter, Direct Drive, Sidewall Propeller Exhaust Fan.....	410.50	79.31
			Note: Includes motor side guard.		
			For Backdraft Damper, Add	79.24	
			For Wall Mount Collar, Add	153.12	
23 34 16 00-0209	EA		1/12 HP, 763 CFM At 1/8" Static Pressure, 10" Diameter, Direct Drive, Sidewall Propeller Exhaust Fan.....	436.02	88.20
			Note: Includes motor side guard.		
			For Backdraft Damper, Add	85.94	
			For Wall Mount Collar, Add	153.12	
23 34 16 00-0210	EA		1/8 HP, 1,149 CFM At 1/8" Static Pressure, 12" Diameter, Direct Drive, Sidewall Propeller Exhaust Fan.....	482.87	97.83
			Note: Includes motor side guard.		
			For Backdraft Damper, Add	94.64	
			For Wall Mount Collar, Add	157.17	
23 34 16 00-0211	EA		1/6 HP, 1,350 CFM At 1/8" Static Pressure, 14" Diameter, Direct Drive, Sidewall Propeller Exhaust Fan.....	696.31	108.21
			For Backdraft Damper, Add	112.35	
			For Wall Mount Collar, Add	160.12	
			For Motor Side Guard, Add	130.98	
23 34 16 00-0212	EA		1/6 HP, 2,012 CFM At 1/8" Static Pressure, 16" Diameter, Direct Drive, Sidewall Propeller Exhaust Fan.....	710.25	120.07
			For Backdraft Damper, Add	112.35	
			For Wall Mount Collar, Add	164.18	
			For Motor Side Guard, Add	139.43	
23 34 16 00-0213	EA		1/4 HP, 2,908 CFM At 1/8" Static Pressure, 18" Diameter, Direct Drive, Sidewall Propeller Exhaust Fan.....	797.93	133.41
			For Backdraft Damper, Add	135.06	
			For Wall Mount Collar, Add	168.22	
			For Motor Side Guard, Add	147.90	
23 34 16 00-0214	EA		1/3 HP, 3,974 CFM At 1/8" Static Pressure, 20" Diameter, Direct Drive, Sidewall Propeller Exhaust Fan.....	909.61	148.23
			For Backdraft Damper, Add	135.06	
			For Wall Mount Collar, Add	171.17	
			For Motor Side Guard, Add	159.67	
23 34 16 00-0215			Belt Drive Propeller Exhaust Fans (23 34 16 00-0206)		
			Note: Wall shutter 1/8" static pressure, with birdscreen.		
23 34 16 00-0216	EA		24" Propeller Exhaust Fan, V-Belt Drive, 5,795 CFM, 1/2 HP, With Wall Shutter.....	1,393.89	211.97
23 34 16 00-0217	EA		30" Propeller Exhaust Fan, V-Belt Drive, 9,060 CFM, 3/4 HP, With Wall Shutter.....	1,597.84	246.81
23 34 16 00-0218	EA		36" Propeller Exhaust Fan, V-Belt Drive, 11,850 CFM, 1 HP, With Wall Shutter.....	1,817.67	296.47
23 34 16 00-0219	EA		42" Propeller Exhaust Fan, V-Belt Drive, 17,400 CFM, 1-1/2 HP, With Wall Shutter.....	2,517.57	370.58
23 34 16 00-0220	EA		48" Propeller Exhaust Fan, V-Belt Drive, 19,870 CFM, 1-1/2 HP, With Wall Shutter.....	3,019.80	494.36
23 34 16 00-0221	EA		54" Propeller Exhaust Fan, V-Belt Drive, 26,000 CFM, 2 HP, With Wall Shutter.....	4,211.75	741.17
23 34 16 00-0222	EA		60" Propeller Exhaust Fan, V-Belt Drive, 35,120 CFM, 3 HP, With Wall Shutter.....	5,074.43	950.18
23 34 16 00-0223			Propeller Exhaust Fan Accessories (23 34 16 00-0206)		
23 34 16 00-0224	SF		Hinged Mesh Screen For Wall Propeller Fans, 1" x 1" Frame (SF Of Fan Opening).....	72.28	
23 34 16 00-0225	SF		Galvanized Weather Hood For Wall Propeller Fan (SF Of Fan Opening).....	165.26	
23 34 16 00-0226			Reversible Ceiling Fans (23 34 16 00-0206)		
23 34 16 00-0227			4 Blade Ceiling Fans (23 34 16 00-0226)		
23 34 16 00-0228	EA		42" 4-Blade Ceiling Fan, Three Speed.....	333.49	39.88
			For Brass Plated Motor, Add	20.25	
			For Light Kit, Add	25.66	
23 34 16 00-0229			5 Blade Ceiling Fans (23 34 16 00-0226)		
23 34 16 00-0230	EA		42" 5-Blade Ceiling Fan, Three Speed.....	364.23	98.70
			For Brass Plated Motor, Add	20.25	
			For Light Kit, Add	25.70	
23 34 16 00-0231	EA		52" 5-Blade Ceiling Fan, Three Speed.....	415.24	98.70
			For Brass Plated Motor, Add	20.25	
			For Light Kit, Add	25.79	
23 34 16 00-0232			3 Blade Weatherproof Ceiling Fans (23 34 16 00-0226)		
23 34 16 00-0233	EA		3-Blade Ceiling Fan, Weatherproof, Three Speed.....	339.14	36.69



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 34 16 00-0234				Ceiling Fan Down Rod <small>(23 34 16 00-0226)</small>		
				23 34 16 00-0235 EA 1' Ceiling Fan Down Rod.....	13.53	
				23 34 16 00-0236 EA 1-1/2' Ceiling Fan Down Rod.....	17.25	
				23 34 16 00-0237 EA 2' Ceiling Fan Down Rod.....	19.11	
				23 34 16 00-0238 EA 3' Ceiling Fan Down Rod.....	25.09	
				23 34 16 00-0239 EA 4' Ceiling Fan Down Rod.....	29.23	
				23 34 16 00-0240 EA 5' Ceiling Fan Down Rod.....	35.58	
				23 34 16 00-0241 EA 6' Ceiling Fan Down Rod.....	44.09	
23 34 16 00-0242				Exhaust Fans <small>(23 34 16)</small>		
23 34 16 00-0243				Exhaust Fans <small>(23 34 16 00-0242)</small>		
				Note: Excludes ducting.		
23 34 16 00-0244				Light Duty Exhaust Fans <small>(23 34 16 00-0243)</small>		
23 34 16 00-0245				Light Duty Exhaust Fans <small>(23 34 16 00-0244)</small>		
				23 34 16 00-0246 EA 50 CFM, Ceiling/Wall Mounted, Polymeric Intake Grille, Light Duty Exhaust Fan (Broan® 670).....	91.11	32.23
				23 34 16 00-0247 EA 70 CFM, Ceiling/Wall Mounted, Polymeric Intake Grille, Light Duty Exhaust Fan (Broan® 671).....	95.56	32.23
				23 34 16 00-0248 EA 180 CFM, Ceiling Mounted, Polymeric Intake Grille, Vertical Discharge, Light Duty Exhaust Fan (Broan® 505).....	148.98	32.23
				23 34 16 00-0249 EA 350 CFM, Ceiling Mounted, Polymeric Intake Grille, Vertical Discharge, Light Duty Exhaust Fan (Broan® 504).....	184.71	32.23
				23 34 16 00-0250 EA 160 CFM, Ceiling/Wall Mounted, Polymeric Intake Grille, Side Discharge, Light Duty Exhaust Fan (Broan® 503).....	166.57	32.23
				23 34 16 00-0251 EA 270 CFM, Ceiling/Wall Mounted, Polymeric Intake Grille, Side Discharge, Light Duty Exhaust Fan (Broan® 502).....	217.30	32.23
23 34 16 00-0252				Light Duty Exhaust Fans With Lights <small>(23 34 16 00-0244)</small>		
				23 34 16 00-0253 EA 50 CFM, Ceiling Mounted, Polymeric Intake Grille, Light Duty Exhaust Fan With Light (Broan® 678).....	114.91	32.23
				23 34 16 00-0254 EA 70 CFM, Ceiling Mounted, Polymeric Intake Grille, Light Duty Exhaust Fan With Light (Broan® 679).....	126.06	32.23
				23 34 16 00-0255 EA 100 CFM, Ceiling Mounted, Polymeric Intake Grille, Light Duty Exhaust Fan With Light (Broan® 680).....	224.11	32.23
23 34 16 00-0256				Light Duty Exhaust Fans With Heaters <small>(23 34 16 00-0244)</small>		
				23 34 16 00-0257 EA 70 CFM, Ceiling Mounted, Polymeric Intake Grille, Light Duty Exhaust Fan With Heater Bulb (Broan® 162).....	117.32	32.23
				23 34 16 00-0258 EA 70 CFM, Ceiling Mounted, Polymeric Intake Grille, Light Duty Exhaust Fan With Heater (Broan® 658).....	178.46	32.23
23 34 16 00-0259				Light Duty Exhaust Fans With Heaters And Lights <small>(23 34 16 00-0244)</small>		
				23 34 16 00-0260 EA 70 CFM, Ceiling Mounted, Polymeric Intake Grille, Light Duty Exhaust Fan With Heater And Light (Broan® 655).....	189.06	32.23
				23 34 16 00-0261 EA 100 CFM, Ceiling Mounted, Polymeric Intake Grille, Light Duty Exhaust Fan With Heater And Light (Broan® 100HL).....	280.05	32.23
23 34 16 00-0262				Heavy Duty/Continuous Operation Exhaust Fans <small>(23 34 16 00-0243)</small>		
23 34 16 00-0263				Heavy Duty/Continuous Operation Exhaust Fans <small>(23 34 16 00-0262)</small>		
				Note: Includes enamel steel or aluminum grille.		
				23 34 16 00-0264 EA 50 CFM, Ceiling/Wall Mounted, Metal Intake Grille, Heavy Duty/Continuous Operation Exhaust Fan (Broan® HD50).....	134.16	32.23
				23 34 16 00-0265 EA 80 CFM, Ceiling/Wall Mounted, Metal Intake Grille, Heavy Duty/Continuous Operation Exhaust Fan (Broan® HD80).....	146.94	32.23
				23 34 16 00-0266 EA 109 CFM, Ceiling/Wall Mounted, Metal Intake Grille, Heavy Duty/Continuous Operation Exhaust Fan (Broan® LoSone® Ventilator L100MG).....	257.53	32.23
				23 34 16 00-0267 EA 157 CFM, Ceiling/Wall Mounted, Metal Intake Grille, Heavy Duty/Continuous Operation Exhaust Fan (Broan® LoSone® Ventilator L150MG).....	263.45	32.23
				23 34 16 00-0268 EA 210 CFM, Ceiling/Wall Mounted, Metal Intake Grille, Heavy Duty/Continuous Operation Exhaust Fan (Broan® LoSone® Ventilator L200MG).....	281.88	32.23
				23 34 16 00-0269 EA 259 CFM, Ceiling/Wall Mounted, Metal Intake Grille, Heavy Duty/Continuous Operation Exhaust Fan (Broan® LoSone® Ventilator L250MG).....	293.66	32.23
				23 34 16 00-0270 EA 308 CFM, Ceiling/Wall Mounted, Metal Intake Grille, Heavy Duty/Continuous Operation Exhaust Fan (Broan® LoSone® Ventilator L300MG).....	298.22	32.23
				23 34 16 00-0271 EA 434 CFM, Ceiling/Wall Mounted, Metal Intake Grille, Heavy Duty/Continuous Operation Exhaust Fan (Broan® LoSone® Ventilator L400).....	339.37	32.23
				23 34 16 00-0272 EA 514 CFM, Ceiling/Wall Mounted, Metal Intake Grille, Heavy Duty/Continuous Operation Exhaust Fan (Broan® LoSone® Ventilator L500).....	384.75	32.23
				23 34 16 00-0273 EA 701 CFM, Ceiling/Wall Mounted, Metal Intake Grille, Heavy Duty/Continuous Operation Exhaust Fan (Broan® LoSone® Ventilator L700).....	410.60	32.23
				23 34 16 00-0274 EA 901 CFM, Ceiling/Wall Mounted, Metal Intake Grille, Heavy Duty/Continuous Operation Exhaust Fan (Broan® LoSone® Ventilator L900).....	486.10	32.23
				23 34 16 00-0275 EA 1,513 CFM, Ceiling/Wall Mounted, Metal Intake Grille, Heavy Duty/Continuous Operation Exhaust Fan (Broan® LoSone® Ventilator L1500).....	620.61	32.23
23 34 16 00-0276				Heavy Duty/Continuous Operation Kitchen Exhaust Fans <small>(23 34 16 00-0262)</small>		
				Note: Includes enamel steel or aluminum grille.		
				23 34 16 00-0277 EA 308 CFM, Ceiling/Wall Mounted, Metal Intake Grille, Kitchen Heavy Duty/Continuous Operation Exhaust Fan (Broan® LoSone® Ventilator L300KMG).....	266.90	32.23
				23 34 16 00-0278 EA 434 CFM, Ceiling/Wall Mounted, Metal Intake Grille, Kitchen Heavy Duty/Continuous Operation Exhaust Fan (Broan® LoSone® Ventilator L400K).....	381.35	32.23
				23 34 16 00-0279 EA 514 CFM, Ceiling/Wall Mounted, Metal Intake Grille, Kitchen Heavy Duty/Continuous Operation Exhaust Fan (Broan® LoSone® Ventilator L500K).....	402.55	32.23

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 34 HVAC Fans**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 34 16 00-0280			Heavy Duty/Continuous Operation Exhaust Fans With Lights (23 34 16 00-0282)		
23 34 16 00-0281	EA		50 CFM, Ceiling/Wall Mounted, Polymeric Intake Grille, Heavy Duty/Continuous Operation Exhaust Fan With Light (Broan® HD50L).....	144.62	32.23
23 34 16 00-0282	EA		80 CFM, Ceiling/Wall Mounted, Polymeric Intake Grille, Heavy Duty/Continuous Operation Exhaust Fan With Light (Broan® HD80L).....	156.62	32.23
23 34 16 00-0283			Fire Rated, Heavy Duty/Continuous Operation Exhaust Fans (23 34 16 00-0282)		
23 34 16 00-0284	EA		50 CFM, Ceiling Mounted, Metal Intake Grille, Fire Rated, Heavy Duty/Continuous Operation Exhaust Fan (Broan® HD50RDF).....	149.89	32.23
23 34 16 00-0285	EA		80 CFM, Ceiling Mounted, Metal Intake Grille, Fire Rated, Heavy Duty/Continuous Operation Exhaust Fan (Broan® HD80RDF).....	157.84	32.23
23 34 16 00-0286	EA		110 CFM, Ceiling Mounted, Metal Intake Grille, Fire Rated, Heavy Duty/Continuous Operation Exhaust Fan (Broan® 110RDF).....	161.67	32.23
23 34 16 00-0287			Low Sound, Direct Drive, Centrifugal Ceiling Exhaust Fans (23 34 16 00-0243)		
23 34 16 00-0288	EA		900 CFM Low Sound, Direct Drive Centrifugal Ceiling Exhaust Fan (Greenheck SP-A900).....	660.86	32.23
23 34 16 00-0289	EA		1050 CFM Low Sound, Direct Drive Centrifugal Ceiling Exhaust Fan (Greenheck SP-A1050).....	660.86	32.23
23 34 16 00-0290	EA		1410 CFM Low Sound, Direct Drive Centrifugal Ceiling Exhaust Fan (Greenheck SP-A1410).....	660.86	32.23
23 34 16 00-0291	EA		1550 CFM Low Sound, Direct Drive Centrifugal Ceiling Exhaust Fan (Greenheck SP-A1550).....	723.86	32.23
23 34 16 00-0292			Room-To-Room Exhaust Fans (23 34 16 00-0243)		
23 34 16 00-0293	EA		90 CFM, Polymeric Grilles, Wall Mounted, Room-To-Room Exhaust Fan (Broan® 512).....	111.91	32.23
23 34 16 00-0294	EA		180 CFM, Polymeric Grilles, Wall Mounted, Room-To-Room Exhaust Fan (Broan® 511).....	176.80	32.23
23 34 16 00-0295	EA		380 CFM, Polymeric Grilles, Wall Mounted, Room-To-Room Exhaust Fan (Broan® 510).....	200.44	32.23
23 34 16 00-0296			Through-Wall Exhaust Fans (23 34 16 00-0243)		
23 34 16 00-0297	EA		250 CFM, Wall Mounted, Polymeric Intake Grille, Chain Operated, Through Wall Exhaust Fan (Broan® 507).....	188.08	32.23
23 34 16 00-0298	EA		470 CFM, Wall Mounted, Polymeric Intake Grille, Chain Operated, Through Wall Exhaust Fan (Broan® 506).....	220.67	32.23
23 34 16 00-0299	EA		180 CFM, Wall Mounted, Polymeric Intake Grille, Through-Wall Exhaust Fan (Broan® 509).....	165.67	32.23
23 34 16 00-0300	EA		270 CFM, Wall Mounted, Polymeric Intake Grille, Through-Wall Exhaust Fan (Broan® 508).....	217.30	32.23
23 34 16 00-0301	EA		360 CFM, Wall Mounted, Polymeric Intake Grille, Through-Wall Exhaust Fan With Motorized Door (Broan® 12C).....	370.14	32.23
23 34 16 00-0302			Exhaust Fan Accessories (23 34 16 00-0243)		
23 34 16 00-0303			Exhaust Fan Controls (23 34 16 00-0302)		
23 34 16 00-0304	EA		Electronic Variable Speed Control Dial, Single Gang, Exhaust Fan Controls (Broan® 57).....	104.34	20.14
23 34 16 00-0305	EA		60-Minute Time Control Dial, Single Gang, Exhaust Fan Controls (Broan® 59).....	75.51	20.14
23 34 16 00-0306	EA		60-Minute Time Control Dial With Rocker Switch, Double Gang, Exhaust Fan Controls (Broan® 61).....	76.20	20.14
23 34 16 00-0307			Roof And Wall Caps For Exhaust Fans (23 34 16 00-0302)		
23 34 16 00-0308			Wall Caps For Exhaust Fans (23 34 16 00-0307)		
23 34 16 00-0309	EA		Aluminum Wall Cap For Up To 12" Duct, Installed On Exterior Walls (Broan® 613).....	169.54	40.24
23 34 16 00-0310	EA		Aluminum Wall Cap For Up To 18" Duct, Installed On Exterior Walls (Broan® 643).....	171.81	40.24
23 34 16 00-0311			Roof Caps For Exhaust Fans (23 34 16 00-0307)		
			Note: Includes flashing and built in bird screen.		
23 34 16 00-0312	EA		Aluminum Roof Cap For Up To 8" Duct, Installed On Flat Roofs (Broan® 611).....	146.12	40.24
23 34 16 00-0313	EA		Aluminum Roof Cap For Up To 12" Duct, Installed On Flat Roofs (Broan® 612).....	205.05	40.24
23 34 16 00-0314	EA		CRCQ Steel Roof Cap For Up To 4" Duct, Installed On Sloped Roofs (Broan® 636).....	100.82	40.24
23 34 16 00-0315	EA		CRCQ Steel Roof Cap For Up To 8" Duct, Installed On Sloped Roofs (Broan® 634).....	118.50	40.24
23 34 16 00-0316			Removal And Reinstallation Of Light Duty Ceiling Exhaust Fan (23 34 16 00-0243)		
			Note: Includes storage and cleaning.		
23 34 16 00-0317	EA		Remove And Reinstall Light Duty Ceiling Exhaust Fan.....	55.59	
23 34 23			HVAC Power Ventilators (23 34)		
23 34 23 00-0001			Power Roof Ventilators (23 34 23)		
23 34 23 00-0002			Direct Drive, Aluminum, Centrifugal Roof Exhausters (23 34 23 00-0001)		
			Note: Greenheck G.		
23 34 23 00-0003	EA		1/25 HP, 310 CFM At 1/4" Static Pressure, 17" x 17" Base, Direct Drive, Aluminum, Centrifugal Roof Exhauster.....	467.15	105.99
			Note: Three speed motor.		
			For 12" Roof Curb, Add	129.28	
			For Backdraft Damper, Add	66.94	
			For Solid State Speed Control, Add	66.05	
			For Damper Motor, Add	113.71	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 34 23 00-0004 EA 1/8 HP, 863 CFM At 1/4" Static Pressure, 17" x 17" Base, Direct Drive, Aluminum, Centrifugal Roof Exhauster Note: Three speed motor. For 12" Roof Curb, Add For Backdraft Damper, Add For Solid State Speed Control, Add For Damper Motor, Add	528.35 129.28 66.94 66.05 113.71	120.07
23 34 23 00-0005 EA 1/6 HP, 1,213 CFM At 1/4" Static Pressure, 19" x 19" Base, Direct Drive, Aluminum, Centrifugal Roof Exhauster For 12" Roof Curb, Add For Backdraft Damper, Add For Solid State Speed Control, Add For Damper Motor, Add	754.16 132.59 72.64 66.05 113.71	140.08
23 34 23 00-0006 EA 1/4 HP, 1,374 CFM At 1/4" Static Pressure, 19" x 19" Base, Direct Drive, Aluminum, Centrifugal Roof Exhauster For 12" Roof Curb, Add For Backdraft Damper, Add For Solid State Speed Control, Add For Damper Motor, Add	796.48 132.59 72.64 66.05 113.71	157.87
23 34 23 00-0007 EA 1/3 HP, 1,905 CFM At 1/4" Static Pressure, 22" x 22" Base, Direct Drive, Aluminum, Centrifugal Roof Exhauster For Solid State Speed Control, Add For Damper Motor, Add	999.65 66.05 113.71	174.18
23 34 23 00-0008 EA 1/2 HP, 3,072 CFM At 1/4" Static Pressure, 22" x 22" Base, Direct Drive, Aluminum, Centrifugal Roof Exhauster For 12" Roof Curb, Add For Backdraft Damper, Add For Solid State Speed Control, Add For Damper Motor, Add	1,112.33 138.11 82.35 100.24 113.71	185.29
23 34 23 00-0009 Belt Drive, Aluminum, Centrifugal Roof Exhausters (23 34 23 00-0001) Note: Greenheck GB.		
23 34 23 00-0010 EA 1/4 HP, 1,556 CFM At 1/4" Static Pressure, 19" x 19" Base, Belt Drive, Aluminum, Centrifugal Roof Exhauster..... For 12" Roof Curb, Add For Backdraft Damper, Add For Damper Motor, Add	990.52 132.59 72.64 113.71	157.87
23 34 23 00-0011 EA 1/3 HP, 1,966 CFM At 1/4" Static Pressure, 22" x 22" Base, Belt Drive, Aluminum, Centrifugal Roof Exhauster..... For 12" Roof Curb, Add For Backdraft Damper, Add For Damper Motor, Add	1,081.09 138.11 82.35 113.71	200.86
23 34 23 00-0012 EA 1/2 HP, 2,943 CFM At 1/4" Static Pressure, 22" x 22" Base, Belt Drive, Aluminum, Centrifugal Roof Exhauster..... For 12" Roof Curb, Add For Backdraft Damper, Add For Damper Motor, Add	1,468.88 138.11 82.35 113.71	239.40
23 34 23 00-0013 EA 3/4 HP, 4,289 CFM At 1/4" Static Pressure, 30" x 30" Base, Belt Drive, Aluminum, Centrifugal Roof Exhauster..... For 12" Roof Curb, Add For Backdraft Damper, Add For Damper Motor, Add	1,874.96 164.58 101.06 113.71	296.47
23 34 23 00-0014 EA 1 HP, 6,157 CFM At 1/4" Static Pressure, 34" x 34" Base, Belt Drive, Aluminum, Centrifugal Roof Exhauster..... For 12" Roof Curb, Add For Backdraft Damper, Add For Damper Motor, Add	2,476.47 176.72 109.77 113.71	370.58
23 34 23 00-0015 EA 1-1/2 HP, 8,906 CFM At 1/4" Static Pressure, 40" x 40" Base, Belt Drive, Aluminum, Centrifugal Roof Exhauster..... For 12" Roof Curb, Add For Backdraft Damper, Add For Damper Motor, Add	3,266.36 195.47 121.47 113.71	463.24
23 34 23 00-0016 EA 2 HP, 10,059 CFM At 1/4" Static Pressure, 40" x 40" Base, Belt Drive, Aluminum, Centrifugal Roof Exhauster..... For 12" Roof Curb, Add For Backdraft Damper, Add For Damper Motor, Add	3,292.83 195.47 121.47 113.71	463.24
23 34 23 00-0017 EA 3 HP, 11,703 CFM At 1/4" Static Pressure, 40" x 40" Base, Belt Drive, Aluminum, Centrifugal Roof Exhauster..... For 12" Roof Curb, Add For Backdraft Damper, Add For Damper Motor, Add	3,578.56 195.47 121.47 113.71	463.24
23 34 23 00-0018 EA 5 HP, 13,897 CFM At 1/4" Static Pressure, 40" x 40" Base, Belt Drive, Aluminum, Centrifugal Roof Exhauster..... For 12" Roof Curb, Add For Backdraft Damper, Add For Damper Motor, Add	3,586.22 195.47 121.47 113.71	463.24
23 34 23 00-0019 Propeller Exhaust Fans, Roof Mounted Upblast (23 34 23 00-0001) Note: Includes back draft damper and birdscreen and curb.		
23 34 23 00-0020 EA 30,300 CFM Belt Drive 5 HP Propeller Exhaust Fan, Roof Mounted, 3/8" Static Pressure	4,688.77	569.96
23 34 23 00-0021 EA 36,000 CFM Belt Drive 15 HP Propeller Exhaust Fan, Roof Mounted, 1/2" Static Pressure	7,637.98	740.95
23 34 23 00-0022 Belt Drive Supply Fans (23 34 23 00-0001)		
23 34 23 00-0023 EA 4,500 CFM, 24" x 24" Supply Fan, Roof Mounted	1,869.41	295.95
23 34 23 00-0024 EA 10,000 CFM, 36" x 36" Supply Fan, Roof Mounted	2,519.56	370.51
23 34 23 00-0025 Fan Thermostat (23 34 23 00-0001)		
23 34 23 00-0026 EA 50 To 120 Degree Line Voltage Fan Thermostat.....	82.77	
23 34 23 00-0027 Power Wall Ventilators (23 34 23)		
23 34 23 00-0028 Centrifugal Sidewall Exhausters (23 34 23 00-0027)		

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 34 HVAC Fans**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 34 23 00-0029 Direct Drive, Aluminum, Centrifugal Sidewall Exhauster (23 34 23 00-0029) Note: Greenheck CW.		
23 34 23 00-0030 EA 1/25 HP, 297 CFM At 1/4" Static Pressure, Direct Drive, Aluminum, Centrifugal Sidewall Exhauster	561.96	119.33
For Solid State Speed Control, Add	100.24	
For Backdraft Damper, Add	85.53	
For Damper Motor, Add	184.06	
For Interior Wall Grill, Add	73.61	
23 34 23 00-0031 EA 1/8 HP, 861 CFM At 1/4" Static Pressure, Direct Drive, Aluminum, Centrifugal Sidewall Exhauster	644.63	140.08
For Solid State Speed Control, Add	100.24	
For Backdraft Damper, Add	95.24	
For Damper Motor, Add	184.06	
For Interior Wall Grill, Add	87.58	
23 34 23 00-0032 EA 1/6 HP, 1,179 CFM At 1/4" Static Pressure, Direct Drive, Aluminum, Centrifugal Sidewall Exhauster	968.51	157.87
For Solid State Speed Control, Add	100.24	
For Backdraft Damper, Add	107.94	
For Damper Motor, Add	184.06	
For Interior Wall Grill, Add	101.57	
23 34 23 00-0033 Belt Drive, Aluminum, Centrifugal Sidewall Exhausters (23 34 23 00-0028) Note: Greenheck CWB.		
23 34 23 00-0034 EA 1/4 HP, 1,633 CFM At 1/4" Static Pressure, Belt Drive, Aluminum, Centrifugal Sidewall Exhauster	1,386.66	89.33
For Solid State Speed Control, Add	100.24	
For Backdraft Damper, Add	102.23	
For Damper Motor, Add	184.06	
For Interior Wall Grill, Add	154.15	
23 34 23 00-0035 EA 1/2 HP, 2,291 CFM At 1/4" Static Pressure, Belt Drive, Aluminum, Centrifugal Sidewall Exhauster	1,466.56	100.60
For Solid State Speed Control, Add	100.24	
For Backdraft Damper, Add	102.23	
For Damper Motor, Add	184.06	
For Interior Wall Grill, Add	154.15	
23 34 23 00-0036 EA 3/4 HP, 3,646 CFM At 1/4" Static Pressure, Belt Drive, Aluminum, Centrifugal Sidewall Exhauster	1,798.92	115.08
For Solid State Speed Control, Add	100.24	
For Backdraft Damper, Add	126.67	
For Damper Motor, Add	184.06	
For Interior Wall Grill, Add	179.17	
23 34 33 Air Curtains (23 34)		
23 34 33 00-0001 Unheated Air Curtains For Entrances (23 34 33) Note: Includes housing and controls.		
23 34 33 00-0002 Personnel Entrance Unheated Air Curtains (23 34 33 00-0001)		
23 34 33 00-0003 EA Air Curtain For 3' x 10' Personnel Entrance, Unheated, Including Housing And Controls.....	1,625.08	543.28
23 34 33 00-0004 EA Air Curtain For 3.5' x 10' Personnel Entrance, Unheated, Including Housing And Controls.....	1,642.51	543.28
23 34 33 00-0005 EA Air Curtain For 4' x 10' Personnel Entrance, Unheated, Including Housing And Controls.....	1,651.22	543.28
23 34 33 00-0006 EA Air Curtain For 5' x 10' Personnel Entrance, Unheated, Including Housing And Controls.....	2,025.86	543.28
23 34 33 00-0007 EA Air Curtain For 6' x 10' Personnel Entrance, Unheated, Including Housing And Controls.....	2,512.94	652.24
23 34 33 00-0008 EA Air Curtain For 7' x 10' Personnel Entrance, Unheated, Including Housing And Controls.....	2,626.21	652.24
23 34 33 00-0009 EA Air Curtain For 10' x 10' Personnel Entrance, Unheated, Including Housing And Controls.....	3,544.96	752.29
23 34 33 00-0010 EA Air Curtain For 12' x 10' Personnel Entrance, Unheated, Including Housing And Controls.....	4,189.69	752.29
23 34 33 00-0011 EA Air Curtain For 15' x 10' Personnel Entrance, Unheated, Including Housing And Controls.....	4,747.30	752.29
23 34 33 00-0012 Receiving/Service Entrance Unheated Air Curtains (23 34 33 00-0001) Note: Normal door sizes.		
23 34 33 00-0013 EA Air Curtain, 3' x 8' Service/Receiving Entrance, Unheated, Including Housing And Controls	1,630.31	543.28
23 34 33 00-0014 EA Air Curtain, 3.5' x 8' Service/Receiving Entrance, Unheated, Including Housing And Controls	1,630.31	543.28
23 34 33 00-0015 EA Air Curtain, 4' x 8' Service/Receiving Entrance, Unheated, Including Housing And Controls	1,645.99	543.28
23 34 33 00-0016 EA Air Curtain, 5' x 8' Service/Receiving Entrance, Unheated, Including Housing And Controls	1,842.90	543.28
23 34 33 00-0017 EA Air Curtain, 6' x 8' Service/Receiving Entrance, Unheated, Including Housing And Controls	2,286.41	652.24
23 34 33 00-0018 EA Air Curtain, 7' x 8' Service/Receiving Entrance, Unheated, Including Housing And Controls	2,591.35	652.24
23 34 33 00-0019 EA Air Curtain, 8' x 8' Service/Receiving Entrance, Unheated, Including Housing And Controls	2,785.22	752.29
23 34 33 00-0020 EA Air Curtain, 10' x 8' Service/Receiving Entrance, Unheated, Including Housing And Controls	3,527.53	752.29
23 34 33 00-0021 EA Air Curtain, 4' x 10' Service/Receiving Entrance, Unheated, Including Housing And Controls	1,947.45	543.28
23 34 33 00-0022 Service Window Unheated Air Curtains (23 34 33 00-0001) Note: Normal window sizes.		
23 34 33 00-0023 EA Air Curtain For 2.5' x 5' Service Window, Unheated, Including Housing And Controls	1,915.86	850.87
23 34 33 00-0024 Heated Air Curtains For Entrances (23 34 33) Note: Includes housing and controls.		
23 34 33 00-0025 EA 60" Heated Air Curtain With 1- 300 MBH Heater	3,137.35	478.43
23 34 33 00-0026 EA 60" Heated Air Curtain With 1- 400 MBH Heater	3,428.05	478.43
23 34 33 00-0027 EA 72" Heated Air Curtain With 1- 350 MBH Heater	3,764.34	574.04
23 34 33 00-0028 EA 72" Heated Air Curtain With 2- 250 MBH Heaters	4,113.18	574.04
23 34 33 00-0029 EA 96" Heated Air Curtain With 1- 400 MBH Heater	5,018.49	765.27
23 34 33 00-0030 EA 96" Heated Air Curtain With 2- 350 MBH Heaters	5,483.61	765.27
23 34 33 00-0031 EA 117" Heated Air Curtain With 2- 300 MBH Heaters	6,115.62	932.40
23 34 33 00-0032 EA 117" Heated Air Curtain With 2- 400 MBH Heaters	6,682.48	932.40



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 34 33 00-0033 EA 147" Heated Air Curtain With 2- 350 MBH Heaters	7,684.14	1,171.43
23 34 33 00-0034 EA 147" Heated Air Curtain With 3- 350 MBH Heaters	9,094.04	1,171.43
23 34 33 00-0035 EA 168" Heated Air Curtain With 2- 400 MBH Heaters	8,782.35	1,338.93
23 34 33 00-0036 EA 168" Heated Air Curtain With 3- 400 MBH Heaters	10,393.31	1,338.93
23 34 33 00-0037 EA 192" Heated Air Curtain With 2- 400 MBH Heaters	10,034.45	1,530.16
23 34 33 00-0038 EA 192" Heated Air Curtain With 4- 350 MBH Heaters	11,875.55	1,530.16

23 35 Special Exhaust Systems (23 30)

23 35 13 Dust Collection Systems (23 35)

23 35 13 00-0001 Dust Collector System (23 35 13)

23 35 13 00-0002 EA 1.5 HP Dust Collector Central Vacuum Unit	2,562.47	643.83
<small>Note: Includes fan bower, stand, cyclone, filter, silencer and 35 gallon fiber drum dust bin.</small>		
23 35 13 00-0003 EA 2 HP Dust Collector Central Vacuum Unit	2,891.97	764.54
<small>Note: Includes fan bower, stand, cyclone, filter, silencer and 35 gallon fiber drum dust bin.</small>		
23 35 13 00-0004 EA 2-1/2 HP Dust Collector Central Vacuum Unit	3,459.64	885.26
<small>Note: Includes fan bower, stand, cyclone, filter, silencer and 35 gallon fiber drum dust bin.</small>		
23 35 13 00-0005 EA 3 HP Dust Collector Central Vacuum Unit	3,962.45	1,046.22
<small>Note: Includes fan bower, stand, cyclone, filter, silencer and 35 gallon fiber drum dust bin.</small>		
23 35 13 00-0006 EA 5 HP Dust Collector Central Vacuum Unit	7,882.24	1,185.38
<small>Note: Includes fan bower, stand, cyclone, filter, silencer and 55 gallon fiber drum dust bin.</small>		
23 35 13 00-0007 EA 7-1/2 HP Dust Collector Central Vacuum Unit	9,538.34	1,382.94
<small>Note: Includes fan bower, stand, cyclone, filter, silencer and 55 gallon fiber drum dust bin.</small>		
23 35 13 00-0008 EA 10 HP Dust Collector Central Vacuum Unit	10,924.21	1,580.50
<small>Note: Includes fan bower, stand, cyclone, filter, silencer and 55 gallon fiber drum dust bin.</small>		
23 35 13 00-0009 EA 15 HP Dust Collector Central Vacuum Unit	12,301.77	1,817.58
<small>Note: Includes fan bower, stand, cyclone, filter, silencer and two 55 gallon fiber drum dust bin.</small>		
23 35 13 00-0010 EA 20 HP Dust Collector Central Vacuum Unit	13,738.87	2,054.65
<small>Note: Includes fan bower, stand, cyclone, filter, silencer and two 55 gallon fiber drum dust bin.</small>		

23 35 13 00-0011 Vacuum Tubing And Accessories (23 35 13)

23 35 13 00-0012 Vacuum Tubing (23 35 13 00-0011)

23 35 13 00-0013 Flexible Hose (23 35 13 00-0012)

23 35 13 00-0014 LF 2" Flexible Hose	7.03	1.33
23 35 13 00-0015 LF 3" Flexible Hose	8.36	1.48
23 35 13 00-0016 LF 4" Flexible Hose	9.09	1.63

23 35 13 00-0017 Galvanized Vacuum Tubing (23 35 13 00-0012)

23 35 13 00-0018 LF 2-1/8" Outside Diameter Vacuum Tubing, Galvanized	5.36	1.33
23 35 13 00-0019 LF 2-1/2" Outside Diameter Vacuum Tubing, Galvanized	5.95	1.41
23 35 13 00-0020 LF 3" Outside Diameter Vacuum Tubing, Galvanized	6.92	1.48
23 35 13 00-0021 LF 3-1/2" Outside Diameter Vacuum Tubing, Galvanized	8.72	1.55
23 35 13 00-0022 LF 4" Outside Diameter Vacuum Tubing, Galvanized	8.99	1.63
23 35 13 00-0023 LF 5" Outside Diameter Vacuum Tubing, Galvanized	14.22	1.85
23 35 13 00-0024 LF 6" Outside Diameter Vacuum Tubing, Galvanized	16.04	2.15
23 35 13 00-0025 LF 8" Outside Diameter Vacuum Tubing, Galvanized	21.78	2.96
23 35 13 00-0026 LF 10" Outside Diameter Vacuum Tubing, Galvanized	25.71	3.71
23 35 13 00-0027 LF 12" Outside Diameter Vacuum Tubing, Galvanized	60.67	4.90

23 35 13 00-0028 Vacuum Fittings, Galvanized (23 35 13 00-0011)

23 35 13 00-0029 Reducer (23 35 13 00-0028)

23 35 13 00-0030 EA 3" Reducer, Vacuum Tubing, Galvanized	30.21	9.93
23 35 13 00-0031 EA 4" Reducer, Vacuum Tubing, Galvanized	33.41	10.75
23 35 13 00-0032 EA 5" Reducer, Vacuum Tubing, Galvanized	40.79	11.86
23 35 13 00-0033 EA 6" Reducer, Vacuum Tubing, Galvanized	44.31	13.19
23 35 13 00-0034 EA 8" Reducer, Vacuum Tubing, Galvanized	51.37	14.82

23 35 13 00-0035 90 Degree Elbow (23 35 13 00-0011)

23 35 13 00-0036 EA 2-1/8" 90 Degree Elbow, Vacuum Tubing, Galvanized	28.39	8.52
23 35 13 00-0037 EA 2-1/2" 90 Degree Elbow, Vacuum Tubing, Galvanized	34.02	9.12
23 35 13 00-0038 EA 3" 90 Degree Elbow, Vacuum Tubing, Galvanized	41.23	9.93
23 35 13 00-0039 EA 3-1/2" 90 Degree Elbow, Vacuum Tubing, Galvanized	47.93	10.75
23 35 13 00-0040 EA 4" 90 Degree Elbow, Vacuum Tubing, Galvanized	56.32	11.86
23 35 13 00-0041 EA 5" 90 Degree Elbow, Vacuum Tubing, Galvanized	87.98	13.19
23 35 13 00-0042 EA 6" 90 Degree Elbow, Vacuum Tubing, Galvanized	114.65	14.82
23 35 13 00-0043 EA 8" 90 Degree Elbow, Vacuum Tubing, Galvanized	200.29	19.79

23 35 13 00-0044 45 Degree Elbow (23 35 13 00-0011)

23 35 13 00-0045 EA 2-1/8" 45 Degree Elbow, Vacuum Tubing, Galvanized	27.02	8.52
23 35 13 00-0046 EA 2-1/2" 45 Degree Elbow, Vacuum Tubing, Galvanized	32.90	9.12
23 35 13 00-0047 EA 3" 45 Degree Elbow, Vacuum Tubing, Galvanized	37.45	9.93
23 35 13 00-0048 EA 3-1/2" 45 Degree Elbow, Vacuum Tubing, Galvanized	43.67	10.75

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 35 Special Exhaust Systems**

MINOR				TOTAL DIRECT	DEMOLITION
CSI	UOM	DESCRIPTION		UNIT COST	UNIT COST
23 35 13 00-0049	EA	4" 45 Degree Elbow, Vacuum Tubing, Galvanized		52.38	11.86
23 35 13 00-0050	EA	5" 45 Degree Elbow, Vacuum Tubing, Galvanized		74.30	13.19
23 35 13 00-0051	EA	6" 45 Degree Elbow, Vacuum Tubing, Galvanized		94.54	14.82
23 35 13 00-0052	EA	8" 45 Degree Elbow, Vacuum Tubing, Galvanized		166.51	19.79
23 35 13 00-0053		Wye <small>(23 35 13 00-0011)</small>			
23 35 13 00-0054	EA	2-1/8" Wye, Vacuum Tubing, Galvanized		50.48	14.09
23 35 13 00-0055	EA	2-1/2" Wye, Vacuum Tubing, Galvanized		59.19	15.19
23 35 13 00-0056	EA	3" Wye, Vacuum Tubing, Galvanized		70.53	16.30
23 35 13 00-0057	EA	3-1/2" Wye, Vacuum Tubing, Galvanized		84.04	18.16
23 35 13 00-0058	EA	4" Wye, Vacuum Tubing, Galvanized.....		108.59	19.64
23 35 13 00-0059	EA	5" Wye, Vacuum Tubing, Galvanized.....		174.22	21.86
23 35 13 00-0060	EA	6" Wye, Vacuum Tubing, Galvanized.....		227.29	24.83
23 35 13 00-0061	EA	8" Wye, Vacuum Tubing, Galvanized.....		431.29	27.05
23 35 13 00-0062	EA	10" Wye, Vacuum Tubing, Galvanized.....		590.98	29.64
23 35 13 00-0063	EA	12" Wye, Vacuum Tubing, Galvanized.....		743.27	33.21
23 35 13 00-0064		Air Gate Valve, Galvanized <small>(23 35 13 00-0011)</small>			
23 35 13 00-0065	EA	2-1/8" Air Gate Valve, Vacuum Tubing, Galvanized		169.82	19.79
23 35 13 00-0066	EA	2-1/2" Air Gate Valve, Vacuum Tubing, Galvanized		178.24	21.12
23 35 13 00-0067	EA	3" Air Gate Valve, Vacuum Tubing, Galvanized.....		203.72	22.75
23 35 13 00-0068	EA	3-1/2" Air Gate Valve, Vacuum Tubing, Galvanized		230.36	24.31
23 35 13 00-0069	EA	4" Air Gate Valve, Vacuum Tubing, Galvanized.....		258.73	25.79
23 35 13 00-0070	EA	5" Air Gate Valve, Vacuum Tubing, Galvanized.....		304.63	29.42
23 35 13 00-0071	EA	6" Air Gate Valve, Vacuum Tubing, Galvanized.....		349.89	32.98
23 35 19		Fume Exhaust <small>(23 35)</small>			
23 35 19 00-0001	EA	Fume Exhauster, 1 1/2 HP 630 CFM With Out Hose And Intake Nozzle		1,485.63	296.24
23 35 19 00-0002	EA	Hose Extension Kit 5'		258.52	65.81
23 36		Air Terminal Units <small>(23 30)</small>			
23 36 13		Constant-Air-Volume Units <small>(23 36)</small>			
23 36 13 00-0001		Duct Boxes, Constant Volume Control <small>(23 36 13)</small>			
23 36 13 00-0002		Single Duct Boxes, Constant Volume Control <small>(23 36 13 00-0001)</small>			
23 36 13 00-0003	EA	4 - 6" Diameter Inlet, 50 - 240 CFM, Single Duct Boxes, Constant Volume Control		835.46	30.58
		<i>For Boxes With Motor, Add</i>		20.00	
23 36 13 00-0004	EA	6 - 8" Diameter Inlet, 100 - 480 CFM, Single Duct Boxes, Constant Volume Control		924.55	33.00
		<i>For Boxes With Motor, Add</i>		20.00	
23 36 13 00-0005	EA	7 - 10" Diameter Inlet, 150 - 720 CFM, Single Duct Boxes, Constant Volume Control		961.15	36.22
		<i>For Boxes With Motor, Add</i>		20.00	
23 36 13 00-0006	EA	9 - 12" Diameter Inlet, 200 - 960 CFM, Single Duct Boxes, Constant Volume Control		978.91	37.83
		<i>For Boxes With Motor, Add</i>		20.00	
23 36 13 00-0007	EA	12" Diameter Inlet, 250 - 1,200 CFM, Single Duct Boxes, Constant Volume Control		994.52	41.85
		<i>For Boxes With Motor, Add</i>		20.00	
23 36 13 00-0008	EA	14" Diameter Inlet, 350 - 1,680 CFM, Single Duct Boxes, Constant Volume Control		1,137.22	46.67
		<i>For Boxes With Motor, Add</i>		20.00	
23 36 13 00-0009	EA	16" Diameter Inlet, 450 - 2,160 CFM, Single Duct Boxes, Constant Volume Control		1,194.19	52.31
		<i>For Boxes With Motor, Add</i>		20.00	
23 36 13 00-0010	EA	20" x 16" Inlet, 550 - 2,640 CFM, Single Duct Boxes, Constant Volume Control		1,269.49	62.78
		<i>For Boxes With Motor, Add</i>		20.00	
23 36 13 00-0011	EA	24" x 16" Inlet, 650 - 3,120 CFM, Single Duct Boxes, Constant Volume Control		1,344.26	72.43
		<i>For Boxes With Motor, Add</i>		20.00	
23 36 13 00-0012		Dual Duct Boxes, Constant Volume Control <small>(23 36 13 00-0001)</small>			
23 36 13 00-0013	EA	4 - 6" Diameter Inlet, 50 - 240 CFM, Dual Duct Boxes, Constant Volume Control		1,171.71	30.58
		<i>For Boxes With Motor, Add</i>		20.00	
23 36 13 00-0014	EA	6 - 8" Diameter Inlet, 100 - 480 CFM, Dual Duct Boxes, Constant Volume Control		1,253.63	33.00
		<i>For Boxes With Motor, Add</i>		20.00	
23 36 13 00-0015	EA	7 - 10" Diameter Inlet, 150 - 720 CFM, Dual Duct Boxes, Constant Volume Control		1,308.93	36.22
		<i>For Boxes With Motor, Add</i>		20.00	
23 36 13 00-0016	EA	9 - 12" Diameter Inlet, 200 - 960 CFM, Dual Duct Boxes, Constant Volume Control		1,363.75	37.83
		<i>For Boxes With Motor, Add</i>		20.00	
23 36 13 00-0017	EA	12" Diameter Inlet, 250 - 1,200 CFM, Dual Duct Boxes, Constant Volume Control		1,379.36	41.85
		<i>For Boxes With Motor, Add</i>		20.00	
23 36 13 00-0018	EA	14" Diameter Inlet, 350 - 1,680 CFM, Dual Duct Boxes, Constant Volume Control		1,585.01	47.48
		<i>For Boxes With Motor, Add</i>		20.00	
23 36 13 00-0019	EA	16" Diameter Inlet, 450 - 2,160 CFM, Dual Duct Boxes, Constant Volume Control		1,733.09	52.31
		<i>For Boxes With Motor, Add</i>		20.00	
23 36 13 00-0020	EA	20" x 16" Inlet, 550 - 2,640 CFM, Dual Duct Boxes, Constant Volume Control.....		1,868.37	62.78
		<i>For Boxes With Motor, Add</i>		20.00	
23 36 13 00-0021	EA	24" x 16" Inlet, 650 - 3,120 CFM, Dual Duct Boxes, Constant Volume Control.....		1,952.67	72.43
		<i>For Boxes With Motor, Add</i>		20.00	



MINOR	CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 36 16	Variable-Air-Volume Units <small>(23 36)</small>		
23 36 16 00-0001	Variable Volume Terminal Unit <small>(23 36 16)</small> Note: Includes flow controllers, insulated plenum, system powered box mounted thermostat.		
23 36 16 00-0002	Single Duct Variable Volume Terminal Unit <small>(23 36 16 00-0001)</small> Note: Enclosure only. For mounting DDC controls.		
23 36 16 00-0003	EA 6" Diameter Inlet, 80 - 500 CFM, Variable Air Volume Box With enclosure only. For mounting DDC controls <i>For Filters And Frames, Add</i>	250.34 6.30	37.02
23 36 16 00-0004	EA 8" Diameter Inlet, 145 - 900 CFM, Variable Air Volume Box With enclosure only. For mounting DDC controls <i>For Filters And Frames, Add</i>	281.71 6.30	41.85
23 36 16 00-0005	EA 10" Diameter Inlet, 230 - 1,400 CFM, Variable Air Volume Box With enclosure only. For mounting DDC controls <i>For Filters And Frames, Add</i>	315.17 6.30	46.67
23 36 16 00-0006	EA 12" Diameter Inlet, 325 - 2,000 CFM, Variable Air Volume Box With enclosure only. For mounting DDC controls <i>For Filters And Frames, Add</i>	341.58 6.30	52.31
23 36 16 00-0007	EA 14" Diameter Inlet, 450 - 3,000 CFM, Variable Air Volume Box With enclosure only. For mounting DDC controls <i>For Filters And Frames, Add</i>	465.01 6.30	112.59
23 36 16 00-0008	EA 16" Diameter Inlet, 580 - 4,000 CFM, Variable Air Volume Box With enclosure only. For mounting DDC controls <i>For Filters And Frames, Add</i>	598.70 6.30	133.59
23 36 16 00-0009	Single Duct Variable Volume Terminal Unit <small>(23 36 16 00-0001)</small> Note: With pneumatic controls.		
23 36 16 00-0010	EA 6" Diameter Inlet, 80 - 500 CFM, Variable Air Volume Box With pneumatic controller <i>For Fan Powered Variable Air Volume Box, Add</i> <i>For Hot Water Coils, Add</i> <i>For Pressure Independent Actuator, Add</i> <i>For Filters And Frames, Add</i>	432.82 384.01 40.55 67.57 6.30	37.02
23 36 16 00-0011	EA 8" Diameter Inlet, 145 - 900 CFM, Variable Air Volume Box With pneumatic controller <i>For Fan Powered Variable Air Volume Box, Add</i> <i>For Hot Water Coils, Add</i> <i>For Pressure Independent Actuator, Add</i> <i>For Filters And Frames, Add</i>	472.75 412.27 40.55 67.57 6.30	41.85
23 36 16 00-0012	EA 10" Diameter Inlet, 230 - 1,400 CFM, Variable Air Volume Box With pneumatic controller <i>For Fan Powered Variable Air Volume Box, Add</i> <i>For Hot Water Coils, Add</i> <i>For Pressure Independent Actuator, Add</i> <i>For Filters And Frames, Add</i>	502.92 426.80 40.55 67.57 6.30	46.67
23 36 16 00-0013	EA 12" Diameter Inlet, 325 - 2,000 CFM, Variable Air Volume Box With pneumatic controller <i>For Fan Powered Variable Air Volume Box, Add</i> <i>For Hot Water Coils, Add</i> <i>For Pressure Independent Actuator, Add</i> <i>For Filters And Frames, Add</i>	532.62 440.52 40.55 67.57 6.30	52.31
23 36 16 00-0014	EA 14" Diameter Inlet, 450 To 3,000 CFM, Variable Air Volume Box With pneumatic controller <i>For Fan Powered Variable Air Volume Box, Add</i> <i>For Hot Water Coils, Add</i> <i>For Pressure Independent Actuator, Add</i> <i>For Filters And Frames, Add</i>	638.26 498.77 40.55 67.57 6.30	112.59
23 36 16 00-0015	EA 16" Diameter Inlet, 580 To 4,000 CFM, Variable Air Volume Box With pneumatic controller <i>For Fan Powered Variable Air Volume Box, Add</i> <i>For Hot Water Coils, Add</i> <i>For Pressure Independent Actuator, Add</i> <i>For Filters And Frames, Add</i>	786.45 551.10 40.55 67.57 6.30	133.59
23 36 16 00-0016	Single Duct Variable Volume Terminal Unit <small>(23 36 16 00-0001)</small> Note: With analog electronic controls.		
23 36 16 00-0017	EA 6" Diameter Inlet, 60 - 500 CFM, Variable Air Volume Box With analog electronic controls <i>For Hot Water Coils, Add</i> <i>For Filters And Frames, Add</i>	660.09 40.55 6.30	37.02
23 36 16 00-0018	EA 8" Diameter Inlet, 105 - 900 CFM, Variable Air Volume Box With analog electronic controls <i>For Hot Water Coils, Add</i> <i>For Filters And Frames, Add</i>	694.76 40.55 6.30	41.85
23 36 16 00-0019	EA 10" Diameter Inlet, 165 - 1,400 CFM, Variable Air Volume Box With analog electronic controls <i>For Hot Water Coils, Add</i> <i>For Filters And Frames, Add</i>	728.21 40.55 6.30	46.67
23 36 16 00-0020	EA 12" Diameter Inlet, 235 - 2,000 CFM, Variable Air Volume Box With analog electronic controls <i>For Hot Water Coils, Add</i> <i>For Filters And Frames, Add</i>	770.43 40.55 6.30	52.31
23 36 16 00-0021	EA 14" Diameter Inlet, 320 - 3,000 CFM, Variable Air Volume Box With analog electronic controls <i>For Hot Water Coils, Add</i> <i>For Filters And Frames, Add</i>	876.73 40.55 6.30	112.59
23 36 16 00-0022	EA 16" Diameter Inlet, 420 - 4,000 CFM, Variable Air Volume Box With analog electronic controls <i>For Hot Water Coils, Add</i> <i>For Filters And Frames, Add</i>	889.91 40.55 6.30	112.59
23 36 16 00-0023	Dual Duct Variable Volume Terminal Unit <small>(23 36 16 00-0001)</small> Note: With flow control installation, plenum system power box, thermostat.		
23 36 16 00-0024	EA 6" Diameter Inlet, 75 - 500 CFM, Variable Air Volume Box, Dual Duct <i>For Filters And Frames, Add</i>	478.96 6.30	73.15
23 36 16 00-0025	EA 8" Diameter Inlet, 200 - 700 CFM, Variable Air Volume Box, Dual Duct <i>For Filters And Frames, Add</i>	527.53 6.30	83.29
23 36 16 00-0026	EA 10" Diameter Inlet, 400 - 1,000 CFM, Variable Air Volume Box, Dual Duct <i>For Filters And Frames, Add</i>	570.39 6.30	94.08

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 36 Air Terminal Units**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 36 16 00-0027	EA		12" Diameter Inlet, 600 - 1,400 CFM, Variable Air Volume Box, Dual Duct	627.60	104.95
			<i>For Filters And Frames, Add</i>	6.30	
23 36 16 00-0028	EA		14" Diameter Inlet, 800 - 2,700 CFM, Variable Air Volume Box, Dual Duct	708.63	120.72
			<i>For Filters And Frames, Add</i>	6.30	
23 36 16 00-0029	EA		16" Diameter Inlet, 1,000 - 3,500 CFM, Variable Air Volume Box, Dual Duct	792.32	144.86
			<i>For Filters And Frames, Add</i>	6.30	
23 36 16 00-0030			Constant Volume To Variable Volume Retrofit Terminal Unit (Titus DQCV-		
			M) <small>(23 36 16 00-0001)</small>		
23 36 16 00-0031	EA		0 To 200 CFM Digital Control, Constant Volume To Variable Volume Retrofit Terminal Unit (Titus DQCV-A)	353.69	50.30
			<i>For Filters And Frames, Add</i>	6.30	
23 36 16 00-0032	EA		0 To 300 CFM Digital Control, Constant Volume To Variable Volume Retrofit Terminal Unit (Titus DQCV-B)	384.49	55.32
			<i>For Filters And Frames, Add</i>	6.30	
23 36 16 00-0033	EA		0 To 400 CFM Digital Control, Constant Volume To Variable Volume Retrofit Terminal Unit (Titus DQCV-C)	416.02	60.36
			<i>For Filters And Frames, Add</i>	6.30	
23 36 16 00-0034	EA		0 To 700 CFM Digital Control, Constant Volume To Variable Volume Retrofit Terminal Unit (Titus DQCV-D)	448.36	65.39
			<i>For Filters And Frames, Add</i>	6.30	
23 36 16 00-0035	EA		0 To 1,000 CFM Digital Control, Constant Volume To Variable Volume Retrofit Terminal Unit (Titus DQCV-E)	481.58	70.42
			<i>For Filters And Frames, Add</i>	6.30	
23 36 16 00-0036	EA		0 To 1,000 CFM Digital Control, Constant Volume To Variable Volume Retrofit Terminal Unit (Titus DQCV-F)	515.67	75.45
			<i>For Filters And Frames, Add</i>	6.30	
23 36 16 00-0037	EA		0 To 1,100 CFM Digital Control, Constant Volume To Variable Volume Retrofit Terminal Unit (Titus DQCV-G)	553.28	80.47
			<i>For Filters And Frames, Add</i>	6.30	
23 36 16 00-0038	EA		0 To 1,900 CFM Digital Control, Constant Volume To Variable Volume Retrofit Terminal Unit (Titus DQCV-H)	589.60	85.51
			<i>For Filters And Frames, Add</i>	6.30	
23 36 16 00-0039	EA		0 To 2,400 CFM Digital Control, Constant Volume To Variable Volume Retrofit Terminal Unit (Titus DQCV-J)	627.05	90.54
			<i>For Filters And Frames, Add</i>	6.30	
23 36 16 00-0040	EA		0 To 3,800 CFM Digital Control, Constant Volume To Variable Volume Retrofit Terminal Unit (Titus DQCV-K)	665.71	95.57
			<i>For Filters And Frames, Add</i>	6.30	
23 36 16 00-0041	EA		0 To 5,400 CFM Digital Control, Constant Volume To Variable Volume Retrofit Terminal Unit (Titus DQCV-L)	705.68	100.60
			<i>For Filters And Frames, Add</i>	6.30	
23 36 16 00-0042	EA		0 To 5,400 CFM Digital Control, Constant Volume To Variable Volume Retrofit Terminal Unit (Titus DQCV-M)	747.02	105.62
			<i>For Filters And Frames, Add</i>	6.30	
23 36 16 00-0043	EA		0 To 6,700 CFM Digital Control, Constant Volume To Variable Volume Retrofit Terminal Unit (Titus DQCV-N)	789.85	110.66
			<i>For Filters And Frames, Add</i>	6.30	
23 36 16 00-0044	EA		0 To 10,000 CFM Digital Control, Constant Volume To Variable Volume Retrofit Terminal Unit (Titus DQCV-P)	830.85	115.68
			<i>For Filters And Frames, Add</i>	6.30	
23 36 16 00-0045	EA		0 To 15,000 CFM Digital Control, Constant Volume To Variable Volume Retrofit Terminal Unit (Titus DQCV-R)	876.73	120.72
			<i>For Filters And Frames, Add</i>	6.30	
23 37 Air Outlets And Inlets <small>(23 30)</small>					
23 37 13 Diffusers, Registers, And Grilles <small>(23 37)</small>					
23 37 13 00-0001 Wall And Floor Diffusers <small>(23 37 13)</small>					
23 37 13 00-0002 Slot Type Linear Diffusers <small>(23 37 13 00-0001)</small>					
			Note: For sidewall sill or ceiling 1/2" 3/4" or 1" slot spacing 1-1/8" border.		
23 37 13 00-0003	LF		1 Slot Linear Diffusers 10 - 70 CFM/LF, Sidewall, Sill, Ceiling	31.88	4.03
			<i>For 3/4" Border, Add</i>	3.75	
			<i>For Floor Mounted Diffusers, Add</i>	4.49	
			<i>For Stainless Steel, Add</i>	19.47	
23 37 13 00-0004	LF		2 Slot Linear Diffusers 20 - 140 CFM/LF, Sidewall, Sill, Ceiling	38.47	4.82
			<i>For 3/4" Border, Add</i>	4.99	
			<i>For Floor Mounted Diffusers, Add</i>	5.99	
			<i>For Stainless Steel, Add</i>	25.96	
23 37 13 00-0005	LF		3 Slot Linear Diffusers 30 - 210 CFM/LF, Sidewall, Sill, Ceiling	52.39	5.63
			<i>For 3/4" Border, Add</i>	7.87	
			<i>For Floor Mounted Diffusers, Add</i>	9.44	
			<i>For Stainless Steel, Add</i>	40.90	
23 37 13 00-0006	LF		4 Slot Linear Diffusers 40 - 280 CFM/LF, Sidewall, Sill, Ceiling	68.27	5.63
			<i>For 3/4" Border, Add</i>	11.24	
			<i>For Floor Mounted Diffusers, Add</i>	13.48	
			<i>For Stainless Steel, Add</i>	58.42	
23 37 13 00-0007	LF		5 Slot Linear Diffusers 50 - 350 CFM/LF, Sidewall, Sill, Ceiling	85.00	6.44
			<i>For 3/4" Border, Add</i>	14.61	
			<i>For Floor Mounted Diffusers, Add</i>	17.53	
			<i>For Stainless Steel, Add</i>	75.95	
23 37 13 00-0008	LF		6 Slot Linear Diffusers 60 - 420 CFM/LF, Sidewall, Sill, Ceiling	99.47	8.05
			<i>For 3/4" Border, Add</i>	17.23	
			<i>For Floor Mounted Diffusers, Add</i>	20.67	
			<i>For Stainless Steel, Add</i>	89.58	
23 37 13 00-0009 Linear Bar Grilles And Registers <small>(23 37 13 00-0001)</small>					
			Note: For sidewall sill or ceiling or 15 degree deflection 1/2" bar spacing 1" border aluminum construction.		
23 37 13 00-0010	LF		2" Wide Linear Bar Grilles/Registers 30 - 70 CFM/LF, Sidewall, Sill, Ceiling	90.91	4.82
			<i>For Floor Mount, Add</i>	7.24	
			<i>For Opposed Blade Damper, Add</i>	14.48	
			<i>For Stainless Steel, Add</i>	94.13	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 37 13 00-0011 LF 3" Wide Linear Bar Grilles/Registers 55 - 143 CFM/LF, Sidewall, Sill, Ceiling.....	108.32	5.63
<i>For Floor Mount, Add</i>	8.74	
<i>For Opposed Blade Damper, Add</i>	17.48	
<i>For Stainless Steel, Add</i>	113.61	
23 37 13 00-0012 LF 4" Wide Linear Bar Grilles/Registers 80 - 208 CFM/LF, Sidewall, Sill, Ceiling.....	118.21	5.63
<i>For Floor Mount, Add</i>	9.49	
<i>For Opposed Blade Damper, Add</i>	18.98	
<i>For Stainless Steel, Add</i>	123.34	
23 37 13 00-0013 LF 6" Wide Linear Bar Grilles/Registers 125 - 325 CFM/LF, Sidewall, Sill, Ceiling.....	145.41	8.05
<i>For Floor Mount, Add</i>	11.49	
<i>For Opposed Blade Damper, Add</i>	22.97	
<i>For Stainless Steel, Add</i>	149.31	
23 37 13 00-0014 LF 9" Wide Linear Bar Grilles/Registers 225 - 450 CFM/LF, Sidewall, Sill, Ceiling.....	200.82	10.46
<i>For Floor Mount, Add</i>	15.98	
<i>For Opposed Blade Damper, Add</i>	31.96	
<i>For Stainless Steel, Add</i>	207.73	
23 37 13 00-0015 LF 12" Wide Linear Bar Grilles/Registers 225 - 495 CFM/LF, Sidewall, Sill, Ceiling.....	232.22	12.08
<i>For Floor Mount, Add</i>	18.23	
<i>For Opposed Blade Damper, Add</i>	36.45	
<i>For Stainless Steel, Add</i>	236.94	
23 37 13 00-0016 Ceiling Diffusers <small>(23 37 13)</small>		
23 37 13 00-0017 Ceiling Diffusers With Perforated Face <small>(23 37 13 00-0016)</small>		
Note: Flush mount, aluminum construction, includes damper.		
23 37 13 00-0018 EA 6" x 6" Ceiling Diffuser With Perforated Face, Flush Mount, Aluminum Construction With Damper	70.54	10.46
<i>For Steel Construction, Deduct</i>	-4.37	
<i>For Surface Mount, Deduct</i>	-3.50	
<i>For Diffuser Without Damper, Deduct</i>	-5.83	
<i>For Stainless Steel, Add</i>	72.90	
23 37 13 00-0019 EA 8" x 8" Ceiling Diffuser With Perforated Face, Flush Mount, Aluminum Construction With Damper	77.02	10.46
<i>For Steel Construction, Deduct</i>	-5.35	
<i>For Surface Mount, Deduct</i>	-4.28	
<i>For Diffuser Without Damper, Deduct</i>	-7.13	
<i>For Stainless Steel, Add</i>	89.10	
23 37 13 00-0020 EA 9" x 9" Ceiling Diffuser With Perforated Face, Flush Mount, Aluminum Construction With Damper	77.02	10.46
<i>For Steel Construction, Deduct</i>	-5.35	
<i>For Surface Mount, Deduct</i>	-4.28	
<i>For Diffuser Without Damper, Deduct</i>	-7.13	
<i>For Stainless Steel, Add</i>	89.10	
23 37 13 00-0021 EA 10" x 10" Ceiling Diffuser With Perforated Face, Flush Mount, Aluminum Construction With Damper	92.62	12.87
<i>For Steel Construction, Deduct</i>	-6.40	
<i>For Surface Mount, Deduct</i>	-5.12	
<i>For Diffuser Without Damper, Deduct</i>	-8.53	
<i>For Stainless Steel, Add</i>	106.65	
23 37 13 00-0022 EA 12" x 12" Ceiling Diffuser With Perforated Face, Flush Mount, Aluminum Construction With Damper	92.62	12.08
<i>For Steel Construction, Deduct</i>	-6.40	
<i>For Surface Mount, Deduct</i>	-5.12	
<i>For Diffuser Without Damper, Deduct</i>	-8.53	
<i>For Stainless Steel, Add</i>	106.65	
23 37 13 00-0023 EA 16" x 16" Ceiling Diffuser With Perforated Face, Flush Mount, Aluminum Construction With Damper	104.50	12.08
<i>For Steel Construction, Deduct</i>	-8.18	
<i>For Surface Mount, Deduct</i>	-6.54	
<i>For Diffuser Without Damper, Deduct</i>	-10.91	
<i>For Stainless Steel, Add</i>	136.35	
23 37 13 00-0024 EA 18" x 18" Ceiling Diffuser With Perforated Face, Flush Mount, Aluminum Construction With Damper	121.36	16.09
<i>For Steel Construction, Deduct</i>	-8.80	
<i>For Surface Mount, Deduct</i>	-7.04	
<i>For Diffuser Without Damper, Deduct</i>	-11.73	
<i>For Stainless Steel, Add</i>	146.63	
23 37 13 00-0025 EA 20" x 20" Ceiling Diffuser With Perforated Face, Flush Mount, Aluminum Construction With Damper	139.08	16.90
<i>For Steel Construction, Deduct</i>	-10.98	
<i>For Surface Mount, Deduct</i>	-8.79	
<i>For Diffuser Without Damper, Deduct</i>	-14.65	
<i>For Stainless Steel, Add</i>	183.08	
23 37 13 00-0026 EA 24" x 24" Ceiling Diffuser With Perforated Face, Flush Mount, Aluminum Construction With Damper	158.09	19.32
<i>For Steel Construction, Deduct</i>	-12.22	
<i>For Surface Mount, Deduct</i>	-9.77	
<i>For Lay-In Mount, Deduct</i>	-9.77	
<i>For Diffuser Without Damper, Deduct</i>	-16.29	
<i>For Stainless Steel, Add</i>	203.60	
23 37 13 00-0027 Ceiling Diffusers With Louver Face <small>(23 37 13 00-0016)</small>		
Note: 1 To 4 way adjustable pattern, surface mount aluminum construction.		
23 37 13 00-0028 EA 6" x 6" Ceiling Diffuser, Louver Face, Adjustable Pattern, Surface Mounted, Aluminum Construction With Damper	72.70	10.46
<i>For Steel Construction, Deduct</i>	-4.70	
<i>For Flush Mount, Add</i>	4.70	
<i>For Stainless Steel, Add</i>	78.30	
23 37 13 00-0029 EA 8" x 8" Ceiling Diffuser, Louver Face, Adjustable Pattern, Surface Mounted, Aluminum Construction With Damper	81.13	10.46
<i>For Steel Construction, Deduct</i>	-5.96	
<i>For Flush Mount, Add</i>	5.96	
<i>For Stainless Steel, Add</i>	99.38	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 37 Air Outlets And Inlets**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 37 13 00-0030	EA		9" x 9" Ceiling Diffuser, Louver Face, Adjustable Pattern, Surface Mounted, Aluminum Construction With Damper	81.13	10.46
			<i>For Steel Construction, Deduct</i>	-5.96	
			<i>For Flush Mount, Add</i>	5.96	
			<i>For Stainless Steel, Add</i>	99.38	
23 37 13 00-0031	EA		10" x 10" Ceiling Diffuser, Louver Face, Adjustable Pattern, Surface Mounted, Aluminum Construction With Damper	97.48	12.08
			<i>For Steel Construction, Deduct</i>	-7.13	
			<i>For Flush Mount, Add</i>	7.13	
			<i>For Stainless Steel, Add</i>	118.80	
23 37 13 00-0032	EA		12" x 12" Ceiling Diffuser, Louver Face, Adjustable Pattern, Surface Mounted, Aluminum Construction With Damper	97.48	12.87
			<i>For Steel Construction, Deduct</i>	-7.13	
			<i>For Flush Mount, Add</i>	7.13	
			<i>For Stainless Steel, Add</i>	118.80	
23 37 13 00-0033	EA		14" x 12" Ceiling Diffuser, Louver Face, Adjustable Pattern, Surface Mounted, Aluminum Construction With Damper	125.19	16.09
			<i>For Steel Construction, Deduct</i>	-9.33	
			<i>For Flush Mount, Add</i>	9.33	
			<i>For Stainless Steel, Add</i>	155.53	
23 37 13 00-0034	EA		14" x 14" Ceiling Diffuser, Louver Face, Adjustable Pattern, Surface Mounted, Aluminum Construction With Damper	113.74	16.09
			<i>For Steel Construction, Deduct</i>	-7.61	
			<i>For Flush Mount, Add</i>	7.61	
			<i>For Stainless Steel, Add</i>	126.90	
23 37 13 00-0035	EA		18" x 18" Ceiling Diffuser, Louver Face, Adjustable Pattern, Surface Mounted, Aluminum Construction With Damper	141.37	19.32
			<i>For Steel Construction, Deduct</i>	-9.77	
			<i>For Flush Mount, Add</i>	9.77	
			<i>For Stainless Steel, Add</i>	162.83	
23 37 13 00-0036	EA		21" x 21" Ceiling Diffuser, Louver Face, Adjustable Pattern, Surface Mounted, Aluminum Construction With Damper	161.40	21.72
			<i>For Steel Construction, Deduct</i>	-12.15	
			<i>For Flush Mount, Add</i>	12.15	
			<i>For Stainless Steel, Add</i>	202.53	
23 37 13 00-0037	EA		24" x 24" Ceiling Diffuser, Louver Face, Adjustable Pattern, Surface Mounted, Aluminum Construction With Damper	175.61	42.57
			<i>For Steel Construction, Deduct</i>	-13.56	
			<i>For Flush Mount, Add</i>	13.56	
			<i>For Lay-In Mount, Add</i>	18.08	
			<i>For Stainless Steel, Add</i>	226.00	
23 37 13 00-0038			Round Ceiling Diffusers With Fixed Pattern (23 37 13 00-0016)		
			Note: Aluminum construction.		
23 37 13 00-0039	EA		6" Round Ceiling Diffuser With Fixed Pattern, Aluminum Construction	111.49	10.46
			<i>For Steel Construction, Deduct</i>	-21.03	
			<i>For Stainless Steel, Add</i>	175.28	
23 37 13 00-0040	EA		8" Round Ceiling Diffuser With Fixed Pattern, Aluminum Construction	115.08	10.46
			<i>For Steel Construction, Deduct</i>	-22.11	
			<i>For Stainless Steel, Add</i>	184.25	
23 37 13 00-0041	EA		10" Round Ceiling Diffuser With Fixed Pattern, Aluminum Construction	130.85	12.87
			<i>For Steel Construction, Deduct</i>	-24.27	
			<i>For Stainless Steel, Add</i>	202.23	
23 37 13 00-0042	EA		12" Round Ceiling Diffuser With Fixed Pattern, Aluminum Construction	139.84	12.08
			<i>For Steel Construction, Deduct</i>	-26.96	
			<i>For Stainless Steel, Add</i>	224.70	
23 37 13 00-0043	EA		14" Round Ceiling Diffuser With Fixed Pattern, Aluminum Construction	196.36	14.48
			<i>For Steel Construction, Deduct</i>	-41.53	
			<i>For Stainless Steel, Add</i>	346.05	
23 37 13 00-0044	EA		16" Round Ceiling Diffuser With Fixed Pattern, Aluminum Construction	206.87	15.29
			<i>For Steel Construction, Deduct</i>	-43.95	
			<i>For Stainless Steel, Add</i>	366.28	
23 37 13 00-0045	EA		18" Round Ceiling Diffuser With Fixed Pattern, Aluminum Construction	217.58	16.09
			<i>For Steel Construction, Deduct</i>	-46.38	
			<i>For Stainless Steel, Add</i>	386.50	
23 37 13 00-0046	EA		20" Round Ceiling Diffuser With Fixed Pattern, Aluminum Construction	249.61	16.09
			<i>For Steel Construction, Deduct</i>	-55.13	
			<i>For Stainless Steel, Add</i>	459.40	
23 37 13 00-0047	EA		24" Round Ceiling Diffuser With Fixed Pattern, Aluminum Construction	296.14	18.51
			<i>For Steel Construction, Deduct</i>	-67.11	
			<i>For Stainless Steel, Add</i>	559.28	
23 37 13 00-0048	EA		28" Round Ceiling Diffuser With Fixed Pattern, Aluminum Construction	331.90	19.32
			<i>For Steel Construction, Deduct</i>	-76.70	
			<i>For Stainless Steel, Add</i>	639.15	
23 37 13 00-0049	EA		32" Round Ceiling Diffuser With Fixed Pattern, Aluminum Construction	394.80	21.72
			<i>For Steel Construction, Deduct</i>	-92.88	
			<i>For Stainless Steel, Add</i>	773.98	
23 37 13 00-0050			Round Ceiling Diffusers With Adjustable Pattern Dropped Style (23 37 13 00-0016)		
			Note: Aluminum construction.		
23 37 13 00-0051	EA		6" Round Ceiling Diffuser With Adjustable Pattern, Aluminum Construction	116.88	10.46
			<i>For Steel Construction, Deduct</i>	-7.55	
			<i>For Flush Mount, Deduct</i>	-3.78	
			<i>For Stainless Steel, Add</i>	188.75	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 37 13 00-0052 EA 8" Round Ceiling Diffuser With Adjustable Pattern, Aluminum Construction	126.17	10.46
<i>For Steel Construction, Deduct</i>	-8.48	
<i>For Flush Mount, Deduct</i>	-4.24	
<i>For Stainless Steel, Add</i>	211.98	
23 37 13 00-0053 EA 10" Round Ceiling Diffuser With Adjustable Pattern, Aluminum Construction	143.84	12.87
<i>For Steel Construction, Deduct</i>	-9.39	
<i>For Flush Mount, Deduct</i>	-4.69	
<i>For Stainless Steel, Add</i>	234.70	
23 37 13 00-0054 EA 12" Round Ceiling Diffuser With Adjustable Pattern, Aluminum Construction	154.22	12.87
<i>For Steel Construction, Deduct</i>	-10.43	
<i>For Flush Mount, Deduct</i>	-5.21	
<i>For Stainless Steel, Add</i>	260.65	
23 37 13 00-0055 EA 14" Round Ceiling Diffuser With Adjustable Pattern, Aluminum Construction	219.73	14.48
<i>For Steel Construction, Deduct</i>	-16.18	
<i>For Flush Mount, Deduct</i>	-8.09	
<i>For Stainless Steel, Add</i>	404.48	
23 37 13 00-0056 EA 16" Round Ceiling Diffuser With Adjustable Pattern, Aluminum Construction	178.90	15.29
<i>For Steel Construction, Deduct</i>	-17.29	
<i>For Flush Mount, Deduct</i>	-8.64	
<i>For Stainless Steel, Add</i>	432.18	
23 37 13 00-0057 EA 18" Round Ceiling Diffuser With Adjustable Pattern, Aluminum Construction	246.94	16.09
<i>For Steel Construction, Deduct</i>	-18.40	
<i>For Flush Mount, Deduct</i>	-9.20	
<i>For Stainless Steel, Add</i>	459.90	
23 37 13 00-0058 EA 20" Round Ceiling Diffuser With Adjustable Pattern, Aluminum Construction	284.56	16.90
<i>For Steel Construction, Deduct</i>	-21.87	
<i>For Flush Mount, Deduct</i>	-10.94	
<i>For Stainless Steel, Add</i>	546.78	
23 37 13 00-0059 EA 24" Round Ceiling Diffuser With Adjustable Pattern, Aluminum Construction	320.90	18.51
<i>For Steel Construction, Deduct</i>	-24.85	
<i>For Flush Mount, Deduct</i>	-12.42	
<i>For Stainless Steel, Add</i>	621.18	
23 37 13 00-0060 EA 28" Round Ceiling Diffuser With Adjustable Pattern, Aluminum Construction	385.83	19.32
<i>For Steel Construction, Deduct</i>	-30.96	
<i>For Flush Mount, Deduct</i>	-15.48	
<i>For Stainless Steel, Add</i>	773.98	
23 37 13 00-0061 EA 32" Round Ceiling Diffuser With Adjustable Pattern, Aluminum Construction	462.92	21.72
<i>For Steel Construction, Deduct</i>	-37.77	
<i>For Flush Mount, Deduct</i>	-18.89	
<i>For Stainless Steel, Add</i>	944.28	
23 37 13 00-0062 EA 36" Round Ceiling Diffuser With Adjustable Pattern, Aluminum Construction	511.79	45.31
<i>For Stainless Steel, Add</i>	1,053.13	
23 37 13 00-0063 Linear Type Ceiling Diffusers With 2-Way Air Deflection <small>(23 37 13 00-0016)</small>		
23 37 13 00-0064 LF 4" Linear Type Ceiling Diffuser 40-200 CFM/LF, With 2-Way Air Deflection.....	93.65	12.08
<i>For Stainless Steel, Add</i>	113.43	
23 37 13 00-0065 LF 6-1/4" Linear Type Ceiling Diffuser, 41 - 206 CFM/LF, With 2-Way Air Deflection	99.81	12.08
<i>For Stainless Steel, Add</i>	128.83	
23 37 13 00-0066 LF 9-1/4" Linear Type Ceiling Diffuser, 62 - 312 CFM/LF, With 2-Way Air Deflection	107.40	12.08
<i>For Stainless Steel, Add</i>	147.80	
23 37 13 00-0067 LF 12-1/4" Linear Type Ceiling Diffuser, 131 - 656 CFM/LF, With 2-Way Air Deflection	114.79	12.08
<i>For Stainless Steel, Add</i>	166.28	
23 37 13 00-0068 Return/Exhaust Registers And Grilles <small>(23 37 13)</small>		
23 37 13 00-0069 Return/Exhaust Registers With Frame <small>(23 37 13 00-0068)</small>		
Note: Single deflection with opposed blade damper aluminum construction wall or ceiling mount.		
23 37 13 00-0070 EA 8" x 4" Single Deflection Return/Exhaust Register, Aluminum, Opposed Blade Damper, Wall/Ceiling.....	65.18	6.44
<i>For Steel Construction, Deduct</i>	-8.04	
<i>For Grilles (No Damper), Deduct</i>	-16.08	
<i>For Removable Core, Add</i>	35.00	
<i>For Cube Core With Frame, Add</i>	4.02	
<i>For Cube Core Lay In, Add</i>	8.04	
<i>For Stainless Steel, Add</i>	100.50	
23 37 13 00-0071 EA 8" x 6" Single Deflection Return/Exhaust Register, Aluminum, Opposed Blade Damper, Wall/Ceiling.....	73.92	6.44
<i>For Steel Construction, Deduct</i>	-9.79	
<i>For Grilles (No Damper), Deduct</i>	-19.58	
<i>For Removable Core, Add</i>	35.00	
<i>For Cube Core With Frame, Add</i>	4.89	
<i>For Cube Core Lay In, Add</i>	9.79	
<i>For Stainless Steel, Add</i>	122.35	
23 37 13 00-0072 EA 10" x 6" Single Deflection Return/Exhaust Register, Aluminum, Opposed Blade Damper, Wall/Ceiling.....	83.16	7.24
<i>For Steel Construction, Deduct</i>	-10.84	
<i>For Grilles (No Damper), Deduct</i>	-21.67	
<i>For Removable Core, Add</i>	35.00	
<i>For Cube Core With Frame, Add</i>	5.42	
<i>For Cube Core Lay In, Add</i>	10.84	
<i>For Stainless Steel, Add</i>	135.45	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 37 Air Outlets And Inlets**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 37 13 00-0073 EA 10" x 10" Single Deflection Return/Exhaust Register, Aluminum, Opposed Blade Damper, Wall/Ceiling.....	87.87	8.05
For Steel Construction, Deduct	-10.84	
For Grilles (No Damper), Deduct	-21.67	
For Removable Core, Add	35.00	
For Cube Core With Frame, Add	5.42	
For Cube Core Lay In, Add	10.84	
For Stainless Steel, Add	135.45	
23 37 13 00-0074 EA 12" x 6" Single Deflection Return/Exhaust Register, Aluminum, Opposed Blade Damper, Wall/Ceiling.....	84.37	8.05
For Steel Construction, Deduct	-10.14	
For Grilles (No Damper), Deduct	-20.27	
For Removable Core, Add	35.00	
For Cube Core With Frame, Add	5.07	
For Cube Core Lay In, Add	10.14	
For Stainless Steel, Add	126.70	
23 37 13 00-0075 EA 12" x 12" Single Deflection Return/Exhaust Register, Aluminum, Opposed Blade Damper, Wall/Ceiling.....	107.79	10.46
For Steel Construction, Deduct	-13.28	
For Grilles (No Damper), Deduct	-26.56	
For Removable Core, Add	35.00	
For Cube Core With Frame, Add	6.64	
For Cube Core Lay In, Add	13.28	
For Stainless Steel, Add	166.03	
23 37 13 00-0076 EA 16" x 16" Single Deflection Return/Exhaust Register, Aluminum, Opposed Blade Damper, Wall/Ceiling.....	129.26	12.08
For Steel Construction, Deduct	-15.86	
For Grilles (No Damper), Deduct	-31.72	
For Removable Core, Add	35.00	
For Cube Core With Frame, Add	7.93	
For Cube Core Lay In, Add	15.86	
For Stainless Steel, Add	198.25	
23 37 13 00-0077 EA 18" x 18" Single Deflection Return/Exhaust Register, Aluminum, Opposed Blade Damper, Wall/Ceiling.....	157.56	14.48
For Steel Construction, Deduct	-19.92	
For Grilles (No Damper), Deduct	-39.85	
For Removable Core, Add	35.00	
For Cube Core With Frame, Add	9.96	
For Cube Core Lay In, Add	19.92	
For Stainless Steel, Add	249.05	
23 37 13 00-0078 EA 20" x 20" Single Deflection Return/Exhaust Register, Aluminum, Opposed Blade Damper, Wall/Ceiling.....	183.61	16.09
For Steel Construction, Deduct	-24.13	
For Grilles (No Damper), Deduct	-48.25	
For Removable Core, Add	35.00	
For Cube Core With Frame, Add	12.06	
For Cube Core Lay In, Add	24.13	
For Stainless Steel, Add	301.58	
23 37 13 00-0079 EA 24" x 12" Single Deflection Return/Exhaust Register, Aluminum, Opposed Blade Damper, Wall/Ceiling.....	166.75	16.09
For Steel Construction, Deduct	-20.18	
For Grilles (No Damper), Deduct	-40.36	
For Removable Core, Add	35.00	
For Cube Core With Frame, Add	10.09	
For Cube Core Lay In, Add	20.18	
For Stainless Steel, Add	252.25	
23 37 13 00-0080 EA 24" x 18" Single Deflection Return/Exhaust Register, Aluminum, Opposed Blade Damper, Wall/Ceiling.....	188.19	16.09
For Steel Construction, Deduct	-24.47	
For Grilles (No Damper), Deduct	-48.94	
For Removable Core, Add	35.00	
For Cube Core With Frame, Add	12.23	
For Cube Core Lay In, Add	24.47	
For Stainless Steel, Add	305.85	
23 37 13 00-0081 EA 24" x 24" Single Deflection Return/Exhaust Register, Aluminum, Opposed Blade Damper, Wall/Ceiling.....	199.23	18.51
For Steel Construction, Deduct	-25.36	
For Grilles (No Damper), Deduct	-50.72	
For Removable Core, Add	35.00	
For Cube Core With Frame, Add	12.68	
For Cube Core Lay In, Add	25.36	
For Stainless Steel, Add	317.00	
23 37 13 00-0082 EA 30" x 12" Single Deflection Return/Exhaust Register, Aluminum, Opposed Blade Damper, Wall/Ceiling.....	210.99	19.32
For Steel Construction, Deduct	-26.95	
For Grilles (No Damper), Deduct	-53.90	
For Removable Core, Add	35.00	
For Cube Core With Frame, Add	13.48	
For Cube Core Lay In, Add	26.95	
For Stainless Steel, Add	336.88	
23 37 13 00-0083 EA 30" x 18" Single Deflection Return/Exhaust Register, Aluminum, Opposed Blade Damper, Wall/Ceiling.....	242.50	21.72
For Steel Construction, Deduct	-31.46	
For Grilles (No Damper), Deduct	-62.92	
For Removable Core, Add	35.00	
For Cube Core With Frame, Add	15.73	
For Cube Core Lay In, Add	31.46	
For Stainless Steel, Add	393.23	
23 37 13 00-0084 EA 30" x 24" Single Deflection Return/Exhaust Register, Aluminum, Opposed Blade Damper, Wall/Ceiling.....	273.69	25.75
For Steel Construction, Deduct	-34.04	
For Grilles (No Damper), Deduct	-68.09	
For Removable Core, Add	35.00	
For Cube Core With Frame, Add	17.02	
For Cube Core Lay In, Add	34.04	
For Stainless Steel, Add	425.55	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 37 13 00-0085 EA 30" x 30" Single Deflection Return/Exhaust Register, Aluminum, Opposed Blade Damper, Wall/Ceiling.....	347.69	25.75
<i>For Steel Construction, Deduct</i>	-48.84	
<i>For Grilles (No Damper), Deduct</i>	-97.69	
<i>For Removable Core, Add</i>	35.00	
<i>For Cube Core With Frame, Add</i>	24.42	
<i>For Cube Core Lay In, Add</i>	48.84	
<i>For Stainless Steel, Add</i>	610.55	
23 37 13 00-0086 EA 36" x 12" Single Deflection Return/Exhaust Register, Aluminum, Opposed Blade Damper, Wall/Ceiling.....	295.31	28.17
<i>For Steel Construction, Deduct</i>	-36.78	
<i>For Grilles (No Damper), Deduct</i>	-73.55	
<i>For Removable Core, Add</i>	35.00	
<i>For Cube Core With Frame, Add</i>	18.39	
<i>For Cube Core Lay In, Add</i>	36.78	
<i>For Stainless Steel, Add</i>	459.70	
23 37 13 00-0087 EA 36" x 18" Single Deflection Return/Exhaust Register, Aluminum, Opposed Blade Damper, Wall/Ceiling.....	288.28	27.37
<i>For Steel Construction, Deduct</i>	-35.37	
<i>For Grilles (No Damper), Deduct</i>	-70.74	
<i>For Removable Core, Add</i>	35.00	
<i>For Cube Core With Frame, Add</i>	17.69	
<i>For Cube Core Lay In, Add</i>	35.37	
<i>For Stainless Steel, Add</i>	442.13	
23 37 13 00-0088 EA 36" x 24" Single Deflection Return/Exhaust Register, Aluminum, Opposed Blade Damper, Wall/Ceiling.....	326.68	30.58
<i>For Steel Construction, Deduct</i>	-41.19	
<i>For Grilles (No Damper), Deduct</i>	-82.38	
<i>For Removable Core, Add</i>	35.00	
<i>For Cube Core With Frame, Add</i>	20.60	
<i>For Cube Core Lay In, Add</i>	41.19	
<i>For Stainless Steel, Add</i>	514.90	
23 37 13 00-0089 EA 36" x 36" Single Deflection Return/Exhaust Register, Aluminum, Opposed Blade Damper, Wall/Ceiling.....	434.81	33.00
<i>For Steel Construction, Deduct</i>	-60.62	
<i>For Grilles (No Damper), Deduct</i>	-121.25	
<i>For Removable Core, Add</i>	35.00	
<i>For Cube Core With Frame, Add</i>	30.31	
<i>For Cube Core Lay In, Add</i>	60.62	
<i>For Stainless Steel, Add</i>	757.80	
23 37 13 00-0090 EA 24" x 20" Single Deflection Return/Exhaust Register, Aluminum, Opposed Blade Damper, Wall/Ceiling.....	196.91	18.59
<i>For Steel Construction, Deduct</i>	-24.53	
<i>For Grilles (No Damper), Deduct</i>	-49.06	
<i>For Removable Core, Add</i>	35.00	
<i>For Cube Core With Frame, Add</i>	12.26	
<i>For Cube Core Lay In, Add</i>	24.53	
<i>For Stainless Steel, Add</i>	306.60	
23 37 13 00-0091 EA 32" x 40" Single Deflection Return/Exhaust Register, Aluminum, Opposed Blade Damper, Wall/Ceiling.....	355.72	32.91
<i>For Steel Construction, Deduct</i>	-44.81	
<i>For Grilles (No Damper), Deduct</i>	-89.61	
<i>For Removable Core, Add</i>	35.00	
<i>For Cube Core With Frame, Add</i>	22.40	
<i>For Cube Core Lay In, Add</i>	44.81	
<i>For Stainless Steel, Add</i>	560.08	
23 37 13 00-0092 EA 48" x 24" Single Deflection Return/Exhaust Register, Aluminum, Opposed Blade Damper, Wall/Ceiling.....	377.79	32.19
<i>For Steel Construction, Deduct</i>	-51.41	
<i>For Grilles (No Damper), Deduct</i>	-102.83	
<i>For Removable Core, Add</i>	35.00	
<i>For Cube Core With Frame, Add</i>	25.71	
<i>For Cube Core Lay In, Add</i>	51.41	
<i>For Stainless Steel, Add</i>	642.68	
23 37 13 00-0093 Return/Exhaust Registers Removable-Reversible <small>(23 37 13 00-0068)</small>		
<i>Note: Double deflection core and opposed blade damper radiused frame with boarder aluminum construction.</i>		
23 37 13 00-0094 EA 8" x 4" Double Deflection Return/Exhaust Register, Aluminum, Opposed Blade Damper, Wall/Ceiling.....	60.63	6.44
<i>For Steel Construction, Deduct</i>	-3.57	
<i>For Flat Frame, Deduct</i>	-0.36	
<i>For Grilles (No Damper), Deduct</i>	-7.13	
<i>For Stainless Steel, Add</i>	89.13	
23 37 13 00-0095 EA 8" x 6" Double Deflection Return/Exhaust Register, Aluminum, Opposed Blade Damper, Wall/Ceiling.....	60.63	6.44
<i>For Steel Construction, Deduct</i>	-3.57	
<i>For Flat Frame, Deduct</i>	-0.36	
<i>For Grilles (No Damper), Deduct</i>	-7.13	
<i>For Stainless Steel, Add</i>	89.13	
23 37 13 00-0096 EA 10" x 6" Double Deflection Return/Exhaust Register, Aluminum, Opposed Blade Damper, Wall/Ceiling.....	74.07	7.24
<i>For Steel Construction, Deduct</i>	-4.51	
<i>For Flat Frame, Deduct</i>	-0.45	
<i>For Grilles (No Damper), Deduct</i>	-9.02	
<i>For Stainless Steel, Add</i>	112.73	
23 37 13 00-0097 EA 10" x 10" Double Deflection Return/Exhaust Register, Aluminum, Opposed Blade Damper, Wall/Ceiling.....	85.07	8.85
<i>For Steel Construction, Deduct</i>	-5.14	
<i>For Flat Frame, Deduct</i>	-0.51	
<i>For Grilles (No Damper), Deduct</i>	-10.28	
<i>For Stainless Steel, Add</i>	128.45	
23 37 13 00-0098 EA 12" x 6" Double Deflection Return/Exhaust Register, Aluminum, Opposed Blade Damper, Wall/Ceiling.....	84.02	8.05
<i>For Steel Construction, Deduct</i>	-5.03	
<i>For Flat Frame, Deduct</i>	-0.50	
<i>For Grilles (No Damper), Deduct</i>	-10.07	
<i>For Stainless Steel, Add</i>	125.83	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 37 Air Outlets And Inlets**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 37 13 00-0099	EA		12" x 12" Double Deflection Return/Exhaust Register, Aluminum, Opposed Blade Damper, Wall/Ceiling	108.49	10.46
			<i>For Steel Construction, Deduct</i>	-6.71	
			<i>For Flat Frame, Deduct</i>	-0.67	
			<i>For Grilles (No Damper), Deduct</i>	-13.42	
			<i>For Stainless Steel, Add</i>	167.78	
23 37 13 00-0100	EA		16" x 16" Double Deflection Return/Exhaust Register, Aluminum, Opposed Blade Damper, Wall/Ceiling	171.25	12.87
			<i>For Steel Construction, Deduct</i>	-12.13	
			<i>For Flat Frame, Deduct</i>	-1.21	
			<i>For Grilles (No Damper), Deduct</i>	-24.26	
			<i>For Stainless Steel, Add</i>	303.23	
23 37 13 00-0101	EA		18" x 18" Double Deflection Return/Exhaust Register, Aluminum, Opposed Blade Damper, Wall/Ceiling	205.80	14.48
			<i>For Steel Construction, Deduct</i>	-14.79	
			<i>For Flat Frame, Deduct</i>	-1.48	
			<i>For Grilles (No Damper), Deduct</i>	-29.57	
			<i>For Stainless Steel, Add</i>	369.65	
23 37 13 00-0102	EA		20" x 20" Double Deflection Return/Exhaust Register, Aluminum, Opposed Blade Damper, Wall/Ceiling	231.81	16.09
			<i>For Steel Construction, Deduct</i>	-16.88	
			<i>For Flat Frame, Deduct</i>	-1.69	
			<i>For Grilles (No Damper), Deduct</i>	-33.77	
			<i>For Stainless Steel, Add</i>	422.08	
23 37 13 00-0103	EA		24" x 12" Double Deflection Return/Exhaust Register, Aluminum, Opposed Blade Damper, Wall/Ceiling	195.88	16.09
			<i>For Steel Construction, Deduct</i>	-13.00	
			<i>For Flat Frame, Deduct</i>	-1.30	
			<i>For Grilles (No Damper), Deduct</i>	-26.01	
			<i>For Stainless Steel, Add</i>	325.08	
23 37 13 00-0104	EA		24" x 18" Double Deflection Return/Exhaust Register, Aluminum, Opposed Blade Damper, Wall/Ceiling	258.80	16.90
			<i>For Steel Construction, Deduct</i>	-19.30	
			<i>For Flat Frame, Deduct</i>	-1.93	
			<i>For Grilles (No Damper), Deduct</i>	-38.59	
			<i>For Stainless Steel, Add</i>	482.38	
23 37 13 00-0105	EA		24" x 24" Double Deflection Return/Exhaust Register, Aluminum, Opposed Blade Damper, Wall/Ceiling	301.03	18.51
			<i>For Steel Construction, Deduct</i>	-22.86	
			<i>For Flat Frame, Deduct</i>	-2.29	
			<i>For Grilles (No Damper), Deduct</i>	-45.72	
			<i>For Stainless Steel, Add</i>	571.50	
23 37 13 00-0106	EA		30" x 12" Double Deflection Return/Exhaust Register, Aluminum, Opposed Blade Damper, Wall/Ceiling	235.63	19.32
			<i>For Steel Construction, Deduct</i>	-15.94	
			<i>For Flat Frame, Deduct</i>	-1.59	
			<i>For Grilles (No Damper), Deduct</i>	-31.88	
			<i>For Stainless Steel, Add</i>	398.48	
23 37 13 00-0107	EA		30" x 18" Double Deflection Return/Exhaust Register, Aluminum, Opposed Blade Damper, Wall/Ceiling	320.10	21.72
			<i>For Steel Construction, Deduct</i>	-23.49	
			<i>For Flat Frame, Deduct</i>	-2.35	
			<i>For Grilles (No Damper), Deduct</i>	-46.98	
			<i>For Stainless Steel, Add</i>	587.23	
23 37 13 00-0108	EA		30" x 24" Double Deflection Return/Exhaust Register, Aluminum, Opposed Blade Damper, Wall/Ceiling	385.55	25.75
			<i>For Steel Construction, Deduct</i>	-28.21	
			<i>For Flat Frame, Deduct</i>	-2.82	
			<i>For Grilles (No Damper), Deduct</i>	-56.42	
			<i>For Stainless Steel, Add</i>	705.20	
23 37 13 00-0109	EA		30" x 30" Double Deflection Return/Exhaust Register, Aluminum, Opposed Blade Damper, Wall/Ceiling	438.51	25.75
			<i>For Steel Construction, Deduct</i>	-33.50	
			<i>For Flat Frame, Deduct</i>	-3.35	
			<i>For Grilles (No Damper), Deduct</i>	-67.01	
			<i>For Stainless Steel, Add</i>	837.60	
23 37 13 00-0110	EA		36" x 12" Double Deflection Return/Exhaust Register, Aluminum, Opposed Blade Damper, Wall/Ceiling	307.52	27.37
			<i>For Steel Construction, Deduct</i>	-19.61	
			<i>For Flat Frame, Deduct</i>	-1.96	
			<i>For Grilles (No Damper), Deduct</i>	-39.22	
			<i>For Stainless Steel, Add</i>	490.23	
23 37 13 00-0111	EA		36" x 18" Double Deflection Return/Exhaust Register, Aluminum, Opposed Blade Damper, Wall/Ceiling	408.19	27.37
			<i>For Steel Construction, Deduct</i>	-29.68	
			<i>For Flat Frame, Deduct</i>	-2.97	
			<i>For Grilles (No Damper), Deduct</i>	-59.35	
			<i>For Stainless Steel, Add</i>	741.90	
23 37 13 00-0112	EA		36" x 24" Double Deflection Return/Exhaust Register, Aluminum, Opposed Blade Damper, Wall/Ceiling	470.96	30.58
			<i>For Steel Construction, Deduct</i>	-35.02	
			<i>For Flat Frame, Deduct</i>	-3.50	
			<i>For Grilles (No Damper), Deduct</i>	-70.05	
			<i>For Stainless Steel, Add</i>	875.60	
23 37 13 00-0113	EA		36" x 30" Double Deflection Return/Exhaust Register, Aluminum, Opposed Blade Damper, Wall/Ceiling	548.52	33.00
			<i>For Steel Construction, Deduct</i>	-41.68	
			<i>For Flat Frame, Deduct</i>	-4.17	
			<i>For Grilles (No Damper), Deduct</i>	-83.37	
			<i>For Stainless Steel, Add</i>	1,042.08	
23 37 13 00-0114	EA		36" x 36" Double Deflection Return/Exhaust Register, Aluminum, Opposed Blade Damper, Wall/Ceiling	577.88	33.00
			<i>For Steel Construction, Deduct</i>	-44.62	
			<i>For Flat Frame, Deduct</i>	-4.46	
			<i>For Grilles (No Damper), Deduct</i>	-89.24	
			<i>For Stainless Steel, Add</i>	1,115.48	
23 37 13 00-0115			Aluminum Eggcrate Ceiling Return Air And Exhaust Grilles (23 37 13 00-0068)		
23 37 13 00-0116	EA		6" x 6" Aluminum Eggcrate Ceiling Return Air And Exhaust Grille.....	35.29	7.86
23 37 13 00-0117	EA		8" x 4" Aluminum Eggcrate Ceiling Return Air And Exhaust Grille.....	35.29	7.86
23 37 13 00-0118	EA		8" x 6" Aluminum Eggcrate Ceiling Return Air And Exhaust Grille.....	37.92	7.86



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 37 13 00-0119 EA 8" x 8" Aluminum Eggcrate Ceiling Return Air And Exhaust Grille.....	38.97	7.86
23 37 13 00-0120 EA 10" x 4" Aluminum Eggcrate Ceiling Return Air And Exhaust Grille.....	37.92	7.86
23 37 13 00-0121 EA 10" x 6" Aluminum Eggcrate Ceiling Return Air And Exhaust Grille.....	38.97	7.86
23 37 13 00-0122 EA 10" x 8" Aluminum Eggcrate Ceiling Return Air And Exhaust Grille.....	47.43	10.30
23 37 13 00-0123 EA 10" x 10" Aluminum Eggcrate Ceiling Return Air And Exhaust Grille.....	48.48	10.30
23 37 13 00-0124 EA 12" x 6" Aluminum Eggcrate Ceiling Return Air And Exhaust Grille.....	46.38	10.30
23 37 13 00-0125 EA 12" x 8" Aluminum Eggcrate Ceiling Return Air And Exhaust Grille.....	48.48	10.30
23 37 13 00-0126 EA 12" x 10" Aluminum Eggcrate Ceiling Return Air And Exhaust Grille.....	49.53	10.30
23 37 13 00-0127 EA 12" x 12" Aluminum Eggcrate Ceiling Return Air And Exhaust Grille.....	50.59	10.30
23 37 13 00-0128 EA 14" x 6" Aluminum Eggcrate Ceiling Return Air And Exhaust Grille.....	49.01	10.30
23 37 13 00-0129 EA 14" x 8" Aluminum Eggcrate Ceiling Return Air And Exhaust Grille.....	51.11	10.30
23 37 13 00-0130 EA 14" x 10" Aluminum Eggcrate Ceiling Return Air And Exhaust Grille.....	52.16	10.30
23 37 13 00-0131 EA 14" x 14" Aluminum Eggcrate Ceiling Return Air And Exhaust Grille.....	56.90	10.30
23 37 13 00-0132 EA 16" x 8" Aluminum Eggcrate Ceiling Return Air And Exhaust Grille.....	51.11	10.30
23 37 13 00-0133 EA 16" x 10" Aluminum Eggcrate Ceiling Return Air And Exhaust Grille.....	54.79	10.30
23 37 13 00-0134 EA 16" x 12" Aluminum Eggcrate Ceiling Return Air And Exhaust Grille.....	56.90	10.30
23 37 13 00-0135 EA 16" x 14" Aluminum Eggcrate Ceiling Return Air And Exhaust Grille.....	74.35	15.19
23 37 13 00-0136 EA 16" x 16" Aluminum Eggcrate Ceiling Return Air And Exhaust Grille.....	75.40	15.19
23 37 13 00-0137 EA 18" x 12" Aluminum Eggcrate Ceiling Return Air And Exhaust Grille.....	73.29	15.19
23 37 13 00-0138 EA 18" x 18" Aluminum Eggcrate Ceiling Return Air And Exhaust Grille.....	89.12	17.64
23 37 13 00-0139 EA 20" x 10" Aluminum Eggcrate Ceiling Return Air And Exhaust Grille.....	72.24	15.19
23 37 13 00-0140 EA 20" x 20" Aluminum Eggcrate Ceiling Return Air And Exhaust Grille.....	94.38	17.64
23 37 13 00-0141 EA 22" x 4" Aluminum Eggcrate Ceiling Return Air And Exhaust Grille.....	50.06	10.30
23 37 13 00-0142 EA 22" x 10" Aluminum Eggcrate Ceiling Return Air And Exhaust Grille.....	73.29	15.19
23 37 13 00-0143 EA 22" x 22" Aluminum Eggcrate Ceiling Return Air And Exhaust Grille.....	106.00	20.09
23 37 13 00-0144 EA 24" x 8" Aluminum Eggcrate Ceiling Return Air And Exhaust Grille.....	72.24	15.19
23 37 13 00-0145 EA 24" x 10" Aluminum Eggcrate Ceiling Return Air And Exhaust Grille.....	74.35	15.19
23 37 13 00-0146 EA 24" x 12" Aluminum Eggcrate Ceiling Return Air And Exhaust Grille.....	85.96	17.64
<i>For Lay-In Installation, Deduct</i>	-37.26	
23 37 13 00-0147 EA 24" x 14" Aluminum Eggcrate Ceiling Return Air And Exhaust Grille.....	89.12	17.64
23 37 13 00-0148 EA 24" x 16" Aluminum Eggcrate Ceiling Return Air And Exhaust Grille.....	99.69	20.09
23 37 13 00-0149 EA 24" x 18" Aluminum Eggcrate Ceiling Return Air And Exhaust Grille.....	102.85	20.09
23 37 13 00-0150 EA 24" x 20" Aluminum Eggcrate Ceiling Return Air And Exhaust Grille.....	106.53	20.09
23 37 13 00-0151 EA 24" x 24" Aluminum Eggcrate Ceiling Return Air And Exhaust Grille.....	113.36	20.09
<i>For Lay-In Installation, Deduct</i>	-42.66	
23 37 13 00-0152 EA 30" x 8" Aluminum Eggcrate Ceiling Return Air And Exhaust Grille.....	87.54	17.64
23 37 13 00-0153 EA 48" x 12" Aluminum Eggcrate Ceiling Return Air And Exhaust Grille.....	137.69	22.02
23 37 13 00-0154 EA 48" x 24" Aluminum Eggcrate Ceiling Return Air And Exhaust Grille.....	228.77	26.90
<i>For Lay-In Installation, Deduct</i>	-61.37	

23 37 13 00-0155 Supply Registers and Grilles (23 37 13)

23 37 13 00-0156 Adjustable Curved Blade Register (23 37 13 00-0155)

Note: Ceiling mount aluminum construction four way pattern flush frame.

23 37 13 00-0157 EA 6" x 6" Adjustable Curved Blade Register, Ceiling Mounted, Aluminum Construction, 4-Way Pattern	55.50	6.44
<i>For Steel Construction, Deduct</i>	-4.58	
<i>For Lay In Frame, Deduct</i>	-7.64	
<i>For Three Way Pattern, Deduct</i>	-3.06	
<i>For Two Way Pattern, Deduct</i>	-2.44	
<i>For One Way Pattern, Deduct</i>	-2.44	
<i>For Grille (No Damper), Deduct</i>	-4.58	
<i>For Stainless Steel, Add</i>	76.40	
23 37 13 00-0158 EA 8" x 8" Adjustable Curved Blade Register, Ceiling Mounted, Aluminum Construction, 4-Way Pattern	57.30	6.44
<i>For Steel Construction, Deduct</i>	-4.85	
<i>For Lay In Frame, Deduct</i>	-8.09	
<i>For Three Way Pattern, Deduct</i>	-3.24	
<i>For Two Way Pattern, Deduct</i>	-2.59	
<i>For One Way Pattern, Deduct</i>	-2.59	
<i>For Grille (No Damper), Deduct</i>	-4.85	
<i>For Stainless Steel, Add</i>	80.90	
23 37 13 00-0159 EA 12" x 6" Adjustable Curved Blade Register, Ceiling Mounted, Aluminum Construction, 4-Way Pattern	64.33	8.85
<i>For Steel Construction, Deduct</i>	-4.58	
<i>For Lay In Frame, Deduct</i>	-7.64	
<i>For Three Way Pattern, Deduct</i>	-3.06	
<i>For Two Way Pattern, Deduct</i>	-2.44	
<i>For One Way Pattern, Deduct</i>	-2.44	
<i>For Grille (No Damper), Deduct</i>	-4.58	
<i>For Stainless Steel, Add</i>	76.40	
23 37 13 00-0160 EA 10" x 10" Adjustable Curved Blade Register, Ceiling Mounted, Aluminum Construction, 4-Way Pattern	70.92	8.05
<i>For Steel Construction, Deduct</i>	-5.57	
<i>For Lay In Frame, Deduct</i>	-9.29	
<i>For Three Way Pattern, Deduct</i>	-3.72	
<i>For Two Way Pattern, Deduct</i>	-2.97	
<i>For One Way Pattern, Deduct</i>	-2.97	
<i>For Grille (No Damper), Deduct</i>	-5.57	
<i>For Stainless Steel, Add</i>	92.88	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 37 Air Outlets And Inlets**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 37 13 00-0161	EA		12" x 12" Adjustable Curved Blade Register, Ceiling Mounted, Aluminum Construction, 4-Way Pattern	85.37	10.46
			<i>For Steel Construction, Deduct</i>	-6.65	
			<i>For Lay In Frame, Deduct</i>	-11.09	
			<i>For Three Way Pattern, Deduct</i>	-4.43	
			<i>For Two Way Pattern, Deduct</i>	-3.55	
			<i>For One Way Pattern, Deduct</i>	-3.55	
			<i>For Grille (No Damper), Deduct</i>	-6.65	
			<i>For Stainless Steel, Add</i>	110.85	
23 37 13 00-0162	EA		14" x 14" Adjustable Curved Blade Register, Ceiling Mounted, Aluminum Construction, 4-Way Pattern	105.09	12.08
			<i>For Steel Construction, Deduct</i>	-8.27	
			<i>For Lay In Frame, Deduct</i>	-13.78	
			<i>For Three Way Pattern, Deduct</i>	-5.51	
			<i>For Two Way Pattern, Deduct</i>	-4.41	
			<i>For One Way Pattern, Deduct</i>	-4.41	
			<i>For Grille (No Damper), Deduct</i>	-8.27	
			<i>For Stainless Steel, Add</i>	137.83	
23 37 13 00-0163	EA		16" x 16" Adjustable Curved Blade Register, Ceiling Mounted, Aluminum Construction, 4-Way Pattern	105.09	12.08
			<i>For Steel Construction, Deduct</i>	-8.27	
			<i>For Lay In Frame, Deduct</i>	-13.78	
			<i>For Three Way Pattern, Deduct</i>	-5.51	
			<i>For Two Way Pattern, Deduct</i>	-4.41	
			<i>For One Way Pattern, Deduct</i>	-4.41	
			<i>For Grille (No Damper), Deduct</i>	-8.27	
			<i>For Stainless Steel, Add</i>	137.83	
23 37 13 00-0164	EA		18" x 18" Adjustable Curved Blade Register, Ceiling Mounted, Aluminum Construction, 4-Way Pattern	129.82	16.09
			<i>For Steel Construction, Deduct</i>	-10.07	
			<i>For Lay In Frame, Deduct</i>	-16.78	
			<i>For Three Way Pattern, Deduct</i>	-6.71	
			<i>For Two Way Pattern, Deduct</i>	-5.37	
			<i>For One Way Pattern, Deduct</i>	-5.37	
			<i>For Grille (No Damper), Deduct</i>	-10.07	
			<i>For Stainless Steel, Add</i>	167.78	
23 37 13 00-0165	EA		24" x 24" Adjustable Curved Blade Register, Ceiling Mounted, Aluminum Construction, 4-Way Pattern	167.12	16.90
			<i>For Steel Construction, Deduct</i>	-15.19	
			<i>For Lay In Frame, Deduct</i>	-25.32	
			<i>For Three Way Pattern, Deduct</i>	-10.13	
			<i>For Two Way Pattern, Deduct</i>	-8.10	
			<i>For One Way Pattern, Deduct</i>	-8.10	
			<i>For Grille (No Damper), Deduct</i>	-15.19	
			<i>For Stainless Steel, Add</i>	253.18	
23 37 13 00-0166	EA		30" x 30" Adjustable Curved Blade Register, Ceiling Mounted, Aluminum Construction, 4-Way Pattern	262.71	34.12
			<i>For Steel Construction, Deduct</i>	-29.17	
			<i>For Lay In Frame, Deduct</i>	-48.61	
			<i>For Three Way Pattern, Deduct</i>	-19.45	
			<i>For Two Way Pattern, Deduct</i>	-15.56	
			<i>For One Way Pattern, Deduct</i>	-15.56	
			<i>For Grille (No Damper), Deduct</i>	-29.17	
			<i>For Stainless Steel, Add</i>	486.13	
23 37 13 00-0167			Removable-Reversible Core Registers <small>(23 37 13 00-0155)</small>		
			Note: Double deflection radiused frame aluminum construction.		
23 37 13 00-0168	EA		6" x 6" Removable/Reversible Core Register, Double Deflection, Radiused Aluminum Frame	63.29	6.44
			<i>For Steel Construction, Deduct</i>	-3.84	
			<i>For Flat Frame, Deduct</i>	-3.84	
			<i>For Grille (No Damper), Deduct</i>	-11.51	
			<i>For Stainless Steel, Add</i>	95.88	
23 37 13 00-0169	EA		8" x 8" Removable/Reversible Core Register, Double Deflection, Radiused Aluminum Frame	78.87	6.44
			<i>For Steel Construction, Deduct</i>	-5.39	
			<i>For Flat Frame, Deduct</i>	-5.39	
			<i>For Grille (No Damper), Deduct</i>	-16.18	
			<i>For Stainless Steel, Add</i>	134.83	
23 37 13 00-0170	EA		12" x 6" Removable/Reversible Core Register, Double Deflection, Radiused Aluminum Frame	100.88	8.85
			<i>For Steel Construction, Deduct</i>	-6.71	
			<i>For Flat Frame, Deduct</i>	-6.71	
			<i>For Grille (No Damper), Deduct</i>	-20.13	
			<i>For Stainless Steel, Add</i>	167.78	
23 37 13 00-0171	EA		10" x 10" Removable/Reversible Core Register, Double Deflection, Radiused Aluminum Frame	102.08	8.85
			<i>For Steel Construction, Deduct</i>	-6.83	
			<i>For Flat Frame, Deduct</i>	-6.83	
			<i>For Grille (No Damper), Deduct</i>	-20.49	
			<i>For Stainless Steel, Add</i>	170.78	
23 37 13 00-0172	EA		12" x 12" Removable/Reversible Core Register, Double Deflection, Radiused Aluminum Frame	129.71	10.46
			<i>For Steel Construction, Deduct</i>	-8.87	
			<i>For Flat Frame, Deduct</i>	-8.87	
			<i>For Grille (No Damper), Deduct</i>	-26.60	
			<i>For Stainless Steel, Add</i>	221.70	
23 37 13 00-0173	EA		14" x 14" Removable/Reversible Core Register, Double Deflection, Radiused Aluminum Frame	182.99	12.87
			<i>For Steel Construction, Deduct</i>	-13.30	
			<i>For Flat Frame, Deduct</i>	-13.30	
			<i>For Grille (No Damper), Deduct</i>	-39.91	
			<i>For Stainless Steel, Add</i>	332.58	
23 37 13 00-0174	EA		16" x 16" Removable/Reversible Core Register, Double Deflection, Radiused Aluminum Frame	204.56	12.08
			<i>For Steel Construction, Deduct</i>	-15.46	
			<i>For Flat Frame, Deduct</i>	-15.46	
			<i>For Grille (No Damper), Deduct</i>	-46.38	
			<i>For Stainless Steel, Add</i>	386.50	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 37 13 00-0175 EA 18" x 18" Removable/Reversible Core Register, Double Deflection, Radiused Aluminum Frame	247.27	16.09
<i>For Steel Construction, Deduct</i>	-18.46	
<i>For Flat Frame, Deduct</i>	-18.46	
<i>For Grille (No Damper), Deduct</i>	-55.37	
<i>For Stainless Steel, Add</i>	461.40	
23 37 13 00-0176 EA 24" x 24" Removable/Reversible Core Register, Double Deflection, Radiused Aluminum Frame	309.13	16.09
<i>For Steel Construction, Deduct</i>	-24.33	
<i>For Flat Frame, Deduct</i>	-24.33	
<i>For Grille (No Damper), Deduct</i>	-72.98	
<i>For Stainless Steel, Add</i>	608.20	
23 37 13 00-0177 Adjustable Shutter Blade Registers <small>(23 37 13 00-0155)</small>		
Note: Double deflection flat frame aluminum construction.		
23 37 13 00-0178 EA 6" x 6" Adjustable Shutter Blade Register, Double Deflection, Flat Aluminum Frame	94.85	6.44
<i>For Steel Construction, Deduct</i>	-6.99	
<i>For Single Deflection, Deduct</i>	-13.98	
<i>For Grille (No Damper), Deduct</i>	-10.49	
<i>For Stainless Steel, Add</i>	174.78	
23 37 13 00-0179 EA 8" x 8" Adjustable Shutter Blade Register, Double Deflection, Flat Aluminum Frame	108.83	6.44
<i>For Steel Construction, Deduct</i>	-8.39	
<i>For Single Deflection, Deduct</i>	-16.78	
<i>For Grille (No Damper), Deduct</i>	-12.58	
<i>For Stainless Steel, Add</i>	209.73	
23 37 13 00-0180 EA 12" x 6" Adjustable Shutter Blade Register, Double Deflection, Flat Aluminum Frame	117.66	8.85
<i>For Steel Construction, Deduct</i>	-8.39	
<i>For Single Deflection, Deduct</i>	-16.78	
<i>For Grille (No Damper), Deduct</i>	-12.58	
<i>For Stainless Steel, Add</i>	209.73	
23 37 13 00-0181 EA 10" x 10" Adjustable Shutter Blade Register, Double Deflection, Flat Aluminum Frame	121.65	8.05
<i>For Steel Construction, Deduct</i>	-8.79	
<i>For Single Deflection, Deduct</i>	-17.58	
<i>For Grille (No Damper), Deduct</i>	-13.18	
<i>For Stainless Steel, Add</i>	219.70	
23 37 13 00-0182 EA 12" x 12" Adjustable Shutter Blade Register, Double Deflection, Flat Aluminum Frame	148.89	10.46
<i>For Steel Construction, Deduct</i>	-10.79	
<i>For Single Deflection, Deduct</i>	-21.57	
<i>For Grille (No Damper), Deduct</i>	-16.18	
<i>For Stainless Steel, Add</i>	269.65	
23 37 13 00-0183 EA 14" x 14" Adjustable Shutter Blade Register, Double Deflection, Flat Aluminum Frame	197.77	12.08
<i>For Steel Construction, Deduct</i>	-14.78	
<i>For Single Deflection, Deduct</i>	-29.56	
<i>For Grille (No Damper), Deduct</i>	-22.17	
<i>For Stainless Steel, Add</i>	369.53	
23 37 13 00-0184 EA 16" x 16" Adjustable Shutter Blade Register, Double Deflection, Flat Aluminum Frame	231.72	12.87
<i>For Steel Construction, Deduct</i>	-18.18	
<i>For Single Deflection, Deduct</i>	-36.35	
<i>For Grille (No Damper), Deduct</i>	-27.26	
<i>For Stainless Steel, Add</i>	454.40	
23 37 13 00-0185 EA 18" x 18" Adjustable Shutter Blade Register, Double Deflection, Flat Aluminum Frame	286.42	16.09
<i>For Steel Construction, Deduct</i>	-22.37	
<i>For Single Deflection, Deduct</i>	-44.74	
<i>For Grille (No Damper), Deduct</i>	-33.56	
<i>For Stainless Steel, Add</i>	559.28	
23 37 13 00-0186 EA 24" x 24" Adjustable Shutter Blade Register, Double Deflection, Flat Aluminum Frame	391.42	16.90
<i>For Steel Construction, Deduct</i>	-32.56	
<i>For Single Deflection, Deduct</i>	-65.11	
<i>For Grille (No Damper), Deduct</i>	-48.84	
<i>For Stainless Steel, Add</i>	813.93	
23 37 13 00-0187 Air Conditioning And Ventilation <small>(23 37 13 00-0155)</small>		
23 37 13 00-0188 EA 10" x 16" Egg Crate Wall Return Air Or Exhaust Grille, Aluminum Construction	47.13	16.90
<i>For Stainless Steel, Add</i>	33.40	
23 37 13 00-0189 EA 18" x 12" Egg Crate Wall Return Air Or Exhaust Grille, Aluminum Construction	77.02	25.15
<i>For Stainless Steel, Add</i>	66.80	
23 37 13 00-0190 EA 30" x 12" Egg Crate Wall Return Air Or Exhaust Grille, Aluminum Construction	114.95	35.21
<i>For Stainless Steel, Add</i>	111.33	
23 37 13 00-0191 EA 48" x 24" Egg Crate Wall Return Air Or Exhaust Grille, Aluminum Construction	243.53	48.28
<i>For Stainless Steel, Add</i>	367.38	
23 37 13 00-0192 Security Supply Or Return Grille <small>(23 37 13 00-0155)</small>		
Note: Designed for maximum security applications, 3/16" steel face plate with 2" x 2" square holes, 1/4" steel backer plate, 3/16" welded steel sleeve, 10 gauge x 2 wire mesh between face and backer plates, 1" x 1" x 3/16" angle iron frame, standard finish.		
23 37 13 00-0193 EA 8" x 4" Steel Security Grille	142.42	12.07
<i>For Anchoring Tabs, Add</i>	11.83	
<i>For Angle Iron Frame, Add</i>	20.16	
<i>For Rear Operated Opposed Blade Damper, Add</i>	43.81	
<i>For Each Square Inch With 1/4" Steel Backer Plate Case Hardened To Rockwell "C" 56/58, Add</i>	0.35	
<i>For 1" x 1" Square Holes On Face, Add</i>	29.57	
<i>For Stainless Steel, Add</i>	153.76	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 37 Air Outlets And Inlets**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 37	13 00-0194	EA	8" x 6" Steel Security Grille	157.57	12.47
			<i>For Anchoring Tabs, Add</i>	13.26	
			<i>For Angle Iron Frame, Add</i>	22.39	
			<i>For Rear Operated Opposed Blade Damper, Add</i>	48.91	
			<i>For Each Square Inch With 1/4" Steel Backer Plate Case Hardened To Rockwell "C" 56/58, Add</i>	0.35	
			<i>For 1" x 1" Square Holes On Face, Add</i>	33.16	
			<i>For Stainless Steel, Add</i>	172.41	
23 37	13 00-0195	EA	8" x 8" Steel Security Grille	180.50	14.09
			<i>For Anchoring Tabs, Add</i>	15.23	
			<i>For Angle Iron Frame, Add</i>	25.67	
			<i>For Rear Operated Opposed Blade Damper, Add</i>	56.13	
			<i>For Each Square Inch With 1/4" Steel Backer Plate Case Hardened To Rockwell "C" 56/58, Add</i>	0.35	
			<i>For 1" x 1" Square Holes On Face, Add</i>	38.08	
			<i>For Stainless Steel, Add</i>	198.03	
23 37	13 00-0196	EA	10" x 4" Steel Security Grille	158.19	13.68
			<i>For Anchoring Tabs, Add</i>	13.08	
			<i>For Angle Iron Frame, Add</i>	22.36	
			<i>For Rear Operated Opposed Blade Damper, Add</i>	48.52	
			<i>For Each Square Inch With 1/4" Steel Backer Plate Case Hardened To Rockwell "C" 56/58, Add</i>	0.35	
			<i>For 1" x 1" Square Holes On Face, Add</i>	32.71	
			<i>For Stainless Steel, Add</i>	170.07	
23 37	13 00-0197	EA	10" x 6" Steel Security Grille	168.77	14.49
			<i>For Anchoring Tabs, Add</i>	13.98	
			<i>For Angle Iron Frame, Add</i>	23.87	
			<i>For Rear Operated Opposed Blade Damper, Add</i>	51.82	
			<i>For Each Square Inch With 1/4" Steel Backer Plate Case Hardened To Rockwell "C" 56/58, Add</i>	0.35	
			<i>For 1" x 1" Square Holes On Face, Add</i>	34.95	
			<i>For Stainless Steel, Add</i>	181.73	
23 37	13 00-0198	EA	10" x 8" Steel Security Grille	192.68	15.70
			<i>For Anchoring Tabs, Add</i>	16.13	
			<i>For Angle Iron Frame, Add</i>	27.33	
			<i>For Rear Operated Opposed Blade Damper, Add</i>	59.59	
			<i>For Each Square Inch With 1/4" Steel Backer Plate Case Hardened To Rockwell "C" 56/58, Add</i>	0.35	
			<i>For 1" x 1" Square Holes On Face, Add</i>	40.32	
			<i>For Stainless Steel, Add</i>	209.68	
23 37	13 00-0199	EA	10" x 10" Steel Security Grille	214.81	16.91
			<i>For Anchoring Tabs, Add</i>	18.10	
			<i>For Angle Iron Frame, Add</i>	30.53	
			<i>For Rear Operated Opposed Blade Damper, Add</i>	66.73	
			<i>For Each Square Inch With 1/4" Steel Backer Plate Case Hardened To Rockwell "C" 56/58, Add</i>	0.35	
			<i>For 1" x 1" Square Holes On Face, Add</i>	45.25	
			<i>For Stainless Steel, Add</i>	235.30	
23 37	13 00-0200	EA	12" x 4" Steel Security Grille	166.79	15.29
			<i>For Anchoring Tabs, Add</i>	13.62	
			<i>For Angle Iron Frame, Add</i>	23.49	
			<i>For Rear Operated Opposed Blade Damper, Add</i>	50.73	
			<i>For Each Square Inch With 1/4" Steel Backer Plate Case Hardened To Rockwell "C" 56/58, Add</i>	0.35	
			<i>For 1" x 1" Square Holes On Face, Add</i>	34.05	
			<i>For Stainless Steel, Add</i>	177.06	
23 37	13 00-0201	EA	12" x 6" Steel Security Grille	186.14	16.91
			<i>For Anchoring Tabs, Add</i>	15.23	
			<i>For Angle Iron Frame, Add</i>	26.23	
			<i>For Rear Operated Opposed Blade Damper, Add</i>	56.70	
			<i>For Each Square Inch With 1/4" Steel Backer Plate Case Hardened To Rockwell "C" 56/58, Add</i>	0.35	
			<i>For 1" x 1" Square Holes On Face, Add</i>	38.08	
			<i>For Stainless Steel, Add</i>	198.03	
23 37	13 00-0202	EA	12" x 8" Steel Security Grille	211.86	18.11
			<i>For Anchoring Tabs, Add</i>	17.56	
			<i>For Angle Iron Frame, Add</i>	29.97	
			<i>For Rear Operated Opposed Blade Damper, Add</i>	65.09	
			<i>For Each Square Inch With 1/4" Steel Backer Plate Case Hardened To Rockwell "C" 56/58, Add</i>	0.35	
			<i>For 1" x 1" Square Holes On Face, Add</i>	43.91	
			<i>For Stainless Steel, Add</i>	228.32	
23 37	13 00-0203	EA	12" x 10" Steel Security Grille	230.39	19.32
			<i>For Anchoring Tabs, Add</i>	19.18	
			<i>For Angle Iron Frame, Add</i>	32.63	
			<i>For Rear Operated Opposed Blade Damper, Add</i>	70.98	
			<i>For Each Square Inch With 1/4" Steel Backer Plate Case Hardened To Rockwell "C" 56/58, Add</i>	0.35	
			<i>For 1" x 1" Square Holes On Face, Add</i>	47.94	
			<i>For Stainless Steel, Add</i>	249.29	
23 37	13 00-0204	EA	12" x 12" Steel Security Grille	254.31	20.53
			<i>For Anchoring Tabs, Add</i>	21.33	
			<i>For Angle Iron Frame, Add</i>	36.09	
			<i>For Rear Operated Opposed Blade Damper, Add</i>	78.75	
			<i>For Each Square Inch With 1/4" Steel Backer Plate Case Hardened To Rockwell "C" 56/58, Add</i>	0.35	
			<i>For 1" x 1" Square Holes On Face, Add</i>	53.32	
			<i>For Stainless Steel, Add</i>	277.24	
23 37	13 00-0205	EA	14" x 4" Steel Security Grille	178.16	16.50
			<i>For Anchoring Tabs, Add</i>	14.52	
			<i>For Angle Iron Frame, Add</i>	25.07	
			<i>For Rear Operated Opposed Blade Damper, Add</i>	54.11	
			<i>For Each Square Inch With 1/4" Steel Backer Plate Case Hardened To Rockwell "C" 56/58, Add</i>	0.35	
			<i>For 1" x 1" Square Holes On Face, Add</i>	36.29	
			<i>For Stainless Steel, Add</i>	188.71	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 37 13 00-0206 EA 14" x 6" Steel Security Grille	200.29	17.71
For Anchoring Tabs, Add	16.49	
For Angle Iron Frame, Add	28.27	
For Rear Operated Opposed Blade Damper, Add	61.25	
For Each Square Inch With 1/4" Steel Backer Plate Case Hardened To Rockwell "C" 56/58, Add	0.35	
For 1" x 1" Square Holes On Face, Add	41.22	
For Stainless Steel, Add	214.33	
23 37 13 00-0207 EA 14" x 8" Steel Security Grille	223.22	19.32
For Anchoring Tabs, Add	18.46	
For Angle Iron Frame, Add	31.55	
For Rear Operated Opposed Blade Damper, Add	68.47	
For Each Square Inch With 1/4" Steel Backer Plate Case Hardened To Rockwell "C" 56/58, Add	0.35	
For 1" x 1" Square Holes On Face, Add	46.15	
For Stainless Steel, Add	239.97	
23 37 13 00-0208 EA 14" x 10" Steel Security Grille	251.54	20.93
For Anchoring Tabs, Add	20.97	
For Angle Iron Frame, Add	35.64	
For Rear Operated Opposed Blade Damper, Add	77.57	
For Each Square Inch With 1/4" Steel Backer Plate Case Hardened To Rockwell "C" 56/58, Add	0.35	
For 1" x 1" Square Holes On Face, Add	52.42	
For Stainless Steel, Add	272.58	
23 37 13 00-0209 EA 14" x 12" Steel Security Grille	277.06	22.95
For Anchoring Tabs, Add	23.12	
For Angle Iron Frame, Add	39.27	
For Rear Operated Opposed Blade Damper, Add	85.50	
For Each Square Inch With 1/4" Steel Backer Plate Case Hardened To Rockwell "C" 56/58, Add	0.35	
For 1" x 1" Square Holes On Face, Add	57.80	
For Stainless Steel, Add	300.53	
23 37 13 00-0210 EA 14" x 14" Steel Security Grille	298.20	24.55
For Anchoring Tabs, Add	24.91	
For Angle Iron Frame, Add	42.28	
For Rear Operated Opposed Blade Damper, Add	92.10	
For Each Square Inch With 1/4" Steel Backer Plate Case Hardened To Rockwell "C" 56/58, Add	0.35	
For 1" x 1" Square Holes On Face, Add	62.28	
For Stainless Steel, Add	323.83	
23 37 13 00-0211 EA 16" x 6" Steel Security Grille	214.26	19.32
For Anchoring Tabs, Add	17.56	
For Angle Iron Frame, Add	30.21	
For Rear Operated Opposed Blade Damper, Add	65.33	
For Each Square Inch With 1/4" Steel Backer Plate Case Hardened To Rockwell "C" 56/58, Add	0.35	
For 1" x 1" Square Holes On Face, Add	43.91	
For Stainless Steel, Add	228.32	
23 37 13 00-0212 EA 16" x 8" Steel Security Grille	244.37	20.93
For Anchoring Tabs, Add	20.25	
For Angle Iron Frame, Add	34.56	
For Rear Operated Opposed Blade Damper, Add	75.06	
For Each Square Inch With 1/4" Steel Backer Plate Case Hardened To Rockwell "C" 56/58, Add	0.35	
For 1" x 1" Square Holes On Face, Add	50.63	
For Stainless Steel, Add	263.26	
23 37 13 00-0213 EA 16" x 10" Steel Security Grille	263.72	22.54
For Anchoring Tabs, Add	21.86	
For Angle Iron Frame, Add	37.30	
For Rear Operated Opposed Blade Damper, Add	81.03	
For Each Square Inch With 1/4" Steel Backer Plate Case Hardened To Rockwell "C" 56/58, Add	0.35	
For 1" x 1" Square Holes On Face, Add	54.66	
For Stainless Steel, Add	284.23	
23 37 13 00-0214 EA 16" x 12" Steel Security Grille	296.59	23.74
For Anchoring Tabs, Add	24.91	
For Angle Iron Frame, Add	42.11	
For Rear Operated Opposed Blade Damper, Add	91.93	
For Each Square Inch With 1/4" Steel Backer Plate Case Hardened To Rockwell "C" 56/58, Add	0.35	
For 1" x 1" Square Holes On Face, Add	62.28	
For Stainless Steel, Add	323.83	
23 37 13 00-0215 EA 16" x 14" Steel Security Grille	314.15	25.35
For Anchoring Tabs, Add	26.34	
For Angle Iron Frame, Add	44.59	
For Rear Operated Opposed Blade Damper, Add	97.28	
For Each Square Inch With 1/4" Steel Backer Plate Case Hardened To Rockwell "C" 56/58, Add	0.35	
For 1" x 1" Square Holes On Face, Add	65.86	
For Stainless Steel, Add	342.47	
23 37 13 00-0216 EA 16" x 16" Steel Security Grille	340.67	26.96
For Anchoring Tabs, Add	28.67	
For Angle Iron Frame, Add	48.40	
For Rear Operated Opposed Blade Damper, Add	105.75	
For Each Square Inch With 1/4" Steel Backer Plate Case Hardened To Rockwell "C" 56/58, Add	0.35	
For 1" x 1" Square Holes On Face, Add	71.69	
For Stainless Steel, Add	372.76	
23 37 13 00-0217 EA 18" x 6" Steel Security Grille	228.06	21.74
For Anchoring Tabs, Add	18.46	
For Angle Iron Frame, Add	32.04	
For Rear Operated Opposed Blade Damper, Add	68.95	
For Each Square Inch With 1/4" Steel Backer Plate Case Hardened To Rockwell "C" 56/58, Add	0.35	
For 1" x 1" Square Holes On Face, Add	46.15	
For Stainless Steel, Add	239.97	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 37 Air Outlets And Inlets**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 37 13 00-0218	EA		18" x 8" Steel Security Grille	259.95	23.35
			<i>For Anchoring Tabs, Add</i>	21.33	
			<i>For Angle Iron Frame, Add</i>	36.66	
			<i>For Rear Operated Opposed Blade Damper, Add</i>	79.31	
			<i>For Each Square Inch With 1/4" Steel Backer Plate Case Hardened To Rockwell "C" 56/58, Add</i>	0.35	
			<i>For 1" x 1" Square Holes On Face, Add</i>	53.32	
			<i>For Stainless Steel, Add</i>	277.24	
23 37 13 00-0219	EA		18" x 10" Steel Security Grille	284.68	24.95
			<i>For Anchoring Tabs, Add</i>	23.48	
			<i>For Angle Iron Frame, Add</i>	40.21	
			<i>For Rear Operated Opposed Blade Damper, Add</i>	87.16	
			<i>For Each Square Inch With 1/4" Steel Backer Plate Case Hardened To Rockwell "C" 56/58, Add</i>	0.35	
			<i>For 1" x 1" Square Holes On Face, Add</i>	58.69	
			<i>For Stainless Steel, Add</i>	305.20	
23 37 13 00-0220	EA		18" x 12" Steel Security Grille	312.98	26.56
			<i>For Anchoring Tabs, Add</i>	25.99	
			<i>For Angle Iron Frame, Add</i>	44.29	
			<i>For Rear Operated Opposed Blade Damper, Add</i>	96.26	
			<i>For Each Square Inch With 1/4" Steel Backer Plate Case Hardened To Rockwell "C" 56/58, Add</i>	0.35	
			<i>For 1" x 1" Square Holes On Face, Add</i>	64.97	
			<i>For Stainless Steel, Add</i>	337.82	
23 37 13 00-0221	EA		18" x 14" Steel Security Grille	333.69	26.16
			<i>For Anchoring Tabs, Add</i>	28.14	
			<i>For Angle Iron Frame, Add</i>	47.44	
			<i>For Rear Operated Opposed Blade Damper, Add</i>	103.71	
			<i>For Each Square Inch With 1/4" Steel Backer Plate Case Hardened To Rockwell "C" 56/58, Add</i>	0.35	
			<i>For 1" x 1" Square Holes On Face, Add</i>	70.34	
			<i>For Stainless Steel, Add</i>	365.77	
23 37 13 00-0222	EA		18" x 16" Steel Security Grille	364.77	27.37
			<i>For Anchoring Tabs, Add</i>	31.00	
			<i>For Angle Iron Frame, Add</i>	51.98	
			<i>For Rear Operated Opposed Blade Damper, Add</i>	113.99	
			<i>For Each Square Inch With 1/4" Steel Backer Plate Case Hardened To Rockwell "C" 56/58, Add</i>	0.35	
			<i>For 1" x 1" Square Holes On Face, Add</i>	77.51	
			<i>For Stainless Steel, Add</i>	403.05	
23 37 13 00-0223	EA		18" x 18" Steel Security Grille	390.48	28.57
			<i>For Anchoring Tabs, Add</i>	33.33	
			<i>For Angle Iron Frame, Add</i>	55.71	
			<i>For Rear Operated Opposed Blade Damper, Add</i>	122.38	
			<i>For Each Square Inch With 1/4" Steel Backer Plate Case Hardened To Rockwell "C" 56/58, Add</i>	0.35	
			<i>For 1" x 1" Square Holes On Face, Add</i>	83.33	
			<i>For Stainless Steel, Add</i>	433.33	
23 37 13 00-0224	EA		20" x 6" Steel Security Grille	244.62	23.74
			<i>For Anchoring Tabs, Add</i>	19.71	
			<i>For Angle Iron Frame, Add</i>	34.32	
			<i>For Rear Operated Opposed Blade Damper, Add</i>	73.74	
			<i>For Each Square Inch With 1/4" Steel Backer Plate Case Hardened To Rockwell "C" 56/58, Add</i>	0.35	
			<i>For 1" x 1" Square Holes On Face, Add</i>	49.28	
			<i>For Stainless Steel, Add</i>	256.27	
23 37 13 00-0225	EA		20" x 8" Steel Security Grille	276.34	26.16
			<i>For Anchoring Tabs, Add</i>	22.40	
			<i>For Angle Iron Frame, Add</i>	38.83	
			<i>For Rear Operated Opposed Blade Damper, Add</i>	83.64	
			<i>For Each Square Inch With 1/4" Steel Backer Plate Case Hardened To Rockwell "C" 56/58, Add</i>	0.35	
			<i>For 1" x 1" Square Holes On Face, Add</i>	56.00	
			<i>For Stainless Steel, Add</i>	291.21	
23 37 13 00-0226	EA		20" x 10" Steel Security Grille	303.83	27.37
			<i>For Anchoring Tabs, Add</i>	24.91	
			<i>For Angle Iron Frame, Add</i>	42.84	
			<i>For Rear Operated Opposed Blade Damper, Add</i>	92.66	
			<i>For Each Square Inch With 1/4" Steel Backer Plate Case Hardened To Rockwell "C" 56/58, Add</i>	0.35	
			<i>For 1" x 1" Square Holes On Face, Add</i>	62.28	
			<i>For Stainless Steel, Add</i>	323.83	
23 37 13 00-0227	EA		20" x 12" Steel Security Grille	333.94	28.98
			<i>For Anchoring Tabs, Add</i>	27.60	
			<i>For Angle Iron Frame, Add</i>	47.19	
			<i>For Rear Operated Opposed Blade Damper, Add</i>	102.39	
			<i>For Each Square Inch With 1/4" Steel Backer Plate Case Hardened To Rockwell "C" 56/58, Add</i>	0.35	
			<i>For 1" x 1" Square Holes On Face, Add</i>	69.00	
			<i>For Stainless Steel, Add</i>	358.79	
23 37 13 00-0228	EA		20" x 14" Steel Security Grille	366.82	30.19
			<i>For Anchoring Tabs, Add</i>	30.65	
			<i>For Angle Iron Frame, Add</i>	52.00	
			<i>For Rear Operated Opposed Blade Damper, Add</i>	113.29	
			<i>For Each Square Inch With 1/4" Steel Backer Plate Case Hardened To Rockwell "C" 56/58, Add</i>	0.35	
			<i>For 1" x 1" Square Holes On Face, Add</i>	76.61	
			<i>For Stainless Steel, Add</i>	398.39	
23 37 13 00-0229	EA		20" x 16" Steel Security Grille	396.11	31.39
			<i>For Anchoring Tabs, Add</i>	33.33	
			<i>For Angle Iron Frame, Add</i>	56.28	
			<i>For Rear Operated Opposed Blade Damper, Add</i>	122.94	
			<i>For Each Square Inch With 1/4" Steel Backer Plate Case Hardened To Rockwell "C" 56/58, Add</i>	0.35	
			<i>For 1" x 1" Square Holes On Face, Add</i>	83.33	
			<i>For Stainless Steel, Add</i>	433.33	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 37 13 00-0230 EA 20" x 18" Steel Security Grille	423.61	32.60
For Anchoring Tabs, Add	35.84	
For Angle Iron Frame, Add	60.28	
For Rear Operated Opposed Blade Damper, Add	131.97	
For Each Square Inch With 1/4" Steel Backer Plate Case Hardened To Rockwell "C" 56/58, Add	0.35	
For 1" x 1" Square Holes On Face, Add	89.61	
For Stainless Steel, Add	465.95	
23 37 13 00-0231 EA 20" x 20" Steel Security Grille	456.50	33.81
For Anchoring Tabs, Add	38.89	
For Angle Iron Frame, Add	65.09	
For Rear Operated Opposed Blade Damper, Add	142.87	
For Each Square Inch With 1/4" Steel Backer Plate Case Hardened To Rockwell "C" 56/58, Add	0.35	
For 1" x 1" Square Holes On Face, Add	97.22	
For Stainless Steel, Add	505.56	
23 37 13 00-0232 EA 24" x 6" Steel Security Grille	271.76	26.56
For Anchoring Tabs, Add	21.86	
For Angle Iron Frame, Add	38.11	
For Rear Operated Opposed Blade Damper, Add	81.84	
For Each Square Inch With 1/4" Steel Backer Plate Case Hardened To Rockwell "C" 56/58, Add	0.35	
For 1" x 1" Square Holes On Face, Add	54.66	
For Stainless Steel, Add	284.23	
23 37 13 00-0233 EA 24" x 8" Steel Security Grille	307.05	28.98
For Anchoring Tabs, Add	24.91	
For Angle Iron Frame, Add	43.16	
For Rear Operated Opposed Blade Damper, Add	92.98	
For Each Square Inch With 1/4" Steel Backer Plate Case Hardened To Rockwell "C" 56/58, Add	0.35	
For 1" x 1" Square Holes On Face, Add	62.28	
For Stainless Steel, Add	323.83	
23 37 13 00-0234 EA 24" x 10" Steel Security Grille	335.55	29.78
For Anchoring Tabs, Add	27.60	
For Angle Iron Frame, Add	47.35	
For Rear Operated Opposed Blade Damper, Add	102.55	
For Each Square Inch With 1/4" Steel Backer Plate Case Hardened To Rockwell "C" 56/58, Add	0.35	
For 1" x 1" Square Holes On Face, Add	69.00	
For Stainless Steel, Add	358.79	
23 37 13 00-0235 EA 24" x 12" Steel Security Grille	376.04	33.00
For Anchoring Tabs, Add	31.00	
For Angle Iron Frame, Add	53.11	
For Rear Operated Opposed Blade Damper, Add	115.11	
For Each Square Inch With 1/4" Steel Backer Plate Case Hardened To Rockwell "C" 56/58, Add	0.35	
For 1" x 1" Square Holes On Face, Add	77.51	
For Stainless Steel, Add	403.05	
23 37 13 00-0236 EA 24" x 14" Steel Security Grille	405.34	34.21
For Anchoring Tabs, Add	33.69	
For Angle Iron Frame, Add	57.38	
For Rear Operated Opposed Blade Damper, Add	124.76	
For Each Square Inch With 1/4" Steel Backer Plate Case Hardened To Rockwell "C" 56/58, Add	0.35	
For 1" x 1" Square Holes On Face, Add	84.23	
For Stainless Steel, Add	438.00	
23 37 13 00-0237 EA 24" x 16" Steel Security Grille	441.79	35.42
For Anchoring Tabs, Add	37.10	
For Angle Iron Frame, Add	62.73	
For Rear Operated Opposed Blade Damper, Add	136.92	
For Each Square Inch With 1/4" Steel Backer Plate Case Hardened To Rockwell "C" 56/58, Add	0.35	
For 1" x 1" Square Holes On Face, Add	92.74	
For Stainless Steel, Add	482.26	
23 37 13 00-0238 EA 24" x 18" Steel Security Grille	483.63	36.63
For Anchoring Tabs, Add	41.04	
For Angle Iron Frame, Add	68.88	
For Rear Operated Opposed Blade Damper, Add	150.96	
For Each Square Inch With 1/4" Steel Backer Plate Case Hardened To Rockwell "C" 56/58, Add	0.35	
For 1" x 1" Square Holes On Face, Add	102.60	
For Stainless Steel, Add	533.51	
23 37 13 00-0239 EA 24" x 20" Steel Security Grille	512.93	37.84
For Anchoring Tabs, Add	43.73	
For Angle Iron Frame, Add	73.16	
For Rear Operated Opposed Blade Damper, Add	160.61	
For Each Square Inch With 1/4" Steel Backer Plate Case Hardened To Rockwell "C" 56/58, Add	0.35	
For 1" x 1" Square Holes On Face, Add	109.32	
For Stainless Steel, Add	568.46	
23 37 13 00-0240 EA 24" x 24" Steel Security Grille	575.10	40.24
For Anchoring Tabs, Add	49.46	
For Angle Iron Frame, Add	82.24	
For Rear Operated Opposed Blade Damper, Add	181.17	
For Each Square Inch With 1/4" Steel Backer Plate Case Hardened To Rockwell "C" 56/58, Add	0.35	
For 1" x 1" Square Holes On Face, Add	123.66	
For Stainless Steel, Add	643.01	
23 37 13 00-0241 Square Wall Return Air And Exhaust Grilles <small>(23 37 13 00-0155)</small>		
Note: Egg crate design aluminum construction.		
23 37 13 00-0242 EA 8" x 8" Egg Crate Wall Return Air Or Exhaust Grille, Aluminum Construction	48.27	20.13
23 37 13 00-0243 EA 12" x 12" Egg Crate Wall Return Air Or Exhaust Grille, Aluminum Construction	50.74	20.13
23 37 13 00-0244 EA 18" x 18" Egg Crate Wall Return Air Or Exhaust Grille, Aluminum Construction	75.81	30.19
23 37 13 00-0245 EA 24" x 24" Egg Crate Wall Return Air Or Exhaust Grille, Aluminum Construction	88.16	30.19
23 37 13 00-0246 EA 28" x 28" Egg Crate Wall Return Air Or Exhaust Grille, Aluminum Construction	136.08	40.24

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 37 Air Outlets And Inlets**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 37 13 00-0247 EA 36" x 36" Egg Crate Wall Return Air Or Exhaust Grille, Aluminum Construction	210.72	40.24
23 37 13 00-0248 Rectangular Four-Way Adjustable Deflection Wall Supply Grilles (23 37 13 00-0155)		
Note: Aluminum construction.		
23 37 13 00-0249 EA 12" x 6" 4-Way Adjustable Wall Supply Grille, Adjustable Deflection, Aluminum Construction	140.58	14.49
23 37 13 00-0250 EA 14" x 6" 4-Way Adjustable Wall Supply Grille, Adjustable Deflection, Aluminum Construction	158.56	14.49
23 37 13 00-0251 EA 18" x 8" 4-Way Adjustable Wall Supply Grille, Adjustable Deflection, Aluminum Construction	190.24	16.10
23 37 13 00-0252 EA 24" x 8" 4-Way Adjustable Wall Supply Grille, Adjustable Deflection, Aluminum Construction	222.17	16.10
23 37 13 00-0253 EA 36" x 20" 4-Way Adjustable Wall Supply Grille, Adjustable Deflection, Aluminum Construction	289.65	50.31
23 37 13 00-0254 Square Ceiling Return Air And Exhaust Grilles (23 37 13 00-0155)		
Note: Egg crate design, plastic construction.		
23 37 13 00-0255 EA 24" x 24" Egg Crate Ceiling Return Air Or Exhaust Grille, Plastic Construction	28.95	9.63
23 37 13 00-0256 EA 24" x 48" Egg Crate Ceiling Return Air Or Exhaust Grille, Plastic Construction	40.69	9.71
23 37 13 00-0257 Door Grilles Sight Proof Inverted Vee Cross Section (23 37 13 00-0155)		
Note: Painted steel louvers and frame.		
23 37 13 00-0258 EA 12" x 6" Sight Proof Door Grilles, Inverted Vee Cross Section, Painted Steel	79.80	14.49
23 37 13 00-0259 EA 12" x 12" Sight Proof Door Grilles, Inverted Vee Cross Section, Painted Steel	102.63	14.49
23 37 13 00-0260 EA 18" x 18" Sight Proof Door Grilles, Inverted Vee Cross Section, Painted Steel	124.60	15.29
23 37 13 00-0261 EA 24" x 24" Sight Proof Door Grilles, Inverted Vee Cross Section, Painted Steel	166.55	18.27
23 37 13 00-0262 EA 24" x 30" Sight Proof Door Grilles, Inverted Vee Cross Section, Painted Steel	185.89	33.57
23 37 13 00-0263 Stainless Steel Devices (23 37 13 00-0155)		
23 37 13 00-0264 304 Stainless Steel, Louvered Partition/Door Grilles (23 37 13 00-0263)		
23 37 13 00-0265 SF Up To 4 SF, 304 Stainless Steel, Louvered Partition/Door Grille	160.52	12.56
For 316 Stainless Steel, Add	27.92	
23 37 13 00-0266 SF >4 SF, 304 Stainless Steel, Louvered Partition/Door Grille	135.05	12.56
For 316 Stainless Steel, Add	22.82	
23 37 13 00-0267 304 Stainless Steel, Single Deflection Supply Grilles (23 37 13 00-0263)		
23 37 13 00-0268 SF Up To 4 SF, 304 Stainless Steel, Single Deflection Supply Grille	120.93	12.56
For 316 Stainless Steel, Add	20.00	
23 37 13 00-0269 SF >4 SF, 304 Stainless Steel, Single Deflection Supply Grille	102.41	12.56
For 316 Stainless Steel, Add	16.30	
23 37 13 00-0270 304 Stainless Steel, Double Deflection Supply Grilles (23 37 13 00-0263)		
23 37 13 00-0271 SF Up To 4 SF, 304 Stainless Steel, Double Deflection Supply Grille	178.23	12.56
For 316 Stainless Steel, Add	31.46	
23 37 13 00-0272 SF >4 SF, 304 Stainless Steel, Double Deflection Supply Grille	151.49	12.56
For 316 Stainless Steel, Add	26.11	
23 37 13 00-0273 304 Stainless Steel Return Grilles (23 37 13 00-0263)		
23 37 13 00-0274 SF Up To 4 SF, 304 Stainless Steel Return Grille	120.93	12.56
For 316 Stainless Steel, Add	20.00	
23 37 13 00-0275 SF >4 SF, 304 Stainless Steel Return Grille	102.41	12.56
For 316 Stainless Steel, Add	16.30	
23 37 13 00-0276 304 Stainless Steel, Louvered Supply/Return Grilles (23 37 13 00-0263)		
23 37 13 00-0277 SF Up To 4 SF, 304 Stainless Steel, Louvered Supply/Return Grille	120.93	12.56
For 316 Stainless Steel, Add	20.00	
23 37 13 00-0278 SF >4 SF, 304 Stainless Steel, Louvered Supply/Return Grille	102.41	12.56
For 316 Stainless Steel, Add	16.30	
23 37 13 00-0279 304 Stainless Steel, Perforated Return Grilles (23 37 13 00-0263)		
23 37 13 00-0280 SF Up To 4 SF, 304 Stainless Steel, Perforated Return Grille	120.93	12.56
For 316 Stainless Steel, Add	20.00	
23 37 13 00-0281 SF >4 SF, 304 Stainless Steel, Perforated Return Grille	97.32	12.56
For 316 Stainless Steel, Add	15.28	
23 37 13 00-0282 304 Stainless Steel, Perforated Supply Grilles (23 37 13 00-0263)		
23 37 13 00-0283 SF Up To 4 SF, 304 Stainless Steel, Perforated Supply Grille	146.98	12.56
For 316 Stainless Steel, Add	25.21	
23 37 13 00-0284 SF >4 SF, 304 Stainless Steel, Perforated Supply Grille	100.03	12.56
For 316 Stainless Steel, Add	15.82	
23 37 13 00-0285 304 Stainless Steel, Door Grilles (23 37 13 00-0263)		
23 37 13 00-0286 SF Up To 4 SF, 304 Stainless Steel, Door Grille	220.94	12.56
For 316 Stainless Steel, Add	40.00	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 37 13 00-0287 SF >4 SF, 304 Stainless Steel, Door Grille <i>For 316 Stainless Steel, Add</i>	183.91 32.60	12.56
23 37 13 00-0288 304 Stainless Steel, Linear Bar Grilles (23 37 13 00-0263)		
23 37 13 00-0289 SF Up To 4 SF, 304 Stainless Steel, Linear Bar Grille..... <i>For 316 Stainless Steel, Add</i>	283.09 52.43	12.56
23 37 13 00-0290 SF >4 SF, 304 Stainless Steel, Linear Bar Grille..... <i>For 316 Stainless Steel, Add</i>	242.00 44.21	12.56
23 37 13 00-0291 304 Stainless Steel, Hinged Filter Grilles (23 37 13 00-0263)		
23 37 13 00-0292 SF Up To 4 SF, 304 Stainless Steel, Hinged Filter Grille..... <i>For 316 Stainless Steel, Add</i>	207.40 37.29	12.56
23 37 13 00-0293 SF >4 SF, 304 Stainless Steel, Hinged Filter Grille..... <i>For 316 Stainless Steel, Add</i>	142.58 24.33	12.56
23 37 13 00-0294 304 Stainless Steel, Opposed Blade Dampers Grilles (23 37 13 00-0263)		
23 37 13 00-0295 SF Up To 4 SF, 304 Stainless Steel, Opposed Blade Dampers Grille <i>For 316 Stainless Steel, Add</i>	110.52 17.92	12.56
23 37 13 00-0296 SF Opposed Blade Dampers Grille, Stainless Steel 304, > 4 SF..... <i>For 316 Stainless Steel, Add</i>	83.55 12.52	12.56
23 37 13 00-0297 304 Stainless Steel, Plaster Frames Replacement (23 37 13 00-0263)		
Note: For frequent replacement.		
23 37 13 00-0298 SF To 4 SF, 304 Stainless Steel, Plaster Frames Replacement..... <i>For 316 Stainless Steel, Add</i>	85.52 12.92	12.56
23 37 13 00-0299 SF >4 SF, 304 Stainless Steel, Plaster Frames Replacement..... <i>For 316 Stainless Steel, Add</i>	44.19 4.65	12.56
23 37 13 00-0300 304 Stainless Steel, Modular Louvered Ceiling Diffusers (23 37 13 00-0263)		
23 37 13 00-0301 SF Up To 4 SF, 304 Stainless Steel, Modular Louvered Ceiling Diffuser..... <i>For 316 Stainless Steel, Add</i>	204.27 36.67	12.56
23 37 13 00-0302 SF >4 SF, 304 Stainless Steel, Modular Louvered Ceiling Diffuser <i>For 316 Stainless Steel, Add</i>	159.25 27.66	12.56
23 37 13 00-0303 304 Stainless Steel, Latticed Supply/Return Grilles (23 37 13 00-0263)		
23 37 13 00-0304 SF Up To 4 SF, 304 Stainless Steel, Latticed Supply/Return Grille <i>For 316 Stainless Steel, Add</i>	69.89 9.79	12.56
23 37 13 00-0305 SF >4 SF, 304 Stainless Steel, Latticed Supply/Return Grille..... <i>For 316 Stainless Steel, Add</i>	69.89 9.79	12.56
23 37 13 00-0306 Removal And Reinstallation Of Distribution Devices (23 37 13)		
Note: Includes storage and cleaning. Excludes ductwork.		
23 37 13 00-0307 EA Remove And Reinstall Variable Air Volume Terminal Unit.....	150.90	
23 37 13 00-0308 EA Remove And Reinstall Fan Powered Variable Volume Terminal Unit.....	166.43	
23 37 13 00-0309 EA Remove And Reinstall Lay-in Diffuser/Register/Grille.....	24.94	
23 37 13 00-0310 EA Remove And Reinstall Surface Mounted Diffuser/Register/Grille.....	33.78	
23 38 Ventilation Hoods (23 30)		
23 38 13 Commercial-Kitchen Hoods (23 38)		
23 38 13 16 Standard Commercial-Kitchen Hoods (23 38 13)		
23 38 13 16-0001 Commercial Kitchen Hood Ventilation System (23 38 13 16)		
Note: Excludes fire suppression. See CSI section 23 34 16 00-0108 for exhaust and supply fans.		
23 38 13 16-0002 Dry Filter Exhaust Hoods (23 38 13 16-0001)		
Note: Includes stainless steel filters, exhaust damper and 48" long fluorescent light fixtures.		
23 38 13 16-0003 EA 8' Long x 60" Deep Dry Filter Exhaust Hood.....	4,791.72	636.73
23 38 13 16-0004 EA 8'-6" Long x 60" Deep Dry Filter Exhaust Hood.....	5,004.86	676.52
23 38 13 16-0005 EA 9' Long x 60" Deep Dry Filter Exhaust Hood.....	5,545.69	716.31
23 38 13 16-0006 EA 9'-6" Long x 60" Deep Dry Filter Exhaust Hood.....	5,730.88	756.11
23 38 13 16-0007 EA 10' Long x 60" Deep Dry Filter Exhaust Hood.....	5,948.41	795.90
23 38 13 16-0008 EA 10'-6" Long x 60" Deep Dry Filter Exhaust Hood.....	6,175.79	835.70
23 38 13 16-0009 EA 11' Long x 60" Deep Dry Filter Exhaust Hood.....	6,393.79	875.49
23 38 13 16-0010 EA 11'-6" Long x 60" Deep Dry Filter Exhaust Hood.....	6,617.47	915.30
23 38 13 16-0011 EA 12' Long x 60" Deep Dry Filter Exhaust Hood.....	6,861.76	955.09
23 38 13 16-0012 EA 12'-6" Long x 60" Deep Dry Filter Exhaust Hood.....	7,077.76	994.88
23 38 13 16-0013 EA 13' Long x 60" Deep Dry Filter Exhaust Hood.....	7,263.73	1,034.68
23 38 13 16-0014 EA 13'-6" Long x 60" Deep Dry Filter Exhaust Hood.....	7,551.79	1,074.47
23 38 13 16-0015 EA 14' Long x 60" Deep Dry Filter Exhaust Hood.....	8,365.12	1,114.27
23 38 13 16-0016 EA 14'-6" Long x 60" Deep Dry Filter Exhaust Hood.....	8,601.11	1,154.06
23 38 13 16-0017 EA 15' Long x 60" Deep Dry Filter Exhaust Hood.....	8,904.55	1,193.85
23 38 13 16-0018 EA 15'-6" Long x 60" Deep Dry Filter Exhaust Hood.....	9,144.18	1,233.65

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 30 HVAC Air Distribution****23 38 Ventilation Hoods**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 38 13 16-0019 EA 16' Long x 60" Deep Dry Filter Exhaust Hood.....	9,482.75	1,273.44
23 38 13 16-0020 Dry Extractor Exhaust Hoods <small>(23 38 13 16-0001)</small>		
Note: Includes extractor inserts, exhaust damper, 48" long fluorescent light fixtures, and UDS filler panels.		
23 38 13 16-0021 EA 8' Long x 60" Deep Dry Extractor Exhaust Hood.....	6,466.52	636.73
23 38 13 16-0022 EA 8'-6" Long x 60" Deep Dry Extractor Exhaust Hood.....	6,690.26	676.52
23 38 13 16-0023 EA 9' Long x 60" Deep Dry Extractor Exhaust Hood.....	7,262.89	716.31
23 38 13 16-0024 EA 9'-6" Long x 60" Deep Dry Extractor Exhaust Hood.....	7,490.48	756.11
23 38 13 16-0025 EA 10' Long x 60" Deep Dry Extractor Exhaust Hood.....	7,718.61	795.90
23 38 13 16-0026 EA 10'-6" Long x 60" Deep Dry Extractor Exhaust Hood.....	7,935.39	835.70
23 38 13 16-0027 EA 11' Long x 60" Deep Dry Extractor Exhaust Hood.....	8,163.99	875.49
23 38 13 16-0028 EA 11'-6" Long x 60" Deep Dry Extractor Exhaust Hood.....	8,382.37	915.30
23 38 13 16-0029 EA 12' Long x 60" Deep Dry Extractor Exhaust Hood.....	8,589.56	955.09
23 38 13 16-0030 EA 12'-6" Long x 60" Deep Dry Extractor Exhaust Hood.....	8,869.16	994.88
23 38 13 16-0031 EA 13' Long x 60" Deep Dry Extractor Exhaust Hood.....	9,187.63	1,034.68
23 38 13 16-0032 EA 13'-6" Long x 60" Deep Dry Extractor Exhaust Hood.....	9,523.39	1,074.47
23 38 13 16-0033 EA 14' Long x 60" Deep Dry Extractor Exhaust Hood.....	10,183.02	1,114.27
23 38 13 16-0034 EA 14'-6" Long x 60" Deep Dry Extractor Exhaust Hood.....	10,525.01	1,154.06
23 38 13 16-0035 EA 15' Long x 60" Deep Dry Extractor Exhaust Hood.....	11,151.75	1,193.85
23 38 13 16-0036 EA 15'-6" Long x 60" Deep Dry Extractor Exhaust Hood.....	11,788.88	1,233.65
23 38 13 16-0037 EA 16' Long x 60" Deep Dry Extractor Exhaust Hood.....	12,418.95	1,273.44
23 38 13 16-0038 Single Manifold Water Wash Exhaust Hoods <small>(23 38 13 16-0001)</small>		
Note: Includes extraction baffles, 48" long fluorescent light fixtures, and UDS filler panels. Excludes fan wash control panel.		
23 38 13 16-0039 EA 8' Long x 60" Deep Single Manifold Water Wash Exhaust Hood.....	6,890.52	636.73
23 38 13 16-0040 EA 8'-6" Long x 60" Deep Single Manifold Water Wash Exhaust Hood.....	7,124.86	676.52
23 38 13 16-0041 EA 9' Long x 60" Deep Single Manifold Water Wash Exhaust Hood.....	7,708.09	716.31
23 38 13 16-0042 EA 9'-6" Long x 60" Deep Single Manifold Water Wash Exhaust Hood.....	7,940.98	756.11
23 38 13 16-0043 EA 10' Long x 60" Deep Single Manifold Water Wash Exhaust Hood.....	8,185.01	795.90
23 38 13 16-0044 EA 10'-6" Long x 60" Deep Single Manifold Water Wash Exhaust Hood.....	8,412.39	835.70
23 38 13 16-0045 EA 11' Long x 60" Deep Single Manifold Water Wash Exhaust Hood.....	8,646.29	875.49
23 38 13 16-0046 EA 11'-6" Long x 60" Deep Single Manifold Water Wash Exhaust Hood.....	8,880.57	915.30
23 38 13 16-0047 EA 12' Long x 60" Deep Single Manifold Water Wash Exhaust Hood.....	9,093.06	955.09
23 38 13 16-0048 EA 12'-6" Long x 60" Deep Single Manifold Water Wash Exhaust Hood.....	9,393.86	994.88
23 38 13 16-0049 EA 13' Long x 60" Deep Single Manifold Water Wash Exhaust Hood.....	9,733.53	1,034.68
23 38 13 16-0050 EA 13'-6" Long x 60" Deep Single Manifold Water Wash Exhaust Hood.....	10,090.49	1,074.47
23 38 13 16-0051 EA 14' Long x 60" Deep Single Manifold Water Wash Exhaust Hood.....	10,771.32	1,114.27
23 38 13 16-0052 EA 14'-6" Long x 60" Deep Single Manifold Water Wash Exhaust Hood.....	11,134.51	1,154.06
23 38 13 16-0053 EA 15' Long x 60" Deep Single Manifold Water Wash Exhaust Hood.....	11,819.55	1,193.85
23 38 13 16-0054 EA 15'-6" Long x 60" Deep Single Manifold Water Wash Exhaust Hood.....	12,181.08	1,233.65
23 38 13 16-0055 EA 16' Long x 60" Deep Single Manifold Water Wash Exhaust Hood.....	12,540.85	1,273.44
23 38 13 16-0056 EA Fan Wash Control Panel.....	4,811.73	318.36
Note: Includes time clock and backflow preventer.		
23 38 13 16-0057 Utility Distribution System (UDS) <small>(23 38 13 16-0001)</small>		
Note: Includes "L" shaped primary riser, secondary riser, horizontal mechanical and electrical raceway; 2" IPS looped gas manifold with two (2) solenoid gas valves; 1" hot water manifold; 1" cold water manifold; 100 Amp 120-208 VAC/3 Ph/60 Hz main shunt trip connectors; equipment restraints; flexible drain connectors; and power interruption device. Excludes main shunt breaker.		
23 38 13 16-0058 EA 8' Long UDS.....	24,814.79	323.78
23 38 13 16-0059 EA 8'-6" Long UDS.....	25,547.42	331.65
23 38 13 16-0060 EA 9' Long UDS.....	26,272.06	339.37
23 38 13 16-0061 EA 9'-6" Long UDS.....	27,002.99	350.20
23 38 13 16-0062 EA 10' Long UDS.....	27,729.43	358.79
23 38 13 16-0063 EA 10'-6" Long UDS.....	28,449.03	367.87
23 38 13 16-0064 EA 11' Long UDS.....	29,178.52	374.16
23 38 13 16-0065 EA 11'-6" Long UDS.....	29,907.43	384.02
23 38 13 16-0066 EA 12' Long UDS.....	30,644.57	397.95
23 38 13 16-0067 EA 12'-6" Long UDS.....	31,391.69	416.89
23 38 13 16-0068 EA 13' Long UDS.....	32,125.43	429.15
23 38 13 16-0069 EA 13'-6" Long UDS.....	32,869.67	446.66
23 38 13 16-0070 EA 14' Long UDS.....	33,607.09	460.75
23 38 13 16-0071 EA 14'-6" Long UDS.....	34,346.36	475.79
23 38 13 16-0072 EA 15' Long UDS.....	35,087.65	491.87
23 38 13 16-0073 EA 15'-6" Long UDS.....	35,831.18	508.98
23 38 13 16-0074 EA 16' Long UDS.....	36,564.64	521.16
23 38 13 16-0075 Stainless Steel Exhaust Hood Material <small>(23 38 13 16)</small>		
Note: Welded seams.		
23 38 13 16-0076 SF 16 Gauge Stainless Steel Exhaust Hood Material.....	60.12	11.09
23 38 13 16-0077 SF 14 Gauge Stainless Steel Exhaust Hood Material.....	75.14	14.79
23 38 13 16-0078 SF 12 Gauge Stainless Steel Exhaust Hood Material.....	104.29	19.96
23 38 13 16-0079 SF 10 Gauge Stainless Steel Exhaust Hood Material.....	130.29	24.40

23 40 HVAC Air Cleaning Devices (23)



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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23 41 Particulate Air Filtration (23 40)

23 41 13 Panel Air Filters (23 41)

23 41 13 00-0001 Disposable Air Filters (23 41 13)

23 41 13 00-0002 EA Throwaway Glass Or Paper Media Filter, Residential9.34

23 41 13 00-0003 Electrostatic Air Filters With Frame, Element And Busbar (23 41 13)

23 41 13 00-0004 MF3 Electrostatic Air Filter, High Efficiency Non Supported With Frame, Element And Busbar54.48
 23 41 13 00-0005 MF3 Electrostatic Air Filter, Medium Efficiency Non Supported With Frame, Element And Busbar52.62
 23 41 13 00-0006 MF3 Electrostatic Air Filter, Glass/Paper Throwaway With Frame, Element And Busbar2.27

23 41 16 Renewable-Media Air Filters (23 41)

23 41 16 00-0001 Renewable-Media Electrostatic Air Filters With Frame, Element And Busbar (23 41 16)

23 41 16 00-0002 MF3 Electrostatic Air Filter, 5' Disposable Roll Renewable With Frame, Element And Busbar93.75

23 41 19 Washable Air Filters (23 41)

23 41 19 00-0001 Washable Electrostatic Air Filters With Frame, Element And Busbar (23 41 19)

23 41 19 00-0002 MF3 Electrostatic Air Filter, Permanent, Washable With Frame, Element And Busbar35.80

23 41 33 High-Efficiency Particulate Filtration (23 41)

23 41 33 00-0001 HEPA Filters (23 41 33)

Note: Includes particle board and kraft paper frame and separator material.

23 41 33 00-0002 HEPA Filters DOP Efficiency-95% (23 41 33 00-0001)

23 41 33 00-0003	EA 12" x 12" x 6" HEPA Filter, 95% DOP Efficiency, 150 CFM, Complete.....	93.54	
	<i>For Removal And Replacement In Existing Equipment, Add</i>	2.25	
	<i>For >10 To 25, Deduct</i>	-2.34	
	<i>For >25 To 50, Deduct</i>	-4.68	
	<i>For >50 To 100, Deduct</i>	-7.02	
	<i>For >100, Deduct</i>	-9.35	
23 41 33 00-0004	EA 24" x 12" x 6" HEPA Filter, 95% DOP Efficiency, 375 CFM, Complete.....	124.86	12.88
	<i>For Removal And Replacement In Existing Equipment, Add</i>	2.58	
	<i>For >10 To 25, Deduct</i>	-3.12	
	<i>For >25 To 50, Deduct</i>	-6.24	
	<i>For >50 To 100, Deduct</i>	-9.36	
	<i>For >100, Deduct</i>	-12.49	
23 41 33 00-0005	EA 24" x 18" x 6" HEPA Filter, 95% DOP Efficiency, 450 CFM, Complete.....	146.17	14.89
	<i>For Removal And Replacement In Existing Equipment, Add</i>	2.98	
	<i>For >10 To 25, Deduct</i>	-3.65	
	<i>For >25 To 50, Deduct</i>	-7.31	
	<i>For >50 To 100, Deduct</i>	-10.96	
	<i>For >100, Deduct</i>	-14.62	
23 41 33 00-0006	EA 24" x 24" x 6" HEPA Filter, 95% DOP Efficiency, 700 CFM, Complete.....	167.52	16.91
	<i>For Removal And Replacement In Existing Equipment, Add</i>	3.38	
	<i>For >10 To 25, Deduct</i>	-4.19	
	<i>For >25 To 50, Deduct</i>	-8.38	
	<i>For >50 To 100, Deduct</i>	-12.56	
	<i>For >100, Deduct</i>	-16.75	
23 41 33 00-0007	EA 12" x 12" x 12" HEPA Filter, 95% DOP Efficiency, 250 CFM, Complete.....	114.34	12.07
	<i>For Removal And Replacement In Existing Equipment, Add</i>	2.41	
	<i>For >10 To 25, Deduct</i>	-2.86	
	<i>For >25 To 50, Deduct</i>	-5.72	
	<i>For >50 To 100, Deduct</i>	-8.58	
	<i>For >100, Deduct</i>	-11.43	
23 41 33 00-0008	EA 24" x 12" x 12" HEPA Filter, 95% DOP Efficiency, 500 CFM, Complete.....	154.07	14.09
	<i>For Removal And Replacement In Existing Equipment, Add</i>	2.82	
	<i>For >10 To 25, Deduct</i>	-3.85	
	<i>For >25 To 50, Deduct</i>	-7.70	
	<i>For >50 To 100, Deduct</i>	-11.56	
	<i>For >100, Deduct</i>	-15.41	
23 41 33 00-0009	EA 24" x 18" x 12" HEPA Filter, 95% DOP Efficiency, 875 CFM, Complete.....	184.34	16.10
	<i>For Removal And Replacement In Existing Equipment, Add</i>	3.22	
	<i>For >10 To 25, Deduct</i>	-4.61	
	<i>For >25 To 50, Deduct</i>	-9.22	
	<i>For >50 To 100, Deduct</i>	-13.83	
	<i>For >100, Deduct</i>	-18.43	
23 41 33 00-0010	EA 24" x 24" x 12" HEPA Filter, 95% DOP Efficiency, 1,000 CFM, Complete.....	218.62	20.13
	<i>For Removal And Replacement In Existing Equipment, Add</i>	4.02	
	<i>For >10 To 25, Deduct</i>	-5.47	
	<i>For >25 To 50, Deduct</i>	-10.93	
	<i>For >50 To 100, Deduct</i>	-16.40	
	<i>For >100, Deduct</i>	-21.86	

23 41 33 00-0011 HEPA Filters DOP Efficiency-99.99% (23 41 33 00-0001)

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 40 HVAC Air Cleaning Devices****23 41 Particulate Air Filtration**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 41 33 00-0012	EA		12" x 12" x 3" HEPA Filter, 99.99% DOP Efficiency, Complete	80.04	10.06
			<i>For Removal And Replacement In Existing Equipment, Add</i>	2.01	
			<i>For >10 To 25, Deduct</i>	-2.00	
			<i>For >25 To 50, Deduct</i>	-4.00	
			<i>For >50 To 100, Deduct</i>	-6.00	
			<i>For >100, Deduct</i>	-8.00	
23 41 33 00-0013	EA		24" x 12" x 3" HEPA Filter, 99.99% DOP Efficiency, Complete	111.20	12.07
			<i>For Removal And Replacement In Existing Equipment, Add</i>	2.41	
			<i>For >10 To 25, Deduct</i>	-2.78	
			<i>For >25 To 50, Deduct</i>	-5.56	
			<i>For >50 To 100, Deduct</i>	-8.34	
			<i>For >100, Deduct</i>	-11.12	
23 41 33 00-0014	EA		24" x 24" x 3" HEPA Filter, 99.99% DOP Efficiency, Complete	171.22	14.09
			<i>For Removal And Replacement In Existing Equipment, Add</i>	2.82	
			<i>For >10 To 25, Deduct</i>	-4.28	
			<i>For >25 To 50, Deduct</i>	-8.56	
			<i>For >50 To 100, Deduct</i>	-12.84	
			<i>For >100, Deduct</i>	-17.12	
23 41 33 00-0015	EA		36" x 24" x 3" HEPA Filter, 99.99% DOP Efficiency, Complete	220.63	16.10
			<i>For Removal And Replacement In Existing Equipment, Add</i>	3.22	
			<i>For >10 To 25, Deduct</i>	-5.52	
			<i>For >25 To 50, Deduct</i>	-11.03	
			<i>For >50 To 100, Deduct</i>	-16.55	
			<i>For >100, Deduct</i>	-22.06	
23 41 33 00-0016	EA		8" x 8" x 6" HEPA Filter, 99.99% DOP Efficiency, Complete	75.96	8.04
			<i>For Removal And Replacement In Existing Equipment, Add</i>	1.61	
			<i>For >10 To 25, Deduct</i>	-1.90	
			<i>For >25 To 50, Deduct</i>	-3.80	
			<i>For >50 To 100, Deduct</i>	-5.70	
			<i>For >100, Deduct</i>	-7.60	
23 41 33 00-0017	EA		12" x 12" x 6" HEPA Filter, 99.99% DOP Efficiency, 150 CFM, Complete.....	100.63	10.86
			<i>For Removal And Replacement In Existing Equipment, Add</i>	2.17	
			<i>For >10 To 25, Deduct</i>	-2.52	
			<i>For >25 To 50, Deduct</i>	-5.03	
			<i>For >50 To 100, Deduct</i>	-7.55	
			<i>For >100, Deduct</i>	-10.06	
23 41 33 00-0018	EA		24" x 12" x 6" HEPA Filter, 99.99% DOP Efficiency, 325 CFM, Complete.....	135.87	12.88
			<i>For Removal And Replacement In Existing Equipment, Add</i>	2.58	
			<i>For >10 To 25, Deduct</i>	-3.40	
			<i>For >25 To 50, Deduct</i>	-6.79	
			<i>For >50 To 100, Deduct</i>	-10.19	
			<i>For >100, Deduct</i>	-13.59	
23 41 33 00-0019	EA		24" x 18" x 6" HEPA Filter, 99.99% DOP Efficiency, 550 CFM, Complete.....	159.52	15.09
			<i>For Removal And Replacement In Existing Equipment, Add</i>	3.02	
			<i>For >10 To 25, Deduct</i>	-3.99	
			<i>For >25 To 50, Deduct</i>	-7.98	
			<i>For >50 To 100, Deduct</i>	-11.96	
			<i>For >100, Deduct</i>	-15.95	
23 41 33 00-0020	EA		24" x 24" x 6" HEPA Filter, 99.99% DOP Efficiency, 775 CFM, Complete.....	182.37	16.91
			<i>For Removal And Replacement In Existing Equipment, Add</i>	3.38	
			<i>For >10 To 25, Deduct</i>	-4.56	
			<i>For >25 To 50, Deduct</i>	-9.12	
			<i>For >50 To 100, Deduct</i>	-13.68	
			<i>For >100, Deduct</i>	-18.24	
23 41 33 00-0021	EA		12" x 12" x 12" HEPA Filter, 99.99% DOP Efficiency, 250 CFM, Complete.....	124.36	12.07
			<i>For Removal And Replacement In Existing Equipment, Add</i>	2.41	
			<i>For >10 To 25, Deduct</i>	-3.11	
			<i>For >25 To 50, Deduct</i>	-6.22	
			<i>For >50 To 100, Deduct</i>	-9.33	
			<i>For >100, Deduct</i>	-12.44	
23 41 33 00-0022	EA		24" x 12" x 12" HEPA Filter, 99.99% DOP Efficiency, 500 CFM, Complete.....	168.06	14.09
			<i>For Removal And Replacement In Existing Equipment, Add</i>	2.82	
			<i>For >10 To 25, Deduct</i>	-4.20	
			<i>For >25 To 50, Deduct</i>	-8.40	
			<i>For >50 To 100, Deduct</i>	-12.60	
			<i>For >100, Deduct</i>	-16.81	
23 41 33 00-0023	EA		24" x 18" x 12" HEPA Filter, 99.99% DOP Efficiency, 775 CFM, Complete.....	201.24	16.10
			<i>For Removal And Replacement In Existing Equipment, Add</i>	3.22	
			<i>For >10 To 25, Deduct</i>	-5.03	
			<i>For >25 To 50, Deduct</i>	-10.06	
			<i>For >50 To 100, Deduct</i>	-15.09	
			<i>For >100, Deduct</i>	-20.12	
23 41 33 00-0024	EA		24" x 24" x 12" HEPA Filter, 99.99% DOP Efficiency, 1,100 CFM, Complete.....	247.86	20.13
			<i>For Removal And Replacement In Existing Equipment, Add</i>	4.02	
			<i>For >10 To 25, Deduct</i>	-6.20	
			<i>For >25 To 50, Deduct</i>	-12.39	
			<i>For >50 To 100, Deduct</i>	-18.59	
			<i>For >100, Deduct</i>	-24.79	
23 41 33 00-0025			HEPA Filter Housings, 14 Gauge Galvanized Sheet Metal <small>(23 41 33)</small>		
			Note: Nominal sizes.		
23 41 33 00-0026	EA		12" x 12" x 6" HEPA Filter Housings 14 Gauge Galvanized Sheet Metal	221.27	60.03
23 41 33 00-0027	EA		24" x 12" x 6" HEPA Filter Housings 14 Gauge Galvanized Sheet Metal	410.59	119.33
23 41 33 00-0028	EA		24" x 18" x 6" HEPA Filter Housings 14 Gauge Galvanized Sheet Metal	417.44	119.33
23 41 33 00-0029	EA		24" x 24" x 6" HEPA Filter Housings 14 Gauge Galvanized Sheet Metal	422.00	119.33



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 41 33 00-0030	EA			24" x 48" x 6" HEPA Filter Housings 14 Gauge Galvanized Sheet Metal	453.94	119.33
23 41 33 00-0031	EA			24" x 72" x 6" HEPA Filter Housings 14 Gauge Galvanized Sheet Metal	493.87	119.33
23 41 33 00-0032	EA			48" x 48" x 6" HEPA Filter Housings 14 Gauge Galvanized Sheet Metal	793.79	239.40
23 41 33 00-0033	EA			48" x 72" x 6" HEPA Filter Housings 14 Gauge Galvanized Sheet Metal	890.76	239.40
23 41 33 00-0034	EA			48" x 96" x 6" HEPA Filter Housings 14 Gauge Galvanized Sheet Metal	1,013.97	239.40
23 41 33 00-0035	EA			12" x 12" x 12" HEPA Filter Housings 14 Gauge Galvanized Sheet Metal	240.66	60.03
23 41 33 00-0036	EA			24" x 12" x 12" HEPA Filter Housings 14 Gauge Galvanized Sheet Metal	443.67	119.33
23 41 33 00-0037	EA			24" x 18" x 12" HEPA Filter Housings 14 Gauge Galvanized Sheet Metal	451.66	119.33
23 41 33 00-0038	EA			24" x 24" x 12" HEPA Filter Housings 14 Gauge Galvanized Sheet Metal	457.37	119.33
23 41 33 00-0039	EA			24" x 48" x 12" HEPA Filter Housings 14 Gauge Galvanized Sheet Metal	495.01	119.33
23 41 33 00-0040	EA			24" x 72" x 12" HEPA Filter Housings 14 Gauge Galvanized Sheet Metal	545.21	119.33
23 41 33 00-0041	EA			48" x 48" x 12" HEPA Filter Housings 14 Gauge Galvanized Sheet Metal	873.65	239.40
23 41 33 00-0042	EA			48" x 72" x 12" HEPA Filter Housings 14 Gauge Galvanized Sheet Metal	994.58	239.40
23 41 33 00-0043	EA			48" x 96" x 12" HEPA Filter Housings 14 Gauge Galvanized Sheet Metal	1,147.45	239.40
23 41 33 00-0044 Filter, Bag Type, 90-95% Efficiency (23 41 33)						
23 41 33 00-0045	EA			0.75 - 1.25 MCFM, 24" x 12" x 29" Filter, Bag Type, 90 - 95% Efficiency	189.67	77.82
23 41 33 00-0046	EA			1.5 - 2.5 MCFM, 24" x 24" x 29" Filter, Bag Type, 90 - 95% Efficiency	221.59	77.82
23 41 33 00-0047 Filter, Bag Type, 80-85% Efficiency (23 41 33)						
23 41 33 00-0048	EA			0.75 - 1.25 MCFM, 24" x 12" x 29" Filter, Bag Type, 80 - 85% Efficiency	186.00	77.82
23 41 33 00-0049	EA			1.5 - 2.5 MCFM, 24" x 24" x 29" Filter, Bag Type, 80 - 85% Efficiency	209.56	77.82
23 42 Gas-Phase Air Filtration (23 40)						
23 42 13 Activated-Carbon Air Filtration (23 42)						
23 42 13 00-0001	EA			12" x 24" x 1" Thick Activated Carbon Honeycomb Disposable Filter	33.73	6.04
23 42 13 00-0002	EA			16" x 20" x 1" Thick Activated Carbon Honeycomb Disposable Filter	34.12	6.04
23 42 13 00-0003	EA			16" x 25" x 1" Thick Activated Carbon Honeycomb Disposable Filter	34.36	6.04
23 42 13 00-0004	EA			20" x 20" x 1" Thick Activated Carbon Honeycomb Disposable Filter	34.36	6.04
23 42 13 00-0005	EA			20" x 25" x 1" Thick Activated Carbon Honeycomb Disposable Filter	37.36	6.04
23 42 13 00-0006	EA			24" x 24" x 1" Thick Activated Carbon Honeycomb Disposable Filter	42.28	6.04
23 42 13 00-0007	EA			12" x 24" x 2" Thick Activated Carbon Honeycomb Disposable Filter	42.77	6.85
23 42 13 00-0008	EA			16" x 20" x 2" Thick Activated Carbon Honeycomb Disposable Filter	43.10	6.85
23 42 13 00-0009	EA			16" x 25" x 2" Thick Activated Carbon Honeycomb Disposable Filter	43.39	6.85
23 42 13 00-0010	EA			20" x 20" x 2" Thick Activated Carbon Honeycomb Disposable Filter	43.39	6.85
23 42 13 00-0011	EA			20" x 25" x 2" Thick Activated Carbon Honeycomb Disposable Filter	46.70	6.85
23 42 13 00-0012	EA			24" x 24" x 2" Thick Activated Carbon Honeycomb Disposable Filter	55.92	6.85
23 42 13 00-0013	EA			16" x 20" x 1" Thick Carbon Impregnated Pleated Air Filter	20.04	6.04
23 42 13 00-0014	EA			16" x 25" x 1" Thick Carbon Impregnated Pleated Air Filter	21.46	6.04
23 42 13 00-0015	EA			20" x 20" x 1" Thick Carbon Impregnated Pleated Air Filter	21.51	6.04
23 42 13 00-0016	EA			20" x 25" x 1" Thick Carbon Impregnated Pleated Air Filter	23.37	6.04
23 42 13 00-0017	EA			24" x 24" x 1" Thick Carbon Impregnated Pleated Air Filter	25.03	6.04
23 42 13 00-0018	EA			16" x 20" x 2" Thick Carbon Impregnated Pleated Air Filter	23.24	6.85
23 42 13 00-0019	EA			16" x 25" x 2" Thick Carbon Impregnated Pleated Air Filter	25.72	6.85
23 42 13 00-0020	EA			20" x 20" x 2" Thick Carbon Impregnated Pleated Air Filter	26.24	6.85
23 42 13 00-0021	EA			20" x 25" x 2" Thick Carbon Impregnated Pleated Air Filter	29.32	6.85
23 42 13 00-0022	EA			24" x 24" x 2" Thick Carbon Impregnated Pleated Air Filter	31.28	6.85
23 42 13 00-0023	EA			24" x 24" x 4" Thick Carbon Impregnated Pleated Air Filter	52.29	7.25
23 44 Ultraviolet HVAC Microbial Control (23 40)						
23 44 00 00-0001 Double Ended Ultraviolet HVAC Microbial Control Fixtures (23 44)						
23 44 00 00-0002	EA			18" Double Ended Ultraviolet HVAC Microbial Control Fixture (Steril-Aire DE-181-VO)	433.15	53.64
Note: Includes tube.						
23 44 00 00-0003	EA			24" Double Ended Ultraviolet HVAC Microbial Control Fixture (Steril-Aire DE-241-VO)	452.35	56.30
Note: Includes tube.						
23 44 00 00-0004	EA			30" Double Ended Ultraviolet HVAC Microbial Control Fixture (Steril-Aire DE-301-VO)	455.01	58.72
Note: Includes tube.						
23 44 00 00-0005	EA			36" Double Ended Ultraviolet HVAC Microbial Control Fixture (Steril-Aire DE-361-VO)	476.22	61.69
Note: Includes tube.						
23 44 00 00-0006	EA			42" Double Ended Ultraviolet HVAC Microbial Control Fixture (Steril-Aire DE-421-VO)	514.02	64.35
Note: Includes tube.						
23 44 00 00-0007	EA			62" Double Ended Ultraviolet HVAC Microbial Control Fixture (Steril-Aire DE-621-VO)	586.37	66.35
Note: Includes tube.						
23 44 00 00-0008 Single Ended Ultraviolet HVAC Microbial Control Fixtures (23 44)						
23 44 00 00-0009	EA			12" Single Ended Ultraviolet HVAC Microbial Control Fixture (Steril-Aire SE-121-VO)	374.42	37.16
Note: Includes tube.						
23 44 00 00-0010	EA			16" Single Ended Ultraviolet HVAC Microbial Control Fixture (Steril-Aire SE-161-VO)	381.42	40.21
Note: Includes tube.						
23 44 00 00-0011	EA			20" Single Ended Ultraviolet HVAC Microbial Control Fixture (Steril-Aire SE-201-VO)	388.60	42.63
Note: Includes tube.						
23 44 00 00-0012	EA			24" Single Ended Ultraviolet HVAC Microbial Control Fixture (Steril-Aire SE-241-VO)	389.36	45.85
Note: Includes tube.						

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 40 HVAC Air Cleaning Devices****23 44 Ultraviolet HVAC Microbial Control**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 44 00 00-0013 EA 30" Single Ended Ultraviolet HVAC Microbial Control Fixture (Steril-Aire SE-301-VO) Note: Includes tube.	405.31	48.26
23 44 00 00-0014 EA 36" Single Ended Ultraviolet HVAC Microbial Control Fixture (Steril-Aire SE-361-VO) Note: Includes tube.	415.13	50.67
23 44 00 00-0015 EA 42" Single Ended Ultraviolet HVAC Microbial Control Fixture (Steril-Aire SE-421-VO) Note: Includes tube.	425.02	53.88
23 44 00 00-0016 EA 12" NEMA 4X Single Ended Ultraviolet HVAC Microbial Control Fixture (Steril-Aire SEN-121-VO) Note: Includes tube.	437.18	37.16
23 44 00 00-0017 EA 16" NEMA 4X Single Ended Ultraviolet HVAC Microbial Control Fixture (Steril-Aire SEN-161-VO) Note: Includes tube.	444.18	40.21
23 44 00 00-0018 EA 20" NEMA 4X Single Ended Ultraviolet HVAC Microbial Control Fixture (Steril-Aire SEN-201-VO) Note: Includes tube.	451.35	42.63
23 44 00 00-0019 EA 24" NEMA 4X Single Ended Ultraviolet HVAC Microbial Control Fixture (Steril-Aire SEN-241-VO) Note: Includes tube.	452.12	45.85
23 44 00 00-0020 EA 30" NEMA 4X Single Ended Ultraviolet HVAC Microbial Control Fixture (Steril-Aire SEN-301-VO) Note: Includes tube.	468.07	48.26
23 44 00 00-0021 EA 36" NEMA 4X Single Ended Ultraviolet HVAC Microbial Control Fixture (Steril-Aire SEN-361-VO) Note: Includes tube.	477.89	50.67
23 44 00 00-0022 EA 42" NEMA 4X Single Ended Ultraviolet HVAC Microbial Control Fixture (Steril-Aire SEN-421-VO) Note: Includes tube.	487.78	53.88
23 44 00 00-0023 EA 16" Residential Type Single Ended Ultraviolet HVAC Microbial Control Fixture (Steril-Aire RSE-161-VO) Note: Includes tube.	307.63	40.21
23 44 00 00-0024 EA 20" Residential Type Single Ended Ultraviolet HVAC Microbial Control Fixture (Steril-Aire RSE-201-VO) Note: Includes tube.	314.80	42.63
23 44 00 00-0025 EA 24" Residential Type Single Ended Ultraviolet HVAC Microbial Control Fixture (Steril-Aire RSE-241-VO) Note: Includes tube.	315.57	45.85
23 44 00 00-0026 EA 30" Residential Type Single Ended Ultraviolet HVAC Microbial Control Fixture (Steril-Aire RSE-301-VO) Note: Includes tube.	331.52	48.26
23 44 00 00-0027 EA 36" Residential Type Single Ended Ultraviolet HVAC Microbial Control Fixture (Steril-Aire RSE-361-VO) Note: Includes tube.	341.34	50.67
23 44 00 00-0028 EA 42" Residential Type Single Ended Ultraviolet HVAC Microbial Control Fixture (Steril-Aire RSE-421-VO) Note: Includes tube.	351.22	53.88
23 44 00 00-0029 Fan Coil Unit Ultraviolet Microbial Control Fixtures (23 44)		
23 44 00 00-0030 EA 16" Fan Coil Unit Ultraviolet Microbial Control Fixture (Steril-Aire) Note: Includes tube.	276.60	51.48
23 44 00 00-0031 EA 20" Fan Coil Unit Ultraviolet Microbial Control Fixture (Steril-Aire) Note: Includes tube.	283.56	53.88
23 44 00 00-0032 EA 24" Fan Coil Unit Ultraviolet Microbial Control Fixture (Steril-Aire) Note: Includes tube.	290.49	56.30
23 44 00 00-0033 EA 30" Fan Coil Unit Ultraviolet Microbial Control Fixture (Steril-Aire) Note: Includes tube.	299.34	58.72
23 44 00 00-0034 EA 36" Fan Coil Unit Ultraviolet Microbial Control Fixture (Steril-Aire) Note: Includes tube.	310.35	61.69
23 44 00 00-0035 EA 42" Fan Coil Unit Ultraviolet Microbial Control Fixture (Steril-Aire) Note: Includes tube.	320.23	64.35
23 44 00 00-0036 Ultraviolet HVAC Microbial Control Replacement Parts (23 44)		
23 44 00 00-0037 EA 18" Double Ended Ultraviolet HVAC Microbial Control Tube Replacement (Steril-Aire GTD-16-VO) 73.08	73.08	
23 44 00 00-0038 EA 24" Double Ended Ultraviolet HVAC Microbial Control Tube Replacement (Steril-Aire GTD-22-VO) 76.76	76.76	
23 44 00 00-0039 EA 30" Double Ended Ultraviolet HVAC Microbial Control Tube Replacement (Steril-Aire GTD-28-VO) 86.52	86.52	
23 44 00 00-0040 EA 36" Double Ended Ultraviolet HVAC Microbial Control Tube Replacement (Steril-Aire GTD-34-VO) 98.97	98.97	
23 44 00 00-0041 EA 42" Double Ended Ultraviolet HVAC Microbial Control Tube Replacement (Steril-Aire GTD-40-VO) 111.70	111.70	
23 44 00 00-0042 EA 62" Double Ended Ultraviolet HVAC Microbial Control Tube Replacement (Steril-Aire GTD-60-VO) 136.10	136.10	
23 44 00 00-0043 EA 12" Single Ended Ultraviolet HVAC Microbial Control Tube Replacement (Steril-Aire GTS-12-VO) 70.66	70.66	
23 44 00 00-0044 EA 16" Single Ended Ultraviolet HVAC Microbial Control Tube Replacement (Steril-Aire GTS-16-VO) 74.46	74.46	
23 44 00 00-0045 EA 20" Single Ended Ultraviolet HVAC Microbial Control Tube Replacement (Steril-Aire GTS-20-VO) 78.40	78.40	
23 44 00 00-0046 EA 24" Single Ended Ultraviolet HVAC Microbial Control Tube Replacement (Steril-Aire GTS-24-VO) 75.96	75.96	
23 44 00 00-0047 EA 30" Single Ended Ultraviolet HVAC Microbial Control Tube Replacement (Steril-Aire GTS-30-VO) 88.69	88.69	
23 44 00 00-0048 EA 36" Single Ended Ultraviolet HVAC Microbial Control Tube Replacement (Steril-Aire GTS-36-VO) 95.30	95.30	
23 44 00 00-0049 EA 42" Single Ended Ultraviolet HVAC Microbial Control Tube Replacement (Steril-Aire GTS-42-VO) 101.96	101.96	
23 44 00 00-0050 EA Replacement Power Supply For Ultraviolet Microbial Control Fixture (Steril-Aire) 207.21	207.21	
23 44 00 00-0051 Ultraviolet HVAC Microbial Control Mounting Accessories (23 44)		
23 44 00 00-0052 EA Two Spring Clip, 61" Emitter Kit For Ultraviolet HVAC Microbial Control Tube (Steril-Aire 11006610) 374.60 Note: Includes 61" emitter, power supply, wires and connectors.	374.60	
23 44 00 00-0053 EA Two Spring Clip, 61" Sleeved Emitter Kit For Ultraviolet HVAC Microbial Control Tube (Steril-Aire 11006620) 472.91 Note: Includes 61" emitter, power supply, wires and connectors.	472.91	
23 44 00 00-0054 EA Two Spring Clip, Air Handler Kit For Ultraviolet HVAC Microbial Control Tube (Steril-Aire 10000166-1) 224.20 Note: Includes power supply, wires and connectors. Excludes emitter.	224.20	
23 44 00 00-0055 EA Two Short Hook Air Handler Kit For Ultraviolet HVAC Microbial Control Tube (Steril-Aire 10000166-2) 236.24 Note: Includes power supply, wires and connectors. Excludes emitter.	236.24	
23 44 00 00-0056 EA Flat Plate For Metal, Air Handler Kit For Ultraviolet HVAC Microbial Control Tube (Steril-Aire 10000166-3) 291.63 Note: Includes power supply, wires and connectors. Excludes emitter.	291.63	
23 44 00 00-0057 EA Flat Plate For Plastic, Air Handler Kit For Ultraviolet HVAC Microbial Control Tube (Steril-Aire 10000166-4) 185.95 Note: Includes power supply, wires and connectors. Excludes emitter.	185.95	
23 44 00 00-0058 EA Insert Lamp Holder, Air Handler Kit For Ultraviolet HVAC Microbial Control Tube (Steril-Aire 10000166-5) 200.76 Note: Includes power supply, wires and connectors. Excludes emitter.	200.76	
23 44 00 00-0059 EA 16" U-Bracket, Air Handler Kit For Ultraviolet HVAC Microbial Control Tube (Steril-Aire 10000166-6) 265.14 Note: Includes power supply, wires and connectors. Excludes emitter.	265.14	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 44 00 00-0060 EA 12" U-Bracket, Air Handler Kit For Ultraviolet HVAC Microbial Control Tube (Steril-Aire 10000166-7) Note: Includes power supply, wires and connectors. Excludes emitter.	261.72	
23 44 00 00-0061 LF 30 x 30 mm Framing Structure For Ultraviolet HVAC Microbial Control Tube (Steril-Aire 15000101)	9.93	
23 44 00 00-0062 EA Vertical Support Kit For Ultraviolet HVAC Microbial Control Tube (Steril-Aire 15000111)	33.98	
23 44 00 00-0063 EA Joint Kit For Ultraviolet HVAC Microbial Control Tube (Steril-Aire 15000112)	12.16	
23 44 00 00-0064 EA Emitter Mounting Kit For Ultraviolet HVAC Microbial Control Tube (Steril-Aire 15000113)	11.56	
23 44 00 00-0065 EA Foundation Bracket FB 8VA For Ultraviolet HVAC Microbial Control Tube (Steril-Aire 15000104)	31.54	
23 44 00 00-0066 EA Slider Assembly Kit For Ultraviolet HVAC Microbial Control Tube (Steril-Aire 15000114)	35.42	
23 44 00 00-0067 EA Splice Kit For Horizontal Rows For Ultraviolet HVAC Microbial Control Tube (Steril-Aire 15000108)	31.63	
23 44 00 00-0068 EA Gusset Kit For Ultraviolet HVAC Microbial Control Tube (Steril-Aire 15000115)	25.93	
23 44 00 00-0069 EA ISO "A" Bracket Hanger For Ultraviolet HVAC Microbial Control Tube (Steril-Aire 15000109)	24.58	
23 44 00 00-0070 EA DE Boot Kit UV Resistant For 1 DE Fixture For Ultraviolet HVAC Microbial Control Tube (Steril-Aire 90000223)	13.95	
23 44 00 00-0071 EA DE Wiring Kit For Up To 65" (DE Bank Install) For Ultraviolet HVAC Microbial Control Tube (Steril-Aire 90000603)	27.45	
23 44 00 00-0072 EA Cleaning Kit For Ultraviolet HVAC Microbial Control Tube (Steril-Aire 90000100)	14.00	
23 44 00 00-0073 EA 480 To 220 Volt AC / 180 VA Step-Down Transformer For Ultraviolet HVAC Microbial Control Tube (Steril-Aire 90000503)	52.58	
23 44 00 00-0074 EA Interlock Switch (16 Amps At 125 Volt, 10 Amps At 250 Volt Maximum Ampacity) For Ultraviolet HVAC Microbial Control Tube (Steril-Aire 90000120)	55.13	

23 50 Central Heating Equipment ⁽²³⁾

Note: Where required, mechanical equipment excludes electrical connection, disconnect, or starter unless title states otherwise. See CSI section 26 05 19 16-0011 for electrical connection and termination, 26 05 83 00-0110 for terminations, 26 28 16 00-0001 for disconnect.

23 51 Breechings, Chimneys, And Stacks ^(23 50)

23 51 13 Draft Control Devices ^(23 51)

23 51 13 00-0001 Vertical Discharge Fans ^(23 51 13)

Note: Includes chimney adapter. Excludes wiring.

23 51 13 00-0002 Axial Vane Vertical Discharge Fans ^(23 51 13 00-0001)

23 51 13 00-0003 EA 450 CFM Vertical Discharge Chimney Fan, Axial Vane.....	3,671.92	163.05
23 51 13 00-0004 EA 950 CFM Vertical Discharge Chimney Fan, Axial Vane.....	4,173.90	177.89
23 51 13 00-0005 EA 1,400 CFM Vertical Discharge Chimney Fan, Axial Vane.....	5,037.51	196.41
23 51 13 00-0006 EA 1,800 CFM Vertical Discharge Chimney Fan, Axial Vane.....	6,629.17	227.91

23 51 13 00-0007 Centrifugal Impeller Vertical Discharge Fans ^(23 51 13 00-0001)

23 51 13 00-0008 EA 700 CFM Vertical Discharge Chimney Fan, Centrifugal Impeller.....	4,442.92	177.89
23 51 13 00-0009 EA 1,100 CFM Vertical Discharge Chimney Fan, Centrifugal Impeller.....	5,450.88	196.41
23 51 13 00-0010 EA 2,300 CFM Vertical Discharge Chimney Fan, Centrifugal Impeller.....	7,118.37	229.77
23 51 13 00-0011 EA 3,000 CFM Vertical Discharge Chimney Fan, Centrifugal Impeller.....	8,453.22	257.55

23 51 13 00-0012 Accessories For Vertical Discharge Fans ^(23 51 13 00-0001)

23 51 13 00-0013 EA Modulating Fan Controller And Sensor.....	465.42	55.59
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23 51 13 00-0014 Flue Shutter Dampers ^(23 51 13 00-0001)

23 51 13 00-0015 EA 8" Flue Size, Shutter Damper	494.41	74.12
23 51 13 00-0016 EA 9" Flue Size, Shutter Damper	533.74	78.93
23 51 13 00-0017 EA 10" Flue Size, Shutter Damper	554.74	84.49
23 51 13 00-0018 EA 12" Flue Size, Shutter Damper	607.63	91.16
23 51 13 00-0019 EA 14" Flue Size, Shutter Damper	682.54	98.94
23 51 13 00-0020 EA 16" Flue Size, Shutter Damper	739.88	107.84
23 51 13 00-0021 EA 18" Flue Size, Shutter Damper	810.84	118.59
23 51 13 00-0022 EA 20" Flue Size, Shutter Damper	901.81	131.93
23 51 13 00-0023 EA 22" Flue Size, Shutter Damper	998.73	148.23
23 51 13 00-0024 EA 24" Flue Size, Shutter Damper	1,105.29	169.36

23 51 16 Fabricated Breechings And Accessories ^(23 51)

23 51 16 00-0001 Round Galvanized Double Wall Flue/Vent Pipe And Fittings ^(23 51 16)

23 51 16 00-0002 Round Galvanized Double Wall Flue/Vent Pipe ^(23 51 16 00-0001)

23 51 16 00-0003 LF 3" Round Flue/Vent Pipe, Galvanized Double Wall Breech/Smoke Pipe.....	22.29	6.60
For Aluminum Liner, Add	0.32	
For Stainless Steel Liner, Add	0.44	
For High Temperature Breaching, Add	3.40	
For Very High Temperature Breaching, Add	5.92	
23 51 16 00-0004 LF 4" Round Flue/Vent Pipe, Galvanized Double Wall Breech/Smoke Pipe.....	24.17	6.96
For Aluminum Liner, Add	0.39	
For Stainless Steel Liner, Add	0.54	
For High Temperature Breaching, Add	3.85	
For Very High Temperature Breaching, Add	6.62	
23 51 16 00-0005 LF 5" Round Flue/Vent Pipe, Galvanized Double Wall Breech/Smoke Pipe.....	26.83	7.42
For Aluminum Liner, Add	0.47	
For Stainless Steel Liner, Add	0.64	
For High Temperature Breaching, Add	4.38	
For Very High Temperature Breaching, Add	7.49	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 50 Central Heating Equipment****23 51 Breechings, Chimneys, And Stacks**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 51 16 00-0006	LF		6" Round Flue/Vent Pipe, Galvanized Double Wall Breech/Smoke Pipe.....	29.41	7.93
			For Aluminum Liner, Add	0.54	
			For Stainless Steel Liner, Add	0.74	
			For High Temperature Breaching, Add	4.91	
			For Very High Temperature Breaching, Add	8.35	
23 51 16 00-0007	LF		7" Round Flue/Vent Pipe, Galvanized Double Wall Breech/Smoke Pipe.....	35.25	8.45
			For Aluminum Liner, Add	0.80	
			For Stainless Steel Liner, Add	1.09	
			For High Temperature Breaching, Add	6.43	
			For Very High Temperature Breaching, Add	10.68	
23 51 16 00-0008	LF		8" Round Flue/Vent Pipe, Galvanized Double Wall Breech/Smoke Pipe.....	39.18	9.12
			For Aluminum Liner, Add	0.89	
			For Stainless Steel Liner, Add	1.21	
			For High Temperature Breaching, Add	7.15	
			For Very High Temperature Breaching, Add	11.88	
23 51 16 00-0009	LF		10" Round Flue/Vent Pipe, Galvanized Double Wall Breech/Smoke Pipe.....	59.03	9.78
			For Aluminum Liner, Add	1.88	
			For Stainless Steel Liner, Add	2.56	
			For High Temperature Breaching, Add	12.73	
			For Very High Temperature Breaching, Add	20.34	
23 51 16 00-0010	LF		12" Round Flue/Vent Pipe, Galvanized Double Wall Breech/Smoke Pipe.....	72.80	10.82
			For Aluminum Liner, Add	2.52	
			For Stainless Steel Liner, Add	3.44	
			For High Temperature Breaching, Add	16.44	
			For Very High Temperature Breaching, Add	26.02	
23 51 16 00-0011	LF		14" Round Flue/Vent Pipe, Galvanized Double Wall Breech/Smoke Pipe.....	105.19	11.26
			For Aluminum Liner, Add	4.23	
			For Stainless Steel Liner, Add	5.77	
			For High Temperature Breaching, Add	25.91	
			For Very High Temperature Breaching, Add	40.28	
23 51 16 00-0012	LF		16" Round Flue/Vent Pipe, Galvanized Double Wall Breech/Smoke Pipe.....	133.26	11.86
			For Aluminum Liner, Add	5.71	
			For Stainless Steel Liner, Add	7.78	
			For High Temperature Breaching, Add	34.08	
			For Very High Temperature Breaching, Add	52.59	
23 51 16 00-0013	LF		18" Round Flue/Vent Pipe, Galvanized Double Wall Breech/Smoke Pipe.....	165.47	12.45
			For Aluminum Liner, Add	7.37	
			For Stainless Steel Liner, Add	10.05	
			For High Temperature Breaching, Add	43.35	
			For Very High Temperature Breaching, Add	66.60	
23 51 16 00-0014	LF		20" Round Flue/Vent Pipe, Galvanized Double Wall Breech/Smoke Pipe.....	207.91	19.79
			For Aluminum Liner, Add	8.75	
			For Stainless Steel Liner, Add	11.93	
			For High Temperature Breaching, Add	52.61	
			For Very High Temperature Breaching, Add	81.35	
23 51 16 00-0015	LF		22" Round Flue/Vent Pipe, Galvanized Double Wall Breech/Smoke Pipe.....	253.33	20.90
			For Aluminum Liner, Add	11.03	
			For Stainless Steel Liner, Add	15.04	
			For High Temperature Breaching, Add	65.45	
			For Very High Temperature Breaching, Add	100.81	
23 51 16 00-0016	LF		24" Round Flue/Vent Pipe, Galvanized Double Wall Breech/Smoke Pipe.....	303.31	22.24
			For Aluminum Liner, Add	13.60	
			For Stainless Steel Liner, Add	18.55	
			For High Temperature Breaching, Add	79.79	
			For Very High Temperature Breaching, Add	122.48	
23 51 16 00-0017			90 Degree Elbows <small>(23 51 16 00-0001)</small>		
23 51 16 00-0018	EA		3" Round Flue/Vent, 90 Degree Elbow, Galvanized Double Wall Breech/Smoke Pipe.....	59.47	13.19
			For Aluminum Liner, Add	1.47	
			For Stainless Steel Liner, Add	2.01	
			For High Temperature Breaching, Add	11.31	
			For Very High Temperature Breaching, Add	18.59	
23 51 16 00-0019	EA		4" Round Flue/Vent, 90 Degree Elbow, Galvanized Double Wall Breech/Smoke Pipe.....	66.37	13.93
			For Aluminum Liner, Add	1.74	
			For Stainless Steel Liner, Add	2.37	
			For High Temperature Breaching, Add	12.96	
			For Very High Temperature Breaching, Add	21.18	
23 51 16 00-0020	EA		5" Round Flue/Vent, 90 Degree Elbow, Galvanized Double Wall Breech/Smoke Pipe.....	74.65	14.82
			For Aluminum Liner, Add	2.08	
			For Stainless Steel Liner, Add	2.83	
			For High Temperature Breaching, Add	15.02	
			For Very High Temperature Breaching, Add	24.37	
23 51 16 00-0021	EA		6" Round Flue/Vent, 90 Degree Elbow, Galvanized Double Wall Breech/Smoke Pipe.....	83.07	15.79
			For Aluminum Liner, Add	2.41	
			For Stainless Steel Liner, Add	3.29	
			For High Temperature Breaching, Add	17.08	
			For Very High Temperature Breaching, Add	27.58	
23 51 16 00-0022	EA		7" Round Flue/Vent, 90 Degree Elbow, Galvanized Double Wall Breech/Smoke Pipe.....	100.69	16.90
			For Aluminum Liner, Add	3.23	
			For Stainless Steel Liner, Add	4.40	
			For High Temperature Breaching, Add	21.81	
			For Very High Temperature Breaching, Add	34.81	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 51 16 00-0023 EA 8" Round Flue/Vent, 90 Degree Elbow, Galvanized Double Wall Breech/Smoke Pipe	119.07	18.24
For Aluminum Liner, Add	4.04	
For Stainless Steel Liner, Add	5.51	
For High Temperature Breaching, Add	26.61	
For Very High Temperature Breaching, Add	42.19	
23 51 16 00-0024 EA 10" Round Flue/Vent, 90 Degree Elbow, Galvanized Double Wall Breech/Smoke Pipe	218.57	19.79
For Aluminum Liner, Add	9.30	
For Stainless Steel Liner, Add	12.68	
For High Temperature Breaching, Add	55.66	
For Very High Temperature Breaching, Add	85.97	
23 51 16 00-0025 EA 12" Round Flue/Vent, 90 Degree Elbow, Galvanized Double Wall Breech/Smoke Pipe	267.00	21.57
For Aluminum Liner, Add	11.72	
For Stainless Steel Liner, Add	15.98	
For High Temperature Breaching, Add	69.32	
For Very High Temperature Breaching, Add	106.68	
23 51 16 00-0026 EA 14" Round Flue/Vent, 90 Degree Elbow, Galvanized Double Wall Breech/Smoke Pipe	351.16	22.61
For Aluminum Liner, Add	16.21	
For Stainless Steel Liner, Add	22.10	
For High Temperature Breaching, Add	94.05	
For Very High Temperature Breaching, Add	143.90	
23 51 16 00-0027 EA 16" Round Flue/Vent, 90 Degree Elbow, Galvanized Double Wall Breech/Smoke Pipe	435.44	23.72
For Aluminum Liner, Add	20.69	
For Stainless Steel Liner, Add	28.22	
For High Temperature Breaching, Add	118.80	
For Very High Temperature Breaching, Add	181.15	
23 51 16 00-0028 EA 18" Round Flue/Vent, 90 Degree Elbow, Galvanized Double Wall Breech/Smoke Pipe	568.07	24.98
For Aluminum Liner, Add	27.81	
For Stainless Steel Liner, Add	37.92	
For High Temperature Breaching, Add	157.93	
For Very High Temperature Breaching, Add	240.01	
23 51 16 00-0029 EA 20" Round Flue/Vent, 90 Degree Elbow, Galvanized Double Wall Breech/Smoke Pipe	797.02	39.51
For Aluminum Liner, Add	38.40	
For Stainless Steel Liner, Add	52.36	
For High Temperature Breaching, Add	219.33	
For Very High Temperature Breaching, Add	333.94	
23 51 16 00-0030 EA 22" Round Flue/Vent, 90 Degree Elbow, Galvanized Double Wall Breech/Smoke Pipe	1,060.05	41.87
For Aluminum Liner, Add	52.54	
For Stainless Steel Liner, Add	71.65	
For High Temperature Breaching, Add	297.08	
For Very High Temperature Breaching, Add	450.85	
23 51 16 00-0031 EA 24" Round Flue/Vent, 90 Degree Elbow, Galvanized Double Wall Breech/Smoke Pipe	1,198.93	44.47
For Aluminum Liner, Add	59.82	
For Stainless Steel Liner, Add	81.57	
For High Temperature Breaching, Add	337.42	
For Very High Temperature Breaching, Add	511.70	
23 51 16 00-0032 45 Degree Elbows (23 51 16 00-0001)		
23 51 16 00-0033 EA 3" Round Flue/Vent, 45 Degree Elbow, Galvanized Double Wall Breech/Smoke Pipe	48.34	13.19
For Aluminum Liner, Add	0.85	
For Stainless Steel Liner, Add	1.16	
For High Temperature Breaching, Add	7.92	
For Very High Temperature Breaching, Add	13.53	
23 51 16 00-0034 EA 4" Round Flue/Vent, 45 Degree Elbow, Galvanized Double Wall Breech/Smoke Pipe	53.10	13.93
For Aluminum Liner, Add	1.00	
For Stainless Steel Liner, Add	1.36	
For High Temperature Breaching, Add	8.95	
For Very High Temperature Breaching, Add	15.17	
23 51 16 00-0035 EA 5" Round Flue/Vent, 45 Degree Elbow, Galvanized Double Wall Breech/Smoke Pipe	58.47	14.82
For Aluminum Liner, Add	1.18	
For Stainless Steel Liner, Add	1.61	
For High Temperature Breaching, Add	10.13	
For Very High Temperature Breaching, Add	17.04	
23 51 16 00-0036 EA 6" Round Flue/Vent, 45 Degree Elbow, Galvanized Double Wall Breech/Smoke Pipe	65.15	15.79
For Aluminum Liner, Add	1.41	
For Stainless Steel Liner, Add	1.92	
For High Temperature Breaching, Add	11.64	
For Very High Temperature Breaching, Add	19.44	
23 51 16 00-0037 EA 7" Round Flue/Vent, 45 Degree Elbow, Galvanized Double Wall Breech/Smoke Pipe	79.08	16.90
For Aluminum Liner, Add	2.02	
For Stainless Steel Liner, Add	2.76	
For High Temperature Breaching, Add	15.26	
For Very High Temperature Breaching, Add	25.00	
23 51 16 00-0038 EA 8" Round Flue/Vent, 45 Degree Elbow, Galvanized Double Wall Breech/Smoke Pipe	87.84	18.24
For Aluminum Liner, Add	2.32	
For Stainless Steel Liner, Add	3.17	
For High Temperature Breaching, Add	17.24	
For Very High Temperature Breaching, Add	28.13	
23 51 16 00-0039 EA 10" Round Flue/Vent, 45 Degree Elbow, Galvanized Double Wall Breech/Smoke Pipe	155.06	19.79
For Aluminum Liner, Add	5.81	
For Stainless Steel Liner, Add	7.92	
For High Temperature Breaching, Add	36.63	
For Very High Temperature Breaching, Add	57.42	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 50 Central Heating Equipment****23 51 Breechings, Chimneys, And Stacks**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 51 16 00-0040	EA		12" Round Flue/Vent, 45 Degree Elbow, Galvanized Double Wall Breech/Smoke Pipe.....	187.09	21.57
			<i>For Aluminum Liner, Add</i>	7.33	
			<i>For Stainless Steel Liner, Add</i>	9.99	
			<i>For High Temperature Breaching, Add</i>	45.35	
			<i>For Very High Temperature Breaching, Add</i>	70.72	
23 51 16 00-0041	EA		14" Round Flue/Vent, 45 Degree Elbow, Galvanized Double Wall Breech/Smoke Pipe.....	243.89	22.61
			<i>For Aluminum Liner, Add</i>	10.31	
			<i>For Stainless Steel Liner, Add</i>	14.06	
			<i>For High Temperature Breaching, Add</i>	61.87	
			<i>For Very High Temperature Breaching, Add</i>	95.63	
23 51 16 00-0042	EA		16" Round Flue/Vent, 45 Degree Elbow, Galvanized Double Wall Breech/Smoke Pipe.....	294.43	23.72
			<i>For Aluminum Liner, Add</i>	12.93	
			<i>For Stainless Steel Liner, Add</i>	17.64	
			<i>For High Temperature Breaching, Add</i>	76.48	
			<i>For Very High Temperature Breaching, Add</i>	117.68	
23 51 16 00-0043	EA		18" Round Flue/Vent, 45 Degree Elbow, Galvanized Double Wall Breech/Smoke Pipe.....	378.41	24.98
			<i>For Aluminum Liner, Add</i>	17.38	
			<i>For Stainless Steel Liner, Add</i>	23.70	
			<i>For High Temperature Breaching, Add</i>	101.04	
			<i>For Very High Temperature Breaching, Add</i>	154.68	
23 51 16 00-0044	EA		20" Round Flue/Vent, 45 Degree Elbow, Galvanized Double Wall Breech/Smoke Pipe.....	454.98	39.43
			<i>For Aluminum Liner, Add</i>	19.60	
			<i>For Stainless Steel Liner, Add</i>	26.73	
			<i>For High Temperature Breaching, Add</i>	116.78	
			<i>For Very High Temperature Breaching, Add</i>	180.10	
23 51 16 00-0045	EA		22" Round Flue/Vent, 45 Degree Elbow, Galvanized Double Wall Breech/Smoke Pipe.....	641.16	41.87
			<i>For Aluminum Liner, Add</i>	29.51	
			<i>For Stainless Steel Liner, Add</i>	40.24	
			<i>For High Temperature Breaching, Add</i>	171.41	
			<i>For Very High Temperature Breaching, Add</i>	262.35	
23 51 16 00-0046	EA		24" Round Flue/Vent, 45 Degree Elbow, Galvanized Double Wall Breech/Smoke Pipe.....	790.87	44.47
			<i>For Aluminum Liner, Add</i>	37.39	
			<i>For Stainless Steel Liner, Add</i>	50.98	
			<i>For High Temperature Breaching, Add</i>	215.04	
			<i>For Very High Temperature Breaching, Add</i>	328.12	
23 51 16 00-0047			Tees <small>(23 51 16 00-0001)</small>		
23 51 16 00-0048	EA		3" Round Flue/Vent, Tee, Galvanized Double Wall Breech/Smoke Pipe.....	81.64	17.56
			<i>For Aluminum Liner, Add</i>	2.07	
			<i>For Stainless Steel Liner, Add</i>	2.82	
			<i>For High Temperature Breaching, Add</i>	15.70	
			<i>For Very High Temperature Breaching, Add</i>	25.74	
23 51 16 00-0049	EA		4" Round Flue/Vent, Tee, Galvanized Double Wall Breech/Smoke Pipe.....	85.08	18.24
			<i>For Aluminum Liner, Add</i>	2.17	
			<i>For Stainless Steel Liner, Add</i>	2.96	
			<i>For High Temperature Breaching, Add</i>	16.41	
			<i>For Very High Temperature Breaching, Add</i>	26.89	
23 51 16 00-0050	EA		5" Round Flue/Vent, Tee, Galvanized Double Wall Breech/Smoke Pipe.....	88.78	18.97
			<i>For Aluminum Liner, Add</i>	2.27	
			<i>For Stainless Steel Liner, Add</i>	3.10	
			<i>For High Temperature Breaching, Add</i>	17.15	
			<i>For Very High Temperature Breaching, Add</i>	28.09	
23 51 16 00-0051	EA		6" Round Flue/Vent, Tee, Galvanized Double Wall Breech/Smoke Pipe.....	95.37	19.79
			<i>For Aluminum Liner, Add</i>	2.53	
			<i>For Stainless Steel Liner, Add</i>	3.44	
			<i>For High Temperature Breaching, Add</i>	18.72	
			<i>For Very High Temperature Breaching, Add</i>	30.56	
23 51 16 00-0052	EA		7" Round Flue/Vent, Tee, Galvanized Double Wall Breech/Smoke Pipe.....	114.97	20.60
			<i>For Aluminum Liner, Add</i>	3.49	
			<i>For Stainless Steel Liner, Add</i>	4.75	
			<i>For High Temperature Breaching, Add</i>	24.17	
			<i>For Very High Temperature Breaching, Add</i>	38.84	
23 51 16 00-0053	EA		8" Round Flue/Vent, Tee, Galvanized Double Wall Breech/Smoke Pipe.....	123.69	21.57
			<i>For Aluminum Liner, Add</i>	3.84	
			<i>For Stainless Steel Liner, Add</i>	5.24	
			<i>For High Temperature Breaching, Add</i>	26.33	
			<i>For Very High Temperature Breaching, Add</i>	42.19	
23 51 16 00-0054	EA		10" Round Flue/Vent, Tee, Galvanized Double Wall Breech/Smoke Pipe.....	245.70	22.61
			<i>For Aluminum Liner, Add</i>	10.41	
			<i>For Stainless Steel Liner, Add</i>	14.19	
			<i>For High Temperature Breaching, Add</i>	62.42	
			<i>For Very High Temperature Breaching, Add</i>	96.45	
23 51 16 00-0055	EA		12" Round Flue/Vent, Tee, Galvanized Double Wall Breech/Smoke Pipe.....	287.09	23.72
			<i>For Aluminum Liner, Add</i>	12.53	
			<i>For Stainless Steel Liner, Add</i>	17.09	
			<i>For High Temperature Breaching, Add</i>	74.27	
			<i>For Very High Temperature Breaching, Add</i>	114.37	
23 51 16 00-0056	EA		14" Round Flue/Vent, Tee, Galvanized Double Wall Breech/Smoke Pipe.....	436.99	26.39
			<i>For Aluminum Liner, Add</i>	20.41	
			<i>For Stainless Steel Liner, Add</i>	27.83	
			<i>For High Temperature Breaching, Add</i>	117.92	
			<i>For Very High Temperature Breaching, Add</i>	180.18	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 51 16 00-0057 EA 16" Round Flue/Vent, Tee, Galvanized Double Wall Breech/Smoke Pipe.....	599.54	29.64
<i>For Aluminum Liner, Add</i>	28.90	
<i>For Stainless Steel Liner, Add</i>	39.41	
<i>For High Temperature Breaching, Add</i>	165.04	
<i>For Very High Temperature Breaching, Add</i>	251.27	
23 51 16 00-0058 EA 18" Round Flue/Vent, Tee, Galvanized Double Wall Breech/Smoke Pipe.....	746.09	33.87
<i>For Aluminum Liner, Add</i>	36.38	
<i>For Stainless Steel Liner, Add</i>	49.61	
<i>For High Temperature Breaching, Add</i>	206.89	
<i>For Very High Temperature Breaching, Add</i>	314.57	
23 51 16 00-0059 EA 20" Round Flue/Vent, Tee, Galvanized Double Wall Breech/Smoke Pipe.....	995.62	41.87
<i>For Aluminum Liner, Add</i>	49.01	
<i>For Stainless Steel Liner, Add</i>	66.83	
<i>For High Temperature Breaching, Add</i>	277.77	
<i>For Very High Temperature Breaching, Add</i>	421.89	
23 51 16 00-0060 EA 22" Round Flue/Vent, Tee, Galvanized Double Wall Breech/Smoke Pipe.....	1,248.27	54.70
<i>For Aluminum Liner, Add</i>	61.13	
<i>For Stainless Steel Liner, Add</i>	83.36	
<i>For High Temperature Breaching, Add</i>	347.13	
<i>For Very High Temperature Breaching, Add</i>	527.53	
23 51 16 00-0061 EA 24" Round Flue/Vent, Tee, Galvanized Double Wall Breech/Smoke Pipe.....	1,439.78	57.81
<i>For Aluminum Liner, Add</i>	71.24	
<i>For Stainless Steel Liner, Add</i>	97.14	
<i>For High Temperature Breaching, Add</i>	403.03	
<i>For Very High Temperature Breaching, Add</i>	611.77	
23 51 16 00-0062 Vent Top Caps (23 51 16 00-0001)		
23 51 16 00-0063 EA 3" Round Flue/Vent Top Caps, Galvanized Double Wall Breech/Smoke Pipe	40.02	10.30
<i>For Aluminum Liner, Add</i>	0.78	
<i>For Stainless Steel Liner, Add</i>	1.07	
<i>For High Temperature Breaching, Add</i>	6.85	
<i>For Very High Temperature Breaching, Add</i>	11.56	
23 51 16 00-0064 EA 4" Round Flue/Vent Top Caps, Galvanized Double Wall Breech/Smoke Pipe	41.94	10.82
<i>For Aluminum Liner, Add</i>	0.82	
<i>For Stainless Steel Liner, Add</i>	1.12	
<i>For High Temperature Breaching, Add</i>	7.19	
<i>For Very High Temperature Breaching, Add</i>	12.13	
23 51 16 00-0065 EA 6" Round Flue/Vent Top Caps, Galvanized Double Wall Breech/Smoke Pipe	55.64	11.86
<i>For Aluminum Liner, Add</i>	1.43	
<i>For Stainless Steel Liner, Add</i>	1.95	
<i>For High Temperature Breaching, Add</i>	10.76	
<i>For Very High Temperature Breaching, Add</i>	17.63	
23 51 16 00-0066 EA 8" Round Flue/Vent Top Caps, Galvanized Double Wall Breech/Smoke Pipe	58.91	13.19
<i>For Aluminum Liner, Add</i>	1.43	
<i>For Stainless Steel Liner, Add</i>	1.95	
<i>For High Temperature Breaching, Add</i>	11.09	
<i>For Very High Temperature Breaching, Add</i>	18.28	
23 51 16 00-0067 EA 10" Round Flue/Vent Top Caps, Galvanized Double Wall Breech/Smoke Pipe	73.14	13.93
<i>For Aluminum Liner, Add</i>	2.11	
<i>For Stainless Steel Liner, Add</i>	2.87	
<i>For High Temperature Breaching, Add</i>	14.98	
<i>For Very High Temperature Breaching, Add</i>	24.21	
23 51 16 00-0068 EA 12" Round Flue/Vent Top Caps, Galvanized Double Wall Breech/Smoke Pipe	87.58	14.82
<i>For Aluminum Liner, Add</i>	2.78	
<i>For Stainless Steel Liner, Add</i>	3.79	
<i>For High Temperature Breaching, Add</i>	18.86	
<i>For Very High Temperature Breaching, Add</i>	30.15	
23 51 16 00-0069 EA 16" Round Flue/Vent Top Caps, Galvanized Double Wall Breech/Smoke Pipe	219.62	16.90
<i>For Aluminum Liner, Add</i>	9.75	
<i>For Stainless Steel Liner, Add</i>	13.30	
<i>For High Temperature Breaching, Add</i>	57.42	
<i>For Very High Temperature Breaching, Add</i>	88.25	
23 51 16 00-0070 EA 18" Round Flue/Vent Top Caps, Galvanized Double Wall Breech/Smoke Pipe	416.70	21.20
<i>For Aluminum Liner, Add</i>	20.01	
<i>For Stainless Steel Liner, Add</i>	27.28	
<i>For High Temperature Breaching, Add</i>	114.42	
<i>For Very High Temperature Breaching, Add</i>	174.28	
23 51 16 00-0071 EA 20" Round Flue/Vent Top Caps, Galvanized Double Wall Breech/Smoke Pipe	780.05	25.42
<i>For Aluminum Liner, Add</i>	39.41	
<i>For Stainless Steel Liner, Add</i>	53.74	
<i>For High Temperature Breaching, Add</i>	221.31	
<i>For Very High Temperature Breaching, Add</i>	335.14	
23 51 16 00-0072 EA 24" Round Flue/Vent Top Caps, Galvanized Double Wall Breech/Smoke Pipe	1,301.53	35.58
<i>For Aluminum Liner, Add</i>	66.69	
<i>For Stainless Steel Liner, Add</i>	90.94	
<i>For High Temperature Breaching, Add</i>	372.67	
<i>For Very High Temperature Breaching, Add</i>	563.45	
23 51 16 00-0073 Wall Thimbles (23 51 16 00-0001)		
23 51 16 00-0074 EA 3" Round Flue/Vent Wall Thimbles, Galvanized Double Wall Breech/Smoke Pipe	15.48	5.56
<i>For Aluminum Liner, Add</i>	0.09	
<i>For Stainless Steel Liner, Add</i>	0.12	
<i>For High Temperature Breaching, Add</i>	1.87	
<i>For Very High Temperature Breaching, Add</i>	3.50	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 50 Central Heating Equipment****23 51 Breechings, Chimneys, And Stacks**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 51 16 00-0075	EA		4" Round Flue/Vent Wall Thimbles, Galvanized Double Wall Breech/Smoke Pipe.....	19.54	7.11
			<i>For Aluminum Liner, Add</i>	0.09	
			<i>For Stainless Steel Liner, Add</i>	0.13	
			<i>For High Temperature Breaching, Add</i>	2.29	
			<i>For Very High Temperature Breaching, Add</i>	4.33	
23 51 16 00-0076	EA		5" Or 6" Round Flue/Vent Wall Thimbles, Galvanized Double Wall Breech/Smoke Pipe	25.97	9.56
			<i>For Aluminum Liner, Add</i>	0.11	
			<i>For Stainless Steel Liner, Add</i>	0.15	
			<i>For High Temperature Breaching, Add</i>	3.01	
			<i>For Very High Temperature Breaching, Add</i>	5.71	
23 51 16 00-0077	EA		7" Or 8" Round Flue/Vent Wall Thimbles, Galvanized Double Wall Breech/Smoke Pipe	32.57	11.86
			<i>For Aluminum Liner, Add</i>	0.16	
			<i>For Stainless Steel Liner, Add</i>	0.22	
			<i>For High Temperature Breaching, Add</i>	3.84	
			<i>For Very High Temperature Breaching, Add</i>	7.25	
23 51 16 00-0078	EA		10" Round Flue/Vent Wall Thimbles, Galvanized Double Wall Breech/Smoke Pipe.....	47.55	16.01
			<i>For Aluminum Liner, Add</i>	0.41	
			<i>For Stainless Steel Liner, Add</i>	0.56	
			<i>For High Temperature Breaching, Add</i>	6.26	
			<i>For Very High Temperature Breaching, Add</i>	11.39	
23 51 16 00-0079	EA		12" Round Flue/Vent Wall Thimbles, Galvanized Double Wall Breech/Smoke Pipe.....	60.32	19.86
			<i>For Aluminum Liner, Add</i>	0.59	
			<i>For Stainless Steel Liner, Add</i>	0.80	
			<i>For High Temperature Breaching, Add</i>	8.16	
			<i>For Very High Temperature Breaching, Add</i>	14.73	
23 51 16 00-0080	EA		14" Or 16" Round Flue/Vent Wall Thimbles, Galvanized Double Wall Breech/Smoke Pipe	77.36	23.72
			<i>For Aluminum Liner, Add</i>	0.99	
			<i>For Stainless Steel Liner, Add</i>	1.35	
			<i>For High Temperature Breaching, Add</i>	11.35	
			<i>For Very High Temperature Breaching, Add</i>	19.99	
23 51 16 00-0081	EA		18" Or 20" Round Flue/Vent Wall Thimbles, Galvanized Double Wall Breech/Smoke Pipe	102.74	28.16
			<i>For Aluminum Liner, Add</i>	1.78	
			<i>For Stainless Steel Liner, Add</i>	2.42	
			<i>For High Temperature Breaching, Add</i>	16.74	
			<i>For Very High Temperature Breaching, Add</i>	28.63	
23 51 16 00-0082	EA		22" Or 24" Round Flue/Vent Wall Thimbles, Galvanized Double Wall Breech/Smoke Pipe	142.82	31.13
			<i>For Aluminum Liner, Add</i>	3.58	
			<i>For Stainless Steel Liner, Add</i>	4.88	
			<i>For High Temperature Breaching, Add</i>	27.28	
			<i>For Very High Temperature Breaching, Add</i>	44.81	
23 51 16 00-0083			Adjustable Roof Flashing (23 51 16 00-0001)		
23 51 16 00-0084	EA		3" Round Flue/Vent Adjustable Roof Flashing, Galvanized Double Wall Breech/Smoke Pipe	43.47	13.19
			<i>For Aluminum Liner, Add</i>	0.58	
			<i>For Stainless Steel Liner, Add</i>	0.79	
			<i>For High Temperature Breaching, Add</i>	6.46	
			<i>For Very High Temperature Breaching, Add</i>	11.33	
23 51 16 00-0085	EA		4" Round Flue/Vent Adjustable Roof Flashing, Galvanized Double Wall Breech/Smoke Pipe	48.50	13.93
			<i>For Aluminum Liner, Add</i>	0.75	
			<i>For Stainless Steel Liner, Add</i>	1.02	
			<i>For High Temperature Breaching, Add</i>	7.57	
			<i>For Very High Temperature Breaching, Add</i>	13.10	
23 51 16 00-0086	EA		6" Round Flue/Vent Adjustable Roof Flashing, Galvanized Double Wall Breech/Smoke Pipe	62.28	15.79
			<i>For Aluminum Liner, Add</i>	1.25	
			<i>For Stainless Steel Liner, Add</i>	1.71	
			<i>For High Temperature Breaching, Add</i>	10.78	
			<i>For Very High Temperature Breaching, Add</i>	18.15	
23 51 16 00-0087	EA		8" Round Flue/Vent Adjustable Roof Flashing, Galvanized Double Wall Breech/Smoke Pipe	76.72	18.24
			<i>For Aluminum Liner, Add</i>	1.71	
			<i>For Stainless Steel Liner, Add</i>	2.34	
			<i>For High Temperature Breaching, Add</i>	13.90	
			<i>For Very High Temperature Breaching, Add</i>	23.13	
23 51 16 00-0088	EA		10" Round Flue/Vent Adjustable Roof Flashing, Galvanized Double Wall Breech/Smoke Pipe	134.87	19.79
			<i>For Aluminum Liner, Add</i>	4.70	
			<i>For Stainless Steel Liner, Add</i>	6.41	
			<i>For High Temperature Breaching, Add</i>	30.57	
			<i>For Very High Temperature Breaching, Add</i>	48.33	
23 51 16 00-0089	EA		12" Round Flue/Vent Adjustable Roof Flashing, Galvanized Double Wall Breech/Smoke Pipe	162.28	21.57
			<i>For Aluminum Liner, Add</i>	5.96	
			<i>For Stainless Steel Liner, Add</i>	8.13	
			<i>For High Temperature Breaching, Add</i>	37.91	
			<i>For Very High Temperature Breaching, Add</i>	59.56	
23 51 16 00-0090	EA		14" Round Flue/Vent Adjustable Roof Flashing, Galvanized Double Wall Breech/Smoke Pipe	192.50	23.72
			<i>For Aluminum Liner, Add</i>	7.33	
			<i>For Stainless Steel Liner, Add</i>	9.99	
			<i>For High Temperature Breaching, Add</i>	45.89	
			<i>For Very High Temperature Breaching, Add</i>	71.80	
23 51 16 00-0091	EA		16" Round Flue/Vent Adjustable Roof Flashing, Galvanized Double Wall Breech/Smoke Pipe	231.32	26.39
			<i>For Aluminum Liner, Add</i>	9.09	
			<i>For Stainless Steel Liner, Add</i>	12.40	
			<i>For High Temperature Breaching, Add</i>	56.20	
			<i>For Very High Temperature Breaching, Add</i>	87.60	



MINOR	TOTAL DIRECT	DEMOLITION
CSI UOM DESCRIPTION	UNIT COST	UNIT COST
23 51 16 00-0092 EA 18" Round Flue/Vent Adjustable Roof Flashing, Galvanized Double Wall Breech/Smoke Pipe	358.92	29.64
For Aluminum Liner, Add	15.66	
For Stainless Steel Liner, Add	21.36	
For High Temperature Breaching, Add	92.85	
For Very High Temperature Breaching, Add	142.98	
23 51 16 00-0093 EA 20" Round Flue/Vent Adjustable Roof Flashing, Galvanized Double Wall Breech/Smoke Pipe	389.10	39.51
For Aluminum Liner, Add	15.97	
For Stainless Steel Liner, Add	21.77	
For High Temperature Breaching, Add	96.97	
For Very High Temperature Breaching, Add	150.39	
23 51 16 00-0094 EA 22" Round Flue/Vent Adjustable Roof Flashing, Galvanized Double Wall Breech/Smoke Pipe	494.52	50.84
For Aluminum Liner, Add	20.21	
For Stainless Steel Liner, Add	27.56	
For High Temperature Breaching, Add	122.94	
For Very High Temperature Breaching, Add	190.76	
23 51 16 00-0095 EA 24" Round Flue/Vent Adjustable Roof Flashing, Galvanized Double Wall Breech/Smoke Pipe	589.16	59.30
For Aluminum Liner, Add	24.25	
For Stainless Steel Liner, Add	33.07	
For High Temperature Breaching, Add	147.10	
For Very High Temperature Breaching, Add	228.06	
23 51 16 00-0096 Galvanized Storm Collars (23 51 16 00-0001)		
23 51 16 00-0097 EA 3" Round Galvanized Storm Collar, Double Wall	16.90	5.56
For Aluminum Liner, Add	0.17	
For Stainless Steel Liner, Add	0.23	
For High Temperature Breaching, Add	2.30	
For Very High Temperature Breaching, Add	4.14	
23 51 16 00-0098 EA 4" Round Galvanized Storm Collar, Double Wall	21.29	7.11
For Aluminum Liner, Add	0.19	
For Stainless Steel Liner, Add	0.26	
For High Temperature Breaching, Add	2.83	
For Very High Temperature Breaching, Add	5.13	
23 51 16 00-0099 EA 5" Round Galvanized Storm Collar, Double Wall	25.11	8.30
For Aluminum Liner, Add	0.24	
For Stainless Steel Liner, Add	0.33	
For High Temperature Breaching, Add	3.38	
For Very High Temperature Breaching, Add	6.11	
23 51 16 00-0100 EA 6" Round Galvanized Storm Collar, Double Wall	28.95	9.49
For Aluminum Liner, Add	0.29	
For Stainless Steel Liner, Add	0.39	
For High Temperature Breaching, Add	3.94	
For Very High Temperature Breaching, Add	7.10	
23 51 16 00-0101 EA 7" Or 8" Round Galvanized Storm Collar, Double Wall	36.61	11.86
For Aluminum Liner, Add	0.38	
For Stainless Steel Liner, Add	0.52	
For High Temperature Breaching, Add	5.05	
For Very High Temperature Breaching, Add	9.06	
23 51 16 00-0102 EA 10" Round Galvanized Storm Collar, Double Wall	50.93	16.01
For Aluminum Liner, Add	0.60	
For Stainless Steel Liner, Add	0.82	
For High Temperature Breaching, Add	7.27	
For Very High Temperature Breaching, Add	12.91	
23 51 16 00-0103 EA 12" Round Galvanized Storm Collar, Double Wall	62.76	19.86
For Aluminum Liner, Add	0.72	
For Stainless Steel Liner, Add	0.98	
For High Temperature Breaching, Add	8.90	
For Very High Temperature Breaching, Add	15.83	
23 51 16 00-0104 EA 14" Or 16" Round Galvanized Storm Collar, Double Wall	81.53	23.72
For Aluminum Liner, Add	1.22	
For Stainless Steel Liner, Add	1.67	
For High Temperature Breaching, Add	12.60	
For Very High Temperature Breaching, Add	21.87	
23 51 16 00-0105 EA 18" Or 20" Round Galvanized Storm Collar, Double Wall	110.66	28.16
For Aluminum Liner, Add	2.21	
For Stainless Steel Liner, Add	3.02	
For High Temperature Breaching, Add	19.12	
For Very High Temperature Breaching, Add	32.19	
23 51 16 00-0106 EA 22" Or 24" Round Galvanized Storm Collar, Double Wall	162.62	31.13
For Aluminum Liner, Add	4.66	
For Stainless Steel Liner, Add	6.36	
For High Temperature Breaching, Add	33.22	
For Very High Temperature Breaching, Add	53.72	
23 51 16 00-0107 Oval Galvanized Double Wall Flue/Vent Pipe And Fittings (23 51 16)		
23 51 16 00-0108 Oval Galvanized Double Wall Flue/Vent Pipe (23 51 16 00-0107)		
23 51 16 00-0109 LF 4" Oval Flue/Vent Pipe, Galvanized Double Wall Breech/Smoke Pipe	30.60	6.96
For High Temperature Breaching, Add	5.70	
For Very High Temperature Breaching, Add	9.42	
23 51 16 00-0110 LF 5" Oval Flue/Vent Pipe, Galvanized Double Wall Breech/Smoke Pipe	34.03	7.42
For High Temperature Breaching, Add	6.53	
For Very High Temperature Breaching, Add	10.72	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 50 Central Heating Equipment****23 51 Breechings, Chimneys, And Stacks**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 51 16 00-0111	LF		6" Oval Flue/Vent Pipe, Galvanized Double Wall Breech/Smoke Pipe <i>For High Temperature Breaching, Add</i> <i>For Very High Temperature Breaching, Add</i>	37.92 7.42 12.12	7.93
23 51 16 00-0112			45 Degree Elbows <small>(23 51 16 00-0107)</small>		
23 51 16 00-0113	EA		4" Standard Oval Flue/Vent 45 Elbow, Galvanized Double Wall Breech/Smoke Pipe <i>For High Temperature Breaching, Add</i> <i>For Very High Temperature Breaching, Add</i>	67.71 13.08 21.43	14.45
23 51 16 00-0114	EA		5" Standard Oval Flue/Vent 45 Elbow, Galvanized Double Wall Breech/Smoke Pipe <i>For High Temperature Breaching, Add</i> <i>For Very High Temperature Breaching, Add</i>	78.99 15.25 24.98	16.90
23 51 16 00-0115	EA		6" Standard Oval Flue/Vent 45 Elbow, Galvanized Double Wall Breech/Smoke Pipe <i>For High Temperature Breaching, Add</i> <i>For Very High Temperature Breaching, Add</i>	94.93 18.92 30.76	19.12
23 51 16 00-0116	EA		4" Flat Oval Flue/Vent 45 Elbow, Galvanized Double Wall Breech/Smoke Pipe <i>For High Temperature Breaching, Add</i> <i>For Very High Temperature Breaching, Add</i>	69.29 13.56 22.14	14.45
23 51 16 00-0117	EA		5" Flat Oval Flue/Vent 45 Elbow, Galvanized Double Wall Breech/Smoke Pipe <i>For High Temperature Breaching, Add</i> <i>For Very High Temperature Breaching, Add</i>	82.83 16.40 26.71	16.90
23 51 16 00-0118	EA		6" Flat Oval Flue/Vent 45 Elbow, Galvanized Double Wall Breech/Smoke Pipe <i>For High Temperature Breaching, Add</i> <i>For Very High Temperature Breaching, Add</i>	97.41 19.66 31.88	19.12
23 51 16 00-0119			Tees <small>(23 51 16 00-0107)</small>		
23 51 16 00-0120	EA		4" Standard Oval Flue/Vent Pipe Tee, Galvanized Double Wall Breech/Smoke Pipe <i>For High Temperature Breaching, Add</i> <i>For Very High Temperature Breaching, Add</i>	115.09 23.55 38.07	21.93
23 51 16 00-0121	EA		4" Short Snout Oval Flue/Vent Tee, Galvanized Double Wall Breech/Smoke Pipe <i>For High Temperature Breaching, Add</i> <i>For Very High Temperature Breaching, Add</i>	117.57 24.29 39.18	21.93
23 51 16 00-0122	EA		5" Standard Oval Flue/Vent Pipe Tee, Galvanized Double Wall Breech/Smoke Pipe <i>For High Temperature Breaching, Add</i> <i>For Very High Temperature Breaching, Add</i>	135.14 27.94 45.06	25.20
23 51 16 00-0123	EA		6" Oval Flue/Vent Tee With Round Coupling, Galvanized Double Wall Breech/Smoke Pipe <i>For High Temperature Breaching, Add</i> <i>For Very High Temperature Breaching, Add</i>	155.12 32.42 52.16	28.24
23 51 16 00-0124			Tops/Caps And Adjustable Flashing <small>(23 51 16 00-0107)</small>		
23 51 16 00-0125	EA		4" Oval Flue/Vent Pipe Top/Cap, Galvanized Double Wall Breech/Smoke Pipe <i>For High Temperature Breaching, Add</i> <i>For Very High Temperature Breaching, Add</i>	45.14 9.97 15.85	7.11
23 51 16 00-0126	EA		6" Oval Flue/Vent Pipe Top/Cap, Galvanized Double Wall Breech/Smoke Pipe <i>For High Temperature Breaching, Add</i> <i>For Very High Temperature Breaching, Add</i>	71.81 16.76 26.34	9.56
23 51 16 00-0127	EA		4" Oval Flue/Vent Adjustable Flashing, Galvanized Double Wall Breech/Smoke Pipe <i>For High Temperature Breaching, Add</i> <i>For Very High Temperature Breaching, Add</i>	35.44 7.06 11.48	7.11
23 51 16 00-0128	EA		6" Oval Flue/Vent Adjustable Flashing, Galvanized Double Wall Breech/Smoke Pipe <i>For High Temperature Breaching, Add</i> <i>For Very High Temperature Breaching, Add</i>	62.68 14.02 22.23	9.56
23 51 16 00-0129			Storm Collars <small>(23 51 16 00-0107)</small>		
23 51 16 00-0130	EA		4" Oval Galvanized Storm Collar, Double Wall <i>For High Temperature Breaching, Add</i> <i>For Very High Temperature Breaching, Add</i>	21.29 2.83 5.13	7.11
23 51 16 00-0131	EA		5" Oval Galvanized Storm Collar, Double Wall <i>For High Temperature Breaching, Add</i> <i>For Very High Temperature Breaching, Add</i>	25.11 3.38 6.11	8.30
23 51 16 00-0132	EA		6" Oval Galvanized Storm Collar, Double Wall <i>For High Temperature Breaching, Add</i> <i>For Very High Temperature Breaching, Add</i>	28.95 3.94 7.10	9.49
23 51 16 00-0133			Round Double Wall Flue/Vent Pipe And Fittings <small>(23 51 16)</small>		
23 51 16 00-0134			Round Double Wall Flue/Vent Pipe <small>(23 51 16 00-0133)</small>		
23 51 16 00-0135	LF		6" Round Flue/Vent Pipe, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket <i>For 316 Stainless Steel, Add</i> <i>For 2" Instead Of 1" Thickness, Add</i> <i>For 3" Instead Of 1" Thickness, Add</i>	77.82 9.28 5.80 11.60	7.93
23 51 16 00-0136	LF		8" Round Flue/Vent Pipe, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket <i>For 316 Stainless Steel, Add</i> <i>For 2" Instead Of 1" Thickness, Add</i> <i>For 3" Instead Of 1" Thickness, Add</i>	93.65 11.33 7.08 14.16	9.12



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 51 16 00-0137 LF 10" Round Flue/Vent Pipe, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket.....	104.03	9.85
<i>For 316 Stainless Steel, Add</i>	12.70	
<i>For 2" Instead Of 1" Thickness, Add</i>	7.94	
<i>For 3" Instead Of 1" Thickness, Add</i>	15.87	
23 51 16 00-0138 LF 12" Round Flue/Vent Pipe, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket.....	117.39	10.75
<i>For 316 Stainless Steel, Add</i>	14.47	
<i>For 2" Instead Of 1" Thickness, Add</i>	9.05	
<i>For 3" Instead Of 1" Thickness, Add</i>	18.09	
23 51 16 00-0139 LF 14" Round Flue/Vent Pipe, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket.....	132.34	11.26
<i>For 316 Stainless Steel, Add</i>	16.66	
<i>For 2" Instead Of 1" Thickness, Add</i>	10.41	
<i>For 3" Instead Of 1" Thickness, Add</i>	20.82	
23 51 16 00-0140 LF 16" Round Flue/Vent Pipe, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket.....	139.78	11.86
<i>For 316 Stainless Steel, Add</i>	17.61	
<i>For 2" Instead Of 1" Thickness, Add</i>	11.01	
<i>For 3" Instead Of 1" Thickness, Add</i>	22.02	
23 51 16 00-0141 LF 18" Round Flue/Vent Pipe, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket.....	154.97	12.52
<i>For 316 Stainless Steel, Add</i>	19.80	
<i>For 2" Instead Of 1" Thickness, Add</i>	12.37	
<i>For 3" Instead Of 1" Thickness, Add</i>	24.75	
23 51 16 00-0142 LF 20" Round Flue/Vent Pipe, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket.....	191.09	19.79
<i>For 316 Stainless Steel, Add</i>	22.66	
<i>For 2" Instead Of 1" Thickness, Add</i>	14.17	
<i>For 3" Instead Of 1" Thickness, Add</i>	28.33	
23 51 16 00-0143 LF 24" Round Flue/Vent Pipe, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket.....	238.21	22.24
<i>For 316 Stainless Steel, Add</i>	29.22	
<i>For 2" Instead Of 1" Thickness, Add</i>	18.26	
<i>For 3" Instead Of 1" Thickness, Add</i>	36.52	
23 51 16 00-0144 90 Degree Elbows <small>(23 51 16 00-0133)</small>		
23 51 16 00-0145 EA 6" Round Flue/Vent, 90 Degree Elbow, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket.....	370.31	16.38
<i>For 316 Stainless Steel, Add</i>	65.88	
<i>For 2" Instead Of 1" Thickness, Add</i>	32.94	
<i>For 3" Instead Of 1" Thickness, Add</i>	65.88	
23 51 16 00-0146 EA 8" Round Flue/Vent, 90 Degree Elbow, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket.....	409.08	18.24
<i>For 316 Stainless Steel, Add</i>	72.70	
<i>For 2" Instead Of 1" Thickness, Add</i>	36.35	
<i>For 3" Instead Of 1" Thickness, Add</i>	72.70	
23 51 16 00-0147 EA 10" Round Flue/Vent, 90 Degree Elbow, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket.....	465.87	19.79
<i>For 316 Stainless Steel, Add</i>	83.28	
<i>For 2" Instead Of 1" Thickness, Add</i>	41.64	
<i>For 3" Instead Of 1" Thickness, Add</i>	83.28	
23 51 16 00-0148 EA 12" Round Flue/Vent, 90 Degree Elbow, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket.....	526.61	21.57
<i>For 316 Stainless Steel, Add</i>	94.55	
<i>For 2" Instead Of 1" Thickness, Add</i>	47.27	
<i>For 3" Instead Of 1" Thickness, Add</i>	94.55	
23 51 16 00-0149 EA 14" Round Flue/Vent, 90 Degree Elbow, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket.....	611.13	22.61
<i>For 316 Stainless Steel, Add</i>	110.93	
<i>For 2" Instead Of 1" Thickness, Add</i>	55.47	
<i>For 3" Instead Of 1" Thickness, Add</i>	110.93	
23 51 16 00-0150 EA 16" Round Flue/Vent, 90 Degree Elbow, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket.....	673.67	23.72
<i>For 316 Stainless Steel, Add</i>	122.88	
<i>For 2" Instead Of 1" Thickness, Add</i>	61.44	
<i>For 3" Instead Of 1" Thickness, Add</i>	122.88	
23 51 16 00-0151 EA 18" Round Flue/Vent, 90 Degree Elbow, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket.....	779.18	24.98
<i>For 316 Stainless Steel, Add</i>	143.36	
<i>For 2" Instead Of 1" Thickness, Add</i>	71.68	
<i>For 3" Instead Of 1" Thickness, Add</i>	143.36	
23 51 16 00-0152 EA 20" Round Flue/Vent, 90 Degree Elbow, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket.....	900.94	39.51
<i>For 316 Stainless Steel, Add</i>	160.42	
<i>For 2" Instead Of 1" Thickness, Add</i>	80.21	
<i>For 3" Instead Of 1" Thickness, Add</i>	160.42	
23 51 16 00-0153 EA 24" Round Flue/Vent, 90 Degree Elbow, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket.....	1,109.54	44.47
<i>For 316 Stainless Steel, Add</i>	199.67	
<i>For 2" Instead Of 1" Thickness, Add</i>	99.84	
<i>For 3" Instead Of 1" Thickness, Add</i>	199.67	

23 51 16 00-0154 45 Degree Elbows (23 51 16 00-0133)

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 50 Central Heating Equipment****23 51 Breechings, Chimneys, And Stacks**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 51 16 00-0155	EA		6" Round Flue/Vent, 45 Degree Elbow, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket	246.01	15.79
			<i>For 316 Stainless Steel, Add</i>	41.30	
			<i>For 2" Instead Of 1" Thickness, Add</i>	20.65	
			<i>For 3" Instead Of 1" Thickness, Add</i>	41.30	
23 51 16 00-0156	EA		8" Round Flue/Vent, 45 Degree Elbow, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket	281.08	18.24
			<i>For 316 Stainless Steel, Add</i>	47.10	
			<i>For 2" Instead Of 1" Thickness, Add</i>	23.55	
			<i>For 3" Instead Of 1" Thickness, Add</i>	47.10	
23 51 16 00-0157	EA		10" Round Flue/Vent, 45 Degree Elbow, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket	312.26	19.79
			<i>For 316 Stainless Steel, Add</i>	52.56	
			<i>For 2" Instead Of 1" Thickness, Add</i>	26.28	
			<i>For 3" Instead Of 1" Thickness, Add</i>	52.56	
23 51 16 00-0158	EA		12" Round Flue/Vent, 45 Degree Elbow, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket	355.96	21.57
			<i>For 316 Stainless Steel, Add</i>	60.41	
			<i>For 2" Instead Of 1" Thickness, Add</i>	30.21	
			<i>For 3" Instead Of 1" Thickness, Add</i>	60.41	
23 51 16 00-0159	EA		14" Round Flue/Vent, 45 Degree Elbow, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket	401.22	22.61
			<i>For 316 Stainless Steel, Add</i>	68.95	
			<i>For 2" Instead Of 1" Thickness, Add</i>	34.47	
			<i>For 3" Instead Of 1" Thickness, Add</i>	68.95	
23 51 16 00-0160	EA		16" Round Flue/Vent, 45 Degree Elbow, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket	450.10	23.72
			<i>For 316 Stainless Steel, Add</i>	78.16	
			<i>For 2" Instead Of 1" Thickness, Add</i>	39.08	
			<i>For 3" Instead Of 1" Thickness, Add</i>	78.16	
23 51 16 00-0161	EA		18" Round Flue/Vent, 45 Degree Elbow, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket	504.41	24.98
			<i>For 316 Stainless Steel, Add</i>	88.40	
			<i>For 2" Instead Of 1" Thickness, Add</i>	44.20	
			<i>For 3" Instead Of 1" Thickness, Add</i>	88.40	
23 51 16 00-0162	EA		20" Round Flue/Vent, 45 Degree Elbow, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket	603.99	39.51
			<i>For 316 Stainless Steel, Add</i>	101.03	
			<i>For 2" Instead Of 1" Thickness, Add</i>	50.52	
			<i>For 3" Instead Of 1" Thickness, Add</i>	101.03	
23 51 16 00-0163	EA		24" Round Flue/Vent, 45 Degree Elbow, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket	759.69	44.47
			<i>For 316 Stainless Steel, Add</i>	129.70	
			<i>For 2" Instead Of 1" Thickness, Add</i>	64.85	
			<i>For 3" Instead Of 1" Thickness, Add</i>	129.70	
23 51 16 00-0164			Tees <small>(23 51 16 00-0133)</small>		
23 51 16 00-0165	EA		6" Round Flue/Vent, Tee, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket	266.20	19.79
			<i>For 316 Stainless Steel, Add</i>	47.68	
			<i>For Tee Cap, Add</i>	60.66	
			<i>For 2" Instead Of 1" Thickness, Add</i>	21.67	
			<i>For 3" Instead Of 1" Thickness, Add</i>	43.35	
23 51 16 00-0166	EA		8" Round Flue/Vent, Tee, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket	303.05	21.57
			<i>For 316 Stainless Steel, Add</i>	54.82	
			<i>For Tee Cap, Add</i>	68.69	
			<i>For 2" Instead Of 1" Thickness, Add</i>	24.92	
			<i>For 3" Instead Of 1" Thickness, Add</i>	49.83	
23 51 16 00-0167	EA		10" Round Flue/Vent, Tee, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket	348.29	22.61
			<i>For 316 Stainless Steel, Add</i>	64.20	
			<i>For Tee Cap, Add</i>	78.13	
			<i>For 2" Instead Of 1" Thickness, Add</i>	29.18	
			<i>For 3" Instead Of 1" Thickness, Add</i>	58.37	
23 51 16 00-0168	EA		12" Round Flue/Vent, Tee, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket	400.60	23.72
			<i>For 316 Stainless Steel, Add</i>	75.09	
			<i>For Tee Cap, Add</i>	89.01	
			<i>For 2" Instead Of 1" Thickness, Add</i>	34.13	
			<i>For 3" Instead Of 1" Thickness, Add</i>	68.26	
23 51 16 00-0169	EA		14" Round Flue/Vent, Tee, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket	468.64	26.39
			<i>For 316 Stainless Steel, Add</i>	88.61	
			<i>For Tee Cap, Add</i>	103.61	
			<i>For 2" Instead Of 1" Thickness, Add</i>	40.28	
			<i>For 3" Instead Of 1" Thickness, Add</i>	80.55	
23 51 16 00-0170	EA		16" Round Flue/Vent, Tee, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket	526.32	29.64
			<i>For 316 Stainless Steel, Add</i>	99.50	
			<i>For Tee Cap, Add</i>	116.37	
			<i>For 2" Instead Of 1" Thickness, Add</i>	45.23	
			<i>For 3" Instead Of 1" Thickness, Add</i>	90.45	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 51 16 00-0171 EA 18" Round Flue/Vent, Tee, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket.....	613.69	33.87
<i>For 316 Stainless Steel, Add</i>	116.39	
<i>For Tee Cap, Add</i>	135.43	
<i>For 2" Instead Of 1" Thickness, Add</i>	52.91	
<i>For 3" Instead Of 1" Thickness, Add</i>	105.81	
23 51 16 00-0172 EA 20" Round Flue/Vent, Tee, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket.....	701.95	41.87
<i>For 316 Stainless Steel, Add</i>	131.41	
<i>For Tee Cap, Add</i>	156.09	
<i>For 2" Instead Of 1" Thickness, Add</i>	59.73	
<i>For 3" Instead Of 1" Thickness, Add</i>	119.46	
23 51 16 00-0173 EA 24" Round Flue/Vent, Tee, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket.....	890.61	59.30
<i>For 316 Stainless Steel, Add</i>	163.32	
<i>For Tee Cap, Add</i>	200.36	
<i>For 2" Instead Of 1" Thickness, Add</i>	74.24	
<i>For 3" Instead Of 1" Thickness, Add</i>	148.48	
23 51 16 00-0174 Bellows <small>(23 51 16 00-0133)</small>		
23 51 16 00-0175 EA 6" Round Flue/Vent, Bellows, Lined, 316 Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket.....	507.12	15.79
<i>For 2" Instead Of 1" Thickness, Add</i>	46.76	
<i>For 3" Instead Of 1" Thickness, Add</i>	93.52	
23 51 16 00-0176 EA 8" Round Flue/Vent, Bellows, Lined, 316 Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket.....	552.43	18.24
<i>For 2" Instead Of 1" Thickness, Add</i>	50.69	
<i>For 3" Instead Of 1" Thickness, Add</i>	101.37	
23 51 16 00-0177 EA 10" Round Flue/Vent, Bellows, Lined, 316 Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket.....	604.11	19.79
<i>For 2" Instead Of 1" Thickness, Add</i>	55.47	
<i>For 3" Instead Of 1" Thickness, Add</i>	110.93	
23 51 16 00-0178 EA 12" Round Flue/Vent, Bellows, Lined, 316 Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket.....	668.26	21.57
<i>For 2" Instead Of 1" Thickness, Add</i>	61.44	
<i>For 3" Instead Of 1" Thickness, Add</i>	122.88	
23 51 16 00-0179 EA 14" Round Flue/Vent, Bellows, Lined, 316 Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket.....	747.66	22.61
<i>For 2" Instead Of 1" Thickness, Add</i>	69.12	
<i>For 3" Instead Of 1" Thickness, Add</i>	138.24	
23 51 16 00-0180 EA 16" Round Flue/Vent, Bellows, Lined, 316 Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket.....	827.26	23.72
<i>For 2" Instead Of 1" Thickness, Add</i>	76.80	
<i>For 3" Instead Of 1" Thickness, Add</i>	153.59	
23 51 16 00-0181 EA 18" Round Flue/Vent, Bellows, Lined, 316 Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket.....	924.24	24.98
<i>For 2" Instead Of 1" Thickness, Add</i>	86.18	
<i>For 3" Instead Of 1" Thickness, Add</i>	172.37	
23 51 16 00-0182 EA 20" Round Flue/Vent, Bellows, Lined, 316 Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket.....	1,071.59	39.51
<i>For 2" Instead Of 1" Thickness, Add</i>	97.28	
<i>For 3" Instead Of 1" Thickness, Add</i>	194.55	
23 51 16 00-0183 EA 24" Round Flue/Vent, Bellows, Lined, 316 Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket.....	1,322.87	44.47
<i>For 2" Instead Of 1" Thickness, Add</i>	121.17	
<i>For 3" Instead Of 1" Thickness, Add</i>	242.34	
23 51 16 00-0184 Ventilated Roof Thimbles <small>(23 51 16 00-0133)</small>		
23 51 16 00-0185 EA 6" Round Flue/Vent, Ventilated Roof Thimble, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket.....	335.72	18.24
<i>For 316 Stainless Steel, Add</i>	29.01	
23 51 16 00-0186 EA 8" Round Flue/Vent, Ventilated Roof Thimble, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket.....	364.49	21.57
<i>For 316 Stainless Steel, Add</i>	31.06	
23 51 16 00-0187 EA 10" Round Flue/Vent, Ventilated Roof Thimble, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket.....	398.89	23.72
<i>For 316 Stainless Steel, Add</i>	33.96	
23 51 16 00-0188 EA 12" Round Flue/Vent, Ventilated Roof Thimble, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket.....	431.14	26.39
<i>For 316 Stainless Steel, Add</i>	36.52	
23 51 16 00-0189 EA 14" Round Flue/Vent, Ventilated Roof Thimble, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket.....	549.33	27.94
<i>For 316 Stainless Steel, Add</i>	47.96	
23 51 16 00-0190 EA 16" Round Flue/Vent, Ventilated Roof Thimble, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket.....	490.52	29.64
<i>For 316 Stainless Steel, Add</i>	41.64	
23 51 16 00-0191 EA 18" Round Flue/Vent, Ventilated Roof Thimble, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket.....	527.93	31.65
<i>For 316 Stainless Steel, Add</i>	44.88	
23 51 16 00-0192 EA 20" Round Flue/Vent, Ventilated Roof Thimble, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket.....	592.44	44.47
<i>For 316 Stainless Steel, Add</i>	48.13	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 50 Central Heating Equipment****23 51 Breechings, Chimneys, And Stacks**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 51 16 00-0193 EA 24" Round Flue/Vent, Ventilated Roof Thimble, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket <i>For 316 Stainless Steel, Add</i>	664.50 53.76	50.77
23 51 16 00-0194 Exit Cones <small>(23 51 16 00-0133)</small>		
23 51 16 00-0195 EA 6" Round Flue/Vent, Exit Cone, 316 Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket	232.30	10.30
23 51 16 00-0196 EA 8" Round Flue/Vent, Exit Cone, 316 Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket	244.98	11.26
23 51 16 00-0197 EA 10" Round Flue/Vent, Exit Cone, 316 Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket	263.45	11.86
23 51 16 00-0198 EA 12" Round Flue/Vent, Exit Cone, 316 Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket	275.25	12.45
23 51 16 00-0199 EA 14" Round Flue/Vent, Exit Cone, 316 Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket	303.39	12.83
23 51 16 00-0200 EA 16" Round Flue/Vent, Exit Cone, 316 Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket	331.54	13.12
23 51 16 00-0201 EA 18" Round Flue/Vent, Exit Cone, 316 Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket	402.48	13.56
23 51 16 00-0202 EA 20" Round Flue/Vent, Exit Cone, 316 Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket	502.14	25.42
23 51 16 00-0203 EA 24" Round Flue/Vent, Exit Cone, 316 Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket	631.58	27.35
23 51 16 00-0204 Vent Top Caps <small>(23 51 16 00-0133)</small>		
23 51 16 00-0205 EA 6" Round Flue/Vent Top Caps, 316 Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket	254.43	10.30
23 51 16 00-0206 EA 8" Round Flue/Vent Top Caps, 316 Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket	294.47	11.26
23 51 16 00-0207 EA 10" Round Flue/Vent Top Caps, 316 Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket	341.93	11.86
23 51 16 00-0208 EA 12" Round Flue/Vent Top Caps, 316 Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket	392.98	12.45
23 51 16 00-0209 EA 14" Round Flue/Vent Top Caps, 316 Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket	458.66	12.83
23 51 16 00-0210 EA 16" Round Flue/Vent Top Caps, 316 Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket	521.02	13.19
23 51 16 00-0211 EA 18" Round Flue/Vent Top Caps, 316 Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket	579.99	13.56
23 51 16 00-0212 EA 20" Round Flue/Vent Top Caps, 316 Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket	694.92	25.42
23 51 16 00-0213 EA 24" Round Flue/Vent Top Caps, 316 Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket	827.84	27.35
23 51 16 00-0214 Roof Support Assemblies <small>(23 51 16 00-0133)</small>		
23 51 16 00-0215 EA 6" Round Flue/Vent, Roof Support Assembly, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket <i>For 316 Stainless Steel, Add</i>	383.58 67.24	18.97
23 51 16 00-0216 EA 8" Round Flue/Vent, Roof Support Assembly, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket <i>For 316 Stainless Steel, Add</i>	423.40 73.38	22.61
23 51 16 00-0217 EA 10" Round Flue/Vent, Roof Support Assembly, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket <i>For 316 Stainless Steel, Add</i>	465.13 80.55	24.98
23 51 16 00-0218 EA 12" Round Flue/Vent, Roof Support Assembly, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket <i>For 316 Stainless Steel, Add</i>	496.36 85.33	27.87
23 51 16 00-0219 EA 14" Round Flue/Vent, Roof Support Assembly, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket <i>For 316 Stainless Steel, Add</i>	553.68 95.91	29.64
23 51 16 00-0220 EA 16" Round Flue/Vent, Roof Support Assembly, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket <i>For 316 Stainless Steel, Add</i>	587.64 101.71	31.65
23 51 16 00-0221 EA 18" Round Flue/Vent, Roof Support Assembly, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket <i>For 316 Stainless Steel, Add</i>	630.90 109.22	33.94
23 51 16 00-0222 EA 20" Round Flue/Vent, Roof Support Assembly, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket <i>For 316 Stainless Steel, Add</i>	698.84 116.05	47.44
23 51 16 00-0223 EA 24" Round Flue/Vent, Roof Support Assembly, Stainless Steel/Aluminum Flue/Vent Pipe, Stainless Steel Inner Wall/Aluminum Steel Outer Jacket <i>For 316 Stainless Steel, Add</i>	785.36 129.70	54.77
23 51 16 00-0224 Round Stainless Steel Double Wall Flue/Vent Pipe And Fittings <small>(23 51 16)</small> Note: With 1" insulation.		
23 51 16 00-0225 Round Stainless Steel Double Wall Flue/Vent Pipe <small>(23 51 16 00-0224)</small> Note: With 1" insulation.		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 51 16 00-0226 LF 6" Round Flue/Vent Pipe, Stainless Steel Flue/Vent Pipe <i>For 2" Instead Of 1" Thickness, Add</i> <i>For 3" Instead Of 1" Thickness, Add</i>	67.59 4.78 9.56	7.93
23 51 16 00-0227 LF 7" Round Flue/Vent Pipe, Stainless Steel Flue/Vent Pipe <i>For 2" Instead Of 1" Thickness, Add</i> <i>For 3" Instead Of 1" Thickness, Add</i>	82.63 6.14 12.29	8.45
23 51 16 00-0228 LF 8" Round Flue/Vent Pipe, Stainless Steel Flue/Vent Pipe <i>For 2" Instead Of 1" Thickness, Add</i> <i>For 3" Instead Of 1" Thickness, Add</i>	94.51 7.17 14.34	9.12
23 51 16 00-0229 LF 10" Round Flue/Vent Pipe, Stainless Steel Flue/Vent Pipe <i>For 2" Instead Of 1" Thickness, Add</i> <i>For 3" Instead Of 1" Thickness, Add</i>	128.73 10.41 20.82	9.85
23 51 16 00-0230 LF 12" Round Flue/Vent Pipe, Stainless Steel Flue/Vent Pipe <i>For 2" Instead Of 1" Thickness, Add</i> <i>For 3" Instead Of 1" Thickness, Add</i>	166.92 13.99 27.99	10.82
23 51 16 00-0231 LF 14" Round Flue/Vent Pipe, Stainless Steel Flue/Vent Pipe <i>For 2" Instead Of 1" Thickness, Add</i> <i>For 3" Instead Of 1" Thickness, Add</i>	212.61 18.43 36.86	11.34
23 51 16 00-0232 90 Degree Elbows <small>(23 51 16 00-0224)</small>		
23 51 16 00-0233 EA 6" Round Flue/Vent, 90 Degree Elbow, Stainless Steel Flue/Vent Pipe <i>For 2" Instead Of 1" Thickness, Add</i> <i>For 3" Instead Of 1" Thickness, Add</i>	146.20 10.67 21.33	15.79
23 51 16 00-0234 EA 7" Round Flue/Vent, 90 Degree Elbow, Stainless Steel Flue/Vent Pipe <i>For 2" Instead Of 1" Thickness, Add</i> <i>For 3" Instead Of 1" Thickness, Add</i>	161.78 11.95 23.89	16.90
23 51 16 00-0235 EA 8" Round Flue/Vent, 90 Degree Elbow, Stainless Steel Flue/Vent Pipe <i>For 2" Instead Of 1" Thickness, Add</i> <i>For 3" Instead Of 1" Thickness, Add</i>	182.13 13.65 27.31	18.24
23 51 16 00-0236 EA 10" Round Flue/Vent, 90 Degree Elbow, Stainless Steel Flue/Vent Pipe <i>For 2" Instead Of 1" Thickness, Add</i> <i>For 3" Instead Of 1" Thickness, Add</i>	226.93 17.75 35.50	19.79
23 51 16 00-0237 EA 12" Round Flue/Vent, 90 Degree Elbow, Stainless Steel Flue/Vent Pipe <i>For 2" Instead Of 1" Thickness, Add</i> <i>For 3" Instead Of 1" Thickness, Add</i>	270.63 21.67 43.35	21.57
23 51 16 00-0238 EA 14" Round Flue/Vent, 90 Degree Elbow, Stainless Steel Flue/Vent Pipe <i>For 2" Instead Of 1" Thickness, Add</i> <i>For 3" Instead Of 1" Thickness, Add</i>	315.84 25.94 51.88	22.61
23 51 16 00-0239 45 Degree Elbows <small>(23 51 16 00-0224)</small>		
23 51 16 00-0240 EA 6" Round Flue/Vent, 45 Degree Elbow, Stainless Steel Flue/Vent Pipe <i>For 2" Instead Of 1" Thickness, Add</i> <i>For 3" Instead Of 1" Thickness, Add</i>	119.54 8.00 16.00	15.79
23 51 16 00-0241 EA 7" Round Flue/Vent, 45 Degree Elbow, Stainless Steel Flue/Vent Pipe <i>For 2" Instead Of 1" Thickness, Add</i> <i>For 3" Instead Of 1" Thickness, Add</i>	131.92 8.96 17.92	16.90
23 51 16 00-0242 EA 8" Round Flue/Vent, 45 Degree Elbow, Stainless Steel Flue/Vent Pipe <i>For 2" Instead Of 1" Thickness, Add</i> <i>For 3" Instead Of 1" Thickness, Add</i>	148.01 10.24 20.48	18.24
23 51 16 00-0243 EA 10" Round Flue/Vent, 45 Degree Elbow, Stainless Steel Flue/Vent Pipe <i>For 2" Instead Of 1" Thickness, Add</i> <i>For 3" Instead Of 1" Thickness, Add</i>	182.56 13.31 26.62	19.79
23 51 16 00-0244 EA 12" Round Flue/Vent, 45 Degree Elbow, Stainless Steel Flue/Vent Pipe <i>For 2" Instead Of 1" Thickness, Add</i> <i>For 3" Instead Of 1" Thickness, Add</i>	216.43 16.26 32.51	21.57
23 51 16 00-0245 EA 14" Round Flue/Vent, 45 Degree Elbow, Stainless Steel Flue/Vent Pipe <i>For 2" Instead Of 1" Thickness, Add</i> <i>For 3" Instead Of 1" Thickness, Add</i>	251.03 19.46 38.91	22.61
23 51 16 00-0246 Tees With Tee Caps <small>(23 51 16 00-0224)</small>		
23 51 16 00-0247 EA 6" Round Flue/Vent, Tee, Stainless Steel Flue/Vent Pipe <i>For 2" Instead Of 1" Thickness, Add</i> <i>For 3" Instead Of 1" Thickness, Add</i>	240.88 20.14 40.28	15.79
23 51 16 00-0248 EA 7" Round Flue/Vent, Tee, Stainless Steel Flue/Vent Pipe <i>For 2" Instead Of 1" Thickness, Add</i> <i>For 3" Instead Of 1" Thickness, Add</i>	305.14 26.28 52.56	16.90
23 51 16 00-0249 EA 8" Round Flue/Vent, Tee, Stainless Steel Flue/Vent Pipe <i>For 2" Instead Of 1" Thickness, Add</i> <i>For 3" Instead Of 1" Thickness, Add</i>	342.53 29.70 59.39	18.24
23 51 16 00-0250 EA 10" Round Flue/Vent, Tee, Stainless Steel Flue/Vent Pipe <i>For 2" Instead Of 1" Thickness, Add</i> <i>For 3" Instead Of 1" Thickness, Add</i>	467.51 41.81 83.62	19.79
23 51 16 00-0251 EA 12" Round Flue/Vent, Tee, Stainless Steel Flue/Vent Pipe <i>For 2" Instead Of 1" Thickness, Add</i> <i>For 3" Instead Of 1" Thickness, Add</i>	642.64 58.88 117.76	21.57
23 51 16 00-0252 EA 14" Round Flue/Vent, Tee, Stainless Steel Flue/Vent Pipe <i>For 2" Instead Of 1" Thickness, Add</i> <i>For 3" Instead Of 1" Thickness, Add</i>	824.39 76.80 153.59	22.61
23 51 16 00-0253 Joist Shields <small>(23 51 16 00-0224)</small>		

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 50 Central Heating Equipment****23 51 Breechings, Chimneys, And Stacks**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 51 16 00-0254 EA 6" Round Flue/Vent, Joist Shield, Stainless Steel Flue/Vent Pipe	100.95	15.79
23 51 16 00-0255 EA 7" Round Flue/Vent, Joist Shield, Stainless Steel Flue/Vent Pipe	108.88	16.90
23 51 16 00-0256 EA 8" Round Flue/Vent, Joist Shield, Stainless Steel Flue/Vent Pipe	127.50	18.24
23 51 16 00-0257 EA 10" Round Flue/Vent, Joist Shield, Stainless Steel Flue/Vent Pipe	159.54	19.79
23 51 16 00-0258 EA 12" Round Flue/Vent, Joist Shield, Stainless Steel Flue/Vent Pipe	191.26	21.57
23 51 16 00-0259 EA 14" Round Flue/Vent, Joist Shield, Stainless Steel Flue/Vent Pipe	227.10	22.61
23 51 16 00-0260 Adjustable Roof Flashing (23 51 16 00-0224)		
23 51 16 00-0261 EA 6" Round Flue/Vent, Adjustable Roof Flashing, Stainless Steel Flue/Vent Pipe	120.57	15.79
23 51 16 00-0262 EA 7" Round Flue/Vent, Adjustable Roof Flashing, Stainless Steel Flue/Vent Pipe	134.48	16.90
23 51 16 00-0263 EA 8" Round Flue/Vent, Adjustable Roof Flashing, Stainless Steel Flue/Vent Pipe	146.26	18.24
23 51 16 00-0264 EA 10" Round Flue/Vent, Adjustable Roof Flashing, Stainless Steel Flue/Vent Pipe	178.30	19.79
23 51 16 00-0265 EA 12" Round Flue/Vent, Adjustable Roof Flashing, Stainless Steel Flue/Vent Pipe	220.32	21.57
23 51 16 00-0266 EA 14" Round Flue/Vent, Adjustable Roof Flashing, Stainless Steel Flue/Vent Pipe	264.63	22.53
23 51 16 00-0267 Vent Top Caps (23 51 16 00-0224)		
23 51 16 00-0268 EA 6" Round Flue/Vent Top Caps, Stainless Steel Flue/Vent Pipe	107.77	15.79
23 51 16 00-0269 EA 7" Round Flue/Vent Top Caps, Stainless Steel Flue/Vent Pipe	135.33	16.90
23 51 16 00-0270 EA 8" Round Flue/Vent Top Caps, Stainless Steel Flue/Vent Pipe	170.16	18.24
23 51 16 00-0271 EA 10" Round Flue/Vent Top Caps, Stainless Steel Flue/Vent Pipe	273.04	19.79
23 51 16 00-0272 EA 12" Round Flue/Vent Top Caps, Stainless Steel Flue/Vent Pipe	373.06	21.57
23 51 16 00-0273 EA 14" Round Flue/Vent Top Caps, Stainless Steel Flue/Vent Pipe	476.29	22.61
23 51 16 00-0274 Roof Support Assemblies (23 51 16 00-0224)		
23 51 16 00-0275 EA 6" Round Flue/Vent, Roof Support Assembly, Stainless Steel Flue/Vent Pipe	161.47	15.79
23 51 16 00-0276 EA 7" Round Flue/Vent, Roof Support Assembly, Stainless Steel Flue/Vent Pipe	179.70	16.90
23 51 16 00-0277 EA 8" Round Flue/Vent, Roof Support Assembly, Stainless Steel Flue/Vent Pipe	194.90	18.24
23 51 16 00-0278 EA 10" Round Flue/Vent, Roof Support Assembly, Stainless Steel Flue/Vent Pipe	245.66	19.79
23 51 16 00-0279 EA 12" Round Flue/Vent, Roof Support Assembly, Stainless Steel Flue/Vent Pipe	291.11	21.57
23 51 16 00-0280 EA 14" Round Flue/Vent, Roof Support Assembly, Stainless Steel Flue/Vent Pipe	356.82	22.61
23 51 16 00-0281 Polyvinyl Chloride (PVC) Flue/Vent Accessories (23 51 16)		
23 51 16 00-0282 Concentric Polyvinyl Chloride (PVC) Vent Termination (23 51 16 00-0281)		
23 51 16 00-0283 EA 2" Concentric Polyvinyl Chloride (PVC) Vent Termination	134.02	30.19
23 51 16 00-0284 EA 3" Concentric Polyvinyl Chloride (PVC) Vent Termination	144.55	30.19
23 51 16 00-0285 Polypropylene (PP) Flue/Vent Pipe And Fittings (23 51 16)		
Note: Centrotherm InnoFlue® Vent System		
23 51 16 00-0286 Polypropylene Flue/Vent Rigid Pipe Sections (23 51 16 00-0285)		
Note: Gasketed rigid single wall polypropylene vent lengths with dedicated male and female ends.		
23 51 16 00-0287 EA 2" x 12" Polypropylene Flue/Vent Rigid Pipe Section	27.06	9.17
23 51 16 00-0288 EA 2" x 24" Polypropylene Flue/Vent Rigid Pipe Section	30.44	9.65
23 51 16 00-0289 EA 2" x 36" Polypropylene Flue/Vent Rigid Pipe Section	34.76	10.72
23 51 16 00-0290 EA 2" x 72" Polypropylene Flue/Vent Rigid Pipe Section	42.88	12.61
23 51 16 00-0291 EA 3" x 12" Polypropylene Flue/Vent Rigid Pipe Section	32.32	10.51
23 51 16 00-0292 EA 3" x 24" Polypropylene Flue/Vent Rigid Pipe Section	38.35	11.06
23 51 16 00-0293 EA 3" x 36" Polypropylene Flue/Vent Rigid Pipe Section	46.54	12.29
23 51 16 00-0294 EA 3" x 72" Polypropylene Flue/Vent Rigid Pipe Section	57.25	14.46
23 51 16 00-0295 EA 4" x 12" Polypropylene Flue/Vent Rigid Pipe Section	52.01	13.90
23 51 16 00-0296 EA 4" x 24" Polypropylene Flue/Vent Rigid Pipe Section	60.70	14.63
23 51 16 00-0297 EA 4" x 36" Polypropylene Flue/Vent Rigid Pipe Section	74.70	16.26
23 51 16 00-0298 EA 4" x 72" Polypropylene Flue/Vent Rigid Pipe Section	96.00	19.13
23 51 16 00-0299 EA 5" x 12" Polypropylene Flue/Vent Rigid Pipe Section	77.11	20.52
23 51 16 00-0300 EA 5" x 24" Polypropylene Flue/Vent Rigid Pipe Section	87.43	21.60
23 51 16 00-0301 EA 5" x 36" Polypropylene Flue/Vent Rigid Pipe Section	112.01	24.00
23 51 16 00-0302 EA 5" x 72" Polypropylene Flue/Vent Rigid Pipe Section	144.40	28.24
23 51 16 00-0303 Polypropylene Flue/Vent Elbows (23 51 16 00-0285)		
Note: Gasketed rigid single wall polypropylene vent fittings with dedicated male and female ends.		
23 51 16 00-0304 EA 2" Polypropylene Flue/Vent 15 Degree Elbow	33.37	11.14
23 51 16 00-0305 EA 3" Polypropylene Flue/Vent 15 Degree Elbow	38.50	11.73
23 51 16 00-0306 EA 4" Polypropylene Flue/Vent 15 Degree Elbow	47.07	12.15
23 51 16 00-0307 EA 5" Polypropylene Flue/Vent 15 Degree Elbow	54.06	12.66
23 51 16 00-0308 EA 2" Polypropylene Flue/Vent 30 Degree Elbow	33.37	11.14
23 51 16 00-0309 EA 3" Polypropylene Flue/Vent 30 Degree Elbow	38.50	11.73
23 51 16 00-0310 EA 4" Polypropylene Flue/Vent 30 Degree Elbow	47.07	12.15
23 51 16 00-0311 EA 5" Polypropylene Flue/Vent 30 Degree Elbow	54.06	12.66
23 51 16 00-0312 EA 2" Polypropylene Flue/Vent 45 Degree Elbow	33.37	11.14
23 51 16 00-0313 EA 3" Polypropylene Flue/Vent 45 Degree Elbow	38.50	11.73
23 51 16 00-0314 EA 4" Polypropylene Flue/Vent 45 Degree Elbow	47.07	12.15
23 51 16 00-0315 EA 5" Polypropylene Flue/Vent 45 Degree Elbow	54.06	12.66
23 51 16 00-0316 EA 2" Polypropylene Flue/Vent 87 Degree Elbow	33.37	11.14
23 51 16 00-0317 EA 3" Polypropylene Flue/Vent 87 Degree Elbow	38.50	11.73



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 51 16 00-0318 EA 4" Polypropylene Flue/Vent 87 Degree Elbow	46.55	12.15
23 51 16 00-0319 EA 5" Polypropylene Flue/Vent 87 Degree Elbow	55.34	12.66
23 51 16 00-0320 Polypropylene Flue/Vent Tees (23 51 16 00-0285) Note: Gasketed rigid single wall polypropylene vent fittings with dedicated male and female ends.		
23 51 16 00-0321 EA 2" Polypropylene Flue/Vent Tee	96.40	16.72
23 51 16 00-0322 EA 3" Polypropylene Flue/Vent Tee	119.71	17.59
23 51 16 00-0323 EA 4" Polypropylene Flue/Vent Tee	139.49	18.24
23 51 16 00-0324 EA 5" Polypropylene Flue/Vent Tee	152.23	18.97
23 51 16 00-0325 Polypropylene Flue/Vent Adaptors (23 51 16 00-0285) Note: Gasketed rigid single wall polypropylene vent fittings with dedicated male and female ends.		
23 51 16 00-0326 EA 2" Polypropylene Flue/Vent Adaptor With Gasket	38.43	11.14
23 51 16 00-0327 EA 3" Polypropylene Flue/Vent Adaptor With Gasket	53.23	11.73
23 51 16 00-0328 EA 4" Polypropylene Flue/Vent Adaptor With Gasket	61.33	12.15
23 51 16 00-0329 EA 5" Polypropylene Flue/Vent Adaptor With Gasket	81.94	12.66
23 51 16 00-0330 Polypropylene Flue/Vent Increases (23 51 16 00-0285) Note: Gasketed rigid single wall polypropylene vent fittings with dedicated male and female ends.		
23 51 16 00-0331 EA 2" to 3" Polypropylene Flue/Vent Centric Increaser	42.18	11.44
23 51 16 00-0332 EA 3" to 4" Polypropylene Flue/Vent Centric Increaser	45.95	11.94
23 51 16 00-0333 EA 4" to 5" Polypropylene Flue/Vent Centric Increaser	78.73	12.40
23 51 16 00-0334 EA 2" to 3" Polypropylene Flue/Vent Eccentric Increaser	55.16	11.44
23 51 16 00-0335 EA 3" to 4" Polypropylene Flue/Vent Eccentric Increaser	44.89	11.94
23 51 16 00-0336 EA 4" to 5" Polypropylene Flue/Vent Eccentric Increaser	106.45	12.40
23 51 16 00-0337 Polypropylene Flue/Vent Reducers (23 51 16 00-0285) Note: Gasketed rigid single wall polypropylene vent fittings with dedicated male and female ends.		
23 51 16 00-0338 EA 3" to 2" Polypropylene Flue/Vent Reducer	42.18	11.44
23 51 16 00-0339 EA 4" to 3" Polypropylene Flue/Vent Reducer	45.95	11.94
23 51 16 00-0340 EA 5" to 4" Polypropylene Flue/Vent Reducer	96.01	12.40
23 51 16 00-0341 Polypropylene Flue/Vent Test Ports (23 51 16 00-0285) Note: Gasketed rigid single wall polypropylene vent fittings with dedicated male and female ends.		
23 51 16 00-0342 EA 2" Polypropylene Flue/Vent Test Port	54.47	16.72
23 51 16 00-0343 EA 3" Polypropylene Flue/Vent Test Port	60.60	17.59
23 51 16 00-0344 EA 4" Polypropylene Flue/Vent Test Port	88.99	18.24
23 51 16 00-0345 EA 5" Polypropylene Flue/Vent Test Port	94.81	18.97
23 51 16 00-0346 Polypropylene Flue/Vent Cascade Components (23 51 16 00-0285) Note: Gasketed rigid single wall polypropylene vent fittings with dedicated male and female ends.		
23 51 16 00-0347 EA 4" x 15" Polypropylene Flue/Vent Branch Tee With 4" Feeder	141.82	18.24
23 51 16 00-0348 EA 4" x 42" Polypropylene Flue/Vent Branch Tee With 4" Feeder	185.26	22.79
23 51 16 00-0349 EA 5" x 12" Polypropylene Flue/Vent Branch Tee With 4" Feeder	118.38	18.97
23 51 16 00-0350 EA 5" x 42" Polypropylene Flue/Vent Branch Tee With 4" Feeder	173.45	23.72
23 51 16 00-0351 EA 3" to 4" Polypropylene Flue/Vent Non-Return Valve	176.10	11.94
23 51 16 00-0352 EA 4" to 4" Polypropylene Flue/Vent Non-Return Valve	203.26	12.40
23 51 16 00-0353 Polypropylene Flue/Vent Condensate Management (23 51 16 00-0285) Note: Gasketed rigid single wall polypropylene vent fittings with dedicated male and female ends.		
23 51 16 00-0354 EA 2" Polypropylene Flue/Vent Horizontal Drain Tee	72.00	16.72
23 51 16 00-0355 EA 3" Polypropylene Flue/Vent Horizontal Drain Tee	85.88	17.59
23 51 16 00-0356 EA 4" Polypropylene Flue/Vent Horizontal Drain Tee	97.53	18.24
23 51 16 00-0357 EA 5" Polypropylene Flue/Vent Horizontal Drain Tee	110.50	18.97
23 51 16 00-0358 EA 4" Polypropylene Flue/Vent Horizontal Drain Fittings	121.25	18.24
23 51 16 00-0359 EA 5" Polypropylene Flue/Vent Horizontal Drain Fittings	133.19	18.97
23 51 16 00-0360 EA 2" Polypropylene Flue/Vent Tee Cap	39.72	5.57
23 51 16 00-0361 EA 3" Polypropylene Flue/Vent Tee Cap	50.44	5.86
23 51 16 00-0362 EA 4" Polypropylene Flue/Vent Tee Cap	59.55	6.08
23 51 16 00-0363 EA 5" Polypropylene Flue/Vent Tee Cap	77.08	6.32
23 51 16 00-0364 EA 2" Polypropylene Flue/Vent Tee Cap With Drain	79.58	16.72
23 51 16 00-0365 EA 3" Polypropylene Flue/Vent Tee Cap With Drain	96.40	17.59
23 51 16 00-0366 EA 4" Polypropylene Flue/Vent Tee Cap With Drain	110.58	18.24
23 51 16 00-0367 EA 5" Polypropylene Flue/Vent Tee Cap With Drain	131.94	18.97
23 51 16 00-0368 Polypropylene Flue/Vent Terminations (23 51 16 00-0285)		
23 51 16 00-0369 EA 2" Polypropylene-UV Black Flue/Vent Chimney Cover	98.83	11.14
23 51 16 00-0370 EA 3" Polypropylene-UV Black Flue/Vent Chimney Cover	88.02	11.73
23 51 16 00-0371 EA 4" Polypropylene-UV Black Flue/Vent Chimney Cover	109.05	12.15
23 51 16 00-0372 EA 3" Stainless Steel Chimney Cover With Polypropylene-UV Black End Pipe	217.03	11.73
23 51 16 00-0373 EA 4" Stainless Steel Chimney Cover With Polypropylene-UV Black End Pipe	231.58	12.15
23 51 16 00-0374 EA 5" Stainless Steel Chimney Cover With Polypropylene-UV Black End Pipe	269.67	12.66
23 51 16 00-0375 EA 2"/4" Polypropylene-UV Black Flue/Vent B-Vent Chimney Cover Rain Collar	60.35	11.14

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 50 Central Heating Equipment****23 51 Breechings, Chimneys, And Stacks**MINOR
CSI UOM DESCRIPTIONTOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

23 51 16 00-0376	EA	2 1/2" Polypropylene-UV Black Flue/Vent B-Vent Chimney Cover Rain Collar	63.60	11.14
23 51 16 00-0377	EA	2 1/2" Polypropylene-UV Black Flue/Vent B-Vent Chimney Cover Rain Collar	66.85	11.14
23 51 16 00-0378	EA	2 1/2" Polypropylene-UV Black Flue/Vent B-Vent Chimney Cover Rain Collar	70.10	11.14
23 51 16 00-0379	EA	3 1/4" Polypropylene-UV Black Flue/Vent B-Vent Chimney Cover Rain Collar	65.07	11.73
23 51 16 00-0380	EA	3 1/2" Polypropylene-UV Black Flue/Vent B-Vent Chimney Cover Rain Collar	68.32	11.73
23 51 16 00-0381	EA	3 1/2" Polypropylene-UV Black Flue/Vent B-Vent Chimney Cover Rain Collar	71.57	11.73
23 51 16 00-0382	EA	3 1/2" Polypropylene-UV Black Flue/Vent B-Vent Chimney Cover Rain Collar	74.82	11.73
23 51 16 00-0383	EA	4 1/2" Polypropylene-UV Black Flue/Vent B-Vent Chimney Cover Rain Collar	72.64	12.15
23 51 16 00-0384	EA	4 1/2" Polypropylene-UV Black Flue/Vent B-Vent Chimney Cover Rain Collar	75.89	12.15
23 51 16 00-0385	EA	4 1/2" Polypropylene-UV Black Flue/Vent B-Vent Chimney Cover Rain Collar	79.14	12.15
23 51 16 00-0386	EA	2" Polypropylene-UV Black Flue/Vent Low Profile Wall Termination	63.57	11.14
23 51 16 00-0387	EA	3" Polypropylene-UV Black Flue/Vent Low Profile Wall Termination	80.34	11.73
23 51 16 00-0388	EA	2" Polypropylene-UV Black Flue/Vent Termination Tee	75.52	16.72
23 51 16 00-0389	EA	3" Polypropylene-UV Black Flue/Vent Termination Tee	97.54	17.59
23 51 16 00-0390	EA	4" Polypropylene-UV Black Flue/Vent Termination Tee	114.21	18.24
23 51 16 00-0391	EA	5" Polypropylene-UV Black Flue/Vent Termination Tee	125.36	18.97
23 51 16 00-0392	EA	2" x 20" Polypropylene-UV Black Flue/Vent End Pipe	28.47	9.65
23 51 16 00-0393	EA	2" x 39" Polypropylene-UV Black Flue/Vent End Pipe	33.72	10.72
23 51 16 00-0394	EA	3" x 20" Polypropylene-UV Black Flue/Vent End Pipe	34.02	11.06
23 51 16 00-0395	EA	3" x 39" Polypropylene-UV Black Flue/Vent End Pipe	41.86	12.29
23 51 16 00-0396	EA	4" x 20" Polypropylene-UV Black Flue/Vent End Pipe	50.47	14.63
23 51 16 00-0397	EA	5" x 20" Polypropylene-UV Black Flue/Vent End Pipe	70.27	21.60
23 51 16 00-0398	EA	5" x 39" Polypropylene-UV Black Flue/Vent End Pipe	84.23	24.00
23 51 16 00-0399	EA	2" x 24" Polypropylene-UV Black Flue/Vent Vent Length	31.08	9.65
23 51 16 00-0400	EA	3" x 24" Polypropylene-UV Black Flue/Vent Vent Length	39.42	11.06
23 51 16 00-0401	EA	4" x 24" Polypropylene-UV Black Flue/Vent Vent Length	63.11	14.63
23 51 16 00-0402	EA	2" Polypropylene-UV Black Flue/Vent 45 Degree Elbow	34.40	11.14
23 51 16 00-0403	EA	3" Polypropylene-UV Black Flue/Vent 45 Degree Elbow	39.80	11.73
23 51 16 00-0404	EA	4" Polypropylene-UV Black Flue/Vent 45 Degree Elbow	48.73	12.15
23 51 16 00-0405	EA	2" Polypropylene-UV Black Flue/Vent 87 Degree Elbow	33.91	11.14
23 51 16 00-0406	EA	3" Polypropylene-UV Black Flue/Vent 87 Degree Elbow	39.48	11.73
23 51 16 00-0407	EA	4" Polypropylene-UV Black Flue/Vent 87 Degree Elbow	48.16	12.15
23 51 16 00-0408	EA	2" Polypropylene-UV Black Bird Screen For Polypropylene Flue/Vent	21.41	5.57
23 51 16 00-0409	EA	3" Polypropylene-UV Black Bird Screen For Polypropylene Flue/Vent	24.70	5.86
23 51 16 00-0410	EA	4" Polypropylene-UV Black Bird Screen For Polypropylene Flue/Vent	27.47	6.08
23 51 16 00-0411	EA	3" Stainless Steel Bird Screen For Polypropylene Flue/Vent	51.33	5.86
23 51 16 00-0412	EA	5" Stainless Steel Bird Screen For Polypropylene Flue/Vent	58.82	6.32

23 51 16 00-0413 Polypropylene Flue/Vent Accessories (23 51 16 00-0285)

23 51 16 00-0414	EA	2" Spacer For Polypropylene Flue/Vent	10.89	2.79
23 51 16 00-0415	EA	3" Spacer For Polypropylene Flue/Vent	10.50	2.93
23 51 16 00-0416	EA	4" Spacer For Polypropylene Flue/Vent	10.82	3.04
23 51 16 00-0417	EA	5" Spacer For Polypropylene Flue/Vent	16.41	3.16
23 51 16 00-0418	EA	2" Flue Clamp For Polypropylene Flue/Vent	20.13	4.18
23 51 16 00-0419	EA	3" Flue Clamp For Polypropylene Flue/Vent	23.45	4.39
23 51 16 00-0420	EA	4" Flue Clamp For Polypropylene Flue/Vent	26.99	4.55
23 51 16 00-0421	EA	2" Support Clamp For Polypropylene Flue/Vent	19.23	4.18
23 51 16 00-0422	EA	4" Support Clamp For Polypropylene Flue/Vent	19.34	4.55
23 51 16 00-0423	EA	5" Support Clamp For Polypropylene Flue/Vent	23.25	4.75
23 51 16 00-0424	EA	3" Plastic Support Clamp For Polypropylene Flue/Vent	15.16	4.39
23 51 16 00-0425	EA	2" Polypropylene-UV Black Wall Plate For Polypropylene Flue/Vent	31.13	11.14
23 51 16 00-0426	EA	3" Polypropylene-UV Black Wall Plate For Polypropylene Flue/Vent	34.10	11.73
23 51 16 00-0427	EA	4" Polypropylene-UV Black Wall Plate For Polypropylene Flue/Vent	36.53	12.15
23 51 16 00-0428	EA	5" Polypropylene-UV Black Wall Plate For Polypropylene Flue/Vent	40.44	12.66
23 51 16 00-0429	EA	2" Single Wall EDPM Gasket For Polypropylene Flue/Vent	2.09	
23 51 16 00-0430	EA	3" Single Wall EDPM Gasket For Polypropylene Flue/Vent	2.33	
23 51 16 00-0431	EA	4" Single Wall EDPM Gasket For Polypropylene Flue/Vent	3.16	
23 51 16 00-0432	EA	5" Single Wall EDPM Gasket For Polypropylene Flue/Vent	5.22	
23 51 16 00-0433	EA	2" Connector Ring For Polypropylene Flue/Vent	9.20	2.79
23 51 16 00-0434	EA	3" Connector Ring For Polypropylene Flue/Vent	10.34	2.93
23 51 16 00-0435	EA	4" Connector Ring For Polypropylene Flue/Vent	11.08	3.04
23 51 16 00-0436	EA	5" Connector Ring For Polypropylene Flue/Vent	12.17	3.16
23 51 16 00-0437	EA	2 1/4" Polypropylene Flue/Vent Air Intake, White	42.98	5.57
23 51 16 00-0438	EA	3 1/2" Polypropylene Flue/Vent Air Intake, White	44.12	5.86
23 51 16 00-0439	EA	4 1/2" Polypropylene Flue/Vent Air Intake, White	33.44	6.08
23 51 16 00-0440	EA	2" Base Support For Polypropylene Flue/Vent	37.11	4.18
23 51 16 00-0441	EA	3" Base Support For Polypropylene Flue/Vent	38.31	4.39
23 51 16 00-0442	EA	4" Base Support For Polypropylene Flue/Vent	50.92	4.55
23 51 16 00-0443	EA	5" Base Support For Polypropylene Flue/Vent	85.15	4.75

23 51 16 00-0444 Polypropylene Flue/Vent Flex Pipe (23 51 16 00-0285)

23 51 16 00-0445	LF	2", Up To 50', Polypropylene Flue/Vent Flex Pipe	6.79	0.98
23 51 16 00-0446	LF	2", > 50', Polypropylene Flue/Vent Flex Pipe	5.92	0.98
23 51 16 00-0447	LF	3", Up To 50', Polypropylene Flue/Vent Flex Pipe	8.32	1.16
23 51 16 00-0448	LF	3", > 50', Polypropylene Flue/Vent Flex Pipe	7.23	1.16
23 51 16 00-0449	LF	4", Up To 50', Polypropylene Flue/Vent Flex Pipe	11.91	1.42
23 51 16 00-0450	LF	4", > 50', Polypropylene Flue/Vent Flex Pipe	10.24	1.42



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 51 16 00-0451				Polypropylene Flue/Vent Couplers <small>(23 51 16 00-0285)</small> Note: Gasketed rigid single wall polypropylene vent fittings with dedicated male and female ends.		
				23 51 16 00-0452 EA 2" Polypropylene Flue/Vent Coupler, Single Wall to Flex 49.38		11.14
				23 51 16 00-0453 EA 2" Polypropylene Flue/Vent Coupler, Flex to Single Wall 54.81		11.14
				23 51 16 00-0454 EA 3" Polypropylene Flue/Vent Coupler, Flex to Single Wall 107.48		11.73
				23 51 16 00-0455 EA 4" Polypropylene Flue/Vent Coupler, Flex to Single Wall 192.89		12.15
				23 51 16 00-0456 EA 2" Polypropylene Flue/Vent Coupler, Flex to Flex 56.41		11.14
				23 51 16 00-0457 EA 3" Polypropylene Flue/Vent Coupler, Flex to Flex 127.31		11.73
				23 51 16 00-0458 EA 4" Polypropylene Flue/Vent Coupler, Flex to Flex 322.89		12.15
23 51 16 00-0459				Polypropylene Flue/Vent Flex End Terminations <small>(23 51 16 00-0285)</small>		
				23 51 16 00-0460 EA 2" Polypropylene-UV Black Flue/Vent Flex End Pipe Termination 63.61		11.14
				23 51 16 00-0461 EA 3" Polypropylene-UV Black Flue/Vent Flex End Pipe Termination 59.31		11.73
				23 51 16 00-0462 EA 4" Polypropylene-UV Black Flue/Vent Flex End Pipe Termination 72.46		12.15
23 52 Heating Boilers <small>(23 50)</small>						
23 52 16 Condensing Boilers <small>(23 52)</small>						
23 52 16 13 Stainless-Steel Condensing Boilers <small>(23 52 16)</small>						
23 52 16 13-0001				Hamilton Evo Series Stainless Steel Condensing Boilers <small>(23 52 16 13)</small> Note: Includes circulating pump, mounting rack, disconnect panel, plumbing and gas manifold, manual reset high limit and LWCO (Cal Code).		
				23 52 16 13-0002 EA 75 MBH Water, Gas Fired, Stainless Steel Condensing Boiler (Hamilton Evo HW79) 9,730.45		294.16
				23 52 16 13-0003 EA 127 MBH Water, Gas Fired, Stainless Steel Condensing Boiler (Hamilton Evo HW129) 9,112.56		388.30
				23 52 16 13-0004 EA 168 MBH Water, Gas Fired, Stainless Steel Condensing Boiler (Hamilton Evo HW179) 9,715.67		436.84
				23 52 16 13-0005 EA 187 MBH Water, Gas Fired, Stainless Steel Condensing Boiler (Hamilton Evo HW199.1) 10,372.89		485.37
				23 52 16 13-0006 EA 281 MBH Water, Gas Fired, Stainless Steel Condensing Boiler (Hamilton Evo HW299) 13,454.71		485.37
				23 52 16 13-0007 EA 374 MBH Water, Gas Fired, Stainless Steel Condensing Boiler (Hamilton Evo HW399) 15,747.48		588.34
				23 52 16 13-0008 EA 589 MBH Water, Gas Fired, Stainless Steel Condensing Boiler (Hamilton Evo HW599) 21,137.32		630.99
				23 52 16 13-0009 EA 785 MBH Water, Gas Fired, Stainless Steel Condensing Boiler (Hamilton Evo HW798) 29,604.99		776.60
				Note: Includes vent manifold.		
				23 52 16 13-0010 EA 980 MBH Water, Gas Fired, Stainless Steel Condensing Boiler (Hamilton Evo HW998) 36,214.52		849.41
				Note: Includes vent manifold.		
				23 52 16 13-0011 EA 1,425 MBH Water, Gas Fired, Stainless Steel Condensing Boiler (Hamilton Evo HW1499) 52,308.91		995.02
				23 52 16 13-0012 EA 1,900 MBH Water, Gas Fired, Stainless Steel Condensing Boiler (Hamilton Evo HW1999) 57,647.49		1,067.82
23 52 16 13-0013				Buderus SB615 Stainless Steel Condensing Boilers <small>(23 52 16 13)</small> Note: Includes Riello burners. Capacity given is IBR rating.		
				23 52 16 13-0014 EA 484 MBH Water, Gas Fired, Stainless Steel Condensing Boiler (Buderus SB615/145) 26,723.92		630.99
				23 52 16 13-0015 EA 612 MBH Water, Gas Fired, Stainless Steel Condensing Boiler (Buderus SB615/185) 27,875.88		630.99
				23 52 16 13-0016 EA 791 MBH Water, Gas Fired, Stainless Steel Condensing Boiler (Buderus SB615/240) 31,216.20		776.60
				23 52 16 13-0017 EA 1,022 MBH Water, Gas Fired, Stainless Steel Condensing Boiler (Buderus SB615/310) 33,814.28		873.68
				23 52 16 13-0018 EA 1,317 MBH Water, Gas Fired, Stainless Steel Condensing Boiler (Buderus SB615/400) 37,545.23		922.21
				23 52 16 13-0019 EA 1,459 MBH Water, Gas Fired, Stainless Steel Condensing Boiler (Buderus SB615/510) 43,013.65		995.02
				23 52 16 13-0020 EA 2,104 MBH Water, Gas Fired, Stainless Steel Condensing Boiler (Buderus SB615/640) 51,425.95		1,067.82
23 52 16 13-0021				Buderus SB735 Stainless Steel Condensing Boilers <small>(23 52 16 13)</small> Note: Includes Riello burners.		
				23 52 16 13-0022 EA 2,650 MBH Water, Gas Fired, Stainless Steel Condensing Boiler (Buderus SB735/790) 54,282.15		1,164.90
				23 52 16 13-0023 EA 3,251 MBH Water, Gas Fired, Stainless Steel Condensing Boiler (Buderus SB735/970) 62,887.92		1,213.44
				23 52 16 13-0024 EA 4,079 MBH Water, Gas Fired, Stainless Steel Condensing Boiler (Buderus SB735/1200) 72,903.71		1,286.25
23 52 16 13-0025				Lochinvar Knight Stainless Steel Condensing Boilers <small>(23 52 16 13)</small>		
				23 52 16 13-0026 EA 165 MBH 95.7% Efficient, Gas Fired, Stainless Steel Heat Exchanger, Condensing Boiler (Lochinvar Knight KBN211) 6,201.86		436.84
				23 52 16 13-0027 EA 226 MBH 96% Efficient, Gas Fired, Stainless Steel Heat Exchanger, Condensing Boiler (Lochinvar Knight KBN286) 8,063.83		485.37
23 52 16 13-0028				Lochinvar Knight XL Stainless Steel Condensing Boilers <small>(23 52 16 13)</small>		
				23 52 16 13-0029 EA 324 MBH 93.3% Efficient, Gas Fired, Stainless Steel Heat Exchanger, Condensing Boiler (Lochinvar Knight XL KBN400) 10,631.47		582.45
				23 52 16 13-0030 EA 406 MBH 93.3% Efficient, Gas Fired, Stainless Steel Heat Exchanger, Condensing Boiler (Lochinvar Knight XL KBN501) 13,110.98		588.34
				23 52 16 13-0031 EA 493 MBH 94.6% Efficient, Gas Fired, Stainless Steel Heat Exchanger, Condensing Boiler (Lochinvar Knight XL KBN601) 15,378.73		630.99
				23 52 16 13-0032 EA 574 MBH 94.3% Efficient, Gas Fired, Stainless Steel Heat Exchanger, Condensing Boiler (Lochinvar Knight XL KBN701) 17,591.94		630.99
				23 52 16 13-0033 EA 654 MBH 94% Efficient, Gas Fired, Stainless Steel Heat Exchanger, Condensing Boiler (Lochinvar Knight XL KBN801) 20,242.73		703.80
23 52 16 13-0034				Lochinvar SYNC Stainless Steel Condensing Boilers <small>(23 52 16 13)</small>		

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 50 Central Heating Equipment****23 52 Heating Boilers**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 52 16 13-0035 EA 941 MBH 94.1% Efficient, Gas Fired, Stainless Steel Heat Exchanger, Condensing Boiler (Lochinvar SYNC SBN1000).....	27,679.05	849.41
23 52 16 13-0036 EA 1,240 MBH 95.4% Efficient, Gas Fired, Stainless Steel Heat Exchanger, Condensing Boiler (Lochinvar SYNC SBN1300).....	31,501.99	922.21
23 52 16 13-0037 EA 1,443 MBH 96.2% Efficient, Gas Fired, Stainless Steel Heat Exchanger, Condensing Boiler (Lochinvar SYNC SBN1500).....	33,834.39	995.02
23 52 16 13-0038 Lochinvar Crest Stainless Steel Condensing Boilers (23 52 16 13)		
23 52 16 13-0039 EA 1,380 MBH 92% Efficient, Gas Fired, Stainless Steel Firetube, Condensing Boiler (Lochinvar Crest FBN1500).....	33,523.43	922.21
23 52 16 13-0040 EA 1,840 MBH 92% Efficient, Gas Fired, Stainless Steel Firetube, Condensing Boiler (Lochinvar Crest FBN2000).....	40,111.44	1,019.29
23 52 16 13-0041 EA 2,300 MBH 92% Efficient, Gas Fired, Stainless Steel Firetube, Condensing Boiler (Lochinvar Crest FBN2500).....	52,252.88	1,116.36
23 52 16 13-0042 EA 2,760 MBH 92% Efficient, Gas Fired, Stainless Steel Firetube, Condensing Boiler (Lochinvar Crest FBN3000).....	57,583.16	1,175.20
23 52 16 13-0043 EA 3,220 MBH 92% Efficient, Gas Fired, Stainless Steel Firetube, Condensing Boiler (Lochinvar Crest FBN3500).....	68,319.74	1,175.20
23 52 16 13-0044 Laars Neotherm Stainless Steel Condensing Boiler (23 52 16 13)		
Note: Compliant with SCAQMD.		
23 52 16 13-0045 EA 80 MBH, Gas Fired, Stainless Steel, Condensing Boiler (Laars Neotherm NTH080).....	5,809.71	291.23
23 52 16 13-0046 EA 105 MBH, Gas Fired, Stainless Steel, Condensing Boiler (Laars Neotherm NTH105).....	6,567.91	315.49
23 52 16 13-0047 EA 150 MBH, Gas Fired, Stainless Steel, Condensing Boiler (Laars Neotherm NTH150).....	7,517.21	436.84
23 52 16 13-0048 EA 210 MBH, Gas Fired, Stainless Steel, Condensing Boiler (Laars Neotherm NTH210).....	8,372.09	485.37
23 52 16 13-0049 EA 285 MBH, Gas Fired, Stainless Steel, Condensing Boiler (Laars Neotherm NTH285).....	10,611.15	485.37
23 52 16 13-0050 EA 399 MBH, Gas Fired, Stainless Steel, Condensing Boiler (Laars Neotherm NTH399).....	13,376.82	582.45
23 52 16 13-0051 EA 500 MBH, Gas Fired, Stainless Steel, Condensing Boiler (Laars Neotherm NTH500).....	17,216.43	630.99
23 52 16 13-0052 EA 600 MBH, Gas Fired, Stainless Steel, Condensing Boiler (Laars Neotherm NTH600).....	18,350.16	630.99
23 52 16 13-0053 EA 750 MBH, Gas Fired, Stainless Steel, Condensing Boiler (Laars Neotherm NTH750).....	19,985.24	728.06
23 52 16 13-0054 EA 850 MBH, Gas Fired, Stainless Steel, Condensing Boiler (Laars Neotherm NTH850).....	21,585.61	825.14
23 52 16 13-0055 EA 1,000 MBH, Gas Fired, Stainless Steel, Condensing Boiler (Laars Neotherm NTH1000).....	31,050.76	873.68
23 52 16 13-0056 EA 1,700 MBH, Gas Fired, Stainless Steel, Condensing Boiler (Laars Neotherm NTH1700).....	41,311.73	1,019.29
23 52 16 13-0057 EA 150 MBH, Gas Fired, Stainless Steel, Condensing Domestic Boiler (Laars Neotherm NTV150).....	8,063.04	436.84
23 52 16 13-0058 EA 199 MBH, Gas Fired, Stainless Steel, Condensing Domestic Boiler (Laars Neotherm NTV199).....	9,510.02	485.37
23 52 16 13-0059 EA 285 MBH, Gas Fired, Stainless Steel, Condensing Domestic Boiler (Laars Neotherm NTV285).....	12,096.16	485.37
23 52 16 13-0060 EA 399 MBH, Gas Fired, Stainless Steel, Condensing Domestic Boiler (Laars Neotherm NTV399).....	14,749.29	582.45
23 52 16 13-0061 EA 500 MBH, Gas Fired, Stainless Steel, Condensing Domestic Boiler (Laars Neotherm NTV500).....	18,434.30	630.99
23 52 16 13-0062 EA 600 MBH, Gas Fired, Stainless Steel, Condensing Domestic Boiler (Laars Neotherm NTV600).....	19,065.32	630.99
23 52 16 13-0063 EA 750 MBH, Gas Fired, Stainless Steel, Condensing Domestic Boiler (Laars Neotherm NTV750).....	21,063.23	728.06
23 52 16 13-0064 EA 800 MBH, Gas Fired, Stainless Steel, Condensing Domestic Boiler (Laars Neotherm NTV800).....	22,601.71	776.60
23 52 16 13-0065 EA 1,000 MBH, Gas Fired, Stainless Steel, Condensing Domestic Boiler (Laars Neotherm NTV1000).....	31,050.76	873.68
23 52 16 13-0066 EA 1,700 MBH, Gas Fired, Stainless Steel, Condensing Domestic Boiler (Laars Neotherm NTV1700).....	41,311.73	1,019.29
23 52 16 13-0067 AERCO Benchmark Stainless-Steel Condensing Boilers (23 52 16 13)		
23 52 16 13-0068 EA 1,500 MBH Water, 120 Volt, 1 Phase, Gas Fired, Stainless Steel Condensing Boiler (AERCO BMK1.5LN).....	30,717.78	995.02
Note: Includes gas PRV and pump delay relay.		
23 52 16 13-0069 EA 2,000 MBH Water, 120 Volt, 1 Phase, Gas Fired, Stainless Steel Condensing Boiler (AERCO BMK2.0LN).....	36,432.25	1,067.82
Note: Includes gas PRV and pump delay relay.		
23 52 16 13-0070 EA 3,000 MBH Water, 220 Volt, 1 Phase, 230 Volt, 3 Phase, Gas Fired, Stainless Steel Condensing Boiler (AERCO BMK3000).....	52,248.99	1,175.20
Note: Includes gas PRV and pump delay relay.		
23 52 16 13-0071 EA 3,000 MBH Water, 480 Volt, 3 Phase, Gas Fired, Stainless Steel Condensing Boiler (AERCO BMK3000).....	55,661.10	1,175.20
Note: Includes gas PRV and pump delay relay.		
23 52 16 16 Aluminum Condensing Boilers (23 52 16)		
23 52 16 16-0001 Patterson Kelly Mach Series Aluminum Condensing Boilers (23 52 16 16)		
Note: Compliant with SCAQMD.		
23 52 16 16-0002 EA 300 MBH Water, Gas Fired, Aluminum Condensing Boiler (Patterson Kelly Mach C300).....	13,490.71	485.37
23 52 16 16-0003 EA 450 MBH Water, Gas Fired, Aluminum Condensing Boiler (Patterson Kelly Mach C450).....	15,345.60	588.34
23 52 16 16-0004 EA 750 MBH Water, Gas Fired, Aluminum Condensing Boiler (Patterson Kelly Mach C750).....	17,368.61	735.42
23 52 16 16-0005 EA 900 MBH Water, Gas Fired, Aluminum Condensing Boiler (Patterson Kelly Mach C900).....	25,778.74	825.14
23 52 16 16-0006 EA 1,050 MBH Water, Gas Fired, Aluminum Condensing Boiler (Patterson Kelly Mach C1050).....	26,927.05	873.68
23 52 16 16-0007 EA 1,500 MBH Water, Gas Fired, Aluminum Condensing Boiler (Patterson Kelly Mach C1500).....	41,842.92	995.02
23 52 16 16-0008 EA 2,000 MBH Water, Gas Fired, Aluminum Condensing Boiler (Patterson Kelly Mach C2000).....	45,312.24	1,067.82
23 52 16 16-0009 EA 2,500 MBH Water, Gas Fired, Aluminum Condensing Boiler (Patterson Kelly Mach C2500).....	52,467.70	1,164.90
23 52 16 16-0010 EA 3,000 MBH Water, Gas Fired, Aluminum Condensing Boiler (Patterson Kelly Mach C3000).....	64,933.50	1,164.90
23 52 16 16-0011 EA 4,000 MBH Water, Gas Fired, Aluminum Condensing Boiler (Patterson Kelly Mach C4000).....	79,463.41	1,286.25
23 52 16 16-0012 Weil McLain Aluminum Condensing Boilers (23 52 16 16)		
23 52 16 16-0013 EA 80 MBH Water Gas Fired Condensing Boiler (Weil McLain Ultra 80).....	4,675.70	294.16
Note: Aluminum block with stainless steel burner. Includes boiler inline circulating pump.		
23 52 16 16-0014 EA 105 MBH Water Gas Fired Condensing Boiler (Weil McLain Ultra 80).....	5,094.60	315.49
Note: Aluminum block with stainless steel burner. Includes boiler inline circulating pump.		
23 52 16 16-0015 EA 155 MBH Water Gas Fired Condensing Boiler (Weil McLain Ultra 80).....	5,922.79	436.84
Note: Aluminum block with stainless steel burner. Includes boiler inline circulating pump.		
23 52 16 16-0016 EA 230 MBH Water Gas Fired Condensing Boiler (Weil McLain Ultra 80).....	6,645.47	485.37
Note: Aluminum block with stainless steel burner. Includes boiler inline circulating pump.		
23 52 16 16-0017 EA 310 MBH Water Gas Fired Condensing Boiler (Weil McLain Ultra 80).....	8,519.36	582.45
Note: Aluminum block with stainless steel burner. Includes boiler inline circulating pump.		



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 52 16 16-0018				Buderus GB142 Wall Hung Aluminum Condensing Boilers <small>(23 52 16 16)</small>		
				Note: Includes standard controls.		
				23 52 16 16-0019 EA 75 MBH Water, Gas Fired, Wall Hung Aluminum Condensing Boiler (Buderus GB142/24) .....5,697.67	294.16	
				Note: Includes an aluminum heat exchanger and three speed circulating pump.		
				23 52 16 16-0020 EA 95 MBH Water, Gas Fired, Wall Hung Aluminum Condensing Boiler (Buderus GB142/30) .....6,541.74	315.49	
				Note: Includes an aluminum heat exchanger and three speed circulating pump.		
				23 52 16 16-0021 EA 143 MBH Water, Gas Fired, Wall Hung Aluminum Condensing Boiler (Buderus GB142/45) .....7,530.34	388.30	
				Note: Includes an aluminum heat exchanger and three speed circulating pump.		
				23 52 16 16-0022 EA 193 MBH Water, Gas Fired, Wall Hung Aluminum Condensing Boiler (Buderus GB142/60) .....8,386.40	485.37	
				Note: Includes an aluminum heat exchanger and three speed circulating pump.		
				23 52 16 16-0023 EA Optional Vertical Or Horizontal 3" Concentric Termination Kit For GB142 (Buderus 60L46) .....253.32	73.54	
				23 52 16 16-0024 EA Optional Stainless Steel Concentric Hood For GB142 (Buderus SJT3).....341.63	73.54	
				23 52 16 16-0025 EA Optional GB Floor Stand For GB142 (Buderus 7098265).....766.58	73.54	
23 52 16 16-0026				Buderus GB162 Wall Hung Aluminum Condensing Boilers <small>(23 52 16 16)</small>		
				Note: Includes standard controls.		
				23 52 16 16-0027 EA 290 MBH Water, Gas Fired, Wall Hung Aluminum Condensing Boiler (Buderus GB162/80) .....7,682.65	485.37	
				Note: Includes an aluminum heat exchanger, connection pump module, low loss header, outdoor reset module, outdoor temperature sensor, and 1-1/2" unions.		
				23 52 16 16-0028 EA 333 MBH Water, Gas Fired, Wall Hung Aluminum Condensing Boiler (Buderus GB162/100) .....9,614.75	582.45	
				Note: Includes an aluminum heat exchanger, connection pump module, low loss header, outdoor reset module, outdoor temperature sensor, and 1-1/2" unions.		
				23 52 16 16-0029 EA 580 MBH Water, Gas Fired, Frame Mounted Aluminum Condensing Boiler In Line Cascade Package (Two Boilers) (Buderus GB162/80-TL2) .....18,940.11	691.66	
				Note: Includes an aluminum heat exchangers, connection pump module, inline cascade package (stand), RC35 controller, outdoor temperature sensor, MCM10 intelligent sequencing module, WM10 low loss header module and insulation package.		
				23 52 16 16-0030 EA 580 MBH Water, Gas Fired, Frame Mounted Aluminum Condensing Boiler Back To Back Cascade Package (Two Boilers) (Buderus GB162/80-TR2).....17,694.80	691.66	
				Note: Includes an aluminum heat exchangers, connection pump module, back to back cascade package (stand), RC35 controller, outdoor temperature sensor, MCM10 intelligent sequencing module, WM10 low loss header module and insulation package.		
				23 52 16 16-0031 EA 666 MBH Water, Gas Fired, Frame Mounted Aluminum Condensing Boiler In Line Cascade Package (Two Boilers) (Buderus GB162/100-TL2) .....22,546.89	703.80	
				Note: Includes an aluminum heat exchangers, connection pump module, inline cascade package (stand), RC35 controller, outdoor temperature sensor, MCM10 intelligent sequencing module, WM10 low loss header module and insulation package.		
				23 52 16 16-0032 EA 666 MBH Water, Gas Fired, Frame Mounted Aluminum Condensing Boiler Back To Back Cascade Package (Two Boilers) (Buderus GB162/100-TR2).....21,301.59	703.80	
				Note: Includes an aluminum heat exchangers, connection pump module, back to back cascade package (stand), RC35 controller, outdoor temperature sensor, MCM10 intelligent sequencing module, WM10 low loss header module and insulation package.		
				23 52 16 16-0033 EA 870 MBH Water, Gas Fired, Frame Mounted Aluminum Condensing Boiler In Line Cascade Package (Three Boilers) (Buderus GB162/80-TL3) .....26,211.60	825.14	
				Note: Includes an aluminum heat exchangers, connection pump module, inline cascade package (stand), RC35 controller, outdoor temperature sensor, MCM10 intelligent sequencing module, WM10 low loss header module and insulation package.		
				23 52 16 16-0034 EA 999 MBH Water, Gas Fired, Frame Mounted Aluminum Condensing Boiler In Line Cascade Package (Three Boilers) (Buderus GB162/100-TL3) .....31,713.72	873.68	
				Note: Includes an aluminum heat exchangers, connection pump module, inline cascade package (stand), RC35 controller, outdoor temperature sensor, MCM10 intelligent sequencing module, WM10 low loss header module and insulation package.		
				23 52 16 16-0035 EA 1,160 MBH Water, Gas Fired, Frame Mounted Aluminum Condensing Boiler In Line Cascade Package (Four Boilers) (Buderus GB162/80-TL4) .....32,590.56	922.21	
				Note: Includes an aluminum heat exchangers, connection pump module, inline cascade package (stand), RC35 controller, outdoor temperature sensor, MCM10 intelligent sequencing module, WM10 low loss header module and insulation package.		
				23 52 16 16-0036 EA 1,160 MBH Water, Gas Fired, Frame Mounted Aluminum Condensing Boiler Back To Back Cascade Package (Four Boilers) (Buderus GB162/80-TR4) .....33,089.31	922.21	
				Note: Includes an aluminum heat exchangers, connection pump module, back to back cascade package (stand), RC35 controller, outdoor temperature sensor, MCM10 intelligent sequencing module, WM10 low loss header module and insulation package.		
				23 52 16 16-0037 EA 1,332 MBH Water, Gas Fired, Frame Mounted Aluminum Condensing Boiler In Line Cascade Package (Four Boilers) (Buderus GB162/100-TL4) .....39,730.59	922.21	
				Note: Includes an aluminum heat exchangers, connection pump module, inline cascade package (stand), RC35 controller, outdoor temperature sensor, MCM10 intelligent sequencing module, WM10 low loss header module and insulation package.		
				23 52 16 16-0038 EA 1,332 MBH Water, Gas Fired, Frame Mounted Aluminum Condensing Boiler Back To Back Cascade Package (Four Boilers) (Buderus GB162/100-TR4) .....40,229.34	922.21	
				Note: Includes an aluminum heat exchangers, connection pump module, back to back cascade package (stand), RC35 controller, outdoor temperature sensor, MCM10 intelligent sequencing module, WM10 low loss header module and insulation package.		
				23 52 16 16-0039 EA EMS Control Module For Condensing Boiler (Buderus RC35) .....529.24	73.54	
23 52 16 16-0040				Buderus GB312 Aluminum Condensing Boilers <small>(23 52 16 16)</small>		
				Note: Includes standard controls.		
				23 52 16 16-0041 EA 305 MBH Water, Gas Fired, Aluminum Condensing Boiler (Buderus GB312/90).....15,268.69	485.37	
				Note: Includes an aluminum heat exchanger.		
				23 52 16 16-0042 EA 409 MBH Water, Gas Fired, Aluminum Condensing Boiler (Buderus GB312/120).....16,958.01	588.34	
				Note: Includes an aluminum heat exchanger.		

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 50 Central Heating Equipment****23 52 Heating Boilers**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 52 16 16-0043 EA 544 MBH Water, Gas Fired, Aluminum Condensing Boiler (Buderus GB312/160).....	20,112.98	630.99
Note: Includes an aluminum heat exchanger.		
23 52 16 16-0044 EA 676 MBH Water, Gas Fired, Aluminum Condensing Boiler (Buderus GB312/200).....	23,200.69	703.80
Note: Includes an aluminum heat exchanger.		
23 52 16 16-0045 EA 810 MBH Water, Gas Fired, Aluminum Condensing Boiler (Buderus GB312/240).....	27,824.33	776.60
Note: Includes an aluminum heat exchanger.		
23 52 16 16-0046 EA 944 MBH Water, Gas Fired, Aluminum Condensing Boiler (Buderus GB312/280).....	30,732.86	849.41
Note: Includes an aluminum heat exchanger.		
23 52 16 16-0047 EA Optional CSD-1 Kit Consisting Of High And Low Gas Pressure Switches For GB312 (Buderus 7747019985).....	457.52	36.77
23 52 16 16-0048 EA Optional L4006E1125 Manual Reset Aquastat For GB312 (Buderus L4006E1125).....	214.33	36.77
23 52 16 16-0049 EA Optional Hydrolevel 550 low Water Cut-Off For GB312 (Buderus 550).....	312.89	36.77
23 52 16 16-0050 EA Optional Condensate Neutralization Tank For GB312 (Buderus 63035899).....	678.96	36.77

23 52 16 19 Copper Water-Tube Condensing Boilers (23 52 16)

23 52 16 19-0001 Laars Rheos+ Copper Fin Tube Condensing Boilers (23 52 16 19)		
23 52 16 19-0002 EA 1,200 MBH Water, Gas Fired, Copper Fin Tube Condensing Boiler (Laars Rheos+).....	31,489.44	922.21
23 52 16 19-0003 EA 1,600 MBH Water, Gas Fired, Copper Fin Tube Condensing Boiler (Laars Rheos+).....	35,508.06	1,019.29
23 52 16 19-0004 EA 2,000 MBH Water, Gas Fired, Copper Fin Tube Condensing Boiler (Laars Rheos+).....	38,862.84	1,067.82
23 52 16 19-0005 EA 2,400 MBH Water, Gas Fired, Copper Fin Tube Condensing Boiler (Laars Rheos+).....	42,090.87	1,164.90

23 52 16 23 Cast Iron Condensing Boilers (23 52 16)

23 52 16 23-0001 Hydrotherm KN Cast Iron Condensing Boilers (23 52 16 23)		
Note: Compliant with SCAQMD.		
23 52 16 23-0002 EA 199 MBH Water, Gas Fired, Cast Iron Condensing Boiler (Hydrotherm KN-2).....	10,678.46	485.37
23 52 16 23-0003 EA 399 MBH Water, Gas Fired, Cast Iron Condensing Boiler (Hydrotherm KN-4).....	15,522.29	588.34
23 52 16 23-0004 EA 600 MBH Water, Gas Fired, Cast Iron Condensing Boiler (Hydrotherm KN-6).....	25,369.21	630.99
23 52 16 23-0005 EA 1,000 MBH Water, Gas Fired, Cast Iron Condensing Boiler (Hydrotherm KN-10).....	33,492.81	873.68
23 52 16 23-0006 EA 1,600 MBH Water, Gas Fired, Cast Iron Condensing Boiler (Hydrotherm KN-16).....	44,646.68	1,019.29
23 52 16 23-0007 EA 1,999 MBH Water, Gas Fired, Cast Iron Condensing Boiler (Hydrotherm KN-20).....	48,700.82	1,067.82
23 52 16 23-0008 EA 2,600 MBH Water, Gas Fired, Cast Iron Condensing Boiler (Hydrotherm KN-26).....	61,980.33	1,164.90
23 52 16 23-0009 EA 3,000 MBH Water, Gas Fired, Cast Iron Condensing Boiler (Hydrotherm KN-30).....	67,672.13	1,164.90

23 52 23 Cast-Iron Boilers (23 52)

23 52 23 00-0001 Weil-McLain Model 80 Cast Iron Boiler (23 52 23)		
Note: Capacities are the steam or water MBH output. Includes burner unit and controls. Excludes flue piping, fuel piping, boiler base or pad.		
23 52 23 00-0002 Gas Fired Weil-McLain Model 80 Cast Iron Boiler (23 52 23 00-0001)		
Note: Field assembled boilers can only be used in situations where package units cannot be installed.		
23 52 23 00-0003 EA 208 MBH Steam, 242 MBH Water Gas Fired Cast Iron Boiler.....	13,160.54	2,618.56
Note: Weil-McLain Model 80. Includes field assembly of individual sections and testing.		
23 52 23 00-0004 EA 297 MBH Steam, 344 MBH Water Gas Fired Cast Iron Boiler.....	14,369.55	2,793.14
Note: Weil-McLain Model 80. Includes field assembly of individual sections and testing.		
23 52 23 00-0005 EA 386 MBH Steam, 448 MBH Water Gas Fired Cast Iron Boiler.....	15,691.10	2,967.71
Note: Weil-McLain Model 80. Includes field assembly of individual sections and testing.		
23 52 23 00-0006 EA 476 MBH Steam, 551 MBH Water Gas Fired Cast Iron Boiler.....	16,921.36	3,142.28
Note: Weil-McLain Model 80. Includes field assembly of individual sections and testing.		
23 52 23 00-0007 EA 565 MBH Steam, 655 MBH Water Gas Fired Cast Iron Boiler.....	18,058.95	3,316.84
Note: Weil-McLain Model 80. Includes field assembly of individual sections and testing.		
23 52 23 00-0008 EA 654 MBH Steam, 758 MBH Water Gas Fired Cast Iron Boiler.....	19,609.41	3,491.42
Note: Weil-McLain Model 80. Includes field assembly of individual sections and testing.		
23 52 23 00-0009 EA 743 MBH Steam, 862 MBH Water Gas Fired Cast Iron Boiler.....	20,811.88	3,665.99
Note: Weil-McLain Model 80. Includes field assembly of individual sections and testing.		
23 52 23 00-0010 EA 833 MBH Steam, 965 MBH Water Gas Fired Cast Iron Boiler.....	21,770.32	3,840.56
Note: Weil-McLain Model 80. Includes field assembly of individual sections and testing.		
23 52 23 00-0011 EA 922 MBH Steam, 1069 MBH Water Gas Fired Cast Iron Boiler.....	22,725.30	4,015.13
Note: Weil-McLain Model 80. Includes field assembly of individual sections and testing.		
23 52 23 00-0012 EA 1,018 MBH Steam, 1172 MBH Water Gas Fired Cast Iron Boiler.....	23,825.19	4,189.71
Note: Weil-McLain Model 80. Includes field assembly of individual sections and testing.		
23 52 23 00-0013 Gas Fired Package Weil-McLain Model 80 Cast Iron Boiler (23 52 23 00-0001)		
23 52 23 00-0014 EA 208 MBH Steam, 242 MBH Water Gas Fired Package Cast Iron Boiler.....	9,002.88	321.35
Note: Weil-McLain Model 80. Fire tested factory assembled package unit.		
23 52 23 00-0015 EA 297 MBH Steam, 344 MBH Water Gas Fired Package Cast Iron Boiler.....	10,018.23	321.35
Note: Weil-McLain Model 80. Fire tested factory assembled package unit.		
23 52 23 00-0016 EA 386 MBH Steam, 448 MBH Water Gas Fired Package Cast Iron Boiler.....	11,469.37	401.69
Note: Weil-McLain Model 80. Fire tested factory assembled package unit.		
23 52 23 00-0017 EA 476 MBH Steam, 551 MBH Water Gas Fired Package Cast Iron Boiler.....	12,504.67	401.69
Note: Weil-McLain Model 80. Fire tested factory assembled package unit.		
23 52 23 00-0018 EA 565 MBH Steam, 655 MBH Water Gas Fired Package Cast Iron Boiler.....	13,772.07	482.01
Note: Weil-McLain Model 80. Fire tested factory assembled package unit.		
23 52 23 00-0019 EA 654 MBH Steam, 758 MBH Water Gas Fired Package Cast Iron Boiler.....	15,141.27	482.01
Note: Weil-McLain Model 80. Fire tested factory assembled package unit.		
23 52 23 00-0020 EA 743 MBH Steam, 862 MBH Water Gas Fired Package Cast Iron Boiler.....	16,471.66	562.35
Note: Weil-McLain Model 80. Fire tested factory assembled package unit.		
23 52 23 00-0021 EA 833 MBH Steam, 965 MBH Water Gas Fired Package Cast Iron Boiler.....	17,558.46	642.69
Note: Weil-McLain Model 80. Fire tested factory assembled package unit.		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 52 23 00-0022 EA 922 MBH Steam, 1069 MBH Water Gas Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 80. Fire tested factory assembled package unit.	18,321.81	642.69
23 52 23 00-0023 EA 1,018 MBH Steam, 1172 MBH Water Gas Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 80. Fire tested factory assembled package unit.	19,548.25	723.02
23 52 23 00-0024 Gas/Oil Fired Weil-McLain Model 80 Cast Iron Boiler <small>(23 52 23 00-0001)</small> Note: Field assembled boilers can only be used in situations where package units cannot be installed.		
23 52 23 00-0025 EA 208 MBH Steam, 242 MBH Water Gas/Oil Fired Cast Iron Boiler Note: Weil-McLain Model 80. Includes field assembly of individual sections and testing.	13,753.79	2,618.56
23 52 23 00-0026 EA 297 MBH Steam, 344 MBH Water Gas/Oil Fired Cast Iron Boiler Note: Weil-McLain Model 80. Includes field assembly of individual sections and testing.	15,068.85	2,793.14
23 52 23 00-0027 EA 386 MBH Steam, 448 MBH Water Gas/Oil Fired Cast Iron Boiler Note: Weil-McLain Model 80. Includes field assembly of individual sections and testing.	16,326.35	2,967.71
23 52 23 00-0028 EA 476 MBH Steam, 551 MBH Water Gas/Oil Fired Cast Iron Boiler Note: Weil-McLain Model 80. Includes field assembly of individual sections and testing.	17,728.81	3,142.28
23 52 23 00-0029 EA 565 MBH Steam, 655 MBH Water Gas/Oil Fired Cast Iron Boiler Note: Weil-McLain Model 80. Includes field assembly of individual sections and testing.	18,888.45	3,316.84
23 52 23 00-0030 EA 654 MBH Steam, 758 MBH Water Gas/Oil Fired Cast Iron Boiler Note: Weil-McLain Model 80. Includes field assembly of individual sections and testing.	20,573.31	3,491.42
23 52 23 00-0031 EA 743 MBH Steam, 862 MBH Water Gas/Oil Fired Cast Iron Boiler Note: Weil-McLain Model 80. Includes field assembly of individual sections and testing.	21,639.28	3,665.99
23 52 23 00-0032 EA 833 MBH Steam, 965 MBH Water Gas/Oil Fired Cast Iron Boiler Note: Weil-McLain Model 80. Includes field assembly of individual sections and testing.	22,676.47	3,840.56
23 52 23 00-0033 EA 922 MBH Steam, 1069 MBH Water Gas/Oil Fired Cast Iron Boiler Note: Weil-McLain Model 80. Includes field assembly of individual sections and testing.	23,632.50	4,015.13
23 52 23 00-0034 EA 1,018 MBH Steam, 1172 MBH Water Gas/Oil Fired Cast Iron Boiler Note: Weil-McLain Model 80. Includes field assembly of individual sections and testing.	24,760.74	4,189.71
23 52 23 00-0035 Gas/Oil Fired Package Weil-McLain Model 80 Cast Iron Boiler <small>(23 52 23 00-0001)</small>		
23 52 23 00-0036 EA 208 MBH Steam, 242 MBH Water Gas/Oil Fired Package CI Boiler Note: Weil-McLain Model 80. Fire tested factory assembled package cast iron unit.	9,596.13	321.35
23 52 23 00-0037 EA 297 MBH Steam, 344 MBH Water Gas/Oil Fired Package CI Boiler Note: Weil-McLain Model 80. Fire tested factory assembled package cast iron unit.	10,717.53	321.35
23 52 23 00-0038 EA 386 MBH Steam, 448 MBH Water Gas/Oil Fired Package CI Boiler Note: Weil-McLain Model 80. Fire tested factory assembled package cast iron unit.	12,104.62	401.69
23 52 23 00-0039 EA 476 MBH Steam, 551 MBH Water Gas/Oil Fired Package CI Boiler Note: Weil-McLain Model 80. Fire tested factory assembled package cast iron unit.	13,312.12	401.69
23 52 23 00-0040 EA 565 MBH Steam, 655 MBH Water Gas/Oil Fired Package CI Boiler Note: Weil-McLain Model 80. Fire tested factory assembled package cast iron unit.	14,601.57	482.01
23 52 23 00-0041 EA 654 MBH Steam, 758 MBH Water Gas/Oil Fired Package CI Boiler Note: Weil-McLain Model 80. Fire tested factory assembled package cast iron unit.	16,105.17	482.01
23 52 23 00-0042 EA 743 MBH Steam, 862 MBH Water Gas/Oil Fired Package CI Boiler Note: Weil-McLain Model 80. Fire tested factory assembled package cast iron unit.	17,299.06	562.35
23 52 23 00-0043 EA 833 MBH Steam, 965 MBH Water Gas/Oil Fired Package CI Boiler Note: Weil-McLain Model 80. Fire tested factory assembled package cast iron unit.	18,464.61	642.69
23 52 23 00-0044 EA 922 MBH Steam, 1069 MBH Water Gas/Oil Fired Package CI Boiler Note: Weil-McLain Model 80. Fire tested factory assembled package cast iron unit.	19,229.01	642.69
23 52 23 00-0045 EA 1,018 MBH Steam, 1172 MBH Water Gas/Oil Fired Package CI Boiler Note: Weil-McLain Model 80. Fire tested factory assembled package cast iron unit.	20,483.80	723.02
23 52 23 00-0046 Weil-McLain Model 88 Cast Iron Boiler <small>(23 52 23)</small> Note: Capacities are the steam or water MBH output. Includes burner unit and controls. Excludes flue piping, fuel piping, boiler base or pad.		
23 52 23 00-0047 Gas Fired Weil-McLain Model 88 Cast Iron Boiler <small>(23 52 23 00-0046)</small> Note: Field assembled boilers can only be used in situations where package units cannot be installed.		
23 52 23 00-0048 EA 608 MBH Steam, 704 MBH Water Gas Fired Cast Iron Boiler..... Note: Weil-McLain Model 88. Includes field assembly of individual sections and testing.	21,287.33	3,927.85
23 52 23 00-0049 EA 813 MBH Steam, 943 MBH Water Gas Fired Cast Iron Boiler..... Note: Weil-McLain Model 88. Includes field assembly of individual sections and testing.	23,477.86	4,167.89
23 52 23 00-0050 EA 1,028 MBH Steam, 1,161 MBH Water Gas Fired Cast Iron Boiler..... Note: Weil-McLain Model 88. Includes field assembly of individual sections and testing.	26,182.96	4,407.92
23 52 23 00-0051 EA 1,254 MBH Steam, 1,419 MBH Water Gas Fired Cast Iron Boiler..... Note: Weil-McLain Model 88. Includes field assembly of individual sections and testing.	28,569.54	4,647.96
23 52 23 00-0052 EA 1,477 MBH Steam, 1,656 MBH Water Gas Fired Cast Iron Boiler..... Note: Weil-McLain Model 88. Includes field assembly of individual sections and testing.	30,648.09	4,887.98
23 52 23 00-0053 EA 1,688 MBH Steam, 1,892 MBH Water Gas Fired Cast Iron Boiler..... Note: Weil-McLain Model 88. Includes field assembly of individual sections and testing.	33,648.40	5,128.02
23 52 23 00-0054 EA 1,904 MBH Steam, 2,132 MBH Water Gas Fired Cast Iron Boiler..... Note: Weil-McLain Model 88. Includes field assembly of individual sections and testing.	35,746.22	5,368.05
23 52 23 00-0055 EA 2,116 MBH Steam, 2,369 MBH Water Gas Fired Cast Iron Boiler..... Note: Weil-McLain Model 88. Includes field assembly of individual sections and testing.	37,605.22	5,608.09
23 52 23 00-0056 EA 2,329 MBH Steam, 2,609 MBH Water Gas Fired Cast Iron Boiler..... Note: Weil-McLain Model 88. Includes field assembly of individual sections and testing.	40,078.12	5,848.12
23 52 23 00-0057 EA 2,539 MBH Steam, 2,843 MBH Water Gas Fired Cast Iron Boiler..... Note: Weil-McLain Model 88. Includes field assembly of individual sections and testing.	42,072.32	6,088.16
23 52 23 00-0058 EA 2,756 MBH Steam, 3,087 MBH Water Gas Fired Cast Iron Boiler..... Note: Weil-McLain Model 88. Includes field assembly of individual sections and testing.	45,399.22	6,328.20
23 52 23 00-0059 EA 2,966 MBH Steam, 3,322 MBH Water Gas Fired Cast Iron Boiler..... Note: Weil-McLain Model 88. Includes field assembly of individual sections and testing.	47,298.00	6,568.23

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 50 Central Heating Equipment****23 52 Heating Boilers**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 52 23 00-0060 EA 3,175 MBH Steam, 3,557 MBH Water Gas Fired Cast Iron Boiler..... Note: Weil-McLain Model 88. Includes field assembly of individual sections and testing.	49,310.30	6,808.27
23 52 23 00-0061 EA 3,383 MBH Steam, 3,800 MBH Water Gas Fired Cast Iron Boiler..... Note: Weil-McLain Model 88. Includes field assembly of individual sections and testing.	51,549.53	7,048.30
23 52 23 00-0062 EA 3,602 MBH Steam, 4,035 MBH Water Gas Fired Cast Iron Boiler..... Note: Weil-McLain Model 88. Includes field assembly of individual sections and testing.	53,376.32	7,288.34
23 52 23 00-0063 Gas Fired Package Weil-McLain Model 88 Cast Iron Boiler (23 52 23 00-0046)		
23 52 23 00-0064 EA 608 MBH Steam, 704 MBH Water Gas Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 88. Fire tested factory assembled package unit.	16,486.36	562.35
23 52 23 00-0065 EA 813 MBH Steam, 943 MBH Water Gas Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 88. Fire tested factory assembled package unit.	18,697.71	642.69
23 52 23 00-0066 EA 1,028 MBH Steam, 1,161 MBH Water Gas Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 88. Fire tested factory assembled package unit.	21,436.15	723.02
23 52 23 00-0067 EA 1,254 MBH Steam, 1,419 MBH Water Gas Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 88. Fire tested factory assembled package unit.	23,833.34	803.36
23 52 23 00-0068 EA 1,477 MBH Steam, 1,656 MBH Water Gas Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 88. Fire tested factory assembled package unit.	25,609.94	803.36
23 52 23 00-0069 EA 1,688 MBH Steam, 1,892 MBH Water Gas Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 88. Fire tested factory assembled package unit.	28,633.98	883.70
23 52 23 00-0070 EA 1,904 MBH Steam, 2,132 MBH Water Gas Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 88. Fire tested factory assembled package unit.	30,432.63	883.70
23 52 23 00-0071 EA 2,116 MBH Steam, 2,369 MBH Water Gas Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 88. Fire tested factory assembled package unit.	32,312.19	964.03
23 52 23 00-0072 EA 2,329 MBH Steam, 2,609 MBH Water Gas Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 88. Fire tested factory assembled package unit.	34,486.74	964.03
23 52 23 00-0073 EA 2,539 MBH Steam, 2,843 MBH Water Gas Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 88. Fire tested factory assembled package unit.	36,501.75	1,044.37
23 52 23 00-0074 EA 2,756 MBH Steam, 3,087 MBH Water Gas Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 88. Fire tested factory assembled package unit.	38,452.68	1,124.71
23 52 23 00-0075 EA 2,966 MBH Steam, 3,322 MBH Water Gas Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 88. Fire tested factory assembled package unit.	40,052.88	1,124.71
23 52 23 00-0076 EA 3,175 MBH Steam, 3,557 MBH Water Gas Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 88. Fire tested factory assembled package unit.	42,086.77	1,205.05
23 52 23 00-0077 EA 3,383 MBH Steam, 3,800 MBH Water Gas Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 88. Fire tested factory assembled package unit.	44,026.12	1,205.05
23 52 23 00-0078 EA 3,602 MBH Steam, 4,035 MBH Water Gas Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 88. Fire tested factory assembled package unit.	45,896.18	1,285.38
23 52 23 00-0079 Gas/Oil Fired Weil-McLain Model 88 Cast Iron Boiler (23 52 23 00-0046)		
Note: Field assembled boilers can only be used in situations where package units cannot be installed.		
23 52 23 00-0080 EA 608 MBH Steam, 704 MBH Water Gas/Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 88. Includes field assembly of individual sections and testing.	22,018.13	3,927.85
23 52 23 00-0081 EA 813 MBH Steam, 943 MBH Water Gas/Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 88. Includes field assembly of individual sections and testing.	24,204.46	4,167.89
23 52 23 00-0082 EA 1,028 MBH Steam, 1,161 MBH Water Gas/Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 88. Includes field assembly of individual sections and testing.	27,098.56	4,407.92
23 52 23 00-0083 EA 1,254 MBH Steam, 1,419 MBH Water Gas/Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 88. Includes field assembly of individual sections and testing.	29,577.54	4,647.96
23 52 23 00-0084 EA 1,477 MBH Steam, 1,656 MBH Water Gas/Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 88. Includes field assembly of individual sections and testing.	31,553.19	4,887.98
23 52 23 00-0085 EA 1,688 MBH Steam, 1,892 MBH Water Gas/Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 88. Includes field assembly of individual sections and testing.	34,496.80	5,128.02
23 52 23 00-0086 EA 1,904 MBH Steam, 2,132 MBH Water Gas/Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 88. Includes field assembly of individual sections and testing.	37,019.87	5,368.05
23 52 23 00-0087 EA 2,116 MBH Steam, 2,369 MBH Water Gas/Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 88. Includes field assembly of individual sections and testing.	38,878.87	5,608.09
23 52 23 00-0088 EA 2,329 MBH Steam, 2,609 MBH Water Gas/Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 88. Includes field assembly of individual sections and testing.	41,326.57	5,848.12
23 52 23 00-0089 EA 2,539 MBH Steam, 2,843 MBH Water Gas/Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 88. Includes field assembly of individual sections and testing.	43,857.32	6,088.16
23 52 23 00-0090 EA 2,756 MBH Steam, 3,087 MBH Water Gas/Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 88. Includes field assembly of individual sections and testing.	47,274.52	6,328.20
23 52 23 00-0091 EA 2,966 MBH Steam, 3,322 MBH Water Gas/Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 88. Includes field assembly of individual sections and testing.	49,804.35	6,568.23
23 52 23 00-0092 EA 3,175 MBH Steam, 3,557 MBH Water Gas/Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 88. Includes field assembly of individual sections and testing.	51,184.55	6,808.27
23 52 23 00-0093 EA 3,383 MBH Steam, 3,800 MBH Water Gas/Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 88. Includes field assembly of individual sections and testing.	53,367.08	7,048.30
23 52 23 00-0094 EA 3,602 MBH Steam, 4,035 MBH Water Gas/Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 88. Includes field assembly of individual sections and testing.	55,213.82	7,288.34
23 52 23 00-0095 Gas/Oil Fired Package Weil-McLain Model 88 Cast Iron Boiler (23 52 23 00-0046)		
23 52 23 00-0096 EA 608 MBH Steam, 704 MBH Water Gas/Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 88. Fire tested factory assembled package cast iron unit.	17,217.16	562.35
23 52 23 00-0097 EA 813 MBH Steam, 943 MBH Water Gas/Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 88. Fire tested factory assembled package cast iron unit.	19,424.31	642.69
23 52 23 00-0098 EA 1,028 MBH Steam, 1,161 MBH Water Gas/Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 88. Fire tested factory assembled package cast iron unit.	22,341.25	723.02
23 52 23 00-0099 EA 1,254 MBH Steam, 1,419 MBH Water Gas/Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 88. Fire tested factory assembled package cast iron unit.	24,841.34	803.36



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 52 23 00-0100 EA 1,477 MBH Steam, 1,656 MBH Water Gas/Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 88. Fire tested factory assembled package cast iron unit.	26,517.14	803.36
23 52 23 00-0101 EA 1,688 MBH Steam, 1,892 MBH Water Gas/Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 88. Fire tested factory assembled package cast iron unit.	29,482.38	883.70
23 52 23 00-0102 EA 1,904 MBH Steam, 2,132 MBH Water Gas/Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 88. Fire tested factory assembled package cast iron unit.	31,706.28	883.70
23 52 23 00-0103 EA 2,116 MBH Steam, 2,369 MBH Water Gas/Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 88. Fire tested factory assembled package cast iron unit.	33,585.84	964.03
23 52 23 00-0104 EA 2,329 MBH Steam, 2,609 MBH Water Gas/Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 88. Fire tested factory assembled package cast iron unit.	35,735.19	964.03
23 52 23 00-0105 EA 2,539 MBH Steam, 2,843 MBH Water Gas/Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 88. Fire tested factory assembled package cast iron unit.	38,292.00	1,044.37
23 52 23 00-0106 EA 2,756 MBH Steam, 3,087 MBH Water Gas/Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 88. Fire tested factory assembled package cast iron unit.	40,327.98	1,124.71
23 52 23 00-0107 EA 2,966 MBH Steam, 3,322 MBH Water Gas/Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 88. Fire tested factory assembled package cast iron unit.	41,509.23	1,124.71
23 52 23 00-0108 EA 3,175 MBH Steam, 3,557 MBH Water Gas/Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 88. Fire tested factory assembled package cast iron unit.	43,961.02	1,205.05
23 52 23 00-0109 EA 3,383 MBH Steam, 3,800 MBH Water Gas/Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 88. Fire tested factory assembled package cast iron unit.	45,843.67	1,205.05
23 52 23 00-0110 EA 3,602 MBH Steam, 4,035 MBH Water Gas/Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 88. Fire tested factory assembled package cast iron unit.	47,712.68	1,285.38
23 52 23 00-0111 Weil-McLain Model 94 Cast Iron Boiler <small>(23 52 23)</small> Note: Capacities are the steam or water MBH output. Includes burner unit and controls. Excludes flue piping, fuel piping, boiler base or pad.		
23 52 23 00-0112 Gas Fired Weil-McLain Model 94 Cast Iron Boiler <small>(23 52 23 00-0111)</small> Note: Field assembled boilers can only be used in situations where package units cannot be installed.		
23 52 23 00-0113 EA 1,575 MBH Steam, 1,763 MBH Water Gas Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	57,592.64	7,637.48
23 52 23 00-0114 EA 1,801 MBH Steam, 2,017 MBH Water Gas Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	62,414.71	8,073.90
23 52 23 00-0115 EA 2,028 MBH Steam, 2,271 MBH Water Gas Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	66,821.64	8,510.34
23 52 23 00-0116 EA 2,255 MBH Steam, 2,525 MBH Water Gas Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	71,137.17	8,946.77
23 52 23 00-0117 EA 2,477 MBH Steam, 2,774 MBH Water Gas Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	75,492.69	9,383.19
23 52 23 00-0118 EA 2,702 MBH Steam, 3,026 MBH Water Gas Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	81,105.15	9,819.62
23 52 23 00-0119 EA 2,927 MBH Steam, 3,278 MBH Water Gas Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	85,210.97	10,256.05
23 52 23 00-0120 EA 3,160 MBH Steam, 3,539 MBH Water Gas Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	89,184.91	10,692.47
23 52 23 00-0121 EA 3,385 MBH Steam, 3,791 MBH Water Gas Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	95,631.44	11,128.90
23 52 23 00-0122 EA 3,610 MBH Steam, 4,043 MBH Water Gas Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	99,603.11	11,565.32
23 52 23 00-0123 EA 3,835 MBH Steam, 4,296 MBH Water Gas Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	103,014.94	12,001.75
23 52 23 00-0124 EA 4,061 MBH Steam, 4,548 MBH Water Gas Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	109,237.96	12,438.18
23 52 23 00-0125 EA 4,286 MBH Steam, 4,800 MBH Water Gas Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	113,242.29	12,874.60
23 52 23 00-0126 EA 4,511 MBH Steam, 5,052 MBH Water Gas Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	119,607.79	13,311.03
23 52 23 00-0127 EA 4,736 MBH Steam, 5,304 MBH Water Gas Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	123,821.32	13,747.47
23 52 23 00-0128 EA 4,961 MBH Steam, 5,557 MBH Water Gas Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	128,428.69	14,183.89
23 52 23 00-0129 EA 5,186 MBH Steam, 5,809 MBH Water Gas Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	132,390.76	14,620.32
23 52 23 00-0130 EA 5,411 MBH Steam, 6,061 MBH Water Gas Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	136,465.74	15,056.75
23 52 23 00-0131 Gas Fired Package Weil-McLain Model 94 Cast Iron Boiler <small>(23 52 23 00-0111)</small>		
23 52 23 00-0132 EA 1,575 MBH Steam, 1,763 MBH Water Gas Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	50,708.25	1,044.37
23 52 23 00-0133 EA 1,801 MBH Steam, 2,017 MBH Water Gas Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	55,310.43	1,124.71
23 52 23 00-0134 EA 2,028 MBH Steam, 2,271 MBH Water Gas Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	59,494.72	1,205.05
23 52 23 00-0135 EA 2,255 MBH Steam, 2,525 MBH Water Gas Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	63,590.78	1,285.38
23 52 23 00-0136 EA 2,477 MBH Steam, 2,774 MBH Water Gas Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	67,402.28	1,285.38
23 52 23 00-0137 EA 2,702 MBH Steam, 3,026 MBH Water Gas Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	71,399.75	1,365.71
23 52 23 00-0138 EA 2,927 MBH Steam, 3,278 MBH Water Gas Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	74,962.40	1,365.71

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 50 Central Heating Equipment****23 52 Heating Boilers**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 52 23 00-0139 EA 3,160 MBH Steam, 3,539 MBH Water Gas Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	78,715.10	1,446.05
23 52 23 00-0140 EA 3,385 MBH Steam, 3,791 MBH Water Gas Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	84,619.25	1,446.05
23 52 23 00-0141 EA 3,610 MBH Steam, 4,043 MBH Water Gas Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	88,370.90	1,526.38
23 52 23 00-0142 EA 3,835 MBH Steam, 4,296 MBH Water Gas Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	91,239.50	1,526.38
23 52 23 00-0143 EA 4,061 MBH Steam, 4,548 MBH Water Gas Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	97,243.49	1,606.72
23 52 23 00-0144 EA 4,286 MBH Steam, 4,800 MBH Water Gas Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	100,704.29	1,606.72
23 52 23 00-0145 EA 4,511 MBH Steam, 5,052 MBH Water Gas Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	106,867.89	1,687.06
23 52 23 00-0146 EA 4,736 MBH Steam, 5,304 MBH Water Gas Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	110,518.74	1,687.06
23 52 23 00-0147 EA 4,961 MBH Steam, 5,557 MBH Water Gas Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	114,903.58	1,767.40
23 52 23 00-0148 EA 5,186 MBH Steam, 5,809 MBH Water Gas Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	118,323.43	1,767.40
23 52 23 00-0149 EA 5,411 MBH Steam, 6,061 MBH Water Gas Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	122,176.93	1,847.73
23 52 23 00-0150 Oil Fired Weil-McLain Model 94 Cast Iron Boiler <small>(23 52 23 00-0111)</small> Note: Field assembled boilers can only be used in situations where package units cannot be installed.		
23 52 23 00-0151 EA 1,575 MBH Steam, 1,763 MBH Water Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	54,459.44	7,637.48
23 52 23 00-0152 EA 1,801 MBH Steam, 2,017 MBH Water Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	59,281.51	8,073.90
23 52 23 00-0153 EA 2,028 MBH Steam, 2,271 MBH Water Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	65,139.54	8,510.34
23 52 23 00-0154 EA 2,255 MBH Steam, 2,525 MBH Water Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	69,076.02	8,946.77
23 52 23 00-0155 EA 2,477 MBH Steam, 2,774 MBH Water Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	73,173.24	9,383.19
23 52 23 00-0156 EA 2,702 MBH Steam, 3,026 MBH Water Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	78,496.95	9,819.62
23 52 23 00-0157 EA 2,927 MBH Steam, 3,278 MBH Water Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	82,798.07	10,256.05
23 52 23 00-0158 EA 3,160 MBH Steam, 3,539 MBH Water Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	86,774.11	10,692.47
23 52 23 00-0159 EA 3,385 MBH Steam, 3,791 MBH Water Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	93,970.34	11,128.90
23 52 23 00-0160 EA 3,610 MBH Steam, 4,043 MBH Water Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	97,943.06	11,565.32
23 52 23 00-0161 EA 3,835 MBH Steam, 4,296 MBH Water Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	101,914.54	12,001.75
23 52 23 00-0162 EA 4,061 MBH Steam, 4,548 MBH Water Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	109,245.31	12,438.18
23 52 23 00-0163 EA 4,286 MBH Steam, 4,800 MBH Water Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	113,249.64	12,874.60
23 52 23 00-0164 EA 4,511 MBH Steam, 5,052 MBH Water Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	119,784.19	13,311.03
23 52 23 00-0165 EA 4,736 MBH Steam, 5,304 MBH Water Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	123,996.67	13,747.47
23 52 23 00-0166 EA 4,961 MBH Steam, 5,557 MBH Water Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	128,513.74	14,183.89
23 52 23 00-0167 EA 5,186 MBH Steam, 5,809 MBH Water Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	132,475.81	14,620.32
23 52 23 00-0168 EA 5,411 MBH Steam, 6,061 MBH Water Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	136,557.09	15,056.75
23 52 23 00-0169 Oil Fired Package Weil-McLain Model 94 Cast Iron Boiler <small>(23 52 23 00-0111)</small>		
23 52 23 00-0170 EA 1,575 MBH Steam, 1,763 MBH Water Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	47,404.95	1,044.37
23 52 23 00-0171 EA 1,801 MBH Steam, 2,017 MBH Water Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	52,007.13	1,124.71
23 52 23 00-0172 EA 2,028 MBH Steam, 2,271 MBH Water Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	57,642.52	1,205.05
23 52 23 00-0173 EA 2,255 MBH Steam, 2,525 MBH Water Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	61,359.53	1,285.38
23 52 23 00-0174 EA 2,477 MBH Steam, 2,774 MBH Water Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	64,912.73	1,285.38
23 52 23 00-0175 EA 2,702 MBH Steam, 3,026 MBH Water Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	68,621.45	1,365.71
23 52 23 00-0176 EA 2,927 MBH Steam, 3,278 MBH Water Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	72,379.40	1,365.71
23 52 23 00-0177 EA 3,160 MBH Steam, 3,539 MBH Water Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	76,132.10	1,446.05
23 52 23 00-0178 EA 3,385 MBH Steam, 3,791 MBH Water Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	82,788.05	1,446.05



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 52 23 00-0179 EA 3,610 MBH Steam, 4,043 MBH Water Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	86,538.65	1,526.38
23 52 23 00-0180 EA 3,835 MBH Steam, 4,296 MBH Water Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	89,969.00	1,526.38
23 52 23 00-0181 EA 4,061 MBH Steam, 4,548 MBH Water Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	97,080.74	1,606.72
23 52 23 00-0182 EA 4,286 MBH Steam, 4,800 MBH Water Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	100,541.54	1,606.72
23 52 23 00-0183 EA 4,511 MBH Steam, 5,052 MBH Water Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	106,853.19	1,687.06
23 52 23 00-0184 EA 4,736 MBH Steam, 5,304 MBH Water Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	110,523.99	1,687.06
23 52 23 00-0185 EA 4,961 MBH Steam, 5,557 MBH Water Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	114,818.53	1,767.40
23 52 23 00-0186 EA 5,186 MBH Steam, 5,809 MBH Water Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	118,238.38	1,767.40
23 52 23 00-0187 EA 5,411 MBH Steam, 6,061 MBH Water Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	122,098.18	1,847.73
23 52 23 00-0188 Gas/Oil Fired Weil-McLain Model 94 Cast Iron Boiler (23 52 23 00-0111) Note: Field assembled boilers can only be used in situations where package units cannot be installed.		
23 52 23 00-0189 EA 1,575 MBH Steam, 1,763 MBH Water Gas/Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	58,577.54	7,637.48
23 52 23 00-0190 EA 1,801 MBH Steam, 2,017 MBH Water Gas/Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	63,400.66	8,073.90
23 52 23 00-0191 EA 2,028 MBH Steam, 2,271 MBH Water Gas/Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	68,076.39	8,510.34
23 52 23 00-0192 EA 2,255 MBH Steam, 2,525 MBH Water Gas/Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	72,497.97	8,946.77
23 52 23 00-0193 EA 2,477 MBH Steam, 2,774 MBH Water Gas/Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	76,829.34	9,383.19
23 52 23 00-0194 EA 2,702 MBH Steam, 3,026 MBH Water Gas/Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	81,598.65	9,819.62
23 52 23 00-0195 EA 2,927 MBH Steam, 3,278 MBH Water Gas/Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	86,850.02	10,256.05
23 52 23 00-0196 EA 3,160 MBH Steam, 3,539 MBH Water Gas/Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	91,082.26	10,692.47
23 52 23 00-0197 EA 3,385 MBH Steam, 3,791 MBH Water Gas/Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	97,693.64	11,128.90
23 52 23 00-0198 EA 3,610 MBH Steam, 4,043 MBH Water Gas/Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	101,665.31	11,565.32
23 52 23 00-0199 EA 3,835 MBH Steam, 4,296 MBH Water Gas/Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	105,150.64	12,001.75
23 52 23 00-0200 EA 4,061 MBH Steam, 4,548 MBH Water Gas/Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	111,445.06	12,438.18
23 52 23 00-0201 EA 4,286 MBH Steam, 4,800 MBH Water Gas/Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	116,499.39	12,874.60
23 52 23 00-0202 EA 4,511 MBH Steam, 5,052 MBH Water Gas/Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	123,427.69	13,311.03
23 52 23 00-0203 EA 4,736 MBH Steam, 5,304 MBH Water Gas/Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	127,609.72	13,747.47
23 52 23 00-0204 EA 4,961 MBH Steam, 5,557 MBH Water Gas/Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	132,412.39	14,183.89
23 52 23 00-0205 EA 5,186 MBH Steam, 5,809 MBH Water Gas/Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	136,375.51	14,620.32
23 52 23 00-0206 EA 5,411 MBH Steam, 6,061 MBH Water Gas/Oil Fired Cast Iron Boiler..... Note: Weil-McLain Model 94. Includes field assembly of individual sections and testing.	140,453.64	15,056.75
23 52 23 00-0207 Gas/Oil Fired Package Weil-McLain Model 94 Cast Iron Boiler (23 52 23 00-0111)		
23 52 23 00-0208 EA 1,575 MBH Steam, 1,763 MBH Water Gas/Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	51,769.80	1,044.37
23 52 23 00-0209 EA 1,801 MBH Steam, 2,017 MBH Water Gas/Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	56,373.03	1,124.71
23 52 23 00-0210 EA 2,028 MBH Steam, 2,271 MBH Water Gas/Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	60,829.27	1,205.05
23 52 23 00-0211 EA 2,255 MBH Steam, 2,525 MBH Water Gas/Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	65,029.28	1,285.38
23 52 23 00-0212 EA 2,477 MBH Steam, 2,774 MBH Water Gas/Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	68,816.63	1,285.38
23 52 23 00-0213 EA 2,702 MBH Steam, 3,026 MBH Water Gas/Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	71,969.90	1,365.71
23 52 23 00-0214 EA 2,927 MBH Steam, 3,278 MBH Water Gas/Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	76,678.10	1,365.71
23 52 23 00-0215 EA 3,160 MBH Steam, 3,539 MBH Water Gas/Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	80,688.05	1,446.05
23 52 23 00-0216 EA 3,385 MBH Steam, 3,791 MBH Water Gas/Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	86,759.15	1,446.05
23 52 23 00-0217 EA 3,610 MBH Steam, 4,043 MBH Water Gas/Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	90,508.70	1,526.38
23 52 23 00-0218 EA 3,835 MBH Steam, 4,296 MBH Water Gas/Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	93,451.85	1,526.38

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 50 Central Heating Equipment****23 52 Heating Boilers**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 52	23 00-0219	EA	4,061 MBH Steam, 4,548 MBH Water Gas/Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	99,527.24	1,606.72
23 52	23 00-0220	EA	4,286 MBH Steam, 4,800 MBH Water Gas/Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	104,039.09	1,606.72
23 52	23 00-0221	EA	4,511 MBH Steam, 5,052 MBH Water Gas/Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	110,744.49	1,687.06
23 52	23 00-0222	EA	4,736 MBH Steam, 5,304 MBH Water Gas/Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	114,384.84	1,687.06
23 52	23 00-0223	EA	4,961 MBH Steam, 5,557 MBH Water Gas/Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	118,963.93	1,767.40
23 52	23 00-0224	EA	5,186 MBH Steam, 5,809 MBH Water Gas/Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	122,384.83	1,767.40
23 52	23 00-0225	EA	5,411 MBH Steam, 6,061 MBH Water Gas/Oil Fired Package Cast Iron Boiler..... Note: Weil-McLain Model 94. Fire tested factory assembled package cast iron unit.	126,242.53	1,847.73

23 52 33 Water-Tube Boilers (23 52)**23 52 33 13 Finned Water-Tube Boilers (23 52 33)****23 52 33 13-0001 Laars Pennant 85% Efficient Water, Gas Fired, Copper Fin Tube LoNox Boiler (23 52 33 13)**

23 52 33	13-0002	EA	200 MBH 85% Efficient, Water, Gas Fired, Copper Fin Tube LoNox Boiler (Laars Pennant).....	6,197.69	436.84
23 52 33	13-0003	EA	300 MBH 85% Efficient, Water, Gas Fired, Copper Fin Tube LoNox Boiler (Laars Pennant).....	6,820.68	485.37
23 52 33	13-0004	EA	400 MBH 85% Efficient, Water, Gas Fired, Copper Fin Tube LoNox Boiler (Laars Pennant).....	7,837.00	582.45
23 52 33	13-0005	EA	500 MBH 85% Efficient, Water, Gas Fired, Copper Fin Tube LoNox Boiler (Laars Pennant).....	10,001.89	606.72
23 52 33	13-0006	EA	750 MBH 85% Efficient, Water, Gas Fired, Copper Fin Tube LoNox Boiler (Laars Pennant).....	11,750.95	728.06
23 52 33	13-0007	EA	1,000 MBH 85% Efficient, Water, Gas Fired, Copper Fin Tube LoNox Boiler (Laars Pennant).....	14,438.15	873.68
23 52 33	13-0008	EA	1,250 MBH 85% Efficient, Water, Gas Fired, Copper Fin Tube LoNox Boiler (Laars Pennant).....	16,397.23	922.21
23 52 33	13-0009	EA	1,500 MBH 85% Efficient, Water, Gas Fired, Copper Fin Tube LoNox Boiler (Laars Pennant).....	18,161.52	995.02
23 52 33	13-0010	EA	1,750 MBH 85% Efficient, Water, Gas Fired, Copper Fin Tube LoNox Boiler (Laars Pennant).....	19,801.48	1,043.56
23 52 33	13-0011	EA	2,000 MBH 85% Efficient, Water, Gas Fired, Copper Fin Tube LoNox Boiler (Laars Pennant).....	21,245.33	1,067.82

23 52 33 13-0012 Patterson Kelly Modufire Forced Draft, Water, Gas Fired, Copper Fin Tube Boiler (23 52 33 13)

23 52 33	13-0013	EA	1,000 MBH Forced Draft, Water, Gas Fired, Copper Fin Tube Boiler (Patterson Kelly Modufire).....	21,594.47	873.68
23 52 33	13-0014	EA	1,500 MBH Forced Draft, Water, Gas Fired, Copper Fin Tube Boiler (Patterson Kelly Modufire).....	26,965.31	995.02
23 52 33	13-0015	EA	2,000 MBH Forced Draft, Water, Gas Fired, Copper Fin Tube Boiler (Patterson Kelly Modufire).....	28,734.02	1,067.82
23 52 33	13-0016	EA	2,500 MBH Forced Draft, Water, Gas Fired, Copper Fin Tube Boiler (Patterson Kelly Modufire).....	40,639.07	1,213.44
23 52 33	13-0017	EA	3,000 MBH Forced Draft, Water, Gas Fired, Copper Fin Tube Boiler (Patterson Kelly Modufire).....	42,630.63	1,359.05

23 52 33 13-0018 Lochinvar Copper-Fin II Finned Tube Boiler (23 52 33 13)

23 52 33	13-0019	EA	340 MBH, 85% Efficient, Gas Fired, Copper Finned Tube Boiler (Lochinvar CHN0402)..... <i>For High And Low Gas Pressure Switch With Manual Reset, Add 259.95</i> <i>For Low Water Cut-Off, Probe Type, Manual Reset With Test, Add 230.29</i>	7,271.47	391.98
23 52 33	13-0020	EA	425 MBH, 85% Efficient, Gas Fired, Copper Finned Tube Boiler (Lochinvar CHN0502)..... <i>For High And Low Gas Pressure Switch With Manual Reset, Add 259.95</i> <i>For Low Water Cut-Off, Probe Type, Manual Reset With Test, Add 230.29</i>	8,742.49	489.79
23 52 33	13-0021	EA	552.5 MBH, 85% Efficient, Gas Fired, Copper Finned Tube Boiler (Lochinvar CHN0652)..... <i>For High And Low Gas Pressure Switch With Manual Reset, Add 259.95</i> <i>For Low Water Cut-Off, Probe Type, Manual Reset With Test, Add 230.29</i>	9,423.77	588.34
23 52 33	13-0022	EA	637.5 MBH, 85% Efficient, Gas Fired, Copper Finned Tube Boiler (Lochinvar CHN0752)..... <i>For High And Low Gas Pressure Switch With Manual Reset, Add 259.95</i> <i>For Low Water Cut-Off, Probe Type, Manual Reset With Test, Add 230.29</i>	9,671.71	588.34
23 52 33	13-0023	EA	841.5 MBH, 85% Efficient, Gas Fired, Copper Finned Tube Boiler (Lochinvar CHN0992)..... <i>For High And Low Gas Pressure Switch With Manual Reset, Add 259.95</i> <i>For Low Water Cut-Off, Probe Type, Manual Reset With Test, Add 230.29</i>	12,001.16	735.42
23 52 33	13-0024	EA	1,071 MBH, 85% Efficient, Gas Fired, Copper Finned Tube Boiler (Lochinvar CHN1262)..... <i>For High And Low Gas Pressure Switch With Manual Reset, Add 259.95</i> <i>For Low Water Cut-Off, Probe Type, Manual Reset With Test, Add 230.29</i>	13,820.85	735.42
23 52 33	13-0025	EA	1,224 MBH, 85% Efficient, Gas Fired, Copper Finned Tube Boiler (Lochinvar CHN1442)..... <i>For High And Low Gas Pressure Switch With Manual Reset, Add 259.95</i> <i>For Low Water Cut-Off, Probe Type, Manual Reset With Test, Add 230.29</i>	15,024.55	735.42
23 52 33	13-0026	EA	1,530 MBH, 85% Efficient, Gas Fired, Copper Finned Tube Boiler (Lochinvar CHN1802)..... <i>For High And Low Gas Pressure Switch With Manual Reset, Add 259.95</i> <i>For Low Water Cut-Off, Probe Type, Manual Reset With Test, Add 230.29</i>	16,255.55	882.50
23 52 33	13-0027	EA	1,759.5 MBH, 85% Efficient, Gas Fired, Copper Finned Tube Boiler (Lochinvar CHN2072)..... <i>For High And Low Gas Pressure Switch With Manual Reset, Add 259.95</i> <i>For Low Water Cut-Off, Probe Type, Manual Reset With Test, Add 230.29</i>	19,216.52	1,029.58

23 52 33 13-0028 Raypak Cupro-Nickel Finned-Tube Boiler With Pump (23 52 33 13)

23 52 33	13-0029	EA	385 MBH Water, Gas Fired, On/Off, Cupro-Nickel Finned-Tube Boiler With Pump (Raypak H4-399B).....	7,117.12	538.76
23 52 33	13-0030	EA	420 MBH Water, Gas Fired, Two Stage, Cupro-Nickel Finned-Tube Boiler With Pump (Raypak H3-499B).....	7,667.70	485.37
23 52 33	13-0031	EA	546 MBH Water, Gas Fired, Two Stage, Cupro-Nickel Finned-Tube Boiler With Pump (Raypak H3-649B).....	8,501.16	582.45
23 52 33	13-0032	EA	630 MBH Water, Gas Fired, Two Stage, Cupro-Nickel Finned-Tube Boiler With Pump (Raypak H3-749B).....	9,030.34	661.21
23 52 33	13-0033	EA	756 MBH Water, Gas Fired, Two Stage, Cupro-Nickel Finned-Tube Boiler With Pump (Raypak H3-899B).....	10,031.21	728.06
23 52 33	13-0034	EA	832 MBH Water, Gas Fired, Two Stage, Cupro-Nickel Finned-Tube Boiler With Pump (Raypak H3-989B).....	10,785.15	783.66
23 52 33	13-0035	EA	1,058 MBH Water, Gas Fired, Three Stage, Cupro-Nickel Finned-Tube Boiler With Pump (Raypak H8-1259B).....	12,314.45	873.68
23 52 33	13-0036	EA	1,285 MBH Water, Gas Fired, Four Stage, Cupro-Nickel Finned-Tube Boiler With Pump (Raypak H9-1529B).....	14,254.29	922.21



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
	23 52 33 13-0037	EA		1,512 MBH Water, Gas Fired, Four Stage, Cupro-Nickel Finned-Tube Boiler With Pump (Raypak H9-1799B).....	15,134.22	995.02
	23 52 33 13-0038	EA		1,679 MBH Water, Gas Fired, Four Stage, Cupro-Nickel Finned-Tube Boiler With Pump (Raypak H9-1999B).....	17,991.61	1,019.29
	23 52 33 13-0039	EA		1,739 MBH Water, Gas Fired, Four Stage, Cupro-Nickel Finned-Tube Boiler With Pump (Raypak H9-2069B).....	18,065.15	1,043.56
	23 52 33 13-0040	EA		1,966 MBH Water, Gas Fired, Four Stage, Cupro-Nickel Finned-Tube Boiler With Pump (Raypak H9-2339B).....	21,047.76	1,067.82
23 52 33 16 Steel Water-Tube Boilers (23 52 33)						
23 52 33 16-0001 Unilux 85% Efficient, Gas Fired, Forced Draft, Hot Water, Steel Flexible Watertube Boiler (23 52 33 16)						
Note: Compliant with SCAQMD.						
	23 52 33 16-0002	EA		1,250 MBH Input/1,062 MBH Output, 85% Efficient, Gas Fired, Forced Draft, Hot Water, Steel Flexible Watertube Boiler (Unilux ZF100).....	44,316.16	1,176.67
	23 52 33 16-0003	EA		1,750 MBH Input/1,488 MBH Output, 85% Efficient, Gas Fired, Forced Draft, Hot Water, Steel Flexible Watertube Boiler (Unilux ZF150).....	47,744.72	1,470.83
	23 52 33 16-0004	EA		2,200 MBH Input/1,870 MBH Output, 85% Efficient, Gas Fired, Forced Draft, Hot Water, Steel Flexible Watertube Boiler (Unilux ZF200).....	99,151.82	1,617.92
	23 52 33 16-0005	EA		2,750 MBH Input/2,338 MBH Output, 85% Efficient, Gas Fired, Forced Draft, Hot Water, Steel Flexible Watertube Boiler (Unilux ZF250).....	102,916.75	1,765.00
	23 52 33 16-0006	EA		3,000 MBH Input/2,550 MBH Output, 85% Efficient, Gas Fired, Forced Draft, Hot Water, Steel Flexible Watertube Boiler (Unilux ZF300).....	104,778.11	1,985.63
	23 52 33 16-0007	EA		3,750 MBH Output/3,188 MBH Input, 85% Efficient, Gas Fired, Forced Draft, Hot Water, Steel Flexible Watertube Boiler (Unilux VZ350).....	110,424.96	2,206.25
	23 52 33 16-0008	EA		4,300 MBH Input/3,655 MBH Output, 85% Efficient, Gas Fired, Forced Draft, Hot Water, Steel Flexible Watertube Boiler (Unilux VZ400).....	112,938.53	2,279.79
23 52 33 16-0009 Unilux 83% Efficient, Gas Fired, Forced Draft, Low Pressure Steam, Steel Flexible Watertube Boiler (23 52 33 16)						
Note: Compliant with SCAQMD.						
	23 52 33 16-0010	EA		1,250 MBH, 31 HP, 83% Efficient, Gas Fired, Forced Draft, Low Pressure Steam, Steel Flexible Watertube Boiler (Unilux ZF100LSG).....	51,709.78	1,323.75
	23 52 33 16-0011	EA		1,750 MBH, 43.5 HP, 83% Efficient, Gas Fired, Forced Draft, Low Pressure Steam, Steel Flexible Watertube Boiler (Unilux ZF150LSG).....	54,359.60	1,544.37
	23 52 33 16-0012	EA		2,200 MBH, 54.5 HP, 83% Efficient, Gas Fired, Forced Draft, Low Pressure Steam, Steel Flexible Watertube Boiler (Unilux ZF200LSG).....	106,398.35	1,691.46
	23 52 33 16-0013	EA		2,750 MBH, 68 HP, 83% Efficient, Gas Fired, Forced Draft, Low Pressure Steam, Steel Flexible Watertube Boiler (Unilux ZF250LSG).....	113,002.40	1,838.54
	23 52 33 16-0014	EA		3,000 MBH, 74 HP, 83% Efficient, Gas Fired, Forced Draft, Low Pressure Steam, Steel Flexible Watertube Boiler (Unilux ZF300LSG).....	115,347.23	1,985.63
	23 52 33 16-0015	EA		3,750 MBH, 93 HP, 83% Efficient, Gas Fired, Forced Draft, Low Pressure Steam, Steel Flexible Watertube Boiler (Unilux ZF350LSG).....	119,889.79	2,206.25
	23 52 33 16-0016	EA		4,300 MBH, 106.5 HP, 83% Efficient, Gas Fired, Forced Draft, Low Pressure Steam, Steel Flexible Watertube Boiler (Unilux ZF400LSG).....	123,973.86	2,353.33
	23 52 33 16-0017	EA		5,400 MBH, 134 HP, 83% Efficient, Gas Fired, Forced Draft, Low Pressure Steam, Steel Flexible Watertube Boiler (Unilux ZF500LSG).....	122,212.96	2,500.41
	23 52 33 16-0018	EA		6,250 MBH, 155 HP, 83% Efficient, Gas Fired, Forced Draft, Low Pressure Steam, Steel Flexible Watertube Boiler (Unilux ZF600LSG).....	132,287.78	2,647.50
	23 52 33 16-0019	EA		7,235 MBH, 179 HP, 83% Efficient, Gas Fired, Forced Draft, Low Pressure Steam, Steel Flexible Watertube Boiler (Unilux ZF700LSG).....	139,207.65	2,794.59
	23 52 33 16-0020	EA		8,270 MBH, 205 HP, 83% Efficient, Gas Fired, Forced Draft, Low Pressure Steam, Steel Flexible Watertube Boiler (Unilux ZF800LSG).....	142,814.67	2,941.67
23 52 33 16-0021 Unilux 81% Efficient, Gas Fired, Forced Draft, High Pressure Steam, Steel Flexible Watertube Boiler (South Coast California) (23 52 33 16)						
Note: Compliant with SCAQMD.						
	23 52 33 16-0022	EA		1,250 MBH, 31 HP, 81% Efficient, Gas Fired, Forced Draft, High Pressure Steam, Steel Flexible Watertube Boiler (Unilux 100HS).....	55,653.18	1,323.75
	23 52 33 16-0023	EA		1,750 MBH, 43.5 HP, 81% Efficient, Gas Fired, Forced Draft, High Pressure Steam, Steel Flexible Watertube Boiler (Unilux 150HS).....	59,092.56	1,544.37
	23 52 33 16-0024	EA		2,200 MBH, 54.5 HP, 81% Efficient, Gas Fired, Forced Draft, High Pressure Steam, Steel Flexible Watertube Boiler (Unilux 200HS).....	111,761.87	1,691.46
	23 52 33 16-0025	EA		2,750 MBH, 68 HP, 81% Efficient, Gas Fired, Forced Draft, High Pressure Steam, Steel Flexible Watertube Boiler (Unilux 250HS).....	118,523.82	1,838.54
	23 52 33 16-0026	EA		3,000 MBH, 74 HP, 81% Efficient, Gas Fired, Forced Draft, High Pressure Steam, Steel Flexible Watertube Boiler (Unilux 300HS).....	120,868.65	1,985.63
	23 52 33 16-0027	EA		3,750 MBH, 93 HP, 81% Efficient, Gas Fired, Forced Draft, High Pressure Steam, Steel Flexible Watertube Boiler (Unilux 350HS).....	124,622.76	2,206.25
	23 52 33 16-0028	EA		4,300 MBH, 106.5 HP, 81% Efficient, Gas Fired, Forced Draft, High Pressure Steam, Steel Flexible Watertube Boiler (Unilux 400HS).....	128,861.42	2,353.33
	23 52 33 16-0029	EA		5,400 MBH, 134 HP, 81% Efficient, Gas Fired, Forced Draft, High Pressure Steam, Steel Flexible Watertube Boiler (Unilux 500HS).....	126,788.02	2,500.41
	23 52 33 16-0030	EA		6,250 MBH, 155 HP, 81% Efficient, Gas Fired, Forced Draft, High Pressure Steam, Steel Flexible Watertube Boiler (Unilux 600HS).....	137,652.39	2,647.50
	23 52 33 16-0031	EA		7,235 MBH, 179 HP, 81% Efficient, Gas Fired, Forced Draft, High Pressure Steam, Steel Flexible Watertube Boiler (Unilux 700HS).....	142,047.88	2,794.59
	23 52 33 16-0032	EA		8,270 MBH, 205 HP, 81% Efficient, Gas Fired, Forced Draft, High Pressure Steam, Steel Flexible Watertube Boiler (Unilux 800HS).....	148,179.29	2,941.67
	23 52 33 16-0033	EA		9,300 MBH, 230 HP, 81% Efficient, Gas Fired, Forced Draft, High Pressure Steam, Steel Flexible Watertube Boiler (Unilux 900HS).....	164,721.91	3,088.75
	23 52 33 16-0034	EA		10,330 MBH, 256 HP, 81% Efficient, Gas Fired, Forced Draft, High Pressure Steam, Steel Flexible Watertube Boiler (Unilux 1000HS).....	237,819.38	3,235.83

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 50 Central Heating Equipment****23 52 Heating Boilers**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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23 52 33 16-0035 EA 12,400 MBH, 307 HP, 81% Efficient, Gas Fired, Forced Draft, High Pressure Steam, Steel Flexible Watertube Boiler (Unilux 1200HS)	249,866.44	3,382.92
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23 52 36 Fire-Box Boiler (23 52)**23 52 36 00-0001 Package Oil Fired Firebox Boilers (23 52 36)**

Note: Prices are good for 15 PSI steam or 30 PSI water. Packaged type, complete with burner and all basic safety controls (low water cut-off, high/low temperature and pressure operating controls, flame failure, main and pilot gas control, etc.) Normally required (Boiler HP). boiler sizes are based on HP rating and gross output.

23 52 36 00-0002 EA 40 HP, 1,339 MBH Oil Fired Firebox Boiler, 15 PSI Steam Or 30 PSI Water	38,322.41	1,928.07
23 52 36 00-0003 EA 46 HP, 1,553 MBH Oil Fired Firebox Boiler, 15 PSI Steam Or 30 PSI Water	40,118.98	2,088.74
23 52 36 00-0004 EA 53 HP, 1,784 MBH Oil Fired Firebox Boiler, 15 PSI Steam Or 30 PSI Water	42,049.63	2,249.41
23 52 36 00-0005 EA 61 HP, 2,062 MBH Oil Fired Firebox Boiler, 15 PSI Steam Or 30 PSI Water	45,455.50	2,410.08
23 52 36 00-0006 EA 69 HP, 2,313 MBH Oil Fired Firebox Boiler, 15 PSI Steam Or 30 PSI Water	47,520.24	2,570.76
23 52 36 00-0007 EA 80 HP, 2,678 MBH Oil Fired Firebox Boiler, 15 PSI Steam Or 30 PSI Water	49,551.56	2,731.43
23 52 36 00-0008 EA 100 HP, 3,348 MBH Oil Fired Firebox Boiler, 15 PSI Steam Or 30 PSI Water	55,009.28	2,892.10
23 52 36 00-0009 EA 127 HP, 4,251 MBH Oil Fired Firebox Boiler, 15 PSI Steam Or 30 PSI Water	63,557.75	3,213.44
23 52 36 00-0010 EA 151 HP, 5,055 MBH Oil Fired Firebox Boiler, 15 PSI Steam Or 30 PSI Water	72,247.09	3,534.79
23 52 36 00-0011 EA 183 HP, 6,126 MBH Oil Fired Firebox Boiler, 15 PSI Steam Or 30 PSI Water	79,273.19	3,896.31
23 52 36 00-0012 EA 220 HP, 7,388 MBH Oil Fired Firebox Boiler, 15 PSI Steam Or 30 PSI Water	86,299.40	4,257.81
23 52 36 00-0013 EA 257 HP, 8,606 MBH Oil Fired Firebox Boiler, 15 PSI Steam Or 30 PSI Water	91,098.32	4,980.84
23 52 36 00-0014 EA 294 HP, 9,842 MBH Oil Fired Firebox Boiler, 15 PSI Steam Or 30 PSI Water	110,749.76	5,703.87
23 52 36 00-0015 EA 368 HP, 12,302 MBH Oil Fired Firebox Boiler, 15 PSI Steam Or 30 PSI Water	130,870.58	6,426.89
23 52 36 00-0016 EA 441 HP, 14,766 MBH Oil Fired Firebox Boiler, 15 PSI Steam Or 30 PSI Water	151,252.71	7,230.25
23 52 36 00-0017 EA 514 HP, 17,220 MBH Oil Fired Firebox Boiler, 15 PSI Steam Or 30 PSI Water	171,031.94	7,832.77

23 53 Heating Boiler Feedwater Equipment (23 50)**23 53 13 Boiler Feedwater Pumps (23 53)**

See CSI section 23 53 16 00-0001 for boiler feedwater units.

23 53 16 Deaerators (23 53)**23 53 16 00-0001 Boiler Feed System (23 53 16)****23 53 16 00-0002 Low Pressure Boiler Feed System (23 53 16 00-0001)**

Note: With deaerator includes pumps and accessories.

23 53 16 00-0003 EA 20 HP, 200 KW Boiler Feed System With Deaerator, Pumps And Accessories, Low Pressure System.....	4,834.02	919.39
23 53 16 00-0004 EA 34 HP, 340 KW Boiler Feed System With Deaerator, Pumps And Accessories, Low Pressure System.....	5,215.55	1,083.13
23 53 16 00-0005 EA 54 HP, 530 KW Boiler Feed System With Deaerator, Pumps And Accessories, Low Pressure System.....	5,604.04	1,121.08
23 53 16 00-0006 EA 67 HP, 660 KW Boiler Feed System With Deaerator, Pumps And Accessories, Low Pressure System.....	5,782.83	1,162.22
23 53 16 00-0007 EA 78 HP, 760 KW Boiler Feed System With Deaerator, Pumps And Accessories, Low Pressure System.....	6,118.85	1,242.09
23 53 16 00-0008 EA 104 HP, 1,020 KW Boiler Feed System With Deaerator, Pumps And Accessories, Low Pressure System.....	9,811.72	1,345.93
23 53 16 00-0009 EA 158 HP, 1,550 KW Boiler Feed System With Deaerator, Pumps And Accessories, Low Pressure System.....	11,073.43	1,437.79
23 53 16 00-0010 EA 219 HP, 2,150 KW Boiler Feed System With Deaerator, Pumps And Accessories, Low Pressure System.....	12,694.98	1,637.48
23 53 16 00-0011 EA 254 HP, 2,500 KW Boiler Feed System With Deaerator, Pumps And Accessories, Low Pressure System.....	13,971.75	1,757.31
23 53 16 00-0012 EA 305 HP, 3,000 KW Boiler Feed System With Deaerator, Pumps And Accessories, Low Pressure System.....	15,053.77	1,877.12

23 53 16 00-0013 High Pressure Boiler Feed System (23 53 16 00-0001)

Note: With deaerator includes pumps and accessories.

23 53 16 00-0014 EA 10 HP, 100 KW Boiler Feed System With Deaerator, Pumps And Accessories, High Pressure System.....	6,727.39	783.84
23 53 16 00-0015 EA 20 HP, 200 KW Boiler Feed System With Deaerator, Pumps And Accessories, High Pressure System.....	7,005.60	919.39
23 53 16 00-0016 EA 34 HP, 340 KW Boiler Feed System With Deaerator, Pumps And Accessories, High Pressure System.....	7,793.42	1,083.13
23 53 16 00-0017 EA 54 HP, 530 KW Boiler Feed System With Deaerator, Pumps And Accessories, High Pressure System.....	8,424.79	1,121.08
23 53 16 00-0018 EA 67 HP, 660 KW Boiler Feed System With Deaerator, Pumps And Accessories, High Pressure System.....	8,571.13	1,162.22
23 53 16 00-0019 EA 78 HP, 760 KW Boiler Feed System With Deaerator, Pumps And Accessories, High Pressure System.....	10,351.80	1,242.09
23 53 16 00-0020 EA 104 HP, 1,020 KW Boiler Feed System With Deaerator, Pumps And Accessories, High Pressure System.....	13,481.34	1,345.93
23 53 16 00-0021 EA 158 HP, 1,550 KW Boiler Feed System With Deaerator, Pumps And Accessories, High Pressure System.....	13,826.65	1,437.79
23 53 16 00-0022 EA 183 HP, 1,800 KW Boiler Feed System With Deaerator, Pumps And Accessories, High Pressure System.....	15,212.31	1,539.71
23 53 16 00-0023 EA 219 HP, 2,150 KW Boiler Feed System With Deaerator, Pumps And Accessories, High Pressure System.....	16,370.93	1,637.48
23 53 16 00-0024 EA 254 HP, 2,500 KW Boiler Feed System With Deaerator, Pumps And Accessories, High Pressure System.....	17,512.84	1,757.31
23 53 16 00-0025 EA 305 HP, 3,000 KW Boiler Feed System With Deaerator, Pumps And Accessories, High Pressure System.....	18,893.64	1,877.12

23 53 16 00-0026 Boiler Feedwater System (23 53 16)

Note: With deaerator includes pumps and accessories.

23 53 16 00-0027 EA 1,380 LB/Hour Feedwater System With Deaerator, Pumps, And Accessories	8,401.37	1,083.13
23 53 16 00-0028 EA 2,600 LB/Hour Feedwater System With Deaerator, Pumps, And Accessories	10,962.57	1,240.89
23 53 16 00-0029 EA 4,300 LB/Hour Feedwater System With Deaerator, Pumps, And Accessories	14,481.09	1,420.22
23 53 16 00-0030 EA 6,900 LB/Hour Feedwater System With Deaerator, Pumps, And Accessories	17,424.62	1,638.29
23 53 16 00-0031 EA 8,500 LB/Hour Feedwater System With Deaerator, Pumps, And Accessories	18,491.81	1,757.31
23 53 16 00-0032 EA 11,000 LB/Hour Feedwater System With Deaerator, Pumps, And Accessories	19,506.29	1,877.12
23 53 16 00-0033 EA 13,800 LB/Hour Feedwater System With Deaerator, Pumps, And Accessories	21,712.51	2,156.77
23 53 16 00-0034 EA 17,250 LB/Hour Feedwater System With Deaerator, Pumps, And Accessories	28,100.02	2,476.36
23 53 16 00-0035 EA 21,500 LB/Hour Feedwater System With Deaerator, Pumps, And Accessories	36,504.52	2,861.37
23 53 16 00-0036 EA 27,600 LB/Hour Feedwater System With Deaerator, Pumps, And Accessories	46,234.14	3,284.56
23 53 16 00-0037 EA 34,500 LB/Hour Feedwater System With Deaerator, Pumps, And Accessories	59,286.07	3,779.00

23 53 16 00-0038 Duplex Vacuum Condensate Pumps (23 53 16)



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 53 16 00-0039 EA 7 CFM, 15 GPM, 45 Gallon Duplex Vacuum Condensate Pump..... Note: Two 3/4 HP vacuum pumps rated for 7 CFM, two 3/4 HP condensate pumps rated for 15 GPM at 20 PSI and 45 GAL cast iron receiver. Skidmore JVC-7-45-102.	16,834.39	639.02
23 53 16 00-0040 EA 9 CFM, 30 GPM, 45 Gallon Duplex Vacuum Condensate Pump..... Note: Two 1 HP vacuum pumps rated for 9 CFM, two 3/4 HP condensate pumps rated for 30 GPM at 15 PSI and 45 GAL cast iron receiver. Skidmore JVC-9-45-201.5.	17,226.52	678.96
23 53 16 00-0041 EA 12 CFM, 45 GPM, 45 Gallon Duplex Vacuum Condensate Pump..... Note: Two 1-1/2 HP vacuum pumps rated for 12 CFM, two 1 HP condensate pumps rated for 45 GPM at 15 PSI and 45 GAL cast iron receiver. Skidmore JVC-12-45-301.5.	17,675.44	718.90
23 53 16 00-0042 EA 18 CFM, 37.5 GPM, 65 Gallon Duplex Vacuum Condensate Pump..... Note: Two 2 HP vacuum pumps rated for 18 CFM, two 1 HP condensate pumps rated for 37.5 GPM at 20 PSI and 65 GAL cast iron receiver. Skidmore JVC-18-65-252.	19,401.79	758.84
23 53 16 00-0043 EA 28 CFM, 60 GPM, 110 Gallon Duplex Vacuum Condensate Pump..... Note: Two 3 HP vacuum pumps rated for 28 CFM, two 1-1/2 HP condensate pumps rated for 60 GPM at 20 PSI and 110 GAL cast iron receiver. Skidmore JVC-28-110-402.	23,115.26	798.78
23 53 16 00-0044 EA 42 CFM, 75 GPM, 110 Gallon Duplex Vacuum Condensate Pump..... Note: Two 5 HP vacuum pumps rated for 42 CFM, two 2 HP condensate pumps rated for 75 GPM at 20 PSI and 110 GAL cast iron receiver. Skidmore JVC-42-110-502.	24,330.64	838.72

23 54 Furnaces (23 50)

Note: All units based on output. See CSI section 23 84 13 00-0000 for humidifiers.

23 54 13 Electric-Resistance Furnaces (23 54)

23 54 13 00-0001 Down Flow Multi-Speed Air Handler/Electric Furnace (23 54 13)

23 54 13 00-0002 EA Up To 2 Ton Down Flow Multi-Speed Air Handler/Electric Furnace Note: Excludes cooling equipment.	744.46	74.12
23 54 13 00-0003 EA >2 To 3.5 Ton Down Flow Multi-Speed Air Handler/Electric Furnace Note: Excludes cooling equipment.	981.57	92.65
23 54 13 00-0004 EA >3.5 To 5 Ton Down Flow Multi-Speed Air Handler/Electric Furnace Note: Excludes cooling equipment.	1,266.70	111.17

23 54 13 00-0005 Up/Horizontal Flow Multi-Speed Air Handler/Electric Furnace (23 54 13)

23 54 13 00-0006 EA Up To 2 Ton Up/Horizontal Flow Multi-Speed Air Handler/Electric Furnace Note: Excludes cooling equipment.	744.46	74.12
23 54 13 00-0007 EA >2 To 2.5 Ton Up/Horizontal Flow Multi-Speed Air Handler/ Electric Furnace Note: Excludes cooling equipment.	888.51	83.39
23 54 13 00-0008 EA >2.5 To 3 Ton Up/Horizontal Flow Multi-Speed Air Handler/ Electric Furnace Note: Excludes cooling equipment.	971.57	92.65
23 54 13 00-0009 EA >3 to 3.5 Ton Up/Horizontal Flow Multi-Speed Air Handler/ Electric Furnace..... Note: Excludes cooling equipment.	1,018.64	101.92
23 54 13 00-0010 EA >3.5 To 5 Ton Up/Horizontal Flow Multi-Speed Air Handler/ Electric Furnace Note: Excludes cooling equipment.	1,266.70	111.17

23 54 13 00-0011 Heating Coil For Air Handler/Electric Furnace (23 54 13)

23 54 13 00-0012 EA 5 KW Heating Coil For Air Handler/Electric Furnace 135.56	135.56	20.14
23 54 13 00-0013 EA 7 KW Heating Coil For Air Handler/Electric Furnace 154.61	154.61	22.16
23 54 13 00-0014 EA 10 KW Heating Coil For Air Handler/Electric Furnace 167.67	167.67	24.17
23 54 13 00-0015 EA 15 KW Heating Coil For Air Handler/Electric Furnace 225.73	225.73	26.18
23 54 13 00-0016 EA 20 KW Heating Coil For Air Handler/Electric Furnace 243.78	243.78	28.20

23 54 16 Fuel-Fired Furnaces (23 54)

23 54 16 13 Gas-Fired Furnaces (23 54 16)

23 54 16 13-0001 Natural Gas Fired Forced Air Furnaces (23 54 16 13)

Note: Excludes flue, condenser, evaporator coil, piping, thermostat, ductwork and electrical connections.

23 54 16 13-0002 Up/Horizontal Flow Multi-Speed, Two Stage 96% AFUE Gas Furnace (23 54 16 13-0001)

23 54 16 13-0003 EA 40 MBH, 800 CFM Up/Horizontal Flow Multi-Speed, Two Stage 96% AFUE Gas Furnace Note: Blower cooling capacity up to 3 tons.	1,151.41	64.86
23 54 16 13-0004 EA 60 MBH, 1,200 CFM Up/Horizontal Flow Multi-Speed, Two Stage 96% AFUE Gas Furnace Note: Blower cooling capacity up to 3 tons.	1,228.46	74.12
23 54 16 13-0005 EA 80 MBH, 1,200 CFM Up/Horizontal Flow Multi-Speed, Two Stage 95% AFUE Gas Furnace Note: Blower cooling capacity up to 4 tons.	1,416.51	83.39
23 54 16 13-0006 EA 100 MBH, 1,600 CFM Up/Horizontal Flow Multi-Speed, Two Stage 96% AFUE Gas Furnace..... Note: Blower cooling capacity up to 5 tons.	1,657.64	101.92
23 54 16 13-0007 EA 120 MBH, 2,000 CFM Up/Horizontal Flow Multi-Speed, Two Stage 96% AFUE Gas Furnace..... Note: Blower cooling capacity up to 5 tons.	1,769.70	111.17

23 54 16 13-0008 Up/Horizontal Flow Variable Speed, Two Stage 95% AFUE Gas Furnace (23 54 16 13-0001)

23 54 16 13-0009 EA 40 MBH, 1,200 CFM Up/Horizontal Flow Variable Speed, Two Stage 96% AFUE Gas Furnace Note: Blower cooling capacity up to 3 tons.	1,279.40	64.86
23 54 16 13-0010 EA 60 MBH, 1,200 CFM Up/Horizontal Flow Variable Speed, Two Stage 96% AFUE Gas Furnace Note: Blower cooling capacity up to 3 tons.	1,402.46	74.12
23 54 16 13-0011 EA 80 MBH, 1,200 CFM Up/Horizontal Flow Variable Speed, Two Stage 96% AFUE Gas Furnace Note: Blower cooling capacity up to 3 tons.	1,489.28	83.39

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 50 Central Heating Equipment****23 54 Furnaces**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 54 16 13-0012 EA 80 MBH, 1,600 CFM Up/Horizontal Flow Variable Speed, Two Stage 96% AFUE Gas Furnace Note: Blower cooling capacity up to 3.5 tons.	1,615.57	92.65
23 54 16 13-0013 EA 100 MBH, 2,000 CFM Up/Horizontal Flow Variable Speed, Two Stage 96% AFUE Gas Furnace Note: Blower cooling capacity up to 5 tons.	1,758.64	101.92
23 54 16 13-0014 EA 120 MBH, 2,000 CFM Up/Horizontal Flow Variable Speed, Two Stage 96% AFUE Gas Furnace Note: Blower cooling capacity up to 5 tons.	1,855.70	111.17
23 54 16 13-0015 Down Flow Multi-Speed, Two Stage 95% AFUE Gas Furnace (23 54 16 13-0001)		
23 54 16 13-0016 EA 45 MBH, 1,600 CFM Down Flow Multi-Speed, Two Stage 95% AFUE Gas Furnace Note: Blower cooling capacity up to 4 tons.	1,129.36	64.86
23 54 16 13-0017 EA 70 MBH, 1,600 CFM Down Flow Multi-Speed, Two Stage 95% AFUE Gas Furnace Note: Blower cooling capacity up to 4 tons.	1,296.42	74.12
23 54 16 13-0018 EA 90 MBH, 1,600 CFM Down Flow Multi-Speed, Two Stage 95% AFUE Gas Furnace Note: Blower cooling capacity up to 4 tons.	1,410.53	92.65
23 54 16 13-0019 EA 90 MBH, 2,000 CFM Down Flow Multi-Speed, Two Stage 95% AFUE Gas Furnace Note: Blower cooling capacity up to 5 tons.	1,507.60	101.92
23 54 16 13-0020 Down Flow Variable Speed, Two Stage 93% AFUE Gas Furnace (23 54 16 13-0001)		
23 54 16 13-0021 EA 40 MBH, 1,200 CFM Down Flow Variable Speed, Two Stage 96% AFUE Gas Furnace..... Note: Blower cooling capacity up to 4 tons.	1,475.40	64.86
23 54 16 13-0022 EA 60 MBH, 1,200 CFM Down Flow Variable Speed, Two Stage 96% AFUE Gas Furnace..... Note: Blower cooling capacity up to 3 tons.	1,556.46	74.12
23 54 16 13-0023 EA 80 MBH, 1,600 CFM Down Flow Variable Speed, Two Stage 96% AFUE Gas Furnace..... Note: Blower cooling capacity up to 4 tons.	1,733.51	83.39
23 54 16 13-0024 EA 100 MBH, 2,000 CFM Down Flow Variable Speed, Two Stage 96% AFUE Gas Furnace..... Note: Blower cooling capacity up to 4 tons.	1,897.64	101.92
23 54 16 13-0025 EA 120 MBH, 2,000 CFM Down Flow Variable Speed, Two Stage 93% AFUE Gas Furnace..... Note: Blower cooling capacity up to 5 tons.	2,034.70	111.17
23 54 16 13-0026 Up/Horizontal Flow Multi-Speed, One Stage 96% AFUE Gas Furnace (23 54 16 13-0001)		
23 54 16 13-0027 EA 40 MBH, 800 CFM Up/Horizontal Flow Multi-Speed, One Stage 96% AFUE Gas Furnace..... Note: Blower cooling capacity up to 3 tons.	1,029.40	64.86
23 54 16 13-0028 EA 60 MBH, 1,200 CFM Up/Horizontal Flow Multi-Speed, One Stage 96% AFUE Gas Furnace..... Note: Blower cooling capacity up to 3 tons.	1,087.46	74.12
23 54 16 13-0029 EA 80 MBH, 1,200 CFM Up/Horizontal Flow Multi-Speed, One Stage 96% AFUE Gas Furnace..... Note: Blower cooling capacity up to 3 tons.	1,213.51	83.39
23 54 16 13-0030 EA 80 MBH, 1,600 CFM Up/Horizontal Flow Multi-Speed, One Stage 96% AFUE Gas Furnace..... Note: Blower cooling capacity up to 4 tons.	1,223.51	83.39
23 54 16 13-0031 EA 80 MBH, 2,000 CFM Up/Horizontal Flow Multi-Speed, One Stage 96% AFUE Gas Furnace..... Note: Blower cooling capacity up to 5 tons.	1,335.57	92.65
23 54 16 13-0032 EA 100 MBH, 2,000 CFM Up/Horizontal Flow Multi-Speed, One Stage 96% AFUE Gas Furnace..... Note: Blower cooling capacity up to 5 tons.	1,409.64	101.92
23 54 16 13-0033 EA 120 MBH, 2,000 CFM Up/Horizontal Flow Multi-Speed, One Stage 96% AFUE Gas Furnace..... Note: Blower cooling capacity up to 5 tons.	1,495.70	111.17
23 54 16 13-0034 Up/Horizontal Flow Multi-Speed, One Stage 80% AFUE Gas Furnace (23 54 16 13-0001)		
23 54 16 13-0035 EA 40 MBH, 1,200 CFM Up/Horizontal Flow Multi-Speed, One Stage 80% AFUE Gas Furnace..... Note: Blower cooling capacity up to 3 tons.	722.40	64.86
23 54 16 13-0036 EA 60 MBH, 1,200 CFM Up/Horizontal Flow Multi-Speed, One Stage 80% AFUE Gas Furnace..... Note: Blower cooling capacity up to 3 tons.	791.46	74.12
23 54 16 13-0037 EA 60 MBH, 1,600 CFM Up/Horizontal Flow Multi-Speed, One Stage 80% AFUE Gas Furnace..... Note: Blower cooling capacity up to 4 tons.	904.51	83.39
23 54 16 13-0038 EA 80 MBH, 1,600 CFM Up/Horizontal Flow Multi-Speed, One Stage 80% AFUE Gas Furnace..... Note: Blower cooling capacity up to 4 tons.	905.51	83.39
23 54 16 13-0039 EA 80 MBH, 2,000 CFM Up/Horizontal Flow Multi-Speed, One Stage 80% AFUE Gas Furnace..... Note: Blower cooling capacity up to 5 tons.	994.57	92.65
23 54 16 13-0040 EA 100 MBH, 2,000 CFM Up/Horizontal Flow Multi-Speed, One Stage 80% AFUE Gas Furnace..... Note: Blower cooling capacity up to 5 tons.	1,023.64	101.92
23 54 16 13-0041 EA 120 MBH, 2,000 CFM Up/Horizontal Flow Multi-Speed, One Stage 80% AFUE Gas Furnace..... Note: Blower cooling capacity up to 5 tons.	1,136.70	111.17
23 54 16 13-0042 Down Flow Multi-Speed, One Stage 80% AFUE Gas Furnace (23 54 16 13-0001)		
23 54 16 13-0043 EA 40 MBH, 1,200 CFM Down Flow Multi-Speed, One Stage 80% AFUE Gas Furnace Note: Blower cooling capacity up to 3 tons.	732.40	64.86
23 54 16 13-0044 EA 60 MBH, 1,200 CFM Down Flow Multi-Speed, One Stage 80% AFUE Gas Furnace Note: Blower cooling capacity up to 3 tons.	794.46	74.12
23 54 16 13-0045 EA 80 MBH, 1,600 CFM Down Flow Multi-Speed, One Stage 80% AFUE Gas Furnace Note: Blower cooling capacity up to 4 tons.	949.51	83.39
23 54 16 13-0046 EA 100 MBH, 2,000 CFM Down Flow Multi-Speed, One Stage 80% AFUE Gas Furnace Note: Blower cooling capacity up to 5 tons.	1,045.57	92.65
23 54 16 13-0047 75% AFUE Gas Wall/Recessed Furnace (23 54 16 13-0001)		
23 54 16 13-0048 EA 35 MBH 75% AFUE Electronic Ignition Gas Wall/Recessed Furnace.....	1,223.30	55.59
23 54 16 13-0049 EA 55 MBH 75% AFUE Electronic Ignition Gas Wall/Recessed Furnace.....	1,413.89	69.52
23 54 16 13-0050 EA 35 MBH 75% AFUE Gas Wall/Recessed Furnace.....	1,108.30	55.59



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 54 16 13-0051 EA 40 MBH 75% AFUE Gas Wall/Recessed Furnace.....	1,184.83	60.26
23 54 16 13-0052 EA 50 MBH 75% AFUE Gas Wall/Recessed Furnace.....	1,176.36	64.86
23 54 16 13-0053 EA 65 MBH 75% AFUE Gas Wall/Recessed Furnace.....	1,212.94	69.52
23 54 16 13-0054 EA 75 MBH 75% AFUE Gas Wall/Recessed Furnace.....	1,255.02	69.52
23 54 16 13-0055 Gas Fired Indoor Duct Furnace <small>(23 54 16 13-0001)</small>		
Note: Includes burner, controls and electronic ignition.		
23 54 16 13-0056 Aluminized Steel Heat Exchanger Gas Fired Indoor Duct Furnace <small>(23 54 16 13-0055)</small>		
23 54 16 13-0057 EA 100 MBH, Aluminized Steel Heat Exchanger Gas Fired Indoor Duct Furnace	1,376.86	144.53
23 54 16 13-0058 EA 150 MBH, Aluminized Steel Heat Exchanger Gas Fired Indoor Duct Furnace	1,538.07	177.89
23 54 16 13-0059 EA 200 MBH, Aluminized Steel Heat Exchanger Gas Fired Indoor Duct Furnace	1,759.76	255.71
23 54 16 13-0060 EA 250 MBH, Aluminized Steel Heat Exchanger Gas Fired Indoor Duct Furnace	1,984.99	289.06
23 54 16 13-0061 EA 300 MBH, Aluminized Steel Heat Exchanger Gas Fired Indoor Duct Furnace	2,312.73	333.52
23 54 16 13-0062 EA 350 MBH, Aluminized Steel Heat Exchanger Gas Fired Indoor Duct Furnace	2,550.21	400.23
23 54 16 13-0063 EA 400 MBH, Aluminized Steel Heat Exchanger Gas Fired Indoor Duct Furnace	2,929.13	533.65
23 54 16 13-0064 Stainless Steel Heat Exchanger Gas Fired Indoor Duct Furnace <small>(23 54 16 13-0055)</small>		
Note: Includes burner, controls and electronic ignition.		
23 54 16 13-0065 EA 100 MBH, Stainless Steel Heat Exchanger Gas Fired Indoor Duct Furnace	1,537.66	144.53
23 54 16 13-0066 EA 150 MBH, Stainless Steel Heat Exchanger Gas Fired Indoor Duct Furnace	1,696.47	177.89
23 54 16 13-0067 EA 200 MBH, Stainless Steel Heat Exchanger Gas Fired Indoor Duct Furnace	1,977.36	255.71
23 54 16 13-0068 EA 250 MBH, Stainless Steel Heat Exchanger Gas Fired Indoor Duct Furnace	2,241.79	289.06
23 54 16 13-0069 EA 300 MBH, Stainless Steel Heat Exchanger Gas Fired Indoor Duct Furnace	2,755.93	333.52
23 54 16 13-0070 EA 350 MBH, Stainless Steel Heat Exchanger Gas Fired Indoor Duct Furnace	3,031.01	400.23
23 54 16 13-0071 EA 400 MBH, Stainless Steel Heat Exchanger Gas Fired Indoor Duct Furnace	3,383.53	533.65
23 54 16 16 Oil-Fired Furnaces <small>(23 54 16)</small>		
23 54 16 16-0001 Oil Fired Forced Air Furnaces <small>(23 54 16 16)</small>		
Note: Excludes flue, condenser, evaporator coil, piping, thermostat, ductwork and electrical connections.		
23 54 16 16-0002 Up Flow Single Speed, One Stage 81% AFUE Oil Furnace <small>(23 54 16 16-0001)</small>		
23 54 16 16-0003 EA 72 MBH, 1,220 CFM Up Flow Single Speed, One Stage 84% AFUE Oil Furnace.....	1,968.46	74.12
Note: Blower cooling capacity up to 3 tons.		
23 54 16 16-0004 EA 95 MBH, 1,590 CFM Up Flow Single Speed, One Stage 83% AFUE Oil Furnace.....	2,101.64	101.92
Note: Blower cooling capacity up to 4 tons.		
23 54 16 16-0005 EA 126 MBH, 1,835 CFM Up Flow Single Speed, One Stage 83% AFUE Oil Furnace.....	2,426.76	120.44
Note: Blower cooling capacity up to 5 tons.		
23 54 16 16-0006 Down/Horizontal Flow Single Speed, One Stage 81% AFUE Oil Furnace <small>(23 54 16 16-0001)</small>		
23 54 16 16-0007 EA 95 MBH, 1,210 CFM Down/Horizontal Flow Single Speed, One Stage 83% AFUE Oil Furnace.....	2,287.64	101.92
Note: Blower cooling capacity up to 3 tons.		
23 54 16 16-0008 EA 126 MBH, 2,005 CFM Down/Horizontal Flow Single Speed, One Stage 84% AFUE Oil Furnace.....	2,313.76	120.44
Note: Blower cooling capacity up to 5 tons.		
23 54 16 16-0009 Up Flow Lowboy Single Speed, One Stage 81% AFUE Oil Furnace <small>(23 54 16 16-0001)</small>		
23 54 16 16-0010 EA 95 MBH, 1,550 CFM Up Flow Lowboy Single Speed, One Stage 83% AFUE Oil Furnace	1,983.64	101.92
Note: Blower cooling capacity up to 4 tons.		
23 54 16 16-0011 EA 127 MBH, 2,130 CFM Up Flow Lowboy Single Speed, One Stage 83% AFUE Oil Furnace	2,354.76	120.44
Note: Blower cooling capacity up to 5 tons.		
23 54 19 Furnace Accessories <small>(23 54)</small>		
23 54 19 00-0001 EA LP Gas Furnace Conversion Kit	119.11	18.53
23 54 19 00-0002 EA 1" Furnace External Filter Rack.....	35.52	
23 54 19 00-0003 EA Remove And Reinstall Forced Air Furnace.....	343.14	
Note: Includes storage and cleaning. Excludes ductwork.		
23 55 Fuel-Fired Heaters <small>(23 50)</small>		
23 55 23 Gas-Fired Radiant Heaters <small>(23 55)</small>		
23 55 23 13 Low-Intensity Gas-Fired Radiant Heaters <small>(23 55 23)</small>		
23 55 23 13-0001 Infrared Heaters-Radiant Energy <small>(23 55 23 13)</small>		
Note: For spot localized or total heating, ceiling hung units, no fan required.		
23 55 23 13-0002 Gas Fired Electric Ignition Infrared Gas Heater <small>(23 55 23 13-0001)</small>		
Note: Ceramic combustion, surface chromized wire screen aluminized steel housing and polished aluminum reflector.		
23 55 23 13-0003 EA 15,000 BTU Infrared Gas Heater, Electric Ignition, Ceiling Hung Unit Without Fan.....	675.70	79.88
23 55 23 13-0004 EA 37,500 BTU Infrared Gas Heater, Electric Ignition, Ceiling Hung Unit Without Fan.....	746.39	87.87
23 55 23 13-0005 EA 50,000 BTU Infrared Gas Heater, Electric Ignition, Ceiling Hung Unit Without Fan.....	798.35	87.87
23 55 23 13-0006 EA 75,000 BTU Infrared Gas Heater, Electric Ignition, Ceiling Hung Unit Without Fan.....	1,001.32	105.44
23 55 23 13-0007 EA 100,000 BTU Infrared Gas Heater, Electric Ignition, Ceiling Hung Unit Without Fan.....	1,010.08	105.44

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 50 Central Heating Equipment****23 55 Fuel-Fired Heaters**

MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
23 55 23 13-0008		Rolled Steel Or Aluminum Housing Infrared Electric Heater (23 55 23 13-0001) Note: Anodized aluminum reflector and quartz/tungsten tubular element with an inner heavy-duty coiled element.			
23 55 23 13-0009	EA	1,000 Watt Infrared Elect Heater, Ceiling Hung Unit, No Fan Required..... <i>For Stainless Steel Housing, Add</i>	742.91 123.97		81.53
23 55 23 13-0010	EA	3,200 Watt Infrared Elect Heater, Ceiling Hung Unit, No Fan Required..... <i>For Stainless Steel Housing, Add</i>	796.31 137.32		81.53
23 55 23 13-0011	EA	5,000 Watt Infrared Elect Heater, Ceiling Hung Unit, No Fan Required..... <i>For Stainless Steel Housing, Add</i>	857.34 152.57		81.53
23 55 23 13-0012	EA	7,300 Watt Infrared Elect Heater, Ceiling Hung Unit, No Fan Required..... <i>For Stainless Steel Housing, Add</i>	930.71 170.92		81.53
23 55 23 13-0013	EA	10,950 Watt Infrared Elect Heater, Ceiling Hung Unit, No Fan Required..... <i>For Stainless Steel Housing, Add</i>	1,017.51 190.45		88.94
23 55 23 13-0014	EA	13,500 Watt Infrared Elect Heater, Ceiling Hung Unit, No Fan Required..... <i>For Stainless Steel Housing, Add</i>	1,087.47 205.10		96.35
23 55 23 13-0015	EA	24,000 Watt Infrared Elect Heater, Ceiling Hung Unit, No Fan Required..... <i>For Stainless Steel Housing, Add</i>	1,761.74 366.25		103.77
23 55 23 13-0016		Gas Fired Tubular Infrared Heater (23 55 23 13-0001) Note: Includes controls and supports.			
23 55 23 13-0017		"U" Package (23 55 23 13-0016)			
23 55 23 13-0018	LF	Up To 75 MBH Input Radiant Heater	55.19		3.99
23 55 23 13-0019	LF	76 To 105 MBH Input Radiant Heater.....	63.75		4.79
23 55 23 13-0020	LF	106 To 130 MBH Input Radiant Heater.....	77.70		5.59
23 55 23 13-0021		"S" Straight Package (23 55 23 13-0016)			
23 55 23 13-0022	LF	Up To 75 MBH Input Radiant Heater	44.95		3.19
23 55 23 13-0023	LF	76 To 105 MBH Input Radiant Heater.....	57.04		3.99
23 55 23 13-0024	LF	106 To 130 MBH Input Radiant Heater.....	69.13		4.79
23 55 33		Fuel-Fired Unit Heaters (23 55)			
23 55 33 00-0001		Gas Fired Unit Heaters (23 55 33)			
23 55 33 00-0002		Horizontal Fan Propelled Gas Fired Unit Heaters, 115 Volt (23 55 33 00-0001)			
23 55 33 00-0003	EA	24.3 MBH Output, 30 MBH Input, 500 CFM Gas Fired Unit Heater Fan Propelled, Horizontal, 115 Volt.....	1,216.85		137.89
23 55 33 00-0004	EA	36.5 MBH Output, 45 MBH Input, 750 CFM Gas Fired Unit Heater Fan Propelled, Horizontal, 115 Volt.....	1,336.67		165.47
23 55 33 00-0005	EA	48.6 MBH Output, 60 MBH Input, 1,000 CFM Gas Fired Unit Heater Fan Propelled, Horizontal, 115 Volt.....	1,356.38		165.47
23 55 33 00-0006	EA	60.8 MBH Output, 75 MBH Input, 1,250 CFM Gas Fired Unit Heater Fan Propelled, Horizontal, 115 Volt.....	1,485.71		193.04
23 55 33 00-0007	EA	72.9 MBH Output, 90 MBH Input, 1,400 CFM Gas Fired Unit Heater Fan Propelled, Horizontal, 115 Volt.....	1,637.07		220.62
23 55 33 00-0008	EA	81 MBH Output, 100 MBH Input, 1,600 CFM Gas Fired Unit Heater Fan Propelled, Horizontal, 115 Volt.....	1,756.14		234.41
23 55 33 00-0009	EA	101.3 MBH Output, 125 MBH Input, 2,200 CFM Gas Fired Unit Heater Fan Propelled, Horizontal, 115 Volt.....	1,805.85		234.41
23 55 33 00-0010	EA	121.5 MBH Output, 150 MBH Input, 2,400 CFM Gas Fired Unit Heater Fan Propelled, Horizontal, 115 Volt.....	1,763.25		234.41
23 55 33 00-0011	EA	141.8 MBH Output, 175 MBH Input, 2,850 CFM Gas Fired Unit Heater Fan Propelled, Horizontal, 115 Volt.....	2,086.64		248.20
23 55 33 00-0012	EA	162 MBH Output, 200 MBH Input, 3,200 CFM Gas Fired Unit Heater Fan Propelled, Horizontal, 115 Volt.....	2,280.69		248.20
23 55 33 00-0013	EA	202.5 MBH Output, 250 MBH Input, 3,450 CFM Gas Fired Unit Heater Fan Propelled, Horizontal, 115 Volt.....	2,441.61		248.20
23 55 33 00-0014	EA	243 MBH Output, 300 MBH Input, 5,000 CFM Gas Fired Unit Heater Fan Propelled, Horizontal, 115 Volt.....	2,911.78		275.78
23 55 33 00-0015	EA	283.5 MBH Output, 350 MBH Input, 5,600 CFM Gas Fired Unit Heater Fan Propelled, Horizontal, 115 Volt.....	3,276.22		275.78
23 55 33 00-0016	EA	324 MBH Output, 400 MBH Input, 5,800 CFM Gas Fired Unit Heater Fan Propelled, Horizontal, 115 Volt.....	3,517.48		303.36
23 55 33 00-0017		Oil Fired Unit Heater (23 55 33)			
23 55 33 00-0018		Horizontal Fan Propelled Oil Fired Unit Heater, 115 Volt (23 55 33 00-0017)			
23 55 33 00-0019	EA	97 MBH Output, 2,000 CFM Oil Fired Unit Heater Fan Propelled, Horizontal, 115 Volt.....	4,807.33		367.70
23 55 33 00-0020	EA	142 MBH Output, 3,200 CFM Oil Fired Unit Heater Fan Propelled, Horizontal, 115 Volt.....	5,160.02		404.48
23 55 33 00-0021	EA	188 MBH Output, 3,200 CFM Oil Fired Unit Heater Fan Propelled, Horizontal, 115 Volt.....	5,544.60		441.25
23 55 33 00-0022		Removal And Reinstallation Of Unit Heaters (23 55 33) Note: Includes disconnection/reconnection of power and piping, storage, cleaning and reinstallation. Excludes removal and reinstallation of equipment supports.			
23 55 33 00-0023	EA	Remove And Reinstall Up To 101.3 MBH Output Gas or Oil Unit Heater	459.30		
23 55 33 00-0024	EA	Remove And Reinstall >101.3 MBH Output Gas or Oil Unit Heater.....	619.05		
23 57		Heat Exchangers for HVAC (23 50)			
23 57 13		Steam-To-Steam Heat Exchangers (23 57)			
23 57 13 00-0001		Steam Generator Heat Exchanger (23 57 13) Note: 35 PSI generated steam using 180 degree feed water; 400 degree F water to valve.			
23 57 13 00-0002	EA	75 LB/Hour Steam Generator Heat Exchanger, 35 PSI.....	11,553.31		1,278.04
23 57 13 00-0003	EA	300 LB/Hour Steam Generator Heat Exchanger, 35 PSI.....	15,419.02		1,357.91
23 57 13 00-0004	EA	525 LB/Hour Steam Generator Heat Exchanger, 35 PSI.....	20,727.77		1,679.90
23 57 16		Steam-To-Water Heat Exchangers (23 57)			



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 57 16 00-0001				Heat Exchanger, Hot Water 40 To 180 Degree By Steam 10 PSI ^(23 57 16) Note: Cast iron head steel shell 4 pass 3/4" outside diameter copper tubes. Excludes controls expansion tank and accessories.		
				EA 8 GPM Heat Exchanger By Steam At 10 PSI, 40-180 Degree, 4 Pass 3/4" Outside Diameter Copper Tube.....	1,337.78	199.69
				<i>For Bronze Head And Tube Sheet, Add</i>	482.18	
				<i>For Copper Nickel Tubes, Add</i>	107.15	
				<i>For Double Wall Tube Bundles, Add</i>	160.73	
				EA 10 GPM Heat Exchanger By Steam At 10 PSI, 40-180 Degree, 4 Pass 3/4" Outside Diameter Copper Tube.....	1,942.10	199.69
				<i>For Bronze Head And Tube Sheet, Add</i>	730.17	
				<i>For Copper Nickel Tubes, Add</i>	162.26	
				<i>For Double Wall Tube Bundles, Add</i>	243.39	
				EA 40 GPM Heat Exchanger By Steam At 10 PSI, 40-180 Degree, 4 Pass 3/4" Outside Diameter Copper Tube.....	2,909.80	279.57
				<i>For Bronze Head And Tube Sheet, Add</i>	1,129.69	
				<i>For Copper Nickel Tubes, Add</i>	251.04	
				<i>For Double Wall Tube Bundles, Add</i>	376.56	
				EA 64 GPM Heat Exchanger By Steam At 10 PSI, 40-180 Degree, 4 Pass 3/4" Outside Diameter Copper Tube.....	4,625.64	279.57
				<i>For Bronze Head And Tube Sheet, Add</i>	1,722.09	
				<i>For Copper Nickel Tubes, Add</i>	382.69	
				<i>For Double Wall Tube Bundles, Add</i>	574.03	
				EA 96 GPM Heat Exchanger By Steam At 10 PSI, 40-180 Degree, 4 Pass 3/4" Outside Diameter Copper Tube.....	6,080.54	329.09
				<i>For Bronze Head And Tube Sheet, Add</i>	2,286.93	
				<i>For Copper Nickel Tubes, Add</i>	508.21	
				<i>For Double Wall Tube Bundles, Add</i>	762.31	
				EA 120 GPM Heat Exchanger By Steam At 10 PSI, 40-180 Degree, 4 Pass 3/4" Outside Diameter Copper Tube.....	7,996.33	416.46
				<i>For Bronze Head And Tube Sheet, Add</i>	3,003.32	
				<i>For Copper Nickel Tubes, Add</i>	667.40	
				<i>For Double Wall Tube Bundles, Add</i>	1,001.11	
				EA 168 GPM Heat Exchanger By Steam At 10 PSI, 40-180 Degree, 4 Pass 3/4" Outside Diameter Copper Tube.....	9,893.14	625.08
				<i>For Bronze Head And Tube Sheet, Add</i>	3,678.38	
				<i>For Copper Nickel Tubes, Add</i>	817.42	
				<i>For Double Wall Tube Bundles, Add</i>	1,226.13	
				EA 240 GPM Heat Exchanger By Steam At 10 PSI, 40-180 Degree, 4 Pass 3/4" Outside Diameter Copper Tube.....	14,884.51	625.08
				<i>For Bronze Head And Tube Sheet, Add</i>	5,731.11	
				<i>For Copper Nickel Tubes, Add</i>	1,273.58	
				<i>For Double Wall Tube Bundles, Add</i>	1,910.37	
23 57 19				Liquid-To-Liquid Heat Exchangers ^(23 57)		
23 57 19 19				Water-To-Water Heat Exchanger ^(23 57 19)		
23 57 19 19-0001				Heat Exchanger Hot Water 40-140 Degree By Water At 200 Degree F ^(23 57 19) ¹⁹⁾ Note: Cast iron head steel shell 4 pass 3/4" outside diameter copper tubes.		
				EA 7 GPM Heat Exchanger By 200 Degree Water, 40-140 Degree, 4 Pass 3/4" Outside Diameter Copper Tube.....	1,582.70	199.69
				<i>For Copper Nickel Tubes, Add</i>	131.64	
				<i>For Double Wall Tube Bundles, Add</i>	197.47	
				EA 16 GPM Heat Exchanger By 200 Degree Water, 40-140 Degree, 4 Pass 3/4" Outside Diameter Copper Tube.....	2,187.02	199.69
				<i>For Copper Nickel Tubes, Add</i>	186.75	
				<i>For Double Wall Tube Bundles, Add</i>	280.13	
				EA 34 GPM Heat Exchanger By 200 Degree Water, 40-140 Degree, 4 Pass 3/4" Outside Diameter Copper Tube.....	3,246.56	279.57
				<i>For Copper Nickel Tubes, Add</i>	284.72	
				<i>For Double Wall Tube Bundles, Add</i>	427.08	
				EA 55 GPM Heat Exchanger By 200 Degree Water, 40-140 Degree, 4 Pass 3/4" Outside Diameter Copper Tube.....	4,634.90	279.57
				<i>For Copper Nickel Tubes, Add</i>	410.24	
				<i>For Double Wall Tube Bundles, Add</i>	615.36	
				EA 74 GPM Heat Exchanger By 200 Degree Water, 40-140 Degree, 4 Pass 3/4" Outside Diameter Copper Tube.....	5,746.04	319.51
				<i>For Copper Nickel Tubes, Add</i>	505.15	
				<i>For Double Wall Tube Bundles, Add</i>	757.72	
				EA 86 GPM Heat Exchanger By 200 Degree Water, 40-140 Degree, 4 Pass 3/4" Outside Diameter Copper Tube.....	7,637.31	319.51
				<i>For Copper Nickel Tubes, Add</i>	679.65	
				<i>For Double Wall Tube Bundles, Add</i>	1,019.48	
				EA 112 GPM Heat Exchanger By 200 Degree Water, 40-140 Degree, 4 Pass 3/4" Outside Diameter Copper Tube.....	9,460.87	312.54
				<i>For Copper Nickel Tubes, Add</i>	844.97	
				<i>For Double Wall Tube Bundles, Add</i>	1,267.46	
				EA 126 GPM Heat Exchanger By 200 Degree Water, 40-140 Degree, 4 Pass 3/4" Outside Diameter Copper Tube.....	11,759.36	312.54
				<i>For Copper Nickel Tubes, Add</i>	1,053.15	
				<i>For Double Wall Tube Bundles, Add</i>	1,579.73	
				EA 152 GPM Heat Exchanger By 200 Degree Water, 40-140 Degree, 4 Pass 3/4" Outside Diameter Copper Tube.....	15,033.24	312.54
				<i>For Copper Nickel Tubes, Add</i>	1,347.05	
				<i>For Double Wall Tube Bundles, Add</i>	2,020.58	
23 57 19 23				Refrigerant-To-Water Heat Exchanger ^(23 57 19)		
23 57 19 23-0001				Heat Exchanger Refrigerant To Water ^(23 57 19 23)		
				EA 10 GPM Heat Exchanger By 385 Degree Water, 40-180 Degree, 3 Pass 3/4" Outside Diameter Copper Tube.....	1,793.12	159.75
				<i>For Copper Nickel Tubes, Add</i>	147.36	
				<i>For Double Wall Tube Bundles, Add</i>	221.04	
				EA 53 GPM Heat Exchanger By 385 Degree Water, 40-180 Degree, 3 Pass 3/4" Outside Diameter Copper Tube.....	4,700.13	266.24
				<i>For Copper Nickel Tubes, Add</i>	416.76	
				<i>For Double Wall Tube Bundles, Add</i>	625.14	
				EA 70 GPM Heat Exchanger By 385 Degree Water, 40-180 Degree, 3 Pass 3/4" Outside Diameter Copper Tube.....	6,327.44	347.30
				<i>For Copper Nickel Tubes, Add</i>	563.41	
				<i>For Double Wall Tube Bundles, Add</i>	845.11	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 50 Central Heating Equipment****23 57 Heat Exchangers for HVAC**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 57 19 23-0005	EA		87 GPM Heat Exchanger By 385 Degree Water, 40-180 Degree, 3 Pass 3/4" Outside Diameter Copper Tube	6,810.76	420.40
			<i>For Copper Nickel Tubes, Add</i>	597.17	
			<i>For Double Wall Tube Bundles, Add</i>	895.76	
23 57 19 23-0006	EA		105 GPM Heat Exchanger By 385 Degree Water, 40-180 Degree, 3 Pass 3/4" Outside Diameter Copper Tube	8,213.83	496.39
			<i>For Copper Nickel Tubes, Add</i>	720.50	
			<i>For Double Wall Tube Bundles, Add</i>	1,080.76	

23 60 Central Cooling Equipment ⁽²³⁾

Note: Where required, mechanical equipment excludes electrical connection, disconnect, or starter unless title states otherwise. See CSI section 26 05 19 16-0011 for electrical connection and termination, 26 05 83 00-0110 for terminations, 26 28 16 00-0001 for disconnect.

23 61 Refrigerant Compressors ^(23 60)**23 61 16 Reciprocating Refrigerant Compressors** ^(23 61)**23 61 16 00-0001 Reciprocating Open Type Refrigerant Compressors** ^(23 61 16)

Note: Includes manual reversible oil pump and automatic pressure regulator. Excludes muffler, vibration isolators, crank case oil heaters, couplings and flywheel.

23 61 16 00-0002	EA	1/4 Ton Refrigerant Compressor, Reciprocating Open Type	382.56	78.65
23 61 16 00-0003	EA	1/3 Ton Refrigerant Compressor, Reciprocating Open Type	444.69	78.65
23 61 16 00-0004	EA	1/2 Ton Refrigerant Compressor, Reciprocating Open Type	597.93	98.29
23 61 16 00-0005	EA	3/4 Ton Refrigerant Compressor, Reciprocating Open Type	726.08	98.29
23 61 16 00-0006	EA	1 Ton Refrigerant Compressor, Reciprocating Open Type	803.75	98.29
23 61 16 00-0007	EA	1-1/4 Ton Refrigerant Compressor, Reciprocating Open Type	816.15	102.26
23 61 16 00-0008	EA	1-1/2 Ton Refrigerant Compressor, Reciprocating Open Type	820.68	102.26
23 61 16 00-0009	EA	1-3/4 Ton Refrigerant Compressor, Reciprocating Open Type	899.85	110.12
23 61 16 00-0010	EA	2 Ton Refrigerant Compressor, Reciprocating Open Type	967.36	117.99
23 61 16 00-0011	EA	2-1/2 Ton Refrigerant Compressor, Reciprocating Open Type	1,052.98	125.86
23 61 16 00-0012	EA	3 Ton Refrigerant Compressor, Reciprocating Open Type	1,186.31	125.86
23 61 16 00-0013	EA	3-1/2 Ton Refrigerant Compressor, Reciprocating Open Type	1,326.30	133.72
23 61 16 00-0014	EA	4 Ton Refrigerant Compressor, Reciprocating Open Type	1,357.59	141.59
23 61 16 00-0015	EA	4-1/2 Ton Refrigerant Compressor, Reciprocating Open Type	1,380.97	145.48
23 61 16 00-0016	EA	5 Ton Refrigerant Compressor, Reciprocating Open Type	2,276.19	761.59
23 61 16 00-0017	EA	7.5 Ton Refrigerant Compressor, Reciprocating Open Type	3,302.26	870.34
23 61 16 00-0018	EA	10 Ton Refrigerant Compressor, Reciprocating Open Type	4,328.44	979.17
23 61 16 00-0019	EA	12.5 Ton Refrigerant Compressor, Reciprocating Open Type	5,610.70	1,060.70
23 61 16 00-0020	EA	15 Ton Refrigerant Compressor, Reciprocating Open Type	6,893.19	1,142.37
23 61 16 00-0021	EA	20 Ton Refrigerant Compressor, Reciprocating Open Type	8,271.83	1,370.85
23 61 16 00-0022	EA	25 Ton Refrigerant Compressor, Reciprocating Open Type	9,871.75	1,473.40
23 61 16 00-0023	EA	30 Ton Refrigerant Compressor, Reciprocating Open Type	11,400.37	1,557.79
23 61 16 00-0024	EA	50 Ton Refrigerant Compressor, Reciprocating Open Type	14,806.99	1,757.52
23 61 16 00-0025	EA	60 Ton Refrigerant Compressor, Reciprocating Open Type	17,335.95	1,803.61
23 61 16 00-0026	EA	70 Ton Refrigerant Compressor, Reciprocating Open Type	21,504.47	1,849.62
23 61 16 00-0027	EA	75 Ton Refrigerant Compressor, Reciprocating Open Type	22,551.45	1,872.71
23 61 16 00-0028	EA	80 Ton Refrigerant Compressor, Reciprocating Open Type	23,555.23	1,895.72
23 61 16 00-0029	EA	90 Ton Refrigerant Compressor, Reciprocating Open Type	25,435.18	1,941.74
23 61 16 00-0030	EA	100 Ton Refrigerant Compressor, Reciprocating Open Type	27,144.98	1,987.90
23 61 16 00-0031	EA	110 Ton Refrigerant Compressor, Reciprocating Open Type	29,119.69	2,222.02
23 61 16 00-0032	EA	120 Ton Refrigerant Compressor, Reciprocating Open Type	30,488.75	2,271.74
23 61 16 00-0033	EA	130 Ton Refrigerant Compressor, Reciprocating Open Type	31,656.16	2,300.66
23 61 16 00-0034	EA	140 Ton Refrigerant Compressor, Reciprocating Open Type	32,715.52	2,371.84
23 61 16 00-0035	EA	150 Ton Refrigerant Compressor, Reciprocating Open Type	33,570.67	2,421.57
23 61 16 00-0036	EA	175 Ton Refrigerant Compressor, Reciprocating Open Type	34,450.21	2,487.93
23 61 16 00-0037	EA	185 Ton Refrigerant Compressor, Reciprocating Open Type	35,269.61	2,514.68
23 61 16 00-0038	EA	200 Ton Refrigerant Compressor, Reciprocating Open Type	36,112.14	2,556.30
23 61 16 00-0039	EA	225 Ton Refrigerant Compressor, Reciprocating Open Type	37,160.43	2,728.70
23 61 16 00-0040	EA	250 Ton Refrigerant Compressor, Reciprocating Open Type	38,167.61	2,875.79

23 61 16 00-0041 Reciprocating Hermetic Type Refrigerant Compressors ^(23 61 16)

Note: Includes automatic reversible oil pump, suction and discharge shut-off valves, device for loading and unloading compressor cylinders and crank case oil heater. Excludes mufflers and vibration isolators.

23 61 16 00-0042 Reciprocating Hermetic Type Refrigerant Compressors <5 Tons ^(23 61 16 00-0041)

23 61 16 00-0043	EA	1/4 Ton Refrigerant Compressor, Reciprocating Hermetic Type	620.20	78.65
23 61 16 00-0044	EA	1/3 Ton Refrigerant Compressor, Reciprocating Hermetic Type	639.89	78.65
23 61 16 00-0045	EA	1/2 Ton Refrigerant Compressor, Reciprocating Hermetic Type	698.91	98.29
23 61 16 00-0046	EA	3/4 Ton Refrigerant Compressor, Reciprocating Hermetic Type	718.61	98.29
23 61 16 00-0047	EA	1 Ton Refrigerant Compressor, Reciprocating Hermetic Type	728.45	98.29
23 61 16 00-0048	EA	1-1/4 Ton Refrigerant Compressor, Reciprocating Hermetic Type	752.08	102.26
23 61 16 00-0049	EA	1-1/2 Ton Refrigerant Compressor, Reciprocating Hermetic Type	773.75	102.26
23 61 16 00-0050	EA	1-3/4 Ton Refrigerant Compressor, Reciprocating Hermetic Type	830.85	110.12
23 61 16 00-0051	EA	2 Ton Refrigerant Compressor, Reciprocating Hermetic Type	885.98	117.99
23 61 16 00-0052	EA	2-1/2 Ton Refrigerant Compressor, Reciprocating Hermetic Type	960.79	125.86
23 61 16 00-0053	EA	3 Ton Refrigerant Compressor, Reciprocating Hermetic Type	1,000.18	125.86
23 61 16 00-0054	EA	3-1/2 Ton Refrigerant Compressor, Reciprocating Hermetic Type	1,074.99	133.72
23 61 16 00-0055	EA	4 Ton Refrigerant Compressor, Reciprocating Hermetic Type	1,268.01	141.59
23 61 16 00-0056	EA	4-1/2 Ton Refrigerant Compressor, Reciprocating Hermetic Type	1,384.19	145.48

23 61 16 00-0057 Reciprocating Hermetic Type Refrigerant Compressors ^(23 61 16 00-0041)



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 61 16 00-0058 EA 5 Ton Refrigerant Compressor, Reciprocating Hermetic Type	1,795.88	391.67
23 61 16 00-0059 EA 10 Ton Refrigerant Compressor, Reciprocating Hermetic Type	3,323.21	489.59
23 61 16 00-0060 EA 15 Ton Refrigerant Compressor, Reciprocating Hermetic Type	5,467.77	596.03
23 61 16 00-0061 EA 20 Ton Refrigerant Compressor, Reciprocating Hermetic Type	6,937.91	685.42
23 61 16 00-0062 EA 25 Ton Refrigerant Compressor, Reciprocating Hermetic Type	7,663.96	761.59
23 61 16 00-0063 EA 30 Ton Refrigerant Compressor, Reciprocating Hermetic Type	8,501.65	856.78
23 61 16 00-0064 EA 35 Ton Refrigerant Compressor, Reciprocating Hermetic Type	10,948.79	979.17
23 61 16 00-0065 EA 40 Ton Refrigerant Compressor, Reciprocating Hermetic Type	13,978.81	979.17
23 61 16 00-0066 EA 50 Ton Refrigerant Compressor, Reciprocating Hermetic Type	17,240.51	1,142.37
23 61 16 00-0067 EA 60 Ton Refrigerant Compressor, Reciprocating Hermetic Type	19,386.91	1,223.97
23 61 16 00-0068 EA 70 Ton Refrigerant Compressor, Reciprocating Hermetic Type	20,479.96	1,282.71
23 61 16 00-0069 EA 75 Ton Refrigerant Compressor, Reciprocating Hermetic Type	21,064.16	1,346.07
23 61 16 00-0070 EA 80 Ton Refrigerant Compressor, Reciprocating Hermetic Type	21,650.10	1,351.30
23 61 16 00-0071 EA 90 Ton Refrigerant Compressor, Reciprocating Hermetic Type	22,740.32	1,414.88
23 61 16 00-0072 EA 100 Ton Refrigerant Compressor, Reciprocating Hermetic Type	23,839.34	1,473.40

23 61 19 Scroll Refrigerant Compressors (23 61)

23 61 19 00-0001 Scroll Refrigerant Compressors (23 61 19)

23 61 19 00-0002 EA Up To 3 Ton Scroll Refrigerant Compressor.....	943.83	125.70
23 61 19 00-0003 EA 3.5 Ton Scroll Refrigerant Compressor	989.98	133.79
23 61 19 00-0004 EA 4 Ton Scroll Refrigerant Compressor	1,015.01	141.51
23 61 19 00-0005 EA 4.5 Ton Scroll Refrigerant Compressor	1,035.09	145.55
23 61 19 00-0006 EA 5 Ton Scroll Refrigerant Compressor	1,283.00	183.78
23 61 19 00-0007 EA 7.5 Ton Scroll Refrigerant Compressor	2,429.80	275.67
23 61 19 00-0008 EA 8.75 Ton Scroll Refrigerant Compressor	2,781.19	321.61
23 61 19 00-0009 EA 10 Ton Scroll Refrigerant Compressor	3,117.32	367.56
23 61 19 00-0010 EA 12 Ton Scroll Refrigerant Compressor	3,766.86	441.07
23 61 19 00-0011 EA 13.5 Ton Scroll Refrigerant Compressor	4,437.22	496.20
23 61 19 00-0012 EA 15 Ton Scroll Refrigerant Compressor	5,199.06	551.34
23 61 19 00-0013 EA 20 Ton Scroll Refrigerant Compressor	7,319.74	735.12
23 61 19 00-0014 EA 25 Ton Scroll Refrigerant Compressor	8,268.23	918.89
23 61 19 00-0015 EA 30 Ton Scroll Refrigerant Compressor	8,861.89	1,102.68

23 61 23 Rotary-Screw Refrigerant Compressors (23 61)

23 61 23 00-0001 Rotary Screw Type Refrigerant Compressors (23 61 23)

23 61 23 00-0002 EA 75 Ton Refrigerant Compressor, Rotary Screw Type	24,723.46	1,872.71
23 61 23 00-0003 EA 80 Ton Refrigerant Compressor, Rotary Screw Type	25,464.51	1,895.72
23 61 23 00-0004 EA 90 Ton Refrigerant Compressor, Rotary Screw Type	27,069.53	1,941.74
23 61 23 00-0005 EA 100 Ton Refrigerant Compressor, Rotary Screw Type	28,658.68	1,987.90
23 61 23 00-0006 EA 110 Ton Refrigerant Compressor, Rotary Screw Type	30,952.98	2,222.02
23 61 23 00-0007 EA 120 Ton Refrigerant Compressor, Rotary Screw Type	32,813.58	2,271.74
23 61 23 00-0008 EA 130 Ton Refrigerant Compressor, Rotary Screw Type	34,627.03	2,300.66
23 61 23 00-0009 EA 140 Ton Refrigerant Compressor, Rotary Screw Type	36,523.56	2,371.84
23 61 23 00-0010 EA 150 Ton Refrigerant Compressor, Rotary Screw Type	38,382.31	2,421.57
23 61 23 00-0011 EA 170 Ton Refrigerant Compressor, Rotary Screw Type	40,995.49	2,487.93
23 61 23 00-0012 EA 185 Ton Refrigerant Compressor, Rotary Screw Type	42,826.28	2,514.68
23 61 23 00-0013 EA 200 Ton Refrigerant Compressor, Rotary Screw Type	43,687.08	2,556.30
23 61 23 00-0014 EA 215 Ton Refrigerant Compressor, Rotary Screw Type	48,992.67	2,728.70
23 61 23 00-0015 EA 225 Ton Refrigerant Compressor, Rotary Screw Type	54,210.27	2,875.79

23 62 Packaged Compressor and Condenser Units (23 60)

23 62 13 Packaged Air-Cooled Refrigerant Compressor and Condenser Units (23 62)

23 62 13 00-0001 Packaged Chiller With Remote Air Cooled Condenser (23 62 13)

Note: With remote air cooled condenser rated by cooling capacity, Units are factory assembled package type and include hermetic compressor, motor, cooler, condenser, internal piping, oil, discharge/suction gauges, lead lag switch, compressor unloaders, removable core filter drier with 3 valve by-pass, sight glass, internal wiring, motor starters, insulation, fan cycling controls, standard oil hi/low safety control switches, operation and safety controls, factory wired and installed control panel, vibration eliminators, phase monitoring for 3 phase units, start-up and equipment rigging. Units include dual compressors. Excludes piping and power wiring.

23 62 13 00-0002 EA 15 Ton Packaged Chiller With Remote Air Cooled Condensers	34,834.33	6,181.79
<i>For Gas Fired Engine Driven, Add</i>	<i>6,040.07</i>	
23 62 13 00-0003 EA 20 Ton Packaged Chiller With Remote Air Cooled Condensers	39,411.09	6,515.94
<i>For Gas Fired Engine Driven, Add</i>	<i>6,905.32</i>	
23 62 13 00-0004 EA 25 Ton Packaged Chiller With Remote Air Cooled Condensers	45,830.96	7,090.81
<i>For Gas Fired Engine Driven, Add</i>	<i>8,103.10</i>	
23 62 13 00-0005 EA 30 Ton Packaged Chiller With Remote Air Cooled Condensers	51,312.22	7,534.02
<i>For Gas Fired Engine Driven, Add</i>	<i>9,132.91</i>	
23 62 13 00-0006 EA 40 Ton Packaged Chiller With Remote Air Cooled Condensers	64,337.56	8,313.39
<i>For Gas Fired Engine Driven, Add</i>	<i>11,621.13</i>	
23 62 13 00-0007 EA 50 Ton Packaged Chiller With Remote Air Cooled Condensers	71,081.64	8,610.27
<i>For Gas Fired Engine Driven, Add</i>	<i>12,925.43</i>	
23 62 13 00-0008 EA 60 Ton Packaged Chiller With Remote Air Cooled Condensers	77,262.02	9,272.61
<i>For Gas Fired Engine Driven, Add</i>	<i>14,062.20</i>	
23 62 13 00-0009 EA 70 Ton Packaged Chiller With Remote Air Cooled Condensers	94,167.90	9,921.38
<i>For Gas Fired Engine Driven, Add</i>	<i>17,327.53</i>	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 60 Central Cooling Equipment****23 62 Packaged Compressor and Condenser Units**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 62 13 00-0010 EA 75 Ton Packaged Chiller With Remote Air Cooled Condensers <i>For Gas Fired Engine Driven, Add</i>	95,297.08 17,542.34	10,118.85
23 62 13 00-0011 EA 80 Ton Packaged Chiller With Remote Air Cooled Condensers <i>For Gas Fired Engine Driven, Add</i>	96,975.62 17,812.09	10,558.83
23 62 13 00-0012 EA 90 Ton Packaged Chiller With Remote Air Cooled Condensers <i>For Gas Fired Engine Driven, Add</i>	107,740.56 19,893.12	11,038.80
23 62 13 00-0013 EA 100 Ton Packaged Chiller With Remote Air Cooled Condensers <i>For Gas Fired Engine Driven, Add</i>	119,335.67 22,133.34	11,564.47
23 62 13 00-0014 EA 110 Ton Packaged Chiller With Remote Air Cooled Condensers <i>For Gas Fired Engine Driven, Add</i>	132,450.54 24,669.62	12,142.66
23 62 13 00-0015 EA 120 Ton Packaged Chiller With Remote Air Cooled Condensers <i>For Gas Fired Engine Driven, Add</i>	143,289.38 26,741.57	12,781.78
23 62 13 00-0016 EA 140 Ton Packaged Chiller With Remote Air Cooled Condensers <i>For Gas Fired Engine Driven, Add</i>	158,248.73 29,626.98	13,491.85

23 62 23 Packaged Water-Cooled Refrigerant Compressor and Condenser Units (23 62)**23 62 23 00-0001 Water Cooled Condensing Units (23 62 23)**

Note: Includes compressor, condenser and motor, and equipment rigging. Excludes piping and power wiring.

23 62 23 00-0002 EA 5 Ton Water Cooled Condensing Unit With Compressor, Condenser And Motor	4,257.46	511.12
23 62 23 00-0003 EA 10 Ton Water Cooled Condensing Unit With Compressor, Condenser And Motor	6,448.09	746.44
23 62 23 00-0004 EA 15 Ton Water Cooled Condensing Unit With Compressor, Condenser And Motor	7,367.38	808.96
23 62 23 00-0005 EA 20 Ton Water Cooled Condensing Unit With Compressor, Condenser And Motor	9,125.01	970.75
23 62 23 00-0006 EA 30 Ton Water Cooled Condensing Unit With Compressor, Condenser And Motor	9,887.93	1,142.10
23 62 23 00-0007 EA 60 Ton Water Cooled Condensing Unit With Compressor, Condenser And Motor	20,726.96	1,694.71
23 62 23 00-0008 EA 80 Ton Water Cooled Condensing Unit With Compressor, Condenser And Motor	25,704.38	2,045.37
23 62 23 00-0009 EA 120 Ton Water Cooled Condensing Unit With Compressor, Condenser And Motor	35,349.37	2,237.95

23 63 Refrigerant Condensers (23 60)**23 63 13 Air-Cooled Refrigerant Condensers (23 63)****23 63 13 00-0001 Air Cooled Condensing Units (23 63 13)**

Note: Includes compressor(s), condenser, fan, motors, discharge/suction gauges, sight glass, fan cycling controls, standard oil hi/low safety control switches, standard controls and liquid line filter dryers and phase monitoring for 3 phase units and equipment rigging. Meets minimum ASHRAE EER requirements. Excludes piping and power wiring.

23 63 13 00-0002 EA 6 Ton Air Cooled Condensing Unit With Compressor, Condenser, Fan And Motor	3,948.86	511.12
<i>For >25 To 50, Deduct</i>	-158.74	
<i>For >50, Deduct</i>	-253.98	
<i>For Low Ambient Protection, 0 Degree F, Add</i>	606.25	
<i>For >10 To 25, Deduct</i>	-95.24	
<i>For Winter Start Control, Add</i>	204.40	
23 63 13 00-0003 EA 7.5 Ton Air Cooled Condensing Unit With Compressor, Condenser, Fan And Motor	4,728.96	606.72
<i>For >25 To 50, Deduct</i>	-190.48	
<i>For >50, Deduct</i>	-304.78	
<i>For Low Ambient Protection, 0 Degree F, Add</i>	534.59	
<i>For >10 To 25, Deduct</i>	-114.29	
<i>For Winter Start Control, Add</i>	168.12	
23 63 13 00-0004 EA 10 Ton Air Cooled Condensing Unit With Compressor, Condenser, Fan And Motor	6,142.82	746.44
<i>For Low Ambient Protection, 0 Degree F, Add</i>	633.65	
<i>For >25 To 50, Deduct</i>	-250.57	
<i>For >50, Deduct</i>	-400.91	
<i>For >10 To 25, Deduct</i>	-150.34	
<i>For Winter Start Control, Add</i>	213.37	
23 63 13 00-0005 EA 12.5 Ton Air Cooled Condensing Unit With Compressor, Condenser, Fan And Motor	7,581.55	776.60
<i>For Low Ambient Protection, 0 Degree F, Add</i>	742.51	
<i>For >25 To 50, Deduct</i>	-320.24	
<i>For >50, Deduct</i>	-512.39	
<i>For >10 To 25, Deduct</i>	-192.15	
<i>For Winter Start Control, Add</i>	245.76	
23 63 13 00-0006 EA 15 Ton Air Cooled Condensing Unit With Compressor, Condenser, Fan And Motor	9,024.06	808.96
<i>For Winter Start Control, Add</i>	200.55	
<i>For >25 To 50, Deduct</i>	-389.92	
<i>For >50, Deduct</i>	-623.87	
<i>For >10 To 25, Deduct</i>	-233.95	
<i>For Low Ambient Protection, 0 Degree F, Add</i>	774.33	
23 63 13 00-0007 EA 20 Ton Air Cooled Condensing Unit With Compressor, Condenser, Fan And Motor	11,621.48	970.75
<i>For Winter Start Control, Add</i>	248.59	
<i>For >25 To 50, Deduct</i>	-507.53	
<i>For >50, Deduct</i>	-812.05	
<i>For >10 To 25, Deduct</i>	-304.52	
<i>For Low Ambient Protection, 0 Degree F, Add</i>	976.75	
23 63 13 00-0008 EA 25 Ton Air Cooled Condensing Unit With Compressor, Condenser, Fan And Motor	13,214.48	1,044.30
<i>For Winter Start Control, Add</i>	274.42	
<i>For >25 To 50, Deduct</i>	-581.68	
<i>For >50, Deduct</i>	-930.69	
<i>For Low Ambient Protection, 0 Degree F, Add</i>	1,035.06	
<i>For >10 To 25, Deduct</i>	-349.01	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 63 13 00-0009 EA 30 Ton Air Cooled Condensing Unit With Compressor, Condenser, Fan And Motor.....	15,148.12	1,139.90
<i>For Low Ambient Protection, 0 Degree F, Add</i>	1,102.35	
<i>For Winter Start Control, Add</i>	306.71	
<i>For >25 To 50, Deduct</i>	-671.17	
<i>For >50, Deduct</i>	-1,073.87	
<i>For >10 To 25, Deduct</i>	-402.70	
23 63 13 00-0010 EA 40 Ton Air Cooled Condensing Unit With Compressor, Condenser, Fan And Motor.....	20,807.85	1,348.06
<i>For Low Ambient Protection, 0 Degree F, Add</i>	1,456.19	
<i>For Winter Start Control, Add</i>	395.19	
<i>For >25 To 50, Deduct</i>	-936.44	
<i>For >50, Deduct</i>	-1,498.31	
<i>For >10 To 25, Deduct</i>	-561.87	
23 63 13 00-0011 EA 50 Ton Air Cooled Condensing Unit With Compressor, Condenser, Fan And Motor.....	25,273.59	1,694.71
<i>For >25 To 50, Deduct</i>	-1,133.00	
<i>For >50, Deduct</i>	-1,612.80	
<i>For Winter Start Control, Add</i>	374.66	
<i>For >10 To 25, Deduct</i>	-679.80	
<i>For Low Ambient Protection, 0 Degree F, Add</i>	1,559.80	
23 63 13 00-0012 EA 60 Ton Air Cooled Condensing Unit With Compressor, Condenser, Fan And Motor.....	29,102.99	1,870.44
<i>For >25 To 50, Deduct</i>	-1,314.73	
<i>For >50, Deduct</i>	-2,103.56	
<i>For Winter Start Control, Add</i>	412.32	
<i>For >10 To 25, Deduct</i>	-788.84	
<i>For Low Ambient Protection, 0 Degree F, Add</i>	1,753.89	
23 63 13 00-0013 EA 80 Ton Air Cooled Condensing Unit With Compressor, Condenser, Fan And Motor.....	37,671.68	2,045.37
<i>For >25 To 50, Deduct</i>	-1,725.87	
<i>For >50, Deduct</i>	-2,761.39	
<i>For Winter Start Control, Add</i>	488.02	
<i>For >10 To 25, Deduct</i>	-1,035.52	
<i>For Low Ambient Protection, 0 Degree F, Add</i>	2,169.28	
23 63 13 00-0014 EA 100 Ton Air Cooled Condensing Unit With Compressor, Condenser, Fan And Motor.....	51,945.44	1,841.63
<i>For >25 To 50, Deduct</i>	-2,409.82	
<i>For >50, Deduct</i>	-3,655.71	
<i>For Winter Start Control, Add</i>	615.88	
<i>For Low Ambient Protection, 0 Degree F, Add</i>	2,383.15	
<i>For >10 To 25, Deduct</i>	-1,445.89	
23 63 13 00-0015 EA 120 Ton Air Cooled Condensing Unit With Compressor, Condenser, Fan And Motor.....	63,961.84	1,904.07
<i>For >25 To 50, Deduct</i>	-3,004.29	
<i>For >50, Deduct</i>	-4,806.86	
<i>For Low Ambient Protection, 0 Degree F, Add</i>	2,771.60	
<i>For >10 To 25, Deduct</i>	-1,802.57	
23 63 13 00-0016 Air Cooled Condensing Units <small>(23 63 13)</small>		
Note: Include compressor(s), condenser, fan, motors, discharge/suction gauges, sight glass, fan cycling controls, standard oil hi/low safety control switches, standard controls and liquid line filter dryers, 13 SEER, 1 or 3 phase and equipment rigging. Higher SEER ratings can be obtained by oversizing evaporators. Excludes piping and power wiring.		
23 63 13 00-0017 EA 1.5 Ton, 13 SEER, Air Cooled Condensing Unit.....	1,545.97	241.43
Note: Precharged with refrigerant capable of charging the system with a 20' length of piping.		
<i>For >25 To 50, Deduct</i>	-59.19	
<i>For >50, Deduct</i>	-94.71	
<i>For >10 To 25, Deduct</i>	-35.51	
<i>For 14 SEER, Add</i>	248.60	
<i>For 15 SEER, Add</i>	284.12	
<i>For 16 SEER, Add</i>	485.37	
<i>For 18 SEER, Add</i>	1,053.60	
23 63 13 00-0018 EA 2 Ton, 13 SEER, Air Cooled Condensing Unit.....	1,661.63	268.39
Note: Precharged with refrigerant capable of charging the system with a 20' length of piping.		
<i>For >25 To 50, Deduct</i>	-62.96	
<i>For >50, Deduct</i>	-100.74	
<i>For >10 To 25, Deduct</i>	-37.78	
<i>For 14 SEER, Add</i>	264.44	
<i>For 15 SEER, Add</i>	302.22	
<i>For 16 SEER, Add</i>	516.29	
<i>For 18 SEER, Add</i>	1,120.72	
23 63 13 00-0019 EA 2.5 Ton, 13 SEER, Air Cooled Condensing Unit.....	1,761.95	295.23
Note: Precharged with refrigerant capable of charging the system with a 20' length of piping.		
<i>For >25 To 50, Deduct</i>	-65.97	
<i>For >50, Deduct</i>	-105.55	
<i>For >10 To 25, Deduct</i>	-39.58	
<i>For 14 SEER, Add</i>	277.06	
<i>For 15 SEER, Add</i>	316.64	
<i>For 16 SEER, Add</i>	540.93	
<i>For 18 SEER, Add</i>	1,174.20	
23 63 13 00-0020 EA 3 Ton, 13 SEER, Air Cooled Condensing Unit.....	2,025.92	321.91
Note: Precharged with refrigerant capable of charging the system with a 20' length of piping.		
<i>For >25 To 50, Deduct</i>	-77.15	
<i>For >50, Deduct</i>	-123.44	
<i>For >10 To 25, Deduct</i>	-46.29	
<i>For 14 SEER, Add</i>	324.04	
<i>For 15 SEER, Add</i>	370.33	
<i>For 16 SEER, Add</i>	632.65	
<i>For 18 SEER, Add</i>	1,373.31	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 60 Central Cooling Equipment****23 63 Refrigerant Condensers**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 63	13 00-0021	EA	3.5 Ton, 13 SEER, Air Cooled Condensing Unit.....	2,144.15	348.92
			Note: Precharged with refrigerant capable of charging the system with a 20' length of piping.		
			For >25 To 50, Deduct	-81.05	
			For >50, Deduct	-129.68	
			For >10 To 25, Deduct	-48.63	
			For 14 SEER, Add	340.42	
			For 15 SEER, Add	389.05	
			For 16 SEER, Add	664.63	
			For 18 SEER, Add	1,442.73	
23 63	13 00-0022	EA	4 Ton, 13 SEER, Air Cooled Condensing Unit.....	2,391.48	375.75
			Note: Precharged with refrigerant capable of charging the system with a 20' length of piping.		
			For >25 To 50, Deduct	-91.41	
			For >50, Deduct	-146.25	
			For >10 To 25, Deduct	-54.84	
			For 14 SEER, Add	383.91	
			For 15 SEER, Add	438.75	
			For 16 SEER, Add	749.54	
			For 18 SEER, Add	1,627.04	
23 63	13 00-0023	EA	5 Ton, 13 SEER, Air Cooled Condensing Unit.....	2,702.05	402.39
			Note: Precharged with refrigerant capable of charging the system with a 20' length of piping.		
			For >25 To 50, Deduct	-104.92	
			For >50, Deduct	-167.88	
			For >10 To 25, Deduct	-62.95	
			For 14 SEER, Add	440.68	
			For 15 SEER, Add	503.63	
			For 16 SEER, Add	860.37	
			For 18 SEER, Add	1,867.64	

23 63 13 00-0024 Removal And Reinstallation Of AC Condensing Unit (23 63 13)

Note: Includes storage and cleaning.

23 63	13 00-0025	EA	Remove And Reinstall Air Cooled Condensing Unit Up To 5 Tons.....	247.05	
23 63	13 00-0026	EA	Remove And Reinstall Air Cooled Condensing Unit 7.5 To 15 Tons	926.47	
23 63	13 00-0027	EA	Remove And Reinstall Air Cooled Condensing Unit 20 To 40 Tons	1,544.99	

23 64 Packaged Water Chillers (23 60)**23 64 13 Absorption Water Chillers (23 64)****23 64 13 16 Indirect-Fired Absorption Water Chillers (23 64 13)****23 64 13 16-0001 Packaged, Steam Driven, Water Cooled Absorption Chillers (23 64 13 16)**

Note: Includes refrigerant monitor with scanner, audible alarm, and lights, 460 V motor, and all accessories, controls (water temperature controller with PE switches, flow switch, etc.) factory wired and installed control panel, and also includes start-up. Price includes closed transition starter. (rated by cooling capacity in tons). Units are factory assembled package type consisting of motor, cooler, condenser, internal piping and wiring, motor starters, insulation, purge unit, controls, gauges, lubrication system, refrigerant charge, oil, phase monitoring for 3 phase units, start-up costs and equipment rigging. Exclude piping and power wiring.

23 64	13 16-0002	EA	50 Ton Packaged, Steam Driven, Water Cooled Absorption Chiller	90,075.76	4,934.54
			For Two Stage Unit, Add	59,909.97	
23 64	13 16-0003	EA	100 Ton Packaged, Steam Driven, Water Cooled Absorption Chiller	114,444.27	5,887.38
			For Two Stage Unit, Add	76,328.15	
23 64	13 16-0004	EA	150 Ton Packaged, Steam Driven, Water Cooled Absorption Chiller	145,135.86	6,044.34
			For Two Stage Unit, Add	97,711.39	
23 64	13 16-0005	EA	200 Ton Packaged, Steam Driven, Water Cooled Absorption Chiller	160,851.11	6,159.32
			For Two Stage Unit, Add	108,638.19	
23 64	13 16-0006	EA	250 Ton Packaged, Steam Driven, Water Cooled Absorption Chiller	179,942.91	6,313.70
			For Two Stage Unit, Add	121,903.24	
23 64	13 16-0007	EA	300 Ton Packaged, Steam Driven, Water Cooled Absorption Chiller	203,319.42	6,686.21
			For Two Stage Unit, Add	138,027.46	
23 64	13 16-0008	EA	350 Ton Packaged, Steam Driven, Water Cooled Absorption Chiller	218,074.22	6,847.79
			For Two Stage Unit, Add	148,251.98	
23 64	13 16-0009	EA	400 Ton Packaged, Steam Driven, Water Cooled Absorption Chiller	259,938.75	7,127.74
			For Two Stage Unit, Add	177,377.28	
23 64	13 16-0010	EA	500 Ton Packaged, Steam Driven, Water Cooled Absorption Chiller	291,333.38	7,335.36
			For Two Stage Unit, Add	199,220.13	
23 64	13 16-0011	EA	650 Ton Packaged, Steam Driven, Water Cooled Absorption Chiller	358,298.03	10,349.92
			For Two Stage Unit, Add	244,158.43	
23 64	13 16-0012	EA	750 Ton Packaged, Steam Driven, Water Cooled Absorption Chiller	390,029.86	12,056.57
			For Two Stage Unit, Add	265,274.14	
23 64	13 16-0013	EA	850 Ton Packaged, Steam Driven, Water Cooled Absorption Chiller	417,810.27	12,592.37
			For Two Stage Unit, Add	284,376.13	
23 64	13 16-0014	EA	950 Ton Packaged, Steam Driven, Water Cooled Absorption Chiller	447,459.07	13,142.41
			For Two Stage Unit, Add	304,866.93	
23 64	13 16-0015	EA	1,125 Ton Packaged, Steam Driven, Water Cooled Absorption Chiller	512,375.86	13,597.87
			For Two Stage Unit, Add	350,019.17	
23 64	13 16-0016	EA	1,250 Ton Packaged, Steam Driven, Water Cooled Absorption Chiller	560,664.48	14,014.13
			For Two Stage Unit, Add	383,556.60	
23 64	13 16-0017	EA	1,450 Ton Packaged, Steam Driven, Water Cooled Absorption Chiller	659,030.53	17,275.25
			For Two Stage Unit, Add	450,339.78	
23 64	13 16-0018	EA	1,700 Ton Packaged, Steam Driven, Water Cooled Absorption Chiller	770,441.50	18,190.55
			For Two Stage Unit, Add	527,745.65	



	MINOR	CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 64 16		Centrifugal Water Chillers (23 64)		
23 64 16 13		Air-Cooled Centrifugal Water Chillers (23 64 16)		
23 64 16 13-0001		Magnetic Bearing, Air Cooled Centrifugal Chillers (23 64 16 13)		
		Note: SMART air cooled oil-free centrifugal chiller with variable speed control, magnetic bearings, lowest ARI IPLV in industry. Includes start up, freight, R-134a refrigerant charge, BACnet or equivalent interface.		
	EA	85 Ton, Single Compressor, Magnetic Bearing, Air Cooled Centrifugal Chiller <i>For 5 Year Parts Only Compressor Warranty, Add</i>	121,051.72 3,312.60	4,481.20
	EA	175 Ton, Two Compressor, Magnetic Bearing, Air Cooled Centrifugal Chiller <i>For 5 Year Parts Only Compressor Warranty, Add</i>	171,667.61 6,625.20	6,011.25
	EA	240 Ton, Three Compressor, Magnetic Bearing, Air Cooled Centrifugal Chiller <i>For 5 Year Parts Only Compressor Warranty, Add</i>	214,193.72 9,937.80	6,357.39
23 64 16 16		Water-Cooled Centrifugal Water Chillers (23 64 16)		
23 64 16 16-0001		Packaged Water-Cooled Centrifugal Water Chillers (23 64 16 16)		
		Note: Includes integral heat exchanger, refrigerant monitor with scanner, audible alarm, and lights, 460 V motor, controls (water temperature controller with PE switches, flow switch, etc.), start-up, and closed transition starter. Rated by cooling capacity in tons. Units are factory assembled package type consisting of compressor, motor, cooler, condenser, internal piping and wiring, motor starters, insulation, purge unit, factory wired and installed control panel, gauges, lubrication system, refrigerant charge, oil, phase monitoring for 3 phase units, start-up costs and equipment rigging. Units greater than 20 tons include dual compressors. Excludes piping and power wiring.		
	EA	180 Ton Packaged Water-Cooled Centrifugal Water Chiller..... Note: Includes integral heat exchanger, controls, and 440/460 V motor. <i>For 208/230 Volt Motor, Add</i>	116,593.96 4,367.14	4,616.36
	EA	200 Ton Packaged Water-Cooled Centrifugal Water Chiller..... Note: Includes integral heat exchanger, controls, and 440/460 V motor. <i>For 208/230 Volt Motor, Add</i>	127,486.73 4,795.24	4,733.27
	EA	225 Ton Packaged Water-Cooled Centrifugal Water Chiller..... Note: Includes integral heat exchanger, controls, and 440/460 V motor. <i>For 208/230 Volt Motor, Add</i>	140,654.53 5,314.32	4,853.58
	EA	250 Ton Packaged Water-Cooled Centrifugal Water Chiller..... Note: Includes integral heat exchanger, controls, and 440/460 V motor. <i>For 208/230 Volt Motor, Add</i>	153,497.84 5,815.55	5,048.17
	EA	275 Ton Packaged Water-Cooled Centrifugal Water Chiller..... Note: Includes integral heat exchanger, controls, and 440/460 V motor. <i>For 208/230 Volt Motor, Add</i>	166,040.36 6,298.93	5,333.22
	EA	300 Ton Packaged Water-Cooled Centrifugal Water Chiller..... Note: Includes integral heat exchanger, controls, and 440/460 V motor. <i>For 208/230 Volt Motor, Add</i>	178,124.12 6,764.47	5,610.51
	EA	325 Ton Packaged Water-Cooled Centrifugal Water Chiller..... Note: Includes integral heat exchanger, controls, and 440/460 V motor. <i>For 208/230 Volt Motor, Add</i>	189,809.23 7,212.11	5,918.13
	EA	350 Ton Packaged Water-Cooled Centrifugal Water Chiller..... Note: Includes integral heat exchanger, controls, and 440/460 V motor. <i>For 208/230 Volt Motor, Add</i>	201,024.16 7,641.96	6,209.97
	EA	375 Ton Packaged Water-Cooled Centrifugal Water Chiller..... Note: Includes integral heat exchanger, controls, and 440/460 V motor. <i>For 208/230 Volt Motor, Add</i>	211,750.31 8,053.90	6,476.08
	EA	400 Ton Packaged Water-Cooled Centrifugal Water Chiller..... Note: Includes integral heat exchanger, controls, and 440/460 V motor. <i>For 208/230 Volt Motor, Add</i>	221,940.34 8,448.00	6,686.21
	EA	425 Ton Packaged Water-Cooled Centrifugal Water Chiller..... Note: Includes integral heat exchanger, controls, and 440/460 V motor. <i>For 208/230 Volt Motor, Add</i>	231,878.70 8,824.25	7,017.46
	EA	450 Ton Packaged Water-Cooled Centrifugal Water Chiller..... Note: Includes integral heat exchanger, controls, and 440/460 V motor. <i>For 208/230 Volt Motor, Add</i>	241,273.80 9,182.66	7,288.19
	EA	475 Ton Packaged Water-Cooled Centrifugal Water Chiller..... Note: Includes integral heat exchanger, controls, and 440/460 V motor. <i>For 208/230 Volt Motor, Add</i>	250,217.08 9,523.22	7,555.44
	EA	500 Ton Packaged Water-Cooled Centrifugal Water Chiller..... Note: Includes integral heat exchanger, controls, and 440/460 V motor. <i>For 208/230 Volt Motor, Add</i>	258,617.43 9,845.93	7,762.40
	EA	550 Ton Packaged Water-Cooled Centrifugal Water Chiller..... Note: Includes integral heat exchanger, controls, and 440/460 V motor. <i>For 208/230 Volt Motor, Add</i>	273,855.46 10,437.77	8,037.66
	EA	600 Ton Packaged Water-Cooled Centrifugal Water Chiller..... Note: Includes integral heat exchanger, controls, and 440/460 V motor. <i>For 208/230 Volt Motor, Add</i>	287,147.39 10,958.22	8,212.43
	EA	650 Ton Packaged Water-Cooled Centrifugal Water Chiller..... Note: Includes integral heat exchanger, controls, and 440/460 V motor. <i>For 208/230 Volt Motor, Add</i>	299,024.74 11,407.23	8,618.36
	EA	700 Ton Packaged Water-Cooled Centrifugal Water Chiller..... Note: Includes integral heat exchanger, controls, and 440/460 V motor. <i>For 208/230 Volt Motor, Add</i>	309,127.25 11,784.85	9,030.43
	EA	750 Ton Packaged Water-Cooled Centrifugal Water Chiller..... Note: Includes integral heat exchanger, controls, and 440/460 V motor. <i>For 208/230 Volt Motor, Add</i>	317,514.21 12,091.20	9,483.78
	EA	800 Ton Packaged Water-Cooled Centrifugal Water Chiller..... Note: Includes integral heat exchanger, controls, and 440/460 V motor. <i>For 208/230 Volt Motor, Add</i>	337,271.73 12,852.10	9,941.33

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 60 Central Cooling Equipment****23 64 Packaged Water Chillers**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 64 16 16-0022 EA 850 Ton Packaged Water-Cooled Centrifugal Water Chiller..... Note: Includes integral heat exchanger, controls, and 440/460 V motor. <i>For 208/230 Volt Motor, Add</i>	356,889.49 13,607.51	10,397.42
23 64 16 16-0023 EA 900 Ton Packaged Water-Cooled Centrifugal Water Chiller..... Note: Includes integral heat exchanger, controls, and 440/460 V motor. <i>For 208/230 Volt Motor, Add</i>	376,437.78 14,357.32	10,897.28
23 64 16 16-0024 EA 950 Ton Packaged Water-Cooled Centrifugal Water Chiller..... Note: Includes integral heat exchanger, controls, and 440/460 V motor. <i>For 208/230 Volt Motor, Add</i>	395,925.94 15,101.49	11,447.63
23 64 16 16-0025 EA 1,000 Ton Packaged Water-Cooled Centrifugal Water Chiller..... Note: Includes integral heat exchanger, controls, and 440/460 V motor. <i>For 208/230 Volt Motor, Add</i>	415,400.81 15,840.00	12,207.85
23 64 16 16-0026 EA 1,100 Ton Packaged Water-Cooled Centrifugal Water Chiller..... Note: Includes integral heat exchanger, controls, and 440/460 V motor. <i>For 208/230 Volt Motor, Add</i>	450,629.19 17,129.75	14,086.03
23 64 16 16-0027 EA 1,200 Ton Packaged Water-Cooled Centrifugal Water Chiller..... Note: Includes integral heat exchanger, controls, and 440/460 V motor. <i>For 208/230 Volt Motor, Add</i>	484,530.41 18,366.06	15,969.57
23 64 16 16-0028 EA 1,300 Ton Packaged Water-Cooled Centrifugal Water Chiller..... Note: Includes integral heat exchanger, controls, and 440/460 V motor. <i>For 208/230 Volt Motor, Add</i>	516,524.47 19,548.83	17,495.33
23 64 16 16-0029 EA 1,400 Ton Packaged Water-Cooled Centrifugal Water Chiller..... Note: Includes integral heat exchanger, controls, and 440/460 V motor. <i>For 208/230 Volt Motor, Add</i>	546,248.13 20,678.06	18,434.74
23 64 16 16-0030 EA 1,500 Ton Packaged Water-Cooled Centrifugal Water Chiller..... Note: Includes integral heat exchanger, controls, and 440/460 V motor. <i>For 208/230 Volt Motor, Add</i>	574,580.72 21,753.60	19,343.44
23 64 16 16-0031 EA 1,600 Ton Packaged Water-Cooled Centrifugal Water Chiller..... Note: Includes integral heat exchanger, controls, and 440/460 V motor. <i>For 208/230 Volt Motor, Add</i>	601,034.88 22,776.12	19,904.16
23 64 16 16-0032 EA 1,700 Ton Packaged Water-Cooled Centrifugal Water Chiller..... Note: Includes integral heat exchanger, controls, and 440/460 V motor. <i>For 208/230 Volt Motor, Add</i>	627,462.43 23,744.95	21,292.79
23 64 16 16-0033 EA 1,800 Ton Packaged Water-Cooled Centrifugal Water Chiller..... Note: Includes integral heat exchanger, controls, and 440/460 V motor. <i>For 208/230 Volt Motor, Add</i>	651,995.30 24,660.24	22,331.45
23 64 16 16-0034 EA 1,900 Ton Packaged Water-Cooled Centrifugal Water Chiller..... Note: Includes integral heat exchanger, controls, and 440/460 V motor. <i>For 208/230 Volt Motor, Add</i>	675,680.61 25,521.99	23,679.06
23 64 16 16-0035 EA 2,000 Ton Packaged Water-Cooled Centrifugal Water Chiller..... Note: Includes integral heat exchanger, controls, and 440/460 V motor. <i>For 208/230 Volt Motor, Add</i>	697,232.44 26,330.30	24,524.76
23 64 16 16-0036 EA 2,250 Ton Packaged Water-Cooled Centrifugal Water Chiller..... Note: Includes integral heat exchanger, controls, and 440/460 V motor. <i>For 208/230 Volt Motor, Add</i>	742,608.56 28,117.00	25,912.96
23 64 16 16-0037 EA 2,500 Ton Packaged Water-Cooled Centrifugal Water Chiller..... Note: Includes integral heat exchanger, controls, and 440/460 V motor. <i>For 208/230 Volt Motor, Add</i>	782,884.83 29,569.32	27,467.70
23 64 16 16-0038 Magnetic Bearing, Water Cooled Centrifugal Water Chillers <small>(23 64 16 16)</small> Note: SMARTD water cooled oil-free centrifugal chiller with variable speed control, magnetic bearings, 10 amp maximum inrush current and ARI part load <0.4kW per ton. Includes start up, freight, R-134a refrigerant charge, BACnet or equivalent interface, 12/18 month compressor warranty.		
23 64 16 16-0039 EA 60 To 85 Ton, Single Compressor, Magnetic Bearing, Water Cooled Centrifugal Water Chiller..... <i>For 5 Year Parts Only Compressor Warranty, Add</i> <i>For Marine Water Box Connections, Add</i>	76,671.04 3,312.60 3,091.76	3,883.71
23 64 16 16-0040 EA 130 To 137 Ton, Single Compressor, Magnetic Bearing, Water Cooled Centrifugal Water Chiller..... <i>For 5 Year Parts Only Compressor Warranty, Add</i> <i>For Marine Water Box Connections, Add</i>	96,382.27 3,312.60 3,091.76	4,514.00
23 64 16 16-0041 EA 125 To 170 Ton, Dual Compressor, Magnetic Bearing, Water Cooled Centrifugal Water Chiller..... <i>For 5 Year Parts Only Compressor Warranty, Add</i> <i>For Marine Water Box Connections, Add</i>	120,421.48 6,625.20 3,091.76	4,616.36
23 64 16 16-0042 EA 240 To 270 Ton, Dual Compressor, Magnetic Bearing, Water Cooled Centrifugal Water Chiller..... <i>For 5 Year Parts Only Compressor Warranty, Add</i> <i>For Marine Water Box Connections, Add</i>	156,519.86 6,625.20 3,091.76	5,333.22
23 64 16 16-0043 EA 210 To 260 Ton, Three Compressor, Magnetic Bearing, Water Cooled Centrifugal Water Chiller..... <i>For 5 Year Parts Only Compressor Warranty, Add</i> <i>For Marine Water Box Connections, Add</i>	157,582.43 9,937.80 3,091.76	5,048.17
23 64 16 16-0044 EA 355 To 405 Ton, Three Compressor, Magnetic Bearing, Water Cooled Centrifugal Water Chiller..... <i>For 5 Year Parts Only Compressor Warranty, Add</i> <i>For Marine Water Box Connections, Add</i>	236,019.22 9,937.80 3,091.76	6,686.21
23 64 16 16-0045 EA 299 To 340 Ton, Four Compressor, Magnetic Bearing, Water Cooled Centrifugal Water Chiller..... <i>For 5 Year Parts Only Compressor Warranty, Add</i> <i>For Marine Water Box Connections, Add</i>	209,230.38 12,146.20 4,306.38	6,209.97
23 64 16 16-0046 EA 540 Ton, Four Compressor, Magnetic Bearing, Water Cooled Centrifugal Water Chiller..... <i>For 5 Year Parts Only Compressor Warranty, Add</i> <i>For Marine Water Box Connections, Add</i>	290,448.62 12,146.20 4,306.38	8,037.66
23 64 16 16-0047 EA 425 Ton, Five Compressor, Magnetic Bearing, Water Cooled Centrifugal Water Chiller..... <i>For 5 Year Parts Only Compressor Warranty, Add</i> <i>For Marine Water Box Connections, Add</i>	260,096.12 14,354.60 4,306.38	7,017.46
23 64 16 16-0048 EA 650 Ton, Five Compressor, Magnetic Bearing, Water Cooled Centrifugal Water Chiller..... <i>For 5 Year Parts Only Compressor Warranty, Add</i> <i>For Marine Water Box Connections, Add</i>	347,771.77 14,354.60 4,306.38	8,618.36



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 64 16 16-0049 EA 510 Ton, Six Compressor, Magnetic Bearing, Water Cooled Centrifugal Water Chiller..... <i>For 5 Year Parts Only Compressor Warranty, Add</i>	309,437.07 16,563.00	7,762.40
23 64 16 16-0050 EA 800 Ton, Six Compressor, Magnetic Bearing, Water Cooled Centrifugal Water Chiller..... <i>For 5 Year Parts Only Compressor Warranty, Add</i> <i>For Marine Water Box Connections, Add</i>	398,662.85 16,563.00 4,527.22	9,941.33
23 64 19 Reciprocating Water Chillers (23 64)		
23 64 19 00-0001 Packaged Water Cooled Reciprocating Water Chillers (23 64 19)		
Note: With reciprocation compressor integral heat exchanger. Rated by cooling capacity in tons. Units are factory assembled package type and include hermetic compressor, motor, cooler, condenser, internal piping, oil, discharge/suction gauges, lead lag switch, compressor unloaders, removable core filter drier with 3 valve by-pass, sight glass, internal wiring, motor starters, insulation, fan cycling controls, standard oil hi/low safety control switches, operation and safety controls, factory wired and installed control panel, refrigerant charge, vibration eliminators, phase monitoring for 3 phase units, start-up costs and equipment rigging. Units greater than 20 tons include dual compressors. Excludes piping and power wiring.		
23 64 19 00-0002 EA 15 Ton Packaged Water Cooled Reciprocating Water Chiller	17,391.62	1,275.84
23 64 19 00-0003 EA 20 Ton Packaged Water Cooled Reciprocating Water Chiller	20,457.39	1,505.15
23 64 19 00-0004 EA 25 Ton Packaged Water Cooled Reciprocating Water Chiller	22,909.17	1,550.61
23 64 19 00-0005 EA 30 Ton Packaged Water Cooled Reciprocating Water Chiller	25,505.40	1,702.25
23 64 19 00-0006 EA 40 Ton Packaged Water Cooled Reciprocating Water Chiller	30,917.25	2,152.57
23 64 19 00-0007 EA 50 Ton Packaged Water Cooled Reciprocating Water Chiller	35,036.71	2,359.00
23 64 19 00-0008 EA 60 Ton Packaged Water Cooled Reciprocating Water Chiller	36,307.59	2,606.40
23 64 23 Scroll Water Chillers (23 64)		
23 64 23 00-0001 Packaged Air Cooled Scroll Water Chillers (23 64 23)		
Note: With integral heat exchanger. Rated by cooling capacity, tons. Units are factory assembled package type and include scroll compressor, motor, cooler, condenser, internal piping, oil, discharge/suction gauges, lead lag switch, compressor unloaders, removable core filter drier with 3-valve by-pass, sight glass, internal wiring, motor starters, insulation, fan cycling controls, standard oil hi/low safety control switches, operation and safety controls, factory wired and installed control panel, refrigerant charge, vibration eliminators, phase monitoring for 3 phase units, factory charge of refrigerant, start-up and equipment rigging. Units greater than 20 tons include dual compressors. Excludes piping and power wiring. Excludes crane and associated personnel.		
23 64 23 00-0002 EA 10 Ton Packaged Air Cooled Scroll Water Chiller	15,053.39	1,163.63
23 64 23 00-0003 EA 15 Ton Packaged Air Cooled Scroll Water Chiller	21,934.86	1,178.55
23 64 23 00-0004 EA 18 Ton Packaged Air Cooled Scroll Water Chiller	23,931.23	1,260.60
23 64 23 00-0005 EA 22 Ton Packaged Air Cooled Scroll Water Chiller	26,315.50	1,350.11
23 64 23 00-0006 EA 25 Ton Packaged Air Cooled Scroll Water Chiller	26,766.34	1,439.63
23 64 23 00-0007 EA 30 Ton Packaged Air Cooled Scroll Water Chiller	28,253.12	1,544.05
23 64 23 00-0008 EA 40 Ton Packaged Air Cooled Scroll Water Chiller	32,273.83	1,670.86
23 64 23 00-0009 EA 45 Ton Packaged Air Cooled Scroll Water Chiller	34,663.74	1,812.58
23 64 23 00-0010 EA 50 Ton Packaged Air Cooled Scroll Water Chiller	36,589.20	1,864.79
23 64 23 00-0011 EA 55 Ton Packaged Air Cooled Scroll Water Chiller	38,214.31	1,946.85
23 64 23 00-0012 EA 60 Ton Packaged Air Cooled Scroll Water Chiller	39,498.43	2,013.98
23 64 23 00-0013 EA 70 Ton Packaged Air Cooled Scroll Water Chiller	45,550.56	2,267.59
23 64 23 00-0014 EA 80 Ton Packaged Air Cooled Scroll Water Chiller	49,046.84	2,483.91
23 64 23 00-0015 EA 90 Ton Packaged Air Cooled Scroll Water Chiller	49,926.46	2,491.37
23 64 23 00-0016 EA 100 Ton Packaged Air Cooled Scroll Water Chiller	52,779.46	2,498.82
23 64 23 00-0017 EA 110 Ton Packaged Air Cooled Scroll Water Chiller	55,555.57	2,506.29
23 64 23 00-0018 EA 120 Ton Packaged Air Cooled Scroll Water Chiller	58,366.17	2,513.75
23 64 23 00-0019 EA 130 Ton Packaged Air Cooled Scroll Water Chiller	61,322.59	2,521.20
23 64 23 00-0020 Packaged Water Cooled Scroll Water Chillers (23 64 23)		
Note: Integral heat exchanger. Rated by cooling capacity in tons. Units are factory assembled package type and include hermetic compressor, motor, cooler, condenser, internal piping, oil, discharge/suction gauges, lead lag switch, compressor unloaders, removable core filter drier with 3 valve by-pass, sight glass, internal wiring, motor starters, insulation, fan cycling controls, standard oil hi/low safety control switches, operation and safety controls, factory wired and installed control panel, refrigerant charge, vibration eliminators, phase monitoring for 3 phase units, start-up costs and equipment rigging. Units greater than 20 tons include dual compressors. Excludes piping and power wiring.		
23 64 23 00-0021 EA 20 Ton Packaged Water Cooled Scroll Water Chiller	33,324.12	1,505.15
23 64 23 00-0022 EA 25 Ton Packaged Water Cooled Scroll Water Chiller	38,462.34	1,550.61
23 64 23 00-0023 EA 30 Ton Packaged Water Cooled Scroll Water Chiller	42,681.12	1,702.25
23 64 23 00-0024 EA 40 Ton Packaged Water Cooled Scroll Water Chiller	52,417.49	2,152.57
23 64 23 00-0025 EA 50 Ton Packaged Water Cooled Scroll Water Chiller	58,001.96	2,359.00
23 64 23 00-0026 EA 60 Ton Packaged Water Cooled Scroll Water Chiller	60,864.71	2,606.40
23 64 26 Rotary-Screw Water Chillers (23 64)		
23 64 26 00-0001 Packaged Air Cooled Rotary-Screw Water Chillers (23 64 26)		
Note: Includes hermetic direct-drive compressors start-up, coil guards, copper fins, copper tubes, factory wired and installed control panel, refrigerant monitor with scanner, audible alarm, and lights, phase monitoring for 3 phase units, 440/460 V motor, motor starters, factory charge of refrigerant and equipment rigging. Units greater than 20 tons include dual compressors. Excludes crane and associated personnel.		
23 64 26 00-0002 EA 70 Ton Packaged Air Cooled Rotary-Screw Water Chiller..... <i>For Aluminum Fins Instead Of Copper, Deduct</i> <i>For 208/230 Volt Motor, Add</i>	88,208.27 -1,258.90 3,357.07	2,856.87

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 60 Central Cooling Equipment****23 64 Packaged Water Chillers**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 64 26 00-0003 EA 80 Ton Packaged Air Cooled Rotary-Screw Water Chiller..... <i>For Aluminum Fins Instead Of Copper, Deduct</i> <i>For 208/230 Volt Motor, Add</i>	94,788.22 -1,352.12 3,605.65	3,103.02
23 64 26 00-0004 EA 90 Ton Packaged Air Cooled Rotary-Screw Water Chiller..... <i>For Aluminum Fins Instead Of Copper, Deduct</i> <i>For 208/230 Volt Motor, Add</i>	99,718.92 -1,422.94 3,794.52	3,237.29
23 64 26 00-0005 EA 100 Ton Packaged Air Cooled Rotary-Screw Water Chiller..... <i>For Aluminum Fins Instead Of Copper, Deduct</i> <i>For 208/230 Volt Motor, Add</i>	103,351.11 -1,471.95 3,925.19	3,483.44
23 64 26 00-0006 EA 110 Ton Packaged Air Cooled Rotary-Screw Water Chiller..... <i>For Aluminum Fins Instead Of Copper, Deduct</i> <i>For 208/230 Volt Motor, Add</i>	110,955.42 -1,582.21 4,219.21	3,655.00
23 64 26 00-0007 EA 120 Ton Packaged Air Cooled Rotary-Screw Water Chiller..... <i>For Aluminum Fins Instead Of Copper, Deduct</i> <i>For 208/230 Volt Motor, Add</i>	117,973.54 -1,685.69 4,495.17	3,729.59
23 64 26 00-0008 EA 130 Ton Packaged Air Cooled Rotary-Screw Water Chiller..... <i>For Aluminum Fins Instead Of Copper, Deduct</i> <i>For 208/230 Volt Motor, Add</i>	124,569.43 -1,781.83 4,751.54	3,856.40
23 64 26 00-0009 EA 140 Ton Packaged Air Cooled Rotary-Screw Water Chiller..... <i>For Aluminum Fins Instead Of Copper, Deduct</i> <i>For 208/230 Volt Motor, Add</i>	128,569.78 -1,839.93 4,906.48	3,938.45
23 64 26 00-0010 EA 160 Ton Packaged Air Cooled Rotary-Screw Water Chiller..... <i>For Aluminum Fins Instead Of Copper, Deduct</i> <i>For 208/230 Volt Motor, Add</i>	135,820.67 -1,946.79 5,191.45	4,020.50
23 64 26 00-0011 EA 170 Ton Packaged Air Cooled Rotary-Screw Water Chiller..... <i>For Aluminum Fins Instead Of Copper, Deduct</i> <i>For 208/230 Volt Motor, Add</i>	141,794.87 -2,033.61 5,422.96	4,147.31
23 64 26 00-0012 EA 180 Ton Packaged Air Cooled Rotary-Screw Water Chiller..... <i>For Aluminum Fins Instead Of Copper, Deduct</i> <i>For 208/230 Volt Motor, Add</i>	149,549.23 -2,146.23 5,723.28	4,311.41
23 64 26 00-0013 EA 200 Ton Packaged Air Cooled Rotary-Screw Water Chiller..... <i>For Aluminum Fins Instead Of Copper, Deduct</i> <i>For 208/230 Volt Motor, Add</i>	156,370.80 -2,246.65 5,991.08	4,400.92
23 64 26 00-0014 EA 215 Ton Packaged Air Cooled Rotary-Screw Water Chiller..... <i>For Aluminum Fins Instead Of Copper, Deduct</i> <i>For 208/230 Volt Motor, Add</i>	167,723.42 -2,415.15 6,440.41	4,475.51
23 64 26 00-0015 EA 225 Ton Packaged Air Cooled Rotary-Screw Water Chiller..... <i>For Aluminum Fins Instead Of Copper, Deduct</i> <i>For 208/230 Volt Motor, Add</i>	175,271.93 -2,527.48 6,739.96	4,520.27
23 64 26 00-0016 EA 240 Ton Packaged Air Cooled Rotary-Screw Water Chiller..... <i>For Aluminum Fins Instead Of Copper, Deduct</i> <i>For 208/230 Volt Motor, Add</i>	182,820.45 -2,639.82 7,039.51	4,557.57
23 64 26 00-0017 EA 260 Ton Packaged Air Cooled Rotary-Screw Water Chiller..... <i>For Aluminum Fins Instead Of Copper, Deduct</i> <i>For 208/230 Volt Motor, Add</i>	205,421.25 -2,976.82 7,938.17	4,647.07
23 64 26 00-0018 EA 280 Ton Packaged Air Cooled Rotary-Screw Water Chiller..... <i>For Aluminum Fins Instead Of Copper, Deduct</i> <i>For 208/230 Volt Motor, Add</i>	216,781.32 -3,145.31 8,387.51	4,736.58
23 64 26 00-0019 EA 300 Ton Packaged Air Cooled Rotary-Screw Water Chiller..... <i>For Aluminum Fins Instead Of Copper, Deduct</i> <i>For 208/230 Volt Motor, Add</i>	231,878.36 -3,369.98 8,986.61	4,811.17
23 64 26 00-0020 EA 325 Ton Packaged Air Cooled Rotary-Screw Water Chiller..... <i>For Aluminum Fins Instead Of Copper, Deduct</i> <i>For 208/230 Volt Motor, Add</i>	254,464.24 -3,706.98 9,885.27	4,893.23
23 64 26 00-0021 EA 350 Ton Packaged Air Cooled Rotary-Screw Water Chiller..... <i>For Aluminum Fins Instead Of Copper, Deduct</i> <i>For 208/230 Volt Motor, Add</i>	277,572.39 -4,052.15 10,805.72	4,952.90
23 64 26 00-0022 Packaged Water Cooled Helical Rotary Water Chillers (23 64 26) Note: Integral heat exchanger. Rated by cooling capacity in tons. Factory assembled package type includes semi-hermetic compressor, motor, cooler, condenser, internal piping, oil, discharge/suction gages, lead-lag switch, compressor unloaders, removable core filter dryer, 3-valve by-pass, sight glass, internal wiring, motor starters, insulation, standard oil hi/low safety control switches, operation and safety controls, factory wired and installed control panel, full factory refrigerant charge, vibration eliminators, NEMA 1 flow switches, wye-delta starter, extended warranty on compressor(s), start-up costs and equipment rigging. Excludes piping and power wiring.		
23 64 26 00-0023 EA 70 Ton Packaged Water Cooled Helical Rotary Water Chiller.....	65,048.05	3,640.98
23 64 26 00-0024 EA 80 Ton Packaged Water Cooled Helical Rotary Water Chiller.....	70,707.46	3,782.57
23 64 26 00-0025 EA 90 Ton Packaged Water Cooled Helical Rotary Water Chiller.....	75,616.16	3,883.71
23 64 26 00-0026 EA 100 Ton Packaged Water Cooled Helical Rotary Water Chiller.....	79,853.66	4,047.55
23 64 26 00-0027 EA 110 Ton Packaged Water Cooled Helical Rotary Water Chiller.....	84,090.45	4,158.81
23 64 26 00-0028 EA 125 Ton Packaged Water Cooled Helical Rotary Water Chiller.....	89,256.89	4,275.56
23 64 26 00-0029 EA 130 Ton Packaged Water Cooled Helical Rotary Water Chiller.....	91,546.84	4,395.06
23 64 26 00-0030 EA 150 Ton Packaged Water Cooled Helical Rotary Water Chiller.....	99,243.97	4,514.00
23 64 26 00-0031 EA 175 Ton Packaged Water Cooled Helical Rotary Water Chiller.....	106,727.96	4,625.74
23 64 26 00-0032 EA 190 Ton Packaged Water Cooled Helical Rotary Water Chiller.....	110,353.63	4,857.07
23 64 26 00-0033 EA 200 Ton Packaged Water Cooled Helical Rotary Water Chiller.....	112,427.71	5,091.30
23 64 26 00-0034 EA 210 Ton Packaged Water Cooled Helical Rotary Water Chiller.....	113,945.18	5,200.29
23 64 26 00-0035 EA 235 Ton Packaged Water Cooled Helical Rotary Water Chiller.....	123,895.58	5,314.04
23 64 26 00-0036 EA 255 Ton Packaged Water Cooled Helical Rotary Water Chiller.....	131,646.51	5,557.26
23 64 26 00-0037 EA 275 Ton Packaged Water Cooled Helical Rotary Water Chiller.....	138,980.41	5,782.20
23 64 26 00-0038 EA 300 Ton Packaged Water Cooled Helical Rotary Water Chiller.....	147,522.97	6,011.25
23 64 26 00-0039 EA 350 Ton Packaged Water Cooled Helical Rotary Water Chiller.....	161,944.90	6,544.05
23 64 26 00-0040 EA 400 Ton Packaged Water Cooled Helical Rotary Water Chiller.....	173,722.49	7,197.81



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 64 26 00-0041	EA			450 Ton Packaged Water Cooled Helical Rotary Water Chiller.....	182,867.99	7,917.91
23 65 Cooling Towers ^(23 60)						
23 65 00 00-0001 Induced Draft Crossflow Film Filled Propeller Type Cooling Towers ^(23 65)						
Note: Galvanized Steel. Includes fan, 2-speed motor, geared speed reducer, louvers, drift eliminators, hot water distribution system, cold water collection basin, float valve and access door, vibration switch, start-up costs and equipment rigging. Excludes motor starter, piping and power wiring. Excludes crane and associated personnel.						
23 65 00 00-0002	EA			10 Ton Induced Draft Crossflow Film Filled Propeller Type Cooling Tower.....	4,922.89	835.43
				<i>For Polymer Coating Over Galvanized Components, Add</i>	550.46	
23 65 00 00-0003	EA			15 Ton Induced Draft Crossflow Film Filled Propeller Type Cooling Tower.....	5,300.06	850.35
				<i>For Polymer Coating Over Galvanized Components, Add</i>	604.80	
23 65 00 00-0004	EA			20 Ton Induced Draft Crossflow Film Filled Propeller Type Cooling Tower.....	5,765.90	924.94
				<i>For Polymer Coating Over Galvanized Components, Add</i>	656.78	
23 65 00 00-0005	EA			25 Ton Induced Draft Crossflow Film Filled Propeller Type Cooling Tower.....	6,715.04	969.69
				<i>For Polymer Coating Over Galvanized Components, Add</i>	789.08	
23 65 00 00-0006	EA			30 Ton Induced Draft Crossflow Film Filled Propeller Type Cooling Tower.....	7,585.42	1,014.45
				<i>For Polymer Coating Over Galvanized Components, Add</i>	909.56	
23 65 00 00-0007	EA			35 Ton Induced Draft Crossflow Film Filled Propeller Type Cooling Tower.....	8,439.22	1,066.66
				<i>For Polymer Coating Over Galvanized Components, Add</i>	1,025.33	
23 65 00 00-0008	EA			40 Ton Induced Draft Crossflow Film Filled Propeller Type Cooling Tower.....	9,222.56	1,118.88
				<i>For Polymer Coating Over Galvanized Components, Add</i>	1,131.64	
23 65 00 00-0009	EA			45 Ton Induced Draft Crossflow Film Filled Propeller Type Cooling Tower.....	10,092.12	1,178.55
				<i>For Polymer Coating Over Galvanized Components, Add</i>	1,249.76	
23 65 00 00-0010	EA			50 Ton Induced Draft Crossflow Film Filled Propeller Type Cooling Tower.....	10,945.09	1,238.22
				<i>For Polymer Coating Over Galvanized Components, Add</i>	1,363.16	
23 65 00 00-0011	EA			60 Ton Induced Draft Crossflow Film Filled Propeller Type Cooling Tower.....	12,614.56	1,335.19
				<i>For Polymer Coating Over Galvanized Components, Add</i>	1,592.33	
23 65 00 00-0012	EA			70 Ton Induced Draft Crossflow Film Filled Propeller Type Cooling Tower.....	14,424.95	1,439.63
				<i>For Polymer Coating Over Galvanized Components, Add</i>	1,840.39	
23 65 00 00-0013	EA			75 Ton Induced Draft Crossflow Film Filled Propeller Type Cooling Tower.....	15,269.64	1,514.22
				<i>For Polymer Coating Over Galvanized Components, Add</i>	1,951.43	
23 65 00 00-0014	EA			80 Ton Induced Draft Crossflow Film Filled Propeller Type Cooling Tower.....	16,203.83	1,641.02
				<i>For Polymer Coating Over Galvanized Components, Add</i>	2,062.46	
23 65 00 00-0015	EA			90 Ton Induced Draft Crossflow Film Filled Propeller Type Cooling Tower.....	16,901.77	1,767.83
				<i>For Polymer Coating Over Galvanized Components, Add</i>	2,138.06	
23 65 00 00-0016	EA			100 Ton Induced Draft Crossflow Film Filled Propeller Type Cooling Tower.....	18,209.77	1,902.10
				<i>For Polymer Coating Over Galvanized Components, Add</i>	2,272.73	
23 65 00 00-0017	EA			125 Ton Induced Draft Crossflow Film Filled Propeller Type Cooling Tower.....	18,993.05	2,125.87
				<i>For Polymer Coating Over Galvanized Components, Add</i>	2,336.51	
23 65 00 00-0018	EA			150 Ton Induced Draft Crossflow Film Filled Propeller Type Cooling Tower.....	22,040.19	2,394.40
				<i>For Polymer Coating Over Galvanized Components, Add</i>	2,728.69	
23 65 00 00-0019	EA			175 Ton Induced Draft Crossflow Film Filled Propeller Type Cooling Tower.....	24,361.16	2,685.31
				<i>For Polymer Coating Over Galvanized Components, Add</i>	3,007.46	
23 65 00 00-0020	EA			200 Ton Induced Draft Crossflow Film Filled Propeller Type Cooling Tower.....	25,688.22	2,991.14
				<i>For Polymer Coating Over Galvanized Components, Add</i>	3,132.68	
23 65 00 00-0021	EA			225 Ton Induced Draft Crossflow Film Filled Propeller Type Cooling Tower.....	29,670.37	3,371.56
				<i>For Polymer Coating Over Galvanized Components, Add</i>	3,638.25	
23 65 00 00-0022	EA			250 Ton Induced Draft Crossflow Film Filled Propeller Type Cooling Tower.....	32,542.56	3,744.51
				<i>For Polymer Coating Over Galvanized Components, Add</i>	3,978.45	
23 65 00 00-0023	EA			275 Ton Induced Draft Crossflow Film Filled Propeller Type Cooling Tower.....	34,914.82	4,430.75
				<i>For Polymer Coating Over Galvanized Components, Add</i>	4,169.81	
23 65 00 00-0024	EA			300 Ton Induced Draft Crossflow Film Filled Propeller Type Cooling Tower.....	37,706.57	4,908.14
				<i>For Polymer Coating Over Galvanized Components, Add</i>	4,472.21	
23 65 00 00-0025	EA			350 Ton Induced Draft Crossflow Film Filled Propeller Type Cooling Tower.....	43,077.15	5,527.26
				<i>For Polymer Coating Over Galvanized Components, Add</i>	5,128.99	
23 65 00 00-0026	EA			400 Ton Induced Draft Crossflow Film Filled Propeller Type Cooling Tower.....	47,478.70	6,064.32
				<i>For Polymer Coating Over Galvanized Components, Add</i>	5,660.55	
23 65 00 00-0027	EA			450 Ton Induced Draft Crossflow Film Filled Propeller Type Cooling Tower.....	52,483.69	6,720.73
				<i>For Polymer Coating Over Galvanized Components, Add</i>	6,253.54	
23 65 00 00-0028	EA			500 Ton Induced Draft Crossflow Film Filled Propeller Type Cooling Tower.....	57,181.17	7,287.63
				<i>For Polymer Coating Over Galvanized Components, Add</i>	6,820.54	
23 65 00 00-0029	EA			600 Ton Induced Draft Crossflow Film Filled Propeller Type Cooling Tower.....	65,238.37	7,891.82
				<i>For Polymer Coating Over Galvanized Components, Add</i>	7,883.66	
23 65 00 00-0030	EA			700 Ton Induced Draft Crossflow Film Filled Propeller Type Cooling Tower.....	72,933.46	8,160.35
				<i>For Polymer Coating Over Galvanized Components, Add</i>	9,020.03	
23 65 00 00-0031	EA			800 Ton Induced Draft Crossflow Film Filled Propeller Type Cooling Tower.....	81,491.28	8,995.77
				<i>For Polymer Coating Over Galvanized Components, Add</i>	10,106.78	
23 65 00 00-0032	EA			900 Ton Induced Draft Crossflow Film Filled Propeller Type Cooling Tower.....	89,821.95	9,905.80
				<i>For Polymer Coating Over Galvanized Components, Add</i>	11,141.55	
23 65 00 00-0033	EA			1,000 Ton Induced Draft Crossflow Film Filled Propeller Type Cooling Tower.....	98,023.25	10,950.09
				<i>For Polymer Coating Over Galvanized Components, Add</i>	12,126.71	
23 65 00 00-0034	EA			1,100 Ton Induced Draft Crossflow Film Filled Propeller Type Cooling Tower.....	107,151.47	11,479.69
				<i>For Polymer Coating Over Galvanized Components, Add</i>	13,371.75	
23 65 00 00-0035	EA			1,200 Ton Induced Draft Crossflow Film Filled Propeller Type Cooling Tower.....	115,951.45	11,972.00
				<i>For Polymer Coating Over Galvanized Components, Add</i>	14,574.26	
23 65 00 00-0036	EA			1,300 Ton Induced Draft Crossflow Film Filled Propeller Type Cooling Tower.....	123,405.88	13,001.36
				<i>For Polymer Coating Over Galvanized Components, Add</i>	15,450.75	
23 65 00 00-0037	EA			1,400 Ton Induced Draft Crossflow Film Filled Propeller Type Cooling Tower.....	130,648.91	14,105.32
				<i>For Polymer Coating Over Galvanized Components, Add</i>	16,277.63	
23 65 00 00-0038	EA			1,500 Ton Induced Draft Crossflow Film Filled Propeller Type Cooling Tower.....	137,658.17	15,268.95
				<i>For Polymer Coating Over Galvanized Components, Add</i>	17,054.89	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 60 Central Cooling Equipment****23 65 Cooling Towers**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 65 00 00-0039 EA 1,600 Ton Induced Draft Cooling Tower <i>For Polymer Coating Over Galvanized Components, Add</i>	144,118.69 17,777.81	16,320.71
23 65 00 00-0040 EA 1,700 Ton Induced Draft Cooling Tower <i>For Polymer Coating Over Galvanized Components, Add</i>	150,478.86 18,448.76	17,521.62
23 65 00 00-0041 EA 1,800 Ton Induced Draft Cooling Tower <i>For Polymer Coating Over Galvanized Components, Add</i>	156,806.62 19,070.10	18,909.05
23 65 00 00-0042 EA 1,900 Ton Induced Draft Cooling Tower <i>For Polymer Coating Over Galvanized Components, Add</i>	162,764.74 19,637.10	20,296.45
23 65 00 00-0043 EA 2,000 Ton Induced Draft Cooling Tower <i>For Polymer Coating Over Galvanized Components, Add</i>	169,182.76 20,154.49	22,191.09
23 65 00 00-0044 Stainless Steel Packaged Propeller Type Cooling Towers ^(23 65) Note: Including internal piping, fan, motor, vibration switch, start-up costs and equipment rigging. Excludes motor starter, piping or power wiring. Rated by cooling capacity in tons. Based on design water temperature 95 degree F in, 85 degree F out 79 degree F wet Bulb. 3 GPM/ton.		
23 65 00 00-0045 Draw-Thru Stainless Steel Propeller Type Cooling Towers ^(23 65 00 00-0044) Note: Excludes crane and associated personnel.		
23 65 00 00-0046 EA 50 Ton Draw-Thru Stainless Steel Propeller Type Cooling Tower	13,471.12	1,238.22
23 65 00 00-0047 EA 75 Ton Draw-Thru Stainless Steel Propeller Type Cooling Tower	18,964.04	1,514.22
23 65 00 00-0048 EA 100 Ton Draw-Thru Stainless Steel Propeller Type Cooling Tower	22,540.22	1,902.10
23 65 00 00-0049 EA 125 Ton Draw-Thru Stainless Steel Propeller Type Cooling Tower	25,527.90	2,125.87
23 65 00 00-0050 EA 150 Ton Draw-Thru Stainless Steel Propeller Type Cooling Tower	28,052.98	2,394.40
23 65 00 00-0051 EA 200 Ton Draw-Thru Stainless Steel Propeller Type Cooling Tower	33,729.85	2,991.14
23 65 00 00-0052 EA 250 Ton Draw-Thru Stainless Steel Propeller Type Cooling Tower	39,872.57	3,744.51
23 65 00 00-0053 EA 300 Ton Draw-Thru Stainless Steel Propeller Type Cooling Tower	47,630.37	4,908.14
23 65 00 00-0054 EA 350 Ton Draw-Thru Stainless Steel Propeller Type Cooling Tower	52,261.22	5,527.26
23 65 00 00-0055 EA 400 Ton Draw-Thru Stainless Steel Propeller Type Cooling Tower	59,092.12	6,064.32
23 65 00 00-0056 EA 500 Ton Draw-Thru Stainless Steel Propeller Type Cooling Tower	68,700.97	7,287.63
23 65 00 00-0057 EA 600 Ton Draw-Thru Stainless Steel Propeller Type Cooling Tower	77,296.95	7,891.82
23 65 00 00-0058 EA 750 Ton Draw-Thru Stainless Steel Propeller Type Cooling Tower	94,876.82	8,578.07
23 65 00 00-0059 EA 1,000 Ton Draw-Thru Stainless Steel Propeller Type Cooling Tower	120,427.80	10,830.74
23 65 00 00-0060 Induced Draft Crossflow Stainless Steel Propeller Type Cooling Towers ^(23 65 00 00-0044) Note: Excludes crane and associated personnel.		
23 65 00 00-0061 EA 100 Ton Induced Draft Crossflow Stainless Steel Propeller Type Cooling Tower..... <i>For Induced Draft Counter Flow Type, Add</i>	31,402.67 1,417.22	1,902.10
23 65 00 00-0062 EA 125 Ton Induced Draft Crossflow Stainless Steel Propeller Type Cooling Tower..... <i>For Induced Draft Counter Flow Type, Add</i>	35,568.64 1,607.62	2,110.95
23 65 00 00-0063 EA 150 Ton Induced Draft Crossflow Stainless Steel Propeller Type Cooling Tower..... <i>For Induced Draft Counter Flow Type, Add</i>	38,927.73 1,753.94	2,394.40
23 65 00 00-0064 EA 200 Ton Induced Draft Crossflow Stainless Steel Propeller Type Cooling Tower..... <i>For Induced Draft Counter Flow Type, Add</i>	43,525.73 1,936.10	2,991.14
23 65 00 00-0065 EA 250 Ton Induced Draft Crossflow Stainless Steel Propeller Type Cooling Tower..... <i>For Induced Draft Counter Flow Type, Add</i>	49,577.93 2,177.92	3,744.51
23 65 00 00-0066 EA 300 Ton Induced Draft Crossflow Stainless Steel Propeller Type Cooling Tower..... <i>For Induced Draft Counter Flow Type, Add</i>	57,390.64 2,474.94	4,908.14
23 65 00 00-0067 EA 350 Ton Induced Draft Crossflow Stainless Steel Propeller Type Cooling Tower..... <i>For Induced Draft Counter Flow Type, Add</i>	62,662.58 2,688.93	5,527.26
23 65 00 00-0068 EA 400 Ton Induced Draft Crossflow Stainless Steel Propeller Type Cooling Tower..... <i>For Induced Draft Counter Flow Type, Add</i>	67,800.23 2,902.93	6,064.32
23 65 00 00-0069 EA 500 Ton Induced Draft Crossflow Stainless Steel Propeller Type Cooling Tower..... <i>For Induced Draft Counter Flow Type, Add</i>	78,479.05 3,338.41	7,287.63
23 65 00 00-0070 EA 600 Ton Induced Draft Crossflow Stainless Steel Propeller Type Cooling Tower..... <i>For Induced Draft Counter Flow Type, Add</i>	88,382.30 3,785.08	7,891.82
23 65 00 00-0071 EA 750 Ton Induced Draft Crossflow Stainless Steel Propeller Type Cooling Tower..... <i>For Induced Draft Counter Flow Type, Add</i>	108,722.93 4,727.52	8,578.07
23 65 00 00-0072 EA 1,000 Ton Induced Draft Crossflow Stainless Steel Propeller Type Cooling Tower..... <i>For Induced Draft Counter Flow Type, Add</i>	140,538.53 6,168.00	10,950.09
23 65 00 00-0073 Belt Driven Stainless Steel Propeller Type Cooling Towers ^(23 65 00 00-0044) Note: Excludes crane and associated personnel.		
23 65 00 00-0074 EA 100 Ton Belt Driven Stainless Steel Propeller Type Cooling Tower	23,417.27	1,902.10
23 65 00 00-0075 EA 125 Ton Belt Driven Stainless Steel Propeller Type Cooling Tower	25,391.37	2,125.87
23 65 00 00-0076 EA 150 Ton Belt Driven Stainless Steel Propeller Type Cooling Tower	27,441.57	2,394.40
23 65 00 00-0077 EA 200 Ton Belt Driven Stainless Steel Propeller Type Cooling Tower	32,573.81	2,991.14
23 65 00 00-0078 EA 250 Ton Belt Driven Stainless Steel Propeller Type Cooling Tower	36,253.09	3,744.51
23 65 00 00-0079 Blow-Thru Centrifugal Fan Type Cooling Towers ^(23 65) Note: Including 2-speed motor, vibration switch, start-up costs and equipment rigging. Excludes motor starter, piping and power wiring. Rated by cooling capacity in tons. Design temperature 95 degree F in, 85 degree F out.		
23 65 00 00-0080 EA 50 Ton Blow-Thru Centrifugal Fan Type Cooling Tower	11,182.60 5,595.16	1,238.22
23 65 00 00-0081 EA 75 Ton Blow-Thru Centrifugal Fan Type Cooling Tower	15,357.42 7,858.37	1,514.22
23 65 00 00-0082 EA 100 Ton Blow-Thru Centrifugal Fan Type Cooling Tower	19,298.90 9,744.38	1,902.10
23 65 00 00-0083 EA 125 Ton Blow-Thru Centrifugal Fan Type Cooling Tower	22,236.47 11,292.10	2,125.87



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 65 00 00-0084 EA 150 Ton Blow-Thru Centrifugal Fan Type Cooling Tower..... <i>For Stainless Steel Cooling Tower, Add</i>	25,403.32 12,932.63	2,394.40
23 65 00 00-0085 EA 175 Ton Blow-Thru Centrifugal Fan Type Cooling Tower..... <i>For Stainless Steel Cooling Tower, Add</i>	28,560.09 14,549.21	2,685.31
23 65 00 00-0086 EA 200 Ton Blow-Thru Centrifugal Fan Type Cooling Tower..... <i>For Stainless Steel Cooling Tower, Add</i>	32,046.06 16,345.40	2,991.14
23 65 00 00-0087 EA 225 Ton Blow-Thru Centrifugal Fan Type Cooling Tower..... <i>For Stainless Steel Cooling Tower, Add</i>	35,052.64 17,782.36	3,371.56
23 65 00 00-0088 EA 250 Ton Blow-Thru Centrifugal Fan Type Cooling Tower..... <i>For Stainless Steel Cooling Tower, Add</i>	38,211.42 19,315.12	3,744.51
23 65 00 00-0089 EA 275 Ton Blow-Thru Centrifugal Fan Type Cooling Tower..... <i>For Stainless Steel Cooling Tower, Add</i>	41,942.36 20,895.77	4,430.75
23 65 00 00-0090 EA 300 Ton Blow-Thru Centrifugal Fan Type Cooling Tower..... <i>For Stainless Steel Cooling Tower, Add</i>	45,611.98 22,632.10	4,908.14
23 65 00 00-0091 EA 325 Ton Blow-Thru Centrifugal Fan Type Cooling Tower..... <i>For Stainless Steel Cooling Tower, Add</i>	48,070.23 23,829.56	5,221.43
23 65 00 00-0092 EA 350 Ton Blow-Thru Centrifugal Fan Type Cooling Tower..... <i>For Stainless Steel Cooling Tower, Add</i>	50,944.88 25,236.59	5,527.26
23 65 00 00-0093 EA 375 Ton Blow-Thru Centrifugal Fan Type Cooling Tower..... <i>For Stainless Steel Cooling Tower, Add</i>	53,722.54 26,643.61	5,795.79
23 65 00 00-0094 EA 400 Ton Blow-Thru Centrifugal Fan Type Cooling Tower..... <i>For Stainless Steel Cooling Tower, Add</i>	56,891.90 28,290.12	6,064.32
23 65 00 00-0095 EA 425 Ton Blow-Thru Centrifugal Fan Type Cooling Tower..... <i>For Stainless Steel Cooling Tower, Add</i>	60,265.48 29,996.51	6,392.53
23 65 00 00-0096 EA 450 Ton Blow-Thru Centrifugal Fan Type Cooling Tower..... <i>For Stainless Steel Cooling Tower, Add</i>	64,080.65 31,972.33	6,720.73
23 65 00 00-0097 EA 475 Ton Blow-Thru Centrifugal Fan Type Cooling Tower..... <i>For Stainless Steel Cooling Tower, Add</i>	67,778.81 33,918.21	7,004.18
23 65 00 00-0098 EA 500 Ton Blow-Thru Centrifugal Fan Type Cooling Tower..... <i>For Stainless Steel Cooling Tower, Add</i>	71,484.41 35,864.09	7,287.63
23 65 00 00-0099 EA 550 Ton Blow-Thru Centrifugal Fan Type Cooling Tower..... <i>For Stainless Steel Cooling Tower, Add</i>	78,455.53 39,755.86	7,593.45
23 65 00 00-0100 EA 600 Ton Blow-Thru Centrifugal Fan Type Cooling Tower..... <i>For Stainless Steel Cooling Tower, Add</i>	86,025.38 44,006.86	7,891.82
23 65 00 00-0101 EA 650 Ton Blow-Thru Centrifugal Fan Type Cooling Tower..... <i>For Stainless Steel Cooling Tower, Add</i>	89,078.72 45,803.06	8,055.93
23 65 00 00-0102 EA 700 Ton Blow-Thru Centrifugal Fan Type Cooling Tower..... <i>For Stainless Steel Cooling Tower, Add</i>	92,730.78 47,958.49	8,160.35
23 65 00 00-0103 EA 750 Ton Blow-Thru Centrifugal Fan Type Cooling Tower..... <i>For Stainless Steel Cooling Tower, Add</i>	97,079.39 50,173.81	8,578.07
23 65 00 00-0104 EA 800 Ton Blow-Thru Centrifugal Fan Type Cooling Tower..... <i>For Stainless Steel Cooling Tower, Add</i>	102,126.49 52,808.23	8,995.77
23 65 00 00-0105 EA 850 Ton Blow-Thru Centrifugal Fan Type Cooling Tower..... <i>For Stainless Steel Cooling Tower, Add</i>	107,233.29 55,442.65	9,450.79
23 65 00 00-0106 EA 900 Ton Blow-Thru Centrifugal Fan Type Cooling Tower..... <i>For Stainless Steel Cooling Tower, Add</i>	113,138.39 58,556.06	9,905.80
23 65 00 00-0107 EA 950 Ton Blow-Thru Centrifugal Fan Type Cooling Tower..... <i>For Stainless Steel Cooling Tower, Add</i>	119,247.71 61,729.34	10,427.95
23 65 00 00-0108 EA 1,000 Ton Centrifugal Type Cooling Tower..... <i>For Stainless Steel Cooling Tower, Add</i>	126,147.86 65,381.62	10,950.09

23 70 Central HVAC Equipment ⁽²³⁾

Note: New air filters shall be provided on HVAC equipment prior to turning over to owner. Where required, mechanical equipment excludes electrical connection, disconnect, or starter unless title states otherwise. See CSI section 26 05 19 16-0011 for electrical connection and termination, 26 05 83 00-0110 for terminations, 26 28 16 00-0001 for disconnect.

23 72 Air-To-Air Energy Recovery Equipment ^(23 70)

23 72 16 Heat-Pipe Air-To-Air Energy-Recovery Equipment ^(23 72)

23 72 16 00-0001 Glycol Heat Pipe Type, 50 Percent Efficient ^(23 72 16)		
23 72 16 00-0002 EA 100 MBH, 1,700 CFM Glycol Heat Recovery Unit.....	9,694.46	399.38
23 72 16 00-0003 EA 160 MBH, 2,700 CFM Glycol Heat Recovery Unit.....	15,193.47	532.54
23 72 16 00-0004 EA 620 MBH, 4,000 CFM Glycol Heat Recovery Unit.....	22,528.56	798.78

23 73 Indoor Central-Station Air-Handling Units ^(23 70)

23 73 13 Modular Indoor Central-Station Air-Handling Units ^(23 73)

Note: Sized by CFM. Includes motor drive vibration isolators. Use modifiers for Filters and heating and cooling coils. Includes double wall insulated casing, fan section, fan motor, internal dampers, starter, vibration isolators and equipment rigging. Variable speed drives are included on units with 10 HP or greater fans. Modifiers include cooling coil sections with 6 row aluminum fin coil and drain pan, heating coil section with 1 row aluminum fin coil, and filter section with replaceable filters.

23 73 13 00-0001 Single Zone Units ^(23 73 13)		
Note: Horizontal/vertical draw-thru fan, motor and cabinet.		

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 70 Central HVAC Equipment****23 73 Indoor Central-Station Air-Handling Units**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 73 13 00-0002	EA		300 CFM Single Zone Air Handling Unit, Built-Up, Constant Volume, Horizontal / Vertical, Draw-Through Fan	1,543.92	419.27
			<i>For Flat Filter Box And Throwaway Filters, Add</i>	124.44	
			<i>For Medium Capacity Filter Box And Throwaway Filters, Add</i>	230.92	
			<i>For Combination Filter Mixing Box And Throwaway Filters, Add</i>	343.38	
			<i>For Manual Roll Filter, Add</i>	579.62	
			<i>For Automatic Roll Filter, Add</i>	626.87	
			<i>For Hot Water Heating Coil, Aluminum Fins, Add</i>	296.14	
			<i>For Electric Heating Coil, Add</i>	485.13	
			<i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i>	485.13	
			<i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i>	437.88	
			<i>For Steam Heating Coil, Aluminum Fins, Add</i>	390.63	
			<i>For Welded Exterior Waterproof Casing, Double-Wall, With Insulation, Add</i>	313.44	
			<i>For Chilled Water Cooling Coil, Copper Fins, Add</i>	579.62	
			<i>For Direct Expansion Cooling Coil, Copper Fins, Add</i>	532.38	
			<i>For Hot Water Heating Coil, Copper Fins, Add</i>	390.63	
			<i>For Variable Air Volume, Add</i>	132.29	
			<i>For Economizer, Panel, Controls And Damper(s), Add</i>	1,059.27	
			<i>For 2 Coils, Independent Circuits, Add</i>	173.29	
23 73 13 00-0003	EA		500 CFM Single Zone Air Handling Unit, Built-Up, Constant Volume, Horizontal / Vertical, Draw-Through Fan	2,390.03	503.13
			<i>For Flat Filter Box And Throwaway Filters, Add</i>	203.09	
			<i>For Medium Capacity Filter Box And Throwaway Filters, Add</i>	384.64	
			<i>For Combination Filter Mixing Box And Throwaway Filters, Add</i>	573.37	
			<i>For Manual Roll Filter, Add</i>	991.34	
			<i>For Automatic Roll Filter, Add</i>	1,074.93	
			<i>For Hot Water Heating Coil, Aluminum Fins, Add</i>	489.78	
			<i>For Electric Heating Coil, Add</i>	824.15	
			<i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i>	824.15	
			<i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i>	740.56	
			<i>For Steam Heating Coil, Aluminum Fins, Add</i>	656.97	
			<i>For Welded Exterior Waterproof Casing, Double-Wall, With Insulation, Add</i>	537.46	
			<i>For Chilled Water Cooling Coil, Copper Fins, Add</i>	991.34	
			<i>For Direct Expansion Cooling Coil, Copper Fins, Add</i>	907.74	
			<i>For Hot Water Heating Coil, Copper Fins, Add</i>	656.97	
			<i>For Variable Air Volume, Add</i>	234.06	
			<i>For Economizer, Panel, Controls And Damper(s), Add</i>	1,142.73	
			<i>For 2 Coils, Independent Circuits, Add</i>	272.44	
23 73 13 00-0004	EA		800 CFM Single Zone Air Handling Unit, Built-Up, Constant Volume, Horizontal / Vertical, Draw-Through Fan	2,693.21	540.34
			<i>For Flat Filter Box And Throwaway Filters, Add</i>	230.73	
			<i>For Medium Capacity Filter Box And Throwaway Filters, Add</i>	438.30	
			<i>For Combination Filter Mixing Box And Throwaway Filters, Add</i>	653.59	
			<i>For Manual Roll Filter, Add</i>	1,133.93	
			<i>For Automatic Roll Filter, Add</i>	1,230.00	
			<i>For Hot Water Heating Coil, Aluminum Fins, Add</i>	557.52	
			<i>For Electric Heating Coil, Add</i>	941.79	
			<i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i>	941.79	
			<i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i>	845.73	
			<i>For Steam Heating Coil, Aluminum Fins, Add</i>	749.66	
			<i>For Welded Exterior Waterproof Casing, Double-Wall, With Insulation, Add</i>	615.00	
			<i>For Chilled Water Cooling Coil, Copper Fins, Add</i>	1,133.93	
			<i>For Direct Expansion Cooling Coil, Copper Fins, Add</i>	1,037.86	
			<i>For Hot Water Heating Coil, Copper Fins, Add</i>	749.66	
			<i>For Variable Air Volume, Add</i>	268.99	
			<i>For Economizer, Panel, Controls And Damper(s), Add</i>	1,180.30	
			<i>For 2 Coils, Independent Circuits, Add</i>	307.75	
23 73 13 00-0005	EA		1,000 CFM Single Zone Air Handling Unit, Built-Up, Constant Volume, Horizontal / Vertical, Draw-Through Fan	3,029.90	580.62
			<i>For Flat Filter Box And Throwaway Filters, Add</i>	261.51	
			<i>For Medium Capacity Filter Box And Throwaway Filters, Add</i>	498.13	
			<i>For Combination Filter Mixing Box And Throwaway Filters, Add</i>	743.05	
			<i>For Manual Roll Filter, Add</i>	1,293.13	
			<i>For Automatic Roll Filter, Add</i>	1,403.15	
			<i>For Hot Water Heating Coil, Aluminum Fins, Add</i>	633.04	
			<i>For Electric Heating Coil, Add</i>	1,073.10	
			<i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i>	1,073.10	
			<i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i>	963.08	
			<i>For Steam Heating Coil, Aluminum Fins, Add</i>	853.07	
			<i>For Welded Exterior Waterproof Casing, Double-Wall, With Insulation, Add</i>	701.57	
			<i>For Chilled Water Cooling Coil, Copper Fins, Add</i>	1,293.13	
			<i>For Direct Expansion Cooling Coil, Copper Fins, Add</i>	1,183.11	
			<i>For Hot Water Heating Coil, Copper Fins, Add</i>	853.07	
			<i>For Variable Air Volume, Add</i>	308.04	
			<i>For Economizer, Panel, Controls And Damper(s), Add</i>	1,220.71	
			<i>For 2 Coils, Independent Circuits, Add</i>	347.00	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 73 13 00-0006 EA 1,200 CFM Single Zone Air Handling Unit, Built-Up, Constant Volume, Horizontal / Vertical, Draw-Through Fan	3,425.60	624.64
For Flat Filter Box And Throwaway Filters, Add	297.99	
For Medium Capacity Filter Box And Throwaway Filters, Add	569.25	
For Combination Filter Mixing Box And Throwaway Filters, Add	849.42	
For Manual Roll Filter, Add	1,482.99	
For Automatic Roll Filter, Add	1,609.71	
For Hot Water Heating Coil, Aluminum Fins, Add	722.70	
For Electric Heating Coil, Add	1,229.56	
For Chilled Water Cooling Coil, Aluminum Fins, Add	1,229.56	
For Direct Expansion Cooling Coil, Aluminum Fins, Add	1,102.85	
For Steam Heating Coil, Aluminum Fins, Add	976.13	
For Welded Exterior Waterproof Casing, Double-Wall, With Insulation, Add	804.85	
For Chilled Water Cooling Coil, Copper Fins, Add	1,482.99	
For Direct Expansion Cooling Coil, Copper Fins, Add	1,356.28	
For Hot Water Heating Coil, Copper Fins, Add	976.13	
For Variable Air Volume, Add	354.80	
For Economizer, Panel, Controls And Damper(s), Add	1,263.92	
For 2 Coils, Independent Circuits, Add	393.25	
23 73 13 00-0007 EA 1,400 CFM Single Zone Air Handling Unit, Built-Up, Constant Volume, Horizontal / Vertical, Draw-Through Fan	3,886.15	671.29
For Flat Filter Box And Throwaway Filters, Add	340.67	
For Medium Capacity Filter Box And Throwaway Filters, Add	652.57	
For Combination Filter Mixing Box And Throwaway Filters, Add	974.06	
For Manual Roll Filter, Add	1,705.86	
For Automatic Roll Filter, Add	1,852.22	
For Hot Water Heating Coil, Aluminum Fins, Add	827.70	
For Electric Heating Coil, Add	1,413.14	
For Chilled Water Cooling Coil, Aluminum Fins, Add	1,413.14	
For Direct Expansion Cooling Coil, Aluminum Fins, Add	1,266.78	
For Steam Heating Coil, Aluminum Fins, Add	1,120.42	
For Welded Exterior Waterproof Casing, Double-Wall, With Insulation, Add	926.11	
For Chilled Water Cooling Coil, Copper Fins, Add	1,705.86	
For Direct Expansion Cooling Coil, Copper Fins, Add	1,559.50	
For Hot Water Heating Coil, Copper Fins, Add	1,120.42	
For Variable Air Volume, Add	409.81	
For Economizer, Panel, Controls And Damper(s), Add	1,311.27	
For 2 Coils, Independent Circuits, Add	447.16	
23 73 13 00-0008 EA 1,600 CFM Single Zone Air Handling Unit, Built-Up, Constant Volume, Horizontal / Vertical, Draw-Through Fan	4,250.68	721.67
For Flat Filter Box And Throwaway Filters, Add	373.63	
For Medium Capacity Filter Box And Throwaway Filters, Add	716.39	
For Combination Filter Mixing Box And Throwaway Filters, Add	1,069.45	
For Manual Roll Filter, Add	1,874.92	
For Automatic Roll Filter, Add	2,036.01	
For Hot Water Heating Coil, Aluminum Fins, Add	908.35	
For Electric Heating Coil, Add	1,552.73	
For Chilled Water Cooling Coil, Aluminum Fins, Add	1,552.73	
For Direct Expansion Cooling Coil, Aluminum Fins, Add	1,391.64	
For Steam Heating Coil, Aluminum Fins, Add	1,230.54	
For Welded Exterior Waterproof Casing, Double-Wall, With Insulation, Add	1,018.01	
For Chilled Water Cooling Coil, Copper Fins, Add	1,874.92	
For Direct Expansion Cooling Coil, Copper Fins, Add	1,713.82	
For Hot Water Heating Coil, Copper Fins, Add	1,230.54	
For Variable Air Volume, Add	451.06	
For Economizer, Panel, Controls And Damper(s), Add	1,360.15	
For 2 Coils, Independent Circuits, Add	489.51	
23 73 13 00-0009 EA 1,800 CFM Single Zone Air Handling Unit, Built-Up, Constant Volume, Horizontal / Vertical, Draw-Through Fan	4,647.05	777.75
For Flat Filter Box And Throwaway Filters, Add	409.16	
For Medium Capacity Filter Box And Throwaway Filters, Add	785.00	
For Combination Filter Mixing Box And Throwaway Filters, Add	1,171.95	
For Manual Roll Filter, Add	2,056.00	
For Automatic Roll Filter, Add	2,232.82	
For Hot Water Heating Coil, Aluminum Fins, Add	995.14	
For Electric Heating Coil, Add	1,702.38	
For Chilled Water Cooling Coil, Aluminum Fins, Add	1,702.38	
For Direct Expansion Cooling Coil, Aluminum Fins, Add	1,525.57	
For Steam Heating Coil, Aluminum Fins, Add	1,348.76	
For Welded Exterior Waterproof Casing, Double-Wall, With Insulation, Add	1,116.41	
For Chilled Water Cooling Coil, Copper Fins, Add	2,056.00	
For Direct Expansion Cooling Coil, Copper Fins, Add	1,879.19	
For Hot Water Heating Coil, Copper Fins, Add	1,348.76	
For Variable Air Volume, Add	495.07	
For Economizer, Panel, Controls And Damper(s), Add	1,360.96	
For 2 Coils, Independent Circuits, Add	535.43	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 70 Central HVAC Equipment****23 73 Indoor Central-Station Air-Handling Units**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 73	13 00-0010	EA	2,000 CFM Single Zone Air Handling Unit, Built-Up, Constant Volume, Horizontal / Vertical, Draw-Through Fan	5,081.09	833.82
			<i>For Flat Filter Box And Throwaway Filters, Add</i>	448.55	
			<i>For Medium Capacity Filter Box And Throwaway Filters, Add</i>	861.36	
			<i>For Combination Filter Mixing Box And Throwaway Filters, Add</i>	1,286.08	
			<i>For Manual Roll Filter, Add</i>	2,258.54	
			<i>For Automatic Roll Filter, Add</i>	2,453.03	
			<i>For Hot Water Heating Coil, Aluminum Fins, Add</i>	1,091.59	
			<i>For Electric Heating Coil, Add</i>	1,869.55	
			<i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i>	1,869.55	
			<i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i>	1,675.06	
			<i>For Steam Heating Coil, Aluminum Fins, Add</i>	1,480.57	
			<i>For Welded Exterior Waterproof Casing, Double-Wall, With Insulation, Add</i>	1,226.51	
			<i>For Chilled Water Cooling Coil, Copper Fins, Add</i>	2,258.54	
			<i>For Direct Expansion Cooling Coil, Copper Fins, Add</i>	2,064.05	
			<i>For Hot Water Heating Coil, Copper Fins, Add</i>	1,480.57	
			<i>For Variable Air Volume, Add</i>	544.58	
			<i>For Economizer, Panel, Controls And Damper(s), Add</i>	1,405.19	
			<i>For 2 Coils, Independent Circuits, Add</i>	585.91	
23 73	13 00-0011	EA	2,250 CFM Single Zone Air Handling Unit, Built-Up, Constant Volume, Horizontal / Vertical, Draw-Through Fan	5,484.55	896.27
			<i>For Flat Filter Box And Throwaway Filters, Add</i>	484.44	
			<i>For Medium Capacity Filter Box And Throwaway Filters, Add</i>	930.46	
			<i>For Combination Filter Mixing Box And Throwaway Filters, Add</i>	1,389.29	
			<i>For Manual Roll Filter, Add</i>	2,440.33	
			<i>For Automatic Roll Filter, Add</i>	2,650.54	
			<i>For Hot Water Heating Coil, Aluminum Fins, Add</i>	1,179.08	
			<i>For Electric Heating Coil, Add</i>	2,019.91	
			<i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i>	2,019.91	
			<i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i>	1,809.71	
			<i>For Steam Heating Coil, Aluminum Fins, Add</i>	1,599.50	
			<i>For Welded Exterior Waterproof Casing, Double-Wall, With Insulation, Add</i>	1,325.27	
			<i>For Chilled Water Cooling Coil, Copper Fins, Add</i>	2,440.33	
			<i>For Direct Expansion Cooling Coil, Copper Fins, Add</i>	2,230.12	
			<i>For Hot Water Heating Coil, Copper Fins, Add</i>	1,599.50	
			<i>For Variable Air Volume, Add</i>	588.58	
			<i>For Economizer, Panel, Controls And Damper(s), Add</i>	1,454.21	
			<i>For 2 Coils, Independent Circuits, Add</i>	632.54	
23 73	13 00-0012	EA	2,500 CFM Single Zone Air Handling Unit, Built-Up, Constant Volume, Horizontal / Vertical, Draw-Through Fan	5,915.70	964.40
			<i>For Flat Filter Box And Throwaway Filters, Add</i>	522.69	
			<i>For Medium Capacity Filter Box And Throwaway Filters, Add</i>	1,004.06	
			<i>For Combination Filter Mixing Box And Throwaway Filters, Add</i>	1,499.20	
			<i>For Manual Roll Filter, Add</i>	2,633.74	
			<i>For Automatic Roll Filter, Add</i>	2,860.65	
			<i>For Hot Water Heating Coil, Aluminum Fins, Add</i>	1,272.29	
			<i>For Electric Heating Coil, Add</i>	2,179.92	
			<i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i>	2,179.92	
			<i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i>	1,953.02	
			<i>For Steam Heating Coil, Aluminum Fins, Add</i>	1,726.11	
			<i>For Welded Exterior Waterproof Casing, Double-Wall, With Insulation, Add</i>	1,430.32	
			<i>For Chilled Water Cooling Coil, Copper Fins, Add</i>	2,633.74	
			<i>For Direct Expansion Cooling Coil, Copper Fins, Add</i>	2,406.83	
			<i>For Hot Water Heating Coil, Copper Fins, Add</i>	1,726.11	
			<i>For Variable Air Volume, Add</i>	635.34	
			<i>For Economizer, Panel, Controls And Damper(s), Add</i>	1,507.65	
			<i>For 2 Coils, Independent Circuits, Add</i>	682.33	
23 73	13 00-0013	EA	3,000 CFM Single Zone Air Handling Unit, Built-Up, Constant Volume, Horizontal / Vertical, Draw-Through Fan	6,879.35	1,116.32
			<i>For Flat Filter Box And Throwaway Filters, Add</i>	608.20	
			<i>For Medium Capacity Filter Box And Throwaway Filters, Add</i>	1,168.56	
			<i>For Combination Filter Mixing Box And Throwaway Filters, Add</i>	1,744.87	
			<i>For Manual Roll Filter, Add</i>	3,066.04	
			<i>For Automatic Roll Filter, Add</i>	3,330.28	
			<i>For Hot Water Heating Coil, Aluminum Fins, Add</i>	1,480.64	
			<i>For Electric Heating Coil, Add</i>	2,537.57	
			<i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i>	2,537.57	
			<i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i>	2,273.34	
			<i>For Steam Heating Coil, Aluminum Fins, Add</i>	2,009.11	
			<i>For Welded Exterior Waterproof Casing, Double-Wall, With Insulation, Add</i>	1,665.14	
			<i>For Chilled Water Cooling Coil, Copper Fins, Add</i>	3,066.04	
			<i>For Direct Expansion Cooling Coil, Copper Fins, Add</i>	2,801.81	
			<i>For Hot Water Heating Coil, Copper Fins, Add</i>	2,009.11	
			<i>For Variable Air Volume, Add</i>	739.86	
			<i>For Economizer, Panel, Controls And Damper(s), Add</i>	1,627.07	
			<i>For 2 Coils, Independent Circuits, Add</i>	793.63	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 73 13 00-0014 EA 3,250 CFM Single Zone Air Handling Unit, Built-Up, Constant Volume, Horizontal / Vertical, Draw-Through Fan	7,215.04	1,199.64
<i>For Flat Filter Box And Throwaway Filters, Add</i>	635.79	
<i>For Medium Capacity Filter Box And Throwaway Filters, Add</i>	1,220.16	
<i>For Combination Filter Mixing Box And Throwaway Filters, Add</i>	1,821.66	
<i>For Manual Roll Filter, Add</i>	3,196.86	
<i>For Automatic Roll Filter, Add</i>	3,471.90	
<i>For Hot Water Heating Coil, Aluminum Fins, Add</i>	1,546.62	
<i>For Electric Heating Coil, Add</i>	2,646.78	
<i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i>	2,646.78	
<i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i>	2,371.74	
<i>For Steam Heating Coil, Aluminum Fins, Add</i>	2,096.70	
<i>For Welded Exterior Waterproof Casing, Double-Wall, With Insulation, Add</i>	1,735.95	
<i>For Chilled Water Cooling Coil, Copper Fins, Add</i>	3,196.86	
<i>For Direct Expansion Cooling Coil, Copper Fins, Add</i>	2,921.82	
<i>For Hot Water Heating Coil, Copper Fins, Add</i>	2,096.70	
<i>For Variable Air Volume, Add</i>	770.11	
<i>For Economizer, Panel, Controls And Damper(s), Add</i>	1,692.84	
<i>For 2 Coils, Independent Circuits, Add</i>	831.52	
23 73 13 00-0015 EA 3,500 CFM Single Zone Air Handling Unit, Built-Up, Constant Volume, Horizontal / Vertical, Draw-Through Fan	7,558.71	1,289.26
<i>For Flat Filter Box And Throwaway Filters, Add</i>	663.78	
<i>For Medium Capacity Filter Box And Throwaway Filters, Add</i>	1,272.31	
<i>For Combination Filter Mixing Box And Throwaway Filters, Add</i>	1,899.25	
<i>For Manual Roll Filter, Add</i>	3,328.47	
<i>For Automatic Roll Filter, Add</i>	3,614.32	
<i>For Hot Water Heating Coil, Aluminum Fins, Add</i>	1,613.40	
<i>For Electric Heating Coil, Add</i>	2,756.78	
<i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i>	2,756.78	
<i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i>	2,470.94	
<i>For Steam Heating Coil, Aluminum Fins, Add</i>	2,185.09	
<i>For Welded Exterior Waterproof Casing, Double-Wall, With Insulation, Add</i>	1,807.16	
<i>For Chilled Water Cooling Coil, Copper Fins, Add</i>	3,328.47	
<i>For Direct Expansion Cooling Coil, Copper Fins, Add</i>	3,042.63	
<i>For Hot Water Heating Coil, Copper Fins, Add</i>	2,185.09	
<i>For Variable Air Volume, Add</i>	800.36	
<i>For Economizer, Panel, Controls And Damper(s), Add</i>	1,763.00	
<i>For 2 Coils, Independent Circuits, Add</i>	870.21	
23 73 13 00-0016 EA 4,000 CFM Single Zone Air Handling Unit, Built-Up, Constant Volume, Horizontal / Vertical, Draw-Through Fan	8,315.37	1,488.42
<i>For Flat Filter Box And Throwaway Filters, Add</i>	725.19	
<i>For Medium Capacity Filter Box And Throwaway Filters, Add</i>	1,386.57	
<i>For Combination Filter Mixing Box And Throwaway Filters, Add</i>	2,069.21	
<i>For Manual Roll Filter, Add</i>	3,616.31	
<i>For Automatic Roll Filter, Add</i>	3,925.73	
<i>For Hot Water Heating Coil, Aluminum Fins, Add</i>	1,759.79	
<i>For Electric Heating Coil, Add</i>	2,997.47	
<i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i>	2,997.47	
<i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i>	2,688.05	
<i>For Steam Heating Coil, Aluminum Fins, Add</i>	2,378.63	
<i>For Welded Exterior Waterproof Casing, Double-Wall, With Insulation, Add</i>	1,962.86	
<i>For Chilled Water Cooling Coil, Copper Fins, Add</i>	3,616.31	
<i>For Direct Expansion Cooling Coil, Copper Fins, Add</i>	3,306.89	
<i>For Hot Water Heating Coil, Copper Fins, Add</i>	2,378.63	
<i>For Variable Air Volume, Add</i>	866.37	
<i>For Economizer, Panel, Controls And Damper(s), Add</i>	1,790.80	
<i>For 2 Coils, Independent Circuits, Add</i>	955.30	
23 73 13 00-0017 EA 4,500 CFM Single Zone Air Handling Unit, Built-Up, Constant Volume, Horizontal / Vertical, Draw-Through Fan	8,315.37	1,488.42
<i>For Flat Filter Box And Throwaway Filters, Add</i>	725.19	
<i>For Medium Capacity Filter Box And Throwaway Filters, Add</i>	1,386.57	
<i>For Combination Filter Mixing Box And Throwaway Filters, Add</i>	2,069.21	
<i>For Manual Roll Filter, Add</i>	3,616.31	
<i>For Automatic Roll Filter, Add</i>	3,925.73	
<i>For Hot Water Heating Coil, Aluminum Fins, Add</i>	1,759.79	
<i>For Electric Heating Coil, Add</i>	2,997.47	
<i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i>	2,997.47	
<i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i>	2,688.05	
<i>For Steam Heating Coil, Aluminum Fins, Add</i>	2,378.63	
<i>For Welded Exterior Waterproof Casing, Double-Wall, With Insulation, Add</i>	1,962.86	
<i>For Chilled Water Cooling Coil, Copper Fins, Add</i>	3,616.31	
<i>For Direct Expansion Cooling Coil, Copper Fins, Add</i>	3,306.89	
<i>For Hot Water Heating Coil, Copper Fins, Add</i>	2,378.63	
<i>For Variable Air Volume, Add</i>	866.37	
<i>For Economizer, Panel, Controls And Damper(s), Add</i>	1,790.80	
<i>For 2 Coils, Independent Circuits, Add</i>	955.30	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 70 Central HVAC Equipment****23 73 Indoor Central-Station Air-Handling Units**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 73 13 00-0018	EA		5,000 CFM Single Zone Air Handling Unit, Built-Up, Constant Volume, Horizontal / Vertical, Draw-Through Fan	9,141.91	1,709.58
			<i>For Flat Filter Box And Throwaway Filters, Add</i>	792.05	
			<i>For Medium Capacity Filter Box And Throwaway Filters, Add</i>	1,510.83	
			<i>For Combination Filter Mixing Box And Throwaway Filters, Add</i>	2,254.03	
			<i>For Manual Roll Filter, Add</i>	3,928.82	
			<i>For Automatic Roll Filter, Add</i>	4,263.78	
			<i>For Hot Water Heating Coil, Aluminum Fins, Add</i>	1,919.07	
			<i>For Electric Heating Coil, Add</i>	3,258.90	
			<i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i>	3,258.90	
			<i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i>	2,923.94	
			<i>For Steam Heating Coil, Aluminum Fins, Add</i>	2,588.98	
			<i>For Welded Exterior Waterproof Casing, Double-Wall, With Insulation, Add</i>	2,131.89	
			<i>For Chilled Water Cooling Coil, Copper Fins, Add</i>	3,928.82	
			<i>For Direct Expansion Cooling Coil, Copper Fins, Add</i>	3,593.86	
			<i>For Hot Water Heating Coil, Copper Fins, Add</i>	2,588.98	
			<i>For Variable Air Volume, Add</i>	937.88	
			<i>For Economizer, Panel, Controls And Damper(s), Add</i>	1,917.10	
			<i>For 2 Coils, Independent Circuits, Add</i>	1,048.17	
23 73 13 00-0019	EA		5,500 CFM Single Zone Air Handling Unit, Built-Up, Constant Volume, Horizontal / Vertical, Draw-Through Fan	9,624.48	1,854.76
			<i>For Flat Filter Box And Throwaway Filters, Add</i>	829.93	
			<i>For Medium Capacity Filter Box And Throwaway Filters, Add</i>	1,580.36	
			<i>For Combination Filter Mixing Box And Throwaway Filters, Add</i>	2,357.29	
			<i>For Manual Roll Filter, Add</i>	4,100.84	
			<i>For Automatic Roll Filter, Add</i>	4,449.55	
			<i>For Hot Water Heating Coil, Aluminum Fins, Add</i>	2,008.58	
			<i>For Electric Heating Coil, Add</i>	3,403.42	
			<i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i>	3,403.42	
			<i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i>	3,054.71	
			<i>For Steam Heating Coil, Aluminum Fins, Add</i>	2,706.00	
			<i>For Welded Exterior Waterproof Casing, Double-Wall, With Insulation, Add</i>	2,224.78	
			<i>For Chilled Water Cooling Coil, Copper Fins, Add</i>	4,100.84	
			<i>For Direct Expansion Cooling Coil, Copper Fins, Add</i>	3,752.13	
			<i>For Hot Water Heating Coil, Copper Fins, Add</i>	2,706.00	
			<i>For Variable Air Volume, Add</i>	976.39	
			<i>For Economizer, Panel, Controls And Damper(s), Add</i>	2,000.11	
			<i>For 2 Coils, Independent Circuits, Add</i>	1,101.93	
23 73 13 00-0020	EA		6,000 CFM Single Zone Air Handling Unit, Built-Up, Constant Volume, Horizontal / Vertical, Draw-Through Fan	10,096.02	1,992.60
			<i>For Flat Filter Box And Throwaway Filters, Add</i>	867.26	
			<i>For Medium Capacity Filter Box And Throwaway Filters, Add</i>	1,649.12	
			<i>For Combination Filter Mixing Box And Throwaway Filters, Add</i>	2,459.45	
			<i>For Manual Roll Filter, Add</i>	4,271.76	
			<i>For Automatic Roll Filter, Add</i>	4,634.23	
			<i>For Hot Water Heating Coil, Aluminum Fins, Add</i>	2,096.99	
			<i>For Electric Heating Coil, Add</i>	3,546.84	
			<i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i>	3,546.84	
			<i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i>	3,184.38	
			<i>For Steam Heating Coil, Aluminum Fins, Add</i>	2,821.91	
			<i>For Welded Exterior Waterproof Casing, Double-Wall, With Insulation, Add</i>	2,317.11	
			<i>For Chilled Water Cooling Coil, Copper Fins, Add</i>	4,271.76	
			<i>For Direct Expansion Cooling Coil, Copper Fins, Add</i>	3,909.30	
			<i>For Hot Water Heating Coil, Copper Fins, Add</i>	2,821.91	
			<i>For Variable Air Volume, Add</i>	1,014.90	
			<i>For Economizer, Panel, Controls And Damper(s), Add</i>	2,078.71	
			<i>For 2 Coils, Independent Circuits, Add</i>	1,154.59	
23 73 13 00-0021	EA		6,500 CFM Single Zone Air Handling Unit, Built-Up, Constant Volume, Horizontal / Vertical, Draw-Through Fan	10,570.88	2,133.05
			<i>For Flat Filter Box And Throwaway Filters, Add</i>	904.76	
			<i>For Medium Capacity Filter Box And Throwaway Filters, Add</i>	1,718.12	
			<i>For Combination Filter Mixing Box And Throwaway Filters, Add</i>	2,561.95	
			<i>For Manual Roll Filter, Add</i>	4,443.02	
			<i>For Automatic Roll Filter, Add</i>	4,819.23	
			<i>For Hot Water Heating Coil, Aluminum Fins, Add</i>	2,185.73	
			<i>For Electric Heating Coil, Add</i>	3,690.59	
			<i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i>	3,690.59	
			<i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i>	3,314.38	
			<i>For Steam Heating Coil, Aluminum Fins, Add</i>	2,938.16	
			<i>For Welded Exterior Waterproof Casing, Double-Wall, With Insulation, Add</i>	2,409.62	
			<i>For Chilled Water Cooling Coil, Copper Fins, Add</i>	4,443.02	
			<i>For Direct Expansion Cooling Coil, Copper Fins, Add</i>	4,066.80	
			<i>For Hot Water Heating Coil, Copper Fins, Add</i>	2,938.16	
			<i>For Variable Air Volume, Add</i>	1,053.40	
			<i>For Economizer, Panel, Controls And Damper(s), Add</i>	2,158.64	
			<i>For 2 Coils, Independent Circuits, Add</i>	1,207.57	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 73 13 00-0022 EA 7,000 CFM Single Zone Air Handling Unit, Built-Up, Constant Volume, Horizontal / Vertical, Draw-Through Fan	11,118.80	2,296.04
<i>For Flat Filter Box And Throwaway Filters, Add</i>	947.87	
<i>For Medium Capacity Filter Box And Throwaway Filters, Add</i>	1,797.34	
<i>For Combination Filter Mixing Box And Throwaway Filters, Add</i>	2,679.60	
<i>For Manual Roll Filter, Add</i>	4,639.26	
<i>For Automatic Roll Filter, Add</i>	5,031.19	
<i>For Hot Water Heating Coil, Aluminum Fins, Add</i>	2,287.67	
<i>For Electric Heating Coil, Add</i>	3,855.40	
<i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i>	3,855.40	
<i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i>	3,463.47	
<i>For Steam Heating Coil, Aluminum Fins, Add</i>	3,071.54	
<i>For Welded Exterior Waterproof Casing, Double-Wall, With Insulation, Add</i>	2,515.60	
<i>For Chilled Water Cooling Coil, Copper Fins, Add</i>	4,639.26	
<i>For Direct Expansion Cooling Coil, Copper Fins, Add</i>	4,247.33	
<i>For Hot Water Heating Coil, Copper Fins, Add</i>	3,071.54	
<i>For Variable Air Volume, Add</i>	1,097.41	
<i>For Economizer, Panel, Controls And Damper(s), Add</i>	2,252.07	
<i>For 2 Coils, Independent Circuits, Add</i>	1,268.65	
23 73 13 00-0023 EA 7,500 CFM Single Zone Air Handling Unit, Built-Up, Constant Volume, Horizontal / Vertical, Draw-Through Fan	11,676.25	2,460.08
<i>For Flat Filter Box And Throwaway Filters, Add</i>	991.46	
<i>For Medium Capacity Filter Box And Throwaway Filters, Add</i>	1,877.22	
<i>For Combination Filter Mixing Box And Throwaway Filters, Add</i>	2,798.22	
<i>For Manual Roll Filter, Add</i>	4,836.45	
<i>For Automatic Roll Filter, Add</i>	5,244.10	
<i>For Hot Water Heating Coil, Aluminum Fins, Add</i>	2,390.57	
<i>For Electric Heating Coil, Add</i>	4,021.16	
<i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i>	4,021.16	
<i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i>	3,613.51	
<i>For Steam Heating Coil, Aluminum Fins, Add</i>	3,205.86	
<i>For Welded Exterior Waterproof Casing, Double-Wall, With Insulation, Add</i>	2,622.05	
<i>For Chilled Water Cooling Coil, Copper Fins, Add</i>	4,836.45	
<i>For Direct Expansion Cooling Coil, Copper Fins, Add</i>	4,428.81	
<i>For Hot Water Heating Coil, Copper Fins, Add</i>	3,205.86	
<i>For Variable Air Volume, Add</i>	1,141.41	
<i>For Economizer, Panel, Controls And Damper(s), Add</i>	2,236.99	
<i>For 2 Coils, Independent Circuits, Add</i>	1,330.68	
23 73 13 00-0024 EA 8,000 CFM Single Zone Air Handling Unit, Built-Up, Constant Volume, Horizontal / Vertical, Draw-Through Fan	12,253.38	2,649.20
<i>For Flat Filter Box And Throwaway Filters, Add</i>	1,036.03	
<i>For Medium Capacity Filter Box And Throwaway Filters, Add</i>	1,958.48	
<i>For Combination Filter Mixing Box And Throwaway Filters, Add</i>	2,918.79	
<i>For Manual Roll Filter, Add</i>	5,035.61	
<i>For Automatic Roll Filter, Add</i>	5,458.98	
<i>For Hot Water Heating Coil, Aluminum Fins, Add</i>	2,495.43	
<i>For Electric Heating Coil, Add</i>	4,188.89	
<i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i>	4,188.89	
<i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i>	3,765.52	
<i>For Steam Heating Coil, Aluminum Fins, Add</i>	3,342.16	
<i>For Welded Exterior Waterproof Casing, Double-Wall, With Insulation, Add</i>	2,729.49	
<i>For Chilled Water Cooling Coil, Copper Fins, Add</i>	5,035.61	
<i>For Direct Expansion Cooling Coil, Copper Fins, Add</i>	4,612.25	
<i>For Hot Water Heating Coil, Copper Fins, Add</i>	3,342.16	
<i>For Variable Air Volume, Add</i>	1,185.42	
<i>For Economizer, Panel, Controls And Damper(s), Add</i>	2,315.83	
<i>For 2 Coils, Independent Circuits, Add</i>	1,394.68	
23 73 13 00-0025 EA 9,000 CFM Single Zone Air Handling Unit, Built-Up, Constant Volume, Horizontal / Vertical, Draw-Through Fan	12,912.16	2,869.92
<i>For Flat Filter Box And Throwaway Filters, Add</i>	1,086.65	
<i>For Medium Capacity Filter Box And Throwaway Filters, Add</i>	2,050.57	
<i>For Combination Filter Mixing Box And Throwaway Filters, Add</i>	3,055.40	
<i>For Manual Roll Filter, Add</i>	5,260.62	
<i>For Automatic Roll Filter, Add</i>	5,701.67	
<i>For Hot Water Heating Coil, Aluminum Fins, Add</i>	2,614.35	
<i>For Electric Heating Coil, Add</i>	4,378.53	
<i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i>	4,378.53	
<i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i>	3,937.49	
<i>For Steam Heating Coil, Aluminum Fins, Add</i>	3,496.44	
<i>For Welded Exterior Waterproof Casing, Double-Wall, With Insulation, Add</i>	2,850.83	
<i>For Chilled Water Cooling Coil, Copper Fins, Add</i>	5,260.62	
<i>For Direct Expansion Cooling Coil, Copper Fins, Add</i>	4,619.58	
<i>For Hot Water Heating Coil, Copper Fins, Add</i>	3,496.44	
<i>For Variable Air Volume, Add</i>	1,234.93	
<i>For Economizer, Panel, Controls And Damper(s), Add</i>	2,407.38	
<i>For 2 Coils, Independent Circuits, Add</i>	1,467.63	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 70 Central HVAC Equipment****23 73 Indoor Central-Station Air-Handling Units**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 73 13 00-0026	EA		10,000 CFM Single Zone Air Handling Unit, Built-Up, Constant Volume, Horizontal / Vertical, Draw-Through Fan <i>For Flat Filter Box And Throwaway Filters, Add</i> <i>For Medium Capacity Filter Box And Throwaway Filters, Add</i> <i>For Combination Filter Mixing Box And Throwaway Filters, Add</i> <i>For Manual Roll Filter, Add</i> <i>For Automatic Roll Filter, Add</i> <i>For Hot Water Heating Coil, Aluminum Fins, Add</i> <i>For Electric Heating Coil, Add</i> <i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i> <i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i> <i>For Steam Heating Coil, Aluminum Fins, Add</i> <i>For Welded Exterior Waterproof Casing, Double-Wall, With Insulation, Add</i> <i>For Chilled Water Cooling Coil, Copper Fins, Add</i> <i>For Direct Expansion Cooling Coil, Copper Fins, Add</i> <i>For Hot Water Heating Coil, Copper Fins, Add</i> <i>For Variable Air Volume, Add</i> <i>For Economizer, Panel, Controls And Damper(s), Add</i> <i>For 2 Coils, Independent Circuits, Add</i>	13,552.90 1,136.37 2,141.39 3,190.20 5,483.83 5,942.56 2,731.47 4,566.38 4,566.38 4,107.65 3,648.92 2,971.28 5,483.83 5,025.10 3,648.92 1,284.43 2,493.51 1,538.78	3,064.14
23 73 13 00-0027	EA		11,500 CFM Single Zone Air Handling Unit, Built-Up, Constant Volume, Horizontal / Vertical, Draw-Through Fan <i>For Flat Filter Box And Throwaway Filters, Add</i> <i>For Medium Capacity Filter Box And Throwaway Filters, Add</i> <i>For Combination Filter Mixing Box And Throwaway Filters, Add</i> <i>For Manual Roll Filter, Add</i> <i>For Automatic Roll Filter, Add</i> <i>For Hot Water Heating Coil, Aluminum Fins, Add</i> <i>For Electric Heating Coil, Add</i> <i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i> <i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i> <i>For Steam Heating Coil, Aluminum Fins, Add</i> <i>For Welded Exterior Waterproof Casing, Double-Wall, With Insulation, Add</i> <i>For Chilled Water Cooling Coil, Copper Fins, Add</i> <i>For Direct Expansion Cooling Coil, Copper Fins, Add</i> <i>For Hot Water Heating Coil, Copper Fins, Add</i> <i>For Variable Air Volume, Add</i> <i>For Economizer, Panel, Controls And Damper(s), Add</i> <i>For 2 Coils, Independent Circuits, Add</i>	13,575.32 1,146.33 2,165.95 3,227.80 5,565.64 6,033.20 2,760.23 4,630.50 4,630.50 4,162.93 3,695.37 3,016.60 5,565.64 5,098.07 3,695.37 1,309.19 2,447.19 1,544.56	2,966.88
23 73 13 00-0028	EA		12,500 CFM Single Zone Air Handling Unit, Built-Up, Constant Volume, Horizontal / Vertical, Draw-Through Fan <i>For Flat Filter Box And Throwaway Filters, Add</i> <i>For Medium Capacity Filter Box And Throwaway Filters, Add</i> <i>For Combination Filter Mixing Box And Throwaway Filters, Add</i> <i>For Manual Roll Filter, Add</i> <i>For Automatic Roll Filter, Add</i> <i>For Hot Water Heating Coil, Aluminum Fins, Add</i> <i>For Electric Heating Coil, Add</i> <i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i> <i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i> <i>For Steam Heating Coil, Aluminum Fins, Add</i> <i>For Welded Exterior Waterproof Casing, Double-Wall, With Insulation, Add</i> <i>For Chilled Water Cooling Coil, Copper Fins, Add</i> <i>For Direct Expansion Cooling Coil, Copper Fins, Add</i> <i>For Hot Water Heating Coil, Copper Fins, Add</i> <i>For Variable Air Volume, Add</i> <i>For Economizer, Panel, Controls And Damper(s), Add</i> <i>For 2 Coils, Independent Circuits, Add</i>	14,229.57 1,187.89 2,234.73 3,328.59 5,710.62 6,187.03 2,852.18 4,757.81 4,757.81 4,281.40 3,804.99 3,093.52 5,710.62 5,234.22 3,804.99 1,333.94 2,590.43 1,613.52	3,291.66
23 73 13 00-0029	EA		13,700 CFM Single Zone Air Handling Unit, Built-Up, Constant Volume, Horizontal / Vertical, Draw-Through Fan <i>For Flat Filter Box And Throwaway Filters, Add</i> <i>For Medium Capacity Filter Box And Throwaway Filters, Add</i> <i>For Combination Filter Mixing Box And Throwaway Filters, Add</i> <i>For Manual Roll Filter, Add</i> <i>For Automatic Roll Filter, Add</i> <i>For Hot Water Heating Coil, Aluminum Fins, Add</i> <i>For Electric Heating Coil, Add</i> <i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i> <i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i> <i>For Steam Heating Coil, Aluminum Fins, Add</i> <i>For Welded Exterior Waterproof Casing, Double-Wall, With Insulation, Add</i> <i>For Chilled Water Cooling Coil, Copper Fins, Add</i> <i>For Direct Expansion Cooling Coil, Copper Fins, Add</i> <i>For Hot Water Heating Coil, Copper Fins, Add</i> <i>For Variable Air Volume, Add</i> <i>For Economizer, Panel, Controls And Damper(s), Add</i> <i>For 2 Coils, Independent Circuits, Add</i>	14,967.47 1,253.27 2,360.45 3,516.32 6,040.79 6,545.68 3,011.43 5,031.00 5,031.00 4,526.11 4,021.21 3,272.84 6,040.79 5,535.90 4,021.21 1,413.70 2,373.92 1,698.70	3,423.88



Heating, Ventilating, And Air-Conditioning (HVAC)		23
Central HVAC Equipment		23 70
Indoor Central-Station Air-Handling Units		23 73

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 73 13 00-0030 EA 15,000 CFM Single Zone Air Handling Unit, Built-Up, Constant Volume, Horizontal / Vertical, Draw-Through Fan <i>For Flat Filter Box And Throwaway Filters, Add</i> <i>For Medium Capacity Filter Box And Throwaway Filters, Add</i> <i>For Combination Filter Mixing Box And Throwaway Filters, Add</i> <i>For Manual Roll Filter, Add</i> <i>For Automatic Roll Filter, Add</i> <i>For Hot Water Heating Coil, Aluminum Fins, Add</i> <i>For Electric Heating Coil, Add</i> <i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i> <i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i> <i>For Steam Heating Coil, Aluminum Fins, Add</i> <i>For Welded Exterior Waterproof Casing, Double-Wall, With Insulation, Add</i> <i>For Chilled Water Cooling Coil, Copper Fins, Add</i> <i>For Direct Expansion Cooling Coil, Copper Fins, Add</i> <i>For Hot Water Heating Coil, Copper Fins, Add</i> <i>For Variable Air Volume, Add</i> <i>For Economizer, Panel, Controls And Damper(s), Add</i> <i>For 2 Coils, Independent Circuits, Add</i>	15,752.16 1,320.99 2,489.44 3,708.74 6,375.64 6,909.02 3,175.36 5,308.88 5,308.88 4,775.50 4,242.12 3,454.51 6,375.64 5,842.26 4,242.12 1,493.46 2,416.91 1,788.57	3,556.48
23 73 13 00-0031 EA 16,500 CFM Single Zone Air Handling Unit, Built-Up, Constant Volume, Horizontal / Vertical, Draw-Through Fan <i>For Flat Filter Box And Throwaway Filters, Add</i> <i>For Medium Capacity Filter Box And Throwaway Filters, Add</i> <i>For Combination Filter Mixing Box And Throwaway Filters, Add</i> <i>For Manual Roll Filter, Add</i> <i>For Automatic Roll Filter, Add</i> <i>For Hot Water Heating Coil, Aluminum Fins, Add</i> <i>For Electric Heating Coil, Add</i> <i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i> <i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i> <i>For Steam Heating Coil, Aluminum Fins, Add</i> <i>For Welded Exterior Waterproof Casing, Double-Wall, With Insulation, Add</i> <i>For Chilled Water Cooling Coil, Copper Fins, Add</i> <i>For Direct Expansion Cooling Coil, Copper Fins, Add</i> <i>For Hot Water Heating Coil, Copper Fins, Add</i> <i>For Variable Air Volume, Add</i> <i>For Economizer, Panel, Controls And Damper(s), Add</i> <i>For 2 Coils, Independent Circuits, Add</i>	16,571.99 1,394.39 2,631.11 3,920.38 6,749.35 7,315.15 3,354.58 5,617.76 5,617.76 5,051.97 4,486.17 3,657.57 6,749.35 6,183.56 4,486.17 1,584.23 2,451.22 1,883.52	3,693.27
23 73 13 00-0032 EA 17,500 CFM Single Zone Air Handling Unit, Built-Up, Constant Volume, Horizontal / Vertical, Draw-Through Fan <i>For Flat Filter Box And Throwaway Filters, Add</i> <i>For Medium Capacity Filter Box And Throwaway Filters, Add</i> <i>For Combination Filter Mixing Box And Throwaway Filters, Add</i> <i>For Manual Roll Filter, Add</i> <i>For Automatic Roll Filter, Add</i> <i>For Hot Water Heating Coil, Aluminum Fins, Add</i> <i>For Electric Heating Coil, Add</i> <i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i> <i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i> <i>For Steam Heating Coil, Aluminum Fins, Add</i> <i>For Welded Exterior Waterproof Casing, Double-Wall, With Insulation, Add</i> <i>For Chilled Water Cooling Coil, Copper Fins, Add</i> <i>For Direct Expansion Cooling Coil, Copper Fins, Add</i> <i>For Hot Water Heating Coil, Copper Fins, Add</i> <i>For Variable Air Volume, Add</i> <i>For Economizer, Panel, Controls And Damper(s), Add</i> <i>For 2 Coils, Independent Circuits, Add</i>	17,433.61 1,469.89 2,775.70 4,136.20 7,127.26 7,725.47 3,537.99 5,930.83 5,930.83 5,332.62 4,734.41 3,862.73 7,127.26 6,529.05 4,734.41 1,674.99 2,493.88 1,982.65	3,830.20
23 73 13 00-0033 EA 20,000 CFM Single Zone Air Handling Unit, Built-Up, Constant Volume, Horizontal / Vertical, Draw-Through Fan <i>For Flat Filter Box And Throwaway Filters, Add</i> <i>For Medium Capacity Filter Box And Throwaway Filters, Add</i> <i>For Combination Filter Mixing Box And Throwaway Filters, Add</i> <i>For Manual Roll Filter, Add</i> <i>For Automatic Roll Filter, Add</i> <i>For Hot Water Heating Coil, Aluminum Fins, Add</i> <i>For Electric Heating Coil, Add</i> <i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i> <i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i> <i>For Steam Heating Coil, Aluminum Fins, Add</i> <i>For Welded Exterior Waterproof Casing, Double Wall, With Insulation, Add</i> <i>For Chilled Water Cooling Coil, Copper Fins, Add</i> <i>For Direct Expansion Cooling Coil, Copper Fins, Add</i> <i>For Hot Water Heating Coil, Copper Fins, Add</i> <i>For Variable Air Volume, Add</i> <i>For Economizer, Panel, Controls And Damper(s), Add</i> <i>For 2 Coils, Independent Circuits, Add</i>	19,385.82 1,645.10 3,114.12 5,317.64 7,615.39 8,020.88 3,290.20 3,560.53 5,993.45 5,317.64 4,641.83 3,672.54 7,345.07 6,669.26 5,317.64 1,892.27 2,762.18 2,208.91	4,106.25

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 70 Central HVAC Equipment****23 73 Indoor Central-Station Air-Handling Units**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 73 13 00-0034	EA		22,500 CFM Single Zone Air Handling Unit, Built-Up, Constant Volume, Horizontal / Vertical, Draw-Through Fan <i>For Flat Filter Box And Throwaway Filters, Add</i> <i>For Medium Capacity Filter Box And Throwaway Filters, Add</i> <i>For Combination Filter Mixing Box And Throwaway Filters, Add</i> <i>For Manual Roll Filter, Add</i> <i>For Automatic Roll Filter, Add</i> <i>For Hot Water Heating Coil, Aluminum Fins, Add</i> <i>For Electric Heating Coil, Add</i> <i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i> <i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i> <i>For Steam Heating Coil, Aluminum Fins, Add</i> <i>For Welded Exterior Waterproof Casing, Double Wall, With Insulation, Add</i> <i>For Chilled Water Cooling Coil, Copper Fins, Add</i> <i>For Direct Expansion Cooling Coil, Copper Fins, Add</i> <i>For Hot Water Heating Coil, Copper Fins, Add</i> <i>For Variable Air Volume, Add</i> <i>For Economizer, Panel, Controls And Damper(s), Add</i> <i>For 2 Coils, Independent Circuits, Add</i>	21,472.08 1,829.96 3,469.58 5,929.00 8,500.62 8,954.43 3,659.92 3,962.47 6,685.36 5,929.00 5,172.64 4,099.04 8,198.07 7,441.71 5,929.00 2,117.80 2,845.36 2,449.75	4,425.42
23 73 13 00-0035	EA		25,000 CFM Single Zone Air Handling Unit, Built-Up, Constant Volume, Horizontal / Vertical, Draw-Through Fan <i>For Flat Filter Box And Throwaway Filters, Add</i> <i>For Medium Capacity Filter Box And Throwaway Filters, Add</i> <i>For Combination Filter Mixing Box And Throwaway Filters, Add</i> <i>For Manual Roll Filter, Add</i> <i>For Automatic Roll Filter, Add</i> <i>For Hot Water Heating Coil, Aluminum Fins, Add</i> <i>For Electric Heating Coil, Add</i> <i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i> <i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i> <i>For Steam Heating Coil, Aluminum Fins, Add</i> <i>For Welded Exterior Waterproof Casing, Double Wall, With Insulation, Add</i> <i>For Chilled Water Cooling Coil, Copper Fins, Add</i> <i>For Direct Expansion Cooling Coil, Copper Fins, Add</i> <i>For Hot Water Heating Coil, Copper Fins, Add</i> <i>For Variable Air Volume, Add</i> <i>For Economizer, Panel, Controls And Damper(s), Add</i> <i>For 2 Coils, Independent Circuits, Add</i>	23,733.20 2,034.37 3,865.37 6,611.87 9,494.09 10,002.71 4,068.74 4,407.83 7,459.58 6,611.87 5,764.16 4,577.50 9,155.00 8,307.29 6,611.87 2,373.59 2,921.32 2,712.40	4,741.74
23 73 13 00-0036	EA		27,500 CFM Single Zone Air Handling Unit, Built-Up, Constant Volume, Horizontal / Vertical, Draw-Through Fan <i>For Flat Filter Box And Throwaway Filters, Add</i> <i>For Medium Capacity Filter Box And Throwaway Filters, Add</i> <i>For Combination Filter Mixing Box And Throwaway Filters, Add</i> <i>For Manual Roll Filter, Add</i> <i>For Automatic Roll Filter, Add</i> <i>For Hot Water Heating Coil, Aluminum Fins, Add</i> <i>For Electric Heating Coil, Add</i> <i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i> <i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i> <i>For Steam Heating Coil, Aluminum Fins, Add</i> <i>For Welded Exterior Waterproof Casing, Double Wall, With Insulation, Add</i> <i>For Chilled Water Cooling Coil, Copper Fins, Add</i> <i>For Direct Expansion Cooling Coil, Copper Fins, Add</i> <i>For Hot Water Heating Coil, Copper Fins, Add</i> <i>For Variable Air Volume, Add</i> <i>For Economizer, Panel, Controls And Damper(s), Add</i> <i>For 2 Coils, Independent Circuits, Add</i>	28,981.36 2,533.51 4,848.24 8,320.34 12,007.44 12,658.10 5,067.02 5,500.79 9,404.78 8,320.34 7,235.90 5,786.83 11,573.66 10,489.22 8,320.34 3,036.43 3,011.20 3,331.91	5,106.74
23 73 13 00-0037	EA		30,000 CFM Single Zone Air Handling Unit, Built-Up, Constant Volume, Horizontal / Vertical, Draw-Through Fan <i>For Flat Filter Box And Throwaway Filters, Add</i> <i>For Medium Capacity Filter Box And Throwaway Filters, Add</i> <i>For Combination Filter Mixing Box And Throwaway Filters, Add</i> <i>For Manual Roll Filter, Add</i> <i>For Automatic Roll Filter, Add</i> <i>For Hot Water Heating Coil, Aluminum Fins, Add</i> <i>For Electric Heating Coil, Add</i> <i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i> <i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i> <i>For Steam Heating Coil, Aluminum Fins, Add</i> <i>For Welded Exterior Waterproof Casing, Double Wall, With Insulation, Add</i> <i>For Chilled Water Cooling Coil, Copper Fins, Add</i> <i>For Direct Expansion Cooling Coil, Copper Fins, Add</i> <i>For Hot Water Heating Coil, Copper Fins, Add</i> <i>For Variable Air Volume, Add</i> <i>For Economizer, Panel, Controls And Damper(s), Add</i> <i>For 2 Coils, Independent Circuits, Add</i>	32,298.74 2,840.83 5,448.22 9,359.32 13,527.35 14,262.88 5,681.65 6,172.01 10,585.21 9,359.32 8,133.43 6,518.50 13,036.99 11,811.10 9,359.32 3,432.49 2,932.14 3,720.23	5,450.69



Heating, Ventilating, And Air-Conditioning (HVAC)	23
Central HVAC Equipment	23 70
Indoor Central-Station Air-Handling Units	23 73

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 73 13 00-0038 EA 32,500 CFM Single Zone Air Handling Unit, Built-Up, Constant Volume, Horizontal / Vertical, Draw-Through Fan <i>For Flat Filter Box And Throwaway Filters, Add</i> <i>For Medium Capacity Filter Box And Throwaway Filters, Add</i> <i>For Combination Filter Mixing Box And Throwaway Filters, Add</i> <i>For Manual Roll Filter, Add</i> <i>For Automatic Roll Filter, Add</i> <i>For Hot Water Heating Coil, Aluminum Fins, Add</i> <i>For Electric Heating Coil, Add</i> <i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i> <i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i> <i>For Steam Heating Coil, Aluminum Fins, Add</i> <i>For Welded Exterior Waterproof Casing, Double Wall, With Insulation, Add</i> <i>For Chilled Water Cooling Coil, Copper Fins, Add</i> <i>For Direct Expansion Cooling Coil, Copper Fins, Add</i> <i>For Hot Water Heating Coil, Copper Fins, Add</i> <i>For Variable Air Volume, Add</i> <i>For Economizer, Panel, Controls And Damper(s), Add</i> <i>For 2 Coils, Independent Circuits, Add</i>	35,354.45 3,116.40 5,981.37 10,278.82 14,864.32 15,673.52 6,232.80 6,772.27 11,627.50 10,278.82 8,930.15 7,162.42 14,324.85 12,976.17 10,278.82 3,776.29 3,022.14 4,074.92	5,869.59
23 73 13 00-0039 EA 35,000 CFM Single Zone Air Handling Unit, Built-Up, Constant Volume, Horizontal / Vertical, Draw-Through Fan <i>For Flat Filter Box And Throwaway Filters, Add</i> <i>For Medium Capacity Filter Box And Throwaway Filters, Add</i> <i>For Combination Filter Mixing Box And Throwaway Filters, Add</i> <i>For Manual Roll Filter, Add</i> <i>For Automatic Roll Filter, Add</i> <i>For Hot Water Heating Coil, Aluminum Fins, Add</i> <i>For Electric Heating Coil, Add</i> <i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i> <i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i> <i>For Steam Heating Coil, Aluminum Fins, Add</i> <i>For Welded Exterior Waterproof Casing, Double Wall, With Insulation, Add</i> <i>For Chilled Water Cooling Coil, Copper Fins, Add</i> <i>For Direct Expansion Cooling Coil, Copper Fins, Add</i> <i>For Hot Water Heating Coil, Copper Fins, Add</i> <i>For Variable Air Volume, Add</i> <i>For Economizer, Panel, Controls And Damper(s), Add</i> <i>For 2 Coils, Independent Circuits, Add</i>	38,770.80 3,421.79 6,570.40 11,293.32 16,336.36 17,226.31 6,843.58 7,436.87 12,776.57 11,293.32 9,810.07 7,871.53 15,743.06 14,259.81 11,293.32 4,153.09 3,130.88 4,470.38	6,806.37
23 73 13 00-0040 EA 37,500 CFM Single Zone Air Handling Unit, Built-Up, Constant Volume, Horizontal / Vertical, Draw-Through Fan <i>For Flat Filter Box And Throwaway Filters, Add</i> <i>For Medium Capacity Filter Box And Throwaway Filters, Add</i> <i>For Combination Filter Mixing Box And Throwaway Filters, Add</i> <i>For Manual Roll Filter, Add</i> <i>For Automatic Roll Filter, Add</i> <i>For Hot Water Heating Coil, Aluminum Fins, Add</i> <i>For Electric Heating Coil, Add</i> <i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i> <i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i> <i>For Steam Heating Coil, Aluminum Fins, Add</i> <i>For Welded Exterior Waterproof Casing, Double Wall, With Insulation, Add</i> <i>For Chilled Water Cooling Coil, Copper Fins, Add</i> <i>For Direct Expansion Cooling Coil, Copper Fins, Add</i> <i>For Hot Water Heating Coil, Copper Fins, Add</i> <i>For Variable Air Volume, Add</i> <i>For Economizer, Panel, Controls And Damper(s), Add</i> <i>For 2 Coils, Independent Circuits, Add</i>	41,695.83 3,686.90 7,084.18 12,180.10 17,627.26 18,588.52 7,373.79 8,014.63 13,782.21 12,180.10 10,578.00 8,493.21 16,986.42 15,384.31 12,180.10 4,485.89 3,213.06 4,810.42	6,760.85
23 73 13 00-0041 EA 40,000 CFM Single Zone Air Handling Unit, Built-Up, Constant Volume, Horizontal / Vertical, Draw-Through Fan <i>For Flat Filter Box And Throwaway Filters, Add</i> <i>For Medium Capacity Filter Box And Throwaway Filters, Add</i> <i>For Combination Filter Mixing Box And Throwaway Filters, Add</i> <i>For Manual Roll Filter, Add</i> <i>For Automatic Roll Filter, Add</i> <i>For Hot Water Heating Coil, Aluminum Fins, Add</i> <i>For Electric Heating Coil, Add</i> <i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i> <i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i> <i>For Steam Heating Coil, Aluminum Fins, Add</i> <i>For Welded Exterior Waterproof Casing, Double Wall, With Insulation, Add</i> <i>For Chilled Water Cooling Coil, Copper Fins, Add</i> <i>For Direct Expansion Cooling Coil, Copper Fins, Add</i> <i>For Hot Water Heating Coil, Copper Fins, Add</i> <i>For Variable Air Volume, Add</i> <i>For Economizer, Panel, Controls And Damper(s), Add</i> <i>For 2 Coils, Independent Circuits, Add</i>	44,962.68 3,977.94 7,644.87 13,145.27 19,026.60 20,064.48 7,955.87 8,647.79 14,875.07 13,145.27 11,415.47 9,167.34 18,334.68 16,604.88 13,145.27 4,843.44 3,125.83 5,188.19	7,232.45

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 70 Central HVAC Equipment****23 73 Indoor Central-Station Air-Handling Units**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 73 13 00-0042	EA		45,000 CFM Single Zone Air Handling Unit, Built-Up, Constant Volume, Horizontal / Vertical, Draw-Through Fan <i>For Flat Filter Box And Throwaway Filters, Add</i> <i>For Medium Capacity Filter Box And Throwaway Filters, Add</i> <i>For Combination Filter Mixing Box And Throwaway Filters, Add</i> <i>For Manual Roll Filter, Add</i> <i>For Automatic Roll Filter, Add</i> <i>For Hot Water Heating Coil, Aluminum Fins, Add</i> <i>For Electric Heating Coil, Add</i> <i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i> <i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i> <i>For Steam Heating Coil, Aluminum Fins, Add</i> <i>For Welded Exterior Waterproof Casing, Double Wall, With Insulation, Add</i> <i>For Chilled Water Cooling Coil, Copper Fins, Add</i> <i>For Direct Expansion Cooling Coil, Copper Fins, Add</i> <i>For Hot Water Heating Coil, Copper Fins, Add</i> <i>For Variable Air Volume, Add</i> <i>For Economizer, Panel, Controls And Damper(s), Add</i> <i>For 2 Coils, Independent Circuits, Add</i>	48,522.22 4,294.41 8,254.14 14,193.74 20,545.97 21,666.95 8,588.83 9,336.15 16,062.04 14,193.74 12,325.43 9,899.32 19,798.65 17,930.34 14,193.74 5,231.25 3,224.52 5,599.54	7,809.03
23 73 13 00-0043	EA		47,500 CFM Single Zone Air Handling Unit, Built-Up, Constant Volume, Horizontal / Vertical, Draw-Through Fan <i>For Flat Filter Box And Throwaway Filters, Add</i> <i>For Medium Capacity Filter Box And Throwaway Filters, Add</i> <i>For Combination Filter Mixing Box And Throwaway Filters, Add</i> <i>For Manual Roll Filter, Add</i> <i>For Automatic Roll Filter, Add</i> <i>For Hot Water Heating Coil, Aluminum Fins, Add</i> <i>For Electric Heating Coil, Add</i> <i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i> <i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i> <i>For Steam Heating Coil, Aluminum Fins, Add</i> <i>For Welded Exterior Waterproof Casing, Double Wall, With Insulation, Add</i> <i>For Chilled Water Cooling Coil, Copper Fins, Add</i> <i>For Direct Expansion Cooling Coil, Copper Fins, Add</i> <i>For Hot Water Heating Coil, Copper Fins, Add</i> <i>For Variable Air Volume, Add</i> <i>For Economizer, Panel, Controls And Damper(s), Add</i> <i>For 2 Coils, Independent Circuits, Add</i>	50,556.37 4,472.74 8,595.74 14,780.24 21,392.97 22,559.93 8,945.48 9,723.45 16,725.16 14,780.24 12,835.32 10,307.50 20,615.01 18,670.08 14,780.24 5,445.78 3,287.24 5,833.61	8,175.82
23 73 13 00-0044	EA		50,000 CFM Single Zone Air Handling Unit, Built-Up, Constant Volume, Horizontal / Vertical, Draw-Through Fan <i>For Flat Filter Box And Throwaway Filters, Add</i> <i>For Medium Capacity Filter Box And Throwaway Filters, Add</i> <i>For Combination Filter Mixing Box And Throwaway Filters, Add</i> <i>For Manual Roll Filter, Add</i> <i>For Automatic Roll Filter, Add</i> <i>For Hot Water Heating Coil, Aluminum Fins, Add</i> <i>For Electric Heating Coil, Add</i> <i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i> <i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i> <i>For Steam Heating Coil, Aluminum Fins, Add</i> <i>For Welded Exterior Waterproof Casing, Double Wall, With Insulation, Add</i> <i>For Chilled Water Cooling Coil, Copper Fins, Add</i> <i>For Direct Expansion Cooling Coil, Copper Fins, Add</i> <i>For Hot Water Heating Coil, Copper Fins, Add</i> <i>For Variable Air Volume, Add</i> <i>For Economizer, Panel, Controls And Damper(s), Add</i> <i>For 2 Coils, Independent Circuits, Add</i>	52,471.49 4,641.18 8,918.79 15,335.20 22,195.07 23,405.64 9,282.37 10,089.41 17,352.81 15,335.20 13,317.59 10,694.01 21,388.03 19,370.42 15,335.20 5,649.31 3,344.91 6,054.19	8,490.27
23 73 13 00-0045	EA		55,000 CFM Single Zone Air Handling Unit, Built-Up, Constant Volume, Horizontal / Vertical, Draw-Through Fan <i>For Flat Filter Box And Throwaway Filters, Add</i> <i>For Medium Capacity Filter Box And Throwaway Filters, Add</i> <i>For Combination Filter Mixing Box And Throwaway Filters, Add</i> <i>For Manual Roll Filter, Add</i> <i>For Automatic Roll Filter, Add</i> <i>For Hot Water Heating Coil, Aluminum Fins, Add</i> <i>For Electric Heating Coil, Add</i> <i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i> <i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i> <i>For Steam Heating Coil, Aluminum Fins, Add</i> <i>For Welded Exterior Waterproof Casing, Double Wall, With Insulation, Add</i> <i>For Chilled Water Cooling Coil, Copper Fins, Add</i> <i>For Direct Expansion Cooling Coil, Copper Fins, Add</i> <i>For Hot Water Heating Coil, Copper Fins, Add</i> <i>For Variable Air Volume, Add</i> <i>For Economizer, Panel, Controls And Damper(s), Add</i> <i>For 2 Coils, Independent Circuits, Add</i>	56,552.02 5,007.29 9,625.83 16,553.63 23,964.57 25,272.38 10,014.58 10,886.45 18,733.32 16,553.63 14,373.95 11,546.35 23,092.69 20,913.01 16,553.63 6,103.12 3,449.79 6,527.08	9,066.77



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 73 13 00-0046 EA 60,000 CFM Single Zone Air Handling Unit, Built-Up, Constant Volume, Horizontal / Vertical, Draw-Through Fan <i>For Flat Filter Box And Throwaway Filters, Add</i> <i>For Medium Capacity Filter Box And Throwaway Filters, Add</i> <i>For Combination Filter Mixing Box And Throwaway Filters, Add</i> <i>For Manual Roll Filter, Add</i> <i>For Automatic Roll Filter, Add</i> <i>For Hot Water Heating Coil, Aluminum Fins, Add</i> <i>For Electric Heating Coil, Add</i> <i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i> <i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i> <i>For Steam Heating Coil, Aluminum Fins, Add</i> <i>For Welded Exterior Waterproof Casing, Double Wall, With Insulation, Add</i> <i>For Chilled Water Cooling Coil, Copper Fins, Add</i> <i>For Direct Expansion Cooling Coil, Copper Fins, Add</i> <i>For Hot Water Heating Coil, Copper Fins, Add</i> <i>For Variable Air Volume, Add</i> <i>For Economizer, Panel, Controls And Damper(s), Add</i> <i>For 2 Coils, Independent Circuits, Add</i>	61,800.24 5,486.78 10,557.62 18,163.88 26,312.90 27,750.96 10,973.57 11,932.27 20,560.65 18,163.88 15,767.11 12,677.10 25,354.19 22,957.42 18,163.88 6,710.96 3,286.48 7,138.73	9,695.68
23 73 13 00-0047 EA 65,000 CFM Single Zone Air Handling Unit, Built-Up, Constant Volume, Horizontal / Vertical, Draw-Through Fan <i>For Flat Filter Box And Throwaway Filters, Add</i> <i>For Medium Capacity Filter Box And Throwaway Filters, Add</i> <i>For Combination Filter Mixing Box And Throwaway Filters, Add</i> <i>For Manual Roll Filter, Add</i> <i>For Automatic Roll Filter, Add</i> <i>For Hot Water Heating Coil, Aluminum Fins, Add</i> <i>For Electric Heating Coil, Add</i> <i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i> <i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i> <i>For Steam Heating Coil, Aluminum Fins, Add</i> <i>For Welded Exterior Waterproof Casing, Double Wall, With Insulation, Add</i> <i>For Chilled Water Cooling Coil, Copper Fins, Add</i> <i>For Direct Expansion Cooling Coil, Copper Fins, Add</i> <i>For Hot Water Heating Coil, Copper Fins, Add</i> <i>For Variable Air Volume, Add</i> <i>For Economizer, Panel, Controls And Damper(s), Add</i> <i>For 2 Coils, Independent Circuits, Add</i>	67,702.99 6,021.60 11,593.98 19,952.54 28,916.47 30,498.34 12,043.20 13,097.78 22,588.99 19,952.54 17,316.09 13,930.94 27,861.89 25,225.44 19,952.54 7,382.06 3,397.40 7,824.88	10,481.81
23 73 13 00-0048 EA 70,000 CFM Single Zone Air Handling Unit, Built-Up, Constant Volume, Horizontal / Vertical, Draw-Through Fan <i>For Flat Filter Box And Throwaway Filters, Add</i> <i>For Medium Capacity Filter Box And Throwaway Filters, Add</i> <i>For Combination Filter Mixing Box And Throwaway Filters, Add</i> <i>For Manual Roll Filter, Add</i> <i>For Automatic Roll Filter, Add</i> <i>For Hot Water Heating Coil, Aluminum Fins, Add</i> <i>For Electric Heating Coil, Add</i> <i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i> <i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i> <i>For Steam Heating Coil, Aluminum Fins, Add</i> <i>For Welded Exterior Waterproof Casing, Double Wall, With Insulation, Add</i> <i>For Chilled Water Cooling Coil, Copper Fins, Add</i> <i>For Direct Expansion Cooling Coil, Copper Fins, Add</i> <i>For Hot Water Heating Coil, Copper Fins, Add</i> <i>For Variable Air Volume, Add</i> <i>For Economizer, Panel, Controls And Damper(s), Add</i> <i>For 2 Coils, Independent Circuits, Add</i>	74,289.74 6,615.17 12,742.06 21,932.39 31,794.71 33,535.12 13,230.34 14,390.61 24,833.07 21,932.39 19,031.70 15,317.22 30,634.43 27,733.75 21,932.39 8,121.91 3,527.61 8,589.25	11,372.77
23 73 13 00-0049 Multi-Zone Units <small>(23 73 13)</small> Note: Horizontal/vertical blow-thru fan, motor and cabinet.		
23 73 13 00-0050 EA 1,000 CFM Multizone Air Handling Unit, Built-Up, Horizontal / Vertical, Draw-Through Fan <i>For Economizer, Panel, Controls And Damper(s), Add</i> <i>For Flat Filter Box And Throwaway Filters, Add</i> <i>For Medium Capacity Filter Box And Throwaway Filters, Add</i> <i>For Combination Filter Mixing Box And Throwaway Filters, Add</i> <i>For Manual Roll Filter, Add</i> <i>For Automatic Roll Filter, Add</i> <i>For Hot Water Heating Coil, Aluminum Fins, Add</i> <i>For Electric Heating Coil, Add</i> <i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i> <i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i> <i>For Chilled Water Cooling Coil, Copper Fins, Add</i> <i>For Direct Expansion Cooling Coil, Copper Fins, Add</i> <i>For 2 Coils, Independent Circuits, Add</i>	4,490.50 1,583.03 381.69 722.97 920.55 1,863.54 1,863.54 449.05 511.92 1,549.21 1,549.21 1,863.54 1,863.54 511.92	943.21
23 73 13 00-0051 EA 1,200 CFM Multizone Air Handling Unit, Built-Up, Horizontal / Vertical, Draw-Through Fan <i>For Economizer, Panel, Controls And Damper(s), Add</i> <i>For Flat Filter Box And Throwaway Filters, Add</i> <i>For Medium Capacity Filter Box And Throwaway Filters, Add</i> <i>For Combination Filter Mixing Box And Throwaway Filters, Add</i> <i>For Manual Roll Filter, Add</i> <i>For Automatic Roll Filter, Add</i> <i>For Hot Water Heating Coil, Aluminum Fins, Add</i> <i>For Electric Heating Coil, Add</i> <i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i> <i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i> <i>For Chilled Water Cooling Coil, Copper Fins, Add</i> <i>For Direct Expansion Cooling Coil, Copper Fins, Add</i> <i>For 2 Coils, Independent Circuits, Add</i>	5,597.65 1,821.71 475.36 900.07 1,146.19 2,319.04 2,319.04 559.77 637.95 1,928.09 1,928.09 2,319.04 2,319.04 637.95	1,181.68

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 70 Central HVAC Equipment****23 73 Indoor Central-Station Air-Handling Units**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 73 13 00-0052	EA		1,600 CFM Multizone Air Handling Unit, Built-Up, Horizontal / Vertical, Draw-Through Fan	6,865.10	1,257.67
			<i>For Economizer, Panel, Controls And Damper(s), Add</i>	1,897.56	
			<i>For Flat Filter Box And Throwaway Filters, Add</i>	596.68	
			<i>For Medium Capacity Filter Box And Throwaway Filters, Add</i>	1,139.47	
			<i>For Combination Filter Mixing Box And Throwaway Filters, Add</i>	1,446.80	
			<i>For Manual Roll Filter, Add</i>	2,967.37	
			<i>For Automatic Roll Filter, Add</i>	2,967.37	
			<i>For Hot Water Heating Coil, Aluminum Fins, Add</i>	686.51	
			<i>For Electric Heating Coil, Add</i>	787.88	
			<i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i>	2,460.51	
			<i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i>	2,460.51	
			<i>For Chilled Water Cooling Coil, Copper Fins, Add</i>	2,967.37	
			<i>For Direct Expansion Cooling Coil, Copper Fins, Add</i>	2,967.37	
			<i>For 2 Coils, Independent Circuits, Add</i>	787.88	
23 73 13 00-0053	EA		2,000 CFM Multizone Air Handling Unit, Built-Up, Horizontal / Vertical, Draw-Through Fan	7,149.19	1,346.77
			<i>For Economizer, Panel, Controls And Damper(s), Add</i>	1,986.41	
			<i>For Flat Filter Box And Throwaway Filters, Add</i>	618.75	
			<i>For Medium Capacity Filter Box And Throwaway Filters, Add</i>	1,179.79	
			<i>For Combination Filter Mixing Box And Throwaway Filters, Add</i>	1,498.78	
			<i>For Manual Roll Filter, Add</i>	3,066.51	
			<i>For Automatic Roll Filter, Add</i>	3,066.51	
			<i>For Hot Water Heating Coil, Aluminum Fins, Add</i>	714.92	
			<i>For Electric Heating Coil, Add</i>	819.43	
			<i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i>	2,543.93	
			<i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i>	2,543.93	
			<i>For Chilled Water Cooling Coil, Copper Fins, Add</i>	3,066.51	
			<i>For Direct Expansion Cooling Coil, Copper Fins, Add</i>	3,066.51	
			<i>For 2 Coils, Independent Circuits, Add</i>	819.43	
23 73 13 00-0054	EA		2,500 CFM Multizone Air Handling Unit, Built-Up, Horizontal / Vertical, Draw-Through Fan	8,329.51	1,443.72
			<i>For Economizer, Panel, Controls And Damper(s), Add</i>	2,083.78	
			<i>For Flat Filter Box And Throwaway Filters, Add</i>	729.82	
			<i>For Medium Capacity Filter Box And Throwaway Filters, Add</i>	1,397.77	
			<i>For Combination Filter Mixing Box And Throwaway Filters, Add</i>	1,773.00	
			<i>For Manual Roll Filter, Add</i>	3,653.09	
			<i>For Automatic Roll Filter, Add</i>	3,653.09	
			<i>For Hot Water Heating Coil, Aluminum Fins, Add</i>	832.95	
			<i>For Electric Heating Coil, Add</i>	958.29	
			<i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i>	3,026.39	
			<i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i>	3,026.39	
			<i>For Chilled Water Cooling Coil, Copper Fins, Add</i>	3,653.09	
			<i>For Direct Expansion Cooling Coil, Copper Fins, Add</i>	3,653.09	
			<i>For 2 Coils, Independent Circuits, Add</i>	958.29	
23 73 13 00-0055	EA		3,000 CFM Multizone Air Handling Unit, Built-Up, Horizontal / Vertical, Draw-Through Fan	8,789.86	1,546.07
			<i>For Economizer, Panel, Controls And Damper(s), Add</i>	2,185.99	
			<i>For Flat Filter Box And Throwaway Filters, Add</i>	768.56	
			<i>For Medium Capacity Filter Box And Throwaway Filters, Add</i>	1,470.86	
			<i>For Combination Filter Mixing Box And Throwaway Filters, Add</i>	1,866.18	
			<i>For Manual Roll Filter, Add</i>	3,840.57	
			<i>For Automatic Roll Filter, Add</i>	3,840.57	
			<i>For Hot Water Heating Coil, Aluminum Fins, Add</i>	878.99	
			<i>For Electric Heating Coil, Add</i>	1,010.61	
			<i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i>	3,182.44	
			<i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i>	3,182.44	
			<i>For Chilled Water Cooling Coil, Copper Fins, Add</i>	3,840.57	
			<i>For Direct Expansion Cooling Coil, Copper Fins, Add</i>	3,840.57	
			<i>For 2 Coils, Independent Circuits, Add</i>	1,010.61	
23 73 13 00-0056	EA		3,500 CFM Multizone Air Handling Unit, Built-Up, Horizontal / Vertical, Draw-Through Fan	9,273.38	1,650.81
			<i>For Economizer, Panel, Controls And Damper(s), Add</i>	2,290.68	
			<i>For Flat Filter Box And Throwaway Filters, Add</i>	809.43	
			<i>For Medium Capacity Filter Box And Throwaway Filters, Add</i>	1,548.12	
			<i>For Combination Filter Mixing Box And Throwaway Filters, Add</i>	1,964.63	
			<i>For Manual Roll Filter, Add</i>	4,039.21	
			<i>For Automatic Roll Filter, Add</i>	4,039.21	
			<i>For Hot Water Heating Coil, Aluminum Fins, Add</i>	927.34	
			<i>For Electric Heating Coil, Add</i>	1,065.64	
			<i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i>	3,347.68	
			<i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i>	3,347.68	
			<i>For Chilled Water Cooling Coil, Copper Fins, Add</i>	4,039.21	
			<i>For Direct Expansion Cooling Coil, Copper Fins, Add</i>	4,039.21	
			<i>For 2 Coils, Independent Circuits, Add</i>	1,065.64	
23 73 13 00-0057	EA		4,000 CFM Multizone Air Handling Unit, Built-Up, Horizontal / Vertical, Draw-Through Fan	10,324.46	1,771.43
			<i>For Economizer, Panel, Controls And Damper(s), Add</i>	2,138.82	
			<i>For Flat Filter Box And Throwaway Filters, Add</i>	906.19	
			<i>For Medium Capacity Filter Box And Throwaway Filters, Add</i>	1,736.63	
			<i>For Combination Filter Mixing Box And Throwaway Filters, Add</i>	2,202.35	
			<i>For Manual Roll Filter, Add</i>	4,542.14	
			<i>For Automatic Roll Filter, Add</i>	4,542.14	
			<i>For Hot Water Heating Coil, Aluminum Fins, Add</i>	1,032.45	
			<i>For Electric Heating Coil, Add</i>	1,188.43	
			<i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i>	3,762.21	
			<i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i>	3,762.21	
			<i>For Chilled Water Cooling Coil, Copper Fins, Add</i>	4,542.14	
			<i>For Direct Expansion Cooling Coil, Copper Fins, Add</i>	4,542.14	
			<i>For 2 Coils, Independent Circuits, Add</i>	1,188.43	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 73 13 00-0058 EA 4,500 CFM Multizone Air Handling Unit, Built-Up, Horizontal / Vertical, Draw-Through Fan	11,275.74	1,897.06
For Economizer, Panel, Controls And Damper(s), Add	2,240.63	
For Flat Filter Box And Throwaway Filters, Add	992.06	
For Medium Capacity Filter Box And Throwaway Filters, Add	1,902.82	
For Combination Filter Mixing Box And Throwaway Filters, Add	2,412.40	
For Manual Roll Filter, Add	4,982.05	
For Automatic Roll Filter, Add	4,982.05	
For Hot Water Heating Coil, Aluminum Fins, Add	1,127.57	
For Electric Heating Coil, Add	1,298.88	
For Chilled Water Cooling Coil, Aluminum Fins, Add	4,125.50	
For Direct Expansion Cooling Coil, Aluminum Fins, Add	4,125.50	
For Chilled Water Cooling Coil, Copper Fins, Add	4,982.05	
For Direct Expansion Cooling Coil, Copper Fins, Add	4,982.05	
For 2 Coils, Independent Circuits, Add	1,298.88	
23 73 13 00-0059 EA 5,000 CFM Multizone Air Handling Unit, Built-Up, Horizontal / Vertical, Draw-Through Fan	11,924.96	2,026.13
For Economizer, Panel, Controls And Damper(s), Add	2,338.37	
For Flat Filter Box And Throwaway Filters, Add	1,048.10	
For Medium Capacity Filter Box And Throwaway Filters, Add	2,009.56	
For Combination Filter Mixing Box And Throwaway Filters, Add	2,548.05	
For Manual Roll Filter, Add	5,259.15	
For Automatic Roll Filter, Add	5,259.15	
For Hot Water Heating Coil, Aluminum Fins, Add	1,192.50	
For Electric Heating Coil, Add	1,373.24	
For Chilled Water Cooling Coil, Aluminum Fins, Add	4,355.45	
For Direct Expansion Cooling Coil, Aluminum Fins, Add	4,355.45	
For Chilled Water Cooling Coil, Copper Fins, Add	5,259.15	
For Direct Expansion Cooling Coil, Copper Fins, Add	5,259.15	
For 2 Coils, Independent Circuits, Add	1,373.24	
23 73 13 00-0060 EA 5,500 CFM Multizone Air Handling Unit, Built-Up, Horizontal / Vertical, Draw-Through Fan	13,132.75	2,164.64
For Economizer, Panel, Controls And Damper(s), Add	2,451.60	
For Flat Filter Box And Throwaway Filters, Add	1,158.58	
For Medium Capacity Filter Box And Throwaway Filters, Add	2,224.35	
For Combination Filter Mixing Box And Throwaway Filters, Add	2,819.12	
For Manual Roll Filter, Add	5,830.80	
For Automatic Roll Filter, Add	5,830.80	
For Hot Water Heating Coil, Aluminum Fins, Add	1,313.28	
For Electric Heating Coil, Add	1,514.05	
For Chilled Water Cooling Coil, Aluminum Fins, Add	4,826.90	
For Direct Expansion Cooling Coil, Aluminum Fins, Add	4,826.90	
For Chilled Water Cooling Coil, Copper Fins, Add	5,830.80	
For Direct Expansion Cooling Coil, Copper Fins, Add	5,830.80	
For 2 Coils, Independent Circuits, Add	1,514.05	
23 73 13 00-0061 EA 6,000 CFM Multizone Air Handling Unit, Built-Up, Horizontal / Vertical, Draw-Through Fan	13,976.78	2,316.63
For Economizer, Panel, Controls And Damper(s), Add	2,570.05	
For Flat Filter Box And Throwaway Filters, Add	1,232.22	
For Medium Capacity Filter Box And Throwaway Filters, Add	2,365.16	
For Combination Filter Mixing Box And Throwaway Filters, Add	2,997.82	
For Manual Roll Filter, Add	6,198.10	
For Automatic Roll Filter, Add	6,198.10	
For Hot Water Heating Coil, Aluminum Fins, Add	1,397.68	
For Electric Heating Coil, Add	1,611.03	
For Chilled Water Cooling Coil, Aluminum Fins, Add	5,131.34	
For Direct Expansion Cooling Coil, Aluminum Fins, Add	5,131.34	
For Chilled Water Cooling Coil, Copper Fins, Add	6,198.10	
For Direct Expansion Cooling Coil, Copper Fins, Add	6,198.10	
For 2 Coils, Independent Circuits, Add	1,611.03	
23 73 13 00-0062 EA 6,500 CFM Multizone Air Handling Unit, Built-Up, Horizontal / Vertical, Draw-Through Fan	15,319.35	2,515.64
For Economizer, Panel, Controls And Damper(s), Add	2,724.99	
For Flat Filter Box And Throwaway Filters, Add	1,352.39	
For Medium Capacity Filter Box And Throwaway Filters, Add	2,597.05	
For Combination Filter Mixing Box And Throwaway Filters, Add	3,291.20	
For Manual Roll Filter, Add	6,809.74	
For Automatic Roll Filter, Add	6,809.74	
For Hot Water Heating Coil, Aluminum Fins, Add	1,531.94	
For Electric Heating Coil, Add	1,766.50	
For Chilled Water Cooling Coil, Aluminum Fins, Add	5,636.90	
For Direct Expansion Cooling Coil, Aluminum Fins, Add	5,636.90	
For Chilled Water Cooling Coil, Copper Fins, Add	6,809.74	
For Direct Expansion Cooling Coil, Copper Fins, Add	6,809.74	
For 2 Coils, Independent Circuits, Add	1,766.50	
23 73 13 00-0063 EA 7,000 CFM Multizone Air Handling Unit, Built-Up, Horizontal / Vertical, Draw-Through Fan	16,462.13	2,709.63
For Economizer, Panel, Controls And Damper(s), Add	2,878.09	
For Flat Filter Box And Throwaway Filters, Add	1,452.75	
For Medium Capacity Filter Box And Throwaway Filters, Add	2,789.42	
For Combination Filter Mixing Box And Throwaway Filters, Add	3,535.14	
For Manual Roll Filter, Add	7,313.00	
For Automatic Roll Filter, Add	7,313.00	
For Hot Water Heating Coil, Aluminum Fins, Add	1,646.21	
For Electric Heating Coil, Add	1,898.07	
For Chilled Water Cooling Coil, Aluminum Fins, Add	6,053.72	
For Direct Expansion Cooling Coil, Aluminum Fins, Add	6,053.72	
For Chilled Water Cooling Coil, Copper Fins, Add	7,313.00	
For Direct Expansion Cooling Coil, Copper Fins, Add	7,313.00	
For 2 Coils, Independent Circuits, Add	1,898.07	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 70 Central HVAC Equipment****23 73 Indoor Central-Station Air-Handling Units**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 73 13 00-0064	EA		7,500 CFM Multizone Air Handling Unit, Built-Up, Horizontal / Vertical, Draw-Through Fan	17,300.15	2,929.67
			<i>For Economizer, Panel, Controls And Damper(s), Add</i>	2,610.74	
			<i>For Flat Filter Box And Throwaway Filters, Add</i>	1,521.17	
			<i>For Medium Capacity Filter Box And Throwaway Filters, Add</i>	2,917.04	
			<i>For Combination Filter Mixing Box And Throwaway Filters, Add</i>	3,698.51	
			<i>For Manual Roll Filter, Add</i>	7,635.50	
			<i>For Automatic Roll Filter, Add</i>	7,635.50	
			<i>For Hot Water Heating Coil, Aluminum Fins, Add</i>	1,730.02	
			<i>For Electric Heating Coil, Add</i>	1,992.48	
			<i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i>	6,323.17	
			<i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i>	6,323.17	
			<i>For Chilled Water Cooling Coil, Copper Fins, Add</i>	7,635.50	
			<i>For Direct Expansion Cooling Coil, Copper Fins, Add</i>	7,635.50	
			<i>For 2 Coils, Independent Circuits, Add</i>	1,992.48	
23 73 13 00-0065	EA		8,000 CFM Multizone Air Handling Unit, Built-Up, Horizontal / Vertical, Draw-Through Fan	19,172.72	3,160.12
			<i>For Economizer, Panel, Controls And Damper(s), Add</i>	2,746.82	
			<i>For Flat Filter Box And Throwaway Filters, Add</i>	1,691.42	
			<i>For Medium Capacity Filter Box And Throwaway Filters, Add</i>	3,247.33	
			<i>For Combination Filter Mixing Box And Throwaway Filters, Add</i>	4,115.62	
			<i>For Manual Roll Filter, Add</i>	8,512.32	
			<i>For Automatic Roll Filter, Add</i>	8,512.32	
			<i>For Hot Water Heating Coil, Aluminum Fins, Add</i>	1,917.27	
			<i>For Electric Heating Coil, Add</i>	2,210.39	
			<i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i>	7,046.76	
			<i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i>	7,046.76	
			<i>For Chilled Water Cooling Coil, Copper Fins, Add</i>	8,512.32	
			<i>For Direct Expansion Cooling Coil, Copper Fins, Add</i>	8,512.32	
			<i>For 2 Coils, Independent Circuits, Add</i>	2,210.39	
23 73 13 00-0066	EA		8,500 CFM Multizone Air Handling Unit, Built-Up, Horizontal / Vertical, Draw-Through Fan	20,212.86	3,406.44
			<i>For Economizer, Panel, Controls And Damper(s), Add</i>	2,887.84	
			<i>For Flat Filter Box And Throwaway Filters, Add</i>	1,777.81	
			<i>For Medium Capacity Filter Box And Throwaway Filters, Add</i>	3,409.52	
			<i>For Combination Filter Mixing Box And Throwaway Filters, Add</i>	4,322.78	
			<i>For Manual Roll Filter, Add</i>	8,925.75	
			<i>For Automatic Roll Filter, Add</i>	8,925.75	
			<i>For Hot Water Heating Coil, Aluminum Fins, Add</i>	2,021.29	
			<i>For Electric Heating Coil, Add</i>	2,328.15	
			<i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i>	7,391.43	
			<i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i>	7,391.43	
			<i>For Chilled Water Cooling Coil, Copper Fins, Add</i>	8,925.75	
			<i>For Direct Expansion Cooling Coil, Copper Fins, Add</i>	8,925.75	
			<i>For 2 Coils, Independent Circuits, Add</i>	2,328.15	
23 73 13 00-0067	EA		9,000 CFM Multizone Air Handling Unit, Built-Up, Horizontal / Vertical, Draw-Through Fan	21,363.49	3,689.60
			<i>For Economizer, Panel, Controls And Damper(s), Add</i>	3,041.62	
			<i>For Flat Filter Box And Throwaway Filters, Add</i>	1,873.65	
			<i>For Medium Capacity Filter Box And Throwaway Filters, Add</i>	3,589.67	
			<i>For Combination Filter Mixing Box And Throwaway Filters, Add</i>	4,552.77	
			<i>For Manual Roll Filter, Add</i>	9,385.60	
			<i>For Automatic Roll Filter, Add</i>	9,385.60	
			<i>For Hot Water Heating Coil, Aluminum Fins, Add</i>	2,136.35	
			<i>For Electric Heating Coil, Add</i>	2,458.54	
			<i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i>	7,774.66	
			<i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i>	7,774.66	
			<i>For Chilled Water Cooling Coil, Copper Fins, Add</i>	9,385.60	
			<i>For Direct Expansion Cooling Coil, Copper Fins, Add</i>	9,385.60	
			<i>For 2 Coils, Independent Circuits, Add</i>	2,458.54	
23 73 13 00-0068	EA		10,000 CFM Multizone Air Handling Unit, Built-Up, Horizontal / Vertical, Draw-Through Fan	22,608.46	3,982.86
			<i>For Economizer, Panel, Controls And Damper(s), Add</i>	2,888.06	
			<i>For Flat Filter Box And Throwaway Filters, Add</i>	1,976.17	
			<i>For Medium Capacity Filter Box And Throwaway Filters, Add</i>	3,781.53	
			<i>For Combination Filter Mixing Box And Throwaway Filters, Add</i>	4,798.08	
			<i>For Manual Roll Filter, Add</i>	9,872.56	
			<i>For Automatic Roll Filter, Add</i>	9,872.56	
			<i>For Hot Water Heating Coil, Aluminum Fins, Add</i>	2,260.85	
			<i>For Electric Heating Coil, Add</i>	2,599.14	
			<i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i>	8,181.07	
			<i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i>	8,181.07	
			<i>For Chilled Water Cooling Coil, Copper Fins, Add</i>	9,872.56	
			<i>For Direct Expansion Cooling Coil, Copper Fins, Add</i>	9,872.56	
			<i>For 2 Coils, Independent Circuits, Add</i>	2,599.14	
23 73 13 00-0069	EA		11,500 CFM Multizone Air Handling Unit, Built-Up, Horizontal / Vertical, Draw-Through Fan	23,258.48	4,135.07
			<i>For Economizer, Panel, Controls And Damper(s), Add</i>	2,956.35	
			<i>For Flat Filter Box And Throwaway Filters, Add</i>	2,029.79	
			<i>For Medium Capacity Filter Box And Throwaway Filters, Add</i>	3,881.94	
			<i>For Combination Filter Mixing Box And Throwaway Filters, Add</i>	4,926.44	
			<i>For Manual Roll Filter, Add</i>	10,127.63	
			<i>For Automatic Roll Filter, Add</i>	10,127.63	
			<i>For Hot Water Heating Coil, Aluminum Fins, Add</i>	2,325.85	
			<i>For Electric Heating Coil, Add</i>	2,672.59	
			<i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i>	8,393.90	
			<i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i>	8,393.90	
			<i>For Chilled Water Cooling Coil, Copper Fins, Add</i>	10,127.63	
			<i>For Direct Expansion Cooling Coil, Copper Fins, Add</i>	10,127.63	
			<i>For 2 Coils, Independent Circuits, Add</i>	2,672.59	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 73 13 00-0070 EA 12,500 CFM Multizone Air Handling Unit, Built-Up, Horizontal / Vertical, Draw-Through Fan	23,874.30	4,282.65
For Economizer, Panel, Controls And Damper(s), Add	3,014.39	
For Flat Filter Box And Throwaway Filters, Add	2,081.70	
For Medium Capacity Filter Box And Throwaway Filters, Add	3,979.96	
For Combination Filter Mixing Box And Throwaway Filters, Add	5,051.38	
For Manual Roll Filter, Add	10,379.29	
For Automatic Roll Filter, Add	10,379.29	
For Hot Water Heating Coil, Aluminum Fins, Add	2,387.43	
For Electric Heating Coil, Add	2,742.62	
For Chilled Water Cooling Coil, Aluminum Fins, Add	8,603.32	
For Direct Expansion Cooling Coil, Aluminum Fins, Add	8,603.32	
For Chilled Water Cooling Coil, Copper Fins, Add	10,379.29	
For Direct Expansion Cooling Coil, Copper Fins, Add	10,379.29	
For 2 Coils, Independent Circuits, Add	2,742.62	
23 73 13 00-0071 EA 13,500 CFM Multizone Air Handling Unit, Built-Up, Horizontal / Vertical, Draw-Through Fan	26,891.04	4,454.77
For Economizer, Panel, Controls And Damper(s), Add	2,676.19	
For Flat Filter Box And Throwaway Filters, Add	2,370.06	
For Medium Capacity Filter Box And Throwaway Filters, Add	4,548.68	
For Combination Filter Mixing Box And Throwaway Filters, Add	5,765.61	
For Manual Roll Filter, Add	11,918.64	
For Automatic Roll Filter, Add	11,918.64	
For Hot Water Heating Coil, Aluminum Fins, Add	2,689.10	
For Electric Heating Coil, Add	3,099.31	
For Chilled Water Cooling Coil, Aluminum Fins, Add	9,867.63	
For Direct Expansion Cooling Coil, Aluminum Fins, Add	9,867.63	
For Chilled Water Cooling Coil, Copper Fins, Add	11,918.64	
For Direct Expansion Cooling Coil, Copper Fins, Add	11,918.64	
For 2 Coils, Independent Circuits, Add	3,099.31	
23 73 13 00-0072 EA 15,000 CFM Multizone Air Handling Unit, Built-Up, Horizontal / Vertical, Draw-Through Fan	29,879.63	4,631.24
For Economizer, Panel, Controls And Damper(s), Add	2,893.35	
For Flat Filter Box And Throwaway Filters, Add	2,657.01	
For Medium Capacity Filter Box And Throwaway Filters, Add	5,115.44	
For Combination Filter Mixing Box And Throwaway Filters, Add	6,477.03	
For Manual Roll Filter, Add	13,455.17	
For Automatic Roll Filter, Add	13,455.17	
For Hot Water Heating Coil, Aluminum Fins, Add	2,987.96	
For Electric Heating Coil, Add	3,453.17	
For Chilled Water Cooling Coil, Aluminum Fins, Add	11,129.13	
For Direct Expansion Cooling Coil, Aluminum Fins, Add	11,129.13	
For Chilled Water Cooling Coil, Copper Fins, Add	13,455.17	
For Direct Expansion Cooling Coil, Copper Fins, Add	13,455.17	
For 2 Coils, Independent Circuits, Add	3,453.17	
23 73 13 00-0073 EA 16,500 CFM Multizone Air Handling Unit, Built-Up, Horizontal / Vertical, Draw-Through Fan	34,218.41	4,805.91
For Economizer, Panel, Controls And Damper(s), Add	2,935.82	
For Flat Filter Box And Throwaway Filters, Add	3,078.75	
For Medium Capacity Filter Box And Throwaway Filters, Add	5,951.65	
For Combination Filter Mixing Box And Throwaway Filters, Add	7,525.33	
For Manual Roll Filter, Add	15,732.31	
For Automatic Roll Filter, Add	15,732.31	
For Hot Water Heating Coil, Aluminum Fins, Add	3,421.84	
For Electric Heating Coil, Add	3,968.97	
For Chilled Water Cooling Coil, Aluminum Fins, Add	12,996.65	
For Direct Expansion Cooling Coil, Aluminum Fins, Add	12,996.65	
For Chilled Water Cooling Coil, Copper Fins, Add	15,732.31	
For Direct Expansion Cooling Coil, Copper Fins, Add	15,732.31	
For 2 Coils, Independent Circuits, Add	3,968.97	
23 73 13 00-0074 EA 17,500 CFM Multizone Air Handling Unit, Built-Up, Horizontal / Vertical, Draw-Through Fan	38,560.63	4,978.86
For Economizer, Panel, Controls And Damper(s), Add	2,978.89	
For Flat Filter Box And Throwaway Filters, Add	3,500.67	
For Medium Capacity Filter Box And Throwaway Filters, Add	6,788.10	
For Combination Filter Mixing Box And Throwaway Filters, Add	8,573.97	
For Manual Roll Filter, Add	18,009.78	
For Automatic Roll Filter, Add	18,009.78	
For Hot Water Heating Coil, Aluminum Fins, Add	3,856.06	
For Electric Heating Coil, Add	4,485.12	
For Chilled Water Cooling Coil, Aluminum Fins, Add	14,864.51	
For Direct Expansion Cooling Coil, Aluminum Fins, Add	14,864.51	
For Chilled Water Cooling Coil, Copper Fins, Add	18,009.78	
For Direct Expansion Cooling Coil, Copper Fins, Add	18,009.78	
For 2 Coils, Independent Circuits, Add	4,485.12	
23 73 13 00-0075 EA 20,000 CFM Multizone Air Handling Unit, Built-Up, Horizontal / Vertical, Draw-Through Fan	43,248.76	5,398.14
For Economizer, Panel, Controls And Damper(s), Add	3,084.21	
For Flat Filter Box And Throwaway Filters, Add	3,939.39	
For Medium Capacity Filter Box And Throwaway Filters, Add	5,870.53	
For Combination Filter Mixing Box And Throwaway Filters, Add	9,655.73	
For Manual Roll Filter, Add	14,986.58	
For Automatic Roll Filter, Add	18,540.48	
For Hot Water Heating Coil, Aluminum Fins, Add	4,324.88	
For Electric Heating Coil, Add	5,035.66	
For Chilled Water Cooling Coil, Aluminum Fins, Add	14,986.58	
For Direct Expansion Cooling Coil, Aluminum Fins, Add	14,986.58	
For Steam Heating Coil, Aluminum Fins, Add	7,878.78	
For Chilled Water Cooling Coil, Copper Fins, Add	18,540.48	
For Direct Expansion Cooling Coil, Copper Fins, Add	18,540.48	
For 2 Coils, Independent Circuits, Add	5,035.66	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 70 Central HVAC Equipment****23 73 Indoor Central-Station Air-Handling Units**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 73 13 00-0076	EA		22,500 CFM Multizone Air Handling Unit, Built-Up, Horizontal / Vertical, Draw-Through Fan	46,648.53	5,869.82
			<i>For Economizer, Panel, Controls And Damper(s), Add</i>	3,015.92	
			<i>For Flat Filter Box And Throwaway Filters, Add</i>	4,247.88	
			<i>For Medium Capacity Filter Box And Throwaway Filters, Add</i>	6,330.12	
			<i>For Combination Filter Mixing Box And Throwaway Filters, Add</i>	10,411.21	
			<i>For Manual Roll Filter, Add</i>	16,157.57	
			<i>For Automatic Roll Filter, Add</i>	19,988.47	
			<i>For Hot Water Heating Coil, Aluminum Fins, Add</i>	4,664.85	
			<i>For Electric Heating Coil, Add</i>	5,431.03	
			<i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i>	16,157.57	
			<i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i>	16,157.57	
			<i>For Steam Heating Coil, Aluminum Fins, Add</i>	8,495.76	
			<i>For Chilled Water Cooling Coil, Copper Fins, Add</i>	19,988.47	
			<i>For Direct Expansion Cooling Coil, Copper Fins, Add</i>	19,988.47	
			<i>For 2 Coils, Independent Circuits, Add</i>	5,431.03	
23 73 13 00-0077	EA		25,000 CFM Multizone Air Handling Unit, Built-Up, Horizontal / Vertical, Draw-Through Fan	55,499.23	6,341.27
			<i>For Economizer, Panel, Controls And Damper(s), Add</i>	3,123.53	
			<i>For Flat Filter Box And Throwaway Filters, Add</i>	5,097.08	
			<i>For Medium Capacity Filter Box And Throwaway Filters, Add</i>	7,600.33	
			<i>For Combination Filter Mixing Box And Throwaway Filters, Add</i>	12,516.28	
			<i>For Manual Roll Filter, Add</i>	19,482.63	
			<i>For Automatic Roll Filter, Add</i>	24,126.86	
			<i>For Hot Water Heating Coil, Aluminum Fins, Add</i>	5,549.92	
			<i>For Electric Heating Coil, Add</i>	6,478.77	
			<i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i>	19,482.63	
			<i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i>	19,482.63	
			<i>For Steam Heating Coil, Aluminum Fins, Add</i>	10,194.16	
			<i>For Chilled Water Cooling Coil, Copper Fins, Add</i>	24,126.86	
			<i>For Direct Expansion Cooling Coil, Copper Fins, Add</i>	24,126.86	
			<i>For 2 Coils, Independent Circuits, Add</i>	6,478.77	
23 73 13 00-0078	EA		27,500 CFM Multizone Air Handling Unit, Built-Up, Horizontal / Vertical, Draw-Through Fan	62,660.55	6,865.58
			<i>For Economizer, Panel, Controls And Damper(s), Add</i>	3,234.11	
			<i>For Flat Filter Box And Throwaway Filters, Add</i>	5,776.35	
			<i>For Medium Capacity Filter Box And Throwaway Filters, Add</i>	8,615.56	
			<i>For Combination Filter Mixing Box And Throwaway Filters, Add</i>	14,196.03	
			<i>For Manual Roll Filter, Add</i>	22,126.00	
			<i>For Automatic Roll Filter, Add</i>	27,412.65	
			<i>For Hot Water Heating Coil, Aluminum Fins, Add</i>	6,266.06	
			<i>For Electric Heating Coil, Add</i>	7,323.38	
			<i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i>	22,126.00	
			<i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i>	22,126.00	
			<i>For Steam Heating Coil, Aluminum Fins, Add</i>	11,552.70	
			<i>For Chilled Water Cooling Coil, Copper Fins, Add</i>	27,412.65	
			<i>For Direct Expansion Cooling Coil, Copper Fins, Add</i>	27,412.65	
			<i>For 2 Coils, Independent Circuits, Add</i>	7,323.38	
23 73 13 00-0079	EA		30,000 CFM Multizone Air Handling Unit, Built-Up, Horizontal / Vertical, Draw-Through Fan	67,907.33	7,389.91
			<i>For Economizer, Panel, Controls And Damper(s), Add</i>	3,349.24	
			<i>For Flat Filter Box And Throwaway Filters, Add</i>	6,262.65	
			<i>For Medium Capacity Filter Box And Throwaway Filters, Add</i>	9,341.17	
			<i>For Combination Filter Mixing Box And Throwaway Filters, Add</i>	15,392.59	
			<i>For Manual Roll Filter, Add</i>	23,994.44	
			<i>For Automatic Roll Filter, Add</i>	29,729.01	
			<i>For Hot Water Heating Coil, Aluminum Fins, Add</i>	6,790.73	
			<i>For Electric Heating Coil, Add</i>	7,937.65	
			<i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i>	23,994.44	
			<i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i>	23,994.44	
			<i>For Steam Heating Coil, Aluminum Fins, Add</i>	12,525.30	
			<i>For Chilled Water Cooling Coil, Copper Fins, Add</i>	29,729.01	
			<i>For Direct Expansion Cooling Coil, Copper Fins, Add</i>	29,729.01	
			<i>For 2 Coils, Independent Circuits, Add</i>	7,937.65	
23 73 13 00-0080	EA		32,500 CFM Multizone Air Handling Unit, Built-Up, Horizontal / Vertical, Draw-Through Fan	75,993.18	8,647.27
			<i>For Economizer, Panel, Controls And Damper(s), Add</i>	3,372.65	
			<i>For Flat Filter Box And Throwaway Filters, Add</i>	6,982.26	
			<i>For Medium Capacity Filter Box And Throwaway Filters, Add</i>	10,411.68	
			<i>For Combination Filter Mixing Box And Throwaway Filters, Add</i>	17,147.11	
			<i>For Manual Roll Filter, Add</i>	26,694.91	
			<i>For Automatic Roll Filter, Add</i>	33,060.10	
			<i>For Hot Water Heating Coil, Aluminum Fins, Add</i>	7,599.32	
			<i>For Electric Heating Coil, Add</i>	8,872.36	
			<i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i>	26,694.91	
			<i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i>	26,694.91	
			<i>For Steam Heating Coil, Aluminum Fins, Add</i>	13,964.51	
			<i>For Chilled Water Cooling Coil, Copper Fins, Add</i>	33,060.10	
			<i>For Direct Expansion Cooling Coil, Copper Fins, Add</i>	33,060.10	
			<i>For 2 Coils, Independent Circuits, Add</i>	8,872.36	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 73 13 00-0081 EA 35,000 CFM Multizone Air Handling Unit, Built-Up, Horizontal / Vertical, Draw-Through Fan	76,454.75	8,961.95
For Economizer, Panel, Controls And Damper(s), Add	3,430.35	
For Flat Filter Box And Throwaway Filters, Add	7,005.34	
For Medium Capacity Filter Box And Throwaway Filters, Add	10,443.99	
For Combination Filter Mixing Box And Throwaway Filters, Add	17,193.27	
For Manual Roll Filter, Add	26,741.06	
For Automatic Roll Filter, Add	33,106.26	
For Hot Water Heating Coil, Aluminum Fins, Add	7,645.48	
For Electric Heating Coil, Add	8,918.51	
For Chilled Water Cooling Coil, Aluminum Fins, Add	26,741.06	
For Direct Expansion Cooling Coil, Aluminum Fins, Add	26,741.06	
For Steam Heating Coil, Aluminum Fins, Add	14,010.67	
For Chilled Water Cooling Coil, Copper Fins, Add	33,106.26	
For Direct Expansion Cooling Coil, Copper Fins, Add	33,106.26	
For 2 Coils, Independent Circuits, Add	8,918.51	
23 73 13 00-0082 EA 37,500 CFM Multizone Air Handling Unit, Built-Up, Horizontal / Vertical, Draw-Through Fan	79,941.75	9,276.10
For Economizer, Panel, Controls And Damper(s), Add	3,488.05	
For Flat Filter Box And Throwaway Filters, Add	7,330.96	
For Medium Capacity Filter Box And Throwaway Filters, Add	10,930.11	
For Combination Filter Mixing Box And Throwaway Filters, Add	17,995.78	
For Manual Roll Filter, Add	27,997.39	
For Automatic Roll Filter, Add	34,665.13	
For Hot Water Heating Coil, Aluminum Fins, Add	7,994.18	
For Electric Heating Coil, Add	9,327.72	
For Chilled Water Cooling Coil, Aluminum Fins, Add	27,997.39	
For Direct Expansion Cooling Coil, Aluminum Fins, Add	27,997.39	
For Steam Heating Coil, Aluminum Fins, Add	14,661.91	
For Chilled Water Cooling Coil, Copper Fins, Add	34,665.13	
For Direct Expansion Cooling Coil, Copper Fins, Add	34,665.13	
For 2 Coils, Independent Circuits, Add	9,327.72	
23 73 13 00-0083 EA 40,000 CFM Multizone Air Handling Unit, Built-Up, Horizontal / Vertical, Draw-Through Fan	83,702.53	9,957.72
For Economizer, Panel, Controls And Damper(s), Add	3,606.98	
For Flat Filter Box And Throwaway Filters, Add	7,659.46	
For Medium Capacity Filter Box And Throwaway Filters, Add	11,418.11	
For Combination Filter Mixing Box And Throwaway Filters, Add	18,793.26	
For Manual Roll Filter, Add	29,216.27	
For Automatic Roll Filter, Add	36,164.94	
For Hot Water Heating Coil, Aluminum Fins, Add	8,370.25	
For Electric Heating Coil, Add	9,759.99	
For Chilled Water Cooling Coil, Aluminum Fins, Add	29,216.27	
For Direct Expansion Cooling Coil, Aluminum Fins, Add	29,216.27	
For Steam Heating Coil, Aluminum Fins, Add	15,318.93	
For Chilled Water Cooling Coil, Copper Fins, Add	36,164.94	
For Direct Expansion Cooling Coil, Copper Fins, Add	36,164.94	
For 2 Coils, Independent Circuits, Add	9,759.99	
23 73 13 00-0084 EA 45,000 CFM Multizone Air Handling Unit, Built-Up, Horizontal / Vertical, Draw-Through Fan	90,131.01	10,481.81
For Economizer, Panel, Controls And Damper(s), Add	3,693.47	
For Flat Filter Box And Throwaway Filters, Add	8,267.71	
For Medium Capacity Filter Box And Throwaway Filters, Add	12,327.03	
For Combination Filter Mixing Box And Throwaway Filters, Add	20,296.59	
For Manual Roll Filter, Add	31,580.08	
For Automatic Roll Filter, Add	39,102.40	
For Hot Water Heating Coil, Aluminum Fins, Add	9,013.10	
For Electric Heating Coil, Add	10,517.57	
For Chilled Water Cooling Coil, Aluminum Fins, Add	31,580.08	
For Direct Expansion Cooling Coil, Aluminum Fins, Add	31,580.08	
For Steam Heating Coil, Aluminum Fins, Add	16,535.43	
For Chilled Water Cooling Coil, Copper Fins, Add	39,102.40	
For Direct Expansion Cooling Coil, Copper Fins, Add	39,102.40	
For 2 Coils, Independent Circuits, Add	10,517.57	
23 73 13 00-0085 EA 50,000 CFM Multizone Air Handling Unit, Built-Up, Horizontal / Vertical, Draw-Through Fan	96,856.03	11,058.32
For Economizer, Panel, Controls And Damper(s), Add	3,481.77	
For Flat Filter Box And Throwaway Filters, Add	8,894.72	
For Medium Capacity Filter Box And Throwaway Filters, Add	13,262.99	
For Combination Filter Mixing Box And Throwaway Filters, Add	21,841.36	
For Manual Roll Filter, Add	33,997.11	
For Automatic Roll Filter, Add	42,100.95	
For Hot Water Heating Coil, Aluminum Fins, Add	9,685.60	
For Electric Heating Coil, Add	11,306.37	
For Chilled Water Cooling Coil, Aluminum Fins, Add	33,997.11	
For Direct Expansion Cooling Coil, Aluminum Fins, Add	33,997.11	
For Steam Heating Coil, Aluminum Fins, Add	17,789.44	
For Chilled Water Cooling Coil, Copper Fins, Add	42,100.95	
For Direct Expansion Cooling Coil, Copper Fins, Add	42,100.95	
For 2 Coils, Independent Circuits, Add	11,306.37	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 70 Central HVAC Equipment****23 73 Indoor Central-Station Air-Handling Units**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 73 13 00-0086	EA		55,000 CFM Multizone Air Handling Unit, Built-Up, Horizontal / Vertical, Draw-Through Fan	104,283.43	11,739.63
			<i>For Economizer, Panel, Controls And Damper(s), Add</i>	3,576.20	
			<i>For Flat Filter Box And Throwaway Filters, Add</i>	9,590.24	
			<i>For Medium Capacity Filter Box And Throwaway Filters, Add</i>	14,301.56	
			<i>For Combination Filter Mixing Box And Throwaway Filters, Add</i>	23,556.56	
			<i>For Manual Roll Filter, Add</i>	36,684.78	
			<i>For Automatic Roll Filter, Add</i>	45,436.92	
			<i>For Hot Water Heating Coil, Aluminum Fins, Add</i>	10,428.34	
			<i>For Electric Heating Coil, Add</i>	12,178.77	
			<i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i>	36,684.78	
			<i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i>	36,684.78	
			<i>For Steam Heating Coil, Aluminum Fins, Add</i>	19,180.49	
			<i>For Chilled Water Cooling Coil, Copper Fins, Add</i>	45,436.92	
			<i>For Direct Expansion Cooling Coil, Copper Fins, Add</i>	45,436.92	
			<i>For 2 Coils, Independent Circuits, Add</i>	12,178.77	
23 73 13 00-0087	EA		60,000 CFM Multizone Air Handling Unit, Built-Up, Horizontal / Vertical, Draw-Through Fan	111,724.52	12,054.09
			<i>For Economizer, Panel, Controls And Damper(s), Add</i>	3,618.96	
			<i>For Flat Filter Box And Throwaway Filters, Add</i>	10,312.97	
			<i>For Medium Capacity Filter Box And Throwaway Filters, Add</i>	15,383.51	
			<i>For Combination Filter Mixing Box And Throwaway Filters, Add</i>	25,352.69	
			<i>For Manual Roll Filter, Add</i>	39,532.93	
			<i>For Automatic Roll Filter, Add</i>	48,986.43	
			<i>For Hot Water Heating Coil, Aluminum Fins, Add</i>	11,172.45	
			<i>For Electric Heating Coil, Add</i>	13,063.15	
			<i>For Chilled Water Cooling Coil, Aluminum Fins, Add</i>	39,532.93	
			<i>For Direct Expansion Cooling Coil, Aluminum Fins, Add</i>	39,532.93	
			<i>For Steam Heating Coil, Aluminum Fins, Add</i>	20,625.95	
			<i>For Chilled Water Cooling Coil, Copper Fins, Add</i>	48,986.43	
			<i>For Direct Expansion Cooling Coil, Copper Fins, Add</i>	48,986.43	
			<i>For 2 Coils, Independent Circuits, Add</i>	13,063.15	
23 73 13 00-0088			Return/Supply Air Fan <small>(23 73 13)</small>		
			Note: Includes vibration mounts.		
23 73 13 00-0089	EA		300 CFM Return Air Fan.....	1,944.14	419.20
23 73 13 00-0090	EA		500 CFM Return Air Fan.....	2,511.03	503.06
23 73 13 00-0091	EA		750 CFM Return Air Fan.....	2,622.49	524.02
23 73 13 00-0092	EA		1,000 CFM Return Air Fan.....	2,982.94	555.46
23 73 13 00-0093	EA		1,250 CFM Return Air Fan.....	3,076.03	581.66
23 73 13 00-0094	EA		1,500 CFM Return Air Fan.....	3,150.48	607.87
23 73 13 00-0095	EA		1,750 CFM Return Air Fan.....	3,306.83	639.31
23 73 13 00-0096	EA		2,000 CFM Return Air Fan.....	3,667.26	670.76
23 73 13 00-0097	EA		2,250 CFM Return Air Fan.....	3,842.09	702.21
23 73 13 00-0098	EA		2,500 CFM Return Air Fan.....	3,942.69	733.65
23 73 13 00-0099	EA		3,000 CFM Return Air Fan.....	4,184.67	812.26
23 73 13 00-0100	EA		3,500 CFM Return Air Fan.....	4,300.38	854.19
23 73 13 00-0101	EA		4,000 CFM Return Air Fan.....	4,408.43	890.88
23 73 13 00-0102	EA		4,500 CFM Return Air Fan.....	4,542.68	932.88
23 73 13 00-0103	EA		5,000 CFM Return Air Fan.....	4,665.65	980.05
23 73 13 00-0104	EA		5,500 CFM Return Air Fan.....	4,904.45	1,095.35
23 73 13 00-0105	EA		6,000 CFM Return Air Fan.....	5,586.06	1,299.74
23 73 13 00-0106	EA		6,500 CFM Return Air Fan.....	5,727.81	1,320.71
23 73 13 00-0107	EA		7,000 CFM Return Air Fan.....	5,790.64	1,325.95
23 73 13 00-0108	EA		8,000 CFM Return Air Fan.....	6,080.84	1,346.91
23 73 13 00-0109	EA		9,000 CFM Return Air Fan.....	6,212.16	1,362.64
23 73 13 00-0110	EA		10,000 CFM Return Air Fan.....	6,530.83	1,415.27
23 73 13 00-0111	EA		12,500 CFM Return Air Fan.....	6,938.06	1,441.17
23 73 13 00-0112	EA		15,000 CFM Return Air Fan.....	7,795.57	1,482.13
23 73 13 00-0113	EA		17,500 CFM Return Air Fan.....	8,484.37	1,561.71
23 73 13 00-0114	EA		20,000 CFM Return Air Fan.....	10,028.78	1,629.69
23 73 13 00-0115	EA		22,500 CFM Return Air Fan.....	10,504.82	1,686.53
23 73 13 00-0116	EA		25,000 CFM Return Air Fan.....	10,972.88	1,734.74
23 73 13 00-0117	EA		27,500 CFM Return Air Fan.....	11,649.61	1,907.70
23 73 13 00-0118	EA		30,000 CFM Return Air Fan.....	12,448.08	2,012.36
23 73 13 00-0119	EA		35,000 CFM Return Air Fan.....	13,997.46	2,096.13
23 73 13 00-0120	EA		40,000 CFM Return Air Fan.....	16,449.58	2,305.77
23 73 13 00-0121	EA		45,000 CFM Return Air Fan.....	20,182.56	2,620.23
23 73 13 00-0122	EA		50,000 CFM Return Air Fan.....	24,437.38	2,714.79
23 73 13 00-0123	EA		55,000 CFM Return Air Fan.....	25,566.34	2,793.18
23 73 13 00-0124	EA		60,000 CFM Return Air Fan.....	26,157.85	2,866.55
23 73 13 00-0125	EA		65,000 CFM Return Air Fan.....	27,427.88	2,992.26
23 73 13 00-0126	EA		70,000 CFM Return Air Fan.....	28,807.85	3,139.61
23 73 13 00-0127	EA		75,000 CFM Return Air Fan.....	30,963.06	3,293.61
23 73 13 00-0128	EA		80,000 CFM Return Air Fan.....	32,344.34	3,468.21
23 73 13 00-0129	EA		90,000 CFM Return Air Fan.....	33,419.56	3,665.71
23 73 13 00-0130	EA		100,000 CFM Return Air Fan.....	35,903.91	3,833.50
23 73 13 00-0131	EA		115,000 CFM Return Air Fan.....	38,596.73	4,016.85
23 73 13 00-0132	EA		130,000 CFM Return Air Fan.....	41,520.03	4,219.23
23 73 13 00-0133	EA		150,000 CFM Return Air Fan.....	45,383.04	4,443.99
23 73 13 00-0134			Removal And Reinstallation Of Air Handling Unit <small>(23 73 13)</small>		
			Note: Air handling units with filter and coils. Includes storage and cleaning. Excludes ductwork.		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 73 13 00-0135 EA Remove And Reinstall Air Handling Unit Up To 11,500 CFM.....	1,919.74	
23 73 13 00-0136 EA Remove And Reinstall Air Handling Unit, >11,500 To 16,500 CFM.....	2,604.17	
23 73 13 00-0137 EA Remove And Reinstall Air Handling Unit, >16,500 To 22,000 CFM.....	3,239.57	
23 73 13 00-0138 EA Remove And Reinstall Air Handling Unit, >22,000 CFM.....	5,910.80	

23 74 Packaged Outdoor HVAC Equipment (23 70)

23 74 13 Packaged, Outdoor, Central-Station Air-Handling Units (23 74)

Note: Includes throwaway filters, filter rack, and manual outside air damper. Units are shipped fully factory assembled in one piece, prepped, charged with refrigerant, and include start-up. Excludes crane and associated personnel.

23 74 13 00-0001 Electric Cooling, Gas Heat, Packaged, Outdoor, Central-Station Air-Handling Units (23 74 13)

23 74 13 00-0002 Electric Cooling, Gas Heat, Self Contained Package Rooftop Unit (23 74 13 00-0001)

Note: Units up to 5 tons have 13 SEER. Units >5 to 19 tons have 11 EER, >19 to 63 tons have 9.3 EER and >63 tons have 9.0 EER. Excludes crane and associated personnel.

23 74 13 00-0003	EA	2 Ton Electric Cooling, 60 MBH Gas Heating, Self Contained Package Rooftop Unit.....	3,414.88	
		<i>For Hot Water Heating Coil Instead Of Gas, Deduct</i>	-156.94	
		<i>For Steam Heating Coil Instead Of Gas, Deduct</i>	-62.78	
		<i>For Unit Economizer, Add</i>	404.27	
		<i>For Unit Placed On Concrete Slab Or Ground Instead Of Roof, Deduct</i>	-41.40	
		<i>For Equipment Base Roof Curb, Add</i>	263.02	
23 74 13 00-0004	EA	3 Ton Electric Cooling, 60 MBH Gas Heating, Self Contained Package Rooftop Unit.....	3,322.29	156.64
		<i>For Hot Water Heating Coil Instead Of Gas, Deduct</i>	-150.45	
		<i>For Steam Heating Coil Instead Of Gas, Deduct</i>	-60.18	
		<i>For Unit Economizer, Add</i>	392.41	
		<i>For Unit Placed On Concrete Slab Or Ground Instead Of Roof, Deduct</i>	-46.99	
		<i>For Equipment Base Roof Curb, Add</i>	257.00	
23 74 13 00-0005	EA	4 Ton Electric Cooling, 80 MBH Gas Heating, Self Contained Package Rooftop Unit.....	3,886.74	164.10
		<i>For Hot Water Heating Coil Instead Of Gas, Deduct</i>	-178.30	
		<i>For Steam Heating Coil Instead Of Gas, Deduct</i>	-71.32	
		<i>For Unit Economizer, Add</i>	459.99	
		<i>For Unit Placed On Concrete Slab Or Ground Instead Of Roof, Deduct</i>	-48.11	
		<i>For Equipment Base Roof Curb, Add</i>	299.52	
23 74 13 00-0006	EA	5 Ton Electric Cooling, 100 MBH Gas Heating, Self Contained Package Rooftop Unit.....	4,384.80	201.39
		<i>For Hot Water Heating Coil Instead Of Gas, Deduct</i>	-199.10	
		<i>For Steam Heating Coil Instead Of Gas, Deduct</i>	-79.64	
		<i>For Unit Economizer, Add</i>	518.12	
		<i>For Unit Placed On Concrete Slab Or Ground Instead Of Roof, Deduct</i>	-60.42	
		<i>For Equipment Base Roof Curb, Add</i>	338.93	
23 74 13 00-0007	EA	6 Ton Electric Cooling, 140 MBH Gas Heating, Self Contained Package Rooftop Unit.....	5,058.63	216.32
		<i>For Hot Water Heating Coil Instead Of Gas, Deduct</i>	-231.30	
		<i>For Steam Heating Coil Instead Of Gas, Deduct</i>	-92.52	
		<i>For Unit Economizer, Add</i>	598.38	
		<i>For Unit Placed On Concrete Slab Or Ground Instead Of Roof, Deduct</i>	-64.89	
		<i>For Equipment Base Roof Curb, Add</i>	390.21	
23 74 13 00-0008	EA	7.5 Ton Electric Cooling, 150 MBH Gas Heating, Self Contained Package Rooftop Unit.....	6,448.47	231.24
		<i>For Hot Water Heating Coil Instead Of Gas, Deduct</i>	-299.30	
		<i>For Steam Heating Coil Instead Of Gas, Deduct</i>	-119.72	
		<i>For Unit Economizer, Add</i>	764.57	
		<i>For Unit Placed On Concrete Slab Or Ground Instead Of Roof, Deduct</i>	-69.37	
		<i>For Equipment Base Roof Curb, Add</i>	495.20	
23 74 13 00-0009	EA	8.5 Ton Electric Cooling, 150 MBH Gas Heating, Self Contained Package Rooftop Unit.....	7,181.39	238.70
		<i>For Hot Water Heating Coil Instead Of Gas, Deduct</i>	-335.20	
		<i>For Steam Heating Coil Instead Of Gas, Deduct</i>	-134.08	
		<i>For Unit Economizer, Add</i>	852.22	
		<i>For Unit Placed On Concrete Slab Or Ground Instead Of Roof, Deduct</i>	-71.61	
		<i>For Equipment Base Roof Curb, Add</i>	550.54	
23 74 13 00-0010	EA	10 Ton Electric Cooling, 200 MBH Gas Heating, Self Contained Package Rooftop Unit.....	7,613.10	246.15
		<i>For Hot Water Heating Coil Instead Of Gas, Deduct</i>	-356.41	
		<i>For Steam Heating Coil Instead Of Gas, Deduct</i>	-142.57	
		<i>For Unit Economizer, Add</i>	903.88	
		<i>For Unit Placed On Concrete Slab Or Ground Instead Of Roof, Deduct</i>	-72.73	
		<i>For Equipment Base Roof Curb, Add</i>	583.10	
23 74 13 00-0011	EA	12.5 Ton Electric Cooling, 250 MBH Gas Heating, Self Contained Package Rooftop Unit.....	10,143.37	305.83
		<i>For Hot Water Heating Coil Instead Of Gas, Deduct</i>	-476.59	
		<i>For Steam Heating Coil Instead Of Gas, Deduct</i>	-190.63	
		<i>For Unit Economizer, Add</i>	1,204.97	
		<i>For Unit Placed On Concrete Slab Or Ground Instead Of Roof, Deduct</i>	-91.75	
		<i>For Equipment Base Roof Curb, Add</i>	776.04	
23 74 13 00-0012	EA	15 Ton Electric Cooling, 300 MBH Gas Heating, Self Contained Package Rooftop Unit.....	12,604.56	365.50
		<i>For Hot Water Heating Coil Instead Of Gas, Deduct</i>	-593.68	
		<i>For Steam Heating Coil Instead Of Gas, Deduct</i>	-237.47	
		<i>For Unit Economizer, Add</i>	1,497.93	
		<i>For Unit Placed On Concrete Slab Or Ground Instead Of Roof, Deduct</i>	-109.65	
		<i>For Equipment Base Roof Curb, Add</i>	963.62	
23 74 13 00-0013	EA	18 Ton Electric Cooling, 300 MBH Gas Heating, Self Contained Package Rooftop Unit.....	15,017.21	425.18
		<i>For Hot Water Heating Coil Instead Of Gas, Deduct</i>	-708.72	
		<i>For Steam Heating Coil Instead Of Gas, Deduct</i>	-283.49	
		<i>For Unit Economizer, Add</i>	1,785.21	
		<i>For Unit Placed On Concrete Slab Or Ground Instead Of Roof, Deduct</i>	-126.43	
		<i>For Equipment Base Roof Curb, Add</i>	1,147.36	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 70 Central HVAC Equipment****23 74 Packaged Outdoor HVAC Equipment**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 74 13 00-0014 EA 20 Ton Electric Cooling, 300 MBH Gas Heating, Self Contained Package Rooftop Unit.....	17,445.54	477.39
<i>For Hot Water Heating Coil Instead Of Gas, Deduct</i>	-824.17	
<i>For Steam Heating Coil Instead Of Gas, Deduct</i>	-329.67	
<i>For Unit Economizer, Add</i>	2,074.22	
<i>For Unit Placed On Concrete Slab Or Ground Instead Of Roof, Deduct</i>	-144.34	
<i>For Equipment Base Roof Curb, Add</i>	1,332.47	
23 74 13 00-0015 EA 25 Ton Electric Cooling, 400 MBH Gas Heating, Self Contained Package Rooftop Unit.....	17,916.15	611.65
<i>For Hot Water Heating Coil Instead Of Gas, Deduct</i>	-834.64	
<i>For Steam Heating Coil Instead Of Gas, Deduct</i>	-333.86	
<i>For Unit Economizer, Add</i>	2,125.47	
<i>For Unit Placed On Concrete Slab Or Ground Instead Of Roof, Deduct</i>	-183.50	
<i>For Equipment Base Roof Curb, Add</i>	1,374.29	
23 74 13 00-0016 EA 30 Ton Electric Cooling, 500 MBH Gas Heating, Self Contained Package Rooftop Unit.....	18,673.59	745.92
<i>For Hot Water Heating Coil Instead Of Gas, Deduct</i>	-859.09	
<i>For Steam Heating Coil Instead Of Gas, Deduct</i>	-343.64	
<i>For Unit Economizer, Add</i>	2,210.99	
<i>For Unit Placed On Concrete Slab Or Ground Instead Of Roof, Deduct</i>	-223.78	
<i>For Equipment Base Roof Curb, Add</i>	1,437.82	
23 74 13 00-0017 EA 40 Ton Electric Cooling, 600 MBH Gas Heating, Self Contained Package Rooftop Unit.....	25,599.72	895.10
<i>For Hot Water Heating Coil Instead Of Gas, Deduct</i>	-1,190.85	
<i>For Steam Heating Coil Instead Of Gas, Deduct</i>	-476.34	
<i>For Unit Economizer, Add</i>	3,036.31	
<i>For Unit Placed On Concrete Slab Or Ground Instead Of Roof, Deduct</i>	-267.41	
<i>For Equipment Base Roof Curb, Add</i>	1,964.55	
23 74 13 00-0018 EA 50 Ton Electric Cooling, 750 MBH Gas Heating, Self Contained Package Rooftop Unit.....	31,502.61	1,118.88
<i>For Hot Water Heating Coil Instead Of Gas, Deduct</i>	-1,463.24	
<i>For Steam Heating Coil Instead Of Gas, Deduct</i>	-585.30	
<i>For Unit Economizer, Add</i>	3,735.56	
<i>For Unit Placed On Concrete Slab Or Ground Instead Of Roof, Deduct</i>	-335.66	
<i>For Equipment Base Roof Curb, Add</i>	2,418.64	
23 74 13 00-0019 EA 60 Ton Electric Cooling, 900 MBH Gas Heating, Self Contained Package Rooftop Unit.....	36,655.50	1,215.84
<i>For Hot Water Heating Coil Instead Of Gas, Deduct</i>	-1,711.19	
<i>For Steam Heating Coil Instead Of Gas, Deduct</i>	-684.48	
<i>For Unit Economizer, Add</i>	4,350.03	
<i>For Unit Placed On Concrete Slab Or Ground Instead Of Roof, Deduct</i>	-364.76	
<i>For Equipment Base Roof Curb, Add</i>	2,809.96	
23 74 13 00-0020 EA 80 Ton Electric Cooling, 1,000 MBH Gas Heating, Self Contained Package Rooftop Unit.....	52,381.90	1,462.01
<i>For Hot Water Heating Coil Instead Of Gas, Deduct</i>	-2,473.27	
<i>For Steam Heating Coil Instead Of Gas, Deduct</i>	-989.31	
<i>For Unit Economizer, Add</i>	6,227.50	
<i>For Unit Placed On Concrete Slab Or Ground Instead Of Roof, Deduct</i>	-437.48	
<i>For Equipment Base Roof Curb, Add</i>	4,001.56	
23 74 13 00-0021 EA 90 Ton Electric Cooling, 1,200 MBH Gas Heating, Self Contained Package Rooftop Unit.....	61,442.24	1,529.13
<i>For Hot Water Heating Coil Instead Of Gas, Deduct</i>	-2,919.57	
<i>For Steam Heating Coil Instead Of Gas, Deduct</i>	-1,167.83	
<i>For Unit Economizer, Add</i>	7,312.05	
<i>For Unit Placed On Concrete Slab Or Ground Instead Of Roof, Deduct</i>	-457.62	
<i>For Equipment Base Roof Curb, Add</i>	4,684.44	
23 74 13 00-0022 EA 100 Ton Electric Cooling, 1,350 MBH Gas Heating, Self Contained Package Rooftop Unit.....	66,136.72	1,678.31
<i>For Hot Water Heating Coil Instead Of Gas, Deduct</i>	-3,139.00	
<i>For Steam Heating Coil Instead Of Gas, Deduct</i>	-1,255.60	
<i>For Unit Economizer, Add</i>	7,869.27	
<i>For Unit Placed On Concrete Slab Or Ground Instead Of Roof, Deduct</i>	-503.49	
<i>For Equipment Base Roof Curb, Add</i>	5,044.17	
23 74 13 00-0023 AAON Rooftop Units <small>(23 74 13)</small>		
Note: The minimum EER for units 5 to 10 tons is 11.2, >10 to 20 tons is 11.0, and >20 is 10.0. See CSI section 26 28 16 00-0001 for disconnects.		
23 74 13 00-0024 AAON RQ Rooftop Units <small>(23 74 13 00-0023)</small>		
Note: Includes 2" double wall foam panel construction, direct drive fan with VFD (or ECM motor), single stage on/off scroll compressor, terminal strip for field supplied thermostat, gas heat, manually adjustable OSA damper, microchannel condenser coils. Excludes economizer, controls, disconnect, freight, roof curb, items not specifically mentioned above. Excludes crane and associated personnel.		
23 74 13 00-0025 EA 2 Ton, Air Cooled Packaged Rooftop Units (AAON RQ-002)	5,395.47	149.18
<i>For Factory Installed And Wired Dry Bulb Economizer, Add</i>	644.47	
<i>For Single Zone VAV Controls, Includes Modulating Compressor And Supply Fan, Add</i>	699.21	
<i>For Factory Authorized Start Up, 4 Hour, One Trip, Add</i>	550.48	
<i>For Factory Installed Non-Fused Disconnect, Add</i>	630.01	
<i>For Factory Installed Exhaust Fan, Add</i>	3,212.01	
<i>For Hot Water Coil In Lieu Of Gas Heat, Add</i>	749.81	
23 74 13 00-0026 EA 3 Ton, Air Cooled Packaged Rooftop Units (AAON RQ-003)	5,813.17	156.64
<i>For Factory Installed And Wired Dry Bulb Economizer, Add</i>	690.94	
<i>For Single Zone VAV Controls, Includes Modulating Compressor And Supply Fan, Add</i>	749.81	
<i>For Factory Authorized Start Up, 4 Hour, One Trip, Add</i>	589.73	
<i>For Factory Installed Non-Fused Disconnect, Add</i>	675.45	
<i>For Factory Installed Exhaust Fan, Add</i>	3,212.01	
<i>For Hot Water Coil In Lieu Of Gas Heat, Add</i>	749.81	
23 74 13 00-0027 EA 4 Ton, Air Cooled Packaged Rooftop Units (AAON RQ-004)	5,920.01	164.10
<i>For Factory Installed And Wired Dry Bulb Economizer, Add</i>	690.94	
<i>For Single Zone VAV Controls, Includes Modulating Compressor And Supply Fan, Add</i>	749.81	
<i>For Factory Authorized Start Up, 4 Hour, One Trip, Add</i>	589.73	
<i>For Factory Installed Non-Fused Disconnect, Add</i>	675.45	
<i>For Factory Installed Exhaust Fan, Add</i>	3,212.01	
<i>For Hot Water Coil In Lieu Of Gas Heat, Add</i>	749.81	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 74 13 00-0028 EA 5 Ton, Air Cooled Packaged Rooftop Units (AAON RQ-005)	6,016.53	179.02
<i>For Factory Installed And Wired Dry Bulb Economizer, Add</i>	690.94	
<i>For Single Zone VAV Controls, Includes Modulating Compressor And Supply Fan, Add</i>	749.81	
<i>For Factory Authorized Start Up, 4 Hour, One Trip, Add</i>	589.73	
<i>For Factory Installed Non-Fused Disconnect, Add</i>	675.45	
<i>For Factory Installed Exhaust Fan, Add</i>	3,212.01	
<i>For Hot Water Coil In Lieu Of Gas Heat, Add</i>	749.81	
23 74 13 00-0029 EA 6 Ton, Air Cooled Packaged Rooftop Units (AAON RQ-006)	6,583.99	186.48
<i>For Factory Installed And Wired Dry Bulb Economizer, Add</i>	690.94	
<i>For Single Zone VAV Controls, Includes Modulating Compressor And Supply Fan, Add</i>	749.81	
<i>For Factory Authorized Start Up, 4 Hour, One Trip, Add</i>	589.73	
<i>For Factory Installed Non-Fused Disconnect, Add</i>	675.45	
<i>For Factory Installed Exhaust Fan, Add</i>	3,212.01	
<i>For Hot Water Coil In Lieu Of Gas Heat, Add</i>	749.81	
23 74 13 00-0030 AAON RNA Rooftop Units <small>(23 74 13 00-0023)</small>		
Note: Includes 2" double wall foam panel construction, direct drive fan with VFD, single stage on/off compressor, terminal strip for field provided thermostat, gas heat, manually adjustable OSA damper. Excludes economizer, controls, disconnect, freight, roof curb, items not specifically mentioned above. Excludes crane and associated personnel.		
23 74 13 00-0031 EA 6 Ton, Air Cooled Packaged Rooftop Units (AAON RNA-006)	8,211.11	193.94
<i>For Factory Installed And Wired Dry Bulb Economizer, Add</i>	672.35	
<i>For Single Zone VAV Controls, Includes Modulating Compressor And Supply Fan, Add</i>	1,032.80	
<i>For Factory Authorized Start Up, 4 Hour, One Trip, Add</i>	688.88	
<i>For Factory Installed Non-Fused Disconnect, Add</i>	636.20	
<i>For Factory Installed Exhaust Fan, Add</i>	1,715.48	
<i>For Hot Water Coil In Lieu Of Gas Heat, Add</i>	584.56	
23 74 13 00-0032 EA 7 Ton, Air Cooled Packaged Rooftop Units (AAON RNA-007)	8,797.63	208.86
<i>For Factory Installed And Wired Dry Bulb Economizer, Add</i>	672.35	
<i>For Single Zone VAV Controls, Includes Modulating Compressor And Supply Fan, Add</i>	1,032.80	
<i>For Factory Authorized Start Up, 4 Hour, One Trip, Add</i>	688.88	
<i>For Factory Installed Non-Fused Disconnect, Add</i>	636.20	
<i>For Factory Installed Exhaust Fan, Add</i>	1,715.48	
<i>For Hot Water Coil In Lieu Of Gas Heat, Add</i>	584.56	
23 74 13 00-0033 EA 8 Ton, Air Cooled Packaged Rooftop Units (AAON RNA-008)	10,178.36	223.77
<i>For Factory Installed And Wired Dry Bulb Economizer, Add</i>	672.35	
<i>For Single Zone VAV Controls, Includes Modulating Compressor And Supply Fan, Add</i>	1,032.80	
<i>For Factory Authorized Start Up, 4 Hour, One Trip, Add</i>	688.88	
<i>For Factory Installed Non-Fused Disconnect, Add</i>	636.20	
<i>For Factory Installed Exhaust Fan, Add</i>	1,715.48	
<i>For Hot Water Coil In Lieu Of Gas Heat, Add</i>	584.56	
23 74 13 00-0034 EA 10 Ton, Air Cooled Packaged Rooftop Units (AAON RNA-010)	10,277.86	246.15
<i>For Factory Installed And Wired Dry Bulb Economizer, Add</i>	672.35	
<i>For Single Zone VAV Controls, Includes Modulating Compressor And Supply Fan, Add</i>	1,032.80	
<i>For Factory Authorized Start Up, 4 Hour, One Trip, Add</i>	688.88	
<i>For Factory Installed Non-Fused Disconnect, Add</i>	636.20	
<i>For Factory Installed Exhaust Fan, Add</i>	1,715.48	
<i>For Hot Water Coil In Lieu Of Gas Heat, Add</i>	584.56	
23 74 13 00-0035 AAON RNB Rooftop Units <small>(23 74 13 00-0023)</small>		
Note: Includes 2" double wall foam panel construction, direct drive fan with VFD, (1) on/off scroll compressors, terminal strip for field provided thermostat, gas heat, factory installed 3 position economizer. Excludes controls, disconnect, freight, roof curb, items not specifically mentioned above. Excludes crane and associated personnel.		
23 74 13 00-0036 EA 9 Ton, Air Cooled Packaged Rooftop Units (AAON RNB-009)	12,420.92	246.15
<i>For Single Zone VAV Controls, Includes Modulating Compressor And Supply Fan, Add</i>	990.46	
<i>For Factory Authorized Start Up, 4 Hour, One Trip, Add</i>	774.60	
<i>For Factory Installed Non-Fused Disconnect, Add</i>	614.52	
<i>For Factory Installed Exhaust Fan, Add</i>	1,635.96	
<i>For Hot Water Coil In Lieu Of Gas Heat, Add</i>	587.66	
23 74 13 00-0037 EA 11 Ton, Air Cooled Packaged Rooftop Units (AAON RNB-011)	12,639.87	275.99
<i>For Single Zone VAV Controls, Includes Modulating Compressor And Supply Fan, Add</i>	990.46	
<i>For Factory Authorized Start Up, 4 Hour, One Trip, Add</i>	774.60	
<i>For Factory Installed Non-Fused Disconnect, Add</i>	614.52	
<i>For Factory Installed Exhaust Fan, Add</i>	1,635.96	
<i>For Hot Water Coil In Lieu Of Gas Heat, Add</i>	587.66	
23 74 13 00-0038 EA 13 Ton, Air Cooled Packaged Rooftop Units (AAON RNB-013)	13,750.93	305.83
<i>For Single Zone VAV Controls, Includes Modulating Compressor And Supply Fan, Add</i>	990.46	
<i>For Factory Authorized Start Up, 4 Hour, One Trip, Add</i>	774.60	
<i>For Factory Installed Non-Fused Disconnect, Add</i>	614.52	
<i>For Factory Installed Exhaust Fan, Add</i>	1,635.96	
<i>For Hot Water Coil In Lieu Of Gas Heat, Add</i>	587.66	
23 74 13 00-0039 EA 15 Ton, Air Cooled Packaged Rooftop Units (AAON RNB-015)	14,050.22	335.66
<i>For Single Zone VAV Controls, Includes Modulating Compressor And Supply Fan, Add</i>	990.46	
<i>For Factory Authorized Start Up, 4 Hour, One Trip, Add</i>	774.60	
<i>For Factory Installed Non-Fused Disconnect, Add</i>	614.52	
<i>For Factory Installed Exhaust Fan, Add</i>	1,635.96	
<i>For Hot Water Coil In Lieu Of Gas Heat, Add</i>	587.66	
23 74 13 00-0040 AAON RNC Rooftop Units <small>(23 74 13 00-0023)</small>		
Note: Includes 2" double wall foam panel construction, direct drive fan with VFD, (2) on/off scroll compressors, terminal strip for field provided thermostat, gas heat, factory installed 3 position economizer. Excludes controls, disconnect, freight, roof curb, items not specifically mentioned above. Excludes crane and associated personnel.		

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 70 Central HVAC Equipment****23 74 Packaged Outdoor HVAC Equipment**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 74 13 00-0041 EA 16 Ton, Air Cooled Packaged Rooftop Units (AAON RNC-016).....	18,542.67	365.50
For Single Zone VAV Controls, Includes Modulating Compressor And Supply Fan, Add	1,462.44	
For Factory Authorized Start Up, 4 Hour, One Trip, Add	1,032.80	
For Factory Installed Non-Fused Disconnect, Add	614.52	
For Factory Installed Exhaust Fan, Add	3,000.28	
For Hot Water Coil In Lieu Of Gas Heat, Add	267.50	
23 74 13 00-0042 EA 18 Ton, Air Cooled Packaged Rooftop Units (AAON RNC-018).....	20,050.33	395.33
For Single Zone VAV Controls, Includes Modulating Compressor And Supply Fan, Add	1,462.44	
For Factory Authorized Start Up, 4 Hour, One Trip, Add	1,032.80	
For Factory Installed Non-Fused Disconnect, Add	614.52	
For Factory Installed Exhaust Fan, Add	3,000.28	
For Hot Water Coil In Lieu Of Gas Heat, Add	267.50	
23 74 13 00-0043 EA 20 Ton, Air Cooled Packaged Rooftop Units (AAON RNC-020).....	21,250.45	425.18
For Single Zone VAV Controls, Includes Modulating Compressor And Supply Fan, Add	1,462.44	
For Factory Authorized Start Up, 4 Hour, One Trip, Add	1,032.80	
For Factory Installed Non-Fused Disconnect, Add	614.52	
For Factory Installed Exhaust Fan, Add	3,000.28	
For Hot Water Coil In Lieu Of Gas Heat, Add	267.50	
23 74 13 00-0044 EA 25 Ton, Air Cooled Packaged Rooftop Units (AAON RNC-025).....	22,750.64	484.85
For Single Zone VAV Controls, Includes Modulating Compressor And Supply Fan, Add	1,462.44	
For Factory Authorized Start Up, 4 Hour, One Trip, Add	1,032.80	
For Factory Installed Non-Fused Disconnect, Add	614.52	
For Factory Installed Exhaust Fan, Add	3,000.28	
For Hot Water Coil In Lieu Of Gas Heat, Add	267.50	
23 74 13 00-0045 EA 30 Ton, Air Cooled Packaged Rooftop Units (AAON RNC-030).....	25,684.37	551.98
For Single Zone VAV Controls, Includes Modulating Compressor And Supply Fan, Add	1,462.44	
For Factory Authorized Start Up, 4 Hour, One Trip, Add	1,032.80	
For Factory Installed Non-Fused Disconnect, Add	614.52	
For Factory Installed Exhaust Fan, Add	3,000.28	
For Hot Water Coil In Lieu Of Gas Heat, Add	267.50	
23 74 13 00-0046 AAON RND Rooftop Units <small>(23 74 13 00-0023)</small>		
Note: Includes 2" double wall foam panel construction, direct drive fan with VFD, (2) variable capacity digital scroll compressor and (2) on/off compressor, VAV unit controller (varies fan speed and compressor capacity for energy savings year round), cooling only - no heat, factory installed economizer with powered exhaust fans with VFD's, (building static pressure control), factory installed non-fused disconnect, freight and factory start up. Excludes roof curb, items not specifically mentioned above. Excludes crane and associated personnel.		
23 74 13 00-0047 EA 26 Ton, Air Cooled Packaged Rooftop Units (AAON RND-026).....	35,728.13	611.65
For Factory Authorized Start Up, 4 Hour, One Trip, Add	1,291.00	
For Factory Installed Non-Fused Disconnect, Add	1,398.41	
For Hot Water Coil In Lieu Of Gas Heat, Add	1,962.32	
23 74 13 00-0048 EA 31 Ton, Air Cooled Packaged Rooftop Units (AAON RND-031).....	40,568.40	671.33
For Factory Authorized Start Up, 4 Hour, One Trip, Add	1,291.00	
For Factory Installed Non-Fused Disconnect, Add	1,398.41	
For Hot Water Coil In Lieu Of Gas Heat, Add	1,962.32	
23 74 13 00-0049 EA 40 Ton, Air Cooled Packaged Rooftop Units (AAON RND-040).....	47,229.50	760.84
For Factory Authorized Start Up, 4 Hour, One Trip, Add	1,291.00	
For Factory Installed Non-Fused Disconnect, Add	1,398.41	
For Hot Water Coil In Lieu Of Gas Heat, Add	1,962.32	
23 74 13 00-0050 EA 50 Ton, Air Cooled Packaged Rooftop Units (AAON RND-050).....	54,958.30	857.81
For Factory Authorized Start Up, 4 Hour, One Trip, Add	1,291.00	
For Factory Installed Non-Fused Disconnect, Add	1,398.41	
For Hot Water Coil In Lieu Of Gas Heat, Add	1,962.32	
23 74 13 00-0051 EA 60 Ton, Air Cooled Packaged Rooftop Units (AAON RND-060).....	59,828.51	947.31
For Factory Authorized Start Up, 4 Hour, One Trip, Add	1,291.00	
For Factory Installed Non-Fused Disconnect, Add	1,398.41	
For Hot Water Coil In Lieu Of Gas Heat, Add	1,962.32	
23 74 13 00-0052 EA 70 Ton, Air Cooled Packaged Rooftop Units (AAON RND-070).....	62,844.64	1,036.83
For Factory Authorized Start Up, 4 Hour, One Trip, Add	1,291.00	
For Factory Installed Non-Fused Disconnect, Add	1,398.41	
For Hot Water Coil In Lieu Of Gas Heat, Add	1,962.32	
23 74 13 00-0053 AAON RNE Rooftop Units <small>(23 74 13 00-0023)</small>		
Note: Includes 2" double wall foam panel construction, direct drive fan with VFD, (1 or 2) variable speed VFD controlled scroll compressor and (1 or 2) on/off compressor, VAV unit controller (varies fan speed and compressor capacity for energy savings year round), cooling only - no heat, factory installed economizer with powered exhaust fans with VFD's, (building static pressure control), Microchannel condenser coils with VFD controlled condenser fans, factory installed non fused disconnect, freight and factory start up. Excludes roof curb, items not specifically mentioned above. Excludes crane and associated personnel.		
23 74 13 00-0054 EA 55 Ton, Air Cooled Packaged Rooftop Units (AAON RNE-055).....	58,977.15	1,156.18
For Factory Authorized Start Up, 4 Hour, One Trip, Add	1,458.31	
For Factory Installed Non-Fused Disconnect, Add	2,094.52	
For Hot Water Coil In Lieu Of Gas Heat, Add	2,788.56	
23 74 13 00-0055 EA 65 Ton, Air Cooled Packaged Rooftop Units (AAON RNE-065).....	64,764.27	1,282.98
For Factory Authorized Start Up, 4 Hour, One Trip, Add	1,458.31	
For Factory Installed Non-Fused Disconnect, Add	2,094.52	
For Hot Water Coil In Lieu Of Gas Heat, Add	2,788.56	
23 74 13 00-0056 EA 75 Ton, Air Cooled Packaged Rooftop Units (AAON RNE-075).....	68,833.62	1,402.33
For Factory Authorized Start Up, 4 Hour, One Trip, Add	1,458.31	
For Factory Installed Non-Fused Disconnect, Add	2,094.52	
For Hot Water Coil In Lieu Of Gas Heat, Add	2,788.56	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 74 13 00-0057 EA 95 Ton, Air Cooled Packaged Rooftop Units (AAON RNE-090)	81,921.61	1,529.13
<i>For Factory Authorized Start Up, 4 Hour, One Trip, Add</i>	1,458.31	
<i>For Factory Installed Non-Fused Disconnect, Add</i>	2,094.52	
<i>For Hot Water Coil In Lieu Of Gas Heat, Add</i>	2,788.56	
23 74 13 00-0058 EA 105 Ton, Air Cooled Packaged Rooftop Units (AAON RNE-105)	88,214.58	1,678.31
<i>For Factory Authorized Start Up, 4 Hour, One Trip, Add</i>	1,458.31	
<i>For Factory Installed Non-Fused Disconnect, Add</i>	2,094.52	
<i>For Hot Water Coil In Lieu Of Gas Heat, Add</i>	2,788.56	
23 74 13 00-0059 EA 120 Ton, Air Cooled Packaged Rooftop Units (AAON RNE-120)	103,345.22	1,827.50
<i>For Factory Authorized Start Up, 4 Hour, One Trip, Add</i>	1,458.31	
<i>For Factory Installed Non-Fused Disconnect, Add</i>	2,094.52	
<i>For Hot Water Coil In Lieu Of Gas Heat, Add</i>	2,788.56	
23 74 13 00-0060 EA 130 Ton, Air Cooled Packaged Rooftop Units (AAON RNE-130)	105,641.25	1,984.14
<i>For Factory Authorized Start Up, 4 Hour, One Trip, Add</i>	1,458.31	
<i>For Factory Installed Non-Fused Disconnect, Add</i>	2,094.52	
<i>For Hot Water Coil In Lieu Of Gas Heat, Add</i>	2,788.56	
23 74 13 00-0061 EA 140 Ton, Air Cooled Packaged Rooftop Units (AAON RNE-140)	109,912.00	2,133.32
<i>For Factory Authorized Start Up, 4 Hour, One Trip, Add</i>	1,458.31	
<i>For Factory Installed Non-Fused Disconnect, Add</i>	2,094.52	
<i>For Hot Water Coil In Lieu Of Gas Heat, Add</i>	2,788.56	

23 74 23 Packaged, Outdoor, Heating-Only Makeup-Air Units (23 74)

23 74 23 00-0001 Make-Up Air Units (23 74 23)		
Note: Including throwaway filters. Units are shipped fully factory assembled in one piece, prewired, prepiped, charged with refrigerant, and include start-up. Excludes crane and associated personnel.		
23 74 23 00-0002 Gas-Fired Electric Spark Make-Up Air Units (23 74 23 00-0001)		
Note: With 2-position damper curb filter and thermostat with capillary. Excludes crane and associated personnel.		
23 74 23 00-0003 EA 100,000 BTU 1/2 HP, 1,200 CFM, Make-up Air Unit, Gas Fired, Electric Spark	4,101.29	335.66
<i>For Welded Exterior Waterproof Casing, Double-Wall, With Insulation, Add</i>	1,062.55	
<i>For Equipment Base Roof Curb, Add</i>	324.38	
23 74 23 00-0004 EA 300,000 BTU 1-1/2 HP, 3,500 CFM, Make-up Air Unit, Gas Fired, Electric Spark	5,280.92	380.42
<i>For Welded Exterior Waterproof Casing, Double-Wall, With Insulation, Add</i>	1,392.20	
<i>For Equipment Base Roof Curb, Add</i>	415.28	
23 74 23 00-0005 EA 500,000 BTU 2 HP, 4,000 CFM, Make-up Air Unit, Gas Fired, Electric Spark	7,313.09	447.56
<i>For Welded Exterior Waterproof Casing, Double-Wall, With Insulation, Add</i>	1,970.15	
<i>For Equipment Base Roof Curb, Add</i>	570.86	
23 74 23 00-0006 EA 670,000 BTU 3 HP, 6,000 CFM, Make-up Air Unit, Gas Fired, Electric Spark	7,385.50	477.39
<i>For Welded Exterior Waterproof Casing, Double-Wall, With Insulation, Add</i>	1,975.09	
<i>For Equipment Base Roof Curb, Add</i>	577.97	
23 74 23 00-0007 EA 800,000 BTU 5 HP, 7,500 CFM, Make-up Air Unit, Gas Fired, Electric Spark	10,044.32	537.06
<i>For Welded Exterior Waterproof Casing, Double-Wall, With Insulation, Add</i>	2,744.77	
<i>For Equipment Base Roof Curb, Add</i>	780.18	
23 74 23 00-0008 EA 1,200,000 BTU 10 HP, 10,000 CFM, Make-up Air Unit, Gas Fired, Electric Spark	15,172.18	671.33
<i>For Welded Exterior Waterproof Casing, Double-Wall, With Insulation, Add</i>	4,215.99	
<i>For Equipment Base Roof Curb, Add</i>	1,171.48	
23 74 23 00-0009 Electric Make-Up Air Units (23 74 23 00-0001)		
Note: With 2-position damper curb filter and thermostat with capillary. Excludes crane and associated personnel.		
23 74 23 00-0010 EA 33 KW 1/2 HP, 1,200 CFM Make-up Air Unit, Electric	8,324.75	335.66
<i>For Welded Exterior Waterproof Casing, Double-Wall, With Insulation, Add</i>	2,329.59	
<i>For Equipment Base Roof Curb, Add</i>	641.14	
23 74 23 00-0011 EA 100 KW 1-1/2 HP, 3,500 CFM Make-up Air Unit, Electric	11,872.34	380.42
<i>For Welded Exterior Waterproof Casing, Double-Wall, With Insulation, Add</i>	3,369.63	
<i>For Equipment Base Roof Curb, Add</i>	909.63	
23 74 23 00-0012 EA 150 KW 2 HP, 4,000 CFM Make-up Air Unit, Electric	14,700.11	447.56
<i>For Welded Exterior Waterproof Casing, Double-Wall, With Insulation, Add</i>	4,186.26	
<i>For Equipment Base Roof Curb, Add</i>	1,124.89	
23 74 23 00-0013 EA 250 KW 5 HP, 7,500 CFM Make-up Air Unit, Electric	19,003.66	537.06
<i>For Welded Exterior Waterproof Casing, Double-Wall, With Insulation, Add</i>	5,432.57	
<i>For Equipment Base Roof Curb, Add</i>	1,452.13	
23 74 23 00-0014 EA 400 KW 10 HP, 10,000 CFM Make-up Air Unit, Electric	30,663.05	671.33
<i>For Welded Exterior Waterproof Casing, Double-Wall, With Insulation, Add</i>	8,863.25	
<i>For Equipment Base Roof Curb, Add</i>	2,333.30	

23 76 Evaporative Air-Cooling Equipment (23 70)

23 76 13 Direct Evaporative Air Coolers (23 76)

23 76 13 00-0001 Residential Side Or Down Draft Evaporative Cooling Unit (23 76 13)		
Note: Includes motor, belt and pads.		
23 76 13 00-0002 EA 3,000 CFM, 1/3 HP Residential Side Or Down Draft Evaporative Cooling Unit	961.52	222.35
23 76 13 00-0003 EA 4,300 CFM, 1/3 HP Residential Side Or Down Draft Evaporative Cooling Unit	1,136.13	259.41
23 76 13 00-0004 EA 4,400 CFM, 1/2 HP Residential Side Or Down Draft Evaporative Cooling Unit	1,475.26	296.47
23 76 13 00-0005 EA 5,000 CFM, 3/4 HP Residential Side Or Down Draft Evaporative Cooling Unit	1,604.60	333.52
23 76 13 00-0006 EA 6,000 CFM, 3/4 HP Residential Side Or Down Draft Evaporative Cooling Unit	1,844.35	370.58
23 76 13 00-0007 EA 7,000 CFM, 1 HP Residential Side Or Down Draft Evaporative Cooling Unit	1,984.73	407.65
23 76 13 00-0008 Industrial Side Draft/Side Discharge Evaporative Coolers (23 76 13)		
Note: Excludes motor starter, piping, power wiring and equipment rigging.		

23 Heating, Ventilating, And Air-Conditioning (HVAC)

23 70 Central HVAC Equipment

23 76 Evaporative Air-Cooling Equipment



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 76	13 00-0009	EA	7,500 CFM, 3/4 HP Industrial Side Or Down Draft Evaporative Cooling Unit	1,867.49	222.61
23 76	13 00-0010	EA	8,500 CFM, 1 HP Industrial Side Or Down Draft Evaporative Cooling Unit	1,927.23	229.81
23 76	13 00-0011	EA	9,500 CFM, 1 1/2 HP Industrial Side Or Down Draft Evaporative Cooling Unit	2,293.70	319.17
23 76	13 00-0012	EA	11,375 CFM, 2 HP Industrial Side Or Down Draft Evaporative Cooling Unit	4,917.76	376.75
23 76	13 00-0013	EA	13,020 CFM, 3 HP Industrial Side Or Down Draft Evaporative Cooling Unit	5,318.18	551.57
23 76	13 00-0014	EA	16,267 CFM, 3 HP Industrial Side Or Down Draft Evaporative Cooling Unit	6,094.05	588.34
23 76	13 00-0015	EA	15,438 CFM, 5 HP Industrial Side Or Down Draft Evaporative Cooling Unit	5,594.02	661.88
23 76	13 00-0016	EA	19,286 CFM, 5 HP Industrial Side Or Down Draft Evaporative Cooling Unit	6,633.91	827.34
23 76	13 00-0017	EA	17,672 CFM, 7-1/2 HP Industrial Side Or Down Draft Evaporative Cooling Unit	6,651.91	1,081.50
23 76	13 00-0018	EA	22,077 CFM, 7-1/2 HP Industrial Side Or Down Draft Evaporative Cooling Unit	7,407.43	1,103.13
23 76	13 00-0019	EA	24,301 CFM, 10 HP Industrial Side Or Down Draft Evaporative Cooling Unit	7,799.44	1,225.72
23 76	13 00-0020	EA	30,000 CFM, 20 HP Industrial Side Or Down Draft Evaporative Cooling Unit	10,456.00	1,915.17
23 76	13 00-0021	EA	35,000 CFM, 20 HP Industrial Side Or Down Draft Evaporative Cooling Unit	11,726.83	1,998.42
23 76	13 00-0022	EA	40,000 CFM, 30 HP Industrial Side Or Down Draft Evaporative Cooling Unit	13,012.78	2,089.25

23 80 Decentralized Unitary HVAC Equipment ⁽²³⁾

Note: Where required, mechanical equipment excludes electrical connection, disconnect, or starter unless title states otherwise. See CSI section 23 05 29 00-0000 for hangers and supports, 26 05 19 16-0011 for electrical connection and termination, 26 05 83 00-0110 for terminations, 26 28 16 00-0001 for disconnect.

23 81 Decentralized Unitary HVAC Equipment ^(23 80)

23 81 13 Packaged Terminal Air-Conditioners ^(23 81)

Note: Units consists of fresh air intake, throwaway filters, exhaust, automatic thermostat, hermetically sealed compressor with 5 year guarantee, "sleeve-type" construction, condensing fan motor enclosed, fan to be aluminum, three wire ground cord, multi speed fan, exposed steel parts to be phosphate bonderized with baked enamel finish and copper tubes mechanically expanded into aluminum of evaporator and condensing coils. Includes equipment rigging. Efficiency Rating (ER) not less than 9.

23 81 13 00-0001 Removal And Reinstallation Of Thru-Wall A/C Unit ^(23 81 13)

Note: Includes storage and cleaning.

23 81	13 00-0002	EA	Remove And Reinstall Thru Wall Air Conditioning Unit.....	148.23	
23 81	13 00-0003	EA	Remove And Reinstall Window Air Conditioning Unit In Lower Sash	92.65	
23 81	13 00-0004	EA	Remove And Reinstall Window Air Conditioning Unit In Upper Sash	201.13	

23 81 13 00-0005 Thru Wall A/C Unit Sleeve ^(23 81 13)

Note: Includes wall case, exterior grille, weather panel and steel closure panels. Includes bolts, nuts, washers, caulking and lintel supports. Not for use with new A/C units where wall sleeve is provided. Excludes cutting opening for unit or patching masonry or concrete.

23 81	13 00-0006	EA	Up To 10,000 BTU Unit, Thru Wall A/C Sleeve	65.41	
23 81	13 00-0007	EA	>10,000 To 20,000 BTU Unit, Thru Wall A/C Sleeve	73.85	
23 81	13 00-0008	EA	>20,000 To 30,000 BTU Unit, Thru Wall A/C Sleeve	82.27	

23 81 13 00-0009 Single Package Vertical Wall Cooling Unit ^(23 81 13)

Note: Air-to-air type with electric heat. Includes throwaway filters. Wall units are wired for 230/208 V, 1 phase, 60 HZ. With solid state electronic controls, thermostat, cord and NEMA plug. Units are shipped fully factory assembled in one piece, prewired, prepiped and charged with refrigerant, complete with push button controls, insulated steel cabinet, with wall sleeve and outdoor grille and stainless steel drain pan. Excludes crane and associated personnel.

23 81	13 00-0010	EA	1/2 Ton Package Cooling, Vertical Wall Unit, Air To Air Type With Electric Heat	2,586.81	169.00
23 81	13 00-0011	EA	1 Ton Single Package Cooling, Vertical Wall Unit, Air To Air Type With Electric Heat	4,079.31	177.05
23 81	13 00-0012	EA	1-1/2 Ton Single Package Cooling, Vertical Wall Unit, Air To Air Type With Electric Heat	5,317.12	185.10
23 81	13 00-0013	EA	2 Ton Single Package Cooling, Vertical Wall Unit, Air To Air Type With Electric Heat	6,110.37	201.19
23 81	13 00-0014	EA	2-1/2 Ton Single Package Cooling, Vertical Wall Unit, Air To Air Type With Electric Heat	7,656.83	233.38
23 81	13 00-0015	EA	3 Ton Single Package Cooling, Vertical Wall Unit, Air To Air Type With Electric Heat	8,230.14	289.72
23 81	13 00-0016	EA	3-1/2 Ton Single Package Cooling, Vertical Wall Unit, Air To Air Type With Electric Heat	9,113.71	321.91
23 81	13 00-0017	EA	4 Ton Single Package Cooling, Vertical Wall Unit, Air To Air Type With Electric Heat	10,037.32	362.15
23 81	13 00-0018	EA	5 Ton Single Package Cooling, Vertical Wall Unit, Air To Air Type With Electric Heat	11,303.75	434.58
23 81	13 00-0019	EA	7-1/2 Ton Single Package Cooling, Vertical Wall Unit, Air To Air Type With Electric Heat	14,605.35	539.20
23 81	13 00-0020	EA	10 Ton Single Package Cooling, Vertical Wall Unit, Air To Air Type With Electric Heat	17,450.97	724.30
23 81	13 00-0021	EA	15 Ton Single Package Cooling, Vertical Wall Unit, Air To Air Type With Electric Heat	24,420.21	885.26
23 81	13 00-0022	EA	20 Ton Single Package Cooling, Vertical Wall Unit, Air To Air Type With Electric Heat	28,144.93	1,054.26
23 81	13 00-0023	EA	25 Ton Single Package Cooling, Vertical Wall Unit, Air To Air Type With Electric Heat	33,609.73	1,183.03

23 81 13 00-0024 Packaged Terminal Air-Conditioners ^(23 81 13)

23 81 13 00-0025 Electric Heat, Heating And Cooling, Packaged Terminal Air-Conditioners ^(23 81 13 00-0024)

23 81	13 00-0026	EA	7,200 BTU, 13 EER, 230/208 Volt, Electric Heat, Heating And Cooling, Packaged Terminal Air-Conditioner.....	1,079.08	138.97
			For >35 To 70, Deduct	-24.03	
			For >70 To 100, Deduct	-40.06	
			For >100, Deduct	-56.08	
23 81	13 00-0027	EA	9,400 BTU, 12.1 EER, 230/208 Volt, Electric Heat, Heating And Cooling, Packaged Terminal Air-Conditioner.....	1,154.69	170.14
			For >35 To 70, Deduct	-24.44	
			For >70 To 100, Deduct	-40.74	
			For >100, Deduct	-57.04	
23 81	13 00-0028	EA	11,800 BTU, 11.6 EER, 230/208 Volt, Electric Heat, Heating And Cooling, Packaged Terminal Air-Conditioner.....	1,223.02	181.32
			For >35 To 70, Deduct	-25.80	
			For >70 To 100, Deduct	-43.00	
			For >100, Deduct	-60.20	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 81 13 00-0029 EA 14,500 BTU, 10.4 EER, 230/208 Volt, Electric Heat, Heating And Cooling, Packaged Terminal Air-Conditioner.....	1,320.98	194.90
<i>For >35 To 70, Deduct</i>	-27.94	
<i>For >70 To 100, Deduct</i>	-46.57	
<i>For >100, Deduct</i>	-65.19	
23 81 13 00-0030 Heat Pump, Heating And Cooling, Packaged Terminal Air-Conditioners <small>(23 81 13 00-0024)</small>		
23 81 13 00-0031 EA 7,200 BTU, 13 EER, 230/208 Volt, Heat Pump, Heating And Cooling, Packaged Terminal Air-Conditioner.....	1,158.12	150.97
<i>For >35 To 70, Deduct</i>	-25.70	
<i>For >70 To 100, Deduct</i>	-42.84	
<i>For >100, Deduct</i>	-59.97	
23 81 13 00-0032 EA 9,400 BTU, 12.1 EER, 230/208 Volt, Heat Pump, Heating And Cooling, Packaged Terminal Air-Conditioner.....	1,227.14	170.14
<i>For >35 To 70, Deduct</i>	-26.62	
<i>For >70 To 100, Deduct</i>	-44.36	
<i>For >100, Deduct</i>	-62.11	
23 81 13 00-0033 EA 11,800 BTU, 11.6 EER, 230/208 Volt, Heat Pump, Heating And Cooling, Packaged Terminal Air-Conditioner.....	1,275.52	181.32
<i>For >35 To 70, Deduct</i>	-27.37	
<i>For >70 To 100, Deduct</i>	-45.62	
<i>For >100, Deduct</i>	-63.87	
23 81 13 00-0034 EA 14,500 BTU, 10.4 EER, 230/208 Volt, Heat Pump, Heating And Cooling, Packaged Terminal Air-Conditioner.....	1,390.28	194.90
<i>For >35 To 70, Deduct</i>	-30.02	
<i>For >70 To 100, Deduct</i>	-50.03	
<i>For >100, Deduct</i>	-70.04	
23 81 16 Room Air-Conditioners <small>(23 81)</small>		
Note: Units consists of fresh air intake, throwaway filters, exhaust, automatic thermostat, hermetically sealed compressor with 5 year guarantee, "sleeve-type" construction, condensing fan motor enclosed, fan to be aluminum, three wire ground cord, multi speed fan, exposed steel parts to be phosphate bonderized with baked enamel finish and copper tubes mechanically expanded into aluminum of evaporator and condensing coils. Includes equipment rigging. Efficiency Rating (ER) not less than 9.		
23 81 16 00-0001 Window Unit, Room Air-Conditioners <small>(23 81 16)</small>		
23 81 16 00-0002 Cooling Only, Window Unit, Room Air-Conditioners <small>(23 81 16 00-0001)</small>		
23 81 16 00-0003 Cooling Only, Window Unit, Room Air-Conditioners (Frigidaire) <small>(23 81 16 00-0002)</small>		
23 81 16 00-0004 EA 5,000 BTU, 11.2 EER, 115 Volt, Cooling Only, Window Unit, Room Air-Conditioner (Frigidaire FFRE0533Q1).....	374.65	77.82
<i>For >10 To 50, Deduct</i>	-10.95	
<i>For >50 To 75, Deduct</i>	-15.33	
<i>For >75 To 100, Deduct</i>	-21.90	
<i>For >100, Deduct</i>	-26.28	
23 81 16 00-0005 EA 6,000 BTU, 11.2 EER, 115 Volt, Cooling Only, Window Unit, Room Air-Conditioner (Frigidaire FFRE0633Q1).....	536.36	77.82
<i>For >10 To 50, Deduct</i>	-11.45	
<i>For >50 To 75, Deduct</i>	-16.03	
<i>For >75 To 100, Deduct</i>	-22.90	
<i>For >100, Deduct</i>	-27.48	
23 81 16 00-0006 EA 8,000 BTU, 11.3 EER, 115 Volt, Cooling Only, Window Unit, Room Air-Conditioner (Frigidaire FFRE0833Q1).....	434.65	77.82
<i>For >10 To 50, Deduct</i>	-13.95	
<i>For >50 To 75, Deduct</i>	-19.53	
<i>For >75 To 100, Deduct</i>	-27.90	
<i>For >100, Deduct</i>	-33.48	
23 81 16 00-0007 EA 10,000 BTU, 11.3 EER, 115 Volt, Cooling Only, Window Unit, Room Air-Conditioner (Frigidaire FFRE1033Q1).....	514.65	77.82
<i>For >10 To 50, Deduct</i>	-17.95	
<i>For >50 To 75, Deduct</i>	-25.13	
<i>For >75 To 100, Deduct</i>	-35.90	
<i>For >100, Deduct</i>	-43.08	
23 81 16 00-0008 EA 12,000 BTU, 11.3 EER, 115 Volt, Cooling Only, Window Unit, Room Air-Conditioner (Frigidaire FFRE1233Q1).....	584.65	77.82
<i>For >10 To 50, Deduct</i>	-21.45	
<i>For >50 To 75, Deduct</i>	-30.03	
<i>For >75 To 100, Deduct</i>	-42.90	
<i>For >100, Deduct</i>	-51.48	
23 81 16 00-0009 EA 15,100 BTU, 11.2 EER, 115 Volt, Cooling Only, Window Unit, Room Air-Conditioner (Frigidaire FFRE1533Q1).....	744.65	77.82
<i>For >10 To 50, Deduct</i>	-29.45	
<i>For >50 To 75, Deduct</i>	-41.23	
<i>For >75 To 100, Deduct</i>	-58.90	
<i>For >100, Deduct</i>	-70.68	
23 81 16 00-0010 EA 8,000 BTU, 10.9 EER, 115 Volt, Cooling Only, Casement Window Unit, Room Air-Conditioner (Frigidaire FFRS0833Q1).....	644.65	77.82
<i>For >10 To 50, Deduct</i>	-24.45	
<i>For >50 To 75, Deduct</i>	-34.23	
<i>For >75 To 100, Deduct</i>	-48.90	
<i>For >100, Deduct</i>	-58.68	
23 81 16 00-0011 EA 10,000 BTU, 9.5 EER, 115 Volt, Cooling Only, Casement Window Unit, Room Air-Conditioner (Frigidaire FFRS1022Q1).....	684.65	77.82
<i>For >10 To 50, Deduct</i>	-26.45	
<i>For >50 To 75, Deduct</i>	-37.03	
<i>For >75 To 100, Deduct</i>	-52.90	
<i>For >100, Deduct</i>	-63.48	
23 81 16 00-0012 EA 12,000 BTU, 9.5 EER, 115 Volt, Cooling Only, Casement Window Unit, Room Air-Conditioner (Frigidaire FFRS1222Q1).....	734.65	77.82
<i>For >10 To 50, Deduct</i>	-28.95	
<i>For >50 To 75, Deduct</i>	-40.53	
<i>For >75 To 100, Deduct</i>	-57.90	
<i>For >100, Deduct</i>	-69.48	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 80 Decentralized Unitary HVAC Equipment****23 81 Decentralized Unitary HVAC Equipment**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 81 16 00-0013	EA		15,100 BTU, 10.7 EER, 230/208 Volt, Cooling Only, Window Unit, Room Air-Conditioner (Frigidaire FFRE1533Q1)	744.65	77.82
			<i>For >10 To 50, Deduct</i>	-29.45	
			<i>For >50 To 75, Deduct</i>	-41.23	
			<i>For >75 To 100, Deduct</i>	-58.90	
			<i>For >100, Deduct</i>	-70.68	
23 81 16 00-0014	EA		18,500 BTU, 11.2 EER, 230/208 Volt, Cooling Only, Window Unit, Room Air-Conditioner (Frigidaire FFRE1833Q2)	794.65	77.82
			<i>For >10 To 50, Deduct</i>	-31.95	
			<i>For >50 To 75, Deduct</i>	-44.73	
			<i>For >75 To 100, Deduct</i>	-63.90	
			<i>For >100, Deduct</i>	-76.68	
23 81 16 00-0015	EA		22,000 BTU, 9.8 EER, 230/208 Volt, Cooling Only, Window Unit, Room Air-Conditioner (Frigidaire FFRE2233Q2)	854.65	77.82
			<i>For >10 To 50, Deduct</i>	-34.95	
			<i>For >50 To 75, Deduct</i>	-48.93	
			<i>For >75 To 100, Deduct</i>	-69.90	
			<i>For >100, Deduct</i>	-83.88	
23 81 16 00-0016	EA		25,000 BTU, 9.8 EER, 230/208 Volt, Cooling Only, Window Unit, Room Air-Conditioner (Frigidaire FFRE2533Q2)	864.65	77.82
			<i>For >10 To 50, Deduct</i>	-35.45	
			<i>For >50 To 75, Deduct</i>	-49.63	
			<i>For >75 To 100, Deduct</i>	-70.90	
			<i>For >100, Deduct</i>	-85.08	
23 81 16 00-0017	EA		28,500 BTU, 8.5 EER, 230/208 Volt, Cooling Only, Window Unit, Room Air-Conditioner (Frigidaire FRA296ST2)	1,024.65	77.82
			<i>For >10 To 50, Deduct</i>	-43.45	
			<i>For >50 To 75, Deduct</i>	-60.83	
			<i>For >75 To 100, Deduct</i>	-86.90	
			<i>For >100, Deduct</i>	-104.28	
23 81 16 00-0018			Cooling Only, Window Unit, Room Air-Conditioners (Friedrich Kuhl) <small>(23 81 16 00-0002)</small>		
23 81 16 00-0019	EA		8,000 BTU, 11.2 EER, 110 Volt, Cooling Only, Window Unit, Room Air-Conditioner (Friedrich SS08N10B)	891.84	77.82
23 81 16 00-0020	EA		9,700 BTU, 11.3 EER, 110 Volt, Cooling Only, Window Unit, Room Air-Conditioner (Friedrich SS10N10B)	918.13	77.82
23 81 16 00-0021	EA		12,000 BTU, 11.3 EER, 110 Volt, Cooling Only, Window Unit, Room Air-Conditioner (Friedrich SS12N10B)	944.43	77.82
23 81 16 00-0022	EA		13,500 BTU, 10.8 EER, 110 Volt, Cooling Only, Window Unit, Room Air-Conditioner (Friedrich SS14N10A)	1,023.30	77.82
23 81 16 00-0023	EA		12,100 BTU, 11.3 EER, 220 Volt, Cooling Only, Window Unit, Room Air-Conditioner (Friedrich SS12N30B)	944.43	77.82
23 81 16 00-0024	EA		15,200 BTU, 10.7 EER, 220 Volt, Cooling Only, Window Unit, Room Air-Conditioner (Friedrich SS16N30)	997.01	77.82
23 81 16 00-0025	EA		17,200 BTU, 10.7 EER, 220 Volt, Cooling Only, Window Unit, Room Air-Conditioner (Friedrich SM18N30)	1,023.30	77.82
23 81 16 00-0026	EA		23,200 BTU, 8.5 EER, 220 Volt, Cooling Only, Window Unit, Room Air-Conditioner (Friedrich SM24N30A)	1,154.77	77.82
23 81 16 00-0027	EA		27,600 BTU, 9.6 EER, 220 Volt, Cooling Only, Window Unit, Room Air-Conditioner (Friedrich SL28N30B)	1,391.40	77.82
23 81 16 00-0028	EA		35,500 BTU, 9 EER, 220 Volt, Cooling Only, Window Unit, Room Air-Conditioner (Friedrich SL36N30B)	1,601.74	77.82
23 81 16 00-0029			Heating And Cooling, Window Unit, Room Air-Conditioners <small>(23 81 16 00-0001)</small>		
23 81 16 00-0030			Electric Heat, Heating And Cooling, Window Unit, Room Air-Conditioners (Frigidaire) <small>(23 81 16 00-0029)</small>		
23 81 16 00-0031	EA		8,000 BTU, 9.8 EER, 115 Volt, Electric Heat, Heating And Cooling, Window Unit, Room Air-Conditioner (Frigidaire FRA12EZU2)	714.65	77.82
			<i>For >10 To 50, Deduct</i>	-27.95	
			<i>For >50 To 75, Deduct</i>	-39.13	
			<i>For >75 To 100, Deduct</i>	-55.90	
			<i>For >100, Deduct</i>	-67.08	
23 81 16 00-0032	EA		12,000 BTU, 9.8 EER, 230/208 Volt, Electric Heat, Heating And Cooling, Window Unit, Room Air-Conditioner (Frigidaire FFRH1222Q2)	944.65	77.82
			<i>For >10 To 50, Deduct</i>	-39.45	
			<i>For >50 To 75, Deduct</i>	-55.23	
			<i>For >75 To 100, Deduct</i>	-78.90	
			<i>For >100, Deduct</i>	-94.68	
23 81 16 00-0033	EA		18,000 BTU, 10.7 EER, 230/208 Volt, Electric Heat, Heating And Cooling, Window Unit, Room Air-Conditioner (Frigidaire FFRH1822Q2)	904.65	77.82
			<i>For >10 To 50, Deduct</i>	-37.45	
			<i>For >50 To 75, Deduct</i>	-52.43	
			<i>For >75 To 100, Deduct</i>	-74.90	
			<i>For >100, Deduct</i>	-89.88	
23 81 16 00-0034	EA		25,000 BTU, 9 EER, 230/208 Volt, Electric Heat, Heating And Cooling, Window Unit, Room Air-Conditioner (Frigidaire FFRH2522Q2)	1,124.65	77.82
			<i>For >10 To 50, Deduct</i>	-48.45	
			<i>For >50 To 75, Deduct</i>	-67.83	
			<i>For >75 To 100, Deduct</i>	-96.90	
			<i>For >100, Deduct</i>	-116.28	
23 81 16 00-0035			Electric Heat, Heating And Cooling, Window Unit, Room Air-Conditioners (Friedrich) <small>(23 81 16 00-0029)</small>		
23 81 16 00-0036	EA		7,900 BTU, 11.2 EER, 230/208 Volt, Electric Heat, Heating And Cooling, Window Unit, Room Air-Conditioner (Friedrich EQ08N11B)	914.65	77.82
23 81 16 00-0037	EA		12,000 BTU, 11.3 EER, 230/208 Volt, Electric Heat, Heating And Cooling, Window Unit, Room Air-Conditioner (Friedrich ES12N33B)	1,254.65	77.82
23 81 16 00-0038	EA		15,500 BTU, 10.7 EER, 230/208 Volt, Electric Heat, Heating And Cooling, Window Unit, Room Air-Conditioner (Friedrich ES16N33)	1,334.65	77.82
23 81 16 00-0039	EA		17,500 BTU, 10.7 EER, 230/208 Volt, Electric Heat, Heating And Cooling, Window Unit, Room Air-Conditioner (Friedrich EM18N34)	1,454.65	77.82
23 81 16 00-0040	EA		23,500 BTU, 8.6 EER, 230/208 Volt, Electric Heat, Heating And Cooling, Window Unit, Room Air-Conditioner (Friedrich EM24N34)	1,594.65	77.82



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 81 16 00-0041 EA 36,000 BTU, 9 EER, 230/208 Volt, Electric Heat, Heating And Cooling, Window Unit, Room Air-Conditioner (Friedrich EM36N35B).....	2,204.65	77.82
23 81 16 00-0042 Accessories (23 81 16 00-0001)		
23 81 16 00-0043 SET Aluminum Air Conditioner Unit Frame And Bracket Assembly.....	325.77	43.93
23 81 16 00-0044 Through-The-Wall, Room Air-Conditioners (23 81 16)		
Note: Base unit excludes wall sleeve.		
23 81 16 00-0045 Cooling Only, Through-The-Wall, Room Air-Conditioners (23 81 16 00-0044)		
23 81 16 00-0046 Cooling Only, Through-The-Wall, Room Air-Conditioners (Friedrich) (23 81 16 00-0045)		
23 81 16 00-0047 EA 8,000 BTU, 10.4 EER, 115 Volt, Cooling Only, Through-The-Wall, Room Air-Conditioner (Friedrich WS08C10D).....	790.17	55.59
For >10 To 50, Deduct -33.95		
For >50 To 75, Deduct -47.53		
For >75 To 100, Deduct -67.90		
For >100, Deduct -81.48		
For 27" Wide x 16-3/4" Deep x 16-3/4" High, Wall Sleeve (Friedrich WSE), Add 196.12		
23 81 16 00-0048 EA 9,700 BTU, 9.8 EER, 115 Volt, Cooling Only, Through-The-Wall, Room Air-Conditioner (Friedrich WS08C10D).....	840.17	55.59
For >10 To 50, Deduct -36.45		
For >50 To 75, Deduct -51.03		
For >75 To 100, Deduct -72.90		
For >100, Deduct -87.48		
For 27" Wide x 16-3/4" Deep x 16-3/4" High, Wall Sleeve (Friedrich WSE), Add 196.12		
23 81 16 00-0049 EA 11,500 BTU, 9.8 EER, 115 Volt, Cooling Only, Through-The-Wall, Room Air-Conditioner (Friedrich WS08C10D).....	960.17	55.59
For >10 To 50, Deduct -42.45		
For >50 To 75, Deduct -59.43		
For >75 To 100, Deduct -84.90		
For >100, Deduct -101.88		
For 27" Wide x 16-3/4" Deep x 16-3/4" High, Wall Sleeve (Friedrich WSE), Add 196.12		
23 81 16 00-0050 EA 10,000 BTU, 9.8 EER, 230/208 Volt, Cooling Only, Through-The-Wall, Room Air-Conditioner (Friedrich WS08C10D).....	840.17	55.59
For >10 To 50, Deduct -36.45		
For >50 To 75, Deduct -51.03		
For >75 To 100, Deduct -72.90		
For >100, Deduct -87.48		
For 27" Wide x 16-3/4" Deep x 16-3/4" High, Wall Sleeve (Friedrich WSE), Add 196.12		
23 81 16 00-0051 EA 11,500 BTU, 9.8 EER, 230/208 Volt, Cooling Only, Through-The-Wall, Room Air-Conditioner (Friedrich WS08C10D).....	960.17	55.59
For >10 To 50, Deduct -42.45		
For >50 To 75, Deduct -59.43		
For >75 To 100, Deduct -84.90		
For >100, Deduct -101.88		
For 27" Wide x 16-3/4" Deep x 16-3/4" High, Wall Sleeve (Friedrich WSE), Add 196.12		
23 81 16 00-0052 EA 15,600 BTU, 8.5 EER, 230/208 Volt, Cooling Only, Through-The-Wall, Room Air-Conditioner (Friedrich WS08C10D).....	1,010.17	55.59
For >10 To 50, Deduct -44.95		
For >50 To 75, Deduct -62.93		
For >75 To 100, Deduct -89.90		
For >100, Deduct -107.88		
For 27" Wide x 16-3/4" Deep x 16-3/4" High, Wall Sleeve (Friedrich WSE), Add 196.12		
23 81 16 00-0053 Heating And Cooling, Through-The-Wall, Room Air-Conditioners (23 81 16 00-0044)		
23 81 16 00-0054 Electric Heat, Heating And Cooling, Through-The-Wall, Room Air-Conditioners (Friedrich) (23 81 16 00-0053)		
23 81 16 00-0055 EA 10,000 BTU, 9.8 EER, 230/208 Volt, Heating And Cooling, Through-The-Wall, Room Air-Conditioner (Friedrich WE10C33D).....	1,010.17	55.59
For >10 To 50, Deduct -44.95		
For >50 To 75, Deduct -62.93		
For >75 To 100, Deduct -89.90		
For >100, Deduct -107.88		
For 27" Wide x 16-3/4" Deep x 16-3/4" High, Wall Sleeve (Friedrich WSE), Add 196.12		
23 81 16 00-0056 EA 11,500 BTU, 9.8 EER, 230/208 Volt, Heating And Cooling, Through-The-Wall, Room Air-Conditioner (Friedrich WE12C33D).....	1,060.17	55.59
For >10 To 50, Deduct -47.45		
For >50 To 75, Deduct -66.43		
For >75 To 100, Deduct -94.90		
For >100, Deduct -113.88		
For 27" Wide x 16-3/4" Deep x 16-3/4" High, Wall Sleeve (Friedrich WSE), Add 196.12		
23 81 23 Computer-Room Air-Conditioners (23 81)		
Note: Includes equipment rigging. Indoor units include filters.		
23 81 23 00-0001 Floor Mounted Air Cooled Direct Expansion Type (23 81 23)		
Note: Includes compressor sequence switch, mode alert monitor, non-locking disconnect switch, firestat, infrared humidifier, auto flush on humidifier, two liquid sensors, floor stand, and outdoor air cooled condenser complete with fan speed control. Excludes precharged copper pipe.		
23 81 23 00-0002 EA 3 Ton Air Cooled Computer Room Air Conditioner, Direct Expansion Type.....	19,493.33	1,581.97
Note: Includes interior unit and remote condenser. Excludes piping.		
For Liebert Unit, Add 2,139.72		

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 80 Decentralized Unitary HVAC Equipment****23 81 Decentralized Unitary HVAC Equipment**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 81 23 00-0003 EA 5 Ton Air Cooled Computer Room Air Conditioner, Direct Expansion Type Note: Includes interior unit and remote condenser. Excludes piping.	21,512.75	1,730.27
<i>For Liebert Unit, Add</i>	2,362.87	
23 81 23 00-0004 EA 6 Ton Air Cooled Computer Room Air Conditioner, Direct Expansion Type Note: Includes interior unit and remote condenser. Excludes piping.	29,657.29	1,977.46
<i>For Liebert Unit, Add</i>	3,339.52	
23 81 23 00-0005 EA 10 Ton Air Cooled Computer Room Air Conditioner, Direct Expansion Type Note: Includes interior unit and remote condenser. Excludes piping.	35,233.77	2,224.63
<i>For Liebert Unit, Add</i>	3,990.62	
23 81 23 00-0006 EA 16 Ton Air Cooled Computer Room Air Conditioner, Direct Expansion Type Note: Includes interior unit and remote condenser. Excludes piping.	39,534.00	2,669.56
<i>For Liebert Unit, Add</i>	4,438.24	
23 81 23 00-0007 EA 20 Ton Air Cooled Computer Room Air Conditioner, Direct Expansion Type Note: Includes interior unit and remote condenser. Excludes piping.	44,643.49	2,966.18
<i>For Liebert Unit, Add</i>	5,028.97	
23 81 23 00-0008 EA 24 Ton Air Cooled Computer Room Air Conditioner, Direct Expansion Type Note: Includes interior unit and remote condenser. Excludes piping.	46,873.21	3,163.93
<i>For Liebert Unit, Add</i>	5,265.26	
23 81 23 00-0009 EA 30 Ton Air Cooled Computer Room Air Conditioner, Direct Expansion Type Note: Includes interior unit and remote condenser. Excludes piping.	54,977.59	3,559.41
<i>For Liebert Unit, Add</i>	6,210.44	
23 81 23 00-0010 Floor Mounted Chilled Water Type ^(23 81 23) Note: Includes mode alert monitor, non-locking disconnect switch, firestat, infrared humidifier, auto flush on humidifier, two liquitect sensors, floor stand. Excludes chilled water source. See CSI section 23 81 23 00-0018 for chilled water source.		
23 81 23 00-0011 EA 3 Ton Computer Room Air Conditioner, Chilled Water Type, Excludes Water Source <i>For Liebert Unit, Add</i>	13,145.07 1,462.47	1,083.97
23 81 23 00-0012 EA 5 Ton Computer Room Air Conditioner, Chilled Water Type, Excludes Water Source <i>For Liebert Unit, Add</i>	14,133.86 1,566.62	1,200.71
23 81 23 00-0013 EA 12 Ton Computer Room Air Conditioner, Chilled Water Type, Excludes Water Source <i>For Liebert Unit, Add</i>	17,556.94 1,889.81	1,828.85
23 81 23 00-0014 EA 16 Ton Computer Room Air Conditioner, Chilled Water Type, Excludes Water Source <i>For Liebert Unit, Add</i>	18,342.80 1,984.06	1,852.93
23 81 23 00-0015 EA 20 Ton Computer Room Air Conditioner, Chilled Water Type, Excludes Water Source <i>For Liebert Unit, Add</i>	19,050.20 2,058.86	1,927.06
23 81 23 00-0016 EA 22 Ton Computer Room Air Conditioner, Chilled Water Type, Excludes Water Source <i>For Liebert Unit, Add</i>	19,526.75 2,088.78	2,112.35
23 81 23 00-0017 EA 31 Ton Computer Room Air Conditioner, Chilled Water Type, Excludes Water Source <i>For Liebert Unit, Add</i>	20,725.07 2,208.47	2,297.64
23 81 23 00-0018 Floor Mounted Water Source ^(23 81 23) Note: Includes mode alert monitor, non-locking disconnect switch, firestat, infrared humidifier, auto flush on humidifier, two liquitect sensors, floor stand. Excludes water source.		
23 81 23 00-0019 EA 3 Ton Chilled Water Source For Computer Room Air Conditioner, Chilled Water Unit <i>For Liebert Unit, Add</i>	10,238.58 1,095.12	988.72
23 81 23 00-0020 EA 5 Ton Chilled Water Source For Computer Room Air Conditioner, Chilled Water Unit <i>For Liebert Unit, Add</i>	11,256.32 1,213.06	1,038.16
23 81 23 00-0021 EA 6 Ton Chilled Water Source For Computer Room Air Conditioner, Chilled Water Unit <i>For Liebert Unit, Add</i>	14,530.95 1,613.20	1,087.60
23 81 23 00-0022 EA 8 Ton Chilled Water Source For Computer Room Air Conditioner, Chilled Water Unit <i>For Liebert Unit, Add</i>	15,664.42 1,735.34	1,186.47
23 81 23 00-0023 EA 10 Ton Chilled Water Source For Computer Room Air Conditioner, Chilled Water Unit <i>For Liebert Unit, Add</i>	17,295.52 1,920.67	1,285.34
23 81 23 00-0024 EA 12 Ton Chilled Water Source For Computer Room Air Conditioner, Chilled Water Unit <i>For Liebert Unit, Add</i>	17,986.46 1,988.06	1,384.22
23 81 23 00-0025 EA 15 Ton Chilled Water Source For Computer Room Air Conditioner, Chilled Water Unit <i>For Liebert Unit, Add</i>	18,784.31 2,072.30	1,483.10
23 81 23 00-0026 EA 20 Ton Chilled Water Source For Computer Room Air Conditioner, Chilled Water Unit <i>For Liebert Unit, Add</i>	19,328.27 2,122.85	1,581.97
23 81 23 00-0027 EA 25 Ton Chilled Water Source For Computer Room Air Conditioner, Chilled Water Unit <i>For Liebert Unit, Add</i>	22,126.52 2,414.88	1,878.58
23 81 23 00-0028 Floor Mounted Glycol System Type ^(23 81 23) Note: Includes drycoolers, mode alert monitor, non-locking disconnect switch, firestat, infrared humidifier, auto flush on humidifier, two liquitect sensors, floor stand. Excludes chilled water source. See CSI section 23 81 23 00-0018 for water source.		
23 81 23 00-0029 EA 3 Ton Computer Room Air Conditioner, Glycol System Type <i>For Liebert Unit, Add</i>	18,854.89 2,176.20	1,083.97
23 81 23 00-0030 EA 5 Ton Computer Room Air Conditioner, Glycol System Type <i>For Liebert Unit, Add</i>	20,305.95 2,338.13	1,200.71
23 81 23 00-0031 EA 6 Ton Computer Room Air Conditioner, Glycol System Type <i>For Liebert Unit, Add</i>	31,176.55 3,672.86	1,345.23
23 81 23 00-0032 EA 9 Ton Computer Room Air Conditioner, Glycol System Type <i>For Liebert Unit, Add</i>	32,200.42 3,776.76	1,489.77
23 81 23 00-0033 EA 10 Ton Computer Room Air Conditioner, Glycol System Type <i>For Liebert Unit, Add</i>	34,474.79 4,036.97	1,634.29
23 81 23 00-0034 EA 16 Ton Computer Room Air Conditioner, Glycol System Type <i>For Liebert Unit, Add</i>	41,233.33 4,843.80	1,852.93
23 81 23 00-0035 EA 20 Ton Computer Room Air Conditioner, Glycol System Type <i>For Liebert Unit, Add</i>	45,178.53 5,324.90	1,927.06



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 81 23 00-0036 EA 22 Ton Computer Room Air Conditioner, Glycol System Type..... <i>For Liebert Unit, Add</i>	46,883.37 5,508.36	2,112.35
23 81 23 00-0037 EA 30 Ton Computer Room Air Conditioner, Glycol System Type..... <i>For Liebert Unit, Add</i>	57,023.36 6,745.75	2,297.64
23 81 23 00-0038 Horizontal Indoor Single Package Cooling Unit (23 81 23) Note: Carrier 50AH With indoor scroll compressor, plenum mounted.		
23 81 23 00-0039 EA 2 Ton Horizontal Indoor Single-Package Cooling Unit, 800 CFM Nominal.....	10,357.00	444.71
23 81 23 00-0040 EA 3 Ton Horizontal Indoor Single-Package Cooling Unit, 1,200 CFM Nominal.....	12,153.15	555.88
23 81 23 00-0041 EA 4 Ton Horizontal Indoor Single-Package Cooling Unit, 1,600 CFM Nominal.....	14,159.67	667.06
23 81 23 00-0042 EA 5 Ton Horizontal Indoor Single-Package Cooling Unit, 2,000 CFM Nominal.....	16,466.85	741.17
23 81 23 00-0043 Removal And Reinstallation Of Computer Room Unit (23 81 23) Note: Includes storage and cleaning. Excludes main mechanical piping. Reconnection of existing valves are included.		
23 81 23 00-0044 EA Remove And Reinstall Computer Room Unit, Chilled Water	1,482.35	
23 81 23 00-0045 EA Remove And Reinstall Computer Room Unit, Direct Expansion.....	1,235.29	
23 81 26 Split-System Air-Conditioners (23 81)		
23 81 26 00-0001 Split System A/C Unit (23 81 26) See CSI section 23 23 16 00-0001 for piping.		
23 81 26 00-0002 Ductless Split System Air Conditioners (23 81 26 00-0001) Note: Excludes refrigerant piping, electrical, and pad. Panasonic units or equal. See CSI section 23 81 49 00-0025 for ductless heat pumps.		
23 81 26 00-0003 Wall Mounted Ductless Split System Air Conditioners (23 81 26 00-0002)		
23 81 26 00-0004 EA 9,000 BTU, 16 SEER, Wall Mounted Ductless Split System Air Conditioners	1,672.60	244.59
23 81 26 00-0005 EA 11,900 BTU, 17 SEER, Wall Mounted Ductless Split System Air Conditioner..... Note: Includes indoor unit, outdoor unit, wireless thermostat and refrigerant charge.	1,808.24	266.82
23 81 26 00-0006 EA 17,500 BTU, 20 SEER, Wall Mounted Ductless Split System Air Conditioners	2,272.39	296.47
23 81 26 00-0007 EA 24,200 BTU, 17 SEER, Wall Mounted Ductless Split System Air Conditioners	2,523.53	326.12
23 81 26 00-0008 EA 25,200 BTU, 14.9 SEER, Wall Mounted Ductless Split System Air Conditioners	3,943.77	355.76
23 81 26 00-0009 EA 29,800 BTU, 15 SEER, Wall Mounted Ductless Split System Air Conditioners	4,608.36	370.58
23 81 26 00-0010 EA 31,400 BTU, 15.9 SEER, Wall Mounted Ductless Split System Air Conditioners	5,060.59	395.05
23 81 26 00-0011 Dual and Tri Zone Wall Mounted Ductless Split System Air Conditioners (23 81 26 00-0002) Note: Use this section only when matching indoor and outdoor capacity units are not used.		
23 81 26 00-0012 EA 7,500 BTU Indoor Unit, Wall Mounted Ductless Split System Air Conditioners	716.12	118.59
23 81 26 00-0013 EA 9,000 BTU Indoor Unit, Wall Mounted Ductless Split System Air Conditioners	755.95	126.00
23 81 26 00-0014 EA 11,900 BTU Indoor Unit, Wall Mounted Ductless Split System Air Conditioners	796.51	133.41
23 81 26 00-0015 EA 17,500 BTU Indoor Unit, Wall Mounted Ductless Split System Air Conditioners	903.92	140.83
23 81 26 00-0016 EA 24,200 BTU Indoor Unit, Wall Mounted Ductless Split System Air Conditioners	967.24	148.23
23 81 26 00-0017 EA 19,700 BTU, 16.5 SEER, Outdoor Unit, Wall Mounted Ductless Split System Air Conditioners..... Note: Includes outdoor unit and refrigerant charge.	2,034.45	177.89
23 81 26 00-0018 EA 25,400 BTU, 16.2 SEER, Outdoor Unit, Wall Mounted Ductless Split System Air Conditioners..... Note: Includes outdoor unit and refrigerant charge.	2,251.46	192.71
23 81 26 00-0019 EA 30,600 BTU, 17.6 SEER, Outdoor Unit, Wall Mounted Ductless Split System Air Conditioners..... Note: Includes outdoor unit and refrigerant charge.	3,599.64	207.53
23 81 26 00-0020 Suspended Ceiling Mounted Ductless Split System Air Conditioners (23 81 26 00-0002) Note: Excludes hangers.		
23 81 26 00-0021 EA 24,400 BTU, 14.5 SEER, Ceiling Suspended Ductless Split System Air Conditioners	4,232.68	355.76
23 81 26 00-0022 EA 31,200 BTU, 15.1 SEER, Ceiling Suspended Ductless Split System Air Conditioners	5,157.90	424.69
23 81 26 00-0023 EA 39,000 BTU, 15.6 SEER, Ceiling Suspended Ductless Split System Air Conditioners..... Note: Includes indoor unit, outdoor unit, wireless thermostat and refrigerant charge.	6,324.39	444.71
23 81 26 00-0024 Recessed Ceiling Mounted Ductless Split System Air Conditioners (23 81 26 00-0002) Note: Excludes hangers.		
23 81 26 00-0025 EA 11,900 BTU, 16 SEER, Ceiling Recessed Ductless Split System Air Conditioners	2,569.87	296.47
23 81 26 00-0026 EA 17,500 BTU, 16 SEER, Ceiling Recessed Ductless Split System Air Conditioners	3,001.70	326.12

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 80 Decentralized Unitary HVAC Equipment****23 81 Decentralized Unitary HVAC Equipment**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 81 26 00-0027	EA		24,800 BTU, 14.1 SEER, Ceiling Recessed Ductless Split System Air Conditioners Note: Includes indoor unit, outdoor unit, wireless thermostat and refrigerant charge.	4,196.62	385.41
23 81 26 00-0028	EA		32,600 BTU, 14.6 SEER, Ceiling Recessed Ductless Split System Air Conditioners Note: Includes indoor unit, outdoor unit, wireless thermostat and refrigerant charge.	4,864.09	424.69
23 81 26 00-0029	EA		39,500 BTU, 14.6 SEER, Ceiling Recessed Ductless Split System Air Conditioners Note: Includes indoor unit, outdoor unit, wireless thermostat and refrigerant charge.	6,177.48	444.71
23 81 26 00-0030			Ductless Split System Accessories <small>(23 81 26 00-0002)</small>		
23 81 26 00-0031	LF		3" Line Set Cover, Rigid Polyvinyl Chloride (PVC) Line Set Covers 7.72		1.07
23 81 26 00-0032	LF		4" Line Set Cover, Rigid Polyvinyl Chloride (PVC) Line Set Covers 9.83		1.17
23 81 26 00-0033	LF		6" Line Set Cover, Rigid Polyvinyl Chloride (PVC) Line Set Covers 12.17		1.29
23 81 26 00-0034	EA		3" Union Coupling, Rigid Polyvinyl Chloride (PVC) Line Set Covers 13.04		1.99
23 81 26 00-0035	EA		4" Union Coupling, Rigid Polyvinyl Chloride (PVC) Line Set Covers 21.84		2.19
23 81 26 00-0036	EA		6" Union Coupling, Rigid Polyvinyl Chloride (PVC) Line Set Covers 24.84		2.41
23 81 26 00-0037	EA		3" 90 Degree Elbow, Rigid Polyvinyl Chloride (PVC) Line Set Covers 31.94		3.99
23 81 26 00-0038	EA		4" 90 Degree Elbow, Rigid Polyvinyl Chloride (PVC) Line Set Covers 51.86		4.38
23 81 26 00-0039	EA		6" 90 Degree Elbow, Rigid Polyvinyl Chloride (PVC) Line Set Covers 57.86		4.82
23 81 26 00-0040	EA		3" 90 Degree Long Radius Elbow, Rigid Polyvinyl Chloride (PVC) Line Set Covers 42.10		4.25
23 81 26 00-0041	EA		4" 90 Degree Long Radius Elbow, Rigid Polyvinyl Chloride (PVC) Line Set Covers 49.24		4.67
23 81 26 00-0042	EA		6" 90 Degree Long Radius Elbow, Rigid Polyvinyl Chloride (PVC) Line Set Covers 75.21		5.15
23 81 26 00-0043	EA		3" 45 Degree Elbow, Rigid Polyvinyl Chloride (PVC) Line Set Covers 31.94		3.99
23 81 26 00-0044	EA		4" 45 Degree Elbow, Rigid Polyvinyl Chloride (PVC) Line Set Covers 51.86		4.38
23 81 26 00-0045	EA		6" 45 Degree Elbow, Rigid Polyvinyl Chloride (PVC) Line Set Covers 57.86		4.82
23 81 26 00-0046	EA		3" Wall Penetration Cover, Rigid Polyvinyl Chloride (PVC) Line Set Covers 42.33		6.65
23 81 26 00-0047	EA		4" Wall Penetration Cover, Rigid Polyvinyl Chloride (PVC) Line Set Covers 60.72		7.31
23 81 26 00-0048	EA		6" Wall Penetration Cover, Rigid Polyvinyl Chloride (PVC) Line Set Covers 72.28		8.03
23 81 26 00-0049	EA		2-1/2" Wall Sleeve, Rigid Polyvinyl Chloride (PVC) Line Set Covers 22.73		1.33
23 81 26 00-0050	EA		3" x 20" Flexible Joint, Rigid Polyvinyl Chloride (PVC) Line Set Covers 26.09		3.99
23 81 26 00-0051	EA		4" x 20" Flexible Joint, Rigid Polyvinyl Chloride (PVC) Line Set Covers 41.33		4.38
23 81 26 00-0052	EA		3" Duct End Termination, Rigid Polyvinyl Chloride (PVC) Line Set Covers 23.75		3.99
23 81 26 00-0053	EA		4" Duct End Termination, Rigid Polyvinyl Chloride (PVC) Line Set Covers 31.98		4.38
23 81 26 00-0054	EA		6" Duct End Termination, Rigid Polyvinyl Chloride (PVC) Line Set Covers 34.48		4.82
23 81 26 00-0055	EA		4" T Joint, Rigid Polyvinyl Chloride (PVC) Line Set Covers 108.46		5.32
23 81 26 00-0056	EA		6" T Joint, Rigid Polyvinyl Chloride (PVC) Line Set Covers 122.94		5.84
23 81 26 00-0057	EA		14" Condensing Unit Mounting Blocks With End Caps 76.73		19.93
23 81 26 00-0058	EA		17" Condensing Unit Mounting Blocks With End Caps 84.27		21.25
23 81 26 00-0059	EA		36" Condensing Unit Mounting Blocks With End Caps 111.68		22.58
23 81 26 00-0060	EA		End Cap, Set of 4 11.68		
23 81 26 00-0061	EA		18" Condensing Unit Type 2 Wall Bracket, 165 LB Capacity 161.73		39.84
23 81 26 00-0062	EA		21" Condensing Unit Type 2 Wall Bracket, 220 LB Capacity 171.79		42.50
23 81 26 00-0063	LF		5/8" ID Condensate Drain Line 1.62		0.11
23 81 26 00-0064	LF		3/4" ID Condensate Drain Line 1.67		0.11
23 81 26 00-0065			Cased A/C Evaporator Coils <small>(23 81 26 00-0001)</small>		
23 81 26 00-0066			Vertical Cased A/C Evaporator Coils <small>(23 81 26 00-0065)</small>		
23 81 26 00-0067	EA		1-1/2 Ton Vertical Cased A/C Evaporator Coil 398.07		79.88
23 81 26 00-0068	EA		2 Ton Vertical Cased A/C Evaporator Coil 416.73		85.86
23 81 26 00-0069	EA		2-1/2 Ton Vertical Cased A/C Evaporator Coil 489.72		91.86
23 81 26 00-0070	EA		3 Ton Vertical Cased A/C Evaporator Coil 554.13		97.85
23 81 26 00-0071	EA		3-1/2 Ton Vertical Cased A/C Evaporator Coil 634.56		101.84
23 81 26 00-0072	EA		4 Ton Vertical Cased A/C Evaporator Coil 703.57		105.84
23 81 26 00-0073	EA		4-1/2 Ton Vertical Cased A/C Evaporator Coil 755.76		113.83
23 81 26 00-0074	EA		5 Ton Vertical Cased A/C Evaporator Coil 763.95		119.82
23 81 26 00-0075			"A" Style Horizontal Cased A/C Evaporator Coils <small>(23 81 26 00-0065)</small>		
23 81 26 00-0076	EA		2 Ton "A" Style Horizontal Cased A/C Evaporator Coil 478.33		81.88
23 81 26 00-0077	EA		2-1/2 Ton "A" Style Horizontal Cased A/C Evaporator Coil 545.63		86.47
23 81 26 00-0078	EA		3 Ton "A" Style Horizontal Cased A/C Evaporator Coil 620.48		91.86
23 81 26 00-0079	EA		3-1/2 Ton "A" Style Horizontal Cased A/C Evaporator Coil 643.15		95.17
23 81 26 00-0080	EA		4 Ton "A" Style Horizontal Cased A/C Evaporator Coil 673.47		99.85
23 81 26 00-0081	EA		4-1/2 Ton "A" Style Horizontal Cased A/C Evaporator Coil 683.96		105.04
23 81 26 00-0082	EA		5 Ton "A" Style Horizontal Cased A/C Evaporator Coil 694.24		110.23
23 81 26 00-0083			Slab Style Horizontal Cased A/C Evaporator Coils <small>(23 81 26 00-0065)</small>		
23 81 26 00-0084	EA		2 Ton Slab Style Horizontal Cased A/C Evaporator Coil 423.99		81.88
23 81 26 00-0085	EA		3 Ton Slab Style Horizontal Cased A/C Evaporator Coil 505.13		91.86
23 81 26 00-0086	EA		4 Ton Slab Style Horizontal Cased A/C Evaporator Coil 580.05		99.85
23 81 26 00-0087	EA		5 Ton Slab Style Horizontal Cased A/C Evaporator Coil 693.29		110.23
23 81 26 00-0088			Mitsubishi City Multi, Variable Refrigerant Flow <small>(23 81 26 00-0001)</small>		
23 81 26 00-0089			Outdoor Units <small>(23 81 26 00-0088)</small>		
23 81 26 00-0090	EA		6 Ton R2-Series Outdoor Unit (Mitsubishi PURY-P72YKMU-A) 12,981.11		389.12
23 81 26 00-0091	EA		8 Ton R2-Series Outdoor Unit (Mitsubishi PURY-P96YKMU-A) 14,058.00		463.24
23 81 26 00-0092	EA		10 Ton R2-Series Outdoor Unit (Mitsubishi PURY-P120YKMU-A) 15,805.07		555.88



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 81 26 00-0093 EA 12 Ton R2-Series Outdoor Unit (Mitsubishi PURY-P144YKMU-A).....	19,510.46	574.41
23 81 26 00-0094 EA 12 Ton R2-Series Outdoor Unit (Mitsubishi PURY-P144YSKMU-A).....	25,969.19	592.94
23 81 26 00-0095 EA 14 Ton R2-Series Outdoor Unit (Mitsubishi PURY-P168YSKMU-A).....	26,934.90	611.47
23 81 26 00-0096 EA 16 Ton R2-Series Outdoor Unit (Mitsubishi PURY-P192YSKMU-A).....	27,900.61	630.00
23 81 26 00-0097 EA 18 Ton R2-Series Outdoor Unit (Mitsubishi PURY-P216YSKMU-A).....	29,536.51	667.06
23 81 26 00-0098 EA 20 Ton R2-Series Outdoor Unit (Mitsubishi PURY-P240YSKMU-A).....	31,172.39	704.12
23 81 26 00-0099 EA 22 Ton R2-Series Outdoor Unit (Mitsubishi PURY-P264YSKMU-A).....	34,914.84	741.17
23 81 26 00-0100 EA 24 Ton R2-Series Outdoor Unit (Mitsubishi PURY-P288YSKMU-A).....	38,657.29	778.23
23 81 26 00-0101 Indoor Units <small>(23 81 26 00-0088)</small>		
23 81 26 00-0102 EA 6 MBH Cooling, 6.7 MBH Heating Wall Mounted Indoor Unit (Mitsubishi PKFY-P06NBMU-E2).....	1,149.55	120.44
23 81 26 00-0103 EA 8 MBH Cooling, 9 MBH Heating Wall Mounted Indoor Unit (Mitsubishi PKFY-P08NBMU-E2).....	1,208.04	129.70
23 81 26 00-0104 EA 12 MBH Cooling, 13.5 MBH Heating Wall Mounted Indoor Unit (Mitsubishi PKFY-P12NBMU-E2).....	1,260.23	138.97
23 81 26 00-0105 EA 15 MBH Cooling, 17 MBH Heating Wall Mounted Indoor Unit (Mitsubishi PKFY-P15NBMU-E2).....	1,322.93	148.23
23 81 26 00-0106 EA 18 MBH Cooling, 20 MBH Heating Wall Mounted Indoor Unit (Mitsubishi PKFY-P18NBMU-E2).....	1,432.15	176.03
23 81 26 00-0107 EA 24 MBH Cooling, 27 MBH Heating Wall Mounted Indoor Unit (Mitsubishi PKFY-P24NBMU-E2).....	1,598.83	213.09
23 81 26 00-0108 EA 30 MBH Cooling, 34 MBH Heating Wall Mounted Indoor Unit (Mitsubishi PKFY-P30NBMU-E2).....	1,731.59	231.62
23 81 26 00-0109 EA 6 MBH Cooling, 6.7 MBH Heating Ceiling Concealed Ducted Indoor Unit (Mitsubishi PEFY-P06NMAU-E2).....	1,667.94	132.48
23 81 26 00-0110 EA 8 MBH Cooling, 9 MBH Heating Ceiling Concealed Ducted Indoor Unit (Mitsubishi PEFY-P08NMAU-E2).....	1,726.18	142.67
23 81 26 00-0111 EA 12 MBH Cooling, 13.5 MBH Heating Ceiling Concealed Ducted Indoor Unit (Mitsubishi PEFY-P12NMAU-E2).....	1,820.19	152.87
23 81 26 00-0112 EA 15 MBH Cooling, 17 MBH Heating Ceiling Concealed Ducted Indoor Unit (Mitsubishi PEFY-P15NMAU-E2).....	1,975.19	163.05
23 81 26 00-0113 EA 18 MBH Cooling, 20 MBH Heating Ceiling Concealed Ducted Indoor Unit (Mitsubishi PEFY-P18NMAU-E2).....	2,083.66	193.63
23 81 26 00-0114 EA 24 MBH Cooling, 27 MBH Heating Ceiling Concealed Ducted Indoor Unit (Mitsubishi PEFY-P24NMAU-E2).....	2,286.13	234.40
23 81 26 00-0115 EA 27 MBH Cooling, 30 MBH Heating Ceiling Concealed Ducted Indoor Unit (Mitsubishi PEFY-P27NMAU-E2).....	2,404.32	244.59
23 81 26 00-0116 EA 30 MBH Cooling, 34 MBH Heating Ceiling Concealed Ducted Indoor Unit (Mitsubishi PEFY-P30NMAU-E2).....	2,535.13	254.78
23 81 26 00-0117 EA 36 MBH Cooling, 40 MBH Heating Ceiling Concealed Ducted Indoor Unit (Mitsubishi PEFY-P36NMAU-E2).....	2,812.21	280.25
23 81 26 00-0118 EA 48 MBH Cooling, 54 MBH Heating Ceiling Concealed Ducted Indoor Unit (Mitsubishi PEFY-P48NMAU-E2).....	3,171.51	308.28
23 81 26 00-0119 EA 54 MBH Cooling, 60 MBH Heating Ceiling Concealed Ducted Indoor Unit (Mitsubishi PEFY-P54NMAU-E2).....	3,373.73	339.11
23 81 26 00-0120 EA 72 MBH Cooling, 80 MBH Heating Ceiling Concealed High Static Ducted Indoor Unit (Mitsubishi PEFY-P72NMHSU-E).....	4,279.75	373.02
23 81 26 00-0121 EA 96 MBH Cooling, 108 MBH Heating Ceiling Concealed High Static Ducted Indoor Unit (Mitsubishi PEFY-P96NMHSU-E).....	4,859.18	410.32
23 81 26 00-0122 EA 12 MBH Cooling, 13.5 MBH Heating 4-Way Ceiling Recessed Cassette With Grille (Mitsubishi PLFY-P12NBMU-ER2).....	1,860.15	152.87
23 81 26 00-0123 EA 15 MBH Cooling, 17 MBH Heating 4-Way Ceiling Recessed Cassette With Grille (Mitsubishi PLFY-P15NBMU-ER2).....	1,961.51	163.05
23 81 26 00-0124 EA 18 MBH Cooling, 20 MBH Heating 4-Way Ceiling Recessed Cassette With Grille (Mitsubishi PLFY-P18NBMU-ER2).....	2,069.99	193.63
23 81 26 00-0125 EA 24 MBH Cooling, 27 MBH Heating 4-Way Ceiling Recessed Cassette With Grille (Mitsubishi PLFY-P24NBMU-ER2).....	2,319.78	234.40
23 81 26 00-0126 EA 30 MBH Cooling, 34 MBH Heating 4-Way Ceiling Recessed Cassette With Grille (Mitsubishi PLFY-P30NBMU-ER2).....	2,498.32	254.78
23 81 26 00-0127 EA 36 MBH Cooling, 40 MBH Heating 4-Way Ceiling Recessed Cassette With Grille (Mitsubishi PLFY-P36NBMU-ER2).....	3,054.10	280.26
23 81 26 00-0128 EA 6 MBH Cooling, 6.7 MBH Heating 1-Way Ceiling Recessed Cassette With Grille (Mitsubishi PMFY-P06NBMU-ER5).....	1,705.80	132.48
23 81 26 00-0129 EA 8 MBH Cooling, 9 MBH Heating 1-Way Ceiling Recessed Cassette With Grille (Mitsubishi PMFY-P08NBMU-ER5).....	1,793.49	142.67
23 81 26 00-0130 EA 12 MBH Cooling, 13.5 MBH Heating 1-Way Ceiling Recessed Cassette With Grille (Mitsubishi PMFY-P12NBMU-ER5).....	1,927.46	152.87
23 81 26 00-0131 EA 15 MBH Cooling, 17 MBH Heating 1-Way Ceiling Recessed Cassette With Grille (Mitsubishi PMFY-P15NBMU-ER5).....	2,028.82	163.05
23 81 26 00-0132 EA 8 MBH Cooling, 9 MBH Heating 4-Way Ceiling Recessed Cassette With Grille (Mitsubishi PLFY-P08NCMU-ER4).....	1,577.89	142.67
23 81 26 00-0133 EA 12 MBH Cooling, 13.5 MBH Heating 4-Way Ceiling Recessed Cassette With Grille (Mitsubishi PLFY-P12NCMU-ER4).....	1,658.23	152.87
23 81 26 00-0134 EA 15 MBH Cooling, 17 MBH Heating 4-Way Ceiling Recessed Cassette With Grille (Mitsubishi PLFY-P15NCMU-ER4).....	1,742.76	163.05
23 81 26 00-0135 Controllers For Outdoor Units <small>(23 81 26 00-0088)</small>		
23 81 26 00-0136 EA 8 Branch (Main BC) (Mitsubishi CMB-P108NU-GA).....	5,772.17	111.17
23 81 26 00-0137 EA 10 Branch (Main BC) (Mitsubishi CMB-P1010NU-GA).....	6,660.06	129.70
23 81 26 00-0138 EA 13 Branch (Main BC) (Mitsubishi CMB-P1013NU-GA).....	7,723.58	148.23
23 81 26 00-0139 EA 16 Branch (Main BC) (Mitsubishi CMB-P1016NU-HA).....	9,167.80	166.76
23 81 26 00-0140 EA 4 Branch (Sub BC) (Mitsubishi CMB-P104NU-GB).....	3,368.54	74.12
23 81 26 00-0141 EA 8 Branch (Sub BC) (Mitsubishi CMB-P108NU-GB).....	5,189.53	111.17
23 81 26 00-0142 EA 16 Branch (Sub BC) (Mitsubishi CMB-P1016NU-HB).....	7,933.10	166.76
23 81 26 00-0143 EA ME Remote Controller (Mitsubishi PAR-F27MEA-US).....	440.60	14.82
23 81 26 00-0144 EA AG-150 Standard Package (Mitsubishi AG-150A-Standard).....	4,671.59	14.82
23 81 26 00-0145 EA GB-50ADA Standard Package (Mitsubishi GB-50ADA-A).....	2,843.74	14.82
23 81 26 00-0146 Energy Recovery Units <small>(23 81 26 00-0088)</small>		
23 81 26 00-0147 EA 36.2 MBH Cooling, 39.9 MBH Heating Hydronic Heat Exchanger Auxiliary Unit (Mitsubishi PWFY-P36NNU-E-AU).....	4,274.55	111.17
23 81 26 00-0148 EA 39.9 MBH Hydronic Heat Exchanger Booster Unit (Mitsubishi PWFY-P36NNU-E-BU).....	8,097.48	111.17
23 81 26 00-0149 EA 112 MBH Cooling, 61.4 MBH Heating Reheat Unit (Mitsubishi PEFY-AF1200CFMR).....	8,212.37	129.70
23 81 26 00-0150 EA Lossnay Energy Recovery Ventilator ERV, 300 CFM (Mitsubishi LGH-F300RX5-E).....	1,699.74	92.65
23 81 26 00-0151 EA Lossnay Energy Recovery Ventilator ERV, 470 CFM (Mitsubishi LGH-F470RX5-E).....	2,167.80	96.35
23 81 26 00-0152 EA Lossnay Energy Recovery Ventilator ERV, 600 CFM (Mitsubishi LGH-F600RX5-E).....	2,586.42	100.06
23 81 26 00-0153 EA Lossnay Energy Recovery Ventilator ERV, 1,200 CFM (Mitsubishi LGH-F1200RX3-E).....	4,721.52	111.17

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 80 Decentralized Unitary HVAC Equipment****23 81 Decentralized Unitary HVAC Equipment**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 81 26 00-0154 Piping Specialties <small>(23 81 26 00-0088)</small>		
23 81 26 00-0155 EA Maintenance Tool Interface (Mitsubishi CMS-MNG-E)	599.47	
23 81 26 00-0156 EA Branch Joint (Mitsubishi CMY-Y102SS-G2)	160.84	30.34
23 81 26 00-0157 EA Branch Joint (Mitsubishi CMY-Y102LS-G2)	160.84	30.34
23 81 26 00-0158 EA Branch Joint (Mitsubishi CMY-Y202S-G2)	178.52	31.94
23 81 26 00-0159 EA Branch Joint (Mitsubishi CMY-Y302S-G2)	223.30	35.93
23 81 26 00-0160 EA Header - 4 Branch (Mitsubishi CMY-Y64-G-E)	292.05	51.90
23 81 26 00-0161 EA Header - 8 Branch (Mitsubishi CMY-Y68-G-E)	496.82	103.80
23 81 26 00-0162 EA Refrigeration Ball Valve-Flare/Schrader/Insulated - 3/8" (Mitsubishi BV38FFSI)	81.30	12.78
23 81 26 00-0163 EA Refrigeration Ball Valve-Flare/Schrader/Insulated - 5/8" (Mitsubishi BV58FFSI)	91.92	17.57
23 81 26 00-0164 Daikin VRV <small>(23 81 26 00-0001)</small>		
23 81 26 00-0165 Heat Pump Outdoor Units <small>(23 81 26 00-0164)</small>		
23 81 26 00-0166 EA 6 Ton Heat Pump Outdoor Unit (Daikin RXYQ72PBTJ)	12,851.54	389.12
23 81 26 00-0167 EA 8 Ton Heat Pump Outdoor Unit (Daikin RXYQ96PBTJ)	14,376.56	463.24
23 81 26 00-0168 EA 10 Ton Heat Pump Outdoor Unit (Daikin RXYQ120PBTJ)	16,044.54	555.88
23 81 26 00-0169 EA 12 Ton Heat Pump Outdoor Unit (Daikin RXYQ144PBTJ)	20,000.13	574.41
23 81 26 00-0170 EA 14 Ton Heat Pump Outdoor Unit (Daikin RXYQ168PBTJ)	26,746.33	611.47
23 81 26 00-0171 EA 16 Ton Heat Pump Outdoor Unit (Daikin RXYQ192PBTJ)	28,266.08	630.00
23 81 26 00-0172 EA 18 Ton Heat Pump Outdoor Unit (Daikin RXYQ216PBTJ)	29,716.98	667.06
23 81 26 00-0173 EA 20 Ton Heat Pump Outdoor Unit (Daikin RXYQ240PBTJ)	31,273.78	704.12
23 81 26 00-0174 EA 22 Ton Heat Pump Outdoor Unit (Daikin RXYQ264PBTJ)	40,455.83	741.17
23 81 26 00-0175 EA 24 Ton Heat Pump Outdoor Unit (Daikin RXYQ288PBTJ)	42,012.63	778.23
23 81 26 00-0176 EA 26 Ton Heat Pump Outdoor Unit (Daikin RXYQ312PBTJ)	43,569.43	815.29
23 81 26 00-0177 EA 28 Ton Heat Pump Outdoor Unit (Daikin RXYQ336PBTJ)	45,020.33	852.35
23 81 26 00-0178 EA 30 Ton Heat Pump Outdoor Unit (Daikin RXYQ360PBTJ)	46,577.14	889.41
23 81 26 00-0179 Heat Recovery Heat Pump Outdoor Units <small>(23 81 26 00-0164)</small>		
23 81 26 00-0180 EA 6 Ton Heat Recovery Heat Pump Outdoor Unit (Daikin REYQ72PBTJ)	16,461.03	505.85
23 81 26 00-0181 EA 8 Ton Heat Recovery Heat Pump Outdoor Unit (Daikin REYQ96PBTJ)	17,971.56	602.20
23 81 26 00-0182 EA 10 Ton Heat Recovery Heat Pump Outdoor Unit (Daikin REYQ120PBTJ)	19,767.06	722.65
23 81 26 00-0183 EA 12 Ton Heat Recovery Heat Pump Outdoor Unit (Daikin REYQ144PBTJ)	24,792.82	746.74
23 81 26 00-0184 EA 14 Ton Heat Recovery Heat Pump Outdoor Unit (Daikin REYQ168PBTJ)	33,467.58	794.91
23 81 26 00-0185 EA 16 Ton Heat Recovery Heat Pump Outdoor Unit (Daikin REYQ192PBTJ)	36,057.51	819.00
23 81 26 00-0186 EA 18 Ton Heat Recovery Heat Pump Outdoor Unit (Daikin REYQ216PBTJ)	37,424.74	867.17
23 81 26 00-0187 EA 20 Ton Heat Recovery Heat Pump Outdoor Unit (Daikin REYQ240PBTJ)	38,791.97	915.35
23 81 26 00-0188 EA 22 Ton Heat Recovery Heat Pump Outdoor Unit (Daikin REYQ264PBTJ)	51,014.58	963.52
23 81 26 00-0189 EA 24 Ton Heat Recovery Heat Pump Outdoor Unit (Daikin REYQ288PBTJ)	52,381.80	1,011.71
23 81 26 00-0190 EA 26 Ton Heat Recovery Heat Pump Outdoor Unit (Daikin REYQ312PBTJ)	55,019.90	1,059.88
23 81 26 00-0191 EA 28 Ton Heat Recovery Heat Pump Outdoor Unit (Daikin REYQ336PBTJ)	56,387.13	1,108.06
23 81 26 00-0192 Indoor Units <small>(23 81 26 00-0164)</small>		
23 81 26 00-0193 EA 7.5 MBH Cooling, 8.5 MBH Heating Wall Mounted Indoor Unit (Daikin FXAQ07PVJU)	1,498.31	129.70
23 81 26 00-0194 EA 9.5 MBH Cooling, 10.5 MBH Heating Wall Mounted Indoor Unit (Daikin FXAQ09PVJU)	1,564.67	133.41
23 81 26 00-0195 EA 12 MBH Cooling, 13.5 MBH Heating Wall Mounted Indoor Unit (Daikin FXAQ12PVJU)	1,766.62	138.97
23 81 26 00-0196 EA 18 MBH Cooling, 20 MBH Heating Wall Mounted Indoor Unit (Daikin FXAQ18PVJU)	1,986.60	176.03
23 81 26 00-0197 EA 24 MBH Cooling, 26.5 MBH Heating Wall Mounted Indoor Unit (Daikin FXAQ24PVJU)	2,186.62	213.09
23 81 26 00-0198 EA 7.5 MBH Cooling, 8.5 MBH Heating Ceiling Concealed Ducted Indoor Unit (Daikin FXMQ07PVJU)	2,179.67	142.67
23 81 26 00-0199 EA 9.5 MBH Cooling, 10.5 MBH Heating Ceiling Concealed Ducted Indoor Unit (Daikin FXMQ09PVJU)	2,252.76	146.75
23 81 26 00-0200 EA 12 MBH Cooling, 13.5 MBH Heating Ceiling Concealed Ducted Indoor Unit (Daikin FXMQ12PVJU)	2,365.92	81.53
23 81 26 00-0201 EA 18 MBH Cooling, 20 MBH Heating Ceiling Concealed Ducted Indoor Unit (Daikin FXMQ18PVJU)	2,522.38	193.63
23 81 26 00-0202 EA 24 MBH Cooling, 27 MBH Heating Ceiling Concealed Ducted Indoor Unit (Daikin FXMQ24PVJU)	2,990.56	234.40
23 81 26 00-0203 EA 30 MBH Cooling, 34 MBH Heating Ceiling Concealed Ducted Indoor Unit (Daikin FXMQ30PVJU)	3,415.99	254.78
23 81 26 00-0204 EA 36 MBH Cooling, 40 MBH Heating Ceiling Concealed Ducted Indoor Unit (Daikin FXMQ36PVJU)	3,652.78	280.25
23 81 26 00-0205 EA 48 MBH Cooling, 54 MBH Heating Ceiling Concealed Ducted Indoor Unit (Daikin FXMQ48PVJU)	3,783.76	308.28
23 81 26 00-0206 EA 7.5 MBH Cooling, 8.7 MBH Heating 4-Way Ceiling Recessed Cassette With Grille (Daikin FXZQ07M7VJU)	2,433.45	142.67
23 81 26 00-0207 EA 9.5 MBH Cooling, 11.1 MBH Heating 4-Way Ceiling Recessed Cassette With Grille (Daikin FXZQ09M7VJU)	2,491.55	146.75
23 81 26 00-0208 EA 12 MBH Cooling, 14 MBH Heating 4-Way Ceiling Recessed Cassette With Grille (Daikin FXZQ12M7VJU)	2,648.66	152.87
23 81 26 00-0209 EA 18 MBH Cooling, 21 MBH Heating 4-Way Ceiling Recessed Cassette With Grille (Daikin FXZQ18M7VJU)	2,835.10	193.63
23 81 26 00-0210 Branch Selector Boxes <small>(23 81 26 00-0164)</small>		
23 81 26 00-0211 EA 144 MBH, 4 Branch, Multi Port Branch Selector Box (Daikin BSV4Q36PVJU)	7,323.33	166.76
23 81 26 00-0212 EA 216 MBH, 6 Branch, Multi Port Branch Selector Box (Daikin BSV6Q36PVJU)	10,823.52	222.35
23 81 26 00-0213 EA 36 MBH, 4 Branch, Single Port Branch Selector Box (Daikin BSVQ36PVJU)	1,457.07	74.12
23 81 26 00-0214 EA 60 MBH, 8 Branch, Single Port Branch Selector Box (Daikin BSVQ60PVJU)	1,967.80	111.17
23 81 26 00-0215 EA 96 MBH, 8 Branch, Single Port Branch Selector Box (Daikin BSVQ96PVJU)	2,451.64	166.76
23 81 26 00-0216 Controllers <small>(23 81 26 00-0164)</small>		
23 81 26 00-0217 EA Up To 16 Units, Navigation Controller (Daikin BRC1E71)	472.94	14.82
23 81 26 00-0218 EA Individual Zone Controller (Daikin BRC2A71)	349.05	14.82
23 81 26 00-0219 EA Up To 16 Groups, Unified ON/OFF Controller (Daikin DCS301C71)	651.78	14.82
23 81 26 00-0220 EA Up To 64 Units, Multizone Controller (Daikin DCS302C71)	902.56	14.82
23 81 26 00-0221 EA I-Touch Manager Replaced Both Daikin IMP-128 thru 1024 and DCS601C71 (Daikin DCM601A71)	8,472.89	177.89
23 81 26 00-0222 EA I-Touch Manager D3net Plus Adapter (Daikin DCM601A72)	1,546.99	14.82



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 81 26 00-0223				Energy Recovery Units <small>(23 81 26 00-0164)</small>		
			EA	300 CFM Energy Recovery Unit (Daikin VAM300GVJU).....	2,542.20	92.65
			EA	470 CFM Energy Recovery Unit (Daikin VAM470GVJU).....	3,290.97	96.35
			EA	600 CFM Energy Recovery Unit (Daikin VAM600GVJU).....	3,933.80	100.06
			EA	1,200 CFM Energy Recovery Unit (Daikin VAM1200GVJU).....	7,318.06	111.17
23 81 43				Air-Source Unitary Heat Pumps <small>(23 81)</small>		
23 81 43 00-0001				Single Package Thru-Wall Heat Pumps <small>(23 81 43)</small>		
				Note: Air-to-air type with electric heat. Includes throwaway filters. Through the wall units are wired for 230/208 V, 1 phase, 60 HZ. With electronic controls, thermostat, cord and NEMA plug. Units are shipped fully factory assembled in one piece, prewired, prepiped and charged with refrigerant, complete with push button controls all mounted in a steel cabinet, wall sleeve and outdoor grille. Excludes crane and associated personnel.		
			EA	1/2 Ton Single Package Heat Pump, Air To Air Type With Electric Heat.....	1,751.62	120.72
				<i>For Unit Economizer, Add</i>	205.53	
				<i>For >35 To 70, Deduct</i>	-45.55	
				<i>For >70 To 100, Deduct</i>	-75.91	
				<i>For >100, Deduct</i>	-106.28	
				<i>For Low Ambient Protection, 0 Degree F, Add</i>	194.99	
			EA	1 Ton Single Package Heat Pump, Air To Air Type With Electric Heat.....	1,936.42	128.77
				<i>For Unit Economizer, Add</i>	227.38	
				<i>For >35 To 70, Deduct</i>	-50.61	
				<i>For >70 To 100, Deduct</i>	-84.35	
				<i>For >100, Deduct</i>	-118.09	
				<i>For Low Ambient Protection, 0 Degree F, Add</i>	214.19	
			EA	1-1/2 Ton Single Package Heat Pump, Air To Air Type With Electric Heat.....	3,353.44	128.77
				<i>For Unit Economizer, Add</i>	397.42	
				<i>For >35 To 70, Deduct</i>	-93.12	
				<i>For >70 To 100, Deduct</i>	-155.20	
				<i>For >100, Deduct</i>	-217.28	
				<i>For Low Ambient Protection, 0 Degree F, Add</i>	341.73	
			EA	2 Ton Single Package Heat Pump, Air To Air Type With Electric Heat.....	3,673.18	128.77
				<i>For Unit Economizer, Add</i>	435.47	
				<i>For >35 To 70, Deduct</i>	-102.23	
				<i>For >70 To 100, Deduct</i>	-170.38	
				<i>For >100, Deduct</i>	-238.53	
				<i>For Low Ambient Protection, 0 Degree F, Add</i>	168.62	
			EA	2-1/2 Ton Single Package Heat Pump, Air To Air Type With Electric Heat.....	4,161.64	136.82
				<i>For Unit Economizer, Add</i>	493.76	
				<i>For >35 To 70, Deduct</i>	-116.40	
				<i>For >70 To 100, Deduct</i>	-194.00	
				<i>For >100, Deduct</i>	-271.60	
				<i>For Low Ambient Protection, 0 Degree F, Add</i>	166.82	
			EA	3 Ton Single Package Heat Pump, Air To Air Type With Electric Heat.....	4,364.07	144.86
				<i>For Unit Economizer, Add</i>	518.05	
				<i>For >35 To 70, Deduct</i>	-122.47	
				<i>For >70 To 100, Deduct</i>	-204.12	
				<i>For >100, Deduct</i>	-285.77	
				<i>For Low Ambient Protection, 0 Degree F, Add</i>	601.13	
			EA	3-1/2 Ton Single Package Heat Pump, Air To Air Type With Electric Heat.....	4,919.98	144.86
				<i>For Unit Economizer, Add</i>	584.44	
				<i>For >35 To 70, Deduct</i>	-138.67	
				<i>For >70 To 100, Deduct</i>	-231.11	
				<i>For >100, Deduct</i>	-323.55	
				<i>For Low Ambient Protection, 0 Degree F, Add</i>	675.33	
			EA	4 Ton Single Package Heat Pump, Air To Air Type With Electric Heat.....	5,434.11	152.91
				<i>For Unit Economizer, Add</i>	645.98	
				<i>For >35 To 70, Deduct</i>	-153.85	
				<i>For >70 To 100, Deduct</i>	-256.41	
				<i>For >100, Deduct</i>	-358.98	
				<i>For Low Ambient Protection, 0 Degree F, Add</i>	743.13	
			EA	5 Ton Single Package Heat Pump, Air To Air Type With Electric Heat.....	6,258.38	177.05
				<i>For Unit Economizer, Add</i>	743.92	
				<i>For >35 To 70, Deduct</i>	-177.13	
				<i>For >70 To 100, Deduct</i>	-295.21	
				<i>For >100, Deduct</i>	-413.30	
				<i>For Low Ambient Protection, 0 Degree F, Add</i>	856.08	
			EA	7-1/2 Ton Single Package Heat Pump, Air To Air Type With Electric Heat.....	11,526.58	209.24
				<i>For Unit Economizer, Add</i>	1,374.66	
				<i>For >35 To 70, Deduct</i>	-333.00	
				<i>For >70 To 100, Deduct</i>	-555.00	
				<i>For >100, Deduct</i>	-777.00	
				<i>For Low Ambient Protection, 0 Degree F, Add</i>	1,549.64	
			EA	10 Ton Single Package Heat Pump, Air To Air Type With Electric Heat.....	14,844.43	265.57
				<i>For Unit Economizer, Add</i>	1,770.55	
				<i>For >35 To 70, Deduct</i>	-429.16	
				<i>For >70 To 100, Deduct</i>	-715.26	
				<i>For >100, Deduct</i>	-1,001.37	
				<i>For Low Ambient Protection, 0 Degree F, Add</i>	277.85	

23 Heating, Ventilating, And Air-Conditioning (HVAC)

23 80 Decentralized Unitary HVAC Equipment

23 81 Decentralized Unitary HVAC Equipment



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 81 43 00-0013	EA		12-1/2 Ton Single Package Heat Pump, Air To Air Type With Electric Heat.....	18,139.68	297.77
			<i>For Unit Economizer, Add</i>	2,164.85	
			<i>For >35 To 70, Deduct</i>	-526.32	
			<i>For >70 To 100, Deduct</i>	-877.21	
			<i>For >100, Deduct</i>	-1,228.09	
			<i>For Low Ambient Protection, 0 Degree F, Add</i>	324.32	
23 81 43 00-0014	EA		15 Ton Single Package Heat Pump, Air To Air Type With Electric Heat.....	22,395.73	338.01
			<i>For Unit Economizer, Add</i>	2,674.13	
			<i>For >35 To 70, Deduct</i>	-651.83	
			<i>For >70 To 100, Deduct</i>	-1,086.39	
			<i>For >100, Deduct</i>	-1,520.94	
			<i>For Low Ambient Protection, 0 Degree F, Add</i>	384.27	
23 81 43 00-0015	EA		20 Ton Single Package Heat Pump, Air To Air Type With Electric Heat.....	29,874.58	362.15
			<i>For Unit Economizer, Add</i>	3,570.46	
			<i>For >35 To 70, Deduct</i>	-874.51	
			<i>For >70 To 100, Deduct</i>	-1,457.51	
			<i>For >100, Deduct</i>	-2,040.52	
			<i>For Low Ambient Protection, 0 Degree F, Add</i>	472.58	
23 81 43 00-0016	EA		25 Ton Single Package Heat Pump, Air To Air Type With Electric Heat.....	36,011.94	394.34
			<i>For Unit Economizer, Add</i>	4,305.66	
			<i>For >35 To 70, Deduct</i>	-1,056.70	
			<i>For >70 To 100, Deduct</i>	-1,761.16	
			<i>For >100, Deduct</i>	-2,465.63	
			<i>For Low Ambient Protection, 0 Degree F, Add</i>	549.40	
23 81 43 00-0017 Single Package Vertical Wall Heat Pumps (23 81 43)					
Note: Air-to-air type with electric heat. Includes throwaway filters. Wall units are wired for 230/208 V, 1 phase, 60 HZ. With solid state electronic controls, thermostat, cord and NEMA plug. Units are shipped fully factory assembled in one piece, prewired, prepiped and charged with refrigerant, complete with push button controls, insulated steel cabinet, with wall sleeve and outdoor grille and stainless steel drain pan. Excludes crane and associated personnel.					
23 81 43 00-0018	EA		1/2 Ton Single Package Heat Pump, Vertical Wall Unit, Air To Air Type With Electric Heat.....	2,696.76	160.96
23 81 43 00-0019	EA		1 Ton Single Package Heat Pump, Vertical Wall Unit, Air To Air Type With Electric Heat.....	3,286.60	177.05
23 81 43 00-0020	EA		1-1/2 Ton Single Package Heat Pump, Vertical Wall Unit, Air To Air Type With Electric Heat	4,271.70	185.10
23 81 43 00-0021	EA		2 Ton Single Package Heat Pump, Vertical Wall Unit, Air To Air Type With Electric Heat.....	4,903.14	201.19
23 81 43 00-0022	EA		2-1/2 Ton Single Package Heat Pump, Vertical Wall Unit, Air To Air Type With Electric Heat	6,140.53	233.38
23 81 43 00-0023	EA		3 Ton Single Package Heat Pump, Vertical Wall Unit, Air To Air Type With Electric Heat.....	6,553.86	265.57
23 81 43 00-0024	EA		3-1/2 Ton Single Package Heat Pump, Vertical Wall Unit, Air To Air Type With Electric Heat	7,110.78	297.77
23 81 43 00-0025	EA		4 Ton Single Package Heat Pump, Vertical Wall Unit, Air To Air Type With Electric Heat.....	8,003.92	329.96
23 81 43 00-0026	EA		5 Ton Single Package Heat Pump, Vertical Wall Unit, Air To Air Type With Electric Heat.....	9,012.43	394.34
23 81 43 00-0027 Heat Pump, Room Air-Conditioners (23 81 43)					
Note: Includes throwaway filters and supplemental heat.					
23 81 43 00-0028 Heat Pump, Window Unit, Room Air-Conditioners (23 81 43 00-0027)					
23 81 43 00-0029 Heat Pump, Window Unit, Room Air-Conditioners (Friedrich) (23 81 43 00-0028)					
23 81 43 00-0030	EA		9,500 BTU, 10.4 EER, 230/208 Volt, Heat Pump, Through-The-Wall, Room Air-Conditioner (Friedrich YS10N10B)	1,284.65	77.82
			<i>For >10 To 50, Deduct</i>	-56.45	
			<i>For >50 To 75, Deduct</i>	-79.03	
			<i>For >75 To 100, Deduct</i>	-112.90	
			<i>For >100, Deduct</i>	-135.48	
23 81 43 00-0031	EA		11,500 BTU, 10.4 EER, 230/208 Volt, Heat Pump, Through-The-Wall, Room Air-Conditioner (Friedrich YS12N33B).....	1,504.65	77.82
			<i>For >10 To 50, Deduct</i>	-67.45	
			<i>For >50 To 75, Deduct</i>	-94.43	
			<i>For >75 To 100, Deduct</i>	-134.90	
			<i>For >100, Deduct</i>	-161.88	
23 81 43 00-0032	EA		17,500 BTU, 10.4 EER, 230/208 Volt, Heat Pump, Through-The-Wall, Room Air-Conditioner (Friedrich YM18N34B).....	1,704.65	77.82
			<i>For >10 To 50, Deduct</i>	-77.45	
			<i>For >50 To 75, Deduct</i>	-108.43	
			<i>For >75 To 100, Deduct</i>	-154.90	
			<i>For >100, Deduct</i>	-185.88	
23 81 43 00-0033	EA		24,000 BTU, 9.8 EER, 230/208 Volt, Heat Pump, Through-The-Wall, Room Air-Conditioner (Friedrich YL24N35B).....	1,934.65	77.82
			<i>For >10 To 50, Deduct</i>	-88.95	
			<i>For >50 To 75, Deduct</i>	-124.53	
			<i>For >75 To 100, Deduct</i>	-177.90	
			<i>For >100, Deduct</i>	-213.48	
23 81 43 00-0034 Heat Pump, Through-The-Wall, Room Air-Conditioners (23 81 43 00-0027)					
Note: Base unit excludes wall sleeve.					
23 81 43 00-0035 Heat Pump, Through-The-Wall, Room Air-Conditioners (Friedrich) (23 81 43 00-0034)					
23 81 43 00-0036	EA		9,300 BTU, 9.8 EER, 230/208 Volt, Heat Pump, Through-The-Wall, Room Air-Conditioner (Friedrich WY09C33D)	1,210.17	55.59
			<i>For >10 To 50, Deduct</i>	-54.95	
			<i>For >50 To 75, Deduct</i>	-76.93	
			<i>For >75 To 100, Deduct</i>	-109.90	
			<i>For >100, Deduct</i>	-131.88	
			<i>For 27" Wide x 16-3/4" Deep x 16-3/4" High, Wall Sleeve (Friedrich WSE), Add</i>	196.12	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 81 43 00-0037 EA 12,000 BTU, 8.6 EER, 230/208 Volt, Heat Pump, Through-The-Wall, Room Air-Conditioner (Friedrich WY12C33).....	1,260.17	55.59
<i>For >10 To 50, Deduct</i>	-57.45	
<i>For >50 To 75, Deduct</i>	-80.43	
<i>For >75 To 100, Deduct</i>	-114.90	
<i>For >100, Deduct</i>	-137.88	
<i>For 27" Wide x 16-3/4" Deep x 16-3/4" High, Wall Sleeve (Friedrich WSE), Add</i>	196.12	
23 81 46 Water-Source Unitary Heat Pumps (23 81)		
23 81 46 00-0001 Horizontal, Ceiling Mounted, Geothermal Water Source Heat Pumps (23 81 46)		
Note: R410a. Includes rubber isolator hanger brackets. McQuay CCW Series.		
23 81 46 00-0002 EA 7 MBH, 300 CFM Horizontal, Ceiling Mounted, Geothermal Water Source Heat Pump	1,672.15	159.75
23 81 46 00-0003 EA 9 MBH, 300 CFM Horizontal, Ceiling Mounted, Geothermal Water Source Heat Pump	1,721.84	159.75
23 81 46 00-0004 EA 12 MBH, 400 CFM Horizontal, Ceiling Mounted, Geothermal Water Source Heat Pump	1,984.58	175.73
23 81 46 00-0005 EA 19 MBH, 630 CFM Horizontal, Ceiling Mounted, Geothermal Water Source Heat Pump	2,094.92	191.70
23 81 46 00-0006 EA 24 MBH, 800 CFM Horizontal, Ceiling Mounted, Geothermal Water Source Heat Pump	2,248.33	207.68
23 81 46 00-0007 EA 30 MBH, 1,000 CFM Horizontal, Ceiling Mounted, Geothermal Water Source Heat Pump	2,633.63	223.66
23 81 46 00-0008 EA 36 MBH, 1,200 CFM Horizontal, Ceiling Mounted, Geothermal Water Source Heat Pump	2,698.70	239.63
23 81 46 00-0009 EA 42 MBH, 1,400 CFM Horizontal, Ceiling Mounted, Geothermal Water Source Heat Pump	2,940.46	255.61
23 81 46 00-0010 EA 48 MBH, 1,600 CFM Horizontal, Ceiling Mounted, Geothermal Water Source Heat Pump	3,138.04	271.58
23 81 46 00-0011 EA 60 MBH, 2,000 CFM Horizontal, Ceiling Mounted, Geothermal Water Source Heat Pump	3,197.60	287.56
23 81 49 Split System Heat Pumps (23 81)		
23 81 49 00-0001 Split System Heat Pump (23 81 49)		
See CSI section 23 23 16 00-0001 for piping.		
23 81 49 00-0002 Air Cooled, Outdoor Section (23 81 49 00-0001)		
23 81 49 00-0003 EA 1.5 Ton, 14 SEER, Outdoor Heat Pump Unit.....	1,850.14	239.02
Note: Precharged with refrigerant capable of charging the system with a 20' length of piping.		
<i>For Low Ambient Protection, 0 Degree F, Add</i>	343.50	
<i>For Winterstart Control, Add</i>	95.73	
<i>For 16 SEER, Add</i>	431.52	
<i>For 18 SEER, Add</i>	654.72	
23 81 49 00-0004 EA 2 Ton, 14 SEER, Outdoor Heat Pump Unit.....	1,919.38	265.57
Note: Precharged with refrigerant capable of charging the system with a 20' length of piping.		
<i>For Low Ambient Protection, 0 Degree F, Add</i>	358.49	
<i>For Winterstart Control, Add</i>	100.92	
<i>For 16 SEER, Add</i>	439.93	
<i>For 18 SEER, Add</i>	667.48	
23 81 49 00-0005 EA 2.5 Ton, 14 SEER, Outdoor Heat Pump Unit.....	2,107.77	308.23
Note: Precharged with refrigerant capable of charging the system with a 20' length of piping.		
<i>For Low Ambient Protection, 0 Degree F, Add</i>	395.66	
<i>For Winterstart Control, Add</i>	112.32	
<i>For 16 SEER, Add</i>	475.89	
<i>For 18 SEER, Add</i>	722.04	
23 81 49 00-0006 EA 3 Ton, 14 SEER, Outdoor Heat Pump Unit.....	2,311.53	354.10
Note: Precharged with refrigerant capable of charging the system with a 20' length of piping.		
<i>For Low Ambient Protection, 0 Degree F, Add</i>	347.13	
<i>For Winterstart Control, Add</i>	124.65	
<i>For 16 SEER, Add</i>	514.75	
<i>For 18 SEER, Add</i>	781.00	
23 81 49 00-0007 EA 3.5 Ton, 14 SEER, Outdoor Heat Pump Unit.....	2,386.13	367.78
Note: Precharged with refrigerant capable of charging the system with a 20' length of piping.		
<i>For Low Ambient Protection, 0 Degree F, Add</i>	358.76	
<i>For Winterstart Control, Add</i>	128.87	
<i>For 16 SEER, Add</i>	530.41	
<i>For 18 SEER, Add</i>	804.76	
23 81 49 00-0008 EA 4 Ton, 14 SEER, Outdoor Heat Pump Unit.....	2,644.57	422.51
Note: Precharged with refrigerant capable of charging the system with a 20' length of piping.		
<i>For Low Ambient Protection, 0 Degree F, Add</i>	395.81	
<i>For Winterstart Control, Add</i>	142.00	
<i>For 16 SEER, Add</i>	591.89	
<i>For 18 SEER, Add</i>	898.04	
23 81 49 00-0009 EA 5 Ton, 14 SEER, Outdoor Heat Pump Unit.....	3,001.93	464.76
Note: Precharged with refrigerant capable of charging the system with a 20' length of piping.		
<i>For Low Ambient Protection, 0 Degree F, Add</i>	282.88	
<i>For Winterstart Control, Add</i>	89.77	
<i>For 16 SEER, Add</i>	678.02	
<i>For 18 SEER, Add</i>	1,028.72	
23 81 49 00-0010 EA 7.5 Ton, 11.5 EER, Outdoor Heat Pump Unit	5,962.56	518.83
Note: Precharged with refrigerant capable of charging the system with a 20' length of piping.		
<i>For Low Ambient Protection, 0 Degree F, Add</i>	446.36	
<i>For Winterstart Control, Add</i>	126.33	
23 81 49 00-0011 EA 10 Ton, 11.1 EER, Outdoor Heat Pump Unit	8,282.56	622.58
Note: Precharged with refrigerant capable of charging the system with a 20' length of piping.		
<i>For Low Ambient Protection, 0 Degree F, Add</i>	303.31	
<i>For Winterstart Control, Add</i>	163.00	
23 81 49 00-0012 EA 15 Ton, 10.9 EER, Outdoor Heat Pump Unit	10,929.40	726.35
Note: Precharged with refrigerant capable of charging the system with a 20' length of piping.		
<i>For Low Ambient Protection, 0 Degree F, Add</i>	339.39	
<i>For Winterstart Control, Add</i>	202.46	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 80 Decentralized Unitary HVAC Equipment****23 81 Decentralized Unitary HVAC Equipment**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 81 49 00-0013 EA 20 Ton, 10.3 EER, Outdoor Heat Pump Unit Note: Precharged with refrigerant capable of charging the system with a 20' length of piping. For Low Ambient Protection, 0 Degree F, Add 358.49 For Winterstart Control, Add 251.61	15,157.34	778.23
23 81 49 00-0014 Indoor Section, Horizontal - Upflow Including Throwaway Filters (23 81 49 00-0001)		
23 81 49 00-0015 EA 2 Ton Indoor Section Split Heat Pump Packaged Unit, Horizontal Upflow With 5 KW Electric Heat For Additional 5 KW Electric Heat, Add 94.37	1,023.44	79.31
23 81 49 00-0016 EA 2-1/2 Ton Indoor Section Split Heat Pump Packaged Unit, Horizontal Upflow With 5 KW Electric Heat For Additional 5 KW Electric Heat, Add 102.39	1,122.75	98.80
23 81 49 00-0017 EA 3 Ton Indoor Section Split Heat Pump Packaged Unit, Horizontal Upflow With 5 KW Electric Heat For Additional 5 KW Electric Heat, Add 104.47	1,164.20	119.33
23 81 49 00-0018 EA 3-1/2 Ton Indoor Section Split Heat Pump Packaged Unit, Horizontal Upflow With 5 KW Electric Heat For Additional 5 KW Electric Heat, Add 143.98	1,579.66	139.71
23 81 49 00-0019 EA 4 Ton Indoor Section Split Heat Pump Packaged Unit, Horizontal Upflow With 10 KW Electric Heat For Additional 5 KW Electric Heat, Add 145.77	1,615.37	157.50
23 81 49 00-0020 EA 5 Ton Indoor Section Split Heat Pump Packaged Unit, Horizontal Upflow With 10 KW Electric Heat For Additional 5 KW Electric Heat, Add 160.82	1,788.93	180.85
23 81 49 00-0021 EA 7-1/2 Ton Indoor Section Split Heat Pump Packaged Unit, Horizontal Upflow With 10 KW Electric Heat For Additional 5 KW Electric Heat, Add 356.49	3,861.39	296.47
23 81 49 00-0022 EA 10 Ton Indoor Section Split Heat Pump Packaged Unit, Horizontal Upflow With 15 kW Electric Heat For Additional 5 KW Electric Heat, Add 541.06	5,744.15	333.52
23 81 49 00-0023 EA 15 Ton Indoor Section Split Heat Pump Packaged Unit, Horizontal Upflow With 15KW Electric Heat For Additional 5 KW Electric Heat, Add 773.59	8,106.46	370.58
23 81 49 00-0024 EA 20 Ton Indoor Section Split Heat Pump Packaged Unit, Horizontal Upflow With 15 KW Electric Heat..... For Additional 5 KW Electric Heat, Add 875.71	9,201.91	444.71
23 81 49 00-0025 Ductless Split System Heat Pumps (23 81 49 00-0001) Note: Excludes refrigerant piping, electrical, and pad. Sanyo units or equal. See CSI section 23 81 26 00-0030 for accessories.		
23 81 49 00-0026 Wall Mounted Ductless Split System Heat Pumps (23 81 49 00-0025)		
23 81 49 00-0027 EA 9,000 BTU Cooling, 12,200 BTU Heating, 16 SEER, Wall Mounted Ductless Split System Heat Pumps..... Note: Includes indoor unit, outdoor unit, wireless thermostat and refrigerant charge.	1,819.50	244.59
23 81 49 00-0028 EA 11,900 BTU Cooling, 13,300 BTU Heating, 17 SEER, Wall Mounted Ductless Split System Heat Pumps..... Note: Includes indoor unit, outdoor unit, wireless thermostat and refrigerant charge.	2,009.50	266.82
23 81 49 00-0029 EA 17,500 BTU Cooling, 20,400 BTU Heating, 20 SEER, Wall Mounted Ductless Split System Heat Pumps..... Note: Includes indoor unit, outdoor unit, wireless thermostat and refrigerant charge.	2,460.43	296.47
23 81 49 00-0030 EA 24,200 BTU Cooling, 29,000 BTU Heating, 17 SEER, Wall Mounted Ductless Split System Heat Pumps..... Note: Includes indoor unit, outdoor unit, wireless thermostat and refrigerant charge.	2,835.70	326.12
23 81 49 00-0031 EA 25,200 BTU Cooling, 29,200 BTU Heating, 14.9 SEER, Wall Mounted Ductless Split System Heat Pumps..... Note: Includes indoor unit, outdoor unit, wireless thermostat and refrigerant charge.	4,060.80	355.76
23 81 49 00-0032 EA 29,800 BTU Cooling, 34,800 BTU Heating, 15 SEER, Wall Mounted Ductless Split System Heat Pumps..... Note: Includes indoor unit, outdoor unit, wireless thermostat and refrigerant charge.	4,720.00	370.58
23 81 49 00-0033 EA 31,400 BTU Cooling, 36,400 BTU Heating, 15.9 SEER, Wall Mounted Ductless Split System Heat Pumps..... Note: Includes indoor unit, outdoor unit, wireless thermostat and refrigerant charge.	5,181.78	395.05
23 81 49 00-0034 Dual and Tri Zone Wall Mounted Ductless Split System Heat Pumps (23 81 49 00-0025) Note: Use this section only when matching indoor and outdoor capacity units are not used.		
23 81 49 00-0035 EA 7,500 BTU Cooling, 8,500 BTU Heating Indoor Unit, Wall Mounted Ductless Split System Heat Pumps..... Note: Includes indoor unit and wireless thermostat.	748.43	118.59
23 81 49 00-0036 EA 9,000 BTU Cooling, 12,200 BTU Heating Indoor Unit, Wall Mounted Ductless Split System Heat Pumps..... Note: Includes indoor unit and wireless thermostat.	789.00	126.00
23 81 49 00-0037 EA 11,900 BTU Cooling, 14,300 BTU Heating Indoor Unit, Wall Mounted Ductless Split System Heat Pumps..... Note: Includes indoor unit and wireless thermostat.	830.30	133.41
23 81 49 00-0038 EA 17,500 BTU Cooling, 20,400 BTU Heating Indoor Unit, Wall Mounted Ductless Split System Heat Pumps..... Note: Includes indoor unit and wireless thermostat.	948.72	140.83
23 81 49 00-0039 EA 24,200 BTU Cooling, 29,000 BTU Heating Indoor Unit, Wall Mounted Ductless Split System Heat Pumps..... Note: Includes indoor unit and wireless thermostat.	1,011.32	148.23
23 81 49 00-0040 EA 19,700 BTU Cooling, 24,800 BTU Heating, 16.4 SEER, Outdoor Unit, Wall Mounted Ductless Split System Heat Pumps Note: Includes outdoor unit and refrigerant charge.	2,306.22	177.89
23 81 49 00-0041 EA 23,200 BTU Cooling, 29,200 BTU Heating, 16.5 SEER, Outdoor Unit, Wall Mounted Ductless Split System Heat Pumps Note: Includes outdoor unit and refrigerant charge.	2,739.92	192.71
23 81 49 00-0042 EA 30,600 BTU Cooling, 32,000 BTU Heating, 17.2 SEER, Outdoor Unit, Wall Mounted Ductless Split System Heat Pumps Note: Includes outdoor unit and refrigerant charge.	4,486.21	207.53
23 81 49 00-0043 Suspended Ceiling Mounted Ductless Split System Heat Pumps (23 81 49 00-0025) Note: Excludes hangers.		
23 81 49 00-0044 EA 24,400 BTU Cooling, 30,800 BTU Heating, 14.5 SEER, Ceiling Suspended Ductless Split System Heat Pumps Note: Includes indoor unit, outdoor unit, wireless thermostat and refrigerant charge.	4,350.21	355.76
23 81 49 00-0045 EA 31,200 BTU Cooling, 37,400 BTU Heating, 15.1 SEER, Ceiling Suspended Ductless Split System Heat Pumps Note: Includes indoor unit, outdoor unit, wireless thermostat and refrigerant charge.	5,279.09	424.69
23 81 49 00-0046 EA 39,000 BTU Cooling, 44,500 BTU Heating, 15.6 SEER, Ceiling Suspended Ductless Split System Heat Pumps Note: Includes indoor unit, outdoor unit, wireless thermostat and refrigerant charge.	6,397.84	444.71



MINOR	TOTAL DIRECT	DEMOLITION
CSI UOM DESCRIPTION	UNIT COST	UNIT COST

23 81 49 00-0047	Recessed Ceiling Mounted Ductless Split System Heat Pumps <small>(23 81 49 00-0025)</small>		
	Note: Excludes hangers.		
23 81 49 00-0048	EA 11,900 BTU Cooling, 13,600 BTU Heating, 16 SEER, Ceiling Recessed Ductless Split System Heat Pumps	2,863.68	296.47
	Note: Includes indoor unit, outdoor unit, wireless thermostat and refrigerant charge.		
23 81 49 00-0049	EA 17,500 BTU Cooling, 20,400 BTU Heating, 16 SEER, Ceiling Recessed Ductless Split System Heat Pumps	3,249.24	326.12
	Note: Includes indoor unit, outdoor unit, wireless thermostat and refrigerant charge.		
23 81 49 00-0050	EA 24,800 BTU Cooling, 29,800 BTU Heating, 14.1 SEER, Ceiling Recessed Ductless Split System Heat Pumps	4,314.15	385.41
	Note: Includes indoor unit, outdoor unit, wireless thermostat and refrigerant charge.		
23 81 49 00-0051	EA 32,600 BTU Cooling, 37,600 BTU Heating, 14.6 SEER, Ceiling Recessed Ductless Split System Heat Pumps	4,985.28	424.69
	Note: Includes indoor unit, outdoor unit, wireless thermostat and refrigerant charge.		
23 81 49 00-0052	EA 39,500 BTU Cooling, 48,000 BTU Heating, 14.6 SEER, Ceiling Recessed Ductless Split System Heat Pumps	6,250.94	444.71
	Note: Includes indoor unit, outdoor unit, wireless thermostat and refrigerant charge.		

23 82 Convection Heating And Cooling Units (23 80)

23 82 16 Air Coils (23 82)

23 82 16 00-0001	Chilled Water Cooling Coils <small>(23 82 16)</small>		
	Note: Flanged construction, 16 gauge galvanized steel casing.		
23 82 16 00-0002	2 Row Chilled Water Cooling Coils <small>(23 82 16 00-0001)</small>		
23 82 16 00-0003	EA 12" x 12" Chilled Water Cooling Coil, 2 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted	825.82	39.94
23 82 16 00-0004	EA 12" x 24" Chilled Water Cooling Coil, 2 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted	1,360.08	54.31
23 82 16 00-0005	EA 24" x 30" Chilled Water Cooling Coil, 2 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted	1,841.91	85.47
23 82 16 00-0006	EA 24" x 48" Chilled Water Cooling Coil, 2 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted	2,243.80	122.21
23 82 16 00-0007	EA 30" x 48" Chilled Water Cooling Coil, 2 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted	2,400.93	150.17
23 82 16 00-0008	EA 30" x 60" Chilled Water Cooling Coil, 2 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted	2,699.41	182.12
23 82 16 00-0009	EA 30" x 72" Chilled Water Cooling Coil, 2 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted	2,907.59	210.87
23 82 16 00-0010	EA 30" x 84" Chilled Water Cooling Coil, 2 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted	3,162.53	372.55
23 82 16 00-0011	EA 34" x 32" Chilled Water Cooling Coil, 2 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted	1,900.58	141.62
23 82 16 00-0012	EA 34" x 48" Chilled Water Cooling Coil, 2 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted	2,479.30	241.15
23 82 16 00-0013	EA 34" x 60" Chilled Water Cooling Coil, 2 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted	2,779.77	299.54
23 82 16 00-0014	EA 34" x 72" Chilled Water Cooling Coil, 2 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted	3,086.29	361.76
23 82 16 00-0015	EA 34" x 84" Chilled Water Cooling Coil, 2 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted	3,387.73	421.27
23 82 16 00-0016	4 Row Chilled Water Cooling Coils <small>(23 82 16 00-0001)</small>		
23 82 16 00-0017	EA 12" x 12" Chilled Water Cooling Coil, 4 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted	1,030.54	83.07
23 82 16 00-0018	EA 12" x 24" Chilled Water Cooling Coil, 4 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted	1,649.85	119.82
23 82 16 00-0019	EA 24" x 30" Chilled Water Cooling Coil, 4 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted	2,271.66	199.69
23 82 16 00-0020	EA 24" x 48" Chilled Water Cooling Coil, 4 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted	2,809.61	296.34
23 82 16 00-0021	EA 30" x 48" Chilled Water Cooling Coil, 4 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted	3,260.94	363.44
23 82 16 00-0022	EA 30" x 60" Chilled Water Cooling Coil, 4 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted	3,883.17	444.12
23 82 16 00-0023	EA 30" x 72" Chilled Water Cooling Coil, 4 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted	4,348.72	532.78
23 82 16 00-0024	EA 30" x 84" Chilled Water Cooling Coil, 4 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted	4,311.78	620.17
23 82 16 00-0025	EA 34" x 32" Chilled Water Cooling Coil, 4 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted	2,637.91	267.67
23 82 16 00-0026	EA 34" x 48" Chilled Water Cooling Coil, 4 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted	3,401.25	402.59
23 82 16 00-0027	EA 34" x 60" Chilled Water Cooling Coil, 4 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted	3,791.39	499.23
23 82 16 00-0028	EA 34" x 72" Chilled Water Cooling Coil, 4 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted	4,274.59	601.47
23 82 16 00-0029	EA 34" x 84" Chilled Water Cooling Coil, 4 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted	4,714.97	703.16
23 82 16 00-0030	6 Row Chilled Water Cooling Coils <small>(23 82 16 00-0001)</small>		
23 82 16 00-0031	EA 12" x 12" Chilled Water Cooling Coil, 6 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted	1,448.79	105.44

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 80 Decentralized Unitary HVAC Equipment****23 82 Convection Heating And Cooling Units**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 82 16 00-0032 EA 12" x 24" Chilled Water Cooling Coil, 6 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted.....	1,724.66	156.56
23 82 16 00-0033 EA 24" x 30" Chilled Water Cooling Coil, 6 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted.....	2,375.99	266.79
23 82 16 00-0034 EA 24" x 48" Chilled Water Cooling Coil, 6 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted.....	3,247.15	399.38
23 82 16 00-0035 EA 30" x 48" Chilled Water Cooling Coil, 6 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted.....	4,253.36	499.23
23 82 16 00-0036 EA 30" x 60" Chilled Water Cooling Coil, 6 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted.....	4,858.22	614.26
23 82 16 00-0037 EA 30" x 72" Chilled Water Cooling Coil, 6 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted.....	5,657.75	726.09
23 82 16 00-0038 EA 30" x 84" Chilled Water Cooling Coil, 6 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted.....	5,472.57	846.14
23 82 16 00-0039 EA 34" x 32" Chilled Water Cooling Coil, 6 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted.....	3,319.20	365.76
23 82 16 00-0040 EA 34" x 48" Chilled Water Cooling Coil, 6 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted.....	4,292.33	548.60
23 82 16 00-0041 EA 34" x 60" Chilled Water Cooling Coil, 6 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted.....	4,871.02	686.94
23 82 16 00-0042 EA 34" x 72" Chilled Water Cooling Coil, 6 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted.....	5,430.78	825.21
23 82 16 00-0043 EA 34" x 84" Chilled Water Cooling Coil, 6 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted.....	5,992.33	960.05
23 82 16 00-0044 8 Row Chilled Water Cooling Coils (23 82 16 00-0001)		
23 82 16 00-0045 EA 12" x 12" Chilled Water Cooling Coil, 8 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted.....	1,809.01	127.00
23 82 16 00-0046 EA 12" x 24" Chilled Water Cooling Coil, 8 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted.....	2,233.12	194.90
23 82 16 00-0047 EA 24" x 30" Chilled Water Cooling Coil, 8 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted.....	3,358.99	347.47
23 82 16 00-0048 EA 24" x 48" Chilled Water Cooling Coil, 8 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted.....	4,492.74	532.78
23 82 16 00-0049 EA 30" x 48" Chilled Water Cooling Coil, 8 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted.....	5,407.10	666.17
23 82 16 00-0050 EA 30" x 60" Chilled Water Cooling Coil, 8 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted.....	6,292.64	798.78
23 82 16 00-0051 EA 30" x 72" Chilled Water Cooling Coil, 8 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted.....	7,219.06	887.44
23 82 16 00-0052 EA 30" x 84" Chilled Water Cooling Coil, 8 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted.....	6,311.48	1,029.38
23 82 16 00-0053 EA 34" x 32" Chilled Water Cooling Coil, 8 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted.....	3,802.69	445.72
23 82 16 00-0054 EA 34" x 48" Chilled Water Cooling Coil, 8 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted.....	4,934.72	670.09
23 82 16 00-0055 EA 34" x 60" Chilled Water Cooling Coil, 8 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted.....	5,606.66	834.72
23 82 16 00-0056 EA 34" x 72" Chilled Water Cooling Coil, 8 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted.....	6,249.91	998.47
23 82 16 00-0057 EA 34" x 84" Chilled Water Cooling Coil, 8 Row Flanged Construction, 16 Gauge Galvanized Steel Casing, Duct Mounted.....	6,930.60	1,174.68
23 82 16 00-0058 Direct Expansion Cooling Coils (23 82 16)		
Note: Flanged construction 16 gauge galvanized steel casing.		
23 82 16 00-0059 2 Row Direct Expansion Cooling Coils (23 82 16 00-0058)		
23 82 16 00-0060 EA 12" x 12" Direct Expansion Cooling Coil, 2 Rows Flanged Construction, 16 Gauge Galvanized Steel Casing.....	701.96	59.91
For 10 Fins Per Inch, Add	11.64	
For 12 Fins Per Inch, Add	29.09	
23 82 16 00-0061 EA 12" x 24" Direct Expansion Cooling Coil, 2 Rows Flanged Construction, 16 Gauge Galvanized Steel Casing.....	1,328.39	82.28
For 10 Fins Per Inch, Add	23.27	
For 12 Fins Per Inch, Add	58.18	
23 82 16 00-0062 EA 24" x 30" Direct Expansion Cooling Coil, 2 Rows Flanged Construction, 16 Gauge Galvanized Steel Casing.....	1,841.91	129.40
For 10 Fins Per Inch, Add	31.68	
For 12 Fins Per Inch, Add	79.21	
23 82 16 00-0063 EA 24" x 48" Direct Expansion Cooling Coil, 2 Rows Flanged Construction, 16 Gauge Galvanized Steel Casing.....	2,243.80	186.11
For 10 Fins Per Inch, Add	37.45	
For 12 Fins Per Inch, Add	93.61	
23 82 16 00-0064 EA 30" x 48" Direct Expansion Cooling Coil, 2 Rows Flanged Construction, 16 Gauge Galvanized Steel Casing.....	2,616.76	227.65
For 10 Fins Per Inch, Add	43.21	
For 12 Fins Per Inch, Add	108.02	
23 82 16 00-0065 EA 30" x 60" Direct Expansion Cooling Coil, 2 Rows Flanged Construction, 16 Gauge Galvanized Steel Casing.....	2,941.63	275.57
For 10 Fins Per Inch, Add	47.82	
For 12 Fins Per Inch, Add	119.54	
23 82 16 00-0066 EA 30" x 72" Direct Expansion Cooling Coil, 2 Rows Flanged Construction, 16 Gauge Galvanized Steel Casing.....	3,375.43	319.51
For 10 Fins Per Inch, Add	54.73	
For 12 Fins Per Inch, Add	136.82	
23 82 16 00-0067 EA 30" x 84" Direct Expansion Cooling Coil, 2 Rows Flanged Construction, 16 Gauge Galvanized Steel Casing.....	4,213.66	372.55
For 10 Fins Per Inch, Add	69.37	
For 12 Fins Per Inch, Add	173.43	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 82 16 00-0068 EA 34" x 32" Direct Expansion Cooling Coil, 2 Rows Flanged Construction, 16 Gauge Galvanized Steel Casing..... <i>For 10 Fins Per Inch, Add</i> <i>For 12 Fins Per Inch, Add</i>	1,616.75 26.67 66.68	141.62
23 82 16 00-0069 EA 34" x 48" Direct Expansion Cooling Coil, 2 Rows Flanged Construction, 16 Gauge Galvanized Steel Casing..... <i>For 10 Fins Per Inch, Add</i> <i>For 12 Fins Per Inch, Add</i>	2,128.84 32.93 82.32	241.15
23 82 16 00-0070 EA 34" x 72" Direct Expansion Cooling Coil, 2 Rows Flanged Construction, 16 Gauge Galvanized Steel Casing..... <i>For 10 Fins Per Inch, Add</i> <i>For 12 Fins Per Inch, Add</i>	2,671.65 38.96 97.41	361.76
23 82 16 00-0071 EA 34" x 84" Direct Expansion Cooling Coil, 2 Rows Flanged Construction, 16 Gauge Galvanized Steel Casing..... <i>For 10 Fins Per Inch, Add</i> <i>For 12 Fins Per Inch, Add</i>	2,941.02 41.97 104.92	421.27
23 82 16 00-0072 4 Row Direct Expansion Cooling Coils <small>(23 82 16 00-0058)</small>		
23 82 16 00-0073 EA 12" x 12" Direct Expansion Cooling Coil, 4 Rows Flanged Construction, 16 Gauge Galvanized Steel Casing..... <i>For 10 Fins Per Inch, Add</i> <i>For 12 Fins Per Inch, Add</i>	1,154.40 19.76 49.40	83.07
23 82 16 00-0074 EA 12" x 24" Direct Expansion Cooling Coil, 4 Rows Flanged Construction, 16 Gauge Galvanized Steel Casing..... <i>For 10 Fins Per Inch, Add</i> <i>For 12 Fins Per Inch, Add</i>	1,649.85 28.23 70.57	119.82
23 82 16 00-0075 EA 24" x 30" Direct Expansion Cooling Coil, 4 Rows Flanged Construction, 16 Gauge Galvanized Steel Casing..... <i>For 10 Fins Per Inch, Add</i> <i>For 12 Fins Per Inch, Add</i>	2,271.66 37.45 93.61	199.69
23 82 16 00-0076 EA 24" x 48" Direct Expansion Cooling Coil, 4 Rows Flanged Construction, 16 Gauge Galvanized Steel Casing..... <i>For 10 Fins Per Inch, Add</i> <i>For 12 Fins Per Inch, Add</i>	2,809.61 44.36 110.90	296.34
23 82 16 00-0077 EA 30" x 48" Direct Expansion Cooling Coil, 4 Rows Flanged Construction, 16 Gauge Galvanized Steel Casing..... <i>For 10 Fins Per Inch, Add</i> <i>For 12 Fins Per Inch, Add</i>	3,260.94 50.70 126.74	363.44
23 82 16 00-0078 EA 30" x 60" Direct Expansion Cooling Coil, 4 Rows Flanged Construction, 16 Gauge Galvanized Steel Casing..... <i>For 10 Fins Per Inch, Add</i> <i>For 12 Fins Per Inch, Add</i>	3,883.17 59.91 149.78	444.12
23 82 16 00-0079 EA 30" x 72" Direct Expansion Cooling Coil, 4 Rows Flanged Construction, 16 Gauge Galvanized Steel Casing..... <i>For 10 Fins Per Inch, Add</i> <i>For 12 Fins Per Inch, Add</i>	4,348.72 65.67 164.18	532.78
23 82 16 00-0080 EA 30" x 84" Direct Expansion Cooling Coil, 4 Rows Flanged Construction, 16 Gauge Galvanized Steel Casing..... <i>For 10 Fins Per Inch, Add</i> <i>For 12 Fins Per Inch, Add</i>	4,311.78 61.43 153.57	620.17
23 82 16 00-0081 EA 34" x 32" Direct Expansion Cooling Coil, 4 Rows Flanged Construction, 16 Gauge Galvanized Steel Casing..... <i>For 10 Fins Per Inch, Add</i> <i>For 12 Fins Per Inch, Add</i>	2,637.91 42.05 105.13	267.67
23 82 16 00-0082 EA 34" x 48" Direct Expansion Cooling Coil, 4 Rows Flanged Construction, 16 Gauge Galvanized Steel Casing..... <i>For 10 Fins Per Inch, Add</i> <i>For 12 Fins Per Inch, Add</i>	3,401.25 51.92 129.80	402.59
23 82 16 00-0083 EA 34" x 72" Direct Expansion Cooling Coil, 4 Rows Flanged Construction, 16 Gauge Galvanized Steel Casing..... <i>For 10 Fins Per Inch, Add</i> <i>For 12 Fins Per Inch, Add</i>	5,199.22 75.66 189.15	708.12
23 82 16 00-0084 EA 34" x 84" Direct Expansion Cooling Coil, 4 Rows Flanged Construction, 16 Gauge Galvanized Steel Casing..... <i>For 10 Fins Per Inch, Add</i> <i>For 12 Fins Per Inch, Add</i>	5,961.98 86.23 215.58	825.21
23 82 16 00-0085 6 Row Direct Expansion Cooling Coils <small>(23 82 16 00-0058)</small>		
23 82 16 00-0086 EA 12" x 12" Direct Expansion Cooling Coil, 6 Rows Flanged Construction, 16 Gauge Galvanized Steel Casing..... <i>For 10 Fins Per Inch, Add</i> <i>For 12 Fins Per Inch, Add</i>	1,477.60 25.35 63.37	104.64
23 82 16 00-0087 EA 12" x 24" Direct Expansion Cooling Coil, 6 Rows Flanged Construction, 16 Gauge Galvanized Steel Casing..... <i>For 10 Fins Per Inch, Add</i> <i>For 12 Fins Per Inch, Add</i>	1,724.66 28.23 70.57	156.56
23 82 16 00-0088 EA 24" x 30" Direct Expansion Cooling Coil, 6 Rows Flanged Construction, 16 Gauge Galvanized Steel Casing..... <i>For 10 Fins Per Inch, Add</i> <i>For 12 Fins Per Inch, Add</i>	2,520.01 39.75 99.38	266.79
23 82 16 00-0089 EA 24" x 48" Direct Expansion Cooling Coil, 6 Rows Flanged Construction, 16 Gauge Galvanized Steel Casing..... <i>For 10 Fins Per Inch, Add</i> <i>For 12 Fins Per Inch, Add</i>	3,247.15 48.97 122.42	399.38
23 82 16 00-0090 EA 30" x 48" Direct Expansion Cooling Coil, 6 Rows Flanged Construction, 16 Gauge Galvanized Steel Casing..... <i>For 10 Fins Per Inch, Add</i> <i>For 12 Fins Per Inch, Add</i>	4,253.36 65.10 162.74	499.23
23 82 16 00-0091 EA 30" x 60" Direct Expansion Cooling Coil, 6 Rows Flanged Construction, 16 Gauge Galvanized Steel Casing..... <i>For 10 Fins Per Inch, Add</i> <i>For 12 Fins Per Inch, Add</i>	4,858.22 72.59 181.47	614.26
23 82 16 00-0092 EA 30" x 72" Direct Expansion Cooling Coil, 6 Rows Flanged Construction, 16 Gauge Galvanized Steel Casing..... <i>For 10 Fins Per Inch, Add</i> <i>For 12 Fins Per Inch, Add</i>	5,657.75 84.11 210.27	726.09
23 82 16 00-0093 EA 30" x 84" Direct Expansion Cooling Coil, 6 Rows Flanged Construction, 16 Gauge Galvanized Steel Casing..... <i>For 10 Fins Per Inch, Add</i> <i>For 12 Fins Per Inch, Add</i>	5,472.57 75.61 189.01	846.14
23 82 16 00-0094 EA 34" x 32" Direct Expansion Cooling Coil, 6 Rows Flanged Construction, 16 Gauge Galvanized Steel Casing..... <i>For 10 Fins Per Inch, Add</i> <i>For 12 Fins Per Inch, Add</i>	3,319.20 51.75 129.39	365.76
23 82 16 00-0095 EA 34" x 48" Direct Expansion Cooling Coil, 6 Rows Flanged Construction, 16 Gauge Galvanized Steel Casing..... <i>For 10 Fins Per Inch, Add</i> <i>For 12 Fins Per Inch, Add</i>	4,292.33 63.90 159.76	548.60

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 80 Decentralized Unitary HVAC Equipment****23 82 Convection Heating And Cooling Units**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 82 16 00-0096	EA		34" x 72" Direct Expansion Cooling Coil, 6 Rows Flanged Construction, 16 Gauge Galvanized Steel Casing.....	5,417.25	818.42
			For 10 Fins Per Inch, Add	75.61	
			For 12 Fins Per Inch, Add	189.02	
23 82 16 00-0097	EA		34" x 84" Direct Expansion Cooling Coil, 6 Rows Flanged Construction, 16 Gauge Galvanized Steel Casing.....	5,992.33	960.05
			For 10 Fins Per Inch, Add	81.44	
			For 12 Fins Per Inch, Add	203.61	
23 82 16 00-0098			8 Row Direct Expansion Cooling Coils <small>(23 82 16 00-0058)</small>		
23 82 16 00-0099	EA		12" x 12" Direct Expansion Cooling Coil, 8 Rows Flanged Construction, 16 Gauge Galvanized Steel Casing.....	1,837.82	126.21
			For 10 Fins Per Inch, Add	31.68	
			For 12 Fins Per Inch, Add	79.21	
23 82 16 00-0100	EA		12" x 24" Direct Expansion Cooling Coil, 8 Rows Flanged Construction, 16 Gauge Galvanized Steel Casing.....	2,233.12	194.90
			For 10 Fins Per Inch, Add	36.87	
			For 12 Fins Per Inch, Add	92.17	
23 82 16 00-0101	EA		24" x 30" Direct Expansion Cooling Coil, 8 Rows Flanged Construction, 16 Gauge Galvanized Steel Casing.....	3,358.99	347.47
			For 10 Fins Per Inch, Add	53.29	
			For 12 Fins Per Inch, Add	133.22	
23 82 16 00-0102	EA		24" x 48" Direct Expansion Cooling Coil, 8 Rows Flanged Construction, 16 Gauge Galvanized Steel Casing.....	4,492.74	532.78
			For 10 Fins Per Inch, Add	68.55	
			For 12 Fins Per Inch, Add	171.39	
23 82 16 00-0103	EA		30" x 48" Direct Expansion Cooling Coil, 8 Rows Flanged Construction, 16 Gauge Galvanized Steel Casing.....	5,407.10	666.17
			For 10 Fins Per Inch, Add	81.52	
			For 12 Fins Per Inch, Add	203.79	
23 82 16 00-0104	EA		30" x 60" Direct Expansion Cooling Coil, 8 Rows Flanged Construction, 16 Gauge Galvanized Steel Casing.....	6,292.64	798.78
			For 10 Fins Per Inch, Add	93.90	
			For 12 Fins Per Inch, Add	234.76	
23 82 16 00-0105	EA		30" x 72" Direct Expansion Cooling Coil, 8 Rows Flanged Construction, 16 Gauge Galvanized Steel Casing.....	7,219.06	887.44
			For 10 Fins Per Inch, Add	108.88	
			For 12 Fins Per Inch, Add	272.20	
23 82 16 00-0106	EA		30" x 84" Direct Expansion Cooling Coil, 8 Rows Flanged Construction, 16 Gauge Galvanized Steel Casing.....	6,311.48	1,029.38
			For 10 Fins Per Inch, Add	85.06	
			For 12 Fins Per Inch, Add	212.64	
23 82 16 00-0107	EA		34" x 32" Direct Expansion Cooling Coil, 8 Rows Flanged Construction, 16 Gauge Galvanized Steel Casing.....	3,802.69	445.72
			For 10 Fins Per Inch, Add	58.22	
			For 12 Fins Per Inch, Add	145.56	
23 82 16 00-0108	EA		34" x 48" Direct Expansion Cooling Coil, 8 Rows Flanged Construction, 16 Gauge Galvanized Steel Casing.....	4,934.72	670.09
			For 10 Fins Per Inch, Add	71.89	
			For 12 Fins Per Inch, Add	179.73	
23 82 16 00-0109	EA		34" x 72" Direct Expansion Cooling Coil, 8 Rows Flanged Construction, 16 Gauge Galvanized Steel Casing.....	6,270.07	1,008.53
			For 10 Fins Per Inch, Add	85.06	
			For 12 Fins Per Inch, Add	212.65	
23 82 16 00-0110	EA		34" x 84" Direct Expansion Cooling Coil, 8 Rows Flanged Construction, 16 Gauge Galvanized Steel Casing.....	6,930.60	1,174.68
			For 10 Fins Per Inch, Add	91.63	
			For 12 Fins Per Inch, Add	229.06	
23 82 16 00-0111			Hot Water Heating Coils <small>(23 82 16)</small>		
			Note: Flanged construction.		
23 82 16 00-0112			1 Row Hot Water Heating Coils <small>(23 82 16 00-0111)</small>		
23 82 16 00-0113	EA		12" x 12" Hot Water Heating Coil, 1 Row Flanged Construction.....	849.58	107.83
			For 10 Fins Per Inch, Add	12.67	
			For 12 Fins Per Inch, Add	31.68	
			For 230 PSIG Heavy Duty, Add	191.51	
23 82 16 00-0114	EA		12" x 24" Hot Water Heating Coil, 1 Row Flanged Construction.....	1,254.79	138.18
			For 10 Fins Per Inch, Add	19.59	
			For 12 Fins Per Inch, Add	48.97	
			For 230 PSIG Heavy Duty, Add	278.50	
23 82 16 00-0115	EA		24" x 30" Hot Water Heating Coil, 1 Row Flanged Construction.....	1,532.54	190.11
			For 10 Fins Per Inch, Add	23.04	
			For 12 Fins Per Inch, Add	57.61	
			For 230 PSIG Heavy Duty, Add	344.55	
23 82 16 00-0116	EA		24" x 48" Hot Water Heating Coil, 1 Row Flanged Construction.....	1,828.70	266.79
			For 10 Fins Per Inch, Add	25.92	
			For 12 Fins Per Inch, Add	64.81	
			For 230 PSIG Heavy Duty, Add	418.99	
23 82 16 00-0117	EA		30" x 48" Hot Water Heating Coil, 1 Row Flanged Construction.....	2,079.24	319.51
			For 10 Fins Per Inch, Add	28.80	
			For 12 Fins Per Inch, Add	72.01	
			For 230 PSIG Heavy Duty, Add	479.75	
23 82 16 00-0118	EA		30" x 60" Hot Water Heating Coil, 1 Row Flanged Construction.....	2,440.62	399.38
			For 10 Fins Per Inch, Add	32.84	
			For 12 Fins Per Inch, Add	82.09	
			For 230 PSIG Heavy Duty, Add	568.00	
23 82 16 00-0119	EA		30" x 72" Hot Water Heating Coil, 1 Row Flanged Construction.....	2,731.00	443.32
			For 10 Fins Per Inch, Add	36.87	
			For 12 Fins Per Inch, Add	92.17	
			For 230 PSIG Heavy Duty, Add	634.95	
23 82 16 00-0120	EA		30" x 84" Hot Water Heating Coil, 1 Row Flanged Construction.....	3,371.37	515.45
			For 10 Fins Per Inch, Add	46.73	
			For 12 Fins Per Inch, Add	116.83	
			For 230 PSIG Heavy Duty, Add	777.74	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 82 16 00-0121 EA 34" x 32" Hot Water Heating Coil, 1 Row Flanged Construction..... <i>For 10 Fins Per Inch, Add</i> <i>For 12 Fins Per Inch, Add</i> <i>For 230 PSIG Heavy Duty, Add</i>	1,455.61 20.18 50.44 335.80	223.33
23 82 16 00-0122 EA 34" x 48" Hot Water Heating Coil, 1 Row Flanged Construction..... <i>For 10 Fins Per Inch, Add</i> <i>For 12 Fins Per Inch, Add</i> <i>For 230 PSIG Heavy Duty, Add</i>	2,183.40 30.27 75.66 503.69	335.09
23 82 16 00-0123 EA 34" x 72" Hot Water Heating Coil, 1 Row Flanged Construction..... <i>For 10 Fins Per Inch, Add</i> <i>For 12 Fins Per Inch, Add</i> <i>For 230 PSIG Heavy Duty, Add</i>	3,283.61 45.40 113.50 758.09	506.82
23 82 16 00-0124 EA 34" x 84" Hot Water Heating Coil, 1 Row Flanged Construction..... <i>For 10 Fins Per Inch, Add</i> <i>For 12 Fins Per Inch, Add</i> <i>For 230 PSIG Heavy Duty, Add</i>	3,822.92 52.97 132.41 882.05	587.34
23 82 16 00-0125 SF >15 SF Hot Water Heating Coil, 1 Row, Flanged Construction..... <i>For 10 Fins Per Inch, Add</i> <i>For 12 Fins Per Inch, Add</i> <i>For 230 PSIG Heavy Duty, Add</i>	175.09 2.32 5.80 40.93	29.55
23 82 16 00-0126 2 Row Hot Water Heating Coils <small>(23 82 16 00-0111)</small>		
23 82 16 00-0127 EA 12" x 12" Hot Water Heating Coil, 2 Row Flanged Construction..... <i>For 10 Fins Per Inch, Add</i> <i>For 12 Fins Per Inch, Add</i> <i>For 230 PSIG Heavy Duty, Add</i>	1,360.82 21.89 54.73 298.79	133.40
23 82 16 00-0128 EA 12" x 24" Hot Water Heating Coil, 2 Row Flanged Construction..... <i>For 10 Fins Per Inch, Add</i> <i>For 12 Fins Per Inch, Add</i> <i>For 230 PSIG Heavy Duty, Add</i>	1,478.38 22.47 56.17 331.18	177.33
23 82 16 00-0129 EA 24" x 30" Hot Water Heating Coil, 2 Row Flanged Construction..... <i>For 10 Fins Per Inch, Add</i> <i>For 12 Fins Per Inch, Add</i> <i>For 230 PSIG Heavy Duty, Add</i>	2,001.53 29.38 73.45 453.56	266.79
23 82 16 00-0130 EA 24" x 48" Hot Water Heating Coil, 2 Row Flanged Construction..... <i>For 10 Fins Per Inch, Add</i> <i>For 12 Fins Per Inch, Add</i> <i>For 230 PSIG Heavy Duty, Add</i>	2,431.39 33.41 83.53 562.35	380.21
23 82 16 00-0131 EA 30" x 48" Hot Water Heating Coil, 2 Row Flanged Construction..... <i>For 10 Fins Per Inch, Add</i> <i>For 12 Fins Per Inch, Add</i> <i>For 230 PSIG Heavy Duty, Add</i>	2,812.01 37.45 93.61 656.38	469.67
23 82 16 00-0132 EA 30" x 60" Hot Water Heating Coil, 2 Row Flanged Construction..... <i>For 10 Fins Per Inch, Add</i> <i>For 12 Fins Per Inch, Add</i> <i>For 230 PSIG Heavy Duty, Add</i>	3,013.39 37.45 93.61 716.79	570.33
23 82 16 00-0133 EA 30" x 72" Hot Water Heating Coil, 2 Row Flanged Construction..... <i>For 10 Fins Per Inch, Add</i> <i>For 12 Fins Per Inch, Add</i> <i>For 230 PSIG Heavy Duty, Add</i>	3,405.20 41.48 103.70 814.17	666.17
23 82 16 00-0134 EA 30" x 84" Hot Water Heating Coil, 2 Row Flanged Construction..... <i>For 10 Fins Per Inch, Add</i> <i>For 12 Fins Per Inch, Add</i> <i>For 230 PSIG Heavy Duty, Add</i>	4,176.79 52.58 131.44 990.16	774.02
23 82 16 00-0135 EA 34" x 32" Hot Water Heating Coil, 2 Row Flanged Construction..... <i>For 10 Fins Per Inch, Add</i> <i>For 12 Fins Per Inch, Add</i> <i>For 230 PSIG Heavy Duty, Add</i>	1,802.84 22.70 56.75 427.36	333.97
23 82 16 00-0136 EA 34" x 48" Hot Water Heating Coil, 2 Row Flanged Construction..... <i>For 10 Fins Per Inch, Add</i> <i>For 12 Fins Per Inch, Add</i> <i>For 230 PSIG Heavy Duty, Add</i>	2,705.93 34.05 85.12 641.54	501.71
23 82 16 00-0137 EA 34" x 72" Hot Water Heating Coil, 2 Row Flanged Construction..... <i>For 10 Fins Per Inch, Add</i> <i>For 12 Fins Per Inch, Add</i> <i>For 230 PSIG Heavy Duty, Add</i>	4,066.49 51.07 127.68 964.58	756.44
23 82 16 00-0138 EA 34" x 84" Hot Water Heating Coil, 2 Row Flanged Construction..... <i>For 10 Fins Per Inch, Add</i> <i>For 12 Fins Per Inch, Add</i> <i>For 230 PSIG Heavy Duty, Add</i>	4,746.49 59.59 148.96 1,126.02	883.60
23 82 16 00-0139 Steam Heating Coils <small>(23 82 16)</small> Note: Flanged construction.		
23 82 16 00-0140 EA 12" x 12" Steam Heating Coils, 1 Row Flanged Construction..... <i>For 2 Row Coil, Add</i> <i>For 4 Row Coil, Add</i>	955.83 316.61 828.87	75.09
23 82 16 00-0141 EA 12" x 24" Steam Heating Coils, 1 Row Flanged Construction..... <i>For 2 Row Coil, Add</i> <i>For 4 Row Coil, Add</i>	1,071.61 362.98 946.50	103.84
23 82 16 00-0142 EA 24" x 30" Steam Heating Coils, 1 Row Flanged Construction..... <i>For 2 Row Coil, Add</i> <i>For 4 Row Coil, Add</i>	1,437.28 505.49 1,309.58	186.11

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 80 Decentralized Unitary HVAC Equipment****23 82 Convection Heating And Cooling Units**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 82 16 00-0143	EA		24" x 48" Steam Heating Coils, 1 Row Flanged Construction..... <i>For 2 Row Coil, Add</i> <i>For 4 Row Coil, Add</i>	1,828.70 655.11 1,691.94	266.79
23 82 16 00-0144	EA		30" x 48" Steam Heating Coils, 1 Row Flanged Construction..... <i>For 2 Row Coil, Add</i> <i>For 4 Row Coil, Add</i>	2,050.43 742.93 1,915.12	319.51
23 82 16 00-0145	EA		30" x 60" Steam Heating Coils, 1 Row Flanged Construction..... <i>For 2 Row Coil, Add</i> <i>For 4 Row Coil, Add</i>	2,325.41 857.38 2,203.80	399.38
23 82 16 00-0146	EA		30" x 72" Steam Heating Coils, 1 Row Flanged Construction..... <i>For 2 Row Coil, Add</i> <i>For 4 Row Coil, Add</i>	2,558.17 944.96 2,428.17	443.32
23 82 16 00-0147	EA		30" x 84" Steam Heating Coils, 1 Row Flanged Construction..... <i>For 2 Row Coil, Add</i> <i>For 4 Row Coil, Add</i>	3,152.29 1,152.62 2,966.74	517.36
23 82 16 00-0148	EA		34" x 32" Steam Heating Coils, 1 Row Flanged Construction..... <i>For 2 Row Coil, Add</i> <i>For 4 Row Coil, Add</i>	1,361.02 497.65 1,280.91	223.33
23 82 16 00-0149	EA		34" x 48" Steam Heating Coils, 1 Row Flanged Construction..... <i>For 2 Row Coil, Add</i> <i>For 4 Row Coil, Add</i>	2,041.53 746.48 1,921.37	335.09
23 82 16 00-0150	EA		34" x 72" Steam Heating Coils, 1 Row Flanged Construction..... <i>For 2 Row Coil, Add</i> <i>For 4 Row Coil, Add</i>	3,060.60 1,118.88 2,879.98	501.71
23 82 16 00-0151	EA		34" x 84" Steam Heating Coils, 1 Row Flanged Construction..... <i>For 2 Row Coil, Add</i> <i>For 4 Row Coil, Add</i>	3,574.64 1,307.33 3,364.82	587.34
23 82 16 00-0152			Hot Water Preheat Coils For Multi-Zone Air Handling Units <small>(23 82 16)</small>		
			Note: 2 Row coils. Coils are sized by air handling unit capacity.		
23 82 16 00-0153	EA		3,000 CFM, Hot Water Preheat Coils, 2 Row Coils, Multi Zone Air Handling Unit..... <i>For Units <16,500 CFM, Add</i>	1,103.79 180.31	101.45
23 82 16 00-0154	EA		4,000 CFM, Hot Water Preheat Coils, 2 Row Coils, Multi Zone Air Handling Unit..... <i>For Units <16,500 CFM, Add</i>	1,403.36 240.23	100.64
23 82 16 00-0155	EA		5,000 CFM, Hot Water Preheat Coils, 2 Row Coils, Multi Zone Air Handling Unit..... <i>For Units <16,500 CFM, Add</i>	1,716.59 300.14	107.83
23 82 16 00-0156	EA		6,500 CFM, Hot Water Preheat Coils, 2 Row Coils, Multi Zone Air Handling Unit..... <i>For Units <16,500 CFM, Add</i>	1,992.00 351.41	117.42
23 82 16 00-0157	EA		7,500 CFM, Hot Water Preheat Coils, 2 Row Coils, Multi Zone Air Handling Unit..... <i>For Units <16,500 CFM, Add</i>	2,002.84 351.41	123.01
23 82 16 00-0158	EA		9,200 CFM, Hot Water Preheat Coils, 2 Row Coils, Multi Zone Air Handling Unit..... <i>For Units <16,500 CFM, Add</i>	2,417.99 432.06	129.40
23 82 16 00-0159	EA		11,500 CFM, Hot Water Preheat Coils, 2 Row Coils, Multi Zone Air Handling Unit..... <i>For Units <16,500 CFM, Add</i>	2,508.39 443.59	145.38
23 82 16 00-0160	EA		13,200 CFM, Hot Water Preheat Coils, 2 Row Coils, Multi Zone Air Handling Unit..... <i>For Units <16,500 CFM, Add</i>	2,774.40 489.67	162.95
23 82 16 00-0161	EA		16,500 CFM, Hot Water Preheat Coils, 2 Row Coils, Multi Zone Air Handling Unit..... <i>For Units <16,500 CFM, Add</i>	3,126.05 547.28	194.90
23 82 16 00-0162	EA		19,500 CFM, Hot Water Preheat Coils, 2 Row Coils, Multi Zone Air Handling Unit..... <i>For Units >19,500 CFM, Add</i>	3,405.28 539.22	204.49
23 82 16 00-0163	EA		22,000 CFM, Hot Water Preheat Coils, 2 Row Coils, Multi Zone Air Handling Unit..... <i>For Units >19,500 CFM, Add</i>	4,349.15 705.13	216.46
23 82 16 00-0164	EA		27,000 CFM, Hot Water Preheat Coils, 2 Row Coils, Multi Zone Air Handling Unit..... <i>For Units >19,500 CFM, Add</i>	5,546.02 891.78	296.34
23 82 16 00-0165	EA		34,000 CFM, Hot Water Preheat Coils, 2 Row Coils, Multi Zone Air Handling Unit..... <i>For Units >19,500 CFM, Add</i>	6,965.17 1,123.02	363.44
23 82 16 00-0166	EA		40,000 CFM, Hot Water Preheat Coils, 2 Row Coils, Multi Zone Air Handling Unit..... <i>For Units >19,500 CFM, Add</i>	8,100.35 1,321.39	380.21
23 82 16 00-0167	EA		47,000 CFM, Hot Water Preheat Coils, 2 Row Coils, Multi Zone Air Handling Unit..... <i>For Units >19,500 CFM, Add</i>	9,514.41 1,552.84	443.32
23 82 19			Fan Coil Units <small>(23 82)</small>		
23 82 19 00-0001			Ceiling Suspended Horizontal Fan Coil Units <small>(23 82 19)</small>		
			Note: Includes cabinet, chilled water coil, baked enamel finish, multispeed fan and fan switch with integral and/or remote thermostat to control valves and on/off and fan speeds.		
23 82 19 00-0002			Horizontal Fan Coil Units With Electric Heating Coil <small>(23 82 19 00-0001)</small>		
23 82 19 00-0003	EA		200 CFM Horizontal Fan Coil, Electric Heating, Ceiling Hung, Chilled Water Coil, With Cabinet.....	1,160.84	129.40
23 82 19 00-0004	EA		300 CFM Horizontal Fan Coil, Electric Heating, Ceiling Hung, Chilled Water Coil, With Cabinet.....	1,281.16	150.97
23 82 19 00-0005	EA		400 CFM Horizontal Fan Coil, Electric Heating, Ceiling Hung, Chilled Water Coil, With Cabinet.....	1,419.77	170.14
23 82 19 00-0006	EA		600 CFM Horizontal Fan Coil, Electric Heating, Ceiling Hung, Chilled Water Coil, With Cabinet.....	1,646.22	194.90
23 82 19 00-0007	EA		800 CFM Horizontal Fan Coil, Electric Heating, Ceiling Hung, Chilled Water Coil, With Cabinet..... <i>For 2-Way Valve Instead Of 3-Way, Deduct</i>	1,842.92 -95.72	204.49
23 82 19 00-0008	EA		1,000 CFM Horizontal Fan Coil, Electric Heating, Ceiling Hung, Chilled Water Coil, With Cabinet..... <i>For 2-Way Valve Instead Of 3-Way, Deduct</i>	2,493.34 -97.38	216.46
23 82 19 00-0009	EA		1,200 CFM Horizontal Fan Coil, Electric Heating, Ceiling Hung, Chilled Water Coil, With Cabinet..... <i>For 2-Way Valve Instead Of 3-Way, Deduct</i>	3,022.30 -100.24	234.84
23 82 19 00-0010			Horizontal Fan Coil Units With Hot Water Heating Coil <small>(23 82 19 00-0001)</small>		
23 82 19 00-0011	EA		200 CFM Horizontal Fan Coil, Hot Water Heating, Ceiling Hung, Chilled Water Coil, With Cabinet..... <i>For 2-Way Valve Instead Of 3-Way, Deduct</i>	655.26 -47.88	129.40



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
23 82 19 00-0012 EA 300 CFM Horizontal Fan Coil, Hot Water Heating, Ceiling Hung, Chilled Water Coil, With Cabinet.....	796.20	150.97
<i>For 2-Way Valve Instead Of 3-Way, Deduct</i>	-50.07	
23 82 19 00-0013 EA 400 CFM Horizontal Fan Coil, Hot Water Heating, Ceiling Hung, Chilled Water Coil, With Cabinet.....	942.67	170.14
<i>For 2-Way Valve Instead Of 3-Way, Deduct</i>	-52.00	
23 82 19 00-0014 EA 600 CFM Horizontal Fan Coil, Hot Water Heating, Ceiling Hung, Chilled Water Coil, With Cabinet.....	1,764.02	194.90
<i>For 2-Way Valve Instead Of 3-Way, Deduct</i>	-54.48	
23 82 19 00-0015 EA 800 CFM Horizontal Fan Coil, Hot Water Heating, Ceiling Hung, Chilled Water Coil, With Cabinet.....	1,980.35	205.28
<i>For 2-Way Valve Instead Of 3-Way, Deduct</i>	-95.72	
23 82 19 00-0016 EA 1,000 CFM Horizontal Fan Coil, Hot Water Heating, Ceiling Hung, Chilled Water Coil, With Cabinet.....	2,689.69	216.46
<i>For 2-Way Valve Instead Of 3-Way, Deduct</i>	-97.38	
23 82 19 00-0017 EA 1,200 CFM Horizontal Fan Coil, Hot Water Heating, Ceiling Hung, Chilled Water Coil, With Cabinet.....	3,395.34	234.84
<i>For 2-Way Valve Instead Of 3-Way, Deduct</i>	-100.24	
23 82 19 00-0018 Floor Mounted Vertical Fan Coil Units (23 82 19)		
Note: Includes cabinet, chilled water coil, baked enamel finish, multispeed fan and fan switch with integral and/or remote thermostat to control valves and on/off and fan speeds.		
23 82 19 00-0019 Vertical Fan Coil Units With Hot Water Heating Coil (23 82 19 00-0018)		
23 82 19 00-0020 EA 200 CFM Vertical Fan Coil, Hot Water Heating, Floor Mounted, Chilled Water Coil, With Cabinet	1,239.37	128.60
<i>For Fan Coil Units Without Cabinet, Deduct</i>	-160.14	
<i>For Thru-Wall Sleeve, Add</i>	106.53	
<i>For 2-Way Valve Instead Of 3-Way, Deduct</i>	-47.88	
23 82 19 00-0021 EA 300 CFM Vertical Fan Coil, Hot Water Heating, Floor Mounted, Chilled Water Coil, With Cabinet	1,400.93	150.97
<i>For Fan Coil Units Without Cabinet, Deduct</i>	-180.00	
<i>For Thru-Wall Sleeve, Add</i>	115.28	
<i>For 2-Way Valve Instead Of 3-Way, Deduct</i>	-50.07	
23 82 19 00-0022 EA 400 CFM Vertical Fan Coil, Hot Water Heating, Floor Mounted, Chilled Water Coil, With Cabinet	1,714.28	170.14
<i>For Fan Coil Units Without Cabinet, Deduct</i>	-223.15	
<i>For Thru-Wall Sleeve, Add</i>	122.98	
<i>For 2-Way Valve Instead Of 3-Way, Deduct</i>	-52.00	
23 82 19 00-0023 EA 600 CFM Vertical Fan Coil, Hot Water Heating, Floor Mounted, Chilled Water Coil, With Cabinet	1,960.36	194.90
<i>For Fan Coil Units Without Cabinet, Deduct</i>	-255.09	
<i>For Thru-Wall Sleeve, Add</i>	132.93	
<i>For 2-Way Valve Instead Of 3-Way, Deduct</i>	-54.48	
23 82 19 00-0024 EA 800 CFM Vertical Fan Coil, Hot Water Heating, Floor Mounted, Chilled Water Coil, With Cabinet	2,176.69	205.28
<i>For Fan Coil Units Without Cabinet, Deduct</i>	-285.54	
<i>For Thru-Wall Sleeve, Add</i>	136.93	
<i>For 2-Way Valve Instead Of 3-Way, Deduct</i>	-95.72	
23 82 19 00-0025 EA 1,000 CFM Vertical Fan Coil, Hot Water Heating, Floor Mounted, Chilled Water Coil, With Cabinet	2,591.51	216.46
<i>For Fan Coil Units Without Cabinet, Deduct</i>	-345.55	
<i>For Thru-Wall Sleeve, Add</i>	141.35	
<i>For 2-Way Valve Instead Of 3-Way, Deduct</i>	-97.38	
23 82 19 00-0026 EA 1,200 CFM Vertical Fan Coil, Hot Water Heating, Floor Mounted, Chilled Water Coil, With Cabinet	3,022.30	234.84
<i>For Fan Coil Units Without Cabinet, Deduct</i>	-406.36	
<i>For Thru-Wall Sleeve, Add</i>	148.97	
<i>For 2-Way Valve Instead Of 3-Way, Deduct</i>	-100.24	
23 82 19 00-0027 Removal And Reinstallation Of Fan Coil Units (23 82 19)		
Note: Includes storage and cleaning. Excludes supports.		
23 82 19 00-0028 EA Remove And Reinstall Fan Coil Unit Horizontal Or Vertical.....	339.62	
23 82 39 Unit Heaters (23 82)		
23 82 39 13 Cabinet Unit Heaters (23 82 39)		
23 82 39 13-0001 Removal and Reinstallation of Cabinet Unit Heaters (23 82 39 13)		
Note: Includes disconnection/reconnection of power and piping, storage, cleaning and reinstallation. Excludes removal and reinstallation of equipment supports.		
23 82 39 13-0002 EA Remove And Reinstall Up To 58" Cabinet Unit Heater, Floor or Wall.....	219.66	
23 82 39 13-0003 EA Remove And Reinstall >58" Cabinet Unit Heater, Floor or Wall	379.43	
23 82 39 13-0004 EA Remove And Reinstall Up To 58" Cabinet Unit Heater, Ceiling.....	452.90	
23 82 39 13-0005 EA Remove And Reinstall >58" Cabinet Unit Heater, Ceiling.....	612.66	
23 82 39 16 Propeller Unit Heaters (23 82 39)		
23 82 39 16-0001 Removal and Reinstallation of Propeller Unit Heaters (23 82 39 16)		
Note: Includes disconnection/reconnection of power and piping, storage, cleaning and reinstallation. Excludes removal and reinstallation of equipment supports.		
23 82 39 16-0002 EA Remove And Reinstall Up To 120 MBH Steam, 87.1 MBH Hot Water Hydronic Unit Heater, Horizontal or Vertical	479.26	
23 82 39 16-0003 EA Remove And Reinstall >120 MBH Steam, 87.1 MBH Hot Water Hydronic Unit Heater, Horizontal or Vertical.....	639.02	
23 82 39 19 Wall and Ceiling Unit Heaters (23 82 39)		
23 82 39 19-0001 Removal And Reinstallation Of Electric Unit Heaters (23 82 39 19)		
Note: Includes disconnection/reconnection of power and piping, storage, cleaning and reinstallation. Excludes removal and reinstallation of equipment supports.		
23 82 39 19-0002 EA Remove And Reinstall Up To 15KW Electric Unit Heater	287.58	
23 82 39 19-0003 EA Remove And Reinstall >15 KW Electric Unit Heater.....	591.16	

23 Heating, Ventilating, And Air-Conditioning (HVAC)**23 80 Decentralized Unitary HVAC Equipment****23 84 Humidity Control Equipment**MINOR
CSI UOM DESCRIPTIONTOTAL DIRECT DEMOLITION
UNIT COST UNIT COST**23 84 Humidity Control Equipment** (23 80)**23 84 13 Humidifiers** (23 84)**23 84 13 00-0001 Steam Type Pneumatically Controlled** (23 84 13)

Note: For duct or air handling installation standard unit with integral operator distribution manifold strainer trap and pneumatic modulating valve. Excludes humidistat and piping.

23 84 13 00-0002	EA	3-191 LB/Hour Steam Humidifier, 24" Manifold, Pneumatic Controls	1,125.18	210.87
		<i>For Electrically Controlled Unit, Add</i>	700.00	
		<i>For Each Additional Manifold, Add</i>	348.20	
23 84 13 00-0003	EA	3-191 LB/Hour Steam Humidifier, 48" Manifold, Pneumatic Controls	1,125.18	210.87
		<i>For Electrically Controlled Unit, Add</i>	700.00	
		<i>For Each Additional Manifold, Add</i>	348.20	
23 84 13 00-0004	EA	65-334 LB/Hour Steam Humidifier, 36" Manifold, Pneumatic Controls	1,583.24	210.87
		<i>For Electrically Controlled Unit, Add</i>	700.00	
		<i>For Each Additional Manifold, Add</i>	485.62	
23 84 13 00-0005	EA	65-334 LB/Hour Steam Humidifier, 72" Manifold, Pneumatic Controls	1,663.11	263.60
		<i>For Electrically Controlled Unit, Add</i>	700.00	
		<i>For Each Additional Manifold, Add</i>	512.25	
23 84 13 00-0006	EA	100-690 LB/Hour Steam Humidifier, 48" Manifold, Pneumatic Controls	2,336.40	210.87
		<i>For Electrically Controlled Unit, Add</i>	700.00	
		<i>For Each Additional Manifold, Add</i>	711.57	
23 84 13 00-0007	EA	100-690 LB/Hour Steam Humidifier, 84" Manifold, Pneumatic Controls	2,416.27	263.60
		<i>For Electrically Controlled Unit, Add</i>	700.00	
		<i>For Each Additional Manifold, Add</i>	738.19	
23 84 13 00-0008	EA	220-2,000 LB/Hour Steam Humidifier, 72" Manifold, Pneumatic Controls	3,593.09	263.60
		<i>For Electrically Controlled Unit, Add</i>	700.00	
		<i>For Each Additional Manifold, Add</i>	1,091.24	
23 84 13 00-0009	EA	220-2,000 LB/Hour Steam Humidifier, 144" Manifold, Pneumatic Controls	3,692.94	329.90
		<i>For Electrically Controlled Unit, Add</i>	700.00	
		<i>For Each Additional Manifold, Add</i>	1,124.52	

23 84 13 00-0010 Residential Humidifiers (23 84 13)

Note: Includes solenoid valve and flow through water supply.

23 84 13 00-0011	EA	Duct Or Furnace Mounted Humidifier, Residential Type	340.80	39.94
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END OF SECTION 23



Integrated Automation	25	25
Integrated Automation Facility Controls	25 50	
Integrated Automation Control Of HVAC	25 55	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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25 Integrated Automation

25 50 Integrated Automation Facility Controls (25)

25 55 Integrated Automation Control Of HVAC (25 50)
See CSI section 23 09 00 00-0000 for Instrumentation And Control For HVAC.

END OF SECTION 25

25 Integrated Automation

25 50 Integrated Automation Facility Controls

25 55 Integrated Automation Control Of HVAC



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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26 Electrical

Note: Termination costs are included with all electrical equipment, panel boards, fixtures and devices. Terminations are not included with patch panels.

26 01 Operation and Maintenance of Electrical Systems ⁽²⁶⁾

26 01 20 Operation and Maintenance of Low-Voltage Electrical Distribution ^(26 01)

26 01 20 00-0001		Lock Out/Tag Out Devices ^(26 01 20)	
		Note: Includes the installation and removal of device lock, pad lock and identifying markers. Includes following OSHA procedures and completing Owner's paperwork. Excludes circuit tracing.	
26 01 20 00-0002	EA	Lock Out/Tag Out Local Disconnect	20.14
26 01 20 00-0003	EA	Lock Out/Tag Out Breaker Or Motor Starter	20.14
26 01 20 00-0004	EA	Lock Out/Tag Out Tags	2.44
26 01 20 00-0005		Existing Circuit Tracing ^(26 01 20)	
26 01 20 00-0006	EA	Motors, Disconnects And Other Single Source Devices, Existing Circuit Tracing Per Device	16.76
26 01 20 00-0007	EA	Lighting, Existing Circuit Tracing Per Circuit	16.76

26 01 30 Operation And Maintenance Of Facility Electrical Power Generating And Storing Equipment ^(26 01)

26 01 30 00-0001		Emergency Generator Permits ^(26 01 30)	
26 01 30 00-0002		Air Pollution Control Board ^(26 01 30 00-0001)	
26 01 30 00-0003	EA	APCD Permit To Construct And Operate Emergency Generator	2,443.70

26 01 50 Operation and Maintenance of Lighting ^(26 01)

26 01 50 51 Luminaire Relamping ^(26 01 50)

26 01 50 51-0001		Replace Lamps In Existing Fixtures ^(26 01 50 51)	
		Note: Includes removal of existing lamp from fixture and installation of new lamp. Excludes disposal of hazardous lamps. See CSI section 26 01 50 51-0121 for disposal of hazardous lamps.	
26 01 50 51-0002		Halogen Lamps ^(26 01 50 51-0001)	
26 01 50 51-0003	EA	300 Watt, T3, Tungsten Halogen Lamp	42.72
26 01 50 51-0004	EA	500 Watt, T3, Tungsten Halogen Lamp	55.90
26 01 50 51-0005	EA	1,000 Watt, T3, Tungsten Halogen Lamp	84.60
26 01 50 51-0006	EA	60 Watt, PAR38, Halogen Lamp	19.37
26 01 50 51-0007	EA	75 Watt, PAR38, Halogen Lamp	19.37
26 01 50 51-0008	EA	90 Watt, PAR38, Halogen Lamp	18.20
26 01 50 51-0009	EA	100 Watt, PAR38, Halogen Lamp	18.20
26 01 50 51-0010		Exit Light Lamps ^(26 01 50 51-0001)	
26 01 50 51-0011	EA	Convert Exit Light Lamps To Red LED Lamps	79.76
		<i>For Green LED Lamps, Add</i>	25.00
26 01 50 51-0012	EA	Fluorescent Lamp For Exit Light	23.03
		<i>For Multiple Lamps In Fixture, Deduct</i>	-5.16
26 01 50 51-0013	EA	Lamp Replacement For Emergency Lights On Exit Sign	34.55
		<i>For Multiple Lamps In Fixture, Deduct</i>	-2.58
26 01 50 51-0014		Fluorescent Lamps ^(26 01 50 51-0001)	
26 01 50 51-0015	EA	18", 15 Watt, T8 Fluorescent Lamp	7.79
		<i>For Multiple Lamps In Fixture, Deduct</i>	-2.07
26 01 50 51-0016	EA	2', 17 Watt, T8 Fluorescent Lamp	9.11
		<i>For Multiple Lamps In Fixture, Deduct</i>	-2.07
26 01 50 51-0017	EA	3', 25 Watt, T8 Fluorescent Lamp	10.43
		<i>For Multiple Lamps In Fixture, Deduct</i>	-2.32
26 01 50 51-0018	EA	4', 28 Watt, Rapid Start T8 Fluorescent Lamp	13.63
		<i>For Multiple Lamps In Fixture, Deduct</i>	-2.32
26 01 50 51-0019	EA	4', 32 Watt, T8 Fluorescent Lamp	10.36
		<i>For Multiple Lamps In Fixture, Deduct</i>	-2.32
26 01 50 51-0020	EA	4', 30 Watt, T8 Fluorescent Lamp	12.71
		<i>For Multiple Lamps In Fixture, Deduct</i>	-2.32
26 01 50 51-0021	EA	4', 28 Watt, T8 Fluorescent Lamp	11.32
		<i>For Multiple Lamps In Fixture, Deduct</i>	-2.32
26 01 50 51-0022	EA	4', 25 Watt, T8 Fluorescent Lamp	11.27
		<i>For Multiple Lamps In Fixture, Deduct</i>	-2.32
26 01 50 51-0023	EA	4', 44 Watt, T8HO Fluorescent Lamp	17.24
		<i>For Multiple Lamps In Fixture, Deduct</i>	-2.32

26 Electrical**26 01 Operation and Maintenance of Electrical Systems****26 01 50 Operation and Maintenance of Lighting**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 01 50 51-0024 EA 8', 59 Watt, T8 Fluorescent Lamp	13.49	
<i>For Multiple Lamps In Fixture, Deduct</i>	-2.32	
26 01 50 51-0025 EA 18", 15 Watt, T12 Fluorescent Lamp	11.12	
<i>For Multiple Lamps In Fixture, Deduct</i>	-2.07	
26 01 50 51-0026 EA 2', 20 Watt, T12 Fluorescent Lamp	8.73	
<i>For Multiple Lamps In Fixture, Deduct</i>	-2.07	
26 01 50 51-0027 EA 3', 30 Watt, T12 Fluorescent Lamp	9.81	
<i>For Multiple Lamps In Fixture, Deduct</i>	-2.32	
26 01 50 51-0028 EA 4', 34 Watt, T12 Fluorescent Lamp	9.85	
<i>For Multiple Lamps In Fixture, Deduct</i>	-2.32	
26 01 50 51-0029 EA 4', 40 Watt, T12 Fluorescent Lamp	9.68	
<i>For Multiple Lamps In Fixture, Deduct</i>	-2.32	
26 01 50 51-0030 EA 8', 60 Watt, T12 Fluorescent Lamp	13.80	
<i>For Multiple Lamps In Fixture, Deduct</i>	-2.32	
26 01 50 51-0031 EA 8', 75 Watt, T12 Fluorescent Lamp	11.88	
<i>For Multiple Lamps In Fixture, Deduct</i>	-2.32	
26 01 50 51-0032 EA 8', 95 Watt, Instant Start T12 Fluorescent Lamp	19.16	
26 01 50 51-0033 EA 6" Diameter, 20 Watt, Circular T9 Fluorescent Lamp	11.24	
<i>For Multiple Lamps In Fixture, Deduct</i>	-2.07	
26 01 50 51-0034 EA 8" Diameter, 22 Watt, Circular T9 Fluorescent Lamp	9.47	
<i>For Multiple Lamps In Fixture, Deduct</i>	-2.07	
26 01 50 51-0035 EA 12" Diameter, 32 Watt, Circular T9 Fluorescent Lamp	9.20	
<i>For Multiple Lamps In Fixture, Deduct</i>	-2.07	
26 01 50 51-0036 EA 16" Diameter, 40 Watt, Circular T9 Fluorescent Lamp	10.04	
<i>For Multiple Lamps In Fixture, Deduct</i>	-2.07	
26 01 50 51-0037 EA 32 Watt, Rapid Start, U-Shaped T8 Fluorescent Lamp	16.08	
<i>For Multiple Lamps In Fixture, Deduct</i>	-2.58	
26 01 50 51-0038 EA 40 Watt, Rapid Start, U-Shaped T12 Fluorescent Lamp	15.56	
<i>For Multiple Lamps In Fixture, Deduct</i>	-2.58	
26 01 50 51-0039 EA 6", 4 Watt, T5 Fluorescent Lamp	8.50	
<i>For Multiple Lamps In Fixture, Deduct</i>	-2.07	
26 01 50 51-0040 EA 9", 6 Watt, T5 Fluorescent Lamp	8.39	
<i>For Multiple Lamps In Fixture, Deduct</i>	-2.07	
26 01 50 51-0041 EA 12", 8 Watt, T5 Fluorescent Lamp	8.61	
<i>For Multiple Lamps In Fixture, Deduct</i>	-2.07	
26 01 50 51-0042 EA 21", 13 Watt, T5 Fluorescent Lamp	8.95	
<i>For Multiple Lamps In Fixture, Deduct</i>	-2.07	
26 01 50 51-0043 EA 24", 14 Watt, T5 Fluorescent Lamp	10.12	
<i>For Multiple Lamps In Fixture, Deduct</i>	-2.07	
26 01 50 51-0044 EA 34", 21 Watt, T5 Fluorescent Lamp	11.05	
<i>For Multiple Lamps In Fixture, Deduct</i>	-2.32	
26 01 50 51-0045 EA 46", 28 Watt, T5 Fluorescent Lamp	10.75	
<i>For Multiple Lamps In Fixture, Deduct</i>	-2.32	
26 01 50 51-0046 EA 46", 54 Watt T5HO Fluorescent Lamp	11.63	
<i>For Multiple Lamps In Fixture, Deduct</i>	-2.32	
26 01 50 51-0047 EA 46", 54 Watt T5 Fluorescent Lamp	12.88	
26 01 50 51-0048 EA 5-13 Watt, 2-Pin Compact Fluorescent Lamp	6.51	
<i>For Multiple Lamps In Fixture, Deduct</i>	-1.29	
26 01 50 51-0049 EA 9-26 Watt, 4-Pin Compact Fluorescent Lamp	7.12	
<i>For Multiple Lamps In Fixture, Deduct</i>	-1.29	
26 01 50 51-0050 EA 27-55 Watt, 4-Pin Compact Fluorescent Lamp	13.81	
<i>For Multiple Lamps In Fixture, Deduct</i>	-1.29	
26 01 50 51-0051 EA Compact Fluorescent 13 Watt, 4-Pin Lamps CF13DD/E/827, Dulux	18.24	
26 01 50 51-0052 EA Compact Fluorescent 18 Watt, 4-Pin Lamps CF18DD/E/827, Dulux	18.24	
26 01 50 51-0053 EA 32 Watt 2D (DoubleD) Fluorescent Lamp, 4-Pin	32.79	
26 01 50 51-0054 EA 26 Watt (1,600 Lumens) 4-pin Quad Tube PL Lamp	12.39	
26 01 50 51-0055 Mercury Vapor Lamps (26 01 50 51-0001)		
26 01 50 51-0056 EA 100 Watt, Mercury Vapor Lamp	27.90	
26 01 50 51-0057 EA 175 Watt, Mercury Vapor Lamp	23.66	
26 01 50 51-0058 EA 250 Watt, Mercury Vapor Lamp	24.28	
26 01 50 51-0059 EA 400 Watt, Mercury Vapor Lamp	28.59	
26 01 50 51-0060 EA 1,000 Watt, Mercury Vapor Lamp	41.58	
26 01 50 51-0061 Metal Halide Lamps (26 01 50 51-0001)		
26 01 50 51-0062 EA 50 Watt, Pulse Start Metal Halide Lamp	26.27	
<i>For Pulse Start Lamps, Add</i>	1.30	
26 01 50 51-0063 EA 70 Watt, Pulse Start Metal Halide Lamp	30.04	
<i>For Pulse Start Lamps, Add</i>	1.68	
26 01 50 51-0064 EA 100 Watt, Pulse Start Metal Halide Lamp	31.05	
<i>For Pulse Start Lamps, Add</i>	1.78	
26 01 50 51-0065 EA 150 Watt, Pulse Start Metal Halide Lamp	32.67	
<i>For Pulse Start Lamps, Add</i>	1.94	
26 01 50 51-0066 EA 175 Watt, Probe Start Metal Halide Lamp	28.72	
26 01 50 51-0067 EA 175 Watt, Pulse Start Metal Halide Lamp	37.51	
26 01 50 51-0068 EA 250 Watt, Probe Start Metal Halide Lamp	26.40	
26 01 50 51-0069 EA 250 Watt, Pulse Start Metal Halide Lamp	34.69	
26 01 50 51-0070 EA 400 Watt, Probe Start Metal Halide Lamp	28.97	
26 01 50 51-0071 EA 400 Watt, Pulse Start Metal Halide Lamp	34.94	
26 01 50 51-0072 EA 1,000 Watt, Probe Start Metal Halide Lamp	35.92	
26 01 50 51-0073 EA 1,000 Watt, Pulse Start Metal Halide Lamp	39.29	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 01 50 51-0074 EA 1,500 Watt, Probe Start Metal Halide Lamp.....	43.63	
26 01 50 51-0075 High Pressure Sodium Lamps (26 01 50 51-0001)		
26 01 50 51-0076 EA 35 Watt, High Pressure Sodium Lamp.....	25.53	
<i>For Enclosed And Gasket Light Fixtures, Add</i>	1.99	
26 01 50 51-0077 EA 50 Watt, High Pressure Sodium Lamp.....	25.53	
<i>For Enclosed And Gasket Light Fixtures, Add</i>	1.99	
26 01 50 51-0078 EA 70 Watt, High Pressure Sodium Lamp.....	25.84	
<i>For Enclosed And Gasket Light Fixtures, Add</i>	1.99	
26 01 50 51-0079 EA 100 Watt, High Pressure Sodium Lamp.....	26.50	
<i>For Enclosed And Gasket Light Fixtures, Add</i>	1.99	
26 01 50 51-0080 EA 150 Watt, High Pressure Sodium Lamp.....	27.07	
<i>For Enclosed And Gasket Light Fixtures, Add</i>	1.99	
26 01 50 51-0081 EA 250 Watt, High Pressure Sodium Lamp.....	25.65	
<i>For Enclosed And Gasket Light Fixtures, Add</i>	1.99	
26 01 50 51-0082 EA 400 Watt, High Pressure Sodium Lamp.....	27.65	
<i>For Enclosed And Gasket Light Fixtures, Add</i>	1.99	
26 01 50 51-0083 EA 1,000 Watt, High Pressure Sodium Lamp.....	56.61	
26 01 50 51-0084 Low Pressure Sodium Lamps (26 01 50 51-0001)		
26 01 50 51-0085 EA 35 Watt, Low Pressure Sodium Lamp	55.45	
26 01 50 51-0086 EA 55 Watt, Low Pressure Sodium Lamp	61.58	
26 01 50 51-0087 EA 70 Watt, Low Pressure Sodium Lamp	62.96	
26 01 50 51-0088 EA 90 Watt, Low Pressure Sodium Lamp	64.34	
26 01 50 51-0089 EA 135 Watt, Low Pressure Sodium Lamp	69.86	
26 01 50 51-0090 EA 180 Watt, Low Pressure Sodium Lamp	94.71	
26 01 50 51-0091 LED Lamps (26 01 50 51-0001)		
26 01 50 51-0092 EA 3 Watt (25 Watt Incandescent Equivalent), Candelabra Base, CA10, Dimmable LED Lamp (Energy Star).....	14.67	
26 01 50 51-0093 EA 8 Watt (40 Watt Incandescent Equivalent), Medium Base, A19, Dimmable LED Lamp (Energy Star).....	24.14	
26 01 50 51-0094 EA 11 Watt (60 Watt Incandescent Equivalent), Medium Base, A19, Dimmable LED Lamp (Energy Star).....	31.36	
26 01 50 51-0095 EA 13.5 Watt (60 Watt Incandescent Equivalent), Medium Base, A19, Dimmable LED Lamp (Energy Star).....	26.19	
26 01 50 51-0096 EA 8 Watt (40 Watt Incandescent Equivalent), Medium Base, A21, Dimmable LED Lamp (Energy Star).....	27.36	
26 01 50 51-0097 EA 17 Watt (75 Watt Incandescent Equivalent), Medium Base, A21, Dimmable LED Lamp (Energy Star).....	44.66	
26 01 50 51-0098 EA 8 Watt (50 Watt Incandescent Equivalent), Medium Base, BR30, Dimmable LED Lamp (Energy Star).....	31.70	
26 01 50 51-0099 EA 11 Watt (65 Watt Incandescent Equivalent), Medium Base, BR30, Dimmable LED Lamp (Energy Star).....	38.31	
26 01 50 51-0100 EA 14 Watt (85 Watt Incandescent Equivalent), Medium Base, BR30, Dimmable LED Lamp (Energy Star).....	44.47	
26 01 50 51-0101 EA 11 Watt (65 Watt Incandescent Equivalent), Medium Base, BR40, Dimmable LED Lamp (Energy Star).....	40.81	
26 01 50 51-0102 EA 14.5 Watt (75 Watt Incandescent Equivalent), Medium Base, BR40, Dimmable LED Lamp (Energy Star).....	42.01	
26 01 50 51-0103 EA 14 Watt (85 Watt Incandescent Equivalent), Medium Base, BR40, Dimmable LED Lamp (Energy Star).....	45.20	
26 01 50 51-0104 EA 18 Watt (90 Watt Incandescent Equivalent), Medium Base, BR40, Dimmable LED Lamp (Energy Star).....	46.77	
26 01 50 51-0105 EA 7 Watt (45 Watt Halogen Equivalent), Medium Base, PAR20, Dimmable LED Lamp (Energy Star).....	29.04	
26 01 50 51-0106 EA 12 Watt (60 Watt Halogen Equivalent), Medium Base, Short Neck Par30, Dimmable LED Lamp (Energy Star).....	41.16	
26 01 50 51-0107 EA 16.3 Watt (65 Watt Halogen Equivalent), Medium Base, Short Neck PAR30, Dimmable LED Lamp (Energy Star).....	42.33	
26 01 50 51-0108 EA 15.6 Watt (70 Watt Halogen Equivalent), Medium Base, Short Neck PAR30, Dimmable LED Lamp (Energy Star).....	42.33	
26 01 50 51-0109 EA 12 Watt (50 Watt Halogen Equivalent), Medium Base, Short Neck PAR30, Dimmable LED Lamp (Energy Star).....	29.39	
26 01 50 51-0110 EA 12 Watt (50 Watt Halogen Equivalent), Medium Base, Long Neck PAR30, Dimmable LED Lamp (Energy Star).....	42.92	
26 01 50 51-0111 EA 15 Watt (75 Watt Halogen Equivalent), Medium Base, Long Neck PAR30, Dimmable LED Lamp (Energy Star).....	38.80	
26 01 50 51-0112 EA 18 Watt (90 Watt Halogen Equivalent), Medium Base, Long Neck PAR30, Dimmable LED Lamp (Energy Star).....	44.69	
26 01 50 51-0113 EA 15 Watt (75 Watt Halogen Equivalent), Medium Base, PAR38, Dimmable LED Lamp (Energy Star).....	42.92	
26 01 50 51-0114 EA 18 Watt (90 Watt Halogen Equivalent), Medium Base, PAR38, Dimmable LED Lamp (Energy Star).....	44.69	
26 01 50 51-0115 EA 19 Watt (120 Watt Halogen Equivalent), Medium Base, Par38, Dimmable LED Lamp (Energy Star).....	47.28	
26 01 50 51-0116 EA 24 Watt (120 Watt Halogen Equivalent), Medium Base, PAR38, Dimmable LED Lamp (Energy Star).....	45.86	
26 01 50 51-0117 EA 4 Watt (20 Watt Halogen Equivalent), GU5.3 Base, MR16, LED Lamp (Energy Star).....	24.13	
26 01 50 51-0118 EA 6 Watt (20 Watt Halogen Equivalent), GU5.3 Base, MR16, Dimmable LED Lamp (Energy Star).....	28.66	
26 01 50 51-0119 EA 6 Watt (30 Watt Halogen Equivalent), GU10 Base, MR16, Dimmable LED Lamp (Energy Star).....	31.70	
26 01 50 51-0120 EA 8 Watt (50 Watt Halogen Equivalent), GU5.3 Base, MR16, Dimmable LED Lamp (Energy Star).....	39.47	
26 01 50 51-0121 Recycle Hazardous Lamps (26 01 50 51)		
Note: Includes containers, shipping costs and recycling fees. Excludes lamp removal. See CSI section 26 01 50 51-0001 for removal of lamps from fixtures.		
26 01 50 51-0122 EA Recycle 2' Length Linear Fluorescent Lamps	0.23	
26 01 50 51-0123 EA Recycle 3' Length Linear Fluorescent Lamps	0.35	
26 01 50 51-0124 EA Recycle 4' Length Linear Fluorescent Lamps	0.47	
26 01 50 51-0125 EA Recycle 6' Length Linear Fluorescent Lamps	0.70	
26 01 50 51-0126 EA Recycle 8' Length Linear Fluorescent Lamps	0.94	
26 01 50 51-0127 EA Recycle Compact Fluorescent Lamps	0.42	
26 01 50 51-0128 EA Recycle U-Shaped Or Circular Fluorescent Lamps	0.42	
26 01 50 51-0129 EA Recycle High Intensity Discharge (HID) Lamps.....	1.46	
26 01 50 52 Ballasts And Accessories (26 01 50)		
26 01 50 52-0001 Lighting Ballasts (26 01 50 52)		
Note: Excludes recycling fees. See CSI section 02 84 16 00-0003 for ballast recycling.		
26 01 50 52-0002 Fluorescent Ballasts (26 01 50 52-0001)		

26 Electrical**26 01 Operation and Maintenance of Electrical Systems****26 01 50 Operation and Maintenance of Lighting**

MINOR	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 01 50 52-0003	T5 Fluorescent Ballasts (26 01 50 52-0002)		
26 01 50 52-0004	T5 Fluorescent Electronic Ballasts (26 01 50 52-0003) Note: Includes 120/277 Volt and normal ballast factor.		
26 01 50 52-0005	14 Watt, T5 Fluorescent Electronic Ballasts (26 01 50 52-0004)		
26 01 50 52-0006	EA 1 Lamp, 14 Watt, Program/Rapid Start, T5 Fluorescent Electronic Ballast.....	53.02	15.64
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.69	
	<i>For High Ballast Factor, Add</i>	2.62	
26 01 50 52-0007	EA 2 Lamp, 14 Watt, Program/Rapid Start, T5 Fluorescent Electronic Ballast.....	56.93	19.55
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.87	
	<i>For High Ballast Factor, Add</i>	2.62	
26 01 50 52-0008	21 Watt, T5 Fluorescent Electronic Ballasts (26 01 50 52-0004)		
26 01 50 52-0009	EA 1 Lamp, 21 Watt, Program/Rapid Start, T5 Fluorescent Electronic Ballast.....	53.02	15.64
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.69	
	<i>For High Ballast Factor, Add</i>	2.62	
26 01 50 52-0010	EA 2 Lamp, 21 Watt, Program/Rapid Start, T5 Fluorescent Electronic Ballast.....	56.93	19.55
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.87	
	<i>For High Ballast Factor, Add</i>	2.62	
26 01 50 52-0011	28 Watt, T5 Fluorescent Electronic Ballasts (26 01 50 52-0004)		
26 01 50 52-0012	EA 1 Lamp, 28 Watt, Program/Rapid Start, T5 Fluorescent Electronic Ballast.....	53.02	15.64
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.69	
	<i>For High Ballast Factor, Add</i>	2.62	
26 01 50 52-0013	EA 2 Lamp, 28 Watt, Program/Rapid Start, T5 Fluorescent Electronic Ballast.....	56.93	19.55
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.87	
	<i>For High Ballast Factor, Add</i>	2.62	
26 01 50 52-0014	35 Watt, T5 Fluorescent Electronic Ballasts (26 01 50 52-0004)		
26 01 50 52-0015	EA 1 Lamp, 35 Watt, Program/Rapid Start, T5 Fluorescent Electronic Ballast.....	53.02	15.64
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.69	
26 01 50 52-0016	EA 2 Lamp, 35 Watt, Program/Rapid Start, T5 Fluorescent Electronic Ballast.....	56.93	19.55
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.87	
26 01 50 52-0017	54 Watt, T5 Fluorescent Electronic Ballasts (26 01 50 52-0004)		
26 01 50 52-0018	EA 1 Lamp, 54 Watt, Program/Rapid Start, T5 Fluorescent Electronic Ballast.....	52.97	15.64
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.69	
26 01 50 52-0019	EA 2 Lamp, 54 Watt, Program/Rapid Start, T5 Fluorescent Electronic Ballast.....	56.88	19.55
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.87	
26 01 50 52-0020	EA 3 Lamp, 54 Watt, Program/Rapid Start, T5 Fluorescent Electronic Ballast.....	76.49	23.47
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	7.04	
26 01 50 52-0021	EA 4 Lamp, 54 Watt, Program/Rapid Start, T5 Fluorescent Electronic Ballast.....	80.39	27.37
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8.21	
26 01 50 52-0022	High-Output, T5HO Fluorescent Electronic Ballasts (26 01 50 52-0003) Note: Includes 120/277 Volt and normal ballast factor.		
26 01 50 52-0023	12 Watt, High-Output, T5HO Fluorescent Electronic Ballasts (26 01 50 52-0022)		
26 01 50 52-0024	EA 1 Lamp, 12 Watt, Programmed Start, High-Output, T5HO Fluorescent Electronic Ballast.....	45.56	15.64
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.69	
26 01 50 52-0025	EA 2 Lamp, 12 Watt, Programmed Start, High-Output, T5HO Fluorescent Electronic Ballast.....	49.47	19.55
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.87	
26 01 50 52-0026	24 Watt, High-Output, T5HO Fluorescent Electronic Ballasts (26 01 50 52-0022)		
26 01 50 52-0027	EA 1 Lamp, 24 Watt, Programmed Start, High-Output, T5HO Fluorescent Electronic Ballast.....	57.48	15.64
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.69	
26 01 50 52-0028	EA 2 Lamp, 24 Watt, Programmed Start, High-Output, T5HO Fluorescent Electronic Ballast.....	61.39	19.55
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.87	
26 01 50 52-0029	39 Watt, High-Output, T5HO Fluorescent Electronic Ballasts (26 01 50 52-0022)		
26 01 50 52-0030	EA 1 Lamp, 39 Watt, Programmed Start, High-Output, T5HO Fluorescent Electronic Ballast.....	57.48	15.64
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.69	
26 01 50 52-0031	EA 2 Lamp, 39 Watt, Programmed Start, High-Output, T5HO Fluorescent Electronic Ballast.....	61.39	19.55
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.87	
26 01 50 52-0032	54 Watt, High-Output, T5HO Fluorescent Electronic Ballasts (26 01 50 52-0022)		
26 01 50 52-0033	EA 1 Lamp, 54 Watt, Programmed Start, High-Output, T5HO Fluorescent Electronic Ballast.....	45.56	15.64
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.69	
26 01 50 52-0034	EA 2 Lamp, 54 Watt, Programmed Start, High-Output, T5HO Fluorescent Electronic Ballast.....	49.47	19.55
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.87	
26 01 50 52-0035	Dimming, T5 Fluorescent Electronic Ballasts (26 01 50 52-0003)		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 01 50 52-0036 Step Dimming, T5 Fluorescent Electronic Ballasts <small>(26 01 50 52-0035)</small> Note: Includes 120/277 Volt and normal ballast factor.		
26 01 50 52-0037 28 Watt, Step Dimming, T5 Fluorescent Electronic Ballast <small>(26 01 50 52-0036)</small>		
26 01 50 52-0038 EA 2 Lamp, 28 Watt, Programmed Start, Step Dimming, T5 Fluorescent Electronic Ballast.....	65.71	19.55
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	5.87	
26 01 50 52-0039 Dimming To 5%, T5 Fluorescent Electronic Ballasts <small>(26 01 50 52-0035)</small> Note: Includes 120/277 Volt and normal ballast factor.		
26 01 50 52-0040 54 Watt, Dimming To 5%, High-Output, T5HO Fluorescent Electronic Ballasts <small>(26 01 50 52-0039)</small>		
26 01 50 52-0041 EA 1 Lamp, 54 Watt, Programmed Start, Dimming To 5%, High-Output, T5HO Fluorescent Electronic Ballast.....	170.38	15.64
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	4.69	
26 01 50 52-0042 EA 2 Lamp, 54 Watt, Programmed Start, Dimming To 5%, High-Output, T5HO Fluorescent Electronic Ballast.....	169.78	19.55
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	5.87	
26 01 50 52-0043 T8 Fluorescent Ballasts <small>(26 01 50 52-0002)</small>		
26 01 50 52-0044 T8 Fluorescent Electronic Ballasts <small>(26 01 50 52-0043)</small> Note: Includes 120/277 Volt and low or normal ballast factor.		
26 01 50 52-0045 17 Watt, T8 Fluorescent Electronic Ballasts <small>(26 01 50 52-0044)</small>		
26 01 50 52-0046 EA 1 Lamp, 17 Watt, Instant Start, T8 Fluorescent Electronic Ballast.....	27.05	15.64
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	4.69	
For High Ballast Factor, Add	6.38	
26 01 50 52-0047 EA 1 Lamp, 17 Watt, Program/Rapid Start, T8 Fluorescent Electronic Ballast.....	42.42	15.64
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	4.69	
For High Ballast Factor, Add	4.20	
26 01 50 52-0048 EA 2 Lamp, 17 Watt, Instant Start, T8 Fluorescent Electronic Ballast.....	30.96	19.55
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	5.87	
For High Ballast Factor, Add	6.38	
26 01 50 52-0049 EA 2 Lamp, 17 Watt, Program/Rapid Start, T8 Fluorescent Electronic Ballast.....	46.33	19.55
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	5.87	
For High Ballast Factor, Add	4.20	
26 01 50 52-0050 EA 3 Lamp, 17 Watt, Instant Start, T8 Fluorescent Electronic Ballast.....	37.58	23.47
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	7.04	
For High Ballast Factor, Add	6.22	
26 01 50 52-0051 EA 3 Lamp, 17 Watt, Program/Rapid Start, T8 Fluorescent Electronic Ballast.....	52.61	23.47
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	7.04	
For High Ballast Factor, Add	3.57	
26 01 50 52-0052 EA 4 Lamp, 17 Watt, Instant Start, T8 Fluorescent Electronic Ballast.....	43.24	27.37
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	8.21	
For High Ballast Factor, Add	15.74	
26 01 50 52-0053 EA 4 Lamp, 17 Watt, Program/Rapid Start, T8 Fluorescent Electronic Ballast.....	58.35	27.37
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	8.21	
For High Ballast Factor, Add	9.19	
26 01 50 52-0054 25 Watt, T8 Fluorescent Electronic Ballasts <small>(26 01 50 52-0044)</small>		
26 01 50 52-0055 EA 1 Lamp, 25 Watt, Instant Start, T8 Fluorescent Electronic Ballast.....	27.05	15.64
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	4.69	
For High Ballast Factor, Add	6.38	
26 01 50 52-0056 EA 1 Lamp, 25 Watt, Program/Rapid Start, T8 Fluorescent Electronic Ballast.....	42.42	15.64
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	4.69	
For High Ballast Factor, Add	4.20	
26 01 50 52-0057 EA 2 Lamp, 25 Watt, Instant Start, T8 Fluorescent Electronic Ballast.....	30.96	19.55
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	5.87	
For High Ballast Factor, Add	6.38	
26 01 50 52-0058 EA 2 Lamp, 25 Watt, Program/Rapid Start, T8 Fluorescent Electronic Ballast.....	46.33	19.55
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	5.87	
For High Ballast Factor, Add	4.20	
26 01 50 52-0059 EA 3 Lamp, 25 Watt, Instant Start, T8 Fluorescent Electronic Ballast.....	37.58	23.47
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	7.04	
For High Ballast Factor, Add	6.22	
26 01 50 52-0060 EA 3 Lamp, 25 Watt, Program/Rapid Start, T8 Fluorescent Electronic Ballast.....	52.61	23.47
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	7.04	
For High Ballast Factor, Add	3.57	
26 01 50 52-0061 EA 4 Lamp, 25 Watt, Instant Start, T8 Fluorescent Electronic Ballast.....	43.24	27.37
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	8.21	
For High Ballast Factor, Add	15.74	
26 01 50 52-0062 EA 4 Lamp, 25 Watt, Program/Rapid Start, T8 Fluorescent Electronic Ballast.....	58.35	27.37
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	8.21	
For High Ballast Factor, Add	9.19	
26 01 50 52-0063 28 Watt, T8 Fluorescent Electronic Ballasts <small>(26 01 50 52-0044)</small>		
26 01 50 52-0064 EA 1 Lamp, 28 Watt, Instant Start, T8 Fluorescent Electronic Ballast.....	27.05	15.64
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	4.69	
For High Ballast Factor, Add	6.38	

26 Electrical**26 01 Operation and Maintenance of Electrical Systems****26 01 50 Operation and Maintenance of Lighting**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 01 50 52-0065 EA 1 Lamp, 28 Watt, Program/Rapid Start, T8 Fluorescent Electronic Ballast.....	42.42	15.64
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	4.69	
For High Ballast Factor, Add	4.20	
26 01 50 52-0066 EA 2 Lamp, 28 Watt, Instant Start, T8 Fluorescent Electronic Ballast.....	30.96	19.55
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	5.87	
For High Ballast Factor, Add	6.38	
26 01 50 52-0067 EA 2 Lamp, 28 Watt, Program/Rapid Start, T8 Fluorescent Electronic Ballast.....	46.33	19.55
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	5.87	
For High Ballast Factor, Add	4.20	
26 01 50 52-0068 EA 3 Lamp, 28 Watt, Instant Start, T8 Fluorescent Electronic Ballast.....	37.58	23.47
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	7.04	
For High Ballast Factor, Add	6.22	
26 01 50 52-0069 EA 3 Lamp, 28 Watt, Program/Rapid Start, T8 Fluorescent Electronic Ballast.....	52.61	23.47
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	7.04	
For High Ballast Factor, Add	3.57	
26 01 50 52-0070 EA 4 Lamp, 28 Watt, Instant Start, T8 Fluorescent Electronic Ballast.....	43.24	27.37
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	8.21	
For High Ballast Factor, Add	15.74	
26 01 50 52-0071 EA 4 Lamp, 28 Watt, Program/Rapid Start, T8 Fluorescent Electronic Ballast.....	58.35	27.37
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	8.21	
For High Ballast Factor, Add	9.19	
26 01 50 52-0072 32 Watt, T8 Fluorescent Electronic Ballasts (26 01 50 52-0044)		
26 01 50 52-0073 EA 1 Lamp, 32 Watt, Instant Start, T8 Fluorescent Electronic Ballast.....	27.05	15.64
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	4.69	
For High Ballast Factor, Add	6.38	
26 01 50 52-0074 EA 1 Lamp, 32 Watt, Program/Rapid Start, T8 Fluorescent Electronic Ballast.....	42.42	15.64
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	4.69	
For High Ballast Factor, Add	4.20	
26 01 50 52-0075 EA 2 Lamp, 32 Watt, Instant Start, T8 Fluorescent Electronic Ballast.....	30.96	19.55
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	5.87	
For High Ballast Factor, Add	6.38	
26 01 50 52-0076 EA 2 Lamp, 32 Watt, Program/Rapid Start, T8 Fluorescent Electronic Ballast.....	46.33	19.55
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	5.87	
For High Ballast Factor, Add	4.20	
26 01 50 52-0077 EA 3 Lamp, 32 Watt, Instant Start, T8 Fluorescent Electronic Ballast.....	37.58	23.47
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	7.04	
For High Ballast Factor, Add	6.22	
26 01 50 52-0078 EA 3 Lamp, 32 Watt, Program/Rapid Start, T8 Fluorescent Electronic Ballast.....	52.61	23.47
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	7.04	
For High Ballast Factor, Add	3.57	
26 01 50 52-0079 EA 4 Lamp, 32 Watt, Instant Start, T8 Fluorescent Electronic Ballast.....	43.24	27.37
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	8.21	
For High Ballast Factor, Add	15.74	
26 01 50 52-0080 EA 4 Lamp, 32 Watt, Program/Rapid Start, T8 Fluorescent Electronic Ballast.....	58.35	27.37
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	8.21	
For High Ballast Factor, Add	9.19	
26 01 50 52-0081 40 Watt, T8 Fluorescent Electronic Ballasts (26 01 50 52-0044)		
26 01 50 52-0082 EA 1 Lamp, 40 Watt, Instant Start, T8 Fluorescent Electronic Ballast.....	39.16	15.64
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	4.69	
For High Ballast Factor, Add	2.73	
26 01 50 52-0083 EA 1 Lamp, 40 Watt, Program/Rapid Start, T8 Fluorescent Electronic Ballast.....	42.42	15.64
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	4.69	
For High Ballast Factor, Add	4.20	
26 01 50 52-0084 EA 2 Lamp, 40 Watt, Instant Start, T8 Fluorescent Electronic Ballast.....	43.07	19.55
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	5.87	
For High Ballast Factor, Add	2.73	
26 01 50 52-0085 EA 2 Lamp, 40 Watt, Program/Rapid Start, T8 Fluorescent Electronic Ballast.....	46.33	19.55
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	5.87	
For High Ballast Factor, Add	4.20	
26 01 50 52-0086 EA 3 Lamp, 40 Watt, Instant Start, T8 Fluorescent Electronic Ballast.....	53.39	23.47
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	7.04	
For High Ballast Factor, Add	1.68	
26 01 50 52-0087 EA 3 Lamp, 40 Watt, Program/Rapid Start, T8 Fluorescent Electronic Ballast.....	52.61	23.47
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	7.04	
26 01 50 52-0088 EA 4 Lamp, 40 Watt, Instant Start, T8 Fluorescent Electronic Ballast.....	57.29	27.37
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	8.21	
For High Ballast Factor, Add	1.68	
26 01 50 52-0089 EA 4 Lamp, 40 Watt, Program/Rapid Start, T8 Fluorescent Electronic Ballast.....	58.35	27.37
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	8.21	
26 01 50 52-0090 96 Watt, T8 Fluorescent Electronic Ballasts (26 01 50 52-0044)		
26 01 50 52-0091 EA 1 Lamp, 96 Watt, Instant Start, T8 Fluorescent Electronic Ballast.....	45.56	15.64
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	4.69	
For High Ballast Factor, Add	5.85	
26 01 50 52-0092 EA 2 Lamp, 96 Watt, Instant Start, T8 Fluorescent Electronic Ballast.....	49.47	19.55
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	5.87	
For High Ballast Factor, Add	5.85	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 01 50 52-0093				High-Output, T8HO Fluorescent Electronic Ballasts (26 01 50 52-0043) Note: Includes 120/277 Volt and normal ballast factor.		
26 01 50 52-0094				48 Watt, High-Output, T8HO Fluorescent Electronic Ballasts (26 01 50 52-0093)		
26 01 50 52-0095	EA			1 Lamp, 48 Watt, Instant Start, High-Output, T8HO Fluorescent Electronic Ballast 53.81 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 4.69		15.64
26 01 50 52-0096	EA			1 Lamp, 48 Watt, Programmed Start, High-Output, T8HO Fluorescent Electronic Ballast 68.05 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 4.69		15.64
26 01 50 52-0097	EA			2 Lamp, 48 Watt, Instant Start, High-Output, T8HO Fluorescent Electronic Ballast 57.72 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 5.87		19.55
26 01 50 52-0098	EA			2 Lamp, 48 Watt, Programmed Start, High-Output, T8HO Fluorescent Electronic Ballast 71.96 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 5.87		19.55
26 01 50 52-0099				60 Watt, High-Output, T8HO Fluorescent Electronic Ballasts (26 01 50 52-0093)		
26 01 50 52-0100	EA			1 Lamp, 60 Watt, Instant Start, High-Output, T8HO Fluorescent Electronic Ballast 53.81 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 4.69		15.64
26 01 50 52-0101	EA			1 Lamp, 60 Watt, Programmed Start, High-Output, T8HO Fluorescent Electronic Ballast 68.05 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 4.69		15.64
26 01 50 52-0102	EA			2 Lamp, 60 Watt, Instant Start, High-Output, T8HO Fluorescent Electronic Ballast 57.72 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 5.87		19.55
26 01 50 52-0103	EA			2 Lamp, 60 Watt, Programmed Start, High-Output, T8HO Fluorescent Electronic Ballast 71.96 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 5.87		19.55
26 01 50 52-0104				72 Watt, High-Output, T8HO Fluorescent Electronic Ballasts (26 01 50 52-0093)		
26 01 50 52-0105	EA			1 Lamp, 72 Watt, Instant Start, High-Output, T8HO Fluorescent Electronic Ballast 53.81 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 4.69		15.64
26 01 50 52-0106	EA			1 Lamp, 72 Watt, Programmed Start, High-Output, T8HO Fluorescent Electronic Ballast 68.05 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 4.69		15.64
26 01 50 52-0107	EA			2 Lamp, 72 Watt, Instant Start, High-Output, T8HO Fluorescent Electronic Ballast 57.72 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 5.87		19.55
26 01 50 52-0108	EA			2 Lamp, 72 Watt, Programmed Start, High-Output, T8HO Fluorescent Electronic Ballast 71.96 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 5.87		19.55
26 01 50 52-0109				96 Watt, High-Output, T8HO Fluorescent Electronic Ballasts (26 01 50 52-0093)		
26 01 50 52-0110	EA			1 Lamp, 96 Watt, Instant Start, High-Output, T8HO Fluorescent Electronic Ballast 53.81 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 4.69		15.64
26 01 50 52-0111	EA			1 Lamp, 96 Watt, Programmed Start, High-Output, T8HO Fluorescent Electronic Ballast 68.05 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 4.69		15.64
26 01 50 52-0112	EA			2 Lamp, 96 Watt, Instant Start, High-Output, T8HO Fluorescent Electronic Ballast 57.72 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 5.87		19.55
26 01 50 52-0113	EA			2 Lamp, 96 Watt, Programmed Start, High-Output, T8HO Fluorescent Electronic Ballast 71.96 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 5.87		19.55
26 01 50 52-0114				Dimming, T8 Fluorescent Electronic Ballasts (26 01 50 52-0043)		
26 01 50 52-0115				Load Shed 0-10 V Dimming, T8 Fluorescent Electronic Ballasts (26 01 50 52-0114) Note: Includes 120/277 Volt and high ballast factor.		
26 01 50 52-0116				17 Watt, Load Shed 0-10 V Dimming, T8 Fluorescent Electronic Ballasts (26 01 50 52-0115)		
26 01 50 52-0117	EA			1 Lamp, 17 Watt, Instant Start, Load Shed 0-10 V Dimming, T8 Fluorescent Electronic Ballast 37.98 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 4.69		15.64
26 01 50 52-0118	EA			2 Lamp, 17 Watt, Instant Start, Load Shed 0-10 V Dimming, T8 Fluorescent Electronic Ballast 41.89 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 5.87		19.55
26 01 50 52-0119	EA			3 Lamp, 17 Watt, Instant Start, Load Shed 0-10 V Dimming, T8 Fluorescent Electronic Ballast 48.46 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 7.04		23.47
26 01 50 52-0120	EA			4 Lamp, 17 Watt, Instant Start, Load Shed 0-10 V Dimming, T8 Fluorescent Electronic Ballast 58.25 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 8.21		27.37
26 01 50 52-0121	EA			5 Lamp, 17 Watt, Instant Start, Load Shed 0-10 V Dimming, T8 Fluorescent Electronic Ballast 85.62 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 9.39		31.29
26 01 50 52-0122	EA			6 Lamp, 17 Watt, Instant Start, Load Shed 0-10 V Dimming, T8 Fluorescent Electronic Ballast 89.53 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 10.56		35.20
26 01 50 52-0123				25 Watt, Load Shed 0-10 V Dimming, T8 Fluorescent Electronic Ballasts (26 01 50 52-0115)		
26 01 50 52-0124	EA			1 Lamp, 25 Watt, Instant Start, Load Shed 0-10 V Dimming, T8 Fluorescent Electronic Ballast 37.98 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 4.69		15.64
26 01 50 52-0125	EA			2 Lamp, 25 Watt, Instant Start, Load Shed 0-10 V Dimming, T8 Fluorescent Electronic Ballast 41.89 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 5.87		19.55
26 01 50 52-0126	EA			3 Lamp, 25 Watt, Instant Start, Load Shed 0-10 V Dimming, T8 Fluorescent Electronic Ballast 48.46 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 7.04		23.47
26 01 50 52-0127	EA			4 Lamp, 25 Watt, Instant Start, Load Shed 0-10 V Dimming, T8 Fluorescent Electronic Ballast 58.25 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 8.21		27.37
26 01 50 52-0128	EA			5 Lamp, 25 Watt, Instant Start, Load Shed 0-10 V Dimming, T8 Fluorescent Electronic Ballast 85.62 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 9.39		31.29
26 01 50 52-0129	EA			6 Lamp, 25 Watt, Instant Start, Load Shed 0-10 V Dimming, T8 Fluorescent Electronic Ballast 89.53 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 10.56		35.20



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 01 50 52-0168 EA 2 Lamp, 28 Watt, Instant Start, Step Dimming, T8 Fluorescent Electronic Ballast.....	41.89	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.87	
26 01 50 52-0169 EA 3 Lamp, 28 Watt, Instant Start, Step Dimming, T8 Fluorescent Electronic Ballast.....	47.28	23.47
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	7.04	
26 01 50 52-0170 EA 4 Lamp, 28 Watt, Instant Start, Step Dimming, T8 Fluorescent Electronic Ballast.....	58.25	27.37
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8.21	
26 01 50 52-0171 EA 5 Lamp, 28 Watt, Instant Start, Step Dimming, T8 Fluorescent Electronic Ballast.....	81.87	31.29
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.39	
26 01 50 52-0172 EA 6 Lamp, 28 Watt, Instant Start, Step Dimming, T8 Fluorescent Electronic Ballast.....	85.78	35.20
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.56	
26 01 50 52-0173 32 Watt, Step Dimming, T8 Fluorescent Electronic Ballasts (26 01 50 52-0151)		
26 01 50 52-0174 EA 1 Lamp, 32 Watt, Instant Start, Step Dimming, T8 Fluorescent Electronic Ballast.....	37.98	15.64
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.69	
26 01 50 52-0175 EA 2 Lamp, 32 Watt, Instant Start, Step Dimming, T8 Fluorescent Electronic Ballast.....	41.89	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.87	
26 01 50 52-0176 EA 3 Lamp, 32 Watt, Instant Start, Step Dimming, T8 Fluorescent Electronic Ballast.....	47.28	23.47
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	7.04	
26 01 50 52-0177 EA 4 Lamp, 32 Watt, Instant Start, Step Dimming, T8 Fluorescent Electronic Ballast.....	58.25	27.37
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8.21	
26 01 50 52-0178 EA 5 Lamp, 32 Watt, Instant Start, Step Dimming, T8 Fluorescent Electronic Ballast.....	81.87	31.29
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.39	
26 01 50 52-0179 EA 6 Lamp, 32 Watt, Instant Start, Step Dimming, T8 Fluorescent Electronic Ballast.....	85.78	35.20
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.56	
26 01 50 52-0180 40 Watt, Step Dimming, T8 Fluorescent Electronic Ballasts (26 01 50 52-0151)		
26 01 50 52-0181 EA 1 Lamp, 40 Watt, Instant Start, Step Dimming, T8 Fluorescent Electronic Ballast.....	37.98	15.64
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.69	
26 01 50 52-0182 EA 2 Lamp, 40 Watt, Instant Start, Step Dimming, T8 Fluorescent Electronic Ballast.....	41.89	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.87	
26 01 50 52-0183 EA 3 Lamp, 40 Watt, Instant Start, Step Dimming, T8 Fluorescent Electronic Ballast.....	47.28	23.47
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	7.04	
26 01 50 52-0184 EA 4 Lamp, 40 Watt, Instant Start, Step Dimming, T8 Fluorescent Electronic Ballast.....	58.25	27.37
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8.21	
26 01 50 52-0185 EA 5 Lamp, 40 Watt, Instant Start, Step Dimming, T8 Fluorescent Electronic Ballast.....	81.87	31.29
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.39	
26 01 50 52-0186 EA 6 Lamp, 40 Watt, Instant Start, Step Dimming, T8 Fluorescent Electronic Ballast.....	85.78	35.20
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.56	
26 01 50 52-0187 Dimming To 3%, T8 Fluorescent Electronic Ballasts (26 01 50 52-0114)		
Note: Includes 120/277 Volt and normal ballast factor.		
26 01 50 52-0188 17 Watt, Dimming To 3%, T8 Fluorescent Electronic Ballasts (26 01 50 52-0187)		
26 01 50 52-0189 EA 1 Lamp, 17 Watt, Program/Rapid Start, Dimming To 3%, T8 Fluorescent Electronic Ballast.....	64.73	15.64
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.69	
26 01 50 52-0190 EA 2 Lamp, 17 Watt, Program/Rapid Start, Dimming To 3%, T8 Fluorescent Electronic Ballast.....	68.64	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.87	
26 01 50 52-0191 EA 3 Lamp, 17 Watt, Program/Rapid Start, Dimming To 3%, T8 Fluorescent Electronic Ballast.....	82.06	23.47
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	7.04	
26 01 50 52-0192 EA 4 Lamp, 17 Watt, Program/Rapid Start, Dimming To 3%, T8 Fluorescent Electronic Ballast.....	85.96	27.37
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8.21	
26 01 50 52-0193 25 Watt, Dimming To 3%, T8 Fluorescent Electronic Ballasts (26 01 50 52-0187)		
26 01 50 52-0194 EA 1 Lamp, 25 Watt, Program/Rapid Start, Dimming To 3%, T8 Fluorescent Electronic Ballast.....	64.73	15.64
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.69	
26 01 50 52-0195 EA 2 Lamp, 25 Watt, Program/Rapid Start, Dimming To 3%, T8 Fluorescent Electronic Ballast.....	68.64	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.87	
26 01 50 52-0196 EA 3 Lamp, 25 Watt, Program/Rapid Start, Dimming To 3%, T8 Fluorescent Electronic Ballast.....	82.06	23.47
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	7.04	
26 01 50 52-0197 EA 4 Lamp, 25 Watt, Program/Rapid Start, Dimming To 3%, T8 Fluorescent Electronic Ballast.....	85.96	27.37
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8.21	
26 01 50 52-0198 28 Watt, Dimming To 3%, T8 Fluorescent Electronic Ballasts (26 01 50 52-0187)		
26 01 50 52-0199 EA 1 Lamp, 28 Watt, Program/Rapid Start, Dimming To 3%, T8 Fluorescent Electronic Ballast.....	64.73	15.64
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.69	
26 01 50 52-0200 EA 2 Lamp, 28 Watt, Program/Rapid Start, Dimming To 3%, T8 Fluorescent Electronic Ballast.....	68.64	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.87	
26 01 50 52-0201 EA 3 Lamp, 28 Watt, Program/Rapid Start, Dimming To 3%, T8 Fluorescent Electronic Ballast.....	82.06	23.47
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	7.04	
26 01 50 52-0202 EA 4 Lamp, 28 Watt, Program/Rapid Start, Dimming To 3%, T8 Fluorescent Electronic Ballast.....	85.96	27.37
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8.21	
26 01 50 52-0203 32 Watt, Dimming To 3%, T8 Fluorescent Electronic Ballasts (26 01 50 52-0187)		
26 01 50 52-0204 EA 1 Lamp, 32 Watt, Program/Rapid Start, Dimming To 3%, T8 Fluorescent Electronic Ballast.....	64.73	15.64
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.69	
26 01 50 52-0205 EA 2 Lamp, 32 Watt, Program/Rapid Start, Dimming To 3%, T8 Fluorescent Electronic Ballast.....	68.64	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.87	

26 Electrical**26 01 Operation and Maintenance of Electrical Systems****26 01 50 Operation and Maintenance of Lighting**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 01 50 52-0206	EA		3 Lamp, 32 Watt, Program/Rapid Start, Dimming To 3%, T8 Fluorescent Electronic Ballast <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	82.06 7.04	23.47
26 01 50 52-0207	EA		4 Lamp, 32 Watt, Program/Rapid Start, Dimming To 3%, T8 Fluorescent Electronic Ballast <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	85.96 8.21	27.37
26 01 50 52-0208			T10 Fluorescent Ballasts (26 01 50 52-0208)		
26 01 50 52-0209			T10 Fluorescent Electronic Ballasts (26 01 50 52-0209) Note: Includes 120/277 Volt and normal ballast factor.		
26 01 50 52-0210			40 Watt, T10 Fluorescent Electronic Ballasts (26 01 50 52-0210)		
26 01 50 52-0211	EA		1 Lamp, 40 Watt, Program/Rapid Start, T10 Fluorescent Electronic Ballast..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	35.48 4.69	15.64
26 01 50 52-0212	EA		2 Lamp, 40 Watt, Program/Rapid Start, T10 Fluorescent Electronic Ballast..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	39.39 5.87	19.55
26 01 50 52-0213	EA		3 Lamp, 40 Watt, Program/Rapid Start, T10 Fluorescent Electronic Ballast..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	48.09 7.04	23.47
26 01 50 52-0214			T12 Fluorescent Ballasts (26 01 50 52-0214)		
26 01 50 52-0215			T12 Fluorescent Electronic Ballasts (26 01 50 52-0215) Note: Includes 120/277 Volt and normal ballast factor.		
26 01 50 52-0216			25 Watt, T12 Fluorescent Electronic Ballasts (26 01 50 52-0216)		
26 01 50 52-0217	EA		1 Lamp, 25 Watt, Instant Start, T12 Fluorescent Electronic Ballast..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	27.05 4.69	15.64
26 01 50 52-0218	EA		1 Lamp, 25 Watt, Program/Rapid Start, T12 Fluorescent Electronic Ballast..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	35.48 4.69	15.64
26 01 50 52-0219	EA		2 Lamp, 25 Watt, Instant Start, T12 Fluorescent Electronic Ballast..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	30.96 5.87	19.55
26 01 50 52-0220	EA		2 Lamp, 25 Watt, Program/Rapid Start, T12 Fluorescent Electronic Ballast..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	39.39 5.87	19.55
26 01 50 52-0221	EA		3 Lamp, 25 Watt, Instant Start, T12 Fluorescent Electronic Ballast..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	37.58 7.04	23.47
26 01 50 52-0222	EA		4 Lamp, 25 Watt, Instant Start, T12 Fluorescent Electronic Ballast..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	43.24 8.21	27.37
26 01 50 52-0223			30 Watt, T12 Fluorescent Electronic Ballasts (26 01 50 52-0223)		
26 01 50 52-0224	EA		1 Lamp, 30 Watt, Program/Rapid Start, T12 Fluorescent Electronic Ballast..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	35.48 4.69	15.64
26 01 50 52-0225	EA		2 Lamp, 30 Watt, Program/Rapid Start, T12 Fluorescent Electronic Ballast..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	39.39 5.87	19.55
26 01 50 52-0226	EA		3 Lamp, 30 Watt, Program/Rapid Start, T12 Fluorescent Electronic Ballast..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	48.09 7.04	23.47
26 01 50 52-0227			34 Watt, T12 Fluorescent Electronic Ballasts (26 01 50 52-0227)		
26 01 50 52-0228	EA		1 Lamp, 34 Watt, Program/Rapid Start, T12 Fluorescent Electronic Ballast..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	35.48 4.69	15.64
26 01 50 52-0229	EA		2 Lamp, 34 Watt, Program/Rapid Start, T12 Fluorescent Electronic Ballast..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	39.39 5.87	19.55
26 01 50 52-0230	EA		3 Lamp, 34 Watt, Program/Rapid Start, T12 Fluorescent Electronic Ballast..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	48.09 7.04	23.47
26 01 50 52-0231			40 Watt, T12 Fluorescent Electronic Ballasts (26 01 50 52-0231)		
26 01 50 52-0232	EA		1 Lamp, 40 Watt, Program/Rapid Start, T12 Fluorescent Electronic Ballast..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	35.48 4.69	15.64
26 01 50 52-0233	EA		2 Lamp, 40 Watt, Program/Rapid Start, T12 Fluorescent Electronic Ballast..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	39.39 5.87	19.55
26 01 50 52-0234	EA		3 Lamp, 40 Watt, Program/Rapid Start, T12 Fluorescent Electronic Ballast..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	48.09 7.04	23.47
26 01 50 52-0235			96 Watt, T12 Fluorescent Electronic Ballasts (26 01 50 52-0235)		
26 01 50 52-0236	EA		1 Lamp, 96 Watt, Program/Rapid Start, T12 Fluorescent Electronic Ballast..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	42.78 4.69	15.64
26 01 50 52-0237	EA		2 Lamp, 96 Watt, Program/Rapid Start, T12 Fluorescent Electronic Ballast..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	49.47 5.87	19.55
26 01 50 52-0238			High-Output, T12HO Fluorescent Electronic Ballasts (26 01 50 52-0238) Note: Includes 120/277 Volt and normal ballast factor.		
26 01 50 52-0239			48 Watt, High-Output, T12HO Fluorescent Electronic Ballasts (26 01 50 52-0239)		
26 01 50 52-0240	EA		1 Lamp, 48 Watt, Program/Rapid Start, High-Output, T12HO Fluorescent Electronic Ballast..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	53.96 4.69	15.64
26 01 50 52-0241	EA		2 Lamp, 48 Watt, Program/Rapid Start, High-Output, T12HO Fluorescent Electronic Ballast..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	57.87 5.87	19.55



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 01 50 52-0242 60 Watt, High-Output, T12HO Fluorescent Electronic Ballasts <small>(26 01 50 52-0238)</small>		
26 01 50 52-0243 EA 1 Lamp, 60 Watt, Program/Rapid Start, High-Output, T12HO Fluorescent Electronic Ballast.....	53.96	15.64
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.69	
26 01 50 52-0244 EA 2 Lamp, 60 Watt, Program/Rapid Start, High-Output, T12HO Fluorescent Electronic Ballast.....	57.87	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.87	
26 01 50 52-0245 72 Watt, High-Output, T12HO Fluorescent Electronic Ballasts <small>(26 01 50 52-0238)</small>		
26 01 50 52-0246 EA 1 Lamp, 72 Watt, Program/Rapid Start, High-Output, T12HO Fluorescent Electronic Ballast.....	53.96	15.64
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.69	
26 01 50 52-0247 EA 2 Lamp, 72 Watt, Program/Rapid Start, High-Output, T12HO Fluorescent Electronic Ballast.....	57.87	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.87	
26 01 50 52-0248 96 Watt, High-Output, T12HO Fluorescent Electronic Ballasts <small>(26 01 50 52-0238)</small>		
26 01 50 52-0249 EA 2 Lamp, 96 Watt, Program/Rapid Start, High-Output, T12HO Fluorescent Electronic Ballast.....	53.96	15.64
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.69	
26 01 50 52-0250 EA 2 Lamp, 96 Watt, Program/Rapid Start, High-Output, T12HO Fluorescent Electronic Ballast.....	57.87	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.87	
26 01 50 52-0251 Emergency Fluorescent Ballasts <small>(26 01 50 52-0002)</small>		
<i>Note: 120/277 Volt.</i>		
26 01 50 52-0252 EA One Lamp, 350-450 Lumens, Code Compliance, Ninety Minute Illumination, Emergency Fluorescent Ballast (Bodine B100).....	87.38	15.64
<i>For Factory Installation In New Fixtures, Deduct</i>	-31.29	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.39	
26 01 50 52-0253 EA Two Lamp, 600-700 Lumens, Ninety Minute Illumination, Emergency Fluorescent Ballast (Bodine B60).....	136.42	19.55
<i>For Factory Installation In New Fixtures, Deduct</i>	-32.86	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.86	
26 01 50 52-0254 EA One Or Two Lamp, 1,100-1,400 Lumens, Ninety Minute Illumination, Emergency Fluorescent Ballast (Bodine B50).....	166.36	19.55
<i>For Factory Installation In New Fixtures, Deduct</i>	-32.86	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.86	
26 01 50 52-0255 EA One Or Two Lamp, 600-700 Lumens, Two Hour Illumination, Emergency Fluorescent Ballast (Bodine B70A).....	126.42	19.55
<i>For Factory Installation In New Fixtures, Deduct</i>	-32.86	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.86	
26 01 50 52-0256 EA Two Or Three Lamp, 2,700-3,400 Lumens, Ninety Minute Illumination, Emergency Fluorescent Ballast (Bodine B33).....	545.57	23.47
<i>For Factory Installation In New Fixtures, Deduct</i>	-34.41	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.32	
26 01 50 52-0257 EA One Lamp, 225-450 Lumens, Four Hour Illumination, Emergency Fluorescent Ballast (Bodine B54).....	167.94	15.64
<i>For Factory Installation In New Fixtures, Deduct</i>	-31.29	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.39	
26 01 50 52-0258 EA One Or Two Lamp, 325-1,000 Lumens, Ninety Minute Illumination, Emergency Compact Fluorescent Ballast (Bodine B84CG).....	273.73	19.55
<i>For Factory Installation In New Fixtures, Deduct</i>	-32.86	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.86	
26 01 50 52-0259 EA One Or Two Lamp, 300-750 Lumens, Ninety Minute Illumination, Emergency Compact Fluorescent Ballast (Bodine B94CG).....	156.50	19.55
<i>For Factory Installation In New Fixtures, Deduct</i>	-32.86	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.86	
26 01 50 52-0260 EA One Lamp, 200-625 Lumens, Ninety Minute Illumination, Damp Location, Emergency Compact Fluorescent Ballast (Bodine B413).....	208.06	15.64
<i>For Factory Installation In New Fixtures, Deduct</i>	-31.29	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.39	
26 01 50 52-0261 EA One Lamp, 300-650 Lumens, Damp Location, Ninety Minute Illumination, Emergency Compact Fluorescent Ballast (Bodine B463).....	164.11	15.64
<i>For Factory Installation In New Fixtures, Deduct</i>	-31.29	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.39	
26 01 50 52-0262 EA One Or Two Lamp, 450-950 Lumens, Ninety Minute Illumination, Damp Location, Emergency Compact Fluorescent Ballast (Bodine B426).....	184.39	19.55
<i>For Factory Installation In New Fixtures, Deduct</i>	-32.86	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.86	
26 01 50 52-0263 EA One Or Two Lamp, 1,100-1,400 Lumens, Ninety Minute Illumination, Damp Location, Emergency Fluorescent Ballast (Bodine BDL500).....	198.47	19.55
<i>For Factory Installation In New Fixtures, Deduct</i>	-32.86	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.86	
26 01 50 52-0264 EA Two Lamp, 600-700 Lumens, Damp Location, Emergency Fluorescent Ballast (Bodine BDL600).....	169.10	19.55
<i>For Factory Installation In New Fixtures, Deduct</i>	-32.86	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.86	
26 01 50 52-0265 EA One Lamp, 600-700 Lumens, Two Hour Illumination, Emergency Fluorescent Ballast (Bodine BDL700).....	170.86	15.64
<i>For Factory Installation In New Fixtures, Deduct</i>	-31.29	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.39	
26 01 50 52-0266 EA One Lamp, 500-600 Lumens, Damp Location, Ninety Minute Illumination, Emergency Fluorescent Ballast (Bodine BDL900).....	150.50	15.64
<i>For Factory Installation In New Fixtures, Deduct</i>	-31.29	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.39	
26 01 50 52-0267 EA One Or Two Lamp, 300-750 Lumens, Damp Location, Ninety Minute Illumination, Emergency Compact Fluorescent Ballast (Bodine BDL94C).....	156.50	19.55
<i>For Factory Installation In New Fixtures, Deduct</i>	-32.86	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.86	

26 Electrical**26 01 Operation and Maintenance of Electrical Systems****26 01 50 Operation and Maintenance of Lighting**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 01 50 52-0268 EA One Lamp, 450 Lumens, Low Profile, Ninety Minute Illumination, Emergency Fluorescent Ballast (Bodine LP400).....	152.69	15.64
<i>For Factory Installation In New Fixtures, Deduct</i>	-31.29	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.39	
26 01 50 52-0269 EA One Or Two Lamp, 1,100-1,400 Lumens, Self Testing, Ninety Minute Illumination, Emergency Fluorescent Ballast (Bodine B50ST)	269.64	19.55
<i>For Factory Installation In New Fixtures, Deduct</i>	-32.86	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.86	
26 01 50 52-0270 EA One Or Two Lamp, 1,800-3,500 Lumens, Self Testing, Ninety Minute Illumination, Emergency Fluorescent Ballast (Bodine B30ST)	333.86	19.55
<i>For Factory Installation In New Fixtures, Deduct</i>	-32.86	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.86	
26 01 50 52-0271 EA One Or Two Lamp, 1,450-3,500 Lumens, Remote Control Testing, Ninety Minute Illumination, Emergency Fluorescent Ballast (Bodine B30RCT)	613.25	19.55
<i>For Factory Installation In New Fixtures, Deduct</i>	-32.86	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.86	
26 01 50 52-0272 EA One Or Two Lamp, 1,100-1,400 Lumens, Remote Control Testing, Ninety Minute Illumination, Emergency Fluorescent Ballast (Bodine B50RCT)	430.02	19.55
<i>For Factory Installation In New Fixtures, Deduct</i>	-32.86	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.86	
26 01 50 52-0273 EA One Or Two Lamp, 1,100-3,100 Lumens, Central Battery, Emergency Fluorescent Ballast With Voltage Sensing Circuit (Bodine CB90-48)	225.17	19.55
<i>For Factory Installation In New Fixtures, Deduct</i>	-32.86	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.86	
26 01 50 52-0274 EA One Lamp, 1,050-3,200 Lumens, Interim Lighting For Generator Backup, Five Minute Illumination, Emergency Fluorescent Ballast (Bodine GEN1)	287.36	15.64
<i>For Factory Installation In New Fixtures, Deduct</i>	-31.29	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.39	
26 01 50 52-0275 EA 250 Watt, Self-Diagnostic, Ninety Minute Illumination, Fluorescent Emergency Lighting Inverter (Bodine ELI-250- SD)	1,550.06	19.55
<i>For Factory Installation In New Fixtures, Deduct</i>	-31.29	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.39	
26 01 50 52-0276 Compact Fluorescent Ballasts (26 01 50 52-0001)		
26 01 50 52-0277 Compact Fluorescent Electronic Ballasts (26 01 50 52-0276) Note: Includes 120/277 Volt and normal ballast factor.		
26 01 50 52-0278 18 Watt, Compact Fluorescent Electronic Ballasts (26 01 50 52-0277)		
26 01 50 52-0279 EA 1 Lamp, 18 Watt, Program/Rapid Start, Compact Fluorescent Electronic Ballast.....	50.50	15.64
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.69	
26 01 50 52-0280 EA 2 Lamp, 18 Watt, Program/Rapid Start, Compact Fluorescent Electronic Ballast.....	54.41	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.87	
26 01 50 52-0281 26 Watt, Compact Fluorescent Electronic Ballasts (26 01 50 52-0277)		
26 01 50 52-0282 EA 1 Lamp, 26 Watt, Program/Rapid Start, Compact Fluorescent Electronic Ballast.....	50.50	15.64
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.69	
26 01 50 52-0283 EA 2 Lamp, 26 Watt, Program/Rapid Start, Compact Fluorescent Electronic Ballast.....	54.41	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.87	
26 01 50 52-0284 32 Watt, Compact Fluorescent Electronic Ballasts (26 01 50 52-0277)		
26 01 50 52-0285 EA 1 Lamp, 32 Watt, Program/Rapid Start, Compact Fluorescent Electronic Ballast.....	61.05	15.64
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.69	
26 01 50 52-0286 EA 2 Lamp, 32 Watt, Program/Rapid Start, Compact Fluorescent Electronic Ballast.....	64.96	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.87	
26 01 50 52-0287 40 Watt, Compact Fluorescent Electronic Ballasts (26 01 50 52-0277)		
26 01 50 52-0288 EA 1 Lamp, 40 Watt, Instant Start, Compact Fluorescent Electronic Ballast.....	49.24	15.64
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.69	
26 01 50 52-0289 EA 1 Lamp, 40 Watt, Program/Rapid Start, Compact Fluorescent Electronic Ballast.....	61.05	15.64
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.69	
26 01 50 52-0290 EA 2 Lamp, 40 Watt, Instant Start, Compact Fluorescent Electronic Ballast.....	88.60	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.87	
26 01 50 52-0291 EA 2 Lamp, 40 Watt, Program/Rapid Start, Compact Fluorescent Electronic Ballast.....	64.96	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.87	
26 01 50 52-0292 EA 3 Lamp, 40 Watt, Instant Start, Compact Fluorescent Electronic Ballast.....	104.87	23.47
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	7.04	
26 01 50 52-0293 42 Watt, Compact Fluorescent Electronic Ballasts (26 01 50 52-0277)		
26 01 50 52-0294 EA 1 Lamp, 42 Watt, Program/Rapid Start, Compact Fluorescent Electronic Ballast.....	61.05	15.64
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.69	
26 01 50 52-0295 EA 2 Lamp, 42 Watt, Program/Rapid Start, Compact Fluorescent Electronic Ballast.....	64.96	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.87	
26 01 50 52-0296 55 Watt, Compact Fluorescent Electronic Ballasts (26 01 50 52-0277)		
26 01 50 52-0297 EA 1 Lamp, 55 Watt, Program/Rapid Start, Compact Fluorescent Electronic Ballast.....	61.05	15.64
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.69	
26 01 50 52-0298 EA 2 Lamp, 55 Watt, Program/Rapid Start, Compact Fluorescent Electronic Ballast.....	64.96	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.87	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 01 50 52-0299 Dimming, Compact Fluorescent Electronic Ballasts (26 01 50 52-0276)		
26 01 50 52-0300 Dimming To 5%, Compact Fluorescent Electronic Ballasts (26 01 50 52-0299) Note: Includes 120/277 Volt and normal ballast factor.		
26 01 50 52-0301 18 Watt, Dimming To 5%, Compact Fluorescent Electronic Ballasts (26 01 50 52-0300)		
26 01 50 52-0302 EA 1 Lamp, 18 Watt, Program/Rapid Start, Dimming To 5%, Compact Fluorescent Electronic Ballast 88.04 For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add 4.69	88.04	15.64
26 01 50 52-0303 EA 2 Lamp, 18 Watt, Program/Rapid Start, Dimming To 5%, Compact Fluorescent Electronic Ballast 91.95 For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add 5.87	91.95	19.55
26 01 50 52-0304 26 Watt, Dimming To 5%, Compact Fluorescent Electronic Ballasts (26 01 50 52-0300)		
26 01 50 52-0305 EA 1 Lamp, 26 Watt, Program/Rapid Start, Dimming To 5%, Compact Fluorescent Electronic Ballast 88.04 For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add 4.69	88.04	15.64
26 01 50 52-0306 EA 2 Lamp, 26 Watt, Program/Rapid Start, Dimming To 5%, Compact Fluorescent Electronic Ballast 91.95 For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add 5.87	91.95	19.55
26 01 50 52-0307 32 Watt, Dimming To 5%, Compact Fluorescent Electronic Ballasts (26 01 50 52-0300)		
26 01 50 52-0308 EA 1 Lamp, 32 Watt, Program/Rapid Start, Dimming To 5%, Compact Fluorescent Electronic Ballast 88.04 For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add 4.69	88.04	15.64
26 01 50 52-0309 EA 2 Lamp, 32 Watt, Program/Rapid Start, Dimming To 5%, Compact Fluorescent Electronic Ballast 97.77 For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add 5.87	97.77	19.55
26 01 50 52-0310 40 Watt, Dimming To 5%, Compact Fluorescent Electronic Ballasts (26 01 50 52-0300)		
26 01 50 52-0311 EA 2 Lamp, 40 Watt, Program/Rapid Start, Dimming To 5%, Compact Fluorescent Electronic Ballast 97.77 For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add 5.87	97.77	19.55
26 01 50 52-0312 42 Watt, Dimming To 5%, Compact Fluorescent Electronic Ballasts (26 01 50 52-0300)		
26 01 50 52-0313 EA 1 Lamp, 42 Watt, Program/Rapid Start, Dimming To 5%, Compact Fluorescent Electronic Ballast 88.04 For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add 4.69	88.04	15.64
26 01 50 52-0314 EA 2 Lamp, 42 Watt, Program/Rapid Start, Dimming To 5%, Compact Fluorescent Electronic Ballast 97.77 For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add 5.87	97.77	19.55
26 01 50 52-0315 55 Watt, Dimming To 5%, Compact Fluorescent Electronic Ballasts (26 01 50 52-0300)		
26 01 50 52-0316 EA 1 Lamp, 55 Watt, Program/Rapid Start, Dimming To 5%, Compact Fluorescent Electronic Ballast 136.86 For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add 4.69	136.86	15.64
26 01 50 52-0317 EA 2 Lamp, 55 Watt, Program/Rapid Start, Dimming To 5%, Compact Fluorescent Electronic Ballast 154.47 For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add 5.87	154.47	19.55
26 01 50 52-0318 High Intensity Discharge (HID) Ballasts (26 01 50 52-0001)		
26 01 50 52-0319 Magnetic High Intensity Discharge (HID) Ballasts (26 01 50 52-0318)		
26 01 50 52-0320 Core And Coil High Intensity Discharge (HID) Ballasts (26 01 50 52-0319)		
26 01 50 52-0321 Metal Halide, Core And Coil High Intensity Discharge (HID) Ballasts (26 01 50 52-0320)		
26 01 50 52-0322 EA 1 Lamp, 100 Watt Metal Halide, 120/277 Volt, Core And Coil High Intensity Discharge (HID) Ballast 100.97 For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add 8.21	100.97	19.55
26 01 50 52-0323 EA 1 Lamp, 250 Watt Metal Halide, 120/277 Volt, Core And Coil High Intensity Discharge (HID) Ballast 103.35 For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add 8.21	103.35	19.55
26 01 50 52-0324 EA 1 Lamp, 250 Watt Metal Halide, 480 Volt, Core And Coil High Intensity Discharge (HID) Ballast 103.35 For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add 8.21	103.35	19.55
26 01 50 52-0325 EA 1 Lamp, 400 Watt Metal Halide, 120/277 Volt, Core And Coil High Intensity Discharge (HID) Ballast 92.65 For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add 8.21	92.65	19.55
26 01 50 52-0326 EA 1 Lamp, 400 Watt Metal Halide, 480 Volt, Core And Coil High Intensity Discharge (HID) Ballast 92.65 For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add 8.21	92.65	19.55
26 01 50 52-0327 EA 1 Lamp, 1,000 Watt Metal Halide, 120/277 Volt, Core And Coil High Intensity Discharge (HID) Ballast 141.98 For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add 8.21	141.98	19.55
26 01 50 52-0328 EA 1 Lamp, 1,000 Watt Metal Halide, 480 Volt, Core And Coil High Intensity Discharge (HID) Ballast 141.98 For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add 8.21	141.98	19.55
26 01 50 52-0329 EA 1 Lamp, 1,500 Watt Metal Halide, 120/277 Volt, Core And Coil High Intensity Discharge (HID) Ballast 181.98 For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add 8.21	181.98	19.55
26 01 50 52-0330 EA 1 Lamp, 1,500 Watt Metal Halide, 480 Volt, Core And Coil High Intensity Discharge (HID) Ballast 202.38 For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add 8.21	202.38	19.55
26 01 50 52-0331 High Pressure Sodium, Core And Coil High Intensity Discharge (HID) Ballasts (26 01 50 52-0320)		
26 01 50 52-0332 EA 1 Lamp, 50 Watt High Pressure Sodium, 120/277 Volt, Core And Coil High Intensity Discharge (HID) Ballast 91.56 For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add 8.21	91.56	19.55

26 Electrical**26 01 Operation and Maintenance of Electrical Systems****26 01 50 Operation and Maintenance of Lighting**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 01 50 52-0333 EA 1 Lamp, 70 Watt High Pressure Sodium, 120/277 Volt, Core And Coil High Intensity Discharge (HID) Ballast.....	96.88	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8.21	
26 01 50 52-0334 EA 1 Lamp, 100 Watt High Pressure Sodium, 120/277 Volt, Core And Coil High Intensity Discharge (HID) Ballast.....	94.59	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8.21	
26 01 50 52-0335 EA 1 Lamp, 150 Watt High Pressure Sodium, 120/277 Volt, Core And Coil High Intensity Discharge (HID) Ballast.....	110.58	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8.21	
26 01 50 52-0336 EA 1 Lamp, 150 Watt High Pressure Sodium, 480 Volt, Core And Coil High Intensity Discharge (HID) Ballast.....	108.30	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8.21	
26 01 50 52-0337 EA 1 Lamp, 250 Watt High Pressure Sodium, 120/277 Volt, Core And Coil High Intensity Discharge (HID) Ballast.....	123.14	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8.21	
26 01 50 52-0338 EA 1 Lamp, 250 Watt High Pressure Sodium, 480 Volt, Core And Coil High Intensity Discharge (HID) Ballast.....	123.14	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8.21	
26 01 50 52-0339 EA 1 Lamp, 400 Watt High Pressure Sodium, 120/277 Volt, Core And Coil High Intensity Discharge (HID) Ballast.....	147.83	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8.21	
26 01 50 52-0340 EA 1 Lamp, 400 Watt High Pressure Sodium, 480 Volt, Core And Coil High Intensity Discharge (HID) Ballast.....	147.83	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8.21	
26 01 50 52-0341 EA 1 Lamp, 1,000 Watt High Pressure Sodium, 120/277 Volt, Core And Coil High Intensity Discharge (HID) Ballast.....	234.45	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8.21	
26 01 50 52-0342 EA 1 Lamp, 1,000 Watt High Pressure Sodium, 480 Volt, Core And Coil High Intensity Discharge (HID) Ballast.....	234.45	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8.21	
26 01 50 52-0343 Mounting Brackets For Core And Coil High Intensity Discharge (HID) Ballasts <small>(26 01 50 52-0320)</small>		
26 01 50 52-0344 EA Single Mounting Bracket For Core And Coil Type	10.66	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2.35	
26 01 50 52-0345 EA Double Mounting Bracket For Core And Coil Type	17.43	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	3.52	
26 01 50 52-0346 F-Can High Intensity Discharge (HID) Ballasts <small>(26 01 50 52-0319)</small>		
26 01 50 52-0347 Metal Halide, F-Can High Intensity Discharge (HID) Ballasts <small>(26 01 50 52-0346)</small>		
26 01 50 52-0348 EA 1 Lamp, 70 Watt Metal Halide, 120/277 Volt, F-Can High Intensity Discharge (HID) Ballast.....	127.18	19.55
<i>For Pulse Start Ballast, Add</i>	9.98	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8.21	
26 01 50 52-0349 EA 1 Lamp, 100 Watt Metal Halide, 120/277 Volt, F-Can High Intensity Discharge (HID) Ballast.....	133.78	19.55
<i>For Pulse Start Ballast, Add</i>	10.64	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8.21	
26 01 50 52-0350 EA 1 Lamp, 175 Watt Metal Halide, 120/277 Volt, F-Can High Intensity Discharge (HID) Ballast.....	122.18	19.55
<i>For Pulse Start Ballast, Add</i>	9.48	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8.21	
26 01 50 52-0351 EA 1 Lamp, 250 Watt Metal Halide, 120/277 Volt, F-Can High Intensity Discharge (HID) Ballast.....	141.25	19.55
<i>For Pulse Start Ballast, Add</i>	11.39	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8.21	
26 01 50 52-0352 EA 1 Lamp, 400 Watt Metal Halide, 120/277 Volt, F-Can High Intensity Discharge (HID) Ballast.....	194.67	19.55
<i>For Pulse Start Ballast, Add</i>	16.73	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8.21	
26 01 50 52-0353 High Pressure Sodium, F-Can High Intensity Discharge (HID) Ballasts <small>(26 01 50 52-0346)</small>		
26 01 50 52-0354 EA 1 Lamp, 70 Watt High Pressure Sodium, 120/277 Volt, F-Can High Intensity Discharge (HID) Ballast.....	152.20	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8.21	
26 01 50 52-0355 EA 1 Lamp, 100 Watt High Pressure Sodium, 120/277 Volt, F-Can High Intensity Discharge (HID) Ballast.....	162.49	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8.21	
26 01 50 52-0356 Postline High Intensity Discharge (HID) Ballasts <small>(26 01 50 52-0319)</small>		
26 01 50 52-0357 Metal Halide, Postline High Intensity Discharge (HID) Ballasts <small>(26 01 50 52-0356)</small>		
26 01 50 52-0358 EA 1 Lamp, 50 Watt Metal Halide, 120 Volt, Postline High Intensity Discharge (HID) Ballast.....	250.86	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8.21	
26 01 50 52-0359 High Pressure Sodium, Postline High Intensity Discharge (HID) Ballasts <small>(26 01 50 52-0356)</small>		
26 01 50 52-0360 EA 1 Lamp, 70 Watt High Pressure Sodium, 120 Volt, Postline High Intensity Discharge (HID) Ballast.....	385.36	20.14
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8.46	
26 01 50 52-0361 EA 1 Lamp, 100 Watt High Pressure Sodium, 120 Volt, Postline High Intensity Discharge (HID) Ballast.....	429.23	20.14
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8.46	
26 01 50 52-0362 EA 1 Lamp, 150 Watt High Pressure Sodium, 120 Volt, Postline High Intensity Discharge (HID) Ballast.....	414.05	20.14
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8.46	
26 01 50 52-0363 Indoor Enclosed High Intensity Discharge (HID) Ballasts <small>(26 01 50 52-0319)</small>		
26 01 50 52-0364 Metal Halide, Indoor Enclosed High Intensity Discharge (HID) Ballasts <small>(26 01 50 52-0363)</small>		
26 01 50 52-0365 EA 1 Lamp, 175 Watt Metal Halide, 120/277 Volt, Indoor Enclosed High Intensity Discharge (HID) Ballast.....	308.01	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8.21	
26 01 50 52-0366 EA 1 Lamp, 250 Watt Metal Halide, 120/277 Volt, Indoor Enclosed High Intensity Discharge (HID) Ballast.....	349.09	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8.21	
26 01 50 52-0367 EA 1 Lamp, 400 Watt Metal Halide, 120/277 Volt, Indoor Enclosed High Intensity Discharge (HID) Ballast.....	459.88	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8.21	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 01 50 52-0368 EA 1 Lamp, 400 Watt Metal Halide, 480 Volt, Indoor Enclosed High Intensity Discharge (HID) Ballast.....	457.49	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	<i>8.21</i>	
26 01 50 52-0369 EA 2 Lamp, 400 Watt Metal Halide, 120/277 Volt, Indoor Enclosed High Intensity Discharge (HID) Ballast.....	639.71	21.12
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	<i>8.68</i>	
26 01 50 52-0370 EA 2 Lamp, 400 Watt Metal Halide, 480 Volt, Indoor Enclosed High Intensity Discharge (HID) Ballast.....	639.71	21.12
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	<i>8.68</i>	
26 01 50 52-0371 EA 1 Lamp, 1,000 Watt Metal Halide, 120/277 Volt, Indoor Enclosed High Intensity Discharge (HID) Ballast.....	441.19	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	<i>8.21</i>	
26 01 50 52-0372 EA 1 Lamp, 1,000 Watt Metal Halide, 480 Volt, Indoor Enclosed High Intensity Discharge (HID) Ballast.....	518.40	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	<i>8.21</i>	
26 01 50 52-0373 High Pressure Sodium, Indoor Enclosed High Intensity Discharge (HID) Ballasts <small>(26 01 50 52-0363)</small>		
26 01 50 52-0374 EA 1 Lamp, 400 Watt High Pressure Sodium, 120/277 Volt, Indoor Enclosed High Intensity Discharge (HID) Ballast.....	571.50	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	<i>8.21</i>	
26 01 50 52-0375 EA 1 Lamp, 400 Watt High Pressure Sodium, 480 Volt, Indoor Enclosed High Intensity Discharge (HID) Ballast.....	544.29	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	<i>8.21</i>	
26 01 50 52-0376 EA 1 Lamp, 1,000 Watt High Pressure Sodium, 120/277 Volt, Indoor Enclosed High Intensity Discharge (HID) Ballast.....	698.57	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	<i>8.21</i>	
26 01 50 52-0377 EA 1 Lamp, 1,000 Watt High Pressure Sodium, 480 Volt, Indoor Enclosed High Intensity Discharge (HID) Ballast.....	698.57	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	<i>8.21</i>	
26 01 50 52-0378 Outdoor Weatherproof High Intensity Discharge (HID) Ballasts <small>(26 01 50 52-0319)</small>		
26 01 50 52-0379 Metal Halide, Outdoor Weatherproof High Intensity Discharge (HID) Ballasts <small>(26 01 50 52-0378)</small>		
26 01 50 52-0380 EA 1 Lamp, 175 Watt Metal Halide, 120/277 Volt, Outdoor Weatherproof High Intensity Discharge (HID) Ballast.....	345.65	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	<i>8.21</i>	
26 01 50 52-0381 EA 1 Lamp, 250 Watt Metal Halide, 120/277 Volt, Outdoor Weatherproof High Intensity Discharge (HID) Ballast.....	373.07	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	<i>8.21</i>	
26 01 50 52-0382 EA 1 Lamp, 400 Watt Metal Halide, 120/277 Volt, Outdoor Weatherproof High Intensity Discharge (HID) Ballast.....	370.37	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	<i>8.21</i>	
26 01 50 52-0383 EA 1 Lamp, 400 Watt Metal Halide, 480 Volt, Outdoor Weatherproof High Intensity Discharge (HID) Ballast.....	388.74	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	<i>8.21</i>	
26 01 50 52-0384 EA 2 Lamp, 400 Watt Metal Halide, 120/277 Volt, Outdoor Weatherproof High Intensity Discharge (HID) Ballast.....	615.75	21.12
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	<i>8.68</i>	
26 01 50 52-0385 EA 2 Lamp, 400 Watt Metal Halide, 480 Volt, Outdoor Weatherproof High Intensity Discharge (HID) Ballast.....	756.02	21.12
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	<i>8.68</i>	
26 01 50 52-0386 EA 1 Lamp, 1,000 Watt Metal Halide, 120/277 Volt, Outdoor Weatherproof High Intensity Discharge (HID) Ballast.....	574.69	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	<i>8.21</i>	
26 01 50 52-0387 EA 1 Lamp, 1,000 Watt Metal Halide, 480 Volt, Outdoor Weatherproof High Intensity Discharge (HID) Ballast.....	523.54	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	<i>8.21</i>	
26 01 50 52-0388 High Pressure Sodium, Outdoor Weatherproof High Intensity Discharge (HID) Ballasts <small>(26 01 50 52-0378)</small>		
26 01 50 52-0389 EA 1 Lamp, 400 Watt High Pressure Sodium, 120/277 Volt, Outdoor Weatherproof High Intensity Discharge (HID) Ballast.....	445.14	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	<i>8.21</i>	
26 01 50 52-0390 EA 1 Lamp, 400 Watt High Pressure Sodium, 480 Volt, Outdoor Weatherproof High Intensity Discharge (HID) Ballast.....	479.73	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	<i>8.21</i>	
26 01 50 52-0391 EA 1 Lamp, 1,000 Watt High Pressure Sodium, 120/277 Volt, Outdoor Weatherproof High Intensity Discharge (HID) Ballast.....	714.54	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	<i>8.21</i>	
26 01 50 52-0392 EA 1 Lamp, 1,000 Watt High Pressure Sodium, 480 Volt, Outdoor Weatherproof High Intensity Discharge (HID) Ballast.....	615.33	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	<i>8.21</i>	
26 01 50 52-0393 Electronic High Intensity Discharge (HID) Ballasts <small>(26 01 50 52-0318)</small>		
26 01 50 52-0394 Electronic Low Frequency High Intensity Discharge (HID) Ballasts <small>(26 01 50 52-0393)</small>		
26 01 50 52-0395 EA 1 Lamp, 70 Watt Metal Halide, 120/277 Volt, Electronic Low Frequency High Intensity Discharge (HID) Ballast.....	140.33	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	<i>8.21</i>	
26 01 50 52-0396 EA 1 Lamp, 100 Watt Metal Halide, 120/277 Volt, Electronic Low Frequency High Intensity Discharge (HID) Ballast.....	140.33	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	<i>8.21</i>	
26 01 50 52-0397 EA 1 Lamp, 150 Watt Metal Halide, 120/277 Volt, Electronic Low Frequency High Intensity Discharge (HID) Ballast.....	157.67	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	<i>8.21</i>	
26 01 50 52-0398 EA 1 Lamp, 250 Watt Metal Halide, 120/277 Volt, Electronic Low Frequency High Intensity Discharge (HID) Ballast.....	400.57	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	<i>8.21</i>	
26 01 50 52-0399 EA 1 Lamp, 300 Watt Metal Halide, 120/277 Volt, Electronic Low Frequency High Intensity Discharge (HID) Ballast.....	400.57	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	<i>8.21</i>	
26 01 50 52-0400 EA 1 Lamp, 320 Watt Metal Halide, 120/277 Volt, Electronic Low Frequency High Intensity Discharge (HID) Ballast.....	400.57	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	<i>8.21</i>	
26 01 50 52-0401 EA 1 Lamp, 350 Watt Metal Halide, 120/277 Volt, Electronic Low Frequency High Intensity Discharge (HID) Ballast.....	400.57	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	<i>8.21</i>	
26 01 50 52-0402 EA 1 Lamp, 400 Watt Metal Halide, 120/277 Volt, Electronic Low Frequency High Intensity Discharge (HID) Ballast.....	400.57	19.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	<i>8.21</i>	
26 01 50 52-0403 Owner Supplied Ballasts <small>(26 01 50 52-0001)</small>		

26 Electrical**26 01 Operation and Maintenance of Electrical Systems****26 01 50 Operation and Maintenance of Lighting**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 01 50 52-0404	EA		Install Owner Supplied, 1 Lamp Fluorescent Ballast.....	15.64	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.69	
26 01 50 52-0405	EA		Install Owner Supplied, 2 Lamp Fluorescent Ballast.....	19.55	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.87	
26 01 50 52-0406	EA		Install Owner Supplied, 3 Lamp Fluorescent Ballast.....	22.68	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	6.80	
26 01 50 52-0407	EA		Install Owner Supplied, 4 Lamp Fluorescent Ballast.....	24.25	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	7.28	
26 01 50 52-0408	EA		Install Owner Supplied, 1 Lamp High Intensity Discharge (HID) Ballast.....	27.37	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8.21	
26 01 50 52-0409	EA		Install Owner Supplied, 2 Lamp High Intensity Discharge (HID) Ballast.....	28.94	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8.68	
26 01 50 52-0410			Retrofit Lighting Fixtures <small>(26 01 50 52)</small>		
26 01 50 52-0411			Retrofit Existing (T12) Fluorescent Fixtures <small>(26 01 50 52-0410)</small>		
			Note: Excludes recycling or disposal of lamps and ballasts. See CSI section 02 84 16 00-0003 for ballast recycling, 02 84 16 00-0008 for leaking ballast disposal, 26 01 50 51-0121 for hazardous lamp recycling.		
26 01 50 52-0412			Retrofit Existing (T12) Strip Style Fluorescent Fixtures Without Reflector <small>(26 01 50 52-0411)</small>		
			Note: Includes ballast, white reflective ballast cover, lamps, lamp holders, clips, wiring, cable connectors and cleaning of fixture.		
26 01 50 52-0413	EA		Retrofit An Existing 4' (T12) Strip Style Fixture Without Reflector To Operate One 4' (T8) Lamp.....	57.50	
			<i>For Specular Ballast Cover, Add</i>	5.86	
26 01 50 52-0414	EA		Retrofit An Existing 4' (T12) Strip Style Fixture Without Reflector To Operate Two 4' (T8) Lamps.....	62.02	
			<i>For Specular Ballast Cover, Add</i>	6.76	
26 01 50 52-0415	EA		Retrofit An Existing 8' (T12) Strip Style Fixture Without Reflector To Operate Two 4' (T8) Lamps.....	82.67	
			<i>For Specular Ballast Cover, Add</i>	10.89	
26 01 50 52-0416	EA		Retrofit An Existing 8' (T12) Strip Style Fixture Without Reflector To Operate Four 4' (T8) Lamps.....	94.96	
			<i>For Specular Ballast Cover, Add</i>	13.35	
26 01 50 52-0417			Retrofit Existing (T12) Strip Style Fluorescent Fixtures With Reflector <small>(26 01 50 52-0411)</small>		
			Note: Includes ballast, white reflector and ballast cover, lamps, lamp holders, clips, wiring, cable connectors and cleaning of fixture.		
26 01 50 52-0418	EA		Retrofit An Existing 4' (T12) Strip Style Fixture With Reflector To Operate One 4' (T8) Lamp.....	60.54	
			<i>For Specular Reflector, Add</i>	17.05	
26 01 50 52-0419	EA		Retrofit An Existing 4' (T12) Strip Style Fixture With Reflector To Operate Two 4' (T8) Lamps.....	65.42	
			<i>For Specular Reflector, Add</i>	17.05	
26 01 50 52-0420	EA		Retrofit An Existing 8' (T12) Strip Style Fixture With Reflector To Operate Two 4' (T8) Lamps.....	86.92	
			<i>For Specular Reflector, Add</i>	17.05	
26 01 50 52-0421	EA		Retrofit An Existing 8' (T12) Strip Style Fixture With Reflector To Operate Four 4' (T8) Lamps.....	107.47	
			<i>For Specular Reflector, Add</i>	17.05	
26 01 50 52-0422			Retrofit Existing (T12) Troffer Style Fluorescent Fixtures <small>(26 01 50 52-0411)</small>		
			Note: Includes ballast, white reflector and ballast cover, lamps, lamp holders, clips, wiring, cable connectors and cleaning of fixture.		
26 01 50 52-0423	EA		Retrofit An Existing 1 x 4 (T12) Troffer Style Fixture To Operate One 4' (T8) Lamps.....	76.49	
			<i>For Specular Reflector, Add</i>	17.05	
26 01 50 52-0424	EA		Retrofit An Existing 1 x 4 (T12) Troffer Style Fixture To Operate Two 4' (T8) Lamps.....	81.01	
			<i>For Specular Reflector, Add</i>	17.05	
26 01 50 52-0425	EA		Retrofit An Existing 2 x 2 (T12) Troffer Style Fixture To Operate Two 2' (T8) Lamps.....	80.10	
			<i>For Specular Reflector, Add</i>	17.05	
26 01 50 52-0426	EA		Retrofit An Existing 2 x 2 (T12) Troffer Style Fixture To Operate Three 2' (T8) Lamps.....	88.08	
			<i>For Specular Reflector, Add</i>	17.05	
26 01 50 52-0427	EA		Retrofit An Existing 2 x 2 (T12) Troffer Style Fixture To Operate Four 2' (T8) Lamps.....	102.77	
			<i>For Specular Reflector, Add</i>	17.05	
26 01 50 52-0428	EA		Retrofit An Existing 2 x 4 (T12) Troffer Style Fixture To Operate Two 4' (T8) Lamps.....	84.66	
			<i>For Specular Reflector, Add</i>	17.05	
26 01 50 52-0429	EA		Retrofit An Existing 2 x 4 (T12) Troffer Style Fixture To Operate Three 4' (T8) Lamps.....	92.49	
			<i>For Specular Reflector, Add</i>	17.05	
26 01 50 52-0430	EA		Retrofit An Existing 2 x 4 (T12) Troffer Style Fixture To Operate Four 4' (T8) Lamps.....	99.37	
			<i>For Specular Reflector, Add</i>	17.05	
26 01 50 52-0431			Retrofit Existing Recessed Lay-In/Troffer Fixtures <small>(26 01 50 52-0410)</small>		
26 01 50 52-0432			Fluorescent Volumetric Lighting Retrofits For Existing Recessed Lay-In/Troffer Fixtures (Lithonia) <small>(26 01 50 52-0431)</small>		
			Note: Includes removing existing lamps and ballast. Includes installing adaptor frame, volumetric reflectors, lamps and ballasts. Excludes recycling or disposal of lamps and ballasts. See CSI section 02 84 16 00-0003 for ballast recycling, 26 01 50 51-0121 for disposal of hazardous lamps.		
26 01 50 52-0433	EA		2 T8 Lamps, 0.78 Ballast Factor, 2' x 4', Volumetric Lighting Retrofit For Existing Parabolic Recessed Fluorescent Fixtures (Lithonia 2RT8R).....	152.45	
26 01 50 52-0434	EA		2 T8 Lamps, 0.88 Ballast Factor, 2' x 4', Volumetric Lighting Retrofit For Existing Parabolic Recessed Fluorescent Fixtures (Lithonia 2RT8R).....	152.45	
26 01 50 52-0435	EA		2 T8 Lamps, 1.20 Ballast Factor, 2' x 4', Volumetric Lighting Retrofit For Existing Parabolic Recessed Fluorescent Fixtures (Lithonia 2RT8R).....	152.45	
26 01 50 52-0436	EA		2 T8 Lamps, 0.88 Ballast Factor, Step Dimming Ballast, 2' x 4', Volumetric Lighting Retrofit For Existing Parabolic Recessed Fluorescent Fixtures (Lithonia 2RT8R).....	167.91	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 01 50 52-0437 EA 2 T8 Lamps, 0.78 Ballast Factor, 2' x 4', Volumetric Lighting Retrofit For Existing Lensed Recessed Fluorescent Fixtures (Lithonia 2RT8RT)	152.45	
26 01 50 52-0438 EA 2 T8 Lamps, 0.88 Ballast Factor, 2' x 4', Volumetric Lighting Retrofit For Existing Lensed Recessed Fluorescent Fixtures (Lithonia 2RT8RT)	152.45	
26 01 50 52-0439 EA 2 T8 Lamps, 1.20 Ballast Factor, 2' x 4', Volumetric Lighting Retrofit For Existing Lensed Recessed Fluorescent Fixtures (Lithonia 2RT8RT)	152.45	
26 01 50 52-0440 EA 2 T8 Lamps, 0.88 Ballast Factor, Step Dimming Ballast, 2' x 4', Volumetric Lighting Retrofit For Existing Lensed Recessed Fluorescent Fixtures (Lithonia 2RT8RT)	167.91	
26 01 50 52-0441 EA 2 T8 Lamps, 0.78 Ballast Factor, 2' x 2', Volumetric Lighting Retrofit For Existing Parabolic Recessed Fluorescent Fixtures (Lithonia 2RT8R)	152.95	
26 01 50 52-0442 EA 2 T8 Lamps, 0.88 Ballast Factor, 2' x 2', Volumetric Lighting Retrofit For Existing Parabolic Recessed Fluorescent Fixtures (Lithonia 2RT8R)	152.95	
26 01 50 52-0443 EA 2 T8 Lamps, 1.20 Ballast Factor, 2' x 2', Volumetric Lighting Retrofit For Existing Parabolic Recessed Fluorescent Fixtures (Lithonia 2RT8R)	152.95	
26 01 50 52-0444 EA 2 T8 Lamps, 0.88 Ballast Factor, Step Dimming Ballast, 2' x 2', Volumetric Lighting Retrofit For Existing Parabolic Recessed Fluorescent Fixtures (Lithonia 2RT8R)	168.41	
26 01 50 52-0445 EA 2 T8 Lamps, 0.78 Ballast Factor, 2' x 2', Volumetric Lighting Retrofit For Existing Lensed Recessed Fluorescent Fixtures (Lithonia 2RT8RT)	152.95	
26 01 50 52-0446 EA 2 T8 Lamps, 0.88 Ballast Factor, 2' x 2', Volumetric Lighting Retrofit For Existing Lensed Recessed Fluorescent Fixtures (Lithonia 2RT8RT)	152.95	
26 01 50 52-0447 EA 2 T8 Lamps, 1.20 Ballast Factor, 2' x 2', Volumetric Lighting Retrofit For Existing Lensed Recessed Fluorescent Fixtures (Lithonia 2RT8RT)	152.95	
26 01 50 52-0448 EA 2 T8 Lamps, 0.88 Ballast Factor, Step Dimming Ballast, 2' x 2', Volumetric Lighting Retrofit For Existing Lensed Recessed Fluorescent Fixtures (Lithonia 2RT8RT)	168.41	
26 01 50 52-0449 LED Architectural Lighting Retrofits For Existing Recessed Lay-In/Troffer Fixtures (PlanLED) <small>(26 01 50 52-0431)</small>		
<small>Note: Includes adaptor frame, optical system, LEDs and driver. Excludes recycling or disposal of lamps and ballasts. See CSI section 02 84 16 00-0003 for ballast recycling, 26 01 50 51-0121 for disposal of hazardous lamps.</small>		
26 01 50 52-0450 EA 2,400 Lumens, 2' x 4', LED Architectural Lighting Retrofit For Existing Recessed Lay-In/Troffer Fixtures (PlanLED FR3E-025)	225.57	
26 01 50 52-0451 EA 4,300 Lumens, 2' x 4', LED Architectural Lighting Retrofit For Existing Recessed Lay-In/Troffer Fixtures (PlanLED FR3E-045)	236.08	
26 01 50 52-0452 LED Architectural Lighting Retrofits For Existing Recessed Lay-In/Troffer Fixtures (Raffino™) <small>(26 01 50 52-0431)</small>		
<small>Note: Includes removing existing lamps and disconnecting existing ballast. Includes installing adaptor frame, LED light panel, dimming driver and trim. Excludes recycling or disposal of lamps and ballasts. See CSI section 02 84 16 00-0003 for ballast recycling, 26 01 50 51-0121 for disposal of hazardous lamps.</small>		
26 01 50 52-0453 EA 2,600 Lumens, 1' x 4', LED Architectural Lighting Retrofit For Existing Recessed Lay-In/Troffer Fixtures (Raffino™ LR14-2600L)	255.74	
26 01 50 52-0454 EA 2,500 Lumens, 2' x 2', LED Architectural Lighting Retrofit For Existing Recessed Lay-In/Troffer Fixtures (Raffino™ LR22-2500L)	262.64	
26 01 50 52-0455 EA 3,300 Lumens, 2' x 2', LED Architectural Lighting Retrofit For Existing Recessed Lay-In/Troffer Fixtures (Raffino™ LR22-3300L)	262.64	
26 01 50 52-0456 EA 3,400 Lumens, 2' x 4', LED Architectural Lighting Retrofit For Existing Recessed Lay-In/Troffer Fixtures (Raffino™ LR24-3400L)	290.25	
26 01 50 52-0457 EA 4,000 Lumens, 2' x 4', LED Architectural Lighting Retrofit For Existing Recessed Lay-In/Troffer Fixtures (Raffino™ LR24-4000L)	296.87	
26 01 50 52-0458 EA 5,000 Lumens, 2' x 4', LED Architectural Lighting Retrofit For Existing Recessed Lay-In/Troffer Fixtures (Raffino™ LR24-5000L)	317.85	
26 01 50 52-0459 Fluorescent Direct-Indirect Louver Lighting Retrofit For Existing Recessed Lay-In/Troffer Fixtures (A.L.P. Lighting Components) <small>(26 01 50 52-0431)</small>		
<small>Note: Includes adaptor frame, optical system, lamps and ballasts. Excludes recycling or disposal of lamps and ballasts. See CSI section 02 84 16 00-0003 for ballast recycling, 26 01 50 51-0121 for disposal of hazardous lamps.</small>		
26 01 50 52-0460 EA 1 T5 Lamp, 2' x 2', Fluorescent Direct-Indirect Louver Lighting Retrofit For Existing Recessed Lay-In/Troffer Fixtures (A.L.P. Lighting Components)	142.85	
26 01 50 52-0461 EA 1 T8 Lamp, 2' x 2', Fluorescent Direct-Indirect Louver Lighting Retrofit For Existing Recessed Lay-In/Troffer Fixtures (A.L.P. Lighting Components)	113.47	
26 01 50 52-0462 EA 2 T5 Lamps, 2' x 2', Fluorescent Direct-Indirect Louver Lighting Retrofit For Existing Recessed Lay-In/Troffer Fixtures (A.L.P. Lighting Components)	146.79	
26 01 50 52-0463 EA 2 T8 Lamps, 2' x 2', Fluorescent Direct-Indirect Louver Lighting Retrofit For Existing Recessed Lay-In/Troffer Fixtures (A.L.P. Lighting Components)	117.38	
26 01 50 52-0464 EA 3 T5 Lamps, 2' x 2', Fluorescent Direct-Indirect Louver Lighting Retrofit For Existing Recessed Lay-In/Troffer Fixtures (A.L.P. Lighting Components)	153.92	
26 01 50 52-0465 EA 3 T8 Lamps, 2' x 2', Fluorescent Direct-Indirect Louver Lighting Retrofit For Existing Recessed Lay-In/Troffer Fixtures (A.L.P. Lighting Components)	126.63	
26 01 50 52-0466 EA 1 T5 Lamp, 2' x 4', Fluorescent Direct-Indirect Louver Lighting Retrofit For Existing Recessed Lay-In/Troffer Fixtures (A.L.P. Lighting Components)	169.29	
26 01 50 52-0467 EA 1 T8 Lamp, 2' x 4', Fluorescent Direct-Indirect Louver Lighting Retrofit For Existing Recessed Lay-In/Troffer Fixtures (A.L.P. Lighting Components)	139.82	
26 01 50 52-0468 EA 2 T5 Lamps, 2' x 4', Fluorescent Direct-Indirect Louver Lighting Retrofit For Existing Recessed Lay-In/Troffer Fixtures (A.L.P. Lighting Components)	172.98	
26 01 50 52-0469 EA 2 T8 Lamps, 2' x 4', Fluorescent Direct-Indirect Louver Lighting Retrofit For Existing Recessed Lay-In/Troffer Fixtures (A.L.P. Lighting Components)	143.54	
26 01 50 52-0470 EA 3 T5 Lamps, 2' x 4', Fluorescent Direct-Indirect Louver Lighting Retrofit For Existing Recessed Lay-In/Troffer Fixtures (A.L.P. Lighting Components)	180.01	

26 Electrical**26 01 Operation and Maintenance of Electrical Systems****26 01 50 Operation and Maintenance of Lighting**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 01 50 52-0471 EA 3 T8 Lamps, 2' x 4', Fluorescent Direct-Indirect Louver Lighting Retrofit For Existing Recessed Lay-In/Troffer Fixtures (A.L.P. Lighting Components).....	152.74	
26 01 50 52-0472 LED Volumetric Lighting Retrofit For Existing Lensed Or Parabolic Recessed Lay-In/Troffer Fixtures (Lithonia 2VTL2R/RT) (26 01 50 52-0431)		
Note: Includes removing existing lamps and ballast. Includes installing LED light engine assembly, dimming driver and trim. Excludes recycling or disposal of lamps and ballasts. See CSI section 02 84 16 00-0003 for ballast recycling, 26 01 50 51-0121 for disposal of hazardous lamps.		
26 01 50 52-0473 EA 3,300 Lumens, 2' x 2', LED Volumetric Lighting Retrofit For Existing Lensed Or Parabolic Recessed Lay-In/Troffer Fixtures (Lithonia 2VTL2R/RT).....	333.15	
26 01 50 52-0474 EA 4,800 Lumens, 2' x 4', LED Volumetric Lighting Retrofit For Existing Lensed Or Parabolic Recessed Lay-In/Troffer Fixtures (Lithonia 2VTL4R/RT).....	369.23	
26 01 50 53 Lens and Accessory Replacement (26 01 50)		
26 01 50 53-0001 EA Parabolic Aluminum Louver Replacement.....	78.99	
26 01 50 53-0002 EA Visor For Fixtures.....	152.64	
26 01 50 53-0003 EA Replace Globe On Pole.....	190.96	
26 01 50 53-0004 EA Replace Lenses For Flat Top Pole Fixtures.....	71.46	
26 01 50 53-0005 EA Replace 1' x 4' Diffuser With Prismatic Acrylic Diffuser, 0.125" Thick.....	23.17	
26 01 50 53-0006 EA Replace 2' x 2' Diffuser With Prismatic Acrylic Diffuser, 0.125" Thick.....	24.30	
26 01 50 53-0007 EA Replace 2' x 4' Diffuser With Prismatic Acrylic Diffuser, 0.125" Thick.....	29.21	
26 01 50 53-0008 EA Replace Slide-On Lampholder.....	9.83	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	2.42	
26 01 50 53-0009 EA Replace Screw Mount Lampholder.....	10.00	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	2.42	
26 01 50 53-0010 EA Replace Medium Bi-Pin Lampholder.....	11.50	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	2.42	
26 01 50 53-0011 EA Replace Fixed High Output Lampholder, Recessed, Double Contact Double Pedestal Type.....	13.81	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	2.42	
26 01 50 53-0012 EA Replace Plunger High Output Lampholder, Recessed, Double Contact Double Pedestal Type.....	15.31	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	2.42	
26 01 50 53-0013 EA Replace Compact Twin-Tube Lampholder, Snap-in.....	11.28	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	2.42	
26 01 50 53-0014 EA Replace Exterior Light Globes.....	44.85	
26 05 Common Work Results For Electrical (26)		
26 05 13 Medium-Voltage Cables (26 05)		
26 05 13 00-0001 Wire And Cable (26 05 13)		
Note: Pulled in conduit except as noted. Includes pull wires, pulling branch circuit conductors, testing, and splicing (#8 and lighter). All conductors are copper except as otherwise noted. No special set-up is required. Excludes terminations.		
26 05 13 00-0002 Wire Connections (26 05 13 00-0001)		
26 05 13 00-0003 Medium Voltage Up To 5 KV (26 05 13 00-0002)		
26 05 13 00-0004 Copper Cable Splice, Crimp Compression Connection (26 05 13 00-0003)		
Note: For bare wire.		
26 05 13 00-0005 EA #6 AWG Crimp Compression Connection For Bare Copper Wire.....	50.65	
26 05 13 00-0006 EA #4 AWG Crimp Compression Connection For Bare Copper Wire.....	55.58	
26 05 13 00-0007 EA #3 AWG Crimp Compression Connection For Bare Copper Wire.....	64.83	
26 05 13 00-0008 EA #2 AWG Crimp Compression Connection For Bare Copper Wire.....	73.78	
26 05 13 00-0009 EA #1 AWG Crimp Compression Connection For Bare Copper Wire.....	83.14	
26 05 13 00-0010 EA 1/0 AWG Crimp Compression Connection For Bare Copper Wire.....	92.33	
26 05 13 00-0011 EA 2/0 AWG Crimp Compression Connection For Bare Copper Wire.....	101.47	
26 05 13 00-0012 EA 3/0 AWG Crimp Compression Connection For Bare Copper Wire.....	110.89	
26 05 13 00-0013 EA 4/0 AWG Crimp Compression Connection For Bare Copper Wire.....	120.14	
26 05 13 00-0014 EA 250 MCM Crimp Compression Connection For Bare Copper Wire.....	129.51	
26 05 13 00-0015 EA 300 MCM Crimp Compression Connection For Bare Copper Wire.....	139.05	
26 05 13 00-0016 EA 350 MCM Crimp Compression Connection For Bare Copper Wire.....	148.19	
26 05 13 00-0017 EA 400 MCM Crimp Compression Connection For Bare Copper Wire.....	167.17	
26 05 13 00-0018 EA 500 MCM Crimp Compression Connection For Bare Copper Wire.....	186.55	
26 05 19 Low-Voltage Electrical Power Conductors And Cables (26 05)		
26 05 19 16 Low-Voltage, Single-And Multi-Conductor Cables (26 05 19)		
26 05 19 16-0001 Cable Installation Methods (26 05 19 16)		
26 05 19 16-0002 Pull Cord (26 05 19 16-0001)		
Note: Left in conduit for others to pull cable. Not to be used when contractor has priced new wire in a conduit. Priced when owner wants a pull cord left in a conduit for owner to pull wire at a later time.		
26 05 19 16-0003 LF Pull String Installed To Remain In Place, In Existing Conduit.....	0.25	
26 05 19 16-0004 LF Pull String Installed To Remain In Place, In New Conduits.....	0.13	
26 05 19 16-0005 LF 1/4" Nylon Pull Cord Installed To Remain In Place, In Existing Conduit.....	0.57	
26 05 19 16-0006 LF 1/4" Nylon Pull Cord Installed To Remain In Place, In New Conduits.....	0.33	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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26 05 19 16-0007			Bore Conduit Into Dirt Or Sand <small>(26 05 19 16-0001)</small>		
<small>Note: For installation under roads, driveways or other structures up to 20'.</small>					
26 05 19 16-0008	LF		Bore 1" To 4" Conduit Into Dirt Or Sand	2.41	
26 05 19 16-0009	LF		Bore 5" To 8" Conduit Into Dirt Or Sand	3.07	
26 05 19 16-0010	EA		Boring Minimum Set-Up Charge	337.61	
<small>Note: For projects where the total boring charge is less than the minimum set-up charge. Use this item exclusively. This item should not be used in conjunction with any other items in this section.</small>					

26 05 19 16-0011			Wire and Cable <small>(26 05 19 16)</small>		
<small>Note: Pulled in conduit except as noted. Includes pull wires, pulling branch circuit conductors, testing, and splicing (#8 and lighter). All conductors are copper except as otherwise noted. No special set-up is required. Excludes terminations.</small>					
26 05 19 16-0012			600 Volt Wire <small>(26 05 19 16-0011)</small>		
26 05 19 16-0013			600 Volt, Armored Cable, Copper Conductors <small>(26 05 19 16-0012)</small>		
26 05 19 16-0014			MC, Solid Or Stranded, Galvanized Steel Armor <small>(26 05 19 16-0013)</small>		
26 05 19 16-0015	MLF	#14 AWG Cable - Type MC, 2 Conductors, Solid Or Stranded, Galvanized Steel Armor	2,527.17	804.31	
26 05 19 16-0016	MLF	#12 AWG Cable - Type MC, 2 Conductors, Solid Or Stranded, Galvanized Steel Armor	2,820.94	903.72	
26 05 19 16-0017	MLF	#10 AWG Cable - Type MC, 2 Conductors, Solid Or Stranded, Galvanized Steel Armor	3,421.58	993.00	
26 05 19 16-0018	MLF	#8 AWG Cable - Type MC, 2 Conductors, Solid Or Stranded, Galvanized Steel Armor	4,444.28	1,061.13	
26 05 19 16-0019	MLF	#6 AWG Cable - Type MC, 2 Conductors, Solid Or Stranded, Galvanized Steel Armor	5,598.03	1,124.91	
26 05 19 16-0020	MLF	#14 AWG Cable - Type MC, 3 Conductors, Solid Or Stranded, Galvanized Steel Armor	2,927.16	903.72	
26 05 19 16-0021	MLF	#12 AWG Cable - Type MC, 3 Conductors, Solid Or Stranded, Galvanized Steel Armor	3,311.42	993.00	
26 05 19 16-0022	MLF	#10 AWG Cable - Type MC, 3 Conductors, Solid Or Stranded, Galvanized Steel Armor	4,250.43	1,132.87	
26 05 19 16-0023	MLF	#8 AWG Cable - Type MC, 3 Conductors, Solid Or Stranded, Galvanized Steel Armor	5,606.18	1,222.39	
26 05 19 16-0024	MLF	#6 AWG Cable - Type MC, 3 Conductors, Solid Or Stranded, Galvanized Steel Armor	6,592.99	1,318.51	
26 05 19 16-0025	MLF	#4 AWG Cable - Type MC, 3 Conductors, Solid Or Stranded, Galvanized Steel Armor	8,230.30	1,416.08	
26 05 19 16-0026	MLF	#2 AWG Cable - Type MC, 3 Conductors, Solid Or Stranded, Galvanized Steel Armor	10,648.35	1,511.87	
26 05 19 16-0027	MLF	#14 AWG Cable - Type MC, 4 Conductors, Solid Or Stranded, Galvanized Steel Armor	3,411.94	993.00	
26 05 19 16-0028	MLF	#12 AWG Cable - Type MC, 4 Conductors, Solid Or Stranded, Galvanized Steel Armor	3,910.30	1,132.87	
26 05 19 16-0029	MLF	#10 AWG Cable - Type MC, 4 Conductors, Solid Or Stranded, Galvanized Steel Armor	6,061.61	1,256.74	
26 05 19 16-0030	MLF	#8 AWG Cable - Type MC, 4 Conductors, Solid Or Stranded, Galvanized Steel Armor	8,329.71	1,384.38	
26 05 19 16-0031	MLF	#6 AWG Cable - Type MC, 4 Conductors, Solid Or Stranded, Galvanized Steel Armor	10,251.90	1,481.23	
26 05 19 16-0032	MLF	#4 AWG Cable - Type MC, 4 Conductors, Solid Or Stranded, Galvanized Steel Armor	13,656.73	1,577.10	
26 05 19 16-0033	MLF	#2 AWG Cable - Type MC, 4 Conductors, Solid Or Stranded, Galvanized Steel Armor	17,767.87	1,672.17	

26 05 19 16-0034			FPLP Solid TFN Red Armored Cable <small>(26 05 19 16-0013)</small>		
<small>Note: Color coded red.</small>					
26 05 19 16-0035	MLF	#18/2 With Bare #18 Ground Type TFN FPLP Red Armored Cable	2,375.42	611.28	
26 05 19 16-0036	MLF	#18/4 With Bare #18 Ground Type TFN FPLP Red Armored Cable	2,702.56	707.79	
26 05 19 16-0037	MLF	#18/6 With Bare #18 Ground Type TFN FPLP Red Armored Cable	3,323.28	804.31	
26 05 19 16-0038	MLF	#18/8 With Bare #18 Ground Type TFN FPLP Red Armored Cable	3,803.80	900.83	
26 05 19 16-0039	MLF	#16/2 With Bare #16 Ground Type TFN FPLP Red Armored Cable	2,708.15	707.79	
26 05 19 16-0040	MLF	#16/4 With Bare #16 Ground Type TFN FPLP Red Armored Cable	3,189.18	804.31	
26 05 19 16-0041	MLF	#16/6 With Bare #16 Ground Type TFN FPLP Red Armored Cable	3,964.82	900.83	
26 05 19 16-0042	MLF	#16/8 With Bare #16 Ground Type TFN FPLP Red Armored Cable	4,500.21	997.35	

26 05 19 16-0043			FPLP Solid THHN Red Armored Cable <small>(26 05 19 16-0013)</small>		
<small>Note: Color coded red.</small>					
26 05 19 16-0044	MLF	#14/2 With #14 Ground Type THHN FPLP Red Armored Cable	3,014.96	804.31	
26 05 19 16-0045	MLF	#14/4 With #14 Ground Type THHN FPLP Red Armored Cable	3,707.80	900.83	
26 05 19 16-0046	MLF	#14/6 With #14 Ground Type THHN FPLP Red Armored Cable	4,859.32	997.35	
26 05 19 16-0047	MLF	#14/8 With #14 Ground Type THHN FPLP Red Armored Cable	5,611.08	1,093.86	
26 05 19 16-0048	MLF	#12/2 With #12 Ground Type THHN FPLP Red Armored Cable	3,761.64	900.83	
26 05 19 16-0049	MLF	#12/4 With #12 Ground Type THHN FPLP Red Armored Cable	4,564.21	997.35	

26 05 19 16-0050			FPLP Twisted Shielded Pair Red Armored Cable <small>(26 05 19 16-0013)</small>		
<small>Note: Color coded red.</small>					
26 05 19 16-0051	MLF	#18/2 With #18 Tinned Ground FPLP Twisted Shielded Pair Red Armored Cable	2,558.28	611.28	
26 05 19 16-0052	MLF	#18/2 With #18 Tinned Ground And #14/2 With #14 Tinned Ground FPLP Twisted Shielded Pair Red Armored Cable	4,070.47	900.83	
26 05 19 16-0053	MLF	#16/2 With #16 Tinned Ground FPLP Twisted Shielded Pair Red Armored Cable	3,130.24	707.79	
26 05 19 16-0054	MLF	#16/4 With Two #16 Tinned Grounds FPLP Twisted Shielded Pair Red Armored Cable	3,685.94	804.31	
26 05 19 16-0055	MLF	#16/2 With #16 Tinned Ground And #12/2 With #12 Ground FPLP Twisted Shielded Pair Red Armored Cable	5,081.28	997.35	
26 05 19 16-0056	MLF	#14/2 With One #16 Tinned Ground And One #14 Ground FPLP Twisted Shielded Pair Red Armored Cable	3,669.35	836.49	
26 05 19 16-0057	MLF	#14/4 With Two #16 Tinned Ground And One #14 Ground FPLP Twisted Shielded Pair Red Armored Cable	4,508.15	965.18	

26 05 19 16-0058			Armored Cable Connectors <small>(26 05 19 16-0013)</small>		
26 05 19 16-0059	EA	3/4" Armored Cable Connector	4.79	1.76	
<small>For Work In Restricted Working Space, Add</small>			1.32		
<small>For Installation Above 14', Add</small>			0.66		
<small>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</small>			1.32		

26 Electrical**26 05 Common Work Results For Electrical****26 05 19 Low-Voltage Electrical Power Conductors And Cables**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 19 16-0060	EA		1" Armored Cable Connector.....	5.65	2.06
			<i>For Work In Restricted Working Space, Add</i>	1.54	
			<i>For Installation Above 14', Add</i>	0.77	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	1.54	
26 05 19 16-0061	EA		1-1/4" Armored Cable Connector.....	8.02	2.94
			<i>For Work In Restricted Working Space, Add</i>	2.21	
			<i>For Installation Above 14', Add</i>	1.10	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2.21	
26 05 19 16-0062			600 Volt, Feeder Wire, Single Stranded Copper <small>(26 05 19 16-0012)</small>		
26 05 19 16-0063	MLF		#3 AWG Cable - XLPE-USE-RHH-RHW 600 Volt Copper, Single Stranded, Placed In Conduit.....	2,229.40	413.91
			<i>For EPR Insulation, Add</i>	146.90	
			<i>For Hypalon (CSPE) Jacket, Add</i>	342.78	
26 05 19 16-0064	MLF		600 MCM Cable - XLPE-USE-RHH-RHW 600 Volt Copper, Single Stranded, Placed In Conduit.....	13,689.15	1,332.76
			<i>For EPR Insulation, Add</i>	1,479.83	
			<i>For Hypalon (CSPE) Jacket, Add</i>	3,452.93	
26 05 19 16-0065	MLF		#18 AWG Cable - Type TFFN 600 Volt Copper, Single Stranded, Placed In Conduit.....	335.80	147.06
26 05 19 16-0066	MLF		#16 AWG Cable - Type TFFN 600 Volt Copper, Single Stranded, Placed In Conduit.....	418.95	161.77
26 05 19 16-0067	MLF		#14 AWG Cable - Type THHN-THWN 600 Volt Copper, Single Stranded, Placed In Conduit.....	441.14	117.94
26 05 19 16-0068	MLF		#12 AWG Cable - Type THHN-THWN 600 Volt Copper, Single Stranded, Placed In Conduit.....	546.31	140.59
26 05 19 16-0069	MLF		#10 AWG Cable - Type THHN-THWN 600 Volt Copper, Single Stranded, Placed In Conduit.....	672.65	176.85
26 05 19 16-0070	MLF		#8 AWG Cable - Type THHN-THWN 600 Volt Copper, Single Stranded, Placed In Conduit.....	936.67	233.10
26 05 19 16-0071	MLF		#6 AWG Cable - Type THHN-THWN 600 Volt Copper, Single Stranded, Placed In Conduit.....	1,263.35	281.48
26 05 19 16-0072	MLF		#4 AWG Cable - Type THHN-THWN 600 Volt Copper, Single Stranded, Placed In Conduit.....	1,656.37	332.66
26 05 19 16-0073	MLF		#3 AWG Cable - Type THHN-THWN 600 Volt Copper, Single Stranded, Placed In Conduit.....	1,974.95	376.56
26 05 19 16-0074	MLF		#2 AWG Cable - Type THHN-THWN 600 Volt Copper, Single Stranded, Placed In Conduit.....	2,352.37	421.71
26 05 19 16-0075	MLF		#1 AWG Cable - Type THHN-THWN 600 Volt Copper, Single Stranded, Placed In Conduit.....	2,791.15	475.90
26 05 19 16-0076	MLF		#1/0 AWG Cable - Type THHN-THWN 600 Volt Copper, Single Stranded, Placed In Conduit.....	3,246.18	521.12
26 05 19 16-0077	MLF		#2/0 AWG Cable - Type THHN-THWN 600 Volt Copper, Single Stranded, Placed In Conduit.....	3,675.78	575.90
26 05 19 16-0078	MLF		#3/0 AWG Cable - Type THHN-THWN 600 Volt Copper, Single Stranded, Placed In Conduit.....	4,339.45	609.13
26 05 19 16-0079	MLF		#4/0 AWG Cable - Type THHN-THWN 600 Volt Copper, Single Stranded, Placed In Conduit.....	5,153.46	685.31
26 05 19 16-0080	MLF		250 MCM Cable - Type THHN-THWN 600 Volt Copper, Single Stranded, Placed In Conduit.....	6,031.93	729.07
26 05 19 16-0081	MLF		300 MCM Cable - Type THHN-THWN 600 Volt Copper, Single Stranded, Placed In Conduit.....	6,946.13	825.69
26 05 19 16-0082	MLF		350 MCM Cable - Type THHN-THWN 600 Volt Copper, Single Stranded, Placed In Conduit.....	7,926.82	913.78
26 05 19 16-0083	MLF		400 MCM Cable - Type THHN-THWN 600 Volt Copper, Single Stranded, Placed In Conduit.....	8,873.97	938.78
26 05 19 16-0084	MLF		500 MCM Cable - Type THHN-THWN 600 Volt Copper, Single Stranded, Placed In Conduit.....	10,496.15	993.19
26 05 19 16-0085	MLF		600 MCM Cable - Type THHN-THWN 600 Volt Copper, Single Stranded, Placed In Conduit.....	12,959.55	1,168.78
26 05 19 16-0086	MLF		750 MCM Cable - Type THHN-THWN 600 Volt Copper, Single Stranded, Placed In Conduit.....	19,680.72	1,384.46
26 05 19 16-0087	MLF		1,000 MCM Cable - Type THHN-THWN 600 Volt Copper, Single Stranded, Placed In Conduit.....	23,555.47	1,671.53
26 05 19 16-0088	MLF		#16 AWG Cable - Type TGGT High Temperature 600 Volt Copper, Single Stranded, Placed In Conduit.....	1,767.58	353.25
26 05 19 16-0089	MLF		#14 AWG Cable - Type TGGT High Temperature 600 Volt Copper, Single Stranded, Placed In Conduit.....	1,967.62	411.63
26 05 19 16-0090	MLF		#12 AWG Cable - Type TGGT High Temperature 600 Volt Copper, Single Stranded, Placed In Conduit.....	2,278.96	470.97
26 05 19 16-0091	MLF		#10 AWG Cable - Type TGGT High Temperature 600 Volt Copper, Single Stranded, Placed In Conduit.....	2,948.56	529.21
26 05 19 16-0092	MLF		#8 AWG Cable - Type TGGT High Temperature 600 Volt Copper, Single Stranded, Placed In Conduit.....	3,339.39	588.26
26 05 19 16-0093	MLF		#6 AWG Cable - Type TGGT High Temperature 600 Volt Copper, Single Stranded, Placed In Conduit.....	4,242.57	646.49
26 05 19 16-0094			Control Tray Cable, Low Voltage <small>(26 05 19 16-0011)</small>		
			Note: Type "TC" multi-conductor (individually numbered conductors) control cables installed in conduit.		
26 05 19 16-0095	MLF		2 Conductor #18 AWG, Stranded, Type TC Control Cable.....	769.91	356.70
			<i>For Installation On Exposed Surface, Deduct</i>	-118.90	
26 05 19 16-0096	MLF		3 Conductor #18 AWG, Stranded, Type TC Control Cable.....	890.55	399.02
			<i>For Installation On Exposed Surface, Deduct</i>	-133.00	
26 05 19 16-0097	MLF		4 Conductor #18 AWG, Stranded, Type TC Control Cable.....	936.49	398.99
			<i>For Installation On Exposed Surface, Deduct</i>	-133.00	
26 05 19 16-0098	MLF		5 Conductor #18 AWG, Stranded, Type TC Control Cable.....	1,172.36	500.45
			<i>For Installation On Exposed Surface, Deduct</i>	-166.81	
26 05 19 16-0099	MLF		7 Conductor #18 AWG, Stranded, Type TC Control Cable.....	1,479.97	609.83
			<i>For Installation On Exposed Surface, Deduct</i>	-203.28	
26 05 19 16-0100	MLF		9 Conductor #18 AWG, Stranded, Type TC Control Cable.....	1,694.02	670.61
			<i>For Installation On Exposed Surface, Deduct</i>	-223.54	
26 05 19 16-0101	MLF		12 Conductor #18 AWG, Stranded, Type TC Control Cable.....	2,021.71	761.98
			<i>For Installation On Exposed Surface, Deduct</i>	-253.99	
26 05 19 16-0102	MLF		15 Conductor #18 AWG, Stranded, Type TC Control Cable.....	2,562.95	931.36
			<i>For Installation On Exposed Surface, Deduct</i>	-310.45	
26 05 19 16-0103	MLF		19 Conductor #18 AWG, Stranded, Type TC Control Cable.....	2,938.00	1,016.06
			<i>For Installation On Exposed Surface, Deduct</i>	-338.69	
26 05 19 16-0104	MLF		25 Conductor #18 AWG, Stranded, Type TC Control Cable.....	3,508.82	1,047.82
			<i>For Installation On Exposed Surface, Deduct</i>	-349.28	
26 05 19 16-0105	MLF		30 Conductor #18 AWG, Stranded, Type TC Control Cable.....	4,299.12	1,309.02
			<i>For Installation On Exposed Surface, Deduct</i>	-436.34	
26 05 19 16-0106	MLF		37 Conductor #18 AWG, Stranded, Type TC Control Cable.....	5,164.14	1,529.83
			<i>For Installation On Exposed Surface, Deduct</i>	-509.94	
26 05 19 16-0107	MLF		2 Conductor #16 AWG, Stranded, Type TC Control Cable.....	845.02	375.74
			<i>For Installation On Exposed Surface, Deduct</i>	-125.15	
26 05 19 16-0108	MLF		3 Conductor #16 AWG, Stranded, Type TC Control Cable.....	981.93	420.01
			<i>For Installation On Exposed Surface, Deduct</i>	-140.00	
26 05 19 16-0109	MLF		4 Conductor #16 AWG, Stranded, Type TC Control Cable.....	1,145.23	483.54
			<i>For Installation On Exposed Surface, Deduct</i>	-161.18	
26 05 19 16-0110	MLF		5 Conductor #16 AWG, Stranded, Type TC Control Cable.....	1,300.82	526.78
			<i>For Installation On Exposed Surface, Deduct</i>	-175.59	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 19 16-0111 MLF 7 Conductor #16 AWG, Stranded, Type TC Control Cable.....	1,649.36	641.93
For Installation On Exposed Surface, Deduct	-213.98	
26 05 19 16-0112 MLF 9 Conductor #16 AWG, Stranded, Type TC Control Cable.....	1,896.94	705.91
For Installation On Exposed Surface, Deduct	-235.30	
26 05 19 16-0113 MLF 12 Conductor #16 AWG, Stranded, Type TC Control Cable.....	2,276.50	802.08
For Installation On Exposed Surface, Deduct	-267.36	
26 05 19 16-0114 MLF 15 Conductor #16 AWG, Stranded, Type TC Control Cable.....	2,897.24	980.33
For Installation On Exposed Surface, Deduct	-326.78	
26 05 19 16-0115 MLF 19 Conductor #16 AWG, Stranded, Type TC Control Cable.....	3,338.12	1,069.44
For Installation On Exposed Surface, Deduct	-356.48	
26 05 19 16-0116 MLF 25 Conductor #16 AWG, Stranded, Type TC Control Cable.....	4,041.35	1,102.98
For Installation On Exposed Surface, Deduct	-367.66	
26 05 19 16-0117 MLF 30 Conductor #16 AWG, Stranded, Type TC Control Cable.....	4,943.19	1,377.84
For Installation On Exposed Surface, Deduct	-459.28	
26 05 19 16-0118 MLF 37 Conductor #16 AWG, Stranded, Type TC Control Cable.....	5,951.94	1,610.34
For Installation On Exposed Surface, Deduct	-536.78	
26 05 19 16-0119 MLF 2 Conductor #14 AWG, Stranded, Type TC Control Cable.....	919.95	392.22
For Installation On Exposed Surface, Deduct	-130.74	
26 05 19 16-0120 MLF 3 Conductor #14 AWG, Stranded, Type TC Control Cable.....	1,105.98	441.19
For Installation On Exposed Surface, Deduct	-147.06	
26 05 19 16-0121 MLF 4 Conductor #14 AWG, Stranded, Type TC Control Cable.....	1,299.87	504.29
For Installation On Exposed Surface, Deduct	-168.09	
26 05 19 16-0122 MLF 5 Conductor #14 AWG, Stranded, Type TC Control Cable.....	1,468.99	543.11
For Installation On Exposed Surface, Deduct	-181.04	
26 05 19 16-0123 MLF 7 Conductor #14 AWG, Stranded, Type TC Control Cable.....	1,970.98	665.75
For Installation On Exposed Surface, Deduct	-221.92	
26 05 19 16-0124 MLF 9 Conductor #14 AWG, Stranded, Type TC Control Cable.....	2,280.32	735.32
For Installation On Exposed Surface, Deduct	-245.16	
26 05 19 16-0125 MLF 12 Conductor #14 AWG, Stranded, Type TC Control Cable.....	2,188.99	820.61
For Installation On Exposed Surface, Deduct	-273.54	
26 05 19 16-0126 MLF 15 Conductor #14 AWG, Stranded, Type TC Control Cable.....	3,367.09	980.18
For Installation On Exposed Surface, Deduct	-326.78	
26 05 19 16-0127 MLF 19 Conductor #14 AWG, Stranded, Type TC Control Cable.....	5,823.68	1,139.01
For Installation On Exposed Surface, Deduct	-379.57	
26 05 19 16-0128 MLF 25 Conductor #14 AWG, Stranded, Type TC Control Cable.....	5,080.76	1,331.66
For Installation On Exposed Surface, Deduct	-443.99	
26 05 19 16-0129 MLF 30 Conductor #14 AWG, Stranded, Type TC Control Cable.....	5,921.06	1,488.14
For Installation On Exposed Surface, Deduct	-496.05	
26 05 19 16-0130 MLF 37 Conductor #14 AWG, Stranded, Type TC Control Cable.....	7,147.07	1,739.17
For Installation On Exposed Surface, Deduct	-579.73	
26 05 19 16-0131 MLF 2 Conductor #12 AWG, Stranded, Type TC Control Cable.....	1,081.12	420.01
For Installation On Exposed Surface, Deduct	-140.00	
26 05 19 16-0132 MLF 3 Conductor #12 AWG, Stranded, Type TC Control Cable.....	1,301.56	464.72
For Installation On Exposed Surface, Deduct	-154.86	
26 05 19 16-0133 MLF 4 Conductor #12 AWG, Stranded, Type TC Control Cable.....	1,590.76	534.73
For Installation On Exposed Surface, Deduct	-178.24	
26 05 19 16-0134 MLF 5 Conductor #12 AWG, Stranded, Type TC Control Cable.....	1,809.94	569.14
For Installation On Exposed Surface, Deduct	-189.71	
26 05 19 16-0135 MLF 7 Conductor #12 AWG, Stranded, Type TC Control Cable.....	2,404.71	678.55
For Installation On Exposed Surface, Deduct	-226.18	
26 05 19 16-0136 MLF 9 Conductor #12 AWG, Stranded, Type TC Control Cable.....	2,976.05	802.08
For Installation On Exposed Surface, Deduct	-267.36	
26 05 19 16-0137 MLF 12 Conductor #12 AWG, Stranded, Type TC Control Cable.....	3,638.09	904.89
For Installation On Exposed Surface, Deduct	-301.63	
26 05 19 16-0138 MLF 15 Conductor #12 AWG, Stranded, Type TC Control Cable.....	4,340.45	1,038.12
For Installation On Exposed Surface, Deduct	-346.04	
26 05 19 16-0139 MLF 19 Conductor #12 AWG, Stranded, Type TC Control Cable.....	5,145.59	1,176.66
For Installation On Exposed Surface, Deduct	-392.22	
26 05 19 16-0140 MLF 25 Conductor #12 AWG, Stranded, Type TC Control Cable.....	6,625.01	1,375.19
For Installation On Exposed Surface, Deduct	-458.40	
26 05 19 16-0141 MLF 30 Conductor #12 AWG, Stranded, Type TC Control Cable.....	7,667.97	1,607.26
For Installation On Exposed Surface, Deduct	-535.75	
26 05 19 16-0142 MLF 37 Conductor #12 AWG, Stranded, Type TC Control Cable.....	9,291.22	1,878.59
For Installation On Exposed Surface, Deduct	-626.20	
26 05 19 16-0143 MLF 2 Conductor #10 AWG, Stranded, Type TC Control Cable.....	1,304.35	441.19
For Installation On Exposed Surface, Deduct	-147.06	
26 05 19 16-0144 MLF 3 Conductor #10 AWG, Stranded, Type TC Control Cable.....	1,646.40	483.84
For Installation On Exposed Surface, Deduct	-161.18	
26 05 19 16-0145 MLF 4 Conductor #10 AWG, Stranded, Type TC Control Cable.....	2,015.44	551.49
For Installation On Exposed Surface, Deduct	-183.83	
26 05 19 16-0146 MLF 5 Conductor #10 AWG, Stranded, Type TC Control Cable.....	2,354.42	598.25
For Installation On Exposed Surface, Deduct	-199.42	
26 05 19 16-0147 MLF 7 Conductor #10 AWG, Stranded, Type TC Control Cable.....	3,203.98	750.91
For Installation On Exposed Surface, Deduct	-250.30	
26 05 19 16-0148 MLF 9 Conductor #10 AWG, Stranded, Type TC Control Cable.....	3,812.65	840.47
For Installation On Exposed Surface, Deduct	-280.16	
26 05 19 16-0149 MLF 12 Conductor #10 AWG, Stranded, Type TC Control Cable.....	4,442.51	980.33
For Installation On Exposed Surface, Deduct	-326.78	
26 05 19 16-0150 MLF 15 Conductor #10 AWG, Stranded, Type TC Control Cable.....	5,261.77	1,121.07
For Installation On Exposed Surface, Deduct	-373.69	
26 05 19 16-0151 MLF 19 Conductor #10 AWG, Stranded, Type TC Control Cable.....	6,257.58	1,270.62
For Installation On Exposed Surface, Deduct	-423.54	
26 05 19 16-0152 MLF 25 Conductor #10 AWG, Stranded, Type TC Control Cable.....	8,108.00	1,485.05
For Installation On Exposed Surface, Deduct	-495.02	

26 Electrical**26 05 Common Work Results For Electrical****26 05 19 Low-Voltage Electrical Power Conductors And Cables**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 19 16-0153 MLF 30 Conductor #10 AWG, Stranded, Type TC Control Cable..... <i>For Installation On Exposed Surface, Deduct</i>	9,378.71 -578.55	1,735.65
26 05 19 16-0154 MLF 37 Conductor #10 AWG, Stranded, Type TC Control Cable..... <i>For Installation On Exposed Surface, Deduct</i>	11,390.03 -676.34	2,029.03
26 05 19 16-0155 Multi-Conductor Cords, Cables And Associated Equipment (26 05 19 16-0011)		
26 05 19 16-0156 Cord Grips, Cable Reels, Extension Cords, And Accessories (26 05 19 16-0155)		
26 05 19 16-0157 Cable Reels (26 05 19 16-0156) Note: Includes handling, mounting, electrical connections and installing cord. See CSI section 26 05 19 16-0155 for cords.		
26 05 23 Control-Voltage Electrical Power Cables (26 05)		
26 05 23 00-0001 Cable For HVAC System Controls (26 05 23)		
26 05 23 00-0002 Low Voltage Thermostat Cable To 300 Volts (26 05 23 00-0001) Note: For surface or conduit installation.		
26 05 23 00-0003 MLF #20/2 Conductor, Low Volt Thermostat Cable	328.90	93.75
26 05 23 00-0004 MLF #20/3 Conductor, Low Volt Thermostat Cable	377.96	98.75
26 05 23 00-0005 MLF #20/4 Conductor, Low Volt Thermostat Cable	410.44	104.42
26 05 23 00-0006 MLF #20/5 Conductor, Low Volt Thermostat Cable	497.04	108.83
26 05 23 00-0007 MLF #20/6 Conductor, Low Volt Thermostat Cable	521.57	113.97
26 05 23 00-0008 MLF #20/7 Conductor, Low Volt Thermostat Cable	575.54	118.71
26 05 23 00-0009 MLF #20/8 Conductor, Low Volt Thermostat Cable	622.13	123.46
26 05 23 00-0010 MLF #20/9 Conductor, Low Volt Thermostat Cable	677.15	128.39
26 05 23 00-0011 MLF #20/10 Conductor, Low Volt Thermostat Cable	730.31	132.24
26 05 23 00-0012 MLF #18/2 Conductor, Low Volt Thermostat Cable	359.63	93.75
26 05 23 00-0013 MLF #18/3 Conductor, Low Volt Thermostat Cable	432.79	98.75
26 05 23 00-0014 MLF #18/4 Conductor, Low Volt Thermostat Cable	497.43	104.42
26 05 23 00-0015 MLF #18/5 Conductor, Low Volt Thermostat Cable	532.95	108.83
26 05 23 00-0016 MLF #18/6 Conductor, Low Volt Thermostat Cable	593.71	113.97
26 05 23 00-0017 MLF #18/7 Conductor, Low Volt Thermostat Cable	608.66	118.71
26 05 23 00-0018 MLF #18/8 Conductor, Low Volt Thermostat Cable	672.67	123.46
26 05 23 00-0019 MLF #18/9 Conductor, Low Volt Thermostat Cable	798.43	128.39
26 05 23 00-0020 MLF #18/10 Conductor, Low Volt Thermostat Cable	879.89	132.24
26 05 26 Grounding And Bonding For Electrical Systems (26 05)		
26 05 26 00-0001 Ground Rods (26 05 26)		
26 05 26 00-0002 Copper-Clad Ground Rods (26 05 26 00-0001)		
26 05 26 00-0003 EA 1/2" Diameter x 8' Long Copper-Clad Ground Rods	71.87	60.32
26 05 26 00-0004 EA 5/8" Diameter x 8' Long Copper-Clad Ground Rods	75.37	60.32
26 05 26 00-0005 EA 3/4" Diameter x 8' Long Copper-Clad Ground Rods	89.50	60.32
26 05 26 00-0006 EA 1/2" Diameter x 10' Long Copper-Clad Ground Rods	84.82	60.32
26 05 26 00-0007 EA 5/8" Diameter x 10' Long Copper-Clad Ground Rods	89.20	60.32
26 05 26 00-0008 EA 3/4" Diameter x 10' Long Copper-Clad Ground Rods	106.86	60.32
26 05 26 00-0009 Copper Grounding Shaft (26 05 26 00-0001)		
26 05 26 00-0010 EA 2-1/8" Diameter x 10' Long Copper Grounding Shaft.....	246.55	60.32
26 05 26 00-0011 EA 2-1/8" Diameter "L" Shaped; 3' Riser x 10' Horizontal Copper Grounding Shaft.....	307.65	60.32
26 05 26 00-0012 EA 2-1/8" Diameter "L" Shaped; 3' Riser x 20' Horizontal Copper Grounding Shaft.....	481.83	60.32
26 05 26 00-0013 Ground Access Wells (26 05 26 00-0001)		
26 05 26 00-0014 Precast Ground Access Wells (26 05 26 00-0013)		
26 05 26 00-0015 EA 8" Diameter x 24" Deep Precast Ground Access Well	163.99	
Note: With cast iron grate.		
26 05 26 00-0016 EA 10" Diameter x 24" Deep Precast Ground Access Well	171.33	
Note: With cast iron grate.		
26 05 26 00-0017 EA 12" Diameter x 24" Deep Precast Ground Access Well	456.76	
Note: With cast iron grate.		
26 05 26 00-0018 EA 18" Diameter x 24" Deep Precast Ground Access Well	464.09	
Note: With cast iron grate.		
26 05 26 00-0019 Polymer Concrete Ground Access Well (26 05 26 00-0013)		
26 05 26 00-0020 EA 12" x 12" x 12" Polymer Concrete Ground Access Well.....	291.06	
26 05 26 00-0021 EA 12" x 12" x 12" Heavy Duty Polymer Concrete Ground Access Well	318.04	
26 05 26 00-0022 EA 12" x 12" x 18" Polymer Concrete Ground Access Well.....	319.88	
26 05 26 00-0023 EA 12" x 12" x 18" Heavy Duty Polymer Concrete Ground Access Well	349.53	
26 05 26 00-0024 EA 12" x 12" x 24" Polymer Concrete Ground Access Well.....	349.77	
26 05 26 00-0025 EA 12" x 12" x 24" Heavy Duty Polymer Concrete Ground Access Well	382.33	
26 05 26 00-0026 EA 13" x 24" x 18" Polymer Concrete Ground Access Well.....	461.98	
26 05 26 00-0027 EA 13" x 24" x 18" Heavy Duty Polymer Concrete Ground Access Well	506.18	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 26 00-0028 High Density Polyethylene (HDPE) Ground Access Well <small>(26 05 26 00-0013)</small>		
26 05 26 00-0029 EA 9" Diameter x 10" Deep High Density Polyethylene (HDPE) Ground Access Well Note: With cover.	113.03	
26 05 26 00-0030 EA 14" Diameter x 18" Deep High Density Polyethylene (HDPE) Ground Access Well Note: With cover.	155.73	
26 05 26 00-0031 Ground Rod Clamps And Fittings <small>(26 05 26)</small>		
26 05 26 00-0032 Bronze Ground Rod Clamp <small>(26 05 26 00-0031)</small>		
26 05 26 00-0033 EA 1/2" Bronze Ground Rod Clamp	17.03	9.09
26 05 26 00-0034 EA 5/8" Bronze Ground Rod Clamp	17.91	9.09
26 05 26 00-0035 EA 3/4" Bronze Ground Rod Clamp	19.16	9.09
26 05 26 00-0036 Bronze Pipe Clamps <small>(26 05 26 00-0031)</small>		
26 05 26 00-0037 EA 1/2" To 1" Bronze Pipe Ground Clamps	22.34	15.12
26 05 26 00-0038 EA 1-1/4" To 2" Bronze Ground Clamps For Pipe	29.07	18.10
26 05 26 00-0039 EA 2-1/2" To 3" Bronze Ground Clamps For Pipe	46.71	21.15
26 05 26 00-0040 EA 2-1/2" To 4" Bronze Ground Clamps For Pipe	56.35	27.18
26 05 26 00-0041 EA 4" To 6" Bronze Ground Clamps For Pipe	87.64	39.25
26 05 26 00-0042 Grounding Fittings <small>(26 05 26 00-0031)</small>		
26 05 26 00-0043 Embedded Fittings <small>(26 05 26 00-0042)</small>		
26 05 26 00-0044 EA Ground Insert With 2 - 3/8 x 16 Holes #2-250 MCM Cable Range, Embedded	114.76	
26 05 26 00-0045 EA Ground Insert With 4 - 3/8 x 16 Holes #2-250 MCM Cable Range, Embedded	122.76	
26 05 26 00-0046 EA Ground Insert With 4 - 3/8 x 16 Holes 250-500 MCM Cable Range, Embedded	136.94	
26 05 26 00-0047 EA Grounding Wire Splice, Copper To Aluminum, #8 - 1 AWG	107.49	
26 05 26 00-0048 EA Grounding Wire Splice, Copper To Aluminum, 1/0 - 3/0 AWG	128.76	
26 05 26 00-0049 EA Grounding Wire Splice, Copper To Aluminum, 4/0 - 300 MCM	151.18	
26 05 26 00-0050 EA Grounding Wire Splice, Copper To Aluminum, 350 MCM And Up	170.73	
26 05 26 00-0051 Ground Rod Receptacle <small>(26 05 26 00-0042)</small>		
26 05 26 00-0052 EA 1/2" Ground Rod Receptacle	248.75	83.65
26 05 26 00-0053 EA 5/8" Ground Rod Receptacle	260.56	86.01
26 05 26 00-0054 EA 3/4" Ground Rod Receptacle	272.63	88.34
26 05 26 00-0055 Ground Kits For Circuit Breaker Panels <small>(26 05 26 00-0042)</small>		
26 05 26 00-0056 EA 14-8 AWG Copper Ground Kit	55.27	20.11
26 05 26 00-0057 EA 12-8 AWG Aluminum Ground Kit	46.84	20.11
26 05 26 00-0058 EA 14-4 AWG Copper Ground Kit	61.99	20.11
26 05 26 00-0059 EA 12-4 AWG Aluminum Ground Kit	51.48	20.11
26 05 26 00-0060 Insulated Grounding Bars <small>(26 05 26 00-0031)</small>		
26 05 26 00-0061 EA Insulated Ground Bar 1/2" x 4" x 10" <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	238.93 36.20	20.19
26 05 26 00-0062 EA Insulated Ground Bar SK 9560 1/2" x 4" x 20" <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	251.91 36.20	20.19
26 05 26 00-0063 Ground Conductor Bonding <small>(26 05 26)</small>		
26 05 26 00-0064 Ground Conductor Bonding <small>(26 05 26 00-0063)</small>		
26 05 26 00-0065 Splice, Lug, Ground Rod, Rebar Or Structural Steel Cadweld <small>(26 05 26 00-0064)</small>		
26 05 26 00-0066 EA Up To #6 AWG Cadweld Connection For Splice, Lug, Ground Rod, Rebar Or Structural Steel Note: Includes molds, materials and all necessary tools to make connections.	98.30	
26 05 26 00-0067 EA #4 To #1 AWG Cadweld Connection For Splice, Lug, Ground Rod, Rebar Or Structural Steel Note: Includes molds, materials and all necessary tools to make connections.	106.33	
26 05 26 00-0068 EA 1/0 To 4/0 AWG Cadweld Connection For Splice, Lug, Ground Rod, Rebar Or Structural Steel Note: Includes molds, materials and all necessary tools to make connections.	114.38	
26 05 26 00-0069 EA 250 To 1,000 MCM AWG Cadweld Connection For Splice, Lug, Ground Rod, Rebar Or Structural Steel Note: Includes molds, materials and all necessary tools to make connections.	162.63	
26 05 26 00-0070 Tee, Wye Or Cross Cadweld <small>(26 05 26 00-0064)</small>		
26 05 26 00-0071 EA Up To #6 AWG Cadweld Connection For Tee, Wye Or Cross Note: Includes molds, materials and all necessary tools to make connections.	110.35	
26 05 26 00-0072 EA #4 To #1 AWG Cadweld Connection For Tee, Wye Or Cross Note: Includes molds, materials and all necessary tools to make connections.	126.44	
26 05 26 00-0073 EA 1/0 To 4/0 AWG Cadweld Connection For Tee, Wye Or Cross Note: Includes molds, materials and all necessary tools to make connections.	154.60	
26 05 26 00-0074 EA 250 To 1,000 MCM AWG Cadweld Connection For Tee, Wye Or Cross Note: Includes molds, materials and all necessary tools to make connections.	186.76	

26 Electrical**26 05 Common Work Results For Electrical****26 05 26 Grounding And Bonding For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 26 00-0075			Grounding Equipment (26 05 26)		
26 05 26 00-0076			Special Grounding Equipment (26 05 26 00-0075)		
26 05 26 00-0077			Ground Reels And Ground Bus (26 05 26 00-0076)		
26 05 26 00-0078	EA		Ground Reel With 50' Of Galvanized Steel Cable.....	584.17	
26 05 26 00-0079			Copper Bars (26 05 26 00-0078)		
26 05 26 00-0080	LF		1/4" x 2" Copper Bar	33.33	
26 05 26 00-0081			Phenolic Insulators (26 05 26 00-0079)		
26 05 26 00-0082	EA		2" x 2" x 1" Long Phenolic Insulators	22.12	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.83	
26 05 26 00-0083			Grounding Studs (26 05 26 00-0082)		
26 05 26 00-0084	EA		Ball Grounding Stud.....	31.89	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	7.20	
26 05 26 00-0085			Equipment Ground Bar Kits (26 05 26 00-0084)		
26 05 26 00-0086	EA		Switch Rating 30 Ground Bar Kit	25.13	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.83	
26 05 26 00-0087	EA		Switch Rating 60 Ground Bar Kit	32.57	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.31	
26 05 26 00-0088	EA		Switch Rating 100 Ground Bar Kit	38.05	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	6.03	
26 05 26 00-0089	EA		Switch Rating 200 Ground Bar Kit	67.79	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	7.24	
26 05 26 00-0090			Panelboard Ground Bar Kits (26 05 26 00-0089)		
26 05 26 00-0091	EA		Panelboard Ground Bar Kit	100.75	6.03
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	6.03	
26 05 26 00-0092			Circuit Breaker Ground Bar Kits (26 05 26 00-0091)		
26 05 26 00-0093	EA		3 Circuit, Ground Bar Kit	21.11	3.62
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	3.62	
26 05 26 00-0094	EA		4 Circuit, Ground Bar Kit	20.69	3.62
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	3.62	
26 05 26 00-0095	EA		7 Circuit, Ground Bar Kit	21.39	3.62
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	3.62	
26 05 26 00-0096	EA		12 Circuit, Ground Bar Kit	24.24	4.10
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.10	
26 05 26 00-0097	EA		20 Circuit, Ground Bar Kit	27.66	4.58
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.59	
26 05 26 00-0098	EA		24 Circuit, Ground Bar Kit	30.52	5.07
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.07	
26 05 26 00-0099	EA		30 Circuit, Ground Bar Kit	34.04	5.79
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.79	
26 05 26 00-0100	EA		54 Circuit, Ground Bar Kit	39.34	6.76
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	6.76	
26 05 26 00-0101	EA		24 Circuit, Ground Bar Kit With #1 To 4/0 Aluminum/Copper Lug	44.56	5.07
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.07	
26 05 26 00-0102	EA		30 Circuit, Ground Bar Kit With #1 To 4/0 Aluminum/Copper Lug	49.19	5.79
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.79	
26 05 26 00-0103	EA		54 Circuit, Ground Bar Kit With #1 To 4/0 Aluminum/Copper Lug	54.64	6.76
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	6.76	
26 05 29			Hangers And Supports For Electrical Systems (26 05)		
26 05 29 00-0001			Supports (26 05 29)		
26 05 29 00-0002			One Hole Steel Conduit Straps (26 05 29 00-0001)		
26 05 29 00-0003	EA		1/2", One Hole Steel Conduit Strap	2.88	
			<i>For >100 To 250, Deduct</i>	-0.27	
			<i>For >50 To 100, Deduct</i>	-0.14	
			<i>For >250 To 500, Deduct</i>	-0.54	
			<i>For Installation On Concrete (Includes Drilling And Fastener), Add</i>	0.75	
			<i>For Work In Restricted Working Space, Add</i>	0.77	
			<i>For >500, Deduct</i>	-0.80	
26 05 29 00-0004	EA		3/4", One Hole Steel Conduit Strap	2.92	
			<i>For >100 To 250, Deduct</i>	-0.28	
			<i>For >50 To 100, Deduct</i>	-0.14	
			<i>For >250 To 500, Deduct</i>	-0.54	
			<i>For Installation On Concrete (Includes Drilling And Fastener), Add</i>	0.75	
			<i>For Work In Restricted Working Space, Add</i>	0.77	
			<i>For >500, Deduct</i>	-0.81	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 29 00-0005 EA 1", One Hole Steel Conduit Strap <i>For >100 To 250, Deduct</i> <i>For >50 To 100, Deduct</i> <i>For >250 To 500, Deduct</i> <i>For Installation On Concrete (Includes Drilling And Fastener), Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For >500, Deduct</i>	3.09 -0.28 -0.14 -0.55 0.75 0.77 -0.83	
26 05 29 00-0006 EA 1-1/4", One Hole Steel Conduit Strap <i>For >100 To 250, Deduct</i> <i>For >50 To 100, Deduct</i> <i>For >250 To 500, Deduct</i> <i>For Installation On Concrete (Includes Drilling And Fastener), Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For >500, Deduct</i>	3.22 -0.29 -0.15 -0.56 0.75 0.77 -0.84	
26 05 29 00-0007 EA 1-1/2", One Hole Steel Conduit Strap <i>For >100 To 250, Deduct</i> <i>For >50 To 100, Deduct</i> <i>For >250 To 500, Deduct</i> <i>For Installation On Concrete (Includes Drilling And Fastener), Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For >500, Deduct</i>	3.30 -0.29 -0.15 -0.57 0.75 0.77 -0.85	
26 05 29 00-0008 EA 2", One Hole Steel Conduit Strap <i>For >100 To 250, Deduct</i> <i>For >50 To 100, Deduct</i> <i>For >250 To 500, Deduct</i> <i>For Installation On Concrete (Includes Drilling And Fastener), Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For >500, Deduct</i>	3.82 -0.32 -0.16 -0.61 0.75 0.77 -0.90	
26 05 29 00-0009 EA 2-1/2", One Hole Steel Conduit Strap <i>For >100 To 250, Deduct</i> <i>For >50 To 100, Deduct</i> <i>For >250 To 500, Deduct</i> <i>For Installation On Concrete (Includes Drilling And Fastener), Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For >500, Deduct</i>	4.35 -0.35 -0.17 -0.65 0.75 0.77 -0.95	
26 05 29 00-0010 EA 3", One Hole Steel Conduit Strap <i>For >100 To 250, Deduct</i> <i>For >50 To 100, Deduct</i> <i>For >250 To 500, Deduct</i> <i>For Installation On Concrete (Includes Drilling And Fastener), Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For >500, Deduct</i>	4.53 -0.36 -0.18 -0.66 0.75 0.77 -0.97	
26 05 29 00-0011 EA 3-1/2", One Hole Steel Conduit Strap <i>For >100 To 250, Deduct</i> <i>For >50 To 100, Deduct</i> <i>For >250 To 500, Deduct</i> <i>For Installation On Concrete (Includes Drilling And Fastener), Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For >500, Deduct</i>	5.40 -0.40 -0.20 -0.73 0.75 0.77 -1.06	
26 05 29 00-0012 EA 4", One Hole Steel Conduit Strap <i>For >100 To 250, Deduct</i> <i>For >50 To 100, Deduct</i> <i>For >250 To 500, Deduct</i> <i>For Installation On Concrete (Includes Drilling And Fastener), Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For >500, Deduct</i>	6.09 -0.43 -0.22 -0.78 0.75 0.77 -1.13	
26 05 29 00-0013 Two Hole Steel Conduits Straps <small>(26 05 29 00-0001)</small>		
26 05 29 00-0014 EA 1/2", Two Hole Steel Conduit Strap <i>For Installation On Concrete (Includes Drilling And Fastener), Add</i> <i>For >100 To 250, Deduct</i> <i>For >50 To 100, Deduct</i> <i>For >250 To 500, Deduct</i> <i>For Work In Restricted Working Space, Add</i> <i>For >500, Deduct</i>	3.30 0.93 -0.31 -0.16 -0.61 0.87 -0.91	
26 05 29 00-0015 EA 3/4", Two Hole Steel Conduit Strap <i>For Installation On Concrete (Includes Drilling And Fastener), Add</i> <i>For >100 To 250, Deduct</i> <i>For >50 To 100, Deduct</i> <i>For >250 To 500, Deduct</i> <i>For Work In Restricted Working Space, Add</i> <i>For >500, Deduct</i>	3.36 0.93 -0.31 -0.16 -0.61 0.87 -0.92	
26 05 29 00-0016 EA 1", Two Hole Steel Conduit Strap <i>For Installation On Concrete (Includes Drilling And Fastener), Add</i> <i>For >100 To 250, Deduct</i> <i>For >50 To 100, Deduct</i> <i>For >250 To 500, Deduct</i> <i>For Work In Restricted Working Space, Add</i> <i>For >500, Deduct</i>	3.39 0.93 -0.31 -0.16 -0.62 0.87 -0.92	
26 05 29 00-0017 EA 1-1/4", Two Hole Steel Conduit Strap <i>For Installation On Concrete (Includes Drilling And Fastener), Add</i> <i>For >100 To 250, Deduct</i> <i>For >50 To 100, Deduct</i> <i>For >250 To 500, Deduct</i> <i>For Work In Restricted Working Space, Add</i> <i>For >500, Deduct</i>	3.43 0.93 -0.32 -0.16 -0.62 0.87 -0.92	

26 Electrical**26 05 Common Work Results For Electrical****26 05 29 Hangers And Supports For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 29 00-0018	EA		1-1/2", Two Hole Steel Conduit Strap .....3.46		
			<i>For Installation On Concrete (Includes Drilling And Fastener), Add</i>	0.93	
			<i>For >100 To 250, Deduct</i>	-0.32	
			<i>For >50 To 100, Deduct</i>	-0.16	
			<i>For >250 To 500, Deduct</i>	-0.62	
			<i>For Work In Restricted Working Space, Add</i>	0.87	
			<i>For >500, Deduct</i>	-0.93	
26 05 29 00-0019	EA		2", Two Hole Steel Conduit Strap .....3.53		
			<i>For Installation On Concrete (Includes Drilling And Fastener), Add</i>	0.93	
			<i>For >100 To 250, Deduct</i>	-0.32	
			<i>For >50 To 100, Deduct</i>	-0.16	
			<i>For >250 To 500, Deduct</i>	-0.63	
			<i>For Work In Restricted Working Space, Add</i>	0.87	
			<i>For >500, Deduct</i>	-0.93	
26 05 29 00-0020	EA		2-1/2", Two Hole Steel Conduit Strap .....3.93		
			<i>For Installation On Concrete (Includes Drilling And Fastener), Add</i>	0.93	
			<i>For >100 To 250, Deduct</i>	-0.34	
			<i>For >50 To 100, Deduct</i>	-0.17	
			<i>For >250 To 500, Deduct</i>	-0.66	
			<i>For Work In Restricted Working Space, Add</i>	0.87	
			<i>For >500, Deduct</i>	-0.97	
26 05 29 00-0021	EA		3", Two Hole Steel Conduit Strap .....4.01		
			<i>For Installation On Concrete (Includes Drilling And Fastener), Add</i>	0.93	
			<i>For >100 To 250, Deduct</i>	-0.35	
			<i>For >50 To 100, Deduct</i>	-0.17	
			<i>For >250 To 500, Deduct</i>	-0.66	
			<i>For Work In Restricted Working Space, Add</i>	0.87	
			<i>For >500, Deduct</i>	-0.98	
26 05 29 00-0022	EA		3-1/2", Two Hole Steel Conduit Strap .....4.32		
			<i>For Installation On Concrete (Includes Drilling And Fastener), Add</i>	0.93	
			<i>For >100 To 250, Deduct</i>	-0.36	
			<i>For >50 To 100, Deduct</i>	-0.18	
			<i>For >250 To 500, Deduct</i>	-0.69	
			<i>For Work In Restricted Working Space, Add</i>	0.87	
			<i>For >500, Deduct</i>	-1.01	
26 05 29 00-0023	EA		4", Two Hole Steel Conduit Strap .....4.54		
			<i>For Installation On Concrete (Includes Drilling And Fastener), Add</i>	0.93	
			<i>For >100 To 250, Deduct</i>	-0.37	
			<i>For >50 To 100, Deduct</i>	-0.19	
			<i>For >250 To 500, Deduct</i>	-0.70	
			<i>For Work In Restricted Working Space, Add</i>	0.87	
			<i>For >500, Deduct</i>	-1.03	
26 05 29 00-0024			Clamp Back Spacers (26 05 29 00-0001).....2.61		
26 05 29 00-0025	EA		1/2" Conduit, Clamp Back Spacer.....2.61		
			<i>For >100 To 250, Deduct</i>	-0.23	
			<i>For >50 To 100, Deduct</i>	-0.12	
			<i>For >250 To 500, Deduct</i>	-0.45	
			<i>For Installation On Concrete (Includes Drilling And Fastener), Add</i>	0.60	
			<i>For Work In Restricted Working Space, Add</i>	0.60	
			<i>For >500, Deduct</i>	-0.66	
26 05 29 00-0026	EA		3/4" Conduit, Clamp Back Spacer.....2.81		
			<i>For >100 To 250, Deduct</i>	-0.24	
			<i>For >50 To 100, Deduct</i>	-0.12	
			<i>For >250 To 500, Deduct</i>	-0.46	
			<i>For Installation On Concrete (Includes Drilling And Fastener), Add</i>	0.60	
			<i>For Work In Restricted Working Space, Add</i>	0.60	
			<i>For >500, Deduct</i>	-0.68	
26 05 29 00-0027	EA		1" Conduit, Clamp Back Spacer.....3.00		
			<i>For >100 To 250, Deduct</i>	-0.25	
			<i>For >50 To 100, Deduct</i>	-0.13	
			<i>For >250 To 500, Deduct</i>	-0.48	
			<i>For Installation On Concrete (Includes Drilling And Fastener), Add</i>	0.60	
			<i>For Work In Restricted Working Space, Add</i>	0.60	
			<i>For >500, Deduct</i>	-0.70	
26 05 29 00-0028	EA		1-1/4" Conduit, Clamp Back Spacer .....3.74		
			<i>For >100 To 250, Deduct</i>	-0.29	
			<i>For >50 To 100, Deduct</i>	-0.14	
			<i>For >250 To 500, Deduct</i>	-0.53	
			<i>For Installation On Concrete (Includes Drilling And Fastener), Add</i>	0.60	
			<i>For Work In Restricted Working Space, Add</i>	0.60	
			<i>For >500, Deduct</i>	-0.78	
26 05 29 00-0029	EA		1-1/2" Conduit, Clamp Back Spacer .....4.33		
			<i>For >100 To 250, Deduct</i>	-0.32	
			<i>For >50 To 100, Deduct</i>	-0.16	
			<i>For >250 To 500, Deduct</i>	-0.58	
			<i>For Installation On Concrete (Includes Drilling And Fastener), Add</i>	0.60	
			<i>For Work In Restricted Working Space, Add</i>	0.60	
			<i>For >500, Deduct</i>	-0.84	
26 05 29 00-0030	EA		2" Conduit, Clamp Back Spacer.....4.96		
			<i>For >100 To 250, Deduct</i>	-0.35	
			<i>For >50 To 100, Deduct</i>	-0.17	
			<i>For >250 To 500, Deduct</i>	-0.62	
			<i>For Installation On Concrete (Includes Drilling And Fastener), Add</i>	0.60	
			<i>For Work In Restricted Working Space, Add</i>	0.60	
			<i>For >500, Deduct</i>	-0.90	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 29 00-0031 EA 2-1/2" Conduit, Clamp Back Spacer	7.50	
For >100 To 250, Deduct	-0.48	
For >50 To 100, Deduct	-0.24	
For >250 To 500, Deduct	-0.81	
For Installation On Concrete (Includes Drilling And Fastener), Add	0.60	
For Work In Restricted Working Space, Add	0.60	
For >500, Deduct	-1.15	
26 05 29 00-0032 EA 3" Conduit, Clamp Back Spacer.....	10.54	
For >100 To 250, Deduct	-0.63	
For >50 To 100, Deduct	-0.31	
For >250 To 500, Deduct	-1.04	
For Installation On Concrete (Includes Drilling And Fastener), Add	0.60	
For Work In Restricted Working Space, Add	0.60	
For >500, Deduct	-1.46	
26 05 29 00-0033 EA 3-1/2" Conduit, Clamp Back Spacer	13.49	
For >100 To 250, Deduct	-0.78	
For >50 To 100, Deduct	-0.39	
For >250 To 500, Deduct	-1.26	
For Installation On Concrete (Includes Drilling And Fastener), Add	0.60	
For Work In Restricted Working Space, Add	0.60	
For >500, Deduct	-1.75	
26 05 29 00-0034 EA 4" Conduit, Clamp Back Spacer.....	27.33	
For >100 To 250, Deduct	-1.47	
For >50 To 100, Deduct	-0.73	
For >250 To 500, Deduct	-2.30	
For Installation On Concrete (Includes Drilling And Fastener), Add	0.60	
For Work In Restricted Working Space, Add	0.60	
For >500, Deduct	-3.14	
26 05 29 00-0035 Conduit Clips <small>(26 05 29 00-0001)</small>		
Note: Push in or clip.		
26 05 29 00-0036 EA 1/2" Conduit Clip.....	3.14	
For >100 To 250, Deduct	-0.29	
For >50 To 100, Deduct	-0.14	
For >250 To 500, Deduct	-0.56	
For Installation On Concrete (Includes Drilling And Fastener), Add	0.75	
For >500, Deduct	-0.83	
26 05 29 00-0037 EA 3/4" Conduit Clip.....	3.14	
For >100 To 250, Deduct	-0.29	
For >50 To 100, Deduct	-0.14	
For >250 To 500, Deduct	-0.56	
For Installation On Concrete (Includes Drilling And Fastener), Add	0.75	
For >500, Deduct	-0.83	
26 05 29 00-0038 EA 1" Conduit Clip.....	3.12	
For >100 To 250, Deduct	-0.29	
For >50 To 100, Deduct	-0.14	
For >250 To 500, Deduct	-0.56	
For Installation On Concrete (Includes Drilling And Fastener), Add	0.75	
For >500, Deduct	-0.83	
26 05 29 00-0039 EA 1-1/4" Conduit Clip.....	3.23	
For >100 To 250, Deduct	-0.29	
For >50 To 100, Deduct	-0.15	
For >250 To 500, Deduct	-0.56	
For Installation On Concrete (Includes Drilling And Fastener), Add	0.75	
For >500, Deduct	-0.84	
26 05 29 00-0040 Bolt And Nut Conduit Clips <small>(26 05 29 00-0001)</small>		
26 05 29 00-0041 EA 3/4" Bolt And Nut Conduit Clip (Minerallac 1B).....	3.95	
For >100 To 250, Deduct	-0.36	
For >50 To 100, Deduct	-0.18	
For >250 To 500, Deduct	-0.70	
For Installation On Concrete (Includes Drilling And Fastener), Add	0.91	
For >500, Deduct	-1.04	
26 05 29 00-0042 EA 1" Bolt And Nut Conduit Clip (Minerallac 2B).....	4.06	
For >100 To 250, Deduct	-0.36	
For >50 To 100, Deduct	-0.18	
For >250 To 500, Deduct	-0.71	
For Installation On Concrete (Includes Drilling And Fastener), Add	0.91	
For >500, Deduct	-1.05	
26 05 29 00-0043 EA 1-1/4" Bolt And Nut Conduit Clip (Minerallac 2-1/2B).....	4.33	
For >100 To 250, Deduct	-0.39	
For >50 To 100, Deduct	-0.19	
For >250 To 500, Deduct	-0.75	
For Installation On Concrete (Includes Drilling And Fastener), Add	0.96	
For >500, Deduct	-1.12	
26 05 29 00-0044 EA 1-1/2" Bolt And Nut Conduit Clip (Minerallac 3B).....	4.39	
For >100 To 250, Deduct	-0.39	
For >50 To 100, Deduct	-0.20	
For >250 To 500, Deduct	-0.76	
For Installation On Concrete (Includes Drilling And Fastener), Add	0.96	
For >500, Deduct	-1.12	

26 Electrical**26 05 Common Work Results For Electrical****26 05 29 Hangers And Supports For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 29 00-0045	EA		2" Bolt And Nut Conduit Clip (Minerallac 5B).....	4.84	
			<i>For >100 To 250, Deduct</i>	-0.41	
			<i>For >50 To 100, Deduct</i>	-0.21	
			<i>For >250 To 500, Deduct</i>	-0.79	
			<i>For Installation On Concrete (Includes Drilling And Fastener), Add</i>	0.96	
			<i>For >500, Deduct</i>	-1.17	
26 05 29 00-0046	EA		2-1/2" Bolt And Nut Conduit Clip (Minerallac 6B).....	5.23	
			<i>For >100 To 250, Deduct</i>	-0.44	
			<i>For >50 To 100, Deduct</i>	-0.22	
			<i>For >250 To 500, Deduct</i>	-0.84	
			<i>For Installation On Concrete (Includes Drilling And Fastener), Add</i>	1.01	
			<i>For >500, Deduct</i>	-1.25	
26 05 29 00-0047	EA		3" Bolt And Nut Conduit Clip (Minerallac 7B).....	5.62	
			<i>For >100 To 250, Deduct</i>	-0.46	
			<i>For >50 To 100, Deduct</i>	-0.23	
			<i>For >250 To 500, Deduct</i>	-0.87	
			<i>For Installation On Concrete (Includes Drilling And Fastener), Add</i>	1.01	
			<i>For >500, Deduct</i>	-1.29	
26 05 29 00-0048	EA		4" Bolt And Nut Conduit Clip (Minerallac 9B).....	9.74	
			<i>For >100 To 250, Deduct</i>	-0.69	
			<i>For >50 To 100, Deduct</i>	-0.34	
			<i>For >250 To 500, Deduct</i>	-1.23	
			<i>For Installation On Concrete (Includes Drilling And Fastener), Add</i>	1.11	
			<i>For >500, Deduct</i>	-1.78	
26 05 29 00-0049			Conduit Hanger From Flange, Wire Or Rod (26 05 29 00-0001)		
			Note: Bat wing.		
26 05 29 00-0050	EA		1/2", Conduit Hanger From Flange, Wire Or Rod	2.29	
			<i>For >100 To 250, Deduct</i>	-0.21	
			<i>For >50 To 100, Deduct</i>	-0.11	
			<i>For >250 To 500, Deduct</i>	-0.41	
			<i>For Installation On Concrete (Includes Drilling And Fastener), Add</i>	0.58	
			<i>For >500, Deduct</i>	-0.62	
26 05 29 00-0051	EA		3/4", Conduit Hanger From Flange, Wire Or Rod	2.32	
			<i>For >100 To 250, Deduct</i>	-0.21	
			<i>For >50 To 100, Deduct</i>	-0.11	
			<i>For >250 To 500, Deduct</i>	-0.42	
			<i>For Installation On Concrete (Includes Drilling And Fastener), Add</i>	0.58	
			<i>For >500, Deduct</i>	-0.62	
26 05 29 00-0052	EA		1", Conduit Hanger From Flange, Wire Or Rod	2.41	
			<i>For >100 To 250, Deduct</i>	-0.22	
			<i>For >50 To 100, Deduct</i>	-0.11	
			<i>For >250 To 500, Deduct</i>	-0.42	
			<i>For Installation On Concrete (Includes Drilling And Fastener), Add</i>	0.58	
			<i>For >500, Deduct</i>	-0.63	
26 05 29 00-0053	EA		1-1/4", Conduit Hanger From Flange, Wire Or Rod	2.62	
			<i>For >100 To 250, Deduct</i>	-0.23	
			<i>For >50 To 100, Deduct</i>	-0.11	
			<i>For >250 To 500, Deduct</i>	-0.44	
			<i>For Installation On Concrete (Includes Drilling And Fastener), Add</i>	0.58	
			<i>For >500, Deduct</i>	-0.65	
26 05 29 00-0054			Beam Flange Clamps (26 05 29 00-0001)		
			Note: For threaded rod, nut not required.		
26 05 29 00-0055	EA		1/8" To 1/4" Flange Thickness, Beam Clamp (Caddy 6TA24)	3.21	
			<i>For >100 To 250, Deduct</i>	-0.26	
			<i>For >50 To 100, Deduct</i>	-0.13	
			<i>For >250 To 500, Deduct</i>	-0.49	
			<i>For >500, Deduct</i>	-0.72	
26 05 29 00-0056	EA		5/16" To 1/2" Flange Thickness, Beam Clamp (Caddy 6TA58)	3.16	
			<i>For >100 To 250, Deduct</i>	-0.26	
			<i>For >50 To 100, Deduct</i>	-0.13	
			<i>For >250 To 500, Deduct</i>	-0.49	
			<i>For >500, Deduct</i>	-0.72	
26 05 29 00-0057	EA		9/16" To 3/4" Flange Thickness, Beam Clamp (Caddy 6TA912)	3.49	
			<i>For >100 To 250, Deduct</i>	-0.28	
			<i>For >50 To 100, Deduct</i>	-0.14	
			<i>For >250 To 500, Deduct</i>	-0.51	
			<i>For >500, Deduct</i>	-0.75	
26 05 29 00-0058			T-Bar Support Clips (26 05 29 00-0001)		
26 05 29 00-0059	EA		9/16" Grid Size, Independent T-Bar Support Clip (Caddy IDS95).....	5.48	
			<i>For >100 To 250, Deduct</i>	-0.48	
			<i>For >50 To 100, Deduct</i>	-0.24	
			<i>For >250 To 500, Deduct</i>	-0.91	
			<i>For >500, Deduct</i>	-1.35	
26 05 29 00-0060	EA		15/16" Grid Size, Independent T-Bar Support Clip (Caddy IDS).....	5.22	
			<i>For >100 To 250, Deduct</i>	-0.46	
			<i>For >50 To 100, Deduct</i>	-0.23	
			<i>For >250 To 500, Deduct</i>	-0.89	
			<i>For >500, Deduct</i>	-1.33	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 29 00-0061 EA 15/16 Grid Size, Twist On T-Bar Support Clip (Caddy 4G16).....	1.89	
<i>For >100 To 250, Deduct</i>	-0.14	
<i>For >50 To 100, Deduct</i>	-0.07	
<i>For >250 To 500, Deduct</i>	-0.27	
<i>For >500, Deduct</i>	-0.39	
26 05 29 00-0062 EA 24" Long Snap On T-Bar Electrical Box Hanger (Caddy 512)	14.46	
<i>For >100 To 250, Deduct</i>	-0.80	
<i>For >50 To 100, Deduct</i>	-0.40	
<i>For >250 To 500, Deduct</i>	-1.28	
<i>For >500, Deduct</i>	-1.77	
26 05 29 00-0063 Switch And Outlet Box Type Supports <small>(26 05 29 00-0001)</small>		
26 05 29 00-0064 EA 1/4" To 3/4" Drywall Thickness, Adjustable Switch And Outlet Box Support (Caddy MFS)	3.80	
<i>For >100 To 250, Deduct</i>	-0.27	
<i>For >50 To 100, Deduct</i>	-0.14	
<i>For >250 To 500, Deduct</i>	-0.49	
<i>For >500, Deduct</i>	-0.70	
26 05 29 00-0065 EA 1/2" Drywall Thickness, Riveted Switch And Outlet Box Support (Caddy MF500).....	3.26	
<i>For >100 To 250, Deduct</i>	-0.24	
<i>For >50 To 100, Deduct</i>	-0.12	
<i>For >250 To 500, Deduct</i>	-0.44	
<i>For >500, Deduct</i>	-0.65	
26 05 29 00-0066 EA Flush, Riveted Switch And Outlet Box Support (Caddy MFO)	3.72	
<i>For >100 To 250, Deduct</i>	-0.27	
<i>For >50 To 100, Deduct</i>	-0.13	
<i>For >250 To 500, Deduct</i>	-0.48	
<i>For >500, Deduct</i>	-0.69	
26 05 29 00-0067 EA Snap On, Switch And Outlet Box Support (Caddy MSF)	2.48	
<i>For >100 To 250, Deduct</i>	-0.20	
<i>For >50 To 100, Deduct</i>	-0.10	
<i>For >250 To 500, Deduct</i>	-0.39	
<i>For >500, Deduct</i>	-0.57	
26 05 29 00-0068 EA 1/4-20 Thread Impression, Switch And Outlet Box Support (Caddy MFI).....	2.58	
<i>For >100 To 250, Deduct</i>	-0.21	
<i>For >50 To 100, Deduct</i>	-0.10	
<i>For >250 To 500, Deduct</i>	-0.39	
<i>For >500, Deduct</i>	-0.58	
26 05 29 00-0069 Lighting Fixture Hanger <small>(26 05 29 00-0001)</small>		
Note: For existing or owner furnished fixtures.		
26 05 29 00-0070 EA Lay-In/Troffer, Straight Lip Type Fixture Support Clip (Caddy 515)	3.75	
<i>For >100 To 250, Deduct</i>	-0.35	
<i>For >50 To 100, Deduct</i>	-0.17	
<i>For >250 To 500, Deduct</i>	-0.68	
<i>For >500, Deduct</i>	-1.02	
26 05 29 00-0071 PR Support Bars For Recessed "High Hat" Light Fixtures (Caddy 517)	11.78	
<i>For >100 To 250, Deduct</i>	-0.75	
<i>For >50 To 100, Deduct</i>	-0.38	
<i>For >250 To 500, Deduct</i>	-1.29	
<i>For >500, Deduct</i>	-1.82	
26 05 29 00-0072 PR Support Bars For Recessed "Lightolier" Light Fixtures (Caddy 520)	16.00	
<i>For >100 To 250, Deduct</i>	-0.96	
<i>For >50 To 100, Deduct</i>	-0.48	
<i>For >250 To 500, Deduct</i>	-1.60	
<i>For >500, Deduct</i>	-2.24	
26 05 29 00-0073 Rigid Steel Conduit Clamps For Unistrut Channel <small>(26 05 29 00-0001)</small>		
26 05 29 00-0074 EA 1/2" Diameter, Rigid Steel Conduit Clamp For Unistrut Channel	3.36	
<i>For >100 To 250, Deduct</i>	-0.29	
<i>For >50 To 100, Deduct</i>	-0.14	
<i>For >250 To 500, Deduct</i>	-0.55	
<i>For Work In Restricted Working Space, Add</i>	0.73	
<i>For >500, Deduct</i>	-0.82	
26 05 29 00-0075 EA 3/4" Diameter, Rigid Steel Conduit Clamp For Unistrut Channel	3.38	
<i>For >100 To 250, Deduct</i>	-0.29	
<i>For >50 To 100, Deduct</i>	-0.15	
<i>For >250 To 500, Deduct</i>	-0.56	
<i>For Work In Restricted Working Space, Add</i>	0.73	
<i>For >500, Deduct</i>	-0.82	
26 05 29 00-0076 EA 1" Diameter, Rigid Steel Conduit Clamp For Unistrut Channel	3.45	
<i>For >100 To 250, Deduct</i>	-0.29	
<i>For >50 To 100, Deduct</i>	-0.15	
<i>For >250 To 500, Deduct</i>	-0.56	
<i>For Work In Restricted Working Space, Add</i>	0.73	
<i>For >500, Deduct</i>	-0.83	
26 05 29 00-0077 EA 1-1/4" Diameter, Rigid Steel Conduit Clamp For Unistrut Channel	4.35	
<i>For >100 To 250, Deduct</i>	-0.38	
<i>For >50 To 100, Deduct</i>	-0.19	
<i>For >250 To 500, Deduct</i>	-0.73	
<i>For Work In Restricted Working Space, Add</i>	0.97	
<i>For >500, Deduct</i>	-1.08	

26 Electrical**26 05 Common Work Results For Electrical****26 05 29 Hangers And Supports For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 29 00-0078	EA		1-1/2" Diameter, Rigid Steel Conduit Clamp For Unistrut Channel	4.74	
			<i>For >100 To 250, Deduct</i>	-0.40	
			<i>For >50 To 100, Deduct</i>	-0.20	
			<i>For >250 To 500, Deduct</i>	-0.76	
			<i>For Work In Restricted Working Space, Add</i>	0.97	
			<i>For >500, Deduct</i>	-1.12	
26 05 29 00-0079	EA		2" Diameter, Rigid Steel Conduit Clamp For Unistrut Channel	4.78	
			<i>For >100 To 250, Deduct</i>	-0.40	
			<i>For >50 To 100, Deduct</i>	-0.20	
			<i>For >250 To 500, Deduct</i>	-0.76	
			<i>For Work In Restricted Working Space, Add</i>	0.97	
			<i>For >500, Deduct</i>	-1.12	
26 05 29 00-0080	EA		2-1/2" Diameter, Rigid Steel Conduit Clamp For Unistrut Channel	5.85	
			<i>For >100 To 250, Deduct</i>	-0.49	
			<i>For >50 To 100, Deduct</i>	-0.25	
			<i>For >250 To 500, Deduct</i>	-0.94	
			<i>For Work In Restricted Working Space, Add</i>	1.21	
			<i>For >500, Deduct</i>	-1.39	
26 05 29 00-0081	EA		3" Diameter, Rigid Steel Conduit Clamp For Unistrut Channel	6.19	
			<i>For >100 To 250, Deduct</i>	-0.51	
			<i>For >50 To 100, Deduct</i>	-0.26	
			<i>For >250 To 500, Deduct</i>	-0.97	
			<i>For Work In Restricted Working Space, Add</i>	1.21	
			<i>For >500, Deduct</i>	-1.42	
26 05 29 00-0082	EA		3-1/2" Diameter, Rigid Steel Conduit Clamp For Unistrut Channel	6.52	
			<i>For >100 To 250, Deduct</i>	-0.53	
			<i>For >50 To 100, Deduct</i>	-0.26	
			<i>For >250 To 500, Deduct</i>	-0.99	
			<i>For Work In Restricted Working Space, Add</i>	1.21	
			<i>For >500, Deduct</i>	-1.46	
26 05 29 00-0083	EA		4" Diameter, Rigid Steel Conduit Clamp For Unistrut Channel	6.63	
			<i>For >100 To 250, Deduct</i>	-0.53	
			<i>For >50 To 100, Deduct</i>	-0.27	
			<i>For >250 To 500, Deduct</i>	-1.00	
			<i>For Work In Restricted Working Space, Add</i>	1.21	
			<i>For >500, Deduct</i>	-1.47	
26 05 29 00-0084			Electrical Metallic Tubing (EMT) Conduit Clamps For Unistrut Channel <small>(26 05 29 00-0001)</small>		
26 05 29 00-0085	EA		1/2" Diameter, Electrical Metallic Tubing (EMT) Conduit Clamp For Unistrut Channel	3.61	
			<i>For >100 To 250, Deduct</i>	-0.30	
			<i>For >50 To 100, Deduct</i>	-0.15	
			<i>For >250 To 500, Deduct</i>	-0.57	
			<i>For Work In Restricted Working Space, Add</i>	0.73	
			<i>For >500, Deduct</i>	-0.85	
26 05 29 00-0086	EA		3/4" Diameter, Electrical Metallic Tubing (EMT) Conduit Clamp For Unistrut Channel	3.58	
			<i>For >100 To 250, Deduct</i>	-0.30	
			<i>For >50 To 100, Deduct</i>	-0.15	
			<i>For >250 To 500, Deduct</i>	-0.57	
			<i>For Work In Restricted Working Space, Add</i>	0.73	
			<i>For >500, Deduct</i>	-0.84	
26 05 29 00-0087	EA		1" Diameter, Electrical Metallic Tubing (EMT) Conduit Clamp For Unistrut Channel	3.54	
			<i>For >100 To 250, Deduct</i>	-0.30	
			<i>For >50 To 100, Deduct</i>	-0.15	
			<i>For >250 To 500, Deduct</i>	-0.57	
			<i>For Work In Restricted Working Space, Add</i>	0.73	
			<i>For >500, Deduct</i>	-0.84	
26 05 29 00-0088	EA		1-1/4" Diameter, Electrical Metallic Tubing (EMT) Conduit Clamp For Unistrut Channel	4.66	
			<i>For >100 To 250, Deduct</i>	-0.39	
			<i>For >50 To 100, Deduct</i>	-0.20	
			<i>For >250 To 500, Deduct</i>	-0.75	
			<i>For Work In Restricted Working Space, Add</i>	0.97	
			<i>For >500, Deduct</i>	-1.11	
26 05 29 00-0089	EA		1-1/2" Diameter, Electrical Metallic Tubing (EMT) Conduit Clamp For Unistrut Channel	5.32	
			<i>For >100 To 250, Deduct</i>	-0.43	
			<i>For >50 To 100, Deduct</i>	-0.21	
			<i>For >250 To 500, Deduct</i>	-0.80	
			<i>For Work In Restricted Working Space, Add</i>	0.97	
			<i>For >500, Deduct</i>	-1.18	
26 05 29 00-0090	EA		2" Diameter, Electrical Metallic Tubing (EMT) Conduit Clamp For Unistrut Channel	5.36	
			<i>For >100 To 250, Deduct</i>	-0.43	
			<i>For >50 To 100, Deduct</i>	-0.21	
			<i>For >250 To 500, Deduct</i>	-0.80	
			<i>For Work In Restricted Working Space, Add</i>	0.97	
			<i>For >500, Deduct</i>	-1.18	
26 05 29 00-0091			"J" Type Conduit Hangers <small>(26 05 29 00-0001)</small>		
26 05 29 00-0092	EA		1/2", "J" Type Conduit Hanger (Unistrut J1205)	14.49	
			<i>For >100 To 250, Deduct</i>	-1.01	
			<i>For >50 To 100, Deduct</i>	-0.50	
			<i>For >250 To 500, Deduct</i>	-1.79	
			<i>For Work In Restricted Working Space, Add</i>	1.69	
			<i>For >500, Deduct</i>	-2.58	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 29 00-0093 EA 3/4", "J" Type Conduit Hanger (Unistrut J1207).....	14.64	
<i>For >100 To 250, Deduct</i>	-1.01	
<i>For >50 To 100, Deduct</i>	-0.51	
<i>For >250 To 500, Deduct</i>	-1.80	
<i>For Work In Restricted Working Space, Add</i>	1.69	
<i>For >500, Deduct</i>	-2.59	
26 05 29 00-0094 EA 1", "J" Type Conduit Hanger (Unistrut J1210).....	15.58	
<i>For >100 To 250, Deduct</i>	-1.10	
<i>For >50 To 100, Deduct</i>	-0.55	
<i>For >250 To 500, Deduct</i>	-1.97	
<i>For Work In Restricted Working Space, Add</i>	1.93	
<i>For >500, Deduct</i>	-2.84	
26 05 29 00-0095 EA 1-1/4", "J" Type Conduit Hanger (Unistrut J1212).....	15.75	
<i>For >100 To 250, Deduct</i>	-1.11	
<i>For >50 To 100, Deduct</i>	-0.55	
<i>For >250 To 500, Deduct</i>	-1.99	
<i>For Work In Restricted Working Space, Add</i>	1.93	
<i>For >500, Deduct</i>	-2.86	
26 05 29 00-0096 EA 1-1/2", "J" Type Conduit Hanger (Unistrut J1215).....	16.67	
<i>For >100 To 250, Deduct</i>	-1.20	
<i>For >50 To 100, Deduct</i>	-0.60	
<i>For >250 To 500, Deduct</i>	-2.16	
<i>For Work In Restricted Working Space, Add</i>	2.17	
<i>For >500, Deduct</i>	-3.12	
26 05 29 00-0097 EA 2", "J" Type Conduit Hanger (Unistrut J1220).....	17.30	
<i>For >100 To 250, Deduct</i>	-1.23	
<i>For >50 To 100, Deduct</i>	-0.61	
<i>For >250 To 500, Deduct</i>	-2.20	
<i>For Work In Restricted Working Space, Add</i>	2.17	
<i>For >500, Deduct</i>	-3.18	
26 05 29 00-0098 EA 2-1/2", "J" Type Conduit Hanger (Unistrut J1225).....	27.09	
<i>For >100 To 250, Deduct</i>	-1.76	
<i>For >50 To 100, Deduct</i>	-0.88	
<i>For >250 To 500, Deduct</i>	-3.04	
<i>For Work In Restricted Working Space, Add</i>	2.41	
<i>For >500, Deduct</i>	-4.32	
26 05 29 00-0099 EA 3", "J" Type Conduit Hanger (Unistrut J1230).....	28.85	
<i>For >100 To 250, Deduct</i>	-1.89	
<i>For >50 To 100, Deduct</i>	-0.94	
<i>For >250 To 500, Deduct</i>	-3.27	
<i>For Work In Restricted Working Space, Add</i>	2.66	
<i>For >500, Deduct</i>	-4.66	
26 05 29 00-0100 EA 3-1/2", "J" Type Conduit Hanger (Unistrut J1235).....	31.07	
<i>For >100 To 250, Deduct</i>	-2.04	
<i>For >50 To 100, Deduct</i>	-1.02	
<i>For >250 To 500, Deduct</i>	-3.54	
<i>For Work In Restricted Working Space, Add</i>	2.90	
<i>For >500, Deduct</i>	-5.04	
26 05 29 00-0101 EA 4", "J" Type Conduit Hanger (Unistrut J1240).....	40.82	
<i>For >100 To 250, Deduct</i>	-2.52	
<i>For >50 To 100, Deduct</i>	-1.26	
<i>For >250 To 500, Deduct</i>	-4.27	
<i>For Work In Restricted Working Space, Add</i>	2.90	
<i>For >500, Deduct</i>	-6.01	
26 05 29 00-0102 EA 5", "J" Type Conduit Hanger (Unistrut J1250).....	44.82	
<i>For >100 To 250, Deduct</i>	-2.76	
<i>For >50 To 100, Deduct</i>	-1.38	
<i>For >250 To 500, Deduct</i>	-4.67	
<i>For Work In Restricted Working Space, Add</i>	3.14	
<i>For >500, Deduct</i>	-6.57	
26 05 29 00-0103 EA 6", "J" Type Conduit Hanger (Unistrut J1260).....	62.79	
<i>For >100 To 250, Deduct</i>	-3.74	
<i>For >50 To 100, Deduct</i>	-1.87	
<i>For >250 To 500, Deduct</i>	-6.22	
<i>For Work In Restricted Working Space, Add</i>	3.62	
<i>For >500, Deduct</i>	-8.69	
26 05 29 00-0104 Between Studs Box Brackets <small>(26 05 29 00-0001)</small>		
26 05 29 00-0105 EA 16" Stud Spacing, 1-1/2" Or 2-1/8" Box Depth, Screw Gun Between Studs Box Bracket (Caddy SGB16A)	5.29	
<i>For >100 To 250, Deduct</i>	-0.39	
<i>For >50 To 100, Deduct</i>	-0.19	
<i>For >250 To 500, Deduct</i>	-0.70	
<i>For Work In Restricted Working Space, Add</i>	0.73	
<i>For >500, Deduct</i>	-1.01	
26 05 29 00-0106 EA 24" Stud Spacing, 1-1/2" Or 2-1/8" Box Depth, Screw Gun Between Studs Box Bracket (Caddy SGB24A)	6.28	
<i>For >100 To 250, Deduct</i>	-0.44	
<i>For >50 To 100, Deduct</i>	-0.22	
<i>For >250 To 500, Deduct</i>	-0.77	
<i>For Work In Restricted Working Space, Add</i>	0.73	
<i>For >500, Deduct</i>	-1.11	
26 05 29 00-0107 Hangers And Brackets <small>(26 05 29 00-0001)</small>		

26 Electrical**26 05 Common Work Results For Electrical****26 05 29 Hangers And Supports For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 29 00-0108	EA		Rod Hangers Only With 1/4" Thread Impression (Caddy 4TI)	1.98	
			<i>For >100 To 250, Deduct</i>	-0.18	
			<i>For >50 To 100, Deduct</i>	-0.09	
			<i>For >250 To 500, Deduct</i>	-0.35	
			<i>For >500, Deduct</i>	-0.52	
26 05 29 00-0109	EA		Angle Bracket Only With 1/4" Hole (Caddy AB)	1.92	
			<i>For >100 To 250, Deduct</i>	-0.18	
			<i>For >50 To 100, Deduct</i>	-0.09	
			<i>For >250 To 500, Deduct</i>	-0.34	
			<i>For >500, Deduct</i>	-0.51	
26 05 29 00-0110	EA		Offset Bracket Only With 1/4" Hole (Caddy AO)	1.92	
			<i>For >100 To 250, Deduct</i>	-0.18	
			<i>For >50 To 100, Deduct</i>	-0.09	
			<i>For >250 To 500, Deduct</i>	-0.34	
			<i>For >500, Deduct</i>	-0.51	
26 05 29 00-0111	EA		Angle Bracket Mount, 1/4" Threaded Rod Hanger With Thread Impression (Caddy 4TIB).....	2.52	
			<i>For >100 To 250, Deduct</i>	-0.21	
			<i>For >50 To 100, Deduct</i>	-0.10	
			<i>For >250 To 500, Deduct</i>	-0.39	
			<i>For >500, Deduct</i>	-0.57	
26 05 29 00-0112	EA		Angle Bracket Mount, 3/8" Threaded Rod Hanger With Thread Impression (Caddy 6TIB).....	2.53	
			<i>For >100 To 250, Deduct</i>	-0.21	
			<i>For >50 To 100, Deduct</i>	-0.10	
			<i>For >250 To 500, Deduct</i>	-0.39	
			<i>For >500, Deduct</i>	-0.57	
26 05 29 00-0113	EA		Angle Bracket Mount, 1/4" Or 3/8" Threaded Rod Hanger With Nut (Caddy 6TB).....	2.46	
			<i>For >100 To 250, Deduct</i>	-0.20	
			<i>For >50 To 100, Deduct</i>	-0.10	
			<i>For >250 To 500, Deduct</i>	-0.38	
			<i>For >500, Deduct</i>	-0.57	
26 05 29 00-0114	EA		Offset Bracket Mount, 1/4" Threaded Rod Hanger With Thread Impression (Caddy 4TIO).....	2.52	
			<i>For >100 To 250, Deduct</i>	-0.21	
			<i>For >50 To 100, Deduct</i>	-0.10	
			<i>For >250 To 500, Deduct</i>	-0.39	
			<i>For >500, Deduct</i>	-0.57	
26 05 29 00-0115	EA		Offset Bracket Mount, 3/8" Threaded Rod Hanger With Thread Impression (Caddy 6TIO).....	2.53	
			<i>For >100 To 250, Deduct</i>	-0.21	
			<i>For >50 To 100, Deduct</i>	-0.10	
			<i>For >250 To 500, Deduct</i>	-0.39	
			<i>For >500, Deduct</i>	-0.57	
26 05 29 00-0116			Clips And Accessories <small>(26 05 29 00-0001)</small>		
26 05 29 00-0117	EA		1/2" Diameter Center, Bridle Ring (Caddy 2BR)	1.33	
			<i>For >100 To 250, Deduct</i>	-0.12	
			<i>For >50 To 100, Deduct</i>	-0.06	
			<i>For >250 To 500, Deduct</i>	-0.22	
			<i>For >500, Deduct</i>	-0.33	
26 05 29 00-0118	EA		3/4" Diameter Center, Bridle Ring (Caddy 2BR12)	1.35	
			<i>For >100 To 250, Deduct</i>	-0.12	
			<i>For >50 To 100, Deduct</i>	-0.06	
			<i>For >250 To 500, Deduct</i>	-0.23	
			<i>For >500, Deduct</i>	-0.34	
26 05 29 00-0119	EA		1-1/4" Diameter Center, Bridle Ring (Caddy 2BR20)	1.44	
			<i>For >100 To 250, Deduct</i>	-0.12	
			<i>For >50 To 100, Deduct</i>	-0.06	
			<i>For >250 To 500, Deduct</i>	-0.23	
			<i>For >500, Deduct</i>	-0.34	
26 05 29 00-0120	EA		2" Diameter Center, Bridle Ring (Caddy 2BR32)	1.63	
			<i>For >100 To 250, Deduct</i>	-0.13	
			<i>For >50 To 100, Deduct</i>	-0.07	
			<i>For >250 To 500, Deduct</i>	-0.25	
			<i>For >500, Deduct</i>	-0.36	
26 05 29 00-0121			Wire Ties <small>(26 05 29 00-0001)</small>		
			Note: Per hundred (C).		
26 05 29 00-0122	C		3" Length, 18 LB Tensile Strength, Nylon Cable Ties	11.24	
			<i>For UV Black, Add</i>	0.43	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2.52	
26 05 29 00-0123	C		4" Length, 18 LB Tensile Strength, Nylon Cable Ties	11.35	
			<i>For UV Black, Add</i>	0.44	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2.52	
26 05 29 00-0124	C		4-3/4" Length, 18 LB Tensile Strength, Nylon Cable Ties	11.43	
			<i>For UV Black, Add</i>	0.46	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2.52	
26 05 29 00-0125	C		5-1/2" Length, 18 LB Tensile Strength, Nylon Cable Ties	11.46	
			<i>For UV Black, Add</i>	0.46	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2.52	
26 05 29 00-0126	C		6-1/2" Length, 18 LB Tensile Strength, Nylon Cable Ties	11.86	
			<i>For UV Black, Add</i>	0.47	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2.63	
26 05 29 00-0127	C		8" Length, 18 LB Tensile Strength, Nylon Cable Ties	14.67	
			<i>For UV Black, Add</i>	0.83	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2.75	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 29 00-0128 C 4-3/4" Length, 40 LB Tensile Strength, Nylon Cable Ties.....	14.30	
For UV Black, Add	0.89	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	2.52	
26 05 29 00-0129 C 6" Length, 40 LB Tensile Strength, Nylon Cable Ties.....	14.71	
For UV Black, Add	0.89	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	2.63	
26 05 29 00-0130 C 8" Length, 40 LB Tensile Strength, Nylon Cable Ties.....	15.14	
For UV Black, Add	0.90	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	2.75	
26 05 29 00-0131 C 10" Length, 40 LB Tensile Strength, Nylon Cable Ties.....	23.67	
For UV Black, Add	2.07	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	2.96	
26 05 29 00-0132 C 11-1/2" Length, 40 LB Tensile Strength, Nylon Cable Ties.....	24.92	
For UV Black, Add	2.26	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	2.96	
26 05 29 00-0133 C 7" Length, 50 LB Tensile Strength, Nylon Cable Ties.....	16.02	
For UV Black, Add	1.03	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	2.75	
26 05 29 00-0134 C 8" Length, 50 LB Tensile Strength, Nylon Cable Ties.....	14.91	
For UV Black, Add	0.86	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	2.75	
26 05 29 00-0135 C 11" Length, 50 LB Tensile Strength, Nylon Cable Ties.....	24.01	
For UV Black, Add	2.12	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	2.96	
26 05 29 00-0136 C 14-1/2" Length, 50 LB Tensile Strength, Nylon Cable Ties.....	27.88	
For UV Black, Add	2.61	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	3.15	
26 05 29 00-0137 C 8" Length, 120 LB Tensile Strength, Nylon Cable Ties.....	27.82	
For UV Black, Add	2.80	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	2.75	
26 05 29 00-0138 C 11" Length, 120 LB Tensile Strength, Nylon Cable Ties.....	30.53	
For UV Black, Add	3.10	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	2.96	
26 05 29 00-0139 C 15" Length, 120 LB Tensile Strength, Nylon Cable Ties.....	37.66	
For UV Black, Add	4.08	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	3.15	
26 05 29 00-0140 C 17" Length, 120 LB Tensile Strength, Nylon Cable Ties.....	55.71	
For UV Black, Add	6.68	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	3.36	
26 05 29 00-0141 C 17-3/4" Length, 175 LB Tensile Strength, Nylon Cable Ties.....	53.81	
For UV Black, Add	6.39	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	3.36	
26 05 29 00-0142 C 21-11/16" Length, 175 LB Tensile Strength, Nylon Cable Ties.....	66.48	
For UV Black, Add	8.22	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	3.51	
26 05 29 00-0143 C 30" Length, 175 LB Tensile Strength, Nylon Cable Ties.....	77.56	
For UV Black, Add	9.79	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	3.68	
26 05 29 00-0144 C 46" Length, 175 LB Tensile Strength, Nylon Cable Ties.....	108.10	
For UV Black, Add	14.23	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	3.98	
26 05 29 00-0145 C 3/4" x 3/4" Self Adhesive Tie Mounts.....	26.57	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	7.55	
26 05 29 00-0146 C 1.1" x 1.1" Tie Mounts With Screw.....	52.78	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	15.11	
26 05 29 00-0147 EA 6" Length x 1/2" Width, Velcro Grip Cable Tie.....	1.29	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	0.12	
26 05 29 00-0148 EA 8" Length x 1/2" Width, Velcro Grip Cable Tie.....	1.28	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	0.10	
26 05 29 00-0149 EA 12" Length x 1/2" Width, Velcro Grip Cable Tie.....	1.56	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	0.10	
26 05 29 00-0150 EA 15" Length x 3/4" Width, Velcro Grip Cable Tie.....	2.15	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	0.10	
26 05 29 00-0151 EA 180" Length x 3/4" Width, Velcro Grip Cable Tie Roll.....	53.92	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	0.76	
26 05 29 00-0152 Fastening Devices For Wireway And Conduit (26 05 29)		
Note: Bolts include drilling of holes with power tools in concrete, brick, concrete block, wood, tile or steel and alignment of hangers and supports.		
26 05 29 00-0153 Toggle Bolts (26 05 29 00-0152)		
Note: Includes machine screw, toggle wing and drilling in concrete, concrete block, wood or steel.		
26 05 29 00-0154 EA 1/8" Diameter, 3" Length, Zinc Plated Steel, Toggle Bolt.....	6.19	
For >50 To 100, Deduct	-0.60	
For >500, Deduct	-2.98	
For >250 To 500, Deduct	-2.08	
For >100 To 250, Deduct	-1.19	
26 05 29 00-0155 EA 1/8" Diameter, 4" Length, Zinc Plated Steel, Toggle Bolt.....	6.35	
For >50 To 100, Deduct	-0.61	
For >500, Deduct	-3.05	
For >250 To 500, Deduct	-2.13	
For >100 To 250, Deduct	-1.22	

26 Electrical**26 05 Common Work Results For Electrical****26 05 29 Hangers And Supports For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 29 00-0156	EA		3/16" Diameter, 3" Length, Zinc Plated Steel, Toggle Bolt.....	6.67	
			<i>For >50 To 100, Deduct</i>	-0.63	
			<i>For >500, Deduct</i>	-3.14	
			<i>For >250 To 500, Deduct</i>	-2.20	
			<i>For >100 To 250, Deduct</i>	-1.26	
26 05 29 00-0157	EA		3/16" Diameter, 4" Length, Zinc Plated Steel, Toggle Bolt.....	6.84	
			<i>For >50 To 100, Deduct</i>	-0.65	
			<i>For >500, Deduct</i>	-3.22	
			<i>For >250 To 500, Deduct</i>	-2.25	
			<i>For >100 To 250, Deduct</i>	-1.29	
26 05 29 00-0158	EA		1/4" Diameter, 4" Length, Zinc Plated Steel, Toggle Bolt.....	6.99	
			<i>For >50 To 100, Deduct</i>	-0.66	
			<i>For >500, Deduct</i>	-3.29	
			<i>For >250 To 500, Deduct</i>	-2.30	
			<i>For >100 To 250, Deduct</i>	-1.32	
26 05 29 00-0159	EA		5/16" Diameter, 4" Length, Zinc Plated Steel, Toggle Bolt.....	7.78	
			<i>For >50 To 100, Deduct</i>	-0.69	
			<i>For >500, Deduct</i>	-3.43	
			<i>For >250 To 500, Deduct</i>	-2.40	
			<i>For >100 To 250, Deduct</i>	-1.38	
26 05 29 00-0160	EA		3/8" Diameter, 4" Length, Zinc Plated Steel, Toggle Bolt.....	8.08	
			<i>For >50 To 100, Deduct</i>	-0.71	
			<i>For >500, Deduct</i>	-3.52	
			<i>For >250 To 500, Deduct</i>	-2.47	
			<i>For >100 To 250, Deduct</i>	-1.42	
26 05 29 00-0161			Machine Screws <small>(26 05 29 00-0152)</small>		
			Note: Includes drilling in concrete, concrete block, wood or steel.		
26 05 29 00-0162	EA		#8 Diameter, 2" Length, Zinc Plated Steel, Machine Screw.....	1.83	
			<i>For >50 To 100, Deduct</i>	-0.18	
			<i>For >500, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-0.63	
			<i>For >100 To 250, Deduct</i>	-0.36	
26 05 29 00-0163	EA		#10 Diameter, 2" Length, Zinc Plated Steel, Machine Screw.....	1.86	
			<i>For >50 To 100, Deduct</i>	-0.18	
			<i>For >500, Deduct</i>	-0.90	
			<i>For >250 To 500, Deduct</i>	-0.63	
			<i>For >100 To 250, Deduct</i>	-0.36	
26 05 29 00-0164	EA		1/4" Diameter, 2" Length, Zinc Plated Steel, Machine Screw.....	2.33	
			<i>For >50 To 100, Deduct</i>	-0.23	
			<i>For >500, Deduct</i>	-1.13	
			<i>For >250 To 500, Deduct</i>	-0.79	
			<i>For >100 To 250, Deduct</i>	-0.45	
26 05 29 00-0165	EA		5/16" Diameter, 2" Length, Zinc Plated Steel, Machine Screw.....	2.42	
			<i>For >50 To 100, Deduct</i>	-0.23	
			<i>For >500, Deduct</i>	-1.14	
			<i>For >250 To 500, Deduct</i>	-0.80	
			<i>For >100 To 250, Deduct</i>	-0.46	
26 05 29 00-0166	EA		3/8" Diameter, 2" Length, Zinc Plated Steel, Machine Screw.....	2.97	
			<i>For >50 To 100, Deduct</i>	-0.28	
			<i>For >500, Deduct</i>	-1.37	
			<i>For >250 To 500, Deduct</i>	-0.96	
			<i>For >100 To 250, Deduct</i>	-0.55	
26 05 29 00-0167			Hex Lag Bolts With Lag Shield Expansion Anchors <small>(26 05 29 00-0152)</small>		
			Note: Includes lag bolt, lag shield expansion anchor and drilling in concrete, concrete block, wood or steel.		
26 05 29 00-0168	EA		1/4" Diameter, 2" Length, Zinc Plated Steel, Hex Lag Bolt With Lag Shield Expansion Anchor.....	2.88	
			<i>For >50 To 100, Deduct</i>	-0.24	
			<i>For >500, Deduct</i>	-1.18	
			<i>For >250 To 500, Deduct</i>	-0.83	
			<i>For >100 To 250, Deduct</i>	-0.48	
26 05 29 00-0169	EA		5/16" Diameter, 2" Length, Zinc Plated Steel, Hex Lag Bolt With Lag Shield Expansion Anchor.....	2.85	
			<i>For >50 To 100, Deduct</i>	-0.24	
			<i>For >500, Deduct</i>	-1.18	
			<i>For >250 To 500, Deduct</i>	-0.83	
			<i>For >100 To 250, Deduct</i>	-0.48	
26 05 29 00-0170	EA		3/8" Diameter, 2" Length, Zinc Plated Steel, Hex Lag Bolt With Lag Shield Expansion Anchor.....	3.95	
			<i>For >50 To 100, Deduct</i>	-0.30	
			<i>For >500, Deduct</i>	-1.47	
			<i>For >250 To 500, Deduct</i>	-1.03	
			<i>For >100 To 250, Deduct</i>	-0.60	
26 05 29 00-0171	EA		1/2" Diameter, 2" Length, Zinc Plated Steel, Hex Lag Bolt With Lag Shield Expansion Anchor.....	4.98	
			<i>For >50 To 100, Deduct</i>	-0.36	
			<i>For >500, Deduct</i>	-1.75	
			<i>For >250 To 500, Deduct</i>	-1.23	
			<i>For >100 To 250, Deduct</i>	-0.72	
26 05 29 00-0172			Hanger Lag Bolts With Hex Nuts <small>(26 05 29 00-0152)</small>		
			Note: Includes hanger lag bolt (threaded one side), hex nut and drilling in concrete, concrete block, wood or steel.		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 29 00-0173 EA 1/4" Diameter, 2" Length, Zinc Plated Steel, Hanger Lag Bolt With Hex Nut.....	2.16	
<i>For >50 To 100, Deduct</i>	-0.19	
<i>For >500, Deduct</i>	-0.93	
<i>For >250 To 500, Deduct</i>	-0.65	
<i>For >100 To 250, Deduct</i>	-0.38	
26 05 29 00-0174 EA 5/16" Diameter, 2" Length, Zinc Plated Steel, Hanger Lag Bolt With Hex Nut.....	2.19	
<i>For >50 To 100, Deduct</i>	-0.19	
<i>For >500, Deduct</i>	-0.93	
<i>For >250 To 500, Deduct</i>	-0.65	
<i>For >100 To 250, Deduct</i>	-0.38	
26 05 29 00-0175 EA 3/8" Diameter, 2-1/2" Length, Zinc Plated Steel, Hanger Lag Bolt With Hex Nut.....	2.59	
<i>For >50 To 100, Deduct</i>	-0.21	
<i>For >500, Deduct</i>	-1.06	
<i>For >250 To 500, Deduct</i>	-0.74	
<i>For >100 To 250, Deduct</i>	-0.43	
26 05 29 00-0176 Hollow Wall Screw Anchors <small>(26 05 29 00-0152)</small>		
26 05 29 00-0177 EA 6-32 Screw Size, 5/16" Hole Diameter, 1/8" To 5/8" Grip Range, Zinc Plated Steel, Hollow Wall Screw Anchor.....	1.28	
<i>For >50 To 100, Deduct</i>	-0.11	
<i>For >500, Deduct</i>	-0.56	
<i>For >250 To 500, Deduct</i>	-0.39	
<i>For >100 To 250, Deduct</i>	-0.22	
26 05 29 00-0178 EA 6-32 Screw Size, 5/16" Hole Diameter, 5/8" To 1-1/4" Grip Range, Zinc Plated Steel, Hollow Wall Screw Anchor.....	1.31	
<i>For >50 To 100, Deduct</i>	-0.11	
<i>For >500, Deduct</i>	-0.56	
<i>For >250 To 500, Deduct</i>	-0.39	
<i>For >100 To 250, Deduct</i>	-0.23	
26 05 29 00-0179 EA 6-32 Screw Size, 5/16" Hole Diameter, 1-1/4" To 1-3/4" Grip Range, Zinc Plated Steel, Hollow Wall Screw Anchor.....	1.37	
<i>For >50 To 100, Deduct</i>	-0.11	
<i>For >500, Deduct</i>	-0.57	
<i>For >250 To 500, Deduct</i>	-0.40	
<i>For >100 To 250, Deduct</i>	-0.23	
26 05 29 00-0180 EA 10-24 Screw Size, 3/8" Hole Diameter, 1/8" To 5/8" Grip Range, Zinc Plated Steel, Hollow Wall Screw Anchor.....	1.71	
<i>For >50 To 100, Deduct</i>	-0.14	
<i>For >500, Deduct</i>	-0.67	
<i>For >250 To 500, Deduct</i>	-0.47	
<i>For >100 To 250, Deduct</i>	-0.27	
26 05 29 00-0181 EA 10-24 Screw Size, 3/8" Hole Diameter, 5/8" To 1-1/4" Grip Range, Zinc Plated Steel, Hollow Wall Screw Anchor.....	1.78	
<i>For >50 To 100, Deduct</i>	-0.14	
<i>For >500, Deduct</i>	-0.67	
<i>For >250 To 500, Deduct</i>	-0.47	
<i>For >100 To 250, Deduct</i>	-0.28	
26 05 29 00-0182 EA 10-24 Screw Size, 3/8" Hole Diameter, 1-1/4" To 1-3/4" Grip Range, Zinc Plated Steel, Hollow Wall Screw Anchor.....	1.80	
<i>For >50 To 100, Deduct</i>	-0.14	
<i>For >500, Deduct</i>	-0.68	
<i>For >250 To 500, Deduct</i>	-0.48	
<i>For >100 To 250, Deduct</i>	-0.28	
26 05 29 00-0183 EA 1/4-20 Screw Size, 7/16" Hole Diameter, 1/8" To 5/8" Grip Range, Zinc Plated Steel, Hollow Wall Screw Anchor.....	1.82	
<i>For >50 To 100, Deduct</i>	-0.14	
<i>For >500, Deduct</i>	-0.68	
<i>For >250 To 500, Deduct</i>	-0.48	
<i>For >100 To 250, Deduct</i>	-0.28	
26 05 29 00-0184 EA 1/4-20 Screw Size, 7/16" Hole Diameter, 5/8" To 1-1/4" Grip Range, Zinc Plated Steel, Hollow Wall Screw Anchor.....	1.92	
<i>For >50 To 100, Deduct</i>	-0.14	
<i>For >500, Deduct</i>	-0.69	
<i>For >250 To 500, Deduct</i>	-0.49	
<i>For >100 To 250, Deduct</i>	-0.28	
26 05 29 00-0185 EA 1/4-20 Screw Size, 7/16" Hole Diameter, 1-1/4" To 1-3/4" Grip Range, Zinc Plated Steel, Hollow Wall Screw Anchor.....	1.96	
<i>For >50 To 100, Deduct</i>	-0.14	
<i>For >500, Deduct</i>	-0.69	
<i>For >250 To 500, Deduct</i>	-0.49	
<i>For >100 To 250, Deduct</i>	-0.28	
26 05 29 00-0186 Lead Screw Anchors <small>(26 05 29 00-0152)</small>		
Note: Includes screw.		
26 05 29 00-0187 EA #6-8 Screw Size, 1/4" Hole Diameter, Lead Screw Anchor With Screw.....	3.02	
<i>For >50 To 100, Deduct</i>	-0.28	
<i>For >500, Deduct</i>	-1.40	
<i>For >250 To 500, Deduct</i>	-0.98	
<i>For >100 To 250, Deduct</i>	-0.56	
26 05 29 00-0188 EA #10-14 Screw Size, 5/16" Hole Diameter, Lead Screw Anchor With Screw.....	3.57	
<i>For >50 To 100, Deduct</i>	-0.33	
<i>For >500, Deduct</i>	-1.63	
<i>For >250 To 500, Deduct</i>	-1.14	
<i>For >100 To 250, Deduct</i>	-0.65	
26 05 29 00-0189 EA #16-18 Screw Size, 5/16" Hole Diameter, Lead Screw Anchor With Screw.....	4.79	
<i>For >50 To 100, Deduct</i>	-0.42	
<i>For >500, Deduct</i>	-2.09	
<i>For >250 To 500, Deduct</i>	-1.47	
<i>For >100 To 250, Deduct</i>	-0.84	

26 Electrical**26 05 Common Work Results For Electrical****26 05 29 Hangers And Supports For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 29 00-0190			Nailing Anchor Hilti HPS Impact Anchor Or Equal (26 05 29 00-0192)		
26 05 29 00-0191	EA		1/4" x 1" Nail-In Drilling In Concrete, Concrete Block, Wood Or Steel.....	1.04	
			<i>For >50 To 100, Deduct</i>	-0.08	
			<i>For >500, Deduct</i>	-0.40	
			<i>For >250 To 500, Deduct</i>	-0.28	
			<i>For >100 To 250, Deduct</i>	-0.16	
26 05 29 00-0192	EA		1/4" x 1-3/4" Nail-In Drilling In Concrete, Concrete Block, Wood Or Steel.....	1.83	
			<i>For >50 To 100, Deduct</i>	-0.16	
			<i>For >500, Deduct</i>	-0.78	
			<i>For >250 To 500, Deduct</i>	-0.54	
			<i>For >100 To 250, Deduct</i>	-0.31	
26 05 29 00-0193	EA		1/4" x 2-1/8" Nail-In Drilling In Concrete, Concrete Block, Wood Or Steel.....	2.63	
			<i>For >50 To 100, Deduct</i>	-0.23	
			<i>For >500, Deduct</i>	-1.16	
			<i>For >250 To 500, Deduct</i>	-0.81	
			<i>For >100 To 250, Deduct</i>	-0.47	
26 05 29 00-0194			Acoustical T-Bar Clips (26 05 29 00-0192)		
			Note: For conduit installation above suspended ceilings up to 15' height.		
26 05 29 00-0195	EA		1/2" Conduit, Push-In Acoustical T-Bar Clip.....	4.90	
			<i>For >50 To 100, Deduct</i>	-0.38	
			<i>For >500, Deduct</i>	-1.86	
			<i>For >250 To 500, Deduct</i>	-1.31	
			<i>For >100 To 250, Deduct</i>	-0.76	
26 05 29 00-0196	EA		3/4" Conduit, Push-In Acoustical T-Bar Clip.....	5.14	
			<i>For >50 To 100, Deduct</i>	-0.40	
			<i>For >500, Deduct</i>	-1.96	
			<i>For >250 To 500, Deduct</i>	-1.38	
			<i>For >100 To 250, Deduct</i>	-0.80	
26 05 29 00-0197	EA		1" Conduit, Push-In Acoustical T-Bar Clip.....	5.58	
			<i>For >50 To 100, Deduct</i>	-0.43	
			<i>For >500, Deduct</i>	-2.08	
			<i>For >250 To 500, Deduct</i>	-1.47	
			<i>For >100 To 250, Deduct</i>	-0.85	
26 05 29 00-0198			Threaded Rod, Accessories And Attachments (26 05 29)		
26 05 29 00-0199			Threaded Rod And Rod Accessories (26 05 29 00-0198)		
26 05 29 00-0200			Carbon Steel Threaded Rod (26 05 29 00-0199)		
			Note: Includes plain finish.		
26 05 29 00-0201	LF		3/8" Diameter, Plain Finish Steel, Low Carbon Threaded Rod.....	2.29	0.51
			<i>For Galvanized, Add</i>	0.52	
			<i>For Zinc Coated, Add</i>	0.37	
26 05 29 00-0202	LF		1/2" Diameter, Plain Finish Steel, Low Carbon Threaded Rod.....	3.12	0.54
			<i>For Galvanized, Add</i>	0.82	
			<i>For Zinc Coated, Add</i>	0.58	
26 05 29 00-0203	LF		5/8" Diameter, Plain Finish Steel, Low Carbon Threaded Rod.....	4.29	0.55
			<i>For Galvanized, Add</i>	1.27	
			<i>For Zinc Coated, Add</i>	0.91	
26 05 29 00-0204	LF		3/4" Diameter, Plain Finish Steel, Low Carbon Threaded Rod.....	6.92	0.57
			<i>For Galvanized, Add</i>	2.31	
			<i>For Zinc Coated, Add</i>	1.65	
26 05 29 00-0205	LF		7/8" Diameter, Plain Finish Steel, Low Carbon Threaded Rod.....	7.53	0.59
			<i>For Galvanized, Add</i>	2.54	
			<i>For Zinc Coated, Add</i>	1.81	
26 05 29 00-0206	LF		1" Diameter, Plain Finish Steel, Low Carbon Threaded Rod.....	10.27	0.67
			<i>For Galvanized, Add</i>	3.57	
			<i>For Zinc Coated, Add</i>	2.54	
26 05 29 00-0207	LF		1-1/8" Diameter, Plain Finish Steel, Low Carbon Threaded Rod.....	12.74	0.74
			<i>For Galvanized, Add</i>	4.50	
			<i>For Zinc Coated, Add</i>	3.21	
26 05 29 00-0208			Threaded Rod Couplings (26 05 29 00-0199)		
26 05 29 00-0209	EA		3/8" Diameter, Threaded Rod Coupling Nut.....	6.25	
26 05 29 00-0210	EA		1/2" Diameter, Threaded Rod Coupling Nut.....	7.07	
26 05 29 00-0211	EA		5/8" Diameter, Threaded Rod Coupling Nut.....	8.69	
26 05 29 00-0212	EA		3/4" Diameter, Threaded Rod Coupling Nut.....	10.42	
26 05 29 00-0213	EA		7/8" Diameter, Threaded Rod Coupling Nut.....	14.70	
26 05 29 00-0214	EA		1" Diameter, Threaded Rod Coupling Nut.....	17.42	
26 05 29 00-0215	EA		1-1/8" Diameter, Threaded Rod Coupling Nut.....	31.79	
26 05 29 00-0216			Flat Washers (26 05 29 00-0199)		
26 05 29 00-0217	EA		3/8" Inside Diameter, Zinc Plated Steel, Low Carbon Flat Washer.....	0.54	0.20
			<i>For Galvanized, Add</i>	0.02	
26 05 29 00-0218	EA		1/2" Inside Diameter, Zinc Plated Steel, Low Carbon Flat Washer.....	0.67	0.20
			<i>For Galvanized, Add</i>	0.04	
26 05 29 00-0219	EA		5/8" Inside Diameter, Zinc Plated Steel, Low Carbon Flat Washer.....	0.86	0.20
			<i>For Galvanized, Add</i>	0.08	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 29 00-0220 EA 3/4" Inside Diameter, Zinc Plated Steel, Low Carbon Flat Washer..... <i>For Galvanized, Add</i>	1.03 0.12	0.40
26 05 29 00-0221 EA 7/8" Inside Diameter, Zinc Plated Steel, Low Carbon Flat Washer..... <i>For Galvanized, Add</i>	1.15 0.14	0.40
26 05 29 00-0222 EA 1" Inside Diameter, Zinc Plated Steel, Low Carbon Flat Washer..... <i>For Galvanized, Add</i>	1.35 0.17	0.40
26 05 29 00-0223 EA 1-1/8" Inside Diameter, Zinc Plated Steel, Low Carbon Flat Washer..... <i>For Galvanized, Add</i>	1.51 0.19	0.40
26 05 29 00-0224 Malleable Iron Eye Sockets (26 05 29 00-0199) Note: Type 16.		
26 05 29 00-0225 EA 3/8" Rod Size, Malleable Iron Eye Socket	7.69	
26 05 29 00-0226 EA 1/2" Rod Size, Malleable Iron Eye Socket	9.22	
26 05 29 00-0227 EA 5/8" Rod Size, Malleable Iron Eye Socket	16.13	
26 05 29 00-0228 EA 3/4" Rod Size, Malleable Iron Eye Socket	23.05	
26 05 29 00-0229 EA 7/8" Rod Size, Malleable Iron Eye Socket	24.54	
26 05 29 00-0230 Hex Nuts (26 05 29 00-0199)		
26 05 29 00-0231 EA 3/8" Diameter, Zinc Plated Steel, Low Carbon/Grade 2 Hex Nut..... <i>For Galvanized, Add</i>	0.52 0.02	0.20
26 05 29 00-0232 EA 1/2" Diameter, Zinc Plated Steel, Low Carbon/Grade 2 Hex Nut..... <i>For Galvanized, Add</i>	0.64 0.04	0.20
26 05 29 00-0233 EA 5/8" Diameter, Zinc Plated Steel, Low Carbon/Grade 2 Hex Nut..... <i>For Galvanized, Add</i>	0.86 0.08	0.20
26 05 29 00-0234 EA 3/4" Diameter, Zinc Plated Steel, Low Carbon/Grade 2 Hex Nut..... <i>For Galvanized, Add</i>	1.00 0.11	0.40
26 05 29 00-0235 EA 7/8" Diameter, Zinc Plated Steel, Low Carbon/Grade 2 Hex Nut..... <i>For Galvanized, Add</i>	1.41 0.21	0.40
26 05 29 00-0236 EA 1" Diameter, Zinc Plated Steel, Low Carbon/Grade 2 Hex Nut..... <i>For Galvanized, Add</i>	1.79 0.28	0.40
26 05 29 00-0237 EA 1-1/8" Diameter, Zinc Plated Steel, Low Carbon/Grade 2 Hex Nut..... <i>For Galvanized, Add</i>	2.86 0.53	0.40
26 05 29 00-0238 Forged Steel Turnbuckles (26 05 29 00-0199) Note: Type 13.		
26 05 29 00-0239 EA 3/8" Thread Diameter, Forged Steel Turnbuckle Body	18.84	
26 05 29 00-0240 EA 1/2" Thread Diameter, Forged Steel Turnbuckle Body	23.30	
26 05 29 00-0241 EA 5/8" Thread Diameter, Forged Steel Turnbuckle Body	31.19	
26 05 29 00-0242 EA 3/4" Thread Diameter, Forged Steel Turnbuckle Body	38.60	
26 05 29 00-0243 EA 7/8" Thread Diameter, Forged Steel Turnbuckle Body	95.06	
26 05 29 00-0244 EA 1" Thread Diameter, Forged Steel Turnbuckle Body	63.25	
26 05 29 00-0245 EA 1-1/4" Thread Diameter, Forged Steel Turnbuckle Body	127.22	
26 05 29 00-0246 Attachments (26 05 29 00-0198)		
26 05 29 00-0247 Welded Beam Attachments (26 05 29 00-0246) Note: Type 22.		
26 05 29 00-0248 EA 3/8" Rod Size, Welded Beam Attachment	34.61	8.04
26 05 29 00-0249 EA 1/2" Rod Size, Welded Beam Attachment	36.90	8.45
26 05 29 00-0250 EA 5/8" Rod Size, Welded Beam Attachment	39.28	8.93
26 05 29 00-0251 EA 3/4" Rod Size, Welded Beam Attachment	49.94	9.49
26 05 29 00-0252 EA 7/8" Rod Size, Welded Beam Attachment	59.80	10.05
26 05 29 00-0253 EA 1" Rod Size, Welded Beam Attachment	83.57	11.51
26 05 29 00-0254 EA 1-1/8" Rod Size, Welded Beam Attachment	117.95	12.07
26 05 29 00-0255 C-Clamp Style Beam Clamps (26 05 29 00-0246) Note: Type 23. Top or bottom flange mount.		
26 05 29 00-0256 EA 3/8" Rod Size, C-Clamp Style Beam Clamp	12.34	6.04
26 05 29 00-0257 EA 1/2" Rod Size, C-Clamp Style Beam Clamp	14.66	6.45
26 05 29 00-0258 EA 5/8" Rod Size, C-Clamp Style Beam Clamp	16.61	6.91
26 05 29 00-0259 EA 3/4" Rod Size, C-Clamp Style Beam Clamp	21.25	7.44
26 05 29 00-0260 EA 7/8" Rod Size, C-Clamp Style Beam Clamp	30.61	8.05
26 05 29 00-0261 Bottom Mount I-Beam Clamps (26 05 29 00-0246) Note: Type 21. For attaching threaded rod centered under beam flanges.		
26 05 29 00-0262 EA 3/8" Rod Size, Up To 6" Flange Width, Bottom Mount I-Beam Clamp	33.31	8.05
26 05 29 00-0263 EA 1/2" Rod Size, Up To 6" Flange Width, Bottom Mount I-Beam Clamp	48.73	8.79
26 05 29 00-0264 EA 5/8" Rod Size, Up To 6" Flange Width, Bottom Mount I-Beam Clamp	69.39	9.67
26 05 29 00-0265 EA 3/4" Rod Size, Up To 6" Flange Width, Bottom Mount I-Beam Clamp	83.00	10.74
26 05 29 00-0266 EA 1" Rod Size, Up To 6" Flange Width, Bottom Mount I-Beam Clamp	199.88	12.09
26 05 29 00-0267 Steel U-Bolts (26 05 29 00-0246) Note: Type 24. Includes plate and nuts.		
26 05 29 00-0268 EA 1/2" Pipe Size, Zinc Plated Steel, U-Bolt	10.04	4.83
26 05 29 00-0269 EA 3/4" Pipe Size, Zinc Plated Steel, U-Bolt	10.89	5.09

26 Electrical**26 05 Common Work Results For Electrical****26 05 29 Hangers And Supports For Electrical Systems**

MINOR				TOTAL DIRECT	DEMOLITION
CSI	UOM	DESCRIPTION		UNIT COST	UNIT COST
26 05 29 00-0270	EA	1" Pipe Size, Zinc Plated Steel, U-Bolt.....		11.72	5.37
26 05 29 00-0271	EA	1-1/4" Pipe Size, Zinc Plated Steel, U-Bolt.....		13.29	5.68
26 05 29 00-0272	EA	1-1/2" Pipe Size, Zinc Plated Steel, U-Bolt.....		13.73	6.04
26 05 29 00-0273	EA	2" Pipe Size, Zinc Plated Steel, U-Bolt.....		14.69	6.45
26 05 29 00-0274	EA	2-1/2" Pipe Size, Zinc Plated Steel, U-Bolt.....		20.98	6.91
26 05 29 00-0275	EA	3" Pipe Size, Zinc Plated Steel, U-Bolt.....		23.12	7.44
26 05 29 00-0276	EA	4" Pipe Size, Zinc Plated Steel, U-Bolt.....		27.85	8.05
26 05 29 00-0277		Stainless Steel Threaded Rod <small>(26 05 29 00-0198)</small>			
26 05 29 00-0278	LF	1/4" Diameter, 304/18-8 Stainless Steel Threaded Rod.....		1.93	0.40
		<i>For 316 Stainless Steel, Add</i>		0.46	
26 05 29 00-0279	LF	5/16" Diameter, 304/18-8 Stainless Steel Threaded Rod.....		2.82	0.44
		<i>For 316 Stainless Steel, Add</i>		0.79	
26 05 29 00-0280	LF	3/8" Diameter, 304/18-8 Stainless Steel Threaded Rod.....		3.58	0.51
		<i>For 316 Stainless Steel, Add</i>		1.04	
26 05 29 00-0281	LF	7/16" Diameter, 304/18-8 Stainless Steel Threaded Rod.....		4.88	0.52
		<i>For 316 Stainless Steel, Add</i>		1.56	
26 05 29 00-0282	LF	1/2" Diameter, 304/18-8 Stainless Steel Threaded Rod.....		5.81	0.54
		<i>For 316 Stainless Steel, Add</i>		1.92	
26 05 29 00-0283	LF	5/8" Diameter, 304/18-8 Stainless Steel Threaded Rod.....		8.55	0.54
		<i>For 316 Stainless Steel, Add</i>		3.02	
26 05 29 00-0284	LF	3/4" Diameter, 304/18-8 Stainless Steel Threaded Rod.....		11.85	0.55
		<i>For 316 Stainless Steel, Add</i>		4.35	
26 05 29 00-0285	LF	7/8" Diameter, 304/18-8 Stainless Steel Threaded Rod.....		16.19	0.57
		<i>For 316 Stainless Steel, Add</i>		6.10	
26 05 29 00-0286	LF	1" Diameter, 304/18-8 Stainless Steel Threaded Rod.....		20.78	0.67
		<i>For 316 Stainless Steel, Add</i>		7.87	
26 05 29 00-0287	LF	1-1/4" Diameter, 304/18-8 Stainless Steel Threaded Rod.....		43.63	0.80
		<i>For 316 Stainless Steel, Add</i>		16.99	
26 05 29 00-0288		Polyvinyl Chloride (PVC) Coated Supports <small>(26 05 29)</small>			
		Note: Includes stainless steel and/or Polyvinyl Chloride (PVC) coated hardware.			
26 05 29 00-0289		Attachments <small>(26 05 29 00-0288)</small>			
26 05 29 00-0290		Polyvinyl Chloride (PVC) Coated Pipe Straps <small>(26 05 29 00-0289)</small>			
		Note: Includes stainless steel nuts and bolts.			
26 05 29 00-0291	EA	1/2" Polyvinyl Chloride (PVC) Coated Pipe Strap.....		14.85	5.31
26 05 29 00-0292	EA	3/4" Polyvinyl Chloride (PVC) Coated Pipe Strap.....		15.66	5.79
26 05 29 00-0293	EA	1" Polyvinyl Chloride (PVC) Coated Pipe Strap.....		17.05	6.27
26 05 29 00-0294	EA	1-1/4" Polyvinyl Chloride (PVC) Coated Pipe Strap.....		19.25	7.24
26 05 29 00-0295	EA	1-1/2" Polyvinyl Chloride (PVC) Coated Pipe Strap.....		22.00	8.21
26 05 29 00-0296	EA	2" Polyvinyl Chloride (PVC) Coated Pipe Strap.....		24.35	8.69
26 05 29 00-0297	EA	2-1/2" Polyvinyl Chloride (PVC) Coated Pipe Strap.....		26.94	9.65
26 05 29 00-0298	EA	3" Polyvinyl Chloride (PVC) Coated Pipe Strap.....		31.82	10.61
26 05 29 00-0299	EA	3-1/2" Polyvinyl Chloride (PVC) Coated Pipe Strap.....		34.67	11.10
26 05 29 00-0300	EA	4" Polyvinyl Chloride (PVC) Coated Pipe Strap.....		36.53	12.07
26 05 29 00-0301	EA	5" Polyvinyl Chloride (PVC) Coated Pipe Strap.....		39.18	13.51
26 05 29 00-0302		Polymer Concrete Pads <small>(26 05 29)</small>			
		Note: Excludes excavation and backfill.			
26 05 29 00-0303		Polymer Concrete, Box Pads <small>(26 05 29 00-0302)</small>			
26 05 29 00-0304	EA	24" x 36", 18" Depth, Polymer Concrete, Box Pad.....		746.26	93.78
26 05 29 00-0305	EA	25" x 25", 24" Depth, Polymer Concrete, Box Pad.....		769.35	93.78
26 05 29 00-0306	EA	40" x 44", 15" Depth, Polymer Concrete, Box Pad.....		981.49	93.78
26 05 29 00-0307	EA	40" x 44", 24" Depth, Polymer Concrete, Box Pad.....		1,016.66	93.78
26 05 29 00-0308	EA	52" x 36", 18" Depth, Polymer Concrete, Box Pad.....		948.74	93.78
26 05 29 00-0309	EA	44" x 44", 32" Depth, Polymer Concrete, Box Pad.....		1,114.85	93.78
26 05 29 00-0310	EA	40" x 58", 24" Depth, Polymer Concrete, Box Pad.....		1,242.22	93.78
26 05 29 00-0311	EA	52" x 50", 18" Depth, Polymer Concrete, Box Pad.....		1,205.81	117.23
26 05 29 00-0312	EA	74" x 76", 36" Depth, Polymer Concrete, Box Pad.....		1,800.91	117.23
26 05 29 00-0313	EA	93" x 93", 36" Depth, Polymer Concrete, Box Pad.....		2,398.95	117.23
26 05 29 00-0314		Polymer Concrete, Telecommunications Equipment Pads <small>(26 05 29 00-0302)</small>			
26 05 29 00-0315	EA	42" x 42", 3" Thick, Polymer Concrete, Telecommunications Equipment Pad.....		370.75	54.79
26 05 29 00-0316	EA	48" x 46", 3" Thick, Polymer Concrete, Telecommunications Equipment Pad.....		433.82	54.79
26 05 29 00-0317	EA	60" x 42", 3" Thick, Polymer Concrete, Telecommunications Equipment Pad.....		554.11	70.34
26 05 29 00-0318	EA	54" x 48", 4" Thick, Polymer Concrete, Telecommunications Equipment Pad.....		577.55	70.34
26 05 29 00-0319	EA	57" x 60", 4" Thick, Polymer Concrete, Telecommunications Equipment Pad.....		816.15	70.34
26 05 29 00-0320	EA	72" x 60", 4" Thick, Polymer Concrete, Telecommunications Equipment Pad.....		849.31	70.34
26 05 29 00-0321	EA	64" x 72", 4" Thick, Polymer Concrete, Telecommunications Equipment Pad.....		911.10	70.34
26 05 29 00-0322	EA	72" x 64", 4" Thick, Polymer Concrete, Telecommunications Equipment Pad.....		911.10	70.34
26 05 29 00-0323	EA	76" x 84", 4" Thick, Polymer Concrete, Telecommunications Equipment Pad.....		1,687.38	70.34
26 05 29 00-0324	EA	96" x 84", 4" Thick, Polymer Concrete, Telecommunications Equipment Pad.....		1,908.89	70.34
26 05 29 00-0325		Polymer Concrete, Electrical Equipment Pads <small>(26 05 29 00-0302)</small>			



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 29 00-0326 EA 24" x 25", 2" Thick, Polymer Concrete, Electrical Equipment Pad	237.18	54.79
26 05 29 00-0327 EA 24" x 36", 2" Thick, Polymer Concrete, Electrical Equipment Pad	253.40	54.79
26 05 29 00-0328 EA 24" x 44", 2" Thick, Polymer Concrete, Electrical Equipment Pad	268.17	54.79
26 05 29 00-0329 EA 24" x 58", 2" Thick, Polymer Concrete, Electrical Equipment Pad	317.22	54.79
26 05 29 00-0330 EA 40" x 40", 3" Thick, Polymer Concrete, Electrical Equipment Pad	295.33	54.79
26 05 29 00-0331 EA 42" x 42", 3" Thick, Polymer Concrete, Electrical Equipment Pad	305.64	54.79
26 05 29 00-0332 EA 48" x 42", 4" Thick, Polymer Concrete, Electrical Equipment Pad	332.39	54.79
26 05 29 00-0333 EA 48" x 46", 3" Thick, Polymer Concrete, Electrical Equipment Pad	347.99	54.79
26 05 29 00-0334 EA 54" x 48", 4" Thick, Polymer Concrete, Electrical Equipment Pad	400.09	54.79
26 05 29 00-0335 EA 56" x 44", 3" Thick, Polymer Concrete, Electrical Equipment Pad	485.91	54.79
26 05 29 00-0336 EA 64" x 64", 4" Thick, Polymer Concrete, Electrical Equipment Pad	701.20	70.34
26 05 29 00-0337 EA 66" x 72", 4" Thick, Polymer Concrete, Electrical Equipment Pad	732.57	70.34
26 05 29 00-0338 EA 75" x 52", 4" Thick, Polymer Concrete, Electrical Equipment Pad	742.46	70.34
26 05 29 00-0339 EA 90" x 48", 4" Thick, Polymer Concrete, Electrical Equipment Pad	808.40	70.34
26 05 29 00-0340 EA 84" x 96", 4" Thick, Polymer Concrete, Electrical Equipment Pad	1,690.36	70.34
26 05 29 00-0341 EA 96" x 80", 4" Thick, Polymer Concrete, Electrical Equipment Pad	1,985.78	70.34

26 05 33 Raceway And Boxes For Electrical Systems (26 05 33)

26 05 33 13 Conduit For Electrical Systems (26 05 33 13)

26 05 33 13-0001 Conduit Assemblies (26 05 33 13)
 Note: With fittings and wire.

26 05 33 13-0002 Electrical Metallic Tubing (EMT) Conduit Assemblies (26 05 33 13-0001)

CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 13-0003 CLF 1/2" Electrical Metallic Tubing (EMT) With 3 #12 THHN/THWN Assembly..... Note: Includes conduit, set screw connectors, set screw couplings, straps, wire as indicated. Not for use where detail is available.	521.87	241.99
26 05 33 13-0004 CLF 1/2" Electrical Metallic Tubing (EMT) With 4 #12 THHN/THWN Assembly..... Note: Includes conduit, set screw connectors, set screw couplings, straps, wire as indicated. Not for use where detail is available.	571.39	264.42
26 05 33 13-0005 CLF 1/2" Electrical Metallic Tubing (EMT) With 3 #10 THHN/THWN Assembly..... Note: Includes conduit, set screw connectors, set screw couplings, straps, wire as indicated. Not for use where detail is available.	552.18	253.10
26 05 33 13-0006 CLF 1/2" Electrical Metallic Tubing (EMT) With 4 #10 THHN/THWN Assembly..... Note: Includes conduit, set screw connectors, set screw couplings, straps, wire as indicated. Not for use where detail is available.	612.46	279.49
26 05 33 13-0007 CLF 3/4" Electrical Metallic Tubing (EMT) With 3 #12 THHN/THWN Assembly..... Note: Includes conduit, set screw connectors, set screw couplings, straps, wire as indicated. Not for use where detail is available.	599.95	275.89
26 05 33 13-0008 CLF 3/4" Electrical Metallic Tubing (EMT) With 4 #12 THHN/THWN Assembly..... Note: Includes conduit, set screw connectors, set screw couplings, straps, wire as indicated. Not for use where detail is available.	650.19	298.47
26 05 33 13-0009 CLF 3/4" Electrical Metallic Tubing (EMT) With 5 #12 THHN/THWN Assembly..... Note: Includes conduit, set screw connectors, set screw couplings, straps, wire as indicated. Not for use where detail is available.	699.62	320.82
26 05 33 13-0010 CLF 3/4" Electrical Metallic Tubing (EMT) With 6 #12 THHN/THWN Assembly..... Note: Includes conduit, set screw connectors, set screw couplings, straps, wire as indicated. Not for use where detail is available.	749.34	343.32
26 05 33 13-0011 CLF 3/4" Electrical Metallic Tubing (EMT) With 3 #10 THHN/THWN Assembly..... Note: Includes conduit, set screw connectors, set screw couplings, straps, wire as indicated. Not for use where detail is available.	630.64	286.99
26 05 33 13-0012 CLF 3/4" Electrical Metallic Tubing (EMT) With 4 #10 THHN/THWN Assembly..... Note: Includes conduit, set screw connectors, set screw couplings, straps, wire as indicated. Not for use where detail is available.	690.53	313.25
26 05 33 13-0013 CLF 3/4" Electrical Metallic Tubing (EMT) With 5 #10 THHN/THWN Assembly..... Note: Includes conduit, set screw connectors, set screw couplings, straps, wire as indicated. Not for use where detail is available.	750.05	339.28
26 05 33 13-0014 CLF 3/4" Electrical Metallic Tubing (EMT) With 6 #10 THHN/THWN Assembly..... Note: Includes conduit, set screw connectors, set screw couplings, straps, wire as indicated. Not for use where detail is available.	809.56	365.31
26 05 33 13-0015 CLF 1" Electrical Metallic Tubing (EMT) With 3 #12 THHN/THWN Assembly..... Note: Includes conduit, set screw connectors, set screw couplings, straps, wire as indicated. Not for use where detail is available.	735.05	332.66
26 05 33 13-0016 CLF 1" Electrical Metallic Tubing (EMT) With 4 #12 THHN/THWN Assembly..... Note: Includes conduit, set screw connectors, set screw couplings, straps, wire as indicated. Not for use where detail is available.	783.85	354.72
26 05 33 13-0017 CLF 1" Electrical Metallic Tubing (EMT) With 5 #12 THHN/THWN Assembly..... Note: Includes conduit, set screw connectors, set screw couplings, straps, wire as indicated. Not for use where detail is available.	829.17	377.22
26 05 33 13-0018 CLF 1" Electrical Metallic Tubing (EMT) With 6 #12 THHN/THWN Assembly..... Note: Includes conduit, set screw connectors, set screw couplings, straps, wire as indicated. Not for use where detail is available.	882.55	399.72
26 05 33 13-0019 CLF 1" Electrical Metallic Tubing (EMT) With 3 #10 THHN/THWN Assembly..... Note: Includes conduit, set screw connectors, set screw couplings, straps, wire as indicated. Not for use where detail is available.	764.54	343.32
26 05 33 13-0020 CLF 1" Electrical Metallic Tubing (EMT) With 4 #10 THHN/THWN Assembly..... Note: Includes conduit, set screw connectors, set screw couplings, straps, wire as indicated. Not for use where detail is available.	823.76	369.28
26 05 33 13-0021 CLF 1" Electrical Metallic Tubing (EMT) With 5 #10 THHN/THWN Assembly..... Note: Includes conduit, set screw connectors, set screw couplings, straps, wire as indicated. Not for use where detail is available.	884.06	395.75

26 Electrical**26 05 Common Work Results For Electrical****26 05 33 Raceway And Boxes For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33	13-0022	CLF	1" Electrical Metallic Tubing (EMT) With 6 #10 THHN/THWN Assembly..... Note: Includes conduit, set screw connectors, set screw couplings, straps, wire as indicated. Not for use where detail is available.	944.89	421.56
26 05 33	13-0023		Rigid Galvanized Steel (RGS) Conduit Assemblies (26 05 33 13-0001) Note: Includes conduit, terminations, straps, and wire as indicated. Per CLF.		
26 05 33	13-0024	CLF	1/2" Rigid Galvanized Steel (RGS) With 3 #12 THHN/THWN Wire Assembly..... Note: Includes conduit, terminations, straps, wire as indicated. Not for use where detail is available.	614.85	270.23
26 05 33	13-0025	CLF	1/2" Rigid Galvanized Steel (RGS) With 4 #12 THHN/THWN Wire Assembly..... Note: Includes conduit, terminations, straps, wire as indicated. Not for use where detail is available.	664.82	292.88
26 05 33	13-0026	CLF	1/2" Rigid Galvanized Steel (RGS) With 3 #10 THHN/THWN Wire Assembly..... Note: Includes conduit, terminations, straps, wire as indicated. Not for use where detail is available.	645.19	281.33
26 05 33	13-0027	CLF	1/2" Rigid Galvanized Steel (RGS) With 4 #10 THHN/THWN Wire Assembly..... Note: Includes conduit, terminations, straps, wire as indicated. Not for use where detail is available.	704.04	307.07
26 05 33	13-0028	CLF	3/4" Rigid Galvanized Steel (RGS) With 3 #12 THHN/THWN Wire Assembly..... Note: Includes conduit, terminations, straps, wire as indicated. Not for use where detail is available.	700.35	305.97
26 05 33	13-0029	CLF	3/4" Rigid Galvanized Steel (RGS) With 4 #12 THHN/THWN Wire Assembly..... Note: Includes conduit, terminations, straps, wire as indicated. Not for use where detail is available.	868.41	387.66
26 05 33	13-0030	CLF	3/4" Rigid Galvanized Steel (RGS) With 5 #12 THHN/THWN Wire Assembly..... Note: Includes conduit, terminations, straps, wire as indicated. Not for use where detail is available.	798.61	350.38
26 05 33	13-0031	CLF	3/4" Rigid Galvanized Steel (RGS) With 3 #10 THHN/THWN Wire Assembly..... Note: Includes conduit, terminations, straps, wire as indicated. Not for use where detail is available.	729.99	316.92
26 05 33	13-0032	CLF	3/4" Rigid Galvanized Steel (RGS) With 4 #10 THHN/THWN Wire Assembly..... Note: Includes conduit, terminations, straps, wire as indicated. Not for use where detail is available.	789.34	343.03
26 05 33	13-0033	CLF	3/4" Rigid Galvanized Steel (RGS) With 5 #10 THHN/THWN Wire Assembly..... Note: Includes conduit, terminations, straps, wire as indicated. Not for use where detail is available.	849.95	369.06
26 05 33	13-0034	CLF	1" Rigid Galvanized Steel (RGS) With 4 #12 THHN/THWN Wire Assembly..... Note: Includes conduit, terminations, straps, wire as indicated. Not for use where detail is available.	891.82	383.10
26 05 33	13-0035	CLF	1" Rigid Galvanized Steel (RGS) With 5 #12 THHN/THWN Wire Assembly..... Note: Includes conduit, terminations, straps, wire as indicated. Not for use where detail is available.	940.01	405.52
26 05 33	13-0036	CLF	1" Rigid Galvanized Steel (RGS) With 6 #12 THHN/THWN Wire Assembly..... Note: Includes conduit, terminations, straps, wire as indicated. Not for use where detail is available.	991.31	427.88
26 05 33	13-0037	CLF	1" Rigid Galvanized Steel (RGS) With 4 #10 THHN/THWN Wire Assembly..... Note: Includes conduit, terminations, straps, wire as indicated. Not for use where detail is available.	931.15	397.80
26 05 33	13-0038	CLF	1" Rigid Galvanized Steel (RGS) With 5 #10 THHN/THWN Wire Assembly..... Note: Includes conduit, terminations, straps, wire as indicated. Not for use where detail is available.	991.71	423.83
26 05 33	13-0039	CLF	1" Rigid Galvanized Steel (RGS) With 6 #10 THHN/THWN Wire Assembly..... Note: Includes conduit, terminations, straps, wire as indicated. Not for use where detail is available.	1,050.32	449.94
26 05 33	13-0040		Conduit (26 05 33 13) Note: Includes warning tape for underground conduits. Where 4-1/2" conduit is required, use tasks for 5" conduit. Add couplings as required at each fitting.		
26 05 33	13-0041		Conduit Installed Above Grade (26 05 33 13-0040)		
26 05 33	13-0042		Rigid Galvanized Steel (RGS) Conduit (26 05 33 13-0041) Note: Exposed installation, branch and feeder conduit. Excludes supporting strap, hanger and fastening.		
26 05 33	13-0043		Rigid Galvanized Steel (RGS) Conduit With Threaded Coupling (26 05 33 13-0042) Note: Includes field bending for conduit up to 1".		
26 05 33	13-0044	LF	1/2" Rigid Galvanized Steel (RGS) Conduit With Threaded Coupling <i>For Installation In Metal Stud Wall, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For >1,000, Deduct</i> <i>For Installation In Concrete Beam, Slab, Etc. (Excludes Concrete), Add</i> <i>For >500 To 1,000, Deduct</i> <i>For Installation In Wood Stud Wall (Includes Drilling), Add</i> <i>For Installation Above 14', Add</i> <i>For >250 To 500, Deduct</i>	5.22 0.40 1.21 -0.42 0.61 -0.29 1.01 0.61 -0.06	1.61
26 05 33	13-0045	LF	3/4" Rigid Galvanized Steel (RGS) Conduit With Threaded Coupling <i>For Installation In Metal Stud Wall, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For >1,000, Deduct</i> <i>For Installation In Concrete Beam, Slab, Etc. (Excludes Concrete), Add</i> <i>For >500 To 1,000, Deduct</i> <i>For Installation In Wood Stud Wall (Includes Drilling), Add</i> <i>For Installation Above 14', Add</i> <i>For >250 To 500, Deduct</i>	5.86 0.44 1.32 -0.48 0.66 -0.33 1.10 0.66 -0.07	1.76
26 05 33	13-0046	LF	1" Rigid Galvanized Steel (RGS) Conduit With Threaded Coupling <i>For Installation In Metal Stud Wall, Add</i> <i>For Work In Restricted Working Space, Add</i> <i>For >1,000, Deduct</i> <i>For Installation In Concrete Beam, Slab, Etc. (Excludes Concrete), Add</i> <i>For >500 To 1,000, Deduct</i> <i>For Installation In Wood Stud Wall (Includes Drilling), Add</i> <i>For Installation Above 14', Add</i> <i>For >250 To 500, Deduct</i>	7.39 0.51 1.54 -0.61 0.77 -0.43 1.29 0.77 -0.11	2.06



MINOR	TOTAL DIRECT	DEMOLITION
CSI UOM DESCRIPTION	UNIT COST	UNIT COST
26 05 33 13-0047 LF 1-1/4" Rigid Galvanized Steel (RGS) Conduit With Threaded Coupling	8.88	2.36
For Installation In Metal Stud Wall, Add	0.59	
For Work In Restricted Working Space, Add	1.77	
For >1,000, Deduct	-0.74	
For Installation In Concrete Beam, Slab, Etc. (Excludes Concrete), Add	0.88	
For >500 To 1,000, Deduct	-0.52	
For Installation In Wood Stud Wall (Includes Drilling), Add	1.47	
For Installation Above 14', Add	0.88	
For >250 To 500, Deduct	-0.15	
26 05 33 13-0048 LF 1-1/2" Rigid Galvanized Steel (RGS) Conduit With Threaded Coupling	10.29	2.65
For Installation In Metal Stud Wall, Add	0.66	
For Work In Restricted Working Space, Add	1.99	
For >1,000, Deduct	-0.86	
For Installation In Concrete Beam, Slab, Etc. (Excludes Concrete), Add	0.99	
For >500 To 1,000, Deduct	-0.61	
For Installation In Wood Stud Wall (Includes Drilling), Add	1.66	
For Installation Above 14', Add	0.99	
For >250 To 500, Deduct	-0.18	
26 05 33 13-0049 LF 2" Rigid Galvanized Steel (RGS) Conduit With Threaded Coupling	12.99	3.24
For Installation In Metal Stud Wall, Add	0.81	
For Work In Restricted Working Space, Add	2.43	
For >1,000, Deduct	-1.10	
For Installation In Concrete Beam, Slab, Etc. (Excludes Concrete), Add	1.21	
For >500 To 1,000, Deduct	-0.77	
For Installation In Wood Stud Wall (Includes Drilling), Add	2.02	
For Installation Above 14', Add	1.21	
For >250 To 500, Deduct	-0.25	
26 05 33 13-0050 LF 2-1/2" Rigid Galvanized Steel (RGS) Conduit With Threaded Coupling	19.16	4.41
For Installation In Metal Stud Wall, Add	1.10	
For Work In Restricted Working Space, Add	3.31	
For >1,000, Deduct	-1.64	
For Installation In Concrete Beam, Slab, Etc. (Excludes Concrete), Add	1.65	
For >500 To 1,000, Deduct	-1.16	
For Installation In Wood Stud Wall (Includes Drilling), Add	2.76	
For Installation Above 14', Add	1.65	
For >250 To 500, Deduct	-0.41	
26 05 33 13-0051 LF 3" Rigid Galvanized Steel (RGS) Conduit With Threaded Coupling	25.05	5.89
For Installation In Metal Stud Wall, Add	1.47	
For Work In Restricted Working Space, Add	4.41	
For >1,000, Deduct	-2.14	
For Installation In Concrete Beam, Slab, Etc. (Excludes Concrete), Add	2.21	
For >500 To 1,000, Deduct	-1.51	
For Installation In Wood Stud Wall (Includes Drilling), Add	3.68	
For Installation Above 14', Add	2.21	
For >250 To 500, Deduct	-0.52	
26 05 33 13-0052 LF 3-1/2" Rigid Galvanized Steel (RGS) Conduit With Threaded Coupling	31.00	7.35
For Installation In Metal Stud Wall, Add	1.84	
For Work In Restricted Working Space, Add	5.51	
For >1,000, Deduct	-2.64	
For Installation In Concrete Beam, Slab, Etc. (Excludes Concrete), Add	2.76	
For >500 To 1,000, Deduct	-1.87	
For Installation In Wood Stud Wall (Includes Drilling), Add	4.60	
For Installation Above 14', Add	2.76	
For >250 To 500, Deduct	-0.63	
26 05 33 13-0053 LF 4" Rigid Galvanized Steel (RGS) Conduit With Threaded Coupling	36.74	8.82
For Installation In Metal Stud Wall, Add	2.21	
For Work In Restricted Working Space, Add	6.62	
For >1,000, Deduct	-3.12	
For Installation In Concrete Beam, Slab, Etc. (Excludes Concrete), Add	3.31	
For >500 To 1,000, Deduct	-2.20	
For Installation In Wood Stud Wall (Includes Drilling), Add	5.52	
For Installation Above 14', Add	3.31	
For >250 To 500, Deduct	-0.73	
26 05 33 13-0054 Rigid Galvanized Steel (RGS) 90 Degree Standard Radius Elbow <small>(26 05 33 13-0042)</small>		
See CSI section 26 05 33 13-1066 for conduit field bending.		
26 05 33 13-0055 EA 1/2" Rigid Galvanized Steel (RGS) 90 Degree Standard Radius Elbow	22.16	7.28
For Work In Restricted Working Space, Add	5.48	
For Installation Above 14', Add	2.74	
26 05 33 13-0056 EA 3/4" Rigid Galvanized Steel (RGS) 90 Degree Standard Radius Elbow	27.85	9.04
For Work In Restricted Working Space, Add	6.81	
For Installation Above 14', Add	3.41	
26 05 33 13-0057 EA 1" Rigid Galvanized Steel (RGS) 90 Degree Standard Radius Elbow	35.60	11.10
For Work In Restricted Working Space, Add	8.30	
For Installation Above 14', Add	4.15	
26 05 33 13-0058 EA 1-1/4" Rigid Galvanized Steel (RGS) 90 Degree Standard Radius Elbow	45.70	12.86
For Work In Restricted Working Space, Add	9.65	
For Installation Above 14', Add	4.82	
26 05 33 13-0059 EA 1-1/2" Rigid Galvanized Steel (RGS) 90 Degree Standard Radius Elbow	53.05	14.78
For Work In Restricted Working Space, Add	11.07	
For Installation Above 14', Add	5.53	
26 05 33 13-0060 EA 2" Rigid Galvanized Steel (RGS) 90 Degree Standard Radius Elbow	62.79	16.25
For Work In Restricted Working Space, Add	12.17	
For Installation Above 14', Add	6.09	

26 Electrical**26 05 Common Work Results For Electrical****26 05 33 Raceway And Boxes For Electrical Systems**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 13-0061 EA 2-1/2" Rigid Galvanized Steel (RGS) 90 Degree Standard Radius Elbow <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	90.31 15.22 7.61	20.29
26 05 33 13-0062 EA 3" Rigid Galvanized Steel (RGS) 90 Degree Standard Radius Elbow <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	128.04 20.73 10.37	27.64
26 05 33 13-0063 EA 3-1/2" Rigid Galvanized Steel (RGS) 90 Degree Standard Radius Elbow <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	170.09 23.39 11.69	31.17
26 05 33 13-0064 EA 4" Rigid Galvanized Steel (RGS) 90 Degree Standard Radius Elbow <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	207.62 30.44 15.22	40.59
26 05 33 13-0065 Rigid Galvanized Steel (RGS) 45 Degree Standard Radius Elbow <small>(26 05 33 13-0042)</small> See CSI section 26 05 33 13-1066 for conduit field bending.		
26 05 33 13-0066 EA 1/2" Rigid Galvanized Steel (RGS) 45 Degree Standard Radius Elbow <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	22.16 5.48 2.74	7.28
26 05 33 13-0067 EA 3/4" Rigid Galvanized Steel (RGS) 45 Degree Standard Radius Elbow <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	27.85 6.81 3.41	9.04
26 05 33 13-0068 EA 1" Rigid Galvanized Steel (RGS) 45 Degree Standard Radius Elbow <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	35.60 8.30 4.15	11.10
26 05 33 13-0069 EA 1-1/4" Rigid Galvanized Steel (RGS) 45 Degree Standard Radius Elbow <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	45.70 9.65 4.82	12.86
26 05 33 13-0070 EA 1-1/2" Rigid Galvanized Steel (RGS) 45 Degree Standard Radius Elbow <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	53.05 11.07 5.53	14.78
26 05 33 13-0071 EA 2" Rigid Galvanized Steel (RGS) 45 Degree Standard Radius Elbow <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	62.79 12.17 6.09	16.25
26 05 33 13-0072 EA 2-1/2" Rigid Galvanized Steel (RGS) 45 Degree Standard Radius Elbow <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	88.70 15.22 7.61	20.29
26 05 33 13-0073 EA 3" Rigid Galvanized Steel (RGS) 45 Degree Standard Radius Elbow <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	121.78 20.73 10.37	27.64
26 05 33 13-0074 EA 3-1/2" Rigid Galvanized Steel (RGS) 45 Degree Standard Radius Elbow <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	161.28 23.39 11.69	31.17
26 05 33 13-0075 EA 4" Rigid Galvanized Steel (RGS) 45 Degree Standard Radius Elbow <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	195.91 30.44 15.22	40.59
26 05 33 13-0076 EA 5" Rigid Galvanized Steel (RGS) 45 Degree Standard Radius Elbow <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	339.66 49.64 24.82	66.18
26 05 33 13-0077 EA 6" Rigid Galvanized Steel (RGS) 45 Degree Standard Radius Elbow <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	510.64 74.56 37.28	99.41
26 05 33 13-0078 Rigid Galvanized Steel (RGS) 12" Large Radius Elbow <small>(26 05 33 13-0042)</small> See CSI section 26 05 33 13-1066 for conduit field bending.		
26 05 33 13-0079 EA 1" Rigid Galvanized Steel (RGS) 12" Large Radius Elbow <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	55.20 10.90 5.45	18.16
26 05 33 13-0080 EA 1-1/4" Rigid Galvanized Steel (RGS) 12" Large Radius Elbow <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	63.59 12.62 6.31	21.03
26 05 33 13-0081 EA 1-1/2" Rigid Galvanized Steel (RGS) 12" Large Radius Elbow <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	73.60 14.34 7.17	23.89
26 05 33 13-0082 EA 2" Rigid Galvanized Steel (RGS) 12" Large Radius Elbow <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	82.97 15.77 7.89	26.29
26 05 33 13-0083 Rigid Galvanized Steel (RGS) 15" Large Radius Elbow <small>(26 05 33 13-0042)</small> See CSI section 26 05 33 13-1066 for conduit field bending.		
26 05 33 13-0084 EA 1" Rigid Galvanized Steel (RGS) 15" Large Radius Elbow <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	60.09 10.90 5.45	18.16
26 05 33 13-0085 EA 1-1/4" Rigid Galvanized Steel (RGS) 15" Large Radius Elbow <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	69.88 12.62 6.31	21.03
26 05 33 13-0086 EA 1-1/2" Rigid Galvanized Steel (RGS) 15" Large Radius Elbow <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	76.46 14.34 7.17	23.89
26 05 33 13-0087 EA 2" Rigid Galvanized Steel (RGS) 15" Large Radius Elbow <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	86.18 15.77 7.89	26.29



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 13-0088 EA 2-1/2" Rigid Galvanized Steel (RGS) 15" Large Radius Elbow..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	114.71 19.79 9.89	32.98
26 05 33 13-0089 EA 3" Rigid Galvanized Steel (RGS) 15" Large Radius Elbow..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	154.34 26.96 13.48	44.93
26 05 33 13-0090 Rigid Galvanized Steel (RGS) 18" Large Radius Elbow <small>(26 05 33 13-0042)</small> See CSI section 26 05 33 13-1066 for conduit field bending.		
26 05 33 13-0091 EA 1" Rigid Galvanized Steel (RGS) 18" Large Radius Elbow..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	60.32 10.90 5.45	18.16
26 05 33 13-0092 EA 1-1/4" Rigid Galvanized Steel (RGS) 18" Large Radius Elbow..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	69.26 12.62 6.31	21.03
26 05 33 13-0093 EA 1-1/2" Rigid Galvanized Steel (RGS) 18" Large Radius Elbow..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	79.56 14.34 7.17	23.89
26 05 33 13-0094 EA 2" Rigid Galvanized Steel (RGS) 18" Large Radius Elbow..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	93.11 15.77 7.89	26.29
26 05 33 13-0095 EA 2-1/2" Rigid Galvanized Steel (RGS) 18" Large Radius Elbow..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	121.16 19.79 9.89	32.98
26 05 33 13-0096 EA 3" Rigid Galvanized Steel (RGS) 18" Large Radius Elbow..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	159.55 26.96 13.48	44.93
26 05 33 13-0097 EA 3-1/2" Rigid Galvanized Steel (RGS) 18" Large Radius Elbow..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	199.84 30.40 15.20	50.66
26 05 33 13-0098 EA 4" Rigid Galvanized Steel (RGS) 18" Large Radius Elbow..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	241.99 39.58 19.79	65.95
26 05 33 13-0099 Rigid Galvanized Steel (RGS) 24" Large Radius Elbow <small>(26 05 33 13-0042)</small> See CSI section 26 05 33 13-1066 for conduit field bending.		
26 05 33 13-0100 EA 1" Rigid Galvanized Steel (RGS) 24" Large Radius Elbow..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	68.12 10.90 5.45	18.16
26 05 33 13-0101 EA 1-1/4" Rigid Galvanized Steel (RGS) 24" Large Radius Elbow..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	76.92 12.62 6.31	21.03
26 05 33 13-0102 EA 1-1/2" Rigid Galvanized Steel (RGS) 24" Large Radius Elbow..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	85.29 14.34 7.17	23.89
26 05 33 13-0103 EA 2" Rigid Galvanized Steel (RGS) 24" Large Radius Elbow..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	101.56 15.77 7.89	26.29
26 05 33 13-0104 EA 2-1/2" Rigid Galvanized Steel (RGS) 24" Large Radius Elbow..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	132.69 19.79 9.89	32.98
26 05 33 13-0105 EA 3" Rigid Galvanized Steel (RGS) 24" Large Radius Elbow..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	177.62 26.96 13.48	44.93
26 05 33 13-0106 EA 3-1/2" Rigid Galvanized Steel (RGS) 24" Large Radius Elbow..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	217.41 30.40 15.20	50.66
26 05 33 13-0107 EA 4" Rigid Galvanized Steel (RGS) 24" Large Radius Elbow..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	256.00 39.58 19.79	65.95
26 05 33 13-0108 Rigid Galvanized Steel (RGS) 30" Large Radius Elbow <small>(26 05 33 13-0042)</small> See CSI section 26 05 33 13-1066 for conduit field bending.		
26 05 33 13-0109 EA 1" Rigid Galvanized Steel (RGS) 30" Large Radius Elbow..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	67.65 10.90 5.45	18.16
26 05 33 13-0110 EA 1-1/4" Rigid Galvanized Steel (RGS) 30" Large Radius Elbow..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	82.61 12.62 6.31	21.03
26 05 33 13-0111 EA 1-1/2" Rigid Galvanized Steel (RGS) 30" Large Radius Elbow..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	91.45 14.34 7.17	23.89
26 05 33 13-0112 EA 2" Rigid Galvanized Steel (RGS) 30" Large Radius Elbow..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	109.61 15.77 7.89	26.29
26 05 33 13-0113 EA 2-1/2" Rigid Galvanized Steel (RGS) 30" Large Radius Elbow..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	143.75 19.79 9.89	32.98
26 05 33 13-0114 EA 3" Rigid Galvanized Steel (RGS) 30" Large Radius Elbow..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	191.89 26.96 13.48	44.93

26 Electrical**26 05 Common Work Results For Electrical****26 05 33 Raceway And Boxes For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33	13-0115	EA	3-1/2" Rigid Galvanized Steel (RGS) 30" Large Radius Elbow <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	234.77 30.40 15.20	50.66
26 05 33	13-0116	EA	4" Rigid Galvanized Steel (RGS) 30" Large Radius Elbow <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	281.70 39.58 19.79	65.95
26 05 33	13-0117	EA	5" Rigid Galvanized Steel (RGS) 30" Large Radius Elbow <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	407.46 64.52 32.26	107.54
26 05 33	13-0118		Rigid Galvanized Steel (RGS) 36" Large Radius Elbow <small>(26 05 33 13-0042)</small> See CSI section 26 05 33 13-1066 for conduit field bending.		
26 05 33	13-0119	EA	1" Rigid Galvanized Steel (RGS) 36" Large Radius Elbow <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	71.82 10.90 5.45	18.16
26 05 33	13-0120	EA	1-1/4" Rigid Galvanized Steel (RGS) 36" Large Radius Elbow <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	85.41 12.62 6.31	21.03
26 05 33	13-0121	EA	1-1/2" Rigid Galvanized Steel (RGS) 36" Large Radius Elbow <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	102.25 14.34 7.17	23.89
26 05 33	13-0122	EA	2" Rigid Galvanized Steel (RGS) 36" Large Radius Elbow <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	115.90 15.77 7.89	26.29
26 05 33	13-0123	EA	2-1/2" Rigid Galvanized Steel (RGS) 36" Large Radius Elbow <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	156.86 19.79 9.89	32.98
26 05 33	13-0124	EA	3" Rigid Galvanized Steel (RGS) 36" Large Radius Elbow <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	204.09 26.96 13.48	44.93
26 05 33	13-0125	EA	3-1/2" Rigid Galvanized Steel (RGS) 36" Large Radius Elbow <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	257.20 30.40 15.20	50.66
26 05 33	13-0126	EA	4" Rigid Galvanized Steel (RGS) 36" Large Radius Elbow <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	293.79 39.58 19.79	65.95
26 05 33	13-0127	EA	5" Rigid Galvanized Steel (RGS) 36" Large Radius Elbow <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	506.12 64.52 32.26	107.54
26 05 33	13-0128	EA	6" Rigid Galvanized Steel (RGS) 36" Large Radius Elbow <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	642.85 96.93 48.47	161.55
26 05 33	13-0129		Rigid Galvanized Steel (RGS) 42" Large Radius Elbow <small>(26 05 33 13-0042)</small> See CSI section 26 05 33 13-1066 for conduit field bending.		
26 05 33	13-0130	EA	1" Rigid Galvanized Steel (RGS) 42" Large Radius Elbow <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	77.92 10.90 5.45	18.16
26 05 33	13-0131	EA	1-1/4" Rigid Galvanized Steel (RGS) 42" Large Radius Elbow <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	92.86 12.62 6.31	21.03
26 05 33	13-0132	EA	1-1/2" Rigid Galvanized Steel (RGS) 42" Large Radius Elbow <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	110.17 14.34 7.17	23.89
26 05 33	13-0133	EA	2" Rigid Galvanized Steel (RGS) 42" Large Radius Elbow <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	124.18 15.77 7.89	26.29
26 05 33	13-0134	EA	2-1/2" Rigid Galvanized Steel (RGS) 42" Large Radius Elbow <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	166.89 19.79 9.89	32.98
26 05 33	13-0135	EA	3" Rigid Galvanized Steel (RGS) 42" Large Radius Elbow <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	221.97 26.96 13.48	44.93
26 05 33	13-0136	EA	3-1/2" Rigid Galvanized Steel (RGS) 42" Large Radius Elbow <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	275.13 30.40 15.20	50.66
26 05 33	13-0137	EA	4" Rigid Galvanized Steel (RGS) 42" Large Radius Elbow <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	345.39 39.58 19.79	65.95
26 05 33	13-0138	EA	5" Rigid Galvanized Steel (RGS) 42" Large Radius Elbow <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	577.30 64.52 32.26	107.54
26 05 33	13-0139	EA	6" Rigid Galvanized Steel (RGS) 42" Large Radius Elbow <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	704.48 96.93 48.47	161.55
26 05 33	13-0140		Rigid Galvanized Steel (RGS) 48" Large Radius Elbow <small>(26 05 33 13-0042)</small> See CSI section 26 05 33 13-1066 for conduit field bending.		
26 05 33	13-0141	EA	1" Rigid Galvanized Steel (RGS) 48" Large Radius Elbow <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	83.00 10.90 5.45	18.16



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 13-0142 EA 1-1/4" Rigid Galvanized Steel (RGS) 48" Large Radius Elbow..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	98.61 12.62 6.31	21.03
26 05 33 13-0143 EA 1-1/2" Rigid Galvanized Steel (RGS) 48" Large Radius Elbow..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	115.18 14.34 7.17	23.89
26 05 33 13-0144 EA 2" Rigid Galvanized Steel (RGS) 48" Large Radius Elbow..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	139.66 15.77 7.89	26.29
26 05 33 13-0145 EA 2-1/2" Rigid Galvanized Steel (RGS) 48" Large Radius Elbow..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	185.39 19.79 9.89	32.98
26 05 33 13-0146 EA 3" Rigid Galvanized Steel (RGS) 48" Large Radius Elbow..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	239.99 26.96 13.48	44.93
26 05 33 13-0147 EA 3-1/2" Rigid Galvanized Steel (RGS) 48" Large Radius Elbow..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	297.67 30.40 15.20	50.66
26 05 33 13-0148 EA 4" Rigid Galvanized Steel (RGS) 48" Large Radius Elbow..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	372.77 39.58 19.79	65.95
26 05 33 13-0149 EA 5" Rigid Galvanized Steel (RGS) 48" Large Radius Elbow..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	599.58 64.52 32.26	107.54
26 05 33 13-0150 EA 6" Rigid Galvanized Steel (RGS) 48" Large Radius Elbow..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	716.95 96.93 48.47	161.55
26 05 33 13-0151 Rigid Galvanized Steel (RGS) Plastic Insulating Bushing <small>(26 05 33 13-0042)</small>		
26 05 33 13-0152 EA 1/2" Rigid Galvanized Steel (RGS) Plastic Insulating Bushing..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.64 2.81 1.41 2.81	4.69
26 05 33 13-0153 EA 3/4" Rigid Galvanized Steel (RGS) Plastic Insulating Bushing..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.36 3.00 1.50 3.00	5.00
26 05 33 13-0154 EA 1" Rigid Galvanized Steel (RGS) Plastic Insulating Bushing..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	11.80 3.38 1.69 3.38	5.62
26 05 33 13-0155 EA 1-1/4" Rigid Galvanized Steel (RGS) Plastic Insulating Bushing..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	13.30 3.75 1.88 3.75	6.25
26 05 33 13-0156 EA 1-1/2" Rigid Galvanized Steel (RGS) Plastic Insulating Bushing..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	16.71 4.69 2.34 4.69	7.81
26 05 33 13-0157 EA 2" Rigid Galvanized Steel (RGS) Plastic Insulating Bushing..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	20.77 5.63 2.81 5.63	9.37
26 05 33 13-0158 EA 2-1/2" Rigid Galvanized Steel (RGS) Plastic Insulating Bushing..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	26.35 6.56 3.28 6.56	10.94
26 05 33 13-0159 EA 3" Rigid Galvanized Steel (RGS) Plastic Insulating Bushing..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	29.71 7.50 3.75 7.50	12.50
26 05 33 13-0160 EA 3-1/2" Rigid Galvanized Steel (RGS) Plastic Insulating Bushing..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	34.67 8.44 4.22 8.44	11.76
26 05 33 13-0161 EA 4" Rigid Galvanized Steel (RGS) Plastic Insulating Bushing..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	38.46 9.38 4.69 9.38	15.62
26 05 33 13-0162 Rigid Galvanized Steel (RGS) Steel Insulated Grounding Bushing <small>(26 05 33 13-0042)</small>		
26 05 33 13-0163 EA 1/2" Rigid Galvanized Steel (RGS) Steel Insulated Grounding Bushing..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	19.25 3.97 1.99 3.97	6.62
26 05 33 13-0164 EA 3/4" Rigid Galvanized Steel (RGS) Steel Insulated Grounding Bushing..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	21.57 4.41 2.21 4.41	7.35
26 05 33 13-0165 EA 1" Rigid Galvanized Steel (RGS) Steel Insulated Grounding Bushing..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	24.73 4.85 2.43 4.85	8.09

26 Electrical**26 05 Common Work Results For Electrical****26 05 33 Raceway And Boxes For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33	13-0166	EA	1-1/4" Rigid Galvanized Steel (RGS) Steel Insulated Grounding Bushing.....	29.45	9.19
			<i>For Work In Restricted Working Space, Add</i>	5.51	
			<i>For Installation Above 14', Add</i>	2.76	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.51	
26 05 33	13-0167	EA	1-1/2" Rigid Galvanized Steel (RGS) Steel Insulated Grounding Bushing.....	35.57	11.40
			<i>For Work In Restricted Working Space, Add</i>	6.84	
			<i>For Installation Above 14', Add</i>	3.42	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	6.84	
26 05 33	13-0168	EA	2" Rigid Galvanized Steel (RGS) Steel Insulated Grounding Bushing.....	44.96	13.61
			<i>For Work In Restricted Working Space, Add</i>	8.16	
			<i>For Installation Above 14', Add</i>	4.08	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8.16	
26 05 33	13-0169	EA	2-1/2" Rigid Galvanized Steel (RGS) Steel Insulated Grounding Bushing.....	60.61	15.81
			<i>For Work In Restricted Working Space, Add</i>	9.48	
			<i>For Installation Above 14', Add</i>	4.74	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.48	
26 05 33	13-0170	EA	3" Rigid Galvanized Steel (RGS) Steel Insulated Grounding Bushing.....	66.69	18.38
			<i>For Work In Restricted Working Space, Add</i>	11.03	
			<i>For Installation Above 14', Add</i>	5.52	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	11.03	
26 05 33	13-0171	EA	3-1/2" Rigid Galvanized Steel (RGS) Steel Insulated Grounding Bushing.....	75.45	20.58
			<i>For Work In Restricted Working Space, Add</i>	12.35	
			<i>For Installation Above 14', Add</i>	6.18	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	12.35	
26 05 33	13-0172	EA	4" Rigid Galvanized Steel (RGS) Steel Insulated Grounding Bushing.....	98.04	22.79
			<i>For Work In Restricted Working Space, Add</i>	13.68	
			<i>For Installation Above 14', Add</i>	6.84	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	13.68	
26 05 33	13-0173		Rigid Galvanized Steel (RGS) Nipples <small>(26 05 33 13-0042)</small>		
26 05 33	13-0174	EA	1/2" x 2" Long Rigid Galvanized Steel (RGS) Nipple.....	10.62	4.78
			<i>For Work In Restricted Working Space, Add</i>	2.87	
			<i>For Installation Above 14', Add</i>	1.43	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2.87	
26 05 33	13-0175	EA	3/4" x 2" Long Rigid Galvanized Steel (RGS) Nipple.....	12.22	5.51
			<i>For Work In Restricted Working Space, Add</i>	3.31	
			<i>For Installation Above 14', Add</i>	1.65	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	3.31	
26 05 33	13-0176	EA	1" x 2" Long Rigid Galvanized Steel (RGS) Nipple.....	15.63	6.99
			<i>For Work In Restricted Working Space, Add</i>	4.19	
			<i>For Installation Above 14', Add</i>	2.10	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.19	
26 05 33	13-0177	EA	1-1/4" x 2" Long Rigid Galvanized Steel (RGS) Nipple.....	18.29	8.09
			<i>For Work In Restricted Working Space, Add</i>	4.85	
			<i>For Installation Above 14', Add</i>	2.43	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.85	
26 05 33	13-0178	EA	1-1/2" x 2" Long Rigid Galvanized Steel (RGS) Nipple.....	20.89	9.19
			<i>For Work In Restricted Working Space, Add</i>	5.51	
			<i>For Installation Above 14', Add</i>	2.76	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.51	
26 05 33	13-0179	EA	1/2" x 2-1/2" Long Rigid Galvanized Steel (RGS) Nipple.....	10.70	4.78
			<i>For Work In Restricted Working Space, Add</i>	2.87	
			<i>For Installation Above 14', Add</i>	1.43	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2.87	
26 05 33	13-0180	EA	3/4" x 2-1/2" Long Rigid Galvanized Steel (RGS) Nipple.....	12.36	5.51
			<i>For Work In Restricted Working Space, Add</i>	3.31	
			<i>For Installation Above 14', Add</i>	1.65	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	3.31	
26 05 33	13-0181	EA	1" x 2-1/2" Long Rigid Galvanized Steel (RGS) Nipple.....	15.78	6.99
			<i>For Work In Restricted Working Space, Add</i>	4.19	
			<i>For Installation Above 14', Add</i>	2.10	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.19	
26 05 33	13-0182	EA	1-1/4" x 2-1/2" Long Rigid Galvanized Steel (RGS) Nipple.....	18.49	8.09
			<i>For Work In Restricted Working Space, Add</i>	4.85	
			<i>For Installation Above 14', Add</i>	2.43	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.85	
26 05 33	13-0183	EA	1-1/2" x 2-1/2" Long Rigid Galvanized Steel (RGS) Nipple.....	21.21	9.19
			<i>For Work In Restricted Working Space, Add</i>	5.51	
			<i>For Installation Above 14', Add</i>	2.76	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.51	
26 05 33	13-0184	EA	2" x 2-1/2" Long Rigid Galvanized Steel (RGS) Nipple.....	24.00	10.30
			<i>For Work In Restricted Working Space, Add</i>	6.17	
			<i>For Installation Above 14', Add</i>	3.09	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	6.17	
26 05 33	13-0185	EA	1/2" x 3" Long Rigid Galvanized Steel (RGS) Nipple.....	10.80	4.78
			<i>For Work In Restricted Working Space, Add</i>	2.87	
			<i>For Installation Above 14', Add</i>	1.43	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2.87	
26 05 33	13-0186	EA	3/4" x 3" Long Rigid Galvanized Steel (RGS) Nipple.....	12.47	5.51
			<i>For Work In Restricted Working Space, Add</i>	3.31	
			<i>For Installation Above 14', Add</i>	1.65	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	3.31	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 13-0187 EA 1" x 3" Long Rigid Galvanized Steel (RGS) Nipple..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	15.99 4.19 2.10 4.19	6.99
26 05 33 13-0188 EA 1-1/4" x 3" Long Rigid Galvanized Steel (RGS) Nipple..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	18.67 4.85 2.43 4.85	8.09
26 05 33 13-0189 EA 1-1/2" x 3" Long Rigid Galvanized Steel (RGS) Nipple..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	21.43 5.51 2.76 5.51	9.19
26 05 33 13-0190 EA 2" x 3" Long Rigid Galvanized Steel (RGS) Nipple..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	24.53 6.17 3.09 6.17	10.30
26 05 33 13-0191 EA 2-1/2" x 3" Long Rigid Galvanized Steel (RGS) Nipple..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	33.16 7.50 3.75 7.50	12.50
26 05 33 13-0192 EA 3" x 3" Long Rigid Galvanized Steel (RGS) Nipple..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	44.59 10.37 5.18 10.37	17.28
26 05 33 13-0193 EA 1/2" x 3-1/2" Long Rigid Galvanized Steel (RGS) Nipple..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.91 2.87 1.43 2.87	4.78
26 05 33 13-0194 EA 3/4" x 3-1/2" Long Rigid Galvanized Steel (RGS) Nipple..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	12.54 3.31 1.65 3.31	5.51
26 05 33 13-0195 EA 1" x 3-1/2" Long Rigid Galvanized Steel (RGS) Nipple..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	16.26 4.19 2.10 4.19	6.99
26 05 33 13-0196 EA 1-1/4" x 3-1/2" Long Rigid Galvanized Steel (RGS) Nipple..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	19.01 4.85 2.43 4.85	8.09
26 05 33 13-0197 EA 1-1/2" x 3-1/2" Long Rigid Galvanized Steel (RGS) Nipple..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	21.88 5.51 2.76 5.51	9.19
26 05 33 13-0198 EA 2" x 3-1/2" Long Rigid Galvanized Steel (RGS) Nipple..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	25.08 6.17 3.09 6.17	10.30
26 05 33 13-0199 EA 2-1/2" x 3-1/2" Long Rigid Galvanized Steel (RGS) Nipple..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	34.65 7.50 3.75 7.50	12.50
26 05 33 13-0200 EA 3" x 3-1/2" Long Rigid Galvanized Steel (RGS) Nipple..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	45.88 10.37 5.18 10.37	17.28
26 05 33 13-0201 EA 1/2" x 4" Long Rigid Galvanized Steel (RGS) Nipple..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	11.03 2.87 1.43 2.87	4.78
26 05 33 13-0202 EA 3/4" x 4" Long Rigid Galvanized Steel (RGS) Nipple..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	12.74 3.31 1.65 3.31	5.51
26 05 33 13-0203 EA 1" x 4" Long Rigid Galvanized Steel (RGS) Nipple..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	16.42 4.19 2.10 4.19	6.99
26 05 33 13-0204 EA 1-1/4" x 4" Long Rigid Galvanized Steel (RGS) Nipple..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	19.18 4.85 2.43 4.85	8.09
26 05 33 13-0205 EA 1-1/2" x 4" Long Rigid Galvanized Steel (RGS) Nipple..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	22.19 5.51 2.76 5.51	9.19
26 05 33 13-0206 EA 2" x 4" Long Rigid Galvanized Steel (RGS) Nipple..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	25.55 6.17 3.09 6.17	10.30
26 05 33 13-0207 EA 2-1/2" x 4" Long Rigid Galvanized Steel (RGS) Nipple..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	35.11 7.50 3.75 7.50	12.50

26 Electrical**26 05 Common Work Results For Electrical****26 05 33 Raceway And Boxes For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33	13-0208	EA	3" x 4" Long Rigid Galvanized Steel (RGS) Nipple <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	46.83 10.37 5.18 10.37	17.28
26 05 33	13-0209	EA	3-1/2" x 4" Long Rigid Galvanized Steel (RGS) Nipple <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	53.91 11.69 5.85 11.69	19.48
26 05 33	13-0210	EA	4" x 4" Long Rigid Galvanized Steel (RGS) Nipple <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	67.50 15.22 7.61 15.22	25.37
26 05 33	13-0211	EA	1/2" x 5" Long Rigid Galvanized Steel (RGS) Nipple <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	11.20 2.87 1.43 2.87	4.78
26 05 33	13-0212	EA	3/4" x 5" Long Rigid Galvanized Steel (RGS) Nipple <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	13.00 3.31 1.65 3.31	5.51
26 05 33	13-0213	EA	1" x 5" Long Rigid Galvanized Steel (RGS) Nipple <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	16.75 4.19 2.10 4.19	6.99
26 05 33	13-0214	EA	1-1/4" x 5" Long Rigid Galvanized Steel (RGS) Nipple <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	19.65 4.85 2.43 4.85	8.09
26 05 33	13-0215	EA	1-1/2" x 5" Long Rigid Galvanized Steel (RGS) Nipple <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	22.65 5.51 2.76 5.51	9.19
26 05 33	13-0216	EA	2" x 5" Long Rigid Galvanized Steel (RGS) Nipple <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	26.38 6.17 3.09 6.17	10.30
26 05 33	13-0217	EA	2-1/2" x 5" Long Rigid Galvanized Steel (RGS) Nipple <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	36.94 7.50 3.75 7.50	12.50
26 05 33	13-0218	EA	3" x 5" Long Rigid Galvanized Steel (RGS) Nipple <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	48.83 10.37 5.18 10.37	17.28
26 05 33	13-0219	EA	3-1/2" x 5" Long Rigid Galvanized Steel (RGS) Nipple <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	55.89 11.69 5.85 11.69	19.48
26 05 33	13-0220	EA	4" x 5" Long Rigid Galvanized Steel (RGS) Nipple <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	70.40 15.22 7.61 15.22	25.37
26 05 33	13-0221	EA	5" x 5" Long Rigid Galvanized Steel (RGS) Nipple <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	108.03 20.96 10.48 20.96	34.93
26 05 33	13-0222	EA	6" x 5" Long Rigid Galvanized Steel (RGS) Nipple <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	137.20 26.89 13.44 26.89	44.78
26 05 33	13-0223	EA	1/2" x 6" Long Rigid Galvanized Steel (RGS) Nipple <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	11.52 2.87 1.43 2.87	4.78
26 05 33	13-0224	EA	3/4" x 6" Long Rigid Galvanized Steel (RGS) Nipple <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	13.32 3.31 1.65 3.31	5.51
26 05 33	13-0225	EA	1" x 6" Long Rigid Galvanized Steel (RGS) Nipple <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	17.01 4.19 2.10 4.19	6.99
26 05 33	13-0226	EA	1-1/4" x 6" Long Rigid Galvanized Steel (RGS) Nipple <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	20.09 4.85 2.43 4.85	8.09
26 05 33	13-0227	EA	1-1/2" x 6" Long Rigid Galvanized Steel (RGS) Nipple <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	23.63 5.51 2.76 5.51	9.19
26 05 33	13-0228	EA	2" x 6" Long Rigid Galvanized Steel (RGS) Nipple <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	27.21 6.17 3.09 6.17	10.30



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 13-0229 EA 2-1/2" x 6" Long Rigid Galvanized Steel (RGS) Nipple..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	38.56 7.50 3.75 7.50	12.50
26 05 33 13-0230 EA 3" x 6" Long Rigid Galvanized Steel (RGS) Nipple..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	50.85 10.37 5.18 10.37	17.28
26 05 33 13-0231 EA 3-1/2" x 6" Long Rigid Galvanized Steel (RGS) Nipple..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	58.31 11.69 5.85 11.69	19.48
26 05 33 13-0232 EA 4" x 6" Long Rigid Galvanized Steel (RGS) Nipple..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	72.69 15.22 7.61 15.22	25.37
26 05 33 13-0233 EA 5" x 6" Long Rigid Galvanized Steel (RGS) Nipple..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	111.39 20.96 10.48 20.96	34.93
26 05 33 13-0234 EA 6" x 6" Long Rigid Galvanized Steel (RGS) Nipple..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	142.12 26.89 13.44 26.89	44.78
26 05 33 13-0235 EA 1/2" x 8" Long Rigid Galvanized Steel (RGS) Nipple..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	12.69 2.87 1.43 2.87	4.78
26 05 33 13-0236 EA 3/4" x 8" Long Rigid Galvanized Steel (RGS) Nipple..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	14.82 3.31 1.65 3.31	5.51
26 05 33 13-0237 EA 1" x 8" Long Rigid Galvanized Steel (RGS) Nipple..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	18.76 4.19 2.10 4.19	6.99
26 05 33 13-0238 EA 1-1/4" x 8" Long Rigid Galvanized Steel (RGS) Nipple..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	22.59 4.85 2.43 4.85	8.09
26 05 33 13-0239 EA 1-1/2" x 8" Long Rigid Galvanized Steel (RGS) Nipple..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	26.42 5.51 2.76 5.51	9.19
26 05 33 13-0240 EA 2" x 8" Long Rigid Galvanized Steel (RGS) Nipple..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	30.15 6.17 3.09 6.17	10.30
26 05 33 13-0241 EA 2-1/2" x 8" Long Rigid Galvanized Steel (RGS) Nipple..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	42.83 7.50 3.75 7.50	12.50
26 05 33 13-0242 EA 3" x 8" Long Rigid Galvanized Steel (RGS) Nipple..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	55.76 10.37 5.18 10.37	17.28
26 05 33 13-0243 EA 3-1/2" x 8" Long Rigid Galvanized Steel (RGS) Nipple..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	63.20 11.69 5.85 11.69	19.48
26 05 33 13-0244 EA 4" x 8" Long Rigid Galvanized Steel (RGS) Nipple..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	78.10 15.22 7.61 15.22	25.37
26 05 33 13-0245 EA 5" x 8" Long Rigid Galvanized Steel (RGS) Nipple..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	119.19 20.96 10.48 20.96	34.93
26 05 33 13-0246 EA 6" x 8" Long Rigid Galvanized Steel (RGS) Nipple..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	150.88 26.89 13.44 26.89	44.78
26 05 33 13-0247 EA 1/2" x 10" Long Rigid Galvanized Steel (RGS) Nipple..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	13.47 2.87 1.43 2.87	4.78
26 05 33 13-0248 EA 3/4" x 10" Long Rigid Galvanized Steel (RGS) Nipple..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	15.58 3.31 1.65 3.31	5.51
26 05 33 13-0249 EA 1" x 10" Long Rigid Galvanized Steel (RGS) Nipple..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	20.16 4.19 2.10 4.19	6.99

26 Electrical**26 05 Common Work Results For Electrical****26 05 33 Raceway And Boxes For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33	13-0250	EA	1-1/4" x 10" Long Rigid Galvanized Steel (RGS) Nipple	24.25	8.09
			<i>For Work In Restricted Working Space, Add</i>	4.85	
			<i>For Installation Above 14', Add</i>	2.43	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.85	
26 05 33	13-0251	EA	1-1/2" x 10" Long Rigid Galvanized Steel (RGS) Nipple	28.05	9.19
			<i>For Work In Restricted Working Space, Add</i>	5.51	
			<i>For Installation Above 14', Add</i>	2.76	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.51	
26 05 33	13-0252	EA	2" x 10" Long Rigid Galvanized Steel (RGS) Nipple	32.04	10.30
			<i>For Work In Restricted Working Space, Add</i>	6.17	
			<i>For Installation Above 14', Add</i>	3.09	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	6.17	
26 05 33	13-0253	EA	2-1/2" x 10" Long Rigid Galvanized Steel (RGS) Nipple	45.70	12.50
			<i>For Work In Restricted Working Space, Add</i>	7.50	
			<i>For Installation Above 14', Add</i>	3.75	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	7.50	
26 05 33	13-0254	EA	3" x 10" Long Rigid Galvanized Steel (RGS) Nipple	59.62	17.28
			<i>For Work In Restricted Working Space, Add</i>	10.37	
			<i>For Installation Above 14', Add</i>	5.18	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.37	
26 05 33	13-0255	EA	3-1/2" x 10" Long Rigid Galvanized Steel (RGS) Nipple	68.28	19.48
			<i>For Work In Restricted Working Space, Add</i>	11.69	
			<i>For Installation Above 14', Add</i>	5.85	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	11.69	
26 05 33	13-0256	EA	4" x 10" Long Rigid Galvanized Steel (RGS) Nipple	84.54	25.37
			<i>For Work In Restricted Working Space, Add</i>	15.22	
			<i>For Installation Above 14', Add</i>	7.61	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	15.22	
26 05 33	13-0257	EA	5" x 10" Long Rigid Galvanized Steel (RGS) Nipple	127.69	34.93
			<i>For Work In Restricted Working Space, Add</i>	20.96	
			<i>For Installation Above 14', Add</i>	10.48	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	20.96	
26 05 33	13-0258	EA	6" x 10" Long Rigid Galvanized Steel (RGS) Nipple	166.18	44.78
			<i>For Work In Restricted Working Space, Add</i>	26.89	
			<i>For Installation Above 14', Add</i>	13.44	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	26.89	
26 05 33	13-0259	EA	1/2" x 12" Long Rigid Galvanized Steel (RGS) Nipple	14.07	4.78
			<i>For Work In Restricted Working Space, Add</i>	2.87	
			<i>For Installation Above 14', Add</i>	1.43	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2.87	
26 05 33	13-0260	EA	3/4" x 12" Long Rigid Galvanized Steel (RGS) Nipple	16.14	5.51
			<i>For Work In Restricted Working Space, Add</i>	3.31	
			<i>For Installation Above 14', Add</i>	1.65	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	3.31	
26 05 33	13-0261	EA	1" x 12" Long Rigid Galvanized Steel (RGS) Nipple	20.99	6.99
			<i>For Work In Restricted Working Space, Add</i>	4.19	
			<i>For Installation Above 14', Add</i>	2.10	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.19	
26 05 33	13-0262	EA	1-1/4" x 12" Long Rigid Galvanized Steel (RGS) Nipple	25.57	8.09
			<i>For Work In Restricted Working Space, Add</i>	4.85	
			<i>For Installation Above 14', Add</i>	2.43	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.85	
26 05 33	13-0263	EA	1-1/2" x 12" Long Rigid Galvanized Steel (RGS) Nipple	28.87	9.19
			<i>For Work In Restricted Working Space, Add</i>	5.51	
			<i>For Installation Above 14', Add</i>	2.76	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.51	
26 05 33	13-0264	EA	2" x 12" Long Rigid Galvanized Steel (RGS) Nipple	33.62	10.30
			<i>For Work In Restricted Working Space, Add</i>	6.17	
			<i>For Installation Above 14', Add</i>	3.09	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	6.17	
26 05 33	13-0265	EA	2-1/2" x 12" Long Rigid Galvanized Steel (RGS) Nipple	49.08	12.50
			<i>For Work In Restricted Working Space, Add</i>	7.50	
			<i>For Installation Above 14', Add</i>	3.75	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	7.50	
26 05 33	13-0266	EA	3" x 12" Long Rigid Galvanized Steel (RGS) Nipple	64.98	17.28
			<i>For Work In Restricted Working Space, Add</i>	10.37	
			<i>For Installation Above 14', Add</i>	5.18	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.37	
26 05 33	13-0267	EA	3-1/2" x 12" Long Rigid Galvanized Steel (RGS) Nipple	73.23	19.48
			<i>For Work In Restricted Working Space, Add</i>	11.69	
			<i>For Installation Above 14', Add</i>	5.85	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	11.69	
26 05 33	13-0268	EA	4" x 12" Long Rigid Galvanized Steel (RGS) Nipple	90.98	25.37
			<i>For Work In Restricted Working Space, Add</i>	15.22	
			<i>For Installation Above 14', Add</i>	7.61	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	15.22	
26 05 33	13-0269	EA	5" x 12" Long Rigid Galvanized Steel (RGS) Nipple	139.92	34.93
			<i>For Work In Restricted Working Space, Add</i>	20.96	
			<i>For Installation Above 14', Add</i>	10.48	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	20.96	
26 05 33	13-0270	EA	6" x 12" Long Rigid Galvanized Steel (RGS) Nipple	174.69	44.78
			<i>For Work In Restricted Working Space, Add</i>	26.89	
			<i>For Installation Above 14', Add</i>	13.44	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	26.89	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 13-0271 Rigid Galvanized Steel (RGS) Off-Set Nipples <small>(26 05 33 13-0042)</small>		
26 05 33 13-0272 EA 1/2" Rigid Galvanized Steel (RGS) Off-Set Nipple.....	10.65	3.82
For Work In Restricted Working Space, Add	2.89	
For Installation Above 14', Add	1.45	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	2.89	
26 05 33 13-0273 EA 3/4" Rigid Galvanized Steel (RGS) Off-Set Nipple.....	12.51	4.41
For Work In Restricted Working Space, Add	3.29	
For Installation Above 14', Add	1.65	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	3.29	
26 05 33 13-0274 EA 1" Rigid Galvanized Steel (RGS) Off-Set Nipple.....	15.79	5.58
For Work In Restricted Working Space, Add	4.21	
For Installation Above 14', Add	2.10	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	4.21	
26 05 33 13-0275 EA 1-1/4" Rigid Galvanized Steel (RGS) Off-Set Nipple, Insulated.....	19.65	6.69
For Work In Restricted Working Space, Add	5.04	
For Installation Above 14', Add	2.52	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	5.04	
26 05 33 13-0276 EA 1-1/2" Rigid Galvanized Steel (RGS) Off-Set Nipple, Insulated.....	21.52	7.35
For Work In Restricted Working Space, Add	5.52	
For Installation Above 14', Add	2.76	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	5.52	
26 05 33 13-0277 EA 2" Rigid Galvanized Steel (RGS) Off-Set Nipple, Insulated.....	27.61	9.04
For Work In Restricted Working Space, Add	6.80	
For Installation Above 14', Add	3.40	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	6.80	
26 05 33 13-0278 EA 2-1/2" Rigid Galvanized Steel (RGS) Off-Set Nipple, Insulated.....	45.02	14.71
For Work In Restricted Working Space, Add	11.03	
For Installation Above 14', Add	5.52	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	11.03	
26 05 33 13-0279 EA 3" Rigid Galvanized Steel (RGS) Off-Set Nipple, Insulated.....	69.46	20.29
For Work In Restricted Working Space, Add	15.22	
For Installation Above 14', Add	7.61	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	15.22	
26 05 33 13-0280 EA 3-1/2" Rigid Galvanized Steel (RGS) Off-Set Nipple, Insulated.....	38.58	5.29
For Work In Restricted Working Space, Add	3.98	
For Installation Above 14', Add	1.99	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	3.98	
26 05 33 13-0281 EA 4" Rigid Galvanized Steel (RGS) Off-Set Nipple, Insulated.....	100.95	27.64
For Work In Restricted Working Space, Add	20.74	
For Installation Above 14', Add	10.37	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	20.74	
26 05 33 13-0282 Rigid Galvanized Steel (RGS) 3-Piece Conduit Coupling <small>(26 05 33 13-0042)</small>		
Note: Erickson fittings.		
26 05 33 13-0283 EA 1/2" Rigid Galvanized Steel (RGS) 3-Piece Conduit Coupling (Erickson).....	31.33	11.76
For Work In Restricted Working Space, Add	8.84	
For Installation Above 14', Add	4.42	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	8.84	
26 05 33 13-0284 EA 3/4" Rigid Galvanized Steel (RGS) 3-Piece Conduit Coupling (Erickson).....	35.28	13.16
For Work In Restricted Working Space, Add	9.86	
For Installation Above 14', Add	4.93	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	9.86	
26 05 33 13-0285 EA 1" Rigid Galvanized Steel (RGS) 3-Piece Conduit Coupling (Erickson).....	41.05	14.63
For Work In Restricted Working Space, Add	10.98	
For Installation Above 14', Add	5.49	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	10.98	
26 05 33 13-0286 EA 1-1/4" Rigid Galvanized Steel (RGS) 3-Piece Conduit Coupling (Erickson).....	49.54	16.03
For Work In Restricted Working Space, Add	12.02	
For Installation Above 14', Add	6.01	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	12.02	
26 05 33 13-0287 EA 1-1/2" Rigid Galvanized Steel (RGS) 3-Piece Conduit Coupling (Erickson).....	55.18	17.50
For Work In Restricted Working Space, Add	13.15	
For Installation Above 14', Add	6.57	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	13.15	
26 05 33 13-0288 EA 2" Rigid Galvanized Steel (RGS) 3-Piece Conduit Coupling (Erickson).....	70.20	18.97
For Work In Restricted Working Space, Add	14.24	
For Installation Above 14', Add	7.12	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	14.24	
26 05 33 13-0289 EA 2-1/2" Rigid Galvanized Steel (RGS) 3-Piece Conduit Coupling (Erickson).....	111.48	23.53
For Work In Restricted Working Space, Add	17.65	
For Installation Above 14', Add	8.82	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	17.65	
26 05 33 13-0290 EA 3" Rigid Galvanized Steel (RGS) 3-Piece Conduit Coupling (Erickson).....	153.45	29.41
For Work In Restricted Working Space, Add	22.06	
For Installation Above 14', Add	11.03	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	22.06	
26 05 33 13-0291 EA 3-1/2" Rigid Galvanized Steel (RGS) 3-Piece Conduit Coupling (Erickson).....	221.38	35.29
For Work In Restricted Working Space, Add	26.48	
For Installation Above 14', Add	13.24	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	26.48	
26 05 33 13-0292 EA 4" Rigid Galvanized Steel (RGS) 3-Piece Conduit Coupling (Erickson).....	252.12	38.24
For Work In Restricted Working Space, Add	28.67	
For Installation Above 14', Add	14.34	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	28.67	

26 Electrical**26 05 Common Work Results For Electrical****26 05 33 Raceway And Boxes For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 13-0293			Rigid Galvanized Steel (RGS) To Electrical Metallic Tubing (EMT) Connectors <small>(26 05 33 13-0042)</small>		
26 05 33 13-0294	EA		1/2" Rigid Galvanized Steel (RGS) To Electrical Metallic Tubing (EMT) Connector	17.41	5.89
			<i>For Work In Restricted Working Space, Add</i>	4.41	
			<i>For Installation Above 14', Add</i>	2.21	
26 05 33 13-0295	EA		3/4" Rigid Galvanized Steel (RGS) To Electrical Metallic Tubing (EMT) Connector	19.37	6.47
			<i>For Work In Restricted Working Space, Add</i>	4.85	
			<i>For Installation Above 14', Add</i>	2.43	
26 05 33 13-0296	EA		1" Rigid Galvanized Steel (RGS) To Electrical Metallic Tubing (EMT) Connector	22.20	7.35
			<i>For Work In Restricted Working Space, Add</i>	5.52	
			<i>For Installation Above 14', Add</i>	2.76	
26 05 33 13-0297	EA		1-1/4" Rigid Galvanized Steel (RGS) To Electrical Metallic Tubing (EMT) Connector	24.87	7.94
			<i>For Work In Restricted Working Space, Add</i>	5.96	
			<i>For Installation Above 14', Add</i>	2.98	
26 05 33 13-0298	EA		1-1/2" Rigid Galvanized Steel (RGS) To Electrical Metallic Tubing (EMT) Connector	29.06	8.82
			<i>For Work In Restricted Working Space, Add</i>	6.62	
			<i>For Installation Above 14', Add</i>	3.31	
26 05 33 13-0299	EA		2" Rigid Galvanized Steel (RGS) To Electrical Metallic Tubing (EMT) Connector	34.61	9.71
			<i>For Work In Restricted Working Space, Add</i>	7.28	
			<i>For Installation Above 14', Add</i>	3.64	
26 05 33 13-0300	EA		2-1/2" Rigid Galvanized Steel (RGS) To Electrical Metallic Tubing (EMT) Connector	46.00	11.76
			<i>For Work In Restricted Working Space, Add</i>	8.82	
			<i>For Installation Above 14', Add</i>	4.41	
26 05 33 13-0301	EA		3" Rigid Galvanized Steel (RGS) To Electrical Metallic Tubing (EMT) Connector	57.01	14.71
			<i>For Work In Restricted Working Space, Add</i>	11.03	
			<i>For Installation Above 14', Add</i>	5.52	
26 05 33 13-0302	EA		3-1/2" Rigid Galvanized Steel (RGS) To Electrical Metallic Tubing (EMT) Connector	68.47	17.65
			<i>For Work In Restricted Working Space, Add</i>	13.24	
			<i>For Installation Above 14', Add</i>	6.62	
26 05 33 13-0303	EA		4" Rigid Galvanized Steel (RGS) To Electrical Metallic Tubing (EMT) Connector	76.72	19.12
			<i>For Work In Restricted Working Space, Add</i>	14.34	
			<i>For Installation Above 14', Add</i>	7.17	
26 05 33 13-0304			Rigid Galvanized Steel (RGS) Water Tight Conduit Hubs <small>(26 05 33 13-0042)</small>		
26 05 33 13-0305	EA		1/2" Rigid Galvanized Steel (RGS) Water Tight Conduit Hubs	16.55	6.62
			<i>For Work In Restricted Working Space, Add</i>	3.97	
			<i>For Installation Above 14', Add</i>	1.99	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	3.97	
26 05 33 13-0306	EA		3/4" Rigid Galvanized Steel (RGS) Water Tight Conduit Hubs	18.44	7.35
			<i>For Work In Restricted Working Space, Add</i>	4.41	
			<i>For Installation Above 14', Add</i>	2.21	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.41	
26 05 33 13-0307	EA		1" Rigid Galvanized Steel (RGS) Water Tight Conduit Hubs	22.76	9.19
			<i>For Work In Restricted Working Space, Add</i>	5.51	
			<i>For Installation Above 14', Add</i>	2.76	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.51	
26 05 33 13-0308	EA		1-1/4" Rigid Galvanized Steel (RGS) Water Tight Conduit Hubs	28.01	11.03
			<i>For Work In Restricted Working Space, Add</i>	6.62	
			<i>For Installation Above 14', Add</i>	3.31	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	6.62	
26 05 33 13-0309	EA		1-1/2" Rigid Galvanized Steel (RGS) Water Tight Conduit Hubs	35.95	14.71
			<i>For Work In Restricted Working Space, Add</i>	8.82	
			<i>For Installation Above 14', Add</i>	4.41	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8.82	
26 05 33 13-0310	EA		2" Rigid Galvanized Steel (RGS) Water Tight Conduit Hubs	41.83	16.54
			<i>For Work In Restricted Working Space, Add</i>	9.93	
			<i>For Installation Above 14', Add</i>	4.96	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.93	
26 05 33 13-0311	EA		2-1/2" Water Tight Conduit Hubs	51.60	18.38
			<i>For Work In Restricted Working Space, Add</i>	11.03	
			<i>For Installation Above 14', Add</i>	5.52	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	11.03	
26 05 33 13-0312	EA		3" Rigid Galvanized Steel (RGS) Water Tight Conduit Hubs	69.57	23.16
			<i>For Work In Restricted Working Space, Add</i>	13.90	
			<i>For Installation Above 14', Add</i>	6.95	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	13.90	
26 05 33 13-0313	EA		3-1/2" Rigid Galvanized Steel (RGS) Water Tight Conduit Hubs	82.59	27.94
			<i>For Work In Restricted Working Space, Add</i>	16.77	
			<i>For Installation Above 14', Add</i>	8.38	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	16.77	
26 05 33 13-0314	EA		4" Rigid Galvanized Steel (RGS) Water Tight Conduit Hubs	101.38	33.09
			<i>For Work In Restricted Working Space, Add</i>	19.85	
			<i>For Installation Above 14', Add</i>	9.93	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	19.85	
26 05 33 13-0315			Rigid Galvanized Steel (RGS) Expansion Fittings, 4" Conduit Movement <small>(26 05 33 13-0042)</small>		
			Note: Type AX		
26 05 33 13-0316	EA		1/2" Rigid Galvanized Steel (RGS) Expansion Fitting, 4" Conduit Movement	79.63	11.76
			<i>For Work In Restricted Working Space, Add</i>	8.83	
			<i>For Installation Above 14', Add</i>	4.41	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 13-0317 EA 3/4" Rigid Galvanized Steel (RGS) Expansion Fitting, 4" Conduit Movement..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	90.41 9.93 4.96	13.24
26 05 33 13-0318 EA 1" Rigid Galvanized Steel (RGS) Expansion Fitting, 4" Conduit Movement <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	107.28 11.03 5.52	14.71
26 05 33 13-0319 EA 1-1/4" Rigid Galvanized Steel (RGS) Expansion Fitting, 4" Conduit Movement <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	131.78 12.14 6.07	16.17
26 05 33 13-0320 EA 1-1/2" Rigid Galvanized Steel (RGS) Expansion Fitting, 4" Conduit Movement <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	166.18 13.24 6.62	17.65
26 05 33 13-0321 EA 2" Rigid Galvanized Steel (RGS) Expansion Fitting, 4" Conduit Movement <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	230.88 14.34 7.17	19.12
26 05 33 13-0322 EA 2-1/2" Rigid Galvanized Steel (RGS) Expansion Fitting, 4" Conduit Movement <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	354.80 17.65 8.82	23.53
26 05 33 13-0323 EA 3" Rigid Galvanized Steel (RGS) Expansion Fitting, 4" Conduit Movement <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	454.73 22.06 11.03	29.41
26 05 33 13-0324 EA 3-1/2" Rigid Galvanized Steel (RGS) Expansion Fitting, 4" Conduit Movement <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	665.50 26.47 13.24	35.29
26 05 33 13-0325 EA 4" Rigid Galvanized Steel (RGS) Expansion Fitting, 4" Conduit Movement <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	709.29 28.67 14.34	38.24
26 05 33 13-0326 Rigid Galvanized Steel (RGS) Expansion Fittings, 8" Conduit Movement ^(26 05 33 13-0042) Note: Type AX-8		
26 05 33 13-0327 EA 1/2" Rigid Galvanized Steel (RGS) Expansion Fitting, 8" Conduit Movement..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	88.02 8.83 4.41	11.76
26 05 33 13-0328 EA 3/4" Rigid Galvanized Steel (RGS) Expansion Fitting, 8" Conduit Movement..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	97.84 9.93 4.96	13.24
26 05 33 13-0329 EA 1" Rigid Galvanized Steel (RGS) Expansion Fitting, 8" Conduit Movement <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	118.95 11.03 5.52	14.71
26 05 33 13-0330 EA 1-1/4" Rigid Galvanized Steel (RGS) Expansion Fitting, 8" Conduit Movement <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	150.16 12.14 6.07	16.17
26 05 33 13-0331 EA 1-1/2" Rigid Galvanized Steel (RGS) Expansion Fitting, 8" Conduit Movement <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	202.70 13.24 6.62	17.65
26 05 33 13-0332 EA 2" Rigid Galvanized Steel (RGS) Expansion Fitting, 8" Conduit Movement <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	248.33 14.34 7.17	19.12
26 05 33 13-0333 EA 2-1/2" Rigid Galvanized Steel (RGS) Expansion Fitting, 8" Conduit Movement <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	467.92 17.65 8.82	23.53
26 05 33 13-0334 EA 3" Rigid Galvanized Steel (RGS) Expansion Fitting, 8" Conduit Movement <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	531.97 22.06 11.03	29.41
26 05 33 13-0335 EA 3-1/2" Rigid Galvanized Steel (RGS) Expansion Fitting, 8" Conduit Movement <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	818.15 26.47 13.24	35.29
26 05 33 13-0336 EA 4" Rigid Galvanized Steel (RGS) Expansion Fitting, 8" Conduit Movement <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	885.73 28.67 14.34	38.24
26 05 33 13-0337 EA 5" Rigid Galvanized Steel (RGS) Expansion Fitting, 8" Conduit Movement <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	1,237.66 35.30 17.65	47.06
26 05 33 13-0338 EA 6" Rigid Galvanized Steel (RGS) Expansion Fitting, 8" Conduit Movement <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	1,530.25 39.18 19.59	52.21
26 05 33 13-0339 Rigid Galvanized Steel (RGS)/Intermediate Metal Conduit (IMC) Expansion Fittings, 8" Conduit Movement ^(26 05 33 13-0042) Note: Type EX		
26 05 33 13-0340 EA 1/2" Rigid Galvanized Steel (RGS)/Intermediate Metal Conduit (IMC) Expansion Fitting, 8" Conduit Movement..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	100.31 8.83 4.41	11.76
26 05 33 13-0341 EA 3/4" Rigid Galvanized Steel (RGS)/Intermediate Metal Conduit (IMC) Expansion Fitting, 8" Conduit Movement..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	126.81 9.93 4.96	13.24
26 05 33 13-0342 EA 1" Rigid Galvanized Steel (RGS)/Intermediate Metal Conduit (IMC) Expansion Fitting, 8" Conduit Movement..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	158.08 11.03 5.52	14.71
26 05 33 13-0343 EA 1-1/4" Rigid Galvanized Steel (RGS)/Intermediate Metal Conduit (IMC) Expansion Fitting, 8" Conduit Movement..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	192.53 12.14 6.07	16.17

26 Electrical**26 05 Common Work Results For Electrical****26 05 33 Raceway And Boxes For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33	13-0344	EA	1-1/2" Rigid Galvanized Steel (RGS)/Intermediate Metal Conduit (IMC) Expansion Fitting, 8" Conduit Movement..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	260.07 13.24 6.62	17.65
26 05 33	13-0345	EA	2" Rigid Galvanized Steel (RGS)/Intermediate Metal Conduit (IMC) Expansion Fitting, 8" Conduit Movement..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	359.19 14.34 7.17	19.12
26 05 33	13-0346	EA	2-1/2" Rigid Galvanized Steel (RGS)/Intermediate Metal Conduit (IMC) Expansion Fitting, 8" Conduit Movement..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	559.19 17.65 8.82	23.53
26 05 33	13-0347	EA	3" Rigid Galvanized Steel (RGS)/Intermediate Metal Conduit (IMC) Expansion Fitting, 8" Conduit Movement..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	754.20 22.06 11.03	29.41
26 05 33	13-0348	EA	3-1/2" Rigid Galvanized Steel (RGS)/Intermediate Metal Conduit (IMC) Expansion Fitting, 8" Conduit Movement..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	1,134.23 26.47 13.24	35.29
26 05 33	13-0349	EA	4" Rigid Galvanized Steel (RGS)/Intermediate Metal Conduit (IMC) Expansion Fitting, 8" Conduit Movement..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	1,173.62 28.67 14.34	38.24
26 05 33	13-0350	EA	5" Rigid Galvanized Steel (RGS)/Intermediate Metal Conduit (IMC) Expansion Fitting, 8" Conduit Movement..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	1,768.35 35.30 17.65	47.06
26 05 33	13-0351	EA	6" Rigid Galvanized Steel (RGS)/Intermediate Metal Conduit (IMC) Expansion Fitting, 8" Conduit Movement..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	2,193.45 39.18 19.59	52.21
26 05 33 13-0352 Rigid Galvanized Steel (RGS)/Intermediate Metal Conduit (IMC) Deflection Expansion Fittings <small>(26 05 33 13-0042)</small>					
Note: Type DX					
26 05 33	13-0353	EA	1/2" Rigid Galvanized Steel (RGS)/Intermediate Metal Conduit (IMC) Deflection Expansion Fitting..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	176.06 8.83 4.41	11.76
26 05 33	13-0354	EA	3/4" Rigid Galvanized Steel (RGS)/Intermediate Metal Conduit (IMC) Deflection Expansion Fitting..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	209.88 9.93 4.96	13.24
26 05 33	13-0355	EA	1" Rigid Galvanized Steel (RGS)/Intermediate Metal Conduit (IMC) Deflection Expansion Fitting..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	253.95 11.03 5.52	14.71
26 05 33	13-0356	EA	1-1/4" Rigid Galvanized Steel (RGS)/Intermediate Metal Conduit (IMC) Deflection Expansion Fitting..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	298.76 12.14 6.07	16.17
26 05 33	13-0357	EA	1-1/2" Rigid Galvanized Steel (RGS)/Intermediate Metal Conduit (IMC) Deflection Expansion Fitting..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	330.42 13.24 6.62	17.65
26 05 33	13-0358	EA	2" Rigid Galvanized Steel (RGS)/Intermediate Metal Conduit (IMC) Deflection Expansion Fitting..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	408.87 14.34 7.17	19.12
26 05 33	13-0359	EA	2-1/2" Rigid Galvanized Steel (RGS)/Intermediate Metal Conduit (IMC) Deflection Expansion Fitting..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	540.75 17.65 8.82	23.53
26 05 33	13-0360	EA	3" Rigid Galvanized Steel (RGS)/Intermediate Metal Conduit (IMC) Deflection Expansion Fitting..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	685.85 22.06 11.03	29.41
26 05 33	13-0361	EA	3-1/2" Rigid Galvanized Steel (RGS)/Intermediate Metal Conduit (IMC) Deflection Expansion Fitting..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	771.29 26.47 13.24	35.29
26 05 33	13-0362	EA	4" Rigid Galvanized Steel (RGS)/Intermediate Metal Conduit (IMC) Deflection Expansion Fitting..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	936.15 28.67 14.34	38.24
26 05 33	13-0363	EA	5" Rigid Galvanized Steel (RGS)/Intermediate Metal Conduit (IMC) Deflection Expansion Fitting..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	1,604.60 35.30 17.65	47.06
26 05 33	13-0364	EA	6" Rigid Galvanized Steel (RGS)/Intermediate Metal Conduit (IMC) Deflection Expansion Fitting..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	2,555.60 39.18 19.59	52.21
26 05 33 13-0365 Rigid Galvanized Steel (RGS) Conduit Bonding Jumpers <small>(26 05 33 13-0042)</small>					
26 05 33	13-0366	EA	1/2" To 3/4" Conduit, 14" Bonding Jumper..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	44.94 4.41 2.21	5.89
26 05 33	13-0367	EA	1" To 1-1/4" Conduit, 14" Bonding Jumper..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	51.68 5.52 2.76	7.35
26 05 33	13-0368	EA	1-1/2" To 2" Conduit, 14" Bonding Jumper..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	63.75 6.62 3.31	8.82
26 05 33	13-0369	EA	2-1/2" To 3" Conduit, 14" Bonding Jumper..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	89.65 8.82 4.41	11.76
26 05 33	13-0370	EA	3-1/2" To 4" Conduit, 14" Bonding Jumper..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	135.88 13.24 6.62	17.65



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 13-0371 EA 5" To 6" Conduit, 14" Bonding Jumper <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	233.14 17.65 8.82	23.53
26 05 33 13-0372 EA 1/2" To 3/4" Conduit, 24" Bonding Jumper <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	50.12 4.41 2.21	5.89
26 05 33 13-0373 EA 1" To 1-1/4" Conduit, 24" Bonding Jumper <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	58.22 5.52 2.76	7.35
26 05 33 13-0374 EA 1-1/2" To 2" Conduit, 24" Bonding Jumper <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	69.74 6.62 3.31	8.82
26 05 33 13-0375 EA 2-1/2" To 3" Conduit, 24" Bonding Jumper <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	97.61 8.82 4.41	11.76
26 05 33 13-0376 EA 3-1/2" To 4" Conduit, 24" Bonding Jumper <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	146.43 13.24 6.62	17.65
26 05 33 13-0377 EA 5" To 6" Conduit, 24" Bonding Jumper <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	267.18 17.65 8.82	23.53
26 05 33 13-0378 Rigid Galvanized Steel (RGS) Sealing Fittings, Vertical/Horizontal <small>(26 05 33 13-0042)</small>		
26 05 33 13-0379 EA 1/2" Rigid Galvanized Steel (RGS) Sealing Fitting, Vertical/Horizontal..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	55.51 11.03 5.52 11.03	18.38
26 05 33 13-0380 EA 3/4" Rigid Galvanized Steel (RGS) Sealing Fitting, Vertical/Horizontal..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	66.13 13.24 6.62 13.24	22.06
26 05 33 13-0381 EA 1" Rigid Galvanized Steel (RGS) Sealing Fitting, Vertical/Horizontal..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	79.77 15.44 7.72 15.44	25.74
26 05 33 13-0382 EA 1-1/4" Rigid Galvanized Steel (RGS) Sealing Fitting, Vertical/Horizontal <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	93.18 17.65 8.82 17.65	29.41
26 05 33 13-0383 EA 1-1/2" Rigid Galvanized Steel (RGS) Sealing Fitting, Vertical/Horizontal <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	117.90 19.85 9.93 19.85	33.09
26 05 33 13-0384 EA 2" Rigid Galvanized Steel (RGS) Sealing Fitting, Vertical/Horizontal..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	140.54 22.06 11.03 22.06	36.77
26 05 33 13-0385 EA 2-1/2" Rigid Galvanized Steel (RGS) Conduit Sealing Fitting, Vertical/Horizontal <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	192.34 26.47 13.23 26.47	44.12
26 05 33 13-0386 EA 3" Rigid Galvanized Steel (RGS) Sealing Fitting, Vertical/Horizontal..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	230.12 30.88 15.44 30.88	51.48
26 05 33 13-0387 EA 3-1/2" Rigid Galvanized Steel (RGS) Sealing Fitting, Vertical/Horizontal <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	484.45 35.30 17.65 35.30	58.83
26 05 33 13-0388 EA 4" Rigid Galvanized Steel (RGS) Sealing Fitting, Vertical/Horizontal..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	556.87 39.71 19.85 39.71	66.18
26 05 33 13-0389 Rigid Galvanized Steel (RGS) Threaded Couplings <small>(26 05 33 13-0042)</small>		
26 05 33 13-0390 EA 1/2" Rigid Galvanized Steel (RGS) Threaded Coupling..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	9.80 2.65 1.32	4.41
26 05 33 13-0391 EA 3/4" Rigid Galvanized Steel (RGS) Threaded Coupling..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	13.73 3.75 1.88	6.25
26 05 33 13-0392 EA 1" Rigid Galvanized Steel (RGS) Threaded Coupling..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	18.05 4.85 2.43	8.09
26 05 33 13-0393 EA 1-1/4" Rigid Galvanized Steel (RGS) Threaded Coupling..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	20.75 5.51 2.76	9.19
26 05 33 13-0394 EA 1-1/2" Rigid Galvanized Steel (RGS) Threaded Coupling..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	25.03 6.62 3.31	11.03
26 05 33 13-0395 EA 2" Rigid Galvanized Steel (RGS) Threaded Coupling..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	29.42 7.50 3.75	12.50

26 Electrical**26 05 Common Work Results For Electrical****26 05 33 Raceway And Boxes For Electrical Systems**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 13-0396 EA 2-1/2" Rigid Galvanized Steel (RGS) Threaded Coupling.....	37.87	13.97
For Work In Restricted Working Space, Add	8.38	
For Installation Above 14', Add	4.19	
26 05 33 13-0397 EA 3" Rigid Galvanized Steel (RGS) Threaded Coupling.....	44.52	15.81
For Work In Restricted Working Space, Add	9.48	
For Installation Above 14', Add	4.74	
26 05 33 13-0398 EA 3-1/2" Rigid Galvanized Steel (RGS) Threaded Coupling.....	52.00	17.28
For Work In Restricted Working Space, Add	10.37	
For Installation Above 14', Add	5.18	
26 05 33 13-0399 EA 4" Threaded Rigid Galvanized Steel (RGS) Coupling.....	54.94	18.38
For Work In Restricted Working Space, Add	11.03	
For Installation Above 14', Add	5.52	
26 05 33 13-0400 Rigid Galvanized Steel (RGS) Sealing Locknut (26 05 33 13-0042)		
26 05 33 13-0401 EA 1/2" Rigid Galvanized Steel (RGS) Sealing Locknut.....	2.34	0.73
26 05 33 13-0402 EA 3/4" Rigid Galvanized Steel (RGS) Sealing Locknut.....	3.21	1.10
26 05 33 13-0403 EA 1" Rigid Galvanized Steel (RGS) Sealing Locknut.....	5.33	1.83
26 05 33 13-0404 EA 1-1/4" Rigid Galvanized Steel (RGS) Sealing Locknut.....	7.72	2.58
26 05 33 13-0405 EA 1-1/2" Rigid Galvanized Steel (RGS) Sealing Locknut.....	9.30	2.94
26 05 33 13-0406 EA 2" Rigid Galvanized Steel (RGS) Sealing Locknut.....	10.96	3.31
26 05 33 13-0407 Rigid Galvanized Steel (RGS) Fire Stop Fittings (26 05 33 13-0042)		
26 05 33 13-0408 EA 1/2" Rigid Galvanized Steel (RGS) Fire Stop Fitting.....	96.98	8.92
For Work In Restricted Working Space, Add	6.69	
For Installation Above 14', Add	3.35	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	6.69	
26 05 33 13-0409 EA 3/4" Rigid Galvanized Steel (RGS) Fire Stop Fitting.....	99.13	9.78
For Work In Restricted Working Space, Add	7.34	
For Installation Above 14', Add	3.67	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	7.34	
26 05 33 13-0410 EA 1" Rigid Galvanized Steel (RGS) Fire Stop Fitting.....	118.18	10.74
For Work In Restricted Working Space, Add	8.04	
For Installation Above 14', Add	4.02	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	8.04	
26 05 33 13-0411 EA 1-1/4" Rigid Galvanized Steel (RGS) Fire Stop Fitting.....	129.74	11.76
For Work In Restricted Working Space, Add	8.83	
For Installation Above 14', Add	4.42	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	8.83	
26 05 33 13-0412 EA 1-1/2" Rigid Galvanized Steel (RGS) Fire Stop Fitting.....	147.88	13.24
For Work In Restricted Working Space, Add	9.93	
For Installation Above 14', Add	4.96	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	9.93	
26 05 33 13-0413 EA 2" Rigid Galvanized Steel (RGS) Fire Stop Fitting.....	215.10	14.71
For Work In Restricted Working Space, Add	11.04	
For Installation Above 14', Add	5.52	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	11.04	
26 05 33 13-0414 EA 2-1/2" Rigid Galvanized Steel (RGS) Fire Stop Fitting.....	249.65	19.63
For Work In Restricted Working Space, Add	14.72	
For Installation Above 14', Add	7.36	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	14.72	
26 05 33 13-0415 EA 3" Rigid Galvanized Steel (RGS) Fire Stop Fitting.....	276.79	21.55
For Work In Restricted Working Space, Add	16.17	
For Installation Above 14', Add	8.09	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	16.17	
26 05 33 13-0416 EA 3-1/2" Rigid Galvanized Steel (RGS) Fire Stop Fitting.....	320.74	23.53
For Work In Restricted Working Space, Add	17.65	
For Installation Above 14', Add	8.83	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	17.65	
26 05 33 13-0417 EA 4" Rigid Galvanized Steel (RGS) Fire Stop Fitting.....	361.51	26.47
For Work In Restricted Working Space, Add	19.85	
For Installation Above 14', Add	9.93	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	19.85	
26 05 33 13-0418 Electrical Metallic Tubing (EMT) Thinwall Conduit (26 05 33 13-0041)		
Note: Exposed installation, branch and feeder conduit. Excludes supporting strap, hanger and fastening.		
26 05 33 13-0419 Electrical Metallic Tubing (EMT) Thinwall Conduit (26 05 33 13-0418)		
Note: Includes field bending conduit up to and including 1".		
26 05 33 13-0420 LF 1/2" Electrical Metallic Tubing (EMT) Conduit.....	3.59	1.32
For Work In Restricted Working Space, Add	0.99	
For >1,000, Deduct	-0.28	
For Installation In Concrete Beam, Slab, Etc. (Excludes Concrete), Add	0.50	
For Installation In Wood Stud Wall (Includes Drilling), Add	0.83	
For >250 To 500, Deduct	-0.01	
For >500 To 1,000, Deduct	-0.19	
For Installation Above 14', Add	0.50	
For Installation In Metal Stud Wall, Add	0.33	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 13-0421 LF 3/4" Electrical Metallic Tubing (EMT) Conduit.....	4.18	1.47
<i>For Work In Restricted Working Space, Add</i>	1.10	
<i>For >1,000, Deduct</i>	-0.33	
<i>For Installation In Concrete Beam, Slab, Etc. (Excludes Concrete), Add</i>	0.55	
<i>For Installation In Wood Stud Wall (Includes Drilling), Add</i>	0.92	
<i>For >250 To 500, Deduct</i>	-0.03	
<i>For >500 To 1,000, Deduct</i>	-0.22	
<i>For Installation Above 14', Add</i>	0.55	
<i>For Installation In Metal Stud Wall, Add</i>	0.37	
26 05 33 13-0422 LF 1" Electrical Metallic Tubing (EMT) Conduit.....	4.93	1.61
<i>For Work In Restricted Working Space, Add</i>	1.21	
<i>For >1,000, Deduct</i>	-0.39	
<i>For Installation In Concrete Beam, Slab, Etc. (Excludes Concrete), Add</i>	0.61	
<i>For Installation In Wood Stud Wall (Includes Drilling), Add</i>	1.01	
<i>For >250 To 500, Deduct</i>	-0.04	
<i>For >500 To 1,000, Deduct</i>	-0.27	
<i>For Installation Above 14', Add</i>	0.61	
<i>For Installation In Metal Stud Wall, Add</i>	0.40	
26 05 33 13-0423 LF 1-1/4" Electrical Metallic Tubing (EMT) Conduit	5.81	1.82
<i>For Work In Restricted Working Space, Add</i>	1.37	
<i>For >1,000, Deduct</i>	-0.47	
<i>For Installation In Concrete Beam, Slab, Etc. (Excludes Concrete), Add</i>	0.68	
<i>For Installation In Wood Stud Wall (Includes Drilling), Add</i>	1.14	
<i>For >250 To 500, Deduct</i>	-0.06	
<i>For >500 To 1,000, Deduct</i>	-0.32	
<i>For Installation Above 14', Add</i>	0.68	
<i>For Installation In Metal Stud Wall, Add</i>	0.46	
26 05 33 13-0424 LF 1-1/2" Electrical Metallic Tubing (EMT) Conduit	6.68	2.06
<i>For Work In Restricted Working Space, Add</i>	1.54	
<i>For >1,000, Deduct</i>	-0.54	
<i>For Installation In Concrete Beam, Slab, Etc. (Excludes Concrete), Add</i>	0.77	
<i>For Installation In Wood Stud Wall (Includes Drilling), Add</i>	1.29	
<i>For >250 To 500, Deduct</i>	-0.08	
<i>For >500 To 1,000, Deduct</i>	-0.37	
<i>For Installation Above 14', Add</i>	0.77	
<i>For Installation In Metal Stud Wall, Add</i>	0.51	
26 05 33 13-0425 LF 2" Electrical Metallic Tubing (EMT) Conduit.....	7.79	2.36
<i>For Work In Restricted Working Space, Add</i>	1.77	
<i>For >1,000, Deduct</i>	-0.63	
<i>For Installation In Concrete Beam, Slab, Etc. (Excludes Concrete), Add</i>	0.88	
<i>For Installation In Wood Stud Wall (Includes Drilling), Add</i>	1.47	
<i>For >250 To 500, Deduct</i>	-0.10	
<i>For >500 To 1,000, Deduct</i>	-0.44	
<i>For Installation Above 14', Add</i>	0.88	
<i>For Installation In Metal Stud Wall, Add</i>	0.59	
26 05 33 13-0426 LF 2-1/2" Electrical Metallic Tubing (EMT) Conduit	9.86	2.80
<i>For Work In Restricted Working Space, Add</i>	2.10	
<i>For >1,000, Deduct</i>	-0.81	
<i>For Installation In Concrete Beam, Slab, Etc. (Excludes Concrete), Add</i>	1.05	
<i>For Installation In Wood Stud Wall (Includes Drilling), Add</i>	1.75	
<i>For >250 To 500, Deduct</i>	-0.14	
<i>For >500 To 1,000, Deduct</i>	-0.56	
<i>For Installation Above 14', Add</i>	1.05	
<i>For Installation In Metal Stud Wall, Add</i>	0.70	
26 05 33 13-0427 LF 3" Electrical Metallic Tubing (EMT) Conduit.....	11.75	3.24
<i>For Work In Restricted Working Space, Add</i>	2.43	
<i>For >1,000, Deduct</i>	-0.97	
<i>For Installation In Concrete Beam, Slab, Etc. (Excludes Concrete), Add</i>	1.21	
<i>For Installation In Wood Stud Wall (Includes Drilling), Add</i>	2.02	
<i>For >250 To 500, Deduct</i>	-0.18	
<i>For >500 To 1,000, Deduct</i>	-0.68	
<i>For Installation Above 14', Add</i>	1.21	
<i>For Installation In Metal Stud Wall, Add</i>	0.81	
26 05 33 13-0428 LF 3-1/2" Electrical Metallic Tubing (EMT) Conduit	14.59	3.82
<i>For Work In Restricted Working Space, Add</i>	2.87	
<i>For >1,000, Deduct</i>	-1.22	
<i>For Installation In Concrete Beam, Slab, Etc. (Excludes Concrete), Add</i>	1.43	
<i>For Installation In Wood Stud Wall (Includes Drilling), Add</i>	2.39	
<i>For >250 To 500, Deduct</i>	-0.25	
<i>For >500 To 1,000, Deduct</i>	-0.86	
<i>For Installation Above 14', Add</i>	1.43	
<i>For Installation In Metal Stud Wall, Add</i>	0.96	
26 05 33 13-0429 LF 4" Electrical Metallic Tubing (EMT) Conduit.....	19.82	5.73
<i>For Work In Restricted Working Space, Add</i>	4.29	
<i>For >1,000, Deduct</i>	-1.62	
<i>For Installation In Concrete Beam, Slab, Etc. (Excludes Concrete), Add</i>	2.15	
<i>For Installation In Wood Stud Wall (Includes Drilling), Add</i>	3.58	
<i>For >250 To 500, Deduct</i>	-0.28	
<i>For >500 To 1,000, Deduct</i>	-1.13	
<i>For Installation Above 14', Add</i>	2.15	
<i>For Installation In Metal Stud Wall, Add</i>	1.43	

26 05 33 13-0430 Electrical Metallic Tubing (EMT) 90 Degree Elbows (26 05 33 13-0418)
 See CSI section 26 05 33 13-1066 for conduit field bending.

26 05 33 13-0431 Electrical Metallic Tubing (EMT) Set Screw Couplings (26 05 33 13-0418)

26 Electrical**26 05 Common Work Results For Electrical****26 05 33 Raceway And Boxes For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33	13-0432	EA	1/2" Electrical Metallic Tubing (EMT) Set Screw Coupling..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	3.84 1.10 0.55	1.76
26 05 33	13-0433	EA	3/4" Electrical Metallic Tubing (EMT) Set Screw Coupling..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	4.69 1.32 0.66	1.76
26 05 33	13-0434	EA	1" Electrical Metallic Tubing (EMT) Set Screw Coupling..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	5.62 1.54 0.77	2.06
26 05 33	13-0435	EA	1-1/4" Electrical Metallic Tubing (EMT) Set Screw Coupling..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	7.47 1.99 0.99	2.65
26 05 33	13-0436	EA	1-1/2" Electrical Metallic Tubing (EMT) Set Screw Coupling..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	9.32 2.43 1.21	3.24
26 05 33	13-0437	EA	2" Electrical Metallic Tubing (EMT) Set Screw Coupling..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	12.64 3.31 1.65	4.41
26 05 33	13-0438	EA	2-1/2" Electrical Metallic Tubing (EMT) Set Screw Coupling..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	18.22 4.41 2.21	5.89
26 05 33	13-0439	EA	3" Electrical Metallic Tubing (EMT) Set Screw Coupling..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	22.65 5.51 2.76	6.77
26 05 33	13-0440	EA	3-1/2" Electrical Metallic Tubing (EMT) Set Screw Coupling..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	27.25 6.62 3.31	7.35
26 05 33	13-0441	EA	4" Electrical Metallic Tubing (EMT) Set Screw Coupling..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	73.25 20.15 10.07	20.74
26 05 33 13-0442 Electrical Metallic Tubing (EMT) Compression Couplings (26 05 33 13-0418)					
26 05 33	13-0443	EA	1/2 Electrical Metallic Tubing (EMT) Compression Coupling..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	5.09 1.45 0.72	1.93
26 05 33	13-0444	EA	3/4" Electrical Metallic Tubing (EMT) Compression Coupling..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	5.54 1.54 0.77	2.06
26 05 33	13-0445	EA	1" Electrical Metallic Tubing (EMT) Compression Coupling..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	8.03 2.21 1.10	2.94
26 05 33	13-0446	EA	1-1/4" Electrical Metallic Tubing (EMT) Compression Coupling..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	10.01 2.65 1.32	3.53
26 05 33	13-0447	EA	1-1/2" Electrical Metallic Tubing (EMT) Compression Coupling..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	11.99 3.09 1.55	4.12
26 05 33	13-0448	EA	2" Electrical Metallic Tubing (EMT) Compression Coupling..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	14.93 3.75 1.88	5.00
26 05 33	13-0449	EA	2-1/2" Electrical Metallic Tubing (EMT) Compression Coupling..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	25.25 5.55 2.78	7.40
26 05 33	13-0450	EA	3" Electrical Metallic Tubing (EMT) Compression Coupling..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	28.89 6.17 3.09	8.23
26 05 33	13-0451	EA	3-1/2" Electrical Metallic Tubing (EMT) Compression Coupling..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	36.61 7.72 3.86	10.30
26 05 33	13-0452	EA	4" Electrical Metallic Tubing (EMT) Compression Coupling..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i>	44.92 9.93 4.96	13.24
26 05 33 13-0453 Electrical Metallic Tubing (EMT) Box Connectors With Set Screw (26 05 33 13-0418)					
26 05 33	13-0454	EA	1/2" Electrical Metallic Tubing (EMT) Box Connector With Set Screw..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	3.87 1.10 0.55 1.10	1.47
26 05 33	13-0455	EA	3/4" Electrical Metallic Tubing (EMT) Box Connector With Set Screw..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.73 1.32 0.66 1.32	1.76
26 05 33	13-0456	EA	1" Electrical Metallic Tubing (EMT) Box Connector With Set Screw..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.61 1.54 0.77 1.54	2.06
26 05 33	13-0457	EA	1-1/4" Electrical Metallic Tubing (EMT) Box Connector With Set Screw..... <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8.12 2.21 1.10 2.21	2.94



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 13-0458 EA 1-1/2" Electrical Metallic Tubing (EMT) Box Connector With Set Screw.....	10.15	3.53
<i>For Work In Restricted Working Space, Add</i>	2.65	
<i>For Installation Above 14', Add</i>	1.32	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2.65	
26 05 33 13-0459 EA 2" Electrical Metallic Tubing (EMT) Box Connector With Set Screw.....	12.76	4.41
<i>For Work In Restricted Working Space, Add</i>	3.31	
<i>For Installation Above 14', Add</i>	1.65	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	3.31	
26 05 33 13-0460 EA 2-1/2" Electrical Metallic Tubing (EMT) Box Connector With Set Screw.....	18.91	5.89
<i>For Work In Restricted Working Space, Add</i>	4.41	
<i>For Installation Above 14', Add</i>	2.21	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.41	
26 05 33 13-0461 EA 3" Electrical Metallic Tubing (EMT) Box Connector With Set Screw.....	23.38	7.35
<i>For Work In Restricted Working Space, Add</i>	5.51	
<i>For Installation Above 14', Add</i>	2.76	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.51	
26 05 33 13-0462 EA 3-1/2" Electrical Metallic Tubing (EMT) Box Connector With Set Screw.....	28.00	8.82
<i>For Work In Restricted Working Space, Add</i>	6.62	
<i>For Installation Above 14', Add</i>	3.31	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	6.62	
26 05 33 13-0463 EA 4" Electrical Metallic Tubing (EMT) Box Connector With Set Screw.....	32.61	10.30
<i>For Work In Restricted Working Space, Add</i>	7.72	
<i>For Installation Above 14', Add</i>	3.86	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	7.72	
26 05 33 13-0464 Electrical Metallic Tubing (EMT) Insulated Box Connectors With Set Screw		
<small>(26 05 33 13-0418)</small>		
26 05 33 13-0465 EA 1/2" Electrical Metallic Tubing (EMT) Insulated Box Connector With Set Screw	5.53	1.99
<i>For Work In Restricted Working Space, Add</i>	1.48	
<i>For Installation Above 14', Add</i>	0.74	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	1.48	
26 05 33 13-0466 EA 3/4" Electrical Metallic Tubing (EMT) Insulated Box Connector With Set Screw	6.33	2.14
<i>For Work In Restricted Working Space, Add</i>	1.61	
<i>For Installation Above 14', Add</i>	0.80	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	1.61	
26 05 33 13-0467 EA 1" Electrical Metallic Tubing (EMT) Insulated Box Connector With Set Screw	8.17	2.65
<i>For Work In Restricted Working Space, Add</i>	1.97	
<i>For Installation Above 14', Add</i>	0.98	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	1.97	
26 05 33 13-0468 EA 1-1/4" Electrical Metallic Tubing (EMT) Insulated Box Connector With Set Screw	11.22	3.38
<i>For Work In Restricted Working Space, Add</i>	2.51	
<i>For Installation Above 14', Add</i>	1.26	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2.51	
26 05 33 13-0469 EA 1-1/2" Electrical Metallic Tubing (EMT) Insulated Box Connector With Set Screw	13.96	3.90
<i>For Work In Restricted Working Space, Add</i>	2.93	
<i>For Installation Above 14', Add</i>	1.47	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2.93	
26 05 33 13-0470 EA 2" Electrical Metallic Tubing (EMT) Insulated Box Connector With Set Screw	17.80	4.70
<i>For Work In Restricted Working Space, Add</i>	3.53	
<i>For Installation Above 14', Add</i>	1.76	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	3.53	
26 05 33 13-0471 EA 2-1/2" Electrical Metallic Tubing (EMT) Insulated Box Connector With Set Screw	43.09	6.55
<i>For Work In Restricted Working Space, Add</i>	4.90	
<i>For Installation Above 14', Add</i>	2.45	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.90	
26 05 33 13-0472 EA 3" Electrical Metallic Tubing (EMT) Insulated Box Connector With Set Screw	53.40	8.67
<i>For Work In Restricted Working Space, Add</i>	6.53	
<i>For Installation Above 14', Add</i>	3.27	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	6.53	
26 05 33 13-0473 EA 3-1/2" Electrical Metallic Tubing (EMT) Insulated Box Connector With Set Screw	71.00	11.18
<i>For Work In Restricted Working Space, Add</i>	8.40	
<i>For Installation Above 14', Add</i>	4.20	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8.40	
26 05 33 13-0474 EA 4" Electrical Metallic Tubing (EMT) Insulated Box Connector With Set Screw	83.81	14.71
<i>For Work In Restricted Working Space, Add</i>	11.03	
<i>For Installation Above 14', Add</i>	5.52	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	11.03	
26 05 33 13-0475 Electrical Metallic Tubing (EMT) Insulated Box Compression Connectors		
<small>(33 13-0418)</small>		
26 05 33 13-0476 EA 1/2" Electrical Metallic Tubing (EMT) Insulated Box Compression Connector.....	6.14	1.99
<i>For Work In Restricted Working Space, Add</i>	1.48	
<i>For Installation Above 14', Add</i>	0.74	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	1.48	
26 05 33 13-0477 EA 3/4" Electrical Metallic Tubing (EMT) Insulated Box Compression Connector.....	7.06	2.14
<i>For Work In Restricted Working Space, Add</i>	1.61	
<i>For Installation Above 14', Add</i>	0.80	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	1.61	
26 05 33 13-0478 EA 1" Electrical Metallic Tubing (EMT) Insulated Box Compression Connector.....	9.47	2.65
<i>For Work In Restricted Working Space, Add</i>	1.97	
<i>For Installation Above 14', Add</i>	0.98	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	1.97	

26 Electrical**26 05 Common Work Results For Electrical****26 05 33 Raceway And Boxes For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 13-0479	EA		1-1/4" Electrical Metallic Tubing (EMT) Insulated Box Compression Connector.....	14.22	3.38
			<i>For Work In Restricted Working Space, Add</i>	2.51	
			<i>For Installation Above 14', Add</i>	1.26	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2.51	
26 05 33 13-0480	EA		1-1/2" Electrical Metallic Tubing (EMT) Insulated Box Compression Connector.....	18.26	3.90
			<i>For Work In Restricted Working Space, Add</i>	2.93	
			<i>For Installation Above 14', Add</i>	1.47	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2.93	
26 05 33 13-0481	EA		2" Electrical Metallic Tubing (EMT) Insulated Box Compression Connector.....	24.09	4.70
			<i>For Work In Restricted Working Space, Add</i>	3.53	
			<i>For Installation Above 14', Add</i>	1.76	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	3.53	
26 05 33 13-0482	EA		2-1/2" Electrical Metallic Tubing (EMT) Insulated Box Compression Connector.....	64.17	6.55
			<i>For Work In Restricted Working Space, Add</i>	4.90	
			<i>For Installation Above 14', Add</i>	2.45	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.90	
26 05 33 13-0483	EA		3" Electrical Metallic Tubing (EMT) Insulated Box Compression Connector.....	83.41	8.67
			<i>For Work In Restricted Working Space, Add</i>	6.53	
			<i>For Installation Above 14', Add</i>	3.27	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	6.53	
26 05 33 13-0484	EA		3-1/2" Electrical Metallic Tubing (EMT) Insulated Box Compression Connector.....	113.18	11.18
			<i>For Work In Restricted Working Space, Add</i>	8.40	
			<i>For Installation Above 14', Add</i>	4.20	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8.40	
26 05 33 13-0485	EA		4" Electrical Metallic Tubing (EMT) Insulated Box Compression Connector.....	128.42	14.71
			<i>For Work In Restricted Working Space, Add</i>	11.03	
			<i>For Installation Above 14', Add</i>	5.52	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	11.03	
26 05 33 13-0486			Electrical Metallic Tubing (EMT) To Flexible Conduit Compression Adapters		
			<small>(26 05 33 13-0418)</small>		
26 05 33 13-0487	EA		1/2" To 3/8" Electrical Metallic Tubing (EMT) To Flexible Conduit Compression Adapter	7.98	2.65
			<i>For Work In Restricted Working Space, Add</i>	1.96	
			<i>For Installation Above 14', Add</i>	0.98	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	1.96	
26 05 33 13-0488	EA		1/2" Electrical Metallic Tubing (EMT) To Flexible Conduit Compression Adapter.....	9.18	2.65
			<i>For Work In Restricted Working Space, Add</i>	1.96	
			<i>For Installation Above 14', Add</i>	0.98	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	1.96	
26 05 33 13-0489	EA		3/4" Electrical Metallic Tubing (EMT) To Flexible Conduit Compression Adapter.....	10.68	2.87
			<i>For Work In Restricted Working Space, Add</i>	2.18	
			<i>For Installation Above 14', Add</i>	1.09	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2.18	
26 05 33 13-0490	EA		1" Electrical Metallic Tubing (EMT) To Flexible Conduit Compression Adapter.....	17.22	3.31
			<i>For Work In Restricted Working Space, Add</i>	2.48	
			<i>For Installation Above 14', Add</i>	1.24	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2.48	
26 05 33 13-0491	EA		1-1/4" Electrical Metallic Tubing (EMT) To Flexible Conduit Compression Adapter.....	20.88	3.97
			<i>For Work In Restricted Working Space, Add</i>	3.00	
			<i>For Installation Above 14', Add</i>	1.50	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	3.00	
26 05 33 13-0492	EA		1-1/2" Electrical Metallic Tubing (EMT) To Flexible Conduit Compression Adapter.....	23.75	4.56
			<i>For Work In Restricted Working Space, Add</i>	3.42	
			<i>For Installation Above 14', Add</i>	1.71	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	3.42	
26 05 33 13-0493	EA		2" Electrical Metallic Tubing (EMT) To Flexible Conduit Compression Adapter.....	32.20	5.74
			<i>For Work In Restricted Working Space, Add</i>	4.28	
			<i>For Installation Above 14', Add</i>	2.14	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.28	
26 05 33 13-0494			Intermediate Metal Conduit (IMC) <small>(26 05 33 13-0041)</small>		
			Note: Exposed installation, branch and feeder conduit. Excludes supporting strap, hanger and fastening.		
26 05 33 13-0495			Intermediate Metal Conduit (IMC) Conduit <small>(26 05 33 13-0494)</small>		
			Note: Includes field bending conduit up to 1".		
26 05 33 13-0496	LF		1/2" Intermediate Metal Conduit (IMC) Conduit	4.49	1.47
			<i>For >500 To 1,000, Deduct</i>	-0.06	
			<i>For Installation In Concrete Beam, Slab, Etc. (Excludes Concrete), Add</i>	0.55	
			<i>For >1,000, Deduct</i>	-0.08	
			<i>For Installation Above 14', Add</i>	0.55	
			<i>For Work In Restricted Working Space, Add</i>	1.10	
			<i>For >250 To 500, Deduct</i>	-0.04	
			<i>For Installation In Wood Stud Wall (Includes Drilling), Add</i>	0.92	
			<i>For Installation In Metal Stud Wall, Add</i>	0.37	
26 05 33 13-0497	LF		3/4" Intermediate Metal Conduit (IMC) Conduit	5.01	1.61
			<i>For >500 To 1,000, Deduct</i>	-0.07	
			<i>For Installation In Concrete Beam, Slab, Etc. (Excludes Concrete), Add</i>	0.61	
			<i>For >1,000, Deduct</i>	-0.10	
			<i>For Installation Above 14', Add</i>	0.61	
			<i>For Work In Restricted Working Space, Add</i>	1.21	
			<i>For >250 To 500, Deduct</i>	-0.05	
			<i>For Installation In Wood Stud Wall (Includes Drilling), Add</i>	1.01	
			<i>For Installation In Metal Stud Wall, Add</i>	0.40	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 13-0498 LF 1" Intermediate Metal Conduit (IMC) Conduit	5.90	1.76
For >500 To 1,000, Deduct	-0.11	
For Installation In Concrete Beam, Slab, Etc. (Excludes Concrete), Add	0.66	
For >1,000, Deduct	-0.15	
For Installation Above 14', Add	0.66	
For Work In Restricted Working Space, Add	1.32	
For >250 To 500, Deduct	-0.07	
For Installation In Wood Stud Wall (Includes Drilling), Add	1.10	
For Installation In Metal Stub Wall, Add	0.44	
26 05 33 13-0499 LF 1-1/4" Intermediate Metal Conduit (IMC) Conduit	7.03	3.53
For >500 To 1,000, Deduct	-0.14	
For Installation In Concrete Beam, Slab, Etc. (Excludes Concrete), Add	0.77	
For >1,000, Deduct	-0.19	
For Installation Above 14', Add	0.77	
For Work In Restricted Working Space, Add	1.54	
For >250 To 500, Deduct	-0.09	
For Installation In Wood Stud Wall (Includes Drilling), Add	1.29	
For Installation In Metal Stub Wall, Add	0.51	
26 05 33 13-0500 LF 1-1/2" Intermediate Metal Conduit (IMC) Conduit	8.12	2.36
For >500 To 1,000, Deduct	-0.17	
For Installation In Concrete Beam, Slab, Etc. (Excludes Concrete), Add	0.88	
For >1,000, Deduct	-0.22	
For Installation Above 14', Add	0.88	
For Work In Restricted Working Space, Add	1.77	
For >250 To 500, Deduct	-0.11	
For Installation In Wood Stud Wall (Includes Drilling), Add	1.47	
For Installation In Metal Stub Wall, Add	0.59	
26 05 33 13-0501 LF 2" Intermediate Metal Conduit (IMC) Conduit	9.65	2.65
For >500 To 1,000, Deduct	-0.23	
For Installation In Concrete Beam, Slab, Etc. (Excludes Concrete), Add	0.99	
For >1,000, Deduct	-0.30	
For Installation Above 14', Add	0.99	
For Work In Restricted Working Space, Add	1.99	
For >250 To 500, Deduct	-0.15	
For Installation In Wood Stud Wall (Includes Drilling), Add	1.66	
For Installation In Metal Stub Wall, Add	0.66	
26 05 33 13-0502 LF 2-1/2" Intermediate Metal Conduit (IMC) Conduit	15.53	3.53
For >500 To 1,000, Deduct	-0.50	
For Installation In Concrete Beam, Slab, Etc. (Excludes Concrete), Add	1.32	
For >1,000, Deduct	-0.67	
For Installation Above 14', Add	1.32	
For Work In Restricted Working Space, Add	2.65	
For >250 To 500, Deduct	-0.34	
For Installation In Wood Stud Wall (Includes Drilling), Add	2.21	
For Installation In Metal Stub Wall, Add	0.88	
26 05 33 13-0503 LF 3" Intermediate Metal Conduit (IMC) Conduit	19.28	4.41
For >500 To 1,000, Deduct	-0.62	
For Installation In Concrete Beam, Slab, Etc. (Excludes Concrete), Add	1.65	
For >1,000, Deduct	-0.83	
For Installation Above 14', Add	1.65	
For Work In Restricted Working Space, Add	3.31	
For >250 To 500, Deduct	-0.41	
For Installation In Wood Stud Wall (Includes Drilling), Add	2.76	
For Installation In Metal Stub Wall, Add	1.10	
26 05 33 13-0504 LF 3-1/2" Intermediate Metal Conduit (IMC) Conduit	22.80	5.29
For >500 To 1,000, Deduct	-0.72	
For Installation In Concrete Beam, Slab, Etc. (Excludes Concrete), Add	1.99	
For >1,000, Deduct	-0.96	
For Installation Above 14', Add	1.99	
For Work In Restricted Working Space, Add	3.97	
For >250 To 500, Deduct	-0.48	
For Installation In Wood Stud Wall (Includes Drilling), Add	3.31	
For Installation In Metal Stub Wall, Add	1.32	
26 05 33 13-0505 LF 4" Intermediate Metal Conduit (IMC) Conduit	26.69	6.18
For >500 To 1,000, Deduct	-0.84	
For Installation In Concrete Beam, Slab, Etc. (Excludes Concrete), Add	2.32	
For >1,000, Deduct	-1.13	
For Installation Above 14', Add	2.32	
For Work In Restricted Working Space, Add	4.63	
For >250 To 500, Deduct	-0.56	
For Installation In Wood Stud Wall (Includes Drilling), Add	3.86	
For Installation In Metal Stub Wall, Add	1.54	
26 05 33 13-0506 Intermediate Metal Conduit (IMC) 90 Degree Elbows <small>(26 05 33 13-0494)</small>		
See CSI section 26 05 33 13-1066 for conduit field bending.		
26 05 33 13-0507 EA 1" Intermediate Metal Conduit (IMC) 90 Degree Elbow	34.55	11.10
For Installation Above 14', Add	4.15	
For Work In Restricted Working Space, Add	8.30	
26 05 33 13-0508 EA 1-1/4" Intermediate Metal Conduit (IMC) 90 Degree Elbow	41.78	12.86
For Installation Above 14', Add	4.82	
For Work In Restricted Working Space, Add	9.65	
26 05 33 13-0509 EA 1-1/2" Intermediate Metal Conduit (IMC) 90 Degree Elbow	49.07	14.78
For Installation Above 14', Add	5.53	
For Work In Restricted Working Space, Add	11.07	

26 Electrical**26 05 Common Work Results For Electrical****26 05 33 Raceway And Boxes For Electrical Systems**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 13-0510 EA 2" Intermediate Metal Conduit (IMC) 90 Degree Elbow	58.11	16.25
For Installation Above 14', Add	6.09	
For Work In Restricted Working Space, Add	12.17	
26 05 33 13-0511 EA 2-1/2" Intermediate Metal Conduit (IMC) 90 Degree Elbow	80.49	20.29
For Installation Above 14', Add	7.61	
For Work In Restricted Working Space, Add	15.22	
26 05 33 13-0512 EA 3" Intermediate Metal Conduit (IMC) 90 Degree Elbow	114.67	27.64
For Installation Above 14', Add	10.37	
For Work In Restricted Working Space, Add	20.73	
26 05 33 13-0513 EA 3-1/2" Intermediate Metal Conduit (IMC) 90 Degree Elbow	158.39	31.17
For Installation Above 14', Add	11.69	
For Work In Restricted Working Space, Add	23.39	
26 05 33 13-0514 EA 4" Intermediate Metal Conduit (IMC) 90 Degree Elbow	194.75	40.59
For Installation Above 14', Add	15.22	
For Work In Restricted Working Space, Add	30.44	
26 05 33 13-0515 Intermediate Metal Conduit (IMC) Bushing Sets With Locknut (26 05 33 13-0494)		
26 05 33 13-0516 EA 1/2" Intermediate Metal Conduit (IMC) Bushing Set With Locknut.....	9.87	3.82
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	2.87	
26 05 33 13-0517 EA 3/4" Intermediate Metal Conduit (IMC) Bushing Set With Locknut.....	11.54	0.44
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	3.31	
26 05 33 13-0518 EA 1" Intermediate Metal Conduit (IMC) Bushing Set With Locknut.....	14.83	5.58
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	4.19	
26 05 33 13-0519 EA 1-1/4" Intermediate Metal Conduit (IMC) Bushing Set With Locknut.....	18.04	6.77
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	5.07	
26 05 33 13-0520 EA 1-1/2" Intermediate Metal Conduit (IMC) Bushing Set With Locknut.....	19.99	7.35
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	5.51	
26 05 33 13-0521 EA 2" Intermediate Metal Conduit (IMC) Bushing Set With Locknut.....	25.45	9.11
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	6.84	
26 05 33 13-0522 EA 2-1/2" Intermediate Metal Conduit (IMC) Bushing Set With Locknut.....	45.07	14.71
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	11.03	
26 05 33 13-0523 EA 3" Intermediate Metal Conduit (IMC) Bushing Set With Locknut.....	57.38	20.00
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	15.00	
26 05 33 13-0524 EA 3-1/2" Intermediate Metal Conduit (IMC) Bushing Set With Locknut.....	72.90	23.82
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	17.87	
26 05 33 13-0525 EA 4" Intermediate Metal Conduit (IMC) Bushing Set With Locknut.....	85.61	27.64
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	20.74	
26 05 33 13-0526 Intermediate Metal Conduit (IMC) Erickson Or "Kwik-Couple" Fittings (26 05 33 13-0494)		
Note: 3-Piece coupling.		
26 05 33 13-0527 EA 1/2" Intermediate Metal Conduit (IMC) Erickson Or "Kwik-Couple" Fitting.....	31.76	11.76
For Installation Above 14', Add	4.42	
For Work In Restricted Working Space, Add	8.84	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	8.84	
26 05 33 13-0528 EA 3/4" Intermediate Metal Conduit (IMC) Erickson Or "Kwik-Couple" Fitting.....	35.84	13.16
For Installation Above 14', Add	4.93	
For Work In Restricted Working Space, Add	9.86	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	9.86	
26 05 33 13-0529 EA 1" Intermediate Metal Conduit (IMC) Erickson Or "Kwik-Couple" Fitting.....	42.34	14.63
For Installation Above 14', Add	5.49	
For Work In Restricted Working Space, Add	10.98	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	10.98	
26 05 33 13-0530 EA 1-1/4" Intermediate Metal Conduit (IMC) Erickson Or "Kwik-Couple" Fitting.....	50.62	16.03
For Installation Above 14', Add	6.01	
For Work In Restricted Working Space, Add	12.02	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	12.02	
26 05 33 13-0531 EA 1-1/2" Intermediate Metal Conduit (IMC) Erickson Or "Kwik-Couple" Fitting.....	57.07	17.50
For Installation Above 14', Add	6.57	
For Work In Restricted Working Space, Add	13.15	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	13.15	
26 05 33 13-0532 EA 2" Intermediate Metal Conduit (IMC) Erickson Or "Kwik-Couple" Fitting.....	73.94	18.97
For Installation Above 14', Add	7.12	
For Work In Restricted Working Space, Add	14.24	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	14.24	
26 05 33 13-0533 EA 2-1/2" Intermediate Metal Conduit (IMC) Erickson Or "Kwik-Couple" Fitting.....	115.46	23.53
For Installation Above 14', Add	8.82	
For Work In Restricted Working Space, Add	17.65	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	17.65	
26 05 33 13-0534 EA 3" Intermediate Metal Conduit (IMC) Erickson Or "Kwik-Couple" Fitting.....	159.89	29.41
For Installation Above 14', Add	11.03	
For Work In Restricted Working Space, Add	22.06	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	22.06	
26 05 33 13-0535 EA 3-1/2" Intermediate Metal Conduit (IMC) Erickson Or "Kwik-Couple" Fitting.....	227.00	35.29
For Installation Above 14', Add	13.24	
For Work In Restricted Working Space, Add	26.48	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	26.48	
26 05 33 13-0536 EA 4" Intermediate Metal Conduit (IMC) Erickson Or "Kwik-Couple" Fitting.....	259.81	38.24
For Installation Above 14', Add	14.34	
For Work In Restricted Working Space, Add	28.67	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	28.67	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 13-0537 Rigid Galvanized Steel (RGS) Or Intermediate Metal Conduit (IMC) To Electrical Metallic Tubing (EMT) Connectors <small>(26 05 33 13-0494)</small>		
26 05 33 13-0538 EA 1/2" Rigid Galvanized Steel (RGS) Or Intermediate Metal Conduit (IMC) To Electrical Metallic Tubing (EMT) Connector.....	17.22	5.89
For Installation Above 14', Add	2.21	
For Work In Restricted Working Space, Add	4.41	
26 05 33 13-0539 EA 3/4" Rigid Galvanized Steel (RGS) Or Intermediate Metal Conduit (IMC) To Electrical Metallic Tubing (EMT) Connector.....	19.14	6.47
For Installation Above 14', Add	2.43	
For Work In Restricted Working Space, Add	4.85	
26 05 33 13-0540 EA 1" Rigid Galvanized Steel (RGS) Or Intermediate Metal Conduit (IMC) To Electrical Metallic Tubing (EMT) Connector.....	21.93	7.35
For Installation Above 14', Add	2.76	
For Work In Restricted Working Space, Add	5.52	
26 05 33 13-0541 EA 1-1/4" Rigid Galvanized Steel (RGS) Or Intermediate Metal Conduit (IMC) To Electrical Metallic Tubing (EMT) Connector.....	24.52	7.94
For Installation Above 14', Add	2.98	
For Work In Restricted Working Space, Add	5.96	
26 05 33 13-0542 EA 1-1/2" Rigid Galvanized Steel (RGS) Or Intermediate Metal Conduit (IMC) To Electrical Metallic Tubing (EMT) Connector.....	28.57	8.82
For Installation Above 14', Add	3.31	
For Work In Restricted Working Space, Add	6.62	
26 05 33 13-0543 EA 2" Rigid Galvanized Steel (RGS) Or Intermediate Metal Conduit (IMC) To Electrical Metallic Tubing (EMT) Connector.....	33.89	9.71
For Installation Above 14', Add	3.64	
For Work In Restricted Working Space, Add	7.28	
26 05 33 13-0544 EA 2-1/2" Rigid Galvanized Steel (RGS) Or Intermediate Metal Conduit (IMC) To Electrical Metallic Tubing (EMT) Connector.....	44.84	11.76
For Installation Above 14', Add	4.41	
For Work In Restricted Working Space, Add	8.82	
26 05 33 13-0545 EA 3" Rigid Galvanized Steel (RGS) Or Intermediate Metal Conduit (IMC) To Electrical Metallic Tubing (EMT) Connector.....	55.60	14.71
For Installation Above 14', Add	5.52	
For Work In Restricted Working Space, Add	11.03	
26 05 33 13-0546 EA 3-1/2" Rigid Galvanized Steel (RGS) Or Intermediate Metal Conduit (IMC) To Electrical Metallic Tubing (EMT) Connector.....	66.77	17.65
For Installation Above 14', Add	6.62	
For Work In Restricted Working Space, Add	13.24	
26 05 33 13-0547 EA 4" Rigid Galvanized Steel (RGS) Or Intermediate Metal Conduit (IMC) To Electrical Metallic Tubing (EMT) Connector.....	74.70	19.12
For Installation Above 14', Add	7.17	
For Work In Restricted Working Space, Add	14.34	
26 05 33 13-0548 Intermediate Metal Conduit (IMC) Rain Tight Threaded Hubs <small>(26 05 33 13-0494)</small>		
26 05 33 13-0549 EA 1/2" Intermediate Metal Conduit (IMC) Rain Tight Threaded Hub	15.76	5.89
For Installation Above 14', Add	2.21	
For Work In Restricted Working Space, Add	4.41	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	4.41	
26 05 33 13-0550 EA 3/4" Intermediate Metal Conduit (IMC) Rain Tight Threaded Hub	19.95	7.35
For Installation Above 14', Add	2.76	
For Work In Restricted Working Space, Add	5.51	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	5.51	
26 05 33 13-0551 EA 1" Intermediate Metal Conduit (IMC) Rain Tight Threaded Hub	24.38	8.82
For Installation Above 14', Add	3.31	
For Work In Restricted Working Space, Add	6.62	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	6.62	
26 05 33 13-0552 EA 1-1/4" Intermediate Metal Conduit (IMC) Rain Tight Threaded Hub	29.02	10.30
For Installation Above 14', Add	3.86	
For Work In Restricted Working Space, Add	7.72	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	7.72	
26 05 33 13-0553 EA 1-1/2" Intermediate Metal Conduit (IMC) Rain Tight Threaded Hub	33.64	11.76
For Installation Above 14', Add	4.41	
For Work In Restricted Working Space, Add	8.82	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	8.82	
26 05 33 13-0554 EA 2" Intermediate Metal Conduit (IMC) Rain Tight Threaded Hub	39.21	13.24
For Installation Above 14', Add	4.96	
For Work In Restricted Working Space, Add	9.93	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	9.93	
26 05 33 13-0555 EA 2-1/2" Intermediate Metal Conduit (IMC) Rain Tight Threaded Hub	47.02	14.71
For Installation Above 14', Add	5.52	
For Work In Restricted Working Space, Add	11.03	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	11.03	
26 05 33 13-0556 EA 3" Intermediate Metal Conduit (IMC) Rain Tight Threaded Hub	54.24	16.17
For Installation Above 14', Add	6.07	
For Work In Restricted Working Space, Add	12.13	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	12.13	
26 05 33 13-0557 EA 3-1/2" Intermediate Metal Conduit (IMC) Rain Tight Threaded Hub	65.70	19.12
For Installation Above 14', Add	7.17	
For Work In Restricted Working Space, Add	14.34	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	14.34	
26 05 33 13-0558 EA 4" Intermediate Metal Conduit (IMC) Rain Tight Threaded Hub	74.05	20.58
For Installation Above 14', Add	7.72	
For Work In Restricted Working Space, Add	15.44	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	15.44	

26 Electrical**26 05 Common Work Results For Electrical****26 05 33 Raceway And Boxes For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 13-0559			Intermediate Metal Conduit (IMC) Expansion Fittings (26 05 33 13-0494)		
26 05 33 13-0560	EA		1/2" Intermediate Metal Conduit (IMC) Expansion Fitting	74.72	11.76
			<i>For Installation Above 14', Add</i>	4.41	
			<i>For Work In Restricted Working Space, Add</i>	8.83	
26 05 33 13-0561	EA		3/4" Intermediate Metal Conduit (IMC) Expansion Fitting	82.92	13.24
			<i>For Installation Above 14', Add</i>	4.96	
			<i>For Work In Restricted Working Space, Add</i>	9.93	
26 05 33 13-0562	EA		1" Intermediate Metal Conduit (IMC) Expansion Fitting	92.15	14.71
			<i>For Installation Above 14', Add</i>	5.52	
			<i>For Work In Restricted Working Space, Add</i>	11.03	
26 05 33 13-0563	EA		1-1/4" Intermediate Metal Conduit (IMC) Expansion Fitting	109.54	16.17
			<i>For Installation Above 14', Add</i>	6.07	
			<i>For Work In Restricted Working Space, Add</i>	12.14	
26 05 33 13-0564	EA		1-1/2" Intermediate Metal Conduit (IMC) Expansion Fitting	131.76	17.65
			<i>For Installation Above 14', Add</i>	6.62	
			<i>For Work In Restricted Working Space, Add</i>	13.24	
26 05 33 13-0565	EA		2" Intermediate Metal Conduit (IMC) Expansion Fitting	168.64	19.12
			<i>For Installation Above 14', Add</i>	7.17	
			<i>For Work In Restricted Working Space, Add</i>	14.34	
26 05 33 13-0566	EA		2-1/2" Intermediate Metal Conduit (IMC) Expansion Fitting	248.65	23.53
			<i>For Installation Above 14', Add</i>	8.82	
			<i>For Work In Restricted Working Space, Add</i>	17.65	
26 05 33 13-0567	EA		3" Intermediate Metal Conduit (IMC) Expansion Fitting	300.19	29.41
			<i>For Installation Above 14', Add</i>	11.03	
			<i>For Work In Restricted Working Space, Add</i>	22.06	
26 05 33 13-0568	EA		3-1/2" Intermediate Metal Conduit (IMC) Expansion Fitting	412.05	35.29
			<i>For Installation Above 14', Add</i>	13.24	
			<i>For Work In Restricted Working Space, Add</i>	26.47	
26 05 33 13-0569	EA		4" Intermediate Metal Conduit (IMC) Expansion Fitting	473.64	38.24
			<i>For Installation Above 14', Add</i>	14.34	
			<i>For Work In Restricted Working Space, Add</i>	28.67	
26 05 33 13-0570			Intermediate Metal Conduit (IMC) Sealing Fittings, Vertical/Horizontal (26 05 33 13-0494)		
26 05 33 13-0571	EA		1/2" Intermediate Metal Conduit (IMC) Sealing Fitting, Vertical/Horizontal	54.20	18.38
			<i>For Installation Above 14', Add</i>	5.52	
			<i>For Work In Restricted Working Space, Add</i>	11.03	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	11.03	
26 05 33 13-0572	EA		3/4" Intermediate Metal Conduit (IMC) Sealing Fitting, Vertical/Horizontal	64.59	22.06
			<i>For Installation Above 14', Add</i>	6.62	
			<i>For Work In Restricted Working Space, Add</i>	13.24	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	13.24	
26 05 33 13-0573	EA		1" Intermediate Metal Conduit (IMC) Sealing Fitting, Vertical/Horizontal	77.79	25.74
			<i>For Installation Above 14', Add</i>	7.72	
			<i>For Work In Restricted Working Space, Add</i>	15.44	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	15.44	
26 05 33 13-0574	EA		1-1/4" Intermediate Metal Conduit (IMC) Sealing Fitting, Vertical/Horizontal	90.78	29.41
			<i>For Installation Above 14', Add</i>	8.82	
			<i>For Work In Restricted Working Space, Add</i>	17.65	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	17.65	
26 05 33 13-0575	EA		1-1/2" Intermediate Metal Conduit (IMC) Sealing Fitting, Vertical/Horizontal	114.29	33.09
			<i>For Installation Above 14', Add</i>	9.93	
			<i>For Work In Restricted Working Space, Add</i>	19.85	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	19.85	
26 05 33 13-0576	EA		2" Intermediate Metal Conduit (IMC) Sealing Fitting, Vertical/Horizontal	135.86	36.77
			<i>For Installation Above 14', Add</i>	11.03	
			<i>For Work In Restricted Working Space, Add</i>	22.06	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	22.06	
26 05 33 13-0577	EA		2-1/2" Intermediate Metal Conduit (IMC) Sealing Fitting, Vertical/Horizontal	185.07	44.12
			<i>For Installation Above 14', Add</i>	13.23	
			<i>For Work In Restricted Working Space, Add</i>	26.47	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	26.47	
26 05 33 13-0578	EA		3" Intermediate Metal Conduit (IMC) Sealing Fitting, Vertical/Horizontal	221.24	51.48
			<i>For Installation Above 14', Add</i>	15.44	
			<i>For Work In Restricted Working Space, Add</i>	30.88	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	30.88	
26 05 33 13-0579	EA		3-1/2" Intermediate Metal Conduit (IMC) Sealing Fitting, Vertical/Horizontal	458.82	58.83
			<i>For Installation Above 14', Add</i>	17.65	
			<i>For Work In Restricted Working Space, Add</i>	35.30	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	35.30	
26 05 33 13-0580	EA		4" Intermediate Metal Conduit (IMC) Sealing Fitting, Vertical/Horizontal	527.22	66.18
			<i>For Installation Above 14', Add</i>	19.85	
			<i>For Work In Restricted Working Space, Add</i>	39.71	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	39.71	
26 05 33 13-0581			Intermediate Metal Conduit (IMC) Threaded Couplings (26 05 33 13-0494)		
26 05 33 13-0582	EA		1/2" Intermediate Metal Conduit (IMC) Threaded Coupling	9.41	3.53
			<i>For Installation Above 14', Add</i>	1.32	
			<i>For Work In Restricted Working Space, Add</i>	2.65	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 13-0583 EA 3/4" Intermediate Metal Conduit (IMC) Threaded Coupling <i>For Installation Above 14', Add</i> <i>For Work In Restricted Working Space, Add</i>	13.22 1.88 3.75	5.00
26 05 33 13-0584 EA 1" Intermediate Metal Conduit (IMC) Threaded Coupling <i>For Installation Above 14', Add</i> <i>For Work In Restricted Working Space, Add</i>	17.24 2.42 4.85	6.47
26 05 33 13-0585 EA 1-1/4" Intermediate Metal Conduit (IMC) Threaded Coupling <i>For Installation Above 14', Add</i> <i>For Work In Restricted Working Space, Add</i>	19.73 2.76 5.52	7.35
26 05 33 13-0586 EA 1-1/2" Intermediate Metal Conduit (IMC) Threaded Coupling <i>For Installation Above 14', Add</i> <i>For Work In Restricted Working Space, Add</i>	23.75 3.31 6.62	8.82
26 05 33 13-0587 EA 2" Intermediate Metal Conduit (IMC) Threaded Coupling <i>For Installation Above 14', Add</i> <i>For Work In Restricted Working Space, Add</i>	27.25 3.75 7.50	10.00
26 05 33 13-0588 EA 2-1/2" Intermediate Metal Conduit (IMC) Threaded Coupling <i>For Installation Above 14', Add</i> <i>For Work In Restricted Working Space, Add</i>	32.89 4.19 8.38	11.18
26 05 33 13-0589 EA 3" Intermediate Metal Conduit (IMC) Threaded Coupling <i>For Installation Above 14', Add</i> <i>For Work In Restricted Working Space, Add</i>	38.39 4.74 9.49	12.64
26 05 33 13-0590 EA 3-1/2" Intermediate Metal Conduit (IMC) Threaded Coupling <i>For Installation Above 14', Add</i> <i>For Work In Restricted Working Space, Add</i>	43.62 5.19 10.37	13.83
26 05 33 13-0591 EA 4" Intermediate Metal Conduit (IMC) Threaded Coupling <i>For Installation Above 14', Add</i> <i>For Work In Restricted Working Space, Add</i>	45.88 5.51 11.03	14.71
26 05 33 13-0592 Intermediate Metal Conduit (IMC) Reducer Bushings <small>(26 05 33 13-0494)</small>		
26 05 33 13-0593 EA 1/2" To 3/4" Intermediate Metal Conduit (IMC) Reducing Bushing <i>For Installation Above 14', Add</i> <i>For Work In Restricted Working Space, Add</i>	4.35 0.55 1.10	1.47
26 05 33 13-0594 EA 3/4" To 1" Intermediate Metal Conduit (IMC) Reducing Bushing <i>For Installation Above 14', Add</i> <i>For Work In Restricted Working Space, Add</i>	4.73 0.55 1.10	1.47
26 05 33 13-0595 Explosion Proof Conduit Fittings <small>(26 05 33 13-0041)</small> Note: For use with Rigid Galvanized Steel (RGS), Electrical Metallic Tubing (EMT) and Intermediate Metal Conduit (IMC) conduit.		
26 05 33 13-0596 Explosion Proof Malleable Iron Conduit Unions <small>(26 05 33 13-0595)</small>		
26 05 33 13-0597 EA 1/2" Explosion Proof Malleable Iron Conduit Union	35.34	6.12
26 05 33 13-0598 EA 3/4" Explosion Proof Malleable Iron Conduit Union	44.40	6.77
26 05 33 13-0599 EA 1" Explosion Proof Malleable Iron Conduit Union	72.34	9.03
26 05 33 13-0600 EA 1-1/4" Explosion Proof Malleable Iron Conduit Union	99.94	9.99
26 05 33 13-0601 EA 1-1/2" Explosion Proof Malleable Iron Conduit Union	126.77	12.25
26 05 33 13-0602 EA 2" Explosion Proof Malleable Iron Conduit Union	159.05	14.18
26 05 33 13-0603 EA 2-1/2" Explosion Proof Malleable Iron Conduit Union	225.10	20.27
26 05 33 13-0604 EA 3" Explosion Proof Malleable Iron Conduit Union	316.71	24.13
26 05 33 13-0605 EA 3-1/2" Explosion Proof Malleable Iron Conduit Union	495.99	28.96
26 05 33 13-0606 EA 4" Explosion Proof Malleable Iron Conduit Union	542.01	37.00
26 05 33 13-0607 Explosion Proof Malleable Iron Hub Bodies <small>(26 05 33 13-0595)</small>		
26 05 33 13-0608 EA 1/2" Explosion Proof Malleable Iron Two Hub Body	69.84	19.34
26 05 33 13-0609 EA 3/4" Explosion Proof Malleable Iron Two Hub Body	84.49	21.92
26 05 33 13-0610 EA 1" Explosion Proof Malleable Iron Two Hub Body	93.42	24.17
26 05 33 13-0611 EA 1/2" Explosion Proof Malleable Iron Three Hub Body	91.86	24.17
26 05 33 13-0612 EA 3/4" Explosion Proof Malleable Iron Three Hub Body	109.51	29.01
26 05 33 13-0613 EA 1" Explosion Proof Malleable Iron Three Hub Body	123.05	33.19
26 05 33 13-0614 Explosion Proof Malleable Iron Conduit Sealing Fitting, Horizontal/Vertical <small>(26 05 33 13-0595)</small>		
26 05 33 13-0615 EA 1/2" Explosion Proof Malleable Iron Conduit Sealing Fitting, Horizontal/Vertical <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	70.31 12.08	16.11
26 05 33 13-0616 EA 3/4" Explosion Proof Malleable Iron Conduit Sealing Fitting, Horizontal/Vertical <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	80.33 13.54	18.05
26 05 33 13-0617 EA 1" Explosion Proof Malleable Iron Conduit Sealing Fitting, Horizontal/Vertical <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	94.64 14.75	19.66
26 05 33 13-0618 EA 1-1/4" Explosion Proof Malleable Iron Conduit Sealing Fitting, Horizontal/Vertical <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	115.34 18.13	24.17
26 05 33 13-0619 EA 1-1/2" Explosion Proof Malleable Iron Conduit Sealing Fitting, Horizontal/Vertical <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	154.14 21.27	28.36
26 05 33 13-0620 EA 2" Explosion Proof Malleable Iron Conduit Sealing Fitting, Horizontal/Vertical <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	188.71 24.17	32.23
26 05 33 13-0621 EA 2-1/2" Explosion Proof Malleable Iron Conduit Sealing Fitting, Horizontal/Vertical <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	286.91 36.20	48.26
26 05 33 13-0622 EA 3" Explosion Proof Malleable Iron Conduit Sealing Fitting, Horizontal/Vertical <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	356.08 45.36	60.48
26 05 33 13-0623 EA 3-1/2" Explosion Proof Malleable Iron Conduit Sealing Fitting, Horizontal/Vertical <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	765.16 49.95	66.59

26 Electrical**26 05 Common Work Results For Electrical****26 05 33 Raceway And Boxes For Electrical Systems**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 13-0624 EA 4" Explosion Proof Malleable Iron Conduit Sealing Fitting, Horizontal/Vertical <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	1,036.79 54.29	72.39
26 05 33 13-0625 Explosion Proof Flexible Conduit Couplings (26 05 33 13-0595)		
26 05 33 13-0626 EA 1/2" x 12" Explosion Proof Flexible Conduit Coupling	376.67	7.41
26 05 33 13-0627 EA 3/4" x 15" Explosion Proof Flexible Conduit Coupling	527.51	8.38
26 05 33 13-0628 Schedule 40 Polyvinyl Chloride (PVC) Conduit (26 05 33 13-0041) Note: Exposed installation, branch and feeder conduit. Excludes supporting strap, hanger and fastening.		
26 05 33 13-0629 Schedule 40 Polyvinyl Chloride (PVC) Conduit With Glued Couplings (26 05 33 13-0628) Note: Includes field bend conduit up to 1".		
26 05 33 13-0630 LF 1/2" Schedule 40 Polyvinyl Chloride (PVC) Conduit With Glued Couplings <i>For Schedule 60, Add</i> <i>For Schedule 80, Add</i>	3.16 0.19 0.36	1.20
26 05 33 13-0631 LF 3/4" Schedule 40 Polyvinyl Chloride (PVC) Conduit With Glued Couplings <i>For Schedule 60, Add</i> <i>For Schedule 80, Add</i>	3.51 0.22 0.41	1.31
26 05 33 13-0632 LF 1" Schedule 40 Polyvinyl Chloride (PVC) Conduit With Glued Couplings <i>For Schedule 60, Add</i> <i>For Schedule 80, Add</i>	4.16 0.27 0.50	1.53
26 05 33 13-0633 LF 1-1/4" Schedule 40 Polyvinyl Chloride (PVC) Conduit With Glued Couplings <i>For Schedule 60, Add</i> <i>For Schedule 80, Add</i>	4.82 0.33 0.59	1.75
26 05 33 13-0634 LF 1-1/2" Schedule 40 Polyvinyl Chloride (PVC) Conduit With Glued Couplings <i>For Schedule 60, Add</i> <i>For Schedule 80, Add</i>	5.64 0.39 0.69	2.04
26 05 33 13-0635 LF 2" Schedule 40 Polyvinyl Chloride (PVC) Conduit With Glued Couplings <i>For Schedule 60, Add</i> <i>For Schedule 80, Add</i>	6.53 0.46 0.82	2.34
26 05 33 13-0636 LF 2-1/2" Schedule 40 Polyvinyl Chloride (PVC) Conduit With Glued Couplings <i>For Schedule 60, Add</i> <i>For Schedule 80, Add</i>	8.03 0.62 1.08	2.77
26 05 33 13-0637 LF 3" Schedule 40 Polyvinyl Chloride (PVC) Conduit With Glued Couplings <i>For Schedule 60, Add</i> <i>For Schedule 80, Add</i>	9.34 0.73 1.26	3.22
26 05 33 13-0638 LF 3-1/2" Schedule 40 Polyvinyl Chloride (PVC) Conduit With Glued Couplings <i>For Schedule 60, Add</i> <i>For Schedule 80, Add</i>	11.17 0.89 1.53	3.80
26 05 33 13-0639 LF 4" Schedule 40 Polyvinyl Chloride (PVC) Conduit With Glued Couplings <i>For Schedule 60, Add</i> <i>For Schedule 80, Add</i>	13.52 1.04 1.81	4.68
26 05 33 13-0640 LF 5" Schedule 40 Polyvinyl Chloride (PVC) Conduit With Glued Couplings <i>For Schedule 60, Add</i> <i>For Schedule 80, Add</i>	19.09 1.48 2.57	6.58
26 05 33 13-0641 LF 6" Schedule 40 Polyvinyl Chloride (PVC) Conduit With Glued Couplings <i>For Schedule 60, Add</i> <i>For Schedule 80, Add</i>	25.42 1.97 3.41	8.77
26 05 33 13-0642 Schedule 40 Polyvinyl Chloride (PVC) Conduit 90 Degree Elbows (26 05 33 13-0628) See CSI section 26 05 33 13-1076 for conduit field bending.		
26 05 33 13-0643 EA 1/2" Schedule 40 Polyvinyl Chloride (PVC) Conduit 90 Degree Elbow <i>For Schedule 60, Add</i> <i>For Schedule 80, Add</i>	15.24 0.89 1.68	5.85
26 05 33 13-0644 EA 3/4" Schedule 40 Polyvinyl Chloride (PVC) Conduit 90 Degree Elbow <i>For Schedule 60, Add</i> <i>For Schedule 80, Add</i>	16.78 0.98 1.85	6.43
26 05 33 13-0645 EA 1" Schedule 40 Polyvinyl Chloride (PVC) Conduit 90 Degree Elbow <i>For Schedule 60, Add</i> <i>For Schedule 80, Add</i>	19.40 1.20 2.22	7.31
26 05 33 13-0646 EA 1-1/4" Schedule 40 Polyvinyl Chloride (PVC) Conduit 90 Degree Elbow <i>For Schedule 60, Add</i> <i>For Schedule 80, Add</i>	25.03 1.58 2.91	9.36
26 05 33 13-0647 EA 1-1/2" Schedule 40 Polyvinyl Chloride (PVC) Conduit 90 Degree Elbow <i>For Schedule 60, Add</i> <i>For Schedule 80, Add</i>	31.46 2.02 3.70	11.70
26 05 33 13-0648 EA 2" Schedule 40 Polyvinyl Chloride (PVC) Conduit 90 Degree Elbow <i>For Schedule 60, Add</i> <i>For Schedule 80, Add</i>	39.51 2.57 4.69	14.62
26 05 33 13-0649 EA 2-1/2" Schedule 40 Polyvinyl Chloride (PVC) Conduit 90 Degree Elbow <i>For Schedule 60, Add</i> <i>For Schedule 80, Add</i>	49.41 3.58 6.33	17.54



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 13-0650 EA 3" Schedule 40 Polyvinyl Chloride (PVC) Conduit 90 Degree Elbow.....	60.50	20.46
See CSI section 26 05 33 13-1076 for conduit field bending.		
For Schedule 60, Add	4.89	
For Schedule 80, Add	8.38	
26 05 33 13-0651 EA 3-1/2" Schedule 40 Polyvinyl Chloride (PVC) Conduit 90 Degree Elbow.....	75.26	24.85
See CSI section 26 05 33 13-1076 for conduit field bending.		
For Schedule 60, Add	6.39	
For Schedule 80, Add	10.81	
26 05 33 13-0652 EA 4" Schedule 40 Polyvinyl Chloride (PVC) Conduit 90 Degree Elbow.....	90.01	29.24
See CSI section 26 05 33 13-1076 for conduit field bending.		
For Schedule 60, Add	7.88	
For Schedule 80, Add	13.23	
26 05 33 13-0653 EA 5" Schedule 40 Polyvinyl Chloride (PVC) Conduit 90 Degree Elbow.....	120.60	36.55
See CSI section 26 05 33 13-1076 for conduit field bending.		
For Schedule 60, Add	11.87	
For Schedule 80, Add	19.37	
26 05 33 13-0654 EA 6" Schedule 40 Polyvinyl Chloride (PVC) Conduit 90 Degree Elbow.....	146.96	43.86
See CSI section 26 05 33 13-1076 for conduit field bending.		
For Schedule 60, Add	14.81	
For Schedule 80, Add	24.02	
26 05 33 13-0655 Schedule 40 Polyvinyl Chloride (PVC) Conduit 45 Degree Elbows <small>(26 05 33 13-0628)</small>		
See CSI section 26 05 33 13-1076 for conduit field bending.		
26 05 33 13-0656 EA 1/2" Schedule 40 Polyvinyl Chloride (PVC) Conduit 45 Degree Elbow.....	15.11	5.85
See CSI section 26 05 33 13-1076 for conduit field bending.		
For Schedule 60, Add	0.85	
For Schedule 80, Add	1.63	
26 05 33 13-0657 EA 3/4" Schedule 40 Polyvinyl Chloride (PVC) Conduit 45 Degree Elbow.....	16.74	6.43
See CSI section 26 05 33 13-1076 for conduit field bending.		
For Schedule 60, Add	0.97	
For Schedule 80, Add	1.84	
26 05 33 13-0658 EA 1" Schedule 40 Polyvinyl Chloride (PVC) Conduit 45 Degree Elbow.....	19.33	7.31
See CSI section 26 05 33 13-1076 for conduit field bending.		
For Schedule 60, Add	1.18	
For Schedule 80, Add	2.20	
26 05 33 13-0659 EA 1-1/4" Schedule 40 Polyvinyl Chloride (PVC) Conduit 45 Degree Elbow.....	24.83	9.36
See CSI section 26 05 33 13-1076 for conduit field bending.		
For Schedule 60, Add	1.53	
For Schedule 80, Add	2.84	
26 05 33 13-0660 EA 1-1/2" Schedule 40 Polyvinyl Chloride (PVC) Conduit 45 Degree Elbow.....	31.02	11.70
See CSI section 26 05 33 13-1076 for conduit field bending.		
For Schedule 60, Add	1.91	
For Schedule 80, Add	3.55	
26 05 33 13-0661 EA 2" Schedule 40 Polyvinyl Chloride (PVC) Conduit 45 Degree Elbow.....	39.27	14.62
See CSI section 26 05 33 13-1076 for conduit field bending.		
For Schedule 60, Add	2.51	
For Schedule 80, Add	4.61	
26 05 33 13-0662 EA 2-1/2" Schedule 40 Polyvinyl Chloride (PVC) Conduit 45 Degree Elbow.....	48.96	17.54
See CSI section 26 05 33 13-1076 for conduit field bending.		
For Schedule 60, Add	3.47	
For Schedule 80, Add	6.17	
26 05 33 13-0663 EA 3" Schedule 40 Polyvinyl Chloride (PVC) Conduit 45 Degree Elbow.....	59.94	20.46
See CSI section 26 05 33 13-1076 for conduit field bending.		
For Schedule 60, Add	4.75	
For Schedule 80, Add	8.19	
26 05 33 13-0664 EA 3-1/2" Schedule 40 Polyvinyl Chloride (PVC) Conduit 45 Degree Elbow.....	73.69	24.85
See CSI section 26 05 33 13-1076 for conduit field bending.		
For Schedule 60, Add	5.99	
For Schedule 80, Add	10.26	
26 05 33 13-0665 EA 4" Schedule 40 Polyvinyl Chloride (PVC) Conduit 45 Degree Elbow.....	88.65	29.24
See CSI section 26 05 33 13-1076 for conduit field bending.		
For Schedule 60, Add	7.54	
For Schedule 80, Add	12.75	
26 05 33 13-0666 EA 5" Schedule 40 Polyvinyl Chloride (PVC) Conduit 45 Degree Elbow.....	118.84	36.55
See CSI section 26 05 33 13-1076 for conduit field bending.		
For Schedule 60, Add	11.43	
For Schedule 80, Add	18.75	
26 05 33 13-0667 EA 6" Schedule 40 Polyvinyl Chloride (PVC) Conduit 45 Degree Elbow.....	141.74	43.86
See CSI section 26 05 33 13-1076 for conduit field bending.		
For Schedule 60, Add	13.50	
For Schedule 80, Add	22.19	
26 05 33 13-0668 Polyvinyl Chloride (PVC) Conduit Adapters <small>(26 05 33 13-0628)</small>		
26 05 33 13-0669 EA 1/2" Polyvinyl Chloride (PVC) Conduit Adapter	10.52	4.10
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	3.07	
26 05 33 13-0670 EA 3/4" Polyvinyl Chloride (PVC) Conduit Adapter	12.07	4.68
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	3.51	
26 05 33 13-0671 EA 1" Polyvinyl Chloride (PVC) Conduit Adapter	13.67	5.26
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	3.95	
26 05 33 13-0672 EA 1-1/4" Polyvinyl Chloride (PVC) Conduit Adapter	15.32	5.85
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	4.39	
26 05 33 13-0673 EA 1-1/2" Polyvinyl Chloride (PVC) Conduit Adapter	19.01	7.31
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	5.48	

26 Electrical**26 05 Common Work Results For Electrical****26 05 33 Raceway And Boxes For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33	13-0674	EA	2" Polyvinyl Chloride (PVC) Conduit Adapter..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	22.93 6.58	8.77
26 05 33	13-0675	EA	2-1/2" Polyvinyl Chloride (PVC) Conduit Adapter <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	31.27 8.77	11.70
26 05 33	13-0676	EA	3" Polyvinyl Chloride (PVC) Conduit Adapter..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	39.37 10.97	14.62
26 05 33	13-0677	EA	3-1/2" Polyvinyl Chloride (PVC) Conduit Adapter <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	51.13 14.26	19.00
26 05 33	13-0678	EA	4" Polyvinyl Chloride (PVC) Conduit Adapter..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	62.18 17.54	23.39
26 05 33	13-0679	EA	5" Polyvinyl Chloride (PVC) Conduit Adapter..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	80.39 21.93	29.24
26 05 33	13-0680	EA	6" Polyvinyl Chloride (PVC) Conduit Adapter..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	100.13 27.41	36.55
26 05 33	13-0681		Polyvinyl Chloride (PVC) Conduit Bell Ends And Plug <small>(26 05 33 13-0628)</small>		
26 05 33	13-0682	EA	1/2" Polyvinyl Chloride (PVC) Conduit Bell End And Plug <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	11.26 2.63	3.51
26 05 33	13-0683	EA	3/4" Polyvinyl Chloride (PVC) Conduit Bell End And Plug <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	12.86 3.07	4.10
26 05 33	13-0684	EA	1" Polyvinyl Chloride (PVC) Conduit Bell End And Plug <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	14.48 3.51	4.68
26 05 33	13-0685	EA	1-1/4" Polyvinyl Chloride (PVC) Conduit Bell End And Plug <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	16.98 3.95	5.26
26 05 33	13-0686	EA	1-1/2" Polyvinyl Chloride (PVC) Conduit Bell End And Plug <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	18.86 4.39	5.85
26 05 33	13-0687	EA	2" Polyvinyl Chloride (PVC) Conduit Bell End And Plug <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	22.26 5.04	6.72
26 05 33	13-0688	EA	2-1/2" Polyvinyl Chloride (PVC) Conduit Bell End And Plug <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	24.96 5.70	7.60
26 05 33	13-0689	EA	3" Polyvinyl Chloride (PVC) Conduit Bell End And Plug <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	28.38 6.58	8.77
26 05 33	13-0690	EA	3-1/2" Polyvinyl Chloride (PVC) Conduit Bell End And Plug <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	33.51 7.67	10.24
26 05 33	13-0691	EA	4" Polyvinyl Chloride (PVC) Conduit Bell End And Plug <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	37.17 8.77	11.70
26 05 33	13-0692	EA	5" Polyvinyl Chloride (PVC) Conduit Bell End And Plug <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	44.73 9.87	13.16
26 05 33	13-0693	EA	6" Polyvinyl Chloride (PVC) Conduit Bell End And Plug <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	49.89 10.97	14.62
26 05 33	13-0694		Polyvinyl Chloride (PVC) Conduit Terminal Adapters <small>(26 05 33 13-0628)</small>		
26 05 33	13-0695	EA	1/2" Polyvinyl Chloride (PVC) Conduit Terminal Adapter..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	11.48 3.38	
26 05 33	13-0696	EA	3/4" Polyvinyl Chloride (PVC) Conduit Terminal Adapter..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	13.85 4.04	
26 05 33	13-0697	EA	1" Polyvinyl Chloride (PVC) Conduit Terminal Adapter..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	15.41 4.49	
26 05 33	13-0698	EA	1-1/4" Polyvinyl Chloride (PVC) Conduit Terminal Adapter..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	17.25 5.00	
26 05 33	13-0699		Type LB, LR Or LL, Two Hub Polyvinyl Chloride (PVC) Conduit Body With Cover <small>(26 05 33 13-0628)</small>		
26 05 33	13-0700	EA	1/2" Type LB, LR Or LL, Two Hub Polyvinyl Chloride (PVC) Conduit Body With Cover <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	32.09 8.77	11.70
26 05 33	13-0701	EA	3/4" Type LB, LR Or LL, Two Hub Polyvinyl Chloride (PVC) Conduit Body With Cover <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	36.92 9.87	13.16
26 05 33	13-0702	EA	1" Type LB, LR Or LL, Two Hub Polyvinyl Chloride (PVC) Conduit Body With Cover <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	40.97 10.97	14.62
26 05 33	13-0703	EA	1-1/4" Type LB, LR Or LL, Two Hub Polyvinyl Chloride (PVC) Conduit Body With Cover <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	50.18 13.16	17.54
26 05 33	13-0704	EA	1-1/2" Type LB, LR Or LL, Two Hub Polyvinyl Chloride (PVC) Conduit Body With Cover <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	62.18 16.45	21.93
26 05 33	13-0705	EA	2" Type LB, LR Or LL, Two Hub Polyvinyl Chloride (PVC) Conduit Body With Cover <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	78.84 19.74	26.31
26 05 33	13-0706	EA	2-1/2" Type LB, LR Or LL, Two Hub Polyvinyl Chloride (PVC) Conduit Body With Cover <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	123.33 21.93	29.24
26 05 33	13-0707	EA	3" Type LB, LR Or LL, Two Hub Polyvinyl Chloride (PVC) Conduit Body With Cover <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	132.33 24.12	32.16
26 05 33	13-0708	EA	3-1/2" Type LB, LR Or LL, Two Hub Polyvinyl Chloride (PVC) Conduit Body With Cover <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	144.95 27.41	36.55
26 05 33	13-0709	EA	4" Type LB, LR Or LL, Two Hub Polyvinyl Chloride (PVC) Conduit Body With Cover <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	162.94 31.80	42.40
26 05 33	13-0710		Type T, Three Hub Polyvinyl Chloride (PVC) Conduit Body With Cover <small>(26 05 33 13-0628)</small>		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 13-0711 EA 1/2" Type T, Three Hub Polyvinyl Chloride (PVC) Conduit Body With Cover	40.56	14.71
For Schedule 60, Add	2.79	
For Schedule 80, Add	5.00	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	11.03	
26 05 33 13-0712 EA 3/4" Type T, Three Hub Polyvinyl Chloride (PVC) Conduit Body With Cover	45.15	16.17
For Schedule 60, Add	3.20	
For Schedule 80, Add	5.69	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	12.14	
26 05 33 13-0713 EA 1" Type T, Three Hub Polyvinyl Chloride (PVC) Conduit Body With Cover	48.88	17.65
For Schedule 60, Add	3.40	
For Schedule 80, Add	6.08	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	13.24	
26 05 33 13-0714 EA 1-1/4" Type T, Three Hub Polyvinyl Chloride (PVC) Conduit Body With Cover	60.16	20.58
For Schedule 60, Add	4.74	
For Schedule 80, Add	8.19	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	15.44	
26 05 33 13-0715 EA 1-1/2" Type T, Three Hub Polyvinyl Chloride (PVC) Conduit Body With Cover	72.71	25.00
For Schedule 60, Add	5.68	
For Schedule 80, Add	9.82	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	18.75	
26 05 33 13-0716 EA 2" Type T, Three Hub Polyvinyl Chloride (PVC) Conduit Body With Cover	88.31	29.41
For Schedule 60, Add	7.37	
For Schedule 80, Add	12.53	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	22.06	
26 05 33 13-0717 Polyvinyl Chloride (PVC) Conduit Expansion Joint (26 05 33 13-0628)		
26 05 33 13-0718 EA 1/2" Polyvinyl Chloride (PVC) Conduit Expansion Joint.....	61.40	14.62
26 05 33 13-0719 EA 3/4" Polyvinyl Chloride (PVC) Conduit Expansion Joint.....	69.29	17.54
26 05 33 13-0720 EA 1" Polyvinyl Chloride (PVC) Conduit Expansion Joint.....	77.57	20.46
26 05 33 13-0721 EA 1-1/4" Polyvinyl Chloride (PVC) Conduit Expansion Joint.....	85.46	23.39
26 05 33 13-0722 EA 1-1/2" Polyvinyl Chloride (PVC) Conduit Expansion Joint.....	93.18	26.31
26 05 33 13-0723 EA 2" Polyvinyl Chloride (PVC) Conduit Expansion Joint.....	101.95	29.24
26 05 33 13-0724 EA 2-1/2" Polyvinyl Chloride (PVC) Conduit Expansion Joint.....	123.17	33.63
26 05 33 13-0725 EA 3" Polyvinyl Chloride (PVC) Conduit Expansion Joint.....	145.87	38.01
26 05 33 13-0726 EA 3-1/2" Polyvinyl Chloride (PVC) Conduit Expansion Joint.....	170.28	43.86
26 05 33 13-0727 EA 4" Polyvinyl Chloride (PVC) Conduit Expansion Joint.....	201.76	51.17
26 05 33 13-0728 EA 5" Polyvinyl Chloride (PVC) Conduit Expansion Joint.....	261.06	61.40
26 05 33 13-0729 EA 6" Polyvinyl Chloride (PVC) Conduit Expansion Joint.....	342.07	78.95
26 05 33 13-0730 Polyvinyl Chloride (PVC) Conduit End Caps (26 05 33 13-0628)		
26 05 33 13-0731 EA 1/2" Polyvinyl Chloride (PVC) Conduit End Cap	8.59	2.92
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	2.19	
26 05 33 13-0732 EA 3/4" Polyvinyl Chloride (PVC) Conduit End Cap	10.17	3.51
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	2.63	
26 05 33 13-0733 EA 1" Polyvinyl Chloride (PVC) Conduit End Cap	11.74	4.10
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	3.07	
26 05 33 13-0734 EA 1-1/4" Polyvinyl Chloride (PVC) Conduit End Cap	13.86	4.68
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	3.51	
26 05 33 13-0735 EA 1-1/2" Polyvinyl Chloride (PVC) Conduit End Cap	16.00	5.26
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	3.95	
26 05 33 13-0736 EA 2" Polyvinyl Chloride (PVC) Conduit End Cap	18.54	5.85
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	4.39	
26 05 33 13-0737 EA 2-1/2" Polyvinyl Chloride (PVC) Conduit End Cap	25.36	6.72
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	5.04	
26 05 33 13-0738 EA 3" Polyvinyl Chloride (PVC) Conduit End Cap	27.93	7.60
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	5.70	
26 05 33 13-0739 EA 3-1/2" Polyvinyl Chloride (PVC) Conduit End Cap	34.84	8.48
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	6.36	
26 05 33 13-0740 EA 4" Polyvinyl Chloride (PVC) Conduit End Cap	41.26	9.07
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	6.80	
26 05 33 13-0741 EA 5" Polyvinyl Chloride (PVC) Conduit End Cap	47.18	10.24
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	7.67	
26 05 33 13-0742 EA 6" Polyvinyl Chloride (PVC) Conduit End Cap	58.79	11.70
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	8.77	
26 05 33 13-0743 Polyvinyl Chloride (PVC) Type LB Telecommunications Conduit Bodies With Cover (Smart Pathways) (26 05 33 13-0628)		
26 05 33 13-0744 EA 2" Polyvinyl Chloride (PVC) Type LB Telecommunications Conduit Body With Cover (Smart Pathways EZLB200)	84.06	26.31
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	19.74	
26 05 33 13-0745 EA 3/4" To 1-1/4" Polyvinyl Chloride (PVC) Type LB Telecommunications Conduit Body With Cover (Smart Pathways KBLB121)	81.66	17.54
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	13.16	
26 05 33 13-0746 EA 1-1/2" To 2-1/2" Polyvinyl Chloride (PVC) Type LB Telecommunications Conduit Body With Cover (Smart Pathways KBLB251)	189.02	29.24
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	21.93	
26 05 33 13-0747 EA 3" To 4" Polyvinyl Chloride (PVC) Type LB Telecommunications Conduit Body With Cover (Smart Pathways KBLB401)	358.38	42.40
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	31.80	

26 Electrical**26 05 Common Work Results For Electrical****26 05 33 Raceway And Boxes For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 13-0748			Conduit Installed Below Grade <small>(26 05 33 13-0040)</small> Note: By direct burial in trench or in concrete slabs or duct banks. Excludes trenching, backfilling and concrete.		
26 05 33 13-0749			Schedule 40 Polyvinyl Chloride (PVC) Conduit, Direct Burial <small>(26 05 33 13-0748)</small>		
26 05 33 13-0750			Schedule 40 Polyvinyl Chloride (PVC) Conduit With Glued Couplings, Direct Burial <small>(26 05 33 13-0749)</small> Note: Includes field bend conduit up to 1".		
26 05 33 13-0751	LF		1/2" Schedule 40 Polyvinyl Chloride (PVC) Conduit With Glued Couplings, Direct Burial	2.53	
			<i>For Schedule 60, Add</i>	0.16	
			<i>For Schedule 80, Add</i>	0.29	
26 05 33 13-0752	LF		3/4" Schedule 40 Polyvinyl Chloride (PVC) Conduit With Glued Couplings, Direct Burial	2.77	
			<i>For Schedule 60, Add</i>	0.18	
			<i>For Schedule 80, Add</i>	0.33	
26 05 33 13-0753	LF		1" Schedule 40 Polyvinyl Chloride (PVC) Conduit With Glued Couplings, Direct Burial	3.06	
			<i>For Schedule 60, Add</i>	0.22	
			<i>For Schedule 80, Add</i>	0.39	
26 05 33 13-0754	LF		1-1/4" Schedule 40 Polyvinyl Chloride (PVC) Conduit With Glued Couplings, Direct Burial	3.35	
			<i>For Schedule 60, Add</i>	0.25	
			<i>For Schedule 80, Add</i>	0.44	
26 05 33 13-0755	LF		1-1/2" Schedule 40 Polyvinyl Chloride (PVC) Conduit With Glued Couplings, Direct Burial	3.63	
			<i>For Schedule 60, Add</i>	0.29	
			<i>For Schedule 80, Add</i>	0.49	
26 05 33 13-0756	LF		2" Schedule 40 Polyvinyl Chloride (PVC) Conduit With Glued Couplings, Direct Burial	3.97	
			<i>For Schedule 60, Add</i>	0.33	
			<i>For Schedule 80, Add</i>	0.57	
26 05 33 13-0757	LF		2-1/2" Schedule 40 Polyvinyl Chloride (PVC) Conduit With Glued Couplings, Direct Burial	4.57	
			<i>For Schedule 60, Add</i>	0.45	
			<i>For Schedule 80, Add</i>	0.73	
26 05 33 13-0758	LF		3" Schedule 40 Polyvinyl Chloride (PVC) Conduit With Glued Couplings, Direct Burial	4.96	
			<i>For Schedule 60, Add</i>	0.51	
			<i>For Schedule 80, Add</i>	0.82	
26 05 33 13-0759	LF		3-1/2" Schedule 40 Polyvinyl Chloride (PVC) Conduit With Glued Couplings, Direct Burial	5.50	
			<i>For Schedule 60, Add</i>	0.61	
			<i>For Schedule 80, Add</i>	0.97	
26 05 33 13-0760	LF		4" Schedule 40 Polyvinyl Chloride (PVC) Conduit With Glued Couplings, Direct Burial	5.84	
			<i>For Schedule 60, Add</i>	0.66	
			<i>For Schedule 80, Add</i>	1.04	
26 05 33 13-0761			Schedule 40 Polyvinyl Chloride (PVC) Conduit 90 Degree Elbows, Direct Burial <small>(26 05 33 13-0749)</small> See CSI section 26 05 33 13-1076 for conduit field bending.		
26 05 33 13-0762	EA		1/2" Schedule 40 Polyvinyl Chloride (PVC) Conduit 90 Degree Elbow, Direct Burial	18.89	
			<i>For Schedule 60, Add</i>	1.07	
			<i>For Schedule 80, Add</i>	2.04	
26 05 33 13-0763	EA		3/4" Schedule 40 Polyvinyl Chloride (PVC) Conduit 90 Degree Elbow, Direct Burial	22.63	
			<i>For Schedule 60, Add</i>	1.27	
			<i>For Schedule 80, Add</i>	2.44	
26 05 33 13-0764	EA		1" Schedule 40 Polyvinyl Chloride (PVC) Conduit 90 Degree Elbow, Direct Burial	26.71	
			<i>For Schedule 60, Add</i>	1.56	
			<i>For Schedule 80, Add</i>	2.95	
26 05 33 13-0765	EA		1-1/4" Schedule 40 Polyvinyl Chloride (PVC) Conduit 90 Degree Elbow, Direct Burial	30.88	
			<i>For Schedule 60, Add</i>	1.87	
			<i>For Schedule 80, Add</i>	3.50	
26 05 33 13-0766	EA		1-1/2" Schedule 40 Polyvinyl Chloride (PVC) Conduit 90 Degree Elbow, Direct Burial	35.12	
			<i>For Schedule 60, Add</i>	2.20	
			<i>For Schedule 80, Add</i>	4.07	
26 05 33 13-0767	EA		2" Schedule 40 Polyvinyl Chloride (PVC) Conduit 90 Degree Elbow, Direct Burial	39.51	
			<i>For Schedule 60, Add</i>	2.57	
			<i>For Schedule 80, Add</i>	4.69	
26 05 33 13-0768	EA		2-1/2" Schedule 40 Polyvinyl Chloride (PVC) Conduit 90 Degree Elbow, Direct Burial	45.76	
			<i>For Schedule 60, Add</i>	3.40	
			<i>For Schedule 80, Add</i>	5.96	
26 05 33 13-0769	EA		3" Schedule 40 Polyvinyl Chloride (PVC) Conduit 90 Degree Elbow, Direct Burial	53.19	
			<i>For Schedule 60, Add</i>	4.53	
			<i>For Schedule 80, Add</i>	7.65	
26 05 33 13-0770	EA		3-1/2" Schedule 40 Polyvinyl Chloride (PVC) Conduit 90 Degree Elbow, Direct Burial	64.29	
			<i>For Schedule 60, Add</i>	5.84	
			<i>For Schedule 80, Add</i>	9.71	
26 05 33 13-0771	EA		4" Schedule 40 Polyvinyl Chloride (PVC) Conduit 90 Degree Elbow, Direct Burial	75.39	
			<i>For Schedule 60, Add</i>	7.15	
			<i>For Schedule 80, Add</i>	11.77	
26 05 33 13-0772			Schedule 40 Polyvinyl Chloride (PVC) Conduit 45 Degree Elbows, Direct Burial <small>(26 05 33 13-0749)</small> See CSI section 26 05 33 13-1076 for conduit field bending.		
26 05 33 13-0773	EA		1/2" Schedule 40 Polyvinyl Chloride (PVC) Conduit 45 Degree Elbow, Direct Burial	18.76	
			<i>For Schedule 60, Add</i>	1.04	
			<i>For Schedule 80, Add</i>	2.00	
26 05 33 13-0774	EA		3/4" Schedule 40 Polyvinyl Chloride (PVC) Conduit 45 Degree Elbow, Direct Burial	22.59	
			<i>For Schedule 60, Add</i>	1.26	
			<i>For Schedule 80, Add</i>	2.42	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 13-0775 EA 1" Schedule 40 Polyvinyl Chloride (PVC) Conduit 45 Degree Elbow, Direct Burial	26.64	
<i>For Schedule 60, Add</i>	1.54	
<i>For Schedule 80, Add</i>	2.93	
26 05 33 13-0776 EA 1-1/4" Schedule 40 Polyvinyl Chloride (PVC) Conduit 45 Degree Elbow, Direct Burial	30.68	
<i>For Schedule 60, Add</i>	1.82	
<i>For Schedule 80, Add</i>	3.43	
26 05 33 13-0777 EA 1-1/2" Schedule 40 Polyvinyl Chloride (PVC) Conduit 45 Degree Elbow, Direct Burial	34.68	
<i>For Schedule 60, Add</i>	2.09	
<i>For Schedule 80, Add</i>	3.91	
26 05 33 13-0778 EA 2" Schedule 40 Polyvinyl Chloride (PVC) Conduit 45 Degree Elbow, Direct Burial	39.27	
<i>For Schedule 60, Add</i>	2.51	
<i>For Schedule 80, Add</i>	4.61	
26 05 33 13-0779 EA 2-1/2" Schedule 40 Polyvinyl Chloride (PVC) Conduit 45 Degree Elbow, Direct Burial	45.31	
<i>For Schedule 60, Add</i>	3.29	
<i>For Schedule 80, Add</i>	5.81	
26 05 33 13-0780 EA 3" Schedule 40 Polyvinyl Chloride (PVC) Conduit 45 Degree Elbow, Direct Burial	52.63	
<i>For Schedule 60, Add</i>	4.39	
<i>For Schedule 80, Add</i>	7.46	
26 05 33 13-0781 EA 3-1/2" Schedule 40 Polyvinyl Chloride (PVC) Conduit 45 Degree Elbow, Direct Burial	62.72	
<i>For Schedule 60, Add</i>	5.45	
<i>For Schedule 80, Add</i>	9.16	
26 05 33 13-0782 EA 4" Schedule 40 Polyvinyl Chloride (PVC) Conduit 45 Degree Elbow, Direct Burial	74.03	
<i>For Schedule 60, Add</i>	6.81	
<i>For Schedule 80, Add</i>	11.29	
26 05 33 13-0783 EA 5" Schedule 40 Polyvinyl Chloride (PVC) Conduit 45 Degree Elbow, Direct Burial	93.25	
<i>For Schedule 60, Add</i>	10.15	
<i>For Schedule 80, Add</i>	16.19	
26 05 33 13-0784 EA 6" Schedule 40 Polyvinyl Chloride (PVC) Conduit 45 Degree Elbow, Direct Burial	105.18	
<i>For Schedule 60, Add</i>	11.68	
<i>For Schedule 80, Add</i>	18.54	
26 05 33 13-0785 Polyvinyl Chloride (PVC) Conduit Adapters, Direct Burial <small>(26 05 33 13-0749)</small>		
26 05 33 13-0786 EA 1/2" Polyvinyl Chloride (PVC) Conduit Adapter, Direct Burial	10.52	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	3.07	
26 05 33 13-0787 EA 3/4" Polyvinyl Chloride (PVC) Conduit Adapter, Direct Burial	12.07	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	3.51	
26 05 33 13-0788 EA 1" Polyvinyl Chloride (PVC) Conduit Adapter, Direct Burial	13.67	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	3.95	
26 05 33 13-0789 EA 1-1/4" Polyvinyl Chloride (PVC) Conduit Adapter, Direct Burial	15.32	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.39	
26 05 33 13-0790 EA 1-1/2" Polyvinyl Chloride (PVC) Conduit Adapter, Direct Burial	16.82	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.82	
26 05 33 13-0791 EA 2" Polyvinyl Chloride (PVC) Conduit Adapter, Direct Burial	18.54	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.26	
26 05 33 13-0792 EA 2-1/2" Polyvinyl Chloride (PVC) Conduit Adapter, Direct Burial	21.76	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.92	
26 05 33 13-0793 EA 3" Polyvinyl Chloride (PVC) Conduit Adapter, Direct Burial	24.75	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	6.58	
26 05 33 13-0794 EA 3-1/2" Polyvinyl Chloride (PVC) Conduit Adapter, Direct Burial	29.19	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	7.67	
26 05 33 13-0795 EA 4" Polyvinyl Chloride (PVC) Conduit Adapter, Direct Burial	32.94	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8.77	
26 05 33 13-0796 Polyvinyl Chloride (PVC) Conduit Bell Ends And Plug, Direct Burial <small>(26 05 33 13-0749)</small>		
26 05 33 13-0797 EA 1-1/4" Polyvinyl Chloride (PVC) Conduit Bell End And Plug, Direct Burial	18.44	
26 05 33 13-0798 EA 1-1/2" Polyvinyl Chloride (PVC) Conduit Bell End And Plug, Direct Burial	20.32	
26 05 33 13-0799 EA 2" Polyvinyl Chloride (PVC) Conduit Bell End And Plug, Direct Burial	22.99	
26 05 33 13-0800 EA 2-1/2" Polyvinyl Chloride (PVC) Conduit Bell End And Plug, Direct Burial	25.69	
26 05 33 13-0801 EA 3" Polyvinyl Chloride (PVC) Conduit Bell End And Plug, Direct Burial	28.38	
26 05 33 13-0802 EA 3-1/2" Polyvinyl Chloride (PVC) Conduit Bell End And Plug, Direct Burial	33.51	
26 05 33 13-0803 EA 4" Polyvinyl Chloride (PVC) Conduit Bell End And Plug, Direct Burial	37.17	
26 05 33 13-0804 Polyvinyl Chloride (PVC) Conduit Terminal Adapters, Direct Burial <small>(26 05 33 13-0749)</small>		
26 05 33 13-0805 EA 1/2" Polyvinyl Chloride (PVC) Conduit Terminal Adapters, Direct Burial	10.47	
26 05 33 13-0806 EA 3/4" Polyvinyl Chloride (PVC) Conduit Terminal Adapters, Direct Burial	12.07	
26 05 33 13-0807 EA 1" Polyvinyl Chloride (PVC) Conduit Terminal Adapters, Direct Burial	13.60	
26 05 33 13-0808 EA 1-1/4" Polyvinyl Chloride (PVC) Conduit Terminal Adapters, Direct Burial	15.20	
26 05 33 13-0809 EA 1-1/2" Polyvinyl Chloride (PVC) Conduit Terminal Adapter, Direct Burial	16.71	
26 05 33 13-0810 EA 2" Polyvinyl Chloride (PVC) Conduit Terminal Adapter, Direct Burial	18.40	
26 05 33 13-0811 EA 2-1/2" Polyvinyl Chloride (PVC) Conduit Terminal Adapter, Direct Burial	21.46	
26 05 33 13-0812 EA 3" Polyvinyl Chloride (PVC) Conduit Terminal Adapter, Direct Burial	24.33	
26 05 33 13-0813 EA 3-1/2" Polyvinyl Chloride (PVC) Conduit Terminal Adapter, Direct Burial	28.66	
26 05 33 13-0814 EA 4" Polyvinyl Chloride (PVC) Conduit Terminal Adapter, Direct Burial	32.39	
26 05 33 13-0815 EA 5" Polyvinyl Chloride (PVC) Conduit Terminal Adapter, Direct Burial	39.11	
26 05 33 13-0816 EA 6" Polyvinyl Chloride (PVC) Conduit Terminal Adapter, Direct Burial	44.01	

26 Electrical**26 05 Common Work Results For Electrical****26 05 33 Raceway And Boxes For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 13-0817			Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Conduit, Direct Burial <small>(26 05 33 13-0748)</small> Note: 40 mil Polyvinyl Chloride (PVC) coated, 2 mil urethane lined (Ocal Blue, Crouse-Hinds, Appleton or O-Z/Gedney).		
26 05 33 13-0818			Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Conduit, Direct Burial <small>(26 05 33 13-0817)</small> Note: Includes field bending for conduit up to 1".		
26 05 33 13-0819	LF		1/2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Conduit, Direct Burial	8.32	1.54
			For >1,000, Deduct	-0.73	
			For >250 To 500, Deduct	-0.32	
			For >500 To 1,000, Deduct	-0.52	
26 05 33 13-0820	LF		3/4" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Conduit, Direct Burial	9.37	1.92
			For >1,000, Deduct	-0.83	
			For >250 To 500, Deduct	-0.36	
			For >500 To 1,000, Deduct	-0.59	
26 05 33 13-0821	LF		1" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Conduit, Direct Burial	11.56	2.14
			For >1,000, Deduct	-1.03	
			For >250 To 500, Deduct	-0.45	
			For >500 To 1,000, Deduct	-0.74	
26 05 33 13-0822	LF		1-1/4" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Conduit, Direct Burial	14.03	2.87
			For >1,000, Deduct	-1.26	
			For >250 To 500, Deduct	-0.55	
			For >500 To 1,000, Deduct	-0.91	
26 05 33 13-0823	LF		1-1/2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Conduit, Direct Burial	16.52	3.24
			For >1,000, Deduct	-1.49	
			For >250 To 500, Deduct	-0.66	
			For >500 To 1,000, Deduct	-1.07	
26 05 33 13-0824	LF		2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Conduit, Direct Burial	20.99	3.53
			For >1,000, Deduct	-1.90	
			For >250 To 500, Deduct	-0.85	
			For >500 To 1,000, Deduct	-1.37	
26 05 33 13-0825	LF		2-1/2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Conduit, Direct Burial	30.59	5.29
			For >1,000, Deduct	-2.78	
			For >250 To 500, Deduct	-1.25	
			For >500 To 1,000, Deduct	-2.02	
26 05 33 13-0826	LF		3" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Conduit, Direct Burial	39.37	6.62
			For >1,000, Deduct	-3.57	
			For >250 To 500, Deduct	-1.60	
			For >500 To 1,000, Deduct	-2.59	
26 05 33 13-0827	LF		3-1/2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Conduit, Direct Burial	48.55	6.99
			For >1,000, Deduct	-4.40	
			For >250 To 500, Deduct	-1.97	
			For >500 To 1,000, Deduct	-3.18	
26 05 33 13-0828	LF		4" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Conduit, Direct Burial	57.62	7.72
			For >1,000, Deduct	-5.21	
			For >250 To 500, Deduct	-2.33	
			For >500 To 1,000, Deduct	-3.77	
26 05 33 13-0829	LF		5" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Conduit, Direct Burial	90.96	10.66
			For >1,000, Deduct	-8.40	
			For >250 To 500, Deduct	-3.85	
			For >500 To 1,000, Deduct	-6.12	
26 05 33 13-0830	LF		6" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Conduit, Direct Burial	121.66	13.97
			For >1,000, Deduct	-11.28	
			For >250 To 500, Deduct	-5.20	
			For >500 To 1,000, Deduct	-8.24	
26 05 33 13-0831			Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Couplings, Direct Burial <small>(26 05 33 13-0817)</small>		
26 05 33 13-0832	EA		1/2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Coupling, Direct Burial.....	8.93	2.21
26 05 33 13-0833	EA		3/4" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Coupling, Direct Burial.....	10.63	2.94
26 05 33 13-0834	EA		1" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Coupling, Direct Burial.....	13.51	3.68
26 05 33 13-0835	EA		1-1/4" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Coupling, Direct Burial.....	15.26	4.04
26 05 33 13-0836	EA		1-1/2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Coupling, Direct Burial.....	18.09	4.78
26 05 33 13-0837	EA		2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Coupling, Direct Burial.....	23.51	5.51
26 05 33 13-0838	EA		2-1/2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Coupling, Direct Burial.....	44.12	6.62
26 05 33 13-0839	EA		3" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Coupling, Direct Burial.....	55.89	9.19
26 05 33 13-0840	EA		3-1/2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Coupling, Direct Burial.....	69.44	10.66
26 05 33 13-0841	EA		4" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Coupling, Direct Burial.....	85.67	14.71
26 05 33 13-0842	EA		5" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Coupling, Direct Burial.....	223.76	20.22
26 05 33 13-0843	EA		6" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Coupling, Direct Burial.....	227.57	11.40
26 05 33 13-0844			Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Standard Radius Elbows, Direct Burial <small>(26 05 33 13-0817)</small> Note: 90, 45, or 30 degree.		
26 05 33 13-0845	EA		1/2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Standard Radius Elbow, Direct Burial.....	34.22	9.19
26 05 33 13-0846	EA		3/4" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Standard Radius Elbow, Direct Burial.....	39.24	11.40
26 05 33 13-0847	EA		1" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Standard Radius Elbow, Direct Burial.....	46.80	13.97



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 13-0848 EA 1-1/4" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Standard Radius Elbow, Direct Burial.....	55.54	16.17
26 05 33 13-0849 EA 1-1/2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Standard Radius Elbow, Direct Burial.....	65.25	18.38
26 05 33 13-0850 EA 2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Standard Radius Elbow, Direct Burial.....	80.20	20.22
26 05 33 13-0851 EA 2-1/2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Standard Radius Elbow, Direct Burial.....	125.63	25.37
26 05 33 13-0852 EA 3" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Standard Radius Elbow, Direct Burial.....	188.80	34.56
26 05 33 13-0853 EA 3-1/2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Standard Radius Elbow, Direct Burial.....	234.99	38.97
26 05 33 13-0854 EA 4" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Standard Radius Elbow, Direct Burial.....	267.48	50.73
26 05 33 13-0855 EA 5" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Standard Radius Elbow, Direct Burial.....	565.49	82.72
26 05 33 13-0856 EA 6" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Standard Radius Elbow, Direct Burial.....	891.56	124.27
26 05 33 13-0857 Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 12" Large Radius Elbows, Direct Burial <small>(26 05 33 13-0817)</small>		
26 05 33 13-0858 EA 1" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 12" Large Radius Elbow, Direct Burial.....	84.14	13.97
26 05 33 13-0859 EA 1-1/4" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 12" Large Radius Elbow, Direct Burial.....	94.52	16.17
26 05 33 13-0860 EA 1-1/2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 12" Large Radius Elbow, Direct Burial.....	107.93	18.38
26 05 33 13-0861 EA 2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 12" Large Radius Elbow, Direct Burial.....	129.45	20.22
26 05 33 13-0862 EA 2-1/2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 12" Large Radius Elbow, Direct Burial.....	181.37	25.37
26 05 33 13-0863 Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 15" Large Radius Elbows, Direct Burial <small>(26 05 33 13-0817)</small>		
26 05 33 13-0864 EA 1" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 15" Large Radius Elbow, Direct Burial.....	94.24	13.97
26 05 33 13-0865 EA 1-1/4" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 15" Large Radius Elbow, Direct Burial.....	111.21	16.17
26 05 33 13-0866 EA 1-1/2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 15" Large Radius Elbow, Direct Burial.....	119.90	18.38
26 05 33 13-0867 EA 2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 15" Large Radius Elbow, Direct Burial.....	155.54	20.22
26 05 33 13-0868 EA 2-1/2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 15" Large Radius Elbow, Direct Burial.....	206.52	25.37
26 05 33 13-0869 EA 3" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 15" Large Radius Elbow, Direct Burial.....	263.40	34.56
26 05 33 13-0870 Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 18" Large Radius Elbows, Direct Burial <small>(26 05 33 13-0817)</small>		
26 05 33 13-0871 EA 1" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 18" Large Radius Elbow, Direct Burial.....	106.31	13.97
26 05 33 13-0872 EA 1-1/4" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 18" Large Radius Elbow, Direct Burial.....	119.90	16.17
26 05 33 13-0873 EA 1-1/2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 18" Large Radius Elbow, Direct Burial.....	135.25	18.38
26 05 33 13-0874 EA 2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 18" Large Radius Elbow, Direct Burial.....	164.19	20.22
26 05 33 13-0875 EA 2-1/2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 18" Large Radius Elbow, Direct Burial.....	235.43	25.37
26 05 33 13-0876 EA 3" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 18" Large Radius Elbow, Direct Burial.....	297.34	34.56
26 05 33 13-0877 EA 3-1/2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 18" Large Radius Elbow, Direct Burial.....	377.11	38.97
26 05 33 13-0878 EA 4" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 18" Large Radius Elbow, Direct Burial.....	422.32	50.73
26 05 33 13-0879 Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 24" Large Radius Elbows, Direct Burial <small>(26 05 33 13-0817)</small>		
26 05 33 13-0880 EA 1" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 24" Large Radius Elbow, Direct Burial.....	127.17	13.97
26 05 33 13-0881 EA 1-1/4" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 24" Large Radius Elbow, Direct Burial.....	140.30	16.17
26 05 33 13-0882 EA 1-1/2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 24" Large Radius Elbow, Direct Burial.....	158.41	18.38
26 05 33 13-0883 EA 2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 24" Large Radius Elbow, Direct Burial.....	197.54	20.22
26 05 33 13-0884 EA 2-1/2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 24" Large Radius Elbow, Direct Burial.....	287.16	25.37

26 Electrical**26 05 Common Work Results For Electrical****26 05 33 Raceway And Boxes For Electrical Systems**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 13-0885 EA 3" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 24" Large Radius Elbow, Direct Burial.....	354.84	34.56
26 05 33 13-0886 EA 3-1/2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 24" Large Radius Elbow, Direct Burial.....	412.22	38.97
26 05 33 13-0887 EA 4" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 24" Large Radius Elbow, Direct Burial.....	486.77	50.73
26 05 33 13-0888 Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 30" Large Radius Elbows, Direct Burial <small>(26 05 33 13-0817)</small>		
26 05 33 13-0889 EA 1" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 30" Large Radius Elbow, Direct Burial.....	143.39	13.97
26 05 33 13-0890 EA 1-1/4" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 30" Large Radius Elbow, Direct Burial.....	159.28	16.17
26 05 33 13-0891 EA 1-1/2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 30" Large Radius Elbow, Direct Burial.....	181.20	18.38
26 05 33 13-0892 EA 2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 30" Large Radius Elbow, Direct Burial.....	226.57	20.22
26 05 33 13-0893 EA 2-1/2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 30" Large Radius Elbow, Direct Burial.....	315.39	25.37
26 05 33 13-0894 EA 3" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 30" Large Radius Elbow, Direct Burial.....	400.83	34.56
26 05 33 13-0895 EA 3-1/2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 30" Large Radius Elbow, Direct Burial.....	497.58	38.97
26 05 33 13-0896 EA 4" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 30" Large Radius Elbow, Direct Burial.....	545.94	50.73
26 05 33 13-0897 EA 5" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 30" Large Radius Elbow, Direct Burial.....	910.88	82.72
26 05 33 13-0898 Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 36" Large Radius Elbows, Direct Burial <small>(26 05 33 13-0817)</small>		
26 05 33 13-0899 EA 1" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 36" Large Radius Elbow, Direct Burial.....	164.62	13.97
26 05 33 13-0900 EA 1-1/4" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 36" Large Radius Elbow, Direct Burial.....	182.23	16.17
26 05 33 13-0901 EA 1-1/2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 36" Large Radius Elbow, Direct Burial.....	206.19	18.38
26 05 33 13-0902 EA 2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 36" Large Radius Elbow, Direct Burial.....	258.77	20.22
26 05 33 13-0903 EA 2-1/2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 36" Large Radius Elbow, Direct Burial.....	362.43	25.37
26 05 33 13-0904 EA 3" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 36" Large Radius Elbow, Direct Burial.....	459.42	34.56
26 05 33 13-0905 EA 3-1/2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 36" Large Radius Elbow, Direct Burial.....	540.35	38.97
26 05 33 13-0906 EA 4" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 36" Large Radius Elbow, Direct Burial.....	622.31	50.73
26 05 33 13-0907 EA 5" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 36" Large Radius Elbow, Direct Burial.....	964.41	82.72
26 05 33 13-0908 EA 6" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 36" Large Radius Elbow, Direct Burial.....	1,314.52	124.27
26 05 33 13-0909 Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 42" Large Radius Elbows, Direct Burial <small>(26 05 33 13-0817)</small>		
26 05 33 13-0910 EA 1" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 42" Large Radius Elbow, Direct Burial.....	194.16	13.97
26 05 33 13-0911 EA 1-1/4" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 42" Large Radius Elbow, Direct Burial.....	202.68	16.17
26 05 33 13-0912 EA 1-1/2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 42" Large Radius Elbow, Direct Burial.....	239.63	18.38
26 05 33 13-0913 EA 2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 42" Large Radius Elbow, Direct Burial.....	303.59	20.22
26 05 33 13-0914 EA 2-1/2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 42" Large Radius Elbow, Direct Burial.....	425.85	25.37
26 05 33 13-0915 EA 3" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 42" Large Radius Elbow, Direct Burial.....	538.42	34.56
26 05 33 13-0916 EA 3-1/2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 42" Large Radius Elbow, Direct Burial.....	659.26	38.97
26 05 33 13-0917 EA 4" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 42" Large Radius Elbow, Direct Burial.....	770.90	50.73
26 05 33 13-0918 EA 5" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 42" Large Radius Elbow, Direct Burial.....	1,139.01	82.72
26 05 33 13-0919 EA 6" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 42" Large Radius Elbow, Direct Burial.....	1,394.67	124.27
26 05 33 13-0920 Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 48" Large Radius Elbows, Direct Burial <small>(26 05 33 13-0817)</small>		
26 05 33 13-0921 EA 1" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 48" Large Radius Elbow, Direct Burial.....	201.28	13.97



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 13-0922 EA 1-1/4" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 48" Large Radius Elbow, Direct Burial.....	237.27	16.17
26 05 33 13-0923 EA 1-1/2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 48" Large Radius Elbow, Direct Burial.....	268.56	18.38
26 05 33 13-0924 EA 2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 48" Large Radius Elbow, Direct Burial.....	317.08	20.22
26 05 33 13-0925 EA 2-1/2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 48" Large Radius Elbow, Direct Burial.....	441.69	25.37
26 05 33 13-0926 EA 3" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 48" Large Radius Elbow, Direct Burial.....	562.71	34.56
26 05 33 13-0927 EA 3-1/2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 48" Large Radius Elbow, Direct Burial.....	724.02	38.97
26 05 33 13-0928 EA 4" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 48" Large Radius Elbow, Direct Burial.....	804.60	50.73
26 05 33 13-0929 EA 5" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 48" Large Radius Elbow, Direct Burial.....	1,185.91	82.72
26 05 33 13-0930 EA 6" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) 48" Large Radius Elbow, Direct Burial.....	1,435.39	124.27
26 05 33 13-0931 Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS), UNF Conduit Unions, Direct Burial (26 05 33 13-0817)		
26 05 33 13-0932 EA 1/2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) UNF Conduit Union, Direct Burial.....	65.60	9.19
26 05 33 13-0933 EA 3/4" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) UNF Conduit Union, Direct Burial.....	70.87	11.40
26 05 33 13-0934 EA 1" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) UNF Conduit Union, Direct Burial.....	92.39	13.97
26 05 33 13-0935 EA 1-1/4" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) UNF Conduit Union, Direct Burial.....	136.09	16.17
26 05 33 13-0936 EA 1-1/2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) UNF Conduit Union, Direct Burial.....	161.88	18.38
26 05 33 13-0937 EA 2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) UNF Conduit Union, Direct Burial.....	207.18	20.22
26 05 33 13-0938 EA 2-1/2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) UNF Conduit Union, Direct Burial.....	276.46	25.37
26 05 33 13-0939 EA 3" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) UNF Conduit Union, Direct Burial.....	361.93	25.37
26 05 33 13-0940 EA 3-1/2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) UNF Conduit Union, Direct Burial.....	463.97	38.97
26 05 33 13-0941 EA 4" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) UNF Conduit Union, Direct Burial.....	597.14	50.73
26 05 33 13-0942 EA 5" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) UNF Conduit Union, Direct Burial.....	1,091.90	82.72
26 05 33 13-0943 EA 6" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) UNF Conduit Union, Direct Burial.....	1,351.93	124.27
26 05 33 13-0944 Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS), UNY Conduit Unions, Direct Burial (26 05 33 13-0817)		
26 05 33 13-0945 EA 1/2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) UNY Conduit Union, Direct Burial.....	67.19	9.19
26 05 33 13-0946 EA 3/4" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) UNY Conduit Union, Direct Burial.....	76.94	11.40
26 05 33 13-0947 EA 1" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) UNY Conduit Union, Direct Burial.....	95.63	13.97
26 05 33 13-0948 EA 1-1/4" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) UNY Conduit Union, Direct Burial.....	142.03	16.17
26 05 33 13-0949 EA 1-1/2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) UNY Conduit Union, Direct Burial.....	170.13	18.38
26 05 33 13-0950 EA 2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) UNY Conduit Union, Direct Burial.....	225.00	20.22
26 05 33 13-0951 EA 2-1/2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) UNY Conduit Union, Direct Burial.....	314.59	25.37
26 05 33 13-0952 EA 3" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) UNY Conduit Union, Direct Burial.....	400.70	25.37
26 05 33 13-0953 EA 3-1/2" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) UNY Conduit Union, Direct Burial.....	534.06	38.97
26 05 33 13-0954 EA 4" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) UNY Conduit Union, Direct Burial.....	666.97	50.73
26 05 33 13-0955 EA 5" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) UNY Conduit Union, Direct Burial.....	1,219.90	82.72
26 05 33 13-0956 EA 6" Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) UNY Conduit Union, Direct Burial.....	1,558.62	124.27
26 05 33 13-0957 Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS), Nipples, Direct Burial (26 05 33 13-0817)		
26 05 33 13-0958 EA 1/2" x 2" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial.....	22.21	4.41
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	<i>2.65</i>	

26 Electrical**26 05 Common Work Results For Electrical****26 05 33 Raceway And Boxes For Electrical Systems**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 13-0959 EA 3/4" x 2" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	24.68	5.51
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	3.31	
26 05 33 13-0960 EA 1" x 2" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	28.37	6.99
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.19	
26 05 33 13-0961 EA 1-1/4" x 2" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	33.88	8.09
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.85	
26 05 33 13-0962 EA 1-1/2" x 2" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	36.67	9.19
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.51	
26 05 33 13-0963 EA 1/2" x 2-1/2" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	24.67	4.78
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2.87	
26 05 33 13-0964 EA 3/4" x 2-1/2" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	26.51	5.51
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	3.31	
26 05 33 13-0965 EA 1" x 2-1/2" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	30.22	6.99
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.19	
26 05 33 13-0966 EA 1-1/4" x 2-1/2" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	35.84	8.09
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.85	
26 05 33 13-0967 EA 1-1/2" x 2-1/2" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	38.78	9.19
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.51	
26 05 33 13-0968 EA 2" x 2-1/2" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	41.89	10.30
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	6.17	
26 05 33 13-0969 EA 1/2" x 3" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	24.80	4.78
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2.87	
26 05 33 13-0970 EA 3/4" x 3" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	26.63	5.51
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	3.31	
26 05 33 13-0971 EA 1" x 3" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	30.45	6.99
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.19	
26 05 33 13-0972 EA 1-1/4" x 3" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	36.09	8.09
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.85	
26 05 33 13-0973 EA 1-1/2" x 3" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	39.03	9.19
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.51	
26 05 33 13-0974 EA 2" x 3" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	42.55	10.30
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	6.17	
26 05 33 13-0975 EA 1/2" x 3-1/2" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	26.54	4.78
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2.87	
26 05 33 13-0976 EA 3/4" x 3-1/2" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	28.37	5.51
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	3.31	
26 05 33 13-0977 EA 1" x 3-1/2" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	32.32	6.99
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.19	
26 05 33 13-0978 EA 1-1/4" x 3-1/2" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	37.15	8.09
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.85	
26 05 33 13-0979 EA 1-1/2" x 3-1/2" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	40.20	9.19
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.51	
26 05 33 13-0980 EA 2" x 3-1/2" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	44.60	10.30
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	6.17	
26 05 33 13-0981 EA 2-1/2" x 3-1/2" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	63.12	12.50
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	7.50	
26 05 33 13-0982 EA 3" x 3-1/2" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	81.21	17.28
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.37	
26 05 33 13-0983 EA 1/2" x 4" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	26.66	4.78
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2.87	
26 05 33 13-0984 EA 3/4" x 4" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	28.61	5.51
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	3.31	
26 05 33 13-0985 EA 1" x 4" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	32.58	6.99
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.19	
26 05 33 13-0986 EA 1-1/4" x 4" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	38.21	8.09
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.85	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 13-0987 EA 1-1/2" x 4" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	41.38	9.19
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.51	
26 05 33 13-0988 EA 2" x 4" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	46.65	10.30
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	6.17	
26 05 33 13-0989 EA 2-1/2" x 4" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	64.94	12.50
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	7.50	
26 05 33 13-0990 EA 3" x 4" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	85.11	17.28
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.37	
26 05 33 13-0991 EA 3-1/2" x 4" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	102.01	19.48
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	11.69	
26 05 33 13-0992 EA 4" x 4" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	118.18	25.37
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	15.22	
26 05 33 13-0993 EA 1/2" x 5" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	26.90	4.78
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2.87	
26 05 33 13-0994 EA 3/4" x 5" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	28.87	5.51
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	3.31	
26 05 33 13-0995 EA 1" x 5" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	32.85	6.99
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.19	
26 05 33 13-0996 EA 1-1/4" x 5" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	38.71	8.09
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.85	
26 05 33 13-0997 EA 1-1/2" x 5" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	41.89	9.19
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.51	
26 05 33 13-0998 EA 2" x 5" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	47.77	10.30
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	6.17	
26 05 33 13-0999 EA 2-1/2" x 5" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	72.14	12.50
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	7.50	
26 05 33 13-1000 EA 3" x 5" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	90.94	17.28
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.37	
26 05 33 13-1001 EA 3-1/2" x 5" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	103.26	19.48
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	11.69	
26 05 33 13-1002 EA 4" x 5" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	121.51	25.37
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	15.22	
26 05 33 13-1003 EA 5" x 5" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	179.94	34.93
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	20.96	
26 05 33 13-1004 EA 1/2" x 6" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	27.36	4.78
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2.87	
26 05 33 13-1005 EA 3/4" x 6" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	29.32	5.51
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	3.31	
26 05 33 13-1006 EA 1" x 6" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	33.34	6.99
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.19	
26 05 33 13-1007 EA 1-1/4" x 6" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	39.62	8.09
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.85	
26 05 33 13-1008 EA 1-1/2" x 6" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	42.99	9.19
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.51	
26 05 33 13-1009 EA 2" x 6" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	48.88	10.30
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	6.17	
26 05 33 13-1010 EA 2-1/2" x 6" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	79.46	12.50
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	7.50	
26 05 33 13-1011 EA 3" x 6" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	98.70	17.28
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.37	
26 05 33 13-1012 EA 3-1/2" x 6" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	110.24	19.48
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	11.69	
26 05 33 13-1013 EA 4" x 6" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	133.29	25.37
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	15.22	
26 05 33 13-1014 EA 5" x 6" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	197.56	34.93
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	20.96	

26 Electrical**26 05 Common Work Results For Electrical****26 05 33 Raceway And Boxes For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 13-1015	EA		1/2" x 8" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	28.07	4.78
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2.87	
26 05 33 13-1016	EA		3/4" x 8" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	30.02	5.51
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	3.31	
26 05 33 13-1017	EA		1" x 8" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	34.44	6.99
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.19	
26 05 33 13-1018	EA		1-1/4" x 8" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	39.86	8.09
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.85	
26 05 33 13-1019	EA		1-1/2" x 8" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	45.22	9.19
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.51	
26 05 33 13-1020	EA		2" x 8" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	54.33	10.30
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	6.17	
26 05 33 13-1021	EA		2-1/2" x 8" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	88.46	12.50
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	7.50	
26 05 33 13-1022	EA		3" x 8" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	109.31	17.28
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.37	
26 05 33 13-1023	EA		3-1/2" x 8" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	127.73	19.48
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	11.69	
26 05 33 13-1024	EA		4" x 8" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	150.98	25.37
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	15.22	
26 05 33 13-1025	EA		5" x 8" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	209.64	34.93
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	20.96	
26 05 33 13-1026	EA		1/2" x 10" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	28.82	4.78
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2.87	
26 05 33 13-1027	EA		3/4" x 10" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	30.75	5.51
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	3.31	
26 05 33 13-1028	EA		1" x 10" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	35.52	6.99
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.19	
26 05 33 13-1029	EA		1-1/4" x 10" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	43.15	8.09
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.85	
26 05 33 13-1030	EA		1-1/2" x 10" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	50.52	9.19
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.51	
26 05 33 13-1031	EA		2" x 10" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	62.35	10.30
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	6.17	
26 05 33 13-1032	EA		2-1/2" x 10" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	97.98	12.50
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	7.50	
26 05 33 13-1033	EA		3" x 10" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	122.90	17.28
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.37	
26 05 33 13-1034	EA		3-1/2" x 10" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	146.10	19.48
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	11.69	
26 05 33 13-1035	EA		4" x 10" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	181.94	25.37
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	15.22	
26 05 33 13-1036	EA		5" x 10" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	233.73	34.93
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	20.96	
26 05 33 13-1037	EA		1/2" x 12" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	29.59	4.78
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2.87	
26 05 33 13-1038	EA		3/4" x 12" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	31.61	5.51
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	3.31	
26 05 33 13-1039	EA		1" x 12" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	38.26	6.99
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.19	
26 05 33 13-1040	EA		1-1/4" x 12" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	48.57	8.09
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.85	
26 05 33 13-1041	EA		1-1/2" x 12" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	56.94	9.19
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.51	
26 05 33 13-1042	EA		2" x 12" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	68.78	10.30
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	6.17	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 13-1043 EA 2-1/2" x 12" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	110.67	12.50
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	7.50	
26 05 33 13-1044 EA 3" x 12" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	143.28	17.28
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.37	
26 05 33 13-1045 EA 3-1/2" x 12" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	157.37	19.48
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	11.69	
26 05 33 13-1046 EA 4" x 12" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	191.43	25.37
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	15.22	
26 05 33 13-1047 EA 5" x 12" Long Polyvinyl Chloride (PVC) Coated, Urethane Lined, Rigid Galvanized Steel (RGS) Nipple, Direct Burial	237.17	34.93
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	20.96	
26 05 33 13-1048 Spacers <small>(26 05 33 13-0748)</small>		
<i>Note: For concrete encasement applications. See CSI section 03 31 13 00-0039 for concrete., 26 05 33 13-0748 for conduit.</i>		
26 05 33 13-1049 EA 1" Base Spacers, Average 4" Wide, Direct Burial	7.54	
26 05 33 13-1050 EA 1" Intermediate Spacers, Average 4" Wide, Direct Burial	8.13	
26 05 33 13-1051 EA 1-1/4" Base Spacer, Average 4" Wide, Direct Burial	9.00	
26 05 33 13-1052 EA 1-1/4" Intermediate Spacers, Average 4" Wide, Direct Burial	9.71	
26 05 33 13-1053 EA 1-1/2" Base Spacer, Average 4" Wide, Direct Burial	9.06	
26 05 33 13-1054 EA 1-1/2" Intermediate Spacers, Average 4" Wide, Direct Burial	9.76	
26 05 33 13-1055 EA 2" Base Spacer, Average 4" Wide, Direct Burial	11.30	
26 05 33 13-1056 EA 2" Intermediate Spacers, Average 4" Wide, Direct Burial	10.50	
26 05 33 13-1057 EA 2-1/2" Base Spacer, Average 4" Wide, Direct Burial	12.51	
26 05 33 13-1058 EA 2-1/2" Intermediate Spacers, Average 4" Wide, Direct Burial	12.09	
26 05 33 13-1059 EA 3" Base Spacer, Average 4" Wide, Direct Burial	14.34	
26 05 33 13-1060 EA 3" Intermediate Spacers, Average 4" Wide, Direct Burial	13.66	
26 05 33 13-1061 EA 3-1/2" Base Spacer, Average 4" Wide, Direct Burial	15.53	
26 05 33 13-1062 EA 3-1/2" Intermediate Spacers, Average 4" Wide, Direct Burial	14.84	
26 05 33 13-1063 EA 4" Base Spacer, Average 4" Wide, Direct Burial	15.99	
26 05 33 13-1064 EA 4" Intermediate Spacers, Average 4" Wide, Direct Burial	15.26	
26 05 33 13-1065 Conduit Field Bending <small>(26 05 33 13-0040)</small>		
26 05 33 13-1066 Metallic Conduit Field Bending <small>(26 05 33 13-1065)</small>		
<i>Note: For use with Rigid Galvanized Steel (RGS), Electrical Metallic Tubing (EMT), Intermediate Metal Conduit (IMC) and aluminum conduits.</i>		
26 05 33 13-1067 EA 1-1/4" Metallic Conduit Field Bending	12.43	
26 05 33 13-1068 EA 1-1/2" Metallic Conduit Field Bending	16.58	
26 05 33 13-1069 EA 2" Metallic Conduit Field Bending	20.72	
26 05 33 13-1070 EA 2-1/2" Metallic Conduit Field Bending	29.00	
26 05 33 13-1071 EA 3" Metallic Conduit Field Bending	37.29	
26 05 33 13-1072 EA 3-1/2" Metallic Conduit Field Bending	45.57	
26 05 33 13-1073 EA 4" Metallic Conduit Field Bending	53.86	
26 05 33 13-1074 EA 5" Metallic Conduit Field Bending	66.29	
26 05 33 13-1075 EA 6" Metallic Conduit Field Bending	78.72	
26 05 33 13-1076 Plastic Conduit Field Bending <small>(26 05 33 13-1065)</small>		
<i>Note: For PVC conduits.</i>		
26 05 33 13-1077 EA 1" Plastic Conduit Field Bending	19.06	
26 05 33 13-1078 EA 1-1/4" Plastic Conduit Field Bending	20.72	
26 05 33 13-1079 EA 1-1/2" Plastic Conduit Field Bending	24.86	
26 05 33 13-1080 EA 2" Plastic Conduit Field Bending	33.14	
26 05 33 13-1081 EA 2-1/2" Plastic Conduit Field Bending	41.43	
26 05 33 13-1082 EA 3" Plastic Conduit Field Bending	49.72	
26 05 33 13-1083 EA 3-1/2" Plastic Conduit Field Bending	58.01	
26 05 33 13-1084 EA 4" Plastic Conduit Field Bending	66.29	
26 05 33 13-1085 EA 5" Plastic Conduit Field Bending	74.58	
26 05 33 13-1086 EA 6" Plastic Conduit Field Bending	82.86	
26 05 33 13-1087 Cut And Thread Existing In-Place Threaded Conduit <small>(26 05 33 13-0040)</small>		
<i>Note: For use when connecting conduit to an existing in-place system.</i>		
26 05 33 13-1088 EA 1/2", Cut And Thread Existing In-Place Threaded Conduit	24.17	
<i>For Work In Restricted Working Space, Add</i>	7.25	
26 05 33 13-1089 EA 3/4", Cut And Thread Existing In-Place Threaded Conduit	26.59	
<i>For Work In Restricted Working Space, Add</i>	7.98	
26 05 33 13-1090 EA 1", Cut And Thread Existing In-Place Threaded Conduit	29.01	
<i>For Work In Restricted Working Space, Add</i>	8.70	
26 05 33 13-1091 EA 1-1/4", Cut And Thread Existing In-Place Threaded Conduit	31.43	
<i>For Work In Restricted Working Space, Add</i>	9.43	
26 05 33 13-1092 EA 1-1/2", Cut And Thread Existing In-Place Threaded Conduit	33.03	
<i>For Work In Restricted Working Space, Add</i>	9.91	
26 05 33 13-1093 EA 2", Cut And Thread Existing In-Place Threaded Conduit	34.65	
<i>For Work In Restricted Working Space, Add</i>	10.40	

26 Electrical**26 05 Common Work Results For Electrical****26 05 33 Raceway And Boxes For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 13-1094	EA		2-1/2", Cut And Thread Existing In-Place Threaded Conduit.....	36.26	
			<i>For Work In Restricted Working Space, Add</i>	10.88	
26 05 33 13-1095	EA		3", Cut And Thread Existing In-Place Threaded Conduit.....	37.87	
			<i>For Work In Restricted Working Space, Add</i>	11.36	
26 05 33 13-1096	EA		3-1/2", Cut And Thread Existing In-Place Threaded Conduit.....	38.67	
			<i>For Work In Restricted Working Space, Add</i>	11.60	
26 05 33 13-1097	EA		4", Cut And Thread Existing In-Place Threaded Conduit.....	39.48	
			<i>For Work In Restricted Working Space, Add</i>	11.84	
26 05 33 13-1098	EA		5", Cut And Thread Existing In-Place Threaded Conduit.....	41.09	
			<i>For Work In Restricted Working Space, Add</i>	12.33	
26 05 33 13-1099	EA		6", Cut And Thread Existing In-Place Threaded Conduit.....	42.70	
			<i>For Work In Restricted Working Space, Add</i>	12.81	
26 05 33 13-1100			Flexible Conduit (26 05 33 13-0040)		
26 05 33 13-1101			Flexible Liquid Tight Metallic Conduit And Connectors (26 05 33 13-1100) Note: Steel inner core with PVC cover.		
26 05 33 13-1102			Flexible Liquid Tight Metallic Conduit (26 05 33 13-1101)		
26 05 33 13-1103	LF		1/2" Flexible Liquid Tight Metallic Conduit.....	3.39	0.88
			<i>For Installation In Concrete Beam, Slab, Etc. (Excludes Concrete), Add</i>	0.33	
			<i>For Work In Restricted Working Space, Add</i>	0.66	
26 05 33 13-1104	LF		3/4" Flexible Liquid Tight Metallic Conduit.....	4.54	1.17
			<i>For Installation In Concrete Beam, Slab, Etc. (Excludes Concrete), Add</i>	0.44	
			<i>For Work In Restricted Working Space, Add</i>	0.88	
26 05 33 13-1105	LF		1" Flexible Liquid Tight Metallic Conduit.....	5.35	1.17
			<i>For Installation In Concrete Beam, Slab, Etc. (Excludes Concrete), Add</i>	0.44	
			<i>For Work In Restricted Working Space, Add</i>	0.88	
26 05 33 13-1106	LF		1-1/4" Flexible Liquid Tight Metallic Conduit.....	6.97	1.47
			<i>For Installation In Concrete Beam, Slab, Etc. (Excludes Concrete), Add</i>	0.55	
			<i>For Work In Restricted Working Space, Add</i>	1.10	
26 05 33 13-1107	LF		1-1/2" Flexible Liquid Tight Metallic Conduit.....	9.03	1.76
			<i>For Installation In Concrete Beam, Slab, Etc. (Excludes Concrete), Add</i>	0.66	
			<i>For Work In Restricted Working Space, Add</i>	1.32	
26 05 33 13-1108	LF		2" Flexible Liquid Tight Metallic Conduit.....	11.87	2.36
			<i>For Installation In Concrete Beam, Slab, Etc. (Excludes Concrete), Add</i>	0.88	
			<i>For Work In Restricted Working Space, Add</i>	1.77	
26 05 33 13-1109	LF		2-1/2" Flexible Liquid Tight Metallic Conduit.....	16.49	2.65
			<i>For Installation In Concrete Beam, Slab, Etc. (Excludes Concrete), Add</i>	0.99	
			<i>For Work In Restricted Working Space, Add</i>	1.99	
26 05 33 13-1110	LF		3" Flexible Liquid Tight Metallic Conduit.....	24.69	3.24
			<i>For Installation In Concrete Beam, Slab, Etc. (Excludes Concrete), Add</i>	1.21	
			<i>For Work In Restricted Working Space, Add</i>	2.43	
26 05 33 13-1111	LF		4" Flexible Liquid Tight Metallic Conduit.....	34.00	4.12
			<i>For Installation In Concrete Beam, Slab, Etc. (Excludes Concrete), Add</i>	1.55	
			<i>For Work In Restricted Working Space, Add</i>	3.09	
26 05 33 13-1112			Straight Connector (26 05 33 13-1101)		
26 05 33 13-1113	EA		1/2" Straight Liquid Tight Connector.....	8.82	2.36
			<i>For Work In Restricted Working Space, Add</i>	1.77	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	1.77	
26 05 33 13-1114	EA		3/4" Straight Liquid Tight Connector.....	10.82	2.65
			<i>For Work In Restricted Working Space, Add</i>	1.99	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	1.99	
26 05 33 13-1115	EA		1" Straight Liquid Tight Connector.....	14.84	2.94
			<i>For Work In Restricted Working Space, Add</i>	2.21	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2.21	
26 05 33 13-1116	EA		1-1/4" Straight Liquid Tight Connector.....	19.41	3.24
			<i>For Work In Restricted Working Space, Add</i>	2.43	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2.43	
26 05 33 13-1117	EA		1-1/2" Straight Liquid Tight Connector.....	24.97	3.53
			<i>For Work In Restricted Working Space, Add</i>	2.65	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2.65	
26 05 33 13-1118	EA		2" Straight Liquid Tight Connector.....	34.90	4.12
			<i>For Work In Restricted Working Space, Add</i>	3.09	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	3.09	
26 05 33 13-1119	EA		2-1/2" Straight Liquid Tight Connector.....	124.92	5.29
			<i>For Work In Restricted Working Space, Add</i>	3.97	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	3.97	
26 05 33 13-1120	EA		3" Straight Liquid Tight Connector.....	161.88	5.58
			<i>For Work In Restricted Working Space, Add</i>	4.19	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.19	
26 05 33 13-1121	EA		4" Straight Liquid Tight Connector.....	197.22	8.23
			<i>For Work In Restricted Working Space, Add</i>	6.17	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	6.17	
26 05 33 13-1122			90 Degree Angle Connector (26 05 33 13-1101)		
26 05 33 13-1123	EA		1/2" 90 Degree Angle Liquid Tight Connector.....	13.61	3.24
			<i>For Work In Restricted Working Space, Add</i>	2.43	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2.43	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 13-1124 EA 3/4" 90 Degree Angle Liquid Tight Connector..... <i>For Work In Restricted Working Space, Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	15.46 2.65 2.65	3.53
26 05 33 13-1125 EA 1" 90 Degree Angle Liquid Tight Connector..... <i>For Work In Restricted Working Space, Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	22.37 3.09 3.09	4.12
26 05 33 13-1126 EA 1-1/4" 90 Degree Angle Liquid Tight Connector <i>For Work In Restricted Working Space, Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	28.69 3.31 3.31	4.41
26 05 33 13-1127 EA 1-1/2" 90 Degree Angle Liquid Tight Connector <i>For Work In Restricted Working Space, Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	35.21 3.53 3.53	4.70
26 05 33 13-1128 EA 2" 90 Degree Angle Liquid Tight Connector..... <i>For Work In Restricted Working Space, Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	47.20 3.97 3.97	5.29
26 05 33 13-1129 EA 2-1/2" 90 Degree Angle Liquid Tight Connector <i>For Work In Restricted Working Space, Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	175.70 4.19 4.19	5.58
26 05 33 13-1130 EA 3" 90 Degree Angle Liquid Tight Connector..... <i>For Work In Restricted Working Space, Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	207.69 4.85 4.85	6.47
26 05 33 13-1131 EA 4" 90 Degree Angle Liquid Tight Connector..... <i>For Work In Restricted Working Space, Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	286.45 7.72 7.72	10.30
26 05 33 13-1132 45 Degree Angle Connector <small>(26 05 33 13-1101)</small>		
26 05 33 13-1133 EA 1/2" 45 Degree Angle Liquid Tight Connector..... <i>For Work In Restricted Working Space, Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	12.92 2.43 2.43	3.24
26 05 33 13-1134 EA 3/4" 45 Degree Angle Liquid Tight Connector..... <i>For Work In Restricted Working Space, Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	15.46 2.65 2.65	3.53
26 05 33 13-1135 EA 1" 45 Degree Angle Liquid Tight Connector..... <i>For Work In Restricted Working Space, Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	24.09 3.09 3.09	4.12
26 05 33 13-1136 EA 1-1/4" 45 Degree Angle Liquid Tight Connector <i>For Work In Restricted Working Space, Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	27.57 3.31 3.31	4.41
26 05 33 13-1137 EA 1-1/2" 45 Degree Angle Liquid Tight Connector <i>For Work In Restricted Working Space, Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	31.05 3.53 3.53	4.70
26 05 33 13-1138 Flexible Metallic Conduit And Connectors <small>(26 05 33 13-1100)</small>		
26 05 33 13-1139 Flexible Steel Conduit <small>(26 05 33 13-1138)</small>		
26 05 33 13-1140 LF 1/2" Flexible Metallic Conduit..... <i>For Installation In Metal Stud Wall, Add</i> <i>For Flexible Aluminum Conduit, Add</i> <i>For Installation In Wood Stud Wall (Includes Drilling), Add</i> <i>For Installation In Concrete Beam, Slab, Etc. (Excludes Concrete), Add</i> <i>For Work In Restricted Working Space, Add</i>	3.01 0.24 0.10 0.61 0.36 0.73	0.96
26 05 33 13-1141 LF 3/4" Flexible Metallic Conduit..... <i>For Installation In Metal Stud Wall, Add</i> <i>For Flexible Aluminum Conduit, Add</i> <i>For Installation In Wood Stud Wall (Includes Drilling), Add</i> <i>For Installation In Concrete Beam, Slab, Etc. (Excludes Concrete), Add</i> <i>For Work In Restricted Working Space, Add</i>	3.43 0.26 0.13 0.66 0.39 0.79	1.28
26 05 33 13-1142 LF 1" Flexible Metallic Conduit..... <i>For Installation In Metal Stud Wall, Add</i> <i>For Flexible Aluminum Conduit, Add</i> <i>For Installation In Wood Stud Wall (Includes Drilling), Add</i> <i>For Installation In Concrete Beam, Slab, Etc. (Excludes Concrete), Add</i> <i>For Work In Restricted Working Space, Add</i>	4.33 0.28 0.25 0.71 0.42 0.85	1.28
26 05 33 13-1143 LF 1-1/4" Flexible Metallic Conduit <i>For Installation In Metal Stud Wall, Add</i> <i>For Flexible Aluminum Conduit, Add</i> <i>For Installation In Wood Stud Wall (Includes Drilling), Add</i> <i>For Installation In Concrete Beam, Slab, Etc. (Excludes Concrete), Add</i> <i>For Work In Restricted Working Space, Add</i>	4.94 0.30 0.32 0.75 0.45 0.89	1.60
26 05 33 13-1144 LF 1-1/2" Flexible Metallic Conduit <i>For Installation In Metal Stud Wall, Add</i> <i>For Flexible Aluminum Conduit, Add</i> <i>For Installation In Wood Stud Wall (Includes Drilling), Add</i> <i>For Installation In Concrete Beam, Slab, Etc. (Excludes Concrete), Add</i> <i>For Work In Restricted Working Space, Add</i>	6.54 0.31 0.57 0.78 0.47 0.93	1.93
26 05 33 13-1145 LF 2" Flexible Metallic Conduit..... <i>For Installation In Metal Stud Wall, Add</i> <i>For Flexible Aluminum Conduit, Add</i> <i>For Installation In Wood Stud Wall (Includes Drilling), Add</i> <i>For Installation In Concrete Beam, Slab, Etc. (Excludes Concrete), Add</i> <i>For Work In Restricted Working Space, Add</i>	7.44 0.32 0.70 0.81 0.48 0.97	2.58

26 Electrical**26 05 Common Work Results For Electrical****26 05 33 Raceway And Boxes For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 13-1146	LF	2-1/2"	Flexible Steel Conduit.....	9.13	2.90
			<i>For Installation In Metal Stud Wall, Add</i>	0.40	
			<i>For Flexible Aluminum Conduit, Add</i>	0.84	
			<i>For Installation In Wood Stud Wall (Includes Drilling), Add</i>	1.01	
			<i>For Installation In Concrete Beam, Slab, Etc. (Excludes Concrete), Add</i>	0.60	
			<i>For Work In Restricted Working Space, Add</i>	1.21	
26 05 33 13-1147	LF	3"	Flexible Metallic Conduit.....	13.69	3.54
			<i>For Installation In Metal Stud Wall, Add</i>	0.48	
			<i>For Flexible Aluminum Conduit, Add</i>	1.46	
			<i>For Installation In Wood Stud Wall (Includes Drilling), Add</i>	1.21	
			<i>For Installation In Concrete Beam, Slab, Etc. (Excludes Concrete), Add</i>	0.72	
			<i>For Work In Restricted Working Space, Add</i>	1.45	
26 05 33 13-1148	LF	3-1/2"	Flexible Metallic Conduit.....	16.81	3.86
			<i>For Installation In Metal Stud Wall, Add</i>	0.56	
			<i>For Flexible Aluminum Conduit, Add</i>	1.84	
			<i>For Installation In Wood Stud Wall (Includes Drilling), Add</i>	1.41	
			<i>For Installation In Concrete Beam, Slab, Etc. (Excludes Concrete), Add</i>	0.84	
			<i>For Work In Restricted Working Space, Add</i>	1.69	
26 05 33 13-1149	LF	4"	Flexible Metallic Conduit.....	19.33	4.50
			<i>For Installation In Metal Stud Wall, Add</i>	0.64	
			<i>For Flexible Aluminum Conduit, Add</i>	2.13	
			<i>For Installation In Wood Stud Wall (Includes Drilling), Add</i>	1.61	
			<i>For Installation In Concrete Beam, Slab, Etc. (Excludes Concrete), Add</i>	0.96	
			<i>For Work In Restricted Working Space, Add</i>	1.93	
26 05 33 13-1150 Plain Squeeze Type Straight Connector (26 05 33 13-1138)					
26 05 33 13-1151	EA	1/2"	Flexible Straight Connectors, Plain.....	6.18	2.90
			<i>For Work In Restricted Working Space, Add</i>	1.21	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	1.21	
26 05 33 13-1152	EA	3/4"	Flexible Straight Connectors, Plain.....	7.10	3.54
			<i>For Work In Restricted Working Space, Add</i>	1.45	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	1.45	
26 05 33 13-1153	EA	1"	Flexible Straight Connectors, Plain.....	11.43	3.86
			<i>For Work In Restricted Working Space, Add</i>	1.93	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	1.93	
26 05 33 13-1154	EA	1-1/4"	Flexible Straight Connectors, Plain.....	16.22	4.50
			<i>For Work In Restricted Working Space, Add</i>	2.41	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2.41	
26 05 33 13-1155	EA	1-1/2"	Flexible Straight Connectors, Plain.....	21.41	5.47
			<i>For Work In Restricted Working Space, Add</i>	3.02	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	3.02	
26 05 33 13-1156	EA	2"	Flexible Straight Connectors, Plain.....	28.22	5.47
			<i>For Work In Restricted Working Space, Add</i>	3.62	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	3.62	
26 05 33 13-1157	EA	2-1/2"	Flexible Straight Connectors, Plain.....	45.80	6.76
			<i>For Work In Restricted Working Space, Add</i>	4.22	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.22	
26 05 33 13-1158	EA	3"	Flexible Straight Connectors, Plain.....	60.08	7.40
			<i>For Work In Restricted Working Space, Add</i>	4.83	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.83	
26 05 33 13-1159	EA	3-1/2"	Flexible Straight Connectors, Plain.....	188.23	8.69
			<i>For Work In Restricted Working Space, Add</i>	5.43	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.43	
26 05 33 13-1160	EA	4"	Flexible Straight Connectors, Plain.....	235.34	10.61
			<i>For Work In Restricted Working Space, Add</i>	6.03	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	6.03	
26 05 33 13-1161 Insulated Throat Squeeze Type Straight Connector (26 05 33 13-1138)					
26 05 33 13-1162	EA	1/2"	Flexible Straight Connectors, Insulated.....	6.92	2.90
			<i>For Work In Restricted Working Space, Add</i>	1.21	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	1.21	
26 05 33 13-1163	EA	3/4"	Flexible Straight Connectors, Insulated.....	8.07	3.54
			<i>For Work In Restricted Working Space, Add</i>	1.45	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	1.45	
26 05 33 13-1164	EA	1"	Flexible Straight Connectors, Insulated.....	12.75	3.86
			<i>For Work In Restricted Working Space, Add</i>	1.93	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	1.93	
26 05 33 13-1165	EA	1-1/4"	Flexible Straight Connectors, Insulated.....	18.66	4.50
			<i>For Work In Restricted Working Space, Add</i>	2.41	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2.41	
26 05 33 13-1166	EA	1-1/2"	Flexible Straight Connectors, Insulated.....	25.75	4.82
			<i>For Work In Restricted Working Space, Add</i>	3.02	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	3.02	
26 05 33 13-1167	EA	2"	Flexible Straight Connectors, Insulated.....	35.89	5.47
			<i>For Work In Restricted Working Space, Add</i>	3.62	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	3.62	
26 05 33 13-1168	EA	2-1/2"	Flexible Straight Connectors, Insulated.....	62.20	6.76
			<i>For Work In Restricted Working Space, Add</i>	4.22	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.22	
26 05 33 13-1169	EA	3"	Flexible Straight Connectors, Insulated.....	79.42	7.40
			<i>For Work In Restricted Working Space, Add</i>	4.83	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.83	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 13-1170 EA 3-1/2" Flexible Straight Connectors, Insulated..... <i>For Work In Restricted Working Space, Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	218.04 5.43 5.43	8.69
26 05 33 13-1171 EA 4" Flexible Straight Connectors, Insulated..... <i>For Work In Restricted Working Space, Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	280.16 6.03 6.03	10.61
26 05 33 13-1172 Plain Squeeze Type 90 Degree Connector (26 05 33 13-1138)		
26 05 33 13-1173 EA 1/2" Flexible 90 Degree Connector, Plain..... <i>For Work In Restricted Working Space, Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.28 1.69 1.69	3.54
26 05 33 13-1174 EA 3/4" Flexible 90 Degree Connector, Plain..... <i>For Work In Restricted Working Space, Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	12.14 1.93 1.93	3.86
26 05 33 13-1175 EA 1" Flexible 90 Degree Connector, Plain..... <i>For Work In Restricted Working Space, Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	17.06 2.41 2.41	4.50
26 05 33 13-1176 EA 1-1/4" Flexible 90 Degree Connector, Plain..... <i>For Work In Restricted Working Space, Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	26.77 2.90 2.90	4.82
26 05 33 13-1177 EA 1-1/2" Flexible 90 Degree Connector, Plain..... <i>For Work In Restricted Working Space, Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	41.99 3.62 3.62	5.63
26 05 33 13-1178 EA 2" Flexible 90 Degree Connector, Plain..... <i>For Work In Restricted Working Space, Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	50.67 4.10 4.10	6.92
26 05 33 13-1179 EA 2-1/2" Flexible 90 Degree Connector, Plain..... <i>For Work In Restricted Working Space, Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	112.53 4.83 4.83	7.40
26 05 33 13-1180 EA 3" Flexible 90 Degree Connector, Plain..... <i>For Work In Restricted Working Space, Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	144.71 5.43 5.43	8.69
26 05 33 13-1181 EA 3-1/2" Flexible 90 Degree Connector, Plain..... <i>For Work In Restricted Working Space, Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	308.03 6.03 6.03	10.61
26 05 33 13-1182 EA 4" Flexible 90 Degree Connector, Plain..... <i>For Work In Restricted Working Space, Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	550.98 7.24 7.24	12.07
26 05 33 13-1183 Insulated Throat Squeeze Type 90 Degree Connector (26 05 33 13-1138)		
26 05 33 13-1184 EA 1/2" Flexible 90 Degree Connector, Insulated..... <i>For Work In Restricted Working Space, Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.31 1.69 1.69	3.54
26 05 33 13-1185 EA 3/4" Flexible 90 Degree Connector, Insulated..... <i>For Work In Restricted Working Space, Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	13.42 1.93 1.93	3.86
26 05 33 13-1186 EA 1" Flexible 90 Degree Connector, Insulated..... <i>For Work In Restricted Working Space, Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	17.06 2.41 2.41	4.50
26 05 33 13-1187 EA 1-1/4" Flexible 90 Degree Connector, Insulated..... <i>For Work In Restricted Working Space, Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	31.29 2.90 2.90	4.82
26 05 33 13-1188 EA 1-1/2" Flexible 90 Degree Connector, Insulated..... <i>For Work In Restricted Working Space, Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	50.21 3.62 3.62	5.63
26 05 33 13-1189 EA 2" Flexible 90 Degree Connector, Insulated..... <i>For Work In Restricted Working Space, Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	64.03 4.10 4.10	6.92
26 05 33 13-1190 EA 2-1/2" Flexible 90 Degree Connector, Insulated..... <i>For Work In Restricted Working Space, Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	154.30 4.83 4.83	7.40
26 05 33 13-1191 EA 3" Flexible 90 Degree Connector, Insulated..... <i>For Work In Restricted Working Space, Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	189.96 5.43 5.43	8.69
26 05 33 13-1192 EA 3-1/2" Flexible 90 Degree Connector, Insulated..... <i>For Work In Restricted Working Space, Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	513.12 6.03 6.03	10.61
26 05 33 13-1193 EA 4" Flexible 90 Degree Connector, Insulated..... <i>For Work In Restricted Working Space, Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	765.80 7.24 7.24	12.07
26 05 33 13-1194 Plain Squeeze Type 45 Degree Connector (26 05 33 13-1138)		
26 05 33 13-1195 EA 3/8" Flexible 45 Degree Connector, Plain..... <i>For Work In Restricted Working Space, Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	7.83 1.45 1.45	3.22
26 05 33 13-1196 EA 1/2" Flexible 45 Degree Connector, Plain..... <i>For Work In Restricted Working Space, Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.61 1.69 1.69	3.54
26 05 33 13-1197 EA 3/4" Flexible 45 Degree Connector, Plain..... <i>For Work In Restricted Working Space, Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	13.63 1.93 1.93	3.86

26 Electrical**26 05 Common Work Results For Electrical****26 05 33 Raceway And Boxes For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 13-1198			Insulated Squeeze Type 45 Degree Connector (26 05 33 13-1138)		
26 05 33 13-1199	EA		3/8" Flexible 45 Degree Connector, Insulated.....	8.41	3.86
			<i>For Work In Restricted Working Space, Add</i>	1.45	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	1.45	
26 05 33 13-1200	EA		1/2" Flexible 45 Degree Connector, Insulated.....	11.56	3.54
			<i>For Work In Restricted Working Space, Add</i>	1.69	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	1.69	
26 05 33 13-1201	EA		3/4" Flexible 45 Degree Connector, Insulated.....	14.97	3.86
			<i>For Work In Restricted Working Space, Add</i>	1.93	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	1.93	
26 05 33 13-1202			Plain Screw-In Connector (26 05 33 13-1138)		
26 05 33 13-1203	EA		3/8" Flexible Steel Screw-in Connector, Plain.....	4.12	2.58
			<i>For Work In Restricted Working Space, Add</i>	1.09	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	1.09	
26 05 33 13-1204	EA		1/2" Flexible Steel Screw-in Connector, Plain.....	4.44	2.90
			<i>For Work In Restricted Working Space, Add</i>	1.21	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	1.21	
26 05 33 13-1205	EA		3/4" Flexible Steel Screw-in Connector, Plain.....	5.67	3.54
			<i>For Work In Restricted Working Space, Add</i>	1.45	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	1.45	
26 05 33 13-1206	EA		1" Flexible Steel Screw-in Connector, Plain.....	8.14	3.86
			<i>For Work In Restricted Working Space, Add</i>	1.93	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	1.93	
26 05 33 13-1207	EA		1-1/4" Flexible Steel Screw-in Connector, Plain.....	12.03	4.50
			<i>For Work In Restricted Working Space, Add</i>	2.41	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2.41	
26 05 33 13-1208	EA		1-1/2" Flexible Steel Screw-in Connector, Plain.....	14.70	4.82
			<i>For Work In Restricted Working Space, Add</i>	3.02	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	3.02	
26 05 33 13-1209	EA		2" Flexible Steel Screw-in Connector, Plain.....	21.72	5.47
			<i>For Work In Restricted Working Space, Add</i>	3.62	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	3.62	
26 05 33 13-1210			Insulated Screw-In Connector (26 05 33 13-1138)		
26 05 33 13-1211	EA		3/8" Flexible Steel Screw-in Connector, Insulated.....	4.37	2.58
			<i>For Work In Restricted Working Space, Add</i>	1.09	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	1.09	
26 05 33 13-1212	EA		1/2" Flexible Steel Screw-in Connector, Insulated.....	4.63	2.90
			<i>For Work In Restricted Working Space, Add</i>	1.21	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	1.21	
26 05 33 13-1213	EA		3/4" Flexible Steel Screw-in Connector, Insulated.....	6.17	3.54
			<i>For Work In Restricted Working Space, Add</i>	1.45	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	1.45	
26 05 33 13-1214	EA		1" Flexible Steel Screw-in Connector, Insulated.....	8.91	3.86
			<i>For Work In Restricted Working Space, Add</i>	1.93	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	1.93	
26 05 33 13-1215	EA		1-1/4" Flexible Steel Screw-in Connector, Insulated.....	13.13	4.50
			<i>For Work In Restricted Working Space, Add</i>	2.41	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2.41	
26 05 33 13-1216	EA		1-1/2" Flexible Steel Screw-in Connector, Insulated.....	16.01	4.82
			<i>For Work In Restricted Working Space, Add</i>	3.02	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	3.02	
26 05 33 13-1217	EA		2" Flexible Steel Screw-in Connector, Insulated.....	22.88	5.47
			<i>For Work In Restricted Working Space, Add</i>	3.62	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	3.62	
26 05 33 13-1218			Screw-In Coupling (26 05 33 13-1138)		
26 05 33 13-1219	EA		1/2" Flexible Steel Screw-in Coupling.....	4.92	2.90
			<i>For Work In Restricted Working Space, Add</i>	1.21	
26 05 33 13-1220	EA		3/4" Flexible Steel Screw-in Coupling.....	6.47	3.54
			<i>For Work In Restricted Working Space, Add</i>	1.45	
26 05 33 13-1221			Flexible To Electrical Metallic Tubing (EMT) Coupling (26 05 33 13-1138)		
26 05 33 13-1222	EA		3/8" Flexible Steel To Electrical Metallic Tubing (EMT) Coupling.....	6.69	2.58
			<i>For Work In Restricted Working Space, Add</i>	1.09	
26 05 33 13-1223	EA		1/2" Flexible Steel To Electrical Metallic Tubing (EMT) Coupling.....	9.13	2.90
			<i>For Work In Restricted Working Space, Add</i>	1.21	
26 05 33 13-1224	EA		3/4" Flexible Steel To Electrical Metallic Tubing (EMT) Coupling.....	12.09	3.54
			<i>For Work In Restricted Working Space, Add</i>	1.45	
26 05 33 13-1225			Die Cast Squeeze Type Straight Connector (26 05 33 13-1138)		
26 05 33 13-1226	EA		3/8" Flexible Straight Connector, Die Cast.....	4.28	2.58
			<i>For Work In Restricted Working Space, Add</i>	1.09	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	1.09	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 13-1227 EA 1/2" Flexible Straight Connector, Die Cast.....	4.84	2.90
For Work In Restricted Working Space, Add	1.21	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	1.21	
26 05 33 13-1228 EA 3/4" Flexible Straight Connector, Die Cast.....	6.01	3.54
For Work In Restricted Working Space, Add	1.45	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	1.45	
26 05 33 13-1229 EA 1" Flexible Straight Connector, Die Cast.....	9.08	3.86
For Work In Restricted Working Space, Add	1.93	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	1.93	
26 05 33 13-1230 EA 1-1/4" Flexible Straight Connector, Die Cast	12.26	4.50
For Work In Restricted Working Space, Add	2.41	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	2.41	
26 05 33 13-1231 EA 1-1/2" Flexible Straight Connector, Die Cast	16.68	4.82
For Work In Restricted Working Space, Add	3.02	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	3.02	
26 05 33 13-1232 EA 2" Flexible Straight Connector, Die Cast.....	21.61	5.47
For Work In Restricted Working Space, Add	3.62	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	3.62	
26 05 33 13-1233 Die Cast Squeeze Type 90 Degree Connector (26 05 33 13-1138)		
26 05 33 13-1234 EA 3/8" Flexible 90 Degree Connector, Die Cast	5.66	3.22
For Work In Restricted Working Space, Add	1.45	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	1.45	
26 05 33 13-1235 EA 1/2" Flexible 90 Degree Connector, Die Cast	7.03	3.54
For Work In Restricted Working Space, Add	1.69	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	1.69	
26 05 33 13-1236 EA 3/4" Flexible 90 Degree Connector, Die Cast	8.55	3.86
For Work In Restricted Working Space, Add	1.93	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	1.93	
26 05 33 13-1237 EA 1" Flexible 90 Degree Connector, Die Cast	13.64	4.50
For Work In Restricted Working Space, Add	2.41	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	2.41	
26 05 33 13-1238 EA 1-1/4" Flexible 90 Degree Connector, Die Cast	19.42	4.82
For Work In Restricted Working Space, Add	2.90	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	2.90	
26 05 33 13-1239 EA 1-1/2" Flexible 90 Degree Connector, Die Cast	30.31	5.63
For Work In Restricted Working Space, Add	3.62	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	3.62	
26 05 33 13-1240 EA 2" Flexible 90 Degree Connector, Die Cast	36.26	6.92
For Work In Restricted Working Space, Add	4.10	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	4.10	
26 05 33 13-1241 Conduit Bodies (26 05 33 13-0040)		
26 05 33 13-1242 Threaded, Cast Aluminum Conduit Body (26 05 33 13-1241)		
26 05 33 13-1243 Type LB, Threaded, Two Hub Cast Aluminum Conduit Body (26 05 33 13-1242)		
26 05 33 13-1244 EA 1/2" Type LB, Threaded, Two Hub Cast Aluminum Conduit Body With Cover	42.29	14.12
For Mogul LB, Add	3.49	
For Work In Restricted Working Space, Add	10.59	
For Installation Above 14', Add	5.29	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	10.59	
26 05 33 13-1245 EA 3/4" Type LB, Threaded, Two Hub Cast Aluminum Conduit Body With Cover	49.96	16.17
For Mogul LB, Add	5.11	
For Work In Restricted Working Space, Add	12.14	
For Installation Above 14', Add	6.07	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	12.14	
26 05 33 13-1246 EA 1" Type LB, Threaded, Two Hub Cast Aluminum Conduit Body With Cover	60.60	18.82
For Mogul LB, Add	7.80	
For Work In Restricted Working Space, Add	14.12	
For Installation Above 14', Add	7.06	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	14.12	
26 05 33 13-1247 EA 1-1/4" Type LB, Threaded, Two Hub Cast Aluminum Conduit Body With Cover	73.90	21.47
For Mogul LB, Add	12.48	
For Work In Restricted Working Space, Add	16.10	
For Installation Above 14', Add	8.05	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	16.10	
26 05 33 13-1248 EA 1-1/2" Type LB, Threaded, Two Hub Cast Aluminum Conduit Body With Cover	84.91	23.53
For Mogul LB, Add	16.62	
For Work In Restricted Working Space, Add	17.65	
For Installation Above 14', Add	8.82	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	17.65	
26 05 33 13-1249 EA 2" Type LB, Threaded, Two Hub Cast Aluminum Conduit Body With Cover	112.72	28.23
For Mogul LB, Add	28.07	
For Work In Restricted Working Space, Add	21.18	
For Installation Above 14', Add	10.59	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	21.18	
26 05 33 13-1250 EA 2-1/2" Type LB, Threaded, Two Hub Cast Aluminum Conduit Body With Cover	192.51	39.71
For Mogul LB, Add	64.97	
For Work In Restricted Working Space, Add	29.78	
For Installation Above 14', Add	14.89	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	29.78	

26 Electrical**26 05 Common Work Results For Electrical****26 05 33 Raceway And Boxes For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 13-1251	EA		3" Type LB, Threaded, Two Hub Cast Aluminum Conduit Body With Cover .....252.75 <i>For Mogul LB, Add</i> 83.67 <i>For Work In Restricted Working Space, Add</i> 39.71 <i>For Installation Above 14', Add</i> 19.85 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 39.71		52.94
26 05 33 13-1252	EA		3-1/2" Type LB, Threaded, Two Hub Cast Aluminum Conduit Body With Cover .....337.63 <i>For Mogul LB, Add</i> 120.86 <i>For Work In Restricted Working Space, Add</i> 49.64 <i>For Installation Above 14', Add</i> 24.82 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 49.64		66.18
26 05 33 13-1253	EA		4" Type LB, Threaded, Two Hub Cast Aluminum Conduit Body With Cover .....440.72 <i>For Mogul LB, Add</i> 169.36 <i>For Work In Restricted Working Space, Add</i> 60.44 <i>For Installation Above 14', Add</i> 30.22 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 60.44		80.59
26 05 33 13-1254			Type LL Or LR, Threaded, Two Hub Cast Aluminum Conduit Body With Cover <small>(26 05 33 13-1242)</small>		
26 05 33 13-1255	EA		1/2" Type LL Or LR, Threaded, Two Hub Cast Aluminum Conduit Body With Cover .....43.15 <i>For Mogul LB, Add</i> 4.13 <i>For Work In Restricted Working Space, Add</i> 10.59 <i>For Installation Above 14', Add</i> 5.29 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 10.59		14.12
26 05 33 13-1256	EA		3/4" Type LL Or LR, Threaded, Two Hub Cast Aluminum Conduit Body With Cover .....50.79 <i>For Mogul LB, Add</i> 5.73 <i>For Work In Restricted Working Space, Add</i> 12.14 <i>For Installation Above 14', Add</i> 6.07 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 12.14		16.17
26 05 33 13-1257	EA		1" Type LL Or LR, Threaded, Two Hub Cast Aluminum Conduit Body With Cover .....62.27 <i>For Mogul LB, Add</i> 9.05 <i>For Work In Restricted Working Space, Add</i> 14.12 <i>For Installation Above 14', Add</i> 7.06 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 14.12		18.82
26 05 33 13-1258	EA		1-1/4" Type LL Or LR, Threaded, Two Hub Cast Aluminum Conduit Body With Cover .....75.94 <i>For Mogul LB, Add</i> 14.01 <i>For Work In Restricted Working Space, Add</i> 16.10 <i>For Installation Above 14', Add</i> 8.05 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 16.10		21.47
26 05 33 13-1259	EA		1-1/2" Type LL Or LR, Threaded, Two Hub Cast Aluminum Conduit Body With Cover .....88.38 <i>For Mogul LB, Add</i> 19.22 <i>For Work In Restricted Working Space, Add</i> 17.65 <i>For Installation Above 14', Add</i> 8.82 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 17.65		23.53
26 05 33 13-1260	EA		2" Type LL Or LR, Threaded, Two Hub Cast Aluminum Conduit Body With Cover .....120.17 <i>For Mogul LB, Add</i> 33.66 <i>For Work In Restricted Working Space, Add</i> 21.18 <i>For Installation Above 14', Add</i> 10.59 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 21.18		28.23
26 05 33 13-1261	EA		2-1/2" Type LL Or LR, Threaded, Two Hub Cast Aluminum Conduit Body With Cover .....188.75 <i>For Mogul LB, Add</i> 62.15 <i>For Work In Restricted Working Space, Add</i> 29.78 <i>For Installation Above 14', Add</i> 14.89 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 29.78		39.71
26 05 33 13-1262	EA		3" Type LL Or LR, Threaded, Two Hub Cast Aluminum Conduit Body With Cover .....240.11 <i>For Mogul LB, Add</i> 74.19 <i>For Work In Restricted Working Space, Add</i> 39.71 <i>For Installation Above 14', Add</i> 19.85 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 39.71		52.94
26 05 33 13-1263	EA		3-1/2" Type LL Or LR, Threaded, Two Hub Cast Aluminum Conduit Body With Cover .....348.40 <i>For Mogul LB, Add</i> 128.94 <i>For Work In Restricted Working Space, Add</i> 49.64 <i>For Installation Above 14', Add</i> 24.82 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 49.64		66.18
26 05 33 13-1264	EA		4" Type LL Or LR, Threaded, Two Hub Cast Aluminum Conduit Body With Cover .....462.74 <i>For Mogul LB, Add</i> 185.88 <i>For Work In Restricted Working Space, Add</i> 60.44 <i>For Installation Above 14', Add</i> 30.22 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 60.44		80.59
26 05 33 13-1265			Type T, Threaded, Three Hub Cast Aluminum Conduit Body With Cover <small>(26 05 33 13-1242)</small>		
26 05 33 13-1266	EA		1/2" Type T, Threaded, Three Hub Cast Aluminum Conduit Body With Cover .....49.74 <i>For Work In Restricted Working Space, Add</i> 12.14 <i>For Installation Above 14', Add</i> 6.07 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 12.14		16.17
26 05 33 13-1267	EA		3/4" Type T, Threaded, Three Hub Cast Aluminum Conduit Body With Cover .....59.02 <i>For Work In Restricted Working Space, Add</i> 14.12 <i>For Installation Above 14', Add</i> 7.06 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 14.12		18.82
26 05 33 13-1268	EA		1" Type T, Threaded, Three Hub Cast Aluminum Conduit Body With Cover .....68.40 <i>For Work In Restricted Working Space, Add</i> 15.44 <i>For Installation Above 14', Add</i> 7.72 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 15.44		20.58



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 13-1269 EA 1-1/4" Type T, Threaded, Three Hub Cast Aluminum Conduit Body With Cover.....	84.48	23.53
For Work In Restricted Working Space, Add	17.65	
For Installation Above 14', Add	8.82	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	17.65	
26 05 33 13-1270 EA 1-1/2" Type T, Threaded, Three Hub Cast Aluminum Conduit Body With Cover.....	98.04	25.88
For Work In Restricted Working Space, Add	19.41	
For Installation Above 14', Add	9.71	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	19.41	
26 05 33 13-1271 EA 2" Type T, Threaded, Three Hub Cast Aluminum Conduit Body With Cover.....	132.75	30.29
For Work In Restricted Working Space, Add	22.72	
For Installation Above 14', Add	11.36	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	22.72	
26 05 33 13-1272 EA 2-1/2" Type T, Threaded, Three Hub Cast Aluminum Conduit Body With Cover.....	211.03	44.12
For Work In Restricted Working Space, Add	33.09	
For Installation Above 14', Add	16.55	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	33.09	
26 05 33 13-1273 EA 3" Type T, Threaded, Three Hub Cast Aluminum Conduit Body With Cover.....	272.52	57.35
For Work In Restricted Working Space, Add	43.02	
For Installation Above 14', Add	21.51	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	43.02	
26 05 33 13-1274 EA 3-1/2" Type T, Threaded, Three Hub Cast Aluminum Conduit Body With Cover.....	444.67	70.59
For Work In Restricted Working Space, Add	52.94	
For Installation Above 14', Add	26.47	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	52.94	
26 05 33 13-1275 EA 4" Type T, Threaded, Three Hub Cast Aluminum Conduit Body With Cover.....	507.79	85.01
For Work In Restricted Working Space, Add	63.75	
For Installation Above 14', Add	31.88	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	63.75	
26 05 33 13-1276 RGS Type C Conduit Bodies With Cover <small>(26 05 33 13-1242)</small>		
26 05 33 13-1277 EA 1/2" Type C, Threaded, Two Hub Cast Aluminum Conduit Body With Cover.....	43.32	14.12
For Work In Restricted Working Space, Add	10.59	
For Installation Above 14', Add	5.29	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	10.59	
26 05 33 13-1278 EA 3/4" Type C, Threaded, Two Hub Cast Aluminum Conduit Body With Cover.....	50.20	16.17
For Work In Restricted Working Space, Add	12.14	
For Installation Above 14', Add	6.07	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	12.14	
26 05 33 13-1279 EA 1" Type C, Threaded, Two Hub Cast Aluminum Conduit Body With Cover.....	60.85	18.53
For Work In Restricted Working Space, Add	13.90	
For Installation Above 14', Add	6.95	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	13.90	
26 05 33 13-1280 EA 1-1/4" Type C, Threaded, Two Hub Cast Aluminum Conduit Body With Cover.....	75.12	21.47
For Work In Restricted Working Space, Add	16.10	
For Installation Above 14', Add	8.05	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	16.10	
26 05 33 13-1281 EA 1-1/2" Type C, Threaded, Two Hub Cast Aluminum Conduit Body With Cover.....	84.34	23.53
For Work In Restricted Working Space, Add	17.65	
For Installation Above 14', Add	8.82	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	17.65	
26 05 33 13-1282 EA 2" Type C, Threaded, Two Hub Cast Aluminum Conduit Body With Cover.....	112.78	28.23
For Work In Restricted Working Space, Add	21.18	
For Installation Above 14', Add	10.59	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	21.18	
26 05 33 13-1283 EA 2-1/2" Type C, Threaded, Two Hub Cast Aluminum Conduit Body With Cover.....	185.59	39.71
For Work In Restricted Working Space, Add	29.78	
For Installation Above 14', Add	14.89	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	29.78	
26 05 33 13-1284 EA 3" Type C, Threaded, Two Hub Cast Aluminum Conduit Body With Cover.....	238.09	52.94
For Work In Restricted Working Space, Add	39.71	
For Installation Above 14', Add	19.85	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	39.71	
26 05 33 13-1285 EA 3-1/2" Type C, Threaded, Two Hub Cast Aluminum Conduit Body With Cover.....	341.92	66.18
For Work In Restricted Working Space, Add	49.64	
For Installation Above 14', Add	24.82	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	49.64	
26 05 33 13-1286 EA 4" Type C, Threaded, Two Hub Cast Aluminum Conduit Body With Cover.....	442.74	80.59
For Work In Restricted Working Space, Add	60.44	
For Installation Above 14', Add	30.22	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	60.44	
26 05 33 13-1287 Type X, Threaded, Four Hub Cast Aluminum Conduit Body With Cover <small>(26 05 33 13-1242)</small>		
26 05 33 13-1288 EA 1/2" Type X, Threaded, Four Hub Cast Aluminum Conduit Body With Cover.....	57.72	18.53
For Work In Restricted Working Space, Add	13.90	
For Installation Above 14', Add	6.95	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	13.90	
26 05 33 13-1289 EA 3/4" Type X, Threaded, Four Hub Cast Aluminum Conduit Body With Cover.....	66.90	20.58
For Work In Restricted Working Space, Add	15.44	
For Installation Above 14', Add	7.72	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	15.44	

26 Electrical**26 05 Common Work Results For Electrical****26 05 33 Raceway And Boxes For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 13-1290	EA		1" Type X, Threaded, Four Hub Cast Aluminum Conduit Body With Cover.....	82.70	22.65
			<i>For Work In Restricted Working Space, Add</i>	16.99	
			<i>For Installation Above 14', Add</i>	8.49	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	16.99	
26 05 33 13-1291	EA		1-1/4" Type X, Threaded, Four Hub Cast Aluminum Conduit Body With Cover.....	95.42	25.88
			<i>For Work In Restricted Working Space, Add</i>	19.41	
			<i>For Installation Above 14', Add</i>	9.71	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	19.41	
26 05 33 13-1292	EA		1-1/2" Type X, Threaded, Four Hub Cast Aluminum Conduit Body With Cover.....	124.38	28.23
			<i>For Work In Restricted Working Space, Add</i>	21.18	
			<i>For Installation Above 14', Add</i>	10.59	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	21.18	
26 05 33 13-1293	EA		2" Type X, Threaded, Four Hub Cast Aluminum Conduit Body With Cover.....	150.20	34.71
			<i>For Work In Restricted Working Space, Add</i>	26.03	
			<i>For Installation Above 14', Add</i>	13.02	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	26.03	
26 05 33 13-1294	EA		2-1/2" Type X, Threaded, Four Hub Cast Aluminum Conduit Body With Cover.....	284.59	50.88
			<i>For Work In Restricted Working Space, Add</i>	38.16	
			<i>For Installation Above 14', Add</i>	19.08	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	38.16	
26 05 33 13-1295	EA		3" Type X, Threaded, Four Hub Cast Aluminum Conduit Body With Cover.....	349.82	66.18
			<i>For Work In Restricted Working Space, Add</i>	49.64	
			<i>For Installation Above 14', Add</i>	24.82	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	49.64	
26 05 33 13-1296	EA		3-1/2" Type X, Threaded, Four Hub Cast Aluminum Conduit Body With Cover.....	503.24	81.77
			<i>For Work In Restricted Working Space, Add</i>	61.77	
			<i>For Installation Above 14', Add</i>	30.88	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	61.77	
26 05 33 13-1297	EA		4" Type X, Threaded, Four Hub Cast Aluminum Conduit Body With Cover.....	608.35	98.24
			<i>For Work In Restricted Working Space, Add</i>	73.68	
			<i>For Installation Above 14', Add</i>	36.84	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	73.68	
26 05 33 13-1298			Threaded, Malleable Iron Conduit Body <small>(26 05 33 13-1241)</small>		
26 05 33 13-1299			Type LB, Threaded, Two Hub Malleable Iron Conduit Body With Cover <small>(26 05 33 13-1298)</small>		
26 05 33 13-1300	EA		1/2" Type LB, Threaded, Two Hub Malleable Iron Conduit Body With Cover.....	44.68	14.12
			<i>For Installation Above 14', Add</i>	5.29	
			<i>For Work In Restricted Working Space, Add</i>	10.59	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.59	
26 05 33 13-1301	EA		3/4" Type LB, Threaded, Two Hub Malleable Iron Conduit Body With Cover.....	51.95	16.17
			<i>For Installation Above 14', Add</i>	6.07	
			<i>For Work In Restricted Working Space, Add</i>	12.13	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	12.13	
26 05 33 13-1302	EA		1" Type LB, Threaded, Two Hub Malleable Iron Conduit Body With Cover.....	64.21	18.82
			<i>For Installation Above 14', Add</i>	7.06	
			<i>For Work In Restricted Working Space, Add</i>	14.12	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	14.12	
26 05 33 13-1303	EA		1-1/4" Type LB, Threaded, Two Hub Malleable Iron Conduit Body With Cover.....	84.44	21.47
			<i>For Installation Above 14', Add</i>	8.05	
			<i>For Work In Restricted Working Space, Add</i>	16.10	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	16.10	
26 05 33 13-1304	EA		1-1/2" Type LB, Threaded, Two Hub Malleable Iron Conduit Body With Cover.....	96.57	23.53
			<i>For Installation Above 14', Add</i>	8.82	
			<i>For Work In Restricted Working Space, Add</i>	17.65	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	17.65	
26 05 33 13-1305	EA		2" Type LB, Threaded, Two Hub Malleable Iron Conduit Body With Cover.....	133.77	28.23
			<i>For Installation Above 14', Add</i>	10.59	
			<i>For Work In Restricted Working Space, Add</i>	21.18	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	21.18	
26 05 33 13-1306	EA		2-1/2" Type LB, Threaded, Two Hub Malleable Iron Conduit Body With Cover.....	228.57	39.71
			<i>For Installation Above 14', Add</i>	14.89	
			<i>For Work In Restricted Working Space, Add</i>	29.78	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	29.78	
26 05 33 13-1307	EA		3" Type LB, Threaded, Two Hub Malleable Iron Conduit Body With Cover.....	325.24	52.94
			<i>For Installation Above 14', Add</i>	19.85	
			<i>For Work In Restricted Working Space, Add</i>	39.71	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	39.71	
26 05 33 13-1308	EA		3-1/2" Type LB, Threaded, Two Hub Malleable Iron Conduit Body With Cover.....	451.00	66.18
			<i>For Installation Above 14', Add</i>	24.82	
			<i>For Work In Restricted Working Space, Add</i>	49.64	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	49.64	
26 05 33 13-1309	EA		4" Type LB, Threaded, Two Hub Malleable Iron Conduit Body With Cover.....	539.15	80.59
			<i>For Installation Above 14', Add</i>	30.22	
			<i>For Work In Restricted Working Space, Add</i>	60.44	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	60.44	
26 05 33 13-1310			Type LL Or LR, Threaded, Two Hub Malleable Iron Conduit Body With Cover <small>(26 05 33 13-1298)</small>		
26 05 33 13-1311	EA		1/2" Type LL Or LR, Threaded, Two Hub Malleable Iron Conduit Body With Cover.....	46.85	14.12
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.59	
26 05 33 13-1312	EA		3/4" Type LL Or LR, Threaded, Two Hub Malleable Iron Conduit Body With Cover.....	52.59	16.17
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	12.13	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 13-1313 EA 1" Type LL Or LR, Threaded, Two Hub Malleable Iron Conduit Body With Cover.....	67.53	18.82
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	14.12	
26 05 33 13-1314 EA 1-1/4" Type LL Or LR, Threaded, Two Hub Malleable Iron Conduit Body With Cover.....	86.66	21.47
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	16.10	
26 05 33 13-1315 EA 1-1/2" Type LL Or LR, Threaded, Two Hub Malleable Iron Conduit Body With Cover.....	99.29	23.53
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	17.65	
26 05 33 13-1316 EA 2" Type LL Or LR, Threaded, Two Hub Malleable Iron Conduit Body With Cover.....	128.19	28.23
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	21.18	
26 05 33 13-1317 EA 2-1/2" Type LL Or LR, Threaded, Two Hub Malleable Iron Conduit Body With Cover.....	197.56	39.71
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	29.78	
26 05 33 13-1318 EA 3" Type LL Or LR, Threaded, Two Hub Malleable Iron Conduit Body With Cover.....	269.49	52.94
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	39.71	
26 05 33 13-1319 EA 3-1/2" Type LL Or LR, Threaded, Two Hub Malleable Iron Conduit Body With Cover.....	483.83	66.18
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	49.64	
26 05 33 13-1320 EA 4" Type LL Or LR, Threaded, Two Hub Malleable Iron Conduit Body With Cover.....	563.36	80.59
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	60.44	
26 05 33 13-1321 Type T, Threaded, Three Hub Malleable Iron Conduit Body With Cover <small>(26 05 33 13-1298)</small>		
26 05 33 13-1322 EA 1/2" Type T, Threaded, Three Hub Malleable Iron Conduit Body With Cover.....	55.95	16.17
<i>For Installation Above 14', Add</i>	6.07	
<i>For Work In Restricted Working Space, Add</i>	12.14	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	12.14	
26 05 33 13-1323 EA 3/4" Type T, Threaded, Three Hub Malleable Iron Conduit Body With Cover.....	65.93	18.82
<i>For Installation Above 14', Add</i>	7.17	
<i>For Work In Restricted Working Space, Add</i>	14.34	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	14.34	
26 05 33 13-1324 EA 1" Type T, Threaded, Three Hub Malleable Iron Conduit Body With Cover.....	78.89	20.58
<i>For Installation Above 14', Add</i>	7.72	
<i>For Work In Restricted Working Space, Add</i>	15.44	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	15.44	
26 05 33 13-1325 EA 1-1/4" Type T, Threaded, Three Hub Malleable Iron Conduit Body With Cover.....	100.56	23.53
<i>For Installation Above 14', Add</i>	8.71	
<i>For Work In Restricted Working Space, Add</i>	17.43	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	17.43	
26 05 33 13-1326 EA 1-1/2" Type T, Threaded, Three Hub Malleable Iron Conduit Body With Cover.....	115.75	25.88
<i>For Installation Above 14', Add</i>	9.71	
<i>For Work In Restricted Working Space, Add</i>	19.41	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	19.41	
26 05 33 13-1327 EA 2" Type T, Threaded, Three Hub Malleable Iron Conduit Body With Cover.....	155.70	30.29
<i>For Installation Above 14', Add</i>	11.36	
<i>For Work In Restricted Working Space, Add</i>	22.72	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	22.72	
26 05 33 13-1328 EA 2-1/2" Type T, Threaded, Three Hub Malleable Iron Conduit Body With Cover.....	194.19	44.12
<i>For Installation Above 14', Add</i>	16.55	
<i>For Work In Restricted Working Space, Add</i>	33.09	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	33.09	
26 05 33 13-1329 EA 3" Type T, Threaded, Three Hub Malleable Iron Conduit Body With Cover.....	282.80	57.35
<i>For Installation Above 14', Add</i>	21.51	
<i>For Work In Restricted Working Space, Add</i>	43.02	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	43.02	
26 05 33 13-1330 EA 3-1/2" Type T, Threaded, Three Hub Malleable Iron Conduit Body With Cover.....	510.03	70.59
<i>For Installation Above 14', Add</i>	26.47	
<i>For Work In Restricted Working Space, Add</i>	52.94	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	52.94	
26 05 33 13-1331 EA 4" Type T, Threaded, Three Hub Malleable Iron Conduit Body With Cover.....	588.23	85.01
<i>For Installation Above 14', Add</i>	31.99	
<i>For Work In Restricted Working Space, Add</i>	63.97	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	63.97	
26 05 33 13-1332 Type C, Threaded, Two Hub Malleable Iron Conduit Body With Cover <small>(26 05 33 13-1298)</small>		
26 05 33 13-1333 EA 1/2" Type C, Threaded, Two Hub Malleable Iron Conduit Body With Cover.....	44.84	14.12
<i>For Installation Above 14', Add</i>	5.29	
<i>For Work In Restricted Working Space, Add</i>	10.59	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.59	
26 05 33 13-1334 EA 3/4" Type C, Threaded, Two Hub Malleable Iron Conduit Body With Cover.....	54.77	16.17
<i>For Installation Above 14', Add</i>	6.07	
<i>For Work In Restricted Working Space, Add</i>	12.14	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	12.14	
26 05 33 13-1335 EA 1" Type C, Threaded, Two Hub Malleable Iron Conduit Body With Cover.....	64.25	18.53
<i>For Installation Above 14', Add</i>	6.95	
<i>For Work In Restricted Working Space, Add</i>	13.90	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	13.90	
26 05 33 13-1336 EA 1-1/4" Type C, Threaded, Two Hub Malleable Iron Conduit Body With Cover.....	88.54	21.47
<i>For Installation Above 14', Add</i>	8.05	
<i>For Work In Restricted Working Space, Add</i>	16.10	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	16.10	
26 05 33 13-1337 EA 1-1/2" Type C, Threaded, Two Hub Malleable Iron Conduit Body With Cover.....	104.25	23.53
<i>For Installation Above 14', Add</i>	8.82	
<i>For Work In Restricted Working Space, Add</i>	17.65	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	17.65	

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MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 13-1338	EA		2" Type C, Threaded, Two Hub Malleable Iron Conduit Body With Cover.....	135.95	28.23
			<i>For Installation Above 14', Add</i>	10.59	
			<i>For Work In Restricted Working Space, Add</i>	21.18	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	21.18	
26 05 33 13-1339	EA		2-1/2" Type C, Threaded, Two Hub Malleable Iron Conduit Body With Cover.....	298.47	74.49
			<i>For Installation Above 14', Add</i>	27.92	
			<i>For Work In Restricted Working Space, Add</i>	55.84	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	55.84	
26 05 33 13-1340	EA		3" Type C, Threaded, Two Hub Malleable Iron Conduit Body With Cover.....	292.91	52.94
			<i>For Installation Above 14', Add</i>	19.85	
			<i>For Work In Restricted Working Space, Add</i>	39.71	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	39.71	
26 05 33 13-1341	EA		3-1/2" Type C, Threaded, Two Hub Malleable Iron Conduit Body With Cover.....	483.83	66.18
			<i>For Installation Above 14', Add</i>	24.82	
			<i>For Work In Restricted Working Space, Add</i>	49.64	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	49.64	
26 05 33 13-1342	EA		4" Type C, Threaded, Two Hub Malleable Iron Conduit Body With Cover.....	563.35	80.59
			<i>For Installation Above 14', Add</i>	30.22	
			<i>For Work In Restricted Working Space, Add</i>	60.44	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	60.44	
26 05 33 13-1343			Type X, Threaded, Four Hub Malleable Iron Conduit Body With Cover <small>(26 05 33 13-1298)</small>		
26 05 33 13-1344	EA		1/2" Type X, Threaded, Four Hub Malleable Iron Conduit Body With Cover.....	63.50	18.53
			<i>For Installation Above 14', Add</i>	6.95	
			<i>For Work In Restricted Working Space, Add</i>	13.90	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	13.90	
26 05 33 13-1345	EA		3/4" Type X, Threaded, Four Hub Malleable Iron Conduit Body With Cover.....	69.30	20.58
			<i>For Installation Above 14', Add</i>	7.72	
			<i>For Work In Restricted Working Space, Add</i>	15.44	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	15.44	
26 05 33 13-1346	EA		1" Type X, Threaded, Four Hub Malleable Iron Conduit Body With Cover.....	81.08	22.65
			<i>For Installation Above 14', Add</i>	8.49	
			<i>For Work In Restricted Working Space, Add</i>	16.99	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	16.99	
26 05 33 13-1347	EA		1-1/4" Type X, Threaded, Four Hub Malleable Iron Conduit Body With Cover.....	97.00	25.88
			<i>For Installation Above 14', Add</i>	9.71	
			<i>For Work In Restricted Working Space, Add</i>	19.41	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	19.41	
26 05 33 13-1348	EA		1-1/2" Type X, Threaded, Four Hub Malleable Iron Conduit Body With Cover.....	112.73	28.23
			<i>For Installation Above 14', Add</i>	10.59	
			<i>For Work In Restricted Working Space, Add</i>	21.18	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	21.18	
26 05 33 13-1349	EA		2" Type X, Threaded, Four Hub Malleable Iron Conduit Body With Cover.....	160.13	34.71
			<i>For Installation Above 14', Add</i>	13.02	
			<i>For Work In Restricted Working Space, Add</i>	26.03	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	26.03	
26 05 33 13-1350	EA		2-1/2" Type X, Threaded, Four Hub Malleable Iron Conduit Body With Cover.....	258.18	50.88
			<i>For Installation Above 14', Add</i>	19.08	
			<i>For Work In Restricted Working Space, Add</i>	38.16	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	38.16	
26 05 33 13-1351	EA		3" Type X, Threaded, Four Hub Malleable Iron Conduit Body With Cover.....	383.10	66.18
			<i>For Installation Above 14', Add</i>	24.82	
			<i>For Work In Restricted Working Space, Add</i>	49.64	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	49.64	
26 05 33 13-1352	EA		3-1/2" Type X, Threaded, Four Hub Malleable Iron Conduit Body With Cover.....	580.79	81.77
			<i>For Installation Above 14', Add</i>	30.66	
			<i>For Work In Restricted Working Space, Add</i>	61.33	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	61.33	
26 05 33 13-1353	EA		4" Type X, Threaded, Four Hub Malleable Iron Conduit Body With Cover.....	645.21	98.24
			<i>For Installation Above 14', Add</i>	36.84	
			<i>For Work In Restricted Working Space, Add</i>	73.68	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	73.68	
26 05 33 13-1354			Set Screw, Cast Aluminum Conduit Body <small>(26 05 33 13-1241)</small>		
26 05 33 13-1355			Type LB, Set Screw, Two Hub Cast Aluminum Conduit Body With Cover <small>(26 05 33 13-1354)</small>		
26 05 33 13-1356	EA		1/2" Type LB, Set Screw, Two Hub Cast Aluminum Conduit Body With Cover.....	22.12	5.58
			<i>For Work In Restricted Working Space, Add</i>	4.19	
			<i>For Installation Above 14', Add</i>	2.10	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.19	
26 05 33 13-1357	EA		3/4" Type LB, Set Screw, Two Hub Cast Aluminum Conduit Body With Cover.....	28.17	7.35
			<i>For Work In Restricted Working Space, Add</i>	5.51	
			<i>For Installation Above 14', Add</i>	2.76	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.51	
26 05 33 13-1358	EA		1" Type LB, Set Screw, Two Hub Cast Aluminum Conduit Body With Cover.....	38.60	9.11
			<i>For Work In Restricted Working Space, Add</i>	6.84	
			<i>For Installation Above 14', Add</i>	3.42	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	6.84	
26 05 33 13-1359	EA		1-1/4" Type LB, Set Screw, Two Hub Cast Aluminum Conduit Body With Cover.....	50.43	11.18
			<i>For Work In Restricted Working Space, Add</i>	8.38	
			<i>For Installation Above 14', Add</i>	4.19	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8.38	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 13-1360 EA 1-1/2" Type LB, Set Screw, Two Hub Cast Aluminum Conduit Body With Cover <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	67.34 9.71 4.85 9.71	12.94
26 05 33 13-1361 EA 2" Type LB, Set Screw, Two Hub Cast Aluminum Conduit Body With Cover <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	90.61 11.03 5.52 11.03	14.71
26 05 33 13-1362 Type LL Or LR, Set Screw, Two Hub Cast Aluminum Conduit Body With Cover <small>(26 05 33 13-1354)</small>		
26 05 33 13-1363 EA 1/2" Type LL Or LR, Set Screw, Two Hub Cast Aluminum Conduit Body With Cover <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	22.34 4.19 2.10 4.19	5.58
26 05 33 13-1364 EA 3/4" Type LL Or LR, Set Screw, Two Hub Cast Aluminum Conduit Body With Cover <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	29.04 5.51 2.76 5.51	7.35
26 05 33 13-1365 EA 1" Type LL Or LR, Set Screw, Two Hub Cast Aluminum Conduit Body With Cover <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	35.61 6.84 3.42 6.84	9.11
26 05 33 13-1366 EA 1-1/4" Type LL Or LR, Set Screw, Two Hub Cast Aluminum Conduit Body With Cover <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	50.18 8.38 4.19 8.38	11.18
26 05 33 13-1367 EA 1-1/2" Type LL Or LR, Set Screw, Two Hub Cast Aluminum Conduit Body With Cover <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	62.37 9.71 4.85 9.71	12.94
26 05 33 13-1368 EA 2" Type LL Or LR, Set Screw, Two Hub Cast Aluminum Conduit Body With Cover <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	90.18 11.03 5.52 11.03	14.71
26 05 33 13-1369 Type T, Set Screw, Three Hub Cast Aluminum Conduit Body With Cover <small>(26 05 33 13-1354)</small>		
26 05 33 13-1370 EA 1/2" Type T, Set Screw, Three Hub Cast Aluminum Conduit Body With Cover <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	28.64 5.51 2.76 5.51	7.35
26 05 33 13-1371 EA 3/4" Type T, Set Screw, Three Hub Cast Aluminum Conduit Body With Cover <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	37.58 6.84 3.42 6.84	9.11
26 05 33 13-1372 EA 1" Type T, Set Screw, Three Hub Cast Aluminum Conduit Body With Cover <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	45.22 8.38 4.19 8.38	11.18
26 05 33 13-1373 EA 1-1/4" Type T, Set Screw, Three Hub Cast Aluminum Conduit Body With Cover <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	63.67 10.15 5.07 10.15	12.94
26 05 33 13-1374 EA 1-1/2" Type T, Set Screw, Three Hub Cast Aluminum Conduit Body With Cover <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	82.48 11.91 5.96 11.91	14.71
26 05 33 13-1375 EA 2" Type T, Set Screw, Three Hub Cast Aluminum Conduit Body With Cover <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	112.80 13.68 6.84 13.68	16.47
26 05 33 13-1376 Type C, Set Screw, Two Hub Cast Aluminum Conduit Body With Cover <small>(26 05 33 13-1354)</small>		
26 05 33 13-1377 EA 1/2" Type C, Set Screw, Two Hub Cast Aluminum Conduit Body With Cover <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	23.07 4.19 2.10 4.19	5.58
26 05 33 13-1378 EA 3/4" Type C, Set Screw, Two Hub Cast Aluminum Conduit Body With Cover <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	30.94 5.51 2.76 5.51	7.35
26 05 33 13-1379 EA 1" Type C, Set Screw, Two Hub Cast Aluminum Conduit Body With Cover <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	39.69 6.84 3.42 6.84	9.11
26 05 33 13-1380 EA 1-1/4" Type C, Set Screw, Two Hub Cast Aluminum Conduit Body With Cover <i>For Work In Restricted Working Space, Add</i> <i>For Installation Above 14', Add</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	51.73 8.38 4.19 8.38	11.18

26 Electrical**26 05 Common Work Results For Electrical****26 05 33 Raceway And Boxes For Electrical Systems**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 13-1381 EA 1-1/2" Type C, Set Screw, Two Hub Cast Aluminum Conduit Body With Cover	34.94	12.94
<i>For Work In Restricted Working Space, Add</i>	9.71	
<i>For Installation Above 14', Add</i>	4.85	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.71	
26 05 33 13-1382 EA 2" Type C, Set Screw, Two Hub Cast Aluminum Conduit Body With Cover	98.49	14.71
<i>For Work In Restricted Working Space, Add</i>	11.03	
<i>For Installation Above 14', Add</i>	5.52	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	11.03	
26 05 33 13-1383 Replacement Covers And Gaskets For Conduit Body (26 05 33 13-1241)		
26 05 33 13-1384 Replacement Stamped Aluminum Conduit Body Cover (26 05 33 13-1383)		
26 05 33 13-1385 1/2" Replacement Stamped Aluminum Conduit Body Cover	8.03	2.87
26 05 33 13-1386 3/4" Replacement Stamped Aluminum Conduit Body Cover	9.90	3.35
26 05 33 13-1387 1" Replacement Stamped Aluminum Conduit Body Cover	12.67	4.30
26 05 33 13-1388 1-1/4" Replacement Stamped Aluminum Conduit Body Cover	15.42	5.25
26 05 33 13-1389 1-1/2" Replacement Stamped Aluminum Conduit Body Cover	19.06	6.22
26 05 33 13-1390 2" Replacement Stamped Aluminum Conduit Body Cover	22.70	7.17
26 05 33 13-1391 2-1/2" Replacement Stamped Aluminum Conduit Body Cover	30.71	8.12
26 05 33 13-1392 3" Replacement Stamped Aluminum Conduit Body Cover	39.09	11.47
26 05 33 13-1393 3-1/2" Replacement Stamped Aluminum Conduit Body Cover	42.39	12.90
26 05 33 13-1394 4" Replacement Stamped Aluminum Conduit Body Cover	53.43	16.25
26 05 33 13-1395 Replacement Cast Steel Conduit Body Cover (26 05 33 13-1383)		
26 05 33 13-1396 1/2" Replacement Cast Steel Conduit Body Cover	9.60	2.87
26 05 33 13-1397 3/4" Replacement Cast Steel Conduit Body Cover	11.26	3.35
26 05 33 13-1398 1" Replacement Cast Steel Conduit Body Cover	16.03	4.30
26 05 33 13-1399 1-1/4" Replacement Cast Steel Conduit Body Cover	19.97	5.25
26 05 33 13-1400 1-1/2" Replacement Cast Steel Conduit Body Cover	24.36	6.22
26 05 33 13-1401 2" Replacement Cast Steel Conduit Body Cover	28.76	7.17
26 05 33 13-1402 2-1/2" Replacement Cast Steel Conduit Body Cover	33.12	8.12
26 05 33 13-1403 3" Replacement Cast Steel Conduit Body Cover	44.77	11.47
26 05 33 13-1404 3-1/2" Replacement Cast Steel Conduit Body Cover	51.35	12.90
26 05 33 13-1405 4" Replacement Cast Steel Conduit Body Cover	64.76	16.25
26 05 33 13-1406 Replacement Velbuna Composition Conduit Body Gasket (26 05 33 13-1383)		
26 05 33 13-1407 1/2" Replacement Velbuna Composition Conduit Body Gasket	7.33	2.87
26 05 33 13-1408 3/4" Replacement Velbuna Composition Conduit Body Gasket	8.33	3.35
26 05 33 13-1409 1" Replacement Velbuna Composition Conduit Body Gasket	10.92	4.30
26 05 33 13-1410 1-1/4" Replacement Velbuna Composition Conduit Body Gasket	14.37	5.25
26 05 33 13-1411 1-1/2" Replacement Velbuna Composition Conduit Body Gasket	16.27	6.22
26 05 33 13-1412 2" Replacement Velbuna Composition Conduit Body Gasket	19.48	7.17
26 05 33 13-1413 2-1/2" Replacement Velbuna Composition Conduit Body Gasket	26.30	8.12
26 05 33 13-1414 3" Replacement Velbuna Composition Conduit Body Gasket	33.58	11.47
26 05 33 13-1415 3-1/2" Replacement Velbuna Composition Conduit Body Gasket	37.18	12.90
26 05 33 13-1416 4" Replacement Velbuna Composition Conduit Body Gasket	43.80	16.25
26 05 33 13-1417 Replacement Neoprene Conduit Body Gasket (26 05 33 13-1383)		
26 05 33 13-1418 1/2" Replacement Neoprene Conduit Body Gasket	8.42	2.87
26 05 33 13-1419 3/4" Replacement Neoprene Conduit Body Gasket	9.37	3.35
26 05 33 13-1420 1" Replacement Neoprene Conduit Body Gasket	12.28	4.30
26 05 33 13-1421 1-1/4" Replacement Neoprene Conduit Body Gasket	15.06	5.25
26 05 33 13-1422 1-1/2" Replacement Neoprene Conduit Body Gasket	16.96	6.22
26 05 33 13-1423 2" Replacement Neoprene Conduit Body Gasket	19.55	7.17
26 05 33 13-1424 2-1/2" Replacement Neoprene Conduit Body Gasket	26.47	8.12
26 05 33 13-1425 3" Replacement Neoprene Conduit Body Gasket	33.75	11.47
26 05 33 13-1426 3-1/2" Replacement Neoprene Conduit Body Gasket	38.33	12.90
26 05 33 13-1427 4" Replacement Neoprene Conduit Body Gasket	44.95	16.25
26 05 33 16 Boxes For Electrical Systems (26 05 33)		
See CSI section 26 27 16 00-0000 for larger junction boxes and enclosures.		
26 05 33 16-0001 Steel Junction, Device, And Fixture Boxes, Rings And Covers (26 05 33 16)		
Note: Thin wall metal. See CSI section 26 27 26 00-0003 for steel box/receptacle assemblies, 26 27 26 00-0120 for steel box/switch assemblies.		
26 05 33 16-0002 4" Square Steel Boxes, Rings And Covers (26 05 33 16-0001)		
26 05 33 16-0003 EA 1-1/2" Depth, 4" Square Steel Box	26.02	12.07
<i>For Stud Bracket, Add</i>	0.46	
26 05 33 16-0004 EA 2-1/8" Depth, 4" Square Steel Box	26.87	12.07
<i>For Stud Bracket, Add</i>	0.83	
26 05 33 16-0005 EA 3-1/2" Depth, 4" Square Steel Box	29.82	12.07
<i>For Stud Bracket, Add</i>	0.91	
26 05 33 16-0006 EA 1-1/2" Depth, 4" Square Steel Extension Ring	20.29	8.04
26 05 33 16-0007 EA 2-1/8" Depth, 4" Square Steel Extension Ring	17.31	8.04
26 05 33 16-0008 EA 1/2" Depth, 1 Gang, 4" Square Steel Mud Ring	8.94	4.02
26 05 33 16-0009 EA 5/8" Depth, 1 Gang, 4" Square Steel Mud Ring	9.08	4.02



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 16-0010 EA 3/4" Depth, 1 Gang, 4" Square Steel Mud Ring.....	9.18	4.02
26 05 33 16-0011 EA 1" Depth, 1 Gang, 4" Square Steel Mud Ring.....	9.49	4.02
26 05 33 16-0012 EA 1-1/4" Depth, 1 Gang, 4" Square Steel Mud Ring.....	9.59	4.02
26 05 33 16-0013 EA 1-1/2" Depth, 1 Gang, 4" Square Steel Mud Ring.....	10.61	4.02
26 05 33 16-0014 EA 1/2" Depth, 2 Gang, 4" Square Steel Mud Ring.....	9.33	4.02
26 05 33 16-0015 EA 5/8" Depth, 2 Gang, 4" Square Steel Mud Ring.....	9.42	4.02
26 05 33 16-0016 EA 3/4" Depth, 2 Gang, 4" Square Steel Mud Ring.....	9.55	4.02
26 05 33 16-0017 EA 1" Depth, 2 Gang, 4" Square Steel Mud Ring.....	10.59	4.02
26 05 33 16-0018 EA 1-1/4" Depth, 2 Gang, 4" Square Steel Mud Ring.....	10.80	4.02
26 05 33 16-0019 EA 1-1/2" Depth, 2 Gang, 4" Square Steel Mud Ring.....	12.13	4.02
26 05 33 16-0020 EA 3/4" Depth, Fixture Cover, 4" Square Mud Rings.....	9.83	4.02
26 05 33 16-0021 EA 1" Depth, Fixture Cover, 4" Square Mud Rings.....	10.68	4.02
26 05 33 16-0022 EA One Toggle Switch, 4" Square Steel Exposed Work Cover.....	9.31	4.02
26 05 33 16-0023 EA Two Toggle Switches, 4" Square Steel Exposed Work Cover.....	9.39	4.02
26 05 33 16-0024 EA One Duplex Receptacle, 4" Square Steel Exposed Work Cover.....	9.29	4.02
26 05 33 16-0025 EA Two Duplex Receptacles, 4" Square Steel Exposed Work Cover.....	9.52	4.02
26 05 33 16-0026 EA One Toggle Switch And One Duplex Receptacle, 4" Square Steel Exposed Work Cover.....	9.70	4.02
26 05 33 16-0027 EA One Toggle Switch And One 1.406" Diameter Receptacle, 4" Square Steel Exposed Work Cover.....	12.04	4.02
26 05 33 16-0028 EA One 1.406" Diameter Receptacle, 4" Square Steel Exposed Work Cover.....	9.67	4.02
26 05 33 16-0029 EA Two 1.406" Diameter Receptacles, 4" Square Steel Exposed Work Cover.....	12.04	4.02
26 05 33 16-0030 EA One 1.620" Diameter Receptacle, 4" Square Steel Exposed Work Cover.....	9.67	4.02
26 05 33 16-0031 EA One 1.719" Diameter Receptacle, 4" Square Steel Exposed Work Cover.....	10.22	4.02
26 05 33 16-0032 EA One 2.165" Diameter Receptacle, 4" Square Steel Exposed Work Cover.....	12.04	4.02
26 05 33 16-0033 EA One 2.480" Diameter Receptacle, 4" Square Steel Exposed Work Cover.....	12.04	4.02
26 05 33 16-0034 EA Flat, 4" Square Steel Exposed Work Cover.....	8.64	4.02
26 05 33 16-0035	4-11/16" Square Steel Boxes, Rings And Covers (26 05 33 16-0001)	
26 05 33 16-0036 EA 1-1/2" Depth, 4-11/16" Square Steel Box.....	29.19	12.07
26 05 33 16-0037 EA 2-1/8" Depth, 4-11/16" Square Steel Box.....	27.25	12.07
	<i>For Stud Bracket, Add</i>	<i>0.44</i>
26 05 33 16-0038 EA 3-1/4" Depth, 4-11/16" Square Steel Box.....	36.99	12.07
26 05 33 16-0039 EA 1-1/2" Depth, 4-11/16" Square Extension Ring.....	21.10	8.04
26 05 33 16-0040 EA 2-1/8" Depth, 4-11/16" Square Extension Ring.....	21.57	8.04
26 05 33 16-0041 EA 1/2" Depth, 1 Gang, 4-11/16" Square Steel Mud Ring.....	10.88	4.02
26 05 33 16-0042 EA 5/8" Depth, 1 Gang, 4-11/16" Square Steel Mud Ring.....	10.90	4.02
26 05 33 16-0043 EA 3/4" Depth, 1 Gang, 4-11/16" Square Steel Mud Ring.....	11.73	4.02
26 05 33 16-0044 EA 1" Depth, 1 Gang, 4-11/16" Square Steel Mud Ring.....	11.40	4.02
26 05 33 16-0045 EA 1-1/4" Depth, 1 Gang, 4-11/16" Square Steel Mud Ring.....	11.32	4.02
26 05 33 16-0046 EA 1-1/2" Depth, 1 Gang, 4-11/16" Square Steel Mud Ring.....	14.76	4.02
26 05 33 16-0047 EA 1/2" Depth, 2 Gang, 4-11/16" Square Steel Mud Ring.....	11.54	4.02
26 05 33 16-0048 EA 5/8" Depth, 2 Gang, 4-11/16" Square Steel Mud Ring.....	11.72	4.02
26 05 33 16-0049 EA 3/4" Depth, 2 Gang, 4-11/16" Square Steel Mud Ring.....	11.73	4.02
26 05 33 16-0050 EA 1" Depth, 2 Gang, 4-11/16" Square Steel Mud Ring.....	12.95	4.02
26 05 33 16-0051 EA 1-1/4" Depth, 2 Gang, 4-11/16" Square Steel Mud Ring.....	13.20	4.02
26 05 33 16-0052 EA 1-1/2" Depth, 2 Gang, 4-11/16" Square Steel Mud Ring.....	16.15	4.02
26 05 33 16-0053 EA 1/2" Depth, Fixture Cover, 4-11/16" Square Steel Mud Ring.....	11.38	4.02
26 05 33 16-0054 EA 5/8" Depth, Fixture Cover, 4-11/16" Square Steel Mud Ring.....	11.46	4.02
26 05 33 16-0055 EA One Toggle Switch, 4-11/16" Square Steel Exposed Work Cover.....	13.75	4.02
26 05 33 16-0056 EA Two Toggle Switches, 4-11/16" Square Steel Exposed Work Cover.....	14.39	4.02
26 05 33 16-0057 EA One Duplex Receptacle, 4-11/16" Square Steel Exposed Work Cover.....	13.56	4.02
26 05 33 16-0058 EA Two Duplex Receptacles, 4-11/16" Square Steel Exposed Work Cover.....	12.86	4.02
26 05 33 16-0059 EA One Toggle Switch And One Duplex Receptacle, 4-11/16" Square Steel Exposed Work Cover.....	15.19	4.02
26 05 33 16-0060 EA One 1.594" Diameter Receptacle, 4-11/16" Square Steel Exposed Work Cover.....	14.38	4.02
26 05 33 16-0061 EA One 2.141" Diameter Receptacle, 4-11/16" Square Steel Exposed Work Cover.....	14.38	4.02
26 05 33 16-0062 EA One 2.625" Diameter Receptacle, 4-11/16" Square Steel Exposed Work Cover.....	14.38	4.02
26 05 33 16-0063 EA Flat, 4-11/16" Square Steel Exposed Work Cover.....	9.17	4.02
26 05 33 16-0064	Steel Square Box Brackets (26 05 33 16-0001)	
26 05 33 16-0065 EA 16" Or 24" Width Box Bracket, For Multiple 1-1/2" And 2-1/8" Deep Boxes.....	12.96	6.04
26 05 33 16-0066 EA Single Box Bracket, One 4" Or 4-11/16" Square Box.....	9.39	4.03
26 05 33 16-0067 EA 16" Box Bracket, Up To Three 4" Or 4-11/16" Square Boxes.....	15.03	6.04
26 05 33 16-0068 EA 24" Box Bracket, Up To Four 4" Or 4-11/16" Square Boxes.....	16.09	6.04
26 05 33 16-0069	4" Octagon Steel Boxes And Covers (26 05 33 16-0001)	
26 05 33 16-0070 EA 1-1/2" Depth, 4" Steel Octagon Box.....	21.66	10.05
	<i>For Stud Bracket, Add</i>	<i>1.13</i>
26 05 33 16-0071 EA 2-1/8" Depth, 4" Steel Octagon Box.....	22.41	10.05
26 05 33 16-0072 EA Flat, 4" Octagon Steel Exposed Work Cover.....	8.59	4.02
26 05 33 16-0073	4" Steel Octagonal Concrete Rings And Steel Covers (26 05 33 16-0001)	
	<i>Note: Placed in concrete slabs or walls.</i>	
26 05 33 16-0074 EA 2" Depth, 4" Steel Octagonal Concrete Ring.....	35.56	
26 05 33 16-0075 EA 2-1/2" Depth, 4" Steel Octagonal Concrete Ring.....	37.73	
26 05 33 16-0076 EA 3" Depth, 4" Steel Octagonal Concrete Ring.....	39.48	
26 05 33 16-0077 EA 3-1/2" Depth, 4" Steel Octagonal Concrete Ring.....	41.19	
26 05 33 16-0078 EA 4" Depth, 4" Steel Octagonal Concrete Ring.....	44.87	
26 05 33 16-0079 EA 5" Depth, 4" Steel Octagonal Concrete Ring.....	48.66	

26 Electrical**26 05 Common Work Results For Electrical****26 05 33 Raceway And Boxes For Electrical Systems**

MINOR				TOTAL DIRECT	DEMOLITION
CSI	UOM	DESCRIPTION		UNIT COST	UNIT COST
26 05 33 16-0080	EA	6" Depth, 4" Steel Octagonal Concrete Ring.....		51.66	
26 05 33 16-0081	EA	Flat, 4" Steel Octagonal Concrete Cover.....		9.63	4.02
26 05 33 16-0082		4-1/2" Steel Gang Boxes <small>(26 05 33 16-0001)</small>			
26 05 33 16-0083	EA	2 Device, 1-5/8" Depth, 4-1/2" Steel Gang Box.....		32.28	10.05
26 05 33 16-0084	EA	3 Device, 1-5/8" Depth, 4-1/2" Steel Gang Box.....		35.44	10.85
26 05 33 16-0085	EA	4 Device, 1-5/8" Depth, 4-1/2" Steel Gang Box.....		42.49	12.07
26 05 33 16-0086	EA	5 Device, 1-5/8" Depth, 4-1/2" Steel Gang Box.....		55.17	13.27
26 05 33 16-0087	EA	6 Device, 1-5/8" Depth, 4-1/2" Steel Gang Box.....		81.22	14.47
26 05 33 16-0088	EA	2 Device, 2-1/2" Depth, 4-1/2" Steel Gang Box.....		43.86	10.05
26 05 33 16-0089	EA	3 Device, 2-1/2" Depth, 4-1/2" Steel Gang Box.....		47.78	10.85
26 05 33 16-0090	EA	4 Device, 2-1/2" Depth, 4-1/2" Steel Gang Box.....		63.33	12.07
26 05 33 16-0091	EA	5 Device, 2-1/2" Depth, 4-1/2" Steel Gang Box.....		81.08	13.27
26 05 33 16-0092	EA	6 Device, 2-1/2" Depth, 4-1/2" Steel Gang Box.....		132.47	14.47
26 05 33 16-0093	EA	2 Device, Gang Box Mud Ring.....		14.06	4.02
26 05 33 16-0094	EA	3 Device, Gang Box Mud Ring.....		14.26	4.02
26 05 33 16-0095	EA	4 Device, Gang Box Mud Ring.....		16.49	4.02
26 05 33 16-0096	EA	5 Device, Gang Box Mud Ring.....		20.33	4.02
26 05 33 16-0097	EA	6 Device, Gang Box Mud Ring.....		28.75	4.02
26 05 33 16-0098	EA	2 Device, Gang Box Flat Cover.....		12.15	4.02
26 05 33 16-0099	EA	3 Device, Gang Box Flat Cover.....		14.24	4.02
26 05 33 16-0100	EA	4 Device, Gang Box Flat Cover.....		17.01	4.02
26 05 33 16-0101	EA	5 Device, Gang Box Flat Cover.....		20.54	4.02
26 05 33 16-0102	EA	6 Device, Gang Box Flat Cover.....		29.34	4.02
26 05 33 16-0103		Steel Switch Boxes <small>(26 05 33 16-0001)</small>			
26 05 33 16-0104	EA	2-1/2" Depth, 3" x 2", Stud Bracket, Steel Switch Box.....		23.10	10.05
26 05 33 16-0105	EA	2-3/4" Depth, 3" x 2", Stud Bracket, Steel Switch Box.....		23.42	10.05
26 05 33 16-0106	EA	3-1/2" Depth, 3" x 2", Stud Bracket, Steel Switch Box.....		25.10	10.05
26 05 33 16-0107	EA	2-1/2" Depth, 2 Device, Stud Bracket, Steel Box.....		28.85	10.05
26 05 33 16-0108	EA	2-1/2" Depth, 3 Device, Stud Bracket, Steel Box.....		29.18	10.05
26 05 33 16-0109	EA	2-1/2" Depth, 4 Device, Stud Bracket, Steel Box.....		34.27	10.05
26 05 33 16-0110		4" x 2" Steel Handy Boxes, Extension Rings And Covers <small>(26 05 33 16-0001)</small>			
26 05 33 16-0111	EA	1-1/2" Deep, 4" x 2" Steel Handy Box.....		21.57	10.05
		<i>For Stud Bracket, Add</i>		1.81	
26 05 33 16-0112	EA	1-7/8" Deep, 4" x 2" Steel Handy Box.....		21.92	10.05
		<i>For Stud Bracket, Add</i>		0.78	
26 05 33 16-0113	EA	2-1/8" Deep, 4" x 2" Steel Handy Box.....		22.69	10.05
		<i>For Stud Bracket, Add</i>		1.06	
26 05 33 16-0114	EA	1-1/2" Deep, 4" x 2" Steel Handy Box Extension Ring.....		14.17	6.03
26 05 33 16-0115	EA	1-7/8" Deep, 4" x 2" Steel Handy Box Extension Ring.....		13.83	6.03
26 05 33 16-0116	EA	GFI Receptacle, 2" x 4" Steel Handy Box Exposed Work Cover.....		4.78	2.01
26 05 33 16-0117	EA	1.406" Diameter Receptacle, 4" x 2" Steel Handy Box Exposed Work Cover.....		4.84	2.01
26 05 33 16-0118	EA	Duplex Receptacle, 4" x 2" Steel Handy Box Exposed Work Cover.....		4.52	2.01
26 05 33 16-0119	EA	Toggle Switch, 4" x 2" Steel Handy Box Exposed Work Cover.....		4.54	2.01
26 05 33 16-0120	EA	1.594" Diameter Receptacle, 4" x 2" Steel Handy Box Exposed Work Cover.....		5.20	2.01
26 05 33 16-0121	EA	Flat, 2" x 4" Steel Handy Box Exposed Work Cover.....		4.54	2.01
26 05 33 16-0122		3"-1/2" Depth, 3-3/4" Steel Masonry Boxes <small>(26 05 33 16-0001)</small>			
26 05 33 16-0123	EA	1 Device, 3"-1/2" Depth, 3-3/4" Steel Masonry Box.....		32.22	14.07
26 05 33 16-0124	EA	2 Device, 3"-1/2" Depth, 3-3/4" Steel Masonry Box.....		35.90	14.88
26 05 33 16-0125	EA	3 Device, 3"-1/2" Depth, 3-3/4" Steel Masonry Box.....		40.99	16.09
26 05 33 16-0126	EA	4 Device, 3"-1/2" Depth, 3-3/4" Steel Masonry Box.....		46.59	17.69
26 05 33 16-0127		Cast Boxes <small>(26 05 33 16)</small>			
		Note: For flush or surface mount.			
26 05 33 16-0128		Cast Iron Alloy Boxes <small>(26 05 33 16-0127)</small>			
		See CSI section 26 27 26 00-0243 for box covers.			
26 05 33 16-0129		Shallow, Single Gang Cast Iron Alloy Boxes <small>(26 05 33 16-0128)</small>			
		Note: Up to 2" deep boxes.			
26 05 33 16-0130	EA	1/2" Depth, Type FS, Shallow, Single Gang Cast Iron Alloy Box.....		69.36	24.13
		Note: One hub.			
26 05 33 16-0131	EA	3/4" Depth, Type FS, Shallow, Single Gang Cast Iron Alloy Box.....		74.64	28.15
		Note: One hub.			
26 05 33 16-0132	EA	1" Depth, Type FS, Shallow, Single Gang Cast Iron Alloy Box.....		87.86	34.18
		Note: One hub.			
26 05 33 16-0133	EA	1/2" Depth, Type FSC, Shallow, Single Gang Cast Iron Alloy Box.....		86.62	32.17
		Note: Two hub.			
26 05 33 16-0134	EA	3/4" Depth, Type FSC, Shallow, Single Gang Cast Iron Alloy Box.....		110.82	38.21
		Note: Two hub.			
26 05 33 16-0135	EA	1/2" Depth, Type FSL, Shallow, Single Gang Cast Iron Alloy Box.....		86.26	32.17
		Note: Two hub.			
26 05 33 16-0136	EA	3/4" Depth, Type FSL, Shallow, Single Gang Cast Iron Alloy Box.....		103.74	38.21
		Note: Two hubs.			



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 16-0137 EA 1/2" Depth, Type FSR, Shallow, Single Gang Cast Iron Alloy Box Note: Two hubs.	88.54	32.17
26 05 33 16-0138 EA 3/4" Depth, Type FSR, Shallow, Single Gang Cast Iron Alloy Box Note: Two hubs.	103.77	38.21
26 05 33 16-0139 EA 1/2" Depth, Type FSS, Shallow, Single Gang Cast Iron Alloy Box Note: Two hubs.	86.26	32.17
26 05 33 16-0140 EA 3/4" Depth, Type FSS, Shallow, Single Gang Cast Iron Alloy Box Note: Two hubs.	100.96	38.21
26 05 33 16-0141 EA 1/2" Depth, Type FSCA, Shallow, Single Gang Cast Iron Alloy Box Note: Three hubs.	102.72	40.21
26 05 33 16-0142 EA 3/4" Depth, Type FSCA, Shallow, Single Gang Cast Iron Alloy Box Note: Three hubs.	121.53	48.26
26 05 33 16-0143 EA 1/2" Depth, Type FSXC, Shallow, Single Gang Cast Iron Alloy Box Note: Three hubs.	107.09	40.21
26 05 33 16-0144 EA 3/4" Depth, Type FSXC, Shallow, Single Gang Cast Iron Alloy Box Note: Three hubs.	138.19	48.26
26 05 33 16-0145 EA 1/2" Depth, Type FSCT, Shallow, Single Gang Cast Iron Alloy Box Note: Three hubs.	109.94	40.21
26 05 33 16-0146 EA 3/4" Depth, Type FSCT, Shallow, Single Gang Cast Iron Alloy Box Note: Three hubs.	131.34	48.26
26 05 33 16-0147 EA 1/2" Depth, Type FST, Shallow, Single Gang Cast Iron Alloy Box Note: Three hubs.	102.35	40.21
26 05 33 16-0148 EA 3/4" Depth, Type FST, Shallow, Single Gang Cast Iron Alloy Box Note: Three hubs.	133.27	48.26
26 05 33 16-0149 EA 1/2" Depth, Type FSX, Shallow, Single Gang Cast Iron Alloy Box Note: Four hubs.	130.55	48.26
26 05 33 16-0150 EA 3/4" Depth, Type FSX, Shallow, Single Gang Cast Iron Alloy Box Note: Four hubs.	157.51	58.31
26 05 33 16-0151 Deep, Single Gang Cast Iron Alloy Boxes (26 05 33 16-0128) Note: >2" deep boxes.		
26 05 33 16-0152 EA 1/2" Depth, Type FD, Deep, Single Gang Cast Iron Alloy Box Note: One hub.	72.58	24.13
26 05 33 16-0153 EA 3/4" Depth, Type FD, Deep, Single Gang Cast Iron Alloy Box Note: One hub.	83.57	28.15
26 05 33 16-0154 EA 1" Depth, Type FD, Deep, Single Gang Cast Iron Alloy Box Note: One hub.	98.16	34.18
26 05 33 16-0155 EA 1/2" Depth, Type FDC, Deep, Single Gang Cast Iron Alloy Box Note: Two hubs.	92.50	32.17
26 05 33 16-0156 EA 3/4" Depth, Type FDC, Deep, Single Gang Cast Iron Alloy Box Note: Two hubs.	106.77	38.21
26 05 33 16-0157 EA 1" Depth, Type FDC, Deep, Single Gang Cast Iron Alloy Box Note: Two hubs.	128.31	46.25
26 05 33 16-0158 EA 3/4" Depth, Type FDS, Deep, Single Gang Cast Iron Alloy Box Note: Two hubs.	114.79	38.21
26 05 33 16-0159 EA 3/4" Depth, Type FDCC, Deep, Single Gang Cast Iron Alloy Box Note: Three hubs.	147.69	48.26
26 05 33 16-0160 Shallow, Two Gang Cast Iron Alloy Boxes (26 05 33 16-0128) Note: Up to 2" deep boxes.		
26 05 33 16-0161 EA 1/2" Depth, Type FS, Shallow, Two Gang Cast Iron Alloy Box Note: One hub.	83.50	26.14
26 05 33 16-0162 EA 3/4" Depth, Type FS, Shallow, Two Gang Cast Iron Alloy Box Note: One hub.	92.49	30.16
26 05 33 16-0163 EA 1" Depth, Type FS, Shallow, Two Gang Cast Iron Alloy Box Note: One hub.	107.42	36.19
26 05 33 16-0164 EA 1/2" Depth, Type FSC, Shallow, Two Gang Cast Iron Alloy Box Note: Two hubs.	101.13	34.18
26 05 33 16-0165 EA 3/4" Depth, Type FSC, Shallow, Two Gang Cast Iron Alloy Box Note: Two hubs.	114.85	40.21
26 05 33 16-0166 Deep, Two Gang Cast Iron Alloy Boxes (26 05 33 16-0128) Note: >2" deep boxes.		
26 05 33 16-0167 EA 1/2" Depth, Type FD, Deep, Two Gang Cast Iron Alloy Box Note: One hub.	93.16	26.14
26 05 33 16-0168 EA 3/4" Depth, Type FD, Deep, Two Gang Cast Iron Alloy Box Note: One hub.	101.57	30.16
26 05 33 16-0169 EA 1/2" Depth, Type FDC, Deep, Two Gang Cast Iron Alloy Box Note: Two hubs.	115.67	34.18
26 05 33 16-0170 EA 3/4" Depth, Type FDC, Deep, Two Gang Cast Iron Alloy Box Note: Two hubs.	130.21	40.21
26 05 33 16-0171 Cast Aluminum Boxes (26 05 33 16-0127) See CSI section 26 27 26 00-0243 for box covers.		
26 05 33 16-0172 Shallow, Single Gang Cast Aluminum Boxes (26 05 33 16-0171) Note: Up to 2" deep boxes.		
26 05 33 16-0173 EA 1/2" Depth, Type FS, Shallow, Single Gang Cast Aluminum Box Note: One hub.	61.31	20.11

26 Electrical**26 05 Common Work Results For Electrical****26 05 33 Raceway And Boxes For Electrical Systems**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 16-0174 EA 3/4" Depth, Type FS, Shallow, Single Gang Cast Aluminum Box Note: One hub.	70.20	24.13
26 05 33 16-0175 EA 1" Depth, Type FS, Shallow, Single Gang Cast Aluminum Box Note: One hub.	77.96	30.16
26 05 33 16-0176 EA 1/2" Depth, Type FSA, Shallow, Single Gang Cast Aluminum Box Note: One hub.	57.56	20.11
26 05 33 16-0177 EA 3/4" Depth, Type FSA, Shallow, Single Gang Cast Aluminum Box Note: One hub.	72.84	24.13
26 05 33 16-0178 EA 1/2" Depth, Type FSC, Shallow, Single Gang Cast Aluminum Box Note: Two hubs.	77.76	28.15
26 05 33 16-0179 EA 3/4" Depth, Type FSC, Shallow, Single Gang Cast Aluminum Box Note: Two hubs.	93.42	34.18
26 05 33 16-0180 EA 1" Depth, Type FSC, Shallow, Single Gang Cast Aluminum Box Note: Two hubs.	117.23	42.23
26 05 33 16-0181 EA 1/2" Depth, Type FSL, Shallow, Single Gang Cast Aluminum Box Note: Two hubs.	84.28	28.15
26 05 33 16-0182 EA 3/4" Depth, Type FSL, Shallow, Single Gang Cast Aluminum Box Note: Two hubs.	90.25	34.18
26 05 33 16-0183 EA 1/2" Depth, Type FSLB, Shallow, Single Gang Cast Aluminum Box Note: Two hubs.	80.57	28.15
26 05 33 16-0184 EA 3/4" Depth, Type FSLB, Shallow, Single Gang Cast Aluminum Box Note: Two hubs.	92.46	34.18
26 05 33 16-0185 EA 1/2" Depth, Type FSR, Shallow, Single Gang Cast Aluminum Box Note: Two hubs.	78.18	28.15
26 05 33 16-0186 EA 3/4" Depth, Type FSR, Shallow, Single Gang Cast Aluminum Box Note: Two hubs.	92.46	34.18
26 05 33 16-0187 EA 1/2" Depth, Type FSS, Shallow, Single Gang Cast Aluminum Box Note: Two hubs.	72.65	28.15
26 05 33 16-0188 EA 3/4" Depth, Type FSS, Shallow, Single Gang Cast Aluminum Box Note: Two hubs.	98.34	34.18
26 05 33 16-0189 EA 1/2" Depth, Type FSCA, Shallow, Single Gang Cast Aluminum Box Note: Three hubs.	92.55	36.19
26 05 33 16-0190 EA 3/4" Depth, Type FSCA, Shallow, Single Gang Cast Aluminum Box Note: Three hubs.	112.45	44.24
26 05 33 16-0191 EA 1/2" Depth, Type FSCC, Shallow, Single Gang Cast Aluminum Box Note: Three hubs.	98.28	36.19
26 05 33 16-0192 EA 3/4" Depth, Type FSCC, Shallow, Single Gang Cast Aluminum Box Note: Three hubs.	132.30	44.24
26 05 33 16-0193 EA 1/2" Depth, Type FSCT, Shallow, Single Gang Cast Aluminum Box Note: Three hubs.	97.80	36.19
26 05 33 16-0194 EA 3/4" Depth, Type FSCT, Shallow, Single Gang Cast Aluminum Box Note: Three hubs.	120.00	44.24
26 05 33 16-0195 EA 3/4" Depth, Type FST, Shallow, Single Gang Cast Aluminum Box Note: Three hubs.	121.70	44.24
26 05 33 16-0196 EA 1/2" Depth, Type FSX, Shallow, Single Gang Cast Aluminum Box Note: Four hubs.	119.25	44.24
26 05 33 16-0197 EA 3/4" Depth, Type FSX, Shallow, Single Gang Cast Aluminum Box Note: Four hubs.	145.56	54.30
26 05 33 16-0198 Deep, Single Gang Cast Aluminum Boxes (26 05 33 16-0171) Note: >2" deep boxes.		
26 05 33 16-0199 EA 1/2" Depth, Type FD, Deep, Single Gang Cast Aluminum Box Note: One hub.	67.96	20.11
26 05 33 16-0200 EA 3/4" Depth, Type FD, Deep, Single Gang Cast Aluminum Box Note: One hub.	81.42	24.13
26 05 33 16-0201 EA 1" Depth, Type FD, Deep, Single Gang Cast Aluminum Box Note: One hub.	93.38	30.16
26 05 33 16-0202 EA 3/4" Depth, Type FDA, Deep, Single Gang Cast Aluminum Box Note: One hub.	87.49	24.13
26 05 33 16-0203 EA 1/2" Depth, Type FDC, Deep, Single Gang Cast Aluminum Box Note: Two hubs.	86.36	28.15
26 05 33 16-0204 EA 3/4" Depth, Type FDC, Deep, Single Gang Cast Aluminum Box Note: Two hubs.	103.98	34.18
26 05 33 16-0205 EA 1" Depth, Type FDC, Deep, Single Gang Cast Aluminum Box Note: Two hubs.	116.24	42.23
26 05 33 16-0206 EA 3/4" Depth, Type FDS, Deep, Single Gang Cast Aluminum Box Note: Two hubs.	105.38	34.18
26 05 33 16-0207 EA 3/4" Depth, Type FDCC, Deep, Single Gang Cast Aluminum Box Note: Three hubs.	128.86	44.24
26 05 33 16-0208 Shallow, Two Gang Cast Aluminum Boxes (26 05 33 16-0171) Note: Up to 2" deep boxes.		
26 05 33 16-0209 EA 1/2" Depth, Type FS, Shallow, Two Gang Cast Aluminum Box Note: One hub.	81.29	22.12
26 05 33 16-0210 EA 3/4" Depth, Type FS, Shallow, Two Gang Cast Aluminum Box Note: One hub.	93.08	26.14
26 05 33 16-0211 EA 1" Depth, Type FS, Shallow, Two Gang Cast Aluminum Box Note: One hub.	99.91	32.17
26 05 33 16-0212 EA 1/2" Depth, Type FSC, Shallow, Two Gang Cast Aluminum Box Note: Two hubs.	101.57	30.16
26 05 33 16-0213 EA 3/4" Depth, Type FSC, Shallow, Two Gang Cast Aluminum Box Note: Two hubs.	103.53	36.19



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 16-0214 EA 1" Depth, Type FSC, Shallow, Two Gang Cast Aluminum Box Note: Two hubs.	127.89	44.24
26 05 33 16-0215 Deep, Two Gang Cast Aluminum Boxes (26 05 33 16-0171) Note: >2" deep boxes.		
26 05 33 16-0216 EA 1/2" Depth, Type FD, Deep, Two Gang Cast Aluminum Box..... Note: One hub.	81.22	22.12
26 05 33 16-0217 EA 3/4" Depth, Type FD, Deep, Two Gang Cast Aluminum Box..... Note: One hub.	93.99	26.14
26 05 33 16-0218 EA 1/2" Depth, Type FDC, Deep, Two Gang Cast Aluminum Box Note: Two hubs.	103.65	30.16
26 05 33 16-0219 EA 3/4" Depth, Type FDC, Deep, Two Gang Cast Aluminum Box Note: Two hubs.	117.43	36.19
26 05 33 16-0220 EA 1/2" Depth, Type FDC, Deep, Two Gang Cast Aluminum Box Note: Two hubs.	103.65	30.16
26 05 33 16-0221 EA 3/4" Depth, Type FDC, Deep, Two Gang Cast Aluminum Box Note: Two hubs.	117.43	36.19
26 05 33 16-0222 Shallow, Three Gang Cast Aluminum Boxes (26 05 33 16-0171) Note: Up to 2" deep boxes.		
26 05 33 16-0223 EA 1/2" Depth, Type FSC, Shallow, Three Gang Cast Aluminum Box..... Note: Two hubs.	108.79	32.17
26 05 33 16-0224 EA 3/4" Depth, Type FSC, Shallow, Three Gang Cast Aluminum Box..... Note: Two hubs.	122.03	38.21
26 05 33 16-0225 Deep, Three Gang Cast Aluminum Boxes (26 05 33 16-0171) Note: >2" deep boxes.		
26 05 33 16-0226 EA 3/4" Depth, Type FD, Deep, Three Gang Cast Aluminum Box Note: One hub.	124.13	28.15
26 05 33 16-0227 EA 1" Depth, Type FD, Deep, Three Gang Cast Aluminum Box Note: One hub.	138.33	34.18
26 05 33 16-0228 Poke Thru Units (26 05 33 16)		
26 05 33 16-0229 Surface Poke Thru Units (26 05 33 16-0228) Note: Excludes concrete drilling.		
26 05 33 16-0230 EA Single 20 Amp Duplex Receptacle RC3 Power And Communications Poke Thru Unit Note: Tile or carpet with brushed aluminum flange with black nonmetallic cover. Excludes communication jacks. Wiremold RC3ATCAL.	377.99	30.16
26 05 33 16-0231 EA Retrofit Kit Upgrades Existing RC3 Series Power And Communications Poke Thru Unit To Meet Scrub Water Requirements Note: Includes 20 Amp duplex receptacle. Tile or carpet with brushed aluminum flange with black nonmetallic cover. Wiremold RC3KTCAL.	241.32	
26 05 33 16-0232 EA Replacement 20 Amp Duplex Receptacle For RC3 Series Power And Communications Poke Thru Unit..... Note: Wiremold RC37REC.	32.73	8.04
26 05 33 16-0233 EA Abandonment Plate For RC3 Series Power And Communications Poke Thru Unit..... Note: Wiremold RC3APTCBK.	40.38	4.02
26 05 33 16-0234 EA Four 20 Amp Receptacles RC4 Power And Communications Poke Thru Unit Note: Tile or carpet with brushed aluminum flange with black nonmetallic cover. Excludes communication jacks. Wiremold RC4ATCAL.	427.80	32.17
26 05 33 16-0235 EA Retrofit Kit Upgrades Existing RC4 Series Power And Communications Poke Thru Unit To Meet Scrub Water Requirements Note: Includes two 20 Amp duplex receptacles. Tile or carpet with brushed aluminum flange with black nonmetallic cover. Excludes communication jacks. Wiremold RC4KTCAL.	225.76	
26 05 33 16-0236 EA Replacement Two 20 Amp Duplex Receptacles For RC4 Series Power And Communications Poke Thru Unit Note: Wiremold RC4REC2.	56.35	12.07
26 05 33 16-0237 EA Abandonment Plate For RC4 Series Power And Communications Poke Thru Unit..... Note: Wiremold RC4APTCBK.	40.38	4.02
26 05 33 16-0238 EA Abandonment Plug For RC4 Series Power And Communications Poke Thru Unit..... Note: Wiremold ABPLUG4.	118.24	8.04
26 05 33 16-0239 EA Four Jack RC9AMD Communications Poke Thru Unit Note: Tile or carpet with brushed aluminum flange with black nonmetallic cover. Includes bezels to accept four Ortronics TracJack inserts and two Ortronics Series II inserts. Excludes communication jacks. Wiremold RC9AMDTCAL.	338.11	28.15
26 05 33 16-0240 EA Abandonment Plate For RC9 Series Communications Poke Thru Unit Note: Wiremold RC9APTCBK.	27.88	4.02
26 05 33 16-0241 EA Eight Jack AMD8 Communications Poke Thru Unit..... Note: Tile or carpet with brushed aluminum flange with black nonmetallic cover. Includes bezels to accept eight Ortronics TracJack inserts and four Ortronics Series II inserts. Excludes communication jacks. Wiremold AMD8ATCAL.	336.53	28.15
26 05 33 16-0242 EA Communication Conduit Adapter For Poke Thru Units Note: Includes two conduit connections for communication systems. Wiremold COM75.	39.01	4.02
26 05 33 16-0243 Recessed Poke Thru Units (26 05 33 16-0228) Note: Excludes concrete drilling.		
26 05 33 16-0244 Evolution 6AT Poke Thru Units (26 05 33 16-0243) Note: Excludes concrete drilling.		

26 Electrical**26 05 Common Work Results For Electrical****26 05 33 Raceway And Boxes For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 16-0245	EA		Recessed Prewired Assembly With Surface Style Cover (Wiremold 6ATCP) Note: For carpet, tile, wood and laminate floors. For use in 6" diameter cored hole. Devices are recessed 3 1/4" below floor surface. Die-cast aluminum cover assembly is available in the following finishes: (BK) painted black, (GY) painted gray, (NK) nickel, (BS) brass, and (BZ) bronze.	630.48	32.17
26 05 33 16-0246	EA		Recessed Prewired Assembly With Flush Style Cover (Wiremold 6ATP)..... Note: For tile, wood and laminate floors. For use in 6" diameter cored hole. Devices are recessed 3 1/4" below floor surface. Die-cast aluminum cover assembly is available in the following finishes: (BK) painted black, (GY) painted gray, (NK) nickel, (BS) brass, and (BZ) bronze.	630.56	32.17
26 05 33 16-0247	EA		Recessed Assembly With Surface Style Cover (Wiremold 6ATC) Note: For carpet, tile, wood and laminate floors. For use in 6" diameter cored hole. Devices are recessed 3 1/4" below floor surface. Diecast aluminum cover is available in the following finishes: (BK) painted black, (GY) painted gray, (NK) nickel, (BS) brass, and (BZ) bronze.	600.62	32.17
26 05 33 16-0248	EA		Recessed Assembly With Flush Style Cover (Wiremold 6AT) Note: For tile, wood or laminate floors. For use in 6" diameter cored hole. Devices are recessed 3 1/4" below floor surface. Die-cast aluminum cover is available in the following finishes: (BK) painted black, (GY) painted gray, (NK) nickel, (BS) brass, and (BZ) bronze.	600.62	32.17
26 05 33 16-0249	EA		Recessed Prewired Audio/Video Assembly With Surface Style Cover (Wiremold 6ATCPA)..... Note: For carpet, tile, wood and laminate floors. For use in 6" diameter cored hole. Devices are recessed 3 1/4" below floor surface. Die-cast aluminum cover assembly is available in the following finishes: (BK) painted black, (GY) painted gray, (NK) nickel, (BS) brass, and (BZ) bronze.	630.48	32.17
26 05 33 16-0250	EA		Recessed Prewired Audio/Video Assembly With Flush Style Cover (Wiremold 6ATPA) Note: For tile, wood and laminate floors. For use in 6" diameter cored hole. Devices are recessed 3 1/4" below floor surface. Die-cast aluminum cover assembly is available in the following finishes: (BK) painted black, (GY) painted gray, (NK) nickel, (BS) brass, and (BZ) bronze.	630.48	32.17
26 05 33 16-0251	EA		Recessed Furniture Feed Assembly With Surface Style Cover (Wiremold 6ATCFF) Note: For carpet, tile, wood and laminate floors. For use in 6" diameter cored hole. Die-cast aluminum cover assembly provides one (1) 3/4" trade size screw plug opening and one (1) concentric 2"-1 1/4" trade size screw plug opening and is available in the following finishes: (BK) painted black, (GY) painted gray, (NK) nickel, (BS) brass, and (BZ) bronze.	575.34	32.17
26 05 33 16-0252	EA		Recessed Assembly With Disposable Plate (Wiremold 6STC)..... Note: Includes 6" core hole poke-thru stem assembly with a disposable plate. Devices are recessed 3 1/4" below floor surface. No cover assembly is included. No device plates are included. For use with the following cover assemblies (purchased separately): 6CTC, 6CT, and 6CFFTC Series.	358.72	30.16
26 05 33 16-0253	EA		Recessed Prewired Audio/Video Assembly With Disposable Plate (Wiremold 6STCPAV) Note: Includes 6" core hole poke-thru stem assembly with a disposable plate. Devices are recessed 3 1/4" below floor surface. No cover assembly is included. For use with the following cover assemblies(purchased separately): 6CTC and 6CT Series.	385.14	30.16
26 05 33 16-0254	EA		Recessed Prewired Assembly With Disposable Plate (Wiremold 6STCP) Note: Includes 6" core hole poke-thru stem assembly with a disposable plate. Devices are recessed 3 1/4" below floor surface. No cover assembly is included. For use with the following cover assemblies (purchased separately): 6CTC and 6CT Series.	387.75	30.16
26 05 33 16-0255	EA		6" Pre-Pour Poke-Thru Sleeve (Wiremold 6PPS) Note: Nonmetallic sleeve attaches to structural decking and maintains 6"-6 1/8" diameter cast in core hole. Unit includes three (3) attachment legs, two (2) end caps and three (3) thumb screws.	108.41	16.09
26 05 33 16-0256	EA		Surface Style Cover Assembly (Wiremold 6CTC)..... Note: Die-cast aluminum cover assembly. Cover assembly is available in the following finishes: black (BK), gray (GY), nickel (NK), brass (BS), and bronze (BZ). 6CTC Series cover assemblies designed for use with 6STC, 6STCP, and 6STCPAV Poke-Thru Stem Assemblies.	255.09	8.04
26 05 33 16-0257	EA		Flush Style Cover Assembly (Wiremold 6CT)..... Note: Die-cast aluminum cover assembly. Cover assembly is available in the following finishes: black (BK), gray (GY), nickel (NK), brass (BS), and bronze (BZ). 6CT Series cover assemblies designed for use with 6STC, 6STCP and 6STCPAV Poke-Thru Stem Assemblies. Includes one (1) 6TS Tile Shim.	255.09	8.04
26 05 33 16-0258	EA		Furniture Feed Cover Assembly (Wiremold 6CFFTC) Note: Surface style, die-cast aluminum cover assembly, with one (1) 3/4" trade size screw plug opening, and one (1) concentric 2"-1 1/4" trade size screw plug opening. Cover assembly is available in finishes: black (BK), gray(GY), nickel (NK), brass (BS), and bronze (BZ). 6CFFTC Series Cover Assemblies designed for use with 6STC Poke- Thru Stem Assembly. Includes one (1) 3/4" and one (1) 2" trade size conduit fittings and one (1) divider to separate services.	211.78	8.04
26 05 33 16-0259	EA		Tile Shim (Wiremold 6TS)..... Note: Used for floor coverings greater than 5/16" The 6TS will allow the top surface of the cover to be flush with the finished floor. Includes: two (2) 1/8" thick shims and two (2) 1/16" thick shims. Up to a total of 3/8" of adjustment.	30.47	2.01
26 05 33 16-0260	EA		Device Mounting Plate (Wiremold 6AAP) Note: Device plate that will accept up to two (2) Extron® Electronics AAP style plates. For use in the center compartment only. Devices supplied by others.	14.32	4.02
26 05 33 16-0261	EA		Device Mounting Plate (Wiremold 6ACT8A) Note: Device plate that will accept up to eight (8) ports of communication devices. For use in the center compartment only. Devices supplied by others.	16.67	4.02
26 05 33 16-0262	EA		Device Mounting Plate (Wiremold 6B) Note: Device plate used to blank off center compartment, when no devices are used.	14.25	4.02
26 05 33 16-0263	EA		Device Mounting Plate (Wiremold 6DEC) Note: Device plate that will accept Decorator style devices such as 20A receptacles, GFCLs, 106 adapters or AVV devices. For use in the center compartment only. Devices supplied by others.	14.30	4.02
26 05 33 16-0264	EA		Device Mounting Plate (Wiremold 6DP)..... Note: Device plate that will accept standard 20A duplex receptacle or duplex Turnlok receptacle. For use in the center compartment only. Devices supplied by others.	14.20	4.02
26 05 33 16-0265	EA		Device Mounting Plate (Wiremold 6MAAP) Note: Device plate that will accept up to six (6) Extron® Electronics MAAP style plates. For use in the center compartment only. Devices supplied by others.	16.92	4.02
26 05 33 16-0266	EA		Device Mounting Plate (Wiremold 6MAAP2A) Note: Combination device plate that will accept up to three (3) Extron® Electronics MAAP style plates, and up to two (2) ports of communication devices. For use in the center compartment only. Devices supplied by others.	16.72	4.02
26 05 33 16-0267	EA		Mosaic Mounting Plate (Wiremold 6MOS) Note: Device plate will accept two (2) standard [45mm x 45mm] or one (1) standard [45mm x 90mm] Mosaic style device(s). Devices supplied by others.	17.15	4.02



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 16-0268 EA Device Mounting Plate (Wiremold 6S1) Note: Receptacle opening 1 3/8". For 6" poke-thru units only.	13.97	4.02
26 05 33 16-0269 EA Device Mounting Plate (Wiremold 6S2) Note: Receptacle opening 1 9/16". For 6" poke-thru units only.	13.98	4.02
26 05 33 16-0270 EA Device Mounting Plate (Wiremold 6SER) Note: Device plate that will accept up to four (4) Ortronics® Series II dual modular inserts. For use in the center compartment only. Devices supplied by others.	13.78	4.02
26 05 33 16-0271 EA Device Mounting Plate (Wiremold 6TRAC) Note: Device plate that will accept up to eight (8) Ortronics® TracJack devices. For use in the center compartment only. Devices supplied by others.	13.78	4.02
26 05 33 16-0272 EA 20AMP Duplex Receptacles (Wiremold 68REC) Note: Two (2) proprietary 20AMP duplex power receptacles with mounting plates. Designed to fit in either of the two side compartments in both the 6ATC and the 8ATC Series Poke-Thru Devices. Receptacle can be wired as a standard or isolated ground device.	33.94	6.03
26 05 33 16-0273 EA Device Mounting Plate (Wiremold 68B) Note: Blank plate. Used to blank off either of the side compartments when no devices or cabling are to be used.	12.55	4.02
26 05 33 16-0274 EA Device Mounting Plate (Wiremold 68MAAP) Note: Device plate that will accept up to two (2) Extron® Electronics MAAP device plates. For use in either of the two side compartments only. Not for use in the center compartment. Extron Devices supplied by others.	12.88	4.02
26 05 33 16-0275 EA 20AMP Duplex Receptacles (Wiremold 68REC-25) Note: Two (2) proprietary 20AMP duplex power receptacles with mounting plates and 25' leads. Designed to fit in either of the two side compartments in both the 6ATC and the 8ATC Series Poke-Thru Devices. Receptacle can be wired as a standard or isolated	109.09	7.24
26 05 33 16-0276 EA Device Mounting Plate (Wiremold 682A) Note: Device plate that will accept up to two (2) ports of communication devices. For use in either of the two side compartments only. Not for use in the center compartment. Communication devices supplied by others.	16.51	4.02
26 05 33 16-0277 EA Bottom Housing Assembly (Wiremold 5PTHA) Note: Half-gang pass through housing assembly. Designed to allow pass through of communication cables when no conduit is required. For use on side compartments only.	17.24	4.02
26 05 33 16-0278 EA Bottom Housing Assembly (Wiremold 5BLH) Note: Half-gang blank housing assembly. Designed to blank off compartment when no cable pass through is required. For use on side compartments only. Includes tunnels for 6" and 8" poke-thru devices.	17.76	4.02
26 05 33 16-0279 EA Bottom Housing Assembly (Wiremold 152CHA) Note: One and a half-gang 2" trade size conduit housing assembly. Recommended for use with furniture feed devices (6ATCFF). Covers the center compartment and one of the side compartments.	26.91	8.04
26 05 33 16-0280 EA Bottom Housing Assembly (Wiremold 575CHA) Note: Half-gang 3/4" trade size conduit housing assembly. Includes junction box attached to 3/4" trade size conduit for electrical power connections. For use on side compartments only.	30.66	10.05
26 05 33 16-0281 EA Bottom Housing Assembly (Wiremold 175CHA) Note: One-gang 3/4" trade size conduit housing assembly. Includes junction box attached to 3/4" trade size conduit for electrical power connections.	34.02	10.05
26 05 33 16-0282 EA Bottom Housing Assembly (Wiremold 1125CHA) Note: One-gang 1 1/4" trade size conduit housing assembly.	25.77	8.04
26 05 33 16-0283 EA Bottom Housing Assembly (Wiremold 1PTHA) Note: One-gang pass through housing assembly. Designed to allow pass through of communication cables when no conduit is required.	17.12	4.02
26 05 33 16-0284 EA Bottom Housing Assembly (Wiremold 1BLH) Note: One-gang blank housing assembly. Designed to blank off compartment when no cable pass through is required.	17.12	4.02
26 05 33 16-0285 EA Bottom Housing Assembly (Wiremold 15FFHA) Note: One and a half-gang pass through conduit housing assembly. Used for furniture feed applications on the center compartment only. Only for use with 6AT Series units.	18.08	4.02
26 05 33 16-0286 EA Bottom Housing Assembly (Wiremold 1BHA) Note: One-gang bottom housing assembly. Designed to accept 175CHA, 1125CHA, 1PTHA, and 1BLH plates.	18.74	4.02
26 05 33 16-0287 Evolution 8AT Poke Thru Units <small>(26 05 33 16-0243)</small> Note: Excludes concrete drilling.		
26 05 33 16-0288 EA Recessed Prewired Assembly With Surface Style Cover (Wiremold 8ATCP) Note: For carpet, tile, wood and laminate floors. For use in 8" diameter cored hole. Devices are recessed 3 1/4" below floor surface. Die-cast aluminum cover assembly is available in the following finishes: (BK) painted black, (GY) painted gray, (NK) nickel, (BS) brass, and (BZ) bronze.	829.13	32.17
26 05 33 16-0289 EA Recessed Prewired Assembly With Flush Style Cover (Wiremold 8ATP) Note: For tile, wood and laminate floors. For use in 8" diameter cored hole. Devices are recessed 3 1/4" [83mm] below floor surface. Die-cast aluminum cover assembly is available in the following finishes: (BK) painted black, (GY) painted gray, (NK) nickel, (BS) brass, and (BZ) bronze.	788.83	32.17
26 05 33 16-0290 EA Recessed Assembly With Surface Style Cover (Wiremold 8ATC) Note: For carpet, tile, wood and laminate floors. For use in 8" diameter cored hole. Devices are recessed 3 1/4" below floor surface. Diecast aluminum cover assembly is available in the following finishes: (BK) painted black, (GY) painted gray, (NK) nickel, (BS) brass, and (BZ) bronze.	781.24	32.17
26 05 33 16-0291 EA Recessed Assembly With Flush Style Cover (Wiremold 8AT) Note: For tile, wood and laminate floors. For use in 8" diameter cored hole. Devices are recessed 3 1/4" below floor surface. Diecast aluminum cover assembly is available in the following finishes: (BK) painted black, (GY) painted gray, (NK) nickel, (BS) brass, and (BZ) bronze.	774.05	32.17
26 05 33 16-0292 EA Recessed Assembly With Disposable Plate (Wiremold 8STC) Note: Includes 8" core hole poke-thru stem assembly with a disposable plate. Devices are recessed 3 1/4" below floor surface. No cover assembly is included. For use with the following cover assemblies (purchased separately): 8CTC and 8CT Series.	465.35	30.16
26 05 33 16-0293 EA Recessed Prewired Assembly With Disposable Plate (Wiremold 8STCP) Note: Includes 8" core hole poke-thru stem assembly with a disposable plate. Devices are recessed 3 1/4" below floor surface. No cover assembly is included. For use with the following cover assemblies (purchased separately): 8CTC and 8CT Series.	522.12	30.16
26 05 33 16-0294 EA 8" Pre-Pour Poke-Thru Sleeve (Wiremold 8PPS) Note: Nonmetallic sleeve attaches to structural decking and maintains 8"-8 1/8" diameter cast in core hole. Unit includes three (3) attachment legs, two (2) end caps and three (3) thumb screws.	130.57	16.09

26 Electrical**26 05 Common Work Results For Electrical****26 05 33 Raceway And Boxes For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 16-0295	EA		Surface Style Cover Assembly (Wiremold 8CTC)..... Note: Die-cast aluminum cover assembly. Cover assembly is available in the following finishes: (BK) painted black, (GY) painted gray, (NK) nickel, (BS) brass, and (BZ) bronze. 8CTC Series Cover Assemblies designed for use with 8STC and 8STCP Poke-Thru Stem Assemblies.	276.00	8.04
26 05 33 16-0296	EA		Flush Style Cover Assembly (Wiremold 8CT)..... Note: Die-cast aluminum cover assembly. Cover assembly is available in the following finishes: (BK) painted black, (GY) painted gray, (NK) nickel, (BS) brass, and (BZ) bronze. 8CTC Series Cover Assemblies designed for use with 8STC and 8STCP Poke-Thru Stem Assemblies. Includes one (1) 8TS Tile Shim.	276.00	8.04
26 05 33 16-0297	EA		Tile Shim (Wiremold 8TS)..... Note: Used for floor coverings greater than 5/16". The 8TS will allow the top surface of the cover to be flush with the finished floor. Includes: two (2) 1/8" thick shims and two (2) 1/16" thick shims. Up to a total of 3/8" [9.5mm] of adjustment.	47.70	2.01
26 05 33 16-0298	EA		Device Mounting Plate (Wiremold 8B)..... Note: Singlegang device plate used to blank off any one (1) of the three (3) gangs in the center compartment, when no devices are used.	14.83	4.02
26 05 33 16-0299	EA		Device Mounting Plate (Wiremold 8DP)..... Note: Singlegang device plate that accepts standard 20A duplex receptacle or a duplex Turnlok receptacle. Fits in any one (1) of the three (3) gangs in the center compartment. Devices supplied by others.	14.92	4.02
26 05 33 16-0300	EA		Device Mounting Plate (Wiremold 8DEC)..... Note: Singlegang device plate that will accept Decorator style devices such as 20A receptacles, GGCI's, 106 adapters or A/V devices. Fits in any one (1) of the three (3) gangs in the center compartment. Devices supplied by others.	15.02	4.02
26 05 33 16-0301	EA		Device Mounting Plate (Wiremold 8ACT6A)..... Note: Singlegang device plate that will accept up to six (6) ports of communication devices. Fits in any one (1) of the three (3) gangs in the center compartment. Devices supplied by others.	17.53	4.02
26 05 33 16-0302	EA		Mosaic Mounting Plate (Wiremold 8MOS)..... Note: Device plate accepts three (3) standard Mosaic devices. Devices supplied by others.	21.41	4.02
26 05 33 16-0303	EA		Crestron Double Gang Plate (Wiremold 8CREST)..... Note: Device plate accepts Crestron double-gang decorator style devices.	21.38	4.02
26 05 33 16-0304	EA		Device Mounting Plate (Wiremold 8S1)..... Note: Receptacle opening 1 3/8". For 8" poke-thru units only.	14.35	4.02
26 05 33 16-0305	EA		Device Mounting Plate (Wiremold 8S2)..... Note: Receptacle opening 1 9/16". For 8" poke-thru units only.	14.55	4.02
26 05 33 16-0306	EA		Device Mounting Plate (Wiremold 8TRAC)..... Note: Singlegang device plate that will accept up to six (6) Ortronics TracJack devices. Fits in any one (1) of the three (3) gangs in the center compartment. Devices supplied by others.	14.35	4.02
26 05 33 16-0307	EA		Device Mounting Plate (Wiremold 8SER)..... Note: Singlegang device plate that will accept up to three (3) Ortronics Series II dual modular inserts. Fits in any one (1) of the three (3) gangs in the center compartment. Devices supplied by others.	14.35	4.02
26 05 33 16-0308	EA		Device Mounting Plate (Wiremold 8MAAP)..... Note: Singlegang device plate that will accept up to four (4) Extron® Electronics MAAP style plates. Fits in any one (1) of the three (3) gangs in the center compartment. Devices supplied by others.	21.06	4.02
26 05 33 16-0309	EA		Device Mounting Plate (Wiremold 8AAP)..... Note: Twogang device plate that will accept up to four (4) Extron® Electronics AAP style plates. 8AAP takes up 2 of the 3 gangs in the center compartment. Devices supplied by others.	17.42	4.02
26 05 33 16-0310	EA		8" Divider (Wiremold 8DIV)..... Note: Divider allows for separation of services when required.	20.21	4.02
26 05 33 16-0311	EA		Bottom Housing Assembly (Wiremold 22CHA)..... Note: Two-gang 2" trade size conduit housing assembly. Used on 8AT Series devices. Covers two (2) of the three (3) gangs in the center compartment. Only for use with 8AT Series units.	26.91	8.04

26 05 33 23 Surface Raceways For Electrical Systems (26 05 33)

26 05 33 23-0001 Raceways (26 05 33 23)

26 05 33 23-0002 Wireway With Screw Cover (26 05 33 23-0001)

Note: Also known as wire trough. Galvanized steel construction. Mounted exposed on flat wall surface. Labor units include material unloading, unpacking at job site, layout of job, assembly and installation.

26 05 33 23-0003 2-1/2" x 2-1/2", Wireway With Screw Cover (26 05 33 23-0002)

26 05 33 23-0004	LF		2-1/2" x 2-1/2", NEMA 1, Surface Mounted Wireway With Screw Cover.....	14.68	3.68
			For Combination Hinged Screw Cover, Add	0.37	
			For Concrete Or Masonry Surface, Add	0.37	
26 05 33 23-0005	EA		2-1/2" x 2-1/2", End Plate For Surface Mounted Wireway With Screw Cover.....	13.69	5.51
			For Combination Hinged Screw Cover, Add	0.13	
26 05 33 23-0006	EA		2-1/2" x 2-1/2", Coupling For Surface Mounted Wireway With Screw Cover.....	16.41	6.88
			For Combination Hinged Screw Cover, Add	0.13	
26 05 33 23-0007	EA		2-1/2" x 2-1/2", Panel Adapter For Surface Mounted Wireway With Screw Cover.....	33.53	12.86
			For Combination Hinged Screw Cover, Add	0.39	
26 05 33 23-0008	EA		2-1/2" x 2-1/2", Elbow For Surface Mounted Wireway With Screw Cover.....	49.05	12.86
			For Combination Hinged Screw Cover, Add	1.17	
26 05 33 23-0009	EA		2-1/2" x 2-1/2", Tee For Surface Mounted Wireway With Screw Cover.....	72.15	18.31
			For Combination Hinged Screw Cover, Add	1.78	
26 05 33 23-0010	EA		2-1/2" x 2-1/2", Cross For Surface Mounted Wireway With Screw Cover.....	80.82	20.22
			For Combination Hinged Screw Cover, Add	2.02	

26 05 33 23-0011 4" x 4", Wireway With Screw Cover (26 05 33 23-0002)

26 05 33 23-0012	LF		4" x 4", NEMA 1, Surface Mounted Wireway With Screw Cover.....	18.03	4.63
			For Combination Hinged Screw Cover, Add	0.44	
			For Concrete Or Masonry Surface, Add	0.46	
26 05 33 23-0013	LF		4" x 4", NEMA 3R, Surface Mounted Wireway With Screw Cover.....	30.07	4.63
			For Combination Hinged Screw Cover, Add	1.04	
			For Concrete Or Masonry Surface, Add	0.46	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 23-0014 EA 4" x 4", End Plate For Surface Mounted Wireway With Screw Cover <i>For Combination Hinged Screw Cover, Add</i>	10.86 0.14	4.04
26 05 33 23-0015 EA 4" x 4", Coupling For Surface Mounted Wireway With Screw Cover <i>For Combination Hinged Screw Cover, Add</i>	18.21 0.14	7.72
26 05 33 23-0016 EA 4" x 4", Panel Adapter For Surface Mounted Wireway With Screw Cover <i>For Combination Hinged Screw Cover, Add</i>	39.95 0.42	15.73
26 05 33 23-0017 EA 4" x 4", Elbow For Surface Mounted Wireway With Screw Cover <i>For Combination Hinged Screw Cover, Add</i>	57.01 1.28	15.73
26 05 33 23-0018 EA 4" x 4", Tee For Surface Mounted Wireway With Screw Cover <i>For Combination Hinged Screw Cover, Add</i>	79.57 1.93	20.44
26 05 33 23-0019 EA 4" x 4", Cross For Surface Mounted Wireway With Screw Cover <i>For Combination Hinged Screw Cover, Add</i>	92.09 2.21	23.89
26 05 33 23-0020 6" x 6", Wireway With Screw Cover <small>(26 05 33 23-0002)</small>		
26 05 33 23-0021 LF 6" x 6", NEMA 1, Surface Mounted Wireway With Screw Cover <i>For Combination Hinged Screw Cover, Add</i> <i>For Concrete Or Masonry Surface, Add</i>	26.11 0.75 0.55	5.51
26 05 33 23-0022 LF 6" x 6", NEMA 3R, Surface Mounted Wireway With Screw Cover <i>For Combination Hinged Screw Cover, Add</i> <i>For Concrete Or Masonry Surface, Add</i>	47.22 1.81 0.55	5.51
26 05 33 23-0023 EA 6" x 6", End Plate For Surface Mounted Wireway With Screw Cover <i>For Combination Hinged Screw Cover, Add</i>	13.28 0.22	4.41
26 05 33 23-0024 EA 6" x 6", Coupling For Surface Mounted Wireway With Screw Cover <i>For Combination Hinged Screw Cover, Add</i>	22.84 0.22	9.19
26 05 33 23-0025 EA 6" x 6", Panel Adapter For Surface Mounted Wireway With Screw Cover <i>For Combination Hinged Screw Cover, Add</i>	53.88 0.87	18.31
26 05 33 23-0026 EA 6" x 6", Elbow For Surface Mounted Wireway With Screw Cover <i>For Combination Hinged Screw Cover, Add</i>	71.90 1.77	18.31
26 05 33 23-0027 EA 6" x 6", Tee For Surface Mounted Wireway With Screw Cover <i>For Combination Hinged Screw Cover, Add</i>	109.22 3.18	22.87
26 05 33 23-0028 EA 6" x 6", Cross For Surface Mounted Wireway With Screw Cover <i>For Combination Hinged Screw Cover, Add</i>	119.48 3.33	26.47
26 05 33 23-0029 8" x 8", Wireway With Screw Cover <small>(26 05 33 23-0002)</small>		
26 05 33 23-0030 LF 8" x 8", NEMA 1, Surface Mounted Wireway With Screw Cover <i>For Combination Hinged Screw Cover, Add</i> <i>For Concrete Or Masonry Surface, Add</i>	40.27 1.41 0.60	6.03
26 05 33 23-0031 LF 8" x 8", NEMA 3R, Surface Mounted Wireway With Screw Cover <i>For Combination Hinged Screw Cover, Add</i> <i>For Concrete Or Masonry Surface, Add</i>	70.33 2.92 0.60	6.03
26 05 33 23-0032 EA 8" x 8", End Plate For Surface Mounted Wireway With Screw Cover <i>For Combination Hinged Screw Cover, Add</i>	14.58 0.25	4.78
26 05 33 23-0033 EA 8" x 8", Coupling For Surface Mounted Wireway With Screw Cover <i>For Combination Hinged Screw Cover, Add</i>	24.87 0.25	9.93
26 05 33 23-0034 EA 8" x 8", Panel Adapter For Surface Mounted Wireway With Screw Cover <i>For Combination Hinged Screw Cover, Add</i>	59.99 0.98	20.14
26 05 33 23-0035 EA 8" x 8", Elbow For Surface Mounted Wireway With Screw Cover <i>For Combination Hinged Screw Cover, Add</i>	89.25 2.45	20.14
26 05 33 23-0036 EA 8" x 8", Tee For Surface Mounted Wireway With Screw Cover <i>For Combination Hinged Screw Cover, Add</i>	129.65 4.00	24.86
26 05 33 23-0037 EA 8" x 8", Cross For Surface Mounted Wireway With Screw Cover <i>For Combination Hinged Screw Cover, Add</i>	178.09 5.89	30.15
26 05 33 23-0038 10" x 10", Wireway With Screw Cover <small>(26 05 33 23-0002)</small>		
26 05 33 23-0039 LF 10" x 10", NEMA 1, Surface Mounted Wireway With Screw Cover <i>For Combination Hinged Screw Cover, Add</i> <i>For Concrete Or Masonry Surface, Add</i>	57.35 2.17 0.70	6.99
26 05 33 23-0040 LF 10" x 10", NEMA 3R, Surface Mounted Wireway With Screw Cover <i>For Combination Hinged Screw Cover, Add</i> <i>For Concrete Or Masonry Surface, Add</i>	98.03 4.20 0.70	6.99
26 05 33 23-0041 EA 10" x 10", End Plate For Surface Mounted Wireway With Screw Cover <i>For Combination Hinged Screw Cover, Add</i>	19.65 0.43	5.51
26 05 33 23-0042 EA 10" x 10", Coupling For Surface Mounted Wireway With Screw Cover <i>For Combination Hinged Screw Cover, Add</i>	30.68 0.43	11.03
26 05 33 23-0043 EA 10" x 10", Panel Adapter For Surface Mounted Wireway With Screw Cover <i>For Combination Hinged Screw Cover, Add</i>	76.82 1.65	21.91
26 05 33 23-0044 EA 10" x 10", Elbow For Surface Mounted Wireway With Screw Cover <i>For Combination Hinged Screw Cover, Add</i>	134.87 4.55	21.91
26 05 33 23-0045 EA 10" x 10", Tee For Surface Mounted Wireway With Screw Cover <i>For Combination Hinged Screw Cover, Add</i>	200.42 7.26	27.64
26 05 33 23-0046 EA 10" x 10", Cross For Surface Mounted Wireway With Screw Cover <i>For Combination Hinged Screw Cover, Add</i>	280.65 10.91	31.25
26 05 33 23-0047 12" x 12", Wireway With Screw Cover <small>(26 05 33 23-0002)</small>		
26 05 33 23-0048 LF 12" x 12", NEMA 1, Surface Mounted Wireway With Screw Cover <i>For Combination Hinged Screw Cover, Add</i> <i>For Concrete Or Masonry Surface, Add</i>	67.50 2.53 0.85	8.45

26 Electrical**26 05 Common Work Results For Electrical****26 05 33 Raceway And Boxes For Electrical Systems**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 23-0049 LF 12" x 12", NEMA 3R, Surface Mounted Wireway With Screw Cover <i>For Combination Hinged Screw Cover, Add</i> <i>For Concrete Or Masonry Surface, Add</i>	108.38 4.57 0.85	8.45
26 05 33 23-0050 EA 12" x 12", End Plate For Surface Mounted Wireway With Screw Cover <i>For Combination Hinged Screw Cover, Add</i>	24.94 0.66	5.89
26 05 33 23-0051 EA 12" x 12", Coupling For Surface Mounted Wireway With Screw Cover..... <i>For Combination Hinged Screw Cover, Add</i>	36.71 0.66	11.76
26 05 33 23-0052 EA 12" x 12", Panel Adapter For Surface Mounted Wireway With Screw Cover <i>For Combination Hinged Screw Cover, Add</i>	97.62 2.49	23.89
26 05 33 23-0053 EA 12" x 12", Elbow For Surface Mounted Wireway With Screw Cover <i>For Combination Hinged Screw Cover, Add</i>	174.50 6.34	23.89
26 05 33 23-0054 EA 12" x 12", Tee For Surface Mounted Wireway With Screw Cover..... <i>For Combination Hinged Screw Cover, Add</i>	224.13 8.27	29.41
26 05 33 23-0055 EA 12" x 12", Cross For Surface Mounted Wireway With Screw Cover <i>For Combination Hinged Screw Cover, Add</i>	355.61 14.47	33.09
26 05 33 23-0056 Surface Metal Raceways <small>(26 05 33 23-0001)</small> Note: Exposed on flat wall surface. Labor units include material unloading, unpacking at job site, layout of job, assembly and installation.		
26 05 33 23-0057 One Piece Surface Metal Raceways <small>(26 05 33 23-0056)</small> Note: Exposed installations on masonry, concrete block or drywall walls or ceilings. Labor units to include material handling, unloading at job site, layout of job, measuring, cutting and assembly (Wiremold or approved equal).		
26 05 33 23-0058 3/4" x 17/32" One Piece Surface Metal Raceways (Wiremold #500) <small>(26 05 33 23-0057)</small> Note: Available in ivory.		
26 05 33 23-0059 LF #500, 3/4" x 17/32" One Piece Surface Metal Raceway <i>For Concrete Or Masonry Surface, Add</i>	3.30 0.11	1.10
26 05 33 23-0060 EA #502 Bushing.....	3.20	1.47
26 05 33 23-0061 EA #504 One Or Two Hole Strap	3.23	1.47
26 05 33 23-0062 EA #506 Connection Cover	3.36	1.47
26 05 33 23-0063 EA #511 Flat 90 Degree Elbow	5.15	1.76
26 05 33 23-0064 EA #512 Flat 45 Degree Elbow	8.64	1.83
26 05 33 23-0065 EA #517 Adjustable Internal Elbow.....	6.41	2.21
26 05 33 23-0066 EA #518 Adjustable External Elbow	6.26	2.21
26 05 33 23-0067 3/4" x 21/32" One Piece Surface Metal Raceways (Wiremold #700) <small>(26 05 33 23-0057)</small> Note: Available in ivory and white.		
26 05 33 23-0068 LF #700, 3/4" x 21/32" One Piece Surface Metal Raceway <i>For Concrete Or Masonry Surface, Add</i>	4.18 0.15	1.47
26 05 33 23-0069 EA #702 Bushing.....	3.30	1.47
26 05 33 23-0070 EA #704 One Or Two Hole Strap	3.40	1.47
26 05 33 23-0071 EA #706 Connection Cover	3.42	1.47
26 05 33 23-0072 EA #711 Flat 90 Degree Elbow	7.58	2.94
26 05 33 23-0073 EA #712 Flat 45 Degree Elbow	12.06	2.94
26 05 33 23-0074 EA #717 Adjustable Internal Elbow.....	8.19	2.94
26 05 33 23-0075 EA #718 Adjustable External Elbow	7.91	2.94
26 05 33 23-0076 One Piece Surface Metal Raceways Fittings (Wiremold #500 And 700 Fittings) <small>(26 05 33 23-0057)</small> Note: Available in ivory.		
26 05 33 23-0077 EA #5700F 18" Flex Fitting, For #500 Or 700.....	23.18	2.21
26 05 33 23-0078 EA #5701 Galvanized Coupling, For #500 Or 700.....	3.38	1.47
26 05 33 23-0079 EA #5703 Supporting Clip, For #500 Or 700	3.38	1.47
26 05 33 23-0080 EA #5709 Ground Clamp.....	10.00	2.21
26 05 33 23-0081 EA #5709GC Grounding Connector	8.41	2.21
26 05 33 23-0082 EA #5711 L Or R (Left Or Right) Twisted Internal Ell	9.52	2.94
26 05 33 23-0083 EA #5715 Tee.....	10.67	3.68
26 05 33 23-0084 EA #5719 Corner Box, 2-1/2" x 2-3/8" x 2-1/2"	18.88	2.94
26 05 33 23-0085 EA #57242 Utility Box For #500 Or #700.....	14.47	2.94
26 05 33 23-0086 EA #5731 Blank Cover, 2-3/8" Diameter	7.75	1.83
26 05 33 23-0087 EA #5733 Outlet Box, 3" Diameter	17.98	2.94
26 05 33 23-0088 EA #5735 Distribution Box, 4-3/4" Square x 1-3/8" Deep	17.90	2.94
26 05 33 23-0089 EA #5736 Blank Cover, 4-3/8".....	8.23	1.83
26 05 33 23-0090 EA #5737 Extension Box/Open Base, 4-3/4" Diameter	16.24	2.94
26 05 33 23-0091 EA #5737A Extension Box/Open Base, 5-1/2" Diameter	15.66	2.94
26 05 33 23-0092 EA #5738 Fixture Box/Solid Base, 4-3/4" Diameter.....	15.80	2.94
26 05 33 23-0093 EA #5738A Fixture Box/Solid Base, 5-1/2" Diameter	15.80	2.94
26 05 33 23-0094 EA #5738AF Fan Box/Solid Base, 5-1/2" Diameter	17.90	2.94
26 05 33 23-0095 EA #5739 Fixture Box/Solid Base, 6-3/8"	17.68	2.94
26 05 33 23-0096 EA #5739A Extension Box/Open Base, 6-3/8" Diameter	18.89	2.94
26 05 33 23-0097 EA #57240 Standard Switch Box For #500, Or #700	21.14	4.78
26 05 33 23-0098 EA #57243G Duplex Receptacle And Box, Ground, For #500 Or #700.....	33.29	9.19
26 05 33 23-0099 EA #5741 Switch And Receptacle Box For Shallow Type Switches, 2-13/16" x 4-5/8" x 1-3/8"	15.85	4.78
26 05 33 23-0100 EA #5744 Extra Deep Switch And Receptacle Box, 1 Gang, 4-5/8" x 2-7/8" x 2-3/4"	25.39	4.78
26 05 33 23-0101 EA #5744-2 Extra Deep Switch And Receptacle Box, 2 Gang, 4-3/4" x 4-3/4" x 2-3/4"	29.18	4.78
26 05 33 23-0102 EA #5744-3 Extra Deep Switch And Receptacle Box, 3 Gang, 4-5/8" x 6-1/2" x 2-3/4"	44.59	4.78
26 05 33 23-0103 EA #5744S Signal Box 1 Gang.....	23.04	4.04



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 23-0104 EA #5744S-2 Signal Box 2 Gang	25.77	4.04
26 05 33 23-0105 EA #5744S-3 Signal Box 3 Gang	41.61	4.04
26 05 33 23-0106 EA #5745 Combination Switch And Receptacle Box With 1/2" KO's, 4-5/8" x 2-7/8" x 1-3/4"	16.57	4.78
26 05 33 23-0107 EA #5747 Shallow Switch And Receptacle Box For Standard Shallow Devices, 1 Gang, 4-5/8" x 2-7/8" x 1-3/8"	14.51	4.78
26 05 33 23-0108 EA #5747-2 Shallow Switch And Receptacle Box For Standard Shallow Devices, 2 Gang, 4-3/4" x 4-3/4" x 1-3/8"	20.63	4.78
26 05 33 23-0109 EA #5747-3 Shallow Switch And Receptacle Box For Standard Shallow Devices, 3 Gang, 4-5/8" x 6-1/2" x 2-3/4"	40.65	4.78
26 05 33 23-0110 EA #5748 Switch And Receptacle Box For Deep Devices, 1 Gang, 4-5/8" x 2-7/8" x 1-3/4"	15.54	4.78
26 05 33 23-0111 EA #5748-2 Switch And Receptacle Box For Deep Devices, 2 Gang, 4-3/4" x 4-3/4" x 1-3/4"	21.87	4.78
26 05 33 23-0112 EA #5748-3 Switch And Receptacle Box For Deep Devices, 3 Gang, 4-5/8" x 6-1/2" x 1-3/4"	39.50	4.78
26 05 33 23-0113 EA #5748-4 Switch And Receptacle Box For Deep Devices, 4 Gang, 4-5/8" x 8-11/32" x 1-3/4"	58.89	4.78
26 05 33 23-0114 EA #5748-5 Switch And Receptacle Box For Deep Devices, 5 Gang, 4-5/8" x 10-5/32" x 1-3/4"	97.46	4.78
26 05 33 23-0115 EA #5748-6 Switch And Receptacle Box For Deep Devices, 6 Gang, 4-5/8" x 11-31/32" x 1-3/4"	99.18	4.78
26 05 33 23-0116 EA #5748-S Shallow Switch And Receptacle Box For Shallow Duplex Devices, 4-3/8" x 2-7/8" x 15/16"	15.35	4.78
26 05 33 23-0117 EA #5751 Flush-Type Extension Adapter, 1 Gang, 4-5/8" x 2-7/8" x 15/16"	14.90	4.78
26 05 33 23-0118 EA #5751-2 Flush-Type Extension Adapter, 2 Gang, 4-3/4" x 4-3/4" x 15/16"	20.01	4.78
26 05 33 23-0119 EA #5751-3 Flush-Type Extension Adapter, 3 Gang, 4-5/8" x 6-1/2" x 15/16"	39.88	4.78
26 05 33 23-0120 EA #5751A Deep Flush-Type Extension Adapter, 1 Gang, 4-5/8" x 2-7/8" x 1-3/4"	16.15	4.78
26 05 33 23-0121 EA #5752 Alarm Device Box, 2 Gang, 4-11/16" x 4-11/16" x 1-3/8"	21.08	4.78
26 05 33 23-0122 EA #5753 Extra Deep Alarm Device Box, 2 Gang, 4-11/16" x 4-11/16" x 2-3/4"	30.61	4.78
26 05 33 23-0123 EA #5760 Blank Extension Box	10.62	1.83
26 05 33 23-0124 EA #5780 Special Nipple, 1/2"	10.11	1.83
26 05 33 23-0125 EA #5781 1/2" Box Connector	6.65	1.83
26 05 33 23-0126 EA #5781A 3/4" Box Connector	12.68	2.21
26 05 33 23-0127 EA #5782 1/2" Conduit Connector	6.71	1.83
26 05 33 23-0128 EA #5782A 3/4" Conduit Connector	15.96	2.21
26 05 33 23-0129 EA #5784 1/2" Elbow Conduit Connector	14.27	2.21
26 05 33 23-0130 EA #5785 Combination Connector, To Any 3-1/4" Or 4" Outlet Box	7.82	2.21
26 05 33 23-0131 EA #5786 Offset Connector	13.23	2.21
26 05 33 23-0132 EA #5790B Armor Cable Connector	6.82	1.83
26 05 33 23-0133 EA #5791 1/2" EMT Connector, For #500 Or 700	6.05	1.47
26 05 33 23-0134	1-9/16" x 11/32" One Piece Surface Metal Raceways (Wiremold #1500) <small>(26 05 33 23-0057)</small>	
	Note: Galvanized finish.	
26 05 33 23-0135 LF #1500-10, 1-9/16" x 11/32" One Piece Surface Metal Raceway	5.94	1.83
	<i>For Concrete Or Masonry Surface, Add</i> 0.18	
26 05 33 23-0136 EA #1500WC Wire Clip	3.69	1.47
26 05 33 23-0137 EA #1502 Bushing	4.37	1.83
26 05 33 23-0138 EA #1504 2-Hole Strap	4.93	2.21
26 05 33 23-0139 EA #1511 Flat Elbow	19.14	6.99
26 05 33 23-0140 EA #1517 Internal Elbow	19.78	6.99
26 05 33 23-0141 EA #1517B Adapter Fitting	21.27	6.99
26 05 33 23-0142 EA #1518 External Elbow	21.14	6.99
26 05 33 23-0143 EA #1528 Utility Box	19.12	4.78
26 05 33 23-0144 EA #1542D Junction Box	19.71	4.78
26 05 33 23-0145 EA #1543GL Duplex Receptacle	38.63	9.19
26 05 33 23-0146 EA #1546A Single Receptacle Box	20.30	4.78
26 05 33 23-0147 EA #1546B Duplex Receptacle Box	24.85	4.78
26 05 33 23-0148 EA #1546T Telephone Box	24.38	4.78
26 05 33 23-0149 EA #1585 Combination Connection	11.78	2.21
26 05 33 23-0150	2-7/32" x 28/32" One Piece Surface Metal Raceways (Wiremold #2600) <small>(26 05 33 23-0057)</small>	
	Note: Galvanized finish.	
26 05 33 23-0151 LF #2600-10, 2-7/32" x 28/32" One Piece Surface Metal Raceway	9.68	3.31
	<i>For Concrete Or Masonry Surface, Add</i> 0.33	
26 05 33 23-0152 EA #2600WC Wire Clip	3.68	1.47
26 05 33 23-0153 EA #2602 Fiber Bushing	4.08	1.47
26 05 33 23-0154 EA #2611 2-5/8 90 Degree Flat Elbow	14.28	2.58
26 05 33 23-0155 EA #2642D Junction Box, 5" Diameter	21.36	3.68
26 05 33 23-0156 EA #2686FO Service Fitting	21.04	4.41
26 05 33 23-0157	Two Piece Surface Metal Raceways <small>(26 05 33 23-0056)</small>	
	Note: Exposed installations on masonry, concrete block or drywall walls or ceilings. Labor units to include material handling, unloading at job site, layout of job, measuring, cutting and assembly (Wiremold or approved equal).	
26 05 33 23-0158	1-9/32" x 3/4" Two Piece Surface Metal Raceways (Wiremold #2000) <small>(26 05 33 23-0157)</small>	
26 05 33 23-0159 LF #2000BC, 1-9/32" x 3/4" Two Piece Surface Metal Raceway Base And Cover	5.68	1.83
	<i>For Concrete Or Masonry Surface, Add</i> 0.18	
26 05 33 23-0160 EA #2000WC Wire Clip	2.72	1.47
26 05 33 23-0161 EA #2001 Coupling	7.26	1.83
26 05 33 23-0162 EA #2003 Supporting Clip	3.51	1.10
26 05 33 23-0163 EA #2006 Cover Clip	3.26	1.10
26 05 33 23-0164 EA #2009 Ground Clamp	8.44	1.83
26 05 33 23-0165 EA #2010A2 Entrance End Fitting	16.71	5.51
26 05 33 23-0166 EA #2010A3 Entrance End Fitting	28.54	7.35
26 05 33 23-0167 EA #2010B Blank End Fitting	4.45	1.83
26 05 33 23-0168 EA #2011 Flat 90 Degree Elbow	14.38	4.78

26 Electrical**26 05 Common Work Results For Electrical****26 05 33 Raceway And Boxes For Electrical Systems**

MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
26 05 33 23-0169	EA	#2015 Tee.....	26.34		6.91
26 05 33 23-0170	EA	#2017TC Internal Corner Coupling.....	9.22		3.68
26 05 33 23-0171	EA	#2048 Single Gang device Box.....	21.75		6.55
26 05 33 23-0172	EA	#2048-2 2-Gang device Box.....	34.26		7.28
26 05 33 23-0173	EA	#2051H Flush Plate Adapter.....	23.58		7.28
26 05 33 23-0174	EA	#2089 Side Reducing Connector.....	19.40		3.68
26 05 33 23-0175	EA	#2089E End Reducing Connector.....	8.01		1.83
26 05 33 23-0176		1-7/8" x 7/8" Two Piece Surface Metal Raceways (Wiremold #2400) <small>(26 05 33 23-0157)</small>			
		Note: Available in gray enamel (G) or ivory (V).			
26 05 33 23-0177	LF	#2400B, 1-7/8" x 7/8" Two Piece Surface Metal Raceway Base.....	4.76		1.83
		<i>For Concrete Or Masonry Surface, Add</i>	0.18		
26 05 33 23-0178	LF	#2400BD, 1-7/8" x 7/8" Divided Two Piece Surface Metal Raceway Base.....	5.19		1.83
		<i>For Concrete Or Masonry Surface, Add</i>	0.18		
26 05 33 23-0179	LF	#2400C Raceway Cover.....	1.83		0.37
26 05 33 23-0180	EA	#2400WC Wire Clip.....	2.68		1.47
26 05 33 23-0181	EA	#2401 Coupling.....	7.16		1.83
26 05 33 23-0182	EA	#2401D Divided Raceway Coupling.....	5.75		1.83
26 05 33 23-0183	EA	#2406 Cover Clip.....	3.20		1.10
26 05 33 23-0184	EA	#2407-2CM Device Bracket Frame.....	23.34		5.51
26 05 33 23-0185	EA	#2407-2TJ Device Bracket Frame.....	22.39		5.51
26 05 33 23-0186	EA	#2409 Ground Clamp.....	6.05		1.47
26 05 33 23-0187	EA	#2410A End Fitting.....	15.62		5.51
26 05 33 23-0188	EA	#2410B Blank End.....	4.42		1.83
26 05 33 23-0189	EA	#2410BD Divided Blank End Fitting.....	4.47		1.83
26 05 33 23-0190	EA	#2410C Entrance End Fitting.....	23.23		5.51
26 05 33 23-0191	EA	#2410D Divided Entrance End Fitting.....	22.32		5.51
26 05 33 23-0192	EA	#2410DFO Divided Entrance End Fitting.....	35.96		5.51
26 05 33 23-0193	EA	#2410FC Full Cap Entrance End Fitting.....	27.78		5.51
26 05 33 23-0194	EA	#2411D Divided Flat 90 Degree Elbow.....	17.40		5.51
26 05 33 23-0195	EA	#2411DFO Radiused Divided Flat 90 Degree Elbow.....	27.28		5.51
26 05 33 23-0196	EA	#2411FO Radiused Flat 90 Degree Elbow.....	24.54		5.44
26 05 33 23-0197	EA	#2411M Flat 90 Degree Elbow.....	16.64		5.51
26 05 33 23-0198	EA	#2415DFO Radiused Divided Tee.....	29.20		5.44
26 05 33 23-0199	EA	#2415FO Radiused Tee.....	27.81		5.44
26 05 33 23-0200	EA	#2415M Tee.....	19.54		5.44
26 05 33 23-0201	EA	#2417D Divided Internal Coupling.....	16.46		5.44
26 05 33 23-0202	EA	#2417DFO Radiused Divided Internal Coupling.....	25.30		5.44
26 05 33 23-0203	EA	#2417FO Radiused Internal Coupling.....	24.58		5.44
26 05 33 23-0204	EA	#2417M Internal Coupling.....	15.98		5.44
26 05 33 23-0205	EA	#2418DFO Radiused Divided External Coupling.....	27.42		5.44
26 05 33 23-0206	EA	#2418FO Radiused External Coupling.....	26.99		5.44
26 05 33 23-0207	EA	#2418M External Coupling.....	19.22		5.44
26 05 33 23-0208	EA	#2444 Extra Deep Switch And Receptacle, 1 Gang.....	24.90		4.78
26 05 33 23-0209	EA	#2444-2 Extra Deep Switch And Receptacle Box, 2 Gang.....	27.57		4.78
26 05 33 23-0210	EA	#2444-2LS Over Raceway Extra Deep Switch And Receptacle Box, 2 Gang.....	27.70		4.78
26 05 33 23-0211	EA	#2444D Divided Extra Deep Switch And Receptacle, 1 Gang.....	26.57		4.78
26 05 33 23-0212	EA	#2444D-2A Divided Extra Deep Switch And Receptacle Box, 2 Gang.....	37.18		4.78
26 05 33 23-0213	EA	#2444D-2N Divided Over Raceway Extra Deep Switch And Receptacle Box, 2 Gang.....	32.83		4.78
26 05 33 23-0214	EA	#2448 Switch And Receptacle Box For Shallow Devices, 1 Gang, 4-5/8" x 2-7/8" x 1-3/4".....	17.68		4.78
26 05 33 23-0215	EA	#2448-2 Switch And Receptacle Box For Shallow Devices, 2 Gang, 4-3/4" x 4-3/4" x 1-3/4".....	26.98		4.78
26 05 33 23-0216	EA	#2450 Adapter Plate, Device Bracket Type.....	8.35		1.83
26 05 33 23-0217	EA	#2451H 4-1/2" x 4-1/2" Back Feed Fitting.....	19.97		5.51
26 05 33 23-0218	EA	#2475D Bridge Fitting 2400/700/500.....	57.67		5.51
26 05 33 23-0219	EA	#2489 Side Reducing Connector.....	17.02		2.94
26 05 33 23-0220		2-3/4" x 1-17/32" Two Piece Surface Metal Raceways (Wiremold #3000) <small>(26 05 33 23-0157)</small>			
		Note: Available in gray enamel (G) or ivory (V).			
26 05 33 23-0221	LF	#3000B, 2-3/4" x 1-17/32" Two Piece Surface Metal Raceway Base.....	9.51		3.31
		<i>For Concrete Or Masonry Surface, Add</i>	0.33		
26 05 33 23-0222	LF	#3000CE Raceway Cover.....	2.23		0.37
26 05 33 23-0223	EA	#3000WC Wire Clips For Conductors.....	3.63		1.47
26 05 33 23-0224	EA	#3001 Couplings.....	9.39		1.47
26 05 33 23-0225	EA	#3001A Rigid Inside Coupling.....	9.22		1.83
26 05 33 23-0226	EA	#3003 Supporting Clip.....	6.83		1.83
26 05 33 23-0227	EA	#3006E Clip Cover.....	3.95		1.47
26 05 33 23-0228	EA	#3007C Device Brackets.....	10.16		2.94
26 05 33 23-0229	EA	#3008C C-Hanger.....	10.06		2.21
26 05 33 23-0230	EA	#3010AE Entrance End Fitting For Connecting To 1/2" Conduit Or Armored Connectors.....	23.54		6.99
26 05 33 23-0231	EA	#3010B Blank End Fittings.....	8.64		2.94
26 05 33 23-0232	EA	#3010C Entrance End Fitting For Connecting To Rigid Or Flexible Conduit.....	26.02		6.99
26 05 33 23-0233	EA	#3011E Flat 90 Degree Elbow.....	39.03		9.11
26 05 33 23-0234	EA	#3014C Wall Box Connector.....	28.00		9.19
26 05 33 23-0235	EA	#3015E Tee Fitting.....	53.61		11.40
26 05 33 23-0236	EA	#3017TCE Internal Corner Coupling.....	25.45		6.99
26 05 33 23-0237	EA	#3018AE External Corner.....	31.30		6.99
26 05 33 23-0238	EA	#3027AE Single Receptacle Cover, With Face Diameters Of 1.38"-1.4".....	22.44		6.99
26 05 33 23-0239	EA	#3028 Utility Box.....	37.77		6.99



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 23-0240 EA #3033JE Single Receptacle Cover, With Face Diameters Of 1.56"-1.57".....	12.17	1.83
26 05 33 23-0241 EA #3036HE Blank Cover.....	13.31	1.83
26 05 33 23-0242 EA #3040CE Switch Cover.....	12.14	1.83
26 05 33 23-0243 EA #3043BE Duplex Receptacle Cover.....	11.97	2.21
26 05 33 23-0244 EA #3043GE 15 Amp, 125 Volt Duplex Grounding Receptacle And Cover.....	32.98	9.56
26 05 33 23-0245 EA #3044-2 Extra Deep Switch And Receptacle Box, 2 Gang.....	42.49	6.99
26 05 33 23-0246 EA #3046BE Duplex Receptacle Cover.....	12.24	2.21
26 05 33 23-0247 EA #3046H-2 Tap Off Fitting.....	11.63	1.83
26 05 33 23-0248 EA #3046KD Circuit Breaker Housing, 1-15/16" Deep x 6" Long.....	44.81	4.41
26 05 33 23-0249 EA #3046KTSQ Circuit Breaker Housing, 2-3/4" Deep x 7-3/8" Long.....	107.04	4.41
26 05 33 23-0250 EA #3046QOU Circuit Breaker Housing, 1-13/16" Deep x 7-3/8" Long.....	39.23	4.41
26 05 33 23-0251 EA #3046S Bump Up Device Plate Cover, 1-13/16" Deep x 7-15/16" Long x 2-13/16" Wide.....	42.32	4.41
26 05 33 23-0252 EA #3046U Bump Up Device Plate Cover, 1-13/32" Deep x 7-15/16" Long x 2-13/16" Wide.....	42.32	4.41
26 05 33 23-0253 EA #3048R Rectangular Receptacle Cover.....	13.75	2.21
26 05 33 23-0254 4-3/4" x 1-3/4" Two Piece Surface Metal Raceways (Wiremold #4000) (26 05 33		
<small>23-0157</small>		
Note: Available in gray enamel (G) or ivory (V).		
26 05 33 23-0255 LF #4000B-10, 4-3/4" x 1-3/4" Two Piece Surface Metal Raceway Base.....	11.65	3.31
<i>For Concrete Or Masonry Surface, Add</i>		
	0.36	
26 05 33 23-0256 LF #4000C Raceway Cover.....	4.08	0.37
26 05 33 23-0257 LF #4000D Divider.....	1.99	0.37
26 05 33 23-0258 EA #4000WC Wire Clips For Conductors.....	4.46	1.83
26 05 33 23-0259 EA #4001A Couplings.....	11.60	2.21
26 05 33 23-0260 EA #4001D Divider Clip.....	5.48	2.21
26 05 33 23-0261 EA #4006 Seam Clip.....	5.58	2.21
26 05 33 23-0262 EA #4007C-1 Device Plate, 1 Gang.....	53.87	4.78
26 05 33 23-0263 EA #4007C-1R Single Device Fitting.....	57.07	4.78
26 05 33 23-0264 EA #4007C-2 Device Plate, 2 Gang.....	60.84	4.78
26 05 33 23-0265 EA #4010B Blank End Fittings.....	12.32	2.94
26 05 33 23-0266 EA #4010DFO Entrance End Fitting.....	47.26	11.32
26 05 33 23-0267 EA #4011 Flat 90 Degree Elbow.....	43.92	9.19
26 05 33 23-0268 EA #4011FO Radiused Flat 90 Degree Elbow.....	51.83	9.19
26 05 33 23-0269 EA #4012TX Internal Or External 45 Degree Elbow.....	47.84	11.40
26 05 33 23-0270 EA #4014A Wall Box Connector.....	63.68	11.40
26 05 33 23-0271 EA #4015 Tee Fitting.....	70.63	11.40
26 05 33 23-0272 EA #4015D Divided Tee Fitting.....	73.42	11.40
26 05 33 23-0273 EA #4015DFO Radiused Full Capacity Divided Tee Fitting.....	87.63	11.40
26 05 33 23-0274 EA #4015FO Radiused Tee Fitting.....	87.90	11.40
26 05 33 23-0275 EA #4017 Internal Elbow.....	38.93	11.40
26 05 33 23-0276 EA #4017FO Internal Elbow.....	69.40	11.40
26 05 33 23-0277 EA #4017N Inverted Internal Elbow.....	43.12	11.40
26 05 33 23-0278 EA #4017TCA Internal Corner Coupling.....	36.71	11.40
26 05 33 23-0279 EA #4018 External Elbow.....	57.97	11.40
26 05 33 23-0280 EA #4018FO Radiused External Elbow.....	67.23	11.40
26 05 33 23-0281 EA #4046ARJ Single Locking Receptacle And Two RJ11/45 Modular Connectors Outlet Cover.....	56.77	4.78
26 05 33 23-0282 EA #4046B-2 Double Duplex Receptacle Outlet Cover.....	60.19	4.78
26 05 33 23-0283 EA #4046DRJ Duplex Receptacle And Two RJ11/45 Modular Connector Cover.....	60.19	4.78
26 05 33 23-0284 EA #4046DRJ-2 Double Duplex Receptacle And Four RJ11/45 Modular Connector Cover.....	80.45	4.78
26 05 33 23-0285 EA #4046H-2 Tap-Off Fitting.....	16.95	4.78
26 05 33 23-0286 EA #4046JRJ Combination Single Receptacle And Phone Outlet Center.....	51.62	2.21
26 05 33 23-0287 EA #4046RRJ Rectangular Receptacle And Two RJ11/45 Modular Connector Cover.....	61.61	4.78
26 05 33 23-0288 EA #4050 Device Mounting Bracket.....	19.05	4.78
26 05 33 23-0289 EA #4074A Take-off Connector, #4000 To #3000.....	88.97	11.40
26 05 33 23-0290 EA #4075D Bridge Fitting.....	80.19	11.40
26 05 33 23-0291 EA #4075DA Bridge Fitting.....	80.19	11.40
26 05 33 23-0292 EA #4086A Panel Connector.....	64.74	21.69
26 05 33 23-0293 EA #4089 Reducing Connector Fitting.....	39.80	11.40
26 05 33 23-0294 4-3/4" x 3-9/16" Two Piece Surface Metal Raceways (Wiremold #6000) (26 05		
<small>33 23-0157</small>		
Note: Available in gray enamel (G) or ivory (V).		
26 05 33 23-0295 LF #6000B-10, 4-3/4" x 3-9/16" Two Piece Surface Metal Raceway Base.....	16.98	4.04
<i>For Concrete Or Masonry Surface, Add</i>		
	0.40	
26 05 33 23-0296 LF #6000C Raceway Cover.....	4.87	1.10
26 05 33 23-0297 LF #6000DA Divider.....	5.13	1.10
26 05 33 23-0298 EA #6000WC Wire Clips For Conductors.....	5.16	1.83
26 05 33 23-0299 EA #6001A Couplings.....	14.23	3.68
26 05 33 23-0300 EA #6001D Divider Clip.....	6.59	1.83
26 05 33 23-0301 EA #6001TX Converter Coupling.....	18.23	4.78
26 05 33 23-0302 EA #6006 Connection Cover.....	17.31	4.78
26 05 33 23-0303 EA #6007C-1 Single Gang Device Plate.....	18.15	4.78
26 05 33 23-0304 EA #6007C-2 Two Gang Device Plate.....	19.86	4.78
26 05 33 23-0305 EA #6008A C-Hanger.....	28.87	6.99
26 05 33 23-0306 EA #6010B Blank End Fittings.....	31.17	11.03
26 05 33 23-0307 EA #6011TX Combination Flat Elbow.....	58.40	11.03
26 05 33 23-0308 EA #6012TX Internal - External 45 Degree Elbow.....	59.39	10.59
26 05 33 23-0309 EA #6014A Connector Fitting.....	84.69	11.40
26 05 33 23-0310 EA #6017TX Combination Internal-External Elbow.....	60.51	12.50
26 05 33 23-0311 EA #6046KD Circuit Breaker Housing.....	105.31	12.50

26 Electrical**26 05 Common Work Results For Electrical****26 05 33 Raceway And Boxes For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 23-0312	EA		#6074 Take-off Connector, #6000 To #6000	101.62	11.03
26 05 33 23-0313	EA		#6074A Take-off Connector, #6000 To #4000	109.93	11.03
26 05 33 23-0314	EA		#6086 Panel Connector	66.85	25.59
26 05 33 23-0315			Two Piece Surface Aluminum Raceways <small>(26 05 33 23-0056)</small> Note: Exposed installations on masonry, concrete block or drywall walls or ceilings. Labor units to include material handling, unloading at job site, layout of job, measuring, cutting and assembly (Wiremold or approved equal).		
26 05 33 23-0316			1-7/16" x 1-1/8" Two Piece Surface Aluminum Raceways (Wiremold #AL2000) <small>(26 05 33 23-0315)</small>		
26 05 33 23-0317	LF		#AL2000B, 1-7/16" x 1-1/8" Two Piece Surface Aluminum Raceway Base	7.32	1.83
			<i>For Concrete Or Masonry Surface, Add</i>	0.18	
26 05 33 23-0318	LF		#AL2000C Aluminum Raceway Cover	3.62	0.37
26 05 33 23-0319	EA		#AL2000WC Wire Clip	3.56	1.47
26 05 33 23-0320	EA		#AL2001 Coupling	7.90	1.83
26 05 33 23-0321	EA		#AL2003 Supporting Clip	3.85	1.10
26 05 33 23-0322	EA		#AL2006 Cover Clip	4.87	1.10
26 05 33 23-0323	EA		#AL2009 Ground Clamp	6.98	1.83
26 05 33 23-0324	EA		#AL2010A Entrance End Fitting	19.50	5.51
26 05 33 23-0325	EA		#AL2010B Blank End Fitting	6.32	1.83
26 05 33 23-0326	EA		#AL2011 Flat 90 Degree Elbow	22.53	4.78
26 05 33 23-0327	EA		#AL2015 Tee	30.58	6.91
26 05 33 23-0328	EA		#AL2017 Internal Corner Elbow	20.35	3.68
26 05 33 23-0329	EA		#AL2018 External Corner Elbow	20.31	3.68
26 05 33 23-0330	EA		#AL2043 In-Line Receptacle, Two 15 Amp	33.29	7.28
26 05 33 23-0331	EA		#AL2038 4-13/16" Round Fixture Box	76.60	6.55
26 05 33 23-0332	EA		#AL2044 4-1/2" x 3" x 2-1/4" D Box	34.23	6.55
26 05 33 23-0333	EA		#AL2044-2 4-5/8" x 4-7/8" x 2-1/2" D Box	70.61	7.28
26 05 33 23-0334	EA		#AL2047 Single Gang Shallow Device Box	35.44	6.55
26 05 33 23-0335	EA		#AL2047-2 2-Gang Shallow Device Box	62.46	7.28
26 05 33 23-0336	EA		#AL2051H Flush Plate Adapter	26.97	7.28
26 05 33 23-0337			2" x 1-9/32" Two Piece Surface Aluminum Raceways (Wiremold #AL2400) <small>(26 05 33 23-0315)</small>		
26 05 33 23-0338	LF		#AL2400B, 2" x 1-9/32" Two Piece Surface Aluminum Raceway Base	7.78	1.83
			<i>For Concrete Or Masonry Surface, Add</i>	0.18	
26 05 33 23-0339	LF		#AL2400C Aluminum Raceway Cover	3.45	0.37
26 05 33 23-0340	EA		#AL2400WC Wire Clip	4.60	1.47
26 05 33 23-0341	EA		#AL2401 Coupling	8.89	1.83
26 05 33 23-0342	EA		#AL2406 Cover Clip	5.92	1.10
26 05 33 23-0343	EA		#AL2409 Ground Clamp	5.23	1.47
26 05 33 23-0344	EA		#AL2410B Blank End	6.66	1.83
26 05 33 23-0345	EA		#AL2410B2 End Fitting	14.64	5.51
26 05 33 23-0346	EA		#AL2411 Flat 90 Degree Elbow	25.69	5.51
26 05 33 23-0347	EA		#AL2415 Tee	27.90	5.44
26 05 33 23-0348	EA		#AL2416 Fourway Fitting	32.55	5.44
26 05 33 23-0349	EA		#AL2417 Internal Coupling	25.60	5.44
26 05 33 23-0350	EA		#AL2418 External Coupling	27.47	5.44
26 05 33 23-0351	EA		#AL2451H 4-1/2" x 4-1/2" Back Feed Fitting	23.04	5.51
26 05 33 23-0352			2-7/8" x 1-7/8" Two Piece Surface Aluminum Raceways (Wiremold #AL3300) <small>(26 05 33 23-0315)</small>		
26 05 33 23-0353	LF		#AL3300B, 2-7/8" x 1-7/8" Two Piece Surface Aluminum Raceway Base	13.37	3.31
			<i>For Concrete Or Masonry Surface, Add</i>	0.33	
26 05 33 23-0354	LF		#AL3300CE Aluminum Raceway Cover	3.80	0.37
26 05 33 23-0355	LF		#AL3300D Raceway Divider	3.15	3.31
26 05 33 23-0356	EA		#AL3300WC Wire Clips For Conductors	6.24	1.47
26 05 33 23-0357	EA		#AL3301 Couplings	11.65	1.47
26 05 33 23-0358	EA		#AL3301D Divider Coupling	9.49	1.83
26 05 33 23-0359	EA		#AL3309 Ground Clamp	6.44	1.47
26 05 33 23-0360	EA		#AL3310B Blank End Fittings	13.36	2.94
26 05 33 23-0361	EA		#AL3310B1 End Fitting	22.19	6.99
26 05 33 23-0362	EA		#AL3311 Flat 90 Degree Elbow	64.70	9.11
			Note: Includes two (2) AL3301 couplings.		
26 05 33 23-0363	EA		#AL3315 Tee Fitting	74.45	11.40
			Note: Includes three (3) AL3301 couplings.		
26 05 33 23-0364	EA		#AL3316 Cross Fitting	83.86	11.40
			Note: Includes four (4) AL3301 couplings.		
26 05 33 23-0365	EA		#AL3317 Internal Elbow	60.28	6.99
			Note: Includes two (2) AL3301 couplings.		
26 05 33 23-0366	EA		#AL3318 External Elbow	60.35	6.99
			Note: Includes two (2) AL3301 couplings.		
26 05 33 23-0367	EA		#AL3346D Duplex Receptacle Cover	13.52	2.21
26 05 33 23-0368	EA		#AL3346E Single Receptacle Cover	13.44	2.21
26 05 33 23-0369	EA		#AL3346G GFCI/ Surge Receptacle Cover	13.30	2.21
26 05 33 23-0370	EA		#AL3356R Single Device Cover Plate	13.24	1.83



	MINOR	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 23-0371		5" x 2" Two Piece Surface Aluminum Raceways (Wiremold #AL5200) <small>(26 05 33 23-0315)</small>		
26 05 33 23-0372	LF	#AL5200B-10, 5" x 2" Two Piece Surface Aluminum Raceway Base <i>For Concrete Or Masonry Surface, Add</i>	17.34 0.36	3.31
26 05 33 23-0373	LF	#AL5200C Aluminum Raceway Cover.....	7.10	0.37
26 05 33 23-0374	LF	#AL5200D Divider.....	4.17	0.37
26 05 33 23-0375	EA	#AL5200WC Wire Clips For Conductors.....	5.74	1.83
26 05 33 23-0376	EA	#AL5200WC2 Wire Clips For Conductors.....	4.82	1.83
26 05 33 23-0377	EA	#AL5200WC3 Wire Clips For Conductors.....	4.79	1.83
26 05 33 23-0378	EA	#AL5201 Couplings.....	11.27	2.21
26 05 33 23-0379	EA	#AL5206 Cover Clip.....	9.94	2.21
26 05 33 23-0380	EA	#AL5209 Ground Adapter.....	12.42	2.21
26 05 33 23-0381	EA	#AL5210B Blank End Fittings.....	13.08	2.94
26 05 33 23-0382	EA	#AL5210B1 Blank End Fittings.....	14.03	2.94
26 05 33 23-0383	EA	#AL5210B2 Blank End Fittings.....	14.24	2.94
26 05 33 23-0384	EA	#AL5210B3 Blank End Fittings.....	13.81	2.94
26 05 33 23-0385	EA	#AL5211 Flat 90 Degree Elbow..... Note: Includes two (2) pairs of AL5201 couplings.	71.74	9.19
26 05 33 23-0386	EA	#AL5214 Wall Box Connector.....	56.65	11.40
26 05 33 23-0387	EA	#AL5215 Tee Fitting..... Note: Includes three (3) pairs of AL5201 couplings.	83.97	11.40
26 05 33 23-0388	EA	#AL5216 Four Way Fitting..... Note: Includes four (4) pairs of AL5201 couplings.	92.06	11.40
26 05 33 23-0389	EA	#AL5217 Internal Elbow..... Note: Includes two (2) pairs of AL5201 couplings.	74.57	11.40
26 05 33 23-0390	EA	#AL5217A Internal Corner Coupling.....	32.00	11.40
26 05 33 23-0391	EA	#AL5217N Inverted Internal Elbow.....	76.62	11.40
26 05 33 23-0392	EA	#AL5218 External Elbow..... Note: Includes two (2) pairs of AL5201 couplings.	75.21	11.40
26 05 33 23-0393	EA	#AL5246B Blank Device Cover Plate.....	16.11	2.21
26 05 33 23-0394	EA	#AL5246D Receptacle Device Cover Plate.....	19.07	2.21
26 05 33 23-0395	EA	#AL5246DD Double Receptacle Device Cover Plate.....	22.61	2.21
26 05 33 23-0396	EA	#AL5246F Device Cover Plate.....	21.21	2.21
26 05 33 23-0397	EA	#AL5246G Device Cover Plate.....	19.59	2.21
26 05 33 23-0398	EA	#AL5260 Offset Divider.....	18.45	4.78
26 05 33 23-0399		3" x 2-1/4" Two Piece Surface Aluminum Raceways (Wiremold #ALA3800) <small>(26 05 33 23-0315)</small>		
26 05 33 23-0400	LF	#ALA3800B-10 Single Channel, 3" x 2-1/4" Two Piece Surface Aluminum Raceway Base.....	15.47	3.31
26 05 33 23-0401	EA	#ALA3806 Cover Clip.....	7.41	2.21
26 05 33 23-0402	EA	#ALA3810B Blank End Fittings.....	12.98	2.94
26 05 33 23-0403	EA	#ALA3810B1 Entrance End Cap Fittings.....	13.93	2.94
26 05 33 23-0404	EA	#ALA3811 Flat 90 Degree Elbow..... Note: Includes two (2) ALA01 couplings.	71.09	9.19
26 05 33 23-0405	EA	#ALA3815 Flat Tee Fitting..... Note: Includes three (3) ALA01 couplings.	73.42	11.40
26 05 33 23-0406	EA	#ALA3817 Internal Elbow..... Note: Includes two (2) ALA01 couplings.	71.60	11.40
26 05 33 23-0407	EA	#ALA3817N Inverted Internal Elbow..... Note: Includes two (2) ALA01 couplings.	84.19	11.40
26 05 33 23-0408	EA	#ALA3818 External Elbow..... Note: Includes two (2) ALA01 couplings.	72.54	11.40
26 05 33 23-0409		6" x 2-1/4" Two Piece Surface Aluminum Raceways (Wiremold #ALA4800) <small>(26 05 33 23-0315)</small>		
26 05 33 23-0410	LF	#ALA4800B-10 Two Channel, 6" x 2-1/4" Two Piece Surface Aluminum Raceway Base.....	22.87	3.31
26 05 33 23-0411	EA	#ALA4806 Cover Clip.....	10.01	2.21
26 05 33 23-0412	EA	#ALA4810B Blank End Fittings.....	13.12	2.94
26 05 33 23-0413	EA	#ALA4810B2 Entrance End Cap Fittings.....	14.55	2.94
26 05 33 23-0414	EA	#ALA4811 Flat 90 Degree Elbow..... Note: Includes four (4) ALA01 couplings.	83.74	9.19
26 05 33 23-0415	EA	#ALA4815 Flat Tee Fitting..... Note: Includes six (6) ALA01 couplings.	114.40	11.40
26 05 33 23-0416	EA	#ALA4817 Internal Elbow..... Note: Includes four (4) ALA01 couplings.	77.87	11.40
26 05 33 23-0417	EA	#ALA4817N Inverted Internal Elbow..... Note: Includes four (4) ALA01 couplings.	91.33	11.40
26 05 33 23-0418	EA	#ALA4818 External Elbow..... Note: Includes four (4) ALA01 couplings.	81.66	11.40
26 05 33 23-0419		Two Piece Surface Aluminum Raceways Fittings (Wiremold #ALA3800 And #ALA4800) <small>(26 05 33 23-0315)</small>		
26 05 33 23-0420	LF	#ALAC-5 3" Wide Aluminum Raceway Cover..... Note: For use with ALA3800 single channel raceway and ALA4800 dual channel raceway.	4.92	0.37
26 05 33 23-0421	EA	#ALAWC Wire Clips.....	4.52	1.83
26 05 33 23-0422	EA	#ALA01 Slide Couplings.....	11.41	2.21
26 05 33 23-0423	EA	#ALA09 Grounding Adapter.....	9.82	2.21
26 05 33 23-0424	EA	#ALA11RI Bend Radius Control Insert For Flat Elbow.....	26.76	9.19
26 05 33 23-0425	EA	#ALA17A Internal Corner Coupling.....	31.99	11.40
26 05 33 23-0426	EA	#ALA17/18RI Bend Radius Control Insert For Internal And External Elbow.....	29.60	9.19

26 Electrical**26 05 Common Work Results For Electrical****26 05 33 Raceway And Boxes For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 23-0427	EA		#ALA-BL Blank Cover Plate.....	12.06	2.21
26 05 33 23-0428	EA		#ALA-DR Duplex Receptacle Cover Plate.....	12.84	2.21
26 05 33 23-0429	EA		#ALA-E Single Receptacle Cover Plate, 1.40" Diameter Opening.....	13.36	2.21
26 05 33 23-0430	EA		#ALA-F Single Receptacle Cover Plate, 1.59" Diameter Opening.....	13.97	2.21
26 05 33 23-0431	EA		#ALA-G GFCI/Surge/Decorator Cover Plate.....	12.95	2.21
26 05 33 23-0432	EA		#ALA-J Single Receptacle Cover Plate, 2.13" Diameter Opening.....	13.37	2.21
26 05 33 23-0433	EA		#ALA-N Toggle Switch Cover Plate.....	13.70	2.21
26 05 33 23-0434	EA		#ALA-LPB Active LPB Cover Plate.....	17.47	2.21
26 05 33 23-0435	EA		#ALA-MAB Active MAB Cover Plate.....	16.44	2.21
26 05 33 23-0436	EA		#ALA-MABRT Ortronics Cover Plate.....	18.90	2.21
26 05 33 23-0437	EA		#ALA-SG 1-3/4" x 2-3/4" Cover Plate.....	13.36	2.21
26 05 33 23-0438	EA		#ALA-2A Active 2A Cover Plate.....	18.27	2.21
26 05 33 23-0439	EA		#ALA-ABRT Ortronics Communications Cover Plate.....	16.75	2.21
26 05 33 23-0440	EA		#ALA-Z 3/4" Grommet/Mousehole Cover Plate.....	13.67	2.21
26 05 33 23-0441	EA		#ALA-LPB3S2 Ortronics Low Profile Cover Plate.....	16.89	2.21
26 05 33 23-0442			Surface Metal Raceway, Preassembled With Outlets (26 05 33 23-0056) Note: Exposed installations on masonry, concrete block or drywall walls or ceilings. Labor units to include material handling, unloading at job site, layout of job, measuring, cutting and assembly (Wiremold or approved equal).		
26 05 33 23-0443	LF		Plugmold #2000, 3' With Outlets 6" On Center, Single Circuit.....	20.28	5.87
			<i>For Concrete Or Masonry Surface, Add</i>	0.59	
26 05 33 23-0444	LF		Plugmold #2000, 6' With Outlets 6" On Center, Single Circuit.....	15.79	4.18
			<i>For Concrete Or Masonry Surface, Add</i>	0.42	
26 05 33 23-0445	LF		Plugmold #2000, 6' With Outlets 9" On Center, Single Circuit.....	14.77	4.42
			<i>For Concrete Or Masonry Surface, Add</i>	0.44	
26 05 33 23-0446	LF		Plugmold #2000, 6' With Outlets 12" On Center, Single Circuit.....	16.42	4.18
			<i>For Concrete Or Masonry Surface, Add</i>	0.42	
26 05 33 23-0447	LF		Plugmold #2000, 6' With Outlets 18" On Center, Single Circuit.....	13.14	4.26
			<i>For Concrete Or Masonry Surface, Add</i>	0.42	
26 05 33 23-0448	LF		Plugmold #2000, 6' With Outlets 9" On Center, Two Circuits.....	18.51	4.18
			<i>For Concrete Or Masonry Surface, Add</i>	0.42	
26 05 33 23-0449	LF		Plugmold #2000, 6' With Outlets 12" On Center, Two Circuits.....	16.23	4.18
			<i>For Concrete Or Masonry Surface, Add</i>	0.42	
26 05 33 23-0450	LF		Plugmold #2000, 6' With Outlets 18" On Center, Two Circuits.....	17.60	4.18
			<i>For Concrete Or Masonry Surface, Add</i>	0.42	
26 05 33 23-0451			Surface Non-Metallic Raceways (26 05 33 23-0001) Note: Exposed on flat wall surface. Labor units include material unloading, unpacking at job site, layout of job, assembly and installation.		
26 05 33 23-0452			One Piece Surface Non-Metallic Raceways (26 05 33 23-0451) Note: Exposed on flat wall surface. Labor units include material unloading, unpacking at job site, layout of job, assembly and installation. (Wiremold or approved equal).		
26 05 33 23-0453			#400, 7/8" x 7/16" (26 05 33 23-0452)		
26 05 33 23-0454	LF		#400BAC, 7/8" x 7/16" One Piece Surface Non-Metallic Raceway Base And Cover.....	4.43	1.47
			<i>For Concrete Or Masonry Surface, Add</i>	0.15	
26 05 33 23-0455	EA		#400WC Wire Clip.....	3.26	1.47
26 05 33 23-0456	EA		#406 Cover Clip.....	3.45	1.47
26 05 33 23-0457	EA		#410B Blank End Clip.....	6.63	2.94
26 05 33 23-0458	EA		#411 Flat 90 Degree Elbow.....	7.86	2.94
26 05 33 23-0459	EA		#415 Tee.....	9.89	3.68
26 05 33 23-0460	EA		#417 Internal Elbow.....	7.71	2.94
26 05 33 23-0461	EA		#418 External Elbow.....	7.71	2.94
26 05 33 23-0462			#800, 1-5/16" x 7/16" (26 05 33 23-0452)		
26 05 33 23-0463	LF		#800BAC, 1-5/16" x 7/16" One Piece Surface Non-Metallic Raceway Base And Cover.....	5.22	1.47
			<i>For Concrete Or Masonry Surface, Add</i>	0.15	
26 05 33 23-0464	EA		#800WC Wire Clip.....	3.32	1.47
26 05 33 23-0465	EA		#806 Cover Clip.....	3.40	1.47
26 05 33 23-0466	EA		#810A2 Entrance End Fitting.....	10.95	2.94
26 05 33 23-0467	EA		#810B Blank End Fitting.....	6.71	2.94
26 05 33 23-0468	EA		#811 Flat 90 Degree Elbow.....	7.94	2.94
26 05 33 23-0469	EA		#815 Tee.....	9.96	3.68
26 05 33 23-0470	EA		#817 Internal Elbow.....	7.76	2.94
26 05 33 23-0471	EA		#818 External Elbow.....	7.76	2.94
26 05 33 23-0472	EA		#889A End Reducer, #800 To #400.....	8.91	2.94
26 05 33 23-0473			#2300, 2-1/4" x 11/16" (26 05 33 23-0452)		
26 05 33 23-0474	LF		#2300BAC, 2-1/4" x 11/16" One Piece Surface Non-Metallic Raceway Base And Cover.....	6.10	1.47
			<i>For Concrete Or Masonry Surface, Add</i>	0.15	
26 05 33 23-0475	LF		#2300BACD, 2-1/4" x 11/16" One Piece Surface Non-Metallic Divided Raceway Base And Cover.....	6.53	1.47
			<i>For Concrete Or Masonry Surface, Add</i>	0.15	
26 05 33 23-0476	EA		#2300WC Wire Clip.....	3.51	1.47
26 05 33 23-0477	EA		#2306 Cover Clip.....	3.73	1.47
26 05 33 23-0478	EA		#2310A Entrance End Fitting.....	11.99	2.94
26 05 33 23-0479	EA		#2310B Blank End Fitting.....	7.13	2.94
26 05 33 23-0480	EA		#2310DFO Divided Entrance End Fitting.....	13.65	2.94



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 23-0481 EA #2311 Flat 90 Degree Elbow	8.11	2.94
26 05 33 23-0482 EA #2311DFO Divided Flat 90 Degree Elbow	8.81	2.94
26 05 33 23-0483 EA #2315 Tee.....	10.06	3.68
26 05 33 23-0484 EA #2317 Internal Elbow	8.11	2.94
26 05 33 23-0485 EA #2317DFO Divided Internal Elbow.....	8.82	2.94
26 05 33 23-0486 EA #2318 External Elbow	8.13	2.94
26 05 33 23-0487 EA #2318DFO Divided External Elbow	8.95	2.94
26 05 33 23-0488 EA #2389 End Reducer, #2300 To #400.....	8.96	2.94
26 05 33 23-0489 EA #2389A End Reducer, #2300 To #800	9.41	2.94
26 05 33 23-0490 #400, #800 Or #2300 Fittings <small>(26 05 33 23-0452)</small>		
26 05 33 23-0491 EA #2336 Blank Cover, 4-1/2" Diameter	10.26	2.58
26 05 33 23-0492 EA #2337A Extension Box, 5-1/2" Diameter.....	17.42	2.94
26 05 33 23-0493 EA #2338-A Fixture Box, 5-1/2" Diameter	17.52	2.94
26 05 33 23-0494 EA #2344 Extra Deep Device Box, 1 Gang, 2-3/4" Deep x 4-3/4" Long x 3" Wide.....	15.69	2.94
26 05 33 23-0495 EA #2344-2 Extra Deep Device Box, 2 Gang, 2-3/4" Deep x 4-3/4" Long x 4-7/8" Wide.....	18.39	2.94
26 05 33 23-0496 EA #2344D Extra Deep Divided Device Box, 1 Gang, 2-3/4" Deep x 4-3/4" Long x 3" Wide	17.21	2.94
26 05 33 23-0497 EA #2344SD-2A Deep Divided Device Box, 2 Gang, 2-1/4" Deep x 4-3/4" Long x 4-7/8" Wide.....	18.81	2.94
26 05 33 23-0498 EA #2347 1-Gang Standard Device Box, 1-3/8" Deep x 4-3/4" Long x 3" Wide.....	14.83	4.78
26 05 33 23-0499 EA #2347-2 2-Gang Standard Device Box, 1-3/8" Deep x 4-3/4" Long x 4-7/8" Wide.....	17.20	4.78
26 05 33 23-0500 EA #2348 1-Gang Deep Device Box, 1-3/4" Deep x 4-3/4" Long x 3" Wide.....	15.52	4.78
26 05 33 23-0501 EA #2348-2 2-Gang Deep Device Box, 1-3/4" Deep x 4-3/4" Long x 4-7/8" Wide.....	19.10	4.78
26 05 33 23-0502 EA #2348-3 3-Gang Deep Device Box, 1-3/4" Deep x 5" Long x 7" Wide	23.26	4.78
26 05 33 23-0503 EA #2348AMP 1-Gang Deep Device Box With Magnetic Backing, 1-3/4" Deep x 4-3/4" Long x 3" Wide	21.94	4.78
26 05 33 23-0504 EA #2348D 1-Gang Divided Deep Device Box, 1-3/4" Deep x 4-3/4" Long x 3" Wide	19.67	4.78
26 05 33 23-0505 EA #2348S/51 Shallow Device And Extension Box, 7/8" Deep x 4-3/4" Long x 3" Wide.....	14.47	4.78
26 05 33 23-0506 #2700, 3/4" x 3/8" <small>(26 05 33 23-0452)</small>		
26 05 33 23-0507 LF #2700, 3/4" x 3/8" One Piece Surface Non-Metallic Raceway Base And Cover	4.13	1.47
<i>For Concrete Or Masonry Surface, Add</i>	<i>0.15</i>	
26 05 33 23-0508 EA #2700WC 3/4" Wire Clip	1.72	0.73
26 05 33 23-0509 EA #2706 Cover Clip	2.73	0.73
26 05 33 23-0510 EA #2710B Blank End	4.19	1.47
26 05 33 23-0511 EA #2711 Flat 90 Degree Elbow	4.96	1.83
26 05 33 23-0512 EA #2715 Tee.....	7.91	3.31
26 05 33 23-0513 EA #2717 Internal Elbow	5.69	2.21
26 05 33 23-0514 EA #2718 External Elbow.....	5.68	2.21
26 05 33 23-0515 EA #2786 Drop Ceiling Connector.....	6.72	2.58
26 05 33 23-0516 #2800, 1" x 1/2" <small>(26 05 33 23-0452)</small>		
26 05 33 23-0517 LF #2800, 1" x 1/2" One Piece Surface Non-Metallic Raceway Base And Cover	5.34	1.83
<i>For Concrete Or Masonry Surface, Add</i>	<i>0.18</i>	
26 05 33 23-0518 EA #2800WC 1" Wire Clip.....	2.57	1.10
26 05 33 23-0519 EA #2806 Cover Clip	3.55	1.10
26 05 33 23-0520 EA #2810B Blank End	5.02	1.83
26 05 33 23-0521 EA #2811 Flat 90 Degree Elbow	6.55	2.58
26 05 33 23-0522 EA #2811FO Radiused Flat 90 Degree Elbow	7.03	2.58
26 05 33 23-0523 EA #2815 Tee.....	9.50	4.04
26 05 33 23-0524 EA #2817 Internal Elbow	7.28	2.94
26 05 33 23-0525 EA #2818 External Elbow	7.30	2.94
26 05 33 23-0526 EA #2815FO Radiused Tee	10.15	4.04
26 05 33 23-0527 EA #2817FO Radiused Internal Elbow	7.86	2.94
26 05 33 23-0528 EA #2818FO Radiused External Elbow	7.78	2.94
26 05 33 23-0529 EA #2886 Drop Ceiling Connector.....	8.21	3.31
26 05 33 23-0530 EA #2889 2800-2700 Reducer	7.41	2.94
26 05 33 23-0531 EA #2911FO Radiused Flat 90 Degree Elbow	8.12	2.94
26 05 33 23-0532 #2900, 1-1/2" x 3/4" <small>(26 05 33 23-0452)</small>		
26 05 33 23-0533 LF #2900, 1-1/2" x 3/4" One Piece Surface Non-Metallic Raceway Base And Cover.....	6.50	2.21
<i>For Concrete Or Masonry Surface, Add</i>	<i>0.22</i>	
26 05 33 23-0534 EA #2900WC 1-1/2" Wire Clip.....	3.38	1.47
26 05 33 23-0535 EA #2906 Cover Clip	4.39	1.47
26 05 33 23-0536 EA #2910B Blank End.....	5.86	2.21
26 05 33 23-0537 EA #2911 Flat 90 Degree Elbow	7.35	2.94
26 05 33 23-0538 EA #2915 Tee.....	10.28	4.41
26 05 33 23-0539 EA #2915FO Radiused Tee	11.07	4.41
26 05 33 23-0540 EA #2917 Internal Elbow	8.08	3.31
26 05 33 23-0541 EA #2917FO Radiused Internal Elbow	8.88	3.31
26 05 33 23-0542 EA #2918FO Radiused External Elbow.....	9.10	3.31
26 05 33 23-0543 EA #2918 External Elbow.....	8.07	3.31
26 05 33 23-0544 EA #2986 Drop Ceiling Connector.....	8.21	3.31
26 05 33 23-0545 EA #2989 2900-2800 Reducer	9.11	3.68
26 05 33 23-0546 EA #2989A 2900-2700 Reducer.....	8.85	3.68

26 Electrical**26 05 Common Work Results For Electrical****26 05 33 Raceway And Boxes For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 23-0547			Two Piece Surface Non-Metallic Raceways (26 05 33 23-0451) Note: Exposed on flat wall surface. Labor units include material unloading, unpacking at job site, layout of job, assembly and installation. (Wiremold or approved equal).		
26 05 33 23-0548			#5000, 5" x 1" (26 05 33 23-0547)		
26 05 33 23-0549	LF		#5000B, 5" x 1" Two Piece Surface Non-Metallic Raceway Base.....	10.39	3.31
			<i>For Concrete Or Masonry Surface, Add</i>	0.33	
26 05 33 23-0550	LF		#5000C Cover, Black, Gray Or White.....	9.81	3.31
26 05 33 23-0551	LF		#5000COA Cover, Oak Veneer.....	19.59	3.31
26 05 33 23-0552	LF		#5000CW Cover, Maple Wood Veneer.....	15.72	3.31
26 05 33 23-0553	LF		#5000T Quarter Round Trim, Black, Gray Or White.....	1.42	0.37
26 05 33 23-0554	LF		#5000TOA Quarter Round Trim, Oak Veneer.....	6.33	0.37
26 05 33 23-0555	LF		#5000TW Quarter Round Trim, Maple Wood Veneer.....	3.87	0.37
26 05 33 23-0556	EA		#5001 Base Coupling.....	9.33	3.68
26 05 33 23-0557	EA		#5004 Blank/Coax Adapter.....	5.33	1.83
26 05 33 23-0558	EA		#5005 Low Voltage Blank Plate.....	7.20	2.21
26 05 33 23-0559	EA		#5006 Cover Clip.....	10.15	3.68
26 05 33 23-0560	EA		#5006A Internal Wire Guard.....	9.41	3.68
26 05 33 23-0561	EA		#5007C Device Bracket.....	10.94	3.68
26 05 33 23-0562	EA		#5007C-1 Device Plate.....	19.56	7.35
26 05 33 23-0563	EA		#5007C-2 Deep Device Plate.....	20.35	7.35
26 05 33 23-0564	EA		#5010 End Cap, Right Or Left.....	16.81	6.99
26 05 33 23-0565	EA		#5010A Entrance End Feed.....	33.48	11.40
26 05 33 23-0566	EA		#5017B Internal Base Elbow.....	22.74	9.19
26 05 33 23-0567	EA		#5017C Internal Cover Elbow.....	20.87	7.35
26 05 33 23-0568	EA		#5017WG Internal Elbow Wire Guard.....	14.12	5.51
26 05 33 23-0569	EA		#5018B External Base Elbow.....	22.68	9.19
26 05 33 23-0570	EA		#5018C External Cover Elbow.....	21.08	7.35
26 05 33 23-0571	EA		#5018WG External Elbow Wire Guard.....	9.20	3.68
26 05 33 23-0572			#5400, 5-1/4" x 1-11/16" (26 05 33 23-0547)		
26 05 33 23-0573	LF		#5400TB Two Compartment, 5-1/4" x 1-11/16" Two Piece Surface Non-Metallic Raceway Base.....	11.03	3.31
			<i>For Concrete Or Masonry Surface, Add</i>	0.33	
26 05 33 23-0574	LF		#5400C Full Width Cover.....	3.96	0.37
26 05 33 23-0575	LF		#5400TC Twin Snap Cover.....	2.53	0.37
26 05 33 23-0576	EA		#5400TWC Twin Snap Cover Wire Clips.....	4.15	1.83
26 05 33 23-0577	EA		#5406A Cover Clip.....	7.15	2.21
26 05 33 23-0578	EA		#5406T Twin Cover Clip.....	5.96	2.21
26 05 33 23-0579	EA		#5406TB Base Seam Clip.....	5.29	2.21
26 05 33 23-0580	EA		#5408 L Or R (Left Or Right) Transition Fitting.....	40.98	11.40
26 05 33 23-0581	EA		#5410 End Cap.....	19.80	6.99
26 05 33 23-0582	EA		#5410DFO Radiused Divided Entrance Cap Fitting.....	39.27	11.40
26 05 33 23-0583	EA		#5411FO Radiused Flat 90 Degree Elbow.....	36.03	9.19
26 05 33 23-0584	EA		#5415 Tee Fitting.....	41.40	11.40
26 05 33 23-0585	EA		#5415FO Radiused Tee Fitting.....	43.44	11.40
26 05 33 23-0586	EA		#5417FO Radiused Internal Elbow.....	33.89	11.40
26 05 33 23-0587	EA		#5418 External Elbow.....	34.40	11.40
26 05 33 23-0588	EA		#5418FO Radiused External Elbow.....	34.88	11.40
26 05 33 23-0589	EA		#5450 5-5/32" x 6" Device Bracket.....	16.74	3.68
26 05 33 23-0590	EA		#5450A3 7-19/32" x 7-1/2" Device Bracket.....	22.32	3.68
26 05 33 23-0591	EA		#5450T 2-1/2" x 4-7/8" Twin Snap Device Bracket.....	12.61	3.68
26 05 33 23-0592	EA		#5474 Transition Fitting.....	35.83	11.40
26 05 33 23-0593			#5500, 6-11/16" x 1-11/16" (26 05 33 23-0547)		
26 05 33 23-0594	LF		#5500BD3 Three Compartment Divided, 6-11/16" x 1-11/16" Two Piece Surface Non-Metallic Raceway Base.....	13.96	3.31
			<i>For Concrete Or Masonry Surface, Add</i>	0.33	
26 05 33 23-0595	LF		#5500C Cover.....	5.23	0.37
26 05 33 23-0596	EA		#5500WC Wire Clips.....	4.90	1.83
26 05 33 23-0597	EA		#5506 Cover Clip.....	8.10	2.21
26 05 33 23-0598	EA		#5506B Base Seam Clip Fitting.....	5.61	2.21
26 05 33 23-0599	EA		#5507AD Modular Furniture Adapter.....	7.52	2.21
26 05 33 23-0600	EA		#5507B Blank Faceplate.....	7.55	2.21
26 05 33 23-0601	EA		#5507D Duplex Receptacle Faceplate.....	7.59	2.21
26 05 33 23-0602	EA		#5507FRJ Dual RJ Connector Faceplate.....	7.59	2.21
26 05 33 23-0603	EA		#5507R Rectangular Receptacle Faceplate.....	7.51	2.21
26 05 33 23-0604	EA		#5507RJ Dual RJ Connector Faceplate.....	7.53	2.21
26 05 33 23-0605	EA		#5507S Rectangular Spacer Fitting.....	7.47	2.21
26 05 33 23-0606	EA		#5507SW Switch Faceplate.....	7.49	2.21
26 05 33 23-0607	EA		#5507T1 Twistlock Faceplate.....	7.55	2.21
26 05 33 23-0608	EA		#5507T2 Single Receptacle Faceplate.....	7.38	2.21
26 05 33 23-0609	EA		#5550 6-5/8" x 6" Device Bracket.....	20.17	3.68
26 05 33 23-0610	EA		#5550A4 9-5/8" x 7-1/2" Device Bracket.....	27.38	3.68
26 05 33 23-0611	EA		#5510 End Cap.....	21.62	6.99
26 05 33 23-0612	EA		#5510D Entrance End Fitting.....	45.07	11.40
26 05 33 23-0613	EA		#5511FO Radiused Flat 90 Degree Elbow.....	41.37	9.19
26 05 33 23-0614	EA		#5514A Backfeed Connector.....	32.86	9.19
26 05 33 23-0615	EA		#5515 Tee Fitting.....	47.47	11.40
26 05 33 23-0616	EA		#5517FO Radiused Internal Elbow.....	37.59	11.40
26 05 33 23-0617	EA		#5518 External Elbow.....	38.58	11.40



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 33 23-0618 EA #5518FO Radiused External Elbow.....	40.66	11.40
26 05 33 23-0619 EA #5574 Transition Fitting	36.60	11.40
26 05 33 23-0620 EA #5574A Transition Fitting.....	50.08	11.40
26 05 36 Cable Trays For Electrical Systems (26 05)		
26 05 36 00-0001 Cable Trays (26 05 36)		
Note: Excludes supporting hangers.		
26 05 36 00-0002 Ladder Bottom Galvanized Steel Cable Tray (26 05 36 00-0001)		
26 05 36 00-0003 4-5/8" High, Straight Sections, Ladder Bottom Galvanized Steel Cable Tray (26 05 36 00-0002)		
26 05 36 00-0004 4" Rung Spacing, 4-5/8" High, Straight Sections, Ladder Bottom Galvanized Steel Cable Tray (26 05 36 00-0003)		
26 05 36 00-0005 LF 6" Wide, 4" Rung Spacing, 4-5/8" High, Straight Sections, Ladder Bottom Galvanized Steel Cable Tray.....	22.69	7.72
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
	-1.62	
26 05 36 00-0006 LF 9" Wide, 4" Rung Spacing, 4-5/8" High, Straight Sections, Ladder Bottom Galvanized Steel Cable Tray.....	24.46	8.29
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
	-1.76	
26 05 36 00-0007 LF 12" Wide, 4" Rung Spacing, 4-5/8" High, Straight Sections, Ladder Bottom Galvanized Steel Cable Tray	26.70	8.93
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
	-1.92	
26 05 36 00-0008 LF 18" Wide, 4" Rung Spacing, 4-5/8" High, Straight Sections, Ladder Bottom Galvanized Steel Cable Tray	29.46	9.49
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
	-2.16	
26 05 36 00-0009 LF 24" Wide, 4" Rung Spacing, 4-5/8" High, Straight Sections, Ladder Bottom Galvanized Steel Cable Tray	32.03	9.81
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
	-2.39	
26 05 36 00-0010 LF 30" Wide, 4" Rung Spacing, 4-5/8" High, Straight Sections, Ladder Bottom Galvanized Steel Cable Tray	38.70	11.34
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
	-2.93	
26 05 36 00-0011 LF 36" Wide, 4" Rung Spacing, 4-5/8" High, Straight Sections, Ladder Bottom Galvanized Steel Cable Tray	43.55	12.95
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
	-3.28	
26 05 36 00-0012 6" Rung Spacing, 4-5/8" High, Straight Sections, Ladder Bottom Galvanized Steel Cable Tray (26 05 36 00-0003)		
26 05 36 00-0013 LF 6" Wide, 6" Rung Spacing, 4-5/8" High, Straight Sections, Ladder Bottom Galvanized Steel Cable Tray.....	21.55	7.56
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
	-1.52	
26 05 36 00-0014 LF 9" Wide, 6" Rung Spacing, 4-5/8" High, Straight Sections, Ladder Bottom Galvanized Steel Cable Tray.....	23.24	8.04
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
	-1.65	
26 05 36 00-0015 LF 12" Wide, 6" Rung Spacing, 4-5/8" High, Straight Sections, Ladder Bottom Galvanized Steel Cable Tray	24.88	8.77
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
	-1.76	
26 05 36 00-0016 LF 18" Wide, 6" Rung Spacing, 4-5/8" High, Straight Sections, Ladder Bottom Galvanized Steel Cable Tray	27.08	9.25
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
	-1.94	
26 05 36 00-0017 LF 24" Wide, 6" Rung Spacing, 4-5/8" High, Straight Sections, Ladder Bottom Galvanized Steel Cable Tray	28.99	9.57
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
	-2.10	
26 05 36 00-0018 LF 30" Wide, 6" Rung Spacing, 4-5/8" High, Straight Sections, Ladder Bottom Galvanized Steel Cable Tray	33.96	11.02
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
	-2.48	
26 05 36 00-0019 LF 36" Wide, 6" Rung Spacing, 4-5/8" High, Straight Sections, Ladder Bottom Galvanized Steel Cable Tray	37.14	12.07
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
	-2.71	
26 05 36 00-0020 9" Rung Spacing, 4-5/8" High, Straight Sections, Ladder Bottom Galvanized Steel Cable Tray (26 05 36 00-0003)		
26 05 36 00-0021 LF 6" Wide, 9" Rung Spacing, 4-5/8" High, Straight Sections, Ladder Bottom Galvanized Steel Cable Tray.....	20.83	7.48
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
	-1.46	
26 05 36 00-0022 LF 9" Wide, 9" Rung Spacing, 4-5/8" High, Straight Sections, Ladder Bottom Galvanized Steel Cable Tray	21.49	7.72
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
	-1.50	
26 05 36 00-0023 LF 12" Wide, 9" Rung Spacing, 4-5/8" High, Straight Sections, Ladder Bottom Galvanized Steel Cable Tray	23.49	8.21
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
	-1.67	
26 05 36 00-0024 LF 18" Wide, 9" Rung Spacing, 4-5/8" High, Straight Sections, Ladder Bottom Galvanized Steel Cable Tray	25.56	8.61
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
	-1.84	
26 05 36 00-0025 LF 24" Wide, 9" Rung Spacing, 4-5/8" High, Straight Sections, Ladder Bottom Galvanized Steel Cable Tray	27.45	8.85
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
	-2.01	
26 05 36 00-0026 LF 30" Wide, 9" Rung Spacing, 4-5/8" High, Straight Sections, Ladder Bottom Galvanized Steel Cable Tray	29.90	9.65
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
	-2.19	
26 05 36 00-0027 LF 36" Wide, 9" Rung Spacing, 4-5/8" High, Straight Sections, Ladder Bottom Galvanized Steel Cable Tray	32.18	10.45
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
	-2.35	
26 05 36 00-0028 12" Rung Spacing, 4-5/8" High, Straight Sections, Ladder Bottom Galvanized Steel Cable Tray (26 05 36 00-0003)		
26 05 36 00-0029 LF 6" Wide, 12" Rung Spacing, 4-5/8" High, Straight Sections, Ladder Bottom Galvanized Steel Cable Tray	20.18	7.16
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
	-1.42	
26 05 36 00-0030 LF 9" Wide, 12" Rung Spacing, 4-5/8" High, Straight Sections, Ladder Bottom Galvanized Steel Cable Tray	20.60	7.32
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
	-1.45	
26 05 36 00-0031 LF 12" Wide, 12" Rung Spacing, 4-5/8" High, Straight Sections, Ladder Bottom Galvanized Steel Cable Tray	21.79	7.72
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
	-1.54	
26 05 36 00-0032 LF 18" Wide, 12" Rung Spacing, 4-5/8" High, Straight Sections, Ladder Bottom Galvanized Steel Cable Tray	23.05	8.12
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
	-1.63	
26 05 36 00-0033 LF 24" Wide, 12" Rung Spacing, 4-5/8" High, Straight Sections, Ladder Bottom Galvanized Steel Cable Tray	23.84	8.12
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
	-1.71	
26 05 36 00-0034 LF 30" Wide, 12" Rung Spacing, 4-5/8" High, Straight Sections, Ladder Bottom Galvanized Steel Cable Tray	26.23	8.77
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
	-1.89	

26 Electrical**26 05 Common Work Results For Electrical****26 05 36 Cable Trays For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-0035	LF		36" Wide, 12" Rung Spacing, 4-5/8" High, Straight Sections, Ladder Bottom Galvanized Steel Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	27.63 -2.00	9.17
26 05 36 00-0036			18" Rung Spacing, 4-5/8" High, Straight Sections, Ladder Bottom Galvanized Steel Cable Tray <small>(26 05 36 00-0036)</small>		
26 05 36 00-0037	LF		6" Wide, 18" Rung Spacing, 4-5/8" High, Straight Sections, Ladder Bottom Galvanized Steel Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	19.88 -1.40	7.00
26 05 36 00-0038	LF		9" Wide, 18" Rung Spacing, 4-5/8" High, Straight Sections, Ladder Bottom Galvanized Steel Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	20.24 -1.43	7.16
26 05 36 00-0039	LF		12" Wide, 18" Rung Spacing, 4-5/8" High, Straight Sections, Ladder Bottom Galvanized Steel Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	21.43 -1.51	7.56
26 05 36 00-0040	LF		18" Wide, 18" Rung Spacing, 4-5/8" High, Straight Sections, Ladder Bottom Galvanized Steel Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	22.49 -1.59	7.88
26 05 36 00-0041	LF		24" Wide, 18" Rung Spacing, 4-5/8" High, Straight Sections, Ladder Bottom Galvanized Steel Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	22.82 -1.62	7.96
26 05 36 00-0042	LF		30" Wide, 18" Rung Spacing, 4-5/8" High, Straight Sections, Ladder Bottom Galvanized Steel Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	24.29 -1.72	8.53
26 05 36 00-0043	LF		36" Wide, 18" Rung Spacing, 4-5/8" High, Straight Sections, Ladder Bottom Galvanized Steel Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	25.38 -1.79	9.01
26 05 36 00-0044			4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fittings <small>(26 05 36 00-0044)</small>		
26 05 36 00-0045			12" Radius, Horizontal 90 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0045)</small>		
26 05 36 00-0046	EA		6" Wide, 12" Radius, Horizontal 90 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	187.37 -12.02	80.68
26 05 36 00-0047	EA		9" Wide, 12" Radius, Horizontal 90 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	210.30 -13.37	91.85
26 05 36 00-0048	EA		12" Wide, 12" Radius, Horizontal 90 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	231.46 -14.68	101.58
26 05 36 00-0049	EA		18" Wide, 12" Radius, Horizontal 90 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	288.20 -18.44	124.51
26 05 36 00-0050	EA		24" Wide, 12" Radius, Horizontal 90 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	329.02 -20.99	142.93
26 05 36 00-0051	EA		30" Wide, 12" Radius, Horizontal 90 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	387.47 -25.34	160.86
26 05 36 00-0052	EA		36" Wide, 12" Radius, Horizontal 90 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	445.96 -29.27	183.86
26 05 36 00-0053			24" Radius, Horizontal 90 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0053)</small>		
26 05 36 00-0054	EA		6" Wide, 24" Radius, Horizontal 90 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	249.10 -17.92	83.89
26 05 36 00-0055	EA		9" Wide, 24" Radius, Horizontal 90 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	273.36 -19.30	96.43
26 05 36 00-0056	EA		12" Wide, 24" Radius, Horizontal 90 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	295.57 -20.62	107.22
26 05 36 00-0057	EA		18" Wide, 24" Radius, Horizontal 90 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	348.02 -23.71	133.20
26 05 36 00-0058	EA		24" Wide, 24" Radius, Horizontal 90 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	392.79 -26.41	154.51
26 05 36 00-0059	EA		30" Wide, 24" Radius, Horizontal 90 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	439.36 -29.32	175.34
26 05 36 00-0060	EA		36" Wide, 24" Radius, Horizontal 90 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	513.35 -34.41	203.09
26 05 36 00-0061			36" Radius, Horizontal 90 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0061)</small>		
26 05 36 00-0062	EA		6" Wide, 36" Radius, Horizontal 90 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	267.18 -19.41	87.67
26 05 36 00-0063	EA		9" Wide, 36" Radius, Horizontal 90 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	296.88 -21.23	101.50



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-0064 EA 12" Wide, 36" Radius, Horizontal 90 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	322.99	113.57
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-22.83	
26 05 36 00-0065 EA 18" Wide, 36" Radius, Horizontal 90 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	391.22	142.93
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-27.21	
26 05 36 00-0066 EA 24" Wide, 36" Radius, Horizontal 90 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	447.77	167.78
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-30.79	
26 05 36 00-0067 EA 30" Wide, 36" Radius, Horizontal 90 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	523.45	193.04
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-36.26	
26 05 36 00-0068 EA 36" Wide, 36" Radius, Horizontal 90 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	598.19	226.81
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-40.92	
26 05 36 00-0069 12" Radius, Horizontal 45 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0044)</small>		
26 05 36 00-0070 EA 6" Wide, 12" Radius, Horizontal 45 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	138.61	58.47
<i>For 30 Degree Bend, Deduct</i>	-42.14	
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-8.99	
<i>For 60 Degree Bend, Deduct</i>	-23.33	
26 05 36 00-0071 EA 9" Wide, 12" Radius, Horizontal 45 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	159.71	70.13
<i>For 30 Degree Bend, Deduct</i>	-46.95	
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-10.13	
<i>For 60 Degree Bend, Deduct</i>	-25.83	
26 05 36 00-0072 EA 12" Wide, 12" Radius, Horizontal 45 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	178.60	80.44
<i>For 30 Degree Bend, Deduct</i>	-51.31	
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-11.16	
<i>For 60 Degree Bend, Deduct</i>	-28.11	
26 05 36 00-0073 EA 18" Wide, 12" Radius, Horizontal 45 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	216.47	101.66
<i>For 30 Degree Bend, Deduct</i>	-59.77	
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-13.18	
<i>For 60 Degree Bend, Deduct</i>	-32.47	
26 05 36 00-0074 EA 24" Wide, 12" Radius, Horizontal 45 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	268.03	124.51
<i>For 30 Degree Bend, Deduct</i>	-74.79	
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-16.43	
<i>For 60 Degree Bend, Deduct</i>	-40.72	
26 05 36 00-0075 EA 30" Wide, 12" Radius, Horizontal 45 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	315.57	142.93
<i>For 30 Degree Bend, Deduct</i>	-90.18	
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-19.65	
<i>For 60 Degree Bend, Deduct</i>	-49.34	
26 05 36 00-0076 EA 36" Wide, 12" Radius, Horizontal 45 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	360.35	167.78
<i>For 30 Degree Bend, Deduct</i>	-100.31	
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-22.05	
<i>For 60 Degree Bend, Deduct</i>	-54.59	
26 05 36 00-0077 24" Radius, Horizontal 45 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0044)</small>		
26 05 36 00-0078 EA 6" Wide, 24" Radius, Horizontal 45 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	152.60	60.32
<i>For 30 Degree Bend, Deduct</i>	-48.76	
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-10.24	
<i>For 60 Degree Bend, Deduct</i>	-27.25	
26 05 36 00-0079 EA 9" Wide, 24" Radius, Horizontal 45 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	176.68	72.71
<i>For 30 Degree Bend, Deduct</i>	-54.75	
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-11.61	
<i>For 60 Degree Bend, Deduct</i>	-30.43	
26 05 36 00-0080 EA 12" Wide, 24" Radius, Horizontal 45 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	202.13	83.97
<i>For 30 Degree Bend, Deduct</i>	-62.20	
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-13.22	
<i>For 60 Degree Bend, Deduct</i>	-34.52	
26 05 36 00-0081 EA 18" Wide, 24" Radius, Horizontal 45 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	242.61	107.22
<i>For 30 Degree Bend, Deduct</i>	-70.88	
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-15.32	
<i>For 60 Degree Bend, Deduct</i>	-38.95	
26 05 36 00-0082 EA 24" Wide, 24" Radius, Horizontal 45 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	299.27	133.20
<i>For 30 Degree Bend, Deduct</i>	-86.92	
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-18.83	
<i>For 60 Degree Bend, Deduct</i>	-47.71	

26 Electrical**26 05 Common Work Results For Electrical****26 05 36 Cable Trays For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-0083	EA		30" Wide, 24" Radius, Horizontal 45 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	349.92	154.51
			<i>For 30 Degree Bend, Deduct</i>	-102.35	
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-22.12	
			<i>For 60 Degree Bend, Deduct</i>	-56.26	
26 05 36 00-0084	EA		36" Wide, 24" Radius, Horizontal 45 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	412.43	183.94
			<i>For 30 Degree Bend, Deduct</i>	-119.55	
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-25.92	
			<i>For 60 Degree Bend, Deduct</i>	-65.60	
26 05 36 00-0085			36" Radius, Horizontal 45 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0044)</small>		
26 05 36 00-0086	EA		6" Wide, 36" Radius, Horizontal 45 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	178.51	62.25
			<i>For 30 Degree Bend, Deduct</i>	-61.89	
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-12.67	
			<i>For 60 Degree Bend, Deduct</i>	-35.06	
26 05 36 00-0087	EA		9" Wide, 36" Radius, Horizontal 45 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	205.00	75.60
			<i>For 30 Degree Bend, Deduct</i>	-68.65	
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-14.20	
			<i>For 60 Degree Bend, Deduct</i>	-38.67	
26 05 36 00-0088	EA		12" Wide, 36" Radius, Horizontal 45 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	226.93	87.75
			<i>For 30 Degree Bend, Deduct</i>	-73.63	
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-15.38	
			<i>For 60 Degree Bend, Deduct</i>	-41.25	
26 05 36 00-0089	EA		18" Wide, 36" Radius, Horizontal 45 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	276.76	113.57
			<i>For 30 Degree Bend, Deduct</i>	-85.95	
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-18.21	
			<i>For 60 Degree Bend, Deduct</i>	-47.78	
26 05 36 00-0090	EA		24" Wide, 36" Radius, Horizontal 45 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	330.70	142.93
			<i>For 30 Degree Bend, Deduct</i>	-98.50	
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-21.16	
			<i>For 60 Degree Bend, Deduct</i>	-54.34	
26 05 36 00-0091	EA		30" Wide, 36" Radius, Horizontal 45 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	399.02	167.78
			<i>For 30 Degree Bend, Deduct</i>	-121.58	
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-25.92	
			<i>For 60 Degree Bend, Deduct</i>	-67.35	
26 05 36 00-0092	EA		36" Wide, 36" Radius, Horizontal 45 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	471.32	203.09
			<i>For 30 Degree Bend, Deduct</i>	-140.75	
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-30.21	
			<i>For 60 Degree Bend, Deduct</i>	-77.68	
26 05 36 00-0093			12" Radius, Vertical 90 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0044)</small>		
26 05 36 00-0094	EA		6" Wide, 12" Radius, Vertical 90 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	199.34	80.44
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-13.23	
26 05 36 00-0095	EA		9" Wide, 12" Radius, Vertical 90 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	219.93	91.85
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-14.34	
26 05 36 00-0096	EA		12" Wide, 12" Radius, Vertical 90 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	238.31	101.58
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-15.37	
26 05 36 00-0097	EA		18" Wide, 12" Radius, Vertical 90 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	279.56	124.51
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-17.58	
26 05 36 00-0098	EA		24" Wide, 12" Radius, Vertical 90 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	313.29	142.93
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-19.42	
26 05 36 00-0099	EA		30" Wide, 12" Radius, Vertical 90 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	349.16	160.86
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-21.51	
26 05 36 00-0100	EA		36" Wide, 12" Radius, Vertical 90 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	390.12	183.62
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-23.71	
26 05 36 00-0101			24" Radius, Vertical 90 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0044)</small>		
26 05 36 00-0102	EA		6" Wide, 24" Radius, Vertical 90 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	232.14	83.89
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-16.22	
26 05 36 00-0103	EA		9" Wide, 24" Radius, Vertical 90 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	255.42	96.51
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-17.50	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-0104 EA 12" Wide, 24" Radius, Vertical 90 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	277.05	107.22
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-18.77	
26 05 36 00-0105 EA 18" Wide, 24" Radius, Vertical 90 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	325.51	133.20
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-21.45	
26 05 36 00-0106 EA 24" Wide, 24" Radius, Vertical 90 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	366.28	154.51
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-23.76	
26 05 36 00-0107 EA 30" Wide, 24" Radius, Vertical 90 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	407.09	175.34
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-26.10	
26 05 36 00-0108 EA 36" Wide, 24" Radius, Vertical 90 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	467.60	203.09
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-29.83	
26 05 36 00-0109 36" Radius, Vertical 90 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-004)</small>		
26 05 36 00-0110 EA 6" Wide, 36" Radius, Vertical 90 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	270.72	87.67
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-19.77	
26 05 36 00-0111 EA 9" Wide, 36" Radius, Vertical 90 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	298.35	101.58
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-21.37	
26 05 36 00-0112 EA 12" Wide, 36" Radius, Vertical 90 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	319.93	113.57
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-22.53	
26 05 36 00-0113 EA 18" Wide, 36" Radius, Vertical 90 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	379.33	142.93
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-26.02	
26 05 36 00-0114 EA 24" Wide, 36" Radius, Vertical 90 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	422.25	167.78
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-28.24	
26 05 36 00-0115 EA 30" Wide, 36" Radius, Vertical 90 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	483.83	193.04
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-32.30	
26 05 36 00-0116 EA 36" Wide, 36" Radius, Vertical 90 Degree Elbows, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	550.57	226.81
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-36.16	
26 05 36 00-0117 12" Radius, Horizontal Tees, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-004)</small>		
26 05 36 00-0118 EA 6" Wide, 12" Radius, Horizontal Tees, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	362.05	154.51
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-23.33	
26 05 36 00-0119 EA 9" Wide, 12" Radius, Horizontal Tees, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	392.05	167.78
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-25.22	
26 05 36 00-0120 EA 12" Wide, 12" Radius, Horizontal Tees, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	410.90	175.34
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-26.48	
26 05 36 00-0121 EA 18" Wide, 12" Radius, Horizontal Tees, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	457.53	193.04
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-29.67	
26 05 36 00-0122 EA 24" Wide, 12" Radius, Horizontal Tees, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	516.38	214.26
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-33.78	
26 05 36 00-0123 EA 30" Wide, 12" Radius, Horizontal Tees, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	569.12	227.21
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-37.98	
26 05 36 00-0124 EA 36" Wide, 12" Radius, Horizontal Tees, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	644.16	257.22
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-42.98	
26 05 36 00-0125 24" Radius, Horizontal Tees, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-004)</small>		
26 05 36 00-0126 EA 6" Wide, 24" Radius, Horizontal Tees, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	443.57	167.78
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-30.37	
26 05 36 00-0127 EA 9" Wide, 24" Radius, Horizontal Tees, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	478.23	183.94
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-32.50	
26 05 36 00-0128 EA 12" Wide, 24" Radius, Horizontal Tees, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	499.68	193.04
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-33.88	
26 05 36 00-0129 EA 18" Wide, 24" Radius, Horizontal Tees, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	522.27	214.26
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-34.37	
26 05 36 00-0130 EA 24" Wide, 24" Radius, Horizontal Tees, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	611.34	241.30
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-41.03	

26 Electrical**26 05 Common Work Results For Electrical****26 05 36 Cable Trays For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-0131	EA		30" Wide, 24" Radius, Horizontal Tees, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	656.65	257.22
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-44.23	
26 05 36 00-0132	EA		36" Wide, 24" Radius, Horizontal Tees, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	787.17	297.20
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-53.95	
26 05 36 00-0133			36" Radius, Horizontal Tees, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0044)</small>		
26 05 36 00-0134	EA		6" Wide, 36" Radius, Horizontal Tees, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	551.60	183.94
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-39.83	
26 05 36 00-0135	EA		9" Wide, 36" Radius, Horizontal Tees, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	592.96	203.09
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-42.37	
26 05 36 00-0136	EA		12" Wide, 36" Radius, Horizontal Tees, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	628.77	214.26
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-45.02	
26 05 36 00-0137	EA		18" Wide, 36" Radius, Horizontal Tees, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	694.07	241.30
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-49.30	
26 05 36 00-0138	EA		24" Wide, 36" Radius, Horizontal Tees, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	788.46	275.48
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-55.89	
26 05 36 00-0139	EA		30" Wide, 36" Radius, Horizontal Tees, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	854.30	297.20
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-60.67	
26 05 36 00-0140	EA		36" Wide, 36" Radius, Horizontal Tees, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	970.11	350.68
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-67.78	
26 05 36 00-0141			12" Radius, Vertical Tees, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0044)</small>		
26 05 36 00-0142	EA		6" Wide, 12" Radius, Vertical Tees, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	416.20	142.93
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-29.71	
26 05 36 00-0143	EA		9" Wide, 12" Radius, Vertical Tees, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	427.15	148.55
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-30.33	
26 05 36 00-0144	EA		12" Wide, 12" Radius, Vertical Tees, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	438.54	154.51
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-30.98	
26 05 36 00-0145	EA		18" Wide, 12" Radius, Vertical Tees, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	463.86	167.78
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-32.40	
26 05 36 00-0146	EA		24" Wide, 12" Radius, Vertical Tees, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	479.58	175.34
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-33.35	
26 05 36 00-0147	EA		30" Wide, 12" Radius, Vertical Tees, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	521.53	193.04
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-36.07	
26 05 36 00-0148	EA		36" Wide, 12" Radius, Vertical Tees, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	564.77	214.26
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-38.62	
26 05 36 00-0149			24" Radius, Vertical Tees, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0044)</small>		
26 05 36 00-0150	EA		6" Wide, 24" Radius, Vertical Tees, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	579.03	154.51
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-45.03	
26 05 36 00-0151	EA		9" Wide, 24" Radius, Vertical Tees, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	594.37	160.86
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-46.03	
26 05 36 00-0152	EA		12" Wide, 24" Radius, Vertical Tees, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	610.60	167.78
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-47.08	
26 05 36 00-0153	EA		18" Wide, 24" Radius, Vertical Tees, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	646.83	183.94
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-49.36	
26 05 36 00-0154	EA		24" Wide, 24" Radius, Vertical Tees, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	671.39	193.04
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-51.05	
26 05 36 00-0155	EA		30" Wide, 24" Radius, Vertical Tees, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	716.19	214.26
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-53.76	
26 05 36 00-0156	EA		36" Wide, 24" Radius, Vertical Tees, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	776.81	241.30
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-57.57	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-0157				36" Radius, Vertical Tees, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0044)</small>		
26 05 36 00-0158	EA			6" Wide, 36" Radius, Vertical Tees, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	880.66	167.78
				<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-74.08	
26 05 36 00-0159	EA			9" Wide, 36" Radius, Vertical Tees, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	901.06	175.34
				<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-75.49	
26 05 36 00-0160	EA			12" Wide, 36" Radius, Vertical Tees, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	923.13	183.94
				<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-76.99	
26 05 36 00-0161	EA			18" Wide, 36" Radius, Vertical Tees, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	962.92	203.09
				<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-79.37	
26 05 36 00-0162	EA			24" Wide, 36" Radius, Vertical Tees, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	989.37	214.26
				<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-81.08	
26 05 36 00-0163	EA			30" Wide, 36" Radius, Vertical Tees, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	1,057.79	241.30
				<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-85.67	
26 05 36 00-0164	EA			36" Wide, 36" Radius, Vertical Tees, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	1,122.52	275.48
				<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-89.30	
26 05 36 00-0165				12" Radius, Horizontal Crosses, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0044)</small>		
26 05 36 00-0166	EA			6" Wide, 12" Radius, Horizontal Crosses, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	451.29	193.04
				<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-29.04	
26 05 36 00-0167	EA			9" Wide, 12" Radius, Horizontal Crosses, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	474.32	203.09
				<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-30.51	
26 05 36 00-0168	EA			12" Wide, 12" Radius, Horizontal Crosses, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	505.45	214.26
				<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-32.69	
26 05 36 00-0169	EA			18" Wide, 12" Radius, Horizontal Crosses, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	541.02	227.21
				<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-35.17	
26 05 36 00-0170	EA			24" Wide, 12" Radius, Horizontal Crosses, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	609.82	257.22
				<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-39.55	
26 05 36 00-0171	EA			30" Wide, 12" Radius, Horizontal Crosses, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	676.06	275.48
				<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-44.65	
26 05 36 00-0172	EA			36" Wide, 12" Radius, Horizontal Crosses, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	737.22	297.20
				<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-48.96	
26 05 36 00-0173				24" Radius, Horizontal Crosses, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0044)</small>		
26 05 36 00-0174	EA			6" Wide, 24" Radius, Horizontal Crosses, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	608.48	214.26
				<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-42.99	
26 05 36 00-0175	EA			9" Wide, 24" Radius, Horizontal Crosses, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	637.80	227.21
				<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-44.85	
26 05 36 00-0176	EA			12" Wide, 24" Radius, Horizontal Crosses, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	669.10	241.30
				<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-46.80	
26 05 36 00-0177	EA			18" Wide, 24" Radius, Horizontal Crosses, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	712.85	257.22
				<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-49.85	
26 05 36 00-0178	EA			24" Wide, 24" Radius, Horizontal Crosses, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	798.10	297.20
				<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-55.05	
26 05 36 00-0179	EA			30" Wide, 24" Radius, Horizontal Crosses, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	859.34	321.72
				<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-59.12	
26 05 36 00-0180	EA			36" Wide, 24" Radius, Horizontal Crosses, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	959.18	350.68
				<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-66.69	
26 05 36 00-0181				36" Radius, Horizontal Crosses, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0044)</small>		
26 05 36 00-0182	EA			6" Wide, 36" Radius, Horizontal Crosses, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	753.39	241.30
				<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-55.23	

26 Electrical**26 05 Common Work Results For Electrical****26 05 36 Cable Trays For Electrical Systems**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-0183 EA 9" Wide, 36" Radius, Horizontal Crosses, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	795.58 -58.12	257.22
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
26 05 36 00-0184 EA 12" Wide, 36" Radius, Horizontal Crosses, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	841.53 -61.20	275.48
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
26 05 36 00-0185 EA 18" Wide, 36" Radius, Horizontal Crosses, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	916.74 -66.91	297.20
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
26 05 36 00-0186 EA 24" Wide, 36" Radius, Horizontal Crosses, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	1,052.84 -76.06	350.68
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
26 05 36 00-0187 EA 30" Wide, 36" Radius, Horizontal Crosses, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	1,149.76 -82.86	385.43
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
26 05 36 00-0188 EA 36" Wide, 36" Radius, Horizontal Crosses, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	1,261.94 -90.42	429.34
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
26 05 36 00-0189 12" Radius, Vertical Crosses, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0044)</small>		
26 05 36 00-0190 EA 6" Wide, 12" Radius, Vertical Crosses, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	509.59 -34.87	193.04
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
26 05 36 00-0191 EA 9" Wide, 12" Radius, Vertical Crosses, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	535.55 -36.62	203.17
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
26 05 36 00-0192 EA 12" Wide, 12" Radius, Vertical Crosses, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	572.12 -39.36	214.26
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
26 05 36 00-0193 EA 18" Wide, 12" Radius, Vertical Crosses, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	614.22 -42.48	227.29
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
26 05 36 00-0194 EA 24" Wide, 12" Radius, Vertical Crosses, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	691.31 -47.69	257.22
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
26 05 36 00-0195 EA 30" Wide, 12" Radius, Vertical Crosses, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	773.92 -54.43	275.56
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
26 05 36 00-0196 EA 36" Wide, 12" Radius, Vertical Crosses, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	845.50 -59.82	296.79
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
26 05 36 00-0197 24" Radius, Vertical Crosses, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0044)</small>		
26 05 36 00-0198 EA 6" Wide, 24" Radius, Vertical Crosses, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	721.57 -54.30	214.26
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
26 05 36 00-0199 EA 9" Wide, 24" Radius, Vertical Crosses, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	754.41 -56.51	227.21
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
26 05 36 00-0200 EA 12" Wide, 24" Radius, Vertical Crosses, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	789.22 -58.81	241.30
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
26 05 36 00-0201 EA 18" Wide, 24" Radius, Vertical Crosses, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	840.70 -62.63	257.22
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
26 05 36 00-0202 EA 24" Wide, 24" Radius, Vertical Crosses, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	934.38 -68.68	297.20
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
26 05 36 00-0203 EA 30" Wide, 24" Radius, Vertical Crosses, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	1,004.75 -73.66	321.72
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
26 05 36 00-0204 EA 36" Wide, 24" Radius, Vertical Crosses, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	1,127.77 -83.55	350.68
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
26 05 36 00-0205 36" Radius, Vertical Crosses, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0044)</small>		
26 05 36 00-0206 EA 6" Wide, 36" Radius, Vertical Crosses, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	911.45 -71.04	241.30
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
26 05 36 00-0207 EA 9" Wide, 36" Radius, Vertical Crosses, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	960.66 -74.63	257.22
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
26 05 36 00-0208 EA 12" Wide, 36" Radius, Vertical Crosses, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	1,013.64 -78.41	275.48
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		
26 05 36 00-0209 EA 18" Wide, 36" Radius, Vertical Crosses, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	1,106.40 -85.88	297.20
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-0210 EA 24" Wide, 36" Radius, Vertical Crosses, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	1,263.58	350.68
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-97.13	
26 05 36 00-0211 EA 30" Wide, 36" Radius, Vertical Crosses, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	1,378.06	385.43
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-105.69	
26 05 36 00-0212 EA 36" Wide, 36" Radius, Vertical Crosses, 4" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	1,507.80	429.34
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-115.00	
26 05 36 00-0213 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fittings <small>(26 05 36 00-0002)</small>		
26 05 36 00-0214 12" Radius, Horizontal 90 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0213)</small>		
26 05 36 00-0215 EA 6" Wide, 12" Radius, Horizontal 90 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	179.80	80.68
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-11.26	
26 05 36 00-0216 EA 9" Wide, 12" Radius, Horizontal 90 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	202.13	91.85
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-12.56	
26 05 36 00-0217 EA 12" Wide, 12" Radius, Horizontal 90 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	222.58	101.58
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-13.80	
26 05 36 00-0218 EA 18" Wide, 12" Radius, Horizontal 90 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	276.68	124.51
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-17.29	
26 05 36 00-0219 EA 24" Wide, 12" Radius, Horizontal 90 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	316.05	142.93
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-19.69	
26 05 36 00-0220 EA 30" Wide, 12" Radius, Horizontal 90 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	370.42	160.86
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-23.64	
26 05 36 00-0221 EA 36" Wide, 12" Radius, Horizontal 90 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	426.03	183.86
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-27.28	
26 05 36 00-0222 24" Radius, Horizontal 90 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0213)</small>		
26 05 36 00-0223 EA 6" Wide, 24" Radius, Horizontal 90 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	233.49	83.89
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-16.36	
26 05 36 00-0224 EA 9" Wide, 24" Radius, Horizontal 90 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	257.27	96.43
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-17.69	
26 05 36 00-0225 EA 12" Wide, 24" Radius, Horizontal 90 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	278.88	107.22
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-18.95	
26 05 36 00-0226 EA 18" Wide, 24" Radius, Horizontal 90 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	330.01	133.20
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-21.90	
26 05 36 00-0227 EA 24" Wide, 24" Radius, Horizontal 90 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	373.46	154.51
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-24.47	
26 05 36 00-0228 EA 30" Wide, 24" Radius, Horizontal 90 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	418.34	175.34
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-27.22	
26 05 36 00-0229 EA 36" Wide, 24" Radius, Horizontal 90 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	488.37	203.09
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-31.91	
26 05 36 00-0230 36" Radius, Horizontal 90 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0213)</small>		
26 05 36 00-0231 EA 6" Wide, 36" Radius, Horizontal 90 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	249.89	87.67
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-17.68	
26 05 36 00-0232 EA 9" Wide, 36" Radius, Horizontal 90 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	278.63	101.50
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-19.41	
26 05 36 00-0233 EA 12" Wide, 36" Radius, Horizontal 90 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	303.90	113.57
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-20.92	
26 05 36 00-0234 EA 18" Wide, 36" Radius, Horizontal 90 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	369.37	142.93
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-25.03	
26 05 36 00-0235 EA 24" Wide, 36" Radius, Horizontal 90 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	423.76	167.78
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-28.39	

26 Electrical**26 05 Common Work Results For Electrical****26 05 36 Cable Trays For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-0236	EA		30" Wide, 36" Radius, Horizontal 90 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	494.63	193.04
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-33.38	
26 05 36 00-0237	EA		36" Wide, 36" Radius, Horizontal 90 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	566.72	226.81
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-37.77	
26 05 36 00-0238			12" Radius, Horizontal 45 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0213)</small>		
26 05 36 00-0239	EA		6" Wide, 12" Radius, Horizontal 45 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	132.72	58.47
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-8.40	
			<i>For 60 Degree Bend, Deduct</i>	-21.39	
			<i>For 30 Degree Bend, Deduct</i>	-38.90	
26 05 36 00-0240	EA		9" Wide, 12" Radius, Horizontal 45 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	153.58	70.13
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-9.52	
			<i>For 60 Degree Bend, Deduct</i>	-23.81	
			<i>For 30 Degree Bend, Deduct</i>	-43.58	
26 05 36 00-0241	EA		12" Wide, 12" Radius, Horizontal 45 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	172.24	80.44
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-10.52	
			<i>For 60 Degree Bend, Deduct</i>	-26.01	
			<i>For 30 Degree Bend, Deduct</i>	-47.81	
26 05 36 00-0242	EA		18" Wide, 12" Radius, Horizontal 45 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	209.75	101.66
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-12.51	
			<i>For 60 Degree Bend, Deduct</i>	-30.26	
			<i>For 30 Degree Bend, Deduct</i>	-56.07	
26 05 36 00-0243	EA		24" Wide, 12" Radius, Horizontal 45 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	259.38	124.51
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-15.56	
			<i>For 60 Degree Bend, Deduct</i>	-37.87	
			<i>For 30 Degree Bend, Deduct</i>	-70.03	
26 05 36 00-0244	EA		30" Wide, 12" Radius, Horizontal 45 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	304.52	142.93
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-18.54	
			<i>For 60 Degree Bend, Deduct</i>	-45.70	
			<i>For 30 Degree Bend, Deduct</i>	-84.10	
26 05 36 00-0245	EA		36" Wide, 12" Radius, Horizontal 45 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	348.83	167.78
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-20.90	
			<i>For 60 Degree Bend, Deduct</i>	-50.79	
			<i>For 30 Degree Bend, Deduct</i>	-93.98	
26 05 36 00-0246			24" Radius, Horizontal 45 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0213)</small>		
26 05 36 00-0247	EA		6" Wide, 24" Radius, Horizontal 45 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	145.16	60.32
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-9.49	
			<i>For 60 Degree Bend, Deduct</i>	-24.79	
			<i>For 30 Degree Bend, Deduct</i>	-44.67	
26 05 36 00-0248	EA		9" Wide, 24" Radius, Horizontal 45 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	168.75	72.71
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-10.82	
			<i>For 60 Degree Bend, Deduct</i>	-27.81	
			<i>For 30 Degree Bend, Deduct</i>	-50.39	
26 05 36 00-0249	EA		12" Wide, 24" Radius, Horizontal 45 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	193.25	83.97
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-12.33	
			<i>For 60 Degree Bend, Deduct</i>	-31.59	
			<i>For 30 Degree Bend, Deduct</i>	-57.31	
26 05 36 00-0250	EA		18" Wide, 24" Radius, Horizontal 45 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	233.49	107.22
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-14.41	
			<i>For 60 Degree Bend, Deduct</i>	-35.94	
			<i>For 30 Degree Bend, Deduct</i>	-65.86	
26 05 36 00-0251	EA		24" Wide, 24" Radius, Horizontal 45 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	288.22	133.20
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-17.73	
			<i>For 60 Degree Bend, Deduct</i>	-44.07	
			<i>For 30 Degree Bend, Deduct</i>	-80.84	
26 05 36 00-0252	EA		30" Wide, 24" Radius, Horizontal 45 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	336.71	154.51
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-20.80	
			<i>For 60 Degree Bend, Deduct</i>	-51.90	
			<i>For 30 Degree Bend, Deduct</i>	-95.08	
26 05 36 00-0253	EA		36" Wide, 24" Radius, Horizontal 45 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	397.30	183.94
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-24.40	
			<i>For 60 Degree Bend, Deduct</i>	-60.61	
			<i>For 30 Degree Bend, Deduct</i>	-111.23	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-0254 36" Radius, Horizontal 45 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0213)</small>		
26 05 36 00-0255 EA 6" Wide, 36" Radius, Horizontal 45 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	167.82	62.25
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-11.60	
For 60 Degree Bend, Deduct	-31.53	
For 30 Degree Bend, Deduct	-56.01	
26 05 36 00-0256 EA 9" Wide, 36" Radius, Horizontal 45 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	193.71	75.60
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-13.07	
For 60 Degree Bend, Deduct	-34.95	
For 30 Degree Bend, Deduct	-62.44	
26 05 36 00-0257 EA 12" Wide, 36" Radius, Horizontal 45 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	215.41	87.75
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-14.23	
For 60 Degree Bend, Deduct	-37.45	
For 30 Degree Bend, Deduct	-67.29	
26 05 36 00-0258 EA 18" Wide, 36" Radius, Horizontal 45 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	264.27	113.57
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-16.96	
For 60 Degree Bend, Deduct	-43.66	
For 30 Degree Bend, Deduct	-79.08	
26 05 36 00-0259 EA 24" Wide, 36" Radius, Horizontal 45 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	317.49	142.93
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-19.84	
For 60 Degree Bend, Deduct	-49.98	
For 30 Degree Bend, Deduct	-91.24	
26 05 36 00-0260 EA 30" Wide, 36" Radius, Horizontal 45 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	381.97	167.78
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-24.21	
For 60 Degree Bend, Deduct	-61.73	
For 30 Degree Bend, Deduct	-112.20	
26 05 36 00-0261 EA 36" Wide, 36" Radius, Horizontal 45 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	452.35	203.09
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-28.31	
For 60 Degree Bend, Deduct	-71.42	
For 30 Degree Bend, Deduct	-130.31	
26 05 36 00-0262 12" Radius, Vertical 90 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0213)</small>		
26 05 36 00-0263 EA 6" Wide, 12" Radius, Vertical 90 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	194.12	80.44
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-12.71	
26 05 36 00-0264 EA 9" Wide, 12" Radius, Vertical 90 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	214.59	91.85
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-13.80	
26 05 36 00-0265 EA 12" Wide, 12" Radius, Vertical 90 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	232.78	101.58
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-14.82	
26 05 36 00-0266 EA 18" Wide, 12" Radius, Vertical 90 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	264.51	124.51
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-16.08	
26 05 36 00-0267 EA 24" Wide, 12" Radius, Vertical 90 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	307.29	142.93
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-18.82	
26 05 36 00-0268 EA 30" Wide, 12" Radius, Vertical 90 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	342.68	160.86
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-20.86	
26 05 36 00-0269 EA 36" Wide, 12" Radius, Vertical 90 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	383.39	183.62
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-23.04	
26 05 36 00-0270 24" Radius, Vertical 90 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0213)</small>		
26 05 36 00-0271 EA 6" Wide, 24" Radius, Vertical 90 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	224.76	83.89
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-15.48	
26 05 36 00-0272 EA 9" Wide, 24" Radius, Vertical 90 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	247.86	96.51
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-16.74	
26 05 36 00-0273 EA 12" Wide, 24" Radius, Vertical 90 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	269.18	107.22
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-17.98	
26 05 36 00-0274 EA 18" Wide, 24" Radius, Vertical 90 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	317.22	133.20
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-20.63	
26 05 36 00-0275 EA 24" Wide, 24" Radius, Vertical 90 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	357.58	154.51
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-22.89	

26 Electrical**26 05 Common Work Results For Electrical****26 05 36 Cable Trays For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-0276	EA		30" Wide, 24" Radius, Vertical 90 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	397.90	175.34
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-25.18	
26 05 36 00-0277	EA		36" Wide, 24" Radius, Vertical 90 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	457.27	203.09
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-28.80	
26 05 36 00-0278			36" Radius, Vertical 90 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0213)</small>		
26 05 36 00-0279	EA		6" Wide, 36" Radius, Vertical 90 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	260.76	87.67
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-18.77	
26 05 36 00-0280	EA		9" Wide, 36" Radius, Vertical 90 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	288.02	101.58
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-20.34	
26 05 36 00-0281	EA		12" Wide, 36" Radius, Vertical 90 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	309.48	113.57
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-21.48	
26 05 36 00-0282	EA		18" Wide, 36" Radius, Vertical 90 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	368.05	142.93
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-24.89	
26 05 36 00-0283	EA		24" Wide, 36" Radius, Vertical 90 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	410.85	167.78
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-27.10	
26 05 36 00-0284	EA		30" Wide, 36" Radius, Vertical 90 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	470.86	193.04
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-31.00	
26 05 36 00-0285	EA		36" Wide, 36" Radius, Vertical 90 Degree Elbows, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	536.77	226.81
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-34.78	
26 05 36 00-0286			12" Radius, Horizontal Tees, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0213)</small>		
26 05 36 00-0287	EA		6" Wide, 12" Radius, Horizontal Tees, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	354.00	154.51
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-22.53	
26 05 36 00-0288	EA		9" Wide, 12" Radius, Horizontal Tees, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	383.41	167.78
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-24.36	
26 05 36 00-0289	EA		12" Wide, 12" Radius, Horizontal Tees, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	401.77	175.34
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-25.56	
26 05 36 00-0290	EA		18" Wide, 12" Radius, Horizontal Tees, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	447.08	193.04
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-28.62	
26 05 36 00-0291	EA		24" Wide, 12" Radius, Horizontal Tees, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	504.13	214.26
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-32.56	
26 05 36 00-0292	EA		30" Wide, 12" Radius, Horizontal Tees, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	554.47	227.21
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-36.51	
26 05 36 00-0293	EA		36" Wide, 12" Radius, Horizontal Tees, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	627.59	257.22
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-41.32	
26 05 36 00-0294			24" Radius, Horizontal Tees, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0213)</small>		
26 05 36 00-0295	EA		6" Wide, 24" Radius, Horizontal Tees, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	430.96	167.78
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-29.11	
26 05 36 00-0296	EA		9" Wide, 24" Radius, Horizontal Tees, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	465.02	183.94
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-31.18	
26 05 36 00-0297	EA		12" Wide, 24" Radius, Horizontal Tees, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	485.99	193.04
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-32.51	
26 05 36 00-0298	EA		18" Wide, 24" Radius, Horizontal Tees, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	534.39	214.26
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-35.58	
26 05 36 00-0299	EA		24" Wide, 24" Radius, Horizontal Tees, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	595.25	241.30
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-39.42	
26 05 36 00-0300	EA		30" Wide, 24" Radius, Horizontal Tees, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	639.12	257.22
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-42.48	
26 05 36 00-0301	EA		36" Wide, 24" Radius, Horizontal Tees, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	764.72	297.20
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-51.71	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-0302 36" Radius, Horizontal Tees, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0213)</small>		
26 05 36 00-0303 EA 6" Wide, 36" Radius, Horizontal Tees, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	532.75	183.94
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-37.95	
26 05 36 00-0304 EA 9" Wide, 36" Radius, Horizontal Tees, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	573.39	203.09
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-40.41	
26 05 36 00-0305 EA 12" Wide, 36" Radius, Horizontal Tees, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	607.88	214.26
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-42.93	
26 05 36 00-0306 EA 18" Wide, 36" Radius, Horizontal Tees, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	671.62	241.30
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-47.05	
26 05 36 00-0307 EA 24" Wide, 36" Radius, Horizontal Tees, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	763.12	275.48
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-53.36	
26 05 36 00-0308 EA 30" Wide, 36" Radius, Horizontal Tees, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	826.68	297.20
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-57.91	
26 05 36 00-0309 EA 36" Wide, 36" Radius, Horizontal Tees, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	940.45	350.68
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-64.82	
26 05 36 00-0310 12" Radius, Vertical Tees, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0213)</small>		
26 05 36 00-0311 EA 6" Wide, 12" Radius, Vertical Tees, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	402.51	142.93
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-28.34	
26 05 36 00-0312 EA 9" Wide, 12" Radius, Vertical Tees, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	413.34	148.55
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-28.95	
26 05 36 00-0313 EA 12" Wide, 12" Radius, Vertical Tees, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	424.61	154.51
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-29.59	
26 05 36 00-0314 EA 18" Wide, 12" Radius, Vertical Tees, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	449.69	167.78
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-30.99	
26 05 36 00-0315 EA 24" Wide, 12" Radius, Vertical Tees, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	465.17	175.34
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-31.90	
26 05 36 00-0316 EA 30" Wide, 12" Radius, Vertical Tees, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	506.16	193.04
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-34.53	
26 05 36 00-0317 EA 36" Wide, 12" Radius, Vertical Tees, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	548.80	214.26
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-37.02	
26 05 36 00-0318 24" Radius, Vertical Tees, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0213)</small>		
26 05 36 00-0319 EA 6" Wide, 24" Radius, Vertical Tees, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	554.30	154.51
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-42.56	
26 05 36 00-0320 EA 9" Wide, 24" Radius, Vertical Tees, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	569.27	160.86
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-43.52	
26 05 36 00-0321 EA 12" Wide, 24" Radius, Vertical Tees, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	585.14	167.78
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-44.53	
26 05 36 00-0322 EA 18" Wide, 24" Radius, Vertical Tees, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	620.65	183.94
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-46.74	
26 05 36 00-0323 EA 24" Wide, 24" Radius, Vertical Tees, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	644.49	193.04
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-48.36	
26 05 36 00-0324 EA 30" Wide, 24" Radius, Vertical Tees, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	688.57	214.26
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-51.00	
26 05 36 00-0325 EA 36" Wide, 24" Radius, Vertical Tees, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	747.99	241.30
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-54.69	
26 05 36 00-0326 36" Radius, Vertical Tees, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0213)</small>		
26 05 36 00-0327 EA 6" Wide, 36" Radius, Vertical Tees, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	834.43	167.78
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-69.46	

26 Electrical**26 05 Common Work Results For Electrical****26 05 36 Cable Trays For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-0328	EA		9" Wide, 36" Radius, Vertical Tees, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	854.23	175.34
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-70.81	
26 05 36 00-0329	EA		12" Wide, 36" Radius, Vertical Tees, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	875.70	183.94
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-72.24	
26 05 36 00-0330	EA		18" Wide, 36" Radius, Vertical Tees, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	914.89	203.09
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-74.56	
26 05 36 00-0331	EA		24" Wide, 36" Radius, Vertical Tees, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	940.74	214.26
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-76.22	
26 05 36 00-0332	EA		30" Wide, 36" Radius, Vertical Tees, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	1,007.36	241.30
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-80.63	
26 05 36 00-0333	EA		36" Wide, 36" Radius, Vertical Tees, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	1,071.49	275.48
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-84.20	
26 05 36 00-0334			12" Radius, Horizontal Crosses, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0213)</small>		
26 05 36 00-0335	EA		6" Wide, 12" Radius, Horizontal Crosses, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	441.32	193.04
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-28.05	
26 05 36 00-0336	EA		9" Wide, 12" Radius, Horizontal Crosses, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	463.87	203.09
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-29.46	
26 05 36 00-0337	EA		12" Wide, 12" Radius, Horizontal Crosses, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	494.04	214.26
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-31.55	
26 05 36 00-0338	EA		18" Wide, 12" Radius, Horizontal Crosses, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	528.53	227.21
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-33.92	
26 05 36 00-0339	EA		24" Wide, 12" Radius, Horizontal Crosses, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	595.89	257.22
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-38.15	
26 05 36 00-0340	EA		30" Wide, 12" Radius, Horizontal Crosses, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	659.37	275.48
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-42.98	
26 05 36 00-0341	EA		36" Wide, 12" Radius, Horizontal Crosses, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	718.61	297.20
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-47.10	
26 05 36 00-0342			24" Radius, Horizontal Crosses, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0213)</small>		
26 05 36 00-0343	EA		6" Wide, 24" Radius, Horizontal Crosses, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	589.14	214.26
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-41.06	
26 05 36 00-0344	EA		9" Wide, 24" Radius, Horizontal Crosses, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	617.87	227.21
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-42.85	
26 05 36 00-0345	EA		12" Wide, 24" Radius, Horizontal Crosses, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	648.56	241.30
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-44.75	
26 05 36 00-0346	EA		18" Wide, 24" Radius, Horizontal Crosses, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	690.99	257.22
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-47.66	
26 05 36 00-0347	EA		24" Wide, 24" Radius, Horizontal Crosses, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	774.81	297.20
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-52.72	
26 05 36 00-0348	EA		30" Wide, 24" Radius, Horizontal Crosses, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	834.49	321.72
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-56.64	
26 05 36 00-0349	EA		36" Wide, 24" Radius, Horizontal Crosses, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	930.36	350.68
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-63.81	
26 05 36 00-0350			36" Radius, Horizontal Crosses, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0213)</small>		
26 05 36 00-0351	EA		6" Wide, 36" Radius, Horizontal Crosses, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	726.37	241.30
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-52.53	
26 05 36 00-0352	EA		9" Wide, 36" Radius, Horizontal Crosses, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	767.36	257.22
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-55.30	
26 05 36 00-0353	EA		12" Wide, 36" Radius, Horizontal Crosses, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	812.11	275.48
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-58.26	
26 05 36 00-0354	EA		18" Wide, 36" Radius, Horizontal Crosses, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	884.32	297.20
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-63.67	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-0355 EA 24" Wide, 36" Radius, Horizontal Crosses, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	1,016.82	350.68
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-72.46	
26 05 36 00-0356 EA 30" Wide, 36" Radius, Horizontal Crosses, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	1,110.73	385.43
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-78.95	
26 05 36 00-0357 EA 36" Wide, 36" Radius, Horizontal Crosses, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	1,219.91	429.34
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-86.21	
26 05 36 00-0358 12" Radius, Vertical Crosses, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0213)</small>		
26 05 36 00-0359 EA 6" Wide, 12" Radius, Vertical Crosses, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	495.14	193.04
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-33.43	
26 05 36 00-0360 EA 9" Wide, 12" Radius, Vertical Crosses, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	520.41	203.17
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-35.11	
26 05 36 00-0361 EA 12" Wide, 12" Radius, Vertical Crosses, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	555.58	214.26
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-37.70	
26 05 36 00-0362 EA 18" Wide, 12" Radius, Vertical Crosses, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	596.12	227.29
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-40.67	
26 05 36 00-0363 EA 24" Wide, 12" Radius, Vertical Crosses, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	671.11	257.22
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-45.67	
26 05 36 00-0364 EA 30" Wide, 12" Radius, Vertical Crosses, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	749.71	275.56
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-52.01	
26 05 36 00-0365 EA 36" Wide, 12" Radius, Vertical Crosses, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	818.51	296.79
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-57.12	
26 05 36 00-0366 24" Radius, Vertical Crosses, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0213)</small>		
26 05 36 00-0367 EA 6" Wide, 24" Radius, Vertical Crosses, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	693.54	214.26
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-51.50	
26 05 36 00-0368 EA 9" Wide, 24" Radius, Vertical Crosses, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	725.51	227.21
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-53.62	
26 05 36 00-0369 EA 12" Wide, 24" Radius, Vertical Crosses, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	759.44	241.30
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-55.84	
26 05 36 00-0370 EA 18" Wide, 24" Radius, Vertical Crosses, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	809.01	257.22
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-59.46	
26 05 36 00-0371 EA 24" Wide, 24" Radius, Vertical Crosses, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	900.60	297.20
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-65.30	
26 05 36 00-0372 EA 30" Wide, 24" Radius, Vertical Crosses, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	968.71	321.72
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-70.06	
26 05 36 00-0373 EA 36" Wide, 24" Radius, Vertical Crosses, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	1,085.98	350.68
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-79.37	
26 05 36 00-0374 36" Radius, Vertical Crosses, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0213)</small>		
26 05 36 00-0375 EA 6" Wide, 36" Radius, Vertical Crosses, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	872.27	241.30
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-67.12	
26 05 36 00-0376 EA 9" Wide, 36" Radius, Vertical Crosses, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	919.75	257.22
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-70.54	
26 05 36 00-0377 EA 12" Wide, 36" Radius, Vertical Crosses, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	970.98	275.48
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-74.14	
26 05 36 00-0378 EA 18" Wide, 36" Radius, Vertical Crosses, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	1,059.39	297.20
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-81.18	
26 05 36 00-0379 EA 24" Wide, 36" Radius, Vertical Crosses, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	1,211.35	350.68
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-91.91	
26 05 36 00-0380 EA 30" Wide, 36" Radius, Vertical Crosses, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	1,321.47	385.43
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-100.03	
26 05 36 00-0381 EA 36" Wide, 36" Radius, Vertical Crosses, 6" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	1,446.86	429.34
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-108.91	

26 Electrical**26 05 Common Work Results For Electrical****26 05 36 Cable Trays For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-0382			9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fittings <small>(26 05 36 00-0002)</small>		
26 05 36 00-0383			12" Radius, Horizontal 90 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0382)</small>		
26 05 36 00-0384	EA		6" Wide, 12" Radius, Horizontal 90 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	172.23	80.68
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-10.50	
26 05 36 00-0385	EA		9" Wide, 12" Radius, Horizontal 90 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	193.97	91.85
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-11.74	
26 05 36 00-0386	EA		12" Wide, 12" Radius, Horizontal 90 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	213.69	101.58
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-12.91	
26 05 36 00-0387	EA		18" Wide, 12" Radius, Horizontal 90 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	265.15	124.51
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-16.14	
26 05 36 00-0388	EA		24" Wide, 12" Radius, Horizontal 90 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	303.08	142.93
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-18.40	
26 05 36 00-0389	EA		30" Wide, 12" Radius, Horizontal 90 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	353.37	160.86
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-21.93	
26 05 36 00-0390	EA		36" Wide, 12" Radius, Horizontal 90 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	406.10	183.86
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-25.29	
26 05 36 00-0391			24" Radius, Horizontal 90 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0382)</small>		
26 05 36 00-0392	EA		6" Wide, 24" Radius, Horizontal 90 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	217.88	83.89
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-14.80	
26 05 36 00-0393	EA		9" Wide, 24" Radius, Horizontal 90 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	241.18	96.43
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-16.08	
26 05 36 00-0394	EA		12" Wide, 24" Radius, Horizontal 90 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	262.19	107.22
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-17.28	
26 05 36 00-0395	EA		18" Wide, 24" Radius, Horizontal 90 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	312.00	133.20
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-20.10	
26 05 36 00-0396	EA		24" Wide, 24" Radius, Horizontal 90 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	354.12	154.51
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-22.54	
26 05 36 00-0397	EA		30" Wide, 24" Radius, Horizontal 90 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	397.33	175.34
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-25.12	
26 05 36 00-0398	EA		36" Wide, 24" Radius, Horizontal 90 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	463.39	203.09
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-29.41	
26 05 36 00-0399			36" Radius, Horizontal 90 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0382)</small>		
26 05 36 00-0400	EA		6" Wide, 36" Radius, Horizontal 90 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	232.60	87.67
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-15.95	
26 05 36 00-0401	EA		9" Wide, 36" Radius, Horizontal 90 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	260.38	101.50
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-17.58	
26 05 36 00-0402	EA		12" Wide, 36" Radius, Horizontal 90 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	284.80	113.57
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-19.01	
26 05 36 00-0403	EA		18" Wide, 36" Radius, Horizontal 90 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	347.51	142.93
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-22.84	
26 05 36 00-0404	EA		24" Wide, 36" Radius, Horizontal 90 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	399.74	167.78
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-25.99	
26 05 36 00-0405	EA		30" Wide, 36" Radius, Horizontal 90 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	465.82	193.04
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-30.50	
26 05 36 00-0406	EA		36" Wide, 36" Radius, Horizontal 90 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	535.26	226.81
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-34.63	
26 05 36 00-0407			12" Radius, Horizontal 45 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0382)</small>		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-0408 EA 6" Wide, 12" Radius, Horizontal 45 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	126.84	58.47
<i>For 60 Degree Bend, Deduct</i>	-19.45	
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-7.81	
<i>For 30 Degree Bend, Deduct</i>	-35.67	
26 05 36 00-0409 EA 9" Wide, 12" Radius, Horizontal 45 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	147.46	70.13
<i>For 60 Degree Bend, Deduct</i>	-21.79	
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-8.90	
<i>For 30 Degree Bend, Deduct</i>	-40.21	
26 05 36 00-0410 EA 12" Wide, 12" Radius, Horizontal 45 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	165.87	80.44
<i>For 60 Degree Bend, Deduct</i>	-23.91	
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-9.88	
<i>For 30 Degree Bend, Deduct</i>	-44.31	
26 05 36 00-0411 EA 18" Wide, 12" Radius, Horizontal 45 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	203.02	101.66
<i>For 60 Degree Bend, Deduct</i>	-28.03	
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-11.83	
<i>For 30 Degree Bend, Deduct</i>	-52.37	
26 05 36 00-0412 EA 24" Wide, 12" Radius, Horizontal 45 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	250.74	124.51
<i>For 60 Degree Bend, Deduct</i>	-35.02	
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-14.70	
<i>For 30 Degree Bend, Deduct</i>	-65.28	
26 05 36 00-0413 EA 30" Wide, 12" Radius, Horizontal 45 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	293.48	142.93
<i>For 60 Degree Bend, Deduct</i>	-42.05	
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-17.44	
<i>For 30 Degree Bend, Deduct</i>	-78.03	
26 05 36 00-0414 EA 36" Wide, 12" Radius, Horizontal 45 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	337.30	167.78
<i>For 60 Degree Bend, Deduct</i>	-46.99	
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-19.75	
<i>For 30 Degree Bend, Deduct</i>	-87.63	
26 05 36 00-0415 24" Radius, Horizontal 45 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0382)</small>		
26 05 36 00-0416 EA 6" Wide, 24" Radius, Horizontal 45 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	137.71	60.32
<i>For 60 Degree Bend, Deduct</i>	-22.33	
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-8.75	
<i>For 30 Degree Bend, Deduct</i>	-40.57	
26 05 36 00-0417 EA 9" Wide, 24" Radius, Horizontal 45 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	160.83	72.71
<i>For 60 Degree Bend, Deduct</i>	-25.20	
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-10.02	
<i>For 30 Degree Bend, Deduct</i>	-46.04	
26 05 36 00-0418 EA 12" Wide, 24" Radius, Horizontal 45 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	184.36	83.97
<i>For 60 Degree Bend, Deduct</i>	-28.65	
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-11.44	
<i>For 30 Degree Bend, Deduct</i>	-52.42	
26 05 36 00-0419 EA 18" Wide, 24" Radius, Horizontal 45 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	224.36	107.22
<i>For 60 Degree Bend, Deduct</i>	-32.93	
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-13.50	
<i>For 30 Degree Bend, Deduct</i>	-60.84	
26 05 36 00-0420 EA 24" Wide, 24" Radius, Horizontal 45 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	277.18	133.20
<i>For 60 Degree Bend, Deduct</i>	-40.42	
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-16.62	
<i>For 30 Degree Bend, Deduct</i>	-74.77	
26 05 36 00-0421 EA 30" Wide, 24" Radius, Horizontal 45 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	323.50	154.51
<i>For 60 Degree Bend, Deduct</i>	-47.54	
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-19.48	
<i>For 30 Degree Bend, Deduct</i>	-87.81	
26 05 36 00-0422 EA 36" Wide, 24" Radius, Horizontal 45 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	382.17	183.94
<i>For 60 Degree Bend, Deduct</i>	-55.62	
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-22.89	
<i>For 30 Degree Bend, Deduct</i>	-102.91	
26 05 36 00-0423 36" Radius, Horizontal 45 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0382)</small>		
26 05 36 00-0424 EA 6" Wide, 36" Radius, Horizontal 45 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	157.14	62.25
<i>For 60 Degree Bend, Deduct</i>	-28.01	
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-10.53	
<i>For 30 Degree Bend, Deduct</i>	-50.13	

26 Electrical**26 05 Common Work Results For Electrical****26 05 36 Cable Trays For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-0425	EA		9" Wide, 36" Radius, Horizontal 45 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	182.43	75.60
			<i>For 60 Degree Bend, Deduct</i>	-31.22	
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-11.94	
			<i>For 30 Degree Bend, Deduct</i>	-56.24	
26 05 36 00-0426	EA		12" Wide, 36" Radius, Horizontal 45 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	203.88	87.75
			<i>For 60 Degree Bend, Deduct</i>	-33.65	
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-13.08	
			<i>For 30 Degree Bend, Deduct</i>	-60.95	
26 05 36 00-0427	EA		18" Wide, 36" Radius, Horizontal 45 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	251.78	113.57
			<i>For 60 Degree Bend, Deduct</i>	-39.54	
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-15.71	
			<i>For 30 Degree Bend, Deduct</i>	-72.21	
26 05 36 00-0428	EA		24" Wide, 36" Radius, Horizontal 45 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	304.28	142.93
			<i>For 60 Degree Bend, Deduct</i>	-45.62	
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-18.52	
			<i>For 30 Degree Bend, Deduct</i>	-83.97	
26 05 36 00-0429	EA		30" Wide, 36" Radius, Horizontal 45 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	364.92	167.78
			<i>For 60 Degree Bend, Deduct</i>	-56.10	
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-22.51	
			<i>For 30 Degree Bend, Deduct</i>	-102.83	
26 05 36 00-0430	EA		36" Wide, 36" Radius, Horizontal 45 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	433.37	203.09
			<i>For 60 Degree Bend, Deduct</i>	-65.15	
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-26.41	
			<i>For 30 Degree Bend, Deduct</i>	-119.88	
26 05 36 00-0431			12" Radius, Vertical 90 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0382)</small>		
26 05 36 00-0432	EA		6" Wide, 12" Radius, Vertical 90 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	186.28	80.44
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-11.93	
26 05 36 00-0433	EA		9" Wide, 12" Radius, Vertical 90 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	206.58	91.85
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-13.00	
26 05 36 00-0434	EA		12" Wide, 12" Radius, Vertical 90 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	224.50	101.58
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-13.99	
26 05 36 00-0435	EA		18" Wide, 12" Radius, Vertical 90 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	265.15	124.51
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-16.14	
26 05 36 00-0436	EA		24" Wide, 12" Radius, Vertical 90 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	298.28	142.93
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-17.92	
26 05 36 00-0437	EA		30" Wide, 12" Radius, Vertical 90 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	332.95	160.86
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-19.89	
26 05 36 00-0438	EA		36" Wide, 12" Radius, Vertical 90 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	373.30	183.62
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-22.03	
26 05 36 00-0439			24" Radius, Vertical 90 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0382)</small>		
26 05 36 00-0440	EA		6" Wide, 24" Radius, Vertical 90 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	213.68	83.89
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-14.38	
26 05 36 00-0441	EA		9" Wide, 24" Radius, Vertical 90 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	236.51	96.51
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-15.61	
26 05 36 00-0442	EA		12" Wide, 24" Radius, Vertical 90 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	257.38	107.22
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-16.80	
26 05 36 00-0443	EA		18" Wide, 24" Radius, Vertical 90 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	304.79	133.20
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-19.38	
26 05 36 00-0444	EA		24" Wide, 24" Radius, Vertical 90 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	344.52	154.51
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-21.58	
26 05 36 00-0445	EA		30" Wide, 24" Radius, Vertical 90 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	384.12	175.34
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-23.80	
26 05 36 00-0446	EA		36" Wide, 24" Radius, Vertical 90 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	441.78	203.09
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-27.25	
26 05 36 00-0447			36" Radius, Vertical 90 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0382)</small>		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-0448 EA 6" Wide, 36" Radius, Vertical 90 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	245.81	87.67
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-17.27	
26 05 36 00-0449 EA 9" Wide, 36" Radius, Vertical 90 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	272.53	101.58
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-18.79	
26 05 36 00-0450 EA 12" Wide, 36" Radius, Vertical 90 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	293.81	113.57
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-19.91	
26 05 36 00-0451 EA 18" Wide, 36" Radius, Vertical 90 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	351.11	142.93
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-23.20	
26 05 36 00-0452 EA 24" Wide, 36" Radius, Vertical 90 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	393.74	167.78
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-25.39	
26 05 36 00-0453 EA 30" Wide, 36" Radius, Vertical 90 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	451.41	193.04
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-29.06	
26 05 36 00-0454 EA 36" Wide, 36" Radius, Vertical 90 Degree Elbows, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	516.05	226.81
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-32.71	
26 05 36 00-0455 12" Radius, Horizontal Tees, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0382)</small>		
26 05 36 00-0456 EA 6" Wide, 12" Radius, Horizontal Tees, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	337.91	154.51
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-20.92	
26 05 36 00-0457 EA 9" Wide, 12" Radius, Horizontal Tees, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	366.12	167.78
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-22.63	
26 05 36 00-0458 EA 12" Wide, 12" Radius, Horizontal Tees, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	383.52	175.34
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-23.74	
26 05 36 00-0459 EA 18" Wide, 12" Radius, Horizontal Tees, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	426.19	193.04
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-26.53	
26 05 36 00-0460 EA 24" Wide, 12" Radius, Horizontal Tees, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	479.63	214.26
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-30.11	
26 05 36 00-0461 EA 30" Wide, 12" Radius, Horizontal Tees, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	525.17	227.21
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-33.58	
26 05 36 00-0462 EA 36" Wide, 12" Radius, Horizontal Tees, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	594.45	257.22
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-38.01	
26 05 36 00-0463 24" Radius, Horizontal Tees, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0382)</small>		
26 05 36 00-0464 EA 6" Wide, 24" Radius, Horizontal Tees, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	405.74	167.78
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-26.59	
26 05 36 00-0465 EA 9" Wide, 24" Radius, Horizontal Tees, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	438.61	183.94
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-28.54	
26 05 36 00-0466 EA 12" Wide, 24" Radius, Horizontal Tees, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	458.61	193.04
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-29.78	
26 05 36 00-0467 EA 18" Wide, 24" Radius, Horizontal Tees, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	504.85	214.26
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-32.63	
26 05 36 00-0468 EA 24" Wide, 24" Radius, Horizontal Tees, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	563.07	241.30
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-36.20	
26 05 36 00-0469 EA 30" Wide, 24" Radius, Horizontal Tees, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	604.06	257.22
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-38.97	
26 05 36 00-0470 EA 36" Wide, 24" Radius, Horizontal Tees, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	719.81	297.20
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-47.22	
26 05 36 00-0471 36" Radius, Horizontal Tees, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0382)</small>		
26 05 36 00-0472 EA 6" Wide, 36" Radius, Horizontal Tees, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	495.04	183.94
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-34.18	
26 05 36 00-0473 EA 9" Wide, 36" Radius, Horizontal Tees, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	534.24	203.09
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-36.50	

26 Electrical**26 05 Common Work Results For Electrical****26 05 36 Cable Trays For Electrical Systems**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-0474 EA 12" Wide, 36" Radius, Horizontal Tees, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	566.09	214.26
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-38.75	
26 05 36 00-0475 EA 18" Wide, 36" Radius, Horizontal Tees, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	626.71	241.30
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-42.56	
26 05 36 00-0476 EA 24" Wide, 36" Radius, Horizontal Tees, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	712.45	275.48
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-48.29	
26 05 36 00-0477 EA 30" Wide, 36" Radius, Horizontal Tees, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	771.44	297.20
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-52.38	
26 05 36 00-0478 EA 36" Wide, 36" Radius, Horizontal Tees, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	881.13	350.68
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-58.89	
26 05 36 00-0479 12" Radius, Vertical Tees, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0382)</small>		
26 05 36 00-0480 EA 6" Wide, 12" Radius, Vertical Tees, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	375.13	142.93
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-25.60	
26 05 36 00-0481 EA 9" Wide, 12" Radius, Vertical Tees, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	385.72	148.55
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-26.19	
26 05 36 00-0482 EA 12" Wide, 12" Radius, Vertical Tees, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	396.75	154.51
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-26.80	
26 05 36 00-0483 EA 18" Wide, 12" Radius, Vertical Tees, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	421.35	167.78
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-28.15	
26 05 36 00-0484 EA 24" Wide, 12" Radius, Vertical Tees, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	436.36	175.34
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-29.02	
26 05 36 00-0485 EA 30" Wide, 12" Radius, Vertical Tees, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	475.42	193.04
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-31.46	
26 05 36 00-0486 EA 36" Wide, 12" Radius, Vertical Tees, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	516.86	214.26
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-33.83	
26 05 36 00-0487 24" Radius, Vertical Tees, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0382)</small>		
26 05 36 00-0488 EA 6" Wide, 24" Radius, Vertical Tees, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	504.82	154.51
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-37.61	
26 05 36 00-0489 EA 9" Wide, 24" Radius, Vertical Tees, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	519.08	160.86
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-38.50	
26 05 36 00-0490 EA 12" Wide, 24" Radius, Vertical Tees, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	534.23	167.78
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-39.44	
26 05 36 00-0491 EA 18" Wide, 24" Radius, Vertical Tees, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	568.29	183.94
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-41.50	
26 05 36 00-0492 EA 24" Wide, 24" Radius, Vertical Tees, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	590.70	193.04
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-42.98	
26 05 36 00-0493 EA 30" Wide, 24" Radius, Vertical Tees, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	633.33	214.26
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-45.48	
26 05 36 00-0494 EA 36" Wide, 24" Radius, Vertical Tees, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	690.35	241.30
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-48.93	
26 05 36 00-0495 36" Radius, Vertical Tees, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0382)</small>		
26 05 36 00-0496 EA 6" Wide, 36" Radius, Vertical Tees, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	741.97	167.78
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-60.21	
26 05 36 00-0497 EA 9" Wide, 36" Radius, Vertical Tees, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	760.57	175.34
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-61.44	
26 05 36 00-0498 EA 12" Wide, 36" Radius, Vertical Tees, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	780.83	183.94
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-62.76	
26 05 36 00-0499 EA 18" Wide, 36" Radius, Vertical Tees, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	818.83	203.09
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-64.96	
26 05 36 00-0500 EA 24" Wide, 36" Radius, Vertical Tees, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	843.47	214.26
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-66.49	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-0501 EA 30" Wide, 36" Radius, Vertical Tees, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	906.49	241.30
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-70.54	
26 05 36 00-0502 EA 36" Wide, 36" Radius, Vertical Tees, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	969.42	275.48
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-73.99	
26 05 36 00-0503 12" Radius, Horizontal Crosses, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0382)</small>		
26 05 36 00-0504 EA 6" Wide, 12" Radius, Horizontal Crosses, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	421.39	193.04
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-26.05	
26 05 36 00-0505 EA 9" Wide, 12" Radius, Horizontal Crosses, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	442.98	203.09
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-27.37	
26 05 36 00-0506 EA 12" Wide, 12" Radius, Horizontal Crosses, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	471.23	214.26
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-29.27	
26 05 36 00-0507 EA 18" Wide, 12" Radius, Horizontal Crosses, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	503.55	227.21
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-31.42	
26 05 36 00-0508 EA 24" Wide, 12" Radius, Horizontal Crosses, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	568.03	257.22
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-35.37	
26 05 36 00-0509 EA 30" Wide, 12" Radius, Horizontal Crosses, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	625.99	275.48
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-39.65	
26 05 36 00-0510 EA 36" Wide, 12" Radius, Horizontal Crosses, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	681.38	297.20
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-43.38	
26 05 36 00-0511 24" Radius, Horizontal Crosses, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0382)</small>		
26 05 36 00-0512 EA 6" Wide, 24" Radius, Horizontal Crosses, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	550.48	214.26
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-37.19	
26 05 36 00-0513 EA 9" Wide, 24" Radius, Horizontal Crosses, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	578.00	227.21
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-38.87	
26 05 36 00-0514 EA 12" Wide, 24" Radius, Horizontal Crosses, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	607.50	241.30
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-40.64	
26 05 36 00-0515 EA 18" Wide, 24" Radius, Horizontal Crosses, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	647.28	257.22
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-43.29	
26 05 36 00-0516 EA 24" Wide, 24" Radius, Horizontal Crosses, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	728.21	297.20
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-48.06	
26 05 36 00-0517 EA 30" Wide, 24" Radius, Horizontal Crosses, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	784.77	321.72
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-51.67	
26 05 36 00-0518 EA 36" Wide, 24" Radius, Horizontal Crosses, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	872.72	350.68
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-58.05	
26 05 36 00-0519 36" Radius, Horizontal Crosses, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0382)</small>		
26 05 36 00-0520 EA 6" Wide, 36" Radius, Horizontal Crosses, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	672.34	241.30
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-47.13	
26 05 36 00-0521 EA 9" Wide, 36" Radius, Horizontal Crosses, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	710.93	257.22
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-49.66	
26 05 36 00-0522 EA 12" Wide, 36" Radius, Horizontal Crosses, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	753.27	275.48
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-52.37	
26 05 36 00-0523 EA 18" Wide, 36" Radius, Horizontal Crosses, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	819.47	297.20
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-57.18	
26 05 36 00-0524 EA 24" Wide, 36" Radius, Horizontal Crosses, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	944.77	350.68
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-65.25	
26 05 36 00-0525 EA 30" Wide, 36" Radius, Horizontal Crosses, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	1,032.68	385.43
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-71.15	
26 05 36 00-0526 EA 36" Wide, 36" Radius, Horizontal Crosses, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	1,135.86	429.34
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-77.81	

26 Electrical**26 05 Common Work Results For Electrical****26 05 36 Cable Trays For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-0527			12" Radius, Vertical Crosses, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0382)</small>		
26 05 36 00-0528	EA		6" Wide, 12" Radius, Vertical Crosses, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	466.24	193.04
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-30.54	
26 05 36 00-0529	EA		9" Wide, 12" Radius, Vertical Crosses, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	490.11	203.17
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-32.08	
26 05 36 00-0530	EA		12" Wide, 12" Radius, Vertical Crosses, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	522.50	214.26
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-34.40	
26 05 36 00-0531	EA		18" Wide, 12" Radius, Vertical Crosses, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	559.90	227.29
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-37.05	
26 05 36 00-0532	EA		24" Wide, 12" Radius, Vertical Crosses, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	630.71	257.22
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-41.63	
26 05 36 00-0533	EA		30" Wide, 12" Radius, Vertical Crosses, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	701.31	275.56
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-47.17	
26 05 36 00-0534	EA		36" Wide, 12" Radius, Vertical Crosses, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	764.54	296.79
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-51.72	
26 05 36 00-0535			24" Radius, Vertical Crosses, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0382)</small>		
26 05 36 00-0536	EA		6" Wide, 24" Radius, Vertical Crosses, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	637.48	214.26
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-45.89	
26 05 36 00-0537	EA		9" Wide, 24" Radius, Vertical Crosses, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	667.70	227.21
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-47.84	
26 05 36 00-0538	EA		12" Wide, 24" Radius, Vertical Crosses, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	699.90	241.30
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-49.88	
26 05 36 00-0539	EA		18" Wide, 24" Radius, Vertical Crosses, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	745.63	257.22
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-53.13	
26 05 36 00-0540	EA		24" Wide, 24" Radius, Vertical Crosses, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	833.04	297.20
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-58.54	
26 05 36 00-0541	EA		30" Wide, 24" Radius, Vertical Crosses, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	896.63	321.72
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-62.85	
26 05 36 00-0542	EA		36" Wide, 24" Radius, Vertical Crosses, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	1,002.41	350.68
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-71.01	
26 05 36 00-0543			36" Radius, Vertical Crosses, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0382)</small>		
26 05 36 00-0544	EA		6" Wide, 36" Radius, Vertical Crosses, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	793.92	241.30
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-59.28	
26 05 36 00-0545	EA		9" Wide, 36" Radius, Vertical Crosses, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	837.91	257.22
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-62.35	
26 05 36 00-0546	EA		12" Wide, 36" Radius, Vertical Crosses, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	885.66	275.48
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-65.61	
26 05 36 00-0547	EA		18" Wide, 36" Radius, Vertical Crosses, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	965.37	297.20
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-71.77	
26 05 36 00-0548	EA		24" Wide, 36" Radius, Vertical Crosses, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	1,106.88	350.68
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-81.46	
26 05 36 00-0549	EA		30" Wide, 36" Radius, Vertical Crosses, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	1,208.29	385.43
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-88.71	
26 05 36 00-0550	EA		36" Wide, 36" Radius, Vertical Crosses, 9" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	1,324.98	429.34
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-96.72	
26 05 36 00-0551			12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fittings <small>(26 05 36 00-0002)</small>		
26 05 36 00-0552			12" Radius, Horizontal 90 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0551)</small>		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-0553 EA 6" Wide, 12" Radius, Horizontal 90 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	169.59	80.68
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-10.24	
26 05 36 00-0554 EA 9" Wide, 12" Radius, Horizontal 90 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	191.11	91.85
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-11.45	
26 05 36 00-0555 EA 12" Wide, 12" Radius, Horizontal 90 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	210.58	101.58
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-12.60	
26 05 36 00-0556 EA 18" Wide, 12" Radius, Horizontal 90 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	261.11	124.51
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-15.74	
26 05 36 00-0557 EA 24" Wide, 12" Radius, Horizontal 90 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	298.54	142.93
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-17.94	
26 05 36 00-0558 EA 30" Wide, 12" Radius, Horizontal 90 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	347.40	160.86
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-21.33	
26 05 36 00-0559 EA 36" Wide, 12" Radius, Horizontal 90 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	399.12	183.86
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-24.59	
26 05 36 00-0560 24" Radius, Horizontal 90 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0551)</small>		
26 05 36 00-0561 EA 6" Wide, 24" Radius, Horizontal 90 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	212.42	83.89
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-14.25	
26 05 36 00-0562 EA 9" Wide, 24" Radius, Horizontal 90 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	235.55	96.43
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-15.52	
26 05 36 00-0563 EA 12" Wide, 24" Radius, Horizontal 90 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	256.34	107.22
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-16.70	
26 05 36 00-0564 EA 18" Wide, 24" Radius, Horizontal 90 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	305.70	133.20
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-19.47	
26 05 36 00-0565 EA 24" Wide, 24" Radius, Horizontal 90 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	347.36	154.51
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-21.86	
26 05 36 00-0566 EA 30" Wide, 24" Radius, Horizontal 90 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	389.97	175.34
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-24.38	
26 05 36 00-0567 EA 36" Wide, 24" Radius, Horizontal 90 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	454.65	203.09
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-28.54	
26 05 36 00-0568 36" Radius, Horizontal 90 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0551)</small>		
26 05 36 00-0569 EA 6" Wide, 36" Radius, Horizontal 90 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	226.55	87.67
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-15.35	
26 05 36 00-0570 EA 9" Wide, 36" Radius, Horizontal 90 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	253.99	101.50
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-16.94	
26 05 36 00-0571 EA 12" Wide, 36" Radius, Horizontal 90 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	278.12	113.57
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-18.35	
26 05 36 00-0572 EA 18" Wide, 36" Radius, Horizontal 90 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	339.86	142.93
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-22.07	
26 05 36 00-0573 EA 24" Wide, 36" Radius, Horizontal 90 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	391.33	167.78
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-25.15	
26 05 36 00-0574 EA 30" Wide, 36" Radius, Horizontal 90 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	455.73	193.04
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-29.49	
26 05 36 00-0575 EA 36" Wide, 36" Radius, Horizontal 90 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	524.25	226.81
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-33.53	
26 05 36 00-0576 12" Radius, Horizontal 45 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0551)</small>		
26 05 36 00-0577 EA 6" Wide, 12" Radius, Horizontal 45 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	124.78	58.47
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-7.61	
<i>For 30 Degree Bend, Deduct</i>	-34.53	
<i>For 60 Degree Bend, Deduct</i>	-18.77	

26 Electrical**26 05 Common Work Results For Electrical****26 05 36 Cable Trays For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-0578	EA		9" Wide, 12" Radius, Horizontal 45 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	145.32	70.13
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-8.69	
			<i>For 30 Degree Bend, Deduct</i>	-39.03	
			<i>For 60 Degree Bend, Deduct</i>	-21.08	
26 05 36 00-0579	EA		12" Wide, 12" Radius, Horizontal 45 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	163.64	80.44
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-9.66	
			<i>For 30 Degree Bend, Deduct</i>	-43.08	
			<i>For 60 Degree Bend, Deduct</i>	-23.17	
26 05 36 00-0580	EA		18" Wide, 12" Radius, Horizontal 45 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	200.67	101.66
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-11.60	
			<i>For 30 Degree Bend, Deduct</i>	-51.08	
			<i>For 60 Degree Bend, Deduct</i>	-27.26	
26 05 36 00-0581	EA		24" Wide, 12" Radius, Horizontal 45 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	247.71	124.51
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-14.40	
			<i>For 30 Degree Bend, Deduct</i>	-63.61	
			<i>For 60 Degree Bend, Deduct</i>	-34.02	
26 05 36 00-0582	EA		30" Wide, 12" Radius, Horizontal 45 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	289.61	142.93
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-17.05	
			<i>For 30 Degree Bend, Deduct</i>	-75.90	
			<i>For 60 Degree Bend, Deduct</i>	-40.78	
26 05 36 00-0583	EA		36" Wide, 12" Radius, Horizontal 45 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	333.26	167.78
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-19.34	
			<i>For 30 Degree Bend, Deduct</i>	-85.41	
			<i>For 60 Degree Bend, Deduct</i>	-45.65	
26 05 36 00-0584			24" Radius, Horizontal 45 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0551)</small>		
26 05 36 00-0585	EA		6" Wide, 24" Radius, Horizontal 45 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	135.11	60.32
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-8.49	
			<i>For 30 Degree Bend, Deduct</i>	-39.14	
			<i>For 60 Degree Bend, Deduct</i>	-21.47	
26 05 36 00-0586	EA		9" Wide, 24" Radius, Horizontal 45 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	158.05	72.71
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-9.75	
			<i>For 30 Degree Bend, Deduct</i>	-44.51	
			<i>For 60 Degree Bend, Deduct</i>	-24.28	
26 05 36 00-0587	EA		12" Wide, 24" Radius, Horizontal 45 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	181.25	83.97
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-11.13	
			<i>For 30 Degree Bend, Deduct</i>	-50.71	
			<i>For 60 Degree Bend, Deduct</i>	-27.63	
26 05 36 00-0588	EA		18" Wide, 24" Radius, Horizontal 45 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	221.17	107.22
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-13.18	
			<i>For 30 Degree Bend, Deduct</i>	-59.09	
			<i>For 60 Degree Bend, Deduct</i>	-31.88	
26 05 36 00-0589	EA		24" Wide, 24" Radius, Horizontal 45 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	273.31	133.20
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-16.23	
			<i>For 30 Degree Bend, Deduct</i>	-72.64	
			<i>For 60 Degree Bend, Deduct</i>	-39.15	
26 05 36 00-0590	EA		30" Wide, 24" Radius, Horizontal 45 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	318.88	154.51
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-19.02	
			<i>For 30 Degree Bend, Deduct</i>	-85.27	
			<i>For 60 Degree Bend, Deduct</i>	-46.01	
26 05 36 00-0591	EA		36" Wide, 24" Radius, Horizontal 45 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	376.87	183.94
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-22.36	
			<i>For 30 Degree Bend, Deduct</i>	-100.00	
			<i>For 60 Degree Bend, Deduct</i>	-53.87	
26 05 36 00-0592			36" Radius, Horizontal 45 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0551)</small>		
26 05 36 00-0593	EA		6" Wide, 36" Radius, Horizontal 45 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	153.40	62.25
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-10.16	
			<i>For 30 Degree Bend, Deduct</i>	-48.08	
			<i>For 60 Degree Bend, Deduct</i>	-26.77	
26 05 36 00-0594	EA		9" Wide, 36" Radius, Horizontal 45 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	178.48	75.60
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-11.55	
			<i>For 30 Degree Bend, Deduct</i>	-54.07	
			<i>For 60 Degree Bend, Deduct</i>	-29.92	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-0595	EA			12" Wide, 36" Radius, Horizontal 45 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 30 Degree Bend, Deduct</i> <i>For 60 Degree Bend, Deduct</i>	199.84 -12.67 -58.73 -32.31	87.75
26 05 36 00-0596	EA			18" Wide, 36" Radius, Horizontal 45 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 30 Degree Bend, Deduct</i> <i>For 60 Degree Bend, Deduct</i>	247.41 -15.27 -69.81 -38.10	113.57
26 05 36 00-0597	EA			24" Wide, 36" Radius, Horizontal 45 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 30 Degree Bend, Deduct</i> <i>For 60 Degree Bend, Deduct</i>	299.66 -18.05 -81.43 -44.09	142.93
26 05 36 00-0598	EA			30" Wide, 36" Radius, Horizontal 45 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 30 Degree Bend, Deduct</i> <i>For 60 Degree Bend, Deduct</i>	358.95 -21.91 -99.54 -54.13	167.78
26 05 36 00-0599	EA			36" Wide, 36" Radius, Horizontal 45 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 30 Degree Bend, Deduct</i> <i>For 60 Degree Bend, Deduct</i>	426.73 -25.75 -116.22 -62.96	203.09
26 05 36 00-0600				12" Radius, Vertical 90 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0551)</small>		
26 05 36 00-0601	EA			6" Wide, 12" Radius, Vertical 90 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	182.63 -11.56	80.44
26 05 36 00-0602	EA			9" Wide, 12" Radius, Vertical 90 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	202.84 -12.63	91.85
26 05 36 00-0603	EA			12" Wide, 12" Radius, Vertical 90 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	220.63 -13.60	101.58
26 05 36 00-0604	EA			18" Wide, 12" Radius, Vertical 90 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	261.11 -15.74	124.51
26 05 36 00-0605	EA			24" Wide, 12" Radius, Vertical 90 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	294.08 -17.50	142.93
26 05 36 00-0606	EA			30" Wide, 12" Radius, Vertical 90 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	328.41 -19.44	160.86
26 05 36 00-0607	EA			36" Wide, 12" Radius, Vertical 90 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	368.60 -21.56	183.62
26 05 36 00-0608				24" Radius, Vertical 90 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0551)</small>		
26 05 36 00-0609	EA			6" Wide, 24" Radius, Vertical 90 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	208.51 -13.86	83.89
26 05 36 00-0610	EA			9" Wide, 24" Radius, Vertical 90 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	231.21 -15.08	96.51
26 05 36 00-0611	EA			12" Wide, 24" Radius, Vertical 90 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	251.88 -16.25	107.22
26 05 36 00-0612	EA			18" Wide, 24" Radius, Vertical 90 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	299.00 -18.80	133.20
26 05 36 00-0613	EA			24" Wide, 24" Radius, Vertical 90 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	338.42 -20.97	154.51
26 05 36 00-0614	EA			30" Wide, 24" Radius, Vertical 90 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	377.69 -23.16	175.34
26 05 36 00-0615	EA			36" Wide, 24" Radius, Vertical 90 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	434.55 -26.53	203.09
26 05 36 00-0616				36" Radius, Vertical 90 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0551)</small>		
26 05 36 00-0617	EA			6" Wide, 36" Radius, Vertical 90 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	238.83 -16.58	87.67

26 Electrical**26 05 Common Work Results For Electrical****26 05 36 Cable Trays For Electrical Systems**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-0618 EA 9" Wide, 36" Radius, Vertical 90 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	265.30	101.58
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-18.07	
26 05 36 00-0619 EA 12" Wide, 36" Radius, Vertical 90 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	286.50	113.57
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-19.18	
26 05 36 00-0620 EA 18" Wide, 36" Radius, Vertical 90 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	343.21	142.93
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-22.41	
26 05 36 00-0621 EA 24" Wide, 36" Radius, Vertical 90 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	385.75	167.78
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-24.59	
26 05 36 00-0622 EA 30" Wide, 36" Radius, Vertical 90 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	442.33	193.04
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-28.15	
26 05 36 00-0623 EA 36" Wide, 36" Radius, Vertical 90 Degree Elbows, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting	506.38	226.81
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-31.74	
26 05 36 00-0624 12" Radius, Horizontal Tees, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0551)</small>		
26 05 36 00-0625 EA 6" Wide, 12" Radius, Horizontal Tees, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	329.87	154.51
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-20.11	
26 05 36 00-0626 EA 9" Wide, 12" Radius, Horizontal Tees, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	357.47	167.78
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-21.76	
26 05 36 00-0627 EA 12" Wide, 12" Radius, Horizontal Tees, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	374.39	175.34
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-22.83	
26 05 36 00-0628 EA 18" Wide, 12" Radius, Horizontal Tees, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	415.74	193.04
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-25.49	
26 05 36 00-0629 EA 24" Wide, 12" Radius, Horizontal Tees, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	467.38	214.26
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-28.88	
26 05 36 00-0630 EA 30" Wide, 12" Radius, Horizontal Tees, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	510.52	227.21
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-32.12	
26 05 36 00-0631 EA 36" Wide, 12" Radius, Horizontal Tees, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	577.88	257.22
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-36.35	
26 05 36 00-0632 24" Radius, Horizontal Tees, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0551)</small>		
26 05 36 00-0633 EA 6" Wide, 24" Radius, Horizontal Tees, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	393.14	167.78
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-25.33	
26 05 36 00-0634 EA 9" Wide, 24" Radius, Horizontal Tees, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	425.40	183.94
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-27.21	
26 05 36 00-0635 EA 12" Wide, 24" Radius, Horizontal Tees, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	444.92	193.04
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-28.41	
26 05 36 00-0636 EA 18" Wide, 24" Radius, Horizontal Tees, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	490.08	214.26
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-31.15	
26 05 36 00-0637 EA 24" Wide, 24" Radius, Horizontal Tees, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	546.98	241.30
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-34.59	
26 05 36 00-0638 EA 30" Wide, 24" Radius, Horizontal Tees, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	586.52	257.22
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-37.22	
26 05 36 00-0639 EA 36" Wide, 24" Radius, Horizontal Tees, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	697.35	297.20
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-44.97	
26 05 36 00-0640 36" Radius, Horizontal Tees, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0551)</small>		
26 05 36 00-0641 EA 6" Wide, 36" Radius, Horizontal Tees, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	476.19	183.94
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-32.29	
26 05 36 00-0642 EA 9" Wide, 36" Radius, Horizontal Tees, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	514.67	203.09
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-34.54	
26 05 36 00-0643 EA 12" Wide, 36" Radius, Horizontal Tees, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	545.19	214.26
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-36.66	
26 05 36 00-0644 EA 18" Wide, 36" Radius, Horizontal Tees, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	604.25	241.30
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-40.32	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-0645 EA 24" Wide, 36" Radius, Horizontal Tees, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	687.11	275.48
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-45.76	
26 05 36 00-0646 EA 30" Wide, 36" Radius, Horizontal Tees, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	743.82	297.20
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-49.62	
26 05 36 00-0647 EA 36" Wide, 36" Radius, Horizontal Tees, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	851.47	350.68
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-55.92	
26 05 36 00-0648 12" Radius, Vertical Tees, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0551)</small>		
26 05 36 00-0649 EA 6" Wide, 12" Radius, Vertical Tees, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	361.44	142.93
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-24.23	
26 05 36 00-0650 EA 9" Wide, 12" Radius, Vertical Tees, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	371.91	148.55
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-24.81	
26 05 36 00-0651 EA 12" Wide, 12" Radius, Vertical Tees, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	382.82	154.51
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-25.41	
26 05 36 00-0652 EA 18" Wide, 12" Radius, Vertical Tees, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	407.18	167.78
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-26.74	
26 05 36 00-0653 EA 24" Wide, 12" Radius, Vertical Tees, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	421.95	175.34
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-27.58	
26 05 36 00-0654 EA 30" Wide, 12" Radius, Vertical Tees, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	460.05	193.04
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-29.92	
26 05 36 00-0655 EA 36" Wide, 12" Radius, Vertical Tees, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	500.89	214.26
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-32.23	
26 05 36 00-0656 24" Radius, Vertical Tees, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0551)</small>		
26 05 36 00-0657 EA 6" Wide, 24" Radius, Vertical Tees, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	480.09	154.51
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-35.14	
26 05 36 00-0658 EA 9" Wide, 24" Radius, Vertical Tees, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	493.98	160.86
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-35.99	
26 05 36 00-0659 EA 12" Wide, 24" Radius, Vertical Tees, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	508.77	167.78
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-36.89	
26 05 36 00-0660 EA 18" Wide, 24" Radius, Vertical Tees, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	542.12	183.94
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-38.89	
26 05 36 00-0661 EA 24" Wide, 24" Radius, Vertical Tees, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	563.80	193.04
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-40.29	
26 05 36 00-0662 EA 30" Wide, 24" Radius, Vertical Tees, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	605.71	214.26
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-42.71	
26 05 36 00-0663 EA 36" Wide, 24" Radius, Vertical Tees, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	661.53	241.30
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-46.05	
26 05 36 00-0664 36" Radius, Vertical Tees, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0551)</small>		
26 05 36 00-0665 EA 6" Wide, 36" Radius, Vertical Tees, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	695.74	167.78
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-55.59	
26 05 36 00-0666 EA 9" Wide, 36" Radius, Vertical Tees, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	713.74	175.34
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-56.76	
26 05 36 00-0667 EA 12" Wide, 36" Radius, Vertical Tees, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	733.40	183.94
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-58.01	
26 05 36 00-0668 EA 18" Wide, 36" Radius, Vertical Tees, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	770.80	203.09
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-60.15	
26 05 36 00-0669 EA 24" Wide, 36" Radius, Vertical Tees, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	794.84	214.26
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-61.63	
26 05 36 00-0670 EA 30" Wide, 36" Radius, Vertical Tees, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	856.06	241.30
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-65.50	
26 05 36 00-0671 EA 36" Wide, 36" Radius, Vertical Tees, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	918.38	275.48
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-68.88	

26 Electrical**26 05 Common Work Results For Electrical****26 05 36 Cable Trays For Electrical Systems**

MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
26 05 36 00-0672		12" Radius, Horizontal Crosses, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0551)</small>			
26 05 36 00-0673	EA	6" Wide, 12" Radius, Horizontal Crosses, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	411.42		193.04
		<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-25.06		
26 05 36 00-0674	EA	9" Wide, 12" Radius, Horizontal Crosses, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	432.53		203.09
		<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-26.33		
26 05 36 00-0675	EA	12" Wide, 12" Radius, Horizontal Crosses, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	459.82		214.26
		<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-28.12		
26 05 36 00-0676	EA	18" Wide, 12" Radius, Horizontal Crosses, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	491.06		227.21
		<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-30.17		
26 05 36 00-0677	EA	24" Wide, 12" Radius, Horizontal Crosses, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	554.10		257.22
		<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-33.97		
26 05 36 00-0678	EA	30" Wide, 12" Radius, Horizontal Crosses, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	609.30		275.48
		<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-37.98		
26 05 36 00-0679	EA	36" Wide, 12" Radius, Horizontal Crosses, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	662.77		297.20
		<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-41.51		
26 05 36 00-0680		24" Radius, Horizontal Crosses, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0551)</small>			
26 05 36 00-0681	EA	6" Wide, 24" Radius, Horizontal Crosses, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	531.15		214.26
		<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-35.26		
26 05 36 00-0682	EA	9" Wide, 24" Radius, Horizontal Crosses, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	558.07		227.21
		<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-36.87		
26 05 36 00-0683	EA	12" Wide, 24" Radius, Horizontal Crosses, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	586.96		241.30
		<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-38.59		
26 05 36 00-0684	EA	18" Wide, 24" Radius, Horizontal Crosses, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	625.43		257.22
		<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-41.11		
26 05 36 00-0685	EA	24" Wide, 24" Radius, Horizontal Crosses, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	704.92		297.20
		<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-45.73		
26 05 36 00-0686	EA	30" Wide, 24" Radius, Horizontal Crosses, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	759.92		321.72
		<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-49.18		
26 05 36 00-0687	EA	36" Wide, 24" Radius, Horizontal Crosses, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	843.90		350.68
		<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-55.16		
26 05 36 00-0688		36" Radius, Horizontal Crosses, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0551)</small>			
26 05 36 00-0689	EA	6" Wide, 36" Radius, Horizontal Crosses, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	645.32		241.30
		<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-44.42		
26 05 36 00-0690	EA	9" Wide, 36" Radius, Horizontal Crosses, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	682.71		257.22
		<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-46.83		
26 05 36 00-0691	EA	12" Wide, 36" Radius, Horizontal Crosses, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	723.86		275.48
		<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-49.43		
26 05 36 00-0692	EA	18" Wide, 36" Radius, Horizontal Crosses, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	787.05		297.20
		<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-53.94		
26 05 36 00-0693	EA	24" Wide, 36" Radius, Horizontal Crosses, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	908.74		350.68
		<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-61.65		
26 05 36 00-0694	EA	30" Wide, 36" Radius, Horizontal Crosses, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	993.65		385.43
		<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-67.24		
26 05 36 00-0695	EA	36" Wide, 36" Radius, Horizontal Crosses, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	1,093.83		429.34
		<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-73.60		
26 05 36 00-0696		12" Radius, Vertical Crosses, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0551)</small>			
26 05 36 00-0697	EA	6" Wide, 12" Radius, Vertical Crosses, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	451.78		193.04
		<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-29.09		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-0698 EA 9" Wide, 12" Radius, Vertical Crosses, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	474.96	203.17
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-30.56	
26 05 36 00-0699 EA 12" Wide, 12" Radius, Vertical Crosses, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	505.96	214.26
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-32.74	
26 05 36 00-0700 EA 18" Wide, 12" Radius, Vertical Crosses, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	541.79	227.29
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-35.24	
26 05 36 00-0701 EA 24" Wide, 12" Radius, Vertical Crosses, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	610.52	257.22
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-39.62	
26 05 36 00-0702 EA 30" Wide, 12" Radius, Vertical Crosses, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	677.11	275.56
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-44.75	
26 05 36 00-0703 EA 36" Wide, 12" Radius, Vertical Crosses, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	737.55	296.79
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-49.02	
26 05 36 00-0704 24" Radius, Vertical Crosses, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0551)</small>		
26 05 36 00-0705 EA 6" Wide, 24" Radius, Vertical Crosses, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	609.44	214.26
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-43.09	
26 05 36 00-0706 EA 9" Wide, 24" Radius, Vertical Crosses, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	638.80	227.21
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-44.95	
26 05 36 00-0707 EA 12" Wide, 24" Radius, Vertical Crosses, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	670.12	241.30
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-46.90	
26 05 36 00-0708 EA 18" Wide, 24" Radius, Vertical Crosses, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	713.94	257.22
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-49.96	
26 05 36 00-0709 EA 24" Wide, 24" Radius, Vertical Crosses, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	799.27	297.20
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-55.16	
26 05 36 00-0710 EA 30" Wide, 24" Radius, Vertical Crosses, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	860.59	321.72
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-59.25	
26 05 36 00-0711 EA 36" Wide, 24" Radius, Vertical Crosses, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	960.62	350.68
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-66.84	
26 05 36 00-0712 36" Radius, Vertical Crosses, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting <small>(26 05 36 00-0551)</small>		
26 05 36 00-0713 EA 6" Wide, 36" Radius, Vertical Crosses, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	754.74	241.30
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-55.37	
26 05 36 00-0714 EA 9" Wide, 36" Radius, Vertical Crosses, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	796.99	257.22
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-58.26	
26 05 36 00-0715 EA 12" Wide, 36" Radius, Vertical Crosses, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	843.00	275.48
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-61.35	
26 05 36 00-0716 EA 18" Wide, 36" Radius, Vertical Crosses, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	918.36	297.20
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-67.07	
26 05 36 00-0717 EA 24" Wide, 36" Radius, Vertical Crosses, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	1,054.64	350.68
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-76.24	
26 05 36 00-0718 EA 30" Wide, 36" Radius, Vertical Crosses, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	1,151.71	385.43
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-83.05	
26 05 36 00-0719 EA 36" Wide, 36" Radius, Vertical Crosses, 12" Rung Spacing, 4-5/8" High, Ladder Bottom Galvanized Steel Cable Tray Fitting.....	1,264.04	429.34
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-90.63	
26 05 36 00-0720 Dropout Or End Plates And Reducers <small>(26 05 36 00-0002)</small>		
26 05 36 00-0721 Straight Reducers <small>(26 05 36 00-0720)</small>		
26 05 36 00-0722 EA 9"-6" Reducer, Steel Cable Tray.....	154.20	59.36
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-10.47	
26 05 36 00-0723 EA 12"-9" Reducer, Steel Cable Tray.....	163.57	64.27
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-11.00	
26 05 36 00-0724 EA 18"-12" Reducer, Steel Cable Tray.....	180.11	74.16
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-11.83	
26 05 36 00-0725 EA 24"-18" Reducer, Steel Cable Tray.....	200.65	85.82
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-12.91	
26 05 36 00-0726 EA 30"-24" Reducer, Steel Cable Tray.....	219.70	96.51
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-13.93	

26 Electrical**26 05 Common Work Results For Electrical****26 05 36 Cable Trays For Electrical Systems**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-0727 EA 36"-30" Reducer, Steel Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	249.84 -15.79	110.27
26 05 36 00-0728 Reducers <small>(26 05 36 00-0720)</small>		
26 05 36 00-0729 EA 18"-6" Reducer, Steel Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	182.59 -12.07	74.24
26 05 36 00-0730 EA 24"-12" Reducer, Steel Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	203.26 -13.17	85.90
26 05 36 00-0731 EA 30"-12" Reducer, Steel Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	224.37 -14.40	96.43
26 05 36 00-0732 EA 30"-18" Reducer, Steel Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	226.65 -14.63	96.35
26 05 36 00-0733 EA 36"-12" Reducer, Steel Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	251.04 -15.91	110.27
26 05 36 00-0734 EA 36"-18" Reducer, Steel Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	258.28 -16.40	113.17
26 05 36 00-0735 EA 36"-24" Reducer, Steel Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	266.71 -16.94	116.79
26 05 36 00-0736 Dropout Or End Plate <small>(26 05 36 00-0720)</small>		
26 05 36 00-0737 EA 6" Dropout Or End Plate, Steel Cable Tray.....	46.39	24.13
26 05 36 00-0738 EA 9" Dropout Or End Plate, Steel Cable Tray.....	53.19	27.58
26 05 36 00-0739 EA 12" Dropout Or End Plate, Steel Cable Tray.....	57.39	29.68
26 05 36 00-0740 EA 18" Dropout Or End Plate, Steel Cable Tray.....	67.78	35.07
26 05 36 00-0741 EA 24" Dropout Or End Plate, Steel Cable Tray.....	75.64	38.61
26 05 36 00-0742 EA 30" Dropout Or End Plate, Steel Cable Tray.....	83.87	42.87
26 05 36 00-0743 EA 36" Dropout Or End Plate, Steel Cable Tray.....	94.61	48.26
26 05 36 00-0744 Ladder Bottom Aluminum Cable Tray <small>(26 05 36 00-0001)</small> Note: 4-5/8" Height		
26 05 36 00-0745 Straight Tray Sections <small>(26 05 36 00-0744)</small>		
26 05 36 00-0746 4" Rung Spacing <small>(26 05 36 00-0745)</small>		
26 05 36 00-0747 LF 6" Aluminum Cable Tray, 4" Rung Spacing, Straight Section <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i> <i>For Class 12C Instead Of Class 12B, Add</i>	23.81 -1.91 1.19 2.63	5.63
26 05 36 00-0748 LF 9" Aluminum Cable Tray, 4" Rung Spacing, Straight Section <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i> <i>For Class 12C Instead Of Class 12B, Add</i>	25.13 -2.02 1.26 2.78	5.95
26 05 36 00-0749 LF 12" Aluminum Cable Tray, 4" Rung Spacing, Straight Section <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i> <i>For Class 12C Instead Of Class 12B, Add</i>	26.43 -2.13 1.32 2.93	6.19
26 05 36 00-0750 LF 18" Aluminum Cable Tray, 4" Rung Spacing, Straight Section <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i> <i>For Class 12C Instead Of Class 12B, Add</i>	29.23 -2.36 1.46 3.25	6.76
26 05 36 00-0751 LF 24" Aluminum Cable Tray, 4" Rung Spacing, Straight Section <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i> <i>For Class 12C Instead Of Class 12B, Add</i>	32.93 -2.69 1.65 3.74	7.24
26 05 36 00-0752 LF 30" Aluminum Cable Tray, 4" Rung Spacing, Straight Section <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i> <i>For Class 12C Instead Of Class 12B, Add</i>	35.85 -2.94 1.79 4.10	7.72
26 05 36 00-0753 LF 36" Aluminum Cable Tray, 4" Rung Spacing, Straight Section <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i> <i>For Class 12C Instead Of Class 12B, Add</i>	38.56 -3.17 1.93 4.41	8.21
26 05 36 00-0754 6" Rung Spacing <small>(26 05 36 00-0745)</small>		
26 05 36 00-0755 LF 6" Aluminum Cable Tray, 6" Rung Spacing, Straight Section <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i> <i>For Class 12C Instead Of Class 12B, Add</i>	22.50 -1.78 1.13 2.43	5.63
26 05 36 00-0756 LF 9" Aluminum Cable Tray, 6" Rung Spacing, Straight Section <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i> <i>For Class 12C Instead Of Class 12B, Add</i>	23.74 -1.88 1.19 2.57	5.95
26 05 36 00-0757 LF 12" Aluminum Cable Tray, 6" Rung Spacing, Straight Section <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i> <i>For Class 12C Instead Of Class 12B, Add</i>	24.97 -1.98 1.25 2.71	6.19
26 05 36 00-0758 LF 18" Aluminum Cable Tray, 6" Rung Spacing, Straight Section <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i> <i>For Class 12C Instead Of Class 12B, Add</i>	27.60 -2.19 1.38 3.01	6.76



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-0759 LF 24" Aluminum Cable Tray, 6" Rung Spacing, Straight Section	31.02	7.24
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-2.50	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	1.55	
<i>For Class 12C Instead Of Class 12B, Add</i>	3.45	
26 05 36 00-0760 LF 30" Aluminum Cable Tray, 6" Rung Spacing, Straight Section	33.76	7.72
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-2.74	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	1.69	
<i>For Class 12C Instead Of Class 12B, Add</i>	3.78	
26 05 36 00-0761 LF 36" Aluminum Cable Tray, 6" Rung Spacing, Straight Section	36.30	8.21
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-2.95	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	1.82	
<i>For Class 12C Instead Of Class 12B, Add</i>	4.08	
26 05 36 00-0762 9" Rung Spacing <small>(26 05 36 00-0745)</small>		
26 05 36 00-0763 LF 6" Aluminum Cable Tray, 9" Rung Spacing, Straight Section	20.51	5.39
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-1.60	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	1.03	
<i>For Class 12C Instead Of Class 12B, Add</i>	2.17	
26 05 36 00-0764 LF 9" Aluminum Cable Tray, 9" Rung Spacing, Straight Section	20.97	5.63
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-1.63	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	1.05	
<i>For Class 12C Instead Of Class 12B, Add</i>	2.20	
26 05 36 00-0765 LF 12" Aluminum Cable Tray, 9" Rung Spacing, Straight Section	22.32	5.95
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-1.74	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	1.12	
<i>For Class 12C Instead Of Class 12B, Add</i>	2.36	
26 05 36 00-0766 LF 18" Aluminum Cable Tray, 9" Rung Spacing, Straight Section	23.87	6.35
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-1.86	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	1.19	
<i>For Class 12C Instead Of Class 12B, Add</i>	2.52	
26 05 36 00-0767 LF 24" Aluminum Cable Tray, 9" Rung Spacing, Straight Section	26.29	6.60
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-2.08	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	1.31	
<i>For Class 12C Instead Of Class 12B, Add</i>	2.85	
26 05 36 00-0768 LF 30" Aluminum Cable Tray, 9" Rung Spacing, Straight Section	28.92	7.08
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-2.30	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	1.45	
<i>For Class 12C Instead Of Class 12B, Add</i>	3.15	
26 05 36 00-0769 LF 36" Aluminum Cable Tray, 9" Rung Spacing, Straight Section	30.89	7.72
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-2.44	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	1.54	
<i>For Class 12C Instead Of Class 12B, Add</i>	3.34	
26 05 36 00-0770 12" Rung Spacing <small>(26 05 36 00-0745)</small>		
26 05 36 00-0771 LF 6" Aluminum Cable Tray, 12" Rung Spacing, Straight Section	20.00	5.23
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-1.57	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	1.00	
<i>For Class 12C Instead Of Class 12B, Add</i>	2.13	
26 05 36 00-0772 LF 9" Aluminum Cable Tray, 12" Rung Spacing, Straight Section	20.38	5.39
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-1.59	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	1.02	
<i>For Class 12C Instead Of Class 12B, Add</i>	2.16	
26 05 36 00-0773 LF 12" Aluminum Cable Tray, 12" Rung Spacing, Straight Section	21.30	5.71
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-1.65	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	1.07	
<i>For Class 12C Instead Of Class 12B, Add</i>	2.24	
26 05 36 00-0774 LF 18" Aluminum Cable Tray, 12" Rung Spacing, Straight Section	22.55	6.03
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-1.75	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	1.13	
<i>For Class 12C Instead Of Class 12B, Add</i>	2.37	
26 05 36 00-0775 LF 24" Aluminum Cable Tray, 12" Rung Spacing, Straight Section	24.10	6.11
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-1.90	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	1.21	
<i>For Class 12C Instead Of Class 12B, Add</i>	2.59	
26 05 36 00-0776 LF 30" Aluminum Cable Tray, 12" Rung Spacing, Straight Section	26.04	6.76
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-2.04	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	1.30	
<i>For Class 12C Instead Of Class 12B, Add</i>	2.78	
26 05 36 00-0777 LF 36" Aluminum Cable Tray, 12" Rung Spacing, Straight Section	27.75	7.32
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-2.17	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	1.39	
<i>For Class 12C Instead Of Class 12B, Add</i>	2.95	
26 05 36 00-0778 18" Rung Spacing <small>(26 05 36 00-0745)</small>		
26 05 36 00-0779 LF 6" Aluminum Cable Tray, 18" Rung Spacing, Straight Section	19.71	5.07
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-1.55	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	0.99	
<i>For Class 12C Instead Of Class 12B, Add</i>	2.11	
26 05 36 00-0780 LF 9" Aluminum Cable Tray, 18" Rung Spacing, Straight Section	19.89	5.31
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-1.55	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	0.99	
<i>For Class 12C Instead Of Class 12B, Add</i>	2.11	

26 Electrical**26 05 Common Work Results For Electrical****26 05 36 Cable Trays For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-0781	LF	12"	Aluminum Cable Tray, 18" Rung Spacing, Straight Section <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i> <i>For Class 12C Instead Of Class 12B, Add</i>	20.90 -1.63 1.05 2.22	5.47
26 05 36 00-0782	LF	18"	Aluminum Cable Tray, 18" Rung Spacing, Straight Section <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i> <i>For Class 12C Instead Of Class 12B, Add</i>	22.00 -1.72 1.10 2.34	5.79
26 05 36 00-0783	LF	24"	Aluminum Cable Tray, 18" Rung Spacing, Straight Section <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i> <i>For Class 12C Instead Of Class 12B, Add</i>	23.11 -1.82 1.16 2.49	5.87
26 05 36 00-0784	LF	30"	Aluminum Cable Tray, 18" Rung Spacing, Straight Section <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i> <i>For Class 12C Instead Of Class 12B, Add</i>	24.45 -1.91 1.22 2.60	6.43
26 05 36 00-0785	LF	36"	Aluminum Cable Tray, 18" Rung Spacing, Straight Section <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i> <i>For Class 12C Instead Of Class 12B, Add</i>	26.12 -2.03 1.31 2.75	7.00
26 05 36 00-0786			4" Rung Tray Fittings (26 05 36 00-0744)		
26 05 36 00-0787			90 Degree, 12" Radius Horizontal Elbows (26 05 36 00-0786)		
26 05 36 00-0788	EA	6"	Horizontal 90 Degree Elbow, 4" Rung Spacing, 12" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	194.43 -12.72 9.72	80.68
26 05 36 00-0789	EA	9"	Horizontal 90 Degree Elbow, 4" Rung Spacing, 12" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	214.68 -13.81 10.73	91.85
26 05 36 00-0790	EA	12"	Horizontal 90 Degree Elbow, 4" Rung Spacing, 12" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	242.19 -15.76 12.11	101.58
26 05 36 00-0791	EA	18"	Horizontal 90 Degree Elbow, 4" Rung Spacing, 12" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	289.56 -18.58 14.48	124.51
26 05 36 00-0792	EA	24"	Horizontal 90 Degree Elbow, 4" Rung Spacing, 12" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	340.04 -22.09 17.00	142.93
26 05 36 00-0793	EA	30"	Horizontal 90 Degree Elbow, 4" Rung Spacing, 12" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	375.99 -24.19 18.80	160.86
26 05 36 00-0794	EA	36"	Horizontal 90 Degree Elbow, 4" Rung Spacing, 12" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	437.10 -28.39 21.86	183.86
26 05 36 00-0795			90 Degree, 24" Radius Horizontal Elbows (26 05 36 00-0786)		
26 05 36 00-0796	EA	6"	Horizontal 90 Degree Elbow, 4" Rung Spacing, 24" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	246.19 -17.63 12.31	83.89
26 05 36 00-0797	EA	9"	Horizontal 90 Degree Elbow, 4" Rung Spacing, 24" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	271.65 -19.13 13.58	96.43
26 05 36 00-0798	EA	12"	Horizontal 90 Degree Elbow, 4" Rung Spacing, 24" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	294.96 -20.56 14.75	107.22
26 05 36 00-0799	EA	18"	Horizontal 90 Degree Elbow, 4" Rung Spacing, 24" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	348.05 -23.71 17.40	133.20
26 05 36 00-0800	EA	24"	Horizontal 90 Degree Elbow, 4" Rung Spacing, 24" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	395.72 -26.70 19.79	154.51
26 05 36 00-0801	EA	30"	Horizontal 90 Degree Elbow, 4" Rung Spacing, 24" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	443.44 -29.73 22.17	175.34
26 05 36 00-0802	EA	36"	Horizontal 90 Degree Elbow, 4" Rung Spacing, 24" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	508.68 -33.94 25.43	203.09
26 05 36 00-0803			90 Degree, 36" Radius Horizontal Elbows (26 05 36 00-0786)		
26 05 36 00-0804	EA	6"	Horizontal 90 Degree Elbow, 4" Rung Spacing, 36" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	263.13 -19.01 13.16	87.67
26 05 36 00-0805	EA	9"	Horizontal 90 Degree Elbow, 4" Rung Spacing, 36" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	289.15 -20.46 14.46	101.50
26 05 36 00-0806	EA	12"	Horizontal 90 Degree Elbow, 4" Rung Spacing, 36" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	323.05 -22.84 16.15	113.57
26 05 36 00-0807	EA	18"	Horizontal 90 Degree Elbow, 4" Rung Spacing, 36" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	388.66 -26.95 19.43	142.93



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-0808 EA 24" Horizontal 90 Degree Elbow, 4" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	449.83	167.78
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-31.00	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	22.49	
26 05 36 00-0809 EA 30" Horizontal 90 Degree Elbow, 4" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	508.61	193.04
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-34.78	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	25.43	
26 05 36 00-0810 EA 36" Horizontal 90 Degree Elbow, 4" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	592.19	226.81
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-40.32	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	29.61	
26 05 36 00-0811 45 Degree, 12" Radius Horizontal Elbows <small>(26 05 36 00-0786)</small>		
26 05 36 00-0812 EA 6" Horizontal 45 Degree Elbow, 4" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	136.92	58.47
<i>For 30 Degree Bend, Deduct</i>	-41.21	
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-8.82	
<i>For 60 Degree Bend, Deduct</i>	-22.78	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	6.85	
26 05 36 00-0813 EA 9" Horizontal 45 Degree Elbow, 4" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	157.86	70.13
<i>For 30 Degree Bend, Deduct</i>	-45.93	
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-9.94	
<i>For 60 Degree Bend, Deduct</i>	-25.22	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	7.89	
26 05 36 00-0814 EA 12" Horizontal 45 Degree Elbow, 4" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	176.59	80.44
<i>For 30 Degree Bend, Deduct</i>	-50.21	
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-10.96	
<i>For 60 Degree Bend, Deduct</i>	-27.44	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	8.83	
26 05 36 00-0815 EA 18" Horizontal 45 Degree Elbow, 4" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	219.54	101.66
<i>For 30 Degree Bend, Deduct</i>	-61.46	
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-13.48	
<i>For 60 Degree Bend, Deduct</i>	-33.49	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	10.98	
26 05 36 00-0816 EA 24" Horizontal 45 Degree Elbow, 4" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	269.81	124.51
<i>For 30 Degree Bend, Deduct</i>	-75.77	
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-16.61	
<i>For 60 Degree Bend, Deduct</i>	-41.31	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	13.49	
26 05 36 00-0817 EA 30" Horizontal 45 Degree Elbow, 4" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	309.65	142.93
<i>For 30 Degree Bend, Deduct</i>	-86.92	
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-19.05	
<i>For 60 Degree Bend, Deduct</i>	-47.39	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	15.48	
26 05 36 00-0818 EA 36" Horizontal 45 Degree Elbow, 4" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	354.11	167.78
<i>For 30 Degree Bend, Deduct</i>	-96.88	
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-21.43	
<i>For 60 Degree Bend, Deduct</i>	-52.53	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	17.71	
26 05 36 00-0819 45 Degree, 24" Radius Horizontal Elbows <small>(26 05 36 00-0786)</small>		
26 05 36 00-0820 EA 6" Horizontal 45 Degree Elbow, 4" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	153.67	60.32
<i>For 30 Degree Bend, Deduct</i>	-49.35	
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-10.34	
<i>For 60 Degree Bend, Deduct</i>	-27.60	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	7.68	
26 05 36 00-0821 EA 9" Horizontal 45 Degree Elbow, 4" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	180.46	72.71
<i>For 30 Degree Bend, Deduct</i>	-56.83	
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-11.99	
<i>For 60 Degree Bend, Deduct</i>	-31.68	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	9.02	
26 05 36 00-0822 EA 12" Horizontal 45 Degree Elbow, 4" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	200.71	83.97
<i>For 30 Degree Bend, Deduct</i>	-61.42	
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-13.07	
<i>For 60 Degree Bend, Deduct</i>	-34.05	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	10.04	
26 05 36 00-0823 EA 18" Horizontal 45 Degree Elbow, 4" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	244.06	107.22
<i>For 30 Degree Bend, Deduct</i>	-71.68	
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-15.47	
<i>For 60 Degree Bend, Deduct</i>	-39.43	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	12.20	
26 05 36 00-0824 EA 24" Horizontal 45 Degree Elbow, 4" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	297.91	133.20
<i>For 30 Degree Bend, Deduct</i>	-86.17	
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-18.69	
<i>For 60 Degree Bend, Deduct</i>	-47.26	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	14.90	
26 05 36 00-0825 EA 30" Horizontal 45 Degree Elbow, 4" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	348.62	154.51
<i>For 30 Degree Bend, Deduct</i>	-101.63	
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-21.99	
<i>For 60 Degree Bend, Deduct</i>	-55.83	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	17.43	
26 05 36 00-0826 EA 36" Horizontal 45 Degree Elbow, 4" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	402.24	183.94
<i>For 30 Degree Bend, Deduct</i>	-113.95	
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-24.90	
<i>For 60 Degree Bend, Deduct</i>	-62.24	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	20.11	

26 Electrical**26 05 Common Work Results For Electrical****26 05 36 Cable Trays For Electrical Systems**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-0827 45 Degree, 36" Radius Horizontal Elbows <small>(26 05 36 00-0786)</small>		
26 05 36 00-0828 EA 6" Horizontal 45 Degree Elbow, 4" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	175.11	62.25
For 30 Degree Bend, Deduct	-60.02	
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-12.33	
For 60 Degree Bend, Deduct	-33.94	
For 6" Overall Height Instead Of 4-5/8", Add	8.76	
26 05 36 00-0829 EA 9" Horizontal 45 Degree Elbow, 4" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	198.92	75.60
For 30 Degree Bend, Deduct	-65.31	
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-13.59	
For 60 Degree Bend, Deduct	-36.67	
For 6" Overall Height Instead Of 4-5/8", Add	9.95	
26 05 36 00-0830 EA 12" Horizontal 45 Degree Elbow, 4" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	220.69	87.75
For 30 Degree Bend, Deduct	-70.20	
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-14.76	
For 60 Degree Bend, Deduct	-39.19	
For 6" Overall Height Instead Of 4-5/8", Add	11.03	
26 05 36 00-0831 EA 18" Horizontal 45 Degree Elbow, 4" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	271.39	113.57
For 30 Degree Bend, Deduct	-83.00	
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-17.67	
For 60 Degree Bend, Deduct	-46.01	
For 6" Overall Height Instead Of 4-5/8", Add	13.57	
26 05 36 00-0832 EA 24" Horizontal 45 Degree Elbow, 4" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	338.52	142.93
For 30 Degree Bend, Deduct	-102.80	
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-21.94	
For 60 Degree Bend, Deduct	-56.92	
For 6" Overall Height Instead Of 4-5/8", Add	16.93	
26 05 36 00-0833 EA 30" Horizontal 45 Degree Elbow, 4" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	386.02	167.78
For 30 Degree Bend, Deduct	-114.43	
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-24.62	
For 60 Degree Bend, Deduct	-63.06	
For 6" Overall Height Instead Of 4-5/8", Add	19.30	
26 05 36 00-0834 EA 36" Horizontal 45 Degree Elbow, 4" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	455.50	203.09
For 30 Degree Bend, Deduct	-132.05	
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-28.62	
For 60 Degree Bend, Deduct	-72.46	
For 6" Overall Height Instead Of 4-5/8", Add	22.78	
26 05 36 00-0835 90 Degree, 12" Radius Vertical Risers <small>(26 05 36 00-0786)</small>		
26 05 36 00-0836 EA 6" Vertical Riser 90 Degree, 4" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	208.66	80.44
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-14.16	
For 6" Overall Height Instead Of 4-5/8", Add	10.43	
26 05 36 00-0837 EA 9" Vertical Riser 90 Degree, 4" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	231.82	91.85
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-15.53	
For 6" Overall Height Instead Of 4-5/8", Add	11.59	
26 05 36 00-0838 EA 12" Vertical Riser 90 Degree, 4" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	249.30	101.58
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-16.47	
For 6" Overall Height Instead Of 4-5/8", Add	12.47	
26 05 36 00-0839 EA 18" Vertical Riser 90 Degree, 4" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	290.26	124.51
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-18.65	
For 6" Overall Height Instead Of 4-5/8", Add	14.51	
26 05 36 00-0840 EA 24" Vertical Riser 90 Degree, 4" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	325.06	142.93
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-20.59	
For 6" Overall Height Instead Of 4-5/8", Add	16.25	
26 05 36 00-0841 EA 30" Vertical Riser 90 Degree, 4" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	359.00	160.86
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-22.49	
For 6" Overall Height Instead Of 4-5/8", Add	17.95	
26 05 36 00-0842 EA 36" Vertical Riser 90 Degree, 4" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	399.67	183.62
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-24.66	
For 6" Overall Height Instead Of 4-5/8", Add	19.98	
26 05 36 00-0843 90 Degree, 24" Radius Vertical Risers <small>(26 05 36 00-0786)</small>		
26 05 36 00-0844 EA 6" Vertical Riser 90 Degree, 4" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	220.55	83.89
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-15.06	
For 6" Overall Height Instead Of 4-5/8", Add	11.03	
26 05 36 00-0845 EA 9" Vertical Riser 90 Degree, 4" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	244.97	96.51
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-16.45	
For 6" Overall Height Instead Of 4-5/8", Add	12.25	
26 05 36 00-0846 EA 12" Vertical Riser 90 Degree, 4" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	264.87	107.22
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-17.55	
For 6" Overall Height Instead Of 4-5/8", Add	13.24	
26 05 36 00-0847 EA 18" Vertical Riser 90 Degree, 4" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	312.83	133.20
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-20.19	
For 6" Overall Height Instead Of 4-5/8", Add	15.64	
26 05 36 00-0848 EA 24" Vertical Riser 90 Degree, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	353.78	154.51
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-22.51	
For 6" Overall Height Instead Of 4-5/8", Add	17.69	
26 05 36 00-0849 EA 30" Vertical Riser 90 Degree, 4" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	394.00	175.34
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-24.79	
For 6" Overall Height Instead Of 4-5/8", Add	19.70	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-0850 EA 36" Vertical Riser 90 Degree, 4" Rung Spacing, 24" Radius, Aluminum Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	447.04 -27.78 22.35	203.09
26 05 36 00-0851 90 Degree, 36" Radius Vertical Risers <small>(26 05 36 00-0786)</small>		
26 05 36 00-0852 EA 6" Vertical Riser 90 Degree, 4" Rung Spacing, 36" Radius, Aluminum Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	270.95 -19.79 13.55	87.67
26 05 36 00-0853 EA 9" Vertical Riser 90 Degree, 4" Rung Spacing, 36" Radius, Aluminum Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	296.78 -21.22 14.84	101.58
26 05 36 00-0854 EA 12" Vertical Riser 90 Degree, 4" Rung Spacing, 36" Radius, Aluminum Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	325.00 -23.03 16.25	113.57
26 05 36 00-0855 EA 18" Vertical Riser 90 Degree, 4" Rung Spacing, 36" Radius, Aluminum Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	379.33 -26.02 18.97	142.93
26 05 36 00-0856 EA 24" Vertical Riser 90 Degree, 4" Rung Spacing, 36" Radius, Aluminum Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	426.17 -28.63 21.31	167.78
26 05 36 00-0857 EA 30" Vertical Riser 90 Degree, 4" Rung Spacing, 36" Radius, Aluminum Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	479.09 -31.82 23.95	193.04
26 05 36 00-0858 EA 36" Vertical Riser 90 Degree, 4" Rung Spacing, 36" Radius, Aluminum Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	542.11 -35.31 27.11	226.81
26 05 36 00-0859 12" Radius Horizontal Tees <small>(26 05 36 00-0786)</small>		
26 05 36 00-0860 EA 6" Horizontal Tee, 4" Rung Spacing, 12" Radius, Aluminum Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	343.52 -21.48 17.18	154.51
26 05 36 00-0861 EA 9" Horizontal Tee, 4" Rung Spacing, 12" Radius, Aluminum Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	371.37 -23.15 18.57	167.78
26 05 36 00-0862 EA 12" Horizontal Tee, 4" Rung Spacing, 12" Radius, Aluminum Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	385.38 -23.93 19.27	175.34
26 05 36 00-0863 EA 18" Horizontal Tee, 4" Rung Spacing, 12" Radius, Aluminum Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	433.18 -27.23 21.66	193.04
26 05 36 00-0864 EA 24" Horizontal Tee, 4" Rung Spacing, 12" Radius, Aluminum Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	479.90 -30.13 24.00	214.26
26 05 36 00-0865 EA 30" Horizontal Tee, 4" Rung Spacing, 12" Radius, Aluminum Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	521.17 -33.18 26.06	227.21
26 05 36 00-0866 EA 36" Horizontal Tee, 4" Rung Spacing, 12" Radius, Aluminum Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	599.45 -38.51 29.97	257.22
26 05 36 00-0867 24" Radius Horizontal Tees <small>(26 05 36 00-0786)</small>		
26 05 36 00-0868 EA 6" Horizontal Tee, 4" Rung Spacing, 24" Radius, Aluminum Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	426.39 -28.66 21.32	167.78
26 05 36 00-0869 EA 9" Horizontal Tee, 4" Rung Spacing, 24" Radius, Aluminum Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	461.72 -30.85 23.09	183.94
26 05 36 00-0870 EA 12" Horizontal Tee, 4" Rung Spacing, 24" Radius, Aluminum Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	481.15 -32.03 24.06	193.04
26 05 36 00-0871 EA 18" Horizontal Tee, 4" Rung Spacing, 24" Radius, Aluminum Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	530.69 -35.21 26.53	214.26
26 05 36 00-0872 EA 24" Horizontal Tee, 4" Rung Spacing, 24" Radius, Aluminum Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	591.22 -39.01 29.56	241.30
26 05 36 00-0873 EA 30" Horizontal Tee, 4" Rung Spacing, 24" Radius, Aluminum Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	636.14 -42.18 31.81	257.22
26 05 36 00-0874 EA 36" Horizontal Tee, 4" Rung Spacing, 24" Radius, Aluminum Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	812.70 -56.51 40.64	297.20
26 05 36 00-0875 36" Radius Horizontal Tees <small>(26 05 36 00-0786)</small>		
26 05 36 00-0876 EA 6" Horizontal Tee, 4" Rung Spacing, 36" Radius, Aluminum Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	513.92 -36.07 25.70	183.94
26 05 36 00-0877 EA 9" Horizontal Tee, 4" Rung Spacing, 36" Radius, Aluminum Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	551.55 -38.23 27.58	203.09

26 Electrical**26 05 Common Work Results For Electrical****26 05 36 Cable Trays For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-0878	EA		12" Horizontal Tee, 4" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	589.94	214.26
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-41.14	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	29.50	
26 05 36 00-0879	EA		18" Horizontal Tee, 4" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	647.65	241.30
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-44.66	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	32.38	
26 05 36 00-0880	EA		24" Horizontal Tee, 4" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	729.97	275.48
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-50.04	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	36.50	
26 05 36 00-0881	EA		30" Horizontal Tee, 4" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	838.10	297.20
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-59.05	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	41.91	
26 05 36 00-0882	EA		36" Horizontal Tee, 4" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	965.46	350.68
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-67.32	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	48.27	
26 05 36 00-0883			12" Radius Vertical Tees <small>(26 05 36 00-0786)</small>		
26 05 36 00-0884	EA		6" Vertical Tee, 4" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	431.53	142.93
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-31.24	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	21.58	
26 05 36 00-0885	EA		9" Vertical Tee, 4" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	446.56	148.55
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-32.27	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	22.33	
26 05 36 00-0886	EA		12" Vertical Tee, 4" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	457.80	154.51
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-32.91	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	22.89	
26 05 36 00-0887	EA		18" Vertical Tee, 4" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	484.24	167.78
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-34.44	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	24.21	
26 05 36 00-0888	EA		24" Vertical Tee, 4" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	513.77	175.34
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-36.76	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	25.69	
26 05 36 00-0889	EA		30" Vertical Tee, 4" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	547.46	193.04
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-38.66	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	27.37	
26 05 36 00-0890	EA		36" Vertical Tee, 4" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	589.94	214.26
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-41.14	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	29.50	
26 05 36 00-0891			24" Radius Vertical Tees <small>(26 05 36 00-0786)</small>		
26 05 36 00-0892	EA		6" Vertical Tee, 4" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	584.78	154.51
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-45.61	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	29.24	
26 05 36 00-0893	EA		9" Vertical Tee, 4" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	599.66	160.86
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-46.56	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	29.98	
26 05 36 00-0894	EA		12" Vertical Tee, 4" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	615.45	167.78
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-47.56	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	30.77	
26 05 36 00-0895	EA		18" Vertical Tee, 4" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	652.18	183.94
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-49.89	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	32.61	
26 05 36 00-0896	EA		24" Vertical Tee, 4" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	675.85	193.04
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-51.50	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	33.79	
26 05 36 00-0897	EA		30" Vertical Tee, 4" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	719.74	214.26
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-54.12	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	35.99	
26 05 36 00-0898	EA		36" Vertical Tee, 4" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	797.20	241.30
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-59.61	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	39.86	
26 05 36 00-0899			36" Radius Vertical Tee <small>(26 05 36 00-0786)</small>		
26 05 36 00-0900	EA		6" Vertical Tee, 4" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	902.34	167.78
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-76.25	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	45.12	
26 05 36 00-0901	EA		9" Vertical Tee, 4" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	923.03	175.34
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-77.69	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	46.15	
26 05 36 00-0902	EA		12" Vertical Tee, 4" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	945.37	183.94
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-79.21	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	47.27	
26 05 36 00-0903	EA		18" Vertical Tee, 4" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	985.46	203.09
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-81.62	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	49.27	
26 05 36 00-0904	EA		24" Vertical Tee, 4" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	1,012.19	214.26
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-83.36	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	50.61	
26 05 36 00-0905	EA		30" Vertical Tee, 4" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	1,081.45	241.30
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-88.04	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	54.07	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-0906 EA 36" Vertical Tee, 4" Rung Spacing, 36" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	1,146.45 -91.69 57.32	275.48
26 05 36 00-0907 12" Radius Horizontal Crosses <small>(26 05 36 00-0786)</small>		
26 05 36 00-0908 EA 6" Horizontal Cross, 4" Rung Spacing, 12" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	441.64 -28.08 22.08	193.04
26 05 36 00-0909 EA 9" Horizontal Cross, 4" Rung Spacing, 12" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	471.13 -30.19 23.56	203.09
26 05 36 00-0910 EA 12" Horizontal Cross, 4" Rung Spacing, 12" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	491.18 -31.26 24.56	214.26
26 05 36 00-0911 EA 18" Horizontal Cross, 4" Rung Spacing, 12" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	540.92 -35.16 27.05	227.21
26 05 36 00-0912 EA 24" Horizontal Cross, 4" Rung Spacing, 12" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	596.63 -38.23 29.83	257.22
26 05 36 00-0913 EA 30" Horizontal Cross, 4" Rung Spacing, 12" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	656.60 -42.71 32.83	275.48
26 05 36 00-0914 EA 36" Horizontal Cross, 4" Rung Spacing, 12" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	742.16 -49.45 37.11	297.20
26 05 36 00-0915 24" Radius Horizontal Crosses <small>(26 05 36 00-0786)</small>		
26 05 36 00-0916 EA 6" Horizontal Cross, 4" Rung Spacing, 24" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	587.12 -40.85 29.36	214.26
26 05 36 00-0917 EA 9" Horizontal Cross, 4" Rung Spacing, 24" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	615.70 -42.64 30.79	227.21
26 05 36 00-0918 EA 12" Horizontal Cross, 4" Rung Spacing, 24" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	646.24 -44.52 32.31	241.30
26 05 36 00-0919 EA 18" Horizontal Cross, 4" Rung Spacing, 24" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	685.52 -47.12 34.28	257.22
26 05 36 00-0920 EA 24" Horizontal Cross, 4" Rung Spacing, 24" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	774.61 -52.70 38.73	297.20
26 05 36 00-0921 EA 30" Horizontal Cross, 4" Rung Spacing, 24" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	820.81 -55.27 41.04	321.72
26 05 36 00-0922 EA 36" Horizontal Cross, 4" Rung Spacing, 24" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	905.38 -61.31 45.27	350.68
26 05 36 00-0923 36" Radius Horizontal Crosses <small>(26 05 36 00-0786)</small>		
26 05 36 00-0924 EA 6" Horizontal Cross, 4" Rung Spacing, 36" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	673.05 -47.20 33.65	241.30
26 05 36 00-0925 EA 9" Horizontal Cross, 4" Rung Spacing, 36" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	697.23 -48.29 34.86	257.22
26 05 36 00-0926 EA 12" Horizontal Cross, 4" Rung Spacing, 36" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	743.68 -51.41 37.18	275.48
26 05 36 00-0927 EA 18" Horizontal Cross, 4" Rung Spacing, 36" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	814.12 -56.65 40.71	297.20
26 05 36 00-0928 EA 24" Horizontal Cross, 4" Rung Spacing, 36" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	979.57 -68.73 48.98	350.68
26 05 36 00-0929 EA 30" Horizontal Cross, 4" Rung Spacing, 36" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	1,079.79 -75.86 53.99	385.43
26 05 36 00-0930 EA 36" Horizontal Cross, 4" Rung Spacing, 36" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	1,202.33 -84.45 60.12	429.34
26 05 36 00-0931 12" Radius Vertical Cross <small>(26 05 36 00-0786)</small>		
26 05 36 00-0932 EA 6" Vertical Cross, 4" Rung Spacing, 12" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	441.64 -28.08 22.08	193.04
26 05 36 00-0933 EA 9" Vertical Cross, 4" Rung Spacing, 12" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	471.25 -30.19 23.56	203.17

26 Electrical**26 05 Common Work Results For Electrical****26 05 36 Cable Trays For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-0934	EA		12" Vertical Cross, 4" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	491.12	214.26
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-31.26	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	24.56	
26 05 36 00-0935	EA		18" Vertical Cross, 4" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	541.07	227.29
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-35.17	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	27.05	
26 05 36 00-0936	EA		24" Vertical Cross, 4" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	596.63	257.22
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-38.23	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	29.83	
26 05 36 00-0937	EA		30" Vertical Cross, 4" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	656.81	275.56
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-42.72	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	32.84	
26 05 36 00-0938	EA		36" Vertical Cross, 4" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	741.56	296.79
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-49.42	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	37.08	
26 05 36 00-0939			24" Radius Vertical Crosses (26 05 36 00-0786)		
26 05 36 00-0940	EA		6" Vertical Cross, 4" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	587.12	214.26
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-40.85	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	29.36	
26 05 36 00-0941	EA		9" Vertical Cross, 4" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	615.70	227.21
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-42.64	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	30.79	
26 05 36 00-0942	EA		12" Vertical Cross, 4" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	646.24	241.30
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-44.52	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	32.31	
26 05 36 00-0943	EA		18" Vertical Cross, 4" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	685.52	257.22
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-47.12	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	34.28	
26 05 36 00-0944	EA		24" Vertical Cross, 4" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	774.61	297.20
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-52.70	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	38.73	
26 05 36 00-0945	EA		30" Vertical Cross, 4" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	835.31	321.72
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-56.72	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	41.77	
26 05 36 00-0946	EA		36" Vertical Cross, 4" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	921.73	350.68
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-62.95	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	46.09	
26 05 36 00-0947			36" Radius Vertical Crosses (26 05 36 00-0786)		
26 05 36 00-0948	EA		6" Vertical Cross, 4" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	794.94	241.30
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-59.39	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	39.75	
26 05 36 00-0949	EA		9" Vertical Cross, 4" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	837.89	257.22
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-62.35	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	41.89	
26 05 36 00-0950	EA		12" Vertical Cross, 4" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	892.78	275.48
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-66.32	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	44.64	
26 05 36 00-0951	EA		18" Vertical Cross, 4" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	957.60	297.20
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-71.00	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	47.88	
26 05 36 00-0952	EA		24" Vertical Cross, 4" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	1,157.34	350.68
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-86.51	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	57.87	
26 05 36 00-0953	EA		30" Vertical Cross, 4" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	1,276.60	385.43
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-95.54	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	63.83	
26 05 36 00-0954	EA		36" Vertical Cross, 4" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	1,421.36	429.34
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-106.36	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	71.07	
26 05 36 00-0955			6" Rung Tray Fittings (26 05 36 00-0744)		
26 05 36 00-0956			90 Degree, 12" Radius Horizontal Elbows (26 05 36 00-0955)		
26 05 36 00-0957	EA		6" Horizontal 90 Degree Elbow, 6" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	185.85	80.68
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-11.86	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	9.29	
26 05 36 00-0958	EA		9" Horizontal 90 Degree Elbow, 6" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	205.88	91.85
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-12.93	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	10.29	
26 05 36 00-0959	EA		12" Horizontal 90 Degree Elbow, 6" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	231.77	101.58
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-14.71	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	11.59	
26 05 36 00-0960	EA		18" Horizontal 90 Degree Elbow, 6" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	277.84	124.51
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-17.41	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	13.89	
26 05 36 00-0961	EA		24" Horizontal 90 Degree Elbow, 6" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	325.50	142.93
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-20.64	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	16.28	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-0962 EA 30" Horizontal 90 Degree Elbow, 6" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	360.58	160.86
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-22.65	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	18.03	
26 05 36 00-0963 EA 36" Horizontal 90 Degree Elbow, 6" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	418.43	183.86
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-26.52	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	20.92	
26 05 36 00-0964 90 Degree, 24" Radius Horizontal Elbows <small>(26 05 36 00-0955)</small>		
26 05 36 00-0965 EA 6" Horizontal 90 Degree Elbow, 6" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	230.99	83.89
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-16.11	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	11.55	
26 05 36 00-0966 EA 9" Horizontal 90 Degree Elbow, 6" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	255.80	96.43
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-17.54	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	12.79	
26 05 36 00-0967 EA 12" Horizontal 90 Degree Elbow, 6" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	278.36	107.22
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-18.90	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	13.92	
26 05 36 00-0968 EA 18" Horizontal 90 Degree Elbow, 6" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	330.03	133.20
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-21.91	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	16.50	
26 05 36 00-0969 EA 24" Horizontal 90 Degree Elbow, 6" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	375.97	154.51
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-24.72	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	18.80	
26 05 36 00-0970 EA 30" Horizontal 90 Degree Elbow, 6" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	421.84	175.34
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-27.57	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	21.09	
26 05 36 00-0971 EA 36" Horizontal 90 Degree Elbow, 6" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	484.37	203.09
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-31.51	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	24.22	
26 05 36 00-0972 90 Degree, 36" Radius Horizontal Elbows <small>(26 05 36 00-0955)</small>		
26 05 36 00-0973 EA 6" Horizontal 90 Degree Elbow, 6" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	246.42	87.67
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-17.34	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	12.32	
26 05 36 00-0974 EA 9" Horizontal 90 Degree Elbow, 6" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	272.00	101.50
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-18.74	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	13.60	
26 05 36 00-0975 EA 12" Horizontal 90 Degree Elbow, 6" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	303.95	113.57
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-20.93	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	15.20	
26 05 36 00-0976 EA 18" Horizontal 90 Degree Elbow, 6" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	367.17	142.93
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-24.81	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	18.36	
26 05 36 00-0977 EA 24" Horizontal 90 Degree Elbow, 6" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	425.52	167.78
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-28.57	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	21.28	
26 05 36 00-0978 EA 30" Horizontal 90 Degree Elbow, 6" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	481.91	193.04
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-32.11	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	24.10	
26 05 36 00-0979 EA 36" Horizontal 90 Degree Elbow, 6" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	561.59	226.81
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-37.26	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	28.08	
26 05 36 00-0980 45 Degree, 12" Radius Horizontal Elbows <small>(26 05 36 00-0955)</small>		
26 05 36 00-0981 EA 6" Horizontal 45 Degree Elbow, 6" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	131.28	58.47
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-8.26	
<i>For 30 Degree Bend, Deduct</i>	-38.11	
<i>For 60 Degree Bend, Deduct</i>	-20.92	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	6.56	
26 05 36 00-0982 EA 9" Horizontal 45 Degree Elbow, 6" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	152.00	70.13
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-9.36	
<i>For 30 Degree Bend, Deduct</i>	-42.71	
<i>For 60 Degree Bend, Deduct</i>	-23.29	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	7.60	
26 05 36 00-0983 EA 12" Horizontal 45 Degree Elbow, 6" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	170.52	80.44
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-10.35	
<i>For 30 Degree Bend, Deduct</i>	-46.87	
<i>For 60 Degree Bend, Deduct</i>	-25.44	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	8.53	
26 05 36 00-0984 EA 18" Horizontal 45 Degree Elbow, 6" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	212.38	101.66
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-12.77	
<i>For 30 Degree Bend, Deduct</i>	-57.52	
<i>For 60 Degree Bend, Deduct</i>	-31.12	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	10.62	
26 05 36 00-0985 EA 24" Horizontal 45 Degree Elbow, 6" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	260.91	124.51
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-15.72	
<i>For 30 Degree Bend, Deduct</i>	-70.87	
<i>For 60 Degree Bend, Deduct</i>	-38.37	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	13.05	

26 Electrical**26 05 Common Work Results For Electrical****26 05 36 Cable Trays For Electrical Systems**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-0986 EA 30" Horizontal 45 Degree Elbow, 6" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	299.45	142.93
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-18.03	
<i>For 30 Degree Bend, Deduct</i>	-81.31	
<i>For 60 Degree Bend, Deduct</i>	-44.02	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	14.97	
26 05 36 00-0987 EA 36" Horizontal 45 Degree Elbow, 6" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	343.47	167.78
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-20.36	
<i>For 30 Degree Bend, Deduct</i>	-91.03	
<i>For 60 Degree Bend, Deduct</i>	-49.02	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	17.17	
26 05 36 00-0988 45 Degree, 24" Radius Horizontal Elbows <small>(26 05 36 00-0985)</small>		
26 05 36 00-0989 EA 6" Horizontal 45 Degree Elbow, 6" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	146.07	60.32
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-9.58	
<i>For 30 Degree Bend, Deduct</i>	-45.17	
<i>For 60 Degree Bend, Deduct</i>	-25.09	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	7.30	
26 05 36 00-0990 EA 9" Horizontal 45 Degree Elbow, 6" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	171.99	72.71
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-11.14	
<i>For 30 Degree Bend, Deduct</i>	-52.17	
<i>For 60 Degree Bend, Deduct</i>	-28.88	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	8.60	
26 05 36 00-0991 EA 12" Horizontal 45 Degree Elbow, 6" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	192.02	83.97
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-12.21	
<i>For 30 Degree Bend, Deduct</i>	-56.64	
<i>For 60 Degree Bend, Deduct</i>	-31.18	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	9.60	
26 05 36 00-0992 EA 18" Horizontal 45 Degree Elbow, 6" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	234.73	107.22
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-14.54	
<i>For 30 Degree Bend, Deduct</i>	-66.55	
<i>For 60 Degree Bend, Deduct</i>	-36.35	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	11.74	
26 05 36 00-0993 EA 24" Horizontal 45 Degree Elbow, 6" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	287.06	133.20
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-17.61	
<i>For 30 Degree Bend, Deduct</i>	-80.20	
<i>For 60 Degree Bend, Deduct</i>	-43.68	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	14.35	
26 05 36 00-0994 EA 30" Horizontal 45 Degree Elbow, 6" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	335.60	154.51
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-20.69	
<i>For 30 Degree Bend, Deduct</i>	-94.47	
<i>For 60 Degree Bend, Deduct</i>	-51.53	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	16.78	
26 05 36 00-0995 EA 36" Horizontal 45 Degree Elbow, 6" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	388.57	183.94
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-23.53	
<i>For 30 Degree Bend, Deduct</i>	-106.43	
<i>For 60 Degree Bend, Deduct</i>	-57.73	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	19.43	
26 05 36 00-0996 45 Degree, 36" Radius Horizontal Elbows <small>(26 05 36 00-0985)</small>		
26 05 36 00-0997 EA 6" Horizontal 45 Degree Elbow, 6" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	164.91	62.25
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-11.31	
<i>For 30 Degree Bend, Deduct</i>	-54.41	
<i>For 60 Degree Bend, Deduct</i>	-30.57	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	8.25	
26 05 36 00-0998 EA 9" Horizontal 45 Degree Elbow, 6" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	188.50	75.60
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-12.55	
<i>For 30 Degree Bend, Deduct</i>	-59.58	
<i>For 60 Degree Bend, Deduct</i>	-33.23	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	9.43	
26 05 36 00-0999 EA 12" Horizontal 45 Degree Elbow, 6" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	210.05	87.75
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-13.69	
<i>For 30 Degree Bend, Deduct</i>	-64.34	
<i>For 60 Degree Bend, Deduct</i>	-35.68	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	10.50	
26 05 36 00-1000 EA 18" Horizontal 45 Degree Elbow, 6" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	259.67	113.57
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-16.50	
<i>For 30 Degree Bend, Deduct</i>	-76.55	
<i>For 60 Degree Bend, Deduct</i>	-42.14	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	12.98	
26 05 36 00-1001 EA 24" Horizontal 45 Degree Elbow, 6" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	324.19	142.93
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-20.51	
<i>For 30 Degree Bend, Deduct</i>	-94.92	
<i>For 60 Degree Bend, Deduct</i>	-52.19	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	16.21	
26 05 36 00-1002 EA 30" Horizontal 45 Degree Elbow, 6" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	370.82	167.78
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-23.10	
<i>For 30 Degree Bend, Deduct</i>	-106.07	
<i>For 60 Degree Bend, Deduct</i>	-58.05	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	18.54	
26 05 36 00-1003 EA 36" Horizontal 45 Degree Elbow, 6" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	438.79	203.09
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-26.95	
<i>For 30 Degree Bend, Deduct</i>	-122.86	
<i>For 60 Degree Bend, Deduct</i>	-66.94	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	21.94	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-1004 90 Degree, 12" Radius Vertical Risers <small>(26 05 36 00-0955)</small>						
	26 05 36 00-1005	EA		6" Vertical Riser 90 Degree, 6" Rung Spacing, 12" Radius, Aluminum Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	202.69 -13.57 10.13	80.44
	26 05 36 00-1006	EA		9" Vertical Riser 90 Degree, 6" Rung Spacing, 12" Radius, Aluminum Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	225.53 -14.90 11.28	91.85
	26 05 36 00-1007	EA		12" Vertical Riser 90 Degree, 6" Rung Spacing, 12" Radius, Aluminum Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	242.90 -15.83 12.15	101.58
	26 05 36 00-1008	EA		18" Vertical Riser 90 Degree, 6" Rung Spacing, 12" Radius, Aluminum Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	283.64 -17.99 14.18	124.51
	26 05 36 00-1009	EA		24" Vertical Riser 90 Degree, 6" Rung Spacing, 12" Radius, Aluminum Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	318.12 -19.90 15.91	142.93
	26 05 36 00-1010	EA		30" Vertical Riser 90 Degree, 6" Rung Spacing, 12" Radius, Aluminum Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	351.73 -21.77 17.59	160.86
	26 05 36 00-1011	EA		36" Vertical Riser 90 Degree, 6" Rung Spacing, 12" Radius, Aluminum Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	392.18 -23.92 19.61	183.62
26 05 36 00-1012 90 Degree, 24" Radius Vertical Risers <small>(26 05 36 00-0955)</small>						
	26 05 36 00-1013	EA		6" Vertical Riser 90 Degree, 6" Rung Spacing, 24" Radius, Aluminum Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	214.09 -14.42 10.70	83.89
	26 05 36 00-1014	EA		9" Vertical Riser 90 Degree, 6" Rung Spacing, 24" Radius, Aluminum Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	238.24 -15.78 11.91	96.51
	26 05 36 00-1015	EA		12" Vertical Riser 90 Degree, 6" Rung Spacing, 24" Radius, Aluminum Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	257.98 -16.86 12.90	107.22
	26 05 36 00-1016	EA		18" Vertical Riser 90 Degree, 6" Rung Spacing, 24" Radius, Aluminum Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	305.56 -19.46 15.28	133.20
	26 05 36 00-1017	EA		24" Vertical Riser 90 Degree, 6" Rung Spacing, 24" Radius, Aluminum Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	346.07 -21.73 17.30	154.51
	26 05 36 00-1018	EA		30" Vertical Riser 90 Degree, 6" Rung Spacing, 24" Radius, Aluminum Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	385.87 -23.97 19.29	175.34
	26 05 36 00-1019	EA		36" Vertical Riser 90 Degree, 6" Rung Spacing, 24" Radius, Aluminum Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	438.36 -26.91 21.92	203.09
26 05 36 00-1020 90 Degree, 36" Radius Vertical Risers <small>(26 05 36 00-0955)</small>						
	26 05 36 00-1021	EA		6" Vertical Riser 90 Degree, 6" Rung Spacing, 36" Radius, Aluminum Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	260.96 -18.79 13.05	87.67
	26 05 36 00-1022	EA		9" Vertical Riser 90 Degree, 6" Rung Spacing, 36" Radius, Aluminum Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	286.58 -20.20 14.33	101.58
	26 05 36 00-1023	EA		12" Vertical Riser 90 Degree, 6" Rung Spacing, 36" Radius, Aluminum Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	314.15 -21.95 15.71	113.57
	26 05 36 00-1024	EA		18" Vertical Riser 90 Degree, 6" Rung Spacing, 36" Radius, Aluminum Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	368.04 -24.89 18.40	142.93
	26 05 36 00-1025	EA		24" Vertical Riser 90 Degree, 6" Rung Spacing, 36" Radius, Aluminum Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	414.45 -27.46 20.72	167.78
	26 05 36 00-1026	EA		30" Vertical Riser 90 Degree, 6" Rung Spacing, 36" Radius, Aluminum Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	466.50 -30.56 23.33	193.04
	26 05 36 00-1027	EA		36" Vertical Riser 90 Degree, 6" Rung Spacing, 36" Radius, Aluminum Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	528.98 -34.00 26.45	226.81
26 05 36 00-1028 12" Radius Horizontal Tees <small>(26 05 36 00-0955)</small>						
	26 05 36 00-1029	EA		6" Horizontal Tee, 6" Rung Spacing, 12" Radius, Aluminum Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	336.90 -20.82 16.85	154.51
	26 05 36 00-1030	EA		9" Horizontal Tee, 6" Rung Spacing, 12" Radius, Aluminum Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	364.31 -22.45 18.22	167.78
	26 05 36 00-1031	EA		12" Horizontal Tee, 6" Rung Spacing, 12" Radius, Aluminum Cable Tray <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	378.21 -23.21 18.91	175.34

26 Electrical**26 05 Common Work Results For Electrical****26 05 36 Cable Trays For Electrical Systems**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-1032 EA 18" Horizontal Tee, 6" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	424.60	193.04
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-26.37	
For 6" Overall Height Instead Of 4-5/8", Add	21.23	
26 05 36 00-1033 EA 24" Horizontal Tee, 6" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	470.45	214.26
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-29.19	
For 6" Overall Height Instead Of 4-5/8", Add	23.52	
26 05 36 00-1034 EA 30" Horizontal Tee, 6" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	510.21	227.21
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-32.09	
For 6" Overall Height Instead Of 4-5/8", Add	25.51	
26 05 36 00-1035 EA 36" Horizontal Tee, 6" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	586.32	257.22
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-37.20	
For 6" Overall Height Instead Of 4-5/8", Add	29.32	
26 05 36 00-1036 24" Radius Horizontal Tees (26 05 36 00-0955)		
26 05 36 00-1037 EA 6" Horizontal Tee, 6" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	415.10	167.78
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-27.53	
For 6" Overall Height Instead Of 4-5/8", Add	20.76	
26 05 36 00-1038 EA 9" Horizontal Tee, 6" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	449.78	183.94
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-29.65	
For 6" Overall Height Instead Of 4-5/8", Add	22.49	
26 05 36 00-1039 EA 12" Horizontal Tee, 6" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	468.88	193.04
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-30.80	
For 6" Overall Height Instead Of 4-5/8", Add	23.44	
26 05 36 00-1040 EA 18" Horizontal Tee, 6" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	517.34	214.26
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-33.88	
For 6" Overall Height Instead Of 4-5/8", Add	25.87	
26 05 36 00-1041 EA 24" Horizontal Tee, 6" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	576.67	241.30
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-37.56	
For 6" Overall Height Instead Of 4-5/8", Add	28.83	
26 05 36 00-1042 EA 30" Horizontal Tee, 6" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	620.18	257.22
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-40.58	
For 6" Overall Height Instead Of 4-5/8", Add	31.01	
26 05 36 00-1043 EA 36" Horizontal Tee, 6" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	788.29	297.20
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-54.07	
For 6" Overall Height Instead Of 4-5/8", Add	39.41	
26 05 36 00-1044 36" Radius Horizontal Tees (26 05 36 00-0955)		
26 05 36 00-1045 EA 6" Horizontal Tee, 6" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	497.96	183.94
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-34.47	
For 6" Overall Height Instead Of 4-5/8", Add	24.90	
26 05 36 00-1046 EA 9" Horizontal Tee, 6" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	535.16	203.09
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-36.59	
For 6" Overall Height Instead Of 4-5/8", Add	26.76	
26 05 36 00-1047 EA 12" Horizontal Tee, 6" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	572.04	214.26
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-39.35	
For 6" Overall Height Instead Of 4-5/8", Add	28.60	
26 05 36 00-1048 EA 18" Horizontal Tee, 6" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	628.77	241.30
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-42.77	
For 6" Overall Height Instead Of 4-5/8", Add	31.44	
26 05 36 00-1049 EA 24" Horizontal Tee, 6" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	709.13	275.48
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-47.96	
For 6" Overall Height Instead Of 4-5/8", Add	35.46	
26 05 36 00-1050 EA 30" Horizontal Tee, 6" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	811.73	297.20
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-56.41	
For 6" Overall Height Instead Of 4-5/8", Add	40.59	
26 05 36 00-1051 EA 36" Horizontal Tee, 6" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	936.16	350.68
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-64.39	
For 6" Overall Height Instead Of 4-5/8", Add	46.81	
26 05 36 00-1052 12" Radius Vertical Tees (26 05 36 00-0955)		
26 05 36 00-1053 EA 6" Vertical Tee, 6" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	416.66	142.93
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-29.75	
For 6" Overall Height Instead Of 4-5/8", Add	20.83	
26 05 36 00-1054 EA 9" Vertical Tee, 6" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	431.26	148.55
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-30.74	
For 6" Overall Height Instead Of 4-5/8", Add	21.56	
26 05 36 00-1055 EA 12" Vertical Tee, 6" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	442.39	154.51
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-31.37	
For 6" Overall Height Instead Of 4-5/8", Add	22.12	
26 05 36 00-1056 EA 18" Vertical Tee, 6" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	468.50	167.78
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-32.87	
For 6" Overall Height Instead Of 4-5/8", Add	23.43	
26 05 36 00-1057 EA 24" Vertical Tee, 6" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	496.73	175.34
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-35.06	
For 6" Overall Height Instead Of 4-5/8", Add	24.84	
26 05 36 00-1058 EA 30" Vertical Tee, 6" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	530.09	193.04
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-36.92	
For 6" Overall Height Instead Of 4-5/8", Add	26.50	
26 05 36 00-1059 EA 36" Vertical Tee, 6" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	572.04	214.26
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-39.35	
For 6" Overall Height Instead Of 4-5/8", Add	28.60	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-1060 24" Radius Vertical Tees <small>(26 05 36 00-0955)</small>		
26 05 36 00-1061 EA 6" Vertical Tee, 6" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	559.60	154.51
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-43.09	
For 6" Overall Height Instead Of 4-5/8", Add	27.98	
26 05 36 00-1062 EA 9" Vertical Tee, 6" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	574.16	160.86
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-44.01	
For 6" Overall Height Instead Of 4-5/8", Add	28.71	
26 05 36 00-1063 EA 12" Vertical Tee, 6" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	589.62	167.78
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-44.98	
For 6" Overall Height Instead Of 4-5/8", Add	29.48	
26 05 36 00-1064 EA 18" Vertical Tee, 6" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	625.59	183.94
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-47.23	
For 6" Overall Height Instead Of 4-5/8", Add	31.28	
26 05 36 00-1065 EA 24" Vertical Tee, 6" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	648.61	193.04
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-48.78	
For 6" Overall Height Instead Of 4-5/8", Add	32.43	
26 05 36 00-1066 EA 30" Vertical Tee, 6" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	691.85	214.26
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-51.33	
For 6" Overall Height Instead Of 4-5/8", Add	34.59	
26 05 36 00-1067 EA 36" Vertical Tee, 6" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	766.81	241.30
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-56.57	
For 6" Overall Height Instead Of 4-5/8", Add	38.34	
26 05 36 00-1068 36" Radius Vertical Tees <small>(26 05 36 00-0955)</small>		
26 05 36 00-1069 EA 6" Vertical Tee, 6" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	854.45	167.78
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-71.46	
For 6" Overall Height Instead Of 4-5/8", Add	42.72	
26 05 36 00-1070 EA 9" Vertical Tee, 6" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	874.51	175.34
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-72.84	
For 6" Overall Height Instead Of 4-5/8", Add	43.73	
26 05 36 00-1071 EA 12" Vertical Tee, 6" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	896.23	183.94
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-74.30	
For 6" Overall Height Instead Of 4-5/8", Add	44.81	
26 05 36 00-1072 EA 18" Vertical Tee, 6" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	935.70	203.09
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-76.64	
For 6" Overall Height Instead Of 4-5/8", Add	46.79	
26 05 36 00-1073 EA 24" Vertical Tee, 6" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	961.80	214.26
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-78.32	
For 6" Overall Height Instead Of 4-5/8", Add	48.09	
26 05 36 00-1074 EA 30" Vertical Tee, 6" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	1,029.20	241.30
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-82.81	
For 6" Overall Height Instead Of 4-5/8", Add	51.46	
26 05 36 00-1075 EA 36" Vertical Tee, 6" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	1,093.58	275.48
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-86.40	
For 6" Overall Height Instead Of 4-5/8", Add	54.68	
26 05 36 00-1076 12" Radius Horizontal Crosses <small>(26 05 36 00-0955)</small>		
26 05 36 00-1077 EA 6" Horizontal Cross, 6" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	432.42	193.04
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-27.16	
For 6" Overall Height Instead Of 4-5/8", Add	21.62	
26 05 36 00-1078 EA 9" Horizontal Cross, 6" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	460.93	203.09
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-29.17	
For 6" Overall Height Instead Of 4-5/8", Add	23.05	
26 05 36 00-1079 EA 12" Horizontal Cross, 6" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	480.87	214.26
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-30.23	
For 6" Overall Height Instead Of 4-5/8", Add	24.04	
26 05 36 00-1080 EA 18" Horizontal Cross, 6" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	528.44	227.21
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-33.91	
For 6" Overall Height Instead Of 4-5/8", Add	26.42	
26 05 36 00-1081 EA 24" Horizontal Cross, 6" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	583.72	257.22
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-36.94	
For 6" Overall Height Instead Of 4-5/8", Add	29.19	
26 05 36 00-1082 EA 30" Horizontal Cross, 6" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	641.41	275.48
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-41.19	
For 6" Overall Height Instead Of 4-5/8", Add	32.07	
26 05 36 00-1083 EA 36" Horizontal Cross, 6" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	723.17	297.20
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-47.55	
For 6" Overall Height Instead Of 4-5/8", Add	36.16	
26 05 36 00-1084 24" Radius Horizontal Crosses <small>(26 05 36 00-0955)</small>		
26 05 36 00-1085 EA 6" Horizontal Cross, 6" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	569.43	214.26
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-39.09	
For 6" Overall Height Instead Of 4-5/8", Add	28.47	
26 05 36 00-1086 EA 9" Horizontal Cross, 6" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	597.46	227.21
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-40.81	
For 6" Overall Height Instead Of 4-5/8", Add	29.87	
26 05 36 00-1087 EA 12" Horizontal Cross, 6" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	627.46	241.30
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-42.64	
For 6" Overall Height Instead Of 4-5/8", Add	31.37	

26 Electrical**26 05 Common Work Results For Electrical****26 05 36 Cable Trays For Electrical Systems**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-1088 EA 18" Horizontal Cross, 6" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	665.77	257.22
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-45.14	
For 6" Overall Height Instead Of 4-5/8", Add	33.29	
26 05 36 00-1089 EA 24" Horizontal Cross, 6" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	753.12	297.20
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-50.55	
For 6" Overall Height Instead Of 4-5/8", Add	37.66	
26 05 36 00-1090 EA 30" Horizontal Cross, 6" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	812.31	321.72
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-54.42	
For 6" Overall Height Instead Of 4-5/8", Add	40.62	
26 05 36 00-1091 EA 36" Horizontal Cross, 6" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	895.79	350.68
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-60.35	
For 6" Overall Height Instead Of 4-5/8", Add	44.79	
26 05 36 00-1092 36" Radius Horizontal Crosses (26 05 36 00-0955)		
26 05 36 00-1093 EA 6" Horizontal Cross, 6" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	652.21	241.30
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-45.11	
For 6" Overall Height Instead Of 4-5/8", Add	32.61	
26 05 36 00-1094 EA 9" Horizontal Cross, 6" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	689.21	257.22
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-47.48	
For 6" Overall Height Instead Of 4-5/8", Add	34.46	
26 05 36 00-1095 EA 12" Horizontal Cross, 6" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	735.18	275.48
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-50.56	
For 6" Overall Height Instead Of 4-5/8", Add	36.76	
26 05 36 00-1096 EA 18" Horizontal Cross, 6" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	789.59	297.20
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-54.20	
For 6" Overall Height Instead Of 4-5/8", Add	39.48	
26 05 36 00-1097 EA 24" Horizontal Cross, 6" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	949.18	350.68
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-65.69	
For 6" Overall Height Instead Of 4-5/8", Add	47.46	
26 05 36 00-1098 EA 30" Horizontal Cross, 6" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	1,046.14	385.43
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-72.49	
For 6" Overall Height Instead Of 4-5/8", Add	52.31	
26 05 36 00-1099 EA 36" Horizontal Cross, 6" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	1,164.89	429.34
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-80.71	
For 6" Overall Height Instead Of 4-5/8", Add	58.24	
26 05 36 00-1100 12" Radius Vertical Crosses (26 05 36 00-0955)		
26 05 36 00-1101 EA 6" Vertical Cross, 6" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	432.42	193.04
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-27.16	
For 6" Overall Height Instead Of 4-5/8", Add	21.62	
26 05 36 00-1102 EA 9" Vertical Cross, 6" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	461.05	203.17
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-29.17	
For 6" Overall Height Instead Of 4-5/8", Add	23.05	
26 05 36 00-1103 EA 12" Vertical Cross, 6" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	480.81	214.26
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-30.23	
For 6" Overall Height Instead Of 4-5/8", Add	24.04	
26 05 36 00-1104 EA 18" Vertical Cross, 6" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	528.59	227.29
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-33.92	
For 6" Overall Height Instead Of 4-5/8", Add	26.43	
26 05 36 00-1105 EA 24" Vertical Cross, 6" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	583.72	257.22
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-36.94	
For 6" Overall Height Instead Of 4-5/8", Add	29.19	
26 05 36 00-1106 EA 30" Vertical Cross, 6" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	641.62	275.56
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-41.20	
For 6" Overall Height Instead Of 4-5/8", Add	32.08	
26 05 36 00-1107 EA 36" Vertical Cross, 6" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	722.57	296.79
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-47.52	
For 6" Overall Height Instead Of 4-5/8", Add	36.13	
26 05 36 00-1108 24" Radius Vertical Crosses (26 05 36 00-0955)		
26 05 36 00-1109 EA 6" Vertical Cross, 6" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	569.43	214.26
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-39.09	
For 6" Overall Height Instead Of 4-5/8", Add	28.47	
26 05 36 00-1110 EA 9" Vertical Cross, 6" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	597.46	227.21
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-40.81	
For 6" Overall Height Instead Of 4-5/8", Add	29.87	
26 05 36 00-1111 EA 12" Vertical Cross, 6" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	627.46	241.30
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-42.64	
For 6" Overall Height Instead Of 4-5/8", Add	31.37	
26 05 36 00-1112 EA 18" Vertical Cross, 6" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	665.77	257.22
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-45.14	
For 6" Overall Height Instead Of 4-5/8", Add	33.29	
26 05 36 00-1113 EA 24" Vertical Cross, 6" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	753.12	297.20
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-50.55	
For 6" Overall Height Instead Of 4-5/8", Add	37.66	
26 05 36 00-1114 EA 30" Vertical Cross, 6" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	812.31	321.72
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-54.42	
For 6" Overall Height Instead Of 4-5/8", Add	40.62	
26 05 36 00-1115 EA 36" Vertical Cross, 6" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	895.79	350.68
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-60.35	
For 6" Overall Height Instead Of 4-5/8", Add	44.79	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-1116 36" Radius Vertical Crosses <small>(26 05 36 00-0955)</small>		
26 05 36 00-1117 EA 6" Vertical Cross, 6" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	764.73	241.30
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-56.37	
For 6" Overall Height Instead Of 4-5/8", Add	38.24	
26 05 36 00-1118 EA 9" Vertical Cross, 6" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	806.42	257.22
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-59.21	
For 6" Overall Height Instead Of 4-5/8", Add	40.32	
26 05 36 00-1119 EA 12" Vertical Cross, 6" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	859.42	275.48
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-62.99	
For 6" Overall Height Instead Of 4-5/8", Add	42.97	
26 05 36 00-1120 EA 18" Vertical Cross, 6" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	922.04	297.20
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-67.44	
For 6" Overall Height Instead Of 4-5/8", Add	46.10	
26 05 36 00-1121 EA 24" Vertical Cross, 6" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	1,113.28	350.68
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-82.10	
For 6" Overall Height Instead Of 4-5/8", Add	55.66	
26 05 36 00-1122 EA 30" Vertical Cross, 6" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	1,227.82	385.43
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-90.66	
For 6" Overall Height Instead Of 4-5/8", Add	61.39	
26 05 36 00-1123 EA 36" Vertical Cross, 6" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	1,367.07	429.34
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-100.93	
For 6" Overall Height Instead Of 4-5/8", Add	68.35	
26 05 36 00-1124 9" Rung Tray Fittings <small>(26 05 36 00-0744)</small>		
26 05 36 00-1125 90 Degree, 12" Radius Horizontal Elbows <small>(26 05 36 00-1124)</small>		
26 05 36 00-1126 EA 6" Horizontal 90 Degree Elbow, 9" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	177.28	80.68
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-11.01	
For 6" Overall Height Instead Of 4-5/8", Add	8.66	
26 05 36 00-1127 EA 9" Horizontal 90 Degree Elbow, 9" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	197.09	91.85
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-12.05	
For 6" Overall Height Instead Of 4-5/8", Add	9.85	
26 05 36 00-1128 EA 12" Horizontal 90 Degree Elbow, 9" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	221.35	101.58
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-13.67	
For 6" Overall Height Instead Of 4-5/8", Add	11.07	
26 05 36 00-1129 EA 18" Horizontal 90 Degree Elbow, 9" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	266.12	124.51
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-16.24	
For 6" Overall Height Instead Of 4-5/8", Add	13.31	
26 05 36 00-1130 EA 24" Horizontal 90 Degree Elbow, 9" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	310.95	142.93
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-19.18	
For 6" Overall Height Instead Of 4-5/8", Add	15.55	
26 05 36 00-1131 EA 30" Horizontal 90 Degree Elbow, 9" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	345.16	160.86
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-21.11	
For 6" Overall Height Instead Of 4-5/8", Add	17.26	
26 05 36 00-1132 EA 36" Horizontal 90 Degree Elbow, 9" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	399.76	183.86
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-24.65	
For 6" Overall Height Instead Of 4-5/8", Add	19.99	
26 05 36 00-1133 90 Degree, 24" Radius Horizontal Elbows <small>(26 05 36 00-1124)</small>		
26 05 36 00-1134 EA 6" Horizontal 90 Degree Elbow, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	215.80	83.89
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-14.59	
For 6" Overall Height Instead Of 4-5/8", Add	10.79	
26 05 36 00-1135 EA 9" Horizontal 90 Degree Elbow, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	239.96	96.43
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-15.96	
For 6" Overall Height Instead Of 4-5/8", Add	12.00	
26 05 36 00-1136 EA 12" Horizontal 90 Degree Elbow, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	261.75	107.22
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-17.24	
For 6" Overall Height Instead Of 4-5/8", Add	13.09	
26 05 36 00-1137 EA 18" Horizontal 90 Degree Elbow, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	312.02	133.20
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-20.11	
For 6" Overall Height Instead Of 4-5/8", Add	15.60	
26 05 36 00-1138 EA 24" Horizontal 90 Degree Elbow, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	356.22	154.51
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-22.75	
For 6" Overall Height Instead Of 4-5/8", Add	17.81	
26 05 36 00-1139 EA 30" Horizontal 90 Degree Elbow, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	400.25	175.34
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-25.41	
For 6" Overall Height Instead Of 4-5/8", Add	20.01	
26 05 36 00-1140 EA 36" Horizontal 90 Degree Elbow, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	460.06	203.09
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-29.08	
For 6" Overall Height Instead Of 4-5/8", Add	23.00	
26 05 36 00-1141 90 Degree, 36" Radius Horizontal Elbows <small>(26 05 36 00-1124)</small>		
26 05 36 00-1142 EA 6" Horizontal 90 Degree Elbow, 9" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	229.71	87.67
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-15.66	
For 6" Overall Height Instead Of 4-5/8", Add	11.49	
26 05 36 00-1143 EA 9" Horizontal 90 Degree Elbow, 9" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	254.86	101.50
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-17.03	
For 6" Overall Height Instead Of 4-5/8", Add	12.74	

26 Electrical**26 05 Common Work Results For Electrical****26 05 36 Cable Trays For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-1144	EA		12" Horizontal 90 Degree Elbow, 9" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	284.84	113.57
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-19.02	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	14.24	
26 05 36 00-1145	EA		18" Horizontal 90 Degree Elbow, 9" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	345.68	142.93
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-22.66	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	17.28	
26 05 36 00-1146	EA		24" Horizontal 90 Degree Elbow, 9" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	401.21	167.78
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-26.14	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	20.06	
26 05 36 00-1147	EA		30" Horizontal 90 Degree Elbow, 9" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	455.21	193.04
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-29.44	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	22.76	
26 05 36 00-1148	EA		36" Horizontal 90 Degree Elbow, 9" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	530.98	226.81
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-34.20	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	26.55	
26 05 36 00-1149			45 Degree, 12" Radius Horizontal Elbows <small>(26 05 36 00-1124)</small>		
26 05 36 00-1150	EA		6" Horizontal 45 Degree Elbow, 9" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	125.64	58.47
			<i>For 30 Degree Bend, Deduct</i>	-35.01	
			<i>For 60 Degree Bend, Deduct</i>	-19.05	
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-7.69	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	6.28	
26 05 36 00-1151	EA		9" Horizontal 45 Degree Elbow, 9" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	146.14	70.13
			<i>For 30 Degree Bend, Deduct</i>	-39.48	
			<i>For 60 Degree Bend, Deduct</i>	-21.35	
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-8.77	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	7.31	
26 05 36 00-1152	EA		12" Horizontal 45 Degree Elbow, 9" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	164.44	80.44
			<i>For 30 Degree Bend, Deduct</i>	-43.52	
			<i>For 60 Degree Bend, Deduct</i>	-23.43	
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-9.74	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	8.22	
26 05 36 00-1153	EA		18" Horizontal 45 Degree Elbow, 9" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	205.21	101.66
			<i>For 30 Degree Bend, Deduct</i>	-53.58	
			<i>For 60 Degree Bend, Deduct</i>	-28.76	
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-12.05	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	10.26	
26 05 36 00-1154	EA		24" Horizontal 45 Degree Elbow, 9" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	252.01	124.51
			<i>For 30 Degree Bend, Deduct</i>	-65.98	
			<i>For 60 Degree Bend, Deduct</i>	-35.44	
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-14.83	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	12.60	
26 05 36 00-1155	EA		30" Horizontal 45 Degree Elbow, 9" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	289.25	142.93
			<i>For 30 Degree Bend, Deduct</i>	-75.70	
			<i>For 60 Degree Bend, Deduct</i>	-40.66	
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-17.01	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	14.46	
26 05 36 00-1156	EA		36" Horizontal 45 Degree Elbow, 9" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	332.84	167.78
			<i>For 30 Degree Bend, Deduct</i>	-85.18	
			<i>For 60 Degree Bend, Deduct</i>	-45.52	
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-19.30	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	16.64	
26 05 36 00-1157			45 Degree, 24" Radius Horizontal Elbows <small>(26 05 36 00-1124)</small>		
26 05 36 00-1158	EA		6" Horizontal 45 Degree Elbow, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	138.47	60.32
			<i>For 30 Degree Bend, Deduct</i>	-40.99	
			<i>For 60 Degree Bend, Deduct</i>	-22.58	
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-8.82	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	6.92	
26 05 36 00-1159	EA		9" Horizontal 45 Degree Elbow, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	163.53	72.71
			<i>For 30 Degree Bend, Deduct</i>	-47.52	
			<i>For 60 Degree Bend, Deduct</i>	-26.09	
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-10.29	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	8.18	
26 05 36 00-1160	EA		12" Horizontal 45 Degree Elbow, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	183.34	83.97
			<i>For 30 Degree Bend, Deduct</i>	-51.86	
			<i>For 60 Degree Bend, Deduct</i>	-28.32	
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-11.34	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	9.17	
26 05 36 00-1161	EA		18" Horizontal 45 Degree Elbow, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	225.40	107.22
			<i>For 30 Degree Bend, Deduct</i>	-61.41	
			<i>For 60 Degree Bend, Deduct</i>	-33.27	
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-13.60	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	11.27	
26 05 36 00-1162	EA		24" Horizontal 45 Degree Elbow, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	276.20	133.20
			<i>For 30 Degree Bend, Deduct</i>	-74.23	
			<i>For 60 Degree Bend, Deduct</i>	-40.10	
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-16.52	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	13.81	
26 05 36 00-1163	EA		30" Horizontal 45 Degree Elbow, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	322.58	154.51
			<i>For 30 Degree Bend, Deduct</i>	-87.31	
			<i>For 60 Degree Bend, Deduct</i>	-47.24	
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-19.39	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	16.13	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-1164 EA 36" Horizontal 45 Degree Elbow, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	374.89	183.94
For 30 Degree Bend, Deduct	-98.91	
For 60 Degree Bend, Deduct	-53.21	
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-22.16	
For 6" Overall Height Instead Of 4-5/8", Add	18.74	
26 05 36 00-1165 45 Degree, 36" Radius Horizontal Elbows <small>(26 05 36 00-1124)</small>		
26 05 36 00-1166 EA 6" Horizontal 45 Degree Elbow, 9" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	154.71	62.25
For 30 Degree Bend, Deduct	-48.80	
For 60 Degree Bend, Deduct	-27.20	
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-10.29	
For 6" Overall Height Instead Of 4-5/8", Add	7.74	
26 05 36 00-1167 EA 9" Horizontal 45 Degree Elbow, 9" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	178.08	75.60
For 30 Degree Bend, Deduct	-53.85	
For 60 Degree Bend, Deduct	-29.79	
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-11.51	
For 6" Overall Height Instead Of 4-5/8", Add	8.90	
26 05 36 00-1168 EA 12" Horizontal 45 Degree Elbow, 9" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	199.42	87.75
For 30 Degree Bend, Deduct	-58.50	
For 60 Degree Bend, Deduct	-32.17	
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-12.63	
For 6" Overall Height Instead Of 4-5/8", Add	9.97	
26 05 36 00-1169 EA 18" Horizontal 45 Degree Elbow, 9" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	247.95	113.57
For 30 Degree Bend, Deduct	-70.10	
For 60 Degree Bend, Deduct	-38.28	
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-15.33	
For 6" Overall Height Instead Of 4-5/8", Add	12.40	
26 05 36 00-1170 EA 24" Horizontal 45 Degree Elbow, 9" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	309.87	142.93
For 30 Degree Bend, Deduct	-87.04	
For 60 Degree Bend, Deduct	-47.46	
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-19.08	
For 6" Overall Height Instead Of 4-5/8", Add	15.49	
26 05 36 00-1171 EA 30" Horizontal 45 Degree Elbow, 9" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	355.63	167.78
For 30 Degree Bend, Deduct	-97.72	
For 60 Degree Bend, Deduct	-53.04	
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-21.58	
For 6" Overall Height Instead Of 4-5/8", Add	17.78	
26 05 36 00-1172 EA 36" Horizontal 45 Degree Elbow, 9" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	422.08	203.09
For 30 Degree Bend, Deduct	-113.67	
For 60 Degree Bend, Deduct	-61.43	
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-25.28	
For 6" Overall Height Instead Of 4-5/8", Add	21.10	
26 05 36 00-1173 90 Degree, 12" Radius Vertical Risers <small>(26 05 36 00-1124)</small>		
26 05 36 00-1174 EA 6" Vertical Riser 90 Degree, 9" Rung Spacing, 12" Radius, Aluminum Cable Tray	193.74	80.44
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-12.67	
For 6" Overall Height Instead Of 4-5/8", Add	9.69	
26 05 36 00-1175 EA 9" Vertical Riser 90 Degree, 9" Rung Spacing, 12" Radius, Aluminum Cable Tray	216.09	91.85
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-13.95	
For 6" Overall Height Instead Of 4-5/8", Add	10.80	
26 05 36 00-1176 EA 12" Vertical Riser 90 Degree, 9" Rung Spacing, 12" Radius, Aluminum Cable Tray	233.29	101.58
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-14.87	
For 6" Overall Height Instead Of 4-5/8", Add	11.66	
26 05 36 00-1177 EA 18" Vertical Riser 90 Degree, 9" Rung Spacing, 12" Radius, Aluminum Cable Tray	273.71	124.51
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-17.00	
For 6" Overall Height Instead Of 4-5/8", Add	13.69	
26 05 36 00-1178 EA 24" Vertical Riser 90 Degree, 9" Rung Spacing, 12" Radius, Aluminum Cable Tray	307.70	142.93
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-18.86	
For 6" Overall Height Instead Of 4-5/8", Add	15.39	
26 05 36 00-1179 EA 30" Vertical Riser 90 Degree, 9" Rung Spacing, 12" Radius, Aluminum Cable Tray	340.82	160.86
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-20.68	
For 6" Overall Height Instead Of 4-5/8", Add	17.04	
26 05 36 00-1180 EA 36" Vertical Riser 90 Degree, 9" Rung Spacing, 12" Radius, Aluminum Cable Tray	380.94	183.62
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-22.79	
For 6" Overall Height Instead Of 4-5/8", Add	19.05	
26 05 36 00-1181 90 Degree, 24" Radius Vertical Risers <small>(26 05 36 00-1124)</small>		
26 05 36 00-1182 EA 6" Vertical Riser 90 Degree, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray	204.40	83.89
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-13.45	
For 6" Overall Height Instead Of 4-5/8", Add	10.22	
26 05 36 00-1183 EA 9" Vertical Riser 90 Degree, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray	228.15	96.51
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-14.77	
For 6" Overall Height Instead Of 4-5/8", Add	11.41	
26 05 36 00-1184 EA 12" Vertical Riser 90 Degree, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray	247.65	107.22
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-15.83	
For 6" Overall Height Instead Of 4-5/8", Add	12.38	
26 05 36 00-1185 EA 18" Vertical Riser 90 Degree, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray	294.65	133.20
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-18.37	
For 6" Overall Height Instead Of 4-5/8", Add	14.73	
26 05 36 00-1186 EA 24" Vertical Riser 90 Degree, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray	334.51	154.51
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-20.58	
For 6" Overall Height Instead Of 4-5/8", Add	16.73	

26 Electrical**26 05 Common Work Results For Electrical****26 05 36 Cable Trays For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-1187	EA		30" Vertical Riser 90 Degree, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray	373.66	175.34
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-22.75	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	18.68	
26 05 36 00-1188	EA		36" Vertical Riser 90 Degree, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray	425.33	203.09
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-25.61	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	21.27	
26 05 36 00-1189			90 Degree, 36" Radius Vertical Risers <small>(26 05 36 00-1124)</small>		
26 05 36 00-1190	EA		6" Vertical Riser 90 Degree, 9" Rung Spacing, 36" Radius, Aluminum Cable Tray	245.99	87.67
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-17.29	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	12.30	
26 05 36 00-1191	EA		9" Vertical Riser 90 Degree, 9" Rung Spacing, 36" Radius, Aluminum Cable Tray	271.28	101.58
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-18.67	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	13.56	
26 05 36 00-1192	EA		12" Vertical Riser 90 Degree, 9" Rung Spacing, 36" Radius, Aluminum Cable Tray	297.87	113.57
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-20.32	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	14.89	
26 05 36 00-1193	EA		18" Vertical Riser 90 Degree, 9" Rung Spacing, 36" Radius, Aluminum Cable Tray	351.11	142.93
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-23.20	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	17.56	
26 05 36 00-1194	EA		24" Vertical Riser 90 Degree, 9" Rung Spacing, 36" Radius, Aluminum Cable Tray	396.87	167.78
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-25.70	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	19.84	
26 05 36 00-1195	EA		30" Vertical Riser 90 Degree, 9" Rung Spacing, 36" Radius, Aluminum Cable Tray	447.61	193.04
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-28.68	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	22.38	
26 05 36 00-1196	EA		36" Vertical Riser 90 Degree, 9" Rung Spacing, 36" Radius, Aluminum Cable Tray	509.28	226.81
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-32.03	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	25.46	
26 05 36 00-1197			12" Radius Horizontal Tees <small>(26 05 36 00-1124)</small>		
26 05 36 00-1198	EA		6" Horizontal Tee, 9" Rung Spacing, 12" Radius, Aluminum Cable Tray	323.66	154.51
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-19.49	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	16.18	
26 05 36 00-1199	EA		9" Horizontal Tee, 9" Rung Spacing, 12" Radius, Aluminum Cable Tray	350.20	167.78
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-21.04	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	17.51	
26 05 36 00-1200	EA		12" Horizontal Tee, 9" Rung Spacing, 12" Radius, Aluminum Cable Tray	363.89	175.34
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-21.78	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	18.19	
26 05 36 00-1201	EA		18" Horizontal Tee, 9" Rung Spacing, 12" Radius, Aluminum Cable Tray	407.46	193.04
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-24.66	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	20.37	
26 05 36 00-1202	EA		24" Horizontal Tee, 9" Rung Spacing, 12" Radius, Aluminum Cable Tray	451.57	214.26
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-27.30	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	22.58	
26 05 36 00-1203	EA		30" Horizontal Tee, 9" Rung Spacing, 12" Radius, Aluminum Cable Tray	488.28	227.21
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-29.89	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	24.41	
26 05 36 00-1204	EA		36" Horizontal Tee, 9" Rung Spacing, 12" Radius, Aluminum Cable Tray	560.06	257.22
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-34.57	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	28.00	
26 05 36 00-1205			24" Radius Horizontal Tees <small>(26 05 36 00-1124)</small>		
26 05 36 00-1206	EA		6" Horizontal Tee, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray	392.53	167.78
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-25.27	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	19.63	
26 05 36 00-1207	EA		9" Horizontal Tee, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray	425.90	183.94
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-27.26	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	21.30	
26 05 36 00-1208	EA		12" Horizontal Tee, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray	444.36	193.04
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-28.35	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	22.22	
26 05 36 00-1209	EA		18" Horizontal Tee, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray	490.64	214.26
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-31.21	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	24.53	
26 05 36 00-1210	EA		24" Horizontal Tee, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray	547.59	241.30
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-34.65	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	27.38	
26 05 36 00-1211	EA		30" Horizontal Tee, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray	588.28	257.22
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-37.39	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	29.41	
26 05 36 00-1212	EA		36" Horizontal Tee, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray	739.45	297.20
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-49.18	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	36.97	
26 05 36 00-1213			36" Radius Horizontal Tees <small>(26 05 36 00-1124)</small>		
26 05 36 00-1214	EA		6" Horizontal Tee, 9" Rung Spacing, 36" Radius, Aluminum Cable Tray	466.06	183.94
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-31.28	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	23.30	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-1215 EA 9" Horizontal Tee, 9" Rung Spacing, 36" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	502.39 -33.31 25.12	203.09
26 05 36 00-1216 EA 12" Horizontal Tee, 9" Rung Spacing, 36" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	536.22 -35.76 26.81	214.26
26 05 36 00-1217 EA 18" Horizontal Tee, 9" Rung Spacing, 36" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	591.00 -38.99 29.55	241.30
26 05 36 00-1218 EA 24" Horizontal Tee, 9" Rung Spacing, 36" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	667.45 -43.79 33.37	275.48
26 05 36 00-1219 EA 30" Horizontal Tee, 9" Rung Spacing, 36" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	758.98 -51.14 37.95	297.20
26 05 36 00-1220 EA 36" Horizontal Tee, 9" Rung Spacing, 36" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	877.56 -58.53 43.88	350.68
26 05 36 00-1221 12" Radius Vertical Tees <small>(26 05 36 00-1124)</small>		
26 05 36 00-1222 EA 6" Vertical Tee, 9" Rung Spacing, 12" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	386.92 -26.78 19.35	142.93
26 05 36 00-1223 EA 9" Vertical Tee, 9" Rung Spacing, 12" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	400.65 -27.68 20.03	148.55
26 05 36 00-1224 EA 12" Vertical Tee, 9" Rung Spacing, 12" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	411.57 -28.28 20.58	154.51
26 05 36 00-1225 EA 18" Vertical Tee, 9" Rung Spacing, 12" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	437.03 -29.72 21.85	167.78
26 05 36 00-1226 EA 24" Vertical Tee, 9" Rung Spacing, 12" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	462.65 -31.65 23.13	175.34
26 05 36 00-1227 EA 30" Vertical Tee, 9" Rung Spacing, 12" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	495.36 -33.45 24.77	193.04
26 05 36 00-1228 EA 36" Vertical Tee, 9" Rung Spacing, 12" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	536.22 -35.76 26.81	214.26
26 05 36 00-1229 24" Radius Vertical Tees <small>(26 05 36 00-1124)</small>		
26 05 36 00-1230 EA 6" Vertical Tee, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	509.24 -38.05 25.46	154.51
26 05 36 00-1231 EA 9" Vertical Tee, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	523.15 -38.91 26.16	160.86
26 05 36 00-1232 EA 12" Vertical Tee, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	537.96 -39.81 26.90	167.78
26 05 36 00-1233 EA 18" Vertical Tee, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	572.41 -41.92 28.62	183.94
26 05 36 00-1234 EA 24" Vertical Tee, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	594.13 -43.33 29.71	193.04
26 05 36 00-1235 EA 30" Vertical Tee, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	636.07 -45.75 31.80	214.26
26 05 36 00-1236 EA 36" Vertical Tee, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	706.04 -50.50 35.30	241.30
26 05 36 00-1237 36" Radius Vertical Tees <small>(26 05 36 00-1124)</small>		
26 05 36 00-1238 EA 6" Vertical Tee, 9" Rung Spacing, 36" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	758.65 -61.88 37.93	167.78
26 05 36 00-1239 EA 9" Vertical Tee, 9" Rung Spacing, 36" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	777.47 -63.13 38.87	175.34
26 05 36 00-1240 EA 12" Vertical Tee, 9" Rung Spacing, 36" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	797.95 -64.47 39.90	183.94
26 05 36 00-1241 EA 18" Vertical Tee, 9" Rung Spacing, 36" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	836.17 -66.69 41.81	203.09
26 05 36 00-1242 EA 24" Vertical Tee, 9" Rung Spacing, 36" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	861.02 -68.24 43.05	214.26

26 Electrical**26 05 Common Work Results For Electrical****26 05 36 Cable Trays For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-1243	EA		30" Vertical Tee, 9" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	924.69	241.30
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-72.36	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	46.23	
26 05 36 00-1244	EA		36" Vertical Tee, 9" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	987.83	275.48
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-75.83	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	49.39	
26 05 36 00-1245			12" Radius Horizontal Crosses <small>(26 05 36 00-1124)</small>		
26 05 36 00-1246	EA		6" Horizontal Cross, 9" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	413.97	193.04
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-25.31	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	20.70	
26 05 36 00-1247	EA		9" Horizontal Cross, 9" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	440.53	203.09
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-27.13	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	22.03	
26 05 36 00-1248	EA		12" Horizontal Cross, 9" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	460.25	214.26
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-28.17	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	23.01	
26 05 36 00-1249	EA		18" Horizontal Cross, 9" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	503.48	227.21
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-31.41	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	25.17	
26 05 36 00-1250	EA		24" Horizontal Cross, 9" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	557.89	257.22
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-34.35	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	27.89	
26 05 36 00-1251	EA		30" Horizontal Cross, 9" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	611.02	275.48
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-38.15	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	30.55	
26 05 36 00-1252	EA		36" Horizontal Cross, 9" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	685.18	297.20
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-43.76	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	34.26	
26 05 36 00-1253			24" Radius Horizontal Crosses <small>(26 05 36 00-1124)</small>		
26 05 36 00-1254	EA		6" Horizontal Cross, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	534.05	214.26
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-35.55	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	26.70	
26 05 36 00-1255	EA		9" Horizontal Cross, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	561.00	227.21
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-37.17	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	28.05	
26 05 36 00-1256	EA		12" Horizontal Cross, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	589.91	241.30
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-38.88	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	29.50	
26 05 36 00-1257	EA		18" Horizontal Cross, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	626.26	257.22
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-41.19	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	31.31	
26 05 36 00-1258	EA		24" Horizontal Cross, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	710.15	297.20
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-46.25	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	35.51	
26 05 36 00-1259	EA		30" Horizontal Cross, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	766.29	321.72
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-49.82	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	38.31	
26 05 36 00-1260	EA		36" Horizontal Cross, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	843.91	350.68
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-55.16	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	42.20	
26 05 36 00-1261			36" Radius Horizontal Crosses <small>(26 05 36 00-1124)</small>		
26 05 36 00-1262	EA		6" Horizontal Cross, 9" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	610.53	241.30
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-40.95	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	30.53	
26 05 36 00-1263	EA		9" Horizontal Cross, 9" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	645.80	257.22
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-43.14	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	32.29	
26 05 36 00-1264	EA		12" Horizontal Cross, 9" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	689.16	275.48
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-45.96	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	34.46	
26 05 36 00-1265	EA		18" Horizontal Cross, 9" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	740.53	297.20
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-49.29	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	37.03	
26 05 36 00-1266	EA		24" Horizontal Cross, 9" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	888.41	350.68
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-59.61	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	44.42	
26 05 36 00-1267	EA		30" Horizontal Cross, 9" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	978.86	385.43
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-65.77	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	48.94	
26 05 36 00-1268	EA		36" Horizontal Cross, 9" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	1,090.00	429.34
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-73.22	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	54.50	
26 05 36 00-1269			12" Radius Vertical Crosses <small>(26 05 36 00-1124)</small>		
26 05 36 00-1270	EA		6" Vertical Cross, 9" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	413.97	193.04
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-25.31	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	20.70	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-1271 EA 9" Vertical Cross, 9" Rung Spacing, 12" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	440.53 -27.13 22.03	203.09
26 05 36 00-1272 EA 12" Vertical Cross, 9" Rung Spacing, 12" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	460.25 -28.17 23.01	214.26
26 05 36 00-1273 EA 18" Vertical Cross, 9" Rung Spacing, 12" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	503.48 -31.41 25.17	227.21
26 05 36 00-1274 EA 24" Vertical Cross, 9" Rung Spacing, 12" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	557.89 -34.35 27.89	257.22
26 05 36 00-1275 EA 30" Vertical Cross, 9" Rung Spacing, 12" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	611.02 -38.15 30.55	275.48
26 05 36 00-1276 EA 36" Vertical Cross, 9" Rung Spacing, 12" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	683.97 -43.69 34.20	296.39
26 05 36 00-1277 24" Radius Vertical Crosses <small>(26 05 36 00-1274)</small>		
26 05 36 00-1278 EA 6" Vertical Cross, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	534.05 -35.55 26.70	214.26
26 05 36 00-1279 EA 9" Vertical Cross, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	561.00 -37.17 28.05	227.21
26 05 36 00-1280 EA 12" Vertical Cross, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	589.91 -38.88 29.50	241.30
26 05 36 00-1281 EA 18" Vertical Cross, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	626.26 -41.19 31.31	257.22
26 05 36 00-1282 EA 24" Vertical Cross, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	710.15 -46.25 35.51	297.20
26 05 36 00-1283 EA 30" Vertical Cross, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	766.29 -49.82 38.31	321.72
26 05 36 00-1284 EA 36" Vertical Cross, 9" Rung Spacing, 24" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	843.91 -55.16 42.20	350.68
26 05 36 00-1285 36" Radius Vertical Crosses <small>(26 05 36 00-1284)</small>		
26 05 36 00-1286 EA 6" Vertical Cross, 9" Rung Spacing, 36" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	704.30 -50.32 35.22	241.30
26 05 36 00-1287 EA 9" Vertical Cross, 9" Rung Spacing, 36" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	743.47 -52.91 37.17	257.22
26 05 36 00-1288 EA 12" Vertical Cross, 9" Rung Spacing, 36" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	792.70 -56.32 39.64	275.48
26 05 36 00-1289 EA 18" Vertical Cross, 9" Rung Spacing, 36" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	850.91 -60.33 42.55	297.20
26 05 36 00-1290 EA 24" Vertical Cross, 9" Rung Spacing, 36" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	1,025.15 -73.29 51.26	350.68
26 05 36 00-1291 EA 30" Vertical Cross, 9" Rung Spacing, 36" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	1,130.25 -80.90 56.51	385.43
26 05 36 00-1292 EA 36" Vertical Cross, 9" Rung Spacing, 36" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	1,258.49 -90.07 62.92	429.34
26 05 36 00-1293 12" Rung Tray Fittings <small>(26 05 36 00-0744)</small>		
26 05 36 00-1294 90 Degree, 12" Radius Horizontal Elbows <small>(26 05 36 00-1293)</small>		
26 05 36 00-1295 EA 6" Horizontal 90 Degree Elbow, 12" Rung Spacing, 12" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	174.28 -10.71 8.71	80.68
26 05 36 00-1296 EA 9" Horizontal 90 Degree Elbow, 12" Rung Spacing, 12" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	194.02 -11.75 9.70	91.85
26 05 36 00-1297 EA 12" Horizontal 90 Degree Elbow, 12" Rung Spacing, 12" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	217.71 -13.31 10.89	101.58
26 05 36 00-1298 EA 18" Horizontal 90 Degree Elbow, 12" Rung Spacing, 12" Radius, Aluminum Cable Tray..... <i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i> <i>For 6" Overall Height Instead Of 4-5/8", Add</i>	262.01 -15.83 13.10	124.51

26 Electrical**26 05 Common Work Results For Electrical****26 05 36 Cable Trays For Electrical Systems**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-1299 EA 24" Horizontal 90 Degree Elbow, 12" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	305.86	142.93
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-18.67	
For 6" Overall Height Instead Of 4-5/8", Add	15.29	
26 05 36 00-1300 EA 30" Horizontal 90 Degree Elbow, 12" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	339.77	160.86
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-20.57	
For 6" Overall Height Instead Of 4-5/8", Add	16.99	
26 05 36 00-1301 EA 36" Horizontal 90 Degree Elbow, 12" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	393.23	183.86
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-24.00	
For 6" Overall Height Instead Of 4-5/8", Add	19.66	
26 05 36 00-1302 90 Degree, 24" Radius Horizontal Elbows (26 05 36 00-1293)		
26 05 36 00-1303 EA 6" Horizontal 90 Degree Elbow, 12" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	210.48	83.89
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-14.06	
For 6" Overall Height Instead Of 4-5/8", Add	10.52	
26 05 36 00-1304 EA 9" Horizontal 90 Degree Elbow, 12" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	234.41	96.43
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-15.40	
For 6" Overall Height Instead Of 4-5/8", Add	11.72	
26 05 36 00-1305 EA 12" Horizontal 90 Degree Elbow, 12" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	255.94	107.22
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-16.66	
For 6" Overall Height Instead Of 4-5/8", Add	12.80	
26 05 36 00-1306 EA 18" Horizontal 90 Degree Elbow, 12" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	305.71	133.20
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-19.47	
For 6" Overall Height Instead Of 4-5/8", Add	15.29	
26 05 36 00-1307 EA 24" Horizontal 90 Degree Elbow, 12" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	349.31	154.51
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-22.06	
For 6" Overall Height Instead Of 4-5/8", Add	17.47	
26 05 36 00-1308 EA 30" Horizontal 90 Degree Elbow, 12" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	392.69	175.34
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-24.66	
For 6" Overall Height Instead Of 4-5/8", Add	19.63	
26 05 36 00-1309 EA 36" Horizontal 90 Degree Elbow, 12" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	451.55	203.09
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-28.23	
For 6" Overall Height Instead Of 4-5/8", Add	22.58	
26 05 36 00-1310 90 Degree, 36" Radius Horizontal Elbows (26 05 36 00-1293)		
26 05 36 00-1311 EA 6" Horizontal 90 Degree Elbow, 12" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	223.86	87.67
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-15.08	
For 6" Overall Height Instead Of 4-5/8", Add	11.19	
26 05 36 00-1312 EA 9" Horizontal 90 Degree Elbow, 12" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	248.86	101.50
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-16.43	
For 6" Overall Height Instead Of 4-5/8", Add	12.44	
26 05 36 00-1313 EA 12" Horizontal 90 Degree Elbow, 12" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	278.16	113.57
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-18.35	
For 6" Overall Height Instead Of 4-5/8", Add	13.91	
26 05 36 00-1314 EA 18" Horizontal 90 Degree Elbow, 12" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	338.16	142.93
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-21.90	
For 6" Overall Height Instead Of 4-5/8", Add	16.91	
26 05 36 00-1315 EA 24" Horizontal 90 Degree Elbow, 12" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	392.70	167.78
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-25.29	
For 6" Overall Height Instead Of 4-5/8", Add	19.64	
26 05 36 00-1316 EA 30" Horizontal 90 Degree Elbow, 12" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	445.87	193.04
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-28.50	
For 6" Overall Height Instead Of 4-5/8", Add	22.29	
26 05 36 00-1317 EA 36" Horizontal 90 Degree Elbow, 12" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	520.27	226.81
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-33.13	
For 6" Overall Height Instead Of 4-5/8", Add	26.01	
26 05 36 00-1318 45 Degree, 12" Radius Horizontal Elbows (26 05 36 00-1293)		
26 05 36 00-1319 EA 6" Horizontal 45 Degree Elbow, 12" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	123.66	58.47
For 30 Degree Bend, Deduct	-33.92	
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-7.50	
For 6" Overall Height Instead Of 4-5/8", Add	6.18	
For 60 Degree Bend, Deduct	-18.40	
26 05 36 00-1320 EA 9" Horizontal 45 Degree Elbow, 12" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	144.09	70.13
For 30 Degree Bend, Deduct	-38.36	
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-8.57	
For 6" Overall Height Instead Of 4-5/8", Add	7.20	
For 60 Degree Bend, Deduct	-20.68	
26 05 36 00-1321 EA 12" Horizontal 45 Degree Elbow, 12" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	162.31	80.44
For 30 Degree Bend, Deduct	-42.35	
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-9.53	
For 6" Overall Height Instead Of 4-5/8", Add	8.12	
For 60 Degree Bend, Deduct	-22.73	
26 05 36 00-1322 EA 18" Horizontal 45 Degree Elbow, 12" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	202.71	101.66
For 30 Degree Bend, Deduct	-52.20	
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-11.80	
For 6" Overall Height Instead Of 4-5/8", Add	10.14	
For 60 Degree Bend, Deduct	-27.93	
26 05 36 00-1323 EA 24" Horizontal 45 Degree Elbow, 12" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	248.89	124.51
For 30 Degree Bend, Deduct	-64.26	
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-14.51	
For 6" Overall Height Instead Of 4-5/8", Add	12.44	
For 60 Degree Bend, Deduct	-34.41	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-1324 EA 30" Horizontal 45 Degree Elbow, 12" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	285.68	142.93
For 30 Degree Bend, Deduct	-73.74	
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-16.66	
For 6" Overall Height Instead Of 4-5/8", Add	14.28	
For 60 Degree Bend, Deduct	-39.48	
26 05 36 00-1325 EA 36" Horizontal 45 Degree Elbow, 12" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	329.12	167.78
For 30 Degree Bend, Deduct	-83.14	
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-18.93	
For 6" Overall Height Instead Of 4-5/8", Add	16.46	
For 60 Degree Bend, Deduct	-44.29	
26 05 36 00-1326 45 Degree, 24" Radius Horizontal Elbows <small>(26 05 36 00-1293)</small>		
26 05 36 00-1327 EA 6" Horizontal 45 Degree Elbow, 12" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	135.82	60.32
For 30 Degree Bend, Deduct	-39.53	
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-8.56	
For 6" Overall Height Instead Of 4-5/8", Add	6.79	
For 60 Degree Bend, Deduct	-21.71	
26 05 36 00-1328 EA 9" Horizontal 45 Degree Elbow, 12" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	160.56	72.71
For 30 Degree Bend, Deduct	-45.89	
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-10.00	
For 6" Overall Height Instead Of 4-5/8", Add	8.03	
For 60 Degree Bend, Deduct	-25.11	
26 05 36 00-1329 EA 12" Horizontal 45 Degree Elbow, 12" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	180.30	83.97
For 30 Degree Bend, Deduct	-50.19	
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-11.03	
For 6" Overall Height Instead Of 4-5/8", Add	9.02	
For 60 Degree Bend, Deduct	-27.32	
26 05 36 00-1330 EA 18" Horizontal 45 Degree Elbow, 12" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	222.13	107.22
For 30 Degree Bend, Deduct	-59.62	
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-13.28	
For 6" Overall Height Instead Of 4-5/8", Add	11.11	
For 60 Degree Bend, Deduct	-32.20	
26 05 36 00-1331 EA 24" Horizontal 45 Degree Elbow, 12" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	272.41	133.20
For 30 Degree Bend, Deduct	-72.15	
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-16.14	
For 6" Overall Height Instead Of 4-5/8", Add	13.62	
For 60 Degree Bend, Deduct	-38.85	
26 05 36 00-1332 EA 30" Horizontal 45 Degree Elbow, 12" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	318.02	154.51
For 30 Degree Bend, Deduct	-84.80	
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-18.93	
For 6" Overall Height Instead Of 4-5/8", Add	15.90	
For 60 Degree Bend, Deduct	-45.73	
26 05 36 00-1333 EA 36" Horizontal 45 Degree Elbow, 12" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	370.11	183.94
For 30 Degree Bend, Deduct	-96.28	
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-21.69	
For 6" Overall Height Instead Of 4-5/8", Add	18.51	
For 60 Degree Bend, Deduct	-51.64	
26 05 36 00-1334 45 Degree, 36" Radius Horizontal Elbows <small>(26 05 36 00-1293)</small>		
26 05 36 00-1335 EA 6" Horizontal 45 Degree Elbow, 12" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	151.14	62.25
For 30 Degree Bend, Deduct	-46.83	
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-9.93	
For 6" Overall Height Instead Of 4-5/8", Add	7.56	
For 60 Degree Bend, Deduct	-26.03	
26 05 36 00-1336 EA 9" Horizontal 45 Degree Elbow, 12" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	174.44	75.60
For 30 Degree Bend, Deduct	-51.85	
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-11.14	
For 6" Overall Height Instead Of 4-5/8", Add	8.72	
For 60 Degree Bend, Deduct	-28.59	
26 05 36 00-1337 EA 12" Horizontal 45 Degree Elbow, 12" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	195.70	87.75
For 30 Degree Bend, Deduct	-56.45	
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-12.26	
For 6" Overall Height Instead Of 4-5/8", Add	9.79	
For 60 Degree Bend, Deduct	-30.95	
26 05 36 00-1338 EA 18" Horizontal 45 Degree Elbow, 12" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	243.84	113.57
For 30 Degree Bend, Deduct	-67.84	
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-14.92	
For 6" Overall Height Instead Of 4-5/8", Add	12.19	
For 60 Degree Bend, Deduct	-36.92	
26 05 36 00-1339 EA 24" Horizontal 45 Degree Elbow, 12" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	304.85	142.93
For 30 Degree Bend, Deduct	-84.28	
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-18.57	
For 6" Overall Height Instead Of 4-5/8", Add	15.24	
For 60 Degree Bend, Deduct	-45.81	
26 05 36 00-1340 EA 30" Horizontal 45 Degree Elbow, 12" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	350.31	167.78
For 30 Degree Bend, Deduct	-94.79	
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-21.05	
For 6" Overall Height Instead Of 4-5/8", Add	17.52	
For 60 Degree Bend, Deduct	-51.28	
26 05 36 00-1341 EA 36" Horizontal 45 Degree Elbow, 12" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	416.23	203.09
For 30 Degree Bend, Deduct	-110.45	
For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-24.70	
For 6" Overall Height Instead Of 4-5/8", Add	20.81	
For 60 Degree Bend, Deduct	-59.50	

26 Electrical**26 05 Common Work Results For Electrical****26 05 36 Cable Trays For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-1342			90 Degree, 12" Radius Vertical Risers <small>(26 05 36 00-1293)</small>		
26 05 36 00-1343	EA		6" Vertical Riser 90 Degree, 12" Rung Spacing, 12" Radius, Aluminum Cable Tray .....187.77		80.44
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-12.07	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	9.39	
26 05 36 00-1344	EA		9" Vertical Riser 90 Degree, 12" Rung Spacing, 12" Radius, Aluminum Cable Tray .....209.79		91.85
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-13.32	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	10.49	
26 05 36 00-1345	EA		12" Vertical Riser 90 Degree, 12" Rung Spacing, 12" Radius, Aluminum Cable Tray .....226.89		101.58
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-14.23	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	11.34	
26 05 36 00-1346	EA		18" Vertical Riser 90 Degree, 12" Rung Spacing, 12" Radius, Aluminum Cable Tray .....267.09		124.51
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-16.33	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	13.35	
26 05 36 00-1347	EA		24" Vertical Riser 90 Degree, 12" Rung Spacing, 12" Radius, Aluminum Cable Tray .....300.75		142.93
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-18.16	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	15.04	
26 05 36 00-1348	EA		30" Vertical Riser 90 Degree, 12" Rung Spacing, 12" Radius, Aluminum Cable Tray .....333.55		160.86
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-19.95	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	16.68	
26 05 36 00-1349	EA		36" Vertical Riser 90 Degree, 12" Rung Spacing, 12" Radius, Aluminum Cable Tray .....373.46		183.62
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-22.04	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	18.67	
26 05 36 00-1350			90 Degree, 24" Radius Vertical Risers <small>(26 05 36 00-1293)</small>		
26 05 36 00-1351	EA		6" Vertical Riser 90 Degree, 12" Rung Spacing, 24" Radius, Aluminum Cable Tray .....197.95		83.89
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-12.80	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	9.90	
26 05 36 00-1352	EA		9" Vertical Riser 90 Degree, 12" Rung Spacing, 24" Radius, Aluminum Cable Tray .....221.42		96.51
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-14.10	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	11.07	
26 05 36 00-1353	EA		12" Vertical Riser 90 Degree, 12" Rung Spacing, 24" Radius, Aluminum Cable Tray .....240.75		107.22
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-15.14	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	12.04	
26 05 36 00-1354	EA		18" Vertical Riser 90 Degree, 12" Rung Spacing, 24" Radius, Aluminum Cable Tray .....287.38		133.20
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-17.64	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	14.37	
26 05 36 00-1355	EA		24" Vertical Riser 90 Degree, 12" Rung Spacing, 24" Radius, Aluminum Cable Tray .....326.81		154.51
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-19.81	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	16.34	
26 05 36 00-1356	EA		30" Vertical Riser 90 Degree, 12" Rung Spacing, 24" Radius, Aluminum Cable Tray .....365.52		175.34
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-21.94	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	18.28	
26 05 36 00-1357	EA		36" Vertical Riser 90 Degree, 12" Rung Spacing, 24" Radius, Aluminum Cable Tray .....416.65		203.09
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-24.74	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	20.83	
26 05 36 00-1358			90 Degree, 36" Radius Vertical Risers <small>(26 05 36 00-1293)</small>		
26 05 36 00-1359	EA		6" Vertical Riser 90 Degree, 12" Rung Spacing, 36" Radius, Aluminum Cable Tray .....236.00		87.67
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-16.29	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	11.80	
26 05 36 00-1360	EA		9" Vertical Riser 90 Degree, 12" Rung Spacing, 36" Radius, Aluminum Cable Tray .....261.07		101.58
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-17.64	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	13.05	
26 05 36 00-1361	EA		12" Vertical Riser 90 Degree, 12" Rung Spacing, 36" Radius, Aluminum Cable Tray .....287.02		113.57
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-19.24	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	14.35	
26 05 36 00-1362	EA		18" Vertical Riser 90 Degree, 12" Rung Spacing, 36" Radius, Aluminum Cable Tray .....339.82		142.93
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-22.07	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	16.99	
26 05 36 00-1363	EA		24" Vertical Riser 90 Degree, 12" Rung Spacing, 36" Radius, Aluminum Cable Tray .....385.15		167.78
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-24.53	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	19.26	
26 05 36 00-1364	EA		30" Vertical Riser 90 Degree, 12" Rung Spacing, 36" Radius, Aluminum Cable Tray .....435.02		193.04
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-27.42	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	21.75	
26 05 36 00-1365	EA		36" Vertical Riser 90 Degree, 12" Rung Spacing, 36" Radius, Aluminum Cable Tray .....496.15		226.81
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-30.72	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	24.81	
26 05 36 00-1366			12" Radius Horizontal Tees <small>(26 05 36 00-1293)</small>		
26 05 36 00-1367	EA		6" Horizontal Tee, 12" Rung Spacing, 12" Radius, Aluminum Cable Tray .....317.04		154.51
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-18.83	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	15.85	
26 05 36 00-1368	EA		9" Horizontal Tee, 12" Rung Spacing, 12" Radius, Aluminum Cable Tray .....343.15		167.78
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-20.33	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	17.16	
26 05 36 00-1369	EA		12" Horizontal Tee, 12" Rung Spacing, 12" Radius, Aluminum Cable Tray .....356.73		175.34
			<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-21.06	
			<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	17.84	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-1370 EA 18" Horizontal Tee, 12" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	398.88	193.04
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-23.80	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	19.94	
26 05 36 00-1371 EA 24" Horizontal Tee, 12" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	442.13	214.26
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-26.36	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	22.11	
26 05 36 00-1372 EA 30" Horizontal Tee, 12" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	477.32	227.21
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-28.80	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	23.87	
26 05 36 00-1373 EA 36" Horizontal Tee, 12" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	546.93	257.22
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-33.26	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	27.35	
26 05 36 00-1374 24" Radius Horizontal Tees <small>(26 05 36 00-1293)</small>		
26 05 36 00-1375 EA 6" Horizontal Tee, 12" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	381.24	167.78
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-24.14	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	19.06	
26 05 36 00-1376 EA 9" Horizontal Tee, 12" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	413.96	183.94
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-26.07	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	20.70	
26 05 36 00-1377 EA 12" Horizontal Tee, 12" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	432.09	193.04
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-27.12	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	21.60	
26 05 36 00-1378 EA 18" Horizontal Tee, 12" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	477.29	214.26
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-29.87	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	23.86	
26 05 36 00-1379 EA 24" Horizontal Tee, 12" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	533.04	241.30
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-33.20	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	26.65	
26 05 36 00-1380 EA 30" Horizontal Tee, 12" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	572.32	257.22
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-35.80	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	28.62	
26 05 36 00-1381 EA 36" Horizontal Tee, 12" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	715.03	297.20
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-46.74	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	35.75	
26 05 36 00-1382 36" Radius Horizontal Tees <small>(26 05 36 00-1293)</small>		
26 05 36 00-1383 EA 6" Horizontal Tee, 12" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	450.10	183.94
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-29.68	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	22.51	
26 05 36 00-1384 EA 9" Horizontal Tee, 12" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	486.00	203.09
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-31.67	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	24.30	
26 05 36 00-1385 EA 12" Horizontal Tee, 12" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	518.31	214.26
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-33.97	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	25.92	
26 05 36 00-1386 EA 18" Horizontal Tee, 12" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	572.11	241.30
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-37.10	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	28.61	
26 05 36 00-1387 EA 24" Horizontal Tee, 12" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	646.62	275.48
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-41.71	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	32.33	
26 05 36 00-1388 EA 30" Horizontal Tee, 12" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	732.61	297.20
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-48.50	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	36.63	
26 05 36 00-1389 EA 36" Horizontal Tee, 12" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	848.25	350.68
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-55.60	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	42.41	
26 05 36 00-1390 12" Radius Vertical Tees <small>(26 05 36 00-1293)</small>		
26 05 36 00-1391 EA 6" Vertical Tee, 12" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	372.06	142.93
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-25.29	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	18.60	
26 05 36 00-1392 EA 9" Vertical Tee, 12" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	385.35	148.55
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-26.15	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	19.27	
26 05 36 00-1393 EA 12" Vertical Tee, 12" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	396.16	154.51
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-26.74	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	19.81	
26 05 36 00-1394 EA 18" Vertical Tee, 12" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	421.29	167.78
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-28.15	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	21.06	
26 05 36 00-1395 EA 24" Vertical Tee, 12" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	445.61	175.34
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-29.95	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	22.28	
26 05 36 00-1396 EA 30" Vertical Tee, 12" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	478.00	193.04
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-31.71	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	23.90	
26 05 36 00-1397 EA 36" Vertical Tee, 12" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	518.31	214.26
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-33.97	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	25.92	

26 Electrical**26 05 Common Work Results For Electrical****26 05 36 Cable Trays For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-1398			24" Radius Vertical Tees (26 05 36 00-1293)		
26 05 36 00-1399	EA		6" Vertical Tee, 12" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	484.07	154.51
			For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-35.53	
			For 6" Overall Height Instead Of 4-5/8", Add	24.20	
26 05 36 00-1400	EA		9" Vertical Tee, 12" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	497.65	160.86
			For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-36.36	
			For 6" Overall Height Instead Of 4-5/8", Add	24.88	
26 05 36 00-1401	EA		12" Vertical Tee, 12" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	512.13	167.78
			For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-37.23	
			For 6" Overall Height Instead Of 4-5/8", Add	25.61	
26 05 36 00-1402	EA		18" Vertical Tee, 12" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	545.82	183.94
			For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-39.26	
			For 6" Overall Height Instead Of 4-5/8", Add	27.29	
26 05 36 00-1403	EA		24" Vertical Tee, 12" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	566.88	193.04
			For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-40.60	
			For 6" Overall Height Instead Of 4-5/8", Add	28.34	
26 05 36 00-1404	EA		30" Vertical Tee, 12" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	608.18	214.26
			For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-42.96	
			For 6" Overall Height Instead Of 4-5/8", Add	30.41	
26 05 36 00-1405	EA		36" Vertical Tee, 12" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	675.65	241.30
			For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-47.46	
			For 6" Overall Height Instead Of 4-5/8", Add	33.78	
26 05 36 00-1406			36" Radius Vertical Tees (26 05 36 00-1293)		
26 05 36 00-1407	EA		6" Vertical Tee, 12" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	710.75	167.78
			For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-57.09	
			For 6" Overall Height Instead Of 4-5/8", Add	35.54	
26 05 36 00-1408	EA		9" Vertical Tee, 12" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	728.95	175.34
			For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-58.28	
			For 6" Overall Height Instead Of 4-5/8", Add	36.45	
26 05 36 00-1409	EA		12" Vertical Tee, 12" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	748.80	183.94
			For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-59.55	
			For 6" Overall Height Instead Of 4-5/8", Add	37.44	
26 05 36 00-1410	EA		18" Vertical Tee, 12" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	786.40	203.09
			For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-61.71	
			For 6" Overall Height Instead Of 4-5/8", Add	39.32	
26 05 36 00-1411	EA		24" Vertical Tee, 12" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	810.64	214.26
			For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-63.21	
			For 6" Overall Height Instead Of 4-5/8", Add	40.53	
26 05 36 00-1412	EA		30" Vertical Tee, 12" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	872.44	241.30
			For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-67.14	
			For 6" Overall Height Instead Of 4-5/8", Add	43.62	
26 05 36 00-1413	EA		36" Vertical Tee, 12" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	934.95	275.48
			For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-70.54	
			For 6" Overall Height Instead Of 4-5/8", Add	46.75	
26 05 36 00-1414			12" Radius Horizontal Crosses (26 05 36 00-1293)		
26 05 36 00-1415	EA		6" Horizontal Cross, 12" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	404.74	193.04
			For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-24.39	
			For 6" Overall Height Instead Of 4-5/8", Add	20.24	
26 05 36 00-1416	EA		9" Horizontal Cross, 12" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	430.32	203.09
			For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-26.11	
			For 6" Overall Height Instead Of 4-5/8", Add	21.52	
26 05 36 00-1417	EA		12" Horizontal Cross, 12" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	449.94	214.26
			For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-27.14	
			For 6" Overall Height Instead Of 4-5/8", Add	22.50	
26 05 36 00-1418	EA		18" Horizontal Cross, 12" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	491.00	227.21
			For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-30.17	
			For 6" Overall Height Instead Of 4-5/8", Add	24.55	
26 05 36 00-1419	EA		24" Horizontal Cross, 12" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	544.97	257.22
			For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-33.06	
			For 6" Overall Height Instead Of 4-5/8", Add	27.25	
26 05 36 00-1420	EA		30" Horizontal Cross, 12" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	595.83	275.48
			For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-36.63	
			For 6" Overall Height Instead Of 4-5/8", Add	29.79	
26 05 36 00-1421	EA		36" Horizontal Cross, 12" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	666.19	297.20
			For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-41.86	
			For 6" Overall Height Instead Of 4-5/8", Add	33.31	
26 05 36 00-1422			24" Radius Horizontal Crosses (26 05 36 00-1293)		
26 05 36 00-1423	EA		6" Horizontal Cross, 12" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	516.36	214.26
			For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-33.78	
			For 6" Overall Height Instead Of 4-5/8", Add	25.82	
26 05 36 00-1424	EA		9" Horizontal Cross, 12" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	542.76	227.21
			For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-35.34	
			For 6" Overall Height Instead Of 4-5/8", Add	27.14	
26 05 36 00-1425	EA		12" Horizontal Cross, 12" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	571.14	241.30
			For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-37.01	
			For 6" Overall Height Instead Of 4-5/8", Add	28.56	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-1426 EA 18" Horizontal Cross, 12" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	606.51	257.22
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-39.21	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	30.33	
26 05 36 00-1427 EA 24" Horizontal Cross, 12" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	688.66	297.20
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-44.10	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	34.43	
26 05 36 00-1428 EA 30" Horizontal Cross, 12" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	743.28	321.72
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-47.52	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	37.16	
26 05 36 00-1429 EA 36" Horizontal Cross, 12" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	817.97	350.68
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-52.57	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	40.90	
26 05 36 00-1430 36" Radius Horizontal Crosses <small>(26 05 36 00-1293)</small>		
26 05 36 00-1431 EA 6" Horizontal Cross, 12" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	589.70	241.30
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-38.86	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	29.49	
26 05 36 00-1432 EA 9" Horizontal Cross, 12" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	624.09	257.22
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-40.97	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	31.20	
26 05 36 00-1433 EA 12" Horizontal Cross, 12" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	666.15	275.48
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-43.66	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	33.31	
26 05 36 00-1434 EA 18" Horizontal Cross, 12" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	716.01	297.20
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-46.84	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	35.80	
26 05 36 00-1435 EA 24" Horizontal Cross, 12" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	858.02	350.68
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-56.58	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	42.90	
26 05 36 00-1436 EA 30" Horizontal Cross, 12" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	945.21	385.43
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-62.40	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	47.26	
26 05 36 00-1437 EA 36" Horizontal Cross, 12" Rung Spacing, 36" Radius, Aluminum Cable Tray.....	1,052.56	429.34
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-69.48	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	52.63	
26 05 36 00-1438 12" Radius Vertical Crosses <small>(26 05 36 00-1293)</small>		
26 05 36 00-1439 EA 6" Vertical Cross, 12" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	404.74	193.04
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-24.39	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	20.24	
26 05 36 00-1440 EA 9" Vertical Cross, 12" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	430.44	203.17
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-26.11	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	21.52	
26 05 36 00-1441 EA 12" Vertical Cross, 12" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	449.88	214.26
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-27.13	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	22.49	
26 05 36 00-1442 EA 18" Vertical Cross, 12" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	491.15	227.29
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-30.17	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	24.56	
26 05 36 00-1443 EA 24" Vertical Cross, 12" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	544.97	257.22
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-33.06	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	27.25	
26 05 36 00-1444 EA 30" Vertical Cross, 12" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	596.04	275.56
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-36.64	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	29.80	
26 05 36 00-1445 EA 36" Vertical Cross, 12" Rung Spacing, 12" Radius, Aluminum Cable Tray.....	665.59	296.79
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-41.83	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	33.28	
26 05 36 00-1446 24" Radius Vertical Crosses <small>(26 05 36 00-1293)</small>		
26 05 36 00-1447 EA 6" Vertical Cross, 12" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	516.36	214.26
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-33.78	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	25.82	
26 05 36 00-1448 EA 9" Vertical Cross, 12" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	542.76	227.21
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-35.34	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	27.14	
26 05 36 00-1449 EA 12" Vertical Cross, 12" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	571.14	241.30
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-37.01	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	28.56	
26 05 36 00-1450 EA 18" Vertical Cross, 12" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	606.51	257.22
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-39.21	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	30.33	
26 05 36 00-1451 EA 24" Vertical Cross, 12" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	688.66	297.20
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-44.10	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	34.43	
26 05 36 00-1452 EA 30" Vertical Cross, 12" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	743.28	321.72
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-47.52	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	37.16	
26 05 36 00-1453 EA 36" Vertical Cross, 12" Rung Spacing, 24" Radius, Aluminum Cable Tray.....	817.97	350.68
<i>For 3-5/8" Overall Height Instead Of 4-5/8", Deduct</i>	-52.57	
<i>For 6" Overall Height Instead Of 4-5/8", Add</i>	40.90	

26 Electrical**26 05 Common Work Results For Electrical****26 05 36 Cable Trays For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-1454			36" Radius Vertical Crosses (26 05 36 00-1293)		
26 05 36 00-1455	EA		6" Vertical Cross, 12" Rung Spacing, 36" Radius, Aluminum Cable Tray .....674.09	674.09	241.30
			For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-47.30	
			For 6" Overall Height Instead Of 4-5/8", Add	33.70	
26 05 36 00-1456	EA		9" Vertical Cross, 12" Rung Spacing, 36" Radius, Aluminum Cable Tray .....712.00	712.00	257.22
			For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-49.76	
			For 6" Overall Height Instead Of 4-5/8", Add	35.60	
26 05 36 00-1457	EA		12" Vertical Cross, 12" Rung Spacing, 36" Radius, Aluminum Cable Tray .....759.33	759.33	275.48
			For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-52.98	
			For 6" Overall Height Instead Of 4-5/8", Add	37.97	
26 05 36 00-1458	EA		18" Vertical Cross, 12" Rung Spacing, 36" Radius, Aluminum Cable Tray .....815.34	815.34	297.20
			For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-56.77	
			For 6" Overall Height Instead Of 4-5/8", Add	40.77	
26 05 36 00-1459	EA		24" Vertical Cross, 12" Rung Spacing, 36" Radius, Aluminum Cable Tray .....981.09	981.09	350.68
			For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-68.88	
			For 6" Overall Height Instead Of 4-5/8", Add	49.05	
26 05 36 00-1460	EA		30" Vertical Cross, 12" Rung Spacing, 36" Radius, Aluminum Cable Tray .....1,081.47	1,081.47	385.43
			For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-76.03	
			For 6" Overall Height Instead Of 4-5/8", Add	54.07	
26 05 36 00-1461	EA		36" Vertical Cross, 12" Rung Spacing, 36" Radius, Aluminum Cable Tray .....1,204.20	1,204.20	429.34
			For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-84.64	
			For 6" Overall Height Instead Of 4-5/8", Add	60.21	
26 05 36 00-1462			Dropout Or End Plates And Reducers (26 05 36 00-0744)		
26 05 36 00-1463			Straight Reducers (26 05 36 00-1462)		
26 05 36 00-1464	EA		9"-6" Reducer, Aluminum Cable Tray .....147.80	147.80	59.36
			For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-9.83	
			For 6" Overall Height Instead Of 4-5/8", Add	7.39	
26 05 36 00-1465	EA		12"-9" Reducer, Aluminum Cable Tray .....157.05	157.05	64.27
			For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-10.35	
			For 6" Overall Height Instead Of 4-5/8", Add	7.85	
26 05 36 00-1466	EA		18"-12" Reducer, Aluminum Cable Tray .....174.68	174.68	74.16
			For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-11.28	
			For 6" Overall Height Instead Of 4-5/8", Add	8.73	
26 05 36 00-1467	EA		24"-18" Reducer, Aluminum Cable Tray .....195.10	195.10	85.82
			For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-12.36	
			For 6" Overall Height Instead Of 4-5/8", Add	9.76	
26 05 36 00-1468	EA		30"-24" Reducer, Aluminum Cable Tray .....214.04	214.04	96.51
			For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-13.36	
			For 6" Overall Height Instead Of 4-5/8", Add	10.70	
26 05 36 00-1469	EA		36"-30" Reducer, Aluminum Cable Tray .....240.23	240.23	110.27
			For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-14.83	
			For 6" Overall Height Instead Of 4-5/8", Add	12.01	
26 05 36 00-1470			Reducers (26 05 36 00-1462)		
26 05 36 00-1471	EA		18"-6" Reducer, Aluminum Cable Tray .....174.76	174.76	74.24
			For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-11.29	
			For 6" Overall Height Instead Of 4-5/8", Add	8.74	
26 05 36 00-1472	EA		24"-12" Reducer, Aluminum Cable Tray .....195.31	195.31	85.90
			For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-12.37	
			For 6" Overall Height Instead Of 4-5/8", Add	9.77	
26 05 36 00-1473	EA		30"-12" Reducer, Aluminum Cable Tray .....213.91	213.91	96.43
			For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-13.35	
			For 6" Overall Height Instead Of 4-5/8", Add	10.70	
26 05 36 00-1474	EA		30"-18" Reducer, Aluminum Cable Tray .....214.87	214.87	96.35
			For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-13.46	
			For 6" Overall Height Instead Of 4-5/8", Add	10.74	
26 05 36 00-1475	EA		36"-12" Reducer, Aluminum Cable Tray .....239.15	239.15	110.27
			For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-14.73	
			For 6" Overall Height Instead Of 4-5/8", Add	11.96	
26 05 36 00-1476	EA		36"-18" Reducer, Aluminum Cable Tray .....245.06	245.06	113.17
			For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-15.07	
			For 6" Overall Height Instead Of 4-5/8", Add	12.25	
26 05 36 00-1477	EA		36"-24" Reducer, Aluminum Cable Tray .....253.27	253.27	116.79
			For 3-5/8" Overall Height Instead Of 4-5/8", Deduct	-15.59	
			For 6" Overall Height Instead Of 4-5/8", Add	12.66	
26 05 36 00-1478			Dropout Or End Plate (26 05 36 00-1462)		
26 05 36 00-1479	EA		6" Dropout Or End Plate, Aluminum Cable Tray .....46.67	46.67	24.13
26 05 36 00-1480	EA		9" Dropout Or End Plate, Aluminum Cable Tray .....52.82	52.82	27.58
26 05 36 00-1481	EA		12" Dropout Or End Plate, Aluminum Cable Tray .....56.95	56.95	29.68
26 05 36 00-1482	EA		18" Dropout Or End Plate, Aluminum Cable Tray .....68.51	68.51	35.07
26 05 36 00-1483	EA		24" Dropout Or End Plate, Aluminum Cable Tray .....76.13	76.13	38.61
26 05 36 00-1484	EA		30" Dropout Or End Plate, Aluminum Cable Tray .....85.50	85.50	42.87
26 05 36 00-1485	EA		36" Dropout Or End Plate, Aluminum Cable Tray .....96.01	96.01	48.26



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-1486				Solid Bottom Cable Tray (26 05 36 00-0001) Note: 3-5/8" Height.		
26 05 36 00-1487				Solid Bottom Galvanized Steel Straight Tray Sections (26 05 36 00-1486)		
26 05 36 00-1488	LF			6" Solid Bottom Steel Cable Tray, Straight Section 18.48		6.27
				For 4-5/8" Overall Height Instead Of 3-5/8", Add 1.72		
26 05 36 00-1489	LF			12" Solid Bottom Steel Cable Tray, Straight Section 22.97		7.72
				For 4-5/8" Overall Height Instead Of 3-5/8", Add 2.16		
26 05 36 00-1490	LF			18" Solid Bottom Steel Cable Tray, Straight Section 30.93		11.10
				For 4-5/8" Overall Height Instead Of 3-5/8", Add 2.79		
26 05 36 00-1491	LF			24" Solid Bottom Steel Cable Tray, Straight Section 35.75		12.71
				For 4-5/8" Overall Height Instead Of 3-5/8", Add 3.24		
26 05 36 00-1492	LF			30" Solid Bottom Steel Cable Tray, Straight Section 42.89		15.37
				For 4-5/8" Overall Height Instead Of 3-5/8", Add 3.87		
26 05 36 00-1493	LF			36" Solid Bottom Steel Cable Tray, Straight Section 54.06		17.61
				For 4-5/8" Overall Height Instead Of 3-5/8", Add 5.18		
26 05 36 00-1494				Solid Bottom Galvanized Steel Cable Tray Fittings (26 05 36 00-1486)		
26 05 36 00-1495				90 Degree, 12" Radius Horizontal Elbows (26 05 36 00-1494)		
26 05 36 00-1496	EA			6" Horizontal 90 Degree Elbow, Solid Bottom, 12" Radius, Steel Cable Tray 194.43		80.52
				For 4-5/8" Overall Height Instead Of 3-5/8", Add 15.75		
26 05 36 00-1497	EA			12" Horizontal 90 Degree Elbow, Solid Bottom, 12" Radius, Steel Cable Tray 256.33		113.25
				For 4-5/8" Overall Height Instead Of 3-5/8", Add 19.57		
26 05 36 00-1498	EA			18" Horizontal 90 Degree Elbow, Solid Bottom, 12" Radius, Steel Cable Tray 315.41		142.93
				For 4-5/8" Overall Height Instead Of 3-5/8", Add 23.49		
26 05 36 00-1499	EA			24" Horizontal 90 Degree Elbow, Solid Bottom, 12" Radius, Steel Cable Tray 386.75		175.58
				For 4-5/8" Overall Height Instead Of 3-5/8", Add 28.74		
26 05 36 00-1500	EA			30" Horizontal 90 Degree Elbow, Solid Bottom, 12" Radius, Steel Cable Tray 451.21		203.49
				For 4-5/8" Overall Height Instead Of 3-5/8", Add 33.77		
26 05 36 00-1501	EA			36" Horizontal 90 Degree Elbow, Solid Bottom, 12" Radius, Steel Cable Tray 506.48		227.21
				For 4-5/8" Overall Height Instead Of 3-5/8", Add 38.11		
26 05 36 00-1502				90 Degree, 24" Radius Horizontal Elbows (26 05 36 00-1494)		
26 05 36 00-1503	EA			6" Horizontal 90 Degree Elbow, Solid Bottom, 24" Radius, Steel Cable Tray 225.34		83.81
				For 4-5/8" Overall Height Instead Of 3-5/8", Add 19.83		
26 05 36 00-1504	EA			12" Horizontal 90 Degree Elbow, Solid Bottom, 24" Radius, Steel Cable Tray 301.36		120.73
				For 4-5/8" Overall Height Instead Of 3-5/8", Add 25.08		
26 05 36 00-1505	EA			18" Horizontal 90 Degree Elbow, Solid Bottom, 24" Radius, Steel Cable Tray 373.21		154.51
				For 4-5/8" Overall Height Instead Of 3-5/8", Add 30.24		
26 05 36 00-1506	EA			24" Horizontal 90 Degree Elbow, Solid Bottom, 24" Radius, Steel Cable Tray 456.76		193.04
				For 4-5/8" Overall Height Instead Of 3-5/8", Add 36.34		
26 05 36 00-1507	EA			30" Horizontal 90 Degree Elbow, Solid Bottom, 24" Radius, Steel Cable Tray 535.91		226.81
				For 4-5/8" Overall Height Instead Of 3-5/8", Add 42.59		
26 05 36 00-1508	EA			36" Horizontal 90 Degree Elbow, Solid Bottom, 24" Radius, Steel Cable Tray 605.98		257.22
				For 4-5/8" Overall Height Instead Of 3-5/8", Add 48.02		
26 05 36 00-1509				90 Degree, 36" Radius Horizontal Elbows (26 05 36 00-1494)		
26 05 36 00-1510	EA			6" Horizontal 90 Degree Elbow, Solid Bottom, 36" Radius, Steel Cable Tray 271.32		87.59
				For 4-5/8" Overall Height Instead Of 3-5/8", Add 26.11		
26 05 36 00-1511	EA			12" Horizontal 90 Degree Elbow, Solid Bottom, 36" Radius, Steel Cable Tray 355.90		128.93
				For 4-5/8" Overall Height Instead Of 3-5/8", Add 31.90		
26 05 36 00-1512	EA			18" Horizontal 90 Degree Elbow, Solid Bottom, 36" Radius, Steel Cable Tray 452.48		168.02
				For 4-5/8" Overall Height Instead Of 3-5/8", Add 39.87		
26 05 36 00-1513	EA			24" Horizontal 90 Degree Elbow, Solid Bottom, 36" Radius, Steel Cable Tray 544.04		214.26
				For 4-5/8" Overall Height Instead Of 3-5/8", Add 45.89		
26 05 36 00-1514	EA			30" Horizontal 90 Degree Elbow, Solid Bottom, 36" Radius, Steel Cable Tray 653.00		257.22
				For 4-5/8" Overall Height Instead Of 3-5/8", Add 55.08		
26 05 36 00-1515	EA			36" Horizontal 90 Degree Elbow, Solid Bottom, 36" Radius, Steel Cable Tray 746.05		296.39
				For 4-5/8" Overall Height Instead Of 3-5/8", Add 62.50		
26 05 36 00-1516				45 Degree, 12" Radius Horizontal Elbows (26 05 36 00-1494)		
26 05 36 00-1517	EA			6" Horizontal 45 Degree Elbow, Solid Bottom, 12" Radius, Steel Cable Tray 179.44		80.52
				For 4-5/8" Overall Height Instead Of 3-5/8", Add 13.49		
26 05 36 00-1518	EA			12" Horizontal 45 Degree Elbow, Solid Bottom, 12" Radius, Steel Cable Tray 239.45		113.25
				For 4-5/8" Overall Height Instead Of 3-5/8", Add 17.04		
26 05 36 00-1519	EA			18" Horizontal 45 Degree Elbow, Solid Bottom, 12" Radius, Steel Cable Tray 295.83		142.77
				For 4-5/8" Overall Height Instead Of 3-5/8", Add 20.58		
26 05 36 00-1520	EA			24" Horizontal 45 Degree Elbow, Solid Bottom, 12" Radius, Steel Cable Tray 362.79		175.34
				For 4-5/8" Overall Height Instead Of 3-5/8", Add 25.19		
26 05 36 00-1521	EA			30" Horizontal 45 Degree Elbow, Solid Bottom, 12" Radius, Steel Cable Tray 423.18		203.49
				For 4-5/8" Overall Height Instead Of 3-5/8", Add 29.57		
26 05 36 00-1522	EA			36" Horizontal 45 Degree Elbow, Solid Bottom, 12" Radius, Steel Cable Tray 473.82		226.81
				For 4-5/8" Overall Height Instead Of 3-5/8", Add 33.28		
26 05 36 00-1523				45 Degree, 24" Radius Horizontal Elbows (26 05 36 00-1494)		
26 05 36 00-1524	EA			6" Horizontal 45 Degree Elbow, Solid Bottom, 24" Radius, Steel Cable Tray 204.03		83.89
				For 4-5/8" Overall Height Instead Of 3-5/8", Add 16.62		

26 Electrical**26 05 Common Work Results For Electrical****26 05 36 Cable Trays For Electrical Systems**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-1525 EA 12" Horizontal 45 Degree Elbow, Solid Bottom, 24" Radius, Steel Cable Tray.....	276.13	120.65
<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	21.31	
26 05 36 00-1526 EA 18" Horizontal 45 Degree Elbow, Solid Bottom, 24" Radius, Steel Cable Tray.....	344.60	154.67
<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	25.91	
26 05 36 00-1527 EA 24" Horizontal 45 Degree Elbow, Solid Bottom, 24" Radius, Steel Cable Tray.....	423.00	193.04
<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	31.28	
26 05 36 00-1528 EA 30" Horizontal 45 Degree Elbow, Solid Bottom, 24" Radius, Steel Cable Tray.....	497.13	227.21
<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	36.70	
26 05 36 00-1529 EA 36" Horizontal 45 Degree Elbow, Solid Bottom, 24" Radius, Steel Cable Tray.....	561.67	257.22
<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	41.38	
26 05 36 00-1530 45 Degree, 36" Radius Horizontal Elbows (26 05 36 00-1494)		
26 05 36 00-1531 EA 6" Horizontal 45 Degree Elbow, Solid Bottom, 36" Radius, Steel Cable Tray.....	240.19	87.67
<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	21.41	
26 05 36 00-1532 EA 12" Horizontal 45 Degree Elbow, Solid Bottom, 36" Radius, Steel Cable Tray.....	300.64	116.87
<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	25.61	
26 05 36 00-1533 EA 18" Horizontal 45 Degree Elbow, Solid Bottom, 36" Radius, Steel Cable Tray.....	409.37	168.02
<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	33.40	
26 05 36 00-1534 EA 24" Horizontal 45 Degree Elbow, Solid Bottom, 36" Radius, Steel Cable Tray.....	497.96	214.68
<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	38.92	
26 05 36 00-1535 EA 30" Horizontal 45 Degree Elbow, Solid Bottom, 36" Radius, Steel Cable Tray.....	596.94	257.22
<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	46.67	
26 05 36 00-1536 EA 36" Horizontal 45 Degree Elbow, Solid Bottom, 36" Radius, Steel Cable Tray.....	684.26	297.20
<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	53.11	
26 05 36 00-1537 90 Degree, 12" Radius Vertical Risers (26 05 36 00-1494)		
26 05 36 00-1538 EA 6" Vertical Riser 90 Degree, Solid Bottom, 12" Radius, Steel Cable Tray.....	207.34	80.28
<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	17.72	
26 05 36 00-1539 EA 12" Vertical Riser 90 Degree, Solid Bottom, 12" Radius, Steel Cable Tray.....	265.98	113.25
<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	21.02	
26 05 36 00-1540 EA 18" Vertical Riser 90 Degree, Solid Bottom, 12" Radius, Steel Cable Tray.....	316.61	142.93
<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	23.67	
26 05 36 00-1541 EA 24" Vertical Riser 90 Degree, Solid Bottom, 12" Radius, Steel Cable Tray.....	384.34	175.58
<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	28.38	
26 05 36 00-1542 EA 30" Vertical Riser 90 Degree, Solid Bottom, 12" Radius, Steel Cable Tray.....	436.74	203.49
<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	31.60	
26 05 36 00-1543 EA 36" Vertical Riser 90 Degree, Solid Bottom, 12" Radius, Steel Cable Tray.....	479.24	226.81
<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	34.09	
26 05 36 00-1544 90 Degree, 24" Radius Vertical Risers (26 05 36 00-1494)		
26 05 36 00-1545 EA 6" Vertical Riser 90 Degree, Solid Bottom, 24" Radius, Steel Cable Tray.....	243.42	83.81
<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	22.54	
26 05 36 00-1546 EA 12" Vertical Riser 90 Degree, Solid Bottom, 24" Radius, Steel Cable Tray.....	314.62	120.73
<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	27.07	
26 05 36 00-1547 EA 18" Vertical Riser 90 Degree, Solid Bottom, 24" Radius, Steel Cable Tray.....	380.44	154.51
<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	31.32	
26 05 36 00-1548 EA 24" Vertical Riser 90 Degree, Solid Bottom, 24" Radius, Steel Cable Tray.....	455.56	193.04
<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	36.16	
26 05 36 00-1549 EA 30" Vertical Riser 90 Degree, Solid Bottom, 24" Radius, Steel Cable Tray.....	519.03	226.81
<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	40.06	
26 05 36 00-1550 EA 36" Vertical Riser 90 Degree, Solid Bottom, 24" Radius, Steel Cable Tray.....	583.07	257.22
<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	44.59	
26 05 36 00-1551 90 Degree, 36" Radius Vertical Risers (26 05 36 00-1494)		
26 05 36 00-1552 EA 6" Vertical Riser 90 Degree, Solid Bottom, 36" Radius, Steel Cable Tray.....	286.99	87.59
<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	28.46	
26 05 36 00-1553 EA 12" Vertical Riser 90 Degree, Solid Bottom, 36" Radius, Steel Cable Tray.....	353.17	117.11
<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	33.45	
26 05 36 00-1554 EA 18" Vertical Riser 90 Degree, Solid Bottom, 36" Radius, Steel Cable Tray.....	452.48	168.02
<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	39.87	
26 05 36 00-1555 EA 24" Vertical Riser 90 Degree, Solid Bottom, 36" Radius, Steel Cable Tray.....	546.45	214.26
<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	46.25	
26 05 36 00-1556 EA 30" Vertical Riser 90 Degree, Solid Bottom, 36" Radius, Steel Cable Tray.....	634.92	257.22
<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	52.36	
26 05 36 00-1557 EA 36" Vertical Riser 90 Degree, Solid Bottom, 36" Radius, Steel Cable Tray.....	718.31	296.39
<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	58.34	
26 05 36 00-1558 12" Radius Horizontal Tees (26 05 36 00-1494)		
26 05 36 00-1559 EA 6" Horizontal Tee, Solid Bottom, 12" Radius, Steel Cable Tray.....	341.86	154.51
<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	25.53	
26 05 36 00-1560 EA 12" Horizontal Tee, Solid Bottom, 12" Radius, Steel Cable Tray.....	412.85	192.71
<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	29.81	
26 05 36 00-1561 EA 18" Horizontal Tee, Solid Bottom, 12" Radius, Steel Cable Tray.....	487.19	227.21
<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	35.21	
26 05 36 00-1562 EA 24" Horizontal Tee, Solid Bottom, 12" Radius, Steel Cable Tray.....	581.91	276.04
<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	41.27	
26 05 36 00-1563 EA 30" Horizontal Tee, Solid Bottom, 12" Radius, Steel Cable Tray.....	633.92	297.20
<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	45.56	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-1564 EA 36" Horizontal Tee, Solid Bottom, 12" Radius, Steel Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	743.69 53.10	350.68
26 05 36 00-1565 24" Radius Horizontal Tees <small>(26 05 36 00-1494)</small>		
26 05 36 00-1566 EA 6" Horizontal Tee, Solid Bottom, 24" Radius, Steel Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	411.08 33.70	167.78
26 05 36 00-1567 EA 12" Horizontal Tee, Solid Bottom, 24" Radius, Steel Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	510.28 40.83	214.26
26 05 36 00-1568 EA 18" Horizontal Tee, Solid Bottom, 24" Radius, Steel Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	598.75 46.94	257.22
26 05 36 00-1569 EA 24" Horizontal Tee, Solid Bottom, 24" Radius, Steel Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	766.50 61.35	321.72
26 05 36 00-1570 EA 30" Horizontal Tee, Solid Bottom, 24" Radius, Steel Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	835.32 66.85	350.68
26 05 36 00-1571 EA 36" Horizontal Tee, Solid Bottom, 24" Radius, Steel Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	986.87 76.47	429.34
26 05 36 00-1572 36" Radius Horizontal Tees <small>(26 05 36 00-1494)</small>		
26 05 36 00-1573 EA 6" Horizontal Tee, Solid Bottom, 36" Radius, Steel Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	512.70 46.25	183.94
26 05 36 00-1574 EA 12" Horizontal Tee, Solid Bottom, 36" Radius, Steel Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	632.45 54.65	241.30
26 05 36 00-1575 EA 18" Horizontal Tee, Solid Bottom, 36" Radius, Steel Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	746.05 62.38	297.20
26 05 36 00-1576 EA 24" Horizontal Tee, Solid Bottom, 36" Radius, Steel Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	906.46 77.52	350.68
26 05 36 00-1577 EA 30" Horizontal Tee, Solid Bottom, 36" Radius, Steel Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	994.14 84.67	386.71
26 05 36 00-1578 EA 36" Horizontal Tee, Solid Bottom, 36" Radius, Steel Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	1,166.03 94.47	482.58
26 05 36 00-1579 12" Radius Vertical Tees <small>(26 05 36 00-1494)</small>		
26 05 36 00-1580 EA 6" Vertical Tee, Solid Bottom, 12" Radius, Steel Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	396.12 33.67	154.51
26 05 36 00-1581 EA 12" Vertical Tee, Solid Bottom, 12" Radius, Steel Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	466.41 37.79	193.04
26 05 36 00-1582 EA 18" Vertical Tee, Solid Bottom, 12" Radius, Steel Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	504.25 39.92	214.26
26 05 36 00-1583 EA 24" Vertical Tee, Solid Bottom, 12" Radius, Steel Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	539.53 43.13	226.81
26 05 36 00-1584 EA 30" Vertical Tee, Solid Bottom, 12" Radius, Steel Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	601.16 47.30	257.22
26 05 36 00-1585 EA 36" Vertical Tee, Solid Bottom, 12" Radius, Steel Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	673.71 51.53	297.20
26 05 36 00-1586 24" Radius Vertical Tees <small>(26 05 36 00-1494)</small>		
26 05 36 00-1587 EA 6" Vertical Tee, Solid Bottom, 24" Radius, Steel Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	484.63 44.73	167.78
26 05 36 00-1588 EA 12" Vertical Tee, Solid Bottom, 24" Radius, Steel Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	571.77 50.05	214.26
26 05 36 00-1589 EA 18" Vertical Tee, Solid Bottom, 24" Radius, Steel Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	627.63 53.93	241.30
26 05 36 00-1590 EA 24" Vertical Tee, Solid Bottom, 24" Radius, Steel Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	665.06 56.89	257.22
26 05 36 00-1591 EA 30" Vertical Tee, Solid Bottom, 24" Radius, Steel Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	754.49 63.65	297.20
26 05 36 00-1592 EA 36" Vertical Tee, Solid Bottom, 24" Radius, Steel Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	855.82 69.92	350.68
26 05 36 00-1593 36" Radius Vertical Tees <small>(26 05 36 00-1494)</small>		
26 05 36 00-1594 EA 6" Vertical Tee, Solid Bottom, 36" Radius, Steel Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	625.58 63.23	183.62
26 05 36 00-1595 EA 12" Vertical Tee, Solid Bottom, 36" Radius, Steel Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	727.71 68.94	241.30
26 05 36 00-1596 EA 18" Vertical Tee, Solid Bottom, 36" Radius, Steel Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	808.74 75.40	275.48
26 05 36 00-1597 EA 24" Vertical Tee, Solid Bottom, 36" Radius, Steel Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	856.98 79.02	297.20
26 05 36 00-1598 EA 30" Vertical Tee, Solid Bottom, 36" Radius, Steel Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	1,006.53 92.53	350.68
26 05 36 00-1599 EA 36" Vertical Tee, Solid Bottom, 36" Radius, Steel Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	1,088.54 99.04	385.43
26 05 36 00-1600 12" Radius Horizontal Crosses <small>(26 05 36 00-1494)</small>		
26 05 36 00-1601 EA 6" Horizontal Cross, Solid Bottom, 12" Radius, Steel Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	423.00 31.28	193.04

26 Electrical**26 05 Common Work Results For Electrical****26 05 36 Cable Trays For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-1602	EA		12" Horizontal Cross, Solid Bottom, 12" Radius, Steel Cable Tray.....	488.39	227.21
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	35.39	
26 05 36 00-1603	EA		18" Horizontal Cross, Solid Bottom, 12" Radius, Steel Cable Tray.....	588.09	275.48
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	42.31	
26 05 36 00-1604	EA		24" Horizontal Cross, Solid Bottom, 12" Radius, Steel Cable Tray.....	680.90	321.72
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	48.51	
26 05 36 00-1605	EA		30" Horizontal Cross, Solid Bottom, 12" Radius, Steel Cable Tray.....	803.99	385.43
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	56.36	
26 05 36 00-1606	EA		36" Horizontal Cross, Solid Bottom, 12" Radius, Steel Cable Tray.....	892.82	429.34
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	62.37	
26 05 36 00-1607			24" Radius Horizontal Crosses <small>(26 05 36 00-1494)</small>		
26 05 36 00-1608	EA		6" Horizontal Cross, Solid Bottom, 24" Radius, Steel Cable Tray.....	542.27	214.68
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	45.56	
26 05 36 00-1609	EA		12" Horizontal Cross, Solid Bottom, 24" Radius, Steel Cable Tray.....	634.92	257.22
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	52.36	
26 05 36 00-1610	EA		18" Horizontal Cross, Solid Bottom, 24" Radius, Steel Cable Tray.....	766.50	321.72
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	61.35	
26 05 36 00-1611	EA		24" Horizontal Cross, Solid Bottom, 24" Radius, Steel Cable Tray.....	939.88	386.71
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	76.53	
26 05 36 00-1612	EA		30" Horizontal Cross, Solid Bottom, 24" Radius, Steel Cable Tray.....	1,035.10	429.34
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	83.71	
26 05 36 00-1613	EA		36" Horizontal Cross, Solid Bottom, 24" Radius, Steel Cable Tray.....	1,141.91	482.58
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	90.86	
26 05 36 00-1614			36" Radius Horizontal Crosses <small>(26 05 36 00-1494)</small>		
26 05 36 00-1615	EA		6" Horizontal Cross, Solid Bottom, 36" Radius, Steel Cable Tray.....	703.59	241.30
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	65.32	
26 05 36 00-1616	EA		12" Horizontal Cross, Solid Bottom, 36" Radius, Steel Cable Tray.....	826.83	297.20
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	74.50	
26 05 36 00-1617	EA		18" Horizontal Cross, Solid Bottom, 36" Radius, Steel Cable Tray.....	1,006.20	386.71
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	86.48	
26 05 36 00-1618	EA		24" Horizontal Cross, Solid Bottom, 36" Radius, Steel Cable Tray.....	1,143.61	429.34
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	99.98	
26 05 36 00-1619	EA		30" Horizontal Cross, Solid Bottom, 36" Radius, Steel Cable Tray.....	1,268.51	482.58
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	109.85	
26 05 36 00-1620	EA		36" Horizontal Cross, Solid Bottom, 36" Radius, Steel Cable Tray.....	1,412.52	550.87
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	120.06	
26 05 36 00-1621			Straight Reducers <small>(26 05 36 00-1494)</small>		
26 05 36 00-1622	EA		12"-6" Reducer, Solid Bottom, Steel Cable Tray.....	166.32	64.35
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	14.22	
26 05 36 00-1623	EA		18"-12" Reducer, Solid Bottom, Steel Cable Tray.....	181.49	72.71
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	15.10	
26 05 36 00-1624	EA		24"-18" Reducer, Solid Bottom, Steel Cable Tray.....	202.34	83.81
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	16.39	
26 05 36 00-1625	EA		30"-24" Reducer, Solid Bottom, Steel Cable Tray.....	228.38	96.51
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	18.17	
26 05 36 00-1626	EA		36"-30" Reducer, Solid Bottom, Steel Cable Tray.....	248.35	107.06
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	19.41	
26 05 36 00-1627			Reducers <small>(26 05 36 00-1494)</small>		
26 05 36 00-1628	EA		18"-6" Reducer, Solid Bottom, Steel Cable Tray.....	181.57	72.79
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	15.11	
26 05 36 00-1629	EA		24"-12" Reducer, Solid Bottom, Steel Cable Tray.....	201.42	83.97
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	16.22	
26 05 36 00-1630	EA		30"-12" Reducer, Solid Bottom, Steel Cable Tray.....	225.84	96.43
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	17.80	
26 05 36 00-1631	EA		30"-18" Reducer, Solid Bottom, Steel Cable Tray.....	226.92	96.35
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	17.98	
26 05 36 00-1632	EA		36"-12" Reducer, Solid Bottom, Steel Cable Tray.....	247.15	107.06
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	19.23	
26 05 36 00-1633	EA		36"-18" Reducer, Solid Bottom, Steel Cable Tray.....	248.35	107.06
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	19.41	
26 05 36 00-1634	EA		36"-24" Reducer, Solid Bottom, Steel Cable Tray.....	249.87	107.22
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	19.61	
26 05 36 00-1635			Dropout Or End Plate <small>(26 05 36 00-1494)</small>		
26 05 36 00-1636	EA		6" Dropout Or End Plate, Solid Bottom, Steel Cable Tray.....	52.51	24.13
26 05 36 00-1637	EA		12" Dropout Or End Plate, Solid Bottom, Steel Cable Tray.....	64.37	29.44
26 05 36 00-1638	EA		18" Dropout Or End Plate, Solid Bottom, Steel Cable Tray.....	74.63	34.91
26 05 36 00-1639	EA		24" Dropout Or End Plate, Solid Bottom, Steel Cable Tray.....	83.70	38.61
26 05 36 00-1640	EA		30" Dropout Or End Plate, Solid Bottom, Steel Cable Tray.....	93.13	42.87
26 05 36 00-1641	EA		36" Dropout Or End Plate, Solid Bottom, Steel Cable Tray.....	103.65	48.26
26 05 36 00-1642			Solid Bottom Aluminum Straight Cable Tray Sections <small>(26 05 36 00-1486)</small>		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-1643 LF 6" Solid Bottom Aluminum Cable Tray, Straight Section..... <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	17.10 1.72	5.07
26 05 36 00-1644 LF 12" Solid Bottom Aluminum Cable Tray, Straight Section..... <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	21.21 2.19	5.95
26 05 36 00-1645 LF 18" Solid Bottom Aluminum Cable Tray, Straight Section..... <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	27.16 2.78	7.72
26 05 36 00-1646 LF 24" Solid Bottom Aluminum Cable Tray, Straight Section..... <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	32.10 3.40	8.53
26 05 36 00-1647 LF 30" Solid Bottom Aluminum Cable Tray, Straight Section..... <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	39.51 4.09	11.02
26 05 36 00-1648 LF 36" Solid Bottom Steel Aluminum Tray, Straight Section..... <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	46.74 5.00	12.07
26 05 36 00-1649 Solid Bottom Aluminum Cable Tray Fittings (26 05 36 00-1486)		
26 05 36 00-1650 90 Degree, 12" Radius Horizontal Elbows (26 05 36 00-1649)		
26 05 36 00-1651 EA 6" Horizontal 90 Degree Elbow, Solid Bottom, 12" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	203.60 17.13	80.52
26 05 36 00-1652 EA 12" Horizontal 90 Degree Elbow, Solid Bottom, 12" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	247.11 20.17	101.34
26 05 36 00-1653 EA 18" Horizontal 90 Degree Elbow, Solid Bottom, 12" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	284.66 23.78	113.49
26 05 36 00-1654 EA 24" Horizontal 90 Degree Elbow, Solid Bottom, 12" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	331.79 27.55	133.28
26 05 36 00-1655 EA 30" Horizontal 90 Degree Elbow, Solid Bottom, 12" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	391.28 32.91	154.67
26 05 36 00-1656 EA 36" Horizontal 90 Degree Elbow, Solid Bottom, 12" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	442.47 37.10	175.58
26 05 36 00-1657 90 Degree, 24" Radius Horizontal Elbows (26 05 36 00-1649)		
26 05 36 00-1658 EA 6" Horizontal 90 Degree Elbow, Solid Bottom, 24" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	238.49 21.80	83.81
26 05 36 00-1659 EA 12" Horizontal 90 Degree Elbow, Solid Bottom, 24" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	296.10 26.53	107.38
26 05 36 00-1660 EA 18" Horizontal 90 Degree Elbow, Solid Bottom, 24" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	334.56 30.08	120.65
26 05 36 00-1661 EA 24" Horizontal 90 Degree Elbow, Solid Bottom, 24" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	403.20 36.66	142.93
26 05 36 00-1662 EA 30" Horizontal 90 Degree Elbow, Solid Bottom, 24" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	468.11 42.29	167.54
26 05 36 00-1663 EA 36" Horizontal 90 Degree Elbow, Solid Bottom, 24" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	538.78 48.65	193.04
26 05 36 00-1664 90 Degree, 36" Radius Horizontal Elbows (26 05 36 00-1649)		
26 05 36 00-1665 EA 6" Horizontal 90 Degree Elbow, Solid Bottom, 36" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	292.43 29.27	87.59
26 05 36 00-1666 EA 12" Horizontal 90 Degree Elbow, Solid Bottom, 36" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	365.34 35.85	113.73
26 05 36 00-1667 EA 18" Horizontal 90 Degree Elbow, Solid Bottom, 36" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	423.20 42.00	128.93
26 05 36 00-1668 EA 24" Horizontal 90 Degree Elbow, Solid Bottom, 36" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	480.70 46.39	154.27
26 05 36 00-1669 EA 30" Horizontal 90 Degree Elbow, Solid Bottom, 36" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	559.39 53.26	183.94
26 05 36 00-1670 EA 36" Horizontal 90 Degree Elbow, Solid Bottom, 36" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	652.80 62.27	213.94
26 05 36 00-1671 45 Degree, 12" Radius Horizontal Elbows (26 05 36 00-1649)		
26 05 36 00-1672 EA 6" Horizontal 45 Degree Elbow, Solid Bottom, 12" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	188.41 14.84	80.52
26 05 36 00-1673 EA 12" Horizontal 45 Degree Elbow, Solid Bottom, 12" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	229.92 17.59	101.34
26 05 36 00-1674 EA 18" Horizontal 45 Degree Elbow, Solid Bottom, 12" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	263.48 20.62	113.41
26 05 36 00-1675 EA 24" Horizontal 45 Degree Elbow, Solid Bottom, 12" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	307.19 23.91	133.04
26 05 36 00-1676 EA 30" Horizontal 45 Degree Elbow, Solid Bottom, 12" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	361.91 28.51	154.67
26 05 36 00-1677 EA 36" Horizontal 45 Degree Elbow, Solid Bottom, 12" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	408.66 32.12	175.09
26 05 36 00-1678 45 Degree, 24" Radius Horizontal Elbows (26 05 36 00-1649)		
26 05 36 00-1679 EA 6" Horizontal 45 Degree Elbow, Solid Bottom, 24" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	216.86 18.55	83.89
26 05 36 00-1680 EA 12" Horizontal 45 Degree Elbow, Solid Bottom, 24" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	270.15 22.65	107.22
26 05 36 00-1681 EA 18" Horizontal 45 Degree Elbow, Solid Bottom, 24" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	305.60 25.69	120.89

26 Electrical**26 05 Common Work Results For Electrical****26 05 36 Cable Trays For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-1682	EA		24" Horizontal 45 Degree Elbow, Solid Bottom, 24" Radius, Aluminum Cable Tray	366.91	142.93
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	31.21	
26 05 36 00-1683	EA		30" Horizontal 45 Degree Elbow, Solid Bottom, 24" Radius, Aluminum Cable Tray	427.35	168.02
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	36.10	
26 05 36 00-1684	EA		36" Horizontal 45 Degree Elbow, Solid Bottom, 24" Radius, Aluminum Cable Tray	491.02	193.04
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	41.48	
26 05 36 00-1685			45 Degree, 36" Radius Horizontal Elbows <small>(26 05 36 00-1649)</small>		
26 05 36 00-1686	EA		6" Horizontal 45 Degree Elbow, Solid Bottom, 36" Radius, Aluminum Cable Tray	260.42	87.67
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	24.45	
26 05 36 00-1687	EA		12" Horizontal 45 Degree Elbow, Solid Bottom, 36" Radius, Aluminum Cable Tray	326.30	113.49
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	30.03	
26 05 36 00-1688	EA		18" Horizontal 45 Degree Elbow, Solid Bottom, 36" Radius, Aluminum Cable Tray	377.36	128.93
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	35.12	
26 05 36 00-1689	EA		24" Horizontal 45 Degree Elbow, Solid Bottom, 36" Radius, Aluminum Cable Tray	432.17	154.67
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	39.05	
26 05 36 00-1690	EA		30" Horizontal 45 Degree Elbow, Solid Bottom, 36" Radius, Aluminum Cable Tray	503.76	183.94
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	44.91	
26 05 36 00-1691	EA		36" Horizontal 45 Degree Elbow, Solid Bottom, 36" Radius, Aluminum Cable Tray	588.89	214.68
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	52.55	
26 05 36 00-1692			90 Degree, 12" Radius Vertical Risers <small>(26 05 36 00-1649)</small>		
26 05 36 00-1693	EA		6" Vertical Riser 90 Degree, Solid Bottom, 12" Radius, Aluminum Cable Tray	216.27	80.28
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	19.06	
26 05 36 00-1694	EA		12" Vertical Riser 90 Degree, Solid Bottom, 12" Radius, Aluminum Cable Tray	254.71	101.34
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	21.31	
26 05 36 00-1695	EA		18" Vertical Riser 90 Degree, Solid Bottom, 12" Radius, Aluminum Cable Tray	285.75	113.49
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	23.95	
26 05 36 00-1696	EA		24" Vertical Riser 90 Degree, Solid Bottom, 12" Radius, Aluminum Cable Tray	324.20	133.28
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	26.41	
26 05 36 00-1697	EA		30" Vertical Riser 90 Degree, Solid Bottom, 12" Radius, Aluminum Cable Tray	366.32	154.67
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	29.17	
26 05 36 00-1698	EA		36" Vertical Riser 90 Degree, Solid Bottom, 12" Radius, Aluminum Cable Tray	403.62	175.09
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	31.36	
26 05 36 00-1699			90 Degree, 24" Radius Vertical Risers <small>(26 05 36 00-1649)</small>		
26 05 36 00-1700	EA		6" Vertical Riser 90 Degree, Solid Bottom, 24" Radius, Aluminum Cable Tray	256.94	83.81
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	24.57	
26 05 36 00-1701	EA		12" Vertical Riser 90 Degree, Solid Bottom, 24" Radius, Aluminum Cable Tray	305.87	107.38
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	27.99	
26 05 36 00-1702	EA		18" Vertical Riser 90 Degree, Solid Bottom, 24" Radius, Aluminum Cable Tray	337.82	120.65
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	30.57	
26 05 36 00-1703	EA		24" Vertical Riser 90 Degree, Solid Bottom, 24" Radius, Aluminum Cable Tray	386.92	142.93
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	34.21	
26 05 36 00-1704	EA		30" Vertical Riser 90 Degree, Solid Bottom, 24" Radius, Aluminum Cable Tray	436.64	167.54
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	37.57	
26 05 36 00-1705	EA		36" Vertical Riser 90 Degree, Solid Bottom, 24" Radius, Aluminum Cable Tray	495.36	193.04
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	42.13	
26 05 36 00-1706			90 Degree, 36" Radius Vertical Risers <small>(26 05 36 00-1649)</small>		
26 05 36 00-1707	EA		6" Vertical Riser 90 Degree, Solid Bottom, 36" Radius, Aluminum Cable Tray	300.03	87.59
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	30.41	
26 05 36 00-1708	EA		12" Vertical Riser 90 Degree, Solid Bottom, 36" Radius, Aluminum Cable Tray	363.16	113.73
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	35.52	
26 05 36 00-1709	EA		18" Vertical Riser 90 Degree, Solid Bottom, 36" Radius, Aluminum Cable Tray	403.67	128.93
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	39.07	
26 05 36 00-1710	EA		24" Vertical Riser 90 Degree, Solid Bottom, 36" Radius, Aluminum Cable Tray	453.57	154.27
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	42.32	
26 05 36 00-1711	EA		30" Vertical Riser 90 Degree, Solid Bottom, 36" Radius, Aluminum Cable Tray	523.58	183.94
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	47.89	
26 05 36 00-1712	EA		36" Vertical Riser 90 Degree, Solid Bottom, 36" Radius, Aluminum Cable Tray	582.26	213.94
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	51.69	
26 05 36 00-1713			12" Radius Horizontal Tees <small>(26 05 36 00-1649)</small>		
26 05 36 00-1714	EA		6" Horizontal Tee, Solid Bottom, 12" Radius, Aluminum Cable Tray	364.90	154.51
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	28.99	
26 05 36 00-1715	EA		12" Horizontal Tee, Solid Bottom, 12" Radius, Aluminum Cable Tray	422.07	175.09
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	34.13	
26 05 36 00-1716	EA		18" Horizontal Tee, Solid Bottom, 12" Radius, Aluminum Cable Tray	468.23	193.04
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	38.06	
26 05 36 00-1717	EA		24" Horizontal Tee, Solid Bottom, 12" Radius, Aluminum Cable Tray	521.67	214.68
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	42.47	
26 05 36 00-1718	EA		30" Horizontal Tee, Solid Bottom, 12" Radius, Aluminum Cable Tray	617.58	257.22
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	49.76	
26 05 36 00-1719	EA		36" Horizontal Tee, Solid Bottom, 12" Radius, Aluminum Cable Tray	753.27	321.72
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	59.37	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-1720 24" Radius Horizontal Tees <small>(26 05 36 00-1649)</small>		
26 05 36 00-1721 EA 6" Horizontal Tee, Solid Bottom, 24" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	456.56 40.52	167.78
26 05 36 00-1722 EA 12" Horizontal Tee, Solid Bottom, 24" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	521.41 46.04	193.04
26 05 36 00-1723 EA 18" Horizontal Tee, Solid Bottom, 24" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	582.89 51.72	214.26
26 05 36 00-1724 EA 24" Horizontal Tee, Solid Bottom, 24" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	705.49 62.95	257.22
26 05 36 00-1725 EA 30" Horizontal Tee, Solid Bottom, 24" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	850.94 74.02	321.72
26 05 36 00-1726 EA 36" Horizontal Tee, Solid Bottom, 24" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	938.95 82.22	351.72
26 05 36 00-1727 36" Radius Horizontal Tees <small>(26 05 36 00-1649)</small>		
26 05 36 00-1728 EA 6" Horizontal Tee, Solid Bottom, 36" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	594.12 58.47	183.94
26 05 36 00-1729 EA 12" Horizontal Tee, Solid Bottom, 36" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	671.88 65.07	214.26
26 05 36 00-1730 EA 18" Horizontal Tee, Solid Bottom, 36" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	765.73 74.64	241.30
26 05 36 00-1731 EA 24" Horizontal Tee, Solid Bottom, 36" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	917.31 88.19	296.39
26 05 36 00-1732 EA 30" Horizontal Tee, Solid Bottom, 36" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	1,111.15 102.22	386.71
26 05 36 00-1733 EA 36" Horizontal Tee, Solid Bottom, 36" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	1,236.51 113.92	429.34
26 05 36 00-1734 12" Radius Vertical Tees <small>(26 05 36 00-1649)</small>		
26 05 36 00-1735 EA 6" Vertical Tee, Solid Bottom, 12" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	410.48 35.83	154.51
26 05 36 00-1736 EA 12" Vertical Tee, Solid Bottom, 12" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	448.54 38.06	175.34
26 05 36 00-1737 EA 18" Vertical Tee, Solid Bottom, 12" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	468.85 39.72	183.62
26 05 36 00-1738 EA 24" Vertical Tee, Solid Bottom, 12" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	494.85 42.11	192.71
26 05 36 00-1739 EA 30" Vertical Tee, Solid Bottom, 12" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	545.99 46.18	214.26
26 05 36 00-1740 EA 36" Vertical Tee, Solid Bottom, 12" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	628.43 51.39	257.22
26 05 36 00-1741 24" Radius Vertical Tees <small>(26 05 36 00-1649)</small>		
26 05 36 00-1742 EA 6" Vertical Tee, Solid Bottom, 24" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	505.40 47.84	167.78
26 05 36 00-1743 EA 12" Vertical Tee, Solid Bottom, 24" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	560.48 51.90	193.04
26 05 36 00-1744 EA 18" Vertical Tee, Solid Bottom, 24" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	593.55 55.18	203.09
26 05 36 00-1745 EA 24" Vertical Tee, Solid Bottom, 24" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	633.90 59.37	214.26
26 05 36 00-1746 EA 30" Vertical Tee, Solid Bottom, 24" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	706.04 65.69	241.30
26 05 36 00-1747 EA 36" Vertical Tee, Solid Bottom, 24" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	814.21 72.73	296.39
26 05 36 00-1748 36" Radius Vertical Tees <small>(26 05 36 00-1649)</small>		
26 05 36 00-1749 EA 6" Vertical Tee, Solid Bottom, 36" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	658.78 68.21	183.62
26 05 36 00-1750 EA 12" Vertical Tee, Solid Bottom, 36" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	721.76 72.99	211.70
26 05 36 00-1751 EA 18" Vertical Tee, Solid Bottom, 36" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	768.66 77.50	226.81
26 05 36 00-1752 EA 24" Vertical Tee, Solid Bottom, 36" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	803.71 80.34	241.30
26 05 36 00-1753 EA 30" Vertical Tee, Solid Bottom, 36" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	893.19 88.07	275.48
26 05 36 00-1754 EA 36" Vertical Tee, Solid Bottom, 36" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	932.28 36.39	350.68
26 05 36 00-1755 12" Radius Horizontal Crosses <small>(26 05 36 00-1649)</small>		
26 05 36 00-1756 EA 6" Horizontal Cross, Solid Bottom, 12" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	429.01 35.13	175.34
26 05 36 00-1757 EA 12" Horizontal Cross, Solid Bottom, 12" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	475.83 39.20	193.04
26 05 36 00-1758 EA 18" Horizontal Cross, Solid Bottom, 12" Radius, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	553.78 45.27	226.81

26 Electrical**26 05 Common Work Results For Electrical****26 05 36 Cable Trays For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-1759	EA		24" Horizontal Cross, Solid Bottom, 12" Radius, Aluminum Cable Tray	658.77	275.48
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	52.91	
26 05 36 00-1760	EA		30" Horizontal Cross, Solid Bottom, 12" Radius, Aluminum Cable Tray	719.79	296.39
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	58.56	
26 05 36 00-1761	EA		36" Horizontal Cross, Solid Bottom, 12" Radius, Aluminum Cable Tray	835.84	351.72
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	66.75	
26 05 36 00-1762			24" Radius Horizontal Crosses <small>(26 05 36 00-1649)</small>		
26 05 36 00-1763	EA		6" Horizontal Cross, Solid Bottom, 24" Radius, Aluminum Cable Tray	561.00	193.36
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	51.93	
26 05 36 00-1764	EA		12" Horizontal Cross, Solid Bottom, 24" Radius, Aluminum Cable Tray	633.90	214.26
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	59.37	
26 05 36 00-1765	EA		18" Horizontal Cross, Solid Bottom, 24" Radius, Aluminum Cable Tray	729.36	257.22
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	66.53	
26 05 36 00-1766	EA		24" Horizontal Cross, Solid Bottom, 24" Radius, Aluminum Cable Tray	901.21	322.61
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	81.42	
26 05 36 00-1767	EA		30" Horizontal Cross, Solid Bottom, 24" Radius, Aluminum Cable Tray	987.78	351.72
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	89.54	
26 05 36 00-1768	EA		36" Horizontal Cross, Solid Bottom, 24" Radius, Aluminum Cable Tray	1,133.41	429.34
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	98.45	
26 05 36 00-1769			36" Radius Horizontal Crosses <small>(26 05 36 00-1649)</small>		
26 05 36 00-1770	EA		6" Horizontal Cross, Solid Bottom, 36" Radius, Aluminum Cable Tray	764.13	214.26
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	78.90	
26 05 36 00-1771	EA		12" Horizontal Cross, Solid Bottom, 36" Radius, Aluminum Cable Tray	841.70	241.30
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	86.04	
26 05 36 00-1772	EA		18" Horizontal Cross, Solid Bottom, 36" Radius, Aluminum Cable Tray	983.64	297.20
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	98.02	
26 05 36 00-1773	EA		24" Horizontal Cross, Solid Bottom, 36" Radius, Aluminum Cable Tray	1,176.27	386.71
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	111.99	
26 05 36 00-1774	EA		30" Horizontal Cross, Solid Bottom, 36" Radius, Aluminum Cable Tray	1,290.78	429.34
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	122.06	
26 05 36 00-1775	EA		36" Horizontal Cross, Solid Bottom, 36" Radius, Aluminum Cable Tray	1,477.18	482.58
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	141.15	
26 05 36 00-1776			Straight Reducers <small>(26 05 36 00-1649)</small>		
26 05 36 00-1777	EA		12"-6" Reducer, Solid Bottom, Aluminum Cable Tray	159.27	55.18
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	14.69	
26 05 36 00-1778	EA		18"-12" Reducer, Solid Bottom, Aluminum Cable Tray	176.53	64.27
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	15.77	
26 05 36 00-1779	EA		24"-18" Reducer, Solid Bottom, Aluminum Cable Tray	195.00	72.71
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	17.13	
26 05 36 00-1780	EA		30"-24" Reducer, Solid Bottom, Aluminum Cable Tray	220.14	83.89
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	19.04	
26 05 36 00-1781	EA		36"-30" Reducer, Solid Bottom, Aluminum Cable Tray	245.26	96.35
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	20.73	
26 05 36 00-1782			Reducers <small>(26 05 36 00-1649)</small>		
26 05 36 00-1783	EA		18"-6" Reducer, Solid Bottom, Aluminum Cable Tray	175.50	64.27
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	15.61	
26 05 36 00-1784	EA		24"-12" Reducer, Solid Bottom, Aluminum Cable Tray	194.13	72.87
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	16.98	
26 05 36 00-1785	EA		30"-12" Reducer, Solid Bottom, Aluminum Cable Tray	217.87	83.81
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	18.71	
26 05 36 00-1786	EA		30"-18" Reducer, Solid Bottom, Aluminum Cable Tray	218.87	83.81
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	18.87	
26 05 36 00-1787	EA		36"-12" Reducer, Solid Bottom, Aluminum Cable Tray	245.26	96.35
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	20.73	
26 05 36 00-1788	EA		36"-18" Reducer, Solid Bottom, Aluminum Cable Tray	246.35	96.35
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	20.89	
26 05 36 00-1789	EA		36"-24" Reducer, Solid Bottom, Aluminum Cable Tray	248.77	96.51
			<i>For 4-5/8" Overall Height Instead Of 3-5/8", Add</i>	21.23	
26 05 36 00-1790			Dropout Or End Plate <small>(26 05 36 00-1649)</small>		
26 05 36 00-1791	EA		6" Dropout Or End Plate, Solid Bottom, Aluminum Cable Tray	53.94	24.13
26 05 36 00-1792	EA		12" Dropout Or End Plate, Solid Bottom, Aluminum Cable Tray	64.58	29.44
26 05 36 00-1793	EA		18" Dropout Or End Plate, Solid Bottom, Aluminum Cable Tray	76.79	34.91
26 05 36 00-1794	EA		24" Dropout Or End Plate, Solid Bottom, Aluminum Cable Tray	84.81	38.61
26 05 36 00-1795	EA		30" Dropout Or End Plate, Solid Bottom, Aluminum Cable Tray	95.31	42.87
26 05 36 00-1796	EA		36" Dropout Or End Plate, Solid Bottom, Aluminum Cable Tray	108.11	48.26
26 05 36 00-1797			Vented Bottom Cable Tray <small>(26 05 36 00-0001)</small>		
			Note: 6" Height.		
26 05 36 00-1798			Vented Bottom Galvanized Steel Cable Tray <small>(26 05 36 00-1797)</small>		
26 05 36 00-1799	LF		6" Vented Bottom Steel Cable Tray, Straight Section	24.52	8.45
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-1.75	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-1800 LF 12" Vented Bottom Steel Cable Tray, Straight Section	28.78	9.65
For 4-5/8" Overall Height Instead Of 6", Deduct	-2.08	
26 05 36 00-1801 LF 18" Vented Bottom Steel Cable Tray, Straight Section	33.81	11.10
For 4-5/8" Overall Height Instead Of 6", Deduct	-2.46	
26 05 36 00-1802 LF 24" Vented Bottom Steel Cable Tray, Straight Section	38.80	12.71
For 4-5/8" Overall Height Instead Of 6", Deduct	-2.82	
26 05 36 00-1803 LF 30" Vented Bottom Steel Cable Tray, Straight Section	50.85	15.37
For 4-5/8" Overall Height Instead Of 6", Deduct	-3.80	
26 05 36 00-1804 LF 36" Vented Bottom Steel Cable Tray, Straight Section	60.43	19.30
For 4-5/8" Overall Height Instead Of 6", Deduct	-4.43	
26 05 36 00-1805 Vented Bottom Galvanized Steel Cable Tray Fittings <small>(26 05 36 00-1797)</small>		
26 05 36 00-1806 90 Degree, 12" Radius Horizontal Elbows <small>(26 05 36 00-1805)</small>		
26 05 36 00-1807 EA 6" Horizontal 90 Degree Elbow, Vented Bottom, 12" Radius, Steel Cable Tray	233.59	101.66
For 4-5/8" Overall Height Instead Of 6", Deduct	-14.89	
26 05 36 00-1808 EA 12" Horizontal 90 Degree Elbow, Vented Bottom, 12" Radius, Steel Cable Tray	305.47	137.54
For 4-5/8" Overall Height Instead Of 6", Deduct	-19.08	
26 05 36 00-1809 EA 18" Horizontal 90 Degree Elbow, Vented Bottom, 12" Radius, Steel Cable Tray	379.85	175.34
For 4-5/8" Overall Height Instead Of 6", Deduct	-23.37	
26 05 36 00-1810 EA 24" Horizontal 90 Degree Elbow, Vented Bottom, 12" Radius, Steel Cable Tray	465.78	214.68
For 4-5/8" Overall Height Instead Of 6", Deduct	-28.69	
26 05 36 00-1811 EA 30" Horizontal 90 Degree Elbow, Vented Bottom, 12" Radius, Steel Cable Tray	525.35	241.78
For 4-5/8" Overall Height Instead Of 6", Deduct	-32.39	
26 05 36 00-1812 EA 36" Horizontal 90 Degree Elbow, Vented Bottom, 12" Radius, Steel Cable Tray	601.71	276.04
For 4-5/8" Overall Height Instead Of 6", Deduct	-37.16	
26 05 36 00-1813 90 Degree, 24" Radius Horizontal Elbows <small>(26 05 36 00-1805)</small>		
26 05 36 00-1814 EA 6" Horizontal 90 Degree Elbow, Vented Bottom, 24" Radius, Steel Cable Tray	273.37	107.14
For 4-5/8" Overall Height Instead Of 6", Deduct	-18.41	
26 05 36 00-1815 EA 12" Horizontal 90 Degree Elbow, Vented Bottom, 24" Radius, Steel Cable Tray	356.82	148.55
For 4-5/8" Overall Height Instead Of 6", Deduct	-23.30	
26 05 36 00-1816 EA 18" Horizontal 90 Degree Elbow, Vented Bottom, 24" Radius, Steel Cable Tray	453.70	193.04
For 4-5/8" Overall Height Instead Of 6", Deduct	-29.28	
26 05 36 00-1817 EA 24" Horizontal 90 Degree Elbow, Vented Bottom, 24" Radius, Steel Cable Tray	550.94	241.30
For 4-5/8" Overall Height Instead Of 6", Deduct	-34.99	
26 05 36 00-1818 EA 30" Horizontal 90 Degree Elbow, Vented Bottom, 24" Radius, Steel Cable Tray	587.03	249.25
For 4-5/8" Overall Height Instead Of 6", Deduct	-37.93	
26 05 36 00-1819 EA 36" Horizontal 90 Degree Elbow, Vented Bottom, 24" Radius, Steel Cable Tray	735.39	321.72
For 4-5/8" Overall Height Instead Of 6", Deduct	-46.73	
26 05 36 00-1820 90 Degree, 36" Radius Horizontal Elbows <small>(26 05 36 00-1805)</small>		
26 05 36 00-1821 EA 6" Horizontal 90 Degree Elbow, Vented Bottom, 36" Radius, Steel Cable Tray	330.39	113.25
For 4-5/8" Overall Height Instead Of 6", Deduct	-23.60	
26 05 36 00-1822 EA 12" Horizontal 90 Degree Elbow, Vented Bottom, 36" Radius, Steel Cable Tray	430.44	161.10
For 4-5/8" Overall Height Instead Of 6", Deduct	-29.62	
26 05 36 00-1823 EA 18" Horizontal 90 Degree Elbow, Vented Bottom, 36" Radius, Steel Cable Tray	552.17	214.68
For 4-5/8" Overall Height Instead Of 6", Deduct	-37.33	
26 05 36 00-1824 EA 24" Horizontal 90 Degree Elbow, Vented Bottom, 36" Radius, Steel Cable Tray	664.26	275.48
For 4-5/8" Overall Height Instead Of 6", Deduct	-43.47	
26 05 36 00-1825 EA 30" Horizontal 90 Degree Elbow, Vented Bottom, 36" Radius, Steel Cable Tray	766.58	321.72
For 4-5/8" Overall Height Instead Of 6", Deduct	-49.85	
26 05 36 00-1826 EA 36" Horizontal 90 Degree Elbow, Vented Bottom, 36" Radius, Steel Cable Tray	899.19	385.43
For 4-5/8" Overall Height Instead Of 6", Deduct	-57.80	
26 05 36 00-1827 45 Degree, 12" Radius Horizontal Elbows <small>(26 05 36 00-1805)</small>		
26 05 36 00-1828 EA 6" Horizontal 45 Degree Elbow, Vented Bottom, 12" Radius, Steel Cable Tray	219.61	101.74
For 4-5/8" Overall Height Instead Of 6", Deduct	-13.48	
26 05 36 00-1829 EA 12" Horizontal 45 Degree Elbow, Vented Bottom, 12" Radius, Steel Cable Tray	288.71	137.54
For 4-5/8" Overall Height Instead Of 6", Deduct	-17.41	
26 05 36 00-1830 EA 18" Horizontal 45 Degree Elbow, Vented Bottom, 12" Radius, Steel Cable Tray	360.16	175.09
For 4-5/8" Overall Height Instead Of 6", Deduct	-21.42	
26 05 36 00-1831 EA 24" Horizontal 45 Degree Elbow, Vented Bottom, 12" Radius, Steel Cable Tray	441.38	214.26
For 4-5/8" Overall Height Instead Of 6", Deduct	-26.28	
26 05 36 00-1832 EA 30" Horizontal 45 Degree Elbow, Vented Bottom, 12" Radius, Steel Cable Tray	498.42	241.78
For 4-5/8" Overall Height Instead Of 6", Deduct	-29.69	
26 05 36 00-1833 EA 36" Horizontal 45 Degree Elbow, Vented Bottom, 12" Radius, Steel Cable Tray	569.52	275.48
For 4-5/8" Overall Height Instead Of 6", Deduct	-34.00	
26 05 36 00-1834 45 Degree, 24" Radius Horizontal Elbows <small>(26 05 36 00-1805)</small>		
26 05 36 00-1835 EA 6" Horizontal 45 Degree Elbow, Vented Bottom, 24" Radius, Steel Cable Tray	252.67	107.22
For 4-5/8" Overall Height Instead Of 6", Deduct	-16.33	
26 05 36 00-1836 EA 12" Horizontal 45 Degree Elbow, Vented Bottom, 24" Radius, Steel Cable Tray	332.80	148.55
For 4-5/8" Overall Height Instead Of 6", Deduct	-20.90	
26 05 36 00-1837 EA 18" Horizontal 45 Degree Elbow, Vented Bottom, 24" Radius, Steel Cable Tray	425.19	193.36
For 4-5/8" Overall Height Instead Of 6", Deduct	-26.41	
26 05 36 00-1838 EA 24" Horizontal 45 Degree Elbow, Vented Bottom, 24" Radius, Steel Cable Tray	518.21	241.30
For 4-5/8" Overall Height Instead Of 6", Deduct	-31.71	

26 Electrical**26 05 Common Work Results For Electrical****26 05 36 Cable Trays For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-1839	EA		30" Horizontal 45 Degree Elbow, Vented Bottom, 24" Radius, Steel Cable Tray.....	593.96	276.04
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-36.39	
26 05 36 00-1840	EA		36" Horizontal 45 Degree Elbow, Vented Bottom, 24" Radius, Steel Cable Tray.....	691.57	321.72
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-42.35	
26 05 36 00-1841			45 Degree, 36" Radius Horizontal Elbows <small>(26 05 36 00-1805)</small>		
26 05 36 00-1842	EA		6" Horizontal 45 Degree Elbow, Vented Bottom, 36" Radius, Steel Cable Tray	299.60	113.49
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-20.50	
26 05 36 00-1843	EA		12" Horizontal 45 Degree Elbow, Vented Bottom, 36" Radius, Steel Cable Tray.....	394.10	160.62
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-26.02	
26 05 36 00-1844	EA		18" Horizontal 45 Degree Elbow, Vented Bottom, 36" Radius, Steel Cable Tray.....	509.40	214.68
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-33.05	
26 05 36 00-1845	EA		24" Horizontal 45 Degree Elbow, Vented Bottom, 36" Radius, Steel Cable Tray.....	620.17	276.04
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-39.01	
26 05 36 00-1846	EA		30" Horizontal 45 Degree Elbow, Vented Bottom, 36" Radius, Steel Cable Tray.....	715.90	321.72
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-44.78	
26 05 36 00-1847	EA		36" Horizontal 45 Degree Elbow, Vented Bottom, 36" Radius, Steel Cable Tray.....	844.76	386.71
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-52.25	
26 05 36 00-1848			90 Degree, 12" Radius Vertical Risers <small>(26 05 36 00-1805)</small>		
26 05 36 00-1849	EA		6" Vertical Riser 90 Degree, Vented Bottom, 12" Radius, Steel Cable Tray	251.76	101.34
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-16.73	
26 05 36 00-1850	EA		12" Vertical Riser 90 Degree, Vented Bottom, 12" Radius, Steel Cable Tray	321.67	137.54
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-20.70	
26 05 36 00-1851	EA		18" Vertical Riser 90 Degree, Vented Bottom, 12" Radius, Steel Cable Tray	385.85	175.34
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-23.97	
26 05 36 00-1852	EA		24" Vertical Riser 90 Degree, Vented Bottom, 12" Radius, Steel Cable Tray	464.58	214.68
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-28.57	
26 05 36 00-1853	EA		30" Vertical Riser 90 Degree, Vented Bottom, 12" Radius, Steel Cable Tray	512.15	241.78
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-31.07	
26 05 36 00-1854	EA		36" Vertical Riser 90 Degree, Vented Bottom, 12" Radius, Steel Cable Tray	574.27	275.48
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-34.47	
26 05 36 00-1855			90 Degree, 24" Radius Vertical Risers <small>(26 05 36 00-1805)</small>		
26 05 36 00-1856	EA		6" Vertical Riser 90 Degree, Vented Bottom, 24" Radius, Steel Cable Tray	297.37	107.14
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-20.81	
26 05 36 00-1857	EA		12" Vertical Riser 90 Degree, Vented Bottom, 24" Radius, Steel Cable Tray	373.62	148.55
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-24.98	
26 05 36 00-1858	EA		18" Vertical Riser 90 Degree, Vented Bottom, 24" Radius, Steel Cable Tray	460.90	193.04
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-30.00	
26 05 36 00-1859	EA		24" Vertical Riser 90 Degree, Vented Bottom, 24" Radius, Steel Cable Tray	546.14	241.30
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-34.51	
26 05 36 00-1860	EA		30" Vertical Riser 90 Degree, Vented Bottom, 24" Radius, Steel Cable Tray	621.06	275.48
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-39.15	
26 05 36 00-1861	EA		36" Vertical Riser 90 Degree, Vented Bottom, 24" Radius, Steel Cable Tray	705.39	321.72
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-43.73	
26 05 36 00-1862			90 Degree, 36" Radius Vertical Risers <small>(26 05 36 00-1805)</small>		
26 05 36 00-1863	EA		6" Vertical Riser 90 Degree, Vented Bottom, 36" Radius, Steel Cable Tray	349.59	113.25
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-25.52	
26 05 36 00-1864	EA		12" Vertical Riser 90 Degree, Vented Bottom, 36" Radius, Steel Cable Tray	438.84	161.10
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-30.46	
26 05 36 00-1865	EA		18" Vertical Riser 90 Degree, Vented Bottom, 36" Radius, Steel Cable Tray	547.37	214.68
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-36.85	
26 05 36 00-1866	EA		24" Vertical Riser 90 Degree, Vented Bottom, 36" Radius, Steel Cable Tray	661.86	275.48
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-43.23	
26 05 36 00-1867	EA		30" Vertical Riser 90 Degree, Vented Bottom, 36" Radius, Steel Cable Tray	743.79	321.72
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-47.57	
26 05 36 00-1868	EA		36" Vertical Riser 90 Degree, Vented Bottom, 36" Radius, Steel Cable Tray	872.79	385.43
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-55.16	
26 05 36 00-1869			12" Radius Horizontal Tees <small>(26 05 36 00-1805)</small>		
26 05 36 00-1870	EA		6" Horizontal Tee, Vented Bottom, 12" Radius, Steel Cable Tray.....	418.91	193.04
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-25.81	
26 05 36 00-1871	EA		12" Horizontal Tee, Vented Bottom, 12" Radius, Steel Cable Tray.....	509.35	240.82
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-30.87	
26 05 36 00-1872	EA		18" Horizontal Tee, Vented Bottom, 12" Radius, Steel Cable Tray.....	582.52	276.04
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-35.25	
26 05 36 00-1873	EA		24" Horizontal Tee, Vented Bottom, 12" Radius, Steel Cable Tray.....	677.79	321.72
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-40.97	
26 05 36 00-1874	EA		30" Horizontal Tee, Vented Bottom, 12" Radius, Steel Cable Tray.....	746.51	350.68
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-45.42	
26 05 36 00-1875	EA		36" Horizontal Tee, Vented Bottom, 12" Radius, Steel Cable Tray.....	820.00	385.43
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-49.88	
26 05 36 00-1876			24" Radius Horizontal Tees <small>(26 05 36 00-1805)</small>		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-1877 EA 6" Horizontal Tee, Vented Bottom, 24" Radius, Steel Cable Tray.....	517.93	214.26
<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-33.94	
26 05 36 00-1878 EA 12" Horizontal Tee, Vented Bottom, 24" Radius, Steel Cable Tray.....	634.26	275.48
<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-40.47	
26 05 36 00-1879 EA 18" Horizontal Tee, Vented Bottom, 24" Radius, Steel Cable Tray.....	731.79	321.72
<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-46.37	
26 05 36 00-1880 EA 24" Horizontal Tee, Vented Bottom, 24" Radius, Steel Cable Tray.....	896.79	385.43
<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-57.56	
26 05 36 00-1881 EA 30" Horizontal Tee, Vented Bottom, 24" Radius, Steel Cable Tray.....	991.55	429.34
<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-63.38	
26 05 36 00-1882 EA 36" Horizontal Tee, Vented Bottom, 24" Radius, Steel Cable Tray.....	1,109.07	482.58
<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-70.69	
26 05 36 00-1883 36" Radius Horizontal Tees <small>(26 05 36 00-1805)</small>		
26 05 36 00-1884 EA 6" Horizontal Tee, Vented Bottom, 36" Radius, Steel Cable Tray.....	632.53	241.30
<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-43.15	
26 05 36 00-1885 EA 12" Horizontal Tee, Vented Bottom, 36" Radius, Steel Cable Tray.....	798.98	321.72
<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-53.09	
26 05 36 00-1886 EA 18" Horizontal Tee, Vented Bottom, 36" Radius, Steel Cable Tray.....	931.25	386.71
<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-60.90	
26 05 36 00-1887 EA 24" Horizontal Tee, Vented Bottom, 36" Radius, Steel Cable Tray.....	1,149.87	482.58
<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-74.77	
26 05 36 00-1888 EA 30" Horizontal Tee, Vented Bottom, 36" Radius, Steel Cable Tray.....	1,288.34	553.45
<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-82.72	
26 05 36 00-1889 EA 36" Horizontal Tee, Vented Bottom, 36" Radius, Steel Cable Tray.....	1,501.52	641.76
<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-96.67	
26 05 36 00-1890 12" Radius Vertical Tees <small>(26 05 36 00-1805)</small>		
26 05 36 00-1891 EA 6" Vertical Tee, Vented Bottom, 12" Radius, Steel Cable Tray.....	483.70	193.04
<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-32.28	
26 05 36 00-1892 EA 12" Vertical Tee, Vented Bottom, 12" Radius, Steel Cable Tray.....	566.54	241.30
<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-36.55	
26 05 36 00-1893 EA 18" Vertical Tee, Vented Bottom, 12" Radius, Steel Cable Tray.....	596.72	257.22
<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-38.24	
26 05 36 00-1894 EA 24" Vertical Tee, Vented Bottom, 12" Radius, Steel Cable Tray.....	636.66	275.48
<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-40.71	
26 05 36 00-1895 EA 30" Vertical Tee, Vented Bottom, 12" Radius, Steel Cable Tray.....	683.64	297.20
<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-43.60	
26 05 36 00-1896 EA 36" Vertical Tee, Vented Bottom, 12" Radius, Steel Cable Tray.....	776.51	350.68
<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-48.42	
26 05 36 00-1897 24" Radius Vertical Tees <small>(26 05 36 00-1805)</small>		
26 05 36 00-1898 EA 6" Vertical Tee, Vented Bottom, 24" Radius, Steel Cable Tray.....	574.32	214.26
<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-39.57	
26 05 36 00-1899 EA 12" Vertical Tee, Vented Bottom, 24" Radius, Steel Cable Tray.....	687.05	275.48
<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-45.75	
26 05 36 00-1900 EA 18" Vertical Tee, Vented Bottom, 24" Radius, Steel Cable Tray.....	734.03	297.20
<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-48.64	
26 05 36 00-1901 EA 24" Vertical Tee, Vented Bottom, 24" Radius, Steel Cable Tray.....	792.98	321.72
<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-52.49	
26 05 36 00-1902 EA 30" Vertical Tee, Vented Bottom, 24" Radius, Steel Cable Tray.....	854.50	350.68
<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-56.22	
26 05 36 00-1903 EA 36" Vertical Tee, Vented Bottom, 24" Radius, Steel Cable Tray.....	1,008.35	429.34
<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-65.06	
26 05 36 00-1904 36" Radius Vertical Tees <small>(26 05 36 00-1805)</small>		
26 05 36 00-1905 EA 6" Vertical Tee, Vented Bottom, 36" Radius, Steel Cable Tray.....	746.92	240.82
<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-54.62	
26 05 36 00-1906 EA 12" Vertical Tee, Vented Bottom, 36" Radius, Steel Cable Tray.....	890.17	321.72
<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-62.21	
26 05 36 00-1907 EA 18" Vertical Tee, Vented Bottom, 36" Radius, Steel Cable Tray.....	950.49	350.68
<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-65.82	
26 05 36 00-1908 EA 24" Vertical Tee, Vented Bottom, 36" Radius, Steel Cable Tray.....	1,034.43	386.71
<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-71.22	
26 05 36 00-1909 EA 30" Vertical Tee, Vented Bottom, 36" Radius, Steel Cable Tray.....	1,165.53	429.34
<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-80.77	
26 05 36 00-1910 EA 36" Vertical Tee, Vented Bottom, 36" Radius, Steel Cable Tray.....	1,374.12	550.87
<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-91.50	
26 05 36 00-1911 12" Radius Horizontal Crosses <small>(26 05 36 00-1805)</small>		
26 05 36 00-1912 EA 6" Horizontal Cross, Vented Bottom, 12" Radius, Steel Cable Tray.....	526.95	241.30
<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-32.59	
26 05 36 00-1913 EA 12" Horizontal Cross, Vented Bottom, 12" Radius, Steel Cable Tray.....	586.12	276.04
<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-35.61	
26 05 36 00-1914 EA 18" Horizontal Cross, Vented Bottom, 12" Radius, Steel Cable Tray.....	676.59	321.72
<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-40.85	
26 05 36 00-1915 EA 24" Horizontal Cross, Vented Bottom, 12" Radius, Steel Cable Tray.....	790.00	385.43
<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-46.88	

26 Electrical**26 05 Common Work Results For Electrical****26 05 36 Cable Trays For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-1916	EA		30" Horizontal Cross, Vented Bottom, 12" Radius, Steel Cable Tray.....	878.62	427.82
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-52.21	
26 05 36 00-1917	EA		36" Horizontal Cross, Vented Bottom, 12" Radius, Steel Cable Tray.....	990.29	482.58
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-58.81	
26 05 36 00-1918			24" Radius Horizontal Crosses <small>(26 05 36 00-1805)</small>		
26 05 36 00-1919	EA		6" Horizontal Cross, Vented Bottom, 24" Radius, Steel Cable Tray.....	655.71	276.04
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-42.56	
26 05 36 00-1920	EA		12" Horizontal Cross, Vented Bottom, 24" Radius, Steel Cable Tray.....	741.39	321.72
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-47.33	
26 05 36 00-1921	EA		18" Horizontal Cross, Vented Bottom, 24" Radius, Steel Cable Tray.....	867.99	385.43
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-54.68	
26 05 36 00-1922	EA		24" Horizontal Cross, Vented Bottom, 24" Radius, Steel Cable Tray.....	1,091.08	482.58
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-68.89	
26 05 36 00-1923	EA		30" Horizontal Cross, Vented Bottom, 24" Radius, Steel Cable Tray.....	1,234.93	550.87
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-77.58	
26 05 36 00-1924	EA		36" Horizontal Cross, Vented Bottom, 24" Radius, Steel Cable Tray.....	1,405.53	641.76
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-87.07	
26 05 36 00-1925			36" Radius Horizontal Crosses <small>(26 05 36 00-1805)</small>		
26 05 36 00-1926	EA		6" Horizontal Cross, Vented Bottom, 36" Radius, Steel Cable Tray.....	866.17	321.72
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-59.81	
26 05 36 00-1927	EA		12" Horizontal Cross, Vented Bottom, 36" Radius, Steel Cable Tray.....	991.24	386.71
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-66.90	
26 05 36 00-1928	EA		18" Horizontal Cross, Vented Bottom, 36" Radius, Steel Cable Tray.....	1,158.27	482.58
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-75.61	
26 05 36 00-1929	EA		24" Horizontal Cross, Vented Bottom, 36" Radius, Steel Cable Tray.....	1,501.23	645.14
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-96.36	
26 05 36 00-1930	EA		30" Horizontal Cross, Vented Bottom, 36" Radius, Steel Cable Tray.....	1,756.91	773.34
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-111.24	
26 05 36 00-1931	EA		36" Horizontal Cross, Vented Bottom, 36" Radius, Steel Cable Tray.....	2,112.56	965.18
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-130.83	
26 05 36 00-1932			Straight Reducers <small>(26 05 36 00-1805)</small>		
26 05 36 00-1933	EA		12"-6" Reducer, Vented Bottom, Steel Cable Tray	197.57	82.20
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-12.91	
26 05 36 00-1934	EA		18"-12" Reducer, Vented Bottom, Steel Cable Tray	216.01	91.85
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-13.95	
26 05 36 00-1935	EA		24"-18" Reducer, Vented Bottom, Steel Cable Tray	245.61	107.06
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-15.64	
26 05 36 00-1936	EA		30"-24" Reducer, Vented Bottom, Steel Cable Tray	270.66	120.65
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-17.01	
26 05 36 00-1937	EA		36"-30" Reducer, Vented Bottom, Steel Cable Tray	295.84	132.88
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-18.51	
26 05 36 00-1938			Reducers <small>(26 05 36 00-1805)</small>		
26 05 36 00-1939	EA		18"-6" Reducer, Vented Bottom, Steel Cable Tray	216.01	91.85
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-13.95	
26 05 36 00-1940	EA		24"-12" Reducer, Vented Bottom, Steel Cable Tray	244.72	107.22
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-15.54	
26 05 36 00-1941	EA		30"-12" Reducer, Vented Bottom, Steel Cable Tray	269.26	120.49
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-16.88	
26 05 36 00-1942	EA		30"-18" Reducer, Vented Bottom, Steel Cable Tray	270.26	120.41
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-16.99	
26 05 36 00-1943	EA		36"-12" Reducer, Vented Bottom, Steel Cable Tray	294.64	132.88
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-18.39	
26 05 36 00-1944	EA		36"-18" Reducer, Vented Bottom, Steel Cable Tray	295.84	132.88
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-18.51	
26 05 36 00-1945	EA		36"-24" Reducer, Vented Bottom, Steel Cable Tray	297.53	133.20
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-18.66	
26 05 36 00-1946			Dropout Or End Plate <small>(26 05 36 00-1805)</small>		
26 05 36 00-1947	EA		6" Dropout Or End Plate, Vented Bottom, Steel Cable Tray	63.92	29.68
26 05 36 00-1948	EA		12" Dropout Or End Plate, Vented Bottom, Steel Cable Tray	75.69	34.83
26 05 36 00-1949	EA		18" Dropout Or End Plate, Vented Bottom, Steel Cable Tray	83.46	38.45
26 05 36 00-1950	EA		24" Dropout Or End Plate, Vented Bottom, Steel Cable Tray	93.76	42.87
26 05 36 00-1951	EA		30" Dropout Or End Plate, Vented Bottom, Steel Cable Tray	104.22	48.18
26 05 36 00-1952	EA		36" Dropout Or End Plate, Vented Bottom, Steel Cable Tray	122.42	57.59
26 05 36 00-1953			Vented Bottom Aluminum Cable Tray <small>(26 05 36 00-1797)</small>		
26 05 36 00-1954	LF		6" Vented Bottom Aluminum Cable Tray, Straight Section	21.92	6.27
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-1.67	
26 05 36 00-1955	LF		9" Vented Bottom Aluminum Cable Tray, Straight Section	24.29	6.92
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-1.86	
26 05 36 00-1956	LF		12" Vented Bottom Aluminum Cable Tray, Straight Section	27.17	7.72
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-2.08	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-1957 LF 18" Vented Bottom Aluminum Cable Tray, Straight Section	31.54	8.61
For 4-5/8" Overall Height Instead Of 6", Deduct	-2.43	
26 05 36 00-1958 LF 24" Vented Bottom Aluminum Cable Tray, Straight Section	36.09	9.57
For 4-5/8" Overall Height Instead Of 6", Deduct	-2.81	
26 05 36 00-1959 LF 30" Vented Bottom Aluminum Cable Tray, Straight Section	45.48	11.02
For 4-5/8" Overall Height Instead Of 6", Deduct	-3.63	
26 05 36 00-1960 LF 36" Vented Bottom Aluminum Cable Tray, Straight Section	50.82	12.95
For 4-5/8" Overall Height Instead Of 6", Deduct	-4.01	
26 05 36 00-1961 Vented Bottom Aluminum Cable Tray Fittings (26 05 36 00-1797)		
26 05 36 00-1962 90 Degree, 12" Radius Horizontal Elbows (26 05 36 00-1961)		
26 05 36 00-1963 EA 6" Horizontal 90 Degree Elbow, Vented Bottom, 12" Radius, Aluminum Cable Tray.....	244.28	101.66
For 4-5/8" Overall Height Instead Of 6", Deduct	-15.96	
26 05 36 00-1964 EA 9" Horizontal 90 Degree Elbow, Vented Bottom, 12" Radius, Aluminum Cable Tray.....	265.36	110.35
For 4-5/8" Overall Height Instead Of 6", Deduct	-17.34	
26 05 36 00-1965 EA 12" Horizontal 90 Degree Elbow, Vented Bottom, 12" Radius, Aluminum Cable Tray.....	293.91	124.27
For 4-5/8" Overall Height Instead Of 6", Deduct	-19.04	
26 05 36 00-1966 EA 18" Horizontal 90 Degree Elbow, Vented Bottom, 12" Radius, Aluminum Cable Tray.....	330.47	137.70
For 4-5/8" Overall Height Instead Of 6", Deduct	-21.57	
26 05 36 00-1967 EA 24" Horizontal 90 Degree Elbow, Vented Bottom, 12" Radius, Aluminum Cable Tray.....	397.27	168.02
For 4-5/8" Overall Height Instead Of 6", Deduct	-25.72	
26 05 36 00-1968 EA 30" Horizontal 90 Degree Elbow, Vented Bottom, 12" Radius, Aluminum Cable Tray.....	466.58	193.36
For 4-5/8" Overall Height Instead Of 6", Deduct	-30.55	
26 05 36 00-1969 EA 36" Horizontal 90 Degree Elbow, Vented Bottom, 12" Radius, Aluminum Cable Tray.....	515.16	214.68
For 4-5/8" Overall Height Instead Of 6", Deduct	-33.63	
26 05 36 00-1970 90 Degree, 24" Radius Horizontal Elbows (26 05 36 00-1961)		
26 05 36 00-1971 EA 6" Horizontal 90 Degree Elbow, Vented Bottom, 24" Radius, Aluminum Cable Tray.....	287.11	107.14
For 4-5/8" Overall Height Instead Of 6", Deduct	-19.78	
26 05 36 00-1972 EA 12" Horizontal 90 Degree Elbow, Vented Bottom, 24" Radius, Aluminum Cable Tray.....	348.92	133.20
For 4-5/8" Overall Height Instead Of 6", Deduct	-23.80	
26 05 36 00-1973 EA 18" Horizontal 90 Degree Elbow, Vented Bottom, 24" Radius, Aluminum Cable Tray.....	394.14	148.55
For 4-5/8" Overall Height Instead Of 6", Deduct	-27.03	
26 05 36 00-1974 EA 24" Horizontal 90 Degree Elbow, Vented Bottom, 24" Radius, Aluminum Cable Tray.....	473.19	183.62
For 4-5/8" Overall Height Instead Of 6", Deduct	-32.02	
26 05 36 00-1975 EA 30" Horizontal 90 Degree Elbow, Vented Bottom, 24" Radius, Aluminum Cable Tray.....	547.53	213.94
For 4-5/8" Overall Height Instead Of 6", Deduct	-36.93	
26 05 36 00-1976 EA 36" Horizontal 90 Degree Elbow, Vented Bottom, 24" Radius, Aluminum Cable Tray.....	608.36	241.30
For 4-5/8" Overall Height Instead Of 6", Deduct	-40.73	
26 05 36 00-1977 90 Degree, 36" Radius Horizontal Elbows (26 05 36 00-1961)		
26 05 36 00-1978 EA 6" Horizontal 90 Degree Elbow, Vented Bottom, 36" Radius, Aluminum Cable Tray.....	341.83	113.25
For 4-5/8" Overall Height Instead Of 6", Deduct	-24.74	
26 05 36 00-1979 EA 12" Horizontal 90 Degree Elbow, Vented Bottom, 36" Radius, Aluminum Cable Tray.....	413.26	143.09
For 4-5/8" Overall Height Instead Of 6", Deduct	-29.40	
26 05 36 00-1980 EA 18" Horizontal 90 Degree Elbow, Vented Bottom, 36" Radius, Aluminum Cable Tray.....	467.07	161.10
For 4-5/8" Overall Height Instead Of 6", Deduct	-33.28	
26 05 36 00-1981 EA 24" Horizontal 90 Degree Elbow, Vented Bottom, 36" Radius, Aluminum Cable Tray.....	555.57	203.09
For 4-5/8" Overall Height Instead Of 6", Deduct	-38.63	
26 05 36 00-1982 EA 30" Horizontal 90 Degree Elbow, Vented Bottom, 36" Radius, Aluminum Cable Tray.....	583.07	196.81
For 4-5/8" Overall Height Instead Of 6", Deduct	-41.91	
26 05 36 00-1983 EA 36" Horizontal 90 Degree Elbow, Vented Bottom, 36" Radius, Aluminum Cable Tray.....	735.83	275.48
For 4-5/8" Overall Height Instead Of 6", Deduct	-50.63	
26 05 36 00-1984 45 Degree, 12" Radius Horizontal Elbows (26 05 36 00-1961)		
26 05 36 00-1985 EA 6" Horizontal 45 Degree Elbow, Vented Bottom, 12" Radius, Aluminum Cable Tray.....	227.95	101.74
For 4-5/8" Overall Height Instead Of 6", Deduct	-14.32	
26 05 36 00-1986 EA 9" Horizontal 45 Degree Elbow, Vented Bottom, 12" Radius, Aluminum Cable Tray.....	247.62	110.51
For 4-5/8" Overall Height Instead Of 6", Deduct	-15.56	
26 05 36 00-1987 EA 12" Horizontal 45 Degree Elbow, Vented Bottom, 12" Radius, Aluminum Cable Tray.....	274.81	124.27
For 4-5/8" Overall Height Instead Of 6", Deduct	-17.13	
26 05 36 00-1988 EA 18" Horizontal 45 Degree Elbow, Vented Bottom, 12" Radius, Aluminum Cable Tray.....	308.01	137.54
For 4-5/8" Overall Height Instead Of 6", Deduct	-19.34	
26 05 36 00-1989 EA 24" Horizontal 45 Degree Elbow, Vented Bottom, 12" Radius, Aluminum Cable Tray.....	371.08	167.78
For 4-5/8" Overall Height Instead Of 6", Deduct	-23.13	
26 05 36 00-1990 EA 30" Horizontal 45 Degree Elbow, Vented Bottom, 12" Radius, Aluminum Cable Tray.....	434.83	193.36
For 4-5/8" Overall Height Instead Of 6", Deduct	-27.37	
26 05 36 00-1991 EA 36" Horizontal 45 Degree Elbow, Vented Bottom, 12" Radius, Aluminum Cable Tray.....	479.90	214.26
For 4-5/8" Overall Height Instead Of 6", Deduct	-30.13	
26 05 36 00-1992 45 Degree, 24" Radius Horizontal Elbows (26 05 36 00-1961)		
26 05 36 00-1993 EA 6" Horizontal 45 Degree Elbow, Vented Bottom, 24" Radius, Aluminum Cable Tray.....	263.38	107.22
For 4-5/8" Overall Height Instead Of 6", Deduct	-17.40	
26 05 36 00-1994 EA 12" Horizontal 45 Degree Elbow, Vented Bottom, 24" Radius, Aluminum Cable Tray.....	320.98	133.20
For 4-5/8" Overall Height Instead Of 6", Deduct	-21.00	
26 05 36 00-1995 EA 18" Horizontal 45 Degree Elbow, Vented Bottom, 24" Radius, Aluminum Cable Tray.....	362.22	148.79
For 4-5/8" Overall Height Instead Of 6", Deduct	-23.83	

26 Electrical**26 05 Common Work Results For Electrical****26 05 36 Cable Trays For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-1996	EA		24" Horizontal 45 Degree Elbow, Vented Bottom, 24" Radius, Aluminum Cable Tray.....	436.88	183.94
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-28.36	
26 05 36 00-1997	EA		30" Horizontal 45 Degree Elbow, Vented Bottom, 24" Radius, Aluminum Cable Tray.....	506.78	214.68
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-32.79	
26 05 36 00-1998	EA		36" Horizontal 45 Degree Elbow, Vented Bottom, 24" Radius, Aluminum Cable Tray.....	563.00	241.30
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-36.19	
26 05 36 00-1999			45 Degree, 36" Radius Horizontal Elbows <small>(26 05 36 00-1961)</small>		
26 05 36 00-2000	EA		6" Horizontal 45 Degree Elbow, Vented Bottom, 36" Radius, Aluminum Cable Tray.....	308.52	113.49
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-21.39	
26 05 36 00-2001	EA		12" Horizontal 45 Degree Elbow, Vented Bottom, 36" Radius, Aluminum Cable Tray.....	374.25	142.77
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-25.53	
26 05 36 00-2002	EA		18" Horizontal 45 Degree Elbow, Vented Bottom, 36" Radius, Aluminum Cable Tray.....	423.37	161.10
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-28.91	
26 05 36 00-2003	EA		24" Horizontal 45 Degree Elbow, Vented Bottom, 36" Radius, Aluminum Cable Tray.....	508.38	203.49
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-33.88	
26 05 36 00-2004	EA		30" Horizontal 45 Degree Elbow, Vented Bottom, 36" Radius, Aluminum Cable Tray.....	577.60	227.21
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-38.83	
26 05 36 00-2005	EA		36" Horizontal 45 Degree Elbow, Vented Bottom, 36" Radius, Aluminum Cable Tray.....	675.99	276.04
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-44.59	
26 05 36 00-2006			90 Degree, 12" Radius Vertical Risers <small>(26 05 36 00-1961)</small>		
26 05 36 00-2007	EA		6" Vertical Riser 90 Degree, Vented Bottom, 12" Radius, Aluminum Cable Tray	260.13	101.34
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-17.56	
26 05 36 00-2008	EA		9" Vertical Riser 90 Degree, Vented Bottom, 12" Radius, Aluminum Cable Tray	280.05	110.11
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-18.83	
26 05 36 00-2009	EA		12" Vertical Riser 90 Degree, Vented Bottom, 12" Radius, Aluminum Cable Tray	304.77	124.27
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-20.12	
26 05 36 00-2010	EA		18" Vertical Riser 90 Degree, Vented Bottom, 12" Radius, Aluminum Cable Tray	330.47	137.70
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-21.57	
26 05 36 00-2011	EA		24" Vertical Riser 90 Degree, Vented Bottom, 12" Radius, Aluminum Cable Tray	391.84	168.02
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-25.18	
26 05 36 00-2012	EA		30" Vertical Riser 90 Degree, Vented Bottom, 12" Radius, Aluminum Cable Tray	439.45	193.36
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-27.83	
26 05 36 00-2013	EA		36" Vertical Riser 90 Degree, Vented Bottom, 12" Radius, Aluminum Cable Tray	475.45	214.26
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-29.69	
26 05 36 00-2014			90 Degree, 24" Radius Vertical Risers <small>(26 05 36 00-1961)</small>		
26 05 36 00-2015	EA		6" Vertical Riser 90 Degree, Vented Bottom, 24" Radius, Aluminum Cable Tray	301.22	107.14
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-21.19	
26 05 36 00-2016	EA		12" Vertical Riser 90 Degree, Vented Bottom, 24" Radius, Aluminum Cable Tray	355.43	133.20
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-24.45	
26 05 36 00-2017	EA		18" Vertical Riser 90 Degree, Vented Bottom, 24" Radius, Aluminum Cable Tray	393.06	148.55
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-26.92	
26 05 36 00-2018	EA		24" Vertical Riser 90 Degree, Vented Bottom, 24" Radius, Aluminum Cable Tray	454.12	183.94
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-30.09	
26 05 36 00-2019	EA		30" Vertical Riser 90 Degree, Vented Bottom, 24" Radius, Aluminum Cable Tray	512.35	214.26
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-33.38	
26 05 36 00-2020	EA		36" Vertical Riser 90 Degree, Vented Bottom, 24" Radius, Aluminum Cable Tray	564.95	241.30
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-36.39	
26 05 36 00-2021			90 Degree, 36" Radius Vertical Risers <small>(26 05 36 00-1961)</small>		
26 05 36 00-2022	EA		6" Vertical Riser 90 Degree, Vented Bottom, 36" Radius, Aluminum Cable Tray	340.75	113.25
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-24.63	
26 05 36 00-2023	EA		12" Vertical Riser 90 Degree, Vented Bottom, 36" Radius, Aluminum Cable Tray	401.32	143.09
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-28.21	
26 05 36 00-2024	EA		18" Vertical Riser 90 Degree, Vented Bottom, 36" Radius, Aluminum Cable Tray	450.79	161.10
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-31.66	
26 05 36 00-2025	EA		24" Vertical Riser 90 Degree, Vented Bottom, 36" Radius, Aluminum Cable Tray	536.03	203.09
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-36.68	
26 05 36 00-2026	EA		30" Vertical Riser 90 Degree, Vented Bottom, 36" Radius, Aluminum Cable Tray	595.73	227.21
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-40.64	
26 05 36 00-2027	EA		36" Vertical Riser 90 Degree, Vented Bottom, 36" Radius, Aluminum Cable Tray	682.65	275.48
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-45.31	
26 05 36 00-2028			12" Radius Horizontal Tees <small>(26 05 36 00-1961)</small>		
26 05 36 00-2029	EA		6" Horizontal Tee, Vented Bottom, 12" Radius, Aluminum Cable Tray	435.67	193.04
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-27.48	
26 05 36 00-2030	EA		9" Horizontal Tee, Vented Bottom, 12" Radius, Aluminum Cable Tray	455.72	203.09
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-28.65	
26 05 36 00-2031	EA		12" Horizontal Tee, Vented Bottom, 12" Radius, Aluminum Cable Tray	483.50	213.94
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-30.52	
26 05 36 00-2032	EA		18" Horizontal Tee, Vented Bottom, 12" Radius, Aluminum Cable Tray	550.56	241.78
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-34.91	
26 05 36 00-2033	EA		24" Horizontal Tee, Vented Bottom, 12" Radius, Aluminum Cable Tray	628.38	275.48
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-39.88	
26 05 36 00-2034	EA		30" Horizontal Tee, Vented Bottom, 12" Radius, Aluminum Cable Tray	717.45	321.72
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-44.93	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-2035 EA 36" Horizontal Tee, Vented Bottom, 12" Radius, Aluminum Cable Tray..... <i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	790.73 -49.85	350.68
26 05 36 00-2036 24" Radius Horizontal Tees <small>(26 05 36 00-1961)</small>		
26 05 36 00-2037 EA 6" Horizontal Tee, Vented Bottom, 24" Radius, Aluminum Cable Tray..... <i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	530.79 -35.22	214.26
26 05 36 00-2038 EA 12" Horizontal Tee, Vented Bottom, 24" Radius, Aluminum Cable Tray..... <i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	598.88 -39.82	240.82
26 05 36 00-2039 EA 18" Horizontal Tee, Vented Bottom, 24" Radius, Aluminum Cable Tray..... <i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	676.14 -44.66	275.48
26 05 36 00-2040 EA 24" Horizontal Tee, Vented Bottom, 24" Radius, Aluminum Cable Tray..... <i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	806.10 -53.87	320.84
26 05 36 00-2041 EA 30" Horizontal Tee, Vented Bottom, 24" Radius, Aluminum Cable Tray..... <i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	937.51 -61.53	386.71
26 05 36 00-2042 EA 36" Horizontal Tee, Vented Bottom, 24" Radius, Aluminum Cable Tray..... <i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	1,057.44 -69.97	429.34
26 05 36 00-2043 36" Radius Horizontal Tees <small>(26 05 36 00-1961)</small>		
26 05 36 00-2044 EA 6" Horizontal Tee, Vented Bottom, 36" Radius, Aluminum Cable Tray..... <i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	681.08 -48.00	241.30
26 05 36 00-2045 EA 12" Horizontal Tee, Vented Bottom, 36" Radius, Aluminum Cable Tray..... <i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	779.24 -54.97	275.48
26 05 36 00-2046 EA 18" Horizontal Tee, Vented Bottom, 36" Radius, Aluminum Cable Tray..... <i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	811.40 -58.75	268.72
26 05 36 00-2047 EA 24" Horizontal Tee, Vented Bottom, 36" Radius, Aluminum Cable Tray..... <i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	1,065.68 -74.45	385.43
26 05 36 00-2048 EA 30" Horizontal Tee, Vented Bottom, 36" Radius, Aluminum Cable Tray..... <i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	1,257.93 -85.42	484.52
26 05 36 00-2049 EA 36" Horizontal Tee, Vented Bottom, 36" Radius, Aluminum Cable Tray..... <i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	1,439.10 -98.00	550.87
26 05 36 00-2050 12" Radius Vertical Tees <small>(26 05 36 00-1961)</small>		
26 05 36 00-2051 EA 6" Vertical Tee, Vented Bottom, 12" Radius, Aluminum Cable Tray..... <i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	478.00 -31.71	193.04
26 05 36 00-2052 EA 9" Vertical Tee, Vented Bottom, 12" Radius, Aluminum Cable Tray..... <i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	495.88 -32.66	203.09
26 05 36 00-2053 EA 12" Vertical Tee, Vented Bottom, 12" Radius, Aluminum Cable Tray..... <i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	526.45 -34.79	214.26
26 05 36 00-2054 EA 18" Vertical Tee, Vented Bottom, 12" Radius, Aluminum Cable Tray..... <i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	549.06 -35.97	227.21
26 05 36 00-2055 EA 24" Vertical Tee, Vented Bottom, 12" Radius, Aluminum Cable Tray..... <i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	576.09 -37.54	240.82
26 05 36 00-2056 EA 30" Vertical Tee, Vented Bottom, 12" Radius, Aluminum Cable Tray..... <i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	611.07 -39.67	257.22
26 05 36 00-2057 EA 36" Vertical Tee, Vented Bottom, 12" Radius, Aluminum Cable Tray..... <i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	683.97 -43.69	296.39
26 05 36 00-2058 24" Radius Vertical Tees <small>(26 05 36 00-1961)</small>		
26 05 36 00-2059 EA 6" Vertical Tee, Vented Bottom, 24" Radius, Aluminum Cable Tray..... <i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	578.55 -40.00	214.26
26 05 36 00-2060 EA 12" Vertical Tee, Vented Bottom, 24" Radius, Aluminum Cable Tray..... <i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	640.12 -43.94	240.82
26 05 36 00-2061 EA 18" Vertical Tee, Vented Bottom, 24" Radius, Aluminum Cable Tray..... <i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	683.78 -46.94	257.22
26 05 36 00-2062 EA 24" Vertical Tee, Vented Bottom, 24" Radius, Aluminum Cable Tray..... <i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	730.40 -50.09	275.48
26 05 36 00-2063 EA 30" Vertical Tee, Vented Bottom, 24" Radius, Aluminum Cable Tray..... <i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	787.08 -54.01	296.39
26 05 36 00-2064 EA 36" Vertical Tee, Vented Bottom, 24" Radius, Aluminum Cable Tray..... <i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	884.68 -59.16	351.72
26 05 36 00-2065 36" Radius Vertical Tees <small>(26 05 36 00-1961)</small>		
26 05 36 00-2066 EA 6" Vertical Tee, Vented Bottom, 36" Radius, Aluminum Cable Tray..... <i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	743.22 -54.25	240.82
26 05 36 00-2067 EA 12" Vertical Tee, Vented Bottom, 36" Radius, Aluminum Cable Tray..... <i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	822.65 -59.31	275.48
26 05 36 00-2068 EA 18" Vertical Tee, Vented Bottom, 36" Radius, Aluminum Cable Tray..... <i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	868.47 -62.14	296.39
26 05 36 00-2069 EA 24" Vertical Tee, Vented Bottom, 36" Radius, Aluminum Cable Tray..... <i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	939.19 -67.04	322.61
26 05 36 00-2070 EA 30" Vertical Tee, Vented Bottom, 36" Radius, Aluminum Cable Tray..... <i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	1,020.34 -72.72	351.72
26 05 36 00-2071 EA 36" Vertical Tee, Vented Bottom, 36" Radius, Aluminum Cable Tray..... <i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	1,168.86 -81.23	427.82
26 05 36 00-2072 12" Radius Horizontal Crosses <small>(26 05 36 00-1961)</small>		

26 Electrical**26 05 Common Work Results For Electrical****26 05 36 Cable Trays For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-2073	EA		6" Horizontal Cross, Vented Bottom, 12" Radius, Aluminum Cable Tray.....	499.32	214.26
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-32.07	
26 05 36 00-2074	EA		9" Horizontal Cross, Vented Bottom, 12" Radius, Aluminum Cable Tray.....	530.61	227.21
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-34.13	
26 05 36 00-2075	EA		12" Horizontal Cross, Vented Bottom, 12" Radius, Aluminum Cable Tray.....	559.24	241.78
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-35.78	
26 05 36 00-2076	EA		18" Horizontal Cross, Vented Bottom, 12" Radius, Aluminum Cable Tray.....	622.96	275.48
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-39.34	
26 05 36 00-2077	EA		24" Horizontal Cross, Vented Bottom, 12" Radius, Aluminum Cable Tray.....	717.11	320.84
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-44.97	
26 05 36 00-2078	EA		30" Horizontal Cross, Vented Bottom, 12" Radius, Aluminum Cable Tray.....	804.23	349.72
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-51.28	
26 05 36 00-2079	EA		36" Horizontal Cross, Vented Bottom, 12" Radius, Aluminum Cable Tray.....	982.56	429.34
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-62.48	
26 05 36 00-2080			24" Radius Horizontal Crosses <small>(26 05 36 00-1961)</small>		
26 05 36 00-2081	EA		6" Horizontal Cross, Vented Bottom, 24" Radius, Aluminum Cable Tray.....	658.00	241.78
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-45.65	
26 05 36 00-2082	EA		12" Horizontal Cross, Vented Bottom, 24" Radius, Aluminum Cable Tray.....	738.00	275.48
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-50.85	
26 05 36 00-2083	EA		18" Horizontal Cross, Vented Bottom, 24" Radius, Aluminum Cable Tray.....	835.40	320.84
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-56.80	
26 05 36 00-2084	EA		24" Horizontal Cross, Vented Bottom, 24" Radius, Aluminum Cable Tray.....	989.71	385.43
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-66.85	
26 05 36 00-2085	EA		30" Horizontal Cross, Vented Bottom, 24" Radius, Aluminum Cable Tray.....	1,087.46	427.82
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-73.09	
26 05 36 00-2086	EA		36" Horizontal Cross, Vented Bottom, 24" Radius, Aluminum Cable Tray.....	1,341.43	550.87
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-88.23	
26 05 36 00-2087			36" Radius Horizontal Crosses <small>(26 05 36 00-1961)</small>		
26 05 36 00-2088	EA		6" Horizontal Cross, Vented Bottom, 36" Radius, Aluminum Cable Tray.....	876.91	275.48
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-64.74	
26 05 36 00-2089	EA		12" Horizontal Cross, Vented Bottom, 36" Radius, Aluminum Cable Tray.....	982.60	322.61
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-71.38	
26 05 36 00-2090	EA		18" Horizontal Cross, Vented Bottom, 36" Radius, Aluminum Cable Tray.....	1,125.37	385.43
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-80.42	
26 05 36 00-2091	EA		24" Horizontal Cross, Vented Bottom, 36" Radius, Aluminum Cable Tray.....	1,366.46	484.52
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-96.27	
26 05 36 00-2092	EA		30" Horizontal Cross, Vented Bottom, 36" Radius, Aluminum Cable Tray.....	1,530.14	553.45
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-106.90	
26 05 36 00-2093	EA		36" Horizontal Cross, Vented Bottom, 36" Radius, Aluminum Cable Tray.....	1,775.00	641.76
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-124.02	
26 05 36 00-2094			Straight Reducers <small>(26 05 36 00-1961)</small>		
26 05 36 00-2095	EA		9"-6" Reducer, Vented Bottom, Aluminum Cable Tray.....	176.76	64.35
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-12.31	
26 05 36 00-2096	EA		12"-9" Reducer, Vented Bottom, Aluminum Cable Tray.....	185.67	67.81
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-12.92	
26 05 36 00-2097	EA		18"-12" Reducer, Vented Bottom, Aluminum Cable Tray.....	212.10	80.36
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-14.51	
26 05 36 00-2098	EA		24"-18" Reducer, Vented Bottom, Aluminum Cable Tray.....	236.48	91.77
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-16.00	
26 05 36 00-2099	EA		30"-24" Reducer, Vented Bottom, Aluminum Cable Tray.....	264.47	107.22
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-17.51	
26 05 36 00-2100	EA		36"-30" Reducer, Vented Bottom, Aluminum Cable Tray.....	289.66	120.41
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-18.93	
26 05 36 00-2101			Reducers <small>(26 05 36 00-1961)</small>		
26 05 36 00-2102	EA		12"-6" Reducer, Vented Bottom, Aluminum Cable Tray.....	185.49	67.65
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-12.91	
26 05 36 00-2103	EA		18"-6" Reducer, Vented Bottom, Aluminum Cable Tray.....	212.01	80.36
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-14.51	
26 05 36 00-2104	EA		18"-9" Reducer, Vented Bottom, Aluminum Cable Tray.....	212.01	80.36
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-14.51	
26 05 36 00-2105	EA		24"-6" Reducer, Vented Bottom, Aluminum Cable Tray.....	236.59	91.85
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-16.01	
26 05 36 00-2106	EA		24"-9" Reducer, Vented Bottom, Aluminum Cable Tray.....	236.59	91.85
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-16.01	
26 05 36 00-2107	EA		24"-12" Reducer, Vented Bottom, Aluminum Cable Tray.....	236.83	91.93
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-16.02	
26 05 36 00-2108	EA		30"-12" Reducer, Vented Bottom, Aluminum Cable Tray.....	266.49	107.14
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-17.72	
26 05 36 00-2109	EA		30"-18" Reducer, Vented Bottom, Aluminum Cable Tray.....	264.16	107.06
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-17.50	
26 05 36 00-2110	EA		36"-12" Reducer, Vented Bottom, Aluminum Cable Tray.....	289.66	120.41
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-18.93	
26 05 36 00-2111	EA		36"-18" Reducer, Vented Bottom, Aluminum Cable Tray.....	289.66	120.41
			<i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	-18.93	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-2112 EA 36"-24" Reducer, Vented Bottom, Aluminum Cable Tray <i>For 4-5/8" Overall Height Instead Of 6", Deduct</i>	290.06 -18.95	120.65
26 05 36 00-2113 Dropout Or End Plate <small>(26 05 36 00-1961)</small>		
26 05 36 00-2114 EA 6" Dropout Or End Plate, Vented Bottom, Aluminum Cable Tray	63.68	29.68
26 05 36 00-2115 EA 9" Dropout Or End Plate, Vented Bottom, Aluminum Cable Tray	69.48	32.41
26 05 36 00-2116 EA 12" Dropout Or End Plate, Vented Bottom, Aluminum Cable Tray	74.81	34.83
26 05 36 00-2117 EA 18" Dropout Or End Plate, Vented Bottom, Aluminum Cable Tray	84.32	38.45
26 05 36 00-2118 EA 24" Dropout Or End Plate, Vented Bottom, Aluminum Cable Tray	95.92	42.87
26 05 36 00-2119 EA 30" Dropout Or End Plate, Vented Bottom, Aluminum Cable Tray	106.39	48.18
26 05 36 00-2120 EA 36" Dropout Or End Plate, Vented Bottom, Aluminum Cable Tray	121.79	55.18
26 05 36 00-2121 Covers And Dividers <small>(26 05 36 00-0001)</small>		
26 05 36 00-2122 Galvanized Steel Covers <small>(26 05 36 00-2121)</small>		
26 05 36 00-2123 Ventilated Straight Sections <small>(26 05 36 00-2122)</small>		
26 05 36 00-2124 LF 6" Steel Cable Tray Cover, Straight Section	6.24	1.44
26 05 36 00-2125 LF 9" Steel Cable Tray Cover, Straight Section	7.50	1.69
26 05 36 00-2126 LF 12" Steel Cable Tray Cover, Straight Section	8.79	1.93
26 05 36 00-2127 LF 18" Steel Cable Tray Cover, Straight Section	11.91	2.58
26 05 36 00-2128 LF 24" Steel Cable Tray Cover, Straight Section	15.16	3.46
26 05 36 00-2129 LF 30" Steel Cable Tray Cover, Straight Section	18.42	4.26
26 05 36 00-2130 LF 36" Steel Cable Tray Cover, Straight Section	93.50	48.34
26 05 36 00-2131 90 Degree, 12" Radius Horizontal Elbows <small>(26 05 36 00-2122)</small>		
26 05 36 00-2132 EA 6" Horizontal 90 Degree Elbow, 12" Radius, Steel Cable Tray Cover	36.81	5.15
26 05 36 00-2133 EA 9" Horizontal 90 Degree Elbow, 12" Radius, Steel Cable Tray Cover	41.25	6.03
26 05 36 00-2134 EA 12" Horizontal 90 Degree Elbow, 12" Radius, Steel Cable Tray Cover	44.88	7.16
26 05 36 00-2135 EA 18" Horizontal 90 Degree Elbow, 12" Radius, Steel Cable Tray Cover	60.87	9.17
26 05 36 00-2136 EA 24" Horizontal 90 Degree Elbow, 12" Radius, Steel Cable Tray Cover	74.67	11.67
26 05 36 00-2137 EA 30" Horizontal 90 Degree Elbow, 12" Radius, Steel Cable Tray Cover	89.91	12.95
26 05 36 00-2138 EA 36" Horizontal 90 Degree Elbow, 12" Radius, Steel Cable Tray Cover	108.56	15.45
26 05 36 00-2139 90 Degree, 24" Radius Horizontal Elbows <small>(26 05 36 00-2122)</small>		
26 05 36 00-2140 EA 6" Horizontal 90 Degree Elbow, 24" Radius, Steel Cable Tray Cover	56.27	5.71
26 05 36 00-2141 EA 9" Horizontal 90 Degree Elbow, 24" Radius, Steel Cable Tray Cover	59.09	6.68
26 05 36 00-2142 EA 12" Horizontal 90 Degree Elbow, 24" Radius, Steel Cable Tray Cover	66.83	8.04
26 05 36 00-2143 EA 18" Horizontal 90 Degree Elbow, 24" Radius, Steel Cable Tray Cover	82.96	10.21
26 05 36 00-2144 EA 24" Horizontal 90 Degree Elbow, 24" Radius, Steel Cable Tray Cover	101.87	12.87
26 05 36 00-2145 EA 30" Horizontal 90 Degree Elbow, 24" Radius, Steel Cable Tray Cover	130.32	14.80
26 05 36 00-2146 EA 36" Horizontal 90 Degree Elbow, 24" Radius, Steel Cable Tray Cover	151.67	17.53
26 05 36 00-2147 90 Degree, 36" Radius Horizontal Elbows <small>(26 05 36 00-2122)</small>		
26 05 36 00-2148 EA 6" Horizontal 90 Degree Elbow, 36" Radius, Steel Cable Tray Cover	79.06	6.43
26 05 36 00-2149 EA 9" Horizontal 90 Degree Elbow, 36" Radius, Steel Cable Tray Cover	87.98	7.40
26 05 36 00-2150 EA 12" Horizontal 90 Degree Elbow, 36" Radius, Steel Cable Tray Cover	95.70	9.17
26 05 36 00-2151 EA 18" Horizontal 90 Degree Elbow, 36" Radius, Steel Cable Tray Cover	121.06	10.69
26 05 36 00-2152 EA 24" Horizontal 90 Degree Elbow, 36" Radius, Steel Cable Tray Cover	147.14	14.88
26 05 36 00-2153 EA 30" Horizontal 90 Degree Elbow, 36" Radius, Steel Cable Tray Cover	173.17	16.81
26 05 36 00-2154 EA 36" Horizontal 90 Degree Elbow, 36" Radius, Steel Cable Tray Cover	202.50	19.30
26 05 36 00-2155 45 Degree, 12" Radius Horizontal Elbows <small>(26 05 36 00-2122)</small>		
26 05 36 00-2156 EA 6" Horizontal 45 Degree Elbow, 12" Radius, Steel Cable Tray Cover	28.66	5.15
<i>For 60 Degree Bend, Deduct</i>	-7.48	
<i>For 30 Degree Bend, Deduct</i>	-12.75	
26 05 36 00-2157 EA 9" Horizontal 45 Degree Elbow, 12" Radius, Steel Cable Tray Cover	34.05	6.03
<i>For 60 Degree Bend, Deduct</i>	-8.93	
<i>For 30 Degree Bend, Deduct</i>	-15.21	
26 05 36 00-2158 EA 12" Horizontal 45 Degree Elbow, 12" Radius, Steel Cable Tray Cover	38.28	7.16
<i>For 60 Degree Bend, Deduct</i>	-9.90	
<i>For 30 Degree Bend, Deduct</i>	-16.90	
26 05 36 00-2159 EA 18" Horizontal 45 Degree Elbow, 12" Radius, Steel Cable Tray Cover	46.40	8.77
<i>For 60 Degree Bend, Deduct</i>	-11.95	
<i>For 30 Degree Bend, Deduct</i>	-20.41	
26 05 36 00-2160 EA 24" Horizontal 45 Degree Elbow, 12" Radius, Steel Cable Tray Cover	54.16	10.13
<i>For 60 Degree Bend, Deduct</i>	-13.97	
<i>For 30 Degree Bend, Deduct</i>	-23.85	
26 05 36 00-2161 EA 30" Horizontal 45 Degree Elbow, 12" Radius, Steel Cable Tray Cover	63.29	11.67
<i>For 60 Degree Bend, Deduct</i>	-16.40	
<i>For 30 Degree Bend, Deduct</i>	-27.98	
26 05 36 00-2162 EA 36" Horizontal 45 Degree Elbow, 12" Radius, Steel Cable Tray Cover	70.64	12.87
<i>For 60 Degree Bend, Deduct</i>	-18.38	
<i>For 30 Degree Bend, Deduct</i>	-31.34	

26 Electrical**26 05 Common Work Results For Electrical****26 05 36 Cable Trays For Electrical Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-2163			45 Degree, 24" Radius Horizontal Elbows <small>(26 05 36 00-2122)</small>		
26 05 36 00-2164	EA		6" Horizontal 45 Degree Elbow, 24" Radius, Steel Cable Tray Cover.....	38.89	5.71
			<i>For 60 Degree Bend, Deduct</i>	-10.65	
			<i>For 30 Degree Bend, Deduct</i>	-18.07	
26 05 36 00-2165	EA		9" Horizontal 45 Degree Elbow, 24" Radius, Steel Cable Tray Cover.....	44.10	6.68
			<i>For 60 Degree Bend, Deduct</i>	-12.00	
			<i>For 30 Degree Bend, Deduct</i>	-20.37	
26 05 36 00-2166	EA		12" Horizontal 45 Degree Elbow, 24" Radius, Steel Cable Tray Cover.....	50.64	8.04
			<i>For 60 Degree Bend, Deduct</i>	-13.62	
			<i>For 30 Degree Bend, Deduct</i>	-23.15	
26 05 36 00-2167	EA		18" Horizontal 45 Degree Elbow, 24" Radius, Steel Cable Tray Cover.....	58.71	9.65
			<i>For 60 Degree Bend, Deduct</i>	-15.67	
			<i>For 30 Degree Bend, Deduct</i>	-26.65	
26 05 36 00-2168	EA		24" Horizontal 45 Degree Elbow, 24" Radius, Steel Cable Tray Cover.....	67.61	11.02
			<i>For 60 Degree Bend, Deduct</i>	-18.07	
			<i>For 30 Degree Bend, Deduct</i>	-30.74	
26 05 36 00-2169	EA		30" Horizontal 45 Degree Elbow, 24" Radius, Steel Cable Tray Cover.....	83.89	12.87
			<i>For 60 Degree Bend, Deduct</i>	-22.74	
			<i>For 30 Degree Bend, Deduct</i>	-38.61	
26 05 36 00-2170	EA		36" Horizontal 45 Degree Elbow, 24" Radius, Steel Cable Tray Cover.....	93.17	14.88
			<i>For 60 Degree Bend, Deduct</i>	-25.05	
			<i>For 30 Degree Bend, Deduct</i>	-42.57	
26 05 36 00-2171			45 Degree, 36" Radius Horizontal Elbows <small>(26 05 36 00-2122)</small>		
26 05 36 00-2172	EA		6" Horizontal 45 Degree Elbow, 36" Radius, Steel Cable Tray Cover.....	53.29	6.43
			<i>For 60 Degree Bend, Deduct</i>	-15.13	
			<i>For 30 Degree Bend, Deduct</i>	-25.57	
26 05 36 00-2173	EA		9" Horizontal 45 Degree Elbow, 36" Radius, Steel Cable Tray Cover.....	60.38	7.40
			<i>For 60 Degree Bend, Deduct</i>	-17.08	
			<i>For 30 Degree Bend, Deduct</i>	-28.87	
26 05 36 00-2174	EA		12" Horizontal 45 Degree Elbow, 36" Radius, Steel Cable Tray Cover.....	68.06	9.17
			<i>For 60 Degree Bend, Deduct</i>	-18.95	
			<i>For 30 Degree Bend, Deduct</i>	-32.09	
26 05 36 00-2175	EA		18" Horizontal 45 Degree Elbow, 36" Radius, Steel Cable Tray Cover.....	77.58	10.21
			<i>For 60 Degree Bend, Deduct</i>	-21.69	
			<i>For 30 Degree Bend, Deduct</i>	-36.72	
26 05 36 00-2176	EA		24" Horizontal 45 Degree Elbow, 36" Radius, Steel Cable Tray Cover.....	94.57	12.47
			<i>For 60 Degree Bend, Deduct</i>	-26.43	
			<i>For 30 Degree Bend, Deduct</i>	-44.74	
26 05 36 00-2177	EA		30" Horizontal 45 Degree Elbow, 36" Radius, Steel Cable Tray Cover.....	105.17	14.88
			<i>For 60 Degree Bend, Deduct</i>	-29.01	
			<i>For 30 Degree Bend, Deduct</i>	-49.17	
26 05 36 00-2178	EA		36" Horizontal 45 Degree Elbow, 36" Radius, Steel Cable Tray Cover.....	124.02	16.09
			<i>For 60 Degree Bend, Deduct</i>	-34.76	
			<i>For 30 Degree Bend, Deduct</i>	-58.82	
26 05 36 00-2179			90 Degree, 12" Radius Vertical Risers <small>(26 05 36 00-2122)</small>		
26 05 36 00-2180	EA		6" Vertical Riser 90 Degree, 12" Radius, Steel Cable Tray Cover.....	32.11	5.15
26 05 36 00-2181	EA		9" Vertical Riser 90 Degree, 12" Radius, Steel Cable Tray Cover.....	34.05	6.03
26 05 36 00-2182	EA		12" Vertical Riser 90 Degree, 12" Radius, Steel Cable Tray Cover.....	37.68	7.16
26 05 36 00-2183	EA		18" Vertical Riser 90 Degree, 12" Radius, Steel Cable Tray Cover.....	44.03	8.77
26 05 36 00-2184	EA		24" Vertical Riser 90 Degree, 12" Radius, Steel Cable Tray Cover.....	48.92	11.34
26 05 36 00-2185	EA		30" Vertical Riser 90 Degree, 12" Radius, Steel Cable Tray Cover.....	54.52	12.95
26 05 36 00-2186	EA		36" Vertical Riser 90 Degree, 12" Radius, Steel Cable Tray Cover.....	68.31	15.45
26 05 36 00-2187			90 Degree, 24" Radius Vertical Risers <small>(26 05 36 00-2122)</small>		
26 05 36 00-2188	EA		6" Vertical Riser 90 Degree, 24" Radius, Steel Cable Tray Cover.....	38.28	5.71
26 05 36 00-2189	EA		9" Vertical Riser 90 Degree, 24" Radius, Steel Cable Tray Cover.....	42.90	6.68
26 05 36 00-2190	EA		12" Vertical Riser 90 Degree, 24" Radius, Steel Cable Tray Cover.....	46.44	8.04
26 05 36 00-2191	EA		18" Vertical Riser 90 Degree, 24" Radius, Steel Cable Tray Cover.....	59.88	9.65
26 05 36 00-2192	EA		24" Vertical Riser 90 Degree, 24" Radius, Steel Cable Tray Cover.....	69.94	12.47
26 05 36 00-2193	EA		30" Vertical Riser 90 Degree, 24" Radius, Steel Cable Tray Cover.....	80.54	14.88
26 05 36 00-2194	EA		36" Vertical Riser 90 Degree, 24" Radius, Steel Cable Tray Cover.....	92.87	17.53
26 05 36 00-2195			90 Degree, 36" Radius Vertical Risers <small>(26 05 36 00-2122)</small>		
26 05 36 00-2196	EA		6" Vertical Riser 90 Degree, 36" Radius, Steel Cable Tray Cover.....	44.27	6.43
26 05 36 00-2197	EA		9" Vertical Riser 90 Degree, 36" Radius, Steel Cable Tray Cover.....	54.99	7.40
26 05 36 00-2198	EA		12" Vertical Riser 90 Degree, 36" Radius, Steel Cable Tray Cover.....	63.30	9.17
26 05 36 00-2199	EA		18" Vertical Riser 90 Degree, 36" Radius, Steel Cable Tray Cover.....	77.58	10.21
26 05 36 00-2200	EA		24" Vertical Riser 90 Degree, 36" Radius, Steel Cable Tray Cover.....	90.96	14.23
26 05 36 00-2201	EA		30" Vertical Riser 90 Degree, 36" Radius, Steel Cable Tray Cover.....	108.38	16.81
26 05 36 00-2202	EA		36" Vertical Riser 90 Degree, 36" Radius, Steel Cable Tray Cover.....	126.91	19.30
26 05 36 00-2203			12" Radius Horizontal Tees <small>(26 05 36 00-2122)</small>		
26 05 36 00-2204	EA		6" Horizontal Tee, 12" Radius, Steel Cable Tray Cover.....	56.59	8.37
26 05 36 00-2205	EA		9" Horizontal Tee, 12" Radius, Steel Cable Tray Cover.....	59.88	9.65
26 05 36 00-2206	EA		12" Horizontal Tee, 12" Radius, Steel Cable Tray Cover.....	68.05	11.34



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-2207 EA 18" Horizontal Tee, 12" Radius, Steel Cable Tray Cover.....	81.49	12.87
26 05 36 00-2208 EA 24" Horizontal Tee, 12" Radius, Steel Cable Tray Cover.....	100.37	14.88
26 05 36 00-2209 EA 30" Horizontal Tee, 12" Radius, Steel Cable Tray Cover.....	124.47	21.40
26 05 36 00-2210 EA 36" Horizontal Tee, 12" Radius, Steel Cable Tray Cover.....	149.59	25.66
26 05 36 00-2211 24" Radius Horizontal Tees <small>(26 05 36 00-2122)</small>		
26 05 36 00-2212 EA 6" Horizontal Tee, 24" Radius, Steel Cable Tray Cover.....	81.81	8.77
26 05 36 00-2213 EA 9" Horizontal Tee, 24" Radius, Steel Cable Tray Cover.....	93.77	10.21
26 05 36 00-2214 EA 12" Horizontal Tee, 24" Radius, Steel Cable Tray Cover.....	99.28	12.07
26 05 36 00-2215 EA 18" Horizontal Tee, 24" Radius, Steel Cable Tray Cover.....	124.99	13.83
26 05 36 00-2216 EA 24" Horizontal Tee, 24" Radius, Steel Cable Tray Cover.....	182.72	16.09
26 05 36 00-2217 EA 30" Horizontal Tee, 24" Radius, Steel Cable Tray Cover.....	217.83	24.13
26 05 36 00-2218 EA 36" Horizontal Tee, 24" Radius, Steel Cable Tray Cover.....	245.04	29.68
26 05 36 00-2219 36" Radius Horizontal Tees <small>(26 05 36 00-2122)</small>		
26 05 36 00-2220 EA 6" Horizontal Tee, 36" Radius, Steel Cable Tray Cover.....	136.48	9.17
26 05 36 00-2221 EA 9" Horizontal Tee, 36" Radius, Steel Cable Tray Cover.....	141.45	10.69
26 05 36 00-2222 EA 12" Horizontal Tee, 36" Radius, Steel Cable Tray Cover.....	158.25	12.87
26 05 36 00-2223 EA 18" Horizontal Tee, 36" Radius, Steel Cable Tray Cover.....	185.60	14.88
26 05 36 00-2224 EA 24" Horizontal Tee, 36" Radius, Steel Cable Tray Cover.....	240.46	17.53
26 05 36 00-2225 EA 30" Horizontal Tee, 36" Radius, Steel Cable Tray Cover.....	275.25	27.66
26 05 36 00-2226 EA 36" Horizontal Tee, 36" Radius, Steel Cable Tray Cover.....	318.68	34.99
26 05 36 00-2227 12" Radius Horizontal Crosses <small>(26 05 36 00-2122)</small>		
26 05 36 00-2228 EA 6" Horizontal Cross, 12" Radius, Steel Cable Tray Cover.....	82.49	11.34
26 05 36 00-2229 EA 9" Horizontal Cross, 12" Radius, Steel Cable Tray Cover.....	87.30	12.07
26 05 36 00-2230 EA 12" Horizontal Cross, 12" Radius, Steel Cable Tray Cover.....	96.49	12.87
26 05 36 00-2231 EA 18" Horizontal Cross, 12" Radius, Steel Cable Tray Cover.....	113.57	14.88
26 05 36 00-2232 EA 24" Horizontal Cross, 12" Radius, Steel Cable Tray Cover.....	143.64	21.40
26 05 36 00-2233 EA 30" Horizontal Cross, 12" Radius, Steel Cable Tray Cover.....	166.35	25.66
26 05 36 00-2234 EA 36" Horizontal Cross, 12" Radius, Steel Cable Tray Cover.....	189.91	27.58
26 05 36 00-2235 24" Radius Horizontal Crosses <small>(26 05 36 00-2122)</small>		
26 05 36 00-2236 EA 6" Horizontal Cross, 24" Radius, Steel Cable Tray Cover.....	141.33	12.07
26 05 36 00-2237 EA 9" Horizontal Cross, 24" Radius, Steel Cable Tray Cover.....	153.46	12.87
26 05 36 00-2238 EA 12" Horizontal Cross, 24" Radius, Steel Cable Tray Cover.....	164.58	13.83
26 05 36 00-2239 EA 18" Horizontal Cross, 24" Radius, Steel Cable Tray Cover.....	195.92	16.09
26 05 36 00-2240 EA 24" Horizontal Cross, 24" Radius, Steel Cable Tray Cover.....	246.59	24.13
26 05 36 00-2241 EA 30" Horizontal Cross, 24" Radius, Steel Cable Tray Cover.....	282.17	29.68
26 05 36 00-2242 EA 36" Horizontal Cross, 24" Radius, Steel Cable Tray Cover.....	315.07	32.09
26 05 36 00-2243 36" Radius Horizontal Crosses <small>(26 05 36 00-2122)</small>		
26 05 36 00-2244 EA 6" Horizontal Cross, 36" Radius, Steel Cable Tray Cover.....	224.25	12.87
26 05 36 00-2245 EA 9" Horizontal Cross, 36" Radius, Steel Cable Tray Cover.....	232.98	13.83
26 05 36 00-2246 EA 12" Horizontal Cross, 36" Radius, Steel Cable Tray Cover.....	245.59	14.88
26 05 36 00-2247 EA 18" Horizontal Cross, 36" Radius, Steel Cable Tray Cover.....	283.65	17.53
26 05 36 00-2248 EA 24" Horizontal Cross, 36" Radius, Steel Cable Tray Cover.....	370.01	27.58
26 05 36 00-2249 EA 30" Horizontal Cross, 36" Radius, Steel Cable Tray Cover.....	406.54	35.15
26 05 36 00-2250 EA 36" Horizontal Cross, 36" Radius, Steel Cable Tray Cover.....	436.31	38.61
26 05 36 00-2251 Reducers <small>(26 05 36 00-2122)</small>		
26 05 36 00-2252 EA 9"-6" Reducer, Steel Cable Tray Covers.....	37.06	6.03
26 05 36 00-2253 EA 12"-6" Reducer, Steel Cable Tray Covers.....	40.11	7.16
26 05 36 00-2254 EA 12"-9" Reducer, Steel Cable Tray Covers.....	40.11	7.16
26 05 36 00-2255 EA 18"-6" Reducer, Steel Cable Tray Covers.....	44.62	8.77
26 05 36 00-2256 EA 18"-12" Reducer, Steel Cable Tray Covers.....	44.62	8.77
26 05 36 00-2257 EA 24"-12" Reducer, Steel Cable Tray Covers.....	54.49	9.65
26 05 36 00-2258 EA 24"-18" Reducer, Steel Cable Tray Covers.....	58.09	9.65
26 05 36 00-2259 EA 30"-12" Reducer, Steel Cable Tray Covers.....	56.80	11.02
26 05 36 00-2260 EA 30"-18" Reducer, Steel Cable Tray Covers.....	60.40	11.02
26 05 36 00-2261 EA 30"-24" Reducer, Steel Cable Tray Covers.....	62.79	11.02
26 05 36 00-2262 EA 36"-12" Reducer, Steel Cable Tray Covers.....	65.66	12.07
26 05 36 00-2263 EA 36"-18" Reducer, Steel Cable Tray Covers.....	66.86	12.07
26 05 36 00-2264 EA 36"-24" Reducer, Steel Cable Tray Covers.....	68.06	12.07
26 05 36 00-2265 EA 36"-30" Reducer, Steel Cable Tray Covers.....	68.66	12.07
26 05 36 00-2266 Aluminum Covers <small>(26 05 36 00-2121)</small>		
26 05 36 00-2267 Ventilated Straight Sections <small>(26 05 36 00-2266)</small>		
26 05 36 00-2268 LF 6" Aluminum Cable Tray Cover, Straight Section.....	5.77	1.44
26 05 36 00-2269 LF 9" Aluminum Cable Tray Cover, Straight Section.....	6.84	1.69
26 05 36 00-2270 LF 12" Aluminum Cable Tray Cover, Straight Section.....	7.99	1.93
26 05 36 00-2271 LF 18" Aluminum Cable Tray Cover, Straight Section.....	10.64	2.58

26 Electrical**26 05 Common Work Results For Electrical****26 05 36 Cable Trays For Electrical Systems**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-2272 LF 24" Aluminum Cable Tray Cover, Straight Section	13.78	3.46
26 05 36 00-2273 LF 30" Aluminum Cable Tray Cover, Straight Section	15.88	4.26
26 05 36 00-2274 LF 36" Aluminum Cable Tray Cover, Straight Section	89.88	48.34
26 05 36 00-2275 90 Degree, 12" Radius Horizontal Elbows (26 05 36 00-2266)		
26 05 36 00-2276 EA 6" Horizontal 90 Degree Elbow, 12" Radius, Aluminum Cable Tray Cover	33.57	5.15
26 05 36 00-2277 EA 9" Horizontal 90 Degree Elbow, 12" Radius, Aluminum Cable Tray Cover	36.10	6.03
26 05 36 00-2278 EA 12" Horizontal 90 Degree Elbow, 12" Radius, Aluminum Cable Tray Cover	40.10	7.16
26 05 36 00-2279 EA 18" Horizontal 90 Degree Elbow, 12" Radius, Aluminum Cable Tray Cover	52.18	9.17
26 05 36 00-2280 EA 24" Horizontal 90 Degree Elbow, 12" Radius, Aluminum Cable Tray Cover	66.15	11.67
26 05 36 00-2281 EA 30" Horizontal 90 Degree Elbow, 12" Radius, Aluminum Cable Tray Cover	77.41	12.95
26 05 36 00-2282 EA 36" Horizontal 90 Degree Elbow, 12" Radius, Aluminum Cable Tray Cover	94.14	15.45
26 05 36 00-2283 90 Degree, 24" Radius Horizontal Elbows (26 05 36 00-2266)		
26 05 36 00-2284 EA 6" Horizontal 90 Degree Elbow, 24" Radius, Aluminum Cable Tray Cover	43.67	5.71
26 05 36 00-2285 EA 9" Horizontal 90 Degree Elbow, 24" Radius, Aluminum Cable Tray Cover	53.43	6.68
26 05 36 00-2286 EA 12" Horizontal 90 Degree Elbow, 24" Radius, Aluminum Cable Tray Cover	60.11	8.04
26 05 36 00-2287 EA 18" Horizontal 90 Degree Elbow, 24" Radius, Aluminum Cable Tray Cover	72.32	10.21
26 05 36 00-2288 EA 24" Horizontal 90 Degree Elbow, 24" Radius, Aluminum Cable Tray Cover	89.85	12.87
26 05 36 00-2289 EA 30" Horizontal 90 Degree Elbow, 24" Radius, Aluminum Cable Tray Cover	108.30	14.80
26 05 36 00-2290 EA 36" Horizontal 90 Degree Elbow, 24" Radius, Aluminum Cable Tray Cover	132.38	17.53
26 05 36 00-2291 90 Degree, 36" Radius Horizontal Elbows (26 05 36 00-2266)		
26 05 36 00-2292 EA 6" Horizontal 90 Degree Elbow, 36" Radius, Aluminum Cable Tray Cover	69.28	6.43
26 05 36 00-2293 EA 9" Horizontal 90 Degree Elbow, 36" Radius, Aluminum Cable Tray Cover	76.42	7.40
26 05 36 00-2294 EA 12" Horizontal 90 Degree Elbow, 36" Radius, Aluminum Cable Tray Cover	88.02	9.17
26 05 36 00-2295 EA 18" Horizontal 90 Degree Elbow, 36" Radius, Aluminum Cable Tray Cover	104.69	10.69
26 05 36 00-2296 EA 24" Horizontal 90 Degree Elbow, 36" Radius, Aluminum Cable Tray Cover	130.02	14.88
26 05 36 00-2297 EA 30" Horizontal 90 Degree Elbow, 36" Radius, Aluminum Cable Tray Cover	149.54	16.81
26 05 36 00-2298 EA 36" Horizontal 90 Degree Elbow, 36" Radius, Aluminum Cable Tray Cover	174.29	19.30
26 05 36 00-2299 45 Degree, 12" Radius Horizontal Elbows (26 05 36 00-2266)		
26 05 36 00-2300 EA 6" Horizontal 45 Degree Elbow, 12" Radius, Aluminum Cable Tray Cover	27.07	5.15
For 30 Degree Bend, Deduct	-11.87	
For 60 Degree Bend, Deduct	-6.95	
26 05 36 00-2301 EA 9" Horizontal 45 Degree Elbow, 12" Radius, Aluminum Cable Tray Cover	29.04	6.03
For 30 Degree Bend, Deduct	-12.45	
For 60 Degree Bend, Deduct	-7.27	
26 05 36 00-2302 EA 12" Horizontal 45 Degree Elbow, 12" Radius, Aluminum Cable Tray Cover	33.15	7.16
For 30 Degree Bend, Deduct	-14.07	
For 60 Degree Bend, Deduct	-8.21	
26 05 36 00-2303 EA 18" Horizontal 45 Degree Elbow, 12" Radius, Aluminum Cable Tray Cover	39.02	8.77
For 30 Degree Bend, Deduct	-16.35	
For 60 Degree Bend, Deduct	-9.52	
26 05 36 00-2304 EA 24" Horizontal 45 Degree Elbow, 12" Radius, Aluminum Cable Tray Cover	44.09	10.13
For 30 Degree Bend, Deduct	-18.31	
For 60 Degree Bend, Deduct	-10.65	
26 05 36 00-2305 EA 30" Horizontal 45 Degree Elbow, 12" Radius, Aluminum Cable Tray Cover	53.69	11.67
For 30 Degree Bend, Deduct	-22.70	
For 60 Degree Bend, Deduct	-13.23	
26 05 36 00-2306 EA 36" Horizontal 45 Degree Elbow, 12" Radius, Aluminum Cable Tray Cover	62.69	12.87
For 30 Degree Bend, Deduct	-26.97	
For 60 Degree Bend, Deduct	-15.75	
26 05 36 00-2307 45 Degree, 24" Radius Horizontal Elbows (26 05 36 00-2266)		
26 05 36 00-2308 EA 6" Horizontal 45 Degree Elbow, 24" Radius, Aluminum Cable Tray Cover	30.92	5.71
For 30 Degree Bend, Deduct	-13.68	
For 60 Degree Bend, Deduct	-8.02	
26 05 36 00-2309 EA 9" Horizontal 45 Degree Elbow, 24" Radius, Aluminum Cable Tray Cover	38.23	6.68
For 30 Degree Bend, Deduct	-17.14	
For 60 Degree Bend, Deduct	-10.06	
26 05 36 00-2310 EA 12" Horizontal 45 Degree Elbow, 24" Radius, Aluminum Cable Tray Cover	41.66	8.04
For 30 Degree Bend, Deduct	-18.21	
For 60 Degree Bend, Deduct	-10.66	
26 05 36 00-2311 EA 18" Horizontal 45 Degree Elbow, 24" Radius, Aluminum Cable Tray Cover	50.30	9.65
For 30 Degree Bend, Deduct	-22.03	
For 60 Degree Bend, Deduct	-12.89	
26 05 36 00-2312 EA 24" Horizontal 45 Degree Elbow, 24" Radius, Aluminum Cable Tray Cover	60.75	11.02
For 30 Degree Bend, Deduct	-26.97	
For 60 Degree Bend, Deduct	-15.81	
26 05 36 00-2313 EA 30" Horizontal 45 Degree Elbow, 24" Radius, Aluminum Cable Tray Cover	70.34	12.87
For 30 Degree Bend, Deduct	-31.16	
For 60 Degree Bend, Deduct	-18.27	
26 05 36 00-2314 EA 36" Horizontal 45 Degree Elbow, 24" Radius, Aluminum Cable Tray Cover	81.21	14.88
For 30 Degree Bend, Deduct	-35.99	
For 60 Degree Bend, Deduct	-21.10	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-2315 45 Degree, 36" Radius Horizontal Elbows <small>(26 05 36 00-2266)</small>		
26 05 36 00-2316 EA 6" Horizontal 45 Degree Elbow, 36" Radius, Aluminum Cable Tray Cover.....	47.59	6.43
<i>For 30 Degree Bend, Deduct</i>	-22.43	
<i>For 60 Degree Bend, Deduct</i>	-13.25	
26 05 36 00-2317 EA 9" Horizontal 45 Degree Elbow, 36" Radius, Aluminum Cable Tray Cover.....	52.55	7.40
<i>For 30 Degree Bend, Deduct</i>	-24.57	
<i>For 60 Degree Bend, Deduct</i>	-14.49	
26 05 36 00-2318 EA 12" Horizontal 45 Degree Elbow, 36" Radius, Aluminum Cable Tray Cover.....	57.60	9.17
<i>For 30 Degree Bend, Deduct</i>	-26.34	
<i>For 60 Degree Bend, Deduct</i>	-15.50	
26 05 36 00-2319 EA 18" Horizontal 45 Degree Elbow, 36" Radius, Aluminum Cable Tray Cover.....	68.00	10.21
<i>For 30 Degree Bend, Deduct</i>	-31.45	
<i>For 60 Degree Bend, Deduct</i>	-18.53	
26 05 36 00-2320 EA 24" Horizontal 45 Degree Elbow, 36" Radius, Aluminum Cable Tray Cover.....	82.64	12.47
<i>For 30 Degree Bend, Deduct</i>	-38.18	
<i>For 60 Degree Bend, Deduct</i>	-22.49	
26 05 36 00-2321 EA 30" Horizontal 45 Degree Elbow, 36" Radius, Aluminum Cable Tray Cover.....	95.32	14.88
<i>For 30 Degree Bend, Deduct</i>	-43.75	
<i>For 60 Degree Bend, Deduct</i>	-25.76	
26 05 36 00-2322 EA 36" Horizontal 45 Degree Elbow, 36" Radius, Aluminum Cable Tray Cover.....	107.14	16.09
<i>For 30 Degree Bend, Deduct</i>	-49.54	
<i>For 60 Degree Bend, Deduct</i>	-29.19	
26 05 36 00-2323 90 Degree, 12" Radius Vertical Risers <small>(26 05 36 00-2266)</small>		
26 05 36 00-2324 EA 6" Vertical Riser 90 Degree, 12" Radius, Aluminum Cable Tray Cover	29.86	5.15
26 05 36 00-2325 EA 9" Vertical Riser 90 Degree, 12" Radius, Aluminum Cable Tray Cover	31.48	6.03
26 05 36 00-2326 EA 12" Vertical Riser 90 Degree, 12" Radius, Aluminum Cable Tray Cover	35.21	7.16
26 05 36 00-2327 EA 18" Vertical Riser 90 Degree, 12" Radius, Aluminum Cable Tray Cover	41.76	8.77
26 05 36 00-2328 EA 24" Vertical Riser 90 Degree, 12" Radius, Aluminum Cable Tray Cover	47.14	11.34
26 05 36 00-2329 EA 30" Vertical Riser 90 Degree, 12" Radius, Aluminum Cable Tray Cover	50.28	12.95
26 05 36 00-2330 EA 36" Vertical Riser 90 Degree, 12" Radius, Aluminum Cable Tray Cover	60.44	15.45
26 05 36 00-2331 90 Degree, 24" Radius Vertical Risers <small>(26 05 36 00-2266)</small>		
26 05 36 00-2332 EA 6" Vertical Riser 90 Degree, 24" Radius, Aluminum Cable Tray Cover	33.90	5.71
26 05 36 00-2333 EA 9" Vertical Riser 90 Degree, 24" Radius, Aluminum Cable Tray Cover	37.69	6.68
26 05 36 00-2334 EA 12" Vertical Riser 90 Degree, 24" Radius, Aluminum Cable Tray Cover	42.20	8.04
26 05 36 00-2335 EA 18" Vertical Riser 90 Degree, 24" Radius, Aluminum Cable Tray Cover	50.82	9.65
26 05 36 00-2336 EA 24" Vertical Riser 90 Degree, 24" Radius, Aluminum Cable Tray Cover	58.73	12.47
26 05 36 00-2337 EA 30" Vertical Riser 90 Degree, 24" Radius, Aluminum Cable Tray Cover	73.59	14.88
26 05 36 00-2338 EA 36" Vertical Riser 90 Degree, 24" Radius, Aluminum Cable Tray Cover	82.46	17.53
26 05 36 00-2339 90 Degree, 36" Radius Vertical Risers <small>(26 05 36 00-2266)</small>		
26 05 36 00-2340 EA 6" Vertical Riser 90 Degree, 36" Radius, Aluminum Cable Tray Cover	38.89	6.43
26 05 36 00-2341 EA 9" Vertical Riser 90 Degree, 36" Radius, Aluminum Cable Tray Cover	47.12	7.40
26 05 36 00-2342 EA 12" Vertical Riser 90 Degree, 36" Radius, Aluminum Cable Tray Cover	55.47	9.17
26 05 36 00-2343 EA 18" Vertical Riser 90 Degree, 36" Radius, Aluminum Cable Tray Cover	65.83	10.21
26 05 36 00-2344 EA 24" Vertical Riser 90 Degree, 36" Radius, Aluminum Cable Tray Cover	81.29	14.23
26 05 36 00-2345 EA 30" Vertical Riser 90 Degree, 36" Radius, Aluminum Cable Tray Cover	100.70	16.81
26 05 36 00-2346 EA 36" Vertical Riser 90 Degree, 36" Radius, Aluminum Cable Tray Cover	110.26	19.30
26 05 36 00-2347 12" Radius Horizontal Tees <small>(26 05 36 00-2266)</small>		
26 05 36 00-2348 EA 6" Horizontal Tee, 12" Radius, Aluminum Cable Tray Cover.....	48.72	8.37
26 05 36 00-2349 EA 9" Horizontal Tee, 12" Radius, Aluminum Cable Tray Cover	52.99	9.65
26 05 36 00-2350 EA 12" Horizontal Tee, 12" Radius, Aluminum Cable Tray Cover	60.10	11.34
26 05 36 00-2351 EA 18" Horizontal Tee, 12" Radius, Aluminum Cable Tray Cover.....	70.34	12.87
26 05 36 00-2352 EA 24" Horizontal Tee, 12" Radius, Aluminum Cable Tray Cover	86.64	14.88
26 05 36 00-2353 EA 30" Horizontal Tee, 12" Radius, Aluminum Cable Tray Cover	108.39	21.40
26 05 36 00-2354 EA 36" Horizontal Tee, 12" Radius, Aluminum Cable Tray Cover	130.71	25.66
26 05 36 00-2355 24" Radius Horizontal Tees <small>(26 05 36 00-2266)</small>		
26 05 36 00-2356 EA 6" Horizontal Tee, 24" Radius, Aluminum Cable Tray Cover.....	71.05	8.77
26 05 36 00-2357 EA 9" Horizontal Tee, 24" Radius, Aluminum Cable Tray Cover.....	79.93	10.21
26 05 36 00-2358 EA 12" Horizontal Tee, 24" Radius, Aluminum Cable Tray Cover.....	90.63	12.07
26 05 36 00-2359 EA 18" Horizontal Tee, 24" Radius, Aluminum Cable Tray Cover.....	105.48	13.83
26 05 36 00-2360 EA 24" Horizontal Tee, 24" Radius, Aluminum Cable Tray Cover.....	158.06	16.09
26 05 36 00-2361 EA 30" Horizontal Tee, 24" Radius, Aluminum Cable Tray Cover.....	185.68	24.13
26 05 36 00-2362 EA 36" Horizontal Tee, 24" Radius, Aluminum Cable Tray Cover.....	211.17	29.68
26 05 36 00-2363 36" Radius Horizontal Tees <small>(26 05 36 00-2266)</small>		
26 05 36 00-2364 EA 6" Horizontal Tee, 36" Radius, Aluminum Cable Tray Cover.....	118.39	9.17
26 05 36 00-2365 EA 9" Horizontal Tee, 36" Radius, Aluminum Cable Tray Cover.....	123.13	10.69
26 05 36 00-2366 EA 12" Horizontal Tee, 36" Radius, Aluminum Cable Tray Cover.....	137.59	12.87
26 05 36 00-2367 EA 18" Horizontal Tee, 36" Radius, Aluminum Cable Tray Cover.....	156.14	14.88
26 05 36 00-2368 EA 24" Horizontal Tee, 36" Radius, Aluminum Cable Tray Cover.....	196.41	17.53

26 Electrical**26 05 Common Work Results For Electrical****26 05 36 Cable Trays For Electrical Systems**

MINOR				TOTAL DIRECT	DEMOLITION
CSI	UOM	DESCRIPTION		UNIT COST	UNIT COST
26 05 36 00-2369	EA	30" Horizontal Tee, 36" Radius, Aluminum Cable Tray Cover		233.83	27.66
26 05 36 00-2370	EA	36" Horizontal Tee, 36" Radius, Aluminum Cable Tray Cover		269.94	34.99
26 05 36 00-2371		12" Radius Horizontal Crosses <small>(26 05 36 00-2266)</small>			
26 05 36 00-2372	EA	6" Horizontal Cross, 12" Radius, Aluminum Cable Tray Cover		72.08	11.34
26 05 36 00-2373	EA	9" Horizontal Cross, 12" Radius, Aluminum Cable Tray Cover		76.54	12.07
26 05 36 00-2374	EA	12" Horizontal Cross, 12" Radius, Aluminum Cable Tray Cover		84.45	12.87
26 05 36 00-2375	EA	18" Horizontal Cross, 12" Radius, Aluminum Cable Tray Cover		100.75	14.88
26 05 36 00-2376	EA	24" Horizontal Cross, 12" Radius, Aluminum Cable Tray Cover		123.56	21.40
26 05 36 00-2377	EA	30" Horizontal Cross, 12" Radius, Aluminum Cable Tray Cover		146.95	25.66
26 05 36 00-2378	EA	36" Horizontal Cross, 12" Radius, Aluminum Cable Tray Cover		166.40	27.58
26 05 36 00-2379		24" Radius Horizontal Crosses <small>(26 05 36 00-2266)</small>			
26 05 36 00-2380	EA	6" Horizontal Cross, 24" Radius, Aluminum Cable Tray Cover		124.33	12.07
26 05 36 00-2381	EA	9" Horizontal Cross, 24" Radius, Aluminum Cable Tray Cover		133.26	12.87
26 05 36 00-2382	EA	12" Horizontal Cross, 24" Radius, Aluminum Cable Tray Cover		143.47	13.83
26 05 36 00-2383	EA	18" Horizontal Cross, 24" Radius, Aluminum Cable Tray Cover		166.74	16.09
26 05 36 00-2384	EA	24" Horizontal Cross, 24" Radius, Aluminum Cable Tray Cover		207.34	24.13
26 05 36 00-2385	EA	30" Horizontal Cross, 24" Radius, Aluminum Cable Tray Cover		244.75	29.68
26 05 36 00-2386	EA	36" Horizontal Cross, 24" Radius, Aluminum Cable Tray Cover		265.13	32.09
26 05 36 00-2387		36" Radius Horizontal Crosses <small>(26 05 36 00-2266)</small>			
26 05 36 00-2388	EA	6" Horizontal Cross, 36" Radius, Aluminum Cable Tray Cover		188.60	12.87
26 05 36 00-2389	EA	9" Horizontal Cross, 36" Radius, Aluminum Cable Tray Cover		197.73	13.83
26 05 36 00-2390	EA	12" Horizontal Cross, 36" Radius, Aluminum Cable Tray Cover		212.57	14.88
26 05 36 00-2391	EA	18" Horizontal Cross, 36" Radius, Aluminum Cable Tray Cover		235.48	17.53
26 05 36 00-2392	EA	24" Horizontal Cross, 36" Radius, Aluminum Cable Tray Cover		301.09	27.58
26 05 36 00-2393	EA	30" Horizontal Cross, 36" Radius, Aluminum Cable Tray Cover		351.61	35.15
26 05 36 00-2394	EA	36" Horizontal Cross, 36" Radius, Aluminum Cable Tray Cover		384.51	38.61
26 05 36 00-2395		Reducers <small>(26 05 36 00-2266)</small>			
26 05 36 00-2396	EA	9"-6" Reducer, Aluminum Cable Tray Covers		36.65	6.03
26 05 36 00-2397	EA	12"-6" Reducer, Aluminum Cable Tray Covers		39.58	7.16
26 05 36 00-2398	EA	12"-9" Reducer, Aluminum Cable Tray Covers		39.58	7.16
26 05 36 00-2399	EA	18"-6" Reducer, Aluminum Cable Tray Covers		45.01	8.77
26 05 36 00-2400	EA	18"-12" Reducer, Aluminum Cable Tray Covers		45.01	8.77
26 05 36 00-2401	EA	24"-12" Reducer, Aluminum Cable Tray Covers		49.73	9.65
26 05 36 00-2402	EA	24"-18" Reducer, Aluminum Cable Tray Covers		54.04	9.65
26 05 36 00-2403	EA	30"-12" Reducer, Aluminum Cable Tray Covers		57.47	11.02
26 05 36 00-2404	EA	30"-18" Reducer, Aluminum Cable Tray Covers		59.08	11.02
26 05 36 00-2405	EA	30"-24" Reducer, Aluminum Cable Tray Covers		60.20	11.02
26 05 36 00-2406	EA	36"-12" Reducer, Aluminum Cable Tray Covers		63.48	12.07
26 05 36 00-2407	EA	36"-18" Reducer, Aluminum Cable Tray Covers		64.57	12.07
26 05 36 00-2408	EA	36"-24" Reducer, Aluminum Cable Tray Covers		65.11	12.07
26 05 36 00-2409	EA	36"-30" Reducer, Aluminum Cable Tray Covers		65.65	12.07
26 05 36 00-2410		Galvanized Steel Dividers <small>(26 05 36 00-2121)</small>			
26 05 36 00-2411		Straight Dividers <small>(26 05 36 00-2410)</small>			
26 05 36 00-2412	LF	3" Deep Galvanized Steel Divider Strip, Straight		6.52	1.93
26 05 36 00-2413	LF	4" Deep Galvanized Steel Divider Strip, Straight		7.63	2.09
26 05 36 00-2414	LF	6" Deep Galvanized Steel Divider Strip, Straight		9.36	2.42
26 05 36 00-2415		3" Deep Vertical Dividers <small>(26 05 36 00-2410)</small>			
26 05 36 00-2416	EA	Vertical Divider, 3" Deep, 12" Radius, 30 Degree, Steel Cable Tray		39.20	13.83
26 05 36 00-2417	EA	Vertical Divider, 3" Deep, 12" Radius, 45 Degree, Steel Cable Tray		44.14	14.31
26 05 36 00-2418	EA	Vertical Divider, 3" Deep, 12" Radius, 60 Degree, Steel Cable Tray		46.38	14.88
26 05 36 00-2419	EA	Vertical Divider, 3" Deep, 12" Radius, 90 Degree, Steel Cable Tray		52.74	15.45
26 05 36 00-2420	EA	Vertical Divider, 3" Deep, 24" Radius, 30 Degree, Steel Cable Tray		50.34	15.45
26 05 36 00-2421	EA	Vertical Divider, 3" Deep, 24" Radius, 45 Degree, Steel Cable Tray		54.38	16.09
26 05 36 00-2422	EA	Vertical Divider, 3" Deep, 24" Radius, 60 Degree, Steel Cable Tray		62.79	16.81
26 05 36 00-2423	EA	Vertical Divider, 3" Deep, 24" Radius, 90 Degree, Steel Cable Tray		76.67	17.53
26 05 36 00-2424	EA	Vertical Divider, 3" Deep, 36" Radius, 30 Degree, Steel Cable Tray		62.28	17.53
26 05 36 00-2425	EA	Vertical Divider, 3" Deep, 36" Radius, 45 Degree, Steel Cable Tray		69.04	18.42
26 05 36 00-2426	EA	Vertical Divider, 3" Deep, 36" Radius, 60 Degree, Steel Cable Tray		77.16	19.30
26 05 36 00-2427	EA	Vertical Divider, 3" Deep, 36" Radius, 90 Degree, Steel Cable Tray		96.25	20.35
26 05 36 00-2428		4" Deep Vertical Dividers <small>(26 05 36 00-2410)</small>			
26 05 36 00-2429	EA	Vertical Divider, 4" Deep, 12" Radius, 30 Degree, Steel Cable Tray		44.44	14.31
26 05 36 00-2430	EA	Vertical Divider, 4" Deep, 12" Radius, 45 Degree, Steel Cable Tray		48.78	14.88
26 05 36 00-2431	EA	Vertical Divider, 4" Deep, 12" Radius, 60 Degree, Steel Cable Tray		52.74	15.45
26 05 36 00-2432	EA	Vertical Divider, 4" Deep, 12" Radius, 90 Degree, Steel Cable Tray		59.78	16.09
26 05 36 00-2433	EA	Vertical Divider, 4" Deep, 24" Radius, 30 Degree, Steel Cable Tray		59.78	16.09



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 36 00-2434 EA Vertical Divider, 4" Deep, 24" Radius, 45 Degree, Steel Cable Tray	69.39	16.81
26 05 36 00-2435 EA Vertical Divider, 4" Deep, 24" Radius, 60 Degree, Steel Cable Tray	76.07	17.53
26 05 36 00-2436 EA Vertical Divider, 4" Deep, 24" Radius, 90 Degree, Steel Cable Tray	93.03	18.42
26 05 36 00-2437 EA Vertical Divider, 4" Deep, 36" Radius, 30 Degree, Steel Cable Tray	66.39	16.81
26 05 36 00-2438 EA Vertical Divider, 4" Deep, 36" Radius, 45 Degree, Steel Cable Tray	73.07	17.53
26 05 36 00-2439 EA Vertical Divider, 4" Deep, 36" Radius, 60 Degree, Steel Cable Tray	85.83	18.42
26 05 36 00-2440 EA Vertical Divider, 4" Deep, 36" Radius, 90 Degree, Steel Cable Tray	107.16	19.30
26 05 36 00-2441 6" Deep Vertical Dividers (26 05 36 00-2410)		
26 05 36 00-2442 EA Vertical Divider, 6" Deep, 12" Radius, 30 Degree, Steel Cable Tray	49.28	16.09
26 05 36 00-2443 EA Vertical Divider, 6" Deep, 12" Radius, 45 Degree, Steel Cable Tray	53.19	16.81
26 05 36 00-2444 EA Vertical Divider, 6" Deep, 12" Radius, 60 Degree, Steel Cable Tray	58.08	17.53
26 05 36 00-2445 EA Vertical Divider, 6" Deep, 12" Radius, 90 Degree, Steel Cable Tray	66.64	18.42
26 05 36 00-2446 EA Vertical Divider, 6" Deep, 24" Radius, 30 Degree, Steel Cable Tray	60.99	16.81
26 05 36 00-2447 EA Vertical Divider, 6" Deep, 24" Radius, 45 Degree, Steel Cable Tray	70.68	17.53
26 05 36 00-2448 EA Vertical Divider, 6" Deep, 24" Radius, 60 Degree, Steel Cable Tray	78.03	18.42
26 05 36 00-2449 EA Vertical Divider, 6" Deep, 24" Radius, 90 Degree, Steel Cable Tray	94.56	19.30
26 05 36 00-2450 EA Vertical Divider, 6" Deep, 36" Radius, 30 Degree, Steel Cable Tray	67.68	17.53
26 05 36 00-2451 EA Vertical Divider, 6" Deep, 36" Radius, 45 Degree, Steel Cable Tray	78.03	18.42
26 05 36 00-2452 EA Vertical Divider, 6" Deep, 36" Radius, 60 Degree, Steel Cable Tray	94.56	19.30
26 05 36 00-2453 EA Vertical Divider, 6" Deep, 36" Radius, 90 Degree, Steel Cable Tray	114.25	20.35
26 05 36 00-2454 Horizontal Dividers (26 05 36 00-2410)		
26 05 36 00-2455 EA 3" Deep Horizontal Fitting Divider Strip, Steel Cable Tray	42.56	11.67
26 05 36 00-2456 EA 4" Deep Horizontal Fitting Divider Strip, Steel Cable Tray	47.28	12.87
26 05 36 00-2457 EA 6" Deep Horizontal Fitting Divider Strip, Steel Cable Tray	56.80	14.31
26 05 36 00-2458 Aluminum Dividers (26 05 36 00-2121)		
26 05 36 00-2459 Straight Dividers (26 05 36 00-2458)		
26 05 36 00-2460 LF 3" Deep Aluminum Divider Strip, Straight	6.04	1.85
26 05 36 00-2461 LF 4" Deep Aluminum Divider Strip, Straight	7.07	2.01
26 05 36 00-2462 LF 6" Deep Aluminum Divider Strip, Straight	8.61	2.26
26 05 36 00-2463 3" Deep Vertical Dividers (26 05 36 00-2458)		
26 05 36 00-2464 EA Vertical Divider, 3" Deep, 12" Radius, 30 Degree, Aluminum Cable Tray	34.63	13.35
26 05 36 00-2465 EA Vertical Divider, 3" Deep, 12" Radius, 45 Degree, Aluminum Cable Tray	37.65	13.83
26 05 36 00-2466 EA Vertical Divider, 3" Deep, 12" Radius, 60 Degree, Aluminum Cable Tray	40.95	14.31
26 05 36 00-2467 EA Vertical Divider, 3" Deep, 12" Radius, 90 Degree, Aluminum Cable Tray	46.49	14.88
26 05 36 00-2468 EA Vertical Divider, 3" Deep, 24" Radius, 30 Degree, Aluminum Cable Tray	45.40	14.88
26 05 36 00-2469 EA Vertical Divider, 3" Deep, 24" Radius, 45 Degree, Aluminum Cable Tray	49.62	15.45
26 05 36 00-2470 EA Vertical Divider, 3" Deep, 24" Radius, 60 Degree, Aluminum Cable Tray	56.63	16.09
26 05 36 00-2471 EA Vertical Divider, 3" Deep, 24" Radius, 90 Degree, Aluminum Cable Tray	68.69	16.81
26 05 36 00-2472 EA Vertical Divider, 3" Deep, 36" Radius, 30 Degree, Aluminum Cable Tray	59.46	16.81
26 05 36 00-2473 EA Vertical Divider, 3" Deep, 36" Radius, 45 Degree, Aluminum Cable Tray	69.98	17.53
26 05 36 00-2474 EA Vertical Divider, 3" Deep, 36" Radius, 60 Degree, Aluminum Cable Tray	83.28	18.42
26 05 36 00-2475 EA Vertical Divider, 3" Deep, 36" Radius, 90 Degree, Aluminum Cable Tray	101.09	19.30
26 05 36 00-2476 4" Deep Vertical Dividers (26 05 36 00-2458)		
26 05 36 00-2477 EA Vertical Divider, 4" Deep, 12" Radius, 30 Degree, Aluminum Cable Tray	40.53	13.83
26 05 36 00-2478 EA Vertical Divider, 4" Deep, 12" Radius, 45 Degree, Aluminum Cable Tray	44.15	14.31
26 05 36 00-2479 EA Vertical Divider, 4" Deep, 12" Radius, 60 Degree, Aluminum Cable Tray	48.11	14.88
26 05 36 00-2480 EA Vertical Divider, 4" Deep, 12" Radius, 90 Degree, Aluminum Cable Tray	53.41	15.45
26 05 36 00-2481 EA Vertical Divider, 4" Deep, 24" Radius, 30 Degree, Aluminum Cable Tray	52.87	15.45
26 05 36 00-2482 EA Vertical Divider, 4" Deep, 24" Radius, 45 Degree, Aluminum Cable Tray	60.42	16.09
26 05 36 00-2483 EA Vertical Divider, 4" Deep, 24" Radius, 60 Degree, Aluminum Cable Tray	67.60	16.81
26 05 36 00-2484 EA Vertical Divider, 4" Deep, 24" Radius, 90 Degree, Aluminum Cable Tray	83.54	17.53
26 05 36 00-2485 EA Vertical Divider, 4" Deep, 36" Radius, 30 Degree, Aluminum Cable Tray	69.11	16.09
26 05 36 00-2486 EA Vertical Divider, 4" Deep, 36" Radius, 45 Degree, Aluminum Cable Tray	82.25	16.81
26 05 36 00-2487 EA Vertical Divider, 4" Deep, 36" Radius, 60 Degree, Aluminum Cable Tray	95.48	17.53
26 05 36 00-2488 EA Vertical Divider, 4" Deep, 36" Radius, 90 Degree, Aluminum Cable Tray	114.21	18.42
26 05 36 00-2489 6" Deep Vertical Dividers (26 05 36 00-2458)		
26 05 36 00-2490 EA Vertical Divider, 6" Deep, 12" Radius, 30 Degree, Aluminum Cable Tray	44.95	15.45
26 05 36 00-2491 EA Vertical Divider, 6" Deep, 12" Radius, 45 Degree, Aluminum Cable Tray	49.57	16.09
26 05 36 00-2492 EA Vertical Divider, 6" Deep, 12" Radius, 60 Degree, Aluminum Cable Tray	51.87	16.81
26 05 36 00-2493 EA Vertical Divider, 6" Deep, 12" Radius, 90 Degree, Aluminum Cable Tray	57.50	17.53
26 05 36 00-2494 EA Vertical Divider, 6" Deep, 24" Radius, 30 Degree, Aluminum Cable Tray	55.00	16.09
26 05 36 00-2495 EA Vertical Divider, 6" Deep, 24" Radius, 45 Degree, Aluminum Cable Tray	66.52	16.81
26 05 36 00-2496 EA Vertical Divider, 6" Deep, 24" Radius, 60 Degree, Aluminum Cable Tray	71.61	17.53
26 05 36 00-2497 EA Vertical Divider, 6" Deep, 24" Radius, 90 Degree, Aluminum Cable Tray	88.16	18.42
26 05 36 00-2498 EA Vertical Divider, 6" Deep, 36" Radius, 30 Degree, Aluminum Cable Tray	70.86	16.81
26 05 36 00-2499 EA Vertical Divider, 6" Deep, 36" Radius, 45 Degree, Aluminum Cable Tray	86.80	17.53
26 05 36 00-2500 EA Vertical Divider, 6" Deep, 36" Radius, 60 Degree, Aluminum Cable Tray	98.47	18.42

26 Electrical**26 05 Common Work Results For Electrical****26 05 36 Cable Trays For Electrical Systems**

MINOR				TOTAL DIRECT	DEMOLITION
CSI	UOM	DESCRIPTION		UNIT COST	UNIT COST
26 05 36 00-2501	EA	Vertical Divider, 6" Deep, 36" Radius, 90 Degree, Aluminum Cable Tray.....		113.57	19.30
26 05 36 00-2502		Horizontal Dividers (26 05 36 00-2458)			
26 05 36 00-2503	EA	3" Deep Horizontal Fitting Divider Strip, Aluminum Cable Tray		38.17	11.02
26 05 36 00-2504	EA	4" Deep Horizontal Fitting Divider Strip, Aluminum Cable Tray		41.82	12.07
26 05 36 00-2505	EA	6" Deep Horizontal Fitting Divider Strip, Aluminum Cable Tray		50.96	13.35
26 05 36 00-2506		Wall Brackets (26 05 36 00-0001)			
26 05 36 00-2507		Wall Brackets (26 05 36 00-2506)			
26 05 36 00-2508	EA	6" Wide Tray Wall Bracket		44.85	16.09
26 05 36 00-2509	EA	9" Wide Tray Wall Bracket		46.58	16.81
26 05 36 00-2510	EA	12" Wide Tray Wall Bracket		50.45	17.53
26 05 36 00-2511	EA	18" Wide Tray Wall Bracket		53.36	18.42
26 05 36 00-2512	EA	24" Wide Tray Wall Bracket		57.47	19.30
26 05 36 00-2513	EA	30" Wide Tray Wall Bracket		66.39	20.35
26 05 36 00-2514	EA	36" Wide Tray Wall Bracket		77.50	21.72
26 05 39		Underfloor Raceways for Electrical Systems (26 05)			
26 05 39 00-0001		Underfloor Ducts (26 05 39)			
26 05 39 00-0002		Straight Duct Sections 10' Long, 14 Gauge Steel (26 05 39 00-0001)			
26 05 39 00-0003		Standard Ducts, 3.8 Square Inches (26 05 39 00-0002)			
26 05 39 00-0004	EA	Standard Underfloor Straight Duct Blank Without Inserts, 10' Long, 14 Gauge, 3.8 Square Inches.....		70.06	14.15
26 05 39 00-0005	EA	Standard Underfloor Straight Duct With 7/8" Inserts On 24" Centers, 10' Long, 14 Gauge, 3.8 Square Inches.....		88.27	16.57
26 05 39 00-0006		Large Capacity Ducts, 8.9 Square Inches (26 05 39 00-0002)			
26 05 39 00-0007	EA	Large Capacity Underfloor Straight Duct Blank Without Inserts, 10' Long, 14 Gauge, 8.9 Square Inches		117.06	17.93
26 05 39 00-0008	EA	Large Capacity Underfloor Straight Duct With 7/8" Inserts On 24" Centers, 10' Long, 14 Gauge, 8.9 Square Inches.....		134.13	19.87
26 05 39 00-0009		Junction Boxes (26 05 39 00-0001)			
26 05 39 00-0010		One Level Junction Boxes (26 05 39 00-0009)			
26 05 39 00-0011	EA	1 Level UF Duct Junction Box, 1 Standard Duct Without Partitions In Box.....		178.40	28.15
26 05 39 00-0012	EA	1 Level UF Duct Junction Box, 1 Large Duct Without Partitions In Box		202.07	30.16
26 05 39 00-0013	EA	1 Level UF Duct Junction Box, 1 Standard And Large Duct Per Side With Partitions In Box.....		326.32	28.15
		Note: Isolate each duct and form a continuous raceway through the box in both directions.			
26 05 39 00-0014	EA	1 Level UF Duct Junction Box, 2 Standard Ducts Per Side With Partitions In Box		221.37	30.16
26 05 39 00-0015	EA	1 Level UF Duct Junction Box, 3 Standard Ducts Per Side With Partitions In Box		351.87	39.65
26 05 39 00-0016	EA	1 Level UF Duct Junction Box, 2 Large Ducts Per Side With Partitions In Box Duct		494.48	43.11
26 05 39 00-0017		Two Level Junction Boxes (26 05 39 00-0009)			
26 05 39 00-0018	EA	2 Level UF Duct Junction Box, 2 Standard Duct Cross, Intersects At Right Angles, Raceway Bottom Level.....		755.68	28.48
		Note: Accepts two standard ducts to form a continuous raceway at right angles to the top level raceway.			
26 05 39 00-0019	EA	2 Level UF Duct Junction Box, 2 Large Duct Bottom Level: Accepts Two Large Capacity Ducts.....		869.63	30.16
26 05 39 00-0020		Elbow Fittings (26 05 39 00-0001)			
26 05 39 00-0021		90 Degree Horizontal Elbow (26 05 39 00-0020)			
26 05 39 00-0022	EA	Underfloor Standard Duct Horizontal Elbow Fitting, 90 Degree		87.34	10.37
26 05 39 00-0023	EA	Underfloor Large Duct Horizontal Elbow Fitting, 90 Degree		89.99	10.37
26 05 39 00-0024		90 Degree Vertical Elbow (26 05 39 00-0020)			
26 05 39 00-0025	EA	Underfloor Standard Duct Vertical Elbow Fitting, 90 Degree		48.75	10.37
26 05 39 00-0026	EA	Underfloor Large Duct Vertical Elbow Fitting, 90 Degree.....		49.81	10.37
26 05 39 00-0027		Offset Elbow (26 05 39 00-0020)			
		Note: Two elbows required for crossover or crossunder.			
26 05 39 00-0028	EA	Underfloor Standard Duct Offset Elbow 45 Degree, 2 Required For Over-Under.....		48.75	12.07
26 05 39 00-0029	EA	Underfloor Large Duct Offset Elbow 45 Degree, 2 Required For Over-Under		49.81	12.07
26 05 39 00-0030		Couplings (26 05 39 00-0001)			
26 05 39 00-0031		Sleeve Couplings (26 05 39 00-0030)			
26 05 39 00-0032	EA	Underfloor Standard Duct Sleeve Coupling		31.26	16.09
26 05 39 00-0033	EA	Underfloor Large Duct Sleeve Coupling.....		48.59	16.09



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 39 00-0034 Expansion Couplings <small>(26 05 39 00-0030)</small>		
26 05 39 00-0035 EA Underfloor Standard Duct Expansion Coupling	69.82	16.09
26 05 39 00-0036 EA Underfloor Large Duct Expansion Coupling.....	71.14	16.97
26 05 39 00-0037 Reducing Couplings <small>(26 05 39 00-0030)</small>		
26 05 39 00-0038 EA Reducing Coupling, Large To Standard Duct Underfloor Duct Coupling	68.08	2.42
26 05 39 00-0039 Duct Supports <small>(26 05 39 00-0001)</small>		
26 05 39 00-0040 Combination Support And Coupling <small>(26 05 39 00-0039)</small>		
<small>Note: Includes leveling legs and anchoring feet.</small>		
26 05 39 00-0041 EA 1 Standard Duct Support And Coupling With Legs With Leveling Legs And Anchor Feet	71.66	33.78
26 05 39 00-0042 EA 2 Standard Duct Support And Coupling With Legs With Leveling Legs And Anchor Feet	79.88	33.78
26 05 39 00-0043 EA 3 Standard Duct Support And Coupling With Legs With Leveling Legs And Anchor Feet	88.17	33.78
26 05 39 00-0044 EA 1 Large Duct Support And Coupling With Legs With Leveling Legs And Anchor Feet	79.88	37.81
26 05 39 00-0045 EA 2 Large Duct Support And Coupling With Legs With Leveling Legs And Anchor Feet	96.64	37.81
26 05 39 00-0046 EA 1 Standard And 1 Large Duct Support And Coupling With Leveling Legs And Anchor Feet	88.17	40.21
26 05 39 00-0047 EA 2 Standard And 1 Large Duct Support And Coupling With Leveling Legs And Anchor Feet	88.17	40.21
26 05 39 00-0048 EA 1 Standard And 2 Large Duct Support And Coupling With Leveling Legs And Anchor Feet	96.64	40.21
26 05 39 00-0049 Duct Support Only <small>(26 05 39 00-0039)</small>		
<small>Note: Includes leveling legs and anchoring feet.</small>		
26 05 39 00-0050 EA 1 Underfloor Duct Support Only With Leveling Legs And Anchor Feet.....	64.61	29.76
26 05 39 00-0051 EA 2 Underfloor Duct Support Only With Leveling Legs And Anchor Feet.....	76.01	29.76
26 05 39 00-0052 EA 3 Underfloor Duct Support Only With Leveling Legs And Anchor Feet.....	88.28	29.76
26 05 39 00-0053 Underfloor Duct Accessories <small>(26 05 39 00-0001)</small>		
26 05 39 00-0054 Plugs For Unused Junction Box Openings And Duct Ends <small>(26 05 39 00-0053)</small>		
26 05 39 00-0055 EA Standard Plugs For Unused Junction Box Opening And Underfloor Duct Ends	6.34	2.42
26 05 39 00-0056 EA Large Plugs For Unused Junction Box Opening And Underfloor Duct Ends	6.76	2.42
26 05 39 00-0057 Conduit Adapters <small>(26 05 39 00-0053)</small>		
26 05 39 00-0058 EA One 1-1/4" Conduit To Standard Duct Underfloor Conduit To Duct, Adapter	26.00	4.02
26 05 39 00-0059 EA Two 1-1/4" Conduit To Standard Duct Underfloor Conduit To Duct, Adapter	27.62	4.02
26 05 39 00-0060 EA One 2" Conduit To Standard Duct Underfloor Conduit To Duct, Adapter	26.82	4.02
26 05 39 00-0061 EA Three 1-1/4" Conduit To Large Duct Underfloor Conduit To Duct, Adapter	27.67	4.02
26 05 39 00-0062 Holders And Caps <small>(26 05 39 00-0053)</small>		
26 05 39 00-0063 EA Tile Holder, Underfloor Duct Accessories	167.96	33.78
26 05 39 00-0064 EA Terrazzo Holder, Underfloor Duct Accessories.....	320.82	33.78
26 05 39 00-0065 EA Closing Caps For Inserts, Underfloor Duct Accessories	2.18	0.80
26 05 39 00-0066 Underfloor Dust Pans <small>(26 05 39 00-0001)</small>		
26 05 39 00-0067 EA Underfloor Dust Carpet Pan.....	73.04	4.41
26 05 43 Underground Ducts And Raceways For Electrical Systems <small>(26 05)</small>		
<small>Note: Underground utilities and conduits include warning tape.</small>		
26 05 43 00-0001 Duct Bank <small>(26 05 43)</small>		
<small>Note: Installation of single or multiple configuration underground utility raceways to have 3" concrete leveling base and encased in concrete envelope. Based on 100' run, minimum 30" bury depth. Labor units include material handling, unloading at job site, layout of job, measuring, cutting and fabrication, installation in trench using the appropriate supports, cleaning to remove any obstructions and installation of nylon pull string. Excludes trenching, concrete, backfilling, grading and seeding. Duct Banks are to be installed according to the appropriate sections of the accompanying specifications. Individual rows to be stacked for larger duct bank configurations.</small>		
26 05 43 00-0002 Rigid Galvanized Steel Conduit, Galvanized Rigid Conduit (GRC) Or Rigid Galvanized Steel (RGS), Duct Bank <small>(26 05 43 00-0001)</small>		
<small>Note: Includes appropriate spacers and fittings.</small>		
26 05 43 00-0003 LF 2 At 2", Rigid Galvanized Conduit Duct Bank	18.09	
26 05 43 00-0004 LF 4 At 2", Rigid Galvanized Conduit Duct Bank	36.20	
26 05 43 00-0005 LF 2 At 3", Rigid Galvanized Conduit Duct Bank	36.75	
26 05 43 00-0006 LF 4 At 3", Rigid Galvanized Conduit Duct Bank	73.68	
26 05 43 00-0007 LF 2 At 4", Rigid Galvanized Conduit Duct Bank	53.97	
26 05 43 00-0008 LF 4 At 4", Rigid Galvanized Conduit Duct Bank	108.69	
26 05 43 00-0009 LF 6 At 4", Rigid Galvanized Conduit Duct Bank	163.77	
26 05 43 00-0010 Polyvinyl Chloride (PVC), Type EB Duct Bank System <small>(26 05 43 00-0001)</small>		
<small>Note: Includes appropriate spacers and fittings.</small>		
26 05 43 00-0011 LF 1 At 2", Duplex Polyvinyl Chloride (PVC), Type EB Duct Bank.....	5.01	
26 05 43 00-0012 LF 2 At 2", Duplex Polyvinyl Chloride (PVC), Type EB Duct Bank.....	11.05	

26 Electrical**26 05 Common Work Results For Electrical****26 05 43 Underground Ducts And Raceways For Electrical Systems**

MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
26 05 43 00-0013	LF	4 At 2", Duplex Polyvinyl Chloride (PVC), Type EB Duct Bank.....	21.17		
26 05 43 00-0014	LF	1 At 3", Duplex Polyvinyl Chloride (PVC), Type EB Duct Bank.....	6.62		
26 05 43 00-0015	LF	2 At 3", Duplex Polyvinyl Chloride (PVC), Type EB Duct Bank.....	13.22		
26 05 43 00-0016	LF	4 At 3", Duplex Polyvinyl Chloride (PVC), Type EB Duct Bank.....	26.87		
26 05 43 00-0017	LF	1 At 4", Duplex Polyvinyl Chloride (PVC), Type EB Duct Bank.....	8.78		
26 05 43 00-0018	LF	2 At 4", Duplex Polyvinyl Chloride (PVC), Type EB Duct Bank.....	17.57		
26 05 43 00-0019	LF	4 At 4", Duplex Polyvinyl Chloride (PVC), Type EB Duct Bank.....	35.17		
26 05 43 00-0020	LF	6 At 4", Duplex Polyvinyl Chloride (PVC), Type EB Duct Bank.....	52.74		
26 05 43 00-0021		Polyvinyl Chloride (PVC), Type DB Duct Bank System <small>(26 05 43 00-0001)</small>			
		Note: Includes appropriate spacers and fittings.			
26 05 43 00-0022	LF	1 At 2", Duplex Polyvinyl Chloride (PVC), Type DB Duct Bank.....	5.56		
26 05 43 00-0023	LF	2 At 2", Duplex Polyvinyl Chloride (PVC), Type DB Duct Bank.....	12.20		
26 05 43 00-0024	LF	4 At 2", Duplex Polyvinyl Chloride (PVC), Type DB Duct Bank.....	23.30		
26 05 43 00-0025	LF	1 At 3", Duplex Polyvinyl Chloride (PVC), Type DB Duct Bank.....	6.85		
26 05 43 00-0026	LF	2 At 3", Duplex Polyvinyl Chloride (PVC), Type DB Duct Bank.....	13.68		
26 05 43 00-0027	LF	4 At 3", Duplex Polyvinyl Chloride (PVC), Type DB Duct Bank.....	27.29		
26 05 43 00-0028	LF	1 At 4", Duplex Polyvinyl Chloride (PVC), Type DB Duct Bank.....	8.95		
26 05 43 00-0029	LF	2 At 4", Duplex Polyvinyl Chloride (PVC), Type DB Duct Bank.....	17.91		
26 05 43 00-0030	LF	4 At 4", Duplex Polyvinyl Chloride (PVC), Type DB Duct Bank.....	35.85		
26 05 43 00-0031	LF	6 At 4", Duplex Polyvinyl Chloride (PVC), Type DB Duct Bank.....	53.75		
26 05 43 00-0032		Male Or Female Adapters <small>(26 05 43 00-0001)</small>			
26 05 43 00-0033	EA	2" Adapter.....	27.18		
26 05 43 00-0034	EA	3" Adapter.....	38.45		
26 05 43 00-0035	EA	4" Adapter.....	49.42		
26 05 53 Identification for Electrical Systems <small>(26 05)</small>					
26 05 53 00-0001		Conduit Markers Pressure-Sensitive <small>(26 05 53)</small>			
		Note: Stick-on, includes arrow tape.			
26 05 53 00-0002	EA	1/2" Outside Diameter Pressure Sensitive Marker Stick-on.....	8.77		
26 05 53 00-0003	EA	3/4" Outside Diameter Pressure Sensitive Marker Stick-on.....	9.17		
26 05 53 00-0004	EA	1" Outside Diameter Pressure Sensitive Marker Stick-on.....	9.98		
26 05 53 00-0005	EA	1-1/4" Outside Diameter Pressure Sensitive Marker Stick-on.....	10.13		
26 05 53 00-0006	EA	1-1/2" Outside Diameter Pressure Sensitive Marker Stick-on.....	10.29		
26 05 53 00-0007	EA	2" Outside Diameter Pressure Sensitive Marker Stick-on.....	10.54		
26 05 53 00-0008	EA	2-1/2" Outside Diameter Pressure Sensitive Marker Stick-on.....	12.21		
26 05 53 00-0009	EA	3" Outside Diameter Pressure Sensitive Marker Stick-on.....	12.53		
26 05 53 00-0010	EA	3-1/2" Outside Diameter Pressure Sensitive Marker Stick-on.....	12.77		
26 05 53 00-0011	EA	4" Outside Diameter Pressure Sensitive Marker Stick-on.....	13.01		
26 05 53 00-0012	EA	4-1/2" Outside Diameter Pressure Sensitive Marker Stick-on.....	13.51		
26 05 53 00-0013	EA	5" Outside Diameter Pressure Sensitive Marker Stick-on.....	14.05		
26 05 53 00-0014	EA	6" Outside Diameter Pressure Sensitive Marker Stick-on.....	14.53		
26 05 53 00-0015	EA	7" Outside Diameter Pressure Sensitive Marker Stick-on.....	15.01		
26 05 53 00-0016	EA	8" Outside Diameter Pressure Sensitive Marker Stick-on.....	16.38		
26 05 53 00-0017	EA	10" Outside Diameter Pressure Sensitive Marker Stick-on.....	17.26		
26 05 53 00-0018		Labeling Electrical Wires <small>(26 05 53)</small>			
26 05 53 00-0019	EA	Labeling Wire.....	1.72		
26 05 83 Wiring Connections <small>(26 05)</small>					
26 05 83 00-0001		Tape Wrapped Compression Connectors <small>(26 05 83)</small>			
26 05 83 00-0002	EA	#6 AWG Compression Connection, Tape Wrapped Low Voltage, To 600 Volts.....	10.21	3.62	
26 05 83 00-0003	EA	#4 AWG Compression Connection, Tape Wrapped Low Voltage, To 600 Volts.....	11.15	4.02	
26 05 83 00-0004	EA	#2 AWG Compression Connection, Tape Wrapped Low Voltage, To 600 Volts.....	11.98	4.42	
26 05 83 00-0005	EA	1/0 AWG Compression Connection, Tape Wrapped Low Voltage, To 600 Volts.....	13.75	4.82	
26 05 83 00-0006	EA	2/0 AWG Compression Connection, Tape Wrapped Low Voltage, To 600 Volts.....	14.80	5.23	
26 05 83 00-0007	EA	3/0 AWG Compression Connection, Tape Wrapped Low Voltage, To 600 Volts.....	16.37	5.63	
26 05 83 00-0008	EA	4/0 AWG Compression Connection, Tape Wrapped Low Voltage, To 600 Volts.....	17.53	6.03	
26 05 83 00-0009	EA	250 MCM Compression Connection, Tape Wrapped Low Voltage, To 600 Volts.....	19.06	6.43	
26 05 83 00-0010	EA	300 MCM Compression Connection, Tape Wrapped Low Voltage, To 600 Volts.....	21.11	7.24	
26 05 83 00-0011	EA	350 MCM Compression Connection, Tape Wrapped Low Voltage, To 600 Volts.....	22.18	7.64	
26 05 83 00-0012	EA	400 MCM Compression Connection, Tape Wrapped Low Voltage, To 600 Volts.....	24.50	8.04	
26 05 83 00-0013	EA	500 MCM Compression Connection, Tape Wrapped Low Voltage, To 600 Volts.....	26.54	8.45	
26 05 83 00-0014	EA	750 MCM Compression Connection, Tape Wrapped Low Voltage, To 600 Volts.....	29.58	9.25	
26 05 83 00-0015	EA	1,000 MCM Compression Connection, Tape Wrapped Low Voltage, To 600 Volts.....	34.21	10.45	
26 05 83 00-0016		One Hole Compression Lugs <small>(26 05 83)</small>			
26 05 83 00-0017	EA	#22-18 AWG Low Voltage (To 600 Volts) One Hole Compression Lug.....	13.71	10.45	
26 05 83 00-0018	EA	#16-14 AWG Low Voltage (To 600 Volts) One Hole Compression Lug.....	13.79	10.45	
26 05 83 00-0019	EA	#12-10 AWG Low Voltage (To 600 Volts) One Hole Compression Lug.....	15.58	11.26	
26 05 83 00-0020	EA	#8 AWG Low Voltage (To 600 Volts) One Hole Compression Lug.....	19.12	12.47	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 83 00-0021 EA #6 AWG Low Voltage (To 600 Volts) One Hole Compression Lug.....	26.96	16.09
26 05 83 00-0022 EA #4 AWG Low Voltage (To 600 Volts) One Hole Compression Lug.....	31.67	16.09
26 05 83 00-0023 EA #2 AWG Low Voltage (To 600 Volts) One Hole Compression Lug.....	36.45	16.09
26 05 83 00-0024 EA 1/0 AWG Low Voltage (To 600 Volts) One Hole Compression Lug.....	44.98	24.13
26 05 83 00-0025 EA 2/0 AWG Low Voltage (To 600 Volts) One Hole Compression Lug.....	52.80	24.13
26 05 83 00-0026 EA 3/0 AWG Low Voltage (To 600 Volts) One Hole Compression Lug.....	61.82	24.13
26 05 83 00-0027 EA 4/0 AWG Low Voltage (To 600 Volts) One Hole Compression Lug.....	74.57	32.17
26 05 83 00-0028 EA 250 MCM Low Voltage (To 600 Volts) One Hole Compression Lug.....	88.46	48.26
26 05 83 00-0029 EA 300 MCM Low Voltage (To 600 Volts) One Hole Compression Lug.....	101.18	48.26
26 05 83 00-0030 EA 350 MCM Low Voltage (To 600 Volts) One Hole Compression Lug.....	108.78	48.26
26 05 83 00-0031 EA 400 MCM Low Voltage (To 600 Volts) One Hole Compression Lug.....	118.38	56.30
26 05 83 00-0032 EA 500 MCM Low Voltage (To 600 Volts) One Hole Compression Lug.....	129.38	56.30
26 05 83 00-0033 EA 750 MCM Low Voltage (To 600 Volts) One Hole Compression Lug.....	140.66	64.35
26 05 83 00-0034 EA 1,000 MCM Compression Lugs, 1 Hole, Low Voltage, To 600 Volts.....	164.86	72.39
26 05 83 00-0035 Tape Wrapped Split Bolt Connectors (26 05 83)		
26 05 83 00-0036 EA #8 AWG Split Bolt Connectors, Wrapped, Low Voltage, To 600 Volts.....	41.96	32.17
26 05 83 00-0037 EA #6 AWG Split Bolt Connectors, Wrapped, Low Voltage, To 600 Volts.....	46.15	34.59
26 05 83 00-0038 EA #4 AWG Split Bolt Connectors, Wrapped, Low Voltage, To 600 Volts.....	52.58	36.19
26 05 83 00-0039 EA #2 AWG Split Bolt Connectors, Wrapped, Low Voltage, To 600 Volts.....	60.91	40.21
26 05 83 00-0040 EA 1/0 AWG Split Bolt Connectors, Wrapped, Low Voltage, To 600 Volts.....	71.75	44.24
26 05 83 00-0041 EA 2/0 AWG Split Bolt Connectors, Wrapped, Low Voltage, To 600 Volts.....	80.02	48.26
26 05 83 00-0042 EA 3/0 AWG Split Bolt Connectors, Wrapped, Low Voltage, To 600 Volts.....	99.85	52.28
26 05 83 00-0043 EA 4/0 AWG Split Bolt Connectors, Wrapped, Low Voltage, To 600 Volts.....	107.10	56.30
26 05 83 00-0044 EA 250 MCM Split Bolt Connectors, Wrapped, Low Voltage, To 600 Volts.....	112.83	60.32
26 05 83 00-0045 EA 300 MCM Split Bolt Connectors, Wrapped, Low Voltage, To 600 Volts.....	128.09	66.35
26 05 83 00-0046 EA 350 MCM Split Bolt Connectors, Wrapped, Low Voltage, To 600 Volts.....	143.34	96.51
26 05 83 00-0047 EA 400 MCM Split Bolt Connectors, Wrapped, Low Voltage, To 600 Volts.....	156.77	80.44
26 05 83 00-0048 EA 500 MCM Split Bolt Connectors, Wrapped, Low Voltage, To 600 Volts.....	170.21	108.58
26 05 83 00-0049 EA 750 MCM Split Bolt Connectors, Wrapped, Low Voltage, To 600 Volts.....	187.69	112.60
26 05 83 00-0050 EA 1,000 MCM Split Bolt Connectors, Wrapped, Low Voltage, To 600 Volts.....	211.36	120.65
26 05 83 00-0051 Cable Termination Lugs Handwrapped, No Stress Cone (26 05 83)		
26 05 83 00-0052 EA #8 Or #6 AWG Cable Termination Lugs, Wrapped, No Stress Cones, Low Volt, To 600 Volts.....	57.52	32.17
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	<i>16.89</i>	
26 05 83 00-0053 EA #4 AWG Cable Termination Lugs, Wrapped, No Stress Cones, Low Volt, To 600 Volts.....	66.38	32.17
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	<i>19.15</i>	
26 05 83 00-0054 EA 1/0 AWG Cable Termination Lugs, Wrapped, No Stress Cones, Low Volt, To 600 Volts.....	91.91	48.26
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	<i>26.81</i>	
26 05 83 00-0055 EA 4/0 AWG Cable Termination Lugs, Wrapped, No Stress Cones, Low Volt, To 600 Volts.....	109.35	48.26
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	<i>30.94</i>	
26 05 83 00-0056 EA 300 MCM Cable Termination Lugs, Wrapped, No Stress Cones, Low Volt, To 600 Volts.....	131.00	60.32
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	<i>36.56</i>	
26 05 83 00-0057 EA 500 MCM Cable Termination Lugs, Wrapped, No Stress Cones, Low Volt, To 600 Volts.....	181.13	80.44
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	<i>50.27</i>	
26 05 83 00-0058 Parallel Gutter Tap Or Motor Connection (26 05 83)		
26 05 83 00-0059 EA #8 AWG Parallel Gutter Tap, Versitap, Insulation With Duct Seal And Tap.....	27.89	14.55
26 05 83 00-0060 EA #6 AWG Parallel Gutter Tap, Versitap, Insulation With Duct Seal And Tap.....	29.91	14.55
26 05 83 00-0061 EA #4 AWG Parallel Gutter Tap, Versitap, Insulation With Duct Seal And Tap.....	31.58	14.55
26 05 83 00-0062 EA #2 AWG Parallel Gutter Tap, Versitap, Insulation With Duct Seal And Tap.....	36.34	16.73
26 05 83 00-0063 EA 1/0 AWG Parallel Gutter Tap, Versitap, Insulation With Duct Seal And Tap.....	44.86	20.91
26 05 83 00-0064 EA 2/0 AWG Parallel Gutter Tap, Versitap, Insulation With Duct Seal And Tap.....	52.68	24.86
26 05 83 00-0065 EA 3/0 AWG Parallel Gutter Tap, Versitap, Insulation With Duct Seal And Tap.....	61.68	29.12
26 05 83 00-0066 EA 4/0 AWG Parallel Gutter Tap, Versitap, Insulation With Duct Seal And Tap.....	74.42	35.31
26 05 83 00-0067 EA 250 MCM Parallel Gutter Tap, Versitap, Insulation With Duct Seal And Tap.....	88.28	41.91
26 05 83 00-0068 EA 300 MCM Parallel Gutter Tap, Versitap, Insulation With Duct Seal And Tap.....	100.98	47.86
26 05 83 00-0069 EA 350 MCM Parallel Gutter Tap, Versitap, Insulation With Duct Seal And Tap.....	108.57	51.56
26 05 83 00-0070 EA 400 MCM Parallel Gutter Tap, Versitap, Insulation With Duct Seal And Tap.....	118.13	55.82
26 05 83 00-0071 EA 500 MCM Parallel Gutter Tap, Versitap, Insulation With Duct Seal And Tap.....	129.09	60.97
26 05 83 00-0072 EA 750 MCM Parallel Gutter Tap, Versitap, Insulation With Duct Seal And Tap.....	129.35	60.97
26 05 83 00-0073 EA #8 AWG Parallel Gutter Tap, Versitap, Insulating Cover.....	27.89	14.55
26 05 83 00-0074 EA #6 AWG Parallel Gutter Tap, Versitap, Insulating Cover.....	29.91	14.55
26 05 83 00-0075 EA #4 AWG Parallel Gutter Tap, Versitap, Insulating Cover.....	31.58	14.55
26 05 83 00-0076 EA #2 AWG Parallel Gutter Tap, Versitap, Insulating Cover.....	36.34	16.73
26 05 83 00-0077 EA 1/0 AWG Parallel Gutter Tap, Versitap, Insulating Cover.....	44.86	20.91
26 05 83 00-0078 EA 2/0 AWG Parallel Gutter Tap, Versitap, Insulating Cover.....	52.68	24.86
26 05 83 00-0079 EA 3/0 AWG Parallel Gutter Tap, Versitap, Insulating Cover.....	61.68	29.12
26 05 83 00-0080 EA 4/0 AWG Parallel Gutter Tap, Versitap, Insulating Cover.....	74.42	35.31
26 05 83 00-0081 EA 250 MCM Parallel Gutter Tap, Versitap, Insulating Cover.....	88.28	41.91
26 05 83 00-0082 EA 300 MCM Parallel Gutter Tap, Versitap, Insulating Cover.....	100.98	47.86
26 05 83 00-0083 EA 350 MCM Parallel Gutter Tap, Versitap, Insulating Cover.....	108.57	51.56
26 05 83 00-0084 EA 400 MCM Parallel Gutter Tap, Versitap, Insulating Cover.....	118.13	55.82
26 05 83 00-0085 EA 500 MCM Parallel Gutter Tap, Versitap, Insulating Cover.....	129.09	60.97
26 05 83 00-0086 EA 750 MCM Parallel Gutter Tap, Versitap, Insulating Cover.....	129.35	60.97
26 05 83 00-0087 Copper Mechanical Lugs (26 05 83)		

26 Electrical**26 05 Common Work Results For Electrical****26 05 83 Wiring Connections**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 83 00-0088	EA		#8 Copper Mechanical Lugs.....	22.18	10.05
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	6.03	
26 05 83 00-0089	EA		#6 Copper Mechanical Lugs.....	26.66	12.15
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	7.29	
26 05 83 00-0090	EA		#4 Copper Mechanical Lugs.....	30.82	14.07
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8.45	
26 05 83 00-0091	EA		#2 Copper Mechanical Lugs.....	40.11	17.93
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.77	
26 05 83 00-0092	EA		1/0 Copper Mechanical Lugs.....	54.00	24.13
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	14.48	
26 05 83 00-0093	EA		2/0 Copper Mechanical Lugs.....	64.02	27.99
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	16.82	
26 05 83 00-0094	EA		3/0 Copper Mechanical Lugs.....	74.57	32.17
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	19.31	
26 05 83 00-0095	EA		4/0 Copper Mechanical Lugs.....	84.63	36.11
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	21.65	
26 05 83 00-0096	EA		250 MCM Copper Mechanical Lugs.....	96.37	40.21
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	24.13	
26 05 83 00-0097	EA		300 MCM Copper Mechanical Lugs.....	107.93	44.24
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	26.55	
26 05 83 00-0098	EA		350 MCM Copper Mechanical Lugs.....	119.42	48.26
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	28.95	
26 05 83 00-0099	EA		400 MCM Copper Mechanical Lugs.....	130.85	52.28
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	31.34	
26 05 83 00-0100	EA		500 MCM Copper Mechanical Lugs.....	142.47	56.30
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	33.78	
26 05 83 00-0101	EA		750 MCM Copper Mechanical Lugs.....	161.62	64.11
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	38.48	
26 05 83 00-0102	EA		1,000 MCM Copper Mechanical Lugs.....	182.87	72.39
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	43.43	
26 05 83 00-0103			Gel Connectors <small>(26 05 83)</small>		
26 05 83 00-0104	EA		3 Port, #14 to 2/0, Push On Gel Stub Splice Kit.....	35.59	
			Note: Kit contains connector, gel filled cap and cap clamp.		
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2.42	
26 05 83 00-0105	EA		4 Port, #14 to 2, Gel Tap Splice Kit.....	34.79	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2.90	
26 05 83 00-0106			Other Connections <small>(26 05 83)</small>		
26 05 83 00-0107	EA		#14 AWG Motor Connection, Spade Lug, Machine Bolt/Nut, Insulated With Tape.....	7.88	3.68
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2.21	
26 05 83 00-0108	EA		#12 AWG Motor Connection, Spade Lug, Machine Bolt/Nut, Insulated With Tape.....	7.93	3.68
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2.21	
26 05 83 00-0109	EA		#10 AWG Motor Connection, Spade Lug, Machine Bolt/Nut, Insulated With Tape.....	7.99	3.68
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2.21	
26 05 83 00-0110			Motor/Equipment Connections And Terminations <small>(26 05 83)</small>		
			Note: Includes rotation testing. If equipment rating is other than horsepower (KW, CFM, tons, Btu/Hr, etc.) convert units to horsepower and select proper circuit characteristics. Includes material conduit (6 LF max.), connectors and conductors. To connect electrical wiring to all new or existing equipment motors.		
26 05 83 00-0111			AC Single Phase, 230 Volt <small>(26 05 83 00-0110)</small>		
26 05 83 00-0112	EA		<1/2 HP AC Motor Single Phase, 230 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	46.05	20.11
26 05 83 00-0113	EA		1/2 HP AC Motor Single Phase, 230 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	45.86	20.11
26 05 83 00-0114	EA		3/4 HP AC Motor Single Phase, 230 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	54.14	24.13
26 05 83 00-0115	EA		1 HP AC Motor Single Phase, 230 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	66.63	30.16
26 05 83 00-0116	EA		1-1/2 HP AC Motor Single Phase, 230 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	67.03	30.16
26 05 83 00-0117	EA		2 HP AC Motor Single Phase, 230 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	67.10	30.16
26 05 83 00-0118	EA		3 HP AC Motor Single Phase, 230 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	68.40	30.16
26 05 83 00-0119	EA		5 HP AC Motor Single Phase, 230 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	88.67	40.21
26 05 83 00-0120	EA		7-1/2 HP AC Motor Single Phase, 230 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	90.13	40.21
26 05 83 00-0121	EA		10 HP AC Motor Single Phase, 230 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	113.48	50.27
26 05 83 00-0122			AC Three Phase, 230 Volt <small>(26 05 83 00-0110)</small>		
26 05 83 00-0123	EA		1/2 HP AC Motor Three Phase, 230 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	45.86	20.11
26 05 83 00-0124	EA		3/4 HP AC Motor Three Phase, 230 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	54.14	24.13
26 05 83 00-0125	EA		1 HP AC Motor Three Phase, 230 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	66.63	30.16
26 05 83 00-0126	EA		1-1/2 HP AC Motor Three Phase, 230 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	67.03	30.16
26 05 83 00-0127	EA		2 HP AC Motor Three Phase, 230 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	67.10	30.16
26 05 83 00-0128	EA		3 HP AC Motor Three Phase, 230 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	68.40	30.16
26 05 83 00-0129	EA		5 HP AC Motor Three Phase, 230 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	88.67	40.21
26 05 83 00-0130	EA		7-1/2 HP AC Motor Three Phase, 230 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	90.13	40.21
26 05 83 00-0131	EA		10 HP AC Motor Three Phase, 230 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	113.48	50.27
26 05 83 00-0132	EA		15 HP AC Motor Three Phase, 230 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	115.44	50.27
26 05 83 00-0133	EA		20 HP AC Motor Three Phase, 230 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	143.28	60.32
26 05 83 00-0134	EA		25 HP AC Motor Three Phase, 230 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	146.26	60.32
26 05 83 00-0135	EA		30 HP AC Motor Three Phase, 230 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	198.11	80.44
26 05 83 00-0136	EA		40 HP AC Motor Three Phase, 230 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	248.13	100.54
26 05 83 00-0137	EA		50 HP AC Motor Three Phase, 230 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	294.09	120.65



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 05 83 00-0138 EA 60 HP AC Motor Three Phase, 230 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	347.85	140.75
26 05 83 00-0139 EA 75 HP AC Motor Three Phase, 230 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	399.13	160.86
26 05 83 00-0140 EA 100 HP AC Motor Three Phase, 230 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	496.47	201.07
26 05 83 00-0141 EA 125 HP AC Motor Three Phase, 230 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	587.70	239.28
26 05 83 00-0142 EA 150 HP AC Motor Three Phase, 230 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	692.78	279.09
26 05 83 00-0143 EA 200 HP AC Motor Three Phase, 230 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	1,003.20	418.57
26 05 83 00-0144 AC Three Phase, 460 Volt <small>(26 05 83 00-0110)</small>		
26 05 83 00-0145 EA 1/2 HP AC Motor Three Phase, 460 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	45.86	20.11
26 05 83 00-0146 EA 3/4 HP AC Motor Three Phase, 460 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	54.14	24.13
26 05 83 00-0147 EA 1 HP AC Motor Three Phase, 460 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	66.63	30.16
26 05 83 00-0148 EA 1-1/2 HP AC Motor Three Phase, 460 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	67.03	30.16
26 05 83 00-0149 EA 2 HP AC Motor Three Phase, 460 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	67.10	30.16
26 05 83 00-0150 EA 3 HP AC Motor Three Phase, 460 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	68.40	30.16
26 05 83 00-0151 EA 5 HP AC Motor Three Phase, 460 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	88.67	40.21
26 05 83 00-0152 EA 7-1/2 HP AC Motor Three Phase, 460 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	90.13	40.21
26 05 83 00-0153 EA 10 HP AC Motor Three Phase, 460 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	113.48	50.27
26 05 83 00-0154 EA 15 HP AC Motor Three Phase, 460 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	115.44	50.27
26 05 83 00-0155 EA 20 HP AC Motor Three Phase, 460 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	143.28	60.32
26 05 83 00-0156 EA 25 HP AC Motor Three Phase, 460 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	146.26	60.32
26 05 83 00-0157 EA 30 HP AC Motor Three Phase, 460 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	198.11	80.44
26 05 83 00-0158 EA 40 HP AC Motor Three Phase, 460 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	248.38	100.70
26 05 83 00-0159 EA 50 HP AC Motor Three Phase, 460 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	294.09	120.65
26 05 83 00-0160 EA 60 HP AC Motor Three Phase, 460 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	347.85	140.75
26 05 83 00-0161 EA 75 HP AC Motor Three Phase, 460 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	399.13	160.86
26 05 83 00-0162 EA 100 HP AC Motor Three Phase, 460 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	496.47	201.07
26 05 83 00-0163 EA 125 HP AC Motor Three Phase, 460 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	587.92	239.36
26 05 83 00-0164 EA 150 HP AC Motor Three Phase, 460 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	693.09	279.25
26 05 83 00-0165 EA 200 HP AC Motor Three Phase, 460 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	1,003.89	418.89
26 05 83 00-0166 AC Single Phase, 120 Volt <small>(26 05 83 00-0110)</small>		
26 05 83 00-0167 EA 1/2 HP AC And Less Single Phase, 120 Volt Motor/Equipment, Connection, Termination And Rotation Testing.....	46.05	20.11
26 05 83 00-0168 Motor Moisture Sensor <small>(26 05 83 00-0110)</small>		
26 05 83 00-0169 EA Motor Moisture Sensor Located In Winding.....	243.28	
26 09 Instrumentation and Control for Electrical Systems <small>(26)</small>		
<small>Note: Includes testing of new devices and certification.</small>		
26 09 23 Lighting Control Devices <small>(26 09)</small>		
26 09 23 00-0001 Lighting Contactors <small>(26 09 23)</small>		
<small>Note: Up to 600 volt.</small>		
26 09 23 00-0002 Electrically Held, Lighting Contactors <small>(26 09 23 00-0001)</small>		
26 09 23 00-0003 NEMA 1 Enclosure, Electrically Held, Lighting Contactors <small>(26 09 23 00-0002)</small>		
26 09 23 00-0004 2-Pole, NEMA 1 Enclosure, Electrically Held, Lighting Contactors <small>(26 09 23 00-0003)</small>		
26 09 23 00-0005 EA 20 Amp, 2-Pole, NEMA 1 Enclosure, Electrically Held, Lighting Contactor.....	290.33	64.35
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
	38.61	
26 09 23 00-0006 EA 30 Amp, 2-Pole, NEMA 1 Enclosure, Electrically Held, Lighting Contactor.....	356.16	72.39
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
	43.43	
26 09 23 00-0007 EA 60 Amp, 2-Pole, NEMA 1 Enclosure, Electrically Held, Lighting Contactor.....	658.21	112.60
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
	67.56	
26 09 23 00-0008 EA 100 Amp, 2-Pole, NEMA 1 Enclosure, Electrically Held, Lighting Contactor.....	1,016.64	152.82
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
	91.69	
26 09 23 00-0009 EA 200 Amp, 2-Pole, NEMA 1 Enclosure, Electrically Held, Lighting Contactor.....	2,074.21	201.07
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
	120.65	
26 09 23 00-0010 3-Pole, NEMA 1 Enclosure, Electrically Held, Lighting Contactors <small>(26 09 23 00-0003)</small>		
26 09 23 00-0011 EA 20 Amp, 3-Pole, NEMA 1 Enclosure, Electrically Held, Lighting Contactor.....	327.77	72.39
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
	43.43	
26 09 23 00-0012 EA 30 Amp, 3-Pole, NEMA 1 Enclosure, Electrically Held, Lighting Contactor.....	390.91	80.44
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
	48.26	
26 09 23 00-0013 EA 60 Amp, 3-Pole, NEMA 1 Enclosure, Electrically Held, Lighting Contactor.....	715.25	128.69
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
	77.21	
26 09 23 00-0014 EA 100 Amp, 3-Pole, NEMA 1 Enclosure, Electrically Held, Lighting Contactor.....	1,099.45	168.91
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
	101.34	
26 09 23 00-0015 EA 200 Amp, 3-Pole, NEMA 1 Enclosure, Electrically Held, Lighting Contactor.....	2,228.56	221.19
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
	132.71	
26 09 23 00-0016 4-Pole, NEMA 1 Enclosure, Electrically Held, Lighting Contactors <small>(26 09 23 00-0003)</small>		
26 09 23 00-0017 EA 20 Amp, 4-Pole, NEMA 1 Enclosure, Electrically Held, Lighting Contactor.....	384.15	80.44
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
	48.26	

26 Electrical**26 09 Instrumentation and Control for Electrical Systems****26 09 23 Lighting Control Devices**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 09 23 00-0018 EA 30 Amp, 4-Pole, NEMA 1 Enclosure, Electrically Held, Lighting Contactor.....	458.07	88.47
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	53.09	
26 09 23 00-0019 EA 60 Amp, 4-Pole, NEMA 1 Enclosure, Electrically Held, Lighting Contactor.....	861.11	144.77
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	86.87	
26 09 23 00-0020 EA 100 Amp, 4-Pole, NEMA 1 Enclosure, Electrically Held, Lighting Contactor.....	1,308.82	185.00
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	110.99	
26 09 23 00-0021 EA 200 Amp, 4-Pole, NEMA 1 Enclosure, Electrically Held, Lighting Contactor.....	2,829.67	241.30
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	144.77	
26 09 23 00-0022 NEMA 4 Enclosure, Electrically Held, Lighting Contactors (26 09 23 00-0022)		
26 09 23 00-0023 2-Pole, NEMA 4 Enclosure, Electrically Held, Lighting Contactors (26 09 23 00-0022)		
26 09 23 00-0024 EA 20 Amp, 2-Pole, NEMA 4 Enclosure, Electrically Held, Lighting Contactor.....	462.17	64.35
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	38.61	
26 09 23 00-0025 EA 30 Amp, 2-Pole, NEMA 4 Enclosure, Electrically Held, Lighting Contactor.....	583.99	72.39
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	43.43	
26 09 23 00-0026 EA 60 Amp, 2-Pole, NEMA 4 Enclosure, Electrically Held, Lighting Contactor.....	1,112.53	112.60
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	67.56	
26 09 23 00-0027 EA 100 Amp, 2-Pole, NEMA 4 Enclosure, Electrically Held, Lighting Contactor.....	1,661.92	152.82
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	91.69	
26 09 23 00-0028 EA 200 Amp, 2-Pole, NEMA 4 Enclosure, Electrically Held, Lighting Contactor.....	3,175.59	201.07
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	120.65	
26 09 23 00-0029 3-Pole, NEMA 4 Enclosure, Electrically Held, Lighting Contactors (26 09 23 00-0022)		
26 09 23 00-0030 EA 20 Amp, 3-Pole, NEMA 4 Enclosure, Electrically Held, Lighting Contactor.....	481.65	72.39
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	43.43	
26 09 23 00-0031 EA 30 Amp, 3-Pole, NEMA 4 Enclosure, Electrically Held, Lighting Contactor.....	618.73	80.44
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	48.26	
26 09 23 00-0032 EA 60 Amp, 3-Pole, NEMA 4 Enclosure, Electrically Held, Lighting Contactor.....	1,170.90	128.69
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	77.21	
26 09 23 00-0033 EA 100 Amp, 3-Pole, NEMA 4 Enclosure, Electrically Held, Lighting Contactor.....	1,744.29	168.91
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	101.34	
26 09 23 00-0034 EA 200 Amp, 3-Pole, NEMA 4 Enclosure, Electrically Held, Lighting Contactor.....	3,329.49	221.19
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	132.71	
26 09 23 00-0035 4-Pole, NEMA 4 Enclosure, Electrically Held, Lighting Contactors (26 09 23 00-0022)		
26 09 23 00-0036 EA 20 Amp, 4-Pole, NEMA 4 Enclosure, Electrically Held, Lighting Contactor.....	521.52	80.44
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	48.26	
26 09 23 00-0037 EA 30 Amp, 4-Pole, NEMA 4 Enclosure, Electrically Held, Lighting Contactor.....	685.89	88.47
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	53.09	
26 09 23 00-0038 EA 60 Amp, 4-Pole, NEMA 4 Enclosure, Electrically Held, Lighting Contactor.....	1,493.96	144.77
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	86.87	
26 09 23 00-0039 EA 100 Amp, 4-Pole, NEMA 4 Enclosure, Electrically Held, Lighting Contactor.....	2,130.85	185.00
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	110.99	
26 09 23 00-0040 EA 200 Amp, 4-Pole, NEMA 4 Enclosure, Electrically Held, Lighting Contactor.....	4,419.12	241.30
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	144.77	
26 09 23 00-0041 Mechanically Held, Lighting Contactors (26 09 23 00-0001)		
26 09 23 00-0042 NEMA 1 Enclosure, Mechanically Held, Lighting Contactors (26 09 23 00-0041)		
26 09 23 00-0043 2-Pole, NEMA 1 Enclosure, Mechanically Held, Lighting Contactors (26 09 23 00-0042)		
26 09 23 00-0044 EA 20 Amp, 2-Pole, NEMA 1 Enclosure, Mechanically Held, Lighting Contactor.....	415.57	64.35
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	38.61	
26 09 23 00-0045 EA 30 Amp, 2-Pole, NEMA 1 Enclosure, Mechanically Held, Lighting Contactor.....	472.52	72.39
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	43.43	
26 09 23 00-0046 EA 60 Amp, 2-Pole, NEMA 1 Enclosure, Mechanically Held, Lighting Contactor.....	884.70	112.60
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	67.56	
26 09 23 00-0047 EA 100 Amp, 2-Pole, NEMA 1 Enclosure, Mechanically Held, Lighting Contactor.....	1,231.14	152.82
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	91.69	
26 09 23 00-0048 EA 200 Amp, 2-Pole, NEMA 1 Enclosure, Mechanically Held, Lighting Contactor.....	2,770.57	201.07
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	120.65	
26 09 23 00-0049 3-Pole, NEMA 1 Enclosure, Mechanically Held, Lighting Contactors (26 09 23 00-0042)		
26 09 23 00-0050 EA 20 Amp, 3-Pole, NEMA 1 Enclosure, Mechanically Held, Lighting Contactor.....	445.73	72.39
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	43.43	
26 09 23 00-0051 EA 30 Amp, 3-Pole, NEMA 1 Enclosure, Mechanically Held, Lighting Contactor.....	508.15	80.44
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	48.26	
26 09 23 00-0052 EA 60 Amp, 3-Pole, NEMA 1 Enclosure, Mechanically Held, Lighting Contactor.....	943.08	128.69
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	77.21	
26 09 23 00-0053 EA 100 Amp, 3-Pole, NEMA 1 Enclosure, Mechanically Held, Lighting Contactor.....	1,314.39	168.91
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	101.34	
26 09 23 00-0054 EA 200 Amp, 3-Pole, NEMA 1 Enclosure, Mechanically Held, Lighting Contactor.....	3,113.66	221.19
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	132.71	
26 09 23 00-0055 4-Pole, NEMA 1 Enclosure, Mechanically Held, Lighting Contactors (26 09 23 00-0042)		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 09 23 00-0056 EA 20 Amp, 4-Pole, NEMA 1 Enclosure, Mechanically Held, Lighting Contactor.....	482.21	80.44
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	48.26	
26 09 23 00-0057 EA 30 Amp, 4-Pole, NEMA 1 Enclosure, Mechanically Held, Lighting Contactor.....	542.89	88.47
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	53.09	
26 09 23 00-0058 EA 60 Amp, 4-Pole, NEMA 1 Enclosure, Mechanically Held, Lighting Contactor.....	1,100.93	144.77
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	86.87	
26 09 23 00-0059 EA 100 Amp, 4-Pole, NEMA 1 Enclosure, Mechanically Held, Lighting Contactor.....	1,536.64	185.00
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	110.99	
26 09 23 00-0060 EA 200 Amp, 4-Pole, NEMA 1 Enclosure, Mechanically Held, Lighting Contactor.....	3,748.08	241.30
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	144.77	
26 09 23 00-0061 NEMA 4 Enclosure, Mechanically Held, Lighting Contactors <small>(26 09 23 00-0041)</small>		
26 09 23 00-0062 2-Pole, NEMA 4 Enclosure, Mechanically Held, Lighting Contactors <small>(26 09 23 00-0061)</small>		
26 09 23 00-0063 EA 20 Amp, 2-Pole, NEMA 4 Enclosure, Mechanically Held, Lighting Contactor.....	609.25	64.35
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	38.61	
26 09 23 00-0064 EA 30 Amp, 2-Pole, NEMA 4 Enclosure, Mechanically Held, Lighting Contactor.....	700.34	72.39
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	43.43	
26 09 23 00-0065 EA 60 Amp, 2-Pole, NEMA 4 Enclosure, Mechanically Held, Lighting Contactor.....	1,340.36	112.60
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	67.56	
26 09 23 00-0066 EA 100 Amp, 2-Pole, NEMA 4 Enclosure, Mechanically Held, Lighting Contactor.....	1,876.43	152.82
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	91.69	
26 09 23 00-0067 EA 200 Amp, 2-Pole, NEMA 4 Enclosure, Mechanically Held, Lighting Contactor.....	3,871.06	201.07
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	120.65	
26 09 23 00-0068 3-Pole, NEMA 4 Enclosure, Mechanically Held, Lighting Contactors <small>(26 09 23 00-0061)</small>		
26 09 23 00-0069 EA 20 Amp, 3-Pole, NEMA 4 Enclosure, Mechanically Held, Lighting Contactor.....	645.72	72.39
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	43.43	
26 09 23 00-0070 EA 30 Amp, 3-Pole, NEMA 4 Enclosure, Mechanically Held, Lighting Contactor.....	735.97	80.44
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	48.26	
26 09 23 00-0071 EA 60 Amp, 3-Pole, NEMA 4 Enclosure, Mechanically Held, Lighting Contactor.....	1,398.73	128.69
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	77.21	
26 09 23 00-0072 EA 100 Amp, 3-Pole, NEMA 4 Enclosure, Mechanically Held, Lighting Contactor.....	1,960.12	168.91
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	101.34	
26 09 23 00-0073 EA 200 Amp, 3-Pole, NEMA 4 Enclosure, Mechanically Held, Lighting Contactor.....	4,215.03	221.19
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	132.71	
26 09 23 00-0074 4-Pole, NEMA 4 Enclosure, Mechanically Held, Lighting Contactors <small>(26 09 23 00-0061)</small>		
26 09 23 00-0075 EA 20 Amp, 4-Pole, NEMA 4 Enclosure, Mechanically Held, Lighting Contactor.....	684.62	80.44
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	48.26	
26 09 23 00-0076 EA 30 Amp, 4-Pole, NEMA 4 Enclosure, Mechanically Held, Lighting Contactor.....	770.72	88.47
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	53.09	
26 09 23 00-0077 EA 60 Amp, 4-Pole, NEMA 4 Enclosure, Mechanically Held, Lighting Contactor.....	1,733.78	144.77
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	86.87	
26 09 23 00-0078 EA 100 Amp, 4-Pole, NEMA 4 Enclosure, Mechanically Held, Lighting Contactor.....	2,358.68	185.00
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	110.99	
26 09 23 00-0079 EA 200 Amp, 4-Pole, NEMA 4 Enclosure, Mechanically Held, Lighting Contactor.....	5,305.11	241.30
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	144.77	
26 09 23 00-0080 Combination Lighting Contactors <small>(26 09 23)</small>		
Note: Up to 600 volt.		
26 09 23 00-0081 Electrically Held, Combination Lighting Contactors <small>(26 09 23 00-0080)</small>		
26 09 23 00-0082 NEMA 1 Enclosure, Electrically Held, Combination Lighting Contactors <small>(26 09 23 00-0081)</small>		
26 09 23 00-0083 3-Pole, NEMA 1 Enclosure, Electrically Held, Combination Lighting Contactors <small>(26 09 23 00-0082)</small>		
26 09 23 00-0084 EA 30 Amp, 3-Pole, NEMA 1 Enclosure, Electrically Held, Combination Lighting Contactor With Fused Disconnect Switch.....	786.48	88.47
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	53.09	
26 09 23 00-0085 EA 60 Amp, 3-Pole, NEMA 1 Enclosure, Electrically Held, Combination Lighting Contactor With Fused Disconnect Switch.....	1,234.38	141.56
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	84.93	
26 09 23 00-0086 EA 100 Amp, 3-Pole, NEMA 1 Enclosure, Electrically Held, Combination Lighting Contactor With Fused Disconnect Switch.....	1,974.37	185.80
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	111.48	
26 09 23 00-0087 EA 200 Amp, 3-Pole, NEMA 1 Enclosure, Electrically Held, Combination Lighting Contactor With Fused Disconnect Switch.....	3,562.25	243.30
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	145.98	
26 09 23 00-0088 NEMA 4 Enclosure, Electrically Held, Combination Lighting Contactors <small>(26 09 23 00-0081)</small>		
26 09 23 00-0089 3-Pole, NEMA 4 Enclosure, Electrically Held, Combination Lighting Contactors <small>(26 09 23 00-0088)</small>		

26 Electrical**26 09 Instrumentation and Control for Electrical Systems****26 09 23 Lighting Control Devices**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 09 23 00-0090 EA 30 Amp, 3-Pole, NEMA 4 Enclosure, Electrically Held, Combination Lighting Contactor With Fused Disconnect Switch 1,393.35	53.09	88.47
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
26 09 23 00-0091 EA 60 Amp, 3-Pole, NEMA 4 Enclosure, Electrically Held, Combination Lighting Contactor With Fused Disconnect Switch 2,169.66	84.93	141.56
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
26 09 23 00-0092 EA 100 Amp, 3-Pole, NEMA 4 Enclosure, Electrically Held, Combination Lighting Contactor With Fused Disconnect Switch 3,606.45	111.48	185.80
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
26 09 23 00-0093 EA 200 Amp, 3-Pole, NEMA 4 Enclosure, Electrically Held, Combination Lighting Contactor With Fused Disconnect Switch 5,649.99	145.98	243.30
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
26 09 23 00-0094 Mechanically Held, Combination Lighting Contactors (26 09 23 00-0080)		
26 09 23 00-0095 NEMA 1 Enclosure, Mechanically Held, Combination Lighting Contactors (26 09 23 00-0094)		
26 09 23 00-0096 3-Pole, NEMA 1 Enclosure, Mechanically Held, Combination Lighting Contactors (26 09 23 00-0095)		
26 09 23 00-0097 EA 30 Amp, 3-Pole, NEMA 1 Enclosure, Mechanically Held, Combination Lighting Contactor With Fused Disconnect Switch 855.76	53.09	88.47
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
26 09 23 00-0098 EA 60 Amp, 3-Pole, NEMA 1 Enclosure, Mechanically Held, Combination Lighting Contactor With Fused Disconnect Switch 1,474.20	84.93	141.56
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
26 09 23 00-0099 EA 100 Amp, 3-Pole, NEMA 1 Enclosure, Mechanically Held, Combination Lighting Contactor With Fused Disconnect Switch 2,201.53	111.48	185.80
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
26 09 23 00-0100 EA 200 Amp, 3-Pole, NEMA 1 Enclosure, Mechanically Held, Combination Lighting Contactor With Fused Disconnect Switch 4,207.76	145.98	243.30
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
26 09 23 00-0101 NEMA 4 Enclosure, Mechanically Held, Combination Lighting Contactors (26 09 23 00-0094)		
26 09 23 00-0102 3-Pole, NEMA 4 Enclosure, Mechanically Held, Combination Lighting Contactors (26 09 23 00-0101)		
26 09 23 00-0103 EA 30 Amp, 3-Pole, NEMA 4 Enclosure, Mechanically Held, Combination Lighting Contactor With Fused Disconnect Switch 1,463.30	53.09	88.47
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
26 09 23 00-0104 EA 60 Amp, 3-Pole, NEMA 4 Enclosure, Mechanically Held, Combination Lighting Contactor With Fused Disconnect Switch 2,410.81	84.93	141.56
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
26 09 23 00-0105 EA 100 Amp, 3-Pole, NEMA 4 Enclosure, Mechanically Held, Combination Lighting Contactor With Fused Disconnect Switch 3,834.28	111.48	185.80
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
26 09 23 00-0106 EA 200 Amp, 3-Pole, NEMA 4 Enclosure, Mechanically Held, Combination Lighting Contactor With Fused Disconnect Switch 6,295.49	145.98	243.30
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
26 09 23 00-0107 Photo-Cell, Relay, Lighting Arrester, Receptacle And Bracket (26 09 23)		
26 09 23 00-0108 EA Photo-Cell, 105-130 Volt Relay, Lighting Arrester, Receptacle And Bracket 85.31	12.57	20.91
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
26 09 23 00-0109 EA Photo-Cell, 105-285 Volt Relay, Lighting Arrester, Receptacle And Bracket 92.50	12.57	20.91
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
26 09 23 00-0110 Dimming Module System (Lutron Grafik Eye) (26 09 23)		
26 09 23 00-0111 EA 2,000 Watt Dimming Capacity, 120/277 Volt, Dimming Module System (Lutron Grafik Eye Hi-Power HP-2) 911.16	48.26	80.44
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
26 09 23 00-0112 EA 4,000 Watt Dimming Capacity, 120/277 Volt, Dimming Module System (Lutron Grafik Eye Hi-Power HP-4) 1,165.98	48.26	80.44
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
26 09 23 00-0113 EA 6,000 Watt Dimming Capacity, 120/277 Volt, Dimming Module System (Lutron Grafik Eye Hi-Power HP-6) 1,425.35	48.26	80.44
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
26 09 23 00-0114 Light Control Panels (26 09 23)		
26 09 23 00-0115 Lighting Control Panels (Watt Stopper) (26 09 23 00-0114)		
26 09 23 00-0116 Lighting Control Panels (Watt Stopper) (26 09 23 00-0115)		
26 09 23 00-0117 EA 4 Relays, Surface Mount, Lighting Control Panel (Watt Stopper LP8S-4) 1,200.28	67.68	112.79
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
26 09 23 00-0118 EA 8 Relays, Surface Mount, Lighting Control Panel (Watt Stopper LP8S-8) 1,297.63	72.51	120.85
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
26 09 23 00-0119 EA 8 Relays, Surface Mount, Lighting Control Panel With Group Switching Card (Watt Stopper LP8S-8-G) 1,460.09	72.51	120.85
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
26 09 23 00-0120 EA 8 Relays, Surface Mount, Lighting Control Panel With DIN Rail (Watt Stopper LP24S-8) 1,791.59	72.51	120.85
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 09 23 00-0121 EA 8 Relays, Surface Mount, Lighting Control Panel With Group Switching Card And DIN Rail (Watt Stopper LP24S-8-G)	1,944.56	120.85
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	72.51	
26 09 23 00-0122 EA 4 Relays, Flush Mount, Lighting Control Panel (Watt Stopper LP8F-4)	1,333.49	112.79
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	67.68	
26 09 23 00-0123 EA 8 Relays, Flush Mount, Lighting Control Panel (Watt Stopper LP8F-8)	1,430.84	120.85
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	72.51	
26 09 23 00-0124 EA 8 Relays, Flush Mount, Lighting Control Panel With Group Switching Card (Watt Stopper LP8F-8-G)	1,593.29	120.85
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	72.51	
26 09 23 00-0125 EA 8 Relays, Flush Mount, Lighting Control Panel With DIN Rail (Watt Stopper LP24F-8)	1,852.84	120.85
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	72.51	
26 09 23 00-0126 EA 8 Relays, Flush Mount, Lighting Control Panel With Group Switching Card And DIN Rail (Watt Stopper LP24F-8-G)	2,006.10	120.85
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	72.51	
26 09 23 00-0127 Accessories For Lighting Control Panels (Watt Stopper) (26 09 23 00-0115)		
26 09 23 00-0128 EA Low Voltage Photocell For Watt Stopper Lighting Control Panels (Watt Stopper EM-24A2)	195.25	20.14
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	12.08	
26 09 23 00-0129 EA Automatic Control Switch For Watt Stopper Lighting Control Panels (Watt Stopper AS-100-W)	96.04	16.11
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	9.67	
26 09 23 00-0130 EA Low Voltage Momentary Switch For Watt Stopper Lighting Control Panels (Watt Stopper DCC2)	51.20	16.11
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	9.67	
26 09 23 00-0131 Lighting Control Panels (Synergy) (26 09 23 00-0114)		
26 09 23 00-0132 Lighting Control Panels (Synergy) (26 09 23 00-0131)		
26 09 23 00-0133 EA 8 Relays, Surface Mount, Lighting Control Panel (Synergy SwitchPak SPAK 8S)	1,442.72	120.85
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	72.51	
26 09 23 00-0134 Accessories For Lighting Control Panels (Synergy) (26 09 23 00-0131)		
26 09 23 00-0135 EA Outdoor Photocell For Synergy SwitchPak Lighting Control Panels (Synergy LSA-APS-OL)	349.29	20.14
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	12.08	
26 09 23 00-0136 EA Sweepswitch, Line Voltage Override Switch For Synergy SwitchPak Lighting Control Panels (Synergy SSPL-20)	135.41	8.05
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	4.83	
26 09 23 00-0137 EA Override Switch For Synergy SwitchPak Lighting Control Panels (Synergy LVPS-2BT)	80.31	12.09
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	7.25	
26 09 23 00-0138 Lighting Switching Panels (Lutron) (26 09 23 00-0114)		
26 09 23 00-0139 Lighting Switching Panels (Lutron) (26 09 23 00-0138)		
26 09 23 00-0140 EA 8 Switch Legs, Surface Mount, Feed-Through, Lighting Switching Panels (Lutron Softswitch128® XPS8-FT)	1,184.81	120.85
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	72.51	
26 09 23 00-0141 EA 12 Switch Legs, Surface Mount, Feed-Through, Lighting Switching Panels (Lutron Softswitch128® XPS12-FT)	1,606.80	128.91
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	77.35	
26 09 23 00-0142 EA 16 Switch Legs, Surface Mount, Feed-Through, Lighting Switching Panels (Lutron Softswitch128® XPS16-FT)	2,088.80	136.97
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	82.18	
26 09 23 00-0143 Wireless (ZigBee) LED Lighting Control Panels (PlanLED GigaTera) (26 09 23 00-0114)		
26 09 23 00-0144 EA 6 Zone, Surface Mount, 0 To 10 Volt Dimming, Wireless (ZigBee) LED Lighting Control Panel (PlanLED GigaTera IPC6Z)	517.49	112.79
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	67.68	
26 09 23 00-0145 EA 12 Zone, Surface Mount, 0 To 10 Volt Dimming, Wireless (ZigBee) LED Lighting Control Panel (PlanLED GigaTera IPC12Z)	715.94	112.79
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	67.68	
26 09 23 00-0146 EA 18 Zone, Surface Mount, 0 To 10 Volt Dimming, Wireless (ZigBee) LED Lighting Control Panel (PlanLED GigaTera IPC18Z)	925.94	112.79
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	67.68	
26 09 23 00-0147 Power Filters (26 09 23 00-0114)		
26 09 23 00-0148 EA 600 Amp 480/277 Volt, 4 Conductor Power Filter With 80" X 60" X 17"	22,883.17	670.24
26 09 23 00-0149 EA 200 Amp 480/277 Volt, 4 Conductor Power Filter With 25" X 40" X 17"	13,508.42	291.40
26 09 23 00-0150 Signal Filters (26 09 23 00-0114)		
26 09 23 00-0151 EA 0.5 Amp 125 V 500 Conductor Signal Filter With 19" X 36-3/4" X 19-1/8 Case	10,553.80	609.35
26 09 23 00-0152 EA 0.5 Amp 125 V 200 Conductor Signal Filter With 29" X 40" X 11" Case	7,207.54	372.40
26 09 23 00-0153 EA 0.5 Amp 125 V 3 Pair Conductor Signal Filter With 12" X 12" X 4" Case	4,022.87	216.20
26 09 23 00-0154 EA 5 Amp 24 V DC 5 V 2 - 1 Pair Conductor Signal Filter With Case	5,459.05	216.20
26 09 23 00-0155 Radio Controlled Devices (Lutron) (26 09 23)		
26 09 23 00-0156 Tabletop Transmitters For Radio Controlled Devices (26 09 23 00-0155)		
26 09 23 00-0157 Switched Lighting Controls, Tabletop Wireless Transmitter (26 09 23 00-0156)		
26 09 23 00-0158 EA One Zone On/Off Switched Lighting Controls, Tabletop Wireless Transmitter (Lutron RTA-TX-SW-B-WH)	261.31	12.09

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MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 09 23 00-0159 EA Two Zones Of On/Off Switched Lighting Controls, Tabletop Wireless Transmitter (Lutron RTA-TX-2SW-B-WH).....	338.48	12.09
26 09 23 00-0160 EA Three Zones Of On/Off Switched Lighting Controls, Tabletop Wireless Transmitter (Lutron RTA-TX-3SW-B-WH)	425.30	12.09
26 09 23 00-0161 Dimmable Lighting Controls, Tabletop Wireless Transmitter (26 09 23 00-0156)		
26 09 23 00-0162 EA One Zone Of Dimmable Lighting Controls, Tabletop Wireless Transmitter (Lutron RTA-TX-L-B-WH)	261.31	12.09
26 09 23 00-0163 EA Two Zones Of Dimmable Lighting Controls, Tabletop Wireless Transmitter (Lutron RTA-TX-2L-B-WH).....	309.54	12.09
26 09 23 00-0164 EA Three Zones Of Dimmable Lighting Controls, Tabletop Wireless Transmitter (Lutron RTA-TX-3L-B-WH)	425.30	12.09
26 09 23 00-0165 EA One Zone Of Four Pre Set Lighting Levels And Dimmable Lighting Controls, Tabletop Wireless Transmitter (Lutron RTA-TX-L-WH).....	261.31	12.09
26 09 23 00-0166 EA Two Zones Of Four Pre Set Lighting Levels And Dimmable Lighting Controls, Tabletop Wireless Transmitter (Lutron RTA-TX-2L-WH).....	338.48	12.09
26 09 23 00-0167 EA Three Zones Of Four Pre Set Lighting Levels And Dimmable Lighting Controls, Tabletop Wireless Transmitter (Lutron RTA-TX-3L-WH).....	425.30	12.09
26 09 23 00-0168 Dimmable And Switched Lighting Controls, Tabletop Wireless Transmitter (26 09 23 00-0156)		
26 09 23 00-0169 EA One Zone Of Dimmable Lighting Controls And One Zone Of On/Off Switched Lighting Controls, Tabletop Wireless Transmitter (Lutron RTA-TX-LSW-B-WH)	338.48	12.09
26 09 23 00-0170 EA Two Zones Of Dimmable Lighting Controls And One Zone Of On/Off Switched Lighting Controls, Tabletop Wireless Transmitter (Lutron RTA-TX-2LSW-B-WH)	425.30	12.09
26 09 23 00-0171 EA One Zone Of Dimmable Lighting Controls And Two Zones Of On/Off Switched Lighting Controls, Tabletop Wireless Transmitter (Lutron RTA-TX-L2SW-B-WH).....	425.30	12.09
26 09 23 00-0172 Dimmable Lighting Controls And Shade Or Projection Controls, Tabletop Wireless Transmitter (26 09 23 00-0156)		
26 09 23 00-0173 EA One Zone Of Open/Stop/Close Motorized Shade Controls, Tabletop Wireless Transmitter (Lutron RTA-TX-C3-B- WH)	261.31	12.09
26 09 23 00-0174 EA Two Zones Of Open/Stop/Close Motorized Shade Controls, Tabletop Wireless Transmitter (Lutron RTA-TX-2C3- B-WH).....	338.48	12.09
26 09 23 00-0175 EA One Zone Of Dimmable Lighting Controls And One Zone Of Output Switch Projection Screen Controls, Tabletop Wireless Transmitter (Lutron RTA-TX-LC2-B-WH)	309.54	12.09
26 09 23 00-0176 EA Two Zones Of Dimmable Lighting Controls And One Zone Of Output Switch Projection Screen Controls, Tabletop Wireless Transmitter (Lutron RTA-TX-2LC2-B-WH).....	377.07	12.09
26 09 23 00-0177 EA One Zone Of Dimmable Lighting Controls And One Zone Of Open/Stop/Close Motorized Shade Controls, Tabletop Wireless Transmitter (Lutron RTA-TX-LC3-B-WH)	338.48	12.09
26 09 23 00-0178 EA Two Zones Of Dimmable Lighting Controls And One Zone Of Open/Stop/Close Motorized Shade Controls, Tabletop Wireless Transmitter (Lutron RTA-TX-2LC3-B-WH)	406.01	12.09
26 09 23 00-0179 EA One Zone Of Dimmable Lighting Controls And Two Zones Of Open/Stop/Close Motorized Shade Controls, Tabletop Wireless Transmitter (Lutron RTA-TX-L2C3-B-WH)	338.48	12.09
26 09 23 00-0180 Dimmable Lighting Controls And Sivoia QED Shade Controls, Tabletop Wireless Transmitter (26 09 23 00-0156)		
26 09 23 00-0181 EA One Zone Of Sivoia QED Open/Stop/Preset Motorized Shade Controls, Tabletop Wireless Transmitter (Lutron RTA-TX-Q-B-WH).....	261.31	12.09
26 09 23 00-0182 EA Two Zones Of Sivoia QED Open/Stop/Preset Motorized Shade Controls, Tabletop Wireless Transmitter (Lutron RTA-TX-2Q-B-WH).....	338.48	12.09
26 09 23 00-0183 EA One Zone Of Dimmable Lighting Controls And One Zone Of Sivoia QED Open/Stop/Preset Motorized Shade Controls, Tabletop Wireless Transmitter (Lutron RTA-TX-LQ-B-WH).....	338.48	12.09
26 09 23 00-0184 EA Two Zones Of Dimmable Lighting Controls And One Zone Of Sivoia QED Open/Stop/Preset Motorized Shade Controls, Tabletop Wireless Transmitter (Lutron RTA-TX-2LQ-B-WH).....	425.30	12.09
26 09 23 00-0185 EA One Zone Of Dimmable Lighting Controls And Two Zones Of Sivoia QED Open/Stop/Preset Motorized Shade Controls, Tabletop Wireless Transmitter (Lutron RTA-TX-L2Q-B-WH).....	338.48	12.09
26 09 23 00-0186 EA One Zone Of Dimmable Lighting Controls, One Zone Of Sivoia QED Open/Stop/Preset Motorized Shade Controls, One Zone Of Output Controls, Tabletop Wireless Transmitter (Lutron RTA-TX-LQC2-B-WH)	425.30	12.09
26 09 23 00-0187 Output Switch Closure Controls, Tabletop Wireless Transmitter (26 09 23 00-0156)		
26 09 23 00-0188 EA Five Buttons Of Output Switch Closures For Grafik Eye Systems, Tabletop Wireless Transmitter (Lutron RTA-TX- C5-WH).....	261.31	12.09
26 09 23 00-0189 EA Nine Buttons Of Output Switch Closures For Grafik Eye Systems, Tabletop Wireless Transmitter (Lutron RTA-TX- C5C4-WH).....	338.48	12.09
26 09 23 00-0190 EA Thirteen Buttons Of Output Switch Closures For Grafik Eye Systems, Tabletop Wireless Transmitter (Lutron RTA- TX-C52C4-WH)	425.30	12.09
26 09 23 00-0191 Accessories For Tabletop Wireless Transmitter (26 09 23 00-0156)		
26 09 23 00-0192 EA Security Mounting Brackets For Tabletop Wireless Transmitters (Lutron RTA-SEC-WH)	58.73	12.09
26 09 23 00-0193 Wall Box Transmitters For Radio Controlled Devices (26 09 23 00-0155)		
26 09 23 00-0194 EA On/Off Switched Lighting Controls, Wall Box Wireless Transmitter (Lutron RTA-WX-2BSW-WH)	242.01	12.09
26 09 23 00-0195 EA Dimmable Lighting Controls, Wall Box Wireless Transmitter (Lutron RTA-WX-2B-WH).....	261.31	12.09
26 09 23 00-0196 EA Four Preset Lighting Level And Dimmable Lighting Controls, Wall Box Wireless Transmitter (Lutron RTA-WX-5B- WH)	261.31	12.09
26 09 23 00-0197 EA Open/Stop/Close Motorized Shade Controls, Wall Box Wireless Transmitter (Lutron RTA-WX-C3LB-WH).....	261.31	12.09
26 09 23 00-0198 EA Up/Down Projection Screen Controls, Wall Box Wireless Transmitter (Lutron RTA-WX-C2LB-WH).....	261.31	12.09
26 09 23 00-0199 EA Open/Stop/Close Sivoia QED Shade Controls, Wall Box Wireless Transmitter (Lutron RTA-WX-Q3LB-WH).....	261.31	12.09



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 09 23 00-0200				Interfaces For Radio Controlled Devices <small>(26 09 23 00-0155)</small>		
	26 09 23 00-0201	EA		Incandescent And Magnetic Low Voltage Lighting Interface For Radio Controlled Devices (Lutron FDI-INC-2000)	242.01	12.09
	26 09 23 00-0202	EA		Lutron Tu-Wire Ballast Interface For Radio Controlled Devices (Lutron FDI-INC-2000)	242.01	12.09
	26 09 23 00-0203	EA		Electronic Low Voltage Lighting Interface For Radio Controlled Devices (Lutron FDI-ELV-1000)	242.01	12.09
	26 09 23 00-0204	EA		Sivoia QED Controllable Window Treatments Contact Closure Interface For Radio Controlled Devices (Lutron SVQ-CCI-8)	487.04	12.09
	26 09 23 00-0205	EA		RS-232 Interface For Radio Controlled Devices (Lutron RTA-RS232)	695.41	12.09
	26 09 23 00-0206	EA		Switch Closure Input Interface For Radio Controlled (Lutron RTA-SCI)	695.41	12.09
26 09 23 00-0207				Fluorescent Controllers For Radio Controlled Devices <small>(26 09 23 00-0155)</small>		
	26 09 23 00-0208	EA		On/Off Switched Fluorescent Controllers For Radio Controlled Devices (Lutron RTA-RX-SW)	309.54	12.09
	26 09 23 00-0209	EA		Dimmable Fluorescent Controllers For Radio Controlled Devices (Lutron RTA-RX-F)	348.13	12.09
	26 09 23 00-0210	EA		Switch Closures And Dimmable Fluorescent Controllers For Radio Controlled Devices (Lutron RTA-RX-F-SC)	406.01	12.09
26 09 23 00-0211				AC Motor Group Controllers For Radio Controlled Devices <small>(26 09 23 00-0155)</small>		
	26 09 23 00-0212	EA		Up To Two Motors, AC Motor Group Controllers For Radio Controlled Devices (Lutron WC-2M-GC)	454.24	12.09
	26 09 23 00-0213	EA		Up To Four Motors, AC Motor Group Controllers For Radio Controlled Devices (Lutron WC-4M-GC)	623.06	12.09
26 09 23 00-0214				Occupancy Sensors (Watt Stopper) <small>(26 09 23)</small>		
				Note: Includes testing of new devices and certification.		
26 09 23 00-0215				Occupancy Sensors <small>(26 09 23 00-0214)</small>		
				Note: Exclude boxes.		
26 09 23 00-0216				Wall Switch Mounted Occupancy Sensors <small>(26 09 23 00-0215)</small>		
26 09 23 00-0217				Ultrasonic, Wall Switch Mounted Occupancy Sensors <small>(26 09 23 00-0216)</small>		
	26 09 23 00-0218	EA		Ultrasonic, Wall Switch Mounted Occupancy Sensor (Watt Stopper UW-100)	93.72	8.05
				<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.83	
	26 09 23 00-0219	EA		Dual Relay, Ultrasonic, Wall Switch Mounted Occupancy Sensor (Watt Stopper UW-200)	110.47	8.05
				<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.83	
26 09 23 00-0220				Passive Infrared, Wall Switch Mounted Occupancy Sensors <small>(26 09 23 00-0216)</small>		
	26 09 23 00-0221	EA		Nightlight, Passive Infrared, Wall Switch Mounted Occupancy Sensor (Watt Stopper WN-100)	69.02	8.05
				<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.83	
	26 09 23 00-0222	EA		Passive Infrared, Wall Switch Mounted Occupancy Sensor (Watt Stopper WS)	69.02	8.05
				<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.83	
	26 09 23 00-0223	EA		Passive Infrared, Wall Switch Mounted Occupancy Sensor (Watt Stopper PW-100)	76.08	8.05
				<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.83	
	26 09 23 00-0224	EA		Passive Infrared, Wall Switch Mounted Occupancy Sensor (Watt Stopper WI-200)	90.19	8.05
				<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.83	
	26 09 23 00-0225	EA		Dual Relay, Passive Infrared, Wall Switch Mounted Occupancy Sensor (Watt Stopper PW-200)	91.95	8.05
				<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.83	
	26 09 23 00-0226	EA		Dimmable, Passive Infrared, Wall Switch Mounted Occupancy Sensor (Watt Stopper WD)	93.72	8.05
				<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.83	
26 09 23 00-0227				Passive Infrared And Ultrasonic, Wall Switch Mounted Occupancy Sensors <small>(26 09 23 00-0216)</small>		
	26 09 23 00-0228	EA		Passive Infrared And Ultrasonic, Wall Switch Mounted Occupancy Sensor (Watt Stopper DW-100)	121.06	8.05
				<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.83	
	26 09 23 00-0229	EA		Dual Relay, Passive Infrared And Ultrasonic, Wall Switch Mounted Occupancy Sensor (Watt Stopper DW-200)	138.69	8.05
				<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.83	
26 09 23 00-0230				Wall Switch Mounted Occupancy Sensor Accessories <small>(26 09 23 00-0216)</small>		
	26 09 23 00-0231	EA		Single Gang, Plastic Switch Plate Cover For Occupancy Sensors (Watt Stopper ASP)	5.09	2.02
	26 09 23 00-0232	EA		One Side Blank, Double Gang, Plastic Switch Plate Cover For Occupancy Sensors (Watt Stopper ASP)	6.23	2.02
	26 09 23 00-0233	EA		Switch Option, Double Gang, Plastic Switch Plate Cover For Occupancy Sensors (Watt Stopper ASP)	6.23	2.02
26 09 23 00-0234				Ceiling Mounted Occupancy Sensors <small>(26 09 23 00-0215)</small>		
26 09 23 00-0235				Ultrasonic, Ceiling Mounted Occupancy Sensors <small>(26 09 23 00-0234)</small>		
26 09 23 00-0236				25 KHZ Ultrasonic, Ceiling Mounted Occupancy Sensors <small>(26 09 23 00-0235)</small>		
	26 09 23 00-0237	EA		500 SF 360 Degree Coverage, 25 KHZ Ultrasonic, Ceiling Mounted Occupancy Sensor (Watt Stopper W-500A)	122.69	18.13
	26 09 23 00-0238	EA		1,000 SF 360 Degree Coverage, 25 KHZ Ultrasonic, Ceiling Mounted Occupancy Sensor (Watt Stopper W-1000A)	141.21	18.13
	26 09 23 00-0239	EA		2,000 SF 360 Degree Coverage, 25 KHZ Ultrasonic, Ceiling Mounted Occupancy Sensor (Watt Stopper W-2000A)	158.84	18.13
	26 09 23 00-0240	EA		90 LF Hallway Coverage, 25 KHZ Ultrasonic, Ceiling Mounted Occupancy Sensor (Watt Stopper W-2000H)	158.84	18.13
26 09 23 00-0241				32 KHZ Ultrasonic, Ceiling Mounted Occupancy Sensors <small>(26 09 23 00-0235)</small>		
	26 09 23 00-0242	EA		600 SF 360 Degree Coverage, 32 KHZ Ultrasonic, Ceiling Mounted Occupancy Sensor (Watt Stopper WT-605)	130.62	18.13

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MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 09 23 00-0243 EA 1,100 SF 360 Degree Coverage, 32 KHZ Ultrasonic, Ceiling Mounted Occupancy Sensor (Watt Stopper WT-1105).....	148.26	18.13
26 09 23 00-0244 EA 2,205 SF 360 Degree Coverage, 32 KHZ Ultrasonic, Ceiling Mounted Occupancy Sensor (Watt Stopper WT-2205).....	165.90	18.13
26 09 23 00-0245 EA 90 LF Hallway Coverage, 32 KHZ Ultrasonic, Ceiling Mounted Occupancy Sensor (Watt Stopper WT-2255).....	165.90	18.13
26 09 23 00-0246 35 KHZ Ultrasonic, Ceiling Mounted Occupancy Sensors (26 09 23 00-0235)		
26 09 23 00-0247 EA 600 SF 360 Degree Coverage, Panel Integrating, 35 KHZ Ultrasonic, Ceiling Mounted Occupancy Sensor (Watt Stopper WP-605).....	127.98	18.13
26 09 23 00-0248 EA 1,100 SF 360 Degree Coverage, Panel Integrating, 35 KHZ Ultrasonic, Ceiling Mounted Occupancy Sensor (Watt Stopper WP-1105).....	145.62	18.13
26 09 23 00-0249 EA 2,200 SF 360 Degree Coverage, Panel Integrating, 35 KHZ Ultrasonic, Ceiling Mounted Occupancy Sensor (Watt Stopper WP-2205).....	163.25	18.13
26 09 23 00-0250 EA 90 LF Hallway Coverage, Panel Integrating, 35 KHZ Ultrasonic, Ceiling Mounted Occupancy Sensor (Watt Stopper WP-2255).....	163.25	18.13
26 09 23 00-0251 EA 600 SF 360 Degree Coverage, Isolated Relay, 35 KHZ Ultrasonic, Ceiling Mounted Occupancy Sensor (Watt Stopper WT-600).....	137.68	18.13
26 09 23 00-0252 EA 1,100 SF 360 Degree Coverage, Isolated Relay, 35 KHZ Ultrasonic, Ceiling Mounted Occupancy Sensor (Watt Stopper WT-1100).....	155.32	18.13
26 09 23 00-0253 EA 2,200 SF 360 Degree Coverage, Isolated Relay, 35 KHZ Ultrasonic, Ceiling Mounted Occupancy Sensor (Watt Stopper WT-2200).....	173.84	18.13
26 09 23 00-0254 EA 90 LF Hallway Coverage, Isolated Relay, 35 KHZ Ultrasonic, Ceiling Mounted Occupancy Sensor (Watt Stopper WT-2250).....	173.84	18.13
26 09 23 00-0255 40 KHZ Ultrasonic, Ceiling Mounted Occupancy Sensors (26 09 23 00-0235)		
26 09 23 00-0256 EA 500 SF 360 Degree Coverage, Isolated Relay, 40 KHZ Ultrasonic, Ceiling Mounted Occupancy Sensor (Watt Stopper UT-300-1).....	137.68	18.13
26 09 23 00-0257 EA 1,000 SF 360 Degree Coverage, Isolated Relay, 40 KHZ Ultrasonic, Ceiling Mounted Occupancy Sensor (Watt Stopper UT-300-2).....	155.32	18.13
26 09 23 00-0258 EA 2,000 SF 360 Degree Coverage, Isolated Relay, 40 KHZ Ultrasonic, Ceiling Mounted Occupancy Sensor (Watt Stopper UT-300-3).....	173.84	18.13
26 09 23 00-0259 EA 500 SF 360 Degree Coverage, Panel Integrating, 40 KHZ Ultrasonic, Ceiling Mounted Occupancy Sensor (Watt Stopper UT-305-1).....	130.62	18.13
26 09 23 00-0260 EA 1,000 SF 360 Degree Coverage, Panel Integrating, 40 KHZ Ultrasonic, Ceiling Mounted Occupancy Sensor (Watt Stopper UT-305-2).....	148.26	18.13
26 09 23 00-0261 EA 2,000 SF 360 Degree Coverage, Panel Integrating, 40 KHZ Ultrasonic, Ceiling Mounted Occupancy Sensor (Watt Stopper UT-305-3).....	165.90	18.13
26 09 23 00-0262 EA 500 SF 360 Degree Coverage, Line Voltage, 40 KHZ Ultrasonic, Ceiling Mounted Occupancy Sensor (Watt Stopper UT-355-1).....	130.62	18.13
26 09 23 00-0263 EA 1,000 SF 360 Degree Coverage, Line Voltage, 40 KHZ Ultrasonic, Ceiling Mounted Occupancy Sensor (Watt Stopper UT-355-2).....	148.26	18.13
26 09 23 00-0264 EA 2,000 SF 360 Degree Coverage, Line Voltage, 40 KHZ Ultrasonic, Ceiling Mounted Occupancy Sensor (Watt Stopper UT-355-3).....	165.90	18.13
26 09 23 00-0265 Passive Infrared, Ceiling Mounted Occupancy Sensors (26 09 23 00-0234)		
26 09 23 00-0266 EA 30 Segment, 5 Level Lens, Passive Infrared, Ceiling Mounted Occupancy Sensor (Watt Stopper WPIR).....	101.52	18.13
26 09 23 00-0267 EA HVAC/BAS, Passive Infrared, Ceiling Mounted Occupancy Sensor (Watt Stopper CI-12/24).....	104.17	18.13
26 09 23 00-0268 EA Passive Infrared, Ceiling Mounted Occupancy Sensor (Watt Stopper CI-205).....	115.63	18.13
26 09 23 00-0269 EA Line Voltage, Passive Infrared, Ceiling Mounted Occupancy Sensor (Watt Stopper CI-355).....	120.92	18.13
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add 10.88</i>		
26 09 23 00-0270 EA Low Profile, Isolated Relay, Passive Infrared, Ceiling Mounted Occupancy Sensor (Watt Stopper CI-305).....	120.92	18.13
26 09 23 00-0271 EA Isolated Relay, Passive Infrared, Ceiling Mounted Occupancy Sensor (Watt Stopper CI-200).....	132.39	18.13
26 09 23 00-0272 EA Low Profile, Passive Infrared, Ceiling Mounted Occupancy Sensor (Watt Stopper CI-300).....	135.91	18.13
26 09 23 00-0273 Passive Infrared And Ultrasonic, Ceiling Mounted Occupancy Sensors (26 09 23 00-0234)		
26 09 23 00-0274 EA 1,000 SF 360 Degree Coverage, Line Voltage, Passive Infrared, Ceiling Mounted Occupancy Sensor (Watt Stopper DT-355).....	171.19	18.13
26 09 23 00-0275 EA 1,000 SF 360 Degree Coverage, Isolated Relay, Passive Infrared, Ceiling Mounted Occupancy Sensor (Watt Stopper DT-300).....	189.71	18.13
26 09 23 00-0276 EA 1,000 SF 360 Degree Coverage, Passive Infrared, Ceiling Mounted Occupancy Sensor (Watt Stopper DT-305).....	189.71	18.13
26 09 23 00-0277 Ceiling/Wall Mounted Occupancy Sensors (26 09 23 00-0215)		
26 09 23 00-0278 Passive Infrared, Ceiling/Wall Mounted Occupancy Sensors (26 09 23 00-0277)		
26 09 23 00-0279 EA 120 LF Coverage, Low Temperature, Passive Infrared, Ceiling/Wall Mounted Occupancy Sensor (Watt Stopper CB-100-1/3).....	189.71	18.13
26 09 23 00-0280 EA 2,000 SF Coverage, Low Temperature, Passive Infrared, Ceiling/Wall Mounted Occupancy Sensor (Watt Stopper CB-100).....	189.71	18.13
26 09 23 00-0281 Passive Infrared And Ultrasonic, Ceiling/Wall Mounted Occupancy Sensors (26 09 23 00-0277)		
26 09 23 00-0282 EA 2,000 SF Coverage, Passive Infrared And Ultrasonic, Ceiling/Wall Mounted Occupancy Sensor (Watt Stopper DT-200).....	189.71	18.13
26 09 23 00-0283 Occupancy Sensor Power Packs (26 09 23 00-0214)		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 09 23 00-0284 Single Voltage, Occupancy Sensor Power Packs <small>(26 09 23 00-0283)</small>		
26 09 23 00-0285 EA 220 - 240 Volt AC, 20 Amp, Occupancy Sensor Power Pack (Watt Stopper B230E-P) <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	59.57 9.67	16.11
26 09 23 00-0286 EA 347 Volt AC, 15 Amp, Occupancy Sensor Power Pack (Watt Stopper B347D-P) <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	59.57 9.67	16.11
26 09 23 00-0287 Auxiliary, Occupancy Sensor Power Packs <small>(26 09 23 00-0283)</small>		
26 09 23 00-0288 EA 120, 277 Or 347 Volt AC, 20 Amp, Auxiliary Occupancy Sensor Power Pack (Watt Stopper S120/277/347E-P) <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	54.28 9.67	16.11
26 09 23 00-0289 Universal Voltage, Power Packs For Occupancy Sensors <small>(26 09 23 00-0283)</small>		
26 09 23 00-0290 EA 120/277 Volt AC, 20 Amp, Dual Voltage, Occupancy Sensor Power Pack (Watt Stopper BZ-100) <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	66.62 9.67	16.11
26 09 23 00-0291 Form C, Occupancy Sensor Power Packs <small>(26 09 23 00-0283)</small>		
26 09 23 00-0292 EA 120 Volt AC, Form C, Occupancy Sensor Power Pack (Watt Stopper A120C-P) <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	64.86 9.67	16.11
26 09 23 00-0293 EA 277 Volt AC, Form C, Occupancy Sensor Power Pack (Watt Stopper A277C-P) <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	64.86 9.67	16.11
26 09 23 00-0294 Two Relay, Occupancy Sensor Power Packs <small>(26 09 23 00-0283)</small>		
26 09 23 00-0295 EA 120 Volt AC, Two Relay, Occupancy Sensor Power Pack (Watt Stopper C120C-P) <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	79.85 9.67	16.11
26 09 23 00-0296 EA 277 Volt AC, Two Relay, Occupancy Sensor Power Pack (Watt Stopper C277E-P) <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	79.85 9.67	16.11
26 09 23 00-0297 Occupancy Sensor Power Supplies <small>(26 09 23 00-0283)</small>		
26 09 23 00-0298 EA 120 Volt AC, Occupancy Sensor Power Supply (Watt Stopper AT-120) <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	150.40 9.67	16.11
26 09 23 00-0299 EA 277 Volt AC, Occupancy Sensor Power Supply (Watt Stopper AT-277) <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	150.40 9.67	16.11
26 09 23 00-0300 Intelligent, Occupancy Sensor Power Packs <small>(26 09 23 00-0283)</small>		
26 09 23 00-0301 EA 120/277 Volt AC, Two Relays, Two Dimming Channels, Intelligent Occupancy Sensor Power Pack (Watt Stopper LC-100)	226.25	16.11
26 09 23 00-0302 DIN Rail Mounted, Occupancy Sensor Power Packs <small>(26 09 23 00-0283)</small>		
26 09 23 00-0303 EA 120/230/277 Volt AC, DIN Rail Mounted, Occupancy Sensor Power Pack (Watt Stopper BD-100)	69.27	16.11
26 09 23 00-0304 Occupancy Sensor Accessories <small>(26 09 23 00-0214)</small>		
26 09 23 00-0305 Protective Cages For Occupancy Sensors <small>(26 09 23 00-0304)</small>		
26 09 23 00-0306 EA Protective Cage For Occupancy Sensors (Watt Stopper WC)	41.19	6.04
26 09 23 00-0307 Mounting Brackets For Occupancy Sensors <small>(26 09 23 00-0304)</small>		
26 09 23 00-0308 EA Mounting Bracket For Occupancy Sensor (Watt Stopper MB) Note: Includes J-plate for mounting to HID fixtures or L-plate for mounting to fluorescent fixtures, walls, shelves and girders.	31.60	10.07
26 09 23 00-0309 Occupancy/Lighting Logger <small>(26 09 23 00-0304)</small>		
26 09 23 00-0310 EA Note: Logs when a space is occupied/vacant and when lighting is on/off. Occupancy/Lighting Logger With Connector Cable (Watt Stopper IT-200)	307.47	34.24
26 09 23 00-0311 Remove And Reinstall Occupancy Sensors <small>(26 09 23 00-0304)</small>		
26 09 23 00-0312 EA Remove And Reinstall Surface Mounted Occupancy Sensor Note: Includes storing and cleaning.	54.39	
26 09 23 00-0313 EA Remove And Reinstall Wall Switch Mounted Occupancy Sensor Note: Includes storing and cleaning.	24.17	
26 09 23 00-0314 Digital Time Light Switches <small>(26 09 23 00-0214)</small>		
26 09 23 00-0315 EA Preset Time, Wall Switch Mounted, Digital Time Light Switch (Watt Stopper TS-400)	67.26	8.05
26 09 23 00-0316 Daylight Sensing Light Switches <small>(26 09 23 00-0214)</small>		
26 09 23 00-0317 EA User Adjustable Light Level Settings, Daylight Sensing Light Switch (Watt Stopper LS-100)	90.19	8.05

26 Electrical**26 09 Instrumentation and Control for Electrical Systems****26 09 23 Lighting Control Devices**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 09 23 00-0318 Occupancy Sensors (Sensor Switch) ^(26 09 23) Note: Includes testing of new devices and certification.		
26 09 23 00-0319 Occupancy Sensors (Sensor Switch) ^(26 09 23 00-0318) Note: Exclude boxes		
26 09 23 00-0320 Wall Switch Mount Occupancy Sensors (Sensor Switch) ^(26 09 23 00-0319)		
26 09 23 00-0321 Passive Infrared, Wall Switch Mount Occupancy Sensors (Sensor Switch) ^(26 09 23 00-0320)		
26 09 23 00-0322 EA Single Pole, Low Voltage, Passive Infrared, Wall Switch Mount Occupancy Sensor (Sensor Switch WSD LV).....	98.61	8.05
For Low Voltage Relay Option, Add	7.50	
For Low Temp/High Humidity Option, Add	6.25	
26 09 23 00-0323 EA Nightlight, Line Voltage, Passive Infrared, Wall Switch Mount Occupancy Sensor (Sensor Switch WSD NL).....	71.11	8.05
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	4.83	
26 09 23 00-0324 EA Single Pole, Line Voltage, Fully Automatic, Passive Infrared, Wall Switch Mount Occupancy Sensor (Sensor Switch WSD).....	68.09	8.05
For Photocell (Inhibit Mode Only) Option, Add	7.50	
For Low Temp/High Humidity Option, Add	6.25	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	4.83	
26 09 23 00-0325 EA Single Pole, Line Voltage, Semi-Automatic, Passive Infrared, Wall Switch Mount Occupancy Sensor (Sensor Switch WSD SA).....	68.09	8.05
For Photocell (Inhibit Mode Only) Option, Add	7.50	
For Low Temp/High Humidity Option, Add	6.25	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	4.83	
26 09 23 00-0326 EA 2-Pole, Line Voltage, Passive Infrared, Wall Switch Mount Occupancy Sensor (Sensor Switch WSD 2P).....	84.86	8.05
For Photocell (Inhibit Mode Only) Option, Add	7.50	
For Low Temp/High Humidity Option, Add	6.25	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	4.83	
26 09 23 00-0327 EA Single Pole, Passive Infrared, Large Area, Wall Switch Mount Occupancy Sensor (Sensor Switch LWS).....	84.86	8.05
For Photocell (Inhibit Mode Only) Option, Add	7.50	
For Low Temp/High Humidity Option, Add	6.25	
26 09 23 00-0328 EA 2-Pole, Passive Infrared, Large Area, Wall Switch Mount Occupancy Sensor (Sensor Switch LWS 2P).....	102.05	8.05
For Photocell (Inhibit Mode Only) Option, Add	7.50	
For Low Temp/High Humidity Option, Add	6.25	
26 09 23 00-0329 EA Single Pole, Passive Infrared, Internally Powered, Wall Switch Mount Occupancy Sensor (Sensor Switch IPD).....	84.86	8.05
For Photocell (Inhibit Mode Only) Option, Add	7.50	
For Low Temp/High Humidity Option, Add	6.25	
26 09 23 00-0330 Dual Technology, Wall Switch Mount Occupancy Sensors (Sensor Switch) ^(26 09 23 00-0320) Note: Includes passive infrared and microphonics detection		
26 09 23 00-0331 EA Single Pole, Low Voltage, Passive Infrared, Wall Switch Mount Occupancy Sensor (Sensor Switch WSD PDT LV).....	126.11	8.05
For Low Voltage Relay Option, Add	7.50	
For Low Temp/High Humidity Option, Add	6.25	
26 09 23 00-0332 EA Nightlight, Line Voltage, Dual Technology, Wall Switch Mount Occupancy Sensor (Sensor Switch WSD PDT NL).....	98.61	8.05
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	4.83	
26 09 23 00-0333 EA Single Pole, Line Voltage, Fully Automatic, Passive Infrared, Wall Switch Mount Occupancy Sensor (Sensor Switch WSD PDT).....	96.55	8.05
For Photocell (Inhibit Mode Only) Option, Add	7.50	
For Low Temp/High Humidity Option, Add	6.25	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	4.83	
26 09 23 00-0334 EA Single Pole, Line Voltage, Semi-Automatic, Passive Infrared, Wall Switch Mount Occupancy Sensor (Sensor Switch WSD PDT SA).....	96.55	8.05
For Photocell (Inhibit Mode Only) Option, Add	7.50	
For Low Temp/High Humidity Option, Add	6.25	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	4.83	
26 09 23 00-0335 EA 2-Pole, Line Voltage, Passive Infrared, Wall Switch Mount Occupancy Sensor (Sensor Switch WSD PDT 2P).....	112.36	8.05
For Photocell (Inhibit Mode Only) Option, Add	7.50	
For Low Temp/High Humidity Option, Add	6.25	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	4.83	
26 09 23 00-0336 EA Single Pole, Dual Technology, Large Area, Wall Switch Mount Occupancy Sensor (Sensor Switch LWS PDT).....	112.36	8.05
For Photocell (Inhibit Mode Only) Option, Add	7.50	
For Low Temp/High Humidity Option, Add	6.25	
26 09 23 00-0337 EA 2-Pole, Dual Technology, Large Area, Wall Switch Mount Occupancy Sensor (Sensor Switch LWS PDT 2P).....	120.61	8.05
For Photocell (Inhibit Mode Only) Option, Add	7.50	
For Low Temp/High Humidity Option, Add	6.25	
26 09 23 00-0338 Wall Switch Mount Occupancy Sensor Accessories (Sensor Switch) ^(26 09 23 00-0320)		
26 09 23 00-0339 EA One Blank, 2-Gang, Plastic Switch Plate Cover For Occupancy Sensors (Sensor Switch WS BPX).....	9.53	2.02
26 09 23 00-0340 EA One Switch, 2-Gang, Plastic Switch Plate Cover For Occupancy Sensors (Sensor Switch WS SPX).....	9.53	2.02
26 09 23 00-0341 EA Two Blanks, 3-Gang, Plastic Switch Plate Cover For Occupancy Sensors (Sensor Switch WS BPX 3).....	17.78	2.02
26 09 23 00-0342 EA Two Switches, 3-Gang, Plastic Switch Plate Cover For Occupancy Sensors (Sensor Switch WS SPX 3).....	17.78	2.02
26 09 23 00-0343 360 Degree View Occupancy Sensors (Sensor Switch) ^(26 09 23 00-0319)		
26 09 23 00-0344 Passive Infrared, 360 Degree View Occupancy Sensors (Sensor Switch) ^(26 09 23 00-0343) Note: One photocell or dimming option per occupancy sensor		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 09 23 00-0345 EA Low Voltage, Passive Infrared, Ceiling Mount, Standard Range, 360 Degree View Occupancy Sensor (Sensor Switch CM 9)	118.76	18.13
<i>For Low Voltage Relay Option, Add</i>	7.50	
<i>For Photocell (Inhibit Mode Only) Option, Add</i>	7.50	
<i>For Low Temp/High Humidity Option, Add</i>	6.25	
<i>For Occupancy Controlled Dimming Option, Add</i>	12.50	
<i>For Photocell Option With Dimming Capability, Add</i>	18.75	
26 09 23 00-0346 EA Low Voltage, Passive Infrared, Recessed Mount, Standard Range, 360 Degree View Occupancy Sensor (Sensor Switch RM 9)	118.76	18.13
<i>For Low Voltage Relay Option, Add</i>	7.50	
<i>For Photocell (Inhibit Mode Only) Option, Add</i>	7.50	
<i>For Low Temp/High Humidity Option, Add</i>	6.25	
<i>For Occupancy Controlled Dimming Option, Add</i>	12.50	
<i>For Photocell Option With Dimming Capability, Add</i>	18.75	
26 09 23 00-0347 EA Low Voltage, Passive Infrared, Fixture (Box) Mount, Standard Range, 360 Degree View Occupancy Sensor (Sensor Switch CMB 9)	118.76	18.13
<i>For Low Voltage Relay Option, Add</i>	7.50	
<i>For Photocell (Inhibit Mode Only) Option, Add</i>	7.50	
<i>For Low Temp/High Humidity Option, Add</i>	6.25	
<i>For Occupancy Controlled Dimming Option, Add</i>	12.50	
<i>For Photocell Option With Dimming Capability, Add</i>	18.75	
26 09 23 00-0348 EA Single Pole, Line Voltage, Passive Infrared, Ceiling Mount, Standard Range, 360 Degree View Occupancy Sensor (Sensor Switch CMR 9)	125.64	18.13
<i>For Photocell (Inhibit Mode Only) Option, Add</i>	7.50	
<i>For Low Temp/High Humidity Option, Add</i>	6.25	
<i>For Occupancy Controlled Dimming Option, Add</i>	12.50	
<i>For Photocell Option With Dimming Capability, Add</i>	18.75	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0349 EA Single Pole, Line Voltage, Passive Infrared, Recessed Mount, Standard Range, 360 Degree View Occupancy Sensor (Sensor Switch RMR 9)	125.64	18.13
<i>For Photocell (Inhibit Mode Only) Option, Add</i>	7.50	
<i>For Low Temp/High Humidity Option, Add</i>	6.25	
<i>For Occupancy Controlled Dimming Option, Add</i>	12.50	
<i>For Photocell Option With Dimming Capability, Add</i>	18.75	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0350 EA Single Pole, Line Voltage, Passive Infrared, Fixture (Box) Mount, Standard Range, 360 Degree View Occupancy Sensor (Sensor Switch CMRB 9)	103.64	18.13
<i>For Photocell (Inhibit Mode Only) Option, Add</i>	7.50	
<i>For Low Temp/High Humidity Option, Add</i>	6.25	
<i>For Occupancy Controlled Dimming Option, Add</i>	12.50	
<i>For Photocell Option With Dimming Capability, Add</i>	18.75	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0351 EA 2-Pole, Line Voltage, Passive Infrared, Ceiling Mount, Standard Range, 360 Degree View Occupancy Sensor (Sensor Switch CMR 9 2P)	153.14	18.13
<i>For Photocell (Inhibit Mode Only) Option, Add</i>	7.50	
<i>For Low Temp/High Humidity Option, Add</i>	6.25	
<i>For Photocell Option With Dual Zone On/Off, Add</i>	18.75	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0352 EA 2-Pole, Line Voltage, Passive Infrared, Recessed Mount, Standard Range, 360 Degree View Occupancy Sensor (Sensor Switch RMR 9 2P)	153.14	18.13
<i>For Photocell (Inhibit Mode Only) Option, Add</i>	7.50	
<i>For Low Temp/High Humidity Option, Add</i>	6.25	
<i>For Photocell Option With Dual Zone On/Off, Add</i>	18.75	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0353 EA 2-Pole, Line Voltage, Passive Infrared, Fixture (Box) Mount, Standard Range, 360 Degree View Occupancy Sensor (Sensor Switch CMRB 9 2P)	131.14	18.13
<i>For Photocell (Inhibit Mode Only) Option, Add</i>	7.50	
<i>For Low Temp/High Humidity Option, Add</i>	6.25	
<i>For Photocell Option With Dual Zone On/Off, Add</i>	18.75	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0354 EA Low Voltage, Passive Infrared, Ceiling Mount, Extended Range, 360 Degree View Occupancy Sensor (Sensor Switch CM 10)	118.76	18.13
<i>For Low Voltage Relay Option, Add</i>	7.50	
<i>For Photocell (Inhibit Mode Only) Option, Add</i>	7.50	
<i>For Low Temp/High Humidity Option, Add</i>	6.25	
<i>For Occupancy Controlled Dimming Option, Add</i>	12.50	
<i>For Photocell Option With Dimming Capability, Add</i>	18.75	
26 09 23 00-0355 EA Low Voltage, Passive Infrared, Recessed Mount, Extended Range, 360 Degree View Occupancy Sensor (Sensor Switch RM 10)	118.76	18.13
<i>For Low Voltage Relay Option, Add</i>	7.50	
<i>For Photocell (Inhibit Mode Only) Option, Add</i>	7.50	
<i>For Low Temp/High Humidity Option, Add</i>	6.25	
<i>For Occupancy Controlled Dimming Option, Add</i>	12.50	
<i>For Photocell Option With Dimming Capability, Add</i>	18.75	
26 09 23 00-0356 EA Low Voltage, Passive Infrared, Fixture (Box) Mount, Extended Range, 360 Degree View Occupancy Sensor (Sensor Switch CMB 10)	118.76	18.13
<i>For Low Voltage Relay Option, Add</i>	7.50	
<i>For Photocell (Inhibit Mode Only) Option, Add</i>	7.50	
<i>For Low Temp/High Humidity Option, Add</i>	6.25	
<i>For Occupancy Controlled Dimming Option, Add</i>	12.50	
<i>For Photocell Option With Dimming Capability, Add</i>	18.75	
26 09 23 00-0357 EA Single Pole, Line Voltage, Passive Infrared, Ceiling Mount, Extended Range, 360 Degree View Occupancy Sensor (Sensor Switch CMR 10)	125.64	18.13
<i>For Photocell (Inhibit Mode Only) Option, Add</i>	7.50	
<i>For Low Temp/High Humidity Option, Add</i>	6.25	
<i>For Occupancy Controlled Dimming Option, Add</i>	12.50	
<i>For Photocell Option With Dimming Capability, Add</i>	18.75	

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MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 09 23 00-0358	EA		Single Pole, Line Voltage, Passive Infrared, Recessed Mount, Extended Range, 360 Degree View Occupancy Sensor (Sensor Switch RMR 10).....	125.64	18.13
			<i>For Photocell (Inhibit Mode Only) Option, Add</i>	7.50	
			<i>For Low Temp/High Humidity Option, Add</i>	6.25	
			<i>For Occupancy Controlled Dimming Option, Add</i>	12.50	
			<i>For Photocell Option With Dimming Capability, Add</i>	18.75	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0359	EA		Single Pole, Line Voltage, Passive Infrared, Fixture (Box) Mount, Extended Range, 360 Degree View Occupancy Sensor (Sensor Switch CMRB 10).....	103.64	18.13
			<i>For Photocell (Inhibit Mode Only) Option, Add</i>	7.50	
			<i>For Low Temp/High Humidity Option, Add</i>	6.25	
			<i>For Occupancy Controlled Dimming Option, Add</i>	12.50	
			<i>For Photocell Option With Dimming Capability, Add</i>	18.75	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0360	EA		2-Pole, Line Voltage, Passive Infrared, Ceiling Mount, Extended Range, 360 Degree View Occupancy Sensor (Sensor Switch CMR 10 2P).....	153.14	18.13
			<i>For Photocell (Inhibit Mode Only) Option, Add</i>	7.50	
			<i>For Low Temp/High Humidity Option, Add</i>	6.25	
			<i>For Photocell Option With Dual Zone On/Off, Add</i>	18.75	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0361	EA		2-Pole, Line Voltage, Passive Infrared, Recessed Mount, Extended Range, 360 Degree View Occupancy Sensor (Sensor Switch RMR 10 2P).....	153.14	18.13
			<i>For Photocell (Inhibit Mode Only) Option, Add</i>	7.50	
			<i>For Low Temp/High Humidity Option, Add</i>	6.25	
			<i>For Photocell Option With Dual Zone On/Off, Add</i>	18.75	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0362	EA		2-Pole, Line Voltage, Passive Infrared, Fixture (Box) Mount, Extended Range, 360 Degree View Occupancy Sensor (Sensor Switch CMRB 10 2P).....	131.14	18.13
			<i>For Photocell (Inhibit Mode Only) Option, Add</i>	7.50	
			<i>For Low Temp/High Humidity Option, Add</i>	6.25	
			<i>For Photocell Option With Dual Zone On/Off, Add</i>	18.75	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0363			Dual Technology, 360 Degree View Occupancy Sensors (Sensor Switch)^(26 09 23 00-0343)		
			Note: One photocell or dimming option per occupancy sensor. Includes passive infrared and microphonics detection		
26 09 23 00-0364	EA		Low Voltage, Dual Technology, Ceiling Mount, Standard Range, 360 Degree View Occupancy Sensor (Sensor Switch CM PDT 9).....	146.26	18.13
			<i>For Low Voltage Relay Option, Add</i>	7.50	
			<i>For Photocell (Inhibit Mode Only) Option, Add</i>	7.50	
			<i>For Low Temp/High Humidity Option, Add</i>	6.25	
			<i>For Occupancy Controlled Dimming Option, Add</i>	12.50	
			<i>For Photocell Option With Dimming Capability, Add</i>	18.75	
26 09 23 00-0365	EA		Low Voltage, Dual Technology, Recessed Mount, Standard Range, 360 Degree View Occupancy Sensor (Sensor Switch RM PDT 9).....	146.26	18.13
			<i>For Low Voltage Relay Option, Add</i>	7.50	
			<i>For Photocell (Inhibit Mode Only) Option, Add</i>	7.50	
			<i>For Low Temp/High Humidity Option, Add</i>	6.25	
			<i>For Occupancy Controlled Dimming Option, Add</i>	12.50	
			<i>For Photocell Option With Dimming Capability, Add</i>	18.75	
26 09 23 00-0366	EA		Low Voltage, Dual Technology, Fixture (Box) Mount, Standard Range, 360 Degree View Occupancy Sensor (Sensor Switch CMB PDT 9).....	146.26	18.13
			<i>For Low Voltage Relay Option, Add</i>	7.50	
			<i>For Photocell (Inhibit Mode Only) Option, Add</i>	7.50	
			<i>For Low Temp/High Humidity Option, Add</i>	6.25	
			<i>For Occupancy Controlled Dimming Option, Add</i>	12.50	
			<i>For Photocell Option With Dimming Capability, Add</i>	18.75	
26 09 23 00-0367	EA		Single Pole, Line Voltage, Dual Technology, Ceiling Mount, Standard Range, 360 Degree View Occupancy Sensor (Sensor Switch CMR PDT 9).....	139.38	18.13
			<i>For Photocell (Inhibit Mode Only) Option, Add</i>	7.50	
			<i>For Low Temp/High Humidity Option, Add</i>	6.25	
			<i>For Occupancy Controlled Dimming Option, Add</i>	12.50	
			<i>For Photocell Option With Dimming Capability, Add</i>	18.75	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0368	EA		Single Pole, Line Voltage, Dual Technology, Recessed Mount, Standard Range, 360 Degree View Occupancy Sensor (Sensor Switch RMR PDT 9).....	139.38	18.13
			<i>For Photocell (Inhibit Mode Only) Option, Add</i>	7.50	
			<i>For Low Temp/High Humidity Option, Add</i>	6.25	
			<i>For Occupancy Controlled Dimming Option, Add</i>	12.50	
			<i>For Photocell Option With Dimming Capability, Add</i>	18.75	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0369	EA		Single Pole, Line Voltage, Dual Technology, Fixture (Box) Mount, Standard Range, 360 Degree View Occupancy Sensor (Sensor Switch CMRB PDT 9).....	117.38	18.13
			<i>For Photocell (Inhibit Mode Only) Option, Add</i>	7.50	
			<i>For Low Temp/High Humidity Option, Add</i>	6.25	
			<i>For Occupancy Controlled Dimming Option, Add</i>	12.50	
			<i>For Photocell Option With Dimming Capability, Add</i>	18.75	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0370	EA		2-Pole, Line Voltage, Dual Technology, Ceiling Mount, Standard Range, 360 Degree View Occupancy Sensor (Sensor Switch CMR PDT 9 2P).....	166.88	18.13
			<i>For Photocell (Inhibit Mode Only) Option, Add</i>	7.50	
			<i>For Low Temp/High Humidity Option, Add</i>	6.25	
			<i>For Photocell Option With Dual Zone On/Off, Add</i>	18.75	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 09 23 00-0371 EA 2-Pole, Line Voltage, Dual Technology, Recessed Mount, Standard Range, 360 Degree View Occupancy Sensor (Sensor Switch RMR PDT 9 2P).....	166.88	18.13
<i>For Photocell (Inhibit Mode Only) Option, Add</i>	7.50	
<i>For Low Temp/High Humidity Option, Add</i>	6.25	
<i>For Photocell Option With Dual Zone On/Off, Add</i>	18.75	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0372 EA 2-Pole, Line Voltage, Dual Technology, Fixture (Box) Mount, Standard Range, 360 Degree View Occupancy Sensor (Sensor Switch CMRB PDT 9 2P).....	144.88	18.13
<i>For Photocell (Inhibit Mode Only) Option, Add</i>	7.50	
<i>For Low Temp/High Humidity Option, Add</i>	6.25	
<i>For Photocell Option With Dual Zone On/Off, Add</i>	18.75	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0373 EA Low Voltage, Dual Technology, Ceiling Mount, Extended Range, 360 Degree View Occupancy Sensor (Sensor Switch CM PDT 10).....	146.26	18.13
<i>For Low Voltage Relay Option, Add</i>	7.50	
<i>For Photocell (Inhibit Mode Only) Option, Add</i>	7.50	
<i>For Low Temp/High Humidity Option, Add</i>	6.25	
<i>For Occupancy Controlled Dimming Option, Add</i>	12.50	
<i>For Photocell Option With Dimming Capability, Add</i>	18.75	
26 09 23 00-0374 EA Low Voltage, Dual Technology, Recessed Mount, Extended Range, 360 Degree View Occupancy Sensor (Sensor Switch RM PDT 10).....	146.26	18.13
<i>For Low Voltage Relay Option, Add</i>	7.50	
<i>For Photocell (Inhibit Mode Only) Option, Add</i>	7.50	
<i>For Low Temp/High Humidity Option, Add</i>	6.25	
<i>For Occupancy Controlled Dimming Option, Add</i>	12.50	
<i>For Photocell Option With Dimming Capability, Add</i>	18.75	
26 09 23 00-0375 EA Low Voltage, Dual Technology, Fixture (Box) Mount, Extended Range, 360 Degree View Occupancy Sensor (Sensor Switch CMB PDT 10).....	146.26	18.13
<i>For Low Voltage Relay Option, Add</i>	7.50	
<i>For Photocell (Inhibit Mode Only) Option, Add</i>	7.50	
<i>For Low Temp/High Humidity Option, Add</i>	6.25	
<i>For Occupancy Controlled Dimming Option, Add</i>	12.50	
<i>For Photocell Option With Dimming Capability, Add</i>	18.75	
26 09 23 00-0376 EA Single Pole, Line Voltage, Dual Technology, Ceiling Mount, Extended Range, 360 Degree View Occupancy Sensor (Sensor Switch CMR PDT 10).....	139.38	18.13
<i>For Photocell (Inhibit Mode Only) Option, Add</i>	7.50	
<i>For Low Temp/High Humidity Option, Add</i>	6.25	
<i>For Occupancy Controlled Dimming Option, Add</i>	12.50	
<i>For Photocell Option With Dimming Capability, Add</i>	18.75	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0377 EA Single Pole, Line Voltage, Dual Technology, Recessed Mount, Extended Range, 360 Degree View Occupancy Sensor (Sensor Switch RMR PDT 10).....	139.38	18.13
<i>For Photocell (Inhibit Mode Only) Option, Add</i>	7.50	
<i>For Low Temp/High Humidity Option, Add</i>	6.25	
<i>For Occupancy Controlled Dimming Option, Add</i>	12.50	
<i>For Photocell Option With Dimming Capability, Add</i>	18.75	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0378 EA Single Pole, Line Voltage, Dual Technology, Fixture (Box) Mount, Extended Range, 360 Degree View Occupancy Sensor (Sensor Switch CMRB PDT 10).....	117.38	18.13
<i>For Photocell (Inhibit Mode Only) Option, Add</i>	7.50	
<i>For Low Temp/High Humidity Option, Add</i>	6.25	
<i>For Occupancy Controlled Dimming Option, Add</i>	12.50	
<i>For Photocell Option With Dimming Capability, Add</i>	18.75	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0379 EA 2-Pole, Line Voltage, Dual Technology, Ceiling Mount, Extended Range, 360 Degree View Occupancy Sensor (Sensor Switch CMR PDT 10 2P).....	166.88	18.13
<i>For Photocell (Inhibit Mode Only) Option, Add</i>	7.50	
<i>For Low Temp/High Humidity Option, Add</i>	6.25	
<i>For Photocell Option With Dual Zone On/Off, Add</i>	18.75	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0380 EA 2-Pole, Line Voltage, Dual Technology, Recessed Mount, Extended Range, 360 Degree View Occupancy Sensor (Sensor Switch RMR PDT 10 2P).....	166.88	18.13
<i>For Photocell (Inhibit Mode Only) Option, Add</i>	7.50	
<i>For Low Temp/High Humidity Option, Add</i>	6.25	
<i>For Photocell Option With Dual Zone On/Off, Add</i>	18.75	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0381 EA 2-Pole, Line Voltage, Dual Technology, Fixture (Box) Mount, Extended Range, 360 Degree View Occupancy Sensor (Sensor Switch CMRB PDT 10 2P).....	144.88	18.13
<i>For Photocell (Inhibit Mode Only) Option, Add</i>	7.50	
<i>For Low Temp/High Humidity Option, Add</i>	6.25	
<i>For Photocell Option With Dual Zone On/Off, Add</i>	18.75	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0382 Wide View And Hallway Occupancy Sensors (Sensor Switch) <small>(26 09 23 00-0319)</small>		
26 09 23 00-0383 Passive Infrared, Wide View And Hallway Occupancy Sensors (Sensor Switch) <small>(26 09 23 00-0382)</small>		
26 09 23 00-0384 EA Low Voltage, Passive Infrared, Wall Mount, Wide View Occupancy Sensor (Sensor Switch WV 16).....	118.76	18.13
<i>For Low Voltage Relay Option, Add</i>	7.50	
<i>For Photocell (Inhibit Mode Only) Option, Add</i>	7.50	
<i>For Ceiling Mount, Add</i>	12.50	
<i>For Low Temp/High Humidity Option, Add</i>	6.25	

26 Electrical**26 09 Instrumentation and Control for Electrical Systems****26 09 23 Lighting Control Devices**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 09 23 00-0385	EA		Low Voltage, Passive Infrared, Wall Mount, Hallway Occupancy Sensor (Sensor Switch HW 13).....	132.51	18.13
			<i>For Low Voltage Relay Option, Add</i>	7.50	
			<i>For Photozell (Inhibit Mode Only) Option, Add</i>	7.50	
			<i>For Ceiling Mount, Add</i>	12.50	
			<i>For Low Temp/High Humidity Option, Add</i>	6.25	
26 09 23 00-0386	EA		Line Voltage, Passive Infrared, Wall Mount, Hallway Occupancy Sensor (Sensor Switch HWR 13).....	160.01	18.13
			<i>For Ceiling Mount, Add</i>	12.50	
			<i>For Low Temp/High Humidity Option, Add</i>	6.25	
26 09 23 00-0387	EA		Single Pole, Line Voltage, Passive Infrared, Wall Mount, Wide View Occupancy Sensor (Sensor Switch WVR 16).....	153.14	18.13
			<i>For Photozell (Inhibit Mode Only) Option, Add</i>	7.50	
			<i>For Ceiling Mount, Add</i>	12.50	
			<i>For Low Temp/High Humidity Option, Add</i>	6.25	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0388	EA		2-Pole, Line Voltage, Passive Infrared, Wall Mount, Wide View Occupancy Sensor (Sensor Switch WVR 16 2P).....	180.64	18.13
			<i>For Photozell (Inhibit Mode Only) Option, Add</i>	7.50	
			<i>For Ceiling Mount, Add</i>	12.50	
			<i>For Low Temp/High Humidity Option, Add</i>	6.25	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0389			Dual Technology, Wide View And Hallway Occupancy Sensors (Sensor Switch) <small>(26 09 23 00-0382)</small>		
			Note: Includes passive infrared and microphonics detection		
26 09 23 00-0390	EA		Low Voltage, Dual Technology, Wall Mount, Wide View Occupancy Sensor (Sensor Switch WV PDT 16).....	146.26	18.13
			<i>For Low Voltage Relay Option, Add</i>	7.50	
			<i>For Photozell (Inhibit Mode Only) Option, Add</i>	7.50	
			<i>For Ceiling Mount, Add</i>	12.50	
			<i>For Low Temp/High Humidity Option, Add</i>	6.25	
26 09 23 00-0391	EA		Single Pole, Line Voltage, Dual Technology, Wall Mount, Wide View Occupancy Sensor (Sensor Switch WVR PDT 16).....	166.88	18.13
			<i>For Photozell (Inhibit Mode Only) Option, Add</i>	7.50	
			<i>For Ceiling Mount, Add</i>	12.50	
			<i>For Low Temp/High Humidity Option, Add</i>	6.25	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0392	EA		2-Pole, Line Voltage, Dual Technology, Wall Mount, Wide View Occupancy Sensor (Sensor Switch WVR PDT 16 2P).....	194.38	18.13
			<i>For Photozell (Inhibit Mode Only) Option, Add</i>	7.50	
			<i>For Ceiling Mount, Add</i>	12.50	
			<i>For Low Temp/High Humidity Option, Add</i>	6.25	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0393			High Bay Occupancy Sensors (Sensor Switch) <small>(26 09 23 00-0319)</small>		
26 09 23 00-0394			Passive Infrared, High Bay Occupancy Sensors (Sensor Switch) <small>(26 09 23 00-0393)</small>		
26 09 23 00-0395	EA		Low Voltage, Passive Infrared, Ceiling Mount, 360 Degree View, High Bay Occupancy Sensor (Sensor Switch CM 6).....	118.76	18.13
			<i>For Photozell Option, Add</i>	12.50	
			<i>For Low Voltage Relay Option, Add</i>	7.50	
			<i>For Low Temp/High Humidity Option, Add</i>	6.25	
			<i>For Occupancy Controlled Dimming Option, Add</i>	12.50	
26 09 23 00-0396	EA		Low Voltage, Passive Infrared, Recessed Mount, 360 Degree View, High Bay Occupancy Sensor (Sensor Switch RM 6).....	118.76	18.13
			<i>For Photozell Option, Add</i>	12.50	
			<i>For Low Voltage Relay Option, Add</i>	7.50	
			<i>For Low Temp/High Humidity Option, Add</i>	6.25	
			<i>For Occupancy Controlled Dimming Option, Add</i>	12.50	
26 09 23 00-0397	EA		Low Voltage, Passive Infrared, Fixture (Box) Mount, 360 Degree View, High Bay Occupancy Sensor (Sensor Switch CMB 6).....	118.76	18.13
			<i>For Photozell Option, Add</i>	12.50	
			<i>For Low Voltage Relay Option, Add</i>	7.50	
			<i>For Low Temp/High Humidity Option, Add</i>	6.25	
			<i>For Occupancy Controlled Dimming Option, Add</i>	12.50	
26 09 23 00-0398	EA		Single Pole, Line Voltage, Passive Infrared, Ceiling Mount, 360 Degree View, High Bay Occupancy Sensor (Sensor Switch CMR 6).....	103.64	18.13
			<i>For Photozell Option, Add</i>	12.50	
			<i>For Start To High, HID Option, Add</i>	7.50	
			<i>For Low Temp/High Humidity Option, Add</i>	6.25	
			<i>For Occupancy Controlled Dimming Option, Add</i>	12.50	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0399	EA		Single Pole, Line Voltage, Passive Infrared, Recessed Mount, 360 Degree View, High Bay Occupancy Sensor (Sensor Switch RMR 6).....	103.64	18.13
			<i>For Photozell Option, Add</i>	12.50	
			<i>For Start To High, HID Option, Add</i>	7.50	
			<i>For Low Temp/High Humidity Option, Add</i>	6.25	
			<i>For Occupancy Controlled Dimming Option, Add</i>	12.50	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0400	EA		Single Pole, Line Voltage, Passive Infrared, Fixture (Box) Mount, 360 Degree View, High Bay Occupancy Sensor (Sensor Switch CMRB 6).....	103.64	18.13
			<i>For Photozell Option, Add</i>	12.50	
			<i>For Start To High, HID Option, Add</i>	7.50	
			<i>For Low Temp/High Humidity Option, Add</i>	6.25	
			<i>For Occupancy Controlled Dimming Option, Add</i>	12.50	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 09 23 00-0401 EA 2-Pole, Line Voltage, Passive Infrared, Ceiling Mount, 360 Degree View, High Bay Occupancy Sensor (Sensor Switch CMR 6 2P)	131.14	18.13
<i>For Photocell Option, Add</i>	12.50	
<i>For Low Temp/High Humidity Option, Add</i>	6.25	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0402 EA 2-Pole, Line Voltage, Passive Infrared, Recessed Mount, 360 Degree View, High Bay Occupancy Sensor (Sensor Switch RMR 6 2P)	131.14	18.13
<i>For Photocell Option, Add</i>	12.50	
<i>For Low Temp/High Humidity Option, Add</i>	6.25	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0403 EA 2-Pole, Line Voltage, Passive Infrared, Ceiling Mount, 360 Degree View, High Bay Occupancy Sensor (Sensor Switch CMRB 6 2P)	131.14	18.13
<i>For Photocell Option, Add</i>	12.50	
<i>For Low Temp/High Humidity Option, Add</i>	6.25	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0404 EA 208/240 Volt AC, Line Voltage, Passive Infrared, Ceiling Mount, 360 Degree View, High Bay Occupancy Sensor (Sensor Switch CMR 6 208)	113.26	18.13
<i>For Photocell Option, Add</i>	12.50	
<i>For Low Temp/High Humidity Option, Add</i>	6.25	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0405 EA 208/240 Volt AC, Line Voltage, Passive Infrared, Recessed Mount, 360 Degree View, High Bay Occupancy Sensor (Sensor Switch RMR 6 208)	113.26	18.13
<i>For Photocell Option, Add</i>	12.50	
<i>For Low Temp/High Humidity Option, Add</i>	6.25	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0406 EA 208/240 Volt AC, Line Voltage, Passive Infrared, Fixture (Box) Mount, 360 Degree View, High Bay Occupancy Sensor (Sensor Switch CMRB 6 208)	113.26	18.13
<i>For Photocell Option, Add</i>	12.50	
<i>For Low Temp/High Humidity Option, Add</i>	6.25	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0407 EA 480 Volt AC, Line Voltage, Passive Infrared, Ceiling Mount, 360 Degree View, High Bay Occupancy Sensor (Sensor Switch CMR 6 480)	113.26	18.13
<i>For Photocell Option, Add</i>	12.50	
<i>For Low Temp/High Humidity Option, Add</i>	6.25	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0408 EA 480 Volt AC, Line Voltage, Passive Infrared, Recessed Mount, 360 Degree View, High Bay Occupancy Sensor (Sensor Switch RMR 6 480)	113.26	18.13
<i>For Photocell Option, Add</i>	12.50	
<i>For Low Temp/High Humidity Option, Add</i>	6.25	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0409 EA 480 Volt AC, Line Voltage, Passive Infrared, Fixture (Box) Mount, 360 Degree View, High Bay Occupancy Sensor (Sensor Switch CMRB 6 480)	113.26	18.13
<i>For Photocell Option, Add</i>	12.50	
<i>For Low Temp/High Humidity Option, Add</i>	6.25	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0410 EA Low Voltage, Passive Infrared, Surface Mount, Bi-Directional Aisle Way View, High Bay Occupancy Sensor (Sensor Switch HM 50)	132.51	18.13
<i>For Low Voltage Relay Option, Add</i>	7.50	
<i>For Low Temp/High Humidity Option, Add</i>	6.25	
<i>For Occupancy Controlled Dimming Option, Add</i>	12.50	
26 09 23 00-0411 EA Low Voltage, Passive Infrared, Recessed Mount, Bi-Directional Aisle Way View, High Bay Occupancy Sensor (Sensor Switch RM 50)	132.51	18.13
<i>For Low Voltage Relay Option, Add</i>	7.50	
<i>For Low Temp/High Humidity Option, Add</i>	6.25	
<i>For Occupancy Controlled Dimming Option, Add</i>	12.50	
26 09 23 00-0412 EA Low Voltage, Passive Infrared, Fixture (Box) Mount, Bi-Directional Aisle Way View, High Bay Occupancy Sensor (Sensor Switch CMB 50)	132.51	18.13
<i>For Photocell Option, Add</i>	12.50	
<i>For Low Voltage Relay Option, Add</i>	7.50	
<i>For Low Temp/High Humidity Option, Add</i>	6.25	
<i>For Occupancy Controlled Dimming Option, Add</i>	12.50	
26 09 23 00-0413 EA Single Pole, Line Voltage, Passive Infrared, Surface Mount, Bi-Directional Aisle Way View, High Bay Occupancy Sensor (Sensor Switch HMR 50)	158.64	18.13
<i>For Start To High, HID Option, Add</i>	7.50	
<i>For Low Temp/High Humidity Option, Add</i>	6.25	
<i>For Occupancy Controlled Dimming Option, Add</i>	12.50	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0414 EA Single Pole, Line Voltage, Passive Infrared, Recessed Mount, Bi-Directional Aisle Way View, High Bay Occupancy Sensor (Sensor Switch RMR 50)	158.64	18.13
<i>For Start To High, HID Option, Add</i>	7.50	
<i>For Low Temp/High Humidity Option, Add</i>	6.25	
<i>For Occupancy Controlled Dimming Option, Add</i>	12.50	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0415 EA Single Pole, Line Voltage, Passive Infrared, Fixture (Box) Mount, Bi-Directional Aisle Way View, High Bay Occupancy Sensor (Sensor Switch CMRB 50)	158.64	18.13
<i>For Photocell Option, Add</i>	12.50	
<i>For Start To High, HID Option, Add</i>	7.50	
<i>For Low Temp/High Humidity Option, Add</i>	6.25	
<i>For Occupancy Controlled Dimming Option, Add</i>	12.50	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0416 EA 2-Pole, Line Voltage, Recessed Mount, Passive Infrared, Bi-Directional Aisle Way View, High Bay Occupancy Sensor (Sensor Switch RMR 50 2P)	140.76	18.13
<i>For Low Temp/High Humidity Option, Add</i>	6.25	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	

26 Electrical**26 09 Instrumentation and Control for Electrical Systems****26 09 23 Lighting Control Devices**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 09 23 00-0417	EA		2-Pole, Line Voltage, Passive Infrared, Fixture (Box) Mount, Bi-Directional Aisle Way View, High Bay Occupancy Sensor (Sensor Switch CMRB 50 2P)	140.76	18.13
			<i>For Photozell Option, Add</i>	12.50	
			<i>For Low Temp/High Humidity Option, Add</i>	6.25	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0418	EA		208/240 Volt AC, Line Voltage, Passive Infrared, Recessed Mount, Bi-Directional Aisle Way View, High Bay Occupancy Sensor (Sensor Switch RMR 50 208)	120.14	18.13
			<i>For Low Temp/High Humidity Option, Add</i>	6.25	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0419	EA		208/240 Volt AC, Line Voltage, Passive Infrared, Fixture (Box) Mount, Bi-Directional Aisle Way View, High Bay Occupancy Sensor (Sensor Switch CMRB 50 208)	120.14	18.13
			<i>For Photozell Option, Add</i>	12.50	
			<i>For Low Temp/High Humidity Option, Add</i>	6.25	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0420	EA		480 Volt AC, Line Voltage, Passive Infrared, Recessed Mount, Bi-Directional Aisle Way View, High Bay Occupancy Sensor (Sensor Switch RMR 50 480)	120.14	18.13
			<i>For Low Temp/High Humidity Option, Add</i>	6.25	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0421	EA		480 Volt AC, Line Voltage, Passive Infrared, Fixture (Box) Mount, Bi-Directional Aisle Way View, High Bay Occupancy Sensor (Sensor Switch CMRB 50 480)	120.14	18.13
			<i>For Photozell Option, Add</i>	12.50	
			<i>For Low Temp/High Humidity Option, Add</i>	6.25	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0422	EA		Low Voltage, Passive Infrared, Surface Mount, End Of Aisle Way View, High Bay Occupancy Sensor (Sensor Switch HM 10)	132.51	18.13
			<i>For Low Voltage Relay Option, Add</i>	7.50	
			<i>For Low Temp/High Humidity Option, Add</i>	6.25	
			<i>For Occupancy Controlled Dimming Option, Add</i>	12.50	
26 09 23 00-0423	EA		Low Voltage, Passive Infrared, Fixture (Box) Mount, End Of Aisle Way View, High Bay Occupancy Sensor (Sensor Switch HMB 10)	132.51	18.13
			<i>For Low Voltage Relay Option, Add</i>	7.50	
			<i>For Low Temp/High Humidity Option, Add</i>	6.25	
			<i>For Occupancy Controlled Dimming Option, Add</i>	12.50	
26 09 23 00-0424	EA		Single Pole, Line Voltage, Passive Infrared, Surface Mount, End Of Aisle Way View, High Bay Occupancy Sensor (Sensor Switch HMR 10)	158.64	18.13
			<i>For Start To High, HID Option, Add</i>	7.50	
			<i>For Low Temp/High Humidity Option, Add</i>	6.25	
			<i>For Occupancy Controlled Dimming Option, Add</i>	12.50	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0425	EA		Single Pole, Line Voltage, Passive Infrared, Fixture (Box) Mount, End Of Aisle Way View, High Bay Occupancy Sensor (Sensor Switch HMRB 10)	158.64	18.13
			<i>For Start To High, HID Option, Add</i>	7.50	
			<i>For Low Temp/High Humidity Option, Add</i>	6.25	
			<i>For Occupancy Controlled Dimming Option, Add</i>	12.50	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0426	EA		2-Pole, Line Voltage, Passive Infrared, Fixture (Box) Mount, End Of Aisle Way View, High Bay Occupancy Sensor (Sensor Switch HMRB 10 2P)	153.14	18.13
			<i>For Low Temp/High Humidity Option, Add</i>	6.25	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0427	EA		480 Volt AC, Line Voltage, Passive Infrared, Fixture (Box) Mount, End Of Aisle Way View, High Bay Occupancy Sensor (Sensor Switch HMRB 10 480)	139.38	18.13
			<i>For Low Temp/High Humidity Option, Add</i>	6.25	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0428	EA		208/240 Volt AC, Line Voltage, Passive Infrared, Fixture (Box) Mount, End Of Aisle Way View, High Bay Occupancy Sensor (Sensor Switch HMRB 10 208)	139.38	18.13
			<i>For Low Temp/High Humidity Option, Add</i>	6.25	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.88	
26 09 23 00-0429			Occupancy Sensor Power Packs (Sensor Switch) <small>(26 09 23 00-0318)</small>		
26 09 23 00-0430	EA		Single Pole, 20 Amp, 120/277 Volt AC, Occupancy Sensor Power Pack With Relay Circuit Protection (Sensor Switch PP20)	70.73	16.11
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.67	
26 09 23 00-0431	EA		2-Pole, 20 Amp, 120/277 Volt AC, Occupancy Sensor Power Pack With Relay Circuit Protection (Sensor Switch PP20 2P)	98.23	16.11
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.67	
26 09 23 00-0432	EA		Single Pole, 20 Amp, 120/277 Volt AC, Occupancy Sensor Power Pack Without Relay Circuit Protection (Sensor Switch MP20)	56.98	16.11
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.67	
26 09 23 00-0433	EA		2-Pole, 20 Amp, 120/277 Volt AC, Occupancy Sensor Slave Pack Without Relay Circuit Protection (Sensor Switch MSP20)	52.85	16.11
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.67	
26 09 23 00-0434	EA		20 Amp, 120/277 Volt AC, Occupancy Sensor Slave Pack (Sensor Switch SP20)	66.61	16.11
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.67	
26 09 23 00-0435	EA		120/277 Volt AC, High Intensity Discharge (HID) Power Pack With 20 Minute Start To High Override (Sensor Switch PP20 SH)	100.98	16.11
			<i>For Low Temp/High Humidity Option, Add</i>	6.25	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.67	
26 09 23 00-0436	EA		120/277 Volt AC, 2-Pole, Power Pack With Alternating Relays (Sensor Switch PP 2PAR)	100.98	16.11
			<i>For Low Temp/High Humidity Option, Add</i>	6.25	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.67	
26 09 23 00-0437	EA		120/277 Volt AC, Power Pack With Momentary Contacts For Latching Contactors Or Relays (Sensor Switch PP 2PM)	100.98	16.11
			<i>For Low Temp/High Humidity Option, Add</i>	6.25	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.67	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 09 23 00-0438 Occupancy Sensor Accessories (Sensor Switch) <small>(26 09 23 00-0318)</small>		
26 09 23 00-0439 Remove And Reinstall Occupancy Sensors <small>(26 09 23 00-0438)</small>		
26 09 23 00-0440 EA Remove And Reinstall Wall Switch Mounted Occupancy Sensor.....	24.17	
<i>Note: Includes storing and cleaning.</i>		
26 09 23 00-0441 EA Remove And Reinstall Surface Mounted Occupancy Sensor.....	54.39	
<i>Note: Includes storing and cleaning.</i>		
 26 09 23 00-0442 Daylighting Control (Sensor Switch) <small>(26 09 23 00-0318)</small>		
26 09 23 00-0443 EA Low Voltage, Ceiling Mount, On-Off Switching Photocell (Sensor Switch CM PC).....	105.01	18.13
<i>For Low Temp/High Humidity Option, Add</i>		
<i>For Dual Zone Option, Add</i>		
26 09 23 00-0444 EA Low Voltage, Recessed Mount, On-Off Switching Photocell (Sensor Switch RM PC).....	105.01	18.13
<i>For Low Temp/High Humidity Option, Add</i>		
<i>For Dual Zone Option, Add</i>		
26 09 23 00-0445 EA Low Voltage, Fixture (Box) Mount, On-Off Switching Photocell (Sensor Switch CMB PC).....	105.01	18.13
<i>For Low Temp/High Humidity Option, Add</i>		
<i>For Dual Zone Option, Add</i>		
26 09 23 00-0446 EA Line Voltage, Ceiling Mount, On-Off Switching Photocell (Sensor Switch CMR PC).....	105.01	18.13
<i>For 480 Volt AC Option, Add</i>		
<i>For Low Temp/High Humidity Option, Add</i>		
<i>For Dual Zone Option, Add</i>		
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
26 09 23 00-0447 EA Line Voltage, Recessed Mount, On-Off Switching Photocell (Sensor Switch RMR PC).....	105.01	18.13
<i>For 480 Volt AC Option, Add</i>		
<i>For Low Temp/High Humidity Option, Add</i>		
<i>For Dual Zone Option, Add</i>		
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
26 09 23 00-0448 EA Line Voltage, Fixture (Box) Mount, On-Off Switching Photocell (Sensor Switch CMRB PC).....	105.01	18.13
<i>For 480 Volt AC Option, Add</i>		
<i>For Low Temp/High Humidity Option, Add</i>		
<i>For Dual Zone Option, Add</i>		
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
26 09 23 00-0449 EA Low Voltage, Ceiling Mount, Automatic Dimming Control Photocell (Sensor Switch CM ADC).....	105.01	18.13
<i>For Low Temp/High Humidity Option, Add</i>		
<i>For Dual Zone Option, Add</i>		
26 09 23 00-0450 EA Low Voltage, Recessed Mount, Automatic Dimming Control Photocell (Sensor Switch RM ADC).....	105.01	18.13
<i>For Low Temp/High Humidity Option, Add</i>		
<i>For Dual Zone Option, Add</i>		
26 09 23 00-0451 EA Low Voltage, Fixture (Box) Mount, Automatic Dimming Control Photocell (Sensor Switch CMB ADC).....	105.01	18.13
<i>For Low Temp/High Humidity Option, Add</i>		
<i>For Dual Zone Option, Add</i>		
26 09 23 00-0452 EA Line Voltage, Ceiling Mount, Automatic Dimming Control Photocell (Sensor Switch CMR ADC).....	105.01	18.13
<i>For Low Temp/High Humidity Option, Add</i>		
<i>For Dual Zone Option, Add</i>		
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
26 09 23 00-0453 EA Line Voltage, Recessed Mount, Automatic Dimming Control Photocell (Sensor Switch RMR ADC).....	105.01	18.13
<i>For Low Temp/High Humidity Option, Add</i>		
<i>For Dual Zone Option, Add</i>		
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
26 09 23 00-0454 EA Line Voltage, Fixture (Box) Mount, Automatic Dimming Control Photocell (Sensor Switch CMRB ADC).....	105.01	18.13
<i>For Low Temp/High Humidity Option, Add</i>		
<i>For Dual Zone Option, Add</i>		
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
26 09 23 00-0455 EA Low Voltage, Ceiling Mount, Combination On/Off And Dimming Control Photocell (Sensor Switch CM PC ADC).....	146.26	18.13
<i>For Low Temp/High Humidity Option, Add</i>		
<i>For Dual Zone Option, Add</i>		
26 09 23 00-0456 EA Low Voltage, Recessed Mount, Combination On/Off And Dimming Control Photocell (Sensor Switch RM PC ADC).....	146.26	18.13
<i>For Low Temp/High Humidity Option, Add</i>		
<i>For Dual Zone Option, Add</i>		
26 09 23 00-0457 EA Low Voltage, Fixture (Box) Mount, Combination On/Off And Dimming Control Photocell (Sensor Switch CMB PC ADC).....	146.26	18.13
<i>For Low Temp/High Humidity Option, Add</i>		
<i>For Dual Zone Option, Add</i>		
26 09 23 00-0458 EA Line Voltage, Ceiling Mount, Combination On/Off And Dimming Control Photocell (Sensor Switch CMR PC ADC).....	146.26	18.13
<i>For Low Temp/High Humidity Option, Add</i>		
<i>For Dual Zone Option, Add</i>		
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
26 09 23 00-0459 EA Line Voltage, Recessed Mount, Combination On/Off And Dimming Control Photocell (Sensor Switch RMR PC ADC).....	146.26	18.13
<i>For Low Temp/High Humidity Option, Add</i>		
<i>For Dual Zone Option, Add</i>		
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
26 09 23 00-0460 EA Line Voltage, Fixture (Box) Mount, Combination On/Off And Dimming Control Photocell (Sensor Switch CMRB PC ADC).....	146.26	18.13
<i>For Low Temp/High Humidity Option, Add</i>		
<i>For Dual Zone Option, Add</i>		
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
 26 09 23 00-0461 Occupancy Sensors (Sensor Switch nLight®) <small>(26 09 23)</small>		
<i>Note: Includes testing of new devices and certification.</i>		

26 Electrical**26 09 Instrumentation and Control for Electrical Systems****26 09 23 Lighting Control Devices**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 09 23 00-0462	Occupancy Sensors (Sensor Switch nLight®) (26 09 23 00-0461) Note: Excludes boxes.	
26 09 23 00-0463	Wall Switch Mount Occupancy Sensors (Sensor Switch nLight®) (26 09 23 00-0462)	
26 09 23 00-0464	Dual Technology, Wall Switch Mount Occupancy Sensors (Sensor Switch nLight®) (26 09 23 00-0463) Note: Includes passive infrared and microphonics detection	
26 09 23 00-0465 EA	Low Voltage, Dual Technology, Wall Switch Mount Occupancy Sensor With Raise/Lower Dim Control (Sensor Switch nLight® nWSX PDT LV DX).....	173.13 8.05
26 09 23 00-0466	360 Degree View Occupancy Sensors (Sensor Switch nLight®) (26 09 23 00-0462)	
26 09 23 00-0467	Passive Infrared, 360 Degree View Occupancy Sensors (Sensor Switch nLight®) (26 09 23 00-0466) Note: One photocell or dimming option per occupancy sensor	
26 09 23 00-0468 EA	Low Voltage, Passive Infrared, Ceiling Mount, Standard Range, 360 Degree View Occupancy Sensor (Sensor Switch nLight® nCM 9).....	208.80 18.13
26 09 23 00-0469 EA	Low Voltage, Passive Infrared, Ceiling Mount, Extended Range, 360 Degree View Occupancy Sensor (Sensor Switch nLight® nCM 10).....	208.80 18.13
26 09 23 00-0470 EA	Low Voltage, Passive Infrared, Ceiling Mount, Extended Range, 360 Degree View Occupancy Sensor With Auto Dimming Control Photocell (Sensor Switch nLight® nCM 10 ADC).....	208.80 18.13
26 09 23 00-0471	Dual Technology, 360 Degree View Occupancy Sensors (Sensor Switch nLight®) (26 09 23 00-0466) Note: One photocell or dimming option per occupancy sensor. Includes passive infrared and microphonics detection	
26 09 23 00-0472 EA	Low Voltage, Dual Technology, Ceiling Mount, Standard Range, 360 Degree View Occupancy Sensor (Sensor Switch nLight® nCM PDT 9).....	243.31 18.13
26 09 23 00-0473 EA	Low Voltage, Dual Technology, Ceiling Mount, Extended Range, 360 Degree View Occupancy Sensor (Sensor Switch nLight® nCM PDT 10).....	243.31 18.13
26 09 23 00-0474 EA	2-Channel, Low Voltage, Dual Technology, Ceiling Mount, Extended Range, 360 Degree View Occupancy Sensor (Sensor Switch nLight® nCM PDT 10 2P).....	251.93 18.13
26 09 23 00-0475	Wide View And Hallway Occupancy Sensors (Sensor Switch nLight®) (26 09 23 00-0462)	
26 09 23 00-0476	Dual Technology, Wide View And Hallway Occupancy Sensors (Sensor Switch nLight®) (26 09 23 00-0475) Note: Includes passive infrared and microphonics detection	
26 09 23 00-0477 EA	Low Voltage, Dual Technology, Corner/Ceiling Mount, Wide View Occupancy Sensor (Sensor Switch nLight® nWV PDT 16).....	243.31 18.13
26 09 23 00-0478	High Bay Occupancy Sensors (Sensor Switch nLight®) (26 09 23 00-0462)	
26 09 23 00-0479	Passive Infrared, High Bay Occupancy Sensors (Sensor Switch nLight®) (26 09 23 00-0478)	
26 09 23 00-0480 EA	Low Voltage, Passive Infrared, Fixture (Box) Mount, 360 Degree View, High Bay Occupancy Sensor (Sensor Switch nLight® nCMB 6).....	208.80 18.13
26 09 23 00-0481	Occupancy Sensor Power Packs (Sensor Switch nLight®) (26 09 23 00-0461)	
26 09 23 00-0482 EA	150mA At 15 Volt DC Output, 120-277 Volt AC Input, Standard Power Supply (Sensor Switch nLight® PS-150).....	75.36 16.11
26 09 23 00-0483 EA	250mA At 15 Volt DC Output, 120-277 Volt AC Input, Standard Power Supply (Sensor Switch nLight® PS-250).....	92.63 16.11
26 09 23 00-0484 EA	30mA/Port At 15 Volt DC Output, 120-277 Volt AC Input, Dimming Power Pack (Sensor Switch nLight® nEPP5 D KO).....	121.95 16.11
26 09 23 00-0485 EA	System Power Pack and Relay, Switching Module (Sensor Switch nLight® nPP 16).....	121.95 16.11
26 09 23 00-0486	Occupancy Sensor Accessories (Sensor Switch nLight®) (26 09 23 00-0461)	
26 09 23 00-0487 EA	RS232 AV Integrator (Sensor Switch nLight® nIO X).....	251.93 18.13
26 09 23 00-0488 EA	8 Port, Aggregation Bridge With Power Supply (Sensor Switch nLight® nBRG 8 KIT).....	338.23 18.13
26 09 23 00-0489	Daylighting Controls (Sensor Switch nLight®) (26 09 23 00-0461)	
26 09 23 00-0490 EA	Low Voltage, Ceiling Mount, Automatic Dimming Control Photocell (Sensor Switch nLight® nCM ADC).....	174.30 18.13
26 09 23 00-0491	Controls (Sensor Switch nLight®) (26 09 23 00-0461)	
26 09 23 00-0492 EA	On/Off And Raise/Lower Control, Push Button Digital Wall Switch, WallPod® Station (Sensor Switch nLight® nPODM DX).....	117.36 18.13
26 09 23 00-0493 EA	1 Scene Controller (2 Buttons), Push Button Digital Wall Switch, WallPod® Station (Sensor Switch nLight® nPODM 1SB).....	165.68 18.13
26 09 23 00-0494 EA	On/Off Push Button Digital Wall Switch, WallPod® Station (Sensor Switch nLight® nPODM).....	372.72 18.13
26 09 23 00-0495 EA	3-1/2" Screen, High Resolution Touch Screen Controller, WallPod® Station (Sensor Switch nLight® nPOD GFX).....	372.72 18.13
26 09 23 00-0496 EA	3-1/2" Screen, Touch Screen Clock And Network Interface Controller, Gateway (Sensor Switch nLight® nGWY2).....	1,373.48 18.13



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 09 23 00-0497				Occupancy Sensors (Lutron) <small>(26 09 23)</small> Note: Includes testing of new devices and certification.		
26 09 23 00-0498				Wireless Occupancy Sensors <small>(26 09 23 00-0497)</small>		
26 09 23 00-0499	EA			Wireless, Passive Infrared, Ceiling Mount, 360 Degree View Occupancy/Vacancy Sensor (Lutron® LRF2-OCR2B-P-WH)	93.99	18.13
26 09 23 00-0500	EA			Wireless, Passive Infrared, Hallway Wall Mount, Occupancy/Vacancy Sensor (Lutron® LRF2-OHLB-P-WH)	93.99	18.13
26 09 23 00-0501	EA			Wireless, Passive Infrared, Hallway Wall Mount, Vacancy Sensor (Lutron® LRF2-VHLB-P-WH)	93.99	18.13
26 09 23 00-0502	EA			Wireless, Passive Infrared, 90 Degree Corner Mount, Occupancy/Vacancy Sensor (Lutron® LRF2-OKLB-P-WH)	93.99	18.13
26 09 23 00-0503	EA			Wireless, Passive Infrared, 90 Degree Corner Mount, Vacancy Sensor (Lutron® LRF2-VKLB-P-WH)	93.99	18.13
26 09 23 00-0504	EA			Wireless, Passive Infrared, 180 Degree Wall Mount, Occupancy/Vacancy Sensor (Lutron® LRF2-OWLB-P-WH)	93.99	18.13
26 09 23 00-0505	EA			Wireless, Passive Infrared, 180 Degree Wall Mount, Vacancy Sensor (Lutron® LRF2-VWLB-P-WH)	93.99	18.13
26 09 23 00-0506	EA			Wireless, Passive Infrared, Ceiling Mount, 360 Degree View, High Bay Occupancy Sensor (Lutron® FHB140NP24V)	66.68	18.13
26 09 23 00-0507	EA			Wireless, Dual Technology, Ceiling Mount, 500 SF Coverage, 180 Degree View Occupancy Sensor (Lutron® LOS-CDT-500-WH)	137.50	18.13
26 09 23 00-0508	EA			Wireless, Dual Technology, Ceiling Mount, 500 SF Coverage, 180 Degree View Occupancy Sensor With Relay (Lutron® LOS-CDT-500R-WH)	145.93	18.13
26 09 23 00-0509	EA			Wireless, Dual Technology, Ceiling Mount, 1,000 SF Coverage, 180 Degree View Occupancy Sensor (Lutron® LOS-CDT-1000-WH)	171.10	18.13
26 09 23 00-0510	EA			Wireless, Dual Technology, Ceiling Mount, 1,000 SF Coverage, 180 Degree View Occupancy Sensor With Relay (Lutron® LOS-CDT-1000R-WH)	185.00	18.13
26 09 23 00-0511	EA			Wireless, Dual Technology, Ceiling Mount, 2,000 SF Coverage, 360 Degree View Occupancy Sensor (Lutron® LOS-CDT-2000-WH)	184.39	18.13
26 09 23 00-0512	EA			Wireless, Dual Technology, Ceiling Mount, 2,000 SF Coverage, 360 Degree View Occupancy Sensor With Relay (Lutron® LOS-CDT-2000R-WH)	196.12	18.13
26 09 23 00-0513	EA			Wireless, Passive Infrared, Ceiling Mount, 450 SF Coverage, 360 Degree View Occupancy Sensor (Lutron® LOS-CIR-450-WH)	128.75	18.13
26 09 23 00-0514	EA			Wireless, Passive Infrared, Ceiling Mount, 1,000 SF Coverage, 360 Degree View Occupancy Sensor (Lutron® LOS-CIR-1500-WH)	114.34	18.13
26 09 23 00-0515	EA			Wireless, Ultrasonic, Ceiling Mount, 500 SF Coverage, 180 Degree View Occupancy Sensor (Lutron® LOS-CUS-500-WH)	145.26	18.13
26 09 23 00-0516	EA			Wireless, Ultrasonic, Ceiling Mount, 1,000 SF Coverage, 180 Degree View Occupancy Sensor (Lutron® LOS-CUS-1000-WH)	151.14	18.13
26 09 23 00-0517	EA			Wireless, Ultrasonic, Ceiling Mount, 2,000 SF Coverage, 360 Degree View Occupancy Sensor (Lutron® LOS-CUS-2000-WH)	178.11	18.13
26 09 23 00-0518	EA			Wireless, Passive Infrared, 1,600 SF Coverage, 110 Degree Wall Mount, Occupancy Sensor (Lutron® LOS-WIR-WH)	148.61	18.13
26 09 23 00-0519				Nodes And Modules <small>(26 09 23 00-0497)</small>		
26 09 23 00-0520	EA			0 Wired Inputs, Ceiling Mount, QS Sensor Module (Lutron® QSM2-XW-C)	131.34	18.13
26 09 23 00-0521	EA			0 Wired Inputs, Junction Box Ceiling Mount, QS Sensor Module (Lutron® QSM2-XW-J)	131.34	18.13
26 09 23 00-0522	EA			4 Wired Inputs, Ceiling Mount, QS Sensor Module (Lutron® QSM2-4W-C)	169.37	18.13
26 09 23 00-0523	EA			4 Wired Inputs, Junction Box Ceiling Mount, QS Sensor Module (Lutron® QSM2-4W-J)	169.37	18.13
26 09 23 00-0524	EA			120 Volt, Gang Box Mount, 3-Wire Fluorescent Power Module (Lutron® PHPM-3F-120-WH)	228.31	20.14
26 09 23 00-0525	EA			120 Volt, Gang Box Mount, Switching Power Module (Lutron® PHPM-SW-DV-WH)	242.41	20.14
26 09 23 00-0526	EA			120 Volt, Gang Box Mount, Phase Adaptive Power Module (Lutron® PHPM-PA-120-WH)	284.46	20.14
26 09 23 00-0527	EA			120 Volt, Gang Box Mount, Phase Adaptive Power Module With 3-Wire Fluorescent Input (Lutron® PHPM-WBX-120-WH)	286.04	20.14
26 09 23 00-0528	EA			120/277 Volt, Gang Box Mount, 3-Wire Fluorescent Power Module (Lutron® PHPM-3F-DV-WH)	353.97	20.14
26 09 23 00-0529	EA			120/277 Volt, Gang Box Mount, Phase Adaptive Power Module (Lutron® PHPM-PA-DV-WH)	385.83	20.14
26 09 23 00-0530	EA			120/277 Volt, Gang Box Mount, Phase Adaptive Power Module With 3-Wire Fluorescent Input (Lutron® PHPM-WBX-DV-WH)	371.73	20.14
26 09 23 00-0531	EA			1 Circuit, Surface Mount, HP Hi-Power Dimming Module System (Lutron® HP-2)	866.69	32.23
26 09 23 00-0532	EA			2 Circuits, Surface Mount, HP Hi-Power Dimming Module System (Lutron® HP-4)	1,147.20	36.26
26 09 23 00-0533	EA			3 Circuits, Surface Mount, HP Hi-Power Dimming Module System (Lutron® HP-6)	1,432.58	40.28
26 09 23 00-0534				Other Accessories <small>(26 09 23 00-0497)</small>		
26 09 23 00-0535	EA			Pico® Wireless Control Wallplate Adapter (Lutron® PJ)	25.90	
26 09 23 00-0536	EA			Pico® Wireless Control (Lutron® PJ)	43.57	
26 09 23 00-0537	EA			4-Scene Wireless Remote Control (Lutron® GRX-IT-WH)	77.78	
26 09 23 00-0538	EA			8-Scene Wireless Remote Control (Lutron® GRX-8IT-WH)	159.81	
26 09 23 00-0539	EA			4 Button, EcoSystem® Wall Control With Raise/Lower (Lutron® CC-4BRL)	151.55	18.13
26 09 23 00-0540	EA			seeTouch® QS Wallstation (Lutron® QSWS2)	223.60	18.13
26 09 23 00-0541	EA			seeTouch® QS Wallstation With Infrared Receiver (Lutron® QSWS2)	252.42	18.13
26 09 23 00-0542	EA			120/277 Volt, Energi Savr Node™ With Softswitch®, Fixture Controller (Lutron® QSN-4S16-S)	357.32	20.14
26 09 23 00-0543	EA			120/277 Volt, Energi Savr Node™ For 0-10 V Models, Fixture Controller (Lutron® QSN-4T16-S)	472.61	20.14
26 09 23 00-0544	EA			Control Interface (Lutron® QSE-CI-NWK-E)	576.68	18.13
26 09 23 00-0545	EA			1 EcoSystem® Digital Link, Energi Savr Node™, Digital Fixture Controller (Lutron® QSN-1ECO-S)	581.22	18.13
26 09 23 00-0546	EA			2 EcoSystem® Digital Links, Energi Savr Node™, Digital Fixture Controller (Lutron® QSN-2ECO-S)	775.85	18.13
26 09 23 00-0547	MLF			5 Conductor, Non-Plenum, Low Voltage Grafik Eye Cable (Lutron® GRX-CBL-346S)	1,415.80	563.02
26 09 23 00-0548	MLF			5 Conductor, Plenum Rated, Low Voltage Grafik Eye Cable (Lutron® GRX-PCBL-346S)	1,873.65	563.02
26 09 23 00-0549				Fixture Mounted Occupancy Sensors (Leviton) <small>(26 09 23)</small> Note: Includes testing of new devices and certification.		
26 09 23 00-0550	EA			120-347 Volt, Passive Infrared, Fixture Mount, 360 Degree View, High Bay Occupancy Sensor (Leviton® OSFHU-ITW)	95.41	18.13
26 09 23 00-0551	EA			480 Volt, Passive Infrared, Fixture Mount, 360 Degree View, High Bay Occupancy Sensor (Leviton® OSFHU-14W)	104.31	18.13

26 Electrical**26 09 Instrumentation and Control for Electrical Systems****26 09 23 Lighting Control Devices**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 09 23 00-0552 EA 120-347 Volt, Passive Infrared, Fixture Mount, 360 Degree View, Cold Storage Occupancy Sensor (Leviton® OSFHU-CTW).....	100.65	18.13
26 09 23 00-0553 EA 480 Volt, Passive Infrared, Fixture Mount, 360 Degree View, Cold Storage Occupancy Sensor (Leviton® OSFHU-C4W)	111.21	18.13
26 09 23 00-0554 Wireless Enabled Communication Devices For Streetlights <small>(26 09 23)</small> Note: Includes testing of new devices and certification.		
26 09 23 00-0555 Wireless Enabled Communication Devices For Streetlights (Roam®) <small>(26 09 23 00-0554)</small>		
26 09 23 00-0556 Wireless Enabled Communication Nodes For Streetlights (Roam®) <small>(26 09 23 00-0555)</small> Note: 2.4GHz wireless enabled communication node for wireless remote on/off, group scheduling, photocontrol and diagnostics.		
26 09 23 00-0557 EA 120/244/277 Voltage, Wireless Enabled Communication Node For Streetlights (Roam® REN127 NM1).....	177.69	
26 09 23 00-0558 EA 480 Voltage, Wireless Enabled Communication Node For Streetlights (Roam® REN480 NM1).....	246.70	
26 09 23 00-0559 Wireless Enabled Communication Devices For Streetlights (Roam®) <small>(26 09 23 00-0555)</small>		
26 09 23 00-0560 EA Retrofit Receptacle Kit (Roam® DUR103)	34.48	
26 09 23 00-0561 EA Wireless Enabled Backbone And Data Backhaul Device, Gateway (Roam® REG127)	6,991.34	44.78
26 09 23 00-0562 Consoles <small>(26 09 23)</small>		
26 09 23 00-0563 EA 20" x 24" Type 12, Oil Tight Consoles, Counter Mounted.....	385.47	100.54
26 09 23 00-0564 Emergency Lighting Controls <small>(26 09 23)</small>		
26 09 23 00-0565 Emergency Lighting Control Units (Watt Stopper ELCU) <small>(26 09 23 00-0564)</small> Note: The ELCU monitors a single circuit and can be wired either as a control device, so that emergency lighting follows the control of normal lighting, or as a bypass device to shunt emergency power around a control device when normal power fails. Includes integral push-to-test button and LED indicator for emergency and normal power.		
26 09 23 00-0566 EA DIN Rail Mount, Emergency Lighting Control/Bypass Shunt Unit (Watt Stopper ELCU-100)	143.18	20.14
26 09 23 00-0567 EA 1/2" Knockout Mount, Emergency Lighting Control/Bypass Shunt Unit (Watt Stopper ELCU-200)	140.03	20.14
26 09 23 00-0568 Emergency Shunt Relays (Lighting Control & Design GR 2001™) <small>(26 09 23 00-0564)</small> Note: Normally-closed, electrically-held relay to be wired in parallel with a wall switch. Manually controlled emergency lighting will be automatically shunted on during a power outage. Includes two-gang NEMA 1 junction box, voltage-separating barrier and plaster ring separating normal and emergency power. Excludes wall plate and switch.		
26 09 23 00-0569 EA 1 Emergency Shunt Relay And NEMA 1 Enclosure (Lighting Control & Design GR 2001™)	212.27	28.20
26 09 23 00-0570 EA 2 Emergency Shunt Relays And NEMA 1 Enclosure (Lighting Control & Design GR 2001™)	287.06	32.23
26 09 23 00-0571 EA 2 Emergency Shunt Relays And NEMA 1 Enclosure (Lighting Control & Design GR 2001™ Dual)	384.24	36.26
Note: Controls normal and emergency lighting from single-pole wall switch.		
26 20 Low-Voltage Electrical Distribution <small>(26)</small>		
26 21 Low-Voltage Electrical Service Entrance <small>(26 20)</small> See CSI section 26 05 13 00-0000 for wire and cables.		
26 21 13 Low-Voltage Overhead Electrical Service Entrance <small>(26 21)</small>		
26 21 13 00-0001 Service Drop Cable And Weatherheads <small>(26 21 13)</small>		
26 21 13 00-0002 600 Volt Insulated Stranded Conductors <small>(26 21 13 00-0001)</small>		
26 21 13 00-0003 Weather Proof Conduit Hubs <small>(26 21 13 00-0002)</small>		
26 21 13 00-0004 EA 1/2" Weatherproof Conduit Hubs	37.70	14.15
26 21 13 00-0005 EA 3/4" Weatherproof Conduit Hubs	43.03	16.09
26 21 13 00-0006 EA 1" Weatherproof Conduit Hubs	50.34	18.02
26 21 13 00-0007 EA 1-1/4" Weatherproof Conduit Hubs	70.75	24.13
26 21 13 00-0008 EA 1-1/2" Weatherproof Conduit Hubs	78.06	26.06
26 21 13 00-0009 EA 2" Weatherproof Conduit Hubs	102.69	30.24
26 21 13 00-0010 EA 2-1/2" Weatherproof Conduit Hubs	137.88	34.10
26 21 13 00-0011 EA 3" Weatherproof Conduit Hubs	180.09	40.21
26 21 13 00-0012 EA 4" Weatherproof Conduit Hubs	314.06	80.44
26 21 13 00-0013 Service Entrance Cap, Threaded Weatherhead, Galvanized <small>(26 21 13 00-0002)</small>		
26 21 13 00-0014 EA 1/2" Galvanized Threaded Service Entrance Weatherhead Cap For #14 Thru #10 AWG Cable Service.....	41.43	14.15
26 21 13 00-0015 EA 3/4" Galvanized Threaded Service Entrance Weatherhead Cap For #12 Thru #8 AWG Cable Service.....	47.50	16.09
26 21 13 00-0016 EA 1" Galvanized Threaded Service Entrance Weatherhead Cap For #6 AWG Cable Service	54.34	18.02
26 21 13 00-0017 EA 1-1/4" Galvanized Threaded Service Entrance Weatherhead Cap For #4 Thru #2 AWG Cable Service.....	73.01	24.13
26 21 13 00-0018 EA 1-1/2" Galvanized Threaded Service Entrance Weatherhead Cap For #4 Thru #2 AWG Cable Service.....	82.44	26.06
26 21 13 00-0019 EA 2" Galvanized Threaded Service Entrance Weatherhead Cap For #1/0 Thru #2/0 AWG Cable Service.....	107.91	30.24
26 21 13 00-0020 EA 2-1/2" Galvanized Threaded Service Entrance Weatherhead Cap For #3/0 Thru #4/0 Cable Service	179.80	34.10



Electrical	26	26
Low-Voltage Electrical Distribution	26 20	
Low-Voltage Electrical Service Entrance	26 21	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 21	13 00-0021	EA	3" Galvanized Threaded Service Entrance Weatherhead Cap For 250 Thru 350 MCM Cable Service.....	204.82	40.21
26 21	13 00-0022	EA	4" Galvanized Threaded Service Entrance Weatherhead Cap For 600 Thru 750 MCM Cable Service.....	338.25	80.44
26 21	13 00-0023		Service Entrance Cap, Clamp-On Weatherhead, Aluminum <small>(26 21 13 00-0002)</small>		
26 21	13 00-0024	EA	1/2" Aluminum Clamp-On Service Entrance Weatherhead Cap For #14 Thru #10 AWG Cable Service.....	39.85	14.15
26 21	13 00-0025	EA	3/4" Aluminum Clamp-On Service Entrance Weatherhead Cap For #12 Thru #8 AWG Cable Service.....	45.00	16.09
26 21	13 00-0026	EA	1" Aluminum Clamp-On Service Entrance Weatherhead Cap For #6 AWG Cable Service.....	51.00	17.93
26 21	13 00-0027	EA	1-1/4" Aluminum Clamp-On Service Entrance Weatherhead Cap For #4 Thru #2 AWG Cable Service.....	67.84	24.13
26 21	13 00-0028	EA	1-1/2" Aluminum Clamp-On Service Entrance Weatherhead Cap For #4 Thru #2 AWG Cable Service.....	75.44	26.06
26 21	13 00-0029	EA	2" Aluminum Clamp-On Service Entrance Weatherhead Cap For #1/0 Thru #2/0 AWG Cable Service.....	88.83	30.24
26 21	13 00-0030	EA	2-1/2" Aluminum Clamp-On Service Entrance Weatherhead Cap For #3/0 Thru #4/0 Cable Service.....	142.17	34.10
26 21	13 00-0031	EA	3" Aluminum Clamp-On Service Entrance Weatherhead Cap For 250 Thru 350 MCM Cable Service.....	182.80	40.21
26 21	13 00-0032	EA	3-1/2" Aluminum Clamp-On Service Entrance Weatherhead Cap For 400 Thru 500 MCM Cable Service.....	258.22	60.32
26 21	13 00-0033	EA	4" Aluminum Clamp-On Service Entrance Weatherhead Cap For 600 Thru 750 MCM Cable Service.....	311.32	80.44
26 21	13 00-0034		Service Entrance Cap, Threaded Weatherhead, Polyvinyl Chloride (PVC) <small>(26 21 13 00-0002)</small>		
26 21	13 00-0035	EA	1/2" Polyvinyl Chloride (PVC) Threaded Service Entrance Weatherhead Cap For #14 Thru #10 AWG Cable Service.....	40.65	14.15
26 21	13 00-0036	EA	3/4" Polyvinyl Chloride (PVC) Threaded Service Entrance Weatherhead Cap For #12 Thru #8 AWG Cable Service.....	46.66	16.09
26 21	13 00-0037	EA	1" Polyvinyl Chloride (PVC) Threaded Service Entrance Weatherhead Cap For #6 AWG Cable Service.....	53.34	17.93
26 21	13 00-0038	EA	1-1/4" Polyvinyl Chloride (PVC) Threaded Service Entrance Weatherhead Cap For #4 Thru #2 AWG Cable Service.....	70.88	24.13
26 21	13 00-0039	EA	1-1/2" Polyvinyl Chloride (PVC) Threaded Service Entrance Weatherhead Cap For #4 Thru #2 AWG Cable Service.....	77.51	26.06
26 21	13 00-0040	EA	2" Polyvinyl Chloride (PVC) Threaded Service Entrance Weatherhead Cap For #1/0 Thru #2/0 AWG Cable Service.....	97.44	30.24
26 21	13 00-0041	EA	2-1/2" Polyvinyl Chloride (PVC) Threaded Service Entrance Weatherhead Cap For #3/0 Thru #4/0 Cable Service.....	185.81	34.10
26 21	13 00-0042	EA	3" Polyvinyl Chloride (PVC) Threaded Service Entrance Weatherhead Cap For 250 Thru 350 MCM Cable Service.....	205.44	40.21
26 21	13 00-0043	EA	3-1/2" Polyvinyl Chloride (PVC) Threaded Service Entrance Weatherhead Cap For 400 Thru 500 MCM Cable Service.....	365.22	60.32
26 21	13 00-0044	EA	4" Polyvinyl Chloride (PVC) Threaded Service Entrance Weatherhead Cap For 600 Thru 750 MCM Cable Service.....	510.16	80.44
26 22	Low-Voltage Transformers <small>(26 22)</small>				
26 22 13	Low-Voltage Distribution Transformers <small>(26 22)</small>				
26 22 13 00-0001	Single Phase General Purpose "Dry Type" Transformers <small>(26 22 13)</small>				
Note: 60 HZ type EP and EPT 115 C rise, 185 C insulation, type DT-3 and DS-3 150 C rise, 220 C insulation. Indoor Use. Wall mounted for up to 10 KVA, floor mounted for 15 KVA and larger. DT-3 and DS-3 use weathershields for outdoor placement. UL listed.					
26 22 13 00-0002	480 Volt, 120/240 Volt, General Purpose Dry Type Transformers <small>(26 22 13 00-0001)</small>				
Note: 2-2.5 Percent taps above and 4-2.5 percent taps below.					
26 22 13 00-0003	EA		1 KVA, 480 Volt - 120/240 Volt Transformer, Dry, 1 Phase, 60 Hertz, General Purpose.....	569.90	207.16
26 22 13 00-0004	EA		3 KVA, 480 Volt - 120/240 Volt Transformer, Dry, 1 Phase, 60 Hertz, General Purpose.....	734.03	248.59
26 22 13 00-0005	EA		5 KVA, 480 Volt - 120/240 Volt Transformer, Dry, 1 Phase, 60 Hertz, General Purpose.....	856.61	259.37
26 22 13 00-0006	EA		7.5 KVA, 480 Volt - 120/240 Volt Transformer, Dry, 1 Phase, 60 Hertz, General Purpose.....	980.17	269.31
26 22 13 00-0007	EA		10 KVA, 480 Volt - 120/240 Volt Transformer, Dry, 1 Phase, 60 Hertz, General Purpose.....	1,272.16	290.02
26 22 13 00-0008	EA		15 KVA, 480 Volt - 120/240 Volt Transformer, Dry, 1 Phase, 60 Hertz, General Purpose.....	1,471.11	310.74
<i>For Silicon Steel Core With High Magnetic Permeability And Low Loss, Add</i>				63.72	
<i>For Stainless Steel Core With High Magnetic Permeability And Low Loss, Add</i>				42.48	
26 22 13 00-0009	EA		25 KVA, 480 Volt - 120/240 Volt Transformer, Dry, 1 Phase, 60 Hertz, General Purpose.....	1,600.69	331.46
<i>For Silicon Steel Core With High Magnetic Permeability And Low Loss, Add</i>				70.33	
<i>For Stainless Steel Core With High Magnetic Permeability And Low Loss, Add</i>				46.89	
26 22 13 00-0010	EA		37.5 KVA, 480 Volt - 120/240 Volt Transformer, Dry, 1 Phase, 60 Hertz, General Purpose.....	1,619.98	372.89
<i>For Silicon Steel Core With High Magnetic Permeability And Low Loss, Add</i>				65.57	
<i>For Stainless Steel Core With High Magnetic Permeability And Low Loss, Add</i>				43.71	
26 22 13 00-0011	EA		50 KVA, 480 Volt - 120/240 Volt Transformer, Dry, 1 Phase, 60 Hertz, General Purpose.....	1,892.38	414.32
<i>For Silicon Steel Core With High Magnetic Permeability And Low Loss, Add</i>				79.78	
<i>For Stainless Steel Core With High Magnetic Permeability And Low Loss, Add</i>				53.19	
26 22 13 00-0012	EA		75 KVA, 480 Volt - 120/240 Volt Transformer, Dry, 1 Phase, 60 Hertz, General Purpose.....	2,436.28	497.18
<i>For Silicon Steel Core With High Magnetic Permeability And Low Loss, Add</i>				108.14	
<i>For Stainless Steel Core With High Magnetic Permeability And Low Loss, Add</i>				72.10	
26 22 13 00-0013	EA		100 KVA, 480 Volt - 120/240 Volt Transformer, Dry, 1 Phase, 60 Hertz, General Purpose.....	3,025.00	580.04
<i>For Silicon Steel Core With High Magnetic Permeability And Low Loss, Add</i>				139.87	
<i>For Stainless Steel Core With High Magnetic Permeability And Low Loss, Add</i>				93.25	
26 22 13 00-0014	EA		167 KVA, 480 Volt - 120/240 Volt Transformer, Dry, 1 Phase, 60 Hertz, General Purpose.....	4,584.85	745.77
<i>For Silicon Steel Core With High Magnetic Permeability And Low Loss, Add</i>				232.00	
<i>For Stainless Steel Core With High Magnetic Permeability And Low Loss, Add</i>				154.67	
26 22 13 00-0015	EA		250 KVA, 480 Volt - 120/240 Volt Transformer, Dry, 1 Phase, 60 Hertz, General Purpose.....	7,691.29	911.50
<i>For Silicon Steel Core With High Magnetic Permeability And Low Loss, Add</i>				440.12	
<i>For Stainless Steel Core With High Magnetic Permeability And Low Loss, Add</i>				293.42	
26 22 13 00-0016	EA		333 KVA, 480 Volt - 120/240 Volt Transformer, Dry, 1 Phase, 60 Hertz, General Purpose.....	11,539.21	1,035.79
<i>For Silicon Steel Core With High Magnetic Permeability And Low Loss, Add</i>				710.07	
<i>For Stainless Steel Core With High Magnetic Permeability And Low Loss, Add</i>				473.38	
26 22 13 00-0017	240 x 480 Volt, 120/240 Volt, General Purpose Dry Type Transformers <small>(26 22 13 00-0001)</small>				
Note: 1-10 Percent x 2-5 percent FCBN taps.					

26 Electrical**26 20 Low-Voltage Electrical Distribution****26 22 Low-Voltage Transformers**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 22 13 00-0018 EA 3 KVA, 240 x 480 Volt - 120/240 Volt Transformer, 1 Phase, 60 Hertz, General Purpose, Dry	661.62	248.59
26 22 13 00-0019 EA 5 KVA, 240 x 480 Volt - 120/240 Volt Transformer, 1 Phase, 60 Hertz, General Purpose, Dry	740.59	258.95
26 22 13 00-0020 EA 7.5 KVA, 240 x 480 Volt - 120/240 Volt Transformer, 1 Phase, 60 Hertz, General Purpose, Dry	850.48	269.31
26 22 13 00-0021 EA 10 KVA, 240 x 480 Volt - 120/240 Volt Transformer, 1 Phase, 60 Hertz, General Purpose, Dry	967.18	290.02
26 22 13 00-0022 240 x 480 Volt, 120/240 Volt, General Purpose Dry Type Transformers (26 22 13 00-0001)		
Note: 2-5 Percent x 4 - 2.5 percent FCBN taps.		
26 22 13 00-0023 EA 15 KVA, 240 x 480 Volt - 120/240 Volt Transformer, 1 Phase, 60 Hertz, General Purpose, Dry	1,471.11	310.74
26 22 13 00-0024 EA 25 KVA, 240 x 480 Volt - 120/240 Volt Transformer, 1 Phase, 60 Hertz, General Purpose, Dry	1,600.69	331.46
26 22 13 00-0025 1 Phase Mounting Brackets (26 22 13 00-0001)		
26 22 13 00-0026 EA 1 Phase Mounting Brackets (Set Of 2) For Transformers Up To 100 KVA	391.93	147.06
26 22 13 00-0027 1 Phase Weathershields (26 22 13 00-0001)		
Note: Use with types DT-3 and DS-3.		
26 22 13 00-0028 EA 37.5 KVA 1 Phase Weathershields, Set Of 2	30.61	
26 22 13 00-0029 EA 50 KVA 1 Phase Weathershields, Set Of 2	39.01	
26 22 13 00-0030 EA 75 KVA 1 Phase Weathershields, Set Of 2	46.52	
26 22 13 00-0031 EA 100 KVA 1 Phase Weathershields, Set Of 2	55.50	
26 22 13 00-0032 EA 167 KVA 1 Phase Weathershields, Set Of 2	75.09	
26 22 13 00-0033 EA 250 KVA 1 Phase Weathershields, Set Of 2	89.78	
26 22 13 00-0034 EA 333 KVA 1 Phase Weathershields, Set Of 2	110.18	
26 22 13 00-0035 Packaged Power Supply (26 22 13 00-0001)		
Note: 2-5 Percent FCBN taps.		
26 22 13 00-0036 EA 5 KVA, 480 Volt - 120/240 Volt, Transformer With 6 - 1 Pole / 3 - 2 Pole Max 20 Amp Breakers	967.87	258.95
26 22 13 00-0037 EA 7.5 KVA, 480 Volt - 120/240 Volt, Transformer With 8 - 1 Pole / 4 - 2 Pole Max 30 Amp Breakers	1,064.76	269.31
26 22 13 00-0038 EA 10 KVA, 480 Volt - 120/240 Volt, Transformer With 10 - 1 Pole / 5 - 2 Pole Max 40 Amp Breakers	1,151.55	290.02
26 22 13 00-0039 EA 15 KVA, 480 Volt - 120/240 Volt, Transformer With 16 - 1 Pole / 8 - 2 Pole Max 60 Amp Breakers	1,363.23	310.74
26 22 13 00-0040 EA 25 KVA, 480 Volt - 120/240 Volt, Transformer With 24 - 1 Pole / 12 - 2 Pole Max 100 Amp Breakers	1,769.29	331.46
26 22 13 00-0041 240 Volt, 120/240 Volt, Single Phase Isolation Transformer Computer Grade (26 22 13 00-0001)		
26 22 13 00-0042 EA 0.5 KVA, 1 Phase, 240 Volt - 120/240 Volt, Isolation Transformer	711.60	186.44
26 22 13 00-0043 EA 1 KVA, 1 Phase, 240 Volt - 120/240 Volt, Isolation Transformer	940.75	207.16
26 22 13 00-0044 EA 2.5 KVA, 1 Phase, 240 Volt - 120/240 Volt, Isolation Transformer	1,105.23	248.59
26 22 13 00-0045 EA 5 KVA, 1 Phase, 240 Volt - 120/240 Volt, Isolation Transformer	1,203.49	258.95
26 22 13 00-0046 EA 7.5 KVA, 1 Phase, 240 Volt - 120/240 Volt, Isolation Transformer	1,330.31	269.31
26 22 13 00-0047 EA 10 KVA, 1 Phase, 240 Volt - 120/240 Volt, Isolation Transformer	1,649.23	290.02
26 22 13 00-0048 EA 15 KVA, 1 Phase, 240 Volt - 120/240 Volt, Isolation Transformer	2,064.47	310.74
26 22 13 00-0049 1 Phase, 208/600 Volt, Dry General Purpose Transformer (26 22 13 00-0001)		
26 22 13 00-0050 EA 15 KVA, 208/600 Volt, Transformer, 1 Phase, 60 Hertz, General Purpose, Dry	2,458.14	310.74
26 22 13 00-0051 EA 25 KVA, 208/600 Volt, Transformer, 1 Phase, 60 Hertz, General Purpose, Dry	2,560.45	331.46
26 22 13 00-0052 EA 30 KVA, 208/600 Volt, Transformer, 1 Phase, 60 Hertz, General Purpose, Dry	2,669.24	352.17
26 22 13 00-0053 EA 37.5 KVA, 208/600 Volt, Transformer, 1 Phase, 60 Hertz, General Purpose, Dry	3,415.13	372.89
26 22 13 00-0054 EA 45 KVA, 208/600 Volt, Transformer, 1 Phase, 60 Hertz, General Purpose, Dry	3,556.00	393.60
26 22 13 00-0055 EA 50 KVA, 208/600 Volt, Transformer, 1 Phase, 60 Hertz, General Purpose, Dry	4,612.97	414.32
26 22 13 00-0056 3 Phase General Purpose "Dry Type" Transformer (26 22 13)		
Note: 60 HZ type EP and EPT 115 C rise, 185 C insulation, type DT-3 and DS-3 150 C rise, 220 C insulation. Indoor use. Wall mounted for up to 10 KVA, floor mounted for 15 KVA and larger. DT-3 and DS-3 use weathershields for outdoor placement. UL listed.		
26 22 13 00-0057 Packaged Power Supply (26 22 13 00-0056)		
Note: 2-5 Percent FCBN taps.		
26 22 13 00-0058 EA 15 KVA, 480 Volt - 208/120 Volt, Transformer With 12 - 1 Pole / 4 - 3 Pole Max, 40 Amp Breakers	3,938.34	890.78
For Stainless Steel Core With High Magnetic Permeability And Low Loss, Add	107.84	
For Silicon Steel Core With High Magnetic Permeability And Low Loss, Add	161.76	
26 22 13 00-0059 EA 22.5 KVA, 480 Volt - 208/120 Volt, Transformer With 18 - 1 Pole / 6 - 3 Pole Max, 60 Amp Breakers	4,578.57	952.93
For Stainless Steel Core With High Magnetic Permeability And Low Loss, Add	133.64	
For Silicon Steel Core With High Magnetic Permeability And Low Loss, Add	200.45	
26 22 13 00-0060 EA 30 KVA, 480 Volt - 208/120 Volt, Transformer With 24 - 1 Pole / 8 - 3 Pole Max, 80 Amp Breakers	5,350.96	1,035.79
For Stainless Steel Core With High Magnetic Permeability And Low Loss, Add	163.97	
For Silicon Steel Core With High Magnetic Permeability And Low Loss, Add	245.95	
26 22 13 00-0061 480 Volt x 208Y/120 Volt, 2-2.5 Percent FCAN And 4-2.5 Percent FCBN Taps (26 22 13 00-0056)		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 22 13 00-0062 EA 30 KVA, 480 x 208 Y / 120 Volt, Transformer, 3 Phase, 60 Hertz, General Purpose, Dry.....	2,786.23	455.75
For K13 Factor Rating, Add	1,874.73	
For Stainless Steel Core With High Magnetic Permeability And Low Loss, Add	93.74	
For K4 Factor Rating, Add	1,312.31	
For K20 Factor Rating, Add	2,437.15	
For Silicon Steel Core With High Magnetic Permeability And Low Loss, Add	140.60	
26 22 13 00-0063 EA 37.5 KVA, 480 x 208 Y / 120 Volt, Transformer, 3 Phase, 60 Hertz, General Purpose, Dry.....	3,311.63	497.18
For K13 Factor Rating, Add	2,317.27	
For Stainless Steel Core With High Magnetic Permeability And Low Loss, Add	115.86	
For K4 Factor Rating, Add	1,622.09	
For K20 Factor Rating, Add	3,012.45	
For Silicon Steel Core With High Magnetic Permeability And Low Loss, Add	173.80	
26 22 13 00-0064 EA 45 KVA, 480 x 208 Y / 120 Volt, Transformer, 3 Phase, 60 Hertz, General Purpose, Dry.....	3,480.82	538.62
For K13 Factor Rating, Add	2,403.60	
For Stainless Steel Core With High Magnetic Permeability And Low Loss, Add	120.18	
For K4 Factor Rating, Add	1,682.52	
For K20 Factor Rating, Add	3,124.68	
For Silicon Steel Core With High Magnetic Permeability And Low Loss, Add	180.27	
26 22 13 00-0065 EA 50 KVA, 480 x 208 Y / 120 Volt, Transformer, 3 Phase, 60 Hertz, General Purpose, Dry.....	4,445.27	580.04
For K13 Factor Rating, Add	3,285.18	
For Stainless Steel Core With High Magnetic Permeability And Low Loss, Add	164.26	
For K4 Factor Rating, Add	2,299.63	
For K20 Factor Rating, Add	4,270.73	
For Silicon Steel Core With High Magnetic Permeability And Low Loss, Add	246.39	
26 22 13 00-0066 EA 75 KVA, 480 x 208 Y / 120 Volt, Transformer, 3 Phase, 60 Hertz, General Purpose, Dry.....	4,432.37	621.47
For K13 Factor Rating, Add	3,189.42	
For Stainless Steel Core With High Magnetic Permeability And Low Loss, Add	159.47	
For K4 Factor Rating, Add	2,232.59	
For K20 Factor Rating, Add	4,146.25	
For Silicon Steel Core With High Magnetic Permeability And Low Loss, Add	239.21	
26 22 13 00-0067 EA 112.5 KVA, 480 x 208 Y / 120 Volt, Transformer, 3 Phase, 60 Hertz, General Purpose, Dry.....	5,489.85	745.77
For K13 Factor Rating, Add	3,998.31	
For Stainless Steel Core With High Magnetic Permeability And Low Loss, Add	199.92	
For K4 Factor Rating, Add	2,798.82	
For K20 Factor Rating, Add	5,197.80	
For Silicon Steel Core With High Magnetic Permeability And Low Loss, Add	299.87	
26 22 13 00-0068 EA 150 KVA, 480 x 208 Y / 120 Volt, Transformer, 3 Phase, 60 Hertz, General Purpose, Dry.....	6,989.63	828.63
For K13 Factor Rating, Add	5,332.36	
For Stainless Steel Core With High Magnetic Permeability And Low Loss, Add	266.62	
For K4 Factor Rating, Add	3,732.65	
For K20 Factor Rating, Add	6,932.07	
For Silicon Steel Core With High Magnetic Permeability And Low Loss, Add	399.93	
26 22 13 00-0069 EA 225 KVA, 480 x 208 Y / 120 Volt, Transformer, 3 Phase, 60 Hertz, General Purpose, Dry.....	9,439.23	1,035.79
For K13 Factor Rating, Add	7,367.65	
For Stainless Steel Core With High Magnetic Permeability And Low Loss, Add	368.38	
For K4 Factor Rating, Add	5,157.36	
For K20 Factor Rating, Add	9,577.95	
For Silicon Steel Core With High Magnetic Permeability And Low Loss, Add	552.57	
26 22 13 00-0070 EA 300 KVA, 480 x 208 Y / 120 Volt, Transformer, 3 Phase, 60 Hertz, General Purpose, Dry.....	11,527.28	1,284.38
For K13 Factor Rating, Add	8,958.51	
For Stainless Steel Core With High Magnetic Permeability And Low Loss, Add	447.93	
For K4 Factor Rating, Add	6,270.96	
For K20 Factor Rating, Add	11,646.06	
For Silicon Steel Core With High Magnetic Permeability And Low Loss, Add	671.89	
26 22 13 00-0071 EA 500 KVA, 480 x 208 Y / 120 Volt, Transformer, 3 Phase, 60 Hertz, General Purpose, Dry.....	16,267.10	1,574.41
For K13 Factor Rating, Add	13,118.29	
For Stainless Steel Core With High Magnetic Permeability And Low Loss, Add	655.91	
For K4 Factor Rating, Add	9,182.80	
For K20 Factor Rating, Add	17,053.78	
For Silicon Steel Core With High Magnetic Permeability And Low Loss, Add	983.87	
26 22 13 00-0072 EA 750 KVA, 480 x 208 Y / 120 Volt, Transformer, 3 Phase, 60 Hertz, General Purpose, Dry.....	35,810.24	1,890.12
For K13 Factor Rating, Add	31,998.52	
For Stainless Steel Core With High Magnetic Permeability And Low Loss, Add	1,599.93	
For K4 Factor Rating, Add	22,398.96	
For K20 Factor Rating, Add	41,598.08	
For Silicon Steel Core With High Magnetic Permeability And Low Loss, Add	2,399.89	
26 22 13 00-0073 EA 1,000 KVA, 480 x 208 Y / 120 Volt, Transformer, 3 Phase, 60 Hertz, General Purpose, Dry.....	46,745.04	2,071.58
For K13 Factor Rating, Add	42,601.87	
For Stainless Steel Core With High Magnetic Permeability And Low Loss, Add	2,130.09	
For K4 Factor Rating, Add	29,821.31	
For K20 Factor Rating, Add	55,382.43	
For Silicon Steel Core With High Magnetic Permeability And Low Loss, Add	3,195.14	
26 22 13 00-0074 480 Volt x 208Y/120 Volt, 2-2.5 Percent FCAN And 2-2.5 Percent FCBN		
Taps <small>(26 22 13 00-0056)</small>		
26 22 13 00-0075 EA 6 KVA, 480 x 208 Y / 120 Volt, Transformer, 3 Phase, 60 Hertz, General Purpose, Dry.....	1,611.61	321.09
For K4 Factor Rating, Add	678.59	
For K13 Factor Rating, Add	969.42	
For K20 Factor Rating, Add	1,260.25	
26 22 13 00-0076 EA 9 KVA, 480 x 208 Y / 120 Volt, Transformer, 3 Phase, 60 Hertz, General Purpose, Dry.....	1,927.44	341.81
For K4 Factor Rating, Add	870.67	
For K13 Factor Rating, Add	1,243.82	
For K20 Factor Rating, Add	1,616.97	

26 Electrical**26 20 Low-Voltage Electrical Distribution****26 22 Low-Voltage Transformers**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 22 13 00-0077	EA		15 KVA, 480 x 208 Y / 120 Volt, Transformer, 3 Phase, 60 Hertz, General Purpose, Dry.....	2,452.44	372.89
			<i>For K4 Factor Rating, Add</i>	1,194.67	
			<i>For K13 Factor Rating, Add</i>	1,706.67	
			<i>For Stainless Steel Core With High Magnetic Permeability And Low Loss, Add</i>	85.33	
			<i>For Silicon Steel Core With High Magnetic Permeability And Low Loss, Add</i>	128.00	
			<i>For K20 Factor Rating, Add</i>	2,218.67	
26 22 13 00-0078			480 Volt x 480Y/277 Volt, 2-2.5 Percent FCAN And 4 Percent FCBN Taps		
26 22 13 00-0079	EA		30 KVA, 480 x 480 Y / 277 Volt, Transformer, 3 Phase, 60 Hertz, General Purpose, Dry.....	4,480.13	455.75
			<i>For K13 Factor Rating, Add</i>	3,568.63	
			<i>For K4 Factor Rating, Add</i>	2,498.04	
			<i>For Stainless Steel Core With High Magnetic Permeability And Low Loss, Add</i>	178.43	
			<i>For Silicon Steel Core With High Magnetic Permeability And Low Loss, Add</i>	267.65	
			<i>For K20 Factor Rating, Add</i>	4,639.22	
26 22 13 00-0080	EA		45 KVA, 480 x 480 Y / 277 Volt, Transformer, 3 Phase, 60 Hertz, General Purpose, Dry.....	5,048.39	538.62
			<i>For K13 Factor Rating, Add</i>	3,971.17	
			<i>For K4 Factor Rating, Add</i>	2,779.82	
			<i>For Stainless Steel Core With High Magnetic Permeability And Low Loss, Add</i>	198.56	
			<i>For Silicon Steel Core With High Magnetic Permeability And Low Loss, Add</i>	297.84	
			<i>For K20 Factor Rating, Add</i>	5,162.52	
26 22 13 00-0081	EA		75 KVA, 480 x 480 Y / 277 Volt, Transformer, 3 Phase, 60 Hertz, General Purpose, Dry.....	7,282.63	621.47
			<i>For K13 Factor Rating, Add</i>	6,039.68	
			<i>For K4 Factor Rating, Add</i>	4,227.78	
			<i>For Stainless Steel Core With High Magnetic Permeability And Low Loss, Add</i>	301.98	
			<i>For Silicon Steel Core With High Magnetic Permeability And Low Loss, Add</i>	452.98	
			<i>For K20 Factor Rating, Add</i>	7,851.58	
26 22 13 00-0082	EA		112.5 KVA, 480 x 480 Y / 277 Volt, Transformer, 3 Phase, 60 Hertz, General Purpose, Dry.....	9,109.73	745.77
			<i>For K13 Factor Rating, Add</i>	7,618.19	
			<i>For K4 Factor Rating, Add</i>	5,332.73	
			<i>For Stainless Steel Core With High Magnetic Permeability And Low Loss, Add</i>	380.91	
			<i>For Silicon Steel Core With High Magnetic Permeability And Low Loss, Add</i>	571.36	
			<i>For K20 Factor Rating, Add</i>	9,903.65	
26 22 13 00-0083	EA		150 KVA, 480 x 480 Y / 277 Volt, Transformer, 3 Phase, 60 Hertz, General Purpose, Dry.....	10,905.24	828.63
			<i>For K13 Factor Rating, Add</i>	9,247.97	
			<i>For K4 Factor Rating, Add</i>	6,473.58	
			<i>For Stainless Steel Core With High Magnetic Permeability And Low Loss, Add</i>	462.40	
			<i>For Silicon Steel Core With High Magnetic Permeability And Low Loss, Add</i>	693.60	
			<i>For K20 Factor Rating, Add</i>	12,022.36	
26 22 13 00-0084	EA		225 KVA, 480 x 480 Y / 277 Volt, Transformer, 3 Phase, 60 Hertz, General Purpose, Dry.....	13,953.43	1,035.79
			<i>For K13 Factor Rating, Add</i>	11,881.85	
			<i>For K4 Factor Rating, Add</i>	8,317.30	
			<i>For Stainless Steel Core With High Magnetic Permeability And Low Loss, Add</i>	594.09	
			<i>For Silicon Steel Core With High Magnetic Permeability And Low Loss, Add</i>	891.14	
			<i>For K20 Factor Rating, Add</i>	15,446.41	
26 22 13 00-0085	EA		300 KVA, 480 x 480 Y / 277 Volt, Transformer, 3 Phase, 60 Hertz, General Purpose, Dry.....	16,989.51	1,284.38
			<i>For K13 Factor Rating, Add</i>	14,420.74	
			<i>For K4 Factor Rating, Add</i>	10,094.52	
			<i>For Stainless Steel Core With High Magnetic Permeability And Low Loss, Add</i>	721.04	
			<i>For Silicon Steel Core With High Magnetic Permeability And Low Loss, Add</i>	1,081.56	
			<i>For K20 Factor Rating, Add</i>	18,746.96	
26 22 13 00-0086	EA		500 KVA, 480 x 480 Y / 277 Volt, Transformer, 3 Phase, 60 Hertz, General Purpose, Dry.....	26,834.11	1,574.41
			<i>For K13 Factor Rating, Add</i>	23,685.30	
			<i>For K4 Factor Rating, Add</i>	16,579.71	
			<i>For Stainless Steel Core With High Magnetic Permeability And Low Loss, Add</i>	1,184.27	
			<i>For Silicon Steel Core With High Magnetic Permeability And Low Loss, Add</i>	1,776.40	
			<i>For K20 Factor Rating, Add</i>	30,790.89	
26 22 13 00-0087			3 Phase 60 Hz K20 Dry Type Transformers <small>(26 22 13 00-0056)</small>		
26 22 13 00-0088			3 Phase 60 Hz K20 Dry Type Transformers, 115 C Rise <small>(26 22 13 00-0087)</small>		
			Note: 220 C insulation 480 V-208 Y/120 V. 2-2.5 Percent above and 4-2.5 percent taps below.		
26 22 13 00-0089	EA		15 KVA, 480 Volt - 208 Y / 120 Volt Transformer, 3 Phase, 60 Hertz, K20.....	2,315.24	372.89
26 22 13 00-0090	EA		30 KVA, 480 Volt - 208 Y / 120 Volt Transformer, 3 Phase, 60 Hertz, K20.....	3,397.63	455.75
26 22 13 00-0091	EA		45 KVA, 480 Volt - 208 Y / 120 Volt Transformer, 3 Phase, 60 Hertz, K20.....	4,862.95	538.62
26 22 13 00-0092	EA		75 KVA, 480 Volt - 208 Y / 120 Volt Transformer, 3 Phase, 60 Hertz, K20.....	6,150.37	621.47
26 22 13 00-0093	EA		112.5 KVA, 480 Volt - 208 Y / 120 Volt Transformer, 3 Phase, 60 Hertz, K20.....	9,061.49	745.77
26 22 13 00-0094	EA		150 KVA, 480 Volt - 208 Y / 120 Volt Transformer, 3 Phase, 60 Hertz, K20.....	10,947.45	828.63
26 22 13 00-0095	EA		225 KVA, 480 Volt - 208 Y / 120 Volt Transformer, 3 Phase, 60 Hertz, K20.....	12,800.07	1,035.79
26 22 13 00-0096	EA		300 KVA, 480 Volt - 208 Y / 120 Volt Transformer, 3 Phase, 60 Hertz, K20.....	19,988.24	1,284.38
26 22 13 00-0097			3 Phase 60 Hz K20 Dry Type Transformers, 80 C Rise <small>(26 22 13 00-0087)</small>		
			Note: 220 C insulation 480 V-208 Y/120 V. 2-2.5 Percent above and 4-2.5 percent taps below.		
26 22 13 00-0098	EA		15 KVA, 480 Volt - 208 Y / 120 Volt Transformer, 3 Phase, 60 Hertz, K20.....	2,630.34	372.89
26 22 13 00-0099	EA		30 KVA, 480 Volt - 208 Y / 120 Volt Transformer, 3 Phase, 60 Hertz, K20.....	3,895.15	455.75
26 22 13 00-0100	EA		45 KVA, 480 Volt - 208 Y / 120 Volt Transformer, 3 Phase, 60 Hertz, K20.....	5,619.79	538.62
26 22 13 00-0101	EA		75 KVA, 480 Volt - 208 Y / 120 Volt Transformer, 3 Phase, 60 Hertz, K20.....	7,130.35	621.47
26 22 13 00-0102	EA		112.5 KVA, 480 Volt - 208 Y / 120 Volt Transformer, 3 Phase, 60 Hertz, K20.....	10,575.18	745.77
26 22 13 00-0103	EA		150 KVA, 480 Volt - 208 Y / 120 Volt Transformer, 3 Phase, 60 Hertz, K20.....	12,806.40	828.63
26 22 13 00-0104	EA		225 KVA, 480 Volt - 208 Y / 120 Volt Transformer, 3 Phase, 60 Hertz, K20.....	14,945.47	1,035.79
26 22 13 00-0105	EA		300 KVA, 480 Volt - 208 Y / 120 Volt Transformer, 3 Phase, 60 Hertz, K20.....	23,472.44	1,284.38



		MINOR CSI UOM DESCRIPTION		TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 22 13 00-0106		NEMA Premium Efficient Dry Type Transformers <small>(26 22 13 00-0056)</small>			
26 22 13 00-0107		Aluminum Windings, NEMA Premium Efficient Dry Type Transformers <small>(26 22 13 00-0106)</small>			
		Note: Two taps at 2.5%, four at -2.5%.			
26 22 13 00-0108		150 Degree C Temperature Rise, Aluminum Windings, NEMA Premium Efficient Dry Type Transformers <small>(26 22 13 00-0107)</small>			
26 22 13 00-0109	EA	15 kVA, 480 Volt Delta 208Y/120 Volt, 3 Phase, K-1, NEMA 2 Enclosure, 150 Degree C Temperature Rise, Aluminum Windings, NEMA Premium Efficient Dry Type Transformer.....	2,996.53		369.81
26 22 13 00-0110	EA	30 kVA, 480 Volt Delta 208Y/120 Volt, 3 Phase, K-1, NEMA 2 Enclosure, 150 Degree C Temperature Rise, Aluminum Windings, NEMA Premium Efficient Dry Type Transformer.....	3,654.88		451.98
26 22 13 00-0111	EA	45 kVA, 480 Volt Delta 208Y/120 Volt, 3 Phase, K-1, NEMA 2 Enclosure, 150 Degree C Temperature Rise, Aluminum Windings, NEMA Premium Efficient Dry Type Transformer.....	4,410.99		534.16
26 22 13 00-0112	EA	75 kVA, 480 Volt Delta 208Y/120 Volt, 3 Phase, K-1, NEMA 2 Enclosure, 150 Degree C Temperature Rise, Aluminum Windings, NEMA Premium Efficient Dry Type Transformer.....	5,969.08		616.35
26 22 13 00-0113	EA	112.5 kVA, 480 Volt Delta 208Y/120 Volt, 3 Phase, K-1, NEMA 2 Enclosure, 150 Degree C Temperature Rise, Aluminum Windings, NEMA Premium Efficient Dry Type Transformer.....	8,025.17		739.61
26 22 13 00-0114	EA	150 kVA, 480 Volt Delta 208Y/120 Volt, 3 Phase, K-1, NEMA 2 Enclosure, 150 Degree C Temperature Rise, Aluminum Windings, NEMA Premium Efficient Dry Type Transformer.....	10,028.81		821.79
26 22 13 00-0115	EA	225 kVA, 480 Volt Delta 208Y/120 Volt, 3 Phase, K-1, NEMA 2 Enclosure, 150 Degree C Temperature Rise, Aluminum Windings, NEMA Premium Efficient Dry Type Transformer.....	13,325.40		1,027.24
26 22 13 00-0116	EA	300 kVA, 480 Volt Delta 208Y/120 Volt, 3 Phase, K-1, NEMA 2 Enclosure, 150 Degree C Temperature Rise, Aluminum Windings, NEMA Premium Efficient Dry Type Transformer.....	18,838.17		1,273.78
26 22 13 00-0117		115 Degree C Temperature Rise, Aluminum Windings, NEMA Premium Efficient Dry Type Transformers <small>(26 22 13 00-0107)</small>			
26 22 13 00-0118	EA	15 kVA, 480 Volt Delta 208Y/120 Volt, 3 Phase, K-1, NEMA 2 Enclosure, 115 Degree C Temperature Rise, Aluminum Windings, NEMA Premium Efficient Dry Type Transformer.....	3,675.58		369.81
26 22 13 00-0119	EA	30 kVA, 480 Volt Delta 208Y/120 Volt, 3 Phase, K-1, NEMA 2 Enclosure, 115 Degree C Temperature Rise, Aluminum Windings, NEMA Premium Efficient Dry Type Transformer.....	4,477.40		451.98
26 22 13 00-0120	EA	45 kVA, 480 Volt Delta 208Y/120 Volt, 3 Phase, K-1, NEMA 2 Enclosure, 115 Degree C Temperature Rise, Aluminum Windings, NEMA Premium Efficient Dry Type Transformer.....	5,414.02		534.16
26 22 13 00-0121	EA	75 kVA, 480 Volt Delta 208Y/120 Volt, 3 Phase, K-1, NEMA 2 Enclosure, 115 Degree C Temperature Rise, Aluminum Windings, NEMA Premium Efficient Dry Type Transformer.....	7,390.23		616.35
26 22 13 00-0122	EA	112.5 kVA, 480 Volt Delta 208Y/120 Volt, 3 Phase, K-1, NEMA 2 Enclosure, 115 Degree C Temperature Rise, Aluminum Windings, NEMA Premium Efficient Dry Type Transformer.....	9,492.01		739.61
26 22 13 00-0123	EA	150 kVA, 480 Volt Delta 208Y/120 Volt, 3 Phase, K-1, NEMA 2 Enclosure, 115 Degree C Temperature Rise, Aluminum Windings, NEMA Premium Efficient Dry Type Transformer.....	12,544.37		821.79
26 22 13 00-0124	EA	225 kVA, 480 Volt Delta 208Y/120 Volt, 3 Phase, K-1, NEMA 2 Enclosure, 115 Degree C Temperature Rise, Aluminum Windings, NEMA Premium Efficient Dry Type Transformer.....	16,706.90		1,027.24
26 22 13 00-0125	EA	300 kVA, 480 Volt Delta 208Y/120 Volt, 3 Phase, K-1, NEMA 2 Enclosure, 115 Degree C Temperature Rise, Aluminum Windings, NEMA Premium Efficient Dry Type Transformer.....	23,725.36		1,273.78
26 22 13 00-0126		80 Degree C Temperature Rise, Aluminum Windings, NEMA Premium Efficient Dry Type Transformers <small>(26 22 13 00-0107)</small>			
26 22 13 00-0127	EA	15 kVA, 480 Volt Delta 208Y/120 Volt, 3 Phase, K-1, NEMA 2 Enclosure, 80 Degree C Temperature Rise, Aluminum Windings, NEMA Premium Efficient Dry Type Transformer.....	4,351.88		369.81
26 22 13 00-0128	EA	30 kVA, 480 Volt Delta 208Y/120 Volt, 3 Phase, K-1, NEMA 2 Enclosure, 80 Degree C Temperature Rise, Aluminum Windings, NEMA Premium Efficient Dry Type Transformer.....	5,302.22		451.98
26 22 13 00-0129	EA	45 kVA, 480 Volt Delta 208Y/120 Volt, 3 Phase, K-1, NEMA 2 Enclosure, 80 Degree C Temperature Rise, Aluminum Windings, NEMA Premium Efficient Dry Type Transformer.....	6,417.05		534.16
26 22 13 00-0130	EA	75 kVA, 480 Volt Delta 208Y/120 Volt, 3 Phase, K-1, NEMA 2 Enclosure, 80 Degree C Temperature Rise, Aluminum Windings, NEMA Premium Efficient Dry Type Transformer.....	8,809.09		616.35
26 22 13 00-0131	EA	112.5 kVA, 480 Volt Delta 208Y/120 Volt, 3 Phase, K-1, NEMA 2 Enclosure, 80 Degree C Temperature Rise, Aluminum Windings, NEMA Premium Efficient Dry Type Transformer.....	11,342.70		739.61
26 22 13 00-0132	EA	150 kVA, 480 Volt Delta 208Y/120 Volt, 3 Phase, K-1, NEMA 2 Enclosure, 80 Degree C Temperature Rise, Aluminum Windings, NEMA Premium Efficient Dry Type Transformer.....	15,059.93		821.79
26 22 13 00-0133	EA	225 kVA, 480 Volt Delta 208Y/120 Volt, 3 Phase, K-1, NEMA 2 Enclosure, 80 Degree C Temperature Rise, Aluminum Windings, NEMA Premium Efficient Dry Type Transformer.....	20,088.41		1,027.24
26 22 13 00-0134	EA	300 kVA, 480 Volt Delta 208Y/120 Volt, 3 Phase, K-1, NEMA 2 Enclosure, 80 Degree C Temperature Rise, Aluminum Windings, NEMA Premium Efficient Dry Type Transformer.....	28,612.55		1,273.78
26 22 13 00-0135		Copper Windings, NEMA Premium Efficient Dry Type Transformers <small>(26 22 13 00-0106)</small>			
		Note: Two taps at 2.5%, four at -2.5%.			
26 22 13 00-0136		150 Degree C Temperature Rise, Copper Windings, NEMA Premium Efficient Dry Type Transformers <small>(26 22 13 00-0135)</small>			
26 22 13 00-0137	EA	15 kVA, 480 Volt Delta 208Y/120 Volt, 3 Phase K-1, NEMA 2 Enclosure, 150 Degree C Temperature Rise, Copper Windings, NEMA Premium Efficient Dry Type Transformer.....	4,125.68		369.81
26 22 13 00-0138	EA	30 kVA, 480 Volt Delta 208Y/120 Volt, 3 Phase K-1, NEMA 2 Enclosure, 150 Degree C Temperature Rise, Copper Windings, NEMA Premium Efficient Dry Type Transformer.....	5,028.04		451.98
26 22 13 00-0139	EA	45 kVA, 480 Volt Delta 208Y/120 Volt, 3 Phase K-1, NEMA 2 Enclosure, 150 Degree C Temperature Rise, Copper Windings, NEMA Premium Efficient Dry Type Transformer.....	6,081.18		534.16
26 22 13 00-0140	EA	75 kVA, 480 Volt Delta 208Y/120 Volt, 3 Phase K-1, NEMA 2 Enclosure, 150 Degree C Temperature Rise, Copper Windings, NEMA Premium Efficient Dry Type Transformer.....	8,336.13		616.35
26 22 13 00-0141	EA	112.5 kVA, 480 Volt Delta 208Y/120 Volt, 3 Phase K-1, NEMA 2 Enclosure, 150 Degree C Temperature Rise, Copper Windings, NEMA Premium Efficient Dry Type Transformer.....	11,370.12		739.61

26 Electrical**26 20 Low-Voltage Electrical Distribution****26 22 Low-Voltage Transformers**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 22 13 00-0142	EA		150 kVA, 480 Volt Delta 208Y/120 Volt, 3 Phase K-1, NEMA 2 Enclosure, 150 Degree C Temperature Rise, Copper Windings, NEMA Premium Efficient Dry Type Transformer.....	14,308.24	821.79
26 22 13 00-0143	EA		225 kVA, 480 Volt Delta 208Y/120 Volt, 3 Phase K-1, NEMA 2 Enclosure, 150 Degree C Temperature Rise, Copper Windings, NEMA Premium Efficient Dry Type Transformer.....	19,076.24	1,027.24
26 22 13 00-0144	EA		300 kVA, 480 Volt Delta 208Y/120 Volt, 3 Phase K-1, NEMA 2 Enclosure, 150 Degree C Temperature Rise, Copper Windings, NEMA Premium Efficient Dry Type Transformer.....	27,152.56	1,273.78
26 22 13 00-0145			115 Degree C Temperature Rise, Copper Windings, NEMA Premium Efficient Dry Type Transformers <small>(26 22 13 00-0135)</small>		
26 22 13 00-0146	EA		15 kVA, 480 Volt Delta 208Y/120 Volt, 3 Phase K-1, NEMA 2 Enclosure, 115 Degree C Temperature Rise, Copper Windings, NEMA Premium Efficient Dry Type Transformer.....	4,801.99	369.81
26 22 13 00-0147	EA		30 kVA, 480 Volt Delta 208Y/120 Volt, 3 Phase K-1, NEMA 2 Enclosure, 115 Degree C Temperature Rise, Copper Windings, NEMA Premium Efficient Dry Type Transformer.....	5,852.86	451.98
26 22 13 00-0148	EA		45 kVA, 480 Volt Delta 208Y/120 Volt, 3 Phase K-1, NEMA 2 Enclosure, 115 Degree C Temperature Rise, Copper Windings, NEMA Premium Efficient Dry Type Transformer.....	7,084.21	534.16
26 22 13 00-0149	EA		75 kVA, 480 Volt Delta 208Y/120 Volt, 3 Phase K-1, NEMA 2 Enclosure, 115 Degree C Temperature Rise, Copper Windings, NEMA Premium Efficient Dry Type Transformer.....	9,757.28	616.35
26 22 13 00-0150	EA		112.5 kVA, 480 Volt Delta 208Y/120 Volt, 3 Phase K-1, NEMA 2 Enclosure, 115 Degree C Temperature Rise, Copper Windings, NEMA Premium Efficient Dry Type Transformer.....	14,970.96	739.61
26 22 13 00-0151	EA		150 kVA, 480 Volt Delta 208Y/120 Volt, 3 Phase K-1, NEMA 2 Enclosure, 115 Degree C Temperature Rise, Copper Windings, NEMA Premium Efficient Dry Type Transformer.....	18,937.24	821.79
26 22 13 00-0152	EA		225 kVA, 480 Volt Delta 208Y/120 Volt, 3 Phase K-1, NEMA 2 Enclosure, 115 Degree C Temperature Rise, Copper Windings, NEMA Premium Efficient Dry Type Transformer.....	24,185.06	1,027.24
26 22 13 00-0153	EA		300 kVA, 480 Volt Delta 208Y/120 Volt, 3 Phase K-1, NEMA 2 Enclosure, 115 Degree C Temperature Rise, Copper Windings, NEMA Premium Efficient Dry Type Transformer.....	36,175.24	1,273.78
26 22 13 00-0154			80 Degree C Temperature Rise, Copper Windings, NEMA Premium Efficient Dry Type Transformers <small>(26 22 13 00-0135)</small>		
26 22 13 00-0155	EA		15 kVA, 480 Volt Delta 208Y/120 Volt, 3 Phase K-1, NEMA 2 Enclosure, 80 Degree C Temperature Rise, Copper Windings, NEMA Premium Efficient Dry Type Transformer.....	5,480.57	369.81
26 22 13 00-0156	EA		30 kVA, 480 Volt Delta 208Y/120 Volt, 3 Phase K-1, NEMA 2 Enclosure, 80 Degree C Temperature Rise, Copper Windings, NEMA Premium Efficient Dry Type Transformer.....	6,677.67	451.98
26 22 13 00-0157	EA		45 kVA, 480 Volt Delta 208Y/120 Volt, 3 Phase K-1, NEMA 2 Enclosure, 80 Degree C Temperature Rise, Copper Windings, NEMA Premium Efficient Dry Type Transformer.....	8,087.23	534.16
26 22 13 00-0158	EA		75 kVA, 480 Volt Delta 208Y/120 Volt, 3 Phase K-1, NEMA 2 Enclosure, 80 Degree C Temperature Rise, Copper Windings, NEMA Premium Efficient Dry Type Transformer.....	11,176.14	616.35
26 22 13 00-0159	EA		112.5 kVA, 480 Volt Delta 208Y/120 Volt, 3 Phase K-1, NEMA 2 Enclosure, 80 Degree C Temperature Rise, Copper Windings, NEMA Premium Efficient Dry Type Transformer.....	17,863.52	739.61
26 22 13 00-0160	EA		150 kVA, 480 Volt Delta 208Y/120 Volt, 3 Phase K-1, NEMA 2 Enclosure, 80 Degree C Temperature Rise, Copper Windings, NEMA Premium Efficient Dry Type Transformer.....	23,134.42	821.79
26 22 13 00-0161	EA		225 kVA, 480 Volt Delta 208Y/120 Volt, 3 Phase K-1, NEMA 2 Enclosure, 80 Degree C Temperature Rise, Copper Windings, NEMA Premium Efficient Dry Type Transformer.....	29,291.58	1,027.24
26 22 13 00-0162	EA		300 kVA, 480 Volt Delta 208Y/120 Volt, 3 Phase K-1, NEMA 2 Enclosure, 80 Degree C Temperature Rise, Copper Windings, NEMA Premium Efficient Dry Type Transformer.....	43,381.49	1,273.78
26 22 13 00-0163			3 Phase Weathershields <small>(26 22 13 00-0056)</small> Note: Use with type DT-3 and DS-3.		
26 22 13 00-0164	EA		45-112.5 KVA 3 Phase Weathershields With DT-3, DS-3, Set Of 2.....	414.61	
26 22 13 00-0165	EA		150-300 KVA 3 Phase Weathershields With DT-3, DS-3, Set Of 2.....	704.08	
26 22 13 00-0166	EA		500-1,000 KVA 3 Phase Weathershields With DT-3, DS-3, Set Of 2.....	704.08	
26 22 13 00-0167			Three Phase Mounting Brackets <small>(26 22 13 00-0056)</small>		
26 22 13 00-0168	EA		3 Phase Mounting Brackets (Set Of 2) For Transformers Up To 112.5 KVA.....	515.45	147.06
26 24			Switchboards And Panelboards <small>(26 20)</small>		
26 24 13			Switchboards <small>(26 24)</small> Note: Installation of free-standing building distribution switchboards. Switchboard sections to be mounted on 4" concrete pad. Includes material, handling, unloading at job site, assembly and installation, wiring connections, testing and cleanup. Exclude concrete pad and foundation.		
26 24 13 00-0001			Fusible Switch Type 240 Volt, 3 Phase, 3 Wire <small>(26 24 13)</small>		
26 24 13 00-0002			Incoming Service Section Main Device Only <small>(26 24 13 00-0001)</small> Note: Copper bus, non-metering type, with fuses.		
26 24 13 00-0003	EA		400 Amp Distribution Switchboard With Main Switch, 240 Volt, 3 Phase, 4 Wire.....	3,165.99	703.53
26 24 13 00-0004	EA		600 Amp Distribution Switchboard With Main Switch, 240 Volt, 3 Phase, 4 Wire.....	3,520.63	744.15
26 24 13 00-0005	EA		800 Amp Distribution Switchboard With Main Switch, 240 Volt, 3 Phase, 4 Wire.....	5,859.99	844.13
26 24 13 00-0006	EA		1,200 Amp Distribution Switchboard With Main Switch, 240 Volt, 3 Phase, 4 Wire.....	6,314.57	904.93
26 24 13 00-0007	EA		1,600 Amp Distribution Switchboard With Main Switch, 240 Volt, 3 Phase, 4 Wire.....	10,368.41	964.85
26 24 13 00-0008	EA		2,000 Amp Distribution Switchboard With Main Switch, 240 Volt, 3 Phase, 4 Wire.....	11,587.06	1,025.90
26 24 13 00-0009	EA		400 Amp Distribution Switchboard With MC Main Breaker, 240 Volt, 3 Phase, 4 Wire.....	3,905.00	703.53
26 24 13 00-0010	EA		600 Amp Distribution Switchboard With MC Main Breaker, 240 Volt, 3 Phase, 4 Wire.....	5,078.11	744.15
26 24 13 00-0011	EA		800 Amp Distribution Switchboard With MC Main Breaker, 240 Volt, 3 Phase, 4 Wire.....	7,171.63	844.85
26 24 13 00-0012	EA		1,200 Amp Distribution Switchboard With MC Main Breaker, 240 Volt, 3 Phase, 4 Wire.....	9,931.69	904.93
26 24 13 00-0013	EA		1,600 Amp Distribution Switchboard With MC Main Breaker, 240 Volt, 3 Phase, 4 Wire.....	10,368.41	965.82
26 24 13 00-0014	EA		2,000 Amp Distribution Switchboard With MC Main Breaker, 240 Volt, 3 Phase, 4 Wire.....	11,587.06	1,025.90
26 24 13 00-0015	EA		2,500 Amp Distribution Switchboard With MC Main Breaker, 240 Volt, 3 Phase, 4 Wire.....	14,004.96	1,072.55



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 24 13 00-0016 EA 3,000 Amp Distribution Switchboard With MC Main Breaker, 240 Volt, 3 Phase, 4 Wire	15,904.03	1,149.04
26 24 13 00-0017 EA 4,000 Amp Distribution Switchboard With MC Main Breaker, 240 Volt, 3 Phase, 4 Wire	18,832.79	1,238.64
26 24 13 00-0018 EA 400 Amp Distribution Switchboard With Main Lug, 240 Volt, 3 Phase, 4 Wire.....	2,077.89	623.34
26 24 13 00-0019 EA 600 Amp Distribution Switchboard With Main Lug, 240 Volt, 3 Phase, 4 Wire.....	2,309.23	663.64
26 24 13 00-0020 EA 800 Amp Distribution Switchboard With Main Lug, 240 Volt, 3 Phase, 4 Wire.....	2,643.09	763.93
26 24 13 00-0021 EA 1,000 Amp Distribution Switchboard With Main Lug, 240 Volt, 3 Phase, 4 Wire.....	2,861.03	796.03
26 24 13 00-0022 EA 1,200 Amp Distribution Switchboard With Main Lug, 240 Volt, 3 Phase, 4 Wire.....	3,058.76	824.74
26 24 13 00-0023 EA 1,600 Amp Distribution Switchboard With Main Lug, 240 Volt, 3 Phase, 4 Wire.....	3,361.79	884.26
26 24 13 00-0024 EA 2,000 Amp Distribution Switchboard With Main Lug, 240 Volt, 3 Phase, 4 Wire.....	3,637.32	944.91
26 24 13 00-0025 Branch Breaker Units <small>(26 24 13 00-0001)</small>		
Note: Includes branch breaker(s) and portion of distribution section occupied by that breaker. 240 V, 3 pole. Use upper range to determine breaker unless designing for future expansion.		
26 24 13 00-0026 EA 15 - 60 Amp MC Branch Breaker, 240 Volt.....	288.90	24.53
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
	14.72	
26 24 13 00-0027 EA 70 - 100 Amp MC Branch Breaker, 240 Volt.....	421.98	38.61
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
	23.16	
26 24 13 00-0028 EA 125 - 225 Amp MC Branch Breaker, 240 Volt.....	1,149.59	70.38
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
	42.23	
26 24 13 00-0029 EA 100 - 400 Amp MC Branch Breaker, 240 Volt.....	2,057.15	91.69
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
	55.01	
26 24 13 00-0030 EA 300 - 600 Amp MC Branch Breaker, 240 Volt.....	3,634.25	225.21
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
	135.10	
26 24 13 00-0031 EA 400 - 800 Amp MC Branch Breaker, 240 Volt.....	5,884.28	225.21
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
	135.10	
26 24 13 00-0032 EA 600 - 1,200 Amp MC Branch Breaker, 240 Volt.....	9,522.49	401.36
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
	240.81	
26 24 13 00-0033 Fusible Switch Type 480 Volt, 3 Phase, 3 Wire <small>(26 24 13)</small>		
26 24 13 00-0034 Incoming Service Section Main Device Only <small>(26 24 13 00-0033)</small>		
Note: Copper bus, non-metering type, with fuses.		
26 24 13 00-0035 EA 400 Amp Distribution Switchboard With Main Switch, 480 Volt, 3 Phase, 3 Wire.....	4,497.89	912.90
26 24 13 00-0036 EA 600 Amp Distribution Switchboard With Main Switch, 480 Volt, 3 Phase, 3 Wire.....	5,047.65	912.90
26 24 13 00-0037 EA 800 Amp Distribution Switchboard With Main Switch, 480 Volt, 3 Phase, 3 Wire.....	7,664.20	1,186.36
26 24 13 00-0038 EA 1,200 Amp Distribution Switchboard With Main Switch, 480 Volt, 3 Phase, 3 Wire.....	8,718.77	1,186.36
26 24 13 00-0039 Fusible Switch Type 120/240 Volt, 1 Phase, 3 Wire <small>(26 24 13)</small>		
26 24 13 00-0040 Incoming Service Section Main Device Only <small>(26 24 13 00-0039)</small>		
Note: Copper bus, non-metering type, with fuses.		
26 24 13 00-0041 EA 200/400 Amp Distribution Switchboard With Main Switch, 120 / 240 Volt, 1 Phase, 3 Wire.....	2,853.55	623.34
26 24 13 00-0042 EA 600 Amp Distribution Switchboard With Main Switch, 120 / 240 Volt, 1 Phase, 3 Wire.....	3,192.03	663.64
26 24 13 00-0043 EA 800 Amp Distribution Switchboard With Main Switch, 120 / 240 Volt, 1 Phase, 3 Wire.....	5,013.15	763.93
26 24 13 00-0044 EA 1,200 Amp Distribution Switchboard With Main Switch, 120 / 240 Volt, 1 Phase, 3 Wire.....	5,449.69	824.10
26 24 13 00-0045 EA 200/400 Amp Distribution Switchboard With MC Main Breaker, 120 / 240 Volt, 1 Phase, 3 Wire.....	3,555.09	623.34
26 24 13 00-0046 EA 600 Amp Distribution Switchboard With MC Main Breaker, 120 / 240 Volt, 1 Phase, 3 Wire.....	4,550.14	663.64
26 24 13 00-0047 EA 800 Amp Distribution Switchboard With MC Main Breaker, 120 / 240 Volt, 1 Phase, 3 Wire.....	6,470.20	763.93
26 24 13 00-0048 EA 1,200 Amp Distribution Switchboard With MC Main Breaker, 120 / 240 Volt, 1 Phase, 3 Wire.....	9,423.58	824.10
26 24 13 00-0049 EA 2,000 Amp Distribution Switchboard With MC Main Breaker, 120 / 240 Volt, 1 Phase, 3 Wire.....	11,083.79	924.96
26 24 13 00-0050 EA 200/400 Amp Distribution Switchboard With Main Lug, 120 / 240 Volt, 1 Phase, 3 Wire.....	1,946.17	542.83
26 24 13 00-0051 EA 600 Amp Distribution Switchboard With Main Lug, 120 / 240 Volt, 1 Phase, 3 Wire.....	2,193.18	583.20
26 24 13 00-0052 EA 800 Amp Distribution Switchboard With Main Lug, 120 / 240 Volt, 1 Phase, 3 Wire.....	2,575.16	683.51
26 24 13 00-0053 EA 1,000 Amp Distribution Switchboard With Main Lug, 120 / 240 Volt, 1 Phase, 3 Wire.....	2,781.77	715.60
26 24 13 00-0054 EA 1,200 Amp Distribution Switchboard With Main Lug, 120 / 240 Volt, 1 Phase, 3 Wire.....	2,982.88	744.15
26 24 13 00-0055 EA 1,600 Amp Distribution Switchboard With Main Lug, 120 / 240 Volt, 1 Phase, 3 Wire.....	3,242.49	796.03
26 24 13 00-0056 EA 2,000 Amp Distribution Switchboard With Main Lug, 120 / 240 Volt, 1 Phase, 3 Wire.....	3,497.62	844.13
26 24 13 00-0057 EA 2,500 Amp Distribution Switchboard With Main Lug, 120 / 240 Volt, 1 Phase, 3 Wire.....	4,343.05	1,045.60
26 24 13 00-0058 EA 3,000 Amp Distribution Switchboard With Main Lug, 120 / 240 Volt, 1 Phase, 3 Wire.....	4,872.59	1,146.14
26 24 13 00-0059 EA 4,000 Amp Distribution Switchboard With Main Lug, 120 / 240 Volt, 1 Phase, 3 Wire.....	5,787.78	1,236.63
26 24 13 00-0060 Branch Breaker Units <small>(26 24 13 00-0039)</small>		
Note: Includes branch breaker(s) and portion of distribution section occupied by that breaker. 240 V, 2 pole. Use upper range to determine breaker unless designing for future expansion.		
26 24 13 00-0061 EA 15 - 60 Amp MC Branch Breaker, 120 / 240 Volt.....	151.46	21.32
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
	12.79	
26 24 13 00-0062 EA 70 - 100 Amp MC Branch Breaker, 120 / 240 Volt.....	239.87	35.39
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
	21.23	
26 24 13 00-0063 EA 125 - 225 Amp MC Branch Breaker, 120 / 240 Volt.....	758.50	49.46
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
	29.68	
26 24 13 00-0064 EA 100 - 400 Amp MC Branch Breaker, 120 / 240 Volt.....	2,218.21	63.54
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
	38.12	
26 24 13 00-0065 EA 300 - 600 Amp MC Branch Breaker, 120 / 240 Volt.....	3,468.06	154.83
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
	92.89	
26 24 13 00-0066 EA 400 - 800 Amp MC Branch Breaker, 120 / 240 Volt.....	4,961.08	154.83
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
	92.89	
26 24 13 00-0067 EA 600 - 1,200 Amp MC Branch Breaker, 120 / 240 Volt.....	8,161.26	295.58
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>		
	177.37	



MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

26 24 13 00-0068	Fusible Switch Type 120/208 Volt, 3 Phase, 4 Wire ^(26 24 13)		
26 24 13 00-0069	Incoming Service Section Main Device Only ^(26 24 13 00-0068)		
	Note: Copper bus, non-metering type, with fuses.		
26 24 13 00-0070	EA 400 Amp Distribution Switchboard With Main Switch, 120 / 208 Volt, 3 Phase, 4 Wire	3,166.97	703.53
26 24 13 00-0071	EA 600 Amp Distribution Switchboard With Main Switch, 120 / 208 Volt, 3 Phase, 4 Wire	3,519.53	744.15
26 24 13 00-0072	EA 800 Amp Distribution Switchboard With Main Switch, 120 / 208 Volt, 3 Phase, 4 Wire	5,858.57	844.13
26 24 13 00-0073	EA 1,200 Amp Distribution Switchboard With Main Switch, 120 / 208 Volt, 3 Phase, 4 Wire	6,312.93	904.93
26 24 13 00-0074	EA 1,600 Amp Distribution Switchboard With Main Switch, 120 / 208 Volt, 3 Phase, 4 Wire	10,364.70	964.85
26 24 13 00-0075	EA 2,000 Amp Distribution Switchboard With Main Switch, 120 / 208 Volt, 3 Phase, 4 Wire	11,587.06	1,025.90
26 24 13 00-0076	EA 400 Amp Distribution Switchboard With MC Main Breaker, 120 / 208 Volt, 3 Phase, 4 Wire.....	3,905.98	703.53
26 24 13 00-0077	EA 600 Amp Distribution Switchboard With MC Main Breaker, 120 / 208 Volt, 3 Phase, 4 Wire.....	5,077.01	744.15
26 24 13 00-0078	EA 800 Amp Distribution Switchboard With MC Main Breaker, 120 / 208 Volt, 3 Phase, 4 Wire.....	7,171.63	844.85
26 24 13 00-0079	EA 1,200 Amp Distribution Switchboard With MC Main Breaker, 120 / 208 Volt, 3 Phase, 4 Wire.....	9,930.05	904.93
26 24 13 00-0080	EA 1,600 Amp Distribution Switchboard With MC Main Breaker, 120 / 208 Volt, 3 Phase, 4 Wire.....	10,366.55	965.82
26 24 13 00-0081	EA 2,000 Amp Distribution Switchboard With MC Main Breaker, 120 / 208 Volt, 3 Phase, 4 Wire.....	11,587.06	1,025.90
26 24 13 00-0082	EA 400 Amp Distribution Switchboard With Main Lug, 120 / 208 Volt, 3 Phase, 4 Wire.....	2,195.48	623.34
26 24 13 00-0083	EA 600 Amp Distribution Switchboard With Main Lug, 120 / 208 Volt, 3 Phase, 4 Wire.....	2,471.00	663.64
26 24 13 00-0084	EA 800 Amp Distribution Switchboard With Main Lug, 120 / 208 Volt, 3 Phase, 4 Wire.....	2,886.05	763.93
26 24 13 00-0085	EA 1,000 Amp Distribution Switchboard With Main Lug, 120 / 208 Volt, 3 Phase, 4 Wire.....	3,118.07	796.03
26 24 13 00-0086	EA 1,200 Amp Distribution Switchboard With Main Lug, 120 / 208 Volt, 3 Phase, 4 Wire.....	3,343.42	824.74
26 24 13 00-0087	EA 1,600 Amp Distribution Switchboard With Main Lug, 120 / 208 Volt, 3 Phase, 4 Wire.....	3,634.78	884.26
26 24 13 00-0088	EA 2,000 Amp Distribution Switchboard With Main Lug, 120 / 208 Volt, 3 Phase, 4 Wire.....	3,929.99	944.91
26 24 13 00-0089	EA 2,500 Amp Distribution Switchboard With Main Lug, 120 / 208 Volt, 3 Phase, 4 Wire.....	4,688.56	1,073.76
26 24 13 00-0090	EA 3,000 Amp Distribution Switchboard With Main Lug, 120 / 208 Volt, 3 Phase, 4 Wire.....	5,206.94	1,148.96
26 24 13 00-0091	EA 4,000 Amp Distribution Switchboard With Main Lug, 120 / 208 Volt, 3 Phase, 4 Wire.....	6,207.65	1,234.62
26 24 13 00-0092	Branch Breaker Units ^(26 24 13 00-0068)		
	Note: Includes branch breaker(s) and portion of distribution section occupied by that breaker. 120/208 V, 3 pole. Use upper range to determine breaker unless designing for future expansion.		
26 24 13 00-0093	EA 15 - 60 Amp MC Branch Breaker, 120/208 Volt.....	288.90	24.53
	For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	14.72	
26 24 13 00-0094	EA 70 - 100 Amp MC Branch Breaker, 120/208 Volt.....	421.98	38.61
	For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	23.16	
26 24 13 00-0095	EA 125 - 225 Amp MC Branch Breaker, 120/208 Volt.....	1,149.59	70.38
	For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	42.23	
26 24 13 00-0096	EA 100 - 400 Amp MC Branch Breaker, 120/208 Volt.....	2,057.15	91.69
	For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	55.01	
26 24 13 00-0097	EA 300 - 600 Amp MC Branch Breaker, 120/208 Volt.....	3,634.25	225.21
	For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	135.10	
26 24 13 00-0098	EA 400 - 800 Amp MC Branch Breaker, 120/208 Volt.....	5,884.28	225.21
	For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	135.10	
26 24 13 00-0099	EA 600 - 1,200 Amp MC Branch Breaker, 120/208 Volt.....	9,522.49	401.36
	For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	240.81	
26 24 13 00-0100	Fusible Switch Type 277/480 Volt, 3 Phase, 4 Wire ^(26 24 13)		
26 24 13 00-0101	Incoming Service Section Main Device Only ^(26 24 13 00-0100)		
	Note: Copper bus, non-metering type, with fuses.		
26 24 13 00-0102	EA 400 Amp Distribution Switchboard With Main Switch, 480 / 277 Volt, 3 Phase, 4 Wire	4,079.32	964.85
26 24 13 00-0103	EA 600 Amp Distribution Switchboard With Main Switch, 480 / 277 Volt, 3 Phase, 4 Wire	4,493.71	1,025.90
26 24 13 00-0104	EA 800 Amp Distribution Switchboard With Main Switch, 480 / 277 Volt, 3 Phase, 4 Wire	6,545.89	1,145.10
26 24 13 00-0105	EA 1,200 Amp Distribution Switchboard With Main Switch, 480 / 277 Volt, 3 Phase, 4 Wire	7,168.08	1,226.10
26 24 13 00-0106	EA 400 Amp Distribution Switchboard With MC Main Breaker, 480 / 277 Volt, 3 Phase, 4 Wire.....	5,334.00	964.85
26 24 13 00-0107	EA 600 Amp Distribution Switchboard With MC Main Breaker, 480 / 277 Volt, 3 Phase, 4 Wire.....	7,305.86	1,025.90
26 24 13 00-0108	EA 800 Amp Distribution Switchboard With MC Main Breaker, 480 / 277 Volt, 3 Phase, 4 Wire.....	8,285.87	1,146.38
26 24 13 00-0109	EA 1,200 Amp Distribution Switchboard With MC Main Breaker, 480 / 277 Volt, 3 Phase, 4 Wire.....	10,572.34	1,226.10
26 24 13 00-0110	EA 1,600 Amp Distribution Switchboard With MC Main Breaker, 480 / 277 Volt, 3 Phase, 4 Wire.....	11,049.77	1,307.41
26 24 13 00-0111	EA 2,000 Amp Distribution Switchboard With MC Main Breaker, 480 / 277 Volt, 3 Phase, 4 Wire.....	12,312.57	1,388.64
26 24 13 00-0112	EA 400 Amp Distribution Switchboard With Main Lug, 480 / 277 Volt, 3 Phase, 4 Wire.....	2,195.48	623.34
26 24 13 00-0113	EA 600 Amp Distribution Switchboard With Main Lug, 480 / 277 Volt, 3 Phase, 4 Wire.....	2,471.00	663.64
26 24 13 00-0114	EA 800 Amp Distribution Switchboard With Main Lug, 480 / 277 Volt, 3 Phase, 4 Wire.....	2,886.05	763.93
26 24 13 00-0115	EA 1,000 Amp Distribution Switchboard With Main Lug, 480 / 277 Volt, 3 Phase, 4 Wire.....	3,118.07	796.03
26 24 13 00-0116	EA 1,200 Amp Distribution Switchboard With Main Lug, 480 / 277 Volt, 3 Phase, 4 Wire.....	3,343.42	824.74
26 24 13 00-0117	EA 1,600 Amp Distribution Switchboard With Main Lug, 480 / 277 Volt, 3 Phase, 4 Wire.....	3,634.78	884.26
26 24 13 00-0118	EA 2,000 Amp Distribution Switchboard With Main Lug, 480 / 277 Volt, 3 Phase, 4 Wire.....	3,929.99	944.91
26 24 13 00-0119	Branch Breaker Units ^(26 24 13 00-0100)		
	Note: Includes branch breaker(s) and portion of distribution section occupied by that breaker. 480 V, 3 pole. Use upper range to determine breaker unless designing for future expansion.		
26 24 13 00-0120	EA 15 - 60 Amp MC Branch Breaker, 480 / 277 Volt.....	611.19	24.53
	For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	14.72	
26 24 13 00-0121	EA 70 - 100 Amp MC Branch Breaker, 480 / 277 Volt.....	699.30	38.61
	For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	23.16	
26 24 13 00-0122	EA 125 - 225 Amp MC Branch Breaker, 480 / 277 Volt.....	1,268.01	70.38
	For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	42.23	
26 24 13 00-0123	EA 100 - 400 Amp MC Branch Breaker, 480 / 277 Volt.....	2,057.15	91.69
	For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	55.01	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 24 13 00-0124 EA 300 - 600 Amp MC Branch Breaker, 480 / 277 Volt..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4,926.40 135.10	225.21
26 24 13 00-0125 EA 400 - 800 Amp MC Branch Breaker, 480 / 277 Volt..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5,041.83 135.10	225.21
26 24 13 00-0126 EA 600 - 1,200 Amp MC Branch Breaker, 480 / 277 Volt..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8,069.94 240.81	401.36
26 24 13 00-0127 Fusible Branch Circuit Switch <small>(26 24 13)</small> Note: Includes switch fuses, and portion of distribution section occupied by that branch device.		
26 24 13 00-0128 240 Volt, 2 Pole Twin Branch Switch Units <small>(26 24 13 00-0127)</small>		
26 24 13 00-0129 EA 30/30 Amp, 240 Volt, 2 Pole Twin Branch Switch Unit <i>For Electrical Interlock Kit, Add</i>	610.72 262.06	63.14
26 24 13 00-0130 EA 30/60 Amp, 240 Volt, 2 Pole Twin Branch Switch Unit <i>For Electrical Interlock Kit, Add</i>	608.47 262.06	63.14
26 24 13 00-0131 EA 60/60 Amp, 240 Volt, 2 Pole Twin Branch Switch Unit <i>For Electrical Interlock Kit, Add</i>	608.47 262.06	63.14
26 24 13 00-0132 EA 60/100 Amp, 240 Volt, 2 Pole Twin Branch Switch Unit <i>For Electrical Interlock Kit, Add</i>	962.93 262.06	83.24
26 24 13 00-0133 EA 100/100 Amp, 240 Volt, 2 Pole Twin Branch Switch Unit <i>For Electrical Interlock Kit, Add</i>	962.93 262.06	83.24
26 24 13 00-0134 240 Volt, 2 Pole Single Branch Switch Units <small>(26 24 13 00-0127)</small>		
26 24 13 00-0135 EA 100 Amp, 240 Volt, 2 Pole Single Branch Switch Unit..... <i>For Electrical Interlock Kit, Add</i>	703.77 251.05	61.93
26 24 13 00-0136 EA 200 Amp, 240 Volt, 2 Pole Single Branch Switch Unit..... <i>For Electrical Interlock Kit, Add</i>	1,040.41 251.05	61.93
26 24 13 00-0137 EA 400 Amp, 240 Volt, 2 Pole Single Branch Switch Unit.....	2,670.28	166.89
26 24 13 00-0138 240 Volt, 3 Pole Twin Branch Switch Units <small>(26 24 13 00-0127)</small>		
26 24 13 00-0139 EA 30/30 Amp, 240 Volt, 3 Pole Twin Branch Switch Unit <i>For Electrical Interlock Kit, Add</i>	787.51 262.06	71.18
26 24 13 00-0140 EA 30/60 Amp, 240 Volt, 3 Pole Twin Branch Switch Unit <i>For Electrical Interlock Kit, Add</i>	785.27 262.06	71.18
26 24 13 00-0141 EA 60/60 Amp, 240 Volt, 3 Pole Twin Branch Switch Unit <i>For Electrical Interlock Kit, Add</i>	785.27 262.06	71.18
26 24 13 00-0142 EA 60/100 Amp, 240 Volt, 3 Pole Twin Branch Switch Unit <i>For Electrical Interlock Kit, Add</i>	1,188.91 262.06	95.31
26 24 13 00-0143 EA 100/100 Amp, 240 Volt, 3 Pole Twin Branch Switch Unit <i>For Electrical Interlock Kit, Add</i>	1,188.91 262.06	95.31
26 24 13 00-0144 240 Volt, 3 Pole Single Branch Switch Units <small>(26 24 13 00-0127)</small>		
26 24 13 00-0145 EA 100 Amp, 240 Volt, 3 Pole Single Branch Switch Unit..... <i>For Electrical Interlock Kit, Add</i>	854.89 262.06	69.97
26 24 13 00-0146 EA 200 Amp, 240 Volt, 3 Pole Single Branch Switch Unit..... <i>For Electrical Interlock Kit, Add</i>	1,403.67 251.05	69.97
26 24 13 00-0147 EA 400 Amp, 240 Volt, 3 Pole Single Branch Switch Unit.....	3,594.76	186.84
26 24 13 00-0148 EA 600 Amp, 240 Volt, 3 Pole Single Branch Switch Unit.....	5,147.31	239.36
26 24 13 00-0149 EA 800 Amp, 240 Volt, 3 Pole Single Branch Switch Unit.....	9,641.49	324.30
26 24 13 00-0150 600 Volt, 3 Pole Twin Branch Switch Units <small>(26 24 13 00-0127)</small>		
26 24 13 00-0151 EA 30/30 Amp, 600 Volt, 3 Pole Twin Branch Switch Unit <i>For Electrical Interlock Kit, Add</i>	1,127.34 262.06	71.18
26 24 13 00-0152 EA 30/60 Amp, 600 Volt, 3 Pole Twin Branch Switch Unit <i>For Electrical Interlock Kit, Add</i>	1,125.06 262.06	71.18
26 24 13 00-0153 EA 60/60 Amp, 600 Volt, 3 Pole Twin Branch Switch Unit <i>For Electrical Interlock Kit, Add</i>	1,127.34 262.06	71.18
26 24 13 00-0154 EA 60/100 Amp, 600 Volt, 3 Pole Twin Branch Switch Unit <i>For Electrical Interlock Kit, Add</i>	1,701.65 262.06	95.31
26 24 13 00-0155 EA 100/100 Amp, 600 Volt, 3 Pole Twin Branch Switch Unit <i>For Electrical Interlock Kit, Add</i>	1,739.60 262.06	95.31
26 24 13 00-0156 EA 200/200 Amp, 600 Volt, 3 Pole Twin Branch Switch Unit <i>For Electrical Interlock Kit, Add</i>	3,743.36 262.06	124.67
26 24 13 00-0157 600 Volt, 3 Pole, Single Branch Switch Units <small>(26 24 13 00-0127)</small>		
26 24 13 00-0158 EA 100 Amp, 600 Volt, 3 Pole Single Branch Switch Unit..... <i>For Electrical Interlock Kit, Add</i>	1,220.89 262.06	69.97
26 24 13 00-0159 EA 200 Amp, 600 Volt, 3 Pole Single Branch Switch Unit..... <i>For Electrical Interlock Kit, Add</i>	1,868.33 251.05	69.97
26 24 13 00-0160 EA 400 Amp, 600 Volt, 3 Pole Single Branch Switch Unit..... <i>For Electrical Interlock Kit, Add</i>	4,537.28 251.05	186.84
26 24 13 00-0161 EA 600 Amp, 600 Volt, 3 Pole Single Branch Switch Unit.....	5,504.06	239.36
26 24 13 00-0162 EA 800 Amp, 600 Volt, 3 Pole Single Branch Switch Unit.....	9,641.49	324.30
26 24 13 00-0163 Service And Distribution Structures <small>(26 24 13)</small>		

26 Electrical**26 20 Low-Voltage Electrical Distribution****26 24 Switchboards And Panelboards**MINOR
CSI UOM DESCRIPTIONTOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

MINOR	CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 24 13 00-0164	Switchboard Sections <small>(26 24 13 00-0163)</small>		
26 24 13 00-0165	EA 600 Amp Switchboard Incoming No Switch Circuit 480 Volt, 4 Wire.....	3,541.69	670.24
26 24 13 00-0166	EA 800 Amp Switchboard Incoming No Switch Circuit 480 Volt, 4 Wire.....	3,881.57	728.55
26 24 13 00-0167	EA 1,200 Amp Switchboard Incoming No Switch Circuit 480 Volt, 4 Wire.....	4,860.52	930.91
26 24 13 00-0168	EA 1,600 Amp Switchboard Incoming No Switch Circuit 480 Volt, 4 Wire.....	5,316.90	1,015.52
26 24 13 00-0169	EA 2,000 Amp Switchboard Incoming No Switch Circuit 480 Volt, 4 Wire.....	5,671.25	1,081.07
26 24 13 00-0170	EA 400 Amp Switchboard Incoming For Switch Circuit Section 480 Volt.....	4,302.19	587.96
26 24 13 00-0171	EA Distribution Section Subfeeder Lug-Rated At 200 Amp.....	2,354.86	558.52
26 24 13 00-0172	EA Distribution Section Subfeeder Lug-Rated At 400 Amp.....	2,614.95	605.65
26 24 13 00-0173	EA Distribution Section Aluminum Bus 120/208 Or 277/480 Volt, 4 Wire.....	2,869.77	670.24
26 24 13 00-0174	EA 800 Amp Switchboard Distribution Section Aluminum Bus Less Breaker.....	3,118.07	672.00
26 24 13 00-0175	EA 1,000 Amp Switchboard Distribution Section Aluminum Bus Less Breaker.....	3,440.18	750.26
26 24 13 00-0176	EA 15 To 60 Amp, 240 Volt, 1 Phase, Feed Section Circuit Breaker FA Frame.....	127.81	40.21
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	24.56	
26 24 13 00-0177	EA 70 To 100 Amp, 240 Volt, 3 Phase, Feed Section Circuit Breaker FA Frame.....	156.69	40.94
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	29.02	
26 24 13 00-0178	EA 70 To 225 Amp, 480 Volt, 3 Phase, Feed Section Circuit Breaker KA Frame.....	776.20	48.34
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	62.51	
26 24 13 00-0179	EA 125 To 400 Amp, 480 Volt, 3 Phase, Feed Section Circuit Breaker LA Frame.....	1,298.23	104.16
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	87.05	
26 24 13 00-0180	EA 100 Amp, Switchboard Feed Section Branch Circuit Breaker, 240 Volt HIC 3 Phase.....	505.71	145.09
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	50.27	
26 24 13 00-0181	EA 225 Amp, Switchboard Feed Section Branch Circuit Breaker, 240 Volt HIC 3 Phase.....	1,484.41	83.81
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	62.51	
26 24 13 00-0182	Switchboard, Structure Per Section Copper 480 V <small>(26 24 13 00-0163)</small>		
26 24 13 00-0183	EA 225 Amp Switchboard, Structure Per Section, Copper, 480 Volt.....	1,835.30	349.07
26 24 13 00-0184	EA 400 Amp Switchboard, Structure Per Section, Copper, 480 Volt.....	2,621.09	472.05
26 24 13 00-0185	EA 600 Amp Switchboard, Structure Per Section, Copper, 480 Volt.....	2,921.43	574.52
26 24 13 00-0186	EA 800 Amp Switchboard, Structure Per Section, Copper, 480 Volt.....	3,650.41	804.31
26 24 13 00-0187	EA 1,200 Amp Switchboard, Structure Per Section, Copper, 480 Volt.....	4,519.81	1,005.39
26 24 13 00-0188	EA 1,600 Amp Switchboard, Structure Per Section, Copper, 480 Volt.....	5,025.19	1,005.39
26 24 13 00-0189	EA 2,000 Amp Switchboard, Structure Per Section, Copper, 480 Volt.....	6,161.50	1,340.55
26 24 13 00-0190	EA 2,500 Amp Switchboard, Structure Per Section, Copper, 480 Volt.....	7,130.55	1,340.55
26 24 13 00-0191	EA 3,000 Amp Switchboard, Structure Per Section, Copper, 480 Volt.....	8,376.64	1,595.84
26 24 13 00-0192	EA 4,000 Amp Switchboard, Structure Per Section, Copper, 480 Volt.....	10,159.79	1,595.84
26 24 13 00-0193	Main Devices <small>(26 24 13)</small>		
26 24 13 00-0194	Power Circuit Breakers <small>(26 24 13 00-0193)</small>		
26 24 13 00-0195	DSL Breaker With Current Limiters And Amptector <small>(26 24 13 00-0194)</small>		
	Note: 11 Static trip not applicable to ground-fault or plug in test feature. Manually operated.		
26 24 13 00-0196	EA 50 - 800 Amp DSL-206, Main Breaker With Current Limiter, Amptector Static Trip.....	6,604.95	844.53
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	505.65	
26 24 13 00-0197	EA 50 - 1,600 Amp DSL-416, Main Breaker With Current Limiter, Amptector Static Trip.....	12,109.22	1,407.55
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	843.68	
26 24 13 00-0198	EA 1,200 - 3,200 Amp DSL-632, Main Breaker With Current Limiter, Amptector Static Trip.....	27,628.31	2,364.67
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	1,406.14	
26 24 13 00-0199	EA 4,000 Amp DSL-840, Main Breaker With Current Limiter, Amptector Static Trip.....	44,455.34	3,828.53
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2,338.12	
26 24 13 00-0200	EA Ground-Fault Trip All Power Breakers - Factory Installed.....	2,426.66	
26 24 13 00-0201	EA Key Interlock All Power Breakers - Factory Installed.....	313.40	
26 24 13 00-0202	EA Short Time Delay Selective Trip - Factory Installed.....	411.15	
26 24 13 00-0203	EA Shunt Trip Manually Open Breakers - Factory Installed.....	296.15	
26 24 13 00-0204	DSL Breaker Electrical Operated And Amptector <small>(26 24 13 00-0194)</small>		
	Note: 11 Static trip not applicable to ground-fault or plug in test feature. Manually operated.		
26 24 13 00-0205	EA 50 - 800 Amp DSL-206, Main Breaker, Electrical Operated With Amptector Static Trip.....	7,781.29	884.74
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	533.36	
26 24 13 00-0206	EA 50 - 1,600 Amp DSL-416, Main Breaker, Electrical Operated With Amptector Static Trip.....	14,528.30	1,487.98
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	888.42	
26 24 13 00-0207	EA 1,200 - 3,200 Amp DSL-632, Main Breaker, Electrical Operated With Amptector Static Trip.....	31,111.36	2,453.15
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	1,478.52	
26 24 13 00-0208	EA 4,000 Amp DSL-840, Main Breaker, Electrical Operated With Amptector Static Trip.....	47,912.85	4,021.56
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2,472.27	
26 24 13 00-0209	DS Breakers With Amptector Static Trip, Manually Operated <small>(26 24 13 00-0194)</small>		
	Note: Includes integral ground fault and plug-in test provision. Excludes system, add price from section drawout mounted manually operated.		
26 24 13 00-0210	EA 50 - 800 Amp DS-206, Main Breaker With Groundfault, Amptector Static Trip.....	5,212.63	772.14
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	464.03	
26 24 13 00-0211	EA 50 - 1,600 Amp DS-416, Main Breaker With Groundfault, Amptector Static Trip.....	9,591.96	1,294.95
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	773.38	
26 24 13 00-0212	EA 2,000 Amp DS-420, Main Breaker With Groundfault, Amptector Static Trip.....	14,113.89	2,171.64
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	1,288.96	
26 24 13 00-0213	EA 1,200 - 3,200 AMP DS-632, Main Breaker With Groundfault, Amptector Static Trip.....	24,414.16	3,498.76
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2,146.74	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 24 13 00-0214 EA 4,000 Amp DS-840, Main Breaker With Groundfault, Amptector Static Trip..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	39,675.37 3,569.43	5,710.62
26 24 13 00-0215 DS Breakers With Amptector Static Trip, Electrically Operated <small>(26 24 13 00-0194)</small> Note: Includes integral ground fault and plug-in test provision. Excludes system, add price from section drawout mounted electrical operated.		
26 24 13 00-0216 EA 50 - 800 Amp DS-206, Main Breaker, Electrical Operated With Groundfault, Amptector Static Trip <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	6,225.08 442.58	739.97
26 24 13 00-0217 EA 50 - 1,600 Amp DS-416, Main Breaker, Electrical Operated With Groundfault, Amptector Static Trip <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	11,681.80 737.45	1,238.64
26 24 13 00-0218 EA 2,000 Amp DS-420, Main Breaker, Electrical Operated With Groundfault, Amptector Static Trip..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	16,504.35 1,231.09	2,059.04
26 24 13 00-0219 EA 1,200 - 3,200 Amp DS-632, Main Breaker, Electrical Operated With Groundfault, Amptector Static Trip <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	27,224.53 2,051.82	3,353.98
26 24 13 00-0220 EA 4,000 Amp DS-840, Main Breaker, Electrical Operated With Groundfault, Amptector Static Trip..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	42,415.18 3,427.47	5,750.83
26 24 13 00-0221 Molded Case Circuit Breakers Conventional <small>(26 24 13 00-0194)</small>		
26 24 13 00-0222 EA 70 - 225 Amp 3 Pole Molded Case Circuit Breaker Conventional..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2,075.02 389.18	675.62
26 24 13 00-0223 EA 125 - 400 Amp 3 Pole Molded Case Circuit Breaker Conventional..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	3,140.50 423.32	675.62
26 24 13 00-0224 EA 300 - 600 Amp 3 Pole Molded Case Circuit Breaker Conventional..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	3,487.52 464.03	804.31
26 24 13 00-0225 EA 400 - 800 Amp 3 Pole Molded Case Circuit Breaker Conventional..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4,181.38 502.70	804.31
26 24 13 00-0226 EA 600 - 1,200 Amp 3 Pole Molded Case Circuit Breaker Conventional..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	6,347.50 550.90	965.18
26 24 13 00-0227 EA 1,000 - 2,000 Amp 3 Pole Molded Case Circuit Breaker Conventional..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10,462.60 609.33	965.18
26 24 13 00-0228 EA Shunt Trip, Factory Installed.....	310.52	
26 24 13 00-0229 EA Groundfault Trip Complete Interrupting Circuit, Factory Installed.....	71.88	
26 24 13 00-0230 Switchboard Branch Breaker 480 Volt <small>(26 24 13 00-0193)</small>		
26 24 13 00-0231 EA 60 Amp, 3 Phase, 480 Volt Switchboard Branch Breaker..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	465.81 34.97	58.31
26 24 13 00-0232 EA 100 Amp, 3 Phase, 480 Volt Switchboard Branch Breaker..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	545.64 46.40	77.38
26 24 13 00-0233 EA 225 Amp, 3 Phase, 480 Volt Switchboard Branch Breaker..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	1,625.18 69.90	116.47
26 24 13 00-0234 EA 400 Amp, 3 Phase, 480 Volt Switchboard Branch Breaker..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2,151.68 87.68	146.15
26 24 13 00-0235 EA 600 Amp, 3 Phase, 480 Volt Switchboard Branch Breaker..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2,595.86 117.59	196.01
26 24 13 00-0236 EA 800 Amp, 3 Phase, 480 Volt Switchboard Branch Breaker..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	3,128.54 150.81	251.35
26 24 13 00-0237 EA 1,000 Amp, 3 Phase, 480 Volt Switchboard Branch Breaker..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5,041.50 229.80	383.01
26 24 13 00-0238 EA 1,200 Amp, 3 Phase, 480 Volt Switchboard Branch Breaker..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5,041.50 229.80	383.01
26 24 13 00-0239 EA 1,600 Amp, 3 Phase, 480 Volt Switchboard Branch Breaker..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	7,071.44 321.72	536.24
26 24 13 00-0240 EA 2,000 Amp, 3 Phase, 480 Volt Switchboard Branch Breaker..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8,763.83 482.59	804.31
26 24 13 00-0241 Switchboard 277/480 Volt Main Breaker <small>(26 24 13 00-0193)</small>		
26 24 13 00-0242 EA 400 Amp, Switchboard 277/480 Volt Main Breaker <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5,763.93 209.46	349.07
26 24 13 00-0243 EA 600 Amp, Switchboard 277/480 Volt Main Breaker <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5,830.29 229.37	382.29
26 24 13 00-0244 EA 800 Amp, Switchboard 277/480 Volt Main Breaker <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	6,214.76 344.71	574.52
26 24 13 00-0245 EA 1,200 Amp, Switchboard 277/480 Volt Main Breaker <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10,709.07 482.59	804.31
26 24 13 00-0246 EA 1,600 Amp, Switchboard 277/480 Volt Main Breaker <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10,879.90 533.84	889.73
26 24 13 00-0247 EA 2,000 Amp, Switchboard 277/480 Volt Main Breaker <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	14,176.62 957.51	1,595.84
26 24 13 00-0248 Branch Or Distribution Devices <small>(26 24 13)</small>		
26 24 13 00-0249 3 Pole, Panel Mounted, Molded Case Circuit Breakers <small>(26 24 13 00-0248)</small> Note: Includes certified refurbished circuit breakers.		
26 24 13 00-0250 EA 15 - 60 Amp, 600 Volt, Type EHB, 3 Pole, Panel Mounted, Molded Case Circuit Breaker <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	337.64 19.31	28.96
26 24 13 00-0251 EA 70 - 100 Amp, 600 Volt, Type EHB, 3 Pole, Panel Mounted, Molded Case Circuit Breaker <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	344.17 24.13	36.19

26 Electrical**26 20 Low-Voltage Electrical Distribution****26 24 Switchboards And Panelboards**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 24 13 00-0252	EA		125 - 150 Amp, 600 Volt, Type FB, 3 Pole, Panel Mounted, Molded Case Circuit Breaker.....	808.22	43.43
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	28.95	
26 24 13 00-0253	EA		70 - 225 Amp, 600 Volt, Type JDB, 3 Pole, Panel Mounted, Molded Case Circuit Breaker.....	1,168.86	56.30
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	37.40	
26 24 13 00-0254	EA		125 - 400 Amp, 600 Volt, Type LBB, 3 Pole, Panel Mounted, Molded Case Circuit Breaker.....	1,643.56	69.49
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	46.33	
26 24 13 00-0255	EA		300 - 600 Amp, 600 Volt, Type LC, 3 Pole, Panel Mounted, Molded Case Circuit Breaker.....	2,148.28	81.24
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	54.29	
26 24 13 00-0256	EA		900 - 1,000 Amp, 600 Volt, Type NB, 3 Pole, Panel Mounted, Molded Case Circuit Breaker.....	3,264.64	91.69
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	61.29	
26 24 13 00-0257			2 Pole, Panel Mounted, Molded Case Circuit Breakers <small>(26 24 13 00-0248)</small>		
			Note: Includes certified refurbished circuit breakers.		
26 24 13 00-0258	EA		15 - 60 Amp, 600 Volt, Type EHB, 2 Pole, Panel Mounted, Molded Case Circuit Breaker.....	233.45	21.72
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	14.48	
26 24 13 00-0259	EA		70 - 100 Amp, 600 Volt, Type EHB, 2 Pole, Panel Mounted, Molded Case Circuit Breaker.....	300.43	28.96
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	19.31	
26 24 13 00-0260	EA		125 - 150 Amp, 600 Volt, Type FB, 2 Pole, Panel Mounted, Molded Case Circuit Breaker.....	802.14	36.19
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	24.13	
26 24 13 00-0261	EA		70 - 225 Amp, 600 Volt, Type JDB, 2 Pole, Panel Mounted, Molded Case Circuit Breaker.....	1,262.88	40.21
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	26.54	
26 24 13 00-0262	EA		125 - 400 Amp, 600 Volt, Type LBB, 2 Pole, Panel Mounted, Molded Case Circuit Breaker.....	1,339.29	52.28
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	34.99	
26 24 13 00-0263	EA		900 - 1,000 Amp, 600 Volt, Type NB, 2 Pole, Panel Mounted, Molded Case Circuit Breaker.....	3,015.74	76.01
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	50.67	
26 24 13 00-0264			Meter Devices And Instrumentation <small>(26 24 13)</small>		
			Note: Factory installed accessories.		
26 24 13 00-0265			Instrument Transformers And Metering Compartments <small>(26 24 13 00-0264)</small>		
26 24 13 00-0266	EA		800 Amp And Below Primary Current Transformer, With Compartment.....	375.21	
26 24 13 00-0267	EA		1,000 - 1,500 Amp Primary Current Transformer, With Compartment.....	541.97	
26 24 13 00-0268	EA		2,000 - 6,000 Amp Primary Current Transformer, With Compartment.....	638.29	
26 24 13 00-0269	EA		Potential Transformer With 200 VA Max.....	460.03	
26 24 13 00-0270	EA		5 To 800 Amp, Three Current Transformers.....	1,489.82	
26 24 13 00-0271	EA		1,000 To 1,500 Amp, Three Current Transformers.....	2,669.95	
26 24 13 00-0272	EA		2,000 To 4,000 Amp, Three Current Transformers.....	3,474.31	
26 24 13 00-0273			Instruments <small>(26 24 13 00-0264)</small>		
26 24 13 00-0274	EA		AC Voltmeter.....	511.78	
26 24 13 00-0275	EA		AC Ammeter.....	511.78	
26 24 13 00-0276	EA		AC Wattmeter.....	1,367.16	
26 24 13 00-0277	EA		Variometer.....	1,543.98	
26 24 13 00-0278	EA		Power Factor Meter.....	1,233.46	
26 24 13 00-0279	EA		Frequency Meter.....	1,361.40	
26 24 13 00-0280	EA		AC Watt-hour Meter Indicating 1 Or 2 Element With Test Block And Plug Block.....	1,732.31	
26 24 13 00-0281	EA		AC Watt-hour Meter Recording 2 Element With Recording KW Demand Type R-2.....	2,898.20	
26 24 13 00-0282	EA		Weatherproof, Modify Meter.....	2,691.84	
26 24 13 00-0283	EA		Control Switch Resistor Type 130 V.....	60.37	
26 24 13 00-0284	EA		Metering Instrument Volt, Amp And Watt Hour.....	3,495.96	
26 24 16			Panelboards <small>(26 24)</small>		
26 24 16 00-0001			Branch Circuit Panelboard <small>(26 24 16)</small>		
			Note: Includes wiring connections, drilling hole (or removing knock-out on residential units), labeling and testing. All NEMA 3R panelboards include weatherproof hubs. Copper bussing.		
26 24 16 00-0002			Assembled Lighting And Power Panelboards <small>(26 24 16 00-0001)</small>		
			Note: Includes main lugs or breaker (as indicated). 20 Amp, 1 pole branch circuit breakers (the number of which is indicated). Panelboard box, trim and connection of main service cable from meter.		
26 24 16 00-0003			120/240 Volt, 3 Wire, 1 Phase, Main Lugs Assembled Panelboards <small>(26 24 16 00-0002)</small>		
26 24 16 00-0004	EA		100 Amp Rating, 8 - 20 Amp Breakers, 120/240 Volt, 3 Wire, 1 Phase Assembled Panelboard, Main Lugs, 12 Circuit Capacity.....	844.74	229.23
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0005	EA		100 Amp Rating, 10 - 20 Amp Breakers, 120/240 Volt, 3 Wire, 1 Phase Assembled Panelboard, Main Lugs, 20 Circuit Capacity.....	967.60	229.23
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0006	EA		100 Amp Rating, 12 - 20 Amp Breakers, 120/240 Volt, 3 Wire, 1 Phase Assembled Panelboard, Main Lugs, 20 Circuit Capacity.....	1,096.95	317.70
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0007	EA		100 Amp Rating, 14 - 20 Amp Breakers, 120/240 Volt, 3 Wire, 1 Phase Assembled Panelboard, Main Lugs, 20 Circuit Capacity.....	1,220.85	317.70
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0008	EA		100 Amp Rating, 16 - 20 Amp Breakers, 120/240 Volt, 3 Wire, 1 Phase Assembled Panelboard, Main Lugs, 20 Circuit Capacity.....	1,345.29	398.14
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0009	EA		100 Amp Rating, 18 - 20 Amp Breakers, 120/240 Volt, 3 Wire, 1 Phase Assembled Panelboard, Main Lugs, 24 Circuit Capacity.....	1,476.00	398.14
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 24 16 00-0010 EA 100 Amp Rating, 20 - 20 Amp Breakers, 120/240 Volt, 3 Wire, 1 Phase Assembled Panelboard, Main Lugs, 24 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	1,593.54 348.00	458.46
26 24 16 00-0011 EA 225 Amp Rating, 22 - 20 Amp Breakers, 120/240 Volt, 3 Wire, 1 Phase Assembled Panelboard, Main Lugs, 30 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	1,897.55 348.00	587.14
26 24 16 00-0012 EA 225 Amp Rating, 24 - 20 Amp Breakers, 120/240 Volt, 3 Wire, 1 Phase Assembled Panelboard, Main Lugs, 30 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	2,021.77 348.00	587.14
26 24 16 00-0013 EA 225 Amp Rating, 26 - 20 Amp Breakers, 120/240 Volt, 3 Wire, 1 Phase Assembled Panelboard, Main Lugs, 30 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	2,555.46 348.00	671.60
26 24 16 00-0014 EA 225 Amp Rating, 28 - 20 Amp Breakers, 120/240 Volt, 3 Wire, 1 Phase Assembled Panelboard, Main Lugs, 42 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	2,744.20 348.00	671.60
26 24 16 00-0015 EA 225 Amp Rating, 30 - 20 Amp Breakers, 120/240 Volt, 3 Wire, 1 Phase Assembled Panelboard, Main Lugs, 42 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	2,863.02 348.00	756.05
26 24 16 00-0016 EA 225 Amp Rating, 32 - 20 Amp Breakers, 120/240 Volt, 3 Wire, 1 Phase Assembled Panelboard, Main Lugs, 42 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	3,034.39 348.00	756.05
26 24 16 00-0017 EA 225 Amp Rating, 34 - 20 Amp Breakers, 120/240 Volt, 3 Wire, 1 Phase Assembled Panelboard, Main Lugs, 42 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	3,145.28 348.00	836.49
26 24 16 00-0018 EA 225 Amp Rating, 36 - 20 Amp Breakers, 120/240 Volt, 3 Wire, 1 Phase Assembled Panelboard, Main Lugs, 42 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	3,322.07 348.00	836.49
26 24 16 00-0019 EA 225 Amp Rating, 38 - 20 Amp Breakers, 120/240 Volt, 3 Wire, 1 Phase Assembled Panelboard, Main Lugs, 42 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	3,519.55 348.00	924.96
26 24 16 00-0020 EA 225 Amp Rating, 40 - 20 Amp Breakers, 120/240 Volt, 3 Wire, 1 Phase Assembled Panelboard, Main Lugs, 54 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	3,581.48 348.00	924.96
26 24 16 00-0021 EA 225 Amp Rating, 42 - 20 Amp Breakers, 120/240 Volt, 3 Wire, 1 Phase Assembled Panelboard, Main Lugs, 54 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	3,818.82 348.00	924.96
26 24 16 00-0022 120/240 Volt, 3 Wire, 1 Phase, Main Breaker Assembled Panelboards <small>(26 24 16 00-0022)</small>		
26 24 16 00-0023 EA 50 Amp Rating, 8 - 20 Amp Breakers, 120/240 Volt, 3 Wire, 1 Phase Assembled Panelboard, Up To 50 Amp Main Breaker, 12 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	932.06 348.00	221.19
26 24 16 00-0024 EA 50 Amp Rating, 10 - 20 Amp Breakers, 120/240 Volt, 3 Wire, 1 Phase Assembled Panelboard, Up To 50 Amp Main Breaker, 12 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	1,056.67 348.00	221.19
26 24 16 00-0025 EA 100 Amp Rating, 12 - 20 Amp Breakers, 120/240 Volt, 3 Wire, 1 Phase Assembled Panelboard, >50 To 100 Amp Main Breaker, 20 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	1,383.46 348.00	378.02
26 24 16 00-0026 EA 100 Amp Rating, 14 - 20 Amp Breakers, 120/240 Volt, 3 Wire, 1 Phase Assembled Panelboard, >50 To 100 Amp Main Breaker, 20 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	1,509.94 348.00	378.02
26 24 16 00-0027 EA 100 Amp Rating, 16 - 20 Amp Breakers, 120/240 Volt, 3 Wire, 1 Phase Assembled Panelboard, >50 To 100 Amp Main Breaker, 20 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	1,635.52 348.00	462.48
26 24 16 00-0028 EA 100 Amp Rating, 18 - 20 Amp Breakers, 120/240 Volt, 3 Wire, 1 Phase Assembled Panelboard, >50 To 100 Amp Main Breaker, 24 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	1,770.21 348.00	462.48
26 24 16 00-0029 EA 100 Amp Rating, 20 - 20 Amp Breakers, 120/240 Volt, 3 Wire, 1 Phase Assembled Panelboard, >50 To 100 Amp Main Breaker, 24 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	1,884.07 348.00	554.98
26 24 16 00-0030 EA 225 Amp Rating, 22 - 20 Amp Breakers, 120/240 Volt, 3 Wire, 1 Phase Assembled Panelboard, >100 To 225 Amp Main Breaker, 30 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	2,678.11 348.00	554.98
26 24 16 00-0031 EA 225 Amp Rating, 24 - 20 Amp Breakers, 120/240 Volt, 3 Wire, 1 Phase Assembled Panelboard, >100 To 225 Amp Main Breaker, 30 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	2,792.72 348.00	679.65
26 24 16 00-0032 EA 225 Amp Rating, 26 - 20 Amp Breakers, 120/240 Volt, 3 Wire, 1 Phase Assembled Panelboard, >100 To 225 Amp Main Breaker, 30 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	2,916.45 348.00	679.65
26 24 16 00-0033 EA 225 Amp Rating, 28 - 20 Amp Breakers, 120/240 Volt, 3 Wire, 1 Phase Assembled Panelboard, >100 To 225 Amp Main Breaker, 42 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	3,051.13 348.00	764.09
26 24 16 00-0034 EA 225 Amp Rating, 30 - 20 Amp Breakers, 120/240 Volt, 3 Wire, 1 Phase Assembled Panelboard, >100 To 225 Amp Main Breaker, 42 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	3,162.00 348.00	764.09
26 24 16 00-0035 EA 225 Amp Rating, 32 - 20 Amp Breakers, 120/240 Volt, 3 Wire, 1 Phase Assembled Panelboard, >100 To 225 Amp Main Breaker, 42 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	3,279.63 348.00	836.49
26 24 16 00-0036 EA 225 Amp Rating, 34 - 20 Amp Breakers, 120/240 Volt, 3 Wire, 1 Phase Assembled Panelboard, >100 To 225 Amp Main Breaker, 42 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	3,405.05 348.00	836.49
26 24 16 00-0037 EA 225 Amp Rating, 36 - 20 Amp Breakers, 120/240 Volt, 3 Wire, 1 Phase Assembled Panelboard, >100 To 225 Amp Main Breaker, 42 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	3,539.56 348.00	989.30

26 Electrical**26 20 Low-Voltage Electrical Distribution****26 24 Switchboards And Panelboards**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 24 16 00-0038	EA		225 Amp Rating, 38 - 20 Amp Breakers, 120/240 Volt, 3 Wire, 1 Phase Assembled Panelboard, >100 To 225 Amp Main Breaker, 42 Circuit Capacity.....	3,684.66	989.30
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0039	EA		225 Amp Rating, 40 - 20 Amp Breakers, 120/240 Volt, 3 Wire, 1 Phase Assembled Panelboard, >100 To 225 Amp Main Breaker, 54 Circuit Capacity.....	3,842.31	989.30
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0040	EA		225 Amp Rating, 42 - 20 Amp Breakers, 120/240 Volt, 3 Wire, 1 Phase Assembled Panelboard, >100 To 225 Amp Main Breaker, 54 Circuit Capacity.....	3,942.09	1,045.60
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0041			120/208 Volt, 4 Wire, 3 Phase, Main Lugs Assembled Panelboards (26 24 16 00-0002)		
26 24 16 00-0042	EA		100 Amp Rating, 8 - 20 Amp Breakers, 120/208 Volt, 4 Wire, 3 Phase Assembled Panelboard, Main Lugs, 12 Circuit Capacity.....	1,168.79	261.40
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0043	EA		100 Amp Rating, 10 - 20 Amp Breakers, 120/208 Volt, 4 Wire, 3 Phase Assembled Panelboard, Main Lugs, 20 Circuit Capacity.....	1,307.05	261.40
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0044	EA		100 Amp Rating, 12 - 20 Amp Breakers, 120/208 Volt, 4 Wire, 3 Phase Assembled Panelboard, Main Lugs, 20 Circuit Capacity.....	1,464.97	349.88
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0045	EA		100 Amp Rating, 14 - 20 Amp Breakers, 120/208 Volt, 4 Wire, 3 Phase Assembled Panelboard, Main Lugs, 20 Circuit Capacity.....	1,632.20	349.88
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0046	EA		100 Amp Rating, 16 - 20 Amp Breakers, 120/208 Volt, 4 Wire, 3 Phase Assembled Panelboard, Main Lugs, 20 Circuit Capacity.....	1,781.26	430.30
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0047	EA		100 Amp Rating, 18 - 20 Amp Breakers, 120/208 Volt, 4 Wire, 3 Phase Assembled Panelboard, Main Lugs, 24 Circuit Capacity.....	1,940.05	430.30
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0048	EA		100 Amp Rating, 20 - 20 Amp Breakers, 120/208 Volt, 4 Wire, 3 Phase Assembled Panelboard, Main Lugs, 24 Circuit Capacity.....	2,090.38	510.74
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0049	EA		100 Amp Rating, 22 - 20 Amp Breakers, 120/208 Volt, 4 Wire, 3 Phase Assembled Panelboard, Main Lugs, 30 Circuit Capacity.....	2,242.99	510.74
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0050	EA		100 Amp Rating, 24 - 20 Amp Breakers, 120/208 Volt, 4 Wire, 3 Phase Assembled Panelboard, Main Lugs, 30 Circuit Capacity.....	2,387.97	599.21
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0051	EA		100 Amp Rating, 26 - 20 Amp Breakers, 120/208 Volt, 4 Wire, 3 Phase Assembled Panelboard, Main Lugs, 30 Circuit Capacity.....	2,554.99	599.21
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0052	EA		100 Amp Rating, 28 - 20 Amp Breakers, 120/208 Volt, 4 Wire, 3 Phase Assembled Panelboard, Main Lugs, 30 Circuit Capacity.....	2,722.51	691.71
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0053	EA		100 Amp Rating, 30 - 20 Amp Breakers, 120/208 Volt, 4 Wire, 3 Phase Assembled Panelboard, Main Lugs, 30 Circuit Capacity.....	2,889.50	691.71
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0054	EA		225 Amp Rating, 32 - 20 Amp Breakers, 120/208 Volt, 4 Wire, 3 Phase Assembled Panelboard, Main Lugs, 42 Circuit Capacity.....	3,214.82	836.49
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0055	EA		225 Amp Rating, 34 - 20 Amp Breakers, 120/208 Volt, 4 Wire, 3 Phase Assembled Panelboard, Main Lugs, 42 Circuit Capacity.....	3,322.86	836.49
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0056	EA		225 Amp Rating, 36 - 20 Amp Breakers, 120/208 Volt, 4 Wire, 3 Phase Assembled Panelboard, Main Lugs, 42 Circuit Capacity.....	3,519.20	928.98
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0057	EA		225 Amp Rating, 38 - 20 Amp Breakers, 120/208 Volt, 4 Wire, 3 Phase Assembled Panelboard, Main Lugs, 42 Circuit Capacity.....	3,693.13	928.98
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0058	EA		225 Amp Rating, 40 - 20 Amp Breakers, 120/208 Volt, 4 Wire, 3 Phase Assembled Panelboard, Main Lugs, 54 Circuit Capacity.....	3,819.88	1,013.44
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0059	EA		225 Amp Rating, 42 - 20 Amp Breakers, 120/208 Volt, 4 Wire, 3 Phase Assembled Panelboard, Main Lugs, 54 Circuit Capacity.....	3,989.29	1,013.44
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0060	EA		400 Amp Rating, 32 - 20 Amp Breakers, 120/208 Volt, 4 Wire, 3 Phase Assembled Panelboard, Main Lugs, 42 Circuit Capacity.....	3,931.34	899.22
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0061	EA		400 Amp Rating, 34 - 20 Amp Breakers, 120/208 Volt, 4 Wire, 3 Phase Assembled Panelboard, Main Lugs, 42 Circuit Capacity.....	4,050.73	945.07
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0062	EA		400 Amp Rating, 36 - 20 Amp Breakers, 120/208 Volt, 4 Wire, 3 Phase Assembled Panelboard, Main Lugs, 42 Circuit Capacity.....	4,255.15	995.34
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0063	EA		400 Amp Rating, 38 - 20 Amp Breakers, 120/208 Volt, 4 Wire, 3 Phase Assembled Panelboard, Main Lugs, 42 Circuit Capacity.....	4,441.02	1,053.65
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0064	EA		400 Amp Rating, 40 - 20 Amp Breakers, 120/208 Volt, 4 Wire, 3 Phase Assembled Panelboard, Main Lugs, 54 Circuit Capacity.....	4,574.62	1,085.82
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0065	EA		400 Amp Rating, 42 - 20 Amp Breakers, 120/208 Volt, 4 Wire, 3 Phase Assembled Panelboard, Main Lugs, 54 Circuit Capacity.....	4,783.50	1,152.18
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
				26 24 16 00-0066 120/208 Volt, 4 Wire, 3 Phase, Main Breaker Assembled Panelboards <small>(26 24 16 00-0002)</small>		
				26 24 16 00-0067 EA 50 Amp Rating, 8 - 20 Amp Breakers, 120/208 Volt, 4 Wire, 3 Phase Assembled Panelboard, Up To 50 Amp Main Breaker, 12 Circuit Capacity.....	1,415.12	253.35
				<i>For Weathertight NEMA 3R Panelboards, Add</i>	<i>348.00</i>	
				26 24 16 00-0068 EA 50 Amp Rating, 10 - 20 Amp Breakers, 120/208 Volt, 4 Wire, 3 Phase Assembled Panelboard, Up To 50 Amp Main Breaker, 20 Circuit Capacity.....	1,555.01	253.35
				<i>For Weathertight NEMA 3R Panelboards, Add</i>	<i>348.00</i>	
				26 24 16 00-0069 EA 50 Amp Rating, 12 - 20 Amp Breakers, 120/208 Volt, 4 Wire, 3 Phase Assembled Panelboard, Up To 50 Amp Main Breaker, 20 Circuit Capacity.....	1,723.83	333.79
				<i>For Weathertight NEMA 3R Panelboards, Add</i>	<i>348.00</i>	
				26 24 16 00-0070 EA 50 Amp Rating, 14 - 20 Amp Breakers, 120/208 Volt, 4 Wire, 3 Phase Assembled Panelboard, Up To 50 Amp Main Breaker, 20 Circuit Capacity.....	1,967.39	333.79
				<i>For Weathertight NEMA 3R Panelboards, Add</i>	<i>348.00</i>	
				26 24 16 00-0071 EA 100 Amp Rating 16 - 20 Amp Breakers, 120/208 Volt, 4 Wire, 3 Phase Assembled Panelboard, >50 To 100 Amp Main Breaker, 20 Circuit Capacity.....	2,296.16	502.70
				<i>For Weathertight NEMA 3R Panelboards, Add</i>	<i>348.00</i>	
				26 24 16 00-0072 EA 100 Amp Rating, 18 - 20 Amp Breakers, 120/208 Volt, 4 Wire, 3 Phase Assembled Panelboard, >50 To 100 Amp Main Breaker, 24 Circuit Capacity.....	2,442.48	502.70
				<i>For Weathertight NEMA 3R Panelboards, Add</i>	<i>348.00</i>	
				26 24 16 00-0073 EA 100 Amp Rating, 20 - 20 Amp Breakers, 120/208 Volt, 4 Wire, 3 Phase Assembled Panelboard, >50 To 100 Amp Main Breaker, 24 Circuit Capacity.....	2,599.44	587.14
				<i>For Weathertight NEMA 3R Panelboards, Add</i>	<i>348.00</i>	
				26 24 16 00-0074 EA 100 Amp Rating, 22 - 20 Amp Breakers, 120/208 Volt, 4 Wire, 3 Phase Assembled Panelboard, >50 To 100 Amp Main Breaker, 30 Circuit Capacity.....	2,728.27	587.14
				<i>For Weathertight NEMA 3R Panelboards, Add</i>	<i>348.00</i>	
				26 24 16 00-0075 EA 100 Amp Rating, 24 - 20 Amp Breakers, 120/208 Volt, 4 Wire, 3 Phase Assembled Panelboard, >50 To 100 Amp Main Breaker, 30 Circuit Capacity.....	2,905.28	679.65
				<i>For Weathertight NEMA 3R Panelboards, Add</i>	<i>348.00</i>	
				26 24 16 00-0076 EA 100 Amp Rating, 26 - 20 Amp Breakers, 120/208 Volt, 4 Wire, 3 Phase Assembled Panelboard, >50 To 100 Amp Main Breaker, 30 Circuit Capacity.....	3,022.63	679.65
				<i>For Weathertight NEMA 3R Panelboards, Add</i>	<i>348.00</i>	
				26 24 16 00-0077 EA 100 Amp Rating, 28 - 20 Amp Breakers, 120/208 Volt, 4 Wire, 3 Phase Assembled Panelboard, >50 To 100 Amp Main Breaker, 30 Circuit Capacity.....	3,221.35	764.09
				<i>For Weathertight NEMA 3R Panelboards, Add</i>	<i>348.00</i>	
				26 24 16 00-0078 EA 100 Amp Rating, 30 - 20 Amp Breakers, 120/208 Volt, 4 Wire, 3 Phase Assembled Panelboard, >50 To 100 Amp Main Breaker, 30 Circuit Capacity.....	3,394.06	764.09
				<i>For Weathertight NEMA 3R Panelboards, Add</i>	<i>348.00</i>	
				26 24 16 00-0079 EA 225 Amp Rating, 32 - 20 Amp Breakers, 120/208 Volt, 4 Wire, 3 Phase Assembled Panelboard, >100 To 225 Amp Main Breaker, 42 Circuit Capacity.....	4,530.02	884.74
				<i>For Weathertight NEMA 3R Panelboards, Add</i>	<i>348.00</i>	
				26 24 16 00-0080 EA 225 Amp Rating, 34 - 20 Amp Breakers, 120/208 Volt, 4 Wire, 3 Phase Assembled Panelboard, >100 To 225 Amp Main Breaker, 42 Circuit Capacity.....	4,720.43	933.00
				<i>For Weathertight NEMA 3R Panelboards, Add</i>	<i>348.00</i>	
				26 24 16 00-0081 EA 225 Amp Rating, 36 - 20 Amp Breakers, 120/208 Volt, 4 Wire, 3 Phase Assembled Panelboard, >100 To 225 Amp Main Breaker, 42 Circuit Capacity.....	4,795.64	933.00
				<i>For Weathertight NEMA 3R Panelboards, Add</i>	<i>348.00</i>	
				26 24 16 00-0082 EA 225 Amp Rating, 38 - 20 Amp Breakers, 120/208 Volt, 4 Wire, 3 Phase Assembled Panelboard, >100 To 225 Amp Main Breaker, 42 Circuit Capacity.....	5,006.33	1,053.65
				<i>For Weathertight NEMA 3R Panelboards, Add</i>	<i>348.00</i>	
				26 24 16 00-0083 EA 225 Amp Rating, 40 - 20 Amp Breakers, 120/208 Volt, 4 Wire, 3 Phase Assembled Panelboard, >100 To 225 Amp Main Breaker, 54 Circuit Capacity.....	5,162.22	1,053.65
				<i>For Weathertight NEMA 3R Panelboards, Add</i>	<i>348.00</i>	
				26 24 16 00-0084 EA 225 Amp Rating, 42 - 20 Amp Breakers, 120/208 Volt, 4 Wire, 3 Phase Assembled Panelboard, >100 To 225 Amp Main Breaker, 54 Circuit Capacity.....	5,251.80	1,053.65
				<i>For Weathertight NEMA 3R Panelboards, Add</i>	<i>348.00</i>	
				26 24 16 00-0085 EA 400 Amp Rating, 32 - 20 Amp Breakers, 120/208 Volt, 4 Wire, 3 Phase Assembled Panelboard, >225 To 400 Amp Main Breaker, 42 Circuit Capacity.....	5,398.12	969.20
				<i>For Weathertight NEMA 3R Panelboards, Add</i>	<i>348.00</i>	
				26 24 16 00-0086 EA 400 Amp Rating, 34 - 20 Amp Breakers, 120/208 Volt, 4 Wire, 3 Phase Assembled Panelboard, >225 To 400 Amp Main Breaker, 42 Circuit Capacity.....	5,603.52	1,025.49
				<i>For Weathertight NEMA 3R Panelboards, Add</i>	<i>348.00</i>	
				26 24 16 00-0087 EA 400 Amp Rating, 36 - 20 Amp Breakers, 120/208 Volt, 4 Wire, 3 Phase Assembled Panelboard, >225 To 400 Amp Main Breaker, 42 Circuit Capacity.....	5,680.60	1,053.65
				<i>For Weathertight NEMA 3R Panelboards, Add</i>	<i>348.00</i>	
				26 24 16 00-0088 EA 400 Amp Rating, 38 - 20 Amp Breakers, 120/208 Volt, 4 Wire, 3 Phase Assembled Panelboard, >225 To 400 Amp Main Breaker, 42 Circuit Capacity.....	5,906.24	1,118.00
				<i>For Weathertight NEMA 3R Panelboards, Add</i>	<i>348.00</i>	
				26 24 16 00-0089 EA 400 Amp Rating, 40 - 20 Amp Breakers, 120/208 Volt, 4 Wire, 3 Phase Assembled Panelboard, >225 To 400 Amp Main Breaker, 54 Circuit Capacity.....	6,060.61	1,150.16
				<i>For Weathertight NEMA 3R Panelboards, Add</i>	<i>348.00</i>	
				26 24 16 00-0090 EA 400 Amp Rating, 42 - 20 Amp Breakers, 120/208 Volt, 4 Wire, 3 Phase Assembled Panelboard, >225 To 400 Amp Main Breaker, 54 Circuit Capacity.....	6,196.44	1,190.39
				<i>For Weathertight NEMA 3R Panelboards, Add</i>	<i>348.00</i>	
				26 24 16 00-0091 480 Volt, 3 Wire, 3 Phase, Main Lugs Assembled Panelboards <small>(26 24 16 00-0002)</small>		
				26 24 16 00-0092 EA 100 Amp Rating, 8 - 20 Amp Breakers, 480 Volt, 3 Wire, 3 Phase Assembled Panelboard, Main Lugs, 12 Circuit Capacity.....	1,334.66	257.38
				<i>For Weathertight NEMA 3R Panelboards, Add</i>	<i>348.00</i>	
				26 24 16 00-0093 EA 100 Amp Rating, 10 - 20 Amp Breakers, 480 Volt, 3 Wire, 3 Phase Assembled Panelboard, Main Lugs, 20 Circuit Capacity.....	1,519.79	257.38
				<i>For Weathertight NEMA 3R Panelboards, Add</i>	<i>348.00</i>	

26 Electrical**26 20 Low-Voltage Electrical Distribution****26 24 Switchboards And Panelboards**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 24 16 00-0094	EA		100 Amp Rating, 12 - 20 Amp Breakers, 480 Volt, 3 Wire, 3 Phase Assembled Panelboard, Main Lugs, 20 Circuit Capacity.....	1,698.01	353.90
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0095	EA		100 Amp Rating, 14 - 20 Amp Breakers, 480 Volt, 3 Wire, 3 Phase Assembled Panelboard, Main Lugs, 20 Circuit Capacity.....	1,883.12	353.90
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0096	EA		100 Amp Rating, 16 - 20 Amp Breakers, 480 Volt, 3 Wire, 3 Phase Assembled Panelboard, Main Lugs, 20 Circuit Capacity.....	2,056.96	442.37
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0097	EA		100 Amp Rating, 18 - 20 Amp Breakers, 480 Volt, 3 Wire, 3 Phase Assembled Panelboard, Main Lugs, 24 Circuit Capacity.....	2,239.19	442.37
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0098	EA		100 Amp Rating, 20 - 20 Amp Breakers, 480 Volt, 3 Wire, 3 Phase Assembled Panelboard, Main Lugs, 24 Circuit Capacity.....	2,428.56	534.86
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0099	EA		100 Amp Rating, 22 - 20 Amp Breakers, 480 Volt, 3 Wire, 3 Phase Assembled Panelboard, Main Lugs, 30 Circuit Capacity.....	2,603.62	534.86
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0100	EA		100 Amp Rating, 24 - 20 Amp Breakers, 480 Volt, 3 Wire, 3 Phase Assembled Panelboard, Main Lugs, 30 Circuit Capacity.....	2,794.29	635.41
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0101	EA		100 Amp Rating, 26 - 20 Amp Breakers, 480 Volt, 3 Wire, 3 Phase Assembled Panelboard, Main Lugs, 30 Circuit Capacity.....	2,979.00	635.41
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0102	EA		100 Amp Rating, 28 - 20 Amp Breakers, 480 Volt, 3 Wire, 3 Phase Assembled Panelboard, Main Lugs, 30 Circuit Capacity.....	3,150.26	723.88
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0103	EA		100 Amp Rating, 30 - 20 Amp Breakers, 480 Volt, 3 Wire, 3 Phase Assembled Panelboard, Main Lugs, 30 Circuit Capacity.....	3,332.48	723.88
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0104	EA		225 Amp Rating, 32 - 20 Amp Breakers, 480 Volt, 3 Wire, 3 Phase Assembled Panelboard, Main Lugs, 42 Circuit Capacity.....	3,714.57	880.72
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0105	EA		225 Amp Rating, 34 - 20 Amp Breakers, 480 Volt, 3 Wire, 3 Phase Assembled Panelboard, Main Lugs, 42 Circuit Capacity.....	3,896.60	880.72
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0106	EA		225 Amp Rating, 36 - 20 Amp Breakers, 480 Volt, 3 Wire, 3 Phase Assembled Panelboard, Main Lugs, 42 Circuit Capacity.....	4,089.24	965.18
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0107	EA		225 Amp Rating, 38 - 20 Amp Breakers, 480 Volt, 3 Wire, 3 Phase Assembled Panelboard, Main Lugs, 42 Circuit Capacity.....	4,234.70	965.18
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0108	EA		225 Amp Rating, 40 - 20 Amp Breakers, 480 Volt, 3 Wire, 3 Phase Assembled Panelboard, Main Lugs, 54 Circuit Capacity.....	4,447.02	1,065.72
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0109	EA		225 Amp Rating, 42 - 20 Amp Breakers, 480 Volt, 3 Wire, 3 Phase Assembled Panelboard, Main Lugs, 54 Circuit Capacity.....	4,603.72	1,065.72
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0110			480 Volt, 3 Wire, 3 Phase, Main Breaker Assembled Panelboards <small>(26 24 16 00-0002)</small>		
26 24 16 00-0111	EA		50 Amp Rating, 8 - 20 Amp Breakers, 480 Volt, 3 Wire, 3 Phase Assembled Panelboard, Up To 50 Amp Main Breaker, 12 Circuit Capacity.....	1,707.27	273.47
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0112	EA		50 Amp Rating, 10 - 20 Amp Breakers, 480 Volt, 3 Wire, 3 Phase Assembled Panelboard, Up To 50 Amp Main Breaker, 20 Circuit Capacity.....	1,888.59	297.60
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0113	EA		50 Amp Rating, 12 - 20 Amp Breakers, 480 Volt, 3 Wire, 3 Phase Assembled Panelboard, Up To 50 Amp Main Breaker, 20 Circuit Capacity.....	2,071.71	369.98
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0114	EA		100 Amp Rating, 14 - 20 Amp Breakers, 480 Volt, 3 Wire, 3 Phase Assembled Panelboard, >50 To 100 Amp Main Breaker, 20 Circuit Capacity.....	2,761.19	450.42
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0115	EA		100 Amp Rating, 16 - 20 Amp Breakers, 480 Volt, 3 Wire, 3 Phase Assembled Panelboard, >50 To 100 Amp Main Breaker, 20 Circuit Capacity.....	2,947.68	498.67
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0116	EA		100 Amp Rating, 18 - 20 Amp Breakers, 480 Volt, 3 Wire, 3 Phase Assembled Panelboard, >50 To 100 Amp Main Breaker, 24 Circuit Capacity.....	3,120.05	538.89
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0117	EA		100 Amp Rating, 20 - 20 Amp Breakers, 480 Volt, 3 Wire, 3 Phase Assembled Panelboard, >50 To 100 Amp Main Breaker, 24 Circuit Capacity.....	3,307.28	587.14
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0118	EA		100 Amp Rating, 22 - 20 Amp Breakers, 480 Volt, 3 Wire, 3 Phase Assembled Panelboard, >50 To 100 Amp Main Breaker, 30 Circuit Capacity.....	3,488.48	635.41
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0119	EA		100 Amp Rating, 24 - 20 Amp Breakers, 480 Volt, 3 Wire, 3 Phase Assembled Panelboard, >50 To 100 Amp Main Breaker, 30 Circuit Capacity.....	3,656.51	675.62
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0120	EA		100 Amp Rating, 26 - 20 Amp Breakers, 480 Volt, 3 Wire, 3 Phase Assembled Panelboard, >50 To 100 Amp Main Breaker, 30 Circuit Capacity.....	3,834.86	715.84
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	
26 24 16 00-0121	EA		100 Amp Rating, 28 - 20 Amp Breakers, 480 Volt, 3 Wire, 3 Phase Assembled Panelboard, >50 To 100 Amp Main Breaker, 30 Circuit Capacity.....	4,025.63	764.09
			<i>For Weathertight NEMA 3R Panelboards, Add</i>	348.00	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
	26 24 16 00-0122	EA		100 Amp Rating, 30 - 20 Amp Breakers, 480 Volt, 3 Wire, 3 Phase Assembled Panelboard, >50 To 100 Amp Main Breaker, 30 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	4,231.67 348.00	824.42
	26 24 16 00-0123	EA		225 Amp Rating, 32 - 20 Amp Breakers, 480 Volt, 3 Wire, 3 Phase Assembled Panelboard, >100 To 225 Amp Main Breaker, 42 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	5,431.23 348.00	916.91
	26 24 16 00-0124	EA		225 Amp Rating, 34 - 20 Amp Breakers, 480 Volt, 3 Wire, 3 Phase Assembled Panelboard, >100 To 225 Amp Main Breaker, 42 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	5,629.89 348.00	973.21
	26 24 16 00-0125	EA		225 Amp Rating, 36 - 20 Amp Breakers, 480 Volt, 3 Wire, 3 Phase Assembled Panelboard, >100 To 225 Amp Main Breaker, 42 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	5,778.74 348.00	997.35
	26 24 16 00-0126	EA		225 Amp Rating, 38 - 20 Amp Breakers, 480 Volt, 3 Wire, 3 Phase Assembled Panelboard, >100 To 225 Amp Main Breaker, 42 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	5,998.91 348.00	1,061.69
	26 24 16 00-0127	EA		225 Amp Rating, 40 - 20 Amp Breakers, 480 Volt, 3 Wire, 3 Phase Assembled Panelboard, >100 To 225 Amp Main Breaker, 54 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	6,160.10 348.00	1,101.91
	26 24 16 00-0128	EA		225 Amp Rating, 42 - 20 Amp Breakers, 480 Volt, 3 Wire, 3 Phase Assembled Panelboard, >100 To 225 Amp Main Breaker, 54 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	6,326.27 348.00	1,136.49
	26 24 16 00-0129			277/480 Volt, 4 Wire, 3 Phase, Main Lugs Assembled Panelboards <small>(26 24 16 00-0002)</small>		
	26 24 16 00-0130	EA		100 Amp Rating, 8 - 20 Amp Breakers, 277/480 Volt, 4 Wire, 3 Phase Assembled Panelboard, Main Lugs, 12 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	1,972.40 348.00	281.51
	26 24 16 00-0131	EA		100 Amp Rating, 10 - 20 Amp Breakers, 277/480 Volt, 4 Wire, 3 Phase Assembled Panelboard, Main Lugs, 20 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	2,308.21 348.00	281.51
	26 24 16 00-0132	EA		100 Amp Rating, 12 - 20 Amp Breakers, 277/480 Volt, 4 Wire, 3 Phase Assembled Panelboard, Main Lugs, 20 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	2,639.13 348.00	374.00
	26 24 16 00-0133	EA		100 Amp Rating, 14 - 20 Amp Breakers, 277/480 Volt, 4 Wire, 3 Phase Assembled Panelboard, Main Lugs, 20 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	2,971.55 348.00	374.00
	26 24 16 00-0134	EA		100 Amp Rating, 16 - 20 Amp Breakers, 277/480 Volt, 4 Wire, 3 Phase Assembled Panelboard, Main Lugs, 20 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	3,307.00 348.00	462.48
	26 24 16 00-0135	EA		100 Amp Rating, 18 - 20 Amp Breakers, 277/480 Volt, 4 Wire, 3 Phase Assembled Panelboard, Main Lugs, 24 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	3,638.54 348.00	462.48
	26 24 16 00-0136	EA		100 Amp Rating, 20 - 20 Amp Breakers, 277/480 Volt, 4 Wire, 3 Phase Assembled Panelboard, Main Lugs, 24 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	3,973.12 348.00	554.98
	26 24 16 00-0137	EA		100 Amp Rating, 22 - 20 Amp Breakers, 277/480 Volt, 4 Wire, 3 Phase Assembled Panelboard, Main Lugs, 30 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	4,306.90 348.00	554.98
	26 24 16 00-0138	EA		100 Amp Rating, 24 - 20 Amp Breakers, 277/480 Volt, 4 Wire, 3 Phase Assembled Panelboard, Main Lugs, 30 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	4,658.00 348.00	651.49
	26 24 16 00-0139	EA		100 Amp Rating, 26 - 20 Amp Breakers, 277/480 Volt, 4 Wire, 3 Phase Assembled Panelboard, Main Lugs, 30 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	4,975.94 348.00	651.49
	26 24 16 00-0140	EA		100 Amp Rating, 28 - 20 Amp Breakers, 277/480 Volt, 4 Wire, 3 Phase Assembled Panelboard, Main Lugs, 30 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	5,303.58 348.00	655.51
	26 24 16 00-0141	EA		100 Amp Rating, 30 - 20 Amp Breakers, 277/480 Volt, 4 Wire, 3 Phase Assembled Panelboard, Main Lugs, 30 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	5,642.88 348.00	655.51
	26 24 16 00-0142	EA		225 Amp Rating, 32 - 20 Amp Breakers, 277/480 Volt, 4 Wire, 3 Phase Assembled Panelboard, Main Lugs, 42 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	6,195.88 348.00	908.88
	26 24 16 00-0143	EA		225 Amp Rating, 34 - 20 Amp Breakers, 277/480 Volt, 4 Wire, 3 Phase Assembled Panelboard, Main Lugs, 42 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	6,535.94 348.00	908.88
	26 24 16 00-0144	EA		225 Amp Rating, 36 - 20 Amp Breakers, 277/480 Volt, 4 Wire, 3 Phase Assembled Panelboard, Main Lugs, 42 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	6,831.21 348.00	957.13
	26 24 16 00-0145	EA		225 Amp Rating, 38 - 20 Amp Breakers, 277/480 Volt, 4 Wire, 3 Phase Assembled Panelboard, Main Lugs, 42 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	7,189.34 348.00	1,021.48
	26 24 16 00-0146	EA		225 Amp Rating, 40 - 20 Amp Breakers, 277/480 Volt, 4 Wire, 3 Phase Assembled Panelboard, Main Lugs, 54 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	7,494.88 348.00	1,021.48
	26 24 16 00-0147	EA		225 Amp Rating, 42 - 20 Amp Breakers, 277/480 Volt, 4 Wire, 3 Phase Assembled Panelboard, Main Lugs, 54 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	7,876.58 348.00	1,118.00
	26 24 16 00-0148			277/480 Volt, 4 Wire, 3 Phase, Main Breaker Assembled Panelboards <small>(26 24 16 00-0002)</small>		
	26 24 16 00-0149	EA		50 Amp Rating, 8 - 20 Amp Breakers, 277/480 Volt, 4 Wire, 3 Phase Assembled Panelboard, Up To 50 Amp Main Breaker, 12 Circuit Capacity <i>For Weathertight NEMA 3R Panelboards, Add</i>	2,398.83 348.00	345.86

26	Electrical
26 20	Low-Voltage Electrical Distribution
26 24	Switchboards And Panelboards



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 24 16 00-0150 EA 50 Amp Rating, 10 - 20 Amp Breakers, 277/480 Volt, 4 Wire, 3 Phase Assembled Panelboard, Up To 50 Amp Main Breaker, 20 Circuit Capacity .....2,739.11 <i>For Weathertight NEMA 3R Panelboards, Add</i> .....348.00		345.86
26 24 16 00-0151 EA 50 Amp Rating, 12 - 20 Amp Breakers, 277/480 Volt, 4 Wire, 3 Phase Assembled Panelboard, Up To 50 Amp Main Breaker, 20 Circuit Capacity .....3,072.11 <i>For Weathertight NEMA 3R Panelboards, Add</i> .....348.00		458.46
26 24 16 00-0152 EA 100 Amp Rating, 14 - 20 Amp Breakers, 277/480 Volt, 4 Wire, 3 Phase Assembled Panelboard, >50 To 100 Amp Main Breaker, 20 Circuit Capacity .....3,687.34 <i>For Weathertight NEMA 3R Panelboards, Add</i> .....348.00		458.46
26 24 16 00-0153 EA 100 Amp Rating, 16 - 20 Amp Breakers, 277/480 Volt, 4 Wire, 3 Phase Assembled Panelboard, >50 To 100 Amp Main Breaker, 20 Circuit Capacity .....4,027.80 <i>For Weathertight NEMA 3R Panelboards, Add</i> .....348.00		579.11
26 24 16 00-0154 EA 100 Amp Rating, 18 - 20 Amp Breakers, 277/480 Volt, 4 Wire, 3 Phase Assembled Panelboard, >50 To 100 Amp Main Breaker, 24 Circuit Capacity .....4,367.98 <i>For Weathertight NEMA 3R Panelboards, Add</i> .....348.00		579.11
26 24 16 00-0155 EA 100 Amp Rating, 20 - 20 Amp Breakers, 277/480 Volt, 4 Wire, 3 Phase Assembled Panelboard, >50 To 100 Amp Main Breaker, 24 Circuit Capacity .....4,702.12 <i>For Weathertight NEMA 3R Panelboards, Add</i> .....348.00		663.56
26 24 16 00-0156 EA 100 Amp Rating, 22 - 20 Amp Breakers, 277/480 Volt, 4 Wire, 3 Phase Assembled Panelboard, >50 To 100 Amp Main Breaker, 30 Circuit Capacity .....5,023.10 <i>For Weathertight NEMA 3R Panelboards, Add</i> .....348.00		663.56
26 24 16 00-0157 EA 100 Amp Rating, 24 - 20 Amp Breakers, 277/480 Volt, 4 Wire, 3 Phase Assembled Panelboard, >50 To 100 Amp Main Breaker, 30 Circuit Capacity .....5,354.38 <i>For Weathertight NEMA 3R Panelboards, Add</i> .....348.00		756.05
26 24 16 00-0158 EA 100 Amp Rating, 26 - 20 Amp Breakers, 277/480 Volt, 4 Wire, 3 Phase Assembled Panelboard, >50 To 100 Amp Main Breaker, 30 Circuit Capacity .....5,698.10 <i>For Weathertight NEMA 3R Panelboards, Add</i> .....348.00		756.05
26 24 16 00-0159 EA 100 Amp Rating, 28 - 20 Amp Breakers, 277/480 Volt, 4 Wire, 3 Phase Assembled Panelboard, >50 To 100 Amp Main Breaker, 30 Circuit Capacity .....6,016.21 <i>For Weathertight NEMA 3R Panelboards, Add</i> .....348.00		836.49
26 24 16 00-0160 EA 100 Amp Rating, 30 - 20 Amp Breakers, 277/480 Volt, 4 Wire, 3 Phase Assembled Panelboard, >50 To 100 Amp Main Breaker, 30 Circuit Capacity .....6,342.11 <i>For Weathertight NEMA 3R Panelboards, Add</i> .....348.00		836.49
26 24 16 00-0161 EA 225 Amp Rating, 32 - 20 Amp Breakers, 277/480 Volt, 4 Wire, 3 Phase Assembled Panelboard, >100 To 225 Amp Main Breaker, 42 Circuit Capacity .....8,527.89 <i>For Weathertight NEMA 3R Panelboards, Add</i> .....348.00		989.30
26 24 16 00-0162 EA 225 Amp Rating, 34 - 20 Amp Breakers, 277/480 Volt, 4 Wire, 3 Phase Assembled Panelboard, >100 To 225 Amp Main Breaker, 42 Circuit Capacity .....8,886.01 <i>For Weathertight NEMA 3R Panelboards, Add</i> .....348.00		989.30
26 24 16 00-0163 EA 225 Amp Rating, 36 - 20 Amp Breakers, 277/480 Volt, 4 Wire, 3 Phase Assembled Panelboard, >100 To 225 Amp Main Breaker, 42 Circuit Capacity .....9,191.55 <i>For Weathertight NEMA 3R Panelboards, Add</i> .....348.00		1,081.79
26 24 16 00-0164 EA 225 Amp Rating, 38 - 20 Amp Breakers, 277/480 Volt, 4 Wire, 3 Phase Assembled Panelboard, >100 To 225 Amp Main Breaker, 42 Circuit Capacity .....9,573.26 <i>For Weathertight NEMA 3R Panelboards, Add</i> .....348.00		1,081.79
26 24 16 00-0165 EA 225 Amp Rating, 40 - 20 Amp Breakers, 277/480 Volt, 4 Wire, 3 Phase Assembled Panelboard, >100 To 225 Amp Main Breaker, 54 Circuit Capacity .....9,892.37 <i>For Weathertight NEMA 3R Panelboards, Add</i> .....348.00		1,182.34
26 24 16 00-0166 EA 225 Amp Rating, 42 - 20 Amp Breakers, 277/480 Volt, 4 Wire, 3 Phase Assembled Panelboard, >100 To 225 Amp Main Breaker, 54 Circuit Capacity .....7,730.51 <i>For Weathertight NEMA 3R Panelboards, Add</i> .....348.00		1,182.34
26 24 16 00-0167 EA 400 Amp Rating, 42 - 20 Amp Breakers, 277/480 Volt, 4 Wire, 3 Phase Assembled Panelboard, >225 To 400 Amp Main Breaker, 54 Circuit Capacity .....11,857.41		1,316.66
26 24 16 00-0168 EA 600 Amp Rating, 42 - 20 Amp Breakers, 277/480 Volt, 4 Wire, 3 Phase Assembled Panelboard, >400 To 600 Amp Main Breaker, 54 Circuit Capacity .....14,476.73		1,580.47
26 24 16 00-0169 Unassembled Lighting And Power Panelboards <small>(26 24 16 00-0001)</small> Note: Listed panelboards include the main device (lugs or breaker), connection of main service cable from meter and that portion of the panel box, trim and interior occupied by that device. Spaces include that portion of the panel box, trim and interior reserved by that space. The maximum single pole capacity of the panelboard main device (lugs, breakers) is indicated. Excludes branch breakers. A complete panelboard will be the sum of main device and the branch circuit breakers and spaces (within the capacity of the main device).		
26 24 16 00-0170 240 Volt AC, 48 Volt DC, 3 Wire, 1 Phase Unassembled Panelboards <small>(26 24 16 00-0169)</small> Note: As manufactured by Square D or equal. Accepts plug-on and bolt-on breakers.		
26 24 16 00-0171 Main Lugs, NEMA 1, 240 Volt AC, 48 Volt DC, 3 Wire, 1 Phase Unassembled Panelboards <small>(26 24 16 00-0170)</small>		
26 24 16 00-0172 EA 100 Amp Rating, 12 Circuit Capacity, Main Lugs, NEMA 1, 240 Volt AC, 48 Volt DC, 3 Wire, 1 Phase Unassembled Panelboard .....536.74 <i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i> .....328.00		
26 24 16 00-0173 EA 100 Amp Rating, 20 Circuit Capacity, Main Lugs, NEMA 1, 240 Volt AC, 48 Volt DC, 3 Wire, 1 Phase Unassembled Panelboard .....615.46 <i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i> .....328.00		
26 24 16 00-0174 EA 225 Amp Rating, 30 Circuit Capacity, Main Lugs, NEMA 1, 240 Volt AC, 48 Volt DC, 3 Wire, 1 Phase Unassembled Panelboard .....828.77 <i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i> .....328.00		
26 24 16 00-0175 EA 225 Amp Rating, 42 Circuit Capacity, Main Lugs, NEMA 1, 240 Volt AC, 48 Volt DC, 3 Wire, 1 Phase Unassembled Panelboard .....954.71 <i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i> .....328.00		
26 24 16 00-0176 EA 225 Amp Rating, 54 Circuit Capacity, Main Lugs, NEMA 1, 240 Volt AC, 48 Volt DC, 3 Wire, 1 Phase Unassembled Panelboard .....1,078.58 <i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i> .....328.00		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 24 16 00-0177 EA 400 Amp Rating, 30 Circuit Capacity, Main Lugs, NEMA 1, 240 Volt AC, 48 Volt DC, 3 Wire, 1 Phase Unassembled Panelboard	1,202.08	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0178 EA 400 Amp Rating, 42 Circuit Capacity, Main Lugs, NEMA 1, 240 Volt AC, 48 Volt DC, 3 Wire, 1 Phase Unassembled Panelboard	1,303.40	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0179 EA 400 Amp Rating, 54 Circuit Capacity, Main Lugs, NEMA 1, 240 Volt AC, 48 Volt DC, 3 Wire, 1 Phase Unassembled Panelboard	1,425.31	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0180 EA 600 Amp Rating, 30 Circuit Capacity, Main Lugs, NEMA 1, 240 Volt AC, 48 Volt DC, 3 Wire, 1 Phase Unassembled Panelboard	1,516.47	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0181 EA 600 Amp Rating, 42 Circuit Capacity, Main Lugs, NEMA 1, 240 Volt AC, 48 Volt DC, 3 Wire, 1 Phase Unassembled Panelboard	1,616.31	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0182 EA 600 Amp Rating, 54 Circuit Capacity, Main Lugs, NEMA 1, 240 Volt AC, 48 Volt DC, 3 Wire, 1 Phase Unassembled Panelboard	1,760.24	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0183 Main Breaker, NEMA 1, 240 Volt AC, 48 Volt DC, 3 Wire, 1 Phase Unassembled Panelboards <small>(26 24 16 00-0170)</small>		
26 24 16 00-0184 EA 100 Amp Rating, 12 Circuit Capacity, Main Breaker, NEMA 1, 240 Volt AC, 48 Volt DC, 3 Wire, 1 Phase Unassembled Panelboard	795.79	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0185 EA 100 Amp Rating, 20 Circuit Capacity, Main Breaker, NEMA 1, 240 Volt AC, 48 Volt DC, 3 Wire, 1 Phase Unassembled Panelboard	898.15	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0186 EA 225 Amp Rating, 30 Circuit Capacity, Main Breaker, NEMA 1, 240 Volt AC, 48 Volt DC, 3 Wire, 1 Phase Unassembled Panelboard	1,431.96	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0187 EA 225 Amp Rating, 42 Circuit Capacity, Main Breaker, NEMA 1, 240 Volt AC, 48 Volt DC, 3 Wire, 1 Phase Unassembled Panelboard	1,585.75	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0188 EA 225 Amp Rating, 54 Circuit Capacity, Main Breaker, NEMA 1, 240 Volt AC, 48 Volt DC, 3 Wire, 1 Phase Unassembled Panelboard	1,728.49	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0189 EA 400 Amp Rating, 30 Circuit Capacity, Main Breaker, NEMA 1, 240 Volt AC, 48 Volt DC, 3 Wire, 1 Phase Unassembled Panelboard	3,056.77	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0190 EA 400 Amp Rating, 42 Circuit Capacity, Main Breaker, NEMA 1, 240 Volt AC, 48 Volt DC, 3 Wire, 1 Phase Unassembled Panelboard	3,220.58	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0191 EA 400 Amp Rating, 54 Circuit Capacity, Main Breaker, NEMA 1, 240 Volt AC, 48 Volt DC, 3 Wire, 1 Phase Unassembled Panelboard	3,370.96	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0192 Main Lugs, NEMA 3R, 5, Or 12, 240 Volt AC, 48 Volt DC, 3 Wire, 1 Phase Unassembled Panelboards <small>(26 24 16 00-0170)</small>		
26 24 16 00-0193 EA 100 Amp Rating, 12 Circuit Capacity, Main Lugs, NEMA 3R, 5, Or 12, 240 Volt AC, 48 Volt DC, 3 Wire, 1 Phase Unassembled Panelboard	1,109.98	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0194 EA 100 Amp Rating, 20 Circuit Capacity, Main Lugs, NEMA 3R, 5, Or 12, 240 Volt AC, 48 Volt DC, 3 Wire, 1 Phase Unassembled Panelboard	1,182.14	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0195 EA 225 Amp Rating, 30 Circuit Capacity, Main Lugs, NEMA 3R, 5, Or 12, 240 Volt AC, 48 Volt DC, 3 Wire, 1 Phase Unassembled Panelboard	1,381.80	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0196 EA 225 Amp Rating, 42 Circuit Capacity, Main Lugs, NEMA 3R, 5, Or 12, 240 Volt AC, 48 Volt DC, 3 Wire, 1 Phase Unassembled Panelboard	1,505.01	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0197 EA 225 Amp Rating, 54 Circuit Capacity, Main Lugs, NEMA 3R, 5, Or 12, 240 Volt AC, 48 Volt DC, 3 Wire, 1 Phase Unassembled Panelboard	1,618.51	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0198 EA 400 Amp Rating, 30 Circuit Capacity, Main Lugs, NEMA 3R, 5, Or 12, 240 Volt AC, 48 Volt DC, 3 Wire, 1 Phase Unassembled Panelboard	1,847.92	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0199 EA 400 Amp Rating, 42 Circuit Capacity, Main Lugs, NEMA 3R, 5, Or 12, 240 Volt AC, 48 Volt DC, 3 Wire, 1 Phase Unassembled Panelboard	1,942.15	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0200 EA 400 Amp Rating, 54 Circuit Capacity, Main Lugs, NEMA 3R, 5, Or 12, 240 Volt AC, 48 Volt DC, 3 Wire, 1 Phase Unassembled Panelboard	2,057.51	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0201 EA 600 Amp Rating, 30 Circuit Capacity, Main Lugs, NEMA 3R, 5, Or 12, 240 Volt AC, 48 Volt DC, 3 Wire, 1 Phase Unassembled Panelboard	2,198.89	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0202 EA 600 Amp Rating, 42 Circuit Capacity, Main Lugs, NEMA 3R, 5, Or 12, 240 Volt AC, 48 Volt DC, 3 Wire, 1 Phase Unassembled Panelboard	2,294.97	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0203 EA 600 Amp Rating, 54 Circuit Capacity, Main Lugs, NEMA 3R, 5, Or 12, 240 Volt AC, 48 Volt DC, 3 Wire, 1 Phase Unassembled Panelboard	2,428.81	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	

26 Electrical**26 20 Low-Voltage Electrical Distribution****26 24 Switchboards And Panelboards**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 24 16 00-0204 Main Breaker, NEMA 3R, 5, Or 12, 240 Volt AC, 48 Volt DC, 3 Wire, 1 Phase Unassembled Panelboards <small>(26 24 16 00-0170)</small>		
26 24 16 00-0205 EA 100 Amp Rating, 12 Circuit Capacity, Main Breaker, NEMA 3R, 5, Or 12, 240 Volt AC, 48 Volt DC, 3 Wire, 1 Phase Unassembled Panelboard	1,362.48	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0206 EA 100 Amp Rating, 20 Circuit Capacity, Main Breaker, NEMA 3R, 5, Or 12, 240 Volt AC, 48 Volt DC, 3 Wire, 1 Phase Unassembled Panelboard	1,457.74	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0207 EA 225 Amp Rating, 30 Circuit Capacity, Main Breaker, NEMA 3R, 5, Or 12, 240 Volt AC, 48 Volt DC, 3 Wire, 1 Phase Unassembled Panelboard	2,090.90	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0208 EA 225 Amp Rating, 42 Circuit Capacity, Main Breaker, NEMA 3R, 5, Or 12, 240 Volt AC, 48 Volt DC, 3 Wire, 1 Phase Unassembled Panelboard	2,231.59	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0209 EA 225 Amp Rating, 54 Circuit Capacity, Main Breaker, NEMA 3R, 5, Or 12, 240 Volt AC, 48 Volt DC, 3 Wire, 1 Phase Unassembled Panelboard	2,364.50	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0210 EA 400 Amp Rating, 30 Circuit Capacity, Main Breaker, NEMA 3R, 5, Or 12, 240 Volt AC, 48 Volt DC, 3 Wire, 1 Phase Unassembled Panelboard	3,679.13	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0211 EA 400 Amp Rating, 42 Circuit Capacity, Main Breaker, NEMA 3R, 5, Or 12, 240 Volt AC, 48 Volt DC, 3 Wire, 1 Phase Unassembled Panelboard	3,836.39	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0212 EA 400 Amp Rating, 54 Circuit Capacity, Main Breaker, NEMA 3R, 5, Or 12, 240 Volt AC, 48 Volt DC, 3 Wire, 1 Phase Unassembled Panelboard	3,985.13	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0213 240 Volt AC, 48 Volt DC, 4 Wire, 3 Phase Unassembled Panelboards <small>(26 24 16 00-0169)</small>		
Note: As manufactured by Square D or equal. Accepts plug-on and bolt-on breakers		
26 24 16 00-0214 Main Lugs, NEMA 1, 240 Volt AC, 48 Volt DC, 4 Wire, 3 Phase Unassembled Panelboards <small>(26 24 16 00-0213)</small>		
26 24 16 00-0215 EA 100 Amp Rating, 12 Circuit Capacity, Main Lugs, NEMA 1, 240 Volt AC, 48 Volt DC, 4 Wire, 3 Phase Unassembled Panelboard	603.23	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0216 EA 100 Amp Rating, 24 Circuit Capacity, Main Lugs, NEMA 1, 240 Volt AC, 48 Volt DC, 4 Wire, 3 Phase Unassembled Panelboard	707.80	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0217 EA 100 Amp Rating, 30 Circuit Capacity, Main Lugs, NEMA 1, 240 Volt AC, 48 Volt DC, 4 Wire, 3 Phase Unassembled Panelboard	793.53	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0218 EA 225 Amp Rating, 30 Circuit Capacity, Main Lugs, NEMA 1, 240 Volt AC, 48 Volt DC, 4 Wire, 3 Phase Unassembled Panelboard	891.67	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0219 EA 225 Amp Rating, 42 Circuit Capacity, Main Lugs, NEMA 1, 240 Volt AC, 48 Volt DC, 4 Wire, 3 Phase Unassembled Panelboard	1,025.18	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0220 EA 225 Amp Rating, 54 Circuit Capacity, Main Lugs, NEMA 1, 240 Volt AC, 48 Volt DC, 4 Wire, 3 Phase Unassembled Panelboard	1,133.64	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0221 EA 400 Amp Rating, 30 Circuit Capacity, Main Lugs, NEMA 1, 240 Volt AC, 48 Volt DC, 4 Wire, 3 Phase Unassembled Panelboard	1,306.12	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0222 EA 400 Amp Rating, 42 Circuit Capacity, Main Lugs, NEMA 1, 240 Volt AC, 48 Volt DC, 4 Wire, 3 Phase Unassembled Panelboard	1,405.43	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0223 EA 400 Amp Rating, 54 Circuit Capacity, Main Lugs, NEMA 1, 240 Volt AC, 48 Volt DC, 4 Wire, 3 Phase Unassembled Panelboard	1,514.03	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0224 EA 600 Amp Rating, 30 Circuit Capacity, Main Lugs, NEMA 1, 240 Volt AC, 48 Volt DC, 4 Wire, 3 Phase Unassembled Panelboard	1,632.52	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0225 EA 600 Amp Rating, 42 Circuit Capacity, Main Lugs, NEMA 1, 240 Volt AC, 48 Volt DC, 4 Wire, 3 Phase Unassembled Panelboard	1,805.81	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0226 EA 600 Amp Rating, 54 Circuit Capacity, Main Lugs, NEMA 1, 240 Volt AC, 48 Volt DC, 4 Wire, 3 Phase Unassembled Panelboard	2,147.80	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0227 Main Breaker, NEMA 1, 240 Volt AC, 48 Volt DC, 4 Wire, 3 Phase Unassembled Panelboards <small>(26 24 16 00-0213)</small>		
26 24 16 00-0228 EA 100 Amp Rating, 12 Circuit Capacity, Main Breaker, NEMA 1, 240 Volt AC, 48 Volt DC, 4 Wire, 3 Phase Unassembled Panelboard	934.93	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0229 EA 100 Amp Rating, 24 Circuit Capacity, Main Breaker, NEMA 1, 240 Volt AC, 48 Volt DC, 4 Wire, 3 Phase Unassembled Panelboard	1,053.26	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0230 EA 100 Amp Rating, 30 Circuit Capacity, Main Breaker, NEMA 1, 240 Volt AC, 48 Volt DC, 4 Wire, 3 Phase Unassembled Panelboard	1,193.53	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 24 16 00-0231 EA 225 Amp Rating, 30 Circuit Capacity, Main Breaker, NEMA 1, 240 Volt AC, 48 Volt DC, 4 Wire, 3 Phase Unassembled Panelboard	1,784.02	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0232 EA 225 Amp Rating, 42 Circuit Capacity, Main Breaker, NEMA 1, 240 Volt AC, 48 Volt DC, 4 Wire, 3 Phase Unassembled Panelboard	1,929.76	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0233 EA 225 Amp Rating, 54 Circuit Capacity, Main Breaker, NEMA 1, 240 Volt AC, 48 Volt DC, 4 Wire, 3 Phase Unassembled Panelboard	2,060.50	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0234 EA 400 Amp Rating, 30 Circuit Capacity, Main Breaker, NEMA 1, 240 Volt AC, 48 Volt DC, 4 Wire, 3 Phase Unassembled Panelboard	2,871.93	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0235 EA 400 Amp Rating, 42 Circuit Capacity, Main Breaker, NEMA 1, 240 Volt AC, 48 Volt DC, 4 Wire, 3 Phase Unassembled Panelboard	3,022.29	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0236 EA 400 Amp Rating, 54 Circuit Capacity, Main Breaker, NEMA 1, 240 Volt AC, 48 Volt DC, 4 Wire, 3 Phase Unassembled Panelboard	3,147.89	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0237 Main Lugs, NEMA 3R, 5, Or 12, 240 Volt AC, 48 Volt DC, 4 Wire, 3 Phase Unassembled Panelboards <small>(26 24 16 00-0213)</small>		
26 24 16 00-0238 EA 100 Amp Rating, 12 Circuit Capacity, Main Lugs, NEMA 3R, 5, Or 12, 240 Volt AC, 48 Volt DC, 4 Wire, 3 Phase Unassembled Panelboard	1,176.46	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0239 EA 100 Amp Rating, 24 Circuit Capacity, Main Lugs, NEMA 3R, 5, Or 12, 240 Volt AC, 48 Volt DC, 4 Wire, 3 Phase Unassembled Panelboard	1,274.48	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0240 EA 100 Amp Rating, 30 Circuit Capacity, Main Lugs, NEMA 3R, 5, Or 12, 240 Volt AC, 48 Volt DC, 4 Wire, 3 Phase Unassembled Panelboard	1,353.12	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0241 EA 225 Amp Rating, 30 Circuit Capacity, Main Lugs, NEMA 3R, 5, Or 12, 240 Volt AC, 48 Volt DC, 4 Wire, 3 Phase Unassembled Panelboard	1,444.70	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0242 EA 225 Amp Rating, 42 Circuit Capacity, Main Lugs, NEMA 3R, 5, Or 12, 240 Volt AC, 48 Volt DC, 4 Wire, 3 Phase Unassembled Panelboard	1,575.49	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0243 EA 225 Amp Rating, 54 Circuit Capacity, Main Lugs, NEMA 3R, 5, Or 12, 240 Volt AC, 48 Volt DC, 4 Wire, 3 Phase Unassembled Panelboard	1,673.57	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0244 EA 400 Amp Rating, 30 Circuit Capacity, Main Lugs, NEMA 3R, 5, Or 12, 240 Volt AC, 48 Volt DC, 4 Wire, 3 Phase Unassembled Panelboard	1,951.96	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0245 EA 400 Amp Rating, 42 Circuit Capacity, Main Lugs, NEMA 3R, 5, Or 12, 240 Volt AC, 48 Volt DC, 4 Wire, 3 Phase Unassembled Panelboard	2,044.18	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0246 EA 400 Amp Rating, 54 Circuit Capacity, Main Lugs, NEMA 3R, 5, Or 12, 240 Volt AC, 48 Volt DC, 4 Wire, 3 Phase Unassembled Panelboard	2,146.22	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0247 EA 600 Amp Rating, 30 Circuit Capacity, Main Lugs, NEMA 3R, 5, Or 12, 240 Volt AC, 48 Volt DC, 4 Wire, 3 Phase Unassembled Panelboard	2,314.94	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0248 EA 600 Amp Rating, 42 Circuit Capacity, Main Lugs, NEMA 3R, 5, Or 12, 240 Volt AC, 48 Volt DC, 4 Wire, 3 Phase Unassembled Panelboard	2,475.67	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0249 EA 600 Amp Rating, 54 Circuit Capacity, Main Lugs, NEMA 3R, 5, Or 12, 240 Volt AC, 48 Volt DC, 4 Wire, 3 Phase Unassembled Panelboard	2,817.66	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0250 Main Breaker, NEMA 3R, 5, Or 12, 240 Volt AC, 48 Volt DC, 4 Wire, 3 Phase Unassembled Panelboards <small>(26 24 16 00-0213)</small>		
26 24 16 00-0251 EA 100 Amp Rating, 12 Circuit Capacity, Main Breaker, NEMA 3R, 5, Or 12, 240 Volt AC, 48 Volt DC, 4 Wire, 3 Phase Unassembled Panelboard	1,501.61	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0252 EA 100 Amp Rating, 24 Circuit Capacity, Main Breaker, NEMA 3R, 5, Or 12, 240 Volt AC, 48 Volt DC, 4 Wire, 3 Phase Unassembled Panelboard	1,612.84	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0253 EA 100 Amp Rating, 30 Circuit Capacity, Main Breaker, NEMA 3R, 5, Or 12, 240 Volt AC, 48 Volt DC, 4 Wire, 3 Phase Unassembled Panelboard	1,749.29	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0254 EA 225 Amp Rating, 30 Circuit Capacity, Main Breaker, NEMA 3R, 5, Or 12, 240 Volt AC, 48 Volt DC, 4 Wire, 3 Phase Unassembled Panelboard	2,442.97	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0255 EA 225 Amp Rating, 42 Circuit Capacity, Main Breaker, NEMA 3R, 5, Or 12, 240 Volt AC, 48 Volt DC, 4 Wire, 3 Phase Unassembled Panelboard	2,575.60	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0256 EA 225 Amp Rating, 54 Circuit Capacity, Main Breaker, NEMA 3R, 5, Or 12, 240 Volt AC, 48 Volt DC, 4 Wire, 3 Phase Unassembled Panelboard	2,696.52	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0257 EA 400 Amp Rating, 30 Circuit Capacity, Main Breaker, NEMA 3R, 5, Or 12, 240 Volt AC, 48 Volt DC, 4 Wire, 3 Phase Unassembled Panelboard	4,066.66	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	

26 Electrical**26 20 Low-Voltage Electrical Distribution****26 24 Switchboards And Panelboards**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 24 16 00-0258 EA 400 Amp Rating, 42 Circuit Capacity, Main Breaker, NEMA 3R, 5, Or 12, 240 Volt AC, 48 Volt DC, 4 Wire, 3 Phase Unassembled Panelboard	4,222.70	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0259 EA 400 Amp Rating, 54 Circuit Capacity, Main Breaker, NEMA 3R, 5, Or 12, 240 Volt AC, 48 Volt DC, 4 Wire, 3 Phase Unassembled Panelboard	4,357.90	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0260 480Y/277 Volt AC, 3 Wire, 1 Phase, Unassembled Panelboards <small>(26 24 16 00-0169)</small> Note: As manufactured by Square D or equal.		
26 24 16 00-0261 Main Lugs, NEMA 1, 480Y/277 Volt AC, 3 Wire, 1 Phase, Unassembled Panelboards <small>(26 24 16 00-0260)</small>		
26 24 16 00-0262 EA 125 Amp Rating, 12 Circuit Capacity, Main Lugs, NEMA 1, 480Y/277 Volt AC, 3 Wire, 1 Phase, Unassembled Panelboard	877.32	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0263 EA 125 Amp Rating, 18 Circuit Capacity, Main Lugs, NEMA 1, 480Y/277 Volt AC, 3 Wire, 1 Phase, Unassembled Panelboard	958.96	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0264 EA 250 Amp Rating, 30 Circuit Capacity, Main Lugs, NEMA 1, 480Y/277 Volt AC, 3 Wire, 1 Phase, Unassembled Panelboard	1,317.47	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0265 EA 250 Amp Rating, 42 Circuit Capacity, Main Lugs, NEMA 1, 480Y/277 Volt AC, 3 Wire, 1 Phase, Unassembled Panelboard	1,465.78	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0266 EA 250 Amp Rating, 54 Circuit Capacity, Main Lugs, NEMA 1, 480Y/277 Volt AC, 3 Wire, 1 Phase, Unassembled Panelboard	1,593.72	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0267 EA 400 Amp Rating, 30 Circuit Capacity, Main Lugs, NEMA 1, 480Y/277 Volt AC, 3 Wire, 1 Phase, Unassembled Panelboard	1,577.22	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0268 EA 400 Amp Rating, 42 Circuit Capacity, Main Lugs, NEMA 1, 480Y/277 Volt AC, 3 Wire, 1 Phase, Unassembled Panelboard	1,658.20	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0269 EA 400 Amp Rating, 54 Circuit Capacity, Main Lugs, NEMA 1, 480Y/277 Volt AC, 3 Wire, 1 Phase, Unassembled Panelboard	1,799.07	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0270 EA 600 Amp Rating, 30 Circuit Capacity, Main Lugs, NEMA 1, 480Y/277 Volt AC, 3 Wire, 1 Phase, Unassembled Panelboard	1,863.68	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0271 EA 600 Amp Rating, 42 Circuit Capacity, Main Lugs, NEMA 1, 480Y/277 Volt AC, 3 Wire, 1 Phase, Unassembled Panelboard	1,997.21	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0272 EA 600 Amp Rating, 54 Circuit Capacity, Main Lugs, NEMA 1, 480Y/277 Volt AC, 3 Wire, 1 Phase, Unassembled Panelboard	2,178.08	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0273 Main Breaker, NEMA 1, 480Y/277 Volt AC, 3 Wire, 1 Phase, Unassembled Panelboards <small>(26 24 16 00-0260)</small>		
26 24 16 00-0274 EA 100 Amp Rating, 12 Circuit Capacity, Main Breaker, NEMA 1, 480Y/277 Volt AC, 3 Wire, 1 Phase, Unassembled Panelboard	1,819.64	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0275 EA 100 Amp Rating, 18 Circuit Capacity, Main Breaker, NEMA 1, 480Y/277 Volt AC, 3 Wire, 1 Phase, Unassembled Panelboard	1,877.28	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0276 EA 125 Amp Rating, 18 Circuit Capacity, Main Breaker, NEMA 1, 480Y/277 Volt AC, 3 Wire, 1 Phase, Unassembled Panelboard	2,036.58	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0277 EA 125 Amp Rating, 30 Circuit Capacity, Main Breaker, NEMA 1, 480Y/277 Volt AC, 3 Wire, 1 Phase, Unassembled Panelboard	2,141.65	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0278 EA 125 Amp Rating, 42 Circuit Capacity, Main Breaker, NEMA 1, 480Y/277 Volt AC, 3 Wire, 1 Phase, Unassembled Panelboard	2,342.23	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0279 EA 250 Amp Rating, 30 Circuit Capacity, Main Breaker, NEMA 1, 480Y/277 Volt AC, 3 Wire, 1 Phase, Unassembled Panelboard	3,046.56	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0280 EA 250 Amp Rating, 42 Circuit Capacity, Main Breaker, NEMA 1, 480Y/277 Volt AC, 3 Wire, 1 Phase, Unassembled Panelboard	3,175.41	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0281 EA 250 Amp Rating, 54 Circuit Capacity, Main Breaker, NEMA 1, 480Y/277 Volt AC, 3 Wire, 1 Phase, Unassembled Panelboard	3,339.54	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0282 EA 400 Amp Rating, 30 Circuit Capacity, Main Breaker, NEMA 1, 480Y/277 Volt AC, 3 Wire, 1 Phase, Unassembled Panelboard	3,426.95	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0283 EA 400 Amp Rating, 42 Circuit Capacity, Main Breaker, NEMA 1, 480Y/277 Volt AC, 3 Wire, 1 Phase, Unassembled Panelboard	3,589.73	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0284 EA 400 Amp Rating, 54 Circuit Capacity, Main Breaker, NEMA 1, 480Y/277 Volt AC, 3 Wire, 1 Phase, Unassembled Panelboard	3,739.87	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 24 16 00-0285 Main Lugs, NEMA 3R, 5, Or 12, 480Y/277 Volt AC, 3 Wire, 1 Phase, Unassembled Panelboards <small>(26 24 16 00-0260)</small>		
26 24 16 00-0286 EA 125 Amp Rating, 12 Circuit Capacity, Main Lugs, NEMA 3R, 5, Or 12, 480Y/277 Volt AC, 3 Wire, 1 Phase, Unassembled Panelboard	1,430.90	
For Hinged Door-In-Door With Yale 5116 With Rosette, Add	328.00	
26 24 16 00-0287 EA 125 Amp Rating, 18 Circuit Capacity, Main Lugs, NEMA 3R, 5, Or 12, 480Y/277 Volt AC, 3 Wire, 1 Phase, Unassembled Panelboard	1,512.54	
For Hinged Door-In-Door With Yale 5116 With Rosette, Add	328.00	
26 24 16 00-0288 EA 250 Amp Rating, 30 Circuit Capacity, Main Lugs, NEMA 3R, 5, Or 12, 480Y/277 Volt AC, 3 Wire, 1 Phase, Unassembled Panelboard	1,857.95	
For Hinged Door-In-Door With Yale 5116 With Rosette, Add	328.00	
26 24 16 00-0289 EA 250 Amp Rating, 42 Circuit Capacity, Main Lugs, NEMA 3R, 5, Or 12, 480Y/277 Volt AC, 3 Wire, 1 Phase, Unassembled Panelboard	2,101.25	
For Hinged Door-In-Door With Yale 5116 With Rosette, Add	328.00	
26 24 16 00-0290 EA 250 Amp Rating, 54 Circuit Capacity, Main Lugs, NEMA 3R, 5, Or 12, 480Y/277 Volt AC, 3 Wire, 1 Phase, Unassembled Panelboard	2,218.27	
For Hinged Door-In-Door With Yale 5116 With Rosette, Add	328.00	
26 24 16 00-0291 EA 400 Amp Rating, 30 Circuit Capacity, Main Lugs, NEMA 3R, 5, Or 12, 480Y/277 Volt AC, 3 Wire, 1 Phase, Unassembled Panelboard	2,201.78	
For Hinged Door-In-Door With Yale 5116 With Rosette, Add	328.00	
26 24 16 00-0292 EA 400 Amp Rating, 42 Circuit Capacity, Main Lugs, NEMA 3R, 5, Or 12, 480Y/277 Volt AC, 3 Wire, 1 Phase, Unassembled Panelboard	2,266.37	
For Hinged Door-In-Door With Yale 5116 With Rosette, Add	328.00	
26 24 16 00-0293 EA 400 Amp Rating, 54 Circuit Capacity, Main Lugs, NEMA 3R, 5, Or 12, 480Y/277 Volt AC, 3 Wire, 1 Phase, Unassembled Panelboard	2,383.77	
For Hinged Door-In-Door With Yale 5116 With Rosette, Add	328.00	
26 24 16 00-0294 EA 600 Amp Rating, 30 Circuit Capacity, Main Lugs, NEMA 3R, 5, Or 12, 480Y/277 Volt AC, 3 Wire, 1 Phase, Unassembled Panelboard	2,502.97	
For Hinged Door-In-Door With Yale 5116 With Rosette, Add	328.00	
26 24 16 00-0295 EA 600 Amp Rating, 42 Circuit Capacity, Main Lugs, NEMA 3R, 5, Or 12, 480Y/277 Volt AC, 3 Wire, 1 Phase, Unassembled Panelboard	2,623.07	
For Hinged Door-In-Door With Yale 5116 With Rosette, Add	328.00	
26 24 16 00-0296 EA 600 Amp Rating, 54 Circuit Capacity, Main Lugs, NEMA 3R, 5, Or 12, 480Y/277 Volt AC, 3 Wire, 1 Phase, Unassembled Panelboard	2,775.08	
For Hinged Door-In-Door With Yale 5116 With Rosette, Add	328.00	
26 24 16 00-0297 Main Breaker, NEMA 3R, 5, Or 12, 480Y/277 Volt AC, 3 Wire, 1 Phase, Unassembled Panelboards <small>(26 24 16 00-0260)</small>		
26 24 16 00-0298 EA 100 Amp Rating, 12 Circuit Capacity, Main Breaker, NEMA 3R, 5, Or 12, 480Y/277 Volt AC, 3 Wire, 1 Phase, Unassembled Panelboard	2,491.14	
For Hinged Door-In-Door With Yale 5116 With Rosette, Add	328.00	
26 24 16 00-0299 EA 100 Amp Rating, 18 Circuit Capacity, Main Breaker, NEMA 3R, 5, Or 12, 480Y/277 Volt AC, 3 Wire, 1 Phase, Unassembled Panelboard	2,548.79	
For Hinged Door-In-Door With Yale 5116 With Rosette, Add	328.00	
26 24 16 00-0300 EA 125 Amp Rating, 18 Circuit Capacity, Main Breaker, NEMA 3R, 5, Or 12, 480Y/277 Volt AC, 3 Wire, 1 Phase, Unassembled Panelboard	2,581.97	
For Hinged Door-In-Door With Yale 5116 With Rosette, Add	328.00	
26 24 16 00-0301 EA 125 Amp Rating, 30 Circuit Capacity, Main Breaker, NEMA 3R, 5, Or 12, 480Y/277 Volt AC, 3 Wire, 1 Phase, Unassembled Panelboard	2,682.13	
For Hinged Door-In-Door With Yale 5116 With Rosette, Add	328.00	
26 24 16 00-0302 EA 125 Amp Rating, 42 Circuit Capacity, Main Breaker, NEMA 3R, 5, Or 12, 480Y/277 Volt AC, 3 Wire, 1 Phase, Unassembled Panelboard	2,977.70	
For Hinged Door-In-Door With Yale 5116 With Rosette, Add	328.00	
26 24 16 00-0303 EA 250 Amp Rating, 30 Circuit Capacity, Main Breaker, NEMA 3R, 5, Or 12, 480Y/277 Volt AC, 3 Wire, 1 Phase, Unassembled Panelboard	3,671.11	
For Hinged Door-In-Door With Yale 5116 With Rosette, Add	328.00	
26 24 16 00-0304 EA 250 Amp Rating, 42 Circuit Capacity, Main Breaker, NEMA 3R, 5, Or 12, 480Y/277 Volt AC, 3 Wire, 1 Phase, Unassembled Panelboard	3,783.58	
For Hinged Door-In-Door With Yale 5116 With Rosette, Add	328.00	
26 24 16 00-0305 EA 250 Amp Rating, 54 Circuit Capacity, Main Breaker, NEMA 3R, 5, Or 12, 480Y/277 Volt AC, 3 Wire, 1 Phase, Unassembled Panelboard	3,924.24	
For Hinged Door-In-Door With Yale 5116 With Rosette, Add	328.00	
26 24 16 00-0306 EA 400 Amp Rating, 30 Circuit Capacity, Main Breaker, NEMA 3R, 5, Or 12, 480Y/277 Volt AC, 3 Wire, 1 Phase, Unassembled Panelboard	4,011.65	
For Hinged Door-In-Door With Yale 5116 With Rosette, Add	328.00	
26 24 16 00-0307 EA 400 Amp Rating, 42 Circuit Capacity, Main Breaker, NEMA 3R, 5, Or 12, 480Y/277 Volt AC, 3 Wire, 1 Phase, Unassembled Panelboard	4,159.37	
For Hinged Door-In-Door With Yale 5116 With Rosette, Add	328.00	
26 24 16 00-0308 EA 400 Amp Rating, 54 Circuit Capacity, Main Breaker, NEMA 3R, 5, Or 12, 480Y/277 Volt AC, 3 Wire, 1 Phase, Unassembled Panelboard	4,307.13	
For Hinged Door-In-Door With Yale 5116 With Rosette, Add	328.00	
26 24 16 00-0309 480Y/277 Volt AC, 4 Wire, 3 Phase, Unassembled Panelboards <small>(26 24 16 00-0169)</small>		
Note: As manufactured by Square D or equal.		
26 24 16 00-0310 Main Lugs, NEMA 1, 480Y/277 Volt AC, 4 Wire, 3 Phase, Unassembled Panelboards <small>(26 24 16 00-0309)</small>		
26 24 16 00-0311 EA 125 Amp, 12 Circuit Capacity, 277/480 Volt, 4 Wire, 3 Phase, NEMA 1 Panelboard, Main Lugs, Unassembled	914.44	
For Hinged Door-In-Door With Yale 5116 With Rosette, Add	328.00	
26 24 16 00-0312 EA 125 Amp, 18 Circuit Capacity, 277/480 Volt, 4 Wire, 3 Phase, NEMA 1 Panelboard, Main Lugs, Unassembled	996.63	
For Hinged Door-In-Door With Yale 5116 With Rosette, Add	328.00	

26	Electrical
26 20	Low-Voltage Electrical Distribution
26 24	Switchboards And Panelboards



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 24 16 00-0313 EA 125 Amp, 30 Circuit Capacity, 277/480 Volt, 4 Wire, 3 Phase, NEMA 1 Panelboard, Main Lugs, Unassembled <i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	1,151.12 328.00	
26 24 16 00-0314 EA 250 Amp, 30 Circuit Capacity, 277/480 Volt, 4 Wire, 3 Phase, NEMA 1 Panelboard, Main Lugs, Unassembled <i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	1,372.09 328.00	
26 24 16 00-0315 EA 250 Amp, 42 Circuit Capacity, 277/480 Volt, 4 Wire, 3 Phase, NEMA 1 Panelboard, Main Lugs, Unassembled <i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	1,521.58 328.00	
26 24 16 00-0316 EA 250 Amp, 54 Circuit Capacity, 277/480 Volt, 4 Wire, 3 Phase, NEMA 1 Panelboard, Main Lugs, Unassembled <i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	1,648.46 328.00	
26 24 16 00-0317 EA 400 Amp, 30 Circuit Capacity, 277/480 Volt, 4 Wire, 3 Phase, NEMA 1 Panelboard, Main Lugs, Unassembled <i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	1,649.51 328.00	
26 24 16 00-0318 EA 400 Amp, 42 Circuit Capacity, 277/480 Volt, 4 Wire, 3 Phase, NEMA 1 Panelboard, Main Lugs, Unassembled <i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	1,747.73 328.00	
26 24 16 00-0319 EA 400 Amp, 54 Circuit Capacity, 277/480 Volt, 4 Wire, 3 Phase, NEMA 1 Panelboard, Main Lugs, Unassembled <i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	1,887.57 328.00	
26 24 16 00-0320 EA 600 Amp, 30 Circuit Capacity, 277/480 Volt, 4 Wire, 3 Phase, NEMA 1 Panelboard, Main Lugs, Unassembled <i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	1,952.44 328.00	
26 24 16 00-0321 EA 600 Amp, 42 Circuit Capacity, 277/480 Volt, 4 Wire, 3 Phase, NEMA 1 Panelboard, Main Lugs, Unassembled <i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	2,086.42 328.00	
26 24 16 00-0322 EA 600 Amp, 54 Circuit Capacity, 277/480 Volt, 4 Wire, 3 Phase, NEMA 1 Panelboard, Main Lugs, Unassembled <i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	2,267.90 328.00	
26 24 16 00-0323 Main Breaker, NEMA 1, 480Y/277 Volt AC, 4 Wire, 3 Phase, Unassembled Panelboards <small>(26 24 16 00-0309)</small>		
26 24 16 00-0324 EA 100 Amp, 12 Circuit Capacity, 277/480 Volt, 4 Wire, 3 Phase, NEMA 1 Panelboard, Main Breaker, Unassembled <i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	2,010.72 328.00	
26 24 16 00-0325 EA 100 Amp, 18 Circuit Capacity, 277/480 Volt, 4 Wire, 3 Phase, NEMA 1 Panelboard, Main Breaker, Unassembled <i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	2,068.91 328.00	
26 24 16 00-0326 EA 100 Amp, 30 Circuit Capacity, 277/480 Volt, 4 Wire, 3 Phase, NEMA 1 Panelboard, Main Breaker, Unassembled <i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	2,240.26 328.00	
26 24 16 00-0327 EA 125 Amp, 18 Circuit Capacity, 277/480 Volt, 4 Wire, 3 Phase, NEMA 1 Panelboard, Main Breaker, Unassembled <i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	2,299.22 328.00	
26 24 16 00-0328 EA 125 Amp, 30 Circuit Capacity, 277/480 Volt, 4 Wire, 3 Phase, NEMA 1 Panelboard, Main Breaker, Unassembled <i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	2,404.78 328.00	
26 24 16 00-0329 EA 125 Amp, 42 Circuit Capacity, 277/480 Volt, 4 Wire, 3 Phase, NEMA 1 Panelboard, Main Breaker, Unassembled <i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	2,604.78 328.00	
26 24 16 00-0330 EA 250 Amp, 30 Circuit Capacity, 277/480 Volt, 4 Wire, 3 Phase, NEMA 1 Panelboard, Main Breaker, Unassembled <i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	3,354.72 328.00	
26 24 16 00-0331 EA 250 Amp, 42 Circuit Capacity, 277/480 Volt, 4 Wire, 3 Phase, NEMA 1 Panelboard, Main Breaker, Unassembled <i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	3,485.13 328.00	
26 24 16 00-0332 EA 250 Amp, 54 Circuit Capacity, 277/480 Volt, 4 Wire, 3 Phase, NEMA 1 Panelboard, Main Breaker, Unassembled <i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	3,647.54 328.00	
26 24 16 00-0333 EA 400 Amp, 30 Circuit Capacity, 277/480 Volt, 4 Wire, 3 Phase, NEMA 1 Panelboard, Main Breaker, Unassembled <i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	3,796.21 328.00	
26 24 16 00-0334 EA 400 Amp, 42 Circuit Capacity, 277/480 Volt, 4 Wire, 3 Phase, NEMA 1 Panelboard, Main Breaker, Unassembled <i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	3,960.65 328.00	
26 24 16 00-0335 EA 400 Amp, 54 Circuit Capacity, 277/480 Volt, 4 Wire, 3 Phase, NEMA 1 Panelboard, Main Breaker, Unassembled <i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	4,110.59 328.00	
26 24 16 00-0336 Main Lugs, NEMA 3R, 5, Or 12, 480Y/277 Volt AC, 4 Wire, 3 Phase, Unassembled Panelboards <small>(26 24 16 00-0309)</small>		
26 24 16 00-0337 EA 125 Amp, 12 Circuit Capacity, 277/480 Volt, 4 Wire, 3 Phase, NEMA 3R, 5, 12 Panelboard, Main Lugs, Unassembled..... <i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	1,468.02 328.00	
26 24 16 00-0338 EA 125 Amp, 18 Circuit Capacity, 277/480 Volt, 4 Wire, 3 Phase, NEMA 3R, 5, 12 Panelboard, Main Lugs, Unassembled..... <i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	1,550.21 328.00	
26 24 16 00-0339 EA 125 Amp, 30 Circuit Capacity, 277/480 Volt, 4 Wire, 3 Phase, NEMA 3R, 5, 12 Panelboard, Main Lugs, Unassembled..... <i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	1,696.51 328.00	
26 24 16 00-0340 EA 250 Amp, 30 Circuit Capacity, 277/480 Volt, 4 Wire, 3 Phase, NEMA 3R, 5, 12 Panelboard, Main Lugs, Unassembled..... <i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	1,912.57 328.00	
26 24 16 00-0341 EA 250 Amp, 42 Circuit Capacity, 277/480 Volt, 4 Wire, 3 Phase, NEMA 3R, 5, 12 Panelboard, Main Lugs, Unassembled..... <i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	2,157.05 328.00	
26 24 16 00-0342 EA 250 Amp, 54 Circuit Capacity, 277/480 Volt, 4 Wire, 3 Phase, NEMA 3R, 5, 12 Panelboard, Main Lugs, Unassembled..... <i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	2,273.01 328.00	
26 24 16 00-0343 EA 400 Amp, 30 Circuit Capacity, 277/480 Volt, 4 Wire, 3 Phase, NEMA 3R, 5, 12 Panelboard, Main Lugs, Unassembled..... <i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	2,275.70 328.00	
26 24 16 00-0344 EA 400 Amp, 42 Circuit Capacity, 277/480 Volt, 4 Wire, 3 Phase, NEMA 3R, 5, 12 Panelboard, Main Lugs, Unassembled..... <i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	2,355.91 328.00	
26 24 16 00-0345 EA 400 Amp, 54 Circuit Capacity, 277/480 Volt, 4 Wire, 3 Phase, NEMA 3R, 5, 12 Panelboard, Main Lugs, Unassembled..... <i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	2,472.27 328.00	
26 24 16 00-0346 EA 600 Amp, 30 Circuit Capacity, 277/480 Volt, 4 Wire, 3 Phase, NEMA 3R, 5, 12 Panelboard, Main Lugs, Unassembled..... <i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	2,591.73 328.00	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 24 16 00-0347 EA 600 Amp, 42 Circuit Capacity, 277/480 Volt, 4 Wire, 3 Phase, NEMA 3R, 5, 12 Panelboard, Main Lugs, Unassembled.....	2,712.06	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0348 EA 600 Amp, 54 Circuit Capacity, 277/480 Volt, 4 Wire, 3 Phase, NEMA 3R, 5, 12 Panelboard, Main Lugs, Unassembled.....	2,864.06	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0349 Main Breaker, NEMA 3R, 5, Or 12, 480Y/277 Volt AC, 4 Wire, 3 Phase, Unassembled Panelboards <small>(26 24 16 00-0309)</small>		
26 24 16 00-0350 EA 100 Amp, 12 Circuit Capacity, 277/480 Volt, 4 Wire, 3 Phase, NEMA 3R, 5, 12 Panelboard, Main Breaker, Unassembled.....	2,551.20	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0351 EA 100 Amp, 18 Circuit Capacity, 277/480 Volt, 4 Wire, 3 Phase, NEMA 3R, 5, 12 Panelboard, Main Breaker, Unassembled.....	2,609.38	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0352 EA 100 Amp, 30 Circuit Capacity, 277/480 Volt, 4 Wire, 3 Phase, NEMA 3R, 5, 12 Panelboard, Main Breaker, Unassembled.....	2,875.73	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0353 EA 125 Amp, 18 Circuit Capacity, 277/480 Volt, 4 Wire, 3 Phase, NEMA 3R, 5, 12 Panelboard, Main Breaker, Unassembled.....	2,844.61	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0354 EA 125 Amp, 30 Circuit Capacity, 277/480 Volt, 4 Wire, 3 Phase, NEMA 3R, 5, 12 Panelboard, Main Breaker, Unassembled.....	2,945.25	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0355 EA 125 Amp, 42 Circuit Capacity, 277/480 Volt, 4 Wire, 3 Phase, NEMA 3R, 5, 12 Panelboard, Main Breaker, Unassembled.....	3,240.25	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0356 EA 250 Amp, 30 Circuit Capacity, 277/480 Volt, 4 Wire, 3 Phase, NEMA 3R, 5, 12 Panelboard, Main Breaker, Unassembled.....	3,979.27	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0357 EA 250 Amp, 42 Circuit Capacity, 277/480 Volt, 4 Wire, 3 Phase, NEMA 3R, 5, 12 Panelboard, Main Breaker, Unassembled.....	4,093.31	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0358 EA 250 Amp, 54 Circuit Capacity, 277/480 Volt, 4 Wire, 3 Phase, NEMA 3R, 5, 12 Panelboard, Main Breaker, Unassembled.....	4,232.24	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0359 EA 400 Amp, 30 Circuit Capacity, 277/480 Volt, 4 Wire, 3 Phase, NEMA 3R, 5, 12 Panelboard, Main Breaker, Unassembled.....	4,380.91	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0360 EA 400 Amp, 42 Circuit Capacity, 277/480 Volt, 4 Wire, 3 Phase, NEMA 3R, 5, 12 Panelboard, Main Breaker, Unassembled.....	4,530.06	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0361 EA 400 Amp, 54 Circuit Capacity, 277/480 Volt, 4 Wire, 3 Phase, NEMA 3R, 5, 12 Panelboard, Main Breaker, Unassembled.....	4,677.28	
<i>For Hinged Door-In-Door With Yale 5116 With Rosette, Add</i>	328.00	
26 24 16 00-0362 600 Volt AC, 250 Volt DC, 3 Phase, Unassembled Panelboards <small>(26 24 16 00-0169)</small>		
Note: Square D I-Line or equal.		
26 24 16 00-0363 Main Lugs, NEMA 1, 600 Volt AC, 250 Volt DC, 3 Phase, Unassembled Panelboards <small>(26 24 16 00-0362)</small>		
26 24 16 00-0364 EA 400 Amp Rating, 27" Breaker Mounting Space, 250 Amp Maximum Branch Breaker Size, Main Lugs, NEMA 1, 600 Volt AC, 250 Volt DC, 3 Phase, Unassembled Panelboard.....	1,499.90	239.34
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	143.61	
26 24 16 00-0365 EA 400 Amp Rating, 45" Breaker Mounted Space, 250 Amp Maximum Branch Breaker Size, Main Lugs, NEMA 1, 600 Volt AC, 250 Volt DC, 3 Phase, Unassembled Panelboard.....	1,773.60	239.27
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	143.57	
26 24 16 00-0366 EA 400 Amp Rating, 63" Breaker Mounting Space, 250 Amp Maximum Branch Breaker Size, Main Lugs, NEMA 1, 600 Volt AC, 250 Volt DC, 3 Phase, Unassembled Panelboard.....	1,979.67	239.27
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	143.57	
26 24 16 00-0367 EA 600 Amp Rating, 27" Breaker Mounting Space, 250 Amp Maximum Branch Breaker Size, Main Lugs, NEMA 1, 600 Volt AC, 250 Volt DC, 3 Phase, Unassembled Panelboard.....	2,207.96	392.95
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	235.77	
26 24 16 00-0368 EA 600 Amp Rating, 45" Breaker Mounting Space, 250 Amp Maximum Branch Breaker Size, Main Lugs, NEMA 1, 600 Volt AC, 250 Volt DC, 3 Phase, Unassembled Panelboard.....	2,367.45	392.95
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	235.77	
26 24 16 00-0369 EA 600 Amp Rating, 63" Breaker Mounting Space, 250 Amp Maximum Branch Breaker Size, Main Lugs, NEMA 1, 600 Volt AC, 250 Volt DC, 3 Phase, Unassembled Panelboard.....	2,542.47	392.95
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	235.77	
26 24 16 00-0370 EA 800 Amp Rating, 27" Breaker Mounting Space, 250 Amp Maximum Branch Breaker Size, Main Lugs, NEMA 1, 600 Volt AC, 250 Volt DC, 3 Phase, Unassembled Panelboard.....	2,705.98	522.37
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	313.41	
26 24 16 00-0371 EA 800 Amp Rating, 45" Breaker Mounting Space, 250 Amp Maximum Branch Breaker Size, Main Lugs, NEMA 1, 600 Volt AC, 250 Volt DC, 3 Phase, Unassembled Panelboard.....	2,858.79	523.92
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	314.36	
26 24 16 00-0372 EA 800 Amp Rating, 63" Breaker Mounting Space, 250 Amp Maximum Branch Breaker Size, Main Lugs, NEMA 1, 600 Volt AC, 250 Volt DC, 3 Phase, Unassembled Panelboard.....	2,921.93	522.37
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	313.41	
26 24 16 00-0373 EA 800 Amp Rating, 99" Breaker Mounting Space, 250 Amp Maximum Branch Breaker Size, Main Lugs, NEMA 1, 600 Volt AC, 250 Volt DC, 3 Phase, Unassembled Panelboard.....	3,427.94	522.37
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	313.41	

26	Electrical
26 20	Low-Voltage Electrical Distribution
26 24	Switchboards And Panelboards



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 24 16 00-0374	EA		1,200 Amp Rating, 27" Breaker Mounting Space, 600 Amp Maximum Branch Breaker Size, Main Lugs, NEMA 1, 600 Volt AC, 250 Volt DC, 3 Phase, Unassembled Panelboard.....	4,423.68	785.91
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	471.55	
26 24 16 00-0375	EA		1,200 Amp Rating, 45" Breaker Mounting Space, 600 Amp Maximum Branch Breaker Size, Main Lugs, NEMA 1, 600 Volt AC, 250 Volt DC, 3 Phase, Unassembled Panelboard.....	4,768.08	785.91
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	471.55	
26 24 16 00-0376	EA		1,200 Amp Rating, 63" Breaker Mounting Space, 600 Amp Maximum Branch Breaker Size, Main Lugs, NEMA 1, 600 Volt AC, 250 Volt DC, 3 Phase, Unassembled Panelboard.....	5,049.66	785.91
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	471.55	
26 24 16 00-0377	EA		1,200 Amp Rating, 99" Breaker Mounting Space, 600 Amp Maximum Branch Breaker Size, Main Lugs, NEMA 1, 600 Volt AC, 250 Volt DC, 3 Phase, Unassembled Panelboard.....	5,393.35	785.91
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	471.55	
26 24 16 00-0378			Main Breaker, NEMA 1, 600 Volt AC, 250 Volt DC, 3 Phase, Unassembled Panelboards <small>(26 24 16 00-0362)</small>		
26 24 16 00-0379	EA		225 Amp Rating, 36" Breaker Mounting Space, 250 Amp Maximum Branch Breaker Size, Main Breaker, NEMA 1, 600 Volt AC, 250 Volt DC, 3 Phase, Unassembled Panelboard.....	2,989.92	244.42
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	146.64	
26 24 16 00-0380	EA		400 Amp Rating, 27" Breaker Mounting Space, 250 Amp Maximum Branch Breaker Size, Main Breaker, NEMA 1, 600 Volt AC, 250 Volt DC, 3 Phase, Unassembled Panelboard.....	3,943.38	277.21
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	166.34	
26 24 16 00-0381	EA		400 Amp Rating, 45" Breaker Mounting Space, 250 Amp Maximum Branch Breaker Size, Main Breaker, NEMA 1, 600 Volt AC, 250 Volt DC, 3 Phase, Unassembled Panelboard.....	4,142.40	277.21
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	166.34	
26 24 16 00-0382	EA		400 Amp Rating, 81" Breaker Mounting Space, 250 Amp Maximum Branch Breaker Size, Main Breaker, NEMA 1, 600 Volt AC, 250 Volt DC, 3 Phase, Unassembled Panelboard.....	4,728.15	277.21
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	166.34	
26 24 16 00-0383	EA		600 Amp Rating, 36" Breaker Mounting Space, 250 Amp Maximum Branch Breaker Size, Main Breaker, NEMA 1, 600 Volt AC, 250 Volt DC, 3 Phase, Unassembled Panelboard.....	6,127.79	454.42
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	272.67	
26 24 16 00-0384	EA		600 Amp Rating, 72" Breaker Mounting Space, 250 Amp Maximum Branch Breaker Size, Main Breaker, NEMA 1, 600 Volt AC, 250 Volt DC, 3 Phase, Unassembled Panelboard.....	6,456.25	455.68
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	273.40	
26 24 16 00-0385	EA		600 Amp Rating, 72" Breaker Mounting Space, 600 Amp Maximum Branch Breaker Size, Main Breaker, NEMA 1, 600 Volt AC, 250 Volt DC, 3 Phase, Unassembled Panelboard.....	6,727.66	454.42
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	272.67	
26 24 16 00-0386	EA		800 Amp Rating, 36" Breaker Mounting Space, 250 Amp Maximum Branch Breaker Size, Main Breaker, NEMA 1, 600 Volt AC, 250 Volt DC, 3 Phase, Unassembled Panelboard.....	7,733.94	607.52
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	364.53	
26 24 16 00-0387	EA		800 Amp Rating, 72" Breaker Mounting Space, 250 Amp Maximum Branch Breaker Size, Main Breaker, NEMA 1, 600 Volt AC, 250 Volt DC, 3 Phase, Unassembled Panelboard.....	8,124.15	605.38
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	363.24	
26 24 16 00-0388	EA		800 Amp Rating, 72" Breaker Mounting Space, 600 Amp Maximum Branch Breaker Size, Main Breaker, NEMA 1, 600 Volt AC, 250 Volt DC, 3 Phase, Unassembled Panelboard.....	8,512.30	605.38
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	363.24	
26 24 16 00-0389			Branch Circuit Breakers <small>(26 24 16 00-0001)</small>		
			Note: For installation in existing and new panelboards. Use task modifier for installation in new panelboards.		
26 24 16 00-0390			Branch Circuit Breakers 10,000 Amp Interrupting Capacity, Plug-On <small>(26 24 16 00-0389)</small>		
			Note: Includes connection of electrical wire.		
26 24 16 00-0391	EA		1 Pole, 120/240 Volt, 15-30 Amp, Branch Circuit Breaker, 10,000 Amp Interrupting Capacity.....	39.88	14.47
			<i>For Bolt-On, Add</i>	10.61	
			<i>For Installation In New Panelboard, Deduct</i>	-8.04	
			Note: Also for use with new interiors in panelboards.		
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.65	
26 24 16 00-0392	EA		1 Pole, 120/240 Volt, 35-60 Amp, Branch Circuit Breaker, 10,000 Amp Interrupting Capacity.....	39.88	14.47
			<i>For Bolt-On, Add</i>	10.61	
			<i>For Installation In New Panelboard, Deduct</i>	-8.04	
			Note: Also for use with new interiors in panelboards.		
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.65	
26 24 16 00-0393	EA		1 Pole, 120/240 Volt, 70-100 Amp, Branch Circuit Breaker, 10,000 Amp Interrupting Capacity.....	58.01	18.10
			<i>For Bolt-On, Add</i>	14.29	
			<i>For Installation In New Panelboard, Deduct</i>	-10.05	
			Note: Also for use with new interiors in panelboards.		
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	12.06	
26 24 16 00-0394	EA		1 Pole GFI, 120/240 Volt, 15-30 Amp, Branch Circuit Breaker, 10,000 Amp Interrupting Capacity.....	87.02	17.69
			<i>For Bolt-On, Add</i>	17.63	
			<i>For Installation In New Panelboard, Deduct</i>	-9.65	
			Note: Also for use with new interiors in panelboards.		
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	11.58	
26 24 16 00-0395	EA		1 Pole GFI, 120/240 Volt, 35-60 Amp, Branch Circuit Breaker, 10,000 Protection Circuit Breaker, 10,000 Amp Interrupting Capacity.....	122.01	17.69
			<i>For Bolt-On, Add</i>	22.01	
			<i>For Installation In New Panelboard, Deduct</i>	-9.65	
			Note: Also for use with new interiors in panelboards.		
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	11.58	
26 24 16 00-0396	EA		1 Pole GFI, 120/240 Volt, 15-30 Amp, UL Listed 30mA Equipment Protection Circuit Breaker, 10,000 Amp Interrupting Capacity.....	141.97	17.69
			<i>For Bolt-On, Add</i>	24.50	
			<i>For Installation In New Panelboard, Deduct</i>	-9.65	
			Note: Also for use with new interiors in panelboards.		
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	11.58	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 24 16 00-0397 EA 1 Pole GFI, 120/240 Volt, 15-20 Amp, "Arc Fault" Circuit Breaker, 10,000 Amp Interrupting Capacity	67.74	17.69
For Bolt-On, Add	15.22	
For Installation In New Panelboard, Deduct	-9.65	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	11.58	
26 24 16 00-0398 EA 2 Pole, 120/240 Volt, 15-30 Amp, Branch Circuit Breaker, 10,000 Amp Interrupting Capacity	66.06	21.72
For Bolt-On, Add	16.70	
For Installation In New Panelboard, Deduct	-12.07	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	14.48	
26 24 16 00-0399 EA 2 Pole, 120/240 Volt, 35-60 Amp, Branch Circuit Breaker, 10,000 Amp Interrupting Capacity	66.06	21.72
For Bolt-On, Add	16.70	
For Installation In New Panelboard, Deduct	-12.07	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	14.48	
26 24 16 00-0400 EA 2 Pole, 120/240 Volt, 70-100 Amp, Branch Circuit Breaker, 10,000 Amp Interrupting Capacity	99.96	28.96
For Bolt-On, Add	23.76	
For Installation In New Panelboard, Deduct	-16.09	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	19.31	
26 24 16 00-0401 EA 2 Pole, 120/240 Volt, 110-125 Amp, Branch Circuit Breaker, 10,000 Amp Interrupting Capacity	166.50	36.19
For Bolt-On, Add	34.89	
For Installation In New Panelboard, Deduct	-20.11	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	24.13	
26 24 16 00-0402 EA 2 Pole, 120/240 Volt, 150 Amp, Branch Circuit Breaker, 10,000 Amp Interrupting Capacity	196.47	40.21
For Bolt-On, Add	40.04	
For Installation In New Panelboard, Deduct	-22.12	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	26.54	
26 24 16 00-0403 EA 2 Pole GFI, 120/240 Volt, 15-50 Amp, Branch Circuit Breaker, 10,000 Amp Interrupting Capacity	167.23	25.74
For Bolt-On, Add	31.04	
For Installation In New Panelboard, Deduct	-14.48	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	17.37	
26 24 16 00-0404 EA 2 Pole, GFI, 120/240 Volt, 15-50 Amp, UL Listed 30mA Equipment Protection Circuit Breaker, 10,000 Amp Interrupting Capacity	224.47	25.74
For Bolt-On, Add	38.19	
For Installation In New Panelboard, Deduct	-14.48	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	17.37	
26 24 16 00-0405 EA 3 Pole, 120/240 Volt, 15-30 Amp, Branch Circuit Breaker, 10,000 Amp Interrupting Capacity	126.66	28.96
For Bolt-On, Add	27.09	
For Installation In New Panelboard, Deduct	-16.09	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	19.31	
26 24 16 00-0406 EA 3 Pole, 120/240 Volt, 35-60 Amp, Branch Circuit Breaker, 10,000 Amp Interrupting Capacity	126.66	28.96
For Bolt-On, Add	27.09	
For Installation In New Panelboard, Deduct	-16.09	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	19.31	
26 24 16 00-0407 EA 3 Pole, 120/240 Volt, 70-100 Amp, Branch Circuit Breaker, 10,000 Amp Interrupting Capacity	166.16	36.19
For Bolt-On, Add	34.85	
For Installation In New Panelboard, Deduct	-20.11	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	24.13	
26 24 16 00-0408 EA 3 Pole, 120/240 Volt, 110-125 Amp, Branch Circuit Breaker, 10,000 Amp Interrupting Capacity	252.23	43.43
For Bolt-On, Add	48.42	
For Installation In New Panelboard, Deduct	-24.13	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	28.95	
26 24 16 00-0409 EA 3 Pole, 120/240 Volt, 150 Amp, Branch Circuit Breaker, 10,000 Amp Interrupting Capacity	322.18	50.67
For Bolt-On, Add	59.98	
For Installation In New Panelboard, Deduct	-28.15	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	33.78	
26 24 16 00-0410 Branch Circuit Breakers 14,000 Amp Interrupting Capacity, Plug-On <small>(26 24 16 00-0389)</small>		
Note: Includes connection of electrical wire.		
26 24 16 00-0411 EA 1 Pole, 277/480 Volt, 15-30 Amp, Branch Circuit Breaker, 14,000 Amp Interrupting Capacity	58.02	14.47
For Bolt-On, Add	12.88	
For Installation In New Panelboard, Deduct	-8.04	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	9.65	
26 24 16 00-0412 EA 1 Pole, 277/480 Volt, 35-60 Amp, Branch Circuit Breaker, 14,000 Amp Interrupting Capacity	58.02	14.47
For Bolt-On, Add	12.88	
For Installation In New Panelboard, Deduct	-8.04	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	9.65	
26 24 16 00-0413 EA 1 Pole, 277/480 Volt, 70-100 Amp, Branch Circuit Breaker, 14,000 Amp Interrupting Capacity	104.37	18.10
For Bolt-On, Add	20.08	
For Installation In New Panelboard, Deduct	-10.05	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	12.06	

26	Electrical
26 20	Low-Voltage Electrical Distribution
26 24	Switchboards And Panelboards



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 24 16 00-0414 EA 1 Pole GFI, 277/480 Volt, 15-60 Amp, Branch Circuit Breaker, 14,000 Amp Interrupting Capacity	161.61	17.69
For Bolt-On, Add	26.96	
For Installation In New Panelboard, Deduct	-9.65	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	11.58	
26 24 16 00-0415 EA 2 Pole, 277/480 Volt, 15-30 Amp, Branch Circuit Breaker, 14,000 Amp Interrupting Capacity	113.80	21.72
For Bolt-On, Add	22.67	
For Installation In New Panelboard, Deduct	-12.07	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	14.48	
26 24 16 00-0416 EA 2 Pole, 277/480 Volt, 35-60 Amp, Branch Circuit Breaker, 14,000 Amp Interrupting Capacity	113.80	21.72
For Bolt-On, Add	22.67	
For Installation In New Panelboard, Deduct	-12.07	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	14.48	
26 24 16 00-0417 EA 2 Pole, 277/480 Volt, 70-100 Amp, Branch Circuit Breaker, 14,000 Amp Interrupting Capacity	225.38	28.96
For Bolt-On, Add	39.43	
For Installation In New Panelboard, Deduct	-16.09	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	19.31	
26 24 16 00-0418 EA 2 Pole, 277/480 Volt, 110-125 Amp, Branch Circuit Breaker, 14,000 Amp Interrupting Capacity	307.35	36.19
For Bolt-On, Add	52.50	
For Installation In New Panelboard, Deduct	-20.11	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	24.13	
26 24 16 00-0419 EA 2 Pole, 277/480 Volt, 150 Amp, Branch Circuit Breaker, 14,000 Amp Interrupting Capacity	452.85	40.21
For Bolt-On, Add	72.09	
For Installation In New Panelboard, Deduct	-22.12	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	26.54	
26 24 16 00-0420 EA 3 Pole, 277/480 Volt, 15-30 Amp, Branch Circuit Breaker, 14,000 Amp Interrupting Capacity	182.05	28.96
For Bolt-On, Add	34.02	
For Installation In New Panelboard, Deduct	-16.09	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	19.31	
26 24 16 00-0421 EA 3 Pole, 277/480 Volt, 35-60 Amp, Branch Circuit Breaker, 14,000 Amp Interrupting Capacity	182.05	28.96
For Bolt-On, Add	34.02	
For Installation In New Panelboard, Deduct	-16.09	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	19.31	
26 24 16 00-0422 EA 3 Pole, 277/480 Volt, 70-100 Amp, Branch Circuit Breaker, 14,000 Amp Interrupting Capacity	272.91	36.19
For Bolt-On, Add	48.19	
For Installation In New Panelboard, Deduct	-20.11	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	24.13	
26 24 16 00-0423 EA 3 Pole, 277/480 Volt, 110-125 Amp, Branch Circuit Breaker, 14,000 Amp Interrupting Capacity	388.97	43.43
For Bolt-On, Add	65.51	
For Installation In New Panelboard, Deduct	-24.13	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	28.95	
26 24 16 00-0424 EA 3 Pole, 277/480 Volt, 150 Amp, Branch Circuit Breaker, 14,000 Amp Interrupting Capacity	603.83	50.67
For Bolt-On, Add	95.18	
For Installation In New Panelboard, Deduct	-28.15	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	33.78	
26 24 16 00-0425 EA 3 Pole, 277/480 Volt, 175 Amp, Branch Circuit Breaker, 14,000 Amp Interrupting Capacity	697.21	54.30
For Bolt-On, Add	108.27	
For Installation In New Panelboard, Deduct	-30.16	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	36.20	
26 24 16 00-0426 EA 3 Pole, 277/480 Volt, 200 Amp, Branch Circuit Breaker, 14,000 Amp Interrupting Capacity	749.07	57.91
For Bolt-On, Add	116.15	
For Installation In New Panelboard, Deduct	-32.17	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	38.61	
26 24 16 00-0427 EA 3 Pole, 277/480 Volt, 225 Amp, Branch Circuit Breaker, 14,000 Amp Interrupting Capacity	887.03	61.53
For Bolt-On, Add	134.81	
For Installation In New Panelboard, Deduct	-34.19	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	41.02	
26 24 16 00-0428 Branch Circuit Breakers 18,000 Amp Interrupting Capacity, Plug-On <small>(26 24 16 00-0389)</small>		
Note: Includes connection of electrical wire.		
26 24 16 00-0429 EA 1 Pole, 240 Volt, 15-30 Amp, Branch Circuit Breaker, 18,000 Amp Interrupting Capacity	69.94	14.47
For Bolt-On, Add	14.37	
For Installation In New Panelboard, Deduct	-8.04	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	9.65	
26 24 16 00-0430 EA 1 Pole, 240 Volt, 35-60 Amp, Branch Circuit Breaker, 18,000 Amp Interrupting Capacity	69.94	14.47
For Bolt-On, Add	14.37	
For Installation In New Panelboard, Deduct	-8.04	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	9.65	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 24 16 00-0431 EA 1 Pole, 240 Volt, 70-100 Amp, Branch Circuit Breaker, 18,000 Amp Interrupting Capacity.....	116.14	18.10
For Bolt-On, Add	21.55	
For Installation In New Panelboard, Deduct	-10.05	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	12.06	
26 24 16 00-0432 EA 2 Pole, 240 Volt, 15-30 Amp, Branch Circuit Breaker, 18,000 Amp Interrupting Capacity.....	144.86	21.72
For Bolt-On, Add	26.55	
For Installation In New Panelboard, Deduct	-12.07	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	14.48	
26 24 16 00-0433 EA 2 Pole, 240 Volt, 35-60 Amp, Branch Circuit Breaker, 18,000 Amp Interrupting Capacity.....	144.86	21.72
For Bolt-On, Add	26.55	
For Installation In New Panelboard, Deduct	-12.07	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	14.48	
26 24 16 00-0434 EA 2 Pole, 240 Volt, 70-100 Amp, Branch Circuit Breaker, 18,000 Amp Interrupting Capacity.....	255.16	28.96
For Bolt-On, Add	43.16	
For Installation In New Panelboard, Deduct	-16.09	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	19.31	
26 24 16 00-0435 EA 2 Pole, 240 Volt, 110-125 Amp, Branch Circuit Breaker, 18,000 Amp Interrupting Capacity.....	658.45	36.19
For Bolt-On, Add	96.38	
For Installation In New Panelboard, Deduct	-20.11	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	24.13	
26 24 16 00-0436 EA 3 Pole, 240 Volt, 15-30 Amp, Branch Circuit Breaker, 18,000 Amp Interrupting Capacity.....	233.30	28.96
For Bolt-On, Add	40.42	
For Installation In New Panelboard, Deduct	-16.09	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	19.31	
26 24 16 00-0437 EA 3 Pole, 240 Volt, 35-60 Amp, Branch Circuit Breaker, 18,000 Amp Interrupting Capacity.....	233.30	28.96
For Bolt-On, Add	40.42	
For Installation In New Panelboard, Deduct	-16.09	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	19.31	
26 24 16 00-0438 EA 3 Pole, 240 Volt, 70-100 Amp, Branch Circuit Breaker, 18,000 Amp Interrupting Capacity.....	310.21	36.19
For Bolt-On, Add	52.85	
For Installation In New Panelboard, Deduct	-20.11	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	24.13	
26 24 16 00-0439 EA 3 Pole, 240 Volt, 110-125 Amp, Branch Circuit Breaker, 18,000 Amp Interrupting Capacity.....	815.24	43.43
For Bolt-On, Add	118.79	
For Installation In New Panelboard, Deduct	-24.13	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	28.95	
26 24 16 00-0440 Branch Circuit Breakers 22,000 Amp Interrupting Capacity, Plug-On <small>(26 24 16 00-0389)</small>		
Note: Includes connection of electrical wire.		
26 24 16 00-0441 EA 1 Pole, 120/240 Volt, 15-30 Amp, Branch Circuit Breaker, 22,000 Amp Interrupting Capacity.....	80.05	14.47
For Bolt-On, Add	15.64	
For Installation In New Panelboard, Deduct	-8.04	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	9.65	
26 24 16 00-0442 EA 1 Pole, 120/240 Volt, 35-60 Amp, Branch Circuit Breaker, 22,000 Amp Interrupting Capacity.....	80.05	14.47
For Bolt-On, Add	15.64	
For Installation In New Panelboard, Deduct	-8.04	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	9.65	
26 24 16 00-0443 EA 1 Pole, 120/240 Volt, 70-100 Amp, Branch Circuit Breaker, 22,000 Amp Interrupting Capacity.....	94.24	18.10
For Bolt-On, Add	18.82	
For Installation In New Panelboard, Deduct	-10.05	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	12.06	
26 24 16 00-0444 EA 1 Pole GFI, 120/240 Volt, 15-30 Amp, Branch Circuit Breaker, 22,000 Amp Interrupting Capacity.....	160.25	17.69
For Bolt-On, Add	26.79	
For Installation In New Panelboard, Deduct	-9.65	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	11.58	
26 24 16 00-0445 EA 2 Pole, 120/240 Volt, 15-30 Amp, Branch Circuit Breaker, 22,000 Amp Interrupting Capacity.....	171.26	21.72
For Bolt-On, Add	29.85	
For Installation In New Panelboard, Deduct	-12.07	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	14.48	
26 24 16 00-0446 EA 2 Pole, 120/240 Volt, 35-60 Amp, Branch Circuit Breaker, 22,000 Amp Interrupting Capacity.....	171.26	21.72
For Bolt-On, Add	29.85	
For Installation In New Panelboard, Deduct	-12.07	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	14.48	
26 24 16 00-0447 EA 2 Pole, 120/240 Volt, 70-100 Amp, Branch Circuit Breaker, 22,000 Amp Interrupting Capacity.....	207.34	28.96
For Bolt-On, Add	37.18	
For Installation In New Panelboard, Deduct	-16.09	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	19.31	

26	Electrical
26 20	Low-Voltage Electrical Distribution
26 24	Switchboards And Panelboards



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 24 16 00-0448 EA 2 Pole, 240 Volt, 110-125 Amp, Branch Circuit Breaker, 22,000 Amp Interrupting Capacity.....	299.64	36.19
For Bolt-On, Add	51.53	
For Installation In New Panelboard, Deduct	-20.11	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	24.13	
26 24 16 00-0449 EA 2 Pole, 240 Volt, 150-225 Amp, Branch Circuit Breaker, 22,000 Amp Interrupting Capacity.....	388.50	40.21
For Bolt-On, Add	64.04	
For Installation In New Panelboard, Deduct	-22.12	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	26.54	
26 24 16 00-0450 EA 2 Pole, 240 Volt, 250 Amp, Branch Circuit Breaker, 22,000 Amp Interrupting Capacity.....	485.42	47.05
For Bolt-On, Add	78.98	
For Installation In New Panelboard, Deduct	-26.14	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	31.37	
26 24 16 00-0451 EA 2 Pole, 240 Volt, 300-400 Amp, Branch Circuit Breaker, 22,000 Amp Interrupting Capacity.....	523.25	54.30
For Bolt-On, Add	86.52	
For Installation In New Panelboard, Deduct	-30.16	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	36.20	
26 24 16 00-0452 EA 3 Pole, 120/240 Volt, 15-30 Amp, Branch Circuit Breaker, 22,000 Amp Interrupting Capacity.....	207.78	28.96
For Bolt-On, Add	37.23	
For Installation In New Panelboard, Deduct	-16.09	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	19.31	
26 24 16 00-0453 EA 3 Pole, 120/240 Volt, 35-60 Amp, Branch Circuit Breaker, 22,000 Amp Interrupting Capacity.....	207.78	28.96
For Bolt-On, Add	37.23	
For Installation In New Panelboard, Deduct	-16.09	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	19.31	
26 24 16 00-0454 EA 3 Pole, 120/240 Volt, 70-100 Amp, Branch Circuit Breaker, 22,000 Amp Interrupting Capacity.....	243.41	36.19
For Bolt-On, Add	44.50	
For Installation In New Panelboard, Deduct	-20.11	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	24.13	
26 24 16 00-0455 EA 3 Pole, 240 Volt, 110-125 Amp, Branch Circuit Breaker, 22,000 Amp Interrupting Capacity.....	371.50	43.43
For Bolt-On, Add	63.33	
For Installation In New Panelboard, Deduct	-24.13	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	28.95	
26 24 16 00-0456 EA 3 Pole, 240 Volt, 150-225 Amp, Branch Circuit Breaker, 22,000 Amp Interrupting Capacity.....	487.73	56.30
For Bolt-On, Add	82.78	
For Installation In New Panelboard, Deduct	-31.17	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	37.40	
26 24 16 00-0457 EA 3 Pole, 240 Volt, 250 Amp, Branch Circuit Breaker, 22,000 Amp Interrupting Capacity.....	603.16	65.15
For Bolt-On, Add	100.73	
For Installation In New Panelboard, Deduct	-36.19	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	43.43	
26 24 16 00-0458 EA 3 Pole, 240 Volt, 300-400 Amp, Branch Circuit Breaker, 22,000 Amp Interrupting Capacity.....	641.52	69.17
For Bolt-On, Add	106.93	
For Installation In New Panelboard, Deduct	-38.21	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	45.85	
26 24 16 00-0459 Branch Circuit Breakers 25,000 Amp Interrupting Capacity, Plug-On (26 24 16 00-0389)		
Note: Includes connection of electrical wire.		
26 24 16 00-0460 EA 2 Pole, 240/480 Volt, 15-30 Amp, Branch Circuit Breaker, 25,000 Amp Interrupting Capacity.....	177.85	21.72
For Installation In New Panelboard, Deduct	-12.07	
Note: Also for use with new interiors in panelboards.		
For Bolt-On, Add	30.68	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	14.48	
26 24 16 00-0461 EA 2 Pole, 240/480 Volt, 35-60 Amp, Branch Circuit Breaker, 25,000 Amp Interrupting Capacity.....	177.85	21.72
For Installation In New Panelboard, Deduct	-12.07	
Note: Also for use with new interiors in panelboards.		
For Bolt-On, Add	30.68	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	14.48	
26 24 16 00-0462 EA 2 Pole, 240/480 Volt, 70-100 Amp, Branch Circuit Breaker, 25,000 Amp Interrupting Capacity.....	271.09	28.96
For Installation In New Panelboard, Deduct	-16.09	
Note: Also for use with new interiors in panelboards.		
For Bolt-On, Add	45.15	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	19.31	
26 24 16 00-0463 EA 2 Pole, 240/480 Volt, 110-125 Amp, Branch Circuit Breaker, 25,000 Amp Interrupting Capacity.....	442.12	36.19
For Installation In New Panelboard, Deduct	-20.11	
Note: Also for use with new interiors in panelboards.		
For Bolt-On, Add	69.34	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	24.13	
26 24 16 00-0464 EA 2 Pole, 240/480 Volt, 150-225 Amp, Branch Circuit Breaker, 25,000 Amp Interrupting Capacity.....	690.51	45.04
For Installation In New Panelboard, Deduct	-25.14	
Note: Also for use with new interiors in panelboards.		
For Bolt-On, Add	103.91	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	30.16	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
	26 24 16 00-0465	EA		2 Pole, 240/480 Volt, 250 Amp, Branch Circuit Breaker, 25,000 Amp Interrupting Capacity 783.40 <i>For Installation In New Panelboard, Deduct</i> -26.14 <i>Note: Also for use with new interiors in panelboards.</i>		47.05
				<i>For Bolt-On, Add</i> 116.22 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 31.37		
	26 24 16 00-0466	EA		2 Pole, 240/480 Volt, 300-400 Amp, Branch Circuit Breaker, 25,000 Amp Interrupting Capacity 855.54 <i>For Installation In New Panelboard, Deduct</i> -30.16 <i>Note: Also for use with new interiors in panelboards.</i>		54.30
				<i>For Bolt-On, Add</i> 128.06 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 36.20		
	26 24 16 00-0467	EA		3 Pole, 240/480 Volt, 15-30 Amp, Branch Circuit Breaker, 25,000 Amp Interrupting Capacity 255.97 <i>For Installation In New Panelboard, Deduct</i> -16.09 <i>Note: Also for use with new interiors in panelboards.</i>		28.96
				<i>For Bolt-On, Add</i> 43.26 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 19.31		
	26 24 16 00-0468	EA		3 Pole, 240/480 Volt, 35-60 Amp, Branch Circuit Breaker, 25,000 Amp Interrupting Capacity 255.97 <i>For Installation In New Panelboard, Deduct</i> -16.09 <i>Note: Also for use with new interiors in panelboards.</i>		28.96
				<i>For Bolt-On, Add</i> 43.26 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 19.31		
	26 24 16 00-0469	EA		3 Pole, 240/480 Volt, 70-100 Amp, Branch Circuit Breaker, 25,000 Amp Interrupting Capacity 322.48 <i>For Installation In New Panelboard, Deduct</i> -20.11 <i>Note: Also for use with new interiors in panelboards.</i>		36.19
				<i>For Bolt-On, Add</i> 54.39 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 24.13		
	26 24 16 00-0470	EA		3 Pole, 240/480 Volt, 110-125 Amp, Branch Circuit Breaker, 25,000 Amp Interrupting Capacity 550.24 <i>For Installation In New Panelboard, Deduct</i> -24.13 <i>Note: Also for use with new interiors in panelboards.</i>		43.43
				<i>For Bolt-On, Add</i> 85.67 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 28.95		
	26 24 16 00-0471	EA		3 Pole, 240/480 Volt, 150-225 Amp, Branch Circuit Breaker, 25,000 Amp Interrupting Capacity 805.41 <i>For Installation In New Panelboard, Deduct</i> -31.17 <i>Note: Also for use with new interiors in panelboards.</i>		56.30
				<i>For Bolt-On, Add</i> 122.49 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 37.40		
	26 24 16 00-0472	EA		3 Pole, 240/480 Volt, 250 Amp, Branch Circuit Breaker, 25,000 Amp Interrupting Capacity 951.54 <i>For Installation In New Panelboard, Deduct</i> -36.19 <i>Note: Also for use with new interiors in panelboards.</i>		65.15
				<i>For Bolt-On, Add</i> 144.28 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 43.43		
	26 24 16 00-0473	EA		3 Pole, 240/480 Volt, 300-400 Amp, Branch Circuit Breaker, 25,000 Amp Interrupting Capacity 1,029.77 <i>For Installation In New Panelboard, Deduct</i> -38.21 <i>Note: Also for use with new interiors in panelboards.</i>		69.17
				<i>For Bolt-On, Add</i> 155.46 <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 45.85		
	26 24 16 00-0474			Branch Circuit Breakers 30,000 Amp Interrupting Capacity, Plug-On <small>(26 24 16 00-0389)</small> <i>Note: Includes connection of electrical wire.</i>		
	26 24 16 00-0475	EA		2 Pole, 240/480 Volt, 15-30 Amp, Branch Circuit Breaker, 30,000 Amp Interrupting Capacity 184.41 <i>For Bolt-On, Add</i> 31.50 <i>For Installation In New Panelboard, Deduct</i> -12.07 <i>Note: Also for use with new interiors in panelboards.</i>		21.72
				<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 14.48		
	26 24 16 00-0476	EA		2 Pole, 240/480 Volt, 35-60 Amp, Branch Circuit Breaker, 30,000 Amp Interrupting Capacity 184.41 <i>For Bolt-On, Add</i> 31.50 <i>For Installation In New Panelboard, Deduct</i> -12.07 <i>Note: Also for use with new interiors in panelboards.</i>		21.72
				<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 14.48		
	26 24 16 00-0477	EA		2 Pole, 240/480 Volt, 70-100 Amp, Branch Circuit Breaker, 30,000 Amp Interrupting Capacity 331.60 <i>For Bolt-On, Add</i> 52.71 <i>For Installation In New Panelboard, Deduct</i> -16.09 <i>Note: Also for use with new interiors in panelboards.</i>		28.96
				<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 19.31		
	26 24 16 00-0478	EA		2 Pole, 240/480 Volt, 110-125 Amp, Branch Circuit Breaker, 30,000 Amp Interrupting Capacity 609.90 <i>For Bolt-On, Add</i> 90.31 <i>For Installation In New Panelboard, Deduct</i> -20.11 <i>Note: Also for use with new interiors in panelboards.</i>		36.19
				<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 24.13		
	26 24 16 00-0479	EA		2 Pole, 240/480 Volt, 150-225 Amp, Branch Circuit Breaker, 30,000 Amp Interrupting Capacity 967.85 <i>For Bolt-On, Add</i> 138.58 <i>For Installation In New Panelboard, Deduct</i> -25.14 <i>Note: Also for use with new interiors in panelboards.</i>		45.04
				<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 30.16		
	26 24 16 00-0480	EA		2 Pole, 240/480 Volt, 250 Amp, Branch Circuit Breaker, 30,000 Amp Interrupting Capacity 1,102.37 <i>For Bolt-On, Add</i> 156.09 <i>For Installation In New Panelboard, Deduct</i> -26.14 <i>Note: Also for use with new interiors in panelboards.</i>		47.05
				<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 31.37		
	26 24 16 00-0481	EA		2 Pole, 240/480 Volt, 300-400 Amp, Branch Circuit Breaker, 30,000 Amp Interrupting Capacity 1,199.75 <i>For Bolt-On, Add</i> 171.08 <i>For Installation In New Panelboard, Deduct</i> -30.16 <i>Note: Also for use with new interiors in panelboards.</i>		54.30
				<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i> 36.20		

26	Electrical
26 20	Low-Voltage Electrical Distribution
26 24	Switchboards And Panelboards



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 24 16 00-0482 EA 3 Pole, 240/480 Volt, 15-30 Amp, Branch Circuit Breaker, 30,000 Amp Interrupting Capacity	301.35	28.96
For Bolt-On, Add	48.93	
For Installation In New Panelboard, Deduct	-16.09	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	19.31	
26 24 16 00-0483 EA 3 Pole, 240/480 Volt, 35-60 Amp, Branch Circuit Breaker, 30,000 Amp Interrupting Capacity	301.35	28.96
For Bolt-On, Add	48.93	
For Installation In New Panelboard, Deduct	-16.09	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	19.31	
26 24 16 00-0484 EA 3 Pole, 240/480 Volt, 70-100 Amp, Branch Circuit Breaker, 30,000 Amp Interrupting Capacity	401.14	36.19
For Bolt-On, Add	64.22	
For Installation In New Panelboard, Deduct	-20.11	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	24.13	
26 24 16 00-0485 EA 3 Pole, 240/480 Volt, 110-125 Amp, Branch Circuit Breaker, 30,000 Amp Interrupting Capacity	741.95	43.43
For Bolt-On, Add	109.63	
For Installation In New Panelboard, Deduct	-24.13	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	28.95	
26 24 16 00-0486 EA 3 Pole, 240/480 Volt, 150-225 Amp, Branch Circuit Breaker, 30,000 Amp Interrupting Capacity	937.19	56.30
For Bolt-On, Add	138.97	
For Installation In New Panelboard, Deduct	-31.17	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	37.40	
26 24 16 00-0487 EA 3 Pole, 240/480 Volt, 250 Amp, Branch Circuit Breaker, 30,000 Amp Interrupting Capacity	1,499.19	65.15
For Bolt-On, Add	212.73	
For Installation In New Panelboard, Deduct	-36.19	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	43.43	
26 24 16 00-0488 EA 3 Pole, 240/480 Volt, 300-400 Amp, Branch Circuit Breaker, 30,000 Amp Interrupting Capacity	1,596.80	69.17
For Bolt-On, Add	226.34	
For Installation In New Panelboard, Deduct	-38.21	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	45.85	
26 24 16 00-0489 Branch Circuit Breakers 35,000 Amp Interrupting Capacity, Plug-On <small>(26 24 16 00-0389)</small>		
Note: Includes connection of electrical wire.		
26 24 16 00-0490 EA 1 Pole, 480 Volt, 15-30 Amp, Branch Circuit Breaker, 35,000 Amp Interrupting Capacity	96.57	14.47
For Bolt-On, Add	17.70	
For Installation In New Panelboard, Deduct	-8.04	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	9.65	
26 24 16 00-0491 EA 1 Pole, 480 Volt, 35-60 Amp, Branch Circuit Breaker, 35,000 Amp Interrupting Capacity	96.57	14.47
For Bolt-On, Add	17.70	
For Installation In New Panelboard, Deduct	-8.04	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	9.65	
26 24 16 00-0492 EA 1 Pole, 480 Volt, 70-100 Amp, Branch Circuit Breaker, 35,000 Amp Interrupting Capacity	168.21	18.10
For Bolt-On, Add	28.06	
For Installation In New Panelboard, Deduct	-10.05	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	12.06	
26 24 16 00-0493 EA 2 Pole, 480 Volt, 15-30 Amp, Branch Circuit Breaker, 35,000 Amp Interrupting Capacity	211.25	21.72
For Bolt-On, Add	34.85	
For Installation In New Panelboard, Deduct	-12.07	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	14.48	
26 24 16 00-0494 EA 2 Pole, 480 Volt, 35-60 Amp, Branch Circuit Breaker, 35,000 Amp Interrupting Capacity	211.25	21.72
For Bolt-On, Add	34.85	
For Installation In New Panelboard, Deduct	-12.07	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	14.48	
26 24 16 00-0495 EA 2 Pole, 480 Volt, 70-100 Amp, Branch Circuit Breaker, 35,000 Amp Interrupting Capacity	387.14	28.96
For Bolt-On, Add	59.65	
For Installation In New Panelboard, Deduct	-16.09	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	19.31	
26 24 16 00-0496 EA 2 Pole, 480 Volt, 110-125 Amp, Branch Circuit Breaker, 35,000 Amp Interrupting Capacity	720.84	36.19
For Bolt-On, Add	104.18	
For Installation In New Panelboard, Deduct	-20.11	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	24.13	
26 24 16 00-0497 EA 2 Pole, 480 Volt, 150-225 Amp, Branch Circuit Breaker, 35,000 Amp Interrupting Capacity	1,406.02	45.04
For Bolt-On, Add	193.35	
For Installation In New Panelboard, Deduct	-25.14	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	30.16	
26 24 16 00-0498 EA 3 Pole, 480 Volt, 15-30 Amp, Branch Circuit Breaker, 35,000 Amp Interrupting Capacity	349.78	28.96
For Bolt-On, Add	54.98	
For Installation In New Panelboard, Deduct	-16.09	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	19.31	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 24 16 00-0499 EA 3 Pole, 480 Volt, 35-60 Amp, Branch Circuit Breaker, 35,000 Amp Interrupting Capacity.....	349.78	28.96
For Bolt-On, Add	54.98	
For Installation In New Panelboard, Deduct	-16.09	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	19.31	
26 24 16 00-0500 EA 3 Pole, 480 Volt, 70-100 Amp, Branch Circuit Breaker, 35,000 Amp Interrupting Capacity.....	468.43	36.19
For Bolt-On, Add	72.63	
For Installation In New Panelboard, Deduct	-20.11	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	24.13	
26 24 16 00-0501 EA 3 Pole, 480 Volt, 110-125 Amp, Branch Circuit Breaker, 35,000 Amp Interrupting Capacity.....	888.18	43.43
For Bolt-On, Add	127.91	
For Installation In New Panelboard, Deduct	-24.13	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	28.95	
26 24 16 00-0502 EA 3 Pole, 480 Volt, 150-225 Amp, Branch Circuit Breaker, 35,000 Amp Interrupting Capacity.....	1,748.18	56.30
For Bolt-On, Add	240.34	
For Installation In New Panelboard, Deduct	-31.17	
Note: Also for use with new interiors in panelboards.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	37.40	
26 24 16 00-0503 Branch Circuit Breakers 42,000 Amp Interrupting Capacity, Plug-On <small>(26 24 16 00-0389)</small>		
Note: Includes connection of electrical wire.		
26 24 16 00-0504 EA 1 Pole, 240 Volt, 15-30 Amp, Branch Circuit Breaker, 42,000 Amp Interrupting Capacity.....	143.11	14.47
For Installation In New Panelboard, Deduct	-8.04	
Note: Also for use with new interiors in panelboards.		
For Bolt-On, Add	23.52	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	9.65	
26 24 16 00-0505 EA 1 Pole, 240 Volt, 35-60 Amp, Branch Circuit Breaker, 42,000 Amp Interrupting Capacity.....	143.11	14.47
For Installation In New Panelboard, Deduct	-8.04	
Note: Also for use with new interiors in panelboards.		
For Bolt-On, Add	23.52	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	9.65	
26 24 16 00-0506 EA 1 Pole, 240 Volt, 70-100 Amp, Branch Circuit Breaker, 42,000 Amp Interrupting Capacity.....	217.71	18.10
For Installation In New Panelboard, Deduct	-10.05	
Note: Also for use with new interiors in panelboards.		
For Bolt-On, Add	34.25	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	12.06	
26 24 16 00-0507 EA 2 Pole, 240 Volt, 15-30 Amp, Branch Circuit Breaker, 42,000 Amp Interrupting Capacity.....	265.09	21.72
For Installation In New Panelboard, Deduct	-12.07	
Note: Also for use with new interiors in panelboards.		
For Bolt-On, Add	41.58	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	14.48	
26 24 16 00-0508 EA 2 Pole, 240 Volt, 35-60 Amp, Branch Circuit Breaker, 42,000 Amp Interrupting Capacity.....	265.09	21.72
For Installation In New Panelboard, Deduct	-12.07	
Note: Also for use with new interiors in panelboards.		
For Bolt-On, Add	41.58	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	14.48	
26 24 16 00-0509 EA 2 Pole, 240 Volt, 70-100 Amp, Branch Circuit Breaker, 42,000 Amp Interrupting Capacity.....	503.05	28.96
For Installation In New Panelboard, Deduct	-16.09	
Note: Also for use with new interiors in panelboards.		
For Bolt-On, Add	74.14	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	19.31	
26 24 16 00-0510 EA 2 Pole, 240 Volt, 110-125 Amp, Branch Circuit Breaker, 42,000 Amp Interrupting Capacity.....	917.50	36.19
For Installation In New Panelboard, Deduct	-20.11	
Note: Also for use with new interiors in panelboards.		
For Bolt-On, Add	128.76	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	24.13	
26 24 16 00-0511 EA 2 Pole, 240 Volt, 150-225 Amp, Branch Circuit Breaker, 42,000 Amp Interrupting Capacity.....	1,838.22	40.21
For Installation In New Panelboard, Deduct	-22.12	
Note: Also for use with new interiors in panelboards.		
For Bolt-On, Add	245.26	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	26.54	
26 24 16 00-0512 EA 3 Pole, 240 Volt, 15-30 Amp, Branch Circuit Breaker, 42,000 Amp Interrupting Capacity.....	457.67	28.96
For Installation In New Panelboard, Deduct	-16.09	
Note: Also for use with new interiors in panelboards.		
For Bolt-On, Add	68.47	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	19.31	
26 24 16 00-0513 EA 3 Pole, 240 Volt, 35-60 Amp, Branch Circuit Breaker, 42,000 Amp Interrupting Capacity.....	457.67	28.96
For Installation In New Panelboard, Deduct	-16.09	
Note: Also for use with new interiors in panelboards.		
For Bolt-On, Add	68.47	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	19.31	
26 24 16 00-0514 EA 3 Pole, 240 Volt, 70-100 Amp, Branch Circuit Breaker, 42,000 Amp Interrupting Capacity.....	635.12	36.19
For Installation In New Panelboard, Deduct	-20.11	
Note: Also for use with new interiors in panelboards.		
For Bolt-On, Add	93.47	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	24.13	
26 24 16 00-0515 EA 3 Pole, 240 Volt, 110-125 Amp, Branch Circuit Breaker, 42,000 Amp Interrupting Capacity.....	1,034.41	43.43
For Installation In New Panelboard, Deduct	-24.13	
Note: Also for use with new interiors in panelboards.		
For Bolt-On, Add	146.19	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	28.95	

26 Electrical**26 20 Low-Voltage Electrical Distribution****26 24 Switchboards And Panelboards**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 24 16 00-0516 EA 3 Pole, 240 Volt, 150-225 Amp, Branch Circuit Breaker, 42,000 Amp Interrupting Capacity.....	2,318.16	56.30
<i>For Installation In New Panelboard, Deduct</i>	-31.17	
<i>Note: Also for use with new interiors in panelboards.</i>		
<i>For Bolt-On, Add</i>	311.59	
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	37.40	
26 24 16 00-0517 Branch Circuit Breakers 65,000 Amp Interrupting Capacity, Plug-On <small>(26 24 16 00-0389)</small>		
<i>Note: Includes connection of electrical wire.</i>		
26 24 16 00-0518 EA 2 Pole, 240 Volt, 15-30 Amp, Branch Circuit Breaker, 65,000 Amp Interrupting Capacity	62.78	14.47
<i>For Bolt-On, Add</i>	13.48	
<i>For Installation In New Panelboard, Deduct</i>	-8.04	
<i>Note: Also for use with new interiors in panelboards.</i>		
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.65	
26 24 16 00-0519 EA 2 Pole, 240 Volt, 15-30 Amp, Branch Circuit Breaker, 65,000 Amp Interrupting Capacity	134.52	21.72
<i>For Bolt-On, Add</i>	25.26	
<i>For Installation In New Panelboard, Deduct</i>	-12.07	
<i>Note: Also for use with new interiors in panelboards.</i>		
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	14.48	
26 24 16 00-0520 EA 3 Pole, 240 Volt, 15-30 Amp, Branch Circuit Breaker, 65,000 Amp Interrupting Capacity	214.62	28.96
<i>For Bolt-On, Add</i>	38.09	
<i>For Installation In New Panelboard, Deduct</i>	-16.09	
<i>Note: Also for use with new interiors in panelboards.</i>		
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	19.31	
26 24 16 00-0521 EA 1 Pole, 480 Volt, 15-30 Amp, Branch Circuit Breaker, 65,000 Amp Interrupting Capacity	135.13	14.47
<i>For Bolt-On, Add</i>	22.52	
<i>For Installation In New Panelboard, Deduct</i>	-8.04	
<i>Note: Also for use with new interiors in panelboards.</i>		
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.65	
26 24 16 00-0522 EA 1 Pole, 480 Volt, 35-60 Amp, Branch Circuit Breaker, 65,000 Amp Interrupting Capacity	135.13	14.47
<i>For Bolt-On, Add</i>	22.52	
<i>For Installation In New Panelboard, Deduct</i>	-8.04	
<i>Note: Also for use with new interiors in panelboards.</i>		
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.65	
26 24 16 00-0523 EA 1 Pole, 480 Volt, 70-100 Amp, Branch Circuit Breaker, 65,000 Amp Interrupting Capacity	269.08	28.96
<i>For Bolt-On, Add</i>	44.90	
<i>For Installation In New Panelboard, Deduct</i>	-16.09	
<i>Note: Also for use with new interiors in panelboards.</i>		
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	19.31	
26 24 16 00-0524 EA 2 Pole, 480 Volt, 15-30 Amp, Branch Circuit Breaker, 65,000 Amp Interrupting Capacity	309.44	21.72
<i>For Bolt-On, Add</i>	47.13	
<i>For Installation In New Panelboard, Deduct</i>	-12.07	
<i>Note: Also for use with new interiors in panelboards.</i>		
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	14.48	
26 24 16 00-0525 EA 2 Pole, 480 Volt, 35-60 Amp, Branch Circuit Breaker, 65,000 Amp Interrupting Capacity	309.44	21.72
<i>For Bolt-On, Add</i>	47.13	
<i>For Installation In New Panelboard, Deduct</i>	-12.07	
<i>Note: Also for use with new interiors in panelboards.</i>		
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	14.48	
26 24 16 00-0526 EA 2 Pole, 480 Volt, 70-100 Amp, Branch Circuit Breaker, 65,000 Amp Interrupting Capacity	603.00	28.96
<i>For Bolt-On, Add</i>	86.64	
<i>For Installation In New Panelboard, Deduct</i>	-16.09	
<i>Note: Also for use with new interiors in panelboards.</i>		
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	19.31	
26 24 16 00-0527 EA 2 Pole, 480 Volt, 110-125 Amp, Branch Circuit Breaker, 65,000 Amp Interrupting Capacity	1,028.43	36.19
<i>For Bolt-On, Add</i>	142.63	
<i>For Installation In New Panelboard, Deduct</i>	-20.11	
<i>Note: Also for use with new interiors in panelboards.</i>		
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	24.13	
26 24 16 00-0528 EA 2 Pole, 480 Volt, 150-225 Amp, Branch Circuit Breaker, 65,000 Amp Interrupting Capacity	2,277.01	45.04
<i>For Bolt-On, Add</i>	302.22	
<i>For Installation In New Panelboard, Deduct</i>	-25.14	
<i>Note: Also for use with new interiors in panelboards.</i>		
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	30.16	
26 24 16 00-0529 EA 3 Pole, 480 Volt, 15-30 Amp, Branch Circuit Breaker, 65,000 Amp Interrupting Capacity	521.11	28.96
<i>For Bolt-On, Add</i>	76.40	
<i>For Installation In New Panelboard, Deduct</i>	-16.09	
<i>Note: Also for use with new interiors in panelboards.</i>		
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	19.31	
26 24 16 00-0530 EA 3 Pole, 480 Volt, 35-60 Amp, Branch Circuit Breaker, 65,000 Amp Interrupting Capacity	521.11	28.96
<i>For Bolt-On, Add</i>	76.40	
<i>For Installation In New Panelboard, Deduct</i>	-16.09	
<i>Note: Also for use with new interiors in panelboards.</i>		
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	19.31	
26 24 16 00-0531 EA 3 Pole, 480 Volt, 70-100 Amp, Branch Circuit Breaker, 65,000 Amp Interrupting Capacity	727.22	36.19
<i>For Bolt-On, Add</i>	104.98	
<i>For Installation In New Panelboard, Deduct</i>	-20.11	
<i>Note: Also for use with new interiors in panelboards.</i>		
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	24.13	
26 24 16 00-0532 EA 3 Pole, 480 Volt, 110-125 Amp, Branch Circuit Breaker, 65,000 Amp Interrupting Capacity	1,115.09	43.43
<i>For Bolt-On, Add</i>	156.28	
<i>For Installation In New Panelboard, Deduct</i>	-24.13	
<i>Note: Also for use with new interiors in panelboards.</i>		
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	28.95	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 24 16 00-0533 EA 3 Pole, 480 Volt, 150-225 Amp, Branch Circuit Breaker, 65,000 Amp Interrupting Capacity..... <i>For Bolt-On, Add</i> <i>For Installation In New Panelboard, Deduct</i> <i>Note: Also for use with new interiors in panelboards.</i> <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2,831.44 375.75 -31.17 37.40	56.30
26 24 16 00-0534 Residential Lighting And Power Panelboards <small>(26 24 16 00-0001)</small>		
26 24 16 00-0535 Residential Type Unassembled Load Center <small>(26 24 16 00-0534)</small> <i>Note: Interior box and cover, includes ground bar kit.</i>		
26 24 16 00-0536 Main Lug Load Center, 3 Phase 4 Wire, 208 Y/120 V AC <small>(26 24 16 00-0535)</small> <i>Note: 3 Phase 4 wire 240/120 V AC Delta, 3 phase 3 wire 240 V AC Delta.</i>		
26 24 16 00-0537 EA 60 Amp, 3 Circuit, Main Lug Load Center Panelboard, 3 Phase 4 Wire, 208 Y/120 Volt AC, 3 Phase 4 Wire 240/120 Volt AC Delta, 3 Phase 3 Wire 240 Volt AC Delta, Unassembled	165.77	44.24
26 24 16 00-0538 EA 125 Amp, 3 Circuit, Main Lug Load Center Panelboard, 3 Phase 4 Wire, 208 Y/120 Volt AC, 3 Phase 4 Wire 240/120 Volt AC Delta, 3 Phase 3 Wire 240 Volt AC Delta, Unassembled	311.63	48.26
26 24 16 00-0539 Main Lug Load Center, 3 Wire 120/240 Volt, Single Phase, Rainproof <small>(26 24 16 00-0535)</small>		
26 24 16 00-0540 EA 40 Amp, 2 Circuit, Main Lug Load Center Panelboard, 3 Wire 120/240 Volt, 1 Phase, Rainproof, Unassembled.....	168.93	44.24
26 24 16 00-0541 EA 70 Amp, 4 Circuit, Main Lug Load Center Panelboard, 3 Wire 120/240 Volt, 1 Phase, Rainproof, Unassembled.....	188.95	48.26
26 24 16 00-0542 EA 100 Amp, 8 Circuit, Main Lug Load Center Panelboard, 3 Wire 120/240 Volt, 1 Phase, Rainproof, Unassembled.....	633.55	229.63
26 24 16 00-0543 EA 150 Amp, 30 Circuit, Main Lug Load Center Panelboard, 3 Wire 120/240 Volt, 1 Phase, Rainproof, Unassembled.....	1,436.12	522.81
26 24 16 00-0544 Main Lug Load Center, 3 Phase 4 Wire, 208 Y/120 V AC <small>(26 24 16 00-0535)</small> <i>Note: 3 Phase 4 wire 240/120 V AC Delta, 3 phase 3 wire 240 V AC Delta, Rainproof.</i>		
26 24 16 00-0545 EA 60 A, 3 Circuit, Main Lug Load Center Panelboard, 3 Phase 4 Wire, 208 Y/120 Volt AC, 3 Phase 4 Wire 240/120 Volt AC Delta, 3 Phase 3 Wire 240 Volt AC Delta, Rainproof, Unassembled.....	213.91	44.24
26 24 16 00-0546 EA 125 A, 20 Circuit, Main Lug Load Center Panelboard, 3 Phase 4 Wire, 208 Y/120 Volt AC, 3 Phase 4 Wire 240/120 Volt AC Delta, 3 Phase 3 Wire 240 Volt AC Delta, Rainproof, Unassembled.....	1,399.13	482.66
26 24 16 00-0547 Main Breaker Load Center, 3 Wire, 120/240 Volt, Single Phase <small>(26 24 16 00-0535)</small>		
26 24 16 00-0548 EA 125 Amp, 24 Circuit, Main Breaker Load Center Panelboard, 3 Wire, 120/240 Volt, Single Phase, Unassembled.....	1,522.77	482.66
26 24 16 00-0549 EA 150 Amp, 30 Circuit, Main Breaker Load Center Panelboard, 3 Wire, 120/240 Volt, Single Phase, Unassembled.....	1,653.43	522.81
26 24 16 00-0550 EA 300 Amp, 42 Circuit, Main Breaker Load Center Panelboard, 3 Wire, 120/240 Volt, Single Phase, Unassembled.....	6,305.01	804.31
26 24 16 00-0551 Main Breaker Load Center, 3 Phase 4 Wire, 208 Y/120 V AC <small>(26 24 16 00-0535)</small> <i>Note: 3 Phase 4 wire 240/120 V AC Delta, 3 phase 3 wire 240 V Delta.</i>		
26 24 16 00-0552 EA 125 Amp, 30 Circuit, Main Breaker Load Center Panelboard, 3 Phase 4 Wire, 208 Y/120 Volt AC, 3 Phase 4 Wire 240/120 Volt AC Delta, 3 Phase 3 Wire 240 Volt AC Delta, Unassembled	2,321.60	482.66
26 24 16 00-0553 EA 150 Amp, 40 Circuit, Main Breaker Load Center Panelboard, 3 Phase 4 Wire, 208 Y/120 Volt AC, 3 Phase 4 Wire 240/120 Volt AC Delta, 3 Phase 3 Wire 240 Volt AC Delta, Unassembled	2,534.09	522.81
26 24 16 00-0554 EA 300 Amp, 42 Circuit, Main Breaker Load Center Panelboard, 3 Phase 4 Wire, 208 Y/120 Volt AC, 3 Phase 4 Wire 240/120 Volt AC Delta, 3 Phase 3 Wire 240 Volt AC Delta, Unassembled	6,977.16	804.31
26 24 16 00-0555 Main Breaker Load Center, 3 Wire 120/240 Volt, Single Phase, Rainproof <small>(26 24 16 00-0535)</small>		
26 24 16 00-0556 EA 125 Amp, 24 Circuit, Main Breaker Load Center Panelboard, 3 Wire 120/240 Volt, 1 Phase, Rainproof, Unassembled.....	1,612.17	482.66
26 24 16 00-0557 EA 150 Amp, 30 Circuit, Main Breaker Load Center Panelboard, 3 Wire 120/240 Volt, 1 Phase, Rainproof, Unassembled.....	1,806.10	522.81
26 24 16 00-0558 Main Breaker Load Center, 3 Phase 4 Wire, 208 Y/120 V AC <small>(26 24 16 00-0535)</small> <i>Note: 3 Phase 4 wire 240/120 V AC Delta, 3 phase 3 wire 240 V AC Delta, Rainproof.</i>		
26 24 16 00-0559 EA 125 Amp, 30 Circuit, Main Breaker Load Center Panelboard, 3 Phase 4 Wire, 208 Y/120 Volt AC, 3 Phase 4 Wire 240/120 Volt AC Delta, 3 Phase 3 Wire 240 Volt AC Delta, Rainproof, Unassembled.....	2,469.87	482.66
26 24 16 00-0560 EA 155 Amp, 30 Circuit, Main Breaker Load Center Panelboard, 3 Phase 4 Wire, 208 Y/120 Volt AC, 3 Phase 4 Wire 240/120 Volt AC Delta, 3 Phase 3 Wire 240 Volt AC Delta, Rainproof, Unassembled.....	2,550.19	522.81
26 24 16 00-0561 Residential Type Assembled Load Center <small>(26 24 16 00-0534)</small>		
26 24 16 00-0562 Main Lug Load Center, 4 Wire, 20 Amp, 120/208 V <small>(26 24 16 00-0561)</small> <i>Note: Includes 1 pole plug-in breaker.</i>		
26 24 16 00-0563 EA 125 Amp Main Lugs, Indoor, 12 Circuit, 4 Wire, 20 Amp, 120/208 Volt, 1 Pole Plug-In Breaker	777.19	268.24
26 24 16 00-0564 EA 125 Amp Main Lugs, Indoor, 18 Circuit, 4 Wire, 20 Amp, 120/208 Volt, 1 Pole Plug-In Breaker	1,157.78	402.16
26 24 16 00-0565 EA 125 Amp Main Lugs, Rainproof, 12 Circuits, 4 Wire, 20 Amp, 120/208 Volt, 1 Pole Plug-In Breaker	822.58	268.24
26 24 16 00-0566 EA 125 Amp Main Lugs, Rainproof, 18 Circuits, 4 Wire, 20 Amp, 120/208 Volt, 1 Pole Plug-In Breaker	1,199.05	402.16
26 24 16 00-0567 EA 200 Amp Main Lugs, Indoor, 24 Circuit, 4 Wire, 20 Amp, 120/208 Volt, 1 Pole Plug-In Breaker	1,471.42	495.05
26 24 16 00-0568 EA 200 Amp Main Lugs, Indoor, 30 Circuit, 4 Wire, 20 Amp, 120/208 Volt, 1 Pole Plug-In Breaker	1,608.81	536.24
26 24 16 00-0569 EA 200 Amp Main Lugs, Indoor, 36 Circuit, 4 Wire, 20 Amp, 120/208 Volt, 1 Pole Plug-In Breaker	1,975.00	643.69
26 24 16 00-0570 EA 200 Amp Main Lugs, Indoor, 42 Circuit, 4 Wire, 20 Amp, 120/208 Volt, 1 Pole Plug-In Breaker	2,358.21	804.31
26 24 16 00-0571 EA 200 Amp Main Lugs, Rainproof, 24 Circuits, 4 Wire, 20 Amp, 120/208 Volt, 1 Pole Plug-In Breaker	1,519.56	495.05
26 24 16 00-0572 EA 200 Amp Main Lugs, Rainproof, 30 Circuits, 4 Wire, 20 Amp, 120/208 Volt, 1 Pole Plug-In Breaker	1,663.26	535.92
26 24 16 00-0573 EA 200 Amp Main Lugs, Rainproof, 36 Circuits, 4 Wire, 20 Amp, 120/208 Volt, 1 Pole Plug-In Breaker	2,159.86	643.20
26 24 16 00-0574 EA 200 Amp Main Lugs, Rainproof, 42 Circuits, 4 Wire, 20 Amp, 120/208 Volt, 1 Pole Plug-In Breaker	2,543.88	804.31

26 Electrical**26 20 Low-Voltage Electrical Distribution****26 24 Switchboards And Panelboards**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 24 16 00-0575 EA 400 Amp Main Lugs, Indoor, 42 Circuit, 4 Wire, 20 Amp, 120/208 Volt, 1 Pole Plug-In Breaker	2,922.05	893.67
26 24 16 00-0576 EA 400 Amp Main Lugs, Rainproof, 42 Circuits, 4 Wire, 20 Amp, 120/208 Volt, 1 Pole Plug-In Breaker	3,087.10	893.67
26 24 16 00-0577 Main Breaker Load Center, 3 Wire, 20 Amp, 120/240 Volt, 1 Phase (26 24 16 00-0561)		
Note: Includes 1 pole plug-in breaker.		
26 24 16 00-0578 EA 125 Amp Main Breaker, Indoor, 12 Circuit, 3 Wire, 20 Amp, 120/240 Volt, 1 Phase, With 1 Pole Plug-In Breakers.....	771.69	268.24
26 24 16 00-0579 EA 125 Amp Main Breaker, Indoor, 18 Circuit, 3 Wire, 20 Amp, 120/240 Volt, 1 Phase, With 1 Pole Plug-In Breakers.....	1,138.53	402.16
26 24 16 00-0580 EA 200 Amp Main Breaker, Indoor, 20 Circuit, 3 Wire, 20 Amp, 120/240 Volt, 1 Phase, With 1 Pole Plug-In Breakers.....	1,332.72	429.10
26 24 16 00-0581 EA 200 Amp Main Breaker, Indoor, 24 Circuit, 3 Wire, 20 Amp, 120/240 Volt, 1 Phase, With 1 Pole Plug-In Breakers.....	1,526.93	495.29
26 24 16 00-0582 EA 200 Amp Main Breaker, Indoor, 30 Circuit, 3 Wire, 20 Amp, 120/240 Volt, 1 Phase, With 1 Pole Plug-In Breakers.....	1,684.46	536.24
26 24 16 00-0583 EA 200 Amp Main Breaker, Indoor, 40 Circuit, 3 Wire, 20 Amp, 120/240 Volt, 1 Phase, 1 Pole Plug-In Breaker	2,227.86	715.03
26 24 16 00-0584 EA 200 Amp Main Breaker, Rainproof, 20 Circuits, 3 Wire, 20 Amp, 120/240 Volt, 1 Phase, 1 Pole Plug-In Breaker	1,346.47	429.10
26 24 16 00-0585 EA 200 Amp Main Breaker, Rainproof, 24 Circuits, 3 Wire, 20 Amp, 120/240 Volt, 1 Phase, 1 Pole Plug-In Breaker	1,553.95	495.05
26 24 16 00-0586 EA 200 Amp Main Breaker, Rainproof, 30 Circuits, 3 Wire, 20 Amp, 120/240 Volt, 1 Phase, 1 Pole Plug-In Breaker	1,690.76	535.92
26 24 16 00-0587 EA 200 Amp Main Breaker, Rainproof, 40 Circuits, 3 Wire, 20 Amp, 120/240 Volt, 1 Phase, 1 Pole Plug-In Breaker	2,152.22	715.03
26 24 16 00-0588 EA 400 Amp Main Breaker, Indoor, 42 Circuit, 3 Wire, 20 Amp, 120/240 Volt, 1 Phase, 1 Pole Plug-In Breaker	4,297.44	893.67
26 24 16 00-0589 EA 400 Amp Main Breaker, Rainproof, 42 Circuits, 3 Wire, 20 Amp, 120/240 Volt, 1 Phase, 1 Pole Plug-In Breaker	4,572.52	893.67
26 24 16 00-0590 Main Breaker Load Center, 4 Wire, 20 Amp, 120/208 V (26 24 16 00-0561)		
Note: Includes 1 pole plug-in breaker.		
26 24 16 00-0591 EA 200 Amp Main Breaker, Indoor, 30 Circuit, 4 Wire, 20 Amp, 120/208 Volt, 1 Pole Plug-In Breaker.....	2,069.56	536.24
26 24 16 00-0592 EA 200 Amp Main Breaker, Indoor, 42 Circuit, 4 Wire, 20 Amp, 120/208 Volt, 1 Pole Plug-In Breaker.....	2,798.33	804.31
26 24 16 00-0593 EA 200 Amp Main Breaker, Rainproof, 30 Circuits, 4 Wire, 20 Amp, 120/208 Volt, 1 Pole Plug-In Breaker	2,151.52	535.92
26 24 16 00-0594 EA 200 Amp Main Breaker, Rainproof, 42 Circuits, 4 Wire, 20 Amp, 120/208 Volt, 1 Pole Plug-In Breaker	2,880.85	804.31
26 24 16 00-0595 Panel Mounted Accessories And Fuseholders (26 24 16 00-0001)		
26 24 16 00-0596 Midget Finger-Safe Fuse Holders (26 24 16 00-0595)		
Note: 30 Amp capacity. Excludes fuse.		
26 24 16 00-0597 EA 1 Pole Midget Finger-Safe Fuse Holder	46.81	14.47
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	9.65	
26 24 16 00-0598 EA 1 Pole With Indicator Midget Finger-Safe Fuse Holder	53.74	14.47
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	9.65	
26 24 16 00-0599 EA 2 Pole Midget Finger-Safe Fuse Holder	74.63	21.72
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	14.48	
26 24 16 00-0600 EA 2 Pole With Indicators Midget Finger-Safe Fuse Holder	92.73	21.72
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	14.48	
26 24 16 00-0601 EA 3 Pole Midget Finger-Safe Fuse Holder	108.06	28.96
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	19.31	
26 24 16 00-0602 EA 3 Pole With Indicators Midget Finger-Safe Fuse Holder	132.10	28.96
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	19.31	
26 24 16 00-0603 EA 3 Pole With 4th Neutral Pole Midget Finger-Safe Fuse Holder	152.21	28.96
Note: With indicators.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	19.31	
26 24 16 00-0604 EA 3 Pole With 4th Neutral Pole Midget Finger-Safe Fuse Holder	125.55	28.96
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	19.31	
26 24 16 00-0605 EA 4 Pole Midget Finger-Safe Fuse Holder	135.95	36.19
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	24.13	
26 24 16 00-0606 EA 4 Pole With Indicator Midget Finger-Safe Fuse Holder	162.35	36.19
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	24.13	
26 24 16 00-0607 EA 12 To 24 Volt DC Midget Finger-Safe Fuse Holder	53.77	14.47
Note: With indicator.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	9.65	
26 24 16 00-0608 EA 20 To 24 Volt DC Midget Finger-Safe Fuse Holder.....	57.45	14.47
Note: With indicator.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	9.65	
26 24 16 00-0609 EA 35 To 48 Volt DC Midget Finger-Safe Fuse Holder.....	54.45	14.47
Note: With indicator.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	9.65	
26 24 16 00-0610 Removal And Reinstallation Of Panelboards (26 24 16 00-0001)		
Note: Includes storage, cleaning and supply materials.		
26 24 16 00-0611 EA Remove And Reinstall Panelboards With Breakers, Up To 42 Circuit Capacity	1,010.94	
Note: Includes removal and reinstallation of main wiring to panelboard.		
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	301.62	
26 24 16 00-0612 EA Remove And Reinstall Breaker, 1-2-3 Pole, Any Amperage	53.88	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	15.68	
26 24 16 00-0613 EA Panelboard Filler Plate, Fits 1" Opening	4.12	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	0.76	
26 24 19 Motor-Control Centers (26 24)		
26 24 19 00-0001 Combination Starters With Molded Case Circuit Breakers (26 24 19)		
Note: Includes NEMA I enclosure of indoor installation, vertical free standing floor mounted sections (90" high x 20" wide x 16" o 20" Deep), fully factory assembled and wired internally.		
26 24 19 00-0002 230 Volt Combination With Molded Case Circuit, Full Volt (26 24 19 00-0001)		
Note: 1-Speed non-reversing.		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 24 19 00-0003 EA 230 Volt, Full Volt, 1 Speed, Non-Reversing, 7-1/2 HP Combination With Molded Case Circuit.....	1,904.86	73.53
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	44.12	
26 24 19 00-0004 EA 230 Volt, Full Volt, 1 Speed, Non-Reversing, 15 HP Combination With Molded Case Circuit.....	2,259.74	77.20
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	46.33	
26 24 19 00-0005 EA 230 Volt, Full Volt, 1 Speed, Non-Reversing, 30 HP Combination With Molded Case Circuit.....	3,375.83	80.88
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	48.53	
26 24 19 00-0006 EA 230 Volt, Full Volt, 1 Speed, Non-Reversing, 50 HP Combination With Molded Case Circuit.....	6,139.41	95.59
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	57.36	
26 24 19 00-0007 EA 230 Volt, Full Volt, 1 Speed, Non-Reversing, 100 HP Combination With Molded Case Circuit.....	12,396.52	110.30
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	66.18	
26 24 19 00-0008 EA 230 Volt, Full Volt, 1 Speed, Non-Reversing, 200 HP Combination With Molded Case Circuit.....	20,871.10	147.06
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	88.24	
26 24 19 00-0009 480 Volt Combination With Molded Case Circuit, Full Volt <small>(26 24 19 00-0001)</small>		
Note: 1-Speed non-reversing.		
26 24 19 00-0010 EA 480 Volt, Full Volt, 1 Speed, Non-Reversing, 10 HP Combination With Molded Case Circuit.....	1,904.86	73.53
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	44.12	
26 24 19 00-0011 EA 480 Volt, Full Volt, 1 Speed, Non-Reversing, 25 HP Combination With Molded Case Circuit.....	2,259.74	77.20
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	46.33	
26 24 19 00-0012 EA 480 Volt, Full Volt, 1 Speed, Non-Reversing, 50 HP Combination With Molded Case Circuit.....	3,375.83	80.88
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	48.53	
26 24 19 00-0013 EA 480 Volt, Full Volt, 1 Speed, Non-Reversing, 100 HP Combination With Molded Case Circuit.....	6,139.41	95.59
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	57.36	
26 24 19 00-0014 EA 480 Volt, Full Volt, 1 Speed, Non-Reversing, 200 HP Combination With Molded Case Circuit.....	12,396.52	110.30
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	66.18	
26 24 19 00-0015 EA 480 Volt, Full Volt, 1 Speed, Non-Reversing, 400 HP Combination With Molded Case Circuit.....	20,871.10	147.06
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	88.24	
26 24 19 00-0016 230 Volt Combination With Molded Case Circuit, Full Volt <small>(26 24 19 00-0001)</small>		
Note: 1-Speed reversing.		
26 24 19 00-0017 EA 230 Volt, Full Volt, 1 Speed, Reversing, 7-1/2 HP Combination With Molded Case Circuit.....	2,772.73	73.53
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	44.12	
26 24 19 00-0018 EA 230 Volt, Full Volt, 1 Speed, Reversing, 15 HP Combination With Molded Case Circuit.....	3,703.12	77.20
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	46.33	
26 24 19 00-0019 EA 230 Volt, Full Volt, 1 Speed, Reversing, 30 HP Combination With Molded Case Circuit.....	5,319.34	80.88
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	48.53	
26 24 19 00-0020 EA 230 Volt, Full Volt, 1 Speed, Reversing, 50 HP Combination With Molded Case Circuit.....	9,324.05	95.59
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	57.36	
26 24 19 00-0021 EA 230 Volt, Full Volt, 1 Speed, Reversing, 100 HP Combination With Molded Case Circuit.....	18,381.51	110.30
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	66.18	
26 24 19 00-0022 EA 230 Volt, Full Volt, 1 Speed, Reversing, 200 HP Combination With Molded Case Circuit.....	31,693.73	147.06
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	88.24	
26 24 19 00-0023 480 Volt Combination With Molded Case Circuit, Full Volt <small>(26 24 19 00-0001)</small>		
Note: 1-Speed reversing.		
26 24 19 00-0024 EA 480 Volt, Full Volt, 1 Speed, Reversing, 10 HP Combination With Molded Case Circuit.....	2,772.73	73.53
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	44.12	
26 24 19 00-0025 EA 480 Volt, Full Volt, 1 Speed, Reversing, 25 HP Combination With Molded Case Circuit.....	3,703.12	77.20
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	46.33	
26 24 19 00-0026 EA 480 Volt, Full Volt, 1 Speed, Reversing, 50 HP Combination With Molded Case Circuit.....	5,319.34	80.88
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	48.53	
26 24 19 00-0027 EA 480 Volt, Full Volt, 1 Speed, Reversing, 100 HP Combination With Molded Case Circuit.....	9,324.05	95.59
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	57.36	
26 24 19 00-0028 EA 480 Volt, Full Volt, 1 Speed, Reversing, 200 HP Combination With Molded Case Circuit.....	18,381.51	110.30
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	66.18	
26 24 19 00-0029 EA 480 Volt, Full Volt, 1 Speed, Reversing, 400 HP Combination With Molded Case Circuit.....	31,693.73	147.06
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	88.24	
26 24 19 00-0030 230 Volt Combination With Molded Case Circuit, Full Volt <small>(26 24 19 00-0001)</small>		
Note: 2-Speed non-reversing, 2 wind.		
26 24 19 00-0031 EA 230 Volt, Full Volt, 2 Speed, 2 Wind Starter, Non-Reverse, 7-1/2 HP Combination With Molded Case Circuit.....	3,362.93	117.65
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	70.59	
26 24 19 00-0032 EA 230 Volt, Full Volt, 2 Speed, 2 Wind Starter, Non-Reverse, 15 HP Combination With Molded Case Circuit.....	4,638.99	125.00
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	75.00	
26 24 19 00-0033 EA 230 Volt, Full Volt, 2 Speed, 2 Wind Starter, Non-Reverse, 30 HP Combination With Molded Case Circuit.....	6,849.11	132.36
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	79.41	
26 24 19 00-0034 EA 230 Volt, Full Volt, 2 Speed, 2 Wind Starter, Non-Reverse, 50 HP Combination With Molded Case Circuit.....	12,271.46	150.74
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	90.44	
26 24 19 00-0035 EA 230 Volt, Full Volt, 2 Speed, 2 Wind Starter, Non-Reverse, 100 HP Combination With Molded Case Circuit.....	20,356.25	176.48
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	105.89	
26 24 19 00-0036 480 Volt Combination With Molded Case Circuit, Full Volt <small>(26 24 19 00-0001)</small>		
Note: 2-Speed non-reversing, 2 wind.		
26 24 19 00-0037 EA 480 Volt, Full Volt, 2 Speed, 2 Wind Starter, Non-Reverse, 10 HP Combination With Molded Case Circuit.....	3,362.93	117.65
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	70.59	
26 24 19 00-0038 EA 480 Volt, Full Volt, 2 Speed, 2 Wind Starter, Non-Reverse, 25 HP Combination With Molded Case Circuit.....	4,638.99	125.00
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	75.00	
26 24 19 00-0039 EA 480 Volt, Full Volt, 2 Speed, 2 Wind Starter, Non-Reverse, 50 HP Combination With Molded Case Circuit.....	6,849.11	132.36
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	79.41	

26 Electrical**26 20 Low-Voltage Electrical Distribution****26 24 Switchboards And Panelboards**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 24 19 00-0040	EA		480 Volt, Full Volt, 2 Speed, 2 Wind Starter, Non-Reverse, 100 HP Combination With Molded Case Circuit <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	12,271.46 90.44	150.74
26 24 19 00-0041	EA		480 Volt, Full Volt, 2 Speed, 2 Wind Starter, Non-Reverse, 200 HP Combination With Molded Case Circuit <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	20,356.25 105.89	176.48
26 24 19 00-0042			230 Volt Combination With Molded Case Circuit, Full Volt <small>(26 24 19 00-0001)</small> Note: 2-Speed non-reversing, 2 wind.		
26 24 19 00-0043	EA		230 Volt, Full Volt, 2 Speed, 1 Wind Starter, Non-Reverse, 7-1/2 HP Combination With Molded Case Circuit <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	3,907.22 44.12	73.53
26 24 19 00-0044	EA		230 Volt, Full Volt, 2 Speed, 1 Wind Starter, Non-Reverse, 15 HP Combination With Molded Case Circuit <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5,826.83 46.33	77.20
26 24 19 00-0045	EA		230 Volt, Full Volt, 2 Speed, 1 Wind Starter, Non-Reverse, 30 HP Combination With Molded Case Circuit <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	7,985.47 48.53	80.88
26 24 19 00-0046	EA		230 Volt, Full Volt, 2 Speed, 1 Wind Starter, Non-Reverse, 50 HP Combination With Molded Case Circuit <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	15,022.20 57.36	95.59
26 24 19 00-0047	EA		230 Volt, Full Volt, 2 Speed, 1 Wind Starter, Non-Reverse, 100 HP Combination With Molded Case Circuit <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	26,047.08 66.18	110.30
26 24 19 00-0048			480 Volt Combination With Molded Case Circuit, Full Volt <small>(26 24 19 00-0001)</small> Note: 2-Speed non-reversing, 1 wind.		
26 24 19 00-0049	EA		480 Volt, Full Volt, 2 Speed, 1 Wind Starter, Non-Reverse, 10 HP Combination With Molded Case Circuit <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	3,907.22 44.12	73.53
26 24 19 00-0050	EA		480 Volt, Full Volt, 2 Speed, 1 Wind Starter, Non-Reverse, 25 HP Combination With Molded Case Circuit <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5,826.83 46.33	77.20
26 24 19 00-0051	EA		480 Volt, Full Volt, 2 Speed, 1 Wind Starter, Non-Reverse, 50 HP Combination With Molded Case Circuit <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	7,985.47 48.53	80.88
26 24 19 00-0052	EA		480 Volt, Full Volt, 2 Speed, 1 Wind Starter, Non-Reverse, 100 HP Combination With Molded Case Circuit <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	15,022.20 57.36	95.59
26 24 19 00-0053	EA		480 Volt, Full Volt, 2 Speed, 1 Wind Starter, Non-Reverse, 200 HP Combination With Molded Case Circuit <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	26,047.08 66.18	110.30
26 24 19 00-0054			230 Volt Combination With Molded Case Circuit <small>(26 24 19 00-0001)</small> Note: Reducing volt, auto-transformer.		
26 24 19 00-0055	EA		230 Volt, Reduced Volt, Auto Transformer, 15 HP Combination With Molded Case Circuit	5,790.06	77.20
26 24 19 00-0056	EA		230 Volt, Reduced Volt, Auto Transformer, 30 HP Combination With Molded Case Circuit	8,877.24	84.56
26 24 19 00-0057	EA		230 Volt, Reduced Volt, Auto Transformer, 50 HP Combination With Molded Case Circuit	14,979.91	95.59
26 24 19 00-0058	EA		230 Volt, Reduced Volt, Auto Transformer, 100 HP Combination With Molded Case Circuit	23,186.05	110.30
26 24 19 00-0059	EA		230 Volt, Reduced Volt, Auto Transformer, 200 HP Combination With Molded Case Circuit	39,681.07	147.06
26 24 19 00-0060			480 Volt Combination With Molded Case Circuit <small>(26 24 19 00-0001)</small> Note: Reducing volt, auto-transformer.		
26 24 19 00-0061	EA		480 Volt, Reduced Volt, Auto Transformer, 25 HP Combination With Molded Case Circuit	5,790.06	77.20
26 24 19 00-0062	EA		480 Volt, Reduced Volt, Auto Transformer, 50 HP Combination With Molded Case Circuit	8,877.24	84.56
26 24 19 00-0063	EA		480 Volt, Reduced Volt, Auto Transformer, 100 HP Combination With Molded Case Circuit	14,979.91	95.59
26 24 19 00-0064	EA		480 Volt, Reduced Volt, Auto Transformer, 200 HP Combination With Molded Case Circuit	23,186.05	110.30
26 24 19 00-0065	EA		480 Volt, Reduced Volt, Auto Transformer, 400 HP Combination With Molded Case Circuit	39,681.07	147.06
26 24 19 00-0066			230 Volt Combination With Molded Case Circuit <small>(26 24 19 00-0001)</small> Note: Reducing volt, part winding.		
26 24 19 00-0067	EA		230 Volt, Reduced Volt, Part Winding Starters, 10 HP Combination With Molded Case Circuit <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	3,931.09 70.59	117.65
26 24 19 00-0068	EA		230 Volt, Reduced Volt, Part Winding Starters, 25 HP Combination With Molded Case Circuit <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5,083.96 81.62	136.03
26 24 19 00-0069	EA		230 Volt, Reduced Volt, Part Winding Starters, 50 HP Combination With Molded Case Circuit <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8,970.98 90.44	150.74
26 24 19 00-0070	EA		230 Volt, Reduced Volt, Part Winding Starters, 75 HP Combination With Molded Case Circuit <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	15,316.35 110.30	183.83
26 24 19 00-0071	EA		230 Volt, Reduced Volt, Part Winding Starters, 150 HP Combination With Molded Case Circuit <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	21,047.59 141.19	235.30
26 24 19 00-0072			480 Volt Combination With Molded Case Circuit <small>(26 24 19 00-0001)</small> Note: Reducing volt, part winding.		
26 24 19 00-0073	EA		480 Volt, Reduced Volt, Part Winding Starters, 15 HP Combination With Molded Case Circuit <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	3,931.09 70.59	117.65
26 24 19 00-0074	EA		480 Volt, Reduced Volt, Part Winding Starters, 40 HP Combination With Molded Case Circuit <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5,083.96 81.62	136.03
26 24 19 00-0075	EA		480 Volt, Reduced Volt, Part Winding Starters, 75 HP Combination With Molded Case Circuit <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8,970.98 90.44	150.74
26 24 19 00-0076	EA		480 Volt, Reduced Volt, Part Winding Starters, 150 HP Combination With Molded Case Circuit <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	15,316.35 110.30	183.83
26 24 19 00-0077	EA		480 Volt, Reduced Volt, Part Winding Starters, 350 HP Combination With Molded Case Circuit <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	21,047.59 141.19	235.30
26 24 19 00-0078			230 Volt Combination With Molded Case Circuit <small>(26 24 19 00-0001)</small> Note: Reducing volt, energy saver.		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 24 19 00-0079 EA 230 Volt, Energy Saver Solid State Reduced Volt Starter With MCP, 7-1/2 HP Combination With Molded Case Circuit.....	16,382.84	95.59
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	57.36	
26 24 19 00-0080 EA 230 Volt, Energy Saver Solid State Reduced Volt Starter With MCP, 15 HP Combination With Molded Case Circuit.....	17,373.88	117.65
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	70.59	
26 24 19 00-0081 EA 230 Volt, Energy Saver Solid State Reduced Volt Starter With MCP, 30 HP Combination With Molded Case Circuit.....	19,183.16	136.03
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	81.62	
26 24 19 00-0082 EA 230 Volt, Energy Saver Solid State Reduced Volt Starter With MCP, 50 HP Combination With Molded Case Circuit.....	29,064.37	150.74
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	90.44	
26 24 19 00-0083 EA 230 Volt, Energy Saver Solid State Reduced Volt Starter With MCP, 100 HP Combination With Molded Case Circuit.....	39,646.12	183.83
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	110.30	
26 24 19 00-0084 EA 230 Volt, Energy Saver Solid State Reduced Volt Starter With MCP, 200 HP Combination With Molded Case Circuit.....	53,807.83	235.30
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	141.19	
26 24 19 00-0085 480 Volt Combination With Molded Case Circuit <small>(26 24 19 00-0001)</small>		
Note: Reducing volt, energy saver.		
26 24 19 00-0086 EA 480 Volt, Energy Saver Solid State Reduced Volt Starter With MCP, 10 HP Combination With Molded Case Circuit.....	16,382.84	95.59
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	57.36	
26 24 19 00-0087 EA 480 Volt, Energy Saver Solid State Reduced Volt Starter With MCP, 25 HP Combination With Molded Case Circuit.....	17,373.88	117.65
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	70.59	
26 24 19 00-0088 EA 480 Volt, Energy Saver Solid State Reduced Volt Starter With MCP, 50 HP Combination With Molded Case Circuit.....	19,183.16	136.03
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	81.62	
26 24 19 00-0089 EA 480 Volt, Energy Saver Solid State Reduced Volt Starter With MCP, 100 HP Combination With Molded Case Circuit.....	29,064.37	150.74
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	90.44	
26 24 19 00-0090 EA 480 Volt, Energy Saver Solid State Reduced Volt Starter With MCP, 200 HP Combination With Molded Case Circuit.....	39,646.12	183.83
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	110.30	
26 24 19 00-0091 EA 480 Volt, Energy Saver Solid State Reduced Volt Starter With MCP, 400 HP Combination With Molded Case Circuit.....	53,807.83	235.30
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	141.19	
26 24 19 00-0092 Combination Starters With Current Limiting Circuit Breakers <small>(26 24 19)</small>		
Note: Includes NEMA I enclosure of indoor installation, vertical free standing floor mounted sections (90" high x 20" wide x 16" to 20" deep), fully factory assembled and wired internally.		
26 24 19 00-0093 230 Volt Combination Starters With Current Limiting Circuit <small>(26 24 19 00-0092)</small>		
Note: Full volt, 1-speed non-reversing.		
26 24 19 00-0094 EA 230 Volt, Full Volt, 1 Speed, Non-Reversing, 7-1/2 HP Combination Starters With Current Limiting Circuit.....	2,557.60	73.53
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	44.12	
26 24 19 00-0095 EA 230 Volt, Full Volt, 1 Speed, Non-Reversing, 15 HP Combination Starters With Current Limiting Circuit.....	2,912.48	77.20
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	46.33	
26 24 19 00-0096 EA 230 Volt, Full Volt, 1 Speed, Non-Reversing, 30 HP Combination Starters With Current Limiting Circuit.....	4,517.67	80.88
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	48.53	
26 24 19 00-0097 EA 230 Volt, Full Volt, 1 Speed, Non-Reversing, 50 HP Combination Starters With Current Limiting Circuit.....	8,344.02	95.59
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	57.36	
26 24 19 00-0098 EA 230 Volt, Full Volt, 1 Speed, Non-Reversing, 100 HP Combination Starters With Current Limiting Circuit.....	14,959.67	110.30
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	66.18	
26 24 19 00-0099 EA 230 Volt, Full Volt, 1 Speed, Non-Reversing, 200 HP Combination Starters With Current Limiting Circuit.....	24,395.90	147.06
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	88.24	
26 24 19 00-0100 480 Volt Combination Starters With Current Limiting Circuit <small>(26 24 19 00-0092)</small>		
Note: Full volt, 1-speed non-reversing.		
26 24 19 00-0101 EA 480 Volt, Full Volt, 1 Speed, Non-Reversing, 10 HP Combination Starters With Current Limiting Circuit.....	2,557.60	73.53
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	44.12	
26 24 19 00-0102 EA 480 Volt, Full Volt, 1 Speed, Non-Reversing, 25 HP Combination Starters With Current Limiting Circuit.....	2,912.48	77.20
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	46.33	
26 24 19 00-0103 EA 480 Volt, Full Volt, 1 Speed, Non-Reversing, 50 HP Combination Starters With Current Limiting Circuit.....	4,517.67	80.88
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	48.53	
26 24 19 00-0104 EA 480 Volt, Full Volt, 1 Speed, Non-Reversing, 100 HP Combination Starters With Current Limiting Circuit.....	8,344.02	95.59
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	57.36	
26 24 19 00-0105 EA 480 Volt, Full Volt, 1 Speed, Non-Reversing, 200 HP Combination Starters With Current Limiting Circuit.....	14,959.67	110.30
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	66.18	
26 24 19 00-0106 EA 480 Volt, Full Volt, 1 Speed, Non-Reversing, 400 HP Combination Starters With Current Limiting Circuit.....	24,395.90	147.06
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	88.24	
26 24 19 00-0107 230 Volt Combination Starters With Current Limiting Circuit <small>(26 24 19 00-0092)</small>		
Note: Full volt, 1-speed reversing.		
26 24 19 00-0108 EA 230 Volt, Full Volt, 1 Speed, Reversing, 7-1/2 HP Combination Starters With Current Limiting Circuit.....	3,419.96	73.53
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	44.12	
26 24 19 00-0109 EA 230 Volt, Full Volt, 1 Speed, Reversing, 15 HP Combination Starters With Current Limiting Circuit.....	4,342.99	77.20
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	46.33	

26 Electrical**26 20 Low-Voltage Electrical Distribution****26 24 Switchboards And Panelboards**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 24 19 00-0110	EA		230 Volt, Full Volt, 1 Speed, Reversing, 30 HP Combination Starters With Current Limiting Circuit	6,435.44	80.88
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	48.53	
26 24 19 00-0111	EA		230 Volt, Full Volt, 1 Speed, Reversing, 50 HP Combination Starters With Current Limiting Circuit	11,499.24	95.59
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	57.36	
26 24 19 00-0112	EA		230 Volt, Full Volt, 1 Speed, Reversing, 100 HP Combination Starters With Current Limiting Circuit	20,893.18	110.30
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	66.18	
26 24 19 00-0113			480 Volt Combination Starters With Current Limiting Circuit <small>(26 24 19 00-0092)</small>		
			Note: Full volt, 1-speed reversing.		
26 24 19 00-0114	EA		480 Volt, Full Volt, 1 Speed, Reversing, 10 HP Combination Starters With Current Limiting Circuit	3,419.96	73.53
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	44.12	
26 24 19 00-0115	EA		480 Volt, Full Volt, 1 Speed, Reversing, 25 HP Combination Starters With Current Limiting Circuit	4,342.99	77.20
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	46.33	
26 24 19 00-0116	EA		480 Volt, Full Volt, 1 Speed, Reversing, 50 HP Combination Starters With Current Limiting Circuit	6,435.44	80.88
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	48.53	
26 24 19 00-0117	EA		480 Volt, Full Volt, 1 Speed, Reversing, 100 HP Combination Starters With Current Limiting Circuit	11,499.24	95.59
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	57.36	
26 24 19 00-0118	EA		480 Volt, Full Volt, 1 Speed, Reversing, 200 HP Combination Starters With Current Limiting Circuit	20,893.18	110.30
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	66.18	
26 24 19 00-0119			230 Volt Combination Starters With Current Limiting Circuit <small>(26 24 19 00-0092)</small>		
			Note: Full volt, 2-speed non-reversing, 2 wind.		
26 24 19 00-0120	EA		230 Volt, Full Volt, 2 Speed, 2 Wind Starter, Non-Reverse, 7-1/2 HP Combination Starters With Current Limiting Circuit	3,999.12	117.65
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	70.59	
26 24 19 00-0121	EA		230 Volt, Full Volt, 2 Speed, 2 Wind Starter, Non-Reverse, 15 HP Combination Starters With Current Limiting Circuit	5,265.99	125.00
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	75.00	
26 24 19 00-0122	EA		230 Volt, Full Volt, 2 Speed, 2 Wind Starter, Non-Reverse, 30 HP Combination Starters With Current Limiting Circuit	7,946.82	132.36
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	79.41	
26 24 19 00-0123	EA		230 Volt, Full Volt, 2 Speed, 2 Wind Starter, Non-Reverse, 50 HP Combination Starters With Current Limiting Circuit	14,420.91	150.74
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	90.44	
26 24 19 00-0124	EA		230 Volt, Full Volt, 2 Speed, 2 Wind Starter, Non-Reverse, 100 HP Combination Starters With Current Limiting Circuit	22,847.70	176.48
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	105.89	
26 24 19 00-0125			480 Volt Combination Starters With Current Limiting Circuit <small>(26 24 19 00-0092)</small>		
			Note: Full volt, 2-speed non-reversing, 2 wind.		
26 24 19 00-0126	EA		480 Volt, Full Volt, 2 Speed, 2 Wind Starter, Non-Reverse, 10 HP Combination Starters With Current Limiting Circuit	3,999.12	117.65
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	70.59	
26 24 19 00-0127	EA		480 Volt, Full Volt, 2 Speed, 2 Wind Starter, Non-Reverse, 25 HP Combination Starters With Current Limiting Circuit	5,265.99	125.00
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	75.00	
26 24 19 00-0128	EA		480 Volt, Full Volt, 2 Speed, 2 Wind Starter, Non-Reverse, 50 HP Combination Starters With Current Limiting Circuit	7,946.82	132.36
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	79.41	
26 24 19 00-0129	EA		480 Volt, Full Volt, 2 Speed, 2 Wind Starter, Non-Reverse, 100 HP Combination Starters With Current Limiting Circuit	14,420.91	150.74
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	90.44	
26 24 19 00-0130	EA		480 Volt, Full Volt, 2 Speed, 2 Wind Starter, Non-Reverse, 200 HP Combination Starters With Current Limiting Circuit	22,847.70	176.48
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	105.89	
26 24 19 00-0131			230 Volt Combination Starters With Current Limiting Circuit <small>(26 24 19 00-0092)</small>		
			Note: Full volt, 2-speed non-reversing, 1 wind.		
26 24 19 00-0132	EA		230 Volt, Full Volt, 2 Speed, 1 Wind Starter, Non-Reverse, 7-1/2 HP Combination Starters With Current Limiting Circuit	4,616.95	110.30
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	66.18	
26 24 19 00-0133	EA		230 Volt, Full Volt, 2 Speed, 1 Wind Starter, Non-Reverse, 15 HP Combination Starters With Current Limiting Circuit	6,523.67	117.65
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	70.59	
26 24 19 00-0134	EA		230 Volt, Full Volt, 2 Speed, 1 Wind Starter, Non-Reverse, 30 HP Combination Starters With Current Limiting Circuit	9,165.89	125.00
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	75.00	
26 24 19 00-0135	EA		230 Volt, Full Volt, 2 Speed, 1 Wind Starter, Non-Reverse, 50 HP Combination Starters With Current Limiting Circuit	17,241.49	143.39
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	86.03	
26 24 19 00-0136	EA		230 Volt, Full Volt, 2 Speed, 1 Wind Starter, Non-Reverse, 100 HP Combination Starters With Current Limiting Circuit	28,606.55	169.13
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	101.48	
26 24 19 00-0137			480 Volt Combination Starters With Current Limiting Circuit <small>(26 24 19 00-0092)</small>		
			Note: Full volt, 2-speed non-reversing, 1 wind.		
26 24 19 00-0138	EA		480 Volt, Full Volt, 2 Speed, 1 Wind Starter, Non-Reverse, 10 HP Combination Starters With Current Limiting Circuit	4,616.95	110.30
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	66.18	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 24 19 00-0139 EA 480 Volt, Full Volt, 2 Speed, 1 Wind Starter, Non-Reverse, 25 HP Combination Starters With Current Limiting Circuit	6,523.67	117.65
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	70.59	
26 24 19 00-0140 EA 480 Volt, Full Volt, 2 Speed, 1 Wind Starter, Non-Reverse, 50 HP Combination Starters With Current Limiting Circuit	9,165.89	125.00
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	75.00	
26 24 19 00-0141 EA 480 Volt, Full Volt, 2 Speed, 1 Wind Starter, Non-Reverse, 100 HP Combination Starters With Current Limiting Circuit	17,241.49	143.39
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	86.03	
26 24 19 00-0142 EA 480 Volt, Full Volt, 2 Speed, 1 Wind Starter, Non-Reverse, 200 HP Combination Starters With Current Limiting Circuit	28,606.55	169.13
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	101.48	
26 24 19 00-0143 230 Volt Combination Starters With Current Limiting Circuit <small>(26 24 19 00-0092)</small>		
Note: Reduced volt, auto-transformer.		
26 24 19 00-0144 EA 230 Volt, Reduced Volt, Auto Transformer, 15 HP Combination Starters With Current Limiting Circuit	6,407.86	77.20
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	46.33	
26 24 19 00-0145 EA 230 Volt, Reduced Volt, Auto Transformer, 30 HP Combination Starters With Current Limiting Circuit	10,333.49	84.56
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	50.74	
26 24 19 00-0146 EA 230 Volt, Reduced Volt, Auto Transformer, 50 HP Combination Starters With Current Limiting Circuit	17,482.39	95.59
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	57.36	
26 24 19 00-0147 EA 230 Volt, Reduced Volt, Auto Transformer, 100 HP Combination Starters With Current Limiting Circuit	26,497.56	110.30
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	66.18	
26 24 19 00-0148 EA 230 Volt, Reduced Volt, Auto Transformer, 200 HP Combination Starters With Current Limiting Circuit	43,610.39	147.06
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	88.24	
26 24 19 00-0149 480 Volt Combination Starters With Current Limiting Circuit <small>(26 24 19 00-0092)</small>		
Note: Reduced volt, auto-transformer.		
26 24 19 00-0150 EA 480 Volt, Reduced Volt, Auto Transformer, 25 HP Combination Starters With Current Limiting Circuit	6,407.86	77.20
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	46.33	
26 24 19 00-0151 EA 480 Volt, Reduced Volt, Auto Transformer, 50 HP Combination Starters With Current Limiting Circuit	10,333.49	84.56
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	50.74	
26 24 19 00-0152 EA 480 Volt, Reduced Volt, Auto Transformer, 100 HP Combination Starters With Current Limiting Circuit	17,482.39	95.59
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	57.36	
26 24 19 00-0153 EA 480 Volt, Reduced Volt, Auto Transformer, 200 HP Combination Starters With Current Limiting Circuit	26,497.56	110.30
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	66.18	
26 24 19 00-0154 EA 480 Volt, Reduced Volt, Auto Transformer, 400 HP Combination Starters With Current Limiting Circuit	43,610.39	147.06
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	88.24	
26 24 19 00-0155 230 Volt Combination Starters With Current Limiting Circuit <small>(26 24 19 00-0092)</small>		
Note: Reduced volt, part winding.		
26 24 19 00-0156 EA 230 Volt, Reduced Volt, Part Winding Starters, 10 HP Combination Starters With Current Limiting Circuit	4,567.28	117.65
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	70.59	
26 24 19 00-0157 EA 230 Volt, Reduced Volt, Part Winding Starters, 25 HP Combination Starters With Current Limiting Circuit	5,707.28	136.03
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	81.62	
26 24 19 00-0158 EA 230 Volt, Reduced Volt, Part Winding Starters, 50 HP Combination Starters With Current Limiting Circuit	10,061.34	150.74
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	90.44	
26 24 19 00-0159 EA 230 Volt, Reduced Volt, Part Winding Starters, 75 HP Combination Starters With Current Limiting Circuit	17,850.09	183.83
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	110.30	
26 24 19 00-0160 EA 230 Volt, Reduced Volt, Part Winding Starters, 150 HP Combination Starters With Current Limiting Circuit	26,346.74	235.30
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	141.19	
26 24 19 00-0161 480 Volt Combination Starters With Current Limiting Circuit <small>(26 24 19 00-0092)</small>		
Note: Reduced volt, part winding.		
26 24 19 00-0162 EA 480 Volt, Reduced Volt, Part Winding Starters, 15 HP Combination Starters With Current Limiting Circuit	4,567.28	117.65
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	70.59	
26 24 19 00-0163 EA 480 Volt, Reduced Volt, Part Winding Starters, 40 HP Combination Starters With Current Limiting Circuit	5,707.28	136.03
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	81.62	
26 24 19 00-0164 EA 480 Volt, Reduced Volt, Part Winding Starters, 75 HP Combination Starters With Current Limiting Circuit	10,061.34	150.74
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	90.44	
26 24 19 00-0165 EA 480 Volt, Reduced Volt, Part Winding Starters, 150 HP Combination Starters With Current Limiting Circuit	17,850.09	183.83
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	110.30	
26 24 19 00-0166 EA 480 Volt, Reduced Volt, Part Winding Starters, 350 HP Combination Starters With Current Limiting Circuit	26,346.74	235.30
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	141.19	
26 24 19 00-0167 230 Volt Combination Starters With Current Limiting Circuit <small>(26 24 19 00-0092)</small>		
Note: Reduced volt, energy saving		
26 24 19 00-0168 EA 230 Volt, Energy Saver Solid State Reduced Volt Starter With MCP, 7.5 HP Combination Starters With Current Limiting Circuit	16,910.55	95.59
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	57.36	
26 24 19 00-0169 EA 230 Volt, Energy Saver Solid State Reduced Volt Starter With MCP, 15 HP Combination Starters With Current Limiting Circuit	17,896.07	117.65
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	70.59	
26 24 19 00-0170 EA 230 Volt, Energy Saver Solid State Reduced Volt Starter With MCP, 30 HP Combination Starters With Current Limiting Circuit	19,686.97	136.03
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	81.62	
26 24 19 00-0171 EA 230 Volt, Energy Saver Solid State Reduced Volt Starter With MCP, 50 HP Combination Starters With Current Limiting Circuit	29,481.76	150.74
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	90.44	

26 Electrical**26 20 Low-Voltage Electrical Distribution****26 24 Switchboards And Panelboards**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 24 19 00-0172 EA 230 Volt, Energy Saver Solid State Reduced Volt Starter With MCP, 100 HP Combination Starters With Current Limiting Circuit.....	39,969.73	183.83
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	110.30	
26 24 19 00-0173 EA 230 Volt, Energy Saver Solid State Reduced Volt Starter With MCP, 200 HP Combination Starters With Current Limiting Circuit.....	56,027.15	235.30
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	141.19	
26 24 19 00-0174 480 Volt Combination Starters With Current Limiting Circuit (26 24 19 00-0092) Note: Reduced volt, energy saving		
26 24 19 00-0175 EA 480 Volt, Energy Saver Solid State Reduced Volt Starter With MCP, 10 HP Combination Starters With Current Limiting Circuit.....	16,910.58	95.59
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	57.37	
26 24 19 00-0176 EA 480 Volt, Energy Saver Solid State Reduced Volt Starter With MCP, 25 HP Combination Starters With Current Limiting Circuit.....	17,896.07	117.65
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	70.59	
26 24 19 00-0177 EA 480 Volt, Energy Saver Solid State Reduced Volt Starter With MCP, 50 HP Combination Starters With Current Limiting Circuit.....	19,686.97	136.03
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	81.62	
26 24 19 00-0178 EA 480 Volt, Energy Saver Solid State Reduced Volt Starter With MCP, 100 HP Combination Starters With Current Limiting Circuit.....	29,481.76	150.74
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	90.44	
26 24 19 00-0179 EA 480 Volt, Energy Saver Solid State Reduced Volt Starter With MCP, 200 HP Combination Starters With Current Limiting Circuit.....	39,969.73	183.83
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	110.30	
26 24 19 00-0180 EA 480 Volt, Energy Saver Solid State Reduced Volt Starter With MCP, 400 HP Combination Starters With Current Limiting Circuit.....	56,027.15	235.30
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	141.19	
26 24 19 00-0181 Combination Starters With Fusible Switch (26 24 19) Note: Includes NEMA I enclosure of indoor installation, vertical free standing floor mounted sections (90" high x 20" wide x 16" to 20" deep), fully factory assembled and Wired Internally.		
26 24 19 00-0182 230 Volt Combination Starters With Fusible Switch, Full Volt (26 24 19 00-0181) Note: 1-Speed non-reversing.		
26 24 19 00-0183 EA 7-1/2 HP, 230 Volt, Combination Starters With Fusible Switch, Full Volt, 1 Speed Non-Reversing.....	1,691.57	73.53
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	44.12	
26 24 19 00-0184 EA 15 HP, 230 Volt, Combination Starters With Fusible Switch, Full Volt, 1 Speed Non-Reversing.....	2,342.48	77.20
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	46.33	
26 24 19 00-0185 EA 30 HP, 230 Volt, Combination Starters With Fusible Switch, Full Volt, 1 Speed Non-Reversing.....	3,967.89	80.88
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	48.53	
26 24 19 00-0186 EA 50 HP, 230 Volt, Combination Starters With Fusible Switch, Full Volt, 1 Speed Non-Reversing.....	7,016.47	95.59
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	57.36	
26 24 19 00-0187 EA 100 HP, 230 Volt, Combination Starters With Fusible Switch, Full Volt, 1 Speed Non-Reversing.....	11,407.29	110.30
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	66.18	
26 24 19 00-0188 EA 200 HP, 230 Volt, Combination Starters With Fusible Switch, Full Volt, 1 Speed Non-Reversing.....	20,365.46	147.06
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	88.24	
26 24 19 00-0189 480 Volt Combination Starters With Fusible Switch, Full Volt (26 24 19 00-0181) Note: 1-Speed non-reversing.		
26 24 19 00-0190 EA 10 HP, 480 Volt, Combination Starters With Fusible Switch, Full Volt, 1 Speed Non-Reversing.....	1,691.57	73.53
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	44.12	
26 24 19 00-0191 EA 25 HP, 480 Volt, Combination Starters With Fusible Switch, Full Volt, 1 Speed Non-Reversing.....	2,342.48	77.20
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	46.33	
26 24 19 00-0192 EA 50 HP, 480 Volt, Combination Starters With Fusible Switch, Full Volt, 1 Speed Non-Reversing.....	3,967.89	80.88
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	48.53	
26 24 19 00-0193 EA 100 HP, 480 Volt, Combination Starters With Fusible Switch, Full Volt, 1 Speed Non-Reversing.....	7,016.47	95.59
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	57.36	
26 24 19 00-0194 EA 200 HP, 480 Volt, Combination Starters With Fusible Switch, Full Volt, 1 Speed Non-Reversing.....	11,407.29	110.30
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	66.18	
26 24 19 00-0195 EA 400 HP, 480 Volt, Combination Starters With Fusible Switch, Full Volt, 1 Speed Non-Reversing.....	20,365.46	147.06
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	88.24	
26 24 19 00-0196 230 Volt Combination Starters With Fusible Switch, Full Volt (26 24 19 00-0181) Note: 1-Speed reversing.		
26 24 19 00-0197 EA 7-1/2 HP, 230 Volt, Combination Starters With Fusible Switch, Full Volt, 1 Speed Reversing.....	2,748.83	73.53
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	44.12	
26 24 19 00-0198 EA 15 HP, 230 Volt, Combination Starters With Fusible Switch, Full Volt, 1 Speed Reversing.....	4,107.64	77.20
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	46.33	
26 24 19 00-0199 EA 30 HP, 230 Volt, Combination Starters With Fusible Switch, Full Volt, 1 Speed Reversing.....	6,588.05	80.88
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	48.53	
26 24 19 00-0200 EA 50 HP, 230 Volt, Combination Starters With Fusible Switch, Full Volt, 1 Speed Reversing.....	10,750.88	95.59
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	57.36	
26 24 19 00-0201 EA 100 HP, 230 Volt, Combination Starters With Fusible Switch, Full Volt, 1 Speed Reversing.....	16,553.83	110.30
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	66.18	
26 24 19 00-0202 EA 200 HP, 230 Volt, Combination Starters With Fusible Switch, Full Volt, 1 Speed Reversing.....	28,154.22	147.06
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	88.24	
26 24 19 00-0203 480 Volt Combination Starters With Fusible Switch, Full Volt (26 24 19 00-0181) Note: 1-Speed reversing.		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 24 19 00-0204 EA 10 HP, 480 Volt, Combination Starters With Fusible Switch, Full Volt, 1 Speed Reversing.....	2,748.83	73.53
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	44.12	
26 24 19 00-0205 EA 25 HP, 480 Volt, Combination Starters With Fusible Switch, Full Volt, 1 Speed Reversing.....	4,107.64	77.20
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	46.33	
26 24 19 00-0206 EA 50 HP, 480 Volt, Combination Starters With Fusible Switch, Full Volt, 1 Speed Reversing.....	6,588.05	80.88
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	48.53	
26 24 19 00-0207 EA 100 HP, 480 Volt, Combination Starters With Fusible Switch, Full Volt, 1 Speed Reversing.....	10,750.88	95.59
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	57.36	
26 24 19 00-0208 EA 200 HP, 480 Volt, Combination Starters With Fusible Switch, Full Volt, 1 Speed Reversing.....	16,553.83	110.30
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	66.18	
26 24 19 00-0209 EA 400 HP, 480 Volt, Combination Starters With Fusible Switch, Full Volt, 1 Speed Reversing.....	28,154.22	147.06
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	88.24	
26 24 19 00-0210 230 Volt Combination Starters With Fusible Switch, Full Volt <small>(26 24 19 00-0181)</small>		
Note: 2-Speed non-reversing, 2 wind.		
26 24 19 00-0211 EA 10 HP, 230 Volt, Combination Starters With Fusible Switch, Full Volt, 2 Speed Non-Reversing, 2 Wind Starter	3,208.48	117.65
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	70.59	
26 24 19 00-0212 EA 15 HP, 230 Volt, Combination Starters With Fusible Switch, Full Volt, 2 Speed Non-Reversing, 2 Wind Starter	4,425.70	125.00
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	75.00	
26 24 19 00-0213 EA 30 HP, 230 Volt, Combination Starters With Fusible Switch, Full Volt, 2 Speed Non-Reversing, 2 Wind Starter	6,987.01	132.36
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	79.41	
26 24 19 00-0214 EA 50 HP, 230 Volt, Combination Starters With Fusible Switch, Full Volt, 2 Speed Non-Reversing, 2 Wind Starter	12,510.49	150.74
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	90.44	
26 24 19 00-0215 EA 100 HP, 230 Volt, Combination Starters With Fusible Switch, Full Volt, 2 Speed Non-Reversing, 2 Wind Starter	19,953.58	176.48
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	105.89	
26 24 19 00-0216 480 Volt Combination Starters With Fusible Switch, Full Volt <small>(26 24 19 00-0181)</small>		
Note: 2-Speed non-reversing, 2 wind.		
26 24 19 00-0217 EA 10 HP, 480 Volt, Combination Starters With Fusible Switch, Full Volt, 2 Speed Non-Reversing, 2 Wind Starter	3,208.48	117.65
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	70.59	
26 24 19 00-0218 EA 25 HP, 480 Volt, Combination Starters With Fusible Switch, Full Volt, 2 Speed Non-Reversing, 2 Wind Starter	4,425.70	125.00
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	75.00	
26 24 19 00-0219 EA 50 HP, 480 Volt, Combination Starters With Fusible Switch, Full Volt, 2 Speed Non-Reversing, 2 Wind Starter	6,987.01	132.36
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	79.41	
26 24 19 00-0220 EA 100 HP, 480 Volt, Combination Starters With Fusible Switch, Full Volt, 2 Speed Non-Reversing, 2 Wind Starter	12,510.49	150.74
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	90.44	
26 24 19 00-0221 EA 200 HP, 480 Volt, Combination Starters With Fusible Switch, Full Volt, 2 Speed Non-Reversing, 2 Wind Starter	19,953.58	176.48
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	105.89	
26 24 19 00-0222 230 Volt Combination Starters With Fusible Switch, Full Volt <small>(26 24 19 00-0181)</small>		
Note: 2-Speed non-reversing, 1 wind.		
26 24 19 00-0223 EA 7-1/2 HP, 230 Volt, Combination Starters With Fusible Switch, Full Volt, 2 Speed Non-Reversing, 1 Wind Starter	3,682.89	73.53
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	44.12	
26 24 19 00-0224 EA 15 HP, 230 Volt, Combination Starters With Fusible Switch, Full Volt, 2 Speed Non-Reversing, 1 Wind Starter	5,628.25	77.20
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	46.33	
26 24 19 00-0225 EA 30 HP, 230 Volt, Combination Starters With Fusible Switch, Full Volt, 2 Speed Non-Reversing, 1 Wind Starter	8,114.18	80.88
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	48.53	
26 24 19 00-0226 EA 50 HP, 230 Volt, Combination Starters With Fusible Switch, Full Volt, 2 Speed Non-Reversing, 1 Wind Starter	16,379.17	95.59
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	57.36	
26 24 19 00-0227 480 Volt Combination Starters With Fusible Switch, Full Volt <small>(26 24 19 00-0181)</small>		
Note: 2-Speed non-reversing, 1 wind.		
26 24 19 00-0228 EA 10 HP, 480 Volt, Combination Starters With Fusible Switch, Full Volt, 2 Speed Non-Reversing, 1 Wind Starter	3,682.89	73.53
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	44.12	
26 24 19 00-0229 EA 25 HP, 480 Volt, Combination Starters With Fusible Switch, Full Volt, 2 Speed Non-Reversing, 1 Wind Starter	5,628.25	77.20
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	46.33	
26 24 19 00-0230 EA 50 HP, 480 Volt, Combination Starters With Fusible Switch, Full Volt, 2 Speed Non-Reversing, 1 Wind Starter	8,114.18	80.88
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	48.53	
26 24 19 00-0231 EA 100 HP, 480 Volt, Combination Starters With Fusible Switch, Full Volt, 2 Speed Non-Reversing, 1 Wind Starter	16,379.17	95.59
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	57.36	
26 24 19 00-0232 230 Volt Combination Starters With Fusible Switch, Reduced Volt <small>(26 24 19 00-0181)</small>		
Note: Auto-transformer.		
26 24 19 00-0233 EA 15 HP, 230 Volt, Combination Starters With Fusible Switch, Reduced Volt, Auto-Transformer	5,589.64	77.20
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	46.33	
26 24 19 00-0234 EA 30 HP, 230 Volt, Combination Starters With Fusible Switch, Reduced Volt, Auto-Transformer	9,886.69	84.56
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	50.74	
26 24 19 00-0235 EA 50 HP, 230 Volt, Combination Starters With Fusible Switch, Reduced Volt, Auto-Transformer	16,487.65	95.59
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	57.36	
26 24 19 00-0236 EA 100 HP, 230 Volt, Combination Starters With Fusible Switch, Reduced Volt, Auto-Transformer.....	22,020.31	110.30
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	66.18	
26 24 19 00-0237 EA 200 HP, 230 Volt, Combination Starters With Fusible Switch, Reduced Volt, Auto-Transformer.....	37,007.59	147.06
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	88.24	
26 24 19 00-0238 480 Volt Combination Starters With Fusible Switch, Reduced Volt <small>(26 24 19 00-0181)</small>		
Note: Auto-transformer.		

26	Electrical
26 20	Low-Voltage Electrical Distribution
26 24	Switchboards And Panelboards



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 24 19 00-0239 EA 25 HP, 480 Volt, Combination Starters With Fusible Switch, Reduced Volt, Auto-Transformer.....	5,589.64	77.20
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	46.33	
26 24 19 00-0240 EA 50 HP, 480 Volt, Combination Starters With Fusible Switch, Reduced Volt, Auto-Transformer.....	9,886.69	84.56
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	50.74	
26 24 19 00-0241 EA 100 HP, 480 Volt, Combination Starters With Fusible Switch, Reduced Volt, Auto-Transformer.....	16,487.65	95.59
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	57.36	
26 24 19 00-0242 EA 200 HP, 480 Volt, Combination Starters With Fusible Switch, Reduced Volt, Auto-Transformer.....	22,020.31	110.30
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	66.18	
26 24 19 00-0243 EA 400 HP, 480 Volt, Combination Starters With Fusible Switch, Reduced Volt, Auto-Transformer.....	37,007.59	147.06
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	88.24	
26 24 19 00-0244 230 Volt Combination Starters With Fusible Switch, Reduced Volt (26 24 19 00-0181)		
Note: Part winding.		
26 24 19 00-0245 EA 10 HP, 230 Volt, Combination Starters With Fusible Switch, Reduced Volt, Part Winding Starters.....	3,954.99	117.65
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	70.59	
26 24 19 00-0246 EA 25 HP, 230 Volt, Combination Starters With Fusible Switch, Reduced Volt, Part Winding Starters.....	5,242.08	136.03
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	81.62	
26 24 19 00-0247 EA 50 HP, 230 Volt, Combination Starters With Fusible Switch, Reduced Volt, Part Winding Starters.....	8,367.89	150.74
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	90.44	
26 24 19 00-0248 EA 75 HP, 230 Volt, Combination Starters With Fusible Switch, Reduced Volt, Part Winding Starters.....	16,719.28	183.83
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	110.30	
26 24 19 00-0249 480 Volt Combination Starters With Fusible Switch, Reduced Volt (26 24 19 00-0181)		
Note: Part winding.		
26 24 19 00-0250 EA 15 HP, 480 Volt, Combination Starters With Fusible Switch, Reduced Volt, Part Winding Starters.....	3,954.99	117.65
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	70.59	
26 24 19 00-0251 EA 40 HP, 480 Volt, Combination Starters With Fusible Switch, Reduced Volt, Part Winding Starters.....	5,242.08	136.03
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	81.62	
26 24 19 00-0252 EA 75 HP, 480 Volt, Combination Starters With Fusible Switch, Reduced Volt, Part Winding Starters.....	8,367.89	150.74
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	90.44	
26 24 19 00-0253 EA 150 HP, 480 Volt, Combination Starters With Fusible Switch, Reduced Volt, Part Winding Starters.....	16,719.28	183.83
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	110.30	
26 24 19 00-0254 230 Volt Combination Starters With Fusible Switch, Reduced Volt (26 24 19 00-0181)		
Note: Energy saver.		
26 24 19 00-0255 EA 7.5 HP, 230 Volt, Combination Starters With Fusible Switch, Reduced Volt, Energy Saver Solid State Starter With MCP.....	16,381.00	95.59
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	57.36	
26 24 19 00-0256 EA 15 HP, 230 Volt, Combination Starters With Fusible Switch, Reduced Volt, Energy Saver Solid State Starter With MCP.....	17,373.88	117.65
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	70.59	
26 24 19 00-0257 EA 30 HP, 230 Volt, Combination Starters With Fusible Switch, Reduced Volt, Energy Saver Solid State Starter With MCP.....	19,183.16	136.03
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	81.62	
26 24 19 00-0258 EA 50 HP, 230 Volt, Combination Starters With Fusible Switch, Reduced Volt, Energy Saver Solid State Starter With MCP.....	29,064.37	150.74
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	90.44	
26 24 19 00-0259 EA 100 HP, 230 Volt, Combination Starters With Fusible Switch, Reduced Volt, Energy Saver Solid State Starter With MCP.....	39,646.12	183.83
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	110.30	
26 24 19 00-0260 EA 200 HP, 230 Volt, Combination Starters With Fusible Switch, Reduced Volt, Energy Saver Solid State Starter With MCP.....	53,807.83	235.30
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	141.19	
26 24 19 00-0261 480 Volt Combination Starters With Fusible Switch, Reduced Volt (26 24 19 00-0181)		
Note: Energy saver.		
26 24 19 00-0262 EA 10 HP, 480 Volt, Combination Starters With Fusible Switch, Reduced Volt, Energy Saver Solid State Starter With MCP.....	16,381.00	95.59
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	57.36	
26 24 19 00-0263 EA 25 HP, 480 Volt, Combination Starters With Fusible Switch, Reduced Volt, Energy Saver Solid State Starter With MCP.....	17,373.88	117.65
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	70.59	
26 24 19 00-0264 EA 50 HP, 480 Volt, Combination Starters With Fusible Switch, Reduced Volt, Energy Saver Solid State Starter With MCP.....	19,183.16	136.03
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	81.62	
26 24 19 00-0265 EA 100 HP, 480 Volt, Combination Starters With Fusible Switch, Reduced Volt, Energy Saver Solid State Starter With MCP.....	29,064.37	150.74
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	90.44	
26 24 19 00-0266 EA 200 HP, 480 Volt, Combination Starters With Fusible Switch, Reduced Volt, Energy Saver Solid State Starter With MCP.....	39,646.12	183.83
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	110.30	
26 24 19 00-0267 EA 400 HP, 480 Volt, Combination Starters With Fusible Switch, Reduced Volt, Energy Saver Solid State Starter With MCP.....	53,807.83	235.30
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	141.19	
26 24 19 00-0268 Starter Accessories (26 24 19)		
26 24 19 00-0269 Starter Modifications (26 24 19 00-0268)		
26 24 19 00-0270 EA Control Circuit Transformer 60 Hertz, Size 1, 2, 50 VA Standard.....	93.93	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 24 19 00-0271 EA Control Circuit Transformer 60 Hertz, Size 3, 4, 150 VA Standard.....	286.84	
26 24 19 00-0272 EA Control Circuit Transformer 60 Hertz, Size 5, 6, 50 VA.....	410.03	
26 24 19 00-0273 EA Control Circuit Transformer 60 Hertz, All Sizes, Extra 50 VA.....	102.97	
26 24 19 00-0274 EA Control Circuit Transformer 60 Hertz, All Sizes, Extra 100 VA.....	145.26	
26 24 19 00-0275 EA Control Circuit Transformer 60 Hertz, All Sizes, Extra 150 VA.....	244.55	
26 24 19 00-0276 EA Overload Relay Heater Elements, 3 Per Starter.....	60.68	
26 24 19 00-0277 EA N.O. Overload Relay Alarm.....	51.48	
26 24 19 00-0278 EA Control Circuit Fuses, Primary/Secondary.....	34.51	
26 24 19 00-0279 EA Control Devices Type PB2 Mount On Device, 2 Unit Pushbutton.....	42.67	
26 24 19 00-0280 EA Control Devices Type PB2 Mount On Device, 3 Unit Pushbutton.....	83.45	
26 24 19 00-0281 EA Control Devices Type PB2 Mount On Device, 2 Or 3 Post Select.....	42.67	
26 24 19 00-0282 EA Control Devices Type PB2 Mount On Device, Individual Light Full V.....	48.94	
26 24 19 00-0283 EA Control Devices Type PB2 Mount On Device, Individual Light Transformer.....	58.98	
26 24 19 00-0284 EA Control Devices Type PB2 Mount On Device, Individual Light Push To.....	69.65	
26 24 19 00-0285 EA Blank Devices Panel.....	13.18	
26 24 19 00-0286 EA Oversize Or Special Color Starter.....	20.71	
26 24 19 00-0287 EA Mini Voltmeter/Ammeter With Current Transformer.....	194.61	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	6.62	
26 24 19 00-0288 EA Mini Elapsed Time Meters, Non Resettable.....	177.67	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	6.62	
26 24 19 00-0289 EA Panel Elapsed Time Meter, Resettable.....	244.71	
26 24 19 00-0290 EA Terminal Blocks, Side Mounted, Press Connection, Plug-In Press.....	20.71	
26 24 19 00-0291 EA Terminal Blocks, Side Mounted, Press Connection, Plug-In Screw.....	29.49	
26 24 19 00-0292 EA Terminal Blocks, Front Mounted, Press Connection, Standard.....	20.71	
26 24 19 00-0293 EA Terminal Blocks, Front Mounted, Press Connection, Plug-In.....	29.49	
26 24 19 00-0294 EA Terminal Blocks, Front Mounted, Press Connection, Screw-Type Utility.....	29.49	
26 24 19 00-0295 EA Terminal Blocks, Front Mounted, Press Connection, Plug-In Screw Type.....	42.67	
26 24 19 00-0296 EA MOR - A Solid State Modular Overload Relay.....	106.04	
26 24 19 00-0297 EA Heater Module.....	39.74	
26 24 19 00-0298 EA LAM - Long Acceleration Module.....	246.86	
26 24 19 00-0299 EA JAM - Jam Protection Module.....	282.98	
26 24 19 00-0300 EA PUM - Phase Unbalance Module.....	537.07	
26 24 19 00-0301 EA ULM - Underload Module.....	257.70	
26 24 19 00-0302 EA Wiring To Common Control Circuit Transformer.....	56.60	
26 24 19 00-0303 EA Handle Operator Separable Source Control Circuit.....	105.97	
26 24 19 00-0304 EA Type SIS Control Wire.....	44.55	
26 24 19 00-0305 EA Ring Or Spade Terminals Control.....	56.60	
26 24 19 00-0306 EA Ring Terminals Power.....	56.60	
26 24 19 00-0307 EA 14 Gauge Control Wire.....	44.55	
26 24 19 00-0308 EA Wiremakers.....	56.60	
26 24 19 00-0309 EA Wiring Diagram On Door.....	33.72	
26 24 19 00-0310 EA Special Color Or Type Control Wire.....	40.94	
26 24 19 00-0311 EA Current Transformer 12.5 VA.....	321.52	
26 24 19 00-0312 EA Ground Fault Relay-Instant Non-Adjust, Size 1 Thru 4.....	1,027.17	
26 24 19 00-0313 EA Ground Fault Relay-Instant Non-Adjust, Size 5 Thru 6.....	1,156.02	
26 24 19 00-0314 Control Relays And Special Components <small>(26 24 19 00-0268)</small>		
26 24 19 00-0315 EA Control Relays, 600 Volt, 2 Pole.....	250.37	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	6.62	
26 24 19 00-0316 EA Control Relays, 600 Volt, 4 Pole.....	299.60	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	11.03	
26 24 19 00-0317 EA Control Relays, 600 Volt, 6 Pole.....	356.18	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	17.65	
26 24 19 00-0318 EA Control Relays, 600 Volt, 8 Pole.....	399.13	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	22.06	
26 24 19 00-0319 EA Control Relays, Pneumatic Timer.....	322.46	
26 24 19 00-0320 EA Control Relays, Motor Driven Timer.....	840.28	
26 24 19 00-0321 EA Control Relays, 7 Day Time Switch.....	1,057.61	
26 24 19 00-0322 EA Control Relays, 24 Hour Time Switch.....	296.57	
26 24 19 00-0323 EA Control Relays, Phase Voltage.....	504.48	
26 24 19 00-0324 EA Control Relays, Two Circuit Alternator.....	706.12	
26 24 19 00-0325 EA Control Relays, Manual 120 Volt.....	69.04	
26 24 19 00-0326 EA Control Relays, Over-Current Relay.....	2,297.59	
26 24 19 00-0327 EA Control Relays, UV-Relay.....	1,945.96	
26 24 19 00-0328 EA Control Relays, Over-Current Relay.....	1,945.96	
26 24 19 00-0329 EA Control Relays, Teleductor.....	520.17	
26 24 19 00-0330 EA Control Relays, Current Transducer.....	1,398.90	
26 24 19 00-0331 EA Control Relays, Watt Transducer.....	2,797.80	
26 24 19 00-0332 EA Control Relays, Blank, Add For Each 1x.....	94.93	
26 24 19 00-0333 EA Control Relays, Fixed Mounted Back Pan, 20" Structure With Wireway.....	142.01	
26 24 19 00-0334 EA Control Relays, Fixed Mounted Back Pan, 24" Structure With Wireway.....	160.05	
26 24 19 00-0335 EA Control Relays, Fixed Mounted Back Pan, 280" Structure With Wireway.....	178.10	
26 24 19 00-0336 EA Control Relays, Fixed Mounted Back Pan, 20" Structure Without Wireway.....	160.05	
26 24 19 00-0337 EA Control Relays, Fixed Mounted Back Pan, 24" Structure Without Wireway.....	178.10	
26 24 19 00-0338 EA Control Relays, Fixed Mounted Back Pan, 2820" Structure Without Wireway.....	187.51	
26 24 19 00-0339 Circuit Breaker Modifications/Accessories <small>(26 24 19 00-0268)</small>		
26 24 19 00-0340 EA Circuit Breaker, Shunt Trip.....	300.65	
26 24 19 00-0341 EA Circuit Breaker, Auxiliary Switch.....	103.85	

26 Electrical**26 20 Low-Voltage Electrical Distribution****26 24 Switchboards And Panelboards**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
	26 24 19 00-0342	EA	Circuit Breaker, Key Interlock.....	373.51	
	26 24 19 00-0343	EA	Circuit Breaker, GFR Ground Fault.....	1,721.85	
	26 24 19 00-0344	EA	Circuit Breaker, Seltronic Breaker.....	997.43	
26 24 19 00-0345	Incoming Line And Feeder Circuit Breakers (26 24 19 00-0268)				
	26 24 19 00-0346	EA	Incoming Line And Feeder Circuit Breaker, Standard Mold, Type A, B, 100.....	947.84	47.80
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	28.67	
	26 24 19 00-0347	EA	Incoming Line And Feeder Circuit Breaker, Standard Mold, Type A, B, 150.....	1,640.50	73.53
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	44.12	
	26 24 19 00-0348	EA	Incoming Line And Feeder Circuit Breaker, Standard Mold, Type A, B, 100/100.....	1,578.40	47.80
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	28.67	
	26 24 19 00-0349	EA	Incoming Line And Feeder Circuit Breaker, Standard Mold, Type A, B, 100/150.....	2,269.74	73.53
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	44.12	
	26 24 19 00-0350	EA	Incoming Line And Feeder Circuit Breaker, Standard Mold, Type A, B, 150/150.....	2,912.25	73.53
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	44.12	
	26 24 19 00-0351	EA	Incoming Line And Feeder Circuit Breaker, Standard Mold, Type A, B, 250.....	1,806.79	95.59
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	57.37	
	26 24 19 00-0352	EA	Incoming Line And Feeder Circuit Breaker, Standard Mold, Type A, B, 400.....	2,923.33	102.94
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	61.78	
	26 24 19 00-0353	EA	Incoming Line And Feeder Circuit Breaker, Standard Mold, Type A, B, 600.....	3,855.50	132.36
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	79.38	
	26 24 19 00-0354	EA	Incoming Line And Feeder Circuit Breaker, Standard Mold, Type A, B, 800.....	4,542.38	202.22
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	121.37	
	26 24 19 00-0355	EA	Incoming Line And Feeder Circuit Breaker, Standard Mold, Type A, B, 1200.....	6,435.88	305.16
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	183.24	
	26 24 19 00-0356	EA	Incoming Line And Feeder Circuit Breaker, Standard Mold, Type A, B, 2000.....	14,068.59	404.42
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	242.45	
	26 24 19 00-0357	EA	Incoming Line And Feeder Circuit Breaker, Standard Mold, Type A, B, 2500.....	21,007.30	507.37
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	304.13	
	26 24 19 00-0358	EA	Incoming Line And Feeder Circuit Breaker, Standard Mold, Type A, B, 3000.....	35,008.93	588.18
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	353.26	
	26 24 19 00-0359	EA	Incoming Line And Feeder Circuit Breaker, Current Limiting Mold, Case Circuit Breakers, 50.....	1,137.67	47.80
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	28.67	
	26 24 19 00-0360	EA	Incoming Line And Feeder Circuit Breaker, Current Limiting Mold, Case Circuit Breakers, 150.....	1,825.02	73.53
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	44.12	
	26 24 19 00-0361	EA	Incoming Line And Feeder Circuit Breaker, Current Limiting Mold, Case Circuit Breakers, 50.....	1,137.67	47.80
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	28.67	
	26 24 19 00-0362	EA	Incoming Line And Feeder Circuit Breaker, Current Limiting Mold, Case Circuit Breakers, 50/50.....	1,825.02	73.53
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	44.12	
	26 24 19 00-0363	EA	Incoming Line And Feeder Circuit Breaker, Current Limiting Mold, Case Circuit Breakers, 50/150.....	1,930.19	47.80
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	28.67	
	26 24 19 00-0364	EA	Incoming Line And Feeder Circuit Breaker, Current Limiting Mold, Case Circuit Breakers, 150/150.....	2,644.09	73.53
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	44.12	
	26 24 19 00-0365	EA	Incoming Line And Feeder Circuit Breaker, Current Limiting Mold, Case Circuit Breakers, 50.....	3,278.64	73.53
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	44.12	
	26 24 19 00-0366	EA	Incoming Line And Feeder Circuit Breaker, Current Limiting Mold, Case Circuit Breakers, 100.....	1,733.43	73.53
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	44.12	
	26 24 19 00-0367	EA	Incoming Line And Feeder Circuit Breaker, Current Limiting Mold, Case Circuit Breakers, 400.....	4,393.70	202.22
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	121.37	
	26 24 19 00-0368	EA	Incoming Line And Feeder Circuit Breaker, Current Limiting Mold, Case Circuit Breakers, 125-225.....	4,393.70	202.22
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	121.37	
	26 24 19 00-0369	EA	Incoming Line And Feeder Circuit Breaker, Current Limiting Mold, Case Circuit Breakers, 125-400.....	5,910.31	220.59
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	132.30	
	26 24 19 00-0370	EA	Incoming Line And Feeder Circuit Breaker, Current Limiting Mold, Case Circuit Breakers, 300-600.....	7,377.69	257.36
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	154.35	
	26 24 19 00-0371	EA	Incoming Line And Feeder Circuit Breaker, Current Limiting Mold, Case Circuit Breakers, 300-800.....	8,490.86	305.16
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	183.24	
26 24 19 00-0372	Incoming Line And Feeder Fusible Switches (26 24 19 00-0268)				
	26 24 19 00-0373	EA	Incoming Line And Feeder Fusible Switches, 30 Or 60 Amps.....	997.22	73.53
	26 24 19 00-0374	EA	Incoming Line And Feeder Fusible Switches, 30 Dual / 60 Dual.....	1,525.85	73.53
	26 24 19 00-0375	EA	Incoming Line And Feeder Fusible Switches, 100 Amps.....	1,641.43	91.91
	26 24 19 00-0376	EA	Incoming Line And Feeder Fusible Switches, 200 Amps.....	2,661.92	110.30
	26 24 19 00-0377	EA	Incoming Line And Feeder Fusible Switches, 400 Amps.....	5,232.40	139.71
	26 24 19 00-0378	EA	Incoming Line And Feeder Fusible Switches, 600 Amps.....	7,337.05	183.83
	26 24 19 00-0379	EA	Incoming Line And Feeder Fusible Switches, 800 Amps.....	17,806.94	246.33
	26 24 19 00-0380	EA	Incoming Line And Feeder Fusible Switches, 1,200 Amps.....	20,102.66	341.93
26 24 19 00-0381	Dry Type Distribution Transformers (26 24 19 00-0268)				
	26 24 19 00-0382	EA	500 VA, Phase 1, Dry Type Distribution Transformers.....	905.36	
	26 24 19 00-0383	EA	750 VA, Phase 1, Dry Type Distribution Transformers.....	934.56	
	26 24 19 00-0384	EA	1,000 VA, Phase 1, Dry Type Distribution Transformers.....	965.09	
	26 24 19 00-0385	EA	1,500 VA, Phase 1, Dry Type Distribution Transformers.....	1,107.14	
	26 24 19 00-0386	EA	2,000 VA, Phase 1, Dry Type Distribution Transformers.....	1,200.06	
	26 24 19 00-0387	EA	3,000 VA, Phase 1, Dry Type Distribution Transformers.....	1,292.09	
	26 24 19 00-0388	EA	5,000 VA, Phase 1, Dry Type Distribution Transformers.....	1,632.83	
	26 24 19 00-0389	EA	7,500 VA, Phase 1, Dry Type Distribution Transformers.....	1,839.92	
	26 24 19 00-0390	EA	9,000 VA, Phase 3, Dry Type Distribution Transformers.....	4,277.21	
	26 24 19 00-0391	EA	10,000 VA, Phase 1, Dry Type Distribution Transformers.....	2,270.03	
	26 24 19 00-0392	EA	15,000 VA, Phase 1, Dry Type Distribution Transformers.....	3,144.85	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 24 19 00-0393 EA 15,000 VA, Phase 3, Dry Type Distribution Transformers	4,901.14	
26 24 19 00-0394 EA 20,000 VA, Phase 1, Dry Type Distribution Transformers	4,538.73	
26 24 19 00-0395 EA 30,000 VA, Phase 1, Dry Type Distribution Transformers	6,289.71	
26 24 19 00-0396 EA 30,000 VA, Phase 3, Dry Type Distribution Transformers	6,177.47	
26 24 19 00-0397 EA 45,000 VA, Phase 1, Dry Type Distribution Transformers	8,556.95	
26 24 19 00-0398 Metering Equipment <small>(26 24 19 00-0268)</small>		
26 24 19 00-0399 EA Metering Equipment, Voltmeter, Panel Type	202.04	
26 24 19 00-0400 EA Metering Equipment, Voltmeter, Switchboard Type	441.73	
26 24 19 00-0401 EA Metering Equipment, Ammeter, Panel	181.96	
26 24 19 00-0402 EA Metering Equipment, Ammeter, Switchboard Type	441.73	
26 24 19 00-0403 EA Metering Equipment, Voltmeter/Ammeter, Switch	245.34	
26 24 19 00-0404 EA Metering Equipment, Control Switch, 4 Circuits	260.40	
26 24 19 00-0405 EA Add For Additional Circuits	66.23	
26 24 19 00-0406 EA Metering Equipment, Indicating Wattmeter	911.08	
26 24 19 00-0407 EA Metering Equipment, Indicating Power Factor	954.37	
26 24 19 00-0408 EA Metering Equipment, Integrating Watt-hour	841.43	
26 24 19 00-0409 EA Add For Demand Attachment	433.51	
26 24 19 00-0410 EA Metering Equipment, Current Transformer, 800 Amp	251.61	
26 24 19 00-0411 EA Metering Equipment, Current Transformer, 1,000 Amp	434.20	
26 24 19 00-0412 EA Metering Equipment, Current Transformer, 2,000 Amp	505.73	
26 24 19 00-0413 EA Metering Equipment, Potential Transformer	421.65	
26 24 19 00-0414 EA Metering Equipment, Surge Arrester	453.66	
26 24 19 00-0415 EA Metering Equipment, Ground Detector System	346.99	
26 24 19 00-0416 Current Limiting Reactors <small>(26 24 19 00-0268)</small>		
26 24 19 00-0417 EA Current Limiting Reactors, 600 Amps	16,385.37	
26 24 19 00-0418 EA Current Limiting Reactors, 800 Amps	23,861.86	
26 24 19 00-0419 EA Current Limiting Reactors, 1,000 Amps	31,355.62	
26 24 19 00-0420 EA Current Limiting Reactors, 1,200 Amps	47,729.04	
26 24 19 00-0421 Incoming Line Cable Space Requirements, Main Lugs Only <small>(26 24 19 00-0268)</small>		
26 24 19 00-0422 EA Incoming Line Cable Space Requirement, 350 MCC, 2 Screw	399.00	
26 24 19 00-0423 EA Incoming Line Cable Space Requirement, 350 MCC, 2 Crimp	399.00	
26 24 19 00-0424 EA Incoming Line Cable Space Requirement, 350 MCC, 4 Screw	551.61	
26 24 19 00-0425 EA Incoming Line Cable Space Requirement, 350 MCC, 4 Crimp	1,009.45	
26 24 19 00-0426 EA Incoming Line Cable Space Requirement, 600 MCC, 2 Screw	551.61	
26 24 19 00-0427 EA Incoming Line Cable Space Requirement, 600 MCC, 2 Crimp	704.22	
26 24 19 00-0428 EA Incoming Line Cable Space Requirement, 600 MCC, 4 Screw	704.22	
26 24 19 00-0429 EA Incoming Line Cable Space Requirement, 600 MCC, 4 Crimp	1,007.61	
26 24 19 00-0430 EA Incoming Line Cable Space Requirement, 750 MCC, 2 Screw	704.22	
26 24 19 00-0431 EA Incoming Line Cable Space Requirement, 750 MCC, 2 Crimp	1,007.61	
26 24 19 00-0432 EA Incoming Line Cable Space Requirement, 750 MCC, 4 Screw	856.84	
26 24 19 00-0433 EA Incoming Line Cable Space Requirement, 750 MCC, 4 Crimp	2,778.29	
26 24 19 00-0434 EA Incoming Line Cable Space Requirement, 1,000 MCC, 2 Screw	856.84	
26 24 19 00-0435 EA Incoming Line Cable Space Requirement, 1,000 MCC, 2 Crimp	1,007.61	
26 24 19 00-0436 EA Incoming Line Cable Space Requirement, 1,000 MCC, 4 Screw	2,778.29	
26 24 19 00-0437 EA Incoming Line Cable Space Requirement, 1,000 MCC, 4 Crimp	2,778.29	
26 24 19 00-0438 EA Bus Duct Transition Pull Box	790.07	
26 24 19 00-0439 EA Throat And Transition To Substation	1,525.22	
26 24 19 00-0440 EA Service Entrance Label	330.31	
26 24 19 00-0441 EA Type W To 5 Star - 10" Transition	690.43	
26 24 19 00-0442 EA 600 Ampere Sub Feed Lugs On Main Bus	287.80	
26 24 19 00-0443 Standard Structures And Structure Options/Modifications <small>(26 24 19 00-0268)</small>		
26 24 19 00-0444 EA Standard Structure Add For Each Additional 4" Of Structure Width	218.11	
26 24 19 00-0445 EA Standard Structure Add For 8" Vertical Wireway In Lieu Of 4"	218.11	
26 24 19 00-0446 EA Standard Structure Single Corner Section "L", 16" Depth	674.74	
26 24 19 00-0447 EA Standard Structure Single Corner Section "L", 21" Depth	761.04	
26 24 19 00-0448 EA Standard Structure Unused Space/Future Space	65.12	
26 24 19 00-0449 EA Standard Structure NEMA 12 Dustproof	175.75	
26 24 19 00-0450 EA Standard Structure Bottom Plate For NEMA 1 Gasket Enclosure	36.88	
26 24 19 00-0451 EA Standard Structure 150 Watt Space	158.48	
26 24 19 00-0452 EA Standard Structure Thermostat For Space Heater Control	350.42	
26 24 19 00-0453 EA Standard Structure Rear Hinged Structure Door, 72" High	158.48	
26 24 19 00-0454 EA Standard Structure NEMA 2 Drip Shield On Top Of MCC	226.39	
26 24 19 00-0455 EA Standard Structure NEMA 3R N-Walk In Front Mounted	3,229.63	
26 24 19 00-0456 EA Standard Structure NEMA 3R N-Walk In Back-to-back	3,732.98	
26 24 19 00-0457 EA Standard Structure NEMA 3R Walk-In Aisle Front Mounted	3,736.59	
26 24 19 00-0458 Installation Hours For Vertical Sections <small>(26 24 19 00-0268)</small>		
26 24 19 00-0459 EA Install Vertical Section, 230/480 Volt, 1 Section, 600 Amps	441.17	220.59
26 24 19 00-0460 EA Install Vertical Section, 230/480 Volt, 2 Section, 600 Amps	661.76	330.90
26 24 19 00-0461 EA Install Vertical Section, 230/480 Volt, 3 Section, 600 Amps	735.32	367.66
26 24 19 00-0462 EA Install Vertical Section, 230/480 Volt, 4 Section, 600 Amps	882.46	441.19



MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

26 24 19 00-0463	EA	Install Vertical Section, 230/480 Volt, Bolt To Floor, 600 Amps	73.53	36.77
26 24 19 00-0464	EA	Install Vertical Section, 230/480 Volt, 1 Section, 800 Amps	441.17	220.59
26 24 19 00-0465	EA	Install Vertical Section, 230/480 Volt, 2 Section, 800 Amps	661.76	330.90
26 24 19 00-0466	EA	Install Vertical Section, 230/480 Volt, 3 Section, 800 Amps	735.32	367.66
26 24 19 00-0467	EA	Install Vertical Section, 230/480 Volt, 4 Section, 800 Amps	882.46	441.19
26 24 19 00-0468	EA	Install Vertical Section, 230/480 Volt, Bolt To Floor, 800 Amps	73.53	36.77
26 24 19 00-0469	EA	Install Vertical Section, 230/480 Volt, 1 Section, 1,200 Amps	514.73	257.36
26 24 19 00-0470	EA	Install Vertical Section, 230/480 Volt, 2 Section, 1,200 Amps	661.76	330.90
26 24 19 00-0471	EA	Install Vertical Section, 230/480 Volt, 3 Section, 1,200 Amps	882.46	441.19
26 24 19 00-0472	EA	Install Vertical Section, 230/480 Volt, 4 Section, 1,200 Amps	1,029.32	514.65
26 24 19 00-0473	EA	Install Vertical Section, 230/480 Volt, Bolt To Floor, 1,200 Amps	110.29	55.15
26 24 19 00-0474	EA	Install Vertical Section, 230/480 Volt, 1 Section, 1,600 Amps	588.26	294.13
26 24 19 00-0475	EA	Install Vertical Section, 230/480 Volt, 2 Section, 1,600 Amps	808.92	404.42
26 24 19 00-0476	EA	Install Vertical Section, 230/480 Volt, 3 Section, 1,600 Amps	1,029.32	514.65
26 24 19 00-0477	EA	Install Vertical Section, 230/480 Volt, 4 Section, 1,600 Amps	1,176.30	588.18
26 24 19 00-0478	EA	Install Vertical Section, 230/480 Volt, Bolt To Floor, 1,600 Amps	147.06	73.53
26 24 19 00-0479	EA	Install Vertical Section, 230/480 Volt, 1 Section, 2,000 Amps	588.26	294.13
26 24 19 00-0480	EA	Install Vertical Section, 230/480 Volt, 2 Section, 2,000 Amps	882.46	441.19
26 24 19 00-0481	EA	Install Vertical Section, 230/480 Volt, 3 Section, 2,000 Amps	1,102.86	551.41
26 24 19 00-0482	EA	Install Vertical Section, 230/480 Volt, 4 Section, 2,000 Amps	1,250.12	625.10
26 24 19 00-0483	EA	Install Vertical Section, 230/480 Volt, Bolt To Floor, 2,000 Amps	147.06	73.53

26 24 19 00-0484 Motor Control Centers (26 24 19)

26 24 19 00-0485 2.4 KV Motor Control Centers (26 24 19 00-0484)

26 24 19 00-0486	EA	2.4 KV CL 11-202, Squirrel Cage Motor Control, 100 To 300 Hp	9,686.91	147.06
		<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	88.24	
26 24 19 00-0487	EA	2.4 KV CL 11-202, Squirrel Cage Motor Control, 400 Hp	9,686.91	147.06
		<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	88.24	
26 24 19 00-0488	EA	2.4 KV CL 11-202, Squirrel Cage Motor Control, 600 Hp	9,686.91	147.06
		<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	88.24	
26 24 19 00-0489	EA	2.4 KV CL 11-202, Squirrel Cage Motor Control, 700 Hp	9,723.69	165.45
		<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	99.27	
26 24 19 00-0490	EA	2.4 KV CL 11-202, Squirrel Cage Motor Control, 1,000 Hp	10,329.17	183.83
		<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	110.30	
26 24 19 00-0491	EA	2,400 KV CL 11-202, Squirrel Cage Motor Control, 1,250 Hp	10,365.92	202.22
		<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	121.32	
26 24 19 00-0492	EA	2.4 KV CL 11-202, Squirrel Cage Motor Control, 1,500 Hp	10,402.68	220.59
		<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	132.35	
26 24 19 00-0493	EA	2.4 KV CL 11-202, Squirrel Cage Motor Control, 1,750 Hp	10,476.24	257.36
		<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	154.42	
26 24 19 00-0494	EA	2.4 KV CL 11-202, Squirrel Cage Motor Control, 2,000 Hp	10,549.77	294.13
		<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	176.48	
26 24 19 00-0495	EA	2.4 KV CL 11-202, Squirrel Cage Motor Control, 2,250 Hp	11,712.38	330.90
		<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	198.53	
26 24 19 00-0496	EA	2.4 KV CL 11-202, Squirrel Cage Motor Control, 2,500 Hp	19,015.33	367.66
		<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	220.60	
26 24 19 00-0497	EA	2.4 KV CL 13-202, Wound Rotor Motor Control, 100 Hp	14,349.40	147.06
		<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	88.24	
26 24 19 00-0498	EA	2.4 KV CL 13-202, Wound Rotor Motor Control, 150 Hp	14,950.55	158.09
		<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	94.86	
26 24 19 00-0499	EA	2.4 KV CL 13-202, Wound Rotor Motor Control, 200 Hp	16,982.59	172.80
		<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	103.68	
26 24 19 00-0500	EA	2.4 KV CL 13-202, Wound Rotor Motor Control, 300 Hp	18,300.44	183.83
		<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	110.30	
26 24 19 00-0501	EA	2.4 KV CL 13-202, Wound Rotor Motor Control, 400 Hp	20,567.84	213.24
		<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	127.95	
26 24 19 00-0502	EA	2.4 KV CL 13-202, Wound Rotor Motor Control, 600 Hp	22,533.24	227.94
		<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	136.77	
26 24 19 00-0503	EA	2.4 KV CL 13-202, Wound Rotor Motor Control, 700 Hp	24,497.47	242.65
		<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	145.58	
26 24 19 00-0504	EA	2.4 KV CL 13-202, Wound Rotor Motor Control, 1,000 Hp	26,829.22	264.71
		<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	158.84	
26 24 19 00-0505	EA	2.4 KV CL 13-202, Wound Rotor Motor Control, 1,250 Hp	31,216.18	294.13
		<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	176.48	
26 24 19 00-0506	EA	2.4 KV CL 13-202, Wound Rotor Motor Control, 1,500 Hp	33,818.62	312.51
		<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	187.52	
26 24 19 00-0507	EA	2.4 KV CL 13-202, Wound Rotor Motor Control, 1,750 Hp	51,611.42	367.66
		<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	220.60	
26 24 19 00-0508	EA	2.4 KV CL 13-202, Wound Rotor Motor Control, 2,000 Hp	54,994.04	404.42
		<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	242.68	
26 24 19 00-0509	EA	2.4 KV CL 13-202, Wound Rotor Motor Control, 2,250 Hp	57,939.99	441.19
		<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	264.74	
26 24 19 00-0510	EA	2.4 KV CL 13-202, Wound Rotor Motor Control, 2,500 Hp	63,089.73	478.03
		<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	286.82	
26 24 19 00-0511	EA	2.4 KV CL 14-202, Synchronous Motor Control, 100 To 300 Hp	13,541.68	147.06
		<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	88.24	
26 24 19 00-0512	EA	2.4 KV CL 14-202, Synchronous Motor Control, 400 Hp	13,578.46	165.45
		<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	99.27	
26 24 19 00-0513	EA	2.4 KV CL 14-202, Synchronous Motor Control, 600 Hp	13,615.21	183.83
		<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	110.30	
26 24 19 00-0514	EA	2.4 KV CL 14-202, Synchronous Motor Control, 700 Hp	13,651.96	202.22
		<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	121.32	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 24 19 00-0515 EA 2.4 KV CL 14-202, Synchronous Motor Control, 1,000 Hp <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	13,691.02 132.35	220.59
26 24 19 00-0516 EA 2,400 Volt CL 14-202, Synchronous Motor Control, 1,250 HP <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	13,727.83 143.39	238.98
26 24 19 00-0517 EA 2.4 KV CL 14-202, Synchronous Motor Control, 1,500 Hp <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	13,764.58 154.42	257.36
26 24 19 00-0518 EA 2.4 KV CL 14-202, Synchronous Motor Control, 1,750 Hp <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	13,911.61 198.53	330.90
26 24 19 00-0519 EA 2.4 KV CL 14-202, Synchronous Motor Control, 2,000 Hp <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	23,639.91 220.60	367.66
26 24 19 00-0520 EA 2.4 KV CL 14-202, Synchronous Motor Control, 2,250 Hp <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	23,713.51 242.68	404.42
26 24 19 00-0521 EA 2.4 KV CL 14-202, Synchronous Motor Control, 2,500 Hp <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	25,009.54 264.74	441.19
26 24 19 00-0522 EA Add For Reversing Starters, 100 To 700 HP <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5,328.89 44.12	
26 24 19 00-0523 EA Add For Reversing Starters, 1,000 To 1,500 Hp <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5,489.74 44.12	
26 24 19 00-0524 EA Add For Reversing Starters, 1,750 To 2,500 HP <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8,390.87 44.12	
26 24 19 00-0525 4.8 KV Motor Control Centers <small>(26 24 19 00-0484)</small>		
26 24 19 00-0526 EA 4.8 KV CL 11-202, Squirrel Cage Motor Control, 100 To 600 HP <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10,563.54 132.35	220.59
26 24 19 00-0527 EA 4.8 KV CL 11-202, Squirrel Cage Motor Control, 700 HP <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10,600.35 143.39	238.98
26 24 19 00-0528 EA 4.8 KV CL 11-202, Squirrel Cage Motor Control, 1,000 HP <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10,637.10 154.42	257.36
26 24 19 00-0529 EA 4.8 KV CL 11-202, Squirrel Cage Motor Control, 1,250 HP <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10,673.89 165.46	275.74
26 24 19 00-0530 EA 4.8 KV CL 11-202, Squirrel Cage Motor Control, 1,500 HP <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	11,273.62 176.48	294.13
26 24 19 00-0531 EA 4.8 KV CL 11-202, Squirrel Cage Motor Control, 1,750 HP <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	11,310.43 187.52	312.51
26 24 19 00-0532 EA 4.8 KV CL 11-202, Squirrel Cage Motor Control, 2,000 HP <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	11,347.12 198.53	330.90
26 24 19 00-0533 EA 4.8 KV CL 11-202, Squirrel Cage Motor Control, 2,250 HP <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	11,383.95 209.58	349.27
26 24 19 00-0534 EA 4.8 KV CL 11-202, Squirrel Cage Motor Control, 2,500 HP <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	11,420.68 220.60	367.66
26 24 19 00-0535 EA 4.8 KV CL 11-202, Squirrel Cage Motor Control, 3,000 HP <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	19,299.28 286.82	478.03
26 24 19 00-0536 EA 4.8 KV CL 11-202, Squirrel Cage Motor Control, 3,500 HP <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	19,372.52 308.80	514.65
26 24 19 00-0537 EA 4.8 KV CL 11-202, Squirrel Cage Motor Control, 4,000 HP <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	20,669.71 330.86	551.41
26 24 19 00-0538 EA 4.8 KV CL 11-202, Squirrel Cage Motor Control, 4,500 HP <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	20,743.15 352.89	588.18
26 24 19 00-0539 EA 4.8 KV CL 13-202, Wound Rotor Motor Control, 100 HP <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	14,659.59 132.35	220.59
26 24 19 00-0540 EA 4.8 KV CL 13-202, Wound Rotor Motor Control, 150 HP <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	14,857.26 143.39	238.98
26 24 19 00-0541 EA 4.8 KV CL 13-202, Wound Rotor Motor Control, 200 HP <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	17,318.32 154.42	257.36
26 24 19 00-0542 EA 4.8 KV CL 13-202, Wound Rotor Motor Control, 300 HP <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	19,245.16 165.46	275.74
26 24 19 00-0543 EA 4.8 KV CL 13-202, Wound Rotor Motor Control, 400 HP <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	20,890.44 176.48	294.13
26 24 19 00-0544 EA 4.8 KV CL 13-202, Wound Rotor Motor Control, 600 HP <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	22,863.26 187.52	312.51
26 24 19 00-0545 EA 4.8 KV CL 13-202, Wound Rotor Motor Control, 700 HP <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	24,715.31 198.53	330.90
26 24 19 00-0546 EA 4.8 KV CL 13-202, Wound Rotor Motor Control, 1,000 HP <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	27,159.22 209.58	349.27
26 24 19 00-0547 EA 4.8 KV CL 13-202, Wound Rotor Motor Control, 1,250 HP <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	31,447.11 220.60	367.66
26 24 19 00-0548 EA 4.8 KV CL 13-202, Wound Rotor Motor Control, 1,500 HP <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	34,363.20 231.63	386.04
26 24 19 00-0549 EA 4.8 KV CL 13-202, Wound Rotor Motor Control, 1,750 HP <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	37,316.05 253.70	422.81
26 24 19 00-0550 EA 4.8 KV CL 13-202, Wound Rotor Motor Control, 2,000 HP <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	39,753.04 264.74	441.19
26 24 19 00-0551 EA 4.8 KV CL 13-202, Wound Rotor Motor Control, 2,250 HP <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	42,052.03 275.74	459.58
26 24 19 00-0552 EA 4.8 KV CL 13-202, Wound Rotor Motor Control, 2,500 HP <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	45,265.86 286.82	478.03
26 24 19 00-0553 EA 4.8 KV CL 13-202, Wound Rotor Motor Control, 3,000 HP <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	71,693.93 352.89	588.18
26 24 19 00-0554 EA 4.8 KV CL 13-202, Wound Rotor Motor Control, 3,500 HP <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	79,718.58 375.04	625.10
26 24 19 00-0555 EA 4.8 KV CL 13-202, Wound Rotor Motor Control, 4,000 HP <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	95,791.29 397.05	661.78

26 Electrical**26 20 Low-Voltage Electrical Distribution****26 24 Switchboards And Panelboards**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 24 19 00-0556	EA		4.8 KV CL 13-202, Wound Rotor Motor Control, 4,500 HP.....	101,312.06	661.78
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	397.05	
26 24 19 00-0557	EA		4.8 KV CL 14-202, Synchronous Motor Control, 100 To 600 HP.....	14,489.57	257.36
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	154.42	
26 24 19 00-0558	EA		4.8 KV CL 14-202, Synchronous Motor Control, 700 HP.....	14,526.36	275.74
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	165.46	
26 24 19 00-0559	EA		4.8 KV CL 14-202, Synchronous Motor Control, 1,000 HP.....	14,563.10	294.13
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	176.48	
26 24 19 00-0560	EA		4.8 KV CL 14-202, Synchronous Motor Control, 1,250 HP.....	14,599.91	312.51
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	187.52	
26 24 19 00-0561	EA		4.8 KV CL 14-202, Synchronous Motor Control, 1,500 HP.....	15,847.61	330.90
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	198.53	
26 24 19 00-0562	EA		4.8 KV CL 14-202, Synchronous Motor Control, 1,750 HP.....	15,884.44	349.27
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	209.58	
26 24 19 00-0563	EA		4.8 KV CL 14-202, Synchronous Motor Control, 2,000 HP.....	15,921.17	367.66
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	220.60	
26 24 19 00-0564	EA		4.8 KV CL 14-202, Synchronous Motor Control, 2,250 HP.....	15,957.95	386.04
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	231.63	
26 24 19 00-0565	EA		4.8 KV CL 14-202, Synchronous Motor Control, 2,500 HP.....	15,994.77	404.42
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	242.68	
26 24 19 00-0566	EA		4.8 KV CL 14-202, Synchronous Motor Control, 3,000 HP.....	16,215.17	514.65
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	308.80	
26 24 19 00-0567	EA		4.8 KV CL 14-202, Synchronous Motor Control, 3,500 HP.....	26,104.31	551.41
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	330.86	
26 24 19 00-0568	EA		4.8 KV CL 14-202, Synchronous Motor Control, 4,000 HP.....	27,395.65	588.18
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	352.89	
26 24 19 00-0569	EA		4.8 KV CL 14-202, Synchronous Motor Control, 4,500 HP.....	27,395.65	588.18
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	352.89	
26 24 19 00-0570	EA		Add For Reversing Starters, 100 To 1,250 HP.....	8,439.63	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	44.12	
26 24 19 00-0571	EA		Add For Reversing Starters, 1,500 To 2,500 HP.....	8,697.05	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	44.12	
26 24 19 00-0572	EA		Add For Reversing Starters, 3,000 To 4,500 HP.....	13,339.78	
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	44.12	
26 24 19 00-0573			2.4/4.8 KV Motor Control Centers, Accessories (2624 19 00-0484)		
26 24 19 00-0574	EA		2.4/4.8 KV Load Break Disconnect Switch 600 Amp.....	10,958.63	147.06
26 24 19 00-0575	EA		2.4/4.8 KV Load Break Disconnect Switch 1,200 Amp.....	13,148.47	220.59
26 24 19 00-0576	EA		2.4/4.8 KV NEMA 3 Weather Resistant.....	4,341.19	
26 24 19 00-0577	EA		2.4/4.8 KV Space Heaters.....	177.32	11.03
26 24 19 00-0578	EA		2.4/4.8 KV Potential Transformer Fused.....	1,257.68	
26 24 19 00-0579	EA		2.4/4.8 KV Current Transformer 600 Volt, 5 KVA.....	674.81	
26 24 19 00-0580	EA		2.4/4.8 KV Control Transformer 4 KVA Max.....	2,009.71	
26 24 19 00-0581	EA		2.4/4.8 KV Pushbuttons Each.....	128.71	
26 24 19 00-0582	EA		2.4/4.8 KV Selector Switch Each.....	426.58	
26 24 19 00-0583	EA		2.4/4.8 KV Indicating Light.....	128.71	
26 24 19 00-0584	EA		2.4/4.8 KV Push To Test Light.....	389.81	
26 24 19 00-0585	EA		2.4/4.8 KV AC Voltmeter, Switchboard Type.....	1,037.03	
26 24 19 00-0586	EA		2.4/4.8 KV AC Ammeter, Switchboard Type.....	1,037.03	
26 24 19 00-0587	EA		2.4/4.8 KV Power Factor Meter.....	3,101.90	
26 24 19 00-0588	EA		2.4/4.8 KV Watt Hr Meter, 2 Element Drawout.....	2,138.42	
26 24 19 00-0589	EA		2.4/4.8 KV Operation Counter.....	411.87	11.03
26 24 19 00-0590	EA		2.4/4.8 KV Phase Failure Protection.....	2,982.36	36.77
26 24 19 00-0591	EA		2.4/4.8 KV Ground Protection.....	5,722.05	18.38
26 24 19 00-0592	EA		2.4/4.8 KV Synchronous Motor DC Protection.....	1,603.96	18.38
26 24 19 00-0593	EA		2.4/4.8 KV Lightning Arresters.....	2,662.84	11.03
26 24 19 00-0594	EA		2.4/4.8 KV Portable Lifting Mechanism.....	3,849.42	
26 24 19 00-0595	EA		2.4/4.8 KV Auxiliary Timing Relay.....	316.75	36.77
26 24 19 00-0596	EA		2.4/4.8 KV Auxiliary Control Relay.....	234.37	36.77
26 24 19 00-0597			Incoming Section And Feeder Air Circuit Breakers (2624 19 00-0484)		
			Note: 3 Pole. Includes structure.		
26 24 19 00-0598	EA		Incoming Section MCC, Air Circuit Breaker, 70 - 100 Amp, 14,000 Amp IC, 3-Pole, With Structure Included.....	791.51	220.38
26 24 19 00-0599	EA		Incoming Section MCC, Air Circuit Breaker, 125 - 225 Amp, 22,000 Amp IC, 3-Pole, With Structure Included.....	1,374.99	390.09
26 24 19 00-0600	EA		Incoming Section MCC, Air Circuit Breaker, 125 - 400 Amp, 30,000 Amp IC, 3-Pole, With Structure Included.....	1,650.30	499.48
26 24 19 00-0601	EA		Incoming Section MCC, Air Circuit Breaker, 125 - 600 Amp, 30,000 Amp IC, 3-Pole, With Structure Included.....	2,644.51	804.31
26 24 19 00-0602	EA		Incoming Section MCC, Air Circuit Breaker, 125 - 1,200 Amp, 30,000 Amp IC, 3-Pole, With Structure Included.....	3,103.99	884.74
26 24 19 00-0603	EA		Incoming Section MCC, Air Circuit Breaker, 125 - 2,000 Amp, 30,000 Amp IC, 3-Pole, With Structure Included.....	3,976.93	981.26
26 24 19 00-0604	EA		Incoming Section MCC, Air Circuit Breaker, 125 - 400 Amp, 45,000 Amp IC, 3-Pole, With Structure Included.....	4,630.14	1,150.16
26 24 19 00-0605	EA		Incoming Section MCC, Air Circuit Breaker, 125 - 400 Amp, 100,000 Amp IC, 3-Pole, With Structure Included.....	7,877.23	1,339.98
26 24 19 00-0606			Main Lugs Only (2624 19 00-0484)		
26 24 19 00-0607	EA		600 Amp Incoming Section, Main Lugs.....	648.26	281.51
26 24 19 00-0608	EA		800 Amp Incoming Section, Main Lugs.....	705.20	281.51
26 24 19 00-0609	EA		1,200 Amp Incoming Section, Main Lugs.....	993.97	442.37
26 24 19 00-0610	EA		2,000 Amp Incoming Section, Main Lugs.....	2,382.27	804.31
26 24 19 00-0611	EA		3,000 Amp Incoming Section, Main Lugs.....	3,614.60	1,166.25
26 24 19 00-0612	EA		4,000 Amp Incoming Section, Main Lugs.....	5,144.95	1,608.62



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 24 19 00-0613				Incoming Main Circuit Breaker Structure <small>(26 24 19 00-0484)</small> Note: Includes structure, main breaker, 42 KA bus bracing, 600 A tin plated copper bus, NEMA 1 enclosure, 15" cabinet depth, and 1/4" x 2" tin plated copper horizontal ground bus.		
26 24 19 00-0614	EA			225 Amp, Main Circuit Breaker Section.....	4,062.71	389.21
				<i>For NEMA 12, Add</i>	245.00	
				<i>For NEMA 1 With Gaskets, Add</i>	97.00	
				<i>For 20" Cabinet Depth, Add</i>	108.00	
				<i>For 800 Amp Tin Plated Copper Bus, Add</i>	182.00	
				<i>For 1,200 Amp Tin Plated Copper Bus, Add</i>	334.00	
26 24 19 00-0615	EA			400 Amp, Main Circuit Breaker Section.....	8,552.53	499.96
				<i>For NEMA 12, Add</i>	245.00	
				<i>For NEMA 1 With Gaskets, Add</i>	97.00	
				<i>For 20" Cabinet Depth, Add</i>	108.00	
				<i>For 800 Amp Tin Plated Copper Bus, Add</i>	182.00	
				<i>For 1,200 Amp Tin Plated Copper Bus, Add</i>	334.00	
26 24 19 00-0616	EA			600 Amp, Main Circuit Breaker Section.....	8,937.11	778.74
				<i>For NEMA 12, Add</i>	245.00	
				<i>For NEMA 1 With Gaskets, Add</i>	97.00	
				<i>For 20" Cabinet Depth, Add</i>	108.00	
				<i>For 800 Amp Tin Plated Copper Bus, Add</i>	182.00	
				<i>For 1,200 Amp Tin Plated Copper Bus, Add</i>	334.00	
26 24 19 00-0617	EA			800 Amp, Main Circuit Breaker Section.....	12,626.36	778.74
				<i>For NEMA 12, Add</i>	245.00	
				<i>For NEMA 1 With Gaskets, Add</i>	97.00	
				<i>For 20" Cabinet Depth, Add</i>	108.00	
				<i>For 800 Amp Tin Plated Copper Bus, Add</i>	182.00	
				<i>For 1,200 Amp Tin Plated Copper Bus, Add</i>	334.00	
26 24 19 00-0618	EA			1,200 Amp, Main Circuit Breaker Section.....	18,221.19	881.12
				<i>For NEMA 12, Add</i>	245.00	
				<i>For NEMA 1 With Gaskets, Add</i>	97.00	
				<i>For 20" Cabinet Depth, Add</i>	108.00	
				<i>For 800 Amp Tin Plated Copper Bus, Add</i>	182.00	
				<i>For 1,200 Amp Tin Plated Copper Bus, Add</i>	334.00	
26 24 19 00-0619				Incoming Fusible Main Disconnect Section <small>(26 24 19 00-0484)</small> Note: Includes structure, fuses, 42 KA bus bracing, 600 A tin plated copper bus, NEMA 1 enclosure, 15" cabinet depth, and 1/4" x 2" tin plated copper horizontal ground bus.		
26 24 19 00-0620	EA			200 Amp, Fusible Main Disconnect Section.....	3,539.04	389.69
				<i>For NEMA 12, Add</i>	245.00	
				<i>For NEMA 1 With Gaskets, Add</i>	97.00	
				<i>For 20" Cabinet Depth, Add</i>	108.00	
				<i>For 800 Amp Tin Plated Copper Bus, Add</i>	182.00	
				<i>For 1,200 Amp Tin Plated Copper Bus, Add</i>	334.00	
26 24 19 00-0621	EA			400 Amp, Fusible Main Disconnect Section.....	4,878.14	500.20
				<i>For NEMA 12, Add</i>	245.00	
				<i>For NEMA 1 With Gaskets, Add</i>	97.00	
				<i>For 20" Cabinet Depth, Add</i>	108.00	
				<i>For 800 Amp Tin Plated Copper Bus, Add</i>	182.00	
				<i>For 1,200 Amp Tin Plated Copper Bus, Add</i>	334.00	
26 24 19 00-0622	EA			600 Amp, Fusible Main Disconnect Section.....	9,486.59	779.38
				<i>For NEMA 12, Add</i>	245.00	
				<i>For NEMA 1 With Gaskets, Add</i>	97.00	
				<i>For 20" Cabinet Depth, Add</i>	108.00	
				<i>For 800 Amp Tin Plated Copper Bus, Add</i>	182.00	
				<i>For 1,200 Amp Tin Plated Copper Bus, Add</i>	334.00	
26 24 19 00-0623	EA			800 Amp, Fusible Main Disconnect Section.....	10,999.99	779.38
				<i>For NEMA 12, Add</i>	245.00	
				<i>For NEMA 1 With Gaskets, Add</i>	97.00	
				<i>For 20" Cabinet Depth, Add</i>	108.00	
				<i>For 800 Amp Tin Plated Copper Bus, Add</i>	182.00	
				<i>For 1,200 Amp Tin Plated Copper Bus, Add</i>	334.00	
26 24 19 00-0624	EA			1,200 Amp, Fusible Main Disconnect Section.....	15,444.76	881.92
				<i>For NEMA 12, Add</i>	245.00	
				<i>For NEMA 1 With Gaskets, Add</i>	97.00	
				<i>For 20" Cabinet Depth, Add</i>	108.00	
				<i>For 800 Amp Tin Plated Copper Bus, Add</i>	182.00	
				<i>For 1,200 Amp Tin Plated Copper Bus, Add</i>	334.00	
26 24 19 00-0625				Circuit Breaker Combination Starters <small>(26 24 19 00-0484)</small>		
26 24 19 00-0626				Class I, Type A <small>(26 24 19 00-0625)</small>		
26 24 19 00-0627	EA			Size 1, Class I, Type A Circuit Breaker Combination Starter.....	653.29	163.28
				<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	93.09	
26 24 19 00-0628	EA			Size 2, Class I, Type A Circuit Breaker Combination Starter.....	757.75	163.28
				<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	103.12	
26 24 19 00-0629	EA			Size 3, Class I, Type A Circuit Breaker Combination Starter.....	1,095.32	231.64
				<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	138.68	
26 24 19 00-0630	EA			Size 4, Class I, Type A Circuit Breaker Combination Starter.....	1,765.32	304.83
				<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	182.80	
26 24 19 00-0631	EA			Size 5, Class I, Type A Circuit Breaker Combination Starter.....	3,120.48	381.24
				<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	228.50	

26	Electrical
26 20	Low-Voltage Electrical Distribution
26 24	Switchboards And Panelboards



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 24 19 00-0632 Class I, Type B <small>(26 24 19 00-0625)</small>		
26 24 19 00-0633 EA Size 1, Class I, Type B Circuit Breaker Combination Starter	615.03	142.36
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	80.43	
26 24 19 00-0634 EA Size 2, Class I, Type B Circuit Breaker Combination Starter	715.95	142.36
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	90.58	
26 24 19 00-0635 EA Size 3, Class I, Type B Circuit Breaker Combination Starter	1,045.54	205.90
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	123.74	
26 24 19 00-0636 EA Size 4, Class I, Type B Circuit Breaker Combination Starter	1,714.54	279.09
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	167.57	
26 24 19 00-0637 EA Size 5, Class I, Type B Circuit Breaker Combination Starter	3,079.53	356.31
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	216.21	
26 24 19 00-0638 Class I, Type C <small>(26 24 19 00-0625)</small>		
26 24 19 00-0639 EA Size 1, Class I, Type C Circuit Breaker Combination Starter	642.90	131.90
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	72.86	
26 24 19 00-0640 EA Size 2, Class I, Type C Circuit Breaker Combination Starter	751.16	131.90
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	85.57	
26 24 19 00-0641 EA Size 3, Class I, Type C Circuit Breaker Combination Starter	1,112.17	197.05
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	118.28	
26 24 19 00-0642 EA Size 4, Class I, Type C Circuit Breaker Combination Starter	1,785.75	272.66
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	163.48	
26 24 19 00-0643 EA Size 5, Class I, Type C Circuit Breaker Combination Starter	3,144.37	349.88
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	209.46	
26 24 19 00-0644 Class II, Type B <small>(26 24 19 00-0625)</small>		
26 24 19 00-0645 EA Size 1, Class II, Type B Circuit Breaker Combination Starter	662.54	195.45
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	110.48	
26 24 19 00-0646 EA Size 2, Class II, Type B Circuit Breaker Combination Starter	901.20	195.45
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	123.36	
26 24 19 00-0647 EA Size 3, Class II, Type B Circuit Breaker Combination Starter	1,267.87	260.60
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	155.87	
26 24 19 00-0648 EA Size 4, Class II, Type B Circuit Breaker Combination Starter	2,044.02	333.79
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	201.08	
26 24 19 00-0649 EA Size 5, Class II, Type B Circuit Breaker Combination Starter	3,629.49	407.79
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	245.22	
26 24 19 00-0650 Class II, Type C <small>(26 24 19 00-0625)</small>		
26 24 19 00-0651 EA Size 1, Class II, Type C Circuit Breaker Combination Starter	811.10	185.00
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	105.83	
26 24 19 00-0652 EA Size 2, Class II, Type C Circuit Breaker Combination Starter	928.38	185.00
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	115.56	
26 24 19 00-0653 EA Size 3, Class II, Type C Circuit Breaker Combination Starter	1,338.34	252.55
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	151.19	
26 24 19 00-0654 EA Size 4, Class II, Type C Circuit Breaker Combination Starter	2,109.33	325.75
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	195.22	
26 24 19 00-0655 EA Size 5, Class II, Type C Circuit Breaker Combination Starter	3,705.73	402.16
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	242.26	
26 24 19 00-0656 Fused Disconnect Combination Starter <small>(26 24 19 00-0494)</small>		
26 24 19 00-0657 Class I, Type A <small>(26 24 19 00-0656)</small>		
26 24 19 00-0658 EA Size 1, Class I, Type A Fused Disconnect Combination Starter	599.17	150.41
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	90.58	
26 24 19 00-0659 EA Size 2, Class I, Type A Fused Disconnect Combination Starter	896.13	205.90
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	123.36	
26 24 19 00-0660 EA Size 3, Class I, Type A Fused Disconnect Combination Starter	1,404.78	267.84
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	160.86	
26 24 19 00-0661 EA Size 4, Class I, Type A Fused Disconnect Combination Starter	1,924.96	375.62
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	225.93	
26 24 19 00-0662 EA Size 5, Class I, Type A Fused Disconnect Combination Starter	3,312.13	478.56
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	287.26	
26 24 19 00-0663 Class I, Type B <small>(26 24 19 00-0656)</small>		
26 24 19 00-0664 EA Size 1, Class I, Type B Fused Disconnect Combination Starter	603.64	134.32
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	80.43	
26 24 19 00-0665 EA Size 2, Class I, Type B Fused Disconnect Combination Starter	814.16	184.18
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	110.48	
26 24 19 00-0666 EA Size 3, Class I, Type B Fused Disconnect Combination Starter	1,195.96	246.12
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	147.85	
26 24 19 00-0667 EA Size 4, Class I, Type B Fused Disconnect Combination Starter	1,982.08	355.51
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	213.91	
26 24 19 00-0668 EA Size 5, Class I, Type B Fused Disconnect Combination Starter	3,358.08	452.02
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	271.73	
26 24 19 00-0669 Class I, Type C <small>(26 24 19 00-0656)</small>		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 24 19 00-0670 EA Size 1, Class I, Type C Fused Disconnect Combination Starter <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	633.40 75.31	125.47
26 24 19 00-0671 EA Size 2, Class I, Type C Fused Disconnect Combination Starter <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	852.47 103.12	170.51
26 24 19 00-0672 EA Size 3, Class I, Type C Fused Disconnect Combination Starter <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	1,290.47 143.63	237.27
26 24 19 00-0673 EA Size 4, Class I, Type C Fused Disconnect Combination Starter <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2,075.84 209.46	349.88
26 24 19 00-0674 EA Size 5, Class I, Type C Fused Disconnect Combination Starter <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	3,182.86 268.10	447.20
26 24 19 00-0675 Class II, Type B <small>(26 24 19 00-0656)</small>		
26 24 19 00-0676 EA Size 1, Class II, Type B Fused Disconnect Combination Starter <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	767.79 112.97	188.21
26 24 19 00-0677 EA Size 2, Class II, Type B Fused Disconnect Combination Starter <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	988.91 140.61	234.86
26 24 19 00-0678 EA Size 3, Class II, Type B Fused Disconnect Combination Starter <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	1,421.29 181.15	302.42
26 24 19 00-0679 EA Size 4, Class II, Type B Fused Disconnect Combination Starter <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2,286.50 245.22	407.79
26 24 19 00-0680 EA Size 5, Class II, Type B Fused Disconnect Combination Starter <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	3,856.58 304.66	509.13
26 24 19 00-0681 Class II, Type C <small>(26 24 19 00-0656)</small>		
26 24 19 00-0682 EA Size 1, Class II, Type C Fused Disconnect Combination Starter <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	790.84 105.83	176.95
26 24 19 00-0683 EA Size 2, Class II, Type C Fused Disconnect Combination Starter <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	1,026.95 133.16	221.99
26 24 19 00-0684 EA Size 3, Class II, Type C Fused Disconnect Combination Starter <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	1,498.15 173.34	288.75
26 24 19 00-0685 EA Size 4, Class II, Type C Fused Disconnect Combination Starter <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	2,369.94 239.38	398.14
26 24 19 00-0686 EA Size 5, Class II, Type C Fused Disconnect Combination Starter <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	3,935.33 295.70	493.05
26 24 19 00-0687 Space Complete With Bus And Hardware <small>(26 24 19 00-0484)</small>		
26 24 19 00-0688 Circuit Breaker Type <small>(26 24 19 00-0687)</small>		
26 24 19 00-0689 EA Circuit Breaker Type, Size 1 Space Complete With Bus And Hardware.....	187.48	54.70
26 24 19 00-0690 EA Circuit Breaker Type, Size 2 Space Complete With Bus And Hardware.....	187.48	54.70
26 24 19 00-0691 EA Circuit Breaker Type, Size 3 Space Complete With Bus And Hardware.....	278.23	79.62
26 24 19 00-0692 EA Circuit Breaker Type, Size 4 Space Complete With Bus And Hardware.....	333.16	104.56
26 24 19 00-0693 EA Circuit Breaker Type, Size 5 Space Complete With Bus And Hardware.....	554.43	159.26
26 24 19 00-0694 Fused Disconnect Type <small>(26 24 19 00-0687)</small>		
26 24 19 00-0695 EA Fused Disconnect Type, Size 1 Space Complete With Bus And Hardware.....	187.48	54.70
26 24 19 00-0696 EA Fused Disconnect Type, Size 2 Space Complete With Bus And Hardware.....	250.68	79.62
26 24 19 00-0697 EA Fused Disconnect Type, Size 3 Space Complete With Bus And Hardware.....	346.64	104.56
26 24 19 00-0698 EA Fused Disconnect Type, Size 4 Space Complete With Bus And Hardware.....	592.05	159.26
26 24 19 00-0699 EA Fused Disconnect Type, Size 5 Space Complete With Bus And Hardware.....	828.09	231.64
26 24 19 00-0700 Blank Space For Future Expansion <small>(26 24 19 00-0687)</small>		
Note: Factory modified no labor costs.		
26 24 19 00-0701 EA Blank Space For Future Expansion, Size 1 Factory Modified, No Crew Costs.....	78.50	
26 24 19 00-0702 EA Blank Space For Future Expansion, Size 2 Factory Modified, No Crew Costs.....	78.50	
26 24 19 00-0703 EA Blank Space For Future Expansion, Size 3 Factory Modified, No Crew Costs.....	119.02	
26 24 19 00-0704 EA Blank Space For Future Expansion, Size 4 Factory Modified, No Crew Costs.....	119.02	
26 24 19 00-0705 EA Blank Space For Future Expansion, Size 5 Factory Modified, No Crew Costs.....	236.77	
26 24 19 00-0706 Structure Combination Of Starters To 72" High <small>(26 24 19 00-0687)</small>		
26 24 19 00-0707 EA Structure Combination Of Starters To 72" High.....	2,122.77	423.31
26 24 19 00-0708 Motor Control Center Basic Distribution Section <small>(26 24 19 00-0484)</small>		
26 24 19 00-0709 EA 20" Wide Basic Section With Vertical Wireway.....	3,668.77	1,102.39
<i>For 2,000 Amp Tin Plated Copper Bus, Add</i>	506.00	
<i>For NEMA 1 With Gasket, Add</i>	97.00	
<i>For 600 Amp Tin Plated Copper Vertical, Add</i>	210.00	
<i>For 1,200 Amp Tin Plated Copper Bus, Add</i>	334.00	
<i>For 1,600 Amp Tin Plated Copper Bus, Add</i>	402.00	
<i>For NEMA 12, Add</i>	245.00	
<i>For 20" Cabinet Depth, Add</i>	108.00	
<i>For 800 Amp Tin Plated Copper Bus, Add</i>	182.00	

26 Electrical**26 20 Low-Voltage Electrical Distribution****26 24 Switchboards And Panelboards**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 24 19 00-0710 EA 25"-35" Wide Basic Section (No Vertical Wireway).....	3,668.77	1,102.39
For 2,000 Amp Tin Plated Copper Bus, Add	506.00	
For NEMA 1 With Gasket, Add	97.00	
For 600 Amp Tin Plated Copper Vertical, Add	210.00	
For 1,200 Amp Tin Plated Copper Bus, Add	334.00	
For 1,600 Amp Tin Plated Copper Bus, Add	402.00	
For NEMA 12, Add	245.00	
For 20" Cabinet Depth, Add	108.00	
For 800 Amp Tin Plated Copper Bus, Add	182.00	
26 24 19 00-0711 EA 25" Wide Basic Section With 9" Wide Vertical Wireway.....	4,013.74	1,102.39
For 2,000 Amp Tin Plated Copper Bus, Add	506.00	
For NEMA 1 With Gasket, Add	97.00	
For 600 Amp Tin Plated Copper Vertical, Add	210.00	
For 1,200 Amp Tin Plated Copper Bus, Add	334.00	
For 1,600 Amp Tin Plated Copper Bus, Add	402.00	
For NEMA 12, Add	245.00	
For 20" Cabinet Depth, Add	108.00	
For 800 Amp Tin Plated Copper Bus, Add	182.00	
26 24 19 00-0712 EA Corner Section.....	4,013.74	1,102.39
For 2,000 Amp Tin Plated Copper Bus, Add	506.00	
For NEMA 1 With Gasket, Add	97.00	
For 600 Amp Tin Plated Copper Vertical, Add	210.00	
For 1,200 Amp Tin Plated Copper Bus, Add	334.00	
For 1,600 Amp Tin Plated Copper Bus, Add	402.00	
For NEMA 12, Add	245.00	
For 20" Cabinet Depth, Add	108.00	
For 800 Amp Tin Plated Copper Bus, Add	182.00	
26 24 19 00-0713 Motor Control Center Starters With HMCP Circuit Breaker <small>(26 24 19 00-0484)</small>		
Note: Includes door, unit support pan, heater elements, and NEMA 1 with gasket, or NEMA 12 enclosure. Line voltages of 208 V, 240 V, 480 V, and 600 V.		
26 24 19 00-0714 FVNR Starters With HMCP Circuit Breaker <small>(26 24 19 00-0713)</small>		
26 24 19 00-0715 EA Class 1, Type A, Size 1 FVNR Starters With HMCP Circuit Breaker.....	909.87	154.83
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	92.89	
26 24 19 00-0716 EA Class 1, Type A, Size 2 FVNR Starters With HMCP Circuit Breaker.....	1,012.55	171.72
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	103.03	
26 24 19 00-0717 EA Class 1, Type A, Size 3 FVNR Starters With HMCP Circuit Breaker.....	1,734.00	230.84
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	138.51	
26 24 19 00-0718 EA Class 1, Type A, Size 4 FVNR Starters With HMCP Circuit Breaker.....	2,505.34	304.35
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	182.63	
26 24 19 00-0719 EA Class 1, Type A, Size 5 FVNR Starters With HMCP Circuit Breaker.....	5,610.81	380.36
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	228.24	
26 24 19 00-0720 EA Class 1, Type A, Size 6 FVNR Starters With HMCP Circuit Breaker.....	12,959.75	380.36
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	228.24	
26 24 19 00-0721 EA Class 1, Type B, Size 1 FVNR Starters With HMCP Circuit Breaker.....	911.44	133.92
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	80.35	
26 24 19 00-0722 EA Class 1, Type B, Size 2 FVNR Starters With HMCP Circuit Breaker.....	1,027.88	150.81
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	90.48	
26 24 19 00-0723 EA Class 1, Type B, Size 3 FVNR Starters With HMCP Circuit Breaker.....	1,763.22	205.90
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	123.54	
26 24 19 00-0724 EA Class 1, Type B, Size 4 FVNR Starters With HMCP Circuit Breaker.....	2,498.77	279.09
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	167.47	
26 24 19 00-0725 EA Class 1, Type B, Size 5 FVNR Starters With HMCP Circuit Breaker.....	5,614.69	360.33
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	216.21	
26 24 19 00-0726 EA Class 1, Type B, Size 6 FVNR Starters With HMCP Circuit Breaker.....	13,042.71	360.33
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	216.21	
26 24 19 00-0727 Two Speed 2-Winding (TS2W) With HMCP Circuit Breaker <small>(26 24 19 00-0713)</small>		
26 24 19 00-0728 EA Class 1, Type A, Size 1 Two Speed 2-Winding (TS2W) With HMCP Circuit Breaker.....	1,439.91	193.76
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	116.23	
26 24 19 00-0729 EA Class 1, Type A, Size 2 Two Speed 2-Winding (TS2W) With HMCP Circuit Breaker.....	1,759.07	214.34
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	128.62	
26 24 19 00-0730 EA Class 1, Type A, Size 3 Two Speed 2-Winding (TS2W) With HMCP Circuit Breaker.....	2,878.07	288.10
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	172.85	
26 24 19 00-0731 EA Class 1, Type A, Size 4 Two Speed 2-Winding (TS2W) With HMCP Circuit Breaker.....	4,914.42	380.84
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	228.50	
26 24 19 00-0732 EA Class 1, Type A, Size 5 Two Speed 2-Winding (TS2W) With HMCP Circuit Breaker.....	8,807.44	476.48
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	285.89	
26 24 19 00-0733 EA Class 1, Type B, Size 1 Two Speed 2-Winding (TS2W) With HMCP Circuit Breaker.....	1,452.99	167.30
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	100.37	
26 24 19 00-0734 EA Class 1, Type B, Size 2 Two Speed 2-Winding (TS2W) With HMCP Circuit Breaker.....	1,786.72	188.62
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	113.18	
26 24 19 00-0735 EA Class 1, Type B, Size 3 Two Speed 2-Winding (TS2W) With HMCP Circuit Breaker.....	2,918.62	257.78
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	154.68	
26 24 19 00-0736 EA Class 1, Type B, Size 4 Two Speed 2-Winding (TS2W) With HMCP Circuit Breaker.....	4,916.90	349.07
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	209.46	
26 24 19 00-0737 EA Class 1, Type B, Size 5 Two Speed 2-Winding (TS2W) With HMCP Circuit Breaker.....	8,822.10	450.82
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	270.51	
26 24 19 00-0738 Two Speed 1-Winding (TS1W) With HMCP Circuit Breaker <small>(26 24 19 00-0713)</small>		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 24 19 00-0739 EA Class 1, Type A, Size 1 Two Speed 1-Winding (TS1W) With HMCP Circuit Breaker.....	1,571.80	193.76
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	116.23	
26 24 19 00-0740 EA Class 1, Type A, Size 2 Two Speed 1-Winding (TS1W) With HMCP Circuit Breaker.....	2,217.16	214.34
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	128.62	
26 24 19 00-0741 EA Class 1, Type A, Size 3 Two Speed 1-Winding (TS1W) With HMCP Circuit Breaker.....	4,146.85	288.10
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	172.85	
26 24 19 00-0742 EA Class 1, Type A, Size 4 Two Speed 1-Winding (TS1W) With HMCP Circuit Breaker.....	5,643.33	380.84
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	228.50	
26 24 19 00-0743 EA Class 1, Type A, Size 5 Two Speed 1-Winding (TS1W) With HMCP Circuit Breaker.....	11,221.02	476.48
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	285.89	
26 24 19 00-0744 EA Class 1, Type B, Size 1 Two Speed 1-Winding (TS1W) With HMCP Circuit Breaker.....	1,584.88	167.30
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	100.37	
26 24 19 00-0745 EA Class 1, Type B, Size 2 Two Speed 1-Winding (TS1W) With HMCP Circuit Breaker.....	2,244.82	188.62
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	113.18	
26 24 19 00-0746 EA Class 1, Type B, Size 3 Two Speed 1-Winding (TS1W) With HMCP Circuit Breaker.....	4,187.39	257.78
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	154.68	
26 24 19 00-0747 EA Class 1, Type B, Size 4 Two Speed 1-Winding (TS1W) With HMCP Circuit Breaker.....	5,645.80	349.07
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	209.46	
26 24 19 00-0748 EA Class 1, Type B, Size 5 Two Speed 1-Winding (TS1W) With HMCP Circuit Breaker.....	11,235.68	450.82
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	270.51	
26 24 19 00-0749 Motor Control Center Starters With Fusible Disconnect <small>(26 24 19 00-0484)</small>		
Note: Includes fuses, door, unit support pan, heater elements, and NEMA 1 with gasket, or NEMA 12 enclosure. Line voltages of 208 V, 240 V, 480 V, and 600 V.		
26 24 19 00-0750 FVNR Starters With Fusible Disconnect <small>(26 24 19 00-0749)</small>		
26 24 19 00-0751 EA Class 1, Type A, Size 1 FVNR Starters With Fusible Disconnect.....	742.43	150.97
26 24 19 00-0752 EA Class 1, Type A, Size 2 FVNR Starters With Fusible Disconnect.....	970.46	205.18
26 24 19 00-0753 EA Class 1, Type A, Size 3 FVNR Starters With Fusible Disconnect.....	1,594.29	267.36
26 24 19 00-0754 EA Class 1, Type A, Size 4 FVNR Starters With Fusible Disconnect.....	2,664.62	376.58
26 24 19 00-0755 EA Class 1, Type A, Size 5 FVNR Starters With Fusible Disconnect.....	5,265.03	478.72
26 24 19 00-0756 EA Class 1, Type A, Size 6 FVNR Starters With Fusible Disconnect.....	13,111.58	478.72
26 24 19 00-0757 EA Class 1, Type B, Size 1 FVNR Starters With Fusible Disconnect.....	751.05	133.84
26 24 19 00-0758 EA Class 1, Type B, Size 2 FVNR Starters With Fusible Disconnect.....	984.84	183.78
26 24 19 00-0759 EA Class 1, Type B, Size 3 FVNR Starters With Fusible Disconnect.....	1,631.49	246.44
26 24 19 00-0760 EA Class 1, Type B, Size 4 FVNR Starters With Fusible Disconnect.....	2,668.52	356.55
26 24 19 00-0761 EA Class 1, Type B, Size 5 FVNR Starters With Fusible Disconnect.....	5,257.23	452.90
26 24 19 00-0762 EA Class 1, Type B, Size 6 FVNR Starters With Fusible Disconnect.....	13,182.91	452.90
26 24 19 00-0763 Two Speed 2-Winding (TS2W) With Fusible Disconnect <small>(26 24 19 00-0749)</small>		
26 24 19 00-0764 EA Class 1, Type A, Size 1 Two Speed 2-Winding (TS2W) With Fusible Disconnect.....	1,256.34	189.02
26 24 19 00-0765 EA Class 1, Type A, Size 2 Two Speed 2-Winding (TS2W) With Fusible Disconnect.....	1,748.31	256.49
26 24 19 00-0766 EA Class 1, Type A, Size 3 Two Speed 2-Winding (TS2W) With Fusible Disconnect.....	2,686.82	334.03
26 24 19 00-0767 EA Class 1, Type A, Size 4 Two Speed 2-Winding (TS2W) With Fusible Disconnect.....	5,559.28	472.05
26 24 19 00-0768 EA Class 1, Type A, Size 5 Two Speed 2-Winding (TS2W) With Fusible Disconnect.....	8,976.00	552.40
26 24 19 00-0769 EA Class 1, Type B, Size 1 Two Speed 2-Winding (TS2W) With Fusible Disconnect.....	1,728.31	167.30
26 24 19 00-0770 EA Class 1, Type B, Size 2 Two Speed 2-Winding (TS2W) With Fusible Disconnect.....	1,773.58	229.55
26 24 19 00-0771 EA Class 1, Type B, Size 3 Two Speed 2-Winding (TS2W) With Fusible Disconnect.....	2,736.70	308.37
26 24 19 00-0772 EA Class 1, Type B, Size 4 Two Speed 2-Winding (TS2W) With Fusible Disconnect.....	5,570.92	444.87
26 24 19 00-0773 EA Class 1, Type B, Size 5 Two Speed 2-Winding (TS2W) With Fusible Disconnect.....	8,978.96	520.95
26 24 19 00-0774 Two Speed 1-Winding (TS1W) With Fusible Disconnect <small>(26 24 19 00-0749)</small>		
26 24 19 00-0775 EA Class 1, Type A, Size 1 Two Speed 1-Winding (TS1W) With Fusible Disconnect.....	1,455.06	189.02
26 24 19 00-0776 EA Class 1, Type A, Size 2 Two Speed 1-Winding (TS1W) With Fusible Disconnect.....	2,213.45	256.49
26 24 19 00-0777 EA Class 1, Type A, Size 3 Two Speed 1-Winding (TS1W) With Fusible Disconnect.....	3,968.78	334.03
26 24 19 00-0778 EA Class 1, Type A, Size 4 Two Speed 1-Winding (TS1W) With Fusible Disconnect.....	5,826.58	472.05
26 24 19 00-0779 EA Class 1, Type A, Size 5 Two Speed 1-Winding (TS1W) With Fusible Disconnect.....	10,898.94	552.40
26 24 19 00-0780 EA Class 1, Type B, Size 1 Two Speed 1-Winding (TS1W) With Fusible Disconnect.....	1,477.61	167.30
26 24 19 00-0781 EA Class 1, Type B, Size 2 Two Speed 1-Winding (TS1W) With Fusible Disconnect.....	2,238.71	229.55
26 24 19 00-0782 EA Class 1, Type B, Size 3 Two Speed 1-Winding (TS1W) With Fusible Disconnect.....	4,018.67	308.37
26 24 19 00-0783 EA Class 1, Type B, Size 4 Two Speed 1-Winding (TS1W) With Fusible Disconnect.....	5,838.21	444.87
26 24 19 00-0784 EA Class 1, Type B, Size 5 Two Speed 1-Winding (TS1W) With Fusible Disconnect.....	10,901.91	520.95
26 24 19 00-0785 Tin Plated Copper Bus Bar And Ground Bus Bar Splice Kit <small>(26 24 19 00-0484)</small>		
Note: Per section. Labor is included in basic distribution section.		
26 24 19 00-0786 EA 600 Amp Horizontal Tin Plated Copper Bus Kit.....	153.79	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	6.04	
26 24 19 00-0787 EA 800 Amp Horizontal Tin Plated Copper Bus Kit.....	187.79	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	6.04	
26 24 19 00-0788 EA 1,200 Amp Horizontal Tin Plated Copper Bus Kit.....	225.81	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	7.25	
26 24 19 00-0789 EA 1,600 Amp Horizontal Tin Plated Copper Bus Kit.....	292.64	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	7.25	
26 24 19 00-0790 EA 2,000 Amp Horizontal Tin Plated Copper Bus Kit.....	488.93	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	8.46	
26 24 19 00-0791 EA 1/4" x 2" Horizontal Tin Plated Copper Ground Bus Kit.....	88.80	
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	4.83	

26 Electrical**26 20 Low-Voltage Electrical Distribution****26 24 Switchboards And Panelboards**

MINOR CSI UOM DESCRIPTION		TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 24 19 00-0792	Disconnect Switch For Motor Control Centers (26 24 19 00-0484)		
26 24 19 00-0793	3 Pole Circuit Breaker Disconnect For Motor Control Center (26 24 19 00-0792) Note: Includes door, unit support pan, inverse time (Thermal Magnetic) circuit breaker, and NEMA 1, NEMA 1 with gasket, or NEMA 12 enclosure. Class 1 type A (no starters).		
26 24 19 00-0794	EA 150 Amp Rating, 15 To 100 Amp Trip Range, 3 Pole Circuit Breaker Disconnect.....	663.12	116.23
26 24 19 00-0795	EA 150 Amp Rating, 125 To 150 Amp Trip Range, 3 Pole Circuit Breaker Disconnect.....	1,165.53	128.69
26 24 19 00-0796	EA 225 Amp Rating, 70 To 225 Amp Trip Range, 3 Pole Circuit Breaker Disconnect.....	1,420.82	173.33
26 24 19 00-0797	EA 400 Amp Rating, 125 To 400 Amp Trip Range, 3 Pole Circuit Breaker Disconnect.....	2,361.62	228.43
26 24 19 00-0798	EA 600 Amp Rating, 300 To 600 Amp Trip Range, 3 Pole Circuit Breaker Disconnect.....	4,087.66	285.53
26 24 19 00-0799	EA 800 Amp Rating, 400 To 800 Amp Trip Range, 3 Pole Circuit Breaker Disconnect.....	4,665.74	285.53
26 24 19 00-0800	EA 1,200 Amp Rating, 600 To 1,200 Amp Trip Range, 3 Pole Circuit Breaker Disconnect.....	9,627.94	357.51
26 24 19 00-0801	Fusible Disconnect Switch For Motor Control Center (26 24 19 00-0792) Note: Includes door, unit support pan, fuses and NEMA 1, NEMA 1 with gasket, or NEMA 12 enclosure. Class 1 type A (no starters).		
26 24 19 00-0802	EA 30 Amp Switch Rating, Fusible Disconnect Switch With 30 Amp Fuse Clips.....	516.17	113.01
26 24 19 00-0803	EA 60 Amp Switch Rating, Fusible Disconnect Switch With 60 Amp Fuse Clips.....	615.81	154.03
26 24 19 00-0804	EA 100 Amp Switch Rating, Fusible Disconnect Switch With 100 Amp Fuse Clips.....	839.03	197.05
26 24 19 00-0805	EA 200 Amp Switch Rating, Fusible Disconnect Switch With 200 Amp Fuse Clips.....	1,534.50	282.31
26 24 19 00-0806	EA 400 Amp Switch Rating, Fusible Disconnect Switch With 400 Amp Fuse Clips.....	2,676.26	359.05
26 24 19 00-0807	EA 600 Amp Switch Rating, Fusible Disconnect Switch With 600 Amp Fuse Clips.....	5,982.29	359.05
26 24 19 00-0808	EA 800 Amp Switch Rating, Fusible Disconnect Switch With 800 Amp Fuse Clips.....	7,397.18	448.81
26 24 19 00-0809	EA 1,200 Amp Switch Rating, Fusible Disconnect Switch With 1,200 Amp Fuse Clips.....	10,857.97	448.81
26 24 19 00-0810	Control Circuit Transformer (26 24 19 00-0484)		
26 24 19 00-0811	EA Control Circuit Transformer, Size 1 Factory Installed.....	41.88	
26 24 19 00-0812	EA Control Circuit Transformer, Size 2 Factory Installed.....	41.88	
26 24 19 00-0813	EA Control Circuit Transformer, Size 3 Factory Installed.....	80.66	
26 24 19 00-0814	EA Control Circuit Transformer, Size 4 Factory Installed.....	80.66	
26 24 19 00-0815	EA Control Circuit Transformer, Size 5 Factory Installed.....	112.05	
26 24 19 00-0816	EA Control Circuit Fuse And Holder Small Dim, Dual Element Time Delay.....	34.50	9.11
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	6.04	
26 24 19 00-0817	Cover Mounted Control Devices (26 24 19 00-0484)		
26 24 19 00-0818	EA Control Device, 2 Unit Push Button Station Cover Mounted.....	75.40	16.09
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.06	
26 24 19 00-0819	EA Control Device, 2-3 Unit Selector Switch Cover Mounted.....	85.32	16.09
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	12.57	
26 24 19 00-0820	EA Control Device, Pilot Light Cover Mounted.....	70.09	16.09
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	7.53	
26 24 19 00-0821	EA Control Device, Hand-Off-Auto Switch Cover Mounted With Pilot Light.....	196.74	54.70
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	32.96	
26 24 19 00-0822	EA Auxiliary Contact Add Per Starter.....	221.96	20.83
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	12.50	
26 24 19 00-0823	Extra Interlocks (26 24 19 00-0484) Note: Per contact.		
26 24 19 00-0824	EA Extra Interlocks, Class I, Type A Per Contact.....	49.63	10.45
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	7.53	
26 24 19 00-0825	EA Extra Interlocks, Class I, Type B Per Contact.....	67.13	10.45
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	7.53	
26 24 19 00-0826	EA Extra Interlocks, Class I, Type C Per Contact.....	73.47	10.45
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	6.29	
26 24 19 00-0827	EA Extra Interlocks, Class II, Type B Per Contact.....	65.78	10.45
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	5.03	
26 24 19 00-0828	EA Extra Interlocks, Class II, Type C Per Contact.....	68.68	10.45
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	3.80	
26 24 19 00-0829	Special Cabinet Provisions (26 24 19 00-0484)		
26 24 19 00-0830	EA Provisions For Bus Duct Entrance Special Cabinet Provisions.....	524.27	
26 24 19 00-0831	Nameplate Requirements (26 24 19 00-0484)		
26 24 19 00-0832	EA Special Cabinet Nameplate Requirements.....	18.61	
26 24 19 00-0833	Auxiliary Relays (26 24 19 00-0484)		
26 24 19 00-0834	EA Industrial Control Relay, 10 Amp Class A600 With 2 Contacts.....	109.22	20.14
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	12.08	
26 24 19 00-0835	EA Timing Relay, Solid State, DPDT 0.1-10 Sec Variable, Off-Delay.....	103.62	18.13
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	12.08	
26 24 19 00-0836	EA General Purpose Control Relay, 240 Volt AC, 10 Amp, With Base.....	61.82	18.13
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	12.08	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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26 24 19 00-0837			Motor Control Center Accessories (26 24 19 00-0484)		
26 24 19 00-0838			Lighting Transformer With Circuit Breaker (26 24 19 00-0837) Note: For 240 V, 480 V, or 600 V primary. Includes door, unit support pan, and NEMA 1, NEMA 1 with gasket, or NEMA 12 enclosure for MCC only.		
26 24 19 00-0839	EA		1 Phase, 5 KVA, 120/240 Volt Secondary Lighting Transformer With Circuit Breaker.....	3,125.69	258.95
26 24 19 00-0840	EA		1 Phase, 7.5 KVA, 120/240 Volt Secondary Lighting Transformer With Circuit Breaker.....	3,249.81	269.31
26 24 19 00-0841	EA		1 Phase, 10 KVA, 120/240 Volt Secondary Lighting Transformer With Circuit Breaker.....	3,554.06	290.02
26 24 19 00-0842	EA		1 Phase, 15 KVA, 120/240 Volt Secondary Lighting Transformer With Circuit Breaker.....	4,448.95	310.74
26 24 19 00-0843	EA		1 Phase, 25 KVA, 120/240 Volt Secondary Lighting Transformer With Circuit Breaker.....	5,951.72	331.46
26 24 19 00-0844	EA		1 Phase, 37.5 KVA, 120/240 Volt Secondary Lighting Transformer With Circuit Breaker.....	7,299.17	372.89
26 24 19 00-0845	EA		1 Phase, 50 KVA, 120/240 Volt Secondary Lighting Transformer With Circuit Breaker.....	9,564.34	414.32
26 24 19 00-0846	EA		3 Phase, 10 KVA, 120/208 Volt Secondary Lighting Transformer With Circuit Breaker.....	5,621.29	341.81
26 24 19 00-0847	EA		3 Phase, 15 KVA, 120/208 Volt Secondary Lighting Transformer With Circuit Breaker.....	6,107.78	372.89
26 24 19 00-0848	EA		3 Phase, 25 KVA, 120/208 Volt Secondary Lighting Transformer With Circuit Breaker.....	6,981.33	414.32
26 24 19 00-0849	EA		3 Phase, 30 KVA, 120/208 Volt Secondary Lighting Transformer With Circuit Breaker.....	7,412.12	455.75
26 24 19 00-0850	EA		3 Phase, 37.5 KVA, 120/208 Volt Secondary Lighting Transformer With Circuit Breaker.....	8,924.36	497.18
26 24 19 00-0851	EA		3 Phase, 45 KVA, 120/208 Volt Secondary Lighting Transformer With Circuit Breaker.....	9,217.27	538.62

26 24 19 00-0852			Bolt-On Lighting Panel (26 24 19 00-0837) Note: Includes door, T-handle, unit support pan, neutral bar (10 KA IC RMS), and NEMA 1, NEMA 1 with gasket, or NEMA 12 enclosure. For MCC only.		
26 24 19 00-0853	EA		18 Circuit Bolt-On Lighting Panel, MLO, 1 Phase, 3 Wire, 120/240 Volt.....	1,405.87	418.57
26 24 19 00-0854	EA		30 Circuit Bolt-On Lighting Panel, MLO, 1 Phase, 3 Wire, 120/240 Volt.....	2,213.25	728.55
26 24 19 00-0855	EA		42 Circuit Bolt-On Lighting Panel, MLO, 1 Phase, 3 Wire, 120/240 Volt.....	2,946.18	985.68
26 24 19 00-0856	EA		18 Circuit Bolt-On Lighting Panel, MLO, 3 Phase, 4 Wire, 120/208 Volt.....	1,474.50	452.90
26 24 19 00-0857	EA		30 Circuit Bolt-On Lighting Panel, MLO, 3 Phase, 4 Wire, 120/208 Volt.....	2,182.25	713.02
26 24 19 00-0858	EA		42 Circuit Bolt-On Lighting Panel, MLO, 3 Phase, 4 Wire, 120/208 Volt.....	3,069.38	1,047.30
26 24 19 00-0859	EA		18 Circuit Bolt-On Lighting Panel, MCB, 1 Phase, 3 Wire, 120/240 Volt.....	2,310.90	485.48
26 24 19 00-0860	EA		30 Circuit Bolt-On Lighting Panel, MCB, 1 Phase, 3 Wire, 120/240 Volt.....	3,114.15	779.38
26 24 19 00-0861	EA		42 Circuit Bolt-On Lighting Panel, MCB, 1 Phase, 3 Wire, 120/240 Volt.....	3,911.72	1,047.30
26 24 19 00-0862	EA		18 Circuit Bolt-On Lighting Panel, MCB, 3 Phase, 4 Wire, 120/208 Volt.....	2,387.27	523.61
26 24 19 00-0863	EA		30 Circuit Bolt-On Lighting Panel, MCB, 3 Phase, 4 Wire, 120/208 Volt.....	3,114.15	779.38
26 24 19 00-0864	EA		42 Circuit Bolt-On Lighting Panel, MCB, 3 Phase, 4 Wire, 120/208 Volt.....	3,979.29	1,081.07

26 24 19 00-0865			Factory Installed Bolt-On Branch Circuit Breaker (26 24 19 00-0837) Note: For MCC lighting panel only.		
26 24 19 00-0866	EA		15 A / 1 Pole - 30 A / 1 Pole Bolt-On Branch Circuit Breaker	17.27	
26 24 19 00-0867	EA		15 A / 1 Pole - 30 A / 1 Pole (GFI) Bolt-On Branch Circuit Breaker	161.57	
26 24 19 00-0868	EA		15 A / 2 Pole - 50 A / 2 Pole Bolt-On Branch Circuit Breaker	33.76	
26 24 19 00-0869	EA		60 A / 2 Pole - 100 A / 2 Pole Bolt-On Branch Circuit Breaker	77.73	
26 24 19 00-0870	EA		15 A / 3 Pole - 50 A / 3 Pole Bolt-On Branch Circuit Breaker	91.08	
26 24 19 00-0871	EA		60 A / 3 Pole - 100 A / 3 Pole Bolt-On Branch Circuit Breaker	138.18	

26 24 19 00-0872			Blank Unit Door (BUD) (26 24 19 00-0837) Note: With NEMA 1, NEMA 1 with gasket, or NEMA 12 enclosure. Factory installed.		
26 24 19 00-0873	EA		6" High Blank Unit Door (BUD) With NEMA 1, NEMA 1 With Gasket, Or NEMA 12 Enclosure.....	43.09	
26 24 19 00-0874	EA		12" High Blank Unit Door (BUD) With NEMA 1, NEMA 1 With Gasket, Or NEMA 12 Enclosure.....	51.70	
26 24 19 00-0875	EA		18" High Blank Unit Door (BUD) With NEMA 1, NEMA 1 With Gasket, Or NEMA 12 Enclosure.....	77.55	
26 24 19 00-0876	EA		24" High Blank Unit Door (BUD) With NEMA 1, NEMA 1 With Gasket, Or NEMA 12 Enclosure.....	103.41	
26 24 19 00-0877	EA		30" High Blank Unit Door (BUD) With NEMA 1, NEMA 1 With Gasket, Or NEMA 12 Enclosure.....	155.11	
26 24 19 00-0878	EA		48" High Blank Unit Door (BUD) With NEMA 1, NEMA 1 With Gasket, Or NEMA 12 Enclosure.....	180.96	
26 24 19 00-0879	EA		72" High Blank Unit Door (BUD) With NEMA 1, NEMA 1 With Gasket, Or NEMA 12 Enclosure.....	206.81	

26 25 Enclosed Bus Assemblies (26 25)

26 25 00 00-0001			Bus Ducts (26 25)		
26 25 00 00-0002			Plug-In Bus Duct (26 25 00 00-0001) Note: Based on an average of 100' horizontal run with a 15' maximum mounting height. Each 100' of bus duct includes 2 elbows, 1 end cap, and switchboard stub. Excludes hangers with anchors and hardware support.		
26 25 00 00-0003			600 Volt, 3-Phase, 3-Wire, Copper Conductors (26 25 00 00-0002)		
26 25 00 00-0004	LF		225 Amp Bus Duct 600 Volt, 3 Phase, 3 Wire Copper Conductors	232.90	24.13
			For Up To 25, Add	58.23	
			For >25 To 50, Add	34.94	
			For >50 To 100, Add	17.47	
26 25 00 00-0005	LF		400 Amp Bus Duct 600 Volt, 3 Phase, 3 Wire Copper Conductors	332.63	24.13
			For Up To 25, Add	83.16	
			For >25 To 50, Add	49.89	
			For >50 To 100, Add	24.95	
26 25 00 00-0006	LF		600 Amp Bus Duct 600 Volt, 3 Phase, 3 Wire Copper Conductors	422.62	32.17
			For Up To 25, Add	105.66	
			For >25 To 50, Add	63.39	
			For >50 To 100, Add	31.70	
26 25 00 00-0007	LF		800 Amp Bus Duct 600 Volt, 3 Phase, 3 Wire Copper Conductors	586.99	32.17
			For Up To 25, Add	146.75	
			For >25 To 50, Add	88.05	
			For >50 To 100, Add	44.02	

26 Electrical**26 20 Low-Voltage Electrical Distribution****26 25 Enclosed Bus Assemblies**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 25 00 00-0008	LF		1,000 Amp Bus Duct 600 Volt, 3 Phase, 3 Wire Copper Conductors.....	619.02	40.21
			<i>For Up To 25, Add</i>	154.76	
			<i>For >25 To 50, Add</i>	92.85	
			<i>For >50 To 100, Add</i>	46.43	
26 25 00 00-0009	LF		1,350 Amp Bus Duct 600 Volt, 3 Phase, 3 Wire Copper Conductors.....	866.48	40.21
			<i>For Up To 25, Add</i>	216.62	
			<i>For >25 To 50, Add</i>	129.97	
			<i>For >50 To 100, Add</i>	64.99	
26 25 00 00-0010	LF		1,600 Amp Bus Duct 600 Volt, 3 Phase, 3 Wire Copper Conductors.....	1,016.08	42.23
			<i>For Up To 25, Add</i>	254.02	
			<i>For >25 To 50, Add</i>	152.41	
			<i>For >50 To 100, Add</i>	76.21	
26 25 00 00-0011	LF		2,000 Amp Bus Duct 600 Volt, 3 Phase, 3 Wire Copper Conductors.....	1,240.17	43.43
			<i>For Up To 25, Add</i>	310.04	
			<i>For >25 To 50, Add</i>	186.03	
			<i>For >50 To 100, Add</i>	93.01	
26 25 00 00-0012	LF		2,500 Amp Bus Duct 600 Volt, 3 Phase, 3 Wire Copper Conductors.....	1,533.46	45.85
			<i>For Up To 25, Add</i>	383.37	
			<i>For >25 To 50, Add</i>	230.02	
			<i>For >50 To 100, Add</i>	115.01	
26 25 00 00-0013	LF		3,000 Amp Bus Duct 600 Volt, 3 Phase, 3 Wire Copper Conductors.....	1,770.42	53.48
			<i>For Up To 25, Add</i>	442.61	
			<i>For >25 To 50, Add</i>	265.56	
			<i>For >50 To 100, Add</i>	132.78	
26 25 00 00-0014	LF		4,000 Amp Bus Duct 600 Volt, 3 Phase, 3 Wire Copper Conductors.....	2,050.18	58.31
			<i>For Up To 25, Add</i>	512.55	
			<i>For >25 To 50, Add</i>	307.53	
			<i>For >50 To 100, Add</i>	153.76	
26 25 00 00-0015			277/480 Volt, 3-Phase, 4-Wire, 100% Neutral, Copper Conductors <small>(26 25 00 00-0002)</small>		
26 25 00 00-0016	LF		225 Amp Bus Duct 277/480 Volt, 3 Phase, 4 Wire Copper Conductors.....	387.87	24.13
			<i>For Up To 25, Add</i>	96.97	
			<i>For >25 To 50, Add</i>	58.18	
			<i>For >50 To 100, Add</i>	29.09	
26 25 00 00-0017	LF		400 Amp Bus Duct 277/480 Volt, 3 Phase, 4 Wire Copper Conductors.....	562.66	24.13
			<i>For Up To 25, Add</i>	140.67	
			<i>For >25 To 50, Add</i>	84.40	
			<i>For >50 To 100, Add</i>	42.20	
26 25 00 00-0018	LF		600 Amp Bus Duct 277/480 Volt, 3 Phase, 4 Wire Copper Conductors.....	636.21	32.17
			<i>For Up To 25, Add</i>	159.05	
			<i>For >25 To 50, Add</i>	95.43	
			<i>For >50 To 100, Add</i>	47.72	
26 25 00 00-0019	LF		800 Amp Bus Duct 277/480 Volt, 3 Phase, 4 Wire Copper Conductors.....	810.76	32.17
			<i>For Up To 25, Add</i>	202.69	
			<i>For >25 To 50, Add</i>	121.61	
			<i>For >50 To 100, Add</i>	60.81	
26 25 00 00-0020	LF		1,000 Amp Bus Duct 277/480 Volt, 3 Phase, 4 Wire Copper Conductors.....	990.64	40.21
			<i>For Up To 25, Add</i>	247.66	
			<i>For >25 To 50, Add</i>	148.60	
			<i>For >50 To 100, Add</i>	74.30	
26 25 00 00-0021	LF		1,350 Amp Bus Duct 277/480 Volt, 3 Phase, 4 Wire Copper Conductors.....	1,286.81	40.21
			<i>For Up To 25, Add</i>	321.70	
			<i>For >25 To 50, Add</i>	193.02	
			<i>For >50 To 100, Add</i>	96.51	
26 25 00 00-0022	LF		1,600 Amp Bus Duct 277/480 Volt, 3 Phase, 4 Wire Copper Conductors.....	1,665.98	41.67
			<i>For Up To 25, Add</i>	416.50	
			<i>For >25 To 50, Add</i>	249.90	
			<i>For >50 To 100, Add</i>	124.95	
26 25 00 00-0023	LF		2,000 Amp Bus Duct 277/480 Volt, 3 Phase, 4 Wire Copper Conductors.....	2,009.00	43.43
			<i>For Up To 25, Add</i>	502.25	
			<i>For >25 To 50, Add</i>	301.35	
			<i>For >50 To 100, Add</i>	150.68	
26 25 00 00-0024	LF		2,500 Amp Bus Duct 277/480 Volt, 3 Phase, 4 Wire Copper Conductors.....	2,494.58	45.44
			<i>For Up To 25, Add</i>	623.65	
			<i>For >25 To 50, Add</i>	374.19	
			<i>For >50 To 100, Add</i>	187.09	
26 25 00 00-0025	LF		3,000 Amp Bus Duct 277/480 Volt, 3 Phase, 4 Wire Copper Conductors.....	2,879.44	53.48
			<i>For Up To 25, Add</i>	719.86	
			<i>For >25 To 50, Add</i>	431.92	
			<i>For >50 To 100, Add</i>	215.96	
26 25 00 00-0026	LF		4,000 Amp Bus Duct 277/480 Volt, 3 Phase, 4 Wire Copper Conductors.....	3,339.21	58.31
			<i>For Up To 25, Add</i>	834.80	
			<i>For >25 To 50, Add</i>	500.88	
			<i>For >50 To 100, Add</i>	250.44	
26 25 00 00-0027			Cable Tap Boxes <small>(26 25 00 00-0002)</small>		
26 25 00 00-0028			600 Volt, 3-Phase, 3-Wire, Copper Conductors <small>(26 25 00 00-0027)</small>		
26 25 00 00-0029	EA		225 Amp Cable Tap Box, 600 Volt, 3 Phase, 3 Wire	1,953.40	112.60
26 25 00 00-0030	EA		400 Amp Cable Tap Box, 600 Volt, 3 Phase, 3 Wire	2,010.10	112.60
26 25 00 00-0031	EA		600 Amp Cable Tap Box, 600 Volt, 3 Phase, 3 Wire	2,167.70	152.82
26 25 00 00-0032	EA		800 Amp Cable Tap Box, 600 Volt, 3 Phase, 3 Wire	2,300.85	152.82
26 25 00 00-0033	EA		1,000 Amp Cable Tap Box, 600 Volt, 3 Phase, 3 Wire	2,463.24	201.07



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 25 00 00-0034 EA 1,350 Amp Cable Tap Box, 600 Volt, 3 Phase, 3 Wire	2,697.14	201.07
26 25 00 00-0035 277/480 Volt, 3-Phase, 4-Wire, 100% Neutral, Copper Conductors (26 25 00 00-0027)		
26 25 00 00-0036 EA 225 Amp Cable Tap Box 277/480 Volt, 3 Phase, 4 Wire	2,010.10	221.19
26 25 00 00-0037 EA 400 Amp Cable Tap Box 277/480 Volt, 3 Phase, 4 Wire	2,176.92	221.19
26 25 00 00-0038 EA 600 Amp Cable Tap Box 277/480 Volt, 3 Phase, 4 Wire	2,318.48	301.62
26 25 00 00-0039 EA 800 Amp Cable Tap Box 277/480 Volt, 3 Phase, 4 Wire	2,603.98	301.62
26 25 00 00-0040 EA 1,000 Amp Cable Tap Box 277/480 Volt, 3 Phase, 4 Wire	2,731.09	402.16
26 25 00 00-0041 EA 1,350 Amp Cable Tap Box 277/480 Volt, 3 Phase, 4 Wire	3,109.79	402.16
26 25 00 00-0042 Bus Duct Plug-In Circuit Breaker (26 25 00 00-0002)		
26 25 00 00-0043 240 Volt, 3-Phase (26 25 00 00-0042)		
26 25 00 00-0044 EA 60 Amp Bus Duct Circuit Breaker 240 Volt, 3 Phase Plug-in Circuit Breaker	867.44	80.44
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	44.00	
26 25 00 00-0045 EA 100 Amp Bus Duct Circuit Breaker 240 Volt, 3 Phase Plug-in Circuit Breaker	1,750.77	80.44
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	56.48	
26 25 00 00-0046 600 Volt, 3-Phase (26 25 00 00-0042)		
26 25 00 00-0047 EA 60 Amp Bus Duct Circuit Breaker 600 Volt, 3 Phase Plug-in Circuit Breaker	1,709.17	80.44
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	44.00	
26 25 00 00-0048 EA 100 Amp Bus Duct Circuit Breaker 600 Volt, 3 Phase Plug-in Circuit Breaker	2,214.17	80.44
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	56.48	
26 25 00 00-0049 120/208 Volt, 3-Phase, 4-Wire (26 25 00 00-0042)		
26 25 00 00-0050 EA 60 Amp Bus Duct Circuit Breaker 120/208 Volt, 3 Phase, 4 Wire Plug-in Circuit Breaker	999.22	96.51
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	50.27	
26 25 00 00-0051 EA 100 Amp Bus Duct Circuit Breaker 120/208 Volt, 3 Phase, 4 Wire Plug-in Circuit Breaker	1,191.46	96.51
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	62.84	
26 25 00 00-0052 277/480 Volt, 3-Phase, 4-Wire (26 25 00 00-0042)		
26 25 00 00-0053 EA 60 Amp Bus Duct Circuit Breaker 277/480 Volt, 3 Phase, 4 Wire Plug-in Circuit Breaker	1,149.58	96.51
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	50.27	
26 25 00 00-0054 EA 100 Amp Bus Duct Circuit Breaker 277/480 Volt, 3 Phase, 4 Wire Plug-in Circuit Breaker	1,780.21	96.51
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	62.84	
26 25 00 00-0055 EA 225 Amp Bus Duct Circuit Breaker 277/480 Volt, 3 Phase, 4 Wire Plug-in Circuit Breaker	2,558.00	333.79
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	144.66	
26 25 00 00-0056 EA 400 Amp Bus Duct Circuit Breaker 277/480 Volt, 3 Phase, 4 Wire Plug-in Circuit Breaker	6,130.35	333.79
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	314.19	
26 25 00 00-0057 EA 600 Amp Bus Duct Circuit Breaker 277/480 Volt, 3 Phase, 4 Wire Plug-in Circuit Breaker	6,779.67	965.18
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	437.13	
26 25 00 00-0058 EA 800 Amp Bus Duct Circuit Breaker 277/480 Volt, 3 Phase, 4 Wire Plug-in Circuit Breaker	8,299.69	965.18
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	773.38	
26 25 00 00-0059 Bus Duct Plug-In Fusible Switch (26 25 00 00-0002)		
26 25 00 00-0060 240 Volt, 3-Pole, 3-Fuse (26 25 00 00-0059)		
26 25 00 00-0061 EA 30 Amp Bus Duct Fusible Switch 240 Volt, 3 Phase Plug-in Fusible Switch, 3 Fuses.....	865.37	80.44
26 25 00 00-0062 EA 60 Amp Bus Duct Fusible Switch 240 Volt, 3 Phase Plug-in Fusible Switch, 3 Fuses.....	946.49	80.44
26 25 00 00-0063 EA 100 Amp Bus Duct Fusible Switch 240 Volt, 3 Phase Plug-in Fusible Switch, 3 Fuses.....	1,313.57	96.51
26 25 00 00-0064 EA 200 Amp Bus Duct Fusible Switch 240 Volt, 3 Phase Plug-in Fusible Switch, 3 Fuses.....	2,212.17	193.04
26 25 00 00-0065 EA 400 Amp Bus Duct Fusible Switch 240 Volt, 3 Phase Plug-in Fusible Switch, 3 Fuses.....	5,623.47	434.33
26 25 00 00-0066 EA 600 Amp Bus Duct Fusible Switch 240 Volt, 3 Phase Plug-in Fusible Switch, 3 Fuses.....	8,344.78	756.05
26 25 00 00-0067 600 Volt, 3-Pole, 3-Fuse (26 25 00 00-0059)		
26 25 00 00-0068 EA 30 Amp Bus Duct Fusible Switch 600 Volt, 3 Phase Plug-in Fusible Switch, 3 Fuses.....	904.61	88.47
26 25 00 00-0069 EA 60 Amp Bus Duct Fusible Switch 600 Volt, 3 Phase Plug-in Fusible Switch, 3 Fuses.....	983.44	88.47
26 25 00 00-0070 EA 100 Amp Bus Duct Fusible Switch 600 Volt, 3 Phase Plug-in Fusible Switch, 3 Fuses.....	1,328.25	88.47
26 25 00 00-0071 EA 200 Amp Bus Duct Fusible Switch 600 Volt, 3 Phase Plug-in Fusible Switch, 3 Fuses.....	2,273.32	185.00
26 25 00 00-0072 EA 400 Amp Bus Duct Fusible Switch 600 Volt, 3 Phase Plug-in Fusible Switch, 3 Fuses.....	5,601.98	418.24
26 25 00 00-0073 EA 600 Amp Bus Duct Fusible Switch 600 Volt, 3 Phase Plug-in Fusible Switch, 3 Fuses.....	8,497.11	804.31
26 25 00 00-0074 EA 800 Amp Bus Duct Fusible Switch 600 Volt, 3 Phase Plug-in Fusible Switch, 3 Fuses.....	14,076.68	1,045.60
26 25 00 00-0075 120/208 Volt, 4-pole, 3 Fuse (26 25 00 00-0059)		
26 25 00 00-0076 EA 30 Amp Bus Duct Fusible Switch 120/208 Volt, 4 Phase Plug-in Fusible Switch, 3 Fuses.....	1,003.20	104.56
26 25 00 00-0077 EA 60 Amp Bus Duct Fusible Switch 120/208 Volt, 4 Phase Plug-in Fusible Switch, 3 Fuses.....	1,071.42	104.56
26 25 00 00-0078 EA 100 Amp Bus Duct Fusible Switch 120/208 Volt, 4 Phase Plug-in Fusible Switch, 3 Fuses.....	1,449.36	104.56
26 25 00 00-0079 EA 200 Amp Bus Duct Fusible Switch 120/208 Volt, 4 Phase Plug-in Fusible Switch, 3 Fuses.....	2,458.75	217.16
26 25 00 00-0080 EA 400 Amp Bus Duct Fusible Switch 120/208 Volt, 4 Phase Plug-in Fusible Switch, 3 Fuses.....	6,159.81	482.58
26 25 00 00-0081 EA 600 Amp Bus Duct Fusible Switch 120/208 Volt, 4 Phase Plug-in Fusible Switch, 3 Fuses.....	8,950.59	739.97
26 25 00 00-0082 277/480 Volt, 4-pole, 3-Fuse (26 25 00 00-0059)		

26	Electrical
26 20	Low-Voltage Electrical Distribution
26 25	Enclosed Bus Assemblies



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 25 00 00-0083	EA		30 Amp Bus Duct Fusible Switch 277/480 Volt, 4 Phase Plug-in Fusible Switch, 3 Fuses.....	1,037.77	104.56
26 25 00 00-0084	EA		60 Amp Bus Duct Fusible Switch 277/480 Volt, 4 Phase Plug-in Fusible Switch, 3 Fuses.....	1,106.00	88.71
26 25 00 00-0085	EA		100 Amp Bus Duct Fusible Switch 277/480 Volt, 4 Phase Plug-in Fusible Switch, 3 Fuses.....	1,549.91	120.65
26 25 00 00-0086	EA		200 Amp Bus Duct Fusible Switch 277/480 Volt, 4 Phase Plug-in Fusible Switch, 3 Fuses.....	2,565.89	217.16
26 25 00 00-0087	EA		400 Amp Bus Duct Fusible Switch 277/480 Volt, 4 Phase Plug-in Fusible Switch, 3 Fuses.....	6,159.81	482.58
26 25 00 00-0088	EA		600 Amp Bus Duct Fusible Switch 277/480 Volt, 4 Phase Plug-in Fusible Switch, 3 Fuses.....	8,950.59	739.97
26 25 00 00-0089	EA		800 Amp Bus Duct Fusible Switch 277/480 Volt, 4 Phase Plug-in Fusible Switch, 3 Fuses.....	14,275.68	981.26
26 25 00 00-0090			Feeder Bus Duct <small>(26 25 00 00-0090)</small> Note: Based on an average of 100' horizontal run with a 15' maximum mounting height. Each 100' of bus duct includes 2 elbows, 1 end cap, and switchboard stub. Excludes hangers with anchors and hardware support.		
26 25 00 00-0091			600 Volt, 3 Phase, 3 Wire, Ventilated Low Impedance <small>(26 25 00 00-0090)</small> Note: Copper conductors.		
26 25 00 00-0092	LF		800 Amp Bus Duct 600 Volt, 3 Phase, 3 Wire Copper Conductors, With Supports.....	710.60	33.78
			For Up To 25, Add	177.65	
			For >25 To 50, Add	106.59	
			For >50 To 100, Add	53.30	
26 25 00 00-0093	LF		1,000 Amp Bus Duct 600 Volt, 3 Phase, 3 Wire Copper Conductors, With Supports.....	719.30	33.78
			For Up To 25, Add	179.83	
			For >25 To 50, Add	107.90	
			For >50 To 100, Add	53.95	
26 25 00 00-0094	LF		1,350 Amp Bus Duct 600 Volt, 3 Phase, 3 Wire Copper Conductors, With Supports.....	944.64	33.78
			For Up To 25, Add	236.16	
			For >25 To 50, Add	141.70	
			For >50 To 100, Add	70.85	
26 25 00 00-0095	LF		1,600 Amp Bus Duct 600 Volt, 3 Phase, 3 Wire Copper Conductors, With Supports.....	1,136.57	33.78
			For Up To 25, Add	284.14	
			For >25 To 50, Add	170.49	
			For >50 To 100, Add	85.24	
26 25 00 00-0096	LF		2,000 Amp Bus Duct 600 Volt, 3 Phase, 3 Wire Copper Conductors, With Supports.....	1,390.57	33.78
			For Up To 25, Add	347.64	
			For >25 To 50, Add	208.59	
			For >50 To 100, Add	104.29	
26 25 00 00-0097	LF		3,000 Amp Bus Duct 600 Volt, 3 Phase, 3 Wire Copper Conductors, With Supports.....	1,896.81	80.44
			For Up To 25, Add	474.20	
			For >25 To 50, Add	284.52	
			For >50 To 100, Add	142.26	
26 25 00 00-0098	LF		4,000 Amp Bus Duct 600 Volt, 3 Phase, 3 Wire Copper Conductors, With Supports.....	2,626.06	80.44
			For Up To 25, Add	656.52	
			For >25 To 50, Add	393.91	
			For >50 To 100, Add	196.95	
26 25 00 00-0099	LF		5,000 Amp Bus Duct 600 Volt, 3 Phase, 3 Wire Copper Conductors, With Supports.....	3,106.80	80.44
			For Up To 25, Add	776.70	
			For >25 To 50, Add	466.02	
			For >50 To 100, Add	233.01	
26 25 00 00-0100	LF		6,000 Amp Bus Duct 600 Volt, 3 Phase, 3 Wire Copper Conductors, With Supports.....	3,829.97	80.44
			For Up To 25, Add	957.49	
			For >25 To 50, Add	574.50	
			For >50 To 100, Add	287.25	
26 25 00 00-0101			277/480 Volt, 3 Phase, 4 Wire, Half Neutral, Ventilated <small>(26 25 00 00-0090)</small> Note: Low impedance, copper conductors.		
26 25 00 00-0102	LF		800 Amp Bus Duct 277/480 Volt, 3 Phase, 4 Wire Copper Conductors, With Supports.....	816.73	36.19
			For Up To 25, Add	204.18	
			For >25 To 50, Add	122.51	
			For >50 To 100, Add	61.25	
26 25 00 00-0103	LF		1,000 Amp Bus Duct 277/480 Volt, 3 Phase, 4 Wire Copper Conductors, With Supports.....	827.90	36.19
			For Up To 25, Add	206.98	
			For >25 To 50, Add	124.19	
			For >50 To 100, Add	62.09	
26 25 00 00-0104	LF		1,350 Amp Bus Duct 277/480 Volt, 3 Phase, 4 Wire Copper Conductors, With Supports.....	1,068.25	36.19
			For Up To 25, Add	267.06	
			For >25 To 50, Add	160.24	
			For >50 To 100, Add	80.12	
26 25 00 00-0105	LF		1,600 Amp Bus Duct 277/480 Volt, 3 Phase, 4 Wire Copper Conductors, With Supports.....	1,266.58	36.19
			For Up To 25, Add	316.65	
			For >25 To 50, Add	189.99	
			For >50 To 100, Add	94.99	
26 25 00 00-0106	LF		2,000 Amp Bus Duct 277/480 Volt, 3 Phase, 4 Wire Copper Conductors, With Supports.....	1,531.12	36.19
			For Up To 25, Add	382.78	
			For >25 To 50, Add	229.67	
			For >50 To 100, Add	114.83	
26 25 00 00-0107	LF		3,000 Amp Bus Duct 277/480 Volt, 3 Phase, 4 Wire Copper Conductors, With Supports.....	2,356.48	61.93
			For Up To 25, Add	589.12	
			For >25 To 50, Add	353.47	
			For >50 To 100, Add	176.74	
26 25 00 00-0108	LF		4,000 Amp Bus Duct 277/480 Volt, 3 Phase, 4 Wire Copper Conductors, With Supports.....	2,956.12	61.93
			For Up To 25, Add	739.03	
			For >25 To 50, Add	443.42	
			For >50 To 100, Add	221.71	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 25 00 00-0109 LF 5,000 Amp Bus Duct 277/480 Volt, 3 Phase, 4 Wire Copper Conductors, With Supports	3,497.07	115.02
<i>For Up To 25, Add</i>	<i>874.27</i>	
<i>For >25 To 50, Add</i>	<i>524.56</i>	
<i>For >50 To 100, Add</i>	<i>262.28</i>	
26 25 00 00-0110 LF 6,000 Amp Bus Duct 277/480 Volt, 3 Phase, 4 Wire Copper Conductors, With Supports	4,317.26	115.02
<i>For Up To 25, Add</i>	<i>1,079.32</i>	
<i>For >25 To 50, Add</i>	<i>647.59</i>	
<i>For >50 To 100, Add</i>	<i>323.79</i>	

26 26 Power Distribution Units (26 20)

Note: Includes wiring connections and testing.

26 26 00 00-0001 Liebert Precision Power Center <small>(26 26)</small>		
Note: With K20 Trans Spike Suppression Modules Lighting/Surge Arrestors. Includes start-up.		
26 26 00 00-0002 EA PDU 15 KVA 480-208/120 (Liebert PPA01C)	11,107.84	247.33
26 26 00 00-0003 EA PDU 15 KVA 208-208/120 (Liebert PPC015C)	10,735.30	247.33
26 26 00 00-0004 EA PDU 30 KVA 480-208/120 (Liebert PPA030C)	12,515.40	268.08
26 26 00 00-0005 EA PDU 30 KVA 208-208/120 (Liebert PPC030C)	12,950.03	268.08
26 26 00 00-0006 EA PDU 50 KVA 480-208/120 (Liebert PPA050C)	14,147.29	297.60
26 26 00 00-0007 EA PDU 50 KVA 208-208/120 (Liebert PPC050C)	14,755.36	297.60
26 26 00 00-0008 EA PDU 75 KVA 480-208/120 (Liebert PPA075C)	15,602.92	321.72
26 26 00 00-0009 EA PDU 75 KVA 208-208/120 (Liebert PPC075C)	16,968.89	321.72
26 26 00 00-0010 EA PDU 100 KVA 480-208/120 (Liebert PPA100C)	16,984.87	402.16
26 26 00 00-0011 EA PDU 100 KVA 208-208/120 (Liebert PPC100C)	18,537.12	402.16
26 26 00 00-0012 EA PDU 125 KVA 480-208/120 (Liebert PPA125C)	19,070.52	482.58
26 26 00 00-0013 EA PDU 125 KVA 208-208/120 (Liebert PPC125C)	20,809.03	482.58
26 26 00 00-0014 EA PDU 150 KVA 480-208/120 (Liebert PPA150C)	23,080.94	563.02
26 26 00 00-0015 EA PDU 150 KVA 208-208/120 (Liebert PPC150C)	24,012.29	563.02
26 26 00 00-0016 EA PDU 200 KVA 480-208/120 (Liebert PPA200C)	25,430.92	643.45
26 26 00 00-0017 EA PDU 225 KVA 480-208/120 (Liebert PPA225C)	26,714.11	723.88
26 26 00 00-0018 EA Ex Panelboard 10-30 KVA	976.30	80.44
26 26 00 00-0019 EA Ex Panelboard 50-125 KVA	1,451.14	100.54
26 26 00 00-0020 EA Ex Panelboard 150-220 KVA	3,229.88	120.65
26 26 00 00-0021 EA Remove And Reinstall, Power Distribution Unit	1,286.90	
Note: Includes disconnection / reconnection of branch circuits, storage and cleaning.		
26 26 00 00-0022 EA Start-Up Liebert Power Distribution Unit Line Item Applies To A Relocation Only	965.18	

26 27 Low-Voltage Distribution Equipment (26 20)

26 27 13 Electricity Metering (26 27)

26 27 13 00-0001 Revenue Metering (26 27 13)

26 27 13 00-0002 Meter Socket Base (26 27 13 00-0001)

Note: NEMA 3R.

26 27 13 00-0003 EA 100 Amp, 1 Phase, 3 Wire, 4 Terminal Meter Socket With Bypass	163.88	52.28
26 27 13 00-0004 EA 100 Amp, 1 Phase, 3 Wire, 5 Terminal Meter Socket With Bypass	172.66	52.28
26 27 13 00-0005 EA 200 Amp, 1 Phase, 3 Wire, 4 Terminal Meter Socket With Bypass	225.25	64.35
26 27 13 00-0006 EA 200 Amp, 1 Phase, 3 Wire, 5 Terminal Meter Socket With Bypass	227.75	64.35
26 27 13 00-0007 EA 200 Amp, 3 Phase, 4 Wire, 7 Terminal Meter Socket With Bypass And Jaw Release	418.92	72.39
26 27 13 00-0008 EA 320 Amp, 3 Phase, 4 Wire, 7 Terminal Meter Socket With Bypass, And Jaw Release	550.59	80.44
26 27 13 00-0009 EA 400 Amp, 3 Phase, 4 Wire, 7 Terminal Meter Socket With Bypass, And Jaw Release	1,315.14	88.47
26 27 13 00-0010 EA Combination Motor And Current Transformer Cabinet, 15-30 A, 13 Terminal, Underground, With Test Switch And Transformer - Socket Base	1,633.63	402.16

26 27 13 00-0011 Meter Device (26 27 13 00-0001)

Note: Direct read, with 15 minute demand.

26 27 13 00-0012 EA 100 To 200 Amp, 120 Volt, Or 240 Volt, 1 Phase, KWH Meter	151.15	16.09
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	<i>9.89</i>	
26 27 13 00-0013 EA 200 Amp, 120 Volt, Or 240 Volt, 3 Phase, KWH Meter	413.57	16.11
<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	<i>10.07</i>	

26 27 13 00-0014 Current Transformer Enclosure (26 27 13 00-0001)

26 27 13 00-0015 EA Current Transformer Cover, Screwed, 18" x 24" x 9", NEMA 3R	344.87	104.56
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26 27 13 00-0016 120/240 Volt Meter Center And Main Breaker, Indoor Housing (26 27 13 00-0001)

26 27 13 00-0017 800 Amp Bus, 4 Jaw Sockets, 125 Amp Max., 2 Pole (26 27 13 00-0016)

26 27 13 00-0018 EA 3 Meters And Main, 120/240 Volt, 800 Amp Bus, 4 Jaw Sockets, 125 Amp Max	583.43	50.27
26 27 13 00-0019 EA 4 Meters And Main, 120/240 Volt, 800 Amp Bus, 4 Jaw Sockets, 125 Amp Max	765.45	60.32
26 27 13 00-0020 EA 5 Meters And Main, 120/240 Volt, 800 Amp Bus, 4 Jaw Sockets, 125 Amp Max	946.51	70.38
26 27 13 00-0021 EA 6 Meters And Main, 120/240 Volt, 800 Amp Bus, 4 Jaw Sockets, 125 Amp Max	1,096.34	80.44
26 27 13 00-0022 EA 7 Meters And Main, 120/240 Volt, 800 Amp Bus, 4 Jaw Sockets, 125 Amp Max	1,421.33	90.49
26 27 13 00-0023 EA 8 Meters And Main, 120/240 Volt, 800 Amp Bus, 4 Jaw Sockets, 125 Amp Max	1,536.11	100.54
26 27 13 00-0024 EA 10 Meters And Main, 120/240 Volt, 800 Amp Bus, 4 Jaw Sockets, 125 Amp Max	1,794.12	120.65

26	Electrical
26 20	Low-Voltage Electrical Distribution
26 27	Low-Voltage Distribution Equipment



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 27 13 00-0025 1,200 Amp Bus, 4 Jaw Sockets, 200 Amp Max., 2 Pole <small>(26 27 13 00-0016)</small>		
26 27 13 00-0026 EA 3 Meters And Main, 120/240 Volt, 1,200 Amp Bus, 4 Jaw Sockets, 200 Amp Max	1,056.85	50.27
26 27 13 00-0027 EA 4 Meters And Main, 120/240 Volt, 1,200 Amp Bus, 4 Jaw Sockets, 200 Amp Max	1,389.41	60.32
26 27 13 00-0028 EA 6 Meters And Main, 120/240 Volt, 1,200 Amp Bus, 4 Jaw Sockets, 200 Amp Max	1,912.52	80.44
26 27 13 00-0029 EA 7 Meters And Main, 120/240 Volt, 1,200 Amp Bus, 4 Jaw Sockets, 200 Amp Max	2,121.99	90.49
26 27 13 00-0030 EA 8 Meters And Main, 120/240 Volt, 1,200 Amp Bus, 4 Jaw Sockets, 200 Amp Max	2,662.85	100.54
26 27 13 00-0031 800 Amp Bus, 4 Jaw Sockets, 42,000 AIC, 2 Pole <small>(26 27 13 00-0016)</small>		
26 27 13 00-0032 EA 3 Meters And Main, 120/240 Volt, 800 Amp Bus, 4 Jaw Sockets, 42,000 AIC	890.65	70.38
26 27 13 00-0033 EA 4 Meters And Main, 120/240 Volt, 800 Amp Bus, 4 Jaw Sockets, 42,000 AIC	1,164.51	80.44
26 27 13 00-0034 EA 5 Meters And Main, 120/240 Volt, 800 Amp Bus, 4 Jaw Sockets, 42,000 AIC	1,421.33	90.49
26 27 13 00-0035 EA 6 Meters And Main, 120/240 Volt, 800 Amp Bus, 4 Jaw Sockets, 42,000 AIC	1,668.67	100.54
26 27 13 00-0036 EA 7 Meters And Main, 120/240 Volt, 800 Amp Bus, 4 Jaw Sockets, 42,000 AIC	2,095.92	110.60
26 27 13 00-0037 EA 8 Meters And Main, 120/240 Volt, 800 Amp Bus, 4 Jaw Sockets, 42,000 AIC	2,201.26	120.65
26 27 13 00-0038 EA 10 Meters And Main, 120/240 Volt, 800 Amp Bus, 4 Jaw Sockets, 42,000 AIC	2,724.34	140.75
26 27 13 00-0039 1,200 Amp Bus, 4 Jaw Sockets, 42,000 AIC, 2 Pole <small>(26 27 13 00-0016)</small>		
26 27 13 00-0040 EA 3 Meters And Main, 120/240 Volt, 1,200 Amp Bus, 4 Jaw Sockets, 42,000 AIC	1,362.17	70.38
26 27 13 00-0041 EA 4 Meters And Main, 120/240 Volt, 1,200 Amp Bus, 4 Jaw Sockets, 42,000 AIC	1,779.95	80.44
26 27 13 00-0042 EA 6 Meters And Main, 120/240 Volt, 1,200 Amp Bus, 4 Jaw Sockets, 42,000 AIC	2,501.89	100.54
26 27 13 00-0043 EA 7 Meters And Main, 120/240 Volt, 1,200 Amp Bus, 4 Jaw Sockets, 42,000 AIC	2,682.96	110.60
26 27 13 00-0044 EA 8 Meters And Main, 120/240 Volt, 1,200 Amp Bus, 4 Jaw Sockets, 42,000 AIC	3,422.65	120.65
26 27 13 00-0045 120/208 Volt Meter Center And Main Breaker, Indoor Housing <small>(26 27 13 00-0001)</small>		
26 27 13 00-0046 800 Amp Bus, 5 Jaw Sockets, 125 A Max., 2 Pole <small>(26 27 13 00-0045)</small>		
26 27 13 00-0047 EA 3 Meters And Main, 120/208 Volt, 800 Amp Bus, 5 Jaw Sockets, 125 Amp Max	637.62	60.32
26 27 13 00-0048 EA 4 Meters And Main, 120/208 Volt, 800 Amp Bus, 5 Jaw Sockets, 125 Amp Max	830.05	70.38
26 27 13 00-0049 EA 5 Meters And Main, 120/208 Volt, 800 Amp Bus, 5 Jaw Sockets, 125 Amp Max	1,021.54	80.44
26 27 13 00-0050 EA 6 Meters And Main, 120/208 Volt, 800 Amp Bus, 5 Jaw Sockets, 125 Amp Max	1,184.62	90.49
26 27 13 00-0051 EA 7 Meters And Main, 120/208 Volt, 800 Amp Bus, 5 Jaw Sockets, 125 Amp Max	1,450.90	100.54
26 27 13 00-0052 EA 8 Meters And Main, 120/208 Volt, 800 Amp Bus, 5 Jaw Sockets, 125 Amp Max	1,565.69	110.60
26 27 13 00-0053 EA 10 Meters And Main, 120/208 Volt, 800 Amp Bus, 5 Jaw Sockets, 125 Amp Max	1,927.84	130.70
26 27 13 00-0054 1,200 Amp Bus, 5 Jaw Sockets, 10,000 AIC, 2 Pole <small>(26 27 13 00-0045)</small>		
26 27 13 00-0055 EA 3 Meters And Main, 120/208 Volt, 1,200 Amp Bus, 5 Jaw Sockets, 10,000 AIC	1,114.83	60.32
26 27 13 00-0056 EA 4 Meters And Main, 120/208 Volt, 1,200 Amp Bus, 5 Jaw Sockets, 10,000 AIC	1,466.33	70.38
26 27 13 00-0057 EA 6 Meters And Main, 120/208 Volt, 1,200 Amp Bus, 5 Jaw Sockets, 10,000 AIC	2,112.52	90.49
26 27 13 00-0058 EA 7 Meters And Main, 120/208 Volt, 1,200 Amp Bus, 5 Jaw Sockets, 10,000 AIC	2,321.99	100.54
26 27 13 00-0059 EA 8 Meters And Main, 120/208 Volt, 1,200 Amp Bus, 5 Jaw Sockets, 10,000 AIC	2,806.08	110.60
26 27 13 00-0060 800 Amp Bus, 5 Jaw Sockets, 42,000 AIC, 2 Pole <small>(26 27 13 00-0045)</small>		
26 27 13 00-0061 EA 3 Meters And Main, 120/208 Volt, 800 Amp Bus, 5 Jaw Sockets, 42,000 AIC	944.85	80.44
26 27 13 00-0062 EA 4 Meters And Main, 120/208 Volt, 800 Amp Bus, 5 Jaw Sockets, 42,000 AIC	1,222.51	90.49
26 27 13 00-0063 EA 5 Meters And Main, 120/208 Volt, 800 Amp Bus, 5 Jaw Sockets, 42,000 AIC	1,507.73	100.54
26 27 13 00-0064 EA 6 Meters And Main, 120/208 Volt, 800 Amp Bus, 5 Jaw Sockets, 42,000 AIC	1,755.09	110.60
26 27 13 00-0065 EA 7 Meters And Main, 120/208 Volt, 800 Amp Bus, 5 Jaw Sockets, 42,000 AIC	2,201.29	120.65
26 27 13 00-0066 EA 8 Meters And Main, 120/208 Volt, 800 Amp Bus, 5 Jaw Sockets, 42,000 AIC	2,306.58	130.70
26 27 13 00-0067 EA 10 Meters And Main, 120/208 Volt, 800 Amp Bus, 5 Jaw Sockets, 42,000 AIC	2,867.58	150.81
26 27 13 00-0068 1,200 Amp Bus, 5 Jaw Sockets, 42,000 AIC, 2 Pole <small>(26 27 13 00-0045)</small>		
26 27 13 00-0069 EA 3 Meters And Main, 120/208 Volt, 1,200 Amp Bus, 5 Jaw Sockets, 42,000 AIC	1,429.63	80.44
26 27 13 00-0070 EA 4 Meters And Main, 120/208 Volt, 1,200 Amp Bus, 5 Jaw Sockets, 42,000 AIC	1,875.83	90.49
26 27 13 00-0071 EA 6 Meters And Main, 120/208 Volt, 1,200 Amp Bus, 5 Jaw Sockets, 42,000 AIC	2,682.99	110.60
26 27 13 00-0072 EA 7 Meters And Main, 120/208 Volt, 1,200 Amp Bus, 5 Jaw Sockets, 42,000 AIC	2,807.24	120.65
26 27 13 00-0073 EA 8 Meters And Main, 120/208 Volt, 1,200 Amp Bus, 5 Jaw Sockets, 42,000 AIC	3,556.41	130.70
26 27 13 00-0074 120/240 Volt Meter Center And Main Breaker, NEMA 3R Housing <small>(26 27 13 00-0001)</small>		
26 27 13 00-0075 800 Amp Bus, 4 Jaw Sockets, 10,000 AIC, 2 Pole <small>(26 27 13 00-0074)</small>		
26 27 13 00-0076 EA 3 Meters And Main, 120/240 Volt, 800 Amp Bus, 4 Jaw Sockets, 10,000 AIC	583.43	50.27
26 27 13 00-0077 EA 4 Meters And Main, 120/240 Volt, 800 Amp Bus, 4 Jaw Sockets, 10,000 AIC	765.45	60.32
26 27 13 00-0078 EA 6 Meters And Main, 120/240 Volt, 800 Amp Bus, 4 Jaw Sockets, 10,000 AIC	1,096.34	80.44
26 27 13 00-0079 EA 7 Meters And Main, 120/240 Volt, 800 Amp Bus, 4 Jaw Sockets, 10,000 AIC	1,421.33	90.49
26 27 13 00-0080 EA 8 Meters And Main, 120/240 Volt, 800 Amp Bus, 4 Jaw Sockets, 10,000 AIC	1,753.88	100.54
26 27 13 00-0081 1,200 Amp Bus, 4 Jaw Sockets, 10,000 AIC, 2 Pole <small>(26 27 13 00-0074)</small>		
26 27 13 00-0082 EA 3 Meters And Main, 120/240 Volt, 1,200 Amp Bus, 4 Jaw Sockets, 10,000 AIC	1,056.85	50.27
26 27 13 00-0083 EA 4 Meters And Main, 120/240 Volt, 1,200 Amp Bus, 4 Jaw Sockets, 10,000 AIC	1,389.41	60.32
26 27 13 00-0084 EA 6 Meters And Main, 120/240 Volt, 1,200 Amp Bus, 4 Jaw Sockets, 10,000 AIC	2,007.19	80.44
26 27 13 00-0085 EA 7 Meters And Main, 120/240 Volt, 1,200 Amp Bus, 4 Jaw Sockets, 10,000 AIC	2,216.67	90.49



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 27 13 00-0086 EA 8 Meters And Main, 120/240 Volt, 1,200 Amp Bus, 4 Jaw Sockets, 10,000 AIC	2,662.85	100.54
26 27 13 00-0087 800 Amp Bus, 4 Jaw Sockets, 42,000 AIC, 2 Pole (26 27 13 00-0074)		
26 27 13 00-0088 EA 3 Meters And Main, 120/240 Volt, 800 Amp Bus, 4 Jaw Sockets, 42,000 AIC	890.65	70.38
26 27 13 00-0089 EA 4 Meters And Main, 120/240 Volt, 800 Amp Bus, 4 Jaw Sockets, 42,000 AIC	1,164.51	80.44
26 27 13 00-0090 EA 6 Meters And Main, 120/240 Volt, 800 Amp Bus, 4 Jaw Sockets, 42,000 AIC	1,668.67	100.54
26 27 13 00-0091 EA 7 Meters And Main, 120/240 Volt, 800 Amp Bus, 4 Jaw Sockets, 42,000 AIC	2,095.92	110.60
26 27 13 00-0092 EA 8 Meters And Main, 120/240 Volt, 800 Amp Bus, 4 Jaw Sockets, 42,000 AIC	2,201.26	120.65
26 27 13 00-0093 1,200 Amp Bus, 4 Jaw Sockets, 42,000 AIC, 2 Pole (26 27 13 00-0074)		
26 27 13 00-0094 EA 3 Meters And Main, 120/240 Volt, 1,200 Amp Bus, 4 Jaw Sockets, 42,000 AIC	1,362.18	70.38
26 27 13 00-0095 EA 4 Meters And Main, 120/240 Volt, 1,200 Amp Bus, 4 Jaw Sockets, 42,000 AIC	1,779.95	80.44
26 27 13 00-0096 EA 6 Meters And Main, 120/240 Volt, 1,200 Amp Bus, 4 Jaw Sockets, 42,000 AIC	2,501.89	100.54
26 27 13 00-0097 EA 7 Meters And Main, 120/240 Volt, 1,200 Amp Bus, 4 Jaw Sockets, 42,000 AIC	2,682.96	110.60
26 27 13 00-0098 EA 8 Meters And Main, 120/240 Volt, 1,200 Amp Bus, 4 Jaw Sockets, 42,000 AIC	3,422.68	120.65
26 27 13 00-0099 120/208 Volt Meter Center And Main Breaker, NEMA 3R Housing (26 27 13 00-0001)		
26 27 13 00-0100 800 Amp Bus, 5 Jaw Sockets, 10,000 AIC, 2 Pole (26 27 13 00-0099)		
26 27 13 00-0101 EA 3 Meters And Main, 120/208 Volt, 800 Amp Bus, 5 Jaw Sockets, 10,000 AIC	637.62	60.32
26 27 13 00-0102 EA 4 Meters And Main, 120/208 Volt, 800 Amp Bus, 5 Jaw Sockets, 10,000 AIC	830.05	70.38
26 27 13 00-0103 EA 6 Meters And Main, 120/208 Volt, 800 Amp Bus, 5 Jaw Sockets, 10,000 AIC	1,184.62	90.49
26 27 13 00-0104 EA 7 Meters And Main, 120/208 Volt, 800 Amp Bus, 5 Jaw Sockets, 10,000 AIC	1,545.58	100.54
26 27 13 00-0105 EA 8 Meters And Main, 120/208 Volt, 800 Amp Bus, 5 Jaw Sockets, 10,000 AIC	1,755.06	110.60
26 27 13 00-0106 1,200 Amp Bus, 5 Jaw Sockets, 10,000 AIC, 2 Pole (26 27 13 00-0099)		
26 27 13 00-0107 EA 3 Meters And Main, 120/208 Volt, 1,200 Amp Bus, 5 Jaw Sockets, 10,000 AIC	1,114.83	60.32
26 27 13 00-0108 EA 4 Meters And Main, 120/208 Volt, 1,200 Amp Bus, 5 Jaw Sockets, 10,000 AIC	1,466.32	70.38
26 27 13 00-0109 EA 6 Meters And Main, 120/208 Volt, 1,200 Amp Bus, 5 Jaw Sockets, 10,000 AIC	2,017.83	90.49
26 27 13 00-0110 EA 7 Meters And Main, 120/208 Volt, 1,200 Amp Bus, 5 Jaw Sockets, 10,000 AIC	2,227.30	100.54
26 27 13 00-0111 EA 8 Meters And Main, 120/208 Volt, 1,200 Amp Bus, 5 Jaw Sockets, 10,000 AIC	2,806.05	110.60
26 27 13 00-0112 800 Amp Bus, 5 Jaw Sockets, 42,000 AIC, 2 Pole (26 27 13 00-0099)		
26 27 13 00-0113 EA 3 Meters And Main, 120/208 Volt, 800 Amp Bus, 5 Jaw Sockets, 42,000 AIC	944.84	80.44
26 27 13 00-0114 EA 4 Meters And Main, 120/208 Volt, 800 Amp Bus, 5 Jaw Sockets, 42,000 AIC	1,222.49	90.49
26 27 13 00-0115 EA 6 Meters And Main, 120/208 Volt, 800 Amp Bus, 5 Jaw Sockets, 42,000 AIC	1,755.06	110.60
26 27 13 00-0116 EA 7 Meters And Main, 120/208 Volt, 800 Amp Bus, 5 Jaw Sockets, 42,000 AIC	2,201.26	120.65
26 27 13 00-0117 EA 8 Meters And Main, 120/208 Volt, 800 Amp Bus, 5 Jaw Sockets, 42,000 AIC	2,306.58	130.70
26 27 13 00-0118 1,200 Amp Bus, 5 Jaw Sockets, 42,000 AIC, 2 Pole (26 27 13 00-0099)		
26 27 13 00-0119 EA 3 Meters And Main, 120/208 Volt, 1,200 Amp Bus, 5 Jaw Sockets, 42,000 AIC	1,429.62	80.44
26 27 13 00-0120 EA 4 Meters And Main, 120/208 Volt, 1,200 Amp Bus, 5 Jaw Sockets, 42,000 AIC	1,875.81	90.49
26 27 13 00-0121 EA 6 Meters And Main, 120/208 Volt, 1,200 Amp Bus, 5 Jaw Sockets, 42,000 AIC	2,682.96	110.60
26 27 13 00-0122 EA 7 Meters And Main, 120/208 Volt, 1,200 Amp Bus, 5 Jaw Sockets, 42,000 AIC	2,807.24	120.65
26 27 13 00-0123 EA 8 Meters And Main, 120/208 Volt, 1,200 Amp Bus, 5 Jaw Sockets, 42,000 AIC	3,556.41	130.70
26 27 13 00-0124 Watt/Hour Meters (26 27 13)		
26 27 13 00-0125 EA Single Phase M-90 Meter, Socket, NEMA 3R Enclosure.....	632.19	48.26
26 27 13 00-0126 EA Three Phase M-90 Meter/Main Breaker Combination With Socket, NEMA 3R Enclosure.....	1,888.79	96.51
26 27 13 00-0127 EA Three Phase M-90 Meter In Line Secondary With Socket, NEMA 3R Enclosure	1,016.90	72.39
26 27 13 00-0128 EA Three Phase M-90 Meter, Primary Side Transformer Mount With Socket Totally Enclosed, NEMA 3R Enclosure	1,233.14	72.39
26 27 13 00-0129 EA Three Phase M-90 Meter, Primary Side Pole Mount With Socket, NEMA 3R Enclosure.....	1,048.67	72.39
26 27 13 00-0130 EA C.T. For M-90 Meter On Primary Side, NEMA 3R Enclosure	704.20	66.75
26 27 13 00-0131 EA P.T. For M-90 Meter On Primary Side, NEMA 3R Enclosure.....	1,206.47	120.65
26 27 13 00-0132 Watt/Hour Meter Systems (26 27 13)		
Note: Includes NEMA 3R enclosure with C.T. and NEMA 3R C.T. enclosure. systems with main breakers include an additional NEMA 3R enclosure.		
26 27 13 00-0133 Watt/Hour Meter System Without Main Breaker (26 27 13 00-0132)		
26 27 13 00-0134 EA 400 Amp System; 200 Amp M-90 Meter And Enclosure.....	3,160.40	482.66
26 27 13 00-0135 EA 600-800 Amp System; 200 Amp M-90 Meter And Enclosure.....	3,670.72	482.66
26 27 13 00-0136 Watt/Hour Meter System With Main Breaker (26 27 13 00-0132)		
26 27 13 00-0137 EA 400 Amp System; 400 Amp Main Breaker, 200 Amp M-90 Meter And Enclosure	5,400.98	482.66
26 27 13 00-0138 EA 600 Amp System; 600 Amp Main Breaker, 200 Amp M-90 Meter And Enclosure	6,513.78	482.66
26 27 13 00-0139 EA 800 Amp System; 800 Amp Main Breaker, 200 Amp M-90 Meter And Enclosure	6,985.71	482.66
26 27 16 Electrical Cabinets And Enclosures (26 27)		
Note: Can be used as enclosure or pull/function boxes.		



MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

MINOR	CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 27 16 00-0001	NEMA 1 Enclosures ^(26 27 16)		
26 27 16 00-0002	Hinged Cover, Galvanized Steel NEMA 1 Enclosures ^(26 27 16 00-0001)		
26 27 16 00-0003	4" Depth, Hinged Cover, Galvanized Steel NEMA 1 Enclosures ^(26 27 16 00-0002)		
26 27 16 00-0004	EA 6" x 4" x 4" Hinged Cover, Galvanized Steel NEMA 1 Enclosure	51.45	16.09
26 27 16 00-0005	EA 6" x 6" x 4" Hinged Cover, Galvanized Steel NEMA 1 Enclosure	57.75	17.69
26 27 16 00-0006	EA 8" x 6" x 4" Hinged Cover, Galvanized Steel NEMA 1 Enclosure	64.11	19.30
26 27 16 00-0007	EA 8" x 8" x 4" Hinged Cover, Galvanized Steel NEMA 1 Enclosure	74.84	22.52
26 27 16 00-0008	EA 10" x 8" x 4" Hinged Cover, Galvanized Steel NEMA 1 Enclosure.....	81.57	24.13
26 27 16 00-0009	EA 10" x 10" x 4" Hinged Cover, Galvanized Steel NEMA 1 Enclosure.....	88.82	25.74
26 27 16 00-0010	EA 12" x 8" x 4" Hinged Cover, Galvanized Steel NEMA 1 Enclosure.....	88.56	25.74
26 27 16 00-0011	EA 12" x 10" x 4" Hinged Cover, Galvanized Steel NEMA 1 Enclosure.....	95.97	27.34
26 27 16 00-0012	EA 12" x 12" x 4" Hinged Cover, Galvanized Steel NEMA 1 Enclosure.....	103.77	28.96
26 27 16 00-0013	EA 16" x 12" x 4" Hinged Cover, Galvanized Steel NEMA 1 Enclosure.....	134.43	38.61
26 27 16 00-0014	EA 16" x 16" x 4" Hinged Cover, Galvanized Steel NEMA 1 Enclosure.....	163.10	46.65
26 27 16 00-0015	EA 18" x 12" x 4" Hinged Cover, Galvanized Steel NEMA 1 Enclosure.....	154.85	45.04
26 27 16 00-0016	6" Depth, Hinged Cover, Galvanized Steel NEMA 1 Enclosures ^(26 27 16 00-0002)		
26 27 16 00-0017	EA 6" x 6" x 6" Hinged Cover, Galvanized Steel NEMA 1 Enclosure	64.61	19.30
26 27 16 00-0018	EA 8" x 8" x 6" Hinged Cover, Galvanized Steel NEMA 1 Enclosure	78.56	22.52
26 27 16 00-0019	EA 10" x 8" x 6" Hinged Cover, Galvanized Steel NEMA 1 Enclosure.....	93.73	27.34
26 27 16 00-0020	EA 10" x 10" x 6" Hinged Cover, Galvanized Steel NEMA 1 Enclosure.....	101.33	28.96
26 27 16 00-0021	EA 12" x 10" x 6" Hinged Cover, Galvanized Steel NEMA 1 Enclosure.....	109.10	30.56
26 27 16 00-0022	EA 12" x 12" x 6" Hinged Cover, Galvanized Steel NEMA 1 Enclosure.....	117.24	32.17
26 27 16 00-0023	EA 16" x 12" x 6" Hinged Cover, Galvanized Steel NEMA 1 Enclosure.....	148.74	41.83
26 27 16 00-0024	EA 16" x 16" x 6" Hinged Cover, Galvanized Steel NEMA 1 Enclosure.....	180.23	51.48
26 27 16 00-0025	EA 18" x 12" x 6" Hinged Cover, Galvanized Steel NEMA 1 Enclosure.....	173.78	49.87
26 27 16 00-0026	EA 18" x 18" x 6" Hinged Cover, Galvanized Steel NEMA 1 Enclosure.....	226.39	64.35
26 27 16 00-0027	EA 24" x 18" x 6" Hinged Cover, Galvanized Steel NEMA 1 Enclosure.....	291.67	74.00
26 27 16 00-0028	EA 24" x 24" x 6" Hinged Cover, Galvanized Steel NEMA 1 Enclosure.....	333.80	80.44
26 27 16 00-0029	EA 30" x 24" x 6" Hinged Cover, Galvanized Steel NEMA 1 Enclosure.....	372.15	85.26
26 27 16 00-0030	EA 36" x 24" x 6" Hinged Cover, Galvanized Steel NEMA 1 Enclosure.....	406.48	88.47
26 27 16 00-0031	Screw Cover, Galvanized Steel NEMA 1 Enclosures ^(26 27 16 00-0001)		
26 27 16 00-0032	3" Depth, Screw Cover, Galvanized Steel NEMA 1 Enclosures ^(26 27 16 00-0031)		
26 27 16 00-0033	EA 4" x 4" x 3" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	37.28	11.26
26 27 16 00-0034	EA 6" x 6" x 3" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	53.29	16.09
26 27 16 00-0035	EA 8" x 6" x 3" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	59.64	17.69
26 27 16 00-0036	4" Depth, Screw Cover, Galvanized Steel NEMA 1 Enclosures ^(26 27 16 00-0031)		
26 27 16 00-0037	EA 4" x 4" x 4" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	41.47	12.87
26 27 16 00-0038	EA 6" x 4" x 4" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	51.31	16.09
26 27 16 00-0039	EA 6" x 6" x 4" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	57.53	17.69
26 27 16 00-0040	EA 8" x 6" x 4" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	63.87	19.30
26 27 16 00-0041	EA 8" x 8" x 4" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	74.52	22.52
26 27 16 00-0042	EA 10" x 8" x 4" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	81.22	24.13
26 27 16 00-0043	EA 10" x 10" x 4" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	88.33	25.74
26 27 16 00-0044	EA 12" x 8" x 4" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	88.02	25.74
26 27 16 00-0045	EA 12" x 10" x 4" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	95.48	27.34
26 27 16 00-0046	EA 12" x 12" x 4" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	103.20	28.96
26 27 16 00-0047	EA 16" x 12" x 4" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	134.43	38.61
26 27 16 00-0048	EA 16" x 16" x 4" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	166.27	48.26
26 27 16 00-0049	EA 18" x 12" x 4" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	154.07	45.04
26 27 16 00-0050	EA 18" x 18" x 4" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	199.90	57.91
26 27 16 00-0051	EA 24" x 24" x 4" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	297.20	72.39
26 27 16 00-0052	6" Depth, Screw Cover, Galvanized Steel NEMA 1 Enclosures ^(26 27 16 00-0031)		
26 27 16 00-0053	EA 6" x 6" x 6" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	64.31	19.30
26 27 16 00-0054	EA 8" x 6" x 6" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	71.23	20.91
26 27 16 00-0055	EA 8" x 8" x 6" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	82.08	24.13
26 27 16 00-0056	EA 10" x 8" x 6" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	93.23	27.34
26 27 16 00-0057	EA 10" x 10" x 6" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	100.81	28.96
26 27 16 00-0058	EA 12" x 10" x 6" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	108.50	30.56
26 27 16 00-0059	EA 12" x 12" x 6" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	116.55	32.17
26 27 16 00-0060	EA 16" x 12" x 6" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	148.74	41.83
26 27 16 00-0061	EA 16" x 16" x 6" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	182.68	51.48
26 27 16 00-0062	EA 18" x 12" x 6" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	172.90	49.87
26 27 16 00-0063	EA 18" x 18" x 6" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	225.19	64.35
26 27 16 00-0064	EA 24" x 18" x 6" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	286.12	74.00
26 27 16 00-0065	EA 24" x 24" x 6" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	331.25	80.44
26 27 16 00-0066	EA 30" x 24" x 6" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	358.86	85.26
26 27 16 00-0067	EA 36" x 24" x 6" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	396.20	88.47



	MINOR	CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 27 16 00-0068		8" Depth, Screw Cover, Galvanized Steel NEMA 1 Enclosures <small>(26 27 16 00-0031)</small>		
	EA	8" x 8" x 8" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	93.23	27.34
	EA	12" x 12" x 8" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	128.64	35.39
	EA	16" x 12" x 8" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	163.49	45.04
	EA	16" x 16" x 8" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	202.62	56.30
	EA	18" x 12" x 8" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	192.99	54.70
	EA	18" x 18" x 8" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	239.22	67.57
	EA	24" x 12" x 8" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	265.35	77.22
	EA	24" x 18" x 8" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	313.52	82.04
	EA	24" x 24" x 8" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	365.45	88.47
	EA	30" x 24" x 8" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	389.49	93.30
	EA	30" x 30" x 8" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	410.35	96.51
	EA	36" x 24" x 8" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	423.17	96.51
26 27 16 00-0081		10" Depth, Screw Cover, Galvanized Steel NEMA 1 Enclosures <small>(26 27 16 00-0031)</small>		
	EA	18" x 12" x 10" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	219.74	61.13
	EA	18" x 18" x 10" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	290.44	78.82
	EA	24" x 12" x 10" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	291.04	83.65
	EA	24" x 18" x 10" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	391.67	90.09
	EA	24" x 24" x 10" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	453.76	99.73
	EA	30" x 24" x 10" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	509.48	102.95
	EA	36" x 24" x 10" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	545.05	107.78
26 27 16 00-0089		12" Depth, Screw Cover, Galvanized Steel NEMA 1 Enclosures <small>(26 27 16 00-0031)</small>		
	EA	18" x 18" x 12" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	320.77	86.87
	EA	24" x 12" x 12" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	315.53	91.69
	EA	24" x 18" x 12" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	430.11	99.73
	EA	24" x 24" x 12" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	494.91	109.38
	EA	30" x 24" x 12" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	561.87	114.21
	EA	36" x 24" x 12" Screw Cover, Galvanized Steel NEMA 1 Enclosure.....	593.72	119.03
26 27 16 00-0096		NEMA 12 Enclosures <small>(26 27 16)</small>		
		Note: Dust-tight enclosures.		
26 27 16 00-0097		Hinged Cover, Galvanized Steel NEMA 12 Enclosures <small>(26 27 16 00-0096)</small>		
26 27 16 00-0098		4" Depth, Hinged Cover, Galvanized Steel NEMA 12 Enclosures <small>(26 27 16 00-0097)</small>		
	EA	4" x 4" x 4" Hinged Cover, Galvanized Steel NEMA 12 Enclosure.....	74.68	12.87
	EA	6" x 6" x 4" Hinged Cover, Galvanized Steel NEMA 12 Enclosure.....	97.11	17.69
	EA	8" x 8" x 4" Hinged Cover, Galvanized Steel NEMA 12 Enclosure.....	120.04	22.52
	EA	10" x 8" x 4" Hinged Cover, Galvanized Steel NEMA 12 Enclosure.....	130.00	24.13
	EA	12" x 6" x 4" Hinged Cover, Galvanized Steel NEMA 12 Enclosure.....	146.15	25.74
	EA	12" x 10" x 4" Hinged Cover, Galvanized Steel NEMA 12 Enclosure.....	157.49	27.34
26 27 16 00-0105		6" Depth, Hinged Cover, Galvanized Steel NEMA 12 Enclosures <small>(26 27 16 00-0097)</small>		
	EA	6" x 6" x 6" Hinged Cover, Galvanized Steel NEMA 12 Enclosure.....	107.87	19.30
	EA	8" x 6" x 6" Hinged Cover, Galvanized Steel NEMA 12 Enclosure.....	118.90	20.91
26 27 16 00-0108		Screw Cover, Galvanized Steel NEMA 12 Enclosures <small>(26 27 16 00-0096)</small>		
26 27 16 00-0109		4" Depth, Screw Cover, Galvanized Steel NEMA 12 Enclosures <small>(26 27 16 00-0108)</small>		
	EA	4" x 4" x 4" Screw Cover, Galvanized Steel NEMA 12 Enclosure.....	79.82	12.87
	EA	6" x 6" x 4" Screw Cover, Galvanized Steel NEMA 12 Enclosure.....	99.00	17.69
	EA	8" x 6" x 4" Screw Cover, Galvanized Steel NEMA 12 Enclosure.....	110.93	19.30
	EA	8" x 8" x 4" Screw Cover, Galvanized Steel NEMA 12 Enclosure.....	127.54	22.52
	EA	10" x 8" x 4" Screw Cover, Galvanized Steel NEMA 12 Enclosure.....	132.57	24.13
	EA	10" x 10" x 4" Screw Cover, Galvanized Steel NEMA 12 Enclosure.....	152.61	25.74
	EA	12" x 10" x 4" Screw Cover, Galvanized Steel NEMA 12 Enclosure.....	163.44	27.34
	EA	12" x 12" x 4" Screw Cover, Galvanized Steel NEMA 12 Enclosure.....	182.88	28.96
26 27 16 00-0118		6" Depth, Screw Cover, Galvanized Steel NEMA 12 Enclosures <small>(26 27 16 00-0108)</small>		
	EA	6" x 6" x 6" Screw Cover, Galvanized Steel NEMA 12 Enclosure.....	117.31	19.30
	EA	8" x 6" x 6" Screw Cover, Galvanized Steel NEMA 12 Enclosure.....	131.31	20.91
	EA	8" x 8" x 6" Screw Cover, Galvanized Steel NEMA 12 Enclosure.....	145.04	24.13
	EA	10" x 10" x 6" Screw Cover, Galvanized Steel NEMA 12 Enclosure.....	172.15	28.96
	EA	12" x 12" x 6" Screw Cover, Galvanized Steel NEMA 12 Enclosure.....	188.01	32.17
	EA	16" x 14" x 6" Screw Cover, Galvanized Steel NEMA 12 Enclosure.....	256.97	41.83
	EA	18" x 18" x 6" Screw Cover, Galvanized Steel NEMA 12 Enclosure.....	397.54	64.35
	EA	24" x 16" x 6" Screw Cover, Galvanized Steel NEMA 12 Enclosure.....	505.96	74.00
	EA	24" x 24" x 6" Screw Cover, Galvanized Steel NEMA 12 Enclosure.....	566.13	80.44
26 27 16 00-0128		8" Depth, Screw Cover, Galvanized Steel NEMA 12 Enclosures <small>(26 27 16 00-0108)</small>		
	EA	24" x 18" x 8" Screw Cover, Galvanized Steel NEMA 12 Enclosure.....	534.58	82.04

26 Electrical**26 20 Low-Voltage Electrical Distribution****26 27 Low-Voltage Distribution Equipment**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 27 16 00-0130	EA		24" x 24" x 8" Screw Cover, Galvanized Steel NEMA 12 Enclosure.....	607.35	88.47
26 27 16 00-0131	EA		30" x 24" x 8" Screw Cover, Galvanized Steel NEMA 12 Enclosure.....	661.94	93.30
26 27 16 00-0132	EA		30" x 30" x 8" Screw Cover, Galvanized Steel NEMA 12 Enclosure.....	720.70	96.51
26 27 16 00-0133	EA		36" x 24" x 8" Screw Cover, Galvanized Steel NEMA 12 Enclosure.....	712.69	96.51
26 27 16 00-0134			NEMA 3 Enclosures <small>(26 27 16)</small>		
			Note: Can be used underground or encased in concrete.		
26 27 16 00-0135			2" Depth, Screw Cover, Galvanized Cast Iron NEMA 3 Enclosures <small>(26 27 16 00-0134)</small>		
26 27 16 00-0136	EA		4" x 4" x 2" Screw Cover, Galvanized Cast Iron NEMA 3 Enclosure.....	209.94	56.30
26 27 16 00-0137			3" Depth, Screw Cover, Galvanized Cast Iron NEMA 3 Enclosures <small>(26 27 16 00-0134)</small>		
26 27 16 00-0138	EA		4" x 4" x 3" Screw Cover, Galvanized Cast Iron NEMA 3 Enclosure.....	225.34	56.30
26 27 16 00-0139	EA		5" x 5" x 3" Screw Cover, Galvanized Cast Iron NEMA 3 Enclosure.....	287.69	58.31
26 27 16 00-0140	EA		6" x 4" x 3" Screw Cover, Galvanized Cast Iron NEMA 3 Enclosure.....	298.17	58.31
26 27 16 00-0141	EA		6" x 6" x 3" Screw Cover, Galvanized Cast Iron NEMA 3 Enclosure.....	374.34	60.32
26 27 16 00-0142			4" Depth, Screw Cover, Galvanized Cast Iron NEMA 3 Enclosures <small>(26 27 16 00-0134)</small>		
26 27 16 00-0143	EA		4" x 4" x 4" Screw Cover, Galvanized Cast Iron NEMA 3 Enclosure.....	284.85	58.31
26 27 16 00-0144	EA		5" x 5" x 4" Screw Cover, Galvanized Cast Iron NEMA 3 Enclosure.....	312.26	58.31
26 27 16 00-0145	EA		6" x 4" x 4" Screw Cover, Galvanized Cast Iron NEMA 3 Enclosure.....	325.49	60.32
26 27 16 00-0146	EA		6" x 6" x 4" Screw Cover, Galvanized Cast Iron NEMA 3 Enclosure.....	409.68	60.32
26 27 16 00-0147	EA		8" x 6" x 4" Screw Cover, Galvanized Cast Iron NEMA 3 Enclosure.....	450.31	64.35
26 27 16 00-0148	EA		8" x 8" x 4" Screw Cover, Galvanized Cast Iron NEMA 3 Enclosure.....	484.71	68.37
26 27 16 00-0149	EA		10" x 6" x 4" Screw Cover, Galvanized Cast Iron NEMA 3 Enclosure.....	504.73	68.37
26 27 16 00-0150	EA		10" x 8" x 4" Screw Cover, Galvanized Cast Iron NEMA 3 Enclosure.....	600.01	70.38
26 27 16 00-0151	EA		12" x 6" x 4" Screw Cover, Galvanized Cast Iron NEMA 3 Enclosure.....	650.86	72.39
26 27 16 00-0152	EA		12" x 12" x 4" Screw Cover, Galvanized Cast Iron NEMA 3 Enclosure.....	890.80	80.44
26 27 16 00-0153			6" Depth, Screw Cover, Galvanized Cast Iron NEMA 3 Enclosures <small>(26 27 16 00-0134)</small>		
26 27 16 00-0154	EA		6" x 6" x 6" Screw Cover, Galvanized Cast Iron NEMA 3 Enclosure.....	432.65	62.33
26 27 16 00-0155	EA		8" x 6" x 6" Screw Cover, Galvanized Cast Iron NEMA 3 Enclosure.....	545.10	70.38
26 27 16 00-0156	EA		8" x 8" x 6" Screw Cover, Galvanized Cast Iron NEMA 3 Enclosure.....	638.55	72.39
26 27 16 00-0157	EA		10" x 8" x 6" Screw Cover, Galvanized Cast Iron NEMA 3 Enclosure.....	735.78	74.40
26 27 16 00-0158	EA		10" x 10" x 6" Screw Cover, Galvanized Cast Iron NEMA 3 Enclosure.....	783.00	74.40
26 27 16 00-0159	EA		12" x 8" x 6" Screw Cover, Galvanized Cast Iron NEMA 3 Enclosure.....	890.55	80.44
26 27 16 00-0160	EA		12" x 12" x 6" Screw Cover, Galvanized Cast Iron NEMA 3 Enclosure.....	1,030.09	90.49
26 27 16 00-0161	EA		16" x 6" x 6" Screw Cover, Galvanized Cast Iron NEMA 3 Enclosure.....	970.66	86.46
26 27 16 00-0162	EA		18" x 12" x 6" Screw Cover, Galvanized Cast Iron NEMA 3 Enclosure.....	1,887.09	160.86
26 27 16 00-0163	EA		18" x 18" x 6" Screw Cover, Galvanized Cast Iron NEMA 3 Enclosure.....	3,268.64	201.07
26 27 16 00-0164			8" Depth, Screw Cover, Galvanized Cast Iron NEMA 3 Enclosures <small>(26 27 16 00-0134)</small>		
26 27 16 00-0165	EA		8" x 8" x 8" Screw Cover, Galvanized Cast Iron NEMA 3 Enclosure.....	790.41	76.41
26 27 16 00-0166	EA		12" x 8" x 8" Screw Cover, Galvanized Cast Iron NEMA 3 Enclosure.....	1,188.48	100.54
26 27 16 00-0167	EA		12" x 12" x 8" Screw Cover, Galvanized Cast Iron NEMA 3 Enclosure.....	1,207.77	100.54
26 27 16 00-0168	EA		16" x 12" x 8" Screw Cover, Galvanized Cast Iron NEMA 3 Enclosure.....	1,636.40	150.81
26 27 16 00-0169	EA		18" x 12" x 8" Screw Cover, Galvanized Cast Iron NEMA 3 Enclosure.....	2,155.00	160.86
26 27 16 00-0170	EA		24" x 24" x 8" Screw Cover, Galvanized Cast Iron NEMA 3 Enclosure.....	5,467.55	281.51
26 27 16 00-0171			10" Depth, Screw Cover, Galvanized Cast Iron NEMA 3 Enclosures <small>(26 27 16 00-0134)</small>		
26 27 16 00-0172	EA		18" x 12" x 10" Screw Cover, Galvanized Cast Iron NEMA 3 Enclosure.....	2,873.35	201.07
26 27 16 00-0173			12" Depth, Screw Cover, Galvanized Cast Iron NEMA 3 Enclosures <small>(26 27 16 00-0134)</small>		
26 27 16 00-0174	EA		18" x 18" x 12" Screw Cover, Galvanized Cast Iron NEMA 3 Enclosure.....	4,418.67	241.30
26 27 16 00-0175	EA		24" x 12" x 12" Screw Cover, Galvanized Cast Iron NEMA 3 Enclosure.....	3,634.06	221.19
26 27 16 00-0176			NEMA 3R Enclosures <small>(26 27 16)</small>		
			Note: Rain-tight enclosures.		
26 27 16 00-0177			Hinged Cover, Galvanized Steel NEMA 3R Enclosures <small>(26 27 16 00-0176)</small>		
26 27 16 00-0178			6" Depth, Hinged Cover, Galvanized Steel NEMA 3R Enclosures <small>(26 27 16 00-0177)</small>		
26 27 16 00-0179	EA		12" x 10" x 6" Hinged Cover, Galvanized Steel NEMA 3R Enclosure.....	161.80	30.56
26 27 16 00-0180	EA		12" x 12" x 6" Hinged Cover, Galvanized Steel NEMA 3R Enclosure.....	174.52	32.17
26 27 16 00-0181	EA		16" x 12" x 6" Hinged Cover, Galvanized Steel NEMA 3R Enclosure.....	227.18	41.83
26 27 16 00-0182	EA		16" x 16" x 6" Hinged Cover, Galvanized Steel NEMA 3R Enclosure.....	272.34	51.48
26 27 16 00-0183	EA		18" x 18" x 6" Hinged Cover, Galvanized Steel NEMA 3R Enclosure.....	313.61	64.35
26 27 16 00-0184			8" Depth, Hinged Cover, Galvanized Steel NEMA 3R Enclosures <small>(26 27 16 00-0177)</small>		
26 27 16 00-0185	EA		24" x 20" x 8" Hinged Cover, Galvanized Steel NEMA 3R Enclosure.....	469.13	82.04
26 27 16 00-0186	EA		24" x 24" x 8" Hinged Cover, Galvanized Steel NEMA 3R Enclosure.....	519.14	88.47



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 27 16 00-0187 EA 30" x 24" x 8" Hinged Cover, Galvanized Steel NEMA 3R Enclosure.....	581.51	93.30
26 27 16 00-0188 EA 30" x 30" x 8" Hinged Cover, Galvanized Steel NEMA 3R Enclosure.....	610.90	96.51
26 27 16 00-0189 10" Depth, Hinged Cover, Galvanized Steel NEMA 3R Enclosures (26 27 16 00-0177)		
26 27 16 00-0190 EA 12" x 48" x 10" Hinged Cover, Galvanized Steel NEMA 3R Enclosure.....	580.80	99.73
26 27 16 00-0191 EA 12" x 54" x 10" Hinged Cover, Galvanized Steel NEMA 3R Enclosure.....	656.06	112.60
26 27 16 00-0192 EA 12" x 60" x 10" Hinged Cover, Galvanized Steel NEMA 3R Enclosure.....	726.39	124.67
26 27 16 00-0193 EA 12" x 66" x 10" Hinged Cover, Galvanized Steel NEMA 3R Enclosure.....	800.05	137.54
26 27 16 00-0194 EA 12" x 72" x 10" Hinged Cover, Galvanized Steel NEMA 3R Enclosure.....	871.18	149.60
26 27 16 00-0195 EA 18" x 18" x 10" Hinged Cover, Galvanized Steel NEMA 3R Enclosure.....	384.45	78.82
26 27 16 00-0196 EA 24" x 24" x 10" Hinged Cover, Galvanized Steel NEMA 3R Enclosure.....	580.80	99.73
26 27 16 00-0197 EA 30" x 24" x 10" Hinged Cover, Galvanized Steel NEMA 3R Enclosure.....	680.76	102.95
26 27 16 00-0198 EA 36" x 36" x 10" Hinged Cover, Galvanized Steel NEMA 3R Enclosure.....	853.67	112.60
26 27 16 00-0199 12" Depth, Hinged Cover, Galvanized Steel NEMA 3R Enclosures (26 27 16 00-0177)		
26 27 16 00-0200 EA 12" x 48" x 12" Hinged Cover, Galvanized Steel NEMA 3R Enclosure.....	555.46	79.62
26 27 16 00-0201 EA 12" x 54" x 12" Hinged Cover, Galvanized Steel NEMA 3R Enclosure.....	622.99	89.28
26 27 16 00-0202 EA 12" x 60" x 12" Hinged Cover, Galvanized Steel NEMA 3R Enclosure.....	689.72	98.93
26 27 16 00-0203 EA 12" x 66" x 12" Hinged Cover, Galvanized Steel NEMA 3R Enclosure.....	762.58	109.38
26 27 16 00-0204 EA 12" x 72" x 12" Hinged Cover, Galvanized Steel NEMA 3R Enclosure.....	830.12	119.03
26 27 16 00-0205 EA 18" x 24" x 12" Hinged Cover, Galvanized Steel NEMA 3R Enclosure.....	415.05	59.52
26 27 16 00-0206 EA 18" x 32" x 12" Hinged Cover, Galvanized Steel NEMA 3R Enclosure.....	555.46	79.62
26 27 16 00-0207 EA 18" x 36" x 12" Hinged Cover, Galvanized Steel NEMA 3R Enclosure.....	622.99	89.28
26 27 16 00-0208 EA 18" x 42" x 12" Hinged Cover, Galvanized Steel NEMA 3R Enclosure.....	729.22	104.56
26 27 16 00-0209 EA 18" x 48" x 12" Hinged Cover, Galvanized Steel NEMA 3R Enclosure.....	830.12	119.03
26 27 16 00-0210 EA 30" x 30" x 12" Hinged Cover, Galvanized Steel NEMA 3R Enclosure.....	790.94	117.43
26 27 16 00-0211 EA 36" x 24" x 12" Hinged Cover, Galvanized Steel NEMA 3R Enclosure.....	830.12	119.03
26 27 16 00-0212 EA 36" x 30" x 12" Hinged Cover, Galvanized Steel NEMA 3R Enclosure.....	872.98	122.25
26 27 16 00-0213 EA 36" x 36" x 12" Hinged Cover, Galvanized Steel NEMA 3R Enclosure.....	969.01	128.69
26 27 16 00-0214 EA 42" x 30" x 12" Hinged Cover, Galvanized Steel NEMA 3R Enclosure.....	1,048.94	135.12
26 27 16 00-0215 Screw Cover, Galvanized Steel NEMA 3R Enclosures (26 27 16 00-0176)		
26 27 16 00-0216 4" Depth, Screw Cover, Galvanized Steel NEMA 3R Enclosures (26 27 16 00-0215)		
26 27 16 00-0217 EA 4" x 4" x 4" Screw Cover, Galvanized Steel NEMA 3R Enclosure.....	49.33	12.87
26 27 16 00-0218 EA 6" x 4" x 4" Screw Cover, Galvanized Steel NEMA 3R Enclosure.....	59.53	16.09
26 27 16 00-0219 EA 6" x 6" x 4" Screw Cover, Galvanized Steel NEMA 3R Enclosure.....	65.75	17.69
26 27 16 00-0220 EA 8" x 6" x 4" Screw Cover, Galvanized Steel NEMA 3R Enclosure.....	72.97	19.30
26 27 16 00-0221 EA 8" x 8" x 4" Screw Cover, Galvanized Steel NEMA 3R Enclosure.....	84.71	22.52
26 27 16 00-0222 EA 10" x 8" x 4" Screw Cover, Galvanized Steel NEMA 3R Enclosure.....	92.41	24.13
26 27 16 00-0223 EA 10" x 10" x 4" Screw Cover, Galvanized Steel NEMA 3R Enclosure.....	100.82	25.74
26 27 16 00-0224 EA 12" x 8" x 4" Screw Cover, Galvanized Steel NEMA 3R Enclosure.....	100.35	25.74
26 27 16 00-0225 EA 12" x 10" x 4" Screw Cover, Galvanized Steel NEMA 3R Enclosure.....	109.84	27.34
26 27 16 00-0226 EA 12" x 12" x 4" Screw Cover, Galvanized Steel NEMA 3R Enclosure.....	118.24	28.96
26 27 16 00-0227 EA 18" x 12" x 4" Screw Cover, Galvanized Steel NEMA 3R Enclosure.....	178.37	45.04
26 27 16 00-0228 EA 18" x 18" x 4" Screw Cover, Galvanized Steel NEMA 3R Enclosure.....	238.37	57.91
26 27 16 00-0229 6" Depth, Screw Cover, Galvanized Steel NEMA 3R Enclosures (26 27 16 00-0215)		
26 27 16 00-0230 EA 6" x 6" x 6" Screw Cover, Galvanized Steel NEMA 3R Enclosure.....	68.28	19.30
26 27 16 00-0231 EA 8" x 8" x 6" Screw Cover, Galvanized Steel NEMA 3R Enclosure.....	93.68	24.13
26 27 16 00-0232 EA 10" x 8" x 6" Screw Cover, Galvanized Steel NEMA 3R Enclosure.....	106.12	27.34
26 27 16 00-0233 EA 10" x 10" x 6" Screw Cover, Galvanized Steel NEMA 3R Enclosure.....	115.17	28.96
26 27 16 00-0234 EA 12" x 8" x 6" Screw Cover, Galvanized Steel NEMA 3R Enclosure.....	114.48	28.96
26 27 16 00-0235 EA 12" x 10" x 6" Screw Cover, Galvanized Steel NEMA 3R Enclosure.....	124.09	30.56
26 27 16 00-0236 EA 12" x 12" x 6" Screw Cover, Galvanized Steel NEMA 3R Enclosure.....	133.80	32.17
26 27 16 00-0237 EA 16" x 12" x 6" Screw Cover, Galvanized Steel NEMA 3R Enclosure.....	174.65	41.83
26 27 16 00-0238 EA 18" x 12" x 6" Screw Cover, Galvanized Steel NEMA 3R Enclosure.....	200.68	49.87
26 27 16 00-0239 EA 18" x 18" x 6" Screw Cover, Galvanized Steel NEMA 3R Enclosure.....	268.26	64.35
26 27 16 00-0240 EA 24" x 12" x 6" Screw Cover, Galvanized Steel NEMA 3R Enclosure.....	279.60	69.17
26 27 16 00-0241 EA 24" x 18" x 6" Screw Cover, Galvanized Steel NEMA 3R Enclosure.....	320.73	74.00
26 27 16 00-0242 EA 24" x 24" x 6" Screw Cover, Galvanized Steel NEMA 3R Enclosure.....	361.91	80.44
26 27 16 00-0243 8" Depth, Screw Cover, Galvanized Steel NEMA 3R Enclosures (26 27 16 00-0215)		
26 27 16 00-0244 EA 12" x 12" x 8" Screw Cover, Galvanized Steel NEMA 3R Enclosure.....	149.89	35.39
26 27 16 00-0245 EA 18" x 12" x 8" Screw Cover, Galvanized Steel NEMA 3R Enclosure.....	216.32	54.70
26 27 16 00-0246 EA 18" x 18" x 8" Screw Cover, Galvanized Steel NEMA 3R Enclosure.....	296.91	70.78
26 27 16 00-0247 EA 24" x 18" x 8" Screw Cover, Galvanized Steel NEMA 3R Enclosure.....	354.85	82.04
26 27 16 00-0248 EA 24" x 24" x 8" Screw Cover, Galvanized Steel NEMA 3R Enclosure.....	402.48	88.47
26 27 16 00-0249 EA 30" x 24" x 8" Screw Cover, Galvanized Steel NEMA 3R Enclosure.....	448.27	93.30
26 27 16 00-0250 10" Depth, Screw Cover, Galvanized Steel NEMA 3R Enclosures (26 27 16 00-0215)		
26 27 16 00-0251 EA 18" x 18" x 10" Screw Cover, Galvanized Steel NEMA 3R Enclosure.....	327.38	78.82
26 27 16 00-0252 EA 24" x 24" x 10" Screw Cover, Galvanized Steel NEMA 3R Enclosure.....	442.02	99.73
26 27 16 00-0253 EA 30" x 24" x 10" Screw Cover, Galvanized Steel NEMA 3R Enclosure.....	486.41	102.95

26 Electrical**26 20 Low-Voltage Electrical Distribution****26 27 Low-Voltage Distribution Equipment**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 27 16 00-0254 12" Depth, Screw Cover, Galvanized Steel NEMA 3R Enclosures <small>(26 27 16 00-0215)</small>		
26 27 16 00-0255 EA 24" x 24" x 12" Screw Cover, Galvanized Steel NEMA 3R Enclosure	488.49	109.38
26 27 16 00-0256 EA 30" x 30" x 12" Screw Cover, Galvanized Steel NEMA 3R Enclosure	687.98	119.03
26 27 16 00-0257 EA 36" x 30" x 12" Screw Cover, Galvanized Steel NEMA 3R Enclosure	711.20	122.25
26 27 16 00-0258 EA 36" x 36" x 12" Screw Cover, Galvanized Steel NEMA 3R Enclosure	835.05	128.69
26 27 16 00-0259 NEMA 4 Enclosures <small>(26 27 16)</small>		
Note: Water-tight enclosures.		
26 27 16 00-0260 Hinge Cover, Painted Steel NEMA 4 Enclosures <small>(26 27 16 00-0259)</small>		
26 27 16 00-0261 EA 12" x 10" x 5" Hinge Cover, Painted Steel NEMA 4 Enclosure	198.11	28.96
26 27 16 00-0262 EA 10" x 8" x 6" Hinge Cover, Painted Steel NEMA 4 Enclosure	182.64	27.34
26 27 16 00-0263 EA 12" x 12" x 6" Hinge Cover, Painted Steel NEMA 4 Enclosure	212.75	32.17
26 27 16 00-0264 EA 14" x 12" x 6" Hinge Cover, Painted Steel NEMA 4 Enclosure	250.85	37.00
26 27 16 00-0265 EA 16" x 14" x 6" Hinge Cover, Painted Steel NEMA 4 Enclosure	302.96	46.65
26 27 16 00-0266 NEMA 4X Enclosures <small>(26 27 16)</small>		
Note: Water-tight enclosures.		
26 27 16 00-0267 Clamp Cover, 304 Stainless Steel NEMA 4X Enclosures <small>(26 27 16 00-0266)</small>		
26 27 16 00-0268 EA 10" x 8" x 4" Clamp Cover, 304 Stainless Steel NEMA 4X Enclosure.....	332.87	24.13
<i>For 316L Stainless Steel, Add</i>		
	73.59	
26 27 16 00-0269 EA 12" x 10" x 6" Clamp Cover, 304 Stainless Steel NEMA 4X Enclosure.....	466.29	30.56
<i>For 316L Stainless Steel, Add</i>		
	105.27	
26 27 16 00-0270 EA 14" x 12" x 6" Clamp Cover, 304 Stainless Steel NEMA 4X Enclosure.....	580.67	37.00
<i>For 316L Stainless Steel, Add</i>		
	131.81	
26 27 16 00-0271 EA 16" x 14" x 6" Clamp Cover, 304 Stainless Steel NEMA 4X Enclosure.....	701.20	46.65
<i>For 316L Stainless Steel, Add</i>		
	157.83	
26 27 16 00-0272 Screw Cover, Polycarbonate NEMA 4X Enclosures <small>(26 27 16 00-0266)</small>		
Note: NEMA 3R, 4, 4X and 12 rated.		
26 27 16 00-0273 EA 6" x 6" x 4" Screw Cover, Polycarbonate NEMA 4X Enclosure With Opaque Cover	85.45	17.69
26 27 16 00-0274 EA 8" x 6" x 4" Screw Cover, Polycarbonate NEMA 4X Enclosure With Opaque Cover	95.98	19.30
26 27 16 00-0275 EA 8" x 8" x 4" Screw Cover, Polycarbonate NEMA 4X Enclosure With Opaque Cover	109.98	22.52
26 27 16 00-0276 EA 10" x 8" x 4" Screw Cover, Polycarbonate NEMA 4X Enclosure With Opaque Cover	119.43	24.13
26 27 16 00-0277 EA 12" x 10" x 4" Screw Cover, Polycarbonate NEMA 4X Enclosure With Opaque Cover	137.77	27.34
26 27 16 00-0278 EA 10" x 8" x 6" Screw Cover, Polycarbonate NEMA 4X Enclosure With Opaque Cover	130.18	27.34
26 27 16 00-0279 EA 12" x 10" x 6" Screw Cover, Polycarbonate NEMA 4X Enclosure With Opaque Cover	151.21	30.56
26 27 16 00-0280 EA 14" x 12" x 6" Screw Cover, Polycarbonate NEMA 4X Enclosure With Opaque Cover	189.01	37.00
26 27 16 00-0281 EA 16" x 14" x 8" Screw Cover, Polycarbonate NEMA 4X Enclosure With Opaque Cover	242.72	50.67
26 27 16 00-0282 EA 18" x 16" x 10" Screw Cover, Polycarbonate NEMA 4X Enclosure With Opaque Cover	315.43	72.95
26 27 16 00-0283 EA 6" x 6" x 4" Screw Cover, Polycarbonate NEMA 4X Enclosure With Clear Cover	91.42	17.69
26 27 16 00-0284 EA 8" x 6" x 4" Screw Cover, Polycarbonate NEMA 4X Enclosure With Clear Cover	103.03	19.30
26 27 16 00-0285 EA 8" x 8" x 4" Screw Cover, Polycarbonate NEMA 4X Enclosure With Clear Cover	117.58	22.52
26 27 16 00-0286 EA 10" x 8" x 4" Screw Cover, Polycarbonate NEMA 4X Enclosure With Clear Cover	128.64	24.13
26 27 16 00-0287 EA 12" x 10" x 4" Screw Cover, Polycarbonate NEMA 4X Enclosure With Clear Cover	147.53	27.34
26 27 16 00-0288 EA 10" x 8" x 6" Screw Cover, Polycarbonate NEMA 4X Enclosure With Clear Cover	139.41	27.34
26 27 16 00-0289 EA 12" x 10" x 6" Screw Cover, Polycarbonate NEMA 4X Enclosure With Clear Cover.....	163.71	30.56
26 27 16 00-0290 EA 14" x 12" x 6" Screw Cover, Polycarbonate NEMA 4X Enclosure With Clear Cover.....	195.51	37.00
26 27 16 00-0291 EA 16" x 14" x 8" Screw Cover, Polycarbonate NEMA 4X Enclosure With Clear Cover.....	256.28	50.67
26 27 16 00-0292 EA 18" x 16" x 10" Screw Cover, Polycarbonate NEMA 4X Enclosure With Clear Cover.....	330.06	72.95
26 27 16 00-0293 Hinged Cover, Polycarbonate NEMA 4X Enclosures <small>(26 27 16 00-0266)</small>		
Note: NEMA 3R, 4, 4X and 12 rated.		
26 27 16 00-0294 EA 6" x 6" x 4" Hinged Cover, Polycarbonate NEMA 4X Enclosure With Opaque Cover.....	102.26	17.69
26 27 16 00-0295 EA 8" x 6" x 4" Hinged Cover, Polycarbonate NEMA 4X Enclosure With Opaque Cover.....	109.54	19.30
26 27 16 00-0296 EA 8" x 8" x 4" Hinged Cover, Polycarbonate NEMA 4X Enclosure With Opaque Cover.....	124.62	22.52
26 27 16 00-0297 EA 10" x 8" x 4" Hinged Cover, Polycarbonate NEMA 4X Enclosure With Opaque Cover.....	134.61	24.13
26 27 16 00-0298 EA 12" x 10" x 4" Hinged Cover, Polycarbonate NEMA 4X Enclosure With Opaque Cover.....	158.93	27.34
26 27 16 00-0299 EA 10" x 8" x 6" Hinged Cover, Polycarbonate NEMA 4X Enclosure With Opaque Cover.....	147.00	27.34
26 27 16 00-0300 EA 12" x 10" x 6" Hinged Cover, Polycarbonate NEMA 4X Enclosure With Opaque Cover.....	179.43	30.56
26 27 16 00-0301 EA 14" x 12" x 6" Hinged Cover, Polycarbonate NEMA 4X Enclosure With Opaque Cover.....	213.41	37.00
26 27 16 00-0302 EA 16" x 14" x 8" Hinged Cover, Polycarbonate NEMA 4X Enclosure With Opaque Cover.....	263.87	50.67
26 27 16 00-0303 EA 18" x 16" x 10" Hinged Cover, Polycarbonate NEMA 4X Enclosure With Opaque Cover.....	343.08	72.95
26 27 16 00-0304 EA 6" x 6" x 4" Hinged Cover, Polycarbonate NEMA 4X Enclosure With Clear Cover.....	106.60	17.69
26 27 16 00-0305 EA 8" x 6" x 4" Hinged Cover, Polycarbonate NEMA 4X Enclosure With Clear Cover.....	117.66	19.30
26 27 16 00-0306 EA 8" x 8" x 4" Hinged Cover, Polycarbonate NEMA 4X Enclosure With Clear Cover.....	132.21	22.52
26 27 16 00-0307 EA 10" x 8" x 4" Hinged Cover, Polycarbonate NEMA 4X Enclosure With Clear Cover.....	142.74	24.13
26 27 16 00-0308 EA 12" x 10" x 4" Hinged Cover, Polycarbonate NEMA 4X Enclosure With Clear Cover.....	169.77	27.34
26 27 16 00-0309 EA 10" x 8" x 6" Hinged Cover, Polycarbonate NEMA 4X Enclosure With Clear Cover.....	156.21	27.34
26 27 16 00-0310 EA 12" x 10" x 6" Hinged Cover, Polycarbonate NEMA 4X Enclosure With Clear Cover.....	190.82	30.56
26 27 16 00-0311 EA 14" x 12" x 6" Hinged Cover, Polycarbonate NEMA 4X Enclosure With Clear Cover.....	218.83	37.00
26 27 16 00-0312 EA 16" x 14" x 8" Hinged Cover, Polycarbonate NEMA 4X Enclosure With Clear Cover.....	281.75	50.67
26 27 16 00-0313 EA 18" x 16" x 10" Hinged Cover, Polycarbonate NEMA 4X Enclosure With Clear Cover.....	362.06	72.95



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 27 16 00-0314 Breaker Enclosures <small>(26 27 16)</small> See CSI section 26 24 16 00-0001 for lighting and power panel boards.		
26 27 16 00-0315 15 To 100 Amp, F-Frame Breaker Enclosures <small>(26 27 16 00-0314)</small>		
26 27 16 00-0316 EA NEMA 1, Painted Steel, 15 To 100 Amp, F-Frame Breaker Enclosure.....	306.35	64.35
26 27 16 00-0317 EA NEMA 3R, Painted Steel, 15 To 100 Amp, F-Frame Breaker Enclosure.....	598.69	64.35
26 27 16 00-0318 EA NEMA 3/3R/4/4X/5/12, Stainless Steel, 15 To 100 Amp, F-Frame Breaker Enclosure.....	1,522.08	88.47
26 27 16 00-0319 EA NEMA 7, Cast Aluminum, 15 To 100 Amp, F-Frame Breaker Enclosure.....	2,078.67	96.51
26 27 16 00-0320 EA NEMA 9, Cast Aluminum, 15 To 100 Amp, F-Frame Breaker Enclosure.....	1,498.69	96.51
26 27 16 00-0321 EA NEMA 12, Painted Steel, 15 To 100 Amp, F-Frame Breaker Enclosure.....	491.86	88.47
26 27 16 00-0322 15 To 250 Amp, H Or J-Frame Breaker Enclosures <small>(26 27 16 00-0314)</small>		
26 27 16 00-0323 EA NEMA 1, Painted Steel, 15 To 250 Amp, H Or J-Frame Breaker Enclosure.....	498.42	88.47
26 27 16 00-0324 EA NEMA 3R, Painted Steel, 15 To 250 Amp, H Or J-Frame Breaker Enclosure.....	966.56	88.47
26 27 16 00-0325 EA NEMA 3/3R/4/4X/5/12, Stainless Steel, 15 To 250 Amp, H Or J-Frame Breaker Enclosure.....	3,425.90	112.60
26 27 16 00-0326 EA NEMA 12, Painted Steel, 15 To 250 Amp, H Or J-Frame Breaker Enclosure.....	772.28	112.60
26 27 16 00-0327 125 To 400 Amp, L-Frame Breaker Enclosures <small>(26 27 16 00-0314)</small>		
26 27 16 00-0328 EA NEMA 1, Painted Steel, 125 To 400 Amp, L-Frame Breaker Enclosure.....	755.27	176.95
26 27 16 00-0329 EA NEMA 3R, Painted Steel, 125 To 400 Amp, L-Frame Breaker Enclosure.....	1,909.65	176.95
26 27 16 00-0330 EA NEMA 3/3R/4/4X/5/12, Stainless Steel, 125 To 400 Amp, L-Frame Breaker Enclosure.....	5,783.06	225.21
26 27 16 00-0331 EA NEMA 12, Painted Steel, 125 To 400 Amp, L-Frame Breaker Enclosure.....	1,299.16	225.21
26 27 16 00-0332 300 To 800 Amp, M-Frame Breaker Enclosures <small>(26 27 16 00-0314)</small>		
26 27 16 00-0333 EA NEMA 1, Painted Steel, 300 To 800 Amp, M-Frame Breaker Enclosure.....	1,485.01	337.81
26 27 16 00-0334 EA NEMA 3R, Painted Steel, 300 To 800 Amp, M-Frame Breaker Enclosure.....	2,705.13	337.81
26 27 16 00-0335 EA NEMA 3/3R/4/4X/5/12, Stainless Steel, 300 To 800 Amp, M-Frame Breaker Enclosure.....	10,386.08	434.33
26 27 16 00-0336 EA NEMA 12, Painted Steel, 300 To 800 Amp, M-Frame Breaker Enclosure.....	5,491.50	434.33
26 27 16 00-0337 250 To 1,200 Amp, P-Frame Breaker Enclosures <small>(26 27 16 00-0314)</small>		
26 27 16 00-0338 EA NEMA 1, Painted Steel, 250 To 1,200 Amp, P-Frame Breaker Enclosure.....	1,860.07	337.81
26 27 16 00-0339 EA NEMA 3R, Painted Steel, 250 To 1,200 Amp, P-Frame Breaker Enclosure.....	3,298.27	337.81
26 27 16 00-0340 EA NEMA 3R/5/12, Painted Steel, 250 To 1,200 Amp, P-Frame Breaker Enclosure.....	6,976.70	434.33
26 27 16 00-0341 Legend Plates <small>(26 27 16)</small>		
26 27 16 00-0342 EA 3" Phenolic Plastic Cabinet Legend Plate Engraved With 1/2" Letters.....	10.40	4.02
26 27 16 00-0343 EA 3" Engraved Aluminum Cabinet Legend Plate Engraved With 1/2" Letters.....	12.41	4.02
26 27 23 Indoor Service Poles <small>(26 27)</small>		
26 27 23 00-0001 Communication And Power Poles <small>(26 27 23)</small> Note: Includes separate compartments for power and communication cable. Includes removable cover plates with knock-outs for modular jacks and openings to accept modular furniture adapters for communication devices. Includes all necessary mounting plates and assemblies. Excludes electrical and communications wire, power outlets and communication devices. Wiremold Tele-Power Pole series.		
26 27 23 00-0002 Steel Communication And Power Poles <small>(26 27 23 00-0001)</small>		
26 27 23 00-0003 2-1/4" Width, Steel Communication And Power Poles <small>(26 27 23 00-0002)</small>		
26 27 23 00-0004 2-1/4" Width, Steel Communication And Power Poles <small>(26 27 23 00-0003)</small>		
26 27 23 00-0005 EA 2-1/4" x 2-5/16", 10'-5" Height, Enamel Finish, Steel Communication And Power Pole.....	212.77	35.66
26 27 23 00-0006 EA 2-1/4" x 2-5/16", 12'-5" Height, Enamel Finish, Steel Communication And Power Pole.....	231.14	35.66
26 27 23 00-0007 EA 2-1/4" x 2-5/16", 15'-5" Height, Enamel Finish, Steel Communication And Power Pole.....	252.40	35.66
26 27 23 00-0008 Additional Cover Plates For 2-1/4" Width, Steel Communication And Power Poles <small>(26 27 23 00-0003)</small> Note: Excludes receptacles, communication jacks and wiring.		
26 27 23 00-0009 EA Add-On Cover Plate For Two Duplex Receptacles And One Single Receptacle.....	45.95	7.35
26 27 23 00-0010 EA Add-On Cover Plate For Three Duplex Receptacles.....	37.76	7.35
26 27 23 00-0011 EA Add-On Cover Plate For Two Duplex Receptacles And One GFCI Receptacle.....	42.76	7.35
26 27 23 00-0012 EA Add-On Cover Plate For Data And A/V Modular Devices.....	31.68	7.35
26 27 23 00-0013 EA Add-On Radius Control Entrance End Fitting.....	26.09	7.35
26 27 23 00-0014 2-3/4" Width, Steel Communication And Power Poles <small>(26 27 23 00-0002)</small>		
26 27 23 00-0015 2-3/4" Width, Steel Communication And Power Poles <small>(26 27 23 00-0014)</small>		
26 27 23 00-0016 EA 2-3/4" x 1-17/32", 10'-5" Height, Enamel Finish, Steel Communication And Power Pole.....	275.78	35.66
26 27 23 00-0017 EA 2-3/4" x 1-17/32", 12'-5" Height, Enamel Finish, Steel Communication And Power Pole.....	315.27	35.66
26 27 23 00-0018 EA 2-3/4" x 1-17/32", 15'-5" Height, Enamel Finish, Steel Communication And Power Pole.....	336.59	35.66

26 Electrical**26 20 Low-Voltage Electrical Distribution****26 27 Low-Voltage Distribution Equipment**

MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
26 27 23 00-0019		Additional Cover Plates For 2-3/4" Width, Steel Communication And Power Poles <small>(26 27 23 00-0014)</small>			
		Note: Excludes receptacles and communication jacks.			
26 27 23 00-0020	EA	Add-On Cover Plate For One Single Receptacle.....	29.21		7.35
26 27 23 00-0021	EA	Add-On Cover Plate For One Duplex Receptacle.....	26.26		7.35
26 27 23 00-0022	EA	Add-On Cover Plate For Data And A/V Modular Devices	28.37		7.35
26 27 23 00-0023		3" Width, Steel Communication And Power Poles <small>(26 27 23 00-0002)</small>			
26 27 23 00-0024		3" Width, Steel Communication And Power Poles <small>(26 27 23 00-0023)</small>			
26 27 23 00-0025	EA	3" x 2-3/4", 10'-5" Height, Enamel Finish, Steel Communication And Power Pole.....	359.47		35.66
26 27 23 00-0026	EA	3" x 2-3/4", 12'-5" Height, Enamel Finish, Steel Communication And Power Pole.....	407.00		35.66
26 27 23 00-0027	EA	3" x 2-3/4", 15'-5" Height, Enamel Finish, Steel Communication And Power Pole.....	438.34		35.66
26 27 23 00-0028		Additional Cover Plates For 3" Width, Steel Communication And Power Poles <small>(26 27 23 00-0023)</small>			
		Note: Excludes receptacles and communication jacks.			
26 27 23 00-0029	EA	Add-On Cover Plate For One Single Receptacle.....	29.21		7.35
26 27 23 00-0030	EA	Add-On Cover Plate For One Duplex Receptacle.....	26.26		7.35
26 27 23 00-0031	EA	Add-On Cover Plate For Data And A/V Modular Devices	28.37		7.35
26 27 23 00-0032		Aluminum Communication And Power Poles <small>(26 27 23 00-0001)</small>			
26 27 23 00-0033		2-1/8" Width, Aluminum Communication And Power Poles <small>(26 27 23 00-0032)</small>			
26 27 23 00-0034		2-1/8" Width, Aluminum Communication And Power Poles <small>(26 27 23 00-0033)</small>			
26 27 23 00-0035	EA	2-1/8" x 2-3/8", 10'-5" Height, Satin Anodized Finish, Aluminum Communication And Power Pole.....	288.15		35.66
26 27 23 00-0036	EA	2-1/8" x 2-3/8", 12'-5" Height, Satin Anodized Finish, Aluminum Communication And Power Pole.....	321.38		35.66
26 27 23 00-0037	EA	2-1/8" x 2-3/8", 15'-5" Height, Satin Anodized Finish, Aluminum Communication And Power Pole.....	358.64		35.66
26 27 23 00-0038		Additional Cover Plates For 2-1/8" Width, Aluminum Communication And Power Poles <small>(26 27 23 00-0033)</small>			
26 27 23 00-0039	EA	Add-On Cover Plate For Two Duplex Receptacles And One Single Receptacle.....	44.70		7.35
26 27 23 00-0040	EA	Add-On Cover Plate For Three Duplex Receptacles	45.64		7.35
26 27 23 00-0041	EA	Add-On Cover Plate For Two Duplex Receptacles And One GFCI Receptacle	48.76		7.35
26 27 23 00-0042	EA	Add-On Cover Plate For Data And A/V Modular Devices	33.43		7.35
26 27 23 00-0043	EA	Add-On Radius Control Entrance End Fitting	26.09		7.35
26 27 23 00-0044		2-1/4" Width, Aluminum Communication And Power Poles <small>(26 27 23 00-0032)</small>			
26 27 23 00-0045	EA	2-1/4" x 2-5/16", 10'-2" Height, Satin Anodized Finish, Aluminum Communication And Power Pole.....	277.77		35.66
26 27 23 00-0046	EA	2-1/4" x 2-5/16", 12'-8" Height, Satin Anodized Finish, Aluminum Communication And Power Pole.....	311.85		35.66
26 27 23 00-0047	EA	2-1/4" x 2-5/16", 15'-2" Height, Satin Anodized Finish, Aluminum Communication And Power Pole.....	352.01		35.66
26 27 23 00-0048		5" Width, Aluminum Communication And Power Poles <small>(26 27 23 00-0032)</small>			
26 27 23 00-0049	EA	5" x 4-3/4", 10'-2" Height, Satin Anodized Finish, Aluminum Communication And Power Pole.....	581.38		35.66
26 27 23 00-0050	EA	5" x 4-3/4", 12'-8" Height, Satin Anodized Finish, Aluminum Communication And Power Pole.....	664.98		35.66
26 27 23 00-0051	EA	5" x 4-3/4", 15'-2" Height, Satin Anodized Finish, Aluminum Communication And Power Pole.....	758.61		35.66
26 27 23 00-0052		2" Diameter, Round Aluminum Communication And Power Pole <small>(26 27 23 00-0032)</small>			
26 27 23 00-0053	EA	2" Diameter, 10'-4" Height, Satin Anodized Finish, Aluminum Communication And Power Pole.....	315.86		35.66
26 27 23 00-0054	EA	2" Diameter, 10'-4" Height, Painted White Finish, Aluminum Communication And Power Pole.....	299.02		35.66
26 27 23 00-0055	EA	2" Diameter, 10'-4" Height, Polished Anodized Finish, Aluminum Communication And Power Pole.....	383.10		35.66
26 27 26		Wiring Devices <small>(26 27)</small>			
		Note: Includes device, installation, wire connections, support clips (where necessary) and testing. Assemblies include outlet device, cover plate, mounting and appropriate box.			
26 27 26 00-0001		Receptacles <small>(26 27 26)</small>			
26 27 26 00-0002		General Use Receptacles <small>(26 27 26 00-0001)</small>			
26 27 26 00-0003		Receptacle Assemblies <small>(26 27 26 00-0002)</small>			
		Note: Includes 4" square steel box, bracket, mud ring, receptacle and cover plate.			
26 27 26 00-0004	EA	1 Gang, 15 Amp, NEMA 5-15, Duplex Receptacle Assembly.....	63.83		28.56
26 27 26 00-0005	EA	1 Gang, 20 Amp, NEMA 5-20, Duplex Receptacle Assembly.....	68.27		30.56
26 27 26 00-0006	EA	2 Gang, 15 Amp, NEMA 5-15, Duplex Receptacle Assembly.....	81.80		36.59
26 27 26 00-0007	EA	2 Gang, 20 Amp, NEMA 5-20, Duplex Receptacle Assembly.....	90.68		40.61
26 27 26 00-0008	EA	1 Gang, 15 Amp, GFI, Duplex Receptacle Assembly	69.46		28.56
26 27 26 00-0009	EA	1 Gang, 20 Amp, GFI, Duplex Receptacle Assembly	74.21		30.56
26 27 26 00-0010		Receptacle Components <small>(26 27 26 00-0002)</small>			



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 27 26 00-0011 EA 15 Amp, NEMA 5-15, Single Receptacle, 125 Volt, 1 Phase.....	17.63	8.04
26 27 26 00-0012 EA 15 Amp, NEMA 5-15, Duplex Receptacle, 125 Volt, 1 Phase.....	17.30	8.04
26 27 26 00-0013 EA 15 Amp, Single Receptacle, 120/277 Volt, 3 Wire.....	19.24	8.04
26 27 26 00-0014 EA 15 Amp, Duplex Receptacle, 120/277 Volt, 3 Wire.....	20.36	8.04
26 27 26 00-0015 EA 15 Amp, NEMA 6-15, Single Receptacle, 250 Volt, 1 Phase.....	25.80	10.05
26 27 26 00-0016 EA 15 Amp, NEMA 6-15, Duplex Receptacle, 250 Volt, 1 Phase.....	29.48	10.05
26 27 26 00-0017 EA 20 Amp, NEMA 5-20, Single Receptacle, 125 Volt, 1 Phase.....	18.06	8.04
26 27 26 00-0018 EA 20 Amp, NEMA 5-20, Duplex Receptacle, 125 Volt, 1 Phase.....	17.71	8.04
26 27 26 00-0019 EA 20 Amp, Single Receptacle, 120/277 Volt.....	22.76	8.04
26 27 26 00-0020 EA 20 Amp, Duplex Receptacle, 120/277 Volt.....	20.00	8.04
26 27 26 00-0021 EA 20 Amp, NEMA 6-20, Single Receptacle, 250 Volt, 1 Phase.....	25.80	10.05
26 27 26 00-0022 EA 20 Amp, NEMA 6-20, Duplex Receptacle, 250 Volt, 1 Phase.....	29.48	10.05
26 27 26 00-0023 EA 20 Amp, NEMA 14-20, Single Receptacle, 125/250 Volt, 1 Phase.....	41.29	10.05
26 27 26 00-0024 EA 20 Amp, NEMA 15-20, Single Receptacle, 250 Volt, 3 Phase.....	41.29	10.05
26 27 26 00-0025 EA 25 Amp, Duplex Receptacle, 120/277 Volt.....	37.73	12.07
26 27 26 00-0026 Specialty Receptacles (26 27 26 00-0001)		
26 27 26 00-0027 Specialty (26 27 26 00-0026)		
26 27 26 00-0028 EA 30 Amp, NEMA 5-30, Single Receptacle, 125 Volt, 1 Phase.....	36.50	14.07
26 27 26 00-0029 EA 30 Amp, NEMA 6-30, Single Receptacle, 250 Volt, 1 Phase.....	36.50	14.07
26 27 26 00-0030 EA 30 Amp, NEMA 10-30 Single Receptacles, 125/250 Volt.....	48.99	14.07
26 27 26 00-0031 EA 30 Amp, NEMA 14-30, Single Receptacle, 125/250 Volt, 1 Phase.....	49.33	14.07
26 27 26 00-0032 EA 30 Amp, NEMA 15-30, Single Receptacle, 250 Volt, 3 Phase.....	53.35	16.09
26 27 26 00-0033 EA 50 Amp, NEMA 5-50, Single Receptacle, 125 Volt, 1 Phase.....	50.29	16.09
26 27 26 00-0034 EA 50 Amp, NEMA 6-50, Single Receptacle, 250 Volt, 1 Phase.....	49.43	16.09
26 27 26 00-0035 EA 50 Amp, NEMA 7-50 Single Receptacles, 277 Volt.....	44.98	16.09
26 27 26 00-0036 EA 50 Amp, NEMA 10-50 Single Receptacles, 125/250 Volt.....	58.86	16.09
26 27 26 00-0037 EA 50 Amp, NEMA 14-50, Single Receptacle, 125/250 Volt, 1 Phase.....	58.05	16.09
26 27 26 00-0038 EA 50 Amp, NEMA 15-50, Single Receptacle, 250 Volt, 3 Phase.....	62.07	18.10
26 27 26 00-0039 EA 60 Amp, NEMA 14-60, Single Receptacle, 125/250 Volt, 1 Phase.....	68.45	20.11
26 27 26 00-0040 EA 60 Amp, NEMA 15-60, Single Receptacle, 250 Volt, 3 Phase.....	76.50	24.13
26 27 26 00-0041 EA 100 Amp, 3 Phase, 480 Volt Joy Receptacle With Box - Complete.....	692.27	189.02
26 27 26 00-0042 EA 400 Amp, 4 Pole Weatherproof Generator Receptacle With Box - Complete.....	1,503.40	231.24
26 27 26 00-0043 EA 30 Amp, Dryer Receptacle, 230 Volt.....	42.97	16.09
26 27 26 00-0044 EA 60 Amp, Range Receptacle, 230 Volt.....	63.39	24.13
26 27 26 00-0045 EA 15 Or 20 Amp, Clock Hanger Receptacle, 120/277 Volt.....	36.19	10.05
26 27 26 00-0046 EA Cable Reel With 20 Amp, 120 Volt Receptacle - Complete.....	765.21	245.08
26 27 26 00-0047 Isolated Ground Receptacles (26 27 26 00-0026)		
26 27 26 00-0048 EA 15 Amp, 125 Volt, NEMA 5-15R Isolated Ground Receptacle, Simplex.....	50.95	8.04
Note: 2 Pole, 3 wire.		
26 27 26 00-0049 EA 20 Amp, 120 Volt Isolated Ground Receptacles, Simplex.....	32.00	10.05
26 27 26 00-0050 EA 20 Amp, 120 Volt Isolated Ground Receptacles, Duplex.....	31.91	10.05
26 27 26 00-0051 EA 30 Amp, 120 Volt Isolated Ground Receptacles, Simplex.....	46.10	16.09
26 27 26 00-0052 EA Locking 15 Amp, 250 Volt Isolated Ground Receptacles.....	34.83	10.05
26 27 26 00-0053 EA Locking 15 Amp, 277 Volt Isolated Ground Receptacles.....	32.63	10.05
26 27 26 00-0054 EA Locking 20 Amp, 120/208 Volt Isolated Ground Receptacles.....	43.54	12.07
26 27 26 00-0055 EA Locking 20 Amp, 277/480 Volt Isolated Ground Receptacles.....	36.68	12.07
26 27 26 00-0056 EA Locking 20 Amp, 347/600 Volt Isolated Ground Receptacles.....	44.36	12.07
26 27 26 00-0057 EA Locking 30 Amp, 120/208 Volt Isolated Ground Receptacles.....	51.84	12.07
26 27 26 00-0058 EA Locking 30 Amp, 277 Volt Isolated Ground Receptacles.....	54.60	16.09
26 27 26 00-0059 Explosion Proof Receptacles (26 27 26 00-0026)		
26 27 26 00-0060 EA 1/2", 20 Amp, 2 Watt, 3 Pole, Type CPS Explosion Proof Receptacle Assembly.....	440.55	20.11
26 27 26 00-0061 EA 3/4", 20 Amp, 2 Watt, 3 Pole, Type CPS Explosion Proof Receptacle Assembly.....	414.17	22.12
26 27 26 00-0062 EA 3/4", 30 Amp, 2 Watt, 3 Pole, Type CES/CESD Explosion Proof Receptacle Assembly.....	680.22	40.21
26 27 26 00-0063 EA 3/4", 30 Amp, 3 Watt, 4 Pole, Type CES/CESD Explosion Proof Receptacle Assembly.....	850.94	40.21
26 27 26 00-0064 EA 1-1/4", 60 Amp, 2 Watt, 4 Pole, Type CES/CESD Explosion Proof Receptacle Assembly.....	1,082.09	60.32
26 27 26 00-0065 EA 1-1/4", 60 Amp, 3 Watt, 4 Pole, Type CES/CESD Explosion Proof Receptacle Assembly.....	1,048.30	60.32
26 27 26 00-0066 Ground Fault Circuit Interrupter (GFCI) (26 27 26 00-0026)		
26 27 26 00-0067 EA 15 Amp Ground Fault Circuit Interrupter (GFCI), Duplex Receptacle.....	20.91	10.05
26 27 26 00-0068 EA 20 Amp Ground Fault Circuit Interrupter (GFCI), Duplex Receptacle.....	31.69	12.07
26 27 26 00-0069 Locking Receptacle (26 27 26 00-0026)		
26 27 26 00-0070 EA Locking, 15 Amp, 250 Volt, NEMA L15-15 Power Receptacles, 2 Phase.....	41.85	10.05
26 27 26 00-0071 EA Locking, 15 Amp, 250 Volt, NEMA L16-15 Power Receptacles, 2 Phase.....	43.14	10.05
26 27 26 00-0072 EA Locking, 20 Amp, 125 Volt, NEMA L5-20 Power Receptacles.....	32.48	12.07
26 27 26 00-0073 EA Locking, 20 Amp, 250 Volt, NEMA L6-20 Power Receptacles.....	32.53	12.07
26 27 26 00-0074 EA Locking, 20 Amp, 480 Volt, NEMA L8-20 Power Receptacles.....	34.26	12.07
26 27 26 00-0075 EA Locking, 20 Amp, 600 Volt, NEMA L9-20 Power Receptacles.....	38.27	12.07
26 27 26 00-0076 EA Locking, 20 Amp, 125/250 Volt, NEMA L10-20 Power Receptacles.....	35.89	12.07
26 27 26 00-0077 EA Locking, 20 Amp, 125/250 Volt, NEMA L14-20 Power Receptacles.....	36.49	12.07
26 27 26 00-0078 EA Locking, 30 Amp, 120 Volt AC, NEMA L5-30 Power Receptacles.....	41.73	16.09

26	Electrical
26 20	Low-Voltage Electrical Distribution
26 27	Low-Voltage Distribution Equipment



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 27 26 00-0079	EA		Locking, 30 Amp, 250 Volt AC, NEMA L6-30 Power Receptacles.....	42.28	16.09
26 27 26 00-0080	EA		Locking, 30 Amp, 250 Volt, NEMA L15-30 Power Receptacles, 3 Phase.....	48.11	16.09
26 27 26 00-0081			Weathertight Pin And Sleeve Receptacle <small>(26 27 26 00-0026)</small>		
26 27 26 00-0082	EA		20 Amp, 2 Pole, 3 Wire, 125 Volt, Watertight Pin And Sleeve Receptacle (Hubbell 320R4W).....	164.94	40.21
26 27 26 00-0083	EA		20 Amp, 2 Pole, 3 Wire, 250 Volt, Watertight Pin And Sleeve Receptacle (Hubbell 320R6W).....	164.59	40.21
26 27 26 00-0084	EA		20 Amp, 2 Pole, 3 Wire, 480 Volt, Watertight Pin And Sleeve Receptacle (Hubbell 320R7W).....	171.18	40.21
26 27 26 00-0085	EA		20 Amp, 3 Pole, 4 Wire, 125/250 Volt, Watertight Pin And Sleeve Receptacle (Hubbell 420R12W).....	207.16	44.24
26 27 26 00-0086	EA		20 Amp, 3 Pole, 4 Wire, 250 Volt, Watertight Pin And Sleeve Receptacle (Hubbell 420R9W).....	207.71	44.24
26 27 26 00-0087	EA		20 Amp, 3 Pole, 4 Wire, 480 Volt, Watertight Pin And Sleeve Receptacle (Hubbell 420R7W).....	206.44	44.24
26 27 26 00-0088	EA		30 Amp, 2 Pole, 3 Wire, 125 Volt, Watertight Pin And Sleeve Receptacle (Hubbell 330R4W).....	246.21	49.46
26 27 26 00-0089	EA		30 Amp, 2 Pole, 3 Wire, 250 Volt, Watertight Pin And Sleeve Receptacle (Hubbell 330R6W).....	235.49	49.46
26 27 26 00-0090	EA		30 Amp, 2 Pole, 3 Wire, 480 Volt, Watertight Pin And Sleeve Receptacle (Hubbell 330R7W).....	252.27	49.46
26 27 26 00-0091	EA		30 Amp, 3 Pole, 4 Wire, 125/250 Volt, Watertight Pin And Sleeve Receptacle (Hubbell 430R12W).....	256.31	54.30
26 27 26 00-0092	EA		30 Amp, 3 Pole, 4 Wire, 250 Volt, Watertight Pin And Sleeve Receptacle (Hubbell 430R9W).....	256.10	54.30
26 27 26 00-0093	EA		30 Amp, 3 Pole, 4 Wire, 480 Volt, Watertight Pin And Sleeve Receptacle (Hubbell 430R7W).....	257.62	54.30
26 27 26 00-0094	EA		60 Amp, 2 Pole, 3 Wire, 125 Volt, Watertight Pin And Sleeve Receptacle (Hubbell 360R4W).....	356.42	64.35
26 27 26 00-0095	EA		60 Amp, 2 Pole, 3 Wire, 250 Volt, Watertight Pin And Sleeve Receptacle (Hubbell 360R6W).....	343.44	64.35
26 27 26 00-0096	EA		60 Amp, 2 Pole, 3 Wire, 480 Volt, Watertight Pin And Sleeve Receptacle (Hubbell 360R7W).....	351.89	64.35
26 27 26 00-0097	EA		60 Amp, 3 Pole, 4 Wire, 125/250 Volt, Watertight Pin And Sleeve Receptacle (Hubbell 460R12W).....	391.85	71.59
26 27 26 00-0098	EA		60 Amp, 3 Pole, 4 Wire, 250 Volt, Watertight Pin And Sleeve Receptacle (Hubbell 460R9W).....	392.10	71.59
26 27 26 00-0099	EA		60 Amp, 3 Pole, 4 Wire, 480 Volt, Watertight Pin And Sleeve Receptacle (Hubbell 460R7W).....	392.35	71.59
26 27 26 00-0100	EA		100 Amp, 2 Pole, 3 Wire, 250 Volt, Watertight Pin And Sleeve Receptacle (Hubbell 3100R6W).....	436.40	80.44
26 27 26 00-0101	EA		100 Amp, 2 Pole, 3 Wire, 480 Volt, Watertight Pin And Sleeve Receptacle (Hubbell 3100R7W).....	453.04	80.44
26 27 26 00-0102	EA		100 Amp, 3 Pole, 4 Wire, 125/250 Volt, Watertight Pin And Sleeve Receptacle (Hubbell 4100R12W).....	488.08	88.47
26 27 26 00-0103	EA		100 Amp, 3 Pole, 4 Wire, 250 Volt, Watertight Pin And Sleeve Receptacle (Hubbell 4100R9W).....	486.83	88.47
26 27 26 00-0104	EA		100 Amp, 3 Pole, 4 Wire, 480 Volt, Watertight Pin And Sleeve Receptacle (Hubbell 4100R7W).....	489.18	88.47
26 27 26 00-0105			Corrosion Resistant Receptacle <small>(26 27 26 00-0026)</small>		
26 27 26 00-0106	EA		15/20 Amp, 125 Volt Corrosion Resistant, Power Receptacles.....	35.73	8.04
26 27 26 00-0107	EA		15/20 Amp, 250 Volt Corrosion Resistant, Power Receptacles.....	66.52	10.05
26 27 26 00-0108			Tamper Resistant Receptacle <small>(26 27 26 00-0026)</small>		
26 27 26 00-0109	EA		15 Amp, 125 Volt Duplex Tamper Resistant Receptacle..... Note: Pass & Seymour 3232-TR.	19.01	8.04
26 27 26 00-0110	EA		20 Amp, 125 Volt Duplex Specification Grade Tamper Resistant Receptacle..... Note: Pass & Seymour TR20.	20.51	8.04
26 27 26 00-0111	EA		15 Amp, 125 Volt Single Specification Grade Tamper Resistant Receptacle..... Note: Pass & Seymour TR5251.	24.81	8.04
26 27 26 00-0112	EA		20 Amp, 125 Volt Single Specification Grade Tamper Resistant Receptacle..... Note: Pass & Seymour TR5351.	26.83	8.04
26 27 26 00-0113	EA		15 Amp, 125 Volt Duplex Ground Fault Circuit Interrupter (GFCI), Tamper Resistant Receptacle..... Note: Pass & Seymour S1595-TR*CC8.	38.97	8.04
26 27 26 00-0114	EA		15 Amp, 125 Volt Duplex Ground Fault Circuit Interrupter (GFCI), Specification Grade Tamper Resistant Receptacle..... Note: Pass & Seymour 1595-TRS.	41.86	8.04
26 27 26 00-0115	EA		20 Amp, 125 Volt Duplex Ground Fault Circuit Interrupter (GFCI), Specification Grade Tamper Resistant Receptacle..... Note: Pass & Seymour 2095-TRS.	44.62	8.04
26 27 26 00-0116			Television Receptacle <small>(26 27 26 00-0001)</small>		
26 27 26 00-0117	EA		TV Receptacle With Cover (Type F) - Complete.....	45.55	18.66
26 27 26 00-0118			Switches <small>(26 27 26)</small>		
26 27 26 00-0119			Switches <small>(26 27 26 00-0118)</small>		
26 27 26 00-0120			Switch Assemblies <small>(26 27 26 00-0119)</small>		
			Note: Includes 4" square steel box, bracket, mud ring, switch and cover plate.		
26 27 26 00-0121	EA		1 Gang, 15 Amp, 120/277 Volt, SPST, Switch Assembly.....	64.84	28.15
26 27 26 00-0122	EA		1 Gang, 20 Amp, 120/277 Volt, SPST, Switch Assembly.....	69.87	30.56
26 27 26 00-0123	EA		2 Gang, 15 Amp, 120/277 Volt, SPST, Switch Assembly.....	85.82	36.79
26 27 26 00-0124	EA		2 Gang, 20 Amp, 120/277 Volt, SPST, Switch Assembly.....	94.28	40.81
26 27 26 00-0125	EA		3 Gang, 15 Amp, 120/277 Volt, SPST, Switch Assembly.....	147.50	63.14
26 27 26 00-0126	EA		3 Gang, 20 Amp, 120/277 Volt, SPST, Switch Assembly.....	160.17	69.17
26 27 26 00-0127	EA		4 Gang, 15 Amp, 120/277 Volt, SPST, Switch Assembly.....	168.37	71.38
26 27 26 00-0128	EA		4 Gang, 20 Amp, 120/277 Volt, SPST, Switch Assembly.....	185.27	79.42
26 27 26 00-0129			Switch Components <small>(26 27 26 00-0119)</small>		
26 27 26 00-0130	EA		15 Amp, 120/277 Volt, SPST Switch.....	19.11	8.04
26 27 26 00-0131	EA		15 Amp, 120/277 Volt, 3-Way Switch.....	24.08	10.05
26 27 26 00-0132	EA		15 Amp, 120/277 Volt, 4-Way Switch.....	43.68	16.09
26 27 26 00-0133	EA		15 Amp, 120/277 Volt, DPST Switch.....	20.87	8.04
26 27 26 00-0134	EA		15 Amp, 120/277 Volt, Thermal Switch.....	35.12	10.05
26 27 26 00-0135	EA		20 Amp, 120/277 Volt, SPST Switch.....	23.33	10.05



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 27 26 00-0136 EA 20 Amp, 120/277 Volt, 3-Way Switch	28.54	12.07
26 27 26 00-0137 EA 20 Amp, 120/277 Volt, 4-Way Switch	54.13	16.09
26 27 26 00-0138 EA 20 Amp, 120/277 Volt, DPST Switch	26.15	10.05
26 27 26 00-0139 EA 20 Amp, 120/277 Volt, DPDT Switch	27.40	10.05
26 27 26 00-0140 EA 15 Amp, 120/277 Volt, Single Pole, Momentary Contact Switch, Toggle, Three Position, Center Off	45.87	10.07
26 27 26 00-0141 EA 15 Amp, 120/277 Volt, Momentary Contact Switch, Key Operated, Single Pole, Three Position, Center Off	57.29	10.07
26 27 26 00-0142 EA Momentary Contact Switch With Separate Neon Pilot	44.62	12.09
Note: Neon Pilot is 125 V, 1 / 125W.		
26 27 26 00-0143 EA 20 Amp, 125 Volt AC, Single Pole, Maintained Contact Switch With Center Off	34.41	14.07
Note: Or 250 VAC 10 Amp, double throw BAT handle.		
26 27 26 00-0144 EA 20 Amp, 125 Volt AC, Double Pole, Maintained Contact Switch	41.28	16.09
Note: Or 250 VAC 10 Amp, with center off double throw BAT handle.		
26 27 26 00-0145 EA 20 Amp, 125 Volt AC, Three Pole, Maintained Contact Switch	54.16	16.09
Note: Or 250 VAC 10 Amp, with center off double throw BAT handle.		
26 27 26 00-0146 EA 30 Amp, 120/277 Volt, Single Pole Local Switch	47.29	16.11
26 27 26 00-0147 EA 30 Amp, 120/277 Volt, Double Pole Local Switch	57.56	16.11
26 27 26 00-0148 EA 30 Amp, 120/277 Volt, Three-Way Local Switch	60.84	20.14
26 27 26 00-0149 EA 30 Amp, 120/277 Volt, Four-Way Local Switch	83.78	22.16
26 27 26 00-0150 EA 15 Amp, 120/277 Volt, Local Switch With Neon Pilot	43.23	13.17
26 27 26 00-0151 EA 15 Amp, 120/277 Volt, Local Switch With Separate Neon Pilot	58.88	13.17
Note: Neon pilot is 125V, 1/25W. Requires 2 gang installation.		
26 27 26 00-0152 EA 15 Amp, 120 Volt, Single Pole Lighted Toggle Switch, Clear Toggle, Lighted In On Position	52.14	13.17
26 27 26 00-0153 EA 15 Amp, 120 Volt, Lighted Toggle Switch, Ivory Toggle, Lighted In Off Position	49.81	13.17
26 27 26 00-0154 EA Automatic Door Switch, Door Open-Light On, 6 Amp, 125 Volt	51.94	6.53
26 27 26 00-0155 EA Automatic Door Switch, Door Closed-Light On, 6 Amp, 125 Volt	55.09	6.53
26 27 26 00-0156 EA 15 Amp, 120/277 Volt, Single Pole Momentary Contact Switch, Three Position, Center Off, Toggle	60.94	25.14
26 27 26 00-0157 EA Momentary Contact Switch, Three Position, Center Off, Key Operated	72.36	25.14
Note: 15A, 120/277 V, Single Pole		
26 27 26 00-0158 Specialty Switches (26 27 26 00-0118)		
26 27 26 00-0159 Dimmers With SPST Switch (26 27 26 00-0158)		
26 27 26 00-0160 EA 600 Watt Dimmers With SPST Switch	42.72	18.10
26 27 26 00-0161 EA 1,000 Watt Dimmers With SPST Switch	63.09	18.10
26 27 26 00-0162 EA 1,500 Watt Dimmers With SPST Switch	110.87	29.12
26 27 26 00-0163 EA 2,000 Watt Dimmers With SPST Switch	136.86	29.12
26 27 26 00-0164 EA 600 Watt Fluorescent Dimmer Switch	80.38	21.48
26 27 26 00-0165 EA 1,000 Watt Fluorescent Dimmer Switch	102.74	21.48
26 27 26 00-0166 EA 1,500 Watt Fluorescent Dimmer Switch	180.82	32.41
26 27 26 00-0167 EA Remote Speed Switch For Paddle Fan	67.95	26.78
26 27 26 00-0168 EA 600 Watt Combination Remote Speed Switch/Incandescent Dimmer	108.73	39.97
26 27 26 00-0169 Time Switches (26 27 26 00-0158)		
26 27 26 00-0170 EA 40 Amp, SPST, 125 Volt, Standard Time Switch	71.79	24.13
26 27 26 00-0171 EA 40 Amp, SPST, 277 Volt, Standard Time Switch	72.97	24.13
26 27 26 00-0172 EA 40 Amp, DPST, 125 Volt, Standard Time Switch	71.79	24.13
26 27 26 00-0173 EA 40 Amp, DPST, 277 Volt, Standard Time Switch	72.97	24.13
26 27 26 00-0174 EA 40 Amp, SPST, 125 Volt, 7-Day Time Switch	79.63	24.13
26 27 26 00-0175 EA 40 Amp, SPST, 277 Volt, 7-Day Time Switch	79.63	24.13
26 27 26 00-0176 EA 40 Amp, DPDT, 125 Volt, 7-Day Time Switch	125.91	24.13
26 27 26 00-0177 EA 40 Amp, DPDT, 277 Volt, 7-Day Time Switch	125.91	24.13
26 27 26 00-0178 EA 20 Amp, SPST, 125 Volt, Programmable Time Switch	111.06	24.13
26 27 26 00-0179 EA 20 Amp, SPST, 277 Volt, Programmable Time Switch	120.13	24.13
26 27 26 00-0180 EA 20 Amp, SPST, 277 Volt, Programmable Time Switch - Weatherproof	120.13	24.13
26 27 26 00-0181 EA 40 Amp, 4PST, 125 Volt, Astro Dial Time Switch	141.56	24.13
26 27 26 00-0182 EA 40 Amp, 4PST, 277 Volt, Astro Dial Time Switch	145.17	24.13
26 27 26 00-0183 EA 40 Amp, SPST, 125 Volt, Standard Time Switch - Weatherproof	71.79	24.13
26 27 26 00-0184 EA 40 Amp, SPST, 277 Volt, Standard Time Switch - Weatherproof	72.97	24.13
26 27 26 00-0185 EA 40 Amp, DPST, 125 Volt, Standard Time Switch - Weatherproof	71.79	24.13
26 27 26 00-0186 EA 40 Amp, DPST, 277 Volt, Standard Time Switch - Weatherproof	72.97	24.13
26 27 26 00-0187 EA 40 Amp, SPST, 125 Volt, 7-Day Time Switch - Weatherproof	79.63	24.13
26 27 26 00-0188 EA 40 Amp, SPST, 277 Volt, 7-Day Time Switch - Weatherproof	79.63	24.13
26 27 26 00-0189 EA 40 Amp, DPDT, 125 Volt, 7-Day Time Switch - Weatherproof	125.91	24.13
26 27 26 00-0190 EA 40 Amp, DPDT, 277 Volt, 7-Day Time Switch - Weatherproof	125.91	24.13
26 27 26 00-0191 EA 40 Amp, 4PST, 125 Volt, Astro Dial Time Switch - Weatherproof	141.56	24.13
26 27 26 00-0192 EA 40 Amp, 4PST, 277 Volt, Astro Dial Time Switch - Weatherproof	145.17	24.13
26 27 26 00-0193 Low Voltage Switching (26 27 26 00-0158)		
26 27 26 00-0194 EA 36 Pin Male Or Female Connector	92.16	8.04
26 27 26 00-0195 Other Switches (26 27 26 00-0158)		
26 27 26 00-0196 EA Locking Switch, SPST Concealed Devices	74.44	32.17
26 27 26 00-0197 EA Locking Switch, 3-Way Concealed Devices	75.10	32.17
26 27 26 00-0198 EA Emergency Off Switch, With 1 Non-Closing Contact, Circular, Red, With Guard	78.10	30.08
26 27 26 00-0199 EA 15 Amp Momentary Contact Switch	75.53	30.08
26 27 26 00-0200 EA 20 Amp Momentary Contact Switch	78.24	30.08

26 Electrical**26 20 Low-Voltage Electrical Distribution****26 27 Low-Voltage Distribution Equipment**
 MINOR
 CSI UOM DESCRIPTION

 TOTAL DIRECT DEMOLITION
 UNIT COST UNIT COST

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 27 26 00-0201			Plates And Covers (26 27 26)		
26 27 26 00-0202			Wall Plates (26 27 26 00-0201)		
26 27 26 00-0203			Nylon Wall Plates (26 27 26 00-0202)		
26 27 26 00-0204	EA		1 Gang Nylon Switch Plate	1.17	0.40
26 27 26 00-0205	EA		2 Gang Nylon Switch Plate	1.95	0.60
26 27 26 00-0206	EA		3 Gang Nylon Switch Plate	2.76	0.80
26 27 26 00-0207	EA		4 Gang Nylon Switch Plate	3.92	1.00
26 27 26 00-0208	EA		1 Gang Duplex Nylon Wall Plate	1.18	0.40
26 27 26 00-0209	EA		2 Gang Duplex Nylon Wall Plate	1.99	0.60
26 27 26 00-0210			Plastic Wall Plates (26 27 26 00-0202)		
26 27 26 00-0211	EA		1 Gang Plastic Switch Plate	1.10	0.40
26 27 26 00-0212	EA		2 Gang Plastic Switch Plate	1.80	0.60
26 27 26 00-0213	EA		3 Gang Plastic Switch Plate	2.52	0.80
26 27 26 00-0214	EA		4 Gang Plastic Switch Plate	3.92	1.00
26 27 26 00-0215	EA		1 Gang Duplex Plastic Wall Plate	1.10	0.40
26 27 26 00-0216	EA		2 Gang Duplex Plastic Wall Plate	1.81	0.60
26 27 26 00-0217			Brass Wall Plates (26 27 26 00-0202)		
26 27 26 00-0218	EA		1 Gang 0.04" Brass Switch Plate	10.67	1.82
26 27 26 00-0219	EA		2 Gang 0.04" Brass Switch Plate	19.48	2.10
26 27 26 00-0220	EA		3 Gang 0.04" Brass Switch Plate	28.21	2.34
26 27 26 00-0221	EA		4 Gang 0.04" Brass Switch Plate	43.46	2.54
26 27 26 00-0222	EA		5 Gang 0.04" Brass Switch Plate	52.77	2.70
26 27 26 00-0223	EA		6 Gang 0.04" Brass Switch Plate	60.96	2.82
26 27 26 00-0224	EA		1 Gang 0.04" Brass Duplex Receptacle Wall Plate	10.67	1.82
26 27 26 00-0225	EA		2 Gang 0.04" Brass Duplex Receptacle Wall Plate	22.69	2.10
26 27 26 00-0226	EA		3 Gang 0.04" Brass Duplex Receptacle Wall Plate	32.44	2.34
26 27 26 00-0227			Stainless Steel Wall Plates (26 27 26 00-0202)		
26 27 26 00-0228	EA		1 Gang, 302 Stainless Steel Switch Plate With Satin Finish	6.03	1.82
26 27 26 00-0229	EA		2 Gang, 302 Stainless Steel Switch Plate With Satin Finish	9.36	2.10
26 27 26 00-0230	EA		3 Gang, 302 Stainless Steel Switch Plate With Satin Finish	12.84	2.34
26 27 26 00-0231	EA		4 Gang, 302 Stainless Steel Switch Plate With Satin Finish	18.50	2.54
26 27 26 00-0232	EA		5 Gang, 302 Stainless Steel Switch Plate With Satin Finish	21.67	2.70
26 27 26 00-0233	EA		6 Gang, 302 Stainless Steel Switch Plate With Satin Finish	26.03	2.82
26 27 26 00-0234	EA		1 Gang, 302 Stainless Steel Duplex Receptacle Wall Plate With Satin Finish	6.54	1.82
26 27 26 00-0235	EA		2 Gang, 302 Stainless Steel Duplex Receptacle Wall Plate With Satin Finish	10.56	2.10
26 27 26 00-0236	EA		3 Gang, 302 Stainless Steel Duplex Receptacle Wall Plate With Satin Finish	16.81	2.34
26 27 26 00-0237	EA		4 Gang, 302 Stainless Steel Duplex Receptacle Wall Plate With Satin Finish	20.22	2.54
26 27 26 00-0238			Chrome Wall Plates (26 27 26 00-0202)		
26 27 26 00-0239	EA		1 Gang 0.040" Chrome Switch Plate With Chromium Finish	20.64	1.82
26 27 26 00-0240	EA		2 Gang 0.040" Chrome Switch Plate With Chromium Finish	38.16	2.10
26 27 26 00-0241	EA		3 Gang 0.040" Chrome Switch Plate With Chromium Finish	55.64	2.34
26 27 26 00-0242	EA		1 Gang 0.040" Chrome Duplex Receptacle Wall Plate With Chromium Finish	20.62	1.82
26 27 26 00-0243			Weatherproof Covers (26 27 26 00-0201)		
26 27 26 00-0244			Stamped Metallic Weatherproof Covers (26 27 26 00-0243)		
			Note: Includes electrostatically applied powder coating and neoprene gasket.		
26 27 26 00-0245	EA		Blank Cover, Single Gang, Stamped Metallic Weatherproof Cover (Killark® 1FBC)	8.16	0.40
26 27 26 00-0246	EA		Duplex Receptacle, Single Gang, Stamped Metallic Weatherproof Cover (Killark® 1FAC)	8.84	0.40
26 27 26 00-0247	EA		Single Receptacle, Single Gang, Stamped Metallic Weatherproof Cover (Killark® 1FRC)	8.84	0.40
26 27 26 00-0248	EA		Toggle Switch, Single Gang, Stamped Metallic Weatherproof Cover (Killark® 1FTC)	8.84	0.40
26 27 26 00-0249	EA		Blank Cover, Two Gang, Stamped Metallic Weatherproof Cover (Killark® 2FBC)	10.84	0.60
26 27 26 00-0250	EA		Duplex Receptacle, Two Gang, Stamped Metallic Weatherproof Cover (Killark® 2FAC)	12.31	0.60
26 27 26 00-0251	EA		Single Receptacle, Two Gang, Stamped Metallic Weatherproof Cover (Killark® 2FRC)	12.46	0.60
26 27 26 00-0252	EA		Toggle Switch, Two Gang, Stamped Metallic Weatherproof Cover (Killark® 2FTC)	12.46	0.60
26 27 26 00-0253	EA		Toggle Switch And Duplex Receptacle, Two Gang, Stamped Metallic Weatherproof Cover (Killark® 2FTAC)	16.94	0.60
26 27 26 00-0254	EA		Blank Cover, Three Gang, Stamped Metallic Weatherproof Cover (Killark® 3FB)	16.05	0.80
26 27 26 00-0255	EA		Toggle Switch, Three Gang, Stamped Metallic Weatherproof Cover (Killark® 3FT)	17.55	0.80
26 27 26 00-0256			Cast Metallic Weatherproof Covers (26 27 26 00-0243)		
			Note: Includes electrostatically applied powder coating and neoprene gasket.		
26 27 26 00-0257	EA		Blank Cover, Single Gang, Cast Metallic Weatherproof Cover (Killark® FSBC)	9.99	0.40
26 27 26 00-0258	EA		Duplex Receptacle, Single Gang, Cast Metallic Weatherproof Cover With Self Closing Lid (Killark® FCLA)	31.93	0.40
26 27 26 00-0259	EA		Single Receptacle, Single Gang, Cast Metallic Weatherproof Cover With Self Closing Lid (Killark® FCLR)	35.81	0.40
26 27 26 00-0260	EA		Guarded Toggle Switch, Single Gang, Cast Metallic Weatherproof Cover (Killark® FSTG)	9.92	0.40
26 27 26 00-0261	EA		Toggle Switch, Single Gang, Cast Metallic Weatherproof Cover With Self Closing Lid (Killark® FCLT)	27.07	0.40
26 27 26 00-0262	EA		Lever Operated Toggle Switch, Single Gang, Cast Metallic Weatherproof Cover (Killark® FSPT)	45.03	0.40
26 27 26 00-0263	EA		Plunger Operated Toggle Switch, Single Gang, Cast Metallic Weatherproof Cover (Killark® FST)	57.34	0.40



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 27 26 00-0264 EA Blank Cover, Two Gang, Cast Metallic Weatherproof Cover (Killark® 2FSBC).....	12.46	0.60
26 27 26 00-0265 EA Plunger Operated Toggle Switch, Two Gang, Cast Metallic Weatherproof Cover (Killark® 2FST)	90.57	0.60
26 27 26 00-0266 EA Blank Cover, Three Gang, Cast Metallic Weatherproof Cover (Killark® 3FSBC)	20.87	0.80
26 27 26 00-0267 EA Plunger Operated Toggle Switch, Three Gang, Cast Metallic Weatherproof Cover (Killark® 3FST).....	86.53	0.80
26 27 26 00-0268 Die Cast Aluminum Weatherproof Covers <small>(26 27 26 00-0243)</small>		
<small>Note: Includes electrostatically applied powder coating and neoprene gasket.</small>		
26 27 26 00-0269 EA Duplex Receptacle, Single Gang, Die Cast Aluminum Weatherproof Cover With Self Closing Lid (Bell® 5027)	3.49	0.40
26 27 26 00-0270 EA Single Receptacle, Single Gang, Die Cast Aluminum Weatherproof Cover With Self Closing Lid (Bell® 5026).....	4.48	0.40
26 27 26 00-0271 EA Duplex Receptacles, Two Gang, Die Cast Aluminum Weatherproof Cover With Self Closing Lid (Bell® 5032).....	6.01	0.60
26 27 26 00-0272 EA Toggle Switch, Two Gang, Die Cast Aluminum Weatherproof Cover With Self Closing Lid (Bell® 5041)	6.52	0.60
26 27 26 00-0273 EA Toggle Switch And Duplex Receptacle, Two Gang, Die Cast Aluminum Weatherproof Cover With Self Closing Lid (Bell® 5042)	6.52	0.60
26 27 26 00-0274 EA Toggle Switch And Single Receptacle, Two Gang, Die Cast Aluminum Weatherproof Cover With Self Closing Lid (Bell® 5043)	7.26	0.60
26 27 26 00-0275 Heavy Duty Die Cast Aluminum Weatherproof Covers <small>(26 27 26 00-0243)</small>		
<small>Note: Includes baked on lacquer finish and neoprene gasket.</small>		
26 27 26 00-0276 EA Duplex Receptacle, Single Gang, Heavy Duty Die Cast Aluminum Weatherproof Cover With Self Closing Lid (Pass & Seymour Legrand® 4510).....	35.55	0.40
26 27 26 00-0277 Polycarbonate Weatherproof Covers <small>(26 27 26 00-0243)</small>		
<small>Note: Includes neoprene gasket.</small>		
26 27 26 00-0278 EA Toggle Switch, Single Gang, Polycarbonate Weatherproof Cover With Tinted Lid (Bell® 5730).....	7.17	0.40
26 27 26 00-0279 EA Duplex Receptacle, Single Gang, Polycarbonate Weatherproof Cover With Tinted Lid (Bell® 5730)	7.17	0.40
26 27 26 00-0280 EA Single Receptacle, Single Gang, Polycarbonate Weatherproof Cover With Tinted Lid (Bell® 5730)	7.17	0.40
26 27 26 00-0281 EA Duplex Receptacle, Two Gang, Polycarbonate Weatherproof Cover With Tinted Lid (Bell® 5775)	8.87	0.60
26 27 26 00-0282 EA Toggle Switch And Single Receptacle, Two Gang, Polycarbonate Weatherproof Cover With Tinted Lid (Bell® 5775)	8.87	0.60
26 27 26 00-0283 High Impact Thermoplastic Weatherproof Covers <small>(26 27 26 00-0243)</small>		
<small>Note: Includes neoprene gasket.</small>		
26 27 26 00-0284 EA Duplex Receptacle, Single Gang, High Impact Thermoplastic Weatherproof Cover With Self Closing Lid (Hubbell® HBL522)	46.08	0.40
26 27 26 00-0285 Removal And Reinstallation Of Wiring Devices <small>(26 27 26)</small>		
<small>Note: Includes storage and cleaning.</small>		
26 27 26 00-0286 EA Remove And Reinstall Receptacle, Switch, Outlet Or Special System Device	52.91	
26 27 26 00-0287 EA Remove And Reinstall Receptacle Or Switch Outlet Cover Plate.....	6.71	
26 27 26 00-0288 In Line Midget Fuseholders <small>(26 27 26)</small>		
<small>See CSI section 26 28 13 00-0066 for fuses.</small>		
26 27 26 00-0289 EA Single Pole Water Resistant In Line Midget Fuseholder	52.79	
26 27 26 00-0290 EA Double Pole Water Resistant In Line Midget Fuseholder	113.10	
26 27 26 00-0291 Limit Switches <small>(26 27 26)</small>		
26 27 26 00-0292 Heavy Duty Precision Oiltight <small>(26 27 26 00-0291)</small>		
26 27 26 00-0293 Lever Arm, Plunger, Wobble Stick Type <small>(26 27 26 00-0292)</small>		
26 27 26 00-0294 EA Limit Switch, Heavy Duty, Lever Arm Weatherproof, 10 Amp Rated	265.99	50.67
26 27 73 Door Chimes <small>(26 27)</small>		
26 27 73 00-0001 Door Bell System <small>(26 27 73)</small>		
26 27 73 00-0002 EA Door Bell, Push-button And Transformer - Complete	398.70	167.54
26 27 73 00-0003 EA Visual Flashing Doorbell Indicator, Wire To Existing System - Complete	140.12	40.21
26 27 73 00-0004 EA Replacement Bell/Buzzer - Complete	59.82	20.11
<small>Note: Includes removal of existing.</small>		
26 28 Low-Voltage Circuit Protective Devices <small>(26 20)</small>		
26 28 13 Fuses <small>(26 28)</small>		
26 28 13 00-0001 Class RK1, Time Delay Fuses <small>(26 28 13)</small>		
26 28 13 00-0002 250 Volt AC, 200 kAmp I.R., Ferrule Type, Class RK1, Time Delay Fuses <small>(26 28 13 00-0001)</small>		
26 28 13 00-0003 EA 1 Amp, 250 Volt AC, 200 kAmp I.R., Ferrule Type, Class RK1, Time Delay Fuse.....	24.94	5.79
<small>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</small>		
	3.86	
26 28 13 00-0004 EA 2 Amp, 250 Volt AC, 200 kAmp I.R., Ferrule Type, Class RK1, Time Delay Fuse.....	23.49	5.79
<small>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</small>		
	3.86	
26 28 13 00-0005 EA 3 Amp, 250 Volt AC, 200 kAmp I.R., Ferrule Type, Class RK1, Time Delay Fuse.....	24.50	5.79
<small>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</small>		
	3.86	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 28 13 00-0046 EA 40 Amp, 600 Volt AC, 200 kAmp I.R., Ferrule Type, Class RK1, Time Delay Fuse..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	43.41 3.86	5.79
26 28 13 00-0047 EA 45 Amp, 600 Volt AC, 200 kAmp I.R., Ferrule Type, Class RK1, Time Delay Fuse..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	42.62 3.86	5.79
26 28 13 00-0048 EA 50 Amp, 600 Volt AC, 200 kAmp I.R., Ferrule Type, Class RK1, Time Delay Fuse..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	42.99 3.86	5.79
26 28 13 00-0049 EA 60 Amp, 600 Volt AC, 200 kAmp I.R., Ferrule Type, Class RK1, Time Delay Fuse..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	43.32 3.86	5.79
26 28 13 00-0050 600 Volt AC, 200 kAmp I.R., Blade Type, Class RK1, Time Delay Fuses <small>(26 28 13 00-0001)</small>		
26 28 13 00-0051 EA 70 Amp, 600 Volt AC, 200 kAmp I.R., Blade Type, Class RK1, Time Delay Fuse..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	79.37 4.83	7.24
26 28 13 00-0052 EA 80 Amp, 600 Volt AC, 200 kAmp I.R., Blade Type, Class RK1, Time Delay Fuse..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	81.60 5.31	7.96
26 28 13 00-0053 EA 90 Amp, 600 Volt AC, 200 kAmp I.R., Blade Type, Class RK1, Time Delay Fuse..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	81.18 5.31	7.96
26 28 13 00-0054 EA 100 Amp, 600 Volt AC, 200 kAmp I.R., Blade Type, Class RK1, Time Delay Fuse..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	81.51 5.31	7.96
26 28 13 00-0055 EA 110 Amp, 600 Volt AC, 200 kAmp I.R., Blade Type, Class RK1, Time Delay Fuse..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	145.85 5.31	7.96
26 28 13 00-0056 EA 125 Amp, 600 Volt AC, 200 kAmp I.R., Blade Type, Class RK1, Time Delay Fuse..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	147.98 5.31	7.96
26 28 13 00-0057 EA 150 Amp, 600 Volt AC, 200 kAmp I.R., Blade Type, Class RK1, Time Delay Fuse..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	147.13 6.52	9.81
26 28 13 00-0058 EA 200 Amp, 600 Volt AC, 200 kAmp I.R., Blade Type, Class RK1, Time Delay Fuse..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	146.78 6.52	9.81
26 28 13 00-0059 EA 250 Amp, 600 Volt AC, 200 kAmp I.R., Blade Type, Class RK1, Time Delay Fuse..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	275.00 6.52	9.81
26 28 13 00-0060 EA 300 Amp, 600 Volt AC, 200 kAmp I.R., Blade Type, Class RK1, Time Delay Fuse..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	277.83 7.96	11.99
26 28 13 00-0061 EA 350 Amp, 600 Volt AC, 200 kAmp I.R., Blade Type, Class RK1, Time Delay Fuse..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	312.47 7.96	11.99
26 28 13 00-0062 EA 400 Amp, 600 Volt AC, 200 kAmp I.R., Blade Type, Class RK1, Time Delay Fuse..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	283.72 7.96	11.99
26 28 13 00-0063 EA 450 Amp, 600 Volt AC, 200 kAmp I.R., Blade Type, Class RK1, Time Delay Fuse..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	504.40 7.96	11.99
26 28 13 00-0064 EA 500 Amp, 600 Volt AC, 200 kAmp I.R., Blade Type, Class RK1, Time Delay Fuse..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	451.44 9.65	14.47
26 28 13 00-0065 EA 600 Amp, 600 Volt AC, 200 kAmp I.R., Blade Type, Class RK1, Time Delay Fuse..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	394.76 9.65	14.47
26 28 13 00-0066 600 Volt AC, Class CC Midget Fuses <small>(26 28 13)</small> Note: 250/300 Volt DC.		
26 28 13 00-0067 EA 1 Amp, 600 Volt AC, Class CC Midget Fuse..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	28.25 3.86	5.79
26 28 13 00-0068 EA 2 Amp, 600 Volt AC, Class CC Midget Fuse..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	28.64 3.86	5.79
26 28 13 00-0069 EA 3 Amp, 600 Volt AC, Class CC Midget Fuse..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	28.53 3.86	5.79
26 28 13 00-0070 EA 5 Amp, 600 Volt AC, Class CC Midget Fuse..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	28.41 3.86	5.79
26 28 13 00-0071 EA 6 Amp, 600 Volt AC, Class CC Midget Fuse..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	30.22 3.86	5.79
26 28 13 00-0072 EA 8 Amp, 600 Volt AC, Class CC Midget Fuse..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	27.31 3.86	5.79
26 28 13 00-0073 EA 10 Amp, 600 Volt AC, Class CC Midget Fuse..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	30.73 3.86	5.79
26 28 13 00-0074 EA 15 Amp, 600 Volt AC, Class CC Midget Fuse..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	28.42 3.86	5.79
26 28 13 00-0075 EA 20 Amp, 600 Volt AC, Class CC Midget Fuse..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	27.94 3.86	5.79
26 28 13 00-0076 EA 25 Amp, 600 Volt AC, Class CC Midget Fuse..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	26.85 3.86	5.79
26 28 13 00-0077 EA 30 Amp, 600 Volt AC, Class CC Midget Fuse..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	27.78 3.86	5.79
26 28 13 00-0078 200,000 Ampere Interrupting Capacity, 600 Volt AC, Class J Bolted Fuse <small>(26 28 13)</small>		
26 28 13 00-0079 EA 1 Amp, 600 Volt AC, 200 kAmp I.R., Class J Bolted Fuse..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	34.44 2.42	4.02
26 28 13 00-0080 EA 3 Amp, 600 Volt AC, 200 kAmp I.R., Class J Bolted Fuse..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	34.69 2.42	4.02
26 28 13 00-0081 EA 6 Amp, 600 Volt AC, 200 kAmp I.R., Class J Bolted Fuse..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	30.54 2.90	4.82
26 28 13 00-0082 EA 10 Amp, 600 Volt AC, 200 kAmp I.R., Class J Bolted Fuse..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	30.94 3.62	6.03
26 28 13 00-0083 EA 15 Amp, 600 Volt AC, 200 kAmp I.R., Class J Bolted Fuse..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	31.54 3.62	6.03
26 28 13 00-0084 EA 20 Amp, 600 Volt AC, 200 kAmp I.R., Class J Bolted Fuse..... <i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	31.00 3.62	6.03

26 Electrical**26 20 Low-Voltage Electrical Distribution****26 28 Low-Voltage Circuit Protective Devices**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 28 13 00-0085	EA		25 Amp, 600 Volt AC, 200 kAmp I.R., Class J Bolted Fuse.....	39.65	8.04
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.83	
26 28 13 00-0086	EA		30 Amp, 600 Volt AC, 200 kAmp I.R., Class J Bolted Fuse.....	33.60	8.04
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.83	
26 28 13 00-0087	EA		35 Amp, 600 Volt AC, 200 kAmp I.R., Class J Bolted Fuse.....	56.19	8.04
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.83	
26 28 13 00-0088	EA		40 Amp, 600 Volt AC, 200 kAmp I.R., Class J Bolted Fuse.....	48.41	8.04
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.83	
26 28 13 00-0089	EA		45 Amp, 600 Volt AC, 200 kAmp I.R., Class J Bolted Fuse.....	55.00	8.04
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	4.83	
26 28 13 00-0090	EA		50 Amp, 600 Volt AC, 200 kAmp I.R., Class J Bolted Fuse.....	50.07	10.05
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	6.03	
26 28 13 00-0091	EA		60 Amp, 600 Volt AC, 200 kAmp I.R., Class J Bolted Fuse.....	49.23	10.05
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	6.03	
26 28 13 00-0092	EA		70 Amp, 600 Volt AC, 200 kAmp I.R., Class J Bolted Fuse.....	74.94	12.07
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	7.24	
26 28 13 00-0093	EA		80 Amp, 600 Volt AC, 200 kAmp I.R., Class J Bolted Fuse.....	79.56	12.07
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	7.24	
26 28 13 00-0094	EA		90 Amp, 600 Volt AC, 200 kAmp I.R., Class J Bolted Fuse.....	78.38	12.07
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	7.24	
26 28 13 00-0095	EA		100 Amp, 600 Volt AC, 200 kAmp I.R., Class J Bolted Fuse.....	70.14	14.07
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8.45	
26 28 13 00-0096	EA		110 Amp, 600 Volt AC, 200 kAmp I.R., Class J Bolted Fuse.....	156.31	14.07
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8.45	
26 28 13 00-0097	EA		125 Amp, 600 Volt AC, 200 kAmp I.R., Class J Bolted Fuse.....	133.72	14.07
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8.45	
26 28 13 00-0098	EA		150 Amp, 600 Volt AC, 200 kAmp I.R., Class J Bolted Fuse.....	128.63	16.09
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.65	
26 28 13 00-0099	EA		175 Amp, 600 Volt AC, 200 kAmp I.R., Class J Bolted Fuse.....	130.42	16.09
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.65	
26 28 13 00-0100	EA		200 Amp, 600 Volt AC, 200 kAmp I.R., Class J Bolted Fuse.....	109.42	16.09
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.65	
26 28 13 00-0101	EA		225 Amp, 600 Volt AC, 200 kAmp I.R., Class J Bolted Fuse.....	266.51	16.09
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.65	
26 28 13 00-0102	EA		250 Amp, 600 Volt AC, 200 kAmp I.R., Class J Bolted Fuse.....	246.90	16.09
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.65	
26 28 13 00-0103	EA		300 Amp, 600 Volt AC, 200 kAmp I.R., Class J Bolted Fuse.....	228.04	16.09
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.65	
26 28 13 00-0104	EA		350 Amp, 600 Volt AC, 200 kAmp I.R., Class J Bolted Fuse.....	248.11	16.09
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.65	
26 28 13 00-0105	EA		400 Amp, 600 Volt AC, 200 kAmp I.R., Class J Bolted Fuse.....	206.85	18.10
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.86	
26 28 13 00-0106	EA		450 Amp, 600 Volt AC, 200 kAmp I.R., Class J Bolted Fuse.....	430.87	18.10
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.86	
26 28 13 00-0107	EA		500 Amp, 600 Volt AC, 200 kAmp I.R., Class J Bolted Fuse.....	367.70	20.11
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	12.07	
26 28 13 00-0108	EA		600 Amp, 600 Volt AC, 200 kAmp I.R., Class J Bolted Fuse.....	275.67	20.11
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	12.07	
26 28 13 00-0109			600 Volt AC, 200 kAmp I.R., Class L Bolted Fuses <small>(26 28 13)</small>		
26 28 13 00-0110	EA		100 Amp, 600 Volt AC, 200 kAmp I.R., Class L Bolted Fuse.....	814.09	10.05
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	6.03	
26 28 13 00-0111	EA		150 Amp, 600 Volt AC, 200 kAmp I.R., Class L Bolted Fuse.....	815.69	10.05
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	6.03	
26 28 13 00-0112	EA		200 Amp, 600 Volt AC, 200 kAmp I.R., Class L Bolted Fuse.....	817.18	10.05
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	6.03	
26 28 13 00-0113	EA		250 Amp, 600 Volt AC, 200 kAmp I.R., Class L Bolted Fuse.....	815.48	12.07
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	7.24	
26 28 13 00-0114	EA		300 Amp, 600 Volt AC, 200 kAmp I.R., Class L Bolted Fuse.....	751.47	12.07
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	7.24	
26 28 13 00-0115	EA		350 Amp, 600 Volt AC, 200 kAmp I.R., Class L Bolted Fuse.....	804.61	14.07
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8.45	
26 28 13 00-0116	EA		400 Amp, 600 Volt AC, 200 kAmp I.R., Class L Bolted Fuse.....	741.07	14.07
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8.45	
26 28 13 00-0117	EA		450 Amp, 600 Volt AC, 200 kAmp I.R., Class L Bolted Fuse.....	828.09	14.07
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8.45	
26 28 13 00-0118	EA		500 Amp, 600 Volt AC, 200 kAmp I.R., Class L Bolted Fuse.....	812.05	14.07
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	8.45	
26 28 13 00-0119	EA		600 Amp, 600 Volt AC, 200 kAmp I.R., Class L Bolted Fuse.....	723.91	16.09
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.65	
26 28 13 00-0120	EA		601 Amp, 600 Volt AC, 200 kAmp I.R., Class L Bolted Fuse.....	743.19	16.09
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.65	
26 28 13 00-0121	EA		650 Amp, 600 Volt AC, 200 kAmp I.R., Class L Bolted Fuse.....	985.59	16.09
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.65	
26 28 13 00-0122	EA		700 Amp, 600 Volt AC, 200 kAmp I.R., Class L Bolted Fuse.....	720.41	16.09
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	9.65	
26 28 13 00-0123	EA		750 Amp, 600 Volt AC, 200 kAmp I.R., Class L Bolted Fuse.....	1,103.13	18.10
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.86	
26 28 13 00-0124	EA		800 Amp, 600 Volt AC, 200 kAmp I.R., Class L Bolted Fuse.....	639.01	18.10
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.86	
26 28 13 00-0125	EA		900 Amp, 600 Volt AC, 200 kAmp I.R., Class L Bolted Fuse.....	929.21	18.10
			<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	10.86	



Electrical	26	
Low-Voltage Electrical Distribution	26 20	26
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MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 28 13 00-0126 EA 1,000 Amp, 600 Volt AC, 200 kAmp I.R., Class L Bolted Fuse.....	628.41	18.10
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	10.86	
26 28 13 00-0127 EA 1,200 Amp, 600 Volt AC, 200 kAmp I.R., Class L Bolted Fuse.....	646.85	18.10
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	10.86	
26 28 13 00-0128 EA 1,350 Amp, 600 Volt AC, 200 kAmp I.R., Class L Bolted Fuse.....	1,427.49	18.10
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	10.86	
26 28 13 00-0129 EA 1,400 Amp, 600 Volt AC, 200 kAmp I.R., Class L Bolted Fuse.....	1,407.56	18.10
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	10.86	
26 28 13 00-0130 EA 1,500 Amp, 600 Volt AC, 200 kAmp I.R., Class L Bolted Fuse.....	1,270.78	18.10
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	10.86	
26 28 13 00-0131 EA 1,600 Amp, 600 Volt AC, 200 kAmp I.R., Class L Bolted Fuse.....	798.14	20.11
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	12.06	
26 28 13 00-0132 EA 1,800 Amp, 600 Volt AC, 200 kAmp I.R., Class L Bolted Fuse.....	1,680.78	20.11
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	12.06	
26 28 13 00-0133 EA 2,000 Amp, 600 Volt AC, 200 kAmp I.R., Class L Bolted Fuse.....	1,079.48	20.11
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	12.06	
26 28 13 00-0134 EA 2,500 Amp, 600 Volt AC, 200 kAmp I.R., Class L Bolted Fuse.....	1,455.90	20.11
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	12.06	
26 28 13 00-0135 EA 2,501 Amp, 600 Volt AC, 200 kAmp I.R., Class L Bolted Fuse.....	2,473.42	20.11
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	12.06	
26 28 13 00-0136 EA 3,000 Amp, 600 Volt AC, 200 kAmp I.R., Class L Bolted Fuse.....	1,622.89	22.12
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	13.27	
26 28 13 00-0137 EA 3,500 Amp, 600 Volt AC, 200 kAmp I.R., Class L Bolted Fuse.....	3,344.74	22.12
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	13.27	
26 28 13 00-0138 EA 3,800 Amp, 600 Volt AC, 200 kAmp I.R., Class L Bolted Fuse.....	3,879.35	22.12
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	13.27	
26 28 13 00-0139 EA 4,000 Amp, 600 Volt AC, 200 kAmp I.R., Class L Bolted Fuse.....	2,247.69	22.12
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	13.27	
26 28 13 00-0140 EA 5,000 Amp, 600 Volt AC, 200 kAmp I.R., Class L Bolted Fuse.....	3,541.03	22.12
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	13.27	
26 28 13 00-0141 EA 6,000 Amp, 600 Volt AC, 200 kAmp I.R., Class L Bolted Fuse.....	5,854.83	22.12
For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add	13.27	

26 28 16 Enclosed Switches And Circuit Breakers (26 28)

26 28 16 00-0001	Motor And Circuit Disconnects (26 28 16)		
	Note: Work includes mounting, material handling, uploading at job site and termination of all conductors entering and leaving the disconnect.		
26 28 16 00-0002	NEMA 1 Enclosure, Neutral Kit, Safety Switches (26 28 16 00-0001)		
26 28 16 00-0003	Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switches (26 28 16 00-0002)		
	Note: Includes fuses and neutral bar.		
26 28 16 00-0004	240 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switches (26 28 16 00-0003)		
26 28 16 00-0005	EA 30 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	285.53	80.44
26 28 16 00-0006	EA 60 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	443.19	96.92
26 28 16 00-0007	EA 100 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	605.38	113.41
26 28 16 00-0008	EA 200 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	1,039.67	178.56
26 28 16 00-0009	EA 400 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	2,191.51	277.49
26 28 16 00-0010	EA 600 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	3,649.60	410.20
26 28 16 00-0011	EA 800 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	4,964.25	482.58
26 28 16 00-0012	EA 1,200 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	6,649.07	563.02
26 28 16 00-0013	600 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switches (26 28 16 00-0003)		
26 28 16 00-0014	EA 30 Amp, 600 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	428.32	89.36
26 28 16 00-0015	EA 60 Amp, 600 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	516.75	107.70
26 28 16 00-0016	EA 100 Amp, 600 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	813.23	125.87
26 28 16 00-0017	EA 200 Amp, 600 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	1,204.79	198.67
26 28 16 00-0018	EA 400 Amp, 600 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	2,605.22	308.21
26 28 16 00-0019	EA 600 Amp, 600 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	4,056.47	455.56
26 28 16 00-0020	EA 800 Amp, 600 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	5,972.59	535.92
26 28 16 00-0021	EA 1,200 Amp, 600 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	8,139.69	625.59

26 Electrical**26 20 Low-Voltage Electrical Distribution****26 28 Low-Voltage Circuit Protective Devices**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 28 16 00-0022 240 Volt Class, 3 Phase, 3 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switches <small>(26 28 16 00-0003)</small>		
26 28 16 00-0023 EA 30 Amp, 240 Volt Class, 3 Phase, 3 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	408.48	126.28
26 28 16 00-0024 EA 60 Amp, 240 Volt Class, 3 Phase, 3 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	598.37	167.70
26 28 16 00-0025 EA 100 Amp, 240 Volt Class, 3 Phase, 3 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	798.21	186.20
26 28 16 00-0026 EA 200 Amp, 240 Volt Class, 3 Phase, 3 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	1,262.06	291.56
26 28 16 00-0027 EA 400 Amp, 240 Volt Class, 3 Phase, 3 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	2,597.52	478.56
26 28 16 00-0028 EA 600 Amp, 240 Volt Class, 3 Phase, 3 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	4,204.28	670.40
26 28 16 00-0029 600 Volt Class, 3 Phase, 3 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switches <small>(26 28 16 00-0003)</small>		
26 28 16 00-0030 EA 30 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	528.86	139.55
26 28 16 00-0031 EA 60 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	673.83	186.20
26 28 16 00-0032 EA 100 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	980.49	209.52
26 28 16 00-0033 EA 200 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	1,445.74	319.32
26 28 16 00-0034 EA 400 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	3,182.72	515.57
26 28 16 00-0035 EA 600 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	5,105.45	744.80
26 28 16 00-0036 EA 800 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	8,066.83	884.74
26 28 16 00-0037 EA 1,200 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	10,287.71	1,005.39
26 28 16 00-0038 240 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switches <small>(26 28 16 00-0003)</small>		
26 28 16 00-0039 EA 30 Amp, 240 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	396.51	126.28
26 28 16 00-0040 EA 60 Amp, 240 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	582.90	167.70
26 28 16 00-0041 EA 100 Amp, 240 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	770.05	186.20
26 28 16 00-0042 EA 200 Amp, 240 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	1,300.78	291.56
26 28 16 00-0043 EA 400 Amp, 240 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	2,815.72	478.56
26 28 16 00-0044 EA 600 Amp, 240 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	4,532.54	670.40
26 28 16 00-0045 EA 800 Amp, 240 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	7,451.34	844.53
26 28 16 00-0046 EA 1,200 Amp, 240 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	9,173.68	965.18
26 28 16 00-0047 600 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switches <small>(26 28 16 00-0003)</small>		
26 28 16 00-0048 EA 30 Amp, 600 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	572.79	139.55
26 28 16 00-0049 EA 60 Amp, 600 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	727.82	186.20
26 28 16 00-0050 EA 100 Amp, 600 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	1,059.43	209.52
26 28 16 00-0051 EA 200 Amp, 600 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	1,563.91	319.32
26 28 16 00-0052 EA 400 Amp, 600 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	3,434.86	515.57
26 28 16 00-0053 EA 600 Amp, 600 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	5,550.75	744.80
26 28 16 00-0054 EA 800 Amp, 600 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	8,806.14	884.74
26 28 16 00-0055 EA 1,200 Amp, 600 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	11,086.32	1,005.39
26 28 16 00-0056 Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switches <small>(26 28 16 00-0002)</small>		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 28 16 00-0057 240 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switches <small>(26 28 16 00-0056)</small>		
26 28 16 00-0058 EA 30 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	277.96	116.99
26 28 16 00-0059 EA 60 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	429.25	161.90
26 28 16 00-0060 EA 100 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	586.61	186.20
26 28 16 00-0061 EA 200 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	919.75	297.92
26 28 16 00-0062 EA 400 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	1,841.59	496.50
26 28 16 00-0063 EA 600 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	2,992.94	677.07
26 28 16 00-0064 EA 800 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	4,254.46	804.31
26 28 16 00-0065 EA 1,200 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	5,601.39	938.71
26 28 16 00-0066 600 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switches <small>(26 28 16 00-0056)</small>		
26 28 16 00-0067 EA 30 Amp, 600 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	307.01	128.45
26 28 16 00-0068 EA 60 Amp, 600 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	485.86	181.70
26 28 16 00-0069 EA 100 Amp, 600 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	662.56	206.87
26 28 16 00-0070 EA 200 Amp, 600 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	1,028.64	323.82
26 28 16 00-0071 EA 400 Amp, 600 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	1,981.32	531.98
26 28 16 00-0072 EA 600 Amp, 600 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	3,310.09	744.72
26 28 16 00-0073 EA 800 Amp, 600 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	4,706.39	804.31
26 28 16 00-0074 EA 1,200 Amp, 600 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	6,220.30	938.71
26 28 16 00-0075 240 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switches <small>(26 28 16 00-0056)</small>		
26 28 16 00-0076 EA 30 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	326.55	104.56
26 28 16 00-0077 EA 60 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	496.85	145.58
26 28 16 00-0078 EA 100 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	664.35	167.70
26 28 16 00-0079 EA 200 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	1,044.76	268.24
26 28 16 00-0080 EA 400 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	2,073.38	446.79
26 28 16 00-0081 EA 600 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	3,319.77	609.26
26 28 16 00-0082 EA 800 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	5,646.54	723.88
26 28 16 00-0083 EA 1,200 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	7,337.99	844.53
26 28 16 00-0084 480 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switches <small>(26 28 16 00-0056)</small>		
26 28 16 00-0085 EA 30 Amp, 480 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	356.54	115.42
26 28 16 00-0086 EA 60 Amp, 480 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	547.04	163.68
26 28 16 00-0087 EA 100 Amp, 480 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	725.11	186.20
26 28 16 00-0088 EA 200 Amp, 480 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	1,127.71	291.56
26 28 16 00-0089 EA 400 Amp, 480 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	2,221.48	478.56
26 28 16 00-0090 EA 600 Amp, 480 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	3,591.72	670.40
26 28 16 00-0091 EA 800 Amp, 480 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	5,945.41	723.88
26 28 16 00-0092 600 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switches <small>(26 28 16 00-0056)</small>		

26 Electrical**26 20 Low-Voltage Electrical Distribution****26 28 Low-Voltage Circuit Protective Devices**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 28 16 00-0093 EA 30 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch	378.83	115.58
26 28 16 00-0094 EA 60 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch	585.06	163.52
26 28 16 00-0095 EA 100 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch	786.93	186.20
26 28 16 00-0096 EA 200 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch	1,222.94	291.40
26 28 16 00-0097 EA 400 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch	2,354.70	478.72
26 28 16 00-0098 EA 600 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch	3,985.98	670.24
26 28 16 00-0099 EA 800 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch	6,395.62	723.88
26 28 16 00-0100 EA 1,200 Amp, 600 Volt Class, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch	8,346.38	844.53
26 28 16 00-0101 240 Volt Class, 3 Phase, 4 Wire, 4 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switches <small>(26 28 16 00-0056)</small>		
26 28 16 00-0102 EA 30 Amp, 240 Volt Class, 3 Phase, 4 Wire, 4 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch	540.68	104.72
26 28 16 00-0103 EA 60 Amp, 240 Volt Class, 3 Phase, 4 Wire, 4 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch	657.44	145.75
26 28 16 00-0104 EA 100 Amp, 240 Volt Class, 3 Phase, 4 Wire, 4 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch	995.58	167.54
26 28 16 00-0105 EA 200 Amp, 240 Volt Class, 3 Phase, 4 Wire, 4 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch	1,497.77	268.08
26 28 16 00-0106 480 Volt Class, 3 Phase, 4 Wire, 4 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switches <small>(26 28 16 00-0056)</small>		
26 28 16 00-0107 EA 30 Amp, 480 Volt Class, 3 Phase, 4 Wire, 4 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch	586.02	115.42
26 28 16 00-0108 EA 60 Amp, 480 Volt Class, 3 Phase, 4 Wire, 4 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch	719.13	163.68
26 28 16 00-0109 EA 100 Amp, 480 Volt Class, 3 Phase, 4 Wire, 4 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch	1,080.00	186.20
26 28 16 00-0110 EA 200 Amp, 480 Volt Class, 3 Phase, 4 Wire, 4 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch	1,613.09	291.56
26 28 16 00-0111 600 Volt Class, 3 Phase, 4 Wire, 4 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switches <small>(26 28 16 00-0056)</small>		
26 28 16 00-0112 EA 30 Amp, 600 Volt Class, 3 Phase, 4 Wire, 4 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch	648.07	115.58
26 28 16 00-0113 EA 60 Amp, 600 Volt Class, 3 Phase, 4 Wire, 4 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch	787.57	163.52
26 28 16 00-0114 EA 100 Amp, 600 Volt Class, 3 Phase, 4 Wire, 4 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch	1,203.08	186.20
26 28 16 00-0115 EA 200 Amp, 600 Volt Class, 3 Phase, 4 Wire, 4 Blades, Heavy Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch	1,792.38	291.40
26 28 16 00-0116 General Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switches <small>(26 28 16 00-0002)</small> Note: Includes fuses and neutral bar.		
26 28 16 00-0117 240 Volt Class, 1 Phase, 2 Wire, 1 Blade And Fuseholder, General Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switches <small>(26 28 16 00-0116)</small>		
26 28 16 00-0118 EA 30 Amp, 240 Volt Class, 1 Phase, 2 Wire, 1 Blade And Fuseholder, General Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch	201.27	69.97
26 28 16 00-0119 EA 60 Amp, 240 Volt Class, 1 Phase, 2 Wire, 1 Blade And Fuseholder, General Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch	271.88	84.21
26 28 16 00-0120 EA 100 Amp, 240 Volt Class, 1 Phase, 2 Wire, 1 Blade And Fuseholder, General Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch	411.33	98.45
26 28 16 00-0121 EA 200 Amp, 240 Volt Class, 1 Phase, 2 Wire, 1 Blade And Fuseholder, General Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch	755.44	155.31
26 28 16 00-0122 EA 400 Amp, 240 Volt Class, 1 Phase, 2 Wire, 1 Blade And Fuseholder, General Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch	1,768.33	240.90
26 28 16 00-0123 EA 600 Amp, 240 Volt Class, 1 Phase, 2 Wire, 1 Blade And Fuseholder, General Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch	3,286.22	356.55
26 28 16 00-0124 240 Volt Class, 3 Phase, 3 Wire, 2 Blades And Fuseholders, General Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switches <small>(26 28 16 00-0116)</small>		
26 28 16 00-0125 EA 30 Amp, 240 Volt Class, 3 Phase, 3 Wire, 2 Blades And Fuseholders, General Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch	281.08	109.95
26 28 16 00-0126 EA 60 Amp, 240 Volt Class, 3 Phase, 3 Wire, 2 Blades And Fuseholders, General Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch	394.66	145.75
26 28 16 00-0127 EA 100 Amp, 240 Volt Class, 3 Phase, 3 Wire, 2 Blades And Fuseholders, General Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch	538.24	161.90



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Low-Voltage Electrical Distribution	26 20	
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MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 28 16 00-0128 EA 200 Amp, 240 Volt Class, 3 Phase, 3 Wire, 2 Blades And Fuseholders, General Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	952.41	253.43
26 28 16 00-0129 EA 400 Amp, 240 Volt Class, 3 Phase, 3 Wire, 2 Blades And Fuseholders, General Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	2,120.79	416.31
26 28 16 00-0130 EA 600 Amp, 240 Volt Class, 3 Phase, 3 Wire, 2 Blades And Fuseholders, General Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	3,742.01	582.80
26 28 16 00-0131 240 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, General Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switches <small>(26 28 16 00-0116)</small>		
26 28 16 00-0132 EA 30 Amp, 240 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, General Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	310.03	109.95
26 28 16 00-0133 EA 60 Amp, 240 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, General Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	441.34	145.75
26 28 16 00-0134 EA 100 Amp, 240 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, General Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	580.71	161.90
26 28 16 00-0135 EA 200 Amp, 240 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, General Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	1,059.42	253.43
26 28 16 00-0136 EA 400 Amp, 240 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, General Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	2,303.70	416.31
26 28 16 00-0137 EA 600 Amp, 240 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, General Duty Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	3,857.95	582.80
26 28 16 00-0138 General Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switches <small>(26 28 16 00-0002)</small>		
26 28 16 00-0139 240 Volt Class, 1 Phase, 2 Wire, 2 Blades, General Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switches <small>(26 28 16 00-0138)</small>		
26 28 16 00-0140 EA 60 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades, General Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	275.39	97.32
26 28 16 00-0141 EA 100 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades, General Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	362.65	111.88
26 28 16 00-0142 EA 200 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades, General Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	802.69	178.80
26 28 16 00-0143 EA 400 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades, General Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	1,702.54	297.60
26 28 16 00-0144 EA 600 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades, General Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	2,923.04	405.54
26 28 16 00-0145 240 Volt Class, 3 Phase, 3 Wire, 3 Blades, General Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switches <small>(26 28 16 00-0138)</small>		
26 28 16 00-0146 EA 30 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades, General Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	259.98	91.05
26 28 16 00-0147 EA 60 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades, General Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	356.64	126.68
26 28 16 00-0148 EA 100 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades, General Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	532.06	145.75
26 28 16 00-0149 EA 200 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades, General Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	911.86	233.17
26 28 16 00-0150 EA 400 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades, General Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	1,885.15	388.65
26 28 16 00-0151 EA 600 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades, General Duty Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Safety Switch.....	3,172.74	529.72
26 28 16 00-0152 NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switches <small>(26 28 16 00-0001)</small>		
26 28 16 00-0153 Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switches <small>(26 28 16 00-0152)</small>		
Note: With fuses, neutral bar, and hub if required.		
26 28 16 00-0154 240 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switches <small>(26 28 16 00-0153)</small>		
26 28 16 00-0155 EA 30 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	414.11	94.51
26 28 16 00-0156 EA 60 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	650.57	113.41
26 28 16 00-0157 EA 100 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	810.92	131.90
26 28 16 00-0158 EA 200 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	1,188.78	201.07
26 28 16 00-0159 EA 400 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	2,599.58	321.72
26 28 16 00-0160 EA 600 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	4,526.15	429.10
26 28 16 00-0161 EA 800 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	6,750.40	482.58
26 28 16 00-0162 EA 1,200 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	8,927.94	563.02

26 Electrical**26 20 Low-Voltage Electrical Distribution****26 28 Low-Voltage Circuit Protective Devices**

MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
26 28 16 00-0163		600 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switches ⁽²⁶⁾			
		<small>28 16 00-0153)</small>			
26 28 16 00-0164	EA	30 Amp, 600 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	704.56		125.95
26 28 16 00-0165	EA	60 Amp, 600 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	839.96		154.43
26 28 16 00-0166	EA	100 Amp, 600 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	1,182.91		177.35
26 28 16 00-0167	EA	200 Amp, 600 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	1,670.23		265.98
26 28 16 00-0168	EA	400 Amp, 600 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	3,602.80		435.21
26 28 16 00-0169	EA	600 Amp, 600 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	6,580.64		598.49
26 28 16 00-0170	EA	800 Amp, 600 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	9,632.85		689.14
26 28 16 00-0171	EA	1,200 Amp, 600 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	10,615.24		775.76
26 28 16 00-0172		240 Volt Class, 3 Phase, 3 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switches ⁽²⁶⁾			
		<small>28 16 00-0153)</small>			
26 28 16 00-0173	EA	30 Amp, 240 Volt Class, 3 Phase, 3 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	534.57		148.79
26 28 16 00-0174	EA	60 Amp, 240 Volt Class, 3 Phase, 3 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	839.80		197.05
26 28 16 00-0175	EA	100 Amp, 240 Volt Class, 3 Phase, 3 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	1,007.43		216.36
26 28 16 00-0176	EA	200 Amp, 240 Volt Class, 3 Phase, 3 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	1,497.01		334.99
26 28 16 00-0177	EA	400 Amp, 240 Volt Class, 3 Phase, 3 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	3,200.54		558.60
26 28 16 00-0178	EA	600 Amp, 240 Volt Class, 3 Phase, 3 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	5,297.36		744.80
26 28 16 00-0179		600 Volt Class, 3 Phase, 3 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switches ⁽²⁶⁾			
		<small>28 16 00-0153)</small>			
26 28 16 00-0180	EA	30 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	806.75		176.39
26 28 16 00-0181	EA	60 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	963.85		216.20
26 28 16 00-0182	EA	100 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	1,281.28		248.21
26 28 16 00-0183	EA	200 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	1,863.89		372.40
26 28 16 00-0184	EA	400 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	3,886.30		609.35
26 28 16 00-0185	EA	600 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	6,961.66		837.85
26 28 16 00-0186	EA	800 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	9,805.81		965.18
26 28 16 00-0187	EA	1,200 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	11,722.64		1,085.82
26 28 16 00-0188		240 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switches ⁽²⁶⁾			
		<small>28 16 00-0153)</small>			
26 28 16 00-0189	EA	30 Amp, 240 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	583.67		148.79
26 28 16 00-0190	EA	60 Amp, 240 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	841.22		197.05
26 28 16 00-0191	EA	100 Amp, 240 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	1,076.46		216.36
26 28 16 00-0192	EA	200 Amp, 240 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	1,543.05		334.99
26 28 16 00-0193	EA	400 Amp, 240 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	3,242.77		558.60
26 28 16 00-0194	EA	600 Amp, 240 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	5,761.91		744.80
26 28 16 00-0195	EA	800 Amp, 240 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	9,528.84		844.53
26 28 16 00-0196	EA	1,200 Amp, 240 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	11,858.55		965.18



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 28 16 00-0197 600 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switches ^(26 28 16 00-0153)		
26 28 16 00-0198 EA 30 Amp, 600 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	834.91	176.55
26 28 16 00-0199 EA 60 Amp, 600 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	995.52	216.36
26 28 16 00-0200 EA 100 Amp, 600 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	1,351.67	248.13
26 28 16 00-0201 EA 200 Amp, 600 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	1,909.64	372.40
26 28 16 00-0202 EA 400 Amp, 600 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	4,051.70	609.26
26 28 16 00-0203 EA 600 Amp, 600 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	7,151.70	837.69
26 28 16 00-0204 EA 800 Amp, 600 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	10,404.23	965.18
26 28 16 00-0205 EA 1,200 Amp, 600 Volt Class, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	12,511.44	1,085.82
26 28 16 00-0206 Heavy Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switches ^(26 28 16 00-0152)		
26 28 16 00-0207 240 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switches ^(26 28 16 00-0206)		
26 28 16 00-0208 EA 30 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	391.61	82.76
26 28 16 00-0209 EA 60 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	634.99	114.61
26 28 16 00-0210 EA 100 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	830.74	131.42
26 28 16 00-0211 EA 200 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	1,113.51	212.82
26 28 16 00-0212 EA 400 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	2,453.46	355.02
26 28 16 00-0213 EA 600 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	4,436.51	473.34
26 28 16 00-0214 EA 800 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	7,094.84	563.26
26 28 16 00-0215 EA 1,200 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	9,344.54	643.69
26 28 16 00-0216 600 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switches ^(26 28 16 00-0206)		
26 28 16 00-0217 EA 30 Amp, 600 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	440.49	91.21
26 28 16 00-0218 EA 60 Amp, 600 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	719.14	127.64
26 28 16 00-0219 EA 100 Amp, 600 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	937.12	144.13
26 28 16 00-0220 EA 200 Amp, 600 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	1,233.08	223.44
26 28 16 00-0221 EA 400 Amp, 600 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	2,777.86	372.40
26 28 16 00-0222 EA 600 Amp, 600 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	4,786.81	496.50
26 28 16 00-0223 EA 800 Amp, 600 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	7,564.13	590.04
26 28 16 00-0224 EA 1,200 Amp, 600 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	9,958.70	670.24
26 28 16 00-0225 240 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switches ^(26 28 16 00-0206)		
26 28 16 00-0226 EA 30 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	474.36	124.11
26 28 16 00-0227 EA 60 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	749.56	171.89
26 28 16 00-0228 EA 100 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	962.16	197.13
26 28 16 00-0229 EA 200 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	1,326.29	319.24
26 28 16 00-0230 EA 400 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	2,843.83	532.46
26 28 16 00-0231 EA 600 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	4,979.10	709.81
26 28 16 00-0232 EA 800 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	7,735.41	844.53
26 28 16 00-0233 EA 1,200 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	10,208.30	965.18

26 Electrical**26 20 Low-Voltage Electrical Distribution****26 28 Low-Voltage Circuit Protective Devices**

MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
26 28 16 00-0234		480 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switches <small>(26 28 16 00-0206)</small>			
26 28 16 00-0235	EA	30 Amp, 480 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch	515.85		136.74
26 28 16 00-0236	EA	60 Amp, 480 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch	817.83		191.51
26 28 16 00-0237	EA	100 Amp, 480 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch	1,040.88		216.20
26 28 16 00-0238	EA	200 Amp, 480 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch	1,407.35		335.15
26 28 16 00-0239	EA	400 Amp, 480 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch	3,022.95		558.52
26 28 16 00-0240	EA	600 Amp, 480 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch	5,302.74		744.72
26 28 16 00-0241	EA	800 Amp, 480 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch	8,247.57		884.74
26 28 16 00-0242	EA	1,200 Amp, 480 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch	10,878.70		1,005.39
26 28 16 00-0243		600 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switches <small>(26 28 16 00-0206)</small>			
26 28 16 00-0244	EA	30 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch	291.89		136.74
26 28 16 00-0245	EA	60 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch	846.80		191.51
26 28 16 00-0246	EA	100 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch	1,081.27		216.20
26 28 16 00-0247	EA	200 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch	1,456.50		335.15
26 28 16 00-0248	EA	400 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch	3,150.22		558.52
26 28 16 00-0249	EA	600 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch	5,283.29		744.72
26 28 16 00-0250	EA	800 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch	8,236.67		884.74
26 28 16 00-0251	EA	1,200 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch	10,863.87		1,005.39
26 28 16 00-0252		General Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switches <small>(26 28 16 00-0152)</small>			
		Note: With fuses, neutral bar, and hub if required.			
26 28 16 00-0253		240 Volt Class, 1 Phase, 2 Wire, 1 Blade And Fuseholder, General Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switches <small>(26 28 16 00-0252)</small>			
26 28 16 00-0254	EA	30 Amp, 240 Volt Class, 1 Phase, 2 Wire, 1 Blade And Fuseholder, General Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch	258.58		82.20
26 28 16 00-0255	EA	60 Amp, 240 Volt Class, 1 Phase, 2 Wire, 1 Blade And Fuseholder, General Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch	361.09		98.61
26 28 16 00-0256	EA	100 Amp, 240 Volt Class, 1 Phase, 2 Wire, 1 Blade And Fuseholder, General Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch	471.70		114.69
26 28 16 00-0257	EA	200 Amp, 240 Volt Class, 1 Phase, 2 Wire, 1 Blade And Fuseholder, General Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch	954.26		174.85
26 28 16 00-0258	EA	400 Amp, 240 Volt Class, 1 Phase, 2 Wire, 1 Blade And Fuseholder, General Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch	2,302.30		279.74
26 28 16 00-0259	EA	600 Amp, 240 Volt Class, 1 Phase, 2 Wire, 1 Blade And Fuseholder, General Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch	4,054.22		373.20
26 28 16 00-0260		240 Volt Class, 3 Phase, 3 Wire, 2 Blades And Fuseholders, General Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switches <small>(26 28 16 00-0252)</small>			
26 28 16 00-0261	EA	30 Amp, 240 Volt Class, 3 Phase, 3 Wire, 2 Blades And Fuseholders, General Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch	353.63		129.58
26 28 16 00-0262	EA	60 Amp, 240 Volt Class, 3 Phase, 3 Wire, 2 Blades And Fuseholders, General Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch	506.93		171.40
26 28 16 00-0263	EA	100 Amp, 240 Volt Class, 3 Phase, 3 Wire, 2 Blades And Fuseholders, General Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch	618.07		188.04
26 28 16 00-0264	EA	200 Amp, 240 Volt Class, 3 Phase, 3 Wire, 2 Blades And Fuseholders, General Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch	1,188.00		291.40
26 28 16 00-0265	EA	400 Amp, 240 Volt Class, 3 Phase, 3 Wire, 2 Blades And Fuseholders, General Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch	2,715.41		485.64
26 28 16 00-0266	EA	600 Amp, 240 Volt Class, 3 Phase, 3 Wire, 2 Blades And Fuseholders, General Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch	4,609.04		647.79



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 28 16 00-0267				240 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, General Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switches <small>(26 28 16 00-0267)</small>		
26 28 16 00-0268	EA			30 Amp, 240 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, General Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	394.21	129.50
26 28 16 00-0269	EA			60 Amp, 240 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, General Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	547.67	171.40
26 28 16 00-0270	EA			100 Amp, 240 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, General Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	749.11	188.04
26 28 16 00-0271	EA			200 Amp, 240 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, General Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	1,272.61	291.40
26 28 16 00-0272	EA			400 Amp, 240 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, General Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	2,769.77	485.72
26 28 16 00-0273	EA			600 Amp, 240 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, General Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	5,033.12	647.79
26 28 16 00-0274	EA			800 Amp, 240 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, General Duty Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	7,151.13	733.85
26 28 16 00-0275				General Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switches <small>(26 28 16 00-0152)</small>		
26 28 16 00-0276				240 Volt Class, 1 Phase, 2 Wire, 2 Blades, General Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switches <small>(26 28 16 00-0275)</small>		
26 28 16 00-0277	EA			30 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades, General Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	232.86	71.99
26 28 16 00-0278	EA			60 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades, General Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	377.18	99.65
26 28 16 00-0279	EA			100 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades, General Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	398.53	114.29
26 28 16 00-0280	EA			200 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades, General Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	974.94	185.00
26 28 16 00-0281	EA			400 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades, General Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	2,360.60	308.69
26 28 16 00-0282	EA			600 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades, General Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	4,132.86	411.57
26 28 16 00-0283				240 Volt Class, 3 Phase, 3 Wire, 3 Blades, General Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switches <small>(26 28 16 00-0275)</small>		
26 28 16 00-0284	EA			30 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades, General Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	363.46	107.94
26 28 16 00-0285	EA			60 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades, General Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	521.94	149.44
26 28 16 00-0286	EA			100 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades, General Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	753.97	171.40
26 28 16 00-0287	EA			200 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades, General Duty Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Bolt-On Hubs, Safety Switch.....	1,292.46	277.57
26 28 16 00-0288				NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switches <small>(26 28 16 00-0001)</small>		
26 28 16 00-0289				Heavy Duty Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switches <small>(26 28 16 00-0288)</small>		
				Note: With fuses and neutral bar (stainless steel).		
26 28 16 00-0290				240 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switches <small>(26 28 16 00-0289)</small>		
26 28 16 00-0291	EA			30 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch.....	1,062.99	80.44
26 28 16 00-0292	EA			60 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch.....	1,276.98	96.92
26 28 16 00-0293	EA			100 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch.....	2,587.10	113.25
26 28 16 00-0294	EA			200 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch.....	3,583.00	178.72
26 28 16 00-0295	EA			400 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch.....	7,265.73	277.33
26 28 16 00-0296	EA			600 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch.....	10,446.37	410.04
26 28 16 00-0297				600 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switches <small>(26 28 16 00-0289)</small>		
26 28 16 00-0298	EA			30 Amp, 600 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch.....	1,346.23	89.36
26 28 16 00-0299	EA			60 Amp, 600 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch.....	1,498.85	107.62
26 28 16 00-0300	EA			100 Amp, 600 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch.....	2,797.89	125.79

26 Electrical**26 20 Low-Voltage Electrical Distribution****26 28 Low-Voltage Circuit Protective Devices**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 28 16 00-0301 EA 200 Amp, 600 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	3,958.71	198.67
26 28 16 00-0302 EA 400 Amp, 600 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	7,549.88	308.37
26 28 16 00-0303 EA 600 Amp, 600 Volt Class, 1 Phase, 2 Wire, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	10,828.31	455.56
26 28 16 00-0304 240 Volt Class, 3 Phase, 3 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switches (26 28 16 00-0289)		
26 28 16 00-0305 EA 30 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	1,202.24	126.44
26 28 16 00-0306 EA 60 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	1,508.82	167.54
26 28 16 00-0307 EA 100 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	2,849.74	186.20
26 28 16 00-0308 EA 200 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	4,056.72	291.40
26 28 16 00-0309 EA 400 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	7,890.60	478.72
26 28 16 00-0310 EA 600 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	11,257.74	670.24
26 28 16 00-0311 600 Volt Class, 3 Phase, 3 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switches (26 28 16 00-0289)		
26 28 16 00-0312 EA 30 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	1,450.41	139.63
26 28 16 00-0313 EA 60 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	1,659.93	186.20
26 28 16 00-0314 EA 100 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	2,973.09	209.44
26 28 16 00-0315 EA 200 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	4,210.76	319.16
26 28 16 00-0316 EA 400 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	8,153.50	515.57
26 28 16 00-0317 EA 600 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	11,604.46	744.72
26 28 16 00-0318 240 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switches (26 28 16 00-0289)		
26 28 16 00-0319 EA 30 Amp, 240 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	1,431.79	126.44
26 28 16 00-0320 EA 60 Amp, 240 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	1,795.79	167.54
26 28 16 00-0321 EA 100 Amp, 240 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	3,423.95	186.20
26 28 16 00-0322 EA 200 Amp, 240 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	4,841.93	291.40
26 28 16 00-0323 EA 400 Amp, 240 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	9,435.99	478.72
26 28 16 00-0324 EA 600 Amp, 240 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	13,381.48	670.24
26 28 16 00-0325 600 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switches (26 28 16 00-0289)		
26 28 16 00-0326 EA 30 Amp, 600 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	1,721.66	139.63
26 28 16 00-0327 EA 60 Amp, 600 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	1,967.51	186.20
26 28 16 00-0328 EA 100 Amp, 600 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	3,559.21	209.44
26 28 16 00-0329 EA 200 Amp, 600 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	5,002.53	319.16
26 28 16 00-0330 EA 400 Amp, 600 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	9,719.74	515.57
26 28 16 00-0331 EA 600 Amp, 600 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	13,757.15	744.72
26 28 16 00-0332 Heavy Duty Stainless Steel Non-Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switches (26 28 16 00-0288)		
26 28 16 00-0333 240 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Stainless Steel Non-Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switches (26 28 16 00-0332)		
26 28 16 00-0334 EA 30 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Stainless Steel Non-Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	1,020.63	80.44
26 28 16 00-0335 EA 60 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Stainless Steel Non-Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	1,245.39	111.88



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 28 16 00-0336 EA 100 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Stainless Steel Non-Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	2,326.25	128.69
26 28 16 00-0337 EA 200 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Stainless Steel Non-Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	3,233.54	205.58
26 28 16 00-0338 EA 400 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Stainless Steel Non-Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	5,879.80	342.32
26 28 16 00-0339 EA 600 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Stainless Steel Non-Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	8,416.01	466.34
26 28 16 00-0340 600 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Stainless Steel Non-Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switches <small>(26 28 16 00-0332)</small>		
26 28 16 00-0341 EA 30 Amp, 600 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Stainless Steel Non-Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	1,160.10	88.71
26 28 16 00-0342 EA 60 Amp, 600 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Stainless Steel Non-Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	1,418.38	125.47
26 28 16 00-0343 EA 100 Amp, 600 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Stainless Steel Non-Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	2,650.40	143.01
26 28 16 00-0344 EA 200 Amp, 600 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Stainless Steel Non-Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	3,672.47	223.44
26 28 16 00-0345 EA 400 Amp, 600 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Stainless Steel Non-Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	6,672.81	367.73
26 28 16 00-0346 EA 600 Amp, 600 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Stainless Steel Non-Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	9,582.00	514.76
26 28 16 00-0347 240 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Stainless Steel Non-Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switches <small>(26 28 16 00-0332)</small>		
26 28 16 00-0348 EA 30 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Stainless Steel Non-Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	1,069.22	104.72
26 28 16 00-0349 EA 60 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Stainless Steel Non-Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	1,296.74	145.75
26 28 16 00-0350 EA 100 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Stainless Steel Non-Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	1,356.70	167.54
26 28 16 00-0351 EA 200 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Stainless Steel Non-Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	2,605.07	268.08
26 28 16 00-0352 EA 400 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Stainless Steel Non-Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	3,716.02	446.88
26 28 16 00-0353 EA 600 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Stainless Steel Non-Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	8,948.44	609.35
26 28 16 00-0354 600 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Stainless Steel Non-Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switches <small>(26 28 16 00-0332)</small>		
26 28 16 00-0355 EA 30 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Stainless Steel Non-Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	1,213.71	115.58
26 28 16 00-0356 EA 60 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Stainless Steel Non-Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	1,494.45	163.52
26 28 16 00-0357 EA 100 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Stainless Steel Non-Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	2,736.78	186.20
26 28 16 00-0358 EA 200 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Stainless Steel Non-Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	3,808.36	291.40
26 28 16 00-0359 EA 400 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Stainless Steel Non-Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	7,581.12	478.72
26 28 16 00-0360 EA 600 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Stainless Steel Non-Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	10,174.56	670.24
26 28 16 00-0361 240 Volt Class, 3 Phase, 4 Wire, 4 Blades, Heavy Duty Stainless Steel Non-Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switches <small>(26 28 16 00-0332)</small>		
26 28 16 00-0362 EA 30 Amp, 240 Volt Class, 3 Phase, 4 Wire, 4 Blades, Heavy Duty Stainless Steel Non-Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	1,461.66	104.72
26 28 16 00-0363 EA 60 Amp, 240 Volt Class, 3 Phase, 4 Wire, 4 Blades, Heavy Duty Stainless Steel Non-Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	1,757.04	145.75
26 28 16 00-0364 EA 100 Amp, 240 Volt Class, 3 Phase, 4 Wire, 4 Blades, Heavy Duty Stainless Steel Non-Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	3,918.75	167.54
26 28 16 00-0365 EA 200 Amp, 240 Volt Class, 3 Phase, 4 Wire, 4 Blades, Heavy Duty Stainless Steel Non-Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	5,980.76	268.08
26 28 16 00-0366 600 Volt Class, 3 Phase, 4 Wire, 4 Blades, Heavy Duty Stainless Steel Non-Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switches <small>(26 28 16 00-0332)</small>		
26 28 16 00-0367 EA 30 Amp, 600 Volt Class, 3 Phase, 4 Wire, 4 Blades, Heavy Duty Stainless Steel Non-Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	1,662.21	115.58
26 28 16 00-0368 EA 60 Amp, 600 Volt Class, 3 Phase, 4 Wire, 4 Blades, Heavy Duty Stainless Steel Non-Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	2,001.95	163.52
26 28 16 00-0369 EA 100 Amp, 600 Volt Class, 3 Phase, 4 Wire, 4 Blades, Heavy Duty Stainless Steel Non-Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	4,467.94	186.20

26 Electrical**26 20 Low-Voltage Electrical Distribution****26 28 Low-Voltage Circuit Protective Devices**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 28 16 00-0370 EA 200 Amp, 600 Volt Class, 3 Phase, 4 Wire, 4 Blades, Heavy Duty Stainless Steel Non-Fusible, NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	6,805.18	291.40
26 28 16 00-0371 Krydon NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switches (26 28 16 00-0288)		
26 28 16 00-0372 600 Volt Class, 3 Phase, 3 Pole, Fusible, Krydon NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switches (26 28 16 00-0371)		
26 28 16 00-0373 EA 30 Amp, 600 Volt Class, 3 Phase, 3 Pole, Fusible, Krydon NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch.....	2,207.32	139.55
26 28 16 00-0374 EA 60 Amp, 600 Volt Class, 3 Phase, 3 Pole, Fusible, Krydon NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch.....	2,516.28	186.20
26 28 16 00-0375 EA 100 Amp, 600 Volt Class, 3 Phase, 3 Pole, Fusible, Krydon NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	4,524.14	209.52
26 28 16 00-0376 600 Volt Class, 3 Phase, 3 Pole, Non-Fusible, Krydon NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switches (26 28 16 00-0371)		
26 28 16 00-0377 EA 30 Amp, 600 Volt Class, 3 Phase, 3 Pole, Non-Fusible, Krydon NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	2,066.32	115.42
26 28 16 00-0378 EA 60 Amp, 600 Volt Class, 3 Phase, 3 Pole, Non-Fusible, Krydon NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	2,368.73	163.68
26 28 16 00-0379 EA 100 Amp, 600 Volt Class, 3 Phase, 3 Pole, Non-Fusible, Krydon NEMA 4, 4X Or 5 Enclosure, Neutral Kit, Safety Switch	4,282.62	186.20
26 28 16 00-0380 NEMA 7 Or 9 Enclosures, Neutral Kit, Safety Switches (26 28 16 00-0001)		
Note: Class 1, groups C and D, division 1 or 2, NEMA 7; Class 2, groups E, F and G, division 1 or 2, NEMA 9; or Class 3, division 1 Or 2, NEMA 9, hazardous locations as defined in NEC article 500.		
26 28 16 00-0381 Heavy Duty Fusible, NEMA 7 Or 9 Enclosures, Neutral Kit, Safety Switches (26 28 16 00-0380)		
Note: With fuses and neutral bar.		
26 28 16 00-0382 EA 30 Amp, 240 Volt, 3 Phase, Heavy Duty Fusible, NEMA 7 Or 9 Enclosure, Neutral Kit, Safety Switch	1,756.78	160.86
26 28 16 00-0383 EA 60 Amp, 240 Volt, 3 Phase, Heavy Duty Fusible, NEMA 7 Or 9 Enclosure, Neutral Kit, Safety Switch	1,818.06	191.51
26 28 16 00-0384 EA 100 Amp, 240 Volt, 3 Phase, Heavy Duty Fusible, NEMA 7 Or 9 Enclosure, Neutral Kit, Safety Switch	2,203.17	216.20
26 28 16 00-0385 EA 200 Amp, 240 Volt, 3 Phase, Heavy Duty Fusible, NEMA 7 Or 9 Enclosure, Neutral Kit, Safety Switch	4,648.14	335.15
26 28 16 00-0386 Heavy Duty Non-Fusible, NEMA 7 Or 9 Enclosure, Neutral Kit, Safety Switches (26 28 16 00-0380)		
26 28 16 00-0387 EA 60 Amp, 240 Volt, 3 Phase, Heavy Duty Non-Fusible, NEMA 7 Or 9 Enclosure, Neutral Kit, Safety Switch	1,379.06	191.51
26 28 16 00-0388 EA 100 Amp, 240 Volt, 3 Phase, Heavy Duty Non-Fusible, NEMA 7 Or 9 Enclosure, Neutral Kit, Safety Switch	1,612.18	216.20
26 28 16 00-0389 EA 200 Amp, 240 Volt, 3 Phase, Heavy Duty Non-Fusible, NEMA 7 Or 9 Enclosure, Neutral Kit, Safety Switch	2,950.21	335.15
26 28 16 00-0390 NEMA 12 Enclosure, Neutral Kit, Safety Switches (26 28 16 00-0001)		
26 28 16 00-0391 Heavy Duty Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switches (26 28 16 00-0390)		
Note: With fuses and neutral bar.		
26 28 16 00-0392 240 Volt Class, 1 Phase, 2 Pole, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switches (26 28 16 00-0391)		
26 28 16 00-0393 EA 30 Amp, 240 Volt Class, 1 Phase, 2 Pole, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch	399.12	80.44
26 28 16 00-0394 EA 60 Amp, 240 Volt Class, 1 Phase, 2 Pole, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch	519.43	96.92
26 28 16 00-0395 EA 100 Amp, 240 Volt Class, 1 Phase, 2 Pole, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch	704.65	113.41
26 28 16 00-0396 EA 200 Amp, 240 Volt Class, 1 Phase, 2 Pole, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch	1,185.82	178.56
26 28 16 00-0397 EA 400 Amp, 240 Volt Class, 1 Phase, 2 Pole, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch	2,507.92	277.49
26 28 16 00-0398 EA 600 Amp, 240 Volt Class, 1 Phase, 2 Pole, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch	4,508.30	410.20
26 28 16 00-0399 600 Volt Class, 1 Phase, 2 Pole, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switches (26 28 16 00-0391)		
26 28 16 00-0400 EA 30 Amp, 600 Volt Class, 1 Phase, 2 Pole, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch	618.65	89.28
26 28 16 00-0401 EA 60 Amp, 600 Volt Class, 1 Phase, 2 Pole, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch	641.25	107.78
26 28 16 00-0402 EA 100 Amp, 600 Volt Class, 1 Phase, 2 Pole, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch	917.32	125.87
26 28 16 00-0403 EA 200 Amp, 600 Volt Class, 1 Phase, 2 Pole, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch	1,435.58	198.67
26 28 16 00-0404 EA 400 Amp, 600 Volt Class, 1 Phase, 2 Pole, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch	3,104.96	308.05
26 28 16 00-0405 EA 600 Amp, 600 Volt Class, 1 Phase, 2 Pole, 2 Blades And Fuseholders, Heavy Duty Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch	6,108.43	455.64



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 28 16 00-0406 240 Volt Class, 3 Phase, 3 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switches <small>(26 28 16 00-0391)</small>		
26 28 16 00-0407 EA 30 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch	557.88	126.28
26 28 16 00-0408 EA 60 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch	771.15	167.70
26 28 16 00-0409 EA 100 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch	1,043.46	186.20
26 28 16 00-0410 EA 200 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch	1,554.12	291.56
26 28 16 00-0411 EA 400 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch	3,030.39	478.56
26 28 16 00-0412 EA 600 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch	4,843.68	670.40
26 28 16 00-0413 600 Volt Class, 3 Phase, 3 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switches <small>(26 28 16 00-0391)</small>		
26 28 16 00-0414 EA 30 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch	736.79	139.55
26 28 16 00-0415 EA 60 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch	840.44	186.20
26 28 16 00-0416 EA 100 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch	1,224.84	209.52
26 28 16 00-0417 EA 200 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch	1,785.64	319.32
26 28 16 00-0418 EA 400 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch	3,709.37	515.57
26 28 16 00-0419 EA 600 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch	6,930.33	744.80
26 28 16 00-0420 240 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switches <small>(26 28 16 00-0391)</small>		
26 28 16 00-0421 EA 30 Amp, 240 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch	594.30	126.28
26 28 16 00-0422 EA 60 Amp, 240 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch	796.17	167.70
26 28 16 00-0423 EA 100 Amp, 240 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch	1,121.99	186.20
26 28 16 00-0424 EA 200 Amp, 240 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch	1,652.71	291.56
26 28 16 00-0425 EA 400 Amp, 240 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch	3,294.35	478.56
26 28 16 00-0426 EA 600 Amp, 240 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch	5,022.00	670.40
26 28 16 00-0427 600 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switches <small>(26 28 16 00-0391)</small>		
26 28 16 00-0428 EA 30 Amp, 600 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch	779.01	139.55
26 28 16 00-0429 EA 60 Amp, 600 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch	953.06	186.20
26 28 16 00-0430 EA 100 Amp, 600 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch	1,302.27	209.52
26 28 16 00-0431 EA 200 Amp, 600 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch	1,933.45	319.32
26 28 16 00-0432 EA 400 Amp, 600 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch	3,948.68	515.57
26 28 16 00-0433 EA 600 Amp, 600 Volt Class, 3 Phase, 4 Wire, 3 Blades And Fuseholders, Heavy Duty Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch	7,127.40	744.80
26 28 16 00-0434 Heavy Duty Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switches <small>(26 28 16 00-0390)</small>		
26 28 16 00-0435 240 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switches <small>(26 28 16 00-0434)</small>		
26 28 16 00-0436 EA 30 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch	416.84	116.23
26 28 16 00-0437 EA 60 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch	553.88	162.07
26 28 16 00-0438 EA 100 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch	730.32	186.20
26 28 16 00-0439 EA 200 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch	1,046.18	298.00
26 28 16 00-0440 EA 400 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch	2,278.05	496.67
26 28 16 00-0441 EA 600 Amp, 240 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch	3,591.64	677.23

26	Electrical
26 20	Low-Voltage Electrical Distribution
26 28	Low-Voltage Circuit Protective Devices



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 28 16 00-0442 600 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switches <small>(26 28 16 00-0434)</small>		
26 28 16 00-0443 EA 30 Amp, 600 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch.....	464.45	128.29
26 28 16 00-0444 EA 60 Amp, Non-Fused, NEMA 12, Heavy Duty Disconnect Switch, 600 Volt, 1 Phase.....	615.82	181.78
26 28 16 00-0445 EA 100 Amp, 600 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch.....	813.89	206.71
26 28 16 00-0446 EA 200 Amp, 600 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch.....	1,136.72	323.74
26 28 16 00-0447 EA 400 Amp, 600 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch.....	2,413.21	532.06
26 28 16 00-0448 EA 600 Amp, 600 Volt Class, 1 Phase, 2 Wire, 2 Blades, Heavy Duty Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch.....	3,968.21	744.80
26 28 16 00-0449 240 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switches <small>(26 28 16 00-0434)</small>		
26 28 16 00-0450 EA 30 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch.....	537.06	104.56
26 28 16 00-0451 EA 60 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch.....	708.09	145.58
26 28 16 00-0452 EA 100 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch.....	937.87	167.70
26 28 16 00-0453 EA 200 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch.....	1,344.11	268.24
26 28 16 00-0454 EA 400 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch.....	2,809.26	446.79
26 28 16 00-0455 EA 600 Amp, 240 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch.....	4,415.26	609.26
26 28 16 00-0456 600 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switches <small>(26 28 16 00-0434)</small>		
26 28 16 00-0457 EA 30 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch.....	528.16	115.42
26 28 16 00-0458 EA 60 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch.....	766.87	163.68
26 28 16 00-0459 EA 100 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch.....	1,005.85	186.20
26 28 16 00-0460 EA 200 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch.....	1,332.45	291.56
26 28 16 00-0461 EA 400 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch.....	2,826.28	478.56
26 28 16 00-0462 EA 600 Amp, 600 Volt Class, 3 Phase, 3 Wire, 3 Blades, Heavy Duty Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch.....	5,246.97	670.40
26 28 16 00-0463 240 Volt Class, 3 Phase, 4 Wire, 4 Blades, Heavy Duty Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switches <small>(26 28 16 00-0434)</small>		
26 28 16 00-0464 EA 30 Amp, 240 Volt Class, 3 Phase, 4 Wire, 4 Blades, Heavy Duty Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch.....	641.24	104.56
26 28 16 00-0465 EA 60 Amp, 240 Volt Class, 3 Phase, 4 Wire, 4 Blades, Heavy Duty Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch.....	767.34	145.58
26 28 16 00-0466 EA 100 Amp, 240 Volt Class, 3 Phase, 4 Wire, 4 Blades, Heavy Duty Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch.....	1,180.60	167.70
26 28 16 00-0467 EA 200 Amp, 240 Volt Class, 3 Phase, 4 Wire, 4 Blades, Heavy Duty Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch.....	1,872.57	268.24
26 28 16 00-0468 EA 400 Amp, 240 Volt Class, 3 Phase, 4 Wire, 4 Blades, Heavy Duty Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch.....	3,360.37	341.83
26 28 16 00-0469 600 Volt Class, 3 Phase, 4 Wire, 4 Blades, Heavy Duty Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switches <small>(26 28 16 00-0434)</small>		
26 28 16 00-0470 EA 30 Amp, 600 Volt Class, 3 Phase, 4 Wire, 4 Blades, Heavy Duty Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch.....	667.52	115.42
26 28 16 00-0471 EA 60 Amp, 600 Volt Class, 3 Phase, 4 Wire, 4 Blades, Heavy Duty Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch.....	837.26	163.68
26 28 16 00-0472 EA 100 Amp, 600 Volt Class, 3 Phase, 4 Wire, 4 Blades, Heavy Duty Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch.....	1,262.76	186.20
26 28 16 00-0473 EA 200 Amp, 600 Volt Class, 3 Phase, 4 Wire, 4 Blades, Heavy Duty Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch.....	1,927.20	291.56
26 28 16 00-0474 EA 400 Amp, 600 Volt Class, 3 Phase, 4 Wire, 4 Blades, Heavy Duty Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Safety Switch.....	3,591.19	450.42
26 28 16 00-0475 Double Throw Safety Switches <small>(26 28 16 00-0001)</small>		
26 28 16 00-0476 NEMA 1 Enclosure, Neutral Kit, Double Throw Safety Switches <small>(26 28 16 00-0475)</small>		



	MINOR	CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 28 16 00-0477		240 Volt Class, 2 Pole, Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Double Throw Safety Switches <small>(26 28 16 00-0476)</small>		
	EA	30 Amp, 240 Volt Class, 2 Pole, Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Double Throw Safety Switch	501.53	103.36
	EA	60 Amp, 240 Volt Class, 2 Pole, Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Double Throw Safety Switch	737.10	135.12
	EA	100 Amp, 240 Volt Class, 2 Pole, Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Double Throw Safety Switch	1,031.13	176.55
	EA	200 Amp, 240 Volt Class, 2 Pole, Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Double Throw Safety Switch	1,373.76	229.63
	EA	400 Amp, 240 Volt Class, 2 Pole, Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Double Throw Safety Switch	3,258.05	287.14
	EA	600 Amp, 240 Volt Class, 2 Pole, Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Double Throw Safety Switch	5,914.13	460.47
	EA	800 Amp, Double Throw Safety Switch, 240 Volt, 2 Pole, Non-Fusible, NEMA 1 Enclosure	6,809.01	643.45
	EA	1,000 Amp, Double Throw Safety Switch, 240 Volt, 2 Pole, Non-Fusible, NEMA 1 Enclosure	9,986.79	723.88
	EA	1,200 Amp, Double Throw Safety Switch, 240 Volt, 2 Pole, Non-Fusible, NEMA 1 Enclosure	11,756.98	804.31
26 28 16 00-0487		240 Volt Class, 3 Pole, Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Double Throw Safety Switches <small>(26 28 16 00-0476)</small>		
	EA	30 Amp, 240 Volt Class, 3 Pole, Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Double Throw Safety Switch	635.92	144.77
	EA	60 Amp, 240 Volt Class, 3 Pole, Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Double Throw Safety Switch	884.87	189.02
	EA	100 Amp, 240 Volt Class, 3 Pole, Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Double Throw Safety Switch	1,323.98	247.33
	EA	200 Amp, 240 Volt Class, 3 Pole, Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Double Throw Safety Switch	1,935.35	321.72
	EA	400 Amp, 240 Volt Class, 3 Pole, Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Double Throw Safety Switch	4,490.91	402.16
	EA	600 Amp, 240 Volt Class, 3 Pole, Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Double Throw Safety Switch	6,284.38	643.45
	EA	800 Amp, Double Throw Safety Switch, 240 Volt, 3 Pole, Non-Fusible, NEMA 1 Enclosure	7,350.16	723.88
	EA	1,000 Amp, Double Throw Safety Switch, 240 Volt, 3 Pole, Non-Fusible, NEMA 1 Enclosure	10,463.59	804.31
	EA	1,200 Amp, Double Throw Safety Switch, 240 Volt, 3 Pole, Non-Fusible, NEMA 1 Enclosure	12,391.01	884.74
26 28 16 00-0497		240 Volt Class, 4 Pole, Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Double Throw Safety Switches <small>(26 28 16 00-0476)</small>		
	EA	30 Amp, 240 Volt Class, 4 Pole, Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Double Throw Safety Switch	842.52	180.97
	EA	60 Amp, 240 Volt Class, 4 Pole, Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Double Throw Safety Switch	1,220.01	236.47
	EA	100 Amp, 240 Volt Class, 4 Pole, Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Double Throw Safety Switch	2,141.60	308.85
	EA	200 Amp, 240 Volt Class, 4 Pole, Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Double Throw Safety Switch	2,929.06	401.36
	EA	400 Amp, 240 Volt Class, 4 Pole, Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Double Throw Safety Switch	5,838.01	502.70
	EA	600 Amp, 240 Volt Class, 4 Pole, Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Double Throw Safety Switch	7,422.25	805.52
	EA	800 Amp, Double Throw Safety Switch, 240 Volt, 4 Pole, Non-Fusible, NEMA 1 Enclosure	9,365.17	884.74
	EA	1,000 Amp, Double Throw Safety Switch, 240 Volt, 4 Pole, Non-Fusible, NEMA 1 Enclosure	12,404.67	924.96
	EA	1,200 Amp, Double Throw Safety Switch, 240 Volt, 4 Pole, Non-Fusible, NEMA 1 Enclosure	13,898.64	965.18
26 28 16 00-0507		600 Volt Class, 2 Pole, Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Double Throw Safety Switches <small>(26 28 16 00-0476)</small>		
	EA	60 Amp, 600 Volt Class, 2 Pole, Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Double Throw Safety Switch	846.88	135.12
	EA	100 Amp, 600 Volt Class, 2 Pole, Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Double Throw Safety Switch	1,267.78	176.55
	EA	200 Amp, 600 Volt Class, 2 Pole, Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Double Throw Safety Switch	1,862.33	229.63
	EA	400 Amp, 600 Volt Class, 2 Pole, Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Double Throw Safety Switch	4,338.11	287.14
	EA	600 Amp, 600 Volt Class, 2 Pole, Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Double Throw Safety Switch	6,420.06	460.47
	EA	800 Amp, Double Throw Safety Switch, 600 Volt, 2 Pole, Non-Fusible, NEMA 1 Enclosure	7,361.22	643.45
	EA	1,000 Amp, Double Throw Safety Switch, 600 Volt, 2 Pole, Non-Fusible, NEMA 1 Enclosure	10,840.70	723.88
	EA	1,200 Amp, Double Throw Safety Switch, 600 Volt, 2 Pole, Non-Fusible, NEMA 1 Enclosure	12,771.81	804.31
26 28 16 00-0516		600 Volt Class, 3 Pole, Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Double Throw Safety Switches <small>(26 28 16 00-0476)</small>		
	EA	60 Amp, 600 Volt Class, 3 Pole, Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Double Throw Safety Switch	954.54	189.02
	EA	100 Amp, 600 Volt Class, 3 Pole, Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Double Throw Safety Switch	1,408.94	247.33
	EA	200 Amp, 600 Volt Class, 3 Pole, Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Double Throw Safety Switch	2,045.74	321.72
	EA	400 Amp, 600 Volt Class, 3 Pole, Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Double Throw Safety Switch	4,567.96	402.16
	EA	600 Amp, 600 Volt Class, 3 Pole, Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Double Throw Safety Switch	6,787.10	643.45
	EA	800 Amp, Double Throw Safety Switch, 600 Volt, 3 Pole, Non-Fusible, NEMA 1 Enclosure	7,940.40	723.88
	EA	1,000 Amp, Double Throw Safety Switch, 600 Volt, 3 Pole, Non-Fusible, NEMA 1 Enclosure	11,349.08	804.31
	EA	1,200 Amp, Double Throw Safety Switch, 600 Volt, 3 Pole, Non-Fusible, NEMA 1 Enclosure	13,453.16	884.74
26 28 16 00-0525		600 Volt Class, 4 Pole, Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Double Throw Safety Switches <small>(26 28 16 00-0476)</small>		
	EA	60 Amp, 600 Volt Class, 4 Pole, Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Double Throw Safety Switch	1,288.74	236.47
	EA	100 Amp, 600 Volt Class, 4 Pole, Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Double Throw Safety Switch	2,240.91	308.85
	EA	200 Amp, 600 Volt Class, 4 Pole, Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Double Throw Safety Switch	3,134.45	401.36
	EA	400 Amp, 600 Volt Class, 4 Pole, Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Double Throw Safety Switch	6,275.59	502.70
	EA	600 Amp, 600 Volt Class, 4 Pole, Non-Fusible, NEMA 1 Enclosure, Neutral Kit, Double Throw Safety Switch	7,912.06	805.52
	EA	800 Amp, Double Throw Safety Switch, 600 Volt, 4 Pole, Non-Fusible, NEMA 1 Enclosure	10,124.74	884.74
	EA	1,000 Amp, Double Throw Safety Switch, 600 Volt, 4 Pole, Non-Fusible, NEMA 1 Enclosure	13,460.14	924.96
	EA	1,200 Amp, Double Throw Safety Switch, 600 Volt, 4 Pole, Non-Fusible, NEMA 1 Enclosure	15,095.47	965.18
26 28 16 00-0534		NEMA 3R Enclosure, Neutral Kit, Double Throw Safety Switches <small>(26 28 16 00-0475)</small>		

26 Electrical**26 20 Low-Voltage Electrical Distribution****26 28 Low-Voltage Circuit Protective Devices**

MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
26 28 16 00-0535		240 Volt Class, 2 Pole, Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Double Throw Safety Switches ^(26 28 16 00-0534)			
26 28 16 00-0536	EA	100 Amp, 240 Volt Class, 2 Pole, Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Double Throw Safety Switch.....	1,279.97		176.55
26 28 16 00-0537	EA	200 Amp, 240 Volt Class, 2 Pole, Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Double Throw Safety Switch.....	2,901.11		229.63
26 28 16 00-0538	EA	400 Amp, 240 Volt Class, 2 Pole, Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Double Throw Safety Switch.....	9,410.76		287.14
26 28 16 00-0539	EA	600 Amp, 240 Volt Class, 2 Pole, Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Double Throw Safety Switch.....	16,201.53		460.47
26 28 16 00-0540		240 Volt Class, 3 Pole, Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Double Throw Safety Switches ^(26 28 16 00-0534)			
26 28 16 00-0541	EA	100 Amp, 240 Volt Class, 3 Pole, Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Double Throw Safety Switch.....	1,680.81		246.92
26 28 16 00-0542	EA	200 Amp, 240 Volt Class, 3 Pole, Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Double Throw Safety Switch.....	2,698.41		321.32
26 28 16 00-0543	EA	400 Amp, 240 Volt Class, 3 Pole, Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Double Throw Safety Switch.....	9,723.87		402.16
26 28 16 00-0544	EA	600 Amp, 240 Volt Class, 3 Pole, Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Double Throw Safety Switch.....	10,608.29		644.66
26 28 16 00-0545		240 Volt Class, 4 Pole, Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Double Throw Safety Switches ^(26 28 16 00-0534)			
26 28 16 00-0546	EA	30 Amp, 240 Volt Class, 4 Pole, Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Double Throw Safety Switch.....	1,608.82		181.05
26 28 16 00-0547	EA	60 Amp, 240 Volt Class, 4 Pole, Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Double Throw Safety Switch.....	1,997.34		236.30
26 28 16 00-0548	EA	100 Amp, 240 Volt Class, 4 Pole, Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Double Throw Safety Switch.....	2,796.21		308.77
26 28 16 00-0549	EA	200 Amp, 240 Volt Class, 4 Pole, Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Double Throw Safety Switch.....	4,035.03		401.52
26 28 16 00-0550	EA	400 Amp, 240 Volt Class, 4 Pole, Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Double Throw Safety Switch.....	6,815.96		502.70
26 28 16 00-0551	EA	600 Amp, 240 Volt Class, 4 Pole, Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Double Throw Safety Switch.....	7,994.00		805.60
26 28 16 00-0552		600 Volt Class, 2 Pole, Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Double Throw Safety Switches ^(26 28 16 00-0534)			
26 28 16 00-0553	EA	60 Amp, 600 Volt Class, 2 Pole, Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Double Throw Safety Switch.....	1,082.69		135.12
26 28 16 00-0554	EA	100 Amp, 600 Volt Class, 2 Pole, Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Double Throw Safety Switch.....	1,642.18		176.55
26 28 16 00-0555	EA	200 Amp, 600 Volt Class, 2 Pole, Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Double Throw Safety Switch.....	2,971.45		229.63
26 28 16 00-0556	EA	400 Amp, 600 Volt Class, 2 Pole, Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Double Throw Safety Switch.....	5,687.16		287.14
26 28 16 00-0557	EA	600 Amp, 600 Volt Class, 2 Pole, Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Double Throw Safety Switch.....	7,615.37		460.47
26 28 16 00-0558		600 Volt Class, 3 Pole, Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Double Throw Safety Switches ^(26 28 16 00-0534)			
26 28 16 00-0559	EA	60 Amp, 600 Volt Class, 3 Pole, Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Double Throw Safety Switch.....	1,233.64		189.02
26 28 16 00-0560	EA	100 Amp, 600 Volt Class, 3 Pole, Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Double Throw Safety Switch.....	1,851.35		246.92
26 28 16 00-0561	EA	200 Amp, 600 Volt Class, 3 Pole, Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Double Throw Safety Switch.....	3,287.05		321.32
26 28 16 00-0562	EA	400 Amp, 600 Volt Class, 3 Pole, Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Double Throw Safety Switch.....	6,186.12		402.16
26 28 16 00-0563	EA	600 Amp, 600 Volt Class, 3 Pole, Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Double Throw Safety Switch.....	8,334.30		644.66
26 28 16 00-0564		600 Volt Class, 4 Pole, Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Double Throw Safety Switches ^(26 28 16 00-0534)			
26 28 16 00-0565	EA	60 Amp, 600 Volt Class, 4 Pole, Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Double Throw Safety Switch.....	2,013.26		236.30
26 28 16 00-0566	EA	100 Amp, 600 Volt Class, 4 Pole, Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Double Throw Safety Switch.....	2,803.51		308.77
26 28 16 00-0567	EA	200 Amp, 600 Volt Class, 4 Pole, Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Double Throw Safety Switch.....	4,136.37		401.52
26 28 16 00-0568	EA	400 Amp, 600 Volt Class, 4 Pole, Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Double Throw Safety Switch.....	6,803.99		502.70
26 28 16 00-0569	EA	600 Amp, 600 Volt Class, 4 Pole, Non-Fusible, NEMA 3R Enclosure, Neutral Kit, Double Throw Safety Switch.....	8,059.95		805.60
26 28 16 00-0570		NEMA 12 Enclosure, Neutral Kit, Double Throw Safety Switches ^(26 28 16 00-0475)			
26 28 16 00-0571		240 Volt Class, 2 Pole, Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Double Throw Safety Switches ^(26 28 16 00-0570)			
26 28 16 00-0572	EA	30 Amp, 240 Volt Class, 2 Pole, Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Double Throw Safety Switch.....	1,279.32		103.44
26 28 16 00-0573	EA	60 Amp, 240 Volt Class, 2 Pole, Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Double Throw Safety Switch.....	1,452.63		135.04
26 28 16 00-0574	EA	100 Amp, 240 Volt Class, 2 Pole, Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Double Throw Safety Switch.....	1,648.34		176.47
26 28 16 00-0575	EA	200 Amp, 240 Volt Class, 2 Pole, Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Double Throw Safety Switch.....	2,263.48		229.47
26 28 16 00-0576	EA	400 Amp, 240 Volt Class, 2 Pole, Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Double Throw Safety Switch.....	4,201.36		287.22
26 28 16 00-0577	EA	600 Amp, 240 Volt Class, 2 Pole, Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Double Throw Safety Switch.....	6,169.20		460.31
26 28 16 00-0578		240 Volt Class, 3 Pole, Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Double Throw Safety Switches ^(26 28 16 00-0570)			
26 28 16 00-0579	EA	30 Amp, 240 Volt Class, 3 Pole, Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Double Throw Safety Switch.....	1,475.25		144.77
26 28 16 00-0580	EA	60 Amp, 240 Volt Class, 3 Pole, Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Double Throw Safety Switch.....	1,748.42		189.02
26 28 16 00-0581	EA	100 Amp, 240 Volt Class, 3 Pole, Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Double Throw Safety Switch.....	2,079.36		246.92
26 28 16 00-0582	EA	200 Amp, 240 Volt Class, 3 Pole, Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Double Throw Safety Switch.....	2,894.54		321.32
26 28 16 00-0583	EA	400 Amp, 240 Volt Class, 3 Pole, Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Double Throw Safety Switch.....	5,239.71		402.16
26 28 16 00-0584	EA	600 Amp, 240 Volt Class, 3 Pole, Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Double Throw Safety Switch.....	6,946.02		644.66
26 28 16 00-0585		240 Volt Class, 4 Pole, Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Double Throw Safety Switches ^(26 28 16 00-0570)			



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 28 16 00-0586 EA 30 Amp, 240 Volt Class, 4 Pole, Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Double Throw Safety Switch	2,197.09	181.05
26 28 16 00-0587 EA 60 Amp, 240 Volt Class, 4 Pole, Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Double Throw Safety Switch	2,575.41	236.30
26 28 16 00-0588 EA 100 Amp, 240 Volt Class, 4 Pole, Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Double Throw Safety Switch	3,527.98	308.77
26 28 16 00-0589 EA 200 Amp, 240 Volt Class, 4 Pole, Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Double Throw Safety Switch	4,789.28	401.52
26 28 16 00-0590 EA 400 Amp, 240 Volt Class, 4 Pole, Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Double Throw Safety Switch	8,818.28	502.70
26 28 16 00-0591 EA 600 Amp, 240 Volt Class, 4 Pole, Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Double Throw Safety Switch	10,991.94	805.60
26 28 16 00-0592 600 Volt Class, 2 Pole, Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Double Throw Safety Switches <small>(26 28 16 00-0570)</small>		
26 28 16 00-0593 EA 60 Amp, 600 Volt Class, 2 Pole, Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Double Throw Safety Switch	1,907.94	135.04
26 28 16 00-0594 EA 100 Amp, 600 Volt Class, 2 Pole, Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Double Throw Safety Switch	2,013.07	176.47
26 28 16 00-0595 EA 200 Amp, 600 Volt Class, 2 Pole, Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Double Throw Safety Switch	3,796.04	229.47
26 28 16 00-0596 EA 400 Amp, 600 Volt Class, 2 Pole, Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Double Throw Safety Switch	5,469.30	287.22
26 28 16 00-0597 EA 600 Amp, 600 Volt Class, 2 Pole, Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Double Throw Safety Switch	7,358.69	460.31
26 28 16 00-0598 600 Volt Class, 3 Pole, Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Double Throw Safety Switches <small>(26 28 16 00-0570)</small>		
26 28 16 00-0599 EA 60 Amp, 600 Volt Class, 3 Pole, Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Double Throw Safety Switch	2,102.16	189.02
26 28 16 00-0600 EA 100 Amp, 600 Volt Class, 3 Pole, Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Double Throw Safety Switch	2,241.70	246.92
26 28 16 00-0601 EA 200 Amp, 600 Volt Class, 3 Pole, Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Double Throw Safety Switch	4,154.91	321.32
26 28 16 00-0602 EA 400 Amp, 600 Volt Class, 3 Pole, Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Double Throw Safety Switch	5,956.59	402.16
26 28 16 00-0603 EA 600 Amp, 600 Volt Class, 3 Pole, Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Double Throw Safety Switch	8,063.83	644.66
26 28 16 00-0604 600 Volt Class, 4 Pole, Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Double Throw Safety Switches <small>(26 28 16 00-0570)</small>		
26 28 16 00-0605 EA 60 Amp, 600 Volt Class, 4 Pole, Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Double Throw Safety Switch	2,601.35	236.30
26 28 16 00-0606 EA 100 Amp, 600 Volt Class, 4 Pole, Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Double Throw Safety Switch	3,719.32	308.77
26 28 16 00-0607 EA 200 Amp, 600 Volt Class, 4 Pole, Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Double Throw Safety Switch	4,902.06	401.52
26 28 16 00-0608 EA 400 Amp, 600 Volt Class, 4 Pole, Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Double Throw Safety Switch	9,061.03	502.70
26 28 16 00-0609 EA 600 Amp, 600 Volt Class, 4 Pole, Non-Fusible, NEMA 12 Enclosure, Neutral Kit, Double Throw Safety Switch	11,313.70	805.60
26 28 16 00-0610 Removal And Reinstallation Of Disconnect Switches <small>(26 28 16 00-0001)</small>		
Note: Includes storage and cleaning.		
26 28 16 00-0611 EA Up To 100 Amp, Remove And Reinstall Safety Disconnect Switch	402.16	
26 28 16 00-0612 EA >100 To 200 Amp, Remove And Reinstall Safety Disconnect Switch	522.83	
26 28 16 00-0613 EA >200 To 300 Amp, Remove And Reinstall Safety Disconnect Switch	583.17	
26 28 16 00-0614 EA >300 To 400 Amp, Remove And Reinstall Safety Disconnect Switch	683.71	
26 28 16 00-0615 Bolted Contact Switches <small>(26 28 16)</small>		
Note: Work includes mounting, material handling, uploading at job site and termination of all conductors entering and leaving the switch.		
26 28 16 00-0616 Electrical Trip, Bolted Contact Switches <small>(26 28 16 00-0615)</small>		
26 28 16 00-0617 Top Feed, Electrical Trip, Bolted Contact Switches <small>(26 28 16 00-0616)</small>		
26 28 16 00-0618 EA 800 Amp, Top Feed, Electrical Trip, Bolted Contact Switch (Eaton CB0833T120480)	5,426.42	804.31
26 28 16 00-0619 EA 1200 Amp, Top Feed, Electrical Trip, Bolted Contact Switch (Eaton CB1233T120480)	5,911.95	965.18
26 28 16 00-0620 EA 1600 Amp, Top Feed, Electrical Trip, Bolted Contact Switch (Eaton CB1633T120480)	6,463.62	1,126.04
26 28 16 00-0621 EA 2000 Amp, Top Feed, Electrical Trip, Bolted Contact Switch (Eaton CB2033T120480)	6,864.10	1,286.90
26 28 16 00-0622 EA 2500 Amp, Top Feed, Electrical Trip, Bolted Contact Switch (Eaton CB2533T120480)	7,749.68	1,447.76
26 28 16 00-0623 EA 3000 Amp, Top Feed, Electrical Trip, Bolted Contact Switch (Eaton CB3033T120480)	9,636.95	1,608.62
26 28 16 00-0624 EA 4000 Amp, Top Feed, Electrical Trip, Bolted Contact Switch (Eaton CB4033T120480)	12,894.89	1,930.35
26 28 16 00-0625 Bottom Feed, Electrical Trip, Bolted Contact Switches <small>(26 28 16 00-0616)</small>		
26 28 16 00-0626 EA 800 Amp, Bottom Feed, Electrical Trip, Bolted Contact Switch (Eaton CB0833B120480)	5,731.97	804.31
26 28 16 00-0627 EA 1200 Amp, Bottom Feed, Electrical Trip, Bolted Contact Switch (Eaton CB1233B120480)	6,277.35	965.18
26 28 16 00-0628 EA 1600 Amp, Bottom Feed, Electrical Trip, Bolted Contact Switch (Eaton CB1633B120480)	6,825.87	1,126.04
26 28 16 00-0629 EA 2000 Amp, Bottom Feed, Electrical Trip, Bolted Contact Switch (Eaton CB2033B120480)	7,383.85	1,286.90
26 28 16 00-0630 EA 2500 Amp, Bottom Feed, Electrical Trip, Bolted Contact Switch (Eaton CB2533B120480)	8,310.38	1,447.76
26 28 16 00-0631 EA 3000 Amp, Bottom Feed, Electrical Trip, Bolted Contact Switch (Eaton CB3033B120480)	10,689.05	1,608.62
26 28 16 00-0632 EA 4000 Amp, Bottom Feed, Electrical Trip, Bolted Contact Switch (Eaton CB4033B120480)	13,991.09	1,930.35
26 28 16 00-0633 Manually Operated, Bolted Contact Switches <small>(26 28 16 00-0615)</small>		
26 28 16 00-0634 Top Feed, Manually Operated, Bolted Contact Switches <small>(26 28 16 00-0615)</small>		
26 28 16 00-0635 EA 800 Amp, Top Feed, Manually Operated, Bolted Contact Switch (Eaton QA0833T480)	4,053.02	804.31
26 28 16 00-0636 EA 1200 Amp, Top Feed, Manually Operated, Bolted Contact Switch (Eaton QA1233T480)	4,554.93	965.18
26 28 16 00-0637 EA 1600 Amp, Top Feed, Manually Operated, Bolted Contact Switch (Eaton QA1633T480)	5,082.66	1,126.04
26 28 16 00-0638 EA 2000 Amp, Top Feed, Manually Operated, Bolted Contact Switch (Eaton QA2033T480)	5,606.62	1,286.90
26 28 16 00-0639 EA 2500 Amp, Top Feed, Manually Operated, Bolted Contact Switch (Eaton QA2533T480)	6,162.08	1,447.76
26 28 16 00-0640 EA 3000 Amp, Top Feed, Manually Operated, Bolted Contact Switch (Eaton QA3033T480)	8,049.35	1,608.62
26 28 16 00-0641 EA 4000 Amp, Top Feed, Manually Operated, Bolted Contact Switch (Eaton QA4033T480)	11,269.49	1,930.35

26	Electrical
26 20	Low-Voltage Electrical Distribution
26 28	Low-Voltage Circuit Protective Devices



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 28 16 00-0642 Bottom Feed, Manually Operated, Bolted Contact Switches <small>(26 28 16 00-0633)</small>		
26 28 16 00-0643 EA 800 Amp, Bottom Feed, Manually Operated, Bolted Contact Switch (Eaton QA0833B480).....	4,255.25	804.31
26 28 16 00-0644 EA 1200 Amp, Bottom Feed, Manually Operated, Bolted Contact Switch (Eaton QA1233B480).....	4,860.48	965.18
26 28 16 00-0645 EA 1600 Amp, Bottom Feed, Manually Operated, Bolted Contact Switch (Eaton QA1633B480).....	5,378.76	1,126.04
26 28 16 00-0646 EA 2000 Amp, Bottom Feed, Manually Operated, Bolted Contact Switch (Eaton QA2033B480).....	5,997.85	1,286.90
26 28 16 00-0647 EA 2500 Amp, Bottom Feed, Manually Operated, Bolted Contact Switch (Eaton QA2533B480).....	6,653.48	1,447.76
26 28 16 00-0648 EA 3000 Amp, Bottom Feed, Manually Operated, Bolted Contact Switch (Eaton QA3033B480).....	9,022.70	1,608.62
26 28 16 00-0649 EA 4000 Amp, Bottom Feed, Manually Operated, Bolted Contact Switch (Eaton QA4033B480).....	12,290.09	1,930.35
26 29 Low-Voltage Controllers <small>(26 20)</small>		
26 29 13 Enclosed Controllers <small>(26 29)</small>		
26 29 13 13 Across-The-Line Motor Controllers <small>(26 29 13)</small>		
26 29 13 13-0001 Manual Motor Starters <small>(26 29 13 13)</small>		
26 29 13 13-0002 Fractional HP Manual Motor Starters <small>(26 29 13 13-0001)</small>		
26 29 13 13-0003 EA NEMA 1, 1 Pole, Toggle Operator, Up To 1 HP, Manual Motor Starter With Thermal Overload Protection (Square D 2510FG1).....	141.85	40.28
For Flush Cover Plate In Lieu Of NEMA 1, Deduct	-1.71	
For Oversized Enclosure, Add	17.10	
For Pilot Light, Add	25.08	
26 29 13 13-0004 EA NEMA 1, 2 Pole, Toggle Operator, Up To 1 HP, Manual Motor Starter With Thermal Overload Protection (Square D 2510FG2).....	185.69	52.37
For Flush Cover Plate In Lieu Of NEMA 1, Deduct	-1.71	
For Oversized Enclosure, Add	17.10	
For Pilot Light, Add	25.08	
26 29 13 13-0005 EA NEMA 1, 1 Pole, Key Operator, Up To 1 HP, Manual Motor Starter With Thermal Overload Protection (Square D 2510FG3).....	158.95	40.28
For Flush Cover Plate In Lieu Of NEMA 1, Deduct	-1.71	
For Oversized Enclosure, Add	17.10	
For Pilot Light, Add	25.08	
26 29 13 13-0006 EA NEMA 1, 2 Pole, Key Operator, Up To 1 HP, Manual Motor Starter With Thermal Overload Protection (Square D 2510FG4).....	202.79	52.37
For Flush Cover Plate In Lieu Of NEMA 1, Deduct	-1.71	
For Oversized Enclosure, Add	17.10	
For Pilot Light, Add	25.08	
26 29 13 13-0007 EA NEMA 1, Handle Guard/Lockoff, 1 Pole, Toggle Operator, Up To 1 HP, Manual Motor Starter With Thermal Overload Protection (Square D 2510FG5).....	149.26	40.28
For Oversized Enclosure, Add	17.10	
26 29 13 13-0008 EA NEMA 1, Handle Guard/Lockoff, 2 Pole, Toggle Operator, Up To 1 HP, Manual Motor Starter With Thermal Overload Protection (Square D 2510FG6).....	195.38	52.37
For Oversized Enclosure, Add	17.10	
26 29 13 13-0009 EA NEMA 4, Handle Guard/Lockoff, 1 Pole, Toggle Operator, Up To 1 HP, Manual Motor Starter With Thermal Overload Protection (Square D 2510FW1).....	291.34	48.34
For Pilot Light, Add	65.55	
26 29 13 13-0010 EA NEMA 4, Handle Guard/Lockoff, 2 Pole, Toggle Operator, Up To 1 HP, Manual Motor Starter With Thermal Overload Protection (Square D 2510FW2).....	336.89	60.42
For Pilot Light, Add	65.55	
26 29 13 13-0011 EA NEMA 3R, 7 And 9, Handle Guard/Lockoff, 1 Pole, Toggle Operator, Up To 1 HP, Manual Motor Starter With Thermal Overload Protection (Square D 2510FR1).....	308.44	48.34
26 29 13 13-0012 EA NEMA 3R, 7 And 9, Handle Guard/Lockoff, 2 Pole, Toggle Operator, Up To 1 HP, Manual Motor Starter With Thermal Overload Protection (Square D 2510FR2).....	352.28	60.42
26 29 13 13-0013 Non Reversing Manual Motor Starters <small>(26 29 13 13-0001)</small>		
26 29 13 13-0014 EA NEMA 1, Non Reversing, 2 Pole, Toggle Operator, 2 HP At 115 Volt, 3 HP At 460 Volt, Manual Motor Starting Switch Without Thermal Overload Protection (Square D 2510KG1).....	116.87	40.28
Note: NEMA 1 or flush cover plate installation.		
For Oversize Enclosure, Add	8.25	
For Pilot Light, Add	39.60	
26 29 13 13-0015 EA NEMA 1, Non Reversing, 3 Pole, Toggle Operator, 2 HP At 115 Volt, 7-1/2 HP At 230 Volt, 10 HP At 460 Volt, Manual Motor Starting Switch Without Thermal Overload Protection (Square D 2510KG2).....	186.69	52.37
Note: NEMA 1 or flush cover plate installation.		
For Oversize Enclosure, Add	8.25	
For Pilot Light, Add	39.60	
26 29 13 13-0016 EA NEMA 1, Non Reversing, 2 Pole, Toggle Operator, 2 HP At 115 Volt, 3 HP At 230 Volt, 7-1/2 HP At 460 Volt, Manual Motor Starting Switch Without Thermal Overload Protection (Square D 2510KG5).....	131.52	44.32
Note: NEMA 1 or flush cover plate installation.		
For Oversize Enclosure, Add	8.25	
For Pilot Light, Add	39.60	
26 29 13 13-0017 EA NEMA 1, Non Reversing, 3 Pole, Toggle Operator, 2 HP At 115 Volt, 7-1/2 HP At 230 Volt, 15 HP At 460 Volt, Manual Motor Starting Switch Without Thermal Overload Protection (Square D 2510KG6).....	201.89	56.40
Note: NEMA 1 or flush cover plate installation.		
For Oversize Enclosure, Add	8.25	
For Pilot Light, Add	39.60	
26 29 13 13-0018 EA NEMA 1, Non Reversing, 2 Pole, Key Operator, 2 HP At 115 Volt, 2 HP At 230 Volt, 3 HP At 460 Volt, Manual Motor Starting Switch Without Thermal Overload Protection (Square D 2510KG3).....	132.82	40.28
Note: NEMA 1 or flush cover plate installation.		
For Oversize Enclosure, Add	8.25	
For Pilot Light, Add	39.60	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 29 13 13-0019 EA NEMA 1, Non Reversing, 3 Pole, Key Operator, 2 HP At 115 Volt, 7-1/2 HP At 230 Volt, 10 HP At 460 Volt, Manual Motor Starting Switch Without Thermal Overload Protection (Square D 2510KG4)	203.19	52.37
Note: NEMA 1 or flush cover plate installation.		
<i>For Oversize Enclosure, Add</i>	8.25	
<i>For Pilot Light, Add</i>	39.60	
26 29 13 13-0020 EA NEMA 4, Non Reversing, 2 Pole, Toggle Operator, 2 HP At 115 Volt, 2 HP At 230 Volt, 3 HP At 460 Volt, Manual Motor Starting Switch Without Thermal Overload Protection (Square D 2510KW1).....	269.38	48.34
<i>For Pilot Light, Add</i>	62.70	
26 29 13 13-0021 EA NEMA 4, Non Reversing, 3 Pole, Toggle Operator, 2 HP At 115 Volt, 7-1/2 HP At 230 Volt, 10 HP At 460 Volt, Manual Motor Starting Switch Without Thermal Overload Protection (Square D 2510KW2).....	333.15	60.42
<i>For Pilot Light, Add</i>	62.70	
26 29 13 13-0022 EA NEMA 4, Non Reversing, 2 Pole, Toggle Operator, 2 HP At 115 Volt, 3 HP At 230 Volt, 7-1/2 HP At 460 Volt, Manual Motor Starting Switch Without Thermal Overload Protection (Square D 2510KW5).....	284.59	52.37
<i>For Pilot Light, Add</i>	62.70	
26 29 13 13-0023 EA NEMA 4, Non Reversing, 3 Pole, Toggle Operator, 2 HP At 115 Volt, 7-1/2 HP At 230 Volt, 15 HP At 460 Volt, Manual Motor Starting Switch Without Thermal Overload Protection (Square D 2510KW6).....	346.71	64.46
<i>For Pilot Light, Add</i>	62.70	
26 29 13 13-0024 EA NEMA 3R, 7 And 9, Non Reversing, 2 Pole, Toggle Operator, 2 HP At 115 Volt, 2 HP At 230 Volt, 3 HP At 460 Volt, Manual Motor Starting Switch Without Thermal Overload Protection (Square D 2510KR1).....	284.78	48.34
26 29 13 13-0025 EA NEMA 3R, 7 And 9, Non Reversing, 3 Pole, Toggle Operator, 2 HP At 115 Volt, 7-1/2 HP At 230 Volt, 10 HP At 460 Volt, Manual Motor Starting Switch Without Thermal Overload Protection (Square D 2510KR2).....	352.95	60.42
26 29 13 13-0026 EA Open Type, Non Reversing, 2 Pole, Toggle Operator, 2 HP At 115 Volt, 2 HP At 230 Volt, 3 HP At 460 Volt, Manual Motor Starting Switch Without Thermal Overload Protection (Square D 2510KO1)	85.00	28.20
<i>For Pilot Light, Add</i>	39.60	
26 29 13 13-0027 EA Open Type, Non Reversing, 3 Pole, Toggle Operator, 2 HP At 115 Volt, 7-1/2 HP At 230 Volt, 10 HP At 460 Volt, Manual Motor Starting Switch Without Thermal Overload Protection (Square D 2510KO2)	154.82	40.28
<i>For Pilot Light, Add</i>	39.60	
26 29 13 13-0028 EA Open Type, Non Reversing, 2 Pole, Toggle Operator, 2 HP At 115 Volt, 3 HP At 230 Volt, 7-1/2 HP At 460 Volt, Manual Motor Starting Switch Without Thermal Overload Protection (Square D 2510KO5)	99.66	32.23
<i>For Pilot Light, Add</i>	39.60	
26 29 13 13-0029 EA Open Type, Non Reversing, 3 Pole, Toggle Operator, 2 HP At 115 Volt, 7-1/2 HP At 230 Volt, 15 HP At 460 Volt, Manual Motor Starting Switch Without Thermal Overload Protection (Square D 2510KO6)	169.47	44.32
<i>For Pilot Light, Add</i>	39.60	
26 29 13 13-0030 Reversing Manual Motor Starters <small>(26 29 13 13-0001)</small>		
26 29 13 13-0031 EA NEMA 1, Reversing, 2 Pole, Toggle Operator, 2 HP At 115 Volt, 2 HP At 230 Volt, 3 HP At 460 Volt, Manual Motor Starting Switch Without Thermal Overload Protection (Square D 2511KG11)	302.87	72.51
<i>For Pilot Light, Add</i>	63.80	
26 29 13 13-0032 EA NEMA 1, Reversing, 3 Pole, Toggle Operator, 2 HP At 115 Volt, 7-1/2 HP At 230 Volt, 10 HP At 460 Volt, Manual Motor Starting Switch Without Thermal Overload Protection (Square D 2511KG22)	435.91	96.68
<i>For Pilot Light, Add</i>	63.80	
26 29 13 13-0033 Two Speed Manual Motor Starters <small>(26 29 13 13-0001)</small>		
26 29 13 13-0034 EA NEMA 1, Two Speed, 2 Pole, Toggle Operator, 2 HP At 115 Volt, 2 HP At 230 Volt, 3 HP At 460 Volt, Manual Motor Starting Switch Without Thermal Overload Protection (Square D 2512KG11)	302.87	72.51
26 29 13 13-0035 EA NEMA 1, Two Speed, 3 Pole, Toggle Operator, 2 HP At 115 Volt, 7-1/2 HP At 230 Volt, 10 HP At 460 Volt, Manual Motor Starting Switch Without Thermal Overload Protection (Square D 2512KG22)	435.91	96.68
26 29 13 13-0036 Non-Reversing Integral HP Manual Motor Starters <small>(26 29 13 13-0001)</small>		
26 29 13 13-0037 EA NEMA 1, Non-Reversing Integral HP, 2 Pole, Push Button Operator, NEMA Size M-0, Manual Motor Starter With Thermal Overload Protection (Square D 2510MBG1)	271.68	48.34
26 29 13 13-0038 EA NEMA 1, Non-Reversing Integral HP, 2 Pole, Toggle Operator, NEMA Size M-0, Manual Motor Starter With Thermal Overload Protection (Square D 2510TBG1)	271.68	48.34
26 29 13 13-0039 EA NEMA 4, Non-Reversing Integral HP, 2 Pole, Push Button Operator, NEMA Size M-0, Manual Motor Starter With Thermal Overload Protection (Square D 2510MBW1).....	547.71	56.40
26 29 13 13-0040 EA NEMA 4X, Non-Reversing Integral HP, 2 Pole, External Toggle Operator To Actuate A Push Button Operator Inside, NEMA Size M-0, Manual Motor Starter With Thermal Overload Protection (Square D 2510MBW1).....	547.71	56.40
26 29 13 13-0041 EA NEMA 7 And 9, Non-Reversing Integral HP, 2 Pole, External Toggle Operator To Actuate A Push Button Operator Inside, NEMA Size M-0, Manual Motor Starter With Thermal Overload Protection (Square D 2510MBR1).....	709.59	56.40
26 29 13 13-0042 EA Type 12, Non-Reversing Integral HP, 2 Pole, Push Button Operator, NEMA Size M-0, Manual Motor Starter With Thermal Overload Protection (Square D 2510MBA1).....	344.22	56.40
26 29 13 13-0043 EA Open, Non-Reversing Integral HP, 2 Pole, Push Button Operator, NEMA Size M-0, Manual Motor Starter With Thermal Overload Protection (Square D 2510MBO1)	230.41	36.26
26 29 13 13-0044 EA NEMA 1, Non-Reversing Integral HP, 2 Pole, Push Button Operator, NEMA Size M-1, Manual Motor Starter With Thermal Overload Protection (Square D 2510MCG1).....	320.78	52.37
26 29 13 13-0045 EA NEMA 1, Non-Reversing Integral HP, 2 Pole, Toggle Operator, NEMA Size M-1, Manual Motor Starter With Thermal Overload Protection (Square D 2510TCG1).....	320.78	52.37
26 29 13 13-0046 EA NEMA 4, Non-Reversing Integral HP, 2 Pole, Push Button Operator, NEMA Size M-1, Manual Motor Starter With Thermal Overload Protection (Square D 2510MCW11)	653.24	60.42
26 29 13 13-0047 EA NEMA 4X, Non-Reversing Integral HP, 2 Pole, External Toggle Operator To Actuate A Push Button Operator Inside, NEMA Size M-1, Manual Motor Starter With Thermal Overload Protection (Square D 2510MCW1).....	653.24	60.42
26 29 13 13-0048 EA NEMA 7 And 9, Non-Reversing Integral HP, 2 Pole, External Toggle Operator To Actuate A Push Button Operator Inside, NEMA Size M-1, Manual Motor Starter With Thermal Overload Protection (Square D 2510MCR1).....	827.66	60.42
26 29 13 13-0049 EA Type 12, Non-Reversing Integral HP, 2 Pole, Push Button Operator, NEMA Size M-1, Manual Motor Starter With Thermal Overload Protection (Square D 2510MCA1)	393.32	60.42
26 29 13 13-0050 EA Open, Non-Reversing Integral HP, 2 Pole, Push Button Operator, NEMA Size M-1, Manual Motor Starter With Thermal Overload Protection (Square D 2510MCO1)	279.51	40.28
26 29 13 13-0051 EA NEMA 1, Non-Reversing Integral HP, 2 Pole, Push Button Operator, NEMA Size M-1P, Manual Motor Starter With Thermal Overload Protection (Square D 2510MCG2).....	417.18	56.40
26 29 13 13-0052 EA NEMA 1, Non-Reversing Integral HP, 2 Pole, Toggle Operator, NEMA Size M-1P, Manual Motor Starter With Thermal Overload Protection (Square D 2510TCG2).....	417.18	56.40

26 Electrical**26 20 Low-Voltage Electrical Distribution****26 29 Low-Voltage Controllers**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 29 13 13-0053	EA		NEMA 4, Non-Reversing Integral HP, 2 Pole, Push Button Operator, NEMA Size M-1P, Manual Motor Starter With Thermal Overload Protection (Square D 2510MCW12).....	774.16	64.46
26 29 13 13-0054	EA		NEMA 4X, Non-Reversing Integral HP, 2 Pole, External Toggle Operator To Actuate A Push Button Operator Inside, NEMA Size M-1P, Manual Motor Starter With Thermal Overload Protection (Square D 2510MCW2).....	774.16	64.46
26 29 13 13-0055	EA		NEMA 7 And 9, Non-Reversing Integral HP, 2 Pole, External Toggle Operator To Actuate A Push Button Operator Inside, NEMA Size M-1P, Manual Motor Starter With Thermal Overload Protection (Square D 2510MCR2).....	941.17	64.46
26 29 13 13-0056	EA		Type 12, Non-Reversing Integral HP, 2 Pole, Push Button Operator, NEMA Size M-1P, Manual Motor Starter With Thermal Overload Protection (Square D 2510MCA2).....	491.44	64.46
26 29 13 13-0057	EA		Open, Non-Reversing Integral HP, 2 Pole, Push Button Operator, NEMA Size M-1P, Manual Motor Starter With Thermal Overload Protection (Square D 2510MCO2).....	377.62	44.32
26 29 13 13-0058	EA		NEMA 1, Non-Reversing Integral HP, 3 Pole, Push Button Operator, NEMA Size M-0, Manual Motor Starter With Thermal Overload Protection (Square D 2510MBG2).....	336.61	60.42
26 29 13 13-0059	EA		NEMA 1, Non-Reversing Integral HP, 3 Pole, Toggle Operator, NEMA Size M-0, Manual Motor Starter With Thermal Overload Protection (Square D 2510TBG2).....	336.61	60.42
26 29 13 13-0060	EA		NEMA 4, Non-Reversing Integral HP, 3 Pole, Push Button Operator, NEMA Size M-0, Manual Motor Starter With Thermal Overload Protection (Square D 2510MBW12).....	612.65	68.48
26 29 13 13-0061	EA		NEMA 4X, Non-Reversing Integral HP, 3 Pole, External Toggle Operator To Actuate A Push Button Operator Inside, NEMA Size M-0, Manual Motor Starter With Thermal Overload Protection (Square D 2510MBW2).....	612.65	68.48
26 29 13 13-0062	EA		NEMA 7 And 9, Non-Reversing Integral HP, 3 Pole, External Toggle Operator To Actuate A Push Button Operator Inside, NEMA Size M-0, Manual Motor Starter With Thermal Overload Protection (Square D 2510MBR2).....	779.09	68.48
26 29 13 13-0063	EA		Type 12, Non-Reversing Integral HP, 3 Pole, Push Button Operator, NEMA Size M-0, Manual Motor Starter With Thermal Overload Protection (Square D 2510MBA2).....	409.73	68.48
26 29 13 13-0064	EA		Open, Non-Reversing Integral HP, 3 Pole, Push Button Operator, NEMA Size M-0, Manual Motor Starter With Thermal Overload Protection (Square D 2510TBG2).....	297.05	48.34
26 29 13 13-0065	EA		NEMA 1, Non-Reversing Integral HP, 3 Pole, Push Button Operator, NEMA Size M-1, Manual Motor Starter With Thermal Overload Protection (Square D 2510MCG3).....	385.71	64.46
26 29 13 13-0066	EA		NEMA 1, Non-Reversing Integral HP, 3 Pole, Toggle Operator, NEMA Size M-1, Manual Motor Starter With Thermal Overload Protection (Square D 2510TCG3).....	385.71	64.46
26 29 13 13-0067	EA		NEMA 4, Non-Reversing Integral HP, 3 Pole, Push Button Operator, NEMA Size M-1, Manual Motor Starter With Thermal Overload Protection (Square D 2510MCW13).....	718.17	72.51
26 29 13 13-0068	EA		NEMA 4X, Non-Reversing Integral HP, 3 Pole, External Toggle Operator To Actuate A Push Button Operator Inside, NEMA Size M-1, Manual Motor Starter With Thermal Overload Protection (Square D 2510MCW3).....	718.17	72.51
26 29 13 13-0069	EA		NEMA 7 And 9, Non-Reversing Integral HP, 3 Pole, External Toggle Operator To Actuate A Push Button Operator Inside, NEMA Size M-1, Manual Motor Starter With Thermal Overload Protection (Square D 2510MCR3).....	896.58	72.51
26 29 13 13-0070	EA		Type 12, Non-Reversing Integral HP, 3 Pole, Push Button Operator, NEMA Size M-1, Manual Motor Starter With Thermal Overload Protection (Square D 2510MCA3).....	458.25	72.51
26 29 13 13-0071	EA		Open, Non-Reversing Integral HP, 3 Pole, Push Button Operator, NEMA Size M-1, Manual Motor Starter With Thermal Overload Protection (Square D 2510MCO3).....	344.44	52.37
26 29 13 13-0072			Reversing Integral HP Manual Motor Starters (26 29 13 13-0001)		
26 29 13 13-0073	EA		NEMA 1, Reversing Integral HP, 3 Pole, Push Button Operator, NEMA Size M-0, Manual Motor Starter With Thermal Overload Protection (Square D 2511MBG1).....	766.86	84.60
26 29 13 13-0074	EA		NEMA 1, Reversing Integral HP, 3 Pole, Toggle Operator, NEMA Size M-0, Manual Motor Starter With Thermal Overload Protection (Square D 2511TBG1).....	766.86	84.60
26 29 13 13-0075	EA		Open, Reversing Integral HP, 3 Pole, Push Button Operator, NEMA Size M-0, Manual Motor Starter With Thermal Overload Protection (Square D 2511MBO1).....	670.06	60.42
26 29 13 13-0076	EA		NEMA 1, Reversing Integral HP, 3 Pole, Push Button Operator, NEMA Size M-1, Manual Motor Starter With Thermal Overload Protection (Square D 2511MCG1).....	904.38	92.65
26 29 13 13-0077	EA		Open, Reversing Integral HP, 3 Pole, Push Button Operator, NEMA Size M-1, Manual Motor Starter With Thermal Overload Protection (Square D 2511MCO1).....	807.59	68.48
26 29 13 13-0078			Two Speed Integral HP Manual Motor Starters (26 29 13 13-0001)		
26 29 13 13-0079	EA		NEMA 1, Two Speed Integral HP, 3 Pole, Push Button Operator, NEMA Size M-0, Manual Motor Starter With Thermal Overload Protection (Square D 2512MBG1).....	766.86	84.60
26 29 13 13-0080	EA		Open, Two Speed Integral HP, 3 Pole, Push Button Operator, NEMA Size M-0, Manual Motor Starter With Thermal Overload Protection (Square D 2512MBO1).....	670.06	60.42
26 29 13 13-0081	EA		NEMA 1, Two Speed Integral HP, 3 Pole, Push Button Operator, NEMA Size M-1, Manual Motor Starter With Thermal Overload Protection (Square D 2512MCG1).....	904.38	92.65
26 29 13 13-0082	EA		Open, Two Speed Integral HP, 3 Pole, Push Button Operator, NEMA Size M-1, Manual Motor Starter With Thermal Overload Protection (Square D 2512MCO1).....	807.59	68.48
26 29 13 13-0083			Magnetic Motor Starters (26 29 13 13)		
26 29 13 13-0084			Non Reversing, Magnetic Contactors (26 29 13 13-0083)		
26 29 13 13-0085			Open Enclosure, Non Reversing, Magnetic Contactors (26 29 13 13-0084)		
26 29 13 13-0086	EA		Size 00, 1 Phase, 2 Pole, 1-1/2 HP At 200/230 Volt, 2 HP At 460/575 Volt, 9 Amp, Open Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SAO11).....	324.73	80.57
			<i>For Factory Installed Accessory, Deduct</i>	-161.14	
26 29 13 13-0087	EA		Size 00, 3 Phase, 3 Pole, 1-1/2 HP At 200/230 Volt, 2 HP At 460/575 Volt, 9 Amp, Open Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SAO12).....	364.78	88.62
			<i>For Factory Installed Accessory, Deduct</i>	-177.25	
26 29 13 13-0088	EA		Size 0, 1 Phase, 1 Pole, 3 HP At 200/230 Volt, 5 HP At 460/575 Volt, 18 Amp, Open Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SBO5).....	348.67	80.57
			<i>For Factory Installed Accessory, Deduct</i>	-161.14	
26 29 13 13-0089	EA		Size 0, 1 Phase, 2 Pole, 3 HP At 200/230 Volt, 5 HP At 460/575 Volt, 18 Amp, Open Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SBO1).....	389.29	88.62
			<i>For Factory Installed Accessory, Deduct</i>	-177.25	
26 29 13 13-0090	EA		Size 0, 3 Phase, 3 Pole, 3 HP At 200/230 Volt, 5 HP At 460/575 Volt, 18 Amp, Open Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SBO2).....	429.34	96.68
			<i>For Factory Installed Accessory, Deduct</i>	-193.36	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 29 13 13-0091 EA Size 0, 3 Phase, 4 Pole, 3 HP At 200/230 Volt, 5 HP At 460/575 Volt, 18 Amp, Open Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SBO3).....	542.10	120.85
<i>For Factory Installed Accessory, Deduct</i>	-241.71	
26 29 13 13-0092 EA Size 0, 3 Phase, 5 Pole, 3 HP At 200/230 Volt, 5 HP At 460/575 Volt, 18 Amp, Open Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SBO4).....	679.92	145.02
<i>For Factory Installed Accessory, Deduct</i>	-290.04	
26 29 13 13-0093 EA Size 1, 1 Phase, 1 Pole, 7-1/2 HP At 200/230 Volt, 10 HP At 460/575 Volt, 27 Amp, Open Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SCO5).....	404.68	88.62
<i>For Factory Installed Accessory, Deduct</i>	-177.25	
26 29 13 13-0094 EA Size 1, 1 Phase, 2 Pole, 7-1/2 HP At 200/230 Volt, 10 HP At 460/575 Volt, 27 Amp, Open Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SCO1).....	444.73	96.68
<i>For Factory Installed Accessory, Deduct</i>	-193.36	
26 29 13 13-0095 EA Size 1, 3 Phase, 3 Pole, 7-1/2 HP At 200/230 Volt, 10 HP At 460/575 Volt, 27 Amp, Open Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SCO2).....	485.93	104.74
<i>For Factory Installed Accessory, Deduct</i>	-209.48	
26 29 13 13-0096 EA Size 1, 3 Phase, 4 Pole, 7-1/2 HP At 200/230 Volt, 10 HP At 460/575 Volt, 27 Amp, Open Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SCO3).....	623.42	140.99
<i>For Factory Installed Accessory, Deduct</i>	-281.99	
26 29 13 13-0097 EA Size 1, 3 Phase, 5 Pole, 7-1/2 HP At 200/230 Volt, 10 HP At 460/575 Volt, 27 Amp, Open Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SCO4).....	760.68	165.16
<i>For Factory Installed Accessory, Deduct</i>	-330.33	
26 29 13 13-0098 EA Size 2, 1 Phase, 2 Pole, 10 HP At 200 Volt, 15 HP At 230 Volt, 25 HP At 460/575 Volt, 45 Amp, Open Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SDO1).....	664.75	96.68
<i>For Factory Installed Accessory, Deduct</i>	-193.36	
26 29 13 13-0099 EA Size 2, 3 Phase, 3 Pole, 10 HP At 200 Volt, 15 HP At 230 Volt, 25 HP At 460/575 Volt, 45 Amp, Open Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SDO2).....	744.45	120.85
<i>For Factory Installed Accessory, Deduct</i>	-241.71	
26 29 13 13-0100 EA Size 2, 3 Phase, 4 Pole, 10 HP At 200 Volt, 15 HP At 230 Volt, 25 HP At 460/575 Volt, 45 Amp, Open Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SDO3).....	971.50	161.14
<i>For Factory Installed Accessory, Deduct</i>	-322.27	
26 29 13 13-0101 EA Size 3, 1 Phase, 2 Pole, 25 HP At 200 Volt, 30 HP At 230 Volt, 50 HP At 460/575 Volt, 90 Amp, Open Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SEO1).....	988.41	120.85
<i>For Factory Installed Accessory, Deduct</i>	-241.71	
26 29 13 13-0102 EA Size 3, 3 Phase, 3 Pole, 25 HP At 200 Volt, 30 HP At 230 Volt, 50 HP At 460/575 Volt, 90 Amp, Open Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SEO2).....	1,134.52	161.14
<i>For Factory Installed Accessory, Deduct</i>	-322.27	
26 29 13 13-0103 EA Size 3, 3 Phase, 4 Pole, 25 HP At 200 Volt, 30 HP At 230 Volt, 50 HP At 460/575 Volt, 90 Amp, Open Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SEO3).....	1,441.95	201.42
<i>For Factory Installed Accessory, Deduct</i>	-402.84	
26 29 13 13-0104 EA Size 3, 3 Phase, 5 Pole, 25 HP At 200 Volt, 30 HP At 230 Volt, 50 HP At 460/575 Volt, 90 Amp, Open Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SEO4).....	2,042.36	241.71
<i>For Factory Installed Accessory, Deduct</i>	-483.41	
26 29 13 13-0105 EA Size 4, 1 Phase, 2 Pole, 40 HP At 200 Volt, 50 HP At 230 Volt, 100 HP At 460/575 Volt, 135 Amp, Open Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SFO1).....	2,205.18	201.42
<i>For Factory Installed Accessory, Deduct</i>	-402.84	
26 29 13 13-0106 EA Size 4, 3 Phase, 3 Pole, 40 HP At 200 Volt, 50 HP At 230 Volt, 100 HP At 460/575 Volt, 135 Amp, Open Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SFO2).....	2,432.24	241.71
<i>For Factory Installed Accessory, Deduct</i>	-483.41	
26 29 13 13-0107 EA Size 4, 3 Phase, 4 Pole, 40 HP At 200 Volt, 50 HP At 230 Volt, 100 HP At 460/575 Volt, 135 Amp, Open Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SFO3).....	3,275.47	281.99
<i>For Factory Installed Accessory, Deduct</i>	-563.98	
26 29 13 13-0108 EA Size 5, 1 Phase, 2 Pole, 75 HP At 200 Volt, 100 HP At 230 Volt, 200 HP At 460/575 Volt, 270 Amp, Open Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SGO1).....	4,389.05	241.71
<i>For Factory Installed Accessory, Deduct</i>	-483.41	
26 29 13 13-0109 EA Size 5, 3 Phase, 3 Pole, 75 HP At 200 Volt, 100 HP At 230 Volt, 200 HP At 460/575 Volt, 270 Amp, Open Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SGO2).....	4,891.62	322.27
<i>For Factory Installed Accessory, Deduct</i>	-644.55	
26 29 13 13-0110 EA Size 6, 3 Phase, 3 Pole, 150 HP At 200 Volt, 200 HP At 230 Volt, 400 HP At 460/575 Volt, 540 Amp, Open Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SHO2).....	12,560.05	483.41
<i>For Factory Installed Accessory, Deduct</i>	-966.82	
26 29 13 13-0111 EA Size 7, 3 Phase, 3 Pole, 300 HP At 230 Volt, 600 HP At 460/575 Volt, 810 Amp, Open Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SJO2).....	17,996.19	725.11
<i>For Factory Installed Accessory, Deduct</i>	-1,450.23	
26 29 13 13-0112 NEMA 1, Non Reversing, Magnetic Contactors <small>(26 29 13 13-0084)</small>		
26 29 13 13-0113 EA Size 00, 1 Phase, 2 Pole, 1-1/2 HP At 200/230 Volt, 2 HP At 460/575 Volt, 9 Amp, NEMA 1 Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SAG11).....	342.40	80.57
<i>For Factory Installed Accessory, Deduct</i>	-161.14	
26 29 13 13-0114 EA Size 00, 3 Phase, 3 Pole, 1-1/2 HP At 200/230 Volt, 2 HP At 460/575 Volt, 9 Amp, NEMA 1 Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SAG12).....	382.45	88.62
<i>For Factory Installed Accessory, Deduct</i>	-177.25	
26 29 13 13-0115 EA Size 0, 1 Phase, 1 Pole, 3 HP At 200/230 Volt, 5 HP At 460/575 Volt, 18 Amp, NEMA 1 Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SBG5).....	366.34	80.57
<i>For Factory Installed Accessory, Deduct</i>	-161.14	
26 29 13 13-0116 EA Size 0, 1 Phase, 2 Pole, 3 HP At 200/230 Volt, 5 HP At 460/575 Volt, 18 Amp, NEMA 1 Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SBG1).....	407.53	88.62
<i>For Factory Installed Accessory, Deduct</i>	-177.25	
26 29 13 13-0117 EA Size 0, 3 Phase, 3 Pole, 3 HP At 200/230 Volt, 5 HP At 460/575 Volt, 18 Amp, NEMA 1 Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SBG2).....	447.58	96.68
<i>For Factory Installed Accessory, Deduct</i>	-193.36	
26 29 13 13-0118 EA Size 0, 3 Phase, 4 Pole, 3 HP At 200/230 Volt, 5 HP At 460/575 Volt, 18 Amp, NEMA 1 Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SBG3).....	561.48	120.85
<i>For Factory Installed Accessory, Deduct</i>	-241.71	

26 Electrical**26 20 Low-Voltage Electrical Distribution****26 29 Low-Voltage Controllers**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 29 13 13-0119	EA		Size 0, 3 Phase, 5 Pole, 3 HP At 200/230 Volt, 5 HP At 460/575 Volt, 18 Amp, NEMA 1 Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SBG4).....	699.87	145.02
			<i>For Factory Installed Accessory, Deduct</i>	-290.04	
26 29 13 13-0120	EA		Size 1, 1 Phase, 1 Pole, 7-1/2 HP At 200/230 Volt, 10 HP At 460/575 Volt, 27 Amp, NEMA 1 Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SCG5).....	423.49	88.62
			<i>For Factory Installed Accessory, Deduct</i>	-177.25	
26 29 13 13-0121	EA		Size 1, 1 Phase, 2 Pole, 7-1/2 HP At 200/230 Volt, 10 HP At 460/575 Volt, 27 Amp, NEMA 1 Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SCG1).....	464.68	96.68
			<i>For Factory Installed Accessory, Deduct</i>	-193.36	
26 29 13 13-0122	EA		Size 1, 3 Phase, 3 Pole, 7-1/2 HP At 200/230 Volt, 10 HP At 460/575 Volt, 27 Amp, NEMA 1 Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SCG2).....	504.74	104.74
			<i>For Factory Installed Accessory, Deduct</i>	-209.48	
26 29 13 13-0123	EA		Size 1, 3 Phase, 4 Pole, 7-1/2 HP At 200/230 Volt, 10 HP At 460/575 Volt, 27 Amp, NEMA 1 Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SCG3).....	642.80	140.99
			<i>For Factory Installed Accessory, Deduct</i>	-281.99	
26 29 13 13-0124	EA		Size 1, 3 Phase, 5 Pole, 7-1/2 HP At 200/230 Volt, 10 HP At 460/575 Volt, 27 Amp, NEMA 1 Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SCG4).....	779.49	165.16
			<i>For Factory Installed Accessory, Deduct</i>	-330.33	
26 29 13 13-0125	EA		Size 2, 1 Phase, 2 Pole, 10 HP At 200 Volt, 15 HP At 230 Volt, 25 HP At 460/575 Volt, 45 Amp, NEMA 1 Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SDG1).....	749.11	96.68
			<i>For Factory Installed Accessory, Deduct</i>	-193.36	
26 29 13 13-0126	EA		Size 2, 3 Phase, 3 Pole, 10 HP At 200 Volt, 15 HP At 230 Volt, 25 HP At 460/575 Volt, 45 Amp, NEMA 1 Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SDG2).....	829.38	120.85
			<i>For Factory Installed Accessory, Deduct</i>	-241.71	
26 29 13 13-0127	EA		Size 2, 3 Phase, 4 Pole, 10 HP At 200 Volt, 15 HP At 230 Volt, 25 HP At 460/575 Volt, 45 Amp, NEMA 1 Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SDG3).....	1,055.86	161.14
			<i>For Factory Installed Accessory, Deduct</i>	-322.27	
26 29 13 13-0128	EA		Size 3, 1 Phase, 2 Pole, 25 HP At 200 Volt, 30 HP At 230 Volt, 50 HP At 460/575 Volt, 90 Amp, NEMA 1 Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SEG1).....	1,154.28	120.85
			<i>For Factory Installed Accessory, Deduct</i>	-241.71	
26 29 13 13-0129	EA		Size 3, 3 Phase, 3 Pole, 25 HP At 200 Volt, 30 HP At 230 Volt, 50 HP At 460/575 Volt, 90 Amp, NEMA 1 Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SEG2).....	1,299.82	161.14
			<i>For Factory Installed Accessory, Deduct</i>	-322.27	
26 29 13 13-0130	EA		Size 3, 3 Phase, 4 Pole, 25 HP At 200 Volt, 30 HP At 230 Volt, 50 HP At 460/575 Volt, 90 Amp, NEMA 1 Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SEG3).....	1,607.82	201.42
			<i>For Factory Installed Accessory, Deduct</i>	-402.84	
26 29 13 13-0131	EA		Size 4, 1 Phase, 2 Pole, 40 HP At 200 Volt, 50 HP At 230 Volt, 100 HP At 460/575 Volt, 135 Amp, NEMA 1 Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SFG1).....	2,548.89	201.42
			<i>For Factory Installed Accessory, Deduct</i>	-402.84	
26 29 13 13-0132	EA		Size 4, 3 Phase, 3 Pole, 40 HP At 200 Volt, 50 HP At 230 Volt, 100 HP At 460/575 Volt, 135 Amp, NEMA 1 Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SFG2).....	2,775.95	241.71
			<i>For Factory Installed Accessory, Deduct</i>	-483.41	
26 29 13 13-0133	EA		Size 5, 3 Phase, 3 Pole, 75 HP At 200 Volt, 100 HP At 230 Volt, 200 HP At 460/575 Volt, 270 Amp, NEMA 1 Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SGG2).....	5,518.05	322.27
			<i>For Factory Installed Accessory, Deduct</i>	-644.55	
26 29 13 13-0134	EA		Size 6, 3 Phase, 3 Pole, 150 HP At 200 Volt, 200 HP At 230 Volt, 400 HP At 460/575 Volt, 540 Amp, NEMA 1 Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SHG2).....	15,314.86	483.41
			<i>For Factory Installed Accessory, Deduct</i>	-966.82	
26 29 13 13-0135	EA		Size 7, 3 Phase, 3 Pole, 300 HP At 230 Volt, 600 HP At 460/575 Volt, 810 Amp, NEMA 1 Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SJG2).....	20,758.98	725.11
			<i>For Factory Installed Accessory, Deduct</i>	-1,450.23	
26 29 13 13-0136			NEMA 12, Non Reversing, Magnetic Contactors <small>(26 29 13 13-0084)</small>		
26 29 13 13-0137	EA		Size 0, 1 Phase, 2 Pole, 3 HP At 200/230 Volt, 5 HP At 460/575 Volt, 18 Amp, NEMA 12 Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SBA1).....	505.00	88.62
			<i>For Factory Installed Accessory, Deduct</i>	-177.25	
26 29 13 13-0138	EA		Size 0, 3 Phase, 3 Pole, 3 HP At 200/230 Volt, 5 HP At 460/575 Volt, 18 Amp, NEMA 12 Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SBA2).....	545.05	96.68
			<i>For Factory Installed Accessory, Deduct</i>	-193.36	
26 29 13 13-0139	EA		Size 1, 3 Phase, 3 Pole, 7-1/2 HP At 200/230 Volt, 10 HP At 460/575 Volt, 27 Amp, NEMA 12 Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SCA2).....	602.21	104.74
			<i>For Factory Installed Accessory, Deduct</i>	-209.48	
26 29 13 13-0140	EA		Size 2, 1 Phase, 2 Pole, 10 HP At 200 Volt, 15 HP At 230 Volt, 25 HP At 460/575 Volt, 45 Amp, NEMA 12 Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SDA1).....	926.95	96.68
			<i>For Factory Installed Accessory, Deduct</i>	-193.36	
26 29 13 13-0141	EA		Size 2, 3 Phase, 3 Pole, 10 HP At 200 Volt, 15 HP At 230 Volt, 25 HP At 460/575 Volt, 45 Amp, NEMA 12 Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SDA2).....	1,007.79	120.85
			<i>For Factory Installed Accessory, Deduct</i>	-241.71	
26 29 13 13-0142	EA		Size 3, 1 Phase, 2 Pole, 25 HP At 200 Volt, 30 HP At 230 Volt, 50 HP At 460/575 Volt, 90 Amp, NEMA 12 Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SEA1).....	1,365.18	120.85
			<i>For Factory Installed Accessory, Deduct</i>	-241.71	
26 29 13 13-0143	EA		Size 3, 3 Phase, 3 Pole, 25 HP At 200 Volt, 30 HP At 230 Volt, 50 HP At 460/575 Volt, 90 Amp, NEMA 12 Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SEA2).....	1,510.15	161.14
			<i>For Factory Installed Accessory, Deduct</i>	-322.27	
26 29 13 13-0144	EA		Size 4, 3 Phase, 3 Pole, 40 HP At 200 Volt, 50 HP At 230 Volt, 100 HP At 460/575 Volt, 135 Amp, NEMA 12 Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SFA2).....	3,474.20	241.71
			<i>For Factory Installed Accessory, Deduct</i>	-483.41	
26 29 13 13-0145	EA		Size 5, 3 Phase, 3 Pole, 75 HP At 200 Volt, 100 HP At 230 Volt, 200 HP At 460/575 Volt, 270 Amp, NEMA 12 Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SGA2).....	7,305.00	322.27
			<i>For Factory Installed Accessory, Deduct</i>	-644.55	
26 29 13 13-0146	EA		Size 6, 3 Phase, 3 Pole, 150 HP At 200 Volt, 200 HP At 230 Volt, 400 HP At 460/575 Volt, 540 Amp, NEMA 12 Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SHA2).....	17,505.94	483.41
			<i>For Factory Installed Accessory, Deduct</i>	-966.82	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 29 13 13-0147 NEMA 4/4X, Non Reversing, Magnetic Contactors <small>(26 29 13 13-0084)</small>		
<i>Note: Brushed stainless steel enclosure.</i>		
26 29 13 13-0148 EA Size 0, 3 Phase, 3 Pole, 3 HP At 200/230 Volt, 5 HP At 460/575 Volt, 18 Amp, NEMA 4/4X Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SBW12)	732.01	96.68
<i>For Factory Installed Accessory, Deduct</i>	<i>-193.36</i>	
26 29 13 13-0149 EA Size 1, 1 Phase, 2 Pole, 7-1/2 HP At 200/230 Volt, 10 HP At 460/575 Volt, 27 Amp, NEMA 4/4X Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SCW11)	757.09	96.68
<i>For Factory Installed Accessory, Deduct</i>	<i>-193.36</i>	
26 29 13 13-0150 EA Size 1, 3 Phase, 3 Pole, 7-1/2 HP At 200/230 Volt, 10 HP At 460/575 Volt, 27 Amp, NEMA 4/4X Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SCW12)	797.15	104.74
<i>For Factory Installed Accessory, Deduct</i>	<i>-209.48</i>	
26 29 13 13-0151 EA Size 1, 3 Phase, 4 Pole, 7-1/2 HP At 200/230 Volt, 10 HP At 460/575 Volt, 27 Amp, NEMA 4/4X Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SCW13)	935.21	140.99
<i>For Factory Installed Accessory, Deduct</i>	<i>-281.99</i>	
26 29 13 13-0152 EA Size 2, 3 Phase, 3 Pole, 10 HP At 200 Volt, 15 HP At 230 Volt, 25 HP At 460/575 Volt, 45 Amp, NEMA 4/4X Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SDW12)	1,414.20	120.85
<i>For Factory Installed Accessory, Deduct</i>	<i>-241.71</i>	
26 29 13 13-0153 EA Size 3, 3 Phase, 3 Pole, 25 HP At 200 Volt, 30 HP At 230 Volt, 50 HP At 460/575 Volt, 90 Amp, NEMA 4/4X Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SEW12)	2,127.46	161.14
<i>For Factory Installed Accessory, Deduct</i>	<i>-322.27</i>	
26 29 13 13-0154 EA Size 4, 3 Phase, 3 Pole, 40 HP At 200 Volt, 50 HP At 230 Volt, 100 HP At 460/575 Volt, 135 Amp, NEMA 4/4X Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SFW12)	4,188.98	241.71
<i>For Factory Installed Accessory, Deduct</i>	<i>-483.41</i>	
26 29 13 13-0155 EA Size 5, 3 Phase, 3 Pole, 75 HP At 200 Volt, 100 HP At 230 Volt, 200 HP At 460/575 Volt, 270 Amp, NEMA 4/4X Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SGW12)	7,305.00	322.27
<i>For Factory Installed Accessory, Deduct</i>	<i>-644.55</i>	
26 29 13 13-0156 EA Size 6, 3 Phase, 3 Pole, 150 HP At 200 Volt, 200 HP At 230 Volt, 400 HP At 460/575 Volt, 540 Amp, NEMA 4/4X Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SHW2)	19,373.26	483.41
<i>For Factory Installed Accessory, Deduct</i>	<i>-966.82</i>	
26 29 13 13-0157 NEMA 7/9, Non Reversing, Magnetic Contactors <small>(26 29 13 13-0084)</small>		
<i>Note: Bolted cast iron enclosure.</i>		
26 29 13 13-0158 EA Size 0, 3 Phase, 3 Pole, 3 HP At 200/230 Volt, 5 HP At 460/575 Volt, 18 Amp, NEMA 7/9 Enclosure, Non Reversing, Magnetic Contactors (Square D 8502SBT2)	1,437.72	128.91
<i>For Factory Installed Accessory, Deduct</i>	<i>-257.82</i>	
26 29 13 13-0159 Non Reversing, Magnetic Starters <small>(26 29 13 13-0083)</small>		
26 29 13 13-0160 Open Enclosure, Non Reversing, Magnetic Starters <small>(26 29 13 13-0159)</small>		
26 29 13 13-0161 EA Size 00, 1 Phase, 2 Pole, 3/4 HP At 115 Volt, 1 HP At 230 Volt, 9 Amp, Open Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SAO11)	381.16	80.57
<i>For Factory Installed Accessory, Deduct</i>	<i>-161.14</i>	
26 29 13 13-0162 EA Size 00, 3 Phase, 3 Pole, 1-1/2 HP At 200/230 Volt, 2 HP At 460/575 Volt, 9 Amp, Open Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SAO12)	397.27	88.62
<i>For Factory Installed Accessory, Deduct</i>	<i>-177.25</i>	
26 29 13 13-0163 EA Size 0, 1 Phase, 2 Pole, 1 HP At 115 Volt, 2 HP At 230 Volt, 18 Amp, Open Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SBO1)	425.20	88.62
<i>For Factory Installed Accessory, Deduct</i>	<i>-177.25</i>	
26 29 13 13-0164 EA Size 0, 3 Phase, 3 Pole, 3 HP At 200/230 Volt, 5 HP At 460/575 Volt, 18 Amp, Open Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SBO2)	469.81	96.68
<i>For Factory Installed Accessory, Deduct</i>	<i>-193.36</i>	
26 29 13 13-0165 EA Size 0, 3 Phase, 5 Pole, 3 HP At 200/230 Volt, 5 HP At 460/575 Volt, 18 Amp, Open Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SBO4)	751.17	145.02
<i>For Factory Installed Accessory, Deduct</i>	<i>-290.04</i>	
26 29 13 13-0166 EA Size 1, 1 Phase, 2 Pole, 2 HP At 115 Volt, 3 HP At 230 Volt, 27 Amp, Open Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SCO1)	482.35	96.68
<i>For Factory Installed Accessory, Deduct</i>	<i>-193.36</i>	
26 29 13 13-0167 EA Size 1, 3 Phase, 3 Pole, 7-1/2 HP At 200/230 Volt, 10 HP At 460/575 Volt, 27 Amp, Open Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SCO3)	562.88	104.74
<i>For Factory Installed Accessory, Deduct</i>	<i>-209.48</i>	
26 29 13 13-0168 EA Size 1, 1 Phase, 2 Pole, 3 HP At 200/230 Volt, 5 HP At 460/575 Volt, 36 Amp, Open Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SCO2)	586.82	104.74
<i>For Factory Installed Accessory, Deduct</i>	<i>-209.48</i>	
26 29 13 13-0169 EA Size 2, 1 Phase, 2 Pole, 3 HP At 115 Volt, 7-1/2 HP At 230 Volt, 45 Amp, Open Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SDO6)	716.62	96.68
<i>For Factory Installed Accessory, Deduct</i>	<i>-193.36</i>	
26 29 13 13-0170 EA Size 2, 3 Phase, 3 Pole, 10 HP At 200 Volt, 15 HP At 230 Volt, 25 HP At 460/575 Volt, 45 Amp, Open Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SDO1)	817.98	120.85
<i>For Factory Installed Accessory, Deduct</i>	<i>-241.71</i>	
26 29 13 13-0171 EA Size 3, 3 Phase, 3 Pole, 25 HP At 200 Volt, 30 HP At 230 Volt, 50 HP At 460/575 Volt, 90 Amp, Open Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SEO1)	1,255.93	161.14
<i>For Factory Installed Accessory, Deduct</i>	<i>-322.27</i>	
26 29 13 13-0172 EA Size 4, 3 Phase, 3 Pole, 40 HP At 200 Volt, 50 HP At 230 Volt, 100 HP At 460/575 Volt, 135 Amp, Open Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SFO1)	2,619.20	241.71
<i>For Factory Installed Accessory, Deduct</i>	<i>-483.41</i>	
26 29 13 13-0173 EA Size 5, 3 Phase, 3 Pole, 75 HP At 200 Volt, 100 HP At 230 Volt, 200 HP At 460/575 Volt, 270 Amp, Open Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SGO1)	5,861.19	322.27
<i>For Factory Installed Accessory, Deduct</i>	<i>-644.55</i>	
26 29 13 13-0174 EA Size 6, 3 Phase, 3 Pole, 150 HP At 200 Volt, 200 HP At 230 Volt, 400 HP At 460/575 Volt, 540 Amp, Open Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SHO2)	13,367.74	483.41
<i>For Factory Installed Accessory, Deduct</i>	<i>-966.82</i>	

26 Electrical**26 20 Low-Voltage Electrical Distribution****26 29 Low-Voltage Controllers**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 29 13 13-0175 EA Size 7, 3 Phase, 3 Pole, 300 HP At 230 Volt, 600 HP At 460/575 Volt, 810 Amp, Open Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SJO2) <i>For Factory Installed Accessory, Deduct</i>	19,268.43 -1,450.23	725.11
26 29 13 13-0176 NEMA 1, Non Reversing, Magnetic Starters (26 29 13 13-0159)		
26 29 13 13-0177 EA Size 00, 1 Phase, 2 Pole, .34 HP At 115 Volt, 1 HP At 230 Volt, 9 Amp, NEMA 1 Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SAG1) <i>For Factory Installed Accessory, Deduct</i>	399.97 -161.14	80.57
26 29 13 13-0178 EA Size 00, 3 Phase, 3 Pole, 1-1/2 HP At 200/230 Volt, 2 HP At 460/575 Volt, 9 Amp, NEMA 1 Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SAG12)..... <i>For Factory Installed Accessory, Deduct</i>	416.08 -177.25	88.62
26 29 13 13-0179 EA Size 0, 1 Phase, 2 Pole, 1 HP At 115 Volt, 2 HP At 230 Volt, 18 Amp, NEMA 1 Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SBG1) <i>For Factory Installed Accessory, Deduct</i>	444.01 -177.25	88.62
26 29 13 13-0180 EA Size 0, 3 Phase, 3 Pole, 3 HP At 200/230 Volt, 5 HP At 460/575 Volt, 18 Amp, NEMA 1 Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SBG2)..... <i>For Factory Installed Accessory, Deduct</i>	488.62 -193.36	96.68
26 29 13 13-0181 EA Size 1, 1 Phase, 2 Pole, 2 HP At 115 Volt, 3 HP At 230 Volt, 27 Amp, NEMA 1 Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SCG1) <i>For Factory Installed Accessory, Deduct</i>	500.59 -193.36	96.68
26 29 13 13-0182 EA Size 1, 3 Phase, 3 Pole, 7-1/2 HP At 200/230 Volt, 10 HP At 460/575 Volt, 27 Amp, NEMA 1 Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SCG3) <i>For Factory Installed Accessory, Deduct</i>	545.78 -209.48	104.74
26 29 13 13-0183 EA Size 1, 1 Phase, 2 Pole, 3 HP At 200/230 Volt, 5 HP At 460/575 Volt, 36 Amp, NEMA 1 Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SCG2)..... <i>For Factory Installed Accessory, Deduct</i>	606.20 -209.48	104.74
26 29 13 13-0184 EA Size 2, 1 Phase, 2 Pole, 3 HP At 115 Volt, 7-1/2 HP At 230 Volt, 45 Amp, NEMA 1 Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SDG6) <i>For Factory Installed Accessory, Deduct</i>	801.55 -193.36	96.68
26 29 13 13-0185 EA Size 2, 3 Phase, 3 Pole, 10 HP At 200 Volt, 15 HP At 230 Volt, 25 HP At 460/575 Volt, 45 Amp, NEMA 1 Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SDG1)..... <i>For Factory Installed Accessory, Deduct</i>	902.91 -241.71	120.85
26 29 13 13-0186 EA Size 3, 3 Phase, 3 Pole, 25 HP At 200 Volt, 30 HP At 230 Volt, 50 HP At 460/575 Volt, 90 Amp, NEMA 1 Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SEG1) <i>For Factory Installed Accessory, Deduct</i>	1,421.80 -322.27	161.14
26 29 13 13-0187 EA Size 4, 3 Phase, 3 Pole, 40 HP At 200 Volt, 50 HP At 230 Volt, 100 HP At 460/575 Volt, 135 Amp, NEMA 1 Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SFG1) <i>For Factory Installed Accessory, Deduct</i>	2,962.91 -483.41	241.71
26 29 13 13-0188 EA Size 5, 3 Phase, 3 Pole, 75 HP At 200 Volt, 100 HP At 230 Volt, 200 HP At 460/575 Volt, 270 Amp, NEMA 1 Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SGG1)..... <i>For Factory Installed Accessory, Deduct</i>	6,489.33 -644.55	322.27
26 29 13 13-0189 NEMA 12, Non Reversing, Magnetic Starters (26 29 13 13-0159)		
26 29 13 13-0190 EA Size 0, 1 Phase, 2 Pole, 1 HP At 115 Volt, 2 HP At 230 Volt, 18 Amp, NEMA 12 Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SBA1)..... <i>For Factory Installed Accessory, Deduct</i>	541.48 -177.25	88.62
26 29 13 13-0191 EA Size 0, 3 Phase, 3 Pole, 3 HP At 200/230 Volt, 5 HP At 460/575 Volt, 18 Amp, NEMA 12 Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SBA2) <i>For Factory Installed Accessory, Deduct</i>	586.09 -193.36	96.68
26 29 13 13-0192 EA Size 1, 1 Phase, 2 Pole, 2 HP At 115 Volt, 3 HP At 230 Volt, 27 Amp, NEMA 12 Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SCA1)..... <i>For Factory Installed Accessory, Deduct</i>	598.06 -193.36	96.68
26 29 13 13-0193 EA Size 1, 3 Phase, 3 Pole, 7-1/2 HP At 200/230 Volt, 10 HP At 460/575 Volt, 27 Amp, NEMA 12 Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SCA3)..... <i>For Factory Installed Accessory, Deduct</i>	643.25 -209.48	104.74
26 29 13 13-0194 EA Size 1, 1 Phase, 2 Pole, 3 HP At 200/230 Volt, 5 HP At 460/575 Volt, 36 Amp, NEMA 12 Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SCA2) <i>For Factory Installed Accessory, Deduct</i>	703.67 -209.48	104.74
26 29 13 13-0195 EA Size 2, 1 Phase, 2 Pole, 3 HP At 115 Volt, 7-1/2 HP At 230 Volt, 45 Amp, NEMA 12 Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SDA6)..... <i>For Factory Installed Accessory, Deduct</i>	979.96 -193.36	96.68
26 29 13 13-0196 EA Size 2, 3 Phase, 3 Pole, 10 HP At 200 Volt, 15 HP At 230 Volt, 25 HP At 460/575 Volt, 45 Amp, NEMA 12 Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SDA1) <i>For Factory Installed Accessory, Deduct</i>	1,080.75 -241.71	120.85
26 29 13 13-0197 EA Size 3, 3 Phase, 3 Pole, 25 HP At 200 Volt, 30 HP At 230 Volt, 50 HP At 460/575 Volt, 90 Amp, NEMA 12 Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SEA1) <i>For Factory Installed Accessory, Deduct</i>	1,632.13 -322.27	161.14
26 29 13 13-0198 EA Size 4, 3 Phase, 3 Pole, 40 HP At 200 Volt, 50 HP At 230 Volt, 100 HP At 460/575 Volt, 135 Amp, NEMA 12 Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SFA1) <i>For Factory Installed Accessory, Deduct</i>	3,660.59 -483.41	241.71
26 29 13 13-0199 EA Size 5, 3 Phase, 3 Pole, 75 HP At 200 Volt, 100 HP At 230 Volt, 200 HP At 460/575 Volt, 270 Amp, NEMA 12 Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SGA1) <i>For Factory Installed Accessory, Deduct</i>	8,274.57 -644.55	322.27
26 29 13 13-0200 EA Size 6, 3 Phase, 3 Pole, 150 HP At 200 Volt, 200 HP At 230 Volt, 400 HP At 460/575 Volt, 540 Amp, NEMA 12 Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SHA2) <i>For Factory Installed Accessory, Deduct</i>	19,621.21 -966.82	483.41
26 29 13 13-0201 NEMA 3R, Non Reversing, Magnetic Starters (26 29 13 13-0159)		
26 29 13 13-0202 EA Size 0, 1 Phase, 2 Pole, 1 HP At 115 Volt, 2 HP At 230 Volt, 18 Amp, NEMA 3R Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SBH1)..... <i>For Factory Installed Accessory, Deduct</i>	541.48 -177.25	88.62



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 29 13 13-0203 EA Size 0, 3 Phase, 3 Pole, 3 HP At 200/230 Volt, 5 HP At 460/575 Volt, 18 Amp, NEMA 3R Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SBH2).....	586.09	96.68
<i>For Factory Installed Accessory, Deduct</i>	-193.36	
26 29 13 13-0204 EA Size 1, 1 Phase, 2 Pole, 2 HP At 115 Volt, 3 HP At 230 Volt, 27 Amp, NEMA 3R Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SCH1).....	598.06	96.68
<i>For Factory Installed Accessory, Deduct</i>	-193.36	
26 29 13 13-0205 EA Size 1, 3 Phase, 3 Pole, 7-1/2 HP At 200/230 Volt, 10 HP At 460/575 Volt, 27 Amp, NEMA 3R Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SCH3).....	643.25	104.74
<i>For Factory Installed Accessory, Deduct</i>	-209.48	
26 29 13 13-0206 EA Size 1, 1 Phase, 2 Pole, 3 HP At 200/230 Volt, 5 HP At 460/575 Volt, 36 Amp, NEMA 3R Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SCH2).....	703.67	104.74
<i>For Factory Installed Accessory, Deduct</i>	-209.48	
26 29 13 13-0207 EA Size 2, 1 Phase, 2 Pole, 3 HP At 115 Volt, 7-1/2 HP At 230 Volt, 45 Amp, NEMA 3R Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SDH6).....	979.96	96.68
<i>For Factory Installed Accessory, Deduct</i>	-193.36	
26 29 13 13-0208 EA Size 2, 3 Phase, 3 Pole, 10 HP At 200 Volt, 15 HP At 230 Volt, 25 HP At 460/575 Volt, 45 Amp, NEMA 3R Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SDH1).....	1,080.75	120.85
<i>For Factory Installed Accessory, Deduct</i>	-241.71	
26 29 13 13-0209 EA Size 3, 3 Phase, 3 Pole, 25 HP At 200 Volt, 30 HP At 230 Volt, 50 HP At 460/575 Volt, 90 Amp, NEMA 3R Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SEH1).....	1,632.13	161.14
<i>For Factory Installed Accessory, Deduct</i>	-322.27	
26 29 13 13-0210 EA Size 4, 3 Phase, 3 Pole, 40 HP At 200 Volt, 50 HP At 230 Volt, 100 HP At 460/575 Volt, 135 Amp, NEMA 3R Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SFH1).....	3,660.59	241.71
<i>For Factory Installed Accessory, Deduct</i>	-483.41	
26 29 13 13-0211 NEMA 3R/4/4X/7/9, Non Reversing, Magnetic Starters <small>(26 29 13 13-0159)</small>		
<i>Note: Bolted cast aluminum enclosure.</i>		
26 29 13 13-0212 EA Size 0, 3 Phase, 3 Pole, 3 HP At 200/230 Volt, 5 HP At 460/575 Volt, 18 Amp, NEMA 3R/4/4X/7/9 Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SBT4).....	1,499.44	136.97
<i>For Factory Installed Accessory, Deduct</i>	-273.94	
26 29 13 13-0213 EA Size 1, 1 Phase, 2 Pole, 2 HP At 115 Volt, 3 HP At 230 Volt, 27 Amp, NEMA 3R/4/4X/7/9 Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SCR1).....	1,831.18	136.97
<i>For Factory Installed Accessory, Deduct</i>	-273.94	
26 29 13 13-0214 EA Size 1, 3 Phase, 3 Pole, 7-1/2 HP At 200/230 Volt, 10 HP At 460/575 Volt, 27 Amp, NEMA 3R/4/4X/7/9 Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SCR3).....	1,888.32	145.02
<i>For Factory Installed Accessory, Deduct</i>	-290.04	
26 29 13 13-0215 EA Size 2, 3 Phase, 3 Pole, 10 HP At 200 Volt, 15 HP At 230 Volt, 25 HP At 460/575 Volt, 45 Amp, NEMA 3R/4/4X/7/9 Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SDR1).....	2,902.66	161.14
<i>For Factory Installed Accessory, Deduct</i>	-322.27	
26 29 13 13-0216 EA Size 3, 3 Phase, 3 Pole, 25 HP At 200 Volt, 30 HP At 230 Volt, 50 HP At 460/575 Volt, 90 Amp, NEMA 3R/4/4X/7/9 Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SET43).....	3,503.07	201.42
<i>For Factory Installed Accessory, Deduct</i>	-402.84	
26 29 13 13-0217 EA Size 4, 3 Phase, 3 Pole, 40 HP At 200 Volt, 50 HP At 230 Volt, 100 HP At 460/575 Volt, 135 Amp, NEMA 3R/4/4X/7/9 Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SFT41).....	5,567.44	281.99
<i>For Factory Installed Accessory, Deduct</i>	-563.98	
26 29 13 13-0218 NEMA 4/4X, Non Reversing, Magnetic Starters <small>(26 29 13 13-0159)</small>		
<i>Note: Brushed stainless steel enclosure.</i>		
26 29 13 13-0219 EA Size 0, 1 Phase, 2 Pole, 1 HP At 115 Volt, 2 HP At 230 Volt, 18 Amp, NEMA 4/4X Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SBW11).....	727.87	88.62
<i>For Factory Installed Accessory, Deduct</i>	-177.25	
26 29 13 13-0220 EA Size 0, 3 Phase, 3 Pole, 3 HP At 200/230 Volt, 5 HP At 460/575 Volt, 18 Amp, NEMA 4/4X Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SBW12).....	773.05	96.68
<i>For Factory Installed Accessory, Deduct</i>	-193.36	
26 29 13 13-0221 EA Size 1, 1 Phase, 2 Pole, 2 HP At 115 Volt, 3 HP At 230 Volt, 27 Amp, NEMA 4/4X Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SCW11).....	793.00	96.68
<i>For Factory Installed Accessory, Deduct</i>	-193.36	
26 29 13 13-0222 EA Size 1, 3 Phase, 3 Pole, 7-1/2 HP At 200/230 Volt, 10 HP At 460/575 Volt, 27 Amp, NEMA 4/4X Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SCW13).....	838.19	104.74
<i>For Factory Installed Accessory, Deduct</i>	-209.48	
26 29 13 13-0223 EA Size 1, 1 Phase, 2 Pole, 3 HP At 200/230 Volt, 7-1/2 HP At 460/575 Volt, 36 Amp, NEMA 4/4X Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SCW12).....	898.61	104.74
<i>For Factory Installed Accessory, Deduct</i>	-209.48	
26 29 13 13-0224 EA Size 2, 1 Phase, 2 Pole, 3 HP At 115 Volt, 7-1/2 HP At 230 Volt, 45 Amp, NEMA 4/4X Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SDW16).....	1,385.23	96.68
<i>For Factory Installed Accessory, Deduct</i>	-193.36	
26 29 13 13-0225 EA Size 3, 3 Phase, 3 Pole, 25 HP At 200 Volt, 30 HP At 230 Volt, 50 HP At 460/575 Volt, 90 Amp, NEMA 4/4X Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SEW11).....	2,248.87	161.14
<i>For Factory Installed Accessory, Deduct</i>	-322.27	
26 29 13 13-0226 EA Size 4, 3 Phase, 3 Pole, 40 HP At 200 Volt, 50 HP At 230 Volt, 100 HP At 460/575 Volt, 135 Amp, NEMA 4/4X Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SFW11).....	4,374.80	241.71
<i>For Factory Installed Accessory, Deduct</i>	-483.41	
26 29 13 13-0227 EA Size 5, 3 Phase, 3 Pole, 75 HP At 200 Volt, 100 HP At 230 Volt, 200 HP At 460/575 Volt, 270 Amp, NEMA 4/4X Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SGW11).....	9,647.70	322.27
<i>For Factory Installed Accessory, Deduct</i>	-644.55	
26 29 13 13-0228 NEMA 4X, Non Reversing, Magnetic Starters <small>(26 29 13 13-0159)</small>		
<i>Note: Glass polyester enclosure.</i>		
26 29 13 13-0229 EA Size 2, 3 Phase, 3 Pole, 10 HP At 200 Volt, 15 HP At 230 Volt, 25 HP At 460/575 Volt, 45 Amp, NEMA 4X Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SDW21).....	1,487.73	120.85
<i>For Factory Installed Accessory, Deduct</i>	-241.71	

26 Electrical**26 20 Low-Voltage Electrical Distribution****26 29 Low-Voltage Controllers**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 29 13 13-0230	EA		Size 3, 3 Phase, 3 Pole, 25 HP At 200 Volt, 30 HP At 230 Volt, 50 HP At 460/575 Volt, 90 Amp, NEMA 4X Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SEW21)	2,731.09	161.14
			<i>For Factory Installed Accessory, Deduct</i>	-322.27	
26 29 13 13-0231	EA		Size 4, 3 Phase, 3 Pole, 40 HP At 200 Volt, 50 HP At 230 Volt, 100 HP At 460/575 Volt, 135 Amp, NEMA 4X Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SF21)	5,348.36	241.71
			<i>For Factory Installed Accessory, Deduct</i>	-483.41	
26 29 13 13-0232			NEMA 7/9, Non Reversing, Magnetic Starters <small>(26 29 13 13-0159)</small>		
			Note: Bolted cast iron enclosure.		
26 29 13 13-0233	EA		Size 0, 1 Phase, 2 Pole, 1 HP At 115 Volt, 2 HP At 230 Volt, 18 Amp, NEMA 7/9 Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SBT1)	1,449.69	128.91
			<i>For Factory Installed Accessory, Deduct</i>	-257.82	
26 29 13 13-0234	EA		Size 0, 3 Phase, 3 Pole, 3 HP At 200/230 Volt, 5 HP At 460/575 Volt, 18 Amp, NEMA 7/9 Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SBT2)	1,499.44	136.97
			<i>For Factory Installed Accessory, Deduct</i>	-273.94	
26 29 13 13-0235	EA		Size 1, 1 Phase, 2 Pole, 2 HP At 115 Volt, 3 HP At 230 Volt, 27 Amp, NEMA 7/9 Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SCT1)	1,519.96	136.97
			<i>For Factory Installed Accessory, Deduct</i>	-273.94	
26 29 13 13-0236	EA		Size 1, 3 Phase, 3 Pole, 7-1/2 HP At 200/230 Volt, 10 HP At 460/575 Volt, 27 Amp, NEMA 7/9 Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SCT3)	1,567.41	145.02
			<i>For Factory Installed Accessory, Deduct</i>	-290.04	
26 29 13 13-0237	EA		Size 1, 1 Phase, 2 Pole, 2 HP At 115 Volt, 3 HP At 230 Volt, 36 Amp, NEMA 7/9 Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SCT2)	1,636.95	145.02
			<i>For Factory Installed Accessory, Deduct</i>	-290.04	
26 29 13 13-0238	EA		Size 2, 3 Phase, 3 Pole, 10 HP At 200 Volt, 15 HP At 230 Volt, 25 HP At 460/575 Volt, 45 Amp, NEMA 7/9 Enclosure, Full Voltage, Non Reversing Magnetic Starter (Square D 8536SDT1)	2,387.38	161.14
			<i>For Factory Installed Accessory, Deduct</i>	-322.27	
26 29 13 13-0239			Reversing, Magnetic Starters <small>(26 29 13 13-0083)</small>		
26 29 13 13-0240			Open Enclosure, Reversing, Magnetic Starters <small>(26 29 13 13-0239)</small>		
26 29 13 13-0241	EA		Size 00, 1 Phase, 3 Pole, 3/4 HP At 115 Volt, 1 HP At 230 Volt, 9 Amp, Open Enclosure, Full Voltage, Reversing Magnetic Starter (Square D 8736SAO13)	701.39	104.74
			<i>For Factory Installed Accessory, Deduct</i>	-209.48	
26 29 13 13-0242	EA		Size 00, 3 Phase, 3 Pole, 1-1/2 HP At 200/230 Volt, 2 HP At 460/575 Volt, 9 Amp, Open Enclosure, Full Voltage, Reversing Magnetic Starter (Square D 8736SAO16)	737.30	104.74
			<i>For Factory Installed Accessory, Deduct</i>	-209.48	
26 29 13 13-0243	EA		Size 0, 1 Phase, 2 Pole, 1 HP At 115 Volt, 2 HP At 230 Volt, 18 Amp, Open Enclosure, Full Voltage, Reversing Magnetic Starter (Square D 8736SBO1)	814.97	112.79
			<i>For Factory Installed Accessory, Deduct</i>	-225.59	
26 29 13 13-0244	EA		Size 0, 1 Phase, 3 Pole, 1 HP At 115 Volt, 2 HP At 230 Volt, 18 Amp, Open Enclosure, Full Voltage, Reversing Magnetic Starter (Square D 8736SBO2)	847.05	120.85
			<i>For Factory Installed Accessory, Deduct</i>	-241.71	
26 29 13 13-0245	EA		Size 0, 3 Phase, 3 Pole, 3 HP At 200/230 Volt, 5 HP At 460/575 Volt, 18 Amp, Open Enclosure, Full Voltage, Reversing Magnetic Starter (Square D 8736SBO10)	867.00	120.85
			<i>For Factory Installed Accessory, Deduct</i>	-241.71	
26 29 13 13-0246	EA		Size 1, 1 Phase, 2 Pole, 2 HP At 115 Volt, 3 HP At 230 Volt, 27 Amp, Open Enclosure, Full Voltage, Reversing Magnetic Starter (Square D 8736SCO2)	927.57	128.91
			<i>For Factory Installed Accessory, Deduct</i>	-257.82	
26 29 13 13-0247	EA		Size 1, 1 Phase, 3 Pole, 2 HP At 115 Volt, 3 HP At 230 Volt, 27 Amp, Open Enclosure, Full Voltage, Reversing Magnetic Starter (Square D 8736SCO3)	968.84	140.99
			<i>For Factory Installed Accessory, Deduct</i>	-281.99	
26 29 13 13-0248	EA		Size 1, 3 Phase, 3 Pole, 7-1/2 HP At 200/230 Volt, 10 HP At 460/575 Volt, 27 Amp, Open Enclosure, Full Voltage, Reversing Magnetic Starter (Square D 8736SCO7)	989.36	140.99
			<i>For Factory Installed Accessory, Deduct</i>	-281.99	
26 29 13 13-0249	EA		Size 2, 3 Phase, 3 Pole, 10 HP At 200 Volt, 15 HP At 230 Volt, 25 HP At 460/575 Volt, 45 Amp, Open Enclosure, Full Voltage, Reversing Magnetic Starter (Square D 8736SDO1)	1,661.20	161.14
			<i>For Factory Installed Accessory, Deduct</i>	-322.27	
26 29 13 13-0250	EA		Size 3, 3 Phase, 3 Pole, 25 HP At 200 Volt, 30 HP At 230 Volt, 50 HP At 460/575 Volt, 90 Amp, Open Enclosure, Full Voltage, Reversing Magnetic Starter (Square D 8736SEO1)	2,707.55	241.71
			<i>For Factory Installed Accessory, Deduct</i>	-483.41	
26 29 13 13-0251	EA		Size 4, 3 Phase, 3 Pole, 40 HP At 200 Volt, 50 HP At 230, 100 HP At 460/575 Volt, 135 Amp, Open Enclosure, Full Voltage, Reversing Magnetic Starter (Square D 8736SFO1)	6,157.21	362.56
			<i>For Factory Installed Accessory, Deduct</i>	-725.11	
26 29 13 13-0252	EA		Size 5, 3 Phase, 3 Pole, 75 HP At 200 Volt, 100 HP At 230 Volt, 200 HP At 460/575 Volt, 270 Amp, Open Enclosure, Full Voltage, Reversing Magnetic Starter (Square D 8736SGO1)	11,402.95	483.41
			<i>For Factory Installed Accessory, Deduct</i>	-966.82	
26 29 13 13-0253	EA		Size 7, 3 Phase, 3 Pole, 300 HP At 230 Volt, 600 HP At 460/575 Volt, 810 Amp, Open Enclosure, Full Voltage, Reversing Magnetic Starter (Square D 8736SJO1)	36,685.00	886.25
			<i>For Factory Installed Accessory, Deduct</i>	-1,772.50	
26 29 13 13-0254			NEMA 1, Reversing, Magnetic Starters <small>(26 29 13 13-0239)</small>		
26 29 13 13-0255	EA		Size 00, 1 Phase, 2 Pole, 3/4 HP At 115 Volt, 1 HP At 230 Volt, 9 Amp, NEMA 1 Enclosure, Full Voltage, Reversing Magnetic Starter (Square D 8736SAG13)	719.47	96.68
			<i>For Factory Installed Accessory, Deduct</i>	-193.36	
26 29 13 13-0256	EA		Size 00, 1 Phase, 3 Pole, 3/4 HP At 115 Volt, 1 HP At 230 Volt, 9 Amp, NEMA 1 Enclosure, Full Voltage, Reversing Magnetic Starter (Square D 8736SAG15)	752.69	104.74
			<i>For Factory Installed Accessory, Deduct</i>	-209.48	
26 29 13 13-0257	EA		Size 00, 3 Phase, 3 Pole, 1-1/2 HP At 200/230 Volt, 2 HP At 460/575 Volt, 9 Amp, NEMA 1 Enclosure, Full Voltage, Reversing Magnetic Starter (Square D 8736SAG16)	773.21	104.74
			<i>For Factory Installed Accessory, Deduct</i>	-209.48	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 29 13 13-0258 EA Size 0, 1 Phase, 2 Pole, 1 HP At 115 Volt, 2 HP At 230 Volt, 18 Amp, NEMA 1 Enclosure, Full Voltage, Reversing Magnetic Starter (Square D 8736SBG1).....	849.17	112.79
<i>For Factory Installed Accessory, Deduct</i>	-225.59	
26 29 13 13-0259 EA Size 0, 1 Phase, 3 Pole, 1 HP At 115 Volt, 2 HP At 230 Volt, 18 Amp, NEMA 1 Enclosure, Full Voltage, Reversing Magnetic Starter (Square D 8736SBG2).....	882.39	120.85
<i>For Factory Installed Accessory, Deduct</i>	-241.71	
26 29 13 13-0260 EA Size 0, 3 Phase, 3 Pole, 3 HP At 200/230 Volt, 5 HP At 460/575 Volt, 18 Amp, NEMA 1 Enclosure, Full Voltage, Reversing Magnetic Starter (Square D 8736SBG4).....	902.91	120.85
<i>For Factory Installed Accessory, Deduct</i>	-241.71	
26 29 13 13-0261 EA Size 1, 1 Phase, 2 Pole, 2 HP At 115 Volt, 3 HP At 230 Volt, 27 Amp, NEMA 1 Enclosure, Full Voltage, Reversing Magnetic Starter (Square D 8736SCG2).....	978.87	128.91
<i>For Factory Installed Accessory, Deduct</i>	-257.82	
26 29 13 13-0262 EA Size 1, 1 Phase, 3 Pole, 2 HP At 115 Volt, 3 HP At 230 Volt, 27 Amp, NEMA 1 Enclosure, Full Voltage, Reversing Magnetic Starter (Square D 8736SCG6).....	1,020.14	140.99
<i>For Factory Installed Accessory, Deduct</i>	-281.99	
26 29 13 13-0263 EA Size 1, 3 Phase, 3 Pole, 7-1/2 HP At 200/230 Volt, 10 HP At 460/575 Volt, 27 Amp, NEMA 1 Enclosure, Full Voltage, Reversing Magnetic Starter (Square D 8736SCG8).....	1,040.66	140.99
<i>For Factory Installed Accessory, Deduct</i>	-281.99	
26 29 13 13-0264 EA Size 2, 3 Phase, 3 Pole, 10 HP At 200 Volt, 15 HP At 230 Volt, 25 HP At 460/575 Volt, 45 Amp, NEMA 1 Enclosure, Full Voltage, Reversing Magnetic Starter (Square D 8736SDG2).....	1,794.58	161.14
<i>For Factory Installed Accessory, Deduct</i>	-322.27	
26 29 13 13-0265 EA Size 3, 3 Phase, 3 Pole, 25 HP At 200 Volt, 30 HP At 230 Volt, 50 HP At 460/575 Volt, 90 Amp, NEMA 1 Enclosure, Full Voltage, Reversing Magnetic Starter (Square D 8736SEG2).....	2,938.40	241.71
<i>For Factory Installed Accessory, Deduct</i>	-483.41	
26 29 13 13-0266 EA Size 4, 3 Phase, 3 Pole, 40 HP At 200 Volt, 50 HP At 230 Volt, 100 HP At 460/575 Volt, 135 Amp, NEMA 1 Enclosure, Full Voltage, Reversing Magnetic Starter (Square D 8736SFG3).....	6,581.29	362.56
<i>For Factory Installed Accessory, Deduct</i>	-725.11	
26 29 13 13-0267 NEMA 12, Reversing, Magnetic Starters <small>(26 29 13 13-0239)</small>		
26 29 13 13-0268 EA Size 0, 1 Phase, 3 Pole, 3/4 HP At 115 Volt, 1 HP At 230 Volt, 18 Amp, NEMA 12 Enclosure, Full Voltage, Reversing Magnetic Starter (Square D 8736SBA2).....	1,028.31	120.85
<i>For Factory Installed Accessory, Deduct</i>	-241.71	
26 29 13 13-0269 EA Size 0, 3 Phase, 3 Pole, 3 HP At 200/230 Volt, 5 HP At 460/575 Volt, 18 Amp, NEMA 12 Enclosure, Full Voltage, Reversing Magnetic Starter (Square D 8736SBA4).....	1,048.83	120.85
<i>For Factory Installed Accessory, Deduct</i>	-241.71	
26 29 13 13-0270 EA Size 1, 3 Phase, 3 Pole, 7-1/2 HP At 200/230 Volt, 10 HP At 460/575 Volt, 27 Amp, NEMA 12 Enclosure, Full Voltage, Reversing Magnetic Starter (Square D 8736SCA4).....	1,186.58	140.99
<i>For Factory Installed Accessory, Deduct</i>	-281.99	
26 29 13 13-0271 EA Size 2, 3 Phase, 3 Pole, 10 HP At 200 Volt, 15 HP At 230 Volt, 25 HP At 460/575 Volt, 45 Amp, NEMA 12 Enclosure, Full Voltage, Reversing Magnetic Starter (Square D 8736SDA1).....	2,038.54	161.14
<i>For Factory Installed Accessory, Deduct</i>	-322.27	
26 29 13 13-0272 NEMA 4X, Reversing, Magnetic Starters <small>(26 29 13 13-0239)</small>		
<i>Note: Brushed stainless steel enclosure.</i>		
26 29 13 13-0273 EA Size 0, 3 Phase, 3 Pole, 3 HP At 200/230 Volt, 5 HP At 460/575 Volt, 18 Amp, NEMA 4/4X Enclosure, Full Voltage, Reversing Magnetic Starter (Square D 8736SBW14).....	1,275.69	120.85
<i>For Factory Installed Accessory, Deduct</i>	-241.71	
26 29 13 13-0274 EA Size 1, 1 Phase, 2 Pole, 2 HP At 115 Volt, 3 HP At 230 Volt, 27 Amp, NEMA 4/4X Enclosure, Full Voltage, Reversing Magnetic Starter (Square D 8736SCW11).....	1,498.71	128.91
<i>For Factory Installed Accessory, Deduct</i>	-257.82	
26 29 13 13-0275 Magnetic Contactor/Starters Accessories <small>(26 29 13 13-0083)</small>		
26 29 13 13-0276 EA NEMA 1 Enclosure Start/Stop Push Button Kit, Contactor/Starter Accessory (Square D 9999SA2).....	95.54	10.07
<i>For Factory Installed Accessory, Deduct</i>	-20.14	
26 29 13 13-0277 EA NEMA 12 Enclosure Start/Stop Push Button Kit, Contactor/Starter Accessory (Square D 9999SA3).....	159.89	10.07
<i>For Factory Installed Accessory, Deduct</i>	-20.14	
26 29 13 13-0278 EA NEMA 1 Enclosure Selector Switch Kit, Contactor/Starter Accessory (Square D 9999SC2).....	95.54	10.07
<i>For Factory Installed Accessory, Deduct</i>	-20.14	
26 29 13 13-0279 EA NEMA 12 Enclosure Selector Switch Kit, Contactor/Starter Accessory (Square D 9999SC8).....	159.89	10.07
<i>For Factory Installed Accessory, Deduct</i>	-20.14	
26 29 13 13-0280 EA NEMA 1 And 12 Enclosure Red Pilot Light Kit, Contactor/Starter Accessory (Square D 9999SP2R).....	159.89	10.07
<i>For Factory Installed Accessory, Deduct</i>	-20.14	
26 29 13 13-0281 EA Internal Nonconvertible Contact Block Kit, 1 Contact, Contactor/Starter Accessory (Square D 9999SX11).....	80.46	8.05
<i>For Factory Installed Accessory, Deduct</i>	-16.11	
26 29 13 13-0282 EA External Convertible Field Contact, 1 Contact, Contactor/Starter Accessory (Square D 9999SX6).....	72.01	8.05
<i>For Factory Installed Accessory, Deduct</i>	-16.11	
26 29 13 13-0283 EA External Convertible Field Contacts, 2 Contacts Or 1 Overlapping Contact, Contactor/Starter Accessory (Square D 9999SX8).....	95.54	10.07
<i>For Factory Installed Accessory, Deduct</i>	-20.14	
26 29 13 13-0284 EA External Field Non Convertible Contact, 1 Contact, Contactor/Starter Accessory (Square D 9999SX13).....	80.46	8.05
<i>For Factory Installed Accessory, Deduct</i>	-16.11	
26 29 13 13-0285 EA External Field Non Convertible Contacts, 2 Contacts Or 1 Overlapping Contact, Contactor/Starter Accessory (Square D 9999SX15).....	107.24	10.07
<i>For Factory Installed Accessory, Deduct</i>	-20.14	
26 29 13 13-0286 EA 30 Amp, 1 Contact Power Pole Adder Kit, Contactor/Starter Accessory (Square D 9999SB6).....	118.81	8.05
<i>For Factory Installed Accessory, Deduct</i>	-16.11	
26 29 13 13-0287 EA 45 Amp, 1 Contact Power Pole Adder Kit, Contactor/Starter Accessory (Square D 9999SB11).....	202.66	8.05
<i>For Factory Installed Accessory, Deduct</i>	-16.11	
26 29 13 13-0288 EA 60 Amp, 1 Contact Power Pole Adder Kit, Contactor/Starter Accessory (Square D 9999SB21).....	215.01	8.05
<i>For Factory Installed Accessory, Deduct</i>	-16.11	

26 Electrical**26 20 Low-Voltage Electrical Distribution****26 29 Low-Voltage Controllers**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 29 13 13-0289 EA 30 Amp, 2 Contact Power Pole Adder Kit, Contactor/Starter Accessory (Square D 9999SB8)	257.39	10.07
<i>For Factory Installed Accessory, Deduct</i>	-20.14	
26 29 13 13-0290 EA 45 Amp, 2 Contact Power Pole Adder Kit, Contactor/Starter Accessory (Square D 9999SB13)	446.54	10.07
<i>For Factory Installed Accessory, Deduct</i>	-20.14	
26 29 13 13-0291 EA 60 Amp, 2 Contact Power Pole Adder Kit, Contactor/Starter Accessory (Square D 9999SB23)	446.54	10.07
<i>For Factory Installed Accessory, Deduct</i>	-20.14	
26 29 13 13-0292 EA Adapter Bracket For Power Pole Adder Kit, Contactor/Starter Accessory (Square D 9999SBT1)	29.06	6.04
<i>For Factory Installed Accessory, Deduct</i>	-12.09	
26 29 13 13-0293 EA 1 Pole Control Circuit Fuse Holder, Contactor/Starter Accessory (Square D 9999SF3)	57.71	8.05
<i>For Factory Installed Accessory, Deduct</i>	-16.11	
26 29 13 13-0294 EA 2 Pole Control Circuit Fuse Holder, Contactor/Starter Accessory (Square D 9999SF4)	76.04	10.07
<i>For Factory Installed Accessory, Deduct</i>	-20.14	
26 29 13 13-0295 EA Transient Suppression Module, Contactor/Starter Accessory (Square D 9999ST1)	60.44	10.07
<i>For Factory Installed Accessory, Deduct</i>	-20.14	
26 29 13 13-0296 EA Terminal Block, Contactor/Starter Accessory (Square D 9999T7)	33.74	6.04
<i>For Factory Installed Accessory, Deduct</i>	-12.09	
26 29 13 13-0297 EA Closing Plate For NEMA 1 Enclosures, Contactor/Starter Accessory (Square D 9999SG1)	21.39	6.04
<i>For Factory Installed Accessory, Deduct</i>	-12.09	
26 29 13 13-0298 EA 1 Pole Disconnect Switch And Breaker Interlock, Contactor/Starter Accessory (Square D 9999R39)	103.86	8.05
<i>For Factory Installed Accessory, Deduct</i>	-16.11	
26 29 13 13-0299 EA 2 Pole Disconnect Switch And Breaker Interlock, Contactor/Starter Accessory (Square D 9999R40)	178.09	10.07
<i>For Factory Installed Accessory, Deduct</i>	-20.14	
26 29 13 13-0300 Definite Purpose Starters <small>(26 29 13 13)</small>		
26 29 13 13-0301 Open Enclosure, Definite Purpose Starter <small>(26 29 13 13-0300)</small>		
26 29 13 13-0302 EA Open Enclosure, 3 Phase, 3 Pole, 3 HP At 230 Volt, 5 HP At 460/575 Volt, 20 Amp, Definite Purpose Starter With Thermal Overload Protection (Square D 8911DPSO13)	362.65	96.68
<i>For Factory Installed Accessory, Deduct</i>	-193.36	
26 29 13 13-0303 EA Open Enclosure, 1 Phase, 2 Pole, 2 HP At 115 Volt, 3 HP At 230 Volt, 25 Amp, Definite Purpose Starter With Thermal Overload Protection (Square D 8911DPSO22)	362.08	96.68
<i>For Factory Installed Accessory, Deduct</i>	-193.36	
26 29 13 13-0304 EA Open Enclosure, 3 Phase, 3 Pole, 7.5 HP At 230 Volt, 10 HP At 460/575 Volt, 25 Amp, Definite Purpose Starter With Thermal Overload Protection (Square D 8911DPSO23)	391.88	104.74
<i>For Factory Installed Accessory, Deduct</i>	-209.48	
26 29 13 13-0305 EA Open Enclosure, 1 Phase, 2 Pole, 2 HP At 115 Volt, 5 HP At 230 Volt, 30 Amp, Definite Purpose Starter With Thermal Overload Protection (Square D 8911DPSO32)	383.17	96.68
<i>For Factory Installed Accessory, Deduct</i>	-193.36	
26 29 13 13-0306 EA Open Enclosure, 3 Phase, 3 Pole, 10 HP At 230 Volt, 15 HP At 460/575 Volt, 30 Amp, Definite Purpose Starter With Thermal Overload Protection (Square D 8911DPSO33)	416.39	104.74
<i>For Factory Installed Accessory, Deduct</i>	-209.48	
26 29 13 13-0307 EA Open Enclosure, 1 Phase, 2 Pole, 3 HP At 115 Volt, 7-1/2 HP At 230 Volt, 40 Amp, Definite Purpose Starter With Thermal Overload Protection (Square D 8911DPSO42)	401.41	96.68
<i>For Factory Installed Accessory, Deduct</i>	-193.36	
26 29 13 13-0308 EA Open Enclosure, 3 Phase, 3 Pole, 10 HP At 230 Volt, 20 HP At 460/575 Volt, 40 Amp, Definite Purpose Starter With Thermal Overload Protection (Square D 8911DPSO43)	469.14	120.85
<i>For Factory Installed Accessory, Deduct</i>	-241.71	
26 29 13 13-0309 EA Open Enclosure, 1 Phase, 2 Pole, 3 HP At 115 Volt, 10 HP At 230 Volt, 50 Amp, Definite Purpose Starter With Thermal Overload Protection (Square D 8911DPSO52)	516.45	120.85
<i>For Factory Installed Accessory, Deduct</i>	-241.71	
26 29 13 13-0310 EA Open Enclosure, 3 Phase, 3 Pole, 15 HP At 230 Volt, 30 HP At 460/575 Volt, 50 Amp, Definite Purpose Starter With Thermal Overload Protection (Square D 8911DPSO53)	645.65	140.99
<i>For Factory Installed Accessory, Deduct</i>	-281.99	
26 29 13 13-0311 NEMA 1, Definite Purpose Starter <small>(26 29 13 13-0300)</small>		
26 29 13 13-0312 EA NEMA 1, 1 Phase, 2 Pole, 1 HP At 115 Volt, 2 HP At 230 Volt, 20 Amp, Definite Purpose Starter With Thermal Overload Protection (Square D 8911DPSG12)	366.49	88.62
<i>For Factory Installed Accessory, Deduct</i>	-177.25	
26 29 13 13-0313 EA NEMA 1, 3 Phase, 3 Pole, 3 HP At 230 Volt, 5 HP At 460/575 Volt, 20 Amp, Definite Purpose Starter With Thermal Overload Protection (Square D 8911DPSG13)	396.28	96.68
<i>For Factory Installed Accessory, Deduct</i>	-193.36	
26 29 13 13-0314 EA NEMA 1, 1 Phase, 2 Pole, 2 HP At 115 Volt, 3 HP At 230 Volt, 25 Amp, Definite Purpose Starter With Thermal Overload Protection (Square D 8911DPSG22)	395.14	96.68
<i>For Factory Installed Accessory, Deduct</i>	-193.36	
26 29 13 13-0315 EA NEMA 1, 3 Phase, 3 Pole, 7.5 HP At 230 Volt, 10 HP At 460/575 Volt, 25 Amp, Definite Purpose Starter With Thermal Overload Protection (Square D 8911DPSG23)	426.65	104.74
<i>For Factory Installed Accessory, Deduct</i>	-209.48	
26 29 13 13-0316 EA NEMA 1, 1 Phase, 2 Pole, 2 HP At 115 Volt, 5 HP At 230 Volt, 30 Amp, Definite Purpose Starter With Thermal Overload Protection (Square D 8911DPSG32)	416.80	96.68
<i>For Factory Installed Accessory, Deduct</i>	-193.36	
26 29 13 13-0317 EA NEMA 1, 3 Phase, 3 Pole, 10 HP At 230 Volt, 15 HP At 460/575 Volt, 30 Amp, Definite Purpose Starter With Thermal Overload Protection (Square D 8911DPSG33)	450.59	104.74
<i>For Factory Installed Accessory, Deduct</i>	-209.48	
26 29 13 13-0318 EA NEMA 1, 1 Phase, 2 Pole, 3 HP At 115 Volt, 7-1/2 HP At 230 Volt, 40 Amp, Definite Purpose Starter With Thermal Overload Protection (Square D 8911DPSG42)	436.18	96.68
<i>For Factory Installed Accessory, Deduct</i>	-193.36	
26 29 13 13-0319 EA NEMA 1, 3 Phase, 3 Pole, 10 HP At 230 Volt, 20 HP At 460/575 Volt, 40 Amp, Definite Purpose Starter With Thermal Overload Protection (Square D 8911DPSG43)	503.34	120.85
<i>For Factory Installed Accessory, Deduct</i>	-241.71	
26 29 13 13-0320 EA NEMA 1, 1 Phase, 2 Pole, 3 HP At 115 Volt, 10 HP At 230 Volt, 50 Amp, Definite Purpose Starter With Thermal Overload Protection (Square D 8911DPSG52)	548.94	120.85
<i>For Factory Installed Accessory, Deduct</i>	-241.71	



Electrical	26	26
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MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 29 13 13-0321 EA NEMA 1, 3 Phase, 3 Pole, 15 HP At 230 Volt, 30 HP At 460/575 Volt, 50 Amp, Definite Purpose Starter With Thermal Overload Protection (Square D 8911DPSG53) <i>For Factory Installed Accessory, Deduct</i>	678.71 -281.99	140.99
26 29 13 13-0322 Definite Purpose Starter Accessory <small>(26 29 13 13-0300)</small>		
26 29 13 13-0323 EA Start-Stop Push Button Kit, Definite Purpose Starter Accessory <i>Note: Or Hand-Off-Auto Selector Switch Kit</i> <i>For Factory Installed Accessory, Deduct</i>	107.24 -20.14	10.07
26 29 13 13-0324 Panel Mounted Miniature Contactor <small>(26 29 13 13)</small>		
26 29 13 13-0325 Non Reversing, Panel Mounted Miniature Contactor <small>(26 29 13 13-0324)</small>		
26 29 13 13-0326 EA 3 Phase (1-1/2 HP At 200/230 Volt, 3 HP At 460/575 Volt), 1 Phase (1/2 HP At 115 Volt, 1-1/2 HP At 230 Volt), 3 Pole, Auxiliary Contacts, 6 Amp, 15 Amp, AC Coil, Non Reversing, Panel Mounted Miniature Contactor (Square D LC1K).....	113.06	40.28
26 29 13 13-0327 EA 3 Phase (2 HP At 200 Volt, 3 HP At 230 Volt, 5 HP At 460/575 Volt), 1 Phase (1/2 HP At 115 Volt, 1-1/2 HP At 230 Volt), 4 Pole, Without Auxiliary Contacts, 9 Amp, 20 Amp, AC Coil, Non Reversing, Panel Mounted Miniature Contactor (Square D LC1K).....	131.37	44.32
26 29 13 13-0328 EA 3 Phase (2 HP At 200 Volt, 3 HP At 230 Volt, 5 HP At 460/575 Volt), 1 Phase (1/2 HP At 115 Volt, 1-1/2 HP At 230 Volt), 3 Pole, Auxiliary Contacts, 9 Amp, 20 Amp, AC Coil, Non Reversing, Panel Mounted Miniature Contactor (Square D LC1K).....	131.37	44.32
26 29 13 13-0329 EA 3 Phase (3 HP At 200/230 Volt, 7-1/2 HP At 460 Volt, 10 HP At 575 Volt), 1 Phase (1/2 HP At 115 Volt, 1-1/2 HP At 230 Volt), 3 Pole, Auxiliary Contacts, 12 Amp, 20 Amp, AC Coil, Non Reversing, Panel Mounted Miniature Contactor (Square D LC1K).....	145.70	48.34
26 29 13 13-0330 EA 3 Phase (1-1/2 HP At 200/230 Volt, 3 HP At 460/575 Volt), 1 Phase (1/2 HP At 115 Volt, 1-1/2 HP At 230 Volt), 3 Pole, Auxiliary Contacts, 6 Amp, 15 Amp, DC Coil, Non Reversing, Panel Mounted Miniature Contactor (Square D LP1K).....	123.32	40.28
26 29 13 13-0331 EA 3 Phase (1-1/2 HP At 200/230 Volt, 3 HP At 460/575 Volt), 1 Phase (1/2 HP At 115 Volt, 1-1/2 HP At 230 Volt), 3 Pole, Auxiliary Contacts, 6 Amp, 15 Amp, DC Coil With Integral Suppression, Non Reversing, Panel Mounted Miniature Contactor (Square D LP1K).....	129.02	40.28
26 29 13 13-0332 EA 3 Phase (2 HP At 200 Volt, 3 HP At 230 Volt, 5 HP At 460/575 Volt), 1 Phase (1/2 HP At 115 Volt, 1-1/2 HP At 230 Volt), 3 Pole, Auxiliary Contacts, 9 Amp, 20 Amp, DC Coil, Non Reversing, Panel Mounted Miniature Contactor (Square D LP1K).....	141.06	44.32
26 29 13 13-0333 EA 3 Phase (2 HP At 200 Volt, 3 HP At 230 Volt, 5 HP At 460/575 Volt), 1 Phase (1/2 HP At 115 Volt, 1-1/2 HP At 230 Volt), 3 Pole, Auxiliary Contacts, 9 Amp, 20 Amp, DC Coil With Integral Suppression, Non Reversing, Panel Mounted Miniature Contactor (Square D LP1K).....	146.76	44.32
26 29 13 13-0334 EA 3 Phase (2 HP At 200 Volt, 3 HP At 230 Volt, 5 HP At 460/575 Volt), 1 Phase (1/2 HP At 115 Volt, 1-1/2 HP At 230 Volt), 4 Pole, Without Auxiliary Contacts, 9 Amp, 20 Amp, DC Coil, Non Reversing, Panel Mounted Miniature Contactor (Square D LP1K).....	144.48	44.32
26 29 13 13-0335 EA 3 Phase (2 HP At 200 Volt, 3 HP At 230 Volt, 5 HP At 460/575 Volt), 1 Phase (1/2 HP At 115 Volt, 1-1/2 HP At 230 Volt), 4 Pole, Without Auxiliary Contacts, 9 Amp, 20 Amp, DC Coil With Integral Suppression, Non Reversing, Panel Mounted Miniature Contactor (Square D LP1K).....	146.76	44.32
26 29 13 13-0336 EA 3 Phase (3 HP At 200/230 Volt, 7-1/2 HP At 460 Volt, 10 HP At 575 Volt), 1 Phase (1/2 HP At 115 Volt, 1-1/2 HP At 230 Volt), 4 Pole, Without Auxiliary Contacts, 12 Amp, 20 Amp, DC Coil, Non Reversing, Panel Mounted Miniature Contactor (Square D LP1K).....	157.10	48.34
26 29 13 13-0337 EA 3 Phase (2 HP At 200 Volt, 3 HP At 230 Volt, 5 HP At 460/575 Volt), 1 Phase (1/2 HP At 115 Volt, 1-1/2 HP At 230 Volt), 4 Pole, Without Auxiliary Contacts, 9 Amp, 20 Amp, DC Coil With Integral Suppression, Non Reversing, Panel Mounted Miniature Contactor (Square D LP1K).....	150.18	44.32
26 29 13 13-0338 EA 3 Phase (3 HP At 200/230 Volt, 7-1/2 HP At 460 Volt, 10 HP At 575 Volt), 1 Phase (1/2 HP At 115 Volt, 1-1/2 HP At 230 Volt), 3 Pole, Auxiliary Contacts, 12 Amp, 20 Amp, DC Coil With Integral Suppression, Non Reversing, Panel Mounted Miniature Contactor (Square D LP1K).....	162.80	48.34
26 29 13 13-0339 EA 3 Phase (2 HP At 200 Volt, 3 HP At 230 Volt, 5 HP At 460/575 Volt), 1 Phase (1/2 HP At 115 Volt, 1-1/2 HP At 230 Volt), 3 Pole, Auxiliary Contacts, 9 Amp, 20 Amp, DC Low Consumption Coil With Integral Suppression, Non Reversing, Panel Mounted Miniature Contactor (Square D LP4K).....	151.32	44.32
26 29 13 13-0340 EA 3 Phase (2 HP At 200 Volt, 3 HP At 230 Volt, 5 HP At 460/575 Volt), 1 Phase (1/2 HP At 115 Volt, 1-1/2 HP At 230 Volt), 4 Pole, Without Auxiliary Contacts, 9 Amp, 20 Amp, DC Low Consumption Coil With Integral Suppression, Non Reversing, Panel Mounted Miniature Contactor (Square D LP4K).....	151.32	44.32
26 29 13 13-0341 EA 3 Phase (3 HP At 200/230 Volt, 7-1/2 HP At 460 Volt, 10 HP At 575 Volt), 1 Phase (1/2 HP At 115 Volt, 1-1/2 HP At 230 Volt), 3 Pole, Auxiliary Contacts, 12 Amp, 20 Amp, DC Low Consumption Coil With Integral Suppression, Non Reversing, Panel Mounted Miniature Contactor (Square D LP4K).....	168.50	48.34
26 29 13 13-0342 EA 3 Phase (3 HP At 200/230 Volt, 7-1/2 HP At 460 Volt, 10 HP At 575 Volt), 1 Phase (1/2 HP At 115 Volt, 1-1/2 HP At 230 Volt), 4 Pole, Without Auxiliary Contacts, 12 Amp, 20 Amp, DC Low Consumption Coil With Integral Suppression, Non Reversing, Panel Mounted Miniature Contactor (Square D LP4K).....	168.50	48.34
26 29 13 13-0343 Reversing, Panel Mounted Miniature Contactor <small>(26 29 13 13-0324)</small>		
26 29 13 13-0344 EA 3 Phase (1-1/2 HP At 200/230 Volt, 3 HP At 460/575 Volt), 1 Phase (1/2 HP At 115 Volt, 1-1/2 HP At 230 Volt), 3 Pole, Auxiliary Contacts, 6 Amp, 15 Amp, AC Coil, Reversing, Panel Mounted Miniature Contactor (Square D LC2K).....	154.67	40.28
26 29 13 13-0345 EA 3 Phase (1-1/2 HP At 200/230 Volt, 3 HP At 460/575 Volt), 1 Phase (1/2 HP At 115 Volt, 1-1/2 HP At 230 Volt), 3 Pole, Auxiliary Contacts, 6 Amp, 15 Amp, AC Coil With Integral Suppression, Reversing, Panel Mounted Miniature Contactor (Square D LC2K).....	166.07	40.28
26 29 13 13-0346 EA 3 Phase (2 HP At 200 Volt, 3 HP At 230 Volt, 5 HP At 460/575 Volt), 1 Phase (1/2 HP At 115 Volt, 1-1/2 HP At 230 Volt), 3 Pole, Auxiliary Contacts, 9 Amp, 20 Amp, AC Coil, Reversing, Panel Mounted Miniature Contactor (Square D LC2K).....	183.81	44.32
26 29 13 13-0347 EA 3 Phase (2 HP At 200 Volt, 3 HP At 230 Volt, 5 HP At 460/575 Volt), 1 Phase (1/2 HP At 115 Volt, 1-1/2 HP At 230 Volt), 4 Pole, Without Auxiliary Contacts, 9 Amp, 20 Amp, AC Coil, Reversing, Panel Mounted Miniature Contactor (Square D LC2K).....	183.81	44.32
26 29 13 13-0348 EA 3 Phase (2 HP At 200 Volt, 3 HP At 230 Volt, 5 HP At 460/575 Volt), 1 Phase (1/2 HP At 115 Volt, 1-1/2 HP At 230 Volt), 3 Pole, Auxiliary Contacts, 9 Amp, 20 Amp, AC Coil With Integral Suppression, Reversing, Panel Mounted Miniature Contactor (Square D LC2K).....	195.21	44.32



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 29 13 13-0349 EA 3 Phase (3 HP At 200/230 Volt, 7-1/2 HP At 460 Volt, 10 HP At 575 Volt), 1 Phase (1/2 HP At 115 Volt, 1-1/2 HP At 230 Volt), 3 Pole, Auxiliary Contacts, 12 Amp, 20 Amp, AC Coil, Reversing, Panel Mounted Miniature Contactor (Square D LC2K).....	205.55	48.34
26 29 13 13-0350 EA 3 Phase (3 HP At 200/230 Volt, 7-1/2 HP At 460 Volt, 10 HP At 575 Volt), 1 Phase (1/2 HP At 115 Volt, 1-1/2 HP At 230 Volt), 4 Pole, Without Auxiliary Contacts, 12 Amp, 20 Amp, AC Coil, Reversing, Panel Mounted Miniature Contactor (Square D LC2K).....	205.55	48.34
26 29 13 13-0351 EA 3 Phase (1-1/2 HP At 200/230 Volt, 3 HP At 460/575 Volt), 1 Phase (1/2 HP At 115 Volt, 1-1/2 HP At 230 Volt), 3 Pole, Auxiliary Contacts, 6 Amp, 15 Amp, DC Coil, Reversing, Panel Mounted Miniature Contactor (Square D LP2K).....	175.76	40.28
26 29 13 13-0352 EA 3 Phase (1-1/2 HP At 200/230 Volt, 3 HP At 460/575 Volt), 1 Phase (1/2 HP At 115 Volt, 1-1/2 HP At 230 Volt), 3 Pole, Auxiliary Contacts, 6 Amp, 15 Amp, DC Coil With Integral Suppression, Reversing, Panel Mounted Miniature Contactor (Square D LP2K).....	187.16	40.28
26 29 13 13-0353 EA 3 Phase (2 HP At 200 Volt, 3 HP At 230 Volt, 5 HP At 460/575 Volt), 1 Phase (1/2 HP At 115 Volt, 1-1/2 HP At 230 Volt), 3 Pole, Auxiliary Contacts, 9 Amp, 20 Amp, DC Coil, Reversing, Panel Mounted Miniature Contactor (Square D LP2K).....	203.76	44.32
26 29 13 13-0354 EA 3 Phase (2 HP At 200 Volt, 3 HP At 230 Volt, 5 HP At 460/575 Volt), 1 Phase (1/2 HP At 115 Volt, 1-1/2 HP At 230 Volt), 3 Pole, Auxiliary Contacts, 9 Amp, 20 Amp, DC Coil With Integral Suppression, Reversing, Panel Mounted Miniature Contactor (Square D LP2K).....	215.16	44.32
26 29 13 13-0355 EA 3 Phase (3 HP At 200/230 Volt, 7-1/2 HP At 460 Volt, 10 HP At 575 Volt), 1 Phase (1/2 HP At 115 Volt, 1-1/2 HP At 230 Volt), 3 Pole, Auxiliary Contacts, 12 Amp, 20 Amp, DC Coil, Reversing, Panel Mounted Miniature Contactor (Square D LP2K).....	228.92	48.34
26 29 13 13-0356 EA 3 Phase (3 HP At 200/230 Volt, 7-1/2 HP At 460 Volt, 10 HP At 575 Volt), 1 Phase (1/2 HP At 115 Volt, 1-1/2 HP At 230 Volt), 3 Pole, Auxiliary Contacts, 12 Amp, 20 Amp, DC Coil With Integral Suppression, Reversing, Panel Mounted Miniature Contactor (Square D LP2K).....	240.32	48.34
26 29 13 13-0357 EA 3 Phase (2 HP At 200 Volt, 3 HP At 230 Volt, 5 HP At 460/575 Volt), 1 Phase (1/2 HP At 115 Volt, 1-1/2 HP At 230 Volt), 3 Pole, Auxiliary Contacts, 9 Amp, 20 Amp, DC Low Consumption Coil With Integral Suppression, Reversing, Panel Mounted Miniature Contactor (Square D LP5K).....	197.49	44.32
26 29 13 13-0358 EA 3 Phase (2 HP At 200 Volt, 3 HP At 230 Volt, 5 HP At 460/575 Volt), 1 Phase (1/2 HP At 115 Volt, 1-1/2 HP At 230 Volt), 3 Pole, Auxiliary Contacts, 9 Amp, 20 Amp, DC Low Consumption Coil With Integral Suppression, Reversing, Panel Mounted Miniature Contactor (Square D LP5K).....	224.28	44.32
26 29 13 13-0359 EA 3 Phase (3 HP At 200/230 Volt, 7-1/2 HP At 460 Volt, 10 HP At 575 Volt), 1 Phase (1/2 HP At 115 Volt, 1-1/2 HP At 230 Volt), 3 Pole, Auxiliary Contacts, 12 Amp, 20 Amp, DC Low Consumption Coil With Integral Suppression, Reversing, Panel Mounted Miniature Contactor (Square D LP5K).....	252.86	48.34
26 29 13 13-0360 Panel Mounted Miniature Contactor Accessories <small>(26 29 13 13-0324)</small>		
26 29 13 13-0361 EA 2 Auxiliary Contacts, 10 Amp, Panel Mounted Miniature Contactor Accessory (Square D LA1KN02).....	49.23	20.14
26 29 13 13-0362 EA 4 Auxiliary Contacts, 10 Amp, Panel Mounted Miniature Contactor Accessory (Square D LA1KN40).....	53.63	20.14
26 29 13 13-0363 EA Electronic Time Delay Contact, 2 Amp, Panel Mounted Miniature Contactor Accessory (Square D LA2KT2U).....	61.60	20.14
26 29 13 13-0364 EA Overload Relay, Panel Mounted Miniature Contactor Accessory (Square D LR2K0301).....	77.45	20.14
26 29 13 13-0365 Reduced Voltage Auto Transformer Type 240-600 Volt, 3 Pole <small>(26 29 13 13)</small>		
26 29 13 13-0366 NEMA 1 Enclosure <small>(26 29 13 13-0365)</small>		
26 29 13 13-0367 EA Reduced Voltage Auto Transformer Starter, Size 3, 50 HP, NEMA 1, 240 - 600 Volt, 3 Pole, Non-Reversing.....	5,741.24	386.07
For NEMA 4, Add	619.09	
26 29 13 13-0368 EA Reduced Voltage Auto Transformer Starter, Size 4, 100 HP, NEMA 1, 240 - 600 Volt, 3 Pole, Non-Reversing.....	10,077.63	514.76
For NEMA 4, Add	1,130.81	
26 29 13 13-0369 EA Reduced Voltage Auto Transformer Starter, Size 5, 200 HP, NEMA 1, 240 - 600 Volt, 3 Pole, Non-Reversing.....	17,729.81	611.28
For NEMA 4, Add	2,063.90	
26 29 13 13-0370 EA Reduced Voltage Auto Transformer Starter, Size 6, 300 HP, NEMA 1, 240 - 600 Volt, 3 Pole, Non-Reversing.....	43,459.02	748.01
For NEMA 4, Add	5,246.20	
26 29 13 13-0371 EA Reduced Voltage Auto Transformer Starter, Size 7, 600 HP, NEMA 1, 240 - 600 Volt, 3 Pole, Non-Reversing.....	69,405.29	957.13
For NEMA 4, Add	8,436.28	
26 29 13 13-0372 NEMA 12 Enclosure <small>(26 29 13 13-0365)</small>		
26 29 13 13-0373 EA Reduced Voltage Auto Transformer Starter, Size 3, 50 HP, NEMA 12, 240 - 600 Volt, 3 Pole, Non-Reversing.....	5,699.99	394.27
26 29 13 13-0374 EA Reduced Voltage Auto Transformer Starter, Size 4, 100 HP, NEMA 12, 240 - 600 Volt, 3 Pole, Non-Reversing.....	10,002.28	515.57
26 29 13 13-0375 EA Reduced Voltage Auto Transformer Starter, Size 5, 200 HP, NEMA 12, 240 - 600 Volt, 3 Pole, Non-Reversing.....	17,592.28	609.35
26 29 13 13-0376 EA Reduced Voltage Auto Transformer Starter, Size 6, 300 HP, NEMA 12, 240 - 600 Volt, 3 Pole, Non-Reversing.....	43,109.44	744.72
26 29 13 13-0377 EA Reduced Voltage Auto Transformer Starter, Size 7, 600 HP, NEMA 12, 240 - 600 Volt, 3 Pole, Non-Reversing.....	68,843.13	957.54
26 29 13 13-0378 Factory Modifications Pilot Devices <small>(26 29 13 13-0365)</small>		
26 29 13 13-0379 EA Start-Stop Push-button, Factory Modification Reduced Voltage Auto Transformer Starter, 240 - 600 Volt, 3 Phase, Pilot Device.....	145.86	
26 29 13 13-0380 EA H-O-A Select Switch, Factory Modification Reduced Voltage Auto Transformer Starter, 240 - 600 Volt, 3 Phase, Pilot Device.....	160.87	
26 29 13 13-0381 EA Forward-Reverse-Stop, Factory Modification Reduced Voltage Auto Transformer Starter, 240 - 600 Volt, 3 Phase, Pilot Device.....	273.82	
26 29 13 13-0382 EA Pilot Light, Factory Modification Reduced Voltage Auto Transformer Starter, 240 - 600 Volt, 3 Phase, Pilot Device.....	148.78	
26 29 13 13-0383 EA Fused Control Circuit, Factory Modification Reduced Voltage Auto Transformer Starter, 240 - 600 Volt, 3 Phase, Pilot Device.....	213.93	
26 29 13 13-0384 EA Auxiliary Interlock, Factory Modification Reduced Voltage Auto Transformer Starter, 240 - 600 Volt, 3 Phase, Pilot Device.....	106.96	
26 29 13 13-0385 EA Auxiliary Relay, Factory Modification Reduced Voltage Auto Transformer Starter, 240 - 600 Volt, 3 Phase, Pilot Device.....	349.12	
26 29 13 13-0386 Factory Modifications Meters <small>(26 29 13 13-0365)</small>		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 29 13 13-0387 EA Ammeter And Switch, Factory Modification Reduced Voltage Auto Transformer Starter, 240 - 600 Volt, 3 Phase, Meter.....	1,403.35	
26 29 13 13-0388 EA Voltmeter, Factory Modification Reduced Voltage Auto Transformer Starter, 240 - 600 Volt, 3 Phase, Meter.....	1,355.45	
26 29 13 13-0389 EA Wattmeter, Factory Modification Reduced Voltage Auto Transformer Starter, 240 - 600 Volt, 3 Phase, Meter.....	479.19	
26 29 13 13-0390 EA Elapsed-time Meter, Factory Modification Reduced Voltage Auto Transformer Starter, 240 - 600 Volt, 3 Phase, Meter.....	397.06	
26 29 13 13-0391 Factory Modifications Main Circuit Breakers <small>(26 29 13 13-0365)</small>		
26 29 13 13-0392 EA Reduced Voltage Auto Transformer Starter, Size 3, Circuit Breaker, Factory Modification Main Circuit Breaker.....	1,854.73	
26 29 13 13-0393 EA Reduced Voltage Auto Transformer Starter, Size 4, Circuit Breaker, Factory Modification Main Circuit Breaker.....	3,392.08	
26 29 13 13-0394 EA Reduced Voltage Auto Transformer Starter, Size 5-7, Circuit Breaker, Factory Modification Main Circuit Breaker.....	7,215.29	
26 29 13 13-0395 Factory Modifications Addition <small>(26 29 13 13-0365)</small>		
<small>Note: For reversing service auto transformer type.</small>		
26 29 13 13-0396 EA Reduced Voltage Auto Transformer Starter, Size 3, Factory Modification For Reversing Type 240 - 600 Volt, 3 Phase.....	311.49	
26 29 13 13-0397 EA Reduced Voltage Auto Transformer Starter, Size 4, Factory Modification For Reversing Type 240 - 600 Volt, 3 Phase.....	311.49	
26 29 13 13-0398 EA Reduced Voltage Auto Transformer Starter, Size 5, Factory Modification For Reversing Type 240 - 600 Volt, 3 Phase.....	311.49	
26 29 13 13-0399 EA Reduced Voltage Auto Transformer Starter, Size 6, 7, Factory Modification For Reversing Type 240 - 600 Volt, 3 Phase.....	311.49	
26 29 13 13-0400 Combination Starters Non-Reversing <small>(26 29 13 13)</small>		
26 29 13 13-0401 240-600 Volts, 3-Pole <small>(26 29 13 13-0400)</small>		
26 29 13 13-0402 NEMA 1 With Disconnect Switch <small>(26 29 13 13-0401)</small>		
26 29 13 13-0403 EA Combination Starter, Size 0, NEMA 1 With Disconnect Switch Non-Reversing, 240 - 600 Volt, 3 Phase.....	1,060.78	185.00
<i>For Electronic Overloads, Add</i>	<i>130.80</i>	
26 29 13 13-0404 EA Combination Starter, Size 1, NEMA 1 With Disconnect Switch Non-Reversing, 240 - 600 Volt, 3 Phase.....	1,309.06	289.55
<i>For Electronic Overloads, Add</i>	<i>137.98</i>	
26 29 13 13-0405 EA Combination Starter, Size 2, NEMA 1 With Disconnect Switch Non-Reversing, 240 - 600 Volt, 3 Phase.....	1,820.13	337.81
<i>For Electronic Overloads, Add</i>	<i>218.48</i>	
26 29 13 13-0406 EA Combination Starter, Size 3, NEMA 1 With Disconnect Switch Non-Reversing, 240 - 600 Volt, 3 Phase.....	2,751.74	418.24
<i>For Electronic Overloads, Add</i>	<i>363.64</i>	
26 29 13 13-0407 EA Combination Starter, Size 4, NEMA 1 With Disconnect Switch Non-Reversing, 240 - 600 Volt, 3 Phase.....	5,032.20	667.58
<i>For Electronic Overloads, Add</i>	<i>701.42</i>	
26 29 13 13-0408 EA Combination Starter, Size 5, NEMA 1 With Disconnect Switch Non-Reversing, 240 - 600 Volt, 3 Phase.....	9,964.27	836.49
<i>For Electronic Overloads, Add</i>	<i>1,574.84</i>	
26 29 13 13-0409 NEMA 1 With Circuit Breaker <small>(26 29 13 13-0401)</small>		
26 29 13 13-0410 EA Combination Starter, Size 0, NEMA 1 With Circuit Breaker, Non-Reversing, 240 - 600 Volt, 3 Phase.....	1,333.11	185.00
<i>For Electronic Overloads, Add</i>	<i>182.54</i>	
26 29 13 13-0411 EA Combination Starter, Size 1, NEMA 1 With Circuit Breaker, Non-Reversing, 240 - 600 Volt, 3 Phase.....	1,581.40	289.55
<i>For Electronic Overloads, Add</i>	<i>189.73</i>	
26 29 13 13-0412 EA Combination Starter, Size 2, NEMA 1 With Circuit Breaker, Non-Reversing, 240 - 600 Volt, 3 Phase.....	2,084.90	337.81
<i>For Electronic Overloads, Add</i>	<i>268.78</i>	
26 29 13 13-0413 EA Combination Starter, Size 3, NEMA 1 With Circuit Breaker, Non-Reversing, 240 - 600 Volt, 3 Phase.....	2,895.48	418.24
<i>For Electronic Overloads, Add</i>	<i>390.96</i>	
26 29 13 13-0414 EA Combination Starter, Size 4, NEMA 1 With Circuit Breaker, Non-Reversing, 240 - 600 Volt, 3 Phase.....	5,856.77	667.58
<i>For Electronic Overloads, Add</i>	<i>858.09</i>	
26 29 13 13-0415 EA Combination Starter, Size 5, NEMA 1 With Circuit Breaker, Non-Reversing, 240 - 600 Volt, 3 Phase.....	12,150.53	836.49
<i>For Electronic Overloads, Add</i>	<i>1,990.23</i>	
26 29 13 13-0416 Factory Modifications For NEMA 1 Enclosure <small>(26 29 13 13-0401)</small>		
26 29 13 13-0417 EA Start-Stop Push-button, Factory Modifications - NEMA 1 Combination Motor Starter, 240 - 600 Volt.....	124.02	
26 29 13 13-0418 EA H-O-A Select Switch, Factory Modifications - NEMA 1 Combination Motor Starter, 240 - 600 Volt.....	291.29	
26 29 13 13-0419 EA Pilot Light, Factory Modifications - NEMA 1 Combination Motor Starter, 240 - 600 Volt.....	201.04	
26 29 13 13-0420 NEMA 4 With Disconnect Switch <small>(26 29 13 13-0401)</small>		
26 29 13 13-0421 EA Combination Starter, Size 0, NEMA 4 With Disconnect Switch Non-Reversing, 240 - 600 Volt, 3 Phase.....	1,911.12	241.30
<i>For Electronic Overloads, Add</i>	<i>268.78</i>	
26 29 13 13-0422 EA Combination Starter, Size 1, NEMA 4 With Disconnect Switch Non-Reversing, 240 - 600 Volt, 3 Phase.....	2,122.72	337.81
<i>For Electronic Overloads, Add</i>	<i>275.97</i>	
26 29 13 13-0423 EA Combination Starter, Size 2, NEMA 4 With Disconnect Switch Non-Reversing, 240 - 600 Volt, 3 Phase.....	3,014.21	369.98
<i>For Electronic Overloads, Add</i>	<i>431.20</i>	
26 29 13 13-0424 EA Combination Starter, Size 3, NEMA 4 With Disconnect Switch Non-Reversing, 240 - 600 Volt, 3 Phase.....	4,759.35	450.42
<i>For Electronic Overloads, Add</i>	<i>734.48</i>	
26 29 13 13-0425 EA Combination Starter, Size 4, NEMA 4 With Disconnect Switch Non-Reversing, 240 - 600 Volt, 3 Phase.....	7,528.62	667.58
<i>For Electronic Overloads, Add</i>	<i>1,175.74</i>	
26 29 13 13-0426 EA Combination Starter, Size 5, NEMA 4 With Disconnect Switch Non-Reversing, 240 - 600 Volt, 3 Phase.....	16,333.93	836.49
<i>For Electronic Overloads, Add</i>	<i>2,785.07</i>	
26 29 13 13-0427 NEMA 4 With Circuit Breaker <small>(26 29 13 13-0401)</small>		

26 Electrical**26 20 Low-Voltage Electrical Distribution****26 29 Low-Voltage Controllers**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 29 13 13-0428 EA Combination Starter, Size 0, NEMA 4 With Circuit Breaker, Non-Reversing, 240 - 600 Volt, 3 Phase.....	2,183.46	241.30
<i>For Electronic Overloads, Add</i>	320.53	
26 29 13 13-0429 EA Combination Starter, Size 1, NEMA 4 With Circuit Breaker, Non-Reversing, 240 - 600 Volt, 3 Phase.....	2,395.06	337.81
<i>For Electronic Overloads, Add</i>	327.71	
26 29 13 13-0430 EA Combination Starter, Size 2, NEMA 4 With Circuit Breaker, Non-Reversing, 240 - 600 Volt, 3 Phase.....	3,278.99	369.98
<i>For Electronic Overloads, Add</i>	481.51	
26 29 13 13-0431 EA Combination Starter, Size 3, NEMA 4 With Circuit Breaker, Non-Reversing, 240 - 600 Volt, 3 Phase.....	4,903.08	450.42
<i>For Electronic Overloads, Add</i>	761.79	
26 29 13 13-0432 EA Combination Starter, Size 4, NEMA 4 With Circuit Breaker, Non-Reversing, 240 - 600 Volt, 3 Phase.....	8,353.19	667.58
<i>For Electronic Overloads, Add</i>	1,332.41	
26 29 13 13-0433 EA Combination Starter, Size 5, NEMA 4 With Circuit Breaker, Non-Reversing, 240 - 600 Volt, 3 Phase.....	15,479.09	836.49
<i>For Electronic Overloads, Add</i>	2,622.65	
26 29 13 13-0434 Factory Modifications For NEMA 4 Enclosure (26 29 13 13-0401)		
26 29 13 13-0435 EA Start-Stop Push-button, Factory Modifications - NEMA 4 Combination Motor Starter, 240 - 600 Volt.....	124.04	
26 29 13 13-0436 EA H-0-A Select Switch, Factory Modifications - NEMA 4 Combination Motor Starter, 240 - 600 Volt.....	291.29	
26 29 13 13-0437 EA Pilot Light, Factory Modifications - NEMA 4 Combination Motor Starter, 240 - 600 Volt.....	201.04	
26 29 13 13-0438 NEMA 12 With Disconnect Switch (26 29 13 13-0401)		
26 29 13 13-0439 EA Combination Starter, Size 0, NEMA 12 With Disconnect Switch Non-Reversing, 240 - 600 Volt, 3 Phase.....	1,095.20	186.20
<i>For Electronic Overloads, Add</i>	137.34	
26 29 13 13-0440 EA Combination Starter, Size 1, NEMA 12 With Disconnect Switch Non-Reversing, 240 - 600 Volt, 3 Phase.....	1,345.37	291.40
<i>For Electronic Overloads, Add</i>	144.88	
26 29 13 13-0441 EA Combination Starter, Size 2, NEMA 12 With Disconnect Switch Non-Reversing, 240 - 600 Volt, 3 Phase.....	1,877.62	335.15
<i>For Electronic Overloads, Add</i>	229.40	
26 29 13 13-0442 EA Combination Starter, Size 3, NEMA 12 With Disconnect Switch Non-Reversing, 240 - 600 Volt, 3 Phase.....	2,847.44	418.89
<i>For Electronic Overloads, Add</i>	381.83	
26 29 13 13-0443 EA Combination Starter, Size 4, NEMA 12 With Disconnect Switch Non-Reversing, 240 - 600 Volt, 3 Phase.....	5,216.78	670.32
<i>For Electronic Overloads, Add</i>	736.49	
26 29 13 13-0444 EA Combination Starter, Size 5, NEMA 12 With Disconnect Switch Non-Reversing, 240 - 600 Volt, 3 Phase.....	10,378.69	837.77
<i>For Electronic Overloads, Add</i>	1,653.58	
26 29 13 13-0445 NEMA 12 With Circuit Breaker (26 29 13 13-0401)		
26 29 13 13-0446 EA Combination Starter, Size 0, NEMA 12 With Circuit Breaker, Non-Reversing, 240 - 600 Volt, 3 Phase.....	1,420.39	186.20
<i>For Electronic Overloads, Add</i>	199.12	
26 29 13 13-0447 EA Combination Starter, Size 1, NEMA 12 With Circuit Breaker, Non-Reversing, 240 - 600 Volt, 3 Phase.....	1,672.11	291.40
<i>For Electronic Overloads, Add</i>	206.96	
26 29 13 13-0448 EA Combination Starter, Size 2, NEMA 12 With Circuit Breaker, Non-Reversing, 240 - 600 Volt, 3 Phase.....	2,213.40	335.15
<i>For Electronic Overloads, Add</i>	293.20	
26 29 13 13-0449 EA Combination Starter, Size 3, NEMA 12 With Circuit Breaker, Non-Reversing, 240 - 600 Volt, 3 Phase.....	3,082.39	418.89
<i>For Electronic Overloads, Add</i>	426.47	
26 29 13 13-0450 EA Combination Starter, Size 4, NEMA 12 With Circuit Breaker, Non-Reversing, 240 - 600 Volt, 3 Phase.....	6,267.02	670.32
<i>For Electronic Overloads, Add</i>	936.04	
26 29 13 13-0451 EA Combination Starter, Size 5, NEMA 12 With Circuit Breaker, Non-Reversing, 240 - 600 Volt, 3 Phase.....	13,102.05	837.77
<i>For Electronic Overloads, Add</i>	2,171.02	
26 29 13 13-0452 Factory Modifications For NEMA 12 Enclosure (26 29 13 13-0401)		
26 29 13 13-0453 EA Start-Stop Push-button, Factory Modifications - NEMA 12 Combination Motor Starter, 240 - 600 Volt.....	123.00	
26 29 13 13-0454 EA H-0-A Select Switch, Factory Modifications - NEMA 12 Combination Motor Starter, 240 - 600 Volt.....	288.87	
26 29 13 13-0455 EA Pilot Light, Factory Modifications - NEMA 12 Combination Motor Starter, 240 - 600 Volt.....	199.37	
26 29 13 13-0456 NEMA 7 Or 9 With Circuit Breaker (26 29 13 13-0401)		
26 29 13 13-0457 EA Combination Starter, Size 0, NEMA 7 Or 9 With Circuit Breaker, Non-Reversing, 240 - 600 Volt, 3 Phase.....	2,476.03	386.07
26 29 13 13-0458 EA Combination Starter, Size 1, NEMA 7 Or 9 With Circuit Breaker, Non-Reversing, 240 - 600 Volt, 3 Phase.....	3,352.46	514.76
26 29 13 13-0459 EA Combination Starter, Size 2, NEMA 7 Or 9 With Circuit Breaker, Non-Reversing, 240 - 600 Volt, 3 Phase.....	3,681.99	707.79
26 29 13 13-0460 EA Combination Starter, Size 3, NEMA 7 Or 9 With Circuit Breaker, Non-Reversing, 240 - 600 Volt, 3 Phase.....	5,449.37	965.18
26 29 13 13-0461 EA Combination Starter, Size 4, NEMA 7 Or 9 With Circuit Breaker, Non-Reversing, 240 - 600 Volt, 3 Phase.....	8,185.47	1,351.25
26 29 13 13-0462 Factory Modifications For NEMA 7 Or 9 Enclosure (26 29 13 13-0401)		
26 29 13 13-0463 EA Start-Stop Push-button, Factory Modifications - NEMA 7 Or 9 Combination Motor Starter, 240 - 600 Volt.....	737.56	
26 29 13 13-0464 EA H-0-A Select Switch, Factory Modifications - NEMA 7 Or 9 Combination Motor Starter, 240 - 600 Volt.....	737.56	
26 29 13 13-0465 EA Pilot Light, Factory Modifications - NEMA 7 Or 9 Combination Motor Starter, 240 - 600 Volt.....	737.56	
26 29 13 13-0466 Combination Starters Reversing (26 29 13 13)		
26 29 13 13-0467 240-600 Volt, 3 Pole (26 29 13 13-0466)		
26 29 13 13-0468 NEMA 1 With Disconnect Switch (26 29 13 13-0467)		
26 29 13 13-0469 EA Combination Starter, Size 0, NEMA 1 With Disconnect Switch, Reversing, 240 - 600 Volt, 3 Phase.....	1,316.84	241.30
26 29 13 13-0470 EA Combination Starter, Size 1, NEMA 1 With Disconnect Switch, Reversing, 240 - 600 Volt, 3 Phase.....	1,545.55	337.81
26 29 13 13-0471 EA Combination Starter, Size 2, NEMA 1 With Disconnect Switch, Reversing, 240 - 600 Volt, 3 Phase.....	2,207.84	369.98
26 29 13 13-0472 EA Combination Starter, Size 3, NEMA 1 With Disconnect Switch, Reversing, 240 - 600 Volt, 3 Phase.....	3,318.14	450.42
26 29 13 13-0473 EA Combination Starter, Size 4, NEMA 1 With Disconnect Switch, Reversing, 240 - 600 Volt, 3 Phase.....	6,418.33	667.58



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 29 13 13-0474 NEMA 1 With Circuit Breaker <small>(26 29 13 13-0467)</small>		
26 29 13 13-0475 EA Combination Starter, Size 0, NEMA 1 With Circuit Breaker, Reversing, 240 - 600 Volt, 3 Phase.....	1,460.53	241.30
26 29 13 13-0476 EA Combination Starter, Size 1, NEMA 1 With Circuit Breaker, Reversing, 240 - 600 Volt, 3 Phase.....	1,698.94	337.81
26 29 13 13-0477 EA Combination Starter, Size 2, NEMA 1 With Circuit Breaker, Reversing, 240 - 600 Volt, 3 Phase.....	2,387.40	369.98
26 29 13 13-0478 EA Combination Starter, Size 3, NEMA 1 With Circuit Breaker, Reversing, 240 - 600 Volt, 3 Phase.....	3,070.93	450.42
26 29 13 13-0479 EA Combination Starter, Size 4, NEMA 1 With Circuit Breaker, Reversing, 240 - 600 Volt, 3 Phase.....	6,904.02	667.58
26 29 13 13-0480 NEMA 12 With Disconnect Switch <small>(26 29 13 13-0467)</small>		
26 29 13 13-0481 EA Combination Starter, Size 0, NEMA 12 With Disconnect Switch, Reversing, 240 - 600 Volt, 3 Phase.....	1,400.40	248.29
26 29 13 13-0482 EA Combination Starter, Size 1, NEMA 12 With Disconnect Switch, Reversing, 240 - 600 Volt, 3 Phase.....	1,634.71	335.15
26 29 13 13-0483 EA Combination Starter, Size 2, NEMA 12 With Disconnect Switch, Reversing, 240 - 600 Volt, 3 Phase.....	2,356.86	372.40
26 29 13 13-0484 EA Combination Starter, Size 3, NEMA 12 With Disconnect Switch, Reversing, 240 - 600 Volt, 3 Phase.....	3,565.08	446.88
26 29 13 13-0485 EA Combination Starter, Size 4, NEMA 12 With Disconnect Switch, Reversing, 240 - 600 Volt, 3 Phase.....	6,935.54	670.32
26 29 13 13-0486 NEMA 12 With Circuit Breaker <small>(26 29 13 13-0467)</small>		
26 29 13 13-0487 EA Combination Starter, Size 0, NEMA 12 With Circuit Breaker, Reversing, 240 - 600 Volt, 3 Phase.....	1,558.73	248.29
26 29 13 13-0488 EA Combination Starter, Size 1, NEMA 12 With Circuit Breaker, Reversing, 240 - 600 Volt, 3 Phase.....	1,803.72	335.15
26 29 13 13-0489 EA Combination Starter, Size 2, NEMA 12 With Circuit Breaker, Reversing, 240 - 600 Volt, 3 Phase.....	2,554.71	372.40
26 29 13 13-0490 EA Combination Starter, Size 3, NEMA 12 With Circuit Breaker, Reversing, 240 - 600 Volt, 3 Phase.....	3,292.70	446.88
26 29 13 13-0491 EA Combination Starter, Size 4, NEMA 12 With Circuit Breaker, Reversing, 240 - 600 Volt, 3 Phase.....	7,470.69	670.32
26 29 13 13-0492 NEMA 7 Or 9 With Circuit Breaker <small>(26 29 13 13-0467)</small>		
26 29 13 13-0493 EA Combination Starter, Size 0, NEMA 7 Or 9 With Circuit Breaker, Reversing, 240 - 600 Volt, 3 Phase.....	3,013.56	514.76
26 29 13 13-0494 EA Combination Starter, Size 1, NEMA 7 Or 9 With Circuit Breaker, Reversing, 240 - 600 Volt, 3 Phase.....	3,258.82	643.45
26 29 13 13-0495 EA Combination Starter, Size 2, NEMA 7 Or 9 With Circuit Breaker, Reversing, 240 - 600 Volt, 3 Phase.....	4,665.15	836.49
26 29 13 13-0496 EA Combination Starter, Size 3, NEMA 7 Or 9 With Circuit Breaker, Reversing, 240 - 600 Volt, 3 Phase.....	7,367.62	1,093.86
26 29 13 13-0497 EA Combination Starter, Size 4, NEMA 7 Or 9 With Circuit Breaker, Reversing, 240 - 600 Volt, 3 Phase.....	13,329.58	1,479.93
26 29 13 13-0498 Solid State Motor Controllers <small>(26 29 13 13)</small>		
26 29 13 13-0499 Adjustable Voltage Drives, DC Motors <small>(26 29 13 13-0498)</small>		
26 29 13 13-0500 EA 0.5-1.5 HP DC Solid State Motor Controller, Reversing With Dynamic Braking.....	1,032.64	144.77
26 29 13 13-0501 EA 0.5-2.0 HP DC Solid State Motor Controller, Non-Reversing With Dynamic Braking.....	1,233.71	144.77
26 29 13 13-0502 Removal And Reinstallation Of Motor Starters <small>(26 29 13 13)</small>		
Note: Includes storage and cleaning.		
26 29 13 13-0503 EA Remove And Reinstall Motor Starter With Disconnect Up To 25 HP.....	574.50	
26 29 13 13-0504 Auxiliary Devices <small>(26 29 13 13)</small>		
26 29 13 13-0505 EA Auxiliary Contact, Normally Open.....	317.41	80.44
26 29 13 13-0506 EA Auxiliary Contact, Normally Closed.....	317.41	80.44
26 29 13 13-0507 EA Pilot Light Kit.....	333.20	80.44
26 29 23 Variable-Frequency Motor Controllers <small>(26 29)</small>		
26 29 23 00-0001 208/230 Volt Variable Frequency Drives <small>(26 29 23)</small>		
Note: 1 or 3 phase. Wall mounted. ABB ACH550 or ACS550 Series. Includes full voltage bypass. NEMA 1 enclosure.		
26 29 23 00-0002 EA 3/4 HP, 208/230 Volt Variable Frequency Drive.....	1,393.86	163.41
26 29 23 00-0003 EA 1 HP, 208/230 Volt Variable Frequency Drive.....	1,564.86	163.41
26 29 23 00-0004 EA 1-1/2 HP, 208/230 Volt Variable Frequency Drive.....	1,820.86	163.41
26 29 23 00-0005 EA 2 HP, 208/230 Volt Variable Frequency Drive.....	1,988.86	163.41
26 29 23 00-0006 EA 3 HP, 208/230 Volt Variable Frequency Drive.....	2,096.86	163.41
26 29 23 00-0007 EA 5 HP, 208/230 Volt Variable Frequency Drive.....	2,160.38	163.41
26 29 23 00-0008 EA 7.5 HP, 208/230 Volt Variable Frequency Drive.....	2,408.99	245.60
26 29 23 00-0009 EA 10 HP, 208/230 Volt Variable Frequency Drive.....	2,931.25	245.60
26 29 23 00-0010 EA 15 HP, 208/230 Volt Variable Frequency Drive.....	3,551.73	326.73
26 29 23 00-0011 EA 20 HP, 208/230 Volt Variable Frequency Drive.....	4,108.47	326.73
26 29 23 00-0012 EA 25 HP, 208/230 Volt Variable Frequency Drive.....	5,111.89	408.93
26 29 23 00-0013 EA 30 HP, 208/230 Volt Variable Frequency Drive.....	6,376.34	408.93
26 29 23 00-0014 EA 40 HP, 208/230 Volt Variable Frequency Drive.....	7,788.21	480.15
26 29 23 00-0015 EA 50 HP, 208/230 Volt Variable Frequency Drive.....	8,754.66	574.07
26 29 23 00-0016 EA 60 HP, 208/230 Volt Variable Frequency Drive.....	9,925.66	574.07
26 29 23 00-0017 EA 75 HP, 208/230 Volt Variable Frequency Drive.....	11,714.66	574.07
26 29 23 00-0018 460/480 Volt Variable Frequency Drives <small>(26 29 23)</small>		
Note: 3 Phase. ABB ACH550 or ACS550 Series. Includes full voltage bypass. NEMA 1 enclosure.		
26 29 23 00-0019 EA 3 HP, 480 Volt Variable Frequency Drive.....	1,891.91	143.46
Note: Wall mounted.		
26 29 23 00-0020 EA 5 HP, 480 Volt Variable Frequency Drive.....	2,029.86	163.41
Note: Wall mounted.		

26 Electrical**26 20 Low-Voltage Electrical Distribution****26 29 Low-Voltage Controllers**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 29 23 00-0021 EA 7.5 HP, 480 Volt Variable Frequency Drive Note: Wall mounted.	2,155.99	245.60
26 29 23 00-0022 EA 10 HP, 480 Volt Variable Frequency Drive Note: Wall mounted.	2,389.18	245.61
26 29 23 00-0023 EA 15 HP, 480 Volt Variable Frequency Drive Note: Wall mounted.	3,020.73	326.73
26 29 23 00-0024 EA 20 HP, 480 Volt Variable Frequency Drive Note: Wall mounted.	3,531.72	326.75
26 29 23 00-0025 EA 25 HP, 480 Volt Variable Frequency Drive Note: Wall mounted.	4,433.89	408.94
26 29 23 00-0026 EA 30 HP, 480 Volt Variable Frequency Drive Note: Wall mounted.	5,062.34	408.93
26 29 23 00-0027 EA 40 HP, 480 Volt Variable Frequency Drive Note: Wall mounted.	6,079.21	480.15
26 29 23 00-0028 EA 50 HP, 480 Volt Variable Frequency Drive Note: Wall mounted.	7,197.66	574.07
26 29 23 00-0029 EA 60 HP, 480 Volt Variable Frequency Drive Note: Wall mounted.	8,366.54	613.78
26 29 23 00-0030 EA 75 HP, 480 Volt Variable Frequency Drive Note: Wall mounted.	9,474.42	653.50
26 29 23 00-0031 EA 100 HP, 480 Volt Variable Frequency Drive Note: Wall mounted.	11,332.01	693.02
26 29 23 00-0032 EA 125 HP, 480 Volt Variable Frequency Drive Note: Wall mounted.	13,449.52	731.95
26 29 23 00-0033 EA 150 HP, 480 Volt Variable Frequency Drive Note: Floor mounted.	15,477.77	817.81
26 29 23 00-0034 EA 200 HP, 480 Volt Variable Frequency Drive Note: Floor mounted.	20,829.87	896.64
26 29 23 00-0035 EA 250 HP, 480 Volt Variable Frequency Drive Note: Floor mounted.	26,824.02	975.91
26 29 23 00-0036 EA 300 HP, 480 Volt Variable Frequency Drive Note: Floor mounted.	31,585.99	1,143.66
26 29 23 00-0037 EA 350 HP, 480 Volt Variable Frequency Drive Note: Floor mounted.	36,685.95	1,295.49
26 29 23 00-0038 EA 400 HP, 480 Volt Variable Frequency Drive Note: Floor mounted.	42,954.03	1,463.91
26 29 23 00-0039 EA 450 HP, 480 Volt Variable Frequency Drive Note: Floor mounted.	46,358.55	1,644.80

26 30 Facility Electrical Power Generating And Storing Equipment

(26)

26 31 Photovoltaic Collectors (26 30)**26 31 00 00-0001****Photovoltaic Collectors** (26 31)

Note: All materials are to be installed per manufacturers specifications and must be in compliance with the California Energy Commission Guidelines (CEC-300-2011-005-CMF). See CSI section 26 28 13 00-0066 for fuses.

26 31 00 00-0002**Rigid Photovoltaic Modules** (26 31)**26 31 00 00-0003****Sanyo Rigid Photovoltaic Modules** (26 31 00 00-0002)

26 31 00 00-0004 EA 205 Watt Hybrid Monocrystalline With Thin Amorphous Layers Photovoltaic Module, 62.2" x 31.4", 16.3% Module Efficiency (Sanyo HIP-205NHKA6).....	1,064.87	76.41
<i>For >50, Deduct</i>	-91.21	
26 31 00 00-0005 EA 210 Watt Hybrid Monocrystalline With Thin Amorphous Layers Photovoltaic Module, 62.2" x 31.4", 16.7% Module Efficiency (Sanyo HIP-210NHKA6).....	1,181.80	76.41
<i>For >50, Deduct</i>	-102.90	
26 31 00 00-0006 EA 215 Watt Hybrid Monocrystalline With Thin Amorphous Layers Photovoltaic Module, 62.2" x 31.4", 17.1% Module Efficiency (Sanyo HIP-215HNKA6).....	1,108.14	76.41
<i>For >50, Deduct</i>	-95.53	

26 31 00 00-0007**Sharp Rigid Photovoltaic Modules** (26 31 00 00-0002)

26 31 00 00-0008 EA 224 Watt Polycrystalline Photovoltaic Module, 64.6" x 39.1", 13.74% Module Efficiency (Sharp ND-224UC1).....	890.65	76.41
<i>For >50, Deduct</i>	-73.78	
26 31 00 00-0009 EA 230 Watt Monocrystalline Photovoltaic Module, 64.6" x 39.1", 14.1% Module Efficiency (Sharp NU-U230F3).....	1,008.75	76.41
<i>For >50, Deduct</i>	-85.59	
26 31 00 00-0010 EA 235 Watt Monocrystalline Photovoltaic Module, 64.6" x 39.1", 14.4% Module Efficiency (Sharp NU-U235F1).....	1,027.46	76.41
<i>For >50, Deduct</i>	-87.46	
26 31 00 00-0011 EA 240 Watt Monocrystalline Photovoltaic Module, 64.6" x 39.1", 14.7% Module Efficiency (Sharp NU-U240F1).....	968.99	76.41
<i>For >50, Deduct</i>	-81.62	

26 31 00 00-0012**BP Solar Rigid Photovoltaic Modules** (26 31 00 00-0002)

Note: Approved for applications in NEC Class 1, Division 2, Groups C and D hazardous locations.

26 31 00 00-0013 EA 50 Watt Polycrystalline Photovoltaic Module, 33" x 21.1" (BP SX350J).....	455.61	76.41
<i>For >50, Deduct</i>	-30.28	
26 31 00 00-0014 EA 75 Watt Polycrystalline Photovoltaic Module, 47.6" x 21.14" (BP SX375J).....	555.00	76.41
<i>For >50, Deduct</i>	-40.22	
26 31 00 00-0015 EA 80 Watt Polycrystalline Photovoltaic Module, 47.6" x 20.9" (BP SX380J).....	594.76	76.41
<i>For >50, Deduct</i>	-44.19	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 31 00 00-0016				Photovoltaic Inverters <small>(26 31)</small>		
26 31 00 00-0017				Fronius Photovoltaic Inverters <small>(26 31 00 00-0016)</small>		
26 31 00 00-0018	EA			3 KW Photovoltaic Inverter (Fronius IG Plus 3.0-1)	2,937.95	80.44
26 31 00 00-0019	EA			5 KW Photovoltaic Inverter (Fronius IG Plus 5.0-1)	4,696.57	80.44
26 31 00 00-0020	EA			6 KW Photovoltaic Inverter (Fronius IG Plus 6.0-1)	4,836.89	80.44
26 31 00 00-0021	EA			7.5 KW Photovoltaic Inverter (Fronius IG Plus 7.5-1)	5,877.57	80.44
26 31 00 00-0022	EA			10 KW Photovoltaic Inverter (Fronius IG Plus 10.0-1)	6,475.33	80.44
26 31 00 00-0023	EA			12 KW Photovoltaic Inverter (Fronius IG Plus 12.0-3-1)	7,521.60	80.44
26 31 00 00-0024	EA			11.4 KW Photovoltaic Inverter (Fronius IG Plus 11.4-3 Delta)	8,529.04	160.86
26 31 00 00-0025	EA			11.4 KW Photovoltaic Inverter (Fronius IG Plus 11.4-3)	8,645.97	160.86
26 31 00 00-0026	EA			Inverter Display Stand (Fronius 4,045,894)	246.13	40.21
26 31 00 00-0027				SMA Photovoltaic Inverters <small>(26 31 00 00-0016)</small>		
26 31 00 00-0028	EA			4 KW AC Photovoltaic Inverter (SMA SB 4000US)	3,043.18	80.44
26 31 00 00-0029	EA			5 KW AC Photovoltaic Inverter (SMA SB 5000US)	3,926.01	80.44
26 31 00 00-0030	EA			6 KW AC Photovoltaic Inverter (SMA SB 6000US)	4,148.17	80.44
26 31 00 00-0031	EA			7 KW AC Photovoltaic Inverter (SMA SB 7000US)	4,439.33	80.44
26 31 00 00-0032	EA			8 KW AC Photovoltaic Inverter (SMA SB 8000US)	4,836.89	80.44
26 31 00 00-0033	EA			36 KW AC Tower Photovoltaic Inverter (SMA ST36)	24,812.88	321.72
26 31 00 00-0034	EA			42 KW AC Tower Photovoltaic Inverter (SMA ST42)	26,794.84	321.72
26 31 00 00-0035				PVPowered Photovoltaic Inverters <small>(26 31 00 00-0016)</small>		
26 31 00 00-0036	EA			120 Volt, 1.1 KW Photovoltaic Inverter (PVPowered PVP1100)	2,435.30	80.44
26 31 00 00-0037	EA			240 Volt, 2 KW Photovoltaic Inverter (PVPowered PVP2000)	2,545.43	80.44
26 31 00 00-0038	EA			240 Volt, 2.5 KW Photovoltaic Inverter (PVPowered PVP2500)	2,808.79	80.44
26 31 00 00-0039	EA			240 Volt, 3.5 KW Photovoltaic Inverter (PVPowered PVP3500)	3,332.61	100.54
26 31 00 00-0040	EA			208 Volt, 4.6 KW Photovoltaic Inverter (PVPowered PVP4600)	4,062.35	120.65
26 31 00 00-0041	EA			240 Volt, 4.8 KW Photovoltaic Inverter (PVPowered PVP4800)	4,095.87	120.65
26 31 00 00-0042	EA			240 Volt, 5.2 KW Photovoltaic Inverter (PVPowered PVP5200)	4,319.00	120.65
26 31 00 00-0043	EA			208 Volt, 75 KW Photovoltaic Inverter (PVPowered PVP75kW)	54,186.03	643.45
26 31 00 00-0044	EA			480 Volt, 75 KW Photovoltaic Inverter (PVPowered PVP75kW)	48,409.69	643.45
26 31 00 00-0045	EA			208 Volt, 100 KW Photovoltaic Inverter (PVPowered PVP100kW)	60,628.88	643.45
26 31 00 00-0046	EA			480 Volt, 100 KW Photovoltaic Inverter (PVPowered PVP100kW)	54,596.46	643.45
26 31 00 00-0047				Solectria Photovoltaic Inverters <small>(26 31 00 00-0016)</small>		
26 31 00 00-0048	EA			208 Or 480 Volt, 10 KW Photovoltaic Inverter (Solectria PVI)	8,077.63	160.86
26 31 00 00-0049	EA			208 Or 480 Volt, 13 KW Photovoltaic Inverter (Solectria PVI)	8,077.63	160.86
26 31 00 00-0050	EA			208 Volt, 15 KW, Photovoltaic Inverter (Solectria PVI)	8,311.87	160.86
26 31 00 00-0051	EA			480 Volt, 15 KW Photovoltaic Inverter (Solectria PVI)	8,311.87	160.86
26 31 00 00-0052	EA			208 Volt, 50 KW Photovoltaic Inverter (Solectria PVI)	25,300.01	482.58
26 31 00 00-0053	EA			480 Volt, 50 KW Photovoltaic Inverter (Solectria PVI)	24,128.82	482.58
26 31 00 00-0054	EA			208 Volt, 60 KW Photovoltaic Inverter (Solectria PVI)	27,642.40	482.58
26 31 00 00-0055	EA			480 Volt, 60 KW Photovoltaic Inverter (Solectria PVI)	26,991.74	482.58
26 31 00 00-0056	EA			208 Volt, 75 KW Photovoltaic Inverter (Solectria PVI)	29,334.13	482.58
26 31 00 00-0057	EA			480 Volt, 75 KW Photovoltaic Inverter (Solectria PVI)	28,032.80	482.58
26 31 00 00-0058	EA			208 Volt, 85 KW Photovoltaic Inverter (Solectria PVI)	30,957.18	643.45
26 31 00 00-0059	EA			480 Volt, 85 KW Photovoltaic Inverter (Solectria PVI)	29,525.72	643.45
26 31 00 00-0060	EA			208 Volt, 100 KW Photovoltaic Inverter (Solectria PVI)	32,128.37	643.45
26 31 00 00-0061	EA			480 Volt, 100 KW Photovoltaic Inverter (Solectria PVI)	30,436.65	643.45
26 31 00 00-0062				Xantrex Photovoltaic Inverters <small>(26 31 00 00-0016)</small>		
26 31 00 00-0063	EA			0.6 KW Photovoltaic Inverter (Xantrex 806-1206)	343.35	20.11
26 31 00 00-0064	EA			1 KW Photovoltaic Inverter (Xantrex 806-1210)	373.46	20.11
26 31 00 00-0065	EA			2 KW Photovoltaic Inverter (Xantrex 806-1220)	594.74	20.11
26 31 00 00-0066				Photovoltaic DC-DC Converters <small>(26 31)</small>		
26 31 00 00-0067	EA			15 Amp, 20 To 35 Volt Input, 13.8 Volt Output DC Voltage Converter (Samlex SDC-20)	209.99	30.16
				Note: Hazardous locations.		
26 31 00 00-0068	EA			20 Amp, 20 To 35 Volt Input, 13.8 Volt Output DC Voltage Converter (Samlex SDC-23)	144.51	30.16
26 31 00 00-0069	EA			60 Amp, 20 To 35 Volt Input, 13.8 Volt Output DC Voltage Converter (Samlex SDC-60)	378.37	30.16
26 31 00 00-0070				Photovoltaic Combiner Boxes <small>(26 31)</small>		
26 31 00 00-0071				Midnight Solar Photovoltaic Combiner Boxes <small>(26 31 00 00-0070)</small>		
26 31 00 00-0072	EA			3 - 150 Volt DC Breaker Or 3 - 600 Volt DC Fuse Holder, NEMA 3R, Aluminum Photovoltaic Combiner Box (Midnite Solar MNPV3)	245.05	80.44
26 31 00 00-0073	EA			6 - 150 Volt DC Breaker Or 4 - 600 Volt DC Fuse Holder, NEMA 3R, Aluminum Photovoltaic Combiner Box (Midnite Solar MNPV6)	263.76	80.44
26 31 00 00-0074	EA			12 - 150 Volt DC Breaker Or 10 - 600 Volt DC Fuse Holder, NEMA 3R, Aluminum Photovoltaic Combiner Box (Midnite Solar MNPV12)	416.70	120.65
26 31 00 00-0075	EA			6 - 300 Volt DC Breaker, NEMA 3R, Aluminum Photovoltaic Combiner Box (Midnite Solar MNPV12-250)	427.22	120.65
26 31 00 00-0076	EA			16, 600 Volt DC Breakers, NEMA 3R, Aluminum Photovoltaic Combiner Box (Midnite Solar MNPV16)	633.02	120.65

26 Electrical**26 30 Facility Electrical Power Generating And Storing Equipment****26 31 Photovoltaic Collectors**

MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
26 31 00 00-0077 SMA Photovoltaic Combiner Boxes (26 31 00 00-0070)					
26 31 00 00-0078	EA	6 Input NEMA 3R, Steel Photovoltaic Combiner Box (SMA SBCB-6).....	568.95		80.44
26 31 00 00-0079	EA	12 Input NEMA 3R, Steel Photovoltaic Combiner Box (SMA SCCB-12).....	727.97		80.44
26 31 00 00-0080	EA	28 Input NEMA 3R, Steel Photovoltaic Combiner Box (SMA SCCB-28).....	1,508.56		160.86
26 31 00 00-0081	EA	52 Input NEMA 3R, Steel Photovoltaic Combiner Box (SMA SCCB-52).....	2,399.57		160.86
26 31 00 00-0082	EA	4 Input NEMA 3R, Steel Combination DC Disconnect And Photovoltaic Combiner Box (SMA Combi-Switch)	821.51		80.44
26 31 00 00-0083 Photovoltaic Charge Controller (26 31)					
26 31 00 00-0084	EA	35 Amp, 12 Or 24 Volt, Charge Controller (Xantrex C-35).....	170.23		30.16
26 31 00 00-0085	EA	40 Amp, 12 Or 24 Volt, Charge Controller (Xantrex C-40).....	222.85		30.16
26 31 00 00-0086	EA	60 Amp, 12 Or 24 Volt, Charge Controller (Xantrex C-60).....	257.93		30.16
26 31 00 00-0087	EA	Remote Digital Meter For Xantrex C-35, 40 And 60.....	200.64		30.16
26 31 00 00-0088	EA	MPPT Charge Controller (Xantrex XW SCC).....	667.37		40.21
26 31 00 00-0089 Photovoltaic Batteries (26 31)					
26 31 00 00-0090 Concorde Photovoltaic Batteries (26 31 00 00-0089)					
26 31 00 00-0091	EA	34 Amp Hours, 12 Volt, Sealed Absorbed Glass Mat (AGM) Battery (Concorde PVX-340T)	150.33		12.07
26 31 00 00-0092	EA	40 Amp Hours, 12 Volt, Sealed Absorbed Glass Mat (AGM) Battery (Concorde PVX-420T)	189.93		16.09
26 31 00 00-0093	EA	49 Amp Hours, 12 Volt, Sealed Absorbed Glass Mat (AGM) Battery (Concorde PVX-490T)	205.17		16.09
26 31 00 00-0094	EA	56 Amp Hours, 12 Volt, Sealed Absorbed Glass Mat (AGM) Battery (Concorde PVX-560T)	237.57		24.13
26 31 00 00-0095	EA	69 Amp Hours, 12 Volt, Sealed Absorbed Glass Mat (AGM) Battery (Concorde PVX-690T)	269.12		24.13
26 31 00 00-0096	EA	89 Amp Hours, 12 Volt, Sealed Absorbed Glass Mat (AGM) Battery (Concorde PVX-890T)	319.22		28.15
26 31 00 00-0097	EA	104 Amp Hours, 12 Volt, Sealed Absorbed Glass Mat (AGM) Battery (Concorde PVX-1040T)	365.97		32.17
26 31 00 00-0098	EA	108 Amp Hours, 12 Volt, Sealed Absorbed Glass Mat (AGM) Battery (Concorde PVX-1080T)	361.98		32.17
26 31 00 00-0099	EA	210 Amp Hours, 12 Volt, Sealed Absorbed Glass Mat (AGM) Battery (Concorde PVX-2120T)	654.85		38.21
26 31 00 00-0100	EA	255 Amp Hours, 12 Volt, Sealed Absorbed Glass Mat (AGM) Battery (Concorde PVX-2580T)	755.63		40.21
26 31 00 00-0101 Deka Photovoltaic Batteries (26 31 00 00-0089)					
26 31 00 00-0102	EA	31 Amp Hours Capacity @ 20 Hour Lead Acid Battery (Deka BYDK8GU1).....	160.72		20.14
26 31 00 00-0103	EA	50 Amp Hours Capacity @ 20 Hour Lead Acid Battery (Deka BYDK8G22NF).....	218.01		20.14
26 31 00 00-0104	EA	74 Amp Hours Capacity @ 20 Hour Lead Acid Battery (Deka BYDK8G24)	317.40		20.14
26 31 00 00-0105	EA	86 Amp Hours Capacity @ 20 Hour Lead Acid Battery (Deka BYDK8G27)	361.84		20.14
26 31 00 00-0106	EA	98 Amp Hours Capacity @ 20 Hour Lead Acid Battery (Deka BYDK8G31)	363.01		20.14
26 31 00 00-0107	EA	183 Amp Hours Capacity @ 20 Hour Lead Acid Battery (Deka BYDK8G4D).....	695.09		20.14
26 31 00 00-0108	EA	225 Amp Hours Capacity @ 20 Hour Lead Acid Battery (Deka BYDK8G8D).....	802.66		20.14
26 31 00 00-0109 Battery Enclosures (26 31 00 00-0089)					
26 31 00 00-0110	EA	14" x 12" x 8" NEMA 3R Aluminum Photovoltaic Battery Enclosure (IronRidge 55-2501-010)	180.53		20.11
26 31 00 00-0111	EA	22" x 16" x 8" NEMA 3R Aluminum Photovoltaic Battery Enclosure (IronRidge BETS1GC).....	850.60		20.14
26 31 00 00-0112	EA	37" x 16" x 8" NEMA 3R Aluminum Photovoltaic Battery Enclosure (IronRidge BETS2GCL).....	800.32		20.14
26 31 00 00-0113	EA	37" x 16" x 14.5" NEMA 3R Aluminum Photovoltaic Battery Enclosure (IronRidge BETS4GC).....	1,063.42		20.14
26 31 00 00-0114	EA	15" x 17.1" x 8.4" NEMA 3R Aluminum Photovoltaic Battery Enclosure (IronRidge BETSLCF1)	478.77		20.14
26 31 00 00-0115	EA	31" x 36" x 14" NEMA 3R Aluminum Photovoltaic Battery Enclosure (IronRidge BETSBR827BP)	1,113.70		20.14
26 31 00 00-0116 Photovoltaic System Monitoring (26 31)					
26 31 00 00-0117	EA	Solar Inverter Monitor (Xantrex 864-0203).....	380.01		40.21
26 31 00 00-0118	EA	Photovoltaic System Monitoring, Remote Diagnosis, Data Storage Communication Hub (SMA Sunny WebBox)	645.91		20.11
26 31 00 00-0119	EA	Sun Radiation And Temperature Monitor (SMA Sunny SensorBox).....	621.35		20.11
26 31 00 00-0120	EA	PT100 Ambient Temperature Sensor For Sunny SensorBox (SMA)	94.00		20.11
26 31 00 00-0121	EA	Wind Sensor Accessory For Sunny SensorBox (SMA).....	220.76		40.21
26 31 00 00-0122	EA	Sunny Boy Control with RS485 (SMA).....	857.55		20.11
26 31 00 00-0123	EA	RS 485 Module (SMA)	180.53		20.11
26 31 00 00-0124	EA	RS 232 Module (SMA)	180.53		20.11
26 31 00 00-0125	EA	Wireless Monitor with Bluetooth (SMA Sunny Beam)	416.03		
26 31 00 00-0126	EA	Bluetooth Piggy-Back Computer Card (SMA)	234.31		20.11
26 31 00 00-0127	EA	RS485-N Communication Computer Card (SMA).....	165.33		20.11
26 31 00 00-0128	EA	Bluetooth Repeater (SMA)	656.43		20.11
26 31 00 00-0129	EA	Sunny Boy PC Service Cable (SMA)	226.05		6.03
26 31 00 00-0130	EA	Integrated Revenue Grade Meter, Option (PVPowered).....	2,999.25		
26 31 00 00-0131	EA	Data Monitoring Module (PVPowered PVM1010)	318.50		20.11
26 31 00 00-0132	EA	Wireless IG Personal Display (Fronius 4,240,108)	390.30		
26 31 00 00-0133	EA	DatCom Power Supply (Fronius 43,0001,2311)	108.28		
26 31 00 00-0134	EA	Wireless Card For IG Personal Display (Fronius 4,240,008,Z)	193.39		20.11
26 31 00 00-0135	EA	Retrofit Solar Inverter Interface And Power Supply Option Communication Card (Fronius 4,240,001,Z)	188.71		20.11
26 31 00 00-0136	EA	Datalogger Pro Box (Fronius 4,240,102)	808.44		20.11
26 31 00 00-0137	EA	Datalogger Easy Box (Fronius 4,240,103)	525.47		20.11
26 31 00 00-0138	EA	Datalogger Interface Box (Fronius 4,240,105)	912.51		20.11
26 31 00 00-0139	EA	Datalogger Web (Fronius 4,240,122).....	1,446.88		20.11
26 31 00 00-0140	EA	Interface Box (Fronius 4,240,109).....	421.40		20.11
26 31 00 00-0141	EA	Interface Card (Fronius 4,240,009,Z).....	257.70		20.11
26 31 00 00-0142	EA	Interface Card Easy (Fronius 4,240,013,Z).....	233.14		20.11
26 31 00 00-0143	EA	Sensor Box (Fronius 4,240,104)	808.44		20.11
26 31 00 00-0144	EA	Ambient Temperature Sensor (Fronius 43,0001,1188).....	95.17		20.11
26 31 00 00-0145	EA	Irradiance Sensor (Fronius 43,0001,1188)	293.95		20.11



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 31 00 00-0146 EA Module Temperature Sensor (Fronius 43,0001,1190).....	155.97	20.11
26 31 00 00-0147 EA Wind Speed Sensor (Fronius 42,0411,0027).....	172.81	40.21
26 31 00 00-0148 Photovoltaic System Accessories (26 31)		
26 31 00 00-0149 EA Four Inverter Bypass Switch (OutBack AC-IOB-100Q).....	514.52	40.21
26 31 00 00-0150 EA Line Communication Filter (Enphase LCF).....	1,023.74	80.44
26 31 00 00-0151 EA 15 Meter RS 485 Communication Cable (SMA).....	127.83	6.03
26 31 00 00-0152 EA 15 Meter RS 232 Communication Cable (SMA).....	127.83	6.03
26 31 00 00-0153 EA 24" #10 AWG Male Or Female Photovoltaic Multi-Contact Module Interconnect.....	21.23	1.99
26 31 00 00-0154 EA 36" #10 AWG Male Or Female Photovoltaic Multi-Contact Module Interconnect.....	22.40	1.99
26 31 00 00-0155 EA 48" #10 AWG Male Or Female Photovoltaic Multi-Contact Module Interconnect.....	23.57	1.99
26 31 00 00-0156 EA 72" #10 AWG Male Or Female Photovoltaic Multi-Contact Module Interconnect.....	25.91	1.99
26 31 00 00-0157 EA 120" #10 AWG Male Or Female Photovoltaic Multi-Contact Module Interconnect.....	29.42	1.99
26 31 00 00-0158 EA 240" #10 AWG Male Or Female Photovoltaic Multi-Contact Module Interconnect.....	47.15	3.98
26 31 00 00-0159 EA 360" #10 AWG Male Or Female Photovoltaic Multi-Contact Module Interconnect.....	63.52	3.98
26 31 00 00-0160 EA 420" #10 AWG Male Or Female Photovoltaic Multi-Contact Module Interconnect.....	76.56	5.97
26 31 00 00-0161 EA 36" #10 AWG Male And Female Photovoltaic Multi-Contact Module Interconnect.....	26.49	1.99
26 31 00 00-0162 EA 120" #10 AWG Male And Female Photovoltaic Multi-Contact Module Interconnect.....	36.43	1.99
26 31 00 00-0163 EA 240" #10 AWG Male And Female Photovoltaic Multi-Contact Module Interconnect.....	54.16	3.98
26 31 00 00-0164 EA 360" #10 AWG Male And Female Photovoltaic Multi-Contact Module Interconnect.....	71.70	3.98
26 31 00 00-0165 EA 600" #10 AWG Male And Female Photovoltaic Multi-Contact Module Interconnect.....	117.09	7.96
26 31 00 00-0166 EA 1200" #10 AWG Male And Female Photovoltaic Multi-Contact Module Interconnect.....	179.65	7.96
26 31 00 00-0167 EA Lighting Kit, 9W Fluorescent, 12 V 4.5 Amp Hour Battery.....	2,080.34	217.16
Note: Tamper proof enclosure.		
26 31 00 00-0168 Photovoltaic Mounting Systems (26 31)		
26 31 00 00-0169 LF Anodized Aluminum Photovoltaic Module Mounting Rail (UNIRAC SolarMount Standard).....	7.83	2.01
26 31 00 00-0170 EA Splice Bar For Photovoltaic Module Mounting Rail (UNIRAC 310229).....	23.97	10.05
26 31 00 00-0171 EA Splice Plate For Photovoltaic Module Mounting Rail (UNIRAC 310216).....	29.44	10.05
26 31 00 00-0172 EA 8" x 3/8" Hanger Bolt (UNIRAC 310046).....	15.08	4.02
Note: Supports mounting rail above tile or metal roof.		
26 31 00 00-0173 EA Mounting Rail Grounding Clip (UNIRAC 980006).....	7.56	3.02
Note: One grounding clip for every two top mounting clamps (end clamps + mid clamps) in your installation. Only one of the two rails in each row requires grounding clips.		
26 31 00 00-0174 EA Mounting Rail Grounding Lugs (UNIRAC 980012).....	15.34	4.02
Note: Two grounding lugs for each rail splice and one additional lug for each rail.		
26 31 00 00-0175 EA Anodized Aluminum Photovoltaic Module Mounting End Clamp (UNIRAC 320002).....	4.13	1.34
Note: Four for each row of modules you plan to mount.		
26 31 00 00-0176 EA Anodized Aluminum Photovoltaic Module Mounting Mid Clamp (UNIRAC 320008).....	4.30	1.34
Note: For each row, take one less than the number of modules in the row and multiply that figure by 2.		
26 31 00 00-0177 EA Photovoltaic Module Mount L-Foot (UNIRAC 310065).....	11.08	4.02
26 31 00 00-0178 EA 12" Leg Extension, Photovoltaic Module One Leg Tilt Kit (UNIRAC 310121).....	65.09	20.11
Note: Includes one square tube, one strut insert, two L-feet, and stainless steel hardware for use with mounting rail. Excludes standoffs.		
26 31 00 00-0179 EA 30" Leg Extension, Photovoltaic Module One Leg Tilt Kit (UNIRAC 310122).....	70.99	20.11
Note: Includes one square tube, one strut insert, two L-feet, and stainless steel hardware for use with mounting rail. Excludes standoffs.		
26 31 00 00-0180 EA 44" Leg Extension, Photovoltaic Module One Leg Tilt Kit (UNIRAC 310123).....	76.22	20.11
Note: Includes one square tube, one strut insert, two L-feet, and stainless steel hardware for use with mounting rail. Excludes standoffs.		
26 31 00 00-0181 EA 12" Leg Extension, Photovoltaic Module Two Leg Tilt Kit (UNIRAC 310107).....	95.68	30.16
Note: Includes two square tubes, two strut inserts, and fasteners for use with mounting rail. Excludes standoffs and L-feet.		
26 31 00 00-0182 EA 44" Leg Extension, Photovoltaic Module Two Leg Tilt Kit (UNIRAC 310108).....	114.01	30.16
Note: Includes two square tubes, two strut inserts, and fasteners for use with mounting rail. Excludes standoffs and L-feet.		
26 31 00 00-0183 EA 72" Leg Extension, Photovoltaic Module Two Leg Tilt Kit (UNIRAC 310109).....	131.04	30.16
Note: Includes two square tubes, two strut inserts, and fasteners for use with mounting rail. Excludes standoffs and L-feet.		
26 31 00 00-0184 EA 18" Leg Extension, Photovoltaic Module Four Leg Tilt Kit (UNIRAC 310111).....	146.58	40.21
Note: Includes four square tubes, four strut inserts, and fasteners for use with mounting rail. Excludes standoffs and L-feet.		
26 31 00 00-0185 EA 64" Leg Extension, Photovoltaic Module Four Leg Tilt Kit (UNIRAC 310112).....	191.10	40.21
Note: Includes four square tubes, four strut inserts, and fasteners for use with mounting rail. Excludes standoffs and L-feet.		
26 31 00 00-0186 EA 104" Leg Extension, Photovoltaic Module Four Leg Tilt Kit (UNIRAC 310110).....	269.29	60.32
Note: Includes four square tubes, four strut inserts, and fasteners for use with mounting rail. Excludes standoffs and L-feet.		
26 31 00 00-0187 EA Ballasted Photovoltaic Module Frame (UNIRAC 310351).....	128.42	
Note: Excludes ballast.		
26 31 00 00-0188 EA Ballasted Photovoltaic Module Frame With Module Mount (UNIRAC 310355).....	236.74	
Note: Excludes ballast.		
26 31 00 00-0189 EA 3" High Galvanized Steel Photovoltaic Module Standoff (UNIRAC 310051).....	52.43	20.11
26 31 00 00-0190 EA 4" High Galvanized Steel Photovoltaic Module Standoff (UNIRAC 310052).....	52.98	20.11
26 31 00 00-0191 EA 6" High Galvanized Steel Photovoltaic Module Standoff (UNIRAC 310053).....	53.52	20.11
26 31 00 00-0192 EA 7" High Galvanized Steel Photovoltaic Module Standoff (UNIRAC 310054).....	54.83	20.11
26 31 00 00-0193 EA 3" High Aluminum Photovoltaic Module Standoff (UNIRAC 310553).....	49.00	20.11
26 31 00 00-0194 EA 4" High Aluminum Photovoltaic Module Standoff (UNIRAC 310554).....	49.65	20.11
26 31 00 00-0195 EA 6" High Aluminum Photovoltaic Module Standoff (UNIRAC 310555).....	51.01	20.11
26 31 00 00-0196 EA 7" High Aluminum Photovoltaic Module Standoff (UNIRAC 310556).....	51.78	20.11
26 31 00 00-0197 EA 3" Photovoltaic Module FastFoot Standoff Assembly (UNIRAC 310390).....	89.95	30.16

26 Electrical**26 30 Facility Electrical Power Generating And Storing Equipment****26 31 Photovoltaic Collectors**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 31 00 00-0198	EA		4" Photovoltaic Module FastFoot Standoff Assembly (UNIRAC 310391).....	90.28	30.16
26 31 00 00-0199	EA		7" Photovoltaic Module FastFoot Standoff Assembly (UNIRAC 310394).....	91.06	30.16
26 31 00 00-0200	EA		Photovoltaic Module Rapidfoot Standoff Assembly (UNIRAC 310370).....	96.33	30.16
26 31 00 00-0201	EA		Photovoltaic Module Standoff Flashing (UNIRAC 990103).....	18.84	4.02
26 31 00 00-0202	EA		Photovoltaic Module Standoff Ethylene Propylene Diene Monomer (EPDM) Patch (UNIRAC 990161).....	12.64	4.02
26 31 00 00-0203	EA		1/4" Photovoltaic Module Standing Seam Metal Roof Mounting Block (UNIRAC 004030M-0100).....	25.96	6.03
26 31 00 00-0204	EA		3/8" Photovoltaic Module Standing Seam Metal Roof Mounting Block (UNIRAC 004031M-0100).....	27.27	6.03
26 31 00 00-0205	EA		Photovoltaic Module Standing Seam Metal Roof Mounting Clamp (UNIRAC 004032M-0100).....	6.61	1.34
			Note: Mid or end clamp.		
26 31 00 00-0206	EA		Photovoltaic Module Tile Roof Mounting Hook (UNIRAC 905011C-0024).....	29.27	4.02
26 31 00 00-0207	EA		Photovoltaic Module Wire Clip (UNIRAC 908002S-0100).....	1.70	

26 32 Packaged Generator Assemblies (26 30)**26 32 13 Engine Generators (26 32)**

See CSI section 23 13 23 13-0001 for fuel storage tanks.

26 32 13 13 Diesel-Engine-Driven Generator Sets (26 32 13)**26 32 13 13-0001 Diesel Generator Sets (26 32 13 13)**

Note: 3 Phase, 4-Wire 480/277 or 208/120 Volt complete with radiator, fuel pump, battery charger, silencer, exhaust flex, indicating and operating controls, electronic governor. Pricing based on installation above grade on concrete pad. Includes manufacturer's representative at startup. Excludes fuel tank, utility piping, wiring, automatic transfer switch, loadbank testing and concrete pad. See CSI section 01 22 23 00-0594 for loadbank rental. 23 13 23 13-0001 for fuel day tank, 26 36 23 00-0000 for automatic transfer switch.

26 32 13 13-0002	EA		25 KW Diesel Generator Set, 3 Phase (Cummins DSKCA).....	16,525.90	698.37
			For Quiesite Level 2 Aluminum Diesel Generator Enclosure, Add	15,270.58	
			For Quiesite Level 2 Steel Diesel Generator Enclosure, Add	9,729.60	
			For Weather Resistant Aluminum Diesel Generator Enclosure, Add	7,895.64	
			For Weather Resistant Steel Diesel Generator Enclosure, Add	3,100.98	
26 32 13 13-0003	EA		35 KW Diesel Generator Set, 3 Phase (Cummins DSFAA).....	20,884.69	859.87
			For Quiesite Level 2 Aluminum Diesel Generator Enclosure, Add	15,270.58	
			For Quiesite Level 2 Steel Diesel Generator Enclosure, Add	9,729.60	
			For Weather Resistant Aluminum Diesel Generator Enclosure, Add	7,895.64	
			For Weather Resistant Steel Diesel Generator Enclosure, Add	3,100.98	
26 32 13 13-0004	EA		40 KW Diesel Generator Set, 3 Phase (Cummins DSFAB).....	21,530.64	942.80
			For Quiesite Level 2 Aluminum Diesel Generator Enclosure, Add	15,270.58	
			For Quiesite Level 2 Steel Diesel Generator Enclosure, Add	9,729.60	
			For Weather Resistant Aluminum Diesel Generator Enclosure, Add	7,895.64	
			For Weather Resistant Steel Diesel Generator Enclosure, Add	3,100.98	
26 32 13 13-0005	EA		50 KW Diesel Generator Set, 3 Phase (Cummins DSFAC).....	23,140.36	1,082.47
			For Quiesite Level 2 Aluminum Diesel Generator Enclosure, Add	15,270.58	
			For Quiesite Level 2 Steel Diesel Generator Enclosure, Add	9,729.60	
			For Weather Resistant Aluminum Diesel Generator Enclosure, Add	7,895.64	
			For Weather Resistant Steel Diesel Generator Enclosure, Add	3,100.98	
26 32 13 13-0006	EA		60 KW Diesel Generator Set, 3 Phase (Cummins DSFAD).....	24,760.21	1,243.97
			For Quiesite Level 2 Aluminum Diesel Generator Enclosure, Add	15,270.58	
			For Quiesite Level 2 Steel Diesel Generator Enclosure, Add	9,729.60	
			For Weather Resistant Aluminum Diesel Generator Enclosure, Add	7,895.64	
			For Weather Resistant Steel Diesel Generator Enclosure, Add	3,100.98	
26 32 13 13-0007	EA		80 KW Diesel Generator Set, 3 Phase (Cummins DSFAE).....	27,632.58	1,457.84
			For Quiesite Level 2 Aluminum Diesel Generator Enclosure, Add	15,270.58	
			For Quiesite Level 2 Steel Diesel Generator Enclosure, Add	9,729.60	
			For Weather Resistant Aluminum Diesel Generator Enclosure, Add	7,895.64	
			For Weather Resistant Steel Diesel Generator Enclosure, Add	3,100.98	
26 32 13 13-0008	EA		100 KW Diesel Generator Set, 3 Phase (Cummins DSGAA).....	32,268.46	1,693.55
			For Quiesite Level 2 Aluminum Diesel Generator Enclosure, Add	16,238.18	
			For Quiesite Level 2 Steel Diesel Generator Enclosure, Add	14,875.73	
			For Weather Resistant Aluminum Diesel Generator Enclosure, Add	10,130.24	
			For Weather Resistant Steel Diesel Generator Enclosure, Add	4,703.53	
26 32 13 13-0009	EA		125 KW Diesel Generator Set, 3 Phase (Cummins DSGAB).....	33,438.04	2,007.81
			For Quiesite Level 2 Aluminum Diesel Generator Enclosure, Add	16,238.18	
			For Quiesite Level 2 Steel Diesel Generator Enclosure, Add	14,875.73	
			For Weather Resistant Aluminum Diesel Generator Enclosure, Add	10,130.24	
			For Weather Resistant Steel Diesel Generator Enclosure, Add	4,703.53	
26 32 13 13-0010	EA		150 KW Diesel Generator Set, 3 Phase (Cummins DSGAC).....	36,868.38	2,212.95
			For Quiesite Level 2 Aluminum Diesel Generator Enclosure, Add	16,238.18	
			For Quiesite Level 2 Steel Diesel Generator Enclosure, Add	14,875.73	
			For Weather Resistant Aluminum Diesel Generator Enclosure, Add	10,130.24	
			For Weather Resistant Steel Diesel Generator Enclosure, Add	4,703.53	
26 32 13 13-0011	EA		175 KW Diesel Generator Set, 3 Phase (Cummins DSHAB).....	42,720.21	2,470.47
			For Quiesite Level 2 Aluminum Diesel Generator Enclosure, Add	16,238.18	
			For Quiesite Level 2 Steel Diesel Generator Enclosure, Add	14,875.73	
			For Weather Resistant Aluminum Diesel Generator Enclosure, Add	10,130.24	
			For Weather Resistant Steel Diesel Generator Enclosure, Add	4,703.53	
26 32 13 13-0012	EA		200 KW Diesel Generator Set, 3 Phase (Cummins DSHAC).....	45,687.59	2,706.17
			For Quiesite Level 2 Aluminum Diesel Generator Enclosure, Add	16,238.18	
			For Quiesite Level 2 Steel Diesel Generator Enclosure, Add	14,875.73	
			For Weather Resistant Aluminum Diesel Generator Enclosure, Add	10,130.24	
			For Weather Resistant Steel Diesel Generator Enclosure, Add	4,703.53	
26 32 13 13-0013	EA		230 KW Diesel Generator Set, 3 Phase (Cummins DSHAD).....	51,214.07	2,858.95
			For Quiesite Level 2 Aluminum Diesel Generator Enclosure, Add	16,238.18	
			For Quiesite Level 2 Steel Diesel Generator Enclosure, Add	14,875.73	
			For Weather Resistant Aluminum Diesel Generator Enclosure, Add	10,130.24	
			For Weather Resistant Steel Diesel Generator Enclosure, Add	4,703.53	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 32 13 13-0014 EA 250 KW Diesel Generator Set, 3 Phase (Cummins DQDAA) <i>For Quietsite Level 2 Aluminum Diesel Generator Enclosure, Add</i> <i>For Weather Resistant Aluminum Diesel Generator Enclosure, Add</i> <i>For Weather Resistant Steel Diesel Generator Enclosure, Add</i> <i>For Quietsite Level 2 Steel Diesel Generator Enclosure, Add</i>	53,516.97 55,049.57 36,996.23 30,503.55 45,035.05	2,976.99
26 32 13 13-0015 EA 275 KW Diesel Generator Set, 3 Phase (Cummins DQHAA) <i>For Quietsite Level 2 Aluminum Diesel Generator Enclosure, Add</i> <i>For Weather Resistant Aluminum Diesel Generator Enclosure, Add</i> <i>For Weather Resistant Steel Diesel Generator Enclosure, Add</i> <i>For Quietsite Level 2 Steel Diesel Generator Enclosure, Add</i>	58,335.43 55,049.57 36,996.23 30,503.55 45,035.05	3,138.29
26 32 13 13-0016 EA 300 KW Diesel Generator Set, 3 Phase (Cummins DQHAB) <i>For Quietsite Level 2 Aluminum Diesel Generator Enclosure, Add</i> <i>For Weather Resistant Aluminum Diesel Generator Enclosure, Add</i> <i>For Weather Resistant Steel Diesel Generator Enclosure, Add</i> <i>For Quietsite Level 2 Steel Diesel Generator Enclosure, Add</i>	59,528.36 55,049.57 36,996.23 30,503.55 45,035.05	3,277.97
26 32 13 13-0017 EA 350 KW Diesel Generator Set, 3 Phase (Cummins DFEG) <i>For Quietsite Level 2 Aluminum Diesel Generator Enclosure, Add</i> <i>For Weather Resistant Aluminum Diesel Generator Enclosure, Add</i> <i>For Weather Resistant Steel Diesel Generator Enclosure, Add</i> <i>For Quietsite Level 2 Steel Diesel Generator Enclosure, Add</i>	67,665.63 55,049.57 36,996.23 30,503.55 45,035.05	3,666.43
26 32 13 13-0018 EA 400 KW Diesel Generator Set, 3 Phase (Cummins DFEH) <i>For Quietsite Level 2 Aluminum Diesel Generator Enclosure, Add</i> <i>For Weather Resistant Aluminum Diesel Generator Enclosure, Add</i> <i>For Weather Resistant Steel Diesel Generator Enclosure, Add</i> <i>For Quietsite Level 2 Steel Diesel Generator Enclosure, Add</i>	73,193.30 55,049.57 36,996.23 30,503.55 45,035.05	4,015.62
26 32 13 13-0019 EA 450 KW Diesel Generator Set, 3 Phase (Cummins DFEJ) <i>For Quietsite Level 2 Aluminum Diesel Generator Enclosure, Add</i> <i>For Weather Resistant Aluminum Diesel Generator Enclosure, Add</i> <i>For Weather Resistant Steel Diesel Generator Enclosure, Add</i> <i>For Quietsite Level 2 Steel Diesel Generator Enclosure, Add</i>	83,081.55 55,049.57 36,996.23 30,503.55 45,035.05	4,325.51
26 32 13 13-0020 EA 500 KW Diesel Generator Set, 3 Phase (Cummins DF EK) <i>For Quietsite Level 2 Aluminum Diesel Generator Enclosure, Add</i> <i>For Weather Resistant Aluminum Diesel Generator Enclosure, Add</i> <i>For Weather Resistant Steel Diesel Generator Enclosure, Add</i> <i>For Quietsite Level 2 Steel Diesel Generator Enclosure, Add</i>	87,710.34 55,049.57 36,996.23 30,503.55 45,035.05	4,609.23
26 32 13 13-0021 EA 600 KW Diesel Generator Set, 3 Phase (Cummins DQCA) <i>For Weather Resistant Aluminum Diesel Generator Enclosure, Add</i> <i>For Quietsite Level 2 Steel Diesel Generator Enclosure, Add</i> <i>For Quietsite Level 2 Aluminum Diesel Generator Enclosure, Add</i> <i>For Weather Resistant Steel Diesel Generator Enclosure, Add</i>	127,917.00 73,292.41 100,052.80 116,560.00 62,313.16	5,076.26
26 32 13 13-0022 EA 750 KW Diesel Generator Set, 3 Phase (Cummins DQCB) <i>For Weather Resistant Aluminum Diesel Generator Enclosure, Add</i> <i>For Quietsite Level 2 Steel Diesel Generator Enclosure, Add</i> <i>For Quietsite Level 2 Aluminum Diesel Generator Enclosure, Add</i> <i>For Weather Resistant Steel Diesel Generator Enclosure, Add</i>	146,446.83 73,292.41 100,052.80 116,560.00 62,313.16	5,582.58
26 32 13 13-0023 EA 800 KW Diesel Generator Set, 3 Phase (Cummins DQCC) <i>For Weather Resistant Aluminum Diesel Generator Enclosure, Add</i> <i>For Quietsite Level 2 Steel Diesel Generator Enclosure, Add</i> <i>For Quietsite Level 2 Aluminum Diesel Generator Enclosure, Add</i> <i>For Weather Resistant Steel Diesel Generator Enclosure, Add</i>	152,909.21 73,292.41 100,052.80 116,560.00 62,313.16	5,704.79
26 32 13 13-0024 EA 900 KW Diesel Generator Set, 3 Phase (Cummins DQFAC) <i>For Weather Resistant Aluminum Diesel Generator Enclosure, Add</i> <i>For Quietsite Level 2 Steel Diesel Generator Enclosure, Add</i> <i>For Quietsite Level 2 Aluminum Diesel Generator Enclosure, Add</i> <i>For Weather Resistant Steel Diesel Generator Enclosure, Add</i>	186,420.15 73,292.41 100,052.80 116,560.00 62,313.16	6,150.00
26 32 13 13-0025 EA 1,000 KW Diesel Generator Set, 3 Phase (Cummins DQFAD) <i>For Weather Resistant Aluminum Diesel Generator Enclosure, Add</i> <i>For Quietsite Level 2 Steel Diesel Generator Enclosure, Add</i> <i>For Quietsite Level 2 Aluminum Diesel Generator Enclosure, Add</i> <i>For Weather Resistant Steel Diesel Generator Enclosure, Add</i>	207,791.66 73,292.41 100,052.80 116,560.00 62,313.16	6,547.19

26 32 13 19 Natural Gas-Engine-Driven Generator Sets (26 32 13)

26 32 13 19-0001	Natural Gas Or Propane Generator Sets (26 32 13 19) Note: 3 Phase, 4-Wire 480/277 or 208/120 Volt complete with radiator, fuel pump, battery charger, silencer, exhaust flex, indicating and operating controls, electronic governor. Pricing based on installation above grade on concrete pad. Includes manufacturer's representative at startup. Excludes fuel tank, utility piping, wiring, automatic transfer switch, loadbank testing and concrete pad. See CSI section 01 22 23 00-0594 for loadbank rental, 26 36 23 00-0000 for automatic transfer switches.		
26 32 13 19-0002	EA 20 KW Natural Gas Or Propane Generator Set, 3 Phase (Cummins GGMA) <i>For Quietsite Level 2 Steel Natural Gas Or Propane Generator Enclosure, Add</i> <i>For Weather Resistant Aluminum Natural Gas Or Propane Generator Enclosure, Add</i> <i>For Weather Resistant Steel Natural Gas Or Propane Generator Enclosure, Add</i> <i>For Quietsite Level 2 Aluminum Natural Gas Or Propane Generator Enclosure, Add</i>	13,151.04 9,729.60 3,054.69 2,820.39 5,068.02	584.88
26 32 13 19-0003	EA 25 KW Natural Gas Or Propane Generator Set, 3 Phase (Cummins GGMB) <i>For Quietsite Level 2 Steel Natural Gas Or Propane Generator Enclosure, Add</i> <i>For Weather Resistant Aluminum Natural Gas Or Propane Generator Enclosure, Add</i> <i>For Weather Resistant Steel Natural Gas Or Propane Generator Enclosure, Add</i> <i>For Quietsite Level 2 Aluminum Natural Gas Or Propane Generator Enclosure, Add</i>	14,865.49 9,729.60 3,054.69 2,820.39 5,068.02	698.37
26 32 13 19-0004	EA 29 KW Natural Gas Or Propane Generator Set, 3 Phase (Cummins GGMC) <i>For Quietsite Level 2 Steel Natural Gas Or Propane Generator Enclosure, Add</i> <i>For Weather Resistant Aluminum Natural Gas Or Propane Generator Enclosure, Add</i> <i>For Weather Resistant Steel Natural Gas Or Propane Generator Enclosure, Add</i> <i>For Quietsite Level 2 Aluminum Natural Gas Or Propane Generator Enclosure, Add</i>	15,908.69 9,729.60 3,054.69 2,820.39 5,068.02	776.94

26 Electrical**26 30 Facility Electrical Power Generating And Storing Equipment****26 32 Packaged Generator Assemblies**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 32 13 19-0005 EA 35 KW Natural Gas Or Propane Generator Set, 3 Phase (Cummins GGPA)	17,328.64	859.87
For Quietsite Level 2 Steel Natural Gas Or Propane Generator Enclosure, Add	9,729.60	
For Quietsite Level 2 Aluminum Natural Gas Or Propane Generator Enclosure, Add	14,502.56	
For Weather Resistant Steel Natural Gas Or Propane Generator Enclosure, Add	2,820.39	
For Weather Resistant Aluminum Natural Gas Generator Enclosure, Add	8,640.50	
26 32 13 19-0006 EA 40 KW Natural Gas Or Propane Generator Set, 3 Phase (Cummins GGPB)	17,842.61	942.80
For Quietsite Level 2 Steel Natural Gas Or Propane Generator Enclosure, Add	9,729.60	
For Quietsite Level 2 Aluminum Natural Gas Or Propane Generator Enclosure, Add	14,502.56	
For Weather Resistant Steel Natural Gas Or Propane Generator Enclosure, Add	2,820.39	
For Weather Resistant Aluminum Natural Gas Generator Enclosure, Add	8,640.50	
26 32 13 19-0007 EA 45 KW Natural Gas Or Propane Generator Set, 3 Phase (Cummins GGPC)	18,401.90	1,017.00
For Quietsite Level 2 Steel Natural Gas Or Propane Generator Enclosure, Add	9,729.60	
For Quietsite Level 2 Aluminum Natural Gas Or Propane Generator Enclosure, Add	14,502.56	
For Weather Resistant Steel Natural Gas Or Propane Generator Enclosure, Add	2,820.39	
For Weather Resistant Aluminum Natural Gas Generator Enclosure, Add	8,640.50	
26 32 13 19-0008 EA 60 KW Natural Gas Or Propane Generator Set, 3 Phase (Cummins GGHE)	19,993.33	1,243.97
For Quietsite Level 2 Steel Natural Gas Or Propane Generator Enclosure, Add	9,729.60	
For Quietsite Level 2 Aluminum Natural Gas Or Propane Generator Enclosure, Add	14,502.56	
For Weather Resistant Steel Natural Gas Or Propane Generator Enclosure, Add	2,820.39	
For Weather Resistant Aluminum Natural Gas Generator Enclosure, Add	8,640.50	
26 32 13 19-0009 EA 70 KW Natural Gas Or Propane Generator Set, 3 Phase (Cummins GGHF)	21,265.58	1,392.37
For Quietsite Level 2 Steel Natural Gas Or Propane Generator Enclosure, Add	9,729.60	
For Quietsite Level 2 Aluminum Natural Gas Or Propane Generator Enclosure, Add	14,502.56	
For Weather Resistant Steel Natural Gas Or Propane Generator Enclosure, Add	2,820.39	
For Weather Resistant Aluminum Natural Gas Generator Enclosure, Add	8,640.50	
26 32 13 19-0010 EA 85 KW Natural Gas Or Propane Generator Set, 3 Phase (Cummins GGHG)	25,509.57	1,488.39
For Quietsite Level 2 Aluminum Natural Gas Or Propane Generator Enclosure, Add	14,502.56	
For Quietsite Level 2 Steel Natural Gas Or Propane Generator Enclosure, Add	14,875.73	
For Weather Resistant Steel Natural Gas Or Propane Generator Enclosure, Add	5,140.33	
For Weather Resistant Aluminum Natural Gas Or Propane Generator Enclosure, Add	10,130.24	
26 32 13 19-0011 EA 100 KW Natural Gas Or Propane Generator Set, 3 Phase (Cummins GGHH)	27,683.42	1,676.08
For Quietsite Level 2 Aluminum Natural Gas Or Propane Generator Enclosure, Add	14,502.56	
For Quietsite Level 2 Steel Natural Gas Or Propane Generator Enclosure, Add	14,875.73	
For Weather Resistant Steel Natural Gas Or Propane Generator Enclosure, Add	5,140.33	
For Weather Resistant Aluminum Natural Gas Or Propane Generator Enclosure, Add	10,130.24	
26 32 13 19-0012 EA 125 KW Natural Gas Or Propane Generator Set, 3 Phase (Cummins GGLA)	34,718.27	2,007.81
For Quietsite Level 2 Aluminum Natural Gas Or Propane Generator Enclosure, Add	14,502.56	
For Quietsite Level 2 Steel Natural Gas Or Propane Generator Enclosure, Add	14,875.73	
For Weather Resistant Steel Natural Gas Or Propane Generator Enclosure, Add	5,140.33	
For Weather Resistant Aluminum Natural Gas Or Propane Generator Enclosure, Add	10,130.24	
26 32 13 19-0013 EA 150 KW Natural Gas Or Propane Generator Set, 3 Phase (Cummins GGLB)	39,568.45	2,212.95
For Quietsite Level 2 Aluminum Natural Gas Or Propane Generator Enclosure, Add	14,502.56	
For Quietsite Level 2 Steel Natural Gas Or Propane Generator Enclosure, Add	14,875.73	
For Weather Resistant Steel Natural Gas Or Propane Generator Enclosure, Add	5,140.33	
For Weather Resistant Aluminum Natural Gas Or Propane Generator Enclosure, Add	10,130.24	
26 32 13 19-0014 EA 175 KW Natural Gas Generator Set, 3 Phase (Cummins GFBA)	96,194.59	5,886.28
For Weather Resistant Steel Natural Gas Generator Enclosure, Add	27,431.50	
For Quietsite Level 2 Aluminum Natural Gas Generator Enclosure, Add	45,007.56	
For Weather Resistant Aluminum Natural Gas Generator Enclosure, Add	29,992.98	
For Quietsite Level 2 Steel Natural Gas Generator Enclosure, Add	40,487.72	
26 32 13 19-0015 EA 205 KW Natural Gas Generator Set, 3 Phase (Cummins GFBB)	102,489.31	2,658.16
For Weather Resistant Steel Natural Gas Generator Enclosure, Add	27,431.50	
For Quietsite Level 2 Aluminum Natural Gas Generator Enclosure, Add	45,007.56	
For Weather Resistant Aluminum Natural Gas Generator Enclosure, Add	29,992.98	
For Quietsite Level 2 Steel Natural Gas Generator Enclosure, Add	40,487.72	
26 32 13 19-0016 EA 250 KW Natural Gas Generator Set, 3 Phase (Cummins GFBC)	103,738.09	2,976.79
For Weather Resistant Steel Natural Gas Generator Enclosure, Add	27,431.50	
For Quietsite Level 2 Aluminum Natural Gas Generator Enclosure, Add	45,007.56	
For Weather Resistant Aluminum Natural Gas Generator Enclosure, Add	29,992.98	
For Quietsite Level 2 Steel Natural Gas Generator Enclosure, Add	40,487.72	
26 32 13 19-0017 EA 300 KW Natural Gas Generator Set, 3 Phase (Cummins GFEA)	142,803.25	3,277.97
For Weather Resistant Steel Natural Gas Generator Enclosure, Add	27,431.50	
For Quietsite Level 2 Aluminum Natural Gas Generator Enclosure, Add	45,007.56	
For Weather Resistant Aluminum Natural Gas Generator Enclosure, Add	29,992.98	
For Quietsite Level 2 Steel Natural Gas Generator Enclosure, Add	40,487.72	
26 32 13 19-0018 EA 350 KW Natural Gas Generator Set, 3 Phase (Cummins GFEB)	144,191.13	3,666.43
For Weather Resistant Steel Natural Gas Generator Enclosure, Add	27,431.50	
For Quietsite Level 2 Aluminum Natural Gas Generator Enclosure, Add	45,007.56	
For Weather Resistant Aluminum Natural Gas Generator Enclosure, Add	29,992.98	
For Quietsite Level 2 Steel Natural Gas Generator Enclosure, Add	40,487.72	
26 32 13 19-0019 EA 450 KW Natural Gas Generator Set, 3 Phase (Cummins GFGA)	202,874.49	4,325.51
For Quietsite Level 2 Steel Natural Gas Generator Enclosure, Add	84,854.54	
For Weather Resistant Steel Natural Gas Generator Enclosure, Add	59,897.74	
For Weather Resistant Aluminum Natural Gas Generator Enclosure, Add	68,033.47	
For Quietsite Level 2 Aluminum Natural Gas Generator Enclosure, Add	96,154.89	
26 32 13 19-0020 EA 500 KW Natural Gas Generator Set, 3 Phase (Cummins GFJB)	276,285.41	4,609.23
For Quietsite Level 2 Steel Natural Gas Generator Enclosure, Add	84,854.54	
For Weather Resistant Steel Natural Gas Generator Enclosure, Add	59,897.74	
For Weather Resistant Aluminum Natural Gas Generator Enclosure, Add	68,033.47	
For Quietsite Level 2 Aluminum Natural Gas Generator Enclosure, Add	96,154.89	
26 32 13 19-0021 EA 550 KW Natural Gas Generator Set, 3 Phase (Cummins GFJC)	290,730.47	4,858.02
For Quietsite Level 2 Steel Natural Gas Generator Enclosure, Add	84,854.54	
For Weather Resistant Steel Natural Gas Generator Enclosure, Add	59,897.74	
For Weather Resistant Aluminum Natural Gas Generator Enclosure, Add	68,033.47	
For Quietsite Level 2 Aluminum Natural Gas Generator Enclosure, Add	96,154.89	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 32 13 19-0022 EA 600 KW Natural Gas Generator Set, 3 Phase (Cummins GFLA)..... <i>For Quietsite Level 2 Steel Natural Gas Generator Enclosure, Add</i> <i>For Weather Resistant Steel Natural Gas Generator Enclosure, Add</i> <i>For Weather Resistant Aluminum Natural Gas Generator Enclosure, Add</i> <i>For Quietsite Level 2 Aluminum Natural Gas Generator Enclosure, Add</i>	331,315.63 84,854.54 59,897.74 68,033.47 96,154.89	5,076.26
26 32 13 19-0023 EA 650 KW Natural Gas Generator Set, 3 Phase (Cummins GFLB)..... <i>For Quietsite Level 2 Steel Natural Gas Generator Enclosure, Add</i> <i>For Weather Resistant Steel Natural Gas Generator Enclosure, Add</i> <i>For Weather Resistant Aluminum Natural Gas Generator Enclosure, Add</i> <i>For Quietsite Level 2 Aluminum Natural Gas Generator Enclosure, Add</i>	346,444.70 84,854.54 59,897.74 68,033.47 96,154.89	5,268.31
26 32 13 19-0024 EA 725 KW Natural Gas Generator Set, 3 Phase (Cummins GFLC)..... <i>For Quietsite Level 2 Steel Natural Gas Generator Enclosure, Add</i> <i>For Weather Resistant Steel Natural Gas Generator Enclosure, Add</i> <i>For Weather Resistant Aluminum Natural Gas Generator Enclosure, Add</i> <i>For Quietsite Level 2 Aluminum Natural Gas Generator Enclosure, Add</i>	366,431.48 84,854.54 59,897.74 68,033.47 96,154.89	5,630.59
26 32 13 19-0025 Small Natural Gas Or Propane Air Cooled Generator Sets (26 32 13 19)		
26 32 13 19-0026 EA 7.5 KW Natural Gas Or Propane Air Cooled Generator Set Note: Includes weatherproof composite enclosure and 100 A automatic transfer switch.	3,206.39	372.89
26 32 13 19-0027 EA 10 KW Natural Gas Or Propane Air Cooled Generator Set Note: Includes weatherproof composite enclosure and 200 A automatic transfer switch.	4,039.52	414.32
26 32 13 19-0028 EA 14 KW Natural Gas Or Propane Air Cooled Generator Set Note: Includes weatherproof composite enclosure and 200 A automatic transfer switch.	4,504.32	379.14
26 32 13 26 AC To DC Electrical Conversion (26 32 13)		
26 32 13 26-0001 60 Hz AC Input 230 Or 460 Volts, 125 Volt DC Output (26 32 13 26)		
26 32 13 26-0002 EA 3 KW, 24 Amp, 125 Volt DC, Rectifier 230 Or 460 AC To DC Conversion.....	4,975.02	160.86
26 32 13 26-0003 EA 5 KW, 40 Amp, 125 Volt DC, Rectifier 230 Or 460 AC To DC Conversion.....	6,045.40	160.86
26 32 13 26-0004 EA 7.5 KW, 60 Amp, 125 Volt DC, Rectifier 230 Or 460 AC To DC Conversion.....	7,986.87	160.86
26 32 13 26-0005 EA 10 KW, 80 Amp, 125 Volt DC, Rectifier 230 Or 460 AC To DC Conversion.....	8,049.17	160.86
26 32 13 26-0006 EA 15 KW, 120 Amp, 125 Volt DC, Rectifier 230 Or 460 AC To DC Conversion.....	8,944.35	201.07
26 32 13 26-0007 EA 20 KW, 160 Amp, 125 Volt DC, Rectifier 230 Or 460 AC To DC Conversion.....	9,679.80	201.07
26 32 13 26-0008 EA 25 KW, 200 Amp, 125 Volt DC, Rectifier 230 Or 460 AC To DC Conversion.....	10,132.06	201.07
26 32 13 26-0009 EA 40 KW, 320 Amp, 125 Volt DC, Rectifier 230 Or 460 AC To DC Conversion.....	12,347.76	265.42
26 32 13 26-0010 EA 50 KW, 400 Amp, 125 Volt DC, Rectifier 230 Or 460 AC To DC Conversion.....	13,711.22	265.42
26 32 13 26-0011 60 Hz AC Input, 230 Or 460 Volts, 250 Volts DC Output (26 32 13 26)		
26 32 13 26-0012 EA 3 KW, 12 Amp, 250 Volt DC, Rectifier 230 Or 460 AC To DC Conversion.....	5,749.92	160.86
26 32 13 26-0013 EA 5 KW, 20 Amp, 250 Volt DC, Rectifier 230 Or 460 AC To DC Conversion.....	6,843.78	160.86
26 32 13 26-0014 EA 7.5 KW, 30 Amp, 250 Volt DC, Rectifier 230 Or 460 AC To DC Conversion.....	7,818.27	160.86
26 32 13 26-0015 EA 10 KW, 40 Amp, 250 Volt DC, Rectifier 230 Or 460 AC To DC Conversion.....	8,033.36	160.86
26 32 13 26-0016 EA 15 KW, 60 Amp, 250 Volt DC, Rectifier 230 Or 460 AC To DC Conversion.....	9,107.08	201.07
26 32 13 26-0017 EA 20 KW, 80 Amp, 250 Volt DC, Rectifier 230 Or 460 AC To DC Conversion.....	10,007.37	201.07
26 32 13 26-0018 EA 25 KW, 100 Amp, 250 Volt DC, Rectifier 230 Or 460 AC To DC Conversion.....	10,334.94	201.07
26 32 13 26-0019 EA 40 KW, 160 Amp, 250 Volt DC, Rectifier 230 Or 460 AC To DC Conversion.....	12,299.16	265.42
26 32 13 26-0020 EA 50 KW, 200 Amp, 250 Volt DC, Rectifier 230 Or 460 AC To DC Conversion.....	13,040.94	265.42
26 32 29 Rotary Converters (26 32)		
26 32 29 00-0001 460 Volt 3 Phase AC Motor Drive 250 Volt DC (26 32 29)		
26 32 29 00-0002 EA 33 KW, 460 Volt AC Drive Motor To 250 Volt DC, AC To DC Electrical Conversion.....	15,485.44	3,055.36
26 32 29 00-0003 EA 40 KW, 460 Volt AC Drive Motor To 250 Volt DC, AC To DC Electrical Conversion.....	17,274.10	3,055.36
26 32 29 00-0004 EA 50 KW, 460 Volt AC Drive Motor To 250 Volt DC, AC To DC Electrical Conversion.....	19,698.68	4,364.80
26 32 29 00-0005 EA 65 KW, 460 Volt AC Drive Motor To 250 Volt DC, AC To DC Electrical Conversion.....	22,863.35	4,364.80
26 32 29 00-0006 EA 85 KW, 460 Volt AC Drive Motor To 250 Volt DC, AC To DC Electrical Conversion.....	25,849.58	4,364.80
26 32 29 00-0007 EA 100 KW, 460 Volt AC Drive Motor To 250 Volt DC, AC To DC Electrical Conversion.....	30,504.24	6,547.19
26 32 29 00-0008 EA 125 KW, 460 Volt AC Drive Motor To 250 Volt DC, AC To DC Electrical Conversion.....	37,153.54	6,547.19
26 33 Battery Equipment (26 30)		
26 33 13 Batteries (26 33)		
26 33 13 00-0001 Standby Batteries (26 33 13)		
26 33 13 00-0002 EA 12 Volt, 100 Amp Hours To 10.5 Volts Capacity, 6-Cell, Valve Regulated Lead-Calcium, Standby Battery.....	609.44	20.14
26 33 13 00-0003 EA 12 Volt, 100 Amp Hours To 10.5 Volts Capacity, 6-Cell, Valve Regulated Lead-Calcium, Standby Battery With Steel Jacket.....	657.67	20.14
26 33 13 00-0004 EA 725CCA, Group 31, 12 Volt Lead Calcium Standby Battery.....	198.42	20.14
26 33 13 00-0005 EA 810CCA, Group 24, 12 Volt Lead Calcium Standby Battery.....	181.02	20.14
26 33 13 00-0006 EA 1080CCA, Group 4D, 12 Volt Lead Calcium Standby Battery.....	305.04	20.14
26 33 13 00-0007 EA 1400CCA, Group 8D, 12 Volt Lead Calcium Standby Battery.....	353.10	20.14
26 33 43 Battery Chargers (26 33)		
26 33 43 00-0001 Solid State Chargers, Single Phase (26 33 43)		
Note: Includes wall bracket, 10' of DC charging cable and standard connector, 208/240/480 V.		
26 33 43 00-0002 EA Solid State Battery Charger, 6 Cell Single Phase With Wall Bracket, 208/240/480 Volt.....	1,898.68	459.58

26 Electrical**26 30 Facility Electrical Power Generating And Storing Equipment****26 33 Battery Equipment**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 33 43 00-0003	EA		Solid State Battery Charger, 9 Cell Single Phase With Wall Bracket, 208/240/480 Volt.....	2,200.68	459.58
26 33 43 00-0004	EA		Solid State Battery Charger, 12 Cell Single Phase With Wall Bracket, 208/240/480 Volt.....	2,419.89	459.58
26 33 43 00-0005	EA		Solid State Battery Charger, 18 Cell Single Phase With Wall Bracket, 208/240/480 Volt.....	2,568.26	544.13
26 33 53 Static Uninterruptible Power Supply (26 33)					
26 33 53 00-0001			Single Phase, Uninterruptible Power Supply Systems (UPS) (26 33 53)		
26 33 53 00-0002			Single Phase, Uninterruptible Power Supply Systems (UPS) (26 33 53 00-0001)		
26 33 53 00-0003			120 Volt AC Output, 120 Volt AC Input, Single Phase, On-Line, Uninterruptible Power Supply (UPS) (26 33 53 00-0002)		
Note: Rack mount or tower configuration. Includes 40 or 70 Hertz automatic frequency detection, internal automatic and manual bypass switch and self diagnostics.					
26 33 53 00-0004	EA		0.5 kVA, 450 Watt, 120 Volt AC Output, 120 Volt AC Input, Single Phase, On-Line, Uninterruptible Power Supply (UPS) (Liebert® GXT3-500RT120).....	763.59	79.62
Note: Includes 12 minutes of battery backup at full load.					
26 33 53 00-0005	EA		0.7 kVA, 630 Watt, 120 Volt AC Output, 120 Volt AC Input, Single Phase, On-Line, Uninterruptible Power Supply (UPS) (Liebert® GXT3-700RT120).....	912.04	92.89
Note: Includes 6 minutes of battery backup at full load.					
26 33 53 00-0006	EA		1 kVA, 900 Watt, 120 Volt AC Output, 120 Volt AC Input, Single Phase, On-Line, Uninterruptible Power Supply (UPS) (Liebert® GXT3-1000RT120).....	1,123.93	106.16
Note: Includes 5 minutes of battery backup at full load.					
26 33 53 00-0007	EA		1.5 KVA, 1,350 Watt, 120 Volt AC Output, 120 Volt AC Input, Single Phase, On-Line, Uninterruptible Power Supply (UPS) (Liebert® GXT3-1500RT120).....	1,372.70	119.44
Note: Includes 5 minutes of battery backup at full load.					
26 33 53 00-0008	EA		2 KVA, 1,800 Watt, 120 Volt AC Output, 120 Volt AC Input, Single Phase, On-Line, Uninterruptible Power Supply (UPS) (Liebert® GXT3-2000RT120).....	1,760.86	132.72
Note: Includes 4 minutes of battery backup at full load.					
26 33 53 00-0009	EA		3 KVA, 2,700 Watt, 120 Volt AC Output, 120 Volt AC Input, Single Phase, On-Line, Uninterruptible Power Supply (UPS) (Liebert® GXT3-3000RT120).....	2,914.84	185.80
Note: Includes 4 minutes of battery backup at full load.					
26 33 53 00-0010			208 Volt AC Output, 208 Volt AC Input, Single Phase, On-Line, Uninterruptible Power Supply (UPS) (26 33 53 00-0002)		
Note: Rack mount or tower configuration. Includes 40 or 70 Hertz automatic frequency detection, internal automatic and manual bypass switch and self diagnostics.					
26 33 53 00-0011	EA		3 KVA, 2,700 Watt, 208 Volt AC Output, 208 Volt AC Input, Single Phase, On-Line, Uninterruptible Power Supply (UPS) (Liebert® GXT3-3000RT208).....	2,862.74	185.80
Note: Includes 4 minutes of battery backup at full load.					
26 33 53 00-0012			120/208 Volt AC Output, 120/208 Volt AC Input, Single Phase, On-Line, Uninterruptible Power Supply (UPS) (26 33 53 00-0002)		
Note: Rack mount or tower configuration. Includes 50 or 60 Hertz automatic frequency detection, internal automatic and manual bypass switch and self diagnostics.					
26 33 53 00-0013	EA		5 KVA, 4,000 Watt, 120/208 Volt AC Output, 120/208 Volt AC Input, Single Phase, On-Line, Uninterruptible Power Supply (UPS) (Liebert® GXT3-5000RT208).....	4,291.05	212.34
Note: Includes 5 minutes of battery backup at full load.					
26 33 53 00-0014	EA		6 KVA, 4,800 Watt, 120/208 Volt AC Output, 120/208 Volt AC Input, Single Phase, On-Line, Uninterruptible Power Supply (UPS) (Liebert® GXT3-6000RT208).....	4,692.78	238.88
Note: Includes 4 minutes of battery backup at full load.					
26 33 53 00-0015	EA		8 KVA, 7,200 Watt, 120/208 Volt AC Output, 120/208 Volt AC Input, Single Phase, On-Line, Uninterruptible Power Supply (UPS) (Liebert® GXT3-8000RT208).....	7,015.21	291.96
Note: Includes 7 minutes of battery backup at full load.					
26 33 53 00-0016	EA		10 KVA, 9,000 Watt, 120/208 Volt AC Output, 120/208 Volt AC Input, Single Phase, On-Line, Uninterruptible Power Supply (UPS) (Liebert® GXT3-10000RT208).....	8,063.58	318.50
Note: Includes 4-1/2 minutes of battery backup at full load.					
26 33 53 00-0017			230 Volt AC Output, 230 Volt AC Input, Single Phase, On-Line, Uninterruptible Power Supply (UPS) (26 33 53 00-0002)		
Note: Rack mount or tower configuration. Includes 40 or 70 Hertz automatic frequency detection, internal automatic and manual bypass switch and self diagnostics.					
26 33 53 00-0018	EA		0.7 KVA, 630 Watt, 230 Volt AC Output, 230 Volt AC Input, Single Phase, On-Line, Uninterruptible Power Supply (UPS) (Liebert® GXT3-700RT230).....	912.04	92.89
Note: Includes 11 minutes of battery backup at full load.					
26 33 53 00-0019	EA		1 KVA, 900 Watt, 230 Volt AC Output, 230 Volt AC Input, Single Phase, On-Line, Uninterruptible Power Supply (UPS) (Liebert® GXT3-1000RT230).....	1,123.93	106.16
Note: Includes 6 minutes of battery backup at full load.					
26 33 53 00-0020	EA		1.5 KVA, 1,350 Watt, 230 Volt AC Output, 230 Volt AC Input, Single Phase, On-Line, Uninterruptible Power Supply (UPS) (Liebert® GXT3-1500RT230).....	1,388.09	119.44
Note: Includes 4 minutes of battery backup at full load.					
26 33 53 00-0021	EA		2 KVA, 1,800 Watt, 230 Volt AC Output, 230 Volt AC Input, Single Phase, On-Line, Uninterruptible Power Supply (UPS) (Liebert® GXT3-2000RT230).....	1,764.57	132.72
Note: Includes 4 minutes of battery backup at full load.					
26 33 53 00-0022	EA		3 KVA, 2,700 Watt, 230 Volt AC Output, 230 Volt AC Input, Single Phase, On-Line, Uninterruptible Power Supply (UPS) (Liebert® GXT3-3000RT230).....	2,926.41	185.80
Note: Includes 4 minutes of battery backup at full load.					
26 33 53 00-0023	EA		5 KVA, 4,000 Watt, 230 Volt AC Output, 230 Volt AC Input, Single Phase, On-Line, Uninterruptible Power Supply (UPS) (Liebert® GXT3-5000RT230).....	4,117.06	212.34
Note: Includes 9 minutes of battery backup at full load.					



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 33 53 00-0024 EA 6 KVA, 4,800 Watt, 230 Volt AC Output, 230 Volt AC Input, Single Phase, On-Line, Uninterruptible Power Supply (UPS) (Liebert® GXT3-6000RT230)	5,054.52	238.88
Note: Includes 6 minutes of battery backup at full load.		
26 33 53 00-0025 EA 10 KVA, 9,000 Watt, 230 Volt AC Output, 230 Volt AC Input, Single Phase, On-Line, Uninterruptible Power Supply (UPS) (Liebert® GXT3-10000RT230).....	7,814.86	318.50
Note: Includes 3 minutes of battery backup at full load.		
26 33 53 00-0026 Optional Accessories For Single Phase, Uninterruptible Power Supply Systems <small>(26 33 53 00-0001)</small>		
26 33 53 00-0027 EA External Battery Cabinet For 0.5 To 2 KVA Single Phase, Uninterruptible Power Supply Systems (Liebert® GXT3-48VBATT).....	505.43	24.13
Note: Rack mount or tower configuration.		
26 33 53 00-0028 EA External Battery Cabinet For 3 KVA Single Phase, Uninterruptible Power Supply Systems (Liebert® GXT3-72VBATT).....	661.94	24.13
Note: Rack mount or tower configuration.		
26 33 53 00-0029 EA External Battery Cabinet For 5 To 6 KVA Single Phase, Uninterruptible Power Supply Systems (Liebert® GXT3-144VBATT).....	644.52	24.13
Note: Rack mount or tower configuration.		
26 33 53 00-0030 EA External Battery Cabinet For 8 To 10 KVA Single Phase, Uninterruptible Power Supply Systems (Liebert® GXT3-288RTVBATT).....	438.01	24.13
Note: Rack mount or tower configuration.		
26 33 53 00-0031 EA Replacement Internal Battery For 5 To 6 KVA Single Phase, Uninterruptible Power Supply Systems (Liebert® GXT3-144VBATKIT).....	649.12	79.62
26 33 53 00-0032 EA Replacement Internal Battery For 8 To 10 KVA Single Phase, Uninterruptible Power Supply Systems (Liebert® GXT3-288RTBKIT).....	729.54	106.16
26 33 53 00-0033 Three Phase, Uninterruptible Power Supply Systems (UPS) <small>(26 33 53)</small>		
26 33 53 00-0034 Three Phase, Uninterruptible Power Supply Systems (UPS) <small>(26 33 53 00-0033)</small>		
26 33 53 00-0035 480 Volt AC Output, 480 Volt AC Input, Three Phase, On-Line, Uninterruptible Power Supply (UPS) <small>(26 33 53 00-0034)</small>		
Note: Includes start-up, 60 Hz frequency, bypass switch and diagnostics.		
26 33 53 00-0036 EA 30 kVA, 24 KW, 480 Volt AC Output, 480 Volt AC Input, Three Phase, On-Line, Uninterruptible Power Supply (UPS) (Liebert® Npower™ 37SA030A0A6E).....	20,688.38	690.10
For 208/208 Volt AC, Add		
For MBC 2-Breaker, Add		
For 34 Minute Battery, Add		
26 33 53 00-0037 EA 40 kVA, 32 KW, 480 Volt AC Output, 480 Volt AC Input, Three Phase, On-Line, Uninterruptible Power Supply (UPS) (Liebert® Npower™ 37SA040A0A6E).....	24,655.85	849.35
For 208/208 Volt AC, Add		
For MBC 2-Breaker, Add		
For 23 Minute Battery, Add		
For 37 Minute Battery, Add		
26 33 53 00-0038 EA 50 kVA, 40 KW, 480 Volt AC Output, 480 Volt AC Input, Three Phase, On-Line, Uninterruptible Power Supply (UPS) (Liebert® Npower™ 37SA050A0A6E).....	27,212.20	1,061.69
For 208/208 Volt AC, Add		
For MBC 2-Breaker, Add		
For 18 Minute Battery, Add		
For 28 Minute Battery, Add		
For 35 Minute Battery, Add		
26 33 53 00-0039 EA 65 kVA, 52 KW, 480 Volt AC Output, 480 Volt AC Input, Three Phase, On-Line, Uninterruptible Power Supply (UPS) (Liebert® Npower™ 37SA065A0A6E).....	30,946.61	1,327.11
For 208/208 Volt AC, Add		
For MBC 2-Breaker, Add		
For 12 Minute Battery, Add		
For 19 Minute Battery, Add		
For 25 Minute Battery, Add		
For 30 Minute Battery, Add		
26 33 53 00-0040 EA 80 kVA, 64 KW, 480 Volt AC Output, 480 Volt AC Input, Three Phase, On-Line, Uninterruptible Power Supply (UPS) (Liebert® Npower™ 37SA080A0A6E).....	32,980.73	1,592.54
For 208/208 Volt AC, Add		
For MBC 3-Breaker, Add		
For 15 Minute Battery, Add		
For 19 Minute Battery, Add		
For 33 Minute Battery, Add		
26 33 53 00-0041 EA 100 kVA, 80 KW, 480 Volt AC Output, 480 Volt AC Input, Three Phase, On-Line, Uninterruptible Power Supply (UPS) (Liebert® Npower™ 37SA100A0A6E).....	35,661.99	1,857.96
For 208/208 Volt AC, Add		
For MBC 3-Breaker, Add		
For 11 Minute Battery, Add		
For 17 Minute Battery, Add		
For 25 Minute Battery, Add		
For 35 Minute Battery, Add		
26 33 53 00-0042 EA 130 kVA, 104 KW, 480 Volt AC Output, 480 Volt AC Input, Three Phase, On-Line, Uninterruptible Power Supply (UPS) (Liebert® Npower™ 37SA130A0A6E).....	38,926.55	2,123.39
For 208/208 Volt AC, Add		
For MBC 3-Breaker, Add		
For 11 Minute Battery, Add		
For 17 Minute Battery, Add		
For 25 Minute Battery, Add		
For 30 Minute Battery, Add		

26 Electrical**26 30 Facility Electrical Power Generating And Storing Equipment****26 33 Battery Equipment**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 33 53 00-0043	EA		225 kVA, 180 KW, 480 Volt AC Output, 480 Volt AC Input, Three Phase, On-Line, Uninterruptible Power Supply (UPS) (Liebert® Series 610, U39SA229AAAK).....	49,328.83	2,388.81
			<i>For Customer Alarm Interface, Add</i>	393.61	
			<i>For Alarm Status Contacts, Add</i>	474.19	
			<i>For Maintenance Bypass Interface, Add</i>	554.77	
			<i>For Communication Interface, Add</i>	619.86	
			<i>For Flush Mount Remote Status Panel, Add</i>	781.03	
			<i>For SNMP, Add</i>	976.29	
			<i>For Load Bus Sync Board, Add</i>	1,456.68	
			<i>For Input Filter with Disconnect, Add</i>	1,907.94	
			<i>For Isolation Transformer, Add</i>	6,260.63	
			<i>For Two Breaker Matching Maintenance Bypass Cabinet, Add</i>	6,972.86	
			<i>For Load Bus Sync Control Panel With Start Up, Add</i>	7,000.13	
			<i>For Three Breaker Matching Maintenance Bypass Cabinet, Add</i>	7,530.73	
			<i>For VRLA 12 Minute Battery, Add</i>	33,081.04	
			<i>For VRLA 14 Minute Battery, Add</i>	35,626.21	
			<i>For VRLA 22 Minute Battery, Add</i>	44,683.60	
			<i>For VRLA 37 Minute Battery, Add</i>	66,518.69	
26 33 53 00-0044	EA		300 kVA, 240 KW, 480 Volt AC Output, 480 Volt AC Input, Three Phase, On-Line, Uninterruptible Power Supply (UPS) (Liebert® Series 610, U39SA300AAAA).....	63,377.80	2,654.23
			<i>For Customer Alarm Interface, Add</i>	393.61	
			<i>For Alarm Status Contacts, Add</i>	474.19	
			<i>For Maintenance Bypass Interface, Add</i>	554.77	
			<i>For Communication Interface, Add</i>	619.86	
			<i>For Flush Mount Remote Status Panel, Add</i>	781.03	
			<i>For SNMP, Add</i>	976.29	
			<i>For Load Bus Sync Board, Add</i>	1,456.68	
			<i>For Input Filter with Disconnect, Add</i>	2,083.36	
			<i>For Load Bus Sync Control Panel With Start Up, Add</i>	7,000.13	
			<i>For Isolation Transformer, Add</i>	7,351.60	
			<i>For Two Breaker Matching Maintenance Bypass Cabinet, Add</i>	8,410.94	
			<i>For Three Breaker Matching Maintenance Bypass Cabinet, Add</i>	9,628.97	
			<i>For VRLA 14 Minute Battery, Add</i>	44,731.86	
			<i>For VRLA 17 Minute Battery, Add</i>	53,129.65	
			<i>For VRLA 26 Minute Battery, Add</i>	66,574.99	
26 33 53 00-0045	EA		500 kVA, 400 KW, 480 Volt AC Output, 480 Volt AC Input, Three Phase, On-Line, Uninterruptible Power Supply (UPS) (Liebert® Series 610, U39SA500AAAA).....	99,735.14	3,185.07
			<i>For Customer Alarm Interface, Add</i>	501.09	
			<i>For Alarm Status Contacts, Add</i>	603.67	
			<i>For Maintenance Bypass Interface, Add</i>	706.25	
			<i>For Communication Interface, Add</i>	789.11	
			<i>For Flush Mount Remote Status Panel, Add</i>	994.29	
			<i>For SNMP, Add</i>	1,242.86	
			<i>For Load Bus Sync Board, Add</i>	1,854.42	
			<i>For Input Filter with Disconnect, Add</i>	5,900.12	
			<i>For Two Breaker Maintenance Bypass Switchboard, Add</i>	8,199.69	
			<i>For Load Bus Sync Control Panel With Start Up, Add</i>	8,965.92	
			<i>For 12 Pulse With Isolation Transformer, Add</i>	11,178.39	
			<i>For Three Breaker Maintenance Bypass Switchboard, Add</i>	12,468.80	
			<i>For VRLA 12 Minute Battery, Add</i>	71,825.29	
26 33 53 00-0046			Optional Accessories For Three Phase, Uninterruptible Power Supply Systems <small>(26 33 53 00-0033)</small>		
26 33 53 00-0047	EA		Programmable Relay Board For Liebert® Npower™ Uninterruptible Power Supply Systems.....	451.12	40.21
26 33 53 00-0048	EA		Network Interface Card For Liebert® Npower™ Uninterruptible Power Supply Systems.....	725.71	40.21
26 33 53 00-0049	EA		Remote Status Panel With 100' Of Cable For Liebert® Npower™ Uninterruptible Power Supply Systems.....	1,394.35	80.44
26 33 53 00-0050	EA		Slim Line Distribution Panel With Two 42 Pole Panels For Liebert® Npower™ Uninterruptible Power Supply Systems.....	4,341.59	321.72
26 33 53 00-0051	EA		Replacement 12 Volt, 3 Phase, 134 Amp Hours, Battery For Uninterruptible Power Supply Systems (C&D UPS12-490MR).....	321.95	40.21
26 33 53 00-0052	EA		Replacement 12 Volt, 204 Watts, 3 Phase, 55 Amp Hours, Battery For Uninterruptible Power Supply Systems (Fiamm 12FLX200).....	177.80	40.21
26 33 53 00-0053	EA		Replacement 12 Volt, 257 Watts, 3 Phase, 65 Amp Hours, Battery For Uninterruptible Power Supply Systems (Fiamm 12FLX250).....	198.84	40.21
26 33 53 00-0054	EA		Replacement 12 Volt, 311 Watts, 3 Phase, 75 Amp Hours, Battery For Uninterruptible Power Supply Systems (Fiamm 12FLX300).....	219.87	40.21
26 33 53 00-0055	EA		Replacement 12 Volt, 374 Watts, 3 Phase, 90 Amp Hours, Battery For Uninterruptible Power Supply Systems (Fiamm 12FLX350).....	257.73	40.21
26 33 53 00-0056	EA		Replacement 12 Volt, 415 Watts, 3 Phase, 100 Amp Hours, Battery For Uninterruptible Power Supply Systems (Fiamm 12FLX400).....	270.35	40.21
26 33 53 00-0057	EA		Replacement 12 Volt, 493 Watts, 3 Phase, 135 Amp Hours, Battery For Uninterruptible Power Supply Systems (Fiamm 12FLX500).....	335.56	40.21
26 33 53 00-0058	EA		Replacement 12 Volt, 540 Watts, 3 Phase, 150 Amp Hours, Battery For Uninterruptible Power Supply Systems (Fiamm 12FLX540).....	351.33	40.21
26 33 53 00-0059			Other Uninterruptable Power Supply Equipment <small>(26 33 53)</small>		
26 33 53 00-0060	EA		Uninterrupted Power Supply Slim-Line Distribution Panel 42 Pole GE Plug-In.....	3,141.82	73.53
26 33 53 00-0061	EA		Uninterrupted Power Supply Slim-Line Distribution Panel 84 Pole GE Plug-In.....	3,805.23	147.06
26 33 53 00-0062	EA		GE Plug-In Breakers 1 Pole 15- 60A For UPS Distribution Panel.....	18.11	4.41
26 33 53 00-0063	EA		GE Plug-In Breakers 2 Pole 15- 40A For UPS Distribution Panel.....	31.68	5.51
26 33 53 00-0064	EA		GE Plug-In Breakers 2 Pole 50- 80A For UPS Distribution Panel.....	57.50	5.51
26 33 53 00-0065	EA		GE Plug-In Breakers 3 Pole 15- 60A For UPS Distribution Panel.....	83.90	7.35
26 33 53 00-0066	EA		GE Plug-In Breakers 3 Pole 70- 100A For UPS Distribution Panel.....	117.98	7.35



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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26 33 53 00-0067	EA	Uninterrupted Power Supply Remote Status Panel	2,160.78	73.53
26 33 53 00-0068	EA	Uninterrupted Power Supply Remote Contact Board.....	729.89	55.15

26 35 Power Filters And Conditioners (26 30)

26 35 33 Power Factor Correction Equipment (26 35)

26 35 33 00-0001 Power Factor Correction Capacitors (26 35 33)

26 35 33 00-0002	EA	Power Factor Correction Capacitors, 2.0 KVAC	364.83	
26 35 33 00-0003	EA	Power Factor Correction Capacitors, 3.0 KVAC	404.06	
26 35 33 00-0004	EA	Power Factor Correction Capacitors, 4.0 KVAC	443.29	
26 35 33 00-0005	EA	Power Factor Correction Capacitors, 5.0 KVAC	480.95	
26 35 33 00-0006	EA	Power Factor Correction Capacitors, 7.5 KVAC	590.79	
26 35 33 00-0007	EA	Power Factor Correction Capacitors, 10.0 KVAC	721.81	
26 35 33 00-0008	EA	Power Factor Correction Capacitors, 15.0 KVAC	1,114.88	
26 35 33 00-0009	EA	Power Factor Correction Capacitors, 20.0 KVAC	1,354.18	
26 35 33 00-0010	EA	Power Factor Correction Capacitors, 25.0 KVAC	1,749.61	
26 35 33 00-0011	EA	Power Factor Correction Capacitors, 30.0 KVAC	1,989.69	
26 35 33 00-0012	EA	Power Factor Correction Capacitors, 50.0 KVAC	3,491.37	
26 35 33 00-0013	EA	Power Factor Correction Capacitors, 75.0 KVAC	5,249.60	
26 35 33 00-0014	EA	Power Factor Correction Capacitors, 100.0 KVAC	7,000.00	
26 35 33 00-0015	EA	Power Factor Correction Capacitors, Fuse Kit.....	324.81	

26 35 43 Static-Frequency Converters (26 35)

26 35 43 00-0001 Rotary Phase Converter With NEMA 1 Indoor Enclosure (26 35 43)

26 35 43 00-0002	EA	750 Watt Output Rotary Phase Converter With NEMA 1 Enclosure.....	394.13	80.44
26 35 43 00-0003	EA	2 KW Output Rotary Phase Converter With NEMA 1 Enclosure.....	673.18	96.51
26 35 43 00-0004	EA	3 KW Output Rotary Phase Converter With NEMA 1 Enclosure.....	773.67	128.69
26 35 43 00-0005	EA	5 KW Output Rotary Phase Converter With NEMA 1 Enclosure.....	1,058.03	160.86
26 35 43 00-0006	EA	7 KW Output Rotary Phase Converter With NEMA 1 Enclosure.....	1,451.55	209.12
26 35 43 00-0007	EA	11 KW Output Rotary Phase Converter With NEMA 1 Enclosure.....	1,869.82	257.38
26 35 43 00-0008	EA	15 KW Output Rotary Phase Converter With NEMA 1 Enclosure.....	2,337.59	305.63
26 35 43 00-0009	EA	21 KW Output Rotary Phase Converter With NEMA 1 Enclosure.....	2,838.77	345.86
26 35 43 00-0010	EA	29 KW Output Rotary Phase Converter With NEMA 1 Enclosure.....	3,305.29	418.24
26 35 43 00-0011	EA	36 KW Output Rotary Phase Converter With NEMA 1 Enclosure.....	3,781.11	470.53
26 35 43 00-0012	EA	44 KW Output Rotary Phase Converter With NEMA 1 Enclosure.....	4,256.91	522.81
26 35 43 00-0013	EA	55 KW Output Rotary Phase Converter With NEMA 1 Enclosure.....	5,278.46	631.39
26 35 43 00-0014	EA	74 KW Output Rotary Phase Converter With NEMA 1 Enclosure.....	6,835.22	760.07
26 35 43 00-0015	EA	87 KW Output Rotary Phase Converter With NEMA 1 Enclosure.....	8,649.98	924.96
26 35 43 00-0016	EA	110 KW Output Rotary Phase Converter With NEMA 1 Enclosure.....	9,904.16	1,081.79
26 35 43 00-0017	EA	125 KW Output Rotary Phase Converter With NEMA 1 Enclosure.....	12,678.00	1,206.47
26 35 43 00-0018	EA	165 KW Output Rotary Phase Converter With NEMA 1 Enclosure.....	19,187.24	1,367.33
26 35 43 00-0019	EA	220 KW Output Rotary Phase Converter With NEMA 1 Enclosure.....	28,418.97	1,528.19

26 35 53 Voltage Regulators (26 35)

26 35 53 00-0001 Voltage Regulators, 480/277 Or 208/120 Volt, 3 Phase (26 35 53)

Note: For diesel motor generator sets mounted in switchgear cabinet.

26 35 53 00-0002	EA	50 KVA Volt Regulator For Diesel M-G 480/277 Or 208/120 Volt, 3 Phase In Switchgear	4,239.42	1,278.86
26 35 53 00-0003	EA	75 KVA Volt Regulator For Diesel M-G 480/277 Or 208/120 Volt, 3 Phase In Switchgear	4,904.92	1,608.62
26 35 53 00-0004	EA	100 KVA Volt Regulator For Diesel M-G 480/277 Or 208/120 Volt, 3 Phase In Switchgear	5,517.72	1,914.26

26 36 Transfer Switches (26 30)

26 36 13 Manual Transfer Switches (26 36)

26 36 13 00-0001 Fused Manual Transfer Switches (26 36 13)

26 36 13 00-0002	EA	30 Amp Manual Transfer Switch, Fused, 3 Pole, 480 Volt.....	1,043.80	140.75
26 36 13 00-0003	EA	60 Amp Manual Transfer Switch, Fused, 3 Pole, 480 Volt.....	1,210.86	174.85

26 36 23 Automatic Transfer Switches (26 36)

26 36 23 00-0001 Automatic Transfer Switch (26 36 23)

26 36 23 00-0002 Automatic Transfer Switch, 2 Pole Circuit Breaker, NEMA 1 Enclosure (26 36 23 00-0001)

Note: Programmable, 120/240 volt single phase, 3 wire.

26 36 23 00-0003	EA	100 Amp, Automatic Transfer Switch, 120/240 Volt, NEMA 1, 2 Pole Circuit Breaker, Programmable, 3 Wire	1,810.87	290.02
26 36 23 00-0004	EA	225 Amp, Automatic Transfer Switch, 120/240 Volt, NEMA 1, 2 Pole Circuit Breaker, Programmable, 3 Wire	2,458.24	372.89
26 36 23 00-0005	EA	400 Amp, Automatic Transfer Switch, 120/240 Volt, NEMA 1, 2 Pole Circuit Breaker, Programmable, 3 Wire	3,884.16	497.18
26 36 23 00-0006	EA	600 Amp, Automatic Transfer Switch, 120/240 Volt, NEMA 1, 2 Pole Circuit Breaker, Programmable, 3 Wire	8,735.04	621.47

26 36 23 00-0007 Automatic Transfer Switch, 3 Pole Circuit Breaker, NEMA 1 Enclosure (26 36 23 00-0001)

26 Electrical**26 30 Facility Electrical Power Generating And Storing Equipment****26 36 Transfer Switches**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 36 23 00-0008	EA		40 Amp Automatic Transfer Switch, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins OTPC40).....	2,921.82	207.16
			<i>For NEMA 4 Enclosure, Add</i>	650.86	
			<i>For NEMA 12 Enclosure, Add</i>	650.86	
			<i>For NEMA 3R Enclosure, Add</i>	614.71	
26 36 23 00-0009	EA		70 Amp Automatic Transfer Switch, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins OTPC70).....	3,375.29	248.59
			<i>For NEMA 4 Enclosure, Add</i>	650.86	
			<i>For NEMA 12 Enclosure, Add</i>	650.86	
			<i>For NEMA 3R Enclosure, Add</i>	614.71	
26 36 23 00-0010	EA		125 Amp Automatic Transfer Switch, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins OTPC125).....	3,714.07	290.02
			<i>For NEMA 4 Enclosure, Add</i>	650.86	
			<i>For NEMA 12 Enclosure, Add</i>	650.86	
			<i>For NEMA 3R Enclosure, Add</i>	614.71	
26 36 23 00-0011	EA		150 Amp Automatic Transfer Switch, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins OTPC150).....	4,415.52	331.46
			<i>For NEMA 12 Enclosure, Add</i>	650.86	
			<i>For NEMA 4 Enclosure, Add</i>	940.13	
			<i>For NEMA 3R Enclosure, Add</i>	723.18	
26 36 23 00-0012	EA		225 Amp Automatic Transfer Switch, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins OTPC225).....	5,040.73	372.89
			<i>For NEMA 12 Enclosure, Add</i>	650.86	
			<i>For NEMA 4 Enclosure, Add</i>	940.13	
			<i>For NEMA 3R Enclosure, Add</i>	723.18	
26 36 23 00-0013	EA		260 Amp Automatic Transfer Switch, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins OTPC260).....	5,563.17	414.32
			<i>For NEMA 12 Enclosure, Add</i>	650.86	
			<i>For NEMA 4 Enclosure, Add</i>	940.13	
			<i>For NEMA 3R Enclosure, Add</i>	723.18	
26 36 23 00-0014	EA		300 Amp Automatic Transfer Switch, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins OTPC300).....	5,817.76	455.75
			<i>For NEMA 12 Enclosure, Add</i>	723.18	
			<i>For NEMA 3R Enclosure, Add</i>	853.35	
			<i>For NEMA 4 Enclosure, Add</i>	1,012.45	
26 36 23 00-0015	EA		400 Amp Automatic Transfer Switch, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins OTPC400).....	6,575.56	497.18
			<i>For NEMA 12 Enclosure, Add</i>	723.18	
			<i>For NEMA 3R Enclosure, Add</i>	853.35	
			<i>For NEMA 4 Enclosure, Add</i>	1,012.45	
26 36 23 00-0016	EA		600 Amp Automatic Transfer Switch, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins OTPC600).....	8,998.81	621.47
			<i>For NEMA 12 Enclosure, Add</i>	723.18	
			<i>For NEMA 3R Enclosure, Add</i>	853.35	
			<i>For NEMA 4 Enclosure, Add</i>	1,012.45	
26 36 23 00-0017	EA		800 Amp Automatic Transfer Switch, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins OTPC800).....	10,102.02	745.77
			<i>For NEMA 3R Enclosure, Add</i>	1,048.60	
			<i>For NEMA 4 Enclosure, Add</i>	1,157.09	
			<i>For NEMA 12 Enclosure, Add</i>	1,012.45	
26 36 23 00-0018	EA		1,000 Amp Automatic Transfer Switch, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins OTPC1000).....	13,075.53	994.36
			<i>For NEMA 3R Enclosure, Add</i>	1,048.60	
			<i>For NEMA 4 Enclosure, Add</i>	1,157.09	
			<i>For NEMA 12 Enclosure, Add</i>	1,012.45	
26 36 23 00-0019	EA		1,200 Amp Automatic Transfer Switch, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins OTPC1200).....	16,948.71	1,077.22
			<i>For NEMA 3R Enclosure, Add</i>	2,314.17	
			<i>For NEMA 4 Enclosure, Add</i>	1,301.72	
			<i>For NEMA 12 Enclosure, Add</i>	1,084.77	
26 36 23 00-0020	EA		1,600 Amp Automatic Transfer Switch, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins OTPC1600).....	18,079.10	1,242.95
			<i>For NEMA 3R Enclosure, Add</i>	3,760.52	
			<i>For NEMA 4 Enclosure, Add</i>	4,628.33	
			<i>For NEMA 12 Enclosure, Add</i>	3,760.52	
26 36 23 00-0021	EA		2,000 Amp Automatic Transfer Switch, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins OTPC2000).....	20,669.95	1,408.68
			<i>For NEMA 3R Enclosure, Add</i>	3,760.52	
			<i>For NEMA 4 Enclosure, Add</i>	4,628.33	
			<i>For NEMA 12 Enclosure, Add</i>	3,760.52	
26 36 23 00-0022	EA		3,000 Amp Automatic Transfer Switch, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins OTPC3000).....	24,967.95	1,740.13
			<i>For NEMA 3R Enclosure, Add</i>	3,760.52	
26 36 23 00-0023	EA		4,000 Amp Automatic Transfer Switch, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins OTPC4000).....	43,242.30	2,071.58
			<i>For NEMA 3R Enclosure, Add</i>	17,674.42	
26 36 23 00-0024			Bypass Isolation Transfer Switch, 3 Pole Circuit Breaker, NEMA 1 Enclosure (26 36 23 00-0001)		
26 36 23 00-0025	EA		150 Amp Bypass Isolation Transfer Switch, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins BTPC150).....	14,642.59	1,574.41
			<i>For NEMA 12 Enclosure, Add</i>	687.03	
			<i>For NEMA 3R Enclosure, Add</i>	1,265.57	
			<i>For NEMA 4 Enclosure, Add</i>	1,301.72	
26 36 23 00-0026	EA		225 Amp Bypass Isolation Transfer Switch, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins BTPC225).....	15,287.14	1,657.27
			<i>For NEMA 12 Enclosure, Add</i>	687.03	
			<i>For NEMA 3R Enclosure, Add</i>	1,265.57	
			<i>For NEMA 4 Enclosure, Add</i>	1,301.72	
26 36 23 00-0027	EA		260 Amp Bypass Isolation Transfer Switch, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins BTPC260).....	16,025.74	1,740.13
			<i>For NEMA 12 Enclosure, Add</i>	687.03	
			<i>For NEMA 3R Enclosure, Add</i>	1,265.57	
			<i>For NEMA 4 Enclosure, Add</i>	1,301.72	
26 36 23 00-0028	EA		300 Amp Bypass Isolation Transfer Switch, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins BTPC300).....	17,864.76	1,781.56
			<i>For NEMA 12 Enclosure, Add</i>	687.03	
			<i>For NEMA 3R Enclosure, Add</i>	1,265.57	
			<i>For NEMA 4 Enclosure, Add</i>	1,301.72	
26 36 23 00-0029	EA		400 Amp Bypass Isolation Transfer Switch, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins BTPC400).....	20,587.13	1,822.99
			<i>For NEMA 12 Enclosure, Add</i>	687.03	
			<i>For NEMA 3R Enclosure, Add</i>	1,265.57	
			<i>For NEMA 4 Enclosure, Add</i>	1,301.72	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 36 23 00-0030 EA 600 Amp Bypass Isolation Transfer Switch, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins BTPC600).....	24,681.01	1,905.86
<i>For NEMA 3R Enclosure, Add</i>	1,265.57	
<i>For NEMA 4 Enclosure, Add</i>	1,301.72	
<i>For NEMA 12 Enclosure, Add</i>	723.18	
26 36 23 00-0031 EA 800 Amp Bypass Isolation Transfer Switch, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins BTPC800).....	27,193.44	1,988.72
<i>For NEMA 3R Enclosure, Add</i>	1,301.72	
<i>For NEMA 4 Enclosure, Add</i>	1,301.72	
<i>For NEMA 12 Enclosure, Add</i>	795.50	
26 36 23 00-0032 EA 1,000 Amp Bypass Isolation Transfer Switch, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins BTPC1000).....	34,144.65	2,320.18
<i>For NEMA 3R Enclosure, Add</i>	1,301.72	
<i>For NEMA 4 Enclosure, Add</i>	1,301.72	
<i>For NEMA 12 Enclosure, Add</i>	795.50	
26 36 23 00-0033 EA 1,200 Amp Bypass Isolation Transfer Switch, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins BTPC1200).....	44,470.16	2,485.90
<i>For NEMA 3R Enclosure, Add</i>	5,785.41	
<i>For NEMA 12 Enclosure, Add</i>	5,785.41	
<i>For NEMA 4 Enclosure, Add</i>	7,231.76	
26 36 23 00-0034 EA 1,600 Amp Bypass Isolation Transfer Switch, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins BTPC1600).....	57,990.75	2,651.63
<i>For NEMA 3R Enclosure, Add</i>	12,293.99	
<i>For NEMA 12 Enclosure, Add</i>	11,455.11	
<i>For NEMA 4 Enclosure, Add</i>	12,293.99	
26 36 23 00-0035 EA 2,000 Amp Bypass Isolation Transfer Switch, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins BTPC2000).....	65,841.32	2,900.22
<i>For NEMA 3R Enclosure, Add</i>	12,293.99	
<i>For NEMA 12 Enclosure, Add</i>	11,455.11	
<i>For NEMA 4 Enclosure, Add</i>	12,293.99	
26 36 23 00-0036 EA 3,000 Amp Bypass Isolation Transfer Switch, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins BTPC3000).....	105,242.67	3,314.54
<i>For NEMA 3R Enclosure, Add</i>	15,186.69	
26 36 23 00-0037 EA 4,000 Amp Bypass Isolation Transfer Switch, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins BTPC4000).....	113,605.11	3,728.86
<i>For NEMA 3R Enclosure, Add</i>	15,186.69	
26 36 23 00-0038 Automatic Transfer Switch/Service Entrance, 3 Pole Circuit Breaker, NEMA 1 Enclosure <small>(26 36 23 00-0001)</small>		
26 36 23 00-0039 EA 40 Amp Automatic Transfer Switch/Service Entrance, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins OTPCSE40).....	4,746.41	207.16
<i>For NEMA 12 Enclosure, Add</i>	650.86	
<i>For NEMA 3R Enclosure, Add</i>	361.59	
26 36 23 00-0040 EA 70 Amp Automatic Transfer Switch/Service Entrance, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins OTPCSE70).....	5,136.91	248.59
<i>For NEMA 12 Enclosure, Add</i>	650.86	
<i>For NEMA 3R Enclosure, Add</i>	361.59	
26 36 23 00-0041 EA 125 Amp Automatic Transfer Switch/Service Entrance, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins OTPCSE125).....	5,526.74	290.02
<i>For NEMA 12 Enclosure, Add</i>	650.86	
<i>For NEMA 3R Enclosure, Add</i>	361.59	
26 36 23 00-0042 EA 150 Amp Automatic Transfer Switch/Service Entrance, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins OTPCSE150).....	6,634.61	331.46
<i>For NEMA 12 Enclosure, Add</i>	650.86	
<i>For NEMA 3R Enclosure, Add</i>	361.59	
<i>For Four Pole Circuit Breaker, Add</i>	1,807.94	
26 36 23 00-0043 EA 225 Amp Automatic Transfer Switch/Service Entrance, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins OTPCSE225).....	8,629.59	372.89
<i>For NEMA 12 Enclosure, Add</i>	650.86	
<i>For NEMA 3R Enclosure, Add</i>	361.59	
<i>For Four Pole Circuit Breaker, Add</i>	1,807.94	
26 36 23 00-0044 EA 250 Amp Automatic Transfer Switch/Service Entrance, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins OTPCSE250).....	9,190.48	414.32
<i>For NEMA 12 Enclosure, Add</i>	650.86	
<i>For NEMA 3R Enclosure, Add</i>	361.59	
<i>For Four Pole Circuit Breaker, Add</i>	1,807.94	
26 36 23 00-0045 EA 300 Amp Automatic Transfer Switch/Service Entrance, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins OTPCSE300).....	9,561.76	455.75
<i>For NEMA 12 Enclosure, Add</i>	723.18	
<i>For NEMA 3R Enclosure, Add</i>	940.13	
<i>For Four Pole Circuit Breaker, Add</i>	2,458.80	
26 36 23 00-0046 EA 400 Amp Automatic Transfer Switch/Service Entrance, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins OTPCSE400).....	10,817.48	497.18
<i>For NEMA 12 Enclosure, Add</i>	723.18	
<i>For NEMA 3R Enclosure, Add</i>	940.13	
<i>For Four Pole Circuit Breaker, Add</i>	2,458.80	
26 36 23 00-0047 EA 600 Amp Automatic Transfer Switch/Service Entrance, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins OTPCSE600).....	13,128.69	621.47
<i>For NEMA 12 Enclosure, Add</i>	723.18	
<i>For NEMA 3R Enclosure, Add</i>	940.13	
<i>For Four Pole Circuit Breaker, Add</i>	2,458.80	
26 36 23 00-0048 EA 800 Amp Automatic Transfer Switch/Service Entrance, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins OTPCSE800).....	13,692.86	745.77
<i>For NEMA 3R Enclosure, Add</i>	1,619.92	
<i>For NEMA 12 Enclosure, Add</i>	1,012.45	
<i>For Four Pole Circuit Breaker, Add</i>	3,507.41	
26 36 23 00-0049 EA 1,000 Amp Automatic Transfer Switch/Service Entrance, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins OTPCSE1000).....	16,178.40	994.36
<i>For NEMA 3R Enclosure, Add</i>	1,619.92	
<i>For NEMA 12 Enclosure, Add</i>	1,012.45	
<i>For Four Pole Circuit Breaker, Add</i>	3,507.41	

26 Electrical**26 30 Facility Electrical Power Generating And Storing Equipment****26 36 Transfer Switches**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 36 23 00-0050			Accessories <small>(26 36 23)</small>		
26 36 23 00-0051	EA		Auxiliary Contacts For Automatic Transfer Switch.....	167.78	
26 36 23 00-0052	EA		Battery Charger For Automatic Transfer Switch.....	1,374.04	
26 36 23 00-0053	EA		Elevator Relay Signal For Automatic Transfer Switch.....	499.00	
26 36 33			Non-Automatic Transfer Switches <small>(26 36)</small>		
26 36 33 00-0001			Non-Automatic Transfer Switch, 3 Pole Circuit Breaker, NEMA 1 Enclosure <small>(26 36 33)</small>		
26 36 33 00-0002	EA		40 Amp Non-Automatic Transfer Switch, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins OT40).....	1,976.37	207.16
			<i>For NEMA 12 Enclosure, Add</i>	578.54	
			<i>For NEMA 3R Enclosure, Add</i>	614.71	
26 36 33 00-0003	EA		70 Amp Non-Automatic Transfer Switch, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins OT70).....	2,194.48	248.59
			<i>For NEMA 12 Enclosure, Add</i>	578.54	
			<i>For NEMA 3R Enclosure, Add</i>	614.71	
26 36 33 00-0004	EA		125 Amp Non-Automatic Transfer Switch, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins OT125).....	2,492.82	290.02
			<i>For NEMA 12 Enclosure, Add</i>	578.54	
			<i>For NEMA 3R Enclosure, Add</i>	614.71	
26 36 33 00-0005	EA		150 Amp Non-Automatic Transfer Switch, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins OT150).....	2,338.78	331.46
			<i>For NEMA 12 Enclosure, Add</i>	578.54	
			<i>For NEMA 3R Enclosure, Add</i>	723.18	
26 36 33 00-0006	EA		225 Amp Non-Automatic Transfer Switch, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins OT225).....	3,812.84	372.89
			<i>For NEMA 12 Enclosure, Add</i>	578.54	
			<i>For NEMA 3R Enclosure, Add</i>	723.18	
26 36 33 00-0007	EA		260 Amp Non-Automatic Transfer Switch, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins OT260).....	4,285.55	414.32
			<i>For NEMA 12 Enclosure, Add</i>	578.54	
			<i>For NEMA 3R Enclosure, Add</i>	723.18	
26 36 33 00-0008	EA		300 Amp Non-Automatic Transfer Switch, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins OT300).....	4,765.56	455.75
			<i>For NEMA 12 Enclosure, Add</i>	723.18	
			<i>For NEMA 3R Enclosure, Add</i>	853.35	
26 36 33 00-0009	EA		400 Amp Non-Automatic Transfer Switch, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins OT400).....	5,585.69	497.18
			<i>For NEMA 12 Enclosure, Add</i>	723.18	
			<i>For NEMA 3R Enclosure, Add</i>	853.35	
26 36 33 00-0010	EA		600 Amp Non-Automatic Transfer Switch, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins OT600).....	7,378.42	621.47
			<i>For NEMA 12 Enclosure, Add</i>	723.18	
			<i>For NEMA 3R Enclosure, Add</i>	853.35	
26 36 33 00-0011	EA		800 Amp Non-Automatic Transfer Switch, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins OT800).....	8,312.56	745.77
			<i>For NEMA 12 Enclosure, Add</i>	1,012.45	
			<i>For NEMA 3R Enclosure, Add</i>	1,048.60	
26 36 33 00-0012	EA		1,000 Amp Non-Automatic Transfer Switch, 3 Pole Circuit Breaker, NEMA 1 Enclosure (Cummins OT1000).....	10,983.75	994.36
			<i>For NEMA 12 Enclosure, Add</i>	1,012.45	
			<i>For NEMA 3R Enclosure, Add</i>	1,048.60	
26 40			Electrical And Cathodic Protection <small>(26)</small>		
26 43			Surge Protective Devices <small>(26 43)</small>		
26 43 13			Surge Protective Devices for Low-Voltage Electrical Power Circuits <small>(26 43)</small>		
26 43 13 00-0001			25 kA Low Exposure (14 kAIC) Transient Voltage Surge Suppression <small>(26 43 13)</small> Note: Liebert LPL		
26 43 13 00-0002	EA		120/240 Volt AC Single Phase, 3 Wire 25 kA Low Exposure Transient Voltage Surge Suppressor.....	192.59	20.11
26 43 13 00-0003	EA		208 Volt AC Three Phase, 3 Wire 25 kA Low Exposure Transient Voltage Surge Suppressor.....	208.05	20.11
26 43 13 00-0004	EA		240/120 Volt AC Three Phase, 4 Wire 25 kA Low Exposure Transient Voltage Surge Suppressor.....	216.10	24.13
26 43 13 00-0005	EA		277 Volt AC Single Phase, 2 Wire 25 kA Low Exposure Transient Voltage Surge Suppressor.....	180.13	16.09
26 43 13 00-0006	EA		480/277 Volt AC Three Phase, 4 Wire 25 kA Low Exposure Transient Voltage Surge Suppressor.....	216.10	24.13
26 43 13 00-0007			50 kA Low Exposure (14 kAIC) Transient Voltage Surge Suppression <small>(26 43 13)</small> Note: Liebert LPL		
26 43 13 00-0008	EA		120/240 Volt AC Single Phase, 3 Wire 50 kA Low Exposure Transient Voltage Surge Suppressor.....	268.78	20.11
26 43 13 00-0009	EA		208/120 Volt AC Three Phase, 4 Wire 50 kA Low Exposure Transient Voltage Surge Suppressor.....	285.66	24.13
26 43 13 00-0010	EA		208 Volt AC Three Phase, 3 Wire 50 kA Low Exposure Transient Voltage Surge Suppressor.....	277.61	20.11
26 43 13 00-0011	EA		480/277 Volt AC Three Phase, 4 Wire 50 kA Low Exposure Transient Voltage Surge Suppressor.....	285.66	24.13
26 43 13 00-0012			100 kA Low Exposure (14 kAIC) Transient Voltage Surge Suppression <small>(26 43 13)</small> Note: Liebert LPL		
26 43 13 00-0013	EA		120/240 Volt AC Single Phase, 3 Wire 100 kA Low Exposure Transient Voltage Surge Suppressor.....	326.20	20.11
26 43 13 00-0014	EA		208/120 Volt AC Three Phase, 4 Wire 100 kA Low Exposure Transient Voltage Surge Suppressor.....	343.08	24.13
26 43 13 00-0015	EA		277 Volt AC Single Phase, 2 Wire 100 kA Low Exposure Transient Voltage Surge Suppressor.....	304.91	16.09
26 43 13 00-0016	EA		480/277 Volt AC Three Phase, 4 Wire 100 kA Low Exposure Transient Voltage Surge Suppressor.....	343.08	24.13
26 43 13 00-0017			100 kA Low Exposure (65 kAIC) Transient Voltage Surge Suppression <small>(26 43 13)</small> Note: Liebert LPM		
26 43 13 00-0018	EA		120/240 Volt AC Single Phase, 3 Wire 100 kA Medium Exposure Transient Voltage Surge Suppressor.....	385.82	20.11
26 43 13 00-0019	EA		208/120 Volt AC Three Phase, 4 Wire 100 kA Medium Exposure Transient Voltage Surge Suppressor.....	434.73	24.13
26 43 13 00-0020	EA		277 Volt AC Three Phase, 2 Wire 100 kA Medium Exposure Transient Voltage Surge Suppressor.....	365.64	16.09



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 43 13 00-0021 160 kA Low Exposure (65 kAIC) Transient Voltage Surge Suppression <small>(26 43 13)</small> Note: Liebert LPM		
26 43 13 00-0022 EA 208/120 Volt AC Single Phase, 4 Wire 160 kA Medium Exposure Transient Voltage Surge Suppressor.....	683.18	24.13
26 43 13 00-0023 EA 208 Volt AC Three Phase, 3 Wire 160 kA Medium Exposure Transient Voltage Surge Suppressor	675.13	20.11
26 43 13 00-0024 EA 480/277 Volt AC Three Phase, 4 Wire 160 kA Medium Exposure Transient Voltage Surge Suppressor	683.18	24.13
26 43 13 00-0025 250 kA, 500 Joule Transient Voltage Surge Suppression <small>(26 43 13)</small> Note: Liebert Interceptor Hybrid.		
26 43 13 00-0026 EA LED Display, 120/208 Volt AC Three Phase, 250 kA Transient Voltage Surge Suppressor.....	3,976.41	40.21
26 43 13 00-0027 EA Audible Alarm/LED Display, 120/208 Volt AC Three Phase, 250 kA Transient Voltage Surge Suppressor	4,859.77	40.21
26 43 13 00-0028 Class 1310 Transient Voltage Surge Suppression <small>(26 43 13)</small> Note: Supplied with audible alarm, alarm enable/disable switch and dry contacts. Square D.		
26 43 13 00-0029 NEMA 1/3R/12 Modular Device Transient Voltage Surge Suppressor <small>(26 43 13 00-0029)</small> Note: Square D. EMA series.		
26 43 13 00-0030 EA 120 kA, 120/240 Volt, 1 Phase, 3 Wire NEMA 1/3R/12 Modular Device Transient Voltage Surge Suppressor.....	3,194.50	104.56
For Integral Disconnect, Add	265.68	
For Surge Counter, Add	203.04	
26 43 13 00-0031 EA 160 kA, 120/240 Volt, 1 Phase, 3 Wire NEMA 1/3R/12 Modular Device Transient Voltage Surge Suppressor.....	3,522.16	120.65
For Integral Disconnect, Add	265.68	
For Surge Counter, Add	203.04	
26 43 13 00-0032 EA 240 kA, 120/240 Volt, 1 Phase, 3 Wire NEMA 1/3R/12 Modular Device Transient Voltage Surge Suppressor.....	5,154.07	140.75
For Integral Disconnect, Add	265.68	
For Surge Counter, Add	203.04	
26 43 13 00-0033 EA 320 kA, 120/240 Volt, 1 Phase, 3 Wire NEMA 1/3R/12 Modular Device Transient Voltage Surge Suppressor.....	6,862.75	160.86
For Integral Disconnect, Add	265.68	
For Surge Counter, Add	203.04	
26 43 13 00-0034 EA 480 kA, 120/240 Volt, 1 Phase, 3 Wire NEMA 1/3R/12 Modular Device Transient Voltage Surge Suppressor.....	10,158.92	221.19
For Integral Disconnect, Add	265.68	
For Surge Counter, Add	203.04	
26 43 13 00-0035 EA 120 kA, 120/208 Volt, 1 Phase, 4 Wire NEMA 1/3R/12 Modular Device Transient Voltage Surge Suppressor.....	3,334.37	104.56
For Integral Disconnect, Add	265.68	
For Surge Counter, Add	203.04	
26 43 13 00-0036 EA 160 kA, 120/208 Volt, 1 Phase, 4 Wire NEMA 1/3R/12 Modular Device Transient Voltage Surge Suppressor.....	3,675.81	120.65
For Integral Disconnect, Add	265.68	
For Surge Counter, Add	203.04	
26 43 13 00-0037 EA 240 kA, 120/208 Volt, 1 Phase, 4 Wire NEMA 1/3R/12 Modular Device Transient Voltage Surge Suppressor.....	5,391.45	140.75
For Integral Disconnect, Add	265.68	
For Surge Counter, Add	203.04	
26 43 13 00-0038 EA 320 kA, 120/208 Volt, 1 Phase, 4 Wire NEMA 1/3R/12 Modular Device Transient Voltage Surge Suppressor.....	7,171.04	160.86
For Integral Disconnect, Add	265.68	
For Surge Counter, Add	203.04	
26 43 13 00-0039 EA 480 kA, 120/208 Volt, 1 Phase, 4 Wire NEMA 1/3R/12 Modular Device Transient Voltage Surge Suppressor.....	10,634.65	221.19
For Integral Disconnect, Add	265.68	
For Surge Counter, Add	203.04	
26 43 13 00-0040 EA 120 kA, 120/208 Volt, 3 Phase, 4 Wire NEMA 1/3R/12 Modular Device Transient Voltage Surge Suppressor.....	3,334.37	104.56
For Integral Disconnect, Add	265.68	
For Surge Counter, Add	203.04	
26 43 13 00-0041 EA 160 kA, 120/208 Volt, 3 Phase, 4 Wire NEMA 1/3R/12 Modular Device Transient Voltage Surge Suppressor.....	3,675.81	120.65
For Integral Disconnect, Add	265.68	
For Surge Counter, Add	203.04	
26 43 13 00-0042 EA 240 kA, 120/208 Volt, 3 Phase, 4 Wire NEMA 1/3R/12 Modular Device Transient Voltage Surge Suppressor.....	5,391.45	140.75
For Integral Disconnect, Add	265.68	
For Surge Counter, Add	203.04	
26 43 13 00-0043 EA 320 kA, 120/208 Volt, 3 Phase, 4 Wire NEMA 1/3R/12 Modular Device Transient Voltage Surge Suppressor.....	7,171.04	160.86
For Integral Disconnect, Add	265.68	
For Surge Counter, Add	203.04	
26 43 13 00-0044 EA 480 kA, 120/208 Volt, 3 Phase, 4 Wire NEMA 1/3R/12 Modular Device Transient Voltage Surge Suppressor.....	10,634.65	221.19
For Integral Disconnect, Add	265.68	
For Surge Counter, Add	203.04	
26 43 13 00-0045 EA 120 kA, 277/480 Volt, 3 Phase, 4 Wire NEMA 1/3R/12 Modular Device Transient Voltage Surge Suppressor.....	3,474.25	104.56
For Integral Disconnect, Add	265.68	
For Surge Counter, Add	203.04	
26 43 13 00-0046 EA 160 kA, 277/480 Volt, 3 Phase, 4 Wire NEMA 1/3R/12 Modular Device Transient Voltage Surge Suppressor.....	3,831.44	120.65
For Integral Disconnect, Add	265.68	
For Surge Counter, Add	203.04	
26 43 13 00-0047 EA 240 kA, 277/480 Volt, 3 Phase, 4 Wire NEMA 1/3R/12 Modular Device Transient Voltage Surge Suppressor.....	5,630.78	140.75
For Integral Disconnect, Add	265.68	
For Surge Counter, Add	203.04	
26 43 13 00-0048 EA 320 kA, 277/480 Volt, 3 Phase, 4 Wire NEMA 1/3R/12 Modular Device Transient Voltage Surge Suppressor.....	7,481.35	160.86
For Integral Disconnect, Add	265.68	
For Surge Counter, Add	203.04	
26 43 13 00-0049 EA 480 kA, 277/480 Volt, 3 Phase, 4 Wire NEMA 1/3R/12 Modular Device Transient Voltage Surge Suppressor.....	11,112.32	221.19
For Integral Disconnect, Add	265.68	
For Surge Counter, Add	203.04	
26 43 13 00-0050 EA 120 kA, 347/600 Volt, 3 Phase, 4 Wire NEMA 1/3R/12 Modular Device Transient Voltage Surge Suppressor.....	3,636.76	104.56
For Integral Disconnect, Add	265.68	
For Surge Counter, Add	203.04	
26 43 13 00-0051 EA 160 kA, 347/600 Volt, 3 Phase, 4 Wire NEMA 1/3R/12 Modular Device Transient Voltage Surge Suppressor.....	3,993.00	120.65
For Integral Disconnect, Add	265.68	
For Surge Counter, Add	203.04	

26 Electrical**26 40 Electrical And Cathodic Protection****26 43 Surge Protective Devices**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 43 13 00-0052	EA		240 kA, 347/600 Volt, 3 Phase, 4 Wire NEMA 1/3R/12 Modular Device Transient Voltage Surge Suppressor.....	5,880.96	140.75
			<i>For Integral Disconnect, Add</i>	265.68	
			<i>For Surge Counter, Add</i>	203.04	
26 43 13 00-0053	EA		320 kA, 347/600 Volt, 3 Phase, 4 Wire NEMA 1/3R/12 Modular Device Transient Voltage Surge Suppressor.....	7,806.38	160.86
			<i>For Integral Disconnect, Add</i>	265.68	
			<i>For Surge Counter, Add</i>	203.04	
26 43 13 00-0054	EA		480 kA, 347/600 Volt, 3 Phase, 4 Wire NEMA 1/3R/12 Modular Device Transient Voltage Surge Suppressor.....	10,936.47	221.19
			<i>For Integral Disconnect, Add</i>	265.68	
			<i>For Surge Counter, Add</i>	203.04	
26 43 13 00-0055			NEMA 1/3R/12 Non-Modular Device Transient Voltage Surge Suppressor ⁽²⁶		
			^{43 13 00-0028)}		
			Note: Square D EBA series.		
26 43 13 00-0056	EA		120 kA, 120/240 Volt, 1 Phase, 3 Wire NEMA 1/3R/12 Non-Modular Device Transient Voltage Surge Suppressor.....	2,485.36	104.56
			<i>For Integral Disconnect, Add</i>	265.68	
			<i>For Surge Counter, Add</i>	203.04	
26 43 13 00-0057	EA		160 kA, 120/240 Volt, 1 Phase, 3 Wire NEMA 1/3R/12 Non-Modular Device Transient Voltage Surge Suppressor.....	3,004.11	120.65
			<i>For Integral Disconnect, Add</i>	265.68	
			<i>For Surge Counter, Add</i>	203.04	
26 43 13 00-0058	EA		240 kA, 120/240 Volt, 1 Phase, 3 Wire NEMA 1/3R/12 Non-Modular Device Transient Voltage Surge Suppressor.....	4,411.42	140.75
			<i>For Integral Disconnect, Add</i>	265.68	
			<i>For Surge Counter, Add</i>	203.04	
26 43 13 00-0059	EA		120 kA, 120/208 Volt, 3 Phase, 4 Wire NEMA 1/3R/12 Non-Modular Device Transient Voltage Surge Suppressor.....	2,565.14	104.56
			<i>For Integral Disconnect, Add</i>	265.68	
			<i>For Surge Counter, Add</i>	203.04	
26 43 13 00-0060	EA		160 kA, 120/208 Volt, 3 Phase, 4 Wire NEMA 1/3R/12 Non-Modular Device Transient Voltage Surge Suppressor.....	3,122.31	120.65
			<i>For Integral Disconnect, Add</i>	265.68	
			<i>For Surge Counter, Add</i>	203.04	
26 43 13 00-0061	EA		240 kA, 120/208 Volt, 3 Phase, 4 Wire NEMA 1/3R/12 Non-Modular Device Transient Voltage Surge Suppressor.....	4,566.06	140.75
			<i>For Integral Disconnect, Add</i>	265.68	
			<i>For Surge Counter, Add</i>	203.04	
26 43 13 00-0062	EA		120 kA, 120/240 Volt, 3 Phase, 4 Wire NEMA 1/3R/12 Non-Modular Device Transient Voltage Surge Suppressor.....	2,565.14	104.56
			<i>For Integral Disconnect, Add</i>	265.68	
			<i>For Surge Counter, Add</i>	203.04	
26 43 13 00-0063	EA		160 kA, 120/240 Volt, 3 Phase, 4 Wire NEMA 1/3R/12 Non-Modular Device Transient Voltage Surge Suppressor.....	3,122.31	120.65
			<i>For Integral Disconnect, Add</i>	265.68	
			<i>For Surge Counter, Add</i>	203.04	
26 43 13 00-0064	EA		240 kA, 120/240 Volt, 3 Phase, 4 Wire NEMA 1/3R/12 Non-Modular Device Transient Voltage Surge Suppressor.....	4,566.06	140.75
			<i>For Integral Disconnect, Add</i>	265.68	
			<i>For Surge Counter, Add</i>	203.04	
26 43 13 00-0065	EA		120 kA, 277/480 Volt, 3 Phase, 4 Wire NEMA 1/3R/12 Non-Modular Device Transient Voltage Surge Suppressor.....	2,666.59	104.56
			<i>For Integral Disconnect, Add</i>	265.68	
			<i>For Surge Counter, Add</i>	203.04	
26 43 13 00-0066	EA		160 kA, 277/480 Volt, 3 Phase, 4 Wire NEMA 1/3R/12 Non-Modular Device Transient Voltage Surge Suppressor.....	3,249.37	120.65
			<i>For Integral Disconnect, Add</i>	265.68	
			<i>For Surge Counter, Add</i>	203.04	
26 43 13 00-0067	EA		240 kA, 277/480 Volt, 3 Phase, 4 Wire NEMA 1/3R/12 Non-Modular Device Transient Voltage Surge Suppressor.....	4,764.03	140.75
			<i>For Integral Disconnect, Add</i>	265.68	
			<i>For Surge Counter, Add</i>	203.04	
26 43 13 00-0068	EA		120 kA, 347/600 Volt, 3 Phase, 4 Wire NEMA 1/3R/12 Non-Modular Device Transient Voltage Surge Suppressor.....	2,772.97	104.56
			<i>For Integral Disconnect, Add</i>	265.68	
			<i>For Surge Counter, Add</i>	203.04	
26 43 13 00-0069	EA		160 kA, 347/600 Volt, 3 Phase, 4 Wire NEMA 1/3R/12 Non-Modular Device Transient Voltage Surge Suppressor.....	3,384.30	120.65
			<i>For Integral Disconnect, Add</i>	265.68	
			<i>For Surge Counter, Add</i>	203.04	
26 43 13 00-0070	EA		240 kA, 347/600 Volt, 3 Phase, 4 Wire NEMA 1/3R/12 Non-Modular Device Transient Voltage Surge Suppressor.....	4,971.85	140.75
			<i>For Integral Disconnect, Add</i>	265.68	
			<i>For Surge Counter, Add</i>	203.04	
26 43 13 00-0071			NEMA 4X Modular Device Transient Voltage Surge Suppressor ^(26 43 13 00-0028)		
			Note: Square D EMA series. Stainless steel.		
26 43 13 00-0072	EA		120 kA, 120/240 Volt, 1 Phase, 3 Wire NEMA 4X Modular Device Transient Voltage Surge Suppressor.....	4,125.27	104.56
			<i>For Integral Disconnect, Add</i>	265.68	
			<i>For Surge Counter, Add</i>	203.04	
26 43 13 00-0073	EA		160 kA, 120/240 Volt, 1 Phase, 3 Wire NEMA 4X Modular Device Transient Voltage Surge Suppressor.....	4,452.94	120.65
			<i>For Integral Disconnect, Add</i>	265.68	
			<i>For Surge Counter, Add</i>	203.04	
26 43 13 00-0074	EA		240 kA, 120/240 Volt, 1 Phase, 3 Wire NEMA 4X Modular Device Transient Voltage Surge Suppressor.....	6,084.84	140.75
			<i>For Integral Disconnect, Add</i>	265.68	
			<i>For Surge Counter, Add</i>	203.04	
26 43 13 00-0075	EA		120 kA, 120/208 Volt, 3 Phase, 4 Wire NEMA 4X Modular Device Transient Voltage Surge Suppressor.....	4,265.14	104.56
			<i>For Integral Disconnect, Add</i>	265.68	
			<i>For Surge Counter, Add</i>	203.04	
26 43 13 00-0076	EA		160 kA, 120/208 Volt, 3 Phase, 4 Wire NEMA 4X Modular Device Transient Voltage Surge Suppressor.....	4,606.59	120.65
			<i>For Integral Disconnect, Add</i>	265.68	
			<i>For Surge Counter, Add</i>	203.04	
26 43 13 00-0077	EA		240 kA, 120/208 Volt, 3 Phase, 4 Wire NEMA 4X Modular Device Transient Voltage Surge Suppressor.....	6,322.22	140.75
			<i>For Integral Disconnect, Add</i>	265.68	
			<i>For Surge Counter, Add</i>	203.04	
26 43 13 00-0078	EA		120 kA, 120/240 Volt, 3 Phase, 4 Wire NEMA 4X Modular Device Transient Voltage Surge Suppressor.....	4,265.14	104.56
			<i>For Integral Disconnect, Add</i>	265.68	
			<i>For Surge Counter, Add</i>	203.04	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 43 13 00-0079 EA 160 kA, 120/240 Volt, 3 Phase, 4 Wire NEMA 4X Modular Device Transient Voltage Surge Suppressor..... <i>For Integral Disconnect, Add</i> <i>For Surge Counter, Add</i>	4,606.59 265.68 203.04	120.65
26 43 13 00-0080 EA 240 kA, 120/240 Volt, 3 Phase, 4 Wire NEMA 4X Modular Device Transient Voltage Surge Suppressor..... <i>For Integral Disconnect, Add</i> <i>For Surge Counter, Add</i>	6,322.18 265.68 203.04	140.75
26 43 13 00-0081 EA 120 kA, 277/480 Volt, 3 Phase, 4 Wire NEMA 4X Modular Device Transient Voltage Surge Suppressor..... <i>For Integral Disconnect, Add</i> <i>For Surge Counter, Add</i>	4,405.02 265.68 203.04	104.56
26 43 13 00-0082 EA 160 kA, 277/480 Volt, 3 Phase, 4 Wire NEMA 4X Modular Device Transient Voltage Surge Suppressor..... <i>For Integral Disconnect, Add</i> <i>For Surge Counter, Add</i>	4,762.21 265.68 203.04	120.65
26 43 13 00-0083 EA 240 kA, 277/480 Volt, 3 Phase, 4 Wire NEMA 4X Modular Device Transient Voltage Surge Suppressor..... <i>For Integral Disconnect, Add</i> <i>For Surge Counter, Add</i>	6,561.56 265.68 203.04	140.75
26 43 13 00-0084 EA 120 kA, 347/600 Volt, 3 Phase, 4 Wire NEMA 4X Modular Device Transient Voltage Surge Suppressor..... <i>For Integral Disconnect, Add</i> <i>For Surge Counter, Add</i>	4,567.54 265.68 203.04	104.56
26 43 13 00-0085 EA 160 kA, 347/600 Volt, 3 Phase, 4 Wire NEMA 4X Modular Device Transient Voltage Surge Suppressor..... <i>For Integral Disconnect, Add</i> <i>For Surge Counter, Add</i>	4,923.78 265.68 203.04	120.65
26 43 13 00-0086 EA 240 kA, 347/600 Volt, 3 Phase, 4 Wire NEMA 4X Modular Device Transient Voltage Surge Suppressor..... <i>For Integral Disconnect, Add</i> <i>For Surge Counter, Add</i>	6,811.73 265.68 203.04	140.75
26 43 13 00-0087 NEMA 4X Non-Modular Device Transient Voltage Surge Suppressor <small>(26 43 13 00-0028)</small> Note: Square D EBA series. Stainless steel.		
26 43 13 00-0088 EA 120 kA, 120/240 Volt, 1 Phase, 3 Wire NEMA 4X Non-Modular Device Transient Voltage Surge Suppressor..... <i>For Integral Disconnect, Add</i> <i>For Surge Counter, Add</i>	3,416.13 265.68 203.04	104.56
26 43 13 00-0089 EA 160 kA, 120/240 Volt, 1 Phase, 3 Wire NEMA 4X Non-Modular Device Transient Voltage Surge Suppressor..... <i>For Integral Disconnect, Add</i> <i>For Surge Counter, Add</i>	3,934.89 265.68 203.04	120.65
26 43 13 00-0090 EA 240 kA, 120/240 Volt, 1 Phase, 3 Wire NEMA 4X Non-Modular Device Transient Voltage Surge Suppressor..... <i>For Integral Disconnect, Add</i> <i>For Surge Counter, Add</i>	5,342.20 265.68 203.04	140.75
26 43 13 00-0091 EA 120 kA, 120/208 Volt, 3 Phase, 4 Wire NEMA 4X Non-Modular Device Transient Voltage Surge Suppressor..... <i>For Integral Disconnect, Add</i> <i>For Surge Counter, Add</i>	3,495.91 265.68 203.04	104.56
26 43 13 00-0092 EA 160 kA, 120/208 Volt, 3 Phase, 4 Wire NEMA 4X Non-Modular Device Transient Voltage Surge Suppressor..... <i>For Integral Disconnect, Add</i> <i>For Surge Counter, Add</i>	4,053.08 265.68 203.04	120.65
26 43 13 00-0093 EA 240 kA, 120/208 Volt, 3 Phase, 4 Wire NEMA 4X Non-Modular Device Transient Voltage Surge Suppressor..... <i>For Integral Disconnect, Add</i> <i>For Surge Counter, Add</i>	5,496.83 265.68 203.04	140.75
26 43 13 00-0094 EA 120 kA, 120/240 Volt, 3 Phase, 4 Wire NEMA 4X Non-Modular Device Transient Voltage Surge Suppressor..... <i>For Integral Disconnect, Add</i> <i>For Surge Counter, Add</i>	3,495.91 265.68 203.04	104.56
26 43 13 00-0095 EA 160 kA, 120/240 Volt, 3 Phase, 4 Wire NEMA 4X Non-Modular Device Transient Voltage Surge Suppressor..... <i>For Integral Disconnect, Add</i> <i>For Surge Counter, Add</i>	4,053.08 265.68 203.04	120.65
26 43 13 00-0096 EA 240 kA, 120/240 Volt, 3 Phase, 4 Wire NEMA 4X Non-Modular Device Transient Voltage Surge Suppressor..... <i>For Integral Disconnect, Add</i> <i>For Surge Counter, Add</i>	5,496.83 265.68 203.04	140.75
26 43 13 00-0097 EA 120 kA, 277/480 Volt, 3 Phase, 4 Wire NEMA 4X Non-Modular Device Transient Voltage Surge Suppressor..... <i>For Integral Disconnect, Add</i> <i>For Surge Counter, Add</i>	3,597.37 265.68 203.04	104.56
26 43 13 00-0098 EA 160 kA, 277/480 Volt, 3 Phase, 4 Wire NEMA 4X Non-Modular Device Transient Voltage Surge Suppressor..... <i>For Integral Disconnect, Add</i> <i>For Surge Counter, Add</i>	4,180.14 265.68 203.04	120.65
26 43 13 00-0099 EA 240 kA, 277/480 Volt, 3 Phase, 4 Wire NEMA 4X Non-Modular Device Transient Voltage Surge Suppressor..... <i>For Integral Disconnect, Add</i> <i>For Surge Counter, Add</i>	5,694.80 265.68 203.04	140.75
26 43 13 00-0100 EA 120 kA, 347/600 Volt, 3 Phase, 4 Wire NEMA 4X Non-Modular Device Transient Voltage Surge Suppressor..... <i>For Integral Disconnect, Add</i> <i>For Surge Counter, Add</i>	3,703.74 265.68 203.04	104.56
26 43 13 00-0101 EA 160 kA, 347/600 Volt, 3 Phase, 4 Wire NEMA 4X Non-Modular Device Transient Voltage Surge Suppressor..... <i>For Integral Disconnect, Add</i> <i>For Surge Counter, Add</i>	4,315.08 265.68 203.04	120.65
26 43 13 00-0102 EA 240 kA, 347/600 Volt, 3 Phase, 4 Wire NEMA 4X Non-Modular Device Transient Voltage Surge Suppressor..... <i>For Integral Disconnect, Add</i> <i>For Surge Counter, Add</i>	5,902.62 265.68 203.04	140.75

26 50 Lighting (26)

Note: Light fixtures include testing of fixture, a set of lamps (light bulbs), wire nuts, ground wire connector, fixture whip, ballast(s), mounting brackets where necessary and cable connectors. Lay-in fixtures include support wire, clips and seismic supports.

26 51 Interior Lighting (26 50)

26 51 13 Interior Lighting Fixtures, Lamps, And Ballasts (26 51)

26 51 13 00-0001 Lighting Accessories (26 51 13)



MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
26 51 13 00-0002		Photocells <small>(26 51 13 00-0001)</small>			
26 51 13 00-0003	EA	Plug-In Photocell For Lighting Fixtures	57.70		
26 51 13 00-0004	EA	Wired Photocell For Lighting Fixtures	139.75		
26 51 13 00-0005		Supports For Light Fixtures <small>(26 51 13 00-0001)</small>			
26 51 13 00-0006	EA	Bracket For Mounting Light Fixture On Wall	82.47		
26 51 13 00-0007		Modular Flexible Wiring Systems <small>(26 51 13 00-0001)</small>			
26 51 13 00-0008	EA	10' Length, 2-Circuit, Modular Power Cable (Day-Brite PC-12-2E-10)	55.17	4.34	
26 51 13 00-0009	EA	15' Length, 2-Circuit, Modular Power Cable (Day-Brite PC-12-2E-15)	63.78	4.34	
26 51 13 00-0010	EA	20' Length, 2-Circuit, Modular Power Cable (Day-Brite PC-12-2E-20)	76.62	4.34	
26 51 13 00-0011	EA	15' Length, 2-Circuit, Modular Lighting Cable (Day-Brite LC-27-2E-15)	63.78	4.34	
26 51 13 00-0012	EA	3 Out, 3-Circuit, Modular Lighting Interface (Day-Brite LI-27-3E)	56.46	4.34	
26 51 13 00-0013	EA	13' Length, 2-Circuit, Modular Reddy-Connect Cable (Day-Brite RC-27-2D-13)	82.31	4.34	
26 51 13 00-0014	EA	3" Length, 2-Circuit, Modular Lighting Adapter (Day-Brite LA-27-7M)	45.96	4.34	
26 51 13 00-0015	EA	3" Length, 2-Circuit, Modular Lighting Tap (Day-Brite LT-27-2E)	51.68	4.34	
26 51 13 00-0016	EA	7' Length, Single Level, Modular Lighting Switch Unit (Day-Brite LS-27-SL-07)	65.27	4.34	
26 51 13 00-0017	EA	7' Length, 1-Circuit Multi-Level, Modular Lighting Switch Unit (Day-Brite LS-27-ML-07)	65.27	4.34	
26 51 13 00-0018	EA	7' Length, 2-Circuit Multi-Level, Modular Lighting Switch Unit (Day-Brite LS-27-2C-07)	66.35	4.34	
26 51 13 00-0019	EA	7' Length, 1st 3-Way, Modular Lighting Switch Unit (Day-Brite LS-27-3A-07)	65.95	4.34	
26 51 13 00-0020	EA	7' Length, 2nd 3-Way, Modular Lighting Switch Unit (Day-Brite LS-27-3B-07)	65.95	4.34	
26 51 13 00-0021	EA	15' Length, Single Level, Modular Lighting Switch Unit (Day-Brite LS-27-SL-15)	75.57	4.34	
26 51 13 00-0022	EA	3" Length, 2-Circuit, Modular Lighting Adapter (Day-Brite LA-27-4D)	35.54	4.34	
26 51 13 00-0023	EA	3" Length, 1-Circuit, Modular Lighting Distribution Cable (Day-Brite LD-27-1E)	33.29	4.34	
26 51 13 00-0024	EA	3" Length, 2-Circuit, Modular Lighting Distribution Cable (Day-Brite LD-27-2E)	34.07	4.34	
26 51 13 00-0025	EA	3" Length, 1-Circuit, Modular Lighting Tap (Day-Brite LT-27-1E)	42.40	4.34	
26 51 13 00-0026	EA	15' Length, 1-Circuit, Modular Lighting Tap (Day-Brite LT-27-1E-15)	55.17	4.34	
26 51 13 00-0027	EA	15' Length, 1-Circuit, Modular Lighting Cable (Day-Brite LC-27-1E-15)	56.52	4.34	
26 51 13 00-0028	EA	Modular Lighting Junction Or Circuit Splitter (Day-Brite LJ-27-3E)	44.47	4.34	
26 51 13 00-0029	EA	3" Length, 1-Circuit, Modular Power Distribution Cable (Day-Brite PD-12-1E)	33.29	4.34	
26 51 13 00-0030	EA	Remove And Reinstall Of Modular Wiring Complete Including Storage And Cleaning	36.19		
26 51 13 00-0031		Removal And Reinstallation Of Light Fixtures <small>(26 51 13)</small>			
		Note: Includes disconnection of wire, on-site storage, general cleaning, installation and electrical wire hook-up.			
26 51 13 00-0032	EA	Remove And Reinstall Lay-In Fluorescent Light Fixture	85.67		
26 51 13 00-0033	EA	Remove And Reinstall Surface Mounted Or Pendant Light Fixture	97.90		
26 51 13 00-0034		Fluorescent Fixtures <small>(26 51 13)</small>			
26 51 13 00-0035		Surface Mounted, Wraparound Fluorescent Fixtures <small>(26 51 13 00-0034)</small>			
26 51 13 00-0036		6" x 2', Surface Mounted, Wraparound Fluorescent Fixtures <small>(26 51 13 00-0035)</small>			
26 51 13 00-0037	EA	1 T8 Lamp, 6" x 2', Surface Mounted, Wraparound Fluorescent Fixture	97.66	23.01	
26 51 13 00-0038	EA	2 T8 Lamps, 6" x 2', Surface Mounted, Wraparound Fluorescent Fixture	108.79	23.01	
26 51 13 00-0039		6" x 4', Surface Mounted, Wraparound Fluorescent Fixtures <small>(26 51 13 00-0035)</small>			
26 51 13 00-0040	EA	1 T8 Lamp, 6" x 4', Surface Mounted, Wraparound Fluorescent Fixture	109.49	23.97	
26 51 13 00-0041	EA	2 T8 Lamps, 6" x 4', Surface Mounted, Wraparound Fluorescent Fixture	121.68	23.97	
26 51 13 00-0042		1' x 4', Surface Mounted, Wraparound Fluorescent Fixtures <small>(26 51 13 00-0035)</small>			
26 51 13 00-0043	EA	2 T8 Lamps, 1' x 4', Surface Mounted, Wraparound Fluorescent Fixture	130.21	26.91	
26 51 13 00-0044	EA	3 T8 Lamps, 1' x 4', Surface Mounted, Wraparound Fluorescent Fixture	152.65	26.91	
26 51 13 00-0045	EA	4 T8 Lamps, 1' x 4', Surface Mounted, Wraparound Fluorescent Fixture	177.32	26.91	
26 51 13 00-0046		2' x 2', Surface Mounted, Wraparound Fluorescent Fixtures <small>(26 51 13 00-0035)</small>			
26 51 13 00-0047	EA	2 T8 Lamps, 2' x 2', Surface Mounted, Wraparound Fluorescent Fixture	109.15	29.41	
26 51 13 00-0048	EA	3 T8 Lamps, 2' x 2', Surface Mounted, Wraparound Fluorescent Fixture	124.54	29.41	
26 51 13 00-0049		2' x 4', Surface Mounted, Wraparound Fluorescent Fixtures <small>(26 51 13 00-0035)</small>			
26 51 13 00-0050	EA	2 T8 Lamps, 2' x 4', Surface Mounted, Wraparound Fluorescent Fixture	166.39	34.27	
26 51 13 00-0051	EA	3 T8 Lamps, 2' x 4', Surface Mounted, Wraparound Fluorescent Fixture	178.28	34.27	
26 51 13 00-0052	EA	4 T8 Lamps, 2' x 4', Surface Mounted, Wraparound Fluorescent Fixture	200.69	34.27	
26 51 13 00-0053		Surface Mounted, Box Type Fluorescent Fixtures <small>(26 51 13 00-0034)</small>			
		Note: Includes prismatic lens.			
26 51 13 00-0054		1' x 4', Surface Mounted, Box Type Fluorescent Fixtures <small>(26 51 13 00-0053)</small>			
26 51 13 00-0055	EA	2 T8 Lamps, 1' x 4', Surface Mounted, Box Type Fluorescent Fixture	129.54	26.69	
26 51 13 00-0056	EA	3 T8 Lamps, 1' x 4', Surface Mounted, Box Type Fluorescent Fixture	203.82	26.69	
26 51 13 00-0057	EA	4 T8 Lamps, 1' x 4', Surface Mounted, Box Type Fluorescent Fixture	231.14	26.69	



Electrical	26	26
Lighting	26 50	
Interior Lighting	26 51	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 51 13 00-0058 2' x 2', Surface Mounted, Box Type Fluorescent Fixtures <small>(26 51 13 00-0053)</small>		
26 51 13 00-0059 EA 2 T8 Lamps, 2' x 2', Surface Mounted, Box Type Fluorescent Fixture.....	197.15	29.41
26 51 13 00-0060 EA 3 T8 Lamps, 2' x 2', Surface Mounted, Box Type Fluorescent Fixture.....	214.46	29.41
26 51 13 00-0061 EA 4 T8 Lamps, 2' x 2', Surface Mounted, Box Type Fluorescent Fixture.....	227.02	29.41
26 51 13 00-0062 2' x 4', Surface Mounted, Box Type Fluorescent Fixtures <small>(26 51 13 00-0053)</small>		
26 51 13 00-0063 EA 2 T8 Lamps, 2' x 4', Surface Mounted, Box Type Fluorescent Fixture.....	201.81	34.27
26 51 13 00-0064 EA 3 T8 Lamps, 2' x 4', Surface Mounted, Box Type Fluorescent Fixture.....	220.27	34.27
26 51 13 00-0065 EA 4 T8 Lamps, 2' x 4', Surface Mounted, Box Type Fluorescent Fixture.....	230.54	34.27
26 51 13 00-0066 EA 6 T8 Lamps, 2' x 4', Surface Mounted, Box Type Fluorescent Fixture.....	246.31	34.27
26 51 13 00-0067 4' x 4', Surface Mounted, Box Type Fluorescent Fixtures <small>(26 51 13 00-0053)</small>		
26 51 13 00-0068 EA 4 T8 Lamps, 4' x 4', Surface Mounted, Box Type Fluorescent Fixture.....	390.81	44.12
26 51 13 00-0069 EA 6 T8 Lamps, 4' x 4', Surface Mounted, Box Type Fluorescent Fixture.....	397.44	44.12
26 51 13 00-0070 EA 8 T8 Lamps, 4' x 4', Surface Mounted, Box Type Fluorescent Fixture.....	621.98	44.12
26 51 13 00-0071 Recessed Fluorescent Fixtures <small>(26 51 13 00-0034)</small>		
26 51 13 00-0072 Lensed, Lay-In/Troffer, Recessed Fluorescent Fixtures <small>(26 51 13 00-0071)</small>		
26 51 13 00-0073 1' x 2', Prismatic Lensed, Lay-In/Troffer Fluorescent Fixture <small>(26 51 13 00-0072)</small>		
26 51 13 00-0074 EA 2 T8 Lamps, 1' x 2', Prismatic Lensed, Lay-In/Troffer Fluorescent Fixture.....	123.24	23.01
<i>For Drywall Or Plaster Ceilings, Add</i>	15.55	
26 51 13 00-0075 1' x 4', Prismatic Lensed, Lay-In/Troffer Fluorescent Fixture <small>(26 51 13 00-0072)</small>		
26 51 13 00-0076 EA 2 T8 Lamps, 1' x 4', Prismatic Lensed, Lay-In/Troffer Fluorescent Fixture.....	158.23	26.69
<i>For Drywall Or Plaster Ceilings, Add</i>	18.20	
26 51 13 00-0077 EA 2 T5 Lamps, 1' x 4', Prismatic Lensed, Lay-In/Troffer Fluorescent Fixture.....	275.12	26.69
<i>For Drywall Or Plaster Ceilings, Add</i>	18.20	
26 51 13 00-0078 2' x 2', Prismatic Lensed, Lay-In/Troffer Fluorescent Fixture <small>(26 51 13 00-0072)</small>		
26 51 13 00-0079 EA 2 T8 Lamps, 2' x 2', Prismatic Lensed, Lay-In/Troffer Fluorescent Fixture.....	161.45	29.41
<i>For Drywall Or Plaster Ceilings, Add</i>	19.85	
26 51 13 00-0080 EA 3 T8 Lamps, 2' x 2', Prismatic Lensed, Lay-In/Troffer Fluorescent Fixture.....	182.48	29.41
<i>For Drywall Or Plaster Ceilings, Add</i>	19.85	
26 51 13 00-0081 EA 4 T8 Lamps, 2' x 2', Prismatic Lensed, Lay-In/Troffer Fluorescent Fixture.....	185.34	29.41
<i>For Drywall Or Plaster Ceilings, Add</i>	19.86	
26 51 13 00-0082 EA 2 T5 Lamps, 2' x 2', Prismatic Lensed, Lay-In/Troffer Fluorescent Fixture.....	199.39	29.41
<i>For Drywall Or Plaster Ceilings, Add</i>	19.85	
26 51 13 00-0083 2' x 4', Prismatic Lensed, Lay-In/Troffer Fluorescent Fixture <small>(26 51 13 00-0072)</small>		
26 51 13 00-0084 EA 2 T8 Lamps, 2' x 4', Prismatic Lensed, Lay-In/Troffer Fluorescent Fixture.....	160.52	34.27
<i>For Drywall Or Plaster Ceilings, Add</i>	23.17	
26 51 13 00-0085 EA 3 T8 Lamps, 2' x 4', Prismatic Lensed, Lay-In/Troffer Fluorescent Fixture.....	214.35	34.27
<i>For Drywall Or Plaster Ceilings, Add</i>	23.17	
26 51 13 00-0086 EA 4 T8 Lamps, 2' x 4', Prismatic Lensed, Lay-In/Troffer Fluorescent Fixture.....	217.67	34.27
<i>For Drywall Or Plaster Ceilings, Add</i>	23.17	
26 51 13 00-0087 EA 6 T8 Lamps, 2' x 4', Prismatic Lensed, Lay-In/Troffer Fluorescent Fixture.....	241.79	34.27
<i>For Drywall Or Plaster Ceilings, Add</i>	23.17	
26 51 13 00-0088 EA 2 T5 Lamps, 2' x 4', Prismatic Lensed, Lay-In/Troffer Fluorescent Fixture.....	210.46	34.27
<i>For Drywall Or Plaster Ceilings, Add</i>	23.17	
26 51 13 00-0089 EA 3 T5 Lamps, 2' x 4', Prismatic Lensed, Lay-In/Troffer Fluorescent Fixture.....	279.95	34.27
<i>For Drywall Or Plaster Ceilings, Add</i>	23.17	
26 51 13 00-0090 EA 4 T5 Lamps, 2' x 4', Prismatic Lensed, Lay-In/Troffer Fluorescent Fixture.....	287.88	34.27
<i>For Drywall Or Plaster Ceilings, Add</i>	23.17	
26 51 13 00-0091 Parabolic, Lay-In/Troffer, Recessed Fluorescent Fixtures <small>(26 51 13 00-0071)</small>		
26 51 13 00-0092 1' x 2', Parabolic, Lay-In/Troffer, Recessed Fluorescent Fixtures <small>(26 51 13 00-0091)</small>		
26 51 13 00-0093 EA 1 T8 Lamp, 1' x 2', Parabolic, Lay-In/Troffer, Recessed Fluorescent Fixture.....	139.82	23.01
<i>For Drywall Or Plaster Ceilings, Add</i>	15.55	
26 51 13 00-0094 EA 2 T8 Lamps, 1' x 2', Parabolic, Lay-In/Troffer, Recessed Fluorescent Fixture.....	142.67	23.01
<i>For Drywall Or Plaster Ceilings, Add</i>	15.55	
26 51 13 00-0095 EA 3 T8 Lamps, 1' x 2', Parabolic, Lay-In/Troffer, Recessed Fluorescent Fixture.....	164.95	23.01
<i>For Drywall Or Plaster Ceilings, Add</i>	15.55	
26 51 13 00-0096 1' x 4', Parabolic, Lay-In/Troffer, Recessed Fluorescent Fixtures <small>(26 51 13 00-0091)</small>		
26 51 13 00-0097 EA 1 T8 Lamp, 1' x 4', Parabolic, Lay-In/Troffer, Recessed Fluorescent Fixture.....	159.36	26.69
<i>For Drywall Or Plaster Ceilings, Add</i>	18.20	
26 51 13 00-0098 EA 2 T8 Lamps, 1' x 4', Parabolic, Lay-In/Troffer, Recessed Fluorescent Fixture.....	162.67	26.69
<i>For Drywall Or Plaster Ceilings, Add</i>	18.20	

26	Electrical
26 50	Lighting
26 51	Interior Lighting



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 51 13 00-0099 EA 3 T8 Lamps, 1' x 4', Parabolic, Lay-In/Troffer, Recessed Fluorescent Fixture <i>For Drywall Or Plaster Ceilings, Add</i>	181.95 18.20	26.69
26 51 13 00-0100 2' x 2', Parabolic, Lay-In/Troffer, Recessed Fluorescent Fixtures (26 51 13 00-0091)		
26 51 13 00-0101 EA 2 T8 Lamps, 2' x 2', Parabolic, Lay-In/Troffer, Recessed Fluorescent Fixture <i>For Drywall Or Plaster Ceilings, Add</i>	165.67 19.86	29.41
26 51 13 00-0102 EA 3 T8 Lamps, 2' x 2', Parabolic, Lay-In/Troffer, Recessed Fluorescent Fixture <i>For Drywall Or Plaster Ceilings, Add</i>	168.53 19.86	29.41
26 51 13 00-0103 EA 4 T8 Lamps, 2' x 2', Parabolic, Lay-In/Troffer, Recessed Fluorescent Fixture <i>For Drywall Or Plaster Ceilings, Add</i>	190.49 19.86	29.41
26 51 13 00-0104 2' x 4', Parabolic, Lay-In/Troffer, Recessed Fluorescent Fixtures (26 51 13 00-0091)		
26 51 13 00-0105 EA 2 T8 Lamps, 2' x 4', Parabolic, Lay-In/Troffer, Recessed Fluorescent Fixture <i>For Drywall Or Plaster Ceilings, Add</i>	160.52 23.17	34.27
26 51 13 00-0106 EA 3 T8 Lamps, 2' x 4', Parabolic, Lay-In/Troffer, Recessed Fluorescent Fixture <i>For Drywall Or Plaster Ceilings, Add</i>	184.32 23.17	34.27
26 51 13 00-0107 EA 4 T8 Lamps, 2' x 4', Parabolic, Lay-In/Troffer, Recessed Fluorescent Fixture <i>For Drywall Or Plaster Ceilings, Add</i>	206.98 23.17	34.27
26 51 13 00-0108 EA 6 T8 Lamps, 2' x 4', Parabolic, Lay-In/Troffer, Recessed Fluorescent Fixture <i>For Drywall Or Plaster Ceilings, Add</i>	233.05 23.17	34.27
26 51 13 00-0109 Direct-Indirect, Recessed Fluorescent Fixtures (26 51 13 00-0071)		
26 51 13 00-0110 1' x 4', Direct-Indirect, Recessed Fluorescent Fixtures (26 51 13 00-0109)		
26 51 13 00-0111 EA 1 T8 Lamp, 1' x 4', Direct-Indirect, Recessed Fluorescent Fixture <i>For Drywall Or Plaster Ceilings, Add</i>	281.19 18.20	26.69
26 51 13 00-0112 EA 2 T8 Lamps, 1' x 4', Direct-Indirect, Recessed Fluorescent Fixture <i>For Drywall Or Plaster Ceilings, Add</i>	284.51 18.20	26.69
26 51 13 00-0113 EA 1 T5 Lamp, 1' x 4', Direct-Indirect, Recessed Fluorescent Fixture <i>For Drywall Or Plaster Ceilings, Add</i>	331.75 18.20	26.69
26 51 13 00-0114 EA 2 T5 Lamps, 1' x 4', Direct-Indirect, Recessed Fluorescent Fixture <i>For Drywall Or Plaster Ceilings, Add</i>	339.68 18.20	26.69
26 51 13 00-0115 2' x 2', Direct-Indirect, Recessed Fluorescent Fixtures (26 51 13 00-0109)		
26 51 13 00-0116 EA 2 T8 Lamps, 2' x 2', Direct-Indirect, Recessed Fluorescent Fixture <i>For Drywall Or Plaster Ceilings, Add</i>	229.94 19.85	29.41
26 51 13 00-0117 EA 3 T8 Lamps, 2' x 2', Direct-Indirect, Recessed Fluorescent Fixture <i>For Drywall Or Plaster Ceilings, Add</i>	254.87 19.85	29.41
26 51 13 00-0118 EA 2 T5 Lamps, 2' x 2', Direct-Indirect, Recessed Fluorescent Fixture <i>For Drywall Or Plaster Ceilings, Add</i>	310.63 19.85	29.41
26 51 13 00-0119 2' x 4', Direct-Indirect, Recessed Fluorescent Fixtures (26 51 13 00-0109)		
26 51 13 00-0120 EA 2 T8 Lamps, 2' x 4', Direct-Indirect, Recessed Fluorescent Fixture <i>For Drywall Or Plaster Ceilings, Add</i>	258.63 23.17	34.27
26 51 13 00-0121 EA 3 T8 Lamps, 2' x 4', Direct-Indirect, Recessed Fluorescent Fixture <i>For Drywall Or Plaster Ceilings, Add</i>	314.40 23.17	34.27
26 51 13 00-0122 EA 1 T5 Lamp, 2' x 4', Direct-Indirect, Recessed Fluorescent Fixture <i>For Drywall Or Plaster Ceilings, Add</i>	331.81 23.17	34.27
26 51 13 00-0123 EA 2 T5 Lamps, 2' x 4', Direct-Indirect, Recessed Fluorescent Fixture <i>For Drywall Or Plaster Ceilings, Add</i>	364.85 23.17	34.27
26 51 13 00-0124 Volumetric, Recessed Fluorescent Fixtures (26 51 13 00-0071)		
26 51 13 00-0125 1' x 4', Volumetric, Recessed Fluorescent Fixtures (26 51 13 00-0124)		
26 51 13 00-0126 EA 2 T8 Lamps, 1' x 4', Volumetric, Recessed Fluorescent Fixture <i>For Drywall Or Plaster Ceilings, Add</i>	222.83 18.20	26.69
26 51 13 00-0127 EA 2 T5 Lamps, 1' x 4', Volumetric, Recessed Fluorescent Fixture <i>For Drywall Or Plaster Ceilings, Add</i>	288.83 18.20	26.69
26 51 13 00-0128 2' x 2', Volumetric, Recessed Fluorescent Fixtures (26 51 13 00-0124)		
26 51 13 00-0129 EA 2 T8 Lamps, 2' x 2', Volumetric, Recessed Fluorescent Fixture <i>For Drywall Or Plaster Ceilings, Add</i>	223.87 19.85	29.41
26 51 13 00-0130 EA 2 T5 Lamps, 2' x 2', Volumetric, Recessed Fluorescent Fixture <i>For Drywall Or Plaster Ceilings, Add</i>	253.38 19.85	29.41
26 51 13 00-0131 2' x 4', Volumetric, Recessed Fluorescent Fixtures (26 51 13 00-0124)		
26 51 13 00-0132 EA 2 T8 Lamps, 2' x 4', Volumetric, Recessed Fluorescent Fixture <i>For Drywall Or Plaster Ceilings, Add</i>	249.46 23.17	34.27
26 51 13 00-0133 EA 2 T5 Lamps, 2' x 4', Volumetric, Recessed Fluorescent Fixture <i>For Drywall Or Plaster Ceilings, Add</i>	249.95 23.17	34.27
26 51 13 00-0134 Wet Location, Lensed, Lay-In/Troffer, Recessed Fluorescent Fixtures (26 51 13 00-0071)		



Electrical	26	26
Lighting	26 50	
Interior Lighting	26 51	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 51 13 00-0135 1' x 4', Wet Location, Lensed, Lay-In/Troffer, Recessed Fluorescent Fixtures <small>(26 51 13 00-0134)</small>		
26 51 13 00-0136 EA 2 T8 Lamps, 1' x 4', Wet Location, Lensed, Lay-In/Troffer, Recessed Fluorescent Fixture <i>For Drywall Or Plaster Ceilings, Add</i>	211.19 18.20	26.69
26 51 13 00-0137 2' x 2', Wet Location, Lensed, Lay-In/Troffer, Recessed Fluorescent Fixtures <small>(26 51 13 00-0134)</small>		
26 51 13 00-0138 EA 2 T8 Lamps, 2' x 2', Wet Location, Lensed, Lay-In/Troffer, Recessed Fluorescent Fixture <i>For Drywall Or Plaster Ceilings, Add</i>	204.64 19.85	29.41
26 51 13 00-0139 2' x 4', Wet Location, Lensed, Lay-In/Troffer, Recessed Fluorescent Fixtures <small>(26 51 13 00-0134)</small>		
26 51 13 00-0140 EA 2 T8 Lamps, 2' x 4', Wet Location, Lensed, Lay-In/Troffer, Recessed Fluorescent Fixture <i>For Drywall Or Plaster Ceilings, Add</i>	246.15 23.17	34.27
26 51 13 00-0141 EA 3 T8 Lamps, 2' x 4', Wet Location, Lensed, Lay-In/Troffer, Recessed Fluorescent Fixture <i>For Drywall Or Plaster Ceilings, Add</i>	316.74 23.17	34.27
26 51 13 00-0142 EA 4 T8 Lamps, 2' x 4', Wet Location, Lensed, Lay-In/Troffer, Recessed Fluorescent Fixture <i>For Drywall Or Plaster Ceilings, Add</i>	280.88 23.17	34.27
26 51 13 00-0143 Vandal Resistant, Lensed, Lay-In/Troffer, Recessed Fluorescent Fixtures <small>(26 51 13 00-0071)</small>		
26 51 13 00-0144 1' x 4', Vandal Resistant, Lensed, Lay-In/Troffer, Recessed Fluorescent Fixtures <small>(26 51 13 00-0143)</small>		
26 51 13 00-0145 EA 2 T8 Lamps, 1' x 4', Vandal Resistant, Lensed, Lay-In/Troffer, Recessed Fluorescent Fixture <i>For Drywall Or Plaster Ceilings, Add</i>	202.23 18.20	26.69
26 51 13 00-0146 2' x 2', Vandal Resistant, Lensed, Lay-In/Troffer, Recessed Fluorescent Fixtures <small>(26 51 13 00-0143)</small>		
26 51 13 00-0147 EA 2 T8 Lamps, 2' x 2', Vandal Resistant, Lensed, Lay-In/Troffer, Recessed Fluorescent Fixture <i>For Drywall Or Plaster Ceilings, Add</i>	204.42 19.85	29.41
26 51 13 00-0148 2' x 4', Vandal Resistant, Lensed, Lay-In/Troffer, Recessed Fluorescent Fixtures <small>(26 51 13 00-0143)</small>		
26 51 13 00-0149 EA 2 T8 Lamps, 2' x 4', Vandal Resistant, Lensed, Lay-In/Troffer, Recessed Fluorescent Fixture <i>For Drywall Or Plaster Ceilings, Add</i>	251.18 23.17	34.27
26 51 13 00-0150 EA 3 T8 Lamps, 2' x 4', Vandal Resistant, Lensed, Lay-In/Troffer, Recessed Fluorescent Fixture <i>For Drywall Or Plaster Ceilings, Add</i>	256.25 23.17	34.27
26 51 13 00-0151 EA 4 T8 Lamps, 2' x 4', Vandal Resistant, Lensed, Lay-In/Troffer, Recessed Fluorescent Fixture <i>For Drywall Or Plaster Ceilings, Add</i>	263.27 23.17	34.27
26 51 13 00-0152 Striplight Fluorescent Fixtures <small>(26 51 13 00-0034)</small>		
26 51 13 00-0153 1 Lamp Cross Section, Striplight Fluorescent Fixtures <small>(26 51 13 00-0152)</small>		
26 51 13 00-0154 EA 1 T8 Lamp, 1-1/2' Length, Striplight Fluorescent Fixture	94.29	22.06
26 51 13 00-0155 EA 1 T8 Lamp, 2' Length, Striplight Fluorescent Fixture.....	112.12	22.06
26 51 13 00-0156 EA 1 T8 Lamp, 3' Length, Striplight Fluorescent Fixture.....	112.46	24.48
26 51 13 00-0157 EA 1 T8 Lamp, 4' Length, Striplight Fluorescent Fixture.....	116.06	26.91
26 51 13 00-0158 EA 1 T8 Lamp, 8' Length, Striplight Fluorescent Fixture.....	137.80	29.12
26 51 13 00-0159 2 Lamp Cross Section, Striplight Fluorescent Fixtures <small>(26 51 13 00-0152)</small>		
26 51 13 00-0160 EA 2 T8 Lamps, 2' Length, Striplight Fluorescent Fixture.....	114.77	24.48
26 51 13 00-0161 EA 2 T8 Lamps, 3' Length, Striplight Fluorescent Fixture.....	119.53	26.91
26 51 13 00-0162 EA 2 T8 Lamps, 4' Length, Striplight Fluorescent Fixture.....	123.05	29.41
26 51 13 00-0163 3 Lamp Cross Section, Striplight Fluorescent Fixtures <small>(26 51 13 00-0152)</small>		
26 51 13 00-0164 EA 3 T8 Lamps, 2' Length, Striplight Fluorescent Fixture.....	159.39	24.48
26 51 13 00-0165 EA 3 T8 Lamps, 3' Length, Striplight Fluorescent Fixture.....	156.93	26.91
26 51 13 00-0166 EA 3 T8 Lamps, 4' Length, Striplight Fluorescent Fixture.....	160.38	29.41
26 51 13 00-0167 Display Case Fluorescent Fixtures <small>(26 51 13 00-0152)</small>		
26 51 13 00-0168 EA 1 T8 Lamp, 1-1/2' Length, Undercabinet/Display Case Fluorescent Fixture (Lightolier TCU15W)	72.82	24.13
26 51 13 00-0169 EA 1 T8 Lamp, 2' Length, Undercabinet/Display Case Fluorescent Fixture (Lightolier TCU20W).....	90.21	24.13
26 51 13 00-0170 EA 1 T8 Lamp, 3' Length, Undercabinet/Display Case Fluorescent Fixture (Lightolier TCU30W).....	97.90	28.15
26 51 13 00-0171 EA 1 T8 Lamp, 4' Length, Undercabinet/Display Case Fluorescent Fixture (Lightolier TCU40W).....	100.21	28.15
26 51 13 00-0172 Industrial Fluorescent Fixtures <small>(26 51 13 00-0034)</small>		
26 51 13 00-0173 1 Lamp Cross Section, Industrial Fluorescent Fixtures <small>(26 51 13 00-0172)</small>		

26	Electrical
26 50	Lighting
26 51	Interior Lighting



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 51	13 00-0174	EA	1 T8 Lamp, 2' Length, Industrial Fluorescent Fixture	128.64	22.06
26 51	13 00-0175	EA	1 T8 Lamp, 4' Length, Industrial Fluorescent Fixture	138.36	26.91
26 51	13 00-0176	EA	1 T8 Lamp, 8' Length, Industrial Fluorescent Fixture	242.12	34.27
26 51	13 00-0177		2 Lamp Cross Section, Industrial Fluorescent Fixtures (26 51 13 00-0172)		
26 51	13 00-0178	EA	2 T8 Lamps, 2' Length, Industrial Fluorescent Fixture	135.17	24.48
26 51	13 00-0179	EA	2 T8 Lamps, 4' Length, Industrial Fluorescent Fixture	145.35	29.41
26 51	13 00-0180	EA	2 T8 Lamps, 8' Length, Industrial Fluorescent Fixture	248.75	34.27
26 51	13 00-0181		3 Lamp Cross Section, Industrial Fluorescent Fixtures (26 51 13 00-0172)		
26 51	13 00-0182	EA	3 T8 Lamps, 2' Length, Industrial Fluorescent Fixture	140.93	24.48
26 51	13 00-0183	EA	3 T8 Lamps, 4' Length, Industrial Fluorescent Fixture	150.86	29.41
26 51	13 00-0184	EA	3 T8 Lamps, 8' Length, Industrial Fluorescent Fixture	222.36	34.27
26 51	13 00-0185		4 Lamp Cross Section, Industrial Fluorescent Fixtures (26 51 13 00-0172)		
26 51	13 00-0186	EA	4 T8 Lamps, 4' Length, Industrial Fluorescent Fixture	198.76	29.41
26 51	13 00-0187	EA	4 T8 Lamps, 8' Length, Industrial Fluorescent Fixture	287.28	34.27
26 51	13 00-0188		Flanged Fluorescent Fixture (26 51 13 00-0034)		
			Note: For plaster or drywall application. With electronic ballast.		
26 51	13 00-0189	EA	2 T8 Lamps, 2' x 4', Prismatic Lensed, Flanged Fluorescent Fixture	196.59	44.12
26 51	13 00-0190	EA	3 T8 Lamps, 2' x 4', Prismatic Lensed, Flanged Fluorescent Fixture	229.05	44.12
26 51	13 00-0191	EA	4 T8 Lamps, 2' x 4', Prismatic Lensed, Flanged Fluorescent Fixture	232.37	44.12
26 51	13 00-0192		Undercabinet Fluorescent Fixtures (26 51 13 00-0034)		
26 51	13 00-0193	EA	1 T5 Lamp, 12-3/16" Length, Slimline Undercabinet Fluorescent Fixture	73.50	19.85
26 51	13 00-0194	EA	1 T5 Lamp, 21-3/16" Length, Slimline Undercabinet Fluorescent Fixture	86.45	24.26
26 51	13 00-0195	EA	2 T5 Lamps, 24-7/16" Length, Slimline Undercabinet Fluorescent Fixture	85.35	24.26
26 51	13 00-0196	EA	1 T5 Lamp, 33-7/16" Length, Slimline Undercabinet Fluorescent Fixture	100.96	26.47
26 51	13 00-0197	EA	2 T5 Lamps, 42-7/16" Length, Slimline Undercabinet Fluorescent Fixture	117.46	30.88
26 51	13 00-0198		Corner Mounted, Fluorescent Fixtures (26 51 13 00-0034)		
			Note: Includes acrylic drop dish diffuser.		
26 51	13 00-0199		2' Length, Corner Mounted, Fluorescent Fixtures (26 51 13 00-0198)		
26 51	13 00-0200	EA	1 T8 Lamp, 2' Length, Corner Mounted, Fluorescent Fixture	127.54	22.06
26 51	13 00-0201	EA	2 T8 Lamps, 2' Length, Corner Mounted, Fluorescent Fixture	141.38	22.06
26 51	13 00-0202		3' Length, Corner Mounted, Fluorescent Fixtures (26 51 13 00-0198)		
26 51	13 00-0203	EA	1 T8 Lamp, 3' Length, Corner Mounted, Fluorescent Fixture	144.66	23.16
26 51	13 00-0204	EA	2 T8 Lamps, 3' Length, Corner Mounted, Fluorescent Fixture	157.94	23.16
26 51	13 00-0205		4' Length, Corner Mounted, Fluorescent Fixtures (26 51 13 00-0198)		
26 51	13 00-0206	EA	1 T8 Lamp, 4' Length, Corner Mounted, Fluorescent Fixture	143.14	24.26
26 51	13 00-0207	EA	2 T8 Lamps, 4' Length, Corner Mounted, Fluorescent Fixture	156.85	24.26
26 51	13 00-0208		Wall Bracket, Fluorescent Fixtures (26 51 13 00-0034)		
26 51	13 00-0209		Wall Bracket, Fluorescent Fixtures (Lithonia W) (26 51 13 00-0208)		
			Note: Includes extruded aluminum housing with brushed finish, acrylic diffuser and solid-state electronic ballast.		
26 51	13 00-0210		2' Length, Wall Bracket, Fluorescent Fixtures (Lithonia W) (26 51 13 00-0209)		
26 51	13 00-0211	EA	1 T8 Lamp, 2' Length, Wall Bracket, Fluorescent Fixture (Lithonia W)	213.99	37.00
26 51	13 00-0212	EA	2 T8 Lamps, 2' Length, Wall Bracket, Fluorescent Fixture (Lithonia W)	216.42	37.00
26 51	13 00-0213		3' Length, Wall Bracket, Fluorescent Fixtures (Lithonia W) (26 51 13 00-0209)		
26 51	13 00-0214	EA	1 T8 Lamp, 3' Length, Wall Bracket, Fluorescent Fixture (Lithonia W)	295.94	37.00
26 51	13 00-0215	EA	2 T8 Lamps, 3' Length, Wall Bracket, Fluorescent Fixture (Lithonia W)	299.33	37.00
26 51	13 00-0216		4' Length, Wall Bracket, Fluorescent Fixtures (Lithonia W) (26 51 13 00-0209)		
26 51	13 00-0217	EA	1 T8 Lamp, 4' Length, Wall Bracket, Fluorescent Fixture (Lithonia W)	309.99	37.00
26 51	13 00-0218	EA	2 T8 Lamps, 4' Length, Wall Bracket, Fluorescent Fixture (Lithonia W)	312.42	37.00
26 51	13 00-0219		Wall Bracket, Fluorescent Fixtures (Lithonia WP) (26 51 13 00-0208)		
			Note: Includes 20 gauge steel housing with baked finish, acrylic diffuser and solid-state electronic ballast.		
26 51	13 00-0220		2' Length, Wall Bracket, Fluorescent Fixtures (Lithonia WP) (26 51 13 00-0219)		
26 51	13 00-0221	EA	1 T8 Lamp, 2' Length, Wall Bracket, Fluorescent Fixture (Lithonia WP)	333.02	37.00
26 51	13 00-0222	EA	2 T8 Lamps, 2' Length, Wall Bracket, Fluorescent Fixture (Lithonia WP)	335.45	37.00



Electrical	26	26
Lighting	26 50	
Interior Lighting	26 51	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 51 13 00-0223 3' Length, Wall Bracket, Fluorescent Fixtures (Lithonia WP) <small>(26 51 13 00-0219)</small>		
26 51 13 00-0224 EA 1 T8 Lamp, 3' Length, Wall Bracket, Fluorescent Fixture (Lithonia WP).....	284.38	37.00
26 51 13 00-0225 EA 2 T8 Lamps, 3' Length, Wall Bracket, Fluorescent Fixture (Lithonia WP).....	287.77	37.00
26 51 13 00-0226 4' Length, Wall Bracket, Fluorescent Fixtures (Lithonia WP) <small>(26 51 13 00-0219)</small>		
26 51 13 00-0227 EA 1 T8 Lamp, 4' Length, Wall Bracket, Fluorescent Fixture (Lithonia WP).....	301.50	37.00
26 51 13 00-0228 EA 2 T8 Lamps, 4' Length, Wall Bracket, Fluorescent Fixture (Lithonia WP).....	303.93	37.00
26 51 13 00-0229 Wall Bracket, Fluorescent Fixtures (Lithonia WC) <small>(26 51 13 00-0208)</small>		
Note: Includes 20 gauge steel housing with baked finish, acrylic diffuser and solid-state electronic ballast.		
26 51 13 00-0230 2' Length, Wall Bracket, Fluorescent Fixtures (Lithonia WC) <small>(26 51 13 00-0229)</small>		
26 51 13 00-0231 EA 1 T8 Lamp, 2' Length, Wall Bracket, Fluorescent Fixture (Lithonia WC).....	202.07	37.00
26 51 13 00-0232 EA 2 T8 Lamps, 2' Length, Wall Bracket, Fluorescent Fixture (Lithonia WC).....	204.49	37.00
26 51 13 00-0233 3' Length, Wall Bracket, Fluorescent Fixtures (Lithonia WC) <small>(26 51 13 00-0229)</small>		
26 51 13 00-0234 EA 1 T8 Lamp, 3' Length, Wall Bracket, Fluorescent Fixture (Lithonia WC).....	203.03	37.00
26 51 13 00-0235 EA 2 T8 Lamps, 3' Length, Wall Bracket, Fluorescent Fixture (Lithonia WC).....	206.42	37.00
26 51 13 00-0236 4' Length, Wall Bracket, Fluorescent Fixtures (Lithonia WC) <small>(26 51 13 00-0229)</small>		
26 51 13 00-0237 EA 1 T8 Lamp, 4' Length, Wall Bracket, Fluorescent Fixture (Lithonia WC).....	192.93	37.00
26 51 13 00-0238 EA 2 T8 Lamps, 4' Length, Wall Bracket, Fluorescent Fixture (Lithonia WC).....	195.36	37.00
26 51 13 00-0239 Low Occupancy, Industrial Fluorescent Fixtures <small>(26 51 13 00-0034)</small>		
26 51 13 00-0240 EA 1 T8 Lamp, 4' Length, Bi-Level Illumination, Industrial Fluorescent Fixture With Integral Occupancy Sensor (Deco SMART™ DSBL-CP).....	288.91	26.91
26 51 13 00-0241 EA 2 T8 Lamps, 4' Length, Bi-Level Illumination, Industrial Fluorescent Fixture With Integral Occupancy Sensor (Deco SMART™ DSBL-CP).....	292.58	29.41
26 51 13 00-0242 Accessories And Modifiers For Fluorescent Fixtures <small>(26 51 13 00-0034)</small>		
26 51 13 00-0243 Lens Modifications <small>(26 51 13 00-0242)</small>		
26 51 13 00-0244 EA For 1' x 2' Drop Dish Diffuser Instead Of Prismatic Lens, Add.....	18.77	
26 51 13 00-0245 EA For 1' x 4' Drop Dish Diffuser Instead Of Prismatic Lens, Add.....	23.19	
26 51 13 00-0246 EA For 2' x 2' Drop Dish Diffuser Instead Of Prismatic Lens, Add.....	24.29	
26 51 13 00-0247 EA For 2' x 4' Drop Dish Diffuser Instead Of Prismatic Lens, Add.....	26.50	
26 51 13 00-0248 EA For 4' x 4' Drop Dish Diffuser Instead Of Prismatic Lens, Add.....	32.02	
26 51 13 00-0249 EA For 1' x 2' Egg Crate/Cube Louvers Instead Of Prismatic Lens, Add.....	7.73	
26 51 13 00-0250 EA For 1' x 4' Egg Crate/Cube Louvers Instead Of Prismatic Lens, Add.....	11.04	
26 51 13 00-0251 EA For 2' x 2' Egg Crate/Cube Louvers Instead Of Prismatic Lens, Add.....	12.15	
26 51 13 00-0252 EA For 2' x 4' Egg Crate/Cube Louvers Instead Of Prismatic Lens, Add.....	14.35	
26 51 13 00-0253 Pendant Mounting Modifications <small>(26 51 13 00-0242)</small>		
Note: Per pendant. Use demolition cost for associated light fixture for demolition of pendant mounted light fixture assembly.		
26 51 13 00-0254 EA For Pendant Mounting Up to 1'-6" Long Section.....	8.39	
Note: Per pendant.		
26 51 13 00-0255 EA For Pendant Mounting 2' Long Section.....	9.72	
Note: Per pendant.		
26 51 13 00-0256 EA For Pendant Mounting 3' Long Section.....	12.43	
Note: Per pendant.		
26 51 13 00-0257 EA For Pendant Mounting 4' Long Section.....	14.69	
Note: Per pendant.		
26 51 13 00-0258 EA For Pendant Mounting 6' Long Section.....	18.55	
Note: Per pendant.		
26 51 13 00-0259 EA For Pendant Mounting 8' Long Section.....	25.18	
Note: Per pendant.		
26 51 13 00-0260 Fluorescent Light Accessories <small>(26 51 13 00-0242)</small>		
26 51 13 00-0261 EA Blank Metal Light Box Plate.....	14.01	
26 51 13 00-0262 EA Factory Installed Fixture Mounted Occupancy Sensor.....	85.02	
26 51 13 00-0263 Wire Guards <small>(26 51 13 00-0242)</small>		
26 51 13 00-0264 EA Wire Guard for 6" x 2' Fixture.....	37.57	4.03
26 51 13 00-0265 EA Wire Guard for 6" x 4' Fixture.....	53.04	6.45
26 51 13 00-0266 EA Wire Guard for 1" x 2' Fixture.....	41.93	4.43
26 51 13 00-0267 EA Wire Guard for 1" x 4' Fixture.....	59.74	6.85
26 51 13 00-0268 EA Wire Guard for 2" x 2' Fixture.....	51.00	4.83
26 51 13 00-0269 EA Wire Guard for 2" x 4' Fixture.....	70.00	7.25
26 51 13 00-0270 EA Wire Guard for Exit Sign Or Emergency Light.....	41.61	6.04

26	Electrical
26 50	Lighting
26 51	Interior Lighting



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 51 13 00-0271 EA Wire Guard for Combination Exit Sign And Emergency Light.....	70.57	6.45
26 51 13 00-0272 LED Fixtures (26 51 13)		
26 51 13 00-0273 Undercabinet LED Fixtures (26 51 13 00-0272)		
26 51 13 00-0274 EA 12" Length, Undercabinet/Modular General Purpose LED Fixture (Lithonia RAZ12-M6)	112.31	19.85
26 51 13 00-0275 EA 18" Length, Undercabinet/Modular General Purpose LED Fixture (Lithonia RAZ18-M6)	143.30	24.26
26 51 13 00-0276 EA 24" Length, Undercabinet/Modular General Purpose LED Fixture (Lithonia RAZ24-M6)	161.29	24.26
26 51 13 00-0277 Striplight LED Fixtures (26 51 13 00-0272)		
26 51 13 00-0278 Striplight LED Fixtures (26 51 13 00-0277)		
26 51 13 00-0279 EA 2' Length, 3,000 Lumens, LED Striplight Fluorescent Fixture (Lithonia ZL1)	227.78	22.06
26 51 13 00-0280 EA 4' Length, 2,800 Lumens, LED Striplight Fluorescent Fixture (Lithonia ZL1)	235.14	26.91
26 51 13 00-0281 EA 2' Length, 1,400 Lumens, Lensed LED Striplight Fluorescent Fixture (Lithonia ZL2)	224.39	22.06
26 51 13 00-0282 EA 4' Length, 2,300 Lumens, Lensed LED Striplight Fluorescent Fixture (Lithonia ZL2)	231.75	26.91
26 51 13 00-0283 EA 4' Length, 4,600 Lumens, Lensed LED Striplight Fluorescent Fixture (Lithonia ZL2)	299.38	26.91
26 51 13 00-0284 Lay-In/Troffer LED Fixtures (26 51 13 00-0272)		
26 51 13 00-0285 Prismatic Lensed, Lay-In/Troffer LED Fixtures (26 51 13 00-0284)		
26 51 13 00-0286 Prismatic Lensed, Lay-In/Troffer LED Fixtures (Lithonia) (26 51 13 00-0285)		
26 51 13 00-0287 EA 4,300 Lumens, 1' x 4', Prismatic Lensed, Lay-In/Troffer LED Fixture (Lithonia TL4)	398.41	34.27
For Drywall Or Plaster Ceilings, Add	23.17	
26 51 13 00-0288 EA 3,300 Lumens, 2' x 2', Prismatic Lensed, Lay-In/Troffer LED Fixture (Lithonia 2TL2)	315.96	29.41
For Drywall Or Plaster Ceilings, Add	19.85	
26 51 13 00-0289 EA 4,600 Lumens, 2' x 4', Prismatic Lensed, Lay-In/Troffer LED Fixture (Lithonia 2TL4)	382.95	34.27
For Drywall Or Plaster Ceilings, Add	23.17	
26 51 13 00-0290 Prismatic Lensed, Lay-In/Troffer LED Fixtures (Lunera) (26 51 13 00-0285)		
26 51 13 00-0291 EA 3,200 Lumens, 1' x 4', Prismatic Lensed, Lay-In/Troffer LED Fixture (Lunera® 14G4)	445.78	34.27
26 51 13 00-0292 EA 3,200 Lumens, 2' x 2', Prismatic Lensed, Lay-In/Troffer LED Fixture (Lunera® 22G5)	308.61	29.41
26 51 13 00-0293 EA 4,175 Lumens, 2' x 4', Prismatic Lensed, Lay-In/Troffer LED Fixture (Lunera® 24G4)	401.38	34.27
26 51 13 00-0294 Prismatic Lensed, Lay-In/Troffer LED Fixtures (PlanLED) (26 51 13 00-0285)		
26 51 13 00-0295 EA 2,591 Lumens, 2' x 2', Prismatic Lensed, Lay-In/Troffer LED Fixture (PlanLED FTB4E)	189.02	29.41
26 51 13 00-0296 EA 3,883 Lumens, 2' x 2', Prismatic Lensed, Lay-In/Troffer LED Fixture (PlanLED FTB4E)	210.02	29.41
26 51 13 00-0297 EA 3,700 Lumens, 2' x 2', Prismatic Lensed, Lay-In/Troffer LED Fixture (PlanLED BL220-40)	197.42	29.41
26 51 13 00-0298 EA 4,200 Lumens, 2' x 2', Prismatic Lensed, Lay-In/Troffer LED Fixture (PlanLED BL220-45)	205.12	29.41
26 51 13 00-0299 EA 4,600 Lumens, 2' x 2', Prismatic Lensed, Lay-In/Troffer LED Fixture (PlanLED BL220-50)	208.97	29.41
26 51 13 00-0300 Volumetric, Lay-In/Troffer LED Fixtures (26 51 13 00-0284)		
26 51 13 00-0301 Volumetric, Lay-In/Troffer LED Fixtures (Lithonia) (26 51 13 00-0300)		
26 51 13 00-0302 EA 2,500 Lumens, 1' x 4', Volumetric, Lay-In/Troffer LED Fixture (Lithonia RTL4)	390.55	26.69
For Drywall Or Plaster Ceilings, Add	18.20	
26 51 13 00-0303 EA 2,400 Lumens, 2' x 2', Volumetric, Lay-In/Troffer LED Fixture (Lithonia 2RTL2)	338.55	29.41
For Drywall Or Plaster Ceilings, Add	19.85	
26 51 13 00-0304 EA 3,300 Lumens, 2' x 2', Volumetric, Lay-In/Troffer LED Fixture (Lithonia 2RTL2)	345.65	29.41
For Drywall Or Plaster Ceilings, Add	19.85	
26 51 13 00-0305 EA 4,000 Lumens, 2' x 4', Volumetric, Lay-In/Troffer LED Fixture (Lithonia 2RTL4)	377.30	34.27
For Drywall Or Plaster Ceilings, Add	23.17	
26 51 13 00-0306 EA 4,800 Lumens, 2' x 4', Volumetric, Lay-In/Troffer LED Fixture (Lithonia 2RTL4)	401.58	34.27
For Drywall Or Plaster Ceilings, Add	23.17	
26 51 13 00-0307 EA 2,400 Lumens, 2' x 4', Volumetric, Lay-In/Troffer LED Fixture (Lithonia 2VTL4)	319.08	34.27
For Drywall Or Plaster Ceilings, Add	23.17	
26 51 13 00-0308 EA 4,000 Lumens, 2' x 4', Volumetric, Lay-In/Troffer LED Fixture (Lithonia 2VTL4)	319.08	34.27
For Drywall Or Plaster Ceilings, Add	23.17	
26 51 13 00-0309 Architectural, Lay-In/Troffer LED Fixtures (26 51 13 00-0284)		
26 51 13 00-0310 Architectural, Lay-In/Troffer LED Fixtures (Lithonia) (26 51 13 00-0309)		
Note: Includes 4,000K color temperature, 120/277 voltage and steel housing assembly. Excludes sensors.		
26 51 13 00-0311 EA 2,100 Lumens, 1' x 4', Architectural, Lay-In/Troffer LED Fixture (Lithonia ALL4)	358.38	34.27
For Drywall Or Plaster Ceilings, Add	23.17	
26 51 13 00-0312 EA 4,300 Lumens, 1' x 4', Architectural, Lay-In/Troffer LED Fixture (Lithonia ALL4)	427.40	34.27
For Drywall Or Plaster Ceilings, Add	23.17	
26 51 13 00-0313 EA 6,400 Lumens, 1' x 4', Architectural, Lay-In/Troffer LED Fixture (Lithonia ALL4)	489.52	34.27
For Drywall Or Plaster Ceilings, Add	23.17	
26 51 13 00-0314 Architectural, Lay-In/Troffer LED Fixtures (CREE®) (26 51 13 00-0309)		
Note: Includes 3,000K, 3,500 or 4,000K color temperature, 120/277 voltage and 20 gauge steel housing assembly. Excludes sensors.		



Electrical	26	26
Lighting	26 50	
Interior Lighting	26 51	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 51 13 00-0315 EA 2,200 Lumens, 1' x 4', Architectural, Lay-In/Troffer LED Fixture (Cree® CR14™) <i>For Expanded Size Junction Box For Through Wiring, Add</i> <i>For Drywall Or Plaster Ceilings, Add</i> <i>For Surface Mount, Add</i>	350.90 3.29 96.17 167.88	34.27
26 51 13 00-0316 EA 3,100 Lumens, 1' x 4', Architectural, Lay-In/Troffer LED Fixture (Cree® CR14™) <i>For Expanded Size Junction Box For Through Wiring, Add</i> <i>For Drywall Or Plaster Ceilings, Add</i> <i>For Surface Mount, Add</i>	357.96 3.29 96.17 167.88	34.27
26 51 13 00-0317 EA 4,000 Lumens, 1' x 4', Architectural, Lay-In/Troffer LED Fixture (Cree® CR14™) <i>For Expanded Size Junction Box For Through Wiring, Add</i> <i>For Drywall Or Plaster Ceilings, Add</i> <i>For Surface Mount, Add</i>	357.96 3.29 96.17 167.88	34.27
26 51 13 00-0318 EA 5,000 Lumens, 1' x 4', Architectural, Lay-In/Troffer LED Fixture (Cree® CR14™) <i>For Expanded Size Junction Box For Through Wiring, Add</i> <i>For Drywall Or Plaster Ceilings, Add</i> <i>For Surface Mount, Add</i>	401.47 3.29 96.17 167.88	34.27
26 51 13 00-0319 EA 2,000 Lumens, 2' x 2', Architectural, Lay-In/Troffer LED Fixture (Cree® CR22™) <i>For Expanded Size Junction Box For Through Wiring, Add</i> <i>For Drywall Or Plaster Ceilings, Add</i> <i>For Surface Mount, Add</i>	289.45 3.29 84.10 158.17	29.41
26 51 13 00-0320 EA 3,200 Lumens, 2' x 2', Architectural, Lay-In/Troffer LED Fixture (Cree® CR22™) <i>For Expanded Size Junction Box For Through Wiring, Add</i> <i>For Drywall Or Plaster Ceilings, Add</i> <i>For Surface Mount, Add</i>	307.09 3.29 84.10 158.17	29.41
26 51 13 00-0321 EA 3,200 Lumens, 2' x 2', Architectural, Lay-In/Troffer LED Fixture (CREE® AR22™) <i>For Expanded Size Junction Box For Through Wiring, Add</i> <i>For Drywall Or Plaster Ceilings, Add</i> <i>For Surface Mount, Add</i>	278.86 3.29 84.10 158.17	29.41
26 51 13 00-0322 EA 3,200 Lumens, 2' x 2', Architectural, Lay-In/Troffer LED Fixture With Step Dimming (CREE® AR22™)..... <i>For Expanded Size Junction Box For Through Wiring, Add</i> <i>For Drywall Or Plaster Ceilings, Add</i> <i>For Surface Mount, Add</i>	307.09 3.29 84.10 158.17	29.41
26 51 13 00-0323 EA 2,200 Lumens, 2' x 4', Architectural, Lay-In/Troffer LED Fixture (Cree® CR24™) <i>For Expanded Size Junction Box For Through Wiring, Add</i> <i>For Drywall Or Plaster Ceilings, Add</i> <i>For Surface Mount, Add</i>	350.90 3.29 98.52 183.17	34.27
26 51 13 00-0324 EA 3,100 Lumens, 2' x 4', Architectural, Lay-In/Troffer LED Fixture (Cree® CR24™) <i>For Expanded Size Junction Box For Through Wiring, Add</i> <i>For Drywall Or Plaster Ceilings, Add</i> <i>For Surface Mount, Add</i>	357.96 3.29 98.52 183.17	34.27
26 51 13 00-0325 EA 4,000 Lumens, 2' x 4', Architectural, Lay-In/Troffer LED Fixture (Cree® CR24™) <i>For Expanded Size Junction Box For Through Wiring, Add</i> <i>For Drywall Or Plaster Ceilings, Add</i> <i>For Surface Mount, Add</i>	357.96 3.29 98.52 183.17	34.27
26 51 13 00-0326 EA 4,000 Lumens, High Efficiency, 2' x 4', Architectural, Lay-In/Troffer LED Fixture (CREE® CR24™)..... <i>For Expanded Size Junction Box For Through Wiring, Add</i> <i>For Drywall Or Plaster Ceilings, Add</i> <i>For Surface Mount, Add</i>	444.62 3.29 98.52 183.17	34.27
26 51 13 00-0327 EA 5,000 Lumens, 2' x 4', Architectural, Lay-In/Troffer LED Fixture (Cree® CR24™) <i>For Expanded Size Junction Box For Through Wiring, Add</i> <i>For Drywall Or Plaster Ceilings, Add</i> <i>For Surface Mount, Add</i>	401.47 3.29 98.52 183.17	34.27
26 51 13 00-0328 EA 4,000 Lumens, 2' x 4', Architectural, Lay-In/Troffer LED Fixture (CREE® AR24™) <i>For Expanded Size Junction Box For Through Wiring, Add</i> <i>For Drywall Or Plaster Ceilings, Add</i> <i>For Surface Mount, Add</i>	323.86 3.29 98.52 183.17	34.27
26 51 13 00-0329 EA 4,000 Lumens, 2' x 4', Architectural, Lay-In/Troffer LED Fixture With Step Dimming (CREE® AR24™)..... <i>For Expanded Size Junction Box For Through Wiring, Add</i> <i>For Drywall Or Plaster Ceilings, Add</i> <i>For Surface Mount, Add</i>	350.90 3.29 98.52 183.17	34.27
26 51 13 00-0330 Architectural, Lay-In/Troffer LED Fixtures (Metalux®) <small>(26 51 13 00-0309)</small> Note: Includes 3,000K, 3,500 or 4,000K color temperature, 120/277 voltage and code gauge steel housing assembly. Excludes sensors.		
26 51 13 00-0331 EA 2,500 Lumens, 2' x 2', Architectural, Lay-In/Troffer LED Fixture (Metalux® Accord™ 2AC).....	265.24	29.41
26 51 13 00-0332 EA 4,700 Lumens, 2' x 4', Architectural, Lay-In/Troffer LED Fixture (Metalux® Accord™ 2AC).....	356.04	34.27
26 51 13 00-0333 Shadow Box Style, Lay-In/Troffer LED Fixtures <small>(26 51 13 00-0284)</small>		
26 51 13 00-0334 Shadow Box Style, Lay-In/Troffer LED Fixtures (Lithonia SBSL) <small>(26 51 13 00-0333)</small>		
26 51 13 00-0335 EA 3,300 Lumens, 2' x 2', Shadow Box Style, Lay-In/Troffer LED Fixture (Lithonia 2SBSL2)..... <i>For Drywall Or Plaster Ceilings, Add</i>	323.05 19.85	29.41
26 51 13 00-0336 EA 4,600 Lumens, 2' x 4', Shadow Box Style, Lay-In/Troffer LED Fixture (Lithonia 2SBSL4)..... <i>For Drywall Or Plaster Ceilings, Add</i>	439.61 23.17	34.27
26 51 13 00-0337 Panel Type, Lay-In/Troffer LED Fixtures <small>(26 51 13 00-0284)</small>		
26 51 13 00-0338 Panel Type, Lay-In/Troffer LED Fixtures (PlanLED Galaxy) <small>(26 51 13 00-0337)</small>		
26 51 13 00-0339 EA 3,100 Lumens, 1' x 4', Panel Type, Lay-In/Troffer LED Fixture (PlanLED Galaxy GL140-34)	226.83	34.27
26 51 13 00-0340 EA 3,100 Lumens, 2' x 2', Panel Type, Lay-In/Troffer LED Fixture (PlanLED Galaxy GL220-34)	227.87	29.41
26 51 13 00-0341 EA 4,000 Lumens, 2' x 4', Panel Type, Lay-In/Troffer LED Fixture (PlanLED Galaxy GL240-40)	290.88	34.27
26 51 13 00-0342 EA 5,000 Lumens, 2' x 4', Panel Type, Lay-In/Troffer LED Fixture (PlanLED Galaxy GL240-52)	290.88	34.27



MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
26 51 13 00-0343		Surface Mount LED Fixtures <small>(26 51 13 00-0272)</small>			
26 51 13 00-0344		Surface Mount, Volumetric LED Fixtures <small>(26 51 13 00-0343)</small>			
26 51 13 00-0345	EA	2' Length, 2,200 Lumens, Surface Mount, Volumetric LED Fixture (Lithonia STL2)	319.29		22.06
26 51 13 00-0346	EA	4' Length, 4,000 Lumens, Surface Mount, Volumetric LED Fixture (Lithonia STL4)	364.19		26.91
26 51 13 00-0347		Surface Mount, Wraparound LED Fixtures <small>(26 51 13 00-0343)</small>			
26 51 13 00-0348	EA	2' Length, 3,500 Lumens, Surface Mount, Wraparound LED Fixture (Lithonia LBL2)	183.09		26.91
26 51 13 00-0349	EA	4' Length, 4,000 Lumens, Surface Mount, Wraparound LED Fixture (Lithonia LBL4)	186.41		26.91
26 51 13 00-0350		Surface Mount, Shadow Box Style LED Fixtures <small>(26 51 13 00-0343)</small>			
26 51 13 00-0351		Surface Mount, Shadow Box Style LED Fixtures (Lithonia SBSLX) <small>(26 51 13 00-0350)</small>			
26 51 13 00-0352	EA	3,300 Lumens, 2' x 2', Surface Mount, Shadow Box Style LED Fixture (Lithonia 2SBSLX2)	412.30		29.41
26 51 13 00-0353	EA	4,600 Lumens, 2' x 4', Surface Mount, Shadow Box Style LED Fixture (Lithonia 2SBSLX4)	528.86		34.27
26 51 13 00-0354		Recessed LED Downlights <small>(26 51 13 00-0272)</small>			
26 51 13 00-0355		Recessed LED Downlights <small>(26 51 13 00-0354)</small>			
26 51 13 00-0356		Recessed LED Downlights (Lithonia) <small>(26 51 13 00-0355)</small>			
		Note: Includes housing and trim.			
26 51 13 00-0357	EA	1,200 Lumens, 8" Diameter, Recessed LED Downlight With Open Trim (Lithonia DOM8 LED) For Dimming Driver And Sensor Switch nLight Dimming Relay, Add	357.22 81.22		35.39
26 51 13 00-0358	EA	1,500 Lumens, 8" Diameter, Recessed LED Downlight With Open Trim (Lithonia DOM8 LED) For Dimming Driver And Sensor Switch nLight Dimming Relay, Add	391.73 81.22		35.39
26 51 13 00-0359		Recessed LED Downlights (Portfolio®) <small>(26 51 13 00-0355)</small>			
		Note: Includes housing and trim.			
26 51 13 00-0360	EA	1,300 Lumens, 4" Diameter, Recessed LED Downlight With Open Trim (Portfolio® LD413)	210.45		35.39
26 51 13 00-0361		Recessed LED Downlights (Gotham® EVO®) <small>(26 51 13 00-0355)</small>			
		Note: Includes housing and trim.			
26 51 13 00-0362	EA	1,800 Lumens, 6" Diameter, Recessed LED Downlight With Open Trim (Gotham® EVO® ALED)	315.19		35.39
26 51 13 00-0363	EA	1,800 Lumens, 6" Diameter, Recessed LED Shower Downlight With Non-Conductive Regressed Lens (Gotham® EVO® ALED)	327.30		35.39
26 51 13 00-0364	EA	1,800 Lumens, 6" Diameter, Recessed LED Wallwash Downlight With Specular Reflector Trim (Gotham® EVO® DLWLED)	376.97		35.39
26 51 13 00-0365	EA	1,800 Lumens, 6" Diameter, Decorative Recessed LED Downlight With Glass Drop Luminous Ring (Gotham® EVO® ALED)	381.82		35.39
26 51 13 00-0366	EA	1,800 Lumens, 6" Diameter, Vandal Resistant, Recessed LED Downlight With Tempered Prismatic Lens (Gotham® EVO® VRALED)	424.22		35.39
26 51 13 00-0367		Recessed LED Downlights (Lightolier) <small>(26 51 13 00-0355)</small>			
		Note: Includes housing and trim.			
26 51 13 00-0368	EA	500 Lumens, 4" Diameter, Recessed LED Downlight With Open Trim (Lightolier C4L05DL)	312.36		35.39
26 51 13 00-0369	EA	1,000 Lumens, 4" Diameter, Recessed LED Downlight With Open Trim (Lightolier C4L10DL)	364.78		35.39
26 51 13 00-0370	EA	1,500 Lumens, 6" Diameter, Recessed LED Downlight With Open Trim (Lightolier C6L1520DL)	390.94		35.39
26 51 13 00-0371	EA	2,000 Lumens, 6" Diameter, Recessed LED Downlight With Open Trim (Lightolier C6L1520DL)	390.94		35.39
26 51 13 00-0372	EA	1,500 Lumens, 7" Diameter, Recessed LED Downlight With Open Trim (Lightolier C7L1520DL)	404.07		35.39
26 51 13 00-0373	EA	2,000 Lumens, 7" Diameter, Recessed LED Downlight With Open Trim (Lightolier C7L1520DL)	417.22		35.39
26 51 13 00-0374		Recessed LED Downlight Retrofits And Trim (CREE®) <small>(26 51 13 00-0354)</small>			
26 51 13 00-0375		Recessed LED Downlight Retrofits (CREE®) <small>(26 51 13 00-0374)</small>			
		Note: Dimmable to 5%. For installation in standard recessed IC or non-IC housings. Includes removal of existing lamp from fixture. Excludes housing and disposal of hazardous lamps.			
26 51 13 00-0376	EA	575 Lumens, 4" Diameter, Recessed LED Downlight Retrofit (Cree® CR4-575L)	69.88		
26 51 13 00-0377	EA	625 Lumens, 6" Diameter, Recessed LED Downlight Retrofit (Cree® CR6-625L)	60.47		
26 51 13 00-0378	EA	800 Lumens, 6" Diameter, Recessed LED Downlight Retrofit (Cree® CR6-800L)	74.58		
26 51 13 00-0379	EA	650 Lumens, 6" Diameter, Recessed LED Downlight Retrofit (Cree® LR6C-277)	136.47		
26 51 13 00-0380	EA	1,000 Lumens, Deep Recess, 6" Diameter, Recessed LED Downlight Retrofit (Cree® LR6C-DR100-277)	103.06		
26 51 13 00-0381	EA	500 Lumens, 6" Diameter, Adjustable Recessed LED Downlight Retrofit (Cree® LE6C-GU24)	105.44		
26 51 13 00-0382	EA	1,000 Lumens, Deep Recess, 6" Diameter, Recessed LED Downlight Retrofit (Cree® LR6-10L-XXX-120V-A-DR)	111.40		
26 51 13 00-0383		Recessed LED Downlight Retrofits Trim (CREE®) <small>(26 51 13 00-0374)</small>			
		Note: For installation in standard recessed IC or non-IC housings. Excludes housing and lamp.			
26 51 13 00-0384	EA	6" Diameter, Diffuse Anodized Finish Reflector For LED Downlight Retrofits (Cree® CT6AX)	28.53		5.63
26 51 13 00-0385	EA	6" Diameter, Diffuse Anodized Finish Reflector With Painted Flange For LED Downlight Retrofits (Cree® LT6AP)	28.78		5.63
26 51 13 00-0386	EA	6" Diameter, Flat Black Finish Trim And Reflector For LED Downlight Retrofits (Cree® CT6BB)	29.71		5.63



Electrical	26	26
Lighting	26 50	
Interior Lighting	26 51	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 51 13 00-0387 Recessed LED Downlight Fixture Housings (CREE®) <small>(26 51 13 00-0374)</small> Note: Excludes lamp and trim.		
26 51 13 00-0388 EA 6" Diameter, IC Rated, Architectural Recessed LED Downlight Fixture Housing (Cree® H6)	64.82	24.13
26 51 13 00-0389 EA 6" Diameter, IC Rated, Retrofit Recessed LED Downlight Fixture Housing (Cree® RR6)	48.12	24.13
26 51 13 00-0390 Can Retrofit Or Surface Mount, LED Downlights <small>(26 51 13 00-0354)</small>		
26 51 13 00-0391 EA 15 Watt, 6" Diameter, Can Retrofit Or Surface Mount, LED Downlight (Lighting Science® GLP6)	84.98	22.06
26 51 13 00-0392 EA 7 Watt, 4" Diameter, Can Retrofit, LED Downlight (Green Creative 01-811-D)	64.82	22.06
26 51 13 00-0393 EA 9.5 Watt, 6" Diameter, Can Retrofit, LED Downlight (Green Creative 01-808-D)	64.82	22.06
26 51 13 00-0394 EA 8.9 Watt, 6" Diameter, Can Retrofit, LED Downlight (Lithonia 6BP)	76.70	22.06
<i>For Recessed IC/Non-IC Rated Housing For New Construction, Add</i>	29.01	
26 51 13 00-0395 Wall Mount LED Cylinder Downlight <small>(26 51 13 00-0272)</small>		
26 51 13 00-0396 EA 2,200 Lumens, 9" Diameter, Wall Mount LED Cylinder Downlight With Semi-Specular Trim (Gotham® EVO® CLED9)	437.16	34.27
26 51 13 00-0397 Concealed Continuous LED Fixtures <small>(26 51 13 00-0272)</small>		
26 51 13 00-0398 Concealed Continuous LED Fixtures (Fraqtir™ S301) <small>(26 51 13 00-0397)</small>		
26 51 13 00-0399 LF Fixed Surface Mount, Concealed Continuous LED Fixture With Remote Driver (Fraqtir™ S301)	359.24	3.68
26 51 13 00-0400 LF Fixed Surface Mount, Concealed Continuous LED Fixture With Remote Dimming Driver (Fraqtir™ S301)	409.39	3.68
26 51 13 00-0401 LED Low Bay Fixtures <small>(26 51 13 00-0272)</small>		
26 51 13 00-0402 LED Linear Low Bay Fixtures (PlanLED) <small>(26 51 13 00-0401)</small>		
26 51 13 00-0403 EA 4' Length, 23 System Watts, LED Linear Low Bay Fixture (PlanLED A1W4)	185.88	44.12
26 51 13 00-0404 EA 4' Length, 42 System Watts, LED Linear Low Bay Fixture (PlanLED A2W4A)	243.63	44.12
26 51 13 00-0405 EA 8' Length, 84 System Watts, LED Linear Low Bay Fixture (PlanLED A2W5A)	395.36	55.15
26 51 13 00-0406 LED Linear Low Bay Fixtures (CREE® CS) <small>(26 51 13 00-0401)</small> Note: Includes 3,500 or 4,000K color temperature, 120/277 voltage and lightweight polymer housing assembly. Excludes sensors.		
26 51 13 00-0407 EA 4,000 Lumens, 4' Length, LED Linear Low Bay Fixture (Cree® CS14™)	501.14	44.12
26 51 13 00-0408 EA 7,500 Lumens, 8' Length, LED Linear Low Bay Fixture (Cree® CS18™)	623.01	55.15
26 51 13 00-0409 EA 8,000 Lumens, 8' Length, LED Linear Low Bay Fixture (Cree® CS18™)	798.23	55.15
26 51 13 00-0410 LED Linear Low Bay Fixtures (Lithonia MSL) <small>(26 51 13 00-0401)</small> Note: Includes 3,500K, 4,000K or 5,000K color temperature, 120/277 voltage and steel housing assembly. Excludes sensors.		
26 51 13 00-0411 EA 4,000 Lumens, 4' Length, LED Linear Low Bay Fixture (Lithonia MSL)	502.16	44.12
26 51 13 00-0412 Wet/Hazardous Location, LED Fixtures <small>(26 51 13 00-0272)</small>		
26 51 13 00-0413 Wet Location, LED Fixtures <small>(26 51 13 00-0412)</small>		
26 51 13 00-0414 Wet Location, NEMA 4X, High Bay/Low Bay, LED Fixture (Cooper Champ® Pro PVM) <small>(26 51 13 00-0413)</small> Note: Includes 5,600K CRI LED arrays, heat and impact resistant glass lens, silicone gaskets, stainless steel external hardware and powder coated aluminum housing.		
26 51 13 00-0415 EA 47 System Watts, 3,240 Lumens, Pendant Mount, Wet Location, NEMA 4X, High Bay/Low Bay, LED Fixture (Cooper Champ® Pro PVM3L)	1,089.87	61.76
<i>For Ceiling Mount, Add</i>	162.28	
<i>For Quick Clip Mounting Option, Add</i>	19.39	
<i>For Frosted Lens, Add</i>	41.69	
<i>For Warm White Color Rendering, Add</i>	55.84	
<i>For Stanchion Mount, Add</i>	214.42	
<i>For Wall Mount, Add</i>	220.96	
<i>For Polycarbonate Lens, Add</i>	80.40	
<i>For Teflon Coated Lens, Add</i>	88.49	
<i>For 347 Or 480 Volt AC, Add</i>	121.77	
26 51 13 00-0416 EA 63 System Watts, 3,778 Lumens, Pendant Mount, Wet Location, NEMA 4X, High Bay/Low Bay, LED Fixture (Cooper Champ® Pro PVM5L)	1,141.55	66.18
<i>For Ceiling Mount, Add</i>	162.28	
<i>For Quick Clip Mounting Option, Add</i>	19.39	
<i>For Frosted Lens, Add</i>	41.69	
<i>For Warm White Color Rendering, Add</i>	55.84	
<i>For Stanchion Mount, Add</i>	214.42	
<i>For Wall Mount, Add</i>	220.96	
<i>For Polycarbonate Lens, Add</i>	80.40	
<i>For Teflon Coated Lens, Add</i>	88.49	
<i>For 347 Or 480 Volt AC, Add</i>	121.77	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 51 13 00-0417	EA		98 System Watts, 6,340 Lumens, Pendant Mount, Wet Location, NEMA 4X, High Bay/Low Bay, LED Fixture (Cooper Champ® Pro PVM7L).....	1,283.64	70.59
			<i>For Ceiling Mount, Add</i>	162.28	
			<i>For Quick Clip Mounting Option, Add</i>	19.39	
			<i>For Frosted Lens, Add</i>	41.69	
			<i>For Warm White Color Rendering, Add</i>	55.84	
			<i>For Stanchion Mount, Add</i>	214.42	
			<i>For Wall Mount, Add</i>	220.96	
			<i>For Polycarbonate Lens, Add</i>	80.40	
			<i>For Teflon Coated Lens, Add</i>	88.49	
			<i>For 347 Or 480 Volt AC, Add</i>	121.77	
26 51 13 00-0418	EA		98 System Watts, 6,340 Lumens, Pendant Mount, Wet Location, NEMA 4X, High Bay/Low Bay, LED Fixture (Cooper Champ® Pro PVM9L).....	1,585.22	75.00
			<i>For Ceiling Mount, Add</i>	162.28	
			<i>For Quick Clip Mounting Option, Add</i>	19.39	
			<i>For Frosted Lens, Add</i>	41.69	
			<i>For Warm White Color Rendering, Add</i>	55.84	
			<i>For Stanchion Mount, Add</i>	214.42	
			<i>For Wall Mount, Add</i>	220.96	
			<i>For Polycarbonate Lens, Add</i>	80.40	
			<i>For Teflon Coated Lens, Add</i>	88.49	
			<i>For 347 Or 480 Volt AC, Add</i>	121.77	
26 51 13 00-0419	EA		137 System Watts, 9,720 Lumens, Pendant Mount, Wet Location, NEMA 4X, High Bay/Low Bay, LED Fixture (Cooper Champ® Pro PVM11L).....	1,850.57	79.41
			<i>For Ceiling Mount, Add</i>	162.28	
			<i>For Quick Clip Mounting Option, Add</i>	19.39	
			<i>For Frosted Lens, Add</i>	41.69	
			<i>For Warm White Color Rendering, Add</i>	55.84	
			<i>For Stanchion Mount, Add</i>	214.42	
			<i>For Wall Mount, Add</i>	220.96	
			<i>For Polycarbonate Lens, Add</i>	80.40	
			<i>For Teflon Coated Lens, Add</i>	88.49	
			<i>For 347 Or 480 Volt AC, Add</i>	121.77	
26 51 13 00-0420			Wet Location, NEMA 4X, LED Floodlight (Cooper Champ® Pro PFM) <small>(26 51 13 00-0413)</small>		
			Note: Includes 5,600K CRI LED arrays, shatter resistant glass lens, silicone gaskets, stainless steel external hardware and powder coated aluminum housing.		
26 51 13 00-0421	EA		64 System Watts, 3,160 Lumens, Yoke Mount, Wet Location, NEMA 4X, LED Floodlight (Cooper Champ® Pro PFM5L).....	1,180.17	66.18
			<i>For Bolt-On Visor, Add</i>	30.49	
			<i>For Bolt-On Wire Guard, Add</i>	55.84	
			<i>For Factory Installed Fuse, Add</i>	78.54	
			<i>For 347 Or 480 Volt AC, Add</i>	121.77	
			<i>For Warm White Color Rendering, Add</i>	124.42	
26 51 13 00-0422	EA		94 System Watts, 4,740 Lumens, Yoke Mount, Wet Location, NEMA 4X, LED Floodlight (Cooper Champ® Pro PFM7L).....	1,464.18	70.59
			<i>For Bolt-On Visor, Add</i>	30.49	
			<i>For Bolt-On Wire Guard, Add</i>	55.84	
			<i>For Factory Installed Fuse, Add</i>	78.54	
			<i>For 347 Or 480 Volt AC, Add</i>	121.77	
			<i>For Warm White Color Rendering, Add</i>	124.42	
26 51 13 00-0423	EA		126 System Watts, 6,320 Lumens, Yoke Mount, Wet Location, NEMA 4X, LED Floodlight (Cooper Champ® Pro PFM9L).....	1,612.84	75.00
			<i>For Bolt-On Visor, Add</i>	30.49	
			<i>For Bolt-On Wire Guard, Add</i>	55.84	
			<i>For Factory Installed Fuse, Add</i>	78.54	
			<i>For 347 Or 480 Volt AC, Add</i>	121.77	
			<i>For Warm White Color Rendering, Add</i>	124.42	
26 51 13 00-0424	EA		188 System Watts, 9,481 Lumens, Yoke Mount, Wet Location, NEMA 4X, LED Floodlight (Cooper Champ® Pro PFM11L).....	1,848.11	79.41
			<i>For Bolt-On Visor, Add</i>	30.49	
			<i>For Bolt-On Wire Guard, Add</i>	55.84	
			<i>For Factory Installed Fuse, Add</i>	78.54	
			<i>For 347 Or 480 Volt AC, Add</i>	121.77	
			<i>For Warm White Color Rendering, Add</i>	124.42	
26 51 13 00-0425			Wet Location, NEMA 4X, Low Bay, LED Fixture (Cooper Vaporgard™ Pro P2L) <small>(26 51 13 00-0413)</small>		
			Note: Includes 5,600K CRI LED arrays, heat resistant glass lens, silicone gaskets, stainless steel external hardware and powder coated aluminum housing.		
26 51 13 00-0426	EA		25 System Watts, 1,400 Lumens, Pendant Mount, Wet Location, NEMA 4X, Low Bay, LED Fixture (Cooper Vaporgard™ Pro P2LC).....	700.13	61.76
			<i>For 12/24 Volt DC Driver, Add</i>	23.56	
			<i>For Frosted Lens, Add</i>	26.53	
			<i>For 55 Degree Ambient Suitability (AC Only), Add</i>	32.06	
			<i>For Warm White Color Rendering, Add</i>	37.54	
			<i>For Ceiling Mount, Add</i>	143.83	
			<i>For Wall Mount, Add</i>	167.09	
			<i>For Teflon Coated Lens, Add</i>	101.76	
			<i>For Wall Mount With Junction Box, Add</i>	201.04	
26 51 13 00-0427			Class I Division 2, Hazardous Location, LED Fixtures <small>(26 51 13 00-0412)</small>		



Electrical	26	26
Lighting	26 50	
Interior Lighting	26 51	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 51 13 00-0428 Class I Division 2, Hazardous Location, NEMA 4X, LED Floodlight (Cooper Champ® FMV) <small>(26 51 13 00-0427)</small> Note: Includes 5,600K CRI LED arrays, shatter resistant glass lens, silicone gaskets, stainless steel external hardware and powder coated aluminum housing.		
26 51 13 00-0429 EA 64 System Watts, 3,160 Lumens, Yoke Mount, Class I Division 2, Hazardous Location, NEMA 4X, LED Floodlight (Cooper Champ® FMV5L).....	1,351.99	66.18
<i>For Bolt-On Visor, Add</i>	35.06	
<i>For Bolt-On Wire Guard, Add</i>	64.21	
<i>For Factory Installed Fuse, Add</i>	78.54	
<i>For 347 Or 480 Volt AC, Add</i>	121.77	
<i>For Warm White Color Rendering, Add</i>	124.42	
26 51 13 00-0430 EA 94 System Watts, 4,740 Lumens, Yoke Mount, Class I Division 2, Hazardous Location, NEMA 4X, LED Floodlight (Cooper Champ® FMV7L).....	1,652.56	70.59
<i>For Bolt-On Visor, Add</i>	35.06	
<i>For Bolt-On Wire Guard, Add</i>	64.21	
<i>For Factory Installed Fuse, Add</i>	78.54	
<i>For 347 Or 480 Volt AC, Add</i>	121.77	
<i>For Warm White Color Rendering, Add</i>	124.42	
26 51 13 00-0431 EA 126 System Watts, 6,320 Lumens, Yoke Mount, Class I Division 2, Hazardous Location, NEMA 4X, LED Floodlight (Cooper Champ® FMV9L).....	1,865.17	75.00
<i>For Bolt-On Visor, Add</i>	35.06	
<i>For Bolt-On Wire Guard, Add</i>	64.21	
<i>For Factory Installed Fuse, Add</i>	78.54	
<i>For 347 Or 480 Volt AC, Add</i>	121.77	
<i>For Warm White Color Rendering, Add</i>	124.42	
26 51 13 00-0432 EA 188 System Watts, 9,481 Lumens, Yoke Mount, Class I Division 2, Hazardous Location, NEMA 4X, LED Floodlight (Cooper Champ® FMV11L).....	2,083.65	79.41
<i>For Bolt-On Visor, Add</i>	35.06	
<i>For Bolt-On Wire Guard, Add</i>	64.21	
<i>For Factory Installed Fuse, Add</i>	78.54	
<i>For 347 Or 480 Volt AC, Add</i>	121.77	
<i>For Warm White Color Rendering, Add</i>	124.42	
26 51 13 00-0433 Class I Division 2, Hazardous Location, NEMA 4X, LED Fixture (Cooper Vaporgard™ V2LC) <small>(26 51 13 00-0427)</small> Note: Includes 5,600K CRI LED arrays, heat resistant glass lens, silicone gaskets, stainless steel external hardware and powder coated aluminum housing.		
26 51 13 00-0434 EA 25 System Watts, 1,600 Lumens, Pendant Mount, Class I Division 2, Hazardous Location, NEMA 4X, LED Fixture (Cooper Vaporgard™ V2LC).....	827.90	61.76
<i>For 12/24 Volt DC Driver, Add</i>	20.49	
<i>For Frosted Lens, Add</i>	23.07	
<i>For Warm White Color Temperature LEDs, Add</i>	27.88	
<i>For 55 Degree Ambient Suitability (AC Only) Option, Add</i>	32.64	
<i>For Stanchion Mount, Add</i>	149.33	
<i>For Ceiling Mount, Add</i>	166.47	
<i>For Wall Mount, Add</i>	190.89	
<i>For Teflon Coated Lens, Add</i>	88.49	
<i>For Wall Mount With Junction Box, Add</i>	226.54	
26 51 13 00-0435 Class I Division 2, Hazardous Location, NEMA 4X, LED Fixture (Cooper Champ® VMV) <small>(26 51 13 00-0427)</small> Note: Includes 5,600K CRI LED arrays, heat and impact resistant glass lens, silicone gaskets, stainless steel external hardware and powder coated aluminum housing.		
26 51 13 00-0436 EA 47 System Watts, 3,240 Lumens, Pendant Mount, Class I Division 2, Hazardous Location, NEMA 4X, LED Fixture (Cooper Champ® VMV3L).....	1,236.99	61.76
<i>For Ceiling Mount, Add</i>	186.98	
<i>For Quick Clip Mounting Option, Add</i>	19.39	
<i>For Frosted Lens, Add</i>	47.95	
<i>For Warm White Color Rendering, Add</i>	55.84	
<i>For Polycarbonate Lens, Add</i>	80.40	
<i>For 347 Or 480 Volt AC, Add</i>	121.77	
26 51 13 00-0437 EA 63 System Watts, 3,778 Lumens, Pendant Mount, Class I Division 2, Hazardous Location, NEMA 4X, LED Fixture (Cooper Champ® VMV5L).....	1,369.40	66.18
<i>For Ceiling Mount, Add</i>	186.98	
<i>For Quick Clip Mounting Option, Add</i>	19.39	
<i>For Frosted Lens, Add</i>	47.95	
<i>For Warm White Color Rendering, Add</i>	55.84	
<i>For Polycarbonate Lens, Add</i>	80.40	
<i>For 347 Or 480 Volt AC, Add</i>	121.77	
26 51 13 00-0438 EA 98 System Watts, 6,340 Lumens, Pendant Mount, Class I Division 2, Hazardous Location, NEMA 4X, LED Fixture (Cooper Champ® VMV7L).....	1,638.83	70.59
<i>For Ceiling Mount, Add</i>	186.98	
<i>For Quick Clip Mounting Option, Add</i>	19.39	
<i>For Frosted Lens, Add</i>	47.95	
<i>For Warm White Color Rendering, Add</i>	55.84	
<i>For Polycarbonate Lens, Add</i>	80.40	
<i>For 347 Or 480 Volt AC, Add</i>	121.77	

26 Electrical**26 50 Lighting****26 51 Interior Lighting**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 51 13 00-0439	EA		98 System Watts, 6,340 Lumens, Pendant Mount, Class I Division 2, Hazardous Location, NEMA 4X, LED Fixture (Cooper Champ® VMV9L).....	1,991.30	75.00
			<i>For Ceiling Mount, Add</i>	186.98	
			<i>For Quick Clip Mounting Option, Add</i>	19.39	
			<i>For Frosted Lens, Add</i>	47.95	
			<i>For Warm White Color Rendering, Add</i>	55.84	
			<i>For Polycarbonate Lens, Add</i>	80.40	
			<i>For 347 Or 480 Volt AC, Add</i>	121.77	
26 51 13 00-0440	EA		137 System Watts, 9,720 Lumens, Pendant Mount, Class I Division 2, Hazardous Location, NEMA 4X, LED Fixture (Cooper Champ® VMV11L).....	2,242.51	79.41
			<i>For Ceiling Mount, Add</i>	186.98	
			<i>For Quick Clip Mounting Option, Add</i>	19.39	
			<i>For Frosted Lens, Add</i>	47.95	
			<i>For Warm White Color Rendering, Add</i>	55.84	
			<i>For Polycarbonate Lens, Add</i>	80.40	
			<i>For 347 Or 480 Volt AC, Add</i>	121.77	
26 51 13 00-0441			Class I Division 1, Explosion Proof, LED Fixtures <small>(26 51 13 00-0412)</small>		
26 51 13 00-0442			Class I Division 1, Explosion Proof, NEMA 4X, High Bay/Low Bay, LED Fixture (Cooper Hazard Gard® EVLL) <small>(26 51 13 00-0441)</small>		
			Note: Includes 5,600K CRI LED arrays, shatter resistant and explosion proof glass lens, silicone gaskets, stainless steel external hardware and powder coated aluminum housing.		
26 51 13 00-0443	EA		80 System Watts, 5,625 Lumens, Pendant Mount, Class I Division 1, Explosion Proof, NEMA 4X, High Bay/Low Bay, LED Fixture (Cooper Hazard Gard® EVLL5L).....	1,789.84	66.18
			<i>For Wall Mount, Deduct</i>	254.45	
			<i>For Warm Color Temperature LEDs, Add</i>	53.18	
			<i>For Stainless Steel Guard, Add</i>	337.31	
			<i>For Ceiling Mount, Add</i>	350.39	
			<i>For Stanchion Mount, Add</i>	393.86	
			<i>For Yoke Mount, Add</i>	331.95	
26 51 13 00-0444	EA		100 System Watts, 6,750 Lumens, Pendant Mount, Class I Division 1, Explosion Proof, NEMA 4X, High Bay/Low Bay, LED Fixture (Cooper Hazard Gard® EVLL7L).....	2,172.38	70.59
			<i>For Wall Mount, Deduct</i>	254.45	
			<i>For Warm Color Temperature LEDs, Add</i>	53.18	
			<i>For Stainless Steel Guard, Add</i>	337.31	
			<i>For Ceiling Mount, Add</i>	350.39	
			<i>For Stanchion Mount, Add</i>	393.86	
			<i>For Yoke Mount, Add</i>	331.95	
26 51 13 00-0445	EA		130 System Watts, 9,000 Lumens, Pendant Mount, Class I Division 1, Explosion Proof, NEMA 4X, High Bay/Low Bay, LED Fixture (Cooper Hazard Gard® EVLL9L).....	2,520.86	75.00
			<i>For Wall Mount, Deduct</i>	254.45	
			<i>For Warm Color Temperature LEDs, Add</i>	53.18	
			<i>For Stainless Steel Guard, Add</i>	337.31	
			<i>For Ceiling Mount, Add</i>	350.39	
			<i>For Stanchion Mount, Add</i>	393.86	
			<i>For Yoke Mount, Add</i>	331.95	
26 51 13 00-0446	EA		151 System Watts, 10,500 Lumens, Pendant Mount, Class I Division 1, Explosion Proof, NEMA 4X, High Bay/Low Bay, LED Fixture (Cooper Hazard Gard® EVLL11L).....	2,875.72	79.41
			<i>For Wall Mount, Deduct</i>	254.45	
			<i>For Warm Color Temperature LEDs, Add</i>	53.18	
			<i>For Stainless Steel Guard, Add</i>	337.31	
			<i>For Ceiling Mount, Add</i>	350.39	
			<i>For Stanchion Mount, Add</i>	393.86	
			<i>For Yoke Mount, Add</i>	331.95	
26 51 13 00-0447	EA		175 System Watts, 13,500 Lumens, Pendant Mount, Class I Division 1, Explosion Proof, NEMA 4X, High Bay/Low Bay, LED Fixture (Cooper Hazard Gard® EVLL13L).....	3,328.77	76.47
			<i>For Wall Mount, Deduct</i>	254.45	
			<i>For Warm Color Temperature LEDs, Add</i>	53.18	
			<i>For Stainless Steel Guard, Add</i>	337.31	
			<i>For Ceiling Mount, Add</i>	350.39	
			<i>For Stanchion Mount, Add</i>	393.86	
			<i>For Yoke Mount, Add</i>	331.95	
26 51 13 00-0448			Refrigeration/Display LED Fixtures <small>(26 51 13 00-0272)</small>		
26 51 13 00-0449			Refrigeration/Display LED Fixtures (Lithonia) <small>(26 51 13 00-0448)</small>		
			Note: Fixtures exclude driver.		
26 51 13 00-0450	EA		5' Length, Center Mount, Refrigeration/Display, Vertical LED Fixture (Lithonia FSV5 CM DLC).....	259.28	34.27
26 51 13 00-0451	EA		5' Length, Left And Right Mount (Pair), Refrigeration/Display, Vertical LED Fixture (Lithonia FSVDRVL RLEM DLC).....	328.42	60.66
26 51 13 00-0452	EA		Up To 5 Door Configuration, LED Driver For Refrigeration/Display, Vertical LED Fixtures (Lithonia FSVDRVL).....	323.10	48.53
26 51 13 00-0453			Recessed Fixtures <small>(26 51 13)</small>		
			Note: Housing and trim priced separately.		
26 51 13 00-0454			Recessed Fixture Housings <small>(26 51 13 00-0453)</small>		
			Note: Lamps included in all prices. The housing insulation must be 3" from housing. ICT may be covered with insulation. Remodel housing may be installed from below ceiling. ICAT housing is air tight. Demo cost of housing includes demo of any fixture trim.		
26 51 13 00-0455			Compact Fluorescent, Recessed Fixture Housings <small>(26 51 13 00-0454)</small>		



Electrical	26	26
Lighting	26 50	
Interior Lighting	26 51	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 51 13 00-0456	EA		4" Round, Compact Fluorescent, T Or ICT Recessed Fixture Housing <i>For ICAT Housing, Add</i>	82.64 6.20	23.00
26 51 13 00-0457	EA		5" Round, Compact Fluorescent, T Or ICT Recessed Fixture Housing <i>For ICAT Housing, Add</i>	84.73 6.47	23.00
26 51 13 00-0458	EA		6" Round, Compact Fluorescent, T Or ICT Recessed Fixture Housing <i>For ICAT Housing, Add</i>	88.01 6.68	24.13
26 51 13 00-0459	EA		7" Round, Compact Fluorescent, T Or ICT Recessed Fixture Housing <i>For ICAT Housing, Add</i>	90.76 6.83	25.18
26 51 13 00-0460	EA		8" Round, Compact Fluorescent, T Or ICT Recessed Fixture Housing <i>For ICAT Housing, Add</i>	93.83 7.02	26.22
26 51 13 00-0461	EA		10" To 12" Round, Compact Fluorescent, T Or ICT Recessed Fixture Housing <i>For ICAT Housing, Add</i>	97.06 7.12	27.82
26 51 13 00-0462			Fluorescent, Recessed Fixture Housings <small>(26 51 13 00-0454)</small>		
26 51 13 00-0463	EA		4" Round, Fluorescent, T Or ICT Recessed Fixture Housing <i>For ICAT Housing, Add</i>	73.52 5.02	23.00
26 51 13 00-0464	EA		5" Round, Fluorescent, T Or ICT Recessed Fixture Housing <i>For ICAT Housing, Add</i>	75.64 5.30	23.00
26 51 13 00-0465	EA		6" Round, Fluorescent, T Or ICT Recessed Fixture Housing <i>For ICAT Housing, Add</i>	78.85 5.50	24.05
26 51 13 00-0466	EA		7" Round, Fluorescent, T Or ICT Recessed Fixture Housing <i>For ICAT Housing, Add</i>	82.80 5.80	24.94
26 51 13 00-0467	EA		8" Round, Fluorescent, T Or ICT Recessed Fixture Housing <i>For ICAT Housing, Add</i>	86.30 6.05	26.22
26 51 13 00-0468	EA		10" To 12" Square, Fluorescent, T Or ICT Recessed Fixture Housing <i>For ICAT Housing, Add</i>	89.69 6.17	27.82
26 51 13 00-0469			High Pressure Sodium, Recessed Fixture Housings <small>(26 51 13 00-0454)</small>		
26 51 13 00-0470	EA		4" Round, High Pressure Sodium, T Or ICT Recessed Fixture Housing <i>For ICAT Housing, Add</i>	85.65 6.59	23.16
26 51 13 00-0471	EA		5" Round, High Pressure Sodium, T Or ICT Recessed Fixture Housing <i>For ICAT Housing, Add</i>	89.06 7.03	23.16
26 51 13 00-0472	EA		6" Round, High Pressure Sodium, T Or ICT Recessed Fixture Housing <i>For ICAT Housing, Add</i>	93.50 7.39	24.13
26 51 13 00-0473	EA		7" Round, High Pressure Sodium, T Or ICT Recessed Fixture Housing <i>For ICAT Housing, Add</i>	96.98 7.63	25.18
26 51 13 00-0474	EA		8" Round, High Pressure Sodium, T Or ICT Recessed Fixture Housing <i>For ICAT Housing, Add</i>	100.41 7.87	26.22
26 51 13 00-0475	EA		10" To 12" Square, High Pressure Sodium, T Or ICT Recessed Fixture Housing <i>For ICAT Housing, Add</i>	103.74 7.99	27.82
26 51 13 00-0476			Incandescent, Recessed Fixture Housings <small>(26 51 13 00-0454)</small>		
26 51 13 00-0477	EA		4" Round, Incandescent, T Or ICT Recessed Fixture Housing <i>For ICAT Housing, Add</i>	49.63 1.94	23.00
26 51 13 00-0478	EA		5" Round, Incandescent, T Or ICT Recessed Fixture Housing <i>For ICAT Housing, Add</i>	49.63 1.94	23.00
26 51 13 00-0479	EA		6" Round, Incandescent, T Or ICT Recessed Fixture Housing <i>For ICAT Housing, Add</i>	52.53 2.11	24.13
26 51 13 00-0480	EA		7" Round, Incandescent, T Or ICT Recessed Fixture Housing <i>For ICAT Housing, Add</i>	55.53 2.29	25.18
26 51 13 00-0481	EA		8" Round, Incandescent, T Or ICT Recessed Fixture Housing <i>For ICAT Housing, Add</i>	58.52 2.47	26.22
26 51 13 00-0482	EA		10" To 12" Square, Incandescent, T Or ICT Recessed Fixture Housing <i>For ICAT Housing, Add</i>	60.14 2.36	27.82
26 51 13 00-0483			Recessed Fixture Trim <small>(26 51 13 00-0453)</small>		
26 51 13 00-0484	EA		Circular, Recessed Fixture Trim	35.50	11.26
26 51 13 00-0485	EA		Circular Clear Lens, Recessed Fixture Trim	38.91	11.26
26 51 13 00-0486	EA		Open/Baffle, Recessed Fixture Trim	44.82	11.26
26 51 13 00-0487	EA		Specular Reflector, Recessed Fixture Trim	47.95	11.26
26 51 13 00-0488	EA		Eyeball, Recessed Fixture Trim	38.96	11.26
26 51 13 00-0489	EA		10" To 12" Square, Clear Lens, Recessed Fixture Trim	37.13	11.26
26 51 13 00-0490	EA		10" To 12" Square, Drop Dish, Recessed Fixture Trim	39.23	11.26
26 51 13 00-0491			Ceiling Mounted Fixtures <small>(26 51 13)</small>		
26 51 13 00-0492			Ceiling Mounted, Compact Fluorescent/Incandescent Fixtures <small>(26 51 13 00-0491)</small>		
26 51 13 00-0493			Glass Globe, Compact Fluorescent/Incandescent Fixtures <small>(26 51 13 00-0492)</small>		
26 51 13 00-0494	EA		6" Diameter, Ceiling Mounted, Glass Globe, Compact Fluorescent/Incandescent Fixture	84.47	32.17
26 51 13 00-0495	EA		9" Diameter, Ceiling Mounted, Mushroom Style Glass Globe, Compact Fluorescent/Incandescent Fixture	96.86	32.17
26 51 13 00-0496			Ceiling Mounted, Circline Fluorescent Fixtures <small>(26 51 13 00-0491)</small>		
26 51 13 00-0497			Exposed Lamps, Circline Fluorescent Fixtures <small>(26 51 13 00-0496)</small>		
26 51 13 00-0498	EA		8-1/2" Diameter, Ceiling Mounted, Exposed Lamps, Circline Fluorescent Fixture	75.05	32.17
26 51 13 00-0499	EA		12" Diameter, Ceiling Mounted, Exposed Lamps, Circline Fluorescent Fixture	81.10	32.17



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 51 13 00-0500 Low Profile Acrylic Diffuser, Circline Fluorescent Fixtures <small>(26 51 13 00-0496)</small>		
26 51 13 00-0501 EA 11" Diameter, Ceiling Mounted, Low Profile Acrylic Diffuser, Circline Fluorescent Fixture	100.89	32.17
26 51 13 00-0502 EA 14" Diameter, Ceiling Mounted, Low Profile Acrylic Diffuser, Circline Fluorescent Fixture	134.98	32.17
26 51 13 00-0503 EA 19" Diameter, Ceiling Mounted, Low Profile Acrylic Diffuser, Circline Fluorescent Fixture	158.61	32.17
26 51 13 00-0504 EA 12" Square, Ceiling Mounted, Low Profile Acrylic Diffuser, Circline Fluorescent Fixture	111.93	32.17
26 51 13 00-0505 EA 15" Square, Ceiling Mounted, Low Profile Acrylic Diffuser, Circline Fluorescent Fixture	135.68	32.17
26 51 13 00-0506 EA 19" Square, Ceiling Mounted, Low Profile Acrylic Diffuser, Circline Fluorescent Fixture	158.61	32.17
26 51 13 00-0507 Ceiling Mounted, Double Twin Tube Compact Fluorescent Fixtures <small>(26 51 13 00-0491)</small>		
26 51 13 00-0508 Low Profile Acrylic Diffuser, Double Twin Tube Compact Fluorescent Fixtures <small>(26 51 13 00-0507)</small>		
26 51 13 00-0509 EA 11" Diameter, Ceiling Mounted, Low Profile Acrylic Diffuser, Double Twin Tube Compact Fluorescent Fixture	103.53	32.17
26 51 13 00-0510 EA 14" Diameter, Ceiling Mounted, Low Profile Acrylic Diffuser, Double Twin Tube Compact Fluorescent Fixture	126.87	32.17
26 51 13 00-0511 EA 19" Diameter, Ceiling Mounted, Low Profile Acrylic Diffuser, Double Twin Tube Compact Fluorescent Fixture	148.10	32.17
26 51 13 00-0512 EA 12" Square, Ceiling Mounted, Low Profile Acrylic Diffuser, Double Twin Tube Compact Fluorescent Fixture	86.04	32.17
26 51 13 00-0513 EA 15" Square, Ceiling Mounted, Low Profile Acrylic Diffuser, Double Twin Tube Compact Fluorescent Fixture	99.04	32.17
26 51 13 00-0514 EA 19" Square, Ceiling Mounted, Low Profile Acrylic Diffuser, Double Twin Tube Compact Fluorescent Fixture	123.69	32.17
26 51 13 00-0515 Pendant Mounted, Compact Fluorescent/Incandescent Downlights <small>(26 51 13 00-0491)</small>		
26 51 13 00-0516 Pendant Mounted, Compact Fluorescent/Incandescent Open Reflector Downlights <small>(26 51 13 00-0515)</small>		
26 51 13 00-0517 EA 6" Diameter, Pendant Mounted, Open Reflector Compact Fluorescent/Incandescent Downlight	145.77	26.43
26 51 13 00-0518 Pendant Mounted, Compact Fluorescent/Incandescent Downlights With Baffle <small>(26 51 13 00-0515)</small>		
26 51 13 00-0519 EA 6" Diameter, Pendant Mounted, Compact Fluorescent/Incandescent Downlight With Baffle	164.62	26.43
26 51 13 00-0520 EA 8" Diameter, Pendant Mounted, Compact Fluorescent/Incandescent Downlight With Baffle	225.45	26.43
26 51 13 00-0521 Pendant Mounted, Horizontal Indirect Fluorescent Fixtures <small>(26 51 13 00-0491)</small>		
26 51 13 00-0522 EA 1 T5HO Lamp, 4' Length, Pendent Mounted, Horizontal Indirect Fluorescent Fixture	163.57	26.43
26 51 13 00-0523 EA 2 T5HO Lamps, 4' Length, Pendent Mounted, Horizontal Indirect Fluorescent Fixture	175.54	26.43
26 51 13 00-0524 EA 3 T5HO Lamps, 4' Length, Pendent Mounted, Horizontal Indirect Fluorescent Fixture	209.99	26.43
26 51 13 00-0525 EA 2 T5HO Lamps, 8' Length, Pendent Mounted, Horizontal Indirect Fluorescent Fixture	215.40	26.43
26 51 13 00-0526 EA 4 T5HO Lamps, 8' Length, Pendent Mounted, Horizontal Indirect Fluorescent Fixture	259.77	26.43
26 51 13 00-0527 EA 6 T5HO Lamps, 8' Length, Pendent Mounted, Horizontal Indirect Fluorescent Fixture	311.30	26.43
26 51 13 00-0528 Track Lighting <small>(26 51 13)</small>		
26 51 13 00-0529 Track Lighting Tracks <small>(26 51 13 00-0528)</small>		
26 51 13 00-0530 LF 1 Circuit Track Lighting Track	22.24	5.31
26 51 13 00-0531 LF 2 Circuit Track Lighting Track	29.61	5.31
26 51 13 00-0532 LF 3 Circuit Track Lighting Track	35.86	5.31
26 51 13 00-0533 LF 4 Circuit Track Lighting Track	42.10	6.43
26 51 13 00-0534 Track Lighting Fixtures <small>(26 51 13 00-0528)</small>		
26 51 13 00-0535 Compact Fluorescent Track Lighting Fixtures <small>(26 51 13 00-0534)</small>		
26 51 13 00-0536 EA Compact Fluorescent Track Lighting Fixture	52.29	13.43
26 51 13 00-0537 Fluorescent Track Lighting Fixtures <small>(26 51 13 00-0534)</small>		
26 51 13 00-0538 EA 2L 18W BX Track Fixture, Electronic Ballast	257.91	13.43
Note: White or Black Finish, 120V.		
26 51 13 00-0539 EA 2L 39W BX Track Fixture, Electronic Ballast	269.90	13.43
Note: White or Black Finish, 120V.		
26 51 13 00-0540 EA 2L 40W BX Track Fixture, Electronic Ballast	277.40	13.43
Note: White or Black Finish, 120V.		
26 51 13 00-0541 EA 2L 50W BX Track Fixture, Electronic Ballast	244.99	13.43
Note: White or Black Finish, 120V.		
26 51 13 00-0542 EA 2L, 55 Watt BX Track Fixture, Electronic Ballast	313.95	13.43
Note: White or Black Finish, 120V.		
26 51 13 00-0543 Metal Halide Track Lighting Fixtures <small>(26 51 13 00-0534)</small>		
26 51 13 00-0544 EA Metal Halide Track Lighting Fixture	55.06	13.43
26 51 13 00-0545 Incandescent Track Lighting Fixtures <small>(26 51 13 00-0534)</small>		
26 51 13 00-0546 EA Incandescent Track Lighting Fixture	45.41	13.43
26 51 13 00-0547 EA Par 20 Track Fixture, White Or Black Finish, 120 Volt	59.27	13.43



Electrical	26	26
Lighting	26 50	
Interior Lighting	26 51	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 51 13 00-0548 EA Par 30 Track Fixture, White Or Black Finish, 120 Volt.....	89.51	13.43
26 51 13 00-0549 EA Par 38 Track Fixture, White Or Black Finish, 120 Volt.....	92.51	13.43
26 51 13 00-0550 EA PAR 16, Baffled Cylinder Track Fixture, White or Black Finish, 120 Volt.....	72.96	13.43
26 51 13 00-0551 EA PAR 20, Baffled Cylinder Track Fixture, White or Black Finish, 120 Volt.....	59.27	13.43
26 51 13 00-0552 EA PAR 30, Baffled Cylinder Track Fixture, White or Black Finish.....	71.52	13.43
Note: 120V.		
26 51 13 00-0553 EA PAR 38, Baffled Cylinder Track Fixture, White or Black Finish, 120 Volt.....	95.50	13.43
26 51 13 00-0554 LED Track Lighting Fixtures (26 51 13 00-0534)		
26 51 13 00-0555 EA 19 Watt, Dimmable, LED Track Lighting Fixture (Juno® TRAC-MASTER® Cylindra™).....	206.10	13.43
26 51 13 00-0556 EA 18 Watt, Dimmable, LED Track Lighting Fixture (HALO® Stasis L805MED).....	368.08	13.43
26 51 13 00-0557 EA 24 Watt, Dimmable, LED Track Lighting Fixture (Amerlux CNTRV33).....	212.26	13.43
26 51 13 00-0558 Track Lighting Accessories (26 51 13 00-0528)		
26 51 13 00-0559 Pendant Mounting (26 51 13 00-0558)		
26 51 13 00-0560 EA Track Lighting Pendant Mounting, Up to 12".....	21.52	
26 51 13 00-0561 EA Track Lighting Pendant Mounting, >12" To 24".....	28.47	
26 51 13 00-0562 EA Track Lighting Pendant Mounting, >24" To 36".....	34.99	
26 51 13 00-0563 Wet Location, Dust Resistant, Vapor Tight Fixtures (26 51 13)		
26 51 13 00-0564 Cast Metal Guard, Enclosed And Gasketed, Vapor Tight Fixtures (26 51 13 00-0563)		
26 51 13 00-0565 Incandescent, Cast Metal Guard, Enclosed And Gasketed, Vapor Tight Fixtures (26 51 13 00-0564)		
26 51 13 00-0566 EA 100 Watt Incandescent, Ceiling Mounted, Cast Metal Guard, Enclosed And Gasketed, Vapor Tight Fixture.....	111.44	32.17
For Wall Mounted, Add	5.10	
26 51 13 00-0567 EA 200 Watt Incandescent, Ceiling Mounted, Cast Metal Guard, Enclosed And Gasketed, Vapor Tight Fixture.....	131.39	32.17
For Wall Mounted, Add	5.10	
26 51 13 00-0568 Compact Fluorescent, Cast Metal Guard, Enclosed And Gasketed, Vapor Tight Fixtures (26 51 13 00-0564)		
26 51 13 00-0569 EA 13 Watt Compact Fluorescent, Ceiling Mounted, Cast Metal Guard, Enclosed And Gasketed, Vapor Tight Fixture.....	121.74	32.17
For Wall Mounted, Add	6.02	
26 51 13 00-0570 EA 22 Watt Compact Fluorescent, Ceiling Mounted, Cast Metal Guard, Enclosed And Gasketed, Vapor Tight Fixture.....	125.66	32.17
For Wall Mounted, Add	6.02	
26 51 13 00-0571 EA 28 Watt Compact Fluorescent, Ceiling Mounted, Cast Metal Guard, Enclosed And Gasketed, Vapor Tight Fixture.....	135.36	32.17
For Wall Mounted, Add	6.02	
26 51 13 00-0572 Metal Halide, Cast Metal Guard, Enclosed And Gasketed, Vapor Tight Fixtures (26 51 13 00-0564)		
26 51 13 00-0573 EA 75 Watt Metal Halide, Ceiling Mounted, Cast Metal Guard, Enclosed And Gasketed, Vapor Tight Fixture.....	155.86	32.17
For Wall Mounted, Add	6.30	
26 51 13 00-0574 EA 100 Watt Metal Halide, Ceiling Mounted, Cast Metal Guard, Enclosed And Gasketed, Vapor Tight Fixture.....	161.36	32.17
For Wall Mounted, Add	6.30	
26 51 13 00-0575 EA 150 Watt Metal Halide, Ceiling Mounted, Cast Metal Guard, Enclosed And Gasketed, Vapor Tight Fixture.....	172.54	32.17
For Wall Mounted, Add	6.30	
26 51 13 00-0576 EA 175 Watt Metal Halide, Ceiling Mounted, Cast Metal Guard, Enclosed And Gasketed, Vapor Tight Fixture.....	189.35	32.17
For Wall Mounted, Add	6.30	
26 51 13 00-0577 High Pressure Sodium, Cast Metal Guard, Enclosed And Gasketed, Vapor Tight Fixtures (26 51 13 00-0564)		
26 51 13 00-0578 EA 70 Watt High Pressure Sodium, Ceiling Mounted, Cast Metal Guard, Enclosed And Gasketed, Vapor Tight Fixture.....	142.76	32.17
For Wall Mounted, Add	6.67	
26 51 13 00-0579 EA 100 Watt High Pressure Sodium, Ceiling Mounted, Cast Metal Guard, Enclosed And Gasketed, Vapor Tight Fixture.....	149.60	32.17
For Wall Mounted, Add	6.67	
26 51 13 00-0580 EA 150 Watt High Pressure Sodium, Ceiling Mounted, Cast Metal Guard, Enclosed And Gasketed, Vapor Tight Fixture.....	176.02	32.17
For Wall Mounted, Add	6.67	
26 51 13 00-0581 Enclosed And Gasketed, Industrial Fluorescent Fixtures (26 51 13 00-0563)		
26 51 13 00-0582 4' Length, Enclosed And Gasketed, Industrial Fluorescent Fixtures (26 51 13 00-0581)		
26 51 13 00-0583 4' Length, Enclosed And Gasketed, Industrial Fluorescent Fixtures (Lithonia DMW) (26 51 13 00-0582)		
Note: Includes high impact acrylic molded lens.		
26 51 13 00-0584 EA 1 T8 Lamp, 4' Length, Enclosed And Gasketed, Industrial Fluorescent Fixture (Lithonia DMW).....	159.06	34.27
For T5 Fixture Instead Of T8, Add	12.32	
26 51 13 00-0585 EA 2 T8 Lamps, 4' Length, Enclosed And Gasketed, Industrial Fluorescent Fixture (Lithonia DMW).....	166.32	34.27
For T5 Fixture Instead Of T8, Add	13.15	

26	Electrical
26 50	Lighting
26 51	Interior Lighting



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 51 13 00-0586 EA 3 T8 Lamps, 4' Length, Enclosed And Gasketed, Industrial Fluorescent Fixture (Lithonia DMW)	253.27	34.27
<i>For T5 Fixture Instead Of T8, Add</i>	23.10	
26 51 13 00-0587 EA 1 T8HO Lamp, 4' Length, Enclosed And Gasketed, Industrial Fluorescent Fixture (Lithonia DMW).....	220.54	34.27
26 51 13 00-0588 EA 2 T8HO Lamps, 4' Length, Enclosed And Gasketed, Industrial Fluorescent Fixture (Lithonia DMW).....	347.58	34.27
26 51 13 00-0589 4' Length, Enclosed And Gasketed, Industrial Fluorescent Fixtures (Day-Brite V2W) <small>(26 51 13 00-0582)</small>		
Note: Includes high impact acrylic molded lens.		
26 51 13 00-0590 EA 1 T8 Lamp, 4' Length, Enclosed And Gasketed, Industrial Fluorescent Fixture (Day-Brite V2W).....	192.99	34.27
26 51 13 00-0591 EA 2 T8 Lamp, 4' Length, Enclosed And Gasketed, Industrial Fluorescent Fixture (Day-Brite V2W).....	195.32	34.27
26 51 13 00-0592 EA 3 T8 Lamp, 4' Length, Enclosed And Gasketed, Industrial Fluorescent Fixture (Day-Brite V2W).....	280.74	34.27
26 51 13 00-0593 EA 1 T8HO Lamp, 4' Length, Enclosed And Gasketed, Industrial Fluorescent Fixture (Day-Brite V2W)	233.55	34.27
26 51 13 00-0594 EA 2 T8HO Lamp, 4' Length, Enclosed And Gasketed, Industrial Fluorescent Fixture (Day-Brite V2W)	243.76	34.27
26 51 13 00-0595 8' Length, Enclosed And Gasketed, Industrial Fluorescent Fixtures <small>(26 51 13 00-0581)</small>		
Note: Includes high impact acrylic molded lens.		
26 51 13 00-0596 8' Length, Enclosed And Gasketed, Industrial Fluorescent Fixtures (Lithonia TDMW) <small>(26 51 13 00-0595)</small>		
Note: Includes high impact acrylic molded lens.		
26 51 13 00-0597 EA 2 T8 Lamps, 8' Length, Enclosed And Gasketed, Industrial Fluorescent Fixture (Lithonia TDMW)	293.84	46.54
<i>For T5 Fixture Instead Of T8, Add</i>	25.65	
26 51 13 00-0598 EA 4 T8 Lamps, 8' Length, Enclosed And Gasketed, Industrial Fluorescent Fixture (Lithonia TDMW).....	305.37	46.54
<i>For T5 Fixture Instead Of T8, Add</i>	26.97	
26 51 13 00-0599 Large Interior Area Fixtures <small>(26 51 13)</small>		
26 51 13 00-0600 Recessed Mounted, Large Interior Area Fixtures <small>(26 51 13 00-0599)</small>		
Note: Cast aluminum socket housing, anodized aluminum reflector, tempered glass or acrylic lens, plaster mounting frames and brackets.		
26 51 13 00-0601 High Pressure Sodium, Recessed Mounted, Large Interior Area Fixtures <small>(26 51 13 00-0600)</small>		
26 51 13 00-0602 EA 150 Watt High Pressure Sodium, Recessed Mounted, Large Interior Area Fixture	260.70	85.74
<i>For Wire Guard, Add</i>	40.50	
<i>For Instant Quartz Restrike, Add</i>	60.00	
26 51 13 00-0603 EA 250 Watt High Pressure Sodium, Recessed Mounted, Large Interior Area Fixture	270.75	91.05
<i>For Wire Guard, Add</i>	40.50	
<i>For Instant Quartz Restrike, Add</i>	60.00	
26 51 13 00-0604 EA 400 Watt High Pressure Sodium, Recessed Mounted, Large Interior Area Fixture	290.48	103.92
<i>For Wire Guard, Add</i>	40.50	
<i>For Instant Quartz Restrike, Add</i>	60.00	
26 51 13 00-0605 Metal Halide, Recessed Mounted, Large Interior Area Fixtures <small>(26 51 13 00-0600)</small>		
26 51 13 00-0606 EA 150 Watt Metal Halide, Recessed Mounted, Large Interior Area Fixture	265.24	85.74
<i>For Wire Guard, Add</i>	40.50	
<i>For Instant Quartz Restrike, Add</i>	60.00	
26 51 13 00-0607 EA 250 Watt Metal Halide, Recessed Mounted, Large Interior Area Fixture	271.64	91.05
<i>For Wire Guard, Add</i>	40.50	
<i>For Instant Quartz Restrike, Add</i>	60.00	
26 51 13 00-0608 EA 400 Watt Metal Halide, Recessed Mounted, Large Interior Area Fixture	290.28	103.92
<i>For Wire Guard, Add</i>	40.50	
<i>For Instant Quartz Restrike, Add</i>	60.00	
26 51 13 00-0609 Low Bay Fixtures, Large Interior Area Fixtures <small>(26 51 13 00-0599)</small>		
Note: Heavy duty steel housing, aluminum reflector, tempered glass or acrylic lens. Low bay fixtures are for mounting below 20-25 feet.		
26 51 13 00-0610 High Pressure Sodium, Low Bay Fixtures <small>(26 51 13 00-0609)</small>		
26 51 13 00-0611 EA 150 Watt High Pressure Sodium, Low Bay Fixture	378.21	78.39
<i>For Wire Guard, Add</i>	40.50	
<i>For Glass Or Acrylic Reflector, Add</i>	90.00	
<i>For Instant Quartz Restrike, Add</i>	60.00	
<i>For Enclosed And Gasketed, Add</i>	75.47	
26 51 13 00-0612 EA 250 Watt High Pressure Sodium, Low Bay Fixture	385.88	83.24
<i>For Wire Guard, Add</i>	40.50	
<i>For Glass Or Acrylic Reflector, Add</i>	90.00	
<i>For Instant Quartz Restrike, Add</i>	60.00	
<i>For Enclosed And Gasketed, Add</i>	75.47	
26 51 13 00-0613 EA 400 Watt High Pressure Sodium, Low Bay Fixture	409.65	95.00
<i>For Wire Guard, Add</i>	40.50	
<i>For Glass Or Acrylic Reflector, Add</i>	90.00	
<i>For Instant Quartz Restrike, Add</i>	60.00	
<i>For Enclosed And Gasketed, Add</i>	75.47	
26 51 13 00-0614 Metal Halide, Low Bay Fixtures <small>(26 51 13 00-0609)</small>		



Electrical	26	26
Lighting	26 50	
Interior Lighting	26 51	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 51 13 00-0615	EA		175 Watt Metal Halide, Low Bay Fixture .....377.76		78.39
			<i>For Wire Guard, Add</i>	40.50	
			<i>For Glass Or Acrylic Reflector, Add</i>	90.00	
			<i>For Instant Quartz Restrike, Add</i>	60.00	
			<i>For Enclosed And Gasketed, Add</i>	75.47	
26 51 13 00-0616	EA		250 Watt Metal Halide, Low Bay Fixture .....384.71		83.24
			<i>For Wire Guard, Add</i>	40.50	
			<i>For Glass Or Acrylic Reflector, Add</i>	90.00	
			<i>For Instant Quartz Restrike, Add</i>	60.00	
			<i>For Enclosed And Gasketed, Add</i>	75.47	
26 51 13 00-0617	EA		400 Watt Metal Halide, Low Bay Fixture .....407.34		95.00
			<i>For Wire Guard, Add</i>	40.50	
			<i>For Glass Or Acrylic Reflector, Add</i>	90.00	
			<i>For Instant Quartz Restrike, Add</i>	60.00	
			<i>For Enclosed And Gasketed, Add</i>	75.47	
26 51 13 00-0618			High Bay Fixtures, Large Interior Area Fixtures <small>(26 51 13 00-0599)</small>		
			Note: High bay fixtures are for mounting above 20-25 feet. See CSI section 01 22 23 00-0001 for lifts.		
26 51 13 00-0619			High Pressure Sodium, High Bay Fixtures <small>(26 51 13 00-0618)</small>		
			Note: Includes heavy duty steel housing and aluminum reflector. Excludes lens.		
26 51 13 00-0620	EA		250 Watt High Pressure Sodium, High Bay Fixture .....338.13		83.24
			<i>For Wire Guard, Add</i>	40.50	
			<i>For Tempered Glass Or Acrylic Lens, Add</i>	60.50	
			<i>For Ballast Safety Chain, Add</i>	12.13	
			<i>For Polycarbonate Lens, Add</i>	47.75	
			<i>For Glass Or Acrylic Reflector, Add</i>	90.00	
			<i>For Security Chain, Add</i>	19.34	
			<i>For Optical Safety Chain, Add</i>	7.47	
			<i>For Instant Quartz Restrike, Add</i>	60.00	
26 51 13 00-0621	EA		400 Watt High Pressure Sodium, High Bay Fixture .....366.94		95.00
			<i>For Wire Guard, Add</i>	40.50	
			<i>For Tempered Glass Or Acrylic Lens, Add</i>	60.50	
			<i>For Ballast Safety Chain, Add</i>	12.13	
			<i>For Polycarbonate Lens, Add</i>	47.75	
			<i>For Glass Or Acrylic Reflector, Add</i>	90.00	
			<i>For Security Chain, Add</i>	19.34	
			<i>For Optical Safety Chain, Add</i>	7.47	
			<i>For Instant Quartz Restrike, Add</i>	60.00	
26 51 13 00-0622	EA		1,000 Watt High Pressure Sodium, High Bay Fixture .....548.75		99.93
			<i>For Wire Guard, Add</i>	40.50	
			<i>For Tempered Glass Or Acrylic Lens, Add</i>	60.50	
			<i>For Ballast Safety Chain, Add</i>	12.13	
			<i>For Polycarbonate Lens, Add</i>	47.75	
			<i>For Glass Or Acrylic Reflector, Add</i>	90.00	
			<i>For Security Chain, Add</i>	19.34	
			<i>For Optical Safety Chain, Add</i>	7.47	
			<i>For Instant Quartz Restrike, Add</i>	60.00	
26 51 13 00-0623			Metal Halide, High Bay Fixtures <small>(26 51 13 00-0618)</small>		
			Note: Includes heavy duty steel housing and aluminum reflector. Excludes lens.		
26 51 13 00-0624	EA		250 Watt Metal Halide, High Bay Fixture .....314.52		83.24
			<i>For Wire Guard, Add</i>	40.50	
			<i>For Tempered Glass Or Acrylic Lens, Add</i>	60.50	
			<i>For Ballast Safety Chain, Add</i>	12.13	
			<i>For Polycarbonate Lens, Add</i>	47.75	
			<i>For Glass Or Acrylic Reflector, Add</i>	90.00	
			<i>For Security Chain, Add</i>	19.34	
			<i>For Optical Safety Chain, Add</i>	7.47	
			<i>For Instant Quartz Restrike, Add</i>	60.00	
26 51 13 00-0625	EA		400 Watt Metal Halide, High Bay Fixture .....336.96		95.00
			<i>For Wire Guard, Add</i>	40.50	
			<i>For Tempered Glass Or Acrylic Lens, Add</i>	60.50	
			<i>For Ballast Safety Chain, Add</i>	12.13	
			<i>For Polycarbonate Lens, Add</i>	47.75	
			<i>For Glass Or Acrylic Reflector, Add</i>	90.00	
			<i>For Security Chain, Add</i>	19.34	
			<i>For Optical Safety Chain, Add</i>	7.47	
			<i>For Instant Quartz Restrike, Add</i>	60.00	
26 51 13 00-0626	EA		1,000 Watt Metal Halide, High Bay Fixture .....465.96		99.93
			<i>For Wire Guard, Add</i>	40.50	
			<i>For Tempered Glass Or Acrylic Lens, Add</i>	60.50	
			<i>For Ballast Safety Chain, Add</i>	12.13	
			<i>For Polycarbonate Lens, Add</i>	47.75	
			<i>For Glass Or Acrylic Reflector, Add</i>	90.00	
			<i>For Security Chain, Add</i>	19.34	
			<i>For Optical Safety Chain, Add</i>	7.47	
			<i>For Instant Quartz Restrike, Add</i>	60.00	
26 51 13 00-0627			(T8) Fluorescent, High Bay Fixtures <small>(26 51 13 00-0618)</small>		
26 51 13 00-0628			(T8) Fluorescent, High Bay Fixtures (Lithonia) <small>(26 51 13 00-0627)</small>		
			Note: For 8' fixture, use two (2) 4' fixtures.		

26	Electrical
26 50	Lighting
26 51	Interior Lighting



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 51	13 00-0629	EA	2 T8 Lamps, 4' Length, Fluorescent High Bay Fixture (Lithonia FGB).....	279.48	75.00
			<i>For Wire Guard, Add</i>	40.50	
			<i>For Acrylic Lens, Add</i>	54.00	
			<i>For Polycarbonate Lens, Add</i>	47.75	
26 51	13 00-0630	EA	3 T8 Lamps, 4' Length, Fluorescent High Bay Fixture (Lithonia FGB).....	294.16	83.09
			<i>For Wire Guard, Add</i>	40.50	
			<i>For Acrylic Lens, Add</i>	54.00	
			<i>For Polycarbonate Lens, Add</i>	47.75	
26 51	13 00-0631	EA	4 T8 Lamps, 4' Length, Fluorescent High Bay Fixture (Lithonia FGB).....	333.90	94.85
			<i>For Wire Guard, Add</i>	40.50	
			<i>For Acrylic Lens, Add</i>	54.00	
			<i>For Polycarbonate Lens, Add</i>	47.75	
26 51	13 00-0632	EA	6 T8 Lamps, 4' Length, Fluorescent High Bay Fixture (Lithonia FGB).....	396.49	99.93
			<i>For Wire Guard, Add</i>	40.50	
			<i>For Acrylic Lens, Add</i>	54.00	
			<i>For Polycarbonate Lens, Add</i>	47.75	
26 51	13 00-0633	EA	8 T8 Lamps, 4' Length, Fluorescent High Bay Fixture (Lithonia FGB).....	430.35	104.57
			<i>For Wire Guard, Add</i>	40.50	
			<i>For Acrylic Lens, Add</i>	54.00	
			<i>For Polycarbonate Lens, Add</i>	47.75	
26 51	13 00-0634	EA	4 T8 Lamps, 4' Length, Fluorescent High Bay Fixture (Lithonia IBZ).....	353.43	94.85
			<i>For Wire Guard, Add</i>	40.50	
			<i>For Acrylic Lens, Add</i>	54.00	
			<i>For Polycarbonate Lens, Add</i>	47.75	
26 51	13 00-0635	EA	6 T8 Lamps, 4' Length, Fluorescent High Bay Fixture (Lithonia IBZ).....	367.42	99.93
			<i>For Wire Guard, Add</i>	40.50	
			<i>For Acrylic Lens, Add</i>	54.00	
			<i>For Polycarbonate Lens, Add</i>	47.75	
26 51	13 00-0636	EA	8 T8 Lamps, 4' Length, Fluorescent High Bay Fixture (Lithonia IBZ).....	430.15	104.57
			<i>For Wire Guard, Add</i>	40.50	
			<i>For Acrylic Lens, Add</i>	54.00	
			<i>For Polycarbonate Lens, Add</i>	47.75	
26 51	13 00-0637		(T5HO) Fluorescent, High Bay Fixtures <small>(26 51 13 00-0618)</small>		
26 51	13 00-0638		(T5HO) Fluorescent, High Bay Fixtures (Lithonia) <small>(26 51 13 00-0637)</small>		
			Note: For 8' fixture, use two (2) 4' fixtures.		
26 51	13 00-0639	EA	2 T5HO Lamps, 4' Length, Fluorescent High Bay Fixture (Lithonia FGB).....	287.28	75.00
			<i>For Wire Guard, Add</i>	40.50	
			<i>For Acrylic Lens, Add</i>	54.00	
			<i>For Polycarbonate Lens, Add</i>	47.75	
26 51	13 00-0640	EA	3 T5HO Lamps, 4' Length, Fluorescent High Bay Fixture (Lithonia FGB).....	304.48	83.09
			<i>For Wire Guard, Add</i>	40.50	
			<i>For Acrylic Lens, Add</i>	54.00	
			<i>For Polycarbonate Lens, Add</i>	47.75	
26 51	13 00-0641	EA	4 T5HO Lamps, 4' Length, Fluorescent High Bay Fixture (Lithonia FGB).....	348.62	94.85
			<i>For Wire Guard, Add</i>	40.50	
			<i>For Acrylic Lens, Add</i>	54.00	
			<i>For Polycarbonate Lens, Add</i>	47.75	
26 51	13 00-0642	EA	6 T5HO Lamps, 4' Length, Fluorescent High Bay Fixture (Lithonia FGB).....	421.10	99.93
			<i>For Wire Guard, Add</i>	40.50	
			<i>For Acrylic Lens, Add</i>	54.00	
			<i>For Polycarbonate Lens, Add</i>	47.75	
26 51	13 00-0643	EA	4 T5HO Lamps, 4' Length, Fluorescent High Bay Fixture (Lithonia IBZ).....	390.42	94.85
			<i>For Wire Guard, Add</i>	40.50	
			<i>For Acrylic Lens, Add</i>	54.00	
			<i>For Polycarbonate Lens, Add</i>	47.75	
26 51	13 00-0644	EA	6 T5HO Lamps, 4' Length, Fluorescent High Bay Fixture (Lithonia IBZ).....	436.48	99.93
			<i>For Wire Guard, Add</i>	40.50	
			<i>For Acrylic Lens, Add</i>	54.00	
			<i>For Polycarbonate Lens, Add</i>	47.75	
26 51	13 00-0645	EA	8 T5HO Lamps, 4' Length, Fluorescent High Bay Fixture (Lithonia IBZ).....	525.23	104.57
			<i>For Wire Guard, Add</i>	40.50	
			<i>For Acrylic Lens, Add</i>	54.00	
			<i>For Polycarbonate Lens, Add</i>	47.75	
26 51	13 00-0646		Induction, High Bay Fixtures <small>(26 51 13 00-0618)</small>		
26 51	13 00-0647		Induction, High Bay Fixtures (Everlast®) <small>(26 51 13 00-0646)</small>		
			Note: Includes die cast aluminum ballast casing and acrylic lens.		
26 51	13 00-0648	EA	100 Watt Induction, High Bay Fixture (Everlast® Huron EHBUS-AC).....	441.77	72.79
			<i>For Impact Resistant Silicon Lens, Add</i>	20.00	
26 51	13 00-0649	EA	120 Watt Induction, High Bay Fixture (Everlast® Huron EHBUS-AC).....	477.47	75.22
			<i>For Impact Resistant Silicon Lens, Add</i>	20.00	
26 51	13 00-0650	EA	150 Watt Induction, High Bay Fixture (Everlast® Huron EHBUS-AC).....	485.57	77.65
			<i>For Impact Resistant Silicon Lens, Add</i>	20.00	
26 51	13 00-0651	EA	200 Watt Induction, High Bay Fixture (Everlast® Huron EHBUS-AC).....	534.52	80.07
			<i>For Impact Resistant Silicon Lens, Add</i>	20.00	
26 51	13 00-0652	EA	250 Watt Induction, High Bay Fixture (Everlast® Huron EHBUS-AC).....	548.13	82.50
			<i>For Impact Resistant Silicon Lens, Add</i>	20.00	
26 51	13 00-0653	EA	100 Watt Induction, Variable Dimming, High Bay Fixture (Everlast® Huron EHBUS-AC).....	480.42	72.79
			<i>For Impact Resistant Silicon Lens, Add</i>	20.00	
26 51	13 00-0654	EA	120 Watt Induction, Variable Dimming, High Bay Fixture (Everlast® Huron EHBUS-AC).....	516.12	75.22
			<i>For Impact Resistant Silicon Lens, Add</i>	20.00	



Electrical	26	26
Lighting	26 50	
Interior Lighting	26 51	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 51 13 00-0655 EA 150 Watt Induction, Variable Dimming, High Bay Fixture (Everlast® Huron EHBUS-AC) <i>For Impact Resistant Silicon Lens, Add</i>	524.22 20.00	77.65
26 51 13 00-0656 EA 200 Watt Induction, Variable Dimming, High Bay Fixture (Everlast® Huron EHBUS-AC) <i>For Impact Resistant Silicon Lens, Add</i>	573.17 20.00	80.07
26 51 13 00-0657 EA 250 Watt Induction, Variable Dimming, High Bay Fixture (Everlast® Huron EHBUS-AC) <i>For Impact Resistant Silicon Lens, Add</i>	586.78 20.00	82.50
26 51 13 00-0658 LED, High Bay Fixtures <small>(26 51 13 00-0618)</small>		
26 51 13 00-0659 LED High Bay Fixtures (Lithonia IBL) <small>(26 51 13 00-0658)</small> Note: Includes aluminum alloy chassis.		
26 51 13 00-0660 EA 9,000 Lumens, 45" Length, LED High Bay Fixture (Lithonia IBL 9L)	553.98	80.88
26 51 13 00-0661 EA 12,000 Lumens, 45" Length, LED High Bay Fixture (Lithonia IBL 12L)	609.19	80.88
26 51 13 00-0662 EA 18,000 Lumens, 45" Length, LED High Bay Fixture (Lithonia IBL 18L)	758.27	80.88
26 51 13 00-0663 EA 24,000 Lumens, 45" Length, LED High Bay Fixture (Lithonia IBL 24L)	817.90	80.88
26 51 13 00-0664 LED High Bay Fixtures (PlanLED) <small>(26 51 13 00-0658)</small>		
26 51 13 00-0665 LED High Bay Fixtures (PlanLED LUNA) <small>(26 51 13 00-0664)</small> Note: Includes aluminum alloy chassis.		
26 51 13 00-0666 EA 7,000 Lumens, LED High Bay Fixture (PlanLED LUNA LN70)	510.37	80.88
26 51 13 00-0667 EA 9,800 Lumens, LED High Bay Fixture (PlanLED LUNA LN98)	597.52	80.88
26 51 13 00-0668 EA 13,000 Lumens, LED High Bay Fixture (PlanLED LUNA LN130)	641.62	80.88
26 51 13 00-0669 EA 16,000 Lumens, LED High Bay Fixture (PlanLED LUNA LN160)	692.02	80.88
26 51 13 00-0670 LED High Bay Fixtures (PlanLED IBL) <small>(26 51 13 00-0664)</small> Note: Includes aluminum alloy chassis.		
26 51 13 00-0671 EA 13,650 Lumens, 130 System Watts, 46.5" Length, LED Indirect High Bay Fixture (PlanLED IBL 130W)..... <i>For 347-480 Volt, Add</i>	505.12 42.00	80.88
26 51 13 00-0672 EA 21,000 Lumens, 200 System Watts, 46.5" Length, LED Indirect High Bay Fixture (PlanLED IBL 200W)..... <i>For 347-480 Volt, Add</i>	676.27 51.45	80.88
26 51 13 00-0673 EA 42,000 Lumens, 400 System Watts, 46.5" Length, LED Indirect High Bay Fixture (PlanLED IBL 400W)..... <i>For 347-480 Volt, Add</i>	1,183.42 57.75	80.88
26 51 13 00-0674 LED High Bay Fixtures (PlanLED SEGA) <small>(26 51 13 00-0664)</small> Note: Includes aluminum alloy chassis.		
26 51 13 00-0675 EA 10,400 Lumens, 80 System Watts, LED High Bay Fixture (PlanLED SEGA SE080)..... <i>For 0 To 10 Volt Dimming, Add</i>	436.87 29.40	80.88
26 51 13 00-0676 EA 13,000 Lumens, 100 System Watts, LED High Bay Fixture (PlanLED SEGA SE100)..... <i>For 0 To 10 Volt Dimming, Add</i>	442.12 29.40	80.88
26 51 13 00-0677 EA 16,900 Lumens, 130 System Watts, LED High Bay Fixture (PlanLED SEGA SE130)..... <i>For 0 To 10 Volt Dimming, Add</i>	515.62 29.40	80.88
26 51 13 00-0678 EA 20,800 Lumens, 160 System Watts, LED High Bay Fixture (PlanLED SEGA SE160)..... <i>For 0 To 10 Volt Dimming, Add</i>	588.07 29.40	80.88
26 51 13 00-0679 EA 50,000 Lumens, 400 System Watts, Array, LED High Bay Fixture (PlanLED SEGA SE400)	1,276.87	80.88
26 51 13 00-0680 EA 57,040 Lumens, 500 System Watts, Array, LED High Bay Fixture (PlanLED SEGA SE500)	1,276.87	80.88
26 51 13 00-0681 EA 80,000 Lumens, 640 System Watts, Array, LED High Bay Fixture (PlanLED SEGA SE640)	1,894.27	80.88
26 51 13 00-0682 Ceiling Mounted, Large Interior Area Fixtures <small>(26 51 13 00-0599)</small> Note: Heavy duty aluminum housing, aluminum reflector, acrylic drop dish lens, fully gasketed.		
26 51 13 00-0683 High Pressure Sodium, Ceiling Mounted, Large Interior Area Fixtures <small>(26 51 13 00-0682)</small>		
26 51 13 00-0684 EA 100 Watt High Pressure Sodium, Ceiling Mounted, Large Interior Area Fixture <i>For Wire Guard, Add</i> <i>For Polycarbonate Lens, Add</i> <i>For Instant Quartz Restrike, Add</i>	301.00 40.50 47.75 60.00	55.74
26 51 13 00-0685 EA 150 Watt High Pressure Sodium, Ceiling Mounted, Large Interior Area Fixture <i>For Wire Guard, Add</i> <i>For Polycarbonate Lens, Add</i> <i>For Instant Quartz Restrike, Add</i>	360.97 40.50 47.75 60.00	55.74
26 51 13 00-0686 EA 250 Watt High Pressure Sodium, Ceiling Mounted, Large Interior Area Fixture <i>For Wire Guard, Add</i> <i>For Polycarbonate Lens, Add</i> <i>For Instant Quartz Restrike, Add</i>	411.63 40.50 47.75 60.00	55.74
26 51 13 00-0687 EA 400 Watt High Pressure Sodium, Ceiling Mounted, Large Interior Area Fixture <i>For Wire Guard, Add</i> <i>For Polycarbonate Lens, Add</i> <i>For Instant Quartz Restrike, Add</i>	550.03 40.50 47.75 60.00	55.74
26 51 13 00-0688 Metal Halide, Ceiling Mounted, Large Interior Area Fixtures <small>(26 51 13 00-0682)</small>		
26 51 13 00-0689 EA 100 Watt Metal Halide, Ceiling Mounted, Large Interior Area Fixture <i>For Wire Guard, Add</i> <i>For Polycarbonate Lens, Add</i> <i>For Instant Quartz Restrike, Add</i>	256.23 40.50 47.75 60.00	55.74
26 51 13 00-0690 EA 175 Watt Metal Halide, Ceiling Mounted, Large Interior Area Fixture <i>For Wire Guard, Add</i> <i>For Polycarbonate Lens, Add</i> <i>For Instant Quartz Restrike, Add</i>	274.83 40.50 47.75 60.00	61.85

26 Electrical**26 50 Lighting****26 51 Interior Lighting**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 51 13 00-0691 EA 250 Watt Metal Halide, Ceiling Mounted, Large Interior Area Fixture	291.11	66.99
For Wire Guard, Add	40.50	
For Polycarbonate Lens, Add	47.75	
For Instant Quartz Restrike, Add	60.00	
26 51 13 00-0692 EA 400 Watt Metal Halide, Ceiling Mounted, Large Interior Area Fixture	316.72	79.78
For Wire Guard, Add	40.50	
For Polycarbonate Lens, Add	47.75	
For Instant Quartz Restrike, Add	60.00	
26 51 13 00-0693 Interior Lighting Accessories (26 51 13)		
26 51 13 00-0694 LF For Each Additional LF Of Interior Lighting Wire Whip, Add	0.92	
Note: Wire whips are included with interior lighting fixtures, where necessary, up to six feet in length. Use this task for additional required whip length. For example, if the fixture requires a 15' wire whip then use 9 LF of this task to reach required length.		
26 52 Emergency Lighting (26 50)		
26 52 00 00-0001 Commercial Emergency Lights (26 52)		
26 52 00 00-0002 Polycarbonate Housing, Commercial Emergency Lights (26 52 00 00-0001)		
Note: Includes lead-calcium batteries and two adjustable lamp heads.		
26 52 00 00-0003 EA 3 Max Wattage At 90 Minutes, 3.6 Volt, Polycarbonate Housing, LED Lamps, Commercial Emergency Light (Lithonia ELM2 LED)	132.82	20.11
26 52 00 00-0004 EA 10.8 Max Wattage At 90 Minutes, 6 Volt, Polycarbonate Housing, Krypton Lamps, Commercial Emergency Light (Lithonia ELM2)	93.90	20.11
For Halogen Lamps, Add	27.55	
For Self-Diagnostics, Add	87.50	
26 52 00 00-0005 EA 18 Max Wattage At 90 Minutes, 6 Volt, Polycarbonate Housing, Krypton Lamps, Commercial Emergency Light (Lithonia ELM618)	144.83	20.11
For Halogen Lamps, Add	27.55	
For Self-Diagnostics, Add	87.50	
26 52 00 00-0006 EA 27 Max Wattage At 90 Minutes, 6 Volt, Remote Capability, Polycarbonate Housing, Krypton Lamps, Commercial Emergency Light (Lithonia ELM627).....	167.89	20.11
For Halogen Lamps, Add	27.55	
For Self-Diagnostics, Add	87.50	
26 52 00 00-0007 EA 54 Max Wattage At 90 Minutes, 6 Volt, Remote Capability, Polycarbonate Housing, Krypton Lamps, Commercial Emergency Light (Lithonia ELM654).....	247.14	20.11
For Halogen Lamps, Add	27.55	
For Self-Diagnostics, Add	87.50	
26 52 00 00-0008 EA 54 Max Wattage At 90 Minutes, 12 Volt, Remote Capability, Polycarbonate Housing, Krypton Lamps, Commercial Emergency Light (Lithonia ELM1254).....	279.31	20.11
For Halogen Lamps, Add	27.55	
For Self-Diagnostics, Add	87.50	
26 52 00 00-0009 EA 72 Max Wattage At 90 Minutes, 12 Volt, Remote Capability, Polycarbonate Housing, Krypton Lamps, Commercial Emergency Light (Lithonia ELM1272).....	404.64	20.11
For Halogen Lamps, Add	27.55	
For Self-Diagnostics, Add	87.50	
26 52 00 00-0010 Remote Heads For Commercial Emergency Lights (26 52 00 00-0001)		
Note: For use with fixtures that have remote capability.		
26 52 00 00-0011 EA 6 Watt, 6 Volt, Aluminum Housing, Halogen Lamp, Emergency Light Remote Head (Lithonia ELA MT H0606)	89.38	12.07
26 52 00 00-0012 EA 6 Watt, 6 Volt, Gasketed Fiberglass Housing, Halogen Lamp, Emergency Light Remote Head (Lithonia ELA NX H0606).....	89.96	12.07
26 52 00 00-0013 EA 8 Watt, 8 Volt, Gasketed Fiberglass Housing, Halogen Lamp, Emergency Light Remote Head (Lithonia ELA NX H0806).....	91.90	12.07
26 52 00 00-0014 EA 12 Watt, 12 Volt, Aluminum Housing, Halogen Lamp, Emergency Light Remote Head (Lithonia ELA MT H1212)	91.59	12.07
26 52 00 00-0015 EA 12 Watt, 12 Volt, Thermoplastic Housing, Halogen Lamp, Emergency Light Remote Head (Lithonia ELA H1212).....	79.64	12.07
26 52 00 00-0016 EA 12 Watt, 12 Volt, Thermoplastic Housing, Incandescent Lamp, Emergency Light Remote Head (Lithonia ELA N1206).....	55.92	12.07
26 52 00 00-0017 Industrial Emergency Lights (26 52)		
26 52 00 00-0018 Painted Steel Housing, Industrial Emergency Lights (26 52 00 00-0017)		
26 52 00 00-0019 Painted Steel Housing, Industrial Emergency Lights (26 52 00 00-0018)		
Note: Includes lead-calcium batteries and two adjustable lamp heads.		
26 52 00 00-0020 EA 16 Max Wattage At 90 Minutes, 6 Volt, Painted Steel Housing, Incandescent Lamps, Industrial Emergency Light (Lithonia ELT16).....	229.64	20.11
For Wireguard, Add	113.97	
26 52 00 00-0021 EA 24 Max Wattage At 90 Minutes, 6 Volt, Remote Capability, Painted Steel Housing, Incandescent Lamps, Industrial Emergency Light (Lithonia ELT24)	193.65	20.11
For Wireguard, Add	113.97	
26 52 00 00-0022 EA 36 Max Wattage At 90 Minutes, 6 Volt, Remote Capability, Painted Steel Housing, Incandescent Lamps, Industrial Emergency Light (Lithonia ELT36)	298.83	20.11
For Wireguard, Add	113.97	
26 52 00 00-0023 EA 50 Max Wattage At 90 Minutes, 12 Volt, Remote Capability, Painted Steel Housing, Incandescent Lamps, Industrial Emergency Light (Lithonia ELT50).....	316.98	20.11
For Wireguard, Add	113.97	
26 52 00 00-0024 EA 125 Max Wattage At 90 Minutes, 12 Volt, Remote Capability, Painted Steel Housing, Incandescent Lamps, Industrial Emergency Light (Lithonia ELT125).....	450.11	20.11
For Wireguard, Add	121.39	



Electrical	26	26
Lighting	26 50	
Emergency Lighting	26 52	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 52 00 00-0025	EA		275 Max Wattage At 90 Minutes, 12 Volt, Remote Capability, Painted Steel Housing, Incandescent Lamps, Industrial Emergency Light (Lithonia ELT275).....	704.78	20.11
			<i>For Wireguard, Add</i>	121.39	
26 52 00 00-0026			Remote Heads For Painted Steel Housing, Industrial Emergency Lights <small>(26 52 00 00-0018)</small>		
			<i>Note: For use with fixtures that have remote capability.</i>		
26 52 00 00-0027	EA		8 Watt, 6 Volt, Thermoplastic Housing, Incandescent Lamp, Emergency Light Remote Head (Lithonia ELA N0806).....	69.59	12.07
			<i>For Wireguard, Add</i>	91.98	
26 52 00 00-0028	EA		12 Watt, 6 Volt, Thermoplastic Housing, Incandescent Lamp, Emergency Light Remote Head (Lithonia ELA N1206).....	71.85	12.07
			<i>For Wireguard, Add</i>	91.98	
26 52 00 00-0029	EA		8 Watt, 12 Volt, Thermoplastic Housing, Halogen Lamp, Emergency Light Remote Head (Lithonia ELA H0812)	69.91	12.07
			<i>For Wireguard, Add</i>	91.98	
26 52 00 00-0030	EA		12 Watt, 12 Volt, Thermoplastic Housing, Incandescent Lamp, Emergency Light Remote Head (Lithonia ELA N1212).....	70.28	12.07
			<i>For Wireguard, Add</i>	91.98	
26 52 00 00-0031	EA		12 Watt, 25 Volt, Thermoplastic Housing, Incandescent Lamp, Emergency Light Remote Head (Lithonia ELA N2512).....	71.85	12.07
			<i>For Wireguard, Add</i>	91.98	
26 52 00 00-0032	EA		12 Watt, 25 Volt, Aluminum Housing, Incandescent Lamp, Emergency Light Remote Head (Lithonia ELA MT N2512).....	83.33	12.07
			<i>For Wireguard, Add</i>	91.98	
26 52 00 00-0033			Rugged Injection-Molded Thermoplastic Housing, Industrial Emergency Lights <small>(26 52 00 00-0017)</small>		
26 52 00 00-0034			Rugged Injection-Molded Thermoplastic Housing, Industrial Emergency Lights <small>(26 52 00 00-0033)</small>		
			<i>Note: Includes lead-calcium batteries and two adjustable lamp heads.</i>		
26 52 00 00-0035	EA		18 Max Wattage At 90 Minutes, 6 Volt, Krypton Lamps, Rugged Injection-Molded Thermoplastic Housing, Industrial Emergency Light (Lithonia IND618)	226.74	20.11
			<i>For Wireguard, Add</i>	110.81	
			<i>For Self-Diagnostics, Add</i>	105.50	
26 52 00 00-0036	EA		36 Max Wattage At 90 Minutes, 12 Volt, Remote Capability, Krypton Lamps, Rugged Injection-Molded Thermoplastic Housing, Industrial Emergency Light (Lithonia IND1236).....	245.95	20.11
			<i>For Wireguard, Add</i>	110.81	
			<i>For Self-Diagnostics, Add</i>	105.50	
26 52 00 00-0037	EA		54 Max Wattage At 90 Minutes, 6 Volt, Remote Capability, Krypton Lamps, Rugged Injection-Molded Thermoplastic Housing, Industrial Emergency Light (Lithonia IND654).....	240.69	20.11
			<i>For Wireguard, Add</i>	110.81	
			<i>For Self-Diagnostics, Add</i>	105.50	
26 52 00 00-0038	EA		54 Max Wattage At 90 Minutes, 12 Volt, Remote Capability, Krypton Lamps, Rugged Injection-Molded Thermoplastic Housing, Industrial Emergency Light (Lithonia IND1254).....	254.10	20.11
			<i>For Wireguard, Add</i>	110.81	
			<i>For Self-Diagnostics, Add</i>	105.50	
26 52 00 00-0039	EA		100 Max Wattage At 90 Minutes, 12 Volt, Remote Capability, Krypton Lamps, Rugged Injection-Molded Thermoplastic Housing, Industrial Emergency Light (Lithonia IND12100).....	424.06	20.11
			<i>For Wireguard, Add</i>	110.81	
			<i>For Self-Diagnostics, Add</i>	105.50	
26 52 00 00-0040	EA		18 Max Wattage At 90 Minutes, 6 Volt, Krypton Lamps, NEMA 4X, Rugged Injection-Molded Thermoplastic Housing, Harsh Environment Industrial Emergency Light (Lithonia INDX618)	334.35	20.11
			<i>For Wireguard, Add</i>	110.81	
			<i>For Self-Diagnostics, Add</i>	61.50	
26 52 00 00-0041	EA		36 Max Wattage At 90 Minutes, 12 Volt, Remote Capability, Krypton Lamps, NEMA 4X, Rugged Injection-Molded Thermoplastic Housing, Harsh Environment Industrial Emergency Light (Lithonia INDX1236).....	373.81	20.11
			<i>For Wireguard, Add</i>	110.81	
			<i>For Self-Diagnostics, Add</i>	61.50	
26 52 00 00-0042	EA		54 Max Wattage At 90 Minutes, 12 Volt, Remote Capability, Krypton Lamps, NEMA 4X, Rugged Injection-Molded Thermoplastic Housing, Harsh Environment Industrial Emergency Light (Lithonia INDX1254).....	393.81	20.11
			<i>For Wireguard, Add</i>	110.81	
			<i>For Self-Diagnostics, Add</i>	61.50	
26 52 00 00-0043			Remote Heads For Rugged Injection-Molded Thermoplastic Housing, Industrial Emergency Lights <small>(26 52 00 00-0033)</small>		
			<i>Note: For use with fixtures that have remote capability.</i>		
26 52 00 00-0044	EA		9 Watt, 6 Volt, Heavyweight Polycarbonate Housing, Krypton Lamp, Emergency Light Remote Head (Lithonia ELA IND K0906)	60.91	12.07
26 52 00 00-0045	EA		12 Watt, 6 Volt, Heavyweight Polycarbonate Housing, Halogen Lamp, Emergency Light Remote Head (Lithonia ELA IND H1206)	65.49	12.07
26 52 00 00-0046	EA		9 Watt, 12 Volt, Heavyweight Polycarbonate Housing, Krypton Lamp, Emergency Light Remote Head (Lithonia ELA IND K0912)	60.96	12.07
26 52 00 00-0047	EA		12 Watt, 12 Volt, Heavyweight Polycarbonate Housing, Halogen Lamp, Emergency Light Remote Head (Lithonia ELA IND H1212)	64.33	12.07
26 52 00 00-0048	EA		12 Watt, 20 Volt, Heavyweight Polycarbonate Housing, Halogen Lamp, Emergency Light Remote Head (Lithonia ELA IND H2012)	55.68	12.07
26 52 00 00-0049			Outdoor Emergency Lights <small>(26 52)</small>		

26	Electrical
26 50	Lighting
26 52	Emergency Lighting



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 52 00 00-0050 Gasketed Die-Cast Aluminum Housing, Outdoor Emergency Lights ^(26 52 00 00-) <i>0049)</i> Note: Includes nickel-cadmium batteries.		
26 52 00 00-0051 EA 10 Max Wattage At 90 Minutes, LED Lamps, Gasketed Aluminum Die-Cast Housing, Outdoor Emergency Light (Dual-Lite PG Series).....	353.55	20.11
26 52 00 00-0052 EA 10 Max Wattage At 90 Minutes, LED Lamps, Gasketed Aluminum Die-Cast Housing, Outdoor Emergency Light With Heater (Dual-Lite PG Series).....	420.64	20.11
26 52 00 00-0053 Recessed Emergency Lights ^(26 52)		
26 52 00 00-0054 EA 10 Watts At 90 Minutes, 6 Volt, Halogen Lamp, 8" Round, Recessed High-Hat Emergency Light (Lithonia ELRG) <i>For Wire Guard, Add</i>	384.27 60.00	20.11
26 52 00 00-0055 EA 16 Watts At 90 Minutes, 6 Volt, 12" x 12" Polycarbonate Housing, Glass Sealed-Beam Lamps, Recessed Emergency Light (Lithonia ELR2).....	312.08	40.21
Note: Includes lead-calcium batteries and two adjustable lamp heads. <i>For Wireguard, Add</i>	121.39	
26 52 00 00-0056 EA 50 Watts At 90 Minutes, 12 Volt, 12" x 12" Polycarbonate Housing, Glass Sealed-Beam Lamps, Recessed Emergency Light (Lithonia ELR4).....	442.10	40.21
Note: Includes lead-calcium batteries and two adjustable lamp heads. <i>For Wireguard, Add</i>	121.39	
26 52 00 00-0057 Square Wraparound Emergency Lights ^(26 52)		
26 52 00 00-0058 EA 10 Watts At 90 Minutes, 6 Volt, Halogen Lamp, 10-5/16" x 10-5/16" Lexan Frame, Square Wraparound Emergency Light (Lithonia ELSQ)	179.20	20.11
26 53 Exit Signs ^(26 50) Note: Excludes pendants.		
26 53 00 00-0001 LED Exit Signs ^(26 53) Note: Includes red LED lamps.		
26 53 00 00-0002 EA Single Face, Thermoplastic Housing, LED Exit Sign (Lithonia LQM)..... <i>For Green LED Lamps, Add</i>	111.72 15.00	29.40
26 53 00 00-0003 EA Double Face, Thermoplastic Housing, LED Exit Sign (Lithonia LQM)	111.72	29.40
<i>For Green LED Lamps, Add</i>	15.00	
26 53 00 00-0004 EA Single Face, Thermoplastic Housing, LED Exit Sign With Battery Back-Up (Lithonia LQM ELN)..... <i>For Self-Diagnostics, Add</i> <i>For Green LED Lamps, Add</i>	169.51 50.00 15.00	29.40
26 53 00 00-0005 EA Double Face, Thermoplastic Housing, LED Exit Sign With Battery Back-Up (Lithonia LQM ELN)	169.51	29.40
<i>For Self-Diagnostics, Add</i> <i>For Green LED Lamps, Add</i>	50.00 15.00	
26 53 00 00-0006 EA Single Face, Die-Cast Aluminum Housing, LED Exit Sign (Lithonia LQC)..... <i>For Green LED Lamps, Add</i>	192.21 15.00	29.40
26 53 00 00-0007 EA Double Face, Die-Cast Aluminum Housing, LED Exit Sign (Lithonia LQC)	212.23	29.40
<i>For Green LED Lamps, Add</i>	15.00	
26 53 00 00-0008 EA Single Face, Die-Cast Aluminum Housing, LED Exit Sign With Battery Back-Up (Lithonia LQC ELN)..... <i>For Self-Diagnostics, Add</i> <i>For Green LED Lamps, Add</i>	205.56 50.00 15.00	29.40
26 53 00 00-0009 EA Double Face, Die-Cast Aluminum Housing, LED Exit Sign With Battery Back-Up (Lithonia LQC ELN)	225.57	29.40
<i>For Self-Diagnostics, Add</i> <i>For Green LED Lamps, Add</i>	50.00 15.00	
26 53 00 00-0010 EA Single Face, Thermoplastic Housing, LED Exit Sign/Emergency Light Combo With Battery Back-Up (Lithonia LHQM)	201.48	29.40
Note: Includes two circular side mounted krypton emergency lights. <i>For Green LED Lamps, Add</i>	15.00	
26 53 00 00-0011 EA Single Face, Thermoplastic Housing, LED Exit Sign/Emergency Light Combo With Battery Back-Up (Lithonia LHQM LED)	289.83	29.40
Note: Includes two circular side mounted LED emergency lights. <i>For Green LED Lamps, Add</i>	15.00	
26 53 00 00-0012 EA Single Face, Powder Coated Steel Housing, LED Exit Sign/Emergency Light Combo With Battery Back-Up (Big Beam COM-PH).....	247.51	29.40
Note: Includes two rectangular front mounted high intensity tungsten emergency lights. <i>For Green LED Lamps, Add</i>	15.00	
26 53 00 00-0013 EA Single Face, Powder Coated Steel Housing, LED Exit Sign/Emergency Light Combo With Battery Back-Up (Big Beam COM).....	258.39	29.40
Note: Includes two circular side mounted PAR 36 emergency lights. <i>For Green LED Lamps, Add</i>	15.00	
26 53 00 00-0014 Edge-Lit LED Exit Signs ^(26 53) Note: Includes red LED lamps.		
26 53 00 00-0015 EA Single Face, Edge-Lit LED Exit Sign..... <i>For Green LED Lamps, Add</i>	227.09 40.00	29.40
26 53 00 00-0016 EA Double Face, Edge-Lit LED Exit Sign	242.92	29.40
<i>For Green LED Lamps, Add</i>	40.00	
26 53 00 00-0017 EA Single Face, Edge-Lit LED Exit Sign With Battery Back-Up	275.97	29.40
<i>For Self-Diagnostics, Add</i> <i>For Green LED Lamps, Add</i>	50.00 40.00	
26 53 00 00-0018 EA Double Face, Edge-Lit LED Exit Sign With Battery Back-Up	287.63	29.40
<i>For Self-Diagnostics, Add</i> <i>For Green LED Lamps, Add</i>	50.00 40.00	



Electrical	26	26
Lighting	26 50	
Exit Signs	26 53	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 53 00 00-0019 Self-Luminous Tritium Exit Signs <small>(26 53)</small>		
<i>Note: Includes red or green tritium filled pyrex glass light tubes with phosphor coating.</i>		
26 53 00 00-0020 EA 10 Year, Single Face, Acrylonitrile Butadiene Styrene (ABS) Housing, Self-Luminous Tritium Exit Sign.....	305.05	29.40
26 53 00 00-0021 EA 10 Year, Double Face, Acrylonitrile Butadiene Styrene (ABS) Housing, Self-Luminous Tritium Exit Sign.....	551.05	29.40
26 53 00 00-0022 EA 20 Year, Single Face, Acrylonitrile Butadiene Styrene (ABS) Housing, Self-Luminous Tritium Exit Sign.....	361.09	29.40
26 53 00 00-0023 EA 20 Year, Double Face, Acrylonitrile Butadiene Styrene (ABS) Housing, Self-Luminous Tritium Exit Sign.....	596.03	29.40
26 53 00 00-0024 EA 10 Year, Single Face, Aluminum Housing, Self-Luminous Tritium Exit Sign.....	332.94	29.40
26 53 00 00-0025 EA 10 Year, Double Face, Aluminum Housing, Self-Luminous Tritium Exit Sign.....	596.03	29.40
26 53 00 00-0026 EA 20 Year, Single Face, Aluminum Housing, Self-Luminous Tritium Exit Sign.....	405.82	29.40
26 53 00 00-0027 EA 20 Year, Double Face, Aluminum Housing, Self-Luminous Tritium Exit Sign.....	737.05	29.40
26 53 00 00-0028 Vandal-Resistant LED Exit Signs <small>(26 53)</small>		
<i>Note: Includes red LED lamps.</i>		
26 53 00 00-0029 EA Single Face, Aluminum Housing, Vandal-Resistant/Wet Location, LED Exit Sign.....	288.48	29.40
26 53 00 00-0030 EA Single Face, Aluminum Housing, Vandal-Resistant/Wet Location, LED Exit Sign With Battery Backup	440.81	29.40
26 53 00 00-0031 EA Single Face, Aluminum Housing, NEMA 4X, Vandal-Resistant/Wet Location, LED Exit Sign With Battery Backup.....	534.21	29.40
26 53 00 00-0032 Remove And Reinstall Exit Light Fixture <small>(26 53)</small>		
26 53 00 00-0033 EA Removal And Reinstall Of Exit Light Fixtures	60.32	
<i>Note: Includes storage and cleaning.</i>		
26 53 00 00-0034 Exit Sign Accessories <small>(26 53)</small>		
26 53 00 00-0035 EA Polycarbonate Vandal Shield For Exit Signs.....	68.72	8.05
26 53 00 00-0036 EA Wire Guard For Exit Signs	74.56	8.05
26 53 00 00-0037 EA Replacement Battery For Exit Signs.....	69.54	10.07
26 55 Special Purpose Lighting <small>(26 50)</small>		
26 55 61 Theatrical Lighting <small>(26 55)</small>		
26 55 61 00-0001 Stage Lighting <small>(26 55 61)</small>		
26 55 61 00-0002 EA Ellipsoidal Spotlight, Two 6" x 9" Lenses	374.29	97.80
<i>Note: Stainless steel shutter blades, complete with color frame, c-clamp, safety cable, 20A, 3W ground, male pin connector and high performance lamp.</i>		
26 55 61 00-0003 EA Ellipsoidal Spotlight, Two 6" x 12" Lenses.....	374.29	97.80
<i>Note: Stainless steel shutter blades, complete with color frame, c-clamp, safety cable, 20A, 3W ground, male pin connector and high performance lamp.</i>		
26 55 61 00-0004 EA Ellipsoidal Spotlight, Two 6" x 16" Lenses.....	374.29	97.80
<i>Note: Stainless steel shutter blades, complete with color frame, c-clamp, safety cable, 20A, 3W ground, male pin connector and high performance lamp.</i>		
26 55 61 00-0005 EA 14" Scoop Floodlight Altman #SC14.....	367.92	97.80
26 55 61 00-0006 EA 6" Diameter Fresnel Spotlight, Spherical Specular Alzak	265.98	97.80
<i>Note: Reflector, heat resistant fresnel lens, slidefocus flood to spot, complete with yoke, c-clamp, safety cable, color frame, male pin connector and lamp.</i>		
26 55 61 00-0007 EA 8" Diameter Fresnel Spotlight, Spherical Specular Alzak	423.13	97.80
<i>Note: Reflector, heat resistant fresnel lens, slidefocus flood to spot, complete with yoke, C-clamp, safety cable, color frame, male pin connector and lamp.</i>		
26 55 61 00-0008 EA Follow Spotlight With Steel Chassis And Lightweight.....	1,166.40	97.80
<i>Note: Aluminum housing, includes lamp adjustment plate, silent lamp fan, dowser, iris and clipper, rear lens control, coated lenses, six color boomerang, color fan, 34" x 34" castered stand.</i>		
26 55 61 00-0009 EA Follow Spotlight With Steel Chassis And Lightweight.....	1,527.41	97.80
<i>Note: Aluminum housing, includes lamp adjustment plate, ballast, electronic power supply, stepdown transformer, silent lamp fan, dowser, iris and clipper, rear lens control, coated lenses, six color boomerang, color fan, 34" x 34" castered stand.</i>		
26 55 61 00-0010 EA PAR 64 Can Lighting With 20 Gauge Sheet Steel.....	247.97	97.80
<i>Note: Formed lamp housing, hinged and latched rear housing secured by retention ring, safety cable, safety screen, PAR 64 lamp, male pin connector.</i>		
26 55 61 00-0011 EA 6' Long Borderlight Sections	696.10	97.80
<i>Note: With continuous sheet steel housing, supported by 1-1/2" x 3/16" steel yoke with C-clamp, includes 30 lights per section wired on 3 circuits, alzak aluminum reflector with matte finish.</i>		
26 56 Exterior Lighting <small>(26 50)</small>		
26 56 13 Lighting Poles And Standards <small>(26 56)</small>		
26 56 13 00-0001 Poles And Standards <small>(26 56 13)</small>		
26 56 13 00-0002 Roadway Light Poles <small>(26 56 13 00-0001)</small>		
26 56 13 00-0003 Steel Roadway Light Poles <small>(26 56 13 00-0002)</small>		
<i>Note: Includes prime painted finish, anchor bolts, steel base with nut covers, reinforced handhole with cover and grounding provisions, and fixture arm(s).</i>		
26 56 13 00-0004 Round Tapered, Steel Roadway Light Poles <small>(26 56 13 00-0003)</small>		
26 56 13 00-0005 Round Tapered, Steel Roadway Light Poles With Upsweep Style Arms <small>(26 56 13 00-0004)</small>		



MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56 13 00-0006			Round Tapered, Steel Roadway Light Poles With Single Upsweep Style Arm <small>(26 56 13 00-0005)</small>		
26 56 13 00-0007	EA		20' High, 5.9" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Single 4' Upsweep Style Arm, Anchor Base.....	2,791.10	268.22
			<i>For Galvanized Finish, Add</i>	67.64	
			<i>For >10 To 20, Deduct</i>	-69.78	
			<i>For >20 To 40, Deduct</i>	-139.56	
			<i>For >40, Deduct</i>	-222.74	
26 56 13 00-0008	EA		20' High, 5.9" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Single 6' Upsweep Style Arm, Anchor Base.....	2,796.66	268.22
			<i>For Galvanized Finish, Add</i>	67.81	
			<i>For >10 To 20, Deduct</i>	-69.92	
			<i>For >20 To 40, Deduct</i>	-139.83	
			<i>For >40, Deduct</i>	-223.16	
26 56 13 00-0009	EA		25' High, 5.9" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Single 4' Upsweep Style Arm, Anchor Base.....	3,008.50	357.63
			<i>For Galvanized Finish, Add</i>	68.80	
			<i>For >10 To 20, Deduct</i>	-75.21	
			<i>For >20 To 40, Deduct</i>	-150.43	
			<i>For >40, Deduct</i>	-243.52	
26 56 13 00-0010	EA		25' High, 5.9" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Single 6' Upsweep Style Arm, Anchor Base.....	3,075.51	357.63
			<i>For Galvanized Finish, Add</i>	70.81	
			<i>For >10 To 20, Deduct</i>	-76.89	
			<i>For >20 To 40, Deduct</i>	-153.78	
			<i>For >40, Deduct</i>	-248.54	
26 56 13 00-0011	EA		25' High, 5.9" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Single 8' Upsweep Style Arm, Anchor Base.....	3,142.51	357.63
			<i>For Galvanized Finish, Add</i>	72.82	
			<i>For >10 To 20, Deduct</i>	-78.56	
			<i>For >20 To 40, Deduct</i>	-157.13	
			<i>For >40, Deduct</i>	-253.57	
26 56 13 00-0012	EA		30' High, 6.6" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Single 4' Upsweep Style Arm, Anchor Base.....	3,246.05	402.33
			<i>For Galvanized Finish, Add</i>	73.24	
			<i>For >10 To 20, Deduct</i>	-81.15	
			<i>For >20 To 40, Deduct</i>	-162.30	
			<i>For >40, Deduct</i>	-263.57	
26 56 13 00-0013	EA		30' High, 6.6" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Single 6' Upsweep Style Arm, Anchor Base.....	3,277.82	402.33
			<i>For Galvanized Finish, Add</i>	74.19	
			<i>For >10 To 20, Deduct</i>	-81.95	
			<i>For >20 To 40, Deduct</i>	-163.89	
			<i>For >40, Deduct</i>	-265.95	
26 56 13 00-0014	EA		30' High, 6.6" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Single 8' Upsweep Style Arm, Anchor Base.....	3,283.87	402.33
			<i>For Galvanized Finish, Add</i>	74.38	
			<i>For >10 To 20, Deduct</i>	-82.10	
			<i>For >20 To 40, Deduct</i>	-164.19	
			<i>For >40, Deduct</i>	-266.41	
26 56 13 00-0015	EA		35' High, 7.3" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Single 4' Upsweep Style Arm, Anchor Base.....	3,441.36	424.68
			<i>For Galvanized Finish, Add</i>	77.76	
			<i>For >10 To 20, Deduct</i>	-86.03	
			<i>For >20 To 40, Deduct</i>	-172.07	
			<i>For >40, Deduct</i>	-279.34	
26 56 13 00-0016	EA		35' High, 7.3" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Single 6' Upsweep Style Arm, Anchor Base.....	3,465.36	424.68
			<i>For Galvanized Finish, Add</i>	78.48	
			<i>For >10 To 20, Deduct</i>	-86.63	
			<i>For >20 To 40, Deduct</i>	-173.27	
			<i>For >40, Deduct</i>	-281.14	
26 56 13 00-0017	EA		35' High, 7.3" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Single 8' Upsweep Style Arm, Anchor Base.....	3,491.57	424.68
			<i>For Galvanized Finish, Add</i>	79.27	
			<i>For >10 To 20, Deduct</i>	-87.29	
			<i>For >20 To 40, Deduct</i>	-174.58	
			<i>For >40, Deduct</i>	-283.10	
26 56 13 00-0018	EA		40' High, 9.0" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Single 4' Upsweep Style Arm, Anchor Base.....	4,005.72	447.03
			<i>For Galvanized Finish, Add</i>	93.35	
			<i>For >10 To 20, Deduct</i>	-100.14	
			<i>For >20 To 40, Deduct</i>	-200.29	
			<i>For >40, Deduct</i>	-322.78	
26 56 13 00-0019	EA		40' High, 9.0" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Single 6' Upsweep Style Arm, Anchor Base.....	4,014.26	447.03
			<i>For Galvanized Finish, Add</i>	93.61	
			<i>For >10 To 20, Deduct</i>	-100.36	
			<i>For >20 To 40, Deduct</i>	-200.71	
			<i>For >40, Deduct</i>	-323.42	
26 56 13 00-0020	EA		40' High, 9.0" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Single 8' Upsweep Style Arm, Anchor Base.....	4,022.71	447.03
			<i>For Galvanized Finish, Add</i>	93.86	
			<i>For >10 To 20, Deduct</i>	-100.57	
			<i>For >20 To 40, Deduct</i>	-201.14	
			<i>For >40, Deduct</i>	-324.06	



Electrical	26	26
Lighting	26 50	
Exterior Lighting	26 56	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56 13 00-0021 Round Tapered, Steel Roadway Light Poles With Two Upsweep Style Arms <small>(26 56 13 00-0005)</small>		
26 56 13 00-0022 EA 20' High, 5.9" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Two 4' Upsweep Style Arms, Anchor Base.....	3,488.67	312.93
For Galvanized Finish, Add	85.88	
For >10 To 20, Deduct	-87.22	
For >20 To 40, Deduct	-174.43	
For >40, Deduct	-277.30	
26 56 13 00-0023 EA 20' High, 5.9" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Two 6' Upsweep Style Arms, Anchor Base.....	3,546.82	324.10
For Galvanized Finish, Add	86.96	
For >10 To 20, Deduct	-88.67	
For >20 To 40, Deduct	-177.34	
For >40, Deduct	-282.22	
26 56 13 00-0024 EA 20' High, 5.9" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Two 8' Upsweep Style Arms, Anchor Base.....	3,596.16	335.28
For Galvanized Finish, Add	87.77	
For >10 To 20, Deduct	-89.90	
For >20 To 40, Deduct	-179.81	
For >40, Deduct	-286.48	
26 56 13 00-0025 EA 25' High, 5.9" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Two 4' Upsweep Style Arms, Anchor Base.....	3,435.36	402.33
For Galvanized Finish, Add	78.92	
For >10 To 20, Deduct	-85.88	
For >20 To 40, Deduct	-171.77	
For >40, Deduct	-277.77	
26 56 13 00-0026 EA 25' High, 5.9" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Two 6' Upsweep Style Arms, Anchor Base.....	3,471.92	413.51
For Galvanized Finish, Add	79.35	
For >10 To 20, Deduct	-86.80	
For >20 To 40, Deduct	-173.60	
For >40, Deduct	-281.07	
26 56 13 00-0027 EA 25' High, 5.9" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Two 8' Upsweep Style Arms, Anchor Base.....	3,500.02	424.68
For Galvanized Finish, Add	79.52	
For >10 To 20, Deduct	-87.50	
For >20 To 40, Deduct	-175.00	
For >40, Deduct	-283.74	
26 56 13 00-0028 EA 30' High, 6.6" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Two 4' Upsweep Style Arms, Anchor Base.....	3,700.25	447.03
For Galvanized Finish, Add	84.19	
For >10 To 20, Deduct	-92.51	
For >20 To 40, Deduct	-185.01	
For >40, Deduct	-299.87	
26 56 13 00-0029 EA 30' High, 6.6" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Two 6' Upsweep Style Arms, Anchor Base.....	3,731.24	458.21
For Galvanized Finish, Add	84.44	
For >10 To 20, Deduct	-93.28	
For >20 To 40, Deduct	-186.56	
For >40, Deduct	-302.75	
26 56 13 00-0030 EA 30' High, 6.6" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Two 8' Upsweep Style Arms, Anchor Base.....	3,759.07	469.39
For Galvanized Finish, Add	84.61	
For >10 To 20, Deduct	-93.98	
For >20 To 40, Deduct	-187.95	
For >40, Deduct	-305.40	
26 56 13 00-0031 EA 35' High, 7.3" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Two 4' Upsweep Style Arms, Anchor Base.....	3,928.80	469.39
For Galvanized Finish, Add	89.70	
For >10 To 20, Deduct	-98.22	
For >20 To 40, Deduct	-196.44	
For >40, Deduct	-318.13	
26 56 13 00-0032 EA 35' High, 7.3" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Two 6' Upsweep Style Arms, Anchor Base.....	3,988.30	480.56
For Galvanized Finish, Add	90.82	
For >10 To 20, Deduct	-99.71	
For >20 To 40, Deduct	-199.42	
For >40, Deduct	-323.15	
26 56 13 00-0033 EA 35' High, 7.3" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Two 8' Upsweep Style Arms, Anchor Base.....	4,045.87	491.74
For Galvanized Finish, Add	91.87	
For >10 To 20, Deduct	-101.15	
For >20 To 40, Deduct	-202.29	
For >40, Deduct	-328.03	
26 56 13 00-0034 EA 40' High, 9.0" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Two 4' Upsweep Style Arms, Anchor Base.....	4,460.11	491.74
For Galvanized Finish, Add	104.30	
For >10 To 20, Deduct	-111.50	
For >20 To 40, Deduct	-223.01	
For >40, Deduct	-359.10	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56 13 00-0035	EA		40' High, 9.0" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Two 6' Upsweep Style Arms, Anchor Base	4,488.04	502.92
			<i>For Galvanized Finish, Add</i>	104.47	
			<i>For >10 To 20, Deduct</i>	-112.20	
			<i>For >20 To 40, Deduct</i>	-224.40	
			<i>For >40, Deduct</i>	-361.75	
26 56 13 00-0036	EA		40' High, 9.0" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Two 8' Upsweep Style Arms, Anchor Base	4,516.15	514.09
			<i>For Galvanized Finish, Add</i>	104.64	
			<i>For >10 To 20, Deduct</i>	-112.90	
			<i>For >20 To 40, Deduct</i>	-225.81	
			<i>For >40, Deduct</i>	-364.42	
26 56 13 00-0037			Round Tapered, Steel Roadway Light Poles With Three Upsweep Style Arms <small>(26 56 13 00-0005)</small>		
26 56 13 00-0038	EA		25' High, 7.0" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Three 4' Upsweep Style Arms, Anchor Base	4,051.03	447.03
			<i>For Galvanized Finish, Add</i>	94.71	
			<i>For >10 To 20, Deduct</i>	-101.28	
			<i>For >20 To 40, Deduct</i>	-202.55	
			<i>For >40, Deduct</i>	-326.18	
26 56 13 00-0039	EA		25' High, 7.0" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Three 6' Upsweep Style Arms, Anchor Base	4,101.40	469.39
			<i>For Galvanized Finish, Add</i>	94.88	
			<i>For >10 To 20, Deduct</i>	-102.54	
			<i>For >20 To 40, Deduct</i>	-205.07	
			<i>For >40, Deduct</i>	-331.07	
26 56 13 00-0040	EA		25' High, 7.0" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Three 8' Upsweep Style Arms, Anchor Base	4,160.21	491.74
			<i>For Galvanized Finish, Add</i>	95.30	
			<i>For >10 To 20, Deduct</i>	-104.01	
			<i>For >20 To 40, Deduct</i>	-208.01	
			<i>For >40, Deduct</i>	-336.60	
26 56 13 00-0041	EA		30' High, 7.5" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Three 4' Upsweep Style Arms, Anchor Base	4,281.93	491.74
			<i>For Galvanized Finish, Add</i>	98.95	
			<i>For >10 To 20, Deduct</i>	-107.05	
			<i>For >20 To 40, Deduct</i>	-214.10	
			<i>For >40, Deduct</i>	-345.73	
26 56 13 00-0042	EA		30' High, 7.5" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Three 6' Upsweep Style Arms, Anchor Base	4,335.00	514.09
			<i>For Galvanized Finish, Add</i>	99.20	
			<i>For >10 To 20, Deduct</i>	-108.38	
			<i>For >20 To 40, Deduct</i>	-216.75	
			<i>For >40, Deduct</i>	-350.83	
26 56 13 00-0043	EA		30' High, 7.5" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Three 8' Upsweep Style Arms, Anchor Base	4,385.37	536.44
			<i>For Galvanized Finish, Add</i>	99.37	
			<i>For >10 To 20, Deduct</i>	-109.63	
			<i>For >20 To 40, Deduct</i>	-219.27	
			<i>For >40, Deduct</i>	-355.73	
26 56 13 00-0044	EA		35' High, 8.0" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Three 4' Upsweep Style Arms, Anchor Base	4,558.39	514.09
			<i>For Galvanized Finish, Add</i>	105.91	
			<i>For >10 To 20, Deduct</i>	-113.96	
			<i>For >20 To 40, Deduct</i>	-227.92	
			<i>For >40, Deduct</i>	-367.58	
26 56 13 00-0045	EA		35' High, 8.0" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Three 6' Upsweep Style Arms, Anchor Base	4,608.76	536.44
			<i>For Galvanized Finish, Add</i>	106.08	
			<i>For >10 To 20, Deduct</i>	-115.22	
			<i>For >20 To 40, Deduct</i>	-230.44	
			<i>For >40, Deduct</i>	-372.48	
26 56 13 00-0046	EA		35' High, 8.5" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Three 8' Upsweep Style Arms, Anchor Base	4,659.13	558.79
			<i>For Galvanized Finish, Add</i>	106.25	
			<i>For >10 To 20, Deduct</i>	-116.48	
			<i>For >20 To 40, Deduct</i>	-232.96	
			<i>For >40, Deduct</i>	-377.37	
26 56 13 00-0047	EA		40' High, 9.0" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Three 4' Upsweep Style Arms, Anchor Base	4,914.52	536.44
			<i>For Galvanized Finish, Add</i>	115.25	
			<i>For >10 To 20, Deduct</i>	-122.86	
			<i>For >20 To 40, Deduct</i>	-245.73	
			<i>For >40, Deduct</i>	-395.41	
26 56 13 00-0048	EA		40' High, 9.0" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Three 6' Upsweep Style Arms, Anchor Base	4,964.60	558.79
			<i>For Galvanized Finish, Add</i>	115.41	
			<i>For >10 To 20, Deduct</i>	-124.12	
			<i>For >20 To 40, Deduct</i>	-248.23	
			<i>For >40, Deduct</i>	-400.28	



Electrical	26	26
Lighting	26 50	
Exterior Lighting	26 56	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56 13 00-0049 EA 40' High, 9.5" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Three 8' Upsweep Style Arms, Anchor Base.....	5,020.63	581.14
For Galvanized Finish, Add	115.75	
For >10 To 20, Deduct	-125.52	
For >20 To 40, Deduct	-251.03	
For >40, Deduct	-405.60	
26 56 13 00-0050 Round Tapered, Steel Roadway Light Poles With Four Upsweep Style Arms <small>(26 56 13 00-0005)</small>		
26 56 13 00-0051 EA 25' High, 7.0" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Four 4' Upsweep Style Arms, Anchor Base.....	4,508.21	491.74
For Galvanized Finish, Add	105.74	
For >10 To 20, Deduct	-112.71	
For >20 To 40, Deduct	-225.41	
For >40, Deduct	-362.70	
26 56 13 00-0052 EA 25' High, 7.0" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Four 6' Upsweep Style Arms, Anchor Base.....	4,583.71	525.27
For Galvanized Finish, Add	106.00	
For >10 To 20, Deduct	-114.59	
For >20 To 40, Deduct	-229.19	
For >40, Deduct	-370.04	
26 56 13 00-0053 EA 25' High, 7.0" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Four 8' Upsweep Style Arms, Anchor Base.....	4,656.34	558.79
For Galvanized Finish, Add	106.16	
For >10 To 20, Deduct	-116.41	
For >20 To 40, Deduct	-232.82	
For >40, Deduct	-377.17	
26 56 13 00-0054 EA 30' High, 8.0" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Four 4' Upsweep Style Arms, Anchor Base.....	4,773.79	536.44
For Galvanized Finish, Add	111.03	
For >10 To 20, Deduct	-119.34	
For >20 To 40, Deduct	-238.69	
For >40, Deduct	-384.86	
26 56 13 00-0055 EA 30' High, 8.0" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Four 6' Upsweep Style Arms, Anchor Base.....	4,846.79	569.97
For Galvanized Finish, Add	111.21	
For >10 To 20, Deduct	-121.17	
For >20 To 40, Deduct	-242.34	
For >40, Deduct	-392.01	
26 56 13 00-0056 EA 30' High, 8.0" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Four 8' Upsweep Style Arms, Anchor Base.....	4,887.16	603.50
For Galvanized Finish, Add	110.40	
For >10 To 20, Deduct	-122.18	
For >20 To 40, Deduct	-244.36	
For >40, Deduct	-396.71	
26 56 13 00-0057 EA 35' High, 9.0" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Four 4' Upsweep Style Arms, Anchor Base.....	5,139.99	558.79
For Galvanized Finish, Add	120.67	
For >10 To 20, Deduct	-128.50	
For >20 To 40, Deduct	-257.00	
For >40, Deduct	-413.44	
26 56 13 00-0058 EA 35' High, 9.0" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Four 6' Upsweep Style Arms, Anchor Base.....	5,251.20	592.32
For Galvanized Finish, Add	122.00	
For >10 To 20, Deduct	-131.28	
For >20 To 40, Deduct	-262.56	
For >40, Deduct	-423.46	
26 56 13 00-0059 EA 35' High, 9.5" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Four 8' Upsweep Style Arms, Anchor Base.....	5,288.40	625.85
For Galvanized Finish, Add	121.10	
For >10 To 20, Deduct	-132.21	
For >20 To 40, Deduct	-264.42	
For >40, Deduct	-427.92	
26 56 13 00-0060 EA 40' High, 10.0" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Four 4' Upsweep Style Arms, Anchor Base.....	5,368.63	581.14
For Galvanized Finish, Add	126.19	
For >10 To 20, Deduct	-134.22	
For >20 To 40, Deduct	-268.43	
For >40, Deduct	-431.70	
26 56 13 00-0061 EA 40' High, 10.0" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Four 6' Upsweep Style Arms, Anchor Base.....	5,441.25	614.67
For Galvanized Finish, Add	126.36	
For >10 To 20, Deduct	-136.03	
For >20 To 40, Deduct	-272.06	
For >40, Deduct	-438.83	
26 56 13 00-0062 EA 40' High, 10.5" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Four 8' Upsweep Style Arms, Anchor Base.....	5,516.75	648.20
For Galvanized Finish, Add	126.61	
For >10 To 20, Deduct	-137.92	
For >20 To 40, Deduct	-275.84	
For >40, Deduct	-446.17	
26 56 13 00-0063 Round Tapered, Steel Roadway Light Poles With Davit Style Arm <small>(26 56 13 00-0004)</small>		



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56 13 00-0064			Round Tapered, Steel Roadway Light Poles With Single Davit Style Arm ^(26 56 13 00-0063)		
26 56 13 00-0065	EA		25' High, 6.4" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Single 6.5' Davit Style Arm, Anchor Base.....	3,215.86	357.63
			<i>For Galvanized Finish, Add</i>	75.02	
			<i>For >10 To 20, Deduct</i>	-80.40	
			<i>For >20 To 40, Deduct</i>	-160.79	
			<i>For >40, Deduct</i>	-259.07	
26 56 13 00-0066	EA		30' High, 7.1" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Single 6.5' Davit Style Arm, Anchor Base.....	3,640.41	402.33
			<i>For Galvanized Finish, Add</i>	85.07	
			<i>For >10 To 20, Deduct</i>	-91.01	
			<i>For >20 To 40, Deduct</i>	-182.02	
			<i>For >40, Deduct</i>	-293.15	
26 56 13 00-0067	EA		35' High, 7.8" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Single 6.5' Davit Style Arm, Anchor Base.....	3,731.76	424.68
			<i>For Galvanized Finish, Add</i>	86.47	
			<i>For >10 To 20, Deduct</i>	-93.29	
			<i>For >20 To 40, Deduct</i>	-186.59	
			<i>For >40, Deduct</i>	-301.12	
26 56 13 00-0068	EA		40' High, 9.5" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Single 6.5' Davit Style Arm, Anchor Base.....	4,492.25	447.03
			<i>For Galvanized Finish, Add</i>	107.95	
			<i>For >10 To 20, Deduct</i>	-112.31	
			<i>For >20 To 40, Deduct</i>	-224.61	
			<i>For >40, Deduct</i>	-359.27	
26 56 13 00-0069			Round Tapered, Steel Roadway Light Poles With Truss Style Arms ^(26 56 13 00-0064)		
26 56 13 00-0070			Round Tapered, Steel Roadway Light Poles With Single Truss Style Arm ^(26 56 13 00-0069)		
26 56 13 00-0071	EA		25' High, 6.5" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Single 10' Truss Style Arm, Anchor Base.....	4,216.85	357.63
			<i>For Galvanized Finish, Add</i>	105.05	
			<i>For >10 To 20, Deduct</i>	-105.42	
			<i>For >20 To 40, Deduct</i>	-210.84	
			<i>For >40, Deduct</i>	-334.15	
26 56 13 00-0072	EA		25' High, 6.5" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Single 12' Truss Style Arm, Anchor Base.....	4,259.76	357.63
			<i>For Galvanized Finish, Add</i>	106.34	
			<i>For >10 To 20, Deduct</i>	-106.49	
			<i>For >20 To 40, Deduct</i>	-212.99	
			<i>For >40, Deduct</i>	-337.36	
26 56 13 00-0073	EA		25' High, 7.0" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Single 15' Truss Style Arm, Anchor Base.....	4,279.35	357.63
			<i>For Galvanized Finish, Add</i>	106.92	
			<i>For >10 To 20, Deduct</i>	-106.98	
			<i>For >20 To 40, Deduct</i>	-213.97	
			<i>For >40, Deduct</i>	-338.83	
26 56 13 00-0074	EA		30' High, 7.0" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Single 10' Truss Style Arm, Anchor Base.....	4,349.18	402.33
			<i>For Galvanized Finish, Add</i>	106.34	
			<i>For >10 To 20, Deduct</i>	-108.73	
			<i>For >20 To 40, Deduct</i>	-217.46	
			<i>For >40, Deduct</i>	-346.31	
26 56 13 00-0075	EA		30' High, 7.0" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Single 12' Truss Style Arm, Anchor Base.....	4,356.67	402.33
			<i>For Galvanized Finish, Add</i>	106.56	
			<i>For >10 To 20, Deduct</i>	-108.92	
			<i>For >20 To 40, Deduct</i>	-217.83	
			<i>For >40, Deduct</i>	-346.87	
26 56 13 00-0076	EA		30' High, 7.5" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Single 15' Truss Style Arm, Anchor Base.....	4,434.05	402.33
			<i>For Galvanized Finish, Add</i>	108.88	
			<i>For >10 To 20, Deduct</i>	-110.85	
			<i>For >20 To 40, Deduct</i>	-221.70	
			<i>For >40, Deduct</i>	-352.67	
26 56 13 00-0077	EA		35' High, 8.0" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Single 10' Truss Style Arm, Anchor Base.....	4,419.31	424.68
			<i>For Galvanized Finish, Add</i>	107.10	
			<i>For >10 To 20, Deduct</i>	-110.48	
			<i>For >20 To 40, Deduct</i>	-220.97	
			<i>For >40, Deduct</i>	-352.68	
26 56 13 00-0078	EA		35' High, 8.0" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Single 12' Truss Style Arm, Anchor Base.....	4,464.62	424.68
			<i>For Galvanized Finish, Add</i>	108.46	
			<i>For >10 To 20, Deduct</i>	-111.62	
			<i>For >20 To 40, Deduct</i>	-223.23	
			<i>For >40, Deduct</i>	-356.08	
26 56 13 00-0079	EA		35' High, 8.5" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Single 15' Truss Style Arm, Anchor Base.....	4,702.22	424.68
			<i>For Galvanized Finish, Add</i>	115.59	
			<i>For >10 To 20, Deduct</i>	-117.56	
			<i>For >20 To 40, Deduct</i>	-235.11	
			<i>For >40, Deduct</i>	-373.90	



Electrical	26	26
Lighting	26 50	
Exterior Lighting	26 56	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56 13 00-0080 Round Tapered, Steel Roadway Light Poles With Two Truss Style Arms <small>(26 56 13 00-0080)</small>		
26 56 13 00-0081 EA 25' High, 6.5" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Two 10' Truss Style Arms, Anchor Base.....	5,537.30	447.03
For Galvanized Finish, Add	139.30	
For >10 To 20, Deduct	-138.43	
For >20 To 40, Deduct	-276.87	
For >40, Deduct	-437.65	
26 56 13 00-0082 EA 25' High, 6.5" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Two 12' Truss Style Arms, Anchor Base.....	5,623.10	469.39
For Galvanized Finish, Add	140.53	
For >10 To 20, Deduct	-140.58	
For >20 To 40, Deduct	-281.16	
For >40, Deduct	-445.20	
26 56 13 00-0083 EA 25' High, 7.0" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Two 15' Truss Style Arms, Anchor Base.....	5,829.07	491.74
For Galvanized Finish, Add	145.37	
For >10 To 20, Deduct	-145.73	
For >20 To 40, Deduct	-291.45	
For >40, Deduct	-461.77	
26 56 13 00-0084 EA 30' High, 7.0" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Two 10' Truss Style Arms, Anchor Base.....	5,602.89	491.74
For Galvanized Finish, Add	138.58	
For >10 To 20, Deduct	-140.07	
For >20 To 40, Deduct	-280.14	
For >40, Deduct	-444.80	
26 56 13 00-0085 EA 30' High, 7.5" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Two 12' Truss Style Arms, Anchor Base.....	5,859.86	514.09
For Galvanized Finish, Add	144.95	
For >10 To 20, Deduct	-146.50	
For >20 To 40, Deduct	-292.99	
For >40, Deduct	-465.19	
26 56 13 00-0086 EA 30' High, 8.0" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Two 15' Truss Style Arms, Anchor Base.....	6,009.02	536.44
For Galvanized Finish, Add	148.08	
For >10 To 20, Deduct	-150.23	
For >20 To 40, Deduct	-300.45	
For >40, Deduct	-477.50	
26 56 13 00-0087 EA 35' High, 8.0" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Two 10' Truss Style Arms, Anchor Base.....	5,766.16	514.09
For Galvanized Finish, Add	142.14	
For >10 To 20, Deduct	-144.15	
For >20 To 40, Deduct	-288.31	
For >40, Deduct	-458.17	
26 56 13 00-0088 EA 35' High, 8.5" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Two 12' Truss Style Arms, Anchor Base.....	6,113.66	536.44
For Galvanized Finish, Add	151.22	
For >10 To 20, Deduct	-152.84	
For >20 To 40, Deduct	-305.68	
For >40, Deduct	-485.35	
26 56 13 00-0089 EA 35' High, 8.5" Base OD, 7 Gauge, Round Tapered, Steel Roadway Light Pole With Two 15' Truss Style Arms, Anchor Base.....	6,313.88	558.79
For Galvanized Finish, Add	155.89	
For >10 To 20, Deduct	-157.85	
For >20 To 40, Deduct	-315.69	
For >40, Deduct	-501.48	
26 56 13 00-0090 Aluminum Roadway Light Poles <small>(26 56 13 00-0090)</small>		
Note: Includes satin finish, anchor bolts, cast aluminum base with nut covers, reinforced handhole with cover and grounding provisions, and fixture arm(s).		
26 56 13 00-0091 Round Tapered, Aluminum Roadway Light Poles <small>(26 56 13 00-0091)</small>		
26 56 13 00-0092 Round Tapered, Aluminum Roadway Light Poles With Upsweep Style Arms <small>(26 56 13 00-0092)</small>		
26 56 13 00-0093 Round Tapered, Aluminum Roadway Light Poles With Single Upsweep Style Arm <small>(26 56 13 00-0093)</small>		
26 56 13 00-0094 EA 20' High, 6" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Single 4' Upsweep Style Arm, Anchor Base.....	2,471.42	268.22
For >10 To 20, Deduct	-61.79	
For >20 To 40, Deduct	-123.57	
For >40, Deduct	-198.77	
26 56 13 00-0095 EA 20' High, 6" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Single 6' Upsweep Style Arm, Anchor Base.....	2,494.84	268.22
For >10 To 20, Deduct	-62.37	
For >20 To 40, Deduct	-124.74	
For >40, Deduct	-200.52	
26 56 13 00-0096 EA 25' High, 7" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Single 4' Upsweep Style Arm, Anchor Base.....	3,003.79	357.63
For >10 To 20, Deduct	-75.09	
For >20 To 40, Deduct	-150.19	
For >40, Deduct	-243.17	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56	13 00-0097	EA	25' High, 7" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Single 6' Upsweep Style Arm, Anchor Base.....	3,048.05	357.63
			<i>For >10 To 20, Deduct</i>	-76.20	
			<i>For >20 To 40, Deduct</i>	-152.40	
			<i>For >40, Deduct</i>	-246.49	
26 56	13 00-0098	EA	25' High, 7" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Single 8' Upsweep Style Arm, Anchor Base.....	3,088.75	357.63
			<i>For >10 To 20, Deduct</i>	-77.22	
			<i>For >20 To 40, Deduct</i>	-154.44	
			<i>For >40, Deduct</i>	-249.54	
26 56	13 00-0099	EA	30' High, 8" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Single 4' Upsweep Style Arm, Anchor Base.....	3,455.33	402.33
			<i>For >10 To 20, Deduct</i>	-86.38	
			<i>For >20 To 40, Deduct</i>	-172.77	
			<i>For >40, Deduct</i>	-279.27	
26 56	13 00-0100	EA	30' High, 8" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Single 6' Upsweep Style Arm, Anchor Base.....	3,492.67	402.33
			<i>For >10 To 20, Deduct</i>	-87.32	
			<i>For >20 To 40, Deduct</i>	-174.63	
			<i>For >40, Deduct</i>	-282.07	
26 56	13 00-0101	EA	30' High, 8" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Single 8' Upsweep Style Arm, Anchor Base.....	3,534.43	402.33
			<i>For >10 To 20, Deduct</i>	-88.36	
			<i>For >20 To 40, Deduct</i>	-176.72	
			<i>For >40, Deduct</i>	-285.20	
26 56	13 00-0102	EA	35' High, 8" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Single 4' Upsweep Style Arm, Anchor Base.....	4,090.80	424.68
			<i>For >10 To 20, Deduct</i>	-102.27	
			<i>For >20 To 40, Deduct</i>	-204.54	
			<i>For >40, Deduct</i>	-328.04	
26 56	13 00-0103	EA	35' High, 8" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Single 6' Upsweep Style Arm, Anchor Base.....	4,128.05	424.68
			<i>For >10 To 20, Deduct</i>	-103.20	
			<i>For >20 To 40, Deduct</i>	-206.40	
			<i>For >40, Deduct</i>	-330.84	
26 56	13 00-0104	EA	35' High, 8" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Single 8' Upsweep Style Arm, Anchor Base.....	4,159.25	424.68
			<i>For >10 To 20, Deduct</i>	-103.98	
			<i>For >20 To 40, Deduct</i>	-207.96	
			<i>For >40, Deduct</i>	-333.18	
26 56	13 00-0105		Round Tapered, Aluminum Roadway Light Poles With Two Upsweep Style Arms <small>(26 56 13 00-0092)</small>		
26 56	13 00-0106	EA	20' High, 6" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Two 4' Upsweep Style Arms, Anchor Base.....	2,826.75	312.93
			<i>For >10 To 20, Deduct</i>	-70.67	
			<i>For >20 To 40, Deduct</i>	-141.34	
			<i>For >40, Deduct</i>	-227.65	
26 56	13 00-0107	EA	20' High, 6" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Two 6' Upsweep Style Arms, Anchor Base.....	3,056.28	312.93
			<i>For >10 To 20, Deduct</i>	-76.41	
			<i>For >20 To 40, Deduct</i>	-152.81	
			<i>For >40, Deduct</i>	-244.87	
26 56	13 00-0108	EA	20' High, 6" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Two 8' Upsweep Style Arms, Anchor Base.....	3,145.73	335.28
			<i>For >10 To 20, Deduct</i>	-78.64	
			<i>For >20 To 40, Deduct</i>	-157.29	
			<i>For >40, Deduct</i>	-252.69	
26 56	13 00-0109	EA	25' High, 7" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Two 4' Upsweep Style Arms, Anchor Base.....	3,346.56	402.33
			<i>For >10 To 20, Deduct</i>	-83.66	
			<i>For >20 To 40, Deduct</i>	-167.33	
			<i>For >40, Deduct</i>	-271.11	
26 56	13 00-0110	EA	25' High, 7" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Two 6' Upsweep Style Arms, Anchor Base.....	3,515.02	413.51
			<i>For >10 To 20, Deduct</i>	-87.88	
			<i>For >20 To 40, Deduct</i>	-175.75	
			<i>For >40, Deduct</i>	-284.30	
26 56	13 00-0111	EA	25' High, 7" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Two 8' Upsweep Style Arms, Anchor Base.....	3,762.48	424.68
			<i>For >10 To 20, Deduct</i>	-94.06	
			<i>For >20 To 40, Deduct</i>	-188.12	
			<i>For >40, Deduct</i>	-303.42	
26 56	13 00-0112	EA	30' High, 8" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Two 4' Upsweep Style Arms, Anchor Base.....	3,878.52	447.03
			<i>For >10 To 20, Deduct</i>	-96.96	
			<i>For >20 To 40, Deduct</i>	-193.93	
			<i>For >40, Deduct</i>	-313.24	
26 56	13 00-0113	EA	30' High, 8" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Two 6' Upsweep Style Arms, Anchor Base.....	4,036.42	458.21
			<i>For >10 To 20, Deduct</i>	-100.91	
			<i>For >20 To 40, Deduct</i>	-201.82	
			<i>For >40, Deduct</i>	-325.64	



Electrical	26	26
Lighting	26 50	
Exterior Lighting	26 56	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56 13 00-0114	EA		30' High, 8" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Two 8' Upsweep Style Arms, Anchor Base.....	4,231.39	469.39
			<i>For >10 To 20, Deduct</i>	-105.78	
			<i>For >20 To 40, Deduct</i>	-211.57	
			<i>For >40, Deduct</i>	-340.82	
26 56 13 00-0115	EA		35' High, 8" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Two 4' Upsweep Style Arms, Anchor Base.....	4,434.43	469.39
			<i>For >10 To 20, Deduct</i>	-110.86	
			<i>For >20 To 40, Deduct</i>	-221.72	
			<i>For >40, Deduct</i>	-356.05	
26 56 13 00-0116	EA		35' High, 8" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Two 6' Upsweep Style Arms, Anchor Base.....	4,879.37	480.56
			<i>For >10 To 20, Deduct</i>	-121.98	
			<i>For >20 To 40, Deduct</i>	-243.97	
			<i>For >40, Deduct</i>	-389.98	
26 56 13 00-0117	EA		35' High, 8" Base OD, 0.250" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Two 8' Upsweep Style Arms, Anchor Base.....	5,398.51	491.74
			<i>For >10 To 20, Deduct</i>	-134.96	
			<i>For >20 To 40, Deduct</i>	-269.93	
			<i>For >40, Deduct</i>	-429.48	
26 56 13 00-0118			Round Tapered, Aluminum Roadway Light Poles With Three Upsweep Style Arms <small>(26 56 13 00-0092)</small>		
26 56 13 00-0119	EA		20' High, 6" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Three 4' Upsweep Style Arms, Anchor Base.....	3,285.65	357.63
			<i>For >10 To 20, Deduct</i>	-82.14	
			<i>For >20 To 40, Deduct</i>	-164.28	
			<i>For >40, Deduct</i>	-264.31	
26 56 13 00-0120	EA		20' High, 6" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Three 6' Upsweep Style Arms, Anchor Base.....	3,516.02	379.98
			<i>For >10 To 20, Deduct</i>	-87.90	
			<i>For >20 To 40, Deduct</i>	-175.80	
			<i>For >40, Deduct</i>	-282.70	
26 56 13 00-0121	EA		25' High, 7" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Three 4' Upsweep Style Arms, Anchor Base.....	3,984.21	447.03
			<i>For >10 To 20, Deduct</i>	-99.61	
			<i>For >20 To 40, Deduct</i>	-199.21	
			<i>For >40, Deduct</i>	-321.17	
26 56 13 00-0122	EA		25' High, 7" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Three 6' Upsweep Style Arms, Anchor Base.....	4,151.71	469.39
			<i>For >10 To 20, Deduct</i>	-103.79	
			<i>For >20 To 40, Deduct</i>	-207.59	
			<i>For >40, Deduct</i>	-334.85	
26 56 13 00-0123	EA		30' High, 8" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Three 4' Upsweep Style Arms, Anchor Base.....	4,347.79	491.74
			<i>For >10 To 20, Deduct</i>	-108.69	
			<i>For >20 To 40, Deduct</i>	-217.39	
			<i>For >40, Deduct</i>	-350.67	
26 56 13 00-0124	EA		30' High, 8" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Three 6' Upsweep Style Arms, Anchor Base.....	4,498.20	514.09
			<i>For >10 To 20, Deduct</i>	-112.46	
			<i>For >20 To 40, Deduct</i>	-224.91	
			<i>For >40, Deduct</i>	-363.07	
26 56 13 00-0125	EA		35' High, 8" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Three 4' Upsweep Style Arms, Anchor Base.....	4,718.04	514.09
			<i>For >10 To 20, Deduct</i>	-117.95	
			<i>For >20 To 40, Deduct</i>	-235.90	
			<i>For >40, Deduct</i>	-379.56	
26 56 13 00-0126	EA		35' High, 8" Base OD, 0.219" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Three 6' Upsweep Style Arms, Anchor Base.....	5,152.89	536.44
			<i>For >10 To 20, Deduct</i>	-128.82	
			<i>For >20 To 40, Deduct</i>	-257.64	
			<i>For >40, Deduct</i>	-413.29	
26 56 13 00-0127	EA		35' High, 8" Base OD, 0.250" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Three 8' Upsweep Style Arms, Anchor Base.....	5,954.86	558.79
			<i>For >10 To 20, Deduct</i>	-148.87	
			<i>For >20 To 40, Deduct</i>	-297.74	
			<i>For >40, Deduct</i>	-474.55	
26 56 13 00-0128			Round Tapered, Aluminum Roadway Light Poles With Four Upsweep Style Arms <small>(26 56 13 00-0092)</small>		
26 56 13 00-0129	EA		20' High, 6" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Four 4' Upsweep Style Arms, Anchor Base.....	3,374.49	402.33
			<i>For >10 To 20, Deduct</i>	-84.36	
			<i>For >20 To 40, Deduct</i>	-168.72	
			<i>For >40, Deduct</i>	-273.20	
26 56 13 00-0130	EA		20' High, 6" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Four 6' Upsweep Style Arms, Anchor Base.....	3,515.04	402.33
			<i>For >10 To 20, Deduct</i>	-87.88	
			<i>For >20 To 40, Deduct</i>	-175.75	
			<i>For >40, Deduct</i>	-283.74	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56	13 00-0131	EA	25' High, 7" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Four 4' Upsweep Style Arms, Anchor Base	4,356.53	491.74
			<i>For >10 To 20, Deduct</i>	-108.91	
			<i>For >20 To 40, Deduct</i>	-217.83	
			<i>For >40, Deduct</i>	-351.33	
26 56	13 00-0132	EA	25' High, 7" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Four 6' Upsweep Style Arms, Anchor Base	4,723.20	525.27
			<i>For >10 To 20, Deduct</i>	-118.08	
			<i>For >20 To 40, Deduct</i>	-236.16	
			<i>For >40, Deduct</i>	-380.50	
26 56	13 00-0133	EA	30' High, 8" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Four 4' Upsweep Style Arms, Anchor Base	4,936.99	536.44
			<i>For >10 To 20, Deduct</i>	-123.42	
			<i>For >20 To 40, Deduct</i>	-246.85	
			<i>For >40, Deduct</i>	-397.10	
26 56	13 00-0134	EA	30' High, 8" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Four 6' Upsweep Style Arms, Anchor Base	5,272.55	569.97
			<i>For >10 To 20, Deduct</i>	-131.81	
			<i>For >20 To 40, Deduct</i>	-263.63	
			<i>For >40, Deduct</i>	-423.94	
26 56	13 00-0135	EA	35' High, 8" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Four 4' Upsweep Style Arms, Anchor Base	5,204.50	558.79
			<i>For >10 To 20, Deduct</i>	-130.11	
			<i>For >20 To 40, Deduct</i>	-260.23	
			<i>For >40, Deduct</i>	-418.28	
26 56	13 00-0136	EA	35' High, 8" Base OD, 0.219" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Four 6' Upsweep Style Arms, Anchor Base	5,959.58	592.32
			<i>For >10 To 20, Deduct</i>	-148.99	
			<i>For >20 To 40, Deduct</i>	-297.98	
			<i>For >40, Deduct</i>	-476.58	
26 56	13 00-0137	EA	35' High, 8" Base OD, 0.250" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Four 8' Upsweep Style Arms, Anchor Base	6,623.57	625.85
			<i>For >10 To 20, Deduct</i>	-165.59	
			<i>For >20 To 40, Deduct</i>	-331.18	
			<i>For >40, Deduct</i>	-528.06	
26 56	13 00-0138		Round Tapered, Aluminum Roadway Light Poles With Truss Style Arms <small>(26 56 13 00-0091)</small>		
26 56	13 00-0139		Round Tapered, Aluminum Roadway Light Poles With Single Truss Style Arm <small>(26 56 13 00-0138)</small>		
26 56	13 00-0140	EA	25' High, 7" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Single 8' Truss Style Arm, Anchor Base	3,654.10	357.63
			<i>For >10 To 20, Deduct</i>	-91.35	
			<i>For >20 To 40, Deduct</i>	-182.71	
			<i>For >40, Deduct</i>	-291.94	
26 56	13 00-0141	EA	25' High, 7" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Single 10' Truss Style Arm, Anchor Base	3,685.39	357.63
			<i>For >10 To 20, Deduct</i>	-92.13	
			<i>For >20 To 40, Deduct</i>	-184.27	
			<i>For >40, Deduct</i>	-294.29	
26 56	13 00-0142	EA	25' High, 7" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Single 12' Truss Style Arm, Anchor Base	3,765.36	357.63
			<i>For >10 To 20, Deduct</i>	-94.13	
			<i>For >20 To 40, Deduct</i>	-188.27	
			<i>For >40, Deduct</i>	-300.28	
26 56	13 00-0143	EA	25' High, 7" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Single 15' Truss Style Arm, Anchor Base	3,885.36	357.63
			<i>For >10 To 20, Deduct</i>	-97.13	
			<i>For >20 To 40, Deduct</i>	-194.27	
			<i>For >40, Deduct</i>	-309.28	
26 56	13 00-0144	EA	30' High, 8" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Single 8' Truss Style Arm, Anchor Base	4,114.56	402.33
			<i>For >10 To 20, Deduct</i>	-102.86	
			<i>For >20 To 40, Deduct</i>	-205.73	
			<i>For >40, Deduct</i>	-328.71	
26 56	13 00-0145	EA	30' High, 8" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Single 10' Truss Style Arm, Anchor Base	4,185.12	402.33
			<i>For >10 To 20, Deduct</i>	-104.63	
			<i>For >20 To 40, Deduct</i>	-209.26	
			<i>For >40, Deduct</i>	-334.00	
26 56	13 00-0146	EA	30' High, 8" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Single 12' Truss Style Arm, Anchor Base	4,260.38	402.33
			<i>For >10 To 20, Deduct</i>	-106.51	
			<i>For >20 To 40, Deduct</i>	-213.02	
			<i>For >40, Deduct</i>	-339.65	
26 56	13 00-0147	EA	30' High, 8" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Single 15' Truss Style Arm, Anchor Base	4,714.37	402.33
			<i>For >10 To 20, Deduct</i>	-117.86	
			<i>For >20 To 40, Deduct</i>	-235.72	
			<i>For >40, Deduct</i>	-373.69	
26 56	13 00-0148	EA	35' High, 8" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Single 8' Truss Style Arm, Anchor Base	4,482.10	424.68
			<i>For >10 To 20, Deduct</i>	-112.05	
			<i>For >20 To 40, Deduct</i>	-224.11	
			<i>For >40, Deduct</i>	-357.39	



Electrical	26	26
Lighting	26 50	
Exterior Lighting	26 56	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56 13 00-0149	EA		35' High, 8" Base OD, 0.219" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Single 10' Truss Style Arm, Anchor Base.....	5,064.62	424.68
			<i>For >10 To 20, Deduct</i>	-126.62	
			<i>For >20 To 40, Deduct</i>	-253.23	
			<i>For >40, Deduct</i>	-401.08	
26 56 13 00-0150	EA		35' High, 8" Base OD, 0.219" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Single 12' Truss Style Arm, Anchor Base.....	5,121.36	424.68
			<i>For >10 To 20, Deduct</i>	-128.03	
			<i>For >20 To 40, Deduct</i>	-256.07	
			<i>For >40, Deduct</i>	-405.34	
26 56 13 00-0151	EA		35' High, 8" Base OD, 0.219" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Single 15' Truss Style Arm, Anchor Base.....	5,481.55	424.68
			<i>For >10 To 20, Deduct</i>	-137.04	
			<i>For >20 To 40, Deduct</i>	-274.08	
			<i>For >40, Deduct</i>	-432.35	
26 56 13 00-0152	EA		35' High, 8" Base OD, 0.250" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Single 15' Truss Style Arm, Anchor Base.....	5,810.06	424.68
			<i>For >10 To 20, Deduct</i>	-145.25	
			<i>For >20 To 40, Deduct</i>	-290.50	
			<i>For >40, Deduct</i>	-456.99	
26 56 13 00-0153			Round Tapered, Aluminum Roadway Light Poles With Two Truss Style Arms <small>(26 56 13 00-0138)</small>		
26 56 13 00-0154	EA		25' High, 8" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Two 10' Truss Style Arms, Anchor Base.....	4,758.17	447.03
			<i>For >10 To 20, Deduct</i>	-118.95	
			<i>For >20 To 40, Deduct</i>	-237.91	
			<i>For >40, Deduct</i>	-379.21	
26 56 13 00-0155	EA		25' High, 8" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Two 12' Truss Style Arms, Anchor Base.....	4,882.84	469.39
			<i>For >10 To 20, Deduct</i>	-122.07	
			<i>For >20 To 40, Deduct</i>	-244.14	
			<i>For >40, Deduct</i>	-389.68	
26 56 13 00-0156	EA		25' High, 8" Base OD, 0.219" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Two 15' Truss Style Arms, Anchor Base.....	4,978.99	491.74
			<i>For >10 To 20, Deduct</i>	-124.47	
			<i>For >20 To 40, Deduct</i>	-248.95	
			<i>For >40, Deduct</i>	-398.01	
26 56 13 00-0157	EA		30' High, 8" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Two 10' Truss Style Arms, Anchor Base.....	5,116.08	491.74
			<i>For >10 To 20, Deduct</i>	-127.90	
			<i>For >20 To 40, Deduct</i>	-255.80	
			<i>For >40, Deduct</i>	-408.29	
26 56 13 00-0158	EA		30' High, 8" Base OD, 0.219" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Two 12' Truss Style Arms, Anchor Base.....	5,577.62	514.09
			<i>For >10 To 20, Deduct</i>	-139.44	
			<i>For >20 To 40, Deduct</i>	-278.88	
			<i>For >40, Deduct</i>	-444.03	
26 56 13 00-0159	EA		30' High, 8" Base OD, 0.250" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Two 15' Truss Style Arms, Anchor Base.....	6,444.76	536.44
			<i>For >10 To 20, Deduct</i>	-161.12	
			<i>For >20 To 40, Deduct</i>	-322.24	
			<i>For >40, Deduct</i>	-510.18	
26 56 13 00-0160	EA		35' High, 8" Base OD, 0.250" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Two 10' Truss Style Arms, Anchor Base.....	6,237.24	514.09
			<i>For >10 To 20, Deduct</i>	-155.93	
			<i>For >20 To 40, Deduct</i>	-311.86	
			<i>For >40, Deduct</i>	-493.50	
26 56 13 00-0161	EA		35' High, 10" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Two 12' Truss Style Arms, Anchor Base.....	6,348.95	536.44
			<i>For >10 To 20, Deduct</i>	-158.72	
			<i>For >20 To 40, Deduct</i>	-317.45	
			<i>For >40, Deduct</i>	-502.99	
26 56 13 00-0162	EA		35' High, 10" Base OD, 0.250" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Two 15' Truss Style Arms, Anchor Base.....	7,800.05	558.79
			<i>For >10 To 20, Deduct</i>	-195.00	
			<i>For >20 To 40, Deduct</i>	-390.00	
			<i>For >40, Deduct</i>	-612.94	
26 56 13 00-0163			Round Tapered, Aluminum Roadway Light Poles With Davit Style Arm <small>(26 56 13 00-0091)</small>		
26 56 13 00-0164			Round Tapered, Aluminum Roadway Light Poles With Single Davit Style Arm <small>(26 56 13 00-0163)</small>		
26 56 13 00-0165	EA		20' High, 6" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Single 4' Davit Style Arm, Anchor Base.....	3,018.42	268.22
			<i>For >10 To 20, Deduct</i>	-75.46	
			<i>For >20 To 40, Deduct</i>	-150.92	
			<i>For >40, Deduct</i>	-239.79	
26 56 13 00-0166	EA		20' High, 6" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Single 6' Davit Style Arm, Anchor Base.....	3,106.84	268.22
			<i>For >10 To 20, Deduct</i>	-77.67	
			<i>For >20 To 40, Deduct</i>	-155.34	
			<i>For >40, Deduct</i>	-246.42	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56	13 00-0167	EA	20' High, 6" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Single 8' Davit Style Arm, Anchor Base	3,195.45	268.22
			<i>For >10 To 20, Deduct</i>	-79.89	
			<i>For >20 To 40, Deduct</i>	-159.77	
			<i>For >40, Deduct</i>	-253.07	
26 56	13 00-0168	EA	25' High, 7" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Single 4' Davit Style Arm, Anchor Base	3,558.77	357.63
			<i>For >10 To 20, Deduct</i>	-88.97	
			<i>For >20 To 40, Deduct</i>	-177.94	
			<i>For >40, Deduct</i>	-284.79	
26 56	13 00-0169	EA	25' High, 7" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Single 6' Davit Style Arm, Anchor Base	3,626.16	357.63
			<i>For >10 To 20, Deduct</i>	-90.65	
			<i>For >20 To 40, Deduct</i>	-181.31	
			<i>For >40, Deduct</i>	-289.84	
26 56	13 00-0170	EA	25' High, 7" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Single 8' Davit Style Arm, Anchor Base	3,699.79	357.63
			<i>For >10 To 20, Deduct</i>	-92.49	
			<i>For >20 To 40, Deduct</i>	-184.99	
			<i>For >40, Deduct</i>	-295.37	
26 56	13 00-0171	EA	30' High, 8" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Single 4' Davit Style Arm, Anchor Base	4,017.60	402.33
			<i>For >10 To 20, Deduct</i>	-100.44	
			<i>For >20 To 40, Deduct</i>	-200.88	
			<i>For >40, Deduct</i>	-321.44	
26 56	13 00-0172	EA	30' High, 8" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Single 6' Davit Style Arm, Anchor Base	4,109.09	402.33
			<i>For >10 To 20, Deduct</i>	-102.73	
			<i>For >20 To 40, Deduct</i>	-205.45	
			<i>For >40, Deduct</i>	-328.30	
26 56	13 00-0173	EA	30' High, 8" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Single 8' Davit Style Arm, Anchor Base	4,122.81	402.33
			<i>For >10 To 20, Deduct</i>	-103.07	
			<i>For >20 To 40, Deduct</i>	-206.14	
			<i>For >40, Deduct</i>	-329.33	
26 56	13 00-0174	EA	35' High, 8" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Single 4' Davit Style Arm, Anchor Base	4,387.82	424.68
			<i>For >10 To 20, Deduct</i>	-109.70	
			<i>For >20 To 40, Deduct</i>	-219.39	
			<i>For >40, Deduct</i>	-350.32	
26 56	13 00-0175	EA	35' High, 8" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Single 6' Davit Style Arm, Anchor Base	4,427.95	424.68
			<i>For >10 To 20, Deduct</i>	-110.70	
			<i>For >20 To 40, Deduct</i>	-221.40	
			<i>For >40, Deduct</i>	-353.33	
26 56	13 00-0176	EA	35' High, 8" Base OD, 0.188" Wall Thickness, Round Tapered, Aluminum Roadway Light Pole With Single 8' Davit Style Arm, Anchor Base	4,522.03	424.68
			<i>For >10 To 20, Deduct</i>	-113.05	
			<i>For >20 To 40, Deduct</i>	-226.10	
			<i>For >40, Deduct</i>	-360.39	
26 56	13 00-0177		Area Light Poles <small>(26 56 13 00-0001)</small>		
26 56	13 00-0178		Steel Area Light Poles <small>(26 56 13 00-0177)</small> Note: Includes powdercoat finish, anchor bolts, base cover, reinforced handhole with cover and grounding provisions, factory drilled fixture mounting holes and tenon, open or capped top.		
26 56	13 00-0179		Round Straight, Steel Area Light Poles <small>(26 56 13 00-0178)</small>		
26 56	13 00-0180		Round Straight, Steel Area Light Poles, Anchor Base <small>(26 56 13 00-0179)</small>		
26 56	13 00-0181	EA	10' High, 3" OD, 11 Gauge, Round Straight, Steel Area Light Pole, Anchor Base.....	710.03	156.46
			<i>For Galvanized Finish, Add</i>	11.91	
			<i>For >10 To 20, Deduct</i>	-23.71	
			<i>For >20 To 40, Deduct</i>	-43.44	
			<i>For >40, Deduct</i>	-90.86	
26 56	13 00-0182	EA	12' High, 3" OD, 11 Gauge, Round Straight, Steel Area Light Pole, Anchor Base.....	776.73	178.82
			<i>For Galvanized Finish, Add</i>	12.57	
			<i>For >10 To 20, Deduct</i>	-25.70	
			<i>For >20 To 40, Deduct</i>	-47.22	
			<i>For >40, Deduct</i>	-98.63	
26 56	13 00-0183	EA	14' High, 3" OD, 11 Gauge, Round Straight, Steel Area Light Pole, Anchor Base.....	868.73	201.17
			<i>For Galvanized Finish, Add</i>	13.99	
			<i>For >10 To 20, Deduct</i>	-28.71	
			<i>For >20 To 40, Deduct</i>	-52.76	
			<i>For >40, Deduct</i>	-110.19	
26 56	13 00-0184	EA	16' High, 3" OD, 11 Gauge, Round Straight, Steel Area Light Pole, Anchor Base.....	962.93	223.52
			<i>For Galvanized Finish, Add</i>	15.48	
			<i>For >10 To 20, Deduct</i>	-31.81	
			<i>For >20 To 40, Deduct</i>	-58.46	
			<i>For >40, Deduct</i>	-122.09	
26 56	13 00-0185	EA	18' High, 3" OD, 11 Gauge, Round Straight, Steel Area Light Pole, Anchor Base.....	1,029.64	245.87
			<i>For Galvanized Finish, Add</i>	16.14	
			<i>For >10 To 20, Deduct</i>	-33.81	
			<i>For >20 To 40, Deduct</i>	-62.24	
			<i>For >40, Deduct</i>	-129.86	



Electrical	26	26
Lighting	26 50	
Exterior Lighting	26 56	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56 13 00-0186	EA		20' High, 3" OD, 11 Gauge, Round Straight, Steel Area Light Pole, Anchor Base.....	1,090.84	268.22
			<i>For Galvanized Finish, Add</i>	16.63	
			<i>For >10 To 20, Deduct</i>	-35.59	
			<i>For >20 To 40, Deduct</i>	-65.63	
			<i>For >40, Deduct</i>	-136.80	
26 56 13 00-0187	EA		10' High, 4" OD, 11 Gauge, Round Straight, Steel Area Light Pole, Anchor Base.....	738.63	156.46
			<i>For Galvanized Finish, Add</i>	12.77	
			<i>For >10 To 20, Deduct</i>	-24.85	
			<i>For >20 To 40, Deduct</i>	-45.45	
			<i>For >40, Deduct</i>	-95.15	
26 56 13 00-0188	EA		12' High, 4" OD, 11 Gauge, Round Straight, Steel Area Light Pole, Anchor Base.....	806.43	178.82
			<i>For Galvanized Finish, Add</i>	13.46	
			<i>For >10 To 20, Deduct</i>	-26.89	
			<i>For >20 To 40, Deduct</i>	-49.30	
			<i>For >40, Deduct</i>	-103.08	
26 56 13 00-0189	EA		14' High, 4" OD, 11 Gauge, Round Straight, Steel Area Light Pole, Anchor Base.....	928.13	201.17
			<i>For Galvanized Finish, Add</i>	15.77	
			<i>For >10 To 20, Deduct</i>	-31.09	
			<i>For >20 To 40, Deduct</i>	-56.92	
			<i>For >40, Deduct</i>	-119.10	
26 56 13 00-0190	EA		16' High, 4" OD, 11 Gauge, Round Straight, Steel Area Light Pole, Anchor Base.....	1,001.43	223.52
			<i>For Galvanized Finish, Add</i>	16.63	
			<i>For >10 To 20, Deduct</i>	-33.35	
			<i>For >20 To 40, Deduct</i>	-61.16	
			<i>For >40, Deduct</i>	-127.86	
26 56 13 00-0191	EA		18' High, 4" OD, 11 Gauge, Round Straight, Steel Area Light Pole, Anchor Base.....	1,071.44	245.87
			<i>For Galvanized Finish, Add</i>	17.39	
			<i>For >10 To 20, Deduct</i>	-35.48	
			<i>For >20 To 40, Deduct</i>	-65.17	
			<i>For >40, Deduct</i>	-136.13	
26 56 13 00-0192	EA		20' High, 4" OD, 11 Gauge, Round Straight, Steel Area Light Pole, Anchor Base.....	1,130.44	268.22
			<i>For Galvanized Finish, Add</i>	17.82	
			<i>For >10 To 20, Deduct</i>	-37.17	
			<i>For >20 To 40, Deduct</i>	-68.40	
			<i>For >40, Deduct</i>	-142.74	
26 56 13 00-0193	EA		25' High, 4" OD, 11 Gauge, Round Straight, Steel Area Light Pole, Anchor Base.....	1,349.95	357.63
			<i>For Galvanized Finish, Add</i>	19.04	
			<i>For >10 To 20, Deduct</i>	-43.27	
			<i>For >20 To 40, Deduct</i>	-80.19	
			<i>For >40, Deduct</i>	-166.73	
26 56 13 00-0194	EA		10' High, 4-1/2" OD, 11 Gauge, Round Straight, Steel Area Light Pole, Anchor Base	738.63	156.46
			<i>For Galvanized Finish, Add</i>	12.77	
			<i>For >10 To 20, Deduct</i>	-24.85	
			<i>For >20 To 40, Deduct</i>	-45.45	
			<i>For >40, Deduct</i>	-95.15	
26 56 13 00-0195	EA		12' High, 4-1/2" OD, 11 Gauge, Round Straight, Steel Area Light Pole, Anchor Base	809.73	178.82
			<i>For Galvanized Finish, Add</i>	13.56	
			<i>For >10 To 20, Deduct</i>	-27.02	
			<i>For >20 To 40, Deduct</i>	-49.53	
			<i>For >40, Deduct</i>	-103.58	
26 56 13 00-0196	EA		14' High, 4-1/2" OD, 11 Gauge, Round Straight, Steel Area Light Pole, Anchor Base	945.73	201.17
			<i>For Galvanized Finish, Add</i>	16.30	
			<i>For >10 To 20, Deduct</i>	-31.79	
			<i>For >20 To 40, Deduct</i>	-58.15	
			<i>For >40, Deduct</i>	-121.74	
26 56 13 00-0197	EA		16' High, 4-1/2" OD, 11 Gauge, Round Straight, Steel Area Light Pole, Anchor Base	1,004.73	223.52
			<i>For Galvanized Finish, Add</i>	16.73	
			<i>For >10 To 20, Deduct</i>	-33.48	
			<i>For >20 To 40, Deduct</i>	-61.39	
			<i>For >40, Deduct</i>	-128.36	
26 56 13 00-0198	EA		18' High, 4-1/2" OD, 11 Gauge, Round Straight, Steel Area Light Pole, Anchor Base	1,071.44	245.87
			<i>For Galvanized Finish, Add</i>	17.39	
			<i>For >10 To 20, Deduct</i>	-35.48	
			<i>For >20 To 40, Deduct</i>	-65.17	
			<i>For >40, Deduct</i>	-136.13	
26 56 13 00-0199	EA		20' High, 4-1/2" OD, 11 Gauge, Round Straight, Steel Area Light Pole, Anchor Base	1,130.44	268.22
			<i>For Galvanized Finish, Add</i>	17.82	
			<i>For >10 To 20, Deduct</i>	-37.17	
			<i>For >20 To 40, Deduct</i>	-68.40	
			<i>For >40, Deduct</i>	-142.74	
26 56 13 00-0200	EA		25' High, 4-1/2" OD, 11 Gauge, Round Straight, Steel Area Light Pole, Anchor Base	1,380.75	357.63
			<i>For Galvanized Finish, Add</i>	19.97	
			<i>For >10 To 20, Deduct</i>	-44.50	
			<i>For >20 To 40, Deduct</i>	-82.35	
			<i>For >40, Deduct</i>	-171.35	
26 56 13 00-0201	EA		30' High, 4-1/2" OD, 11 Gauge, Round Straight, Steel Area Light Pole, Anchor Base	1,527.37	402.33
			<i>For Galvanized Finish, Add</i>	21.68	
			<i>For >10 To 20, Deduct</i>	-49.02	
			<i>For >20 To 40, Deduct</i>	-90.82	
			<i>For >40, Deduct</i>	-188.87	
26 56 13 00-0202	EA		20' High, 5" OD, 11 Gauge, Round Straight, Steel Area Light Pole, Anchor Base.....	1,200.84	268.22
			<i>For Galvanized Finish, Add</i>	19.93	
			<i>For >10 To 20, Deduct</i>	-39.99	
			<i>For >20 To 40, Deduct</i>	-73.33	
			<i>For >40, Deduct</i>	-153.30	

26	Electrical
26 50	Lighting
26 56	Exterior Lighting



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56	13 00-0203	EA	25' High, 5" OD, 11 Gauge, Round Straight, Steel Area Light Pole, Anchor Base.....	1,395.05	357.63
			<i>For Galvanized Finish, Add</i>	20.39	
			<i>For >10 To 20, Deduct</i>	-45.07	
			<i>For >20 To 40, Deduct</i>	-83.35	
			<i>For >40, Deduct</i>	-173.50	
26 56	13 00-0204	EA	30' High, 5" OD, 11 Gauge, Round Straight, Steel Area Light Pole, Anchor Base.....	1,554.87	402.33
			<i>For Galvanized Finish, Add</i>	22.51	
			<i>For >10 To 20, Deduct</i>	-50.12	
			<i>For >20 To 40, Deduct</i>	-92.75	
			<i>For >40, Deduct</i>	-193.00	
26 56	13 00-0205		Round Tapered, Steel Area Light Poles <small>(26 56 13 00-0178)</small>		
26 56	13 00-0206		Round Tapered, Steel Area Light Poles, Anchor Base <small>(26 56 13 00-0205)</small>		
26 56	13 00-0207	EA	20' High, 5.90" Base OD, 11 Gauge, Round Tapered, Steel Area Light Pole, Anchor Base.....	1,449.44	268.22
			<i>For Galvanized Finish, Add</i>	27.39	
			<i>For >10 To 20, Deduct</i>	-49.93	
			<i>For >20 To 40, Deduct</i>	-90.73	
			<i>For >40, Deduct</i>	-190.59	
26 56	13 00-0208	EA	20' High, 6.50" Base OD, 11 Gauge, Round Tapered, Steel Area Light Pole, Anchor Base.....	1,483.54	268.22
			<i>For Galvanized Finish, Add</i>	28.41	
			<i>For >10 To 20, Deduct</i>	-51.30	
			<i>For >20 To 40, Deduct</i>	-93.12	
			<i>For >40, Deduct</i>	-195.71	
26 56	13 00-0209	EA	25' High, 5.90" Base OD, 11 Gauge, Round Tapered, Steel Area Light Pole, Anchor Base.....	1,737.15	357.63
			<i>For Galvanized Finish, Add</i>	30.66	
			<i>For >10 To 20, Deduct</i>	-58.76	
			<i>For >20 To 40, Deduct</i>	-107.30	
			<i>For >40, Deduct</i>	-224.81	
26 56	13 00-0210	EA	25' High, 7.00" Base OD, 11 Gauge, Round Tapered, Steel Area Light Pole, Anchor Base.....	1,807.55	357.63
			<i>For Galvanized Finish, Add</i>	32.77	
			<i>For >10 To 20, Deduct</i>	-61.57	
			<i>For >20 To 40, Deduct</i>	-112.22	
			<i>For >40, Deduct</i>	-235.37	
26 56	13 00-0211	EA	30' High, 6.60" Base OD, 11 Gauge, Round Tapered, Steel Area Light Pole, Anchor Base.....	1,936.57	402.33
			<i>For Galvanized Finish, Add</i>	33.96	
			<i>For >10 To 20, Deduct</i>	-65.39	
			<i>For >20 To 40, Deduct</i>	-119.47	
			<i>For >40, Deduct</i>	-250.25	
26 56	13 00-0212	EA	30' High, 8.00" Base OD, 11 Gauge, Round Tapered, Steel Area Light Pole, Anchor Base.....	2,054.27	402.33
			<i>For Galvanized Finish, Add</i>	37.49	
			<i>For >10 To 20, Deduct</i>	-70.10	
			<i>For >20 To 40, Deduct</i>	-127.71	
			<i>For >40, Deduct</i>	-267.91	
26 56	13 00-0213	EA	35' High, 7.30" Base OD, 11 Gauge, Round Tapered, Steel Area Light Pole, Anchor Base.....	2,123.16	424.68
			<i>For Galvanized Finish, Add</i>	38.21	
			<i>For >10 To 20, Deduct</i>	-72.19	
			<i>For >20 To 40, Deduct</i>	-131.63	
			<i>For >40, Deduct</i>	-276.01	
26 56	13 00-0214	EA	35' High, 8.50" Base OD, 11 Gauge, Round Tapered, Steel Area Light Pole, Anchor Base.....	2,195.76	424.68
			<i>For Galvanized Finish, Add</i>	40.39	
			<i>For >10 To 20, Deduct</i>	-75.09	
			<i>For >20 To 40, Deduct</i>	-136.72	
			<i>For >40, Deduct</i>	-286.90	
26 56	13 00-0215	EA	35' High, 9.50" Base OD, 11 Gauge, Round Tapered, Steel Area Light Pole, Anchor Base.....	2,369.56	424.68
			<i>For Galvanized Finish, Add</i>	45.61	
			<i>For >10 To 20, Deduct</i>	-82.04	
			<i>For >20 To 40, Deduct</i>	-148.88	
			<i>For >40, Deduct</i>	-312.97	
26 56	13 00-0216	EA	39' High, 7.82" Base OD, 11 Gauge, Round Tapered, Steel Area Light Pole, Anchor Base.....	2,401.07	447.03
			<i>For Galvanized Finish, Add</i>	45.21	
			<i>For >10 To 20, Deduct</i>	-82.63	
			<i>For >20 To 40, Deduct</i>	-150.19	
			<i>For >40, Deduct</i>	-315.46	
26 56	13 00-0217	EA	39' High, 9.00" Base OD, 11 Gauge, Round Tapered, Steel Area Light Pole, Anchor Base.....	2,431.87	447.03
			<i>For Galvanized Finish, Add</i>	46.13	
			<i>For >10 To 20, Deduct</i>	-83.86	
			<i>For >20 To 40, Deduct</i>	-152.35	
			<i>For >40, Deduct</i>	-320.08	
26 56	13 00-0218	EA	45' High, 10.00" Base OD, 11 Gauge, Round Tapered, Steel Area Light Pole, Anchor Base.....	3,292.99	581.14
			<i>For Galvanized Finish, Add</i>	63.92	
			<i>For >10 To 20, Deduct</i>	-114.29	
			<i>For >20 To 40, Deduct</i>	-207.26	
			<i>For >40, Deduct</i>	-435.83	
26 56	13 00-0219	EA	50' High, 10.00" Base OD, 11 Gauge, Round Tapered, Steel Area Light Pole, Anchor Base.....	3,465.21	670.56
			<i>For Galvanized Finish, Add</i>	63.72	
			<i>For >10 To 20, Deduct</i>	-118.49	
			<i>For >20 To 40, Deduct</i>	-215.74	
			<i>For >40, Deduct</i>	-452.73	
26 56	13 00-0220	EA	25' High, 7.00" Base OD, 7 Gauge, Round Tapered, Steel Area Light Pole, Anchor Base.....	2,284.95	357.63
			<i>For Galvanized Finish, Add</i>	47.09	
			<i>For >10 To 20, Deduct</i>	-80.67	
			<i>For >20 To 40, Deduct</i>	-145.64	
			<i>For >40, Deduct</i>	-306.98	



Electrical	26	26
Lighting	26 50	
Exterior Lighting	26 56	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56 13 00-0221	EA		30' High, 8.00" Base OD, 7 Gauge, Round Tapered, Steel Area Light Pole, Anchor Base <i>For Galvanized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	2,592.17 53.63 -91.62 -165.36 -348.59	402.33
26 56 13 00-0222	EA		39' High, 9.00" Base OD, 7 Gauge, Round Tapered, Steel Area Light Pole, Anchor Base <i>For Galvanized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	2,993.97 63.00 -106.35 -191.70 -404.39	447.03
26 56 13 00-0223	EA		45' High, 10.00" Base OD, 7 Gauge, Round Tapered, Steel Area Light Pole, Anchor Base <i>For Galvanized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	3,636.19 74.22 -128.01 -231.29 -487.31	581.14
26 56 13 00-0224	EA		50' High, 10.00" Base OD, 7 Gauge, Round Tapered, Steel Area Light Pole, Anchor Base <i>For Galvanized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	4,239.61 86.96 -149.47 -269.95 -568.89	670.56
26 56 13 00-0225	EA		50' High, 11.00" Base OD, 7 Gauge, Round Tapered, Steel Area Light Pole, Anchor Base <i>For Galvanized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	4,687.31 100.39 -167.38 -301.29 -636.04	670.56
26 56 13 00-0226	EA		50' High, 13.00" Base OD, 7 Gauge, Round Tapered, Steel Area Light Pole, Anchor Base <i>For Galvanized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	6,183.31 145.27 -227.22 -406.01 -860.44	670.56
26 56 13 00-0227	EA		50' High, 13.00" Base OD, 3 Gauge, Round Tapered, Steel Area Light Pole, Anchor Base <i>For Galvanized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	6,909.31 167.05 -256.26 -456.83 -969.34	670.56
26 56 13 00-0228			Square Straight, Steel Area Light Poles <small>(26 56 13 00-0178)</small>		
26 56 13 00-0229			Square Straight, Steel Area Light Poles, Anchor Base <small>(26 56 13 00-0228)</small>		
26 56 13 00-0230	EA		10' High, 4" OD, 11 Gauge, Square Straight, Steel Area Light Pole, Anchor Base..... <i>For Galvanized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	701.23 11.65 -23.36 -42.83 -89.54	156.46
26 56 13 00-0231	EA		12' High, 4" OD, 11 Gauge, Square Straight, Steel Area Light Pole, Anchor Base..... <i>For Galvanized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	745.93 11.65 -24.47 -45.06 -94.01	178.82
26 56 13 00-0232	EA		14' High, 4" OD, 11 Gauge, Square Straight, Steel Area Light Pole, Anchor Base..... <i>For Galvanized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	809.33 12.21 -26.34 -48.61 -101.28	201.17
26 56 13 00-0233	EA		15' High, 4" OD, 11 Gauge, Square Straight, Steel Area Light Pole, Anchor Base..... <i>For Galvanized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	858.08 13.00 -27.95 -51.57 -107.48	212.35
26 56 13 00-0234	EA		16' High, 4" OD, 11 Gauge, Square Straight, Steel Area Light Pole, Anchor Base..... <i>For Galvanized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	880.43 13.00 -28.51 -52.69 -109.71	223.52
26 56 13 00-0235	EA		18' High, 4" OD, 11 Gauge, Square Straight, Steel Area Light Pole, Anchor Base..... <i>For Galvanized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	937.24 13.37 -30.11 -55.77 -116.00	245.87
26 56 13 00-0236	EA		20' High, 4" OD, 11 Gauge, Square Straight, Steel Area Light Pole, Anchor Base..... <i>For Galvanized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	991.84 13.66 -31.63 -58.70 -121.95	268.22
26 56 13 00-0237	EA		25' High, 4" OD, 11 Gauge, Square Straight, Steel Area Light Pole, Anchor Base..... <i>For Galvanized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,236.65 15.64 -38.74 -72.26 -149.74	357.63
26 56 13 00-0238	EA		20' High, 5" OD, 11 Gauge, Square Straight, Steel Area Light Pole, Anchor Base..... <i>For Galvanized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,140.34 18.12 -37.57 -69.10 -144.23	268.22

26	Electrical
26 50	Lighting
26 56	Exterior Lighting



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56	13 00-0239	EA	25' High, 5" OD, 11 Gauge, Square Straight, Steel Area Light Pole, Anchor Base.....	1,441.25	357.63
			<i>For Galvanized Finish, Add</i>	21.78	
			<i>For >10 To 20, Deduct</i>	-46.92	
			<i>For >20 To 40, Deduct</i>	-86.58	
			<i>For >40, Deduct</i>	-180.43	
26 56	13 00-0240	EA	30' High, 5" OD, 11 Gauge, Square Straight, Steel Area Light Pole, Anchor Base.....	1,650.57	402.33
			<i>For Galvanized Finish, Add</i>	25.38	
			<i>For >10 To 20, Deduct</i>	-53.95	
			<i>For >20 To 40, Deduct</i>	-99.45	
			<i>For >40, Deduct</i>	-207.35	
26 56	13 00-0241	EA	20' High, 4" OD, 7 Gauge, Square Straight, Steel Area Light Pole, Anchor Base.....	1,099.64	268.22
			<i>For Galvanized Finish, Add</i>	16.90	
			<i>For >10 To 20, Deduct</i>	-35.94	
			<i>For >20 To 40, Deduct</i>	-66.25	
			<i>For >40, Deduct</i>	-138.12	
26 56	13 00-0242	EA	25' High, 4" OD, 7 Gauge, Square Straight, Steel Area Light Pole, Anchor Base.....	1,362.05	357.63
			<i>For Galvanized Finish, Add</i>	19.40	
			<i>For >10 To 20, Deduct</i>	-43.75	
			<i>For >20 To 40, Deduct</i>	-81.04	
			<i>For >40, Deduct</i>	-168.55	
26 56	13 00-0243	EA	30' High, 4" OD, 7 Gauge, Square Straight, Steel Area Light Pole, Anchor Base.....	1,582.37	402.33
			<i>For Galvanized Finish, Add</i>	23.33	
			<i>For >10 To 20, Deduct</i>	-51.22	
			<i>For >20 To 40, Deduct</i>	-94.67	
			<i>For >40, Deduct</i>	-197.12	
26 56	13 00-0244	EA	20' High, 5" OD, 7 Gauge, Square Straight, Steel Area Light Pole, Anchor Base.....	1,239.34	268.22
			<i>For Galvanized Finish, Add</i>	21.09	
			<i>For >10 To 20, Deduct</i>	-41.53	
			<i>For >20 To 40, Deduct</i>	-76.03	
			<i>For >40, Deduct</i>	-159.08	
26 56	13 00-0245	EA	25' High, 5" OD, 7 Gauge, Square Straight, Steel Area Light Pole, Anchor Base.....	1,540.25	357.63
			<i>For Galvanized Finish, Add</i>	24.75	
			<i>For >10 To 20, Deduct</i>	-50.88	
			<i>For >20 To 40, Deduct</i>	-93.51	
			<i>For >40, Deduct</i>	-195.28	
26 56	13 00-0246	EA	30' High, 5" OD, 7 Gauge, Square Straight, Steel Area Light Pole, Anchor Base.....	1,744.07	402.33
			<i>For Galvanized Finish, Add</i>	28.18	
			<i>For >10 To 20, Deduct</i>	-57.69	
			<i>For >20 To 40, Deduct</i>	-105.99	
			<i>For >40, Deduct</i>	-221.38	
26 56	13 00-0247	EA	35' High, 5" OD, 7 Gauge, Square Straight, Steel Area Light Pole, Anchor Base.....	1,925.16	424.68
			<i>For Galvanized Finish, Add</i>	32.27	
			<i>For >10 To 20, Deduct</i>	-64.27	
			<i>For >20 To 40, Deduct</i>	-117.77	
			<i>For >40, Deduct</i>	-246.31	
26 56	13 00-0248	EA	30' High, 6" OD, 7 Gauge, Square Straight, Steel Area Light Pole, Anchor Base.....	1,960.77	402.33
			<i>For Galvanized Finish, Add</i>	34.68	
			<i>For >10 To 20, Deduct</i>	-66.36	
			<i>For >20 To 40, Deduct</i>	-121.16	
			<i>For >40, Deduct</i>	-253.88	
26 56	13 00-0249	EA	35' High, 6" OD, 7 Gauge, Square Straight, Steel Area Light Pole, Anchor Base.....	2,142.96	424.68
			<i>For Galvanized Finish, Add</i>	38.81	
			<i>For >10 To 20, Deduct</i>	-72.98	
			<i>For >20 To 40, Deduct</i>	-133.02	
			<i>For >40, Deduct</i>	-278.98	
26 56	13 00-0250	EA	40' High, 6" OD, 7 Gauge, Square Straight, Steel Area Light Pole, Anchor Base.....	2,265.77	447.03
			<i>For Galvanized Finish, Add</i>	41.15	
			<i>For >10 To 20, Deduct</i>	-77.22	
			<i>For >20 To 40, Deduct</i>	-140.72	
			<i>For >40, Deduct</i>	-295.16	
26 56	13 00-0251		Hinged, Square Straight, Steel Area Light Poles <small>(26 56 13 00-0178)</small>		
26 56	13 00-0252		Hinged, Square Straight, Steel Area Light Poles, Anchor Base <small>(26 56 13 00-0251)</small>		
26 56	13 00-0253	EA	20' High, 6.44" OD, 11 Gauge, Hinged, Square Straight, Steel Area Light Pole, Anchor Base	2,360.47	268.22
			<i>For Galvanized Finish, Add</i>	54.72	
			<i>For >10 To 20, Deduct</i>	-86.37	
			<i>For >20 To 40, Deduct</i>	-154.50	
			<i>For >40, Deduct</i>	-327.25	
26 56	13 00-0254	EA	25' High, 6.44" OD, 11 Gauge, Hinged, Square Straight, Steel Area Light Pole, Anchor Base	2,663.30	357.63
			<i>For Galvanized Finish, Add</i>	58.44	
			<i>For >10 To 20, Deduct</i>	-95.80	
			<i>For >20 To 40, Deduct</i>	-172.13	
			<i>For >40, Deduct</i>	-363.73	
26 56	13 00-0255	EA	30' High, 6.44" OD, 11 Gauge, Hinged, Square Straight, Steel Area Light Pole, Anchor Base	3,679.36	402.33
			<i>For Galvanized Finish, Add</i>	86.24	
			<i>For >10 To 20, Deduct</i>	-135.10	
			<i>For >20 To 40, Deduct</i>	-241.46	
			<i>For >40, Deduct</i>	-511.67	
26 56	13 00-0256	EA	20' High, 7.32" OD, 11 Gauge, Hinged, Square Straight, Steel Area Light Pole, Anchor Base	2,404.93	268.22
			<i>For Galvanized Finish, Add</i>	56.05	
			<i>For >10 To 20, Deduct</i>	-88.15	
			<i>For >20 To 40, Deduct</i>	-157.62	
			<i>For >40, Deduct</i>	-333.92	



Electrical	26	26
Lighting	26 50	
Exterior Lighting	26 56	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56 13 00-0257	EA		25' High, 7.32" OD, 11 Gauge, Hinged, Square Straight, Steel Area Light Pole, Anchor Base <i>For Galvanized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	2,921.87 66.20 -106.15 -190.23 -402.52	357.63
26 56 13 00-0258	EA		30' High, 7.32" OD, 11 Gauge, Hinged, Square Straight, Steel Area Light Pole, Anchor Base <i>For Galvanized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	4,064.29 97.79 -150.50 -268.41 -569.41	402.33
26 56 13 00-0259	EA		35' High, 7.32" OD, 11 Gauge, Hinged, Square Straight, Steel Area Light Pole, Anchor Base <i>For Galvanized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	4,664.01 113.90 -173.10 -308.23 -654.43	424.68
26 56 13 00-0260	EA		39' High, 7.32" OD, 11 Gauge, Hinged, Square Straight, Steel Area Light Pole, Anchor Base <i>For Galvanized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	5,436.01 136.26 -204.03 -362.64 -770.70	447.03
26 56 13 00-0261	EA		20' High, 4" OD, 7 Gauge, Hinged, Square Straight, Steel Area Light Pole, Anchor Base <i>For Galvanized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	2,290.27 52.61 -83.56 -149.59 -316.72	268.22
26 56 13 00-0262	EA		25' High, 4" OD, 7 Gauge, Hinged, Square Straight, Steel Area Light Pole, Anchor Base <i>For Galvanized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	2,550.98 55.07 -91.31 -164.26 -346.88	357.63
26 56 13 00-0263	EA		30' High, 4" OD, 7 Gauge, Hinged, Square Straight, Steel Area Light Pole, Anchor Base <i>For Galvanized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	3,481.63 80.31 -127.20 -227.62 -482.01	402.33
26 56 13 00-0264	EA		20' High, 6.44" OD, 7 Gauge, Hinged, Square Straight, Steel Area Light Pole, Anchor Base <i>For Galvanized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	2,371.00 55.04 -86.79 -155.24 -328.83	268.22
26 56 13 00-0265	EA		25' High, 6.44" OD, 7 Gauge, Hinged, Square Straight, Steel Area Light Pole, Anchor Base <i>For Galvanized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	2,816.57 63.04 -101.93 -182.85 -386.72	357.63
26 56 13 00-0266	EA		30' High, 6.44" OD, 7 Gauge, Hinged Square Straight, Steel Area Light Pole, Anchor Base <i>For Galvanized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	3,918.04 93.40 -144.65 -258.17 -547.47	402.33
26 56 13 00-0267	EA		20' High, 7.32" OD, 7 Gauge, Hinged, Square Straight, Steel Area Light Pole, Anchor Base <i>For Galvanized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	2,495.02 58.76 -91.75 -163.92 -347.43	268.22
26 56 13 00-0268	EA		25' High, 7.32" OD, 7 Gauge, Hinged, Square Straight, Steel Area Light Pole, Anchor Base <i>For Galvanized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	3,040.04 69.74 -110.87 -198.50 -420.24	357.63
26 56 13 00-0269	EA		30' High, 7.32" OD, 7 Gauge, Hinged, Square Straight, Steel Area Light Pole, Anchor Base <i>For Galvanized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	4,181.29 101.30 -155.18 -276.60 -586.96	402.33
26 56 13 00-0270	EA		35' High, 7.32" OD, 7 Gauge, Hinged, Square Straight, Steel Area Light Pole, Anchor Base <i>For Galvanized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	4,788.75 118.18 -178.81 -318.23 -675.84	424.68
26 56 13 00-0271	EA		39' High, 7.32" OD, 7 Gauge, Hinged, Square Straight, Steel Area Light Pole, Anchor Base <i>For Galvanized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	5,512.06 138.54 -207.07 -367.96 -782.11	447.03
26 56 13 00-0272			Square Tapered, Steel Area Light Poles <small>(26 56 13 00-0178)</small>		
26 56 13 00-0273			Square Tapered, Steel Area Light Poles, Anchor Base <small>(26 56 13 00-0272)</small>		
26 56 13 00-0274	EA		20' High, 5.25" Base OD, 11 Gauge, Square Tapered, Steel Area Light Pole, Anchor Base <i>For Galvanized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,820.14 38.51 -64.76 -116.68 -246.20	268.22

26	Electrical
26 50	Lighting
26 56	Exterior Lighting



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56	13 00-0275	EA	25' High, 6.00" Base OD, 11 Gauge, Square Tapered, Steel Area Light Pole, Anchor Base.....	2,225.55	357.63
			<i>For Galvanized Finish, Add</i>	45.31	
			<i>For >10 To 20, Deduct</i>	-78.29	
			<i>For >20 To 40, Deduct</i>	-141.48	
			<i>For >40, Deduct</i>	-298.07	
26 56	13 00-0276	EA	30' High, 6.41" Base OD, 11 Gauge, Square Tapered, Steel Area Light Pole, Anchor Base.....	2,478.87	402.33
			<i>For Galvanized Finish, Add</i>	50.23	
			<i>For >10 To 20, Deduct</i>	-87.08	
			<i>For >20 To 40, Deduct</i>	-157.43	
			<i>For >40, Deduct</i>	-331.60	
26 56	13 00-0277	EA	35' High, 6.81" Base OD, 11 Gauge, Square Tapered, Steel Area Light Pole, Anchor Base.....	2,740.26	424.68
			<i>For Galvanized Finish, Add</i>	56.73	
			<i>For >10 To 20, Deduct</i>	-96.87	
			<i>For >20 To 40, Deduct</i>	-174.83	
			<i>For >40, Deduct</i>	-368.57	
26 56	13 00-0278	EA	39' High, 7.18" Base OD, 11 Gauge, Square Tapered, Steel Area Light Pole, Anchor Base.....	2,888.37	447.03
			<i>For Galvanized Finish, Add</i>	59.83	
			<i>For >10 To 20, Deduct</i>	-102.12	
			<i>For >20 To 40, Deduct</i>	-184.30	
			<i>For >40, Deduct</i>	-388.55	
26 56	13 00-0279	EA	20' High, 5.50" Base OD, 7 Gauge, Square Tapered, Steel Area Light Pole, Anchor Base.....	2,314.04	268.22
			<i>For Galvanized Finish, Add</i>	53.33	
			<i>For >10 To 20, Deduct</i>	-84.52	
			<i>For >20 To 40, Deduct</i>	-151.25	
			<i>For >40, Deduct</i>	-320.28	
26 56	13 00-0280	EA	25' High, 6.41" Base OD, 7 Gauge, Square Tapered, Steel Area Light Pole, Anchor Base.....	2,612.75	357.63
			<i>For Galvanized Finish, Add</i>	56.93	
			<i>For >10 To 20, Deduct</i>	-93.78	
			<i>For >20 To 40, Deduct</i>	-168.59	
			<i>For >40, Deduct</i>	-356.15	
26 56	13 00-0281	EA	30' High, 6.41" Base OD, 7 Gauge, Square Tapered, Steel Area Light Pole, Anchor Base.....	2,795.67	402.33
			<i>For Galvanized Finish, Add</i>	59.73	
			<i>For >10 To 20, Deduct</i>	-99.76	
			<i>For >20 To 40, Deduct</i>	-179.60	
			<i>For >40, Deduct</i>	-379.12	
26 56	13 00-0282	EA	30' High, 7.13" Base OD, 7 Gauge, Square Tapered, Steel Area Light Pole, Anchor Base.....	3,086.07	402.33
			<i>For Galvanized Finish, Add</i>	68.44	
			<i>For >10 To 20, Deduct</i>	-111.37	
			<i>For >20 To 40, Deduct</i>	-199.93	
			<i>For >40, Deduct</i>	-422.68	
26 56	13 00-0283	EA	35' High, 7.13" Base OD, 7 Gauge, Square Tapered, Steel Area Light Pole, Anchor Base.....	3,339.76	424.68
			<i>For Galvanized Finish, Add</i>	74.71	
			<i>For >10 To 20, Deduct</i>	-120.85	
			<i>For >20 To 40, Deduct</i>	-216.80	
			<i>For >40, Deduct</i>	-458.50	
26 56	13 00-0284	EA	35' High, 7.88" Base OD, 7 Gauge, Square Tapered, Steel Area Light Pole, Anchor Base.....	3,699.46	424.68
			<i>For Galvanized Finish, Add</i>	85.50	
			<i>For >10 To 20, Deduct</i>	-135.24	
			<i>For >20 To 40, Deduct</i>	-241.98	
			<i>For >40, Deduct</i>	-512.45	
26 56	13 00-0285	EA	39' High, 7.13" Base OD, 7 Gauge, Square Tapered, Steel Area Light Pole, Anchor Base.....	3,400.97	447.03
			<i>For Galvanized Finish, Add</i>	75.21	
			<i>For >10 To 20, Deduct</i>	-122.63	
			<i>For >20 To 40, Deduct</i>	-220.19	
			<i>For >40, Deduct</i>	-465.44	
26 56	13 00-0286	EA	39' High, 8.75" Base OD, 7 Gauge, Square Tapered, Steel Area Light Pole, Anchor Base.....	4,286.47	447.03
			<i>For Galvanized Finish, Add</i>	101.77	
			<i>For >10 To 20, Deduct</i>	-158.05	
			<i>For >20 To 40, Deduct</i>	-282.17	
			<i>For >40, Deduct</i>	-598.27	
26 56	13 00-0287	EA	45' High, 7.88" Base OD, 7 Gauge, Square Tapered, Steel Area Light Pole, Anchor Base.....	4,042.09	581.14
			<i>For Galvanized Finish, Add</i>	86.39	
			<i>For >10 To 20, Deduct</i>	-144.25	
			<i>For >20 To 40, Deduct</i>	-259.70	
			<i>For >40, Deduct</i>	-548.20	
26 56	13 00-0288	EA	45' High, 8.75" Base OD, 7 Gauge, Square Tapered, Steel Area Light Pole, Anchor Base.....	4,645.99	581.14
			<i>For Galvanized Finish, Add</i>	104.51	
			<i>For >10 To 20, Deduct</i>	-168.41	
			<i>For >20 To 40, Deduct</i>	-301.97	
			<i>For >40, Deduct</i>	-638.78	
26 56	13 00-0289	EA	50' High, 8.81" Base OD, 7 Gauge, Square Tapered, Steel Area Light Pole, Anchor Base.....	4,855.61	670.56
			<i>For Galvanized Finish, Add</i>	105.44	
			<i>For >10 To 20, Deduct</i>	-174.11	
			<i>For >20 To 40, Deduct</i>	-313.07	
			<i>For >40, Deduct</i>	-661.29	
26 56	13 00-0290		Factory Accessories For Steel Area Light Poles <small>(26 56 13 00-0178)</small>		
	26 56 13 00-0291	EA	1/2", 3/4" Or 1" Factory Threaded Pipe Coupling Or Nipple For Steel Area Light Poles.....	39.00	
	26 56 13 00-0292	EA	Festoon Outlet Provision For Steel Area Light Poles.....	54.00	
			Note: Excludes electrical outlet.		
	26 56 13 00-0293	EA	Extra Handhole For Steel Area Light Poles	58.00	
	26 56 13 00-0294	EA	Vibration Dampener For Steel Area Light Poles	59.00	



Electrical	26	26
Lighting	26 50	
Exterior Lighting	26 56	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56 13 00-0295 Aluminum Area Light Poles <small>(26 56 13 00-0177)</small> Note: Includes satin brushed or painted finish, anchor bolts, base cover, reinforced handhole with cover and grounding provisions, factory drilled fixture mounting holes and tenon, open or capped top.		
26 56 13 00-0296 Round Straight, Aluminum Area Light Poles <small>(26 56 13 00-0295)</small>		
26 56 13 00-0297 Round Straight, Aluminum Area Light Poles, Anchor Base <small>(26 56 13 00-0296)</small>		
26 56 13 00-0298 EA 8' High, 4" OD, 0.125", Round Straight, Aluminum Area Light Pole, Anchor Base For Bronze Or Satin Anodized Finish, Add For Black Anodized Finish, Add For >10 To 20, Deduct For >20 To 40, Deduct For >40, Deduct	697.22 42.90 85.80 -23.87 -43.44 -91.17	134.11
26 56 13 00-0299 EA 10' High, 4" OD, 0.125", Round Straight, Aluminum Area Light Pole, Anchor Base For Bronze Or Satin Anodized Finish, Add For Black Anodized Finish, Add For >10 To 20, Deduct For >20 To 40, Deduct For >40, Deduct	763.93 45.10 90.20 -25.86 -47.22 -98.94	156.46
26 56 13 00-0300 EA 12' High, 4" OD, 0.125", Round Straight, Aluminum Area Light Pole, Anchor Base For Bronze Or Satin Anodized Finish, Add For Black Anodized Finish, Add For >10 To 20, Deduct For >20 To 40, Deduct For >40, Deduct	836.13 47.85 95.70 -28.08 -51.38 -107.54	178.82
26 56 13 00-0301 EA 14' High, 4" OD, 0.125", Round Straight, Aluminum Area Light Pole, Anchor Base For Bronze Or Satin Anodized Finish, Add For Black Anodized Finish, Add For >10 To 20, Deduct For >20 To 40, Deduct For >40, Deduct	909.43 50.71 101.42 -30.34 -55.61 -116.30	201.17
26 56 13 00-0302 EA 15' High, 4" OD, 0.125", Round Straight, Aluminum Area Light Pole, Anchor Base For Bronze Or Satin Anodized Finish, Add For Black Anodized Finish, Add For >10 To 20, Deduct For >20 To 40, Deduct For >40, Deduct	950.48 52.58 105.16 -31.65 -58.04 -121.34	212.35
26 56 13 00-0303 EA 16' High, 4" OD, 0.125", Round Straight, Aluminum Area Light Pole, Anchor Base For Bronze Or Satin Anodized Finish, Add For Black Anodized Finish, Add For >10 To 20, Deduct For >20 To 40, Deduct For >40, Deduct	990.43 54.34 108.68 -32.91 -60.39 -126.21	223.52
26 56 13 00-0304 EA 16' High, 4" OD, 0.188", Round Straight, Aluminum Area Light Pole, Anchor Base For Bronze Or Satin Anodized Finish, Add For Black Anodized Finish, Add For >10 To 20, Deduct For >20 To 40, Deduct For >40, Deduct	1,056.43 60.94 121.88 -35.55 -65.01 -136.11	223.52
26 56 13 00-0305 EA 18' High, 4" OD, 0.188", Round Straight, Aluminum Area Light Pole, Anchor Base For Bronze Or Satin Anodized Finish, Add For Black Anodized Finish, Add For >10 To 20, Deduct For >20 To 40, Deduct For >40, Deduct	1,142.94 65.12 130.24 -38.34 -70.17 -146.85	245.87
26 56 13 00-0306 EA 20' High, 4" OD, 0.188", Round Straight, Aluminum Area Light Pole, Anchor Base For Bronze Or Satin Anodized Finish, Add For Black Anodized Finish, Add For >10 To 20, Deduct For >20 To 40, Deduct For >40, Deduct	1,222.84 68.64 137.28 -40.87 -74.87 -156.60	268.22
26 56 13 00-0307 EA 15' High, 5" OD, 0.188", Round Straight, Aluminum Area Light Pole, Anchor Base For Bronze Or Satin Anodized Finish, Add For Black Anodized Finish, Add For >10 To 20, Deduct For >20 To 40, Deduct For >40, Deduct	1,193.58 76.89 153.78 -41.37 -75.06 -157.80	212.35
26 56 13 00-0308 EA 20' High, 5" OD, 0.188", Round Straight, Aluminum Area Light Pole, Anchor Base For Bronze Or Satin Anodized Finish, Add For Black Anodized Finish, Add For >10 To 20, Deduct For >20 To 40, Deduct For >40, Deduct	1,465.94 92.95 185.90 -50.59 -91.89 -193.07	268.22
26 56 13 00-0309 EA 20' High, 6" OD, 0.188", Round Straight, Aluminum Area Light Pole, Anchor Base For Bronze Or Satin Anodized Finish, Add For Black Anodized Finish, Add For >10 To 20, Deduct For >20 To 40, Deduct For >40, Deduct	1,589.14 105.27 210.54 -55.52 -100.51 -211.55	268.22
26 56 13 00-0310 EA 25' High, 6" OD, 0.188", Round Straight, Aluminum Area Light Pole, Anchor Base For Bronze Or Satin Anodized Finish, Add For Black Anodized Finish, Add For >10 To 20, Deduct For >20 To 40, Deduct For >40, Deduct	1,883.45 116.82 233.64 -64.61 -117.54 -246.76	357.63



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56	13 00-0311	EA	30' High, 6" OD, 0.188", Round Straight, Aluminum Area Light Pole, Anchor Base	2,191.77	402.33
			<i>For Bronze Or Satin Anodized Finish, Add</i>	138.71	
			<i>For Black Anodized Finish, Add</i>	277.42	
			<i>For >10 To 20, Deduct</i>	-75.60	
			<i>For >20 To 40, Deduct</i>	-137.33	
			<i>For >40, Deduct</i>	-288.53	
26 56	13 00-0312	EA	20' High, 4" OD, 0.250", Round Straight, Aluminum Area Light Pole, Anchor Base	1,298.74	268.22
			<i>For Bronze Or Satin Anodized Finish, Add</i>	76.23	
			<i>For Black Anodized Finish, Add</i>	152.46	
			<i>For >10 To 20, Deduct</i>	-43.90	
			<i>For >20 To 40, Deduct</i>	-80.18	
			<i>For >40, Deduct</i>	-167.99	
26 56	13 00-0313	EA	20' High, 5" OD, 0.250", Round Straight, Aluminum Area Light Pole, Anchor Base	1,579.24	268.22
			<i>For Bronze Or Satin Anodized Finish, Add</i>	104.28	
			<i>For Black Anodized Finish, Add</i>	208.56	
			<i>For >10 To 20, Deduct</i>	-55.12	
			<i>For >20 To 40, Deduct</i>	-99.82	
			<i>For >40, Deduct</i>	-210.06	
26 56	13 00-0314	EA	25' High, 5" OD, 0.250", Round Straight, Aluminum Area Light Pole, Anchor Base	1,865.85	357.63
			<i>For Bronze Or Satin Anodized Finish, Add</i>	115.06	
			<i>For Black Anodized Finish, Add</i>	230.12	
			<i>For >10 To 20, Deduct</i>	-63.91	
			<i>For >20 To 40, Deduct</i>	-116.30	
			<i>For >40, Deduct</i>	-244.12	
26 56	13 00-0315	EA	25' High, 6" OD, 0.250", Round Straight, Aluminum Area Light Pole, Anchor Base	2,025.35	357.63
			<i>For Bronze Or Satin Anodized Finish, Add</i>	131.01	
			<i>For Black Anodized Finish, Add</i>	262.02	
			<i>For >10 To 20, Deduct</i>	-70.29	
			<i>For >20 To 40, Deduct</i>	-127.47	
			<i>For >40, Deduct</i>	-268.04	
26 56	13 00-0316	EA	30' High, 6" OD, 0.250", Round Straight, Aluminum Area Light Pole, Anchor Base	2,372.17	402.33
			<i>For Bronze Or Satin Anodized Finish, Add</i>	156.75	
			<i>For Black Anodized Finish, Add</i>	313.50	
			<i>For >10 To 20, Deduct</i>	-82.82	
			<i>For >20 To 40, Deduct</i>	-149.96	
			<i>For >40, Deduct</i>	-315.59	
26 56	13 00-0317		Round Straight, Aluminum Area Light Poles, Hinged Anchor Base <small>(26 56 13 00-0296)</small>		
26 56	13 00-0318	EA	8' High, 4" OD, 0.125", Round Straight, Aluminum Area Light Pole, Hinged Anchor Base	809.42	134.11
			<i>For Bronze, Satin Or Black Anodized Finish, Add</i>	81.18	
			<i>For >10 To 20, Deduct</i>	-28.35	
			<i>For >20 To 40, Deduct</i>	-51.30	
			<i>For >40, Deduct</i>	-108.00	
26 56	13 00-0319	EA	10' High, 4" OD, 0.125", Round Straight, Aluminum Area Light Pole, Hinged Anchor Base	898.13	156.46
			<i>For Bronze, Satin Or Black Anodized Finish, Add</i>	87.78	
			<i>For >10 To 20, Deduct</i>	-31.23	
			<i>For >20 To 40, Deduct</i>	-56.61	
			<i>For >40, Deduct</i>	-119.07	
26 56	13 00-0320	EA	12' High, 4" OD, 0.125", Round Straight, Aluminum Area Light Pole, Hinged Anchor Base	982.43	178.82
			<i>For Bronze, Satin Or Black Anodized Finish, Add</i>	93.72	
			<i>For >10 To 20, Deduct</i>	-33.93	
			<i>For >20 To 40, Deduct</i>	-61.62	
			<i>For >40, Deduct</i>	-129.48	
26 56	13 00-0321	EA	14' High, 4" OD, 0.125", Round Straight, Aluminum Area Light Pole, Hinged Anchor Base	1,045.83	201.17
			<i>For Bronze, Satin Or Black Anodized Finish, Add</i>	96.53	
			<i>For >10 To 20, Deduct</i>	-35.80	
			<i>For >20 To 40, Deduct</i>	-65.16	
			<i>For >40, Deduct</i>	-136.76	
26 56	13 00-0322	EA	16' High, 4" OD, 0.125", Round Straight, Aluminum Area Light Pole, Hinged Anchor Base	1,122.43	223.52
			<i>For Bronze, Satin Or Black Anodized Finish, Add</i>	101.31	
			<i>For >10 To 20, Deduct</i>	-38.19	
			<i>For >20 To 40, Deduct</i>	-69.63	
			<i>For >40, Deduct</i>	-146.01	
26 56	13 00-0323	EA	10' High, 5" OD, 0.125", Round Straight, Aluminum Area Light Pole, Hinged Anchor Base	921.23	156.46
			<i>For Bronze, Satin Or Black Anodized Finish, Add</i>	91.25	
			<i>For >10 To 20, Deduct</i>	-32.16	
			<i>For >20 To 40, Deduct</i>	-58.23	
			<i>For >40, Deduct</i>	-122.54	
26 56	13 00-0324	EA	12' High, 5" OD, 0.125", Round Straight, Aluminum Area Light Pole, Hinged Anchor Base	1,003.33	178.82
			<i>For Bronze, Satin Or Black Anodized Finish, Add</i>	96.86	
			<i>For >10 To 20, Deduct</i>	-34.77	
			<i>For >20 To 40, Deduct</i>	-63.08	
			<i>For >40, Deduct</i>	-132.62	
26 56	13 00-0325	EA	14' High, 5" OD, 0.125", Round Straight, Aluminum Area Light Pole, Hinged Anchor Base	1,088.73	201.17
			<i>For Bronze, Satin Or Black Anodized Finish, Add</i>	102.96	
			<i>For >10 To 20, Deduct</i>	-37.51	
			<i>For >20 To 40, Deduct</i>	-68.16	
			<i>For >40, Deduct</i>	-143.19	
26 56	13 00-0326	EA	16' High, 5" OD, 0.125", Round Straight, Aluminum Area Light Pole, Hinged Anchor Base	1,173.03	223.52
			<i>For Bronze, Satin Or Black Anodized Finish, Add</i>	108.90	
			<i>For >10 To 20, Deduct</i>	-40.22	
			<i>For >20 To 40, Deduct</i>	-73.17	
			<i>For >40, Deduct</i>	-153.60	



Electrical	26	26
Lighting	26 50	
Exterior Lighting	26 56	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56 13 00-0327	EA		18' High, 5" OD, 0.125", Round Straight, Aluminum Area Light Pole, Hinged Anchor Base <i>For Bronze, Satin Or Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,262.84 115.67 -43.14 -78.56 -164.84	245.87
26 56 13 00-0328	EA		20' High, 5" OD, 0.125", Round Straight, Aluminum Area Light Pole, Hinged Anchor Base <i>For Bronze, Satin Or Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,346.04 121.44 -45.80 -83.49 -175.08	268.22
26 56 13 00-0329	EA		12' High, 5" OD, 0.156", Round Straight, Aluminum Area Light Pole, Hinged Anchor Base <i>For Bronze, Satin Or Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,046.23 103.29 -36.48 -66.08 -139.05	178.82
26 56 13 00-0330	EA		14' High, 5" OD, 0.156", Round Straight, Aluminum Area Light Pole, Hinged Anchor Base <i>For Bronze, Satin Or Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,139.33 110.55 -39.54 -71.71 -150.78	201.17
26 56 13 00-0331	EA		16' High, 5" OD, 0.156", Round Straight, Aluminum Area Light Pole, Hinged Anchor Base <i>For Bronze, Satin Or Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,231.33 117.65 -42.55 -77.25 -162.35	223.52
26 56 13 00-0332	EA		18' High, 5" OD, 0.156", Round Straight, Aluminum Area Light Pole, Hinged Anchor Base <i>For Bronze, Satin Or Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,325.54 125.07 -45.65 -82.95 -174.24	245.87
26 56 13 00-0333	EA		16' High, 6" OD, 0.156", Round Straight, Aluminum Area Light Pole, Hinged Anchor Base <i>For Bronze, Satin Or Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,292.93 126.89 -45.01 -81.56 -171.59	223.52
26 56 13 00-0334	EA		20' High, 6" OD, 0.156", Round Straight, Aluminum Area Light Pole, Hinged Anchor Base <i>For Bronze, Satin Or Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,490.14 143.06 -51.56 -93.58 -196.70	268.22
26 56 13 00-0335	EA		12' High, 5" OD, 0.188", Round Straight, Aluminum Area Light Pole, Hinged Anchor Base <i>For Bronze, Satin Or Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,086.93 109.40 -38.11 -68.93 -145.16	178.82
26 56 13 00-0336	EA		14' High, 5" OD, 0.188", Round Straight, Aluminum Area Light Pole, Hinged Anchor Base <i>For Bronze, Satin Or Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,192.13 118.47 -41.65 -75.40 -158.70	201.17
26 56 13 00-0337	EA		16' High, 5" OD, 0.188", Round Straight, Aluminum Area Light Pole, Hinged Anchor Base <i>For Bronze, Satin Or Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,286.33 125.90 -44.75 -81.10 -170.60	223.52
26 56 13 00-0338	EA		18' High, 5" OD, 0.188", Round Straight, Aluminum Area Light Pole, Hinged Anchor Base <i>For Bronze, Satin Or Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,387.14 134.31 -48.11 -87.27 -183.48	245.87
26 56 13 00-0339	EA		20' High, 5" OD, 0.188", Round Straight, Aluminum Area Light Pole, Hinged Anchor Base <i>For Bronze, Satin Or Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,484.64 142.23 -51.34 -93.20 -195.87	268.22
26 56 13 00-0340	EA		16' High, 6" OD, 0.188", Round Straight, Aluminum Area Light Pole, Hinged Anchor Base <i>For Bronze, Satin Or Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,366.63 137.94 -47.96 -86.72 -182.64	223.52
26 56 13 00-0341	EA		18' High, 6" OD, 0.188", Round Straight, Aluminum Area Light Pole, Hinged Anchor Base <i>For Bronze, Satin Or Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,477.34 147.84 -51.72 -93.58 -197.01	245.87
26 56 13 00-0342	EA		20' High, 6" OD, 0.188", Round Straight, Aluminum Area Light Pole, Hinged Anchor Base <i>For Bronze, Satin Or Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,518.74 147.35 -52.70 -95.58 -200.99	268.22

26 56 13 00-0343 Round Straight, Aluminum Area Light Poles, Direct Burial (26 56 13 00-0296)
Note: Includes rubberized undercoating on embedded portion.

26	Electrical
26 50	Lighting
26 56	Exterior Lighting



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56	13 00-0344	EA	10' High, 4" OD, 0.125", Round Straight, Aluminum Area Light Pole, Direct Burial	628.32	111.76
			<i>For Bronze Or Satin Anodized Finish, Add</i>	40.48	
			<i>For Black Anodized Finish, Add</i>	80.96	
			<i>For >10 To 20, Deduct</i>	-21.78	
			<i>For >20 To 40, Deduct</i>	-39.51	
			<i>For >40, Deduct</i>	-83.07	
26 56	13 00-0345	EA	12' High, 4" OD, 0.125", Round Straight, Aluminum Area Light Pole, Direct Burial	671.57	122.93
			<i>For Bronze Or Satin Anodized Finish, Add</i>	42.57	
			<i>For Black Anodized Finish, Add</i>	85.14	
			<i>For >10 To 20, Deduct</i>	-23.17	
			<i>For >20 To 40, Deduct</i>	-42.09	
			<i>For >40, Deduct</i>	-88.44	
26 56	13 00-0346	EA	14' High, 4" OD, 0.125", Round Straight, Aluminum Area Light Pole, Direct Burial	743.42	134.11
			<i>For Bronze Or Satin Anodized Finish, Add</i>	47.52	
			<i>For Black Anodized Finish, Add</i>	95.04	
			<i>For >10 To 20, Deduct</i>	-25.71	
			<i>For >20 To 40, Deduct</i>	-46.68	
			<i>For >40, Deduct</i>	-98.10	
26 56	13 00-0347	EA	15' High, 4" OD, 0.125", Round Straight, Aluminum Area Light Pole, Direct Burial	768.72	134.11
			<i>For Bronze Or Satin Anodized Finish, Add</i>	50.05	
			<i>For Black Anodized Finish, Add</i>	100.10	
			<i>For >10 To 20, Deduct</i>	-26.73	
			<i>For >20 To 40, Deduct</i>	-48.45	
			<i>For >40, Deduct</i>	-101.90	
26 56	13 00-0348	EA	16' High, 4" OD, 0.125", Round Straight, Aluminum Area Light Pole, Direct Burial	800.62	134.11
			<i>For Bronze Or Satin Anodized Finish, Add</i>	53.24	
			<i>For Black Anodized Finish, Add</i>	106.48	
			<i>For >10 To 20, Deduct</i>	-28.00	
			<i>For >20 To 40, Deduct</i>	-50.68	
			<i>For >40, Deduct</i>	-106.68	
26 56	13 00-0349	EA	18' High, 4" OD, 0.188", Round Straight, Aluminum Area Light Pole, Direct Burial	919.77	145.29
			<i>For Bronze Or Satin Anodized Finish, Add</i>	62.92	
			<i>For Black Anodized Finish, Add</i>	125.84	
			<i>For >10 To 20, Deduct</i>	-32.43	
			<i>For >20 To 40, Deduct</i>	-58.57	
			<i>For >40, Deduct</i>	-123.44	
26 56	13 00-0350	EA	20' High, 4" OD, 0.188", Round Straight, Aluminum Area Light Pole, Direct Burial	982.83	156.46
			<i>For Bronze Or Satin Anodized Finish, Add</i>	66.99	
			<i>For Black Anodized Finish, Add</i>	133.98	
			<i>For >10 To 20, Deduct</i>	-34.62	
			<i>For >20 To 40, Deduct</i>	-62.54	
			<i>For >40, Deduct</i>	-131.78	
26 56	13 00-0351	EA	20' High, 5" OD, 0.188", Round Straight, Aluminum Area Light Pole, Direct Burial	1,153.33	156.46
			<i>For Bronze Or Satin Anodized Finish, Add</i>	84.04	
			<i>For Black Anodized Finish, Add</i>	168.08	
			<i>For >10 To 20, Deduct</i>	-41.44	
			<i>For >20 To 40, Deduct</i>	-74.47	
			<i>For >40, Deduct</i>	-157.35	
26 56	13 00-0352	EA	25' High, 6" OD, 0.188", Round Straight, Aluminum Area Light Pole, Direct Burial	1,416.93	178.82
			<i>For Bronze Or Satin Anodized Finish, Add</i>	105.93	
			<i>For Black Anodized Finish, Add</i>	211.86	
			<i>For >10 To 20, Deduct</i>	-51.31	
			<i>For >20 To 40, Deduct</i>	-92.03	
			<i>For >40, Deduct</i>	-194.66	
26 56	13 00-0353	EA	30' High, 6" OD, 0.188", Round Straight, Aluminum Area Light Pole, Direct Burial	1,609.03	201.17
			<i>For Bronze Or Satin Anodized Finish, Add</i>	120.67	
			<i>For Black Anodized Finish, Add</i>	241.34	
			<i>For >10 To 20, Deduct</i>	-58.33	
			<i>For >20 To 40, Deduct</i>	-104.59	
			<i>For >40, Deduct</i>	-221.24	
26 56	13 00-0354	EA	30' High, 6" OD, 0.250", Round Straight, Aluminum Area Light Pole, Direct Burial	1,810.33	201.17
			<i>For Bronze Or Satin Anodized Finish, Add</i>	140.80	
			<i>For Black Anodized Finish, Add</i>	281.60	
			<i>For >10 To 20, Deduct</i>	-66.38	
			<i>For >20 To 40, Deduct</i>	-118.68	
			<i>For >40, Deduct</i>	-251.43	
26 56	13 00-0355		Round Tapered, Aluminum Area Light Poles <small>(26 56 13 00-0295)</small>		
26 56	13 00-0356		Round Tapered, Aluminum Area Light Poles, Anchor Base <small>(26 56 13 00-0355)</small>		
26 56	13 00-0357	EA	8' High, 4" OD, 0.125", Round Tapered, Aluminum Area Light Pole, Anchor Base	579.52	134.11
			<i>For Bronze Or Satin Anodized Finish, Add</i>	31.13	
			<i>For Black Anodized Finish, Add</i>	62.26	
			<i>For >10 To 20, Deduct</i>	-19.16	
			<i>For >20 To 40, Deduct</i>	-35.20	
			<i>For >40, Deduct</i>	-73.52	
26 56	13 00-0358	EA	10' High, 4" OD, 0.125", Round Tapered, Aluminum Area Light Pole, Anchor Base	649.53	156.46
			<i>For Bronze Or Satin Anodized Finish, Add</i>	33.66	
			<i>For Black Anodized Finish, Add</i>	67.32	
			<i>For >10 To 20, Deduct</i>	-21.29	
			<i>For >20 To 40, Deduct</i>	-39.21	
			<i>For >40, Deduct</i>	-81.78	



Electrical	26	26
Lighting	26 50	
Exterior Lighting	26 56	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56	13 00-0359	EA	12' High, 4" OD, 0.125", Round Tapered, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	719.53 36.19 72.38 -23.42 -43.21 -90.05	178.82
26 56	13 00-0360	EA	14' High, 4" OD, 0.125", Round Tapered, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	799.43 39.71 79.42 -25.94 -47.91 -99.80	201.17
26 56	13 00-0361	EA	16' High, 4" OD, 0.125", Round Tapered, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	878.23 43.12 86.24 -28.42 -52.54 -109.38	223.52
26 56	13 00-0362	EA	10' High, 5" OD, 0.125", Round Tapered, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	678.13 36.52 73.04 -22.43 -41.21 -86.07	156.46
26 56	13 00-0363	EA	12' High, 5" OD, 0.125", Round Tapered, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	764.63 40.70 81.40 -25.22 -46.37 -96.81	178.82
26 56	13 00-0364	EA	14' High, 5" OD, 0.125", Round Tapered, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	847.83 44.55 89.10 -27.88 -51.30 -107.06	201.17
26 56	13 00-0365	EA	18' High, 5" OD, 0.125", Round Tapered, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,006.54 51.48 102.96 -32.89 -60.62 -126.39	245.87
26 56	13 00-0366	EA	20' High, 5" OD, 0.125", Round Tapered, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,078.74 54.23 108.46 -35.10 -64.78 -134.99	268.22
26 56	13 00-0367	EA	12' High, 5" OD, 0.156", Round Tapered, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	805.33 44.77 89.54 -26.85 -49.22 -102.92	178.82
26 56	13 00-0368	EA	14' High, 5" OD, 0.156", Round Tapered, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	895.13 49.28 98.56 -29.77 -54.61 -114.15	201.17
26 56	13 00-0369	EA	16' High, 5" OD, 0.156", Round Tapered, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	992.63 54.56 109.12 -33.00 -60.54 -126.54	223.52
26 56	13 00-0370	EA	18' High, 5" OD, 0.156", Round Tapered, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,070.34 57.86 115.72 -35.44 -65.09 -135.96	245.87
26 56	13 00-0371	EA	20' High, 5" OD, 0.156", Round Tapered, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,163.44 62.70 125.40 -38.49 -70.71 -147.69	268.22
26 56	13 00-0372	EA	16' High, 6" OD, 0.156", Round Tapered, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,100.43 65.34 130.68 -37.31 -68.09 -142.71	223.52

26	Electrical
26 50	Lighting
26 56	Exterior Lighting



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56 13 00-0373	EA		18' High, 6" OD, 0.156", Round Tapered, Aluminum Area Light Pole, Anchor Base	1,207.84	245.87
			<i>For Bronze Or Satin Anodized Finish, Add</i>	71.61	
			<i>For Black Anodized Finish, Add</i>	143.22	
			<i>For >10 To 20, Deduct</i>	-40.94	
			<i>For >20 To 40, Deduct</i>	-74.71	
			<i>For >40, Deduct</i>	-156.59	
26 56 13 00-0374	EA		20' High, 6" OD, 0.156", Round Tapered, Aluminum Area Light Pole, Anchor Base	1,270.14	268.22
			<i>For Bronze Or Satin Anodized Finish, Add</i>	73.37	
			<i>For Black Anodized Finish, Add</i>	146.74	
			<i>For >10 To 20, Deduct</i>	-42.76	
			<i>For >20 To 40, Deduct</i>	-78.18	
			<i>For >40, Deduct</i>	-163.70	
26 56 13 00-0375	EA		23' High, 6" OD, 0.156", Round Tapered, Aluminum Area Light Pole, Anchor Base	1,457.45	312.93
			<i>For Bronze Or Satin Anodized Finish, Add</i>	83.16	
			<i>For Black Anodized Finish, Add</i>	166.32	
			<i>For >10 To 20, Deduct</i>	-48.91	
			<i>For >20 To 40, Deduct</i>	-89.50	
			<i>For >40, Deduct</i>	-187.33	
26 56 13 00-0376	EA		25' High, 6" OD, 0.156", Round Tapered, Aluminum Area Light Pole, Anchor Base	1,651.35	357.63
			<i>For Bronze Or Satin Anodized Finish, Add</i>	93.61	
			<i>For Black Anodized Finish, Add</i>	187.22	
			<i>For >10 To 20, Deduct</i>	-55.33	
			<i>For >20 To 40, Deduct</i>	-101.29	
			<i>For >40, Deduct</i>	-211.94	
26 56 13 00-0377	EA		18' High, 7" OD, 0.156", Round Tapered, Aluminum Area Light Pole, Anchor Base	1,315.64	245.87
			<i>For Bronze Or Satin Anodized Finish, Add</i>	82.39	
			<i>For Black Anodized Finish, Add</i>	164.78	
			<i>For >10 To 20, Deduct</i>	-45.25	
			<i>For >20 To 40, Deduct</i>	-82.26	
			<i>For >40, Deduct</i>	-172.76	
26 56 13 00-0378	EA		20' High, 7" OD, 0.156", Round Tapered, Aluminum Area Light Pole, Anchor Base	1,401.04	268.22
			<i>For Bronze Or Satin Anodized Finish, Add</i>	86.46	
			<i>For Black Anodized Finish, Add</i>	172.92	
			<i>For >10 To 20, Deduct</i>	-48.00	
			<i>For >20 To 40, Deduct</i>	-87.34	
			<i>For >40, Deduct</i>	-183.33	
26 56 13 00-0379	EA		23' High, 7" OD, 0.156", Round Tapered, Aluminum Area Light Pole, Anchor Base	1,560.85	312.93
			<i>For Bronze Or Satin Anodized Finish, Add</i>	93.50	
			<i>For Black Anodized Finish, Add</i>	187.00	
			<i>For >10 To 20, Deduct</i>	-53.05	
			<i>For >20 To 40, Deduct</i>	-96.74	
			<i>For >40, Deduct</i>	-202.84	
26 56 13 00-0380	EA		25' High, 7" OD, 0.156", Round Tapered, Aluminum Area Light Pole, Anchor Base	1,730.55	357.63
			<i>For Bronze Or Satin Anodized Finish, Add</i>	101.53	
			<i>For Black Anodized Finish, Add</i>	203.06	
			<i>For >10 To 20, Deduct</i>	-58.49	
			<i>For >20 To 40, Deduct</i>	-106.83	
			<i>For >40, Deduct</i>	-223.82	
26 56 13 00-0381	EA		28' High, 7" OD, 0.156", Round Tapered, Aluminum Area Light Pole, Anchor Base	1,864.36	379.98
			<i>For Bronze Or Satin Anodized Finish, Add</i>	110.44	
			<i>For Black Anodized Finish, Add</i>	220.88	
			<i>For >10 To 20, Deduct</i>	-63.18	
			<i>For >20 To 40, Deduct</i>	-115.31	
			<i>For >40, Deduct</i>	-241.66	
26 56 13 00-0382	EA		30' High, 7" OD, 0.156", Round Tapered, Aluminum Area Light Pole, Anchor Base	2,000.37	402.33
			<i>For Bronze Or Satin Anodized Finish, Add</i>	119.57	
			<i>For Black Anodized Finish, Add</i>	239.14	
			<i>For >10 To 20, Deduct</i>	-67.94	
			<i>For >20 To 40, Deduct</i>	-123.93	
			<i>For >40, Deduct</i>	-259.82	
26 56 13 00-0383	EA		23' High, 8" OD, 0.156", Round Tapered, Aluminum Area Light Pole, Anchor Base	1,663.15	312.93
			<i>For Bronze Or Satin Anodized Finish, Add</i>	103.73	
			<i>For Black Anodized Finish, Add</i>	207.46	
			<i>For >10 To 20, Deduct</i>	-57.14	
			<i>For >20 To 40, Deduct</i>	-103.90	
			<i>For >40, Deduct</i>	-218.18	
26 56 13 00-0384	EA		25' High, 8" OD, 0.156", Round Tapered, Aluminum Area Light Pole, Anchor Base	1,798.75	357.63
			<i>For Bronze Or Satin Anodized Finish, Add</i>	108.35	
			<i>For Black Anodized Finish, Add</i>	216.70	
			<i>For >10 To 20, Deduct</i>	-61.22	
			<i>For >20 To 40, Deduct</i>	-111.61	
			<i>For >40, Deduct</i>	-234.05	
26 56 13 00-0385	EA		28' High, 8" OD, 0.156", Round Tapered, Aluminum Area Light Pole, Anchor Base	1,938.06	379.98
			<i>For Bronze Or Satin Anodized Finish, Add</i>	117.81	
			<i>For Black Anodized Finish, Add</i>	235.62	
			<i>For >10 To 20, Deduct</i>	-66.12	
			<i>For >20 To 40, Deduct</i>	-120.47	
			<i>For >40, Deduct</i>	-252.71	
26 56 13 00-0386	EA		30' High, 8" OD, 0.156", Round Tapered, Aluminum Area Light Pole, Anchor Base	2,114.77	402.33
			<i>For Bronze Or Satin Anodized Finish, Add</i>	131.01	
			<i>For Black Anodized Finish, Add</i>	262.02	
			<i>For >10 To 20, Deduct</i>	-72.52	
			<i>For >20 To 40, Deduct</i>	-131.94	
			<i>For >40, Deduct</i>	-276.98	



Electrical	26	26
Lighting	26 50	
Exterior Lighting	26 56	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56 13 00-0387	EA		33' High, 8" OD, 0.156", Round Tapered, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	2,186.62 135.96 271.92 -75.06 -136.52 -286.64	413.51
26 56 13 00-0388	EA		35' High, 8" OD, 0.156", Round Tapered, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	2,342.06 149.27 298.54 -80.94 -146.96 -308.84	424.68
26 56 13 00-0389	EA		12' High, 5" OD, 0.188", Round Tapered, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	850.43 49.28 98.56 -28.65 -52.38 -109.68	178.82
26 56 13 00-0390	EA		14' High, 5" OD, 0.188", Round Tapered, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	947.93 54.56 109.12 -31.88 -58.31 -122.07	201.17
26 56 13 00-0391	EA		16' High, 5" OD, 0.188", Round Tapered, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,049.83 60.28 120.56 -35.29 -64.55 -135.12	223.52
26 56 13 00-0392	EA		18' High, 5" OD, 0.188", Round Tapered, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,139.64 64.79 129.58 -38.21 -69.94 -146.36	245.87
26 56 13 00-0393	EA		20' High, 5" OD, 0.188", Round Tapered, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,228.34 69.19 138.38 -41.09 -75.26 -157.43	268.22
26 56 13 00-0394	EA		16' High, 6" OD, 0.188", Round Tapered, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,169.73 72.27 144.54 -40.08 -72.94 -153.11	223.52
26 56 13 00-0395	EA		18' High, 6" OD, 0.188", Round Tapered, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,280.44 78.87 157.74 -43.84 -79.80 -167.48	245.87
26 56 13 00-0396	EA		20' High, 6" OD, 0.188", Round Tapered, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,357.04 82.06 164.12 -46.24 -84.26 -176.73	268.22
26 56 13 00-0397	EA		23' High, 6" OD, 0.188", Round Tapered, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,538.85 91.30 182.60 -52.17 -95.20 -199.54	312.93
26 56 13 00-0398	EA		25' High, 6" OD, 0.188", Round Tapered, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,727.25 101.20 202.40 -58.36 -106.60 -223.33	357.63
26 56 13 00-0399	EA		23' High, 8" OD, 0.188", Round Tapered, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,787.45 116.16 232.32 -62.11 -112.60 -236.83	312.93
26 56 13 00-0400	EA		25' High, 8" OD, 0.188", Round Tapered, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,963.75 124.85 249.70 -67.82 -123.16 -258.80	357.63

26	Electrical
26 50	Lighting
26 56	Exterior Lighting



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56	13 00-0401	EA	28' High, 8" OD, 0.188", Round Tapered, Aluminum Area Light Pole, Anchor Base	2,116.26	379.98
			<i>For Bronze Or Satin Anodized Finish, Add</i>	135.63	
			<i>For Black Anodized Finish, Add</i>	271.26	
			<i>For >10 To 20, Deduct</i>	-73.25	
			<i>For >20 To 40, Deduct</i>	-132.94	
			<i>For >40, Deduct</i>	-279.44	
26 56	13 00-0402	EA	30' High, 8" OD, 0.188", Round Tapered, Aluminum Area Light Pole, Anchor Base	2,250.07	402.33
			<i>For Bronze Or Satin Anodized Finish, Add</i>	144.54	
			<i>For Black Anodized Finish, Add</i>	289.08	
			<i>For >10 To 20, Deduct</i>	-77.93	
			<i>For >20 To 40, Deduct</i>	-141.41	
			<i>For >40, Deduct</i>	-297.28	
26 56	13 00-0403	EA	33' High, 8" OD, 0.188", Round Tapered, Aluminum Area Light Pole, Anchor Base	2,379.12	413.51
			<i>For Bronze Or Satin Anodized Finish, Add</i>	155.21	
			<i>For Black Anodized Finish, Add</i>	310.42	
			<i>For >10 To 20, Deduct</i>	-82.76	
			<i>For >20 To 40, Deduct</i>	-150.00	
			<i>For >40, Deduct</i>	-315.52	
26 56	13 00-0404	EA	35' High, 8" OD, 0.188", Round Tapered, Aluminum Area Light Pole, Anchor Base	2,490.56	424.68
			<i>For Bronze Or Satin Anodized Finish, Add</i>	164.12	
			<i>For Black Anodized Finish, Add</i>	328.24	
			<i>For >10 To 20, Deduct</i>	-86.88	
			<i>For >20 To 40, Deduct</i>	-157.35	
			<i>For >40, Deduct</i>	-331.12	
26 56	13 00-0405	EA	37' High, 8" OD, 0.188", Round Tapered, Aluminum Area Light Pole, Anchor Base	2,584.42	435.86
			<i>For Bronze Or Satin Anodized Finish, Add</i>	171.27	
			<i>For Black Anodized Finish, Add</i>	342.54	
			<i>For >10 To 20, Deduct</i>	-90.30	
			<i>For >20 To 40, Deduct</i>	-163.48	
			<i>For >40, Deduct</i>	-344.08	
26 56	13 00-0406	EA	39' High, 8" OD, 0.188", Round Tapered, Aluminum Area Light Pole, Anchor Base	2,760.77	447.03
			<i>For Bronze Or Satin Anodized Finish, Add</i>	186.67	
			<i>For Black Anodized Finish, Add</i>	373.34	
			<i>For >10 To 20, Deduct</i>	-97.02	
			<i>For >20 To 40, Deduct</i>	-175.37	
			<i>For >40, Deduct</i>	-369.41	
26 56	13 00-0407	EA	28' High, 10" OD, 0.188", Round Tapered, Aluminum Area Light Pole, Anchor Base	2,591.46	379.98
			<i>For Bronze Or Satin Anodized Finish, Add</i>	183.15	
			<i>For Black Anodized Finish, Add</i>	366.30	
			<i>For >10 To 20, Deduct</i>	-92.26	
			<i>For >20 To 40, Deduct</i>	-166.20	
			<i>For >40, Deduct</i>	-350.72	
26 56	13 00-0408	EA	30' High, 10" OD, 0.188", Round Tapered, Aluminum Area Light Pole, Anchor Base	2,800.07	402.33
			<i>For Bronze Or Satin Anodized Finish, Add</i>	199.54	
			<i>For Black Anodized Finish, Add</i>	399.08	
			<i>For >10 To 20, Deduct</i>	-99.93	
			<i>For >20 To 40, Deduct</i>	-179.91	
			<i>For >40, Deduct</i>	-379.78	
26 56	13 00-0409	EA	33' High, 10" OD, 0.188", Round Tapered, Aluminum Area Light Pole, Anchor Base	2,951.12	413.51
			<i>For Bronze Or Satin Anodized Finish, Add</i>	212.41	
			<i>For Black Anodized Finish, Add</i>	424.82	
			<i>For >10 To 20, Deduct</i>	-105.64	
			<i>For >20 To 40, Deduct</i>	-190.04	
			<i>For >40, Deduct</i>	-401.32	
26 56	13 00-0410	EA	35' High, 10" OD, 0.188", Round Tapered, Aluminum Area Light Pole, Anchor Base	3,063.66	424.68
			<i>For Bronze Or Satin Anodized Finish, Add</i>	221.43	
			<i>For Black Anodized Finish, Add</i>	442.86	
			<i>For >10 To 20, Deduct</i>	-109.81	
			<i>For >20 To 40, Deduct</i>	-197.47	
			<i>For >40, Deduct</i>	-417.08	
26 56	13 00-0411	EA	37' High, 10" OD, 0.188", Round Tapered, Aluminum Area Light Pole, Anchor Base	3,122.32	435.86
			<i>For Bronze Or Satin Anodized Finish, Add</i>	225.06	
			<i>For Black Anodized Finish, Add</i>	450.12	
			<i>For >10 To 20, Deduct</i>	-111.82	
			<i>For >20 To 40, Deduct</i>	-201.13	
			<i>For >40, Deduct</i>	-424.76	
26 56	13 00-0412	EA	39' High, 10" OD, 0.188", Round Tapered, Aluminum Area Light Pole, Anchor Base	3,317.37	447.03
			<i>For Bronze Or Satin Anodized Finish, Add</i>	242.33	
			<i>For Black Anodized Finish, Add</i>	484.66	
			<i>For >10 To 20, Deduct</i>	-119.28	
			<i>For >20 To 40, Deduct</i>	-214.33	
			<i>For >40, Deduct</i>	-452.90	
26 56	13 00-0413	EA	28' High, 8" OD, 0.250", Round Tapered, Aluminum Area Light Pole, Anchor Base	2,440.76	379.98
			<i>For Bronze Or Satin Anodized Finish, Add</i>	168.08	
			<i>For Black Anodized Finish, Add</i>	336.16	
			<i>For >10 To 20, Deduct</i>	-86.23	
			<i>For >20 To 40, Deduct</i>	-155.65	
			<i>For >40, Deduct</i>	-328.12	
26 56	13 00-0414	EA	30' High, 8" OD, 0.250", Round Tapered, Aluminum Area Light Pole, Anchor Base	2,629.57	402.33
			<i>For Bronze Or Satin Anodized Finish, Add</i>	182.49	
			<i>For Black Anodized Finish, Add</i>	364.98	
			<i>For >10 To 20, Deduct</i>	-93.11	
			<i>For >20 To 40, Deduct</i>	-167.98	
			<i>For >40, Deduct</i>	-354.20	



Electrical	26	26
Lighting	26 50	
Exterior Lighting	26 56	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56 13 00-0415 EA 33' High, 8" OD, 0.250", Round Tapered, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	2,701.42 187.44 374.88 -95.65 -172.56 -363.86	413.51
26 56 13 00-0416 EA 35' High, 8" OD, 0.250", Round Tapered, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	2,899.76 205.04 410.08 -103.25 -186.00 -392.50	424.68
26 56 13 00-0417 EA 37' High, 8" OD, 0.250", Round Tapered, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	2,992.52 212.08 424.16 -106.63 -192.04 -405.29	435.86
26 56 13 00-0418 EA 39' High, 8" OD, 0.250", Round Tapered, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	3,188.67 229.46 458.92 -114.14 -205.33 -433.60	447.03
26 56 13 00-0419 EA 28' High, 10" OD, 0.250", Round Tapered, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	3,129.36 236.94 473.88 -113.78 -203.86 -431.41	379.98
26 56 13 00-0420 EA 30' High, 10" OD, 0.250", Round Tapered, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	3,308.27 250.36 500.72 -120.26 -215.49 -456.01	402.33
26 56 13 00-0421 EA 33' High, 10" OD, 0.250", Round Tapered, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	3,461.52 263.45 526.90 -126.06 -225.77 -477.88	413.51
26 56 13 00-0422 EA 35' High, 10" OD, 0.250", Round Tapered, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	3,703.86 285.45 570.90 -135.41 -242.28 -513.11	424.68
26 56 13 00-0423 EA 37' High, 10" OD, 0.250", Round Tapered, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	3,750.42 287.87 575.74 -136.94 -245.10 -518.98	435.86
26 56 13 00-0424 EA 39' High, 10" OD, 0.250", Round Tapered, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	3,991.67 309.76 619.52 -146.26 -261.54 -554.05	447.03
26 56 13 00-0425 EA 48' High, 10" OD, 0.250", Round Tapered, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	4,948.01 360.69 721.38 -177.80 -319.54 -675.15	670.56
26 56 13 00-0426 EA 50' High, 10" OD, 0.250", Round Tapered, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	5,084.41 374.33 748.66 -183.26 -329.09 -695.61	670.56
26 56 13 00-0427 Round Tapered, Aluminum Area Light Poles, Hinged Anchor Base (26 56 13 00-0355)		
26 56 13 00-0428 EA 8' High, 4" OD, 0.125", Round Tapered, Aluminum Area Light Pole, Hinged Anchor Base <i>For Bronze, Satin Or Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	816.02 82.17 -28.62 -51.76 -108.99	134.11
26 56 13 00-0429 EA 10' High, 4" OD, 0.125", Round Tapered, Aluminum Area Light Pole, Hinged Anchor Base <i>For Bronze, Satin Or Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	883.83 85.64 -30.66 -55.61 -116.93	156.46

26	Electrical
26 50	Lighting
26 56	Exterior Lighting



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56 13 00-0430 EA 12' High, 4" OD, 0.125", Round Tapered, Aluminum Area Light Pole, Hinged Anchor Base <i>For Bronze, Satin Or Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	952.73 89.27 -32.74 -59.54 -125.03	178.82
26 56 13 00-0431 EA 14' High, 4" OD, 0.125", Round Tapered, Aluminum Area Light Pole, Hinged Anchor Base <i>For Bronze, Satin Or Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,023.83 93.23 -34.92 -63.62 -133.46	201.17
26 56 13 00-0432 EA 16' High, 4" OD, 0.125", Round Tapered, Aluminum Area Light Pole, Hinged Anchor Base <i>For Bronze, Satin Or Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,093.83 97.02 -37.05 -67.63 -141.72	223.52
26 56 13 00-0433 EA 10' High, 5" OD, 0.125", Round Tapered, Aluminum Area Light Pole, Hinged Anchor Base <i>For Bronze, Satin Or Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	897.03 87.62 -31.19 -56.53 -118.91	156.46
26 56 13 00-0434 EA 12' High, 5" OD, 0.125", Round Tapered, Aluminum Area Light Pole, Hinged Anchor Base <i>For Bronze, Satin Or Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	968.13 91.58 -33.36 -60.62 -127.34	178.82
26 56 13 00-0435 EA 14' High, 5" OD, 0.125", Round Tapered, Aluminum Area Light Pole, Hinged Anchor Base <i>For Bronze, Satin Or Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,041.43 95.87 -35.62 -64.85 -136.10	201.17
26 56 13 00-0436 EA 16' High, 5" OD, 0.125", Round Tapered, Aluminum Area Light Pole, Hinged Anchor Base <i>For Bronze, Satin Or Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,113.63 99.99 -37.84 -69.01 -144.69	223.52
26 56 13 00-0437 EA 18' High, 5" OD, 0.125", Round Tapered, Aluminum Area Light Pole, Hinged Anchor Base <i>For Bronze, Satin Or Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,200.14 106.26 -40.63 -74.18 -155.43	245.87
26 56 13 00-0438 EA 20' High, 5" OD, 0.125", Round Tapered, Aluminum Area Light Pole, Hinged Anchor Base <i>For Bronze, Satin Or Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,276.74 111.05 -43.02 -78.64 -164.69	268.22
26 56 13 00-0439 EA 12' High, 5" OD, 0.156", Round Tapered, Aluminum Area Light Pole, Hinged Anchor Base <i>For Bronze, Satin Or Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,011.03 98.01 -35.08 -63.62 -133.77	178.82
26 56 13 00-0440 EA 14' High, 5" OD, 0.156", Round Tapered, Aluminum Area Light Pole, Hinged Anchor Base <i>For Bronze, Satin Or Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,089.83 103.13 -37.56 -68.24 -143.36	201.17
26 56 13 00-0441 EA 16' High, 5" OD, 0.156", Round Tapered, Aluminum Area Light Pole, Hinged Anchor Base <i>For Bronze, Satin Or Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,181.83 110.22 -40.57 -73.79 -154.92	223.52
26 56 13 00-0442 EA 18' High, 5" OD, 0.156", Round Tapered, Aluminum Area Light Pole, Hinged Anchor Base <i>For Bronze, Satin Or Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,262.84 115.67 -43.14 -78.56 -164.84	245.87
26 56 13 00-0443 EA 20' High, 5" OD, 0.156", Round Tapered, Aluminum Area Light Pole, Hinged Anchor Base <i>For Bronze, Satin Or Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,358.14 123.26 -46.28 -84.34 -176.90	268.22
26 56 13 00-0444 EA 16' High, 6" OD, 0.156", Round Tapered, Aluminum Area Light Pole, Hinged Anchor Base <i>For Bronze, Satin Or Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,244.53 119.63 -43.08 -78.18 -164.33	223.52
26 56 13 00-0445 EA 18' High, 6" OD, 0.156", Round Tapered, Aluminum Area Light Pole, Hinged Anchor Base <i>For Bronze, Satin Or Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,347.54 128.37 -46.53 -84.49 -177.54	245.87
26 56 13 00-0446 EA 20' High, 6" OD, 0.156", Round Tapered, Aluminum Area Light Pole, Hinged Anchor Base <i>For Bronze, Satin Or Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,426.34 133.49 -49.01 -89.12 -187.13	268.22



Electrical	26	26
Lighting	26 50	
Exterior Lighting	26 56	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56 13 00-0447	EA		12' High, 5" OD, 0.188", Round Tapered, Aluminum Area Light Pole, Hinged Anchor Base <i>For Bronze, Satin Or Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,045.13 103.13 -36.44 -66.01 -138.89	178.82
26 56 13 00-0448	EA		14' High, 5" OD, 0.188", Round Tapered, Aluminum Area Light Pole, Hinged Anchor Base <i>For Bronze, Satin Or Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,141.53 110.88 -39.63 -71.86 -151.11	201.17
26 56 13 00-0449	EA		16' High, 5" OD, 0.188", Round Tapered, Aluminum Area Light Pole, Hinged Anchor Base <i>For Bronze, Satin Or Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,244.53 119.63 -43.08 -78.18 -164.33	223.52
26 56 13 00-0450	EA		18' High, 5" OD, 0.188", Round Tapered, Aluminum Area Light Pole, Hinged Anchor Base <i>For Bronze, Satin Or Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,334.34 126.39 -46.00 -83.57 -175.56	245.87
26 56 13 00-0451	EA		20' High, 5" OD, 0.188", Round Tapered, Aluminum Area Light Pole, Hinged Anchor Base <i>For Bronze, Satin Or Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,431.84 134.31 -49.23 -89.50 -187.95	268.22
26 56 13 00-0452	EA		16' High, 6" OD, 0.188", Round Tapered, Aluminum Area Light Pole, Hinged Anchor Base <i>For Bronze, Satin Or Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,316.03 130.35 -45.94 -83.18 -175.05	223.52
26 56 13 00-0453	EA		18' High, 6" OD, 0.188", Round Tapered, Aluminum Area Light Pole, Hinged Anchor Base <i>For Bronze, Satin Or Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,427.84 140.42 -49.74 -90.11 -189.59	245.87
26 56 13 00-0454	EA		20' High, 6" OD, 0.188", Round Tapered, Aluminum Area Light Pole, Hinged Anchor Base <i>For Bronze, Satin Or Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,512.14 146.36 -52.44 -95.12 -200.00	268.22
26 56 13 00-0455			Round Tapered, Aluminum Area Light Poles, Direct Burial (26 56 13 00-0355) Note: Includes rubberized undercoating on embedded portion.		
26 56 13 00-0456	EA		8' High, 4" OD, 0.125", Round Tapered, Aluminum Area Light Pole, Direct Burial <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	549.12 32.56 65.12 -18.61 -33.97 -71.19	111.76
26 56 13 00-0457	EA		10' High, 4" OD, 0.125", Round Tapered, Aluminum Area Light Pole, Direct Burial <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	579.92 35.64 71.28 -19.84 -36.12 -75.81	111.76
26 56 13 00-0458	EA		12' High, 4" OD, 0.125", Round Tapered, Aluminum Area Light Pole, Direct Burial <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	627.57 38.17 76.34 -21.41 -39.01 -81.84	122.93
26 56 13 00-0459	EA		14' High, 4" OD, 0.125", Round Tapered, Aluminum Area Light Pole, Direct Burial <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	667.52 39.93 79.86 -22.68 -41.36 -86.72	134.11
26 56 13 00-0460	EA		16' High, 4" OD, 0.125", Round Tapered, Aluminum Area Light Pole, Direct Burial <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	707.12 43.89 87.78 -24.26 -44.13 -92.66	134.11
26 56 13 00-0461	EA		12' High, 5" OD, 0.125", Round Tapered, Aluminum Area Light Pole, Direct Burial <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	657.27 41.14 82.28 -22.60 -41.09 -86.30	122.93
26 56 13 00-0462	EA		14' High, 5" OD, 0.125", Round Tapered, Aluminum Area Light Pole, Direct Burial <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	710.42 44.22 88.44 -24.39 -44.37 -93.15	134.11



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56 13 00-0463	EA		16' High, 5" OD, 0.125", Round Tapered, Aluminum Area Light Pole, Direct Burial	732.42	134.11
			<i>For Bronze Or Satin Anodized Finish, Add</i>	46.42	
			<i>For Black Anodized Finish, Add</i>	92.84	
			<i>For >10 To 20, Deduct</i>	-25.27	
			<i>For >20 To 40, Deduct</i>	-45.91	
			<i>For >40, Deduct</i>	-96.45	
26 56 13 00-0464	EA		18' High, 5" OD, 0.125", Round Tapered, Aluminum Area Light Pole, Direct Burial	789.97	145.29
			<i>For Bronze Or Satin Anodized Finish, Add</i>	49.94	
			<i>For Black Anodized Finish, Add</i>	99.88	
			<i>For >10 To 20, Deduct</i>	-27.24	
			<i>For >20 To 40, Deduct</i>	-49.49	
			<i>For >40, Deduct</i>	-103.97	
26 56 13 00-0465	EA		20' High, 5" OD, 0.125", Round Tapered, Aluminum Area Light Pole, Direct Burial	843.13	156.46
			<i>For Bronze Or Satin Anodized Finish, Add</i>	53.02	
			<i>For Black Anodized Finish, Add</i>	106.04	
			<i>For >10 To 20, Deduct</i>	-29.03	
			<i>For >20 To 40, Deduct</i>	-52.76	
			<i>For >40, Deduct</i>	-110.82	
26 56 13 00-0466	EA		16' High, 5" OD, 0.156", Round Tapered, Aluminum Area Light Pole, Direct Burial	796.22	134.11
			<i>For Bronze Or Satin Anodized Finish, Add</i>	52.80	
			<i>For Black Anodized Finish, Add</i>	105.60	
			<i>For >10 To 20, Deduct</i>	-27.83	
			<i>For >20 To 40, Deduct</i>	-50.37	
			<i>For >40, Deduct</i>	-106.02	
26 56 13 00-0467	EA		18' High, 5" OD, 0.156", Round Tapered, Aluminum Area Light Pole, Direct Burial	860.37	145.29
			<i>For Bronze Or Satin Anodized Finish, Add</i>	56.98	
			<i>For Black Anodized Finish, Add</i>	113.96	
			<i>For >10 To 20, Deduct</i>	-30.06	
			<i>For >20 To 40, Deduct</i>	-54.41	
			<i>For >40, Deduct</i>	-114.53	
26 56 13 00-0468	EA		20' High, 5" OD, 0.156", Round Tapered, Aluminum Area Light Pole, Direct Burial	919.03	156.46
			<i>For Bronze Or Satin Anodized Finish, Add</i>	60.61	
			<i>For Black Anodized Finish, Add</i>	121.22	
			<i>For >10 To 20, Deduct</i>	-32.07	
			<i>For >20 To 40, Deduct</i>	-58.07	
			<i>For >40, Deduct</i>	-122.21	
26 56 13 00-0469	EA		18' High, 6" OD, 0.156", Round Tapered, Aluminum Area Light Pole, Direct Burial	950.57	145.29
			<i>For Bronze Or Satin Anodized Finish, Add</i>	66.00	
			<i>For Black Anodized Finish, Add</i>	132.00	
			<i>For >10 To 20, Deduct</i>	-33.66	
			<i>For >20 To 40, Deduct</i>	-60.73	
			<i>For >40, Deduct</i>	-128.06	
26 56 13 00-0470	EA		25' High, 6" OD, 0.156", Round Tapered, Aluminum Area Light Pole, Direct Burial	1,223.33	178.82
			<i>For Bronze Or Satin Anodized Finish, Add</i>	86.57	
			<i>For Black Anodized Finish, Add</i>	173.14	
			<i>For >10 To 20, Deduct</i>	-43.57	
			<i>For >20 To 40, Deduct</i>	-78.48	
			<i>For >40, Deduct</i>	-165.62	
26 56 13 00-0471	EA		25' High, 6" OD, 0.188", Round Tapered, Aluminum Area Light Pole, Direct Burial	1,347.63	178.82
			<i>For Bronze Or Satin Anodized Finish, Add</i>	99.00	
			<i>For Black Anodized Finish, Add</i>	198.00	
			<i>For >10 To 20, Deduct</i>	-48.54	
			<i>For >20 To 40, Deduct</i>	-87.18	
			<i>For >40, Deduct</i>	-184.26	
26 56 13 00-0472	EA		30' High, 7" OD, 0.156", Round Tapered, Aluminum Area Light Pole, Direct Burial	1,499.03	201.17
			<i>For Bronze Or Satin Anodized Finish, Add</i>	109.67	
			<i>For Black Anodized Finish, Add</i>	219.34	
			<i>For >10 To 20, Deduct</i>	-53.93	
			<i>For >20 To 40, Deduct</i>	-96.89	
			<i>For >40, Deduct</i>	-204.74	
26 56 13 00-0473	EA		30' High, 8" OD, 0.156", Round Tapered, Aluminum Area Light Pole, Direct Burial	1,634.33	201.17
			<i>For Bronze Or Satin Anodized Finish, Add</i>	123.20	
			<i>For Black Anodized Finish, Add</i>	246.40	
			<i>For >10 To 20, Deduct</i>	-59.34	
			<i>For >20 To 40, Deduct</i>	-106.36	
			<i>For >40, Deduct</i>	-225.03	
26 56 13 00-0474			Square Straight, Aluminum Area Light Poles <small>(26 56 13 00-0295)</small>		
26 56 13 00-0475			Square Straight, Aluminum Area Light Poles, Anchor Base <small>(26 56 13 00-0474)</small>		
26 56 13 00-0476	EA		8' High, 4" OD, 0.125", Square Straight, Aluminum Area Light Pole, Anchor Base	722.52	134.11
			<i>For Bronze Or Satin Anodized Finish, Add</i>	45.43	
			<i>For Black Anodized Finish, Add</i>	90.86	
			<i>For >10 To 20, Deduct</i>	-24.88	
			<i>For >20 To 40, Deduct</i>	-45.21	
			<i>For >40, Deduct</i>	-94.97	
26 56 13 00-0477	EA		10' High, 4" OD, 0.125", Square Straight, Aluminum Area Light Pole, Anchor Base	790.33	156.46
			<i>For Bronze Or Satin Anodized Finish, Add</i>	47.74	
			<i>For Black Anodized Finish, Add</i>	95.48	
			<i>For >10 To 20, Deduct</i>	-26.92	
			<i>For >20 To 40, Deduct</i>	-49.06	
			<i>For >40, Deduct</i>	-102.90	



Electrical	26	26
Lighting	26 50	
Exterior Lighting	26 56	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56	13 00-0478	EA	12' High, 4" OD, 0.125", Square Straight, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	866.93 50.93 101.86 -29.31 -53.53 -112.16	178.82
26 56	13 00-0479	EA	14' High, 4" OD, 0.125", Square Straight, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	942.43 54.01 108.02 -31.66 -57.92 -121.25	201.17
26 56	13 00-0480	EA	15' High, 4" OD, 0.125", Square Straight, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	984.58 55.99 111.98 -33.01 -60.43 -126.45	212.35
26 56	13 00-0481	EA	16' High, 4" OD, 0.125", Square Straight, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,026.73 57.97 115.94 -34.36 -62.93 -131.66	223.52
26 56	13 00-0482	EA	18' High, 4" OD, 0.125", Square Straight, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,108.84 61.71 123.42 -36.98 -67.78 -141.74	245.87
26 56	13 00-0483	EA	20' High, 4" OD, 0.125", Square Straight, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,200.84 66.44 132.88 -39.99 -73.33 -153.30	268.22
26 56	13 00-0484	EA	16' High, 4" OD, 0.188", Square Straight, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,102.63 65.56 131.12 -37.40 -68.24 -143.04	223.52
26 56	13 00-0485	EA	18' High, 4" OD, 0.188", Square Straight, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,186.94 69.52 139.04 -40.10 -73.25 -153.45	245.87
26 56	13 00-0486	EA	20' High, 4" OD, 0.188", Square Straight, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,285.54 74.91 149.82 -43.38 -79.26 -166.01	268.22
26 56	13 00-0487	EA	15' High, 5" OD, 0.188", Square Straight, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,314.58 88.99 177.98 -46.21 -83.53 -175.95	212.35
26 56	13 00-0488	EA	20' High, 5" OD, 0.188", Square Straight, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,601.24 106.48 212.96 -56.00 -101.36 -213.36	268.22
26 56	13 00-0489	EA	25' High, 5" OD, 0.188", Square Straight, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,917.55 120.23 240.46 -65.97 -119.92 -251.87	357.63
26 56	13 00-0490	EA	20' High, 4" OD, 0.250", Square Straight, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,353.74 81.73 163.46 -46.10 -84.03 -176.24	268.22
26 56	13 00-0491	EA	20' High, 5" OD, 0.250", Square Straight, Aluminum Area Light Pole, Anchor Base <i>For Bronze Or Satin Anodized Finish, Add</i> <i>For Black Anodized Finish, Add</i> <i>For >10 To 20, Deduct</i> <i>For >20 To 40, Deduct</i> <i>For >40, Deduct</i>	1,734.34 119.79 239.58 -61.33 -110.68 -233.33	268.22

26	Electrical
26 50	Lighting
26 56	Exterior Lighting



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56 13 00-0492	EA		25' High, 5" OD, 0.250", Square Straight, Aluminum Area Light Pole, Anchor Base	2,038.55	357.63
			<i>For Bronze Or Satin Anodized Finish, Add</i>	132.33	
			<i>For Black Anodized Finish, Add</i>	264.66	
			<i>For >10 To 20, Deduct</i>	-70.81	
			<i>For >20 To 40, Deduct</i>	-128.39	
			<i>For >40, Deduct</i>	-270.02	
26 56 13 00-0493	EA		20' High, 6" OD, 0.250", Square Straight, Aluminum Area Light Pole, Anchor Base	1,943.34	268.22
			<i>For Bronze Or Satin Anodized Finish, Add</i>	140.69	
			<i>For Black Anodized Finish, Add</i>	281.38	
			<i>For >10 To 20, Deduct</i>	-69.69	
			<i>For >20 To 40, Deduct</i>	-125.31	
			<i>For >40, Deduct</i>	-264.68	
26 56 13 00-0494	EA		25' High, 6" OD, 0.250", Square Straight, Aluminum Area Light Pole, Anchor Base	2,311.35	357.63
			<i>For Bronze Or Satin Anodized Finish, Add</i>	159.61	
			<i>For Black Anodized Finish, Add</i>	319.22	
			<i>For >10 To 20, Deduct</i>	-81.73	
			<i>For >20 To 40, Deduct</i>	-147.49	
			<i>For >40, Deduct</i>	-310.94	
26 56 13 00-0495	EA		30' High, 6" OD, 0.250", Square Straight, Aluminum Area Light Pole, Anchor Base	2,684.57	402.33
			<i>For Bronze Or Satin Anodized Finish, Add</i>	187.99	
			<i>For Black Anodized Finish, Add</i>	375.98	
			<i>For >10 To 20, Deduct</i>	-95.31	
			<i>For >20 To 40, Deduct</i>	-171.83	
			<i>For >40, Deduct</i>	-362.45	
26 56 13 00-0496			Square Straight, Aluminum Area Light Poles, Direct Burial <small>(26 56 13 00-0474)</small>		
			Note: Includes rubberized undercoating on embedded portion.		
26 56 13 00-0497	EA		10' High, 4" OD, 0.125", Square Straight, Aluminum Area Light Pole, Direct Burial	656.92	111.76
			<i>For Bronze Or Satin Anodized Finish, Add</i>	43.34	
			<i>For Black Anodized Finish, Add</i>	86.68	
			<i>For >10 To 20, Deduct</i>	-22.92	
			<i>For >20 To 40, Deduct</i>	-41.51	
			<i>For >40, Deduct</i>	-87.36	
26 56 13 00-0498	EA		12' High, 4" OD, 0.125", Square Straight, Aluminum Area Light Pole, Direct Burial	735.37	122.93
			<i>For Bronze Or Satin Anodized Finish, Add</i>	48.95	
			<i>For Black Anodized Finish, Add</i>	97.90	
			<i>For >10 To 20, Deduct</i>	-25.73	
			<i>For >20 To 40, Deduct</i>	-46.56	
			<i>For >40, Deduct</i>	-98.01	
26 56 13 00-0499	EA		14' High, 4" OD, 0.125", Square Straight, Aluminum Area Light Pole, Direct Burial	780.82	134.11
			<i>For Bronze Or Satin Anodized Finish, Add</i>	51.26	
			<i>For Black Anodized Finish, Add</i>	102.52	
			<i>For >10 To 20, Deduct</i>	-27.21	
			<i>For >20 To 40, Deduct</i>	-49.29	
			<i>For >40, Deduct</i>	-103.71	
26 56 13 00-0500	EA		15' High, 4" OD, 0.125", Square Straight, Aluminum Area Light Pole, Direct Burial	808.32	134.11
			<i>For Bronze Or Satin Anodized Finish, Add</i>	54.01	
			<i>For Black Anodized Finish, Add</i>	108.02	
			<i>For >10 To 20, Deduct</i>	-28.31	
			<i>For >20 To 40, Deduct</i>	-51.22	
			<i>For >40, Deduct</i>	-107.84	
26 56 13 00-0501	EA		16' High, 4" OD, 0.125", Square Straight, Aluminum Area Light Pole, Direct Burial	842.42	134.11
			<i>For Bronze Or Satin Anodized Finish, Add</i>	57.42	
			<i>For Black Anodized Finish, Add</i>	114.84	
			<i>For >10 To 20, Deduct</i>	-29.67	
			<i>For >20 To 40, Deduct</i>	-53.61	
			<i>For >40, Deduct</i>	-112.95	
26 56 13 00-0502	EA		18' High, 4" OD, 0.188", Square Straight, Aluminum Area Light Pole, Direct Burial	981.37	145.29
			<i>For Bronze Or Satin Anodized Finish, Add</i>	69.08	
			<i>For Black Anodized Finish, Add</i>	138.16	
			<i>For >10 To 20, Deduct</i>	-34.90	
			<i>For >20 To 40, Deduct</i>	-62.88	
			<i>For >40, Deduct</i>	-132.68	
26 56 13 00-0503	EA		20' High, 4" OD, 0.188", Square Straight, Aluminum Area Light Pole, Direct Burial	1,051.03	156.46
			<i>For Bronze Or Satin Anodized Finish, Add</i>	73.81	
			<i>For Black Anodized Finish, Add</i>	147.62	
			<i>For >10 To 20, Deduct</i>	-37.35	
			<i>For >20 To 40, Deduct</i>	-67.31	
			<i>For >40, Deduct</i>	-142.01	
26 56 13 00-0504	EA		20' High, 5" OD, 0.188", Square Straight, Aluminum Area Light Pole, Direct Burial	1,223.73	156.46
			<i>For Bronze Or Satin Anodized Finish, Add</i>	91.08	
			<i>For Black Anodized Finish, Add</i>	182.16	
			<i>For >10 To 20, Deduct</i>	-44.26	
			<i>For >20 To 40, Deduct</i>	-79.40	
			<i>For >40, Deduct</i>	-167.91	
26 56 13 00-0505	EA		25' High, 5" OD, 0.188", Square Straight, Aluminum Area Light Pole, Direct Burial	1,407.03	178.82
			<i>For Bronze Or Satin Anodized Finish, Add</i>	104.94	
			<i>For Black Anodized Finish, Add</i>	209.88	
			<i>For >10 To 20, Deduct</i>	-50.92	
			<i>For >20 To 40, Deduct</i>	-91.34	
			<i>For >40, Deduct</i>	-193.17	



Electrical	26	26
Lighting	26 50	
Exterior Lighting	26 56	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56 13 00-0506 EA 25' High, 6" OD, 0.250", Square Straight, Aluminum Area Light Pole, Direct Burial	1,793.13	178.82
For Bronze Or Satin Anodized Finish, Add	143.55	
For Black Anodized Finish, Add	287.10	
For >10 To 20, Deduct	-66.36	
For >20 To 40, Deduct	-118.37	
For >40, Deduct	-251.09	
26 56 13 00-0507 Factory Accessories For Aluminum Area Light Poles <small>(26 56 13 00-0295)</small>		
26 56 13 00-0508 EA 1/2", 3/4" Or 1" Factory Threaded Pipe Coupling Or Nipple For Aluminum Area Light Poles	39.00	
26 56 13 00-0509 EA Extra Handhole For Aluminum Area Light Poles.....	41.00	
26 56 13 00-0510 EA Festoon Outlet Provision For Aluminum Area Light Poles	42.00	
Note: Excludes electrical outlet.		
26 56 13 00-0511 EA Vibration Dampener For Aluminum Area Light Poles	59.00	
26 56 13 00-0512 Fiberglass Area Light Poles <small>(26 56 13 00-0177)</small>		
Note: Includes UV resistant textured weave finish, anchor bolts, base cover, reinforced handhole with cover and grounding provisions and tenon top.		
26 56 13 00-0513 Round Tapered, Fiberglass Area Light Poles <small>(26 56 13 00-0512)</small>		
26 56 13 00-0514 Round Tapered, Fiberglass Area Light Poles, Anchor Base <small>(26 56 13 00-0513)</small>		
26 56 13 00-0515 EA 10' High, 3.5" Top OD, Round Tapered, Fiberglass Area Light Pole, Anchor Base.....	959.73	156.46
For >10 To 20, Deduct	-33.70	
For >20 To 40, Deduct	-60.92	
For >40, Deduct	-128.31	
26 56 13 00-0516 EA 12' High, 3.5" Top OD, Round Tapered, Fiberglass Area Light Pole, Anchor Base.....	1,042.93	178.82
For >10 To 20, Deduct	-36.35	
For >20 To 40, Deduct	-65.85	
For >40, Deduct	-138.56	
26 56 13 00-0517 EA 14' High, 3.5" Top OD, Round Tapered, Fiberglass Area Light Pole, Anchor Base.....	1,127.23	201.17
For >10 To 20, Deduct	-39.05	
For >20 To 40, Deduct	-70.86	
For >40, Deduct	-148.97	
26 56 13 00-0518 EA 16' High, 3.5" Top OD, Round Tapered, Fiberglass Area Light Pole, Anchor Base.....	1,210.43	223.52
For >10 To 20, Deduct	-41.71	
For >20 To 40, Deduct	-75.79	
For >40, Deduct	-159.21	
26 56 13 00-0519 EA 18' High, 3.5" Top OD, Round Tapered, Fiberglass Area Light Pole, Anchor Base.....	1,313.44	245.87
For >10 To 20, Deduct	-45.16	
For >20 To 40, Deduct	-82.11	
For >40, Deduct	-172.43	
26 56 13 00-0520 EA 20' High, 3.5" Top OD, Round Tapered, Fiberglass Area Light Pole, Anchor Base.....	1,398.84	268.22
For >10 To 20, Deduct	-47.91	
For >20 To 40, Deduct	-87.19	
For >40, Deduct	-183.00	
26 56 13 00-0521 EA 22' High, 3.5" Top OD, Round Tapered, Fiberglass Area Light Pole, Anchor Base.....	1,527.85	312.93
For >10 To 20, Deduct	-51.73	
For >20 To 40, Deduct	-94.43	
For >40, Deduct	-197.89	
26 56 13 00-0522 EA 24' High, 3.5" Top OD, Round Tapered, Fiberglass Area Light Pole, Anchor Base.....	1,655.75	357.63
For >10 To 20, Deduct	-55.50	
For >20 To 40, Deduct	-101.60	
For >40, Deduct	-212.60	
26 56 13 00-0523 EA 26' High, 3.5" Top OD, Round Tapered, Fiberglass Area Light Pole, Anchor Base.....	1,744.85	357.63
For >10 To 20, Deduct	-59.07	
For >20 To 40, Deduct	-107.83	
For >40, Deduct	-225.97	
26 56 13 00-0524 EA 28' High, 3.5" Top OD, Round Tapered, Fiberglass Area Light Pole, Anchor Base.....	1,867.66	379.98
For >10 To 20, Deduct	-63.31	
For >20 To 40, Deduct	-115.54	
For >40, Deduct	-242.15	
26 56 13 00-0525 EA 30' High, 3.5" Top OD, Round Tapered, Fiberglass Area Light Pole, Anchor Base.....	1,990.47	402.33
For >10 To 20, Deduct	-67.55	
For >20 To 40, Deduct	-123.24	
For >40, Deduct	-258.34	
26 56 13 00-0526 EA 10' High, 4.5" Top OD, Round Tapered, Fiberglass Area Light Pole, Anchor Base.....	1,060.93	156.46
For >10 To 20, Deduct	-37.74	
For >20 To 40, Deduct	-68.01	
For >40, Deduct	-143.49	
26 56 13 00-0527 EA 12' High, 4.5" Top OD, Round Tapered, Fiberglass Area Light Pole, Anchor Base.....	1,124.33	178.82
For >10 To 20, Deduct	-39.61	
For >20 To 40, Deduct	-71.55	
For >40, Deduct	-150.77	
26 56 13 00-0528 EA 14' High, 4.5" Top OD, Round Tapered, Fiberglass Area Light Pole, Anchor Base.....	1,188.83	201.17
For >10 To 20, Deduct	-41.52	
For >20 To 40, Deduct	-75.17	
For >40, Deduct	-158.21	
26 56 13 00-0529 EA 16' High, 4.5" Top OD, Round Tapered, Fiberglass Area Light Pole, Anchor Base.....	1,255.53	223.52
For >10 To 20, Deduct	-43.52	
For >20 To 40, Deduct	-78.95	
For >40, Deduct	-165.98	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56 13 00-0530 EA 18' High, 4.5" Top OD, Round Tapered, Fiberglass Area Light Pole, Anchor Base.....	1,327.74	245.87
For >10 To 20, Deduct	-45.73	
For >20 To 40, Deduct	-83.11	
For >40, Deduct	-174.57	
26 56 13 00-0531 EA 20' High, 4.5" Top OD, Round Tapered, Fiberglass Area Light Pole, Anchor Base.....	1,398.84	268.22
For >10 To 20, Deduct	-47.91	
For >20 To 40, Deduct	-87.19	
For >40, Deduct	-183.00	
26 56 13 00-0532 EA 22' High, 4.5" Top OD, Round Tapered, Fiberglass Area Light Pole, Anchor Base.....	1,514.65	312.93
For >10 To 20, Deduct	-51.20	
For >20 To 40, Deduct	-93.51	
For >40, Deduct	-195.91	
26 56 13 00-0533 EA 24' High, 4.5" Top OD, Round Tapered, Fiberglass Area Light Pole, Anchor Base.....	1,655.75	357.63
For >10 To 20, Deduct	-55.50	
For >20 To 40, Deduct	-101.60	
For >40, Deduct	-212.60	
26 56 13 00-0534 EA 26' High, 4.5" Top OD, Round Tapered, Fiberglass Area Light Pole, Anchor Base.....	1,693.15	357.63
For >10 To 20, Deduct	-57.00	
For >20 To 40, Deduct	-104.22	
For >40, Deduct	-218.21	
26 56 13 00-0535 EA 28' High, 4.5" Top OD, Round Tapered, Fiberglass Area Light Pole, Anchor Base.....	1,776.36	379.98
For >10 To 20, Deduct	-59.66	
For >20 To 40, Deduct	-109.15	
For >40, Deduct	-228.46	
26 56 13 00-0536 EA 30' High, 4.5" Top OD, Round Tapered, Fiberglass Area Light Pole, Anchor Base.....	1,859.57	402.33
For >10 To 20, Deduct	-62.31	
For >20 To 40, Deduct	-114.08	
For >40, Deduct	-238.70	
26 56 13 00-0537 EA 10' High, 5" Top OD, Round Tapered, Fiberglass Area Light Pole, Anchor Base.....	1,209.43	156.46
For >10 To 20, Deduct	-43.68	
For >20 To 40, Deduct	-78.40	
For >40, Deduct	-165.77	
26 56 13 00-0538 EA 12' High, 5" Top OD, Round Tapered, Fiberglass Area Light Pole, Anchor Base.....	1,288.23	178.82
For >10 To 20, Deduct	-46.16	
For >20 To 40, Deduct	-83.02	
For >40, Deduct	-175.35	
26 56 13 00-0539 EA 14' High, 5" Top OD, Round Tapered, Fiberglass Area Light Pole, Anchor Base.....	1,367.03	201.17
For >10 To 20, Deduct	-48.65	
For >20 To 40, Deduct	-87.65	
For >40, Deduct	-184.94	
26 56 13 00-0540 EA 16' High, 5" Top OD, Round Tapered, Fiberglass Area Light Pole, Anchor Base.....	1,446.93	223.52
For >10 To 20, Deduct	-51.17	
For >20 To 40, Deduct	-92.34	
For >40, Deduct	-194.69	
26 56 13 00-0541 EA 18' High, 5" Top OD, Round Tapered, Fiberglass Area Light Pole, Anchor Base.....	1,531.24	245.87
For >10 To 20, Deduct	-53.87	
For >20 To 40, Deduct	-97.35	
For >40, Deduct	-205.10	
26 56 13 00-0542 EA 20' High, 5" Top OD, Round Tapered, Fiberglass Area Light Pole, Anchor Base.....	1,622.14	268.22
For >10 To 20, Deduct	-56.84	
For >20 To 40, Deduct	-102.82	
For >40, Deduct	-216.50	
26 56 13 00-0543 EA 22' High, 5" Top OD, Round Tapered, Fiberglass Area Light Pole, Anchor Base.....	1,767.65	312.93
For >10 To 20, Deduct	-61.32	
For >20 To 40, Deduct	-111.22	
For >40, Deduct	-233.86	
26 56 13 00-0544 EA 24' High, 5" Top OD, Round Tapered, Fiberglass Area Light Pole, Anchor Base.....	1,914.25	357.63
For >10 To 20, Deduct	-65.84	
For >20 To 40, Deduct	-119.69	
For >40, Deduct	-251.38	
26 56 13 00-0545 EA 26' High, 5" Top OD, Round Tapered, Fiberglass Area Light Pole, Anchor Base.....	1,971.45	357.63
For >10 To 20, Deduct	-68.13	
For >20 To 40, Deduct	-123.70	
For >40, Deduct	-259.96	
26 56 13 00-0546 EA 28' High, 5" Top OD, Round Tapered, Fiberglass Area Light Pole, Anchor Base.....	2,106.36	379.98
For >10 To 20, Deduct	-72.86	
For >20 To 40, Deduct	-132.25	
For >40, Deduct	-277.96	
26 56 13 00-0547 EA 30' High, 5" Top OD, Round Tapered, Fiberglass Area Light Pole, Anchor Base.....	2,215.97	402.33
For >10 To 20, Deduct	-76.57	
For >20 To 40, Deduct	-139.02	
For >40, Deduct	-292.16	
26 56 13 00-0548 EA 32' High, 5" Top OD, Round Tapered, Fiberglass Area Light Pole, Anchor Base.....	2,303.22	413.51
For >10 To 20, Deduct	-79.72	
For >20 To 40, Deduct	-144.69	
For >40, Deduct	-304.13	
26 56 13 00-0549 EA 34' High, 5" Top OD, Round Tapered, Fiberglass Area Light Pole, Anchor Base.....	2,390.46	424.68
For >10 To 20, Deduct	-82.88	
For >20 To 40, Deduct	-150.35	
For >40, Deduct	-316.10	

26 56 13 00-0550 Round Tapered, Fiberglass Area Light Poles, Direct Burial (26 56 13 00-0513)



Electrical	26
Lighting	26 50
Exterior Lighting	26 56

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56 13 00-0551	EA		10' High, 3.5" Top OD, Round Tapered, Fiberglass Area Light Pole, Direct Burial.....	593.12	111.76
			<i>For >10 To 20, Deduct</i>	-20.37	
			<i>For >20 To 40, Deduct</i>	-37.05	
			<i>For >40, Deduct</i>	-77.79	
26 56 13 00-0552	EA		12' High, 3.5" Top OD, Round Tapered, Fiberglass Area Light Pole, Direct Burial.....	636.37	122.93
			<i>For >10 To 20, Deduct</i>	-21.77	
			<i>For >20 To 40, Deduct</i>	-39.63	
			<i>For >40, Deduct</i>	-83.16	
26 56 13 00-0553	EA		14' High, 3.5" Top OD, Round Tapered, Fiberglass Area Light Pole, Direct Burial.....	678.52	134.11
			<i>For >10 To 20, Deduct</i>	-23.12	
			<i>For >20 To 40, Deduct</i>	-42.13	
			<i>For >40, Deduct</i>	-88.37	
26 56 13 00-0554	EA		16' High, 3.5" Top OD, Round Tapered, Fiberglass Area Light Pole, Direct Burial.....	697.22	134.11
			<i>For >10 To 20, Deduct</i>	-23.87	
			<i>For >20 To 40, Deduct</i>	-43.44	
			<i>For >40, Deduct</i>	-91.17	
26 56 13 00-0555	EA		18' High, 3.5" Top OD, Round Tapered, Fiberglass Area Light Pole, Direct Burial.....	750.37	145.29
			<i>For >10 To 20, Deduct</i>	-25.66	
			<i>For >20 To 40, Deduct</i>	-46.71	
			<i>For >40, Deduct</i>	-98.03	
26 56 13 00-0556	EA		20' High, 3.5" Top OD, Round Tapered, Fiberglass Area Light Pole, Direct Burial.....	794.73	156.46
			<i>For >10 To 20, Deduct</i>	-27.10	
			<i>For >20 To 40, Deduct</i>	-49.37	
			<i>For >40, Deduct</i>	-103.56	
26 56 13 00-0557	EA		22' High, 3.5" Top OD, Round Tapered, Fiberglass Area Light Pole, Direct Burial.....	842.38	167.64
			<i>For >10 To 20, Deduct</i>	-28.67	
			<i>For >20 To 40, Deduct</i>	-52.26	
			<i>For >40, Deduct</i>	-109.59	
26 56 13 00-0558	EA		24' High, 3.5" Top OD, Round Tapered, Fiberglass Area Light Pole, Direct Burial.....	895.53	178.82
			<i>For >10 To 20, Deduct</i>	-30.46	
			<i>For >20 To 40, Deduct</i>	-55.53	
			<i>For >40, Deduct</i>	-116.45	
26 56 13 00-0559	EA		26' High, 3.5" Top OD, Round Tapered, Fiberglass Area Light Pole, Direct Burial.....	1,001.13	178.82
			<i>For >10 To 20, Deduct</i>	-34.68	
			<i>For >20 To 40, Deduct</i>	-62.93	
			<i>For >40, Deduct</i>	-132.29	
26 56 13 00-0560	EA		28' High, 3.5" Top OD, Round Tapered, Fiberglass Area Light Pole, Direct Burial.....	1,129.08	189.99
			<i>For >10 To 20, Deduct</i>	-39.46	
			<i>For >20 To 40, Deduct</i>	-71.44	
			<i>For >40, Deduct</i>	-150.36	
26 56 13 00-0561	EA		30' High, 3.5" Top OD, Round Tapered, Fiberglass Area Light Pole, Direct Burial.....	1,257.03	201.17
			<i>For >10 To 20, Deduct</i>	-44.25	
			<i>For >20 To 40, Deduct</i>	-79.95	
			<i>For >40, Deduct</i>	-168.44	
26 56 13 00-0562	EA		10' High, 4.5" Top OD, Round Tapered, Fiberglass Area Light Pole, Direct Burial.....	694.32	111.76
			<i>For >10 To 20, Deduct</i>	-24.42	
			<i>For >20 To 40, Deduct</i>	-44.13	
			<i>For >40, Deduct</i>	-92.97	
26 56 13 00-0563	EA		12' High, 4.5" Top OD, Round Tapered, Fiberglass Area Light Pole, Direct Burial.....	743.07	122.93
			<i>For >10 To 20, Deduct</i>	-26.03	
			<i>For >20 To 40, Deduct</i>	-47.10	
			<i>For >40, Deduct</i>	-99.17	
26 56 13 00-0564	EA		14' High, 4.5" Top OD, Round Tapered, Fiberglass Area Light Pole, Direct Burial.....	791.82	134.11
			<i>For >10 To 20, Deduct</i>	-27.65	
			<i>For >20 To 40, Deduct</i>	-50.06	
			<i>For >40, Deduct</i>	-105.36	
26 56 13 00-0565	EA		16' High, 4.5" Top OD, Round Tapered, Fiberglass Area Light Pole, Direct Burial.....	819.32	134.11
			<i>For >10 To 20, Deduct</i>	-28.75	
			<i>For >20 To 40, Deduct</i>	-51.99	
			<i>For >40, Deduct</i>	-109.49	
26 56 13 00-0566	EA		18' High, 4.5" Top OD, Round Tapered, Fiberglass Area Light Pole, Direct Burial.....	868.07	145.29
			<i>For >10 To 20, Deduct</i>	-30.36	
			<i>For >20 To 40, Deduct</i>	-54.95	
			<i>For >40, Deduct</i>	-115.68	
26 56 13 00-0567	EA		20' High, 4.5" Top OD, Round Tapered, Fiberglass Area Light Pole, Direct Burial.....	916.83	156.46
			<i>For >10 To 20, Deduct</i>	-31.98	
			<i>For >20 To 40, Deduct</i>	-57.92	
			<i>For >40, Deduct</i>	-121.88	
26 56 13 00-0568	EA		22' High, 4.5" Top OD, Round Tapered, Fiberglass Area Light Pole, Direct Burial.....	965.58	167.64
			<i>For >10 To 20, Deduct</i>	-33.59	
			<i>For >20 To 40, Deduct</i>	-60.89	
			<i>For >40, Deduct</i>	-128.07	
26 56 13 00-0569	EA		24' High, 4.5" Top OD, Round Tapered, Fiberglass Area Light Pole, Direct Burial.....	1,039.63	178.82
			<i>For >10 To 20, Deduct</i>	-36.22	
			<i>For >20 To 40, Deduct</i>	-65.62	
			<i>For >40, Deduct</i>	-138.06	
26 56 13 00-0570	EA		26' High, 4.5" Top OD, Round Tapered, Fiberglass Area Light Pole, Direct Burial.....	1,141.93	178.82
			<i>For >10 To 20, Deduct</i>	-40.31	
			<i>For >20 To 40, Deduct</i>	-72.78	
			<i>For >40, Deduct</i>	-153.41	
26 56 13 00-0571	EA		28' High, 4.5" Top OD, Round Tapered, Fiberglass Area Light Pole, Direct Burial.....	1,267.68	189.99
			<i>For >10 To 20, Deduct</i>	-45.01	
			<i>For >20 To 40, Deduct</i>	-81.14	
			<i>For >40, Deduct</i>	-171.15	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56 13 00-0572 EA 30' High, 4.5" Top OD, Round Tapered, Fiberglass Area Light Pole, Direct Burial.....	1,392.33	201.17
For >10 To 20, Deduct	-49.66	
For >20 To 40, Deduct	-89.42	
For >40, Deduct	-188.73	
26 56 13 00-0573 EA 10' High, 5" Top OD, Round Tapered, Fiberglass Area Light Pole, Direct Burial.....	783.42	111.76
For >10 To 20, Deduct	-27.98	
For >20 To 40, Deduct	-50.37	
For >40, Deduct	-106.34	
26 56 13 00-0574 EA 12' High, 5" Top OD, Round Tapered, Fiberglass Area Light Pole, Direct Burial.....	825.57	122.93
For >10 To 20, Deduct	-29.33	
For >20 To 40, Deduct	-52.87	
For >40, Deduct	-111.54	
26 56 13 00-0575 EA 14' High, 5" Top OD, Round Tapered, Fiberglass Area Light Pole, Direct Burial.....	866.62	134.11
For >10 To 20, Deduct	-30.64	
For >20 To 40, Deduct	-55.30	
For >40, Deduct	-116.58	
26 56 13 00-0576 EA 16' High, 5" Top OD, Round Tapered, Fiberglass Area Light Pole, Direct Burial.....	885.32	134.11
For >10 To 20, Deduct	-31.39	
For >20 To 40, Deduct	-56.61	
For >40, Deduct	-119.39	
26 56 13 00-0577 EA 18' High, 5" Top OD, Round Tapered, Fiberglass Area Light Pole, Direct Burial.....	926.37	145.29
For >10 To 20, Deduct	-32.70	
For >20 To 40, Deduct	-59.03	
For >40, Deduct	-124.43	
26 56 13 00-0578 EA 20' High, 5" Top OD, Round Tapered, Fiberglass Area Light Pole, Direct Burial.....	968.53	156.46
For >10 To 20, Deduct	-34.05	
For >20 To 40, Deduct	-61.54	
For >40, Deduct	-129.63	
26 56 13 00-0579 EA 22' High, 5" Top OD, Round Tapered, Fiberglass Area Light Pole, Direct Burial.....	1,048.08	167.64
For >10 To 20, Deduct	-36.89	
For >20 To 40, Deduct	-66.66	
For >40, Deduct	-140.45	
26 56 13 00-0580 EA 24' High, 5" Top OD, Round Tapered, Fiberglass Area Light Pole, Direct Burial.....	1,140.83	178.82
For >10 To 20, Deduct	-40.27	
For >20 To 40, Deduct	-72.71	
For >40, Deduct	-153.24	
26 56 13 00-0581 EA 26' High, 5" Top OD, Round Tapered, Fiberglass Area Light Pole, Direct Burial.....	1,204.63	178.82
For >10 To 20, Deduct	-42.82	
For >20 To 40, Deduct	-77.17	
For >40, Deduct	-162.81	
26 56 13 00-0582 EA 28' High, 5" Top OD, Round Tapered, Fiberglass Area Light Pole, Direct Burial.....	1,291.88	189.99
For >10 To 20, Deduct	-45.98	
For >20 To 40, Deduct	-82.83	
For >40, Deduct	-174.78	
26 56 13 00-0583 EA 30' High, 5" Top OD, Round Tapered, Fiberglass Area Light Pole, Direct Burial.....	1,379.13	201.17
For >10 To 20, Deduct	-49.13	
For >20 To 40, Deduct	-88.49	
For >40, Deduct	-186.75	
26 56 13 00-0584 Factory Accessories For Fiberglass Area Light Poles (26 56 13 00-0512)		
26 56 13 00-0585 EA Open Or Capped Top For Fiberglass Area Light Poles.....	39.00	
26 56 13 00-0586 EA Factory Side Drilling Up To Four Fixtures On Fiberglass Area Light Poles.....	39.00	
26 56 13 00-0587 EA Smooth Shaft Finish For Fiberglass Area Light Poles.....	74.00	
26 56 13 00-0588 EA Festoon Outlet Provision For Fiberglass Area Light Poles.....	78.00	
Note: Excludes electrical outlet.		
26 56 13 00-0589 EA Vibration Dampener For Fiberglass Area Light Poles.....	98.00	
26 56 13 00-0590 Concrete Area Light Poles (26 56 13 00-0177)		
26 56 13 00-0591 Octagonal Tapered, Spun Concrete Area Light Poles, Anchor Base (26 56 13 00-0590)		
26 56 13 00-0592 EA 28' High, Octagonal Tapered, Spun Concrete Area Light Pole, Anchor Base.....	1,483.25	379.98
26 56 13 00-0593 EA 30' High, Octagonal Tapered, Spun Concrete Area Light Pole, Anchor Base.....	1,564.13	402.33
26 56 13 00-0594 EA 33' High, Octagonal Tapered, Spun Concrete Area Light Pole, Anchor Base.....	1,621.80	413.51
26 56 13 00-0595 EA 36' High, Octagonal Tapered, Spun Concrete Area Light Pole, Anchor Base.....	2,000.58	424.68
26 56 13 00-0596 EA 38' High, Octagonal Tapered, Spun Concrete Area Light Pole, Anchor Base.....	2,217.96	447.03
26 56 13 00-0597 EA 43' High, Octagonal Tapered, Spun Concrete Area Light Pole, Anchor Base.....	2,750.19	581.14
26 56 13 00-0598 EA 47' High, Octagonal Tapered, Spun Concrete Area Light Pole, Anchor Base.....	3,298.11	715.25
26 56 13 00-0599 EA 27' High, Octagonal Tapered, Spun Concrete Area Light Pole, Anchor Base.....	3,141.30	379.98
Note: Polished brown with acrylic coating finish.		
26 56 13 00-0600 EA 30' High, Octagonal Tapered, Spun Concrete Area Light Pole, Anchor Base.....	3,618.99	402.33
Note: Polished brown with acrylic coating finish.		
26 56 13 00-0601 EA Pole Adapter Base Plate, Galvanized Steel, 1" Thick For Adapting Up To 40'.....	400.15	134.11
26 56 13 00-0602 EA 13' High Concrete Octagonal Area Light Pole, Pink With Acrylic Coating, Finish Design.....	1,881.25	268.13
26 56 13 00-0603 EA Pole Base Cover For All Octagon Poles.....	155.64	54.72
26 56 13 00-0604 EA Pole Arms 24" Long, Square, 250 Watt Fixture, Dark, Architectural Bronze.....	318.32	109.43
26 56 13 00-0605 Tapered, Spun Concrete Area Light Poles, Direct Burial (26 56 13 00-0590)		
Note: Round or square.		
26 56 13 00-0606 EA 13' High, Tapered, Spun Concrete Area Light Pole, Direct Burial.....	1,552.43	178.82
26 56 13 00-0607 EA 16' High, Tapered, Spun Concrete Area Light Pole, Direct Burial.....	1,758.03	223.52
26 56 13 00-0608 EA 18' High, Tapered, Spun Concrete Area Light Pole, Direct Burial.....	1,945.08	268.22



Electrical	26	26
Lighting	26 50	
Exterior Lighting	26 56	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56 13 00-0609 EA 30' High, Tapered, Spun Concrete Area Light Pole, Direct Burial.....	2,715.33	402.33
26 56 13 00-0610 EA 35' High, Tapered, Spun Concrete Area Light Pole, Direct Burial.....	3,124.17	424.68
26 56 13 00-0611 EA 40' High, Tapered, Spun Concrete Area Light Pole, Direct Burial.....	3,565.94	447.03
26 56 13 00-0612 EA 45' High, Tapered, Spun Concrete Area Light Pole, Direct Burial.....	4,144.99	581.14
26 56 13 00-0613 Round Tapered, Spun Concrete Area Light Poles, Direct Burial (26 56 13 00-0590)		
26 56 13 00-0614 EA 60' High, Round Tapered, Spun Concrete Area Light Pole, Direct Burial (Lithonia SPRTC C2 60 9-22).....	9,697.54	1,005.83
26 56 13 00-0615 EA 70' High, Round Tapered, Spun Concrete Area Light Pole, Direct Burial (Lithonia SPRTC C2 70 9-24).....	11,560.57	1,243.97
26 56 13 00-0616 EA 80' High, Round Tapered, Spun Concrete Area Light Pole, Direct Burial (Lithonia SPRTC C1 80 9-26).....	13,747.00	1,680.45
26 56 13 00-0617 Cast Iron Decorative Light Posts (26 56 13 00-0177)		
26 56 13 00-0618 Round Tapered, Cast Iron Decorative Light Post, Anchor Base (26 56 13 00-0617)		
Note: As manufactured by Hadco and King Luminaries or an approved equal.		
26 56 13 00-0619 EA 10' High, Round Tapered, Cast Iron Decorative Light Post, Anchor Base.....	760.54	111.76
26 56 13 00-0620 EA 12' High, Round Tapered, Cast Iron Decorative Light Post, Anchor Base.....	808.77	128.75
26 56 13 00-0621 EA 14' High, Round Tapered, Cast Iron Decorative Light Post, Anchor Base.....	873.64	134.11
26 56 13 00-0622 EA 16' High, Round Tapered, Cast Iron Decorative Light Post, Anchor Base.....	1,068.27	156.46
26 56 13 00-0623 EA 18' High, Round Tapered, Cast Iron Decorative Light Post, Anchor Base.....	1,239.76	169.87
26 56 13 00-0624 EA 20' High, Round Tapered, Cast Iron Decorative Light Post, Anchor Base.....	1,419.13	183.28
26 56 13 00-0625 Landscape Light Poles (26 56 13 00-0001)		
26 56 13 00-0626 Aluminum Landscape Light Poles (26 56 13 00-0625)		
Note: Includes painted finish.		
26 56 13 00-0627 Round Straight, Aluminum Landscape Light Poles (26 56 13 00-0626)		
26 56 13 00-0628 Round Straight, Aluminum Landscape Light Poles, Anchor Base (26 56 13 00-0627)		
26 56 13 00-0629 EA 7' High, 3" OD, Round Straight, Aluminum Landscape Light Pole, Anchor Base.....	366.11	134.11
26 56 13 00-0630 EA 12' High, 3" OD, Round Straight, Aluminum Landscape Light Pole, Anchor Base.....	667.43	178.82
26 56 13 00-0631 Round Straight, Aluminum Landscape Light Poles, Direct Burial (26 56 13 00-0627)		
26 56 13 00-0632 EA 7' High, 3" OD, Round Straight, Aluminum Landscape Light Pole, Direct Burial.....	320.04	134.11
26 56 13 00-0633 EA 12' High, 3" OD, Round Straight, Aluminum Landscape Light Pole, Direct Burial.....	621.37	178.82
26 56 13 00-0634 Steel Landscape Light Poles (26 56 13 00-0625)		
Note: Includes painted finish.		
26 56 13 00-0635 Round Straight, Steel Landscape Light Poles (26 56 13 00-0634)		
26 56 13 00-0636 Round Straight, Steel Landscape Light Poles, Anchor Base (26 56 13 00-0635)		
26 56 13 00-0637 EA 6'-8" High, 3" OD, Round Straight, Steel Landscape Light Pole, Anchor Base.....	334.80	134.11
26 56 13 00-0638 Round Straight, Steel Landscape Light Poles, Direct Burial (26 56 13 00-0635)		
26 56 13 00-0639 EA 6'-8" High, 3" OD, Round Straight, Steel Landscape Light Pole, Direct Burial.....	319.89	134.11
26 56 13 00-0640 Light Pole Brackets And Arms (26 56 13 00-0001)		
26 56 13 00-0641 Light Pole Brackets (26 56 13 00-0640)		
26 56 13 00-0642 Bullhorn Style, Pole Top Area Light Brackets (26 56 13 00-0641)		
26 56 13 00-0643 Round Bullhorn Style, Pole Top Area Light Brackets (26 56 13 00-0642)		
26 56 13 00-0644 Steel, Round Bullhorn Style, Pole Top Area Light Brackets (26 56 13 00-0643)		
Note: Includes powdercoat finish.		
26 56 13 00-0645 EA Two Tenons At 180 Degrees, Steel, Round Bullhorn Style, Pole Top Area Light Bracket.....	320.65	26.82
For Galvanized Finish, Add		26.70
26 56 13 00-0646 EA Three Tenons At 180 Degrees, Steel, Round Bullhorn Style, Pole Top Area Light Bracket.....	401.21	26.82
For Galvanized Finish, Add		34.76
26 56 13 00-0647 EA Three Tenons At 120 Degrees, Steel, Round Bullhorn Style, Pole Top Area Light Bracket.....	425.81	26.82
For Galvanized Finish, Add		37.22
26 56 13 00-0648 EA Four Tenons At 90 Degrees, Steel, Round Bullhorn Style, Pole Top Area Light Bracket.....	577.60	26.82
For Galvanized Finish, Add		52.40
26 56 13 00-0649 EA Four Tenons At 180 Degrees, Steel, Round Bullhorn Style, Pole Top Area Light Bracket.....	601.24	26.82
For Galvanized Finish, Add		54.76
26 56 13 00-0650 Aluminum, Round Bullhorn Style, Pole Top Area Light Brackets (26 56 13 00-0643)		
Note: Includes satin brushed or painted finish.		
26 56 13 00-0651 EA Two Tenons At 180 Degrees, Aluminum, Round Bullhorn Style, Pole Top Area Light Bracket.....	232.94	26.82
For Bronze Or Satin Anodized Finish, Add		17.93
For Black Anodized Finish, Add		35.86
26 56 13 00-0652 EA Three Tenons At 120 Degrees, Aluminum, Round Bullhorn Style, Pole Top Area Light Bracket.....	290.14	26.82
For Bronze Or Satin Anodized Finish, Add		23.65
For Black Anodized Finish, Add		47.30



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56 13 00-0653	EA		Three Tenons At 180 Degrees, Aluminum, Round Bullhorn Style, Pole Top Area Light Bracket.....	305.54	26.82
			<i>For Bronze Or Satin Anodized Finish, Add</i>	25.19	
			<i>For Black Anodized Finish, Add</i>	50.38	
26 56 13 00-0654	EA		Four Tenons At 90 Degrees, Aluminum, Round Bullhorn Style, Pole Top Area Light Bracket.....	359.44	26.82
			<i>For Bronze Or Satin Anodized Finish, Add</i>	30.58	
			<i>For Black Anodized Finish, Add</i>	61.16	
26 56 13 00-0655	EA		Four Tenons At 180 Degrees, Aluminum, Round Bullhorn Style, Pole Top Area Light Bracket.....	370.44	26.82
			<i>For Bronze Or Satin Anodized Finish, Add</i>	31.68	
			<i>For Black Anodized Finish, Add</i>	63.36	
26 56 13 00-0656			Square Bullhorn Style, Pole Top Area Light Brackets (26 56 13 00-0642)		
26 56 13 00-0657			Steel, Square Bullhorn Style, Pole Top Area Light Brackets (26 56 13 00-0656)		
			Note: Includes powdercoat finish.		
26 56 13 00-0658	EA		Two Tenons At 180 Degrees, Steel, Square Bullhorn Style, Pole Top Area Light Bracket.....	343.66	26.82
			<i>For Galvanized Finish, Add</i>	29.00	
26 56 13 00-0659	EA		Three Tenons At 180 Degrees, Steel, Square Bullhorn Style, Pole Top Area Light Bracket.....	420.82	26.82
			<i>For Galvanized Finish, Add</i>	36.72	
26 56 13 00-0660	EA		Four Tenons At 180 Degrees, Steel, Square Bullhorn Style, Pole Top Area Light Bracket.....	511.45	26.82
			<i>For Galvanized Finish, Add</i>	45.78	
26 56 13 00-0661	EA		Four Tenons At 90 Degrees, Steel, Square Bullhorn Style, Pole Top Area Light Bracket.....	602.51	26.82
			<i>For Galvanized Finish, Add</i>	54.89	
26 56 13 00-0662			Wood Pole Clamp On Style, Pole Top Area Light Brackets (26 56 13 00-0641)		
26 56 13 00-0663			Steel, Wood Pole Clamp On Style, Pole Top Area Light Brackets (26 56 13 00-0662)		
			Note: Includes powdercoat finish.		
26 56 13 00-0664	EA		One Tenon, Steel, Wood Pole Clamp On Style, Pole Top Area Light Bracket.....	336.38	44.71
26 56 13 00-0665	EA		Two Tenons At 90, 120 Or 180 Degrees, Steel, Wood Pole Clamp On Style, Pole Top Area Light Bracket.....	494.32	44.71
26 56 13 00-0666	EA		Three Tenons At 120 Degrees, Steel, Wood Pole Clamp On Style, Pole Top Area Light Bracket.....	681.20	44.71
26 56 13 00-0667	EA		Four Tenons At 90 Degrees, Steel, Wood Pole Clamp On Style, Pole Top Area Light Bracket.....	742.68	44.71
26 56 13 00-0668			Light Pole Arms (26 56 13 00-0640)		
26 56 13 00-0669			Wood Pole Streetlight Arms (26 56 13 00-0668)		
26 56 13 00-0670			Steel, Wood Pole Streetlight Arms (26 56 13 00-0669)		
26 56 13 00-0671	EA		1-1/4" Arm Diameter, 2-1/2' Arm Length, Galvanized Steel, Wood Pole Streetlight Arm, Bolt Mount.....	203.64	40.24
26 56 13 00-0672	EA		1-1/4" Arm Diameter, 3-1/2' Arm Length, Galvanized Steel, Wood Pole Streetlight Arm, Bolt Mount.....	216.71	44.71
26 56 13 00-0673	EA		1-1/4" Arm Diameter, 5-1/2' Arm Length, Galvanized Steel, Wood Pole Streetlight Arm, Bolt Mount.....	253.59	55.88
26 56 13 00-0674	EA		2" Arm Diameter, 3-1/2' Arm Length, Galvanized Steel, Wood Pole Streetlight Arm, Bolt Mount.....	292.39	44.71
26 56 13 00-0675	EA		2" Arm Diameter, 5-1/2' Arm Length, Galvanized Steel, Wood Pole Streetlight Arm, Bolt Mount.....	329.06	55.88
26 56 13 00-0676	EA		2" Arm Diameter, 7-1/2' Arm Length, Galvanized Steel, Wood Pole Streetlight Arm, Bolt Mount.....	399.00	67.06
26 56 13 00-0677			Aluminum, Wood Pole Streetlight Arms (26 56 13 00-0669)		
26 56 13 00-0678	EA		1-1/4" Arm Diameter, 42" Arm Length, Aluminum Arm, Wood Pole Streetlight Arm, Bolt Mount.....	212.57	44.71
26 56 13 00-0679	EA		2" Arm Diameter, 42" Arm Length, Aluminum Arm, Wood Pole Streetlight Arm, Bolt Mount.....	275.75	44.71
26 56 13 00-0680	EA		2" Arm Diameter, 66" Arm Length, Aluminum Arm, Wood Pole Streetlight Arm, Bolt Mount.....	373.16	55.88
26 56 13 00-0681	EA		2" Arm Diameter, 90" Arm Length, Aluminum Arm, Wood Pole Streetlight Arm, Bolt Mount.....	496.74	67.06
26 56 13 00-0682			Area Light Arms (26 56 13 00-0668)		
26 56 13 00-0683			Steel Area Light Arms (26 56 13 00-0682)		
26 56 13 00-0684	EA		Single, 2.38" Arm Diameter, 4' Arm Length, Upsweep Style, Steel Area Light Arm, Hub Mount.....	371.00	44.71
26 56 13 00-0685	EA		Two, 2.38" Arm Diameter, 4' Arm Length, Upsweep Style, Steel Area Light Arms, Hub Mount.....	570.25	49.18
26 56 13 00-0686	EA		Three, 2.38" Arm Diameter, 4' Arm Length, Upsweep Style, Steel Area Light Arms, Hub Mount.....	633.09	53.64
26 56 13 00-0687	EA		Four, 2.38" Arm Diameter, 4' Arm Length, Upsweep Style, Steel Area Light Arms, Hub Mount.....	748.72	58.11
26 56 13 00-0688	EA		Single, 2.38" Arm Diameter, 6' Arm Length, Upsweep Style, Steel Area Light Arm, Hub Mount.....	443.96	55.88
26 56 13 00-0689	EA		Two, 2.38" Arm Diameter, 6' Arm Length, Upsweep Style, Steel Area Light Arms, Hub Mount.....	623.40	60.35
26 56 13 00-0690			Aluminum Area Light Arms (26 56 13 00-0682)		
26 56 13 00-0691	EA		Single, 4' Arm Length, Mast Style, Aluminum Area Light Arm, Bolt Mount.....	268.70	44.71
26 56 13 00-0692	EA		Single, 6' Arm Length, Mast Style, Aluminum Area Light Arm, Bolt Mount.....	330.66	55.88
26 56 13 00-0693	EA		Single, 8' Arm Length, Mast Style, Aluminum Area Light Arm, Bolt Mount.....	394.81	67.06
26 56 13 00-0694	EA		Single, 4' Arm Length, Mast Style, Aluminum Area Light Arm, Hub Mount.....	266.50	44.71
26 56 13 00-0695	EA		Two, 4' Arm Length, Mast Style, Aluminum Area Light Arms, Hub Mount.....	394.25	49.18
26 56 13 00-0696	EA		Single, 6' Arm Length, Mast Style, Aluminum Area Light Arm, Hub Mount.....	326.26	55.88
26 56 13 00-0697	EA		Two, 6' Arm Length, Mast Style, Aluminum Area Light Arms, Hub Mount.....	480.40	60.35
26 56 13 00-0698	EA		Single, 8' Arm Length, Mast Style, Aluminum Area Light Arm, Hub Mount.....	397.01	67.06
26 56 13 00-0699	EA		Two, 8' Arm Length, Mast Style, Aluminum Area Light Arms, Hub Mount.....	585.25	71.53
26 56 13 00-0700			Removal And Reinstallation Of Lighting Pole (26 56 13 00-0001)		
26 56 13 00-0701	EA		Remove And Relocate Lighting Pole And Standards With One Or Two Arms, Up To 45'.....	1,475.21	



Electrical	26	26
Lighting	26 50	
Exterior Lighting	26 56	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56 13 00-0702 High Mast Lighting (26 56 13 00-0001)		
26 56 13 00-0703 High Mast Lighting Assemblies (26 56 13 00-0702)		
Note: Includes non-latching system, ring assembly with internal bumper, acrylic top cover, pulley supports, cast arm filter for pipe tension, transition assembly, standard head frame assembly, standard hoist, and powder coated pole.		
26 56 13 00-0704 EA 60'-100' High Mast Lighting Assembly	22,759.93	2,335.17
26 56 13 00-0705 EA 110' High Mast Lighting Assembly	24,468.61	2,564.32
26 56 13 00-0706 EA 120' High Mast Lighting Assembly	25,763.05	2,804.38
26 56 13 00-0707 EA 130' High Mast Lighting Assembly	26,955.73	3,033.54
26 56 13 00-0708 EA 140' High Mast Lighting Assembly	28,250.17	3,273.60
26 56 13 00-0709 EA 150' High Mast Lighting Assembly	29,759.68	3,508.25
26 56 13 00-0710 High Mast Light Poles (26 56 13 00-0702)		
26 56 13 00-0711 EA 60'-100' High Mast Light Poles	14,083.06	1,868.14
26 56 13 00-0712 EA 110' High Mast Light Poles	15,420.16	2,051.45
26 56 13 00-0713 EA 120' High Mast Light Poles	16,452.11	2,243.51
26 56 13 00-0714 EA 130' High Mast Light Poles	17,382.35	2,426.83
26 56 13 00-0715 EA 140' High Mast Light Poles	18,414.32	2,618.87
26 56 13 00-0716 EA 150' High Mast Light Poles	19,548.01	2,806.56
26 56 13 00-0717 High Mast Lighting Accessories (26 56 13 00-0702)		
26 56 13 00-0718 EA Bottom Latching System	335.09	
26 56 13 00-0719 EA Top Latching System	888.30	
26 56 13 00-0720 EA Centering Springs	671.86	
26 56 13 00-0721 EA Electric Power Cord	297.98	
26 56 13 00-0722 EA Aircraft Warning Lights	700.79	
26 56 13 00-0723 EA Internal Motorized Hoist	5,194.73	
26 56 13 00-0724 EA Portable Hoist Motor With Step Down Transformer	5,267.83	
26 56 13 00-0725 Concrete Bases (26 56 13 00-0001)		
26 56 13 00-0726 Concrete Bases, Cast In Place (26 56 13 00-0725)		
Note: Includes excavation/drilling, concrete, reinforcement, forms for exposed base, anchors/supports and backfill. Excludes conduit.		
26 56 13 00-0727 VLF 2' Diameter Concrete Base For Poles	66.47	
26 56 13 00-0728 VLF 2-1/2' Diameter Concrete Base For Poles	83.40	
26 56 13 00-0729 VLF 3' Diameter Concrete Base For Poles	100.59	
26 56 13 00-0730 VLF 3-1/2' Diameter Concrete Base For Poles	123.82	
26 56 13 00-0731 VLF 4' Diameter Concrete Base For Poles	147.48	
26 56 13 00-0732 VLF 5' Diameter Concrete Base For Poles	201.27	
26 56 13 00-0733 VLF 6' Diameter Concrete Base For Poles	265.36	
26 56 19 Roadway Lighting (26 56)		
26 56 19 00-0001 Metal Halide, Pole Mounted (26 56 19)		
26 56 19 00-0002 EA 175 Watt Metal Halide, Enclosed And Gasketed, Exterior Roadway Fixture	556.89	180.97
26 56 19 00-0003 EA 250 Watt Metal Halide, Enclosed And Gasketed, Exterior Roadway Fixture	631.28	196.44
26 56 19 00-0004 EA 400 Watt Metal Halide, Enclosed And Gasketed, Exterior Roadway Fixture	742.75	211.32
26 56 19 00-0005 EA 1,000 Watt Metal Halide, Enclosed And Gasketed, Exterior Roadway Fixture	928.24	247.66
26 56 19 00-0006 High Pressure Sodium, Pole Mounted (26 56 19)		
26 56 19 00-0007 EA 100 Watt High Pressure Sodium, Enclosed And Gasketed, Exterior Roadway Fixture	458.11	211.32
26 56 19 00-0008 EA 150 Watt High Pressure Sodium, Enclosed And Gasketed, Exterior Roadway Fixture	471.28	211.32
26 56 19 00-0009 EA 175 Watt High Pressure Sodium, Enclosed And Gasketed, Exterior Roadway Fixture	492.27	211.32
26 56 19 00-0010 EA 250 Watt High Pressure Sodium, Enclosed And Gasketed, Exterior Roadway Fixture	542.41	211.32
26 56 19 00-0011 EA 400 Watt High Pressure Sodium, Enclosed And Gasketed, Exterior Roadway Fixture	629.91	211.32
26 56 19 00-0012 EA 1,000 Watt High Pressure Sodium, Enclosed And Gasketed, Exterior Roadway Fixture	873.85	211.32
26 56 19 00-0013 Low Pressure Sodium, Pole Mounted (26 56 19)		
26 56 19 00-0014 EA 135 Watt Low Pressure Sodium Exterior Roadway Fixture, Enclosed And Gasketed	539.80	114.95
26 56 19 00-0015 EA 135 Watt Low Pressure Sodium Fixture, Enclosed And Gasketed	545.04	169.06
26 56 19 00-0016 EA 180 Watt Low Pressure Sodium Fixture, Enclosed And Gasketed	651.11	169.06
26 56 19 00-0017 Street Light Accessories (26 56 19)		
26 56 19 00-0018 Photo Controls (26 56 19 00-0017)		
26 56 19 00-0019 EA Photo Control, 120 Volt As Manufactured By Cooper Lighting #RA1014	62.58	
26 56 19 00-0020 EA Photo Control, Multi-Tap As Manufactured By Cooper Lighting #RA1016	70.89	
26 56 19 00-0021 High Mast Fixtures (26 56 19)		
26 56 19 00-0022 Metal Halide (26 56 19 00-0021)		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56 19 00-0023 EA 400 W High Mast Metal Halide Fixture (VA 25 Type V) As Manufactured By Metrolux	957.42	110.99
26 56 19 00-0024 EA 400 W High Mast Metal Halide Fixture (VA 25 Type VS, VF 1 And 3) As Manufactured By Metrolux	1,020.42	110.99
26 56 19 00-0025 EA 750 W High Mast Metal Halide Fixture (VA 25 Type V) As Manufactured By Metrolux	1,023.31	126.79
26 56 19 00-0026 EA 750 W High Mast Metal Halide Fixture (VA 25 Type VS, VF 1 And 3) As Manufactured By Metrolux	1,061.11	126.79
26 56 19 00-0027 EA 1,000 W High Mast Metal Halide Fixture (VA 25 Type V) As Manufactured By Metrolux	1,084.47	158.49
26 56 19 00-0028 EA 1,000 W High Mast Metal Halide Fixture (VA 25 Type VS, VF 1 And 3) As Manufactured By Metrolux	1,122.27	158.49
26 56 19 00-0029 High Pressure Sodium <small>(26 56 19 00-0021)</small>		
26 56 19 00-0030 EA 400 W High Mast HPS Fixture (VA 25 Type V) As Manufactured By Metrolux.....	993.90	110.99
26 56 19 00-0031 EA 400 W High Mast HPS Fixture (VA 25 Type VS, VF 1 And 3) As Manufactured By Metrolux.....	1,031.70	110.99
26 56 19 00-0032 EA 600 Watt High Mast HPS Fixture (VA 25 Type V, VS, VF 1 And 3) As Manufactured By Metrolux	1,199.07	117.33
26 56 19 00-0033 EA 750 Watt High Mast HPS Fixture (VA 25 Type V, VS, VF 1 And 3) As Manufactured By Metrolux	1,230.66	126.79
26 56 19 00-0034 EA 1,000 Watt High Mast HPS Fixture (VA 25 Type V, VS, VF 1 And 3) As Manufactured By Metrolux	1,310.72	158.49
26 56 19 00-0035 LED Roadway Lighting <small>(26 56 19)</small>		
26 56 19 00-0036 LED Roadway Lighting (Philips Lumec) <small>(26 56 19 00-0035)</small>		
26 56 19 00-0037 Horizontal Tenon Mount, LED Cobra Head Street Lights (Philips Lumec GPL Series) <small>(26 56 19 00-0036)</small>		
Note: UL wet listed. Includes 4,000K color temperature, 120-480 voltage, 570mA driver, die-cast extruded aluminum housing assembly and powder coat finish. Excludes sensors.		
26 56 19 00-0038 EA 49 LEDs, 102 System Watts, Horizontal Tenon Mount, LED Cobra Head Street Light (Philips Lumec GPLS Series)	854.65	107.69
26 56 19 00-0039 EA 98 LEDs, 204 System Watts, Horizontal Tenon Mount, LED Cobra Head Street Light (Philips Lumec GPLM Series)	1,311.93	110.60
26 56 19 00-0040 LED Roadway Lighting (Lithonia) <small>(26 56 19 00-0035)</small>		
26 56 19 00-0041 Horizontal Tenon Mount, LED Cobra Head Street Lights (Lithonia CSX1 Series) <small>(26 56 19 00-0040)</small>		
Note: UL wet listed. Includes 4,000K color temperature, 120-480 voltage, 700mA driver, die-cast extruded aluminum housing assembly and bronze powder coat finish. Excludes sensors.		
26 56 19 00-0042 EA 30 LEDs, 74 System Watts, Horizontal Tenon Mount, LED Cobra Head Street Light (Lithonia CSX1 Series)	1,220.65	101.87
26 56 19 00-0043 EA 60 LEDs, 146 System Watts, Horizontal Tenon Mount, LED Cobra Head Street Light (Lithonia CSX1 Series)	1,993.59	104.78
26 56 19 00-0044 LED Roadway Lighting (CREE® BetaLED®) <small>(26 56 19 00-0035)</small>		
26 56 19 00-0045 Horizontal Tenon Mount, LED Cobra Head Street Lights (CREE® BetaLED® LEDway® STR-LWY) <small>(26 56 19 00-0044)</small>		
Note: UL wet listed. Includes 6,000K color temperature, 120-480 voltage, 350mA driver, die-cast extruded aluminum housing assembly and white, black, silver or bronze powder coat finish. Excludes sensors.		
26 56 19 00-0046 EA 20 LEDs, 25 System Watts, Horizontal Tenon Mount, LED Cobra Head Street Light (CREE® BetaLED® LEDway® STR-LWY)	543.95	98.96
26 56 19 00-0047 EA 30 LEDs, 35 System Watts, Horizontal Tenon Mount, LED Cobra Head Street Light (CREE® BetaLED® LEDway® STR-LWY)	609.43	101.87
26 56 19 00-0048 EA 40 LEDs, 45 System Watts, Horizontal Tenon Mount, LED Cobra Head Street Light (CREE® BetaLED® LEDway® STR-LWY)	686.85	104.78
26 56 19 00-0049 EA 50 LEDs, 55 System Watts, Horizontal Tenon Mount, LED Cobra Head Street Light (CREE® BetaLED® LEDway® STR-LWY)	752.32	107.69
26 56 19 00-0050 EA 60 LEDs, 65 System Watts, Horizontal Tenon Mount, LED Cobra Head Street Light (CREE® BetaLED® LEDway® STR-LWY)	817.80	110.60
26 56 19 00-0051 EA 70 LEDs, 75 System Watts, Horizontal Tenon Mount, LED Cobra Head Street Light (CREE® BetaLED® LEDway® STR-LWY)	972.77	113.51
26 56 19 00-0052 EA 80 LEDs, 86 System Watts, Horizontal Tenon Mount, LED Cobra Head Street Light (CREE® BetaLED® LEDway® STR-LWY)	1,038.25	116.43
26 56 19 00-0053 EA 90 LEDs, 96 System Watts, Horizontal Tenon Mount, LED Cobra Head Street Light (CREE® BetaLED® LEDway® STR-LWY)	1,103.72	119.33
26 56 19 00-0054 EA 100 LEDs, 111 System Watts, Horizontal Tenon Mount, LED Cobra Head Street Light (CREE® BetaLED® LEDway® STR-LWY)	1,228.87	122.25
26 56 19 00-0055 EA 110 LEDs, 122 System Watts, Horizontal Tenon Mount, LED Cobra Head Street Light (CREE® BetaLED® LEDway® STR-LWY)	1,294.36	125.15
26 56 19 00-0056 EA 120 LEDs, 133 System Watts, Horizontal Tenon Mount, LED Cobra Head Street Light (CREE® BetaLED® LEDway® STR-LWY)	1,359.84	128.07
26 56 19 00-0057 Horizontal Tenon Mount, Low Profile, LED Roadway Fixtures (CREE® BetaLED® LEDway® STR-SLM™) <small>(26 56 19 00-0044)</small>		
Note: UL wet listed. Includes 5,700K color temperature, 120-480 voltage, 525mA driver, die-cast extruded aluminum housing assembly and white, black, silver or bronze powder coat finish. Excludes sensors.		
26 56 19 00-0058 EA 20 LEDs, 38 System Watts, Horizontal Tenon Mount, Low Profile, LED Roadway Fixture (CREE® BetaLED® LEDway® STR-SLM™)	621.28	98.96
26 56 19 00-0059 EA 30 LEDs, 55 System Watts, Horizontal Tenon Mount, Low Profile, LED Roadway Fixture (CREE® BetaLED® LEDway® STR-SLM™)	704.73	101.87
26 56 19 00-0060 EA 40 LEDs, 70 System Watts, Horizontal Tenon Mount, Low Profile, LED Roadway Fixture (CREE® BetaLED® LEDway® STR-SLM™)	805.80	104.78
26 56 19 00-0061 EA 50 LEDs, 88 System Watts, Horizontal Tenon Mount, Low Profile, LED Roadway Fixture (CREE® BetaLED® LEDway® STR-SLM™)	890.41	107.69



Electrical	26	26
Lighting	26 50	
Exterior Lighting	26 56	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56 19 00-0062 EA 60 LEDs, 106 System Watts, Horizontal Tenon Mount, Low Profile, LED Roadway Fixture (CREE® BetaLED® LEDway® STR-SLM1™).....	973.85	110.60
26 56 19 00-0063 Vertical/Horizontal Tenon Mount, IP66 Rated, Low Profile, LED Roadway Fixtures (CREE® BetaLED® LEDway® STR-SLMIP66™) (26 56 19 00-0044) Note: UL wet listed. Includes 5,700K color temperature, 120-480 voltage, 525mA driver, die-cast extruded aluminum housing assembly and white, black, silver or bronze powder coat finish. Excludes sensors.		
26 56 19 00-0064 EA 20 LEDs, 38 System Watts, Vertical/Horizontal Tenon Mount, IP66 Rated, Low Profile, LED Roadway Fixture (CREE® BetaLED® LEDway® STR-SLMIP66™).....	661.26	98.96
26 56 19 00-0065 EA 30 LEDs, 55 System Watts, Vertical/Horizontal Tenon Mount, IP66 Rated, Low Profile, LED Roadway Fixture (CREE® BetaLED® LEDway® STR-SLMIP66™).....	744.71	101.87
26 56 19 00-0066 EA 40 LEDs, 70 System Watts, Vertical/Horizontal Tenon Mount, IP66 Rated, Low Profile, LED Roadway Fixture (CREE® BetaLED® LEDway® STR-SLMIP66™).....	844.61	104.78
26 56 19 00-0067 EA 50 LEDs, 88 System Watts, Vertical/Horizontal Tenon Mount, IP66 Rated, Low Profile, LED Roadway Fixture (CREE® BetaLED® LEDway® STR-SLMIP66™).....	929.22	107.69
26 56 19 00-0068 EA 60 LEDs, 106 System Watts, Vertical/Horizontal Tenon Mount, IP66 Rated, Low Profile, LED Roadway Fixture (CREE® BetaLED® LEDway® STR-SLMIP66™).....	1,013.83	110.60
26 56 19 00-0069 Surface Mount, LED Transportation Fixtures (CREE® BetaLED® Edge® TSP-EDG) (26 56 19 00-0044) Note: Direct, cantenary or pendant mount. UL wet listed. Includes 5,700K color temperature, 120-480 voltage, 350mA driver, die-cast extruded aluminum housing assembly and white, black, silver or bronze powder coat finish. Excludes sensors.		
26 56 19 00-0070 EA 40 LEDs, 47 System Watts, Surface Mount, LED Transportation Fixture (CREE® BetaLED® Edge® TSP-EDG)..... <i>For Multi-Level Drive Currents, Add</i>	1,323.24 164.64	104.78
26 56 19 00-0071 EA 60 LEDs, 68 System Watts, Surface Mount, LED Transportation Fixture (CREE® BetaLED® Edge® TSP-EDG)..... <i>For Multi-Level Drive Currents, Add</i>	1,531.27 164.64	110.60
26 56 19 00-0072 EA 80 LEDs, 90 System Watts, Surface Mount, LED Transportation Fixture (CREE® BetaLED® Edge® TSP-EDG)..... <i>For Multi-Level Drive Currents, Add</i>	1,738.13 164.64	116.43
26 56 19 00-0073 EA 100 LEDs, 111 System Watts, Surface Mount, LED Transportation Fixture (CREE® BetaLED® Edge® TSP-EDG)..... <i>For Multi-Level Drive Currents, Add</i>	1,946.16 164.64	122.25
26 56 19 00-0074 EA 120 LEDs, 132 System Watts, Surface Mount, LED Transportation Fixture (CREE® BetaLED® Edge® TSP-EDG)..... <i>For Multi-Level Drive Currents, Add</i>	2,569.33 164.64	128.07
26 56 19 00-0075 EA 140 LEDs, 157 System Watts, Surface Mount, LED Transportation Fixture (CREE® BetaLED® Edge® TSP-EDG)..... <i>For Multi-Level Drive Currents, Add</i>	2,777.36 164.64	133.89
26 56 19 00-0076 EA 160 LEDs, 179 System Watts, Surface Mount, LED Transportation Fixture (CREE® BetaLED® Edge® TSP-EDG)..... <i>For Multi-Level Drive Currents, Add</i>	2,984.22 164.64	139.71
26 56 19 00-0077 EA 200 LEDs, 234 System Watts, Surface Mount, LED Transportation Fixture (CREE® BetaLED® Edge® TSP-EDG)..... <i>For Multi-Level Drive Currents, Add</i>	3,713.11 164.64	151.35
26 56 19 00-0078 EA 240 LEDs, 269 System Watts, Surface Mount, LED Transportation Fixture (CREE® BetaLED® Edge® TSP-EDG)..... <i>For Multi-Level Drive Currents, Add</i>	4,117.53 164.64	157.18
26 56 19 00-0079 Horizontal Tenon Mount, LED Cobra Head Street Lights (CREE® BetaLED® XSP) (26 56 19 00-0044) Note: UL wet listed. Includes 120-277 voltage, die-cast extruded aluminum housing assembly and white, black, silver or bronze powder coat finish. Excludes sensors.		
26 56 19 00-0080 EA 4,806 Lumens, 4,000K, Horizontal Tenon Mount, LED Cobra Head Street Light (CREE® XSP1™ BXSP-B-HT-XXX-A)..... <i>For 3 Or 7-Pin NEMA Photocell Receptacle, Add</i> <i>For Backlight Control Shield, Add</i> <i>For Field Adjustable Output, Add</i> <i>For Bird Spikes, Add</i> <i>For Field Adjustable Output And Utility Label, Add</i> <i>For Fuse, Add</i> <i>For Field Adjustable Output, Utility Label And 3 Or 7-Pin NEMA Photocell Receptacle, Add</i> <i>For 480 Volt, Add</i> <i>For Multi-Level, Add</i>	468.33 12.38 22.19 18.58 33.88 24.77 37.15 37.15 55.73 80.49	104.78
26 56 19 00-0081 EA 5,340 Lumens, 5,700K, Horizontal Tenon Mount, LED Cobra Head Street Light (CREE® XSP1™ BXSP-B-HT-XXX-A)..... <i>For 3 Or 7-Pin NEMA Photocell Receptacle, Add</i> <i>For Backlight Control Shield, Add</i> <i>For Field Adjustable Output, Add</i> <i>For Bird Spikes, Add</i> <i>For Field Adjustable Output And Utility Label, Add</i> <i>For Fuse, Add</i> <i>For Field Adjustable Output, Utility Label And 3 Or 7-Pin NEMA Photocell Receptacle, Add</i> <i>For 480 Volt, Add</i> <i>For Multi-Level, Add</i>	468.33 12.38 22.19 18.58 33.88 24.77 37.15 37.15 55.73 80.49	104.78
26 56 19 00-0082 EA 8,407 Lumens, 4,000K, Horizontal Tenon Mount, LED Cobra Head Street Light (CREE® XSP1™ BXSP-C-HT-XXX-E)..... <i>For 3 Or 7-Pin NEMA Photocell Receptacle, Add</i> <i>For Backlight Control Shield, Add</i> <i>For Field Adjustable Output, Add</i> <i>For Bird Spikes, Add</i> <i>For Field Adjustable Output And Utility Label, Add</i> <i>For Field Adjustable Output, Utility Label And 3 Or 7-Pin NEMA Photocell Receptacle, Add</i> <i>For 480 Volt, Add</i>	515.14 12.38 22.19 18.58 33.88 24.77 37.15 55.73	104.78



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56	19 00-0083	EA	8,820 Lumens, 5,700K, Horizontal Tenon Mount, LED Cobra Head Street Light (CREE® XSP1™ BXSP-C-HT-XXX-E).....	515.14	104.78
			For 3 Or 7-Pin NEMA Photocell Receptacle, Add	12.38	
			For Backlight Control Shield, Add	22.19	
			For Field Adjustable Output, Add	18.58	
			For Bird Spikes, Add	33.88	
			For Field Adjustable Output And Utility Label, Add	24.77	
			For Field Adjustable Output, Utility Label And 3 Or 7-Pin NEMA Photocell Receptacle, Add	37.15	
			For 480 Volt, Add	55.73	
26 56	19 00-0084	EA	9,612 Lumens, 4,000K, Horizontal Tenon Mount, LED Cobra Head Street Light (CREE® XSP2™ BXSP-B-HT-XXX-B).....	598.35	104.78
			For 3 Or 7-Pin NEMA Photocell Receptacle, Add	12.38	
			For Field Adjustable Output, Add	18.58	
			For Backlight Control Shield, Add	31.28	
			For Field Adjustable Output And Utility Label, Add	24.77	
			For Fuse, Add	37.15	
			For Field Adjustable Output, Utility Label And 3 Or 7-Pin NEMA Photocell Receptacle, Add	37.15	
			For Bird Spikes, Add	54.70	
			For 480 Volt, Add	55.73	
			For Multi-Level, Add	80.49	
26 56	19 00-0085	EA	10,680 Lumens, 5,700K, Horizontal Tenon Mount, LED Cobra Head Street Light (CREE® XSP2™ BXSP-B-HT-XXX-B).....	598.35	104.78
			For 3 Or 7-Pin NEMA Photocell Receptacle, Add	12.38	
			For Field Adjustable Output, Add	18.58	
			For Backlight Control Shield, Add	31.28	
			For Field Adjustable Output And Utility Label, Add	24.77	
			For Fuse, Add	37.15	
			For Field Adjustable Output, Utility Label And 3 Or 7-Pin NEMA Photocell Receptacle, Add	37.15	
			For Bird Spikes, Add	54.70	
			For 480 Volt, Add	55.73	
			For Multi-Level, Add	80.49	
26 56	19 00-0086	EA	11,700 Lumens, 4,000K, Horizontal Tenon Mount, LED Cobra Head Street Light (CREE® XSP2L™ BXSP-B-HT-XXX-D).....	728.40	104.78
			For 3 Or 7-Pin NEMA Photocell Receptacle, Add	12.38	
			For Field Adjustable Output, Add	18.58	
			For Backlight Control Shield, Add	31.28	
			For Field Adjustable Output And Utility Label, Add	24.77	
			For Fuse, Add	37.15	
			For Field Adjustable Output, Utility Label And 3 Or 7-Pin NEMA Photocell Receptacle, Add	37.15	
			For Bird Spikes, Add	54.70	
			For 480 Volt, Add	55.73	
			For Multi-Level, Add	80.49	
26 56	19 00-0087	EA	12,187 Lumens, 5,700K, Horizontal Tenon Mount, LED Cobra Head Street Light (CREE® XSP2L™ BXSP-B-HT-XXX-D).....	728.40	104.78
			For 3 Or 7-Pin NEMA Photocell Receptacle, Add	12.38	
			For Field Adjustable Output, Add	18.58	
			For Backlight Control Shield, Add	31.28	
			For Field Adjustable Output And Utility Label, Add	24.77	
			For Fuse, Add	37.15	
			For Field Adjustable Output, Utility Label And 3 Or 7-Pin NEMA Photocell Receptacle, Add	37.15	
			For Bird Spikes, Add	54.70	
			For 480 Volt, Add	55.73	
			For Multi-Level, Add	80.49	
26 56	19 00-0088	EA	13,732 Lumens, 4,000K, Horizontal Tenon Mount, LED Cobra Head Street Light (CREE® XSP2™ BXSP-C-HT-XXX-F).....	676.38	104.78
			For 3 Or 7-Pin NEMA Photocell Receptacle, Add	12.38	
			For Field Adjustable Output, Add	18.58	
			For Backlight Control Shield, Add	31.28	
			For Field Adjustable Output And Utility Label, Add	24.77	
			For Field Adjustable Output, Utility Label And 3 Or 7-Pin NEMA Photocell Receptacle, Add	37.15	
			For Bird Spikes, Add	54.70	
			For 480 Volt, Add	55.73	
26 56	19 00-0089	EA	14,408 Lumens, 5,700K, Horizontal Tenon Mount, LED Cobra Head Street Light (CREE® XSP2™ BXSP-C-HT-XXX-F).....	676.38	104.78
			For 3 Or 7-Pin NEMA Photocell Receptacle, Add	12.38	
			For Field Adjustable Output, Add	18.58	
			For Backlight Control Shield, Add	31.28	
			For Field Adjustable Output And Utility Label, Add	24.77	
			For Field Adjustable Output, Utility Label And 3 Or 7-Pin NEMA Photocell Receptacle, Add	37.15	
			For Bird Spikes, Add	54.70	
			For 480 Volt, Add	55.73	
26 56	19 00-0090	EA	2,529 Lumens, 4,000K, Horizontal Tenon Mount, LED Cobra Head Street Light (CREE® XSPR™ BXSPR-A-O-X-X-G).....	385.11	104.78
			For Utility Label, Add	6.19	
			For 3 Or 7-Pin NEMA Photocell Receptacle, Add	12.38	
			For Utility Label And 3 Or 7-Pin NEMA Photocell Receptacle, Add	18.58	
			For 0 To 10 Volt Dimming, Add	37.15	
26 56	19 00-0091	EA	2,722 Lumens, 5,700K, Horizontal Tenon Mount, LED Cobra Head Street Light (CREE® XSPR™ BXSPR-A-O-X-X-G).....	385.11	104.78
			For Utility Label, Add	6.19	
			For 3 Or 7-Pin NEMA Photocell Receptacle, Add	12.38	
			For Utility Label And 3 Or 7-Pin NEMA Photocell Receptacle, Add	18.58	
			For 0 To 10 Volt Dimming, Add	37.15	



Electrical	26	26
Lighting	26 50	
Exterior Lighting	26 56	

MINOR			TOTAL DIRECT	DEMOLITION
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST
26 56 19 00-0092	EA	3,819 Lumens, 4,000K, Horizontal Tenon Mount, LED Cobra Head Street Light (CREE® XSPR™BXSPR-A-O-X-X-C).....	404.62	104.78
		For Utility Label, Add	6.19	
		For 3 Or 7-Pin NEMA Photocell Receptacle, Add	12.38	
		For Utility Label And 3 Or 7-Pin NEMA Photocell Receptacle, Add	18.58	
		For 0 To 10 Volt Dimming, Add	37.15	
26 56 19 00-0093	EA	4,109 Lumens, 5,700K, Horizontal Tenon Mount, LED Cobra Head Street Light (CREE® XSPR™BXSPR-A-O-X-X-C).....	404.62	104.78
		For Utility Label, Add	6.19	
		For 3 Or 7-Pin NEMA Photocell Receptacle, Add	12.38	
		For Utility Label And 3 Or 7-Pin NEMA Photocell Receptacle, Add	18.58	
		For 0 To 10 Volt Dimming, Add	37.15	
26 56 19 00-0094	EA	4,548 Lumens, 4,000K, Horizontal Tenon Mount, LED Cobra Head Street Light (CREE® XSPR™ BXSPR-B-HT-XXX-A).....	411.12	104.78
		For 3 Or 7-Pin NEMA Photocell Receptacle, Add	12.38	
		For Field Adjustable Output, Add	18.58	
		For Field Adjustable Output And Utility Label, Add	24.77	
		For Field Adjustable Output, Utility Label And 3 Or 7-Pin NEMA Photocell Receptacle, Add	37.15	
		For 0 To 10 Volt Dimming, Add	37.15	
26 56 19 00-0095	EA	4,627 Lumens, 5,700K, Horizontal Tenon Mount, LED Cobra Head Street Light (CREE® XSPR™ BXSPR-B-HT-XXX-A).....	411.12	104.78
		For 3 Or 7-Pin NEMA Photocell Receptacle, Add	12.38	
		For Field Adjustable Output, Add	18.58	
		For Field Adjustable Output And Utility Label, Add	24.77	
		For Field Adjustable Output, Utility Label And 3 Or 7-Pin NEMA Photocell Receptacle, Add	37.15	
		For 0 To 10 Volt Dimming, Add	37.15	
26 56 19 00-0096		LED Roadway Lighting (Cooper Lighting) (26 56 19 00-0035)		
26 56 19 00-0097		Horizontal Tenon Mount, LED Roadway Fixtures (Cooper Lighting Streetworks NVN™) (26 56 19 00-0096)		
		Note: UL wet listed. Includes 4,000K color temperature, 120-480 voltage, die-cast extruded aluminum housing assembly and powder coat finish. Excludes sensors.		
26 56 19 00-0098	EA	1 LED Light Square, 51 System Watts, Horizontal Tenon Mount, LED Roadway Fixture (Cooper Lighting Streetworks™ NVN-AA).....	559.26	104.78
26 56 19 00-0099	EA	2 LED Light Squares, 103 System Watts, Horizontal Tenon Mount, LED Roadway Fixture (Cooper Lighting Streetworks™ NVN-AA).....	748.11	116.43
26 56 19 00-0100	EA	3 LED Light Squares, 154 System Watts, Horizontal Tenon Mount, LED Roadway Fixture (Cooper Lighting Streetworks™ NVN-AA).....	805.95	133.89
26 56 19 00-0101	EA	4 LED Light Squares, 206 System Watts, Horizontal Tenon Mount, LED Roadway Fixture (Cooper Lighting Streetworks™ NVN-AA).....	1,178.39	145.53
26 56 19 00-0102	EA	6 LED Light Squares, 309 System Watts, Horizontal Tenon Mount, LED Roadway Fixture (Cooper Lighting Streetworks™ NVN-AA).....	1,535.77	165.68
26 56 19 00-0103		LED Roadway Lighting (PlanLED) (26 56 19 00-0035)		
26 56 19 00-0104		Horizontal Tenon Mount, LED Roadway Fixtures (PlanLED GigaTera HERA) (26 56 19 00-0103)		
		Note: UL wet listed. Includes 3,000K, 4,000K or 5,000K color temperature, 120-277 voltage, integral 20kV surge suppression, die-cast extruded aluminum housing assembly and powder coat finish. Excludes sensors.		
26 56 19 00-0105	EA	8,500 Lumens, 85 System Watts, Horizontal Tenon Mount, LED Roadway Fixture (PlanLED GigaTera HERA 85W).....	683.60	101.87
26 56 19 00-0106	EA	11,000 Lumens, 110 System Watts, Horizontal Tenon Mount, LED Roadway Fixture (PlanLED GigaTera HERA 110W).....	707.88	102.99
26 56 19 00-0107	EA	15,000 Lumens, 150 System Watts, Horizontal Tenon Mount, LED Roadway Fixture (PlanLED GigaTera HERA 150W).....	744.02	104.78
26 56 19 00-0108		Horizontal Tenon Mount, LED Roadway Fixtures (PlanLED GigaTera SETA) (26 56 19 00-0103)		
		Note: UL wet listed. Includes 3,000K, 3,500K, 4,000K or 5,000K color temperature, 120-277 voltage, integral 20kV surge suppression, die-cast extruded aluminum housing assembly and powder coat finish. Excludes sensors.		
26 56 19 00-0109	EA	7,200 Lumens, 60 System Watts, Horizontal Tenon Mount, LED Roadway Fixture (PlanLED GigaTera SETA SET060).....	461.32	99.41
26 56 19 00-0110	EA	10,000 Lumens, 80 System Watts, Horizontal Tenon Mount, LED Roadway Fixture (PlanLED GigaTera SETA SET080).....	489.05	101.20
26 56 19 00-0111	EA	12,500 Lumens, 100 System Watts, Horizontal Tenon Mount, LED Roadway Fixture (PlanLED GigaTera SETA SET100).....	527.28	102.99
26 56 19 00-0112		Horizontal Tenon Mount, LED Roadway Fixtures (PlanLED GigaTera META) (26 56 19 00-0103)		
		Note: UL wet listed. Includes 3,000K, 4,000K or 5,000K color temperature, 120-277 voltage, integral 20kV surge suppression, die-cast extruded aluminum housing assembly and powder coat finish. Excludes sensors.		
26 56 19 00-0113	EA	13,000 Lumens, 100 System Watts, Horizontal Tenon Mount, LED Roadway Fixture (PlanLED GigaTera META MT100).....	573.48	102.99
		For 0 To 10 Volt Dimming, Add	29.40	
		For 347-480 Volt, Add	29.40	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56 19 00-0114	EA		16,900 Lumens, 130 System Watts, Horizontal Tenon Mount, LED Roadway Fixture (PlanLED GigaTera META MT130).....	599.43	103.89
			<i>For 0 To 10 Volt Dimming, Add</i>	29.40	
			<i>For 347-480 Volt, Add</i>	28.35	
26 56 19 00-0115	EA		19,500 Lumens, 150 System Watts, Horizontal Tenon Mount, LED Roadway Fixture (PlanLED GigaTera META MT150).....	624.32	104.78
			<i>For 0 To 10 Volt Dimming, Add</i>	29.40	
			<i>For 347-480 Volt, Add</i>	29.40	
26 56 19 00-0116			LED Roadway Lighting (General Electric) (26 56 19 00-0035)		
26 56 19 00-0117			Horizontal Tenon Mount, LED Cobra Head Street Lights (General Electric) <small>(26 56 19 00-0116)</small> Note: UL wet listed. Includes 4,000K or 5,700K color temperature, 120-480 voltage, die-cast extruded aluminum housing assembly and black or gray powder coat finish. Excludes sensors.		
26 56 19 00-0118	EA		2,700 Lumens, Horizontal Tenon Mount, LED Cobra Head Street Light (General Electric ERX1 0 23).....	413.78	98.96
			<i>For LightGrid™ Wireless Outdoor Controller, Add</i>	20.00	
26 56 19 00-0119	EA		4,100 Lumens, Horizontal Tenon Mount, LED Cobra Head Street Light (General Electric ERX1 0 B1).....	442.33	101.87
			<i>For LightGrid™ Wireless Outdoor Controller, Add</i>	20.00	
26 56 19 00-0120	EA		5,200 Lumens, Horizontal Tenon Mount, LED Cobra Head Street Light (General Electric ERX1 0 C1).....	460.05	102.99
			<i>For LightGrid™ Wireless Outdoor Controller, Add</i>	20.00	
26 56 19 00-0121	EA		9,600 Lumens, Horizontal Tenon Mount, LED Cobra Head Street Light (General Electric ERX1 0 G1).....	509.74	107.69
			<i>For LightGrid™ Wireless Outdoor Controller, Add</i>	20.00	
26 56 19 00-0122	EA		2,800 Lumens, Horizontal Tenon Mount, LED Cobra Head Street Light (General Electric ERS1 0 23).....	434.43	98.96
			<i>For LightGrid™ Wireless Outdoor Controller, Add</i>	20.00	
26 56 19 00-0123	EA		4,200 Lumens, Horizontal Tenon Mount, LED Cobra Head Street Light (General Electric ERS1 0 B2).....	481.57	101.87
			<i>For LightGrid™ Wireless Outdoor Controller, Add</i>	20.00	
26 56 19 00-0124	EA		5,300 Lumens, Horizontal Tenon Mount, LED Cobra Head Street Light (General Electric ERS1 0 C2).....	492.07	102.99
			<i>For LightGrid™ Wireless Outdoor Controller, Add</i>	20.00	
26 56 19 00-0125	EA		10,200 Lumens, Horizontal Tenon Mount, LED Cobra Head Street Light (General Electric ERS1 0 G2).....	532.46	107.69
			<i>For LightGrid™ Wireless Outdoor Controller, Add</i>	20.00	
26 56 19 00-0126	EA		11,600 Lumens, Horizontal Tenon Mount, LED Cobra Head Street Light (General Electric ERS2 0 E3).....	620.90	110.60
			<i>For LightGrid™ Wireless Outdoor Controller, Add</i>	20.00	
26 56 19 00-0127	EA		19,200 Lumens, Horizontal Tenon Mount, LED Cobra Head Street Light (General Electric ERS2 0 G3).....	697.61	116.43
			<i>For LightGrid™ Wireless Outdoor Controller, Add</i>	20.00	
26 56 19 00-0128			LED Roadway Lighting (Acuity AEL Autobahn) (26 56 19 00-0035)		
26 56 19 00-0129			Horizontal Tenon Mount, LED Cobra Head Street Lights (Acuity AEL Autobahn) <small>(26 56 19 00-0128)</small> Note: UL wet listed. Includes 4,000K or 5,000K color temperature, 120-480 voltage, integral 10kV surge suppression, 0-10V dimming, die-cast extruded aluminum housing assembly and white, black, gray, graphite or bronze powder coat finish. Excludes sensors.		
26 56 19 00-0130	EA		4,200 Lumens, Horizontal Tenon Mount, LED Cobra Head Street Light (Acuity AEL Autobahn ATB0 20ALEDE70).....	643.81	101.87
26 56 19 00-0131	EA		6,700 Lumens, Horizontal Tenon Mount, LED Cobra Head Street Light (Acuity AEL Autobahn ATB0 30BLEDE70).....	790.74	104.78
26 56 19 00-0132	EA		9,000 Lumens, Horizontal Tenon Mount, LED Cobra Head Street Light (Acuity AEL Autobahn ATB2 40BLEDE70).....	1,087.22	107.69
26 56 19 00-0133	EA		13,500 Lumens, Horizontal Tenon Mount, LED Cobra Head Street Light (Acuity AEL Autobahn ATB2 60BLEDE70).....	1,386.31	111.95
26 56 19 00-0134	EA		17,800 Lumens, Horizontal Tenon Mount, LED Cobra Head Street Light (Acuity AEL Autobahn ATB2 80BLEDE70).....	1,678.21	115.08
26 56 19 00-0135			LED Roadway Lighting (Leotek) (26 56 19 00-0035)		
26 56 19 00-0136			Horizontal Tenon Mount, LED Cobra Head Street Lights (Leotek) <small>(26 56 19 00-0135)</small> Note: UL wet listed. Includes 4,000K color temperature, 120-277 voltage, integral surge protector, die-cast and extruded aluminum housing assembly and gray powder coat finish. Excludes sensors.		
26 56 19 00-0137	EA		2,500 Lumens, Horizontal Tenon Mount, LED Cobra Head Street Light (Leotek EC1-4M-MV-NW-X-GY-WL-XXX).....	318.29	98.96
			<i>For Utility Wattage Label, Add</i>	1.24	
			<i>For ANSI 5-wire Photocontrol Receptacle, Add</i>	12.39	
			<i>For ANSI 7-wire Photocontrol Receptacle, Add</i>	13.63	
			<i>For House Or Cul-De-Sac Side Shield, Add</i>	28.92	
26 56 19 00-0138	EA		4,000 Lumens, Horizontal Tenon Mount, LED Cobra Head Street Light (Leotek EC1-6M-MV-NW-X-GY-WL-XXX).....	362.08	101.87
			<i>For Utility Wattage Label, Add</i>	1.24	
			<i>For ANSI 5-wire Photocontrol Receptacle, Add</i>	12.39	
			<i>For ANSI 7-wire Photocontrol Receptacle, Add</i>	13.63	
			<i>For House Or Cul-De-Sac Side Shield, Add</i>	28.92	
26 56 19 00-0139	EA		6,500 Lumens, Horizontal Tenon Mount, LED Cobra Head Street Light (Leotek EC3-10M-MV-NW-X-GY-WL-XXX).....	414.53	104.78
			<i>For Utility Wattage Label, Add</i>	1.24	
			<i>For ANSI 5-wire Photocontrol Receptacle, Add</i>	12.39	
			<i>For ANSI 7-wire Photocontrol Receptacle, Add</i>	13.63	
			<i>For House Or Cul-De-Sac Side Shield, Add</i>	30.98	
26 56 19 00-0140	EA		9,400 Lumens, Horizontal Tenon Mount, LED Cobra Head Street Light (Leotek EC4-14M-MV-NW-X-GY-WL-XXX).....	465.90	107.69
			<i>For Utility Wattage Label, Add</i>	1.24	
			<i>For ANSI 5-wire Photocontrol Receptacle, Add</i>	12.39	
			<i>For ANSI 7-wire Photocontrol Receptacle, Add</i>	13.63	
			<i>For House Or Cul-De-Sac Side Shield, Add</i>	34.08	
26 56 19 00-0141	EA		11,900 Lumens, Horizontal Tenon Mount, LED Cobra Head Street Light (Leotek EC7-18M-MV-NW-X-GY-WL-XXX).....	562.81	110.60
			<i>For Utility Wattage Label, Add</i>	1.24	
			<i>For ANSI 5-wire Photocontrol Receptacle, Add</i>	12.39	
			<i>For ANSI 7-wire Photocontrol Receptacle, Add</i>	13.63	
			<i>For House Or Cul-De-Sac Side Shield, Add</i>	37.18	



Electrical	26	26
Lighting	26 50	
Exterior Lighting	26 56	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56 19 00-0142 EA 15,800 Lumens, Horizontal Tenon Mount, LED Cobra Head Street Light (Leotek EC7-24M-MV-NW-X-GY-WL-XXX)	645.62	113.51
For Utility Wattage Label, Add	1.24	
For ANSI 5-wire Photocontrol Receptacle, Add	12.39	
For ANSI 7-wire Photocontrol Receptacle, Add	13.63	
For House Or Cul-De-Sac Side Shield, Add	37.18	
26 56 19 00-0143 EA 19,100 Lumens, Horizontal Tenon Mount, LED Cobra Head Street Light (Leotek EC9-30M-MV-NW-X-GY-WL-XXX)	715.43	116.43
For Utility Wattage Label, Add	1.24	
For ANSI 5-wire Photocontrol Receptacle, Add	12.39	
For ANSI 7-wire Photocontrol Receptacle, Add	13.63	
For House Or Cul-De-Sac Side Shield, Add	37.18	
26 56 19 00-0144 Induction Roadway Lighting (26 56 19)		
26 56 19 00-0145 Induction Roadway Lighting (Crystal Lighting) (26 56 19 00-0144)		
Note: Includes gray powder coat finish heavy duty die cast aluminum body and borosilicate drop glass lens.		
26 56 19 00-0146 EA 40 Watt Induction, Horizontal Tenon Mount, Cobra Head Street Light (Crystal Lighting CLP-CH29)	487.33	134.34
For Black Powder Coat Finish, Add	20.00	
26 56 19 00-0147 EA 65 Watt Induction, Horizontal Tenon Mount, Cobra Head Street Light (Crystal Lighting CLP-CH29)	521.68	138.82
For Black Powder Coat Finish, Add	20.00	
26 56 19 00-0148 EA 80 Watt Induction, Horizontal Tenon Mount, Cobra Head Street Light (Crystal Lighting CLP-CH29)	544.99	143.29
For Black Powder Coat Finish, Add	20.00	
For Dimming, Add	80.00	
26 56 19 00-0149 EA 100 Watt Induction, Horizontal Tenon Mount, Cobra Head Street Light (Crystal Lighting CLP-CH29)	573.82	147.77
For Black Powder Coat Finish, Add	20.00	
26 56 19 00-0150 EA 120 Watt Induction, Horizontal Tenon Mount, Cobra Head Street Light (Crystal Lighting CLP-CH36)	724.13	152.25
For Black Powder Coat Finish, Add	20.00	
26 56 19 00-0151 EA 150 Watt Induction, Horizontal Tenon Mount, Cobra Head Street Light (Crystal Lighting CLP-CH36)	739.70	156.73
For Black Powder Coat Finish, Add	20.00	
For Dimming, Add	80.00	
26 56 19 00-0152 EA 200 Watt Induction, Horizontal Tenon Mount, Cobra Head Street Light (Crystal Lighting CLP-CH36)	770.75	161.21
For Black Powder Coat Finish, Add	20.00	
For Dimming, Add	80.00	
26 56 19 00-0153 Induction Roadway Lighting (US Lighting Tech) (26 56 19 00-0144)		
Note: Includes gray powder coat finish heavy duty die cast aluminum body and flat glass lens.		
26 56 19 00-0154 EA 40 Watt Induction, Horizontal Tenon Mount, Street Light (US Lighting Tech Jersey HR, 511)	550.27	134.34
26 56 19 00-0155 EA 70 Watt Induction, Horizontal Tenon Mount, Street Light (US Lighting Tech Jersey HR, 511)	614.44	138.82
26 56 19 00-0156 EA 100 Watt Induction, Horizontal Tenon Mount, Street Light (US Lighting Tech Jersey HR, 511)	632.35	147.77
26 56 19 00-0157 EA 150 Watt Induction, Horizontal Tenon Mount, Street Light (US Lighting Tech Jersey HR, 511)	650.26	156.73
26 56 19 00-0158 EA 200 Watt Induction, Horizontal Tenon Mount, Street Light (US Lighting Tech Jersey HR, 511)	786.21	161.21
26 56 19 00-0159 EA 250 Watt Induction, Horizontal Tenon Mount, Street Light (US Lighting Tech Jersey HR, 511)	799.59	165.68
26 56 19 00-0160 EA 40 Watt Induction, Horizontal Tenon Mount, Cobra Head Street Light (US Lighting Tech Cobra 100, 512)	503.89	134.34
26 56 19 00-0161 EA 70 Watt Induction, Horizontal Tenon Mount, Cobra Head Street Light (US Lighting Tech Cobra 100, 512)	574.68	138.82
26 56 19 00-0162 EA 100 Watt Induction, Horizontal Tenon Mount, Cobra Head Street Light (US Lighting Tech Cobra 100, 512)	592.59	147.77
26 56 19 00-0163 EA 150 Watt Induction, Horizontal Tenon Mount, Cobra Head Street Light (US Lighting Tech Cobra 100, 512)	610.50	156.73
26 56 23 Area Lighting (26 56)		
26 56 23 00-0001 Exterior Globe (26 56 23)		
26 56 23 00-0002 Incandescent (26 56 23 00-0001)		
26 56 23 00-0003 EA 100 Watt Incandescent, Enclosed And Gasketed, Exterior Wall Fixture	45.85	14.71
26 56 23 00-0004 EA 150-200 Watt Incandescent, Enclosed And Gasketed, Exterior Wall Fixture	76.42	14.71
26 56 23 00-0005 EA 100 Watt Incandescent, Enclosed And Gasketed With Guard, Exterior Wall Fixture	56.40	14.71
26 56 23 00-0006 EA 150-200 Watt Incandescent, Enclosed And Gasketed With Guard, Exterior Wall Fixture	80.49	14.71
26 56 23 00-0007 Surface Mounted, Rectangular Exterior Area Fixture (26 56 23)		
26 56 23 00-0008 Metal Halide (26 56 23 00-0007)		
26 56 23 00-0009 EA 175 Watt Metal Halide, Surface Mounted, Enclosed And Gasketed, Rectangular Exterior Area Fixture	516.15	169.06
26 56 23 00-0010 EA 250 Watt Metal Halide, Surface Mounted, Enclosed And Gasketed, Rectangular Exterior Area Fixture	594.36	190.18
26 56 23 00-0011 EA 400 Watt Metal Halide, Surface Mounted, Enclosed And Gasketed, Rectangular Exterior Area Fixture	721.92	211.32
26 56 23 00-0012 EA 1,000 Watt Metal Halide, Surface Mounted, Enclosed And Gasketed, Rectangular Exterior Area Fixture	908.87	247.66
26 56 23 00-0013 High Pressure Sodium (26 56 23 00-0007)		
26 56 23 00-0014 EA 70 Watt High Pressure Sodium, Surface Mounted, Enclosed And Gasketed, Rectangular Exterior Area Fixture (LumaPro)	508.82	144.53
26 56 23 00-0015 EA 100 Watt High Pressure Sodium, Surface Mounted, Enclosed And Gasketed, Rectangular Exterior Area Fixture (LumaPro)	555.36	153.83
26 56 23 00-0016 EA 150 Watt High Pressure Sodium, Surface Mounted, Enclosed And Gasketed, Rectangular Exterior Area Fixture (LumaPro)	603.25	162.29
26 56 23 00-0017 EA 175 Watt High Pressure Sodium, Surface Mounted, Enclosed And Gasketed, Rectangular Exterior Area Fixture	622.72	169.06
26 56 23 00-0018 EA 250 Watt High Pressure Sodium, Surface Mounted, Enclosed And Gasketed, Rectangular Exterior Area Fixture	693.98	190.18
26 56 23 00-0019 EA 400 Watt High Pressure Sodium, Surface Mounted, Enclosed And Gasketed, Rectangular Exterior Area Fixture	753.53	211.32
26 56 23 00-0020 EA 1,000 Watt High Pressure Sodium, Surface Mounted, Enclosed And Gasketed, Rectangular Exterior Area Fixture	1,012.02	247.66



MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

26 56 23 00-0021	Vandal Resistant, Surface Mounted, Rectangular Exterior Area Fixtures ^(26 56 23 00-0021)		
26 56 23 00-0022	High Pressure Sodium, Vandal Resistant, Surface Mounted, Rectangular Exterior Area Fixtures ^(26 56 23 00-0021)		
	Note: Includes cast aluminum powder coated housing, polycarbonate lens and tamperproof screws.		
26 56 23 00-0023	EA 35 Watt High Pressure Sodium, Vandal Resistant, Surface Mounted, Rectangular Exterior Area Fixture.....	491.41	114.11
26 56 23 00-0024	EA 50 Watt High Pressure Sodium, Vandal Resistant, Surface Mounted, Rectangular Exterior Area Fixture.....	510.58	126.79
26 56 23 00-0025	EA 70 Watt High Pressure Sodium, Vandal Resistant, Surface Mounted, Rectangular Exterior Area Fixture.....	479.89	144.53
26 56 23 00-0026	EA 100 Watt High Pressure Sodium, Vandal Resistant, Surface Mounted, Rectangular Exterior Area Fixture.....	561.59	153.83
26 56 23 00-0027	EA 150 Watt High Pressure Sodium, Vandal Resistant, Surface Mounted, Rectangular Exterior Area Fixture.....	579.33	162.29
26 56 23 00-0028	EA 175 Watt High Pressure Sodium, Vandal Resistant, Surface Mounted, Rectangular Exterior Area Fixture.....	606.83	169.06
26 56 23 00-0029	EA 250 Watt High Pressure Sodium, Vandal Resistant, Surface Mounted, Rectangular Exterior Area Fixture.....	663.21	190.18
26 56 23 00-0030	EA 400 Watt High Pressure Sodium, Vandal Resistant, Surface Mounted, Rectangular Exterior Area Fixture.....	806.31	211.32
26 56 23 00-0031	Metal Halide, Vandal Resistant, Surface Mounted, Rectangular Exterior Area Fixtures ^(26 56 23 00-0021)		
	Note: Includes cast aluminum powder coated housing, polycarbonate lens and tamperproof screws.		
26 56 23 00-0032	EA 50 Watt Metal Halide, Vandal Resistant, Surface Mounted, Rectangular Exterior Area Fixture	466.75	126.79
26 56 23 00-0033	EA 70 Watt Metal Halide, Vandal Resistant, Surface Mounted, Rectangular Exterior Area Fixture	501.94	144.53
26 56 23 00-0034	EA 100 Watt Metal Halide, Vandal Resistant, Surface Mounted, Rectangular Exterior Area Fixture.....	518.02	153.83
26 56 23 00-0035	EA 150 Watt Metal Halide, Vandal Resistant, Surface Mounted, Rectangular Exterior Area Fixture.....	543.28	162.29
26 56 23 00-0036	EA 175 Watt Metal Halide, Vandal Resistant, Surface Mounted, Rectangular Exterior Area Fixture.....	555.48	169.06
26 56 23 00-0037	EA 250 Watt Metal Halide, Vandal Resistant, Surface Mounted, Rectangular Exterior Area Fixture.....	604.66	190.18
26 56 23 00-0038	EA 400 Watt Metal Halide, Vandal Resistant, Surface Mounted, Rectangular Exterior Area Fixture.....	753.63	211.32
26 56 23 00-0039	Compact Fluorescent And Incandescent, Vandal Resistant, Surface Mounted, Rectangular Exterior Area Fixtures ^(26 56 23 00-0021)		
	Note: Includes cast aluminum powder coated housing, polycarbonate lens and tamperproof screws.		
26 56 23 00-0040	EA 7 Watt Fluorescent, Vandal Resistant, Surface Mounted, Rectangular Exterior Area Fixture.....	157.15	58.83
26 56 23 00-0041	EA 9 Watt Fluorescent, Vandal Resistant, Surface Mounted, Rectangular Exterior Area Fixture.....	164.53	62.51
26 56 23 00-0042	EA 13 Or 14 Watt Fluorescent, Vandal Resistant, Surface Mounted, Rectangular Exterior Area Fixture.....	179.57	66.18
26 56 23 00-0043	EA 75 Watt Incandescent, Vandal Resistant, Surface Mounted, Rectangular Exterior Area Fixture	184.73	73.53
26 56 23 00-0044	EA 100 Watt Incandescent, Vandal Resistant, Surface Mounted, Rectangular Exterior Area Fixture.....	207.75	84.56
26 56 23 00-0045	Wall Packs ^(26 56 23)		
26 56 23 00-0046	Non Cutoff, Polycarbonate Lens, Mini Wall Packs ^(26 56 23 00-0045)		
	Note: Polycarbonate body and aluminum reflector. 11" x 6-1/2" x 5-1/4". Lithonia TWS.		
26 56 23 00-0047	EA 13 Watt Compact Fluorescent, Non Cutoff, Polycarbonate Lens, Mini Wall Pack.....	212.11	40.21
26 56 23 00-0048	EA 50 Watt Metal Halide, Non Cutoff, Polycarbonate Lens, Mini Wall Pack.....	225.55	40.21
26 56 23 00-0049	EA 35 Watt High Pressure Sodium, Non Cutoff, Polycarbonate Lens, Mini Wall Pack.....	225.55	40.21
26 56 23 00-0050	EA 70 Watt High Pressure Sodium, Non Cutoff, Polycarbonate Lens, Mini Wall Pack.....	290.70	40.21
26 56 23 00-0051	Semi Cutoff, Polycarbonate Lens, Mini Wall Packs ^(26 56 23 00-0045)		
	Note: Polycarbonate body and diffused aluminum reflector. 10" x 11-1/2" x 8-15/16". Lithonia TWA.		
26 56 23 00-0052	EA 42 Watt Compact Fluorescent, Semi Cutoff, Polycarbonate Lens, Mini Wall Pack.....	395.86	40.21
26 56 23 00-0053	EA 50 Watt Metal Halide, Semi Cutoff, Polycarbonate Lens, Mini Wall Pack.....	400.69	40.21
26 56 23 00-0054	EA 70 Watt Metal Halide, Semi Cutoff, Polycarbonate Lens, Mini Wall Pack.....	404.87	40.21
26 56 23 00-0055	EA 100 Watt Metal Halide, Semi Cutoff, Polycarbonate Lens, Mini Wall Pack.....	397.25	40.21
26 56 23 00-0056	EA 70 Watt High Pressure Sodium, Semi Cutoff, Polycarbonate Lens, Mini Wall Pack.....	365.90	40.21
26 56 23 00-0057	EA 100 Watt High Pressure Sodium, Semi Cutoff, Polycarbonate Lens, Mini Wall Pack.....	348.68	40.21
26 56 23 00-0058	Cutoff, Polycarbonate Lens, Mini Wall Packs ^(26 56 23 00-0045)		
	Note: Polycarbonate body and diffused aluminum reflector. 10" x 11-1/2" x 8-15/16". Lithonia TWAC.		
26 56 23 00-0059	EA 50 Watt Metal Halide, Cutoff, Polycarbonate Lens, Mini Wall Pack.....	415.70	40.21
26 56 23 00-0060	EA 70 Watt Metal Halide, Cutoff, Polycarbonate Lens, Mini Wall Pack.....	420.10	40.21
26 56 23 00-0061	EA 100 Watt Metal Halide, Cutoff, Polycarbonate Lens, Mini Wall Pack.....	412.49	40.21
26 56 23 00-0062	EA 70 Watt High Pressure Sodium, Cutoff, Polycarbonate Lens, Mini Wall Pack.....	418.62	40.21
26 56 23 00-0063	EA 100 Watt High Pressure Sodium, Cutoff, Polycarbonate Lens, Mini Wall Pack.....	418.62	40.21
26 56 23 00-0064	Non Cutoff, Borosilicate Glass Lens, Small Wall Packs ^(26 56 23 00-0045)		
	Note: Aluminum body and reflector. 9" x 13" x 7-3/8". Lithonia TWR1.		
26 56 23 00-0065	EA 70 Watt Metal Halide, Non Cutoff, Borosilicate Glass Lens, Small Wall Pack	405.25	53.56
26 56 23 00-0066	EA 100 Watt Metal Halide, Non Cutoff, Borosilicate Glass Lens, Small Wall Pack	405.25	53.56
26 56 23 00-0067	EA 175 Watt Metal Halide, Non Cutoff, Borosilicate Glass Lens, Small Wall Pack	381.65	53.56
26 56 23 00-0068	EA 70 Watt High Pressure Sodium, Non Cutoff, Borosilicate Glass Lens, Small Wall Pack.....	390.70	53.56
26 56 23 00-0069	EA 100 Watt High Pressure Sodium, Non Cutoff, Borosilicate Glass Lens, Small Wall Pack.....	390.70	53.56
26 56 23 00-0070	EA 150 Watt High Pressure Sodium, Non Cutoff, Borosilicate Glass Lens, Small Wall Pack.....	364.53	53.56
26 56 23 00-0071	Cutoff, Borosilicate Glass Lens, Small Wall Packs ^(26 56 23 00-0045)		
	Note: Aluminum body and reflector. 10-1/4" x 13" x 8-15/32". Lithonia TWR1C.		
26 56 23 00-0072	EA 70 Watt Metal Halide, Cutoff, Borosilicate Glass Lens, Small Wall Pack.....	419.23	53.56
26 56 23 00-0073	EA 100 Watt Metal Halide, Cutoff, Borosilicate Glass Lens, Small Wall Pack.....	419.23	53.56



Electrical	26	26
Lighting	26 50	
Exterior Lighting	26 56	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56 23 00-0074 EA 175 Watt Metal Halide, Cutoff, Borosilicate Glass Lens, Small Wall Pack.....	419.23	53.56
26 56 23 00-0075 EA 70 Watt High Pressure Sodium, Cutoff, Borosilicate Glass Lens, Small Wall Pack	405.35	53.56
26 56 23 00-0076 EA 100 Watt High Pressure Sodium, Cutoff, Borosilicate Glass Lens, Small Wall Pack.....	405.35	53.56
26 56 23 00-0077 EA 150 Watt High Pressure Sodium, Cutoff, Borosilicate Glass Lens, Small Wall Pack.....	405.35	53.56
26 56 23 00-0078 Full Cutoff, Tempered Glass Lens, Small Wall Packs <small>(26 56 23 00-0045)</small>		
Note: Aluminum body and reflector. 9-3/8" x 14-3/8" x 8-3/4". Meets Nighttime Friendly criteria. Lithonia TWR1S.		
26 56 23 00-0079 EA 175 Watt Metal Halide, Full Cutoff, Tempered Glass Lens, Small Wall Pack	532.17	53.56
26 56 23 00-0080 Cutoff, Borosilicate Glass Lens, Medium Wall Packs <small>(26 56 23 00-0045)</small>		
Note: Aluminum body and reflector. Lithonia TWR2.		
26 56 23 00-0081 EA 250 Watt Metal Halide, Cutoff, Borosilicate Glass Lens, Medium Wall Pack.....	510.38	66.35
Note: 9-1/4" x 17-7/8" x 9-3/8".		
26 56 23 00-0082 EA 400 Watt Metal Halide, Cutoff, Borosilicate Glass Lens, Medium Wall Pack.....	542.37	66.35
Note: 9-1/4" x 17-7/8" x 12-1/2".		
26 56 23 00-0083 EA 250 Watt High Pressure Sodium, Cutoff, Borosilicate Glass Lens, Medium Wall Pack	580.51	66.35
Note: 9-1/4" x 17-7/8" x 9-3/8".		
26 56 23 00-0084 EA 400 Watt High Pressure Sodium, Cutoff, Borosilicate Glass Lens, Medium Wall Pack.....	591.01	66.35
Note: 9-1/4" x 17-7/8" x 12-1/2".		
26 56 23 00-0085 Cutoff, Tempered Glass Lens, Medium Wall Packs <small>(26 56 23 00-0045)</small>		
Note: Aluminum body and reflector. 10" x 17-1/8" x 14-1/2". Lithonia TWR2C.		
26 56 23 00-0086 EA 250 Watt Metal Halide, Cutoff, Tempered Glass Lens, Medium Wall Pack	551.53	66.35
26 56 23 00-0087 EA 400 Watt Metal Halide, Cutoff, Tempered Glass Lens, Medium Wall Pack	587.47	66.35
26 56 23 00-0088 Non Cutoff, Polycarbonate Lens, Large Wall Packs <small>(26 56 23 00-0045)</small>		
Note: Polycarbonate body and powder coated reflector. 15-7/16" x 16-1/8" x 7-3/4". Lithonia TWP.		
26 56 23 00-0089 EA 100 Watt Metal Halide, Non Cutoff, Polycarbonate Lens, Large Wall Pack.....	520.45	80.44
26 56 23 00-0090 EA 175 Watt Metal Halide, Non Cutoff, Polycarbonate Lens, Large Wall Pack	482.38	80.44
26 56 23 00-0091 EA 70 Watt High Pressure Sodium, Non Cutoff, Polycarbonate Lens, Large Wall Pack	511.64	80.44
26 56 23 00-0092 EA 100 Watt High Pressure Sodium, Non Cutoff, Polycarbonate Lens, Large Wall Pack.....	514.55	80.44
26 56 23 00-0093 EA 150 Watt High Pressure Sodium, Non Cutoff, Polycarbonate Lens, Large Wall Pack.....	517.60	80.44
26 56 23 00-0094 Non Cutoff, Borosilicate Glass Lens, Large Wall Packs <small>(26 56 23 00-0045)</small>		
Note: Aluminum body and reflector. 15-3/4" x 16-1/4" x 8". Lithonia TWH.		
26 56 23 00-0095 EA 175 Watt Metal Halide, Non Cutoff, Borosilicate Glass Lens, Large Wall Pack	520.46	80.44
26 56 23 00-0096 EA 250 Watt Metal Halide, Non Cutoff, Borosilicate Glass Lens, Large Wall Pack	533.16	80.44
26 56 23 00-0097 EA 400 Watt Metal Halide, Non Cutoff, Borosilicate Glass Lens, Large Wall Pack	571.23	80.44
26 56 23 00-0098 EA 150 Watt High Pressure Sodium, Non Cutoff, Borosilicate Glass Lens, Large Wall Pack	545.85	80.44
26 56 23 00-0099 EA 250 Watt High Pressure Sodium, Non Cutoff, Borosilicate Glass Lens, Large Wall Pack	558.55	80.44
26 56 23 00-0100 EA 400 Watt High Pressure Sodium, Non Cutoff, Borosilicate Glass Lens, Large Wall Pack	583.91	80.44
26 56 23 00-0101 Full Cutoff, LED Wall Packs <small>(26 56 23 00-0045)</small>		
26 56 23 00-0102 Full Cutoff, LED Wall Packs (Lithonia) <small>(26 56 23 00-0101)</small>		
26 56 23 00-0103 EA 30 LEDs, 57 System Watts, 530 mA Drive Current, Full Cutoff, LED Wall Pack (Lithonia CSXW LED).....	970.59	78.36
26 56 23 00-0104 EA 30 LEDs, 35 System Watts, 350 mA Drive Current, Full Cutoff, LED Wall Pack (Lithonia CSXW LED).....	1,058.93	78.36
26 56 23 00-0105 Full Cutoff, LED Wall Packs (CREE® BetaLED®) <small>(26 56 23 00-0101)</small>		
26 56 23 00-0106 Wall Mount, Full Cutoff, LED Wall Packs (CREE® BetaLED® Edge® SEC-EDG) <small>(26 56 23 00-0105)</small>		
Note: UL wet listed. Includes 4,000K or 5,700K color temperature, 120-277 voltage, 350mA driver, die-cast extruded aluminum housing assembly and white, black, silver or bronze powder coat finish. Excludes sensors.		
26 56 23 00-0107 EA 20 LEDs, 26 System Watts, Wall Mount, Full Cutoff, LED Wall Pack (CREE® BetaLED® Edge® SEC-EDG).....	600.85	76.12
Note: Includes 350mA or 525mA driver.		
For 3 Or 7-Pin NEMA Photocell Receptacle, Add		12.38
For Bird Spikes, Add		31.01
For Fuse, Add		37.15
For 0 To 10 Volt Dimming, Add		37.15
For 480 Volt, Add		55.73
For Multi-Level, Add		80.49
26 56 23 00-0108 EA 40 LEDs, 47 System Watts, Wall Mount, Full Cutoff, LED Wall Pack (CREE® BetaLED® Edge® SEC-EDG).....	772.35	80.60
Note: Includes 350mA or 525mA driver.		
For 3 Or 7-Pin NEMA Photocell Receptacle, Add		12.38
For Bird Spikes, Add		31.46
For Fuse, Add		37.15
For 0 To 10 Volt Dimming, Add		37.15
For 480 Volt, Add		55.73
For Multi-Level, Add		80.49



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56 23 00-0109	EA		60 LEDs, 68 System Watts, Wall Mount, Full Cutoff, LED Wall Pack (CREE® BetaLED® Edge® SEC-EDG).....	943.84	85.08
			Note: Includes 350mA or 525mA driver.		
			For 3 Or 7-Pin NEMA Photocell Receptacle, Add	12.38	
			For Bird Spikes, Add	31.91	
			For Fuse, Add	37.15	
			For 0 To 10 Volt Dimming, Add	37.15	
			For 480 Volt, Add	55.73	
			For Multi-Level, Add	80.49	
26 56 23 00-0110	EA		80 LEDs, 90 System Watts, Wall Mount, Full Cutoff, LED Wall Pack (CREE® BetaLED® Edge® SEC-EDG).....	1,115.34	89.56
			Note: Includes 350mA or 525mA driver.		
			For 3 Or 7-Pin NEMA Photocell Receptacle, Add	12.38	
			For Bird Spikes, Add	32.36	
			For Fuse, Add	37.15	
			For 0 To 10 Volt Dimming, Add	37.15	
			For 480 Volt, Add	55.73	
			For Multi-Level, Add	80.49	
26 56 23 00-0111	EA		100 LEDs, 111 System Watts, Wall Mount, Full Cutoff, LED Wall Pack (CREE® BetaLED® Edge® SEC-EDG).....	1,286.83	94.04
			For 3 Or 7-Pin NEMA Photocell Receptacle, Add	12.38	
			For Bird Spikes, Add	32.80	
			For Fuse, Add	37.15	
			For 0 To 10 Volt Dimming, Add	37.15	
			For 480 Volt, Add	55.73	
			For Multi-Level, Add	80.49	
26 56 23 00-0112	EA		120 LEDs, 132 System Watts, Wall Mount, Full Cutoff, LED Wall Pack (CREE® BetaLED® Edge® SEC-EDG).....	1,458.33	98.51
			For 3 Or 7-Pin NEMA Photocell Receptacle, Add	12.38	
			For Bird Spikes, Add	33.25	
			For Fuse, Add	37.15	
			For 0 To 10 Volt Dimming, Add	37.15	
			For 480 Volt, Add	55.73	
			For Multi-Level, Add	80.49	
26 56 23 00-0113			Wall Mount, Full Cutoff, LED Wall Packs (CREE® BetaLED® XSPW™) (26 56		
			23 00-0105)		
			Note: UL wet listed. Includes 4,000K or 5,700K color temperature, 120-277 voltage, Class 2 driver, die-cast extruded aluminum housing assembly and white, black, silver or bronze powder coat finish. Excludes sensors.		
26 56 23 00-0114	EA		25 System Watts, Wall Mount, Full Cutoff, LED Wall Pack (CREE® BetaLED® XSPW™).....	359.49	76.12
			For 3 Or 7-Pin NEMA Photocell Receptacle, Add	12.38	
			For 0 To 10 Volt Dimming, Add	37.15	
			For Multi-Level, Add	37.15	
26 56 23 00-0115	EA		42 System Watts, Wall Mount, Full Cutoff, LED Wall Pack (CREE® BetaLED® XSPW™).....	416.80	80.60
			For 3 Or 7-Pin NEMA Photocell Receptacle, Add	12.38	
			For 0 To 10 Volt Dimming, Add	37.15	
			For Multi-Level, Add	37.15	
26 56 23 00-0116			Semi Cutoff, Induction Wall Packs (26 56 23 00-0045)		
26 56 23 00-0117			Semi Cutoff, Induction Wall Packs (Everlast®) (26 56 23 00-0116)		
			Note: UL wet listed. Includes bi-level ballast, die-cast aluminum housing assembly and bronze powder coat finish. Excludes sensors.		
26 56 23 00-0118	EA		70 Watts, Wall Mount, Semi Cutoff, Bi-Level Induction Wall Pack (Everlast® EOF-ED-70).....	638.89	76.12
26 56 23 00-0119	EA		80 Watts, Wall Mount, Semi Cutoff, Bi-Level Induction Wall Pack (Everlast® EOF-ED-80).....	653.27	80.60
26 56 23 00-0120	EA		100 Watts, Wall Mount, Semi Cutoff, Bi-Level Induction Wall Pack (Everlast® EOF-ED-100).....	667.65	85.08
26 56 23 00-0121	EA		120 Watts, Wall Mount, Semi Cutoff, Bi-Level Induction Wall Pack (Everlast® EOF-ED-120).....	741.67	89.56
26 56 23 00-0122			Wall Pack Accessories (26 56 23 00-0045)		
26 56 23 00-0123	EA		Photocell For Wall Pack.....	79.13	20.11
26 56 23 00-0124	EA		Wire Guard For Mini And Small Wall Pack.....	87.26	20.11
26 56 23 00-0125	EA		Wire Guard For Medium And Large Wall Pack.....	121.28	20.11
26 56 23 00-0126	EA		Vandal Guard For Wall Pack.....	170.38	20.11
26 56 23 00-0127	EA		Full Cutoff Visor For Wall Pack.....	85.04	20.11
26 56 23 00-0128			LED Area Fixtures (26 56 23)		
26 56 23 00-0129			Pole Mount, LED Area Fixtures (26 56 23 00-0128)		
26 56 23 00-0130			Pole Mount, Rectangular, LED Architectural Area Fixtures (Lithonia DSX) (26		
			56 23 00-0129)		
			Note: UL wet listed. Includes 4,000K color temperature, 480 voltage, 700mA remote driver, die-cast extruded aluminum housing assembly and white, black, aluminum or bronze powder coat finish. Excludes sensors.		
26 56 23 00-0131	EA		20 LEDs, 45 System Watts, Pole Mount, LED Architectural Area Fixture (Lithonia DSXO LED).....	1,877.70	76.12
26 56 23 00-0132	EA		40 LEDs, 91 System Watts, Pole Mount, LED Architectural Area Fixture (Lithonia DSXO LED).....	2,024.69	80.60
26 56 23 00-0133	EA		80 LEDs, 188 System Watts, Pole Mount, LED Architectural Area Fixture (Lithonia DSX2 LED).....	2,180.64	89.56
26 56 23 00-0134	EA		100 LEDs, 218 System Watts, Pole Mount, LED Architectural Area Fixture (Lithonia DSX2 LED).....	2,189.59	94.04
26 56 23 00-0135			Pole Mount, Rectangular, LED Architectural Area Fixtures (CREE®		
			Aeroblades™ BXABP) (26 56 23 00-0129)		
			Note: UL wet listed. Includes 5,700K color temperature, 120/277 voltage, 525mA remote driver, die-cast extruded aluminum housing assembly and white, black, silver or bronze powder coat finish. Excludes sensors.		



Electrical	26
Lighting	26 50
Exterior Lighting	26 56

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56 23 00-0136 EA 20 LEDs, 39 System Watts, Pole Mount, Rectangular, LED Architectural Area Fixture (CREE® Aeroblades™ BXABP)	1,344.71	76.12
For 0 To 10 Volt Dimming, Add	47.04	
For 347-480 Volt, Add	53.70	
26 56 23 00-0137 EA 40 LEDs, 70 System Watts, Pole Mount, Rectangular, LED Architectural Area Fixture (CREE® Aeroblades™ BXABP)	1,824.07	80.60
For 0 To 10 Volt Dimming, Add	47.04	
For 347-480 Volt, Add	53.70	
26 56 23 00-0138 EA 60 LEDs, 103 System Watts, Pole Mount, Rectangular, LED Architectural Area Fixture (CREE® Aeroblades™ BXABP)	2,303.42	85.08
For 0 To 10 Volt Dimming, Add	47.04	
For 347-480 Volt, Add	53.70	
26 56 23 00-0139 Arm Mount, Rectangular, LED Area Fixtures (CREE® BetaLED® Edge® ARE-EDG) <small>(26 56 23 00-0129)</small>		
Note: UL wet listed. Includes 4,000K or 5,700K color temperature, 120/277 voltage, 350mA driver, die-cast extruded aluminum housing assembly and white, black, silver or bronze powder coat finish. Excludes sensors. All fixtures without the backlight control shield are DLC qualified		
26 56 23 00-0140 EA 40 LEDs, 47 System Watts, Arm Mount, Rectangular, LED Area Fixture (CREE® BetaLED® Edge® ARE-EDG).....	781.67	80.60
For Backlight Shielding, Add	16.46	
For 347-480 Volt, Add	53.70	
For Multi-Level Drive Currents, Add	164.64	
For Post Top Mount, Add	950.14	
26 56 23 00-0141 EA 60 LEDs, 68 System Watts, Arm Mount, Rectangular, LED Area Fixture (CREE® BetaLED® Edge® ARE-EDG).....	939.76	85.08
For Backlight Shielding, Add	16.46	
For 347-480 Volt, Add	53.70	
For Multi-Level Drive Currents, Add	164.64	
For Post Top Mount, Add	952.83	
26 56 23 00-0142 EA 80 LEDs, 90 System Watts, Arm Mount, Rectangular, LED Area Fixture (CREE® BetaLED® Edge® ARE-EDG).....	1,157.53	89.56
For Backlight Shielding, Add	16.46	
For 347-480 Volt, Add	53.70	
For Multi-Level Drive Currents, Add	164.64	
For Post Top Mount, Add	955.52	
26 56 23 00-0143 EA 100 LEDs, 111 System Watts, Arm Mount, Rectangular, LED Area Fixture (CREE® BetaLED® Edge® ARE-EDG)	1,315.62	94.04
For Backlight Shielding, Add	16.46	
For 347-480 Volt, Add	53.70	
For Multi-Level Drive Currents, Add	164.64	
For Post Top Mount, Add	958.20	
26 56 23 00-0144 EA 120 LEDs, 132 System Watts, Arm Mount, Rectangular, LED Area Fixture (CREE® BetaLED® Edge® ARE-EDG)	1,473.74	98.51
For Backlight Shielding, Add	16.46	
For 347-480 Volt, Add	53.70	
For Multi-Level Drive Currents, Add	164.64	
For Post Top Mount, Add	960.89	
26 56 23 00-0145 EA 140 LEDs, 157 System Watts, Arm Mount, Rectangular, LED Area Fixture (CREE® BetaLED® Edge® ARE-EDG)	1,679.56	102.99
For Backlight Shielding, Add	16.46	
For 347-480 Volt, Add	53.70	
For Multi-Level Drive Currents, Add	164.64	
For Post Top Mount, Add	963.57	
26 56 23 00-0146 EA 160 LEDs, 179 System Watts, Arm Mount, Rectangular, LED Area Fixture (CREE® BetaLED® Edge® ARE-EDG)	1,837.66	107.47
For Backlight Shielding, Add	16.46	
For 347-480 Volt, Add	53.70	
For Multi-Level Drive Currents, Add	164.64	
For Post Top Mount, Add	966.26	
26 56 23 00-0147 EA 200 LEDs, 221 System Watts, Arm Mount, Rectangular, LED Area Fixture (CREE® BetaLED® Edge® ARE-EDG)	2,153.88	116.43
For Backlight Shielding, Add	16.46	
For 347-480 Volt, Add	53.70	
For Multi-Level Drive Currents, Add	164.64	
For Post Top Mount, Add	971.64	
26 56 23 00-0148 EA 240 LEDs, 264 System Watts, Arm Mount, Rectangular, LED Area Fixture (CREE® BetaLED® Edge® ARE-EDG)	2,461.13	120.90
For Backlight Shielding, Add	16.46	
For 347-480 Volt, Add	53.70	
For Multi-Level Drive Currents, Add	164.64	
For Post Top Mount, Add	974.32	
26 56 23 00-0149 Arm Mount, Round, LED Area Fixtures (CREE® BetaLED® Edge® ARE-EDR) <small>(26 56 23 00-0129)</small>		
Note: UL wet listed. Includes 5,700K color temperature, 120/277 voltage, 350mA driver, die-cast extruded aluminum housing assembly and white, black, silver or bronze powder coat finish. Excludes sensors.		
26 56 23 00-0150 EA 40 LEDs, 47 System Watts, Arm Mount, Round, LED Area Fixture (CREE® BetaLED® Edge® ARE-EDR).....	1,118.47	80.60
For Backlight Shielding, Add	16.46	
For 347-480 Volt, Add	53.70	
For Multi-Level Drive Currents, Add	164.64	
For Post Top Mount, Add	950.14	

26	Electrical
26 50	Lighting
26 56	Exterior Lighting



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56 23 00-0151	EA		60 LEDs, 68 System Watts, Arm Mount, Round, LED Area Fixture (CREE® BetaLED® Edge® ARE-EDR).....	1,322.64	85.08
			<i>For Backlight Shielding, Add</i>	16.46	
			<i>For 347-480 Volt, Add</i>	53.70	
			<i>For Multi-Level Drive Currents, Add</i>	164.64	
			<i>For Post Top Mount, Add</i>	952.83	
26 56 23 00-0152	EA		80 LEDs, 90 System Watts, Arm Mount, Round, LED Area Fixture (CREE® BetaLED® Edge® ARE-EDR).....	1,527.99	89.56
			<i>For Backlight Shielding, Add</i>	16.46	
			<i>For 347-480 Volt, Add</i>	53.70	
			<i>For Multi-Level Drive Currents, Add</i>	164.64	
			<i>For Post Top Mount, Add</i>	955.52	
26 56 23 00-0153	EA		111 System Watts, Arm Mount, Round, LED Area Fixture (CREE® BetaLED® Edge® ARE-EDR).....	1,733.33	94.04
			<i>For Backlight Shielding, Add</i>	16.46	
			<i>For 347-480 Volt, Add</i>	53.70	
			<i>For Multi-Level Drive Currents, Add</i>	164.64	
			<i>For Post Top Mount, Add</i>	958.20	
26 56 23 00-0154	EA		120 LEDs, 132 System Watts, Arm Mount, Round, LED Area Fixture (CREE® BetaLED® Edge® ARE-EDR).....	1,937.51	98.51
			<i>For Backlight Shielding, Add</i>	16.46	
			<i>For 347-480 Volt, Add</i>	53.70	
			<i>For Multi-Level Drive Currents, Add</i>	164.64	
			<i>For Post Top Mount, Add</i>	960.89	
26 56 23 00-0155			Direct Or Arm Mount, Rectangular, High Output, LED Area Fixtures (CREE® BetaLED® Edge® ARE-EHO) <small>(26 56 23 00-0129)</small>		
			Note: UL wet listed. Includes 5,700K color temperature, 120/277 voltage, 700mA driver, die-cast extruded aluminum housing assembly and white, black, silver or bronze powder coat finish. Excludes sensors.		
26 56 23 00-0156	EA		120 LEDs, 267 System Watts, Direct Or Arm Mount, Rectangular, High Output, LED Area Fixture (CREE® BetaLED® Edge® ARE-EHO).....	1,405.01	98.51
			<i>For 3 Or 7-Pin NEMA Photocell Receptacle, Add</i>	12.38	
			<i>For Bird Spikes, Add</i>	29.36	
			<i>For 5,000K Color Temperature, Add</i>	30.96	
			<i>For Fuse, Add</i>	37.15	
			<i>For 0 To 10 Volt Dimming, Add</i>	37.15	
			<i>For 480 Volt, Add</i>	55.73	
			<i>For Multi-Level, Add</i>	80.49	
			<i>For 1,000mA Driver, Add</i>	104.03	
26 56 23 00-0157	EA		240 LEDs, 533 System Watts, Direct Or Arm Mount, Rectangular, High Output, LED Area Fixture (CREE® BetaLED® Edge® ARE-EHO).....	2,359.66	120.90
			<i>For 3 Or 7-Pin NEMA Photocell Receptacle, Add</i>	12.38	
			<i>For 5,000K Color Temperature, Add</i>	30.96	
			<i>For Fuse, Add</i>	37.15	
			<i>For 0 To 10 Volt Dimming, Add</i>	37.15	
			<i>For Bird Spikes, Add</i>	43.31	
			<i>For Multi-Level, Add</i>	80.49	
			<i>For 1,000mA Driver, Add</i>	104.38	
			<i>For 480 Volt, Add</i>	111.45	
26 56 23 00-0158			Wall Mount, LED Area Fixtures <small>(26 56 23 00-0128)</small>		
26 56 23 00-0159			Wall Mount, LED Architectural Area Fixtures (Lithonia DSXW) <small>(26 56 23 00-0158)</small>		
			Note: UL wet listed. Includes 4,000K color temperature, 277 voltage, 700mA remote driver, die-cast extruded aluminum housing assembly and white, black, aluminum or bronze powder coat finish. Excludes sensors.		
26 56 23 00-0160	EA		20 LEDs, 47 System Watts, Wall Mount, LED Architectural Area Fixture (Lithonia DSXW2 LED).....	816.20	76.12
26 56 23 00-0161	EA		30 LEDs, 71 System Watts, Wall Mount, LED Architectural Area Fixture (Lithonia DSXW2 LED).....	834.11	85.08
26 56 23 00-0162			Wall Mount, Rectangular, LED Architectural Area Fixtures (CREE® Aeroblades™ BXABR) <small>(26 56 23 00-0158)</small>		
			Note: UL wet listed. Includes 5,700K color temperature, 120/277 voltage, 525mA remote driver, die-cast extruded aluminum housing assembly and white, black, silver or bronze powder coat finish. Excludes sensors.		
26 56 23 00-0163	EA		20 LEDs, 39 System Watts, Wall Mount, Rectangular, LED Architectural Area Fixture (CREE® Aeroblades™ BXABR).....	1,297.67	76.12
			<i>For 0 To 10 Volt Dimming, Add</i>	47.04	
			<i>For 347-480 Volt, Add</i>	53.70	
26 56 23 00-0164	EA		40 LEDs, 70 System Watts, Wall Mount, Rectangular, LED Architectural Area Fixture (CREE® Aeroblades™ BXABR).....	1,785.98	85.08
			<i>For 0 To 10 Volt Dimming, Add</i>	47.04	
			<i>For 347-480 Volt, Add</i>	53.70	
26 56 23 00-0165	EA		60 LEDs, 103 System Watts, Wall Mount, Rectangular, LED Architectural Area Fixture (CREE® Aeroblades™ BXABR).....	2,256.38	85.08
			<i>For 0 To 10 Volt Dimming, Add</i>	47.04	
			<i>For 347-480 Volt, Add</i>	53.70	
26 56 23 00-0166			Surface Mount, LED Parking Structure Fixtures <small>(26 56 23 00-0128)</small>		
26 56 23 00-0167			Surface Mount, Rectangular, LED Parking Structure Fixtures (CREE® BetaLED® Edge® PKG-EDG) <small>(26 56 23 00-0166)</small>		
			Note: Direct or pendant mount. UL wet listed. Includes 5,700K color temperature, 120-480 voltage, 350mA driver, die-cast extruded aluminum housing assembly and white, black, silver or bronze powder coat finish. Excludes sensors.		



Electrical	26	26
Lighting	26 50	
Exterior Lighting	26 56	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56 23 00-0168	EA		20 LEDs, 26 System Watts, Surface Mount, Rectangular, LED Parking Structure Fixture (CREE® BetaLED® Edge® PKG-EDG).....	654.40	76.12
			<i>For Multi-Level Drive Currents, Add</i>	164.64	
26 56 23 00-0169	EA		40 LEDs, 47 System Watts, Surface Mount, Rectangular, LED Parking Structure Fixture (CREE® BetaLED® Edge® PKG-EDG).....	859.75	80.60
			<i>For Multi-Level Drive Currents, Add</i>	164.64	
26 56 23 00-0170	EA		60 LEDs, 68 System Watts, Surface Mount, Rectangular, LED Parking Structure Fixture (CREE® BetaLED® Edge® PKG-EDG).....	1,063.92	85.08
			<i>For Multi-Level Drive Currents, Add</i>	164.64	
26 56 23 00-0171	EA		80 LEDs, 90 System Watts, Surface Mount, Rectangular, LED Parking Structure Fixture (CREE® BetaLED® Edge® PKG-EDG).....	1,269.27	89.56
			<i>For Multi-Level Drive Currents, Add</i>	164.64	
26 56 23 00-0172	EA		100 LEDs, 111 System Watts, Surface Mount, Rectangular, LED Parking Structure Fixture (CREE® BetaLED® Edge® PKG-EDG).....	1,474.61	94.04
			<i>For Multi-Level Drive Currents, Add</i>	164.64	
26 56 23 00-0173			Surface Mount, Square, LED Parking Structure Fixtures (CREE® BetaLED® Edge® PKG-304) <small>(26 56 23 00-0166)</small> Note: Direct or pendant mount. UL wet listed. Includes 5,700K color temperature, 120-480 voltage, 350mA driver, die-cast extruded aluminum housing assembly and white, black, silver or bronze powder coat finish. Excludes sensors.		
26 56 23 00-0174	EA		40 LEDs, 47 System Watts, Surface Mount, Square, LED Parking Structure Fixture (CREE® BetaLED® Edge® PKG-304).....	828.00	80.60
			<i>For Multi-Level Drive Currents, Add</i>	164.64	
26 56 23 00-0175	EA		60 LEDs, 68 System Watts, Surface Mount, Square, LED Parking Structure Fixture (CREE® BetaLED® Edge® PKG-304).....	915.74	85.08
			<i>For Multi-Level Drive Currents, Add</i>	164.64	
26 56 23 00-0176			Surface Mount, Square, LED Parking Structure Fixtures (CREE® BetaLED® VG) <small>(26 56 23 00-0166)</small> Note: UL wet listed. Includes 4,000K color temperature, 120-277 voltage, die-cast extruded aluminum housing assembly and white, black, silver or bronze powder coat finish. Excludes sensors.		
26 56 23 00-0177	EA		3,700 Lumens, 50 System Watts, Surface Mount, Square, LED Parking Structure Fixtures (CREE® BetaLED® VGADM5MA40KUL).....	520.10	80.60
26 56 23 00-0178			Surface Mount, Rectangular, LED Parking Structure Fixtures (Philips Gardco ELG) <small>(26 56 23 00-0166)</small> Note: Direct or pendant mount. UL wet listed. Includes 4,000K color temperature, 120-277 voltage, die-cast extruded aluminum housing assembly and aluminum finish. Excludes sensors.		
26 56 23 00-0179	EA		70 System Watts, Surface Mount, Rectangular, LED Parking Structure Fixture (Philips Gardco ELG).....	1,036.24	85.08
26 56 23 00-0180	EA		110 System Watts, Surface Mount, Rectangular, LED Parking Structure Fixture (Philips Gardco ELG).....	1,054.15	94.04
26 56 23 00-0181			Surface Mount, LED Canopy Fixtures <small>(26 56 23 00-0128)</small>		
26 56 23 00-0182			Surface Mount, Rectangular, LED Canopy Fixtures (CREE® BetaLED® Edge® CAN-EDG) <small>(26 56 23 00-0181)</small> Note: Direct or pendant mount. UL wet listed. Includes 6,000K color temperature, 120-480 voltage, 350mA driver, die-cast extruded aluminum housing assembly and white, black, silver or bronze powder coat finish. Excludes sensors.		
26 56 23 00-0183	EA		40 LEDs, 47 System Watts, Surface Mount, Rectangular, LED Canopy Fixture (CREE® BetaLED® Edge® CAN-EDG).....	1,000.87	80.60
			<i>For Multi-Level Drive Currents, Add</i>	164.64	
26 56 23 00-0184	EA		60 LEDs, 68 System Watts, Surface Mount, Rectangular, LED Canopy Fixture (CREE® BetaLED® Edge® CAN-EDG).....	1,205.04	85.08
			<i>For Multi-Level Drive Currents, Add</i>	164.64	
26 56 23 00-0185	EA		80 LEDs, 90 System Watts, Surface Mount, Rectangular, LED Canopy Fixture (CREE® BetaLED® Edge® CAN-EDG).....	1,410.39	89.56
			<i>For Multi-Level Drive Currents, Add</i>	164.64	
26 56 23 00-0186	EA		100 LEDs, 111 System Watts, Surface Mount, Rectangular, LED Canopy Fixture (CREE® BetaLED® Edge® CAN-EDG).....	1,615.73	94.04
			<i>For Multi-Level Drive Currents, Add</i>	164.64	
26 56 23 00-0187	EA		120 LEDs, 132 System Watts, Surface Mount, Rectangular, LED Canopy Fixture (CREE® BetaLED® Edge® CAN-EDG).....	1,819.91	98.51
			<i>For Multi-Level Drive Currents, Add</i>	164.64	
26 56 23 00-0188	EA		140 LEDs, 157 System Watts, Surface Mount, Rectangular, LED Canopy Fixture (CREE® BetaLED® Edge® CAN-EDG).....	2,104.04	102.99
			<i>For Multi-Level Drive Currents, Add</i>	164.64	
26 56 23 00-0189	EA		160 LEDs, 179 System Watts, Surface Mount, Rectangular, LED Canopy Fixture (CREE® BetaLED® Edge® CAN-EDG).....	2,308.22	107.47
			<i>For Multi-Level Drive Currents, Add</i>	164.64	
26 56 23 00-0190	EA		200 LEDs, 221 System Watts, Surface Mount, Rectangular, LED Canopy Fixture (CREE® BetaLED® Edge® CAN-EDG).....	2,718.91	116.43
			<i>For Multi-Level Drive Currents, Add</i>	164.64	
26 56 23 00-0191	EA		240 LEDs, 264 System Watts, Surface Mount, Rectangular, LED Canopy Fixture (CREE® BetaLED® Edge® CAN-EDG).....	3,119.48	120.90
			<i>For Multi-Level Drive Currents, Add</i>	164.64	

26	Electrical
26 50	Lighting
26 56	Exterior Lighting



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56 23 00-0192 Surface Mount, Square, LED Canopy/Soffit Fixtures (CREE® BetaLED® CPY250) <small>(26 56 23 00-0181)</small> Note: UL wet listed. Includes 5,700K color temperature, 120-277 voltage, die-cast extruded aluminum housing assembly and white, black, silver or bronze powder coat finish. Excludes sensors.		
26 56 23 00-0193 EA 8,000 Lumens, 82 System Watts, Surface Mount, Square, LED Canopy/Soffit Fixture (CREE® BetaLED® CPY250).....	593.23	89.56
26 56 23 00-0194 Recessed Mount, LED Soffit Fixtures <small>(26 56 23 00-0128)</small>		
26 56 23 00-0195 Recessed Mount, Rectangular, LED Soffit Fixtures (CREE® BetaLED® SFT-227) <small>(26 56 23 00-0194)</small> Note: UL wet listed. Includes 5,700K color temperature, 120/277 voltage, 350mA driver, die-cast extruded aluminum housing assembly and white, black, silver or bronze powder coat finish. Excludes sensors.		
26 56 23 00-0196 EA 30 LEDs, 36 System Watts, Recessed Mount, Rectangular, LED Soffit Fixture (CREE® BetaLED® SFT-227)	829.40	78.36
26 56 23 00-0197 EA 60 LEDs, 68 System Watts, Recessed Mount, Rectangular, LED Soffit Fixture (CREE® BetaLED® SFT-227)	1,086.26	85.08
26 56 23 00-0198 EA 90 LEDs, 101 System Watts, Recessed Mount, Rectangular, LED Soffit Fixture (CREE® BetaLED® SFT-227)	1,437.22	91.80
26 56 23 00-0199 EA 120 LEDs, 139 System Watts, Recessed Mount, Rectangular, LED Soffit Fixture (CREE® BetaLED® SFT-227)	1,661.15	98.51
26 56 23 00-0200 Recessed Mount, Square, LED Soffit Fixtures (CREE® BetaLED® SFT-304) <small>(26 56 23 00-0194)</small> Note: UL wet listed. Includes 5,700K color temperature, 120/277 voltage, 350mA driver, die-cast extruded aluminum housing assembly and white, black, silver or bronze powder coat finish. Excludes sensors.		
26 56 23 00-0201 EA 40 LEDs, 47 System Watts, Recessed Mount, Square, LED Soffit Fixture (CREE® BetaLED® SFT-304).....	843.29	80.60
26 56 23 00-0202 EA 60 LEDs, 68 System Watts, Recessed Mount, Square, LED Soffit Fixture (CREE® BetaLED® SFT-304).....	929.86	85.08
26 56 23 00-0203 Surface Mount, LED Area Fixtures <small>(26 56 23 00-0128)</small>		
26 56 23 00-0204 Surface Mount, Square, LED Multi-Purpose Area Fixtures (LSI Industries® Crossover® XPG) <small>(26 56 23 00-0203)</small> Note: UL wet listed. Includes 5,300K color temperature, 120/277 voltage, 350mA driver, die-cast extruded aluminum housing assembly and white, black or silver powder coat finish. Excludes sensors.		
26 56 23 00-0205 EA 50 LEDs, 59 System Watts, Surface Mount, Square, LED Multi-Purpose Area Fixture (LSI Industries® Crossover® XPG).....	613.65	80.60
26 56 23 00-0206 EA 50 LEDs, 59 System Watts, Pendant Mount, Square, LED Multi-Purpose Area Fixture (LSI Industries® Crossover® XPG).....	763.74	80.60
26 56 23 00-0207 EA 68 LEDs, 79 System Watts, Surface Mount, Square, LED Multi-Purpose Area Fixture (LSI Industries® Crossover® XPG).....	645.35	89.56
26 56 23 00-0208 EA 68 LEDs, 79 System Watts, Pendant Mount, Square, LED Multi-Purpose Area Fixture (LSI Industries® Crossover® XPG).....	789.22	89.56
26 56 23 00-0209 Surface Mount, LED Multi-Purpose Area Fixture (Lumark Crosstour®) <small>(26 56 23 00-0203)</small> Note: Wall, inverted, post, bollard, floodlight trunnion, or floodlight knuckle mount. UL wet listed. Includes 5,000K color temperature, 120/277 voltage, die-cast extruded aluminum housing assembly and white or bronze powder coat finish. Excludes sensors.		
26 56 23 00-0210 EA 13 System Watts, Surface Mount, LED Multi-Purpose Area Fixture (Lumark Crosstour® XTOR1A)	200.87	28.96
For Knuckle Mount Or Trunnion Mount Base, Add	45.00	
26 56 23 00-0211 EA 20 System Watts, Surface Mount, LED Multi-Purpose Area Fixture (Lumark Crosstour® XTOR2A)	233.24	28.96
For Knuckle Mount Or Trunnion Mount Base, Add	45.00	
26 56 23 00-0212 EA 30 System Watts, Surface Mount, LED Multi-Purpose Area Fixture (Lumark Crosstour® XTOR3A)	294.90	28.96
For Knuckle Mount Or Trunnion Mount Base, Add	45.00	
26 56 23 00-0213 Surface Mount, LED Facade Fixtures <small>(26 56 23 00-0128)</small>		
26 56 23 00-0214 Surface Mount, LED Facade Fixtures (lumenpulse™ lumenfacade™) <small>(26 56 23 00-0213)</small>		
26 56 23 00-0215 EA 12" Length, Fixed Surface Mount, LED Façade Fixture (lumenpulse™ lumenfacade™).....	391.03	33.83
26 56 23 00-0216 EA 24" Length, Fixed Surface Mount, LED Façade Fixture (lumenpulse™ lumenfacade™).....	628.56	30.88
26 56 23 00-0217 EA 36" Length, Fixed Surface Mount, LED Façade Fixture (lumenpulse™ lumenfacade™).....	798.51	25.74
26 56 23 00-0218 EA 48" Length, Fixed Surface Mount, LED Façade Fixture (lumenpulse™ lumenfacade™).....	968.43	20.58
26 56 23 00-0219 Post Top, LED Area Fixtures <small>(26 56 23 00-0128)</small>		
26 56 23 00-0220 Post Top, LED Area Fixtures (Cooper Lighting Invue® MSA) <small>(26 56 23 00-0219)</small> Note: UL wet listed. Includes 4,000K color temperature, 120-480 voltage, 350mA remote driver, die-cast extruded aluminum housing assembly and white, black, grey, dark platinum, graphite metallic or bronze powder coat finish. Excludes sensors.		
26 56 23 00-0221 EA 1,800 Lumens, 27 System Watts, Post Top Mount, Acorn Style LED Area Fixture (Cooper Lighting Invue® MSA-CO1).....	1,117.70	123.14
26 56 23 00-0222 EA 3,400 Lumens, 54 System Watts, Post Top Mount, Acorn Style LED Area Fixture (Cooper Lighting Invue® MSA-CO2).....	1,228.88	123.14
26 56 23 00-0223 EA 77 System Watts, Post Top Mount, Acorn Style LED Area Fixture (Cooper Lighting Invue® MSA-CO3).....	1,316.77	123.14
26 56 23 00-0224 Post Top, LED Area Fixtures (General Electric EPAS) <small>(26 56 23 00-0219)</small> Note: UL wet listed. Includes 4,100K color temperature, 120-480 voltage, die-cast extruded aluminum housing assembly and black, green or bronze powder coat finish. Includes photocontrol sensor.		



Electrical	26	26
Lighting	26 50	
Exterior Lighting	26 56	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56 23 00-0225 EA 2,400 Lumens, 49 System Watts, Post Top Mount, Acorn Style LED Area Fixture (General Electric EPAS).....	2,194.57	123.14
26 56 23 00-0226 EA 4,600 Lumens, 86 System Watts, Post Top Mount, Acorn Style LED Area Fixture (General Electric EPAS).....	2,278.17	123.14
26 56 23 00-0227 Post Top, LED Area Fixtures (CREE® BetaLED® Edge® ARE-EDR) (26 56 23 00-0219)		
Note: UL wet listed. Includes 4,000K color temperature, 120/277 voltage, die-cast extruded aluminum housing assembly and white, black, silver or bronze powder coat finish. Excludes sensors.		
26 56 23 00-0228 EA 13,800 Lumens, 130 System Watts, Post Top Mount, LED Area Fixture (CREE® BetaLED® Edge® ARE-EDR)	1,847.50	123.14
26 56 23 00-0229 LED Retrofit For Post Top, Holophane® Utility Granville Acorn Area Fixtures (CREE® BetaLED® BXRAAH53) (26 56 23 00-0219)		
Note: Includes 4,000K color temperature and 120/277 voltage retrofit assembly. Excludes recycling or disposal of lamps and ballasts. See CSI section 02 84 16 00-0003 for ballast recycling, 26 01 50 51-0121 for disposal of hazardous lamps.		
26 56 23 00-0230 EA LED Retrofit For Post Top, Holophane® Utility Granville Acorn Area Fixtures (CREE® BetaLED® BXRAAH53).....	517.94	67.17
<i>For 0 To 10 Volt Dimming, Add</i>		
	37.15	
26 56 23 00-0231 LED Retrofit For Post Top, Decorative Area Fixtures (CREE® DPT) (26 56 23 00-0219)		
Note: Includes 3,000K color temperature and 120/277 voltage retrofit assembly. Excludes recycling or disposal of lamps and ballasts. See CSI section 02 84 16 00-0003 for ballast recycling, 26 01 50 51-0121 for disposal of hazardous lamps.		
26 56 23 00-0232 EA LED Retrofit For Post Top, Decorative Area Fixtures (CREE® DPT)	322.58	14.33
<i>For Backlight Control Shield, Add</i>		
	24.97	
26 56 23 00-0233 Induction Area Fixtures (26 56 23)		
26 56 23 00-0234 Post Top, Induction Area Fixtures (26 56 23 00-0233)		
26 56 23 00-0235 Post Top, Induction Area Fixtures (Crystal Lighting) (26 56 23 00-0234)		
Note: Includes black powder coat finish heavy duty die cast aluminum body and acrylic lens.		
26 56 23 00-0236 EA 65 Watt Induction, Post Top Mount, Acorn Style Area Fixture (Crystal Lighting CLP-ACRN).....	621.75	123.14
26 56 23 00-0237 EA 80 Watt Induction, Post Top Mount, Acorn Style Area Fixture (Crystal Lighting CLP-ACRN).....	686.90	123.14
26 56 23 00-0238 Post Top, Induction Area Fixtures (US Lighting Tech) (26 56 23 00-0234)		
Note: Includes black powder coat finish heavy duty die cast aluminum body and no-lite lid acrylic lens.		
26 56 23 00-0239 EA 40 Watt Induction, Post Top Mount, Acorn Style Area Fixture (US Lighting Tech Acorn, 571).....	644.94	123.14
26 56 23 00-0240 EA 70 Watt Induction, Post Top Mount, Acorn Style Area Fixture (US Lighting Tech Acorn, 571).....	708.99	123.14
26 56 23 00-0241 EA 100 Watt Induction, Post Top Mount, Acorn Style Area Fixture (US Lighting Tech Acorn, 571).....	708.99	123.14
26 56 23 00-0242 EA 150 Watt Induction, Post Top Mount, Acorn Style Area Fixture (US Lighting Tech Acorn, 571).....	708.99	123.14
26 56 23 00-0243 Surface Mount, Induction Parking Structure Fixtures (26 56 23 00-0233)		
26 56 23 00-0244 Surface Mount, Induction Parking Structure Fixtures (Everlast®) (26 56 23 00-0243)		
26 56 23 00-0245 EA 40 Watt Induction, Surface Mount, Round, Parking Structure Fixture (Everlast® Davenport EGFUS-EC).....	568.63	111.95
26 56 23 00-0246 EA 55 Watt Induction, Surface Mount, Round, Parking Structure Fixture (Everlast® Davenport EGFUS-EC).....	610.64	114.19
26 56 23 00-0247 EA 70 Watt Induction, Surface Mount, Round, Parking Structure Fixture (Everlast® Davenport EGFUS-EC).....	619.54	116.43
26 56 23 00-0248 EA 80 Watt Induction, Surface Mount, Round, Parking Structure Fixture (Everlast® Davenport EGFUS-EC).....	628.44	118.67
26 56 23 00-0249 EA 100 Watt Induction, Surface Mount, Round, Parking Structure Fixture (Everlast® Davenport EGFUS-EC).....	637.33	120.90
26 56 23 00-0250 EA 120 Watt Induction, Surface Mount, Round, Parking Structure Fixture (Everlast® Davenport EGFUS-EC).....	650.65	123.14
26 56 23 00-0251 EA 70/28 Watt Bi-Level Induction, Surface Mount, Round, Parking Structure Fixture (Everlast® Davenport EGFUS-EC).....	683.59	116.43
26 56 23 00-0252 EA 80/32 Watt Bi-Level Induction, Surface Mount, Round, Parking Structure Fixture (Everlast® Davenport EGFUS-EC).....	692.48	118.67
26 56 23 00-0253 EA 100/40 Watt Bi-Level Induction, Surface Mount, Round, Parking Structure Fixture (Everlast® Davenport EGFUS-EC).....	701.38	120.90
26 56 23 00-0254 EA 120/48 Watt Bi-Level Induction, Surface Mount, Round, Parking Structure Fixture (Everlast® Davenport EGFUS-EC).....	733.47	123.14
26 56 23 00-0255 Pole Mount, Induction Area Fixtures (26 56 23 00-0233)		
26 56 23 00-0256 Pole Mount, Bi-Level Induction Area Fixtures (Everlast® ESB-ED) (26 56 23 00-0255)		
Note: UL wet listed. Includes bi-level ballast, die-cast aluminum housing assembly and bronze powder coat finish. Excludes sensors.		
26 56 23 00-0257 EA 70 Watts, Pole Mount, Bi-Level Induction Area Fixture (Everlast® ESB-ED-70)	666.00	76.12
26 56 23 00-0258 EA 80 Watts, Pole Mount, Bi-Level Induction Area Fixture (Everlast® ESB-ED-80)	685.81	80.60
26 56 23 00-0259 EA 100 Watts, Pole Mount, Bi-Level Induction Area Fixture (Everlast® ESB-ED-100)	705.60	85.08
26 56 23 00-0260 Metal Halide Area Fixtures (26 56 23)		
26 56 23 00-0261 Pole Mount, Metal Halide Area Fixtures (26 56 23 00-0260)		
Note: Includes pulse start ballast.		
26 56 23 00-0262 EA 150 Watt, Metal Halide Area Fixture, Pole Mount.....	626.56	111.76
26 56 23 00-0263 EA 175 Watt, Metal Halide Area Fixture, Pole Mount.....	690.41	122.93
26 56 23 00-0264 EA 250 Watt, Metal Halide Area Fixture, Pole Mount.....	760.67	134.11
26 56 23 00-0265 EA 400 Watt, Metal Halide Area Fixture, Pole Mount.....	807.96	156.46



MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

26 56 23 00-0266	High Pressure Sodium Area Fixtures <small>(26 56 23)</small>		
26 56 23 00-0267	Pole Mount, High Pressure Sodium Area Fixtures <small>(26 56 23 00-0266)</small>		
26 56 23 00-0268	EA 100 Watt, High Pressure Sodium Area Fixture, Pole Mount	520.94	89.40
26 56 23 00-0269	EA 150 Watt, High Pressure Sodium Area Fixture, Pole Mount	574.04	111.76
26 56 23 00-0270	EA 250 Watt, High Pressure Sodium Area Fixture, Pole Mount	626.11	134.11
26 56 23 00-0271	EA 400 Watt, High Pressure Sodium Area Fixture, Pole Mount	669.36	156.46
26 56 23 00-0272	Area Lighting Accessories <small>(26 56 23)</small>		
26 56 23 00-0273	Outdoor Motion Sensors <small>(26 56 23 00-0272)</small>		
26 56 23 00-0274	EA 70' Range, 180 Degree Detection Zone, 8 Amp Switching Capacity, Polycarbonate Housing, Outdoor Motion Sensor (Lithonia OMS 1000)	73.79	20.14
26 56 23 00-0275	EA 70' Range, 200 Degree Detection Zone, 10 Amp Switching Capacity, Cast Aluminum Housing, Outdoor Motion Sensor (Lithonia OMS 2000)	79.86	20.14
26 56 23 00-0276	EA 30' Range, 360 Degree Detection Zone, Line Voltage, Plastic Housing, IP66 Rated, Outdoor Motion Sensor With Photocell (SensorSwitch SBOR).....	305.43	20.14
	<i>For Personal Protective Equipment (Arc Flash) When Working On Energized Equipment, Add</i>	<i>12.08</i>	
26 56 26	Landscape Lighting <small>(26 56)</small>		
26 56 26 00-0001	Bollards <small>(26 56 26)</small> Note: Excludes concrete base.		
26 56 26 00-0002	Aluminum Architectural Bollards <small>(26 56 26 00-0001)</small>		
26 56 26 00-0003	High Pressure Sodium, Aluminum Architectural Bollards <small>(26 56 26 00-0002)</small>		
26 56 26 00-0004	Square, High Pressure Sodium, Aluminum Architectural Bollards <small>(26 56 26 00-0003)</small>		
26 56 26 00-0005	EA 24" Overall Height, 6-3/4" Square, 35 Watt High Pressure Sodium, Aluminum Architectural Bollard	823.92	68.37
26 56 26 00-0006	EA 30" Overall Height, 6-3/4" Square, 35 Watt High Pressure Sodium, Aluminum Architectural Bollard	831.95	72.39
26 56 26 00-0007	EA 36" Overall Height, 6-3/4" Square, 35 Watt High Pressure Sodium, Aluminum Architectural Bollard	840.00	76.41
26 56 26 00-0008	EA 42" Overall Height, 6-3/4" Square, 35 Watt High Pressure Sodium, Aluminum Architectural Bollard	781.68	80.44
26 56 26 00-0009	EA 24" Overall Height, 6-3/4" Square, 50 Watt High Pressure Sodium, Aluminum Architectural Bollard	823.92	68.37
26 56 26 00-0010	EA 30" Overall Height, 6-3/4" Square, 50 Watt High Pressure Sodium, Aluminum Architectural Bollard	831.95	72.39
26 56 26 00-0011	EA 36" Overall Height, 6-3/4" Square, 50 Watt High Pressure Sodium, Aluminum Architectural Bollard	840.00	76.41
26 56 26 00-0012	EA 42" Overall Height, 6-3/4" Square, 50 Watt High Pressure Sodium, Aluminum Architectural Bollard	781.68	80.44
26 56 26 00-0013	EA 24" Overall Height, 6-3/4" Square, 70 Watt High Pressure Sodium, Aluminum Architectural Bollard	823.92	68.37
26 56 26 00-0014	EA 30" Overall Height, 6-3/4" Square, 70 Watt High Pressure Sodium, Aluminum Architectural Bollard	831.95	72.39
26 56 26 00-0015	EA 36" Overall Height, 6-3/4" Square, 70 Watt High Pressure Sodium, Aluminum Architectural Bollard	840.00	76.41
26 56 26 00-0016	EA 42" Overall Height, 6-3/4" Square, 70 Watt High Pressure Sodium, Aluminum Architectural Bollard	781.68	80.44
26 56 26 00-0017	EA 24" Overall Height, 6-3/4" Square, 100 Watt High Pressure Sodium, Aluminum Architectural Bollard	823.92	68.37
26 56 26 00-0018	EA 30" Overall Height, 6-3/4" Square, 100 Watt High Pressure Sodium, Aluminum Architectural Bollard	831.95	72.39
26 56 26 00-0019	EA 36" Overall Height, 6-3/4" Square, 100 Watt High Pressure Sodium, Aluminum Architectural Bollard	840.00	76.41
26 56 26 00-0020	EA 42" Overall Height, 6-3/4" Square, 100 Watt High Pressure Sodium, Aluminum Architectural Bollard	781.68	80.44
26 56 26 00-0021	Round, High Pressure Sodium, Aluminum Architectural Bollards <small>(26 56 26 00-0003)</small>		
26 56 26 00-0022	EA 24" Overall Height, 7" Diameter, 35 Watt High Pressure Sodium, Aluminum Architectural Bollard	793.45	68.37
26 56 26 00-0023	EA 30" Overall Height, 7" Diameter, 35 Watt High Pressure Sodium, Aluminum Architectural Bollard	801.48	72.39
26 56 26 00-0024	EA 36" Overall Height, 7" Diameter, 35 Watt High Pressure Sodium, Aluminum Architectural Bollard	809.53	76.41
26 56 26 00-0025	EA 42" Overall Height, 7" Diameter, 35 Watt High Pressure Sodium, Aluminum Architectural Bollard	750.93	80.44
26 56 26 00-0026	EA 24" Overall Height, 7" Diameter, 50 Watt High Pressure Sodium, Aluminum Architectural Bollard	793.45	68.37
26 56 26 00-0027	EA 30" Overall Height, 7" Diameter, 50 Watt High Pressure Sodium, Aluminum Architectural Bollard	801.48	72.39
26 56 26 00-0028	EA 36" Overall Height, 7" Diameter, 50 Watt High Pressure Sodium, Aluminum Architectural Bollard	809.53	76.41
26 56 26 00-0029	EA 42" Overall Height, 7" Diameter, 50 Watt High Pressure Sodium, Aluminum Architectural Bollard	750.93	80.44
26 56 26 00-0030	EA 24" Overall Height, 7" Diameter, 70 Watt High Pressure Sodium, Aluminum Architectural Bollard	793.45	68.37
26 56 26 00-0031	EA 30" Overall Height, 7" Diameter, 70 Watt High Pressure Sodium, Aluminum Architectural Bollard	801.48	72.39
26 56 26 00-0032	EA 36" Overall Height, 7" Diameter, 70 Watt High Pressure Sodium, Aluminum Architectural Bollard	809.53	76.41
26 56 26 00-0033	EA 42" Overall Height, 7" Diameter, 70 Watt High Pressure Sodium, Aluminum Architectural Bollard	750.93	80.44
26 56 26 00-0034	EA 24" Overall Height, 7" Diameter, 100 Watt High Pressure Sodium, Aluminum Architectural Bollard	793.45	68.37
26 56 26 00-0035	EA 30" Overall Height, 7" Diameter, 100 Watt High Pressure Sodium, Aluminum Architectural Bollard	801.48	72.39
26 56 26 00-0036	EA 36" Overall Height, 7" Diameter, 100 Watt High Pressure Sodium, Aluminum Architectural Bollard	809.53	76.41
26 56 26 00-0037	EA 42" Overall Height, 7" Diameter, 100 Watt High Pressure Sodium, Aluminum Architectural Bollard	750.93	80.44
26 56 26 00-0038	Metal Halide, Aluminum Architectural Bollards <small>(26 56 26 00-0002)</small>		
26 56 26 00-0039	Square, Metal Halide, Aluminum Architectural Bollards <small>(26 56 26 00-0038)</small>		
26 56 26 00-0040	EA 24" Overall Height, 6-3/4" Square, 50 Watt Metal Halide, Aluminum Architectural Bollard	863.49	68.37
26 56 26 00-0041	EA 30" Overall Height, 6-3/4" Square, 50 Watt Metal Halide, Aluminum Architectural Bollard	871.52	72.39
26 56 26 00-0042	EA 36" Overall Height, 6-3/4" Square, 50 Watt Metal Halide, Aluminum Architectural Bollard	879.57	76.41
26 56 26 00-0043	EA 42" Overall Height, 6-3/4" Square, 50 Watt Metal Halide, Aluminum Architectural Bollard	820.97	80.44
26 56 26 00-0044	EA 24" Overall Height, 6-3/4" Square, 70 Watt Metal Halide, Aluminum Architectural Bollard	863.49	68.37
26 56 26 00-0045	EA 30" Overall Height, 6-3/4" Square, 70 Watt Metal Halide, Aluminum Architectural Bollard	871.52	72.39
26 56 26 00-0046	EA 36" Overall Height, 6-3/4" Square, 70 Watt Metal Halide, Aluminum Architectural Bollard	879.57	76.41
26 56 26 00-0047	EA 42" Overall Height, 6-3/4" Square, 70 Watt Metal Halide, Aluminum Architectural Bollard	820.97	80.44
26 56 26 00-0048	EA 24" Overall Height, 6-3/4" Square, 100 Watt Metal Halide, Aluminum Architectural Bollard	863.49	68.37
26 56 26 00-0049	EA 30" Overall Height, 6-3/4" Square, 100 Watt Metal Halide, Aluminum Architectural Bollard	871.52	72.39



Electrical	26	26
Lighting	26 50	
Exterior Lighting	26 56	

MINOR		TOTAL DIRECT		DEMOLITION
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST
26 56 26 00-0050	EA	36" Overall Height, 6-3/4" Square, 100 Watt Metal Halide, Aluminum Architectural Bollard.....	879.57	76.41
26 56 26 00-0051	EA	42" Overall Height, 6-3/4" Square, 100 Watt Metal Halide, Aluminum Architectural Bollard.....	854.08	80.44
26 56 26 00-0052		Round, Metal Halide, Aluminum Architectural Bollards (26 56 26 00-0038)		
26 56 26 00-0053	EA	24" Overall Height, 7" Diameter, 50 Watt Metal Halide, Aluminum Architectural Bollard.....	832.74	68.37
26 56 26 00-0054	EA	30" Overall Height, 7" Diameter, 50 Watt Metal Halide, Aluminum Architectural Bollard.....	840.77	72.39
26 56 26 00-0055	EA	36" Overall Height, 7" Diameter, 50 Watt Metal Halide, Aluminum Architectural Bollard.....	848.82	76.41
26 56 26 00-0056	EA	42" Overall Height, 7" Diameter, 50 Watt Metal Halide, Aluminum Architectural Bollard.....	790.22	80.44
26 56 26 00-0057	EA	24" Overall Height, 7" Diameter, 70 Watt Metal Halide, Aluminum Architectural Bollard.....	832.74	68.37
26 56 26 00-0058	EA	30" Overall Height, 7" Diameter, 70 Watt Metal Halide, Aluminum Architectural Bollard.....	840.77	72.39
26 56 26 00-0059	EA	36" Overall Height, 7" Diameter, 70 Watt Metal Halide, Aluminum Architectural Bollard.....	848.82	76.41
26 56 26 00-0060	EA	42" Overall Height, 7" Diameter, 70 Watt Metal Halide, Aluminum Architectural Bollard.....	790.22	80.44
26 56 26 00-0061	EA	24" Overall Height, 7" Diameter, 100 Watt Metal Halide, Aluminum Architectural Bollard.....	832.74	68.37
26 56 26 00-0062	EA	30" Overall Height, 7" Diameter, 100 Watt Metal Halide, Aluminum Architectural Bollard.....	840.77	72.39
26 56 26 00-0063	EA	36" Overall Height, 7" Diameter, 100 Watt Metal Halide, Aluminum Architectural Bollard.....	848.82	76.41
26 56 26 00-0064	EA	42" Overall Height, 7" Diameter, 100 Watt Metal Halide, Aluminum Architectural Bollard.....	790.22	80.44
26 56 26 00-0065		Compact Fluorescent, Aluminum Architectural Bollards (26 56 26 00-0002)		
26 56 26 00-0066		Square, Compact Fluorescent, Aluminum Architectural Bollards (26 56 26 00-0065)		
26 56 26 00-0067	EA	24" Overall Height, 6-3/4" Square, 26 Watt Compact Fluorescent, Aluminum Architectural Bollard.....	820.45	68.37
26 56 26 00-0068	EA	30" Overall Height, 6-3/4" Square, 26 Watt Compact Fluorescent, Aluminum Architectural Bollard.....	828.48	72.39
26 56 26 00-0069	EA	36" Overall Height, 6-3/4" Square, 26 Watt Compact Fluorescent, Aluminum Architectural Bollard.....	836.53	76.41
26 56 26 00-0070	EA	42" Overall Height, 6-3/4" Square, 26 Watt Compact Fluorescent, Aluminum Architectural Bollard.....	778.84	80.44
26 56 26 00-0071	EA	24" Overall Height, 6-3/4" Square, 32 Watt Compact Fluorescent, Aluminum Architectural Bollard.....	820.45	68.37
26 56 26 00-0072	EA	30" Overall Height, 6-3/4" Square, 32 Watt Compact Fluorescent, Aluminum Architectural Bollard.....	828.48	72.39
26 56 26 00-0073	EA	36" Overall Height, 6-3/4" Square, 32 Watt Compact Fluorescent, Aluminum Architectural Bollard.....	836.53	76.41
26 56 26 00-0074	EA	42" Overall Height, 6-3/4" Square, 32 Watt Compact Fluorescent, Aluminum Architectural Bollard.....	778.84	80.44
26 56 26 00-0075	EA	24" Overall Height, 6-3/4" Square, 42 Watt Compact Fluorescent, Aluminum Architectural Bollard.....	820.45	68.37
26 56 26 00-0076	EA	30" Overall Height, 6-3/4" Square, 42 Watt Compact Fluorescent, Aluminum Architectural Bollard.....	828.48	72.39
26 56 26 00-0077	EA	36" Overall Height, 6-3/4" Square, 42 Watt Compact Fluorescent, Aluminum Architectural Bollard.....	836.53	76.41
26 56 26 00-0078	EA	42" Overall Height, 6-3/4" Square, 42 Watt Compact Fluorescent, Aluminum Architectural Bollard.....	778.84	80.44
26 56 26 00-0079		Round, Compact Fluorescent, Aluminum Architectural Bollards (26 56 26 00-0065)		
26 56 26 00-0080	EA	24" Overall Height, 7" Diameter, 26 Watt Compact Fluorescent, Aluminum Architectural Bollard.....	790.37	68.37
26 56 26 00-0081	EA	30" Overall Height, 7" Diameter, 26 Watt Compact Fluorescent, Aluminum Architectural Bollard.....	798.40	72.39
26 56 26 00-0082	EA	36" Overall Height, 7" Diameter, 26 Watt Compact Fluorescent, Aluminum Architectural Bollard.....	806.45	76.41
26 56 26 00-0083	EA	42" Overall Height, 7" Diameter, 26 Watt Compact Fluorescent, Aluminum Architectural Bollard.....	749.34	80.44
26 56 26 00-0084	EA	24" Overall Height, 7" Diameter, 32 Watt Compact Fluorescent, Aluminum Architectural Bollard.....	790.37	68.37
26 56 26 00-0085	EA	30" Overall Height, 7" Diameter, 32 Watt Compact Fluorescent, Aluminum Architectural Bollard.....	798.40	72.39
26 56 26 00-0086	EA	36" Overall Height, 7" Diameter, 32 Watt Compact Fluorescent, Aluminum Architectural Bollard.....	806.45	76.41
26 56 26 00-0087	EA	42" Overall Height, 7" Diameter, 32 Watt Compact Fluorescent, Aluminum Architectural Bollard.....	749.34	80.44
26 56 26 00-0088	EA	24" Overall Height, 7" Diameter, 42 Watt Compact Fluorescent, Aluminum Architectural Bollard.....	790.37	68.37
26 56 26 00-0089	EA	30" Overall Height, 7" Diameter, 42 Watt Compact Fluorescent, Aluminum Architectural Bollard.....	798.40	72.39
26 56 26 00-0090	EA	36" Overall Height, 7" Diameter, 42 Watt Compact Fluorescent, Aluminum Architectural Bollard.....	806.45	76.41
26 56 26 00-0091	EA	42" Overall Height, 7" Diameter, 42 Watt Compact Fluorescent, Aluminum Architectural Bollard.....	749.34	80.44
26 56 26 00-0092		LED, Aluminum Architectural Bollards (26 56 26 00-0002)		
26 56 26 00-0093		Square, LED, Aluminum Architectural Bollards (26 56 26 00-0092)		
26 56 26 00-0094	EA	24" Overall Height, 6-3/4" Square, 12 LEDs, LED, Aluminum Architectural Bollard.....	976.63	68.37
26 56 26 00-0095	EA	30" Overall Height, 6-3/4" Square, 12 LEDs, LED, Aluminum Architectural Bollard.....	984.66	72.39
26 56 26 00-0096	EA	36" Overall Height, 6-3/4" Square, 12 LEDs, LED, Aluminum Architectural Bollard.....	992.71	76.41
26 56 26 00-0097	EA	42" Overall Height, 6-3/4" Square, 12 LEDs, LED, Aluminum Architectural Bollard.....	935.85	80.44
26 56 26 00-0098	EA	24" Overall Height, 6-3/4" Square, 24 LEDs, LED, Aluminum Architectural Bollard.....	1,186.02	68.37
26 56 26 00-0099	EA	30" Overall Height, 6-3/4" Square, 24 LEDs, LED, Aluminum Architectural Bollard.....	1,194.05	72.39
26 56 26 00-0100	EA	36" Overall Height, 6-3/4" Square, 24 LEDs, LED, Aluminum Architectural Bollard.....	1,202.10	76.41
26 56 26 00-0101	EA	42" Overall Height, 6-3/4" Square, 24 LEDs, LED, Aluminum Architectural Bollard.....	1,144.20	80.44
26 56 26 00-0102		Round, LED, Aluminum Architectural Bollards (26 56 26 00-0092)		
26 56 26 00-0103	EA	24" Overall Height, 7" Diameter, 12 LEDs, LED, Aluminum Architectural Bollard.....	945.39	68.37
26 56 26 00-0104	EA	30" Overall Height, 7" Diameter, 12 LEDs, LED, Aluminum Architectural Bollard.....	953.42	72.39
26 56 26 00-0105	EA	36" Overall Height, 7" Diameter, 12 LEDs, LED, Aluminum Architectural Bollard.....	961.47	76.41
26 56 26 00-0106	EA	42" Overall Height, 7" Diameter, 12 LEDs, LED, Aluminum Architectural Bollard.....	903.57	80.44
26 56 26 00-0107	EA	24" Overall Height, 7" Diameter, 24 LEDs, LED, Aluminum Architectural Bollard.....	1,154.79	68.37
26 56 26 00-0108	EA	30" Overall Height, 7" Diameter, 24 LEDs, LED, Aluminum Architectural Bollard.....	1,162.82	72.39
26 56 26 00-0109	EA	36" Overall Height, 7" Diameter, 24 LEDs, LED, Aluminum Architectural Bollard.....	1,170.87	76.41
26 56 26 00-0110	EA	42" Overall Height, 7" Diameter, 24 LEDs, LED, Aluminum Architectural Bollard.....	1,113.33	80.44
26 56 26 00-0111		Reinforced Concrete Bollards (26 56 26 00-0001)		
26 56 26 00-0112	EA	48" Overall Height, 12" Diameter, LED Light, Reinforced Concrete Bollard.....	873.61	201.07
26 56 26 00-0113	EA	58" Overall Height, 18" Diameter, High Intensity Discharge (HID) Light, Reinforced Concrete Bollard.....	1,435.39	268.08

26	Electrical
26 50	Lighting
26 56	Exterior Lighting



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56 26 00-0114 Low Voltage <small>(26 56 26)</small>		
26 56 26 00-0115 EA Low Voltage Recessed Uplight	615.67	146.39
26 56 26 00-0116 EA Low Voltage Walkway	451.99	80.44
26 56 26 00-0117 EA Low Voltage Malibu - 5 Light Set	426.49	107.38
26 56 26 00-0118 EA Low Voltage Mushroom 24" Pier	377.88	80.44
26 56 26 00-0119 Recessed, Adjustable <small>(26 56 26)</small>		
26 56 26 00-0120 EA 150 Watt Incandescent Recessed, Adjustable	749.63	128.69
26 56 26 00-0121 EA 300 Watt Incandescent Recessed, Adjustable	829.03	128.69
26 56 26 00-0122 Recessed, Uplight <small>(26 56 26)</small>		
26 56 26 00-0123 EA 50 Watt Incandescent Recessed Uplight	659.65	128.69
26 56 26 00-0124 EA 150 Watt Incandescent Recessed Uplight	675.53	128.69
26 56 26 00-0125 EA 300 Watt Incandescent Recessed Uplight	723.16	128.69
26 56 26 00-0126 EA 500 Watt Quartz Recessed Uplight	717.87	128.69
26 56 26 00-0127 EA 5 Watt LED Recessed Uplight	639.49	128.69
26 56 26 00-0128 EA 15 Watt LED Recessed Uplight	697.81	128.69
26 56 26 00-0129 Recessed Wall Light <small>(26 56 26)</small>		
26 56 26 00-0130 EA 100 Watt Incandescent Recessed Wall Light	330.24	80.44
26 56 26 00-0131 EA 100 Watt Fluorescent Recessed Wall Light	314.36	80.44
26 56 26 00-0132 EA 100 Watt High Intensity Discharge (HID) Recessed Wall Light	527.06	107.38
26 56 26 00-0133 Step Lights <small>(26 56 26)</small>		
26 56 26 00-0134 EA Incandescent Step Light	271.57	64.35
26 56 26 00-0135 EA Fluorescent Step Light	324.54	64.35
26 56 26 00-0136 EA 5 Watt LED Step Light	348.36	64.35
26 56 26 00-0137 EA 15 Watt LED Step Light	410.56	64.35
26 56 26 00-0138 Tree Lights, Surface Adjustable <small>(26 56 26)</small>		
26 56 26 00-0139 EA 50 Watt Incandescent Tree Lights	595.87	107.38
26 56 26 00-0140 EA 100 Watt Incandescent Tree Lights	611.75	107.38
26 56 26 00-0141 EA 150 Watt Incandescent Tree Lights	745.18	160.86
26 56 26 00-0142 Underwater Lights <small>(26 56 26)</small>		
26 56 26 00-0143 EA 150 Watt, 120 Volt Underwater Lights	514.56	53.48
26 56 26 00-0144 EA 300 Watt, 120 Volt Underwater Lights	578.08	53.48
26 56 26 00-0145 EA 1,000 Watt, 120 Volt Underwater Lights	1,457.70	80.44
26 56 26 00-0146 EA 50 Watt, 12 V Underwater Lights	541.02	53.48
26 56 26 00-0147 EA 300 Watt, 12 V Underwater Lights	615.13	53.48
26 56 26 00-0148 EA Under Water Fountain Fixture, Set Of 6, 300 Watt, Incandescent	1,590.73	120.65
26 56 33 Walkway Lighting <small>(26 56)</small>		
26 56 33 00-0001 Incandescent Walkway <small>(26 56 33)</small>		
26 56 33 00-0002 EA Post Top 300 Watt Incandescent Walkway Fixture	340.45	74.80
26 56 33 00-0003 Metal Halide Walkway <small>(26 56 33)</small>		
26 56 33 00-0004 EA Post Top 100 Watt Metal Halide Walkway Fixture	521.83	117.59
26 56 33 00-0005 EA Post Top 150-175 Watt Metal Halide Walkway Fixture	555.32	121.85
26 56 33 00-0006 EA Post Top 250 Watt Metal Halide Walkway Fixture	603.87	126.52
26 56 33 00-0007 EA Post Top 400 Watt Metal Halide Walkway Fixture	645.31	136.74
26 56 33 00-0008 EA Round Luminaries 100 Watt Metal Halide Walkway Fixture	570.45	126.52
26 56 33 00-0009 EA Round Luminaries 150-175 Watt Metal Halide Walkway Fixture	586.13	117.59
26 56 33 00-0010 EA Round Luminaries 250 Watt Metal Halide Walkway Fixture	595.45	121.85
26 56 33 00-0011 EA Spherical 100 Watt Metal Halide Walkway Fixture	485.10	83.81
26 56 33 00-0012 EA Spherical 150-175 Watt Metal Halide Walkway Fixture	518.53	83.81
26 56 33 00-0013 EA Spherical 250 Watt Metal Halide Walkway Fixture	551.95	83.81
26 56 33 00-0014 EA Spherical 400 Watt Metal Halide Walkway Fixture	623.33	94.35
26 56 33 00-0015 EA Low Walkway 100 Watt Metal Halide Walkway Fixture	468.15	75.28
26 56 33 00-0016 High Pressure Sodium Walkway <small>(26 56 33)</small>		
26 56 33 00-0017 EA Post Top 100 Watt High Pressure Sodium Walkway Fixture	459.13	117.59
26 56 33 00-0018 EA Post Top 150-175 Watt High Pressure Sodium Walkway Fixture	487.16	121.85
26 56 33 00-0019 EA Post Top 250 Watt High Pressure Sodium Walkway Fixture	527.10	126.52
26 56 33 00-0020 EA Post Top 400 Watt High Pressure Sodium Walkway Fixture	563.99	136.74
26 56 33 00-0021 EA Round Luminaries 100 Watt High Pressure Sodium Walkway Fixture	500.99	126.52
26 56 33 00-0022 EA Round Luminaries 150-175 Watt High Pressure Sodium Walkway Fixture	509.36	117.59
26 56 33 00-0023 EA Round Luminaries 250 Watt High Pressure Sodium Walkway Fixture	518.51	121.85
26 56 33 00-0024 EA Spherical 100 Watt High Pressure Sodium Walkway Fixture	415.64	83.81



Electrical	26	26
Lighting	26 50	
Exterior Lighting	26 56	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56 33 00-0025 EA Spherical 175 150-Watt High Pressure Sodium Walkway Fixture	441.76	83.81
26 56 33 00-0026 EA Spherical 250 Watt High Pressure Sodium Walkway Fixture	467.87	83.81
26 56 33 00-0027 EA Spherical 400 Watt High Pressure Sodium Walkway Fixture	528.28	94.35
26 56 33 00-0028 EA Low Walkway 100 Watt High Pressure Sodium Walkway Fixture.....	398.69	75.28
26 56 33 00-0029 Walkway, Adjustable <small>(26 56 33)</small>		
26 56 33 00-0030 EA 2' Fluorescent Adjustable Walkway Fixture	495.11	107.38
26 56 33 00-0031 EA 4' Fluorescent Adjustable Walkway Fixture	511.60	107.38
26 56 33 00-0032 EA 8' Fluorescent Adjustable Walkway Fixture	904.40	160.86
26 56 33 00-0033 EA 50 Watt Incandescent Adjustable Walkway Fixture	424.71	80.44
26 56 33 00-0034 EA 150 Watt Incandescent Adjustable Walkway Fixture	446.70	80.44
26 56 33 00-0035 Wall Or Post Mounted, Outdoor Area Lighting (Prisma Lighting) <small>(26 56 33)</small>		
Note: Excludes posts.		
26 56 33 00-0036 EA 42 Watt Compact Fluorescent, Wet Location, Aluminum Construction, Wall Luminaire (Prisma Nikko +45/G).....	510.76	28.20
26 56 33 00-0037 LED Walkway <small>(26 56 33)</small>		
26 56 33 00-0038 LED Pathway Fixtures (CREE® BetaLED® Edge® PWY-EDG) <small>(26 56 33 00-0037)</small>		
Note: UL wet listed. Includes 5,700K color temperature, 120/277 voltage, 350mA driver, die-cast extruded aluminum housing assembly and white, black, silver or bronze powder coat finish. Excludes sensors.		
26 56 33 00-0039 EA 13" Height, 1,248 Lumens, 22 System Watts, LED Pathway Fixture (CREE® BetaLED® Edge® PWY-EDG).....	690.94	61.76
For Multi-Level Drive Currents, Add		164.64
26 56 33 00-0040 EA 18" Height, 1,248 Lumens, 22 System Watts, LED Pathway Fixture (CREE® BetaLED® Edge® PWY-EDG).....	714.46	61.76
For Multi-Level Drive Currents, Add		164.64
26 56 33 00-0041 EA 36" Height, 1,248 Lumens, 22 System Watts, LED Pathway Fixture (CREE® BetaLED® Edge® PWY-EDG).....	754.44	61.76
For Multi-Level Drive Currents, Add		164.64
26 56 33 00-0042 EA 42" Height, 1,248 Lumens, 22 System Watts, LED Pathway Fixture (CREE® BetaLED® Edge® PWY-EDG).....	785.02	61.76
For Multi-Level Drive Currents, Add		164.64
26 56 33 00-0043 EA 96" Height, 1,248 Lumens, 22 System Watts, LED Pathway Fixture (CREE® BetaLED® Edge® PWY-EDG).....	901.46	79.41
For Multi-Level Drive Currents, Add		164.64
26 56 36 Flood Lighting <small>(26 56)</small>		
26 56 36 00-0001 General Electric Powerflood® Flood Lights <small>(26 56 36)</small>		
26 56 36 00-0002 MPF (Small Size) Series GE Flood Lights <small>(26 56 36 00-0001)</small>		
Note: For perimeters, entrances, building facades and sign lighting. Includes die-cast aluminum housing, corrosion resistant polyester powder finish and thermal shock resistant lens. Anodized aluminum reflector. 1/2" threaded mounting knuckle.		
26 56 36 00-0003 High Pressure Sodium MPF Series GE Flood Lights <small>(26 56 36 00-0002)</small>		
26 56 36 00-0004 EA 70 Watt High Pressure Sodium MPF Series GE Flood Light	220.45	67.06
26 56 36 00-0005 EA 100 Watt High Pressure Sodium MPF Series GE Flood Light	222.18	67.06
26 56 36 00-0006 EA 150 Watt High Pressure Sodium MPF Series GE Flood Light	225.05	67.06
26 56 36 00-0007 Metal Halide MPF Series GE Flood Lights <small>(26 56 36 00-0002)</small>		
26 56 36 00-0008 EA 70 Watt Metal Halide MPF Series GE Flood Light	288.95	67.06
26 56 36 00-0009 P-154 (Small Size) Series GE Flood Lights <small>(26 56 36 00-0001)</small>		
Note: For parking lots, building security, building facades, recreation areas and sign lighting. Includes die-cast aluminum housing, corrosion resistant polyester powder finish and thermal shock resistant lens. Anodized aluminum reflector. Yoke or slip fitter mounting.		
26 56 36 00-0010 High Pressure Sodium P-154 Series GE Flood Lights <small>(26 56 36 00-0009)</small>		
26 56 36 00-0011 EA 70 Watt High Pressure Sodium P-154 Series GE Flood Light	426.90	89.40
26 56 36 00-0012 EA 100 Watt High Pressure Sodium P-154 Series GE Flood Light	429.21	89.40
26 56 36 00-0013 EA 150 Watt High Pressure Sodium P-154 Series GE Flood Light	433.24	89.40
26 56 36 00-0014 EA 250 Watt High Pressure Sodium P-154 Series GE Flood Light	478.71	89.40
26 56 36 00-0015 EA 400 Watt High Pressure Sodium P-154 Series GE Flood Light	491.95	89.40
26 56 36 00-0016 Metal Halide P-154 Series GE Flood Lights <small>(26 56 36 00-0009)</small>		
26 56 36 00-0017 EA 175 Watt Metal Halide P-154 Series GE Flood Light	422.87	89.40
26 56 36 00-0018 EA 250 Watt Metal Halide P-154 Series GE Flood Light	443.02	89.40
26 56 36 00-0019 EA 400 Watt Metal Halide P-154 Series GE Flood Light	453.38	89.40
26 56 36 00-0020 PF-154 (Medium Size) Series GE Flood Lights <small>(26 56 36 00-0001)</small>		
Note: For parking lots, building security and building facades. Includes die-cast aluminum housing, corrosion resistant polyester powder finish and thermal shock resistant lens. Anodized aluminum reflector. Yoke or slip fitter mounting.		
26 56 36 00-0021 High Pressure Sodium PF-154 Series GE Flood Lights <small>(26 56 36 00-0020)</small>		
26 56 36 00-0022 EA 70 Watt High Pressure Sodium PF-154 Series GE Flood Light	439.47	100.58
26 56 36 00-0023 EA 100 Watt High Pressure Sodium PF-154 Series GE Flood Light	442.35	100.58
26 56 36 00-0024 EA 150 Watt High Pressure Sodium PF-154 Series GE Flood Light	446.95	100.58

26	Electrical
26 50	Lighting
26 56	Exterior Lighting



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56 36 00-0025 EA 250 Watt High Pressure Sodium PF-154 Series GE Flood Light	491.85	100.58
26 56 36 00-0026 EA 400 Watt High Pressure Sodium PF-154 Series GE Flood Light	504.51	100.58
26 56 36 00-0027 Metal Halide PF-154 GE Flood Lights (26 56 36 00-0020)		
26 56 36 00-0028 EA 175 Watt Metal Halide PF-154 Series GE Flood Light	436.01	100.58
26 56 36 00-0029 EA 250 Watt Metal Halide PF-154 Series GE Flood Light	455.59	100.58
26 56 36 00-0030 EA 400 Watt Metal Halide PF-154 Series GE Flood Light	465.95	100.58
26 56 36 00-0031 PF-400 (Medium Size) Series GE Flood Lights (26 56 36 00-0001)		
Note: For parking lots, building security, building facades, shipping yards and rail yards. Includes die-cast aluminum housing, corrosion resistant polyester powder finish and thermal shock resistant lens. Formed aluminum reflector. Yoke or slip fitter mounting.		
26 56 36 00-0032 High Pressure Sodium PF-400 Series GE Flood Lights (26 56 36 00-0031)		
26 56 36 00-0033 EA 150 Watt High Pressure Sodium PF-400 Series GE Flood Light	575.31	100.58
26 56 36 00-0034 EA 200 Watt High Pressure Sodium PF-400 Series GE Flood Light	615.60	100.58
26 56 36 00-0035 EA 250 Watt High Pressure Sodium PF-400 Series GE Flood Light	612.72	100.58
26 56 36 00-0036 EA 400 Watt High Pressure Sodium PF-400 Series GE Flood Light	627.11	100.58
26 56 36 00-0037 Metal Halide PF-400 GE Flood Lights (26 56 36 00-0031)		
26 56 36 00-0038 EA 175 Watt Metal Halide PF-400 Series GE Flood Light	590.28	100.58
26 56 36 00-0039 EA 250 Watt Metal Halide PF-400 Series GE Flood Light	602.36	100.58
26 56 36 00-0040 EA 400 Watt Metal Halide PF-400 Series GE Flood Light	615.03	100.58
26 56 36 00-0041 PF-1000 (Large Size) Series GE Flood Lights (26 56 36 00-0001)		
Note: For parking lots, industrial yards and sports stadiums. Includes die-cast aluminum housing, corrosion resistant polyester powder finish and thermal shock resistant lens. Formed aluminum reflector. Yoke or slip fitter mounting.		
26 56 36 00-0042 High Pressure Sodium PF-1000 Series GE Flood Lights (26 56 36 00-0041)		
26 56 36 00-0043 EA 750 Watt High Pressure Sodium PF-1000 Series GE Flood Light	769.76	111.76
26 56 36 00-0044 EA 1,000 Watt High Pressure Sodium PF-1000 Series GE Flood Light	769.76	111.76
26 56 36 00-0045 Metal Halide PF-1000 Series GE Flood Lights (26 56 36 00-0041)		
26 56 36 00-0046 EA 1,000 Watt Metal Halide PF-1000 Series GE Flood Light	736.38	111.76
26 56 36 00-0047 HLU/VLU (Medium Size) FRP Series GE Flood Lights (26 56 36 00-0001)		
Note: For parking lots, industrial yards, construction sites, recreation areas and facades. Includes corrosion resistant reinforced polyester housing and thermal shock resistant lens. Hydroformed aluminum reflector. Yoke or slip fitter mounting.		
26 56 36 00-0048 High Pressure Sodium HLU/VLU FRP Series GE Flood Lights (26 56 36 00-0047)		
26 56 36 00-0049 EA 250 Watt High Pressure Sodium HLU/VLU FRP Series GE Flood Light	630.57	100.58
26 56 36 00-0050 EA 400 Watt High Pressure Sodium HLU/VLU FRP Series GE Flood Light	641.50	100.58
26 56 36 00-0051 Metal Halide HLU/VLU Series GE Flood Lights (26 56 36 00-0047)		
26 56 36 00-0052 EA 400 Watt Metal Halide HLU/VLU FRP Series GE Flood Light	636.90	100.58
26 56 36 00-0053 Accessories For Powerflood GE Flood Lights (26 56 36 00-0001)		
26 56 36 00-0054 EA Wireguard For Powerflood GE Flood Light	110.90	22.35
26 56 36 00-0055 EA Polycarbonate Vandal Shield For Powerflood GE Flood Light	68.31	22.35
26 56 36 00-0056 EA Top Visor For Powerflood Flood Light	94.79	22.35
26 56 36 00-0057 EA Top And Two Side Visors For Powerflood GE Flood Light	74.64	22.35
26 56 36 00-0058 EA Pipe Wall Mounting Bracket For Powerflood GE Flood Light	192.82	67.06
26 56 36 00-0059 EA Multiple Mounting Channel For Powerflood GE Flood Light	80.97	22.35
26 56 36 00-0060 EA Wall Or Flat Surface Bracket For Powerflood GE Flood Light	149.65	67.06
26 56 36 00-0061 EA Steel Angle Bracket For Powerflood GE Flood Light	154.83	67.06
26 56 36 00-0062 EA Cross Arm Adaptor For Powerflood GE Flood Light	63.13	22.35
26 56 36 00-0063 EA 120/240 Volt, 277 Volt, NEMA Twistlock Photocontrol For Powerflood GE Flood Light	61.40	22.35
26 56 36 00-0064 Lithonia Contour Series Flood Lights (26 56 36)		
26 56 36 00-0065 TFM (Small Size) Series Lithonia Flood Lights (26 56 36 00-0064)		
Note: For signs, flags, facades and landscaping. Includes die-cast aluminum housing, corrosion resistant polyester powder finish and thermal shock resistant lens. Faceted parabolic optics. 1/2" threaded mounting knuckle.		
26 56 36 00-0066 High Pressure Sodium TFM Series Lithonia Flood Lights (26 56 36 00-0065)		
26 56 36 00-0067 EA 70 Watt High Pressure Sodium TFM Series Lithonia Flood Light	396.26	89.40
26 56 36 00-0068 EA 100 Watt High Pressure Sodium TFM Series Lithonia Flood Light	429.49	89.40
26 56 36 00-0069 EA 150 Watt High Pressure Sodium TFM Series Lithonia Flood Light	462.04	89.40



Electrical	26	26
Lighting	26 50	
Exterior Lighting	26 56	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56 36 00-0070 Metal Halide TFM Series Lithonia Flood Lights (26 56 36 00-0065)		
26 56 36 00-0071 EA 50 Watt Metal Halide TFM Series Lithonia Flood Light.....	502.65	89.40
26 56 36 00-0072 EA 70 Watt Metal Halide TFM Series Lithonia Flood Light.....	494.65	89.40
26 56 36 00-0073 EA 100 Watt Metal Halide TFM Series Lithonia Flood Light.....	481.76	89.40
26 56 36 00-0074 EA 175 Watt Metal Halide TFM Series Lithonia Flood Light.....	480.80	89.40
26 56 36 00-0075 Compact Fluorescent TFM Series Lithonia Flood Lights (26 56 36 00-0065)		
26 56 36 00-0076 EA 42 Watt Compact Fluorescent TFM Series Lithonia Flood Light.....	499.34	89.40
26 56 36 00-0077 TFL (Medium Size) Series Lithonia Flood Lights (26 56 36 00-0064)		
Note: For recreation areas, parking lots, building facades and car lots. Includes die-cast aluminum housing, corrosion resistant polyester powder finish and thermal shock resistant lens. Anodized aluminum reflector. Yoke or slip fitter mounting.		
26 56 36 00-0078 High Pressure Sodium TFL Series Lithonia Flood Lights (26 56 36 00-0077)		
26 56 36 00-0079 EA 250 Watt High Pressure Sodium TFL Series Lithonia Flood Light.....	591.80	100.58
26 56 36 00-0080 EA 400 Watt High Pressure Sodium TFL Series Lithonia Flood Light.....	602.88	100.58
26 56 36 00-0081 Metal Halide TFL Series Lithonia Flood Lights (26 56 36 00-0077)		
26 56 36 00-0082 EA 175 Watt Metal Halide TFL Series Lithonia Flood Light.....	566.88	100.58
26 56 36 00-0083 EA 250 Watt Metal Halide TFL Series Lithonia Flood Light.....	566.88	100.58
26 56 36 00-0084 EA 400 Watt Metal Halide TFL Series Lithonia Flood Light.....	584.27	100.58
26 56 36 00-0085 TFR (Low Profile) Series Lithonia Flood Lights (26 56 36 00-0064)		
Note: For recreation areas, parking lots, building facades and car lots. Includes die-cast aluminum housing, corrosion resistant polyester powder finish and thermal shock resistant lens. Anodized aluminum reflector. Yoke or slip fitter mounting.		
26 56 36 00-0086 High Pressure Sodium TFR Lithonia Flood Lights (26 56 36 00-0085)		
26 56 36 00-0087 EA 150 Watt High Pressure Sodium Horizontal TFR Series Lithonia Flood Light.....	563.92	89.40
26 56 36 00-0088 EA 250 Watt High Pressure Sodium Horizontal TFR Series Lithonia Flood Light.....	580.51	89.40
26 56 36 00-0089 EA 400 Watt High Pressure Sodium Horizontal TFR Series Lithonia Flood Light.....	594.37	89.40
26 56 36 00-0090 Metal Halide TFR Lithonia Flood Lights (26 56 36 00-0085)		
26 56 36 00-0091 EA 250 Watt Metal Halide TFR Series Lithonia Flood Light.....	558.37	89.40
26 56 36 00-0092 EA 400 Watt Metal Halide TFR Series Lithonia Flood Light.....	574.98	89.40
26 56 36 00-0093 TFA (Large Size) Series Lithonia Flood Lights (26 56 36 00-0064)		
Note: For industrial yards, parking lots, construction sites, streets and recreational areas. Includes die-cast aluminum housing, corrosion resistant polyester powder finish and thermal shock resistant lens. Anodized aluminum reflector. Yoke or slip fitter mounting.		
26 56 36 00-0094 High Pressure Sodium TFA Series Lithonia Flood Lights (26 56 36 00-0093)		
26 56 36 00-0095 EA 1,000 Watt High Pressure Sodium TFA Series Lithonia Flood Light.....	1,068.36	111.76
26 56 36 00-0096 Metal Halide TFA Series Lithonia Flood Lights (26 56 36 00-0093)		
26 56 36 00-0097 EA 400 Watt Metal Halide TFA Series Lithonia Flood Light.....	832.91	111.76
26 56 36 00-0098 EA 1,000 Watt Metal Halide TFA Series Lithonia Flood Light.....	916.00	111.76
26 56 36 00-0099 Accessories For Contour Series Lithonia Flood Lights (26 56 36 00-0064)		
26 56 36 00-0100 EA Wireguard For Contour Series Lithonia Flood Light.....	96.94	22.35
26 56 36 00-0101 EA Vandal Guard For Contour Series Lithonia Flood Light.....	178.50	22.35
26 56 36 00-0102 EA Upper Visor For Contour Series Lithonia Flood Light.....	81.55	22.35
26 56 36 00-0103 EA Full Visor For Contour Series Lithonia Flood Light.....	106.47	22.35
26 56 36 00-0104 EA Pipe Wall Mounting Bracket For Contour Series Lithonia Flood Light.....	244.89	67.06
26 56 36 00-0105 EA Radius Wall Bracket For Contour Series Lithonia Flood Light.....	200.79	67.06
26 56 36 00-0106 EA Steel Angle Bracket For Contour Series Lithonia Flood Light.....	200.79	67.06
26 56 36 00-0107 EA U Bolt Wall Bracket For Contour Series Lithonia Flood Light, Mounts To 2" Pipe.....	218.38	67.06
26 56 36 00-0108 EA Crossarm Adapter For Horizontal Mounted Contour Lithonia Series Flood Light.....	93.15	22.35
26 56 36 00-0109 EA 120/240 Volt, 277 Volt, NEMA Twistlock Photocontrol For Contour Lithonia Series Flood Light.....	76.25	22.35
26 56 36 00-0110 Ruud Flood Lights (26 56 36)		
26 56 36 00-0111 NS (Micro) Series Ruud Flood Lights (26 56 36 00-0110)		
Note: Provides conventional floodlighting, 1/2" threaded mounting knuckle.		
26 56 36 00-0112 High Pressure Sodium NS Series Ruud Flood Lights (26 56 36 00-0111)		
26 56 36 00-0113 EA 35 Watt High Pressure Sodium NS Series Ruud Flood Light.....	264.20	67.06
26 56 36 00-0114 EA 50 Watt High Pressure Sodium NS Series Ruud Flood Light.....	264.20	67.06
26 56 36 00-0115 EA 70 Watt High Pressure Sodium NS Series Ruud Flood Light.....	264.20	67.06
26 56 36 00-0116 EA 100 Watt High Pressure Sodium NS Series Ruud Flood Light.....	264.20	67.06
26 56 36 00-0117 EA 150 Watt High Pressure Sodium NS Series Ruud Flood Light.....	264.20	67.06



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56 36 00-0118	Metal Halide NS Series Ruud Flood Lights (26 56 36 00-0111)	
26 56 36 00-0119 EA 50 Watt Metal Halide NS Series Ruud Flood Light	296.43	67.06
26 56 36 00-0120 EA 70 Watt Metal Halide NS Series Ruud Flood Light	296.43	67.06
26 56 36 00-0121 EA 100 Watt Metal Halide NS Series Ruud Flood Light	296.43	67.06
26 56 36 00-0122	Compact Fluorescent NS Series Ruud Flood Lights (26 56 36 00-0111)	
26 56 36 00-0123 EA 13 Watt Compact Fluorescent NS Series Ruud Flood Light	230.81	67.06
26 56 36 00-0124 EA 26 Watt Compact Fluorescent NS Series Ruud Flood Light	238.87	67.06
26 56 36 00-0125 EA 32 Watt Compact Fluorescent NS Series Ruud Flood Light	241.17	67.06
26 56 36 00-0126 EA 42 Watt Compact Fluorescent NS Series Ruud Flood Light	243.47	67.06
26 56 36 00-0127	NSF/NSW/NSC (Standard, Wide And Cutoff Micro) Series Ruud Flood Lights (26 56 36 00-0110)	
Note: The NSF is suited for large open areas and façade applications. The NSW is suited for roadway applications, parking areas or security. The NSC is designed for parking lot and outdoor sports areas. Yoke or slip fitter mounting.		
26 56 36 00-0128	High Pressure Sodium NSF/NSW/NSC Series Ruud Flood Lights (26 56 36 00-0127)	
26 56 36 00-0129 EA 150 Watt High Pressure Sodium NSF/NSW/NSC Series Ruud Flood Light	406.08	100.58
26 56 36 00-0130 EA 250 Watt High Pressure Sodium NSF/NSW/NSC Series Ruud Flood Light	426.81	100.58
26 56 36 00-0131 EA 400 Watt High Pressure Sodium NSF/NSW/NSC Series Ruud Flood Light	438.32	100.58
26 56 36 00-0132	Metal Halide NSF/NSW/NSC Series Ruud Flood Lights (26 56 36 00-0127)	
26 56 36 00-0133 EA 175 Watt Metal Halide NSF/NSW/NSC Series Ruud Flood Light	401.48	100.58
26 56 36 00-0134 EA 250 Watt Metal Halide NSF/NSW/NSC Series Ruud Flood Light	403.78	100.58
26 56 36 00-0135 EA 400 Watt Metal Halide NSF/NSW/NSC Series Ruud Flood Light	410.69	100.58
26 56 36 00-0136	Compact Fluorescent NSF/NSW/NSC Series Ruud Flood Lights (26 56 36 00-0127)	
26 56 36 00-0137 EA 70 Watt Compact Fluorescent NSF/NSW/NSC Series Ruud Flood Light	393.42	100.58
26 56 36 00-0138	FS (Square) Series Ruud Flood Lights (26 56 36 00-0110)	
Note: For signs, large open areas and façade applications. Yoke or slip fitter mounting.		
26 56 36 00-0139	High Pressure Sodium FS Series Ruud Flood Lights (26 56 36 00-0138)	
26 56 36 00-0140 EA 250 Watt High Pressure Sodium FS Series Ruud Flood Light	467.10	100.58
26 56 36 00-0141 EA 400 Watt High Pressure Sodium FS Series Ruud Flood Light	469.40	100.58
26 56 36 00-0142 EA 1,000 Watt High Pressure Sodium FS Series Ruud Flood Light	770.34	111.76
26 56 36 00-0143	Metal Halide FS Series Ruud Flood Lights (26 56 36 00-0138)	
26 56 36 00-0144 EA 175 Watt Metal Halide FS Series Ruud Flood Light	467.10	100.58
26 56 36 00-0145 EA 250 Watt Metal Halide FS Series Ruud Flood Light	469.40	100.58
26 56 36 00-0146 EA 400 Watt Metal Halide FS Series Ruud Flood Light	476.31	100.58
26 56 36 00-0147 EA 1,000 Watt Metal Halide FS Series Ruud Flood Light	694.36	111.76
26 56 36 00-0148	MFS (Mini Square) Series Ruud Flood Lights (26 56 36 00-0110)	
Note: For signs, large open areas and façade applications. Yoke or slip fitter mounting.		
26 56 36 00-0149	High Pressure Sodium MFS Series Ruud Flood Lights (26 56 36 00-0148)	
26 56 36 00-0150 EA 35 Watt High Pressure Sodium MFS Series Ruud Flood Light	371.07	89.40
26 56 36 00-0151 EA 50 Watt High Pressure Sodium MFS Series Ruud Flood Light	395.25	89.40
26 56 36 00-0152 EA 70 Watt High Pressure Sodium MFS Series Ruud Flood Light	395.25	89.40
26 56 36 00-0153 EA 100 Watt High Pressure Sodium MFS Series Ruud Flood Light	395.25	89.40
26 56 36 00-0154 EA 150 Watt High Pressure Sodium MFS Series Ruud Flood Light	395.25	89.40
26 56 36 00-0155	Metal Halide MFS Series Ruud Flood Lights (26 56 36 00-0148)	
26 56 36 00-0156 EA 50 Watt Metal Halide MFS Series Ruud Flood Light	403.30	89.40
26 56 36 00-0157 EA 70 Watt Metal Halide MFS Series Ruud Flood Light	403.30	89.40
26 56 36 00-0158 EA 100 Watt Metal Halide MFS Series Ruud Flood Light	403.30	89.40
26 56 36 00-0159 EA 175 Watt Metal Halide MFS Series Ruud Flood Light	390.64	89.40
26 56 36 00-0160	MCF/MPM/MPN (Mini Cutoff, Parabolic Medium And Narrow Mini Square) Series Ruud Flood Lights (26 56 36 00-0110)	
Note: The MCF is suited for parking lots, volleyball courts and tennis courts. The MPM and MPN are suited for flagpoles, columns and narrow signs. Yoke or slip fitter mounting.		
26 56 36 00-0161	High Pressure Sodium MCF/MPM/MPN Series Ruud Flood Lights (26 56 36 00-0160)	
26 56 36 00-0162 EA 35 Watt High Pressure Sodium MCF/MPM/MPN Series Ruud Flood Light	399.85	89.40
26 56 36 00-0163 EA 50 Watt High Pressure Sodium MCF/MPM/MPN Series Ruud Flood Light	424.03	89.40
26 56 36 00-0164 EA 70 Watt High Pressure Sodium MCF/MPM/MPN Series Ruud Flood Light	424.03	89.40
26 56 36 00-0165 EA 100 Watt High Pressure Sodium MCF/MPM/MPN Series Ruud Flood Light	424.03	89.40



Electrical	26	26
Lighting	26 50	
Exterior Lighting	26 56	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56 36 00-0166 EA 150 Watt High Pressure Sodium MCF/MPM/MPN Series Ruud Flood Light	424.03	89.40
26 56 36 00-0167 Metal Halide MCF/MPM/MPN Series Ruud Flood Lights <small>(26 56 36 00-0160)</small>		
26 56 36 00-0168 EA 50 Watt Metal Halide MCF/MPM/MPN Series Ruud Flood Light	432.08	89.40
26 56 36 00-0169 EA 70 Watt Metal Halide MCF/MPM/MPN Series Ruud Flood Light	432.08	89.40
26 56 36 00-0170 EA 100 Watt Metal Halide MCF/MPM/MPN Series Ruud Flood Light	432.08	89.40
26 56 36 00-0171 EA 175 Watt Metal Halide MCF/MPM/MPN Series Ruud Flood Light	419.42	89.40
26 56 36 00-0172 CF (Cutoff Square) Series Ruud Flood Lights <small>(26 56 36 00-0110)</small>		
<small>Note: The CF is suited for parking lots, volleyball courts and tennis courts. Yoke or slip fitter mounting.</small>		
26 56 36 00-0173 High Pressure Sodium CF Series Ruud Flood Lights <small>(26 56 36 00-0172)</small>		
26 56 36 00-0174 EA 250 Watt High Pressure Sodium CF Series Ruud Flood Light.....	521.20	100.58
26 56 36 00-0175 EA 400 Watt High Pressure Sodium CF Series Ruud Flood Light.....	532.72	100.58
26 56 36 00-0176 EA 1,000 Watt High Pressure Sodium CF Series Ruud Flood Light.....	799.12	111.76
26 56 36 00-0177 Metal Halide CF Series Ruud Flood Lights <small>(26 56 36 00-0172)</small>		
26 56 36 00-0178 EA 175 Watt Metal Halide CF Series Ruud Flood Light	495.88	100.58
26 56 36 00-0179 EA 250 Watt Metal Halide CF Series Ruud Flood Light	498.18	100.58
26 56 36 00-0180 EA 400 Watt Metal Halide CF Series Ruud Flood Light	505.09	100.58
26 56 36 00-0181 EA 1,000 Watt Metal Halide CF Series Ruud Flood Light	723.14	111.76
26 56 36 00-0182 CN (Narrow Beam Cutoff Square) Series Ruud Flood Lights <small>(26 56 36 00-0110)</small>		
<small>Note: The CN is suited for large sports fields, building facades and signs. Yoke or slip fitter mounting.</small>		
26 56 36 00-0183 High Pressure Sodium CN Series Ruud Flood Lights <small>(26 56 36 00-0182)</small>		
26 56 36 00-0184 EA 400 High Pressure Sodium CN Series Ruud Flood Light	665.58	111.76
26 56 36 00-0185 EA 1,000 High Pressure Sodium CN Series Ruud Flood Light.....	785.31	111.76
26 56 36 00-0186 Metal Halide CN Series Ruud Flood Lights <small>(26 56 36 00-0182)</small>		
26 56 36 00-0187 EA 400 Watt Metal Halide CN Series Ruud Flood Light.....	637.95	111.76
26 56 36 00-0188 EA 1,000 Watt Metal Halide CN Series Ruud Flood Light.....	709.33	111.76
26 56 36 00-0189 PM/PN (Parabolic Medium And Narrow Square) Series Ruud Flood Lights <small>(26 56 36 00-0110)</small>		
<small>Note: The PM and PN are suited for flagpoles, columns and narrow signs. Yoke or slip fitter mounting.</small>		
26 56 36 00-0190 High Pressure Sodium PM/PN Series Ruud Flood Lights <small>(26 56 36 00-0189)</small>		
26 56 36 00-0191 EA 250 Watt High Pressure Sodium PM/PN Series Ruud Flood Light.....	537.32	100.58
26 56 36 00-0192 EA 400 Watt High Pressure Sodium PM/PN Series Ruud Flood Light	548.83	100.58
26 56 36 00-0193 Metal Halide PM/PN Series Ruud Flood Lights <small>(26 56 36 00-0189)</small>		
26 56 36 00-0194 EA 175 Watt Metal Halide PM/PN Series Ruud Flood Light.....	511.99	100.58
26 56 36 00-0195 EA 250 Watt Metal Halide PM/PN Series Ruud Flood Light.....	514.30	100.58
26 56 36 00-0196 EA 400 Watt Metal Halide PM/PN Series Ruud Flood Light.....	521.20	100.58
26 56 36 00-0197 EA 1,000 Watt Metal Halide PM/PN Series Ruud Flood Light.....	739.26	111.76
26 56 36 00-0198 Accessories For Ruud Flood Lighting <small>(26 56 36 00-0110)</small>		
26 56 36 00-0199 EA Wireguard For Ruud Flood Light.....	61.98	22.35
26 56 36 00-0200 EA Deep Baffle (Full Visor) For Ruud Flood Light.....	93.06	22.35
26 56 36 00-0201 EA Glare Guard (Upper Visor) For Ruud Flood Light	70.04	22.35
26 56 36 00-0202 EA Vandal Shield For Ruud Flood Light.....	81.55	22.35
26 56 36 00-0203 EA Pipe Mounting Bracket For Ruud Flood Light	173.25	67.06
26 56 36 00-0204 EA 120/240 Volt, 277 Volt, NEMA Twistlock Photocontrol For Ruud Flood Light.....	55.07	22.35
26 56 36 00-0205 Lumark Flood Lights <small>(26 56 36)</small>		
26 56 36 00-0206 QZ Wedge Series Quartz Lumark Flood Lights <small>(26 56 36 00-0205)</small>		
<small>Note: For small outdoor areas. Die-cast aluminum housing heat and weather resistant gaskets.</small>		
26 56 36 00-0207 EA 500 Watt QZ Wedge Series Quartz Lumark Flood Light.....	157.65	67.06
26 56 36 00-0208 LQL Series Quartz Lumark Flood Lights <small>(26 56 36 00-0205)</small>		
<small>Note: For medium size outdoor areas. Die-cast aluminum housing heat and weather resistant gaskets.</small>		
26 56 36 00-0209 EA 1,500 Watt LQL Series Quartz Lumark Flood Light	191.61	67.06
26 56 36 00-0210 Kim Lighting <small>(26 56 36)</small>		
26 56 36 00-0211 MicroFlood® Series Kim Lighting Flood Lights <small>(26 56 36 00-0210)</small>		
<small>Note: For signs, flags, facades and landscaping. Includes die-cast aluminum housing, corrosion resistant polyester powder finish and gasketed and tempered lens. 1/2" threaded mounting knuckle.</small>		



MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
26 56 36 00-0212		LED MicroFlood® Series Kim Lighting Flood Lights (26 56 36 00-0211)			
26 56 36 00-0213	EA	5 Watt LED MicroFlood® Series Kim Lighting Flood Light.....	283.01		28.20
26 56 36 00-0214	EA	15 Watt LED MicroFlood® Series Kim Lighting Flood Light.....	346.88		28.20
26 56 36 00-0215		Scarab® Series Kim Lighting Flood Lights (26 56 36 00-0210)			
		Note: For signs, flags, facades and landscaping. Includes die-cast aluminum housing, corrosion resistant polyester powder finish and gasketed and tempered lens. 1/2" threaded mounting knuckle.			
26 56 36 00-0216		LED Scarab® Series Kim Lighting Accent Flood Lights (26 56 36 00-0215)			
		Note: Spot or narrow style accent flood lights.			
26 56 36 00-0217	EA	6 Watt LED Scarab® Series Kim Lighting Accent Flood Light (Kim EL731)	425.45		28.20
26 56 36 00-0218	EA	15 Watt LED Scarab® Series Kim Lighting Accent Flood Light (Kim EL733)	462.11		28.20
		Note: Includes adjustable glare shield.			
26 56 36 00-0219		Cooper Lighting (26 56 36)			
26 56 36 00-0220		Flood Lights; Lumiere® Series Cooper Lighting (26 56 36 00-0219)			
		Note: For signs, flags, facades and landscaping. Includes die-cast aluminum housing, corrosion resistant polyester powder finish and gasketed and tempered lens. 1/2" threaded mounting knuckle.			
26 56 36 00-0221		LED Lumiere® Series Cooper Lighting Flood Lights (26 56 36 00-0220)			
26 56 36 00-0222	EA	12 Watt LED, Aluminum Construction, Lumiere® Series Cooper Lighting Flood Light (Lumiere® Cambria 203).....	364.43		28.20
		For Tree Mount, Add	42.30		
26 56 36 00-0223	EA	12 Watt LED, Brass Construction, Lumiere® Series Cooper Lighting Flood Light (Lumiere® Cambria 203)	459.22		28.20
		For Tree Mount, Add	42.30		
26 56 36 00-0224	EA	12 Watt LED, Aluminum Construction, Lumiere® Series Cooper Lighting Hanging Flood Light (Lumiere® Cambria 213)	403.07		28.20
26 56 36 00-0225	EA	Expanding Tree Strap, Tree Mounting Accessory For Lumiere® Flood Lights (Lumiere TM04-4).....	166.77		20.14
		Note: For use with up to four fixtures.			
26 56 36 00-0226	EA	12 Volt, Wet Listed, Low Voltage Lighting Transformer For Lumiere® 203 Flood Lights (Lumiere T100)	257.76		16.11
26 56 36 00-0227	EA	12 Volt, Wet Listed, Low Voltage Lighting Transformer For Lumiere® 213 Flood Lights (Lumiere)	93.93		16.11
26 56 36 00-0228		CREE® BetaLED® Flood Lights (26 56 36)			
26 56 36 00-0229		Yoke Mount, Square, LED Flood Lights (CREE® BetaLED® FLD-304) (26 56 36 00-0228)			
		Note: UL wet listed. Includes 5,700K color temperature, 120-480 voltage, 350mA driver, die-cast extruded aluminum housing assembly and white, black, silver or bronze powder coat finish. Excludes sensors.			
26 56 36 00-0230	EA	40 LEDs, 47 System Watts, Yoke Mount, Square, LED Flood Light (CREE® BetaLED® FLD-304).....	890.33		80.60
26 56 36 00-0231	EA	60 LEDs, 68 System Watts, Yoke Mount, Square, LED Flood Light (CREE® BetaLED® FLD-304).....	978.07		85.08
26 56 36 00-0232		Adjustable Arm Mount, Rectangular, LED Flood Lights (CREE® BetaLED® Edge® FLD-EDG) (26 56 36 00-0228)			
		Note: UL wet listed. Includes 5,700K color temperature, 120/277 voltage, 350mA driver, die-cast extruded aluminum housing assembly and white, black, silver or bronze powder coat finish. Excludes sensors.			
26 56 36 00-0233	EA	20 LEDs, 26 System Watts, Adjustable Arm Mount, Rectangular, LED Flood Light (CREE® BetaLED® Edge® FLD-EDG).....	772.00		76.12
		For 347-480 Volt, Add	53.70		
26 56 36 00-0234	EA	40 LEDs, 47 System Watts, Adjustable Arm Mount, Rectangular, LED Flood Light (CREE® BetaLED® Edge® FLD-EDG).....	977.35		80.60
		For 347-480 Volt, Add	53.70		
26 56 36 00-0235	EA	60 LEDs, 68 System Watts, Adjustable Arm Mount, Rectangular, LED Flood Light (CREE® BetaLED® Edge® FLD-EDG).....	1,181.52		85.08
		For 347-480 Volt, Add	53.70		
26 56 36 00-0236	EA	80 LEDs, 90 System Watts, Adjustable Arm Mount, Rectangular, LED Flood Light (CREE® BetaLED® Edge® FLD-EDG).....	1,465.66		89.56
		For 347-480 Volt, Add	53.70		
26 56 36 00-0237	EA	100 LEDs, 111 System Watts, Adjustable Arm Mount, Rectangular, LED Flood Light (CREE® BetaLED® Edge® FLD-EDG).....	1,669.83		94.04
		For 347-480 Volt, Add	53.70		
26 56 36 00-0238	EA	120 LEDs, 132 System Watts, Adjustable Arm Mount, Rectangular, LED Flood Light (CREE® BetaLED® Edge® FLD-EDG).....	1,875.18		98.51
		For 347-480 Volt, Add	53.70		
26 56 36 00-0239	EA	140 LEDs, 157 System Watts, Adjustable Arm Mount, Rectangular, LED Flood Light (CREE® BetaLED® Edge® FLD-EDG).....	2,142.85		102.99
		For 347-480 Volt, Add	53.70		
26 56 36 00-0240	EA	160 LEDs, 179 System Watts, Adjustable Arm Mount, Rectangular, LED Flood Light (CREE® BetaLED® Edge® FLD-EDG).....	2,348.20		107.47
		For 347-480 Volt, Add	53.70		
26 56 36 00-0241	EA	200 LEDs, 221 System Watts, Adjustable Arm Mount, Rectangular, LED Flood Light (CREE® BetaLED® Edge® FLD-EDG).....	2,757.72		116.43
		For 347-480 Volt, Add	53.70		
26 56 36 00-0242	EA	240 LEDs, 264 System Watts, Adjustable Arm Mount, Rectangular, LED Flood Light (CREE® BetaLED® Edge® FLD-EDG).....	3,158.29		120.90
		For 347-480 Volt, Add	53.70		



Electrical	26	26
Lighting	26 50	
Exterior Lighting	26 56	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56 36 00-0243 Adjustable Arm Mount, Round, LED Flood Lights (CREE® BetaLED® Edge® FLD-EDR) (26 56 36 00-0228) Note: UL wet listed. Includes 5,700K color temperature, 120/277 voltage, 350mA driver, die-cast extruded aluminum housing assembly and white, black, silver or bronze powder coat finish. Excludes sensors.		
26 56 36 00-0244 EA 40 LEDs, 47 System Watts, Adjustable Arm Mount, Round, LED Flood Light (CREE® BetaLED® Edge® FLD-EDR).....	1,118.47	80.60
For 347-480 Volt, Add	53.70	
26 56 36 00-0245 EA 60 LEDs, 68 System Watts, Adjustable Arm Mount, Round, LED Flood Light (CREE® BetaLED® Edge® FLD-EDR).....	1,322.64	85.08
For 347-480 Volt, Add	53.70	
26 56 36 00-0246 EA 80 LEDs, 90 System Watts, Adjustable Arm Mount, Round, LED Flood Light (CREE® BetaLED® Edge® FLD-EDR).....	1,458.61	89.56
For 347-480 Volt, Add	53.70	
26 56 36 00-0247 EA 100 LEDs, 111 System Watts, Adjustable Arm Mount, Round, LED Flood Light (CREE® BetaLED® Edge® FLD-EDR).....	1,733.33	94.04
For 347-480 Volt, Add	53.70	
26 56 36 00-0248 EA 120 LEDs, 132 System Watts, Adjustable Arm Mount, Round, LED Flood Light (CREE® BetaLED® Edge® FLD-EDR).....	1,937.51	98.51
For 347-480 Volt, Add	53.70	
26 56 36 00-0249 Adjustable Arm Mount, Rectangular, High Output, LED Flood Lights (CREE® BetaLED® Edge® FLD-EHO) (26 56 36 00-0228) Note: UL wet listed. Includes 5,700K color temperature, 120/277 voltage, 700mA driver, die-cast extruded aluminum housing assembly and white, black, silver or bronze powder coat finish. Excludes sensors.		
26 56 36 00-0250 EA 120 LEDs, 267 System Watts, Adjustable Arm Mount, Rectangular, High Output, LED Flood Light (CREE® BetaLED® Edge® FLD-EHO)	1,457.03	98.51
For 3 Or 7-Pin NEMA Photocell Receptacle, Add	12.38	
For Bird Spikes, Add	29.36	
For 5,000K Color Temperature, Add	30.96	
For Fuse, Add	37.15	
For 0 To 10 Volt Dimming, Add	37.15	
For 480 Volt, Add	55.73	
For Multi-Level, Add	80.49	
For 1,000mA Driver, Add	104.02	
26 56 36 00-0251 EA 240 LEDs, 533 System Watts, Adjustable Arm Mount, Rectangular, High Output, LED Flood Light (CREE® BetaLED® Edge® FLD-EHO)	2,464.04	120.90
For 3 Or 7-Pin NEMA Photocell Receptacle, Add	12.38	
For 5,000K Color Temperature, Add	30.96	
For Fuse, Add	37.15	
For 0 To 10 Volt Dimming, Add	37.15	
For Bird Spikes, Add	43.31	
For Multi-Level, Add	80.49	
For 1,000mA Driver, Add	104.02	
For 480 Volt, Add	111.45	
26 56 36 00-0252 Direct Or Adjustable Arm Mount, Rectangular, High Output, LED Flood Lights (CREE® BetaLED® OSQ™) (26 56 36 00-0228) Note: UL wet listed. Includes 3,000K or 4,000K or 5,700K color temperature, 120/277 voltage, Class 1 driver, die-cast extruded aluminum housing assembly and white, black, silver or bronze powder coat finish. Excludes sensors.		
26 56 36 00-0253 EA 112 System Watts, Direct Or Adjustable Arm Mount, Rectangular, High Output, LED Flood Light (CREE® BetaLED® OSQ™ OSQ-A-NM-XXX-A-XXX-US-UL) (DLC Certified).....	860.19	98.51
For 3 Or 7-Pin NEMA Photocell Receptacle, Add	12.38	
For Front Facing Optics, Back Light Shield, Add	22.85	
For Rotated Optics, Back Light Shield, Add	22.85	
For Field Adjustable Output, Add	18.58	
For Fuse, Add	37.15	
For 0 To 10 Volt Dimming, Add	37.15	
For Multi-Level, Add	80.49	
26 56 36 00-0254 EA 168 System Watts, Direct Or Adjustable Arm Mount, Rectangular, High Output, LED Flood Light (CREE® BetaLED® OSQ™ OSQ-A-NM-XXX-J-XXX-US-UL) (DLC Certified)	918.71	98.51
Note: Type III, IV or V medium optics only.		
For 3 Or 7-Pin NEMA Photocell Receptacle, Add	12.38	
For Front Facing Optics, Back Light Shield, Add	22.85	
For Rotated Optics, Back Light Shield, Add	22.85	
For Field Adjustable Output, Add	18.58	
For Fuse, Add	37.15	
For 0 To 10 Volt Dimming, Add	37.15	
For Type II Medium Or Type V Short Optics, Add	71.52	
For Multi-Level, Add	80.49	
26 56 36 00-0255 EA 223 System Watts, Direct Or Adjustable Arm Mount, Rectangular, High Output, LED Flood Light (CREE® BetaLED® OSQ™ OSQ-A-NM-XXX-S-XXX-US-UL) (DLC Certified).....	1,178.03	120.90
For 3 Or 7-Pin NEMA Photocell Receptacle, Add	12.38	
For Field Adjustable Output, Add	18.58	
For Front Facing Optics, Back Light Shield, Add	27.69	
For Rotated Optics, Back Light Shield, Add	27.69	
For Fuse, Add	37.15	
For 0 To 10 Volt Dimming, Add	37.15	
For Multi-Level, Add	80.49	
26 56 36 00-0256 PlanLED Flood Lights (26 56 36)		

26	Electrical
26 50	Lighting
26 56	Exterior Lighting



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56 36 00-0257			Adjustable Arm Mount, LED Flood Lights (PlanLED WAPA) (26 56 36 00-0256)		
26 56 36 00-0258	EA		6,250 Lumens, 50 System Watts, Adjustable Arm Mount, Rectangular, LED Flood Light (PlanLED WAPA WP050)	365.96	80.60
26 56 36 00-0259	EA		9,375 Lumens, 75 System Watts, Adjustable Arm Mount, Rectangular, LED Flood Light (PlanLED WAPA WP075)	421.11	85.08
26 56 36 00-0260	EA		12,500 Lumens, 100 System Watts, Adjustable Arm Mount, Rectangular, LED Flood Light (PlanLED WAPA WP100).....	481.80	91.80
26 56 36 00-0261			Adjustable Arm Mount, LED Sports Flood Lights (PlanLED SUFA) (26 56 36 00-0256)		
26 56 36 00-0262	EA		21,000 Lumens, 200 System Watts, LED Sports Flood Light (PlanLED SUFA SF200).....	994.52	179.12
			<i>For 0 To 10 Volt Dimming, Add</i>	29.40	
26 56 36 00-0263	EA		42,000 Lumens, 400 System Watts, LED Sports Flood Light (PlanLED SUFA SF400).....	1,572.02	179.12
			<i>For 0 To 10 Volt Dimming, Add</i>	29.40	
26 56 36 00-0264	EA		84,000 Lumens, 800 System Watts, LED Sports Flood Light (PlanLED SUFA SF800).....	2,575.82	179.12
			<i>For 0 To 10 Volt Dimming, Add</i>	29.40	
26 56 36 00-0265			Adjustable Arm Mount, LED High Mast Flood Lights (PlanLED MAHA) (26 56 36 00-0256)		
26 56 36 00-0266	EA		26,000 Lumens, 200 System Watts, Adjustable Arm Mount, Rectangular, LED High Mast Flood Light (PlanLED MAHA MA200).....	828.20	116.43
			<i>For 0 To 10 Volt Dimming, Add</i>	29.40	
			<i>For 347-480 Volt, Add</i>	29.40	
26 56 36 00-0267	EA		39,000 Lumens, 300 System Watts, Adjustable Arm Mount, Rectangular, LED High Mast Flood Light (PlanLED MAHA MA300).....	1,105.96	120.90
			<i>For 0 To 10 Volt Dimming, Add</i>	29.40	
			<i>For 347-480 Volt, Add</i>	57.75	
26 56 36 00-0268	EA		52,000 Lumens, 400 System Watts, Adjustable Arm Mount, Rectangular, LED High Mast Flood Light (PlanLED MAHA MA400).....	1,388.96	125.38
			<i>For 0 To 10 Volt Dimming, Add</i>	29.40	
			<i>For 347-480 Volt, Add</i>	57.75	
26 56 39			Hazardous Location Flood Lights (26 56)		
			Note: For general to heavy industrial applications in marine and corrosive environments. Class 1 Division 2.		
26 56 39 00-0001			Lithonia Hazardous Location Flood Lights (26 56 39)		
26 56 39 00-0002			HFR (Horizontally Oriented Mogul Base) Series Hazardous Location Flood Lights (26 56 39 00-0001)		
			Note: Includes die-cast aluminum housing, corrosion resistant polyester powder finish and thermal shock resistant lens. Precision-formed reflector. Yoke mounting.		
26 56 39 00-0003			High Pressure Sodium HFR Series Hazardous Location Flood Lights (26 56 39 00-0002)		
26 56 39 00-0004	EA		150 Watt High Pressure Sodium HFR Series Lithonia Class 1 Div 2 Hazardous Location Flood Light	559.07	89.40
26 56 39 00-0005	EA		250 Watt High Pressure Sodium HFR Series Lithonia Class 1 Div 2 Hazardous Location Flood Light	594.76	89.40
26 56 39 00-0006	EA		400 Watt High Pressure Sodium HFR Series Lithonia Class 1 Div 2 Hazardous Location Flood Light	560.22	89.40
26 56 39 00-0007			Metal Halide HFR Series Lithonia Hazardous Location Flood Lights (26 56 39 00-0002)		
26 56 39 00-0008	EA		250 Watt Metal Halide HFR Series Lithonia Class 1 Div 2 Hazardous Location Flood Light	590.95	89.40
26 56 39 00-0009	EA		400 Watt Metal Halide HFR Series Lithonia Class 1 Div 2 Hazardous Location Flood Light	574.04	89.40
26 56 39 00-0010			HFM (Medium Base) Series Hazardous Location Flood Lights (26 56 39 00-0001)		
			Note: Includes die-cast aluminum housing, corrosion resistant polyester powder finish and thermal shock resistant lens. Precision-formed reflector. Yoke mounting.		
26 56 39 00-0011			High Pressure Sodium HFM Series Lithonia Hazardous Location Flood Lights (26 56 39 00-0010)		
26 56 39 00-0012	EA		100 Watt High Pressure Sodium HFM Series Lithonia Class 1 Div 2 Hazardous Location Flood Light	534.54	89.40
26 56 39 00-0013	EA		150 Watt High Pressure Sodium HFM Series Lithonia Class 1 Div 2 Hazardous Location Flood Light	555.84	89.40
26 56 39 00-0014			Metal Halide HFM Series Lithonia Hazardous Location Flood Lights (26 56 39 00-0010)		
26 56 39 00-0015	EA		175 Watt Metal Halide HFM Series Lithonia Class 1 Div 2 Hazardous Location Flood Light.....	476.98	89.40
26 56 39 00-0016			HFA (Large) Series Hazardous Location Flood Lights (26 56 39 00-0001)		
			Note: Includes die-cast aluminum housing, corrosion resistant polyester powder finish and thermal shock resistant lens. Precision-formed reflector. Yoke mounting.		
26 56 39 00-0017			High Pressure Sodium HFA Series Lithonia Hazardous Location Flood Lights (26 56 39 00-0016)		
26 56 39 00-0018	EA		250 Watt High Pressure Sodium HFA Series Lithonia Class 1 Div 2 Hazardous Location Flood Light	749.62	111.76
26 56 39 00-0019	EA		400 Watt High Pressure Sodium HFA Series Lithonia Class 1 Div 2 Hazardous Location Flood Light	759.98	111.76
26 56 39 00-0020			Metal Halide HFA Series Lithonia Hazardous Location Flood Lights (26 56 39 00-0016)		
26 56 39 00-0021	EA		250 Watt Metal Halide HFA Series Lithonia Class 1 Div 2 Hazardous Location Flood Light	746.16	111.76
26 56 39 00-0022	EA		400 Watt Metal Halide HFA Series Lithonia Class 1 Div 2 Hazardous Location Flood Light	759.98	111.76



Electrical	26	26
Lighting	26 50	
Exterior Lighting	26 56	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56 39 00-0023 HFL (Medium) Series Hazardous Location Flood Lights <small>(26 56 39 00-0001)</small> Note: Includes die-cast aluminum housing, corrosion resistant polyester powder finish and thermal shock resistant lens. Precision-formed reflector. Yoke mounting.		
26 56 39 00-0024 High Pressure Sodium HFL Series Lithonia Hazardous Location Flood Lights <small>(26 56 39 00-0023)</small>		
26 56 39 00-0025 EA 400 Watt High Pressure Sodium HFL Series Lithonia Class 1 Div 2 Hazardous Location Flood Light.....	563.80	100.58
26 56 39 00-0026 Metal Halide HFL Series Lithonia Hazardous Location Flood Lights <small>(26 56 39 00-0023)</small>		
26 56 39 00-0027 EA 400 Watt Metal Halide HFL Series Lithonia Class 1 Div 2 Hazardous Location Flood Light.....	604.09	100.58
26 56 39 00-0028 Accessories For Lithonia Hazardous Location Flood Lights <small>(26 56 39 00-0001)</small> See CSI section 26 56 36 00-0099 for accessories.		
26 56 43 High Performance Flood Lights <small>(26 56)</small> Note: For airport aprons and parking areas.		
26 56 43 00-0001 Lithonia High Performance Flood Lights <small>(26 56 43)</small>		
26 56 43 00-0002 170S Series Lithonia High Performance Flood Lights <small>(26 56 43 00-0001)</small> Note: Die-cast aluminum housing welded seams, stainless steel hardware, corrosion resistant polyester powder finish, and thermal and shock resistant flat lens.		
26 56 43 00-0003 High Pressure Sodium 170S Series Lithonia High Performance Flood Lights <small>(26 56 43 00-0002)</small>		
26 56 43 00-0004 EA 250 Watt High Pressure Sodium 170S Series Lithonia High Performance Flood Light	1,268.61	134.11
26 56 43 00-0005 EA 400 Watt High Pressure Sodium 170S Series Lithonia High Performance Flood Light	1,363.01	134.11
26 56 43 00-0006 EA 750 Watt High Pressure Sodium 170S Series Lithonia High Performance Flood Light	1,367.62	134.11
26 56 43 00-0007 EA 1,000 Watt High Pressure Sodium 170S Series Lithonia High Performance Flood Light	1,511.52	134.11
26 56 43 00-0008 Metal Halide 170S Series Lithonia High Performance Flood Lights <small>(26 56 43 00-0002)</small>		
26 56 43 00-0009 EA 320 Watt Metal Halide 170S Series Lithonia High Performance Flood Light	1,451.65	134.11
26 56 43 00-0010 EA 350 Watt Metal Halide 170S Series Lithonia High Performance Flood Light	1,387.82	134.11
26 56 43 00-0011 EA 400 Watt Metal Halide 170S Series Lithonia High Performance Flood Light	1,327.32	134.11
26 56 43 00-0012 EA 1,000 Watt Metal Halide 170S Series Lithonia High Performance Flood Light	1,387.19	134.11
26 56 43 00-0013 Accessories For Lithonia High Performance Flood Lights <small>(26 56 43 00-0002)</small> See CSI section 26 56 36 00-0099 for accessories.		
26 56 68 Exterior Athletic Lighting <small>(26 56)</small>		
26 56 68 00-0001 Sports Lighting System <small>(26 56 68)</small> Note: Musco.		
26 56 68 00-0002 Round Steel Tapered Poles <small>(26 56 68 00-0001)</small> Note: With Internal wiring harness.		
26 56 68 00-0003 EA 20' Steel Tapered Pole With Precast Concrete Foundation Sleeve	2,239.88	429.15
26 56 68 00-0004 EA 25' Steel Tapered Pole With Precast Concrete Foundation Sleeve	2,696.08	518.56
26 56 68 00-0005 EA 30' Steel Tapered Pole With Precast Concrete Foundation Sleeve	3,030.66	563.26
26 56 68 00-0006 EA 35' Steel Tapered Pole With Precast Concrete Foundation Sleeve	3,302.65	585.61
26 56 68 00-0007 EA 40' Steel Tapered Pole With Precast Concrete Foundation Sleeve	4,095.39	607.97
26 56 68 00-0008 EA 45' Steel Tapered Pole With Precast Concrete Foundation Sleeve	4,716.80	742.08
26 56 68 00-0009 EA 50' Steel Tapered Pole With Precast Concrete Foundation Sleeve	5,064.82	786.78
26 56 68 00-0010 EA 55' Steel Tapered Pole With Precast Concrete Foundation Sleeve	5,753.52	894.07
26 56 68 00-0011 EA 60' Steel Tapered Pole With Precast Concrete Foundation Sleeve	6,528.75	1,005.83
26 56 68 00-0012 EA 65' Steel Tapered Pole With Precast Concrete Foundation Sleeve	7,225.87	1,113.03
26 56 68 00-0013 EA 70' Steel Tapered Pole With Precast Concrete Foundation Sleeve	7,892.92	1,243.97
26 56 68 00-0014 EA 75' Steel Tapered Pole With Precast Concrete Foundation Sleeve	8,620.86	1,396.73
26 56 68 00-0015 EA 80' Steel Tapered Pole With Precast Concrete Foundation Sleeve	9,714.12	1,680.45
26 56 68 00-0016 Steel Pole Brackets <small>(26 56 68 00-0001)</small>		
26 56 68 00-0017 EA Two Light Bracket	341.09	44.71
26 56 68 00-0018 EA Three Light Bracket	429.96	62.58
26 56 68 00-0019 EA Four Light Bracket	617.28	76.00
26 56 68 00-0020 EA Five Light Bracket	704.24	89.40
26 56 68 00-0021 EA Six Light Bracket	853.29	102.82
26 56 68 00-0022 EA Seven Light Bracket.....	977.01	116.22
26 56 68 00-0023 EA Eight Light Bracket.....	1,116.61	134.11
26 56 68 00-0024 EA Nine Light Bracket	1,261.01	147.53
26 56 68 00-0025 Light Fixtures <small>(26 56 68 00-0001)</small>		
26 56 68 00-0026 EA 120 or 270 Volt, Sportlite Fixtures Complete with 1,000 Watt Metal Halide Lamp, Hook Cord And Plug	1,235.12	7.71
	<i>For 1,500 Watt Metal Halide Lamp, Add</i>	

26	Electrical
26 50	Lighting
26 56	Exterior Lighting



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
26 56 68 00-0027	Electrical Component Enclosure <small>(26 56 68 00-0001)</small>	
Note: Pole mounted NEMA 3R enclosure with thermal magnetic breaker and multiple ballasts to match total light fixtures. For light structures with more than 6 lights, use multiple enclosures.		
26 56 68 00-0028 EA Electrical Component Enclosure For 2 Lights, Pole Mounted	531.50	52.28
26 56 68 00-0029 EA Electrical Component Enclosure For 3 Lights, Pole Mounted	798.42	80.44
26 56 68 00-0030 EA Electrical Component Enclosure For 4 Lights, Pole Mounted	915.30	100.54
26 56 68 00-0031 EA Electrical Component Enclosure For 5 Lights, Pole Mounted	1,181.55	112.60
26 56 68 00-0032 EA Electrical Component Enclosure For 6 Lights, Pole Mounted	1,326.90	120.65
26 56 68 00-0033	Accessories <small>(26 56 68 00-0001)</small>	
26 56 68 00-0034 EA Time Delay Kit (Musco®)	588.72	161.14
26 56 68 00-0035 EA Remote Switch Box Push Button (Musco®)	1,121.62	161.14
26 56 68 00-0036 EA Push Button Strobe Kit (Musco®)	1,334.78	161.14
26 56 68 00-0037 EA Additional Control-Link Unit (Musco®)	6,295.84	483.41
26 56 68 00-0038 EA Auxiliary Brackets For Speakers Or Egress Fixtures, For New Installations (Musco®)	693.76	80.44
26 56 68 00-0039 EA Auxiliary Brackets For Speakers Or Egress Fixtures, For Retrofit Applications (Musco®)	854.62	160.86

END OF SECTION 26



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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27 Communications

Note: Termination costs are included with all communication equipment, panel boards, and devices. Terminations are not included with patch panels.

27 05 Common Work Results for Communications ⁽²⁷⁾

27 05 26 Grounding and Bonding for Communications Systems ^(27 05)

27 05 26 00-0001	EA	25 Pair Outdoor, Enclosed Building Entrance Terminal (ADC 6649 1 720-00).....	565.67	82.34
Note: Excludes terminations.				
27 05 26 00-0002	EA	50 Pair Outdoor, Enclosed Building Entrance Terminal (ADC 6649 1 820-00).....	729.40	109.81
Note: Excludes terminations.				
27 05 26 00-0003	EA	100 Pair Outdoor, Enclosed Building Entrance Terminal (ADC 6649 1 630-00).....	1,147.85	164.68
Note: Excludes terminations.				
27 05 26 00-0004	EA	Lucent 3B1-EW, Gas Tube Protector Unit.....	6.86	1.20
27 05 26 00-0005	EA	44 Terminal Copper Ground Bus Bar (Siemens ECGK).....	51.74	21.76
27 05 26 00-0006	EA	2" x 1/4" x 12", TGB Pattern, Grounding Bus Bar.....	157.94	21.76
27 05 26 00-0007	EA	4" x 1/4" x 12", TMGB Pattern, Grounding Bus Bar.....	187.44	21.76
27 05 26 00-0008	EA	#6 AWG, Cable Runway Ground Strap.....	39.78	4.03
27 05 26 00-0009	EA	1/4" Screw Size, #6 AWG Compression Lug.....	15.10	4.03
27 05 26 00-0010	EA	3/8" Screw Size, #6 AWG Compression Lug.....	15.97	4.03
27 05 26 00-0011	EA	Two Mounting Hole, Ground Terminal Block.....	17.58	4.03

27 05 29 Hangers And Supports For Communications Systems ^(27 05)

See CSI section 26 05 29 00-0000 for hangers and supports.

27 05 29 00-0001 Communications And Low Voltage Cable Hooks (J-Hooks) ^(27 05 29)

27 05 29 00-0002 Screw On Attachment, Communications And Low Voltage Cable Hooks (J-Hooks) ^(27 05 29 00-0001)

Note: Includes screw.

27 05 29 00-0003	EA	3/4" Hook Size, Pre-Galvanized Finish, Screw On, Communications And Low Voltage Cable Hook (J-Hook) (Cooper B-line BCH12).....	5.78	2.02
<i>For >50 To 100, Deduct</i>				
-0.25				
<i>For >100 To 250, Deduct</i>				
-0.49				
<i>For >250 To 500, Deduct</i>				
-0.94				
<i>For >500, Deduct</i>				
-1.38				
<i>For Installation On Concrete (Includes Drilling And Fastener), Add</i>				
1.11				
<i>For Work In Restricted Working Space, Add</i>				
1.21				
<i>For Painted Powder Coated Finish, Add</i>				
0.36				
27 05 29 00-0004	EA	1-5/16" Hook Size, Pre-Galvanized Finish, Screw On, Communications And Low Voltage Cable Hook (J-Hook) (Cooper B-line BCH21).....	6.06	2.02
<i>For >50 To 100, Deduct</i>				
-0.25				
<i>For >100 To 250, Deduct</i>				
-0.50				
<i>For >250 To 500, Deduct</i>				
-0.96				
<i>For >500, Deduct</i>				
-1.41				
<i>For Installation On Concrete (Includes Drilling And Fastener), Add</i>				
1.11				
<i>For Work In Restricted Working Space, Add</i>				
1.21				
<i>For Painted Powder Coated Finish, Add</i>				
1.25				
<i>For Low Friction Xylan® Coated Finish, Add</i>				
4.45				
27 05 29 00-0005	EA	2" Hook Size, Pre-Galvanized Finish, Screw On, Communications And Low Voltage Cable Hook (J-Hook) (Cooper B-line BCH32).....	6.48	2.02
<i>For >50 To 100, Deduct</i>				
-0.26				
<i>For >100 To 250, Deduct</i>				
-0.53				
<i>For >250 To 500, Deduct</i>				
-0.99				
<i>For >500, Deduct</i>				
-1.45				
<i>For Installation On Concrete (Includes Drilling And Fastener), Add</i>				
1.11				
<i>For Work In Restricted Working Space, Add</i>				
1.21				
<i>For Painted Powder Coated Finish, Add</i>				
1.53				
<i>For Low Friction Xylan® Coated Finish, Add</i>				
5.53				
27 05 29 00-0006	EA	4" Hook Size, Pre-Galvanized Finish, Screw On, Communications And Low Voltage Cable Hook (J-Hook) (Cooper B-line BCH64).....	10.12	2.02
<i>For >50 To 100, Deduct</i>				
-0.35				
<i>For >100 To 250, Deduct</i>				
-0.71				
<i>For >250 To 500, Deduct</i>				
-1.26				
<i>For >500, Deduct</i>				
-1.82				
<i>For Installation On Concrete (Includes Drilling And Fastener), Add</i>				
1.11				
<i>For Work In Restricted Working Space, Add</i>				
1.21				
<i>For Painted Powder Coated Finish, Add</i>				
0.82				
<i>For Low Friction Xylan® Coated Finish, Add</i>				
4.90				

27 05 29 00-0007 Screw On Angle Bracket Attachment, Communications And Low Voltage Cable Hooks (J-Hooks) ^(27 05 29 00-0001)

Note: Includes screw.

27 05 29 00-0008	EA	3/4" Hook Size, Pre-Galvanized Finish, Screw On Angle Bracket Attachment, Communications And Low Voltage Cable Hook (J-Hook) (Cooper B-line BCH12-RB).....	6.42	2.02
<i>For >50 To 100, Deduct</i>				
-0.26				
<i>For >100 To 250, Deduct</i>				
-0.52				
<i>For >250 To 500, Deduct</i>				
-0.99				
<i>For >500, Deduct</i>				
-1.45				
<i>For Installation On Concrete (Includes Drilling And Fastener), Add</i>				
1.11				
<i>For Work In Restricted Working Space, Add</i>				
1.21				

27 Communications**27 05 Common Work Results for Communications****27 05 29 Hangers And Supports For Communications Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
27 05 29 00-0009	EA		1-5/16" Hook Size, Pre-Galvanized Finish, Screw On Angle Bracket Attachment, Communications And Low Voltage Cable Hook (J-Hook) (Cooper B-line BCH21-RB)	8.06	2.02
			<i>For >50 To 100, Deduct</i>	-0.30	
			<i>For >100 To 250, Deduct</i>	-0.60	
			<i>For >250 To 500, Deduct</i>	-1.11	
			<i>For >500, Deduct</i>	-1.61	
			<i>For Installation On Concrete (Includes Drilling And Fastener), Add</i>	1.11	
			<i>For Work In Restricted Working Space, Add</i>	1.21	
27 05 29 00-0010	EA		2" Hook Size, Pre-Galvanized Finish, Screw On Angle Bracket Attachment, Communications And Low Voltage Cable Hook (J-Hook) (Cooper B-line BCH32-RB)	8.86	2.02
			<i>For >50 To 100, Deduct</i>	-0.32	
			<i>For >100 To 250, Deduct</i>	-0.64	
			<i>For >250 To 500, Deduct</i>	-1.17	
			<i>For >500, Deduct</i>	-1.69	
			<i>For Installation On Concrete (Includes Drilling And Fastener), Add</i>	1.11	
			<i>For Work In Restricted Working Space, Add</i>	1.21	
27 05 29 00-0011	EA		4" Hook Size, Pre-Galvanized Finish, Screw On Angle Bracket Attachment, Communications And Low Voltage Cable Hook (J-Hook) (Cooper B-line BCH4-RB)	11.72	2.02
			<i>For >50 To 100, Deduct</i>	-0.39	
			<i>For >100 To 250, Deduct</i>	-0.79	
			<i>For >250 To 500, Deduct</i>	-1.38	
			<i>For >500, Deduct</i>	-1.98	
			<i>For Installation On Concrete (Includes Drilling And Fastener), Add</i>	1.11	
			<i>For Work In Restricted Working Space, Add</i>	1.21	
27 05 29 00-0012			Strut Attachment, Communications And Low Voltage Cable Hooks (J-Hooks) <small>(27 05 29 00-0001)</small>		
			Note: Excludes strut.		
27 05 29 00-0013	EA		3/4" Hook Size, Pre-Galvanized Finish, Strut Attachment, Communications And Low Voltage Cable Hook (J-Hook) (Cooper B-line BCH12-SC4)	6.73	2.02
			<i>For >50 To 100, Deduct</i>	-0.27	
			<i>For >100 To 250, Deduct</i>	-0.54	
			<i>For >250 To 500, Deduct</i>	-1.01	
			<i>For >500, Deduct</i>	-1.48	
			<i>For Work In Restricted Working Space, Add</i>	1.21	
27 05 29 00-0014	EA		1-5/16" Hook Size, Pre-Galvanized Finish, Strut Attachment, Communications And Low Voltage Cable Hook (J-Hook) (Cooper B-line BCH21-SC4)	7.82	2.02
			<i>For >50 To 100, Deduct</i>	-0.30	
			<i>For >100 To 250, Deduct</i>	-0.59	
			<i>For >250 To 500, Deduct</i>	-1.09	
			<i>For >500, Deduct</i>	-1.59	
			<i>For Work In Restricted Working Space, Add</i>	1.21	
27 05 29 00-0015	EA		2" Hook Size, Pre-Galvanized Finish, Strut Attachment, Communications And Low Voltage Cable Hook (J-Hook) (Cooper B-line BCH32-SC4)	8.39	2.02
			<i>For >50 To 100, Deduct</i>	-0.31	
			<i>For >100 To 250, Deduct</i>	-0.62	
			<i>For >250 To 500, Deduct</i>	-1.13	
			<i>For >500, Deduct</i>	-1.65	
			<i>For Work In Restricted Working Space, Add</i>	1.21	
27 05 29 00-0016	EA		4" Hook Size, Pre-Galvanized Finish, Strut Attachment, Communications And Low Voltage Cable Hook (J-Hook) (Cooper B-line BCH64-SC4)	11.09	2.02
			<i>For >50 To 100, Deduct</i>	-0.38	
			<i>For >100 To 250, Deduct</i>	-0.76	
			<i>For >250 To 500, Deduct</i>	-1.34	
			<i>For >500, Deduct</i>	-1.92	
			<i>For Work In Restricted Working Space, Add</i>	1.21	
27 05 29 00-0017			T-Bar Attachment, Communications And Low Voltage Cable Hooks (J-Hooks) <small>(27 05 29 00-0001)</small>		
			Note: Excludes T-Bar.		
27 05 29 00-0018	EA		3/4" Hook Size, Pre-Galvanized Finish, T-Bar Attachment, Communications And Low Voltage Cable Hook (J-Hook) (Cooper B-line BCH12-A28)	7.93	2.02
			<i>For >50 To 100, Deduct</i>	-0.30	
			<i>For >100 To 250, Deduct</i>	-0.60	
			<i>For >250 To 500, Deduct</i>	-1.10	
			<i>For >500, Deduct</i>	-1.60	
			<i>For Work In Restricted Working Space, Add</i>	1.21	
27 05 29 00-0019	EA		1-5/16" Hook Size, Pre-Galvanized Finish, T-Bar Attachment, Communications And Low Voltage Cable Hook (J-Hook) (Cooper B-line BCH21-A28)	9.77	2.02
			<i>For >50 To 100, Deduct</i>	-0.35	
			<i>For >100 To 250, Deduct</i>	-0.69	
			<i>For >250 To 500, Deduct</i>	-1.24	
			<i>For >500, Deduct</i>	-1.78	
			<i>For Work In Restricted Working Space, Add</i>	1.21	
27 05 29 00-0020	EA		2" Hook Size, Pre-Galvanized Finish, T-Bar Attachment, Communications And Low Voltage Cable Hook (J-Hook) (Cooper B-line BCH32-A28)	10.26	2.02
			<i>For >50 To 100, Deduct</i>	-0.36	
			<i>For >100 To 250, Deduct</i>	-0.71	
			<i>For >250 To 500, Deduct</i>	-1.27	
			<i>For >500, Deduct</i>	-1.83	
			<i>For Work In Restricted Working Space, Add</i>	1.21	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
27 05 29 00-0021 Plain Or Threaded Rod Clip-On Attachment, Communications And Low Voltage Cable Hooks (J-Hooks) <small>(27 05 29 00-0001)</small>		
<small>Note: Excludes threaded rod. See CSI section 26 05 29 00-0198 for threaded rod.</small>		
27 05 29 00-0022 EA 3/4" Hook Size, Pre-Galvanized Finish, Plain Or Threaded Rod Clip-On Attachment, Communications And Low Voltage Cable Hook (J-Hook) (Cooper B-line BCH12-W6).....	6.58	2.02
<i>For >50 To 100, Deduct</i>	-0.27	
<i>For >100 To 250, Deduct</i>	-0.53	
<i>For >250 To 500, Deduct</i>	-1.00	
<i>For >500, Deduct</i>	-1.46	
<i>For Work In Restricted Working Space, Add</i>	1.21	
27 05 29 00-0023 EA 1-5/16" Hook Size, Pre-Galvanized Finish, Plain Or Threaded Rod Clip-On Attachment, Communications And Low Voltage Cable Hook (J-Hook) (Cooper B-line BCH21-W6).....	6.83	2.02
<i>For >50 To 100, Deduct</i>	-0.27	
<i>For >100 To 250, Deduct</i>	-0.54	
<i>For >250 To 500, Deduct</i>	-1.02	
<i>For >500, Deduct</i>	-1.49	
<i>For Work In Restricted Working Space, Add</i>	1.21	
27 05 29 00-0024 EA 2" Hook Size, Pre-Galvanized Finish, Plain Or Threaded Rod Clip-On Attachment, Communications And Low Voltage Cable Hook (J-Hook) (Cooper B-line BCH32-W6).....	8.11	2.02
<i>For >50 To 100, Deduct</i>	-0.30	
<i>For >100 To 250, Deduct</i>	-0.61	
<i>For >250 To 500, Deduct</i>	-1.11	
<i>For >500, Deduct</i>	-1.62	
<i>For Work In Restricted Working Space, Add</i>	1.21	
27 05 29 00-0025 Threaded Rod Attachment, Communications And Low Voltage Cable Hooks (J-Hooks) <small>(27 05 29 00-0001)</small>		
<small>Note: Excludes threaded rod, nuts and washers. See CSI section 26 05 29 00-0198 for threaded rod, nuts and washers.</small>		
27 05 29 00-0026 EA 1-5/16" Hook Size, Pre-Galvanized Finish, Threaded Rod Attachment, Communications And Low Voltage Cable Hook (J-Hook) (Cooper B-line BCH21-AB).....	7.97	2.02
<i>For >50 To 100, Deduct</i>	-0.30	
<i>For >100 To 250, Deduct</i>	-0.60	
<i>For >250 To 500, Deduct</i>	-1.10	
<i>For >500, Deduct</i>	-1.60	
<i>For Work In Restricted Working Space, Add</i>	1.21	
27 05 29 00-0027 EA 2" Hook Size, Pre-Galvanized Finish, Threaded Rod Attachment, Communications And Low Voltage Cable Hook (J-Hook) (Cooper B-line BCH32-AB).....	8.57	2.02
<i>For >50 To 100, Deduct</i>	-0.32	
<i>For >100 To 250, Deduct</i>	-0.63	
<i>For >250 To 500, Deduct</i>	-1.15	
<i>For >500, Deduct</i>	-1.66	
<i>For Work In Restricted Working Space, Add</i>	1.21	
27 05 29 00-0028 EA 4" Hook Size, Pre-Galvanized Finish, Threaded Rod Attachment, Communications And Low Voltage Cable Hook (J-Hook) (Cooper B-line BCH64-AB).....	11.55	2.02
<i>For >50 To 100, Deduct</i>	-0.39	
<i>For >100 To 250, Deduct</i>	-0.78	
<i>For >250 To 500, Deduct</i>	-1.37	
<i>For >500, Deduct</i>	-1.96	
<i>For Work In Restricted Working Space, Add</i>	1.21	
27 05 29 00-0029 Beam Clamp Attachment, Communications And Low Voltage Cable Hooks (J-Hooks) <small>(27 05 29 00-0001)</small>		
27 05 29 00-0030 EA 3/4" Hook Size, Pre-Galvanized Finish, Beam Clamp Attachment, Communications And Low Voltage Cable Hook (J-Hook) (Cooper B-line BCH12-C442A).....	7.88	2.02
<i>For >50 To 100, Deduct</i>	-0.30	
<i>For >100 To 250, Deduct</i>	-0.60	
<i>For >250 To 500, Deduct</i>	-1.09	
<i>For >500, Deduct</i>	-1.59	
<i>For Work In Restricted Working Space, Add</i>	1.21	
27 05 29 00-0031 EA 1-5/16" Hook Size, Pre-Galvanized Finish, Beam Clamp Attachment, Communications And Low Voltage Cable Hook (J-Hook) (Cooper B-line BCH21-C442A).....	8.95	2.02
<i>For >50 To 100, Deduct</i>	-0.32	
<i>For >100 To 250, Deduct</i>	-0.65	
<i>For >250 To 500, Deduct</i>	-1.18	
<i>For >500, Deduct</i>	-1.70	
<i>For Work In Restricted Working Space, Add</i>	1.21	
27 05 29 00-0032 EA 2" Hook Size, Pre-Galvanized Finish, Beam Clamp Attachment, Communications And Low Voltage Cable Hook (J-Hook) (Cooper B-line BCH32-C442A).....	9.52	2.02
<i>For >50 To 100, Deduct</i>	-0.34	
<i>For >100 To 250, Deduct</i>	-0.68	
<i>For >250 To 500, Deduct</i>	-1.22	
<i>For >500, Deduct</i>	-1.76	
<i>For Work In Restricted Working Space, Add</i>	1.21	
27 05 29 00-0033 EA 4" Hook Size, Pre-Galvanized Finish, Beam Clamp Attachment, Communications And Low Voltage Cable Hook (J-Hook) (Cooper B-line BCH64-C442A).....	12.63	2.02
<i>For >50 To 100, Deduct</i>	-0.42	
<i>For >100 To 250, Deduct</i>	-0.83	
<i>For >250 To 500, Deduct</i>	-1.45	
<i>For >500, Deduct</i>	-2.07	
<i>For Work In Restricted Working Space, Add</i>	1.21	

27 Communications**27 05 Common Work Results for Communications****27 05 29 Hangers And Supports For Communications Systems**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
27 05 29 00-0034			Adjustable Cable Supports (Caddy® CableCat CAT425) ^(27 05 29)		
27 05 29 00-0035	EA		Wall Mount, 4" To 6" Diameter Loop, Adjustable Cable Support (Caddy® CableCat CAT425).....	21.73	2.66
			<i>For >50 To 100, Deduct</i>	-0.74	
			<i>For >100 To 250, Deduct</i>	-1.49	
			<i>For >250 To 500, Deduct</i>	-2.63	
			<i>For >500, Deduct</i>	-3.78	
			<i>For Installation On Concrete (Includes Drilling And Fastener), Add</i>	2.11	
			<i>For Work In Restricted Working Space, Add</i>	2.41	
27 05 29 00-0036	EA		Threaded Rod Or Horizontal Surface Mount, 4" To 6" Diameter Loop, Adjustable Cable Support (Caddy® CableCat CAT425)	22.13	2.66
			<i>For >50 To 100, Deduct</i>	-0.75	
			<i>For >100 To 250, Deduct</i>	-1.51	
			<i>For >250 To 500, Deduct</i>	-2.66	
			<i>For >500, Deduct</i>	-3.82	
			<i>For Work In Restricted Working Space, Add</i>	2.41	
27 05 29 00-0037	EA		Up To 1/4" Flange, Hammer On Flange Clip, 4" To 6" Diameter Loop, Adjustable Cable Support (Caddy® CableCat CAT425)	24.21	2.66
			<i>For >50 To 100, Deduct</i>	-0.81	
			<i>For >100 To 250, Deduct</i>	-1.61	
			<i>For >250 To 500, Deduct</i>	-2.82	
			<i>For >500, Deduct</i>	-4.03	
			<i>For Work In Restricted Working Space, Add</i>	2.41	
27 05 29 00-0038	EA		>1/4" To 3/4" Flange, Hammer On Flange Clip, 4" To 6" Diameter Loop, Adjustable Cable Support (Caddy® CableCat CAT425)	21.66	2.66
			<i>For >50 To 100, Deduct</i>	-0.74	
			<i>For >100 To 250, Deduct</i>	-1.49	
			<i>For >250 To 500, Deduct</i>	-2.63	
			<i>For >500, Deduct</i>	-3.77	
			<i>For Work In Restricted Working Space, Add</i>	2.41	
27 05 29 00-0039	EA		Up To 1/2" Flange, Beam Clamp, 4" To 6" Diameter Loop, Adjustable Cable Support (Caddy® CableCat CAT425)	22.63	2.66
			<i>For >50 To 100, Deduct</i>	-0.77	
			<i>For >100 To 250, Deduct</i>	-1.53	
			<i>For >250 To 500, Deduct</i>	-2.70	
			<i>For >500, Deduct</i>	-3.87	
			<i>For Work In Restricted Working Space, Add</i>	2.41	
27 05 29 00-0040	EA		>1/2" To 5/8" Flange, Beam Clamp, 4" To 6" Diameter Loop, Adjustable Cable Support (Caddy® CableCat CAT425)	23.58	2.66
			<i>For >50 To 100, Deduct</i>	-0.79	
			<i>For >100 To 250, Deduct</i>	-1.58	
			<i>For >250 To 500, Deduct</i>	-2.77	
			<i>For >500, Deduct</i>	-3.97	
			<i>For Work In Restricted Working Space, Add</i>	2.41	
27 05 29 00-0041	EA		Up To 1/4" Flange, Hammer On Purlin Clip, 4" To 6" Diameter Loop, Adjustable Cable Support (Caddy® CableCat CAT425)	22.30	2.66
			<i>For >50 To 100, Deduct</i>	-0.76	
			<i>For >100 To 250, Deduct</i>	-1.52	
			<i>For >250 To 500, Deduct</i>	-2.68	
			<i>For >500, Deduct</i>	-3.84	
			<i>For Work In Restricted Working Space, Add</i>	2.41	
27 05 33			Conduits And Backboxes For Communications Systems ^(27 05)		
			See CSI section 26 05 33 00-0000 for conduit and boxes.		
27 05 36			Cable Trays For Communications Systems ^(27 05)		
			See CSI section 26 05 36 00-0000 for cable trays.		
27 05 39			Surface Raceways For Communications Systems ^(27 05)		
			See CSI section 26 05 33 00-0000 for surface raceways.		
27 05 43			Underground Ducts And Raceways For Communications Systems ^(27 05)		
			See CSI section 26 05 43 00-0000 for underground ducts and raceways.		
27 05 53			Identification For Communications Systems ^(27 05)		
			See CSI section 26 05 53 00-0000 for identification.		
27 10			Structured Cabling ⁽²⁷⁾		
			Note: Includes testing.		
27 11			Communications Equipment Room Fittings ^(27 10)		
27 11 16			Communications Cabinets, Racks, Frames, And Enclosures ^(27 11)		
27 11 16 00-0001			3/4" Fire Retardant Plywood Backboards ^(27 11 16)		
27 11 16 00-0002	EA		4' x 4' x 3/4" Fire Retardant Plywood Phone Backboard.....	59.87	20.91
			<i>For Two Coats Of Non-Conductive, Fire Retardant Paint, Add</i>	31.42	
27 11 16 00-0003	EA		4' x 8' x 3/4" Fire Retardant Plywood Phone Backboard.....	119.74	41.83
			<i>For Two Coats Of Non-Conductive, Fire Retardant Paint, Add</i>	62.84	
27 11 16 00-0004			Terminal Cabinets ^(27 11 16)		
27 11 16 00-0005	EA		12" x 12" x 4" Phone Terminal Cabinet With Wood Backboard	222.15	60.32



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
				27 11 16 00-0006 EA 18" x 12" x 4" Phone Terminal Cabinet With Wood Backboard.....	277.71	66.35
				27 11 16 00-0007 EA 24" x 12" x 4" Phone Terminal Cabinet With Wood Backboard.....	319.56	76.41
				27 11 16 00-0008 EA 18" x 18" x 4" Phone Terminal Cabinet With Wood Backboard.....	331.52	78.42
				27 11 16 00-0009 EA 24" x 18" x 4" Phone Terminal Cabinet With Wood Backboard.....	400.81	80.44
				27 11 16 00-0010 EA 26" x 36" x 4" Phone Terminal Cabinet With Wood Backboard.....	493.51	90.49
				27 11 16 00-0011 EA 24" x 24" x 6" Phone Terminal Cabinet With Wood Backboard.....	503.98	88.47
				27 11 16 00-0012 EA 30" x 24" x 6" Phone Terminal Cabinet With Wood Backboard.....	651.03	126.03
				27 11 16 00-0013 EA 36" x 24" x 6" Phone Terminal Cabinet With Wood Backboard.....	697.54	138.50
				27 11 16 00-0014 EA 42" x 24" x 6" Phone Terminal Cabinet With Wood Backboard.....	836.49	146.31
				27 11 16 00-0015 EA 30" x 30" x 6" Phone Terminal Cabinet With Wood Backboard.....	690.81	120.65
				27 11 16 00-0016 EA 36" x 30" x 6" Phone Terminal Cabinet With Wood Backboard.....	747.16	130.70
				27 11 16 00-0017 EA 48" x 30" x 6" Phone Terminal Cabinet With Wood Backboard.....	932.87	167.54
				27 11 16 00-0018 EA 54" x 30" x 6" Phone Terminal Cabinet With Wood Backboard.....	1,122.63	209.44
				27 11 16 00-0019 EA 48" x 36" x 6" Phone Terminal Cabinet With Wood Backboard.....	1,264.02	207.11
				27 11 16 00-0020 EA 60" x 36" x 6" Phone Terminal Cabinet With Wood Backboard.....	1,456.03	251.99
				27 11 16 00-0021 Equipment Racks And Cable Managers (27 11 16)		
				27 11 16 00-0022 Equipment Racks (27 11 16 00-0021)		
				Note: Electronics Industries Association EIA-310-D compliant. Includes aluminum construction with clear grained aluminum or black epoxy-polyester hybrid powder coat finish.		
				27 11 16 00-0023 Standard Equipment Racks (27 11 16 00-0022)		
				27 11 16 00-0024 19" Width, Standard Equipment Racks (27 11 16 00-0023)		
				27 11 16 00-0025 EA 84" Height, 19" Width, 3" Depth, 45U, Standard Equipment Rack (Chatsworth 55053-X03).....	408.28	128.69
				For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add	7.55	
				27 11 16 00-0026 EA 96" Height, 19" Width, 3" Depth, 51U, Standard Equipment Rack (Chatsworth 55053-X15).....	571.25	136.74
				For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add	14.89	
				27 11 16 00-0027 EA 108" Height, 19" Width, 3" Depth, 58U, Standard Equipment Rack (Chatsworth 55053-X08).....	617.41	144.77
				For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add	16.39	
				27 11 16 00-0028 Universal Equipment Racks (27 11 16 00-0022)		
				27 11 16 00-0029 Universal Equipment Racks (27 11 16 00-0028)		
				27 11 16 00-0030 19" Width, EIA Universal Equipment Racks (27 11 16 00-0029)		
				27 11 16 00-0031 EA 36" Height, 19" Width, 3" Depth, 17U, EIA Universal Equipment Rack (Chatsworth 46353-X31).....	537.27	112.60
				For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add	15.60	
				27 11 16 00-0032 EA 48" Height, 19" Width, 3" Depth, 24U, EIA Universal Equipment Rack (Chatsworth 46353-X20).....	588.04	114.61
				For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add	17.94	
				27 11 16 00-0033 EA 60" Height, 19" Width, 3" Depth, 31U, EIA Universal Equipment Rack (Chatsworth 46353-X19).....	587.03	116.63
				For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add	17.69	
				27 11 16 00-0034 EA 66" Height, 19" Width, 3" Depth, 34U, EIA Universal Equipment Rack (Chatsworth 46353-X00).....	602.22	118.63
				For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add	18.25	
				27 11 16 00-0035 EA 72" Height, 19" Width, 3" Depth, 38U, EIA Universal Equipment Rack (Chatsworth 46353-X01).....	617.25	120.65
				For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add	18.80	
				27 11 16 00-0036 EA 78" Height, 19" Width, 3" Depth, 41U, EIA Universal Equipment Rack (Chatsworth 46353-X02).....	633.53	122.65
				For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add	19.41	
				27 11 16 00-0037 EA 84" Height, 19" Width, 3" Depth, 45U, EIA Universal Equipment Rack (Chatsworth 46353-X03).....	537.53	124.67
				For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add	14.41	
				27 11 16 00-0038 EA 90" Height, 19" Width, 3" Depth, 48U, EIA Universal Equipment Rack (Chatsworth 46353-X05).....	665.14	126.68
				For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add	20.59	
				27 11 16 00-0039 EA 96" Height, 19" Width, 3" Depth, 51U, EIA Universal Equipment Rack (Chatsworth 46353-X15).....	688.97	128.69
				For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add	21.58	
				27 11 16 00-0040 EA 102" Height, 19" Width, 3" Depth, 55U, EIA Universal Equipment Rack (Chatsworth 46353-X17).....	709.74	130.70
				For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add	22.42	
				27 11 16 00-0041 EA 108" Height, 19" Width, 3" Depth, 58U, EIA Universal Equipment Rack (Chatsworth 46353-X08).....	714.60	132.72
				For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add	22.46	
				27 11 16 00-0042 23" Width, Universal Equipment Racks (27 11 16 00-0029)		
				27 11 16 00-0043 EA 36" Height, 23" Width, 3" Depth, 17U, Universal Equipment Rack (Chatsworth 46383-X31).....	569.29	112.60
				For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add	17.20	
				27 11 16 00-0044 EA 48" Height, 23" Width, 3" Depth, 24U, Universal Equipment Rack (Chatsworth 46383-X20).....	589.23	114.61
				For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add	18.00	
				27 11 16 00-0045 EA 60" Height, 23" Width, 3" Depth, 31U, Universal Equipment Rack (Chatsworth 46383-X19).....	606.75	116.63
				For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add	18.68	
				27 11 16 00-0046 EA 66" Height, 23" Width, 3" Depth, 34U, Universal Equipment Rack (Chatsworth 46383-X00).....	639.72	118.63
				For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add	20.12	
				27 11 16 00-0047 EA 72" Height, 23" Width, 3" Depth, 38U, Universal Equipment Rack (Chatsworth 46383-X01).....	655.86	120.65
				For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add	20.73	
				27 11 16 00-0048 EA 78" Height, 23" Width, 3" Depth, 41U, Universal Equipment Rack (Chatsworth 46383-X02).....	673.41	122.65
				For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add	21.40	
				27 11 16 00-0049 EA 84" Height, 23" Width, 3" Depth, 45U, Universal Equipment Rack (Chatsworth 46383-X03).....	577.88	124.67
				For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add	16.43	
				27 11 16 00-0050 EA 90" Height, 23" Width, 3" Depth, 48U, Universal Equipment Rack (Chatsworth 46383-X05).....	707.47	126.68
				For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add	22.71	
				27 11 16 00-0051 EA 96" Height, 23" Width, 3" Depth, 51U, Universal Equipment Rack (Chatsworth 46383-X15).....	733.30	128.69
				For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add	23.80	
				27 11 16 00-0052 EA 102" Height, 23" Width, 3" Depth, 55U, Universal Equipment Rack (Chatsworth 46383-X17).....	755.82	130.70
				For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add	24.72	

27 Communications**27 10 Structured Cabling****27 11 Communications Equipment Room Fittings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
27 11 16 00-0053	EA		108" Height, 23" Width, 3" Depth, 58U, Universal Equipment Rack (Chatsworth 46383-X08)..... <i>For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add</i>	760.76 24.77	132.72
27 11 16 00-0054			35" Width, Universal Equipment Racks (27 11 16 00-0029)		
27 11 16 00-0055	EA		72" Height, 35" Width, 3" Depth, 38U, Universal Equipment Rack (Chatsworth 46363-X01)..... <i>For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add</i>	710.14 23.44	120.65
27 11 16 00-0056	EA		84" Height, 35" Width, 3" Depth, 45U, Universal Equipment Rack (Chatsworth 46363-X03)..... <i>For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add</i>	748.09 24.94	124.67
27 11 16 00-0057			UL Listed Universal Equipment Racks (27 11 16 00-0028) Note: UL listed as a communications circuit accessory.		
27 11 16 00-0058			19" Width, UL Listed Universal Equipment Racks (27 11 16 00-0057)		
27 11 16 00-0059	EA		36" Height, 19" Width, 3" Depth, 17U, UL Listed Universal Equipment Rack (Chatsworth 48353-X31) <i>For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add</i>	568.48 17.16	112.60
27 11 16 00-0060	EA		48" Height, 19" Width, 3" Depth, 24U, UL Listed Universal Equipment Rack (Chatsworth 48353-X20) <i>For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add</i>	615.36 19.31	114.61
27 11 16 00-0061	EA		60" Height, 19" Width, 3" Depth, 31U, UL Listed Universal Equipment Rack (Chatsworth 48353-X19) <i>For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add</i>	624.75 19.58	116.63
27 11 16 00-0062	EA		66" Height, 19" Width, 3" Depth, 34U, UL Listed Universal Equipment Rack (Chatsworth 48353-X00) <i>For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add</i>	638.74 20.07	118.63
27 11 16 00-0063	EA		72" Height, 19" Width, 3" Depth, 38U, UL Listed Universal Equipment Rack (Chatsworth 48353-X01) <i>For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add</i>	654.83 20.68	120.65
27 11 16 00-0064	EA		78" Height, 19" Width, 3" Depth, 41U, UL Listed Universal Equipment Rack (Chatsworth 48353-X02) <i>For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add</i>	672.34 21.35	122.65
27 11 16 00-0065	EA		84" Height, 19" Width, 3" Depth, 45U, UL Listed Universal Equipment Rack (Chatsworth 48353-X03) <i>For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add</i>	689.15 21.99	124.67
27 11 16 00-0066	EA		90" Height, 19" Width, 3" Depth, 48U, UL Listed Universal Equipment Rack (Chatsworth 48353-X05) <i>For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add</i>	706.34 22.65	126.68
27 11 16 00-0067	EA		96" Height, 19" Width, 3" Depth, 51U, UL Listed Universal Equipment Rack (Chatsworth 48353-X15) <i>For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add</i>	732.14 23.74	128.69
27 11 16 00-0068	EA		102" Height, 19" Width, 3" Depth, 55U, UL Listed Universal Equipment Rack (Chatsworth 48353-X17) <i>For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add</i>	754.60 24.66	130.70
27 11 16 00-0069	EA		108" Height, 19" Width, 3" Depth, 58U, UL Listed Universal Equipment Rack (Chatsworth 48353-X08) <i>For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add</i>	759.48 24.70	132.72
27 11 16 00-0070			23" Width, UL Listed Universal Equipment Racks (27 11 16 00-0057)		
27 11 16 00-0071	EA		36" Height, 23" Width, 3" Depth, 17U, UL Listed Universal Equipment Rack (Chatsworth 48383-X31) <i>For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add</i>	603.73 18.93	112.60
27 11 16 00-0072	EA		48" Height, 23" Width, 3" Depth, 24U, UL Listed Universal Equipment Rack (Chatsworth 48383-X20) <i>For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add</i>	663.17 21.70	114.61
27 11 16 00-0073	EA		60" Height, 23" Width, 3" Depth, 31U, UL Listed Universal Equipment Rack (Chatsworth 48383-X19) <i>For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add</i>	671.55 21.92	116.63
27 11 16 00-0074	EA		66" Height, 23" Width, 3" Depth, 34U, UL Listed Universal Equipment Rack (Chatsworth 48383-X00) <i>For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add</i>	679.96 22.13	118.63
27 11 16 00-0075	EA		72" Height, 23" Width, 3" Depth, 38U, UL Listed Universal Equipment Rack (Chatsworth 48383-X01) <i>For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add</i>	697.30 22.80	120.65
27 11 16 00-0076	EA		78" Height, 23" Width, 3" Depth, 41U, UL Listed Universal Equipment Rack (Chatsworth 48383-X02) <i>For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add</i>	716.23 23.55	122.65
27 11 16 00-0077	EA		84" Height, 23" Width, 3" Depth, 45U, UL Listed Universal Equipment Rack (Chatsworth 48383-X03) <i>For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add</i>	734.33 24.25	124.67
27 11 16 00-0078	EA		90" Height, 23" Width, 3" Depth, 48U, UL Listed Universal Equipment Rack (Chatsworth 48383-X05) <i>For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add</i>	752.87 24.98	126.68
27 11 16 00-0079	EA		96" Height, 23" Width, 3" Depth, 51U, UL Listed Universal Equipment Rack (Chatsworth 48383-X15) <i>For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add</i>	780.88 26.18	128.69
27 11 16 00-0080	EA		102" Height, 23" Width, 3" Depth, 55U, UL Listed Universal Equipment Rack (Chatsworth 48383-X17) <i>For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add</i>	805.27 27.19	130.70
27 11 16 00-0081	EA		108" Height, 23" Width, 3" Depth, 58U, UL Listed Universal Equipment Rack (Chatsworth 48383-X08) <i>For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add</i>	810.37 27.25	132.72
27 11 16 00-0082			4-Post Equipment Racks And Server Frames (27 11 16 00-0022)		
27 11 16 00-0083			4-Post Equipment Racks (27 11 16 00-0082)		
27 11 16 00-0084	EA		19" Width, 29" Depth, 84" Height, 4-Post Equipment Rack (Chatsworth 50120-X03)..... <i>For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add</i>	1,152.09 37.50	201.07
27 11 16 00-0085	EA		19" Width, 29" Depth, 96" Height, 4-Post Equipment Rack (Chatsworth 50120-X15)..... <i>For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add</i>	1,259.19 42.05	209.12
27 11 16 00-0086	EA		19" Width, 29" Depth, 108" Height, 4-Post Equipment Rack (Chatsworth 50120-X08)..... <i>For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add</i>	1,360.16 46.29	217.16
27 11 16 00-0087			4-Post Server Frame (27 11 16 00-0082)		
27 11 16 00-0088	EA		19" Width, 29" Depth, 84" Height, Server Frame (Chatsworth 15053-X03) <i>For Gray Or Computer Beige Epoxy-Polyester Hybrid Powder Coat Finish, Add</i>	1,185.08 39.15	201.07
27 11 16 00-0089			Cable Managers (27 11 16 00-0021)		
27 11 16 00-0090			Horizontal Cable Managers (27 11 16 00-0089)		



	MINOR	UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
27 11 16 00-0091		Single-Sided, Horizontal Cable Managers (27 11 16 00-0090)		
	EA	1U Height, 19" Width, 4.96" Depth, Single-Sided, Horizontal Cable Manager (Chatsworth 30139-719)	67.13	8.04
	EA	1U Height, 23" Width, 4.96" Depth, Single-Sided, Horizontal Cable Manager (Chatsworth 30139-723)	74.87	8.04
	EA	1U Height, 19" Width, 5.9" Depth, Single-Sided, Horizontal Cable Manager (Chatsworth 13930-701)	55.87	8.04
	EA	2U Height, 19" Width, 5.14" Depth, Single-Sided, Horizontal Cable Manager (Chatsworth 30130-719)	68.29	8.04
	EA	2U Height, 23" Width, 5.14" Depth, Single-Sided, Horizontal Cable Manager (Chatsworth 30130-723)	80.28	8.04
	EA	2U Height, 19" Width, 5.9" Depth, Single-Sided, Horizontal Cable Manager (Chatsworth 13930-702)	61.99	8.04
	EA	3U Height, 19" Width, 5.14" Depth, Single-Sided, Horizontal Cable Manager (Chatsworth 30131-719)	92.44	8.04
	EA	3U Height, 23" Width, 5.14" Depth, Single-Sided, Horizontal Cable Manager (Chatsworth 30131-723)	105.37	8.04
	EA	3U Height, 19" Width, 5.9" Depth, Single-Sided, Horizontal Cable Manager (Chatsworth 13930-703)	74.23	8.04
27 11 16 00-0101		Double-Sided, Horizontal Cable Managers (27 11 16 00-0090)		
	EA	1U Height, 19" Width, 11.73" Depth, Double-Sided, Horizontal Cable Manager (Chatsworth 30529-719)	83.63	8.04
	EA	1U Height, 23" Width, 11.73" Depth, Double-Sided, Horizontal Cable Manager (Chatsworth 30529-723)	93.83	8.04
	EA	2U Height, 19" Width, 11.73" Depth, Double-Sided, Horizontal Cable Manager (Chatsworth 30530-719)	88.05	8.04
	EA	2U Height, 23" Width, 11.73" Depth, Double-Sided, Horizontal Cable Manager (Chatsworth 30530-723)	102.66	8.04
	EA	3U Height, 19" Width, 11.73" Depth, Double-Sided, Horizontal Cable Manager (Chatsworth 30531-719)	114.24	8.04
	EA	3U Height, 23" Width, 11.73" Depth, Double-Sided, Horizontal Cable Manager (Chatsworth 30531-723)	128.06	8.04
27 11 16 00-0108		Vertical Cable Managers (27 11 16 00-0089)		
27 11 16 00-0109		Single-Sided, Vertical Cable Managers (27 11 16 00-0108)		
	EA	3.6" Width, 9.7" Depth, 70" Height, Single-Sided, Vertical Cable Manager (Chatsworth 13901-701)	151.12	12.07
	EA	6" Width, 9.8" Depth, 70" Height, Single-Sided, Vertical Cable Manager (Chatsworth 13902-701)	213.85	12.07
	EA	10" Width, 10.3" Depth, 70" Height, Single-Sided, Vertical Cable Manager (Chatsworth 13904-701)	345.43	12.07
	EA	12" Width, 10.4" Depth, 70" Height, Single-Sided, Vertical Cable Manager (Chatsworth 13905-701)	391.33	12.07
	EA	3.6" Width, 9.7" Depth, 80.5" Height, Single-Sided, Vertical Cable Manager (Chatsworth 13901-703)	161.83	12.07
	EA	6" Width, 9.8" Depth, 80.5" Height, Single-Sided, Vertical Cable Manager (Chatsworth 13902-703)	230.68	12.07
	EA	10" Width, 10.3" Depth, 80.5" Height, Single-Sided, Vertical Cable Manager (Chatsworth 13904-703)	376.03	12.07
	EA	12" Width, 10.4" Depth, 80.5" Height, Single-Sided, Vertical Cable Manager (Chatsworth 13905-703)	421.93	12.07
	EA	3.6" Width, 9.7" Depth, 91" Height, Single-Sided, Vertical Cable Manager (Chatsworth 13901-715)	183.25	12.07
	EA	6" Width, 9.8" Depth, 91" Height, Single-Sided, Vertical Cable Manager (Chatsworth 13902-715)	253.63	12.07
	EA	10" Width, 10.3" Depth, 91" Height, Single-Sided, Vertical Cable Manager (Chatsworth 13904-715)	421.93	12.07
	EA	12" Width, 10.4" Depth, 91" Height, Single-Sided, Vertical Cable Manager (Chatsworth 13905-715)	467.83	12.07
27 11 16 00-0122		Double-Sided, Vertical Cable Managers (27 11 16 00-0108)		
	EA	3.6" Width, 16.4" Depth, 70" Height, Double-Sided, Vertical Cable Manager (Chatsworth 13911-701)	219.97	12.07
	EA	6" Width, 16.6" Depth, 70" Height, Double-Sided, Vertical Cable Manager (Chatsworth 13912-701)	259.75	12.07
	EA	10" Width, 17.5" Depth, 70" Height, Double-Sided, Vertical Cable Manager (Chatsworth 13914-701)	421.93	12.07
	EA	12" Width, 17.8" Depth, 70" Height, Double-Sided, Vertical Cable Manager (Chatsworth 13915-701)	498.43	12.07
	EA	3.6" Width, 16.4" Depth, 80.5" Height, Double-Sided, Vertical Cable Manager (Chatsworth 13911-703)	238.33	12.07
	EA	6" Width, 16.6" Depth, 80.5" Height, Double-Sided, Vertical Cable Manager (Chatsworth 13912-703)	278.11	12.07
	EA	10" Width, 17.5" Depth, 80.5" Height, Double-Sided, Vertical Cable Manager (Chatsworth 13914-703)	452.53	12.07
	EA	12" Width, 17.8" Depth, 80.5" Height, Double-Sided, Vertical Cable Manager (Chatsworth 13915-703)	529.03	12.07
	EA	3.6" Width, 16.4" Depth, 91" Height, Double-Sided, Vertical Cable Manager (Chatsworth 13911-715)	262.81	12.07
	EA	6" Width, 16.6" Depth, 91" Height, Double-Sided, Vertical Cable Manager (Chatsworth 13912-715)	302.59	12.07
	EA	10" Width, 17.5" Depth, 91" Height, Double-Sided, Vertical Cable Manager (Chatsworth 13914-715)	498.43	12.07
	EA	12" Width, 17.8" Depth, 91" Height, Double-Sided, Vertical Cable Manager (Chatsworth 13915-715)	574.93	12.07
27 11 16 00-0135		Accessories For Vertical Cable Managers (27 11 16 00-0108)		
	EA	Cable Ring Kit For 3.6" Width x 70" Height, Vertical Cable Managers (Chatsworth 13934-716)	92.59	8.04
	EA	Cable Ring Kit For 3.6" Width x 80.5" Height, Vertical Cable Managers (Chatsworth 13934-717)	98.71	8.04
	EA	Cable Ring Kit For 3.6" Width x 91" Height, Vertical Cable Managers (Chatsworth 13934-718)	104.83	8.04
	EA	Cable Ring Kit For 6" Width x 70" Height, Vertical Cable Managers (Chatsworth 13934-726)	95.65	8.04
	EA	Cable Ring Kit For 6" Width x 80.5" Height, Vertical Cable Managers (Chatsworth 13934-727)	104.83	8.04
	EA	Cable Ring Kit For 6" Width x 91" Height, Vertical Cable Managers (Chatsworth 13934-728)	114.01	8.04
	EA	Cable Ring Kit For 10" Width x 70" Height, Vertical Cable Managers (Chatsworth 13934-746)	107.89	8.04
	EA	Cable Ring Kit For 10" Width x 80.5" Height, Vertical Cable Managers (Chatsworth 13934-747)	117.07	8.04
	EA	Cable Ring Kit For 10" Width x 91" Height, Vertical Cable Managers (Chatsworth 13934-748)	126.25	8.04
	EA	Cable Ring Kit For 12" Width x 70" Height, Vertical Cable Managers (Chatsworth 13934-756)	114.01	8.04
	EA	Cable Ring Kit For 12" Width x 80.5" Height, Vertical Cable Managers (Chatsworth 13934-757)	126.25	8.04
	EA	Cable Ring Kit For 12" Width x 91" Height, Vertical Cable Managers (Chatsworth 13934-758)	135.43	8.04
	EA	Cable Lashing Bar Kit For Vertical Cable Managers (Chatsworth 13928-001)	77.29	8.04
	EA	Cable Spool Kit For Vertical Cable Managers (Chatsworth 13935-701)	89.53	8.04
	EA	Cable Distribution Spools For Vertical Cable Managers (Chatsworth 15008-001)	93.66	8.04
	EA	Cable Distribution Spool Spacer Kit For Vertical Cable Managers (Chatsworth 35505-001)	58.93	8.04
27 11 19		Communications Termination Blocks And Patch Panels (27 11)		
		Note: The terminating, testing, and labeling of the cables in question should be done according to the task description as well as the current contract specifications. See CSI section 27 14 43 00-0074 for labeling.		
27 11 19 00-0001		Computer Network Components (27 11 19)		
27 11 19 00-0002		Ethernet Patch Panels (27 11 19 00-0001)		
	EA	12 Port, Category 5E Patch Panel	170.71	40.21
	EA	24 Port, Category 5E Patch Panel	247.73	40.21

27	Communications
27 10	Structured Cabling
27 11	Communications Equipment Room Fittings



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
27 11 19 00-0005 EA 32 Port, Category 5E Patch Panel	320.60	40.21
27 11 19 00-0006 EA 48 Port, Category 5E Patch Panel	388.51	40.21
27 11 19 00-0007 EA 64 Port, Category 5E Patch Panel	536.95	50.27
27 11 19 00-0008 EA 96 Port, Category 5E Patch Panel	713.61	60.32
27 11 19 00-0009 EA 12 Port, Category 6 Patch Panel.....	204.66	40.21
27 11 19 00-0010 EA 24 Port, Category 6 Patch Panel.....	252.70	40.21
27 11 19 00-0011 EA 48 Port, Category 6 Patch Panel.....	424.95	40.21
27 11 19 00-0012 EA 96 Port, Category 6 Patch Panel.....	783.17	60.32
27 11 19 00-0013 EA Up To 5 Cables, Terminate One End Of A 4 Pair Cable To Category "X" Specifications	28.50	
27 11 19 00-0014 EA >5 To 10 Cables, Terminate One End Of A 4 Pair Cable To Category "X" Specifications.....	23.74	
27 11 19 00-0015 EA >10 Cables, Terminate One End Of A 4 Pair Cable To Category "X" Specifications.....	14.25	
27 11 19 00-0016 EA Up To 20 Pairs, Terminate One End Of A Twisted Pair Of Wires.....	7.84	
27 11 19 00-0017 EA >20 To 40 Pairs, Terminate One End Of A Twisted Pair Of Wires.....	6.54	
27 11 19 00-0018 EA >40 Pairs, Terminate One End Of A Twisted Pair Of Wires.....	3.92	
27 11 19 00-0019 Fiber Optic Cable Patch Panels And Enclosures (27 11 19 00-0001)		
27 11 19 00-0020 Fiber Optic Cable Connector Housings (27 11 19 00-0019)		
27 11 19 00-0021 Wall Mount, Fiber Optic Cable Connector Housings (27 11 19 00-0020) Note: Includes mounting hardware. Excludes connector panels. See CSI section 27 11 19 00-0049 for connector panels.		
27 11 19 00-0022 EA 1-Panel Capacity, Wall Mount, Fiber Optic Cable Connector Housing	91.53	18.10
27 11 19 00-0023 EA 2-Panel Capacity, Wall Mount, Fiber Optic Cable Connector Housing	134.60	18.10
27 11 19 00-0024 EA 4-Panel Capacity, Wall Mount, Fiber Optic Cable Connector Housing	198.32	18.10
27 11 19 00-0025 EA 6-Panel Capacity, Wall Mount, Fiber Optic Cable Connector Housing	293.41	30.16
27 11 19 00-0026 EA 12-Panel Capacity, Wall Mount, Fiber Optic Cable Connector Housing	406.86	30.16
27 11 19 00-0027 Rack Mount, Fiber Optic Cable Connector Housings (27 11 19 00-0020) Note: Includes mounting hardware. Excludes connector panels. See CSI section 27 11 19 00-0049 for connector panels.		
27 11 19 00-0028 EA 2-Panel Capacity, Rack Mount, Fiber Optic Cable Connector Housing	305.04	30.16
27 11 19 00-0029 EA 4-Panel Capacity, Rack Mount, Fiber Optic Cable Connector Housing	348.29	30.16
27 11 19 00-0030 EA 6-Panel Capacity, Rack Mount, Fiber Optic Cable Connector Housing	374.75	30.16
27 11 19 00-0031 EA 12-Panel Capacity, Rack Mount, Fiber Optic Cable Connector Housing	438.68	30.16
27 11 19 00-0032 Rack Mount, Fiber Optic Cable Pretium® Connector Housings (27 11 19 00-0020) Note: Includes mounting hardware. Excludes connector panels. See CSI section 27 11 19 00-0049 for connector panels.		
27 11 19 00-0033 EA 2-Panel Capacity, Rack Mount, Fiber Optic Cable Pretium® Connector Housing	379.17	30.16
For Splice Tray Bracket, Add	40.02	
27 11 19 00-0034 EA 4-Panel Capacity, Rack Mount, Fiber Optic Cable Pretium® Connector Housing	443.51	30.16
For Splice Tray Bracket, Add	43.76	
27 11 19 00-0035 EA 12-Panel Capacity, Rack Mount, Fiber Optic Cable Pretium® Connector Housing	551.95	30.16
For Splice Tray Bracket, Add	159.42	
27 11 19 00-0036 Rack Mount, Fiber Optic Cable Pretium Edge® Connector Housings (27 11 19 00-0020) Note: Includes mounting hardware. Excludes connector panels. See CSI section 27 11 19 00-0049 for connector panels.		
27 11 19 00-0037 EA 8 Pretium Edge® Module Or Panel Capacity, Rack Mount, Fiber Optic Cable Pretium Edge® Connector Housing.....	480.14	30.16
27 11 19 00-0038 EA 12 Pretium Edge® Module Or Panel Capacity, Rack Mount, Fiber Optic Cable Pretium Edge® Connector Housing.....	612.82	30.16
27 11 19 00-0039 EA 24 Pretium Edge® Module Or Panel Capacity, Rack Mount, Fiber Optic Cable Pretium Edge® Connector Housing.....	693.25	30.16
27 11 19 00-0040 EA 48 Pretium Edge® Module Or Panel Capacity, Rack Mount, Fiber Optic Cable Pretium Edge® Connector Housing.....	898.37	30.16
27 11 19 00-0041 Wall Mount, Fiber Optic Cable Industrial Connector Housings (27 11 19 00-0020) Note: Includes powder-coat finish, pad lockable outer door and mounting hardware. Excludes connector panels. See CSI section 27 11 19 00-0049 for connector panels.		
27 11 19 00-0042 EA 2-Panel Capacity, Wall Mount, Fiber Optic Cable Industrial Connector Housing.....	427.51	18.10
27 11 19 00-0043 EA 6-Panel Capacity, Wall Mount, Fiber Optic Cable Industrial Connector Housing.....	592.04	30.16
27 11 19 00-0044 EA 12-Panel Capacity, Wall Mount, Fiber Optic Cable Industrial Connector Housing.....	621.09	30.16
27 11 19 00-0045 Wall Mount, Fiber Optic Cable Environmental Connector Housings (27 11 19 00-0020) Note: Includes NEMA 4X enclosure, pad lockable outer door and mounting hardware. Excludes connector panels. See CSI section 27 11 19 00-0049 for connector panels.		
27 11 19 00-0046 EA 2-Panel Capacity, Wall Mount, Fiber Optic Cable Environmental Connector Housing.....	447.59	18.10
27 11 19 00-0047 EA 6-Panel Capacity, Wall Mount, Fiber Optic Cable Environmental Connector Housing.....	591.69	30.16
27 11 19 00-0048 EA 12-Panel Capacity, Wall Mount, Fiber Optic Cable Environmental Connector Housing.....	694.46	30.16
27 11 19 00-0049 Fiber Optic Cable Connector Panels (27 11 19 00-0019)		
27 11 19 00-0050 SC Simplex, Fiber Optic Cable Connector Panels (27 11 19 00-0049)		
27 11 19 00-0051 EA 6-Fiber, Multimode, SC Simplex, Fiber Optic Cable Connector Panel.....	59.04	4.02
27 11 19 00-0052 EA 6-Fiber, Singlemode, SC Simplex, Fiber Optic Cable Connector Panel.....	64.03	4.02
27 11 19 00-0053 EA 8-Fiber, Multimode, SC Simplex, Fiber Optic Cable Connector Panel.....	71.76	4.02
27 11 19 00-0054 EA 8-Fiber, Singlemode, SC Simplex, Fiber Optic Cable Connector Panel.....	78.41	4.02



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
27 11 19 00-0055 EA 12-Fiber, Multimode, SC Simplex, Fiber Optic Cable Connector Panel.....	97.23	4.02
27 11 19 00-0056 EA 12-Fiber, Singlemode, SC Simplex, Fiber Optic Cable Connector Panel	107.17	4.02
27 11 19 00-0057 SC Duplex, Fiber Optic Cable Connector Panels (27 11 19 00-0049)		
27 11 19 00-0058 EA 6-Fiber, Multimode, SC Duplex, Fiber Optic Cable Connector Panel	56.83	4.02
27 11 19 00-0059 EA 6-Fiber, Singlemode, SC Duplex, Fiber Optic Cable Connector Panel	58.00	4.02
27 11 19 00-0060 EA 8-Fiber, Multimode, SC Duplex, Fiber Optic Cable Connector Panel	68.84	4.02
27 11 19 00-0061 EA 8-Fiber, Singlemode, SC Duplex, Fiber Optic Cable Connector Panel	70.40	4.02
27 11 19 00-0062 EA 12-Fiber, Multimode, SC Duplex, Fiber Optic Cable Connector Panel	92.85	4.02
27 11 19 00-0063 EA 12-Fiber, Singlemode, SC Duplex, Fiber Optic Cable Connector Panel.....	95.17	4.02
27 11 19 00-0064 LC Duplex, Fiber Optic Cable Connector Panels (27 11 19 00-0049)		
27 11 19 00-0065 EA 6-Fiber, Multimode, LC Duplex, Fiber Optic Cable Connector Panel.....	61.33	4.02
27 11 19 00-0066 EA 6-Fiber, Singlemode, LC Duplex, Fiber Optic Cable Connector Panel	67.21	4.02
27 11 19 00-0067 EA 8-Fiber, Multimode, LC Duplex, Fiber Optic Cable Connector Panel.....	74.82	4.02
27 11 19 00-0068 EA 8-Fiber, Singlemode, LC Duplex, Fiber Optic Cable Connector Panel	82.66	4.02
27 11 19 00-0069 EA 12-Fiber, Multimode, LC Duplex, Fiber Optic Cable Connector Panel.....	101.82	4.02
27 11 19 00-0070 EA 12-Fiber, Singlemode, LC Duplex, Fiber Optic Cable Connector Panel	113.56	4.02
27 11 19 00-0071 EA 16-Fiber, Multimode, LC Duplex, Fiber Optic Cable Connector Panel	128.82	4.02
27 11 19 00-0072 EA 16-Fiber, Singlemode, LC Duplex, Fiber Optic Cable Connector Panel	144.46	4.02
27 11 19 00-0073 EA 24-Fiber, Multimode, LC Duplex, Fiber Optic Cable Connector Panel.....	182.79	4.02
27 11 19 00-0074 EA 24-Fiber, Singlemode, LC Duplex, Fiber Optic Cable Connector Panel	188.24	4.02
27 11 19 00-0075 ST Simplex, Fiber Optic Cable Connector Panels (27 11 19 00-0049)		
27 11 19 00-0076 EA 6-Fiber, Multimode, ST Simplex, Fiber Optic Cable Connector Panel	49.17	4.02
27 11 19 00-0077 EA 6-Fiber, Singlemode, ST Simplex, Fiber Optic Cable Connector Panel	52.94	4.02
27 11 19 00-0078 EA 8-Fiber, Multimode, ST Simplex, Fiber Optic Cable Connector Panel	58.61	4.02
27 11 19 00-0079 EA 8-Fiber, Singlemode, ST Simplex, Fiber Optic Cable Connector Panel	63.64	4.02
27 11 19 00-0080 EA 12-Fiber, Multimode, ST Simplex, Fiber Optic Cable Connector Panel	77.48	4.02
27 11 19 00-0081 EA 12-Fiber, Singlemode, ST Simplex, Fiber Optic Cable Connector Panel.....	85.03	4.02
27 11 19 00-0082 MT-RJ, Fiber Optic Cable Connector Panels (27 11 19 00-0049)		
27 11 19 00-0083 EA 12-Fiber, Multimode, MT-RJ, Fiber Optic Cable Connector Panel	60.98	4.02
27 11 19 00-0084 EA 12-Fiber, Singlemode, MT-RJ, Fiber Optic Cable Connector Panel	90.97	4.02
27 11 19 00-0085 Fiber Optic Cable Pretium Edge® Modules (27 11 19 00-0049)		
27 11 19 00-0086 EA 12-Fiber, Singlemode, LC Duplex To MTP, Fiber Optic Cable Pretium Edge® Module	520.94	4.02
27 11 19 00-0087 EA 12-Fiber, Multimode, LC Duplex To MTP, Fiber Optic Cable Pretium Edge® Module.....	522.75	4.02
27 11 19 00-0088 Fiber Optic Cable Splice Housings (27 11 19 00-0019)		
27 11 19 00-0089 Wall Mount, Fiber Optic Cable Splice Housings (27 11 19 00-0088)		
Note: Includes mounting hardware. Excludes splice trays.		
27 11 19 00-0090 EA 12 Splice Tray Capacity, Wall Mount, Fiber Optic Splice Housing With Locking Door.....	214.05	40.21
27 11 19 00-0091 Rack Mount, Fiber Optic Cable Splice Housings (27 11 19 00-0088)		
Note: Includes mounting hardware. Excludes splice trays.		
27 11 19 00-0092 EA 12 Splice Tray Capacity, Rack Mount, Fiber Optic Cable Splice Housing	316.27	30.16
27 11 19 00-0093 EA 22 Splice Tray Capacity, Rack Mount, Fiber Optic Cable Splice Housing	320.96	30.16
27 11 19 00-0094 Fiber Optic Cable Splice Trays (27 11 19 00-0088)		
27 11 19 00-0095 EA Fiber Optic Cable Splice Tray.....	60.99	10.05
27 11 19 00-0096 Fiber Optic Cable Jumper Management Panels (27 11 19 00-0019)		
Note: Includes mounting hardware.		
27 11 19 00-0097 EA Rack Mount, Fiber Optic Cable Jumper Management Panel.....	120.06	30.16
27 11 19 00-0098 Miscellaneous Accessories (27 11 19 00-0001)		
27 11 19 00-0099 EA Wall Mount Bracket For 12 Or 24 Port Patch Panel.....	44.34	
27 11 19 00-0100 EA Wall Mount Bracket For 32 Or 48 Port Patch Panel.....	58.87	
27 11 19 00-0101 EA Wall Mount Bracket For 64 Or 72 Port Patch Panel.....	64.41	
27 11 19 00-0102 EA Wall Mount Bracket For 96 Port Patch Panel.....	71.83	
27 11 19 00-0103 EA Lightning Protection Plus Stainless Steel Modules, Simon.....	283.51	40.21
27 11 19 00-0104 Telephone Components (27 11 19)		
27 11 19 00-0105 Terminal Blocks With Wide Range Of 22-8 AWG (27 11 19 00-0104)		
27 11 19 00-0106 EA Terminal Block, Circuit Isolation Switch With Wire Range 22-8 AWG	22.15	8.05
27 11 19 00-0107 EA Terminal Block, Fuse Holder 600 Volt, 6.3 Amp With Wire Range 22-8 AWG.....	38.81	8.05

27	Communications
27 10	Structured Cabling
27 11	Communications Equipment Room Fittings



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
27 11 19 00-0108	EA		Terminal Block, Fuse Holder 600 Volt, 10 Amp With Wire Range 22-8 AWG.....	31.99	8.05
27 11 19 00-0109	EA		Terminal Block, Solderless Box With Lugs And Wire Range 22-8 AWG.....	17.64	8.05
27 11 19 00-0110	EA		Flat Terminal Block Connection With Wire Range 22-8 AWG.....	12.56	5.64
27 11 19 00-0111	EA		Ground Terminal Block With Wire Range 22-8 AWG.....	22.87	8.05
27 11 19 00-0112	EA		Terminal Block, Solderless Box With Lug 600 Volt, 60 Amp With Wire Range 22-8 AWG.....	17.64	8.05
27 11 19 00-0113	EA		Terminal Block, Mini Box Lug 300 Volt, 30 Amp With Wire Range 22-8 AWG.....	12.45	5.64
27 11 19 00-0114	EA		Flat Terminal Block Connection 300 Volt, 20 Amp With Wire Range 22-8 AWG.....	12.38	5.64
27 11 19 00-0115	EA		Self Lifting Terminal Block, 300 Volt, 40 Amp Wire Connection With Wire Range 22-12 AWG.....	12.71	5.64
27 11 19 00-0116			Terminal Block Mounting Channel <small>(27 11 19 00-0104)</small>		
27 11 19 00-0117	EA		Terminal Block Mounting Channel, .5 M Galvanized Steel.....	11.60	4.03
27 11 19 00-0118	EA		Terminal Block Mounting Channel, 1 M Galvanized Steel.....	14.49	4.03
27 11 19 00-0119	EA		Terminal Block Mounting Channel, 2 M Galvanized Steel.....	19.53	4.03
27 11 19 00-0120	EA		Terminal Block Mounting Channel, .5 M Bi-Chrome Zinc.....	14.59	4.83
27 11 19 00-0121	EA		Terminal Block Mounting Channel, 1 M Bi-Chrome Zinc.....	19.37	4.83
27 11 19 00-0122	EA		Terminal Block Mounting Channel, 2 M Bi-Chrome Zinc.....	27.14	4.83
27 11 19 00-0123			Outlet Termination Hardware <small>(27 11 19 00-0104)</small>		
27 11 19 00-0124	EA		Telephone Outlet Blocks.....	20.63	4.03
27 11 19 00-0125	EA		Phone Outlet Block For Floor Box..... Note: Excludes box.	66.31	30.56
27 11 19 00-0126	EA		Fiber Optic "SC" Type Modular Bulkhead.....	54.25	18.10
27 11 19 00-0127	EA		Fiber Optic "ST" Type Modular Bulkhead.....	54.25	18.10
27 11 19 00-0128	EA		Type "F" Coaxial Connector Male.....	32.41	12.07
27 11 19 00-0129	EA		Modular Plate For 3-RJ-45, 4 - "SC" And 1 -"F" Connector.....	78.59	20.11
27 11 19 00-0130	EA		Modular Plate For 3-RJ-45, 4 - "ST" And 1 -"F" Connector.....	78.59	20.11
27 11 19 00-0131	EA		Access Floor Box With 3-RJ-45, 4 - "SC" And 1 -"F" Connector.....	92.89	20.11
27 11 19 00-0132	EA		Access Floor Box With 3-RJ-45, 4 - "ST" And 1 -"F" Connector.....	92.89	20.11
27 11 19 00-0133	EA		Access Floor Box With 2-RJ-45, 4 - "SC" And 1 -25 Pin Connector.....	85.37	20.11
27 11 19 00-0134	EA		Terminal Type - Punch Down Block 110 Type - 300 Pair Category 5.....	706.82	100.54
27 11 19 00-0135	EA		Wiring (Punch Down) Block with Stand-Off Legs, 100 Pair, Category V..... Note: Excludes cable terminations.	37.37	8.04
27 11 19 00-0136	EA		Connecting Block, 5-Pair.....	2.32	0.80
27 11 19 00-0137	EA		Connecting Block, 4-Pair.....	2.26	0.80
27 11 19 00-0138	EA		Plastic Label Holder, Transparent.....	9.50	2.01
27 11 19 00-0139	EA		Marked Label, White, 5-Pair.....	2.66	
27 11 19 00-0140	EA		Marked Label, Blue, 4-Pair.....	2.66	
27 11 19 00-0141			Terminations in Manhole or Junction Box <small>(27 11 19 00-0104)</small>		
27 11 19 00-0142	EA		25 Pair Cable Termination In Manhole Or Junction Box.....	128.69	
27 11 19 00-0143	EA		50 Pair Cable Termination In Manhole Or Junction Box.....	257.38	
27 11 19 00-0144	EA		100 Pair Cable Termination In Manhole Or Junction Box.....	514.76	
27 11 19 00-0145	EA		150 Pair Cable Termination In Manhole Or Junction Box.....	772.14	
27 11 19 00-0146	EA		200 Pair Cable Termination In Manhole Or Junction Box.....	903.24	
27 11 19 00-0147	EA		300 Pair Cable Termination In Manhole Or Junction Box.....	1,354.46	
27 11 19 00-0148	EA		400 Pair Cable Termination In Manhole Or Junction Box.....	1,703.53	
27 11 19 00-0149	EA		500 Pair Cable Termination In Manhole Or Junction Box.....	2,129.81	
27 11 19 00-0150	EA		750 Pair Cable Termination In Manhole Or Junction Box.....	3,194.71	
27 11 19 00-0151	EA		1,000 Pair Cable Termination In Manhole Or Junction Box.....	3,874.33	
27 11 19 00-0152	EA		1,200 Pair Cable Termination In Manhole Or Junction Box.....	4,415.70	
27 11 23			Communications Cable Management and Ladder Rack <small>(27 11)</small>		
27 11 23 00-0001			Equipment Supports <small>(27 11 23)</small>		
27 11 23 00-0002	EA		12" x 5'-11" Tubular Runway.....	70.91	19.30
27 11 23 00-0003	EA		12" x 9'-11" Tubular Runway.....	122.35	32.17
27 11 23 00-0004	EA		Shelf Bracket Support For Tubular Runway.....	22.53	6.03
27 11 23 00-0005	EA		Straight Clamp Hardware For Tubular Runway.....	10.20	4.02
27 11 23 00-0006	EA		Corner Clamp Hardware For Tubular Runway.....	10.74	4.02
27 11 23 00-0007	EA		90 Degree Edge Clamp Hardware For Tubular Runway.....	23.85	7.24
27 11 23 00-0008	EA		Wall Angle Assembly Hardware For 12" Wide Tubular Runway.....	49.48	12.07
27 11 23 00-0009	EA		J-Bolt Hardware For Tubular Runway.....	4.73	1.77
27 11 23 00-0010	EA		T Bracket Hardware For Tubular Runway.....	26.14	10.05
27 11 23 00-0011	EA		110 Jumper Trough (Commscope 107831133).....	23.37	4.02
27 11 23 00-0012	LF		Velcro CMP.....	1.94	0.80
27 14			Communications Cabling <small>(27 10)</small>		
27 14 13			Communications Copper Cabling <small>(27 14)</small>		
27 14 13 13			Communications Copper Cable Splicing and Terminations <small>(27 14 13)</small>		
27 14 13 13-0001			Building Entrance Terminals <small>(27 14 13 13)</small>		
27 14 13 13-0002	EA		25 Pair Gas Protective Unit Assembly Complete With Gas Protector.....	1,354.14	176.48
27 14 13 13-0003	EA		50 Pair Gas Protective Unit Assembly Complete With Gas Protector.....	1,843.13	294.13
27 14 13 13-0004	EA		100 Pair Gas Protective Unit Assembly Complete With Gas Protector.....	2,645.37	470.97



Communications	27
Structured Cabling	27 10
Communications Cabling	27 14

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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27 14 13 13-0005 Modular Plugs For Copper Communications Cable <small>(27 14 13 13)</small>		
27 14 13 13-0006 EA	Modular Plug For Non-Shielded Copper Communications Cable..... 18.15 Note: Up to 8-position/8-contact non-shielded modular plug for solid or stranded wire. Includes termination. <i>For >10, Deduct</i> -4.82 <i>For >5 To 10, Deduct</i> -2.41	
27 14 13 13-0007 EA	Modular Plug For Shielded Copper Communications Cable..... 20.60 Note: Up to 8-position/8-contact shielded modular plug for solid or stranded wire. Includes termination. <i>For >10, Deduct</i> -5.42 <i>For >5 To 10, Deduct</i> -2.71	
27 14 13 13-0008 Testing And Certification Of Copper Communications Cable <small>(27 14 13 13)</small>		
Note: Use for existing systems.		
27 14 13 13-0009 PR	Test 1-Pair Of A Copper Communications Cable For Continuity 4.02 <i>For >25-Pair, Deduct</i> -1.60	
27 14 13 13-0010 PR	Certify 1-Pair Of A Copper Communications Cable 6.03 <i>For >25-Pair, Deduct</i> -2.41	
27 14 13 13-0011 PR	Certify And Document 1-Pair Of A Copper Communications Cable 9.65 <i>For >25-Pair, Deduct</i> -3.85	
27 14 13 13-0012 PR	Test 4-Pair Cat 5-7 Telecommunications Cable For Continuity 16.09 <i>For >25-Pair, Deduct</i> -6.42	
27 14 13 13-0013 PR	Certify 4-Pair Cat 5-7 Telecommunications Cable 24.13 <i>For >25-Pair, Deduct</i> -9.63	
27 14 13 13-0014 PR	Certify And Document 4-Pair Cat 5-7 Telecommunications Cable 38.61 <i>For >25-Pair, Deduct</i> -15.41	
27 14 13 13-0015 Communications Termination Blocks <small>(27 14 13 13)</small>		
27 14 13 13-0016 EA	100-Pair, 110 Block With Legs..... 35.68	10.05
27 14 13 13-0017 EA	300-Pair, 110 Block With Legs..... 56.74	10.05
27 14 13 13-0018 EA	Clear Label Holder For 110 Wiring Block..... 10.19	4.02
27 14 13 13-0019 EA	4-Pair, 110C Connecting Block..... 4.67	2.01
27 14 13 13-0020 EA	5-Pair, 110C Connecting Block..... 4.77	2.01
27 14 13 13-0021 EA	100-Pair, 110 Jack Panel System..... 163.99	12.07
Note: Includes twelve 8-pin modular jacks and mounting legs.		
27 14 13 13-0022 EA	300-Pair, 110 Jack Panel System..... 419.71	12.07
Note: Includes twelve 8-pin modular jacks and mounting legs.		
27 14 13 16 Communications Copper Cabling <small>(27 14 13)</small>		
27 14 13 16-0001 Solid Conductor Low Voltage Cable <small>(27 14 13 16)</small>		
27 14 13 16-0002 Shielded, Low Voltage Cable, Pulled In Conduit <small>(27 14 13 16-0001)</small>		
27 14 13 16-0003 #14 AWG Low Voltage Cable, Pulled In Conduit, Shielded <small>(27 14 13 16-0002)</small>		
27 14 13 16-0004 MLF	1 Pair #14 AWG, Solid, Low Voltage, Placed In Conduit, Alarm And Communications Cable 1,524.00	636.79
<i>For Installation On Exposed Surface, Deduct</i> -212.21		
27 14 13 16-0005 MLF	2 Pair #14 AWG, Solid, Low Voltage, Placed In Conduit, Alarm And Communications Cable 1,953.56	659.58
<i>For Installation On Exposed Surface, Deduct</i> -219.86		
27 14 13 16-0006 MLF	3 Pair #14 AWG, Solid, Low Voltage, Placed In Conduit, Alarm And Communications Cable 2,327.70	682.38
<i>For Installation On Exposed Surface, Deduct</i> -227.51		
27 14 13 16-0007 MLF	4 Pair #14 AWG, Solid, Low Voltage, Placed In Conduit, Alarm And Communications Cable 2,723.70	705.91
<i>For Installation On Exposed Surface, Deduct</i> -235.30		
27 14 13 16-0008 MLF	5 Pair #14 AWG, Solid, Low Voltage, Placed In Conduit, Alarm And Communications Cable 3,139.01	753.71
<i>For Installation On Exposed Surface, Deduct</i> -251.19		
27 14 13 16-0009 MLF	6 Pair #14 AWG, Solid, Low Voltage, Placed In Conduit, Alarm And Communications Cable 3,514.79	800.76
<i>For Installation On Exposed Surface, Deduct</i> -266.77		
27 14 13 16-0010 MLF	8 Pair #14 AWG, Solid, Low Voltage, Placed In Conduit, Alarm And Communications Cable 3,789.33	895.62
<i>For Installation On Exposed Surface, Deduct</i> -298.54		
27 14 13 16-0011 MLF	12 Pair #14 AWG, Solid, Low Voltage, Placed In Conduit, Alarm And Communications Cable 5,029.16	1,180.18
<i>For Installation On Exposed Surface, Deduct</i> -393.39		
27 14 13 16-0012 MLF	24 Pair #14 AWG, Solid, Low Voltage, Placed In Conduit, Alarm And Communications Cable 7,499.26	1,743.44
<i>For Installation On Exposed Surface, Deduct</i> -581.19		
27 14 13 16-0013 #16 AWG Low Voltage Cable, Pulled In Conduit, Shielded <small>(27 14 13 16-0002)</small>		
27 14 13 16-0014 MLF	1 Pair #16 AWG, Solid, Low Voltage, Placed In Conduit, Alarm And Communications Cable 1,355.47	568.40
<i>For Installation On Exposed Surface, Deduct</i> -189.56		
27 14 13 16-0015 MLF	2 Pair #16 AWG, Solid, Low Voltage, Placed In Conduit, Alarm And Communications Cable 1,635.79	588.99
<i>For Installation On Exposed Surface, Deduct</i> -196.33		
27 14 13 16-0016 MLF	3 Pair #16 AWG, Solid, Low Voltage, Placed In Conduit, Alarm And Communications Cable 2,063.52	609.57
<i>For Installation On Exposed Surface, Deduct</i> -203.09		
27 14 13 16-0017 MLF	4 Pair #16 AWG, Solid, Low Voltage, Placed In Conduit, Alarm And Communications Cable 2,413.23	630.17
<i>For Installation On Exposed Surface, Deduct</i> -210.15		
27 14 13 16-0018 MLF	5 Pair #16 AWG, Solid, Low Voltage, Placed In Conduit, Alarm And Communications Cable 2,779.60	672.81
<i>For Installation On Exposed Surface, Deduct</i> -224.27		
27 14 13 16-0019 MLF	6 Pair #16 AWG, Solid, Low Voltage, Placed In Conduit, Alarm And Communications Cable 3,111.74	714.73
<i>For Installation On Exposed Surface, Deduct</i> -238.24		
27 14 13 16-0020 MLF	7 Pair #16 AWG, Solid, Low Voltage, Placed In Conduit, Alarm And Communications Cable 3,233.28	757.38
<i>For Installation On Exposed Surface, Deduct</i> -252.36		

27	Communications
27 10	Structured Cabling
27 14	Communications Cabling



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
27 14 13 16-0021 MLF 8 Pair #16 AWG, Solid, Low Voltage, Placed In Conduit, Alarm And Communications Cable..... <i>For Installation On Exposed Surface, Deduct</i>	3,355.55 -266.63	800.03
27 14 13 16-0022 MLF 9 Pair #16 AWG, Solid, Low Voltage, Placed In Conduit, Alarm And Communications Cable..... <i>For Installation On Exposed Surface, Deduct</i>	3,777.19 -283.54	850.76
27 14 13 16-0023 MLF 12 Pair #16 AWG, Solid, Low Voltage, Placed In Conduit, Alarm And Communications Cable..... <i>For Installation On Exposed Surface, Deduct</i>	4,452.87 -351.26	1,053.71
27 14 13 16-0024 MLF 24 Pair #16 AWG, Solid, Low Voltage, Placed In Conduit, Alarm And Communications Cable..... <i>For Installation On Exposed Surface, Deduct</i>	6,639.42 -518.91	1,556.67
27 14 13 16-0025 #18 AWG Low Voltage Cable, Pulled In Conduit, Shielded (27 14 13 16-0002)		
27 14 13 16-0026 MLF 1 Pair #18 AWG, Solid, Low Voltage, Placed In Conduit, Alarm And Communications Cable..... <i>For Installation On Exposed Surface, Deduct</i>	1,121.69 -166.77	500.76
27 14 13 16-0027 MLF 2 Pair #18 AWG, Solid, Low Voltage, Placed In Conduit, Alarm And Communications Cable..... <i>For Installation On Exposed Surface, Deduct</i>	1,395.16 -172.80	518.40
27 14 13 16-0028 MLF 3 Pair #18 AWG, Solid, Low Voltage, Placed In Conduit, Alarm And Communications Cable..... <i>For Installation On Exposed Surface, Deduct</i>	1,634.17 -178.83	536.05
27 14 13 16-0029 MLF 4 Pair #18 AWG, Solid, Low Voltage, Placed In Conduit, Alarm And Communications Cable..... <i>For Installation On Exposed Surface, Deduct</i>	1,886.32 -184.86	554.43
27 14 13 16-0030 MLF 5 Pair #18 AWG, Solid, Low Voltage, Placed In Conduit, Alarm And Communications Cable..... <i>For Installation On Exposed Surface, Deduct</i>	2,157.66 -197.36	591.93
27 14 13 16-0031 MLF 6 Pair #18 AWG, Solid, Low Voltage, Placed In Conduit, Alarm And Communications Cable..... <i>For Installation On Exposed Surface, Deduct</i>	2,404.64 -209.71	628.69
27 14 13 16-0032 MLF 8 Pair #18 AWG, Solid, Low Voltage, Placed In Conduit, Alarm And Communications Cable..... <i>For Installation On Exposed Surface, Deduct</i>	2,600.86 -234.57	703.70
27 14 13 16-0033 MLF 12 Pair #18 AWG, Solid, Low Voltage, Placed In Conduit, Alarm And Communications Cable..... <i>For Installation On Exposed Surface, Deduct</i>	3,449.65 -309.13	927.24
27 14 13 16-0034 MLF 24 Pair #18 AWG, Solid, Low Voltage, Placed In Conduit, Alarm And Communications Cable..... <i>For Installation On Exposed Surface, Deduct</i>	5,139.20 -456.63	1,369.90
27 14 13 16-0035 #20 AWG Low Voltage Cable, Pulled In Conduit, Shielded (27 14 13 16-0002)		
27 14 13 16-0036 MLF 1 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Alarm And Communications Cable..... <i>For Installation On Exposed Surface, Deduct</i>	979.32 -151.62	455.17
27 14 13 16-0037 MLF 2 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Alarm And Communications Cable..... <i>For Installation On Exposed Surface, Deduct</i>	1,194.72 -157.06	471.34
27 14 13 16-0038 MLF 3 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Alarm And Communications Cable..... <i>For Installation On Exposed Surface, Deduct</i>	1,381.21 -162.50	487.88
27 14 13 16-0039 MLF 4 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Alarm And Communications Cable..... <i>For Installation On Exposed Surface, Deduct</i>	1,577.73 -168.09	504.43
27 14 13 16-0040 MLF 5 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Alarm And Communications Cable..... <i>For Installation On Exposed Surface, Deduct</i>	1,796.51 -179.34	538.26
27 14 13 16-0041 MLF 6 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Alarm And Communications Cable..... <i>For Installation On Exposed Surface, Deduct</i>	1,995.08 -190.59	572.07
27 14 13 16-0042 MLF 8 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Alarm And Communications Cable..... <i>For Installation On Exposed Surface, Deduct</i>	2,179.58 -213.24	639.72
27 14 13 16-0043 MLF 12 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Alarm And Communications Cable..... <i>For Installation On Exposed Surface, Deduct</i>	2,868.40 -281.04	843.41
27 14 13 16-0044 MLF 24 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Alarm And Communications Cable..... <i>For Installation On Exposed Surface, Deduct</i>	4,270.61 -415.16	1,245.63
27 14 13 16-0045 MLF 25 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Alarm And Communications Cable..... <i>For Installation On Exposed Surface, Deduct</i>	4,567.57 -425.01	1,275.04
27 14 13 16-0046 MLF 36 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Alarm And Communications Cable..... <i>For Installation On Exposed Surface, Deduct</i>	5,467.27 -494.87	1,484.61
27 14 13 16-0047 MLF 40 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Alarm And Communications Cable..... <i>For Installation On Exposed Surface, Deduct</i>	5,868.57 -529.72	1,589.02
27 14 13 16-0048 MLF 50 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Alarm And Communications Cable..... <i>For Installation On Exposed Surface, Deduct</i>	6,956.20 -661.93	1,986.09
27 14 13 16-0049 MLF 100 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Alarm And Communications Cable..... <i>For Installation On Exposed Surface, Deduct</i>	9,517.68 -871.49	2,614.79
27 14 13 16-0050 #22 AWG Low Voltage Cable, Pulled In Conduit, Shielded (27 14 13 16-0002)		
27 14 13 16-0051 MLF 1 Pair #22 AWG, Solid, Low Voltage, Placed In Conduit, Alarm And Communications Cable..... <i>For Installation On Exposed Surface, Deduct</i>	798.10 -136.48	409.57
27 14 13 16-0052 MLF 2 Pair #22 AWG, Solid, Low Voltage, Placed In Conduit, Alarm And Communications Cable..... <i>For Installation On Exposed Surface, Deduct</i>	864.99 -141.33	424.28
27 14 13 16-0053 MLF 3 Pair #22 AWG, Solid, Low Voltage, Placed In Conduit, Alarm And Communications Cable..... <i>For Installation On Exposed Surface, Deduct</i>	948.87 -146.33	438.98
27 14 13 16-0054 MLF 4 Pair #22 AWG, Solid, Low Voltage, Placed In Conduit, Alarm And Communications Cable..... <i>For Installation On Exposed Surface, Deduct</i>	1,040.85 -151.33	453.69
27 14 13 16-0055 MLF 5 Pair #22 AWG, Solid, Low Voltage, Placed In Conduit, Alarm And Communications Cable..... <i>For Installation On Exposed Surface, Deduct</i>	1,171.98 -161.48	484.57
27 14 13 16-0056 MLF 6 Pair #22 AWG, Solid, Low Voltage, Placed In Conduit, Alarm And Communications Cable..... <i>For Installation On Exposed Surface, Deduct</i>	1,305.68 -171.18	513.25
27 14 13 16-0057 Triad (27 14 13 16-0002)		
27 14 13 16-0058 MLF 1 Triad #16 AWG, Stranded, Low Voltage, Placed In Conduit.....	1,868.37	609.57
27 14 13 16-0059 MLF 4 Triad #20 AWG, Stranded, Low Voltage, Placed In Conduit.....	2,430.82	843.41
27 14 13 16-0060 MLF 8 Triad #20 AWG, Stranded, Low Voltage, Placed In Conduit.....	3,803.18	1,245.63
27 14 13 16-0061 MLF 12 Triad #20 AWG, Stranded, Low Voltage, Placed In Conduit.....	4,741.54	1,484.61
27 14 13 16-0062 MLF 24 Triad #20 AWG, Stranded, Low Voltage, Placed In Conduit.....	7,773.80	2,300.07



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
27 14 13 16-0063 MLF 36 Triad #20 AWG, Stranded, Low Voltage, Placed In Conduit.....	8,945.83	2,614.79
27 14 13 16-0064 Non-Shielded Low Voltage Cable Pulled In Conduit <small>(27 14 13 16-0001)</small>		
27 14 13 16-0065 #14 AWG Low Voltage Cable, Pulled In Conduit, Non-Shielded <small>(27 14 13 16-0064)</small>		
27 14 13 16-0066 MLF 1 Pair #14 AWG, Solid, Low Voltage, Placed In Conduit, Non-Shielded	1,527.87	636.79
<i>For Installation On Exposed Surface, Deduct</i>	-212.21	
27 14 13 16-0067 MLF 2 Pair #14 AWG, Solid, Low Voltage, Placed In Conduit, Non-Shielded	1,960.72	659.58
<i>For Installation On Exposed Surface, Deduct</i>	-219.86	
27 14 13 16-0068 MLF 3 Pair #14 AWG, Solid, Low Voltage, Placed In Conduit, Non-Shielded	2,337.67	682.38
<i>For Installation On Exposed Surface, Deduct</i>	-227.51	
27 14 13 16-0069 MLF 4 Pair #14 AWG, Solid, Low Voltage, Placed In Conduit, Non-Shielded	2,736.67	705.91
<i>For Installation On Exposed Surface, Deduct</i>	-235.30	
27 14 13 16-0070 MLF 5 Pair #14 AWG, Solid, Low Voltage, Placed In Conduit, Non-Shielded	3,153.32	752.96
<i>For Installation On Exposed Surface, Deduct</i>	-250.89	
27 14 13 16-0071 MLF 6 Pair #14 AWG, Solid, Low Voltage, Placed In Conduit, Non-Shielded	3,532.34	800.03
<i>For Installation On Exposed Surface, Deduct</i>	-266.63	
27 14 13 16-0072 MLF 8 Pair #14 AWG, Solid, Low Voltage, Placed In Conduit, Non-Shielded	3,808.58	895.62
<i>For Installation On Exposed Surface, Deduct</i>	-298.54	
27 14 13 16-0073 MLF 12 Pair #14 AWG, Solid, Low Voltage, Placed In Conduit, Non-Shielded	5,054.83	1,180.18
<i>For Installation On Exposed Surface, Deduct</i>	-393.39	
27 14 13 16-0074 MLF 24 Pair #14 AWG, Solid, Low Voltage, Placed In Conduit, Non-Shielded	7,537.76	1,743.44
<i>For Installation On Exposed Surface, Deduct</i>	-581.19	
27 14 13 16-0075 #16 AWG Low Voltage Cable, Pulled In Conduit, Non-Shielded <small>(27 14 13 16-0064)</small>		
27 14 13 16-0076 MLF 1 Pair #16 AWG, Solid, Low Voltage, Placed In Conduit, Non-Shielded	1,358.89	568.40
<i>For Installation On Exposed Surface, Deduct</i>	-189.56	
27 14 13 16-0077 MLF 2 Pair #16 AWG, Solid, Low Voltage, Placed In Conduit, Non-Shielded	1,740.22	588.99
<i>For Installation On Exposed Surface, Deduct</i>	-196.33	
27 14 13 16-0078 MLF 3 Pair #16 AWG, Solid, Low Voltage, Placed In Conduit, Non-Shielded	2,072.31	609.57
<i>For Installation On Exposed Surface, Deduct</i>	-203.09	
27 14 13 16-0079 MLF 4 Pair #16 AWG, Solid, Low Voltage, Placed In Conduit, Non-Shielded	2,424.65	630.17
<i>For Installation On Exposed Surface, Deduct</i>	-210.15	
27 14 13 16-0080 MLF 5 Pair #16 AWG, Solid, Low Voltage, Placed In Conduit, Non-Shielded	2,792.77	672.08
<i>For Installation On Exposed Surface, Deduct</i>	-224.13	
27 14 13 16-0081 MLF 6 Pair #16 AWG, Solid, Low Voltage, Placed In Conduit, Non-Shielded	3,127.84	714.73
<i>For Installation On Exposed Surface, Deduct</i>	-238.24	
27 14 13 16-0082 MLF 7 Pair #16 AWG, Solid, Low Voltage, Placed In Conduit, Non-Shielded	3,249.81	757.38
<i>For Installation On Exposed Surface, Deduct</i>	-252.36	
27 14 13 16-0083 MLF 8 Pair #16 AWG, Solid, Low Voltage, Placed In Conduit, Non-Shielded	3,504.33	800.03
<i>For Installation On Exposed Surface, Deduct</i>	-266.63	
27 14 13 16-0084 MLF 9 Pair #16 AWG, Solid, Low Voltage, Placed In Conduit, Non-Shielded	3,950.68	850.76
<i>For Installation On Exposed Surface, Deduct</i>	-283.52	
27 14 13 16-0085 MLF 12 Pair #16 AWG, Solid, Low Voltage, Placed In Conduit, Non-Shielded	4,475.48	1,053.71
<i>For Installation On Exposed Surface, Deduct</i>	-351.26	
27 14 13 16-0086 MLF 24 Pair #16 AWG, Solid, Low Voltage, Placed In Conduit, Non-Shielded	6,673.69	1,556.67
<i>For Installation On Exposed Surface, Deduct</i>	-518.99	
27 14 13 16-0087 #18 AWG Low Voltage Cable, Pulled In Conduit, Non-Shielded <small>(27 14 13 16-0064)</small>		
27 14 13 16-0088 MLF 1 Pair #18 AWG, Solid, Low Voltage, Placed In Conduit, Non-Shielded	1,176.93	500.01
<i>For Installation On Exposed Surface, Deduct</i>	-166.77	
27 14 13 16-0089 MLF 2 Pair #18 AWG, Solid, Low Voltage, Placed In Conduit, Non-Shielded	1,479.18	518.40
<i>For Installation On Exposed Surface, Deduct</i>	-172.80	
27 14 13 16-0090 MLF 3 Pair #18 AWG, Solid, Low Voltage, Placed In Conduit, Non-Shielded	1,651.29	536.78
<i>For Installation On Exposed Surface, Deduct</i>	-178.83	
27 14 13 16-0091 MLF 4 Pair #18 AWG, Solid, Low Voltage, Placed In Conduit, Non-Shielded	1,894.38	554.43
<i>For Installation On Exposed Surface, Deduct</i>	-184.86	
27 14 13 16-0092 MLF 5 Pair #18 AWG, Solid, Low Voltage, Placed In Conduit, Non-Shielded	2,146.16	591.93
<i>For Installation On Exposed Surface, Deduct</i>	-197.36	
27 14 13 16-0093 MLF 6 Pair #18 AWG, Solid, Low Voltage, Placed In Conduit, Non-Shielded	2,397.22	629.44
<i>For Installation On Exposed Surface, Deduct</i>	-209.71	
27 14 13 16-0094 MLF 8 Pair #18 AWG, Solid, Low Voltage, Placed In Conduit, Non-Shielded	3,018.37	703.70
<i>For Installation On Exposed Surface, Deduct</i>	-234.57	
27 14 13 16-0095 MLF 12 Pair #18 AWG, Solid, Low Voltage, Placed In Conduit, Non-Shielded	3,886.63	927.24
<i>For Installation On Exposed Surface, Deduct</i>	-309.13	
27 14 13 16-0096 MLF 24 Pair #18 AWG, Solid, Low Voltage, Placed In Conduit, Non-Shielded	5,832.24	1,369.90
<i>For Installation On Exposed Surface, Deduct</i>	-456.63	
27 14 13 16-0097 #20 AWG Low Voltage Cable, Pulled In Conduit, Non-Shielded <small>(27 14 13 16-0064)</small>		
27 14 13 16-0098 MLF 1 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Non-Shielded	1,000.29	455.17
<i>For Installation On Exposed Surface, Deduct</i>	-151.62	
27 14 13 16-0099 MLF 2 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Non-Shielded	1,198.15	471.34
<i>For Installation On Exposed Surface, Deduct</i>	-157.06	
27 14 13 16-0100 MLF 3 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Non-Shielded	1,467.61	536.78
<i>For Installation On Exposed Surface, Deduct</i>	-178.83	
27 14 13 16-0101 MLF 4 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Non-Shielded	1,583.91	504.43
<i>For Installation On Exposed Surface, Deduct</i>	-168.09	
27 14 13 16-0102 MLF 5 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Non-Shielded	1,894.12	591.93
<i>For Installation On Exposed Surface, Deduct</i>	-197.36	

27 Communications
27 10 Structured Cabling
27 14 Communications Cabling



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
27 14 13 16-0103 MLF 6 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Non-Shielded..... <i>For Installation On Exposed Surface, Deduct</i>	2,099.42 -209.71	629.44
27 14 13 16-0104 MLF 8 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Non-Shielded..... <i>For Installation On Exposed Surface, Deduct</i>	2,290.39 -233.54	700.46
27 14 13 16-0105 MLF 12 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Non-Shielded..... <i>For Installation On Exposed Surface, Deduct</i>	2,880.66 -281.04	843.41
27 14 13 16-0106 MLF 24 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Non-Shielded..... <i>For Installation On Exposed Surface, Deduct</i>	4,289.01 -415.16	1,245.63
27 14 13 16-0107 MLF 25 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Non-Shielded..... <i>For Installation On Exposed Surface, Deduct</i>	4,588.05 -425.01	1,275.04
27 14 13 16-0108 MLF 36 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Non-Shielded..... <i>For Installation On Exposed Surface, Deduct</i>	5,492.36 -494.87	1,484.61
27 14 13 16-0109 MLF 40 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Non-Shielded..... <i>For Installation On Exposed Surface, Deduct</i>	5,895.57 -529.72	1,589.02
27 14 13 16-0110 MLF 50 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Non-Shielded..... <i>For Installation On Exposed Surface, Deduct</i>	6,986.77 -661.93	1,986.09
27 14 13 16-0111 MLF 100 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Non-Shielded..... <i>For Installation On Exposed Surface, Deduct</i>	9,560.94 -871.49	2,614.79
27 14 13 16-0112 #22 AWG Low Voltage Cable, Pulled In Conduit, Non-Shielded (27 14 13 16-0064)		
27 14 13 16-0113 MLF 1 Pair #22 AWG, Solid, Low Voltage, Placed In Conduit, Non-Shielded..... <i>For Installation On Exposed Surface, Deduct</i>	842.94 -136.48 -136.48	409.57
27 14 13 16-0114 MLF 2 Pair #22 AWG, Solid, Low Voltage, Placed In Conduit, Non-Shielded..... <i>For Installation On Exposed Surface, Deduct</i>	926.35 -141.33 -141.33	424.28
27 14 13 16-0115 MLF 3 Pair #22 AWG, Solid, Low Voltage, Placed In Conduit, Non-Shielded..... <i>For Installation On Exposed Surface, Deduct</i>	1,044.03 -146.33 -146.33	438.98
27 14 13 16-0116 MLF 4 Pair #22 AWG, Solid, Low Voltage, Placed In Conduit, Non-Shielded..... <i>For Installation On Exposed Surface, Deduct</i>	1,175.45 -151.33 -151.33	453.69
27 14 13 16-0117 MLF 5 Pair #22 AWG, Solid, Low Voltage, Placed In Conduit, Non-Shielded..... <i>For Installation On Exposed Surface, Deduct</i>	1,325.74 -161.48 -161.48	484.57
27 14 13 16-0118 MLF 6 Pair #22 AWG, Solid, Low Voltage, Placed In Conduit, Non-Shielded..... <i>For Installation On Exposed Surface, Deduct</i>	1,495.35 -171.18 -171.18	513.25
27 14 13 16-0119 Shielded Plenum Rated, Low Voltage Cable, Pulled In Conduit (27 14 13 16-0001)		
27 14 13 16-0120 MLF 1 Pair #16 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	1,315.86	568.40
27 14 13 16-0121 MLF 2 Pair #16 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	1,847.31	588.99
27 14 13 16-0122 MLF 3 Pair #16 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	2,206.62	609.57
27 14 13 16-0123 MLF 4 Pair #16 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	2,371.77	630.17
27 14 13 16-0124 MLF 5 Pair #16 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	3,069.10	672.08
27 14 13 16-0125 MLF 6 Pair #16 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	3,355.37	714.73
27 14 13 16-0126 MLF 8 Pair #16 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	4,449.52	800.03
27 14 13 16-0127 MLF 12 Pair #16 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	5,369.22	1,053.71
27 14 13 16-0128 MLF 24 Pair #16 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	8,265.03	1,556.67
27 14 13 16-0129 MLF 1 Pair #18 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	1,112.09	500.01
27 14 13 16-0130 MLF 2 Pair #18 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	1,545.65	518.40
27 14 13 16-0131 MLF 3 Pair #18 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	1,896.09	536.78
27 14 13 16-0132 MLF 4 Pair #18 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	2,045.69	554.43
27 14 13 16-0133 MLF 5 Pair #18 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	2,637.90	591.93
27 14 13 16-0134 MLF 6 Pair #18 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	3,056.77	629.44
27 14 13 16-0135 MLF 8 Pair #18 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	3,471.03	703.70
27 14 13 16-0136 MLF 12 Pair #18 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	4,437.08	927.24
27 14 13 16-0137 MLF 24 Pair #18 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	7,383.87	1,369.90
27 14 13 16-0138 MLF 1 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	948.57	455.17
27 14 13 16-0139 MLF 2 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	1,211.23	471.34
27 14 13 16-0140 MLF 3 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	1,464.46	487.51
27 14 13 16-0141 MLF 4 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	1,607.45	504.43
27 14 13 16-0142 MLF 5 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	1,779.12	538.26
27 14 13 16-0143 MLF 6 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	1,984.62	572.07
27 14 13 16-0144 MLF 8 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	2,224.47	639.72
27 14 13 16-0145 MLF 12 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	3,171.14	843.41
27 14 13 16-0146 MLF 24 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	4,912.54	1,245.63
27 14 13 16-0147 MLF 25 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	5,281.73	1,275.04
27 14 13 16-0148 MLF 36 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	6,321.34	1,484.61
27 14 13 16-0149 MLF 40 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	6,810.38	1,589.02
27 14 13 16-0150 MLF 50 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	8,022.75	1,986.09
27 14 13 16-0151 MLF 100 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	11,026.97	2,614.79
27 14 13 16-0152 MLF 250 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	22,060.12	4,816.33
27 14 13 16-0153 MLF 500 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	35,514.68	6,373.74
27 14 13 16-0154 MLF 750 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	48,867.76	8,031.88
27 14 13 16-0155 MLF 1200 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	69,590.24	11,017.26
27 14 13 16-0156 MLF 1 Pair #22 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	879.95	455.17
27 14 13 16-0157 MLF 2 Pair #22 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	1,057.76	471.34
27 14 13 16-0158 MLF 3 Pair #22 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	1,229.56	487.51
27 14 13 16-0159 MLF 4 Pair #22 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	1,331.09	504.43



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
27 14 13 16-0160 MLF 5 Pair #22 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	1,461.31	538.26
27 14 13 16-0161 MLF 6 Pair #22 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	1,612.89	572.07
27 14 13 16-0162 MLF 8 Pair #22 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	1,807.11	639.72
27 14 13 16-0163 MLF 12 Pair #22 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	2,534.84	843.41
27 14 13 16-0164 MLF 24 Pair #22 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	3,890.41	1,245.63
27 14 13 16-0165 MLF 25 Pair #22 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	4,144.32	1,275.04
27 14 13 16-0166 MLF 36 Pair #22 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	4,948.82	1,484.61
27 14 13 16-0167 MLF 40 Pair #22 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	5,310.79	1,589.02
27 14 13 16-0168 MLF 50 Pair #22 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	6,324.51	1,986.09
27 14 13 16-0169 MLF 100 Pair #22 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	8,623.80	2,614.79
27 14 13 16-0170 MLF 250 Pair #22 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	16,974.39	4,816.33
27 14 13 16-0171 MLF 500 Pair #22 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	26,535.74	6,373.74
27 14 13 16-0172 MLF 750 Pair #22 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	36,069.26	8,031.88
27 14 13 16-0173 MLF 1200 Pair #22 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Shielded.....	51,113.26	11,017.26
27 14 13 16-0174 Non-Shielded Plenum Rated, Low Voltage Cable, Pulled In Conduit <small>(27 14 13 16-0001)</small>		
27 14 13 16-0175 MLF 1 Pair #16 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	1,398.06	568.40
27 14 13 16-0176 MLF 2 Pair #16 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	1,788.97	588.99
27 14 13 16-0177 MLF 3 Pair #16 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	2,009.09	609.57
27 14 13 16-0178 MLF 4 Pair #16 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	2,323.11	630.17
27 14 13 16-0179 MLF 5 Pair #16 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	2,642.85	672.08
27 14 13 16-0180 MLF 6 Pair #16 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	2,961.10	714.73
27 14 13 16-0181 MLF 8 Pair #16 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	3,755.09	800.03
27 14 13 16-0182 MLF 12 Pair #16 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	4,830.70	1,053.71
27 14 13 16-0183 MLF 24 Pair #16 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	7,252.54	1,556.67
27 14 13 16-0184 MLF 1 Pair #18 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	1,216.56	500.01
27 14 13 16-0185 MLF 2 Pair #18 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	1,550.22	518.40
27 14 13 16-0186 MLF 3 Pair #18 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	1,738.73	536.78
27 14 13 16-0187 MLF 4 Pair #18 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	2,006.43	554.43
27 14 13 16-0188 MLF 5 Pair #18 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	2,280.07	591.93
27 14 13 16-0189 MLF 6 Pair #18 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	2,552.99	629.44
27 14 13 16-0190 MLF 8 Pair #18 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	3,231.51	703.70
27 14 13 16-0191 MLF 12 Pair #18 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	4,158.57	927.24
27 14 13 16-0192 MLF 24 Pair #18 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	6,242.13	1,369.90
27 14 13 16-0193 MLF 1 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	1,028.26	455.17
27 14 13 16-0194 MLF 2 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	1,313.18	471.34
27 14 13 16-0195 MLF 3 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	1,498.75	487.51
27 14 13 16-0196 MLF 4 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	1,872.57	504.43
27 14 13 16-0197 MLF 5 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	2,145.33	538.26
27 14 13 16-0198 MLF 6 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	2,761.37	572.07
27 14 13 16-0199 MLF 8 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	3,084.51	639.72
27 14 13 16-0200 MLF 12 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	3,796.10	843.41
27 14 13 16-0201 MLF 24 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	5,801.89	1,245.63
27 14 13 16-0202 MLF 25 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	6,269.19	1,275.04
27 14 13 16-0203 MLF 36 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	7,552.75	1,484.61
27 14 13 16-0204 MLF 40 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	8,112.25	1,589.02
27 14 13 16-0205 MLF 50 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	9,497.08	1,986.09
27 14 13 16-0206 MLF 100 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	13,113.30	2,614.79
27 14 13 16-0207 MLF 250 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	26,476.47	4,816.33
27 14 13 16-0208 MLF 500 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	43,311.34	6,373.74
27 14 13 16-0209 MLF 750 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	59,979.78	8,031.88
27 14 13 16-0210 MLF 1200 Pair #20 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	85,632.64	11,016.53
27 14 13 16-0211 MLF 1 Pair #22 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	930.92	455.17
27 14 13 16-0212 MLF 2 Pair #22 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	1,122.99	471.34
27 14 13 16-0213 MLF 3 Pair #22 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	1,251.51	487.51
27 14 13 16-0214 MLF 4 Pair #22 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	1,500.68	504.43
27 14 13 16-0215 MLF 5 Pair #22 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	1,695.56	538.26
27 14 13 16-0216 MLF 6 Pair #22 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	2,109.77	572.07
27 14 13 16-0217 MLF 8 Pair #22 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	2,357.28	639.72
27 14 13 16-0218 MLF 12 Pair #22 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	2,934.61	843.41
27 14 13 16-0219 MLF 24 Pair #22 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	4,459.30	1,245.63
27 14 13 16-0220 MLF 25 Pair #22 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	4,775.97	1,275.04
27 14 13 16-0221 MLF 36 Pair #22 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	5,722.87	1,484.61
27 14 13 16-0222 MLF 40 Pair #22 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	6,143.58	1,589.02
27 14 13 16-0223 MLF 50 Pair #22 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	7,267.60	1,986.09
27 14 13 16-0224 MLF 100 Pair #22 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	9,958.38	2,614.79
27 14 13 16-0225 MLF 250 Pair #22 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	19,799.21	4,816.33
27 14 13 16-0226 MLF 500 Pair #22 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	31,523.13	6,373.74
27 14 13 16-0227 MLF 750 Pair #22 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	43,178.13	8,031.88
27 14 13 16-0228 MLF 1200 Pair #22 AWG, Solid, Low Voltage, Placed In Conduit, Plenum Rated, Non-Shielded.....	61,376.86	11,017.26

27 14 13 16-0229

Copper Telecommunications Cable (27 14 13 16)

27 14 13 16-0230

Indoor Telecommunications Cable (27 14 13 16-0229)

Note: Telecommunications cable installed in conduit includes pull wires and installation in conduit, innerduct, wiremold, etc. Telecommunications cable installed exposed includes installation on exposed surfaces, uncovered wireways, cable trays, etc. Shielded twisted pair cables (STP) include a metallic foil wrap. Un-shielded twisted pair cables (UTP) exclude any shielding.



MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

27 14 13 16-0231	Category 3, Indoor Telecommunications Cable <small>(27 14 13 16-0230)</small> Note: Un-shielded twisted pair cables (UTP).		
27 14 13 16-0232	Category 3, Indoor Telecommunications Riser Cable <small>(27 14 13 16-0231)</small>		
27 14 13 16-0233	24 AWG, Category 3, Indoor Telecommunications Riser Cable <small>(27 14 13 16-0232)</small>		
27 14 13 16-0234	24 AWG, Category 3, Indoor Telecommunications Riser Cable, Installed In Conduit <small>(27 14 13 16-0233)</small>		
27 14 13 16-0235	MLF 2-Pair 24 AWG, Category 3, Indoor Telecommunications Riser Cable, Installed In Conduit.....	643.87	337.81
27 14 13 16-0236	MLF 3-Pair 24 AWG, Category 3, Indoor Telecommunications Riser Cable, Installed In Conduit.....	678.27	337.81
27 14 13 16-0237	MLF 4-Pair 24 AWG, Category 3, Indoor Telecommunications Riser Cable, Installed In Conduit.....	690.31	337.81
27 14 13 16-0238	MLF 6-Pair 24 AWG, Category 3, Indoor Telecommunications Riser Cable, Installed In Conduit.....	839.55	386.07
27 14 13 16-0239	MLF 12-Pair 24 AWG, Category 3, Indoor Telecommunications Riser Cable, Installed In Conduit.....	1,092.42	386.07
27 14 13 16-0240	MLF 25-Pair 24 AWG, Category 3, Indoor Telecommunications Riser Cable, Installed In Conduit.....	1,494.94	386.07
27 14 13 16-0241	MLF 50-Pair 24 AWG, Category 3, Indoor Telecommunications Riser Cable, Installed In Conduit.....	2,416.12	482.58
27 14 13 16-0242	MLF 100-Pair 24 AWG, Category 3, Indoor Telecommunications Riser Cable, Installed In Conduit.....	4,391.83	772.14
27 14 13 16-0243	MLF 150-Pair 24 AWG, Category 3, Indoor Telecommunications Riser Cable, Installed In Conduit.....	5,990.75	868.65
27 14 13 16-0244	MLF 200-Pair 24 AWG, Category 3, Indoor Telecommunications Riser Cable, Installed In Conduit.....	8,007.67	965.18
27 14 13 16-0245	MLF 300-Pair 24 AWG, Category 3, Indoor Telecommunications Riser Cable, Installed In Conduit.....	11,726.81	1,351.25
27 14 13 16-0246	MLF 400-Pair 24 AWG, Category 3, Indoor Telecommunications Riser Cable, Installed In Conduit.....	15,395.27	1,669.75
27 14 13 16-0247	MLF 600-Pair 24 AWG, Category 3, Indoor Telecommunications Riser Cable, Installed In Conduit.....	24,036.65	2,316.42
27 14 13 16-0248	MLF 900-Pair 24 AWG, Category 3, Indoor Telecommunications Riser Cable, Installed In Conduit.....	38,863.50	4,632.83
27 14 13 16-0249	MLF 1,200-Pair 24 AWG, Category 3, Indoor Telecommunications Riser Cable, Installed In Conduit.....	52,701.22	6,949.26
27 14 13 16-0250	24 AWG, Category 3, Indoor Telecommunications Riser Cable, Installed Exposed <small>(27 14 13 16-0233)</small>		
27 14 13 16-0251	MLF 2-Pair 24 AWG, Category 3, Indoor Telecommunications Riser Cable, Installed Exposed.....	1,206.89	675.62
27 14 13 16-0252	MLF 3-Pair 24 AWG, Category 3, Indoor Telecommunications Riser Cable, Installed Exposed.....	1,241.29	675.62
27 14 13 16-0253	MLF 4-Pair 24 AWG, Category 3, Indoor Telecommunications Riser Cable, Installed Exposed.....	1,253.33	675.62
27 14 13 16-0254	MLF 6-Pair 24 AWG, Category 3, Indoor Telecommunications Riser Cable, Installed Exposed.....	1,322.14	675.62
27 14 13 16-0255	MLF 12-Pair 24 AWG, Category 3, Indoor Telecommunications Riser Cable, Installed Exposed.....	1,575.01	675.62
27 14 13 16-0256	MLF 25-Pair 24 AWG, Category 3, Indoor Telecommunications Riser Cable, Installed Exposed.....	2,138.39	772.14
27 14 13 16-0257	MLF 50-Pair 24 AWG, Category 3, Indoor Telecommunications Riser Cable, Installed Exposed.....	3,220.43	965.18
27 14 13 16-0258	MLF 100-Pair 24 AWG, Category 3, Indoor Telecommunications Riser Cable, Installed Exposed.....	5,035.28	1,158.21
27 14 13 16-0259	MLF 150-Pair 24 AWG, Category 3, Indoor Telecommunications Riser Cable, Installed Exposed.....	6,714.63	1,302.98
27 14 13 16-0260	MLF 200-Pair 24 AWG, Category 3, Indoor Telecommunications Riser Cable, Installed Exposed.....	8,811.98	1,447.76
27 14 13 16-0261	MLF 300-Pair 24 AWG, Category 3, Indoor Telecommunications Riser Cable, Installed Exposed.....	12,852.85	2,026.86
27 14 13 16-0262	MLF 400-Pair 24 AWG, Category 3, Indoor Telecommunications Riser Cable, Installed Exposed.....	16,794.77	2,509.46
27 14 13 16-0263	MLF 600-Pair 24 AWG, Category 3, Indoor Telecommunications Riser Cable, Installed Exposed.....	25,967.00	3,474.63
27 14 13 16-0264	MLF 900-Pair 24 AWG, Category 3, Indoor Telecommunications Riser Cable, Installed Exposed.....	42,724.19	6,949.26
27 14 13 16-0265	MLF 1,200-Pair 24 AWG, Category 3, Indoor Telecommunications Riser Cable, Installed Exposed.....	58,492.27	10,423.89
27 14 13 16-0266	22 AWG, Category 3, Indoor Telecommunications Riser Cable <small>(27 14 13 16-0232)</small>		
27 14 13 16-0267	22 AWG, Category 3, Indoor Telecommunications Riser Cable, Installed In Conduit <small>(27 14 13 16-0266)</small>		
27 14 13 16-0268	MLF 25-Pair 22 AWG, Category 3, Indoor Telecommunications Riser Cable, Installed In Conduit.....	2,456.00	386.07
27 14 13 16-0269	MLF 50-Pair 22 AWG, Category 3, Indoor Telecommunications Riser Cable, Installed In Conduit.....	3,681.65	482.58
27 14 13 16-0270	MLF 100-Pair 22 AWG, Category 3, Indoor Telecommunications Riser Cable, Installed In Conduit.....	6,751.22	772.14
27 14 13 16-0271	MLF 200-Pair 22 AWG, Category 3, Indoor Telecommunications Riser Cable, Installed In Conduit.....	12,094.13	965.18
27 14 13 16-0272	MLF 300-Pair 22 AWG, Category 3, Indoor Telecommunications Riser Cable, Installed In Conduit.....	17,898.80	1,351.25
27 14 13 16-0273	MLF 400-Pair 22 AWG, Category 3, Indoor Telecommunications Riser Cable, Installed In Conduit.....	23,336.59	1,669.75
27 14 13 16-0274	MLF 600-Pair 22 AWG, Category 3, Indoor Telecommunications Riser Cable, Installed In Conduit.....	34,461.45	2,316.42
27 14 13 16-0275	22 AWG, Category 3, Indoor Telecommunications Riser Cable, Installed Exposed <small>(27 14 13 16-0266)</small>		
27 14 13 16-0276	MLF 25-Pair 22 AWG, Category 3, Indoor Telecommunications Riser Cable, Installed Exposed.....	3,099.45	772.14
27 14 13 16-0277	MLF 50-Pair 22 AWG, Category 3, Indoor Telecommunications Riser Cable, Installed Exposed.....	4,485.96	965.18
27 14 13 16-0278	MLF 100-Pair 22 AWG, Category 3, Indoor Telecommunications Riser Cable, Installed Exposed.....	7,394.67	1,158.21
27 14 13 16-0279	MLF 200-Pair 22 AWG, Category 3, Indoor Telecommunications Riser Cable, Installed Exposed.....	12,898.44	1,447.76
27 14 13 16-0280	MLF 300-Pair 22 AWG, Category 3, Indoor Telecommunications Riser Cable, Installed Exposed.....	19,024.84	2,026.86
27 14 13 16-0281	MLF 400-Pair 22 AWG, Category 3, Indoor Telecommunications Riser Cable, Installed Exposed.....	24,736.09	2,509.46
27 14 13 16-0282	MLF 600-Pair 22 AWG, Category 3, Indoor Telecommunications Riser Cable, Installed Exposed.....	36,391.80	3,474.63
27 14 13 16-0283	Category 3, Indoor Telecommunications Plenum Cable <small>(27 14 13 16-0231)</small>		
27 14 13 16-0284	24 AWG, Category 3, Indoor Telecommunications Plenum Cable <small>(27 14 13 16-0283)</small>		
27 14 13 16-0285	24 AWG, Category 3, Indoor Telecommunications Plenum Cable, Installed In Conduit <small>(27 14 13 16-0284)</small>		
27 14 13 16-0286	MLF 2-Pair 24 AWG, Category 3, Indoor Telecommunications Plenum Cable, Installed In Conduit.....	666.24	337.81
27 14 13 16-0287	MLF 3-Pair 24 AWG, Category 3, Indoor Telecommunications Plenum Cable, Installed In Conduit.....	700.63	337.81
27 14 13 16-0288	MLF 4-Pair 24 AWG, Category 3, Indoor Telecommunications Plenum Cable, Installed In Conduit.....	724.72	337.81
27 14 13 16-0289	MLF 6-Pair 24 AWG, Category 3, Indoor Telecommunications Plenum Cable, Installed In Conduit.....	875.68	386.07
27 14 13 16-0290	MLF 12-Pair 24 AWG, Category 3, Indoor Telecommunications Plenum Cable, Installed In Conduit.....	1,138.86	386.07



Communications	27	27
Structured Cabling	27 10	
Communications Cabling	27 14	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
27 14 13 16-0291 MLF 25-Pair 24 AWG, Category 3, Indoor Telecommunications Plenum Cable, Installed In Conduit	1,856.17	386.07
27 14 13 16-0292 MLF 50-Pair 24 AWG, Category 3, Indoor Telecommunications Plenum Cable, Installed In Conduit	3,140.32	482.58
27 14 13 16-0293 MLF 100-Pair 24 AWG, Category 3, Indoor Telecommunications Plenum Cable, Installed In Conduit	5,960.62	772.14
27 14 13 16-0294 MLF 200-Pair 24 AWG, Category 3, Indoor Telecommunications Plenum Cable, Installed In Conduit	10,398.73	965.18
27 14 13 16-0295 MLF 300-Pair 24 AWG, Category 3, Indoor Telecommunications Plenum Cable, Installed In Conduit	15,605.80	1,351.25
27 14 13 16-0296 24 AWG, Category 3, Indoor Telecommunications Plenum Cable, Installed Exposed <small>(27 14 13 16-0284)</small>		
27 14 13 16-0297 MLF 2-Pair 24 AWG, Category 3, Indoor Telecommunications Plenum Cable, Installed Exposed.....	1,229.26	675.62
27 14 13 16-0298 MLF 3-Pair 24 AWG, Category 3, Indoor Telecommunications Plenum Cable, Installed Exposed.....	1,263.65	675.62
27 14 13 16-0299 MLF 4-Pair 24 AWG, Category 3, Indoor Telecommunications Plenum Cable, Installed Exposed.....	1,287.74	675.62
27 14 13 16-0300 MLF 6-Pair 24 AWG, Category 3, Indoor Telecommunications Plenum Cable, Installed Exposed.....	1,358.27	675.62
27 14 13 16-0301 MLF 12-Pair 24 AWG, Category 3, Indoor Telecommunications Plenum Cable, Installed Exposed.....	1,621.45	675.62
27 14 13 16-0302 MLF 25-Pair 24 AWG, Category 3, Indoor Telecommunications Plenum Cable, Installed Exposed.....	2,499.62	772.14
27 14 13 16-0303 MLF 50-Pair 24 AWG, Category 3, Indoor Telecommunications Plenum Cable, Installed Exposed.....	3,944.63	965.18
27 14 13 16-0304 MLF 100-Pair 24 AWG, Category 3, Indoor Telecommunications Plenum Cable, Installed Exposed.....	6,604.07	1,158.21
27 14 13 16-0305 MLF 200-Pair 24 AWG, Category 3, Indoor Telecommunications Plenum Cable, Installed Exposed.....	11,203.04	1,447.76
27 14 13 16-0306 MLF 300-Pair 24 AWG, Category 3, Indoor Telecommunications Plenum Cable, Installed Exposed.....	16,731.84	2,026.86
27 14 13 16-0307 Category 5E, Indoor Telecommunications Cable <small>(27 14 13 16-0230)</small>		
27 14 13 16-0308 Category 5E, Indoor Telecommunications Riser Cable <small>(27 14 13 16-0307)</small>		
27 14 13 16-0309 Category 5E, Indoor Telecommunications Riser Cable, Installed In Conduit <small>(27 14 13 16-0306)</small>		
27 14 13 16-0310 MLF 4-Pair Solid UTP, 24 AWG, Category 5E, Indoor Telecommunications Riser Cable, Installed In Conduit.....	752.24	337.81
27 14 13 16-0311 MLF 4-Pair Stranded UTP, 24 AWG, Category 5E, Indoor Telecommunications Riser Cable, Installed In Conduit.....	796.68	337.81
27 14 13 16-0312 MLF 4-Pair Solid STP, 24 AWG, Category 5E, Indoor Telecommunications Riser Cable, Installed In Conduit.....	877.98	386.07
27 14 13 16-0313 MLF 4-Pair Stranded STP, 24 AWG, Category 5E, Indoor Telecommunications Riser Cable, Installed In Conduit.....	922.69	386.07
27 14 13 16-0314 Category 5E, Indoor Telecommunications Riser Cable, Installed Exposed <small>(27 14 13 16-0308)</small>		
27 14 13 16-0315 MLF 4-Pair Solid UTP, 24 AWG, Category 5E, Indoor Telecommunications Riser Cable, Installed Exposed	1,315.26	675.62
27 14 13 16-0316 MLF 4-Pair Stranded UTP, 24 AWG, Category 5E, Indoor Telecommunications Riser Cable, Installed Exposed	1,359.70	675.62
27 14 13 16-0317 MLF 4-Pair Solid STP, 24 AWG, Category 5E, Indoor Telecommunications Riser Cable, Installed Exposed	1,521.43	772.14
27 14 13 16-0318 MLF 4-Pair Stranded STP, 24 AWG, Category 5E, Indoor Telecommunications Riser Cable, Installed Exposed.....	1,566.14	772.14
27 14 13 16-0319 Category 5E, Indoor Telecommunications Plenum Cable <small>(27 14 13 16-0307)</small>		
27 14 13 16-0320 Category 5E, Indoor Telecommunications Plenum Cable, Installed In Conduit <small>(27 14 13 16-0319)</small>		
27 14 13 16-0321 MLF 4-Pair Solid UTP, 24 AWG, Category 5E, Indoor Telecommunications Plenum Cable, Installed In Conduit.....	900.17	337.81
27 14 13 16-0322 MLF 4-Pair Solid STP, 24 AWG, Category 5E, Indoor Telecommunications Plenum Cable, Installed In Conduit.....	1,311.89	386.07
27 14 13 16-0323 Category 5E, Indoor Telecommunications Plenum Cable, Installed Exposed <small>(27 14 13 16-0319)</small>		
27 14 13 16-0324 MLF 4-Pair Solid UTP, 24 AWG, Category 5E, Indoor Telecommunications Plenum Cable, Installed Exposed	1,463.19	675.62
27 14 13 16-0325 MLF 4-Pair Solid STP, 24 AWG, Category 5E, Indoor Telecommunications Plenum Cable, Installed Exposed	1,955.34	772.14
27 14 13 16-0326 Category 6, Indoor Telecommunications Cable <small>(27 14 13 16-0230)</small>		
27 14 13 16-0327 Category 6, Indoor Telecommunications Riser Cable <small>(27 14 13 16-0326)</small>		
27 14 13 16-0328 Category 6, Indoor Telecommunications Riser Cable, Installed In Conduit <small>(27 14 13 16-0327)</small>		
27 14 13 16-0329 MLF 4-Pair Solid UTP, 23 AWG, Category 6, Indoor Telecommunications Riser Cable, Installed In Conduit.....	862.33	337.81
27 14 13 16-0330 MLF 4-Pair Stranded UTP, 23 AWG, Category 6, Indoor Telecommunications Riser Cable, Installed In Conduit	895.79	337.81
27 14 13 16-0331 Category 6, Indoor Telecommunications Riser Cable, Installed Exposed <small>(27 14 13 16-0327)</small>		
27 14 13 16-0332 MLF 4-Pair Solid UTP, 23 AWG, Category 6, Indoor Telecommunications Riser Cable, Installed Exposed	1,425.35	675.62
27 14 13 16-0333 MLF 4-Pair Stranded UTP, 23 AWG, Category 6, Indoor Telecommunications Riser Cable, Installed Exposed.....	1,458.81	675.62
27 14 13 16-0334 Category 6, Indoor Telecommunications Plenum Cable <small>(27 14 13 16-0326)</small>		
27 14 13 16-0335 Category 6, Indoor Telecommunications Plenum Cable, Installed In Conduit <small>(27 14 13 16-0334)</small>		
27 14 13 16-0336 MLF 4-Pair Solid UTP, 23 AWG, Category 6, Indoor Telecommunications Plenum Cable, Installed In Conduit	1,171.96	337.81
27 14 13 16-0337 Category 6, Indoor Telecommunications Plenum Cable, Installed Exposed <small>(27 14 13 16-0334)</small>		
27 14 13 16-0338 MLF 4-Pair Solid UTP, 23 AWG, Category 6, Indoor Telecommunications Plenum Cable, Installed Exposed.....	1,734.98	675.62
27 14 13 16-0339 Category 6a, Indoor Telecommunications Cable <small>(27 14 13 16-0230)</small>		

27	Communications
27 10	Structured Cabling
27 14	Communications Cabling



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
27 14 13 16-0340	Category 6a, Indoor Telecommunications Riser Cable (27 14 13 16-0339)	
27 14 13 16-0341	Category 6a Indoor Telecommunications Riser Cable, Installed In Conduit (27 14 13 16-0340)	
27 14 13 16-0342	MLF 4-Pair Solid UTP, 23 AWG, Category 6a, Indoor Telecommunications Riser Cable, Installed In Conduit.....	915.80 337.81
27 14 13 16-0343	Category 6a, Indoor Telecommunications Riser Cable, Installed Exposed (27 14 13 16-0340)	
27 14 13 16-0344	MLF 4-Pair Solid UTP, 23 AWG, Category 6a, Indoor Telecommunications Riser Cable, Installed Exposed.....	1,478.82 675.62
27 14 13 16-0345	Category 6a, Indoor Telecommunications Plenum Cable (27 14 13 16-0339)	
27 14 13 16-0346	Category 6a, Indoor Telecommunications Plenum Cable, Installed In Conduit (27 14 13 16-0345)	
27 14 13 16-0347	MLF 4-Pair Solid UTP, 23 AWG, Category 6a, Indoor Telecommunications Plenum Cable, Installed In Conduit	1,330.23 337.81
27 14 13 16-0348	Category 6a, Indoor Telecommunications Plenum Cable, Installed Exposed (27 14 13 16-0345)	
27 14 13 16-0349	MLF 4-Pair Solid UTP, 23 AWG, Category 6a, Indoor Telecommunications Plenum Cable, Installed Exposed.....	1,893.25 675.62
27 14 13 16-0350	Category 7, Indoor Telecommunications Cable (27 14 13 16-0230)	
27 14 13 16-0351	Category 7, Indoor Telecommunications Cable, Installed In Conduit (27 14 13 16-0350)	
27 14 13 16-0352	MLF 4-Pair Solid STP, 22 AWG, Category 7, Indoor Telecommunications Riser Cable, Installed In Conduit	2,003.43 386.07
27 14 13 16-0353	MLF 4-Pair Solid STP, 22 AWG, Category 7, Indoor Telecommunications Plenum Cable, Installed In Conduit.....	3,963.24 386.07
27 14 13 16-0354	Category 7, Indoor Telecommunications Cable, Installed Exposed (27 14 13 16-0350)	
27 14 13 16-0355	MLF 4-Pair Solid STP, 22 AWG, Category 7, Indoor Telecommunications Riser Cable, Installed Exposed.....	2,646.88 772.14
27 14 13 16-0356	MLF 4-Pair Solid STP, 22 AWG, Category 7, Indoor Telecommunications Plenum Cable, Installed Exposed.....	4,606.69 772.14
27 14 13 16-0357	Outdoor Telecommunications Cable (27 14 13 16-0229) Note: Telecommunications cable installed in conduit includes pull wires and installation in conduit, innerduct, etc. Telecommunications cable buried in trench excludes excavation.	
27 14 13 16-0358	PE-89 Outdoor Telecommunications Cable (27 14 13 16-0357) Note: Includes foam-skin polyolefin insulated conductors.	
27 14 13 16-0359	24 AWG, PE-89 Outdoor Telecommunications Cable (27 14 13 16-0358)	
27 14 13 16-0360	24 AWG, PE-89 Outdoor Telecommunications Cable, Installed In Conduit (27 14 13 16-0359)	
27 14 13 16-0361	MLF 6-Pair 24 AWG, PE-89 Outdoor Telecommunications Cable, Installed In Conduit	1,446.35 675.62
27 14 13 16-0362	MLF 12-Pair 24 AWG, PE-89 Outdoor Telecommunications Cable, Installed In Conduit	1,581.83 675.62
27 14 13 16-0363	MLF 25-Pair 24 AWG, PE-89 Outdoor Telecommunications Cable, Installed In Conduit	1,873.69 675.62
27 14 13 16-0364	MLF 50-Pair 24 AWG, PE-89 Outdoor Telecommunications Cable, Installed In Conduit	2,429.69 675.62
27 14 13 16-0365	MLF 75-Pair 24 AWG, PE-89 Outdoor Telecommunications Cable, Installed In Conduit	2,982.32 675.62
27 14 13 16-0366	MLF 100-Pair 24 AWG, PE-89 Outdoor Telecommunications Cable, Installed In Conduit	3,536.24 675.62
27 14 13 16-0367	MLF 200-Pair 24 AWG, PE-89 Outdoor Telecommunications Cable, Installed In Conduit	6,021.28 868.65
27 14 13 16-0368	MLF 300-Pair 24 AWG, PE-89 Outdoor Telecommunications Cable, Installed In Conduit	8,835.59 1,254.72
27 14 13 16-0369	MLF 400-Pair 24 AWG, PE-89 Outdoor Telecommunications Cable, Installed In Conduit	11,692.01 1,640.79
27 14 13 16-0370	MLF 600-Pair 24 AWG, PE-89 Outdoor Telecommunications Cable, Installed In Conduit	15,872.85 2,219.90
27 14 13 16-0371	MLF 900-Pair 24 AWG, PE-89 Outdoor Telecommunications Cable, Installed In Conduit	25,735.04 4,439.80
27 14 13 16-0372	MLF 1,200-Pair 24 AWG, PE-89 Outdoor Telecommunications Cable, Installed In Conduit	35,529.02 6,563.19
27 14 13 16-0373	24 AWG, PE-89 Outdoor Telecommunications Cable, Buried In Trench (27 14 13 16-0359)	
27 14 13 16-0374	MLF 6-Pair 24 AWG, PE-89 Outdoor Telecommunications Cable, Buried In Trench	1,205.05
27 14 13 16-0375	MLF 12-Pair 24 AWG, PE-89 Outdoor Telecommunications Cable, Buried In Trench.....	1,340.53
27 14 13 16-0376	MLF 25-Pair 24 AWG, PE-89 Outdoor Telecommunications Cable, Buried In Trench.....	1,632.39
27 14 13 16-0377	MLF 50-Pair 24 AWG, PE-89 Outdoor Telecommunications Cable, Buried In Trench.....	2,188.39
27 14 13 16-0378	MLF 75-Pair 24 AWG, PE-89 Outdoor Telecommunications Cable, Buried In Trench.....	2,741.02
27 14 13 16-0379	MLF 100-Pair 24 AWG, PE-89 Outdoor Telecommunications Cable, Buried In Trench.....	3,294.94
27 14 13 16-0380	MLF 200-Pair 24 AWG, PE-89 Outdoor Telecommunications Cable, Buried In Trench.....	5,860.42
27 14 13 16-0381	MLF 300-Pair 24 AWG, PE-89 Outdoor Telecommunications Cable, Buried In Trench.....	8,353.00
27 14 13 16-0382	MLF 400-Pair 24 AWG, PE-89 Outdoor Telecommunications Cable, Buried In Trench.....	10,686.62
27 14 13 16-0383	MLF 600-Pair 24 AWG, PE-89 Outdoor Telecommunications Cable, Buried In Trench.....	14,103.37
27 14 13 16-0384	MLF 900-Pair 24 AWG, PE-89 Outdoor Telecommunications Cable, Buried In Trench.....	20,909.17
27 14 13 16-0385	MLF 1,200-Pair 24 AWG, PE-89 Outdoor Telecommunications Cable, Buried In Trench	28,451.06
27 14 13 16-0386	22 AWG, PE-89 Outdoor Telecommunications Cable (27 14 13 16-0358)	
27 14 13 16-0387	22 AWG, PE-89 Outdoor Telecommunications Cable, Installed In Conduit (27 14 13 16-0386)	
27 14 13 16-0388	MLF 6-Pair 22 AWG, PE-89 Outdoor Telecommunications Cable, Installed In Conduit	1,532.48 675.62
27 14 13 16-0389	MLF 12-Pair 22 AWG, PE-89 Outdoor Telecommunications Cable, Installed In Conduit	1,742.75 675.62
27 14 13 16-0390	MLF 25-Pair 22 AWG, PE-89 Outdoor Telecommunications Cable, Installed In Conduit	2,203.07 675.62



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MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
27 14 13 16-0391 MLF 50-Pair 22 AWG, PE-89 Outdoor Telecommunications Cable, Installed In Conduit	3,015.96	675.62
27 14 13 16-0392 MLF 75-Pair 22 AWG, PE-89 Outdoor Telecommunications Cable, Installed In Conduit	3,898.50	675.62
27 14 13 16-0393 MLF 100-Pair 22 AWG, PE-89 Outdoor Telecommunications Cable, Installed In Conduit	4,781.76	675.62
27 14 13 16-0394 MLF 200-Pair 22 AWG, PE-89 Outdoor Telecommunications Cable, Installed In Conduit	8,424.06	868.65
27 14 13 16-0395 MLF 300-Pair 22 AWG, PE-89 Outdoor Telecommunications Cable, Installed In Conduit	12,262.44	1,254.72
27 14 13 16-0396 MLF 400-Pair 22 AWG, PE-89 Outdoor Telecommunications Cable, Installed In Conduit	16,311.70	1,640.79
27 14 13 16-0397 MLF 600-Pair 22 AWG, PE-89 Outdoor Telecommunications Cable, Installed In Conduit	23,940.27	2,219.90
27 14 13 16-0398 MLF 900-Pair 22 AWG, PE-89 Outdoor Telecommunications Cable, Installed In Conduit	35,923.53	4,439.80
27 14 13 16-0399 MLF 1,200-Pair 22 AWG, PE-89 Outdoor Telecommunications Cable, Installed In Conduit	50,771.93	6,563.19
27 14 13 16-0400 22 AWG, PE-89 Outdoor Telecommunications Cable, Buried In Trench <small>(27 14 13 16-0386)</small>		
27 14 13 16-0401 MLF 6-Pair 22 AWG, PE-89 Outdoor Telecommunications Cable, Buried In Trench	1,291.18	
27 14 13 16-0402 MLF 12-Pair 22 AWG, PE-89 Outdoor Telecommunications Cable, Buried In Trench	1,501.45	
27 14 13 16-0403 MLF 25-Pair 22 AWG, PE-89 Outdoor Telecommunications Cable, Buried In Trench	1,961.77	
27 14 13 16-0404 MLF 50-Pair 22 AWG, PE-89 Outdoor Telecommunications Cable, Buried In Trench	2,774.66	
27 14 13 16-0405 MLF 75-Pair 22 AWG, PE-89 Outdoor Telecommunications Cable, Buried In Trench	3,657.20	
27 14 13 16-0406 MLF 100-Pair 22 AWG, PE-89 Outdoor Telecommunications Cable, Buried In Trench	4,540.46	
27 14 13 16-0407 MLF 200-Pair 22 AWG, PE-89 Outdoor Telecommunications Cable, Buried In Trench	8,263.20	
27 14 13 16-0408 MLF 300-Pair 22 AWG, PE-89 Outdoor Telecommunications Cable, Buried In Trench	11,779.85	
27 14 13 16-0409 MLF 400-Pair 22 AWG, PE-89 Outdoor Telecommunications Cable, Buried In Trench	15,306.31	
27 14 13 16-0410 MLF 600-Pair 22 AWG, PE-89 Outdoor Telecommunications Cable, Buried In Trench	22,170.79	
27 14 13 16-0411 MLF 900-Pair 22 AWG, PE-89 Outdoor Telecommunications Cable, Buried In Trench	31,097.66	
27 14 13 16-0412 MLF 1,200-Pair 22 AWG, PE-89 Outdoor Telecommunications Cable, Buried In Trench	43,693.97	
27 14 13 16-0413 19 AWG, PE-89 Outdoor Telecommunications Cable <small>(27 14 13 16-0358)</small>		
27 14 13 16-0414 19 AWG, PE-89 Outdoor Telecommunications Cable, Installed In Conduit <small>(27 14 13 16-0413)</small>		
27 14 13 16-0415 MLF 25-Pair 19 AWG, PE-89 Outdoor Telecommunications Cable, Installed In Conduit	3,218.50	675.62
27 14 13 16-0416 MLF 50-Pair 19 AWG, PE-89 Outdoor Telecommunications Cable, Installed In Conduit	5,000.80	675.62
27 14 13 16-0417 MLF 75-Pair 19 AWG, PE-89 Outdoor Telecommunications Cable, Installed In Conduit	7,429.15	675.62
27 14 13 16-0418 MLF 100-Pair 19 AWG, PE-89 Outdoor Telecommunications Cable, Installed In Conduit	8,713.14	675.62
27 14 13 16-0419 19 AWG, PE-89 Outdoor Telecommunications Cable, Buried In Trench <small>(27 14 13 16-0413)</small>		
27 14 13 16-0420 MLF 25-Pair 19 AWG, PE-89 Outdoor Telecommunications Cable, Buried In Trench	2,977.20	
27 14 13 16-0421 MLF 50-Pair 19 AWG, PE-89 Outdoor Telecommunications Cable, Buried In Trench	4,759.50	
27 14 13 16-0422 MLF 75-Pair 19 AWG, PE-89 Outdoor Telecommunications Cable, Buried In Trench	7,187.85	
27 14 13 16-0423 MLF 100-Pair 19 AWG, PE-89 Outdoor Telecommunications Cable, Buried In Trench	8,471.84	
27 14 13 16-0424 PE-39 Outdoor Telecommunications Cable <small>(27 14 13 16-0357)</small>		
Note: Includes solid polyolefin insulated conductors.		
27 14 13 16-0425 24 AWG, PE-39 Outdoor Telecommunications Cable <small>(27 14 13 16-0424)</small>		
27 14 13 16-0426 24 AWG, PE-39 Outdoor Telecommunications Cable, Installed In Conduit <small>(27 14 13 16-0425)</small>		
27 14 13 16-0427 MLF 6-Pair 24 AWG, PE-39 Outdoor Telecommunications Cable, Installed In Conduit	1,458.46	675.62
27 14 13 16-0428 MLF 12-Pair 24 AWG, PE-39 Outdoor Telecommunications Cable, Installed In Conduit	1,624.21	675.62
27 14 13 16-0429 MLF 25-Pair 24 AWG, PE-39 Outdoor Telecommunications Cable, Installed In Conduit	1,958.60	675.62
27 14 13 16-0430 MLF 50-Pair 24 AWG, PE-39 Outdoor Telecommunications Cable, Installed In Conduit	2,560.77	675.62
27 14 13 16-0431 MLF 100-Pair 24 AWG, PE-39 Outdoor Telecommunications Cable, Installed In Conduit	3,782.07	675.62
27 14 13 16-0432 MLF 200-Pair 24 AWG, PE-39 Outdoor Telecommunications Cable, Installed In Conduit	6,583.49	868.65
27 14 13 16-0433 MLF 300-Pair 24 AWG, PE-39 Outdoor Telecommunications Cable, Installed In Conduit	9,602.47	1,254.72
27 14 13 16-0434 MLF 400-Pair 24 AWG, PE-39 Outdoor Telecommunications Cable, Installed In Conduit	12,626.45	1,640.79
27 14 13 16-0435 MLF 600-Pair 24 AWG, PE-39 Outdoor Telecommunications Cable, Installed In Conduit	17,237.20	2,219.90
27 14 13 16-0436 MLF 900-Pair 24 AWG, PE-39 Outdoor Telecommunications Cable, Installed In Conduit	27,499.48	4,439.80
27 14 13 16-0437 MLF 1,200-Pair 24 AWG, PE-39 Outdoor Telecommunications Cable, Installed In Conduit	40,105.25	6,563.19
27 14 13 16-0438 24 AWG, PE-39 Outdoor Telecommunications Cable, Buried In Trench <small>(27 14 13 16-0425)</small>		
27 14 13 16-0439 MLF 6-Pair 24 AWG, PE-39 Outdoor Telecommunications Cable, Buried In Trench	1,217.16	
27 14 13 16-0440 MLF 12-Pair 24 AWG, PE-39 Outdoor Telecommunications Cable, Buried In Trench	1,382.91	
27 14 13 16-0441 MLF 25-Pair 24 AWG, PE-39 Outdoor Telecommunications Cable, Buried In Trench	1,717.30	
27 14 13 16-0442 MLF 50-Pair 24 AWG, PE-39 Outdoor Telecommunications Cable, Buried In Trench	2,319.47	
27 14 13 16-0443 MLF 100-Pair 24 AWG, PE-39 Outdoor Telecommunications Cable, Buried In Trench	3,540.77	
27 14 13 16-0444 MLF 200-Pair 24 AWG, PE-39 Outdoor Telecommunications Cable, Buried In Trench	6,422.63	
27 14 13 16-0445 MLF 300-Pair 24 AWG, PE-39 Outdoor Telecommunications Cable, Buried In Trench	9,119.88	
27 14 13 16-0446 MLF 400-Pair 24 AWG, PE-39 Outdoor Telecommunications Cable, Buried In Trench	11,621.06	
27 14 13 16-0447 MLF 600-Pair 24 AWG, PE-39 Outdoor Telecommunications Cable, Buried In Trench	15,467.72	
27 14 13 16-0448 MLF 900-Pair 24 AWG, PE-39 Outdoor Telecommunications Cable, Buried In Trench	22,673.61	
27 14 13 16-0449 MLF 1,200-Pair 24 AWG, PE-39 Outdoor Telecommunications Cable, Buried In Trench	33,027.29	
27 14 13 16-0450 22 AWG, PE-39 Outdoor Telecommunications Cable <small>(27 14 13 16-0424)</small>		
27 14 13 16-0451 22 AWG, PE-39 Outdoor Telecommunications Cable, Installed In Conduit <small>(27 14 13 16-0450)</small>		
27 14 13 16-0452 MLF 6-Pair 22 AWG, PE-39 Outdoor Telecommunications Cable, Installed In Conduit	1,554.29	675.62

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27 10	Structured Cabling
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MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
27 14 13 16-0453 MLF 12-Pair 22 AWG, PE-39 Outdoor Telecommunications Cable, Installed In Conduit	1,797.85	675.62
27 14 13 16-0454 MLF 25-Pair 22 AWG, PE-39 Outdoor Telecommunications Cable, Installed In Conduit	2,316.16	675.62
27 14 13 16-0455 MLF 50-Pair 22 AWG, PE-39 Outdoor Telecommunications Cable, Installed In Conduit	3,269.66	675.62
27 14 13 16-0456 MLF 100-Pair 22 AWG, PE-39 Outdoor Telecommunications Cable, Installed In Conduit	5,259.50	675.62
27 14 13 16-0457 MLF 200-Pair 22 AWG, PE-39 Outdoor Telecommunications Cable, Installed In Conduit	9,426.77	868.65
27 14 13 16-0458 MLF 300-Pair 22 AWG, PE-39 Outdoor Telecommunications Cable, Installed In Conduit	13,799.51	1,254.72
27 14 13 16-0459 MLF 400-Pair 22 AWG, PE-39 Outdoor Telecommunications Cable, Installed In Conduit	17,702.68	1,640.79
27 14 13 16-0460 MLF 600-Pair 22 AWG, PE-39 Outdoor Telecommunications Cable, Installed In Conduit	24,675.05	2,219.90
27 14 13 16-0461 MLF 900-Pair 22 AWG, PE-39 Outdoor Telecommunications Cable, Installed In Conduit	39,543.08	4,439.80
27 14 13 16-0462 22 AWG, PE-39 Outdoor Telecommunications Cable, Buried In Trench (27 14 13 16-0450)		
27 14 13 16-0463 MLF 6-Pair 22 AWG, PE-39 Outdoor Telecommunications Cable, Buried In Trench	1,312.99	
27 14 13 16-0464 MLF 12-Pair 22 AWG, PE-39 Outdoor Telecommunications Cable, Buried In Trench.....	1,556.55	
27 14 13 16-0465 MLF 25-Pair 22 AWG, PE-39 Outdoor Telecommunications Cable, Buried In Trench.....	2,074.86	
27 14 13 16-0466 MLF 50-Pair 22 AWG, PE-39 Outdoor Telecommunications Cable, Buried In Trench.....	3,028.36	
27 14 13 16-0467 MLF 100-Pair 22 AWG, PE-39 Outdoor Telecommunications Cable, Buried In Trench.....	5,018.20	
27 14 13 16-0468 MLF 200-Pair 22 AWG, PE-39 Outdoor Telecommunications Cable, Buried In Trench.....	9,265.91	
27 14 13 16-0469 MLF 300-Pair 22 AWG, PE-39 Outdoor Telecommunications Cable, Buried In Trench.....	13,316.92	
27 14 13 16-0470 MLF 400-Pair 22 AWG, PE-39 Outdoor Telecommunications Cable, Buried In Trench.....	16,697.29	
27 14 13 16-0471 MLF 600-Pair 22 AWG, PE-39 Outdoor Telecommunications Cable, Buried In Trench.....	22,905.57	
27 14 13 16-0472 MLF 900-Pair 22 AWG, PE-39 Outdoor Telecommunications Cable, Buried In Trench.....	34,717.21	
27 14 13 16-0473 19 AWG, PE-39 Outdoor Telecommunications Cable (27 14 13 16-0424)		
27 14 13 16-0474 19 AWG, PE-39 Outdoor Telecommunications Cable, Installed In Conduit (27 14 13 16-0473)		
27 14 13 16-0475 MLF 25-Pair 19 AWG, PE-39 Outdoor Telecommunications Cable, Installed In Conduit	3,464.33	675.62
27 14 13 16-0476 MLF 50-Pair 19 AWG, PE-39 Outdoor Telecommunications Cable, Installed In Conduit	5,398.17	675.62
27 14 13 16-0477 MLF 100-Pair 19 AWG, PE-39 Outdoor Telecommunications Cable, Installed In Conduit	9,408.26	675.62
27 14 13 16-0478 19 AWG, PE-39 Outdoor Telecommunications Cable, Buried In Trench (27 14 13 16-0473)		
27 14 13 16-0479 MLF 25-Pair 19 AWG, PE-39 Outdoor Telecommunications Cable, Buried In Trench.....	3,223.03	
27 14 13 16-0480 MLF 50-Pair 19 AWG, PE-39 Outdoor Telecommunications Cable, Buried In Trench.....	5,156.87	
27 14 13 16-0481 MLF 100-Pair 19 AWG, PE-39 Outdoor Telecommunications Cable, Buried In Trench.....	9,166.96	
27 14 13 16-0482 (Aerial) Outdoor Telecommunications Cable (27 14 13 16-0357)		
Note: Includes support wire.		
27 14 13 16-0483 24 AWG, (Aerial) Outdoor Telecommunications Cable, Installed On Poles (27 14 13 16-0482)		
27 14 13 16-0484 MLF 6-Pair 24 AWG, (Aerial) Outdoor Telecommunications Cable, Installed On Poles	4,345.73	1,352.41
27 14 13 16-0485 MLF 12-Pair 24 AWG, (Aerial) Outdoor Telecommunications Cable, Installed On Poles	4,483.64	1,352.41
27 14 13 16-0486 MLF 25-Pair 24 AWG, (Aerial) Outdoor Telecommunications Cable, Installed On Poles	4,826.05	1,352.41
27 14 13 16-0487 MLF 50-Pair 24 AWG, (Aerial) Outdoor Telecommunications Cable, Installed On Poles	5,460.01	1,352.41
27 14 13 16-0488 MLF 100-Pair 24 AWG, (Aerial) Outdoor Telecommunications Cable, Installed On Poles	6,684.49	1,352.41
27 14 13 16-0489 MLF 200-Pair 24 AWG, (Aerial) Outdoor Telecommunications Cable, Installed On Poles	9,449.16	1,487.66
27 14 13 16-0490 MLF 300-Pair 24 AWG, (Aerial) Outdoor Telecommunications Cable, Installed On Poles	12,228.99	1,622.89
27 14 13 16-0491 22 AWG, (Aerial) Outdoor Telecommunications Cable, Installed On Poles (27 14 13 16-0482)		
27 14 13 16-0492 MLF 6-Pair 22 AWG, (Aerial) Outdoor Telecommunications Cable, Installed On Poles	4,510.73	1,352.41
27 14 13 16-0493 MLF 12-Pair 22 AWG, (Aerial) Outdoor Telecommunications Cable, Installed On Poles	4,714.48	1,352.41
27 14 13 16-0494 MLF 25-Pair 22 AWG, (Aerial) Outdoor Telecommunications Cable, Installed On Poles	5,205.25	1,352.41
27 14 13 16-0495 MLF 50-Pair 22 AWG, (Aerial) Outdoor Telecommunications Cable, Installed On Poles	6,174.80	1,352.41
27 14 13 16-0496 MLF 100-Pair 22 AWG, (Aerial) Outdoor Telecommunications Cable, Installed On Poles	8,495.96	1,352.41
27 14 13 16-0497 MLF 200-Pair 22 AWG, (Aerial) Outdoor Telecommunications Cable, Installed On Poles	12,556.42	1,487.66
27 14 13 16-0498 19 AWG, (Aerial) Outdoor Telecommunications Cable, Installed On Poles (27 14 13 16-0482)		
27 14 13 16-0499 MLF 6-Pair 19 AWG, (Aerial) Outdoor Telecommunications Cable, Installed On Poles	4,728.87	1,352.41
27 14 13 16-0500 MLF 12-Pair 19 AWG, (Aerial) Outdoor Telecommunications Cable, Installed On Poles	5,189.65	1,352.41
27 14 13 16-0501 MLF 25-Pair 19 AWG, (Aerial) Outdoor Telecommunications Cable, Installed On Poles	6,095.63	1,352.41
27 14 13 16-0502 MLF 50-Pair 19 AWG, (Aerial) Outdoor Telecommunications Cable, Installed On Poles	7,907.59	1,352.41
27 14 13 16-0503 MLF 100-Pair 19 AWG, (Aerial) Outdoor Telecommunications Cable, Installed On Poles	11,735.85	1,352.41
27 14 23 Communications Optical Fiber Cabling (27 14)		
27 14 23 13 Communications Optical Fiber Splicing And Terminations (27 14 23)		
27 14 23 13-0001 Fiber Optic Cable Connectors (27 14 23 13)		
27 14 23 13-0002 EA ST Connector For Multimode Fiber Optic Cable	23.12	
27 14 23 13-0003 EA ST Connector For Singlemode Fiber Optic Cable.....	26.61	
27 14 23 13-0004 EA SC Connector For Multimode Fiber Optic Cable.....	25.71	
27 14 23 13-0005 EA SC Connector For Singlemode Fiber Optic Cable	30.16	
27 14 23 13-0006 EA LC Connector For Multimode Fiber Optic Cable	35.09	



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27 14 23 13-0007 EA LC Connector For Singlemode Fiber Optic Cable.....	36.13	
27 14 23 13-0008 EA MT-RJ Connector For Multimode Fiber Optic Cable.....	52.23	
27 14 23 13-0009 Fiber Optic Cable Fan Out Kits (27 14 23 13)		
27 14 23 13-0010 Buffer Tube Fan Out Kits For Fiber Optic Cable (27 14 23 13-0009)		
27 14 23 13-0011 EA 6-Fiber, Indoor Buffer Tube Fan Out Kit For Fiber Optic Cable.....	185.95	
27 14 23 13-0012 EA 12-Fiber, Indoor Buffer Tube Fan Out Kit For Fiber Optic Cable.....	189.40	
27 14 23 13-0013 EA 6-Fiber, Outdoor Buffer Tube Fan Out Kit For Fiber Optic Cable.....	228.29	
27 14 23 13-0014 EA 12-Fiber, Outdoor Buffer Tube Fan Out Kit For Fiber Optic Cable.....	262.06	
27 14 23 13-0015 Spider Fan Out Kits For Fiber Optic Cable (27 14 23 13-0009)		
Note: For tight buffered or loose tube non-armored cables. Includes aramid yarn strength member, outer protective PVDF jacket and one meter fan out lengths.		
27 14 23 13-0016 EA 6-Fiber, Spider Fan Out Kit For Fiber Optic Cable.....	229.39	
27 14 23 13-0017 EA 12-Fiber, Spider Fan Out Kit For Fiber Optic Cable.....	254.75	
27 14 23 13-0018 EA 18-Fiber, Spider Fan Out Kit For Fiber Optic Cable.....	351.71	
27 14 23 13-0019 EA 24-Fiber, Spider Fan Out Kit For Fiber Optic Cable.....	457.50	
27 14 23 13-0020 Fiber Optic Cable Splice Closures (27 14 23 13)		
Note: Includes mounting hardware. Excludes splicing and splice trays.		
27 14 23 13-0021 EA Up To 144-Fiber Capacity, Pedestal Fiber Optic Cable Splice Closure.....	528.82	80.44
27 14 23 13-0022 EA Up To 144-Fiber Capacity, Underground Fiber Optic Cable Splice Closure.....	689.68	160.86
27 14 23 13-0023 EA Up To 144-Fiber Capacity, Aerial Fiber Optic Cable Splice Closure.....	689.68	160.86
27 14 23 13-0024 EA Up To 288-Fiber Capacity, Pedestal Fiber Optic Cable Splice Closure.....	861.76	80.44
27 14 23 13-0025 EA Up To 288-Fiber Capacity, Underground Fiber Optic Cable Splice Closure.....	1,022.62	160.86
27 14 23 13-0026 EA Up To 288-Fiber Capacity, Aerial Fiber Optic Cable Splice Closure.....	1,022.62	160.86
27 14 23 13-0027 EA Splice Tray For Fiber Optic Cable Splice Closure.....	38.66	10.05
Note: Up to 12-fiber, mechanical or fusion splice tray. Excludes splice.		
27 14 23 13-0028 Fiber Optic Cable Testing (27 14 23 13)		
Note: Price based on testing one wavelength.		
27 14 23 13-0029 Fiber Optic Cable Testing Using An OTDR (27 14 23 13-0028)		
Note: Testing using an optical time domain reflectometer.		
27 14 23 13-0030 EA Test 1-Strand Of Fiber Optic Cable Using A Single Directional OTDR Test.....	16.09	
For >12 To 48 Strands, Deduct	-1.21	
For >48 Strands, Deduct	-1.61	
27 14 23 13-0031 EA Test 1-Strand Of Fiber Optic Cable Using A Multi-Directional OTDR Test.....	24.13	
For >12 To 48 Strands, Deduct	-1.81	
For >48 Strands, Deduct	-2.41	
27 14 23 13-0032 EA Test 1-Strand Of Fiber Optic Cable Using A Single Directional OTDR Test With Documentation.....	40.21	
For >12 To 48 Strands, Deduct	-3.02	
For >48 Strands, Deduct	-4.02	
27 14 23 13-0033 EA Test 1-Strand Of Fiber Optic Cable Using A Multi-Directional OTDR Test With Documentation.....	60.32	
For >12 To 48 Strands, Deduct	-4.52	
For >48 Strands, Deduct	-6.03	
27 14 23 13-0034 Fiber Optic Cable Testing Using A Power Meter (27 14 23 13-0028)		
27 14 23 13-0035 EA Test 1-Strand Of Fiber Optic Cable Using A Single Directional Power Meter Test.....	16.09	
For >12 To 48 Strands, Deduct	-1.21	
For >48 Strands, Deduct	-1.61	
27 14 23 13-0036 EA Test 1-Strand Of Fiber Optic Cable Using A Multi-Directional Power Meter Test.....	24.13	
For >12 To 48 Strands, Deduct	-1.81	
For >48 Strands, Deduct	-2.41	
27 14 23 13-0037 Fiber Optic Cable Light Source/Continuity Testing (27 14 23 13-0028)		
27 14 23 13-0038 EA Test 1-Strand Of Fiber Optic Cable Using A Light Source/Continuity Test.....	16.09	
For >12 To 48 Strands, Deduct	-1.21	
For >48 Strands, Deduct	-1.61	
27 14 23 13-0039 Fiber Optic Cable Splicing (27 14 23 13)		
27 14 23 13-0040 EA Single Strand, Fusion Splice Of Fiber Optic Cable.....	24.13	
27 14 23 13-0041 EA 12-Strand Ribbon, Fusion Splice Of Fiber Optic Cable.....	80.44	
27 14 23 13-0042 Other Fiber Optic Cable Splicing (27 14 23 13)		
27 14 23 13-0043 EA Fiber Optic Finger Splice.....	25.22	15.12
27 14 23 13-0044 EA Fiber Optic Splice Box - Manholes.....	2,968.20	
27 14 23 16 Communications Optical Fiber Cabling (27 14 23)		

27	Communications
27 10	Structured Cabling
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27 14 23 16-0001	Indoor Fiber Optic Cable ^(27 14 23 16)		
	Note: Distribution cables contain multiple tight-buffered fibers bundled under the same jacket with Kevlar strength members. Break-out cables contain multiple individually reinforced and jacketed simplex cables bundled together.		
27 14 23 16-0002	Indoor Fiber Optic Cable, Installed In Conduit ^(27 14 23 16-0001)		
	Note: Excludes conduit or innerduct.		
27 14 23 16-0003	Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit ^(27 14 23 16-0002)		
27 14 23 16-0004	Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit ^(27 14 23 16-0003)		
27 14 23 16-0005	Singlemode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit ^(27 14 23 16-0004)		
27 14 23 16-0006	MLF 1-Fiber, Singlemode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	749.17	289.55
27 14 23 16-0007	MLF 2-Fiber, Singlemode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	829.51	289.55
27 14 23 16-0008	MLF 4-Fiber, Singlemode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	856.34	289.55
27 14 23 16-0009	MLF 6-Fiber, Singlemode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	951.87	289.55
	For Aluminum Armored Cable, Add	1,173.16	
	For Steel Armored Cable, Add	1,246.15	
27 14 23 16-0010	MLF 8-Fiber, Singlemode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	979.26	289.55
27 14 23 16-0011	MLF 12-Fiber, Singlemode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	1,144.82	289.55
	For Aluminum Armored Cable, Add	1,213.20	
	For Steel Armored Cable, Add	1,294.36	
27 14 23 16-0012	MLF 18-Fiber, Singlemode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	2,026.64	337.81
27 14 23 16-0013	MLF 24-Fiber, Singlemode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	2,911.06	337.81
	For Aluminum Armored Cable With Sub-Units, Add	1,517.83	
	For Steel Armored Cable, Add	1,486.52	
27 14 23 16-0014	MLF 36-Fiber, Singlemode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	3,583.22	337.81
	For Aluminum Armored Cable With Sub-Units, Add	1,600.08	
	For Steel Armored Cable, Add	1,423.75	
27 14 23 16-0015	MLF 48-Fiber, Singlemode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	3,713.59	337.81
	For Aluminum Armored Cable With Sub-Units, Add	1,678.80	
	For Steel Armored Cable, Add	1,492.07	
27 14 23 16-0016	MLF 60-Fiber, Singlemode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	4,535.69	337.81
27 14 23 16-0017	MLF 72-Fiber, Singlemode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	4,754.31	337.81
27 14 23 16-0018	MLF 96-Fiber, Singlemode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	5,904.28	337.81
27 14 23 16-0019	MLF 120-Fiber, Singlemode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	7,961.53	386.07
27 14 23 16-0020	MLF 144-Fiber, Singlemode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	9,529.69	386.07
27 14 23 16-0021	50 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit ^(27 14 23 16-0004)		
27 14 23 16-0022	MLF 1-Fiber, 50 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	772.30	289.55
27 14 23 16-0023	MLF 2-Fiber, 50 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	868.77	289.55
27 14 23 16-0024	MLF 4-Fiber, 50 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	998.92	289.55
27 14 23 16-0025	MLF 6-Fiber, 50 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	1,210.16	289.55
	For Aluminum Armored Cable, Add	1,154.47	
	For Steel Armored Cable, Add	1,224.14	
27 14 23 16-0026	MLF 8-Fiber, 50 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	1,314.70	289.55
27 14 23 16-0027	MLF 12-Fiber, 50 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	1,716.75	289.55
	For Aluminum Armored Cable, Add	1,184.55	
	For Steel Armored Cable, Add	1,262.02	
27 14 23 16-0028	MLF 18-Fiber, 50 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	3,385.71	337.81
27 14 23 16-0029	MLF 24-Fiber, 50 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	3,849.97	337.81
	For Aluminum Armored Cable With Sub-Units, Add	1,660.25	
	For Steel Armored Cable, Add	1,630.38	
27 14 23 16-0030	MLF 36-Fiber, 50 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	4,935.51	337.81
27 14 23 16-0031	MLF 48-Fiber, 50 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	5,900.89	337.81
	For Aluminum Armored Cable With Sub-Units, Add	1,786.09	
27 14 23 16-0032	MLF 60-Fiber, 50 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	6,835.66	337.81
27 14 23 16-0033	MLF 72-Fiber, 50 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	7,829.17	337.81
27 14 23 16-0034	MLF 96-Fiber, 50 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	10,053.58	337.81
	For Aluminum Armored Cable With Sub-Units, Add	1,319.14	
27 14 23 16-0035	MLF 120-Fiber, 50 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	14,756.89	386.07
27 14 23 16-0036	MLF 144-Fiber, 50 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	19,147.74	386.07



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27 14 23 16-0037 62.5 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit <small>(27 14 23 16-0004)</small>		
27 14 23 16-0038 MLF 1-Fiber, 62.5 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	786.79	289.55
27 14 23 16-0039 MLF 2-Fiber, 62.5 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	888.07	289.55
27 14 23 16-0040 MLF 4-Fiber, 62.5 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	1,024.74	289.55
27 14 23 16-0041 MLF 6-Fiber, 62.5 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	1,246.54	289.55
27 14 23 16-0042 MLF 8-Fiber, 62.5 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	1,356.30	289.55
27 14 23 16-0043 MLF 12-Fiber, 62.5 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	1,778.46	289.55
27 14 23 16-0044 MLF 18-Fiber, 62.5 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	3,526.84	337.81
27 14 23 16-0045 MLF 24-Fiber, 62.5 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	4,014.31	337.81
27 14 23 16-0046 MLF 36-Fiber, 62.5 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	5,154.13	337.81
27 14 23 16-0047 MLF 48-Fiber, 62.5 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	6,167.78	337.81
27 14 23 16-0048 MLF 60-Fiber, 62.5 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	7,149.29	337.81
27 14 23 16-0049 MLF 72-Fiber, 62.5 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	8,192.48	337.81
27 14 23 16-0050 MLF 96-Fiber, 62.5 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	10,528.10	337.81
27 14 23 16-0051 MLF 120-Fiber, 62.5 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	15,462.56	386.07
27 14 23 16-0052 MLF 144-Fiber, 62.5 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	20,072.95	386.07
27 14 23 16-0053 Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit <small>(27 14 23 16-0003)</small>		
27 14 23 16-0054 Singlemode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit <small>(27 14 23 16-0053)</small>		
27 14 23 16-0055 MLF 2-Fiber, Singlemode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	1,493.80	289.55
27 14 23 16-0056 MLF 4-Fiber, Singlemode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	1,793.44	289.55
27 14 23 16-0057 MLF 6-Fiber, Singlemode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	2,452.62	289.55
27 14 23 16-0058 MLF 8-Fiber, Singlemode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	2,767.20	289.55
27 14 23 16-0059 MLF 12-Fiber, Singlemode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	4,910.36	289.55
27 14 23 16-0060 MLF 18-Fiber, Singlemode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	5,169.75	337.81
27 14 23 16-0061 MLF 24-Fiber, Singlemode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	6,550.53	337.81
27 14 23 16-0062 MLF 36-Fiber, Singlemode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	9,289.58	337.81
27 14 23 16-0063 MLF 48-Fiber, Singlemode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	11,424.42	337.81
27 14 23 16-0064 50 Micron Multimode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit <small>(27 14 23 16-0053)</small>		
27 14 23 16-0065 MLF 2-Fiber, 50 Micron Multimode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	1,784.32	289.55
27 14 23 16-0066 MLF 4-Fiber, 50 Micron Multimode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	1,928.79	289.55
27 14 23 16-0067 MLF 6-Fiber, 50 Micron Multimode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	2,520.10	289.55
27 14 23 16-0068 MLF 8-Fiber, 50 Micron Multimode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	3,096.18	289.55
27 14 23 16-0069 MLF 12-Fiber, 50 Micron Multimode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	3,799.32	289.55
27 14 23 16-0070 MLF 18-Fiber, 50 Micron Multimode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	4,953.87	337.81
27 14 23 16-0071 MLF 24-Fiber, 50 Micron Multimode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	6,396.97	337.81
27 14 23 16-0072 MLF 36-Fiber, 50 Micron Multimode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	9,658.35	337.81
27 14 23 16-0073 MLF 48-Fiber, 50 Micron Multimode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	12,585.58	337.81
27 14 23 16-0074 62.5 Micron Multimode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit <small>(27 14 23 16-0053)</small>		
27 14 23 16-0075 MLF 2-Fiber, 62.5 Micron Multimode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	1,849.41	289.55
27 14 23 16-0076 MLF 4-Fiber, 62.5 Micron Multimode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	2,001.10	289.55
27 14 23 16-0077 MLF 6-Fiber, 62.5 Micron Multimode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	2,621.98	289.55
27 14 23 16-0078 MLF 8-Fiber, 62.5 Micron Multimode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	3,226.86	289.55
27 14 23 16-0079 MLF 12-Fiber, 62.5 Micron Multimode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	3,965.16	289.55

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27 10	Structured Cabling
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27 14 23 16-0080 MLF 18-Fiber, 62.5 Micron Multimode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	5,173.41	337.81
27 14 23 16-0081 MLF 24-Fiber, 62.5 Micron Multimode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	6,688.67	337.81
27 14 23 16-0082 MLF 36-Fiber, 62.5 Micron Multimode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	10,113.11	337.81
27 14 23 16-0083 MLF 48-Fiber, 62.5 Micron Multimode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	13,186.71	337.81
27 14 23 16-0084 Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit <i>(27 14 23 16-0082)</i>		
27 14 23 16-0085 Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit <i>(27 14 23 16-0084)</i>		
27 14 23 16-0086 Singlemode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit <i>(27 14 23 16-0085)</i>		
27 14 23 16-0087 MLF 1-Fiber, Singlemode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	691.67	289.55
27 14 23 16-0088 MLF 2-Fiber, Singlemode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	694.83	289.55
27 14 23 16-0089 MLF 4-Fiber, Singlemode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	860.46	289.55
27 14 23 16-0090 MLF 6-Fiber, Singlemode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	879.85	289.55
<i>For Aluminum Armored Cable, Add</i>	897.57	
<i>For Steel Armored Cable, Add</i>	1,501.91	
27 14 23 16-0091 MLF 8-Fiber, Singlemode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	977.42	289.55
27 14 23 16-0092 MLF 12-Fiber, Singlemode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	995.67	289.55
<i>For Aluminum Armored Cable, Add</i>	962.09	
<i>For Steel Armored Cable, Add</i>	1,566.37	
27 14 23 16-0093 MLF 18-Fiber, Singlemode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	2,235.72	337.81
27 14 23 16-0094 MLF 24-Fiber, Singlemode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	2,862.99	337.81
<i>For Aluminum Armored Cable With Sub-Units, Add</i>	625.78	
<i>For Steel Armored Cable, Add</i>	715.02	
27 14 23 16-0095 MLF 36-Fiber, Singlemode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	4,523.28	337.81
27 14 23 16-0096 MLF 48-Fiber, Singlemode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	4,640.24	337.81
<i>For Aluminum Armored Cable With Sub-Units, Add</i>	120.01	
<i>For Steel Armored Cable, Add</i>	260.61	
27 14 23 16-0097 MLF 60-Fiber, Singlemode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	5,592.00	337.81
27 14 23 16-0098 MLF 72-Fiber, Singlemode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	6,608.19	337.81
27 14 23 16-0099 MLF 96-Fiber, Singlemode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	8,720.03	337.81
27 14 23 16-0100 50 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit <i>(27 14 23 16-0085)</i>		
27 14 23 16-0101 MLF 1-Fiber, 50 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	770.75	289.55
27 14 23 16-0102 MLF 2-Fiber, 50 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	761.06	289.55
27 14 23 16-0103 MLF 4-Fiber, 50 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	1,002.30	289.55
27 14 23 16-0104 MLF 6-Fiber, 50 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	1,095.57	289.55
<i>For Aluminum Armored Cable, Add</i>	1,011.09	
<i>For Steel Armored Cable, Add</i>	1,615.40	
27 14 23 16-0105 MLF 8-Fiber, 50 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	1,313.18	289.55
27 14 23 16-0106 MLF 12-Fiber, 50 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	1,596.06	289.55
<i>For Aluminum Armored Cable, Add</i>	1,020.17	
<i>For Steel Armored Cable, Add</i>	1,624.44	
27 14 23 16-0107 MLF 18-Fiber, 50 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	4,012.97	337.81
27 14 23 16-0108 MLF 24-Fiber, 50 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	4,326.60	337.81
<i>For Aluminum Armored Cable With Sub-Units, Add</i>	286.22	
<i>For Steel Armored Cable, Add</i>	568.31	
27 14 23 16-0109 MLF 36-Fiber, 50 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	6,480.47	337.81
27 14 23 16-0110 MLF 48-Fiber, 50 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	7,253.84	337.81
<i>For Aluminum Armored Cable With Sub-Units, Add</i>	140.24	
27 14 23 16-0111 MLF 60-Fiber, 50 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	8,248.97	337.81
27 14 23 16-0112 MLF 72-Fiber, 50 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	9,795.30	337.81
27 14 23 16-0113 MLF 96-Fiber, 50 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	12,957.89	337.81
<i>For Aluminum Armored Cable With Sub-Units, Add</i>	1,183.24	
27 14 23 16-0114 62.5 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit <i>(27 14 23 16-0085)</i>		
27 14 23 16-0115 MLF 1-Fiber, 62.5 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit	785.15	289.55



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
27 14 23 16-0116 MLF 2-Fiber, 62.5 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit.....	774.99	289.55
27 14 23 16-0117 MLF 4-Fiber, 62.5 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit.....	1,028.29	289.55
27 14 23 16-0118 MLF 6-Fiber, 62.5 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit.....	1,126.22	289.55
27 14 23 16-0119 MLF 8-Fiber, 62.5 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit.....	1,354.71	289.55
27 14 23 16-0120 MLF 12-Fiber, 62.5 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit.....	1,651.73	289.55
27 14 23 16-0121 MLF 18-Fiber, 62.5 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit.....	4,185.47	337.81
27 14 23 16-0122 MLF 24-Fiber, 62.5 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit.....	4,514.78	337.81
27 14 23 16-0123 MLF 36-Fiber, 62.5 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit.....	6,776.34	337.81
27 14 23 16-0124 MLF 48-Fiber, 62.5 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit.....	7,588.38	337.81
27 14 23 16-0125 MLF 60-Fiber, 62.5 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit.....	8,633.27	337.81
27 14 23 16-0126 MLF 72-Fiber, 62.5 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit.....	10,256.91	337.81
27 14 23 16-0127 MLF 96-Fiber, 62.5 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit.....	13,577.64	337.81
27 14 23 16-0128 Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit (27 14 23 16-0084)		
27 14 23 16-0129 Singlemode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit (27 14 23 16-0128)		
27 14 23 16-0130 MLF 2-Fiber, Singlemode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit.....	2,410.15	289.55
27 14 23 16-0131 MLF 4-Fiber, Singlemode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit.....	2,774.71	289.55
27 14 23 16-0132 MLF 6-Fiber, Singlemode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit.....	3,651.11	289.55
27 14 23 16-0133 MLF 8-Fiber, Singlemode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit.....	4,510.01	289.55
27 14 23 16-0134 MLF 12-Fiber, Singlemode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit.....	5,880.80	289.55
27 14 23 16-0135 MLF 18-Fiber, Singlemode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit.....	8,413.18	337.81
27 14 23 16-0136 MLF 24-Fiber, Singlemode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit.....	12,187.98	337.81
27 14 23 16-0137 MLF 36-Fiber, Singlemode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit.....	14,770.24	337.81
27 14 23 16-0138 MLF 48-Fiber, Singlemode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit.....	18,460.62	337.81
27 14 23 16-0139 50 Micron Multimode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit (27 14 23 16-0128)		
27 14 23 16-0140 MLF 2-Fiber, 50 Micron Multimode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit.....	2,058.37	289.55
27 14 23 16-0141 MLF 4-Fiber, 50 Micron Multimode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit.....	2,834.82	289.55
27 14 23 16-0142 MLF 6-Fiber, 50 Micron Multimode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit.....	3,292.71	289.55
27 14 23 16-0143 MLF 8-Fiber, 50 Micron Multimode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit.....	3,932.53	289.55
27 14 23 16-0144 MLF 12-Fiber, 50 Micron Multimode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit.....	5,153.85	289.55
27 14 23 16-0145 MLF 18-Fiber, 50 Micron Multimode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit.....	6,835.66	337.81
27 14 23 16-0146 MLF 24-Fiber, 50 Micron Multimode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit.....	8,219.21	337.81
27 14 23 16-0147 MLF 36-Fiber, 50 Micron Multimode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit.....	12,031.09	337.81
27 14 23 16-0148 MLF 48-Fiber, 50 Micron Multimode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit.....	16,244.62	337.81
27 14 23 16-0149 62.5 Micron Multimode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit (27 14 23 16-0128)		
27 14 23 16-0150 MLF 2-Fiber, 62.5 Micron Multimode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit.....	2,137.16	289.55
27 14 23 16-0151 MLF 4-Fiber, 62.5 Micron Multimode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit.....	2,952.43	289.55
27 14 23 16-0152 MLF 6-Fiber, 62.5 Micron Multimode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit.....	3,433.22	289.55
27 14 23 16-0153 MLF 8-Fiber, 62.5 Micron Multimode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit.....	4,105.03	289.55
27 14 23 16-0154 MLF 12-Fiber, 62.5 Micron Multimode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit.....	5,387.41	289.55
27 14 23 16-0155 MLF 18-Fiber, 62.5 Micron Multimode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit.....	7,149.29	337.81
27 14 23 16-0156 MLF 24-Fiber, 62.5 Micron Multimode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit.....	8,602.02	337.81
27 14 23 16-0157 MLF 36-Fiber, 62.5 Micron Multimode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit.....	12,604.49	337.81

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27 14 23 16-0158	MLF		48-Fiber, 62.5 Micron Multimode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed In Conduit.....	17,028.70	337.81
27 14 23 16-0159			Indoor Fiber Optic Cable, Installed Exposed (27 14 23 16-0001) Note: For non-conduit installations such as cable trays, surface runways, etc.		
27 14 23 16-0160			Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed (27 14 23 16-0159)		
27 14 23 16-0161			Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed (27 14 23 16-0160)		
27 14 23 16-0162			Singlemode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed (27 14 23 16-0161)		
27 14 23 16-0163	MLF		1-Fiber, Singlemode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	910.04	386.07
27 14 23 16-0164	MLF		2-Fiber, Singlemode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	990.38	386.07
27 14 23 16-0165	MLF		4-Fiber, Singlemode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	1,017.21	386.07
27 14 23 16-0166	MLF		6-Fiber, Singlemode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	1,112.74	386.07
			<i>For Aluminum Armored Cable, Add</i>	1,173.16	
			<i>For Steel Armored Cable, Add</i>	1,246.15	
27 14 23 16-0167	MLF		8-Fiber, Singlemode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	1,140.13	386.07
27 14 23 16-0168	MLF		12-Fiber, Singlemode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	1,305.69	386.07
			<i>For Aluminum Armored Cable, Add</i>	1,213.20	
			<i>For Steel Armored Cable, Add</i>	1,294.36	
27 14 23 16-0169	MLF		18-Fiber, Singlemode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	2,187.50	434.33
27 14 23 16-0170	MLF		24-Fiber, Singlemode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	3,071.92	434.33
			<i>For Aluminum Armored Cable With Sub-Units, Add</i>	1,517.83	
			<i>For Steel Armored Cable, Add</i>	1,486.52	
27 14 23 16-0171	MLF		36-Fiber, Singlemode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	3,744.08	434.33
			<i>For Aluminum Armored Cable With Sub-Units, Add</i>	1,600.08	
			<i>For Steel Armored Cable, Add</i>	1,423.75	
27 14 23 16-0172	MLF		48-Fiber, Singlemode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	3,874.45	434.33
			<i>For Aluminum Armored Cable With Sub-Units, Add</i>	1,678.80	
			<i>For Steel Armored Cable, Add</i>	1,492.07	
27 14 23 16-0173	MLF		60-Fiber, Singlemode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	4,696.55	434.33
27 14 23 16-0174	MLF		72-Fiber, Singlemode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	4,915.17	434.33
27 14 23 16-0175	MLF		96-Fiber, Singlemode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	6,065.14	434.33
27 14 23 16-0176	MLF		120-Fiber, Singlemode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	8,122.39	482.58
27 14 23 16-0177	MLF		144-Fiber, Singlemode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	9,690.55	482.58
27 14 23 16-0178			50 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed (27 14 23 16-0161)		
27 14 23 16-0179	MLF		1-Fiber, 50 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed.....	933.17	386.07
27 14 23 16-0180	MLF		2-Fiber, 50 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	1,029.64	386.07
27 14 23 16-0181	MLF		4-Fiber, 50 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	1,159.79	386.07
27 14 23 16-0182	MLF		6-Fiber, 50 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	1,371.03	386.07
			<i>For Aluminum Armored Cable, Add</i>	1,154.47	
			<i>For Steel Armored Cable, Add</i>	1,224.14	
27 14 23 16-0183	MLF		8-Fiber, 50 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	1,475.57	386.07
27 14 23 16-0184	MLF		12-Fiber, 50 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	1,877.62	386.07
			<i>For Aluminum Armored Cable, Add</i>	1,184.55	
			<i>For Steel Armored Cable, Add</i>	1,262.02	
27 14 23 16-0185	MLF		18-Fiber, 50 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	3,546.57	434.33
27 14 23 16-0186	MLF		24-Fiber, 50 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	4,010.83	434.33
			<i>For Aluminum Armored Cable With Sub-Units, Add</i>	1,660.25	
			<i>For Steel Armored Cable, Add</i>	1,630.38	
27 14 23 16-0187	MLF		36-Fiber, 50 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	5,096.37	434.33
27 14 23 16-0188	MLF		48-Fiber, 50 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	6,061.75	434.33
			<i>For Aluminum Armored Cable With Sub-Units, Add</i>	1,786.09	
27 14 23 16-0189	MLF		60-Fiber, 50 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	6,996.52	434.33
27 14 23 16-0190	MLF		72-Fiber, 50 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	7,990.03	434.33
27 14 23 16-0191	MLF		96-Fiber, 50 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	10,214.44	434.33
			<i>For Aluminum Armored Cable With Sub-Units, Add</i>	1,319.14	
27 14 23 16-0192	MLF		120-Fiber, 50 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed.....	14,917.75	482.58
27 14 23 16-0193	MLF		144-Fiber, 50 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed.....	19,308.60	482.58
27 14 23 16-0194			62.5 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed (27 14 23 16-0161)		
27 14 23 16-0195	MLF		1-Fiber, 62.5 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed.....	947.66	386.07
27 14 23 16-0196	MLF		2-Fiber, 62.5 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed.....	1,048.94	386.07
27 14 23 16-0197	MLF		4-Fiber, 62.5 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed.....	1,185.61	386.07
27 14 23 16-0198	MLF		6-Fiber, 62.5 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed.....	1,407.41	386.07
27 14 23 16-0199	MLF		8-Fiber, 62.5 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed.....	1,517.17	386.07



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27 14 23 16-0200 MLF 12-Fiber, 62.5 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	1,939.33	386.07
27 14 23 16-0201 MLF 18-Fiber, 62.5 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	3,687.70	434.33
27 14 23 16-0202 MLF 24-Fiber, 62.5 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	4,175.17	434.33
27 14 23 16-0203 MLF 36-Fiber, 62.5 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	5,314.99	434.33
27 14 23 16-0204 MLF 48-Fiber, 62.5 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	6,328.64	434.33
27 14 23 16-0205 MLF 60-Fiber, 62.5 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	7,310.15	434.33
27 14 23 16-0206 MLF 72-Fiber, 62.5 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	8,353.34	434.33
27 14 23 16-0207 MLF 96-Fiber, 62.5 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	10,688.96	434.33
27 14 23 16-0208 MLF 120-Fiber, 62.5 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	15,623.42	482.58
27 14 23 16-0209 MLF 144-Fiber, 62.5 Micron Multimode, Distribution Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	20,233.81	482.58
27 14 23 16-0210 Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed <small>(27 14 23 16-0160)</small>		
27 14 23 16-0211 Singlemode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed <small>(27 14 23 16-0210)</small>		
27 14 23 16-0212 MLF 2-Fiber, Singlemode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	1,654.67	386.07
27 14 23 16-0213 MLF 4-Fiber, Singlemode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	1,954.31	386.07
27 14 23 16-0214 MLF 6-Fiber, Singlemode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	2,613.49	386.07
27 14 23 16-0215 MLF 8-Fiber, Singlemode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	2,928.07	386.07
27 14 23 16-0216 MLF 12-Fiber, Singlemode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	5,071.23	386.07
27 14 23 16-0217 MLF 18-Fiber, Singlemode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	5,330.61	434.33
27 14 23 16-0218 MLF 24-Fiber, Singlemode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	6,711.39	434.33
27 14 23 16-0219 MLF 36-Fiber, Singlemode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	9,450.44	434.33
27 14 23 16-0220 MLF 48-Fiber, Singlemode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	11,585.28	434.33
27 14 23 16-0221 50 Micron Multimode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed <small>(27 14 23 16-0210)</small>		
27 14 23 16-0222 MLF 2-Fiber, 50 Micron Multimode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	1,945.19	386.07
27 14 23 16-0223 MLF 4-Fiber, 50 Micron Multimode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	2,089.66	386.07
27 14 23 16-0224 MLF 6-Fiber, 50 Micron Multimode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	2,680.97	386.07
27 14 23 16-0225 MLF 8-Fiber, 50 Micron Multimode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	3,257.05	386.07
27 14 23 16-0226 MLF 12-Fiber, 50 Micron Multimode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	3,960.19	386.07
27 14 23 16-0227 MLF 18-Fiber, 50 Micron Multimode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	5,114.73	434.33
27 14 23 16-0228 MLF 24-Fiber, 50 Micron Multimode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	6,557.83	434.33
27 14 23 16-0229 MLF 36-Fiber, 50 Micron Multimode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	9,819.21	434.33
27 14 23 16-0230 MLF 48-Fiber, 50 Micron Multimode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	12,746.44	434.33
27 14 23 16-0231 62.5 Micron Multimode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed <small>(27 14 23 16-0210)</small>		
27 14 23 16-0232 MLF 2-Fiber, 62.5 Micron Multimode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	2,010.28	386.07
27 14 23 16-0233 MLF 4-Fiber, 62.5 Micron Multimode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	2,161.97	386.07
27 14 23 16-0234 MLF 6-Fiber, 62.5 Micron Multimode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	2,782.85	386.07
27 14 23 16-0235 MLF 8-Fiber, 62.5 Micron Multimode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	3,387.73	386.07
27 14 23 16-0236 MLF 12-Fiber, 62.5 Micron Multimode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	4,126.03	386.07
27 14 23 16-0237 MLF 18-Fiber, 62.5 Micron Multimode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	5,334.27	434.33
27 14 23 16-0238 MLF 24-Fiber, 62.5 Micron Multimode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	6,849.53	434.33
27 14 23 16-0239 MLF 36-Fiber, 62.5 Micron Multimode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	10,273.97	434.33
27 14 23 16-0240 MLF 48-Fiber, 62.5 Micron Multimode, Break-Out Riser Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	13,347.57	434.33
27 14 23 16-0241 Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed <small>(27 14 23 16-0159)</small>		
27 14 23 16-0242 Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed <small>(27 14 23 16-0241)</small>		
27 14 23 16-0243 Singlemode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed <small>(27 14 23 16-0242)</small>		
27 14 23 16-0244 MLF 1-Fiber, Singlemode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	852.54	386.07
27 14 23 16-0245 MLF 2-Fiber, Singlemode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	855.70	386.07
27 14 23 16-0246 MLF 4-Fiber, Singlemode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	1,021.33	386.07

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27 14 23 16-0247 MLF 6-Fiber, Singlemode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed.....	1,040.72	386.07
<i>For Aluminum Armored Cable, Add</i>	897.57	
<i>For Steel Armored Cable, Add</i>	1,501.91	
27 14 23 16-0248 MLF 8-Fiber, Singlemode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed.....	1,138.29	386.07
27 14 23 16-0249 MLF 12-Fiber, Singlemode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed.....	1,156.54	386.07
<i>For Aluminum Armored Cable, Add</i>	962.09	
<i>For Steel Armored Cable, Add</i>	1,566.37	
27 14 23 16-0250 MLF 18-Fiber, Singlemode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed.....	2,396.58	434.33
27 14 23 16-0251 MLF 24-Fiber, Singlemode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed.....	3,023.85	434.33
<i>For Aluminum Armored Cable With Sub-Units, Add</i>	625.78	
<i>For Steel Armored Cable, Add</i>	715.02	
27 14 23 16-0252 MLF 36-Fiber, Singlemode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed.....	4,684.14	434.33
27 14 23 16-0253 MLF 48-Fiber, Singlemode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed.....	4,801.10	434.33
<i>For Aluminum Armored Cable With Sub-Units, Add</i>	120.01	
<i>For Steel Armored Cable, Add</i>	260.61	
27 14 23 16-0254 MLF 60-Fiber, Singlemode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed.....	5,752.86	434.33
27 14 23 16-0255 MLF 72-Fiber, Singlemode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed.....	6,769.05	434.33
27 14 23 16-0256 MLF 96-Fiber, Singlemode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed.....	8,880.89	434.33
27 14 23 16-0257 50 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed (27 14 23 16-0242)		
27 14 23 16-0258 MLF 1-Fiber, 50 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed.....	931.62	386.07
27 14 23 16-0259 MLF 2-Fiber, 50 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed.....	921.93	386.07
27 14 23 16-0260 MLF 4-Fiber, 50 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed.....	1,163.17	386.07
27 14 23 16-0261 MLF 6-Fiber, 50 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed.....	1,256.44	386.07
<i>For Aluminum Armored Cable, Add</i>	1,011.09	
<i>For Steel Armored Cable, Add</i>	1,615.40	
27 14 23 16-0262 MLF 8-Fiber, 50 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed.....	1,474.05	386.07
27 14 23 16-0263 MLF 12-Fiber, 50 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed.....	1,756.93	386.07
<i>For Aluminum Armored Cable, Add</i>	1,020.17	
<i>For Steel Armored Cable, Add</i>	1,624.44	
27 14 23 16-0264 MLF 18-Fiber, 50 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed.....	4,173.83	434.33
27 14 23 16-0265 MLF 24-Fiber, 50 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed.....	4,487.46	434.33
<i>For Aluminum Armored Cable With Sub-Units, Add</i>	286.22	
<i>For Steel Armored Cable, Add</i>	568.31	
27 14 23 16-0266 MLF 36-Fiber, 50 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed.....	6,641.33	434.33
27 14 23 16-0267 MLF 48-Fiber, 50 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed.....	7,414.70	434.33
<i>For Aluminum Armored Cable With Sub-Units, Add</i>	140.24	
27 14 23 16-0268 MLF 60-Fiber, 50 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed.....	8,409.83	434.33
27 14 23 16-0269 MLF 72-Fiber, 50 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed.....	9,956.16	434.33
27 14 23 16-0270 MLF 96-Fiber, 50 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed.....	13,118.75	434.33
<i>For Aluminum Armored Cable With Sub-Units, Add</i>	1,183.24	
27 14 23 16-0271 62.5 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed (27 14 23 16-0242)		
27 14 23 16-0272 MLF 1-Fiber, 62.5 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed.....	946.02	386.07
27 14 23 16-0273 MLF 2-Fiber, 62.5 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed.....	935.86	386.07
27 14 23 16-0274 MLF 4-Fiber, 62.5 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed.....	1,189.16	386.07
27 14 23 16-0275 MLF 6-Fiber, 62.5 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed.....	1,287.09	386.07
27 14 23 16-0276 MLF 8-Fiber, 62.5 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed.....	1,515.58	386.07
27 14 23 16-0277 MLF 12-Fiber, 62.5 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed.....	1,812.60	386.07
27 14 23 16-0278 MLF 18-Fiber, 62.5 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed.....	4,346.33	434.33
27 14 23 16-0279 MLF 24-Fiber, 62.5 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed.....	4,675.64	434.33
27 14 23 16-0280 MLF 36-Fiber, 62.5 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed.....	6,937.20	434.33
27 14 23 16-0281 MLF 48-Fiber, 62.5 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed.....	7,749.24	434.33
27 14 23 16-0282 MLF 60-Fiber, 62.5 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed.....	8,794.13	434.33



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
27 14 23 16-0283 MLF 72-Fiber, 62.5 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	10,417.77	434.33
27 14 23 16-0284 MLF 96-Fiber, 62.5 Micron Multimode, Distribution Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	13,738.50	434.33
27 14 23 16-0285 Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed (27 14 23 16-0241)		
27 14 23 16-0286 Singlemode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed (27 14 23 16-0285)		
27 14 23 16-0287 MLF 2-Fiber, Singlemode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	2,571.02	386.07
27 14 23 16-0288 MLF 4-Fiber, Singlemode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	2,935.58	386.07
27 14 23 16-0289 MLF 6-Fiber, Singlemode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	3,811.98	386.07
27 14 23 16-0290 MLF 8-Fiber, Singlemode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	4,670.88	386.07
27 14 23 16-0291 MLF 12-Fiber, Singlemode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	6,041.67	386.07
27 14 23 16-0292 MLF 18-Fiber, Singlemode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	8,574.04	434.33
27 14 23 16-0293 MLF 24-Fiber, Singlemode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	12,348.84	434.33
27 14 23 16-0294 MLF 36-Fiber, Singlemode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	14,931.10	434.33
27 14 23 16-0295 MLF 48-Fiber, Singlemode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	18,621.48	434.33
27 14 23 16-0296 50 Micron Multimode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed (27 14 23 16-0285)		
27 14 23 16-0297 MLF 2-Fiber, 50 Micron Multimode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	2,219.24	386.07
27 14 23 16-0298 MLF 4-Fiber, 50 Micron Multimode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	2,995.69	386.07
27 14 23 16-0299 MLF 6-Fiber, 50 Micron Multimode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	3,453.58	386.07
27 14 23 16-0300 MLF 8-Fiber, 50 Micron Multimode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	4,093.40	386.07
27 14 23 16-0301 MLF 12-Fiber, 50 Micron Multimode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	5,314.72	386.07
27 14 23 16-0302 MLF 18-Fiber, 50 Micron Multimode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	6,996.52	434.33
27 14 23 16-0303 MLF 24-Fiber, 50 Micron Multimode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	8,380.07	434.33
27 14 23 16-0304 MLF 36-Fiber, 50 Micron Multimode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	12,191.95	434.33
27 14 23 16-0305 MLF 48-Fiber, 50 Micron Multimode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	16,405.48	434.33
27 14 23 16-0306 62.5 Micron Multimode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed (27 14 23 16-0285)		
27 14 23 16-0307 MLF 2-Fiber, 62.5 Micron Multimode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	2,298.03	386.07
27 14 23 16-0308 MLF 4-Fiber, 62.5 Micron Multimode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	3,113.30	386.07
27 14 23 16-0309 MLF 6-Fiber, 62.5 Micron Multimode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	3,594.09	386.07
27 14 23 16-0310 MLF 8-Fiber, 62.5 Micron Multimode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	4,265.90	386.07
27 14 23 16-0311 MLF 12-Fiber, 62.5 Micron Multimode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	5,548.28	386.07
27 14 23 16-0312 MLF 18-Fiber, 62.5 Micron Multimode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	7,310.15	434.33
27 14 23 16-0313 MLF 24-Fiber, 62.5 Micron Multimode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	8,762.88	434.33
27 14 23 16-0314 MLF 36-Fiber, 62.5 Micron Multimode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	12,765.35	434.33
27 14 23 16-0315 MLF 48-Fiber, 62.5 Micron Multimode, Break-Out Plenum Rated, Tight Buffer, Indoor Fiber Optic Cable, Installed Exposed	17,189.56	434.33
27 14 23 16-0316 Hybrid, Indoor Fiber Optic Cable, Installed In Conduit (27 14 23 16-0001) Note: Singlemode and multimode combination cable. Excludes conduit or innerduct.		
27 14 23 16-0317 Distribution Riser Rated, Hybrid, Indoor Fiber Optic Cable, Installed In Conduit (27 14 23 16-0316)		
27 14 23 16-0318 MLF 6-Fiber, 2 Singlemode/4 Multimode, Distribution Riser Rated, Hybrid, Indoor Fiber Optic Cable, Installed In Conduit	1,135.52	289.55
27 14 23 16-0319 MLF 12-Fiber, 6 Singlemode/6 Multimode, Distribution Riser Rated, Hybrid, Indoor Fiber Optic Cable, Installed In Conduit	1,742.14	289.55
27 14 23 16-0320 MLF 24-Fiber, 12 Singlemode/12 Multimode, Distribution Riser Rated, Hybrid, Indoor Fiber Optic Cable, Installed In Conduit	3,007.62	337.81
27 14 23 16-0321 MLF 48-Fiber, 24 Singlemode/24 Multimode, Distribution Riser Rated, Hybrid, Indoor Fiber Optic Cable, Installed In Conduit	3,719.59	337.81
27 14 23 16-0322 Distribution Plenum Rated, Hybrid, Indoor Fiber Optic Cable, Installed In Conduit (27 14 23 16-0316)		
27 14 23 16-0323 MLF 6-Fiber, 2 Singlemode/4 Multimode, Distribution Plenum Rated, Hybrid, Indoor Fiber Optic Cable, Installed In Conduit	1,350.66	289.55

27	Communications
27 10	Structured Cabling
27 14	Communications Cabling



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
27 14 23 16-0324 MLF 12-Fiber, 6 Singlemode/6 Multimode, Distribution Plenum Rated, Hybrid, Indoor Fiber Optic Cable, Installed In Conduit	2,052.97	289.55
27 14 23 16-0325 MLF 24-Fiber, 12 Singlemode/12 Multimode, Distribution Plenum Rated, Hybrid, Indoor Fiber Optic Cable, Installed In Conduit	3,428.94	337.81
27 14 23 16-0326 MLF 48-Fiber, 24 Singlemode/24 Multimode, Distribution Plenum Rated, Hybrid, Indoor Fiber Optic Cable, Installed In Conduit	10,032.92	337.81
27 14 23 16-0327 Hybrid, Indoor Fiber Optic Cable, Installed Exposed <small>(27 14 23 16-0001)</small> Note: Singlemode and multimode combination cable. For non-conduit installations such as cable trays, surface runways, etc.		
27 14 23 16-0328 Distribution Riser Rated, Hybrid, Indoor Fiber Optic Cable, Installed Exposed <small>(27 14 23 16-0327)</small>		
27 14 23 16-0329 MLF 6-Fiber, 2 Singlemode/4 Multimode, Distribution Riser Rated, Hybrid, Indoor Fiber Optic Cable, Installed Exposed	1,296.39	386.07
27 14 23 16-0330 MLF 12-Fiber, 6 Singlemode/6 Multimode, Distribution Riser Rated, Hybrid, Indoor Fiber Optic Cable, Installed Exposed	1,903.01	386.07
27 14 23 16-0331 MLF 24-Fiber, 12 Singlemode/12 Multimode, Distribution Riser Rated, Hybrid, Indoor Fiber Optic Cable, Installed Exposed	3,168.48	434.33
27 14 23 16-0332 MLF 48-Fiber, 24 Singlemode/24 Multimode, Distribution Riser Rated, Hybrid, Indoor Fiber Optic Cable, Installed Exposed	3,880.45	434.33
27 14 23 16-0333 Distribution Plenum Rated, Hybrid, Indoor Fiber Optic Cable, Installed Exposed <small>(27 14 23 16-0327)</small>		
27 14 23 16-0334 MLF 6-Fiber, 2 Singlemode/4 Multimode, Distribution Plenum Rated, Hybrid, Indoor Fiber Optic Cable, Installed Exposed	1,511.53	386.07
27 14 23 16-0335 MLF 12-Fiber, 6 Singlemode/6 Multimode, Distribution Plenum Rated, Hybrid, Indoor Fiber Optic Cable, Installed Exposed	2,213.84	386.07
27 14 23 16-0336 MLF 24-Fiber, 12 Singlemode/12 Multimode, Distribution Plenum Rated, Hybrid, Indoor Fiber Optic Cable, Installed Exposed	3,589.80	434.33
27 14 23 16-0337 MLF 48-Fiber, 24 Singlemode/24 Multimode, Distribution Plenum Rated, Hybrid, Indoor Fiber Optic Cable, Installed Exposed	10,193.78	434.33
27 14 23 16-0338 Outdoor Fiber Optic Cable <small>(27 14 23 16)</small>		
27 14 23 16-0339 Outdoor Fiber Optic Cable, Installed In Conduit <small>(27 14 23 16-0338)</small> Note: Excludes conduit or innerduct.		
27 14 23 16-0340 Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit <small>(27 14 23 16-0339)</small>		
27 14 23 16-0341 Singlemode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit <small>(27 14 23 16-0340)</small>		
27 14 23 16-0342 MLF 2-Fiber, Singlemode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit	1,186.11	579.11
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	118.66	
27 14 23 16-0343 MLF 4-Fiber, Singlemode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit	1,198.66	579.11
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	118.84	
27 14 23 16-0344 MLF 6-Fiber, Singlemode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit	1,211.38	579.11
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	118.82	
27 14 23 16-0345 MLF 8-Fiber, Singlemode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit	1,223.93	579.11
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	119.00	
27 14 23 16-0346 MLF 12-Fiber, Singlemode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit	1,249.18	579.11
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	119.18	
27 14 23 16-0347 MLF 18-Fiber, Singlemode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit	1,309.13	579.11
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	115.00	
27 14 23 16-0348 MLF 24-Fiber, Singlemode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit	1,346.77	579.11
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	115.52	
27 14 23 16-0349 MLF 36-Fiber, Singlemode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit	1,436.32	579.11
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	122.32	
27 14 23 16-0350 MLF 48-Fiber, Singlemode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit	1,530.59	579.11
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	123.54	
27 14 23 16-0351 MLF 60-Fiber, Singlemode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit	1,623.45	579.11
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	124.76	
27 14 23 16-0352 MLF 72-Fiber, Singlemode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit	1,745.95	579.11
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	150.02	
27 14 23 16-0353 MLF 96-Fiber, Singlemode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit	1,987.79	579.11
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	161.00	
27 14 23 16-0354 MLF 120-Fiber, Singlemode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit	2,230.85	579.11
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	190.63	
27 14 23 16-0355 MLF 144-Fiber, Singlemode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit	2,482.64	579.11
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	205.60	
27 14 23 16-0356 50 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit <small>(27 14 23 16-0340)</small>		
27 14 23 16-0357 MLF 2-Fiber, 50 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit	1,305.59	579.11
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	119.41	
27 14 23 16-0358 MLF 4-Fiber, 50 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit	1,435.63	579.11
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	122.14	
27 14 23 16-0359 MLF 6-Fiber, 50 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit	1,568.74	579.11
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	122.49	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
27 14 23 16-0360 MLF 8-Fiber, 50 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,700.47 123.02	579.11
27 14 23 16-0361 MLF 12-Fiber, 50 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,963.92 125.11	579.11
27 14 23 16-0362 MLF 18-Fiber, 50 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	2,380.35 126.85	579.11
27 14 23 16-0363 MLF 24-Fiber, 50 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	2,775.53 128.24	579.11
27 14 23 16-0364 MLF 36-Fiber, 50 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	3,579.12 151.59	579.11
27 14 23 16-0365 MLF 48-Fiber, 50 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	4,387.60 162.74	579.11
27 14 23 16-0366 MLF 60-Fiber, 50 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	5,194.85 173.89	579.11
27 14 23 16-0367 MLF 72-Fiber, 50 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	6,043.40 208.91	579.11
27 14 23 16-0368 MLF 96-Fiber, 50 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	7,754.61 239.93	579.11
27 14 23 16-0369 MLF 120-Fiber, 50 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	9,485.52 289.75	579.11
27 14 23 16-0370 MLF 144-Fiber, 50 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	11,250.74 292.20	579.11
27 14 23 16-0371 62.5 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit <small>(27 14 23 16-0340)</small>		
27 14 23 16-0372 MLF 2-Fiber, 62.5 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,241.75 99.94	579.11
27 14 23 16-0373 MLF 4-Fiber, 62.5 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,337.84 107.18	579.11
27 14 23 16-0374 MLF 6-Fiber, 62.5 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,433.78 114.24	579.11
27 14 23 16-0375 MLF 8-Fiber, 62.5 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,552.30 130.05	579.11
27 14 23 16-0376 MLF 12-Fiber, 62.5 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,722.04 135.61	579.11
27 14 23 16-0377 MLF 18-Fiber, 62.5 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	2,022.13 144.53	579.11
27 14 23 16-0378 MLF 24-Fiber, 62.5 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	2,306.40 166.21	579.11
27 14 23 16-0379 MLF 36-Fiber, 62.5 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	2,850.45 184.70	579.11
27 14 23 16-0380 MLF 48-Fiber, 62.5 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	3,486.79 212.37	579.11
27 14 23 16-0381 MLF 60-Fiber, 62.5 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	4,074.54 228.52	579.11
27 14 23 16-0382 MLF 72-Fiber, 62.5 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	4,694.88 258.65	579.11
27 14 23 16-0383 MLF 96-Fiber, 62.5 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	5,949.53 290.82	579.11
27 14 23 16-0384 MLF 120-Fiber, 62.5 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	7,224.33 330.05	579.11
27 14 23 16-0385 MLF 144-Fiber, 62.5 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	8,518.81 303.17	579.11
27 14 23 16-0386 Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit <small>(27 14 23 16-0339)</small>		
27 14 23 16-0387 Singlemode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit <small>(27 14 23 16-0386)</small>		
27 14 23 16-0388 MLF 2-Fiber, Singlemode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,270.09 148.11	579.11
27 14 23 16-0389 MLF 4-Fiber, Singlemode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,282.82 148.11	579.11
27 14 23 16-0390 MLF 6-Fiber, Singlemode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,295.18 148.81	579.11
27 14 23 16-0391 MLF 8-Fiber, Singlemode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,307.91 148.80	579.11
27 14 23 16-0392 MLF 12-Fiber, Singlemode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,332.82 149.85	579.11
27 14 23 16-0393 MLF 18-Fiber, Singlemode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,387.88 151.24	579.11
27 14 23 16-0394 MLF 24-Fiber, Singlemode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,425.52 152.11	579.11
27 14 23 16-0395 MLF 36-Fiber, Singlemode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,519.43 151.42	579.11
27 14 23 16-0396 MLF 48-Fiber, Singlemode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,613.70 156.82	579.11
27 14 23 16-0397 MLF 60-Fiber, Singlemode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,706.56 158.91	579.11
27 14 23 16-0398 MLF 72-Fiber, Singlemode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,836.38 169.02	579.11

27	Communications
27 10	Structured Cabling
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MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
27 14 23 16-0399 MLF 96-Fiber, Singlemode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	2,085.37 192.53	579.11
27 14 23 16-0400 MLF 120-Fiber, Singlemode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	2,366.94 200.38	579.11
27 14 23 16-0401 MLF 144-Fiber, Singlemode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	2,596.76 221.47	579.11
27 14 23 16-0402 50 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit <small>(27 14 23 16-0386)</small>		
27 14 23 16-0403 MLF 2-Fiber, 50 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,388.58 151.41	579.11
27 14 23 16-0404 MLF 4-Fiber, 50 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,519.09 155.59	579.11
27 14 23 16-0405 MLF 6-Fiber, 50 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,526.46 157.99	579.11
27 14 23 16-0406 MLF 8-Fiber, 50 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,780.79 163.09	579.11
27 14 23 16-0407 MLF 12-Fiber, 50 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	2,042.33 170.92	579.11
27 14 23 16-0408 MLF 18-Fiber, 50 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	2,451.96 183.12	579.11
27 14 23 16-0409 MLF 24-Fiber, 50 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	2,844.36 194.62	579.11
27 14 23 16-0410 MLF 36-Fiber, 50 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	3,647.95 236.62	579.11
27 14 23 16-0411 MLF 48-Fiber, 50 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	4,451.37 242.02	579.11
27 14 23 16-0412 MLF 60-Fiber, 50 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	5,257.40 261.72	579.11
27 14 23 16-0413 MLF 72-Fiber, 50 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	6,101.07 288.90	579.11
27 14 23 16-0414 MLF 96-Fiber, 50 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	7,808.98 285.06	579.11
27 14 23 16-0415 MLF 120-Fiber, 50 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	9,627.70 293.59	579.11
27 14 23 16-0416 MLF 144-Fiber, 50 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	11,309.63 333.15	579.11
27 14 23 16-0417 62.5 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit <small>(27 14 23 16-0386)</small>		
27 14 23 16-0418 MLF 2-Fiber, 62.5 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,306.63 125.45	579.11
27 14 23 16-0419 MLF 4-Fiber, 62.5 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,400.72 135.61	579.11
27 14 23 16-0420 MLF 6-Fiber, 62.5 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,494.66 145.76	579.11
27 14 23 16-0421 MLF 8-Fiber, 62.5 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,588.75 155.90	579.11
27 14 23 16-0422 MLF 12-Fiber, 62.5 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,832.48 167.69	579.11
27 14 23 16-0423 MLF 18-Fiber, 62.5 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	2,071.48 196.50	579.11
27 14 23 16-0424 MLF 24-Fiber, 62.5 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	2,364.33 213.44	579.11
27 14 23 16-0425 MLF 36-Fiber, 62.5 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	2,931.18 263.71	579.11
27 14 23 16-0426 MLF 48-Fiber, 62.5 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	3,508.63 302.14	579.11
27 14 23 16-0427 MLF 60-Fiber, 62.5 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	4,088.07 336.45	579.11
27 14 23 16-0428 MLF 72-Fiber, 62.5 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	4,697.34 375.20	579.11
27 14 23 16-0429 MLF 96-Fiber, 62.5 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	5,933.70 442.41	579.11
27 14 23 16-0430 MLF 120-Fiber, 62.5 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	10,060.82 457.34	579.11
27 14 23 16-0431 MLF 144-Fiber, 62.5 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Installed In Conduit..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	8,464.70 472.12	579.11
27 14 23 16-0432 Outdoor Fiber Optic Cable, Buried In Trench <small>(27 14 23 16-0338)</small> Note: Excludes trenching.		
27 14 23 16-0433 Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench <small>(27 14 23 16-0432)</small>		
27 14 23 16-0434 Singlemode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench <small>(27 14 23 16-0433)</small>		
27 14 23 16-0435 MLF 2-Fiber, Singlemode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,105.67 118.66	
27 14 23 16-0436 MLF 4-Fiber, Singlemode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,118.22 118.84	



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MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
27 14 23 16-0437 MLF 6-Fiber, Singlemode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,130.94 118.82	
27 14 23 16-0438 MLF 8-Fiber, Singlemode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,143.49 119.00	
27 14 23 16-0439 MLF 12-Fiber, Singlemode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,168.74 119.18	
27 14 23 16-0440 MLF 18-Fiber, Singlemode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,228.69 115.00	
27 14 23 16-0441 MLF 24-Fiber, Singlemode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,266.33 115.52	
27 14 23 16-0442 MLF 36-Fiber, Singlemode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,355.88 122.32	
27 14 23 16-0443 MLF 48-Fiber, Singlemode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,450.15 123.54	
27 14 23 16-0444 MLF 60-Fiber, Singlemode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,543.01 124.76	
27 14 23 16-0445 MLF 72-Fiber, Singlemode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,665.51 150.02	
27 14 23 16-0446 MLF 96-Fiber, Singlemode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,907.35 161.00	
27 14 23 16-0447 MLF 120-Fiber, Singlemode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	2,150.41 190.63	
27 14 23 16-0448 MLF 144-Fiber, Singlemode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	2,402.20 205.60	
27 14 23 16-0449 50 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench <small>(27 14 23 16-0433)</small>		
27 14 23 16-0450 MLF 2-Fiber, 50 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,225.15 119.41	
27 14 23 16-0451 MLF 4-Fiber, 50 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,355.19 122.14	
27 14 23 16-0452 MLF 6-Fiber, 50 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,488.30 122.49	
27 14 23 16-0453 MLF 8-Fiber, 50 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,620.03 123.02	
27 14 23 16-0454 MLF 12-Fiber, 50 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,883.48 125.11	
27 14 23 16-0455 MLF 18-Fiber, 50 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	2,299.91 126.85	
27 14 23 16-0456 MLF 24-Fiber, 50 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	2,695.09 128.24	
27 14 23 16-0457 MLF 36-Fiber, 50 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	3,498.68 151.59	
27 14 23 16-0458 MLF 48-Fiber, 50 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	4,307.16 162.74	
27 14 23 16-0459 MLF 60-Fiber, 50 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	5,114.41 173.89	
27 14 23 16-0460 MLF 72-Fiber, 50 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	5,962.96 208.91	
27 14 23 16-0461 MLF 96-Fiber, 50 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	7,674.17 239.93	
27 14 23 16-0462 MLF 120-Fiber, 50 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	9,405.08 289.75	
27 14 23 16-0463 MLF 144-Fiber, 50 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	11,170.30 292.20	
27 14 23 16-0464 62.5 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench <small>(27 14 23 16-0433)</small>		
27 14 23 16-0465 MLF 2-Fiber, 62.5 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,161.31 99.94	
27 14 23 16-0466 MLF 4-Fiber, 62.5 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,257.40 107.18	
27 14 23 16-0467 MLF 6-Fiber, 62.5 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,353.34 114.24	
27 14 23 16-0468 MLF 8-Fiber, 62.5 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,471.86 130.05	
27 14 23 16-0469 MLF 12-Fiber, 62.5 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,641.60 135.61	
27 14 23 16-0470 MLF 18-Fiber, 62.5 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,941.69 144.53	
27 14 23 16-0471 MLF 24-Fiber, 62.5 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	2,225.96 166.21	
27 14 23 16-0472 MLF 36-Fiber, 62.5 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	2,770.01 184.70	
27 14 23 16-0473 MLF 48-Fiber, 62.5 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	3,406.35 212.37	
27 14 23 16-0474 MLF 60-Fiber, 62.5 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	3,994.10 228.52	
27 14 23 16-0475 MLF 72-Fiber, 62.5 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	4,614.44 258.65	

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27 10	Structured Cabling
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MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
27 14 23 16-0476 MLF 96-Fiber, 62.5 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench	5,869.09	
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	290.82	
27 14 23 16-0477 MLF 120-Fiber, 62.5 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench	7,143.89	
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	330.05	
27 14 23 16-0478 MLF 144-Fiber, 62.5 Micron Multimode, Single Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench	8,438.37	
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	303.17	
27 14 23 16-0479 Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench ^(27 14 23 16-0479)		
27 14 23 16-0480 Singlemode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench ^(27 14 23 16-0480)		
27 14 23 16-0481 MLF 2-Fiber, Singlemode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench	1,189.65	
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	148.11	
27 14 23 16-0482 MLF 4-Fiber, Singlemode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench	1,202.38	
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	148.11	
27 14 23 16-0483 MLF 6-Fiber, Singlemode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench	1,214.74	
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	148.81	
27 14 23 16-0484 MLF 8-Fiber, Singlemode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench	1,227.47	
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	148.80	
27 14 23 16-0485 MLF 12-Fiber, Singlemode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench	1,252.38	
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	149.85	
27 14 23 16-0486 MLF 18-Fiber, Singlemode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench	1,307.44	
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	151.24	
27 14 23 16-0487 MLF 24-Fiber, Singlemode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench	1,345.08	
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	152.11	
27 14 23 16-0488 MLF 36-Fiber, Singlemode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench	1,438.99	
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	151.42	
27 14 23 16-0489 MLF 48-Fiber, Singlemode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench	1,533.26	
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	156.82	
27 14 23 16-0490 MLF 60-Fiber, Singlemode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench	1,626.12	
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	158.91	
27 14 23 16-0491 MLF 72-Fiber, Singlemode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench	1,755.94	
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	169.02	
27 14 23 16-0492 MLF 96-Fiber, Singlemode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench	2,004.93	
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	192.53	
27 14 23 16-0493 MLF 120-Fiber, Singlemode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench	2,286.50	
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	200.38	
27 14 23 16-0494 MLF 144-Fiber, Singlemode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench	2,516.32	
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	221.47	
27 14 23 16-0495 50 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench ^(27 14 23 16-0495)		
27 14 23 16-0496 MLF 2-Fiber, 50 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench	1,308.14	
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	151.41	
27 14 23 16-0497 MLF 4-Fiber, 50 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench	1,438.65	
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	155.59	
27 14 23 16-0498 MLF 6-Fiber, 50 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench	1,446.02	
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	157.99	
27 14 23 16-0499 MLF 8-Fiber, 50 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench	1,700.35	
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	163.09	
27 14 23 16-0500 MLF 12-Fiber, 50 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench	1,961.89	
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	170.92	
27 14 23 16-0501 MLF 18-Fiber, 50 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench	2,371.52	
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	183.12	
27 14 23 16-0502 MLF 24-Fiber, 50 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench	2,763.92	
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	194.62	
27 14 23 16-0503 MLF 36-Fiber, 50 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench	3,567.51	
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	236.62	
27 14 23 16-0504 MLF 48-Fiber, 50 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench	4,370.93	
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	242.02	
27 14 23 16-0505 MLF 60-Fiber, 50 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench	5,176.96	
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	261.72	
27 14 23 16-0506 MLF 72-Fiber, 50 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench	6,020.63	
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	288.90	
27 14 23 16-0507 MLF 96-Fiber, 50 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench	7,728.54	
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	285.06	
27 14 23 16-0508 MLF 120-Fiber, 50 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench	9,547.26	
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	293.59	
27 14 23 16-0509 MLF 144-Fiber, 50 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench	11,229.19	
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	333.15	
27 14 23 16-0510 62.5 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench ^(27 14 23 16-0510)		
27 14 23 16-0511 MLF 2-Fiber, 62.5 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench	1,226.19	
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	125.45	
27 14 23 16-0512 MLF 4-Fiber, 62.5 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench	1,320.28	
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	135.61	
27 14 23 16-0513 MLF 6-Fiber, 62.5 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench	1,414.22	
<i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	145.76	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
27 14 23 16-0514 MLF 8-Fiber, 62.5 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,508.31 155.90	
27 14 23 16-0515 MLF 12-Fiber, 62.5 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,752.04 167.69	
27 14 23 16-0516 MLF 18-Fiber, 62.5 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	1,991.04 196.50	
27 14 23 16-0517 MLF 24-Fiber, 62.5 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	2,283.89 213.44	
27 14 23 16-0518 MLF 36-Fiber, 62.5 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	2,850.74 263.71	
27 14 23 16-0519 MLF 48-Fiber, 62.5 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	3,428.19 302.14	
27 14 23 16-0520 MLF 60-Fiber, 62.5 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	4,007.63 336.45	
27 14 23 16-0521 MLF 72-Fiber, 62.5 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	4,616.90 375.20	
27 14 23 16-0522 MLF 96-Fiber, 62.5 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	5,853.26 442.41	
27 14 23 16-0523 MLF 120-Fiber, 62.5 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	7,170.49 457.34	
27 14 23 16-0524 MLF 144-Fiber, 62.5 Micron Multimode, Double Jacket Loose Tube, Outdoor Fiber Optic Cable, Buried In Trench..... <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	8,384.26 472.12	
27 14 23 16-0525 (Aerial) Outdoor Fiber Optic Cable, Installed On Poles <small>(27 14 23 16-0338)</small>		
27 14 23 16-0526 Single Jacket Loose Tube, (Aerial) Outdoor Fiber Optic Cable, Installed On Poles <small>(27 14 23 16-0525)</small>		
27 14 23 16-0527 Singlemode, Single Jacket Loose Tube, (Aerial) Outdoor Fiber Optic Cable, Installed On Poles <small>(27 14 23 16-0526)</small>		
27 14 23 16-0528 MLF 2-Fiber, Singlemode, Single Jacket Loose Tube, (Aerial) Outdoor Fiber Optic Cable, Installed On Poles <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	6,010.50 115.69	2,145.77
27 14 23 16-0529 MLF 4-Fiber, Singlemode, Single Jacket Loose Tube, (Aerial) Outdoor Fiber Optic Cable, Installed On Poles <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	6,024.96 116.22	2,145.77
27 14 23 16-0530 MLF 6-Fiber, Singlemode, Single Jacket Loose Tube, (Aerial) Outdoor Fiber Optic Cable, Installed On Poles <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	6,039.60 116.57	2,145.77
27 14 23 16-0531 MLF 8-Fiber, Singlemode, Single Jacket Loose Tube, (Aerial) Outdoor Fiber Optic Cable, Installed On Poles <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	6,054.41 116.91	2,145.77
27 14 23 16-0532 MLF 12-Fiber, Singlemode, Single Jacket Loose Tube, (Aerial) Outdoor Fiber Optic Cable, Installed On Poles <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	6,083.50 117.79	2,145.77
27 14 23 16-0533 MLF 18-Fiber, Singlemode, Single Jacket Loose Tube, (Aerial) Outdoor Fiber Optic Cable, Installed On Poles <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	6,146.41 119.70	2,145.77
27 14 23 16-0534 MLF 24-Fiber, Singlemode, Single Jacket Loose Tube, (Aerial) Outdoor Fiber Optic Cable, Installed On Poles <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	6,190.14 121.27	2,145.77
27 14 23 16-0535 MLF 36-Fiber, Singlemode, Single Jacket Loose Tube, (Aerial) Outdoor Fiber Optic Cable, Installed On Poles <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	6,298.34 124.41	2,145.77
27 14 23 16-0536 MLF 48-Fiber, Singlemode, Single Jacket Loose Tube, (Aerial) Outdoor Fiber Optic Cable, Installed On Poles <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	6,382.16 141.66	2,145.77
27 14 23 16-0537 MLF 60-Fiber, Singlemode, Single Jacket Loose Tube, (Aerial) Outdoor Fiber Optic Cable, Installed On Poles <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	6,506.39 144.45	2,145.77
27 14 23 16-0538 MLF 72-Fiber, Singlemode, Single Jacket Loose Tube, (Aerial) Outdoor Fiber Optic Cable, Installed On Poles <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	6,621.91 163.43	2,145.77
27 14 23 16-0539 MLF 96-Fiber, Singlemode, Single Jacket Loose Tube, (Aerial) Outdoor Fiber Optic Cable, Installed On Poles <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	6,889.72 181.38	2,145.77
27 14 23 16-0540 MLF 120-Fiber, Singlemode, Single Jacket Loose Tube, (Aerial) Outdoor Fiber Optic Cable, Installed On Poles <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	7,159.26 211.00	2,145.77
27 14 23 16-0541 MLF 144-Fiber, Singlemode, Single Jacket Loose Tube, (Aerial) Outdoor Fiber Optic Cable, Installed On Poles <i>For Corrugated Coated Steel Tape Armored Cable, Add</i>	7,444.32 234.35	2,145.77
27 14 23 16-0542 Hybrid, Indoor/Outdoor Fiber Optic Cable, Installed In Conduit <small>(27 14 23 16-0338)</small> Note: Singlemode and multimode combination cable. Excludes conduit or innerduct.		
27 14 23 16-0543 Riser Rated, Hybrid, Indoor/Outdoor Fiber Optic Cable, Installed In Conduit <small>(27 14 23 16-0542)</small>		
27 14 23 16-0544 MLF 12-Fiber, 6 Singlemode/6 Multimode, Riser Rated, Hybrid, Indoor/Outdoor Fiber Optic Cable, Installed In Conduit.....	2,984.70	482.58
27 14 23 16-0545 MLF 24-Fiber, 12 Singlemode/12 Multimode, Riser Rated, Hybrid, Indoor/Outdoor Fiber Optic Cable, Installed In Conduit	3,831.10	482.58
27 14 23 16-0546 MLF 48-Fiber, 24 Singlemode/24 Multimode, Riser Rated, Hybrid, Indoor/Outdoor Fiber Optic Cable, Installed In Conduit	5,716.58	482.58
27 14 23 16-0547 Plenum Rated, Hybrid, Indoor/Outdoor Fiber Optic Cable, Installed In Conduit <small>(27 14 23 16-0542)</small>		
27 14 23 16-0548 MLF 12-Fiber, 6 Singlemode/6 Multimode, Plenum Rated, Hybrid, Indoor/Outdoor Fiber Optic Cable, Installed In Conduit	4,064.24	482.58
27 14 23 16-0549 MLF 24-Fiber, 12 Singlemode/12 Multimode, Plenum Rated, Hybrid, Indoor/Outdoor Fiber Optic Cable, Installed In Conduit	4,545.24	482.58
27 14 23 16-0550 MLF 48-Fiber, 24 Singlemode/24 Multimode, Plenum Rated, Hybrid, Indoor/Outdoor Fiber Optic Cable, Installed In Conduit	6,649.25	482.58

27	Communications
27 10	Structured Cabling
27 14	Communications Cabling



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
27 14 23 16-0551 Hybrid, Indoor/Outdoor Fiber Optic Cable, Buried In Trench ^(27 14 23 16-0338) Note: Singlemode and multimode combination cable. Excludes trenching.		
27 14 23 16-0552 Riser Rated, Hybrid, Indoor/Outdoor Fiber Optic Cable, Buried In Trench ^(27 14 23 16-0551)		
27 14 23 16-0553 MLF 12-Fiber, 6 Singlemode/6 Multimode, Riser Rated, Hybrid, Indoor/Outdoor Fiber Optic Cable, Buried In Trench.....	2,904.26	442.37
27 14 23 16-0554 MLF 24-Fiber, 12 Singlemode/12 Multimode, Riser Rated, Hybrid, Indoor/Outdoor Fiber Optic Cable, Buried In Trench.....	3,750.66	442.37
27 14 23 16-0555 MLF 48-Fiber, 24 Singlemode/24 Multimode, Riser Rated, Hybrid, Indoor/Outdoor Fiber Optic Cable, Buried In Trench.....	5,636.14	442.37
27 14 23 16-0556 Plenum Rated, Hybrid, Indoor/Outdoor Fiber Optic Cable, Buried In Trench ^(27 14 23 16-0551)		
27 14 23 16-0557 MLF 12-Fiber, 6 Singlemode/6 Multimode, Plenum Rated, Hybrid, Indoor/Outdoor Fiber Optic Cable, Buried In Trench.....	3,983.80	442.37
27 14 23 16-0558 MLF 24-Fiber, 12 Singlemode/12 Multimode, Plenum Rated, Hybrid, Indoor/Outdoor Fiber Optic Cable, Buried In Trench.....	4,464.80	442.37
27 14 23 16-0559 MLF 48-Fiber, 24 Singlemode/24 Multimode, Plenum Rated, Hybrid, Indoor/Outdoor Fiber Optic Cable, Buried In Trench.....	6,568.81	442.37
27 14 33 Communications Coaxial Cabling ^(27 14)		
27 14 33 16 Communications Coaxial Cabling ^(27 14 33)		
27 14 33 16-0001 Indoor Coaxial Cable ^(27 14 33 16)		
27 14 33 16-0002 Coaxial, Indoor Telecommunications Cable ^(27 14 33 16-0001)		
27 14 33 16-0003 Coaxial, Indoor Telecommunications Cable, Installed In Conduit ^(27 14 33 16-0002)		
27 14 33 16-0004 MLF RG 59/U Coaxial, Indoor Telecommunications Cable, Installed In Conduit (Belden 9108).....	964.99	337.81
27 14 33 16-0005 MLF RG 59/U Plenum Coaxial, Indoor Telecommunications Cable, Installed In Conduit (Belden 82108).....	2,111.55	337.81
27 14 33 16-0006 MLF RG 6/U Coaxial, Indoor Telecommunications Cable, Installed In Conduit (Belden 9114).....	837.02	386.07
27 14 33 16-0007 MLF RG 6/U Plenum Coaxial, Indoor Telecommunications Cable, Installed In Conduit (Belden 82120).....	2,643.63	386.07
27 14 33 16-0008 Coaxial, Indoor Telecommunications Cable, Installed Exposed ^(27 14 33 16-0002)		
27 14 33 16-0009 MLF RG 59/U Coaxial, Indoor Telecommunications Cable, Installed Exposed (Belden 9108).....	1,528.01	675.62
27 14 33 16-0010 MLF RG 59/U Plenum Coaxial, Indoor Telecommunications Cable, Installed Exposed (Belden 82108).....	2,674.57	675.62
27 14 33 16-0011 MLF RG 6/U Coaxial, Indoor Telecommunications Cable, Installed Exposed (Belden 9114).....	1,480.47	772.14
27 14 33 16-0012 MLF RG 6/U Plenum Coaxial, Indoor Telecommunications Cable, Installed Exposed (Belden 82120).....	3,287.08	772.14
27 14 43 Communications Faceplates And Connectors ^(27 14)		
27 14 43 00-0001 Wall Mounted Telephone Faceplates ^(27 14 43) Note: Includes standard telephone mounting studs.		
27 14 43 00-0002 Plastic Faceplates For Wall Mounted Telephones ^(27 14 43 00-0001)		
27 14 43 00-0003 EA Single Gang, 6-Position RJ25 Jack, Flush, Plastic Faceplate For Wall Mounted Telephones.....	26.62	10.05
27 14 43 00-0004 Stainless Steel Faceplates For Wall Mounted Telephones ^(27 14 43 00-0001)		
27 14 43 00-0005 EA Single Gang, Keystone Opening, Flush, Stainless Steel Faceplate For Wall Mounted Telephones..... Note: Requires one snap-in modular jack.	22.59	4.02
27 14 43 00-0006 EA Single Gang, 6-Position RJ25 Jack, Flush, Stainless Steel Faceplate For Wall Mounted Telephones.....	39.76	10.05
27 14 43 00-0007 EA Single Gang, 8-Position RJ45 Jack, Flush, Stainless Steel Faceplate For Wall Mounted Telephones.....	46.33	12.07
27 14 43 00-0008 EA Single Gang, Keystone Opening, Recessed, Stainless Steel Faceplate For Wall Mounted Telephones..... Note: Requires one snap-in modular jack.	21.74	4.02
27 14 43 00-0009 EA Single Gang, 6-Position RJ25 Jack, Recessed, Stainless Steel Faceplate For Wall Mounted Telephones.....	36.17	10.05
27 14 43 00-0010 EA Single Gang, 8-Position RJ45 Jack, Recessed, Stainless Steel Faceplate For Wall Mounted Telephones.....	42.83	12.07
27 14 43 00-0011 Plastic Communications Faceplates ^(27 14 43) Note: Excludes modular jacks. See CSI section 27 14 43 00-0051 for modular jacks.		
27 14 43 00-0012 EA One Port, Single Gang, Plastic Communication Faceplate With Station ID.....	6.37	2.02
27 14 43 00-0013 EA Two Port, Single Gang, Plastic Communication Faceplate With Station ID.....	6.37	2.02
27 14 43 00-0014 EA Three Port, Single Gang, Plastic Communication Faceplate With Station ID.....	6.37	2.02
27 14 43 00-0015 EA Four Port, Single Gang, Plastic Communication Faceplate With Station ID.....	6.37	2.02
27 14 43 00-0016 EA Six Port, Single Gang, Plastic Communication Faceplate With Station ID.....	6.37	2.02
27 14 43 00-0017 EA Four Port, Double Gang, Plastic Communications Faceplate With Station ID.....	9.50	2.02
27 14 43 00-0018 EA Six Port, Double Gang, Plastic Communication Faceplate With Station ID.....	9.50	2.02
27 14 43 00-0019 EA Eight Port, Double Gang, Plastic Communication Faceplate With Station ID.....	9.50	2.02
27 14 43 00-0020 EA Nine Port, Double Gang, Plastic Communication Faceplate With Station ID.....	9.50	2.02
27 14 43 00-0021 EA Twelve Port, Double Gang, Plastic Communication Faceplate With Station ID.....	9.50	2.02
27 14 43 00-0022 Stainless Steel Communications Faceplates ^(27 14 43) Note: Excludes modular jacks. See CSI section 27 14 43 00-0051 for modular jacks.		
27 14 43 00-0023 Stainless Steel Communications Faceplates ^(27 14 43 00-0022)		
27 14 43 00-0024 EA One Port, Single Gang, Stainless Steel Communications Faceplate.....	12.03	2.02
27 14 43 00-0025 EA Two Port, Single Gang, Stainless Steel Communications Faceplate.....	12.03	2.02
27 14 43 00-0026 EA Three Port, Single Gang, Stainless Steel Communications Faceplate.....	12.03	2.02
27 14 43 00-0027 EA Four Port, Single Gang, Stainless Steel Communications Faceplate.....	12.86	2.02
27 14 43 00-0028 EA Six Port, Single Gang, Stainless Steel Communications Faceplate.....	12.86	2.02



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
27 14 43 00-0029 EA Four Port, Double Gang, Stainless Steel Communications Faceplate.....	17.33	2.02
27 14 43 00-0030 EA Six Port, Double Gang, Stainless Steel Communications Faceplate.....	17.85	2.02
27 14 43 00-0031 EA Eight Port, Double Gang, Stainless Steel Communications Faceplate.....	20.65	2.02
27 14 43 00-0032 EA Nine Port, Double Gang, Stainless Steel Communication Faceplate.....	20.65	2.02
27 14 43 00-0033 EA Twelve Port, Double Gang, Stainless Steel Communications Faceplate.....	20.65	2.02
27 14 43 00-0034 Stainless Steel Communications Faceplates With Station ID <small>(27 14 43 00-0022)</small>		
27 14 43 00-0035 EA One Port, Single Gang, Stainless Steel Communications Faceplate With Station ID.....	17.23	2.02
27 14 43 00-0036 EA Two Port, Single Gang, Stainless Steel Communications Faceplate With Station ID.....	17.23	2.02
27 14 43 00-0037 EA Three Port, Single Gang, Stainless Steel Communications Faceplate With Station ID.....	17.23	2.02
27 14 43 00-0038 EA Four Port, Single Gang, Stainless Steel Communications Faceplate With Station ID.....	17.23	2.02
27 14 43 00-0039 EA Six Port, Single Gang, Stainless Steel Communications Faceplate With Station ID.....	17.23	2.02
27 14 43 00-0040 EA Four Port, Double Gang, Stainless Steel Communications Faceplate With Station ID.....	37.07	2.02
27 14 43 00-0041 EA Six Port, Double Gang, Stainless Steel Communications Faceplate With Station ID.....	37.07	2.02
27 14 43 00-0042 EA Eight Port, Double Gang, Stainless Steel Communications Faceplate With Station ID.....	37.07	2.02
27 14 43 00-0043 EA Nine Port, Double Gang, Stainless Steel Communication Faceplate With Station ID.....	37.07	2.02
27 14 43 00-0044 EA Twelve Port, Double Gang, Stainless Steel Communications Faceplate With Station ID.....	37.07	2.02
27 14 43 00-0045 Surface Mount Plastic Communication Boxes <small>(27 14 43)</small>		
<i>Note: Excludes modular jacks. See CSI section 27 14 43 00-0051 for modular jacks.</i>		
27 14 43 00-0046 EA One Port, Surface Mount Plastic Communication Box With Station ID.....	23.10	10.07
27 14 43 00-0047 EA Two Port, Surface Mount Plastic Communication Box With Station ID.....	23.62	10.07
27 14 43 00-0048 EA Four Port, Surface Mount Plastic Communication Box With Station ID.....	27.21	10.07
27 14 43 00-0049 EA Six Port, Surface Mount Plastic Communication Box With Station ID.....	31.47	10.07
27 14 43 00-0050 EA Twelve Port, Surface Mount Plastic Communication Box With Station ID.....	35.93	10.07
27 14 43 00-0051 Snap-In Modular Jacks <small>(27 14 43)</small>		
<i>Note: Includes termination.</i>		
27 14 43 00-0052 EA Cat 3, Snap-In Modular Jack.....	22.03	8.05
27 14 43 00-0053 EA Cat 5E, Snap-In Modular Jack.....	23.18	8.05
27 14 43 00-0054 EA Cat 5E Shielded, Snap-In Modular Jack.....	26.60	8.05
27 14 43 00-0055 EA Cat 6, Snap-In Modular Jack.....	26.60	8.05
27 14 43 00-0056 EA Cat 6 Shielded, Snap-In Modular Jack.....	30.45	8.05
27 14 43 00-0057 EA Cat 6A, Snap-In Modular Jack.....	31.03	8.05
27 14 43 00-0058 EA Voice, RJ-11, Snap-In Modular Jack.....	14.32	4.03
27 14 43 00-0059 EA SC Type Fiber Optic, Snap-In Modular Jack.....	24.63	8.05
27 14 43 00-0060 EA ST Type Fiber Optic, Snap-In Modular Jack.....	27.54	8.05
27 14 43 00-0061 EA LC Type Fiber Optic, Snap-In Modular Jack.....	33.25	8.05
27 14 43 00-0062 EA Blank Fill In, Snap-In Modular Jack.....	4.57	2.02
27 14 43 00-0063 EA Open Cable Pass Through Insert, Snap-In Modular Jack.....	5.13	2.02
27 14 43 00-0064 EA Coaxial F-Type Coupler, Snap-In Modular Jack.....	18.43	6.04
<i>Note: Includes female to female connection.</i>		
<i>For Gold Bulkhead, Add</i>		<i>1.11</i>
27 14 43 00-0065 EA RCA Jack Pass-Through Coupler, Snap-In Modular Jack.....	18.64	6.04
<i>Note: Includes female to female connection.</i>		
27 14 43 00-0066 EA RCA Solder Coupler, Snap-In Modular Jack.....	37.11	8.05
27 14 43 00-0067 EA RCA Jack With 110 Punch Down, Snap-In Modular Jack.....	45.53	8.05
27 14 43 00-0068 EA 3.5 m Mini Stereo Jack, Snap-In Modular Jack.....	22.86	8.05
27 14 43 00-0069 EA MT-RJ Pass-Through Coupler, Snap-In Modular Jack.....	24.13	4.03
27 14 43 00-0070 EA BNC Connector, Snap-In Modular Jack.....	26.29	8.05
27 14 43 00-0071 EA S-Video With 110 Punch Down, Snap-In Modular Jack.....	29.41	8.05
27 14 43 00-0072 PR Speaker Connectors, Snap-In Modular Jack.....	37.49	12.09
<i>Note: Includes a pair of binding posts, banana jacks or spring clip connectors. Requires two open ports.</i>		
27 14 43 00-0073 EA USB Audio Video Connector, Snap-In Modular Jack.....	43.75	8.05
27 14 43 00-0074 Communications Equipment Labeling <small>(27 14 43)</small>		
27 14 43 00-0075 EA Label Both Ends Of One 4 Pair Cable.....	15.84	
27 14 43 00-0076 EA Label single gang face plate (2 labels required).....	12.67	
27 14 43 00-0077 EA Label two gang face plate (4 labels required).....	19.00	
27 14 43 00-0078 EA Label both ends of a Siamese (dual 4 Pair cable).....	15.84	
27 14 53 Communications Cable Innerduct <small>(27 14)</small>		
<i>Note: Includes pull rope. Excludes conduit.</i>		
27 14 53 00-0001 Indoor Innerduct <small>(27 14 53)</small>		
27 14 53 00-0002 Indoor Innerduct, Installed In Conduit <small>(27 14 53 00-0001)</small>		
27 14 53 00-0003 Riser Rated, Indoor Innerduct, Installed In Conduit <small>(27 14 53 00-0002)</small>		
27 14 53 00-0004 MLF 1" Riser Rated, Indoor Innerduct, Installed In Conduit.....	3,009.75	1,206.47
27 14 53 00-0005 MLF 1-1/4" Riser Rated, Indoor Innerduct, Installed In Conduit.....	3,915.66	1,608.62
27 14 53 00-0006 MLF 1-1/2" Riser Rated, Indoor Innerduct, Installed In Conduit.....	5,151.71	2,010.78
27 14 53 00-0007 MLF 2" Riser Rated, Indoor Innerduct, Installed In Conduit.....	6,044.91	2,412.93
27 14 53 00-0008 Plenum Rated, Indoor Innerduct, Installed In Conduit <small>(27 14 53 00-0002)</small>		
27 14 53 00-0009 MLF 1" Plenum Rated, Indoor Innerduct, Installed In Conduit.....	4,279.58	1,206.47

27	27	Communications
	27 10	Structured Cabling
	27 14	Communications Cabling



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
27 14 53 00-0010 MLF 1-1/4" Plenum Rated, Indoor Innerduct, Installed In Conduit	5,401.36	1,608.62
27 14 53 00-0011 MLF 1-1/2" Plenum Rated, Indoor Innerduct, Installed In Conduit	7,119.95	2,010.78
27 14 53 00-0012 MLF 2" Plenum Rated, Indoor Innerduct, Installed In Conduit	8,584.57	2,412.93
27 14 53 00-0013 Indoor Innerduct, Installed Exposed (27 14 53 00-0001)		
27 14 53 00-0014 Riser Rated, Indoor Innerduct, Installed Exposed (27 14 53 00-0013)		
27 14 53 00-0015 MLF 1" Riser Rated, Indoor Innerduct, Installed Exposed	3,814.07	1,608.62
27 14 53 00-0016 MLF 1-1/4" Riser Rated, Indoor Innerduct, Installed Exposed	4,719.97	2,010.78
27 14 53 00-0017 MLF 1-1/2" Riser Rated, Indoor Innerduct, Installed Exposed	5,956.02	2,412.93
27 14 53 00-0018 MLF 2" Riser Rated, Indoor Innerduct, Installed Exposed	6,849.22	2,815.09
27 14 53 00-0019 Plenum Rated, Indoor Innerduct, Installed Exposed (27 14 53 00-0013)		
27 14 53 00-0020 MLF 1" Plenum Rated, Indoor Innerduct, Installed Exposed.....	5,083.90	1,608.62
27 14 53 00-0021 MLF 1-1/4" Plenum Rated, Indoor Innerduct, Installed Exposed.....	6,205.67	2,010.78
27 14 53 00-0022 MLF 1-1/2" Plenum Rated, Indoor Innerduct, Installed Exposed.....	7,924.26	2,412.93
27 14 53 00-0023 MLF 2" Plenum Rated, Indoor Innerduct, Installed Exposed.....	9,388.88	2,815.09
27 14 53 00-0024 Outdoor Innerduct (27 14 53)		
27 14 53 00-0025 Outdoor Innerduct, Installed In Conduit (27 14 53 00-0024)		
27 14 53 00-0026 MLF 1" Outdoor Innerduct, Installed In Conduit.....	2,857.37	1,206.47
27 14 53 00-0027 MLF 1-1/4" Outdoor Innerduct, Installed In Conduit.....	3,690.95	1,608.62
27 14 53 00-0028 MLF 1-1/2" Outdoor Innerduct, Installed In Conduit.....	4,697.36	2,010.78
27 14 53 00-0029 MLF 2" Outdoor Innerduct, Installed In Conduit.....	5,614.94	2,412.93
27 14 53 00-0030 Outdoor Innerduct, Buried In Trench (27 14 53 00-0024)		
27 14 53 00-0031 MLF 1" Outdoor Innerduct, Buried In Trench	2,053.66	
27 14 53 00-0032 MLF 1-1/4" Outdoor Innerduct, Buried In Trench	2,886.63	
27 14 53 00-0033 MLF 1-1/2" Outdoor Innerduct, Buried In Trench	3,893.05	
27 14 53 00-0034 MLF 2" Outdoor Innerduct, Buried In Trench	4,810.63	
27 14 63 Communications Multimedia Modular Patch Panels (27 14)		
27 14 63 00-0001 Communications Multimedia Modular Patch Panels (27 14 63)		
Note: Unloaded multimedia patch panels that accept modular jacks for category 3, 5e, 6, fiber optic, etc. Excludes rack, modular jacks and terminations. See CSI section 27 14 43 00-0051 for modular jacks.		
27 14 63 00-0002 EA 12 Port, Wall Mount Multimedia Modular Patch Panel, Unloaded.....	72.46	4.02
27 14 63 00-0003 EA 16 Port, Rack Mount Multimedia Modular Patch Panel, Unloaded.....	79.93	4.02
27 14 63 00-0004 EA 24 Port, Rack Mount Multimedia Modular Patch Panel, Unloaded.....	94.39	4.02
27 14 63 00-0005 EA 36 Port, Rack Mount Multimedia Modular Patch Panel, Unloaded.....	98.84	4.02
27 14 63 00-0006 EA 48 Port, Rack Mount Multimedia Modular Patch Panel, Unloaded.....	108.16	5.03
27 14 63 00-0007 EA 24 Port, Rack Mount Multimedia Modular Angled Patch Panel, Unloaded	102.52	4.02
27 14 63 00-0008 EA 48 Port, Rack Mount Multimedia Modular Angled Patch Panel, Unloaded	128.66	5.03
27 14 63 00-0009 EA Rack Mount Rear Cable Management Bar	35.85	5.03
27 16 Communications Connecting Cords, Devices, And Adapters (27 16)		
27 16 16 Communications Media Converters, Adapters, and Transceivers (27 16)		
27 16 16 00-0001 Fiber Optic Receivers (27 16 16)		
27 16 16 00-0002 EA Fiber Optic Receiver, Range 6.2 Miles	433.50	40.21
27 16 16 00-0003 Fiber Optic Transmitters (27 16 16)		
27 16 16 00-0004 EA Fiber Optic Transmitter, Range 6.2 Miles	433.50	40.21
27 16 16 00-0005 Fiber Optic Repeaters (27 16 16)		
Note: Consist of transmitter and receiver, back-to-back. Excludes power source.		
27 16 16 00-0006 EA Fiber Optic Repeater, 6.2 Miles Transmitter And Receiver Back-Back, No Power	513.92	80.44
27 16 16 00-0007 EA Fiber Optic Digital Repeater, 2,000 Miles Transmitter And Receiver Back-Back, No Power	830.91	160.86
27 16 16 00-0008 Fiber Optic Transceivers (27 16 16)		
27 16 16 00-0009 EA Fiber Optic Transceivers, 3,000 Miles Range.....	591.42	160.86
27 16 16 00-0010 EA Fiber Optic Transceivers, Digital 2,000 Miles Range	591.42	160.86
27 16 16 00-0011 EA Fiber Optic Ethernet Transceiver	766.94	241.30
27 16 16 00-0012 EA Transceiver (Low Cost Bi- Directional).....	256.45	60.32
27 16 19 Communications Patch Cords, Station Cords, And Cross Connect Wire (27 16)		
27 16 19 00-0001 Cross Connect Wire (27 16 19)		
Note: Up to 20' length.		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
27 16 19 00-0002 EA 2-Pair Cross Connect Wire	12.90	
27 16 19 00-0003 EA 3-Pair Cross Connect Wire	17.28	
27 16 19 00-0004 EA 4-Pair Cross Connect Wire	21.61	
27 16 19 00-0005 Fiber Optic Patch Cords (27 16 19)		
27 16 19 00-0006 Simplex Fiber Optic Patch Cables (27 16 19 00-0005)		
27 16 19 00-0007 Singlemode, Simplex Fiber Optic Patch Cables (27 16 19 00-0006)		
27 16 19 00-0008 EA ST To ST Connectors, 1 Meter Length, Singlemode, Simplex Fiber Optic Patch Cable.....	29.82	
For Each Additional Meter In Length, Add	0.26	
27 16 19 00-0009 EA ST To SC Connectors, 1 Meter Length, Singlemode, Simplex Fiber Optic Patch Cable	24.56	
For Each Additional Meter In Length, Add	0.26	
27 16 19 00-0010 EA ST To LC Connectors, 1 Meter Length, Singlemode, Simplex Fiber Optic Patch Cable.....	31.40	
For Each Additional Meter In Length, Add	0.26	
27 16 19 00-0011 EA SC To SC Connectors, 1 Meter Length, Singlemode, Simplex Fiber Optic Patch Cable.....	25.76	
For Each Additional Meter In Length, Add	0.26	
27 16 19 00-0012 EA SC To LC Connectors, 1 Meter Length, Singlemode, Simplex Fiber Optic Patch Cable	29.60	
For Each Additional Meter In Length, Add	0.26	
27 16 19 00-0013 EA LC To LC Connectors, 1 Meter Length, Singlemode, Simplex Fiber Optic Patch Cable.....	29.17	
For Each Additional Meter In Length, Add	0.26	
27 16 19 00-0014 Duplex Fiber Optic Patch Cables (27 16 19 00-0005)		
27 16 19 00-0015 Singlemode, Duplex Fiber Optic Patch Cables (27 16 19 00-0014)		
27 16 19 00-0016 EA ST To ST Connectors, 1 Meter Length, Singlemode, Duplex Fiber Optic Patch Cable	50.96	
For Each Additional Meter In Length, Add	0.51	
27 16 19 00-0017 EA ST To SC Connectors, 1 Meter Length, Singlemode, Duplex Fiber Optic Patch Cable	49.48	
For Each Additional Meter In Length, Add	0.51	
27 16 19 00-0018 EA ST To LC Connectors, 1 Meter Length, Singlemode, Duplex Fiber Optic Patch Cable	54.75	
For Each Additional Meter In Length, Add	0.51	
27 16 19 00-0019 EA SC To SC Connectors, 1 Meter Length, Singlemode, Duplex Fiber Optic Patch Cable	42.86	
For Each Additional Meter In Length, Add	0.51	
27 16 19 00-0020 EA SC To LC Connectors, 1 Meter Length, Singlemode, Duplex Fiber Optic Patch Cable.....	50.53	
For Each Additional Meter In Length, Add	0.51	
27 16 19 00-0021 EA LC To LC Connectors, 1 Meter Length, Singlemode, Duplex Fiber Optic Patch Cable	49.69	
For Each Additional Meter In Length, Add	0.51	
27 16 19 00-0022 Multimode, Duplex Fiber Optic Patch Cables (27 16 19 00-0014)		
27 16 19 00-0023 EA ST To ST Connectors, 1 Meter Length, Multimode, Duplex Fiber Optic Patch Cable.....	38.81	
For Each Additional Meter In Length, Add	1.48	
27 16 19 00-0024 EA ST To SC Connectors, 1 Meter Length, Multimode, Duplex Fiber Optic Patch Cable	42.24	
For Each Additional Meter In Length, Add	1.48	
27 16 19 00-0025 EA ST To MTRJ Connectors, 1 Meter Length, Multimode, Duplex Fiber Optic Patch Cable.....	42.60	
For Each Additional Meter In Length, Add	1.48	
27 16 19 00-0026 EA ST To LC Connectors, 1 Meter Length, Multimode, Duplex Fiber Optic Patch Cable.....	43.70	
For Each Additional Meter In Length, Add	1.48	
27 16 19 00-0027 EA SC To SC Connectors, 1 Meter Length, Multimode, Duplex Fiber Optic Patch Cable.....	38.95	
For Each Additional Meter In Length, Add	1.48	
27 16 19 00-0028 EA SC To MTRJ Connectors, 1 Meter Length, Multimode, Duplex Fiber Optic Patch Cable	43.90	
For Each Additional Meter In Length, Add	1.48	
27 16 19 00-0029 EA SC To LC Connectors, 1 Meter Length, Multimode, Duplex Fiber Optic Patch Cable	51.35	
For Each Additional Meter In Length, Add	1.48	
27 16 19 00-0030 EA MTRJ To MTRJ Connectors, 1 Meter Length, Multimode, Duplex Fiber Optic Patch Cable.....	35.78	
For Each Additional Meter In Length, Add	1.48	
27 16 19 00-0031 EA LC To LC Connectors, 1 Meter Length, Multimode, Duplex Fiber Optic Patch Cable.....	43.25	
For Each Additional Meter In Length, Add	1.48	
27 16 19 00-0032 Fiber Optic Cable Pig Tail (27 16 19)		
27 16 19 00-0033 EA Simplex Fiber Optic Cable Pig Tail	52.27	28.15
27 16 19 00-0034 EA Duplex Fiber Optic Cable Pig Tail.....	64.75	28.15
27 16 19 00-0035 Ethernet Patch Cords (27 16 19)		
27 16 19 00-0036 EA 3' Category 5E Patch Cables With Boots.....	12.96	
27 16 19 00-0037 EA 5' Category 5E Patch Cables With Boots.....	13.70	
27 16 19 00-0038 EA 7' Category 5E Patch Cables With Boots.....	14.43	
27 16 19 00-0039 EA 10' Category 5E Patch Cables With Boots.....	19.56	
27 16 19 00-0040 EA 15' Category 5E Patch Cables With Boots.....	21.40	
27 16 19 00-0041 EA 25' Category 5E Patch Cables With Boots.....	25.08	
27 16 19 00-0042 EA 3' Category 6 Patch Cables With Boots.....	14.00	
27 16 19 00-0043 EA 5' Category 6 Patch Cables With Boots.....	14.95	
27 16 19 00-0044 EA 7' Category 6 Patch Cables With Boots.....	15.89	
27 16 19 00-0045 EA 10' Category 6 Patch Cables With Boots.....	21.33	
27 16 19 00-0046 EA 15' Category 6 Patch Cables With Boots.....	23.70	
27 16 19 00-0047 EA 25' Category 6 Patch Cables With Boots.....	28.44	
27 16 19 00-0048 EA 50' Category 6 Patch Cables With Boots.....	40.27	
27 16 19 00-0049 EA 100' Category 6 Patch Cables With Boots.....	67.99	
27 16 19 00-0050 EA 3' Category 6A Patch Cables With Boots.....	17.96	

27 Communications**27 10 Structured Cabling****27 16 Communications Connecting Cords, Devices, And Adapters**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
27 16 19 00-0051	EA		5' Category 6A Patch Cables With Boots.....	19.81	
27 16 19 00-0052	EA		7' Category 6A Patch Cables With Boots.....	21.67	
27 16 19 00-0053	EA		10' Category 6A Patch Cables With Boots.....	28.47	
27 16 19 00-0054	EA		15' Category 6A Patch Cables With Boots.....	33.11	
27 16 19 00-0055	EA		25' Category 6A Patch Cables With Boots.....	42.38	
27 16 19 00-0056	EA		50' Category 6A Patch Cables With Boots.....	65.56	
27 16 19 00-0057	EA		100' Category 6A Patch Cables With Boots.....	115.97	

27 20 Data Communications (27)**27 21 Data Communications Network Equipment** (27 20)

Note: Includes testing of new devices and certification.

27 21 16 Data Communications Routers, CSU/DSU, Multiplexers, Codecs, and Modems

27 21 16 00-0001 Fiber Optic Modems <small>(27 21 16)</small>					
27 21 16 00-0002	EA		Fiber Optic Modems, Range 6.2 Miles.....	910.15	160.86
27 21 16 00-0003	EA		Fiber Optic Modem, Range 3.1 Miles, 12 Channel.....	1,645.69	160.86
27 21 16 00-0004 Ethernet Hubs and Switches <small>(27 21 16)</small>					
27 21 16 00-0005	EA		16 Port Managed Hub With Fiberport And Standard Management.....	2,107.54	120.85
27 21 16 00-0006	EA		16 Port Unmanaged Hub.....	402.00	80.57
27 21 16 00-0007 Network Equipment <small>(27 21 16)</small>					
27 21 16 00-0008 Communications Entrance Protection <small>(27 21 16 00-0007)</small>					
27 21 16 00-0009	EA		100-Pair, 5 Pin Configuration, 110 Termination, Building Entrance Terminal With Cover (Porta 24100-110-M110C).....	612.19	60.42
Note: Excludes terminations.					
27 21 16 00-0010	EA		Solid State Protector Module With 4 OHM Heat Coils (CommScope 4C1S).....	7.42	0.80
27 21 16 00-0011 Communications Cabinets, Racks, Frames And Enclosures <small>(27 21 16 00-0007)</small>					
27 21 16 00-0012	EA		19" Width x 24" Depth x 36" Height, Wall Mounted Telecommunications Enclosure (Chatsworth 11840-736).....	738.00	60.42
27 21 16 00-0013	EA		10 Outlet, 125 Volt, 20 Amp Telecommunications Cabinet Power Strip (Chatsworth 13239-757).....	652.32	4.03
27 21 16 00-0014	EA		Fan Kit For Telecommunications Cabinet (Chatsworth 12804-701).....	119.28	16.11
27 21 16 00-0015 Communications Termination Blocks And Patch Panels <small>(27 21 16 00-0007)</small>					
27 21 16 00-0016 Communications Termination Blocks <small>(27 21 16 00-0015)</small>					
27 21 16 00-0017	EA		4-Pair, 300-Pair Count, 110 Patch Panel System Terminal Block (CommScope 107058810).....	232.17	12.07
27 21 16 00-0018	EA		5-Pair, 300-Pair Count, 110 Patch Panel System Terminal Block (CommScope 107058802).....	216.06	12.07
27 21 16 00-0019	EA		4-Pair, 900-Pair Count, 110 Patch Panel System Terminal Block (CommScope 107058869).....	518.04	12.07
27 21 16 00-0020	EA		5-Pair, 900-Pair Count, 110 Patch Panel System Terminal Block (CommScope 107058851).....	481.81	12.07
27 21 16 00-0021	EA		110 Connector System Mounting Brackets (CommScope 107535593).....	72.71	12.07
27 21 16 00-0022	EA		110 Connector System Mounting Brackets (CommScope 107535585).....	78.57	12.07
27 21 16 00-0023	EA		110 Connector System Mounting Brackets (CommScope 107098816).....	89.53	12.07
27 21 16 00-0024 Communications Copper Patch Panels <small>(27 21 16 00-0015)</small>					
Note: Excludes cabinet and terminations.					
27 21 16 00-0025	EA		24 Port, Category 5E Patch Panel (CommScope 108208919).....	229.27	26.18
27 21 16 00-0026	EA		48 Port, Category 5E Patch Panel (CommScope 108208935).....	418.25	32.23
27 21 16 00-0027	EA		24 Port, Category 6 Patch Panel (CommScope 760062372).....	339.63	26.18
27 21 16 00-0028	EA		48 Port, Category 6 Patch Panel (CommScope 760062380).....	634.38	32.23
27 21 16 00-0029 Communications Optical Fiber Patch Panels <small>(27 21 16 00-0015)</small>					
27 21 16 00-0030 Closet Connector Housings <small>(27 21 16 00-0029)</small>					
27 21 16 00-0031	EA		48 Fiber Total Capacity, Closet Connector Housing (Corning CCH-01U).....	263.38	16.11
Note: Accepts up to 2 closet connector housing panels. Excludes panels.					
27 21 16 00-0032	EA		96 Fiber Total Capacity, Closet Connector Housing (Corning CCH-02U).....	307.09	16.11
Note: Accepts up to 4 closet connector housing panels. Excludes panels.					
27 21 16 00-0033	EA		288 Fiber Total Capacity, Closet Connector Housing (Corning CCH-04U).....	382.47	16.11
Note: Accepts up to 12 closet connector housing panels. Excludes panels.					
27 21 16 00-0034	EA		SC Duplex Multimode, 62.5 Micron, 12 Fiber, Closet Connector Housing Panel (Corning CCH-CP-91).....	82.38	8.05
27 21 16 00-0035	EA		SC Duplex Singlemode, 12 Fiber, Closet Connector Housing Panel (Corning CCH-CP-59).....	112.03	8.05
27 21 16 00-0036	EA		SC Simplex Multimode, 62.5 Micron, 12 Fiber, Closet Connector Housing Panel (Corning CCH-CP-56).....	92.85	8.05
27 21 16 00-0037	EA		SC Simplex Singlemode, 12 Fiber, Closet Connector Housing Panel (Corning CCH-CP-3C).....	121.61	8.05
27 21 16 00-0038 Communications Cable Management <small>(27 21 16 00-0007)</small>					
27 21 16 00-0039 Horizontal Communication Cable Management <small>(27 21 16 00-0038)</small>					
27 21 16 00-0040	EA		1.7" Height, 19" Width, 3.7" Depth, 1 RU, Front Only, Horizontal Cable Manager (Panduit WMPFSE).....	87.60	16.11
27 21 16 00-0041	EA		3-1/2" Height, 19" Width, 3.7" Depth, Horizontal Cable Manager (Panduit WMPF1E).....	90.47	16.11



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
27 21 16 00-0042 Vertical Communication Cable Management <small>(2721 16 00-0038)</small>		
27 21 16 00-0043 EA 6" Width x 84" Height, Double-Sided Vertical Cabling Section (Chatsworth 11729-703)	516.16	40.28
27 21 16 00-0044 EA 19" Width x 84" Height, Universal Rack (Chatsworth 48353-703)	534.70	40.28
27 21 16 00-0045 EA 23" Width x 84" Height, Universal Rack (Chatsworth 48383-703)	576.50	40.28
27 21 16 00-0046 Communications Patch Cords, Station Cords, And Cross Connect Wire <small>(2721 16 00-0007)</small>		
27 21 16 00-0047 Premise Cross-Connect Wire <small>(2721 16 00-0046)</small>		
27 21 16 00-0048 LF 1-Pair, 22 AWG Premise Cross-Connect Wire (General Cable 7041973)	0.83	0.40
27 21 16 00-0049 Pathways For Communications Systems <small>(2721 16 00-0007)</small>		
27 21 16 00-0050 Conduits And Backboxes For Communication Systems <small>(2721 16 00-0049)</small>		
27 21 16 00-0051 Flexible Conduit For Communication Systems <small>(2721 16 00-0050)</small>		
27 21 16 00-0052 CLF 1" Diameter, Riser Rated, Non-Metallic Flexible Conduit With Pull Tape (Carlson DF4X1C)	333.18	144.77
27 21 16 00-0053 CLF 1" Diameter, Plenum Rated, Non-Metallic Flexible Conduit With Pull Tape (Carlson CF4X1C)	483.26	144.77
27 21 16 00-0054 Tube Cables For Communication Systems <small>(2721 16 00-0050)</small>		
27 21 16 00-0055 Outdoor/All-Dielectric Tube Cables <small>(2721 16 00-0054)</small>		
27 21 16 00-0056 CLF Two Tube, Outdoor/All-Dielectric Tube Cable (Sumitomo TC02TOX)	287.18	96.51
27 21 16 00-0057 CLF Seven Tube, Outdoor/All-Dielectric Tube Cable (Sumitomo TC07TOX)	430.63	120.65
27 21 16 00-0058 CLF Nineteen Tube, Outdoor/All-Dielectric Tube Cable (Sumitomo TC19TOX)	721.07	144.77
27 21 16 00-0059 Indoor/Riser Rated Tube Cables <small>(2721 16 00-0054)</small>		
27 21 16 00-0060 CLF Two Tube, Indoor/Riser Rated Tube Cable (Sumitomo TC02TRX)	330.91	96.51
27 21 16 00-0061 CLF Four Tube, Indoor/Riser Rated Tube Cable (Sumitomo TC04TRX)	405.67	108.58
27 21 16 00-0062 CLF Seven Tube, Indoor/Riser Rated Tube Cable (Sumitomo TC07TRX)	461.00	120.65
27 21 16 00-0063 CLF Nineteen Tube, Indoor/Riser Rated Tube Cable (Sumitomo TC19TRX)	858.33	144.77
27 21 16 00-0064 Indoor/Plenum Rated Tube Cables <small>(2721 16 00-0054)</small>		
27 21 16 00-0065 CLF Single Tube, Indoor/Plenum Rated Tube Cable (Sumitomo TC01TPX)	239.81	96.51
27 21 16 00-0066 CLF Two Tube, Indoor/Plenum Rated Tube Cable (Sumitomo TC02TP2)	351.56	96.51
27 21 16 00-0067 CLF Four Tube, Indoor/Plenum Rated Tube Cable (Sumitomo TC04TP2)	546.57	108.58
27 21 16 00-0068 CLF Seven Tube, Indoor/Plenum Rated Tube Cable (Sumitomo TC07TP2)	799.88	120.65
27 21 16 00-0069 CLF Nineteen Tube, Indoor/Plenum Rated Tube Cable (Sumitomo TC19TP2)	2,516.28	144.77
27 21 16 00-0070 Unjacketed Single Tube Cables <small>(2721 16 00-0054)</small>		
27 21 16 00-0071 CLF Single Tube, Unjacketed Single Tube Cable (Sumitomo TC01TGX)	205.80	96.51
27 21 16 00-0072 Multimode Fiber Bundles <small>(2721 16 00-0054)</small>		
<small>Note: Includes optical fiber cables.</small>		
27 21 16 00-0073 CLF 2-Fiber, 62.5 Micron, Multimode Fiber Bundle (Sumitomo FR02M6)	89.56	28.96
27 21 16 00-0074 CLF 4-Fiber, 62.5 Micron, Multimode Fiber Bundle (Sumitomo FB04M6)	136.93	28.96
27 21 16 00-0075 CLF 6-Fiber, 62.5 Micron, Multimode Fiber Bundle (Sumitomo FB06M6)	187.94	28.96
27 21 16 00-0076 CLF 12-Fiber, 62.5 Micron, Multimode Fiber Bundle (Sumitomo FB12M6)	343.41	28.96
27 21 16 00-0077 CLF 18-Fiber, 62.5 Micron, Multimode Fiber Bundle (Sumitomo FB18M6)	498.42	33.78
27 21 16 00-0078 CLF 24-Fiber, 62.5 Micron, Multimode Fiber Bundle (Sumitomo FB24M6)	653.89	33.78
27 21 16 00-0079 Singlemode Fiber Bundles <small>(2721 16 00-0054)</small>		
<small>Note: Includes optical fiber cables.</small>		
27 21 16 00-0080 CLF 2-Fiber, Singlemode Fiber Bundle (Sumitomo FR02SX)	79.84	28.96
27 21 16 00-0081 CLF 4-Fiber, Singlemode Fiber Bundle (Sumitomo FB04SX)	100.49	28.96
27 21 16 00-0082 CLF 6-Fiber, Singlemode Fiber Bundle (Sumitomo FB06SX)	117.49	28.96
27 21 16 00-0083 CLF 12-Fiber, Singlemode Fiber Bundle (Sumitomo FB12SX)	150.29	28.96
27 21 16 00-0084 CLF 18-Fiber, Singlemode Fiber Bundle (Sumitomo FB18SX)	231.21	33.78
27 21 16 00-0085 CLF 24-Fiber, Singlemode Fiber Bundle (Sumitomo FB24SX)	305.30	33.78
27 21 16 00-0086 Tube Distribution Cabinets <small>(2721 16 00-0054)</small>		
27 21 16 00-0087 EA Modular Tube Distribution Cabinet (Sumitomo DE06MDU)	175.03	40.28
<small>Note: Up to six 7-tube cables or two 19-tube cables.</small>		
27 21 16 00-0088 Modular Fiber Termination Cabinets <small>(2721 16 00-0054)</small>		
27 21 16 00-0089 EA 24-Fiber Capacity, Wall Mount, Modular Fiber Termination Cabinet (Sumitomo FT24WFM)	222.66	40.28
27 21 16 00-0090 EA 48-Fiber Capacity, Wall Mount, Modular Fiber Termination Cabinet (Sumitomo FT48WFM)	237.72	40.28

27 Communications**27 20 Data Communications****27 21 Data Communications Network Equipment**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
27 21 16 00-0091			Tube Distribution Accessories (27 21 16 00-0054)		
27 21 16 00-0092	EA		Plastic Push/Pull Quick Release Pneumatic Cap For 8 mm Tube (Sumitomo DE08MA)	9.74	4.03
27 21 16 00-0093	EA		Plastic Push/Pull Quick Release Pneumatic Coupling For 8 mm Tube (Sumitomo DE08MC2).....	10.79	4.03
27 21 16 00-0094	EA		Brass Push/Pull Quick Release Pneumatic Coupling For 8 mm Bulkhead Tube (Sumitomo DE08MB)	13.52	4.03
27 21 16 00-0095			Communications Optical Fiber Cabling (27 21 16 00-0007)		
27 21 16 00-0096			Communications Optical Fiber Cable Splicing And Terminations (27 21 16 00-0095)		
27 21 16 00-0097			Field Installed Fiber Connectors (27 21 16 00-0096)		
27 21 16 00-0098	EA		SC Type, Singlemode, Field Installed Fiber Connector (Corning 95-200-42)	29.19	6.04
27 21 16 00-0099	EA		SC Type, 62.5 Micron Multimode, Field Installed Fiber Connector (Corning 95-000-41).....	25.71	6.04
27 21 16 00-0100			Buffer Tube Fan-Out Kits (27 21 16 00-0096)		
27 21 16 00-0101			Buffer Tube Breakout Kits (Sumitomo) (27 21 16 00-0100) Note: Includes 900 micron tubing.		
27 21 16 00-0102	EA		2-Fiber Breakout Kit (Sumitomo FTFLD02)	175.44	80.44
27 21 16 00-0103	EA		4-Fiber Breakout Kit (Sumitomo FTFLD04)	179.08	80.44
27 21 16 00-0104	EA		6-Fiber Breakout Kit (Sumitomo FTFLD06)	182.30	80.44
27 21 16 00-0105	EA		12-Fiber Breakout Kit (Sumitomo FTFLD12)	192.29	80.44
27 21 16 00-0106	EA		18-Fiber Breakout Kit (Sumitomo FTFLD18)	205.97	80.44
27 21 16 00-0107	EA		24-Fiber Breakout Kit (Sumitomo FTFLD24)	216.13	80.44
27 21 16 00-0108			Buffer Tube Fan-Out Kits (Corning) (27 21 16 00-0100)		
27 21 16 00-0109	EA		12 Fiber, 25" Tube Length, Indoor Buffer Tube Fan-Out Kit (Corning Fan-BT25-12)	177.12	80.44
27 21 16 00-0110	EA		12 Fiber, 25" Tube Length, Outdoor Buffer Tube Fan-Out Kit (Corning Fan-OD25-12).....	213.21	80.44
27 21 16 00-0111			Communications Copper Cabling (27 21 16 00-0007)		
27 21 16 00-0112			Copper Communications Cable Splicing And Terminations (27 21 16 00-0111)		
27 21 16 00-0113			Copper Communications Cable Splice Cases (27 21 16 00-0112)		
27 21 16 00-0114	EA		6.5" x 28.4" Copper Communications Cable Splice Case (Preformed Line Products 8000626)	687.88	160.86
27 21 16 00-0115	EA		9.5" x 28.4" Copper Communications Cable Splice Case (Preformed Line Products 8000630).....	792.53	160.86
27 21 16 00-0116	EA		12.5" x 28.4" Copper Communications Cable Splice Case (Preformed Line Products 8006219).....	1,140.28	160.86
27 21 16 00-0117			Modular Splice Connectors (27 21 16 00-0112)		
27 21 16 00-0118	EA		25-Pair, Straight Body Only, 26-24 Gauge Cable, Filled Modular Splice Connector (3M 710-SC1-25)	85.52	40.21
27 21 16 00-0119	EA		25-Pair, Straight/Half Tap Body, 26-24 Gauge Cable, Dry Modular Splice Connector (3M 710-SD1-25).....	84.39	40.21
27 21 16 00-0120	EA		25-Pair, Straight/Half Tap Body, 26-24 Gauge Cable, Filled Modular Splice Connector (3M 710-TC1-25).....	85.54	40.21
27 21 16 00-0121	EA		25-Pair, Bridge Body, 26-22 Gauge Cable, Filled Modular Splice Connector (3M 710-BC1-25)	85.38	40.21
27 30			Voice Communications (27)		
27 31			Voice Communications Switching and Routing Equipment (27 30) Note: Includes testing of new devices and certification.		
27 31 13			PBX/Key Systems (27 31)		
27 31 13 00-0001			Interior PBX Telephone System (27 31 13) Note: Includes telephone instruments cabling and solid state switching.		
27 31 13 00-0002			Interior PBX Telephone System (27 31 13 00-0001) Note: Cost is for each line up to 1000 lines.		
27 31 13 00-0003	EA		1 Line PBX Connection, Cost Per Each Line Up To 1,000	1,120.30	419.57
27 31 13 00-0004			Additional Telephones Less Solid State Switching (PBX) (27 31 13 00-0001)		
27 31 13 00-0005	EA		Add For Each Additional PBX Phone Line Less Solid State Switching	341.18	32.98
27 31 13 00-0006			Telephones (27 31 13 00-0001)		
27 31 13 00-0007	EA		Telephones, Desk Type Intercommunication Equipment.....	140.71	31.37
27 31 13 00-0008	EA		Telephones, Wall Type Intercommunication Equipment.....	161.85	41.83
27 32			Voice Communications Terminal Equipment (27 30) Note: Includes testing of new devices and certification.		
27 32 19			Interior Telephone System (27 32)		
27 32 19 00-0001			Components (27 32 19)		
27 32 19 00-0002	EA		Solid State Exchange Unit With Power Supply	4,125.67	734.98
27 32 19 00-0003	EA		Dial Telephone - Handset In Cabinet	485.45	60.08



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
27 32 19 00-0004 EA Elevator Cab Telephone With Trailer Cable.....	258.33	64.43
27 32 19 00-0005 EA Loud Ring Bell, 6".....	205.94	59.76
27 32 19 00-0006 EA Audio/Visual Indicator.....	255.43	56.30
27 32 19 00-0007 EA Administrative Telephone With Digital Display.....	263.19	50.51
27 32 19 00-0008 EA Processing Unit For 16 Station System.....	1,361.23	412.05
27 32 19 00-0009 EA Handset For 16 Station System.....	187.48	41.02
27 32 19 00-0010 EA Handset In Cabinet, For 16 Station System.....	253.88	55.34
27 32 19 00-0011 MLF 20 Conductor Unshielded Cable, #22.....	1,878.86	886.92
27 32 19 00-0012 EA Power Supply For 16 Station System.....	256.16	109.46
27 32 19 00-0013 EA Intercom Terminal Board.....	235.74	123.22
27 32 19 00-0014 EA Power Supply For Five Station System, 24 Volt DC.....	264.75	109.46
27 32 19 00-0015 EA Telephone Communication Board, Insulated Blueboard 24" x 24" x 1/2" Thick.....	126.21	45.00
27 32 19 00-0016 EA Telephone Cabinet With Backboard 24" High x 24" Wide x 6" Deep.....	380.02	99.04
27 32 19 00-0017 EA Telephone Cabinet With Backboard 30" High x 24" Wide x 6" Deep.....	447.23	112.58
27 32 19 00-0018 EA Telephone Cabinet With Backboard 30" High x 30" Wide x 6" Deep.....	541.27	133.24
27 32 19 00-0019 EA Telephone Cabinet With Backboard 36" High x 30" Wide x 6" Deep.....	634.16	144.05
27 32 19 00-0020 EA Telephone Cabinet With Backboard 48" High x 30" Wide x 6" Deep.....	967.56	163.90
27 32 19 00-0021 EA Ring Rung 3".....	8.39	4.48
27 32 19 00-0022 EA G66B50 Telephone Blocks Including 50 Terminators, Exterior Ring, Marking, ID.....	20.48	7.96
27 32 19 00-0023 EA G110 Data Blocks Including Terminator, Exterior Ring, Marking, ID And Testing.....	37.99	16.33

27 32 19 00-0024 Accessories (27 32 19)

27 32 19 00-0025 EA Blank Telephone Receptacle, Exposed Devices - Complete.....	8.86	4.34
27 32 19 00-0026 EA 4-Pin Telephone Receptacle, Exposed Devices - Complete.....	18.46	16.73
27 32 19 00-0027 EA Level 5, RJ-45 Jack, Dual Flush Mounted - Complete.....	43.83	18.38
27 32 19 00-0028 EA Level 5, RJ-45 Jack, Wall Mount - Complete.....	42.26	18.38
27 32 19 00-0029 EA Terminating Strips, Inside.....	85.30	36.77
27 32 19 00-0030 EA Dual Outlet, 4-Pin Telephone Receptacle, Concealed Type RJ-45 - Complete.....	39.62	18.90
27 32 19 00-0031 EA Ready Access Closure 3 To 25 Pair.....	102.93	44.32
27 32 19 00-0032 EA Ready Access Closure 25 To 100 Pair.....	118.61	49.54
27 32 19 00-0033 EA Termination Block With Bracket 25 Pair.....	37.48	14.88
27 32 19 00-0034 EA RJ-11 Telephone Receptacle, Concealed Devices - Complete.....	38.94	18.66
27 32 19 00-0035 EA Interior Protected Terminal 25 Pair.....	378.25	107.46
27 32 19 00-0036 EA Interior Protected Terminal 50 Pair.....	434.09	109.14
27 32 19 00-0037 EA Pedestal 6" x 6" x 50" 3 To 100 Pair.....	152.09	44.72
27 32 19 00-0038 EA Pedestal 8" x 8" x 50" 100 To 300 Pair.....	155.85	44.72
27 32 19 00-0039 EA Pedestal 10" x 10" x 43" 300 To 600 Pair.....	204.37	57.18
27 32 19 00-0040 EA Pedestal 10" x 16" x 439 600 Pair.....	411.93	103.03
27 32 19 00-0041 EA Entrance Protector Terminal 100 Pair.....	550.43	117.59
27 32 19 00-0042 EA Gas Protection Module.....	10.22	4.02
27 32 19 00-0043 EA Terminating Boxes, Outside With 3 Element Protectors, Per Pair.....	15.19	3.68

27 32 26 Ring-Down Emergency Telephones (27 32 26)

27 32 26 00-0001 Emergency Telephone (27 32 26)

Note: Standard features include: CB3000 speakerphone, 3 auxiliary inputs, 2 auxiliary outputs, phone line surge suppressor, analog telephone connection, 70w area light with blue beacon, high power strobe, lighted faceplate, 110VAC power, ultra weather resistant finish, vandal resistant hardware, UV resistant lens, dome vent; flat area for directory, access control or other options; 12.75" diameter/8'-6" height, 1/4" thick steel construction, foundation anchor kit, ADA compliant.

27 32 26 00-0002 EA Code Blue 1-Standard Emergency Telephone Pedestal Unit (CB 1-s).....	6,131.50	331.46
Note: Includes IA4100 FP1 analog speakerphone with single red "Push For Help" button, "Push For Help" bezel, hard wire phone line, passive vent at top, 24V AC, and standard color.		
27 32 26 00-0003 EA Code Blue 1-Dual Emergency Telephone Pedestal Unit (CB 1-d).....	6,430.11	331.46
Note: Includes IA4100 FP1 analog speakerphone with single red "Push For Help" button, "Push For Help" bezel, blank stainless steel plate second opening, hard wire phone line, passive vent at top, 24V AC, and standard color.		
27 32 26 00-0004 EA Analog Speakerphone With Black "Info" Button And Red "Push For Help" Button Code Blue Option (Code Blue IA4100 FP2).....	99.54	
27 32 26 00-0005 EA Analog Speakerphone With Black "Call" Button, Keypad And Red "Push For Help" Button Code Blue Option (Code Blue IA4100 FP2-K).....	149.31	
27 32 26 00-0006 EA IP Speakerphone With Single Red "Push For Help" Button Code Blue Option (Code Blue IP5000 FP1).....	373.27	
27 32 26 00-0007 EA IP Speakerphone With Back "Info" Button And Red "Push For Help" Button Code Blue Option (Code Blue IP5000 FP2).....	507.64	
27 32 26 00-0008 EA IP Speakerphone With Black "Call" Button, Keypad And Red "Push For Help" Button Code Blue Option (Code Blue IP5000 FP2-K).....	557.41	
27 32 26 00-0009 EA EMERGENCY (Raised Letters With Braille) Main Bezel Code Blue Option.....	9.95	
27 32 26 00-0010 EA EMERGENCY/EMERGENCIA (Raised Letters With Braille) Main Bezel Code Blue Option.....	9.95	
27 32 26 00-0011 EA Directory, Second Opening Code Blue Option.....	89.58	
27 32 26 00-0012 EA Camera Enclosure With Color IP Camera, Second Opening Code Blue Option.....	945.61	
27 32 26 00-0013 EA HID Card Reader, Second Opening Code Blue Option.....	437.97	
27 32 26 00-0014 EA HID Card Reader And Color IP Camera, Second Opening Code Blue Option.....	1,418.42	
27 32 26 00-0015 EA IP Wireless Communication Code Blue Option.....	2,981.16	
Note: 802.11g or secure mesh 5.8. (system UPS backup or unit Night Charge recommended). IP5000 VoIP Speakerphone option must be ordered when selecting IP Wireless Communications. Requires Base Unit(s) and site survey.		
27 32 26 00-0016 EA Active Venting Code Blue Option.....	159.26	
27 32 26 00-0017 EA Night Charge Power Code Blue Option.....	1,388.55	
Note: Requires 120V AC external power supplied to Code Blue unit.		
27 32 26 00-0018 EA Power Transformer Kit, Alternate Incoming Power Code Blue Option.....	348.38	

27	Communications
27 30	Voice Communications
27 32	Voice Communications Terminal Equipment



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
27 32 26 00-0019	EA		Overhead Camera Mount Code Blue Option Note: Excludes camera.	791.33	
27 32 26 00-0020	EA		Custom Color For Overhead Camera Mount Code Blue Option.....	34.84	
27 32 26 00-0021			City Police Call System (27 32 26)		
27 32 26 00-0022			Components (27 32 26 00-0021)		
27 32 26 00-0023	EA		City Police Call System.....	482.84	93.79
27 32 26 00-0024	EA		Concrete Foundation For Police Department Telephone Post.....	449.93	135.85

27 40 Audio-Video Communications (27)

27 41 Audio-Video Systems (27 40)

27 41 16 Integrated Audio-Video Systems and Equipment (27 41)

Note: Includes testing of new devices and certification.

27 41 16 00-0001			Television Distribution System (27 41 16) See CSI section 26 05 13 00-0001 for basic wiring.		
27 41 16 00-0002			Television Support System (27 41 16 00-0001)		
27 41 16 00-0003	EA		Ceiling Mounted Television Support, 19" To 20".....	288.45	90.24
27 41 16 00-0004	EA		Ceiling Mounted Television Support, 19" To 20" With Rack.....	365.66	100.71
27 41 16 00-0005	EA		Ceiling Mounted Television Support, 25" To 27".....	299.50	90.24
27 41 16 00-0006	EA		Ceiling Mounted Television Support, 25" To 27" With Rack.....	376.71	100.71
27 41 16 00-0007	EA		Wall Mounted Television Support, 13".....	228.00	72.51
27 41 16 00-0008	EA		Wall Mounted Television Support, 13" With Rack.....	305.21	80.57
27 41 16 00-0009	EA		Wall Mounted Television Support, 19" To 20".....	242.50	72.51
27 41 16 00-0010	EA		Wall Mounted Television Support, 19" To 20" With Rack.....	319.71	80.57
27 41 16 00-0011	EA		Wall Mounted Television Support, 25" To 27".....	257.00	72.51
27 41 16 00-0012	EA		Wall Mounted Television Support, 25" To 27" With Rack.....	334.21	80.57
27 41 16 00-0013			Distribution System (27 41 16 00-0001) See CSI section 26 05 13 00-0001 for wire and cabling.		
27 41 16 00-0014			TV Distribution Rack (27 41 16 00-0013)		
27 41 16 00-0015	EA		Steel Rack Cabinet With Shelves.....	929.88	147.91
27 41 16 00-0016	EA		Switch And Pilot Light.....	158.94	65.71
27 41 16 00-0017	LF		Surface Raceway With Outlets.....	19.39	8.93
27 41 16 00-0018	EA		Service Label.....	23.57	12.31
27 41 16 00-0019			Head End Amplifier (27 41 16 00-0013)		
27 41 16 00-0020	EA		Head End Amplifier.....	620.32	98.45
27 41 16 00-0021			UHF In-Line Booster Amplifier And Power Supply (27 41 16 00-0013)		
27 41 16 00-0022	EA		UHF In-Line Booster.....	375.97	98.45
27 41 16 00-0023			Preamplifiers (27 41 16 00-0013)		
27 41 16 00-0024	EA		VHF Preamplifier.....	462.01	98.45
27 41 16 00-0025	EA		UHF Preamplifier.....	375.97	98.45
27 41 16 00-0026			Power Supplies (27 41 16 00-0013)		
27 41 16 00-0027	EA		Common Power Supply.....	660.01	140.67
27 41 16 00-0028			Line Splitter And Mixer (27 41 16 00-0013)		
27 41 16 00-0029	EA		Line Splitter.....	63.97	32.82
27 41 16 00-0030	EA		Two-Way Splitter.....	70.82	32.82
27 41 16 00-0031	EA		Frequency Filter.....	149.31	49.30
27 41 16 00-0032	EA		Line Splitter And Mixer.....	194.73	72.39
27 41 16 00-0033			Power Line Filters (27 41 16 00-0013)		
27 41 16 00-0034	EA		120-Volt Power Supply Line Filter.....	279.39	65.71
27 41 16 00-0035			Wall Box And Receiver Outlets (27 41 16 00-0013)		
27 41 16 00-0036	EA		Wall Box With Lockable Cover, Excluding Outlet Plug.....	149.31	49.30
27 41 16 00-0037	EA		TV Receiver Outlet Plug.....	70.82	32.82
27 41 16 00-0038	EA		TV Camera Outlet Plug.....	70.82	32.82
27 41 16 00-0039	EA		Audio Outlet Plug.....	62.24	32.82
27 41 16 00-0040	EA		12 Ft RG 6U Cable With G-59 And TV Set Fittings.....	128.82	65.71
27 41 16 00-0041	EA		Male Plug PL-259.....	70.82	32.82
27 41 16 00-0042	EA		Wall Box And Receiver Outlet Television Outlets.....	86.27	34.43



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
27 41 16 00-0043 Metal And Electric Shop Antenna Systems <small>(27 41 16)</small>		
27 41 16 00-0044 Antenna <small>(27 41 16 00-0043)</small>		
27 41 16 00-0045 EA Amateur Radio Antenna	588.64	120.65
27 41 16 00-0046 EA Multi-Band Radio Antenna	465.38	120.65
27 41 16 00-0047 Receptacles <small>(27 41 16 00-0043)</small>		
27 41 16 00-0048 EA Amateur Radio Antenna System Receptacle With Mating Plugs And Adapter	140.71	49.30
27 41 16 00-0049 EA Multi-Band Radio Antenna System Receptacle With Mating Plugs	140.71	49.30

27 50 Distributed Communications And Monitoring Systems (27)

27 51 Distributed Audio-Video Communications Systems (27 50)

27 51 33 Sound Reinforcement (27 51)

Note: Includes testing of new devices and certification.

27 51 33 00-0001 Amplifiers (27 51 33)

27 51 33 00-0002 EA 10 Watt PA/Paging System Amplifier, 70 Volt (Bogen C10)	317.32	80.57
27 51 33 00-0003 EA 35 Watt PA/Paging System Amplifier, 70 Volt (Bogen C35)	434.39	80.57
27 51 33 00-0004 EA 60 Watt PA/Paging System Amplifier, 70 Volt (Bogen C60)	509.54	80.57
27 51 33 00-0005 EA 100 Watt PA/Paging System Amplifier, 70 Volt (Bogen 100)	563.16	80.57
27 51 33 00-0006 EA 150 Watt PA/Paging System Amplifier, 70 Volt (Bogen GS150)	693.08	80.57
27 51 33 00-0007 EA 250 Watt PA/Paging System Amplifier, 70 Volt (Bogen GS250)	887.36	80.57
27 51 33 00-0008 EA Rack Mount Kit For PA/Paging System Amplifiers (Bogen GSRPK)	35.55	4.03

27 51 33 00-0009 Speakers (27 51 33)

27 51 33 00-0010 EA 8", 5 Watt Recessed Ceiling Mounted Speaker With Transformer And Baffle (Atlas Sound FD72W)	133.91	21.56
27 51 33 00-0011 EA 8" Steel Baffle (Atlas Sound 51-8)	39.67	4.02
27 51 33 00-0012 EA T-Bar Support (Atlas Sound EZ95-8)	43.76	4.02
27 51 33 00-0013 EA 8" Cylindrical Enclosure With Undercoating (Atlas Sound Q408)	65.67	4.02
27 51 33 00-0014 EA Plate Mounted 10 Watt Attenuator With Priority Relay (Atlas Sound AT10-PA)	64.80	7.24

27 51 33 00-0015 Accessories (27 51 33)

27 51 33 00-0016 EA Microphone And Stand For Audio/Video System (Bogen MBS-1000A)	168.80	10.07
27 51 33 00-0017 EA Tape Deck For Audio/Video System	122.76	10.07
27 51 33 00-0018 EA 5 Disk CD Player For Audio/Video System (Bogen DCM290-P)	373.74	10.07
27 51 33 00-0019 EA Weather Proof Horn For Audio/Video System (Bogen SPT5A)	102.48	20.14
27 51 33 00-0020 EA Trumpet Driver And Line Matching Transformer For Audio/Video System	182.20	20.14
27 51 33 00-0021 EA Headset Microphone For Audio/Video System	135.57	20.11
27 51 33 00-0022 EA Microphone Jack For Audio/Video System	67.54	20.14
27 51 33 00-0023 EA Terminal Cabinet For Audio/Video System	531.37	80.57
27 51 33 00-0024 EA Volume Control For Audio/Video System (Bogen AT10A)	64.96	20.14

27 51 33 00-0025 Remove And Reinstall Speakers (27 51 33)

Note: Includes storage, cleaning and supply materials.

27 51 33 00-0026 EA Remove And Reinstall Ceiling Mounted Speaker	112.60	
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27 53 Distributed Systems (27 50)

27 53 13 Clock Systems (27 53)

27 53 13 00-0001 Wired Self-Corrective Clock Systems (27 53 13)

27 53 13 00-0002 Wired Self-Corrective Clocks (27 53 13 00-0001)

27 53 13 00-0003 Analog, Wired Self-Corrective Clocks (Telecor) (27 53 13 00-0002)

27 53 13 00-0004 24 Volt AC, Analog, Wired Self-Corrective Clocks (27 53 13 00-0003)

27 53 13 00-0005 EA 12", Single Sided, 24 Volt AC, Analog, Wired Self-Corrective Clock, Semi-Flush Mount	180.51	20.11
For >50 To 100, Deduct	-11.63	
For >100, Deduct	-17.24	
27 53 13 00-0006 EA 12", Dual Sided, 24 Volt AC, Analog, Wired Self-Corrective Clock, Surface Mount	430.91	20.11
For >50 To 100, Deduct	-21.65	
For >100, Deduct	-37.27	
27 53 13 00-0007 EA 16", Single Sided, 24 Volt AC, Analog, Wired Self-Corrective Clock, Semi-Flush Mount	226.68	20.11
For >50 To 100, Deduct	-15.34	
For >100, Deduct	-22.80	
27 53 13 00-0008 EA 16", Dual Sided, 24 Volt AC, Analog, Wired Self-Corrective Clock, Surface Mount	569.43	20.11
For >50 To 100, Deduct	-58.94	
For >100, Deduct	-80.11	

27 53 13 00-0009 120 Volt AC, Analog, Wired Self-Corrective Clocks (27 53 13 00-0003)

27	Communications
27 50	Distributed Communications And Monitoring Systems
27 53	Distributed Systems



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
27 53 13 00-0010	EA		12", Single Sided, 120 Volt AC, Analog, Wired Self-Corrective Clock, Semi-Flush Mount.....	180.51	20.11
			<i>For >50 To 100, Deduct</i>	-11.63	
			<i>For >100, Deduct</i>	-17.24	
27 53 13 00-0011	EA		12", Dual Sided, 120 Volt AC, Analog, Wired Self-Corrective Clock, Surface Mount.....	430.91	20.11
			<i>For >50 To 100, Deduct</i>	-21.65	
			<i>For >100, Deduct</i>	-37.27	
27 53 13 00-0012	EA		16", Single Sided, 120 Volt AC, Analog, Wired Self-Corrective Clock, Semi-Flush Mount.....	226.68	20.11
			<i>For >50 To 100, Deduct</i>	-15.34	
			<i>For >100, Deduct</i>	-22.80	
27 53 13 00-0013	EA		16", Dual Sided, 120 Volt AC, Analog, Wired Self-Corrective Clock, Surface Mount.....	569.43	20.11
			<i>For >50 To 100, Deduct</i>	-58.94	
			<i>For >100, Deduct</i>	-80.11	
27 53 13 00-0014			Accessories For Analog Wired Self-Corrective Clocks (27 53 13 00-0003)		
27 53 13 00-0015	EA		Wire Guards For 12", 15" Or 16" Analog Wired Self-Corrective Clocks.....	148.86	10.05
27 53 13 00-0016	EA		Back Box For 10", 12" Or 15" Flush Mount Analog Wired Self-Corrective Clocks	37.87	10.05
27 53 13 00-0017	EA		Surface Mounting Rings For 12" Analog Wired Self-Corrective Clocks	48.09	10.05
27 53 13 00-0018	EA		Surface Mounting Rings For 15" Analog Wired Self-Corrective Clocks	58.74	10.05
27 53 13 00-0019	EA		Combination Back Box For Speaker And Clock.....	86.75	16.09
27 53 13 00-0020			Digital, Wired Self-Corrective Clocks (Telecor) (27 53 13 00-0002)		
27 53 13 00-0021			24 Volt AC, Digital, Wired Self-Corrective Clocks (27 53 13 00-0020)		
27 53 13 00-0022	EA		2.5", 24 Volt AC, Digital, Wired Self-Corrective Clock, Flush Mount	223.13	20.11
			<i>For Surface Mount, Add</i>	36.58	
			<i>For >50 To 100, Deduct</i>	-10.98	
			<i>For >100, Deduct</i>	-18.29	
27 53 13 00-0023	EA		4", 24 Volt AC, Digital, Wired Self-Corrective Clock, Flush Mount	343.89	20.11
			<i>For Surface Mount, Add</i>	60.74	
			<i>For >50 To 100, Deduct</i>	-18.22	
			<i>For >100, Deduct</i>	-30.37	
27 53 13 00-0024			120 Volt AC, Digital, Wired Self-Corrective Clocks (27 53 13 00-0020)		
27 53 13 00-0025	EA		2.5", 120 Volt AC, Digital, Wired Self-Corrective Clock, Flush Mount.....	223.13	20.11
			<i>For Surface Mount, Add</i>	36.58	
			<i>For >50 To 100, Deduct</i>	-10.98	
			<i>For >100, Deduct</i>	-18.29	
27 53 13 00-0026	EA		4", 120 Volt AC, Digital, Wired Self-Corrective Clock, Flush Mount.....	343.89	20.11
			<i>For Surface Mount, Add</i>	60.74	
			<i>For >50 To 100, Deduct</i>	-18.22	
			<i>For >100, Deduct</i>	-30.37	
27 53 13 00-0027			Replacement Modules For 24 Volt AC, Digital, Wired Self-Corrective Clocks (27 53 13 00-0020)		
27 53 13 00-0028	EA		2.5", Replacement Module For 24 Volt AC, Digital, Wired Self-Corrective Clocks.....	190.72	20.11
			<i>For >50 To 100, Deduct</i>	-9.03	
			<i>For >100, Deduct</i>	-15.05	
27 53 13 00-0029	EA		4" Replacement Module For 24 Volt AC, Digital, Wired Self-Corrective Clocks.....	314.59	20.11
			<i>For >50 To 100, Deduct</i>	-16.46	
			<i>For >100, Deduct</i>	-27.44	
27 53 13 00-0030			Replacement Modules For 120 Volt AC, Digital, Wired Self-Corrective Clocks (27 53 13 00-0020)		
27 53 13 00-0031	EA		2.5", Replacement Module For 120 Volt AC, Digital, Wired Self-Corrective Clocks.....	190.72	20.11
			<i>For >50 To 100, Deduct</i>	-9.03	
			<i>For >100, Deduct</i>	-15.05	
27 53 13 00-0032	EA		4" Replacement Module For 120 Volt AC, Digital, Wired Self-Corrective Clocks.....	314.59	20.11
			<i>For >50 To 100, Deduct</i>	-16.46	
			<i>For >100, Deduct</i>	-27.44	
27 53 13 00-0033			Accessories For Digital Wired Self-Corrective Clocks (27 53 13 00-0020)		
27 53 13 00-0034	EA		Wire Guard For 4" Surface Mount Analog Wired Self-Corrective Clocks.....	203.03	10.05
27 53 13 00-0035	EA		2.5", Recessed Back Box For Flush Mount Digital Wired Self-Corrective Clocks.....	48.52	10.05
27 53 13 00-0036	EA		4", Recessed Back Box For Flush Mount Digital Wired Self-Corrective Clocks	67.17	10.05
27 53 13 00-0037	EA		Dual Mounting Kit For Surface Mount Digital Wired Self-Corrective Clocks	177.28	10.05
27 53 13 00-0038	EA		4 Gang Extension Ring For Surface Mount Digital Wired Self-Corrective Clocks.....	49.86	10.05
27 53 13 00-0039			Wired Self-Corrective Master Clocks (27 53 13 00-0001)		
27 53 13 00-0040			Wired Self-Corrective Master Clocks (27 53 13 00-0039)		
27 53 13 00-0041	EA		24 Volt AC, Wired Self-Corrective Master Clock, Surface Mount (Telecor 2400-S-24).....	2,094.06	160.86
27 53 13 00-0042	EA		120 Volt AC, Wired Self-Corrective Master Clock, Surface Mount (Telecor 2400-S-120).....	2,227.26	160.86
27 53 13 00-0043			Accessories For Wired Self-Corrective Master Clocks (27 53 13 00-0039)		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
27 53 13 00-0044 EA 5 Amp Power Transformer For 24 Volt AC, Wired Self-Corrective Clock Systems (Telecor 2405).....	214.97	40.21
27 53 13 00-0045 EA 10 Amp Power Transformer For 24 Volt AC, Wired Self-Corrective Clock Systems (Telecor 2406).....	242.93	40.21
27 53 13 00-0046 GPS Wireless Clock Systems (27 53 13)		
27 53 13 00-0047 Wireless Synchronized Clocks (27 53 13 00-0046)		
27 53 13 00-0048 Analog, Wireless Synchronized Clocks (Primex Traditional Series) (27 53 13 00-0047)		
27 53 13 00-0049 EA 12.5", Battery Operated, Single Sided, Analog, Wireless Synchronized Clock.....	176.60	20.11
<i>For >100 To 250, Deduct</i>	-30.57	
<i>For >250, Deduct</i>	-36.02	
27 53 13 00-0050 EA 12.5", Battery Operated, Dual Sided, Analog, Wireless Synchronized Clock	329.09	20.11
<i>For >100 To 250, Deduct</i>	-21.91	
<i>For >250, Deduct</i>	-26.24	
27 53 13 00-0051 EA 16", Battery Operated, Single Sided, Analog, Wireless Synchronized Clock.....	207.85	20.11
<i>For >100 To 250, Deduct</i>	-36.19	
<i>For >250, Deduct</i>	-42.90	
27 53 13 00-0052 EA 12.5", Water Resistant, Battery Operated, Single Sided, Analog, Wireless Synchronized Clock	238.16	20.11
<i>For >100 To 250, Deduct</i>	-21.85	
<i>For >250, Deduct</i>	-27.79	
27 53 13 00-0053 EA 12.5", Electric, Single Sided, Analog, Wireless Synchronized Clock	207.85	20.11
<i>For >100 To 250, Deduct</i>	-36.19	
<i>For >250, Deduct</i>	-42.90	
27 53 13 00-0054 EA 12.5", Electric, Dual Sided, Analog, Wireless Synchronized Clock.....	395.39	20.11
<i>For >100 To 250, Deduct</i>	-25.55	
<i>For >250, Deduct</i>	-30.88	
27 53 13 00-0055 EA 16", Electric, Single Sided, Analog, Wireless Synchronized Clock	232.48	20.11
<i>For >100 To 250, Deduct</i>	-27.17	
<i>For >250, Deduct</i>	-34.86	
27 53 13 00-0056 Digital, Wireless Synchronized Clocks (Primex Digital Series) (27 53 13 00-0047)		
27 53 13 00-0057 4-Digit, Digital, Wireless Synchronized Clocks (27 53 13 00-0056)		
27 53 13 00-0058 EA 2.5", Single Sided, 4-Digit, Red LED Digital, Wireless Synchronized Clock	329.09	20.11
<i>For Green LED, Add</i>	28.89	
<i>For >100 To 250, Deduct</i>	-29.13	
<i>For >250, Deduct</i>	-43.57	
27 53 13 00-0059 EA 2.5", Dual Sided, 4-Digit, Red LED Digital, Wireless Synchronized Clock	572.50	20.11
<i>For Green LED, Add</i>	53.23	
<i>For >100 To 250, Deduct</i>	-59.25	
<i>For >250, Deduct</i>	-149.74	
27 53 13 00-0060 EA 4", Single Sided, 4-Digit, Red LED Digital, Wireless Synchronized Clock	379.29	20.11
<i>For Green LED, Add</i>	33.91	
<i>For >100 To 250, Deduct</i>	-21.28	
<i>For >250, Deduct</i>	-31.45	
27 53 13 00-0061 EA 4", Dual Sided, 4-Digit, Red LED Digital, Wireless Synchronized Clock.....	734.47	20.11
<i>For Green LED, Add</i>	69.43	
<i>For >100 To 250, Deduct</i>	-61.56	
<i>For >250, Deduct</i>	-193.47	
27 53 13 00-0062 6-Digit, Digital, Wireless Synchronized Clocks (27 53 13 00-0056)		
27 53 13 00-0063 EA 2.5", Single Sided, 6-Digit, Red LED Digital, Wireless Synchronized Clock	415.28	20.11
<i>For Green LED, Add</i>	37.51	
<i>For >100 To 250, Deduct</i>	-26.65	
<i>For >250, Deduct</i>	-38.65	
27 53 13 00-0064 EA 2.5", Dual Sided, 6-Digit, Red LED Digital, Wireless Synchronized Clock.....	795.08	20.11
<i>For Green LED, Add</i>	75.49	
<i>For >100 To 250, Deduct</i>	-59.61	
<i>For >250, Deduct</i>	-141.89	
27 53 13 00-0065 EA 2.5", Flush Mount, 6-Digit, Red LED Digital, Wireless Synchronized Clock.....	460.74	20.11
<i>For Green LED, Add</i>	42.05	
<i>For >100 To 250, Deduct</i>	-20.74	
<i>For >250, Deduct</i>	-31.25	
27 53 13 00-0066 EA 4", Single Sided, 6-Digit, Red LED Digital, Wireless Synchronized Clock	486.31	20.11
<i>For Green LED, Add</i>	44.61	
<i>For >100 To 250, Deduct</i>	-21.63	
<i>For >250, Deduct</i>	-32.78	
27 53 13 00-0067 Wire Guards For Wireless Synchronized Clocks (27 53 13 00-0047)		
27 53 13 00-0068 EA 14" x 14" Analog Clock Wire Guard For 12.5" Wireless Synchronized Clocks.....	75.99	10.05
27 53 13 00-0069 EA 18" x 18" Analog Clock Wire Guard For 16" Wireless Synchronized Clocks	91.15	10.05
27 53 13 00-0070 EA Digital Clock Wire Guard For 2.5" Wireless Synchronized Clocks.....	75.99	10.05
27 53 13 00-0071 EA Digital Clock Wire Guard For 4" Wireless Synchronized Clocks.....	91.15	10.05
27 53 13 00-0072 Wireless Synchronized Clock Transmitters (27 53 13 00-0046)		
27 53 13 00-0073 Wireless Synchronized Clock Transmitters (27 53 13 00-0072)		
Note: Includes 16 channel transmitter with daylight savings bypass and time zone switch, GPS receiver, 16' cable and window installation hardware.		

27 Communications**27 50 Distributed Communications And Monitoring Systems****27 53 Distributed Systems**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
27 53 13 00-0074 EA Internal Antenna, One Watt GPS Wireless Clock Transmitter (Primex 14000).....	2,294.35	60.32
<i>For Roof Mounted GPS Receiver, Add</i>	<i>337.74</i>	
27 53 13 00-0075 EA External Antenna, One Watt GPS Wireless Clock Transmitter (Primex 14000-E).....	4,422.58	60.32
Note: Includes 100' antenna cable, 29.4" high x 41.5" wide ground plane antenna with direct ground lightning protection.		
<i>For Roof Mounted GPS Receiver, Add</i>	<i>550.56</i>	
27 53 13 00-0076 EA Repeater, Satellite Transmitter (Primex 14006).....	2,254.14	40.21
Note: Includes 100' antenna cable, 29.4" high x 41.5" wide ground plane antenna with direct ground lightning protection.		
27 53 13 00-0077 Accessories For Wireless Synchronized Clock Transmitters <small>(27 53 13 00-0072)</small>		
27 53 13 00-0078 EA External Antenna Mounting Kit For Wireless Synchronized Clock Transmitters	118.36	16.09
27 53 13 00-0079 EA Transmitter Rack For Wireless Synchronized Clock Transmitters	79.53	16.09
27 53 13 00-0080 EA Surge Protector And Battery Back Up For Wireless Synchronized Clock Transmitters	109.38	8.04
27 53 13 00-0081 EA 50' GPS Receiver Cable For Wireless Synchronized Clock Transmitters.....	100.83	20.11
27 53 13 00-0082 EA 100' GPS Receiver Cable For Wireless Synchronized Clock Transmitters.....	141.77	30.16
27 53 13 00-0083 EA 200' GPS Receiver Cable For Wireless Synchronized Clock Transmitters.....	207.12	40.21
27 53 13 00-0084 Other Clock And Program Systems <small>(27 53 13)</small>		
27 53 13 00-0085 EA 4 Circuit Master Clock And Signal Control (Lathem LTR4-512).....	1,029.07	80.44
27 53 13 00-0086 EA 8 Circuit Master Clock And Signal Control (Lathem LTR8-512).....	1,272.24	160.86
27 53 13 00-0087 EA Program Bell (Lathem 906-6).....	164.04	40.21
27 53 13 00-0088 EA Combination Clock And Speaker	376.47	100.54

END OF SECTION 27



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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28 Electronic Safety And Security

Note: Termination costs are included with all safety and security equipment, panel boards, and devices. Terminations are not included with patch panels.

28 05 Common Work Results For Electronic Safety And Security ⁽²⁸⁾

28 05 13 Conductors And Cables For Electronic Safety And Security ^(28 05)

28 05 13 13 **CCTV Communications Conductors And Cables** ^(28 05 13)

See CSI section 26 05 19 00-0000 for low-voltage electrical power cable, 26 05 23 00-0000 for control-voltage electrical power cable, 27 14 00 00-0000 for conductors and cables.

28 05 13 16 **Access Control Communications Conductors And Cables** ^(28 05 13)

See CSI section 26 05 19 00-0000 for low-voltage electrical power cable, 26 05 23 00-0000 for control-voltage electrical power cable, 27 14 00 00-0000 for conductors and cables.

28 05 13 19 **Intrusion Detection Communications Conductors And Cables** ^(28 05 13)

See CSI section 26 05 19 00-0000 for low-voltage electrical power cable, 26 05 23 00-0000 for control-voltage electrical power cable, 27 14 00 00-0000 for conductors and cables, 28 05 13 23-0000 for Type FPLP.

28 05 13 23 **Fire Alarm Communications Conductors And Cables** ^(28 05 13)

28 05 13 23-0001 Fire Alarm/Life Safety Cable ^(28 05 13 23)

28 05 13 23-0002 Twisted Pair, Non-Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable ^(28 05 13 23-0001)

28 05 13 23-0003 Twisted Pair, Non-Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed In Conduit ^(28 05 13 23-0002)

28 05 13 23-0004	MLF	1-Pair, 18 AWG, Twisted Pair, Non-Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed In Conduit	1,522.58	
28 05 13 23-0005	MLF	2-Pair, 18 AWG, Twisted Pair, Non-Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed In Conduit	1,960.36	547.25
28 05 13 23-0006	MLF	1-Pair, 16 AWG, Twisted Pair, Non-Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed In Conduit	1,737.88	567.04
28 05 13 23-0007	MLF	2-Pair, 16 AWG, Twisted Pair, Non-Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed In Conduit	2,443.80	622.05
28 05 13 23-0008	MLF	1-Pair, 14 AWG, Twisted Pair, Non-Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed In Conduit	2,012.42	644.26
28 05 13 23-0009	MLF	2-Pair, 14 AWG, Twisted Pair, Non-Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed In Conduit	3,023.48	696.38
28 05 13 23-0010	MLF	1-Pair, 12 AWG, Twisted Pair, Non-Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed In Conduit	2,660.60	721.46
28 05 13 23-0011	MLF	2-Pair, 12 AWG, Twisted Pair, Non-Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed In Conduit	4,240.58	796.27

28 05 13 23-0012 Twisted Pair, Non-Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed Exposed ^(28 05 13 23-0002)

28 05 13 23-0013	MLF	1-Pair, 18 AWG, Twisted Pair, Non-Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed Exposed	2,434.67	
28 05 13 23-0014	MLF	2-Pair, 18 AWG, Twisted Pair, Non-Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed Exposed	2,905.42	1,094.66
28 05 13 23-0015	MLF	1-Pair, 16 AWG, Twisted Pair, Non-Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed Exposed	2,774.63	1,134.08
28 05 13 23-0016	MLF	2-Pair, 16 AWG, Twisted Pair, Non-Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed Exposed	3,517.55	1,244.27
28 05 13 23-0017	MLF	1-Pair, 14 AWG, Twisted Pair, Non-Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed Exposed	3,173.03	1,288.51
28 05 13 23-0018	MLF	2-Pair, 14 AWG, Twisted Pair, Non-Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed Exposed	4,225.94	1,393.07
28 05 13 23-0019	MLF	1-Pair, 12 AWG, Twisted Pair, Non-Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed Exposed	3,987.72	1,442.94
28 05 13 23-0020	MLF	2-Pair, 12 AWG, Twisted Pair, Non-Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed Exposed	5,615.15	1,592.54

28 05 13 23-0021 Shielded, Non-Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed In Conduit ^(28 05 13 23-0001)

28 05 13 23-0022	MLF	2/c #22 AWG, Shielded, Non-Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed In Conduit	879.19	
28 05 13 23-0023	MLF	4/c #22 AWG, Shielded, Non-Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed In Conduit	968.48	447.84
28 05 13 23-0024	MLF	2/c #18 AWG, Shielded, Non-Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed In Conduit	1,067.49	463.77
28 05 13 23-0025	MLF	3/c #18 AWG, Shielded, Non-Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed In Conduit	1,161.19	547.25
28 05 13 23-0026	MLF	4/c #18 AWG, Shielded, Non-Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed In Conduit	1,215.00	557.14
28 05 13 23-0027	MLF	6/c #18 AWG, Shielded, Non-Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed In Conduit	1,398.45	567.04

28 Electronic Safety And Security
28 05 Common Work Results For Electronic Safety And Security
28 05 13 Conductors And Cables For Electronic Safety And Security



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 05 13 23-0028 MLF 8/c #18 AWG, Shielded, Non-Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed In Conduit.....	1,669.09	606.61
28 05 13 23-0029 MLF 2/c #16 AWG, Shielded, Non-Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed In Conduit.....	1,259.59	622.05
28 05 13 23-0030 MLF 4/c #16 AWG, Shielded, Non-Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed In Conduit.....	1,464.30	644.26
28 05 13 23-0031 MLF 2/c #14 AWG, Shielded, Non-Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed In Conduit.....	1,479.98	696.38
28 05 13 23-0032 MLF 4/c #14 AWG, Shielded, Non-Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed In Conduit.....	1,808.01	721.46
28 05 13 23-0033 MLF 2/c #12 AWG, Shielded, Non-Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed In Conduit.....	1,852.43	796.27
28 05 13 23-0034 MLF 4/c #12 AWG, Shielded, Non-Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed In Conduit.....	2,391.83	824.66
28 05 13 23-0035 Non-Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable (28 05 13 23-0001)		
28 05 13 23-0036 Non-Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed In Conduit (28 05 13 23-0035)		
28 05 13 23-0037 MLF 2/c #22 AWG, Non-Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed In Conduit.....	868.74	447.84
28 05 13 23-0038 MLF 2/c #18 AWG, Non-Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed In Conduit.....	1,060.70	547.25
28 05 13 23-0039 MLF 3/c #18 AWG, Non-Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed In Conduit.....	1,226.81	557.14
28 05 13 23-0040 MLF 4/c #18 AWG, Non-Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed In Conduit.....	1,233.17	567.04
28 05 13 23-0041 MLF 6/c #18 AWG, Non-Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed In Conduit.....	1,493.28	586.82
28 05 13 23-0042 MLF 2/c #16 AWG, Non-Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed In Conduit.....	1,249.33	622.05
28 05 13 23-0043 MLF 4/c #16 AWG, Non-Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed In Conduit.....	1,487.32	644.26
28 05 13 23-0044 MLF 2/c #14 AWG, Non-Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed In Conduit.....	1,433.80	696.38
28 05 13 23-0045 MLF 4/c #14 AWG, Non-Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed In Conduit.....	1,991.54	721.46
28 05 13 23-0046 MLF 2/c #12 AWG, Non-Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed In Conduit.....	1,837.34	796.27
28 05 13 23-0047 MLF 4/c #12 AWG, Non-Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed In Conduit.....	2,670.45	824.66
28 05 13 23-0048 Non-Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed Exposed (28 05 13 23-0035)		
28 05 13 23-0049 MLF 2/c #22 AWG, Non-Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed Exposed.....	1,615.14	896.01
28 05 13 23-0050 MLF 2/c #18 AWG, Non-Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed Exposed.....	1,972.79	1,094.66
28 05 13 23-0051 MLF 3/c #18 AWG, Non-Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed Exposed.....	2,154.98	1,113.97
28 05 13 23-0052 MLF 4/c #18 AWG, Non-Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed Exposed.....	2,178.23	1,134.08
28 05 13 23-0053 MLF 6/c #18 AWG, Non-Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed Exposed.....	2,471.32	1,173.50
28 05 13 23-0054 MLF 2/c #16 AWG, Non-Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed Exposed.....	2,286.08	1,244.27
28 05 13 23-0055 MLF 4/c #16 AWG, Non-Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed Exposed.....	2,561.07	1,288.51
28 05 13 23-0056 MLF 2/c #14 AWG, Non-Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed Exposed.....	2,594.41	1,393.07
28 05 13 23-0057 MLF 4/c #14 AWG, Non-Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed Exposed.....	3,194.00	1,442.94
28 05 13 23-0058 MLF 2/c #12 AWG, Non-Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed Exposed.....	3,164.46	1,592.54
28 05 13 23-0059 MLF 4/c #12 AWG, Non-Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed Exposed.....	4,045.02	1,649.64
28 05 13 23-0060 Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable (28 05 13 23-0001)		
28 05 13 23-0061 Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed In Conduit (28 05 13 23-0060)		
28 05 13 23-0062 MLF 2/c #22 AWG, Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed In Conduit.....	911.76	447.84
28 05 13 23-0063 MLF 2/c #18 AWG, Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed In Conduit.....	1,091.42	547.25
28 05 13 23-0064 MLF 3/c #18 AWG, Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed In Conduit.....	1,340.85	557.14
28 05 13 23-0065 MLF 4/c #18 AWG, Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed In Conduit.....	1,264.61	567.04
28 05 13 23-0066 MLF 6/c #18 AWG, Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed In Conduit.....	1,525.43	586.82
28 05 13 23-0067 MLF 2/c #16 AWG, Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed In Conduit.....	1,319.94	622.05



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 05 13 23-0068 MLF 4/c #16 AWG, Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed In Conduit.....	1,519.98	644.26
28 05 13 23-0069 MLF 2/c #14 AWG, Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed In Conduit.....	1,586.09	696.38
28 05 13 23-0070 MLF 4/c #14 AWG, Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed In Conduit.....	1,915.18	721.46
28 05 13 23-0071 MLF 2/c #12 AWG, Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed In Conduit.....	1,950.03	796.27
28 05 13 23-0072 MLF 4/c #12 AWG, Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed In Conduit.....	2,438.61	824.66
28 05 13 23-0073 Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed Exposed <small>(28 05 13 23-0060)</small>		
28 05 13 23-0074 MLF 2/c #22 AWG, Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed Exposed	1,658.16	896.01
28 05 13 23-0075 MLF 2/c #18 AWG, Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed Exposed	2,003.51	1,094.66
28 05 13 23-0076 MLF 3/c #18 AWG, Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed Exposed	2,269.02	1,113.97
28 05 13 23-0077 MLF 4/c #18 AWG, Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed Exposed	2,209.67	1,134.08
28 05 13 23-0078 MLF 6/c #18 AWG, Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed Exposed	2,503.47	1,173.50
28 05 13 23-0079 MLF 2/c #16 AWG, Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed Exposed	2,356.69	1,244.27
28 05 13 23-0080 MLF 4/c #16 AWG, Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed Exposed	2,593.73	1,288.51
28 05 13 23-0081 MLF 2/c #14 AWG, Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed Exposed	2,746.70	1,393.07
28 05 13 23-0082 MLF 4/c #14 AWG, Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed Exposed	3,117.64	1,442.94
28 05 13 23-0083 MLF 2/c #12 AWG, Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed Exposed	3,277.15	1,592.54
28 05 13 23-0084 MLF 4/c #12 AWG, Shielded, Plenum Rated, Solid Type FPLP (Red), Fire Alarm/Life Safety Cable, Installed Exposed	3,813.18	1,649.64
28 05 26 Grounding And Bonding For Electronic Safety And Security <small>(28 05)</small>		
See CSI section 26 05 26 00-0000 for grounding and bonding.		
28 05 28 Pathways For Electronic Safety And Security <small>(28 05)</small>		
28 05 28 29 Hangers And Supports For Electronic Safety And Security <small>(28 05 28)</small>		
See CSI section 26 05 29 00-0000 for hangers and supports.		
28 05 28 33 Conduits And Backboxes For Electronic Safety And Security <small>(28 05 28)</small>		
See CSI section 26 05 33 13-0000 for conduits.		
28 05 28 36 Cable Trays For Electronic Safety And Security <small>(28 05 28)</small>		
See CSI section 26 05 36 00-0000 for cable trays.		
28 05 28 39 Surface Raceways For Electronic Safety And Security <small>(28 05 28)</small>		
See CSI section 26 05 33 23-0000 for surface raceways.		
28 05 53 Identification For Electronic Safety And Security <small>(28 05)</small>		
See CSI section 26 05 53 00-0000 for identification.		
28 10 Electronic Access Control And Intrusion Detection <small>(28)</small>		
Note: Includes testing of new devices and certification.		
28 13 Access Control <small>(28 10)</small>		
28 13 33 Access Control Interfaces <small>(28 13)</small>		
28 13 33 16 Access Control Interfaces to Access Control Hardware <small>(28 13 33)</small>		
28 13 33 16-0001 Stand Alone Access Controls <small>(28 13 33 16)</small>		
28 13 33 16-0002 Push Button Controls, Stand Alone Access Controls <small>(28 13 33 16-0001)</small>		
28 13 33 16-0003 Interior Mount, Push Button Controls, Stand Alone Access Controls <small>(28 13 33 16-0002)</small>		
28 13 33 16-0004 EA Exit Push Button, Push Button Controls, Interior Stand Alone Access Controls.....	76.21	20.11
Note: Controls mount to a standard mullion.		
28 13 33 16-0005 EA Exit Push Button, Push Button Controls, Interior Stand Alone Access Controls.....	79.21	20.11
Note: Controls mount into a single gang electrical box. Excludes electrical box.		
28 13 33 16-0006 EA Three Button, Push Button Controls, Interior Stand Alone Access Controls For Gate Operators.....	96.46	20.11
Note: Controls mount into a single gang electrical box. Excludes electrical box.		
28 13 33 16-0007 Exterior Mount, Push Button Controls, Stand Alone Access Controls <small>(28 13 33 16-0002)</small>		
Note: Includes a lockable, gasketed 16 gauge steel enclosure. Excludes mounting posts.		
28 13 33 16-0008 EA Handicap/Push To Open, Push Button Controls, Exterior Stand Alone Access Controls.....	92.21	20.11
Note: Controls mount into a single gang electrical box. Excludes electrical box.		
28 13 33 16-0009 EA 42" High Aluminum Post With Handicap/Push To Open, Push Button Controls, Exterior Stand Alone Access Controls.....	419.65	60.32
Note: Includes post, mounting base and push button control. Excludes concrete foundation.		
28 13 33 16-0010 EA Three Button, Exterior Stand Alone Access Controls For Gate Operators.....	141.46	20.11
Note: Includes open, close and stop controls.		
28 13 33 16-0011 Key Controls, Stand Alone Access Controls <small>(28 13 33 16-0001)</small>		
28 13 33 16-0012 Interior Mount, Key Controls, Stand Alone Access Controls <small>(28 13 33 16-0011)</small>		
28 13 33 16-0013 EA Standard Mortise Key, Key Controls, Interior Stand Alone Access Controls.....	102.09	20.11
Note: Controls mount into a single gang electrical box. Excludes electrical box.		

28	Electronic Safety And Security
28 10	Electronic Access Control And Intrusion Detection
28 13	Access Control



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 13 33 16-0014 Exterior Mount, Key Controls, Stand Alone Access Controls <small>(28 13 33 16-0011)</small> Note: Includes a lockable NEMA rain resistant steel enclosure. Excludes mounting posts.		
28 13 33 16-0015 EA Postal Or Fire Department Lock Box, Key Controls, Exterior Stand Alone Access Controls Note: Opens door or gate with a postal or fire department key.	162.94	40.21
28 13 33 16-0016 EA Standard Mortise Key, Key Controls, Exterior Stand Alone Access Controls	242.44	40.21
28 13 33 16-0017 EA Ace Key, Key Controls, Exterior Stand Alone Access Controls	242.44	40.21
28 13 33 16-0018 EA Standard Mortise Key And Push Button Intercom, Key Controls, Exterior Stand Alone Access Controls.....	356.44	40.21
28 13 33 16-0019 Keypad Controls, Stand Alone Access Controls <small>(28 13 33 16-0001)</small>		
28 13 33 16-0020 Interior Mount, Keypad Controls, Stand Alone Access Controls <small>(28 13 33 16-0019)</small>		
28 13 33 16-0021 EA One Code Memory, Keypad Control, Interior Stand Alone Access Controls..... Note: Stores one 4-digit entry code and one 4-digit hold code. Controls mount into a single gang electrical box. Excludes electrical box.	137.71	20.11
28 13 33 16-0022 Exterior Mount, Keypad Controls, Stand Alone Access Controls <small>(28 13 33 16-0019)</small> Note: Includes a surface mounted lockable NEMA rain resistant steel enclosure. Excludes mounting posts.		
28 13 33 16-0023 Keypad Controls, Exterior Stand Alone Access Controls <small>(28 13 33 16-0022)</small>		
28 13 33 16-0024 EA 1000 Code Memory, Keypad Control, Exterior Stand Alone Access Controls Note: Includes lighted keypad. Stores one thousand 4-digit entry codes and six 5-digit entry codes.	573.36	80.44
<i>For Flush Mount, Add</i>	92.81	
28 13 33 16-0025 Keypad Controls With Push Button Intercom, Exterior Stand Alone Access Controls <small>(28 13 33 16-0022)</small> Note: Includes intercom sub-station. Excludes additional receiving intercoms.		
28 13 33 16-0026 EA 1000 Code Memory, Keypad Controls With Push Button Intercom, Exterior Stand Alone Access Controls..... Note: Includes lighted keypad. Stores one thousand 4-digit entry codes and six 5-digit entry codes.	690.97	90.49
<i>For Flush Mount, Add</i>	114.75	
28 13 33 16-0027 RF Controls, Stand Alone Access Controls <small>(28 13 33 16-0001)</small>		
28 13 33 16-0028 Exterior Mount, RF Controls, Stand Alone Access Controls <small>(28 13 33 16-0027)</small> Note: Includes a lockable NEMA rain resistant steel enclosure. Excludes mounting posts and transmitters.		
28 13 33 16-0029 RF Receivers, RF Controls, Exterior Stand Alone Access Controls <small>(28 13 33 16-0028)</small> Note: Includes a lockable NEMA rain resistant steel enclosure. Excludes mounting posts and transmitters.		
28 13 33 16-0030 EA 50 Code Memory, RF Receiver, RF Controls, Exterior Stand Alone Access Controls	363.36	80.44
28 13 33 16-0031 EA 100 Code Memory, RF Receiver, RF Controls, Exterior Stand Alone Access Controls.....	403.86	80.44
28 13 33 16-0032 EA 250 Code Memory, RF Receiver, RF Controls, Exterior Stand Alone Access Controls.....	442.86	80.44
28 13 33 16-0033 EA 500 Code Memory, RF Receiver, RF Controls, Exterior Stand Alone Access Controls.....	484.86	80.44
28 13 33 16-0034 EA 1000 Code Memory, RF Receiver, RF Controls, Exterior Stand Alone Access Controls.....	523.86	80.44
28 13 33 16-0035 EA 5000 Code Memory, RF Receiver, RF Controls, Exterior Stand Alone Access Controls.....	565.86	80.44
28 13 33 16-0036 EA 16000 Code Memory, RF Receiver, RF Controls, Exterior Stand Alone Access Controls.....	604.86	80.44
28 13 33 16-0037 RF Transmitters, RF Controls, Exterior Stand Alone Access Controls <small>(28 13 33 16-0028)</small>		
28 13 33 16-0038 EA 1 Button, RF Transmitter, RF Controls, Exterior Stand Alone Access Controls.....	25.50	
<i>For >40 To 110, Deduct</i>	-1.28	
<i>For >110, Deduct</i>	-2.55	
<i>For Built In Proximity Tags, Add</i>	5.10	
28 13 33 16-0039 EA 2 Button, RF Transmitter, RF Controls, Exterior Stand Alone Access Controls.....	27.00	
<i>For >40 To 110, Deduct</i>	-1.35	
<i>For >110, Deduct</i>	-2.70	
<i>For Built In Proximity Tags, Add</i>	5.40	
28 13 33 16-0040 EA 3 Button, RF Transmitter, RF Controls, Exterior Stand Alone Access Controls.....	28.50	
<i>For >40 To 110, Deduct</i>	-1.43	
<i>For >110, Deduct</i>	-2.85	
<i>For Built In Proximity Tags, Add</i>	5.70	
28 13 33 16-0041 Accessories For RF Receivers, Exterior Stand Alone Access Controls <small>(28 13 33 16-0028)</small>		
28 13 33 16-0042 EA Coax Antenna Kit For RF Receivers, Exterior Stand Alone Access Controls	156.65	60.32
Note: Includes 15' of coax cable.		
28 13 33 16-0043 EA Antenna Amplifier For RF Receivers, Exterior Stand Alone Access Controls	270.65	60.32
Note: Includes 20' of coax cable.		
28 13 33 16-0044 EA Yagi High-Gain Antenna Kit For RF Receivers, Exterior Stand Alone Access Controls.....	249.65	60.32
Note: Includes 15' of coax cable.		
28 13 33 16-0045 Proximity Card Controls, Stand Alone Access Controls <small>(28 13 33 16-0001)</small>		
28 13 33 16-0046 Exterior Mount, Proximity Card Controls, Stand Alone Access Controls <small>(28 13 33 16-0045)</small> Note: Includes a lockable NEMA rain resistant steel enclosure. Excludes mounting posts.		
28 13 33 16-0047 DKS Proximity Card Controls, Exterior Stand Alone Access Controls <small>(28 13 33 16-0046)</small>		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 13 33 16-0048 DKS Proximity Card Readers, Exterior Stand Alone Access Controls (28 13 33 16-0047)		
28 13 33 16-0049 EA DKS Proximity Card Reader, Exterior Stand Alone Access Controls.....	648.36	80.44
28 13 33 16-0050 AWID Proximity Card Controls, Exterior Stand Alone Access Controls (28 13 33 16-0046)		
28 13 33 16-0051 AWID Proximity Card Readers, Exterior Stand Alone Access Controls (28 13 33 16-0050)		
28 13 33 16-0052 EA AWID Proximity Card Reader, Exterior Stand Alone Access Controls.....	700.86	80.44
28 13 33 16-0053 HID Proximity Card Controls, Exterior Stand Alone Access Controls (28 13 33 16-0046)		
28 13 33 16-0054 HID Proximity Card Readers, Exterior Stand Alone Access Controls (28 13 33 16-0053)		
28 13 33 16-0055 EA HID Proximity Card Reader, Exterior Stand Alone Access Controls.....	820.86	80.44
28 13 33 16-0056 Magnetic Stripe Card Controls, Stand Alone Access Controls (28 13 33 16-0001)		
28 13 33 16-0057 Interior Mount, Magnetic Stripe Card Controls, Stand Alone Access Controls (28 13 33 16-0056)		
28 13 33 16-0058 EA Magnetic Stripe Reader, Interior Stand Alone Access Controls.....	408.36	80.44
28 13 33 16-0059 Exterior Mount, Magnetic Stripe Card Controls, Stand Alone Access Controls (28 13 33 16-0056)		
Note: Includes a lockable NEMA rain resistant steel enclosure. Excludes mounting posts.		
28 13 33 16-0060 EA Magnetic Stripe Reader, Exterior Stand Alone Access Controls.....	493.06	80.44
28 13 33 16-0061 Other Stand Alone Access Controls (28 13 33 16-0001)		
28 13 33 16-0062 EA Toggle Switch, Interior Access Controls For Gate Operators	73.96	20.11
Note: Controls mount into a single gang electrical box. Excludes electrical box.		
28 13 33 16-0063 Wiegand Output Access Controls (28 13 33 16)		
Note: Excludes controllers.		
28 13 33 16-0064 Proximity Card Controls, Wiegand Output Access Controls (28 13 33 16-0063)		
28 13 33 16-0065 DKS, Proximity Card Controls, Wiegand Output Access Controls (28 13 33 16-0064)		
28 13 33 16-0066 DKS, Proximity Cards (28 13 33 16-0065)		
28 13 33 16-0067 EA Clamshell Type, DKS Proximity Card (DKS 170).....	3.99	
28 13 33 16-0068 EA ISO Compliant Graphics Card, DKS Proximity Card (DKS 80).....	6.58	
28 13 33 16-0069 EA DKS Proximity Key Fob (DKS 50).....	6.93	
28 13 33 16-0070 EA Active Tag, DKS Proximity Tag (DKS 150).....	39.20	
Note: Battery powered tag to boost signal.		
28 13 33 16-0071 EA Active Tag, DKS Proximity Tag (DKS 200).....	51.10	
Note: Battery powered tag to boost signal.		
28 13 33 16-0072 DKS, Proximity Card Readers, Wiegand Output Access Controls (28 13 33 16-0065)		
28 13 33 16-0073 EA Up To 2" Read Range, 12 Volt DC, DKS Proximity Card Reader, Wiegand Output Access Controls (DKS Small).....	280.87	100.54
28 13 33 16-0074 EA Up To 3" Read Range, 12 Volt DC, DKS Proximity Card Reader, Wiegand Output Access Controls (DKS Mullion)	280.87	100.54
28 13 33 16-0075 EA Up To 4" Read Range, 12 Volt DC, DKS Proximity Card Reader, Wiegand Output Access Controls (DKS Single Gang)	280.87	100.54
28 13 33 16-0076 EA Up To 30" Read Range, 12 Volt DC, DKS Proximity Card Reader, Wiegand Output Access Controls (DKS).....	654.67	100.54
Note: Includes mounting bracket and 12 VDC regulated power supply.		
28 13 33 16-0077 AWID, Proximity Card Controls, Wiegand Output Access Controls (28 13 33 16-0064)		
28 13 33 16-0078 AWID, Proximity Cards (28 13 33 16-0077)		
28 13 33 16-0079 EA Clamshell Type, AWID Proximity Card (AWID Prox-Linc CS).....	3.36	
28 13 33 16-0080 EA ISO Compliant Graphics Card, AWID Proximity Card (AWID Prox-Linc GR).....	5.25	
28 13 33 16-0081 EA AWID Proximity Key Fob (AWID Prox-Linc KT)	5.60	
28 13 33 16-0082 EA Windshield Tag For LR 2000 Readers, AWID Proximity Tag	19.60	
28 13 33 16-0083 EA Metal Mount Tag For LR 2000 Readers, AWID Proximity Tag	19.60	
28 13 33 16-0084 AWID, Proximity Card Readers, Wiegand Output Access Controls (28 13 33 16-0077)		
28 13 33 16-0085 EA Up To 4" Read Range, 5-12 Volt DC, AWID Proximity Card Reader, Wiegand Output Access Controls (AWID SR 2400).....	327.07	100.54
Note: For mullion mounting.		
28 13 33 16-0086 EA Up To 8" Read Range, 5-12 Volt DC, AWID Proximity Card Reader, Wiegand Output Access Controls (AWID MM 6800)	427.87	100.54
Note: For mullion mounting.		

28	Electronic Safety And Security
28 10	Electronic Access Control And Intrusion Detection
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MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 13 33 16-0087 EA Up To 8" Read Range, 5-12 Volt DC, AWID Proximity Card Reader, Wiegand Output Access Controls (AWID MM 6820).....	427.87	100.54
Note: For single gang electrical box mounting.		
28 13 33 16-0088 EA Up To 24" Read Range, 5-12 Volt DC, AWID Proximity Card Reader, Wiegand Output Access Controls (AWID MR 1824).....	656.07	100.54
Note: Includes 12 VDC regulated power supply.		
28 13 33 16-0089 EA Up To 11" Read Range, 12 Volt DC, AWID Proximity Card Reader, Wiegand Output Access Controls (AWID LR 2000).....	3,394.47	100.54
Note: Includes mounting bracket and 12 VDC regulated power supply.		
28 13 33 16-0090 HID, Proximity Card Controls, Wiegand Output Access Controls <small>(28 13 33 16-0064)</small>		
28 13 33 16-0091 HID, Proximity Cards <small>(28 13 33 16-0090)</small>		
28 13 33 16-0092 EA Clamshell Type, HID Proximity Card (HID ProxCard II).....	10.09	
28 13 33 16-0093 EA ISO Compliant Graphics Card, HID Proximity Card (HID ISOProx II).....	12.61	
28 13 33 16-0094 EA HID Proximity Key Fob (HID ProxKey II).....	12.89	
28 13 33 16-0095 HID, Proximity Card Readers, Wiegand Output Access Controls <small>(28 13 33 16-0090)</small>		
28 13 33 16-0096 EA Up To 3" Read Range, 5-16 Volt DC, HID Proximity Card Reader, Wiegand Output Access Controls (HID ProxPoint Plus).....	323.81	100.54
Note: For mullion mounting. (HID P/N 6005).		
28 13 33 16-0097 EA Up To 5" Read Range, 5-16 Volt DC, HID Proximity Card Reader, Wiegand Output Access Controls (HID ThinLine II).....	373.41	100.54
Note: For single gang electrical box mounting. (HID P/N 5395).		
28 13 33 16-0098 EA Up To 5" Read Range, 5-16 Volt DC, HID Proximity Card Reader, Wiegand Output Access Controls (HID MiniProx).....	410.60	100.54
Note: For mullion mounting. (HID P/N 5365).		
28 13 33 16-0099 EA EntryProx Single-Door Proximity Access Control.....	511.03	100.54
Note: (HID P/N 4045) Stores up to 2,000 users and 1,000 time-stamped transactions 12 position keypad for Pin entry or programming optional use with card/key fob, code only or card plus pin code Wiegand output mode. Continental Instrument CICR2358P.		
28 13 33 16-0100 Contactless Smart Card Controls, Wiegand Output Access Controls <small>(28 13 33 16-0063)</small>		
28 13 33 16-0101 HID, Contactless Smart Cards <small>(28 13 33 16-0100)</small>		
28 13 33 16-0102 EA 2K Bits, Clamshell Type, HID iClass, Contactless Smart Card.....	6.16	
28 13 33 16-0103 EA 16K Bits, ISO Compliant Graphics Card, HID iClass, Contactless Smart Card.....	6.72	
28 13 33 16-0104 EA 16K Bits, Contactless Smartcard Key Fob, HID iClass, Contactless Smart Card.....	8.80	
28 13 33 16-0105 EA 16K Bits, Contactless Smartcard Tag, HID iClass, Contactless Smart Card.....	4.76	
Note: Battery powered tag to boost signal.		
28 13 33 16-0106 HID, Contactless Smart Card Readers, Wiegand Output Access Controls <small>(28 13 33 16-0100)</small>		
28 13 33 16-0107 EA Up To 3-1/4" Read Range, 5-16 Volt DC, HID iClass Contactless Smart Card Reader, Wiegand Output Access Controls (HID R10).....	312.17	100.54
Note: For mullion mounting.		
28 13 33 16-0108 EA Up To 4-1/4" Read Range, 5-12 Volt DC, HID iClass Contactless Smart Card Reader, Wiegand Output Access Controls (HID R40).....	404.57	100.54
Note: For mullion mounting.		
28 13 33 16-0109 EA Up To 4-1/4" Read Range, 5-12 Volt DC, HID iClass Contactless Smart Card Reader With Keypad, Wiegand Output Access Controls (HID RK40).....	612.47	100.54
Note: For mullion mounting.		
28 13 33 16-0110 HID, Contactless Smart Card Programmer, Wiegand Output Access Controls <small>(28 13 33 16-0100)</small>		
28 13 33 16-0111 EA HID iClass Contactless Smart Card Programmer, Wiegand Output Access Controls (HID CP400).....	1,781.77	100.54
Note: For mullion mounting.		
28 13 33 16-0112 Call Station Controls, Wiegand Output Access Controls <small>(28 13 33 16-0063)</small>		
Note: Includes intercom sub-station. Excludes additional receiving intercoms.		
28 13 33 16-0113 EA Call Station With Entry Keypad, Exterior Wiegand Output Access Controls.....	741.07	100.54
Note: For mullion mounting.		
28 13 33 16-0114 EA Call Station With Proximity Card Reader, Exterior Wiegand Output Access Controls.....	628.57	100.54
Note: For mullion mounting.		
28 13 33 16-0115 Biometrics Readers, Wiegand Output Access Controls <small>(28 13 33 16-0063)</small>		
28 13 33 16-0116 EA Palm Reader Recognition System, Biometrics Readers, Wiegand Output Access Controls.....	3,086.81	80.44
28 13 33 16-0117 EA CCD Camera, Face Image, Biometrics Readers, Wiegand Output Access Controls.....	3,759.16	80.44
28 13 33 16-0118 EA Video Grabber Card For DFR Reader, Biometrics Readers, Wiegand Output Access Controls.....	1,512.34	80.44
28 13 33 16-0119 EA Fingerprint Reader, Biometrics Readers, Wiegand Output Access Controls (Bioscrypt V-Pass).....	925.36	80.44
28 13 33 16-0120 EA Fingerprint Reader With HID Card Reader, Biometrics Readers, Wiegand Output Access Controls (Bioscrypt V-Prox).....	1,024.36	80.44
28 13 33 16-0121 EA Fingerprint Reader With Contactless Smart Card Reader, Biometrics Readers, Wiegand Output Access Controls (Bioscrypt V-Smart).....	925.36	80.44



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 13 33	16-0122		Exterior Mounting Posts For Gate Operator Access Controls <small>(28 13 33 16)</small> Note: Includes mounting plate for access controls, baked on enamel finish and mounting bolt covers. Excludes concrete pads and electrical connections.		
28 13 33	16-0123		2" x 2" Steel, Exterior Mounting Posts For Gate Operator Access Controls <small>(28 13 33 16-0122)</small>		
28 13 33	16-0124	EA	44" Tall, Gooseneck Style, Single Mount, 2" x 2" Steel, Exterior Mounting Post For Gate Operator Access Controls.....	197.04	18.26
			Note: Includes a 5" x 5" base plate.		
28 13 33	16-0125	EA	73" Tall, Gooseneck Style, Dual Mount, 2" x 2" Steel, Exterior Mounting Post For Gate Operator Access Controls.....	374.04	18.26
			Note: Includes an 8" x 8" base plate.		
28 13 33	16-0126	EA	Anchor Post For 2" x 2" Steel, Exterior Mounting Post For Gate Operator Access Controls	179.04	18.26
			Note: Includes a 24" in-ground post with matching base plate, conduit access and mounting hardware.		
28 13 33	16-0127		4" x 4" Steel, Exterior Mounting Posts For Gate Operator Access Controls <small>(28 13 33 16-0122)</small>		
28 13 33	16-0128	EA	59" Tall, Straight Style, Single Mount, 4" x 4" Steel, Exterior Mounting Post For Vehicular Gate Operator Access Controls.....	345.54	18.26
			Note: Includes an 8" x 8" base plate.		
28 13 33	16-0129	EA	49" Tall, Offset Style, Single Mount, 4" x 4" Steel, Exterior Mounting Post For Vehicular Gate Operator Access Controls.....	411.54	18.26
			Note: Includes an 8" x 8" base plate and a 14" offset from back of post.		
28 13 33	16-0130	EA	Anchor Post For 4" x 4" Steel, Exterior Mounting Post For Vehicular Gate Operator Access Controls	254.04	18.26
			Note: Includes a 24" in-ground post with matching base plate, conduit access and mounting hardware.		
28 13 33	16-0131		4" x 8" Steel, Exterior Mounting Posts For Gate Operator Access Controls <small>(28 13 33 16-0122)</small>		
28 13 33	16-0132	EA	59" Tall, Straight Style, Single Mount, 4" x 8" Steel, Exterior Mounting Post For Gate Operator Access Controls.....	1,109.04	18.26
			Note: Includes a 11" x 13" base plate.		
28 13 33	16-0133	EA	50" Tall, Offset Style, Single Mount, 4" x 8" Steel, Exterior Mounting Post For Gate Operator Access Controls.....	1,161.54	18.26
			Note: Includes a 10" x 14" base plate and a 14" offset from back of post.		
28 13 33	16-0134	EA	Anchor Post For 4" x 8" Steel, Exterior Mounting Post For Gate Operator Access Controls	479.04	18.26
			Note: Includes a 24" in-ground post with matching base plate, conduit access and mounting hardware.		
28 13 33	16-0135	EA	48" Light Tower For 4" x 8" Steel, Exterior Mounting Post For Gate Operator Access Controls.....	764.04	18.26
28 13 33	16-0136		Access Control Accessories <small>(28 13 33 16)</small>		
28 13 33	16-0137	EA	Modem: Multitech, Mt2834L.....	1,282.53	
28 13 33	16-0138	EA	6 Volt DC, 12 Volt DC, Or 24 Volt DC, @ 4 Amps, Power Supply/Charger (Altronix SMP-5).....	343.53	
28 13 33	16-0139	EA	12 Volt, 7 Amp, Battery.....	42.86	
28 13 33	16-0140	EA	12 Volt, 18 Amp, Battery.....	95.53	
28 13 33	16-0141	EA	Door Personality Module (Sensormatic RM-4).....	372.56	20.11
28 13 33	16-0142	EA	Mini-Alert Door Ajar Sounder (System Sensor PA400).....	161.94	40.21
28 13 33	16-0143	EA	Recessed Contact For Steel Doors, Door Monitor Switch (Sentrol 1078C).....	59.38	24.13
28 13 33	16-0144	EA	Access Control Systems Power Supply (Altronix AL400ULACMCB).....	397.79	16.09
28 13 33	16-0145	EA	Surge Suppressor (Tripp-Lite IBAR4).....	60.72	4.03
28 13 33	16-0146	EA	Door Strike Relay (Altronix RBSN-TTL).....	48.43	16.09
28 13 33	16-0147		Access Controllers <small>(28 13 33 16)</small>		
28 13 33	16-0148		Microterm Controller <small>(28 13 33 16-0147)</small>		
28 13 33	16-0149	EA	Microterm Stand Alone One Or Two Door Processing Panel (Continental Instruments CICIP1100).....	963.37	100.54
			Note: Up to 1,000 card capacity. Includes 2 alarm inputs, tamper alarm, and 3 relay outputs.		
28 13 33	16-0150	EA	Microterm PC Board (Continental Instruments CICIP1100PCB)	683.03	60.32
28 13 33	16-0151	EA	Battery Standby For Microterm (Continental Instruments CICIP1100BAT-2)	317.27	
			Note: Input 120VAC, output 12VDC to temporarily power the Microterm only.		
28 13 33	16-0152		Miniterm Controller <small>(28 13 33 16-0147)</small>		
28 13 33	16-0153	EA	Miniterm Two Reader Processing Panel (Continental Instrument CICIP1200).....	1,486.72	100.54
			Note: Up to 3,000 card capacity. Includes 8 EOL Class A supervised alarm inputs, tamper alarm, and 5 relay outputs. Complete in a lockable steel enclosure with battery standby for memory and system operation.		
28 13 33	16-0154	EA	Miniterm PC Board (Continental Instrument CICIP1200PCB)	1,110.79	60.32
28 13 33	16-0155		Super-2 Controller <small>(28 13 33 16-0147)</small>		
28 13 33	16-0156	EA	Super-Two - Two Reader Processing Panel (Continental Instruments CICIP1300)	1,110.45	100.54
			Note: For use with CA3000 V2.0.25 and above. Up to a 125,000 card capacity, 8 EOL supervised alarm inputs, tamper, 5 relay outputs. Support for on-board LAN adapter, 57,600 baud rate, 6 access groups per card-holder and compressed data mode. Complete in a lockable steel enclosure with battery standby for memory and system operation.		
28 13 33	16-0157	EA	Super-Two - PC Board (Continental Instruments CICIP1300BD).....	751.18	60.32
28 13 33	16-0158	EA	Network Interface Board For Super-2 (Continental Instruments CICIP1300NETBD)	218.44	60.32
			Note: Optional on-board adapter allows for communication over TCP/IP.		
28 13 33	16-0159		Smarterm Controller <small>(28 13 33 16-0147)</small>		
28 13 33	16-0160	EA	Smarterm Four Reader Processing Panel (Continental Instrument CICIP1400)	3,088.28	120.65
			Note: Card capacity up to 2,500. Includes 16 alarm inputs, tamper alarm, and 9 relay outputs. Complete in a lockable steel enclosure with battery standby for memory and system operation.		

28	Electronic Safety And Security
28 10	Electronic Access Control And Intrusion Detection
28 13	Access Control



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 13 33 16-0161 EA Smarterm PC Board (Continental Instrument CICIP1400PCB)	2,357.64	60.32
28 13 33 16-0162 EA Smarterm Memory Board - 256K (Continental Instrument CICIP1400MB256-1)..... Note: Up to 10,000 cardholders.	926.25	60.32
28 13 33 16-0163 EA Smarterm Memory Board - 2MB (Continental Instrument CICIP1400MB2-1)..... Note: Up to 50,000 cardholders.	1,310.72	60.32
28 13 33 16-0164 EA Smarterm Relay Expander Board (Continental Instrument CICIP1400RB)	1,022.62	60.32
28 13 33 16-0165 EA Smarterm Alarm Expander Board (Continental Instrument CICIP1400RB)	1,022.62	60.32
28 13 33 16-0165 Note: (Supervised) 16 alarm inputs.		
28 13 33 16-0166 Superterm-4 Controller (28 13 33 16-0147)		
28 13 33 16-0167 EA Superterm-4 - Four Reader Processing Panel (Continental Instrument CICIP1400UL).....	2,853.66	120.65
28 13 33 16-0167 Note: 20,000 card capacity, 12 supervised alarm inputs, tamper alarm, and 9 relay outputs. Complete in a painted steel enclosure with 7 AH battery standby for system operation.		
28 13 33 16-0168 EA Superterm-4 PC Board (Continental Instrument CICIP1400ULPCB).....	2,318.20	60.32
28 13 33 16-0169 Superterm-8 Controller (28 13 33 16-0147)		
28 13 33 16-0170 EA Superterm-8 - Eight Reader Processing Panel (Continental Instrument CICIP1800)	3,813.02	201.07
28 13 33 16-0170 Note: Up to 20,000 card capacity, 24 supervised alarm inputs, tamper alarm, and 17 relay outputs. Complete in a steel enclosure including 7 AH battery standby for memory and system operation.		
28 13 33 16-0171 EA Superterm-8 - Eight Reader Processing Panel, Expanded Power (Continental Instrument CICIP1800EXP)	4,133.42	201.07
28 13 33 16-0171 Note: With expanded power supply. (required if more than 1 relay expander board is used.) Up to 20,000 card capacity, 24 supervised alarm inputs, tamper alarm, and 17 relay outputs. Complete in a steel enclosure including 7 AH battery standby for memory and system operation.		
28 13 33 16-0172 EA Superterm-8 PC Board (Continental Instrument CICIP1800PCB)	3,116.70	60.32
28 13 33 16-0173 Turbo Superterm-4 Controller (28 13 33 16-0147)		
28 13 33 16-0174 EA Turbo Superterm-4 - Four Reader Processing Panel (Continental Instrument CICIP1400ULT).....	2,853.66	120.65
28 13 33 16-0174 Note: 20,000 Card capacity, 12 supervised alarm inputs, tamper alarm, and 9 relay outputs. Complete in a painted steel enclosure with 7 AH battery standby for system operation.		
28 13 33 16-0175 EA Turbo Superterm-4 PC Board (Continental Instrument CICIP1400ULTPCB)	2,318.20	60.32
28 13 33 16-0176 Turbo Superterm-8 Controller (28 13 33 16-0147)		
28 13 33 16-0177 EA Turbo Superterm-8 - Eight Reader Processing Panel (Continental Instrument CICIP1800T).....	3,813.02	201.07
28 13 33 16-0177 Note: For use with CA3000 V2.0.25 and above. Up to 40,000 card capacity, 24 supervised alarm inputs, tamper alarm, and 17 relay outputs. Complete in a steel enclosure including a 7 AH battery standby for memory and system operation.		
28 13 33 16-0178 EA Turbo Superterm-8 -Eight Reader Processing Panel, Expanded Power (Continental Instrument CICIP1800TEXP)	4,133.42	201.07
28 13 33 16-0178 Note: Required if more than one relay expander board is used. Up to 40,000 card capacity, 24 supervised alarm inputs, tamper alarm, and 17 relay outputs. Complete in a steel enclosure including a 7 AH battery standby for memory and system operation.		
28 13 33 16-0179 EA Turbo Superterm-8 PC Board (Continental Instrument CICIP1800TPCB).....	3,116.70	60.32
28 13 33 16-0180 EA Superterm Memory Board - 2MB (Continental Instrument CICIP1800MB2).....	1,310.72	60.32
28 13 33 16-0180 Note: Up to 140,000 cardholders.		
28 13 33 16-0181 EA Turbo/Superterm-8 Memory Board - 2MB (Continental Instrument CICIP1800MB2X2)	1,105.66	60.32
28 13 33 16-0181 Note: Up to 140,000 cardholders.		
28 13 33 16-0182 EA Turbo Superterm-8 Relay Expander Board (Continental Instrument CICIP1800RB).....	1,023.66	60.32
28 13 33 16-0182 Note: 16 Output relays, 8 alarm inputs.		
28 13 33 16-0183 EA Turbo Superterm-8 Alarm Expander Board (Continental Instrument CICIP1800RB).....	1,023.66	60.32
28 13 33 16-0183 Note: (Supervised) 16 Alarm inputs.		
28 13 33 16-0184 EA Expanded Power Supply For Superterm Or Turbo Superterm (Continental Instrument CICIPEXPWS).....	410.97	
28 13 33 16-0185 Access Control Bundled System (28 13 33 16)		
28 13 33 16-0186 EA CA 3000 Bundled System, Supports 25 Users (Continental Instrument CA3B250P4O3V0R0).....	20,479.32	
28 13 33 16-0186 Note: System includes PC, monitor, keyboard, mouse, OS, Card Access 3000 file server software, MS SQL 2000, 1 SQL host license, and security key.		
28 13 33 16-0187 Magnetic Locks (28 13 33 16)		
28 13 33 16-0187 Note: Excludes access controls.		
28 13 33 16-0188 Magnetic Door Locks (28 13 33 16-0187)		
28 13 33 16-0189 300 LB Magnetic Door Locks (28 13 33 16-0188)		
28 13 33 16-0190 EA Single Door, Surface Mount, 300 LB Magnetic Door Lock.....	339.36	80.44
28 13 33 16-0191 600 LB Magnetic Door Locks (28 13 33 16-0188)		
28 13 33 16-0192 EA Single Door, Surface Mount, 600 LB Magnetic Door Lock.....	463.11	80.44
28 13 33 16-0192 For LED Status Indicator And Signal Relay, Add	37.78	
28 13 33 16-0192 For LED Status Indicator, Signal Relay And Built-In Delay Timer, Add	75.56	
28 13 33 16-0192 For Mortise Mount, Deduct	-60.45	
28 13 33 16-0193 EA Dual Doors, Surface Mount, 600 LB Magnetic Door Lock.....	666.36	80.44
28 13 33 16-0193 For LED Status Indicator And Signal Relay, Add	63.19	
28 13 33 16-0193 For LED Status Indicator, Signal Relay And Built-In Delay Timer, Add	126.38	
28 13 33 16-0194 1,200 LB Magnetic Door Locks (28 13 33 16-0188)		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 13 33 16-0195 EA Single Door, Surface Mount, 1,200 LB Magnetic Door Lock..... <i>For LED Status Indicator And Signal Relay, Add</i>	481.86 73.83 96.30	80.44
28 13 33 16-0196 EA Dual Doors, Surface Mount, 1,200 LB Magnetic Door Lock..... <i>For LED Status Indicator And Signal Relay, Add</i> <i>For LED Status Indicator, Signal Relay And Built-In Delay Timer, Add</i>	706.86 125.58 163.80	80.44
28 13 33 16-0197 2,000 LB Shear Lock, Magnetic And Mechanical Locks (28 13 33 16-0188) Note: Includes LED status indicator and built-in signal relay.		
28 13 33 16-0198 EA Single Door, Mortise Mount, 2,000 LB Shear Lock, Magnetic And Mechanical Door Lock.....	502.11	80.44
28 13 33 16-0199 Magnetic Gate Locks (28 13 33 16-0187)		
28 13 33 16-0200 600 LB Magnetic Gate Locks (28 13 33 16-0199)		
28 13 33 16-0201 EA 600 LB Magnetic Gate Lock.....	388.86	80.44
28 13 33 16-0202 1,200 LB Magnetic Gate Locks (28 13 33 16-0199)		
28 13 33 16-0203 EA 1,200 LB Magnetic Gate Lock..... <i>For LED Status Indicator And Signal Relay, Add</i> <i>For LED Status Indicator, Signal Relay And Built-In Delay Timer, Add</i> <i>For Mortise Mount, Deduct</i>	457.11 37.03 74.06 -59.25	80.44
28 13 33 16-0204 Magnetic Lock Power Supply And Chargers (28 13 33 16-0187) Note: Includes lockable metal enclosure, batteries, battery charger and electronically regulated outputs.		
28 13 33 16-0205 EA 12/24 Volt DC At 1 Amp, Magnetic Lock Backup Power Supply And Charger.....	301.54	80.44
28 13 33 16-0206 EA 12/24 Volt DC At 2-1/2 Amp, Magnetic Lock Backup Power Supply And Charger	369.54	80.44
28 13 33 16-0207 EA 12 Volt DC At 4 Amp And 24 Volt DC At 3 Amp, Magnetic Lock Backup Power Supply And Charger	409.54	80.44
28 13 33 16-0208 EA 12/24 Volt DC At 6 Amp, Magnetic Lock Backup Power Supply And Charger.....	501.54	80.44
28 13 33 16-0209 Master Door Buzzer Stations (28 13 33 16)		
28 13 33 16-0210 Master Stations (28 13 33 16-0209)		
28 13 33 16-0211 EA Master Stations, 5 Station Intercommunication Equipment	647.19	125.47
28 13 33 16-0212 EA Master Stations, 10 Station Intercommunication Equipment	996.07	242.90
28 13 33 16-0213 EA Master Station, Desk Style Remote Intercommunication Equipment.....	281.94	62.73
28 13 33 16-0214 EA Master Station, Flush Wall Remote Intercommunication Equipment	371.50	104.56
28 13 33 16-0215 EA Sound System Outlet, Protector	101.48	40.94
28 13 33 16-0216 EA Sound System Microphone Outlet.....	182.81	83.81
28 13 33 16-0217 EA Sound System Speaker Ceiling Or Wall	129.79	40.94
28 13 33 16-0218 EA Sound System Monitor Panel	363.62	83.81
28 13 33 16-0219 EA Sound System Volume Control.....	114.54	40.94
28 13 33 16-0220 EA Sound System Amplifier 250 W	1,659.41	335.15
28 13 33 16-0221 EA Sound System Cabinet.....	1,029.68	335.15
28 13 33 16-0222 Master Door Stations (28 13 33 16-0209)		
28 13 33 16-0223 EA Master Door Stations, Button Buzzer Type, 25 Station..... <i>For Intercom Type Master Door Station, Add</i>	1,566.58 108.76	
28 13 33 16-0224 EA Master Door Stations, Button Buzzer Type, 50 Station..... <i>For Intercom Type Master Door Station, Add</i>	2,598.07 176.19	
28 13 33 16-0225 EA Master Door Stations, Button Buzzer Type, 75 Station..... <i>For Intercom Type Master Door Station, Add</i>	3,577.51 228.39	
28 13 33 16-0226 EA Master Door Stations, Button Buzzer Type, 100 Station..... <i>For Intercom Type Master Door Station, Add</i>	4,083.52 267.54	
28 13 33 16-0227 EA Master Door Stations, Button Buzzer Type, 150 Station..... <i>For Intercom Type Master Door Station, Add</i>	4,895.77 391.53	
28 13 33 16-0228 EA Master Door Stations, Button Buzzer Type, 200 Station..... <i>For Intercom Type Master Door Station, Add</i>	5,703.68 504.64	
28 13 33 16-0229 EA Master Door Stations, Button Buzzer Type, 250 Station..... <i>For Intercom Type Master Door Station, Add</i>	7,164.68 652.55	
28 13 33 16-0230 EA Master Door Stations, Button Buzzer Type, 300 Station..... <i>For Intercom Type Master Door Station, Add</i>	8,587.44 748.25	
28 13 33 16-0231 EA Transformer	108.72	
28 13 33 16-0232 EA Door Opener	161.22	
28 13 33 16-0233 EA Buzzer With Door Release And Plate.....	201.46	
28 13 33 16-0234 EA Amplifier For Intercom Type Unit	308.26	
28 13 33 16-0235 EA Speaker With Door Release	132.28	

28 20 Electronic Surveillance (28)
Note: Includes testing of new devices and certification.

28 23 Video Surveillance (28 20)

28 23 00 00-0001 Closed Circuit Television And Surveillance Systems (28 23)
Note: Includes programming of equipment, testing of new devices and certification.

28 Electronic Safety And Security**28 20 Electronic Surveillance****28 23 Video Surveillance**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 23 00 00-0002 Cameras And Accessories <small>(28 23 00 00-0001)</small>		
28 23 00 00-0003 Cameras <small>(28 23 00 00-0002)</small>		
28 23 00 00-0004 General Use Video Camera <small>(28 23 00 00-0003)</small>		
28 23 00 00-0005 EA Samsung SHC-721A – Day/Night With Auto Iris Lens	838.30	79.21
28 23 00 00-0006 EA Panasonic WV-CW 474S With Auto Iris Lens	394.03	79.21
28 23 00 00-0007 EA Panasonic CW244 With Auto Iris Lens	736.10	79.21
28 23 00 00-0008 EA Panasonic Dome WC-CW-244	601.00	79.21
28 23 00 00-0009 EA Pelco PTZ 23X Zoom Day Night Pole Mounted	1,650.09	79.21
28 23 00 00-0010 EA Arecont Vision AV8365 8 Megapixel 360 Degree IP Camera	1,789.20	79.21
28 23 00 00-0011 EA Arecont Vision AV8155 8 Megapixel 360 Degree IP Camera	3,157.20	79.21
28 23 00 00-0012 EA Arecont Vision 8 Megapixel 180 Degree IP Camera	1,786.95	79.21
28 23 00 00-0013 EA Arecont Vision AV3155 3 Megapixel Day/Night Camera	1,287.72	79.21
28 23 00 00-0014 EA Arecont Vision AV5155 5 Megapixel Day/Night Camera	1,358.08	79.21
28 23 00 00-0015 EA JVC 920U Hi-Res Day/Night Camera	289.11	79.21
28 23 00 00-0016 EA NUVICO Vandal Dome Camera D/N 580TVL 2.8-10MM 12/24	290.24	79.21
28 23 00 00-0017 EA NUVICO Indoor Dome Camera 580TVL 2.8-10MM, 12/24	276.77	79.21
28 23 00 00-0018 Camera Power Supply <small>(28 23 00 00-0003)</small>		
28 23 00 00-0019 EA 100 VA Outdoor Power Supply	243.45	39.60
28 23 00 00-0020 EA Surge Protector, Isolated Coax Protector For CCTV	110.63	19.55
28 23 00 00-0021 EA Altronics Power Supply With 8 Fused Outputs	513.51	79.21
28 23 00 00-0022 Camera Mounting <small>(28 23 00 00-0002)</small>		
28 23 00 00-0023 Camera Wall Mounts <small>(28 23 00 00-0022)</small>		
28 23 00 00-0024 EA Parapet Camera Wall Mount, 1.5" Diameter Pipe	535.06	79.12
28 23 00 00-0025 EA Spectra Wall Mount, Gray	131.59	39.60
28 23 00 00-0026 EA Spectra Wall Mount Pole Adapter For SWM-GY	110.37	39.60
28 23 00 00-0027 EA Wall Mount Bracket For Exterior CCTV	405.93	79.21
28 23 00 00-0028 Video Monitor <small>(28 23 00 00-0002)</small>		
28 23 00 00-0029 EA 17" Color Video Monitor	1,093.86	160.86
Note: JVC model number TM-H1700GU.		
28 23 00 00-0030 Digital Video Recorders <small>(28 23 00 00-0002)</small>		
28 23 00 00-0031 EA Dedicated Micros 16 Channel 500 GB HD; DMSP 16MINA	2,866.28	
28 23 00 00-0032 EA Dedicated Micros 4 Channel 80 GB HD; D4A-DX4C	735.79	
28 23 00 00-0033 EA Dedicated Micros Digital Sprite 2; DS2PD 16500	3,341.13	
28 23 00 00-0034 EA Enterprise Class Timesight NVR, Video Lifecycle Management Server; DM-SDEXC16MAX-A	5,612.52	
Note: (Hybrid NVR/DVR 8 Analog & 4 IP Channels)		
28 23 00 00-0035 EA Enterprise Class Timesight NVR, Video Lifecycle Management Server; DM-SDACP32MAX-A	480.49	
Note: (Hybrid NVR/DVR 8 Analog & 4 IP Channels)		
28 23 00 00-0036 EA Enterprise Class Timesight NVR, Video Lifecycle Management Server; DM-SDACP16MAX-A	4,628.11	
Note: (Hybrid NVR/DVR 8 Analog & 4 IP Channels)		
28 23 00 00-0037 EA Enterprise Class Timesight NVR, Video Lifecycle Management Server; DM-SDACP16MIN-A	3,677.24	
Note: (Hybrid NVR/DVR 8 Analog & 4 IP Channels)		
28 23 00 00-0038 EA Enterprise Class Timesight NVR, Video Lifecycle Management Server; DM-SDACP08MIN-A	3,127.62	
Note: (Hybrid NVR/DVR 8 Analog & 4 IP Channels)		
28 23 00 00-0039 EA Prodigy 8 Channel 1000 GB HD	2,279.52	
28 23 00 00-0040 Wireless Hardware <small>(28 23 00 00-0002)</small>		
28 23 00 00-0041 EA MIMO PB24M24 Outdoor Wireless Box	929.42	
28 23 00 00-0042 EA VLRM24 Wireless 2.4GHz MIMO Access Point	582.09	
28 23 00 00-0043 Closed Circuit Television And Surveillance Systems (Vicon) <small>(28 23)</small>		
Note: Includes a 3 year manufacturer's warranty. Use Vicon replacement models, "or equal", when the listed models are superseded.		
28 23 00 00-0044 Vicon CCTV Factory Project Management Program <small>(28 23 00 00-0043)</small>		
Note: For first time installations at a facility.		
28 23 00 00-0045 EA Factory Project Management Program For 1 To 20 Camera System Vicon CCTV Installation Support	3,499.80	
Note: Includes two site visits by a Vicon technical representative. First site visit to generate punch list and 2nd site visit for final inspection and training.		
28 23 00 00-0046 EA Factory Project Management Program For 21 To 40 Camera System Vicon CCTV Installation Support	4,374.75	
Note: Includes two site visits by a Vicon technical representative. First site visit to generate punch list and 2nd site visit for final inspection and training.		
28 23 00 00-0047 EA Factory Project Management Program For >40 Camera System Vicon CCTV Installation Support	5,249.70	
Note: Includes three site visits by a Vicon technical representative. First site visit during installation commencement, 2nd to generate punch list, and 3rd site visit for final inspection and training.		
28 23 00 00-0048 Digital Video Transport And Storage Systems <small>(28 23 00 00-0043)</small>		
28 23 00 00-0049 Kollektor Pro Digital Recorders <small>(28 23 00 00-0048)</small>		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 23 00 00-0050 EA 2-Port KVM Switch.....	125.35	9.03
Note: Allows control of two Kollektors from one keyboard, mouse, and monitor. Vicon model VTK-205I.		
28 23 00 00-0051 EA 16-Channel Digital Recorder, 30 fps, 160 GB HDD.....	4,046.19	20.14
Note: Kollektor Pro, Preloaded ViconNet Version 3. Vicon model KPX30-160.		
28 23 00 00-0052 EA 16-Channel Digital Recorder, 30 fps, 160 GB HDD.....	4,334.93	20.14
Note: Kollektor Pro, Preloaded ViconNet Version 3. 16 x 4 Analog video matrix. Vicon model KPX30M-160.		
28 23 00 00-0053 EA 16-Channel Digital Recorder, 30 fps, 320 GB HDD.....	4,499.77	20.14
Note: Kollektor Pro, Preloaded ViconNet Version 3. Vicon model KPX30-320.		
28 23 00 00-0054 EA 16-Channel Digital Recorder, 30 fps, 320 GB HDD.....	4,788.50	20.14
Note: Kollektor Pro, Preloaded ViconNet Version 3. 16 x 4 Analog Video Matrix. Vicon model KPX30M-320.		
28 23 00 00-0055 EA 16-Channel Digital Recorder, 30 fps, 500 GB HDD.....	4,954.39	20.14
Note: Kollektor Pro, Preloaded ViconNet Version 3. Vicon model KPX30-500.		
28 23 00 00-0056 EA 16-Channel Digital Recorder, 30 fps, 500 GB HDD.....	5,243.13	20.14
Note: Kollektor Pro, Preloaded ViconNet Version 3. 16 x 4 Analog Video Matrix. Vicon model KPX30M-500.		
28 23 00 00-0057 EA 16-Channel Digital Recorder, 60 fps, 250 GB HDD.....	4,897.69	20.14
Note: Kollektor Pro, Preloaded ViconNet Version 3. Vicon model KPX60-250.		
28 23 00 00-0058 EA 16-Channel Digital Recorder, 60 fps, 250 GB HDD.....	5,186.43	20.14
Note: Kollektor Pro, Preloaded ViconNet Version 3. 16 x 4 Analog Video Matrix. Vicon model KPX60M-250.		
28 23 00 00-0059 EA 16-Channel Digital Recorder, 60 fps, 400 GB HDD.....	5,464.66	20.14
Note: Kollektor Pro, Preloaded ViconNet Version 3. Vicon model KPX60-400.		
28 23 00 00-0060 EA 16-Channel Digital Recorder, 60 fps, 400 GB HDD.....	5,753.40	20.14
Note: Kollektor Pro, Preloaded ViconNet Version 3. 16 x 4 Analog Video Matrix. Vicon model KPX60M-400.		
28 23 00 00-0061 EA 16-Channel Digital Recorder, 60 fps, 660 GB HDD.....	6,032.68	20.14
Note: Kollektor Pro, Preloaded ViconNet Version 3. Vicon model KP60-660.		
28 23 00 00-0062 EA 16-Channel Digital Recorder, 60 fps, 660 GB HDD.....	6,321.41	20.14
Note: Kollektor Pro, Preloaded ViconNet Version 3. 16 x 4 Analog Video Matrix. Vicon model KPX60M-660.		
28 23 00 00-0063 EA 16-Channel Digital Recorder, 120 fps, 250 GB HDD.....	6,089.38	20.14
Note: Kollektor Pro, Preloaded ViconNet Version 3. Vicon model KPX120-250.		
28 23 00 00-0064 EA 16-Channel Digital Recorder, 120 fps, 250 GB HDD.....	6,378.11	20.14
Note: Kollektor Pro, Preloaded ViconNet Version 3. 16 x 4 Analog Video Matrix. Vicon model KPX120M-250.		
28 23 00 00-0065 EA 16-Channel Digital Recorder, 120 fps, 500 GB HDD.....	6,940.88	20.14
Note: Kollektor Pro, Preloaded ViconNet Version 3. Vicon model KPX120-500.		
28 23 00 00-0066 EA 16-Channel Digital Recorder, 120 fps, 500 GB HDD.....	7,229.61	20.14
Note: Kollektor Pro, Preloaded ViconNet Version 3. 16 x 4 Analog Video Matrix. Vicon model KPX120M-500.		
28 23 00 00-0067 EA 16-Channel Digital Recorder, 120 fps, 900 GB HDD.....	8,075.86	20.14
Note: Kollektor Pro, Preloaded ViconNet Version 3. Vicon model KPX120-900.		
28 23 00 00-0068 EA 16-Channel Digital Recorder, 120 fps, 900 GB HDD.....	8,364.60	20.14
Note: Kollektor Pro, Preloaded ViconNet Version 3. 16 x 4 Analog Video Matrix. Vicon model KPX120M-900.		
28 23 00 00-0069 EA 16-Channel Digital Recorder, 120 fps, 1200 GB HDD.....	8,934.71	20.14
Note: Kollektor Pro, Preloaded ViconNet Version 3. Vicon model KPX120-1200.		
28 23 00 00-0070 EA 16-Channel Digital Recorder, 120 fps, 1200 GB HDD.....	9,223.45	20.14
Note: Kollektor Pro, Preloaded ViconNet Version 3. 16 x 4 Analog Video Matrix. Vicon model KPX120M-1200.		
28 23 00 00-0071 EA 16-Channel Digital Recorder, 240 fps, 320 GB HDD.....	8,927.36	20.14
Note: Kollektor Pro, Preloaded ViconNet Version 3. Vicon model KPX240-320.		
28 23 00 00-0072 EA 16-Channel Digital Recorder, 240 fps, 320 GB HDD.....	9,216.10	20.14
Note: Kollektor Pro, Preloaded ViconNet Version 3. 16 x 4 Analog Video Matrix. Vicon model KPX240M-320.		
28 23 00 00-0073 EA 16-Channel Digital Recorder, 240 fps, 900 GB HDD.....	10,629.32	20.14
Note: Kollektor Pro, Preloaded ViconNet Version 3. Vicon model KPX240-900.		
28 23 00 00-0074 EA 16-Channel Digital Recorder, 240 fps, 900 GB HDD.....	10,918.05	20.14
Note: Kollektor Pro, Preloaded ViconNet Version 3. 16 x 4 Analog Video Matrix. Vicon model KPX240M-900.		
28 23 00 00-0075 EA 16-Channel Digital Recorder, 240 fps, 1200 GB HDD.....	11,480.82	20.14
Note: Kollektor Pro, Preloaded ViconNet Version 3. Vicon model KPX24-1200.		
28 23 00 00-0076 EA 16-Channel Digital Recorder, 240 fps, 1200 GB HDD.....	11,769.55	20.14
Note: Kollektor Pro, Preloaded ViconNet Version 3. 16 x 4 Analog Video Matrix. Vicon model KPX24M-1200.		
28 23 00 00-0077 Kollektor Elite Digital Recorders And Master Workstations <small>(28 23 00 00-0048)</small>		
28 23 00 00-0078 EA 16-Channel Digital Recorder, 120 fps, 250 GB Internal HDD.....	8,586.13	20.14
Note: Kollektor Elite Hybrid digital network video recorder, preloaded ViconNet version 3. 16-Channel audio, 16 x 4 analog video matrix. Vicon model KEX120M-250.		
28 23 00 00-0079 EA 16-Channel Digital Recorder, 120 fps, 500 GB Internal HDD.....	9,437.64	20.14
Note: Kollektor Elite Hybrid digital network video recorder, preloaded ViconNet version 3. 16-Channel audio, 16 x 4 analog video matrix. Vicon model KEX120M-500.		
28 23 00 00-0080 EA 16-Channel Digital Recorder, 120 fps, 900 GB Internal HDD.....	10,289.14	20.14
Note: Kollektor Elite Hybrid digital network video recorder, preloaded ViconNet version 3. 16-Channel audio, 16 x 4 analog video matrix. Vicon model KEX120M-900.		
28 23 00 00-0081 EA 16-Channel Digital Recorder, 120 fps, 1200 GB Internal HDD.....	11,141.69	20.14
Note: Kollektor Elite Hybrid digital network video recorder, preloaded ViconNet version 3. 16-Channel audio, 16 x 4 analog video matrix. Vicon model KEX120M-1200.		
28 23 00 00-0082 EA 16-Channel Digital Recorder, 120 fps, 1600 GB Internal HDD.....	12,275.62	20.14
Note: Kollektor Elite Hybrid digital network video recorder, preloaded ViconNet version 3. 16-Channel audio, 16 x 4 analog video matrix. Vicon model KEX120M-1600.		
28 23 00 00-0083 EA 16-Channel Digital Recorder, 240 fps, 320 GB Internal HDD.....	10,998.90	20.14
Note: Kollektor Elite Hybrid digital network video recorder, preloaded ViconNet version 3. 16-Channel audio, 16 x 4 analog video matrix. Vicon model KEX240M-300.		
28 23 00 00-0084 EA 16-Channel Digital Recorder, 240 fps, 660 GB Internal HDD.....	11,849.35	20.14
Note: Kollektor Elite Hybrid digital network video recorder, preloaded ViconNet version 3. 16-Channel audio, 16 x 4 analog video matrix. Vicon model KEX240M-660.		
28 23 00 00-0085 EA 16-Channel Digital Recorder, 240 fps, 900 GB Internal HDD.....	12,700.85	20.14
Note: Kollektor Elite Hybrid digital network video recorder, preloaded ViconNet version 3. 16-Channel audio, 16 x 4 analog video matrix. Vicon model KEX240M-900.		
28 23 00 00-0086 EA 16-Channel Digital Recorder, 240 fps, 1200 GB Internal HDD.....	13,551.30	20.14
Note: Kollektor Elite Hybrid digital network video recorder, preloaded ViconNet version 3. 16-Channel audio, 16 x 4 analog video matrix. Vicon model KEX240M-1200.		

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MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 23 00 00-0087 EA 16-Channel Digital Recorder, 240 fps, 1600 GB Internal HDD Note: Kollektor Elite Hybrid digital network video recorder, preloaded ViconNet version 3. 16-Channel audio, 16 x 4 analog video matrix. Vicon model KEX240M-1600.	14,690.49	20.14
28 23 00 00-0088 EA 16-Channel Digital Recorder, 480 fps, 250 GB Internal HDD Note: Kollektor Elite Hybrid digital network video recorder, preloaded ViconNet version 3. 16-Channel audio, 16 x 4 analog video matrix. Vicon model KEX480M-250.	13,724.54	20.14
28 23 00 00-0089 EA 16-Channel Digital Recorder, 480 fps, 1200 GB Internal HDD Note: Kollektor Elite Hybrid digital network video recorder, preloaded ViconNet version 3. 16-Channel audio, 16 x 4 analog video matrix. Vicon model KEX480M-1200.	16,136.25	20.14
28 23 00 00-0090 EA 16-Channel Digital Recorder, 480 fps, 1600 GB Internal HDD Note: Kollektor Elite Hybrid digital network video recorder, preloaded ViconNet version 3. 16-Channel audio, 16 x 4 analog video matrix. Vicon model KEX480M-1600.	17,299.59	20.14
28 23 00 00-0091 Kollektor Network Servers (28 23 00 00-0048)		
28 23 00 00-0092 EA Kollektor Network Server, 120 fps, 40 GB HD, 4 Sensor Channels Note: 16-Channel networked digital video server, NTSC/EIA and PAL/CCIR. Includes ViconNet software for local viewing of live and recorded video. Windows XP. Vicon model KNS120-40.	4,329.33	20.14
28 23 00 00-0093 EA Kollektor Network Server, 120 fps, 400 GB HD, 4 Sensor Channels Note: 16-Channel networked digital video server, NTSC/EIA and PAL/CCIR. Includes ViconNet software for local viewing of live and recorded video. Windows XP. Vicon model KNS120-400.	5,606.75	20.14
28 23 00 00-0094 EA Kollektor Network Server, 120 fps, 800 GB HD, 4 Sensor Channels Note: 16-Channel networked digital video server, NTSC/EIA and PAL/CCIR. Includes ViconNet software for local viewing of live and recorded video. Windows XP. Vicon model KNS120-800.	7,167.67	20.14
28 23 00 00-0095 ViconNet IP Video Servers And Camera/Server (28 23 00 00-0048)		
28 23 00 00-0096 EA ViconNet 1-Channel Video Server Note: Accepts 1 analog video input for transmission over TCP/IP network (30 fps total). Includes ViconNet VN100V3 4-channel viewing software. Vicon model VN-301TV3.	924.72	20.14
28 23 00 00-0097 EA ViconNet 4-Channel Digital Video Server Note: 120 fps, ViconNet VN100V3 4-channel viewing software. Vicon model KTX-4.	1,650.23	20.14
28 23 00 00-0098 EA IP Camera/ 4-Channel Digital Video Server Note: 120 fps, ViconNet Version 3.0; audio input/output; power over ethernet capability. Vicon model VN-755IPV3.	1,209.26	20.14
28 23 00 00-0099 EA Alarm/Audio Accessory Kit For VN-755IP Note: Provides for alarm and audio capability. Vicon model VN-755KIT.	44.83	8.05
28 23 00 00-0100 EA Double Width Rack Kit For Use With KTX-4 IP Encoder Note: Mounts two (2) KTX-4 encoders in standard 19" rack. Vicon model KX-4-RK2.	122.66	4.79
28 23 00 00-0101 ViconNet Software Enhancement (28 23 00 00-0048)		
28 23 00 00-0102 EA Viconnet Software Enhancements For Kollektor Elite Recorders Note: Includes ViconNet software released by Vicon within the period of one year from date of purchase. All revisions are approved and released at the sole discretion of the Company. (One user license) Vicon model VN-KE-SE.	1,107.52	
28 23 00 00-0103 EA Viconnet Software Enhancements For Kollektor Pro Recorders..... Note: Includes ViconNet software released by Vicon within the period of one year from date of purchase. All revisions are approved and released at the sole discretion of the Company. (One user license) Vicon model VN-KPR-SE.	960.03	
28 23 00 00-0104 EA Viconnet Software Enhancements For Kollektor Network Servers Note: Includes ViconNet software released by Vicon within the period of one year from date of purchase. All revisions are approved and released at the sole discretion of the Company. (One user license) Vicon model VN-KN-SE.	720.30	
28 23 00 00-0105 EA Viconnet Software Enhancements For Master Workstations Note: For ViconNet VN1000/5000 master workstations and software. Includes ViconNet software released by Vicon within the period of one year from date of purchase. All revisions are approved and released at the sole discretion of the Company. (One user license) Vicon model VN-SW-1000-SE.	245.10	
28 23 00 00-0106 EA Viconnet Software Enhancements For 16-Channel Viewer Software Note: For ViconNet VN500. Includes ViconNet software released by Vicon within the period of one year from date of purchase. All revisions are approved and released at the sole discretion of the Company. (One user license) Vicon model VN-SW-500-SE.	73.57	
28 23 00 00-0107 ViconNet Software Maintenance Programs (28 23 00 00-0048)		
28 23 00 00-0108 EA ViconNet Software Maintenance For Kollektor Elite Recorders Note: Includes all ViconNet software patches released by Vicon for the original revision within the period of one year from date of purchase. All patches are approved and released at the sole discretion of the Company. (One user license) Vicon model VN-KE-SM.	140.10	
28 23 00 00-0109 EA ViconNet Software Maintenance For Kollektor Pro Recorders Note: Includes all ViconNet software patches released by Vicon for the original revision within the period of one year from date of purchase. All patches are approved and released at the sole discretion of the Company. (One user license) Vicon model VN-KPR-SM.	125.35	
28 23 00 00-0110 EA ViconNet Software Maintenance For Master Workstations Note: For ViconNet VN1000/5000 master workstations and software. Includes all ViconNet software patches released by Vicon for the original revision within the period of one year from date of purchase. All patches are approved and released at the sole discretion of the Company. (One user license) Vicon model VN-1000-SM.	66.37	
28 23 00 00-0111 EA ViconNet Software Maintenance For 16-Channel Viewer Note: For ViconNet VN500. Includes all ViconNet software patches released by Vicon for the original revision within the period of one year from date of purchase. All patches are approved and released at the sole discretion of the Company. (One user license) Vicon model VN-500-SM.	36.87	
28 23 00 00-0112 ViconNet Options (28 23 00 00-0048)		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 23 00 00-0113 EA 16-Bay Raid Storage Unit, 16-160 GB Hot Swappable Hard Drives..... Note: Used with Kollektor Elite and Pro Recorders. Provides RAID 3 protection. Vicon model VN-RAID-16-160.	12,770.84	20.14
28 23 00 00-0114 EA 16-Bay Raid Storage Unit, 16-250 GB Hot Swappable Hard Drives..... Note: Used with Kollektor Elite and Pro Recorders. Provides RAID 3 protection. Vicon model VN-RAID-16-250.	15,369.45	20.14
28 23 00 00-0115 EA Network Switch, 8-Channel LAN Connections..... Note: 10/100 Autosensing ports. Vicon model NETSWITCH-8.	169.20	13.42
28 23 00 00-0116 EA Network Switch, 16-Channel LAN Connections..... Note: 10/100 Autosensing ports. Vicon model NETSWITCH-16.	216.45	13.42
28 23 00 00-0117 EA Network Switch, 24-Channel LAN Connections..... Note: 10/100/1000 Autosensing ports. Vicon model NETSWITCH-24.	869.16	13.42
28 23 00 00-0118 EA Uninterruptible Power Supply, Desk-top, 725 VA/450W..... Note: USB control port, 120 VAC input/output. Vicon model V725-UPS.	184.95	13.42
28 23 00 00-0119 EA 8-Bay Raid Storage Unit, 8-250 GB Hot Swappable Hard Drives..... Note: Used with Kollektor Elite and Pro Recorders. Provides RAID 3 protection, includes eight 250 GB hot swappable hard drives. Vicon model VN-RAID-8-250.	8,188.21	20.14
28 23 00 00-0120 EA 17" S-VGA Monitor..... Note: For use with Kollektor Elite and Kollektor Pro Recorders and VN-NVR Workstation. Vicon model VN-MON.	330.19	13.42
28 23 00 00-0121 EA 17" S-VGA TFT LCD Monitor..... Note: For use with Kollektor Elite and Kollektor Pro Recorders and VN-NVR Workstation. Vicon model VN-17FLT.	736.17	13.42
28 23 00 00-0122 EA PC-To-TV Converter, Self-Powered USB Interface..... Note: VGA in and VGA out connections, composite and S-video (NTSC) output. Vicon model VGEZ-1000.	160.80	13.42
28 23 00 00-0123 AurorACorD Digital Video Multiplexer And Recorder (28 23 00 00-0048)		
28 23 00 00-0124 EA Digital Video Multiplexer And Recorder, 30 fps, 80 GB HDD..... Note: Auroracord, 16-Channel, color, duplex, includes floppy drive, and CD drive. Vicon model AURC-FCD80.	2,623.17	20.14
28 23 00 00-0125 EA Digital Video Multiplexer And Recorder, 30 fps, 160 GB HDD..... Note: Auroracord, 16-Channel, color, duplex, includes floppy drive, and CD drive. Vicon model AURC-FCD160.	2,770.17	20.14
28 23 00 00-0126 EA Digital Video Multiplexer And Recorder, 30 fps, 2-160 GB HDDs..... Note: Auroracord, 16-Channel, color, duplex, includes floppy drive, and CD drive. Vicon model AURC-CD320.	3,142.89	20.14
28 23 00 00-0127 EA Digital Video Multiplexer And Recorder, 30 fps, 2-250 GB HDDs..... Note: Auroracord, 16-Channel, color, duplex, includes floppy drive, and CD drive. Vicon model AURC-CD500.	3,569.87	20.14
28 23 00 00-0128 AurorACorD Options (28 23 00 00-0048)		
28 23 00 00-0129 EA Remote Keyboard..... Note: Provides control for up to 16 AurorA 2000 or AurorACorD units and 16 VCRs. Vicon model AUR2K-KBD.	613.68	13.42
28 23 00 00-0130 Digital Video Recorders (28 23 00 00-0048)		
28 23 00 00-0131 EA 4-Channel Digital Video Recorder, 120 GB Hard Drive, 30 fps..... Note: CD/RW, PTZ control, audio, network control and viewing software included. Vicon model VDR-204-12CD.	1,392.99	20.14
28 23 00 00-0132 EA 4-Channel Digital Video Recorder, 300 GB Hard Drive, 30 fps..... Note: CD/RW, PTZ control, audio, network control and viewing software included. Vicon model VDR-204-30CD.	1,634.48	20.14
28 23 00 00-0133 EA 8-Channel Digital Video Recorder, 300 GB Hard Drive, 30 fps..... Note: CD/RW, PTZ control, audio, network control and viewing software included. Vicon model VDR-204-30CD.	2,201.45	20.14
28 23 00 00-0134 EA 4-Channel Digital Video Recorder, 500 GB Hard Drive, 30 fps..... Note: CD/RW, PTZ control, audio, network control and viewing software included. Vicon model VDR-204-50CD.	2,217.20	20.14
28 23 00 00-0135 ViconNet Network Video Recorder Software Version 3.0 (28 23 00 00-0048)		
28 23 00 00-0136 EA ViconNet NVR And Workstation Software..... Note: For use with ViconNet 3.0 digital recorders, video servers and ViconNet IP cameras. Single PC license. Vicon model VN1000V3	1,492.74	
28 23 00 00-0137 EA ViconNet Multi-Pack, 10 User License Pack Of VN1000V3 NVR..... Note: Vicon model VN1000V3-10.	8,470.92	
28 23 00 00-0138 EA ViconNet 16-Channel Viewer Software, Version 3..... Note: Single PC license. Vicon model VN500V3.	646.49	
28 23 00 00-0139 EA ViconNet 4-Channel Viewer Software, Version 3..... Note: Single PC license. Vicon model VN500V3.	211.81	
28 23 00 00-0140 EA ViconNet-Hirsch Integration Software..... Note: To use ViconNet on a Hirsch Velocity access control workstation. Vicon model VN-HIRSCH-INT.	4,280.33	
28 23 00 00-0141 Network Video Recorders Version 3.0 (28 23 00 00-0048)		
28 23 00 00-0142 EA Network Video Recorder, 80 GB Internal HDD Storage..... Note: Preloaded ViconNet Version 3, view, record and configure ViconNet IP devices and recorders. Vicon model VN-NVR-80.	3,620.97	20.14
28 23 00 00-0143 EA Network Video Recorder, 800 GB Internal HDD Storage..... Note: Preloaded ViconNet Version 3, view, record and configure ViconNet IP devices and recorders. Vicon model VN-NVR-800.	5,889.89	20.14
28 23 00 00-0144 EA Network Video Recorder, 1200 GB Internal HDD Storage..... Note: Preloaded ViconNet Version 3, view, record and configure ViconNet IP devices and recorders. Vicon model VN-NVR-1200.	7,041.67	20.14
28 23 00 00-0145 EA Network Video Recorder, 1600 GB Internal HDD Storage..... Note: Preloaded ViconNet Version 3, view, record and configure ViconNet IP devices and recorders. Vicon model VN-NVR-1600.	8,165.11	20.14
28 23 00 00-0146 ViconNet Version 3.0 Compatible Keypads Interface Converter (28 23 00 00-0048)		

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MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 23 00 00-0147 EA RS-252/RS-422 Interface Converter..... Note: Required to allow matrix keyboard to work with all PC workstations and Kollector Elites and Pros with older version hardware backpanels (with RJ-45 connectors). Vicon model V422-CONV.	250.66	20.14
28 23 00 00-0148 Cameras And Accessories (28 23 00 00-0043)		
28 23 00 00-0149 Camera Dome Systems And Cameras (28 23 00 00-0148)		
28 23 00 00-0150 SurveyorVFT 22X High Sensitivity IP Camera Dome Systems (28 23 00 00-0149)		
28 23 00 00-0151 EA Indoor/In-Ceiling, Color Camera Dome..... Note: Vicon model SVFT-C22. Includes variable-speed drive, in-ceiling metal housing, 22X high-sensitivity high-resolution color camera/lens with ExView technology and smoked lower dome.	2,413.99	117.90
28 23 00 00-0152 EA Indoor/Pendant, Color Camera Dome..... Note: Vicon model SVFT-P22. Includes variable-speed drive; pendant upper housing, 22X high-sensitivity high-resolution color camera/lens with ExView technology and smoked lower dome.	2,555.35	124.80
28 23 00 00-0153 EA Outdoor Camera Dome..... Note: Vicon model SVFT-W22. Includes variable-speed drive, environmental housing, 22X high-sensitivity high-resolution camera/lens with ExView technology and clear outer dome.	2,624.94	128.20
28 23 00 00-0154 SurveyorVFT 23X Day/Night Camera Dome Systems (28 23 00 00-0149)		
28 23 00 00-0155 EA Indoor In-Ceiling Day/Night Camera Dome..... Note: Includes variable-speed drive, in-ceiling metal housing, 23X day/night camera/lens with wide dynamic range and smoked lower dome. Vicon model SVFT-C23.	2,625.29	128.20
28 23 00 00-0156 EA Indoor Pendant Day/Night Camera Dome Note: Includes variable-speed drive, pendant upper housing, 23X day/night camera/lens with wide dynamic range and smoked lower dome. Vicon model SVFT-P23.	2,766.29	135.11
28 23 00 00-0157 EA Outdoor Day/Night Camera Dome Note: Includes variable-speed drive, environmental housing, 23X high-resolution day/night camera/lens with wide dynamic range and clear outer dome. Vicon model SVFT-W23.	2,835.89	138.50
28 23 00 00-0158 SurveyorVFT 35X Day/Night Camera Dome Systems (28 23 00 00-0149)		
Note: Wide dynamic range and image stabilization camera dome systems.		
28 23 00 00-0159 EA Outdoor Day/Night Camera Dome Note: Includes variable speed drive, environmental housing, 35X high-resolution day/night camera/lens with wide dynamic range and image stabilization and clear outer dome. Vicon model SVFT-W35.	3,239.37	159.66
28 23 00 00-0160 SurveyorVFT 22X Cost Effective Camera Dome Systems (28 23 00 00-0149)		
28 23 00 00-0161 EA Indoor/In-Ceiling, Color Camera Dome Note: Vicon model SVFT-C22CA. Includes variable-speed drive, housing, 22X high-resolution color camera/lens and smoked lower dome.	1,720.24	84.02
28 23 00 00-0162 EA Indoor/Pendant, Color Camera Dome..... Note: Vicon model SVFT-P22CA. Includes variable-speed drive, housing, 22X high-resolution color camera/lens and smoked lower dome.	1,772.44	86.57
28 23 00 00-0163 EA Outdoor Variable-Speed Color Camera Dome Note: Vicon model SVFT-W22CA. Includes camera drive, environmental housing, 22X high-resolution color camera/lens and clear outer dome.	1,861.60	90.92
28 23 00 00-0164 SurveyorVFT Indoor Lower Dome Options (28 23 00 00-0149)		
28 23 00 00-0165 EA Smoked Lower Dome, For SurveyorVFT Indoor Domes..... Note: Vicon model SVFT-SMK.	60.90	2.97
28 23 00 00-0166 EA Chrome Lower Dome, For SurveyorVFT Indoor Domes Note: Vicon model SVFT-CHR.	132.65	6.48
28 23 00 00-0167 EA Gold Lower Dome, For SurveyorVFT Indoor Domes Note: Vicon model SVFT-GLD.	202.25	9.88
28 23 00 00-0168 SurveyorVFT Video Transmission Options (28 23 00 00-0149)		
28 23 00 00-0169 EA Fiber Optic Option, For SurveyorVFT Domes Note: Vicon "F" option. Add -F suffix to any Surveyor VFT dome model number and substitute -30 at the end of the product code. (ex: SVFT-C22 (8701-00) becomes SVFT-C22-F (8701-30)). Use with VF-1400 series fiber receivers only (found in Fiber optic section).	837.29	40.89
28 23 00 00-0170 EA NVT Twisted Pair Option, For SurveyorVFT Domes Note: Vicon "T" option. Add -T suffix to any Surveyor VFT dome model number and substitute -40 at the end of the product code. (ex: SVFT-C22 (8701-00) becomes SVFT-C22-T (8701-40)).	34.80	1.70
28 23 00 00-0171 EA ViconNet TCP/IP Option, For SurveyorVFT Domes..... Note: Vicon "V3" option. Add "V3" suffix to any SurveyorVFT dome model number and substitute -25 at the end of the product code. (ex: SVFT-C22 (8701-00) becomes SVFT-C22-V3 (8701-25)).	801.94	40.89
28 23 00 00-0172 SurveyorVFT Hardware Options (28 23 00 00-0149)		
28 23 00 00-0173 EA Upgrade Kit, Converts Non-IP SurveyorVFT Domes To IP Version..... Note: Vicon model SVFT-IP-UPG.	978.65	47.80
28 23 00 00-0174 SurveyorVFT Pressurized Camera Dome Systems And Accessories (28 23 00 00-0149)		
28 23 00 00-0175 EA Wall Mount For SurveyorVFT Pressurized Domes Note: Vicon model SVFT-PR-WMA.	173.98	8.49



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 23 00 00-0176 EA Pipe Adapter..... Note: For mounting SurveyorVFT Pressurized Domes to 1-1/2" diameter pipe. Vicon model SVFT-PR-P.	104.39	5.10
28 23 00 00-0177 EA Fiber Optic Option For SurveyorVFT Pressurized Domes Note: Add -F suffix to any Surveyor VFT Pressurized dome model number and substitute -30 at the end of the product code. (ex: SVFT-PRS23 (8769-00) becomes SVFT-PRS23-F (8769-30)). Use with VF-1400 series fiber receivers only (found in fiber optic section). Vicon model "F" Pressurized Option.	1,576.70	77.01
28 23 00 00-0178 EA NVT Twisted Pair Option For SurveyorVFT Pressurized Domes..... Note: Add -T suffix to any Surveyor VFT Pressurized dome model number and substitute -40 at the end of the product code. (ex: SVFT-PRS23 (8769-00) becomes SVFT-PRS23-T (8769-40)). Vicon model "T" Pressurized Option.	34.80	1.70
28 23 00 00-0179 EA VICONNET TCP/IP Option For SurveyorVFT Pressurized Domes..... Note: Add "V3-V" suffix to any SurveyorVFT pressurized dome model number and substitute -25 at the end of the product code. Vicon model "V3" Pressurized Option. (ex: SVFT-PRS23 (8769-00) becomes SVFT-PRS23-V3 (8769-25)).	1,145.76	55.97
28 23 00 00-0180 EA Pressurized Camera Dome..... Note: Includes variable-speed camera drive, 22X high-resolution color camera with ExView technology and cast aluminum upper housing with clear lower dome. Vicon model SVFT-PRS22E.	3,396.17	178.66
28 23 00 00-0181 EA Pressurized Camera Dome, Day/Night, 23X High-Resolution..... Note: Includes variable-speed drive, 23X high-resolution day/night camera with wide dynamic range, cast aluminum upper housing and clear lower dome. Vicon model SVFT-PRS23.	3,591.75	185.03
28 23 00 00-0182 EA Pressurized Camera Dome, Day/Night, 35X High-Resolution..... Note: Includes variable-speed drive, 35X high-resolution day/night camera with wide dynamic range and image stabilization, cast aluminum upper housing and clear lower dome. Vicon model SVFT-PRS35.	3,910.93	185.03
28 23 00 00-0183 EA Pre-Wired Coaxial Cable..... Note: For use with Surveyor VFT pressurized dome Vicon model SVFT-PRC12.	247.79	
28 23 00 00-0184 EA Pre-Wired Twisted Pair Cable..... Note: For use with Surveyor VFT pressurized dome Vicon model SVFT-PRC12T.	268.78	
28 23 00 00-0185 SurveyorVFT Impact-Resistant Camera Domes And Accessories (28 23 00 00-0149)		
28 23 00 00-0186 EA Impact-Resistant Camera Dome, 22X High-Resolution Camera Lens Note: Includes variable-speed drive, aluminum upper housing, lower polycarbonate dome and 22X high-resolution color camera/lens. Vicon model SVFT-M22.	2,194.78	107.19
28 23 00 00-0187 EA Impact-Resistant Camera Dome, 22X High-Resolution Camera Lens Note: Includes variable-speed drive, aluminum upper housing, lower polycarbonate dome and 22X high-sensitivity high-resolution color camera/lens with ExView technology. Vicon model SVFT-M22E.	2,764.55	160.91
28 23 00 00-0188 EA Impact-Resistant Camera Dome, 23X High-Resolution Camera Lens Note: Includes variable-speed drive, aluminum upper housing, lower polycarbonate dome and 23X high-resolution day/night color camera with wide dynamic range. Vicon model SVFT-M23.	2,986.25	173.83
28 23 00 00-0189 EA Impact-Resistant Camera Dome, 35X High-Resolution Camera Lens Note: Includes variable-speed drive, aluminum upper housing, lower polycarbonate dome and 35X high-resolution day/night color camera with wide dynamic range and image stabilization. Vicon model SVFT-M35.	3,402.31	198.04
28 23 00 00-0190 SurveyorVFT Fixed Camera Domes, Color (28 23 00 00-0149)		
28 23 00 00-0191 EA Outdoor Fixed Camera Dome, 5-50 mm Varifocal Lens..... Note: Includes 1/3" ExView high-resolution color camera, 5-50 mm varifocal lens and smoked lower dome, 24 VAC. Vicon model SVFT-W550A.	1,039.53	50.77
28 23 00 00-0192 EA In-Ceiling Fixed Camera Dome, 3.3-12 mm Autoiris Varifocal Lens..... Note: Includes 1/3" ExView high-resolution color camera, 3.3-12mm autoiris varifocal lens and smoked lower dome, 24 VAC. Vicon model SVFT-C3312.	615.81	30.06
28 23 00 00-0193 EA Pendant Fixed Camera Dome, 3.3-12 mm Autoiris Varifocal Lens..... Note: Includes 1/3" ExView high-resolution color camera, 3.3-12mm autoiris varifocal lens and smoked lower dome, 24 VAC. Vicon model SVFT-P3312.	668.00	32.61
28 23 00 00-0194 EA Outdoor Fixed Camera Dome, 3.3-12 mm Autoiris Varifocal Lens Note: Includes 1/3" ExView high-resolution color camera, 3.3-12mm autoiris varifocal lens and smoked lower dome, 24 VAC. Vicon model SVFT-W3312.	827.11	40.36
28 23 00 00-0195 EA Outdoor Fixed Camera Dome, 3.3-1 mm Autoiris Varifocal Lens, D/N..... Note: Includes 1/4" ExView high-resolution color camera, 3.3-12mm autoiris varifocal lens and smoked lower dome, 24 VAC. Vicon model SVFT-W3312DN.	932.98	45.56
28 23 00 00-0196 SurveyorVFT Power Supplies For Camera Domes (28 23 00 00-0149)		
28 23 00 00-0197 EA Power Supply, 28 Volt AC Output, 2.5 Amps..... Note: For indoor SurveyorVFT camera domes. Vicon model S28PS-1.	30.44	1.49
28 23 00 00-0198 EA Power Supply, 28 Volt AC Output, 4 Amps..... Note: For outdoor SurveyorVFT camera domes. Vicon model S28WPS-1.	43.49	2.13
28 23 00 00-0199 EA Power Supply; 120 Volt AC Input / 24 Volt AC Output For Camera Domes, UL Listed Class 2/3 Note: For outdoor SurveyorVFT camera domes. Vicon model S24WPS-1.	34.29	1.49
28 23 00 00-0200 EA Power Supply, Four-Channel, 120 Volt AC Input, 24/28 Volt AC Output..... Note: 7/6.25 amps (total). Vicon model V2448-175PS.	173.98	8.49
28 23 00 00-0201 EA Power Supply, Eight-Channel, 120 Volt AC Input, 24/28 Volt AC Output Note: 12.5/10 amps (total). Vicon model V248-300PS.	226.18	11.04
28 23 00 00-0202 EA Power Supply, Eight-Channel, 120 Volt AC Input, 24 Volt AC Output Note: 25 amps (total). Vicon model V248-600PS.	260.97	12.74
28 23 00 00-0203 EA Power Supply, Sixteen-Channel, 120 Volt AC Input, 24/28 Volt AC Output Note: 25/20 amps (total). Vicon model V2416-300PS.	387.10	18.91
28 23 00 00-0204 EA Power Supply, Heavy Duty Single-Channel..... Note: For use with SurveyorVFT pressurized and outdoor impact-resistant camera domes; 28 VAC output, 6.25 amps. Vicon model S28HD-PS.	82.64	4.04
28 23 00 00-0205 SurveyorVFT Dome Mounting Options (28 23 00 00-0149)		

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MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 23 00 00-0206 EA Ceiling Panel Support, For SurveyorVFT Camera Dome Systems..... Note: Vicon model SVFT-UCP.	69.59	3.40
28 23 00 00-0207 EA Wall Mount, Indoor/Outdoor, For SurveyorVFT Camera Dome Systems..... Note: Vicon model SVFT-UWM.	126.13	6.16
28 23 00 00-0208 EA Wall Mount, Indoor/Outdoor, Short Note: For SurveyorVFT camera dome systems. Vicon model SVFT-WM.	84.82	4.15
28 23 00 00-0209 EA Ceiling Mount, Indoor/Outdoor For SurveyorVFT Camera Dome System Note: Vicon model SVFT-UCM.	43.49	2.13
28 23 00 00-0210 EA Goose Neck Parapet Mount For SurveyorVFT Camera Dome Systems Note: Vicon model SVFT-UPM-1.	280.55	13.70
28 23 00 00-0211 EA Goose Neck Roof Mount For SurveyorVFT Camera Dome Systems Note: Vicon model SVFT-URM-1.	456.70	22.31
28 23 00 00-0212 EA In-Ceiling Mount Kit For SurveyorVFT Camera Dome Systems Note: Vicon model SVFT-IC-KT.	43.49	2.13
28 23 00 00-0213 Cost-Effective Impact-Resistant Camera Dome (28 23 00 00-0149)		
28 23 00 00-0214 EA Outdoor 3" Camera Dome, Color 3.3-12mm Varifocal Autoiris Lens Note: 550 HTVL, INT/LL, 12VDC/24VAC isolated power supply. Vicon model VC-600W.	423.90	20.14
28 23 00 00-0215 EA Outdoor 3" Camera Dome, Color 3.3-12mm Varifocal Autoiris Lens Note: Day/Night. 550 HTVL, INT/LL, 12VDC/24VAC isolated power supply. Vicon model VC-600WDN.	484.80	20.14
28 23 00 00-0216 EA Outdoor 3" Camera Dome, IR Illuminated, Color 3.7mm Fixed Lens..... Note: 550 HTVL, day/night, INT/LL, 12VDC/24VAC isolated power supply. Vicon model VC-600WIR.	456.45	20.14
28 23 00 00-0217 EA Outdoor 3" Camera Dome, Color 3.3-12mm Varifocal Autoiris Lens Note: Wide dynamic range, color 3.3-12mm varifocal autoiris lens, 480 HTVL, day/night, INT/LL, 12VDC/24VAC isolated power supply. Vicon model VC-610W.	527.84	20.14
28 23 00 00-0218 Fixed Position Domes (28 23 00 00-0149)		
28 23 00 00-0219 EA 3" Camera Dome, Color, 3.3-12mm Varifocal Autoiris Lens Note: 550 HTVL, INT/LL, 12VDC/24VAC isolated power supply. Vicon model VC-600.	357.75	20.14
28 23 00 00-0220 EA 3" Camera Dome, Color, 3.3-12mm Varifocal Autoiris Lens Note: 480 HTVL, wide dynamic range, INT/LL, 12VDC/24VAC isolated power supply. Vicon model VC-610.	498.45	20.14
28 23 00 00-0221 EA Adapter Plate Note: To mount the VC-600/VC-610 into a 4" x 4" electrical box. Vicon model VC-610.	20.65	2.02
28 23 00 00-0222 Roughneck V926 Impact Resistant Camera Domes (28 23 00 00-0149)		
28 23 00 00-0223 EA In-Ceiling Dome Camera, Outdoor, 2.8 mm Varifocal Autoiris Lens Note: Includes 1/3" high-resolution color camera with ExView high-sensitivity CCD, 2.8 mm varifocal autoiris lens, heater and smoked lower dome. Vicon model V926FF-CA.	450.17	21.99
28 23 00 00-0224 EA In-Ceiling Dome Camera, Outdoor, 3.36-12 Varifocal Autoiris Lens Note: Includes 1/3" high-resolution color camera with ExView high-sensitivity CCD, 3.36-12mm varifocal autoiris lens, heater and smoked lower dome. Vicon model V926-W3312.	597.71	29.21
28 23 00 00-0225 EA In-Ceiling Dome Camera, Outdoor, 3.3-12 Varifocal Autoiris Lens Note: Includes 1/3" high-resolution color camera with ExView high-sensitivity CCD, 3.3-12mm varifocal autoiris lens, heater and smoked lower dome; UTP video transmission. Vicon model V926-W3312T.	623.81	30.48
28 23 00 00-0226 EA In-Ceiling Dome Camera, 3.3-12mm Varifocal Autoiris Lens Note: Outdoor, includes 1/3" high-resolution color camera with ExView high-sensitivity CCD, 3.3-12mm varifocal autoiris lens, heater and smoked lower dome; UTP video transmission. Vicon model V926W3312DN.	682.76	29.21
28 23 00 00-0227 Roughneck V910 Impact Resistant Camera Domes (28 23 00 00-0149)		
28 23 00 00-0228 EA Surface Mount Dome Camera, 2.8mm Varifocal Autoiris Lens..... Note: Outdoor. Includes 1/3" high-resolution color camera with ExView high-sensitivity CCD, 2.8 mm varifocal autoiris lens, heater and smoked lower dome. Vicon model V910FF-CA.	450.17	21.99
28 23 00 00-0229 EA Surface Mount Dome Camera, 3.3-12mm Varifocal Autoiris Lens..... Note: Outdoor. Includes 1/3-in. high-resolution color camera with ExView high-sensitivity CCD and 3.3-12 mm varifocal autoiris lens and heater; UTP video transmission, 24 VAC. Vicon model V910-W3312T.	623.81	30.48
28 23 00 00-0230 EA Surface Mount Day/Night Outdoor Dome Camera..... Note: Includes 1/4" high-resolution color/monochrome camera and 3.3-12mm day/night varifocal autoiris lens and heater, 24 VAC. Vicon model V910-W3312DN.	703.15	34.31
28 23 00 00-0231 EA Surface Mount Dome Camera, 3.3-12mm Varifocal Autoiris Lens..... Note: Outdoor. Includes 1/3" high-resolution color camera with ExView high-sensitivity CCD and 3.3-12mm varifocal autoiris lens and heater, 24 VAC. Vicon model V910-W3312.	597.71	29.21
28 23 00 00-0232 Roughneck V910 Mounting Options (28 23 00 00-0149)		
28 23 00 00-0233 EA Pendant Adapter, For Use With V910 Dome Series Note: Adapts V910 to work with SVFT-UWM, SVT-WM, and SVFT-UCM pendant mounts; indoor/outdoor. Vicon model V910-PH.	43.14	2.13
28 23 00 00-0234 EA In-Ceiling Mounting Kit, For Use With V910 Dome Series..... Note: For drop ceiling installations. Vicon model V910-ICD.	163.11	7.96
28 23 00 00-0235 EA In-Ceiling Mounting Kit, For Use With V910 Dome Series..... Note: For hard ceiling installations. Vicon model V910-ICH.	150.06	7.33
28 23 00 00-0236 Roughneck V910 Fixed Impact Resistant IP Camera Dome (28 23 00 00-0149)		
28 23 00 00-0237 EA Surface Mount Indoor Dome Camera Note: UTP video transmission. Vicon model V910-3312T.	550.63	24.53



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 23 00 00-0238 EA Fixed IP Outdoor Camera Dome, 3.3-12mm Autoiris Varifocal Lens..... Note: Transmits high-quality video across the network for remote viewing and recording. Compatible with ViconNet version 3.0 Network Video Recorders (NVRs) and workstations. Surface-mount; 1/3" ExView color camera and 3.3-12mm autoiris varifocal lens; heater. Vicon model V910-W3312V3.	1,391.15	67.98
28 23 00 00-0239 EA Fixed IP Outdoor Camera Dome, 3.3-12mm Autoiris Varifocal Lens..... Note: Transmits high-quality video across the network for remote viewing and recording. Compatible with ViconNet version 3.0 Network Video Recorders (NVRs) and workstations. Surface-mount; 1/4" day/night camera and 3.3-12mm autoiris varifocal lens; heater. Vicon model V910-W3312DNV3.	1,496.59	73.07
28 23 00 00-0240 EA Fixed IP Outdoor Camera Dome, 2.8mm Autoiris Varifocal Lens..... Note: Transmits high-quality video across the network for remote viewing and recording. Compatible with ViconNet version 3.0 Network Video Recorders (NVRs) and workstations. Surface-mount; 1/3" ExView color camera and 2.8mm autoiris fixed lens; heater. Vicon model V910-28V3.	1,242.76	60.75
28 23 00 00-0241 Roughneck Corner Mount High Security Camera (28 23 00 00-0149)		
28 23 00 00-0242 EA Indoor, 1/3" High-Resolution Color Camera..... Note: With ExView CCD and isolated power input, 3.3-12mm autoiris varifocal lens, brushed stainless steel finish. Vicon model V894CSH-3312.	605.06	29.21
28 23 00 00-0243 EA Indoor, 1/4" Day/Night High-Resolution Color Camera..... Note: With isolated power input, 3.3-12mm autoiris varifocal lens, brushed stainless steel finish. Vicon model V894CSH-3312DN.	703.15	34.31
28 23 00 00-0244 Roughneck Wall Mount High Security Camera (28 23 00 00-0149)		
28 23 00 00-0245 EA Indoor, 1/3" High-Resolution Color Camera..... Note: With ExView CCD and isolated power input, 3.3-12mm autoiris varifocal lens, brushed stainless steel finish. Vicon model V894WSH-3312.	605.06	29.21
28 23 00 00-0246 EA Indoor, 1/4" Day/Night High-Resolution Camera..... Note: With isolated power input, 3.3-12mm autoiris varifocal lens, brushed stainless steel finish. Vicon model V894WSH-3312DN.	703.15	34.31
28 23 00 00-0247 Environmental Housing Cameras (28 23 00 00-0149)		
28 23 00 00-0248 EA Outdoor, 1/3" Day/Night Color Camera..... Note: 3.3-12mm Autoiris varifocal lens, 550 TVL resolution, 12VDC/24VAC; IR illumination; metallic gray aluminum. Vicon model VC-620.	502.37	24.54
28 23 00 00-0249 EA Outdoor, 1/3" Day/Night Color Camera..... Note: 5-50mm autoiris varifocal lens, 550 TVL resolution, 12VDC/24VAC; IR illumination; metallic gray aluminum. Vicon model VC-621.	1,040.99	24.54
28 23 00 00-0250 Monochrome Cameras (28 23 00 00-0149)		
28 23 00 00-0251 EA 1/3" Format, 24 Volt AC, 380 Lines Resolution..... Note: With linear shutter. Vicon model VC2153A-24.	150.06	7.33
28 23 00 00-0252 EA 1/3" Format, 24 Volt AC, 580 Lines High-Resolution..... Note: With linear shutter. Vicon model VC2430A-24.	210.95	10.30
28 23 00 00-0253 Color Cameras (28 23 00 00-0149)		
28 23 00 00-0254 EA 1/3" Format, 24 Volt AC, 330 TVL (0.2 lux)..... Note: Vicon model VC355-DSP.	210.95	10.30
28 23 00 00-0255 EA 1/3" Format, High-Resolution Color, 480 TVL (0.4 lux)..... Note: Vicon model VC365-DSP.	245.75	12.00
28 23 00 00-0256 EA 1/3" Format, High-Resolution Color, 480 TVL (0.4 lux), ExView..... Note: ExView Super HAD CCD. Vicon model VC465-DSP.	326.21	15.93
28 23 00 00-0257 EA 1/3" Format, DSP, 3.3-12mm Autoiris Varifocal Lens..... Note: 480 TVL (0.2 lux), 12VDC/24VAC. Vicon model VC-630.	344.48	15.93
28 23 00 00-0258 Day/Night Cameras (28 23 00 00-0149)		
28 23 00 00-0259 EA Day/Night Camera, 1/3" Format..... Note: 24 VAC high-resolution color/monochrome operation; 480 TVL (day) and 580 TVL (night) horizontal resolution. Vicon model VC565DN.	440.77	27.51
28 23 00 00-0260 EA Wide Dynamic Range Day/Night Camera..... Note: Color/Monochrome operation, C/CS mount, 480 HTVL, INT/LL, 12VDC/24VAC isolated power supply. Vicon model VC632.	506.92	27.51
28 23 00 00-0261 Camera Power Supplies (28 23 00 00-0149)		
28 23 00 00-0262 EA Power Supply, Converts 120 Volt AC To 24 Volt AC..... Note: Vicon model VC24PS-1.	15.22	0.74
28 23 00 00-0263 EA Power Supply, For Roughneck Corner And Wall Mount Cameras..... Note: Converts 120 VAC to 12 VDC, 0.5 amps. Vicon model V894PS-12.	34.80	1.70
28 23 00 00-0264 EA Power Supply, 8-Channel, Converts 120 Volt AC To 24 Volt AC..... Note: 0.4 Amps/channel; used for fixed cameras with isolation. Vicon model V248-3.5PS.	184.85	9.03
28 23 00 00-0265 EA Power Supply, 16-Channel, Converts 120 Volt AC To 24 Volt AC..... Note: 0.5 Amps/channel; used for fixed cameras with isolation. Vicon model V2416-8PS.	343.61	16.78
28 23 00 00-0266 Pan And Tilt Devices (28 23 00 00-0148)		
28 23 00 00-0267 Pan-And-Tilt Drives (28 23 00 00-0266)		

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MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 23 00 00-0268 EA 7.5 LB Load, Indoor, With Integral Wall Mount Note: Vicon model V3030APT.	297.94	14.55
28 23 00 00-0269 EA 7.5 LB Load, Indoor, With Square Base..... Note: For mounting on horizontal surfaces. Vicon model V3030APT-SB.	297.94	14.55
28 23 00 00-0270 EA 10 LB Load, Outdoor..... Note: Vicon model V3400APT-1.	615.46	30.06
28 23 00 00-0271 EA 35 LB Load, Outdoor..... Note: Vicon model VIST35.	826.41	40.36
28 23 00 00-0272 EA 35 LB Load, Outdoor, With Autopan Note: Vicon model VIST35-AP.	878.61	42.91
28 23 00 00-0273 EA 35 LB Load, Outdoor, With Preset Operation Note: Vicon model VIST35-P.	1,054.76	51.52
28 23 00 00-0274 EA 25 LB Load, Outdoor, Variable Speed With Preset Operation Note: Vicon model VIST-VP.	1,143.92	55.87
28 23 00 00-0275 EA 25 LB Load, Outdoor, Variable Speed With Continuous Rotation..... Note: Also with preset operation. Vicon model VIST25-VRP.	1,585.41	77.43
28 23 00 00-0276 EA 80 LB Load, Outdoor..... Note: Vicon model V390APT.	1,757.21	85.82
28 23 00 00-0277 EA 80 LB Load, Outdoor, With Preset Operation Note: Vicon model V390APT-PP.	2,098.64	102.50
28 23 00 00-0278 EA 80 LB Load, Explosion Proof Note: Meets IEC class IIC rating requirements (minimum 25 pieces order required). Vicon model V380PTX-S-VPP.	5,280.33	257.89
28 23 00 00-0279 Pan-And-Tilt Options (28 23 00 00-0266)		
28 23 00 00-0280 EA Square Base Option For 10 LB Load Outdoor Pan And Tilt Device..... Note: Vicon model V3400SB.	43.49	2.13
28 23 00 00-0281 Camera Housings (28 23 00 00-0148)		
28 23 00 00-0282 Indoor Camera Housings (28 23 00 00-0281)		
28 23 00 00-0283 EA 6.4" W x 12.6" L In-Ceiling, All-Plastic Construction Note: Vicon model V8612H. Tamperproof.	95.69	4.67
28 23 00 00-0284 Indoor/Outdoor Camera Housings (28 23 00 00-0281)		
28 23 00 00-0285 EA Small, 2-Piece Hinged Aluminum..... Note: Vicon model V9312H.	87.00	4.25
28 23 00 00-0286 EA Small, 2-Piece Hinged Aluminum, Sunshield..... Note: Vicon model V9312H-HS-24. Includes 24 VAC heater.	171.80	8.39
28 23 00 00-0287 EA Small, 1-Piece, Extruded Aluminum With Plastic End Caps Note: Vicon model V4.5H-12-1.	102.22	4.99
28 23 00 00-0288 EA Medium, 1-Piece, Extruded Aluminum With Plastic End Caps Note: Vicon model V4.5H-15-1.	104.39	5.10
28 23 00 00-0289 EA Medium, 2-Piece, Hinged Aluminum With Sunshield..... Note: Vicon model V9315HC-HS. Includes 24 VAC transformer, and 120 VAC heater.	191.38	9.35
28 23 00 00-0290 EA Medium, 2-Piece, Hinged Aluminum With Sunshield..... Note: Vicon model V9315H-HS-24. Includes 24 VAC heater.	187.03	9.14
28 23 00 00-0291 EA Medium, 2-Piece, Hinged Extruded Aluminum With Sunshield..... Note: Vicon model V9317H-SHB-24. Includes 24VAC blower/heater.	239.23	11.69
28 23 00 00-0292 Indoor/Outdoor Camera Housings With Wiper (28 23 00 00-0281)		
28 23 00 00-0293 EA Medium, 2-Piece, Hinged Aluminum..... Note: Vicon model V9315H-WH-24. Includes 24 VAC heater and wiper.	237.05	11.58
28 23 00 00-0294 Special Purpose Housings (28 23 00 00-0281)		
28 23 00 00-0295 EA Explosion-Proof, Tubular Aluminum..... Note: Vicon model V8540H-SP.	1,054.76	51.52
28 23 00 00-0296 EA Maximum Security, 10-Gauge Steel, Wall Or Ceiling Mount..... Note: Vicon model V894MSH.	439.30	21.46
28 23 00 00-0297 EA Maximum Security, Outdoor, 10-Gauge Steel, Wall Or Ceiling Mount..... Note: Vicon model V896MSH.	474.10	23.15
28 23 00 00-0298 EA Maximum Security, 10-Gauge Steel, Corner Mount..... Note: Vicon model V898MSH.	474.10	23.15
28 23 00 00-0299 Indoor Housing Accessories (28 23 00 00-0281)		
28 23 00 00-0300 EA 2' x 2' Adjustable Ceiling Panel, Aluminum Construction Note: 360° rotation. Vicon model V8612H-ACP. For Vicon model V8612H.	126.13	6.16
28 23 00 00-0301 Lenses (28 23 00 00-0148)		
28 23 00 00-0302 1/3" Varifocal Lenses (28 23 00 00-0301)		
28 23 00 00-0303 EA Varifocal, 2.8-6 mm, F/1.4, Adjustable Iris Note: Vicon model V2.8-6VFI.	91.34	4.46
28 23 00 00-0304 EA Varifocal, 3.5-8 mm, F/1.4, Adjustable Iris Note: Vicon model V3.5-8VFI-2.	80.47	3.93



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 23 00 00-0305 EA Varifocal, 2.8-12 mm, F/1.2, Adjustable Iris Note: Vicon model V2.8-12VFI.	91.34	4.46
28 23 00 00-0306 EA Varifocal, 5-50 mm, F/1.3, Adjustable Iris Note: Vicon model V5-50VFI.	193.55	9.46
28 23 00 00-0307 1/3" Autoiris Lenses, DC-Type (28 23 00 00-0301)		
28 23 00 00-0308 EA Wide Angle, 4 mm, F/1.2 Note: Vicon model V4.0-1.2CS-G-3.	104.39	5.10
28 23 00 00-0309 1/3" Varifocal Autoiris Lenses, DC-Type (28 23 00 00-0301)		
28 23 00 00-0310 EA Varifocal, 3.5-8 mm, F/1.4, Autoiris..... Note: Vicon model V3.5-8VF-CS-G-4.	104.39	5.10
28 23 00 00-0311 EA Varifocal, 2.8-12 mm, F/1.2, Autoiris..... Note: Vicon model V2.8-12VF-CS-G.	126.13	6.16
28 23 00 00-0312 EA Varifocal, 5-50 mm, f/1.3, Autoiris..... Note: Vicon model V5-50VF-CS-G.	237.05	11.58
28 23 00 00-0313 EA Varifocal, 2.7-8 mm, F/1.0, Autoiris..... Note: Vicon model V2.7-8VF-CS-G.	126.93	6.80
28 23 00 00-0314 Motorized Zoom Lenses With Spot Filter And Autoiris (28 23 00 00-0301)		
28 23 00 00-0315 EA 1/3" Format, 10x Zoom Range, F/1.2, CS Mount, High-Speed..... Note: Vicon model V6-60AC-HS-1.	722.02	35.26
28 23 00 00-0316 EA 1/2" Format, 10x Zoom Range, F/1.4, C Mount, High-Speed Note: Vicon model V8-80AC-HS-1.	702.45	34.31
28 23 00 00-0317 Mounting Equipment (28 23 00 00-0148)		
28 23 00 00-0318 Wall Mounts With Adjustable Heads (28 23 00 00-0317)		
28 23 00 00-0319 EA Wall Mount, 7.5 LB Load, Molded Plastic, 9" Long..... Note: Mounts to junction box. Vicon model V1100AWM.	36.97	1.81
28 23 00 00-0320 EA Wall Mount, 20 LB Load, Aluminum, 10" Long Note: Vicon model V110AWM.	30.44	1.49
28 23 00 00-0321 EA Wall Mount, 20 LB Load, Cast Aluminum, 11.6" Long Note: Vicon model V814AWM.	30.44	1.49
28 23 00 00-0322 Fixed Wall Mounts (28 23 00 00-0317)		
28 23 00 00-0323 EA Wall Mount 40 LB Load, Aluminum, 16" Long Note: Vicon model V1600WM.	69.59	3.40
28 23 00 00-0324 EA Wall Mount 200 LB Load, Steel, 24" Long Note: Vicon model V24WM.	80.47	3.93
28 23 00 00-0325 EA Wall Mount 200 LB Load, Stainless Steel, 24" Long Note: Vicon model V24WM-SS.	263.15	12.85
28 23 00 00-0326 Adjustable Heads (28 23 00 00-0317)		
28 23 00 00-0327 EA Adjustable Head, Medium-Duty, 60 LB Capacity..... Note: Vicon model V1600AH.	28.27	1.39
28 23 00 00-0328 EA Adjustable Head, Medium To Heavy-Duty, 100 LB Capacity..... Note: Vicon model V2400AH.	89.17	4.36
28 23 00 00-0329 Accessories For Wall Mounts (28 23 00 00-0317)		
28 23 00 00-0330 EA Outside Corner Mount Bracket Note: Vicon model V24CMB. For V24WM and surveyor series wall mounts.	71.77	3.50
28 23 00 00-0331 Ceiling Mounts (28 23 00 00-0317)		
28 23 00 00-0332 EA Ceiling Mount, 7.5 LB Load, Molded Plastic, 6" Long..... Note: Vicon model V800ACM.	30.44	1.49
28 23 00 00-0333 EA Ceiling Mount, 20 LB Load, Aluminum, 9" Long Note: Vicon model V8ACM.	36.97	1.81
28 23 00 00-0334 EA Ceiling Mount, 20 LB Load, Steel, Chrome Plated, 11" Long Note: Vicon model V10UM.	54.37	2.65
28 23 00 00-0335 Pole And Parapet Mounts (28 23 00 00-0317)		
28 23 00 00-0336 EA Pole Mount For 3"-4" Diameter Poles, Medium Duty Note: Vicon model V22PA. Use with V1600WM and V2000WM wall mounts.	132.65	6.48
28 23 00 00-0337 EA Pole Mount Adapter For 4"-10" Diameter Poles..... Note: Vicon model V20B. Painted Aluminum construction, no mounting straps.	121.62	5.99
28 23 00 00-0338 EA Pole Mount Adapter For 4"-10" Diameter Poles..... Note: Vicon model V20B-A. Painted Aluminum construction, includes mounting straps.	167.39	8.25
28 23 00 00-0339 Multiplexers And Quads (28 23 00 00-0043)		

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MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 23 00 00-0340 Aurora A2000 Color Video Multiplexers With PTZ Control (28 23 00 00-0339)		
28 23 00 00-0341 EA 16-Channel Color Simplex Multiplexer, 30 Images Per Second Note: Live view refresh. Vicon model AUR2K-SC3.	1,492.74	20.14
28 23 00 00-0342 EA 16-Channel Color Duplex Multiplexer, 30 Images Per Second Note: Live view refresh. Vicon model AUR2K-DC3.	1,989.71	20.14
28 23 00 00-0343 EA 16-Channel Color Duplex Multiplexer, 60 Images Per Second Note: Live view refresh. Vicon model AUR2K-DC6.	2,201.45	20.14
28 23 00 00-0344 Aurora A2000 Color Video Multiplexers With Looping Cables (28 23 00 00-0339) Note: With PTZ control.		
28 23 00 00-0345 EA 16-Channel Color Simplex Multiplexer, 30 Images Per Second Note: Live view refresh. Includes looping cables. Vicon model AUR2K-SC3C.	1,534.74	20.14
28 23 00 00-0346 EA 16-Channel Color Duplex Multiplexer, 30 Images Per Second Note: Live view refresh. Includes looping cables. Vicon model AUR2K-DC3C.	2,031.71	20.14
28 23 00 00-0347 EA 16-Channel Color Duplex Multiplexer, 60 Images Per Second Note: Live view refresh. Includes looping cables. Vicon model AUR2K-DC6C.	2,245.20	20.14
28 23 00 00-0348 GENESYS Quad Splitter (28 23 00 00-0339)		
28 23 00 00-0349 EA Real-Time Color Quad Splitter Note: Displays four cameras on one monitor. Full-featured with alarms, titling, freeze, full-screen sequential switching and on-screen programming. Vicon model V4400QS-1.	640.54	20.14
28 23 00 00-0350 Monitors And Time Lapse Recorders (28 23 00 00-0043)		
28 23 00 00-0351 Monochrome Monitors (28 23 00 00-0350)		
28 23 00 00-0352 EA 9" Screen, High Resolution, 1,000 TV Lines Note: Vicon model VM5094.	207.71	13.42
28 23 00 00-0353 EA 12" Screen, High Resolution, 1,000 TV Lines Note: Vicon model VM5124.	223.46	13.42
28 23 00 00-0354 EA 15" Screen, High Resolution, 1,000 TV Lines Note: Vicon model VM5124.	307.46	13.42
28 23 00 00-0355 Color Monitors (28 23 00 00-0350)		
28 23 00 00-0356 EA 9" Screen 280 Lines Resolution Note: Vicon model VM6093.	618.93	13.42
28 23 00 00-0357 EA 14" Screen 400 Lines Resolution, NTSC/PAL Note: Vicon model VM614-3.	407.19	13.42
28 23 00 00-0358 EA 15" Screen 650 TV Lines High Resolution, NTSC/PAL Note: Vicon model VM615-5.	576.93	13.42
28 23 00 00-0359 EA 21" Screen 450 TV Lines High Resolution, Accepts NTSC/PAL Note: Vicon model VM621-5.	501.68	13.42
28 23 00 00-0360 EA 17" Flat Panel LCD Monitor Note: Resolution up to 1280 x 1024 (depending on scan rate); VGA, BNC, or S-Video video input and output; accepts NTSC/PAL. Vicon model VM-617LCD.	940.91	13.42
28 23 00 00-0361 EA 19" Flat Panel LCD Monitor Note: Resolution up to 1280x1024@60/75Hz depending on scan rate. VGA, BNC, or S-Video video input and output; accepts NTSC/PAL. Vicon model VM-619LCD.	1,109.95	13.42
28 23 00 00-0362 Monitor Mounting Accessories (28 23 00 00-0350)		
28 23 00 00-0363 EA Monitor Mount, For VM621-5 Monitor Note: May be mounted to ceiling with V1502CA ceiling mount or to a wall with V1501WM wall mount. Vicon model VM615-5-MM.	387.10	18.91
28 23 00 00-0364 EA Monitor Mount, For VM614-3 And VM615-5 Monitors Note: May be mounted to ceiling with V1502CA ceiling mount or to a wall with V1501WM wall mount. Vicon model VM61514-5-MM.	386.40	18.91
28 23 00 00-0365 EA Wall Mount For V161514-5-MM And V1621-5-MM Monitor Mounts Note: Vicon model V1501WM.	114.91	5.63
28 23 00 00-0366 EA Ceiling Mount For V161514-5-MM And V1621-5-MM Monitor Mounts Note: Vicon model V1502CA.	74.30	3.61
28 23 00 00-0367 EA Rack Kit For Use With VM-617LCD Monitor Note: Vicon model VM-617LCD-RK.	46.98	3.61
28 23 00 00-0368 EA Rack Kit For Use With VM-619LCD Monitor Note: Vicon model VM-619LCD-RK.	46.98	3.61
28 23 00 00-0369 Monitor Racking Kits (28 23 00 00-0350)		
28 23 00 00-0370 EA Dual Rack-Mounting Kit For Two VM6093 Monitors Note: Vicon model VM6092RK.	87.00	4.25
28 23 00 00-0371 EA Single Rack-Mounting Kit For VM615-5 Monitor Note: Vicon model VM615-5-RK.	108.75	5.31
28 23 00 00-0372 Time-Lapse Video Cassette Recorders (28 23 00 00-0350)		
28 23 00 00-0373 EA Video Cassette Recorder 480 Hour Time-Lapse Note: Vicon model VCR480TL.	471.95	13.42



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 23 00 00-0374 Video Recorder Rack Mount Kit <small>(28 23 00 00-0350)</small>		
28 23 00 00-0375 EA Rack Kit For Mounting VCR480TL..... Note: Vicon model VCR-RK-1.	86.30	4.25
28 23 00 00-0376 Video Signal Equipment <small>(28 23 00 00-0043)</small>		
28 23 00 00-0377 Amplifiers <small>(28 23 00 00-0376)</small>		
28 23 00 00-0378 EA Distribution Amplifier, One Input, Six Outputs, Phase 8..... Note: Vicon model V210DA.	206.56	20.14
28 23 00 00-0379 EA Distribution Amplifier, One Input, Six Outputs, Desk-Top Note: Vicon model V210DA-B.	206.56	20.14
28 23 00 00-0380 EA Video Distribution Amplifier, Rack Mount..... Note: 8 Input x 2 output or 2 input or 8 output configurations. Vicon model VDA8-16.	238.06	20.14
28 23 00 00-0381 Phase Eight Racking Systems <small>(28 23 00 00-0376)</small>		
28 23 00 00-0382 EA Rack Accepts Any Combination Of Phase 8 Modules Note: Totaling eight single-width units. Vicon model VP8RK.	63.07	3.08
28 23 00 00-0383 EA Closure Panel, Single Width Closure Panel For VP8RK Note: Vicon model VP8-CP-1.	10.88	0.53
28 23 00 00-0384 EA Closure Panel, Double Width Closure Panel For VP8RK Note: Vicon model VP8-CP-2.	17.40	0.85
28 23 00 00-0385 Ground Loop Corrector <small>(28 23 00 00-0376)</small>		
28 23 00 00-0386 EA Passive Ground Loop Correction Transformer Note: Single channel, for Vicoax. Vicon model V235GLTA.	121.79	5.94
28 23 00 00-0387 Twisted Pair Video Transmission <small>(28 23 00 00-0376)</small>		
28 23 00 00-0388 EA Video Transceiver, Transmits Or Receives Video And Vicoax Data..... Note: Transmits or receives video and Vicoax data up to 500' over twisted-pair wire (can be used as receiver for UTP camera domes). Vicon model V212-NVT.	93.52	4.57
28 23 00 00-0389 EA Video Transceiver, Transmits Or Receives Video And Vicoax Data..... Note: Transmits or receives video and Vicoax data up to 1000' over twisted-pair wire (can be used as receiver for UTP camera domes). Vicon model V213-NVT.	139.18	6.80
28 23 00 00-0390 EA Video Receiver, Receives Video From V213-NVT Transmitter..... Note: Up to 3000' over twisted-pair wire (can be used as receiver for UTP camera domes). Vicon model V652R-NVT.	350.13	17.10
28 23 00 00-0391 Surge Protectors <small>(28 23 00 00-0376)</small>		
28 23 00 00-0392 EA Surge Protector..... Note: Protects video equipment from induced power surges in video lines. Vicon model V15LPG.	45.68	2.23
28 23 00 00-0393 Fiber Optic Transmission Equipment <small>(28 23 00 00-0043)</small>		
28 23 00 00-0394 Single Channel Video Transmission <small>(28 23 00 00-0393)</small>		
28 23 00 00-0395 EA Video Transmitter, 13 dB..... Note: Vicon model V700T.	214.00	10.45
28 23 00 00-0396 EA Video Transmitter, 13 dB, Rack Mount..... Note: Vicon model V700T-R.	236.18	11.54
28 23 00 00-0397 EA Video Receiver, 13 dB..... Note: Vicon model V700R.	259.67	12.68
28 23 00 00-0398 EA Video Receiver, 13 dB, Rack Mount..... Note: Vicon model V700R-R.	259.67	12.68
28 23 00 00-0399 EA Video Receiver, 2-Channel, 2-Fibers, 13 dB, Rack Mount Note: Vicon model V702R-R.	471.06	23.00
28 23 00 00-0400 EA Video Transmitter, 13 dB..... Note: Vicon model V701T.	262.28	12.81
28 23 00 00-0401 EA Video Transmitter, 13 dB, Rack Mount..... Note: Vicon model V701T-R.	262.28	12.81
28 23 00 00-0402 EA Video Receiver, 13 dB..... Note: Vicon model V701R.	315.78	15.42
28 23 00 00-0403 EA Video Receiver, 13 dB, Rack Mount..... Note: Vicon model V701R-R.	315.78	15.42
28 23 00 00-0404 Multi-channel Video Transmission <small>(28 23 00 00-0393)</small>		
28 23 00 00-0405 EA Video Transmitter, 4-Channel..... Note: Vicon model V707T.	1,193.95	58.31
28 23 00 00-0406 EA Video Transmitter, 4-Channel, Rack Mount..... Note: Vicon model V707T-R.	1,193.95	58.31
28 23 00 00-0407 EA Video Receiver, 4-Channel..... Note: Vicon model V707R.	1,193.95	58.31
28 23 00 00-0408 EA Video Receiver, 4-Channel, Rack Mount..... Note: Vicon model V707R-R.	1,193.95	58.31
28 23 00 00-0409 EA Video Transmitter, 2-Channel..... Note: Vicon model V703T.	641.99	31.36

28 Electronic Safety And Security**28 20 Electronic Surveillance****28 23 Video Surveillance**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 23 00 00-0410 EA Video Transmitter, 2-Channel, Rack Mount..... Note: Vicon model V703T-R.	641.99	31.36
28 23 00 00-0411 EA Video Receiver, 2-Channel..... Note: Vicon model V703R.	641.99	31.36
28 23 00 00-0412 EA Video Receiver, 2-Channel, Rack Mount..... Note: Vicon model V703R-R.	641.99	31.36
28 23 00 00-0413 Bidirectional Video For Vicoax (28 23 00 00-0393)		
28 23 00 00-0414 EA Bidirectional Fiber-Optic Transmitter, For Vicoax..... Note: Vicon model V739T.	823.36	40.21
28 23 00 00-0415 EA Bidirectional Fiber-Optic Transmitter, For Vicoax, Rack Mount..... Note: Vicon model V739T-R.	823.36	40.21
28 23 00 00-0416 EA Bidirectional Fiber-Optic Receiver, For Vicoax..... Note: Vicon model V739R.	823.36	40.21
28 23 00 00-0417 EA Bidirectional Fiber-Optic Receiver, For Vicoax, Rack Mount..... Note: Vicon model V739R-R.	823.36	40.21
28 23 00 00-0418 Video And Data Transmission (28 23 00 00-0393)		
28 23 00 00-0419 EA Video Receiver, Standalone Fiber Receiver, 1 Channel..... Note: For use with V910 fixed camera dome internal fiber trans module. Vicon model VF-140R.	795.83	40.68
28 23 00 00-0420 EA Video Receiver, Standalone Fiber Receiver, 1 Channel, Rack Mount..... Note: For use with V910 fixed camera dome internal fiber trans module. Vicon model VF-140RR.	795.83	40.68
28 23 00 00-0421 EA Video/Data Transmitter, Single Fiber, Duplex RS-422..... Note: Simplex Video, For NOVA Systems. Vicon model V732T.	833.63	40.68
28 23 00 00-0422 EA Video/Data Receiver, Single Fiber, Duplex RS-422..... Note: Simplex Video, For NOVA Systems. Vicon model V732R.	833.63	40.68
28 23 00 00-0423 EA Video/Data Receiver, Single Fiber, Duplex RS-422, Rack Mount..... Note: Simplex Video, For NOVA Systems. Vicon model V732R-R.	833.63	40.68
28 23 00 00-0424 Racking Equipment And Power Supplies (28 23 00 00-0393)		
28 23 00 00-0425 EA Special 19" Rack Panel..... Note: Houses 3 V-VH439 4-channel UTP transmitters. Vicon model V-RK439.	190.36	8.47
28 23 00 00-0426 EA Special 19" Rack Panel Assemblies..... Note: Includes 3 V-VH439 4-channel UTP transmitters. Vicon model V-VRK439X3.	2,235.78	99.59
28 23 00 00-0427 EA Winsted 35" Vertical Rack..... Note: Vicon model VW-RACK-PKG5.	1,565.05	69.72
28 23 00 00-0428 EA 15-Channel Rack, With 6 Amp Power Supply..... Note: Vicon model V515R-PS.	1,060.78	43.13
28 23 00 00-0429 EA 17-Channel Rack, Use With V517E-PS..... Note: Vicon model V517R-PS.	420.04	17.08
28 23 00 00-0430 EA Blank Filler Panel, For Rack, 1" Wide..... Note: Vicon model VOP-CP1.	30.09	1.22
28 23 00 00-0431 EA High-Output Power Supply, 19" Rack Mount..... Note: Powers two V517R-PS racks. Vicon model V517E-PS.	1,072.07	43.59
28 23 00 00-0432 EA Power Supply, 120 Volt AC To 12 Volt DC..... Note: Vicon model VOPPS-120DC.	42.64	1.74
28 23 00 00-0433 EA Power Supply, 120 Volt AC To 12 Volt DC, High Output..... Note: Vicon model VOPPS-120HDC.	76.49	3.11
28 23 00 00-0434 SurveyorVFT Fiber Receivers And Racking (28 23 00 00-0393)		
28 23 00 00-0435 EA Video/Data Receiver, Single Fiber, Duplex RS-422, Simplex Video..... Note: For use with SurveyorVFT fiber domes only. Vicon model VF-1400R.	832.05	40.28
28 23 00 00-0436 EA Video/Data Receiver Rack Mount, Single Fiber, Duplex RS-422..... Note: Simplex video. For use with SurveyorVFT fiber domes only. Vicon model VF-1400R.	832.05	40.28
28 23 00 00-0437 EA Rack, 14 Slots, With 100 W Power Supply..... Note: For use with VF-1400 series receivers. Blank panels are VF-BPS-1. Vicon model VF-1400R.	1,123.27	54.87
28 23 00 00-0438 EA Blank Panel, For Use With VF-SR20/2 Rack..... Note: Vicon model VF-BPS-1.	23.49	1.14
28 23 00 00-0439 EA Video/Data Receiver, Stand Alone..... Note: For use with SVFT camera dome internal fiber trans module. Vicon model VF-1631R.	832.05	40.28
28 23 00 00-0440 EA Video/Data Receiver, Rack Module..... Note: For use with SVFT camera dome internal fiber trans module. Vicon model VF-1631RR.	832.05	40.28
28 23 00 00-0441 Hubs And Terminators (28 23 00 00-0393)		
28 23 00 00-0442 EA 75-OHM Terminator For Unused Video Looping BNCs..... Note: Vicon model V75T.	4.35	0.21
28 23 00 00-0443 EA Special 4-Port Video Mini-Hub, 3000' Maximum Distance..... Note: 4-Channel UTP transmitter. Vicon model V-VH439.	664.34	29.59
28 23 00 00-0444 System Controls And Matrix Systems (28 23 00 00-0043)		
28 23 00 00-0445 NOVA V1422 UTP Or Coaxial 32 x 8 Matrix System (28 23 00 00-0444)		
28 23 00 00-0446 EA Advanced Digital Control And Matrix Switcher..... Note: 32 Camera inputs, 8 monitor outputs. Full camera station control and matrix switching. NOVA and Vicoax compatible. Includes V1400VGC Windows-based configuration software. Vicon model V1422.	3,179.64	20.14



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 23 00 00-0447				NOVA V1344 Matrix Prepacs <small>(28 23 00 00-0444)</small> Note: Programmable systems with internal CPU.		
			EA	Controls 8 Cameras And 8 Monitors..... Note: Includes 1 switcher card cage, V1344SCPU-HDA internal CPU, programming keyboard and 9" monochrome monitor. Vicon model V8X8-ICPS.	3,340.42	33.23
			EA	Controls 16 Cameras And 8 Monitors..... Note: Includes 1 switcher card cage, V1344SCPU-HDA internal CPU, programming keyboard and 9" monochrome monitor. Vicon model V16X8-ICPS.	3,740.72	34.24
			EA	Controls 24 Cameras And 8 Monitors..... Note: Includes 1 switcher card cage, V1344SCPU-HDA internal CPU, programming keyboard and 9" monochrome monitor. Vicon model V24X8-ICPS.	4,375.51	35.25
			EA	Controls 32 Cameras And 8 Monitors..... Note: Includes 1 switcher card cage, V1344SCPU-HDA internal CPU, programming keyboard and 9" monochrome monitor. Vicon model V32X8-ICPS.	4,541.32	36.26
			EA	Controls 40 Cameras And 8 Monitors..... Note: Includes 1 switcher card cage, V1344SCPU-HDA internal CPU, programming keyboard and 9" monochrome monitor. Vicon model V40X8-ICPS.	4,941.62	37.26
			EA	Controls 48 Cameras And 8 Monitors..... Note: Includes 1 switcher card cage, V1344SCPU-HDA internal CPU, programming keyboard and 9" monochrome monitor. Vicon model V48X8-ICPS.	5,207.17	38.27
			EA	Controls 56 Cameras And 8 Monitors..... Note: Includes 1 switcher card cage, V1344SCPU-HDA internal CPU, programming keyboard and 9" monochrome monitor. Vicon model V56X8-ICPS.	5,479.73	39.28
			EA	Controls 64 Cameras And 8 Monitors..... Note: Includes 1 switcher card cage, V1344SCPU-HDA internal CPU, programming keyboard and 9" monochrome monitor. Vicon model V64X8-ICPS.	5,829.28	40.28
			EA	Controls 72 Cameras And 8 Monitors..... Note: Includes 1 switcher card cage, V1344SCPU-HDA internal CPU, programming keyboard and 9" monochrome monitor. Vicon model V72X8-ICPS.	5,986.34	41.30
			EA	Controls 80 Cameras And 8 Monitors..... Note: Includes 1 switcher card cage, V1344SCPU-HDA internal CPU, programming keyboard and 9" monochrome monitor. Vicon model V80X8-ICPS.	6,346.39	42.30
			EA	Controls 88 Cameras And 8 Monitors..... Note: Includes 1 switcher card cage, V1344SCPU-HDA internal CPU, programming keyboard and 9" monochrome monitor. Vicon model V88X8-ICPS.	6,781.69	43.30
			EA	Controls 96 Cameras And 8 Monitors..... Note: Includes 1 switcher card cage, V1344SCPU-HDA internal CPU, programming keyboard and 9" monochrome monitor. Vicon model V96X8-ICPS.	7,076.99	44.32
			EA	Controls 104 Cameras And 8 Monitors..... Note: Includes 1 switcher card cage, V1344SCPU-HDA internal CPU, programming keyboard and 9" monochrome monitor. Vicon model V104X8-ICPS.	7,563.03	45.32
			EA	Controls 112 Cameras And 8 Monitors..... Note: Includes 1 switcher card cage, V1344SCPU-HDA internal CPU, programming keyboard and 9" monochrome monitor. Vicon model V112X8-ICPS.	7,837.35	46.33
			EA	Controls 120 Cameras And 8 Monitors..... Note: Includes 1 switcher card cage, V1344SCPU-HDA internal CPU, programming keyboard and 9" monochrome monitor. Vicon model V120X8-ICPS.	8,113.40	47.33
			EA	Controls 128 Cameras And 8 Monitors..... Note: Includes 1 switcher card cage, V1344SCPU-HDA internal CPU, programming keyboard and 9" monochrome monitor. Vicon model V128X8-ICPS.	8,389.46	48.34
28 23 00 00-0464				NOVA V1344 Internal CPU And Titler <small>(28 23 00 00-0444)</small>		
			EA	Internal CPU For Matrix Switcher Card Cage..... Note: Controls video switcher, pan-and-tilt, lens and auxiliary functions. Controls matrix switching for up to 128 cameras and 24 monitors. Vicon model V1344SCPU-HDA.	1,131.65	13.42
			EA	Time/Date/Titler Card..... Note: Provides three lines for titling and one line for time and date. Used with V1344 CPU system only. Vicon model V1344STDT-HD.	380.94	13.42
			EA	Programming Keyboard For V1344SCPU, V1466SCPU-A And V1500 CPUs..... Note: Vicon model V1300X-PKA.	162.20	13.42
28 23 00 00-0468				MATRIX 44 High Density Switcher Components <small>(28 23 00 00-0444)</small>		
			EA	Card Cage 128 Inputs x 8 Outputs..... Note: Contains power supply, video output amplifier, and motherboard for up to 16 V4410S-HD video switching cards. Vicon model V4481SCC-HD.	1,643.23	20.14
			EA	Video Switch Card..... Note: Switching and decoding circuitry for eight camera inputs. Connector panel V4411RP-BNC or V4411RP-RIB ordered separately. Vicon model V4410S-HD.	308.82	15.08
			EA	Rear Connector Panel, 1 Ribbon Cable Connector..... Note: 8 BNC connectors. Use with V4410S-HD. Vicon model V4411RP-BNC.	91.34	4.46
			EA	Rear Connector Panel, 2 Ribbon Cable Connectors..... Note: Use with V4410S-HD. Vicon model V4411RP-RIB.	76.12	3.71
			EA	Address Decoder..... Note: Decodes CPU control signal. One required for each V4481SCC-HD. If system uses V1344SCPU-HD, eliminate one V4430ADEC-HD. Vicon model V4430ADEC-HD.	387.10	18.91
			EA	Expander Card For Systems With More Than 128 Camera Inputs..... Note: One required for each camera expansion card cage. Vicon model V4441SEXP-HD.	504.54	24.64
			EA	Blank Rear Closure Panel For V4481SCC-HD..... Note: Vicon model V4450RCP-HD.	21.75	1.06
			EA	21" Coaxial Ribbon Cable..... Note: For distributing video between V4410S-HD cards. Vicon model V44RCP-21-1.	21.75	1.06

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MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 23 00 00-0477 EA 12" Coaxial Ribbon Cable Assembly Note: For distributing video signals from V4410S-HD switcher cards to external devices. Terminated with eight BNCs. Vicon model V44RCB-12-1.	104.39	5.10
28 23 00 00-0478 EA 75-OHM Terminator Note: For unused looping outputs and looping video coaxial ribbon cable connectors, Matrix 44. Vicon model V75TR-1.	36.60	1.28
28 23 00 00-0479 NOVA 1466A Matrix Prepacs, Programmable Systems (28 23 00 00-0444) Note: With internal CPU.		
28 23 00 00-0480 EA Controls 64 Cameras And 16 Monitors Note: Includes 1 switcher card cage, internal V1466A CPU titler, programming keyboard and 9" monochrome monitor. Vicon model V64X16A-IHCPS.	5,791.13	40.28
28 23 00 00-0481 EA Controls 64 Cameras And 32 Monitors Note: Includes 2 switcher card cages, internal V1466A CPU titler, programming keyboard and 9" monochrome monitor. Vicon model V64X32A-IHCPS.	9,480.62	40.28
28 23 00 00-0482 EA Controls 128 Cameras And 16 Monitors Note: Includes 1 switcher card cage, internal V1466A CPU titler, programming keyboard and 9" monochrome monitor. Vicon model V128X16A-IHCPS.	7,166.28	48.34
28 23 00 00-0483 EA Controls 128 Cameras And 32 Monitors Note: Includes 2 switcher card cages, internal V1466A CPU titler, programming keyboard and 9" monochrome monitor. Vicon model V128X32A-IHCPS.	10,277.25	48.34
28 23 00 00-0484 EA Controls 192 Cameras And 16 Monitors Note: Includes 1 switcher card cage, internal V1466A CPU titler, programming keyboard and 9" monochrome monitor. Vicon model V192X16A-IHCPS.	7,617.48	56.40
28 23 00 00-0485 EA Controls 192 Cameras And 32 Monitors Note: Includes 2 switcher card cages, internal V1466A CPU titler, programming keyboard and 9" monochrome monitor. Vicon model V192X32A-IHCPS.	11,700.69	56.40
28 23 00 00-0486 EA Controls 256 Cameras And 16 Monitors Note: Includes 1 switcher card cage, internal V1466A CPU titler, programming keyboard and 9" monochrome monitor. Vicon model V256X16A-IHCPS.	9,343.30	64.46
28 23 00 00-0487 EA Controls 256 Cameras And 32 Monitors Note: Includes 2 switcher card cages, internal V1466A CPU titler, programming keyboard and 9" monochrome monitor. Vicon model V256X32A-IHCPS.	13,490.57	64.46
28 23 00 00-0488 NOVA V1466A Matrix Prepacs, Single Cage Programmable Systems (28 23 00 00-0444) Note: With internal CPU. Expandable to 128 cameras x 32 monitors.		
28 23 00 00-0489 EA Controls 64 Cameras And 32 Monitors Note: Includes 1 switcher card cage, internal V1466A CPU titler, programming keyboard and 9" monochrome monitor. Vicon model V64X32A-IHCPS-S.	7,206.45	40.28
28 23 00 00-0490 EA Controls 128 Cameras And 32 Monitors Note: Includes 1 switcher card cage, internal V1466A CPU titler, programming keyboard and 9" monochrome monitor. Vicon model V128X32A-IHCPS-S.	10,123.96	48.34
28 23 00 00-0491 NOVA V1466A Internal CPU And Titler (28 23 00 00-0444)		
28 23 00 00-0492 EA Internal CPU For Matrix 66 Card Cage Note: Controls video switcher, pan-and-tilt, lens, and auxiliary functions. Controls matrix switching for up to 256 cameras and 32 monitors. Vicon model V1466ASCPA-A.	927.26	13.42
28 23 00 00-0493 EA Time/Date/Titler Card, For Monitors 1-16 Note: Provides advanced titling capability including sectors, presets and camera ID in addition to time and date. Used only with V1466ASCPA-A. Vicon model V1466ATDTSHD-16.	768.72	13.42
28 23 00 00-0494 EA Time/Date/Titler Card, For Monitors 17-32 Note: Provides advanced titling capability including sectors, presets and camera ID in addition to time and date. Used only with V1466ASCPA-A. Vicon model V1466ATDTSHD-32.	1,181.35	13.42
28 23 00 00-0495 Matrix 66 Super High Density Switcher Components (28 23 00 00-0444)		
28 23 00 00-0496 EA Coaxial Ribbon Cable, 1 D-Shell Connector And 8 BNCs Note: Vicon model V66RCB-24.	108.75	5.31
28 23 00 00-0497 EA Coaxial Ribbon Cable, 2 D-Shell Connectors Note: Vicon model V66RC-36.	108.75	5.31
28 23 00 00-0498 EA 75-OHM Terminator For Unused Looping Outputs Note: Also for looping video D-shell Connectors, Matrix 66. Vicon model V75TR-SHD.	39.15	1.91
28 23 00 00-0499 EA Card Cage (256x16) Note: Accepts up to 4 switcher cards. Includes motherboard and power supply. Vicon model V6680SCC-16-1A.	2,282.29	20.14
28 23 00 00-0500 EA Card Cage (128x32) Note: Accepts up to 4 switcher cards. Includes motherboard and power supply. Vicon model V6680SCC-32-1A.	932.07	20.14
28 23 00 00-0501 EA Decoder Board, For External CPU Note: Vicon model V1466ADCDB.	345.78	16.89
28 23 00 00-0502 EA Video Switcher Card, Switching For 64 Camera Inputs Note: Rear connector panels ordered separately. Vicon model V6610S-1A.	1,204.38	58.83
28 23 00 00-0503 EA Camera Input Panel, 64 BNC Connectors Note: Vicon model V6610RP64-1A.	215.30	10.51
28 23 00 00-0504 EA Camera Input Panel, 32 BNC Connectors Note: Vicon model V6610RP32-1A.	185.27	9.05
28 23 00 00-0505 EA Monitor Output Panel, 16 BNC Connectors Note: Vicon model V6610RP16-OA.	167.03	8.15
28 23 00 00-0506 EA Monitor Output Panel, 32 BNC Connectors Note: Vicon model V6610RP32-OA.	181.35	8.86
28 23 00 00-0507 EA Camera Looping Panel, 64 Channels, 16 D-Shell Cable Connectors Note: Vicon model V6610RP64-LA.	176.16	8.60



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 23 00 00-0508 EA Expander Card, 32 Channels, For Use In Star Configuration Note: Vicon model V6640SEXP32-A.	737.25	36.00
28 23 00 00-0509 EA Expander Card, 16 Channels, For Use In Serial Loop Configuration..... Note: Vicon model V6640SEXP16-A.	502.37	24.54
28 23 00 00-0510 EA Video Amplifier Board, Outputs For Monitors 1-16 Or 17-32 Note: Vicon model V6632-AMP-1A or V6632-AMP-1A.	864.88	20.14
28 23 00 00-0511 EA Card Extender, For Switcher Slots (For Service)..... Note: Vicon model V6670XS-A.	112.07	20.14
28 23 00 00-0512 EA Card Extender, For AMP/OSD Slots (For Service)..... Note: Vicon model V6670XA-A.	379.80	20.14
28 23 00 00-0513 EA Blank Rear Closure Panel, For Unused Card Positions..... Note: Vicon model V6650RCP-A.	19.58	0.96
28 23 00 00-0514 Matrix 66 Prepacs With Titling For Use With NOVA 1500 <small>(28 23 00 00-0444)</small>		
28 23 00 00-0515 EA Controls 64 Cameras And 16 Monitors..... Note: Includes 1 switcher card cage and titling card cage. Vicon model V64X16-MX66A.	7,146.60	40.28
28 23 00 00-0516 EA Controls 64 Cameras And 32 Monitors..... Note: Includes 2 switcher card cages and titling card cage. Vicon model V64X32-MX66A.	12,598.94	40.28
28 23 00 00-0517 EA Controls 64 Cameras And 48 Monitors..... Note: Includes 3 switcher card cages and titling card cage. Vicon model V64X48-MX66A.	19,415.15	40.28
28 23 00 00-0518 EA Controls 64 Cameras And 64 Monitors..... Note: Includes 4 switcher card cages and titling card cage. Vicon model V64X64-MX66A.	24,792.95	40.28
28 23 00 00-0519 EA Controls 128 Cameras And 16 Monitors..... Note: Includes 1 switcher card cage and titling card cage. Vicon model V128X16-MX66A.	10,089.31	48.34
28 23 00 00-0520 EA Controls 128 Cameras And 32 Monitors..... Note: Includes 2 switcher card cages and titling card cage. Vicon model V128X32-MX66A.	15,960.58	48.34
28 23 00 00-0521 EA Controls 128 Cameras And 48 Monitors..... Note: Includes 3 switcher card cages and titling card cage. Vicon model V128X48-MX66A.	23,690.23	48.34
28 23 00 00-0522 EA Controls 128 Cameras And 64 Monitors..... Note: Includes 4 switcher card cages and titling card cage. Vicon model V128X64-MX66A.	31,851.42	48.34
28 23 00 00-0523 EA Controls 192 Cameras And 16 Monitors..... Note: Includes 1 switcher card cage and titling card cage. Vicon model V192X16-MX66A.	12,658.24	56.40
28 23 00 00-0524 EA Controls 192 Cameras And 32 Monitors..... Note: Includes 2 switcher card cages and titling card cage. Vicon model V192X32-MX66A.	19,982.62	56.40
28 23 00 00-0525 EA Controls 192 Cameras And 48 Monitors..... Note: Includes 3 switcher card cages and titling card cage. Vicon model V192X48-MX66A.	30,123.99	56.40
28 23 00 00-0526 EA Controls 192 Cameras And 64 Monitors..... Note: Includes 4 switcher card cages and titling card cage. Vicon model V192X64-MX66A.	36,673.52	56.40
28 23 00 00-0527 EA Controls 256 Cameras And 16 Monitors..... Note: Includes 1 switcher card cage and titling card cage. Vicon model V256X16-MX66A.	15,156.47	64.46
28 23 00 00-0528 EA Controls 256 Cameras And 32 Monitors..... Note: Includes 2 switcher card cages and titling card cage. Vicon model V256X32-MX66A.	23,635.09	64.46
28 23 00 00-0529 EA Controls 256 Cameras And 48 Monitors..... Note: Includes 3 switcher card cages and titling card cage. Vicon model V256X48-MX66A.	35,442.71	64.46
28 23 00 00-0530 EA Controls 256 Cameras And 64 Monitors..... Note: Includes 4 switcher card cages and titling card cage. Vicon model V256X64-MX66A.	45,965.21	64.46
28 23 00 00-0531 EA Controls 320 Cameras And 16 Monitors..... Note: Includes 1 switcher card cage and titling card cage. Vicon model V320X16-MX66A.	21,449.61	80.57
28 23 00 00-0532 EA Controls 320 Cameras And 32 Monitors..... Note: Includes 2 switcher card cages and titling card cage. Vicon model V320X32-MX66A.	34,721.90	80.57
28 23 00 00-0533 EA Controls 320 Cameras And 48 Monitors..... Note: Includes 3 switcher card cages and titling card cage. Vicon model V320X48-MX66A.	50,862.63	80.57
28 23 00 00-0534 EA Controls 320 Cameras And 64 Monitors..... Note: Includes 4 switcher card cages and titling card cage. Vicon model V320X64-MX66A.	67,738.32	80.57
28 23 00 00-0535 EA Controls 384 Cameras And 16 Monitors..... Note: Includes 1 switcher card cage and titling card cage. Vicon model V384X16-MX66A.	24,057.10	96.68
28 23 00 00-0536 EA Controls 384 Cameras And 32 Monitors..... Note: Includes 2 switcher card cages and titling card cage. Vicon model V384X32-MX66A.	38,412.93	96.68
28 23 00 00-0537 EA Controls 384 Cameras And 48 Monitors..... Note: Includes 3 switcher card cages and titling card cage. Vicon model V384X48-MX66A.	57,308.70	96.68
28 23 00 00-0538 EA Controls 384 Cameras And 64 Monitors..... Note: Includes 4 switcher card cages and titling card cage. Vicon model V384X64-MX66A.	74,769.20	96.68
28 23 00 00-0539 EA Controls 448 Cameras And 16 Monitors..... Note: Includes 1 switcher card cage and titling card cage. Vicon model V448X16-MX66A.	26,678.25	112.79
28 23 00 00-0540 EA Controls 448 Cameras And 32 Monitors..... Note: Includes 2 switcher card cages and titling card cage. Vicon model V448X32-MX66A.	42,189.01	112.79
28 23 00 00-0541 EA Controls 448 Cameras And 48 Monitors..... Note: Includes 3 switcher card cages and titling card cage. Vicon model V448X48-MX66A.	62,707.99	112.79
28 23 00 00-0542 EA Controls 448 Cameras And 64 Monitors..... Note: Includes 4 switcher card cages and titling card cage. Vicon model V448X64-MX66A.	81,905.09	112.79
28 23 00 00-0543 EA Controls 512 Cameras And 16 Monitors..... Note: Includes 1 switcher card cage and titling card cage. Vicon model V512X16-MX66A.	29,330.89	128.91
28 23 00 00-0544 EA Controls 512 Cameras And 32 Monitors..... Note: Includes 2 switcher card cages and titling card cage. Vicon model V512X32-MX66A.	45,919.94	128.91
28 23 00 00-0545 EA Controls 512 Cameras And 48 Monitors..... Note: Includes 3 switcher card cages and titling card cage. Vicon model V512X48-MX66A.	68,178.67	128.91
28 23 00 00-0546 EA Controls 512 Cameras And 64 Monitors..... Note: Includes 4 switcher card cages and titling card cage. Vicon model V512X64-MX66A.	89,149.12	128.91
28 23 00 00-0547 NOVA 1500 Network Switching Control System <small>(28 23 00 00-0444)</small>		

28 Electronic Safety And Security**28 20 Electronic Surveillance****28 23 Video Surveillance**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 23 00 00-0548	EA		NOVA 1500 Central Processing Unit..... Note: Includes internal graphic configurator, capable of addressing over 8000 camera and 500 monitor and keypad stations. Use with companion NOVA 1500-CDU Communication Distribution Unit and Matrix Switching Systems. Vicon model V1500CPU.	5,316.27	20.14
28 23 00 00-0549	EA		NOVA 1500 Communication Distribution Unit..... Note: Configured to address 2046 cameras, 128 monitors, 32 keypads, one RS-232 port and monitor titling. Includes one network interface card and one power supply module. Vicon model V1500CDU-1.	3,909.35	20.14
28 23 00 00-0550	EA		NOVA 1500 CDU, Internal Redundant Configuration..... Note: Configured to address 2046 cameras, 128 monitors, 32 keypads, one RS-232 port and monitor titling. Includes redundant personality modules, power supplies and network cards for automatic switchover Vicon model V1500CDU-H-1.	5,584.01	20.14
28 23 00 00-0551	EA		NOVA 1500CDU, Chassis..... Note: Includes one network interface card and power supply module. Must be populated with CDU personality modules. Vicon model V1500CDU-CC.	1,772.72	20.14
28 23 00 00-0552	EA		NOVA 1500CDU, Alarm Module..... Note: Provides communication from V1500CDU to Vicon alarm devices Vicon model V1500CDU-ALRM.	516.30	20.14
28 23 00 00-0553	EA		NOVA 1500CDU, Time/Date/Title Module..... Note: Provides control communication between V1500CDU and matrix time/date/titling devices. Vicon model V1500CDU-TDT.	511.05	20.14
28 23 00 00-0554	EA		NOVA 1500CDU, Video Module..... Note: Provides control communication between V1500CDU and matrix video switcher. Vicon model V1500CDU-VID.	498.80	20.14
28 23 00 00-0555	EA		NOVA 1500CDU, Serial Module..... Note: Provides control communication between V1500CDU and Vicon system keypads/PTZ receivers or host RS-232 devices Vicon model V1500CDU-SER.	481.30	20.14
28 23 00 00-0556	EA		NOVA 1500CDU, Rear Closure Panel..... Note: Closes un-populated slots in V1500CDU chassis. Vicon model V1500CDU-RCP.	13.47	0.74
28 23 00 00-0557	EA		NOVA 1500CDU, Redundant Power Supply Module..... Note: Provides internal power redundancy for the V1500CDU. Vicon model V1500CDU-HSB-POW.	274.09	16.47
28 23 00 00-0558	EA		NOVA 1500CDU, Redundant Network Interface Module..... Note: Provides internal network communication redundancy for the V1500CDU. Vicon model V1500CDU-HSB-NET.	560.34	33.78
28 23 00 00-0559	EA		NOVA 1500CDU, Redundant Alarm Module..... Note: Provides internal redundant communication from V1500CDU to alarm devices. Vicon model V1500CDU-HSB-ALRM.	882.02	20.14
28 23 00 00-0560	EA		NOVA 1500CDU, Redundant Time/Date/Title Module..... Note: Provides internal redundant communication from V1500CDU to time/date/title device Vicon model V1500CDU-HSB-TDT.	869.77	20.14
28 23 00 00-0561	EA		NOVA 1500CDU, Redundant Video Module..... Note: Provides internal redundant communication from V1500CDU to video matrix switcher. Vicon model V1500CDU-HSB-VID.	885.52	20.14
28 23 00 00-0562	EA		NOVA 1500CDU, Redundant Serial Module..... Note: Provides internal redundant communication from V1500CDU to system keypads, receivers, host RS-232 devices. Vicon model V1500CDU-HSB-SER.	855.78	20.14
28 23 00 00-0563	EA		Multi-Input VGA Monitor/Keyboard..... Note: Used with V1500CPU, accepts 8 VGA inputs from multiple PCs, includes 2 PC cables. Rack mount only. Vicon model V1500KVM-R.	4,518.35	30.21
28 23 00 00-0564	EA		Cable For Use With V1500-KVM-R..... Note: Connects additional PCs to V1500-KVM-R. Vicon model V1500KVM-R.	50.02	2.44
28 23 00 00-0565	EA		10' Patch 5 Cable..... Note: Vicon model CAT5e-Patch-10.	43.02	2.44
28 23 00 00-0566			Time/Date/Titlers For NOVA 1500 (28 23 00 00-0444)		
28 23 00 00-0567	EA		Card Cage..... Note: Holds up to 16 V1300X-TDT circuit cards, each of which titles 2 monitors (32 monitors total per card cage). Vicon model V1300X-TCC.	549.54	20.14
28 23 00 00-0568	EA		Power Supply..... Note: Used in V1300X-TCC-1, 1 per card cage. Vicon model V1300X-TC-PS.	324.04	15.82
28 23 00 00-0569	EA		Master Module..... Note: Provides addressing for 32 monitors and loop-through signaling for additional V1300X-TCC card cage Vicon model V1400X-TDT-MA.	236.31	20.14
28 23 00 00-0570	EA		Slave Module..... Note: Provides addressing for 32 monitors in additional V1300X-TCC card cage. Vicon model V1300X-TC-SL-1.	239.81	20.14
28 23 00 00-0571	EA		Time/Date/Title Assembly..... Note: Circuit card provides time/date/titles for 2 monitors. Vicon model V1300X-TDT.	299.31	20.14
28 23 00 00-0572	EA		Blank Rear Closure Panel For V1300X-TCC..... Note: Vicon model V1300X-RCT.	30.44	1.49
28 23 00 00-0573			System Console Control Station (28 23 00 00-0444)		
28 23 00 00-0574	EA		System Console..... Note: Controls NOVA Matrix Systems, AurorA 2000 / AurorAcorD multiplexers and recorders and time-lapse VCRs. Vicon model V1400X-DVC-3.	1,477.84	15.11
28 23 00 00-0575	EA		Trackball For Use With System Console..... Note: Vicon model V1400X-JST.	272.16	15.11
28 23 00 00-0576	EA		Desktop Joystick For Use With System Console..... Note: Vicon model V1400X-DJT.	314.16	15.11
28 23 00 00-0577			NOVA Control Keypads (28 23 00 00-0444)		
28 23 00 00-0578	EA		Control Keypad, Small Profile Desk-Top..... Note: Provides multi-function control for camera stations with variable-speed joystick for pan-and-tilt control and push buttons for lens function. Vicon model V1410X-DVC.	620.39	15.11



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 23 00 00-0579 EA Control Keypad, Desk-Top Version With Variable-Speed Joystick..... Note: Provides multi-function control for camera stations with variable-speed joystick for pan-and-tilt control and push buttons for lens function. Vicon model V1411X-DVC.	762.13	15.11
28 23 00 00-0580 EA Control Keypad, Desk-Top Version With 3-Function Joystick..... Note: Provides multi-function control for camera stations with three-function variable-speed joystick for pan-and-tilt control and push buttons for lens function. Vicon model V1411J-DVC.	903.87	15.11
28 23 00 00-0581 EA Control Keypad, Rack-Mount Version..... Note: Provides complete switching and control functions for camera stations with variable-speed and fixed-speed pan-and-tilt units. Vicon model V1300X-RVC.	1,194.36	15.11
28 23 00 00-0582 EA Control Keypad, Desk-Top Version Note: Provides complete switching and control functions for camera stations with variable-speed and fixed-speed pan-and-tilt units Vicon model V1300X-DVC.	1,194.36	15.11
28 23 00 00-0583 Additional System Capabilities NOVA Systems (28 23 00 00-0444)		
28 23 00 00-0584 EA Vicoax Translator..... Note: Converts Vicon RS-422 PTZ commands to Vicoax, 16 channels. Vicon model V422-VI.	715.78	20.14
28 23 00 00-0585 EA RS-422 Dual Input Code Merger Note: Merges control data from two separate control systems into one device. Vicon model VSCM-200.	682.54	20.14
28 23 00 00-0586 EA Video Loss Detector Accepts Up To 256 Camera Inputs..... Note: Merges control data from two separate control systems into one device. Vicon model V1400X-VLD.	1,214.51	20.14
28 23 00 00-0587 EA Distribution Line Control Note: Provides up to 10 communication lines from CPU when used in star configuration. Vicon model V1400X-IDL.	715.78	20.14
28 23 00 00-0588 EA Alarm Interface, Accepts Up To 32 Custom Alarm Inputs..... Note: Vicon model V1300X-IA.	733.28	20.14
28 23 00 00-0589 EA Alarm Interface, Accepts Up To 64 Custom Alarm Inputs..... Note: Vicon model V1300X-IA-EX.	864.53	20.14
28 23 00 00-0590 EA Alarm Interface, With Relay Follow..... Note: Vicon model V1300X-IAF.	1,356.25	20.14
28 23 00 00-0591 EA Cable Adapter 34-25 Pin Note: Vicon model V1300X-CA.	89.17	4.36
28 23 00 00-0592 EA Relay/Audio-Follow-Video Switcher..... Note: Mono, 32 inputs, for use with matrix switching systems. Vicon model V1332AF.	791.03	20.14
28 23 00 00-0593 PTZ Receivers (28 23 00 00-0444)		
28 23 00 00-0594 EA Outdoor Variable-Speed Receiver..... Note: For VIST25 pan-and-tilt, 120 VAC input, 24 VDC output to pan-and-tilt drives. Vicon model V1305R-DC1.	826.41	40.36
28 23 00 00-0595 EA Outdoor Universal Receiver, 24 Volt AC Input..... Note: 24 VAC output to pan-and-tilt drives, requires V1311R-VI-1 interface card for Vicoax control and V1311R-VPS-1 interface card for NOVA control. Vicon model V1311RB-1WA.	437.13	21.35
28 23 00 00-0596 EA Outdoor Universal Receiver, 120 Volt AC Input..... Note: 24 or 120 VAC output to pan-and-tilt drives, requires V1311R-VI-1 interface card for Vicoax control and V1311R-VPS-1 interface card for NOVA control. Vicon model V1311RB-2WA.	437.13	21.35
28 23 00 00-0597 Receiver Options (28 23 00 00-0444)		
28 23 00 00-0598 EA Interface Card..... Note: Internal board adapts V1311RB receivers for use with NOVA CPUs. Vicon model V1311R-VPS-1.	239.23	11.69
28 23 00 00-0599 EA Vicoax Interface Card Note: Adapts V1311RB receiver for use with Vicoax transmitter. Vicon model V1311R-VI-1.	160.93	7.86
28 23 00 00-0600 Closed Circuit Television And Surveillance Systems (Pelco) (28 23)		
Note: Includes programming of equipment, testing of new devices and certification.		
28 23 00 00-0601 Cameras And Accessories (28 23 00 00-0600)		
28 23 00 00-0602 Cameras (28 23 00 00-0601)		
28 23 00 00-0603 1/3" Format Cameras (28 23 00 00-0602)		
28 23 00 00-0604 High Resolution Color, 1/3" Format Cameras (28 23 00 00-0603)		
28 23 00 00-0605 EA Extended Dynamic Range, High Resolution Color, 1/3" Format Camera (Pelco CC3701H-2).....	340.22	20.14
28 23 00 00-0606 EA Low Light, Digital Slow Shutter, High Resolution Color, 1/3" Format Camera (Pelco CC3751H-2).....	455.76	20.14
28 23 00 00-0607 Compact, 1/3" Format Cameras (28 23 00 00-0602)		
28 23 00 00-0608 High Resolution Color, Compact, 1/3" Format Cameras (28 23 00 00-0607)		
28 23 00 00-0609 EA Wide Dynamic Range, High Resolution Day/Night, Compact, 1/3" Format Camera (Pelco CCC1390H).....	545.37	20.14
28 23 00 00-0610 EA High Resolution Day/Night, Compact, 1/3" Format Camera (Pelco C10DN-6).....	446.87	20.14
28 23 00 00-0611 Day/Night, Compact, 1/3" Format Cameras (28 23 00 00-0607)		
28 23 00 00-0612 EA High Resolution Color, Compact, 1/3" Format Camera (Pelco C10CH-6).....	262.46	20.14
28 23 00 00-0613 Camerapaks (28 23 00 00-0601)		
Note: Includes camera and lens.		
28 23 00 00-0614 Camerapaks (28 23 00 00-0613)		

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MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 23 00 00-0615			High Resolution Color, Camerapaks <small>(28 23 00 00-0614)</small>		
28 23 00 00-0616			Fixed Focus, High Resolution Color, Camerapaks <small>(28 23 00 00-0615)</small>		
28 23 00 00-0617			Manual Iris, Fixed Focus, High Resolution Color, Camerapaks <small>(28 23 00 00-0616)</small>		
28 23 00 00-0618	EA		2.3 mm, Manual Iris, Fixed Focus, High Resolution Color, Camerapak (Pelco C10CH-6F2.3)	342.44	20.14
28 23 00 00-0619	EA		2.8 mm, Manual Iris, Fixed Focus, High Resolution Color, Camerapak (Pelco C10CH-6F2.8)	321.71	20.14
28 23 00 00-0620	EA		4 mm, Manual Iris, Fixed Focus, High Resolution Color, Camerapak (Pelco C10CH-6F4)	312.08	20.14
28 23 00 00-0621	EA		8 mm, Manual Iris, Fixed Focus, High Resolution Color, Camerapak (Pelco C10CH-6F8)	309.86	20.14
28 23 00 00-0622			Direct Drive Auto Iris, Fixed Focus, High Resolution Color, Camerapaks <small>(28 23 00 00-0616)</small>		
28 23 00 00-0623	EA		2.3 mm, Direct Drive Auto Iris, Fixed Focus, High Resolution Color, Camerapak (Pelco C10CH-6F2.3A)	373.55	20.14
28 23 00 00-0624	EA		2.8 mm, Direct Drive Auto Iris, Fixed Focus, High Resolution Color, Camerapak (Pelco C10CH-6F2.8A)	342.44	20.14
28 23 00 00-0625	EA		4 mm, Direct Drive Auto Iris, Fixed Focus, High Resolution Color, Camerapak (Pelco C10CH-6F4A)	335.04	20.14
28 23 00 00-0626	EA		8 mm, Direct Drive Auto Iris, Fixed Focus, High Resolution Color, Camerapak (Pelco C10CH-6F8A)	329.11	20.14
28 23 00 00-0627			Varifocal, High Resolution Color, Camerapaks <small>(28 23 00 00-0615)</small>		
28 23 00 00-0628			Manual Iris, Varifocal, High Resolution Color, Camerapaks <small>(28 23 00 00-0627)</small>		
28 23 00 00-0629	EA		1-3 mm, Manual Iris, Varifocal, High Resolution Color, Camerapak (Pelco C10CH-6V1)	403.91	20.14
28 23 00 00-0630	EA		2.5-6 mm, Manual Iris, Varifocal, High Resolution Color, Camerapak (Pelco C10CH-6V2)	363.92	20.14
28 23 00 00-0631	EA		2.8-12 mm, Manual Iris, Varifocal, High Resolution Color, Camerapak (Pelco C10CH-6V21)	331.34	20.14
28 23 00 00-0632	EA		3-8 mm, Manual Iris, Varifocal, High Resolution Color, Camerapak (Pelco C10CH-6V3)	318.00	20.14
28 23 00 00-0633	EA		5-40 mm, Manual Iris, Varifocal, High Resolution Color, Camerapak (Pelco C10CH-6V5)	367.63	20.14
28 23 00 00-0634			Direct Drive Auto Iris, Varifocal, High Resolution Color, Camerapaks <small>(28 23 00 00-0627)</small>		
28 23 00 00-0635	EA		1-3 mm, Direct Drive Auto Iris, Varifocal, High Resolution Color, Camerapak (Pelco C10CH-6V1A)	436.50	20.14
28 23 00 00-0636	EA		2.5-6 mm, Direct Drive Auto Iris, Varifocal, High Resolution Color, Camerapak (Pelco C10CH-6V2A)	409.10	20.14
28 23 00 00-0637	EA		2.8-12 mm, Direct Drive Auto Iris, Varifocal, High Resolution Color, Camerapak (Pelco C10CH-6V21A)	362.44	20.14
28 23 00 00-0638	EA		3-8 mm, Direct Drive Auto Iris, Varifocal, High Resolution Color, Camerapak (Pelco C10CH-6V3A)	323.19	20.14
28 23 00 00-0639	EA		5-40 mm, Direct Drive Auto Iris, Varifocal, High Resolution Color, Camerapak (Pelco C10CH-6V5A)	383.18	20.14
28 23 00 00-0640	EA		5-50 mm, Direct Drive Auto Iris, Varifocal, High Resolution Color, Camerapak (Pelco C10CH-6V50A)	433.54	20.14
28 23 00 00-0641	EA		5.5-82.5 mm, Direct Drive Auto Iris, Varifocal, High Resolution Color, Camerapak (Pelco C10CH-6V55A)	497.97	20.14
28 23 00 00-0642			Infrared Corrected, Direct Drive Auto Iris, Varifocal, High Resolution Color, Camerapaks <small>(28 23 00 00-0627)</small>		
28 23 00 00-0643	EA		3-8.5 mm, Infrared Corrected, Direct Drive Auto Iris, Varifocal, High Resolution Color, Camerapak (Pelco C10CH-6R3A)	340.22	20.14
28 23 00 00-0644	EA		7.5-50 mm, Infrared Corrected, Direct Drive Auto Iris, Varifocal, High Resolution Color, Camerapak (Pelco C10CH-6R75A)	407.62	20.14
28 23 00 00-0645			High Resolution Day/Night, Camerapaks <small>(28 23 00 00-0614)</small>		
28 23 00 00-0646			Varifocal, High Resolution Day/Night, Camerapaks <small>(28 23 00 00-0645)</small>		
28 23 00 00-0647			Direct Drive Auto Iris, Varifocal, High Resolution Day/Night, Camerapaks <small>(28 23 00 00-0646)</small>		
28 23 00 00-0648	EA		2.5-6 mm, Direct Drive Auto Iris, Varifocal, High Resolution Day/Night, Camerapak (Pelco C1390H-6V2A)	692.01	20.14
28 23 00 00-0649	EA		2.8-12 mm, Direct Drive Auto Iris, Varifocal, High Resolution Day/Night, Camerapak (Pelco C1390H-6V21A)	645.35	20.14
28 23 00 00-0650	EA		3-8 mm, Direct Drive Auto Iris, Varifocal, High Resolution Day/Night, Camerapak (Pelco C1390H-6V3A)	606.10	20.14
28 23 00 00-0651	EA		5-40 mm, Direct Drive Auto Iris, Varifocal, High Resolution Day/Night, Camerapak (Pelco C1390H-6V5A)	666.09	20.14
28 23 00 00-0652	EA		5-50 mm, Direct Drive Auto Iris, Varifocal, High Resolution Day/Night, Camerapak (Pelco C1390H-6V50A)	716.45	20.14
28 23 00 00-0653	EA		5.5-82.5 mm, Direct Drive Auto Iris, Varifocal, High Resolution Day/Night, Camerapak (Pelco C1390H-6V55A)	780.14	20.14
28 23 00 00-0654			Infrared Corrected, Direct Drive Auto Iris, Varifocal, High Resolution Day/Night, Camerapaks <small>(28 23 00 00-0646)</small>		
28 23 00 00-0655	EA		3-8.5 mm, Infrared Corrected, Direct Drive Auto Iris, Varifocal, High Resolution Day/Night, Camerapak (Pelco C1390H-6R3A)	623.13	20.14
28 23 00 00-0656	EA		7.5-50 mm, Infrared Corrected, Direct Drive Auto Iris, Varifocal, High Resolution Day/Night, Camerapak (Pelco C1390H-6R75A)	690.53	20.14
28 23 00 00-0657			Compact Camerapaks <small>(28 23 00 00-0613)</small>		
28 23 00 00-0658			High Resolution Color, Compact Camerapaks <small>(28 23 00 00-0657)</small>		
28 23 00 00-0659			DSS, High Resolution Color, Compact Camerapaks <small>(28 23 00 00-0658)</small>		
28 23 00 00-0660			Fixed Focus, DSS, High Resolution Color, Camerapaks <small>(28 23 00 00-0659)</small>		
28 23 00 00-0661			Manual Iris, Fixed Focus, DSS, High Resolution Color, Camerapaks <small>(28 23 00 00-0660)</small>		
28 23 00 00-0662	EA		2.3 mm, Manual Iris, Fixed Focus, DSS, High Resolution Color, Camerapak (Pelco C3751H-2F2.3)	535.74	20.14
28 23 00 00-0663	EA		2.8 mm, Manual Iris, Fixed Focus, DSS, High Resolution Color, Camerapak (Pelco C3751H-2F2.8)	515.00	20.14
28 23 00 00-0664	EA		4 mm, Manual Iris, Fixed Focus, DSS, High Resolution Color, Camerapak (Pelco C3751H-2F4)	504.64	20.14
28 23 00 00-0665	EA		8 mm, Manual Iris, Fixed Focus, DSS, High Resolution Color, Camerapak (Pelco C3751H-2F8)	502.41	20.14



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 23 00	00-0666		Direct Drive Auto Iris, Fixed Focus, DSS, High Resolution Color, Camerapaks <small>(28 23 00 00-0666)</small>		
	28 23 00 00-0667	EA	2.3 mm, Direct Drive Auto Iris, Fixed Focus, DSS, High Resolution Color, Camerapak (Pelco C3751H-2F2.3A).....	566.11	20.14
	28 23 00 00-0668	EA	2.8 mm, Direct Drive Auto Iris, Fixed Focus, DSS, High Resolution Color, Camerapak (Pelco C3751H-2F2.8A).....	535.74	20.14
	28 23 00 00-0669	EA	4 mm, Direct Drive Auto Iris, Fixed Focus, DSS, High Resolution Color, Camerapak (Pelco C3751H-2F4A).....	528.34	20.14
	28 23 00 00-0670	EA	8 mm, Direct Drive Auto Iris, Fixed Focus, DSS, High Resolution Color, Camerapak (Pelco C3751H-2F8A).....	522.41	20.14
28 23 00	00-0671		Varifocal, DSS, High Resolution Color, Camerapaks <small>(28 23 00 00-0659)</small>		
28 23 00	00-0672		Manual Iris, Varifocal, DSS, High Resolution Color, Camerapaks <small>(28 23 00 00-0671)</small>		
	28 23 00 00-0673	EA	1-3 mm, Manual Iris, Varifocal, DSS, High Resolution Color, Camerapak (Pelco C3751H-2V1).....	597.21	20.14
	28 23 00 00-0674	EA	2.5-6 mm, Manual Iris, Varifocal, DSS, High Resolution Color, Camerapak (Pelco C3751H-2V2).....	556.48	20.14
	28 23 00 00-0675	EA	2.8-12 mm, Manual Iris, Varifocal, DSS, High Resolution Color, Camerapak (Pelco C3751H-2V21).....	524.63	20.14
	28 23 00 00-0676	EA	3-8 mm, Manual Iris, Varifocal, DSS, High Resolution Color, Camerapak (Pelco C3751H-2V3).....	511.30	20.14
	28 23 00 00-0677	EA	5-40 mm, Manual Iris, Varifocal, DSS, High Resolution Color, Camerapak (Pelco C3751H-2V5).....	560.18	20.14
	28 23 00 00-0678	EA	5-50 mm, Manual Iris, Varifocal, DSS, High Resolution Color, Camerapak (Pelco C3751H-2V50).....	592.03	20.14
	28 23 00 00-0679	EA	5.5-82.5 mm, Manual Iris, Varifocal, DSS, High Resolution Color, Camerapak (Pelco C3751H-2V55).....	667.57	20.14
28 23 00	00-0680		Direct Drive Auto Iris, Varifocal, DSS, High Resolution Color, Camerapaks <small>(28 23 00 00-0671)</small>		
	28 23 00 00-0681	EA	1-3 mm, Direct Drive Auto Iris, Varifocal, DSS, High Resolution Color, Camerapak (Pelco C3751H-2V1A).....	629.06	20.14
	28 23 00 00-0682	EA	2.5-6 mm, Direct Drive Auto Iris, Varifocal, DSS, High Resolution Color, Camerapak (Pelco C3751H-2V2A).....	602.40	20.14
	28 23 00 00-0683	EA	2.8-12 mm, Direct Drive Auto Iris, Varifocal, DSS, High Resolution Color, Camerapak (Pelco C3751H-2V21A).....	555.74	20.14
	28 23 00 00-0684	EA	3-8 mm, Direct Drive Auto Iris, Varifocal, DSS, High Resolution Color, Camerapak (Pelco C3751H-2V3A).....	515.75	20.14
	28 23 00 00-0685	EA	5-40 mm, Direct Drive Auto Iris, Varifocal, DSS, High Resolution Color, Camerapak (Pelco C3751H-2V5A).....	576.47	20.14
	28 23 00 00-0686	EA	5-50 mm, Direct Drive Auto Iris, Varifocal, DSS, High Resolution Color, Camerapak (Pelco C3751H-2V50A).....	626.84	20.14
	28 23 00 00-0687	EA	5.5-82.5 mm, Direct Drive Auto Iris, Varifocal, DSS, High Resolution Color, Camerapak (Pelco C3751H-2V55A).....	690.53	20.14
28 23 00	00-0688		Infrared Corrected, Direct Drive Auto Iris, Varifocal, DSS, High Resolution Color, Camerapaks <small>(28 23 00 00-0671)</small>		
	28 23 00 00-0689	EA	3-8.5 mm, Infrared Corrected, Direct Drive Auto Iris, Varifocal, DSS, High Resolution Color, Camerapak (Pelco C3751H-2R3A).....	533.52	20.14
	28 23 00 00-0690	EA	7.5-50 mm, Infrared Corrected, Direct Drive Auto Iris, Varifocal, DSS, High Resolution Color, Camerapak (Pelco C3751H-2R75A).....	600.91	20.14
28 23 00	00-0691		EDR, High Resolution Color, Compact Camerapaks <small>(28 23 00 00-0658)</small>		
28 23 00	00-0692		Fixed Focus, EDR, High Resolution Color, Camerapaks <small>(28 23 00 00-0691)</small>		
28 23 00	00-0693		Manual Iris, Fixed Focus, EDR, High Resolution Color, Camerapaks <small>(28 23 00 00-0692)</small>		
	28 23 00 00-0694	EA	2.3 mm, Manual Iris, Fixed Focus, EDR, High Resolution Color, Camerapak (Pelco C3701H-2F2.3).....	535.74	20.14
	28 23 00 00-0695	EA	2.8 mm, Manual Iris, Fixed Focus, EDR, High Resolution Color, Camerapak (Pelco C3701H-2F2.8).....	399.47	20.14
	28 23 00 00-0696	EA	4 mm, Manual Iris, Fixed Focus, EDR, High Resolution Color, Camerapak (Pelco C3701H-2F4).....	389.10	20.14
	28 23 00 00-0697	EA	8 mm, Manual Iris, Fixed Focus, EDR, High Resolution Color, Camerapak (Pelco C3701H-2F8).....	386.88	20.14
28 23 00	00-0698		Direct Drive Auto Iris, Fixed Focus, EDR, High Resolution Color, Camerapaks <small>(28 23 00 00-0692)</small>		
	28 23 00 00-0699	EA	2.3 mm, Direct Drive Auto Iris, Fixed Focus, EDR, High Resolution Color, Camerapak (Pelco C3701H-2F2.3A).....	450.57	20.14
	28 23 00 00-0700	EA	2.8 mm, Direct Drive Auto Iris, Fixed Focus, EDR, High Resolution Color, Camerapak (Pelco C3701H-2F2.8A).....	420.21	20.14
	28 23 00 00-0701	EA	4 mm, Direct Drive Auto Iris, Fixed Focus, EDR, High Resolution Color, Camerapak (Pelco C3701H-2F4A).....	412.80	20.14
	28 23 00 00-0702	EA	8 mm, Direct Drive Auto Iris, Fixed Focus, EDR, High Resolution Color, Camerapak (Pelco C3701H-2F8A).....	412.80	20.14
28 23 00	00-0703		Varifocal, EDR, High Resolution Color, Camerapaks <small>(28 23 00 00-0691)</small>		
28 23 00	00-0704		Manual Iris, Varifocal, EDR, High Resolution Color, Camerapaks <small>(28 23 00 00-0703)</small>		
	28 23 00 00-0705	EA	1-3 mm, Manual Iris, Varifocal, EDR, High Resolution Color, Camerapak (Pelco C3701H-2V1).....	481.68	20.14
	28 23 00 00-0706	EA	2.5-6 mm, Manual Iris, Varifocal, EDR, High Resolution Color, Camerapak (Pelco C3701H-2V2).....	440.94	20.14
	28 23 00 00-0707	EA	2.8-12 mm, Manual Iris, Varifocal, EDR, High Resolution Color, Camerapak (Pelco C3701H-2V21).....	409.10	20.14
	28 23 00 00-0708	EA	3-8 mm, Manual Iris, Varifocal, EDR, High Resolution Color, Camerapak (Pelco C3701H-2V3).....	395.77	20.14
	28 23 00 00-0709	EA	5-40 mm, Manual Iris, Varifocal, EDR, High Resolution Color, Camerapak (Pelco C3701H-2V5).....	444.65	20.14
	28 23 00 00-0710	EA	5-50 mm, Manual Iris, Varifocal, EDR, High Resolution Color, Camerapak (Pelco C3701H-2V50).....	476.49	20.14
	28 23 00 00-0711	EA	5.5-82.5 mm, Manual Iris, Varifocal, EDR, High Resolution Color, Camerapak (Pelco C3701H-2V55).....	552.03	20.14
28 23 00	00-0712		Direct Drive Auto Iris, Varifocal, EDR, High Resolution Color, Camerapaks <small>(28 23 00 00-0703)</small>		
	28 23 00 00-0713	EA	1-3 mm, Direct Drive Auto Iris, Varifocal, EDR, High Resolution Color, Camerapak (Pelco C3701H-2V1A).....	513.52	20.14
	28 23 00 00-0714	EA	2.5-6 mm, Direct Drive Auto Iris, Varifocal, EDR, High Resolution Color, Camerapak (Pelco C3701H-2V2A).....	486.86	20.14
	28 23 00 00-0715	EA	2.8-12 mm, Direct Drive Auto Iris, Varifocal, EDR, High Resolution Color, Camerapak (Pelco C3701H-2V21A).....	439.46	20.14
	28 23 00 00-0716	EA	3-8 mm, Direct Drive Auto Iris, Varifocal, EDR, High Resolution Color, Camerapak (Pelco C3701H-2V3A).....	400.21	20.14
	28 23 00 00-0717	EA	5-40 mm, Direct Drive Auto Iris, Varifocal, EDR, High Resolution Color, Camerapak (Pelco C3701H-2V5A).....	460.94	20.14
	28 23 00 00-0718	EA	5-50 mm, Direct Drive Auto Iris, Varifocal, EDR, High Resolution Color, Camerapak (Pelco C3701H-2V50A).....	511.30	20.14
	28 23 00 00-0719	EA	5.5-82.5 mm, Direct Drive Auto Iris, Varifocal, EDR, High Resolution Color, Camerapak (Pelco C3701H-2V55A).....	574.99	20.14

28 Electronic Safety And Security**28 20 Electronic Surveillance****28 23 Video Surveillance**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 23 00 00-0720 Infrared Corrected, Direct Drive Auto Iris, Varifocal, EDR, High Resolution Color, Camerapaks <small>(28 23 00 00-0703)</small>		
28 23 00 00-0721 EA 3-8.5 mm, Infrared Corrected, Direct Drive Auto Iris, Varifocal, EDR, High Resolution Color, Camerapak (Pelco C3701H-2R3A)	417.99	20.14
28 23 00 00-0722 EA 7.5-50 mm, Infrared Corrected, Direct Drive Auto Iris, Varifocal, EDR, High Resolution Color, Camerapak (Pelco C3701H-2R75A)	485.38	20.14
28 23 00 00-0723 High Resolution Day/Night, Compact Camerapaks <small>(28 23 00 00-0657)</small>		
28 23 00 00-0724 Fixed Focus, High Resolution Day/Night, Compact Camerapaks <small>(28 23 00 00-0723)</small>		
28 23 00 00-0725 Manual Iris, Fixed Focus, High Resolution Day/Night, Compact Camerapaks <small>(28 23 00 00-0724)</small>		
28 23 00 00-0726 EA 8 mm, Manual Iris, Fixed Focus, High Resolution Day/Night, Compact Camerapak (Pelco C10DN-6F8)	494.27	20.14
28 23 00 00-0727 DC-Drive Auto Iris, Fixed Focus, High Resolution Day/Night, Compact Camerapaks <small>(28 23 00 00-0724)</small>		
28 23 00 00-0728 EA 2.3 mm, Direct Drive Auto Iris, Fixed Focus, High Resolution Day/Night, Compact Camerapak (Pelco C10DN-6F2.3A)	557.96	20.14
28 23 00 00-0729 EA 2.8 mm, Direct Drive Auto Iris, Fixed Focus, High Resolution Day/Night, Compact Camerapak (Pelco C10DN-6F2.8A)	526.85	20.14
28 23 00 00-0730 Varifocal, High Resolution Day/Night, Compact Camerapaks <small>(28 23 00 00-0723)</small>		
28 23 00 00-0731 Manual Iris, Varifocal, High Resolution Day/Night, Compact Camerapaks <small>(28 23 00 00-0730)</small>		
28 23 00 00-0732 EA 2.8-12 mm, Manual Iris, Varifocal, High Resolution Day/Night, Compact Camerapak (Pelco C10DN-6V21)	515.75	20.14
28 23 00 00-0733 EA 3-8 mm, Manual Iris, Varifocal, High Resolution Day/Night, Compact Camerapak (Pelco C10DN-6V3)	502.41	20.14
28 23 00 00-0734 EA 5-50 mm, Manual Iris, Varifocal, High Resolution Day/Night, Compact Camerapak (Pelco C10DN-6V50)	583.88	20.14
28 23 00 00-0735 Direct Drive Auto Iris, Varifocal, High Resolution Day/Night, Compact Camerapaks <small>(28 23 00 00-0730)</small>		
28 23 00 00-0736 EA 2.5-6 mm, Direct Drive Auto Iris, Varifocal, High Resolution Day/Night, Compact Camerapak (Pelco C10DN-6V2A)	593.51	20.14
28 23 00 00-0737 EA 2.8-12 mm, Direct Drive Auto Iris, Varifocal, High Resolution Day/Night, Compact Camerapak (Pelco C10DN-6V21A)	546.85	20.14
28 23 00 00-0738 EA 3-8 mm, Direct Drive Auto Iris, Varifocal, High Resolution Day/Night, Compact Camerapak (Pelco C10DN-6V3A)	507.60	20.14
28 23 00 00-0739 EA 5-40 mm, Direct Drive Auto Iris, Varifocal, High Resolution Day/Night, Compact Camerapak (Pelco C10DN-6V5A)	567.59	20.14
28 23 00 00-0740 EA 5-50 mm, Direct Drive Auto Iris, Varifocal, High Resolution Day/Night, Compact Camerapak (Pelco C10DN-6V50A)	617.95	20.14
28 23 00 00-0741 EA 5.5-82.5 mm, Direct Drive Auto Iris, Varifocal, High Resolution Day/Night, Compact Camerapak (Pelco C10DN-6V55A)	682.38	20.14
28 23 00 00-0742 Infrared Corrected, Direct Drive Auto Iris, Varifocal, High Resolution Day/Night, Compact Camerapaks <small>(28 23 00 00-0730)</small>		
28 23 00 00-0743 EA 3-8.5 mm, Infrared Corrected, Direct Drive Auto Iris, Varifocal, High Resolution Day/Night, Compact Camerapak (Pelco C10DN-6R3A)	524.63	20.14
28 23 00 00-0744 EA 7.5-50 mm, Infrared Corrected, Direct Drive Auto Iris, Varifocal, High Resolution Day/Night, Compact Camerapak (Pelco C10DN-6R75A)	592.03	20.14
28 23 00 00-0745 Camera Systems <small>(28 23 00 00-0601)</small>		
28 23 00 00-0746 Camera Dome Systems <small>(28 23 00 00-0745)</small>		
28 23 00 00-0747 Spectra®, Pan/Tilt Camera Dome Systems <small>(28 23 00 00-0746)</small>		
28 23 00 00-0748 Spectra®, Pan/Tilt Camera Dome Systems <small>(28 23 00 00-0747)</small>		
Note: Includes dome drive, camera, lens, back box, clear or smoked lower dome and mounting hardware.		
28 23 00 00-0749 Spectra® IV, Pan/Tilt Camera Dome Systems <small>(28 23 00 00-0748)</small>		
28 23 00 00-0750 Black And White, Spectra® IV, Pan/Tilt Camera Dome Systems <small>(28 23 00 00-0749)</small>		
28 23 00 00-0751 EA 22X, Surface Mount, Black And White, Spectra® IV, Pan/Tilt Camera Dome System (Pelco SD4M22-SMB)	2,188.01	120.85
28 23 00 00-0752 EA 22X, In-Ceiling Mount, Black And White, Spectra® IV, Pan/Tilt Camera Dome System (Pelco SD4M22-F)	2,491.65	120.85
28 23 00 00-0753 EA 22X, Pendant Mount, Black And White, Spectra® IV, Pan/Tilt Camera Dome System (Pelco SD4M22-PB)	2,627.92	120.85
28 23 00 00-0754 EA 22X, Environmental Pendant Mount, Black And White, Spectra® IV, Pan/Tilt Camera Dome System (Pelco SD4M22-PG-E)	3,646.99	120.85
28 23 00 00-0755 Color, Spectra® IV, Pan/Tilt Camera Dome Systems <small>(28 23 00 00-0749)</small>		
28 23 00 00-0756 EA 16X, Surface Mount, Color, Spectra® IV, Pan/Tilt Camera Dome System (Pelco SD4TC-SMB)	1,843.63	120.85
28 23 00 00-0757 EA 16X, In-Ceiling Mount, Color, Spectra® IV, Pan/Tilt Camera Dome System (Pelco SD4TC-F)	1,996.93	120.85
28 23 00 00-0758 EA 16X, Pendant Mount, Color, Spectra® IV, Pan/Tilt Camera Dome System (Pelco SD4TC-PB)	2,133.94	120.85
28 23 00 00-0759 EA 16X, Environmental In-Ceiling Mount, Color, Spectra® IV, Pan/Tilt Camera Dome System (Pelco SD4TC-F-E)	2,212.45	120.85



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 23 00 00-0760 EA 16X, Environmental Pendant Mount, Color, Spectra® IV, Pan/Tilt Camera Dome System (Pelco SD4TC-PG-E)	2,212.45	120.85
28 23 00 00-0761 EA 22X, Surface Mount, Color, Spectra® IV, Pan/Tilt Camera Dome System (Pelco SD4C22-SMB)	2,318.35	120.85
28 23 00 00-0762 EA 22X, In-Ceiling Mount, Color, Spectra® IV, Pan/Tilt Camera Dome System (Pelco SD4C22-F)	2,622.74	120.85
28 23 00 00-0763 EA 22X, Pendant Mount, Color, Spectra® IV, Pan/Tilt Camera Dome System (Pelco SD4C22-PB)	2,759.75	120.85
28 23 00 00-0764 EA 22X, Environmental In-Ceiling Mount, Color, Spectra® IV, Pan/Tilt Camera Dome System (Pelco SD4C22-F-E)	2,838.25	120.85
28 23 00 00-0765 EA 22X, Environmental Pendant Mount, Color, Spectra® IV, Pan/Tilt Camera Dome System (Pelco SD4C22-PG-E)	2,838.25	120.85
28 23 00 00-0766 Color/Black And White, Spectra® IV, Pan/Tilt Camera Dome Systems (28 23 00 00-0749)		
28 23 00 00-0767 EA 23X, Surface Mount, Color/Black And White, Spectra® IV, Pan/Tilt Camera Dome System (Pelco SD4CBW-SMB)	2,698.28	120.85
28 23 00 00-0768 EA 23X, In-Ceiling Mount, Color/Black And White, Spectra® IV, Pan/Tilt Camera Dome System (Pelco SD4CBW-F)	3,002.67	120.85
28 23 00 00-0769 EA 23X, Pendant Mount, Color/Black And White, Spectra® IV, Pan/Tilt Camera Dome System (Pelco SD4CBW-PB)	3,139.68	120.85
28 23 00 00-0770 EA 23X, Environmental In-Ceiling Mount, Color/Black And White, Spectra® IV, Pan/Tilt Camera Dome System (Pelco SD4CBW-F-E)	3,218.18	120.85
28 23 00 00-0771 EA 23X, Environmental Pendant Mount, Color/Black And White, Spectra® IV, Pan/Tilt Camera Dome System (Pelco SD4CBW-PG-E)	3,218.18	120.85
28 23 00 00-0772 Day/Night, Spectra® IV, Pan/Tilt Camera Dome Systems (28 23 00 00-0749)		
28 23 00 00-0773 EA 18X, Surface Mount, Day/Night, Spectra® IV, Pan/Tilt Camera Dome System (Pelco SD418-SMB)	2,449.44	120.85
28 23 00 00-0774 EA 18X, In-Ceiling Mount, Day/Night, Spectra® IV, Pan/Tilt Camera Dome System (Pelco SD418-F)	2,603.48	120.85
28 23 00 00-0775 EA 18X, Pendant Mount, Day/Night, Spectra® IV, Pan/Tilt Camera Dome System (Pelco SD418-PB)	2,739.75	120.85
28 23 00 00-0776 EA 18X, Environmental In-Ceiling Mount, Day/Night, Spectra® IV, Pan/Tilt Camera Dome System (Pelco SD418-F-E)	2,818.26	120.85
28 23 00 00-0777 EA 18X, Environmental Pendant Mount, Day/Night, Spectra® IV, Pan/Tilt Camera Dome System (Pelco SD418-PG-E)	2,818.26	120.85
28 23 00 00-0778 EA 35X, Surface Mount, Day/Night, Spectra® IV, Pan/Tilt Camera Dome System (Pelco SD435-SMB)	2,947.86	120.85
28 23 00 00-0779 EA 35X, In-Ceiling Mount, Day/Night, Spectra® IV, Pan/Tilt Camera Dome System (Pelco SD435-F)	3,190.04	120.85
28 23 00 00-0780 EA 35X, Pendant Mount, Day/Night, Spectra® IV, Pan/Tilt Camera Dome System (Pelco SD435-PB)	3,326.31	120.85
28 23 00 00-0781 EA 35X, Environmental In-Ceiling Mount, Day/Night, Spectra® IV, Pan/Tilt Camera Dome System (Pelco SD435-F-E)	3,404.81	120.85
28 23 00 00-0782 EA 35X, Environmental Pendant Mount, Day/Night, Spectra® IV, Pan/Tilt Camera Dome System (Pelco SD435-PG-E)	3,404.81	120.85
28 23 00 00-0783 Heavy Duty Spectra® IV, Pan/Tilt Camera Dome Systems (28 23 00 00-0748)		
28 23 00 00-0784 Color, Heavy Duty Spectra® IV, Pan/Tilt Camera Dome Systems (28 23 00 00-0783)		
28 23 00 00-0785 EA 16X, In-Ceiling Mount, Color, Heavy Duty Spectra® IV, Pan/Tilt Camera Dome System (Pelco SD4TC-HF)	2,396.86	120.85
For Protective Lower Dome Cage, Add	34.65	
28 23 00 00-0786 EA 16X, Pendant Mount, Color, Heavy Duty Spectra® IV, Pan/Tilt Camera Dome System (Pelco SD4TC-HP)	2,528.68	120.85
For Protective Lower Dome Cage, Add	34.65	
28 23 00 00-0787 EA 16X, Environmental Pendant Mount, Color, Heavy Duty Spectra® IV, Pan/Tilt Camera Dome System (Pelco SD4TC-HPE)	2,633.85	120.85
For Protective Lower Dome Cage, Add	34.65	
28 23 00 00-0788 EA 22X, In-Ceiling Mount, Color, Heavy Duty Spectra® IV, Pan/Tilt Camera Dome System (Pelco SD4C22-HF)	2,976.75	120.85
For Protective Lower Dome Cage, Add	34.65	
28 23 00 00-0789 EA 22X, Pendant Mount, Color, Heavy Duty Spectra® IV, Pan/Tilt Camera Dome System (Pelco SD4C22-HP)	3,108.57	120.85
For Protective Lower Dome Cage, Add	34.65	
28 23 00 00-0790 EA 22X, Environmental Pendant Mount, Color, Heavy Duty Spectra® IV, Pan/Tilt Camera Dome System (Pelco SD4C22-HPE)	3,214.48	120.85
For Protective Lower Dome Cage, Add	34.65	
28 23 00 00-0791 Day/Night, Heavy Duty Spectra® IV, Pan/Tilt Camera Dome Systems (28 23 00 00-0783)		
28 23 00 00-0792 EA 18X, In-Ceiling Mount, Day/Night, Heavy Duty Spectra® IV, Pan/Tilt Camera Dome System (Pelco SD418-HF)	3,002.67	120.85
For Protective Lower Dome Cage, Add	34.65	
28 23 00 00-0793 EA 18X, Pendant Mount, Day/Night, Heavy Duty Spectra® IV, Pan/Tilt Camera Dome System (Pelco SD418-HP)	3,134.49	120.85
For Protective Lower Dome Cage, Add	34.65	
28 23 00 00-0794 EA 18X, Environmental Pendant Mount, Day/Night, Heavy Duty Spectra® IV, Pan/Tilt Camera Dome System (Pelco SD418-HPE)	3,240.40	120.85
For Protective Lower Dome Cage, Add	34.65	
28 23 00 00-0795 EA 35X, In-Ceiling Mount, Day/Night, Heavy Duty Spectra® IV, Pan/Tilt Camera Dome System (Pelco SD435-HF)	3,544.05	120.85
For Protective Lower Dome Cage, Add	34.65	
28 23 00 00-0796 EA 35X, Pendant Mount, Day/Night, Heavy Duty Spectra® IV, Pan/Tilt Camera Dome System (Pelco SD435-HP)	3,675.13	120.85
For Protective Lower Dome Cage, Add	34.65	
28 23 00 00-0797 EA 35X, Environmental Pendant Mount, Day/Night, Heavy Duty Spectra® IV, Pan/Tilt Camera Dome System (Pelco SD435-HPE)	3,781.04	120.85
For Protective Lower Dome Cage, Add	34.65	
28 23 00 00-0798 Pressurized Spectra® IV, Pan/Tilt Camera Dome Systems (28 23 00 00-0748)		
28 23 00 00-0799 Day/Night, Pressurized Spectra® IV, Pan/Tilt Camera Dome Systems (28 23 00 00-0798)		
28 23 00 00-0800 EA 18X, Environmental Pendant Mount, Day/Night, Pressurized Spectra® IV, Pan/Tilt Camera Dome System (Pelco SD418-PRE)	3,975.07	120.85
28 23 00 00-0801 EA 35X, Environmental Pendant Mount, Day/Night, Pressurized Spectra® IV, Pan/Tilt Camera Dome System (Pelco SD435-PRE)	4,516.45	120.85
28 23 00 00-0802 Stainless Steel Spectra® IV, Pan/Tilt Camera Dome Systems (28 23 00 00-0748)		

28 Electronic Safety And Security**28 20 Electronic Surveillance****28 23 Video Surveillance**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 23 00 00-0803 Black And White, Stainless Steel Spectra® IV, Pan/Tilt Camera Dome Systems <small>(28 23 00 00-0802)</small>		
28 23 00 00-0804 EA 22X, Environmental Pendant Mount, Black And White, Stainless Steel Spectra® IV, Pan/Tilt Camera Dome System (Pelco SD4M22-PSGE)	3,455.17	120.85
28 23 00 00-0805 Color, Stainless Steel Spectra® IV, Pan/Tilt Camera Dome Systems <small>(28 23 00 00-0802)</small>		
28 23 00 00-0806 EA 16X, Environmental Pendant Mount, Color, Stainless Steel Spectra® IV, Pan/Tilt Camera Dome System (Pelco SD4TC-PSGE).....	3,006.37	120.85
28 23 00 00-0807 EA 22X, Environmental Pendant Mount, Color, Stainless Steel Spectra® IV, Pan/Tilt Camera Dome System (Pelco SD4C22-PSGE).....	3,587.00	120.85
28 23 00 00-0808 Color/Black And White, Stainless Steel Spectra® IV, Pan/Tilt Camera Dome Systems <small>(28 23 00 00-0802)</small>		
28 23 00 00-0809 EA 23X, Environmental Pendant Mount, Color/Black And White, Stainless Steel Spectra® IV, Pan/Tilt Camera Dome System (Pelco SD4CBW-PSGE).....	3,966.93	120.85
28 23 00 00-0810 Day/Night, Stainless Steel Spectra® IV, Pan/Tilt Camera Dome Systems <small>(28 23 00 00-0802)</small>		
28 23 00 00-0811 EA 18X, Environmental Pendant Mount, Day/Night, Stainless Steel Spectra® IV, Pan/Tilt Camera Dome System (Pelco SD418-PSGE).....	3,612.92	120.85
28 23 00 00-0812 EA 35X, Environmental Pendant Mount, Day/Night, Stainless Steel Spectra® IV, Pan/Tilt Camera Dome System (Pelco SD435-PSGE).....	4,153.56	120.85
28 23 00 00-0813 Miniature Spectra®, Mini Pan/Tilt Camera Dome Systems <small>(28 23 00 00-0748)</small>		
28 23 00 00-0814 Color, Miniature Spectra®, Mini Pan/Tilt Camera Dome Systems <small>(28 23 00 00-0813)</small>		
28 23 00 00-0815 EA 10X, In-Ceiling Mount, Color, Miniature Spectra®, Mini Pan/Tilt Camera Dome System (Pelco SD4-B).....	1,380.01	120.85
28 23 00 00-0816 Spectra® IP Network, Pan/Tilt Camera Dome Systems <small>(28 23 00 00-0747)</small> Note: Includes simultaneous IP and analog video and control, dome drive, camera, lens, back box, clear or smoked lower dome and mounting hardware.		
28 23 00 00-0817 Spectra® IV IP Network, Pan/Tilt Camera Dome Systems <small>(28 23 00 00-0816)</small>		
28 23 00 00-0818 Color, Spectra® IV IP Network, Pan/Tilt Camera Dome Systems <small>(28 23 00 00-0817)</small>		
28 23 00 00-0819 EA 16X, In-Ceiling Mount, Color, Spectra® IV IP Network, Pan/Tilt Camera Dome System (Pelco SD4NTC-F).....	2,550.16	120.85
28 23 00 00-0820 EA 16X, Pendant Mount, Color, Spectra® IV IP Network, Pan/Tilt Camera Dome System (Pelco SD4NTC-PB).....	2,687.17	120.85
28 23 00 00-0821 EA 16X, Environmental In-Ceiling Mount, Color, Spectra® IV IP Network, Pan/Tilt Camera Dome System (Pelco SD4NTC-F-E).....	2,765.67	120.85
28 23 00 00-0822 EA 16X, Environmental Pendant Mount, Color, Spectra® IV IP Network, Pan/Tilt Camera Dome System (Pelco SD4NTC-PG-E).....	2,765.67	120.85
28 23 00 00-0823 EA 22X, In-Ceiling Mount, Color, Spectra® IV IP Network, Pan/Tilt Camera Dome System (Pelco SD4NC22-F1).....	3,175.97	120.85
28 23 00 00-0824 EA 22X, Pendant Mount, Color, Spectra® IV IP Network, Pan/Tilt Camera Dome System (Pelco SD4NC22-PB-1).....	3,312.98	120.85
28 23 00 00-0825 EA 22X, Environmental In-Ceiling Mount, Color, Spectra® IV IP Network, Pan/Tilt Camera Dome System (Pelco SD4NC22-F-E1).....	3,391.48	120.85
28 23 00 00-0826 EA 22X, Environmental Pendant Mount, Color, Spectra® IV IP Network, Pan/Tilt Camera Dome System (Pelco SD4NC22-PG-E1).....	3,391.48	120.85
28 23 00 00-0827 Color/Black And White, Spectra® IV IP Network, Pan/Tilt Camera Dome Systems <small>(28 23 00 00-0817)</small>		
28 23 00 00-0828 EA 23X, In-Ceiling Mount, Color/Black And White, Spectra® IV IP Network, Pan/Tilt Camera Dome System (Pelco SD4NCBW-F1).....	3,555.89	120.85
28 23 00 00-0829 EA 23X, Pendant Mount, Color/Black And White, Spectra® IV IP Network, Pan/Tilt Camera Dome System (Pelco SD4NCBW-PB-1).....	3,692.91	120.85
28 23 00 00-0830 EA 23X, Environmental In-Ceiling Mount, Color/Black And White, Spectra® IV IP Network, Pan/Tilt Camera Dome System (Pelco SD4NCBW-F-E1).....	3,771.41	120.85
28 23 00 00-0831 EA 23X, Environmental Pendant Mount, Color/Black And White, Spectra® IV IP Network, Pan/Tilt Camera Dome System (Pelco SD4NCBW-PG-E1).....	3,771.41	120.85
28 23 00 00-0832 Heavy Duty Spectra® IV IP Network, Pan/Tilt Camera Dome Systems <small>(28 23 00 00-0816)</small>		
28 23 00 00-0833 Color, Heavy Duty Spectra® IV IP Network, Pan/Tilt Camera Dome Systems <small>(28 23 00 00-0832)</small>		
28 23 00 00-0834 EA 16X, In-Ceiling Mount, Color, Heavy Duty Spectra® IV IP Network, Camera Dome System (Pelco SD4NTC-HF1).....	2,950.08	120.85
For Protective Lower Dome Cage, Add	34.65	
28 23 00 00-0835 EA 16X, Pendant Mount, Color, Heavy Duty Spectra® IV IP Network, Camera Dome System (Pelco SD4NTC-HP1).....	3,081.91	120.85
For Protective Lower Dome Cage, Add	34.65	
28 23 00 00-0836 EA 16X, Environmental Pendant Mount, Color, Heavy Duty Spectra® IV IP Network, Camera Dome System (Pelco SD4NTC-HPE1).....	3,187.08	120.85
For Protective Lower Dome Cage, Add	34.65	
28 23 00 00-0837 EA 22X, In-Ceiling Mount, Color, Heavy Duty Spectra® IV IP Network, Camera Dome System (Pelco SD4NC22-HF1).....	3,529.97	120.85
For Protective Lower Dome Cage, Add	34.65	
28 23 00 00-0838 EA 22X, Pendant Mount, Color, Heavy Duty Spectra® IV IP Network, Camera Dome System (Pelco SD4NC22-HP1).....	3,661.80	120.85
For Protective Lower Dome Cage, Add	34.65	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 23 00 00-0839	EA		22X, Environmental Pendant Mount, Color, Heavy Duty Spectra® IV IP Network, Camera Dome System (Pelco SD4NC22-HPE1)..... <i>For Protective Lower Dome Cage, Add</i>	3,767.71 34.65	120.85
28 23 00 00-0840			Day/Night, Heavy Duty Spectra® IV IP Network, Pan/Tilt Camera Dome Systems <small>(28 23 00 00-0832)</small>		
28 23 00 00-0841	EA		18X, In-Ceiling Mount, Day/Night, Heavy Duty Spectra® IV IP Network, Camera Dome System (Pelco SD4N18-HF1) <i>For Protective Lower Dome Cage, Add</i>	3,555.89 34.65	120.85
28 23 00 00-0842	EA		18X, Pendant Mount, Day/Night, Heavy Duty Spectra® IV IP Network, Camera Dome System (Pelco SD4N18-HP1) <i>For Protective Lower Dome Cage, Add</i>	3,687.72 34.65	120.85
28 23 00 00-0843	EA		18X, Environmental Pendant Mount, Day/Night, Heavy Duty Spectra® IV IP Network, Camera Dome System (Pelco SD4N18-HPE1) <i>For Protective Lower Dome Cage, Add</i>	3,793.63 34.65	120.85
28 23 00 00-0844	EA		35X, In-Ceiling Mount, Day/Night, Heavy Duty Spectra® IV IP Network, Camera Dome System (Pelco SD4N35-HF1) <i>For Protective Lower Dome Cage, Add</i>	4,097.27 34.65	120.85
28 23 00 00-0845	EA		35X, Pendant Mount, Day/Night, Heavy Duty Spectra® IV IP Network, Camera Dome System (Pelco SD4N35-HP1) <i>For Protective Lower Dome Cage, Add</i>	4,228.36 34.65	120.85
28 23 00 00-0846	EA		35X, Environmental Pendant Mount, Day/Night, Heavy Duty Spectra® IV IP Network, Camera Dome System (Pelco SD4N35-HPE1) <i>For Protective Lower Dome Cage, Add</i>	4,334.27 34.65	120.85
28 23 00 00-0847			Stainless Steel Spectra® IV IP Network, Pan/Tilt Camera Dome Systems <small>(28 23 00 00-0816)</small>		
28 23 00 00-0848			Color, Stainless Steel Spectra® IV IP Network, Camera Dome Systems <small>(28 23 00 00-0847)</small>		
28 23 00 00-0849	EA		16X, Environmental Pendant Mount, Color, Stainless Steel Spectra® IV IP Network, Camera Dome System (Pelco SD4NTC-PSGE1).....	3,559.60	120.85
28 23 00 00-0850	EA		22X, Environmental Pendant Mount, Color, Stainless Steel Spectra® IV IP Network, Camera Dome System (Pelco SD4NC22-PSGE1).....	4,140.23	120.85
28 23 00 00-0851			Color/Black And White, Stainless Steel Spectra® IV IP Network, Camera Dome Systems <small>(28 23 00 00-0847)</small>		
28 23 00 00-0852	EA		23X, Environmental Pendant Mount, Color/Black And White, Stainless Steel Spectra® IV IP Network, Camera Dome System (Pelco SD4N35-PSGE1).....	4,520.16	120.85
28 23 00 00-0853			Day/Night, Stainless Steel Spectra® IV IP Network, Camera Dome Systems <small>(28 23 00 00-0847)</small>		
28 23 00 00-0854	EA		18X, Environmental Pendant Mount, Day/Night, Stainless Steel Spectra® IV IP Network, Camera Dome System (Pelco SD4N18-PSGE1).....	4,166.15	120.85
28 23 00 00-0855	EA		35X, Environmental Pendant Mount, Day/Night, Stainless Steel Spectra® IV IP Network, Camera Dome System (Pelco SD4N35-PSGE1).....	4,706.79	120.85
28 23 00 00-0856			Miniature Spectra® IP Network, Mini Pan/Tilt Camera Dome Systems <small>(28 23 00 00-0816)</small>		
28 23 00 00-0857			Color, Miniature Spectra® IP Network, Mini Camera Dome Systems <small>(28 23 00 00-0856)</small>		
28 23 00 00-0858	EA		10X, In-Ceiling Mount, Color, Miniature Spectra® IP Network, Black Mini Camera Dome System (Pelco SD4N-W1).....	1,736.98	120.85
28 23 00 00-0859			Spectra®, Pan/Tilt Dome Drives <small>(28 23 00 00-0747)</small> Note: Includes dome drive, camera and lens.		
28 23 00 00-0860	EA		10X, Color Camera, Spectra® Mini Dome Drive (Pelco DD4).....	1,284.18	100.71
28 23 00 00-0861	EA		10X, Color Camera, Spectra® IP Network, Mini Dome Drive (Pelco DD4N).....	1,639.67	100.71
28 23 00 00-0862	EA		22X, Black And White Camera, Spectra® IV Dome Drive (Pelco DD4M22).....	2,078.84	100.71
28 23 00 00-0863	EA		16X, Color Camera, Spectra® IV Dome Drive (Pelco DD4TC16).....	1,630.04	100.71
28 23 00 00-0864	EA		22X, Color Camera, Spectra® IV Dome Drive (Pelco DD4C22).....	2,209.93	100.71
28 23 00 00-0865	EA		18X, Day/Night Camera, Spectra® IV Dome Drive (Pelco DD4CBW18).....	2,235.85	100.71
28 23 00 00-0866	EA		23X, Day/Night Camera, Spectra® IV Dome Drive (Pelco DD4CBW23).....	2,589.86	100.71
28 23 00 00-0867	EA		35X, Day/Night Camera, Spectra® IV Dome Drive (Pelco DD4CBW35).....	2,777.23	100.71
28 23 00 00-0868	EA		35X, Color/Black And White Camera, Spectra® IV Horizon Dome Drive (Pelco DD4H35).....	2,777.23	100.71
28 23 00 00-0869			Accessories For Spectra® Pan/Tilt Camera Dome Systems <small>(28 23 00 00-0747)</small>		
28 23 00 00-0870	EA		Upgrade To Chrome Lower Dome (Pelco Spectra).....	104.42	
28 23 00 00-0871	EA		Upgrade To Gold Lower Dome (Pelco Spectra).....	136.27	
28 23 00 00-0872	EA		Wall Mount For Spectra® Systems (Pelco IWM24-BK).....	111.97	10.07
28 23 00 00-0873	EA		24 Volt Out, Wall Mount For Spectra® Systems (Pelco IWM24-BK).....	284.53	10.07
28 23 00 00-0874	EA		Wall Arm Mount For Spectra® Systems (Pelco IDM4018).....	109.01	10.07
28 23 00 00-0875	EA		Wall Arm Mount With Feed Through For Stainless Steel Spectra® IV Systems (Pelco IDM4012SS).....	303.79	10.07
28 23 00 00-0876	EA		Pole Mount Adapter For Spectra® Systems (Pelco PA402).....	56.23	5.99

28 Electronic Safety And Security**28 20 Electronic Surveillance****28 23 Video Surveillance**

MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
28 23 00 00-0877		Camclosure®, Camera Dome Systems <small>(28 23 00 00-0746)</small>			
28 23 00 00-0878		Camclosure® IS Integrated, Camera Dome Systems <small>(28 23 00 00-0877)</small>			
28 23 00 00-0879		Camclosure® IS Integrated, Camera Dome Systems <small>(28 23 00 00-0878)</small>			
28 23 00 00-0880		High Resolution Color, Camclosure® IS Integrated, Camera Dome Systems <small>(28 23 00 00-0879)</small>			
28 23 00 00-0881	EA	12 mm, Indoor Surface/In-Ceiling Mount, High Resolution Color, Camclosure® IS Integrated, Camera Dome System (Pelco IS90-CH12).....	504.62		120.85
28 23 00 00-0882	EA	9-22 mm, Indoor Surface/In-Ceiling Mount, High Resolution Color, Camclosure® IS Integrated, Camera Dome System (Pelco IS90-CHV22).....	549.06		120.85
28 23 00 00-0883	EA	12 mm, Environmental Surface Mount, High Resolution Color, Camclosure® IS Integrated, Camera Dome System (Pelco IS110-CH12).....	612.01		120.85
28 23 00 00-0884	EA	12 mm, Environmental In-Ceiling Mount, High Resolution Color, Camclosure® IS Integrated, Camera Dome System (Pelco IS150-CH12).....	612.01		120.85
28 23 00 00-0885		Wide Dynamic Range Color, Camclosure® IS Integrated, Camera Dome Systems <small>(28 23 00 00-0879)</small>			
28 23 00 00-0886	EA	9-22 mm, Indoor Surface/In-Ceiling Mount, Wide Dynamic Range Color, Camclosure® IS Integrated, Camera Dome System (Pelco IS90B-CWV22).....	620.16		120.85
28 23 00 00-0887	EA	9-22 mm, Environmental Surface Mount, Wide Dynamic Range Color, Camclosure® IS Integrated, Camera Dome System (Pelco IS111-CWV22).....	677.92		120.85
28 23 00 00-0888	EA	9-22 mm, Environmental In-Ceiling Mount, Wide Dynamic Range Color, Camclosure® IS Integrated, Camera Dome System (Pelco IS151-CWV22).....	677.92		120.85
28 23 00 00-0889		Day/Night, Camclosure® IS Integrated, Camera Dome Systems <small>(28 23 00 00-0879)</small>			
28 23 00 00-0890	EA	9-22 mm, Indoor Surface/In-Ceiling Mount, Day/Night, Camclosure® IS Integrated, White Camera Dome System (Pelco IS90-DNV22).....	713.47		120.85
28 23 00 00-0891	EA	9-22 mm, Environmental Surface Mount, Day/Night, Camclosure® IS Integrated, Camera Dome System (Pelco IS111-DNV22).....	856.41		120.85
28 23 00 00-0892	EA	9-22 mm, Environmental In-Ceiling Mount, Day/Night, Camclosure® IS Integrated, Camera Dome System (Pelco IS151-DNV22).....	856.41		120.85
28 23 00 00-0893		Wide Dynamic Range Day/Night, Camclosure® IS Integrated, Camera Dome Systems <small>(28 23 00 00-0879)</small>			
28 23 00 00-0894	EA	9-22 mm, Indoor Surface/In-Ceiling Mount, Wide Dynamic Range Day/Night, Camclosure® IS Integrated, Camera Dome System (Pelco IS90-DWV22).....	781.61		120.85
28 23 00 00-0895	EA	9-22 mm, Environmental In-Ceiling Mount, Wide Dynamic Range Day/Night, Camclosure® IS Integrated, Camera Dome System (Pelco IS151-DWV22).....	873.44		120.85
28 23 00 00-0896		Camclosure® IS Integrated, Bullet Style Camera Systems <small>(28 23 00 00-0878)</small>			
28 23 00 00-0897		High Resolution Color, Camclosure® IS Integrated, Bullet Style Camera Systems <small>(28 23 00 00-0896)</small>			
28 23 00 00-0898	EA	3.6 mm, Wall/Ceiling Mount, High Resolution Color, Camclosure® IS Integrated, Bullet Style Camera System (Pelco IS310-CH3.6).....	564.03		80.57
28 23 00 00-0899		Wide Dynamic Range Color, Camclosure® IS Integrated, Bullet Style Camera Systems <small>(28 23 00 00-0896)</small>			
28 23 00 00-0900	EA	9-22 mm, Wall/Ceiling Mount, Wide Dynamic Range Color, Camclosure® IS Integrated, Bullet Style Camera System (Pelco IS310-CWV22).....	647.71		80.57
28 23 00 00-0901		Day/Night, Camclosure® IS Integrated, Bullet Style Camera Systems <small>(28 23 00 00-0896)</small>			
28 23 00 00-0902	EA	9-22 mm, Wall/Ceiling Mount, Day/Night, Camclosure® IS Integrated, Bullet Style Camera System (Pelco IS310-DNV22).....	714.37		80.57
28 23 00 00-0903		Wide Dynamic Range Day/Night, Camclosure® IS Integrated, Bullet Style Camera Systems <small>(28 23 00 00-0896)</small>			
28 23 00 00-0904	EA	9-22 mm, Wall/Ceiling Mount, Wide Dynamic Range Day/Night, Camclosure® IS Integrated, Bullet Style Camera System (Pelco IS310-DWV22).....	747.70		80.57
28 23 00 00-0905		Camclosure® IS Integrated Cameras <small>(28 23 00 00-0878)</small>			
28 23 00 00-0906	EA	12 mm, High Resolution Color, Camclosure® IS Integrated Camera (Pelco IS-CH12).....	393.69		80.57
28 23 00 00-0907	EA	9-22 mm, High Resolution Color, Camclosure® IS Integrated Camera (Pelco IS-CHV22).....	393.69		80.57
28 23 00 00-0908	EA	9-22 mm, Wide Dynamic Range Color, Camclosure® IS Integrated Camera (Pelco IS-CWV22).....	459.60		80.57
28 23 00 00-0909	EA	9-22 mm, Day/Night, Camclosure® IS Integrated Camera (Pelco IS-DNV22).....	638.09		80.57
28 23 00 00-0910	EA	9-22 mm, Wide Dynamic Range Day/Night, Camclosure® IS Integrated Camera (Pelco IS-DWV22).....	655.12		80.57
28 23 00 00-0911		Camclosure® ICS Integrated, Camera Dome Systems <small>(28 23 00 00-0877)</small>			



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 23 00 00-0912 Camclosure® ICS Integrated, Camera Dome Systems <small>(28 23 00 00-0911)</small>		
28 23 00 00-0913 Standard Resolution Color, Camclosure® ICS Integrated, Camera Dome Systems <small>(28 23 00 00-0912)</small>		
28 23 00 00-0914 EA 12 mm, Indoor Surface/In-Ceiling Mount, Standard Resolution Color, Camclosure® ICS Integrated, Camera Dome System (Pelco ICS090B-CA12)	431.30	120.85
28 23 00 00-0915 EA 12 mm, UTP, Indoor Surface/In-Ceiling Mount, Standard Resolution Color, Camclosure® ICS Integrated, Camera Dome System (Pelco ICS090B-CA12T)	463.15	120.85
28 23 00 00-0916 EA 12 mm, Environmental Surface Mount, Standard Resolution Color, Camclosure® ICS Integrated, Camera Dome System (Pelco ICS110-CA12)	590.53	120.85
28 23 00 00-0917 EA 12 mm, Environmental In-Ceiling Mount, Standard Resolution Color, Camclosure® ICS Integrated, Camera Dome System (Pelco ICS150-CA12)	590.53	120.85
28 23 00 00-0918 High Resolution Color, Camclosure® ICS Integrated, Camera Dome Systems <small>(28 23 00 00-0912)</small>		
28 23 00 00-0919 EA 3-9 mm, Environmental In-Ceiling Mount, High Resolution Color, Camclosure® ICS Integrated, Camera Dome System (Pelco ICS151-CDV39A)	733.47	120.85
28 23 00 00-0920 Camclosure® ICS Integrated, Bullet Style Camera Systems <small>(28 23 00 00-0911)</small>		
28 23 00 00-0921 Standard Resolution, Camclosure® ICS Integrated, Bullet Style Camera Systems <small>(28 23 00 00-0920)</small>		
28 23 00 00-0922 EA 12 mm, Wall/Ceiling Mount, Standard Resolution, Camclosure® ICS Integrated, Bullet Style Camera System (Pelco ICS310-CA12)	509.96	80.57
28 23 00 00-0923 Camclosure® ICS Integrated, Wedge Style Camera Systems <small>(28 23 00 00-0911)</small>		
28 23 00 00-0924 High Resolution Color, Camclosure® ICS Integrated, Wedge Style Camera Systems <small>(28 23 00 00-0923)</small>		
28 23 00 00-0925 EA 9-22 mm, High Resolution, Camclosure® ICS Integrated, Wedge Style Camera System (Pelco IS210-CHV22)	677.92	120.85
28 23 00 00-0926 Wide Dynamic Range Color, Camclosure® ICS Integrated, Wedge Style Camera Systems <small>(28 23 00 00-0923)</small>		
28 23 00 00-0927 EA 9-22 mm, Wide Dynamic Range, Camclosure® ICS Integrated, Wedge Style Camera System (Pelco IS210-CWV22)	744.58	120.85
28 23 00 00-0928 Day/Night, Camclosure® ICS Integrated, Wedge Style Camera Systems <small>(28 23 00 00-0923)</small>		
28 23 00 00-0929 EA 9-22 mm, Day/Night, Camclosure® ICS Integrated, Wedge Style Camera System (Pelco IS210-DNV22)	828.27	120.85
28 23 00 00-0930 Wide Dynamic Range Day/Night, Camclosure® ICS Integrated, Wedge Style Camera Systems <small>(28 23 00 00-0923)</small>		
28 23 00 00-0931 EA 9-22 mm, Wide Dynamic Range Day/Night, Camclosure® ICS Integrated, Wedge Style Camera System (Pelco IS210-DWV22)	861.59	120.85
28 23 00 00-0932 Camclosure® IP Network, Camera Dome Systems <small>(28 23 00 00-0977)</small>		
28 23 00 00-0933 Camclosure® IP Network, Camera Dome Systems <small>(28 23 00 00-0932)</small>		
28 23 00 00-0934 High Resolution Color, Camclosure® IP Network, Camera Dome Systems <small>(28 23 00 00-0933)</small>		
28 23 00 00-0935 EA 3-9.5 mm, Environmental Surface Mount, High Resolution Color, Camclosure® IP Network, Camera Dome System (Pelco IP111-CHV9)	1,228.93	120.85
28 23 00 00-0936 EA 9-22 mm, Environmental Surface Mount, High Resolution Color, Camclosure® IP Network, Camera Dome System (Pelco IP111-CHV22)	1,228.93	120.85
28 23 00 00-0937 Wide Dynamic Range Color, Camclosure® IP Network, Camera Dome Systems <small>(28 23 00 00-0933)</small>		
28 23 00 00-0938 EA 3-9.5 mm, Environmental Surface Mount, Wide Dynamic Range Color, Camclosure® IP Network, Camera Dome System (Pelco IP111-CWV9)	1,320.76	120.85
28 23 00 00-0939 EA 9-22 mm, Environmental Surface Mount, Wide Dynamic Range Color, Camclosure® IP Network, Camera Dome System (Pelco IP111-CWV22)	1,320.76	120.85
28 23 00 00-0940 Day/Night, Camclosure® IP Network, Camera Dome Systems <small>(28 23 00 00-0933)</small>		
28 23 00 00-0941 EA 3-9.5 mm, Environmental Surface Mount, Day/Night, Camclosure® IP Network, Camera Dome System (Pelco IP111-DNV9)	1,462.22	120.85
28 23 00 00-0942 EA 9-22 mm, Environmental Surface Mount, Day/Night, Camclosure® IP Network, Camera Dome System (Pelco IP111-DNV22)	1,462.22	120.85

28 Electronic Safety And Security**28 20 Electronic Surveillance****28 23 Video Surveillance**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 23 00 00-0943 Wide Dynamic Range Day/Night, Camclosure® IP Network, Camera Dome Systems <small>(28 23 00 00-0933)</small>		
28 23 00 00-0944 EA 3-9.5 mm, Environmental Surface Mount, Wide Dynamic Range Day/Night, Camclosure® IP Network, Camera Dome System (Pelco IP110-DWV9).....	1,562.20	120.85
28 23 00 00-0945 EA 9-22 mm, Environmental Surface Mount, Wide Dynamic Range Day/Night, Camclosure® IP Network, Camera Dome System (Pelco IP110-DWV22).....	1,562.20	120.85
28 23 00 00-0946 Accessories For Camclosure® Camera Dome Systems <small>(28 23 00 00-0877)</small>		
28 23 00 00-0947 EA 4S Gangbox Adapter Plate For ICS110 Camclosure® Systems (Pelco ICS110-AP)	25.42	6.04
28 23 00 00-0948 EA 4S Adapter Plate For ICS310 Camclosure® Systems (Pelco ICS310-AP).....	25.42	6.04
28 23 00 00-0949 EA Sun Shield For ICS310 Camclosure® Systems (Pelco ICS310-SS).....	33.47	10.07
28 23 00 00-0950 EA Conduit Adapter For ICS310 Camclosure® Systems (Pelco ICS310-COND)	54.21	10.07
28 23 00 00-0951 EA 2' x 2' Ceiling Panel For ICS150 Camclosure® Systems (Pelco ICS150-P)	56.53	6.04
28 23 00 00-0952 EA Pendant Mount Adapter For Camclosure® ICS110 Systems (Pelco ICS110-PG).....	54.21	10.07
28 23 00 00-0953 EA Corner Mount Adapter For ICS200 Camclosure® Systems (Pelco ICS210-CM).....	69.02	10.07
28 23 00 00-0954 EA Smoked, Surface Mount, Dome For Camclosure® ICS Systems (Pelco ICS-DO110A).....	185.44	20.14
28 23 00 00-0955 EA Clear, Surface Mount, Dome For Camclosure® ICS Systems (Pelco ICS-DO111A).....	185.44	20.14
28 23 00 00-0956 EA Smoked, In-Ceiling Mount, Dome For Camclosure® ICS Systems (Pelco ICS-DO150A)	185.44	20.14
28 23 00 00-0957 EA Clear, In-Ceiling Mount, Dome For Camclosure® ICS Systems (Pelco ICS-DO151A).....	185.44	20.14
28 23 00 00-0958 EA Pendant Mount Adapter For Camclosure® IP Systems (Pelco IP110-P).....	65.32	10.07
28 23 00 00-0959 EA Smoked Lower Dome For Surface Mount Camclosure® IP Systems (Pelco IP110-LD).....	73.61	20.14
28 23 00 00-0960 EA Clear Lower Dome For Surface Mount Camclosure® IP Systems (Pelco IP111-LD).....	73.61	20.14
28 23 00 00-0961 EA Smoked Lower Dome For Surface Mount Camclosure® IS Systems (Pelco IS110-LD).....	73.61	20.14
28 23 00 00-0962 EA Clear Lower Dome For Surface Mount Camclosure® IS Systems (Pelco IS111-LD)	73.61	20.14
28 23 00 00-0963 EA Smoked Lower Dome For Ceiling Mount Camclosure® IS Systems (Pelco IS150-LD)	73.61	20.14
28 23 00 00-0964 EA Clear Lower Dome For Ceiling Mount Camclosure® IS Systems (Pelco IS151-LD).....	73.61	20.14
28 23 00 00-0965 EA Surface Mount Enclosure Only, Environmental, Camclosure® IS Systems (Pelco IS110-ENC)	214.46	27.51
28 23 00 00-0966 EA Ceiling Mount Enclosure Only, Environmental, Camclosure® IS Systems (Pelco IS150-ENC).....	214.46	27.51
28 23 00 00-0967 EA Black Pendant Mount For Indoor Camclosure® IS Systems (Pelco IS90B-P).....	46.06	10.07
28 23 00 00-0968 EA Black Pendant Wall Mount For Indoor Camclosure® IS Systems (Pelco IS90B-PW).....	79.39	10.07
28 23 00 00-0969 EA White Pendant Mount For Indoor Camclosure® IS Systems (Pelco IS90-P).....	46.06	10.07
28 23 00 00-0970 EA White Pendant Wall Mount For Indoor Camclosure® IS Systems (Pelco IS90-PW).....	79.39	10.07
28 23 00 00-0971 EA Surface Mount Enclosure Only, Environmental, IP Camclosure® (Pelco IP110-ENC)	1,145.24	120.85
28 23 00 00-0972 Pan/Tilt Camera Systems <small>(28 23 00 00-0745)</small>		
28 23 00 00-0973 Esprit® CBZ, Pan/Tilt Camera Systems <small>(28 23 00 00-0972)</small>		
Note: Includes powder coated aluminum pan/tilt enclosure, receiver, camera, lens, built in heater, window defroster/defogger, sun shroud, insulation blanket, 24V power supply and mounting hardware.		
28 23 00 00-0974 EDR, High Resolution Color, Esprit® CBZ, Pan/Tilt Camera Systems <small>(28 23 00 00-0973)</small>		
28 23 00 00-0975 Pedestal Mount, EDR, High Resolution Color, Esprit® CBZ, Pan/Tilt Camera Systems <small>(28 23 00 00-0974)</small>		
28 23 00 00-0976 EA 10X, Pedestal Mount, EDR, High Resolution Color, Esprit® CBZ, Pan/Tilt Camera System (Pelco ES3012-2CBZ10N).....	3,260.53	181.28
28 23 00 00-0977 EA 20X, Pedestal Mount, EDR, High Resolution Color, Esprit® CBZ, Pan/Tilt Camera System (Pelco ES3012-2CBZ20N).....	3,705.63	181.28
28 23 00 00-0978 EA 30X, Pedestal Mount, EDR, High Resolution Color, Esprit® CBZ, Pan/Tilt Camera System (Pelco ES3012-2CBZ30N).....	4,322.55	181.28
28 23 00 00-0979 EA 10X, Preset Positioning, Pedestal Mount, EDR, High Resolution Color, Esprit® CBZ, Pan/Tilt Camera System (Pelco ES3012-2CBZ10PN)	3,356.07	181.28
28 23 00 00-0980 EA 20X, Preset Positioning, Pedestal Mount, EDR, High Resolution Color, Esprit® CBZ, Pan/Tilt Camera System (Pelco ES3012-2CBZ20PN)	3,821.16	181.28
28 23 00 00-0981 EA 30X, Preset Positioning, Pedestal Mount, EDR, High Resolution Color, Esprit® CBZ, Pan/Tilt Camera System (Pelco ES3012-2CBZ30PN)	4,438.08	181.28
28 23 00 00-0982 Wall Mount, EDR, High Resolution Color, Esprit® CBZ, Pan/Tilt Camera Systems <small>(28 23 00 00-0974)</small>		
28 23 00 00-0983 EA 10X, Wall Mount, EDR, High Resolution Color, Esprit® CBZ, Pan/Tilt Camera System (Pelco ES3012-2CBZ10W).....	3,290.89	181.28
28 23 00 00-0984 EA 20X, Wall Mount, EDR, High Resolution Color, Esprit® CBZ, Pan/Tilt Camera System (Pelco ES3012-2CBZ20W).....	3,735.99	181.28
28 23 00 00-0985 EA 30X, Wall Mount, EDR, High Resolution Color, Esprit® CBZ, Pan/Tilt Camera System (Pelco ES3012-2CBZ30W).....	4,352.91	181.28
28 23 00 00-0986 EA 10X, Preset Positioning, Wall Mount, EDR, High Resolution Color, Esprit® CBZ, Pan/Tilt Camera System (Pelco ES3012-2CBZ10PW).....	3,387.17	181.28
28 23 00 00-0987 EA 20X, Preset Positioning, Wall Mount, EDR, High Resolution Color, Esprit® CBZ, Pan/Tilt Camera System (Pelco ES3012-2CBZ20PW).....	3,851.53	181.28
28 23 00 00-0988 EA 30X, Preset Positioning, Wall Mount, EDR, High Resolution Color, Esprit® CBZ, Pan/Tilt Camera System (Pelco ES3012-2CBZ30PW).....	4,468.45	181.28
28 23 00 00-0989 Esprit® CLZ, Pan/Tilt Camera Systems <small>(28 23 00 00-0972)</small>		
28 23 00 00-0990 DSS, High Resolution Color, Esprit® CLZ, Pan/Tilt Camera Systems <small>(28 23 00 00-0989)</small>		
28 23 00 00-0991 Pedestal Mount, DSS, High Resolution Color, Esprit® CLZ, Pan/Tilt Camera Systems <small>(28 23 00 00-0990)</small>		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 23 00 00-0992 EA 10X, Pedestal Mount, DSS, High Resolution Color, Esprit® CLZ, Pan/Tilt Camera System (Pelco ES3012-2CLZ10N).....	3,376.06	181.28
28 23 00 00-0993 EA 20X, Pedestal Mount, DSS, High Resolution Color, Esprit® CLZ, Pan/Tilt Camera System (Pelco ES3012-2CLZ20N).....	3,821.16	181.28
28 23 00 00-0994 EA 30X, Pedestal Mount, DSS, High Resolution Color, Esprit® CLZ, Pan/Tilt Camera System (Pelco ES3012-2CLZ30N).....	4,438.08	181.28
28 23 00 00-0995 EA 10X, Preset Positioning, Pedestal Mount, DSS, High Resolution Color, Esprit® CLZ, Pan/Tilt Camera System (Pelco ES3012-2CLZ10PN).....	3,471.60	181.28
28 23 00 00-0996 EA 20X, Preset Positioning, Pedestal Mount, DSS, High Resolution Color, Esprit® CLZ, Pan/Tilt Camera System (Pelco ES3012-2CLZ20PN).....	3,936.70	181.28
28 23 00 00-0997 EA 30X, Preset Positioning, Pedestal Mount, DSS, High Resolution Color, Esprit® CLZ, Pan/Tilt Camera System (Pelco ES3012-2CLZ30PN).....	4,553.62	181.28
28 23 00 00-0998 Wall Mount, DSS, High Resolution Color, Esprit® CLZ, Pan/Tilt Camera Systems <small>(28 23 00 00-0990)</small>		
28 23 00 00-0999 EA 10X, Wall Mount, DSS, High Resolution Color, Esprit® CLZ, Pan/Tilt Camera System (Pelco ES3012-2CLZ10W).....	3,406.43	181.28
28 23 00 00-1000 EA 20X, Wall Mount, DSS, High Resolution Color, Esprit® CLZ, Pan/Tilt Camera System (Pelco ES3012-2CLZ20W).....	3,851.53	181.28
28 23 00 00-1001 EA 30X, Wall Mount, DSS, High Resolution Color, Esprit® CLZ, Pan/Tilt Camera System (Pelco ES3012-2CLZ30W).....	4,468.45	181.28
28 23 00 00-1002 EA 10X, Preset Positioning, Wall Mount, DSS, High Resolution Color, Esprit® CLZ, Pan/Tilt Camera System (Pelco ES3012-2CLZ10PW).....	3,502.70	181.28
28 23 00 00-1003 EA 20X, Preset Positioning, Wall Mount, DSS, High Resolution Color, Esprit® CLZ, Pan/Tilt Camera System (Pelco ES3012-2CLZ20PW).....	3,967.06	181.28
28 23 00 00-1004 EA 30X, Preset Positioning, Wall Mount, DSS, High Resolution Color, Esprit® CLZ, Pan/Tilt Camera System (Pelco ES3012-2CLZ30PW).....	4,583.98	181.28
28 23 00 00-1005 Esprit® AJZ, Pan/Tilt Camera Systems <small>(28 23 00 00-0972)</small>		
28 23 00 00-1006 High Resolution Color, Esprit® AJZ, Pan/Tilt Camera Systems <small>(28 23 00 00-1005)</small>		
28 23 00 00-1007 Pedestal Mount, High Resolution Color, Esprit® AJZ, Pan/Tilt Camera Systems <small>(28 23 00 00-1006)</small>		
28 23 00 00-1008 EA 6 x 10, Pedestal Mount, High Resolution Color, Esprit® AJZ, Pan/Tilt Camera System (Pelco ES3012-2AJZ10N).....	3,182.76	181.28
28 23 00 00-1009 EA 5.6 x 20, Pedestal Mount, High Resolution Color, Esprit® AJZ, Pan/Tilt Camera System (Pelco ES3012-2AJZ20N).....	3,627.87	181.28
28 23 00 00-1010 EA 5.5 x 30, Pedestal Mount, High Resolution Color, Esprit® AJZ, Pan/Tilt Camera System (Pelco ES3012-2AJZ30N).....	4,244.79	181.28
28 23 00 00-1011 EA 6 x 10, Preset Positioning, Pedestal Mount, High Resolution Color, Esprit® AJZ, Pan/Tilt Camera System (Pelco ES3012-2AJZ10PN).....	3,279.04	181.28
28 23 00 00-1012 EA 5.6 x 20, Preset Positioning, Pedestal Mount, High Resolution Color, Esprit® AJZ, Pan/Tilt Camera System (Pelco ES3012-2AJZ20PN).....	3,743.40	181.28
28 23 00 00-1013 EA 5.5 x 30, Preset Positioning, Preset Positioning, Pedestal Mount, High Resolution Color, Esprit® AJZ, Pan/Tilt Camera System (Pelco ES3012-2AJZ30PN).....	4,360.32	181.28
28 23 00 00-1014 Wall Mount, High Resolution Color, Esprit® AJZ, Pan/Tilt Camera Systems <small>(28 23 00 00-1006)</small>		
28 23 00 00-1015 EA 6 x 10, Wall Mount, High Resolution Color, Esprit® AJZ, Pan/Tilt Camera System (Pelco ES3012-2AJZ10W).....	3,213.87	181.28
28 23 00 00-1016 EA 5.6 x 20, Wall Mount, High Resolution Color, Esprit® AJZ, Pan/Tilt Camera System (Pelco ES3012-2AJZ20W).....	3,658.23	181.28
28 23 00 00-1017 EA 5.5 x 30, Wall Mount, High Resolution Color, Esprit® AJZ, Pan/Tilt Camera System (Pelco ES3012-2AJZ30W).....	4,275.89	181.28
28 23 00 00-1018 EA 6 x 8, Preset Positioning, Wall Mount, High Resolution Color, Esprit® AJZ, Pan/Tilt Camera System (Pelco ES3012-2AJZ8PW).....	3,235.35	181.28
28 23 00 00-1019 EA 6 x 10, Preset Positioning, Wall Mount, High Resolution Color, Esprit® AJZ, Pan/Tilt Camera System (Pelco ES3012-2AJZ10W).....	3,309.41	181.28
28 23 00 00-1020 EA 5.6 x 20, Preset Positioning, Wall Mount, High Resolution Color, Esprit® AJZ, Pan/Tilt Camera System (Pelco ES3012-2AJZ20PW).....	3,773.76	181.28
28 23 00 00-1021 EA 5.5 x 30, Preset Positioning, Wall Mount, High Resolution Color, Esprit® AJZ, Pan/Tilt Camera System (Pelco ES3012-2AJZ30PW).....	4,391.42	181.28
28 23 00 00-1022 Esprit® AMZ, Pan/Tilt Camera Systems <small>(28 23 00 00-0972)</small>		
28 23 00 00-1023 Day/Night, Esprit® AMZ, Pan/Tilt Camera Systems <small>(28 23 00 00-1022)</small>		
28 23 00 00-1024 Pedestal Mount, Day/Night, Esprit® AMZ, Pan/Tilt Camera Systems <small>(28 23 00 00-1023)</small>		
28 23 00 00-1025 EA 5.6 x 20, Pedestal Mount, Day/Night, Esprit® AMZ, Pan/Tilt Camera System (Pelco ES3012-2AMZ20N).....	3,812.27	181.28
28 23 00 00-1026 EA 5.5 x 30, Pedestal Mount, Day/Night, Esprit® AMZ, Pan/Tilt Camera System (Pelco ES3012-2AMZ30N).....	4,429.19	181.28
28 23 00 00-1027 EA 6 x 10, Preset Positioning, Pedestal Mount, Day/Night, Esprit® AMZ, Pan/Tilt Camera System (Pelco ES3012-2AMZ10PN).....	3,463.45	181.28
28 23 00 00-1028 EA 5.6 x 20, Preset Positioning, Pedestal Mount, Day/Night, Esprit® AMZ, Pan/Tilt Camera System (Pelco ES3012-2AMZ20PN).....	3,927.81	181.28
28 23 00 00-1029 EA 5.5 x 30, Preset Positioning, Pedestal Mount, Day/Night, Esprit® AMZ, Pan/Tilt Camera System (Pelco ES3012-2AMZ30PN).....	4,544.73	181.28
28 23 00 00-1030 Wall Mount, Day/Night, Esprit® AMZ, Pan/Tilt Camera Systems <small>(28 23 00 00-1023)</small>		
28 23 00 00-1031 EA 6 x 10, Wall Mount, Day/Night, Esprit® AMZ, Pan/Tilt Camera System (Pelco ES3012-2AMZ10W).....	3,398.28	181.28
28 23 00 00-1032 EA 5.6 x 20, Wall Mount, Day/Night, Esprit® AMZ, Pan/Tilt Camera System (Pelco ES3012-2AMZ20W).....	3,842.64	181.28
28 23 00 00-1033 EA 5.5 x 30, Wall Mount, Day/Night, Esprit® AMZ, Pan/Tilt Camera System (Pelco ES3012-2AMZ30W).....	4,460.30	181.28
28 23 00 00-1034 EA 6 x 10, Preset Positioning, Wall Mount, Day/Night, Esprit® AMZ, Pan/Tilt Camera System (Pelco ES3012-2AMZ10PW).....	3,493.82	181.28

28 Electronic Safety And Security**28 20 Electronic Surveillance****28 23 Video Surveillance**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 23 00 00-1035 EA 5.6 x 20, Preset Positioning, Wall Mount, Day/Night, Esprit® AMZ, Pan/Tilt Camera System (Pelco ES3012-2AMZ20PW).....	3,958.17	181.28
28 23 00 00-1036 EA 5.5 x 30, Preset Positioning, Wall Mount, Day/Night, Esprit® AMZ, Pan/Tilt Camera System (Pelco ES3012-2AMZ30PW).....	4,575.83	181.28
28 23 00 00-1037 Esprit® KWZ, Pan/Tilt Camera Systems (28 23 00 00-0972)		
28 23 00 00-1038 Day/Night, Esprit® KWZ, Pan/Tilt Camera Systems (28 23 00 00-1037)		
28 23 00 00-1039 Pedestal Mount, Day/Night, Esprit® KWZ, Pan/Tilt Camera Systems (28 23 00 00-1038)		
28 23 00 00-1040 EA 5.5 x 30, Pedestal Mount, Day/Night, Esprit® KWZ, Pan/Tilt Camera System (Pelco ES3012-2KWZ30N).....	4,527.69	181.28
28 23 00 00-1041 EA 6 x 10, Preset Positioning, Pedestal Mount, Day/Night, Esprit® KWZ, Pan/Tilt Camera System (Pelco ES3012-2KWZ10PN).....	3,561.21	181.28
28 23 00 00-1042 EA 5.5 x 30, Preset Positioning, Pedestal Mount, Day/Night, Esprit® KWZ, Pan/Tilt Camera System (Pelco ES3012-2KWZ30PN).....	4,643.23	181.28
28 23 00 00-1043 Wall Mount, Day/Night, Esprit® KWZ, Pan/Tilt Camera Systems (28 23 00 00-1038)		
28 23 00 00-1044 EA 6 x 10, Wall Mount, Day/Night, Esprit® KWZ, Pan/Tilt Camera System (Pelco ES3012-2KWZ10W).....	3,496.04	181.28
28 23 00 00-1045 EA 5.5 x 30, Wall Mount, Day/Night, Esprit® KWZ, Pan/Tilt Camera System (Pelco ES3012-2KWZ30W).....	4,558.80	181.28
28 23 00 00-1046 EA 6 x 10, Preset Positioning, Wall Mount, Day/Night, Esprit® KWZ, Pan/Tilt Camera System (Pelco ES3012-2KWZ10PW).....	3,592.32	181.28
28 23 00 00-1047 EA 5.6 x 20, Preset Positioning, Wall Mount, Day/Night, Esprit® KWZ, Pan/Tilt Camera System (Pelco ES3012-2KWZ20PW).....	4,056.67	181.28
28 23 00 00-1048 EA 5.5 x 30, Preset Positioning, Wall Mount, Day/Night, Esprit® KWZ, Pan/Tilt Camera System (Pelco ES3012-2KWZ30PW).....	4,674.33	181.28
28 23 00 00-1049 Esprit® IOC, Pan/Tilt Camera Systems (28 23 00 00-0972)		
28 23 00 00-1050 Standard Resolution Color, Esprit® IOC, Pan/Tilt Camera Systems (28 23 00 00-1049)		
28 23 00 00-1051 Pedestal Mount, Standard Resolution Color, Esprit® IOC, Pan/Tilt Camera Systems (28 23 00 00-1050)		
28 23 00 00-1052 EA 16X, Pedestal Mount, Standard Resolution Color, Esprit® IOC, Pan/Tilt Camera System (Pelco ES30PC16-2N).....	3,806.35	181.28
28 23 00 00-1053 Wall Mount, Standard Resolution Color, Esprit® IOC, Pan/Tilt Camera Systems (28 23 00 00-1050)		
28 23 00 00-1054 EA 16X, Wall Mount, Standard Resolution Color, Esprit® IOC, Pan/Tilt Camera System (Pelco ES30PC16-2W).....	3,836.71	181.28
28 23 00 00-1055 High Resolution Color, Esprit® IOC, Pan/Tilt Camera Systems (28 23 00 00-1049)		
28 23 00 00-1056 Pedestal Mount, High Resolution Color, Esprit® IOC, Pan/Tilt Camera Systems (28 23 00 00-1055)		
28 23 00 00-1057 EA 22X, Pedestal Mount, High Resolution Color, Esprit® IOC, Pan/Tilt Camera System (Pelco ES30PC22-2N).....	4,527.69	181.28
28 23 00 00-1058 EA 24X, Pedestal Mount, High Resolution Color, Esprit® IOC, Pan/Tilt Camera System (Pelco ES30PCBW24-2N).....	4,376.61	181.28
28 23 00 00-1059 EA 35X, Pedestal Mount, High Resolution Color, Esprit® IOC, Pan/Tilt Camera System (Pelco ES30PCBW35-2N).....	4,980.20	181.28
28 23 00 00-1060 Wall Mount, High Resolution Color, Esprit® IOC, Pan/Tilt Camera Systems (28 23 00 00-1055)		
28 23 00 00-1061 EA 22X, Wall Mount, High Resolution Color, Esprit® IOC, Pan/Tilt Camera System (Pelco ES30PC22-2W).....	4,557.32	181.28
28 23 00 00-1062 EA 24X, Wall Mount, High Resolution Color, Esprit® IOC, Pan/Tilt Camera System (Pelco ES30PCBW24-2W).....	4,376.61	181.28
28 23 00 00-1063 EA 35X, Wall Mount, High Resolution Color, Esprit® IOC, Pan/Tilt Camera System (Pelco ES30PCBW35-2W).....	5,013.53	181.28
28 23 00 00-1064 Esprit® IOP, Pan/Tilt Camera Systems (28 23 00 00-0972)		
28 23 00 00-1065 High Resolution Color, Esprit® IOP, Pan/Tilt Camera Systems (28 23 00 00-1064)		
28 23 00 00-1066 Pedestal Mount, High Resolution Color, Esprit® IOP, Pan/Tilt Camera Systems (28 23 00 00-1065)		
28 23 00 00-1067 EA 16X, Pedestal Mount, High Resolution Color, Esprit® IOP, Pan/Tilt Camera System (Pelco ES30C16-2N).....	2,918.37	181.28
28 23 00 00-1068 EA 22X, Pedestal Mount, High Resolution Color, Esprit® IOP, Pan/Tilt Camera System (Pelco ES30C22-2N).....	3,640.46	181.28
28 23 00 00-1069 EA 24X, Pedestal Mount, High Resolution Color, Esprit® IOP, Pan/Tilt Camera System (Pelco ES30CBW24-2N).....	3,491.60	181.28
28 23 00 00-1070 EA 35X, Pedestal Mount, High Resolution Color, Esprit® IOP, Pan/Tilt Camera System (Pelco ES30CBW35-2N).....	3,961.88	181.28
28 23 00 00-1071 Wall Mount, High Resolution Color, Esprit® IOP, Pan/Tilt Camera Systems (28 23 00 00-1065)		
28 23 00 00-1072 EA 16X, Wall Mount, High Resolution Color, Esprit® IOP, Pan/Tilt Camera System (Pelco ES30C16-2W).....	2,947.99	181.28
28 23 00 00-1073 EA 22X, Wall Mount, High Resolution Color, Esprit® IOP, Pan/Tilt Camera System (Pelco ES30C22-2W).....	3,670.82	181.28
28 23 00 00-1074 EA 24X, Wall Mount, High Resolution Color, Esprit® IOP, Pan/Tilt Camera System (Pelco ES30CBW24-2W).....	3,521.96	181.28
28 23 00 00-1075 EA 35X, Wall Mount, High Resolution Color, Esprit® IOP, Pan/Tilt Camera System (Pelco ES30CBW35-2W).....	3,995.20	181.28
28 23 00 00-1076 Esprit® Thermal, Pan/Tilt Camera Systems (28 23 00 00-0972)		



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 23 00 00-1077				Esprit® Thermal, Pan/Tilt Camera Systems (28 23 00 00-1076)		
28 23 00 00-1078				Pedestal Mount, Esprit® Thermal, Pan/Tilt Camera Systems (28 23 00 00-1077)		
	EA			14.25 mm, Pedestal Mount, Esprit® Thermal, Pan/Tilt Camera System (Pelco ES3014TI-2N)	18,956.80	181.28
	EA			35 mm, Pedestal Mount, Esprit® Thermal, Pan/Tilt Camera System (Pelco ES3035TI-2N)	20,388.38	181.28
	EA			50 mm, Pedestal Mount, Esprit® Thermal, Pan/Tilt Camera System (Pelco ES3050TI-2N)	20,869.03	181.28
28 23 00 00-1082				Wall Mount, Esprit® Thermal, Pan/Tilt Camera Systems (28 23 00 00-1077)		
	EA			14.25 mm, Wall Mount, Esprit® Thermal, Pan/Tilt Camera System (Pelco ES3014TI-2W).....	18,987.91	181.28
	EA			35 mm, 30 Hertz, Wall Mount, Esprit® Thermal, Pan/Tilt Camera System (Pelco ES3035TI-2W)	20,418.75	181.28
	EA			50 mm, Wall Mount, Esprit® Thermal, Pan/Tilt Camera System (Pelco ES3050TI-2W)	20,899.40	181.28
28 23 00 00-1086				Accessories For Esprit® Pan/Tilt Camera Systems (28 23 00 00-0972)		
	EA			Wiper Blade Replacement For Esprit® Systems (Pelco ES-REPLBLADE)	7.96	2.02
	EA			Marine Mounting Kit For Esprit® Systems (Pelco ES-MKIT)	46.06	10.07
	EA			Indoor/Outdoor Wall Mount For Esprit® Systems (Pelco EWM)	72.72	10.07
	EA			Wall Mount For High Security Enclosures (Pelco HSWM12)	92.72	10.07
	EA			Ground Isolation Transformer (Pelco GIT100).....	266.31	27.51
	EA			High Security, Indoor Wedge Style Enclosure (Pelco HS2100).....	262.60	27.51
	EA			High Security, Indoor 10" Length Enclosure (Pelco HS3000)	320.37	27.51
	EA			High Security, Indoor Medium Corner Mount Enclosure (Pelco HS1500).....	594.39	27.51
	EA			High Security, Ceiling Mount, Lexan Window, Aluminum Enclosure (Pelco HS8080)	246.31	27.51
	EA			High Security, Ceiling Mount, Lexan Window, Steel Enclosure (Pelco HS8134)	476.64	27.51
	EA			Bullet-Resistant, Outdoor Enclosure (Pelco HS4514).....	1,017.28	27.51
	EA			Bullet-Resistant, Outdoor Enclosure With Mount (Pelco HS4514/MT)	1,210.57	27.51
	EA			24X, Color/Black And White, Esprit® Camera Module (Pelco ESIOPCBW24).....	1,254.27	27.51
	EA			35X, Color/Black And White, Esprit® Camera Module (Pelco ESIOPCBW35).....	1,323.14	27.51
	EA			24 Volt AC, Esprit® Pan Tilt Enclosure Receiver (Pelco ES3012-2)	2,217.05	27.51
	EA			115/230 Volt AC, Esprit® Pan/Tilt Enclosure Receiver (Pelco ES3012-5).....	2,217.05	27.51
	EA			24 Volt AC, Pedestal Mount, Esprit® Pan/Tilt Enclosure Receiver (Pelco ES3012-2N)	2,239.26	27.51
	EA			120 Volt AC, Pedestal Mount, Esprit® Pan/Tilt Enclosure Receiver (Pelco ES3012-5N)	2,239.26	27.51
	EA			24 Volt AC, Wall Mount, Esprit® Pan/Tilt Enclosure Receiver (Pelco ES3012-2W)	2,270.37	27.51
	EA			120 Volt AC, Wall Mount, Esprit® Pan/Tilt Enclosure Receiver (Pelco ES3012-5W)	2,270.37	27.51
	EA			30X, 24 Volt AC, DSS, Color High Resolution, Esprit® CLZ Pan/Tilt Camera System (Pelco ES3012-2CLZ30)	4,163.34	27.51
	EA			30X, 24 Volt AC, Preset Positioning, DSS, Color High Resolution, Esprit® CLZ Pan/Tilt Camera System (Pelco ES3012-2CLZ30P)	4,278.88	27.51
	EA			Esprit® Camera Pole Mount Adapter (Pelco EPM)	65.41	6.48
	EA			Pole Mount Adapter For Esprit® Systems (Pelco EPM)	65.41	6.48
28 23 00 00-1111				Camera Lenses (28 23 00 00-0601)		
28 23 00 00-1112				Fixed Focus Camera Lenses (28 23 00 00-1111) Note: 1/3" format and manual focus.		
28 23 00 00-1113				Manual Iris, Fixed Focus Camera Lenses (28 23 00 00-1112)		
	EA			2.3 mm, Manual Iris, Fixed Focus Camera Lens (Pelco 13FA2.3).....	117.79	9.46
	EA			2.8 mm, Manual Iris, Fixed Focus Camera Lens (Pelco 13FA2.8)	97.06	9.46
	EA			4 mm, Manual Iris, Fixed Focus Camera Lens (Pelco 13FA4).....	86.69	9.46
	EA			8 mm, Manual Iris, Fixed Focus Camera Lens (Pelco 13FA8).....	84.47	9.46
28 23 00 00-1118				Direct Drive Auto Iris, Fixed Focus Camera Lenses (28 23 00 00-1112) Note: Includes spot filter. Excludes amplifier.		
	EA			2.3 mm, Direct Drive Auto Iris, Fixed Focus Camera Lens (Pelco 13FD2.3).....	148.16	9.46
	EA			2.8 mm, Direct Drive Auto Iris, Fixed Focus Camera Lens (Pelco 13FD2.8)	117.79	9.46
	EA			4 mm, Direct Drive Auto Iris, Fixed Focus Camera Lens (Pelco 13FD4)	110.39	9.46
	EA			8 mm, Direct Drive Auto Iris, Fixed Focus Camera Lens (Pelco 13FD8)	77.80	9.46
28 23 00 00-1123				Video Drive Auto Iris, Fixed Focus Camera Lenses (28 23 00 00-1112) Note: Includes LDC100 adapter to convert DC auto iris to video drive.		
	EA			2.3 mm, Video Drive Auto Iris, Fixed Focus Camera Lenses (Pelco 13FV2.3S)	175.56	9.46
	EA			2.8 mm, Video Drive Auto Iris, Fixed Focus Camera Lenses (Pelco 13FV2.8S)	144.46	9.46
	EA			4 mm, Video Drive Auto Iris, Fixed Focus Camera Lenses (Pelco 13FV4S)	137.05	9.46
	EA			8 mm, Video Drive Auto Iris, Fixed Focus Camera Lenses (Pelco 13FV8S)	131.13	9.46
28 23 00 00-1128				Varifocal Camera Lenses (28 23 00 00-1111) Note: 1/3" format and manual focus and zoom.		
28 23 00 00-1129				Manual Iris, Varifocal Camera Lenses (28 23 00 00-1128)		
	EA			1.6-3.4 mm, Manual Iris, Varifocal Camera Lens (Pelco 13VA1-3).....	179.26	9.46
	EA			2.5-6 mm, Manual Iris, Varifocal Camera Lens (Pelco 13VA2.5-6).....	138.53	9.46
	EA			2.8-12 mm, Manual Iris, Varifocal Camera Lens (Pelco 13VA2.8-12).....	106.69	9.46
	EA			3-8 mm, Manual Iris, Varifocal Camera Lens (Pelco 13VA3-8).....	93.35	9.46
	EA			5.5-82.5 mm, Manual Iris, Varifocal Camera Lens (Pelco 13VA5.5-82.5).....	249.62	9.46
	EA			5-40 mm, Manual Iris, Varifocal Camera Lens (Pelco 13VA5-40).....	142.23	9.46
	EA			5-50 mm, Manual Iris, Varifocal Camera Lens (Pelco 13VA5-50).....	174.08	9.46

28 Electronic Safety And Security**28 20 Electronic Surveillance****28 23 Video Surveillance**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 23 00 00-1137			Direct Drive Auto Iris, Varifocal Camera Lenses (28 23 00 00-1128) Note: Includes spot filter.		
28 23 00 00-1138	EA		1.6-3.4 mm, Direct Drive Auto Iris, Varifocal Camera Lens (Pelco 13VD1-3)	211.11	9.46
28 23 00 00-1139	EA		2.5-6 mm, Direct Drive Auto Iris, Varifocal Camera Lens (Pelco 13VD2.5-6)	184.45	9.46
28 23 00 00-1140	EA		2.8-12 mm, Direct Drive Auto Iris, Varifocal Camera Lens (Pelco 13VD2.8-12)	137.05	9.46
28 23 00 00-1141	EA		3-8 mm, Direct Drive Auto Iris, Varifocal Camera Lens (Pelco 13VD3-8)	97.80	9.46
28 23 00 00-1142	EA		5.5-82.5 mm, Direct Drive Auto Iris, Varifocal Camera Lens (Pelco 13VD5.5-82.5)	272.58	9.46
28 23 00 00-1143	EA		5-40 mm, Direct Drive Auto Iris, Varifocal Camera Lens (Pelco 13VD5-40)	158.53	9.46
28 23 00 00-1144	EA		5-50 mm, Direct Drive Auto Iris, Varifocal Camera Lens (Pelco 13VD5-50)	208.89	9.46
28 23 00 00-1145			Video Drive Auto Iris, Varifocal Camera Lenses (28 23 00 00-1128) Note: Includes spot filter.		
28 23 00 00-1146	EA		1.6-3.4 mm, Video Drive Auto Iris, Varifocal Camera Lens (Pelco 13VV1-3S)	238.51	9.46
28 23 00 00-1147	EA		2.5-6 mm, Video Drive Auto Iris, Varifocal Camera Lens (Pelco 13VV2.5-6S)	211.11	9.46
28 23 00 00-1148	EA		3-8 mm, Video Drive Auto Iris, Varifocal Camera Lens (Pelco 13VV3-8S)	125.20	9.46
28 23 00 00-1149	EA		5-50 mm, Video Drive Auto Iris, Varifocal Camera Lens (Pelco 13VV5-50S)	235.55	9.46
28 23 00 00-1150			Infrared Corrected, Direct Drive Auto Iris, Varifocal Camera Lenses (28 23 00 00-1128) Note: Includes spot filter.		
28 23 00 00-1151	EA		3-8.5 mm, Infrared Corrected, Direct Drive Auto Iris, Varifocal Camera Lens (Pelco 13VDIR3-8.5)	115.57	9.46
28 23 00 00-1152	EA		7.5-50 mm, Infrared Corrected, Direct Drive Auto Iris, Varifocal Camera Lens (Pelco 13VDIR7.5-50)	182.97	9.46
28 23 00 00-1153			Motorized Zoom Camera Lenses (28 23 00 00-1111) Note: 1/3" format.		
28 23 00 00-1154			Manual Iris, Motorized Zoom Camera Lenses (28 23 00 00-1153)		
28 23 00 00-1155	EA		8X Zoom, 6-48 mm, Manual Iris, Motorized Zoom Camera Lens (Pelco 13ZM6X8)	436.25	9.46
28 23 00 00-1156	EA		10X Zoom, 6-60 mm, Manual Iris, Motorized Zoom Camera Lens (Pelco 13ZM6X10)	545.86	9.46
28 23 00 00-1157	EA		15X Zoom, 6-90 mm, Manual Iris, Motorized Zoom Camera Lens (Pelco 13ZM6X15)	582.15	9.46
28 23 00 00-1158			Direct Drive Auto Iris, Motorized Zoom Camera Lenses (28 23 00 00-1153) Note: Includes spot filter.		
28 23 00 00-1159	EA		6X Zoom, 6-48 mm, Direct Drive Auto Iris, Motorized Zoom Camera Lens (Pelco 13ZD6X8)	419.96	9.46
28 23 00 00-1160	EA		10X Zoom, 6-60 mm, Direct Drive Auto Iris, Motorized Zoom Camera Lens (Pelco 13ZD6X10)	505.87	9.46
28 23 00 00-1161	EA		15X Zoom, 6-90 mm, Direct Drive Auto Iris, Motorized Zoom Camera Lens (Pelco 13ZD6X15)	643.62	9.46
28 23 00 00-1162	EA		20X Zoom, 5.6-112 mm, Direct Drive Auto Iris, Motorized Zoom Camera Lens (Pelco 13ZD5.6X20)	950.97	9.46
28 23 00 00-1163	EA		30X Zoom, 5.5-165 mm, Direct Drive Auto Iris, Motorized Zoom Camera Lens (Pelco 13ZD5.5X30)	1,568.63	9.46
28 23 00 00-1164			Video Drive Auto Iris, Motorized Zoom Camera Lenses (28 23 00 00-1153) Note: Includes spot filter.		
28 23 00 00-1165	EA		8X Zoom, 6-48 mm, Video Drive Auto Iris, Motorized Zoom Camera Lens (Pelco 13ZV6X8S)	447.36	9.46
28 23 00 00-1166	EA		10X Zoom, 6-60 mm, Video Drive Auto Iris, Motorized Zoom Camera Lens (Pelco 13ZV6X10S)	533.27	9.46
28 23 00 00-1167	EA		15X Zoom, 6-90 mm, Video Drive Auto Iris, Motorized Zoom Camera Lens (Pelco 13ZV6X15S)	671.02	9.46
28 23 00 00-1168	EA		20X Zoom, 5.6-112 mm, Video Drive Auto Iris, Motorized Zoom Camera Lens (Pelco 13ZV5.6X20S)	978.37	9.46
28 23 00 00-1169	EA		30X Zoom, 5.5-165 mm, Video Drive Auto Iris, Motorized Zoom Camera Lens (Pelco 13ZV5.5X30S)	1,595.29	9.46
28 23 00 00-1170			Camera Power Supplies (28 23 00 00-0601)		
28 23 00 00-1171	EA		20 VA, 24 Volt AC, Camera Power Transformer (Pelco TF2000)	29.44	8.05
28 23 00 00-1172	EA		50 VA, 24 Volt AC, Camera Power Transformer (Pelco TF9000)	51.66	8.05
28 23 00 00-1173	EA		2 Amp, 4 Outputs, Camera Power Supply (Pelco MCS4-2)	114.44	16.11
28 23 00 00-1174	EA		5 Amp, 8 Outputs, Camera Power Supply (Pelco MCS8-5)	157.95	24.17
28 23 00 00-1175	EA		10 Amp, 16 Outputs, Camera Power Supply (Pelco MCS16-10)	228.13	32.23
			For Switchable Outputs, Add	98.20	
28 23 00 00-1176	EA		20 Amp, 16 Outputs, Camera Power Supply (Pelco MCS16-20)	282.01	40.28
			For Switchable Outputs, Add	120.86	
28 23 00 00-1177			Camera Illuminators (28 23 00 00-0601)		
28 23 00 00-1178			Camera Illuminators (28 23 00 00-1177) Note: Includes lamp and mounting bracket.		
28 23 00 00-1179	EA		Narrow Spot Lamp, Low Light Level Camera Illuminator (Pelco LL27MF)	1,166.83	16.11
28 23 00 00-1180	EA		Infrared Narrow Spot Lamp, Low Light Level Camera Illuminator (Pelco LL27NS)	1,166.83	16.11
28 23 00 00-1181	EA		Flood Lamp, Low Light Level Camera Illuminator (Pelco LL27WF)	1,166.83	16.11
28 23 00 00-1182			Camera Illuminator Accessories (28 23 00 00-1177)		
28 23 00 00-1183	EA		Replacement Lamp For Low Light Level Camera Illuminator (Pelco PAR56)	95.18	16.11
28 23 00 00-1184			Camera Receivers (28 23 00 00-0601)		
28 23 00 00-1185	EA		24 Volt AC, Coaxitron® Outdoor Camera Receiver With Preset Positioning (Pelco CX9024RX-PP)	1,126.88	27.51
28 23 00 00-1186	EA		120 Volt AC, Coaxitron® Outdoor Camera Receiver With Preset Positioning (Pelco CX9115RX-PP)	1,126.88	27.51



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 23 00 00-1187 Pan And Tilt Drives <small>(28 23 00 00-0601)</small>		
28 23 00 00-1188 EA 15 LB Load, 24 Volt AC, Outdoor Pan And Tilt Drive (Pelco PT270-24P)	797.02	60.42
28 23 00 00-1189 EA 40 LB Load, 24/120 Volt AC, Outdoor Pan And Tilt Drive (Pelco PT570-24P)	1,013.27	60.42
<i>For Preset Positioning, Add</i>	<i>165.00</i>	
28 23 00 00-1190 EA 100 LB Load, 120 Volt AC, Outdoor Pan And Tilt Drive (Pelco PT1250P)	2,147.87	60.42
<i>For Preset Positioning, Add</i>	<i>165.00</i>	
28 23 00 00-1191 EA 100 LB Load, 120 Volt DC, Outdoor Pan And Tilt Drive (Pelco PT1250DC)	2,455.22	60.42
<i>For Preset Positioning, Add</i>	<i>165.00</i>	
28 23 00 00-1192 EA 100 LB Load, 120 Volt DC, 360 Degree Outdoor Pan And Tilt Drive (Pelco PT1280SL).....	2,841.81	60.42
<i>For Preset Positioning, Add</i>	<i>165.00</i>	
28 23 00 00-1193 EA 100 LB Load, 120 Volt DC, Explosion Proof Outdoor Pan And Tilt Drive (Pelco PT1260EX).....	3,663.88	60.42
<i>For Preset Positioning, Add</i>	<i>165.00</i>	
28 23 00 00-1194 Scanners <small>(28 23 00 00-0601)</small>		
28 23 00 00-1195 EA 35 LB Load, 24 Volt AC, Indoor/Outdoor Scanner (Pelco PS20-24).....	910.33	60.42
<i>For Wall Mount, Add</i>	<i>39.05</i>	
<i>For Pressure Sensor Alarm, Add</i>	<i>51.15</i>	
28 23 00 00-1196 EA 35 LB Load, 120 Volt AC, Indoor/Outdoor Scanner (Pelco PS20).....	956.99	60.42
<i>For Wall Mount, Add</i>	<i>39.05</i>	
<i>For Pressure Sensor Alarm, Add</i>	<i>51.15</i>	
28 23 00 00-1197 Camera Monitors <small>(28 23 00 00-0600)</small>		
28 23 00 00-1198 Camera Monitors <small>(28 23 00 00-1197)</small>		
28 23 00 00-1199 Monochrome Camera Monitors <small>(28 23 00 00-1198)</small>		
28 23 00 00-1200 EA 9" Monochrome Camera Monitor (Pelco PMM9A)	177.47	12.09
28 23 00 00-1201 EA 12" Monochrome Camera Monitor (Pelco PMM12A).....	203.40	12.09
28 23 00 00-1202 EA 15" Monochrome Camera Monitor (Pelco PMM15A).....	313.00	12.09
28 23 00 00-1203 EA 20" Monochrome Camera Monitor (Pelco PMM20A).....	504.82	12.09
28 23 00 00-1204 Color Camera Monitors <small>(28 23 00 00-1198)</small>		
28 23 00 00-1205 EA 9", High Resolution Color, Camera Monitor (Pelco PMC9A)	569.99	12.09
28 23 00 00-1206 EA 15", High Resolution Color, Camera Monitor (Pelco PMCS15A)	461.86	12.09
28 23 00 00-1207 EA 17", High Resolution Color, Camera Monitor (Pelco PMCS17A)	672.19	12.09
28 23 00 00-1208 EA 19", High Resolution Color, Camera Monitor (Pelco PMCS19A)	894.37	12.09
28 23 00 00-1209 LCD Camera Monitors <small>(28 23 00 00-1197)</small>		
28 23 00 00-1210 VGA Signal, Color LCD Camera Monitors (Pelco 200 Series) <small>(28 23 00 00-1209)</small>		
<i>Note: Displays VGA computer signals.</i>		
28 23 00 00-1211 EA 17", VGA Signal, High Resolution Color, LCD Camera Monitor (Pelco PMCL217)	644.79	12.09
28 23 00 00-1212 EA 19", VGA Signal, High Resolution Color, LCD Camera Monitor (Pelco PMCL219)	840.31	12.09
28 23 00 00-1213 Multimode, Color LCD Camera Monitors (Pelco 300 Series) <small>(28 23 00 00-1209)</small>		
<i>Note: Displays VGA computer signals and/or composite video signals.</i>		
28 23 00 00-1214 EA 15", Multimode, High Resolution Color, LCD Camera Monitor (Pelco PMCL315)	733.66	12.09
28 23 00 00-1215 EA 17", Multimode, High Resolution Color, LCD Camera Monitor (Pelco PMCL317)	878.82	12.09
28 23 00 00-1216 EA 19", Multimode, High Resolution Color, LCD Camera Monitor (Pelco PMCL319)	1,081.75	12.09
28 23 00 00-1217 Multimode With PIP, Color LCD Camera Monitors (Pelco 400 Series) <small>(28 23 00 00-1209)</small>		
<i>Note: Displays VGA computer signals and/or composite video signals. Includes picture in picture option.</i>		
28 23 00 00-1218 EA 15", Multimode With PIP, High Resolution Color, LCD Camera Monitor (Pelco PMCL415)	942.51	12.09
28 23 00 00-1219 EA 17", Multimode With PIP, High Resolution Color, LCD Camera Monitor (Pelco PMCL417)	1,093.60	12.09
28 23 00 00-1220 EA 19", Multimode With PIP, High Resolution Color, LCD Camera Monitor (Pelco PMCL419)	1,372.80	12.09
28 23 00 00-1221 Camera Monitor Mounting Accessories <small>(28 23 00 00-1197)</small>		
28 23 00 00-1222 Camera Monitor Mounts <small>(28 23 00 00-1221)</small>		
28 23 00 00-1223 EA Up To 14", Camera Monitor Mount (Pelco).....	217.38	16.11
28 23 00 00-1224 EA >14" To 17", Camera Monitor Mount (Pelco).....	253.67	16.11
28 23 00 00-1225 EA >17" To 21", Camera Monitor Mount (Pelco).....	298.11	16.11
28 23 00 00-1226 Camera Monitor Rack Mount Kits <small>(28 23 00 00-1221)</small>		
28 23 00 00-1227 EA Camera Monitor Rack Mount Kit (Pelco PMCL-RM).....	130.73	16.11
28 23 00 00-1228 Video Transmission Equipment <small>(28 23 00 00-0600)</small>		
28 23 00 00-1229 UTP Cable, Video Transmission Equipment <small>(28 23 00 00-1228)</small>		
28 23 00 00-1230 UTP Cable, Active Video Receivers <small>(28 23 00 00-1229)</small>		

28 Electronic Safety And Security**28 20 Electronic Surveillance****28 23 Video Surveillance**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 23 00 00-1231 EA Single Channel, UTP Cable, Active Video Receiver (Pelco TW3001AR)	273.57	20.14
28 23 00 00-1232 EA Four Channel, UTP Cable, Active Video Receiver (Pelco TW3004AR)	949.74	20.14
28 23 00 00-1233 EA Eight Channel, 4 Outputs, UTP Cable, Active Video Receiver (Pelco TW3008AR-4-US)	1,871.78	20.14
28 23 00 00-1234 EA Sixteen Channel, UTP Cable, Active Video Receiver (Pelco TW3016AR1-US)	3,076.74	20.14
28 23 00 00-1235 EA Sixteen Channel, 2 Outputs, UTP Cable, Active Video Receiver (Pelco TW3016AR-2-US)	3,592.94	20.14
28 23 00 00-1236 UTP Cable, Passive Video Transceivers (28 23 00 00-1229)		
28 23 00 00-1237 EA Single Channel, UTP Cable, Passive Video Transceiver (Pelco TW3001P)	78.05	20.14
28 23 00 00-1238 EA Four Channel, UTP Cable, Passive Video Transceiver (Pelco TW3004P)	273.57	20.14
28 23 00 00-1239 EA Eight Channel, UTP Cable, Passive Video Transceiver (Pelco TW3008P)	507.60	20.14
28 23 00 00-1240 EA Sixteen Channel, UTP Cable, Passive Video Transceiver (Pelco TW3016P)	968.25	20.14
28 23 00 00-1241 EA Thirty Two Channel, UTP Cable, Passive Video Transceiver (Pelco TW3032P)	1,896.96	20.14
28 23 00 00-1242 UTP Cable, Active Video Transmitters (28 23 00 00-1229)		
28 23 00 00-1243 EA Single Channel, UTP Cable, Active Video Transmitter (Pelco TW3001AT)	286.16	20.14
28 23 00 00-1244 Fiber Optics, Video Transmission Equipment (28 23 00 00-1228)		
28 23 00 00-1245 Data Only, Fiber Optics Transmission Equipment (28 23 00 00-1244)		
28 23 00 00-1246 Bidirectional Data, Fiber Optics Transmitters (28 23 00 00-1245)		
28 23 00 00-1247 EA Single-Channel, Single Mode, Bidirectional Data, Fiber Optics Transmitter (Pelco FT8101AS)	1,671.38	40.28
28 23 00 00-1248 EA Single-Channel, Multimode, Bidirectional Data, Fiber Optics Transmitter (Pelco FT8101AM)	680.46	40.28
28 23 00 00-1249 EA Four-Channel, Single Mode, Bidirectional Data, Fiber Optics Transmitter (Pelco FT8104S)	1,220.35	40.28
28 23 00 00-1250 EA Four-Channel, Multimode, Bidirectional Data, Fiber Optics Transmitter (Pelco FT8104M)	840.43	40.28
28 23 00 00-1251 Bidirectional Data, Fiber Optics Receivers (28 23 00 00-1245)		
28 23 00 00-1252 EA Single-Channel, Single Mode, Bidirectional Data, Fiber Optics Receiver (Pelco FR8101AS)	1,671.38	40.28
28 23 00 00-1253 EA Single-Channel, Multimode, Bidirectional Data, Fiber Optics Receiver (Pelco FR8101AM)	680.46	40.28
28 23 00 00-1254 EA Four-Channel, Single Mode, Bidirectional Data, Fiber Optics Receiver (Pelco FR8104S)	1,220.35	40.28
28 23 00 00-1255 EA Four-Channel, Multimode, Bidirectional Data, Fiber Optics Receiver (Pelco FR8104M)	840.43	40.28
28 23 00 00-1256 Video Only, Fiber Optics Transmission Equipment (28 23 00 00-1244)		
28 23 00 00-1257 Digitally Encoded Video, Fiber Optics Transmitters (28 23 00 00-1256)		
28 23 00 00-1258 EA Single-Channel, Single Mode, Digitally Encoded Video, Fiber Optics Transmitter (Pelco FT8301AS)	739.70	40.28
28 23 00 00-1259 EA Single-Channel, Multimode, Digitally Encoded Video, Fiber Optics Transmitter (Pelco FT8301AM)	320.52	40.28
28 23 00 00-1260 EA Four-Channel, Single Mode, Digitally Encoded Video, Fiber Optics Transmitter (Pelco FT8304S)	2,057.23	40.28
28 23 00 00-1261 EA Four-Channel, Multimode, Digitally Encoded Video, Fiber Optics Transmitter (Pelco FT8304M)	1,235.17	40.28
28 23 00 00-1262 EA Eight-Channel, Single Mode, Digitally Encoded Video, Fiber Optics Transmitter (Pelco FT8308S)	3,372.54	40.28
28 23 00 00-1263 EA Eight-Channel, Multimode, Digitally Encoded Video, Fiber Optics Transmitter (Pelco FT8308M)	2,803.76	40.28
28 23 00 00-1264 EA Sixteen-Channel, Single Mode, Digitally Encoded Video, Fiber Optics Transmitter (Pelco FT8316S)	8,378.99	40.28
28 23 00 00-1265 EA Sixteen-Channel, Multimode, Digitally Encoded Video, Fiber Optics Transmitter (Pelco FT8316M)	7,456.95	40.28
28 23 00 00-1266 Digitally Encoded Video, Fiber Optics Receivers (28 23 00 00-1256)		
28 23 00 00-1267 EA Single-Channel, Single Mode, Digitally Encoded Video, Fiber Optics Receiver (Pelco FR8301AS)	739.70	40.28
28 23 00 00-1268 EA Single-Channel, Multimode, Digitally Encoded Video, Fiber Optics Receiver (Pelco FR8301AM)	320.52	40.28
28 23 00 00-1269 EA Two-Channel, Single Mode, Digitally Encoded Video, Fiber Optics Receiver (Pelco FR8302AS)	1,265.53	40.28
28 23 00 00-1270 EA Two-Channel, Multimode, Digitally Encoded Video, Fiber Optics Receiver (Pelco FR8302AM)	510.86	40.28
28 23 00 00-1271 EA Four-Channel, Single Mode, Digitally Encoded Video, Fiber Optics Receiver (Pelco FR8304S)	2,057.23	40.28
28 23 00 00-1272 EA Four-Channel, Multimode, Digitally Encoded Video, Fiber Optics Receiver (Pelco FR8304M)	1,235.17	40.28
28 23 00 00-1273 EA Eight-Channel, Single Mode, Digitally Encoded Video, Fiber Optics Receiver (Pelco FR8308S)	3,372.54	40.28
28 23 00 00-1274 EA Eight-Channel, Multimode, Digitally Encoded Video, Fiber Optics Receiver (Pelco FR8308M)	2,803.76	40.28
28 23 00 00-1275 EA Sixteen-Channel, Single Mode, Digitally Encoded Video, Fiber Optics Receiver (Pelco FR8316S)	8,378.99	40.28
28 23 00 00-1276 EA Sixteen-Channel, Multimode, Digitally Encoded Video, Fiber Optics Receiver (Pelco FR8316M)	7,456.95	40.28
28 23 00 00-1277 Video And Data, Fiber Optics Transmission Equipment (28 23 00 00-1244)		
28 23 00 00-1278 Digitally Encoded Video With Bidirectional Data, Fiber Optics Transmitters (28 23 00 00-1277)		
28 23 00 00-1279 EA Single-Channel, Single Mode, Digitally Encoded Video With Bidirectional Data, Fiber Optics Transmitter (Pelco FT85011AS)	1,278.12	40.28
28 23 00 00-1280 EA Single-Channel, Multimode, Digitally Encoded Video With Bidirectional Data, Fiber Optics Transmitter (Pelco FT85011AM)	760.44	40.28
28 23 00 00-1281 EA Four-Channel, Single Mode, Digitally Encoded Video With Bidirectional Data, Fiber Optics Transmitter (Pelco FT85041S)	2,980.76	40.28
28 23 00 00-1282 EA Four-Channel, Multimode, Digitally Encoded Video With Bidirectional Data, Fiber Optics Transmitter (Pelco FT85041M)	2,580.09	40.28
28 23 00 00-1283 EA Eight-Channel, Single Mode, Digitally Encoded Video With Bidirectional Data, Fiber Optics Transmitter (Pelco FT85081S)	4,827.08	40.28
28 23 00 00-1284 EA Eight-Channel, Multimode, Digitally Encoded Video With Bidirectional Data, Fiber Optics Transmitter (Pelco FT85081M)	3,498.44	40.28



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 23 00 00-1285				Digitally Encoded Video With Bidirectional Data, Fiber Optics Receivers <small>(28 23 00 00-1277)</small>		
28 23 00 00-1286	EA			Single-Channel, Single Mode, Digitally Encoded Video With Bidirectional Data, Fiber Optics Receiver (Pelco FR85011AS).....	1,278.12	40.28
28 23 00 00-1287	EA			Single-Channel, Multimode, Digitally Encoded Video With Bidirectional Data, Fiber Optics Receiver (Pelco FR85011AM).....	760.44	40.28
28 23 00 00-1288	EA			Four-Channel, Single Mode, Digitally Encoded Video With Bidirectional Data, Fiber Optics Receiver (Pelco FR85041S).....	2,980.76	40.28
28 23 00 00-1289	EA			Four-Channel, Multimode, Digitally Encoded Video With Bidirectional Data, Fiber Optics Receiver (Pelco FR85041M).....	2,580.09	40.28
28 23 00 00-1290	EA			Eight-Channel, Single Mode, Digitally Encoded Video With Bidirectional Data, Fiber Optics Receiver (Pelco FR85081S).....	4,827.08	40.28
28 23 00 00-1291	EA			Eight-Channel, Multimode, Digitally Encoded Video With Bidirectional Data, Fiber Optics Receiver (Pelco FR85081M).....	3,498.44	40.28
28 23 00 00-1292				Video, Audio And Data, Fiber Optics Transmission Equipment <small>(28 23 00 00-1244)</small>		
28 23 00 00-1293				Digitally Encoded Video With Bidirectional Audio, Data And Contact Closure, Fiber Optics Transmitters <small>(28 23 00 00-1292)</small>		
28 23 00 00-1294	EA			Single-Channel, Single Mode, Digitally Encoded Video With Bidirectional Audio, Data And Contact Closure, Fiber Optics Transmitter (Pelco FT86011S).....	1,647.68	40.28
28 23 00 00-1295	EA			Single-Channel, Multimode, Digitally Encoded Video With Bidirectional Audio, Data And Contact Closure, Fiber Optics Transmitter (Pelco FT86011M).....	1,309.97	40.28
28 23 00 00-1296				Digitally Encoded Video With Bidirectional Audio, Data And Contact Closure, Fiber Optics Receivers <small>(28 23 00 00-1292)</small>		
28 23 00 00-1297	EA			Single-Channel, Single Mode, Digitally Encoded Video With Bidirectional Audio, Data And Contact Closure, Fiber Optics Receiver (Pelco FR86011S).....	1,647.68	40.28
28 23 00 00-1298	EA			Single-Channel, Multimode, Digitally Encoded Video With Bidirectional Audio, Data And Contact Closure, Fiber Optics Receiver (Pelco FR86011M).....	1,309.97	40.28
28 23 00 00-1299				Video Amplifiers <small>(28 23 00 00-1228)</small>		
28 23 00 00-1300				Video Distribution Amplifiers <small>(28 23 00 00-1299)</small>		
28 23 00 00-1301	EA			1 Input, 4 Outputs, Video Distribution Amplifier (Pelco DA104DT).....	203.07	10.07
28 23 00 00-1302	EA			16 Channel, Master, Video Distribution Amplifier (Pelco CM9760-MDA).....	1,657.61	10.07
				Note: Inserts time-date and title on up to 16 video inputs.		
28 23 00 00-1303				Video Equalizing Amplifiers <small>(28 23 00 00-1299)</small>		
28 23 00 00-1304	EA			Video Equalizing Amplifier (Pelco EA2010).....	220.84	10.07
28 23 00 00-1305	EA			Half-Duplex, Video Equalizing Amplifier (Pelco EA2000).....	347.49	10.07
28 23 00 00-1306				Network Video Equipment <small>(28 23 00 00-0600)</small>		
28 23 00 00-1307				Video Encoders/Decoders <small>(28 23 00 00-1306)</small>		
28 23 00 00-1308	EA			MPEG4 IP Video Receiver (Pelco NET300R).....	818.21	20.14
28 23 00 00-1309	EA			MPEG4 IP Video Transmitter (Pelco NET300T).....	818.21	20.14
28 23 00 00-1310	EA			MPEG4 IP Video Receiver With Audio (Pelco NET350R).....	942.63	20.14
28 23 00 00-1311	EA			MPEG4 IP Video Transmitter With Audio And Local Storage (Pelco NET350T).....	942.63	20.14
28 23 00 00-1312				Network Video Recorders <small>(28 23 00 00-1306)</small>		
28 23 00 00-1313	EA			16 Device Or 100MBPS, Network Video Recorder (Pelco NVR316).....	5,209.97	40.28
28 23 00 00-1314	EA			32 Device Or 100MBPS, Network Video Recorder (Pelco NVR332).....	6,063.88	40.28
28 23 00 00-1315	EA			64 Device Or 100MBPS, Network Video Recorder (Pelco NVR364).....	7,773.18	40.28
28 23 00 00-1316	EA			64 Device Or 100MBPS, PelcoNet Network Video Recorder (Pelco NVR300).....	5,145.53	40.28
28 23 00 00-1317				Network Video Recorder Software <small>(28 23 00 00-1306)</small>		
28 23 00 00-1318	EA			10 User, License Pack (Pelco VMX300-LIC-10).....	515.46	
28 23 00 00-1319	EA			20 User, License Pack (Pelco VMX300-LIC-20).....	929.45	
28 23 00 00-1320	EA			50 User, License Pack (Pelco VMX300-LIC-50).....	2,064.05	
28 23 00 00-1321	EA			100 User, License Pack (Pelco VMX300-LIC-100).....	3,610.42	
28 23 00 00-1322	EA			10 User, Enterprise License Pack (Pelco VMX300-E-LIC10).....	860.58	
28 23 00 00-1323	EA			20 User, Enterprise License Pack (Pelco VMX300-E-LIC20).....	1,547.85	
28 23 00 00-1324	EA			50 User, Enterprise License Pack (Pelco VMX300-E-LIC50).....	3,440.09	
28 23 00 00-1325	EA			100 User, Enterprise License Pack (Pelco VMX300-E-LIC100).....	6,018.86	
28 23 00 00-1326	EA			200 User, Enterprise License Pack (Pelco VMX300-E-LIC200).....	10,317.30	
28 23 00 00-1327	EA			500 User, Enterprise License Pack (Pelco VMX300-E-LIC500).....	21,493.69	
28 23 00 00-1328	EA			0 Analog Inputs, No Monitors, Video Management Client Software Installed On Pelco Workstation (Pelco VMX300-CL-0).....	4,636.42	
28 23 00 00-1329	EA			1 Analog Inputs, No Monitors, Video Management Client Software Installed On Pelco Workstation (Pelco VMX300-CL-1).....	4,923.03	
28 23 00 00-1330	EA			4 Analog Inputs, No Monitors, Video Management Client Software Installed On Pelco Workstation (Pelco VMX300-CL-4).....	7,789.90	

28 Electronic Safety And Security**28 20 Electronic Surveillance****28 23 Video Surveillance**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 23 00 00-1331 EA 0 Analog Inputs, No Monitors, Video Management Client/Server Software Installed On Pelco Workstation (Pelco VMX300-CSVR-0).....	5,152.62	
28 23 00 00-1332 EA 1 Analog Input, No Monitors, Video Management Client/Server Software Installed On Pelco Workstation (Pelco VMX300-CSVR-1).....	5,439.23	
28 23 00 00-1333 EA 4 Analog Inputs, No Monitors, Video Management Client/Server Software Installed On Pelco Workstation (Pelco VMX300-CSVR-4).....	8,304.61	
28 23 00 00-1334 EA 0 Analog Inputs, No Monitors, Enterprise Video Management Client Software Installed On Pelco Enterprise Workstation (Pelco VMX300-E-CL-0).....	4,980.80	
28 23 00 00-1335 EA 1 Analog Input, No Monitors, Enterprise Video Management Client Software Installed On Pelco Enterprise Workstation (Pelco VMX300-E-CL-1).....	5,268.15	
28 23 00 00-1336 EA 4 Analog Inputs, No Monitors, Enterprise Video Management Client Software Installed On Pelco Enterprise Workstation (Pelco VMX300-E-CL-4).....	8,134.27	
28 23 00 00-1337 EA 0 Analog Inputs, No Monitors, Enterprise Video Management Client/Server Software Installed On Pelco Enterprise Workstation (Pelco VMX300-E-CSVR-0).....	5,839.90	
28 23 00 00-1338 EA 1 Analog Input, No Monitors, Enterprise Video Management Client/Server Software Installed On Pelco Enterprise Workstation (Pelco VMX300-E-CSVR-1).....	6,126.51	
28 23 00 00-1339 EA 4 Analog Inputs, No Monitors, Enterprise Video Management Client/Server Software Installed On Pelco Enterprise Workstation (Pelco VMX300-E-CSVR-4).....	8,993.37	
28 23 00 00-1340 Video Recording Equipment (28 23 00 00-0600)		
28 23 00 00-1341 Digital Video Recorders (28 23 00 00-1340)		
28 23 00 00-1342 EA 8 Channel, 1 TB Hard Drive, Digital Video Recorder With DVDRW (Pelco DX4608DVD-1000)..... Note: Includes 8 camera inputs, MPEG4 compression; CIF, 2CIF, 4CIF programmable by channel; 240 IPS; pixel search, 4 audio ins, 1 out; 16 alarms ins, 4 relay outs.	4,193.12	40.28
28 23 00 00-1343 EA 8 Channel, 2 TB Hard Drive, Digital Video Recorder With DVDRW (Pelco DX4608DVD-2000)..... Note: Includes 8 camera inputs, MPEG4 compression; CIF, 2CIF, 4CIF programmable by channel; 240 IPS; pixel search, 4 audio ins, 1 out; 16 alarms ins, 4 relay outs.	5,668.40	40.28
28 23 00 00-1344 EA 8 Channel, 3 TB Hard Drive, Digital Video Recorder With DVDRW (Pelco DX4608DVD-3000)..... Note: Includes 8 camera inputs, MPEG4 compression; CIF, 2CIF, 4CIF programmable by channel; 240 IPS; pixel search, 4 audio ins, 1 out; 16 alarms ins, 4 relay outs.	7,143.67	40.28
28 23 00 00-1345 EA 16 Channel, 1 TB Hard Drive, Digital Video Recorder With DVDRW (Pelco DX4616DVD-1000)..... Note: Includes 16 camera inputs, MPEG4 compression; CIF, 2CIF, 4CIF programmable by channel; 480 IPS; pixel search, 4 audio ins, 1 out; 16 alarms ins, 4 relay outs.	4,807.82	40.28
28 23 00 00-1346 EA 16 Channel, 2 TB Hard Drive, Digital Video Recorder With DVDRW (Pelco DX4616DVD-2000)..... Note: Includes 16 camera inputs, MPEG4 compression; CIF, 2CIF, 4CIF programmable by channel; 480 IPS; pixel search, 4 audio ins, 1 out; 16 alarms ins, 4 relay outs.	6,283.09	40.28
28 23 00 00-1347 EA 16 Channel, 3 TB Hard Drive, Digital Video Recorder With DVDRW (Pelco DX4616DVD-3000)..... Note: Includes 16 camera inputs, MPEG4 compression; CIF, 2CIF, 4CIF programmable by channel; 480 IPS; pixel search, 4 audio ins, 1 out; 16 alarms ins, 4 relay outs.	7,758.37	40.28
28 23 00 00-1348 EA 8 Channel, 1TB Hard Drive, 8 Channel Audio, Digital Video Recorder With DVD (Pelco DX8108-1000A).....	8,161.26	40.28
28 23 00 00-1349 EA 8 Channel, 2 TB Hard Drive, 8 Channel Audio, Digital Video Recorder With DVD (Pelco DX8108-2000A).....	11,193.27	40.28
28 23 00 00-1350 EA 8 Channel, 3 TB Hard Drive, 8 Channel Audio, Digital Video Recorder With DVD (Pelco DX8108-3000A).....	14,226.03	40.28
28 23 00 00-1351 EA 16 Channel, 1 TB Hard Drive, 16 Channel Audio, Digital Video Recorder With DVD (Pelco DX8116-1000A).....	9,826.87	40.28
28 23 00 00-1352 EA 16 Channel, 2 TB Hard Drive, 16 Channel Audio, Digital Video Recorder With DVD (Pelco DX8116-2000A).....	12,858.88	40.28
28 23 00 00-1353 EA 16 Channel, 3 TB Hard Drive, 16 Channel Audio, Digital Video Recorder With DVD (Pelco DX8116-3000A).....	15,891.64	40.28
28 23 00 00-1354 EA 24 Channel, 1 TB Hard Drive, 24 Channel Audio, Digital Video Recorder With DVD (Pelco DX8124-1000A).....	10,742.99	40.28
28 23 00 00-1355 EA 24 Channel, 2 TB Hard Drive, 24 Channel Audio, Digital Video Recorder With DVD (Pelco DX8124-2000A).....	13,775.00	40.28
28 23 00 00-1356 EA 24 Channel, 3 TB Hard Drive, 24 Channel Audio, Digital Video Recorder With DVD (Pelco DX8124-3000A).....	16,807.76	40.28
28 23 00 00-1357 EA 32 Channel, 1 TB Hard Drive, 32 Channel Audio, Digital Video Recorder With DVD (Pelco DX8132-1000A).....	12,408.60	40.28
28 23 00 00-1358 EA 32 Channel, 2 TB Hard Drive, 32 Channel Audio, Digital Video Recorder With DVD (Pelco DX8132-2000A).....	15,440.61	40.28
28 23 00 00-1359 EA 32 Channel, 3 TB Hard Drive, 32 Channel Audio, Digital Video Recorder With DVD (Pelco DX8132-3000A).....	18,473.37	40.28
28 23 00 00-1360 EA 16 Channel, 30 IPS, Digital Video Recorder (Pelco DX9116F-1500).....	9,009.47	40.28
28 23 00 00-1361 Digital Video Recorder Accessories (28 23 00 00-1340)		
28 23 00 00-1362 EA 16 Channel, Multiplexed Analog Output Display Card (Pelco DX8000-MUX16).....	791.55	20.14
28 23 00 00-1363 Matrix Systems And Controls (28 23 00 00-0600)		
28 23 00 00-1364 Video Multiplexers (28 23 00 00-1363)		
28 23 00 00-1365 Monochrome Duplex, Video Multiplexers (28 23 00 00-1364)		
28 23 00 00-1366 EA 9 Channel, Monochrome Duplex, Video Multiplexer (Pelco MX4009MD).....	1,498.08	40.28
28 23 00 00-1367 EA 16 Channel, Monochrome Duplex, Video Multiplexer (Pelco MX4016MD).....	1,415.87	40.28
28 23 00 00-1368 Color Duplex, Video Multiplexers (28 23 00 00-1364)		
28 23 00 00-1369 EA 4 Channel, Color Duplex, Video Multiplexer (Pelco MX4004CD).....	1,011.50	40.28
28 23 00 00-1370 EA 9 Channel, Color Duplex, Video Multiplexer (Pelco MX4009CD).....	1,930.59	40.28
28 23 00 00-1371 EA 16 Channel, Color Duplex, Video Multiplexer (Pelco MX4016CD).....	2,092.78	40.28
28 23 00 00-1372 Color Simplex, Video Multiplexers (28 23 00 00-1364)		
28 23 00 00-1373 EA 9 Channel, Monochrome Simplex, Video Multiplexer (Pelco MX4009CS).....	1,622.50	40.28
28 23 00 00-1374 EA 16 Channel, Monochrome Simplex, Video Multiplexer (Pelco MX4016CS).....	1,895.04	40.28
28 23 00 00-1375 Video Multiplexer Accessories (28 23 00 00-1364)		
28 23 00 00-1376 EA Pushbutton/Joystick Desktop Controls For PTZ, Fixed/Variable-Speed, Multiplexer Controller (Pelco KBD4000).....	892.11	27.51



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 23 00 00-1377 EA Pushbutton Desktop Controls For PTZ, Fixed/Variable-Speed, Multiplexer Controller (Pelco KBD4002)	523.29	27.51
28 23 00 00-1378 EA Video Multiplexer Server (Pelco MX4000SVR)	1,498.08	40.28
28 23 00 00-1379 Quad Video Processor <small>(28 23 00 00-1363)</small>		
28 23 00 00-1380 EA Monochrome, Quad Video Processor (Pelco QD104M)	463.16	20.14
28 23 00 00-1381 EA Color, Quad Video Processor (Pelco QD104C)	759.40	20.14
28 23 00 00-1382 Switcher <small>(28 23 00 00-1363)</small>		
28 23 00 00-1383 Terminating Manual Switchers <small>(28 23 00 00-1382)</small>		
28 23 00 00-1384 Terminating Manual Switchers <small>(28 23 00 00-1383)</small>		
28 23 00 00-1385 EA 4 Inputs, Terminating Manual Switcher (Pelco MS504DT)	160.35	16.11
28 23 00 00-1386 EA 8 Inputs, Terminating Manual Switcher (Pelco MS508DT)	218.12	16.11
28 23 00 00-1387 EA 12 Inputs, Terminating Manual Switcher (Pelco MS512DT)	265.52	16.11
28 23 00 00-1388 EA 18 Inputs, Terminating Manual Switcher (Pelco MS518DT)	435.12	16.11
28 23 00 00-1389 Audio Follow, Terminating Manual Switchers <small>(28 23 00 00-1383)</small>		
28 23 00 00-1390 EA 4 Inputs, Audio Follow, Terminating Manual Switcher (Pelco MS504AF)	207.75	16.11
28 23 00 00-1391 EA 8 Inputs, Audio Follow, Terminating Manual Switcher (Pelco MS508AF)	366.98	16.11
28 23 00 00-1392 EA 18 Inputs, Audio Follow, Terminating Manual Switcher (Pelco MS518AF)	641.74	16.11
28 23 00 00-1393 Balanced Audio Follow, Terminating Manual Switchers <small>(28 23 00 00-1383)</small>		
28 23 00 00-1394 EA 4 Inputs, Balanced Audio Follow, Terminating Manual Switcher (Pelco MS504BAF)	278.11	16.11
28 23 00 00-1395 EA 8 Inputs, Balanced Audio Follow, Terminating Manual Switcher (Pelco MS508BAF)	510.66	16.11
28 23 00 00-1396 Looping Manual Switchers <small>(28 23 00 00-1382)</small>		
28 23 00 00-1397 Looping Manual Switchers <small>(28 23 00 00-1396)</small>		
28 23 00 00-1398 EA 4 Inputs, Looping Manual Switcher (Pelco MS504LDT)	179.61	16.11
28 23 00 00-1399 EA 8 Inputs, Looping Manual Switcher (Pelco MS508LDT)	247.00	16.11
28 23 00 00-1400 EA 12 Inputs, Looping Manual Switcher (Pelco MS512LDT)	315.14	16.11
28 23 00 00-1401 EA 18 Inputs, Looping Manual Switcher (Pelco MS518LDT)	520.29	16.11
28 23 00 00-1402 Audio Follow, Looping Manual Switchers <small>(28 23 00 00-1396)</small>		
28 23 00 00-1403 EA 4 Inputs, Audio Follow, Looping Manual Switcher (Pelco MS504AFL)	224.05	16.11
28 23 00 00-1404 EA 8 Inputs, Audio Follow, Looping Manual Switcher (Pelco MS508AFL)	392.16	16.11
28 23 00 00-1405 EA 12 Inputs, Audio Follow, Looping Manual Switcher (Pelco MS512AFL)	538.80	16.11
28 23 00 00-1406 Balanced Audio Follow, Looping Manual Switchers <small>(28 23 00 00-1396)</small>		
28 23 00 00-1407 EA 4 Inputs, Balanced Audio Follow, Looping Manual Switcher (Pelco MS504BAFL)	298.11	16.11
28 23 00 00-1408 EA 8 Inputs, Balanced Audio Follow, Looping Manual Switcher (Pelco MS508BAFL)	541.02	16.11
28 23 00 00-1409 EA 12 Inputs, Balanced Audio Follow, Looping Manual Switcher (Pelco MS512BAFL)	681.00	16.11
28 23 00 00-1410 Sequential Switchers <small>(28 23 00 00-1382)</small>		
28 23 00 00-1411 Single Output, Sequential Switchers <small>(28 23 00 00-1410)</small>		
28 23 00 00-1412 EA 4 Inputs, Single Output, Sequential Desktop Switcher (Pelco VA6104)	315.88	16.11
28 23 00 00-1413 EA 8 Inputs, Single Output, Sequential Desktop Switcher (Pelco VA6108)	471.41	16.11
28 23 00 00-1414 Dual Outputs, Sequential Switchers <small>(28 23 00 00-1410)</small>		
28 23 00 00-1415 EA 4 Inputs, Dual Outputs, Sequential Desktop Switcher (Pelco VA6204)	395.12	16.11
28 23 00 00-1416 EA 8 Inputs, Dual Outputs, Sequential Desktop Switcher (Pelco VA6208)	547.69	16.11
28 23 00 00-1417 Controls <small>(28 23 00 00-1363)</small>		
28 23 00 00-1418 Direct/Multi-Cable Controls <small>(28 23 00 00-1417)</small>		
28 23 00 00-1419 EA Scanner Control Module (Pelco MPS524DT)	270.16	40.28
28 23 00 00-1420 EA 120 Volt AC Pan/Tilt Control Module (Pelco MPT115DT)	288.68	40.28
28 23 00 00-1421 EA 24 Volt AC Pan/Tilt Control Module (Pelco MPT24DT)	320.52	40.28
28 23 00 00-1422 EA Motorized Zoom Lens Control Module (Pelco MLZ6DT)	335.34	40.28
28 23 00 00-1423 EA 120 Volt AC Pan/Tilt, Scanner And Lens Control Module (Pelco MPTAZ115DT)	530.85	40.28
28 23 00 00-1424 EA 24 Volt AC Pan/Tilt, Scanner And Lens Control Module (Pelco MPTAZ24DT)	584.92	40.28
28 23 00 00-1425 Coaxitron Controls <small>(28 23 00 00-1417)</small>		
28 23 00 00-1426 EA Desktop Keyboard, Fixed Speed Coaxitron Controller And Transmitter (Pelco KBD9000)	385.54	27.51
28 23 00 00-1427 EA 8 Position Joystick Pan/Tilt Controls, Switch Camera Lens Controls, Desktop Coaxitron Controller And Transmitter (Pelco MPT9000)	734.37	27.51

28 Electronic Safety And Security**28 20 Electronic Surveillance****28 23 Video Surveillance**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 23 00 00-1428 EA Integral Switcher, 8 Position Joystick Pan/Tilt Controls, Switch Camera Lens Controls, Desktop Coaxitron Controller And Transmitter (Pelco MPT9008).....	834.35	27.51
28 23 00 00-1429 Digital Controls (28 23 00 00-1417)		
28 23 00 00-1430 EA Pushbutton Desktop Controls For Pan/Tilt/Zoom, Fixed/Variable-Speed, Digital Controller (Pelco KBD200A).....	519.59	27.51
28 23 00 00-1431 EA Pushbutton/Joystick Desktop Controls For Pan/Tilt/Zoom, Fixed/Variable-Speed, Digital Controller (Pelco KBD300A).....	884.71	27.51
28 23 00 00-1432 Lock Boxes (28 23 00 00-1363)		
28 23 00 00-1433 EA VCR Lock Box (Pelco LB1000).....	318.89	30.21
For Wall Mount, Add	165.00	
28 23 00 00-1434 EA Computer Disk Drive Lock Box (Pelco LB2000).....	326.30	30.21
28 23 00 00-1435 EA VCR And Multiplexer Lock Box (Pelco LB3000).....	600.32	30.21
Note: Includes storage for 32 VCR tapes.		

28 26 Electronic Personal Protection Systems (28 20)**28 26 13 Electronic Personal Safety Detection Systems** (28 26)**28 26 13 00-0001 Personnel Alarm Locating System** (28 26 13)

Note: Includes a central computer, 17" VGA color monitor, keyboard and mouse, personal alarm locating software, a printer, interface cards and panels, eighty (80) personal alarm transmitters with lithium batteries, eighty (80) lapel readers, two hundred fifty (250) IR locators, twenty one (21) repeaters and receivers, back boxes, cables.

28 26 13 00-0002 EA Personnel Alarm Locating System.....	12,166.91	645.60
Note: Includes Pentium III central computer, 17" VGA color monitor, keyboard and mouse, personal alarm locating software, a printer, interface cards and panels.		
28 26 13 00-0003 EA Personnel Alarm Transmitters With Lithium Batteries.....	94.26	
28 26 13 00-0004 EA Lapel Reader.....	36.25	
28 26 13 00-0005 EA IR Locator.....	142.58	24.17
28 26 13 00-0006 EA Repeater And Receivers.....	356.90	80.57

28 26 23 Electronic Personal Safety Emergency Aid Devices (28 26)**28 26 23 00-0001 Electronic Personal Safety Emergency Aid Devices (Edwards Signaling)** (28 26**28 26 23 00-0002 Call For Assistance Kits, Emergency Aid Devices (Edwards Signaling)** (28 26 23

28 26 23 00-0003 EA Pull Cord Call For Assistance Kit With Strobe/Buzzer, Emergency Aid Devices (Edwards Signaling 7008B-N5).....	192.62	48.34
Note: Includes 1 high intensity strobe/buzzer (7007B-N5) and 1 emergency pull cord station (6537).		
28 26 23 00-0004 EA Push Button Call For Assistance Kit With Strobe/Horn, Emergency Aid Devices (Edwards Signaling 7005-G5).....	228.15	56.40
Note: Includes 1 high intensity strobe/horn (6536-G5), 1 emergency pull cord station (6537), and 1 transformer 592.		
28 26 23 00-0005 EA Pull Cord Call For Assistance Kit With Strobe/Horn, Emergency Aid Devices (Edwards Signaling 6538-G5).....	229.67	56.40
Note: Includes 1 high intensity strobe/horn (6536-G5), 1 wall mounted push button (620/147-10), and 1 transformer 592.		

28 26 23 00-0006 Audible/Visual Signaling Devices, Emergency Aid Devices (Edwards Signaling) (28 26 23 00-0001)

28 26 23 00-0007 EA High Intensity Strobe/Buzzer, Emergency Aid Devices (Edwards Signaling 7007B-N5).....	139.50	30.21
28 26 23 00-0008 EA High Intensity Strobe/Horn, Emergency Aid Devices (Edwards Signaling 6536-G5).....	133.66	24.17
28 26 23 00-0009 EA Transformer For High Intensity Strobe/Horns, Emergency Aid Devices (Edwards Signaling 592).....	67.48	24.17
28 26 23 00-0010 EA 1 Lamp, Dome Station, Emergency Aid Devices (Edwards Signaling 7641-1N5).....	110.16	24.17
28 26 23 00-0011 EA 2 Lamp, Dome Station, Emergency Aid Devices (Edwards Signaling 7641-2N5).....	125.42	24.17
28 26 23 00-0012 EA 4 Lamp, Dome Station, Emergency Aid Devices (Edwards Signaling 7641-4G5).....	141.26	24.17
28 26 23 00-0013 EA 2 Lamp, Dome Station/Buzzer, Emergency Aid Devices (Edwards Signaling 7633-2).....	192.17	24.17
28 26 23 00-0014 EA 4 Lamp, Dome Station/Buzzer, Emergency Aid Devices (Edwards Signaling 7633-4).....	214.07	24.17

28 26 23 00-0015 Call Activation Devices, Emergency Aid Devices (Edwards Signaling) (28 26 23 00-0001)

28 26 23 00-0016 EA Double Pole Single Throw Switch, Pull Cord Station With Stainless Steel Face Plate, Emergency Aid Devices (Edwards Signaling 6537).....	86.63	24.17
28 26 23 00-0017 EA Pushbutton Wall Station/Indicator Lamp With Stainless Steel Face Plate, Emergency Aid Devices (Edwards Signaling 7603E).....	123.01	24.17
28 26 23 00-0018 EA Pushbutton Wall Station/Indicator Lamp With Stainless Steel Face Plate, Emergency Aid Devices (Edwards Signaling 7613E).....	158.13	24.17
28 26 23 00-0019 EA 3 Maintained Contacts, Pull Cord Station With Stainless Steel Face Plate, Emergency Aid Devices (Edwards Signaling 7302).....	161.98	8.05
28 26 23 00-0020 EA Bedside Wall Station Receptacle, Emergency Aid Devices (Edwards Signaling 7930).....	126.25	24.17
28 26 23 00-0021 EA Bedside Wall Station Receptacle With Lamp, Emergency Aid Devices (Edwards Signaling 7930L).....	147.26	24.17
28 26 23 00-0022 EA Locking Button, Pull Cord Station With Stainless Steel Face Plate, Emergency Aid Devices (Edwards Signaling 7932L).....	242.97	24.17
28 26 23 00-0023 EA Pendant Push Button, Emergency Aid Devices (Edwards Signaling 7620).....	120.48	24.17
28 26 23 00-0024 EA Single 6' Calling Cord Set For Bedside Wall Station Receptacles, Emergency Aid Devices (Edwards Signaling 7675).....	137.44	8.05
28 26 23 00-0025 EA Double 6' Calling Cord Set For Bedside Wall Station Receptacles, Emergency Aid Devices (Edwards Signaling 7676).....	210.74	8.05



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 26 23 00-0026 EA Single 15' Calling Cord Set For Bedside Wall Station Receptacles, Emergency Aid Devices (Edwards Signaling 7685)	215.25	8.05
28 26 23 00-0027 EA Double 15' Calling Cord Set For Bedside Wall Station Receptacles, Emergency Aid Devices (Edwards Signaling 7686)	282.57	8.05

28 30 Electronic Detection And Alarm ⁽²⁸⁾

Note: Includes testing of new devices and certification.

28 31 Fire Detection And Alarm ^(28 30)

28 31 23 Fire Detection and Alarm Annunciation Panels and Fire Stations ^(28 31)

28 31 23 00-0001	Edwards Fire Alarm ^(28 31 23)		
28 31 23 00-0002	EST3 Life Safety And Security Control ^(28 31 23 00-0001)		
28 31 23 00-0003	EST3 Network ^(28 31 23 00-0002)		
28 31 23 00-0004	Remote Annunciators ^(28 31 23 00-0003)		
28 31 23 00-0005	EA Remote LCD Command Module Annunciator (EST3 3-LCDANN).....	838.88	60.42
	Note: Includes LCD display, CPU and doors. Order surface or semi-flush mount wallbox separately.		
28 31 23 00-0006	EA Six Position Base Annunciator (EST3 3-6ANN).....	688.67	60.42
	Note: Includes door, CPU card, two annunciator support modules and five blank filler plates. Space provided for up to four Control/Display Modules and one 3-LCD Liquid Crystal Display Module.		
28 31 23 00-0007	EA Ten Position Base Annunciator (EST3 3-10ANN).....	863.82	60.42
	Note: Includes door, CPU card, two annunciator support modules and nine blank filler plates. Space provided for up to eight Control/Display Modules and one 3-LCD Liquid Crystal Display Module.		
28 31 23 00-0008	EA Annunciator CPU (EST3 3-ANNCPU3)	560.46	60.42
	Note: One Required per graphic annunciator.		
28 31 23 00-0009	EA Annunciator Support Module (EST3 3-ANNSM)	107.18	20.14
	Note: Takes one space in Annunciator box. Supports one Control/Display module.		
28 31 23 00-0010	EA Liquid Crystal Display Module (EST3 3-LCD)	370.04	60.42
	Note: Mounts over 3-CPU(1).		
28 31 23 00-0011	EA Liquid Crystal Display Module (EST3 3-LCDXL).....	383.96	60.42
	Note: Mounts over 3-ANNCPU plus two spaces.		
28 31 23 00-0012	EA LED/SWITCH Driver Module Assembly For Third Part Graphics (EST3 3-EVDVRA)	413.95	60.42
	Note: Assembled version of 3-EVDVR, comes packaged with cables, mounting hardware installation instructions used for third party graphics. Mounts in 3-EVDVRX.		
28 31 23 00-0013	EA Power Supply Assembly With 19" Rail Mounting Chassis Assembly (EST3 3-EVPWRA).....	468.91	40.28
	Note: Assembled version of 3-EVPWR, comes packaged with cables, mounting hardware and mounting plate for 3-ANNCPU1. Used for third party graphics.		
28 31 23 00-0014	EA Plastic Mounting Extrusion 19" Mounting (EST3 3-EVDVRX)	77.36	20.14
	Note: Mounts up to three 3-EVDVRA modules.		
28 31 23 00-0015	EA Central Processor Unit Module (EST3 3-CPU3)	887.17	60.42
	Note: Includes LCD display, CPU and doors. Order surface or semi-flush mount wallbox separately.		
28 31 23 00-0016	EA Primary Power Supply With Local Rail Module, 120 VAC, 50/60 Hz (EST3 3-CPU3)	858.18	20.14
	Note: Includes LCD display, CPU and doors. Order surface or semi-flush mount wallbox separately.		
28 31 23 00-0017	Remote Annunciators Cabinets ^(28 31 23 00-0003)		
28 31 23 00-0018	EA Remote LCD Command Module Flush Mount LCD Wallbox (EST3 RLCM/B).....	82.69	20.14
28 31 23 00-0019	EA Remote LCD Command Module Surface Mount LCD Wallbox (EST3 RLCM/B-S)	74.64	16.11
28 31 23 00-0020	EA Six Position LED/LCD Flush Wallbox (EST3 6ANN/B)	92.10	20.14
28 31 23 00-0021	EA Six Position LED/LCD Surface Wallbox (EST3 6ANN/B-S)	84.05	16.11
28 31 23 00-0022	EA Ten Position LED/LCD Flush Wallbox (EST3 10ANN/B)	100.93	20.14
28 31 23 00-0023	EA Ten Position LED/LCD Surface Wallbox (EST3 10ANN/B-S)	92.88	16.11
28 31 23 00-0024	Audio And Telephone Masters ^(28 31 23 00-0003)		
28 31 23 00-0025	EA Audio Source Unit With Local Microphone And Firefighters' Telephone (EST3 3-ASU/FT)	2,681.54	80.57
28 31 23 00-0026	EA Audio Source Unit With Local Microphone (Provides Four Local Rail Spaces) (EST3 3-ASU/4).....	1,509.30	80.57
28 31 23 00-0027	EA Audio Source Unit With Local Microphone And Inner Door Filler Plate (EST3 3-ASU).....	1,414.06	80.57
28 31 23 00-0028	EA Fire Fighters Telephone Control Unit With Inner Door Filler Plate (EST3 3-FTCU)	1,428.70	80.57
28 31 23 00-0029	EA Audio Source Unit Memory Expansion, 100 Minutes (EST3 3-ASUMX/100).....	1,626.48	80.57
28 31 23 00-0030	EA Zoned Audio Amplifier Module (EST3 3-ZA95).....	1,507.09	40.28
28 31 23 00-0031	Battery Distribution Unit ^(28 31 23 00-0003)		
28 31 23 00-0032	EA Battery Distribution Unit (EST3 3-BTSEN).....	328.20	247.63
28 31 23 00-0033	Remote Booster Power Supply ^(28 31 23 00-0003)		
28 31 23 00-0034	EA 6.5 Amp, 120 VAC, Booster Power Supply (EST3 BPS6A).....	487.23	60.42
28 31 23 00-0035	EA 10 Amp, 110 VAC Booster Power Supply (EST3 BPS10)	552.42	60.42
28 31 23 00-0036	EA 10 Amp, 220 VAC Booster Power Supply (EST3 BPS10220)	600.45	60.42
28 31 23 00-0037	EA Tamper Switch - For CAB7, 14 And 21 Series Cabinets (EST3 3-TAMP)	84.27	20.14
28 31 23 00-0038	Batteries And Battery Cabinets ^(28 31 23 00-0003)		
28 31 23 00-0039	EA 1.2 Amp Hours Sealed Lead Acid Battery - 12 VDC (EST3 12V1A2 (1.2 Amp Hours)).....	66.37	20.14
28 31 23 00-0040	EA 4 Amp Hours Sealed Lead Acid Battery - 12 VDC (EST3 12V4A (4.5 Amp Hours)).....	80.53	20.14

28 Electronic Safety And Security**28 30 Electronic Detection And Alarm****28 31 Fire Detection And Alarm**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 31	23 00-0041	EA	24 Amp Hours Sealed Lead Acid Battery - 12 VDC (EST3 12V24A (26 Amp Hours)).....	178.23	20.14
28 31	23 00-0042	EA	6.5 Amp Hours Sealed Lead Acid Battery - 12 VDC (EST3 12V6A5 (7.2 Amp Hours)).....	86.20	20.14
28 31	23 00-0043	EA	40 Amp Hours Sealed Lead Acid Battery - 12 VDC (EST3 12V40A (40 Amp Hours)).....	223.59	20.14
28 31	23 00-0044	EA	10 Amp Hours Sealed Lead Acid Battery - 12 VDC (EST3 12V10A (11 Amp Hours)).....	129.70	20.14
28 31	23 00-0045	EA	50 Amp Hours Sealed Lead Acid Battery - 12 VDC (EST3 12V50A (50 Amp Hours)).....	444.58	20.14
28 31	23 00-0046	EA	17 Amp Hours Sealed Lead Acid Battery - 12 VDC (EST3 12V17A (18 Amp Hours)).....	132.62	20.14
28 31	23 00-0047	EA	65 Amp Hours Sealed Lead Acid Battery - 12 VDC (EST3 12V65A (65 Amp Hours)).....	533.43	20.14
28 31	23 00-0048	EA	8.0 Amp Hours Sealed Lead Acid Battery - 6 VDC (EST3 6V8A (8 Amp Hours)).....	77.77	20.14
28 31	23 00-0049	EA	10 Amp Hours Sealed Lead Acid Battery - 6 VDC (EST3 6V10A (12 Amp Hours)).....	70.69	20.14
28 31	23 00-0050	EA	Battery Cabinet, 14.0" x 18.25" x 7.25" Free Standing Cabinet With Key Lock (EST3 BC-1)..... Note: Supports up to 40 Ah batteries will hold up to two 12V24A batteries.	238.57	40.28
28 31	23 00-0051	EA	Battery Cabinet, Gray 22" X 15" X 3.75" (EST3 BC-2)..... Note: Holds up to two 12V17A batteries.	200.42	40.28
28 31	23 00-0052	EA	Remote Closet Enclosure (EST3 3-RCC7R)	659.41	80.57
28 31	23 00-0053	EA	Remote Closet Enclosure (EST3 3-RCC14R)	809.58	80.57
28 31	23 00-0054	EA	Remote Closet Enclosure (EST3 3-RCC21R)	1,120.96	80.57
28 31	23 00-0055		Serial Printer (28 31 23 00-0003)		
28 31	23 00-0056	EA	System Printer - Desk Top Style (EST3 PT-1S)	854.37	20.14
28 31	23 00-0057		Intelligent Analog Initiating Devices (28 31 23 00-0002)		
28 31	23 00-0058		Detectors, Signature (28 31 23 00-0057)		
28 31	23 00-0059	EA	Intelligent 4D Multisensor Detector - Ionization, Photoelectric, Heat (EST3 SIGA-IPHS)	145.84	30.21
28 31	23 00-0060	EA	Intelligent 4D Multisensor Detector, Black - Ionization, Photoelectric, Heat (EST3 SIGA-IPHSB)	162.32	30.21
28 31	23 00-0061	EA	Intelligent 3D Multisensor Detector - Photoelectric, Heat (EST3 SIGA-PHS)	140.93	30.21
28 31	23 00-0062	EA	Intelligent Photoelectric Smoke Detector (EST3 SIGA-PS)	126.19	30.21
28 31	23 00-0063	EA	Intelligent Ionization Smoke Detector (EST3 SIGA-IS)	131.10	30.21
28 31	23 00-0064	EA	Intelligent Fixed Temperature / Rate-of-Rise Heat Detector - 135F, 15F Per Minute (EST3 SIGA-HRS)	109.76	30.21
28 31	23 00-0065	EA	Intelligent Fixed Temperature Heat Detector - 135 Degree F (EST3 SIGA-HFS)	109.76	30.21
28 31	23 00-0066	EA	Passive Infrared Motion Detector (EST3 SIGA-MD)	166.71	30.21
28 31	23 00-0067	EA	Passive Infrared Motion Detector With Swivel Mount For Single Gang Boxes (EST3 SIGA-MDS).....	182.80	30.21
28 31	23 00-0068	EA	Intelligent Photoelectric Smoke Detector (EST3 SIGA2-PS)	156.26	30.21
28 31	23 00-0069	EA	Intelligent Combination Photo Electric And CO Sensor (EST3 SIGA2-PCOS)	220.19	30.21
28 31	23 00-0070	EA	Intelligent Fixed Temperature Heat Detector - 135 Degree F (EST3 SIGA2-HFS)	132.41	30.21
28 31	23 00-0071	EA	Intelligent Fixed Temperature / Rate-of-Rise Heat Detector - 135F, 15F Per Minute (EST3 SIGA2-HRS).....	132.41	30.21
28 31	23 00-0072	EA	Intelligent 3D Multisensor Detector - Photoelectric, Heat (EST3 SIGA2-PHS)	177.75	30.21
28 31	23 00-0073		Detectors, Duct Housings and Accessories, Signature (28 31 23 00-0057)		
28 31	23 00-0074	EA	Superduct, Signature Duct Smoke Detector (EST3 SIGA-SD)	290.49	50.35
28 31	23 00-0075	EA	Superduct, Test Magnet Kit (EST3 SD-MAG).....	14.23	
28 31	23 00-0076	EA	Superduct, 120" Air Sample Tube (EST3 SD-T120).....	40.52	12.09
28 31	23 00-0077	EA	Superduct, Remote Test Station, Keyed, 2-Wire And SIGA (EST3 SD-TRK).....	77.13	16.11
28 31	23 00-0078	EA	Duct Smoke Detector Test Station, 2-Gang Plastic Plate With Key Switch, 2 Keys, Use With Duct Detector Only (EST3 SIGA-DTS)	102.06	16.11
28 31	23 00-0079	EA	High Temp Heat Detector, 194 Degree F, Combination Rate-Of-Rise And Fixed Temperature (EST3 282B-PL).....	48.70	16.11
28 31	23 00-0080		Detectors, Smoke, Beam (28 31 23 00-0057)		
28 31	23 00-0081	EA	Firearay 2000 Beam Alignment Aid, For Quick Alignment Of Beam Detector Transmitter And Receiver Heads (EST3 0201-01-A).....	96.36	
28 31	23 00-0082	EA	Firearay 2000 Beam Smoke Detector (By Fire Fighting Enterprises) (EST3 22310-18-01)..... Note: Includes controller and remote mount transmitter and receiver head.	1,126.83	30.21
28 31	23 00-0083	EA	Firearay 2000 Beam Detector Prism, Use To Reflect Beam When Mounting Transmitter And Receiver Heads On Same Wall (EST3 23901-00).....	70.74	10.07
28 31	23 00-0084	EA	Replacement Reflector, For EC-50R/-100R Reflective Beam Detectors (EST3 23901-01)	83.35	10.07
28 31	23 00-0085	EA	160 - 330' Reflective Beam Detector (EST3 EC-100R)	1,155.79	30.21
28 31	23 00-0086	EA	15 - 160' Reflective Beam Detector (EST3 EC-50R)	987.27	30.21
28 31	23 00-0087	EA	Remote Test Station, For EC-50R/-100R Reflective Beam Detectors (EST3 EC-LLT).....	230.84	10.07
28 31	23 00-0088	EA	160 - 330' Self Adjusting Reflective Beam Detector (EST3 EC-5000R).....	1,217.91	30.21
28 31	23 00-0089		Modules, Signature (28 31 23 00-0057)		
28 31	23 00-0090	EA	Universal Class A/B Module - UIO Mount (EST3 SIGA-MAB)	133.89	20.14
28 31	23 00-0091	EA	Class B Single Input Module (One Gang Standard Mount) (EST3 SIGA-CT1).....	90.40	20.14
28 31	23 00-0092	EA	Class B Dual Input Module (One Gang Standard Mount) (EST3 SIGA-CT2)	125.70	20.14
28 31	23 00-0093	EA	Class B Dual Input UIO (Plug In) Module (EST3 SIGA-MCT2).....	120.75	20.14
28 31	23 00-0094	EA	Single Input (Riser) Module, Features A Built-In Ring Tone Generator, Use For Switching A Single Signal Or Audio Circuit (EST3 SIGA-CC1)	114.25	20.14
28 31	23 00-0095	EA	Dual Input (Riser) Module, Use For Switching (Selecting) Either Of Two Signal Or Audio Input Circuits To One Signal Output Circuit (EST3 SIGA-CC2).....	135.59	20.14
28 31	23 00-0096	EA	Control Relay Module (One Gang Standard Mount) (EST3 SIGA-CR)	109.27	20.14
			Note: Select for either N.O. or N.C. operation. Rated at 2 amps (24Vdc).		
28 31	23 00-0097	EA	Control Relay UIO (Plug In) Module (EST3 SIGA-MCR)	106.05	20.14
28 31	23 00-0098	EA	Single Input (Riser) Module With Strobe Synchronization Output (EST3 SIGA-CC1S).....	138.89	20.14
28 31	23 00-0099	EA	Universal Input/Output Module - Input With Programmable Output (EST3 SIGA-IO)	135.59	20.14
28 31	23 00-0100	EA	Input/Output Module - UIO Mount, Multifunction Module With Input And Program (EST3 SIGA-MIO)	130.68	20.14
28 31	23 00-0101	EA	Waterflow/Tamper Module (One Gang Standard Mount) (EST3 SIGA-WTM).....	120.49	100.35



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 31 23 00-0102 EA Monitor Module (One Gang Standard Mount) (EST3 SIGA-MM1).....	90.40	20.14
28 31 23 00-0103 EA Single Input (Riser) Module, With Synchronization Output (EST3 SIGA-MCC1S).....	139.52	20.14
28 31 23 00-0104 Module Accessories, Signature <small>(28 31 23 00-0057)</small>		
Note: Universal I/O motherboards are required for UIO plug-in modules. Module mounting plates can be used to mount multiple 1 & 2-gang modules.		
28 31 23 00-0105 EA Module Mounting Bracket - For 4" Square Box, Mounting Kit Allows Installing 2 Single Gang Signature Modules Into A Single 4" Square Box (EST3 SIGA-MB4).....	36.64	10.07
28 31 23 00-0106 EA Universal Input/Output Module Motherboard - 6 Position, Use For M Series Modules (EST3 SIGA-UIO6).....	119.16	20.14
28 31 23 00-0107 EA Transient Protector - For Bell And Horn Circuits, Provides Transient Protection To -CC1, -MCC1, -CC2, -MCC2, -UM And -MAB Modules (EST3 235196P).....	14.55	6.04
28 31 23 00-0108 EA Signature Module Mounting Plate, 1 Footprint, Space For Up To Four 2-Gang Signature Modules Or Eight 1-Gang Signature Modules (EST3 SIGA-MP1).....	42.32	10.07
28 31 23 00-0109 EA Signature Module Mounting Plate, 1/2 Footprint, Space For Up To Two 2-Gang Signature Modules Or Four 1-Gang Signature Modules (EST3 SIGA-MP2).....	38.24	10.07
28 31 23 00-0110 EA Signature Module Mounting Plate, 1/2 Extended Footprint, Space For Up To Three 2-Gang Signature Modules Or Six 1-Gang Signature Modules (EST3 SIGA-MP2L).....	39.85	10.07
28 31 23 00-0111 Single Action Pull Stations, Signature <small>(28 31 23 00-0057)</small>		
28 31 23 00-0112 EA One Stage Fire Alarm Station, English Markings (EST3 SIGA-270).....	154.54	41.90
28 31 23 00-0113 EA Two Stage (Pre Signal) Fire Alarm Station, English Markings (EST3 SIGA-270P).....	179.18	41.90
28 31 23 00-0114 EA GA Key - For Pre Signal Station (EST3 276-K2).....	20.56	16.54
28 31 23 00-0115 EA 20 Glass Rods For SIGA-270 Series Stations (EST3 270-GLR).....	25.31	21.29
28 31 23 00-0116 EA Surface Mount Box, Red - For SIGA-270 Series (EST3 276B-RSB).....	42.87	26.75
28 31 23 00-0117 Double Action Pull Stations, Signature <small>(28 31 23 00-0057)</small>		
28 31 23 00-0118 EA Double Action (One Stage) Fire Alarm Station, English Markings (EST3 SIGA-278).....	159.45	41.90
28 31 23 00-0119 EA 12 Glass Rods For SIGA-278 Series (EST3 276-GLR).....	25.66	4.03
28 31 23 00-0120 Detector Bases and Accessories, Signature <small>(28 31 23 00-0057)</small>		
Note: For raised floor and plenum applications. Order detector mounting base and detector separately. Compatible with -PS, and -PHS detectors and -SB, -RB and -IB bases.		
28 31 23 00-0121 EA Audible (Sounder) Base (EST3 SIGA-AB4G).....	73.09	10.07
28 31 23 00-0122 EA Surface Box - For Sounder Base, Use With -AB4G Models Only (EST3 AB4G-SB).....	30.04	10.07
28 31 23 00-0123 EA Audible (Sounder) Base, Mounts To 4" Square, 2-1/8" Deep Box (EST3 SIGA-AB4).....	90.18	10.07
28 31 23 00-0124 EA Detector (Smoke) Guard, Covers Detectors Mounted To Flush Boxes, Compatible With -IPHS And -PS Signature Detectors (EST3 SIGA-DG).....	53.06	10.07
28 31 23 00-0125 EA Detector (Smoke) Guard Surface Box - For SIGA-DG (EST3 SIGA-DGSB).....	61.26	10.07
28 31 23 00-0126 EA Detector Mounting Plate (EST3 SIGA-DMP).....	94.11	10.07
Note: For raised floor and plenum applications. Order detector mounting base and detector separately. Compatible with -PS, -PHS and -IPHS detectors and -SB, -RB and -IB bases. SIGA-IPHS 4D detector is limited to operation in air velocities less than 500 feet per minute.		
28 31 23 00-0127 EA Remote Alarm LED, Use With -SB And -SB4 Standard Base Only (EST3 SIGA-LED).....	36.64	10.07
28 31 23 00-0128 EA Trim Skirt/Ring - For Octagon Box (EST3 SIGA-TS).....	14.62	6.04
28 31 23 00-0129 EA Trim Skirt/Ring - For 4" Square Box, Use To Hide Imperfections Around Electric Boxes Not Completely Hidden By Standard Bases, With All 4" Bases (EST3 SIGA-TS4).....	14.62	6.04
28 31 23 00-0130 EA Detector (Smoke) Guard Mounting Flange, Provides Secure Mounting While Offering Easy Guard Removal, With Tamper Hardware (EST3 SIGA-DGMF).....	36.80	6.04
28 31 23 00-0131 EA Detector Base With Isolator (EST3 SIGA-IB).....	60.43	10.07
28 31 23 00-0132 EA Detector Base With Isolator - For 4" Square Box, With TS4 Skirt (EST3 SIGA-IB4).....	63.95	10.07
28 31 23 00-0133 EA Detector Base With Form 'C' Relay (EST3 SIGA-RB).....	54.30	10.07
28 31 23 00-0134 EA Detector Base With Form 'C' Relay - For 4" Square Box, With TS4 Skirt (EST3 SIGA-RB4).....	54.30	10.07
28 31 23 00-0135 EA Detector Base - Standard, For 4" Square Box, With TS4 Skirt (EST3 SIGA-SB4).....	31.27	10.07
28 31 23 00-0136 Controllers, Signature <small>(28 31 23 00-0057)</small>		
28 31 23 00-0137 EA Signature Dual Driver Controller (EST3 3-SDDC1).....	1,926.00	60.42
28 31 23 00-0138 EA Single Signature Loop Controller (EST3 3-SSDC1).....	1,115.62	60.42
28 31 23 00-0139 EA Signature Loop Controller (EST3 3-SDC1).....	1,005.01	60.42
28 31 23 00-0140 EA Analog Addressable Loop Controller (EST3 3-AADC1).....	1,594.45	60.42
28 31 23 00-0141 Relays And Accessories <small>(28 31 23 00-0057)</small>		
28 31 23 00-0142 EA Multi Voltage Relay (EST3 MR101).....	109.86	20.14
28 31 23 00-0143 EA Single SPDT Auxiliary Relay With LED Track Mounting (EST3 MR101/T).....	34.56	10.07
28 31 23 00-0144 Notification Appliances <small>(28 31 23 00-0002)</small>		
28 31 23 00-0145 Wall Strobes, Horns And Chimes <small>(28 31 23 00-0144)</small>		
28 31 23 00-0146 EA Strobe (15, 30, 75, Or 110 cd Output), White (EST3 G1-VM).....	95.53	30.21
28 31 23 00-0147 EA Strobe (15, 30, 75, Or 110 cd Output), Red (EST3 G1R-VM).....	95.53	30.21
28 31 23 00-0148 EA Horn-Strobe (15, 30, 75, Or 110 cd Output, High Or Low dB Output), White (EST3 G1-HDVM).....	106.97	30.21
28 31 23 00-0149 EA Temporal Horn (Selectable High Or Low dB Output), White (EST3 G1-HD).....	82.65	30.21
28 31 23 00-0150 EA Temporal Horn (Selectable High Or Low dB Output), Red (EST3 G1R-HD).....	82.65	30.21
28 31 23 00-0151 EA Temporal Horn, Hi/Lo dB Output, 24 VDC, White, With The Word "FIRE" On Housing (EST3 G1F-HD).....	82.65	30.21

28 Electronic Safety And Security**28 30 Electronic Detection And Alarm****28 31 Fire Detection And Alarm**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 31 23 00-0152 EA Temporal Horn, Hi/Lo dB Output, 24 VDC, Red, With The Word "FIRE" On Housing (EST3 G1RF-HD).....	82.65	30.21
28 31 23 00-0153 EA Horn (Steady Tone), 24 VDC, White, Not Compatible With Signal Master (EST3 G1-P).....	71.82	30.21
28 31 23 00-0154 EA Horn (Steady Tone) - 24 VDC, Red, Not Compatible With Signal Master (EST3 G1R-P).....	71.82	30.21
28 31 23 00-0155 EA Horn (Steady Tone), 24 VDC, Red, With The Word "FIRE" On Housing, Not Compatible With Signal Master (EST3 G1RF-P).....	71.82	30.21
28 31 23 00-0156 EA Genesis Chime-Strobe (15, 30, 75, Or 110 cd Output, High Or Low dB Output), White (EST3 G1-CVM).....	153.65	30.21
28 31 23 00-0157 EA Genesis Chime-Strobe (15, 30, 75, Or 110 cd Output, High Or Low dB Output), Red (EST3 G1R-CVM).....	153.65	30.21
28 31 23 00-0158 EA Genesis Chime (Selectable High Or Low dB Output), White (EST3 G1-C).....	105.58	30.21
28 31 23 00-0159 EA Genesis Chime (Selectable High Or Low dB Output), Red (EST3 G1R-C).....	105.58	30.21
28 31 23 00-0160 EA Wall Strobe, 15/75 cd, White, With The Word "FIRE" On Housing (EST3 G1F-V1575).....	95.53	30.21
28 31 23 00-0161 EA Multi-cd Strobe, 24 VDC, White, With The Word "FIRE" On Housing (EST3 G1F-VM).....	95.53	30.21
28 31 23 00-0162 EA Multi-Candela Strobe, 24 VDC, Red, With The Word "FIRE" On Housing (EST3 G1RF-VM).....	95.53	30.21
28 31 23 00-0163 EA Wall Strobe, 15/75 cd, Red, With The Word "FIRE" On Housing (EST3 G1RF-V1575).....	95.53	30.21
28 31 23 00-0164 EA Genesis Ceiling Strobe, 15-95 Multi-cd, FIRE Marking, Mounts To 4" Square x 2-1/8" Box (EST3 GCF-VM).....	98.75	30.21
28 31 23 00-0165 EA Genesis Ceiling Strobe, 15-95 Multi-cd, FIRE Marking, Mounts To 4" Square x 2-1/8" Box (EST3 GCFR-VM).....	98.75	30.21
28 31 23 00-0166 EA Genesis Ceiling Strobe, 95-177 Multi-cd, FIRE Marking, Mounts To 4" Square x 2-1/8" Box (EST3 GCF-VMH).....	106.27	30.21
28 31 23 00-0167 EA Genesis Ceiling Strobe, 15-95 Multi-cd, Mounts To 4" Square x 2-1/8" Box (EST3 GC-VM).....	98.75	30.21
28 31 23 00-0168 EA Genesis Ceiling Strobe, 95-177 Multi-cd, Mounts To 4" Square x 2-1/8" Box (EST3 GC-VMH).....	98.75	30.21
28 31 23 00-0169 EA Genesis Trim Plate (For Two-Gang Or 4" Square Boxes) With "FIRE" Markings, White (EST3 G1T-FIRE).....	64.78	30.21
28 31 23 00-0170 EA Genesis Trim Plate (For Two-Gang Or 4" Square Boxes) With "FIRE" Markings, Red (EST3 G1RT-FIRE).....	64.78	30.21
28 31 23 00-0171 Wall Speakers And Speaker Strobes (28 31 23 00-0144)		
28 31 23 00-0172 EA Multi-Wattage 25 VRMS Speaker (EST3 G4-S2).....	81.68	30.21
28 31 23 00-0173 EA Multi-Candela/Wattage 25 VRMS Speaker-Strobe (EST3 G4-S2VM).....	117.95	30.21
28 31 23 00-0174 EA Multi-Wattage 70 VRMS Speaker (EST3 G4-S7).....	81.68	30.21
28 31 23 00-0175 EA Multi-Candela/Wattage 70 VRMS Speaker-Strobe (EST3 G4-S7VM).....	117.95	30.21
28 31 23 00-0176 EA Surface Box, White, For Genesis Speaker (EST3 G4B).....	41.07	16.11
28 31 23 00-0177 EA Surface Box, Red, For Genesis Speaker (EST3 G4RB).....	41.07	16.11
28 31 23 00-0178 Ceiling Speakers And Speaker Strobes (28 31 23 00-0144)		
28 31 23 00-0179 EA Genesis Ceiling Speaker, 70 VRMS, Mounts To 4" Square x 2-1/8" Box (EST3 GC-S7).....	94.83	30.21
28 31 23 00-0180 EA Genesis Ceiling Speaker/Strobe, 70 VRMS, 15-95 Multi-cd, Mounts To 4" Square x 2-1/8" Box (EST3 GC-S7VM).....	117.95	30.21
28 31 23 00-0181 EA Genesis Ceiling Speaker/Strobe, 70 VRMS, 95-177 Multi-cd, Mounts To 4" Square x 2-1/8" Box (EST3 GC-S7VMH).....	125.27	30.21
28 31 23 00-0182 Harsh Environment Signals (28 31 23 00-0144)		
28 31 23 00-0183 EA Temporal Horn, Self-Synchronized, 24 VDC (EST3 757-1A-T).....	85.83	30.21
28 31 23 00-0184 EA 15/75 Candela Temporal Horn/Strobe, 24 VDC (EST3 757-7A-T).....	114.70	30.21
28 31 23 00-0185 EA 110 Candela Temporal Horn/Strobe, 24 VDC (EST3 757-8A-T).....	114.70	30.21
28 31 23 00-0186 EA 15 Candela Synchronized, 24 VDC, Strobe (EST3 405-5A-T).....	106.12	30.21
28 31 23 00-0187 EA 15/75 Candela Synchronized, 24 VDC, Strobe (EST3 405-7A-T).....	100.41	30.21
28 31 23 00-0188 EA 30 Candela Synchronized, 24 VDC, Strobe (EST3 405-3A-T).....	106.12	30.21
28 31 23 00-0189 EA 60 Candela Synchronized, 24 VDC, Strobe (EST3 405-6A-T).....	106.12	30.21
28 31 23 00-0190 EA 110 Candela Synchronized, 24 VDC, Strobe (EST3 405-8A-T).....	106.12	30.21
28 31 23 00-0191 EA 15/75 Candela Synchronized, 24 VDC, Red, Outdoor Listed, Strobe (EST3 CS405-7A-T).....	117.72	34.24
28 31 23 00-0192 EA 110 Candela Synchronized, 24 VDC, Red, Outdoor Listed, Strobe (EST3 CS405-8A-T).....	117.72	34.24
28 31 23 00-0193 EA 15 Candela Temporal Horn/Strobe, 24 VDC (EST3 757-5A-T).....	89.34	30.21
28 31 23 00-0194 EA 30 Candela Temporal Horn/Strobe, 24 VDC (EST3 757-3A-T).....	112.01	30.21
28 31 23 00-0195 Fire Alarm Bells (28 31 23 00-0144)		
28 31 23 00-0196 EA 10" Single Stroke Fire Alarm Bells, 24 VDC (EST3 323D-10AW).....	122.71	30.21
28 31 23 00-0197 EA 6" Vibrating Fire Alarm Bells, 24 VDC (EST3 439D-6AW).....	101.15	30.21
28 31 23 00-0198 EA 10" Vibrating Fire Alarm Bells, 24 VDC (EST3 439D-10AW).....	110.35	30.21
28 31 23 00-0199 Multiple Tone Signal (28 31 23 00-0144)		
28 31 23 00-0200 EA 27 Tone Selectable Signal, 24 VDC (EST3 5530MD-24AW).....	707.39	677.18
28 31 23 00-0201 Multi-Purpose Loudspeaker (28 31 23 00-0144)		
28 31 23 00-0202 EA 15 Watt Loudspeaker, Gray (EST3 HPSA15G2570).....	157.10	30.21
28 31 23 00-0203 EA 15 Watt Loudspeaker, Red (EST3 HPSA15R2570).....	157.10	30.21
28 31 23 00-0204 Bell/Strobe Plate (28 31 23 00-0144)		
28 31 23 00-0205 EA Bell/Strobe Plate - 15cd (EST3 403-5A-R).....	79.88	16.11
28 31 23 00-0206 Mounting Accessories (28 31 23 00-0144)		
28 31 23 00-0207 EA Surface Mount Box - Indoor, Red, 1-Gang (EST3 27193-11).....	41.74	16.11
28 31 23 00-0208 EA One Gang Surface Mount Box, Red, No Bottom KO (EST3 27193-11-NY).....	41.74	16.11
28 31 23 00-0209 EA Surface Mount Box - Indoor, White, 1-Gang (EST3 27193-16).....	41.74	16.11
28 31 23 00-0210 EA Surface Mount Box - Indoor, Red, 2-Gang (EST3 27193-21).....	41.74	16.11
28 31 23 00-0211 EA Surface Mount Box - Indoor, White, 2-Gang (EST3 27193-26).....	41.74	16.11



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 31 23 00-0212				Firefighters' Telephones <small>(28 31 23 00-0144)</small>		
			EA	Remote Telephone Warden Station - Flush, Red, 5' Armored Cable, Hinged Door With Magnetic Latch, 4-State (EST3 6830-NY-F4).....	644.91	50.35
			EA	Four State Remote Telephone Warden Station - Surface, Armored Cord (EST3 6830-NY-S4).....	372.82	50.35
			EA	Remote Telephone Warden Station - Flush, Armored Cord (EST3 6830-NY-F).....	274.83	50.35
			EA	Telephone Handset Assembly - Red c/w 60" Coiled Cord (EST3 6830-1).....	206.52	50.35
			EA	Remote Telephone Handset Station - 4-State, Red, 5' Coiled Cord (EST3 6830-4).....	360.62	50.35
			EA	Three State Telephone Handset Assembly - Red, 60" Coiled Cord, Push To Talk Button (EST3 6830-5A).....	230.90	50.35
			EA	Remote Telephone Handset Station - 4-State, Red, 'Push To Talk' Button, 5' Coiled Cord (EST3 6830-5A-4).....	403.80	50.35
			EA	Three State Telephone Handset Assembly - Red, 60" Armored Cord, Push To Talk Button (EST3 6830-6A).....	239.03	50.35
			EA	Remote Telephone Handset Station - 4-State, Red, 'Push To Talk' Button, 5' Armored Cable (EST3 6830-6A-4).....	459.10	50.35
			EA	Portable Handset Receptacle, 1 Gang Stainless Steel Faceplate (EST3 6833-1).....	55.03	16.11
			EA	Portable Telephone Receptacle - 1-Gang, SS, 4-State (EST3 6833-4).....	62.11	16.11
			EA	Portable Telephone Handset - Black, Coiled Cord (EST3 6830-3).....	78.42	
			EA	Portable Telephone Handset - Red, Coiled Cord (EST3 6700-0061).....	78.42	
			EA	Frontplate - Flush Mount, Red Finish, Break Glass Type, With Two Keys (EST3 6831-1).....	125.17	20.14
			EA	Frontplate - Flush Mount, Red Finish, Non Break Glass Type With Two Keys (EST3 6831-2).....	153.33	20.14
			EA	Frontplate - Surface Mount, Red Finish, Break Glass Type, With Two Keys (EST3 6831-3).....	111.09	20.14
			EA	Frontplate - Surface Mount, Red Finish, Non Break Glass Type, With Two Keys (EST3 6831-4).....	106.95	20.14
			EA	Wallbox - Flush Or Surface Mount, Red Finish, 14" x 8-1/2" x 3-1/2" (EST3 6832-1).....	86.14	30.21
			EA	Portable Handset Storage Cabinet, Surface Mount, With Keylock, Red Finish (EST3 TCS-6).....	660.32	40.28
28 31 23 00-0232				Mass Notification EC Appliances <small>(28 31 23 00-0144)</small>		
			EA	G1 Wall, Strobe, White Housing, Alert Markings, Amber Lens (EST3 G1WA-VMA).....	98.77	30.21
			EA	G1 Wall, Strobe, White Housing, Alert Markings, Clear Lens (EST3 G1WA-VMC).....	95.85	30.21
			EA	G1 Wall, Strobe, White Housing, No Markings, Amber Lens (EST3 G1WN-VMA).....	98.77	30.21
			EA	G1 Wall, Strobe, White Housing, No Markings, Clear Lens (EST3 G1WN-VMC).....	95.85	30.21
			EA	G1 Wall, White Trim Ring, Alert Marking (EST3 G1WT-ALERT).....	15.59	6.04
28 31 23 00-0238				Hazardous Location Devices <small>(28 31 23 00-0002)</small>		
28 31 23 00-0239				Detectors, Rate Compensation Heat, For Explosion/Weather/Moisture Proof And Ordinary Location <small>(28 31 23 00-0238)</small>		
			EA	Heat Detector, Rate Compensation, Interior Vertical Surface Mount FM And UL, 135 Degree F (EST3 302-135).....	89.45	30.21
			EA	Heat Detector, Rate Compensation, Interior Vertical Surface Mount FM And UL, 194 Degree F (EST3 302-194).....	89.45	30.21
			EA	Heat Detector - Rate Compensation, All-Weather Vertical Mounting, FM And UL, 135 Degree F (EST3 302-AW-135).....	91.89	30.21
			EA	Heat Detector - Rate Compensation, All-Weather Vertical Mounting, FM And UL, 194 Degree F (EST3 302-AW-194).....	91.89	30.21
			EA	Heat Detector, Rate Compensation, Explosion Proof Mounting, Interior Vertical Surface Mount FM And UL, 135 Degree F, Requires JALX-11 Or Equal (EST3 302-EPM-135).....	120.93	30.21
			EA	Heat Detector, Rate Compensation, Explosion Proof Mounting, Interior Vertical Surface Mount FM And UL, 194 Degree F, Requires JALX-11 Or Equal (EST3 302-EPM-194).....	120.93	30.21
			EA	Heat Detector, Rate Compensation, All-Weather Vertical, Box Mount (1/2" NPT), FM And UL, 135 Degree F, Requires STONCO27 Or Equal (EST3 302-ET-135).....	91.89	30.21
			EA	Heat Detector, Rate Compensation, All-Weather Vertical, Box Mount (1/2" NPT), FM And UL, 194 Degree F, Requires STONCO27 Or Equal (EST3 302-ET-194).....	91.89	30.21
28 31 23 00-0248				Hazardous Locations Fire Alarm Station <small>(28 31 23 00-0238)</small>		
			EA	Hazardous Location Fire Alarm Station (EST3 XAL53).....	681.81	50.35
			EA	Explosion Proof, Weatherproof, Fire Alarm Station, Single Action, Cat 45 Key Reset, Terminal Connections, DPDT (EST3 MPSR1-D45WX-GE).....	650.23	50.35
28 31 23 00-0251				Hazardous Location Strobes <small>(28 31 23 00-0238)</small>		
			EA	Explosion Proof Strobe (EST3 116DEXSTC-FJ).....	992.06	30.21
			EA	Wall Bracket Mounting Elbow (EST3 116EX-B).....	187.27	10.07
			EA	Ceiling / Wall Mounting Module (EST3 116EX-C).....	244.48	12.09
			EA	Pendant Mounting Module (EST3 116EX-P).....	180.94	12.09
28 31 23 00-0256				Hazardous Location Bells <small>(28 31 23 00-0238)</small>		
			EA	6" Hazardous Location Bells, 24 VDC (EST3 439DEX-6AW).....	719.91	30.21
			EA	8" Hazardous Location Bells, 24 VDC (EST3 439DEX-8AW).....	738.18	30.21
			EA	10" Hazardous Location Bells, 24 VDC (EST3 439DEX-10AW).....	744.76	30.21
28 31 23 00-0260				Hazardous Location Horns <small>(28 31 23 00-0238)</small>		
			EA	Hazardous Location Horns (EST3 888D-N5).....	704.15	30.21
			EA	Explosion Proof Horn, Diode Polarized, 24 VDC (EST3 889D-AW).....	577.68	30.21
28 31 23 00-0263				Door Holders And Relays <small>(28 31 23 00-0002)</small>		
28 31 23 00-0264				Electromagnetic Door Holders <small>(28 31 23 00-0263)</small>		
			EA	Door Holder, Single, Floor Mount - 24 VAC / 24 VDC / 120 VAC (EST3 1501-AQN5).....	137.77	30.21
			EA	Door Holder, Double, Floor Mount - 24 VAC / 24 VDC / 120 VAC (EST3 1502-AQN5).....	174.45	30.21

28 Electronic Safety And Security**28 30 Electronic Detection And Alarm****28 31 Fire Detection And Alarm**

MINOR				TOTAL DIRECT	DEMOLITION
CSI	UOM	DESCRIPTION		UNIT COST	UNIT COST
28 31 23 00-0267	EA	Door Holder, Flush, Wall Mount - 24 VAC / 24 VDC / 120 VAC (EST3 1504-AQN5).....	119.04		30.21
28 31 23 00-0268	EA	Door Holder, Flush, Wall Mount, Short Catch Plate - 24 VAC / 24 VDC / 120 VAC (EST3 1505-AQN5).....	119.04		30.21
28 31 23 00-0269	EA	Door Holder, Surface, Wall Mount - 24 VAC / 24 VDC / 120 VAC (EST3 1508-AQN5).....	120.73		30.21
28 31 23 00-0270	EA	Door Holder, Completely Flush, Wall Mount - 24 VAC / 24 VDC / 120 VAC (EST3 1509-AQN5).....	122.35		30.21
28 31 23 00-0271		Control Relays, Multi-Voltage (28 31 23 00-0263)			
28 31 23 00-0272	EA	Single SPDT With LED, Adhesive Tape Mounting (EST3 PAM1).....	27.83		6.04
28 31 23 00-0273		FireShield Plus (28 31 23 00-0002)			
28 31 23 00-0274		3 Zone System (28 31 23 00-0273)			
28 31 23 00-0275	EA	Conventional Fire Alarm Control Panel, 3 Class B IDC Zones, 2 Class B NAC's, 3.5 Amp NAC Power, Red Enclosure, 120 VAC, Capacity For (2) 10 Amp Hours Batteries (EST3 FSP302R).....	783.04		241.71
28 31 23 00-0276	EA	Conventional Fire Alarm Control Panel, 3 Class B IDC Zones, 2 Class B NAC's, 3.5 Amp NAC Power, Red Enclosure, 120 VAC, Capacity For (2) 10 Amp Hours Batteries, With Upload/Download DACT (EST3 FSP302RD).....	1,126.89		322.27
28 31 23 00-0277	EA	Conventional Fire Alarm Control Panel, 3 Class B IDC Zones, 2 Class B NAC's, 3.5 Amp NAC Power, Gray Enclosure, 120 VAC, Capacity For (2) 10 Amp Hours Batteries (EST3 FSP302G).....	783.04		241.71
28 31 23 00-0278	EA	Conventional Fire Alarm Control Panel, 3 Class B IDC Zones, 2 Class B NAC's, 3.5 Amp NAC Power, Gray Enclosure, 120 VAC, Capacity For (2) 10 Amp Hours Batteries, With Upload/Download DACT (EST3 FSP302GD).....	1,126.89		322.27
28 31 23 00-0279	EA	Semi Flush Trim Kit For 3 Or 5 Zone Enclosures, Gray (EST3 F-TRIM35G).....	51.75		10.07
28 31 23 00-0280	EA	Semi Flush Trim Kit For 3 Or 5 Zone Enclosures, Red (EST3 F-TRIM35R).....	51.75		10.07
28 31 23 00-0281		5 Zone System (28 31 23 00-0273)			
28 31 23 00-0282	EA	Conventional Fire Alarm Control Panel, 5 Class B IDC Zones, 2 Class B NAC's, 3.5 Amp NAC Power, Red Enclosure, 120 VAC, Capacity For (2) 10 Amp Hours Batteries (EST3 FSP502R).....	834.20		241.71
28 31 23 00-0283	EA	Conventional Fire Alarm Control Panel, 5 Class B IDC Zones, 2 Class B NAC's, 3.5 Amp NAC Power, Red Enclosure, 120 VAC, Capacity For (2) 10 Amp Hours Batteries, With Upload/Download DACT (EST3 FSP502RD).....	1,175.12		322.27
28 31 23 00-0284	EA	Conventional Fire Alarm Control Panel, 5 Class B IDC Zones, 2 Class B NAC's, 3.5 Amp NAC Power, Gray Enclosure, 120 VAC, Capacity For (2) 10 Amp Hours Batteries (EST3 FSP502G).....	834.20		241.71
28 31 23 00-0285	EA	Conventional Fire Alarm Control Panel, 5 Class B IDC Zones, 2 Class B NAC's, 3.5 Amp NAC Power, Gray Enclosure, 120 VAC, Capacity For (2) 10 Amp Hours Batteries, With Upload/Download DACT (EST3 FSP502GD).....	1,175.12		322.27
28 31 23 00-0286	EA	Semi Flush Trim Kit For 3 Or 5 Zone Enclosures, Gray (EST3 F-TRIM35G).....	51.75		10.07
28 31 23 00-0287	EA	Semi Flush Trim Kit For 3 Or 5 Zone Enclosures, Red (EST3 F-TRIM35R).....	51.75		10.07
28 31 23 00-0288		10 Zone System (28 31 23 00-0273)			
28 31 23 00-0289	EA	Conventional Fire Alarm Control Panel, 10 Class B IDC Zones, 4 Class B NAC's, 3.5 Amp NAC Power, Red Enclosure, 120 VAC, Capacity For (2) 17 Amp Hours Batteries (EST3 FSP1004R).....	1,192.66		322.27
28 31 23 00-0290	EA	Conventional Fire Alarm Control Panel, 10 Class B IDC Zones, 4 Class B NAC's, 3.5 Amp NAC Power, Red Enclosure, 120 VAC, Capacity For (2) 17 Amp Hours Batteries, With Upload/Download DACT (EST3 FSP1004RD).....	1,536.50		402.84
28 31 23 00-0291	EA	Conventional Fire Alarm Control Panel, 10 Class B IDC Zones, 4 Class B NAC's, 3.5 Amp NAC Power, Gray Enclosure, 120 VAC, Capacity For (2) 17 Amp Hours Batteries (EST3 FSP1004G).....	1,170.73		322.27
28 31 23 00-0292	EA	Conventional Fire Alarm Control Panel, 10 Class B IDC Zones, 4 Class B NAC's, 3.5 Amp NAC Power, Gray Enclosure, 120 VAC, Capacity For (2) 17 Amp Hours Batteries, With Upload/Download DACT (EST3 FSP1004GD).....	1,536.50		402.84
28 31 23 00-0293	EA	Semi Flush Trim Kit For 10 Zone Enclosures, Gray (EST3 F-TRIM10G).....	59.66		10.07
28 31 23 00-0294	EA	NAC Power Expansion Transformer, 120 VAC, Increases 10 Zone FACP NAC (EST3 F-XTR120).....	109.88		20.14
28 31 23 00-0295		FireShield Plus Off Premise Communication Options (28 31 23 00-0273)			
28 31 23 00-0296	EA	F-Series Upload/Download DACT And Modem, Dual Line, With 2x16 LCD (EST3 F-DACT).....	230.29		20.14
28 31 23 00-0297		FireShield Plus Remote LED Annunciators (28 31 23 00-0273)			
28 31 23 00-0298	EA	Remote System Indicator, Power, Alarm, Supervisory, Trouble And Ground Fault LED's With Local Buzzer, Single Gang, And White Trim Plate (EST3 FSRSI).....	107.85		30.21
28 31 23 00-0299	EA	Remote Zone Indicator, Contains 5 Red LED's For Alarm Zone Indication, With Jumper Selectable Zone Settings, Single Gang, And White Trim Plate (EST3 FSRZI-A).....	107.85		30.21
28 31 23 00-0300	EA	Remote Zone Indicator, Contains 5 Bi-Color LED's (Red/Yellow) For Alarm Or Supervisory Zone Indication, With Jumper Selectable Zone Settings, Single Gang, And White Trim Plate (EST3 FSRZI-SA).....	111.58		30.21
28 31 23 00-0301	EA	Remote Annunciator Trim Plate - 2 Gang - White (EST3 FSAT2).....	21.60		6.04
28 31 23 00-0302	EA	Remote Annunciator Trim Plate - 3 Gang - White (EST3 FSAT3).....	26.37		6.04
28 31 23 00-0303	EA	Remote Annunciator Trim Plate - 4 Gang - White (EST3 FSAT4).....	37.83		6.04
28 31 23 00-0304		FireShield Plus Remote 10 Zone LED Annunciators (28 31 23 00-0273)			
28 31 23 00-0305	EA	Remote LED Annunciator, With Common System Indicators, 10 Zone Indicators, White Housing, Mounts To 4" Electrical Box, For Use With 10 Zone Panels Only (EST3 FSRA10).....	308.90		30.21
28 31 23 00-0306	EA	Remote LED Annunciator, With Common System Indicators, 10 Zone Indicators And Common Control Switches, White Housing, Mounts To 4" Electrical Box, For Use With 10 Zone Panels Only (EST3 FSRA10C).....	338.13		30.21
28 31 23 00-0307	EA	Single Unit Remote Annunciator Enclosure, 4" Box Mount, Key Locked Door, Plexiglas Window, Gray (EST3 RA-ENC1).....	113.36		20.14



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 31 23 00-0308 FireShield Plus Remote Relays And Interfaces <small>(28 31 23 00-0273)</small>		
28 31 23 00-0309 EA Remote Relay Module, 5 Form C Contacts, Jumper Selectable Operation, With Mounting Track (EST3 FSRRM24).....	119.32	20.14
28 31 23 00-0310 EA 11" Snap Track Holds 2-4 RRM's, Used To Mount FSRRM's In MFC-A Or Other Listed Enclosure, MFC-A Will Hold Two FSRRM-11S (EST3 FSRRM-S11).....	51.10	12.09
28 31 23 00-0311 EA Common Function Graphic Driver/Interface - 9 Relays And 5 Switch Inputs For Common System Indicators And Controls (EST3 FSUIM).....	184.98	20.14
28 31 23 00-0312 FireShield Plus Accessories <small>(28 31 23 00-0273)</small>		
28 31 23 00-0313 EA Resistor Kit With 1-3.6K And 1-1.1K (46071-0409) (EST3 EOL3.6-1.1).....	11.63	
28 31 23 00-0314 EA 4.7k UL End Of Line Resistor With FireShield Panels (EST3 EOL47PK7).....	7.63	
28 31 23 00-0315 iO Series Fire Control Panels <small>(28 31 23 00-0002)</small>		
28 31 23 00-0316 Intelligent Analog Control Panels <small>(28 31 23 00-0315)</small>		
28 31 23 00-0317 EA FACP, 1 Intelligent Loop Supporting 125 Detectors/125 Modules, 2nd Loop Optional, 4 Class B NAC's, 6.5 Amp Power Supply, Gray Door, 115 VAC, Capacity For Up (2) 18a/h Batteries, English (EST3 iO500G).....	2,383.10	402.84
28 31 23 00-0318 EA FACP, 1 Intelligent Loop Supporting 125 Detectors/125 Modules, 2nd Loop Optional, 4 Class B NAC's, 6.5 Amp Power Supply, Gray Door, 115 VAC, Capacity For Up (2) 18 a/h Batteries, With Dual Line Dialer/Modem, English (EST3 iO500GD).....	2,524.88	402.84
28 31 23 00-0319 EA FACP, 1 Loop, 64 Intelligent Devices Max, 2 Class B NAC's, 4.25 Amp Power Supply, Gray Door, 115 VAC, Capacity For Up (2) 10 a/h Batteries, English (EST3 iO64G).....	1,902.97	322.27
28 31 23 00-0320 EA FACP, 1 Loop, 64 Intelligent Devices Max, 2 Class B NAC's, 4.25 Amp Power Supply, Gray Door, 115 VAC, Capacity For Up (2) 10a/h Batteries, With Dual Line Dialer/Modem, English (EST3 iO64GD).....	1,968.75	322.27
28 31 23 00-0321 Option Modules And Accessories For iO Series <small>(28 31 23 00-0315)</small>		
28 31 23 00-0322 EA 16 Zone LED Annunciator, 2 LED's Per Zone, Customizable Insert Labels, Left Side Mounting, Zones 1-16 (EST3 D16L-iO-1).....	206.58	30.21
28 31 23 00-0323 EA 16 Zone LED Annunciator, 2 LED's Per Zone, Customizable Insert Labels, Right Side Mounting, Zones 17-32, Requires D16L-iO-1 (EST3 D16L-iO-2).....	133.50	30.21
28 31 23 00-0324 EA Serial Interface, RS232, 4 Terminal Connections For Supervised/Unsupervised Printers And Connection To PC's (EST3 SA-232).....	133.50	30.21
28 31 23 00-0325 EA Class A NAC Module, For 64 Point Systems Only, Mounts To Main Board (EST3 SA-CLA).....	113.36	20.14
28 31 23 00-0326 EA Dialer/Modem, Two Telephone Line Connections, RJ31, Mounts To Base Plate (EST3 SA-DACT).....	222.24	16.11
28 31 23 00-0327 EA Ethernet Port Interface, RJ45, Mounts To Base Plate (EST3 SA-ETH).....	397.64	16.11
28 31 23 00-0328 EA Trim Kit For Semi-Flush Mounting 64 Point Systems (EST3 SA-TRIM1).....	50.83	10.07
28 31 23 00-0329 EA Trim Kit For Semi-Flush Mounting 500 Point Systems (EST3 SA-TRIM2).....	58.14	10.07
28 31 23 00-0330 EA Expansion Loop For iO500 Systems, 125 Detectors/125 Modules, Mounts On Main Board (EST3 XAL250).....	738.30	40.28
28 31 23 00-0331 Remote Annunciators For iO Series <small>(28 31 23 00-0315)</small>		
28 31 23 00-0332 EA Remote Annunciator, 80 Character LCD, Common System Indicators, Beige Housing, Mounts To 4" Box With Supplied Ring (EST3 RLCD).....	407.55	30.21
28 31 23 00-0333 EA Remote Annunciator, 80 Character LCD, Common System Indicators And Controls, Beige Housing, Mounts To 4" Box With Supplied Ring (EST3 RLCD-C).....	425.83	30.21
28 31 23 00-0334 Remote Annunciator Accessories <small>(28 31 23 00-0315)</small>		
28 31 23 00-0335 EA 24 Expander Cable Assembly, With Cable And Hardware (EST3 730073).....	49.37	10.07
28 31 23 00-0336 EA 12 Expander Cable (Cable Only) (EST3 7120313-01).....	34.76	10.07
28 31 23 00-0337 EA 24 Expander Cable (Cable Only) (EST3 7120313-02).....	45.71	10.07
28 31 23 00-0338 EA Single Unit Remote Annunciator Enclosure, 4" Box Mount, Key Locked Door, Plexiglas Window, Beige (EST3 RA-ENC1).....	133.50	30.21
28 31 23 00-0339 EA Dual Unit Remote Annunciator Enclosure, 4" Box Mount, Key Locked Door, Plexiglas Window, Beige (EST3 RA-ENC2).....	151.77	30.21
28 31 23 00-0340 EA Three Unit Remote Annunciator Enclosure, 4" Box Mount, Key Locked Door, Plexiglas Window, Beige (EST3 RA-ENC3).....	170.04	30.21
28 31 23 00-0341 EA Blank Zone Card Insert For RLEDx Controllers (EST3 RA-LED16ZC).....	34.76	10.07
28 31 23 00-0342 EA Blank Zone Card Insert For RLED24x Controllers (EST3 RA-LED24ZC).....	34.76	10.07
28 31 23 00-0343 EA Remote Key Switch, Single Gang Mount, Provides Keyed Control To Enable/Disable Common Control Switches On Remote Annunciators (EST3 RKEY).....	66.69	10.07
28 31 23 00-0344 System Accessories <small>(28 31 23 00-0315)</small>		
28 31 23 00-0345 EA Battery Cabinet, 14" x 18.25" x 7.25" Free Standing Cabinet With Key Lock, Supports Up To 40 Amp Hours Batteries, Will Hold Up To Two 12 VDC, 24 Amp Batteries (EST3 BC-1).....	238.57	40.28
28 31 23 00-0346 EA Isolator Module - RS232, For Use With Short Haul Modems, VDU-3, CCA Series, CGP Series And FCOM-232, Requires 1/2 Size Cabinet Footprint (EST3 IOP3A).....	1,143.26	322.27
28 31 23 00-0347 Conventional Initiating Devices <small>(28 31 23 00-0002)</small>		
28 31 23 00-0348 Detectors, Heat, Double Pole <small>(28 31 23 00-0347)</small>		
Note: WARNING, Heat detectors are not Life Safety Devices, use for property protection only.		
28 31 23 00-0349 EA Heat Detector, 135 Degree F Fixed Temperature (CF135-2).....	99.80	30.21
28 31 23 00-0350 EA Heat Detector, 200 Degree F Fixed Temperature (CF200-2).....	99.80	30.21
28 31 23 00-0351 EA Heat Detector, 135 Degree F ROR/Fixed Temperature (CR135-2).....	99.80	30.21
28 31 23 00-0352 EA Heat Detector, 200 Degree F ROR/Fixed Temperature (CR200-2).....	99.80	30.21

28 Electronic Safety And Security**28 30 Electronic Detection And Alarm****28 31 Fire Detection And Alarm**

MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
28 31 23 00-0353		Detectors, Rate Compensation Heat, Accessories (28 31 23 00-0347)			
28 31 23 00-0354	EA	Heat Detector, Rate Compensation, Adapter Plate For Mounting 302 And 302-AW To Any 3 Outlet Box Or 4" Octagon Outlet Box (GE AP-P).....	65.94		30.21
28 31 23 00-0355	EA	Explosion Proof Outlet Body With Cover, 1/2" Threaded Hubs On Back, Four Sides And Cover (GE JALX11).....	151.70		16.11
28 31 23 00-0356	EA	4" Weatherproof, Octagon Backbox And Cover, 1/2" Threaded Hubs On Back, Four Sides And Cover (GE STONCO27).....	54.52		20.14
28 31 23 00-0357		Detectors, Heat, Fire-Lite (28 31 23 00-0347)			
Note: WARNING, Heat detectors are not Life Safety Devices, use for property protection only.					
28 31 23 00-0358	EA	Explosion Heat Detector, 135 Degree F Fixed Temperature, Rate-Anticipation Heat Detector, All-Weather Vertical Mounting (302-EPM-135).....	94.21		30.21
28 31 23 00-0359	EA	Explosion Heat Detector, 194 Degree F Fixed Temperature, Rate-Anticipation Heat Detector, All-Weather Vertical Mounting (302-EPM-194).....	94.21		30.21
28 31 23 00-0360		Audio Notification Systems (Standalone Voice Evacuation) (28 31 23 00-0002)			
28 31 23 00-0361		Audio Notification Panels (28 31 23 00-0360)			
28 31 23 00-0362	EA	Audio Notification Panel, 100W Amplifier, DMR, Temporal Pattern, Power Supply And Battery Charger, Standard Message, Microphone, And 14.5" x 18" x 4" Gray Cabinet (GE ANS100MDG).....	2,976.20		402.84
28 31 23 00-0363	EA	Audio Notification Panel, 100W Amplifier, DMR, Temporal Pattern, Power Supply And Battery Charger, Standard Message, Microphone, And 14.5" x 18" x 4" Red Cabinet (GE ANS100MDR).....	2,976.20		402.84
28 31 23 00-0364	EA	Audio Notification Panel, 25 Watt Amplifier, DMR, Temporal Pattern, Power Supply And Battery Charger, Standard Message, Microphone, And 14.5" x 18" x 4" Gray Cabinet (GE ANS25MDG).....	2,267.31		402.84
28 31 23 00-0365	EA	Audio Notification Panel, 25 Watt Amplifier, DMR, Temporal Pattern, Power Supply And Battery Charger, Standard Message, Microphone, And 14.5" x 18" x 4" Red Cabinet (GE ANS25MDR).....	2,267.31		402.84
28 31 23 00-0366	EA	Audio Notification Panel, 50W Amplifier, DMR, Temporal Pattern, Power Supply And Battery Charger, Standard Message, Microphone, And 14.5" x 18" x 4" Gray Cabinet (GE ANS50MDG).....	2,618.11		402.84
28 31 23 00-0367	EA	Audio Notification Panel, 50W Amplifier, DMR, Temporal Pattern, Power Supply And Battery Charger, Standard Message, Microphone, And 14.5" x 18" x 4" Red Cabinet (GE ANS50MDR).....	2,618.11		402.84
28 31 23 00-0368		Audio Notification Expander Panels (28 31 23 00-0360)			
28 31 23 00-0369	EA	Audio Expander Panel, 100W With Out DMR Or Microphone, Power Supply And Battery Charger, 14.5" x 18" x 4" Gray Cabinet (GE ANS100XG).....	2,325.78		402.84
28 31 23 00-0370	EA	Audio Expander Panel, 100W With Out DMR Or Microphone, Power Supply And Battery Charger, 14.5" x 18" x 4" Red Cabinet (GE ANS100XR).....	2,325.78		402.84
28 31 23 00-0371	EA	Audio Expander Panel, 25 Watt Without DMR Or Microphone, Power Supply And Battery Charger, 14.5" x 18" x 4" Gray Cabinet (GE ANS25XG).....	1,638.82		402.84
28 31 23 00-0372	EA	Audio Expander Panel, 25 Watt Without DMR Or Microphone, Power Supply And Battery Charger, 14.5" x 18" x 4" Red Cabinet (GE ANS25XR).....	1,638.82		402.84
28 31 23 00-0373	EA	Audio Expander Panel, 50W With Out DMR Or Microphone, Power Supply And Battery Charger, 14.5" x 18" x 4" Gray Cabinet (GE ANS50XG).....	2,040.76		402.84
28 31 23 00-0374	EA	Audio Expander Panel, 50W With Out DMR Or Microphone, Power Supply And Battery Charger, 14.5" x 18" x 4" Red Cabinet (GE ANS50XR).....	2,040.76		402.84
28 31 23 00-0375		Audio Notification Output Accessories (28 31 23 00-0360)			
28 31 23 00-0376	EA	Zone Adapter, 1 Circuit To 2 Circuit's (GE ANSZC2B).....	85.91		10.07
28 31 23 00-0377	EA	Zone Splitter, 2 Class A Circuits With Zone Selection Switches And All-Call Switch (GE ANSZS2A).....	369.15		20.14
28 31 23 00-0378	EA	Zone Splitter, 4 Class B Circuits With Zone Selection Switches And All-Call Switch (GE ANSZS4B).....	369.15		20.14
28 31 23 00-0379	EA	Class A Converter (GE ANSZSC4A).....	266.83		20.14
28 31 23 00-0380		Audio Notification Remote Microphone (28 31 23 00-0360)			
28 31 23 00-0381	EA	Microphone (GE ANSMIKE).....	106.05		20.14
28 31 23 00-0382	EA	Remote Microphone, Supervised In Surface/Semi-Flush Gray Cabinet, Requires EVX-SC Card In Evacuation Panel (GE ANSREMG).....	405.69		20.14
28 31 23 00-0383	EA	Remote Microphone, Supervised In Surface/Semi-Flush Red Cabinet, Requires EVX-SC Card In Evacuation Panel (GE ANSREMR).....	405.69		20.14
28 31 23 00-0384	EA	Remote Microphone Supervisory Card, One Per System, Supervises Up To 5 Remote Microphones (GE ANSREMSUP).....	93.22		10.07
28 31 23 00-0385	EA	Relay Card For Supervision/Zone Splitter To Remote Microphone (GE ANSZSR).....	53.02		10.07
28 31 23 00-0386		Audio Notification Accessories (28 31 23 00-0360)			
28 31 23 00-0387	EA	Audio Matching - Line Input/Output Card (GE ANSAUX).....	171.83		20.14
28 31 23 00-0388	EA	Class B Backup Amplifier Switching Module (GE ANSBKUP).....	171.83		20.14
28 31 23 00-0389	EA	Class A Backup Amplifier Switching Module (GE ANSBKUPA).....	171.83		20.14
28 31 23 00-0390	EA	Eight Input Remote Serial Interface Module, Accepts Dry Contact Interface To Control Up To 8 Messages, Message Recording Included With Module, For Industrial Signaling Only, Not UL Listed For Fire Alarm / Life Safety Applications (GE ANSRIS8).....	369.15		20.14
28 31 23 00-0391		Audio Notification Modules, Without Cabinet And Transformer (28 31 23 00-0360)			
28 31 23 00-0392	EA	100W Expander Module (No Microphone OR DMR), Requires Transformer Ordered Separately (GE ANS100A).....	1,330.26		40.28
Note: Excludes cabinet.					



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 31 23 00-0393 EA 100W Expander Module With Microphone (No DMR), Requires Transformer Ordered Separately (GE ANS100AM).....	1,396.03	40.28
Note: Excludes cabinet.		
28 31 23 00-0394 EA 100W Audio Notification Module With DMR And Microphone, Requires Transformer Ordered Separately (GE ANS100AMD)	1,922.22	40.28
Note: Excludes cabinet.		
28 31 23 00-0395 EA 25 Watt Expander Module (No Microphone Or DMR), Requires Transformer Ordered Separately (GE ANS25A).....	738.30	40.28
Note: Excludes cabinet.		
28 31 23 00-0396 EA 25 Watt Expander Module With Microphone (No DMR), Requires Transformer (GE ANS25AM)	738.30	40.28
Note: Excludes cabinet.		
28 31 23 00-0397 EA 25 Watt Audio Notification Module With DMR And Microphone, Requires Transformer Ordered Separately (GE ANS25AMD)	1,330.26	40.28
28 31 23 00-0398 EA 50W Expander Module (No Microphone Or DMR) (GE ANS50A)	1,067.17	40.28
Note: Excludes cabinet.		
28 31 23 00-0399 EA 50W Expander Module With Microphone (No DMR) (GE ANS50AM)	1,132.94	40.28
Note: Excludes cabinet.		
28 31 23 00-0400 EA 50W Audio Notification Module With DMR And Microphone (GE ANS50AMD).....	1,659.13	40.28
Note: Excludes cabinet.		
28 31 23 00-0401 EA Power Transformer, Open Frame, 28 VAC @ 180 VA (EVAX 50/100) (GE ANST28180).....	85.91	10.07
28 31 23 00-0402 EA Power Transformer, Open Frame, 28 VAC @ 100 VA (EVAX 25) (GE ANST2885).....	64.75	10.07
28 31 23 00-0403 Simplex Fire Alarm <small>(28 31 23)</small>		
28 31 23 00-0404 4100 Fire Alarm Control Panel <small>(28 31 23 00-0403)</small>		
28 31 23 00-0405 EA 4100U Master Controller Assembly With LCD And Operator Interface, 9 Amp System Power Supply/Battery Charger (SPS), 250 Point IDNet Interface, 3 NACS, Auxiliary Relay And External RUI Communications Interface, 120 VAC Input (Simplex 4100-9111)	3,824.85	402.16
28 31 23 00-0406 EA 4100ES NDU With Master Controller, LCD And Operator Interface, Network Interface Module (Select Media Card Separately), 9 Amp System Power Supply/Battery Charger, And External RUI Communications Interface (Power Supply/Battery Charger Is An SPS With Its IDNet Channel And NACs Disabled), 120 VAC Input (Simplex 4100-9141)	4,142.32	402.16
28 31 23 00-0407 EA 4100ES NDU With VCC Includes The First Bay Equipment Described For The NDU And A Second Bay Assembly With Separate: Master Controller For Voice Functions, Network Interface (Select Media Card Separately), And A Standard SPS With 250 Point IDNet Channel; And 3, 3 A Class A/B NACs Capable Of SmartSync Two-Wire Operation, 120 V Input (Simplex 4100-9142)	5,805.07	402.16
28 31 23 00-0408 EA IDNet Module, Up To 127 Points (Simplex 4100-3104).....	2,577.25	402.16
Note: Add-on module.		
28 31 23 00-0409 EA IDNet Module, Up To 64 Points (Simplex 4100-3105).....	2,093.09	402.16
Note: Add-on module.		
28 31 23 00-0410 EA Expansion Power Supply, 3 NACs, 120 VAC (Simplex 4100-5101)	1,151.20	100.54
Note: Add-on module.		
28 31 23 00-0411 EA Alarm Relay, 3 Form C Relays, 2 Amp @ 32 VDC, For SPS Or RPS (Simplex 4100-6033)	240.41	20.11
Note: Add-on module.		
28 31 23 00-0412 EA Dual Port RS-232 Interface Card (Simplex 4100-6038).....	673.63	20.11
Note: Add-on module.		
28 31 23 00-0413 4100U Backbox <small>(28 31 23 00-0403)</small>		
28 31 23 00-0414 EA 2 Bay Backbox With Glass Door And Dress Panel (Simplex 2975-9425).....	1,188.10	80.44
Note: 24" x 40" beige backbox.		
28 31 23 00-0415 EA 3 Bay Backbox With Glass Door And Dress Panel (Simplex 2975-9443).....	1,659.13	80.44
Note: 24" x 56" beige backbox.		
28 31 23 00-0416 DACT (Digital Alarm Communicator Transmitter) <small>(28 31 23 00-0403)</small>		
28 31 23 00-0417 EA 6 Zone Fire Control Communicator (Silent Knight SK-5104)	648.88	40.21
28 31 23 00-0418 4010 Fire Alarm Control Panel <small>(28 31 23 00-0403)</small>		
28 31 23 00-0419 EA 120 VAC Fire Alarm Control Panel With Door, Cabinet, Power Supply/Battery Charger, IDNet Interface, 4 NACs, 2 Programmable Auxiliary Relays, External N2 Communications Interface, And Internal Common Event Reporting DACT (Simplex 4010-9101)	3,630.22	402.16
28 31 23 00-0420 EA 240 VAC Fire Alarm Control Panel With Door, Cabinet, Power Supply/Battery Charger, IDNet Interface, 4 NACs, 2 Programmable Auxiliary Relays, And External N2 Communications Interface (Simplex 4010-9201)	3,662.31	402.16
28 31 23 00-0421 EA Dual Circuit Class A NAC Adapter Module (Simplex 4010-9806).....	133.73	20.11
28 31 23 00-0422 EA Dual RS-232 Interface Module Expansion Slot Option (Simplex 4010-9811)	559.13	20.11
28 31 23 00-0423 EA Single RS-232 Interface Module With Service Modem Connection Expansion Slot Option (Simplex 4010-9812).....	766.34	20.11
28 31 23 00-0424 EA 120 VAC, 4 Amp Expansion Power Supply Expansion Module (Simplex 4010-9813).....	396.86	20.11
28 31 23 00-0425 EA 240 VAC, 4 Amp Expansion Power Supply Expansion Module (Simplex 4010-9823).....	428.94	20.11
28 31 23 00-0426 EA Battery Meter Module Expansion Module (Simplex 4010-9820)	164.90	20.11
28 31 23 00-0427 Printer <small>(28 31 23 00-0403)</small>		
28 31 23 00-0428 EA 24 Pin Dot Matrix Printer (Simplex 4190-9013).....	1,155.78	20.11
28 31 23 00-0429 NAC Panel / Power Booster <small>(28 31 23 00-0403)</small>		
28 31 23 00-0430 EA IDNet NAC Extender With 4, Class B (Style Y) NACs and 8 Amp Power Supply, 120 VAC (Simplex 4009-9201).....	784.39	100.54
Note: Power supply for horns and strobes.		

28 Electronic Safety And Security**28 30 Electronic Detection And Alarm****28 31 Fire Detection And Alarm**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 31 23 00-0431 Battery <small>(28 31 23 00-0403)</small>		
28 31 23 00-0432 EA 50 Amp Hours Sealed Lead Acid Battery (Simplex 2081-9296).....	472.44	20.11
Note: Two required for 24 volt DC.		
28 31 23 00-0433 EA 33 Amp Hours Sealed Lead Acid Battery (Simplex 2081-9276).....	316.68	20.11
Note: Two required for 24 volt DC.		
28 31 23 00-0434 EA 6.2 Amp Hours Sealed Lead Acid Battery (Simplex 2081-9272)	119.39	20.11
Note: Two required for 24 volt DC.		
28 31 23 00-0435 Interface Modules <small>(28 31 23 00-0403)</small>		
28 31 23 00-0436 EA Supervised Individual Addressable Modules (Simplex 4090-9001)	97.98	20.11
Note: Monitor modules for waterflow/tamper, etc.		
28 31 23 00-0437 EA Relay Individual Addressable Modules (Simplex 4090-9002)	194.13	20.11
Note: Control modules for gas shutdown, door holders, etc.		
28 31 23 00-0438 EA Relay SPDT With LED MR-801/T (Simplex 2088-9032)	52.69	20.11
Note: Interface relay for 120VAC		
28 31 23 00-0439 EA SmartSync™ Adapter Module For Non-Addressable Notification Appliance Circuits (NACs) (Simplex 4905-9815).....	99.04	20.11
28 31 23 00-0440 EA Surface Mount Cover Plate For SmartSync Adapter Module (Simplex 4905-9817).....	44.53	10.05
28 31 23 00-0441 EA Flush Mount Cover Plate For SmartSync Adapter Module (Simplex 4905-9818)	42.50	10.05
28 31 23 00-0442 Pull Stations <small>(28 31 23 00-0403)</small>		
28 31 23 00-0443 EA Addressable Single Action Manual Pull Station (Simplex 4099-9001)	118.61	20.11
28 31 23 00-0444 EA N.O. Contacts, Single Action, Non-Coded, Non-Addressable Manual Pull Stations (Simplex 2099-9101)	87.04	20.11
28 31 23 00-0445 EA N.C. Contacts, Single Action, Non-Coded, Non-Addressable Manual Pull Stations (Simplex 2099-9102)	93.14	20.11
28 31 23 00-0446 EA Break-Glass, Double Action, Non-Coded, Non-Addressable Manual Pull Stations (Simplex 2099-9103)	84.29	20.11
28 31 23 00-0447 EA N.O. Contacts, Break-Glass, Double Action, Non-Coded, Non-Addressable Manual Pull Stations (Simplex 2099-9104)	97.21	20.11
28 31 23 00-0448 EA N.C. Contacts, Break-Glass, Double Action, Non-Coded, Non-Addressable Manual Pull Stations (Simplex 2099-9105)	143.67	20.11
28 31 23 00-0449 EA Pre-Signal, N.O. Contacts, Single Action, Non-Coded, Non-Addressable Manual Pull Stations (Simplex 2099-9107)	121.64	20.11
28 31 23 00-0450 EA Pre-Signal, N.O. Contacts, Break-Glass, Double Action, Non-Coded, Non-Addressable Manual Pull Stations (Simplex 2099-9108)	142.00	20.11
28 31 23 00-0451 EA Single Action, Non-Coded, Non-Addressable Manual Pull Stations (Simplex 2099-9754)	70.07	20.11
28 31 23 00-0452 EA Local Alarm Cover, Single Action, Non-Coded, Non-Addressable Manual Pull Stations (Simplex 2099-9755)	73.80	20.11
28 31 23 00-0453 EA Push, Double Action, Non-Coded, Non-Addressable Manual Pull Stations (Simplex 2099-9756).....	85.79	20.11
28 31 23 00-0454 EA N.C. Contacts, Push, Double Action, Non-Coded, Non-Addressable Manual Pull Stations (Simplex 2099-9758).....	129.40	20.11
28 31 23 00-0455 EA Pre-Signal, N.O. Contacts, Push, Double Action, Non-Coded, Non-Addressable Manual Pull Stations (Simplex 2099-9759)	218.58	20.11
28 31 23 00-0456 EA Institutional Cover, Single Action, Non-Coded, Non-Addressable Manual Pull Stations (Simplex 2099-9762).....	76.86	20.11
28 31 23 00-0457 EA Surface Mount Steel Box For Manual Pull Station (Simplex 2975-9178)	46.58	10.05
28 31 23 00-0458 Weatherproof Pull Stations <small>(28 31 23 00-0403)</small>		
28 31 23 00-0459 EA Weather Proof Single Action Pull Station, Cast Metal, B Lock, SPST (Simplex 2099-9138)	117.49	24.13
28 31 23 00-0460 EA Surface Mount Cast Aluminum Box For Exterior Pull Station (Simplex 2975-9211)	73.63	10.05
28 31 23 00-0461 Heat / Smoke Sensor <small>(28 31 23 00-0403)</small>		
28 31 23 00-0462 EA 32 To 122 Degree F Heat Sensor (Simplex 4098-9733)	120.29	30.16
28 31 23 00-0463 EA Photoelectric Smoke Sensor (Simplex 4098-9714).....	170.26	30.16
28 31 23 00-0464 EA Sensor Base With Relay Driver (Simplex 4098-9791)	314.24	10.05
28 31 23 00-0465 EA Standard Sensor Base (Simplex 4098-9792).....	161.48	10.05
28 31 23 00-0466 EA Remote Supervised Relay Accessory For Sensor Base With Relay Driver (Simplex 2098-9737)	98.36	20.11
Note: Relay for 4098-9791		
28 31 23 00-0467 Explosion Proof Heat Detector <small>(28 31 23 00-0403)</small>		
28 31 23 00-0468 EA 135 Degree F Explosion Proof Heat Detector (Simplex 2098-9488).....	126.68	30.16
28 31 23 00-0469 EA Explosion Proof Backbox (Killark JLX-21).....	79.16	10.05
28 31 23 00-0470 EA Explosion Proof Backbox Plugs (Killark CUP-2)	7.63	2.01
28 31 23 00-0471 Weatherproof Heat Detector <small>(28 31 23 00-0403)</small>		
28 31 23 00-0472 EA 194 Degree F Fixed Hardwired Weatherproof Heat Detector (Simplex 2098-9490)	94.57	30.16
28 31 23 00-0473 200 Degree F Heat Detector <small>(28 31 23 00-0403)</small>		
28 31 23 00-0474 EA 194 Degree F Heat Detector, ROR/Fixed Temperature (Simplex 5604).....	80.22	30.16
Note: Used in kiln rooms and kitchens.		
28 31 23 00-0475 Duct Smoke Sensor <small>(28 31 23 00-0403)</small>		
28 31 23 00-0476 EA Duct Sensor Housing (Simplex 4098-9755).....	256.95	16.09
28 31 23 00-0477 EA Duct Sensor Housing With Supervised Output For Multiple Remote Relays, 4-Wire (Simplex 4098-9756).....	351.78	36.19
Note: Relay output for AHU shutdown.		
28 31 23 00-0478 EA 46" To 71" Duct Sampling Tube (Simplex 2098-9798).....	41.34	10.05
Note: 25", 49", 73" or 97" sampling tube length.		
28 31 23 00-0479 EA Remote Duct Test Station With Key Switch And Red LED Status Indicator (Simplex 2098-9806)	100.63	30.16



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 31 23 00-0480				Interior Horn <small>(28 31 23 00-0403)</small>		
				28 31 23 00-0481 EA Red With White "FIRE" Lettering, TrueAlert Addressable Electronic Horn (Simplex 4901-9850).....	93.95	30.16
				28 31 23 00-0482 EA White With Red "FIRE" Lettering, TrueAlert Addressable Electronic Horn (Simplex 4901-9853).....	93.95	30.16
28 31 23 00-0483				Interior Horn Strobe <small>(28 31 23 00-0403)</small>		
				28 31 23 00-0484 EA Wall Mounted Horn Strobe, 75Cd, Red (Simplex 4903-9426)	125.70	30.16
				28 31 23 00-0485 EA Wall Mounted Horn Strobe, 110Cd, Red (Simplex 4903-9427)	125.70	30.16
				28 31 23 00-0486 EA Wall Mount, Red Housing, White Lettering, Horn And Intensity Selectable (15, 30, 75 Or 110 Candela) Multi-Candela Strobe (Simplex 4906-9127)	118.46	30.16
				28 31 23 00-0487 EA Ceiling Mount, Red Housing, White Lettering, Horn And Intensity Selectable (15, 30, 75 Or 110 Candela) Multi-Candela Strobe (Simplex 4906-9128)	118.46	30.16
				28 31 23 00-0488 EA Wall Mount, White Housing, Red Lettering, Horn And Intensity Selectable (15, 30, 75 Or 110 Candela) Multi-Candela Strobe (Simplex 4906-9129)	118.46	30.16
				28 31 23 00-0489 EA Ceiling Mount, White Housing, Red Lettering, Horn And Intensity Selectable (15, 30, 75 Or 110 Candela) Multi-Candela Strobe (Simplex 4906-9130)	118.46	30.16
				28 31 23 00-0490 EA Weatherproof, Red Housing, White Lettering, Horn And Intensity Selectable (15, 60 Or 75 Candela) Multi-Candela Strobe (Simplex 4906-9131).....	120.89	30.16
				28 31 23 00-0491 EA Weatherproof, White Housing, Red Lettering, Horn And Intensity Selectable (15, 60 Or 75 Candela) Multi-Candela Strobe (Simplex 4906-9132).....	120.89	30.16
				28 31 23 00-0492 EA Wall Mount, Red Housing, White Lettering, Horn And Intensity Selectable (135, 177 Or 185 Candela) Multi-Candela Strobe (Simplex 4906-9139)	125.16	30.16
				28 31 23 00-0493 EA Ceiling Mount, Red Housing, White Lettering, Horn And Intensity Selectable (135, 177 Or 185 Candela) Multi-Candela Strobe (Simplex 4906-9140)	123.19	30.16
				28 31 23 00-0494 EA Wall Mount, White Housing, Red Lettering, Horn And Intensity Selectable (135, 177 Or 185 Candela) Multi-Candela Strobe (Simplex 4906-9141)	125.16	30.16
				28 31 23 00-0495 EA Ceiling Mount, White Housing, Red Lettering, Horn And Intensity Selectable (135, 177 Or 185 Candela) Multi-Candela Strobe (Simplex 4906-9142)	123.19	30.16
				28 31 23 00-0496 EA Wall Mount, Red Housing, White Lettering, Horn And Intensity Selectable (15, 30, 75 Or 110 Candela) Multi-Candela Addressable Strobe (Simplex 4906-9227).....	118.46	30.16
				28 31 23 00-0497 EA Ceiling Mount, Red Housing, White Lettering, Horn And Intensity Selectable (15, 30, 75 Or 110 Candela) Multi-Candela Addressable Strobe (Simplex 4906-9228).....	118.46	30.16
				28 31 23 00-0498 EA Wall Mount, White Housing, Red Lettering, Horn And Intensity Selectable (15, 30, 75 Or 110 Candela) Multi-Candela Addressable Strobe (Simplex 4906-9229).....	118.46	30.16
				28 31 23 00-0499 EA Ceiling Mount, White Housing, Red Lettering, Horn And Intensity Selectable (15, 30, 75 Or 110 Candela) Multi-Candela Addressable Strobe (Simplex 4906-9230).....	118.46	30.16
28 31 23 00-0500				Interior Strobe <small>(28 31 23 00-0403)</small>		
				28 31 23 00-0501 EA Wall Mount, Red Housing, White Lettering, Intensity Selectable (15, 30, 75 Or 110 Candela) Multi-Candela Strobe (Simplex 4906-9101)	103.07	30.16
				28 31 23 00-0502 EA Ceiling Mount, Red Housing, White Lettering, Intensity Selectable (15, 30, 75 Or 110 Candela) Multi-Candela Strobe (Simplex 4906-9102).....	103.07	30.16
				28 31 23 00-0503 EA Wall Mount, White Housing, Red Lettering, Intensity Selectable (15, 30, 75 Or 110 Candela) Multi-Candela Strobe (Simplex 4906-9103)	103.04	30.16
				28 31 23 00-0504 EA Ceiling Mount, White Housing, Red Lettering, Intensity Selectable (15, 30, 75 Or 110 Candela) Multi-Candela Strobe (Simplex 4906-9104).....	103.07	30.16
				28 31 23 00-0505 EA Weatherproof, Red Housing, White Lettering, Intensity Selectable (15, 60 Or 75 Candela) Multi-Candela Strobe (Simplex 4906-9105)	112.27	30.16
				28 31 23 00-0506 EA Weatherproof, White Housing, Red Lettering, Intensity Selectable (15, 60 Or 75 Candela) Multi-Candela Strobe (Simplex 4906-9106)	112.27	30.16
				28 31 23 00-0507 EA Wall Mount, Red Housing, White Lettering, Intensity Selectable (135, 177 Or 185 Candela) Multi-Candela Strobe (Simplex 4906-9109)	112.86	30.16
				28 31 23 00-0508 EA Ceiling Mount, Red Housing, White Lettering, Intensity Selectable (135, 177 Or 185 Candela) Multi-Candela Strobe (Simplex 4906-9110).....	114.47	30.16
				28 31 23 00-0509 EA Wall Mount, White Housing, Red Lettering, Intensity Selectable (135, 177 Or 185 Candela) Multi-Candela Strobe (Simplex 4906-9111)	114.47	30.16
				28 31 23 00-0510 EA Ceiling Mount, White Housing, Red Lettering, Intensity Selectable (135, 177 Or 185 Candela) Multi-Candela Strobe (Simplex 4906-9112).....	114.47	30.16
				28 31 23 00-0511 EA Wall Mount, Red Housing, White Lettering, Intensity Selectable (15, 30, 75 Or 110 Candela) Multi-Candela Addressable Strobe (Simplex 4906-9201).....	103.07	30.16
				28 31 23 00-0512 EA Ceiling Mount, Red Housing, White Lettering, Intensity Selectable (15, 30, 75 Or 110 Candela) Multi-Candela Addressable Strobe (Simplex 4906-9202)	103.07	30.16
				28 31 23 00-0513 EA Wall Mount, White Housing, Red Lettering, Intensity Selectable (15, 30, 75 Or 110 Candela) Multi-Candela Addressable Strobe (Simplex 4906-9203).....	103.07	30.16
				28 31 23 00-0514 EA Ceiling Mount, White Housing, Red Lettering, Intensity Selectable (15, 30, 75 Or 110 Candela) Multi-Candela Addressable Strobe (Simplex 4906-9204).....	103.07	30.16
28 31 23 00-0515				Interior Speakers <small>(28 31 23 00-0403)</small>		
				28 31 23 00-0516 EA Red With White "FIRE" Lettering, Wall Mount Speaker, Rectangular Housing (Simplex 4902-9716).....	86.16	30.16
				28 31 23 00-0517 EA White With Red "FIRE" Lettering, Wall Mount Speaker, Rectangular Housing (Simplex 4902-9717).....	86.16	30.16
				28 31 23 00-0518 EA Ceiling Or Wall Mount, Round Housing Speaker (Simplex 4902-9721)	86.16	30.16
28 31 23 00-0519				Interior Speaker Strobe <small>(28 31 23 00-0403)</small>		
				28 31 23 00-0520 EA Red Housing, White Lettering, Multi-Tapped Speaker And Intensity Selectable (15, 30, 75 Or 110 Candela) Multi-Candela Strobe (Simplex 4906-9151)	132.88	30.16
				28 31 23 00-0521 EA White Housing, Red Lettering, Multi-Tapped Speaker And Intensity Selectable (15, 30, 75 Or 110 Candela) Multi-Candela Strobe (Simplex 4906-9153)	132.88	30.16

28 Electronic Safety And Security**28 30 Electronic Detection And Alarm****28 31 Fire Detection And Alarm**

MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
28 31 23 00-0522		Surge Suppressors (28 31 23 00-0403)			
28 31 23 00-0523	EA	Overvoltage Suppressor (Simplex 2081-9044)	80.60		6.03
28 31 23 00-0524	EA	Isolated Loop Circuit Protector (Simplex 2081-9028)	52.40		6.03
28 31 23 00-0525	EA	120 VAC, 20 Amp Multi Stage Hybrid Surge Protector With EMI/RFI Filtering (Ditek 120S20A)	169.93		6.03
28 31 23 00-0526	EA	24 VAC Data And Loop Circuit Surge Protector (Ditek DTK-2MHLP24B)	59.67		6.03
28 31 23 00-0527	EA	Mounting Base For Two DTK-2MHLP (Ditek DTK-2MB)	90.27		10.05
28 31 23 00-0528	EA	120 VAC, 22,500 Amp, Equipment Panel/Dedicated Circuit Surge Protector (Ditek DTK-120HW)	64.38		6.03
28 31 23 00-0529	EA	<105 VAC, 9,000 Amp, RJ31 Connection, Alarm Dialer Surge Protection (Ditek DTK-MRJ31SCWP)	48.88		6.03
28 31 23 00-0530		Boxes And Adapters (28 31 23 00-0403)			
28 31 23 00-0531	EA	Semi-Flush Mount Modular Adapter Using Standard 4" Square Electrical Box (Simplex 4905-9921)	42.50		10.05
28 31 23 00-0532	EA	Surface Mount Modular Adapter Using Simplex Box (Simplex 4905-9925)	40.47		10.05
28 31 23 00-0533	EA	Red, Surface Mount Adapter Skirt (Simplex 4905-9937)	36.47		10.05
28 31 23 00-0534	EA	White, Surface Mount Adapter Skirt (Simplex 4905-9940)	30.81		10.05
28 31 23 00-0535		Accessories (28 31 23 00-0403)			
28 31 23 00-0536	EA	End-Of-Line Resistor Harness, 10 k Ohms, 1/2 Watt, Two Required, One Each For Audible And Visible Output (Simplex 4081-9008)	22.48		10.05
28 31 23 00-0537		Siemens Fire Alarm (28 31 23)			
28 31 23 00-0538		Conventional Control Panels (28 31 23 00-0537)			
28 31 23 00-0539		SXL Batteries And Power Supplies (28 31 23 00-0538)			
28 31 23 00-0540	EA	6 Amp Notification Appliance Circuit Expander With Built-In Auxiliary Power Output (Siemens PAD-3)	676.78		40.21
28 31 23 00-0541	EA	Main Board Only For PAD-3 (Siemens PAD-3-MB)	548.16		40.21
28 31 23 00-0542		Digital Fire Communicators (28 31 23 00-0538)			
28 31 23 00-0543	EA	Four Channel Digital Slave Fire Communicator (Siemens 5129)	531.21		40.21
28 31 23 00-0544		Addressable Control Panels (28 31 23 00-0537)			
28 31 23 00-0545		Fireseeker Equipment (28 31 23 00-0544)			
28 31 23 00-0546		FS-250 System Panels (28 31 23 00-0545)			
28 31 23 00-0547	EA	FS-250 Electronics Package Including One FS-250-CON And Two FS-NPE, Excludes Enclosure (Siemens FS-250-EKIT)	1,749.10		402.16
		Note: FS-250-CON is an electronics package for releasing water or agent. FS-NPE is a system transformer.			
28 31 23 00-0548	EA	FS-250 Electronics Package Including One FS-250-CON, Two FS-NPE, One FS-RPT And One FS-REL, Excludes Enclosure (Siemens FS-250-REL-EKIT)	2,141.99		402.16
		Note: FS-250-CON is an electronics package for releasing water or agent. FS-NPE is a system transformer. FS-RPT is a releasing power transformer. FS-REL is a Releasing Module.			
28 31 23 00-0549	EA	FS-250-SRX Releasing Electronics Package Including One FS-250-CON2-SRX, Two FS-NPE, One FS-RPT And One FS-REL, Excludes Enclosure (Siemens FS-250-SRX-EKIT)	1,309.95		321.72
		Note: FS-250-CON2-SRX is an electronics package for releasing water or agent. FS-NPE is a system transformer. FS-RPT is a releasing power transformer. FS-REL is a Releasing Module.			
28 31 23 00-0550	EA	Electronics Package For Releasing Water Or Agent (Siemens FS-250-CON)	1,751.44		402.16
28 31 23 00-0551		FS-250 Optional Modules (28 31 23 00-0545)			
28 31 23 00-0552	EA	Main Board Module (Siemens FS-MB2)	681.46		40.21
28 31 23 00-0553	EA	Display Board Module (Siemens FS-DB2)	526.64		20.11
28 31 23 00-0554	EA	Device Loop Card (Siemens FS-DLC)	433.09		20.11
28 31 23 00-0555	EA	Releasing Module (Siemens FS-REL)	196.90		20.11
28 31 23 00-0556	EA	Remote LCD Annunciator (Siemens FS-RD2)	430.17		20.11
28 31 23 00-0557	EA	Relay Processor Card (Siemens FS-RU2)	374.63		20.11
28 31 23 00-0558	EA	Relay Expander Board (Siemens FS-RE8)	320.84		20.11
28 31 23 00-0559	EA	Serial Annunciator Processor Card (Siemens FS-SAU2)	430.17		20.11
28 31 23 00-0560	EA	16 Output Annunciator Extender (Siemens FS-SAE16)	337.21		20.11
28 31 23 00-0561	EA	Digital Alarm Communication Transmitter (Siemens FS-DACT)	307.40		20.11
28 31 23 00-0562	EA	Municipal Tie Module (Siemens FS-MT)	262.38		20.11
28 31 23 00-0563	EA	Configuration Tool Including Laptop To FS-250 Cable And Software (Siemens FS-CT2)	248.23		
28 31 23 00-0564	EA	Programming Cable Kit (Siemens CBL-UD)	65.13		10.05
28 31 23 00-0565	EA	Notification Appliance Circuit Power Expander Transformer (Siemens FS-NPE)	117.97		20.11
28 31 23 00-0566	EA	Releasing Power Transformer (Siemens FS-RPT-A)	119.72		20.11
28 31 23 00-0567	EA	Surface Mounted Box For Remote LCD Annunciator (Siemens FS-RD-SB)	132.73		16.09
28 31 23 00-0568	EA	Cabinet Trim Kit (Siemens RD-CAB-TK)	209.54		10.05
28 31 23 00-0569		Firefinder Systems (28 31 23 00-0544)			
28 31 23 00-0570		XLS Basic Fire System Packages Without Backbox (28 31 23 00-0569)			



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 31 23 00-0571 EA 500 Point Firefinder Package Including Two DLC, One PMI, One ZIC-4A, One CC-5, One PSC-12 And One ID-SP (Siemens XLS-500-ID-SP)..... Note: DLC is a device loop card. PMI is a person machine interface. ZIC-4A is a four circuit zone indicating card. CC-5 is a five slot card cage. PSC-12 is a 12 Amp power supply charger module. ID-SP is an inner door blank single plate.	5,907.55	402.16
28 31 23 00-0572 EA 250 Point Firefinder Package Including One DLC, One PMI, One ZIC-4A, One CC-5, One PSC-12 And One ID-SP (Siemens XLS-250-ID-SP)..... Note: DLC is a device loop card. PMI is a person machine interface. ZIC-4A is a four circuit zone indicating card. CC-5 is a five slot card cage. PSC-12 is a 12 Amp power supply charger module. ID-SP is an inner door blank single plate.	5,239.88	402.16
28 31 23 00-0573 EA 250 Point Firefinder Package Including One DLC, One PMI-INT, One ZIC-4A, One CC-5, One PSC-12 And One ID-SP (Siemens XLS-250-INT-ID-SP)..... Note: DLC is a device loop card. PMI-INT is a person machine interface with multilingual overlays. ZIC-4A is a four circuit zone indicating card. CC-5 is a five slot card cage. PSC-12 is a 12 Amp power supply charger module. ID-SP is an inner door blank single plate.	5,239.88	402.16
28 31 23 00-0574 EA 250 Point Firefinder Package Including One DLC, One PMI, One ZIC-4A, One CC-5, One PSC-12, One CAB2-BD And One OD-LP (Siemens XLS-250-CAB2-BD)..... Note: DLC is a device loop card. PMI is a person machine interface. ZIC-4A is a four circuit zone indicating card. CC-5 is a five slot card cage. PSC-12 is a 12 Amp power supply charger module. CAB2-BD is a two row inner and outer door set. OD-LP is an outer door clear plastic lens plate.	8,558.35	402.16
28 31 23 00-0575 EA 250 Point Firefinder Package Including One DLC, One PMI, One ZIC-4A, One CC-5, One PSC-12, One CAB3-BD, One BCL, One ID-SP And One OD-LP (Siemens XLS-250-CAB3-BD)..... Note: DLC is a device loop card. PMI is a person machine interface. ZIC-4A is a four circuit zone indicating card. CC-5 is a five slot card cage. PSC-12 is a 12 Amp power supply charger module. CAB3-BD is a three row inner and outer door set. ID-SP is an inner door blank single plate. OD-LP is an outer door clear plastic lens plate.	8,835.48	402.16
28 31 23 00-0576 EA 250 Point Firefinder Package Including One DLC, One PMI, One ZIC-4A, One CC-5, And One PSC-12 (Siemens XLS-250-ZIC4A-EP)..... Note: DLC is a device loop card. PMI is a person machine interface. ZIC-4A is a four circuit zone indicating card. CC-5 is a five slot card cage. PSC-12 is a 12 Amp power supply charger module.	5,172.65	402.16
28 31 23 00-0577 EA 250 Point Firefinder Package Including One DLC, One PMI-INT, One ZIC-4A, One CC-5, And One PSC-12 (Siemens XLS-250-ZIC4A-INT-EP)..... Note: DLC is a device loop card. PMI-INT is a person machine interface with multilingual overlays. ZIC-4A is a four circuit zone indicating card. CC-5 is a five slot card cage. PSC-12 is a 12 Amp power supply charger module.	5,172.65	402.16
28 31 23 00-0578 EA 250 Point Firefinder Package Including One DLC, One PMI, One ZIC-8B, One CC-5, And One PSC-12 (Siemens XLS-250-ZIC8B-EP)..... Note: DLC is a device loop card. PMI is a person machine interface. ZIC-8B is an eight circuit zone indicating card. CC-5 is a five slot card cage. PSC-12 is a 12 Amp power supply charger module.	5,953.74	402.16
28 31 23 00-0579 Firefinder - XLS Basic System Equipment (28 31 23 00-0569)		
28 31 23 00-0580 EA Person Machine Interface With Central Processor (Siemens PMI)..... Note: Includes inner door.	2,752.95	402.16
28 31 23 00-0581 EA Person Machine Interface With Central Processor, DE-2 And DPU (Siemens PMI-DPU-ENC)..... Note: Includes inner door.	4,478.25	402.16
28 31 23 00-0582 EA Person Machine Interface With Multilingual Overlays And Central Processor (Siemens PMI-INT)..... Note: Includes inner door.	2,752.95	402.16
28 31 23 00-0583 EA Two Slot Card Cage (Siemens CC-2).....	330.20	20.11
28 31 23 00-0584 EA Five Slot Card Cage (Siemens CC-5).....	552.95	20.11
28 31 23 00-0585 EA Four Circuit Zone Indicating Card (Siemens ZIC-4A).....	786.81	20.11
28 31 23 00-0586 EA Eight Circuit Zone Indicating Card (Siemens ZIC-8B).....	821.30	20.11
28 31 23 00-0587 EA Two Channel Adapter Card For ZIC-8B (Siemens ZIC-2C).....	264.72	20.11
28 31 23 00-0588 EA Device Loop Card (Siemens DLC)..... Note: Interfaces with up to 252 detectors and devices.	931.22	20.11
28 31 23 00-0589 EA Controllable Relay Card (Siemens CRC-6)..... Note: Provides six programmable relays.	530.73	20.11
28 31 23 00-0590 EA 12 Amp Power Supply Charger Module (Siemens PSC-12).....	1,988.85	20.11
28 31 23 00-0591 EA Person Machine Interface With Central Processor And GPML-UK Software Upgrade Kit (Siemens GPML)..... Note: Software kit provides interface with multiple FireFinder XLS and MXL systems.	3,532.87	402.16
28 31 23 00-0592 EA Network Interface Card (Siemens NIC-C)..... Note: Provides HNET Or XNET communication between enclosures.	619.60	20.11
28 31 23 00-0593 EA 12 Amp Power Supply Extender (Siemens PSX-12)..... Note: Extends PSC-12 with an additional 24 volt DC.	1,655.60	20.11
28 31 23 00-0594 EA Power Termination Board (Siemens PTB)..... Note: Used with systems requiring more than one PSX-12.	285.76	20.11
28 31 23 00-0595 EA Conventional Detector Card (Siemens CDC-4).....	597.38	20.11
28 31 23 00-0596 EA Multi-Mode Network Fiber Optic Interface Module (Siemens D2300CPS).....	1,162.74	20.11
28 31 23 00-0597 EA Single-Mode Network Fiber Optic Interface Module (Siemens D2325CPS).....	4,160.82	20.11
28 31 23 00-0598 Remote Lobby Enclosure (28 31 23 00-0569)		
28 31 23 00-0599 EA 14-1/2" x 18-1/2" x 5" Two Module Remote Enclosure (Siemens REMBOX2)..... Note: Flush mounted. Includes clear lens plate on cover.	796.37	80.44
28 31 23 00-0600 EA 24" x 18-1/2" x 5" Four Module Remote Enclosure (Siemens REMBOX4)..... Note: Flush mounted. Includes clear lens plate on cover.	1,018.54	80.44
28 31 23 00-0601 EA Optional Mounting Plate For REMBOX2 (Siemens REMBOX2-MP)..... Note: Required to mount up to four SIM-16 or OCM-16 modules.	129.66	20.11
28 31 23 00-0602 EA Optional Mounting Plate For REMBOX4 (Siemens REMBOX4-MP)..... Note: Required to mount up to eight SIM-16 or OCM-16 modules.	140.77	20.11
28 31 23 00-0603 Battery Enclosures (28 31 23 00-0569)		
28 31 23 00-0604 EA Enclosure For 100 Amp Hours Batteries (Siemens CAB-BATT).....	506.39	80.44

28 Electronic Safety And Security**28 30 Electronic Detection And Alarm****28 31 Fire Detection And Alarm**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 31 23 00-0605			Graphic Annunciator Output Drivers And Inputs (28 31 23 00-0569)		
28 31 23 00-0606	EA		Output Control Module (Siemens OCM-16)	385.74	20.11
28 31 23 00-0607	EA		Supervised Input Module (Siemens SIM-16)	385.74	20.11
28 31 23 00-0608			Remote LCD Displays (28 31 23 00-0569)		
28 31 23 00-0609	EA		Remote LED/LCD System Status Display (Siemens SSD)	899.99	60.32
			Note: No control or menu capability.		
28 31 23 00-0610	EA		Remote LED/LCD System Status Display, Buttons To Acknowledge Events, Silence Audible Circuits And Resetting (Siemens SSD-C)	1,011.66	60.32
28 31 23 00-0611			Voice Equipment (28 31 23 00-0569)		
28 31 23 00-0612	EA		40W Zone Amplifier Card (Siemens ZAC-40)	877.43	20.11
28 31 23 00-0613	EA		180W Zone Amplifier Module (Siemens ZAM-180)	1,933.89	20.11
28 31 23 00-0614	EA		Live Voice Module (Siemens LVM)	819.55	20.11
			Note: Includes a dynamic microphone with a push-to-talk switch and ready-to-page indicator light, as well as a small local speaker and volume control for monitoring audio signals.		
28 31 23 00-0615			MXL Series Equipment (28 31 23 00-0544)		
28 31 23 00-0616			MXL Optional Equipment (28 31 23 00-0615)		
28 31 23 00-0617	EA		Two Circuit Analog Loop Driver (Siemens ALD-21)	952.74	40.21
28 31 23 00-0618	EA		CXL/MXL Interface Module (Siemens CMI-300)	2,425.58	20.11
28 31 23 00-0619	EA		Four Relay Programmable Relay Module (Siemens CRM-4)	423.74	20.11
28 31 23 00-0620	EA		Two Circuit Controllable Signal/Releasing Module (Siemens CSM-4)	509.68	20.11
28 31 23 00-0621	EA		Remote Conventional Zone Module (Siemens CZM-1B6)	197.48	20.11
28 31 23 00-0622	EA		Short Circuit Line Isolator Module (Siemens Model LIM-1)	125.57	20.11
28 31 23 00-0623	EA		Four Circuit Conventional Zone Module (Siemens CZM-4)	496.24	20.11
28 31 23 00-0624	EA		12" x 16" x 3" Enclosure For PAD-3 (Siemens EN-PAD)	188.94	30.16
28 31 23 00-0625	EA		Lexan Window For RCC (Siemens GENBOX-WD)	126.30	16.09
28 31 23 00-0626	EA		Input Driver Module (Siemens MID-16)	328.44	20.11
28 31 23 00-0627	EA		Programmable Output Driver Module (Siemens MOD-16)	328.44	20.11
28 31 23 00-0628	EA		MXL Output/Input Module (Siemens MOI-7)	520.21	20.11
28 31 23 00-0629	EA		Two Slot Network Option Module Card Cage (Siemens MOM-2)	281.09	20.11
28 31 23 00-0630	EA		Four Slot Network Option Module Card Cage (Siemens MOM-4)	437.19	20.11
28 31 23 00-0631	EA		12 Amp, 220 VAC Power Supply For MXL (Siemens MPS-12/220)	1,080.06	60.32
28 31 23 00-0632	EA		12 Amp, 240 VAC Power Supply For MXL (Siemens MPS-12/240)	1,080.06	60.32
28 31 23 00-0633	EA		Network Interface Module (Siemens NIM-1W)	771.61	20.11
28 31 23 00-0634	EA		U.L. Listed Parallel Printer (Siemens PAL-1)	2,031.74	80.44
28 31 23 00-0635	EA		Peripheral Interface Module, Model PIM-1 (Siemens 500-691324)	232.56	20.11
28 31 23 00-0636	EA		Surface Mounted Remote Command Center (Siemens RCC-1)	2,362.40	402.16
28 31 23 00-0637	EA		Enclosure And Door With Lens For RCC-1 (Siemens RCC-1DL)	286.82	40.21
28 31 23 00-0638	EA		Flush Mounted Remote Command Center (Siemens RCC-1F)	2,362.40	402.16
28 31 23 00-0639	EA		Enclosure And Door With Lens For RCC-1F (Siemens RCC-1FDL)	293.84	40.21
28 31 23 00-0640	EA		Remote Control Center With System Control Functions And Sequential Event Display (Siemens RCC-2)	1,856.68	402.16
28 31 23 00-0641	EA		MXL/MXLV Remote Annunciator/Keyboard With Enhanced Display (Siemens RCC-3)	2,692.14	402.16
28 31 23 00-0642	EA		RCC-2/RSE-1 Trim Ring (Siemens RCF-1)	46.42	10.05
28 31 23 00-0643	EA		Remote Diagnostics Module For MXL (Siemens RDM-MXL)	3,120.62	40.21
28 31 23 00-0644	EA		Remote Diagnostics Module For PC (Siemens RDM-PC)	6,626.77	40.21
28 31 23 00-0645	EA		Releasing End Of Line Module (Siemens REL-EOL)	103.94	20.11
28 31 23 00-0646	EA		36 Zone Tabular Graphic Annunciator With Restart System Key (Siemens RSA-MBSC)	1,996.34	40.21
28 31 23 00-0647	EA		36 Zone Tabular Graphic Annunciator (Siemens RSA-MBTL)	1,906.89	40.21
28 31 23 00-0648	EA		8-3/8" x 6-1/4" Remote Control Enclosure (Siemens RSE-1)	1,038.42	80.44
28 31 23 00-0649			Complete MXL And MXLV System Packages Without Enclosure (28 31 23 00-0615)		
28 31 23 00-0650	EA		MXL System Electronics Package Including One MMB-3, One Display/Control Keyboard, One MDL-1, One MKB-2, One Mps-6, One MOM-2, One ALD-21 And One PIM-1 (Siemens MXL-SS-EP)	7,600.11	402.16
			Note: MMB-3 is a MXL/MXLV main control board. MDL-1 is a clear lens. MKB-2 is a MXL/MXLV display/keyboard module with hinged frame. MPS-6 is a 6 Amp power supply for MXL. MOM-2 is a two slot network option module card cage. ALD-21 is a two circuit analog loop driver. PIM-1 is a peripheral interface module.		
28 31 23 00-0651	EA		MXL Voice System Electronics Package Including One MMB-3, One MKB-2, One MPS-6, One ACM-1, One TBM-2, One MMM-1, One OMM-2, One ZAC-30, One OCC-1, One MHD-5, One VSM-1 And Four VSB-1 (Siemens MXLV-SS-EP)	9,791.38	402.16
			Note: MMB-3 is a MXL/MXLV main control board. MKB-2 is a MXL/MXLV display/keyboard module with hinged frame. MPS-6 is a 6 Amp power supply for MXL. ACM-1 is an audio control module. TBM-2 is a voice terminal module. MMM-1 is a master microphone module. OMM-2 is a two half width slot card cage. ZAC-30 is a MXLV zone amplifier card. OCC-1 is a MXLV output control card. MHD-5 is a deadfront panel for MSE-2 backbox. VSM-1 is an eight switch module. VSB-1 is a module blank with overlay.		
28 31 23 00-0652	EA		MXLV Demonstration Panel (Siemens MXLV DEMO)	20,025.10	402.16
28 31 23 00-0653			MXL Basic System (28 31 23 00-0615)		
28 31 23 00-0654	EA		MXL/MXLV Main Control Board (Siemens MMB-3)	4,842.90	402.16
28 31 23 00-0655	EA		MXL System Electronics Package Including One MMB-3, One DE-2 And One DPU (Siemens MMB-DPU-ENCL)	6,151.94	402.16
			Note: MMB-3 is a MXL/MXLV main control board. DE-2 is an enclosure for document storage. DPU is a handheld device programming and testing unit.		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 31 23 00-0656 EA MXL/MXLV Display/Keyboard Module With Hinged Frame (Siemens MKB-2).....	1,686.47	40.21
28 31 23 00-0657 EA MXL/MXLV Keyboard With Enhanced Display With Hinged Frame (Siemens MKB-5)	2,108.59	40.21
28 31 23 00-0658 EA 6 Amp Power Supply For MXL (Siemens MPS-6)	752.07	60.32
28 31 23 00-0659 EA 220/240 VAC Adapter Cable (Siemens CIA-12)	58.11	10.05
28 31 23 00-0660 MXL/MXLR System Expansion Accessories (28 31 23 00-0615)		
28 31 23 00-0661 EA MXL Remote Power Supply Module (Siemens PSR-1)	917.53	60.32
28 31 23 00-0662 EA Style 4 Communication Module (Siemens NET-4).....	191.63	20.11
28 31 23 00-0663 EA Style 7 Communication Module (Siemens NET-7).....	341.89	20.11
28 31 23 00-0664 EA MXL/MXL-IQ/MXLV Intelligent Control Point, B6 Chip (Siemens ICP-B6).....	208.59	20.11
28 31 23 00-0665 Peripheral Devices (28 31 23 00-0544)		
28 31 23 00-0666 Thermal Detectors (28 31 23 00-0665)		
28 31 23 00-0667 EA Rate Of Rise And 135 Degree F Fixed Temperature Thermal Detector (Siemens DT-135R).....	88.97	30.16
28 31 23 00-0668 EA Rate Of Rise And 200 Degree F Fixed Temperature Thermal Detector (Siemens DT-200R).....	88.97	30.16
28 31 23 00-0669 EA 135 Degree F Fixed Temperature Thermal Detector (Siemens DT-135F).....	88.97	30.16
28 31 23 00-0670 EA 200 Degree F Fixed Temperature Thermal Detector (Siemens DT-200F).....	88.97	30.16
28 31 23 00-0671 EA Weatherproof 135 Degree F Rate Compensation/Fixed Temperature Thermal Detector (Siemens DT-135WP).....	132.82	30.16
28 31 23 00-0672 EA Weatherproof 200 Degree F Rate Compensation/Fixed Temperature Thermal Detector (Siemens DT-200WP).....	132.82	30.16
28 31 23 00-0673 EA Explosion Proof 190 Degree F Rate Compensation/Fixed Temperature Thermal Detector (Siemens DT-190EP).....	309.97	30.16
28 31 23 00-0674 Beam Smoke Detector (28 31 23 00-0665)		
28 31 23 00-0675 EA Linear Beam Smoke Detector (Siemens PBA-1191)	1,429.96	30.16
28 31 23 00-0676 EA Base For Linear Beam Smoke Detector (Siemens PBB-1191).....	165.10	10.05
28 31 23 00-0677 EA 20cm x 20cm Flat Reflector For Linear Beam Smoke Detector (Siemens PBR-1192)	166.86	10.05
28 31 23 00-0678 EA 10cm x 10cm Flat Reflector For Linear Beam Smoke Detector (Siemens PBR-1193)	87.34	10.05
28 31 23 00-0679 Bases For Detectors (28 31 23 00-0665)		
28 31 23 00-0680 EA Detector Base (Siemens DB-11).....	28.88	10.05
28 31 23 00-0681 EA Universal Base (Siemens DB-3S).....	27.13	10.05
28 31 23 00-0682 Manual Stations (28 31 23 00-0665)		
28 31 23 00-0683 EA Weatherproof Metal Manual Pull Station With Key (Siemens MSM-K-WP).....	187.99	24.13
28 31 23 00-0684 Addressable Devices (28 31 23 00-0544)		
28 31 23 00-0685 Intelligent Detectors And Devices For Firefinder XLS And FS-250 (28 31 23 00-0684)		
28 31 23 00-0686 EA Addressable Fireprint Fire Detector (Siemens HFP-11)	160.88	30.16
28 31 23 00-0687 EA Addressable Thermal Fire Detector (Siemens HFPT-11)	140.42	30.16
28 31 23 00-0688 EA Relay Base For H-Series Intelligent Detectors (Siemens DB-HR)	116.45	30.16
28 31 23 00-0689 EA Ceiling Mounted Remote Alarm Indicator (Siemens RL-HC)	81.95	30.16
28 31 23 00-0690 EA Wall Mounted Remote Alarm Indicator (Siemens RL-HW)	81.95	30.16
28 31 23 00-0691 EA Addressable Single Action Manual Pull Station (Siemens HMS-S)	163.57	20.11
28 31 23 00-0692 EA Addressable Double Action Manual Pull Station (Siemens HMS-D).....	156.56	20.11
28 31 23 00-0693 EA Single Input Intelligent Initiating Devices Interface Module (Siemens HTRI-S).....	125.57	20.11
28 31 23 00-0694 EA Dual Input Intelligent Initiating Devices Interface Module (Siemens HTRI-D)	151.88	20.11
28 31 23 00-0695 EA Single Input Intelligent Initiating Devices Interface Module With Relay (Siemens HTRI-R)	151.88	20.11
28 31 23 00-0696 EA Mini Single Input Intelligent Initiating Devices Interface Module (Siemens HTRI-M).....	116.80	20.11
28 31 23 00-0697 EA Line Isolator Module (Siemens HLIM).....	120.31	20.11
28 31 23 00-0698 EA Remote Convention Zone Module (Siemens HZM)	174.09	20.11
28 31 23 00-0699 EA Intelligent Control Point Module (Siemens HCP)	218.53	20.11
28 31 23 00-0700 EA Handheld Programming And Testing Unit (Siemens DPU).....	932.16	
28 31 23 00-0701 EA DPU Carrying Case (Siemens DPU-C1).....	145.37	
28 31 23 00-0702 EA Label Printer And Carrying Case (Siemens DPU-PR1)	1,597.72	20.11
28 31 23 00-0703 Air Duct Housings And Detectors (28 31 23 00-0684)		
28 31 23 00-0704 EA Air-Duct Housing (Siemens AD2-P).....	176.58	16.09
28 31 23 00-0705 EA Air-Duct Housing With Relay (Siemens AD2-XHR).....	198.80	16.09
28 31 23 00-0706 EA Weatherproof Enclosure For Duct Housing (Siemens WP-2000)	162.40	20.11
28 31 23 00-0707 EA 6" To 1' Duct Sampling Tube (Siemens ST-10)	23.76	6.03
28 31 23 00-0708 EA >1' To 3' Duct Sampling Tube (Siemens ST-25).....	29.54	8.04
28 31 23 00-0709 EA >3' To 5' Duct Sampling Tube (Siemens ST-50).....	37.06	10.05
28 31 23 00-0710 EA >5' To 10' Duct Sampling Tube (Siemens ST-100).....	43.42	12.07
28 31 23 00-0711 Intelligent Initiating Devices For MXL, MXL-LQ And MXLV (28 31 23 00-0684)		
28 31 23 00-0712 EA Addressable Fireprint Fire Detector (Siemens FP-11)	167.31	30.16
28 31 23 00-0713 EA Addressable Thermal Fire Detector (Siemens FPT-11).....	145.68	30.16
28 31 23 00-0714 EA Intelligent Ionization Smoke Detector (Siemens ILI-1)	183.68	30.16
28 31 23 00-0715 EA Addressable Single Action Manual Pull Station (Siemens MSI-10B).....	159.48	20.11
28 31 23 00-0716 EA Addressable Double Action Manual Pull Station (Siemens MSI-20B).....	175.26	20.11
28 31 23 00-0717 EA Single Input Intelligent Initiating Devices Interface Module (Siemens TRI-S)	161.23	20.11

28 Electronic Safety And Security**28 30 Electronic Detection And Alarm****28 31 Fire Detection And Alarm**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 31 23 00-0718	EA		Dual Input Intelligent Initiating Devices Interface Module (Siemens TRI-D).....	177.60	20.11
28 31 23 00-0719	EA		Single Input Intelligent Initiating Devices Interface Module With Relay (Siemens TRI-R).....	177.60	20.11
28 31 23 00-0720			Detector Universal Bases (28 31 23 00-0684)		
28 31 23 00-0721	EA		Detector Base With Relay (Siemens DB-X11RS).....	75.65	10.05
28 31 23 00-0722	EA		PE-11 To DB-3 Base Adapter (Siemens DB-ADPT).....	40.57	10.05
28 31 23 00-0723	EA		Locking Kit (Siemens LK-11).....	8.51	
28 31 23 00-0724	EA		Detector Base With Relay (Siemens DB-X3RS).....	75.65	10.05
28 31 23 00-0725	EA		Audible Base For Addressable Fireprint Fire Detector (Siemens ADBX-11).....	87.34	10.05
28 31 23 00-0726	EA		Retrofit Adapter Box For Audible Bases Ionization Detector Air Duct (Siemens ADB-BOX).....	38.82	10.05
28 31 23 00-0727	EA		Flush Trim Ring For Bases (Siemens RA-ADB).....	19.09	6.03
28 31 23 00-0728	EA		Seal For DB-11 (Siemens DB11-SEAL).....	9.92	
28 31 23 00-0729	EA		Gasket For DB-11 (Siemens DB-SEAL).....	10.69	
28 31 23 00-0730	EA		Detector Guard Housing (Siemens DGH-11).....	108.98	10.05
28 31 23 00-0731	EA		Small Detector Base (Siemens DB-11E).....	31.22	10.05
28 31 23 00-0732	EA		Audible Base For Series 3 (Siemens ADBI-60A).....	97.87	10.05
28 31 23 00-0733	EA		Base Plug (Siemens DB-11-DP).....	8.48	
28 31 23 00-0734			Air Duct Smoke Detectors (28 31 23 00-0684)		
28 31 23 00-0735	EA		Intelligent Remote Duct Relay Module (Siemens DA-X3SR).....	87.57	20.11
28 31 23 00-0736	EA		Weatherproof Enclosure For Duct Housing (Siemens EAD-3).....	418.48	20.11
28 31 23 00-0737			Notification Devices (28 31 23 00-0544)		
28 31 23 00-0738			Synchronization Control Devices (28 31 23 00-0737)		
28 31 23 00-0739	EA		Dual Synchronization Control Module (Siemens DSC).....	125.57	20.11
28 31 23 00-0740			Stand Alone Strobes (28 31 23 00-0737)		
28 31 23 00-0741	EA		Wall Mounted Multi-Candela Strobe (Siemens ZR-MC-R).....	110.02	30.16
28 31 23 00-0742	EA		Wall Mounted High, Multi-Candela Strobe (Siemens ZR-HMC-R).....	118.78	30.16
28 31 23 00-0743	EA		Ceiling Mounted Multi-Candela Strobe (Siemens ZR-MC-CR).....	110.02	30.16
28 31 23 00-0744	EA		Ceiling Mounted High, Multi-Candela Strobe (Siemens ZR-HMC-CR).....	118.78	30.16
28 31 23 00-0745	EA		Ceiling Mounted High Multi-Candela Strobe (Siemens ST-HMC-CW).....	118.78	30.16
28 31 23 00-0746	EA		Ceiling Mounted Multi-Candela Strobe (Siemens ST-MC-CW).....	110.02	30.16
28 31 23 00-0747	EA		Retrofit Plate Multi-Candela Strobe (Siemens ST-MC-RETRO-R).....	125.22	30.16
28 31 23 00-0748	EA		Weatherproof Ceiling Mounted Strobe (Siemens ST-75-CR-WP).....	120.54	30.16
28 31 23 00-0749	EA		Weatherproof Wall Mounted Strobe (Siemens ST-75-R-WP).....	120.54	30.16
28 31 23 00-0750	EA		Weatherproof Ceiling Mounted High Multi-Candela Strobe (Siemens ST-HMC-CR-WP).....	128.14	30.16
28 31 23 00-0751	EA		Weatherproof Wall Mounted High Multi-Candela Strobe (Siemens ST-HMC-R-WP).....	128.14	30.16
28 31 23 00-0752			Horns And Strobes (28 31 23 00-0737)		
28 31 23 00-0753	EA		Wall Mounted Multi-Candela Horn/Strobe (Siemens SE-MC-R).....	144.51	30.16
28 31 23 00-0754	EA		Wall Mounted High Multi-Candela Horn/Strobe (Siemens SE-HMC-R).....	152.11	30.16
28 31 23 00-0755	EA		Wall Mounted Horn (Siemens SE-R).....	88.97	30.16
28 31 23 00-0756	EA		Ceiling Mounted Multi-Candela Horn/Strobe (Siemens SE-MC-CR).....	144.51	30.16
28 31 23 00-0757	EA		Ceiling Mounted High Multi-Candela Horn/Strobe (Siemens SE-HMC-CR).....	152.11	30.16
28 31 23 00-0758	EA		Ceiling Mounted Horn (Siemens SEC-R).....	92.48	30.16
28 31 23 00-0759	EA		Wall Mounted Low Profile Multi-Candela Horn/Strobe (Siemens SEF-MC-R).....	144.51	30.16
28 31 23 00-0760	EA		Wall Mounted Low Profile High Multi-Candela Horn/Strobe (Siemens SEF-HMC-R).....	152.11	30.16
28 31 23 00-0761	EA		Wall Mounted Low Profile Horn (Siemens SEF-R).....	88.97	30.16
28 31 23 00-0762	EA		Ceiling Mounted Low Profile Multi-Candela Horn/Strobe (Siemens SEF-MC-CW).....	144.51	30.16
28 31 23 00-0763	EA		Ceiling Mounted Low Profile High Multi-Candela Horn/Strobe (Siemens SEF-HMC-CW).....	152.11	30.16
28 31 23 00-0764	EA		Ceiling Mounted Low Profile Horn (Siemens SEF-CR).....	92.48	30.16
28 31 23 00-0765	EA		Mini Horn (Siemens MH-R).....	76.11	30.16
28 31 23 00-0766	EA		Indoor/Outdoor Multi Tone Horn (Siemens MTH-R).....	93.65	30.16
28 31 23 00-0767	EA		Indoor/Outdoor Multi Tone, Multi-Candela Horn/Strobe (Siemens MTH-MC-R).....	136.91	30.16
28 31 23 00-0768	EA		Industrial Tri-Tone Horn (Siemens ASR).....	367.26	30.16
28 31 23 00-0769	EA		Wall Mounted Horn (Siemens HS-R).....	93.65	30.16
28 31 23 00-0770	EA		Wall Mounted Multi-Candela Horn/Strobe (Siemens HS-MC-R).....	137.49	30.16
28 31 23 00-0771	EA		Wall Mounted High Multi-Candela Horn/Strobe (Siemens HS-HMC-R).....	146.85	30.16
28 31 23 00-0772	EA		6" Motor Bell (Siemens MBDC-6).....	105.34	30.16
28 31 23 00-0773	EA		10" Motor Bell (Siemens MBDC-10).....	114.11	30.16
28 31 23 00-0774			Mounting Accessories (28 31 23 00-0737)		
28 31 23 00-0775	EA		Concealed Conduit Adapter Plate (Siemens APS-R).....	27.13	10.05
28 31 23 00-0776	EA		4" x 1-1/2" Surface Mounted Back Box (Siemens BBS-R).....	27.13	10.05
28 31 23 00-0777	EA		4" x 2-1/8" Surface Mounted Back Box (Siemens DBBS-R).....	27.71	10.05
28 31 23 00-0778	EA		Red Weatherproof Surface Mount Backbox (Siemens MT-SUR-BOX).....	41.74	10.05
28 31 23 00-0779	EA		White Weatherproof Surface Mount Backbox (Siemens MT-SUR-BOX-W).....	34.14	10.05
28 31 23 00-0780	EA		Surface Mounted Speaker Backbox (Siemens SBBS-R).....	35.90	10.05
28 31 23 00-0781	EA		Surface Mounted Speaker Backbox (Siemens SBL2S-R).....	38.23	10.05
28 31 23 00-0782	EA		Square Semi-Flush Extension Ring (Siemens SERS-R).....	31.22	10.05
28 31 23 00-0783	EA		Semi-Flush Plate (Siemens SFPS-R).....	26.54	10.05
28 31 23 00-0784	EA		Square Surface Backbox (Siemens SHBBS-R).....	31.22	10.05



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 31 23 00-0785 EA Horn Adapter Plate (Siemens SHMPS-R).....	30.05	10.05
28 31 23 00-0786 EA Ceiling Speaker Extension Ring (Siemens SPEXT-R).....	27.13	10.05
28 31 23 00-0787 EA Wall Mounted Surface Mounted Speaker Backbox (Siemens SPSB-R).....	34.14	10.05
28 31 23 00-0788 EA Wall Mounted Surface Mounted Speaker/Strobe Backbox (Siemens SPSSB-R).....	35.90	10.05
28 31 23 00-0789 EA Weatherproof Speaker Backbox (Siemens WBBS-R).....	34.73	10.05
28 31 23 00-0790 EA Weatherproof Speaker Backbox With 3/4" Knockout (Siemens WBBS-R-3/4T-3/4B).....	38.23	10.05
28 31 23 00-0791 EA Weatherproof Flush Plate (Siemens WFPAS-R).....	38.23	10.05
28 31 23 00-0792 EA Weatherproof Horn Flush Plate (Siemens WFPS-R).....	38.23	10.05
28 31 23 00-0793 EA Weatherproof Horn Backbox (Siemens WPBBS-R).....	35.90	10.05
28 31 23 00-0794 EA Weatherproof Strobe Backbox (Siemens WPSBBS-R).....	35.90	10.05
28 31 23 00-0795 EA Surface Mounted Weatherproof Backbox Kit (Siemens WPS-KIT).....	27.13	10.05
28 31 23 00-0796 EA Z Series Backbox (Siemens ZBB-R).....	30.05	10.05
28 31 23 00-0797 Door Holders <small>(28 31 23 00-0797)</small>		
28 31 23 00-0798 EA 120 VAC Concealed Wiring Fire Door Holder (Siemens SDH-2A).....	211.16	30.16
28 31 23 00-0799 EA 24 VDC Concealed Wiring Fire Door Holder (Siemens SDH-2D).....	211.16	30.16
28 31 23 00-0800 Voice Equipment <small>(28 31 23 00-0544)</small>		
28 31 23 00-0801 Voicecom <small>(28 31 23 00-0800)</small>		
28 31 23 00-0802 EA Emergency Voice Alarm Communication System, 3.5 Amp Power Supply And Battery Charger, 50W Amplifier, Battery Cables, Main Control Board With One Speaker Circuit, Paging Microphone And Enclosure With Deadfront And Space For Five Modules (Siemens VOICECOM).....	3,210.14	402.16
28 31 23 00-0803 EA Emergency Voice Alarm Communication System, 3.5 Amp Power Supply And Battery Charger, Two 50W Amplifier, Battery Cables, Main Control Board With One Speaker Circuit, Paging Microphone, Enclosure With Deadfront And Space For 11 Modules, Auxiliary Power Supply, Four PS-AUX Strobe Zone Cables And One AM-25-50 Speaker Zone Cables (Siemens VOICECOM-L).....	4,993.33	402.16
28 31 23 00-0804 Johnson Controls Fire Alarm <small>(28 31 23)</small>		
28 31 23 00-0805 EA Intelligent Addressable ION Detector; With FlashScan. (Johnson Controls, Inc. #1951J).....	128.49	30.16
28 31 23 00-0806 EA Intelligent Addressable Photo Detector; With FlashScan. (Johnson Controls, Inc. #2951J).....	127.22	30.16
28 31 23 00-0807 EA Intelligent Addressable Photo/Thermal Detector; With FlashScan. (Johnson Controls, Inc. #2951TJ).....	156.25	30.16
28 31 23 00-0808 EA Acclimate™ Intelligent Photo Thermal Detector; With FlashScan. (Johnson Controls, Inc. #2951TMJ).....	155.85	30.16
28 31 23 00-0809 EA 411UD, 4 Channel Dual. (Johnson Controls, Inc. #411UD).....	413.76	40.21
28 31 23 00-0810 EA Intelligent Addressable High Temperature Heat Detector; With FlashScan. (Johnson Controls, Inc. #5951HJ).....	122.01	30.16
28 31 23 00-0811 EA Intelligent Addressable High Temperature Heat Detector; With FlashScan. (Johnson Controls, Inc. #5951J).....	110.00	30.16
28 31 23 00-0812 EA Intelligent Addressable Rate-of-Rise Thermal Detector; With FlashScan. (Johnson Controls, Inc. #5951RJ).....	107.45	30.16
28 31 23 00-0813 EA Intelligent Addressable Laser Detector; Low Profile, Use With IFC Series Panels Only. (Johnson Controls, Inc. #7351J).....	303.27	30.16
28 31 23 00-0814 EA 100 Watt Audio Amplifier @ 70.7 VRMS With Built-in Tone Generator, 120 VAC. (Johnson Controls, Inc. #AA-100).....	1,445.18	60.32
28 31 23 00-0815 EA AUDIO Amplifier, 100 Watt, 230 VAC (Johnson Controls, Inc. #AA-100E).....	1,400.88	60.32
28 31 23 00-0816 EA 120 Watt Audio Amplifier @ 25 VRMS With Built-in Tone Generator, 120 VAC (Johnson Controls, Inc. #AA-120).....	1,424.78	60.32
28 31 23 00-0817 EA AUDIO Amplifier, 120 Watt, 230 VAC (Johnson Controls, Inc. #AA-120E).....	1,365.12	60.32
28 31 23 00-0818 EA 30 Watt Audio Amplifier @ 25 VRMS, 120 VAC (Johnson Controls, Inc. #AA-30).....	675.84	60.32
28 31 23 00-0819 EA AUDIO Amplifier, 30 Watt, 230 VAC (Johnson Controls, Inc. #AA-30E).....	675.84	60.32
28 31 23 00-0820 EA Annunciator Control Module With; 16 Red Alarm LED's, 16 Yellow Trouble LED's, And 16 Control Switches, On-line, System Trouble Led, And Local Sounder, Local Acknowledge And Lamp Test Switch, Supports 1, 2 Or 3 AEM-16AT Expander Modules. (Johnson Controls, Inc. #ACM-16AT).....	662.45	20.11
28 31 23 00-0821 EA IFC Series ACS Annunciator; Up To 96 Points Of Annunciation With Alarm Or Active LED, Trouble LED And Switch Per Circuit. Active/Alarm LEDs Can Be Programmed (By Powered Up Switch Selection) By Point To Be Red, Green Or Yellow And The Trouble LED Is Always Yellow. Expandable With One, Two Or Three AEM-24AT's. (Johnson Controls, Inc. #ACM-24AT).....	688.75	20.11
28 31 23 00-0822 EA Annunciator Control Module; Includes 32 Red Alarm LED's, System Trouble LED And On-line LED, Local Acknowledge, Lamp Test Switch, And Local Piezo Sounder, Supports One AEM-32A Expander Module. (Johnson Controls, Inc. #ACM-32A).....	507.78	20.11
28 31 23 00-0823 EA IFC Series ACS Annunciator; Up To 96 Points Of Annunciation With Alarm Or Active LED Per Circuit. Active/Alarm LEDs Can Be Programmed (By Powered Up Switch Selection) In Groups Of 24 To Be Red, Green Or Yellow. Expandable To 96 Points With One AEM-48A. (Johnson Controls, Inc. #ACM-48A).....	507.78	20.11
28 31 23 00-0824 EA Annunciator, Relay, Form C. (Johnson Controls, Inc. #ACM-8R).....	360.28	20.11
28 31 23 00-0825 EA Charger Power Supply - 6 Or 10 Amps; Mounts In CAB-PS1, CAB-3/4, EQ Cabx, BB-25, Or CHS-PS1; Comes With The PK-PPS Programming Utility. Windows® PC And USB Cable Required For Programming. (Johnson Controls, Inc. #ACPS-610).....	1,153.26	40.21
28 31 23 00-0826 EA Annunciator Expander Module With: 16 Red Alarm LED's, 16 Yellow Trouble LED's, 16 Control Switches, Cable For Connection To The ACM-16AT Master. (Johnson Controls, Inc. #AEM-16AT).....	507.78	20.11
28 31 23 00-0827 EA Annunciator Expander Module; 24 Alarm And Trouble LEDs, Expands The ACM-24AT To 48, 72 Or 96 Points. (Johnson Controls, Inc. #AEM-24AT).....	527.55	20.11
28 31 23 00-0828 EA Annunciator Expander Module With: 32 Red Alarm LED's, Cable For Connection To The ACM-32A Master. (Johnson Controls, Inc. #AEM-32A).....	455.92	20.11
28 31 23 00-0829 EA Annunciator Expander Module; 48 Alarm LEDs, Expands The ACM-48A To 96 Points. (Johnson Controls, Inc. #AEM-48A).....	455.92	20.11
28 31 23 00-0830 EA Back Box, Flush Or Surface Mount; Requires A Door And Telephone Chassis. (Johnson Controls, Inc. #FAWS-BX).....	81.78	18.10
28 31 23 00-0831 EA Receiver, Multimode Fiber. (Johnson Controls, Inc. #AFL-RM).....	700.90	40.21
28 31 23 00-0832 EA Receiver, Singlemode Fiber. (Johnson Controls, Inc. #AFL-RS).....	1,510.86	40.21
28 31 23 00-0833 EA Transmit, Multimode Fiber. (Johnson Controls, Inc. #AFL-TM).....	700.90	40.21
28 31 23 00-0834 EA Transmit, Singlemode Fiber. (Johnson Controls, Inc. #AFL-TS).....	1,510.86	40.21
28 31 23 00-0835 EA Base, Smoke Detector, 2 Wire. (Johnson Controls, Inc. #B110LP).....	30.84	10.05
28 31 23 00-0836 EA Base, Smoke Detector, Intelligent. (Johnson Controls, Inc. #B224BI).....	76.98	10.05
28 31 23 00-0837 EA Base, Smoke Detector, Intelligent. (Johnson Controls, Inc. #B224RB).....	72.81	10.05

28 Electronic Safety And Security**28 30 Electronic Detection And Alarm****28 31 Fire Detection And Alarm**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 31 23 00-0838 EA Base, Smoke Detector, 2 Wire. (Johnson Controls, Inc. #B401)	32.62	10.05
28 31 23 00-0839 EA Intelligent Detector Base, Without Flange. (Johnson Controls, Inc. #B501J)	29.66	10.05
28 31 23 00-0840 EA Battery Cabinet, Lockable. (Johnson Controls, Inc. #BB-100)	514.97	40.21
28 31 23 00-0841 EA Projected Beam Smoke Detector, Single-ended Reflected Type, Includes Trouble Relay, Transmitter/Receiver In One Unit. (Johnson Controls, Inc. #Beam1224)	1,193.47	60.32
28 31 23 00-0842 EA Same As Beam1224 With Built-in Sensitivity Test Filter. (Johnson Controls, Inc. #Beam1224S)	1,260.52	60.32
28 31 23 00-0843 EA Mounting Kit, Long RG, Beam. (Johnson Controls, Inc. #BeamLRK)	140.80	10.05
28 31 23 00-0844 EA Mounting Kit, Beam Detect. (Johnson Controls, Inc. #BeamMMK)	96.11	10.05
28 31 23 00-0845 EA Digital Audio Amplifier, 50 Watt, 25 VRMS (Johnson Controls, Inc. #DAA-5025)	1,194.45	60.32
28 31 23 00-0846 EA Digital Audio Amplifier, 50 Watt, 25 VRMS, Multi-Fiber (Johnson Controls, Inc. #DAA-5025F)	1,104.06	60.32
28 31 23 00-0847 EA Digital Audio Amplifier, 50 Watt, 25 VRMS, Single-Fiber (Johnson Controls, Inc. #DAA-5025SF)	1,104.06	60.32
28 31 23 00-0848 EA Digital Audio Amplifier, 50 Watt, 70 VRMS (Johnson Controls, Inc. #DAA-5070)	1,292.09	60.32
28 31 23 00-0849 EA Amplifier, Digital Audio. (Johnson Controls, Inc. #DAA-5070E)	1,193.47	60.32
28 31 23 00-0850 EA Digital Audio Amplifier, 50 Watt, 70 VRMS, Multi-Fiber (Johnson Controls, Inc. #DAA-5070F)	1,193.47	60.32
28 31 23 00-0851 EA Digital Audio Amplifier, 50 Watt, 70 VRMS, Single-Fiber (Johnson Controls, Inc. #DAA-5070SF)	1,193.47	60.32
28 31 23 00-0852 EA Digital Audio Amplifier, 75 Watt, 25 VRMS (Johnson Controls, Inc. #DAA-7525)	1,423.36	60.32
28 31 23 00-0853 EA Digital Audio Amplifier, 75 Watt, 25 VRMS, Multi Fiber (Johnson Controls, Inc. #DAA-7525F)	1,423.36	60.32
28 31 23 00-0854 EA Digital Audio Amplifier, 75 Watt, 25 VRMS, Single Fiber (Johnson Controls, Inc. #DAA-7525SF)	1,423.36	60.32
28 31 23 00-0855 EA Innovairflex Intelligent. (Johnson Controls, Inc. #DNR)	152.92	20.11
28 31 23 00-0856 EA Innovairflex Duct Detect. (Johnson Controls, Inc. #DNRW)	231.09	20.11
28 31 23 00-0857 EA Innovairflex Sample Tube. (Johnson Controls, Inc. #DST1)	23.21	8.04
28 31 23 00-0858 EA Innovairflex Sample Tube. (Johnson Controls, Inc. #DST1.5)	25.05	8.04
28 31 23 00-0859 EA Innovairflex Sample Tube. (Johnson Controls, Inc. #DST10)	58.52	12.07
28 31 23 00-0860 EA Innovairflex Sample Tube. (Johnson Controls, Inc. #DST3)	29.17	8.04
28 31 23 00-0861 EA Innovairflex Sample Tube. (Johnson Controls, Inc. #DST5)	39.06	10.05
28 31 23 00-0862 EA Digital Voice Command, Analog Output. (Johnson Controls, Inc. #DVC-AO)	232.41	20.11
28 31 23 00-0863 EA Digital Voice Command, Keypad. (Johnson Controls, Inc. #DVC-KD)	388.88	40.21
28 31 23 00-0864 EA Equipment Cabinet Used To House DAA Digital Amplifiers, XP10/6 Series Transponders, AA-Amplifiers, ACPS- 610 Or AMPS-24; B Size, Black. (Johnson Controls, Inc. #EQBB-B4)	332.68	60.32
28 31 23 00-0865 EA Equipment Cabinet Used To House DAA Digital Amplifiers, XP10/6 Series Transponders, AA-Amplifiers, ACPS- 610 Or AMPS-24; C Size, Black. (Johnson Controls, Inc. #EQBB-C4)	453.07	60.32
28 31 23 00-0866 EA Equipment Cabinet Used To House DAA Digital Amplifiers, XP10/6 Series Transponders, AA-Amplifiers, ACPS- 610 Or AMPS-24; D Size, Black. (Johnson Controls, Inc. #EQBB-D4)	493.30	60.32
28 31 23 00-0867 EA Equipment Cabinet Door; B Size Black. (Johnson Controls, Inc. #EQDR-B4)	252.37	8.04
28 31 23 00-0868 EA Equipment Cabinet Door; C Size Black. (Johnson Controls, Inc. #EQDR-C4)	379.05	8.04
28 31 23 00-0869 EA Equipment Cabinet Door; D Size Black. (Johnson Controls, Inc. #EQDR-D4)	416.31	8.04
28 31 23 00-0870 EA 6.0 Amps, 120 VAC Remote Charger Power Supply. Includes Main Printed Circuit Board, Transformers And Installation Instructions (Johnson Controls, Inc. #FCPS-24S6)	680.10	80.44
28 31 23 00-0871 EA 8.0 Amps, 120 VAC Remote Charger Power Supply. Includes Main Printed Circuit Board, Transformers And Installation Instructions (Johnson Controls, Inc. #FCPS-24S8)	684.45	80.44
28 31 23 00-0872 EA 80 Character Display Annunciator. "Security Keypad" Mechanical Design. For Use With The IFC-320, JCPU2- 640, JCPU-640 And IFC-400/300 (Rev 3.62+) Only. (Johnson Controls, Inc. #FDU-80G)	643.66	60.32
28 31 23 00-0873 EA Fireman's Telephone Hand Set. (Johnson Controls, Inc. #FHS)	118.46	10.05
28 31 23 00-0874 EA Fire Phone Storage Cabinet, Recessed, Holds 6 Phones. (Johnson Controls, Inc. #FHSC-R)	332.55	20.11
28 31 23 00-0875 EA Door Holder, Magnetic, Floor. (Johnson Controls, Inc. #FM980)	182.72	30.16
28 31 23 00-0876 EA Door Holder, Magnetic, Wall. (Johnson Controls, Inc. #FM996)	151.01	30.16
28 31 23 00-0877 EA Door Holder, Magnetic, Wall. (Johnson Controls, Inc. #FM998)	158.23	30.16
28 31 23 00-0878 EA Addressable Beam Detector. (Johnson Controls, Inc. #FSB-200)	1,208.40	40.21
28 31 23 00-0879 EA Addressable Beam Detector With Remote Test Feature. (Johnson Controls, Inc. #FSB-200S)	1,472.99	40.21
28 31 23 00-0880 EA Intelligent Addressable HARSH (Hostile Area Smoke Head) Detector; Photo, Requires B501B-FTXJ Base. (Johnson Controls, Inc. #FTX-P2J)	447.82	20.11
28 31 23 00-0881 EA IFC-320 Intelligent Fire Alarm Panel; Single Printed Circuit Board With One SLC Loop (318 Devices), Back-lit, 80 Character Display, System And Programming Keypad And 6.0 Amp Power Supply, 120 VAC, Includes Door, Dress Panel And Back Box, Black (Johnson Controls, Inc. #IFC-320)	3,112.99	321.72
28 31 23 00-0882 EA Upgrade Kit, ORG BLD, 640. (Johnson Controls, Inc. #IFC-640UG)	1,485.83	40.21
28 31 23 00-0883 EA Workstation Only Workstation GUI Software And Hardware Package. (Johnson Controls, Inc. #IFI)	19,810.65	482.58
28 31 23 00-0884 EA Workstation With NFN Fiber PC Card Workstation GUI Software And Hardware Package. Includes NFN Gateway (JNFN-GW-PC-F) Fiber Version. (Johnson Controls, Inc. #IFI-F)	21,598.68	482.58
28 31 23 00-0885 EA Workstation With Echelon Wire PC Card Workstation GUI Software And Hardware Package For Building Systems Integration, WSSUP Workstation Supervisor. Includes Echelon® Gateway (ECH-GW-PC-W) Wire Version. (Johnson Controls, Inc. #IFI-IP)	24,280.73	482.58
28 31 23 00-0886 EA Workstation With NFN Wire PC Card Workstation GUI Software And Hardware Package. Includes NFN Gateway (JNFN-GW-PC-W) Wire Version. (Johnson Controls, Inc. #IFI-W)	21,598.68	482.58
28 31 23 00-0887 EA Annunciator Flush Box. Mounts One Annunciator Module. (Johnson Controls, Inc. #JABF-1B)	147.51	12.07
28 31 23 00-0888 EA Annunciator Flush Box. One Module. Attractive Glass Door And Key Lock. (Johnson Controls, Inc. #JABF-1DB)	165.39	12.07
28 31 23 00-0889 EA Annunciator Flush Box. Mounts Two Annunciator Modules. (Johnson Controls, Inc. #JABF-2B)	179.69	12.07
28 31 23 00-0890 EA Annunciator Flush Box. Mounts Four Annunciator Modules. (Johnson Controls, Inc. #JABF-4B)	331.68	12.07
28 31 23 00-0891 EA Annunciator Surface Box. Deep With Trim Cover. (Johnson Controls, Inc. #JABS-1TB)	109.06	8.04
28 31 23 00-0892 EA Surface (or Semi-flush) Mount Backbox. Used With The INA, ACS Annunciators, SCS Series, JNCA And JNCA-2 Black. (Johnson Controls, Inc. #JABS-2D)	172.38	18.10
28 31 23 00-0893 EA Surface (or Semi-flush) Mount Backbox. Used With The INA, ACS Annunciators, SCS Series, JNCA And JNCA-2 Red. (Johnson Controls, Inc. #JABS-2DR)	182.63	18.10
28 31 23 00-0894 EA Surface (or Semi-flush) Mount INA, ACS, Or SCS Backbox, Black. (Johnson Controls, Inc. #JABS-4D)	329.42	18.10
28 31 23 00-0895 EA Audio Command Door For CAB-B4, Black; Required When Using CA-2. (Johnson Controls, Inc. #JADDR-B4)	324.53	8.04
28 31 23 00-0896 EA Audio Command Door For CAB-C4, Black; Required When Using CA-2. (Johnson Controls, Inc. #JADDR-C4)	436.29	8.04
28 31 23 00-0897 EA Audio Command Door For CAB-D4, Black; Required When Using CA-2. (Johnson Controls, Inc. #JADDR-D4)	539.10	8.04
28 31 23 00-0898 EA Addressable Pull Station; With FlashScan. (Johnson Controls, Inc. #JBG-12LX)	158.82	20.11
28 31 23 00-0899 EA Battery Dress Panel For CAB-4 Series; For Use With The JCPU2-3030, JCPU2-640, JNCA-2, And DVC Systems. (Johnson Controls, Inc. #JBP2-4)	73.59	8.04



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 31 23 00-0900	EA		JCPU2-3030 CPU With 640-character Display; Required For Single Panel (One CPU2-3030) Systems. Includes: CPU, 640-Character Backlit LCD Display, QWERTY Programming And Control Keypad, Installation, Programming And Operating Manuals. Supports One To 10 Signaling Line Circuits (Up To Five LCM-320 And Five LEM-320). Order One Per System Or As Necessary (Up To 103 Network Nodes) For A Networked System. Requires Top Row Of A Cabinet. (Johnson Controls, Inc. #JCPU2-3030D).....	3,106.22	321.72
28 31 23 00-0901	EA		Central Processing Unit For The JCPU2-640 With Integral 120 VAC Power Supply, Includes CHS2-M2 Chassis (Johnson Controls, Inc. #JCPU2-640).....	2,246.12	241.30
28 31 23 00-0902	EA		Main Board, CPU, IFC3030, DI. (Johnson Controls, Inc. #JCPU-3030D).....	3,993.80	321.72
28 31 23 00-0903	EA		Main Board, CPU, IFC640. (Johnson Controls, Inc. #JCPU-640).....	3,808.39	241.30
28 31 23 00-0904	EA		Main Board, CPU, IFC640, EUR. (Johnson Controls, Inc. #JCPU-640E).....	2,771.51	241.30
28 31 23 00-0905	EA		Digital Voice Command, Extended Memory. (Johnson Controls, Inc. #JDVC-EM).....	1,475.82	30.16
28 31 23 00-0906	EA		Digital Voice Command, Extended Memory, Multi-Fiber. (Johnson Controls, Inc. #JDVC-EMF).....	1,490.74	30.16
28 31 23 00-0907	EA		Digital Voice Command, Extended Memory, Single-Fiber. (Johnson Controls, Inc. #JDVC-EMSF).....	1,490.74	30.16
28 31 23 00-0908	EA		Annunciator, Network Control. (Johnson Controls, Inc. #JNCA).....	1,766.12	40.21
28 31 23 00-0909	EA		Network Control Annunciator-2, 640-characters; On Single Panel (one JCPU2-640) JCPU2-640 Systems, The JNCA-2 Can Be The Primary Display For The Panel And Connects Directly To The JCPU2-640. On Network Systems (Two Or More JCPU2-640's), One Network Display (Either JNCA-2 Or IFW) Is Required For Every System And Each JNCA-2 Connects To And Requires An NCM Network Control Module. Mounts In A Row Of FACP Node Or In Two Annunciator Module Positions. Mounting Options Include: NCA/640-2-Kit (directly Mounting To The CHS2-M2), CA-2, ADP-4B, Or In An Annunciator Box, Such As The ABS-2DB (requires The CHS-2D). (Johnson Controls, Inc. #JNCA-2).....	1,499.24	40.21
28 31 23 00-0910	EA		Mass Notification Voice Paging; Requires JNOTIFY-PAA Hardware Package (Sold Separately). (Johnson Controls, Inc. #JNOTIFY-IP).....	1,376.60	241.30
28 31 23 00-0911	EA		160 Character Display Annunciator; For Use With JCPU-3030 And JCPU2-3030. (Johnson Controls, Inc. #LCD-160).....	1,069.78	40.21
28 31 23 00-0912	EA		80 Character LCD Annunciator. Mounts In ABS-1T, ABF-1D, ABF-2D, Or Flush Back Box. (Johnson Controls, Inc. #LCD-80).....	882.89	40.21
28 31 23 00-0913	EA		Loop Control Module. Each LCM May Be Expanded To Two Loops By Adding A LEM-320. IFC2- 3030 And IFC-3030 Only. (Johnson Controls, Inc. #LCM-320).....	1,411.08	40.21
28 31 23 00-0914	EA		Lamp Driver Annunciator Control Module. For Use With Custom Graphic Annunciators. 32 Points. (Johnson Controls, Inc. #LDM-32).....	435.82	10.05
28 31 23 00-0915	EA		Cable 24": LDM TO Annunciator. (Johnson Controls, Inc. #LDM-CBL24).....	142.14	8.04
28 31 23 00-0916	EA		Cable 48": LDM TO Annunciator. (Johnson Controls, Inc. #LDM-CBL48).....	174.32	8.04
28 31 23 00-0917	EA		Lamp Driver Annunciator Expander Module. For Use With Custom Graphic Annunciators. 32 Points. (Johnson Controls, Inc. #LDM-E32).....	351.80	10.05
28 31 23 00-0918	EA		Relay Module. 32 Form-A Contacts. Connects To LDM-32 Or LDM-E32. (Johnson Controls, Inc. #LDM-R32).....	642.35	10.05
28 31 23 00-0919	EA		Loop Expander Module. Mounts As Daughter Board To LCM-320 To Provide Even Numbered SLC Loops. (Johnson Controls, Inc. #LEM-320).....	1,160.67	10.05
28 31 23 00-0920	EA		Addressable Control Module With FlashScan; Configured For One Class A Or Class B NAC. (Johnson Controls, Inc. #M300CJ).....	94.66	10.05
28 31 23 00-0921	EA		Addressable Dual Monitor Module; With FlashScan, Two Class B Circuits. (Johnson Controls, Inc. #M300DJ).....	148.48	10.05
28 31 23 00-0922	EA		Addressable Monitor Module; With FlashScan; Supervises Either A Class A Or Class B Circuit Of N.D. Dry-contact Input Devices. (Johnson Controls, Inc. #M300MJ).....	75.16	10.05
28 31 23 00-0923	EA		Addressable Relay Module With FlashScan; Provides Two Form-C Dry Contacts That Switch Together. (Johnson Controls, Inc. #M300RJ).....	103.87	10.05
28 31 23 00-0924	EA		Addressable Mini Module With FlashScan; Supervises A Class B Circuit Of N.D. Dry-contact Devices. (Johnson Controls, Inc. #M301MJ).....	82.70	10.05
28 31 23 00-0925	EA		Addressable 2-Wire Detector Monitor Module; With FlashScan. (Johnson Controls, Inc. #M302MJ).....	132.36	10.05
28 31 23 00-0926	EA		Addressable Firephone Control Module With Flashscan. (Johnson Controls, Inc. #M500FPJ).....	150.39	10.05
28 31 23 00-0927	EA		SLC Loop Isolator Module; Isolates Against Short Circuits On The SLC. (Johnson Controls, Inc. #M500XJ).....	86.54	10.05
28 31 23 00-0928	EA		Network INTFC, P2P, Wire. (Johnson Controls, Inc. #MIB-W).....	1,233.27	30.16
28 31 23 00-0929	EA		Network Adapter, Fiber. (Johnson Controls, Inc. #NAM-232F).....	1,094.25	20.11
28 31 23 00-0930	EA		Network Adapter, Wire. (Johnson Controls, Inc. #NAM-232W).....	1,012.00	20.11
28 31 23 00-0931	EA		Plate, Retrofit, NCA-2. (Johnson Controls, Inc. #NCA-2RETRO).....	39.33	4.02
28 31 23 00-0932	EA		Network Control Module - Multi Mode Fiber; Order One NCM Per Network Node (JCPU-640/3030, JNCA, JCPU2-640/3030, JNCA-2, DVC, Etc). (Johnson Controls, Inc. #NCM-F).....	886.31	20.11
28 31 23 00-0933	EA		Network Control Module - Wire; Order One NCM Per Network Node (JCPU-640/3030, JNCA, JCPU2-640/3030, JNCA-2, DVC, Etc). (Johnson Controls, Inc. #NCM-W).....	844.35	20.11
28 31 23 00-0934	EA		NFV-25/50. (Johnson Controls, Inc. #NFV-25/50).....	2,151.29	40.21
28 31 23 00-0935	EA		NU-RPT101-1U RS485. (Johnson Controls, Inc. #NU-RPT101-1U).....	601.13	20.11
28 31 23 00-0936	EA		Key Switch, Remote Control. (Johnson Controls, Inc. #RKS-S).....	165.38	8.04
28 31 23 00-0937	EA		Microphone Assembly For Mounting To An ADP-4 Dress Panel. (Johnson Controls, Inc. #RM-1).....	382.63	20.11
28 31 23 00-0938	EA		Microphone Assembly For Mounting In An CAB-RM Cabinet. (Johnson Controls, Inc. #RM-1SA).....	382.63	20.11
28 31 23 00-0939	EA		Remote Page Jack. Allows Remote All-Call Paging. (Johnson Controls, Inc. #RPJ-1).....	103.71	8.04
28 31 23 00-0940	EA		SA-WBB, Weatherproof. (Johnson Controls, Inc. #SA-WBB).....	28.26	4.02
28 31 23 00-0941	EA		SA-WBBC, Weatherproof. (Johnson Controls, Inc. #SA-WBBC).....	28.26	4.02
28 31 23 00-0942	EA		Strobe, Standard, 12/24 VDC, Red (Johnson Controls, Inc. #SCR).....	113.97	30.16
28 31 23 00-0943	EA		Strobe, HI, 12/24 VDC, Red (Johnson Controls, Inc. #SCRH).....	126.48	30.16
28 31 23 00-0944	EA		Strobe, HI, Outdoor, Red. (Johnson Controls, Inc. #SCRHK).....	148.83	34.18
28 31 23 00-0945	EA		Strobe, Standard, Outdoor, Red. (Johnson Controls, Inc. #SCRK).....	147.04	34.18
28 31 23 00-0946	EA		Smoke Control Master; Includes Eight On/off/auto Switches. Supports One SCE-8. Includes Manual, Slide-in Labels. Mounts In ADP-4 Or ABS-4D. (Johnson Controls, Inc. #SCS-8).....	928.82	80.44
28 31 23 00-0947	EA		Smoke Control Lamp Driver. Outputs For 8 On/off/auto Switches With LED's. Intended For Custom Built Smoke Control Stations. Support One SCE-8L. (Johnson Controls, Inc. #SCS-8L).....	732.13	80.44
28 31 23 00-0948	EA		Strobe, Standard, 12/24 VDC, White (Johnson Controls, Inc. #SCW).....	113.97	30.16
28 31 23 00-0949	EA		Strobe, HI, 12/24 VDC, Red (Johnson Controls, Inc. #SCWH).....	126.48	30.16
28 31 23 00-0950	EA		Strobe, Standard, 12/24 VDC, White (Johnson Controls, Inc. #SCW-P).....	113.97	30.16
28 31 23 00-0951	EA		Mounting Kit, M300/M500. (Johnson Controls, Inc. #SMB500).....	21.77	8.04
28 31 23 00-0952	EA		SMK-MOV Kit-LON. (Johnson Controls, Inc. #SMK-MOVKit-LON).....	22.39	4.02
28 31 23 00-0953	EA		SMK-MOV Kit-MSTP. (Johnson Controls, Inc. #SMK-MOVKit-MSTP).....	25.26	4.02
28 31 23 00-0954	EA		SPBBS, Wall, Back Box. (Johnson Controls, Inc. #SPBBS).....	22.41	4.02
28 31 23 00-0955	EA		Strobe, Standard, 12/24 VDC, Red (Johnson Controls, Inc. #SR).....	105.34	30.16
28 31 23 00-0956	EA		Strobe, HI, 12/24 VDC, Red (Johnson Controls, Inc. #SRH).....	126.48	30.16

28 Electronic Safety And Security**28 30 Electronic Detection And Alarm****28 31 Fire Detection And Alarm**

MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
28 31	23 00-0957	EA Strobe, HI, Outdoor, Red. (Johnson Controls, Inc. #SRHK)	148.83		34.18
28 31	23 00-0958	EA Strobe, HI, 12/24 VDC, Red (Johnson Controls, Inc. #SRH-P).....	126.48		30.16
28 31	23 00-0959	EA Strobe, Standard, Outdoor, Red. (Johnson Controls, Inc. #SRK)	147.04		34.18
28 31	23 00-0960	EA Strobe, Standard, 12/24 VDC, Red (Johnson Controls, Inc. #SR-P)	113.97		30.16
28 31	23 00-0961	EA Strobe, Standard, 12/24 VDC, White (Johnson Controls, Inc. #SW).....	113.97		30.16
28 31	23 00-0962	EA Strobe, HI, 12/24 VDC, White (Johnson Controls, Inc. #SWH).....	126.48		30.16
28 31	23 00-0963	EA Strobe, HI, 12/24 VDC, White (Johnson Controls, Inc. #SWH-P)	126.48		30.16
28 31	23 00-0964	EA Strobe, Standard, 12/24 VDC, White (Johnson Controls, Inc. #SW-P)	113.97		30.16
28 31	23 00-0965	EA Firefighter's Telephone Handset Only. (Johnson Controls, Inc. #TELH-1).....	144.37		10.05
28 31	23 00-0966	EA Universal Digital Alarm Communicator Transmitter. (Johnson Controls, Inc. #UDACT)	635.39		40.21
28 31	23 00-0967	EA Speaker Strobe, Ceiling, White, 2 W (MAX), Dual Voltage, Multi (Johnson Controls, Inc. #SPSCW).....	167.07		40.21
28 31	23 00-0968	EA Speaker, White, Ceiling Mount. (Johnson Controls, Inc. #SPCW).....	72.66		20.11
28 31	23 00-0969	EA Speaker, White, Ceiling Mount, High Db. (Johnson Controls, Inc. #SPCWV).....	72.66		20.11
28 31	23 00-0970	EA Speaker Strobe, Red, Ceiling Mount, Standard Candela. (Johnson Controls, Inc. #SPSCR).....	126.84		20.11
28 31	23 00-0971	EA Speaker Strobe, Red, Ceiling Mount, High Candela. (Johnson Controls, Inc. #SPSCRH)	137.21		20.11
28 31	23 00-0972	EA Speaker Strobe, Red, Ceiling Mount, High Candela, High Db. (Johnson Controls, Inc. #SPSCRVH).....	137.21		20.11
28 31	23 00-0973	EA Speaker Strobe, White, Ceiling Mount, High Db. (Johnson Controls, Inc. #SPSCWV).....	122.73		20.11
28 31	23 00-0974	EA Speaker Strobe Wall, WP, White, 2W (MAX), Dual Volt, Multi D (Johnson Controls, Inc. #SPSWK)	164.22		20.11
28 31	23 00-0975	EA Speaker Strobe, Wall, White, Standard Candela. (Johnson Controls, Inc. #SPSW).....	126.84		20.11
28 31	23 00-0976	EA Wall Mount Speaker, White. (Johnson Controls, Inc. #SPW)	72.66		20.11
28 31	23 00-0977	EA Wall Mount Speaker, Red. (Johnson Controls, Inc. #SPR).....	72.66		20.11
28 31	23 00-0978	EA Speaker Strobe, Wall, White, High Cd. (Johnson Controls, Inc. #SPSWH)	137.21		20.11
28 31	23 00-0979	EA Speaker Strobe, Wall, Red, High Cd. (Johnson Controls, Inc. #SPSR)	126.84		20.11
28 31	23 00-0980	EA Speaker Strobe, Wall, Red, High Db, High Candela. (Johnson Controls, Inc. #SPSRV).....	126.84		20.11
28 31	23 00-0981	Honeywell Fire Alarm <small>(28 31 23)</small>			
28 31	23 00-0982	Notifier Fire Alarm <small>(28 31 23 00-0981)</small>			
28 31	23 00-0983	Fire Alarm Control Panel And Accessories <small>(28 31 23 00-0982)</small>			
28 31	23 00-0984	EA NFS2-3030 CPU For Intelligent Fire Alarm Control Panel (Notifier CPU2-3030D)	3,719.82		402.16
28 31	23 00-0985	EA NFS2-640 CPU For Intelligent Fire Alarm Control Panel (Notifier CPU2-640).....	3,107.82		402.16
28 31	23 00-0986	EA Black, 120 VAC, Intelligent Fire Alarm Control Panel (Notifier NFS-320)	3,712.62		402.16
28 31	23 00-0987	EA Supports Installation Of Optional ACM-Series Annunciator In Same Cabinet, Black, 120 VAC, Intelligent Fire Alarm Control Panel (Notifier NFS-320C).....	3,807.82		402.16
28 31	23 00-0988	EA Black, 240 VAC, Intelligent Fire Alarm Control Panel (Notifier NFS-320E).....	3,712.62		402.16
28 31	23 00-0989	EA Red, 120 VAC, Intelligent Fire Alarm Control Panel (Notifier NFS-320R)	3,712.62		402.16
28 31	23 00-0990	EA Two-Tone Sequential Module (Notifier 2TTM)	192.21		20.11
28 31	23 00-0991	EA 5', Not Low Loss, Antenna Cable (Notifier 7626-5C)	57.64		4.02
28 31	23 00-0992	EA 25', Low Loss, Antenna Cable (Notifier 7626-25HC)	112.09		8.04
28 31	23 00-0993	EA 50', Low Loss, Antenna Cable (Notifier 7626-50HC)	170.53		12.07
28 31	23 00-0994	EA IPGSM-COM, IPGSM-COMa Handheld Programmer (Notifier 7720P).....	268.80		
28 31	23 00-0995	EA RJ45-DB9F Serial Programming Cable (Notifier ALMSC-119)	38.40		
28 31	23 00-0996	EA 120VAC Power Supply, Chassis, 80-Character Display, Keypad, NFS-320SYS CPU (Notifier CPU-320SYS).....	3,635.02		402.16
28 31	23 00-0997	EA 240VAC Power Supply, Chassis, 80-Character Display, Keypad, NFS-320SYS CPU (Notifier CPU-320SYSE)	3,635.02		402.16
28 31	23 00-0998	EA 3 dB Gain External/Remote Antenna (Notifier GSM-ANT3dB).....	144.84		4.02
28 31	23 00-0999	EA Plug In Transformer Box For IPGSM Communicator (Notifier HPTCOVER)	44.04		4.02
28 31	23 00-1000	EA Mounting Bracket Kit For SFB-5UD, SFB-10UD, NFW2-100 And NFW-50 (Notifier IPBRKT)	56.09		8.04
28 31	23 00-1001	EA Chassis To Mount IP Communicator In CHSA Series Chassis (Notifier IPCHSKIT).....	63.31		10.05
28 31	23 00-1002	EA IP Communicator (Notifier IPDACT-2)	485.01		20.11
28 31	23 00-1003	EA IP Communicator With Upload/Download Capability (Notifier IPDACT-2UD)	565.01		20.11
28 31	23 00-1004	EA Red, IP Communicator External Mounting Enclosure (Notifier IPENC)	129.01		20.11
		Note: Includes IPBRKT.			
28 31	23 00-1005	EA Black, IP Communicator External Mounting Enclosure (Notifier IPENC-B).....	129.01		20.11
		Note: Includes IPBRKT			
28 31	23 00-1006	EA Single Or Dual Path Commercial Fire Communicator (Notifier IPGSM-4G).....	676.32		30.16
28 31	23 00-1007	EA Dual 8TPC To Single 8TPC "Y" Splitter With Two 9" Cables For Combining Panel Phone Jacks To One IPDACT Input (Notifier IPSPLT).....	33.69		8.04
28 31	23 00-1008	EA Loop Control Module (Notifier LCM-320)	1,287.64		40.21
28 31	23 00-1009	EA Loop Expander Module (Notifier LEM-320).....	1,116.44		40.21
28 31	23 00-1010	EA Keyboard Display Module For CPU2-640 (Notifier KDM-R2).....	979.64		40.21
28 31	23 00-1011	EA 7' DACT Phone Cord (Notifier MCBL-7).....	16.04		
28 31	23 00-1012	EA Backbox For UDACT, With Viewing Window And Optional Relay Mount (Notifier UBS-1)	120.91		10.05
28 31	23 00-1013	EA Red, Metal Enclosure With Solid Door For Remote Mounting Of The UDACT-2 (Notifier UBS-1R)	141.01		20.11
28 31	23 00-1014	EA Black, Metal Enclosure With Solid Door For Remote Mounting Of The UDACT-2 (Notifier UBS-1B)	141.01		20.11
28 31	23 00-1015	EA Universal Digital Alarm Communicator Transmitter (Notifier UDACT-2)	540.21		20.11
28 31	23 00-1016	EA Universal Zone Coder (Notifier UZC-256)	728.21		20.11
28 31	23 00-1017	EA Hardware Kit To Connect UZC-256 To A PC (Notifier UZC-HI).....	220.84		
		Note: Includes null modem cable, AC power adapter, and 9-pin to 25-pin converter.			
28 31	23 00-1018	EA Programming Software For ONYX Series Products, DVC And Associated Amplifiers, DVC-RPU And UDACT-2 (Notifier VERIFIRE-TCD).....	493.66		
28 31	23 00-1019	EA ONYX Series Verifire Tools Upgrade (Notifier VERIFIREUG-TCD)	327.26		
28 31	23 00-1020	EA Central Station Receiver For Fire And Security (Notifier VISORALARM-PLUS).....	3,404.13		12.07
28 31	23 00-1021	ONYX Cabinets <small>(28 31 23 00-0982)</small>			
28 31	23 00-1022	EA Red, Two Tier Door For CA-2 Chassis Configuration (Notifier ADDR-B4R)	313.71		10.05
28 31	23 00-1023	EA Red, Three Tier Door For CA-2 Chassis Configuration (Notifier ADDR-C4R)	419.31		10.05
28 31	23 00-1024	EA Red, Four Tier Door For CA-2 Chassis Configuration (Notifier ADDR-D4R)	516.91		10.05
28 31	23 00-1025	EA Battery Dress Plate For NFS-640 And NFS-3030 (Notifier BP-4)	77.73		12.07
28 31	23 00-1026	EA Chassis Bridge (Notifier CB-1).....	68.11		10.05



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 31 23 00-1027	EA			Four Position Chassis (Notifier CHS-4)	115.31	10.05
28 31 23 00-1028	EA			Low Profile 1st Row Chassis Assembly For CPU-640 / CPU-640E (Notifier CHS-M2)	134.61	20.11
28 31 23 00-1029	EA			Black, Dress Panel Blank, Covers Unused Cabinet Row(s) (Notifier DP-1B)	61.33	12.07
28 31 23 00-1030	EA			Dress Plate For Top Row With CPU2-3030D (Notifier DP-DISP)	84.93	12.07
28 31 23 00-1031	EA			One Tier, "A" Size Door Assembly, Lexan Window, Lock And Keys (Notifier DR-A4)	245.01	20.11
28 31 23 00-1032	EA			One Tier, "A" Size Door Assembly, Solid Door, Lock And Keys (Notifier DR-A4B)	157.81	20.11
28 31 23 00-1033	EA			Two Tier, "B" Size Door Assembly, Lexan Window, Lock And Keys (Notifier DR-B4)	311.52	30.16
28 31 23 00-1034	EA			Two Tier, "B" Size Door Assembly, Solid Door, Lock And Keys (Notifier DR-B4B)	195.52	30.16
28 31 23 00-1035	EA			Three Tier, "C" Size Door Assembly, Lexan Window, Lock And Keys (Notifier DR-C4)	463.64	40.21
28 31 23 00-1036	EA			Three Tier, "C" Size Door Assembly, Solid Door, Lock And Keys (Notifier DR-C4B)	286.84	40.21
28 31 23 00-1037	EA			Four Tier, "D" Size Door Assembly, Lexan Window, Lock And Keys (Notifier DR-D4)	562.94	50.27
28 31 23 00-1038	EA			Four Tier, "D" Size Door Assembly, Solid Door, Lock And Keys (Notifier DR-D4B)	334.14	50.27
28 31 23 00-1039	EA			Black, One Tier, "AA" Size Door Assembly With Window, Lock And Keys (Notifier DR-AA4)	176.11	10.05
28 31 23 00-1040	EA			Black, One Tier, "AA" Size Door Assembly, Lock And Keys (Notifier DR-AA4B)	117.71	10.05
28 31 23 00-1041	EA			Red, One Tier, "AA" Size Door Assembly, Lock And Keys (Notifier DR-AA4BR)	110.51	10.05
28 31 23 00-1042	EA			Red, One Tier, "AA" Size Door Assembly With Window, Lock And Keys (Notifier DR-AA4R)	176.91	10.05
28 31 23 00-1043	EA			Red, One Tier, "A" Size Blank Door Assembly, Lock And Keys (Notifier DR-A4BR)	137.71	10.05
28 31 23 00-1044	EA			Red, One Tier, "A" Size Door Assembly, Lexan Window, Lock And Keys (Notifier DR-A4R)	224.91	10.05
28 31 23 00-1045	EA			Red, Two Tier, "B" Size Door Assembly, Solid Door, Lock And Keys (Notifier DR-B4BR)	155.31	10.05
28 31 23 00-1046	EA			Red, Two Tier, "B" Size Door Assembly, Lexan Window, Lock And Keys (Notifier DR-B4R)	271.31	10.05
28 31 23 00-1047	EA			Red, Three Tier, "C" Size Door Assembly, Solid Door, Lock And Keys (Notifier DR-C4BR)	226.51	10.05
28 31 23 00-1048	EA			Red, Three Tier, "C" Size Door Assembly, Lexan Window, Lock And Keys (Notifier DR-C4R)	403.31	10.05
28 31 23 00-1049	EA			Red, Four Tier, "D" Size Door Assembly, Solid Door, Lock And Keys (Notifier DR-D4BR)	253.71	10.05
28 31 23 00-1050	EA			Red, Four Tier, "D" Size Door Assembly, Lexan Window, Lock And Keys (Notifier DR-D4R)	482.51	10.05
28 31 23 00-1051	EA			Black, Two Tiers, Equipment Backbox Assembly (Notifier EQBB-B4)	241.01	20.11
28 31 23 00-1052	EA			Black, Three Tiers, Equipment Backbox Assembly (Notifier EQBB-C4)	351.41	20.11
28 31 23 00-1053	EA			Black, Four Tiers, Equipment Backbox Assembly (Notifier EQBB-D4)	414.61	20.11
28 31 23 00-1054	EA			Black, Vented, Two Tiers, Equipment Door Assembly (Notifier EQDR-B4)	258.61	20.11
28 31 23 00-1055	EA			Black, Vented, Three Tiers, Equipment Door Assembly (Notifier EQDR-C4)	376.21	20.11
28 31 23 00-1056	EA			Black, Vented, Four Tiers, Equipment Door Assembly (Notifier EQDR-D4)	437.81	20.11
28 31 23 00-1057	EA			Red, Two Tiers, Equipment Backbox Assembly (Notifier EQBB-B4R)	241.01	20.11
28 31 23 00-1058	EA			Red, Three Tiers, Equipment Backbox Assembly (Notifier EQBB-C4R)	351.41	20.11
28 31 23 00-1059	EA			Red, Four Tiers, Equipment Backbox Assembly (Notifier EQBB-D4R)	414.61	20.11
28 31 23 00-1060	EA			Red, Vented, Two Tiers, Equipment Door Assembly (Notifier EQDR-B4R)	258.61	20.11
28 31 23 00-1061	EA			Red, Vented, Three Tiers, Equipment Door Assembly (Notifier EQDR-C4R)	376.21	20.11
28 31 23 00-1062	EA			Red, Vented, Four Tiers, Equipment Door Assembly (Notifier EQDR-D4R)	437.81	20.11
28 31 23 00-1063	EA			Backbox With Door For ONYX Firstvision™ (Notifier FIRSTVISION-ENC)	2,234.16	100.54
28 31 23 00-1064	EA			CAB-4 Series Mounting Kit (Notifier P40-KITB)	220.21	20.11
Note: Includes chassis, hinged dress plate, and mounting hardware.						
28 31 23 00-1065	EA			Black, One Tier Backbox Assembly (Notifier SBB-A4)	256.65	60.32
28 31 23 00-1066	EA			Black, Two Tier Backbox Assembly (Notifier SBB-B4)	361.66	80.44
28 31 23 00-1067	EA			Black, Three Tier Backbox Assembly (Notifier SBB-C4)	469.66	80.44
28 31 23 00-1068	EA			Black, Four Tier Backbox Assembly (Notifier SBB-D4)	572.27	100.54
28 31 23 00-1069	EA			Black, Mini, One Tier, Backbox (Notifier SBB-AA4)	141.01	20.11
28 31 23 00-1070	EA			Red, Mini, One Tier, Backbox (Notifier SBB-AA4R)	141.01	20.11
28 31 23 00-1071	EA			Red, One Tier Backbox Assembly (Notifier SBB-A4R)	176.21	20.11
28 31 23 00-1072	EA			Red, Two Tier Backbox Assembly (Notifier SBB-B4R)	241.01	20.11
28 31 23 00-1073	EA			Red, Three Tier Backbox Assembly (Notifier SBB-C4R)	349.01	20.11
28 31 23 00-1074	EA			Red, Four Tier Backbox Assembly (Notifier SBB-D4R)	411.41	20.11
28 31 23 00-1075	EA			Trim Ring For NFS-320 Cabinet (Notifier TR-320)	129.73	12.07
28 31 23 00-1076	EA			Red, Trim Ring For NFS-320 Cabinet (Notifier TR-320R)	129.73	12.07
28 31 23 00-1077	EA			Black, "AA" Size Trim Ring For CAB-4 Or CAB-3 Series Cabinet (Notifier TR-AA4)	169.73	12.07
28 31 23 00-1078	EA			Black, "A" Size Trim Ring For CAB-4 Or CAB-3 Series Cabinet (Notifier TR-A4)	138.53	12.07
28 31 23 00-1079	EA			Black, "B" Size Trim Ring For CAB-4 Or CAB-3 Series Cabinet (Notifier TR-B4)	138.53	12.07
28 31 23 00-1080	EA			Black, "C" Size Trim Ring For CAB-4 Or CAB-3 Series Cabinet (Notifier TR-C4)	136.93	12.07
28 31 23 00-1081	EA			Black, "D" Size Trim Ring For CAB-4 Or CAB-3 Series Cabinet (Notifier TR-D4)	140.13	12.07
28 31 23 00-1082	EA			2" Filler Dress Plate For ADP-4B Installed In The Top Row Of A CAB-4 Series Backbox (Notifier VP-2B)	56.53	12.07
28 31 23 00-1083	EA			Wire Trays For Routing Wire In A CAB-4 Series Backbox (Notifier WC-2)	36.44	4.02
28 31 23 00-1084				NFS2-3030/640 Cabinet Mechanicals (28 31 23 00-0982)		
28 31 23 00-1085	EA			Dress Plate For Middle Rows With CPU2-640 (Notifier ADP2-640)	82.53	12.07
28 31 23 00-1086	EA			Blank Module Dress Plate (Notifier BM-1B)	68.93	12.07
28 31 23 00-1087	EA			Battery Dress Plate For NFS2-3030, NFS2-640, NCA-2 And DVC System (Notifier BP2-4)	77.73	12.07
28 31 23 00-1088	EA			Four Position Expansion Chassis (Notifier CHS-4MB)	171.31	10.05
28 31 23 00-1089	EA			Standard 1st Row Chassis Assembly For CPU-3030 (Notifier CHS-M3)	175.52	30.16
28 31 23 00-1090	EA			Dress Plate For Top Row With CPU2-640 (Notifier DP-DISP2)	85.73	12.07
28 31 23 00-1091				NFS-3030/640 Cabinet Mechanicals (28 31 23 00-0982)		
28 31 23 00-1092	EA			Annunciator Dress Plate (Notifier ADP-4B)	78.53	12.07
28 31 23 00-1093	EA			Blank Module Dress Plate (Notifier BMP-1)	50.53	12.07
28 31 23 00-1094	EA			Low Profile Four Position Chassis For AA-30 Or LDM (Notifier CHS-4L)	111.81	20.11
28 31 23 00-1095	EA			Module Dress Plate (Notifier MP-1B)	79.33	12.07
28 31 23 00-1096				Battery Cabinets (28 31 23 00-0982)		
28 31 23 00-1097	EA			Six Position Chassis (Notifier CHS-6)	74.05	20.11
28 31 23 00-1098	EA			Black, 24" x 14" x 7-3/4" Battery Backbox (Notifier NFS-LBB)	355.85	60.32

28 Electronic Safety And Security**28 30 Electronic Detection And Alarm****28 31 Fire Detection And Alarm**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 31 23 00-1099 Digital Voice <small>(28 31 23 00-0982)</small>		
28 31 23 00-1100 EA Chassis Used With BB-XP (Notifier 18439)	36.51	10.05
28 31 23 00-1101 EA 220 VAC, 100 Watts, 70.7 VRMS, Tone Generator, Audio Amplifier (Notifier AA-100E)	1,479.52	30.16
28 31 23 00-1102 EA 220 VAC, 120 Watts, 25 VRMS, Tone Generator, Audio Amplifier (Notifier AA-120E)	1,437.92	30.16
28 31 23 00-1103 EA 220 VAC, 30 Watts, 25 VRMS Audio Amplifier (Notifier AA-30E)	691.52	30.16
28 31 23 00-1104 EA Black, Two Tier Door For CA-2 Chassis Configuration (Notifier ADDR-B4).....	353.92	30.16
28 31 23 00-1105 EA Black, Three Tier Door For CA-2 Chassis Configuration (Notifier ADDR-C4)	479.64	40.21
28 31 23 00-1106 EA Black, Four Tier Door For CA-2 Chassis Configuration (Notifier ADDR-D4).....	597.34	50.27
28 31 23 00-1107 EA Multimode Audio Fiber Link Receiver (Notifier AFL-RM)	608.21	20.11
28 31 23 00-1108 EA Single Mode Audio Fiber Link Receiver (Notifier AFL-RS).....	1,345.01	20.11
28 31 23 00-1109 EA Multimode Audio Fiber Link Transmitter (Notifier AFL-TM)	608.21	20.11
28 31 23 00-1110 EA Single Mode Audio Fiber Link Transmitter (Notifier AFL-TS)	1,345.01	20.11
28 31 23 00-1111 EA 15" x 8-3/8" x 3-3/8", Flush Or Surface Mounted Backbox (Notifier AFAWS-BX)	75.71	10.05
28 31 23 00-1112 EA Flush Mounted, Key Lock, Door (Notifier AFAWS-KR)	121.71	10.05
28 31 23 00-1113 EA Surface Mounted, Key Lock, Door (Notifier AFAWS-KS).....	123.71	10.05
28 31 23 00-1114 EA Flush Mounted, Latch Style Lock, Door (Notifier AFAWS-LR)	122.11	10.05
28 31 23 00-1115 EA Surface Mounted, Latch Style Lock, Door (Notifier AFAWS-LS).....	123.71	10.05
28 31 23 00-1116 EA Armored Coil Cord, Telephone Chassis (Notifier AFAWS-TELA)	233.71	10.05
28 31 23 00-1117 EA Coil Cord, Telephone Chassis (Notifier AFAWS-TELC)	190.11	10.05
28 31 23 00-1118 EA Hammer Attached To Chain, Breakglass Insert (Notifier BRKG-B).....	52.04	
28 31 23 00-1119 EA For 25 VRMS DAX Or DAA2 Series, Back-Up Digital Amplifier (Notifier BDA-25V)	408.21	20.11
28 31 23 00-1120 EA For 70 VRMS DAX Or DAA2 Series, Back-Up Digital Amplifier (Notifier BDA-70V)	408.21	20.11
28 31 23 00-1121 EA Blank Dress Plate For CA-2 (Notifier BP-CA2)	71.31	10.05
28 31 23 00-1122 EA One Tier Chassis For Digital Voice Command Panel (Notifier CA-1).....	97.81	20.11
28 31 23 00-1123 EA Two Tier Chassis For Digital Voice Command Panel, With MIC-1 (Notifier CA-2).....	295.52	30.16
28 31 23 00-1124 EA Black, 6.08" x 8.301" x 3.655", Remote Cabinet (Notifier CAB-RM)	145.81	20.11
28 31 23 00-1125 EA Red, 6.08" x 8.301" x 3.655", Remote Cabinet (Notifier CAB-RMR)	145.81	20.11
28 31 23 00-1126 EA Chassis, Phone Well, TELH-1 And Hardware (Notifier CFFT-1).....	167.31	10.05
28 31 23 00-1127 EA Chassis With Paging Microphone With Well (Notifier CMIC-1)	192.11	10.05
28 31 23 00-1128 EA 120 VAC, 50 Watts, 25 VRMS Digital Audio Amplifier (Notifier DAA-5025).....	1,190.61	20.11
28 31 23 00-1129 EA Multi-Mode Fiber-Optic Media 50 Watts, 25 VRMS Digital Audio Amplifier (Notifier DAA-5025F)	966.30	20.11
28 31 23 00-1130 EA Single-Mode Fiber-Optic Media 50 Watts, 25 VRMS Digital Audio Amplifier (Notifier DAA-5025SF)	966.30	20.11
28 31 23 00-1131 EA 120 VAC, 50 Watts, 70 VRMS Digital Audio Amplifier (Notifier DAA-5070)	1,229.01	20.11
28 31 23 00-1132 EA Multi-Mode Fiber-Optic Media 50 Watts, 70 VRMS Digital Audio Amplifier (Notifier DAA-5070F)	1,050.49	20.11
28 31 23 00-1133 EA 120 VAC, 75 Watts, 25 VRMS Digital Audio Amplifier (Notifier DAA-7525).....	1,276.21	20.11
28 31 23 00-1134 EA Single-Mode Fiber-Optic Media 75 Watts, 25 VRMS Digital Audio Amplifier (Notifier DAA-7525SF)	1,260.96	20.11
28 31 23 00-1135 EA Single-Mode Fiber-Optic Media 75 Watt, 25 VRMS Digital Audio Amplifier (Notifier DAA-7525SF)	1,260.96	20.11
28 31 23 00-1136 EA 220-240 VAC, 50 Watts, 25 VRMS Digital Audio Amplifier (Notifier DAA2-5025E)	1,190.61	20.11
28 31 23 00-1137 EA 220-240 VAC, 50 Watts, 70 VRMS Digital Audio Amplifier (Notifier DAA2-5070E)	1,229.01	20.11
28 31 23 00-1138 EA 220-240 VAC, 75 Watts, 25 VRMS Digital Audio Amplifier (Notifier DAA2-7525E)	1,276.21	20.11
28 31 23 00-1139 EA 120 VAC, 35 Watts, 25 VRMS, Digital Audio Amplifier (Notifier DAX-3525)	815.41	20.11
28 31 23 00-1140 EA 220-240 VAC, 35 Watts, 25 VRMS, Digital Audio Amplifier (Notifier DAX-3525E)	815.41	20.11
28 31 23 00-1141 EA 120 VAC, 35 Watts, 70 VRMS, Digital Audio Amplifier (Notifier DAX-3570)	867.41	20.11
28 31 23 00-1142 EA 220-240 VAC, 35 Watts, 70 VRMS, Digital Audio Amplifier (Notifier DAX-3570E)	867.41	20.11
28 31 23 00-1143 EA 120 VAC, 50 Watts, 25 VRMS, Digital Audio Amplifier (Notifier DAX-5025)	901.01	20.11
28 31 23 00-1144 EA 220-240 VAC, 50 Watts, 25 VRMS, Digital Audio Amplifier (Notifier DAX-5025E)	901.01	20.11
28 31 23 00-1145 EA 120 VAC, 50 Watts, 70 VRMS, Digital Audio Amplifier (Notifier DAX-5070)	953.01	20.11
28 31 23 00-1146 EA 220-240 VAC, 50 Watts, 70 VRMS, Digital Audio Amplifier (Notifier DAX-5070E)	953.01	20.11
28 31 23 00-1147 EA Dress Plate For CFFT-1 (Notifier DP-CFFT).....	82.51	10.05
28 31 23 00-1148 EA Dress Panel For One Tier Chassis For Digital Voice Command Panel (Notifier DPA-1)	74.53	12.07
28 31 23 00-1149 EA Dress Panel For One Tier Chassis For Digital Voice Command Panel, Supports Keypad (Notifier DPA-1A4).....	85.73	12.07
28 31 23 00-1150 EA Dress Panel For Two Tier Chassis For Digital Voice Command Panel (Notifier DPA-2B)	145.73	12.07
28 31 23 00-1151 EA WPS Power Amplifier (Notifier DPA3204P)	480.21	20.11
28 31 23 00-1152 EA WPS Power Amplifier (Notifier DPA4001P)	404.21	20.11
28 31 23 00-1153 EA Modem Interface For Direct Wire (No Dial-Up Capabilities) For Interconnecting Panels (Notifier DPI-232)	848.21	20.11
28 31 23 00-1154 EA 120 VAC, 125 Watts, 25 VRMS Digital Series Amplifier (Can Be Converted To 70 VRMS, 100 Watts With A DS-XF70V) (Notifier DS-AMP)	640.21	20.11
28 31 23 00-1155 EA 220-240 VAC, 125 Watts, 25 VRMS Digital Series Amplifier (Can Be Converted To 70 VRMS, 100 Watts With A DS-XF70V) (Notifier DS-AMPE)	640.21	20.11
28 31 23 00-1156 EA Digital Series Distribution Board, Supports One To Four DS-Amp Or DS-AMPE (Notifier DS-DB)	1,080.21	20.11
28 31 23 00-1157 EA 125 Watts, 25 VRMS DS Series Backup Amplifier Board (Can Be Converted To 70 VRMS, 100 Watts Amplifier With A DS-XF70V) (Notifier DS-BDA).....	440.21	20.11
28 31 23 00-1158 EA Converts One DAX Or DAA2 DAL Port To Multi-Mode Fiber, Fiber Option Module (Notifier DS-FM)	224.21	20.11
28 31 23 00-1159 EA Converts One DAX Or DAA2 Port To ST Style Multi-Mode Fiber (For Connection To DVC-EMF Or DAA-XXXF Series Amplifier), Fiber Option Module (Notifier DS-RFM)	224.21	20.11
28 31 23 00-1160 EA Converts One DAX Or DAA2 DAL Port To Single-Mode Fiber, Fiber Option Module (Notifier DS-SFM).....	224.21	20.11
28 31 23 00-1161 EA Converts DS-AMP, DS-AMPE, Or DS-BDA To 70 VRMS, 100 Watts, DS Series Transformer (Notifier DS-XF70V)	96.21	20.11
28 31 23 00-1162 EA Analog Output Board For Digital Voice Command (Notifier DVC-AO)	212.21	20.11
28 31 23 00-1163 EA Extended Memory For Digital Voice Command (Notifier DVC-EM)	1,200.21	20.11
28 31 23 00-1164 EA Keypad For Digital Voice Command (Notifier DVC-KD).....	356.44	40.21
28 31 23 00-1165 EA Replacement Microphone For NFC-50/100, NFC-LOC, NFC-RPU And NFC-RM (Notifier ECC-MICROPHONE)	169.64	
28 31 23 00-1166 EA Fire Fighters Telephone Control With Master Handset (Notifier FFT-7).....	1,227.26	40.21
28 31 23 00-1167 EA Portable Fireman's Telephone Handset (Notifier FHS)	108.44	
28 31 23 00-1168 EA Red, Fireman's Telephone Handset (Notifier FHS-F)	108.44	
28 31 23 00-1169 EA Recessed, Fireman's Handset Storage Cabinet, Holds Six Handsets (Notifier FHSC-R).....	301.81	20.11
28 31 23 00-1170 EA Surface Mounted, Fireman's Handset Storage Cabinet, Holds Six Handsets (Notifier FHSC-S).....	301.81	20.11
28 31 23 00-1171 EA Fireman's Phone Jack On A Single Gang Plate (Notifier FPJ)	49.67	6.03
28 31 23 00-1172 EA Paging Microphone Only (Notifier MIC-1)	145.01	20.11
28 31 23 00-1173 EA Firefighter's Telephone Handset (Notifier TELH-1).....	119.24	
28 31 23 00-1174 EA Remote Microphone Assembly For Mounting On An ADP-4 Dress Plate (Notifier RM-1).....	351.41	20.11
28 31 23 00-1175 EA Remote Microphone Assembly For Mounting In A Stand Alone Cabinet (Notifier RM-1SA)	351.41	20.11



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 31 23 00-1176 Amplifiers <small>(28 31 23 00-0982)</small>		
28 31 23 00-1177 EA 30 Watt Audio Amplifier At 25 VRMS, 120 VAC (Notifier AA-30).....	671.41	20.11
28 31 23 00-1178 EA 100 Watt Audio Amplifier At 70.7 VRMS, 120 VAC, Tone Generator (Notifier AA-100).....	1,459.41	20.11
28 31 23 00-1179 EA 120 Watt Audio Amplifier At 25 VRMS, 120 VAC, Tone Generator (Notifier AA-120).....	1,417.81	20.11
28 31 23 00-1180 EA Audio Coupling Transformer (Notifier ACT-1).....	106.61	20.11
28 31 23 00-1181 EA Audio Coupling Transformer For Analog Amplifiers (Notifier ACT-2).....	124.21	20.11
28 31 23 00-1182 EA Audio Coupling Transformer For DVC-AO (Notifier ACT-4).....	124.21	20.11
28 31 23 00-1183 EA Audio Coupling Transformer For DAA-5025 (Notifier ACT-25).....	124.21	20.11
28 31 23 00-1184 EA Audio Coupling Transformer For DAA-5070 (Notifier ACT-70).....	124.21	20.11
28 31 23 00-1185 FireVoice-25/50 Emergency Voice Evacuation Control Panels <small>(28 31 23 00-0982)</small>		
28 31 23 00-1186 EA 25 Watt, 25 VRMS Voice Evacuation Control Panel (Notifier NFV-25/50).....	2,744.88	402.16
28 31 23 00-1187 EA Single Channel 25 Watt, 25 VRMS Voice Evacuation Control Panel (Notifier NFV-25/50DA).....	1,982.96	402.16
28 31 23 00-1188 EA Single Channel 25 Watt, 25 VRMS Voice Evacuation Control Panel Used With NFV-25/50ZS (Notifier NFV-25/50DAZS).....	2,530.20	402.16
28 31 23 00-1189 EA Zoned System 25 Watt, 25 VRMS Voice Evacuation Control Panel (Notifier NFV-25/50ZS).....	3,245.81	402.16
28 31 23 00-1190 EA Zoned System With Telephone 25 Watt, 25 VRMS Voice Evacuation Control Panel (Notifier NFV-25/50ZST).....	3,574.15	402.16
28 31 23 00-1191 System Printer <small>(28 31 23 00-0982)</small>		
28 31 23 00-1192 EA 80 Column, 120 VAC, Desktop Printer (Notifier PRN-6).....	1,449.81	20.11
28 31 23 00-1193 Batteries <small>(28 31 23 00-0982)</small>		
28 31 23 00-1194 EA 5 Amp Hour, 12 VDC, Sealed Battery Pack (Notifier BAT-1250-BP).....	405.01	20.11
28 31 23 00-1195 EA 7 Amp Hour, 12 VDC, Sealed Battery Pack (Notifier BAT-1270-BP).....	313.81	20.11
28 31 23 00-1196 EA 12 Amp Hour, 12 VDC, Sealed Battery Pack (Notifier BAT-12120-BP).....	411.41	20.11
28 31 23 00-1197 EA 18 Amp Hour, 12 VDC, Sealed Battery Pack (Notifier BAT-12180-BP).....	221.65	20.11
28 31 23 00-1198 EA 26 Amp Hour, 12 VDC, Sealed Battery Pack (Notifier BAT-12260-BP).....	336.21	20.11
28 31 23 00-1199 EA 55 Amp Hour, 12 VDC, Sealed Battery (Notifier BAT-12550).....	335.41	20.11
28 31 23 00-1200 EA 100 Amp Hour, 12 VDC, Sealed Battery (Notifier BAT-121000).....	531.25	20.11
28 31 23 00-1201 Battery Backboxes And Miscellaneous Mechanicals <small>(28 31 23 00-0982)</small>		
28 31 23 00-1202 EA 14-1/2" x 8-1/4" x 4-3/4", Holds Up To Two BAT-12180 Batteries, Battery Backbox (Notifier BB-17).....	103.37	16.09
28 31 23 00-1203 EA 24" x 12.55" x 5.218", Mounts Up To Six XP6 Boards Or ACPS-610, Cabinet (Notifier BB-25)..... Note: XP6 modules require a CHS-6.	159.37	16.09
28 31 23 00-1204 EA 15.6" x 15.5" x 5.152", Mounts Up To Two 26 Amp Hour And Charger, Battery Backbox (Notifier BB-26).....	287.26	80.44
28 31 23 00-1205 EA Holds Up To Two BAT-12120 12 Amp Hour Batteries, Battery Holder (Notifier CHS-BH).....	137.24	40.21
28 31 23 00-1206 EA Holds Up To Two BAT-12120 12 Amp Hour Batteries, Battery Holder (Notifier CHS-BH1).....	62.51	10.05
28 31 23 00-1207 EA Battery Bracket For Two 26 Amp Hour Batteries (Notifier SEISKIT-BB25).....	175.37	16.09
28 31 23 00-1208 EA Two 26 Amp Hour Battery Bracket Seismic Kit For CAB-4 Series Cabinets (Notifier SEISKIT-CAB).....	136.17	16.09
28 31 23 00-1209 EA Two 12 Amp Hour Battery Bracket Seismic Kit For DAX, DAA, And DAA2 Series Amplifiers (Notifier SEISKIT-DAA).....	150.57	16.09
28 31 23 00-1210 EA Two 55 Amp Hour Battery Bracket Seismic Kit For NFS-LBB (Notifier SEISKIT-LBB).....	163.37	16.09
28 31 23 00-1211 Power Supplies And Chargers <small>(28 31 23 00-0982)</small>		
28 31 23 00-1212 EA 120 VAC, 6 Or 10 Amps, Addressable Charging Power Supply (Notifier ACPS-610).....	1,020.32	30.16
28 31 23 00-1213 EA 220/240 VAC, 6 Or 10 Amps, Addressable Charging Power Supply (Notifier ACPS-610E).....	1,020.32	30.16
28 31 23 00-1214 EA Addressable Power Supply, 120 VAC For NFS-3030, NFS2-3030 And NCA-2 (Notifier AMPS-24).....	1,023.41	20.11
28 31 23 00-1215 EA 6A Auxiliary Power Supply (Notifier APS-6R).....	522.62	20.11
28 31 23 00-1216 EA 10 Amp Battery Charger (Notifier BC10A).....	644.32	30.16
28 31 23 00-1217 EA 33.34" x 22.5" x 7.5", Holds Four 55 Amp Hour Or Two 100 Amp Hour Batteries, For NFS-3030 Or NFS2-3030, Combination Power Supply And Battery Enclosure (Notifier BB-100).....	379.46	24.13
28 31 23 00-1218 EA 33.34" x 22.5" x 7.5", Holds Four 55 Amp Hour Or Two 100 Amp Hour Batteries, For NFS-3030 Or NFS2-3030, Red, Combination Power Supply And Battery Enclosure (Notifier BB-100R).....	379.46	24.13
28 31 23 00-1219 EA 30.34" x 36.5" x 7.5", Holds Four 55 Amp Hour Or Four 100 Amp Hour Batteries, For NFS2-3030, Combination Power Supply And Battery Enclosure (Notifier BB-200).....	545.06	24.13
28 31 23 00-1220 EA 30.34" x 36.5" x 7.5", Holds Four 55 Amp Hour Or Four 100 Amp Hour Batteries, For NFS2-3030, Red, Combination Power Supply And Battery Enclosure (Notifier BB-200R).....	545.06	24.13
28 31 23 00-1221 EA 15.218" x 14.5" x 3.562" ACPS Stand-Alone Cabinet (Notifier CAB-PS1).....	102.61	20.11
28 31 23 00-1222 EA 25 To 120 Amp Hour Battery Charger (Notifier CHG-120).....	789.81	20.11
28 31 23 00-1223 EA Mounts XPIQ-Ps And/Or CHS-BH In A CAB-3/4 Row, Also Mount One ACPS-610 In CAB-3 Row, Chassis Assembly (Notifier CHS-PS).....	58.51	10.05
28 31 23 00-1224 EA Replacement Door Used For Mounting ACPS-610 (E) In A CAB-PS1 Cabinet When Replacing ACPS-2406 (Notifier DR-PS1).....	92.11	10.05
28 31 23 00-1225 EA 8.0 Amps, 120 VAC Remote Charger Power Supply (Notifier FCPS-24S8).....	525.01	20.11
28 31 23 00-1226 EA 8.0 Amps, 240 VAC Remote Charger Power Supply (Notifier FCPS-24S8E).....	605.45	60.32
28 31 23 00-1227 EA Red, 8.0 Amps, 240 VAC Remote Charger Power Supply (Notifier FCPS-24S8R).....	605.45	60.32
28 31 23 00-1228 EA 8 Amp, 24 VDC, 120 VAC, NAC Fire Alarm Power Supply (Notifier HPFF8).....	691.05	60.32
28 31 23 00-1229 EA 8 Amp, 24 VDC, 220 VAC, NAC Fire Alarm Power Supply (Notifier HPFF8E).....	691.05	60.32
28 31 23 00-1230 EA Chassis Mounted, 8 Amp, 24 VDC, 120 VAC, NAC Fire Alarm Power Supply (Notifier HPFF8CM).....	660.32	30.16
28 31 23 00-1231 EA Chassis Mounted, 8 Amp, 24 VDC, 220 VAC, NAC Fire Alarm Power Supply (Notifier HPFF8CME).....	660.32	30.16
28 31 23 00-1232 EA 12 Amp, 24 VDC, 120 VAC, NAC Fire Alarm Power Supply (Notifier HPFF12).....	800.32	30.16
28 31 23 00-1233 EA 12 Amp, 24 VDC, 220 VAC, NAC Fire Alarm Power Supply (Notifier HPFF12E).....	800.32	30.16
28 31 23 00-1234 EA Chassis Mounted, 12 Amp, 24 VDC, 120 VAC, NAC Fire Alarm Power Supply (Notifier HPFF12CM).....	830.72	60.32
28 31 23 00-1235 EA Chassis Mounted, 12 Amp, 24 VDC, 220 VAC, NAC Fire Alarm Power Supply (Notifier HPFF12CME).....	830.72	60.32

28 Electronic Safety And Security**28 30 Electronic Detection And Alarm****28 31 Fire Detection And Alarm**

MINOR			TOTAL DIRECT	DEMOLITION
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST
28 31 23 00-1236	EA	6 Amp, 24 VDC, 120 VAC, NAC Fire Alarm Power Supply (Notifier HPF24S6).....	577.45	60.32
28 31 23 00-1237	EA	6 Amp, 24 VDC, 220 VAC, NAC Fire Alarm Power Supply (Notifier HPF24S6E).....	577.45	60.32
28 31 23 00-1238	EA	8 Amp, 24 VDC, 120 VAC, NAC Fire Alarm Power Supply (Notifier HPF24S8).....	623.05	60.32
28 31 23 00-1239	EA	8 Amp, 24 VDC, 220 VAC, NAC Fire Alarm Power Supply (Notifier HPF24S8E).....	623.05	60.32
28 31 23 00-1240	EA	6 Amp, 24 VDC, 120 VAC, NAC Fire Alarm Power Supply (Notifier HPF602ULADA).....	500.65	60.32
28 31 23 00-1241	EA	9 Amp, 24 VDC, 120 VAC, NAC Fire Alarm Power Supply (Notifier HPF902ULADA).....	590.25	60.32
28 31 23 00-1242	EA	Class A Adapter HPFF8/HPFF12 (Notifier HPP31076).....	120.11	10.05
28 31 23 00-1243	EA	Main Power Supply And Charger, Up To 3 Amps (Notifier MPS-24A).....	755.82	20.11
28 31 23 00-1244	EA	Class A (Style Y) NAC Option Module For FCPS-2406 And FCPS-2408 (Notifier ZNAC-4).....	139.41	20.11
28 31 23 00-1245		Network Control Annunciators (28 31 23 00-0982)		
28 31 23 00-1246	EA	Network Control Annunciator For NFS2-3030, NFS-3030, NFS-320, NFS-640 And NFS2-640 (Notifier NCA-2).....	1,440.65	60.32
28 31 23 00-1247	EA	Retro-Fit Plate For Mounting NCA2 (Notifier NCA-2RETRO).....	56.93	12.07
28 31 23 00-1248	EA	Kit For Mounting NCA-2 To CHS-M2 (Notifier NCA/640-2-Kit).....	41.73	12.07
28 31 23 00-1249		FIRSTVISION Firefighter's Display (28 31 23 00-0982)		
28 31 23 00-1250	EA	Replacement ONYX Firstvision™ Touchscreen Assembly (Notifier FIRSTVISION-LCD).....	11,208.62	402.16
28 31 23 00-1251		FlashScan Addressable Modules (28 31 23 00-0982)		
28 31 23 00-1252	EA	Intelligent Addressable Control Module (Notifier FCM-1).....	127.41	20.11
28 31 23 00-1253	EA	Addressable Dual Monitor Module (Notifier FDM-1).....	141.81	20.11
28 31 23 00-1254	EA	Intelligent Addressable Monitor Module (Notifier FMM-1).....	106.61	20.11
28 31 23 00-1255	EA	Intelligent Addressable Miniature Monitor Module (Notifier FMM-101).....	95.41	20.11
28 31 23 00-1256	EA	Intelligent Addressable 4 - 20mA Analog Input Module (Notifier FMM-4-20).....	192.21	20.11
28 31 23 00-1257	EA	Intelligent Addressable Relay Module (Notifier FRM-1).....	122.61	20.11
28 31 23 00-1258	EA	Intelligent Addressable 2-Wire Detector Monitor Module (Notifier FZM-1).....	159.41	20.11
28 31 23 00-1259	EA	SLC Loop Powered Fault Isolator Module (Notifier ISO-X).....	105.01	20.11
28 31 23 00-1260		Addressable Device Bases And Accessories (28 31 23 00-0982)		
28 31 23 00-1261	EA	Intelligent Detector Base With Flange (Notifier B710LP).....	36.11	10.05
28 31 23 00-1262	EA	Weatherproof Device Housing (Notifier DH400OE-1).....	321.01	20.11
28 31 23 00-1263		XP6/XP10 Transponder (28 31 23 00-0982)		
28 31 23 00-1264	EA	Synchronization Daughter Module For XP6-C (Notifier SYNC-1).....	95.01	20.11
28 31 23 00-1265	EA	Six Circuit Supervised Control Module (Notifier XP6-C).....	459.41	20.11
28 31 23 00-1266	EA	Six Zone Intelligent To Conventional Interface Module (Notifier XP6-MA).....	555.41	20.11
28 31 23 00-1267	EA	Six Relay Control Module (Notifier XP6-R).....	441.81	20.11
28 31 23 00-1268	EA	Ten Input Monitor Module (Notifier XP10-M).....	531.41	20.11
28 31 23 00-1269		LCD Display Annunciators (28 31 23 00-0982)		
28 31 23 00-1270	EA	80 Character LCD Fire Annunciator For FireWarden-100-2, NFS-640, NFS2-640 And NFS-320 (Notifier FDU-80).....	596.65	60.32
28 31 23 00-1271	EA	80 Character LCD Annunciator For NFS-640, NFS-3030, NFS2-640, NFS2-3030 And NFS-320 (Notifier LCD-80).....	832.65	60.32
28 31 23 00-1272	EA	640 Character LCD Annunciator For NFS-3030 And NFS2-3030 (Notifier LCD-160).....	861.45	60.32
28 31 23 00-1273	EA	8 To 16 Switch Smoke Control Expander (Notifier SCE-8).....	563.41	20.11
28 31 23 00-1274	EA	8 To 16 Switch Smoke Control Lamp Driver Expander (Notifier SCE-8L).....	300.21	20.11
28 31 23 00-1275	EA	Eight Switch Smoke Control Master Module (Notifier SCS-8).....	731.41	20.11
28 31 23 00-1276		ONYX ACM And AEM Series LED Annunciators (28 31 23 00-0982)		
28 31 23 00-1277	EA	Remote, Eight Form C Relay Module (Notifier ACM-8R).....	331.41	20.11
28 31 23 00-1278	EA	16 Alarm LEDs, 16 Trouble LEDs, 16 Controls Switches, Annunciator Control Module (Notifier ACM-16AT).....	607.41	20.11
28 31 23 00-1279	EA	16 Alarm LEDs, 16 Trouble LEDs, 16 Control Switches, Annunciator Expander Module (Notifier AEM-16AT).....	465.81	20.11
28 31 23 00-1280	EA	24 Alarm LEDs, 24 Trouble LEDs, 24 Control Switches, Annunciator Control Module (Notifier ACM-24AT).....	607.41	20.11
28 31 23 00-1281	EA	24 Alarm LEDs, 24 Trouble LEDs, 24 Control Switches, Annunciator Expander Module (Notifier AEM-24AT).....	465.81	20.11
28 31 23 00-1282	EA	32 Alarm LEDs And 1 Trouble LED, Control Module (Notifier ACM-32A).....	465.81	20.11
28 31 23 00-1283	EA	32 Alarm And 1 Trouble LED, Annunciator Expander Module (Notifier AEM-32A).....	417.81	20.11
28 31 23 00-1284	EA	48 Alarm And 1 Trouble LED Annunciator Control Module (Notifier ACM-48A).....	465.81	20.11
28 31 23 00-1285	EA	48 Alarm And 1 Trouble LED, Annunciator Expander Module (Notifier AEM-48A).....	417.81	20.11
28 31 23 00-1286		Graphic Annunciator - Lamp Driver Modules (28 31 23 00-0982)		
28 31 23 00-1287	EA	Single Annunciator Flush Mounted Backbox (Notifier ABF-1B).....	197.24	40.21
28 31 23 00-1288	EA	Single Annunciator Flush Mounted Backbox With Glass Door And Key Lock (Notifier ABF-1DB).....	214.04	40.21
28 31 23 00-1289	EA	Two Annunciator Flush Mounted Backbox (Notifier ABF-2B).....	246.94	50.27
28 31 23 00-1290	EA	Two Annunciator Flush Mounted Backbox With Glass Door And Key Lock (Notifier ABF-2DB).....	268.54	50.27
28 31 23 00-1291	EA	Four Annunciator Flush Mounted Backbox (Notifier ABF-4B).....	430.35	70.38
28 31 23 00-1292	EA	Annunciator Blank Plate Used With ACM-32A/ACM-16AT (Notifier ABM-1).....	76.53	12.07
28 31 23 00-1293	EA	Single Annunciator Surface Mounted Backbox (Notifier ABS-1B).....	128.84	40.21
28 31 23 00-1294	EA	Single Annunciator Surface Mounted Backbox With Trim (Notifier ABS-1TB).....	107.31	10.05
28 31 23 00-1295	EA	Two Annunciator Surface Mounted Backbox (Notifier ABS-2B).....	159.64	40.21
28 31 23 00-1296	EA	12" x 12" x 3-3/4" Surface Or Semi-Flush Mount Backbox (Notifier ABS-2D).....	279.74	50.27
28 31 23 00-1297	EA	Red, Surface (Or Semi-Flush) Mounted Backbox For ACS Annunciators, SCS Series, NCA And NCA-2 (Notifier ABS-2DR).....	199.31	10.05



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 31 23 00-1298 EA Black, 12" x 20" x 3-1/2" Surface Or Semi-Flush Backbox (Notifier ABS-4D).....	451.95	70.38
28 31 23 00-1299 EA Red, 12" x 20" x 3-1/2" Surface Or Semi-Flush Backbox (Notifier ABS-4DR)	335.33	12.07
28 31 23 00-1300 EA Black, 9-15/16" x 4-5/8" x 2-1/2" Surface Backbox (Notifier ABS-8RB)	130.57	16.09
28 31 23 00-1301 EA Annunciator Key Switch (Notifier AKS-1B).....	64.07	6.03
28 31 23 00-1302 EA Chassis Used To Mount NCA-2 In ABS-2D (Notifier CHS-2D).....	74.21	20.11
28 31 23 00-1303 EA 32 Alarm Lamp Driver Annunciator Control Module (Notifier LDM-32)	417.81	20.11
28 31 23 00-1304 EA 24" Lamp Driver Annunciator Cable (Notifier LDM-CBL24)	122.44	4.02
28 31 23 00-1305 EA 48" Lamp Driver Annunciator Cable (Notifier LDM-CBL48)	152.84	4.02
28 31 23 00-1306 EA 32 Alarm Lamp Driver Annunciator Expander Module (Notifier LDM-E32).....	345.01	20.11
28 31 23 00-1307 EA Lamp Driver Module (Notifier LDM-R32)	599.41	20.11
28 31 23 00-1308 EA Eight Switch Smoke Control Lamp Driver Master Module (Notifier SCS-8L)	556.21	20.11
28 31 23 00-1309 EA 48" Cable Assembly For Smoke Control Lamp Driver (Notifier SCS8L-CBL48)	155.24	4.02
28 31 23 00-1310 EA Black, Trim Ring For ABS-2D Cabinet (Notifier TR-ABS2D).....	128.13	12.07
28 31 23 00-1311 EA Black, Trim Ring For ABS-4D Cabinet (Notifier TR-ABS4D).....	79.33	12.07
28 31 23 00-1312 EA Red, Trim Ring For ABS-4D Cabinet (Notifier TR-ABS4DR)	79.33	12.07
28 31 23 00-1313 Network Gateways <small>(28 31 23 00-0982)</small>		
28 31 23 00-1314 EA Common Alerting Protocol Gateway (Notifier CAP-GW)	2,240.21	20.11
28 31 23 00-1315 EA PC Version, Receivers Gateway (Notifier DACR-GW)	1,752.21	20.11
28 31 23 00-1316 EA Fiber-Optic Cable Interface (Multi-Mode), High-Speed Network Communications Module (Notifier HS-NCM-MF)	1,672.21	20.11
28 31 23 00-1317 EA Fiber-Optic Cable Interface (Multi-Mode Fiber To Single-Mode Fiber), High-Speed Network Communications Module (Notifier HS-NCM-MFSF).....	1,872.21	20.11
28 31 23 00-1318 EA Fiber-Optic Cable Interface (Single-Mode), High-Speed Network Communications Module (Notifier HS-NCM-SF)	2,080.21	20.11
28 31 23 00-1319 EA Twisted-Pair Wire Interface, High-Speed Network Communications Module (Notifier HS-NCM-W).....	1,592.21	20.11
28 31 23 00-1320 EA Wire And Fiber-Optic Cable Interface, High-Speed Network Communications Module (Multi-Mode) (Notifier HS-NCM-WMF)	1,632.21	20.11
28 31 23 00-1321 EA Wire And Fiber-Optic Cable Interface (Single-Mode), High-Speed Network Communications Module (Notifier HS-NCM-WSF)	1,836.21	20.11
28 31 23 00-1322 EA Modbus Gateway (Notifier MODBUS-GW)	1,752.21	20.11
28 31 23 00-1323 EA 22" Widescreen HD LED Color Monitor With Speakers (Notifier MON-22LCDW)	2,133.08	13.27
28 31 23 00-1324 EA Capacitive Touch-Screen, 22" Widescreen HD LED Color Monitor With Speakers (Notifier MON-22LCDW-TS)	3,180.28	13.27
28 31 23 00-1325 EA 1920x1080P Wide Screen (Notifier MON-42LCDW)	10,093.08	13.27
28 31 23 00-1326 EA Single Monitor, Wall Mounted, Horizontal, Tilt, Bracket (Notifier MON-42HORZ-SD).....	412.32	30.16
28 31 23 00-1327 EA Single Monitor, Vertical Mounted, Bracket (Notifier MON-42VERT-SD)	752.32	30.16
28 31 23 00-1328 EA Dual Monitors, Vertical Wall Mounted, Fixed Position, Bracket (Notifier MON-42VERT-DD)	1,096.32	30.16
28 31 23 00-1329 EA Mass Notification Voice Paging (Notifier NOTIFY-IP)	840.00	
28 31 23 00-1330 EA Non UL Listed Applications, Mass Notification Voice Paging (Notifier NOTIFY-IP-NOUL)	840.00	
28 31 23 00-1331 EA Embedded NFN Gateway (Notifier NFN-GW-EM)	1,752.21	20.11
28 31 23 00-1332 EA NFN Gateway PC Card With Fiber (Notifier NFN-GW-PC-F)	1,752.21	20.11
28 31 23 00-1333 EA High Speed NFN Gateway PC Card For Multimode Fiber (Included With ONYXworks-HNMF) (Notifier NFN-GW-PC-HNMF).....	2,552.21	20.11
28 31 23 00-1334 EA High Speed NFN Gateway PC Card For Single Mode Fiber (Included With ONYXworks-HNSF) (Notifier NFN-GW-PC-HNSF)	2,976.21	20.11
28 31 23 00-1335 EA High Speed NFN Gateway PC Card For Wire (Included With ONYXworks-HNW) (Notifier NFN-GW-PC-HNW)	2,552.21	20.11
28 31 23 00-1336 EA NFN Gateway PC Card With Wire (Notifier NFN-GW-PC-W).....	1,752.21	20.11
28 31 23 00-1337 EA E-Mail Option For ONYXworks (Notifier ONYX-NOTIFY).....	840.00	
28 31 23 00-1338 EA Alpha-Numeric Pager Option For ONYXworks (Notifier ONYX-PAGER).....	840.00	
28 31 23 00-1339 EA ONYXWorks Workstation (Notifier ONYXWORKS-WS)	15,930.35	482.58
28 31 23 00-1340 EA Fiber Network Graphical User Interface (Notifier ONYXWorks-Lite OW-LITE-NW).....	3,360.86	
Note: Includes PC slot network fiber card, workstation software and security key with a four node license. Excludes PC workstation.		
28 31 23 00-1341 EA Wired Network Graphical User Interface (Notifier ONYXWorks-Lite OW-LITE-NF).....	3,360.86	
Note: Includes PC slot network fiber card, workstation software and security key with a four node license. Excludes PC workstation.		
28 31 23 00-1342 EA Fiber Optics, Standard Network Repeater Board (Notifier RPT-F)	777.81	20.11
28 31 23 00-1343 EA Wire, Standard Network Repeater Board (Notifier RPT-W)	631.41	20.11
28 31 23 00-1344 EA Wire To Fiber Optics, Standard Network Repeater Board (Notifier RPT-WF).....	757.01	20.11
28 31 23 00-1345 EA Signaling Line Circuit Integration Module (Notifier SLC-IM).....	836.21	20.11
28 31 23 00-1346 EA VESDA Gateway That Provides A Communication Link Between The Noti-Fire-Net™ Network And Vesda™ Detectors On The Vesdanet™ (Notifier VESDA-HLI-GW).....	1,752.21	20.11
28 31 23 00-1347 EA Vesda™ High Level Interface Card Used With SLC-IM And Vesda-HLI-GW To Provide A Communication Link Between The Noti-Fire-Net™ Network And Vesda™ Detectors On The Vesdanet™ (Notifier VHx-1420-HFS)	1,448.21	20.11
28 31 23 00-1348 EA Windows 7 Hard Drive Upgrade (Notifier WIN7-UG-US-3).....	1,600.00	
28 31 23 00-1349 NOTI-FIRE-NET Network Components <small>(28 31 23 00-0982)</small>		
28 31 23 00-1350 EA Interface Between NOTI-FIRE-NET 50 And BACnet (Notifier BACNET-GW-3)	1,752.21	20.11
28 31 23 00-1351 EA Fiber Optic Network Communications Module (Notifier NCM-F).....	781.81	20.11
28 31 23 00-1352 EA NOTI-FIRE-NET Web Server (Notifier NWS).....	1,752.21	20.11
28 31 23 00-1353 EA Wired Network Communications Module (Notifier NCM-W)	745.01	20.11
28 31 23 00-1354 EA Fiber Optic Converter Module Mounting Kit (Notifier SMF-Kit)	72.31	10.05
28 31 23 00-1355 FireWarden Addressable Fire Panels <small>(28 31 23 00-0982)</small>		
28 31 23 00-1356 EA 50 Point, Addressable Fire Alarm Control Panel With Digital Alarm Communicator/Transmitter (Notifier NFW-50).....	1,568.31	402.16
28 31 23 00-1357 EA Black, One SLC Loop, 120 VAC, 198 Point Addressable Fire Alarm Control Panel With Digital Alarm Communicator/Transmitter (Notifier NFW2-100)	1,852.31	402.16
28 31 23 00-1358 EA Black, One DC Loop, 120 VAC, 198 Point Addressable Fire Alarm Control Panel With Digital Alarm Communicator/Transmitter (Notifier NFW2-100C).....	1,852.31	201.07
28 31 23 00-1359 EA Black, One SLC Loop, 240 VAC, 198 Point Addressable Fire Alarm Control Panel With Digital Alarm Communicator/Transmitter (Notifier NFW2-100E).....	1,852.31	201.07

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MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 31 23 00-1360 EA Red, One SLC Loop, 120 VAC, 198 Point Addressable Fire Alarm Control Panel With Digital Alarm Communicator/Transmitter (Notifier NFW2-100R).....	1,852.31	201.07
28 31 23 00-1361 FireWarden Accessories (28 31 23 00-0982)		
28 31 23 00-1362 EA Intelligent Multicriteria Photo/Thermal Detector With Base (Notifier NP-A100).....	139.52	30.16
28 31 23 00-1363 EA Intelligent Addressable Photo/Thermal Detector With Base (Notifier NP-100T).....	138.72	30.16
28 31 23 00-1364 FireWarden Devices (28 31 23 00-0982)		
28 31 23 00-1365 EA SLC Loop Powered Fault Isolator Module (Notifier N100-ISO).....	104.21	20.11
28 31 23 00-1366 EA Intelligent Addressable Control Module (Notifier NC-100).....	123.41	20.11
28 31 23 00-1367 EA Intelligent Addressable Relay Module (Notifier NC-100R).....	118.61	20.11
28 31 23 00-1368 EA Intelligent Addressable Low Flow Duct Photoelectric Smoke Detector (Notifier ND-100).....	253.11	30.16
28 31 23 00-1369 EA Intelligent Addressable Low Flow Duct Photoelectric Smoke Detector With DPDT Relay (Notifier ND-100R).....	303.63	30.16
28 31 23 00-1370 EA Two Zone Intelligent Addressable, Two Wire Detector Monitor Module (Notifier NDM-100).....	118.61	20.11
28 31 23 00-1371 EA Intelligent Addressable Thermal Detector With Base (Notifier NH-100).....	122.72	30.16
28 31 23 00-1372 EA Intelligent Addressable High Temperature Thermal Detector With Base (Notifier NH-100H).....	122.72	30.16
28 31 23 00-1373 EA Intelligent Addressable Rate-Of-Rise Thermal Detector With Base (Notifier NH-100R).....	122.72	30.16
28 31 23 00-1374 EA Intelligent Addressable Ionization Smoke Detector With Base (Notifier NI-100).....	164.32	30.16
28 31 23 00-1375 EA Intelligent Addressable Monitor Module (Notifier NMM-100).....	102.61	20.11
28 31 23 00-1376 EA Intelligent Addressable Mini Monitor Module (Notifier NMM-100P).....	93.41	20.11
28 31 23 00-1377 EA Intelligent Addressable Manual Pull Station (Notifier NOT-BG12LX).....	138.21	20.11
28 31 23 00-1378 EA Intelligent Addressable Photoelectric Smoke Detector With Base (Notifier NP-100).....	128.32	30.16
28 31 23 00-1379 EA Intelligent Addressable 2-Wire Detector Monitor Module (Notifier NZM-100).....	154.61	20.11
28 31 23 00-1380 EA Six Zone Intelligent Addressable 2-Wire Detector Monitor Module (Notifier NZM-100-6).....	542.61	20.11
28 31 23 00-1381 SFP-2402 And SFP-2404 2 And 4-Zone Control Panels And Accessories (28 31 23 00-0982)		
28 31 23 00-1382 EA 120 VAC, Two Zone Conventional Fire Alarm Control Panel (Notifier SFP-2402).....	1,043.45	321.72
28 31 23 00-1383 EA 120 VAC, Four Zone Conventional Fire Alarm Control Panel (Notifier SFP-2404).....	1,146.65	321.72
28 31 23 00-1384 EA 240 VAC, Two Zone Conventional Fire Alarm Control Panel (Notifier SFB-2402E).....	802.16	100.54
28 31 23 00-1385 EA 240 VAC, Four Zone Conventional Fire Alarm Control Panel (Notifier SFB-2404E).....	905.36	100.54
28 31 23 00-1386 EA Class A Converter Module (Notifier CAC-4).....	271.41	20.11
28 31 23 00-1387 EA Optional Internal Dress Panel For SFB-2402 And SFB-2404 Only (Notifier DP-3-B).....	91.33	12.07
28 31 23 00-1388 EA Internal Dress Plate, Required For FM And ULC (Notifier DP-4X).....	92.93	12.07
28 31 23 00-1389 EA Remote Zone Annunciator (Notifier RZA-4X).....	135.52	30.16
28 31 23 00-1390 SFP-5UD 5 Zone Control Panels And Accessories (28 31 23 00-0982)		
28 31 23 00-1391 EA 120 VAC, Five Zone Conventional Fire Alarm Control Panel (Notifier SFP-5UD).....	1,600.31	402.16
28 31 23 00-1392 EA 120 VAC, Five Zone Conventional Fire Alarm Control Panel (Notifier SFB-5UDC).....	2,422.47	301.62
28 31 23 00-1393 EA 240 VAC, Five Zone Conventional Fire Alarm Control Panel (Notifier SFB-5UDE).....	1,600.31	201.07
28 31 23 00-1394 EA Red, 120 VAC, Five Zone Conventional Fire Alarm Control Panel (Notifier SFB-5UDR).....	1,600.31	201.07
28 31 23 00-1395 EA Class A Converter Module (Notifier N-CAC-5X).....	271.41	20.11
28 31 23 00-1396 EA Red, Trim Ring For NFW2-100, NFW-50, SFB-5UD, SFB-10UD, RP-2001, RP-2002 Cabinet (Notifier TR-CE).....	108.13	12.07
28 31 23 00-1397 SFP-10UD 10 Zone Control Panels And Accessories (28 31 23 00-0982)		
28 31 23 00-1398 EA 120 VAC, 10 Zone Conventional Fire Alarm Control Panel With Built-In Digital Alarm Communicator Transmitter (Notifier SFB-10UDC).....	2,980.62	402.16
28 31 23 00-1399 EA 240 VAC, 10 Zone Conventional Fire Alarm Control Panel With Built-In Digital Alarm Communicator Transmitter (Notifier SFB-10UDE).....	2,229.67	301.62
28 31 23 00-1400 EA 120 VAC, 10 Zone Conventional Fire Alarm Control Panel With Built-In Digital Alarm Communicator Transmitter (Notifier SFP-10UD).....	1,824.31	402.16
28 31 23 00-1401 EA Red, 120 VAC, 10 Zone Conventional Fire Alarm Control Panel With Built-In Digital Alarm Communicator Transmitter (Notifier SFB-10UDR).....	2,631.82	402.16
28 31 23 00-1402 EA Four Channel, Dual Line, Stand Alone Fire Alarm Communicator (Fire-Lite 411UDAC).....	463.05	60.32
28 31 23 00-1403 Smoke Detectors (28 31 23 00-0982)		
28 31 23 00-1404 EA Intelligent Addressable Beam Smoke Detector (Notifier FSB-200).....	1,160.44	40.21
28 31 23 00-1405 EA Intelligent Addressable Beam Smoke Detector With Remote Test Feature (Notifier FSB-200S).....	1,320.44	40.21
28 31 23 00-1406 EA Low Profile Intelligent Addressable Ionization Smoke Detector (Notifier FSI-851).....	175.52	30.16
28 31 23 00-1407 EA Intelligent Addressable Laser Smoke Detector (Notifier FSL-751).....	292.32	30.16
28 31 23 00-1408 EA Intelligent Addressable Laser Duct Smoke Detector (Notifier FSL-751D).....	733.84	30.16
28 31 23 00-1409 EA Low Profile Intelligent Addressable Photoelectric Smoke Detector (Notifier FSP-851).....	142.72	30.16
28 31 23 00-1410 EA Remote Test Capable, Low Profile Intelligent Addressable Photoelectric Smoke Detector (Notifier FSP-851R).....	145.12	30.16
28 31 23 00-1411 EA Intelligent Addressable Thermal Detector (Notifier FST-851).....	118.72	30.16
28 31 23 00-1412 EA Intelligent Addressable High Temperature Thermal Detector (Notifier FST-851H).....	118.72	30.16
28 31 23 00-1413 EA Intelligent Addressable Rate-Of-Rise Thermal Detector (Notifier FST-851R).....	118.72	30.16
28 31 23 00-1414 EA Remote Test Capable Intelligent Addressable Photo Detector (Notifier NP-100R).....	130.72	30.16
Note: For use with DNR(W) duct detector housing.		
28 31 23 00-1415 EA Filters For Harsh Detector (Notifier RF-FTX).....	15.77	
28 31 23 00-1416 EA Key Activated Remote Test Station For Duct Smoke Detector (Notifier RTS151KEY).....	106.41	20.11
28 31 23 00-1417 Pull Stations (28 31 23 00-0982)		
28 31 23 00-1418 EA Trim Ring For NBG12 Series Pull Station (Notifier BG12TR).....	22.44	4.02
28 31 23 00-1419 EA One End Tapped For 1/2" Conduit, Aluminum, Surface Mounted Backbox (Notifier BG-2).....	48.91	10.05



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
				28 31 23 00-1420 EA Red, One End Tapped For 1/2" Conduit, Aluminum, Surface Mounted Backbox (Notifier BG-2R)	48.91	10.05
				28 31 23 00-1421 EA Red Letters, Spring Retainer, Aluminum Single Action Pull Station (Notifier BNG-1)	67.81	20.11
				28 31 23 00-1422 EA DPDT Switch, Red Letters, Spring Retainer, Aluminum Single Action Pull Station (Notifier BNG-1F)	73.81	20.11
				28 31 23 00-1423 EA Terminal Switch, DPDT Switch, Red Letters, Spring Retainer, Aluminum Single Action Pull Station (Notifier BNG-1FTS)	97.41	20.11
				28 31 23 00-1424 EA Red Body, Silver Letters, Spring Retainer, Aluminum Single Action Pull Station (Notifier BNG-1R)	67.81	20.11
				28 31 23 00-1425 EA Red Letters, Spring Retainer, Aluminum Single Action Pull Station With Terminal Strip (Notifier BNG-1TS)	76.61	20.11
				28 31 23 00-1426 EA Standard "Local" Style Red Letters, Spring Retainer, Aluminum Single Action Pull Station With Terminal Strip (Notifier BNG-1TSL)	76.61	20.11
				28 31 23 00-1427 EA Terminal Strip, Red Body, Red Letters, Spring Retainer, Aluminum Single Action Pull Station (Notifier BNG-1TSR)	76.61	20.11
				28 31 23 00-1428 EA Red Letters, Breakglass, Aluminum Single Action Pull Station (Notifier BRG-1)	73.01	20.11
				28 31 23 00-1429 EA Red Body, Silver Letters, Breakglass, Aluminum Single Action Pull Station (Notifier BRG-1R)	78.21	20.11
				28 31 23 00-1430 EA Hazardous, Non-Hazardous, Weatherproof, Harsh Locations Fire Alarm Pull Station (Notifier HAZ-WP-PULL)	548.26	24.13
				28 31 23 00-1431 EA Red, Key Lock, Dual Action Fire Alarm Pull Station (Notifier NBG-12L)	73.21	20.11
				28 31 23 00-1432 EA Red, Outdoor, Key Lock, Dual Action Fire Alarm Pull Station (Notifier NBG-12LOB)	164.26	24.13
				28 31 23 00-1433 EA Red, Presignal, Key Lock, Dual Action Fire Alarm Pull Station (Notifier NBG-12LPS)	97.81	20.11
				28 31 23 00-1434 EA Red, Agent Releasing, Key Lock, Dual Action Fire Alarm Pull Station (Notifier NBG-12LR)	66.21	20.11
				28 31 23 00-1435 EA Addressable Manual Dual Action Fire Alarm Pull Station (Notifier NBG-12LX)	139.01	20.11
				28 31 23 00-1436 EA Pull Station Trim Plate For New York City, For Use With All NBG Series Pull Stations (Notifier NY-PLATE)	34.44	4.02
28 31 23 00-1437				Rate Compensation Heat Detectors (28 31 23 00-0982)		
				28 31 23 00-1438 EA 135 Degree F Explosion Proof Rate Compensation Heat Detectors (Edwards Signaling 302-EPM-135)	130.72	30.16
				28 31 23 00-1439 EA 194 Degree F Explosion Proof Rate Compensation Heat Detectors (Edwards Signaling 302-EPM-194)	130.72	30.16
28 31 23 00-1440				FM Series Door Releases (28 31 23 00-0982)		
				28 31 23 00-1441 EA 1/2" Door Holder Spacer (Notifier FM900-50)	21.67	6.03
				28 31 23 00-1442 EA 3/4" Door Holder Spacer (Notifier FM900-75)	21.67	6.03
				28 31 23 00-1443 EA 1" Door Holder Spacer (Notifier FM900-100)	21.67	6.03
				28 31 23 00-1444 EA Door Holder Extension Kit (Notifier FM900)	22.87	6.03
				28 31 23 00-1445 EA 90 Degree Door Holder Extension Kit (Notifier FM900-Z)	23.27	6.03
				28 31 23 00-1446 EA Floor Mounted, 12VDC, 24VAC/DC Or 120VAC, Door Holder (Notifier FM980)	157.12	30.16
				28 31 23 00-1447 EA Surface Mounted, 12VDC, 24VAC/DC Or 120VAC, Door Holder (Notifier FM996)	137.12	30.16
				28 31 23 00-1448 EA Recessed Mounted, Concealed Wiring, 12VDC, 24VAC/DC Or 120VAC, Door Holder (Notifier FM998)	137.12	30.16
28 31 23 00-1449				Multicriteria Fire Detector (28 31 23 00-0982)		
				28 31 23 00-1450 EA Intelligent Addressable Combination Multi-Criteria Fire/Carbon Monoxide Detector With Flashscan (Notifier FCO-851)	236.32	30.16
				28 31 23 00-1451 EA Intelligent Addressable Multicriteria Fire Detector (Notifier FSC-851)	218.72	30.16
				Note: Detects fire, thermal, photo, CO and IR, with Flashscan.		
				28 31 23 00-1452 EA Low Profile Intelligent Addressable Photoelectric Smoke Detector With Built-In 135°F Fixed Temperature Thermal Device (Notifier FSP-851T)	143.52	30.16
28 31 23 00-1453				Modules (28 31 23 00-0982)		
				28 31 23 00-1454 EA Intelligent Addressable Dual Monitor/Dual Relay Module (Notifier FDRM-1)	266.61	20.11
				28 31 23 00-1455 EA Addressable Firephone Control Module (Notifier FTM-1)	158.61	20.11
28 31 23 00-1456				DH Series Door Releases (28 31 23 00-0982)		
				28 31 23 00-1457 EA Semi-Flush, Powder Coated Chrome, Electromagnetic Door Holder (Notifier DH24120FPC)	135.52	30.16
				28 31 23 00-1458 EA Semi-Flush, Plated Brass, Electromagnetic Door Holder (Notifier DH24120FB)	143.84	30.16
				28 31 23 00-1459 EA Semi-Flush, Powder Coated Dark Bronze, Electromagnetic Door Holder (Notifier DH24120FD)	152.32	30.16
				28 31 23 00-1460 EA Surface Mounted, Powder Coated Chrome, Electromagnetic Door Holder (Notifier DH24120SPC)	149.92	30.16
				28 31 23 00-1461 EA Surface Mounted, Plated Brass, Electromagnetic Door Holder (Notifier DH24120SB)	157.12	30.16
				28 31 23 00-1462 EA Surface Mounted, Powder Coated Dark Bronze, Electromagnetic Door Holder (Notifier DH24120SPD)	162.72	30.16
				28 31 23 00-1463 EA Recessed, Powder Coated Chrome, Electromagnetic Door Holder (Notifier DH24120WPC)	135.52	30.16
				28 31 23 00-1464 EA Recessed, Plated Brass, Electromagnetic Door Holder (Notifier DH24120WB)	143.52	30.16
				28 31 23 00-1465 EA Recessed, Powder Coated Dark Bronze, Electromagnetic Door Holder (Notifier DH24120WD)	152.32	30.16
				28 31 23 00-1466 EA Floor Mounted, Single Door, Powder Coated Chrome, Electromagnetic Door Holder (Notifier DH24120GPC1)	171.52	30.16
				28 31 23 00-1467 EA Floor Mounted, Single Door, Plated Brass, Electromagnetic Door Holder (Notifier DH24120GB1)	182.72	30.16
				28 31 23 00-1468 EA Floor Mounted, Single Door, Powder Coated Dark Bronze, Electromagnetic Door Holder (Notifier DH24120GPD1)	195.52	30.16
				28 31 23 00-1469 EA Floor Mounted, Double Door, Powder Coated Chrome, Electromagnetic Door Holder (Notifier DH24120GPC2)	198.72	30.16
				28 31 23 00-1470 EA Floor Mounted, Double Door, Plated Brass, Electromagnetic Door Holder (Notifier DH24120GB2)	211.52	30.16
				28 31 23 00-1471 EA Floor Mounted, Double Door, Powder Coated Dark Bronze, Electromagnetic Door Holder (Notifier DH24120GPD2)	227.52	30.16
				28 31 23 00-1472 EA .5" Extension Rod, Powder Coated Chrome, Electromagnetic Door Holder Extension (Notifier DHE.5PC)	15.72	4.02
				28 31 23 00-1473 EA .5" Extension Rod, Plated Brass, Electromagnetic Door Holder Extension (Notifier DHE.5B)	15.72	4.02
				28 31 23 00-1474 EA .5" Extension Rod, Powder Coated Dark Bronze, Electromagnetic Door Holder Extension (Notifier DHE.5D)	17.00	4.02
				28 31 23 00-1475 EA 1" Extension Rod, Powder Coated Chrome, Electromagnetic Door Holder Extension (Notifier DHE1PC)	15.72	4.02
				28 31 23 00-1476 EA 1" Extension Rod, Plated Brass, Electromagnetic Door Holder Extension (Notifier DHE1B)	15.72	4.02
				28 31 23 00-1477 EA 1" Extension Rod, Powder Coated Dark Bronze, Electromagnetic Door Holder Extension (Notifier DHE1D)	17.00	4.02
				28 31 23 00-1478 EA 1.5" Extension Rod, Powder Coated Chrome, Electromagnetic Door Holder Extension (Notifier DHE1.5PC)	16.68	4.02
				28 31 23 00-1479 EA 1.5" Adjustable Extension Rod, Powder Coated Chrome, Electromagnetic Door Holder Extension (Notifier DHE1.5APC)	16.68	4.02
				28 31 23 00-1480 EA 1.5" Extension Rod, Plated Brass, Electromagnetic Door Holder Extension (Notifier DHE1.5B)	17.00	4.02
				28 31 23 00-1481 EA 1.5" Extension Rod, Powder Coated Dark Bronze, Electromagnetic Door Holder Extension (Notifier DHE1.5D)	17.96	4.02
				28 31 23 00-1482 EA 2" Extension Rod, Powder Coated Chrome, Electromagnetic Door Holder Extension (Notifier DHE2PC)	17.96	4.02

28 Electronic Safety And Security**28 30 Electronic Detection And Alarm****28 31 Fire Detection And Alarm**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 31	23 00-1483	EA	2" Adjustable Extension Rod, Powder Coated Chrome, Electromagnetic Door Holder Extension (Notifier DHE2APC)	17.96	4.02
28 31	23 00-1484	EA	2" Extension Rod, Plated Brass, Electromagnetic Door Holder Extension (Notifier DHE2B).....	18.44	4.02
28 31	23 00-1485	EA	2" Extension Rod, Powder Coated Dark Bronze, Electromagnetic Door Holder Extension (Notifier DHE2D)	18.76	4.02
28 31	23 00-1486	EA	3" Extension Rod, Powder Coated Chrome, Electromagnetic Door Holder Extension (Notifier DHE3PC).....	18.76	4.02
28 31	23 00-1487	EA	3" Extension Rod, Plated Brass, Electromagnetic Door Holder Extension (Notifier DHE3B).....	19.72	4.02
28 31	23 00-1488	EA	3" Extension Rod, Powder Coated Dark Bronze, Electromagnetic Door Holder Extension (Notifier DHE3D)	19.72	4.02
28 31	23 00-1489	EA	4" Extension Rod, Powder Coated Chrome, Electromagnetic Door Holder Extension (Notifier DHE4PC)	20.04	4.02
28 31	23 00-1490	EA	4" Adjustable Extension Rod, Powder Coated Chrome, Electromagnetic Door Holder Extension (Notifier DHE4APC)	20.04	4.02
28 31	23 00-1491	EA	4" Adjustable Extension Rod, Plated Brass, Electromagnetic Door Holder Extension (Notifier DHE4AB).....	20.84	4.02
28 31	23 00-1492	EA	4" Adjustable Extension Rod, Powder Coated Dark Bronze, Electromagnetic Door Holder Extension (Notifier DHE4AD).....	23.24	4.02
28 31	23 00-1493	EA	5" Extension Rod, Powder Coated Chrome, Electromagnetic Door Holder Extension (Notifier DHE5PC).....	20.84	4.02
28 31	23 00-1494	EA	5" Extension Rod, Plated Brass, Electromagnetic Door Holder Extension (Notifier DHE5B).....	21.80	4.02
28 31	23 00-1495	EA	5" Extension Rod, Powder Coated Dark Bronze, Electromagnetic Door Holder Extension (Notifier DHE5D)	23.24	4.02
28 31	23 00-1496	EA	Catch Plate, Powder Coated Chrome For Electromagnetic Door Holder (Notifier DHCP)	22.15	6.03
28 31	23 00-1497	EA	Catch Plate, Plated Brass For Electromagnetic Door Holder (Notifier DHCPB).....	22.79	6.03
28 31	23 00-1498	EA	Catch Plate, Powder Coated Dark Bronze For Electromagnetic Door Holder (Notifier DHCPD)	24.87	6.03
28 31	23 00-1499	EA	Swivel Base, Powder Coated Chrome, For Electromagnetic Door Holder (Notifier DHSBPC)	39.75	6.03
28 31	23 00-1500	EA	Swivel Base, Plated Brass, For Electromagnetic Door Holder (Notifier DHSBB).....	42.31	6.03
28 31	23 00-1501	EA	Swivel Base, Powder Coated Dark Bronze, For Electromagnetic Door Holder (Notifier DHSBD)	44.87	6.03
28 31	23 00-1502	EA	Surface Mounted Backbox, Powder Coated Chrome For Electromagnetic Door Holder (Notifier DHBBPC).....	37.39	10.05
28 31	23 00-1503	EA	Surface Mounted Backbox, Plated Brass For Electromagnetic Door Holder (Notifier DHBBB)	39.31	10.05
28 31	23 00-1504	EA	Surface Mounted Backbox, Powder Coated Dark Bronze For Electromagnetic Door Holder (Notifier DHBBD)	42.03	10.05
28 31	23 00-1505	EA	Swivel Base Mounting Drill Fixture For Electromagnetic Door Holder (Notifier DHDF).....	216.00	
28 31	23 00-1506	EA	Two Piece Extension Wrench (Notifier DHW).....	2.40	
28 31	23 00-1507		First Command <small>(28 31 23 00-0982)</small>		
28 31	23 00-1508	EA	Black, 120 VAC, 50 Watts, 25 VRMS, One Class A/B Speaker Circuit, Primary Operating Console (Notifier NFC-50/100)	4,259.58	502.70
28 31	23 00-1509	EA	Black, 220-240 VAC, 50 Watts, 25 VRMS, One Class A/B Speaker Circuit, Primary Operating Console (Notifier NFC-50/100E).....	4,259.58	502.70
28 31	23 00-1510	EA	Black, 120 VAC, 50 Watts, 25 VRMS Or 70 VRMS, Four Class A/B Speaker Circuits, Distributed (Remote) Audio Amplifier (Notifier NFC-50DA).....	1,157.66	40.21
28 31	23 00-1511	EA	Black, 220-240 VAC, 50 Watts, 25 VRMS Or 70 VRMS, Four Class A/B Speaker Circuits, Distributed (Remote) Audio Amplifier (Notifier NFC-50DAE)	1,157.66	40.21
28 31	23 00-1512	EA	Black, 120 VAC, 125 Watts, 25 VRMS, Four Class A/B Speaker Outputs, Distributed Audio Amplifier (Notifier NFC-125DA).....	2,111.26	40.21
28 31	23 00-1513	EA	Black, 220-240 VAC, 125 Watts, 25 VRMS, Four Class A/B Speaker Outputs, Distributed Audio Amplifier (Notifier NFC-125DAE)	2,111.26	40.21
28 31	23 00-1514	EA	50 Watts, 25 VRMS Audio Amplifier Module For A Second Speaker Circuit Or Backup (Notifier NFC-BDA-25 Volt).....	460.21	20.11
28 31	23 00-1515	EA	50 Watts, 70 VRMS Audio Amplifier Module For A Second Speaker Circuit Or Backup (Notifier NFC-BDA-70 Volt).....	460.21	20.11
28 31	23 00-1516	EA	Circuit Expander Module For NFC-50/125DA(E), Four Additional Class A/B Speaker Circuits (Notifier NFC-CE4)	313.01	20.11
28 31	23 00-1517	EA	Circuit Expander Module For NFC-50/100(E), Six Additional Class A/B Speaker Circuits (Notifier NFC-CE6)	440.21	20.11
28 31	23 00-1518	EA	Standalone Firefighter Telephone System (Notifier NFC-FFT)	1,564.86	40.21
28 31	23 00-1519	EA	Note: Includes onboard SLC supports up to 24 monitor modules, built-in handset, black. Local Operator Console (Notifier NFC-LOC)	1,513.66	40.21
28 31	23 00-1520	EA	Note: Includes built-in microphone, message and zone control switches, black. Black, Remote Microphone (Notifier NFC-RM)	435.24	
28 31	23 00-1521	EA	Remote Page Unit (Notifier NFC-RPU).....	1,280.86	40.21
28 31	23 00-1522	EA	Note: Includes built-in microphone, message control switches, black. Remote Telephone Zone Module (Notifier NFC-RTZM)	581.01	20.11
28 31	23 00-1523	EA	70 V Conversion Module For NFC-50/100 (Notifier NFC-XRM-70V)	237.81	20.11
28 31	23 00-1524	EA	Firefighters Phone Jack (Notifier N-FPJ)	109.67	6.03
28 31	23 00-1525	EA	Thumbatch Option For NFC-LOC And NFC-RPU (Notifier THUMBATCH)	31.27	6.03
28 31	23 00-1526	EA	Black, Trim Ring For NFC-RPU Cabinet (Notifier TR-6-B).....	95.33	12.07
28 31	23 00-1527		LED Displays <small>(28 31 23 00-0982)</small>		
28 31	23 00-1528	EA	2.1" x 27" Programmable LED Indoor Display (Notifier ALPHA-215)	1,048.26	24.13
28 31	23 00-1529	EA	Instant And Integrated Emergency Notification System (Notifier LEDSIGN-GW)	1,776.35	32.17
28 31	23 00-1530	EA	4" x 45-1/2" Programmable LED Array, Mass Notification Device (Notifier MEGADOT)	1,824.35	32.17
28 31	23 00-1531	EA	8 Messages, FACP Interface For LED Arrays (Notifier MNS-CONTROL8)	1,224.35	32.17
28 31	23 00-1532	EA	16 Messages, FACP Interface For LED Arrays (Notifier MNS-CONTROL16)	1,864.35	32.17
28 31	23 00-1533	EA	LED Sign, Instant And Integrated Emergency Notification System (Notifier OAX2-24V)	1,824.35	32.17
28 31	23 00-1534		Control Relays <small>(28 31 23 00-0982)</small>		
28 31	23 00-1535	EA	Single SPDT Relay With LED With Metal Backbox And Red Plastic Cover (Notifier MR-101/CR)	47.31	10.05
28 31	23 00-1536	EA	Single SPDT Relay With LED With Track Mounting Hardware (Notifier MR-101/T)	37.71	10.05
28 31	23 00-1537	EA	Four Position SPDT Relay With LEDs With Metal Backbox And Red Plastic Cover (Notifier MR-104/CR)	123.41	20.11
28 31	23 00-1538	EA	Four Position SPDT Relay With LED With Track Mounting Hardware (Notifier MR-104/T).....	76.11	10.05
28 31	23 00-1539	EA	Four Position DSPDT Relay With LED With Track Mounting Hardware (Notifier MR-204/T).....	90.51	10.05
28 31	23 00-1540	EA	24 VDC, 30 Amp Contacts, DPDT Relay In Steel Enclosure (Notifier MR-199X-13C).....	110.61	20.11
28 31	23 00-1541	EA	120 VAC, 30 Amp Contacts, DPDT Relay In Steel Enclosure (Notifier MR-199X-14C).....	110.61	20.11
28 31	23 00-1542	EA	Single DPDT Relay With LED With Metal Backbox And Red Plastic Cover (Notifier MR-201/CR).....	70.61	20.11
28 31	23 00-1543	EA	Single DPDT Relay With LED With Track Mounting Hardware (Notifier MR-201/T)	40.51	10.05
28 31	23 00-1544	EA	Four Position DPDT Relay With LEDs With Metal Backbox And Red Plastic Cover (Notifier MR-204/CR)	140.21	20.11
28 31	23 00-1545	EA	24 VDC/24 VAC/115 VAC, 10 Amp, Form C, Multi-Voltage Relay Module (Notifier PAM-1)	53.01	20.11



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 31 23 00-1546 EA 12/24 VDC, 7 Amp, Form C, Multi-Voltage Relay Module (Notifier PAM-2).....	53.01	20.11
28 31 23 00-1547 EA 9 To 40 VDC, 10 Amp, Form C, Multi-Voltage Relay Module (Notifier PAM-4).....	53.01	20.11
28 31 23 00-1548 Gamewell-FCI Fire Control Instruments (28 31 23 00-0982)		
28 31 23 00-1549 7100 Series And NetSOLO® (28 31 23 00-1548)		
28 31 23 00-1550 7100 Compact Analog Addressable Fire Alarm Control Panels (28 31 23 00-1549)		
28 31 23 00-1551 EA Enclosure With Metal Door (Gamewell-FCI 7100-ENCL-M).....	682.30	241.30
28 31 23 00-1552 EA Basic Systems Kit, 2 Signaling Line Circuits (SLC) (Gamewell-FCI BK-7100-2).....	2,833.11	402.16
28 31 23 00-1553 EA Basic Systems Kit, With Digital Alarm Communicator Transmitter (DACT), 2 Signaling Line Circuits (SLC) (Gamewell-FCI BK-7100-2D).....	3,065.57	402.16
28 31 23 00-1554 EA Basic Systems Kit, 2 Signaling Line Circuits (SLC), 240 VAC (Gamewell-FCI BK-7100-2-E).....	2,833.11	402.16
28 31 23 00-1555 EA Basic Systems Kit, With Digital Alarm Communicator Transmitter (DACT), 2 Signaling Line Circuits (SLC), 240 VAC (Gamewell-FCI BK-7100-2D-E).....	3,065.57	402.16
28 31 23 00-1556 EA Replacement Board For 7100-1D (Gamewell-FCI BSM-7100-1).....	796.64	40.21
28 31 23 00-1557 EA Replacement Board For 7100-2 (Gamewell-FCI BSM-7100-1D).....	952.15	40.21
28 31 23 00-1558 EA Analog Loop Unit (Gamewell-FCI ALU).....	952.15	40.21
28 31 23 00-1559 NetSOLO® Intelligent Network (28 31 23 00-1549)		
28 31 23 00-1560 EA Intelligent Network Interface Module, Fiber Optic (Gamewell-FCI INI-7100-FO)..... Note: Mounted in 7100 panel.	1,054.47	40.21
28 31 23 00-1561 EA Intelligent Network Interface Module, Unshielded Twisted Pair (Gamewell-FCI INI-7100-UTP)..... Note: Mounted in 7100 panel.	840.84	40.21
28 31 23 00-1562 Components And Accessories (28 31 23 00-1549)		
28 31 23 00-1563 EA Remote Serial Annunciator, LCD Display (Gamewell-FCI LCD-7100).....	523.60	30.16
28 31 23 00-1564 EA Remote LED Driver Module, Outputs For Remote Panel Switches And 33 Remote LEDs (Gamewell-FCI LDM-7100).....	404.57	40.21
28 31 23 00-1565 EA Fiber Optic Line Driver Module (Gamewell-FCI FLD-1).....	729.52	40.21
28 31 23 00-1566 EA Class "A" Optional Module For Both Signaling Line Circuits (SLC) (Gamewell-FCI CAOM).....	303.07	40.21
28 31 23 00-1567 EA Replacement Enclosure Box (Gamewell-FCI EN-7100).....	264.81	80.44
28 31 23 00-1568 EA Serial Printer (Order RJAA To Db25 Connector Separately) (Gamewell-FCI P7200-TR-2).....	753.95	20.11
28 31 23 00-1569 E3 Series® Basic System (28 31 23 00-1548)		
28 31 23 00-1570 EA Intelligent Loop Interface, Mother Board (Gamewell-FCI ILI-MB-E3).....	717.80	40.21
28 31 23 00-1571 EA Intelligent Loop Interface, Supplemental (Gamewell-FCI ILI-S-E3).....	621.53	40.21
28 31 23 00-1572 EA Intelligent Loop Interface, Mother Board, XP95 Protocol (Gamewell-FCI ILI95-MB-E3).....	717.80	40.21
28 31 23 00-1573 EA Intelligent Loop Interface, Supplemental, XP95 Protocol (Gamewell-FCI ILI95-S-E3).....	621.53	40.21
28 31 23 00-1574 EA LCD Keypad Display (Gamewell-FCI LCD-E3).....	452.18	40.21
28 31 23 00-1575 EA Power Supply Module (Gamewell-FCI PM-9).....	587.80	40.21
28 31 23 00-1576 EA Transponder 9 Ampere Power Supply (Gamewell-FCI PM-9 INX).....	496.98	40.21
28 31 23 00-1577 EA Power Supply And Charger, 120/220 VAC (Gamewell-FCI PM-9G 9A).....	484.16	20.11
28 31 23 00-1578 EA Digital Alarm Communication Transmitter (Gamewell-FCI DACT-E3).....	289.04	40.21
28 31 23 00-1579 EA Network Repeater, Fiber Optic (Gamewell-FCI RPT-E3-FO).....	749.05	40.21
28 31 23 00-1580 EA Network Repeater, Unshielded Twisted Pair (Gamewell-FCI RPT-E3-UTP).....	630.03	40.21
28 31 23 00-1581 EA Local Operating Console (Gamewell-FCI 1100-0455).....	422.06	30.16
28 31 23 00-1582 EA Network Graphic Annunciator (Gamewell-FCI 1100-0505).....	1,335.31	30.16
28 31 23 00-1583 EA 70.7 VRMS Audio Output Series Amplifier Module (Gamewell-FCI AM-50-70).....	540.55	40.21
28 31 23 00-1584 EA INI-VGE-UTP Classic Enabled Voice Gateway Module (Gamewell-FCI 1100-1326).....	1,616.47	40.21
28 31 23 00-1585 EA 8-1/4" Wide x 10" High x 4-1/2" Deep Cabinet (Gamewell-FCI E3BB-BAA1).....	400.21	80.44
28 31 23 00-1586 EA C Size, Black, Command Center Enclosure (Gamewell-FCI E3BB-BC/INCC).....	302.61	80.44
28 31 23 00-1587 EA Double Size, Blank, Inner Door Panel (Gamewell-FCI E3-BP).....	67.32	20.11
28 31 23 00-1588 EA Programmable Switch Module (Gamewell-FCI ASM-16).....	383.31	40.21
28 31 23 00-1589 EA LED Driver module (Gamewell-FCI ANU-48).....	383.31	40.21
28 31 23 00-1590 EA Network Graphic Annunciator (Gamewell-FCI NGA).....	1,120.72	30.16
28 31 23 00-1591 Addressable Devices, Module, Pulls And Accessories (28 31 23 00-1548)		
28 31 23 00-1592 Velociti® Series Sensors And Bases (28 31 23 00-1591)		
28 31 23 00-1593 EA Analog Addressable Plug-In Ionization Smoke Sensor (Gamewell-FCI ASD-IL2F).....	127.44	30.16
28 31 23 00-1594 EA Analog Addressable Plug-In Photoelectric Smoke Sensor (Gamewell-FCI ASD-PL2F).....	129.89	30.16
28 31 23 00-1595 EA Analog Addressable Plug-In Photoelectric Smoke Sensor With 135 Degree F Fixed Temperature Thermal Sensing (Gamewell-FCI ASD-PTL2F).....	137.26	30.16
28 31 23 00-1596 EA Addressable Plug-In Thermal Sensor, 15 Degree F Rate Of Rise, 135 Degree F (Gamewell-FCI ATD-RL2F).....	107.79	30.16
28 31 23 00-1597 EA Addressable Plug-In Thermal Sensor, 190 Degree F (Gamewell-FCI ATD-HL2F).....	111.89	30.16
28 31 23 00-1598 EA Addressable Plug-In Thermal Sensor, 135 Degree F (Gamewell-FCI ATD-L2F).....	107.79	30.16
28 31 23 00-1599 EA Addressable Plug-In Multi-Criteria Analog Sensor (Gamewell-FCI MCS-ACCLIMATE2F).....	154.45	30.16
28 31 23 00-1600 EA Analog Addressable Laser Smoke Sensor, Low Profile (Gamewell-FCI ASD-LS).....	326.34	30.16
28 31 23 00-1601 EA Analog Addressable Low Flow Photoelectric Smoke Duct Detector Without Relay (Gamewell-FCI ADPF).....	284.70	50.27
28 31 23 00-1602 EA Analog Addressable Low Flow Photoelectric Smoke Duct Detector With Relay (Gamewell-FCI ADPRF).....	317.45	50.27
28 31 23 00-1603 EA Replacement Duct Detector Board (Gamewell-FCI ADP-F-SB).....	163.57	50.27
28 31 23 00-1604 EA Flanged Mounting Base, For Use With Analog Sensor Or Velociti Sensors (Gamewell-FCI ADB-FLF).....	33.21	10.05
28 31 23 00-1605 EA Harsh Environment Analog Addressable Photoelectric Smoke Sensor (Gamewell-FCI ASD-FILTREX-F).....	350.89	30.16
28 31 23 00-1606 EA Flanged Mounting Base, For Use With ASD-FILTREX Or ASD-FILTREX-F (Gamewell-FCI ADB-FILTREXF).....	71.27	10.05
28 31 23 00-1607 EA Addressable Single-Ended Reflected Beam Smoke Sensor (Gamewell-FCI ABD-2F).....	1,225.64	60.32

28 Electronic Safety And Security**28 30 Electronic Detection And Alarm****28 31 Fire Detection And Alarm**

MINOR CSI UOM DESCRIPTION		TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 31 23 00-1608	Velociti® Series Modules And Pull Station (28 31 23 00-1591)		
28 31 23 00-1609	EA Style "B", Class "B" Addressable Monitor Module (Gamewell-FCI AMM-2F)	92.19	20.11
28 31 23 00-1610	EA Dual Style "B", Class "B" Addressable Monitor Module (Gamewell-FCI AMM-2IF)	144.16	20.11
28 31 23 00-1611	EA Style "D", Class "A" Addressable Monitor Module (Gamewell-FCI AMM-4F)	100.37	20.11
28 31 23 00-1612	EA Subloop Style "D", Class "A" Addressable Monitor Module (Gamewell-FCI AMM-4SF)	138.43	20.11
28 31 23 00-1613	EA Addressable Output Relay Control Module (Gamewell-FCI AOM-2RF)	116.74	20.11
28 31 23 00-1614	EA Addressable Output Supervised Module (Gamewell-FCI AOM-2SF)	120.83	20.11
28 31 23 00-1615	EA Addressable Double Action Station, With AMM-2SF Mini-Mod (Gamewell-FCI MS-7AF)	173.34	40.21
28 31 23 00-1616	EA Addressable Single Action Pull Station (Gamewell-FCI MS-7ASF)	124.52	20.11
28 31 23 00-1617	EA Telephone Filters (Gamewell-FCI AOM-TEL-FL)	20.32	4.02
28 31 23 00-1618	Components And Accessories (28 31 23 00-1591)		
28 31 23 00-1619	EA Remote LED Annunciator Alarm (Gamewell-FCI RA400Z)	52.63	16.09
	Note: Mounts on single gang box.		
28 31 23 00-1620	EA Up To 2' Wide Ducts Metal Sampling Tube (Gamewell-FCI ST-1.5)	26.32	8.04
28 31 23 00-1621	EA >2' To 4' Wide Ducts Metal Sampling Tube (Gamewell-FCI ST-3)	27.96	8.04
28 31 23 00-1622	EA >4' To 8' Wide Ducts Metal Sampling Tube (Gamewell-FCI ST-5)	33.62	10.05
28 31 23 00-1623	EA >8' To 10' Wide Ducts Metal Sampling Tube (Gamewell-FCI ST-10)	52.78	12.07
28 31 23 00-1624	EA Remote Test Station With LED Alarm And Magnet Test Switch (Gamewell-FCI RTS451)	78.01	16.09
	Note: Mounts on single gang box.		
28 31 23 00-1625	Fixed And Rate of Rise Heat Detectors (28 31 23 00-1591)		
28 31 23 00-1626	EA 135 Degree F Fixed Temperature And Rate Of Rise Heat Detector (Gamewell-FCI 5601P)	74.23	30.16
28 31 23 00-1627	EA 194 Degree F Fixed Temperature And Rate Of Rise Heat Detector (Gamewell-FCI 5602)	74.23	30.16
28 31 23 00-1628	EA 135 Degree F Fixed Temperature Heat Detector (Gamewell-FCI 5603)	74.23	30.16
28 31 23 00-1629	EA 194 Degree F Fixed Temperature Heat Detector (Gamewell-FCI 5604)	74.23	30.16
28 31 23 00-1630	NAC Expander/Power Supply (28 31 23 00-1591)		
28 31 23 00-1631	EA FireForce 8 NAC Expander/Power Supply, 12/24 VDC, 8 Amp, 4 Notification Appliance Circuits, Built-in Synchronization Protocols For Gamewell, Wheelock, Gentex, Faraday, And System Sensor (Gamewell-FCI FF8)	1,232.78	321.72
28 31 23 00-1632	EA 6A Supplementary Notification Appliance Circuit Power Supply With Sync (Gamewell-FCI GFPS-6)	1,077.26	321.72
28 31 23 00-1633	EA 9A Supplementary Notification Appliance Circuit Power Supply With Sync (Gamewell-FCI GFPS-9)	1,155.02	321.72
28 31 23 00-1634	Batteries And Accessories (28 31 23 00-1548)		
28 31 23 00-1635	EA B-17R, 12 VDC, 17 Amp Hours Sealed Lead Acid Battery (Gamewell-FCI 100-2010A)	180.99	20.11
28 31 23 00-1636	EA B-55R, 12 VDC, 55 Amp Hours Sealed Lead Acid Battery (Gamewell-FCI 100-2710A)	447.83	20.11
28 31 23 00-1637	EA B-7R, 12 VDC, 7 Amp Hours Sealed Lead Acid Battery (Gamewell-FCI 100-2311A)	99.14	20.11
28 31 23 00-1638	EA BC-1, Battery Cabinet, Beige (Gamewell-FCI 1100-0653)	228.59	40.21
28 31 23 00-1639	EA BC-1R, Battery Cabinet, Red (Gamewell-FCI 1100-0654)	228.59	40.21
28 31 23 00-1640	EA 12"H x 12"W x 24"L Vented Steel Battery Cabinet With Hinged Key Lockable Cover (Gamewell-FCI GW70970)	204.85	40.21
28 31 23 00-1641	Electronic Door Holders (28 31 23 00-1548)		
	Note: Rixson products.		
28 31 23 00-1642	EA XK-996, Door Holder Extender Kit, 1-1/2" Spacer (Gamewell-FCI 140-30000)	32.10	4.02
28 31 23 00-1643	EA FM-980, Floor Mount Door Holder, 12 VDC, 24 VAC/DC Or 120 VAC (Gamewell-FCI 140-90000)	256.76	30.16
28 31 23 00-1644	EA FM-981, Floor Mount Holder For Double Doors, 12 VDC, 24 VAC/DC Or 120 VAC (Gamewell-FCI 140-90001)	345.98	30.16
28 31 23 00-1645	EA FM-990, Low Profile Mount Door Holder, 12 VDC, 24 VAC/DC Or 120 VAC (Gamewell-FCI 140-90002)	167.87	30.16
28 31 23 00-1646	EA FM-996, Surface Mount Door Holder, 12 VDC, 24 VAC/DC Or 120 VAC (Gamewell-FCI 140-90003)	160.51	30.16
28 31 23 00-1647	EA FM-997 Recessed Mount Door Holder, 12 VDC, 24 VAC/DC Or 120 VAC (Gamewell-FCI 140-90004)	167.87	30.16
28 31 23 00-1648	EA FM-998, Recessed Mount Door Holder With Concealed Wiring, 12 VDC, 24 VAC/DC Or 120 VAC (Gamewell-FCI 140-90005)	167.54	30.16
28 31 23 00-1649	SpectraAlert® Advance Wall Mount 2-Wire Horn/Strobes (28 31 23 00-1548)		
	See CSI section 28 31 23 00-1813 for devices.		
28 31 23 00-1650	SpectraAlert® Advance Accessories (28 31 23 00-1548)		
	See CSI section 28 31 23 00-1813 for backboxes, 28 31 23 00-2070 for backboxes.		
28 31 23 00-1651	Fire Alarm Programming (28 31 23 00-1548)		
	Note: For device replacement projects only. Do not use these tasks on projects where a fire alarm panel is replaced.		
28 31 23 00-1652	EA Program And Test Up To 5 Fire Alarm Devices	500.00	
28 31 23 00-1653	EA Program And Test >5 To 20 Fire Alarm Devices	1,000.00	
28 31 23 00-1654	EA Program And Test >20 To 50 Fire Alarm Devices	2,000.00	
28 31 23 00-1655	Fire-Lite Fire Alarm (28 31 23 00-0981)		
28 31 23 00-1656	Addressable Control Panels (28 31 23 00-1655)		
28 31 23 00-1657	EA 25 Point Intelligent Control (Fire Lite MS-25)	1,275.47	402.16
28 31 23 00-1658	EA 50 Point Intelligent Control (Fire Lite MS-9050UD)	1,390.11	402.16
28 31 23 00-1659	EA 198-Point Intelligent Control (Fire Lite MS-9200UDLS)	1,968.95	402.16
28 31 23 00-1660	EA 636-Point Intelligent Control (Fire Lite MS-9600LS)	2,873.82	402.16
28 31 23 00-1661	EA 636-Point Intelligent Control (Fire Lite MS-9600UDLS)	2,764.44	402.16



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 31 23 00-1662				Silent Knight Fire Alarm <small>(28 31 23 00-0981)</small>		
28 31 23 00-1663	EA			Addressable Fire Alarm Control Panel With Integrated Emergency Communication System (Silent Knight 5820XL-EVS)	2,966.85	201.07
28 31 23 00-1664	EA			Supervised Remote Command Unit (Silent Knight EVS-RCU)	1,238.94	120.65
28 31 23 00-1665	EA			50 Watt Amplifier (Silent Knight EVS-50W)	867.91	80.44
28 31 23 00-1666	EA			125 Watt Amplifier (Silent Knight EVS-125W)	1,532.61	80.44
28 31 23 00-1667	EA			Voice Evacuation System (Silent Knight SKE-450)	1,466.73	80.44
28 31 23 00-1668	EA			Fire Fighters Telephone (Silent Knight SK-FFT)	1,219.67	80.44
28 31 23 00-1669	EA			Multi-Loop Addressable Fire Alarm Control/Communicator System (Silent Knight 5820XL)	1,256.58	120.65
28 31 23 00-1670	EA			Single Loop Addressable Fire Alarm Control/Communicator System (Silent Knight 5808)	932.61	80.44
28 31 23 00-1671	EA			Single Loop Addressable Fire Alarm Control/Communicator System (Silent Knight 5700)	716.80	80.44
28 31 23 00-1672	EA			Hybrid Conventional Fire Alarm Control/Communicator System (Silent Knight 5600)	620.37	80.44
28 31 23 00-1673	EA			Combination Fire And CO Detector (Silent Knight SK-FIRE-CO)	198.86	30.16
28 31 23 00-1674	EA			Photoelectric Detector (Silent Knight SK-PHOTO)	116.09	30.16
28 31 23 00-1675	EA			Photoelectric Thermal Detector (Silent Knight SK-PHOTO-T)	121.85	30.16
28 31 23 00-1676	EA			Ionization Smoke Detector (Silent Knight SK-ION)	122.50	30.16
28 31 23 00-1677	EA			135 Degree Fixed Temperature Detector (Silent Knight SK-HEAT)	107.61	30.16
28 31 23 00-1678	EA			190 Degree Fixed Temperature Detector (Silent Knight SK-HEAT-HT)	112.87	30.16
28 31 23 00-1679	EA			135 Degree Fixed Temperature Rate-of-Rise Detector (Silent Knight SK-HEAT-ROR)	114.81	30.16
28 31 23 00-1680	EA			Sounder Base (Silent Knight B200SR)	67.53	10.05
28 31 23 00-1681	EA			Intelligent Sounder Base (Silent Knight B200S)	71.38	10.05
28 31 23 00-1682	EA			Isolator Base (Silent Knight B224BI)	56.65	10.05
28 31 23 00-1683	EA			Relay Base (Silent Knight B224RB)	57.28	10.05
28 31 23 00-1684	EA			Multi-Criteria Photoelectric Detector With Thermal Sensing (Silent Knight SK-ACCLIMATE)	124.51	30.16
28 31 23 00-1685	EA			Photoelectric Duct Detector (Silent Knight SK-DUCT)	196.45	30.16
28 31 23 00-1686	EA			Single-Ended Reflected Beam Smoke Detector (Silent Knight SK-BEAM)	676.78	30.16
28 31 23 00-1687	EA			Single-Ended Reflected Beam Smoke Detector (Silent Knight SK-BEAM-T)	772.07	30.16
28 31 23 00-1688	EA			Dual Monitor Module (Silent Knight SK-MONITOR-2)	146.73	30.16
28 31 23 00-1689	EA			Supervised Control Module (Silent Knight SK-CONTROL)	123.27	30.16
28 31 23 00-1690	EA			Six Circuit Supervised Control Module (Silent Knight SK-CONTROL-6)	401.86	40.21
28 31 23 00-1691	EA			Relay Control Module (Silent Knight SK-RELAY)	104.40	20.11
28 31 23 00-1692	EA			Six Relay Control Module (Silent Knight SK-RELAY-6)	388.76	40.21
28 31 23 00-1693	EA			Zone Interface Module (Silent Knight SK-ZONE)	125.74	30.16
28 31 23 00-1694	EA			Six Zone Interface Module (Silent Knight SK-ZONE-6)	463.76	40.21
28 31 23 00-1695	EA			Monitor Module (Silent Knight SK-MONITOR)	109.03	30.16
28 31 23 00-1696	EA			10 Input Monitor Module (Silent Knight SK-MON-10)	449.48	40.21
28 31 23 00-1697	EA			Monitor Module (Silent Knight SK-MINIMON)	101.99	30.16
28 31 23 00-1698	EA			Fault Isolator Module (Silent Knight SK-ISO)	112.87	30.16
28 31 23 00-1699	EA			Addressable Heat Sensor (Silent Knight SD505-AHS)	110.96	30.16
28 31 23 00-1700	EA			Analog Ionization Smoke Detector (Silent Knight SD505-AIS)	120.04	30.16
28 31 23 00-1701	EA			Addressable Photoelectric Smoke Detector (Silent Knight SD505-APS)	112.87	30.16
28 31 23 00-1702	EA			6" Addressable Sounder Base (Silent Knight SD505-6SB)	82.29	10.05
28 31 23 00-1703	EA			6" Addressable Relay Base (Silent Knight SD505-6RB)	77.79	10.05
28 31 23 00-1704	EA			6" Isolator Base (Silent Knight SD505-6IB)	70.75	10.05
28 31 23 00-1705	EA			Addressable Input Module (Silent Knight SD500-AIM)	112.24	30.16
28 31 23 00-1706	EA			Addressable Notification Module (Silent Knight SD500-ANM)	136.85	30.16
28 31 23 00-1707	EA			Addressable Relay Module (Silent Knight SD500-ARM)	123.27	30.16
28 31 23 00-1708	EA			SLC Annunciator Driver Module (Silent Knight SD500-LED)	467.07	60.32
28 31 23 00-1709	EA			Loop Isolation Module (Silent Knight SD500-LIM)	116.72	30.16
28 31 23 00-1710	EA			Addressable Mini Input Module (Silent Knight SD500-MIM)	90.85	20.11
28 31 23 00-1711	EA			Single Action Addressable Pull Station (Silent Knight SD500-PS)	115.51	20.11
28 31 23 00-1712	EA			Dual Action Addressable Pull Station (Silent Knight SD500-PSDA)	110.57	20.11
28 31 23 00-1713	EA			Back Box (Silent Knight SK-PSSMBB)	52.84	16.09
28 31 23 00-1714	EA			Smoke Detector Module (Silent Knight SD500-SDM)	129.44	30.16
28 31 23 00-1715	EA			Addressable Smoke 4" Detector Base (Silent Knight SD505-4AB)	31.83	10.05
28 31 23 00-1716	EA			Addressable Smoke 6" Detector Base (Silent Knight SD505-6AB)	31.83	10.05
28 31 23 00-1717	EA			Addressable Duct Housing (Silent Knight SD505-DUCT)	204.89	30.16
28 31 23 00-1718	EA			Addressable Duct Housing With Built-In Relay (Silent Knight SD505-DUCTR)	263.92	30.16
28 31 23 00-1719	EA			Addressable Duct Detector Test Switch (Silent Knight SD505-DTS)	115.44	30.16
28 31 23 00-1720	EA			Intelligent Power Module (Silent Knight 5895XL)	671.56	80.44
28 31 23 00-1721	EA			Addressable Power Supply (Silent Knight 5496)	469.45	60.32
28 31 23 00-1722	EA			Relay Interface Board (Silent Knight 5883)	178.75	20.11
28 31 23 00-1723	EA			Remote LED Annunciator (Silent Knight 5865-3)	367.33	40.21
28 31 23 00-1724	EA			Remote LED Annunciator (Silent Knight 5865-4)	414.72	40.21
28 31 23 00-1725	EA			Remote LCD Annunciator (Silent Knight SK-5860)	399.21	60.32
28 31 23 00-1726	EA			Serial/Parallel Printer Interface (Silent Knight 5824)	253.45	20.11
28 31 23 00-1727	EA			LED Input/Output Module (Silent Knight / IntelliKnight 5880)	299.59	30.16
28 31 23 00-1728	EA			Addressable Pull Station (Silent Knight SK-Pull-DA/SA)	110.57	20.11
28 31 23 00-1729	EA			Digital Fire Communicator with Cabinet (Silent Knight SK-5104)	382.54	60.32
28 31 23 00-1730	EA			Communicator (Silent Knight IPGSM-4G)	551.94	40.21
28 31 23 00-1731	EA			Ten Zone Conventional Fire Alarm Control Panel (Silent Knight SK-5208)	877.32	80.44
28 31 23 00-1732	EA			10 Zone Expander (Silent Knight SK-5217)	245.02	20.11
28 31 23 00-1733	EA			Remote Annunciator (Silent Knight SK-5235)	251.51	40.21
28 31 23 00-1734	EA			Status Display Module (Silent Knight 5280)	75.47	20.11
28 31 23 00-1735	EA			Serial/Parallel Module (Silent Knight 5824)	293.68	40.21
28 31 23 00-1736	EA			Four Zone Conventional Fire Alarm Control Panel (Silent Knight SK-4)	509.66	80.44
28 31 23 00-1737	EA			Four Zone Conventional Fire Alarm Control Panel (Silent Knight SK-4E)	519.18	80.44
28 31 23 00-1738	EA			Dress Panel (Silent Knight SK-DP2/4)	97.89	20.11
28 31 23 00-1739	EA			Class A Convertor (Silent Knight SK-CAC4)	248.26	30.16

28 Electronic Safety And Security**28 30 Electronic Detection And Alarm****28 31 Fire Detection And Alarm**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 31	23 00-1740	EA	Transmitter Module (Silent Knight SK-4XTM).....	135.62	30.16
28 31	23 00-1741	EA	LED Interface Module (Silent Knight SK-4XLM).....	125.74	30.16
28 31	23 00-1742	EA	110 VAC Transformer, 3-6A (Silent Knight SK-XRM24).....	125.38	20.11
28 31	23 00-1743	EA	Remote Annunciator (Silent Knight SK-RZA4).....	125.74	30.16
28 31	23 00-1744	EA	Zone Relay Module (Silent Knight SK-4XZM).....	134.38	30.16
28 31	23 00-1745	EA	Two Zone Conventional Fire Alarm Control Panel (Silent Knight SK-2).....	444.18	80.44
28 31	23 00-1746	EA	Remote Battery Box Accessory Cabinet (Silent Knight RBB).....	110.57	20.11
28 31	23 00-1747	EA	Manual Pull Station (single action) (Silent Knight PS-SATK).....	64.11	20.11
28 31	23 00-1748	EA	Manual Pull Station (dual action) (Silent Knight PS-DATK).....	68.88	20.11
28 31	23 00-1749	EA	Manual Pull Station (dual action) (Silent Knight PS-DA).....	67.54	20.11
28 31	23 00-1750	EA	Dual Action Manual Pull Station, Hex Key (Silent Knight PS-DAH).....	61.00	20.11
28 31	23 00-1751	EA	Dual Action Listed Outdoor Manual Pull Station With Black Box (Silent Knight PS-DALOB).....	129.73	24.13
28 31	23 00-1752	EA	6 Amp, 24 VDC, Distributed Power Module (with cabinet) (Silent Knight SK-5495).....	442.07	60.32
28 31	23 00-1753	EA	9 Amp, 24 VDC, Distributed Power Module (with cabinet) (Silent Knight SK-5499).....	494.45	60.32
28 31	23 00-1754		Alerton <small>(28 31 23)</small>		
	28 31	23 00-1755	EA UL Listed Surge Protector In CHS-M3 Or CPU2-640 Chassis (Alerton ESD-100).....	388.07	6.03
28 31	23 00-1756		Cooper Fire Alarm <small>(28 31 23)</small>		
	28 31	23 00-1757	EA Single Circuit Class A / Multiple B, 12 Or 24 VDC, Sync Module (Cooper DSM-12/24-R).....	136.21	20.11
	28 31	23 00-1758	EA Red Lens, 21 Joules, 24 VDC, Class I, Div 1, Groups C, D, NEMA 4X And 6, Strobe (Cooper EP109205-001).....	2,270.77	34.18
	28 31	23 00-1759	EA Red, 100 dB, 24 VDC, Class I, Div 1, Groups C, D, NEMA 4X, Multitone Horn (Cooper EP109206-002).....	2,990.77	34.18
	28 31	23 00-1760	EA Red Lens, 5 Joules, 24 VDC, Red Finish, Class I, Div 2, Groups C And D, NEMA 4X And 6, Strobe (Cooper HL109201-001).....	1,102.04	40.21
	28 31	23 00-1761	EA Clear Lens, 5 Joules, 24 VDC, Red Finish, Class I, Div 2, Groups C And D, NEMA 4X And 6, Strobe (Cooper HL109201-002).....	1,108.44	40.21
	28 31	23 00-1762	EA Amber Lens, 5 Joules, 110 VAC, Red Finish, Class I, Div 2, Groups C And D, NEMA 4X And 6, Strobe (Cooper HL109201-007).....	1,108.44	40.21
	28 31	23 00-1763	EA Red Lens, 10 Joules, 24 VDC, Wire Guard, Black Finish, Class I, Div 2, Groups A, B, C And D, NEMA 4X And 6, Strobe (Cooper HL109202-001).....	825.24	40.21
	28 31	23 00-1764	EA Amber Lens, 10 Joules, 120 VAC, Wire Guard, Black Finish, Class I, Div 2, Groups A, B, C And D, NEMA 4X And 6, Strobe (Cooper HL109202-003).....	825.24	40.21
	28 31	23 00-1765	EA Red Lens, 10 Joules, 120 VAC, Wire Guard, Black Finish, Class I, Div 2, Groups A, B, C And D, NEMA 4X And 6, Strobe (Cooper HL109202-004).....	825.24	40.21
	28 31	23 00-1766	EA Amber Lens, 15 Joules, 120 VAC, Wire Guard, Black Finish, Backstrap, Class I, Div 2, Groups A, B, C And D, NEMA 4X And 6, Strobe (Cooper HL109202-005).....	1,108.44	40.21
	28 31	23 00-1767	EA Amber Lens, 15 Joules, 120 VAC, Wire Guard, Black Finish, Pendant Mounted, Class I, Div 2, Groups A, B, C And D, NEMA 4X And 6, Strobe (Cooper HL109202-006).....	1,108.44	40.21
	28 31	23 00-1768	EA Red Lens, 15 Joules, 120 VAC, Wire Guard, Black Finish, Backstrap, Class I, Div 2, Groups A, B, C And D, NEMA 4X And 6, Strobe (Cooper HL109202-007).....	1,108.44	40.21
	28 31	23 00-1769	EA Red Lens, 15 Joules, 120 VAC, Wire Guard, Black Finish, Pendant Mounted, Class I, Div 2, Groups A, B, C And D, NEMA 4X And 6, Strobe (Cooper HL109202-008).....	1,108.44	40.21
	28 31	23 00-1770	EA Red Lens, 15 Joules, 24 VDC, Wire Guard, Blackstrap, Black Finish, Class I, Div 2, Groups A, B, C And D, NEMA 4X And 6, Strobe (Cooper HL109203-002).....	1,108.44	40.21
	28 31	23 00-1771	EA Red Lens, 21 Joules, 24 VDC, Red Finish, Class I, Div 2, Groups C And D, NEMA 4X And 6, Strobe (Cooper HL109204-001).....	1,274.04	40.21
	28 31	23 00-1772	EA Red Lens, 21 Joules, 24 VDC, Black Finish, Class I, Div 2, Groups C And D, NEMA 4X And 6, Strobe (Cooper HL109204-003).....	1,184.44	40.21
	28 31	23 00-1773	EA Amber Lens, 21 Joules, 110 VAC, Red Finish, Class I, Div 2, Groups C And D, NEMA 4X And 6, Strobe (Cooper HL109204-005).....	1,184.44	40.21
	28 31	23 00-1774	EA Red Lens, 21 Joules, 110 VAC, Red Finish, Class I, Div 2, Groups C And D, NEMA 4X And 6, Strobe (Cooper HL109204-006).....	1,184.44	40.21
28 31	23 00-1775		Light Engineered Displays Message Boards <small>(28 31 23)</small>		
	28 31	23 00-1776	EA Two Message Sign, "Announcement" And "Evacuate" (LED SP-2/MNS).....	404.26	24.13
	28 31	23 00-1777	EA Four Message Sign, "Fire", "Weather", "Announcement", "E Voltuate" (LED SP-4).....	492.26	24.13
28 31	23 00-1778		STI Fire Alarm <small>(28 31 23)</small>		
	28 31	23 00-1779	EA Pull Station Polycarbonate Cover, Semi Flush With Horn (STI-1100)..... Note: Include 9 VDC self contained battery.	95.79	12.07
	28 31	23 00-1780	EA Surface Mounted, Manual Pull Station Polycarbonate Cover With Horn (STI-1130).....	125.73	12.07
	28 31	23 00-1781	EA Flush Mounted, Manual Pull Station Polycarbonate Cover (STI-1200).....	84.93	12.07
	28 31	23 00-1782	EA Surface Mounted, Horn Strobe Polycarbonate Cover (STI-1210D)..... Note: For surface mounted horn strobes.	76.93	12.07
	28 31	23 00-1783	EA Flush Mounted, Horn Strobe Polycarbonate Cover (STI-1210E).....	68.13	12.07
	28 31	23 00-1784	EA Strobe Damage Stopper And Open Backbox With Conduit Knockout (STI-1221D)..... Note: For surface mounted strobe.	76.93	12.07
	28 31	23 00-1785	EA Strobe Damage Stopper And Open Backbox, Semi Flush (STI-1221E).....	76.75	12.07
	28 31	23 00-1786	EA NEMA 4X Rated Polycarbonate Dome Cover (STI-1229).....	156.93	12.07
	28 31	23 00-1787	EA Surface Mounted, Manual Pull Station Polycarbonate Cover (STI-1230)..... Note: For surface mounted pull stations.	102.53	12.07
	28 31	23 00-1788	EA Backplate For Polycarbonate Cover (STI-1280).....	46.33	12.07
	28 31	23 00-1789	EA Conduit Gasket For Polycarbonate Cover (STI-3003).....	32.33	12.07
	28 31	23 00-1790	EA Conduit Spacer For Surface Mounted Polycarbonate Cover (STI-3100).....	55.13	12.07
	28 31	23 00-1791	EA Weather Resistant, Surface Mounted, Manual Pull Station Polycarbonate Cover (STI-3150).....	105.73	12.07
	28 31	23 00-1792	EA 8.5" x 6.5" x 4.6", Thumb Lock, Lockable Enclosure (STI-7511A).....	93.53	12.07
	28 31	23 00-1793	EA 24.7" x 19.7" x 7.3", Key Lock, Lockable Enclosure (STI-7550).....	493.73	12.07
	28 31	23 00-1794	EA Flush Mounted, Smoke Detector Polycarbonate Cover (STI-8100).....	75.33	12.07



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 31 23 00-1795 EA Flush Mounted, Low Profile, Smoke Detector Steel Wire Cover (STI-9601).....	69.33	12.07
28 31 23 00-1796 EA Surface Mounted, Low Profile, Smoke Detector, Polyester Shell, Steel Wire Cover (STI-9602).....	63.73	12.07
28 31 23 00-1797 EA Flush Mounted, Mini Smoke Detector, Polyester Shell, Steel Wire Cover (STI-9604).....	69.33	12.07
28 31 23 00-1798 EA Surface Mounted, Mini Smoke Detector, Polyester Shell, Steel Wire Cover (STI-9605).....	63.73	12.07
28 31 23 00-1799 EA Flush Mounted, High Profile, Smoke Detector, Polyester Shell, Steel Wire Cover (STI-9609).....	69.33	12.07
28 31 23 00-1800 EA Surface Mounted, High Profile, Smoke Detector, Polyester Shell, Steel Wire Cover (STI-9610).....	63.73	12.07
28 31 23 00-1801 EA Beam Smoke Detector, Polyester Shell, Steel Wire Cover (STI-9625).....	116.93	12.07
28 31 23 00-1802 EA White, Flush Mounted, Horn/Strobe/Speaker, Polyester Shell, Steel Wire Cover (STI-9705).....	58.53	12.07
28 31 23 00-1803 EA Red, Flush Mounted, Horn/Strobe/Speaker, Polyester Shell, Steel Wire Cover (STI-9705-R).....	58.53	12.07
28 31 23 00-1804 EA Flush Mounted, Beam Smoke Detector, Polyester Shell, Steel Wire Cover (STI-9706).....	89.73	12.07
28 31 23 00-1805 EA Surface Mounted, Beam Smoke Detector, Polyester Shell, Steel Wire Cover (STI-9707).....	89.73	12.07
28 31 23 00-1806 EA White, Surface Mounted, Horn/Strobe/Speaker, Polyester Shell, Steel Wire Cover (STI-9708).....	64.13	12.07
28 31 23 00-1807 EA Red, Surface Mounted, Horn/Strobe/Speaker, Polyester Shell, Steel Wire Cover (STI-9708-R).....	64.13	12.07
28 31 23 00-1808 EA White, Flush Mounted, Horn/Strobe/Speaker, Polyester Shell, Steel Wire Cover (STI-9711).....	58.53	12.07
28 31 23 00-1809 EA Flush Mounted, Smoke Detector, Polyester Shell, Steel Wire Cover (STI-9713).....	63.73	12.07
28 31 23 00-1810 EA White, Surface Mounted, Horn/Strobe/Speaker, Polyester Shell, Steel Wire Cover (STI-9714).....	64.13	12.07
28 31 23 00-1811 EA Yellow, "High Threat", Push Button Station (STI SS-2201).....	67.07	6.03
28 31 23 00-1812 EA Gasket Kit For STI Covers (STI SUB-121).....	29.61	
28 31 23 00-1813	System Sensor Fire Alarm (28 31 23)	
28 31 23 00-1814	Smoke Detectors (28 31 23 00-1813)	
28 31 23 00-1815 EA Beam Detector Heater Kit (System Sensor BEAMHK).....	40.04	4.02
28 31 23 00-1816 EA Reflectors, Beam Detector Heater Kit (System Sensor BEAMHKR).....	164.04	4.02
Note: Four used with long range kit.		
28 31 23 00-1817 EA Projected Beam Smoke Detector Long Range Kit (System Sensor BEAMLRK).....	202.04	40.21
28 31 23 00-1818 EA Wall Or Ceiling Mounted, Projected Beam Smoke Detector Multi-Mount Kit (System Sensor BEAMMMK).....	148.44	40.21
28 31 23 00-1819 EA Projected Beam Smoke Detector Surface Mounted Kit (System Sensor BEAMSMK).....	121.24	40.21
28 31 23 00-1820 EA Two Wire, Photoelectric Smoke Detector (System Sensor 2W-B).....	112.32	30.16
28 31 23 00-1821 EA Two Wire, Photoelectric Smoke Detector With Thermal Sensor (System Sensor 2WT-B).....	113.92	30.16
28 31 23 00-1822 EA Two Wire, Photoelectric Smoke Detector With Thermal Sensor And Built In Sounder (System Sensor 2WTA-B).....	117.92	30.16
28 31 23 00-1823 EA Four Wire, Photoelectric Smoke Detector (System Sensor 4W-B).....	114.12	30.16
28 31 23 00-1824 EA Four Wire, Photoelectric Smoke Detector With Thermal Sensor, 12/24 VDC (System Sensor 4WT-B).....	121.92	30.16
28 31 23 00-1825 EA Four Wire, Photoelectric Smoke Detector With Thermal Sensor And Built In Sounder (System Sensor 4WTA-B).....	120.72	30.16
28 31 23 00-1826 EA Four Wire, Photoelectric Smoke Detector With Isolated Thermal Sensor, Built In Sounder, Form C Relay (System Sensor 4WITAR-B).....	146.72	30.16
28 31 23 00-1827 EA Photoelectric, Low-Profile, Smoke Detector Head (System Sensor 2151).....	86.61	20.11
28 31 23 00-1828 EA Photoelectric With Thermal Sensor, Low-Profile, Smoke Detector Head (System Sensor 2151T).....	97.81	20.11
Note: Requires B100 series base.		
28 31 23 00-1829 EA Heavy Duty Multi-Mount Kit (System Sensor 6500-MMK).....	186.51	10.05
28 31 23 00-1830 EA Surface-Mount Kit For Use With Beam1224 And FSB-200 When Using 6500-MMK Heavy Duty Multi-Mount Kit (System Sensor 6500-SMK).....	64.11	10.05
28 31 23 00-1831	Duct Smoke Detectors (28 31 23 00-1813)	
28 31 23 00-1832 EA Two Wire Conventional Photoelectric Duct Detector (Includes 2151 Detector) (System Sensor D2).....	238.92	30.16
28 31 23 00-1833 EA Four Wire Conventional Photoelectric Duct Detector (Includes 2D51 Detector) (System Sensor D4120).....	241.52	30.16
28 31 23 00-1834 EA Watertight, Four Wire Conventional Photoelectric Duct Detector (Includes 2D51 Detector) (System Sensor D4120W).....	310.97	34.18
28 31 23 00-1835 EA Sensor Only, Four Wire Conventional Photoelectric Duct Detector (System Sensor D4S).....	157.01	20.11
28 31 23 00-1836 EA Duct Accessory Coil (Required On DNR If A Remote Test Station Is Used) (System Sensor DCOIL).....	42.47	6.03
28 31 23 00-1837 EA Intelligent, Non-Relay, Duct Smoke Detector Housing (System Sensor DNR).....	136.17	16.09
28 31 23 00-1838 EA Watertight, Intelligent, Non-Relay, Duct Smoke Detector Housing (System Sensor DNRW).....	221.81	20.11
28 31 23 00-1839 EA 1' Steel Sampling Tube (System Sensor DST1).....	24.89	8.04
28 31 23 00-1840 EA 1.5' Steel Sampling Tube (System Sensor DST1.5).....	26.89	8.04
28 31 23 00-1841 EA 3' Steel Sampling Tube (System Sensor DST3).....	30.89	8.04
28 31 23 00-1842 EA 5' Steel Sampling Tube (System Sensor DST5).....	36.51	10.05
28 31 23 00-1843 EA 10' Steel Sampling Tube (System Sensor DST10).....	57.53	12.07
28 31 23 00-1844 EA 1', Steel, Exhaust Tube Duct (System Sensor ETX).....	27.69	8.04
28 31 23 00-1845 EA Remote Test Station For Duct Smoke Detector (System Sensor RTS151).....	64.71	10.05
28 31 23 00-1846 EA Detector Installation/Removal Tool Kit For 700 Series Detectors (System Sensor XR2).....	140.00	
28 31 23 00-1847 EA Detector Installation/Removal Tool Kit For 800 And 355 Series Detectors (System Sensor XR2B).....	150.40	
28 31 23 00-1848	Heat Detectors (28 31 23 00-1813)	
28 31 23 00-1849 EA Single Circuit, 135 Degree F, Fixed And Rate-Of-Rise, Heat Detector (System Sensor 5601P).....	77.12	30.16
28 31 23 00-1850 EA Single Circuit, 194 Degree F, Fixed And Rate-Of-Rise, Heat Detector (System Sensor 5602).....	77.12	30.16
28 31 23 00-1851 EA Dual Circuit, 135 Degree F, Fixed And Rate-Of-Rise, Heat Detector (System Sensor 5621).....	89.92	30.16
28 31 23 00-1852 EA Dual Circuit, 194 Degree F, Fixed And Rate-Of-Rise, Heat Detector (System Sensor 5622).....	89.92	30.16
28 31 23 00-1853	Horns (28 31 23 00-1813)	
28 31 23 00-1854 EA Red, Mini Horn (System Sensor MHR).....	82.32	30.16
28 31 23 00-1855 EA White, Mini Horn (System Sensor MHW).....	82.32	30.16
28 31 23 00-1856 EA White, 12/24 VDC, Wall Mounted Horn Only (System Sensor HW).....	93.52	30.16
28 31 23 00-1857 EA Red, Outdoor, Wall Mounted Replacement Horn (System Sensor HRK-R).....	104.37	34.18
28 31 23 00-1858 EA Red, Interior, Wall Mounted, Horn (System Sensor HR).....	93.52	30.16
28 31 23 00-1859 EA Red, Outdoor, Wall Mounted, Horn (System Sensor HRK).....	112.32	30.16

28 Electronic Safety And Security**28 30 Electronic Detection And Alarm****28 31 Fire Detection And Alarm**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 31 23 00-1860			Wall Mounted Horns/Strobes <small>(28 31 23 00-1813)</small>		
28 31 23 00-1861	EA		Red, Two Wire, 12/24 VDC, Selectable Intensity (15, 15/75, 30, 75, 110, 115 Candela) Multi-Candela, Wall Mounted Horn/Strobe (System Sensor P2R).....	121.12	30.16
28 31 23 00-1862	EA		Red, Two Wire, 12/24 VDC, Selectable Intensity (135, 150, 177, 185 Candela) High-Candela, Wall Mounted Horn/Strobe (System Sensor P2RH).....	125.92	30.16
28 31 23 00-1863	EA		Outdoor Backbox, Red, Two Wire, 12/24 VDC, Selectable Intensity (135, 150, 177, 185 Candela) High-Candela, Wall Mounted Horn/Strobe (System Sensor P2RHK).....	161.17	34.18
28 31 23 00-1864	EA		Plain, Outdoor Backbox, Red, Two Wire, 12/24 VDC, Selectable Intensity (135, 150, 177, 185 Candela) High-Candela, Wall Mounted Horn/Strobe (System Sensor P2RHK-P).....	161.17	34.18
28 31 23 00-1865	EA		Low Frequency, Red, Two Wire, 12/24 VDC, Selectable Intensity (135, 150, 177, 185 Candela) High-Candela, Wall Mounted Horn/Strobe (System Sensor P2RH-LF).....	169.12	30.16
28 31 23 00-1866	EA		Outdoor Backbox, Red, 120 VAC, Selectable Intensity (135, 150, 177, 185 Candela) High-Candela, Wall Mounted Horn/Strobe (System Sensor P2RHK-120).....	173.17	34.18
28 31 23 00-1867	EA		Outdoor Backbox, Red, Two Wire, 12/24 VDC, Selectable Intensity (15, 15/75, 30, 75, 110, 115 Candela) Multi-Candela, Wall Mounted Horn/Strobe (System Sensor P2RK).....	151.97	34.18
28 31 23 00-1868	EA		Plain, Outdoor Backbox, Red, Two Wire, 12/24 VDC, Selectable Intensity (15, 15/75, 30, 75, 110, 115 Candela) Multi-Candela, Wall Mounted Horn/Strobe (System Sensor P2RK-P).....	156.37	34.18
28 31 23 00-1869	EA		Replacement, Outdoor, Red, Two Wire, 12/24 VDC, Selectable Intensity (15, 15/75, 30, 75, 110, 115 Candela) Multi-Candela, Wall Mounted Horn/Strobe (System Sensor P2RK-R).....	136.32	30.16
28 31 23 00-1870	EA		Plain, Red, Two Wire, 12/24 VDC, Selectable Intensity (15, 15/75, 30, 75, 110, 115 Candela) Multi-Candela, Wall Mounted Horn/Strobe (System Sensor P2R-P).....	121.12	30.16
28 31 23 00-1871	EA		White, Two Wire, 12/24 VDC, Selectable Intensity (15, 15/75, 30, 75, 110, 115 Candela) Multi-Candela, Wall Mounted Horn/Strobe (System Sensor P2W).....	121.12	30.16
28 31 23 00-1872	EA		White, Two Wire, 12/24 VDC, Selectable Intensity (135, 150, 177, 185 Candela) High-Candela, Wall Mounted Horn/Strobe (System Sensor P2WH).....	126.72	30.16
28 31 23 00-1873	EA		Low Frequency, White, Two Wire, 12/24 VDC, Selectable Intensity (135, 150, 177, 185 Candela) High-Candela, Wall Mounted Horn/Strobe (System Sensor P2WH-LF).....	169.12	30.16
28 31 23 00-1874	EA		Outdoor Backbox, White, Two Wire, 12/24 VDC, Selectable Intensity (135, 150, 177, 185 Candela) High-Candela, Wall Mounted Horn/Strobe (System Sensor P2WHK).....	161.17	34.18
28 31 23 00-1875	EA		Plain, Outdoor Backbox, White, Two Wire, 12/24 VDC, Selectable Intensity (135, 150, 177, 185 Candela) High-Candela, Wall Mounted Horn/Strobe (System Sensor P2WHK-P).....	161.17	34.18
28 31 23 00-1876	EA		Plain, White, Two Wire, 12/24 VDC, Selectable Intensity (135, 150, 177, 185 Candela) High-Candela, Wall Mounted Horn/Strobe (System Sensor P2WH-P).....	125.92	30.16
28 31 23 00-1877	EA		Outdoor Backbox, White, Two Wire, 12/24 VDC, Selectable Intensity (15, 15/75, 30, 75, 110, 115 Candela) Multi-Candela, Wall Mounted Horn/Strobe (System Sensor P2WK).....	156.37	34.18
28 31 23 00-1878	EA		Plain, Outdoor Backbox, White, Two Wire, 12/24 VDC, Selectable Intensity (15, 15/75, 30, 75, 110, 115 Candela) Multi-Candela, Wall Mounted Horn/Strobe (System Sensor P2WK-P).....	156.37	34.18
28 31 23 00-1879	EA		Plain, White, Two Wire, 12/24 VDC, Selectable Intensity (15, 15/75, 30, 75, 110, 115 Candela) Multi-Candela, Wall Mounted Horn/Strobe (System Sensor P2W-P).....	121.12	30.16
28 31 23 00-1880	EA		Red, Four Wire, 12/24 VDC, Selectable Intensity (15, 15/75, 30, 75, 110, 115 Candela) Multi-Candela, Wall Mounted Horn/Strobe (System Sensor P4R).....	137.92	30.16
28 31 23 00-1881	EA		Red, Four Wire, 12/24 VDC, Selectable Intensity (135, 150, 177, 185 Candela) High-Candela, Wall Mounted Horn/Strobe (System Sensor P4RH).....	141.12	30.16
28 31 23 00-1882	EA		Outdoor Backbox, Red, Four Wire, 12/24 VDC, Selectable Intensity (15, 15/75, 30, 75, 110, 115 Candela) Multi-Candela, Wall Mounted Horn/Strobe (System Sensor P4RK).....	162.77	34.18
28 31 23 00-1883	EA		Replacement, Outdoor, Red, Four Wire, 12/24 VDC, Selectable Intensity (15, 15/75, 30, 75, 110, 115 Candela) Multi-Candela, Wall Mounted Horn/Strobe (System Sensor P4RK-R).....	153.17	34.18
28 31 23 00-1884	EA		White, Four Wire, 12/24 VDC, Selectable Intensity (15, 15/75, 30, 75, 110, 115 Candela) Multi-Candela, Wall Mounted Horn/Strobe (System Sensor P4W).....	137.92	30.16
28 31 23 00-1885	EA		Outdoor Backbox, White, Four Wire, 12/24 VDC, Selectable Intensity (135, 150, 177, 185 Candela) High-Candela, Wall Mounted Horn/Strobe (System Sensor P4WHK).....	157.97	34.18
28 31 23 00-1886	EA		Outdoor Backbox, White, Four Wire, 12/24 VDC, Selectable Intensity (15, 15/75, 30, 75, 110, 115 Candela) Multi-Candela, Wall Mounted Horn/Strobe (System Sensor P4WK).....	162.77	34.18
28 31 23 00-1887			Ceiling Mounted Horns/Strobes <small>(28 31 23 00-1813)</small>		
28 31 23 00-1888	EA		Red, Two Wire, 12/24 VDC, Selectable Intensity (15, 15/75, 30, 75, 110, 115 Candela) Multi-Candela, Ceiling Mounted Horn/Strobe (System Sensor PC2R).....	121.12	30.16
28 31 23 00-1889	EA		Red, Two Wire, 12/24 VDC, Selectable Intensity (135, 150, 177, 185 Candela) High-Candela, Ceiling Mounted Horn/Strobe (System Sensor PC2RH).....	127.52	30.16
28 31 23 00-1890	EA		Outdoor Backbox, Red, Two Wire, 12/24 VDC, Selectable Intensity (135, 150, 177, 185 Candela) High-Candela, Ceiling Mounted Horn/Strobe (System Sensor PC2RHK).....	161.17	34.18
28 31 23 00-1891	EA		Outdoor Backbox, Red, Two Wire, 12/24 VDC, Selectable Intensity (15, 15/75, 30, 75, 110, 115 Candela) Multi-Candela, Ceiling Mounted Horn/Strobe (System Sensor PC2RK).....	156.37	34.18
28 31 23 00-1892	EA		Plain, Red, Two Wire, 12/24 VDC, Selectable Intensity (15, 15/75, 30, 75, 110, 115 Candela) Multi-Candela, Ceiling Mounted Horn/Strobe (System Sensor PC2R-P).....	121.92	30.16
28 31 23 00-1893	EA		White, Two Wire, 12/24 VDC, Selectable Intensity (15, 15/75, 30, 75, 110, 115 Candela) Multi-Candela, Ceiling Mounted Horn/Strobe (System Sensor PC2W).....	121.12	30.16
28 31 23 00-1894	EA		White, Two Wire, 12/24 VDC, Selectable Intensity (135, 150, 177, 185 Candela) High-Candela, Ceiling Mounted Horn/Strobe (System Sensor PC2WH).....	127.52	30.16
28 31 23 00-1895	EA		Outdoor Backbox, White, Two Wire, 12/24 VDC, Selectable Intensity (135, 150, 177, 185 Candela) High-Candela, Ceiling Mounted Horn/Strobe (System Sensor PC2WHK).....	161.17	34.18
28 31 23 00-1896	EA		Plain, White, Two Wire, 12/24 VDC, Selectable Intensity (135, 150, 177, 185 Candela) High-Candela, Ceiling Mounted Horn/Strobe (System Sensor PC2WH-P).....	127.52	30.16
28 31 23 00-1897	EA		Outdoor Backbox, White, Two Wire, 12/24 VDC, Selectable Intensity (15, 15/75, 30, 75, 110, 115 Candela) Multi-Candela, Ceiling Mounted Horn/Strobe (System Sensor PC2WK).....	156.37	34.18
28 31 23 00-1898	EA		Plain, White, Two Wire, 12/24 VDC, Selectable Intensity (15, 15/75, 30, 75, 110, 115 Candela) Multi-Candela, Ceiling Mounted Horn/Strobe (System Sensor PC2W-P).....	121.12	30.16
28 31 23 00-1899	EA		Red, Ceiling Mounted, Four Wire, 12/24 VDC, Selectable Intensity (15, 15/75, 30, 75, 110, 115 Candela) Multi-Candela, Horn/Strobe (System Sensor PC4R).....	137.92	30.16
28 31 23 00-1900	EA		Red, Ceiling Mounted, Four Wire, 12/24 VDC, Selectable Intensity (135, 150, 177, 185 Candela) High-Candela, Horn/Strobe (System Sensor PC4RH).....	141.12	30.16



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 31 23 00-1901 EA White, Four Wire, 12/24 VDC, Selectable Intensity (15, 15/75, 30, 75, 110, 115 Candela) Multi-Candela, Ceiling Mounted Horn/Strobe (System Sensor PC4W)	137.92	30.16
28 31 23 00-1902 Wall Mounted Strobes <small>(28 31 23 00-1813)</small>		
28 31 23 00-1903 EA White Strobe Expander Plate Backbox Skirt (System Sensor SEP-BBSW)	47.31	10.05
28 31 23 00-1904 EA White Strobe Expander Plate With Standard Candela (System Sensor SEP-SW)	88.91	10.05
28 31 23 00-1905 EA Red, Selectable Candela (15, 15/75, 30, 75, 110, 115 Candela) Multi-Candela, Wall Mounted Strobe (System Sensor SR)	109.12	30.16
28 31 23 00-1906 EA Red, Selectable Candela (135, 150, 177, 185 Candela) High-Candela, Wall Mounted Strobe (System Sensor SRH)	120.32	30.16
28 31 23 00-1907 EA Red, Outdoor, Selectable Candela (135, 150, 177, 185 Candela) High-Candela, Wall Mounted Strobe (System Sensor SRHK)	145.97	34.18
28 31 23 00-1908 EA Red, Outdoor, Selectable Candela (15, 15/75, 30, 75, 110, 115 Candela) Multi-Candela, Wall Mounted Strobe (System Sensor SRK)	144.37	34.18
28 31 23 00-1909 EA Red, Plain, Outdoor, Selectable Candela (15, 15/75, 30, 75, 110, 115 Candela) Multi-Candela, Wall Mounted Strobe (System Sensor SRK-P)	144.37	34.18
28 31 23 00-1910 EA Replacement Unit, Red, Outdoor, Selectable Candela (15, 15/75, 30, 75, 110, 115 Candela) Multi-Candela, Wall Mounted Strobe (System Sensor SRK-R)	126.77	34.18
28 31 23 00-1911 EA Red, Plain, Selectable Candela (15, 15/75, 30, 75, 110, 115 Candela) Multi-Candela, Wall Mounted Strobe (System Sensor SR-P)	109.12	30.16
28 31 23 00-1912 EA White, 12/24 VDC, Selectable (15, 15 /75, 30, 75 , 110, 115 Candela) Multi-Candela, Wall Mounted Strobe (System Sensor SW)	109.12	30.16
28 31 23 00-1913 EA White, Amber Lens, 12/24 VDC, Selectable (15, 15 /75, 30, 75 , 110, 115 Candela) Multi-Candela, Wall Mounted Strobe (System Sensor SW-ALERT)	117.92	30.16
28 31 23 00-1914 EA White, Clear Lens, 12/24 VDC, Selectable (15, 15 /75, 30, 75 , 110, 115 Candela) Multi-Candela, Wall Mounted Strobe (System Sensor SW-CLR-ALERT)	115.52	30.16
28 31 23 00-1915 EA White, High-Candela, Selectable Candela (135, 150, 177, 185 Candela), Wall Mounted Strobe (System Sensor SWH)	120.32	30.16
28 31 23 00-1916 EA White, Amber Lens, High-Candela, Selectable Candela (135, 150, 177, 185 Candela), Wall Mounted Strobe (System Sensor SWH-ALERT)	119.52	30.16
28 31 23 00-1917 EA White, Plain, High-Candela, Selectable Candela (135, 150, 177, 185 Candela), Wall Mounted Strobe (System Sensor SWH-P)	119.52	30.16
28 31 23 00-1918 EA Red, Plain, Outdoor, Selectable Candela (135, 150, 177, 185 Candela) High-Candela, Wall Mounted Strobe (System Sensor SRHK-P)	145.97	34.18
28 31 23 00-1919 EA White, Outdoor, High-Candela, Selectable Candela (135, 150, 177, 185 Candela), Wall Mounted Strobe (System Sensor SWHK)	145.97	34.18
28 31 23 00-1920 EA White, Plain, Outdoor, High-Candela, Selectable Candela (135, 150, 177, 185 Candela), Wall Mounted Strobe (System Sensor SWHK-P)	145.97	34.18
28 31 23 00-1921 EA Replacement Unit, Red, Outdoor, Selectable Candela (135, 150, 177, 185 Candela) High-Candela, Wall Mounted Strobe (System Sensor SRHK-R)	129.97	34.18
28 31 23 00-1922 EA White, Outdoor, Selectable Candela (15, 15/75, 30, 75, 95, 110, 115 Candela), Wall Mounted Strobe (System Sensor SWK)	144.37	34.18
28 31 23 00-1923 EA White, Plain, Outdoor, Selectable Candela (15, 15/75, 30, 75, 95, 110, 115 Candela), Wall Mounted Strobe (System Sensor SWK-P)	144.37	34.18
28 31 23 00-1924 EA White, Plain, 12/24 VDC, Selectable (15, 15 /75, 30, 75 , 110, 115 Candela) Multi-Candela, Wall Mounted Strobe (System Sensor SW-P)	108.32	30.16
28 31 23 00-1925 EA Amber, Wall Strobe Lens Attachment (System Sensor LENS-A)	16.84	4.02
28 31 23 00-1926 EA Blue, Wall Strobe Lens Attachment (System Sensor LENS-B)	16.84	4.02
28 31 23 00-1927 EA Green, Wall Strobe Lens Attachment (System Sensor LENS-G)	16.84	4.02
28 31 23 00-1928 EA Red, Wall Strobe Lens Attachment (System Sensor LENS-R)	16.84	4.02
28 31 23 00-1929 Ceiling Mounted Strobes <small>(28 31 23 00-1813)</small>		
28 31 23 00-1930 EA Red, Two Wire, 12/24 VDC, Selectable Intensity (15, 15/75, 30, 75, 110, 115 Candela) Multi-Candela, Ceiling Mounted Strobe (System Sensor SCR)	109.12	30.16
28 31 23 00-1931 EA Red, Two Wire, 12/24 VDC, Selectable Intensity (135, 150, 177, 185 Candela) High-Candela, Ceiling Mounted Strobe (System Sensor SCRH)	121.92	30.16
28 31 23 00-1932 EA Outdoor Backbox, Red, Two Wire, 12/24 VDC, Selectable Intensity (135, 150, 177, 185 Candela) High-Candela, Ceiling Mounted Strobe (System Sensor SCRHK)	145.97	34.18
28 31 23 00-1933 EA Outdoor Backbox, Red, Two Wire, 12/24 VDC, Selectable Intensity (15, 15/75, 30, 75, 110, 115 Candela) Multi-Candela, Ceiling Mounted Strobe (System Sensor SCRK)	145.97	34.18
28 31 23 00-1934 EA White, Two Wire, 12/24 VDC, Selectable Intensity (15, 15/75, 30, 75, 110, 115 Candela) Multi-Candela, Ceiling Mounted Strobe (System Sensor SCW)	109.12	30.16
28 31 23 00-1935 EA Clear Lens, White, Two Wire, 12/24 VDC, Standard Candela, Ceiling Mounted Strobe (System Sensor SCW-CLR-ALERT)	115.52	30.16
28 31 23 00-1936 EA White, Two Wire, 12/24 VDC, Selectable Intensity (135, 150, 177, 185 Candela) High-Candela, Ceiling Mounted Strobe (System Sensor SCWH)	121.92	30.16
28 31 23 00-1937 EA Outdoor Backbox, White, Two Wire, 12/24 VDC, Selectable Intensity (135, 150, 177, 185 Candela) High-Candela, Ceiling Mounted Strobe (System Sensor SCWHK)	145.97	34.18
28 31 23 00-1938 EA Outdoor Backbox, White, Two Wire, 12/24 VDC, Selectable Intensity (15, 15/75, 30, 75, 110, 115 Candela) Multi-Candela, Ceiling Mounted Strobe (System Sensor SCWK)	144.37	34.18
28 31 23 00-1939 EA Plain, White, Two Wire, 12/24 VDC, Selectable Intensity (15, 15/75, 30, 75, 110, 115 Candela) Multi-Candela, Ceiling Mounted Strobe (System Sensor SCW-P)	109.92	30.16
28 31 23 00-1940 EA Blue, Ceiling Strobe Lens Attachment (System Sensor LENS-BC)	16.84	4.02
28 31 23 00-1941 EA Red, Ceiling Strobe Lens Attachment (System Sensor LENS-RC)	16.84	4.02
28 31 23 00-1942 EA Green, Ceiling Strobe Lens Attachment (System Sensor LENS-GC)	16.84	4.02
28 31 23 00-1943 EA Amber, Ceiling Strobe Lens Attachment (System Sensor LENS-AC)	16.84	4.02
28 31 23 00-1944 Wall Mounted Speakers <small>(28 31 23 00-1813)</small>		
28 31 23 00-1945 EA 24 VDC, 4 Field Selectable Sound Pulse Patterns, Directional Sound Speaker With Voice And Integral Audio Amplifier (System Sensor PF24V)	259.52	30.16

28 Electronic Safety And Security**28 30 Electronic Detection And Alarm****28 31 Fire Detection And Alarm**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 31	23 00-1946	EA	Red, Wall Mounted Speaker (System Sensor SPR)	91.52	30.16
28 31	23 00-1947	EA	Red, Outdoor, Wall Mounted Speaker (System Sensor SPRK)	132.72	30.16
28 31	23 00-1948	EA	Replacement Unit, Red, Outdoor, Wall Mounted Speaker (System Sensor SPRK-R)	115.97	34.18
28 31	23 00-1949	EA	Red, High dB, Wall Mounted Speaker (System Sensor SPRV)	100.32	30.16
28 31	23 00-1950	EA	White, Wall Mounted Speaker (System Sensor SPW)	91.52	30.16
28 31	23 00-1951	EA	White, Outdoor, Wall Mounted Speaker (System Sensor SPWK)	140.77	34.18
28 31	23 00-1952	EA	White, High dB, Wall Mounted Speaker (System Sensor SPWV)	100.32	30.16
28 31	23 00-1953		Ceiling Mounted Speakers <small>(28 31 23 00-1813)</small>		
28 31	23 00-1954	EA	Red, Ceiling Mounted Speaker (System Sensor SPCR)	91.52	30.16
28 31	23 00-1955	EA	Outdoor, Ceiling Mounted Speaker (System Sensor SPCRK)	132.72	30.16
28 31	23 00-1956	EA	Red, High dB, Ceiling Mounted Speaker (System Sensor SPCRK)	100.32	30.16
28 31	23 00-1957	EA	White, Ceiling Mounted Speaker (System Sensor SPCW)	91.52	30.16
28 31	23 00-1958	EA	White, High dB, Ceiling Mounted Speaker (System Sensor SPCWV)	100.32	30.16
28 31	23 00-1959	EA	White, Outdoor, Ceiling Mounted Speaker (System Sensor SPCWK)	140.77	34.18
28 31	23 00-1960		Wall Mounted Speakers/Strobes <small>(28 31 23 00-1813)</small>		
28 31	23 00-1961	EA	White Speaker Strobe Expander Plate With Standard Candela (System Sensor SEP-SPSW)	96.11	10.05
28 31	23 00-1962	EA	White Speaker Strobe Expander Plate Backbox Skirt (System Sensor SPSEP-BBSW)	47.31	10.05
28 31	23 00-1963	EA	Red, Selectable Candela (15, 15/75, 30, 75, 95, 110, 115 Candela), Wall Mounted Speaker/Strobe (System Sensor SPSR)	141.92	30.16
28 31	23 00-1964	EA	Red, High-Candela, Selectable Candela (135, 150, 177, 185 Candela), Wall Mounted Speaker/Strobe (System Sensor SPSRH)	150.72	30.16
28 31	23 00-1965	EA	Red, Outdoor, Selectable Candela (15, 15/75, 30, 75, 95, 110, 115 Candela), Wall Mounted Speaker/Strobe (System Sensor SPSRK)	199.57	34.18
28 31	23 00-1966	EA	Red, Plain, Outdoor, Selectable Candela (15, 15/75, 30, 75, 95, 110, 115 Candela), Wall Mounted Speaker/Strobe (System Sensor SPSRK-P)	199.57	34.18
28 31	23 00-1967	EA	Replacement Unit, Red, Outdoor, Selectable Candela (15, 15/75, 30, 75, 95, 110, 115 Candela), Wall Mounted Speaker/Strobe (System Sensor SPSRK-R)	170.77	34.18
28 31	23 00-1968	EA	Red, Plain, Selectable Candela (15, 15/75, 30, 75, 95, 110, 115 Candela), Wall Mounted Speaker/Strobe (System Sensor SPSR-P)	141.92	30.16
28 31	23 00-1969	EA	Red, High dB, Selectable Candela (15, 15/75, 30, 75, 95, 110, 115 Candela), Wall Mounted Speaker/Strobe (System Sensor SPSRV)	145.92	30.16
28 31	23 00-1970	EA	White, Amber Lens, Wall Mounted, Selectable Candela (15, 15/75, 30, 75, 95, 110, 115 Candela), Wall Mounted Speaker/Strobe (System Sensor SPSW-ALERT)	159.52	30.16
28 31	23 00-1971	EA	White, Clear Lens, Outdoor, Selectable Candela (15, 15/75, 30, 75, 95, 110, 115 Candela), Wall Mounted Speaker/Strobe (System Sensor SPSWK-CLR-ALERT)	202.77	34.18
28 31	23 00-1972	EA	White, Selectable Candela (15, 15/75, 30, 75, 95, 110, 115 Candela), Wall Mounted Speaker/Strobe (System Sensor SPSW)	141.92	30.16
28 31	23 00-1973	EA	White, High-Candela, Selectable Candela (135, 150, 177, 185 Candela), Wall Mounted Speaker/Strobe (System Sensor SPSWH)	150.72	30.16
28 31	23 00-1974	EA	White, Plain, High-Candela, Selectable Candela (135, 150, 177, 185 Candela), Wall Mounted Speaker/Strobe (System Sensor SPSWH-P)	150.72	30.16
28 31	23 00-1975	EA	White, Outdoor, Selectable Candela (15, 15/75, 30, 75, 95, 110, 115 Candela), Wall Mounted Speaker/Strobe (System Sensor SPSWK)	199.57	34.18
28 31	23 00-1976	EA	White, Plain, Outdoor, Selectable Candela (15, 15/75, 30, 75, 95, 110, 115 Candela), Wall Mounted Speaker/Strobe (System Sensor SPSWK-P)	199.57	34.18
28 31	23 00-1977	EA	White, Plain, Selectable Candela (15, 15/75, 30, 75, 95, 110, 115 Candela), Wall Mounted Speaker/Strobe (System Sensor SPSW-P)	141.92	30.16
28 31	23 00-1978	EA	White, High dB, Selectable Candela (15, 15/75, 30, 75, 95, 110, 115 Candela), Wall Mounted Speaker/Strobe (System Sensor SPSWV)	145.92	30.16
28 31	23 00-1979	EA	White, Plain, High dB, Selectable Candela (15, 15/75, 30, 75, 95, 110, 115 Candela), Wall Mounted Speaker/Strobe (System Sensor SPSWV-P)	145.92	30.16
28 31	23 00-1980		Ceiling Mounted Speakers/Strobes <small>(28 31 23 00-1813)</small>		
28 31	23 00-1981	EA	Red, Selectable Candela (15, 15/75, 30, 75, 95, 110, 115 Candela), Ceiling Mounted Speaker/Strobe (System Sensor SPSCR)	141.92	30.16
28 31	23 00-1982	EA	Red, Selectable Candela (135, 150, 177, 185) Candela, High-Candela, Ceiling Mounted Speaker/Strobe (System Sensor SPSCRH)	152.32	30.16
28 31	23 00-1983	EA	Red, High dB, Selectable Candela (15, 15/75, 30, 75, 95, 110, 115), Ceiling Mounted Speaker/Strobe (System Sensor SPSCRV)	145.92	30.16
28 31	23 00-1984	EA	White, Selectable Candela (15, 15/75, 30, 75, 95, 110, 115 Candela), Ceiling Mounted Speaker/Strobe (System Sensor SPSCW)	141.92	30.16
28 31	23 00-1985	EA	White, Clear Lens, Selectable Candela (15, 15/75, 30, 75, 95, 110, 115 Candela), Ceiling Mounted Speaker/Strobe (System Sensor SPSCW-CLR-ALERT)	152.32	30.16
28 31	23 00-1986	EA	White, High-Candela, Selectable Candela (135, 150, 177, 185 Candela), Ceiling Mounted Speaker/Strobe (System Sensor SPSCWH)	150.72	30.16
28 31	23 00-1987	EA	White, Outdoor, High-Candela, Selectable Candela (135, 150, 177, 185 Candela), Ceiling Mounted Speaker/Strobe (System Sensor SPSCWHK)	201.97	34.18
28 31	23 00-1988	EA	White, Plain, High-Candela, Selectable Candela (135, 150, 177, 185 Candela), Ceiling Mounted Speaker/Strobe (System Sensor SPSCWH-P)	150.72	30.16
28 31	23 00-1989	EA	White, Outdoor, Clear Lens, Selectable Candela (15, 15/75, 30, 75, 95, 110, 115 Candela), Ceiling Mounted Speaker/Strobe (System Sensor SPSCWK-CLR-ALERT)	202.77	34.18
28 31	23 00-1990	EA	White, Outdoor, Selectable Candela (15, 15/75, 30, 75, 95, 110, 115 Candela), Ceiling Mounted Speaker/Strobe (System Sensor SPSCWK)	199.57	34.18
28 31	23 00-1991	EA	White, Plain, Selectable Candela (15, 15/75, 30, 75, 95, 110, 115 Candela), Ceiling Mounted Speaker/Strobe (System Sensor SPSCW-P)	141.92	30.16
28 31	23 00-1992	EA	White, High dB, Selectable Candela (15, 15/75, 30, 75, 95, 110, 115 Candela), Ceiling Mounted Speaker/Strobe (System Sensor SPSCWV)	145.92	30.16



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 31 23 00-1993 EA White, High-Candela/High dB, Selectable Candela (135, 150, 177, 185 Candela), Ceiling Mounted Speaker/Strobe (System Sensor SPSCWVH).....	150.72	30.16
28 31 23 00-1994 EA White, Plain, High dB, Selectable Candela (15, 15/75, 30, 75, 95, 110, 115 Candela), Ceiling Mounted Speaker/Strobe (System Sensor SPSCWV-P).....	145.92	30.16
28 31 23 00-1995 EA High-Candela/High dB, Ceiling Mounted Speaker/Strobe (System Sensor SPSCRVH).....	151.24	30.16
28 31 23 00-1996 Electric Alarm Bells (28 31 23 00-1813)		
28 31 23 00-1997 EA 6" Alarm Bell (System Sensor SSM24-6).....	109.12	30.16
28 31 23 00-1998 EA 8" Alarm Bell (System Sensor SSM24-8).....	117.92	30.16
28 31 23 00-1999 EA 10" Alarm Bell (System Sensor SSM24-10).....	138.90	30.16
28 31 23 00-2000 Device Bases (28 31 23 00-1813)		
28 31 23 00-2001 EA High Or Low Volume Output, Code 3 Or 4, Continuous, March Or Custom Tone, Intelligent, Addressable, Programmable Plug-In Sounder Base (System Sensor B200S).....	81.71	10.05
28 31 23 00-2002 EA Code 3 Or Continuous Tone, Intelligent Plug-In Sounder Base (System Sensor B200SR).....	79.71	10.05
28 31 23 00-2003 EA Intelligent Isolator Base (System Sensor B224BI).....	65.91	10.05
28 31 23 00-2004 EA Intelligent Relay Base (System Sensor B224RB).....	66.91	10.05
28 31 23 00-2005 EA Flangeless, Intelligent Detector Base (System Sensor B501).....	38.31	10.05
28 31 23 00-2006 Boxes, Plates And Decals (28 31 23 00-1813)		
28 31 23 00-2007 EA Two Wire, Flanged, 12/24 VDC, Low-Profile, Adapter Base (System Sensor B110LP).....	33.31	10.05
28 31 23 00-2008 EA Four Wire, Form A And C, 24 VDC Low-Profile, Adapter Base (System Sensor B112LP).....	62.93	12.07
28 31 23 00-2009 EA Conventional Flanged Mounting Base (System Sensor B210LP).....	32.11	10.05
28 31 23 00-2010 EA 120 VAC, Mounting Plate, For Spectralert Advance Devices (System Sensor MP120K).....	60.91	10.05
28 31 23 00-2011 EA Red, Wall Mounted, Metal, Weatherproof Backbox (System Sensor MWBB).....	53.71	10.05
28 31 23 00-2012 EA White, Ceiling Mounted, Metal, Weatherproof Backbox (System Sensor MWBBCW).....	59.31	10.05
28 31 23 00-2013 EA White, Wall Mounted, Metal, Weatherproof Backbox (System Sensor MWBBW).....	53.71	10.05
28 31 23 00-2014 EA Red Retrofit Plate (System Sensor RFP).....	26.15	6.03
28 31 23 00-2015 EA White Retrofit Plate (System Sensor RFPW).....	26.15	6.03
28 31 23 00-2016 EA Red, Wall Mounted, Weatherproof Backbox (System Sensor SA-WBB).....	45.71	10.05
28 31 23 00-2017 EA Red, Ceiling Mounted, Weatherproof Backbox (System Sensor SA-WBBC).....	46.91	10.05
28 31 23 00-2018 EA Red, Ceiling Mounted, Surface Mounted, Backbox (System Sensor SBBCR).....	38.91	10.05
28 31 23 00-2019 EA White, Ceiling Mounted, Surface Mounted, Backbox (System Sensor SBBCW).....	38.91	10.05
28 31 23 00-2020 EA Red, Wall Mounted, Surface Mounted, Backbox (System Sensor SBBR).....	33.31	10.05
28 31 23 00-2021 EA Red, Wall Mounted, Surface Mounted, Backbox For Speaker (System Sensor SBBSPR).....	37.31	10.05
28 31 23 00-2022 EA White, Wall Mounted, Surface Mounted, Backbox For Speaker (System Sensor SBBSPW).....	37.31	10.05
28 31 23 00-2023 EA White, Wall Mounted, Surface Mounted, Backbox (System Sensor SBBW).....	33.31	10.05
28 31 23 00-2024 EA Surface Mounted Box For Intelligent Control Or Monitor Modules (System Sensor SMB500).....	32.91	10.05
28 31 23 00-2025 EA Surface Mounted Box For 400 And 500 Series Detectors And Sounder Bases (System Sensor SMB600).....	32.91	10.05
28 31 23 00-2026 EA Red, Wall Mounted, Trim Ring (System Sensor TR).....	13.88	4.02
28 31 23 00-2027 EA Red, Ceiling Mounted, Trim Ring (System Sensor TRC).....	13.88	4.02
28 31 23 00-2028 EA White, Ceiling Mounted, Trim Ring (System Sensor TRCW).....	13.88	4.02
28 31 23 00-2029 EA Red, Wall Mounted Horn/Strobe Trim Ring (System Sensor TR-HS).....	12.00	4.02
28 31 23 00-2030 EA White, Wall Mounted, Trim Ring (System Sensor TRW).....	13.88	4.02
28 31 23 00-2031 EA Red Decals, Two Pack, Spectralert Advance Wall Products (System Sensor DECAL-R).....	17.80	
28 31 23 00-2032 EA Red Decals, Three Pack, Spectralert Advance Ceiling Products (System Sensor DECAL-RC).....	24.77	
28 31 23 00-2033 EA White Decals, Two Pack, Spectralert Advance Wall Products (System Sensor DECAL-W).....	17.80	
28 31 23 00-2034 EA White Decals, Three Pack, Spectralert Advance Wall Products (System Sensor DECAL-WC).....	24.77	
28 31 23 00-2035 Chimes (28 31 23 00-1813)		
28 31 23 00-2036 EA Red, 12/24 VDC, Ceiling Or Wall Mounted Chime (System Sensor CHR).....	96.32	30.16
28 31 23 00-2037 EA White, 12/24 VDC, Ceiling Or Wall Mounted Chime (System Sensor CHW).....	96.32	30.16
28 31 23 00-2038 Chime/Strobes (28 31 23 00-1813)		
28 31 23 00-2039 EA Red, 15, 15/75, 30, 75, 110 Multi-Candela, 24 VDC, Ceiling Or Wall Mounted Chime/Strobe (System Sensor CHSR).....	171.52	30.16
28 31 23 00-2040 EA White, 15, 15/75, 30, 75, 110 Multi-Candela, 24 VDC, Ceiling Or Wall Mounted Chime/Strobe (System Sensor CHSW).....	171.52	30.16
28 31 23 00-2041 Carbon Monoxide Detectors (28 31 23 00-1813)		
28 31 23 00-2042 EA Conventional Carbon Monoxide Detector (System Sensor CO1224).....	181.64	40.21
28 31 23 00-2043 EA Round, Sounder And Trouble Relay With Test Function, 12/24 VDC, Conventional Carbon Monoxide Detector (System Sensor CO1224TR).....	161.52	30.16
28 31 23 00-2044 EA CO Detector Plate For Replacing Round CO Detectors With The CO1224T (System Sensor CO-PLATE).....	11.24	4.02
28 31 23 00-2045 Switches (28 31 23 00-1813)		
28 31 23 00-2046 EA SPDT Switch, 4 - 20 PSI, Waterflow Alarm Pressure Switch (System Sensor EPS10-1).....	136.97	16.09
28 31 23 00-2047 EA Two SPDT Switches, 4 - 20 PSI, Waterflow Alarm Pressure Switch (System Sensor EPS10-2).....	152.97	16.09
28 31 23 00-2048 EA SPDT Switch, 10 - 100 PSI, Waterflow Alarm Pressure Switch (System Sensor EPS40-1).....	136.97	16.09
28 31 23 00-2049 EA Two SPDT Switches, 10 - 100 PSI, Waterflow Alarm Pressure Switch (System Sensor EPS40-2).....	152.97	16.09
28 31 23 00-2050 EA Outside Screw And Yoke Valve, Two SPDT, Supervisory Switch (System Sensor OSY2).....	140.17	16.09
28 31 23 00-2051 EA Post Indicator Butterfly Valve, SPDT, Supervisory Switch (System Sensor PIBV2).....	132.17	16.09

28 Electronic Safety And Security**28 30 Electronic Detection And Alarm****28 31 Fire Detection And Alarm**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 31 23 00-2052 Low Frequency Sounders <small>(28 31 23 00-1813)</small>		
28 31 23 00-2053 EA Red, Low Frequency Sounder (System Sensor HR-LF)	122.72	30.16
28 31 23 00-2054 EA White, Low Frequency Sounder (System Sensor HW-LF)	122.72	30.16
28 31 23 00-2055 Sync Modules <small>(28 31 23 00-1813)</small>		
28 31 23 00-2056 EA Red, 12/24 VDC, Sync Module (System Sensor MDL3R)	108.21	20.11
28 31 23 00-2057 EA White, 12/24 VDC, Sync Module (System Sensor MDL3W)	108.21	20.11
28 31 23 00-2058 Relays <small>(28 31 23 00-1813)</small>		
28 31 23 00-2059 EA Metal Enclosure, SPDT, Track Mounted, Multivoltage, Relay (System Sensor R-10E)	61.53	16.09
28 31 23 00-2060 EA SPDT, Track Mounted, Multivoltage, Relay (System Sensor R-10T)	39.63	10.05
28 31 23 00-2061 EA 4-Gang Relay, Metal Enclosure, SPDT, Track Mounted, Multivoltage, Relay (System Sensor R-14E)	114.51	10.05
28 31 23 00-2062 EA 4-Gang Relay, SPDT, Track Mounted, Multivoltage, Relay (System Sensor R-14T)	84.31	10.05
28 31 23 00-2063 EA Metal Enclosure, DPDT, Track Mounted, Multivoltage, Relay (System Sensor R-20E)	66.09	16.09
28 31 23 00-2064 EA DPDT, Track Mounted, Multivoltage, Relay (System Sensor R-20T)	40.91	10.05
28 31 23 00-2065 EA 4-Gang Relay, Metal Enclosure, DPDT, Track Mounted, Multivoltage, Relay (System Sensor R-24E)	128.91	10.05
28 31 23 00-2066 EA 4-Gang Relay, DPDT, Track Mounted, Multivoltage, Relay (System Sensor R-24T)	96.11	10.05
28 31 23 00-2067 EA 18 To 35 VDC, 18 To 35 VAC, 120 VAC, SPDT Multivoltage Relay (System Sensor PR-1)	34.51	10.05
28 31 23 00-2068 EA 10 To 40 VDC, SPDT Multivoltage Relay (System Sensor PR-2)	34.51	10.05
28 31 23 00-2069 EA Redundant Power Input, 10 To 40 VDC, SPDT Multivoltage Relay (System Sensor PR-3)	34.51	10.05
28 31 23 00-2070 Wheelock Fire Alarm <small>(28 31 23)</small>		
28 31 23 00-2071 Ceiling Mounted Chimes/Strobes <small>(28 31 23 00-2070)</small>		
28 31 23 00-2072 EA White, Round, Selectable Candela (15, 30, 75, 100 Candela), 24 VDC, Ceiling Mounted Chime/Strobe (Wheelock CH90-24MCC-FW)	199.52	30.16
28 31 23 00-2073 Wall Mounted Chimes/Strobes <small>(28 31 23 00-2070)</small>		
28 31 23 00-2074 EA Red, Selectable Candela (15, 30, 75, 110 Candela), 24 VDC, Wall Mounted Chime/Strobe (Wheelock CH70-24MCW-FR)	199.52	30.16
28 31 23 00-2075 EA White, Selectable Candela (15, 30, 75, 110 Candela), 24 VDC, Wall Mounted Chime/Strobe (Wheelock CH70-24MCW-FW)	199.52	30.16
28 31 23 00-2076 Ceiling Mounted Horns/Strobes <small>(28 31 23 00-2070)</small>		
28 31 23 00-2077 EA Red, Two Wire, 12/24 VDC, Multi-Candela, Ceiling Mounted Horn/Strobe (Wheelock HSRC)	125.12	30.16
28 31 23 00-2078 EA White, Two Wire, 12/24 VDC, Multi-Candela, Ceiling Mounted Horn/Strobe (Wheelock HSWC)	125.12	30.16
28 31 23 00-2079 Wall Mounted Horns/Strobes <small>(28 31 23 00-2070)</small>		
28 31 23 00-2080 EA Red, Weatherproof, 24 VDC, 75 Candela, Wall Mounted, Horn/Strobe (Wheelock ASWP-2475W-FR)	133.92	30.16
28 31 23 00-2081 EA Red, 24 VDC, 15/75 Candela, Continuous Or Code 3 Tone, Wall Mounted Horn/Strobe (Wheelock HS4-241575 Watt-FR)	151.52	30.16
28 31 23 00-2082 EA Red, 24 VDC, Selectable Candela (15,,30, 75, 110 Candela), Wall Mounted Horn/Strobe (Wheelock HS4-24MCW-FR)	141.12	30.16
28 31 23 00-2083 EA White, 24 VDC, Selectable Candela (15,,30, 75, 110 Candela), Wall Mounted Horn/Strobe (Wheelock HS4-24MCW-FW)	141.12	30.16
28 31 23 00-2084 EA Red, Flush, 24 VAC, 15/75 Candela, Sync/Non-Sync, Wall Mounted Horn/Strobe (Wheelock MT-241575 Watt-FR)	144.32	30.16
28 31 23 00-2085 EA Red, 24 VAC, Multi-Candela, Wall Mounted Horn/Strobe (Wheelock MT-24MCW-FR)	138.32	30.16
28 31 23 00-2086 EA Red, 115 VAC, Wall Mounted Horn/Strobe (Wheelock MT4-115-WH-VFR)	137.92	30.16
28 31 23 00-2087 EA Red, Weatherproof, 24 VDC, 75 Candela, Wall Mounted Horn/Strobe (Wheelock MTWP-2475W-FR)	155.57	34.18
28 31 23 00-2088 EA Red, Two Wire, 12/24 VDC, Multi-Candela, Wall Mounted Horn/Strobe (Wheelock HSR)	125.52	30.16
28 31 23 00-2089 EA White, Two Wire, 12/24 VDC, Multi-Candela, Wall Mounted Horn/Strobe (Wheelock HSW)	125.52	30.16
28 31 23 00-2090 Ceiling Mounted Strobes <small>(28 31 23 00-2070)</small>		
28 31 23 00-2091 EA Red, 24 VDC, Multi-Candela (15, 30, 75, 95 Candela), Ceiling Mounted Strobe (Wheelock RSS-24MCC-FR)	111.92	30.16
28 31 23 00-2092 EA White, 24 VDC, Multi-Candela (15, 30, 75, 95 Candela), Ceiling Mounted Strobe (Wheelock RSS-24MCC-FW)	111.92	30.16
28 31 23 00-2093 EA Red, Two Wire, 12/24 VDC, Multi-Candela, Ceiling Mounted Strobe (Wheelock STRC)	113.92	30.16
28 31 23 00-2094 EA White, Two Wire, 12/24 VDC, Multi-Candela, Ceiling Mounted Strobe (Wheelock STWC)	113.92	30.16
28 31 23 00-2095 Wall Mounted Strobes <small>(28 31 23 00-2070)</small>		
28 31 23 00-2096 EA Red, Multi-Candela, 24 VDC, Wall Mounted Strobe (Wheelock AMT-24MCW-FR)	172.32	30.16
28 31 23 00-2097 EA Red, Retrofit Plate, 12 VDC, 15/75 Candela, Wall Mounted Strobe (Wheelock RSSP-121575W-FR)	140.32	30.16
28 31 23 00-2098 EA Red, 24 VDC, 15/75 Candela, Wall Mounted Strobe (Wheelock RSS-241575W-FR)	123.52	30.16
28 31 23 00-2099 EA Red, 24 VDC, Multi-Candela (15, 30, 75, 95 Candela), Wall Mounted Strobe (Wheelock RSS-24MCW-FR)	115.52	30.16
28 31 23 00-2100 EA White, 24 VDC, Multi-Candela (15, 30, 75, 95 Candela), Wall Mounted Strobe (Wheelock RSS-24MCW-FW)	115.52	30.16
28 31 23 00-2101 EA Red, Retrofit Plate, 24 VDC, Multi-Candela (15, 30, 75, 95 Candela), Wall Mounted Strobe (Wheelock RSSP-24MCW-FR)	127.12	30.16
28 31 23 00-2102 EA Outdoor, Red, 24 VDC, 75 Candela, Wall Mounted Strobe (Wheelock RSSWP-2475W-FR)	130.77	34.18
Note: Requires WPSBB-R.		
28 31 23 00-2103 EA Red, Two Wire, 12/24 VDC, Multi-Candela, Wall Mounted Strobe (Wheelock STR)	113.92	30.16
28 31 23 00-2104 EA White, Two Wire, 12/24 VDC, Multi-Candela, Wall Mounted Strobe (Wheelock STW)	113.92	30.16



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 31 23 00-2105				Ceiling Mounted Speakers/Strobes <small>(28 31 23 00-2070)</small>		
				28 31 23 00-2106 EA Red, 24 VDC, Selectable Candela (15, 30, 75, 110 Candela), Ceiling Mounted Speaker/Strobe (Wheelock E60-24MCC-FR).....	149.92	30.16
				28 31 23 00-2107 EA White, 24 VDC, Selectable Candela (15, 30, 75, 110 Candela), Ceiling Mounted Speaker/Strobe (Wheelock E60-24MCC-FW).....	149.92	30.16
				28 31 23 00-2108 EA White, 24 VDC, Selectable Candela (15, 30, 75, 110 Candela), Ceiling Mounted Speaker/Strobe (Wheelock E70-24MCC-FW).....	148.32	30.16
				28 31 23 00-2109 EA White, 24 VDC, Multi-Candela (15, 30, 75, 110 Candela), Ceiling Mounted Speaker/Strobe (Wheelock E90-24MCC-FW).....	149.92	30.16
				28 31 23 00-2110 EA White, 24 VDC, Multi-Candela 115/177, Ceiling Mounted Speaker/Strobe (Wheelock E90-24MCCH-FW).....	159.92	30.16
				28 31 23 00-2111 EA White, 24 VDC, Multi-Candela (15, 30, 75, 95 Candela), Ceiling Mounted Speaker/Strobe (Wheelock ET90-24MCC-FW).....	163.52	30.16
28 31 23 00-2112				Wall Mounted Speakers/Strobes <small>(28 31 23 00-2070)</small>		
				28 31 23 00-2113 EA Red, Square, 24 VDC, 15/75 Candela, 25/70.7 VRMS, Wall Mounted Speaker/Strobe (Wheelock E50-241575 Watt-FR).....	165.12	30.16
				28 31 23 00-2114 EA White, Square, 24 VDC, 15/75 Candela, 25/70.7 VRMS, Wall Mounted Speaker/Strobe (Wheelock E50-241575 Watt-FW).....	165.12	30.16
				28 31 23 00-2115 EA Red, 24 VDC, Multi-Candela 115/177, Wall Mounted Speaker/Strobe (Wheelock E60-24MCCH-FR).....	159.92	30.16
				28 31 23 00-2116 EA White, 24 VDC, Multi-Candela 115/177, Wall Mounted Speaker/Strobe (Wheelock E60-24MCCH-FW).....	159.92	30.16
				28 31 23 00-2117 EA Red, Square, 24 VDC, Selectable Candela 15/30/75/110, Wall Mounted Speaker/Strobe (Wheelock E50-24MCW-FR).....	149.92	30.16
				28 31 23 00-2118 EA White, Square, 24 VDC, Selectable Candela 15/30/75/110, Wall Mounted Speaker/Strobe (Wheelock E50-24MCW-FW).....	146.72	30.16
				28 31 23 00-2119 EA Red, 24 VDC, Multi-Candela 135/185, Wall Mounted Speaker/Strobe (Wheelock E50-24MCWH-FR).....	159.92	30.16
				28 31 23 00-2120 EA White, 24 VDC, Multi-Candela 135/185, Wall Mounted Speaker/Strobe (Wheelock E50-24MCWH-FW).....	159.92	30.16
				28 31 23 00-2121 EA Red, Square, 24 VDC, 15/75 Candela, 25/70.7 VRMS, Wall Mounted Speaker/Strobe (Wheelock E70-241575 Watt-FR).....	163.52	30.16
				28 31 23 00-2122 EA Red, Square, 24 VDC, Selectable Candela 15/30/75/110, Wall Mounted Speaker/Strobe (Wheelock E70-24MCW-FR).....	149.92	30.16
				28 31 23 00-2123 EA White, Square, 24 VDC, Selectable Candela 15/30/75/110, Wall Mounted Speaker/Strobe (Wheelock E70-24MCW-FW).....	146.72	30.16
				28 31 23 00-2124 EA Red, 24 VDC, Multi-Candela 135/185, Wall Mounted Speaker/Strobe (Wheelock E70-24MCWH-FR).....	159.92	30.16
				28 31 23 00-2125 EA White, 24 VDC, Multi-Candela 135/185, Wall Mounted Speaker/Strobe (Wheelock E70-24MCWH-FW).....	163.52	30.16
				28 31 23 00-2126 EA Red, 24 VDC, Selectable Candela 15/30/75/110, Wall Mounted Speaker/Strobe (Wheelock ET70-24MCW-FR).....	163.52	30.16
				28 31 23 00-2127 EA White, 24 VDC, Selectable Candela 15/30/75/110, Wall Mounted Speaker/Strobe (Wheelock ET70-24MCW-FW).....	163.52	30.16
				28 31 23 00-2128 EA Weatherproof, Red, 24 VDC, 75 Candela, Wall Mounted Speaker Strobe (Wheelock ET70WP-2475 W-FR).....	178.37	34.18
				Note: Requires weatherproof backbox (IOB).		
28 31 23 00-2129				Electric Alarm Bells <small>(28 31 23 00-2070)</small>		
				28 31 23 00-2130 EA 6", 24 VDC, Red, Vibrating Bell (Wheelock 43T-G6-24-R).....	127.92	30.16
				28 31 23 00-2131 EA 6", 115 VAC, Red, Vibrating Bell (Wheelock 43T-G6-115-R).....	127.92	30.16
				28 31 23 00-2132 EA 10", 115 VAC, Red, Vibrating Bell (Wheelock 43T-G10-115-R).....	165.12	30.16
				28 31 23 00-2133 EA 115 VAC, Single Stroke, Red, 10" Explosion Proof Bell (Wheelock CSX10-115-R).....	1,117.17	34.18
				28 31 23 00-2134 EA Outdoor, 115 VAC, Single Stroke, Red, 10" Explosion Proof Bell (Wheelock CSXG10-115-R).....	1,764.37	34.18
				28 31 23 00-2135 EA Vibrating, Outdoor, 115 VAC, Single Stroke, Red, 10" Explosion Proof Bell (Wheelock CVXG10-115-R).....	1,648.37	34.18
				28 31 23 00-2136 EA 6", ADA, 24 VDC, Red, Motor Bell (Wheelock MB-G6-24-R).....	103.92	30.16
				28 31 23 00-2137 EA 10", ADA, 24 VDC, Red, Motor Bell (Wheelock MB-G10-24-R).....	122.72	30.16
28 31 23 00-2138				Horns <small>(28 31 23 00-2070)</small>		
				28 31 23 00-2139 EA Two Wire, 24 VDC, Indoor Or Outdoor, Continuous Or Code 3, Sync Or Non Sync Horn (Wheelock AH-24WP-R).....	92.32	30.16
				28 31 23 00-2140 EA Red, Two Wire, 12/24 VDC, Wall Mounted Horn (Wheelock HNR).....	91.92	30.16
				28 31 23 00-2141 EA White, Two Wire, 12/24 VDC, Wall Mounted Horn (Wheelock HNW).....	91.92	30.16
				28 31 23 00-2142 EA Red, Two Wire, 12/24 VDC, Ceiling Mounted Horn (Wheelock HNR).....	92.32	30.16
				28 31 23 00-2143 EA White, Two Wire, 12/24 VDC, Ceiling Mounted Horn (Wheelock HNW).....	92.32	30.16
				28 31 23 00-2144 EA Red, 24 VDC, Sync With Built-In Temporal, Mini-Horn (Wheelock MIZ-24S-R).....	78.72	30.16
				28 31 23 00-2145 EA White, 24 VDC, Sync With Built-In Temporal, Mini-Horn (Wheelock MIZ-24S-W).....	78.72	30.16
				28 31 23 00-2146 EA Red, Flush, 12/24 VAC, Horn (Wheelock MT-12/24-R).....	90.32	30.16
28 31 23 00-2147				Speakers <small>(28 31 23 00-2070)</small>		
				28 31 23 00-2148 EA Red, Square, 25 Or 70.7 VRMS, 1/8 To 2 Watts, Wall Mounted Speaker (Wheelock E50-R).....	94.72	30.16
				28 31 23 00-2149 EA White, Square, 25 Or 70.7 VRMS, 1/8 To 2 Watts, Wall Mounted Speaker (Wheelock E50-W).....	94.72	30.16
				28 31 23 00-2150 EA Red, Square, 25 Or 70.7 VRMS, 1/8 To 2 Watts, Ceiling Mounted Speaker (Wheelock E60-R).....	94.72	30.16
				28 31 23 00-2151 EA White, Square, 25 Or 70.7 VRMS, 1/8 To 2 Watts, Ceiling Mounted Speaker (Wheelock E60-W).....	92.72	30.16
				28 31 23 00-2152 EA Red, Flush, Square, 25 Or 70.7 VRMS, 1/8 To 2 Watts, Wall Or Ceiling Mounted Speaker (Wheelock E70-R).....	94.72	30.16
				28 31 23 00-2153 EA White, Flush, Square, 25 Or 70.7 VRMS, 1/8 To 2 Watts, Wall Or Ceiling Mounted Speaker (Wheelock E70-W).....	94.72	30.16
				28 31 23 00-2154 EA Red, Round, 25 Or 70.7 VRMS, 1/8 To 2 Watts, Wall Or Ceiling Mounted Speaker (Wheelock E90-R).....	94.72	30.16
				28 31 23 00-2155 EA White, Round, 25 Or 70.7 VRMS, 1/8 To 2 Watts, Wall Or Ceiling Mounted Speaker (Wheelock E90-W).....	94.72	30.16
				28 31 23 00-2156 EA Red, Flush Or Surface, Square, 1/8 - 8 Watts, Wall Mounted Speaker (Wheelock ET70-R).....	107.52	30.16
				28 31 23 00-2157 EA White, Flush Or Surface, Square, 1/8 - 8 Watts, Wall Mounted Speaker (Wheelock ET70-W).....	107.52	30.16
				28 31 23 00-2158 EA White, Round, 25 Or 70.7 VRMS, 1/8 - 8 Watts Ceiling Mounted Speaker (Wheelock ET90-W).....	109.12	30.16
				28 31 23 00-2159 EA Red, Surface Mounted, Vandal Resistant, Square, 1/8 - 8 Watts, Wall Or Ceiling Mounted Speaker (Wheelock ET-1010-R).....	120.72	30.16
				28 31 23 00-2160 EA Red, Flush Mounted, Vandal Resistant, Square, 1/8 - 8 Watts, Wall Or Ceiling Mounted Speaker (Wheelock ET-1080-R).....	115.52	30.16

28 Electronic Safety And Security**28 30 Electronic Detection And Alarm****28 31 Fire Detection And Alarm**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
28 31 23 00-2161	EA		Grey, 1 To 15 Watts, 25/70/100 V Transformer, Loud Speaker (Wheelock STH-15S).....	219.52	30.16
28 31 23 00-2162	EA		Red, 1 To 15 Watts, 25/70/100 V Transformer, Loud Speaker (Wheelock STH-15SR).....	219.52	30.16
28 31 23 00-2163			Sync Modules <small>(28 31 23 00-2070)</small>		
28 31 23 00-2164	EA		12 Or 24 VDC, Single Circuit Class B, Sync Module (Wheelock SM-12/24-R).....	102.61	20.11
28 31 23 00-2165			Boxes, Plates And Rings <small>(28 31 23 00-2070)</small>		
28 31 23 00-2166	EA		4" Square, Red, Surface Backbox (Wheelock BB-R).....	27.51	10.05
28 31 23 00-2167	EA		Standard 4" Square Box (Wheelock BB-STD).....	25.39	10.05
28 31 23 00-2168	EA		Black, Backbox For UZC-256 (Wheelock BB-UZC).....	141.01	20.11
28 31 23 00-2169	EA		Red, Backbox For UZC-256 (Wheelock BB-UZC-R).....	141.01	20.11
28 31 23 00-2170	EA		9" x 12" x 2.75", For Two XP Boards, Surface Mounted Cabinet (Wheelock BB-XP).....	104.97	16.09
28 31 23 00-2171	EA		Red, Extender Ring For E60 Series (Wheelock E60EXT-R).....	15.04	4.02
28 31 23 00-2172	EA		White, Extender Ring For E60 Series (Wheelock E60EXT-W).....	14.84	4.02
28 31 23 00-2173	EA		Red, Surface Mounted Backbox For E50 Speakers (Wheelock E50SB-R).....	35.71	10.05
28 31 23 00-2174	EA		White, Surface Mounted Backbox For E50 Speakers (Wheelock E50SB-W).....	34.11	10.05
28 31 23 00-2175	EA		Red, Surface Mounted Backbox For E50 Speaker Strobe (Wheelock E50SSB-R).....	36.51	10.05
28 31 23 00-2176	EA		White, Surface Mounted Backbox For E50 Speaker Strobe (Wheelock E50SSB-W).....	36.51	10.05
28 31 23 00-2177	EA		4" Square Backbox (Wheelock DBB-R).....	29.31	10.05
28 31 23 00-2178	EA		Red, Surface Backbox (Wheelock IOB-R).....	34.91	10.05
28 31 23 00-2179	EA		White, Surface, Backbox (Wheelock IOB-W).....	34.91	10.05
28 31 23 00-2180	EA		White, Indoor, Surface Extender (Wheelock ISP2-W).....	14.24	4.02
28 31 23 00-2181	EA		Red, RS/RSS Strobe Trim Plate (Wheelock NATP-R).....	14.84	4.02
28 31 23 00-2182	EA		White, RS/RSS Strobe Trim Plate (Wheelock NATP-W).....	14.84	4.02
28 31 23 00-2183	EA		Red Retrofit Plate (Wheelock RP-R).....	17.24	4.02
28 31 23 00-2184	EA		4" Speaker/Strobe Ceiling Tile Support Bracket (Wheelock SSB-4).....	24.84	4.02
28 31 23 00-2185	EA		Red, Surface Mounted, Backbox For Chimes, Speakers (Wheelock SBB-R).....	36.51	10.05
28 31 23 00-2186	EA		White, Surface Mounted, Backbox For Chimes, Speaker (Wheelock SBB-W).....	36.51	10.05
28 31 23 00-2187	EA		Red, Surface Mounted, Backbox For With RSSP (Wheelock SBL2-R).....	39.51	10.05
28 31 23 00-2188	EA		Red, Semi-Flush Plate (Wheelock SFB-R).....	15.44	4.02
28 31 23 00-2189	EA		White, Semi-Flush Plate (Wheelock SFB-W).....	15.44	4.02
28 31 23 00-2190	EA		Red, Shallow Surface Mounted, Backbox (Wheelock SHBB-R).....	32.11	10.05
28 31 23 00-2191	EA		White, Shallow Surface Mounted, Backbox (Wheelock SHBB-W).....	32.11	10.05
28 31 23 00-2192	EA		Red, Adapter Plate For Mounting Sth-15S And Sth-15SR (Wheelock SHMP-R).....	21.44	4.02
28 31 23 00-2193	EA		Red, Weatherproof Backbox (Wheelock WBB).....	45.71	10.05
28 31 23 00-2194	EA		Weather Resistant Backbox (Wheelock WBB-R).....	36.51	10.05
28 31 23 00-2195	EA		Red, Flush Outdoor Mounting Plate For RS, ET, AH And MT Series (Wheelock WFP-R).....	27.44	4.02
28 31 23 00-2196	EA		White, Flush Outdoor Mounting Plate For RS, ET, AH And MT Series (Wheelock WFP-W).....	27.44	4.02
28 31 23 00-2197	EA		Red, Flush Outdoor Mounting Plate For ASWP Series (Wheelock WFPA-R).....	27.44	4.02
28 31 23 00-2198	EA		White, Flush Outdoor Mounting Plate For ASWP Series (Wheelock WFPA-W).....	27.44	4.02
28 31 23 00-2199	EA		Gasket Kit For Rear Wiring To Outdoor Backbox (Wheelock WP-KIT).....	15.44	4.02
28 31 23 00-2200	EA		Weather Resistant Backbox For ASWP (Wheelock WPBB-R).....	38.51	10.05
28 31 23 00-2201	EA		Weather Resistant Backbox For RSSWP (Wheelock WPSBB-R).....	36.51	10.05
28 31 23 00-2202			Fire Alarm Terminal Cabinets <small>(28 31 23)</small>		
28 31 23 00-2203	EA		18 Point Lockable Fire Alarm Terminal Cabinet.....	145.90	40.28
28 31 23 00-2204	EA		32 Point Lockable Fire Alarm Terminal Cabinet.....	185.11	40.28
28 31 23 00-2205	EA		64 Point Lockable Fire Alarm Terminal Cabinet.....	263.52	40.28
28 31 23 00-2206	EA		128 Point Lockable Fire Alarm Terminal Cabinet.....	341.91	40.28
28 33 Gas Detection and Alarm <small>(28 30)</small>					
28 33 00 00-0001			Hydrogen Gas Detection <small>(28 33)</small>		
28 33 00 00-0002	EA		Hydrogen Gas Detector Sensor, 1% Fan Relay, 2% Alarm (SBS HGDI-DR).....	1,018.34	30.21
28 33 00 00-0003	EA		Hydrogen Gas Detector Junction Box (SBS HGDI-JB).....	57.60	10.07
28 33 00 00-0004	EA		Remote Display With 25' Cable For Hydrogen Gas Detector (SBS HGDI-REM).....	269.13	30.21
28 33 00 00-0005			Monitoring System For Underground Tanks <small>(28 33)</small>		
28 33 00 00-0006			Continuous Leak Detection System <small>(28 33 00 00-0005)</small>		
Note: Includes calibration, electronic control module and probes. Excludes sample wells, electrical power supply and sensor cable.					
28 33 00 00-0007	EA		Single Channel Underground Tank Monitoring System.....	3,191.88	329.77
28 33 00 00-0008	EA		2 Channel Underground Tank Monitoring System.....	4,301.33	439.95
28 33 00 00-0009	EA		3 Channel Underground Tank Monitoring System.....	5,934.06	471.33
28 33 00 00-0010	EA		4 Channel Underground Tank Monitoring System.....	6,520.21	659.53
28 33 00 00-0011	EA		Control Panel, 1-8 Tanks, Single Wall Tank Monitoring System.....	4,172.16	56.30
28 33 00 00-0012	EA		Control Panel, 1-4 Tanks, Double Wall Tank Monitoring System.....	3,761.93	50.27
28 33 00 00-0013	EA		Control Panel, 1-8 Tanks, Double Wall Tank Monitoring System.....	4,936.97	56.30
28 33 00 00-0014	EA		Tank Leak Detection Probe.....	1,522.84	12.07
28 33 00 00-0015	EA		Secondary Containment Collar Probe.....	189.27	4.82
28 33 00 00-0016	EA		Interstitial Leak Detection Probe.....	348.13	10.05
28 33 00 00-0017	EA		Liquid Phase Detection.....	1,145.83	30.16
28 33 00 00-0018	EA		Hydrocarbon Vapor, Fixed.....	1,059.99	30.16
28 33 00 00-0019	EA		Hydrocarbon Vapor, Float Mounted.....	1,235.49	34.18
28 33 00 00-0020	EA		Liquid And Vapor Hydrocarbon.....	1,407.18	34.18



Electronic Safety And Security	28	28
Electronic Detection And Alarm	28 30	
Gas Detection and Alarm	28 33	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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28 34 Fuel-Oil Detection and Alarm (28 30)
See CSI section 28 33 00 00-0000 for detection and alarms.

END OF SECTION 28

28 Electronic Safety And Security

28 30 Electronic Detection And Alarm

28 34 Fuel-Oil Detection and Alarm



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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31 Earthwork

31 01 Maintenance of Earthwork ⁽³¹⁾

31 01 20 Maintenance of Earth Moving ^(31 01)

31 01 20 00-0001 Rip Settling Basins ^(31 01 20)

Note: Rip through light soil and sand in settling basin. 8' on center (machine width).

31 01 20 00-0002	ACR Rip Light Soil And Sand, By Dozer	469.05
31 01 20 00-0003	ACR Rip Light Soil And Sand, By Grader With Rear Ripper	768.55
31 01 20 00-0004	ACR Rip Light Soil And Sand, By Rubber Tire Front End Loader	653.38

31 05 Common Work Results For Earthwork ⁽³¹⁾

31 05 13 Soils For Earthwork ^(31 05)

Note: Includes delivery up to 15 miles from the closest approved source and dumping. Excludes spreading or backfilling. See CSI section 01 74 19 00-0034 for hauling greater than 15 miles.

31 05 13 00-0001 Fill Material (Loose, Purchased Material) ^(31 05 13)

Note: Includes delivery up to 15 miles from the closest approved source, loading and dumping. Excludes spreading or backfilling. See CSI section 01 74 19 00-0034 for hauling greater than 15 miles.

31 05 13 00-0002	CY Sand, Bank Run.....	53.90
	For Up To 10, Add	15.60
	For >10 To 25, Add	5.39
31 05 13 00-0003	CY 3/8" Minus, ASTM C33, Screened/Washed Bedding Sand.....	37.40
	For Up To 10, Add	10.65
	For >10 To 25, Add	3.74
31 05 13 00-0004	CY Native Clean Fill Soil/Dirt - Common	31.40
	For Up To 10, Add	8.85
	For >10 To 25, Add	3.14
31 05 13 00-0005	CY Lime Rock Screening.....	36.90
	For Up To 10, Add	10.50
	For >10 To 25, Add	3.69
31 05 13 00-0006	CY Crushed Lime Rock Maximum 3-1/2"	33.77
	For Up To 10, Add	9.56
	For >10 To 25, Add	3.38
31 05 13 00-0007	CY Asphalt Sand	50.00
	For Up To 10, Add	14.43
	For >10 To 25, Add	5.00
31 05 13 00-0008	CY Lawn Sand.....	38.93
	For Up To 10, Add	11.11
	For >10 To 25, Add	3.89
31 05 13 00-0009	CY Sand/Clay	52.66
	For Up To 10, Add	15.23
	For >10 To 25, Add	5.27
31 05 13 00-0010	CY Recycled Concrete Aggregate	72.66
	For Up To 10, Add	21.23
	For >10 To 25, Add	7.27
31 05 13 00-0011	CY Sand Fill, Washed Aggregate	74.63
	For Up To 10, Add	21.82
	For >10 To 25, Add	7.46
31 05 13 00-0012	CY Pond Sand	29.38
	For Up To 10, Add	8.24
	For >10 To 25, Add	2.94
31 05 13 00-0013	CY Pitrun Clay	41.30
	For Up To 10, Add	11.82
	For >10 To 25, Add	4.13
31 05 13 00-0014	CY Light Clay / Loam	62.51
	For Up To 10, Add	18.18
	For >10 To 25, Add	6.25
31 05 13 00-0015	CY Heavy Clay	51.99
	For Up To 10, Add	15.03
	For >10 To 25, Add	5.20

31 05 16 Aggregates For Earthwork ^(31 05)

See CSI section 01 74 19 00-0034 for hauling greater than 15 miles.

31 05 16 00-0001 Aggregate (Loose, Purchased Material) ^(31 05 16)

Note: Includes delivery up to 15 miles from the closest approved source, loading and dumping. Excludes spreading or backfilling. See CSI section 01 74 19 00-0034 for hauling greater than 15 miles.

31 05 16 00-0002	CY #2 Stone Aggregate Fill (1-1/2" To 2-1/2" Clean).....	57.58
	For Up To 10, Add	16.70
	For >10 To 25, Add	5.76
31 05 16 00-0003	CY #3 Stone Aggregate Fill (1" To 2" Clean).....	49.40
	For Up To 10, Add	14.25
	For >10 To 25, Add	4.94
31 05 16 00-0004	CY #4 Stone Aggregate Fill (3/4" To 1-1/2" Clean).....	50.43
	For Up To 10, Add	14.56
	For >10 To 25, Add	5.04

31 Earthwork
31 05 Common Work Results For Earthwork
31 05 16 Aggregates For Earthwork



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
31 05 16 00-0005	CY		#5 Stone Aggregate Fill (1/2" To 1" Clean)	55.36	
			For Up To 10, Add	16.04	
			For >10 To 25, Add	5.54	
31 05 16 00-0006	CY		#6 Stone Aggregate Fill (3/8" To 3/4" Clean)	56.36	
			For Up To 10, Add	16.34	
			For >10 To 25, Add	5.64	
31 05 16 00-0007	CY		#56 Stone Aggregate Fill (3/8" To 1")	58.39	
			For Up To 10, Add	16.95	
			For >10 To 25, Add	5.84	
31 05 16 00-0008	CY		#57 Stone Aggregate Fill (#4 To 1")	59.58	
			For Up To 10, Add	17.30	
			For >10 To 25, Add	5.96	
31 05 16 00-0009	CY		#67 Or #68 Stone Aggregate Fill (#4 To 3/4")	60.71	
			For Up To 10, Add	17.64	
			For >10 To 25, Add	6.07	
31 05 16 00-0010	CY		#7 Stone Aggregate Fill (1/2" To #4)	60.91	
			For Up To 10, Add	17.70	
			For >10 To 25, Add	6.09	
31 05 16 00-0011	CY		#78 Stone Aggregate Fill (#8 To 1/2")	62.94	
			For Up To 10, Add	18.31	
			For >10 To 25, Add	6.29	
31 05 16 00-0012	CY		#8 Stone Aggregate Fill (3/8" x 1/8")	64.96	
			For Up To 10, Add	18.92	
			For >10 To 25, Add	6.50	
31 05 16 00-0013	CY		#89 Stone Aggregate Fill (#16 To 3/8")	65.28	
			For Up To 10, Add	19.01	
			For >10 To 25, Add	6.53	
31 05 16 00-0014	CY		#9 Stone Aggregate Fill (1/4" Clean)	65.60	
			For Up To 10, Add	19.11	
			For >10 To 25, Add	6.56	
31 05 16 00-0015	CY		#10 Stone Aggregate Fill (#8 To 3/4)	68.68	
			For Up To 10, Add	20.03	
			For >10 To 25, Add	6.87	
31 05 16 00-0016	CY		#610 Modified Stone Aggregate Fill (#16 To 3/4")	62.52	
			For Up To 10, Add	18.19	
			For >10 To 25, Add	6.25	
31 05 16 00-0017	CY		Screenings Stone Aggregate Fill	47.54	
			For Up To 10, Add	13.69	
			For >10 To 25, Add	4.75	
31 05 16 00-0018	CY		Stone Aggregate Fill, Random Size, Over 6" To 12"	70.22	
			For Up To 10, Add	20.50	
			For >10 To 25, Add	7.02	
31 05 16 00-0019	CY		Graded Stone Aggregate Fill, Over 6" To 12"	79.06	
			For Up To 10, Add	23.15	
			For >10 To 25, Add	7.91	
31 05 16 00-0020	CY		Surge Stone Aggregate Fill (3" To 7" Random)	60.58	
			For Up To 10, Add	17.60	
			For >10 To 25, Add	6.06	
31 05 16 00-0021	CY		Surge Stone Graded Aggregate Fill (3" To 7")	72.31	
			For Up To 10, Add	21.12	
			For >10 To 25, Add	7.23	
31 05 16 00-0022	CY		Crusher Run Aggregate Fill (2-1/2" Minus)	57.29	
			For Up To 10, Add	16.62	
			For >10 To 25, Add	5.73	
31 05 16 00-0023	CY		Crusher Run Aggregate Fill (1-1/2" Minus)	55.28	
			For Up To 10, Add	16.01	
			For >10 To 25, Add	5.53	
31 05 16 00-0024	CY		Crusher Run Aggregate Fill (3/4" Minus)	48.40	
			For Up To 10, Add	13.95	
			For >10 To 25, Add	4.84	
31 05 16 00-0025	CY		Miscellaneous Crushed Base, Processed Concrete, Paving	35.21	
			For Up To 10, Add	9.99	
			For >10 To 25, Add	3.52	

31 05 36 Equipment Delivery, Pickup, Mobilization And Demobilization ⁽³¹⁾

⁽⁰⁵⁾
See CSI section 01 71 13 00-0001 for equipment delivery, pickup, mobilization and demobilization.

31 10 Site Clearing ⁽³¹⁾

31 11 Clearing And Grubbing ^(31 10)

31 11 00 00-0001 Clear And Grub Roots And Stumps ^(31 11)

Note: Tree diameter (diameter at breast height) is the diameter of the tree trunk measured at 4.5' above ground level. Based on tree density (light, medium or heavy) to be removed. Excludes loading. See CSI section 31 13 13 00-0001 for small areas or individual trees removal.

31 11 00 00-0002	ACR		Clear And Grub Light Trees Up To 6" Diameter, Cut And Chip	6,536.96	
			Note: Includes grub and removal of stump		
31 11 00 00-0003	ACR		Clear And Grub Light Stumps Only Up To 6" Diameter	1,502.14	
31 11 00 00-0004	ACR		Clear And Grub Medium Trees Up To 10" Diameter, Cut And Chip	7,626.45	
			Note: Includes grub and removal of stump		
31 11 00 00-0005	ACR		Clear And Grub Medium Stumps Only Up To 10" Diameter	2,503.57	
31 11 00 00-0006	ACR		Clear And Grub Heavy Trees Up To 16" Diameter, Cut And Chip	8,666.41	
			Note: Includes grub and removal of stump		



Earthwork	31	13
Site Clearing	31 10	
Clearing And Grubbing	31 11	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
31 11 00 00-0007 ACR Clear And Grub Heavy Stumps Only Up To 16" Diameter.....	2,845.30	
31 11 00 00-0008 ACR Clearing By Machine - Light Brush Without Grub	251.77	
31 11 00 00-0009 ACR Clearing By Machine - Medium Brush Without Grub	510.95	
31 11 00 00-0010 ACR Clearing By Machine - Heavy Brush Without Grub	725.37	
31 11 00 00-0011 ACR Chipping - Light Brush	2,034.08	
31 11 00 00-0012 ACR Chipping - Medium Brush	2,615.38	
31 11 00 00-0013 ACR Chipping - Heavy Brush	3,661.87	
31 11 00 00-0014 Loading Of Cleared And Grubbed Material <small>(31 11)</small>		
See CSI section 01 74 19 00-0034 for hauling.		
31 11 00 00-0015 CY Machine Loading Of Cleared And Grubbed Material	8.52	
31 11 00 00-0016 CY Chute Loading Of Cleared And Grubbed Material	10.22	
31 11 00 00-0017 CY Hand Loading Of Cleared And Grubbed Material	33.21	
31 11 00 00-0018 CY Wheel And Ramp Loading Of Cleared And Grubbed Material.....	26.09	
31 13 Selective Tree And Shrub Removal And Trimming <small>(31 10)</small>		
31 13 13 Selective Tree And Shrub Removal <small>(31 13)</small>		
31 13 13 00-0001 Individual Tree Removal <small>(31 13 13)</small>		
Note: Includes sawing and chipping branches. Tree diameter, D.B.H. (Diameter At Breast Height) is the diameter of the tree trunk measured at 4.5' above ground elevation. Excludes stump removal or grinding.		
31 13 13 00-0002 EA Up To 6" D.B.H. (Diameter At Breast Height) Tree Removal.....	476.65	
Note: Includes cutting up tree, chipping and loading.		
31 13 13 00-0003 EA >6" To 12" D.B.H. (Diameter At Breast Height) Tree Removal	714.98	
Note: Includes cutting up tree, chipping and loading.		
31 13 13 00-0004 EA >12" To 24" D.B.H. (Diameter At Breast Height) Tree Removal	953.31	
Note: Includes cutting up tree, chipping and loading.		
31 13 13 00-0005 EA >24" To 36" D.B.H. (Diameter At Breast Height) Tree Removal	1,429.96	
Note: Includes cutting up tree, chipping and loading.		
31 13 13 00-0006 EA >36" To 48" D.B.H. (Diameter At Breast Height) Tree Removal	1,906.61	
Note: Includes cutting up tree, chipping and loading.		
31 13 13 00-0007 Stump Removal <small>(31 13 13)</small>		
Note: Measured by diameter of stump.		
31 13 13 00-0008 Stump Removal By Machine <small>(31 13 13 00-0007)</small>		
31 13 13 00-0009 EA Up To 6" Diameter Stump Removal	75.11	
Note: Includes excavation necessary to remove stump and loading.		
31 13 13 00-0010 EA >6" To 12" Diameter Stump Removal	143.95	
Note: Includes excavation necessary to remove stump and loading.		
31 13 13 00-0011 EA >12" To 24" Diameter Stump Removal	187.77	
Note: Includes excavation necessary to remove stump and loading.		
31 13 13 00-0012 EA >24" To 36" Diameter Stump Removal	281.66	
Note: Includes excavation necessary to remove stump and loading.		
31 13 13 00-0013 EA >36" To 48" Diameter Stump Removal	331.74	
Note: Includes excavation necessary to remove stump and loading.		
31 13 13 00-0014 Stump Removal By Hand <small>(31 13 13 00-0007)</small>		
31 13 13 00-0015 EA Up To 6" Diameter Stump Removal By Hand	500.78	
Note: Where stump removal is inaccessible by machine. Includes excavation necessary to remove stump and loading.		
31 13 13 00-0016 EA >6" To 12" Diameter Stump Removal By Hand	625.96	
Note: Where stump removal is inaccessible by machine. Includes excavation necessary to remove stump and loading.		
31 13 13 00-0017 EA >12" To 24" Diameter Stump Removal By Hand	918.09	
Note: Where stump removal is inaccessible by machine. Includes excavation necessary to remove stump and loading.		
31 13 13 00-0018 EA >24" To 36" Diameter Stump Removal By Hand	1,251.93	
Note: Where stump removal is inaccessible by machine. Includes excavation necessary to remove stump and loading.		
31 13 13 00-0019 EA >36" To 48" Diameter Stump Removal By Hand	1,669.25	
Note: Where stump removal is inaccessible by machine. Includes excavation necessary to remove stump and loading.		
31 13 13 00-0020 Stump Grinding <small>(31 13 13)</small>		
Note: Measured by diameter of stump.		
31 13 13 00-0021 Stump Grinding, 18" Deep Below Surface Of Soil <small>(31 13 13 00-0020)</small>		
Note: Level soil to match existing surface area.		
31 13 13 00-0022 EA Stump Grinding Up To 6" Tree	95.36	
For 24" Depth, Add	19.07	
31 13 13 00-0023 EA Stump Grinding >6" To 12" Tree.....	127.15	
For 24" Depth, Add	25.43	
31 13 13 00-0024 EA Stump Grinding >12" To 15" Tree.....	143.04	
For 24" Depth, Add	28.61	
31 13 13 00-0025 EA Stump Grinding >15" To 18" Tree.....	158.94	
For 24" Depth, Add	31.79	

31 Earthwork**31 10 Site Clearing****31 13 Selective Tree And Shrub Removal And Trimming**

MINOR		TOTAL DIRECT	DEMOLITION
CSI	UOM DESCRIPTION	UNIT COST	UNIT COST
31 13 13 00-0026	EA Stump Grinding >18" To 21" Tree..... <i>For 24" Depth, Add</i>	170.86 34.17	
31 13 13 00-0027	EA Stump Grinding >21" To 24" Tree..... <i>For 24" Depth, Add</i>	182.78 36.56	
31 13 13 00-0028	EA Stump Grinding >24" To 27" Tree..... <i>For 24" Depth, Add</i>	198.67 39.73	
31 13 13 00-0029	EA Stump Grinding >27" To 30" Tree..... <i>For 24" Depth, Add</i>	215.52 43.10	
31 13 13 00-0030	EA Stump Grinding >30" To 33" Tree..... <i>For 24" Depth, Add</i>	239.47 47.89	
31 13 13 00-0031	EA Stump Grinding >33" To 36" Tree..... <i>For 24" Depth, Add</i>	255.43 51.09	
31 13 13 00-0032	EA Stump Grinding >36" To 42" Tree..... <i>For 24" Depth, Add</i>	287.36 57.47	
31 13 13 00-0033	EA Stump Grinding >42" To 48" Tree..... <i>For 24" Depth, Add</i>	319.29 63.86	
31 13 13 00-0034	Shrub Removal, Dig And Lace <small>(31 13 13)</small>		
31 13 13 00-0035	EA Remove 18" To 24" Shrub, Broadleaf Evergreen.....	36.18	
31 13 13 00-0036	EA Remove 2' To 3' Shrub, Broadleaf Evergreen.....	56.73	
31 13 13 00-0037	EA Remove 3' To 4' Shrub, Broadleaf Evergreen.....	65.79	
31 13 13 00-0038	EA Remove 4' To 5' Shrub, Broadleaf Evergreen.....	98.67	
31 13 13 00-0039	EA Remove 12" To 15" Shrub, Deciduous.....	18.09	
31 13 13 00-0040	EA Remove 18" To 24" Shrub, Deciduous.....	27.96	
31 13 13 00-0041	EA Remove 2' To 3' Shrub, Deciduous.....	36.18	
31 13 13 00-0042	EA Remove 3' To 4' Shrub, Deciduous.....	39.47	
31 13 13 00-0043	EA Remove 18" To 24" Shrub, Evergreen.....	36.18	
31 13 13 00-0044	EA Remove 24" To 30" Shrub, Evergreen.....	39.47	
31 13 13 00-0045	EA Remove 30" To 36" Shrub, Evergreen.....	56.73	
31 13 13 00-0046	EA Remove 36" To 42" Shrub, Evergreen.....	98.67	
31 13 16	Selective Tree And Shrub Trimming <small>(31 13)</small>		
31 13 16 00-0001	Tree Trimming For Pole Line Construction And Maintenance <small>(31 13 16)</small>		
	Note: Area to be vertical cleared (to include overhanging limbs) is minimum 20' wide (10' each side of structure) and 16' above ground. All materials to 6" D.B.H. (Diameter At Breast Height) to be chipped in place. Larger material may be chipped or disposed. Trees greater than 18" diameter use individual tree removal tasks. Quantity based on running foot of power line to be cleared.		
31 13 16 00-0002	LF Tree Trimming, Light Cutting To 6" Diameter For Pole Line Construction.....	1.61	
31 13 16 00-0003	LF Tree Trimming, Medium Cutting >6" To 12" Diameter For Pole Line Construction.....	2.41	
31 13 16 00-0004	LF Tree Trimming, Heavy Cutting >12" To 18" Diameter For Pole Line Construction.....	2.84	
31 20	Earth Moving <small>(31)</small>		
	Note: Per OSHA -Soil Classification - 1926 Subpart P App A. Light material: Class A site material, normally referred to as "easy digging". Consisting of loose, soft, free running materials. Close lying, which will fill blade, digger or bucket to capacity, and frequently provide a heaped load. Materials such as dry sand, small gravel, unpacked earth, loam, etc., would fall into this category. Medium material: Class B site material, normally referred to as "medium and tough, wet and sticky clay would be examples of this medium digging", consisting of harder materials that are not difficult to dig without assistance such as ripping, blasting, etc. Material break up with some bulkiness causing voids in digger or bucket. Materials such as packed earth, common earth with some clay, soil with less than 25% rock content would be examples of this category. Heavy/wet material: Class C site material, normally referred to as "hard digging", consisting of materials which may require some assistance in breaking up. Bulky and somewhat hard to penetrate materials would be found in this category and voids in dipper or bucket would be common. Materials such as very hard packed soil, with up to 50% to 70% rock content and hard category. Soil conditions will be determined by soil analysis to provide appropriate percentage (%) for the various types of soil conditions. Apply the percentages to the various soil types to generate an appropriate representation of the soil condition.		
31 23	Excavation And Fill <small>(31 23)</small>		
31 23 16	Excavation <small>(31 23)</small>		
31 23 16 13	Trenching <small>(31 23 16)</small>		
	Note: Use this section for trenching operations even if the total project volume exceeds 500 CY. Use tasks for work by hand only for areas not accessible by machine.		
31 23 16 13-0001	Excavation For Trenching By Machine <small>(31 23 16 13)</small>		
	Note: Includes stockpiling excess materials and trimming sides and bottom of trench.		
31 23 16 13-0002	CY 12" Wide or Less, Excavation for Trenching by Machine in Soil.....	8.27	
	<i>For Excavation In Light Material (Class A), Deduct</i>	-1.03	
	<i>For Excavation In Heavy/Wet Material (Class C), Add</i>	3.31	
	<i>For Up To 20, Add</i>	6.62	
	<i>For >20 To 50, Add</i>	4.14	
	<i>For >50 To 250, Add</i>	2.07	
	<i>For >500 To 1,000, Deduct</i>	-1.24	
	<i>For >1,000, Deduct</i>	-2.48	
31 23 16 13-0003	CY Over 12" Wide, Excavation for Trenching by Machine in Soil.....	5.31	
	<i>For Excavation In Light Material (Class A), Deduct</i>	-0.66	
	<i>For Excavation In Heavy/Wet Material (Class C), Add</i>	2.12	
	<i>For Up To 20, Add</i>	4.25	
	<i>For >20 To 50, Add</i>	2.66	
	<i>For >50 To 250, Add</i>	1.33	
	<i>For >500 To 1,000, Deduct</i>	-0.80	
	<i>For >1,000, Deduct</i>	-1.59	



Earthwork	31	15
Earth Moving	31 20	
Excavation And Fill	31 23	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
31 23 16 13-0004 CY 12" Wide or Less, Excavation for Trenching by Machine in Loose Rock.....	13.70	
For Up To 20, Add	10.96	
For >20 To 50, Add	6.85	
For >50 To 250, Add	3.43	
For >500 To 1,000, Deduct	-2.06	
For >1,000, Deduct	-4.11	
31 23 16 13-0005 CY Over 12" Wide, Excavation for Trenching by Machine in Loose Rock.....	9.42	
For Up To 20, Add	7.54	
For >20 To 50, Add	4.71	
For >50 To 250, Add	2.36	
For >500 To 1,000, Deduct	-1.41	
For >1,000, Deduct	-2.83	
31 23 16 13-0006 Excavation For Trenching By Hand (31 23 16 13)		
31 23 16 13-0007 CY Excavation For Trenching By Hand In Soil.....	109.59	
Note: Includes stockpiling excess materials and trimming sides and bottom of trench.		
31 23 16 13-0008 CY Excavation For Trenching By Hand In Loose Rock.....	187.99	
Note: Includes stockpiling excess materials and trimming sides and bottom of trench.		
31 23 16 13-0009 Backfilling Or Placing Subbase For Trenches (31 23 16 13)		
Note: With imported or stockpiled materials.		
31 23 16 13-0010 CY Backfilling or Placing Subbase for Trenches with Imported or Stockpiled Materials by Machine.....	2.90	
For Up To 20, Add	2.32	
For >20 To 50, Add	1.45	
For >50 To 250, Add	0.73	
For >500 To 1,000, Deduct	-0.44	
For >1,000, Deduct	-0.87	
31 23 16 13-0011 CY Backfilling or Placing Subbase for Trenches with Imported or Stockpiled Materials by Hand.....	30.44	
31 23 16 13-0012 Compaction Of Fill Or Subbase For Trenches (31 23 16 13)		
Note: Includes restoration of final grade.		
31 23 16 13-0013 CY Compaction of Fill or Subbase for Trenches by Vibratory Plate, Air Tamper, Etcetera.....	6.33	
For Up To 20, Add	5.06	
For >20 To 50, Add	3.17	
For >50 To 250, Add	1.58	
For >500 To 1,000, Deduct	-0.95	
For >1,000, Deduct	-1.90	
31 23 16 13-0014 CY Compaction of Fill or Subbase for Trenches by Hand.....	34.34	
31 23 16 13-0015 Loading Excess Material For Removal From Excavation For Trenches (31 23 16 13)		
Note: Includes hand work by laborer for clean-up. Not to be used when excavated material can be loaded directly into truck instead of stock-piling.		
31 23 16 13-0016 CY Load Excess Material by Machine for Removal from Excavation for Trenching.....	5.05	
For Up To 20, Add	4.04	
For >20 To 50, Add	2.53	
For >50 To 250, Add	1.26	
For >500 To 1,000, Deduct	-0.76	
For >1,000, Deduct	-1.52	
31 23 16 13-0017 CY Load Excess Material by Hand for Removal from Excavation for Trenching.....	80.36	
31 23 16 13-0018 Spread Excess Or Imported Material For Trenches (31 23 16 13)		
Note: Includes hand work by laborer for clean-up.		
31 23 16 13-0019 CY Spread Excess Or Imported Material On Site With Machine.....	2.30	
31 23 16 13-0020 Direct Burial (Plowed-in) Cable Or Piping By Machine (31 23 16 13)		
Note: Includes trench, backfill, compaction and restoration of final grade.		
31 23 16 13-0021 LF Direct Burial of Cable or Piping up to 12" Deep.....	1.71	
31 23 16 13-0022 LF Direct Burial of Cable or Piping >12" to 24" Deep.....	1.88	
31 23 16 13-0023 LF Direct Burial of Cable or Piping >24" to 36" Deep.....	2.68	
31 23 16 13-0024 LF Direct Burial of Cable or Piping >36" to 48" Deep.....	3.02	
31 23 16 13-0025 Utility Chain Trencher (31 23 16 13)		
31 23 16 13-0026 Utility Trench, Chain Trencher (31 23 16 13-0025)		
Note: Earth left adjacent to trench.		
31 23 16 13-0027 LF 4" Wide, 12" Deep Trench, Medium Soil, Chain Trencher.....	0.97	
31 23 16 13-0028 LF 4" Wide, 18" Deep Trench, Medium Soil, Chain Trencher.....	1.06	
31 23 16 13-0029 LF 4" Wide, 24" Deep Trench, Medium Soil, Chain Trencher.....	1.11	
31 23 16 13-0030 LF 6" Wide, 12" Deep Trench, Medium Soil, Chain Trencher.....	1.16	
31 23 16 13-0031 LF 6" Wide, 18" Deep Trench, Medium Soil, Chain Trencher.....	1.28	
31 23 16 13-0032 LF 6" Wide, 24" Deep Trench, Medium Soil, Chain Trencher.....	1.45	
31 23 16 13-0033 LF 6" Wide, 36" Deep Trench, Medium Soil, Chain Trencher.....	1.75	
31 23 16 13-0034 LF 8" Wide, 12" Deep Trench, Medium Soil, Chain Trencher.....	1.65	
31 23 16 13-0035 LF 8" Wide, 18" Deep Trench, Medium Soil, Chain Trencher.....	1.95	
31 23 16 13-0036 LF 8" Wide, 24" Deep Trench, Medium Soil, Chain Trencher.....	2.20	
31 23 16 13-0037 LF 8" Wide, 36" Deep Trench, Medium Soil, Chain Trencher.....	2.62	

31 Earthwork**31 20 Earth Moving****31 23 Excavation And Fill**

MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

31 23 16 13-0038	Backfill Trenches With Compaction <small>(31 23 16 13-0025)</small>	
31 23 16 13-0039	LF Backfill 4" Wide, 12" Deep Trench, With Compaction	0.15
31 23 16 13-0040	LF Backfill 4" Wide, 18" Deep Trench, With Compaction	0.24
31 23 16 13-0041	LF Backfill 4" Wide, 24" Deep Trench, With Compaction	0.31
31 23 16 13-0042	LF Backfill 6" Wide, 12" Deep Trench, With Compaction	0.24
31 23 16 13-0043	LF Backfill 6" Wide, 18" Deep Trench, With Compaction	0.31
31 23 16 13-0044	LF Backfill 6" Wide, 24" Deep Trench, With Compaction	0.47
31 23 16 13-0045	LF Backfill 6" Wide, 36" Deep Trench, With Compaction	0.68
31 23 16 13-0046	LF Backfill 8" Wide, 12" Deep Trench, With Compaction	0.31
31 23 16 13-0047	LF Backfill 8" Wide, 18" Deep Trench, With Compaction	0.47
31 23 16 13-0048	LF Backfill 8" Wide, 24" Deep Trench, With Compaction	0.63
31 23 16 13-0049	LF Backfill 8" Wide, 36" Deep Trench, With Compaction	0.95
31 23 16 33	Bulk Excavation <small>(31 23 16)</small>	
	Note: For excavations where the total quantity for a project is greater than 500 cubic yards. See CSI section 31 05 16 00-0000 for imported material.	
31 23 16 33-0001	Excavation <small>(31 23 16 33)</small>	
	Note: For bulk excavation. Includes stockpiling excavated materials within 100' of point of excavation.	
31 23 16 33-0002	CY Bulk Excavation by Dozer in Soil	7.21
	<i>For Excavation In Light Material (Class A), Deduct</i>	-0.90
	<i>For Excavation In Heavy/Wet Material (Class C), Add</i>	2.88
	<i>For >1,000, Deduct</i>	-1.08
31 23 16 33-0003	CY Bulk Excavation by Hydraulic Excavator, Front End Loader, Backhoe in Soil	4.28
	<i>For Excavation In Light Material (Class A), Deduct</i>	-0.54
	<i>For Excavation In Heavy/Wet Material (Class C), Add</i>	1.71
	<i>For >1,000, Deduct</i>	-0.64
31 23 16 33-0004	CY Bulk Excavation by Dozer in Loose Rock	8.87
	<i>For >1,000, Deduct</i>	-1.33
31 23 16 33-0005	CY Bulk Excavation by Hydraulic Excavator, Front End Loader, Backhoe in Loose Rock	5.27
	<i>For >1,000, Deduct</i>	-0.79
31 23 16 33-0006	Spreading, Shaping And Rough Grading <small>(31 23 16 33)</small>	
	Note: Imported or stockpiled material for bulk excavation.	
31 23 16 33-0007	CY Spreading, Shaping, and Rough Grading Imported or Stockpiled Material for Bulk Excavation by Machine	4.45
	<i>For >1,000, Deduct</i>	-0.67
31 23 16 33-0008	Cutting, Shaping and Rough Grading Of Existing Elevations <small>(31 23 16 33)</small>	
	Note: For bulk excavation.	
31 23 16 33-0009	CY Cutting, Shaping and Rough Grading Existing Elevations For Bulk Excavation by Machine	4.94
	<i>For >1,000, Deduct</i>	-0.74
31 23 16 33-0010	Relocating On Site Excavated Material From Excavation <small>(31 23 16 33)</small>	
	Note: For bulk excavation.	
31 23 16 33-0011	CY Relocating On Site Excavated Material From Bulk Excavation >100' to 300'	3.96
	<i>For >1,000, Deduct</i>	-0.59
31 23 16 33-0012	CY Relocating On Site Excavated Material From Bulk Excavation >300' to 500'	5.93
	<i>For >1,000, Deduct</i>	-0.89
31 23 16 33-0013	CY Relocating On Site Excavated Material From Bulk Excavation >500' To 1,000'	8.90
	<i>For >1,000, Deduct</i>	-1.34
31 23 16 33-0014	CY Relocating On Site Excavated Material From Bulk Excavation >1,000'	11.87
	<i>For >1,000, Deduct</i>	-1.78
31 23 16 33-0015	Finish Grading <small>(31 23 16 33)</small>	
	Note: For bulk excavation.	
31 23 16 33-0016	SY Finish Grading for Bulk Excavation by Machine	0.49
31 23 16 33-0017	Compaction Of Fill Or Subbase, Per Lift <small>(31 23 16 33)</small>	
	Note: For bulk excavation.	
31 23 16 33-0018	SY Compaction of Fill or Subbase for Bulk Excavation by Machine	0.51
	Note: Per Lift	
31 23 16 33-0019	Loading Excess Material For Removal From Excavation <small>(31 23 16 33)</small>	
	Note: For bulk excavation. Includes hand work by laborer for clean-up. Not to be used when excavated material can be loaded directly into truck instead of stock-piling.	
31 23 16 33-0020	CY Loading Excess Material For Removal From Bulk Excavation	4.16
	<i>For >1,000, Deduct</i>	-0.62
31 23 16 36	Excavation For Building Foundations And Other Structures <small>(31 23 16)</small>	
	Note: Use of a Bobcat is limited to access restricted areas and by owner's approval. See CSI section 31 05 16 00-0000 for imported material, 31 23 16 33-0000 for bulk excavation operations over 500 CY.	



Earthwork	31	15
Earth Moving	31 20	
Excavation And Fill	31 23	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
31 23 16 36-0001 Excavation <small>(31 23 16 36)</small> Note: For building foundations and other structures by machine. Includes stockpiling excess materials within 100' of point of excavation, shaping, trimming and rough grading excavation.		
31 23 16 36-0002 Excavation For Building Foundations And Other Structures By Bobcat <small>(31 23 16 36-0001)</small>		
31 23 16 36-0003 CY Excavation For Building Foundations And Other Structures By Bobcat In Soil.....	6.84	
For Excavation In Light Material (Class A), Deduct	-0.86	
For Excavation In Heavy/Wet Material (Class C), Add	2.74	
For Up To 20, Add	6.84	
For >20 To 50, Add	5.13	
For >50 To 250, Add	2.74	
For >250 To 500, Add	1.03	
31 23 16 36-0004 CY Excavation For Building Foundations And Other Structures By Bobcat In Loose Rock.....	8.40	
For Up To 20, Add	8.40	
For >20 To 50, Add	6.30	
For >50 To 250, Add	3.36	
For >250 To 500, Add	1.26	
31 23 16 36-0005 Excavation For Building Foundations And Other Structures By Hydraulic Excavator, Backhoe, Loader <small>(31 23 16 36-0001)</small>		
31 23 16 36-0006 CY Excavation For Building Foundations And Other Structures By Hydraulic Excavator, Backhoe, Loader in Soil	5.14	
For Excavation In Light Material (Class A), Deduct	-0.64	
For Excavation In Heavy/Wet Material (Class C), Add	2.06	
For Up To 20, Add	5.14	
For >20 To 50, Add	3.86	
For >50 To 250, Add	2.06	
For >250 To 500, Add	0.77	
31 23 16 36-0007 CY Excavation For Building Foundations And Other Structures By Hydraulic Excavator, Backhoe, Loader in Loose Rock	6.12	
For Up To 20, Add	6.12	
For >20 To 50, Add	4.59	
For >50 To 250, Add	2.45	
For >250 To 500, Add	0.92	
31 23 16 36-0008 Excavation For Building Foundations And Other Structures By Hand <small>(31 23 16 36-0001)</small> Note: For areas not accessible by machine and only with owner's approval.		
31 23 16 36-0009 CY Excavation For Building Foundations And Other Structures By Hand in Soil	109.59	
For Excavation In Light Material (Class A), Deduct	-13.70	
For Excavation In Heavy/Wet Material (Class C), Add	43.84	
31 23 16 36-0010 CY Excavation For Building Foundations And Other Structures By Hand in Loose Rock.....	187.99	
31 23 16 36-0011 Relocating On Site Excavated Material From Excavation <small>(31 23 16 36)</small> Note: For building foundations and other structures over 100'.		
31 23 16 36-0012 CY Relocating On Site Excavated Material From Excavation For Building Foundations and Other Structures >100' to 300'	3.96	
For Up To 20, Add	3.96	
For >20 To 50, Add	2.97	
For >50 To 250, Add	1.58	
For >250 To 500, Add	0.59	
31 23 16 36-0013 CY Relocating On Site Excavated Material From Excavation For Building Foundations and Other Structures >300' to 500'	5.93	
For Up To 20, Add	5.93	
For >20 To 50, Add	4.45	
For >50 To 250, Add	2.37	
For >250 To 500, Add	0.89	
31 23 16 36-0014 CY Relocating On Site Excavated Material From Excavation For Building Foundations and Other Structures >500' to 1,000'	8.90	
For Up To 20, Add	8.90	
For >20 To 50, Add	6.68	
For >50 To 250, Add	3.56	
For >250 To 500, Add	1.34	
31 23 16 36-0015 CY Relocating On Site Excavated Material From Excavation For Building Foundations and Other Structures >1,000'	11.87	
For Up To 20, Add	11.87	
For >20 To 50, Add	8.90	
For >50 To 250, Add	4.75	
For >250 To 500, Add	1.78	
31 23 16 36-0016 Backfilling <small>(31 23 16 36)</small> Note: For building foundations and other structures with imported or stockpiled materials. Includes rough grading.		
31 23 16 36-0017 CY Backfilling Around Building Foundations And Other Structures By Bobcat.....	3.33	
For Up To 20, Add	3.33	
For >20 To 50, Add	2.50	
For >50 To 250, Add	1.33	
For >250 To 500, Add	0.50	
31 23 16 36-0018 CY Backfilling Around Building Foundations And Other Structures By Hydraulic Excavator, Backhoe, Loader	3.98	
For Up To 20, Add	3.98	
For >20 To 50, Add	2.99	
For >50 To 250, Add	1.59	
For >250 To 500, Add	0.60	

31	31	Earthwork
	31 20	Earth Moving
	31 23	Excavation And Fill



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
31 23 16 36-0019 CY Backfilling Around Building Foundations And Other Structures By Hand.....	52.19	
31 23 16 36-0020 Compaction Of Fill Or Subbase <small>(31 23 16 36)</small> Note: For building foundations and other structures.		
31 23 16 36-0021 CY Compaction Of Fill Or Subbase For Building Foundations and Other Structures by Vibratory Plate, Air Tamper, Etcetera	10.02	
<i>For Up To 20, Add</i>	10.02	
<i>For >20 To 50, Add</i>	7.52	
<i>For >50 To 250, Add</i>	4.01	
<i>For >250 To 500, Add</i>	1.50	
31 23 16 36-0022 CY Compaction Of Fill Or Subbase For Building Foundations and Other Structures by Hand.....	34.34	
31 23 16 36-0023 Grading <small>(31 23 16 36)</small> Note: For building foundations and other structures.		
31 23 16 36-0024 SY Rough Grading For Building Foundations And Other Structures by Machine	0.85	
31 23 16 36-0025 SY Finish Grading For Building Foundations And Other Structures by Machine	1.38	
31 23 16 36-0026 SY Finish Grading For Building Foundations And Other Structures by Hand.....	10.15	
31 23 16 36-0027 Loading Excess Material For Removal From Excavation <small>(31 23 16 36)</small> Note: For building foundations and other structures. Includes hand work by laborer for clean-up. Not to be used when excavated material can be loaded directly into truck instead of stock-piling.		
31 23 16 36-0028 CY Load Excess Material For Removal From Excavation For Building Foundations and Other Structures by Machine	4.34	
<i>For Up To 20, Add</i>	4.34	
<i>For >20 To 50, Add</i>	3.26	
<i>For >50 To 250, Add</i>	1.74	
<i>For >250 To 500, Add</i>	0.65	
31 23 16 36-0029 CY Load Excess Material For Removal From Excavation For Building Foundations and Other Structures by Hand	80.36	
31 23 16 36-0030 Spread Material <small>(31 23 16 36)</small> Note: For building foundations and other structures.		
31 23 16 36-0031 CY Spread Excess Or Imported Material On Site By Machine	2.30	
<i>For Up To 20, Add</i>	2.30	
<i>For >20 To 50, Add</i>	1.73	
<i>For >50 To 250, Add</i>	0.92	
<i>For >250 To 500, Add</i>	0.35	
31 23 16 36-0032 CY Spread Excess Or Imported Material On Site By Hand	44.35	
31 23 16 43 Mass Excavation <small>(31 23 16)</small>		
31 23 16 43-0001 Mass Excavation By Dozer <small>(31 23 16 43)</small> Note: In CY/Hour and using 50 Min/Hour, +5% grade, average operator and material conversion factors. Pushed to stockpile area.		
31 23 16 43-0002 Dozing Distance Averages 150 Feet Push <small>(31 23 16 43-0001)</small>		
31 23 16 43-0003 Dozer With Blade, 65 HP, (D-3B) <small>(31 23 16 43-0002)</small>		
31 23 16 43-0004 BCY Mass Excavation, D-3B Dozer, Light Material 65 HP With Blade, 150' Push, 30 CY/Hour	5.44	
31 23 16 43-0005 BCY Mass Excavation, D-3B Dozer, Medium Material 65 HP With Blade, 150' Push, 25 CY/Hour	6.52	
31 23 16 43-0006 BCY Mass Excavation, D-3B Dozer, Wet/Loose Rock 65 HP With Blade, 150' Push 20 CY/Hour	8.16	
31 23 16 43-0007 Dozer With Blade, 90 HP, (D-4H) <small>(31 23 16 43-0002)</small>		
31 23 16 43-0008 BCY Mass Excavation, D-4H Dozer, Light Material 90 HP With Blade, 150' Push, 60 CY/Hour.....	2.67	
31 23 16 43-0009 BCY Mass Excavation, D-4H Dozer, Medium Material 90 HP With Blade, 150' Push, 45 CY/Hour	3.55	
31 23 16 43-0010 BCY Mass Excavation, D-4H Dozer, Wet/Loose Rock 90 HP With Blade, 150' Push, 35 CY/Hour	4.57	
31 23 16 43-0011 Dozer With Blade, 120 HP, (D-5H) <small>(31 23 16 43-0002)</small>		
31 23 16 43-0012 BCY Mass Excavation, D-5H Dozer, Light Material 120 HP With Blade, 150' Push, 85 CY/Hour.....	1.96	
31 23 16 43-0013 BCY Mass Excavation, D-5H Dozer, Medium Material 120 HP With Blade, 150' Push, 70 CY/Hour	2.39	
31 23 16 43-0014 BCY Mass Excavation, D-5H Dozer, Wet/Loose Rock 120 HP With Blade, 150' Push, 50 CY/Hour	3.34	
31 23 16 43-0015 Dozer With Blade, 140 HP, (D-6D) <small>(31 23 16 43-0002)</small>		
31 23 16 43-0016 BCY Mass Excavation, D-6D Dozer, Light Material 140 HP With Blade, 150' Push, 115 CY/Hour.....	1.69	
31 23 16 43-0017 BCY Mass Excavation, D-6D Dozer, Medium Material 140 HP With Blade, 150' Push, 90 CY/Hour	2.16	
31 23 16 43-0018 BCY Mass Excavation, D-6D Dozer, Wet/Loose Rock 140 HP With Blade, 150' Push, 70 CY/Hour	2.78	
31 23 16 43-0019 Dozer With U-Blade, 200 HP, (D-7G) <small>(31 23 16 43-0002)</small>		
31 23 16 43-0020 BCY Mass Excavation, D-7G Dozer, Light Material 200 HP With U-Blade, 150' Push, 185 CY/Hour	1.12	
31 23 16 43-0021 BCY Mass Excavation, D-7G Dozer, Medium Material 200 HP With U-Blade 150' Push, 150 CY/Hour	1.37	
31 23 16 43-0022 BCY Mass Excavation, D-7G Dozer, Wet/Loose Rock 200 HP With U-Blade, 150' Push, 115 CY/Hour	1.80	
31 23 16 43-0023 BCY Mass Excavation, D-7G Dozer, Blasted Rock 200 HP With U-Blade, 150' Push, 90 CY/Hour	2.29	
31 23 16 43-0024 Dozer With U-Blade, 335 HP, (D-8L) <small>(31 23 16 43-0002)</small>		



Earthwork	31	15
Earth Moving	31 20	
Excavation And Fill	31 23	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
31 23 16 43-0025 BCY Mass Excavation, D-8L Dozer, Light Material 335 HP With U-Blade, 150' Push, 290 CY/Hour.....	0.89	
31 23 16 43-0026 BCY Mass Excavation, D-8L Dozer, Medium Material 335 HP With U-Blade 150' Push, 235 CY/Hour.....	1.10	
31 23 16 43-0027 BCY Mass Excavation, D-8L Dozer, Wet/Loose Rock 335 HP With U-Blade, 150' Push, 180 CY/Hour.....	1.44	
31 23 16 43-0028 BCY Mass Excavation, D-8L Dozer, Blasted Rock 335 HP With U-Blade, 150' Push, 145 CY/Hour.....	1.80	
31 23 16 43-0029 Dozer With U-Blade, 460 HP, (D-9L) <small>(31 23 16 43-0002)</small>		
31 23 16 43-0030 BCY Mass Excavation, D-9L Dozer, Light Material 460 HP With U-Blade, 150' Push, 375 CY/Hour.....	0.67	
31 23 16 43-0031 BCY Mass Excavation, D-9L Dozer, Medium Material 460 HP With U-Blade 150' Push, 300 CY/Hour.....	0.83	
31 23 16 43-0032 BCY Mass Excavation, D-9L Dozer, Wet/Loose Rock 460 HP With U-Blade, 150' Push, 230 CY/Hour.....	1.09	
31 23 16 43-0033 BCY Mass Excavation, D-9L Dozer, Blasted Rock 460 HP With U-Blade, 150' Push, 185 CY/Hour.....	1.35	
31 23 16 43-0034 Dozer With U-Blade, 700 HP, (D-10) <small>(31 23 16 43-0002)</small>		
31 23 16 43-0035 BCY Mass Excavation, D-10 Dozer, Light Material 700 HP With U-Blade, 150' Push, 495 CY/Hour.....	0.55	
31 23 16 43-0036 BCY Mass Excavation, D-10 Dozer, Medium Material 700 HP With U-Blade 150' Push, 400 CY/Hour.....	0.68	
31 23 16 43-0037 BCY Mass Excavation, D-10 Dozer, Wet/Loose Rock 700 HP With U-Blade, 150' Push, 305 CY/Hour.....	0.89	
31 23 16 43-0038 BCY Mass Excavation, D-10 Dozer, Blasted Rock 700 HP With U-Blade, 150' Push, 245 CY/Hour.....	1.11	
31 23 16 43-0039 Dozing Distance Averages 300 Feet Push <small>(31 23 16 43-0001)</small>		
31 23 16 43-0040 Dozer With Blade, 65 HP, (D-3B) <small>(31 23 16 43-0039)</small>		
31 23 16 43-0041 BCY Mass Excavation, D-3B Dozer, Light Material 65 HP With Blade, 12.5 CY/Hour, 300' Push.....	13.06	
31 23 16 43-0042 BCY Mass Excavation, D-3B Dozer, Medium Material 65 HP With Blade, 10 CY/Hour, 300' Push.....	16.32	
31 23 16 43-0043 Dozer With Blade, 90 HP, (D-4H) <small>(31 23 16 43-0039)</small>		
31 23 16 43-0044 BCY Mass Excavation, D-4H Dozer, Light Material 90 HP With Blade, 20 CY/Hour, 300' Push.....	8.00	
31 23 16 43-0045 BCY Mass Excavation, D-4H Dozer, Medium Material 90 HP With Blade, 17.5 CY/Hour, 300' Push.....	9.14	
31 23 16 43-0046 BCY Mass Excavation, D-4H Dozer, Loose Rock 90 HP With Blade, 15 CY/Hour, 300' Push.....	10.66	
31 23 16 43-0047 Dozer With Blade, 120 HP, (D-5H) <small>(31 23 16 43-0039)</small>		
31 23 16 43-0048 BCY Mass Excavation, D-5H Dozer, Light Material 120 HP With Blade, 35 CY/Hour, 300' Push.....	4.77	
31 23 16 43-0049 BCY Mass Excavation, D-5H Dozer, Medium Material 120 HP With Blade, 30 CY/Hour, 300' Push.....	5.56	
31 23 16 43-0050 BCY Mass Excavation, D-5H Dozer, Loose Rock 120 HP With Blade, 25 CY/Hour, 300' Push.....	6.67	
31 23 16 43-0051 Dozer With Blade, 140 HP, (D-6D) <small>(31 23 16 43-0039)</small>		
31 23 16 43-0052 BCY Mass Excavation, D-6D Dozer, Light Material 140 HP With Blade, 55 CY/Hour, 300' Push.....	3.53	
31 23 16 43-0053 BCY Mass Excavation, D-6D Dozer, Medium Material 140 HP With Blade, 45 CY/Hour, 300' Push.....	4.32	
31 23 16 43-0054 BCY Mass Excavation, D-6D Dozer, Loose Rock 140 HP With Blade, 35 CY/Hour, 300' Push.....	5.55	
31 23 16 43-0055 Dozer With U-Blade, 200 HP, (D-7G) <small>(31 23 16 43-0039)</small>		
31 23 16 43-0056 BCY Mass Excavation, D-7G Dozer, Light Material 200 HP With U-Blade, 85 CY/Hour, 300' Push.....	2.43	
31 23 16 43-0057 BCY Mass Excavation, D-7G Dozer, Medium Material 200 HP With U-Blade 65 CY/Hour, 300' Push.....	3.18	
31 23 16 43-0058 BCY Mass Excavation, D-7G Dozer, Loose Rock 200 HP With U-Blade, 50 CY/Hour, 300' Push.....	4.13	
31 23 16 43-0059 BCY Mass Excavation, D-7G Dozer, Blasted Rock 200 HP With U-Blade, 40 CY/Hour, 300' Push.....	5.16	
31 23 16 43-0060 Dozer With U-Blade, 335 HP, (D-8L) <small>(31 23 16 43-0039)</small>		
31 23 16 43-0061 BCY Mass Excavation, D-8L Dozer, Light Material 335 HP With U-Blade, 145 CY/Hour, 300' Push.....	1.80	
31 23 16 43-0062 BCY Mass Excavation, D-8L Dozer, Medium Material 335 HP With U-Blade 115 CY/Hour, 300' Push.....	2.26	
31 23 16 43-0063 BCY Mass Excavation, D-8L Dozer, Loose Rock 335 HP With U-Blade, 90 CY/Hour, 300' Push.....	2.89	
31 23 16 43-0064 BCY Mass Excavation, D-8L Dozer, Blasted Rock 335 HP With U-Blade, 70 CY/Hour, 300' Push.....	3.71	
31 23 16 43-0065 Dozer With U-Blade, 460 HP, (D-9L) <small>(31 23 16 43-0039)</small>		
31 23 16 43-0066 BCY Mass Excavation, D-9L Dozer, Light Material 460 HP With U-Blade, 195 CY/Hour, 300' Push.....	1.28	
31 23 16 43-0067 BCY Mass Excavation, D-9L Dozer, Medium Material 460 HP With U-Blade 160 CY/Hour, 300' Push.....	1.56	
31 23 16 43-0068 BCY Mass Excavation, D-9L Dozer, Loose Rock 460 HP With U-Blade, 120 CY/Hour, 300' Push.....	2.07	
31 23 16 43-0069 BCY Mass Excavation, D-9L Dozer, Blasted Rock 460 HP With U-Blade, 95 CY/Hour, 300' Push.....	2.63	
31 23 16 43-0070 Dozer With U-Blade, 700 HP, (D-10) <small>(31 23 16 43-0039)</small>		
31 23 16 43-0071 BCY Mass Excavation, D-10 Dozer, Light Material 700 HP With U-Blade, 275 CY/Hour, 300' Push.....	0.99	
31 23 16 43-0072 BCY Mass Excavation, D-10 Dozer, Medium Material 700 HP With U-Blade 220 CY/Hour, 300' Push.....	1.23	
31 23 16 43-0073 BCY Mass Excavation, D-10 Dozer, Loose Rock 700 HP With U-Blade, 170 CY/Hour, 300' Push.....	1.60	
31 23 16 43-0074 BCY Mass Excavation, D-10 Dozer, Blasted Rock 700 HP With U-Blade, 135 CY/Hour, 300' Push.....	2.02	
31 23 16 43-0075 Dozing Distance Averages 450 Feet Push <small>(31 23 16 43-0001)</small>		
31 23 16 43-0076 Dozer With U-Blade, 215 HP, (D-7G) <small>(31 23 16 43-0075)</small>		
31 23 16 43-0077 BCY Mass Excavation, D-7G Dozer, Light Material 215 HP With U-Blade, 75 CY/Hour, 450' Push.....	2.75	
31 23 16 43-0078 BCY Mass Excavation, D-7G Dozer, Medium Material 215 HP With U-Blade 60 CY/Hour, 450' Push.....	3.44	
31 23 16 43-0079 BCY Mass Excavation, D-7G Dozer, Loose Rock 215 HP With U-Blade, 45 CY/Hour, 450' Push.....	4.59	

31	31	Earthwork
	31 20	Earth Moving
	31 23	Excavation And Fill



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
31 23 16 43-0080 BCY Mass Excavation, D-7G Dozer, Blasted Rock 215 HP With U-Blade, 35 CY/Hour, 450' Push	5.90	
31 23 16 43-0081 Dozer With U-Blade, 335 HP, (D-8L) <small>(31 23 16 43-0075)</small>		
31 23 16 43-0082 BCY Mass Excavation, D-8L Dozer, Light Material 335 HP With U-Blade, 105 CY/Hour, 450' Push.....	2.48	
31 23 16 43-0083 BCY Mass Excavation, D-8L Dozer, Medium Material 335 HP With U-Blade 85 CY/Hour, 450' Push.....	3.06	
31 23 16 43-0084 BCY Mass Excavation, D-8L Dozer, Loose Rock 335 HP With U-Blade, 65 CY/Hour, 450' Push	4.00	
31 23 16 43-0085 BCY Mass Excavation, D-8L Dozer, Blasted Rock 335 HP With U-Blade, 50 CY/Hour, 450' Push	5.20	
31 23 16 43-0086 Dozer With U-Blade, 460 HP, (D-9L) <small>(31 23 16 43-0075)</small>		
31 23 16 43-0087 BCY Mass Excavation, D-9L Dozer, Light Material 460 HP With U-Blade, 145 CY/Hour, 450' Push.....	1.72	
31 23 16 43-0088 BCY Mass Excavation, D-9L Dozer, Medium Material 460 HP With U-Blade 115 CY/Hour, 450' Push.....	2.17	
31 23 16 43-0089 BCY Mass Excavation, D-9L Dozer, Loose Rock 460 HP With U-Blade, 90 CY/Hour, 450' Push	2.78	
31 23 16 43-0090 BCY Mass Excavation, D-9L Dozer, Blasted Rock 460 HP With U-Blade, 70 CY/Hour, 450' Push	3.56	
31 23 16 43-0091 Dozer With U-Blade, 700 HP, (D-10) <small>(31 23 16 43-0075)</small>		
31 23 16 43-0092 BCY Mass Excavation, D-10 Dozer, Light Material 700 HP With U-Blade, 185 CY/Hour, 450' Push.....	1.47	
31 23 16 43-0093 BCY Mass Excavation, D-10 Dozer, Medium Material 700 HP With U-Blade 150 CY/Hour, 450' Push.....	1.82	
31 23 16 43-0094 BCY Mass Excavation, D-10 Dozer, Loose Rock 700 HP With U-Blade, 115 CY/Hour, 450' Push	2.36	
31 23 16 43-0095 BCY Mass Excavation, D-10 Dozer, Blasted Rock 700 HP With U-Blade, 90 CY/Hour, 450' Push	3.03	
31 23 16 43-0096 Excavation By Push Loaded Scraper <small>(31 23 16 43)</small>		
Note: Choose scraper capacity and cycle time.		
31 23 16 43-0097 Self Propelled Scraper Capacity 9 BCY <small>(31 23 16 43-0096)</small>		
31 23 16 43-0098 BCY Excavation With Push Loaded Self Propelled Scraper 9 BCY, 9 Cycles Per Hour	3.16	
31 23 16 43-0099 Self Propelled Scraper Capacity 16 BCY <small>(31 23 16 43-0096)</small>		
31 23 16 43-0100 BCY Excavation With Push Loaded Self Propelled Scraper 16 BCY, 9 Cycles Per Hour	2.18	
31 23 16 43-0101 BCY Excavation With Push Loaded Self Propelled Scraper 16 BCY, 6 Cycles Per Hour	3.27	
31 23 16 43-0102 BCY Excavation With Push Loaded Self Propelled Scraper 16 BCY, 4.5 Cycles Per Hour	4.91	
31 23 16 43-0103 BCY Roadway Excavation Scraper - Soil.....	2.21	
31 23 16 43-0104 BCY Roadway Excavation Scraper - Sand	9.10	
31 23 16 43-0105 BCY Roadway Excavation Scraper - Rock Borrow	12.23	
31 23 16 43-0106 BCY Roadway Excavation Scraper - Rock No Borrow.....	8.41	
31 23 16 43-0107 Self Propelled Scraper Capacity 25 BCY <small>(31 23 16 43-0096)</small>		
31 23 16 43-0108 BCY Excavation With Push Loaded Self Propelled Scraper 25 BCY, 9 Cycles Per Hour	1.40	
31 23 16 43-0109 BCY Excavation With Push Loaded Self Propelled Scraper 25 BCY, 6 Cycles Per Hour	2.12	
31 23 16 43-0110 BCY Excavation With Push Loaded Self Propelled Scraper 25 BCY, 4.5 Cycles Per Hour	2.50	
31 23 16 43-0111 Self Propelled Scraper Capacity 35 BCY <small>(31 23 16 43-0096)</small>		
31 23 16 43-0112 BCY Excavation With Push Loaded Self Propelled Scraper 35 BCY, 9 Cycles Per Hour	1.06	
31 23 16 43-0113 BCY Excavation With Push Loaded Self Propelled Scraper 35 BCY, 6 Cycles Per Hour	1.60	
31 23 16 43-0114 BCY Excavation With Push Loaded Self Propelled Scraper 35 BCY, 4.5 Cycles Per Hour	2.15	
31 23 16 43-0115 Self Propelled Scraper Capacity 43 BCY <small>(31 23 16 43-0096)</small>		
31 23 16 43-0116 BCY Excavation With Push Loaded Self Propelled Scraper 43 BCY, 9 Cycles Per Hour	0.86	
31 23 16 43-0117 BCY Excavation With Push Loaded Self Propelled Scraper 43 BCY, 6 Cycles Per Hour	1.28	
31 23 16 43-0118 BCY Excavation With Push Loaded Self Propelled Scraper 43 BCY, 4.5 Cycles Per Hour	1.63	
31 23 23 Fill <small>(31 23)</small>		
31 23 23 23 Compaction <small>(31 23 23)</small>		
31 23 23 23-0001 Compaction Water, Water Truck And Operator <small>(31 23 23 23)</small>		
31 23 23 23-0002 MGL Compaction Water, Water Truck And Operator	150.35	
Note: Use this task in situations where fill, base material, etc. requires additional moisture to comply with the compaction specification. Includes delivery up to 15 miles. (Per 1000 Gallons) See CSI section 01 22 23 00-1008 for water truck when water is available on site.		
31 23 23 33 Flowable Fill <small>(31 23 23)</small>		
31 23 23 33-0001 Flowable Cement Backfill For Trenches <small>(31 23 23 33)</small>		
Note: Includes compaction and restoration of final grade.		
31 23 23 33-0002 CY Flowable Cement Backfill for Trenches.....	92.23	
For Up To 20, Add	39.33	
For >20 To 50, Add	25.45	
For >50 To 250, Add	12.72	
For >500 To 1,000, Deduct	-6.94	
For >1,000, Deduct	-13.89	



Earthwork	31	15
Earth Moving	31 20	
Embankments	31 24	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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31 24 Embankments (31 20)

31 24 13 Roadway Embankments (31 24)

31 24 13 00-0001 Roadway, Parking Areas, Landscaping And Embankment Excavation And Shaping Operations (31 24 13)

Note: Use this section for excavation and shaping operations even if the total quantity for the project exceeds 500 CY.

31 24 13 00-0002 Cutting, Shaping And Rough Grading (31 24 13 00-0001)

Note: For roadways, parking areas, landscaping, and embankments. Includes loading or stockpiling excess materials within 300' of initial cut.

31 24 13 00-0003 Cutting, Shaping, And Rough Grading By Machine (31 24 13 00-0002)

31 24 13 00-0004	CY	Cut, Shape, and Rough Grading for Roadways, Parking Areas, Landscaping and Embankments by Machine in Soil.....	4.94
		<i>For Up To 20, Add</i>	4.94
		<i>For >20 To 50, Add</i>	3.71
		<i>For >50 To 250, Add</i>	1.98
		<i>For >250 To 500, Add</i>	0.74
		<i>For >1,000, Deduct</i>	-0.74
31 24 13 00-0005	CY	Cut, Shape, and Rough Grading for Roadways, Parking Areas, Landscaping and Embankments by Machine in Loose Rock.....	6.13
		<i>For Up To 20, Add</i>	6.13
		<i>For >20 To 50, Add</i>	4.60
		<i>For >50 To 250, Add</i>	2.45
		<i>For >250 To 500, Add</i>	0.92
		<i>For >1,000, Deduct</i>	-0.92

31 24 13 00-0006 Cutting, Shaping, And Rough Grading By Hand (31 24 13 00-0002)

31 24 13 00-0007	SY	Shape Embankment/Slope By Hand Up To 1 On 4 Slope.....	5.62
31 24 13 00-0008	SY	Shape Embankment/Slope By Hand Greater Than 1 On 4 Slope	7.31

31 24 13 00-0009 Scarify Soil (31 24 13 00-0001)

Note: For roadways, parking areas, landscaping and embankments by machine.

31 24 13 00-0010	CSF	Scarify Soil For Roadways, Parking Areas, Landscaping And Embankments By Machine	4.58
		<i>For Up To 20, Add</i>	2.29
		<i>For >20 To 50, Add</i>	1.15
		<i>For >250 To 500, Deduct</i>	-0.46
		<i>For >500, Deduct</i>	-0.92

31 24 13 00-0011 Relocating On Site Excavated Material (31 24 13 00-0001)

31 24 13 00-0012	CY	>500' To 1,000', Relocating On Site Excavated Material For Roadways, Parking Areas, Landscaping And Embankments.....	8.90
		<i>For Up To 20, Add</i>	8.90
		<i>For >20 To 50, Add</i>	6.68
		<i>For >50 To 250, Add</i>	3.56
		<i>For >250 To 500, Add</i>	1.34
		<i>For >1,000, Deduct</i>	-1.34
31 24 13 00-0013	CY	>1,000', Relocating On Site Excavated Material For Roadways, Parking Areas, Landscaping And Embankments.....	11.87
		<i>For Up To 20, Add</i>	11.87
		<i>For >20 To 50, Add</i>	8.90
		<i>For >50 To 250, Add</i>	4.75
		<i>For >250 To 500, Add</i>	1.78
		<i>For >1,000, Deduct</i>	-1.78

31 24 13 00-0014 Spread And Shape Imported Or Stockpiled Material (31 24 13 00-0001)

Note: For roadways, parking areas, landscaping and embankments.

31 24 13 00-0015	CY	Spread And Shape Imported Or Stockpiled Material For Roadways, Parking Areas, Landscaping and Embankments.....	5.44
		<i>For Up To 20, Add</i>	5.44
		<i>For >20 To 50, Add</i>	4.08
		<i>For >50 To 250, Add</i>	2.18
		<i>For >250 To 500, Add</i>	0.82
		<i>For >1,000, Deduct</i>	-0.82

31 24 13 00-0016 Grading (31 24 13 00-0001)

Note: For roadways, parking areas, landscaping and embankments by machine.

31 24 13 00-0017	SY	Rough Grade Roadway, Parking Areas, Landscaping And Embankments By Machine.....	0.59
31 24 13 00-0018	SY	Finish Grade Roadway, Parking Areas, Landscaping And Embankments By Machine.....	0.78
31 24 13 00-0019	LF	Finish Grade For Curb	0.88
31 24 13 00-0020	LF	Finish Grade For Curb And Gutter.....	1.07

31 24 13 00-0021 Compaction Of Fill Or Subbase (31 24 13 00-0001)

Note: For roadways, parking areas, landscaping and embankments by machine, per lift.

31	31	Earthwork
	31 20	Earth Moving
	31 24	Embankments



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
31 24 13 00-0022 SY Compaction Of Fill Or Subbase For Roadways, Parking Areas, Landscaping And Embankments By Machine Per Lift.....	0.51	
For Up To 250, Add	0.51	
For >250 To 500, Add	0.38	
For >500 To 1,000, Add	0.20	
For >5,000, Deduct	-0.08	
31 24 13 00-0023 Loading Excess Material For Removal From Excavation (31 24 13 00-0001)		
Note: For roadways, parking areas, landscaping and embankments by machine. Includes hand work by laborer for clean-up.		
31 24 13 00-0024 CY Load Excess Material For Removal For Roadways, Parking Areas, Landscaping and Embankments by Machine	4.16	
For Up To 20, Add	4.16	
For >20 To 50, Add	3.12	
For >50 To 250, Add	1.66	
For >250 To 500, Add	0.62	
For >1,000, Deduct	-0.62	
31 25 Erosion And Sedimentation Controls (31 20)		
31 25 14 Stabilization Measures For Erosion And Sedimentation Control (31 25)		
31 25 14 13 Hydraulically-Applied Erosion Control (31 25 14)		
31 25 14 13-0001 Bonded Fiber Matrix (31 25 14 13)		
31 25 14 13-0002 MSF Up To 25,000 SF Bonded Fiber Matrix, Hydraulically Applied	38.55	
31 25 14 13-0003 MSF >25,000 To 50,000 SF Bonded Fiber Matrix, Hydraulically Applied	34.91	
31 25 14 13-0004 MSF >50,000 To 100,000 SF Bonded Fiber Matrix, Hydraulically Applied	31.81	
31 25 14 13-0005 MSF >100,000 Bonded Fiber Matrix, Hydraulically Applied	30.05	
31 25 14 16 Rolled Erosion Control Mats And Blankets (31 25 14)		
31 25 14 16-0001 Erosion Control Blankets And Turf Reinforcement Mats (31 25 14 16)		
31 25 14 16-0002 Erosion Control Blankets, Short Term, Light Duty (31 25 14 16-0001)		
31 25 14 16-0003 SY S75 Single Net Erosion Control Blanket	1.41	
Note: Straw matrix with degradable thread to a single standard photodegradable polypropylene netting as manufactured by North American Green.		
31 25 14 16-0004 SY S75BN Single Net Erosion Control Blanket	1.65	
Note: Straw Matrix with Biodegradable Thread to a Single Natural Fiber Netting as manufactured by North American Green.		
31 25 14 16-0005 SY Curlex 1, Single Net Erosion Control Blanket	1.37	
Note: As manufactured by American Excelsior		
31 25 14 16-0006 SY Curlex 1, Single Net Erosion Control Blanket	1.41	
Note: As manufactured by American Green.		
31 25 14 16-0007 SY Futerra Erosion Control Blanket, Wood Fibers With Biodegradable Netting	1.31	
31 25 14 16-0008 Erosion Control Blankets, Intermediate Duration (31 25 14 16-0001)		
31 25 14 16-0009 SY S150 Double Net Erosion Control Blanket	1.77	
Note: Straw matrix with degradable thread to a double standard photodegradable polypropylene netting as manufactured by North American Green.		
31 25 14 16-0010 SY S150 BN Double Net Erosion Control Blanket	2.15	
Note: Straw matrix with biodegradable thread to a double natural fiber netting as manufactured by North American Green.		
31 25 14 16-0011 SY Curlex II, Double Net Erosion Control Blanket, Natural	1.59	
Note: As manufactured by American Excelsior.		
31 25 14 16-0012 SY Curlex II, Double Net Erosion Control Blanket, Green	1.63	
Note: As manufactured by American Excelsior.		
31 25 14 16-0013 SY Enforcer Double Net Erosion Control Blanket	1.70	
Note: As manufactured by American Excelsior.		
31 25 14 16-0014 Turf Reinforcement Mats (TRM) (31 25 14 16-0001)		
Note: Permanent, UV stabilized.		
31 25 14 16-0015 SY P300 Permanent Polypropylene Turf Reinforcement Mat	8.52	
Note: 100% synthetic, UV stabilized, two layer netting.		
31 25 14 16-0016 SY C350 Permanent Turf Reinforcement Mat	7.93	
Note: 100% synthetic, UV stabilized netting incorporating natural coconut fibers as manufactured by North American Green.		
31 25 14 16-0017 SY Recyclex TRM, Permanent Turf Reinforcement Mat	6.63	
Note: As manufactured by American Excelsior, 100% recycled		
31 25 14 16-0018 Jute Mesh Erosion Control Blankets (31 25 14 16-0001)		
31 25 14 16-0019 SY Jute Mesh, Open Uniform Weave	1.50	
31 25 14 16-0020 Revegetation Mat (31 25 14 16-0001)		
31 25 14 16-0021 SY 3-Dimensional Webbed Revegetation Mat, Polyolefin Fiber	5.91	
Note: Polyolefin fibers oriented and mechanically bonded between two nets. Landlok TRM 450 or equal.		



Earthwork	31	13
Earth Moving	31 20	
Erosion And Sedimentation Controls	31 25	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
31 25 14 16-0022 SY Webbed Revegetation Mat, Polypropylene Fiber.....	8.36	
Note: Polypropylene fibers positioned between two high strength biaxially oriented nets and mechanically held together by parallel stitching with polypropylene thread. Landlok TRM 1060 or equal.		
31 25 14 23 Stabilization Measures For Erosion Control (31 25 14)		
Note: Includes all erosion control blankets and turf reinforcement mats staples or stakes. See CSI section 01 74 19 00-0034 for hauling greater than 15 miles.		
31 25 14 23-0001 Sand And Gravel Bags (31 25 14 23)		
Note: Bags filled on site with delivered material. Includes material and placement of bags.		
31 25 14 23-0002 BAG 50 LB Capacity Nylon Or Poly Sand Bag With Sand.....	5.89	
For >2,500 To 5,000, Deduct	-0.46	
For >5,000, Deduct	-1.05	
31 25 14 23-0003 BAG 50 LB Capacity Biodegradable Burlap Sand Bag With Sand.....	6.15	
For >2,500 To 5,000, Deduct	-0.46	
For >5,000, Deduct	-1.08	
31 25 14 23-0004 BAG 33 LB Capacity Nylon Or Poly Bag With 5/16" To 3/4" Gravel.....	3.80	
For >2,500 To 5,000, Deduct	-0.31	
For >5,000, Deduct	-0.69	
31 25 14 23-0005 BAG Remove 50 LB Sand Or Gravel Bag.....	2.03	
31 25 14 23-0006 Turbidity Curtain (31 25 14 23)		
Note: Type 2 curtain.		
31 25 14 23-0007 LF 3' High Turbidity Curtain	17.82	
31 25 14 23-0008 LF 4' High Turbidity Curtain	19.29	
31 25 14 23-0009 LF 5' High Turbidity Curtain	21.28	
31 25 14 23-0010 LF 6' High Turbidity Curtain	22.99	
31 25 14 23-0011 LF 7' High Turbidity Curtain	24.13	
31 25 14 23-0012 LF 8' High Turbidity Curtain	25.28	
31 25 14 23-0013 LF 9' High Turbidity Curtain	26.60	
31 25 14 23-0014 LF 10' High Turbidity Curtain	28.38	
31 25 14 23-0015 LF 12' High Turbidity Curtain	29.82	
31 25 14 23-0016 LF 13' High Turbidity Curtain	31.73	
31 25 14 23-0017 LF 14' High Turbidity Curtain	33.52	
31 25 14 23-0018 LF 15' High Turbidity Curtain	35.26	
31 25 14 23-0019 LF 16' High Turbidity Curtain	38.29	
31 25 14 23-0020 LF 17' High Turbidity Curtain	40.16	
31 25 14 23-0021 LF 18' High Turbidity Curtain	41.98	
31 25 14 23-0022 LF 19' High Turbidity Curtain	43.90	
31 25 14 23-0023 LF 20' High Turbidity Curtain	45.79	
31 25 14 23-0024 Filter Bags (31 25 14 23)		
31 25 14 23-0025 Non-Woven Filter Bags (31 25 14 23-0024)		
31 25 14 23-0026 EA 6' x 15' Non-Woven Filter Bag	131.60	
31 25 14 23-0027 EA 13' x 15' Non-Woven Filter Bag	189.64	
31 25 14 23-0028 EA 15' x 15' Non-Woven Filter Bag	218.96	
31 25 14 23-0029 Monofilament Filter Bags (31 25 14 23-0024)		
31 25 14 23-0030 EA 5' x 15' Monofilament Filter Bag.....	136.55	
31 25 14 23-0031 EA 10' x 15' Monofilament Filter Bag.....	188.13	
31 25 14 23-0032 Cable Articulating Concrete Block (31 25 14 23)		
Note: 4000 PSI Compressive strength, 12 LB/CF maximum absorption. Interlocking block with longitudinal revetment cable and fill. Includes anchoring block to 12" x 12" x 6" concrete pier every 5' with anchor.		
31 25 14 23-0033 SF 4.75" Open Cell Articulated Concrete Block With Earth Backfill	29.96	
For Gravel Fill, Add	0.68	
For Up To 500, Add	6.92	
For >500 To 1,000, Add	3.93	
31 25 14 23-0034 SF 6" Open Cell Articulated Concrete Block With Earth Backfill	33.91	
For Gravel Fill, Add	0.77	
For Up To 500, Add	7.80	
For >500 To 1,000, Add	4.40	
31 25 14 23-0035 SF 7.5" Open Cell Articulated Concrete Block With Earth Backfill	38.48	
For Gravel Fill, Add	0.87	
For Up To 500, Add	8.81	
For >500 To 1,000, Add	4.96	
31 25 14 23-0036 SF 9" Open Cell Articulated Concrete Block With Earth Backfill	43.26	
For Gravel Fill, Add	0.97	
For Up To 500, Add	9.89	
For >500 To 1,000, Add	5.57	
31 25 14 23-0037 SF 4.75" Closed Cell Articulated Concrete Block.....	31.67	
For Up To 500, Add	7.26	
For >500 To 1,000, Add	4.10	
31 25 14 23-0038 SF 6" Closed Cell Articulated Concrete Block.....	35.96	
For Up To 500, Add	8.21	
For >500 To 1,000, Add	4.61	

31	Earthwork
31 20	Earth Moving
31 25	Erosion And Sedimentation Controls



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
	31 25 14 23-0039	SF	7.5" Closed Cell Articulated Concrete Block	40.91	
			<i>For Up To 500, Add</i>	9.30	
			<i>For >500 To 1,000, Add</i>	5.21	
	31 25 14 23-0040	SF	9" Closed Cell Articulated Concrete Block	46.04	
			<i>For Up To 500, Add</i>	10.45	
			<i>For >500 To 1,000, Add</i>	5.84	
31 25 14 26 Stabilization Measures For Sedimentation Control (31 25 14)					
	31 25 14 26-0001		Silt Fences And Dike Barriers (31 25 14 26) Note: Includes stakes and embedding.		
	31 25 14 26-0002		Silt Fences 2' High (31 25 14 26-0001)		
	31 25 14 26-0003	LF	2' High Silt Fence with Stakes at 4' On Center.....	2.32	
	31 25 14 26-0004	LF	2' High Silt Fence with Stakes at 6' On Center.....	1.79	
	31 25 14 26-0005	LF	2' High Silt Fence with Stakes at 8' On Center.....	1.26	
	31 25 14 26-0006	LF	2' High Silt Fence with Stakes at 10' On Center.....	1.07	
	31 25 14 26-0007		Silt Fences 3' High (31 25 14 26-0001)		
	31 25 14 26-0008	LF	3' High Silt Fence with Stakes at 4' On Center.....	2.22	
	31 25 14 26-0009	LF	3' High Silt Fence with Stakes at 6' On Center.....	1.84	
	31 25 14 26-0010	LF	3' High Silt Fence with Stakes at 8' On Center.....	1.19	
	31 25 14 26-0011	LF	3' High Silt Fence with Stakes at 10' On Center.....	1.11	
	31 25 14 26-0012		Silt Dike Barrier (31 25 14 26-0001)		
	31 25 14 26-0013	LF	Silt Dike Barrier With Stakes.....	2.48	
	31 25 14 26-0014		Silt Fences Removal (31 25 14 26-0001)		
	31 25 14 26-0015	LF	Remove Silt Fence And Stakes.....	0.73	
	31 25 14 26-0016		Hay And Straw Bales (31 25 14 26) Note: Includes stakes.		
	31 25 14 26-0017	LF	Place Sterilized Straw Bales..... Note: Includes securing in ground with stakes.	3.96	
	31 25 14 26-0018	LF	Place Hay Bales..... Note: Includes securing in ground with stakes.	3.69	
	31 25 14 26-0019	LF	Remove Hay Or Straw Bales..... Note: Includes removal of stakes.	1.30	
	31 25 14 26-0020		Sediment Logs (Degradable) (31 25 14 26)		
	31 25 14 26-0021		Sediment Logs (Degradable) (31 25 14 26-0020) Note: Includes stakes and removal after use. Curlex sediment logs as manufactured by American Excelsior.		
	31 25 14 26-0022	LF	12" Sediment Log	6.71	
	31 25 14 26-0023	LF	20" Sediment Log	7.77	
	31 25 14 26-0024		Wattles (Degradable) (31 25 14 26-0020) Note: Includes trench for placement, 24" wood staking at 4' O.C.		
	31 25 14 26-0025	EA	Wattles (Sterile Straw Filled Rolls), 9" x 25'	125.61	
	31 25 14 26-0026	EA	Wattles (Sterile Straw Filled Rolls), 12" x 20'	116.98	
	31 25 14 26-0027		Inlet Protection Sediment Bags (31 25 14 26) Note: Includes removal, cleaning, and replacement per each location.		
	31 25 14 26-0028	EA	2' x 2' x 3' Inlet Protection Sediment Bag.....	43.24	
	31 25 14 26-0029	EA	2' x 3' x 3' Inlet Protection Sediment Bag.....	53.11	
	31 25 14 26-0030	EA	2' x 4' x 3' Inlet Protection Sediment Bag.....	64.38	
31 30 Earthwork Methods (31)					
31 31 Soil Treatment (31 30)					
31 31 19 Vegetation Control (31 31)					
31 31 19 13 Chemical Vegetation Control (31 31 19)					
	31 31 19 13-0001		Soil Sterilants (31 31 19 13)		
	31 31 19 13-0002	MSF	Soil Sterilant.....	18.90	
			Note: Use only in areas where complete control of all vegetation is desired, such as industrial sites, right-of-way, lumberyards, petroleum tank farms, around farm buildings, along fence lines, etc. When applied to the soil, this product usually inhibits plant growth for a year or more.		
			<i>For >45 To 90, Deduct</i>	-0.37	
			<i>For >90 To 225, Deduct</i>	-1.68	
			<i>For >225, Deduct</i>	-2.41	



Earthwork	31	15
Earthwork Methods	31 30	
Soil Treatment	31 31	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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31 32 Soil Stabilization (31 30)

31 32 13 Soil Mixing Stabilization (31 32)

31 32 13 16 Cement Soil Stabilization (31 32 13)

31 32 13 16-0001 Cementitious Soil Binder (31 32 13 16)

31 32 13 16-0002	CY	Cementitious Soil Binder, 4% Cement Mix By Volume	27.55
31 32 13 16-0003	CY	Cementitious Soil Binder, 6% Cement Mix By Volume	31.31
31 32 13 16-0004	CY	Cementitious Soil Binder, 9% Cement Mix By Volume	37.52
31 32 13 16-0005	CY	Cementitious Soil Binder, 12% Cement Mix By Volume	43.63

31 32 13 19 Lime Soil Stabilization (31 32 13)

Note: Includes delivery up to 15 miles from the closest approved source, the cost for loading, and dumping. The price excludes the cost for spreading or backfilling. See CSI section 01 74 19 00-0034 for hauling greater than 15 miles.

31 32 13 19-0001 Lime Slurry (31 32 13 19)

31 32 13 19-0002	LCY	Soil Stabilization With Lime Slurry 10% Lime Slurry By Volume	25.53
31 32 13 19-0003	TON	Cement Stabilized Base Material	85.10
31 32 13 19-0004	CWT	Lime For Soil Stabilization	13.66
Note: Excludes the cost for spreading or backfilling			
31 32 13 19-0005	LCY	Roller, Grader - Lime Stabilization	12.47
31 32 13 19-0006	LCY	Roller, Grader - Cement Stabilization	2.93

31 32 13 19-0007 Lime Stabilized Subgrade (31 32 13 19)

Note: Based on soil weight of 110 LB/CF using lime weight of 5.5 LB/CF (5%).

31 32 13 19-0008	SY	6" Thick Lime Stabilized Subgrade, 25 LB	8.66
For 4% Lime Instead Of 5%, Deduct			-0.24
For 6% Lime Instead Of 5%, Add			0.24
31 32 13 19-0009	SY	7" Thick Lime Stabilized Subgrade, 29 LB	10.04
For 4% Lime Instead Of 5%, Deduct			-0.28
For 6% Lime Instead Of 5%, Add			0.28
31 32 13 19-0010	SY	8" Thick Lime Stabilized Subgrade, 33 LB	11.47
For 4% Lime Instead Of 5%, Deduct			-0.32
For 6% Lime Instead Of 5%, Add			0.32

31 32 13 29 Liquid Soil Stabilization (31 32 13)

31 32 13 29-0001	GAL	Polyacrylamide And Calcium Solution	1.80
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31 32 19 Geosynthetic Soil Stabilization And Layer Separation (31 32)

31 32 19 13 Geogrid Soil Stabilization (31 32 19)

31 32 19 13-0001 Geogrid Fabrics (31 32 19 13)

Note: For reinforcement of over steepened earth slopes, segmental retaining walls and other mechanically stabilized earth applications.

31 32 19 13-0002	SY	5.3 Oz/SY, 1,700 LB/FT Wide Width Tensile Ultimate Bi-Directional Woven Polyester Geogrid Fabric (Carthage Mills GX-150)	2.24
For Up To 50, Add			0.54
For >50 To 150, Add			0.40
For >150 To 250, Add			0.25
For >250 To 500, Add			0.13
31 32 19 13-0003	SY	6.9 Oz/SY, 3,100 LB/FT Wide Width Tensile Ultimate Bi-Directional Woven Polyester Geogrid Fabric (Carthage Mills GX-300)	2.55
For Up To 50, Add			0.61
For >50 To 150, Add			0.45
For >150 To 250, Add			0.29
For >250 To 500, Add			0.14
31 32 19 13-0004	SY	8.7 Oz/SY, 4,280 LB/FT Wide Width Tensile Ultimate Bi-Directional Woven Polyester Geogrid Fabric (Carthage Mills GX-500)	2.76
For Up To 50, Add			0.65
For >50 To 150, Add			0.48
For >150 To 250, Add			0.31
For >250 To 500, Add			0.15
31 32 19 13-0005	SY	12.6 Oz/SY, 7,315 LB/FT Wide Width Tensile Ultimate Bi-Directional Woven Polyester Geogrid Fabric (Carthage Mills GX-800)	3.92
For Up To 50, Add			0.89
For >50 To 150, Add			0.66
For >150 To 250, Add			0.43
For >250 To 500, Add			0.21
31 32 19 13-0006	SY	14.1 Oz/SY, 9,790 LB/FT Wide Width Tensile Ultimate Bi-Directional Woven Polyester Geogrid Fabric (Carthage Mills GX-1000)	4.46
For Up To 50, Add			1.00
For >50 To 150, Add			0.74
For >150 To 250, Add			0.48
For >250 To 500, Add			0.24

31	Earthwork
31 30	Earthwork Methods
31 32	Soil Stabilization



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
	31 32 19 13-0007	SY	4.3 Oz/SY, 1,658 LB/FT Wide Width Tensile Ultimate Bi-Axial Extruded Polypropylene Geogrid Fabric (Carthage Mills Enkagrid Max 20)	2.27	
			For Up To 50, Add	0.54	
			For >50 To 150, Add	0.40	
			For >150 To 250, Add	0.26	
			For >250 To 500, Add	0.13	
	31 32 19 13-0008	SY	5.9 Oz/SY, 2,192 LB/FT Wide Width Tensile Ultimate Bi-Axial Extruded Polypropylene Geogrid Fabric (Carthage Mills Enkagrid Max 30)	3.29	
			For Up To 50, Add	0.75	
			For >50 To 150, Add	0.56	
			For >150 To 250, Add	0.36	
			For >250 To 500, Add	0.18	
31 32 19 16 Geotextile Soil Stabilization (31 32 19)					
31 32 19 16-0001 Nonwoven Polypropylene Geotextiles (31 32 19 16)					
Note: For drainage, filtration and separation.					
	31 32 19 16-0002	SY	3.0 Oz/SY, 40 Mil, 80 LB Grab Tensile Nonwoven Polypropylene Geotextile Fabric (Carthage Mills FX-30HS).....	0.71	
			For Up To 50, Add	0.18	
			For >50 To 150, Add	0.13	
			For >150 To 250, Add	0.08	
			For >250 To 500, Add	0.04	
	31 32 19 16-0003	SY	3.5 Oz/SY, 50 Mil, 95 LB Grab Tensile Nonwoven Polypropylene Geotextile Fabric (Carthage Mills FX-35HS).....	0.76	
			For Up To 50, Add	0.19	
			For >50 To 150, Add	0.14	
			For >150 To 250, Add	0.09	
			For >250 To 500, Add	0.04	
	31 32 19 16-0004	SY	4.0 Oz/SY, 60 Mil, 115 LB Grab Tensile Nonwoven Polypropylene Geotextile Fabric (Carthage Mills FX-40HS).....	0.82	
			For Up To 50, Add	0.20	
			For >50 To 150, Add	0.15	
			For >150 To 250, Add	0.09	
			For >250 To 500, Add	0.05	
	31 32 19 16-0005	SY	4.5 Oz/SY, 55 Mil, 120 LB Grab Tensile Nonwoven Polypropylene Geotextile Fabric (Carthage Mills FX-45HS).....	0.87	
			For Up To 50, Add	0.21	
			For >50 To 150, Add	0.15	
			For >150 To 250, Add	0.10	
			For >250 To 500, Add	0.05	
	31 32 19 16-0006	SY	6.0 Oz/SY, 70 Mil, 160 LB Grab Tensile Nonwoven Polypropylene Geotextile Fabric (Carthage Mills FX-60HS).....	1.02	
			For Up To 50, Add	0.24	
			For >50 To 150, Add	0.18	
			For >150 To 250, Add	0.11	
			For >250 To 500, Add	0.06	
	31 32 19 16-0007	SY	7.0 Oz/SY, 85 Mil, 180 LB Grab Tensile Nonwoven Polypropylene Geotextile Fabric (Carthage Mills FX-70HS).....	1.21	
			For Up To 50, Add	0.29	
			For >50 To 150, Add	0.21	
			For >150 To 250, Add	0.14	
			For >250 To 500, Add	0.07	
	31 32 19 16-0008	SY	8.0 Oz/SY, 85 Mil, 205 LB Grab Tensile Nonwoven Polypropylene Geotextile Fabric (Carthage Mills FX-80HS).....	1.32	
			For Up To 50, Add	0.31	
			For >50 To 150, Add	0.23	
			For >150 To 250, Add	0.15	
			For >250 To 500, Add	0.07	
	31 32 19 16-0009	SY	10 Oz/SY, 115 Mil, 250 LB Grab Tensile Nonwoven Polypropylene Geotextile Fabric (Carthage Mills FX-100HS).....	1.61	
			For Up To 50, Add	0.37	
			For >50 To 150, Add	0.27	
			For >150 To 250, Add	0.18	
			For >250 To 500, Add	0.09	
31 32 19 16-0010 Woven Geotextiles Fabric (31 32 19 16)					
	31 32 19 16-0011	SY	200 LB Grab Tensile Woven Slit Film Geotextile Fabric (Carthage Mills FX-55)	1.00	
			For Up To 50, Add	0.24	
			For >50 To 150, Add	0.17	
			For >150 To 250, Add	0.11	
			For >250 To 500, Add	0.06	
	31 32 19 16-0012	SY	315 LB Grab Tensile Woven Slit Film Geotextile Fabric (Carthage Mills FX-66)	1.38	
			For Up To 50, Add	0.31	
			For >50 To 150, Add	0.23	
			For >150 To 250, Add	0.15	
			For >250 To 500, Add	0.08	
	31 32 19 16-0013	SY	4 To 6% Open Area, 370 x 250 LB Grab Tensile Woven Monofilament Geotextile Fabric (Carthage Mills Carthage 6%).....	2.41	
			For Up To 50, Add	0.53	
			For >50 To 150, Add	0.39	
			For >150 To 250, Add	0.26	
			For >250 To 500, Add	0.13	
	31 32 19 16-0014	SY	11 To 15% Open Area, 370 x 220 LB Grab Tensile Woven Monofilament Geotextile Fabric (Carthage Mills Carthage 15%).....	2.35	
			For Up To 50, Add	0.52	
			For >50 To 150, Add	0.38	
			For >150 To 250, Add	0.25	
			For >250 To 500, Add	0.13	



Earthwork	31	13
Earthwork Methods	31 30	
Soil Stabilization	31 32	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
31 32 19 16-0015 SY 6.9 Oz/SY, 250 LB/IN Wide Width Tensile Ultimate Woven Twill Weave Geotextile Fabric (Carthage Mills FX-250TF).....	2.06	
For Up To 50, Add	0.46	
For >50 To 150, Add	0.34	
For >150 To 250, Add	0.22	
For >250 To 500, Add	0.11	
31 32 19 16-0016 SY 9.1 Oz/SY, 333 LB/IN Wide Width Tensile Ultimate Woven Twill Weave Geotextile Fabric (Carthage Mills FX-330TF).....	2.20	
For Up To 50, Add	0.49	
For >50 To 150, Add	0.36	
For >150 To 250, Add	0.24	
For >250 To 500, Add	0.12	
31 32 19 16-0017 SY 12.1 Oz/SY, 400 LB/IN Wide Width Tensile Ultimate Woven Twill Weave Geotextile Fabric (Carthage Mills FX-400TF).....	2.79	
For Up To 50, Add	0.60	
For >50 To 150, Add	0.45	
For >150 To 250, Add	0.29	
For >250 To 500, Add	0.15	
31 32 19 16-0018 SY 12.1 Oz/SY, 400 LB/IN Wide Width Tensile Ultimate Woven Monofilament And Fibrillated Geotextile Fabric (Carthage Mills FX-400MF).....	3.95	
For Up To 50, Add	0.64	
For >50 To 150, Add	0.62	
For >150 To 250, Add	0.41	
For >250 To 500, Add	0.21	
31 32 19 16-0019 Geomembranes <small>(31 32 19 16)</small>		
31 32 19 16-0020 Polyvinyl Chloride (PVC) Geomembrane <small>(31 32 19 16-0019)</small>		
31 32 19 16-0021 SF 20 Mil Polyvinyl Chloride (PVC) Geomembrane (US Fabrics).....	0.80	
31 32 19 16-0022 SF 30 Mil Polyvinyl Chloride (PVC) Geomembrane (US Fabrics).....	0.92	
31 32 19 16-0023 SF 40 Mil Polyvinyl Chloride (PVC) Geomembrane (US Fabrics).....	1.11	
31 32 19 16-0024 SF 50 Mil Polyvinyl Chloride (PVC) Geomembrane (US Fabrics).....	1.32	
31 32 19 16-0025 SF 60 Mil Polyvinyl Chloride (PVC) Geomembrane (US Fabrics).....	1.50	
31 32 19 16-0026 SF 70 Mil Polyvinyl Chloride (PVC) Geomembrane (US Fabrics).....	1.64	
31 32 19 16-0027 SF 80 Mil Polyvinyl Chloride (PVC) Geomembrane (US Fabrics).....	1.77	
31 32 19 16-0028 SF 90 Mil Polyvinyl Chloride (PVC) Geomembrane (US Fabrics).....	1.95	
31 32 19 16-0029 SF 100 Mil Polyvinyl Chloride (PVC) Geomembrane (US Fabrics).....	2.12	
31 32 19 16-0030 High Density Polyethylene (HDPE) Geomembrane <small>(31 32 19 16-0019)</small>		
31 32 19 16-0031 SF 20 Mil High Density Polyethylene Membrane (US Fabrics).....	0.63	
31 32 19 16-0032 SF 30 Mil High Density Polyethylene Membrane (US Fabrics).....	0.83	
31 32 19 16-0033 SF 40 Mil High Density Polyethylene Membrane (US Fabrics).....	0.96	
31 32 19 16-0034 SF 50 Mil High Density Polyethylene Membrane (US Fabrics).....	1.55	
31 32 19 16-0035 SF 60 Mil High Density Polyethylene Membrane (US Fabrics).....	1.21	
31 32 19 16-0036 SF 80 Mil High Density Polyethylene Membrane (US Fabrics).....	1.49	
31 32 19 16-0037 SF 100 Mil High Density Polyethylene Membrane (US Fabrics).....	1.76	
31 32 19 16-0038 SF 120 Mil High Density Polyethylene Membrane (US Fabrics).....	3.14	
31 32 19 16-0039 SF 140 Mil High Density Polyethylene Membrane (US Fabrics).....	3.25	
31 32 19 26 Geoweb Cellular Confinement System <small>(31 32 19)</small>		
Note: Includes staples, stakes and filling cells with stockpiled material. Excludes site preparation and imported materials.		
31 32 19 26-0001 Geoweb Cellular Confinement System <small>(31 32 19 26)</small>		
Note: Includes staples, stakes and filling cells with stockpiled material. Excludes site preparation and imported materials.		
31 32 19 26-0002 SF 4" Geoweb Cellular Confinement System (Presto Geosystems).....	4.39	
For >20,000, Deduct	-0.08	
For >2:1 Slope, Add	0.95	
31 32 19 26-0003 SF 6" Geoweb Cellular Confinement System (Presto Geosystems).....	5.07	
For >20,000, Deduct	-0.11	
For >2:1 Slope, Add	0.95	
31 32 19 26-0004 SF 8" Geoweb Cellular Confinement System (Presto Geosystems).....	5.88	
For >20,000, Deduct	-0.15	
For >2:1 Slope, Add	0.95	
31 32 36 Soil Nailing <small>(31 32)</small>		
31 32 36 00-0001 Landslide and Slip-Out Stabilization <small>(31 32 36)</small>		
Note: Work shall consist of the Contractor stabilizing identified slides by internally reinforcing the soil mass with reinforcing elements (nails) by using one or more of the installation methods specified in this contract. The Owner will identify locations for work to be performed as specified herein. The Contractor shall review all locations with Owner representatives to determine the method to be used. The Contractor will provide all necessary engineering plans and details required to successfully repair slides as noted. These plans shall be stamped by a registered professional engineer with a current California license who is knowledgeable in the design and implementation of slope stabilization with soil nails and related work. The contractor shall furnish all labor, materials, and equipment required to complete the work. Any necessary installation methods and associated costs are the responsibility of the contractor. The Contractor and the Contractor's Engineer will also warrant the stability of the repaired roadway section for a period of 5 years.		

31	31 Earthwork
	31 30 Earthwork Methods
	31 32 Soil Stabilization



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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31 32 36 00-0002	Launched Soil Nails™ <small>(31 32 36 00-0001)</small> Note: Furnish Launched Soil Nails™ up to 20 feet in length composed of a tube (1.5 inch outside diameter, 0.120 inch wall thickness hot-dipped galvanized 36ksi steel (ASTM A513) that is mechanically deformed or GalvaDized™ to produce a plurality of surficial asperities). Alternately, the tube may be composed of fiberglass (1.5 inch outside diameter, 0.5 inch wall thickness Strongwell EXTREN Series 625 Vinyl Ester fiberglass. Furnish equipment and incidentals necessary to complete the work. Insert Launched Soil Nails™ with a single stroke at initial velocities in excess of 200 miles per hour. Inserted length and spacing will be determined by the Contractor's Engineer and identified in the Contractor's stamped plans and submittals.	
31 32 36 00-0003	EA Fiberglass SuperNail® .....780.00 Note: perforated fiberglass tube up to 20 ft. length, pressure grouted with #6 epoxy coated inner Bar.	
31 32 36 00-0004	EA GalvaDized™ SuperNail® .....620.00 Note: perforated GalvaDized™ steel tube up to 20 ft. length, pressure grouted with #6 epoxy coated inner Bar.	
31 32 36 00-0005	EA Temporary Launched Soil Nail .....520.00 Note: bare steel tube up to 20 ft. length.	
31 32 36 00-0006	EA Fiberglass SuperDrain™ .....585.00 Note: perforated fiberglass tube up to 20 ft. length.	
31 32 36 00-0007	EA GalvaDized™ SuperDrain™ .....550.00 Note: perforated GalvaDized™ steel tube up to 20 ft. length.	

31 32 36 00-0008	Drilled SuperNails® (Permanently Cased Soil Nails) <small>(31 32 36 00-0001)</small> Note: Furnish SuperNails® that are a three stage construction including installation of (1) an outer tube (1.5 inch outside diameter, 0.120 inch wall thickness hot-dipped galvanized steel tube that is mechanically deformed or GalvaDized™ to produce a plurality of surficial asperities); (2) neat cement grout that completely encases and fills the outer tube; and (3) immediately install an epoxy coated, #6 (or greater) grade 75 threadbar as the inner bar. SuperNails® may be in lengths up to 60 feet. Although field adjustments in design may be allowed on certain projects (subject to approval by the Contractor's Engineer and the Owner) bidding an equivalent system is not allowed (i.e. the winning bidder must have the ability to install the above system). Furnish equipment and incidentals necessary to complete the work. Insert SuperNail® outer tubes with a single stroke at initial velocities in excess of 200 miles per hour or by drilling a hole to a prescribed depth and inserting the outer tube. Fill the outer tube with neat cement grout and immediately insert a #6 or larger epoxy coated inner threadbar. Inserted length and spacing will be determined by the Contractor's Engineer and identified in the Contractor's stamped plans and submittals.	
31 32 36 00-0009	EA Drilled GalvaDized™ SuperNail® up to 20 ft. length .....650.00 Note: GalvaDized™ steel tube, drilled and grouted with #6 epoxy coated inner Bar.	
31 32 36 00-0010	EA Drilled GalvaDized™ SuperNail® up to 30 ft. length .....975.00 Note: GalvaDized™ steel tube, drilled and grouted with #6 epoxy coated inner Bar.	
31 32 36 00-0011	EA Drilled GalvaDized™ SuperNail® up to 40 ft. length .....1,235.00 Note: GalvaDized™ steel tube, drilled and grouted with #6 epoxy coated inner Bar.	
31 32 36 00-0012	EA Drilled GalvaDized™ SuperNail® up to 50 ft. length .....1,495.00 Note: GalvaDized™ steel tube, drilled and grouted with #6 epoxy coated inner Bar.	
31 32 36 00-0013	EA Drilled GalvaDized™ SuperNail® up to 60 ft. length .....1,755.00 Note: GalvaDized™ steel tube, drilled and grouted with #6 epoxy coated inner Bar.	
31 32 36 00-0014	EA Drilled GalvaDized™ SuperNail® up to 70 ft. length .....2,015.00 Note: GalvaDized™ steel tube, drilled and grouted with #6 epoxy coated inner Bar.	
31 32 36 00-0015	EA Drilled GalvaDized™ SuperNail® up to 80 ft. length .....2,275.00 Note: GalvaDized™ steel tube, drilled and grouted with #6 epoxy coated inner Bar.	

31 32 36 00-0016	Self-Drilling SuperNails® / SuperMicropiles™ <small>(31 32 36 00-0001)</small> Note: Furnish Self-Drilling SuperNails® / SuperMicropiles™ that consist of a hollow, threaded bar with a sacrificial drill bit. Multiple bars may be coupled to produce final length. Bar thread pattern should be continuous and conform to the pullout requirements of ASTM A 615 (Williams Form Engineering "B7X" or Ischebeck "Titan" bars, or approved equivalent). R-thread bars, bars/couplers made from high carbon (>0.20%) or high phosphorous (>0.06%) steels, or bars/couplers made from steels that do not meet the tensile ductility requirements of ASTM A 615 shall not be used for any tensile applications. Bar outer diameters shall be a minimum of 1.5 inches and up to and 3 inches depending on design load. Corrosion Protection for Self Drilling Nails shall follow current FHWA guidance. Inserted length and spacing of Self-Drilling SuperNails® / SuperMicropiles™ will be determined by the Contractor's Engineer and identified in the Contractor's stamped plans and submittals.	
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31 32 36 00-0017	Self-Drilling SuperNails® <small>(31 32 36 00-0016)</small>	
31 32 36 00-0018	EA Self Drilling SuperNails® up to 20-ft910.00	
31 32 36 00-0019	EA Self Drilling SuperNails® up to 30-ft .....1,300.00	
31 32 36 00-0020	EA Self Drilling SuperNails® up to 40-ft .....1,820.00	
31 32 36 00-0021	EA Self Drilling SuperNails® up to 50-ft .....2,340.00	
31 32 36 00-0022	EA Self Drilling SuperNails® up to 60-ft .....2,860.00	
31 32 36 00-0023	EA Self Drilling SuperNails® up to 70-ft .....3,380.00	
31 32 36 00-0024	EA Self Drilling SuperNails® up to 80-ft .....3,900.00	

31 32 36 00-0025	Self-Drilling SuperMicropiles™ <small>(31 32 36 00-0016)</small>	
31 32 36 00-0026	EA Self Drilling SuperNails® SuperMicropiles™ up to 20-ft .....910.00	
31 32 36 00-0027	EA Self Drilling SuperNails® SuperMicropiles™ up to 30-ft .....1,300.00	
31 32 36 00-0028	EA Self Drilling SuperNails® SuperMicropiles™ up to 40-ft .....1,820.00	
31 32 36 00-0029	EA Self Drilling SuperNails® SuperMicropiles™ up to 50-ft .....2,340.00	
31 32 36 00-0030	LF Micropile Cap – 12" thick shotcrete .....130.00	



Earthwork	31	13
Earthwork Methods	31 30	
Soil Stabilization	31 32	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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31 32 36 00-0031	Drilled / Launched SuperMicropiles™ <small>(31 32 36 00-0001)</small> Note: Furnish SuperMicropiles™ that are a three stage construction including installation of (1) an outer tube (1.5 inch outside diameter, 0.120 inch wall thickness hot-dipped galvanized steel tube that is cement grout that completely encases and fills the outer tube; and (3) immediately install an epoxy coated, #6 (or greater) grade 75 threadbar as the inner bar. SuperMicropiles™ may be in lengths up to 60 feet. Although field adjustments in design may be allowed on certain projects (subject to approval by the Contractor's Engineer and the Owner) bidding an equivalent system is not allowed (i.e. the winning bidder must have the ability to install the above system). Furnish equipment and incidentals necessary to complete the work. Insert SuperMicropile™ outer tubes with a single stroke at initial velocities in excess of 200 miles per hour or by drilling a hole to a prescribed depth and inserting the outer tube. Fill the outer tube with neat cement grout and immediately insert a #6 or larger epoxy coated inner threadbar. Inserted length and spacing will be determined by the Contractor's Engineer and identified in the Contractor's stamped plans and submittals.	
31 32 36 00-0032	EA SuperMicropiles™ up to 20 ft. length..... 695.00 Note: GalvaDized™ steel tube, grouted with #6 epoxy coated inner Bar.	
31 32 36 00-0033	EA SuperMicropiles™ up to 30 ft. length..... 1,020.00 Note: GalvaDized™ steel tube, grouted with #6 epoxy coated inner Bar.	
31 32 36 00-0034	EA SuperMicropiles™ up to 40 ft. length..... 1,280.00 Note: GalvaDized™ steel tube, grouted with #6 epoxy coated inner Bar.	
31 32 36 00-0035	EA SuperMicropiles™ up to 50 ft. length..... 1,540.00 Note: GalvaDized™ steel tube, grouted with #6 epoxy coated inner Bar.	

31 32 36 00-0036	Shotcrete or Gunite <small>(31 32 36 00-0001)</small>	
31 32 36 00-0037	Dry-Mix Shotcrete for use with Launched Soil Nails™, SuperNails®, SuperMicropiles™, Self-Drilling SuperNails® / SuperMicropiles™ <small>(31 32 36 00-0036)</small> Note: Furnish steel reinforced shotcrete to integrate with Launched Soil Nails™, SuperNails®, SuperMicropiles™, Self Drilling SuperMicropiles™ or Self Drilling SuperNails® and complying with the requirements of ACI 506.2, "Specifications for Materials, Proportioning and Application of Shotcrete", except as otherwise specified. Shotcreting consists applying of one or more layers of concrete conveyed through a hose pneumatically projected at a high velocity against a prepared surface. Produce shotcrete by a dry-mix. The dry-mix process consists of thoroughly mixing Portland cement and aggregate (and or synthetic fiber) thoroughly mixed dry, passed through a cement gun and conveyed by air through a flexible tube, hydrated at a nozzle at the end of such flexible tube and deposited by air pressure in its place of final repose. For additional descriptive information, refer to the American Concrete Institute ACI 506R "Guide to Shotcrete." The Contractor's Engineer shall provide all necessary details required to successfully construct the temporary or permanent facing and facing drainage system to satisfy the design intent of the facing. Comply with AASHTO Specifications, or accepted industry standards for any specific items that may not be addressed herein or elsewhere in this Contract Document. Use materials for shotcrete conforming to the following requirements: Cement AASHTO M85/ ASTM C150, Type I, II, or III. Fine Aggregate AASHTO M6/ASTM C33 clean, natural. Coarse Aggregate AASHTO M80, Class B for quality Fiber Reinforcement ASTM C116-00 Water Clean and Potable. AASHTO M157/ASTM C94 and shall be maintained at a uniform pressure which shall be at least 15 pounds per square inch above air pressure at the nozzle. Chemical Admixtures Accelerator Fluid type, applied at nozzle, meeting requirements of AASHTO M194/ASTM C494/ASTM C1141. Water-reducer and Superplasticizer AASHTO M194/ASTM C494 Type A, C, D, E, F, or G Retarders AASHTO M194/ ASTM C494 Type B or D. Mineral Admixtures Fly Ash AASHTO M295/ASTM C618 Type F or C, cement replacement up to 35 percent by weight of cement. Silica Fume ASTM C1240, 90 percent minimum silicon dioxide solids content, not to exceed 12 percent by weight of cement. Welded Wire Fabric AASHTO M55/ASTM A185 or A497. Double twisted hexagonal ASTM A975-97 guidelines for Double Twisted Hexagonal Mesh Gabions Prepackaged Shotcrete ASTM C928. PVC Drain Pipes: Pipe ASTM 1785 Schedule 40 PVC, solid and perforated wall, cell classification 12454-B or 12354-C, wall thickness SDR 35, with solvent weld or elastomeric gasket joints. Deliver, store and handle materials to prevent contamination, segregation, corrosion or damage. Store liquid admixtures to prevent evaporation and freezing. Use aggregate for shotcrete meeting the strength and durability requirements of AASHTO M6/M80, as applicable, and the following gradation requirements: Sieve Size Percent Passing by Weight 1/2" 100 3/8" 90-100 No. 4 70-85 No. 8 100 Proportion the shotcrete to be pumpable with the concrete pump furnished for the work, with a cementing materials content of at least 390 kilograms per cubic meter and water/cement ratio not greater than 0.50. Do not use admixtures unless approved by the Contractor's Engineer. Thoroughly mix admixtures into the shotcrete at the rate specified by the manufacturer. Use only accelerators compatible with the cement used, non-corrosive to steel, and not promoting other detrimental effects such as cracking or excessive shrinkage. The maximum allowable chloride ion content of all ingredients is 0.10% when tested to AASHTO T260. Air entrainment is not required for temporary shotcrete construction facings. Provide shotcrete with a design compressive strength of 2000 Psi in 3 days and 4000 Psi in 28 days. Batch aggregate and cement by weight or by volume in accordance with the requirements of ASTM C94 or AASHTO M241/ASTM C685. Use	
31 32 36 00-0038	SFI Dry-Mix Reinforced Gunite..... 13.00 Note: sold per inch thickness over one square face foot of area (includes reinforcing steel).	



MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

31 32 36 00-0039	<p>Wet-Mix Shotcrete for use with Launched Soil Nails™, SuperNails®, SuperMicropiles™, Self-Drilling SuperNails® / SuperMicropiles™ <small>(31 32 36 00-0036)</small></p> <p>Note: Furnish steel reinforced shotcrete to integrate with Launched Soil Nails™, SuperNails®, SuperMicropiles™, Self Drilling SuperMicropiles™ or Self Drilling SuperNails® and complying with the requirements of ACI 506.2, "Specifications for Materials, Proportioning and Application of Shotcrete", except as otherwise specified. Shotcreting consists applying of one or more layers of concrete conveyed through a hose pneumatically projected at a high velocity against a prepared surface. Produce shotcrete by a wet-mix. The wet-mix process consists of thoroughly mixing all the ingredients except accelerating admixtures, but including the mixing water, introducing the mixture into the delivery equipment and delivering it, by positive displacement, to the nozzle. Air jet the wet-mix shotcrete from the nozzle at high velocity onto the surface. For additional descriptive information, refer to the American Concrete Institute ACI 506R "Guide to Shotcrete." The Contractor's Engineer shall provide all necessary details required to successfully construct the temporary or permanent facing and facing drainage system to satisfy the design intent of the facing. Comply with AASHTO Specifications, or accepted industry standards for any specific items that may not be addressed herein or elsewhere in this Contract Document. Use materials for shotcrete conforming to the following requirements: Cement AASHTO M85/ ASTM C150, Type I, II, III or V. Fine Aggregate AASHTO M6/ASTM C33 clean, natural. Coarse Aggregate Class B for quality Water Clean and Potable. AASHTO M157/ASTM C94 Chemical Admixtures Accelerator Fluid type, applied at nozzle, meeting requirements of AASHTO M194/ASTM C494/ASTM C1141. AASHTO M80, Water-reducer and Superplasticizer AASHTO M194/ASTM C494 Type A, C, D, E, F, or G Retarders AASHTO M194/ ASTM C494 Type B or D. Mineral Admixtures Fly Ash AASHTO M295/ASTM C618 Type F or C, cement replacement up to 35 percent by weight of cement. Silica Fume ASTM C1240, 90 percent minimum silicon dioxide solids content, not to exceed 12 percent by weight of cement. Welded Wire Fabric AASHTO M55/ASTM A185 or A497. Double twisted hexagonal ASTM A975-97 guidelines for Double Twisted Hexagonal Mesh Gabions Prepackaged Shotcrete ASTM C928. PVC Drain Pipes: Pipe ASTM 1785 Schedule 40 PVC, solid and perforated wall, cell classification 12454-B or 12354-C, wall thickness SDR 35, with solvent weld or elastomeric gasket joints. Deliver, store and handle materials to prevent contamination, segregation, corrosion or damage. Store liquid admixtures to prevent evaporation and freezing. Use aggregate for shotcrete meeting the strength and durability requirements of AASHTO M6/M80, as applicable, and the following gradation requirements: Sieve Size Percent Passing by Weight 1/2" 100 3/8" 90-100 No. 4 70-85 No. 8</p> <p>100 Proportion the shotcrete to be pumpable with the concrete pump furnished for the work, with a cementing materials content of at least 390 kilograms per cubic meter and water/cement ratio not greater than 0.50. Do not use admixtures unless approved by the Contractor's Engineer. Thoroughly mix admixtures into the shotcrete at the rate specified by the manufacturer. Use only accelerators compatible with the cement used, non- corrosive to steel, and not promoting other detrimental effects such as cracking or excessive shrinkage. The maximum allowable chloride ion content of all ingredients is 0.10% when tested to AASHTO T260. Air entrainment is not required for temporary shotcrete construction facings. Provide shotcrete with a design compressive strength of 2000 Psi in 3 days and 4000 Psi in 28 days. Batch aggregate and cement by weight or by volume in accordance with the requirements of ASTM C94 or AASHTO M241/ASTM C685. Use mixing equipment that thoroughly blends the materials in sufficient quantity to maintain placing continuity. Produce ready mix shotcrete complying with A</p>	
31 32 36 00-0040	<p>SFI Wet-Mix Reinforced Shotcrete .....6.50</p> <p>Note: sold per inch thickness over one square face foot of area (includes reinforcing steel).</p>	
31 32 36 00-0041	<p>Shotcrete or Gunitite for use with Launched Soil Nails™, SuperNails® and Self Drilling SuperNails® <small>(31 32 36 00-0036)</small></p>	
31 32 36 00-0042	<p>LF Shotcrete shoulder build-out .....260.00</p>	
31 32 36 00-0043	<p>SF Acid Stained Shotcrete (gun finished) shotcrete .....3.25</p>	
31 32 36 00-0044	<p>SF Sculpt and stain shotcrete.....22.50</p>	
31 32 36 00-0045	<p>Steel Mesh, Turf Reinforcement Matting and Steel Plates for use with Launched Soil Nails™, SuperNails® and Self Drilling SuperNails® <small>(31 32 36 00-0001)</small></p>	
31 32 36 00-0046	<p>Steel Mesh Surface Treatment for use with Launched Soil Nails™, SuperNails® and Self Drilling SuperNails® <small>(31 32 36 00-0045)</small></p> <p>Note: Furnish Galfan® Coated Steel Mesh for use with Launched Soil Nails™, SuperNails®, or Self Drilling SuperNails® that is a double twisted hexagonal galvanized steel wire mesh manufactured according to ASTM A975-97 guidelines for Double Twisted Hexagonal Mesh Gabions. Alternately, the mesh may be a diamond shaped, three dimensional mesh made with high capacity 3-millimeter diameter wire. Furnish steel plates to connect the mesh to the nail systems described herein. Furnish equipment and incidentals necessary to complete the work. Soil Nail to mesh connection details will be determined by the Contractor's Engineer and identified in the Contractor's stamped plans and submittals.</p>	
31 32 36 00-0047	<p>SF High Capacity Diamond Mesh.....19.50</p> <p>Note: sold per square face foot</p>	
31 32 36 00-0048	<p>SF Double Twist Wire Mesh.....10.00</p> <p>Note: sold per square face foot</p>	
31 32 36 00-0049	<p>Permanent Turf Reinforcing Mat (TRM) <small>(31 32 36 00-0045)</small></p> <p>Note: Furnish a web of mechanically bonded synthetic fibers that are entangled to form a strong and dimensionally stable mat. Place fibers between 2 or 3 high-strength, biaxially oriented nets mechanically bound together by stitching with polyolefin thread. The netting material must be resistant to biological, chemical, and ultra-violet degradation.</p>	
31 32 36 00-0050	<p>SF Permanent Turf Reinforcement Mat.....1.30</p> <p>Note: sold per square face foot</p>	
31 32 36 00-0051	<p>Biodegradable Turf Reinforcing Mat (TRM) <small>(31 32 36 00-0045)</small></p> <p>Note: Furnish a geotextile composed of seed free processed natural fiber matrix mechanically bound together with 100% degradable binding fiber or netting to form a continuous matrix.</p>	



Earthwork	31	15
Earthwork Methods	31 30	
Soil Stabilization	31 32	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
31 32 36 00-0052 SF Biodegradable Turf Reinforcement Mat Note: sold per square face foot	0.35	
31 32 36 00-0053 Steel Plates (31 32 36 00-0045)		
31 32 36 00-0054 EA Galvanized Steel Plates.....	35.00	
31 32 36 00-0055 BioWall® (31 32 36 00-0001) Note: Furnish and install the BioWall® to integrate with Launched Soil Nails™, SuperNails® or Self Drilling SuperNails®. The BioWall® is a confined soil/compost mass capable of sustaining vegetation at slope angles up to ¼(H):1(V), and is composed of 2 layers of galvanized wire mesh and 2 layers of lightweight geosynthetic encasing a seeded compost and/or topsoil mix, tied to the soil nails by steel plates. Furnish equipment and incidentals necessary to complete the work. BioWall® to soil nail connection details will be determined by the Contractor's Engineer and identified in the Contractor's stamped plans and submittals.		
31 32 36 00-0056 SF BioWall®.....	50.00	
31 32 36 00-0057 GeoSynthetically Confined Soil™ (GCS®) Components (31 32 36 00-0001) Note: Furnish and install geosynthetic reinforcement, backfill and facing element to construct a Geosynthetically Confined Soil Wall™ (GCS®). Designs shall comply with the Design Standards for Geosynthetically Confined Soil Walls (adapted from the NCHRP Report 556 –“Design and Construction Guidelines for Geosynthetic – Reinforced Soil Bridge Abutments with a Flexible Facing”) noted below. Reinforcement Selection and Placement: Geosynthetic reinforcement shall consist of high-tenacity geotextiles manufactured for soil reinforcement applications. Geotextiles shall not be exposed to sunlight and extreme temperatures for an extended period of time. Damaged or improperly handled geosynthetic reinforcement shall be rejected. Use a woven polypropylene geotextile with ultimate tensile strength of 2400 lbs/ft (Amoco 2044 or similar) in the cross-machine direction (as per ASTM D4595). The geosynthetic reinforcement perpendicular to the wall face should consist of one continuous piece of material. Overlap of reinforcement in the design strength direction is not permitted. Adjacent sections of geosynthetic reinforcement should be placed so as to ensure that horizontal coverage shown on the plans is provided. Tracked construction equipment shall not be operated directly on the geosynthetic reinforcement. A minimum backfill thickness of 150 mm (6 in.) is required before operation of tracked vehicles over the geosynthetic reinforcement. Turning of tracked vehicles should be kept to a minimum to prevent displacing the fill and damaging or moving the geosynthetic reinforcement. Rubber-tired equipment may pass over the geosynthetic reinforcement at slow speeds less than 17 km/hr (10 miles/hr). Sudden braking and sharp turning should be avoided. Backfill Specifications: Structure backfill material should consist of material free from organic or other unsuitable material as determined by the Contractor's Engineer. Grading of the backfill should be as follows: 100 percent passing 100 mm (4 in.) sieve, 0-60 percent passing No. 40 (0.425 mm) sieve, and 0-15 percent passing No. 200 (0.075mm) sieve; plasticity index (PI) as determined by AASHTO T90, should not exceed 6. The backfill should exhibit an angle of internal friction of not less than 34 degrees, as determined by the standard direct shear test on the portion finer than 2 mm (No.10) sieve, using a sample compacted to 95 percent of AASHTO T-99, Methods C or D, at optimum moisture content. No testing is required for backfills where 80 percent of sizes are greater than 19 mm. The backfill should be substantially free of shale or other soft, poor durability particles and should have an organic content not larger than 1 percent. The backfill should have a pH between 4.5 and 9. Backfill Placement: Reinforced fill should be placed as specified in construction plans in compacted lift thickness of 8in, but in no case in lifts greater than 12in. Reinforced fill should be placed and compacted at or within 2 percent dry of the optimum moisture content. If the reinforced fill is free draining (i.e., with less than 5 percent passing a No. 200 sieve), water content of the fill may be within ±3 percent of the optimum. A minimum density of 90 percent of standard Proctor density is required. Optimum compaction is 100 percent of AASHTO T-99 (or 95 percent of AASHTO T-180) but this may not be possible throughout the wall structure. If significant percentage of the backfill is coarse material (i.e., greater than 30 percent retained on the 19 mm, or ¾ in., sieve), a procedural specification may be used to verify compaction, (no less than two passes with a conventional vibratory plate compaction equipment). Backfill should be placed, spread, and compacted so as to prevent the development of wrinkles or movement of the geosynthetic reinforcement and the wall facing units. Only hand-operated compaction equipment should be allowed within 0.5 m (1.5 ft) of the front of t		
31 32 36 00-0058 SF GeoSynthetically Confined Soil™ (GCS®) Wall Note: Installation sold per square face foot (excludes materials)	32.50	
31 32 36 00-0059 EA GeoSynthetically Confined Soil™ (GCS®) Wall Concrete Masonry Units (approximately 8" x 8" x 16").....	4.60	
31 32 36 00-0060 EA GeoSynthetically Confined Soil™ (GCS®) Wall Galvanized Wire Basket Units (approximately 10" x 120").....	100.00	
31 32 36 00-0061 SF GeoSynthetically Confined Soil™ (GCS®) Wall Woven Geotextile.....	0.65	
31 32 36 00-0062 Launched SuperDrain™ (Horizontal Drains) (31 32 36 00-0001) Note: Furnish Launched SuperDrain™ up to 20 feet in length composed of a tube (1.5 inch outside diameter, 0.120 inch wall thickness hot-dipped galvanized 36ksi steel (ASTM A513) that is mechanically deformed or GalvaDized™ to produce a plurality of surficial asperities). Drainage perforations consist of 0.5-inch diameter holes drilled or torch-cut at 6 inch spacing along the distal 5 feet of nail. Every other hole is rotated 90° about the longitudinal axis of the nail. Furnish equipment and incidentals necessary to complete the work. Insert Launched SuperDrain™ with a single stroke at initial velocities in excess of 200 miles per hour. Inserted length and spacing will be determined by the Contractor's Engineer and identified in the Contractor's stamped plans and submittals.		
31 32 36 00-0063 EA Drilled PVC Horizontal Drains up to 20 ft. length.....	650.00	
31 32 36 00-0064 EA Drilled PVC Horizontal Drains up to 30 ft. length.....	975.00	
31 32 36 00-0065 EA Drilled PVC Horizontal Drains up to 40 ft. length.....	1,300.00	
31 32 36 00-0066 EA Drilled PVC Horizontal Drains up to 50 ft. length.....	2,275.00	
31 32 36 00-0067 EA Drilled PVC Horizontal Drains up to 60 ft. length.....	2,730.00	
31 32 36 00-0068 EA Drilled PVC Horizontal Drains up to 70 ft. length.....	3,185.00	
31 32 36 00-0069 EA Drilled PVC Horizontal Drains up to 80 ft. length.....	3,640.00	
31 32 36 00-0070 Mobilization / Demobilization (31 32 36 00-0001)		
31 32 36 00-0071 EA Mobilization (Out of State).....	15,600.00	
31 32 36 00-0072 EA Mobilization (In State).....	7,800.00	
31 32 36 00-0073 DAY Limited or Remote Access Surcharge.....	7,700.00	

31	31	Earthwork
	31 30	Earthwork Methods
	31 32	Soil Stabilization



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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31 32 36 00-0074 Grouting (31 32 36 00-0001)

31 32 36 00-0075 Compaction Grouting (31 32 36 00-0074)

Note: A. Furnish compaction grout material manufactured on-site (at the project location) in volumetric batching equipment so that grout rheology can be controlled real-time. The grout shall have a slump of 0.50" to 3.0" depending on the specific requirements of the project and shall conform to the engineering plans developed and submitted by the Contractor. Grout components shall consist of Type I/II cement, potable water and aggregate. Fly Ash may be added to the mix per the engineering plans. All aggregate for the compaction grout material shall meet the following requirements: a. 100% passing the 1/2" sieve b. Less than 2% organics c. No bentonite or other clay of medium to high plasticity shall be used. Site conditions and re-leveling requirements shall determine the exact proportions of cement, water and soil. The grout mix shall generally consist of aggregate with up to 12% cement by weight and water to form a very stiff mortar-like mixture. No admixtures shall be used without the Project Manager's approval, and previous testing. Mix design and test results of grout mixture must be submitted and approved by the Project Manager 15 Days prior to the commencement of the work. A. Gradations of the aggregate material to be utilized shall be submitted as part of the submittal process and prior to any work taking place. B. The compaction grouting mixer shall be of a type to ensure complete mixing of the stiff grout, as approved by the Project Manager. The compaction grout mixer shall be of sufficient capacity to continuously deliver grout having a slump of less than 1.5 inches at pressures up to 1,000 psi, at flow rates ranging from 0.1 to 5.0 cubic feet per minute. Gauges shall be provided at the pump and the grout pipe head to measure pressure the rate of flow. Type and location of gauges shall be as specified by the Contractor. A dial gauge or meter capable of measuring to 0.5 cubic feet or less shall be provided to measure the amount of grout pumped into the hole. A pressure gauge shall be graduated in 10-psi increments or less and used to measure the applied pressure. Compaction grout hose shall have a minimum inside diameter of 2 inches with non-restrictive full flow couplings. The hose shall be of sufficient strength for the pressures anticipated, and shall be in good condition.

31 32 36 00-0076	LF	Compaction Grouting Casing Installation.....	22.60
31 32 36 00-0077	CF	Compaction Grout Injection for Soils Densification.....	17.00
31 32 36 00-0078	CF	Compaction Grout For Void Fill.....	10.25

31 32 36 00-0079 Polyurethane Grouting (31 32 36 00-0074)

Note: A. The material shall be a two part 1:1 ratio by volume, polyurethane-forming mixture, having a water insoluble diluent, which permits the formation of polyurethanes in excess water. The material shall reach 90% Compressive strength in 30 minutes such that traffic may be returned to roadway within 30 minutes after last injection of material. Polyurethane Free-rise Physical Properties Property I Units ASTM Minimum Maximum Density - lb/cf D 1622 3.0 lb/cf 6.0 lb/cf Tensile Strength - psi D 1623 80 psi Compressive Strength at Yield Point - psi D 1621 60 psi B. Furnish equipment and incidentals necessary to complete the work. Polyurethane grout shall not be used for deep injection (deeper than 3 ft below bottom of structure) or soils densification, it shall only be used for void filling under structures and for re-leveling. The Contractor shall prepare a profile to determine the areas that require void filling and re-leveling and determine the locations of the injection holes for each treated area. The Contractor shall obtain approval for the final proposed grades and the location of injection holes. The Contractor shall submit a plan for approval of the proposed polyurethane injection methods for the designated project areas. The plan shall include, but not be limited to: proposed diameter of casing (if required), depth of placement, angle of inclination, injection tube spacing, and project staging. The plan shall include monitoring procedures to ensure that damage will not occur to any existing structures due to the injection process. Monitoring devices shall be installed on mechanically stabilized earth retaining systems and between approach slabs and approach slab footings or other components to help prevent damage. The Contractor shall drill a pattern of holes as proposed in his plan. The holes shall be located in a manner that the void filling and structure lifting process does not affect any adjoining structures, such as mechanically stabilized earth retaining walls. Holes shall not be drilled within 4" of the edge of the slab, construction joints or major cracks. No more holes shall be drilled and tubes installed during the day than can be filled during that day. On bridge approach and roadway projects, and as applicable, the initial lift shall be at the sleeper footer. The Contractor shall lift the sleeper footer and the approach slab to the desired elevation by injecting material under the structures with care to assure that polyurethane material is not placed between the sleeper footer and the approach slab. The amount of rise shall be controlled by regulating the rate of injection of the high density polyurethane material. When the nozzle is removed from the hole, any excessive polyurethane material shall be removed from the area.

31 32 36 00-0080	LBS	Polyurethane Grouting For Void Fill and Re-Leveling.....	9.35
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31 36 Gabions (31 30)

Note: Includes the cost for loading, hauling up to 15 miles from the closest approved source, unloading and placing. See CSI section 01 74 19 00-0034 for hauling greater than 15 miles.

31 36 13 Gabion Boxes (31 36)

31 36 13 00-0001 Stone Filled Gabion Slope Protection (31 36 13)

Note: Machine placed by SY of total top face area for depth indicated.

31 36 13 00-0002	SY	6" Deep Stone Filled Gabion Slope Protection	81.65
31 36 13 00-0003	SY	9" Deep Stone Filled Gabion Slope Protection	98.51
31 36 13 00-0004	SY	12" Deep Stone Filled Gabion Slope Protection	124.01
31 36 13 00-0005	SY	15" Deep Stone Filled Gabion Slope Protection	144.47
31 36 13 00-0006	SY	18" Deep Stone Filled Gabion Slope Protection	168.91
31 36 13 00-0007	SY	24" Deep Stone Filled Gabion Slope Protection	232.85
31 36 13 00-0008	SY	36" Deep Stone Filled Gabion Slope Protection	295.98

31 37 Riprap (31 30)

Note: Includes the cost for loading, hauling up to 15 miles from the closest approved source, and dumping. See CSI section 01 74 19 00-0034 for hauling greater than 15 miles.

31 37 00 00-0001 Random - Filter Stone (31 37)

31 37 00 00-0002	CY	10 To 50 LB Average Pieces Random, Dumped From Truck, Rip Rap	78.54
		<i>For Chinking Material, Add</i>	12.85
31 37 00 00-0003	CY	>50 To 100 LB Average Pieces Random, Dumped From Truck, Rip Rap	92.79
		<i>For Chinking Material, Add</i>	12.85



Earthwork	31	13
Earthwork Methods	31 30	
Riprap	31 37	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
31 37 00 00-0004 CY >100 To 200 LB Average Pieces Random, Dumped From Truck, Rip Rap..... <i>For Chinking Material, Add</i>	99.50 12.85	
31 37 00 00-0005 CY >200 To 300 LB Average Pieces Random, Dumped From Truck, Rip Rap..... <i>For Chinking Material, Add</i>	107.14 12.85	
31 37 00 00-0006 CY >300 To 600 LB Average Pieces Random, Dumped From Truck, Rip Rap..... <i>For Chinking Material, Add</i>	113.30 12.85	
31 37 00 00-0007 CY >600 LB Average Pieces Random, Dumped From Truck, Rip Rap.....	123.38	
31 37 00 00-0008 CY 3/8 To 1/4 CY Pieces Random, Dumped From Truck, Machine Spread And Placed Slope Protection (Keyed) Rip Rap.....	133.45	
31 37 00 00-0009 TON 10 To 50 LB Average Pieces Random, Dumped From Truck, Rip Rap.....	51.19	
31 37 00 00-0010 TON >50 To 100 LB Average Pieces Random, Dumped From Truck, Rip Rap.....	60.24	
31 37 00 00-0011 TON >100 To 200 LB Average Pieces Random, Dumped From Truck, Rip Rap.....	64.50	
31 37 00 00-0012 TON >200 To 300 LB Average Pieces Random, Dumped From Truck, Rip Rap.....	69.35	
31 37 00 00-0013 TON >300 To 600 LB Average Pieces Random, Dumped From Truck, Rip Rap.....	73.26	
31 37 00 00-0014 TON >600 LB Average Pieces Random, Dumped From Truck, Rip Rap.....	79.73	
31 37 00 00-0015 TON 3/8 To 1/4 CY Pieces Random, Dumped From Truck, Machine Spread And Placed Slope Protection (Keyed) Rip Rap.....	88.37	

31 40 Shoring And Underpinning ⁽³¹⁾

31 41 Shoring ^(31 40)

31 41 13 Timber Shoring ^(31 41)

31 41 13 00-0001 Wood Sheet Piling ^(31 41 13)

31 41 13 00-0002 Pull And Salvage ^(31 41 13 00-0001)

Note: Includes soldier beams and lagging (wales, braces and spacers). Excludes tie-backs (rock bolting) where required.

31 41 13 00-0003 SF Wood Shoring, 8' Deep Excavation, Pull And Salvage..... <i>For Wood Sheeting Left In Place</i>	10.59 -0.89	
31 41 13 00-0004 SF Wood Shoring, 10' Deep Excavation, Pull And Salvage..... <i>For Wood Sheeting Left In Place</i>	11.46 -1.04	
31 41 13 00-0005 SF Wood Shoring, 12' Deep Excavation, Pull And Salvage..... <i>For Wood Sheeting Left In Place</i>	12.42 -1.22	
31 41 13 00-0006 SF Wood Shoring, 14' Deep Excavation, Pull And Salvage..... <i>For Wood Sheeting Left In Place</i>	13.44 -1.42	
31 41 13 00-0007 SF Wood Shoring, 16' Deep Excavation, Pull And Salvage..... <i>For Wood Sheeting Left In Place</i>	14.55 -1.64	
31 41 13 00-0008 SF Wood Shoring, 18' Deep Excavation, Pull And Salvage..... <i>For Wood Sheeting Left In Place</i>	15.76 -1.89	
31 41 13 00-0009 SF Wood Shoring, 20' Deep Excavation, Pull And Salvage..... <i>For Wood Sheeting Left In Place</i>	17.09 -2.16	

31 41 16 Sheet Piling ^(31 41)

31 41 16 13 Steel Sheet Piling ^(31 41 16)

31 41 16 13-0001 Standard Carbon Grade Steel Sheeting - Pull And Salvage ^(31 41 16 13)

Note: Up to 3 months. 38.5 KSI steel per SF minimum. PSF indicated is for the weight of the material per square foot. Includes soldier beams and lagging (wales, braces and spacers). Excludes tie-backs (rock bolting) where required.

31 41 16 13-0002 TON Shoring For 15' Excavation, 22 PSF Steel Sheeting, Pull And Salvage..... <i>For Standard Sheeting Left In Place, Add</i> <i>For Lightweight Steel Sheeting 8.6 And 9.2 PSF Left In Place, Add</i> <i>For High Strength Sheeting 45,000 To 50,000 PSI Grade, Add</i> <i>For High Strength Sheeting 55,000 PSI Grade, Add</i> <i>For Lightweight Steel Sheeting 8.6 And 9.2 PSF, Add</i> <i>For Each Additional Month >3 Months, Add</i>	1,596.36 859.93 1,223.90 90.99 101.10 313.42 50.55	
31 41 16 13-0003 TON Shoring For 20' Excavation, 27 PSF Steel Sheeting, Pull And Salvage..... <i>For Standard Sheeting Left In Place, Add</i> <i>For Lightweight Steel Sheeting 8.6 And 9.2 PSF Left In Place, Add</i> <i>For High Strength Sheeting 45,000 To 50,000 PSI Grade, Add</i> <i>For High Strength Sheeting 55,000 PSI Grade, Add</i> <i>For Lightweight Steel Sheeting 8.6 And 9.2 PSF, Add</i> <i>For Each Additional Month >3 Months, Add</i>	1,655.13 830.54 1,194.52 90.99 101.10 313.42 50.55	
31 41 16 13-0004 TON Shoring For 25' Excavation, 38 PSF Steel Sheeting, Pull And Salvage..... <i>For Standard Sheeting Left In Place, Add</i> <i>For Lightweight Steel Sheeting 8.6 And 9.2 PSF Left In Place, Add</i> <i>For High Strength Sheeting 45,000 To 50,000 PSI Grade, Add</i> <i>For High Strength Sheeting 55,000 PSI Grade, Add</i> <i>For Lightweight Steel Sheeting 8.6 And 9.2 PSF, Add</i> <i>For Each Additional Month >3 Months, Add</i>	1,928.35 693.93 1,057.91 90.99 101.10 313.42 50.55	
31 41 16 13-0005 TON Shoring For 30' Excavation, 38 PSF Steel Sheeting, Pull And Salvage..... <i>For Standard Sheeting Left In Place, Add</i> <i>For Lightweight Steel Sheeting 8.6 And 9.2 PSF Left In Place, Add</i> <i>For High Strength Sheeting 45,000 To 50,000 PSI Grade, Add</i> <i>For High Strength Sheeting 55,000 PSI Grade, Add</i> <i>For Lightweight Steel Sheeting 8.6 And 9.2 PSF, Add</i> <i>For Each Additional Month >3 Months, Add</i>	2,191.27 562.47 926.45 90.99 101.10 313.42 50.55	

31	Earthwork
31 40	Shoring And Underpinning
31 41	Shoring



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
31 41 16 13-0006 TON Shoring For 35' Excavation, 38 PSF Steel Sheeting, Pull And Salvage.....	2,345.92	
For Standard Sheeting Left In Place, Add	485.15	
For Lightweight Steel Sheeting 8.6 And 9.2 PSF Left In Place, Add	849.12	
For High Strength Sheeting 45,000 To 50,000 PSI Grade, Add	90.99	
For High Strength Sheeting 55,000 PSI Grade, Add	101.10	
For Lightweight Steel Sheeting 8.6 And 9.2 PSF, Add	313.42	
For Each Additional Month >3 Months, Add	50.55	
31 41 16 13-0007 TON Shoring For 40' Excavation, 38 PSF Steel Sheeting, Pull And Salvage.....	2,503.68	
For Standard Sheeting Left In Place, Add	406.27	
For Lightweight Steel Sheeting 8.6 And 9.2 PSF Left In Place, Add	770.24	
For High Strength Sheeting 45,000 To 50,000 PSI Grade, Add	90.99	
For High Strength Sheeting 55,000 PSI Grade, Add	101.10	
For Lightweight Steel Sheeting 8.6 And 9.2 PSF, Add	313.42	
For Each Additional Month >3 Months, Add	50.55	
31 41 16 13-0008 Steel Shoring Plates (31 41 16 13)		
31 41 16 13-0009 EA 1/2" x 12" x 12" Steel Plate For Shoring.....	21.40	
31 45 Vibroflotation And Densification (31 45)		
31 45 13 Vibroflotation (31 45)		
31 45 13 00-0001 LCY Soil Stabilization, Vibroflotation.....	10.58	
31 50 Excavation Support And Protection (31)		
31 52 Cofferdams (31 50)		
31 52 21 Portable Cofferdams (31 52)		
31 52 21 00-0001 Portable Cofferdam (31 52 21)		
Note: Excludes dewatering and pumps.		
31 52 21 00-0002 Portable Cofferdam Rental (31 52 21 00-0001)		
Note: Excludes delivery and installation.		
31 52 21 00-0003 LF 3' High x 7' Width, Portable Cofferdam, Rental Per Month	25.00	
Note: Minimum 40'		
31 52 21 00-0004 LF 4' High x 9' Width, Portable Cofferdam, Rental Per Month	32.00	
Note: Minimum 40'		
31 52 21 00-0005 LF 5' High x 11' Width, Portable Cofferdam, Rental Per Month	45.00	
Note: Minimum 40'		
31 52 21 00-0006 LF 6' High x 13' Width, Portable Cofferdam, Rental Per Month	58.00	
Note: Minimum 40'		
31 52 21 00-0007 LF 8' High x 17' Width, Portable Cofferdam, Rental Per Month	75.00	
Note: Minimum 40'		
31 52 21 00-0008 LF 10' High x 21' Width, Portable Cofferdam, Rental Per Month.....	150.00	
Note: Minimum 40'		
31 52 21 00-0009 LF 12' High x 25' Width, Portable Cofferdam, Rental Per Month.....	210.00	
Note: Minimum 40'		
31 52 21 00-0010 LF 16' High x 33' Width, Portable Cofferdam, Rental Per Month.....	297.00	
Note: Minimum 40'		
31 52 21 00-0011 Portable Cofferdam Delivery And Set-up (31 52 21 00-0001)		
Note: Excludes crane usage where required.		
31 52 21 00-0012 LF Up To 5' High, Portable Cofferdam, Delivery And Set-up In Dynamic (Rivers Or Streams) Water	9.14	
31 52 21 00-0013 LF 6' To 8' High, Portable Cofferdam, Delivery And Set-up In Dynamic (Rivers Or Streams) Water	14.61	
31 52 21 00-0014 LF 10' To 12' High, Portable Cofferdam, Delivery And Set-up In Dynamic (Rivers Or Streams) Water	21.93	
31 52 21 00-0015 LF 16' High, Portable Cofferdam, Delivery And Set-up In Dynamic (Rivers Or Streams) Water.....	29.23	
31 52 21 00-0016 LF Up To 5' High, Portable Cofferdam, Delivery And Set-up In Static (Lakes Or Ponds) Water.....	5.48	
31 52 21 00-0017 LF 6' To 8' High, Portable Cofferdam, Delivery And Set-up In Static (Lakes Or Ponds) Water.....	9.14	
31 52 21 00-0018 LF 10' To 12' High, Portable Cofferdam, Delivery And Set-up In Static (Lakes Or Ponds) Water.....	14.61	
31 52 21 00-0019 LF 16' High, Portable Cofferdam, Delivery And Set-up In Static (Lakes Or Ponds) Water.....	20.09	
31 52 21 00-0020 Portable Cofferdam Repositioning (31 52 21 00-0001)		
31 52 21 00-0021 LF Up To 5' High, Portable Cofferdam, Repositioning	4.56	
31 52 21 00-0022 LF 6' To 8' High, Portable Cofferdam, Repositioning	7.31	
31 52 21 00-0023 LF 10' To 12' High, Portable Cofferdam, Repositioning	10.96	
31 52 21 00-0024 LF 16' High, Portable Cofferdam, Repositioning	14.61	
31 60 Special Foundations And Load-bearing Elements (31)		
31 62 Driven Piles (31 60)		
31 62 13 Concrete Piles (31 62)		
31 62 13 19 Precast Concrete Piles (31 62 13)		



Earthwork	31	15
Special Foundations And Load-bearing Elements	31 60	
Driven Piles	31 62	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
31 62 13 19-0001 Tapered Friction Piles With Fluted Steel Casing Up To 50' <small>(31 62 13 19)</small> Note: With 4000 PSI concrete. Excludes reinforcing.		
31 62 13 19-0002 VLF 12" Diameter Tapered Friction Steel Pile, 7 Gauge.....	42.09	
For Piles Driven In Water, Add	14.42	
31 62 13 19-0003 VLF 14" Diameter Tapered Friction Steel Pile, 7 Gauge.....	43.29	
For Piles Driven In Water, Add	15.27	
31 62 13 19-0004 VLF 16" Diameter Tapered Friction Steel Pile, 7 Gauge.....	52.53	
For Piles Driven In Water, Add	17.03	
31 62 13 19-0005 VLF 18" Diameter Tapered Friction Steel Pile, 7 Gauge.....	60.44	
For Piles Driven In Water, Add	18.81	
31 62 13 19-0006 Constant Diameter Pile, End Bearing, With Fluted Steel Casing <small>(31 62 13 19)</small> Note: Up to 50'. Excludes reinforced.		
31 62 13 19-0007 VLF 12" Diameter Constant Diameter Steel Pipe Pile, 7 Gauge.....	42.87	
For Piles Driven In Water, Add	14.50	
31 62 13 19-0008 VLF 14" Diameter Constant Diameter Steel Pipe Pile, 7 Gauge.....	51.74	
For Piles Driven In Water, Add	16.12	
31 62 13 19-0009 VLF 16" Diameter Constant Diameter Steel Pipe Pile, 7 Gauge.....	58.45	
For Piles Driven In Water, Add	17.63	
31 62 13 19-0010 VLF 18" Diameter Constant Diameter Steel Pipe Pile, 7 Gauge.....	63.57	
For Piles Driven In Water, Add	19.12	
31 62 13 19-0011 Thin Wall Shell Straight Sided <small>(31 62 13 19)</small>		
31 62 13 19-0012 VLF 8" Diameter, 16 Gauge Steel Thin Wall Shell Straight Sided.....	25.77	
For Piles Driven In Water, Add	11.19	
For Thick Wall Shell, Add	0.04	
31 62 13 19-0013 VLF 10" Diameter, 16 Gauge Steel Thin Wall Shell Straight Sided.....	28.46	
For Piles Driven In Water, Add	12.42	
For Thick Wall Shell, Add	0.04	
31 62 13 19-0014 VLF 12" Diameter, 16 Gauge Steel Thin Wall Shell Straight Sided.....	31.13	
For Piles Driven In Water, Add	13.64	
For Thick Wall Shell, Add	0.05	
31 62 13 19-0015 VLF 14" Diameter, 16 Gauge Steel Thin Wall Shell Straight Sided.....	33.81	
For Piles Driven In Water, Add	14.87	
For Thick Wall Shell, Add	0.05	
31 62 13 19-0016 VLF 16" Diameter, 16 Gauge Steel Thin Wall Shell Straight Sided.....	36.51	
For Piles Driven In Water, Add	16.10	
For Thick Wall Shell, Add	0.06	
31 62 13 23 Prestressed Concrete Piles <small>(31 62 13)</small>		
31 62 13 23-0001 Square Piles <small>(31 62 13 23)</small>		
31 62 13 23-0002 VLF 10" Prestressed Square Concrete Pile.....	19.96	
For Piles Driven In Water, Add	10.74	
31 62 13 23-0003 VLF 12" Prestressed Square Concrete Pile.....	24.71	
For Piles Driven In Water, Add	12.05	
31 62 13 23-0004 VLF 14" Prestressed Square Concrete Pile.....	29.63	
For Piles Driven In Water, Add	13.18	
31 62 13 23-0005 VLF 16" Prestressed Square Concrete Pile.....	35.92	
For Piles Driven In Water, Add	14.54	
31 62 13 23-0006 VLF 18" Prestressed Square Concrete Pile.....	43.25	
For Piles Driven In Water, Add	16.11	
31 62 13 23-0007 VLF 20" Prestressed Square Concrete Pile.....	49.82	
For Piles Driven In Water, Add	17.74	
31 62 13 23-0008 VLF 24" Prestressed Square Concrete Pile.....	63.01	
For Piles Driven In Water, Add	20.23	
31 62 13 23-0009 Octagonal Pile <small>(31 62 13 23)</small>		
31 62 13 23-0010 VLF 12" Prestressed Octagonal Concrete Pile.....	31.94	
For Piles Driven In Water, Add	12.20	
31 62 13 23-0011 VLF 14" Prestressed Octagonal Concrete Pile.....	39.89	
For Piles Driven In Water, Add	13.57	
31 62 13 23-0012 VLF 16" Prestressed Octagonal Concrete Pile.....	47.91	
For Piles Driven In Water, Add	15.01	
31 62 13 23-0013 VLF 18" Prestressed Octagonal Concrete Pile.....	57.86	
For Piles Driven In Water, Add	16.73	
31 62 13 23-0014 VLF 20" Prestressed Octagonal Concrete Pile.....	104.49	
For Piles Driven In Water, Add	22.23	
31 62 13 23-0015 VLF 24" Prestressed Octagonal Concrete Pile.....	65.36	
For Piles Driven In Water, Add	19.30	
31 62 13 23-0016 Straight Cylinder <small>(31 62 13 23)</small>		
31 62 13 23-0017 VLF 12" Diameter Prestressed Concrete Pile 2-3/8" Wall, Straight Cylinder.....	24.27	
For Piles Driven In Water, Add	10.94	
31 62 13 23-0018 VLF 14" Diameter Prestressed Concrete Pile 2-1/2" Wall, Straight Cylinder.....	28.20	
For Piles Driven In Water, Add	11.83	
31 62 13 23-0019 VLF 16" Diameter Prestressed Concrete Pile 3" Wall, Straight Cylinder.....	32.85	
For Piles Driven In Water, Add	12.86	

31 Earthwork**31 60 Special Foundations And Load-bearing Elements****31 62 Driven Piles**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
	31 62 13 23-0020	VLF	18" Diameter Prestressed Concrete Pile 3" Wall, Straight Cylinder..... <i>For Piles Driven In Water, Add</i>	36.85 13.90	
	31 62 13 23-0021	VLF	20" Diameter Prestressed Concrete Pile 3-1/2" Wall, Straight Cylinder..... <i>For Piles Driven In Water, Add</i>	45.34 15.48	
	31 62 13 23-0022	VLF	24" Diameter Prestressed Concrete Pile 3-1/2" Wall, Straight Cylinder..... <i>For Piles Driven In Water, Add</i>	55.13 17.29	
31 62 16 Steel Piles ^(31 62)					
31 62 16 16 Steel H Piles ^(31 62 16)					
31 62 16 16-0001 Steel H-Section Piles ^(31 62 16 16)					
	31 62 16 16-0002	VLF	8 x 8 x 36 LB/FT Driven Steel H-Section Pile Rolled Steel <i>For Piles Driven In Water, Add</i>	39.93 13.57	
	31 62 16 16-0003	VLF	10 x 10 x 42 LB/FT Driven Steel H-Section Pile Rolled Steel <i>For Piles Driven In Water, Add</i>	45.35 14.59	
	31 62 16 16-0004	VLF	10 x 10 x 57 LB/FT Driven Steel H-Section Pile Rolled Steel <i>For Piles Driven In Water, Add</i>	57.55 15.81	
	31 62 16 16-0005	VLF	12 x 12 x 53 LB/FT Driven Steel H-Section Pile Rolled Steel <i>For Piles Driven In Water, Add</i>	54.63 15.81	
	31 62 16 16-0006	VLF	12 x 12 x 63 LB/FT Driven Steel H-Section Pile Rolled Steel <i>For Piles Driven In Water, Add</i>	62.76 16.63	
	31 62 16 16-0007	VLF	12 x 12 x 74 LB/FT Driven Steel H-Section Pile Rolled Steel <i>For Piles Driven In Water, Add</i>	72.67 18.47	
	31 62 16 16-0008	VLF	12 x 12 x 84 LB/FT Driven Steel H-Section Pile Rolled Steel <i>For Piles Driven In Water, Add</i>	80.80 19.29	
	31 62 16 16-0009	VLF	14 x 14 x 73 LB/FT Driven Steel H-Section Pile Rolled Steel <i>For Piles Driven In Water, Add</i>	72.16 18.70	
	31 62 16 16-0010	VLF	14 x 14 x 89 LB/FT Driven Steel H-Section Pile Rolled Steel <i>For Piles Driven In Water, Add</i>	85.99 20.08	
	31 62 16 16-0011	VLF	14 x 14 x 102 LB/FT Driven Steel H-Section Pile Rolled Steel <i>For Piles Driven In Water, Add</i>	96.83 22.13	
	31 62 16 16-0012	VLF	14 x 14 x 117 LB/FT Driven Steel H-Section Pile Rolled Steel <i>For Piles Driven In Water, Add</i>	109.85 23.43	
31 62 16 16-0013 Splices, Caps, And Points For H-Piles ^(31 62 16 16)					
	31 62 16 16-0014	EA	8" H-Section Pile Splice Rolled Steel.....	302.73	
	31 62 16 16-0015	EA	10" H-Section Pile Splice Rolled Steel.....	360.53	
	31 62 16 16-0016	EA	12" H-Section Pile Splice Rolled Steel.....	477.15	
	31 62 16 16-0017	EA	14" H-Section Pile Splice Rolled Steel.....	506.05	
	31 62 16 16-0018	EA	8" H-Section Driving Cap Rolled Steel.....	4,717.33	
	31 62 16 16-0019	EA	10" H-Section Driving Cap Rolled Steel.....	4,717.33	
	31 62 16 16-0020	EA	12" H-Section Driving Cap Rolled Steel.....	4,763.38	
	31 62 16 16-0021	EA	14" H-Section Driving Cap Rolled Steel.....	7,219.75	
	31 62 16 16-0022	EA	8" H-Section Standard Point Standard, Rolled Steel.....	331.63	
	31 62 16 16-0023	EA	10" H-Section Standard Point Standard, Rolled Steel.....	360.53	
	31 62 16 16-0024	EA	12" H-Section Standard Point Standard, Rolled Steel.....	477.15	
	31 62 16 16-0025	EA	14" H-Section Standard Point Standard, Rolled Steel.....	563.85	
	31 62 16 16-0026	EA	10" H-Section Standard Point Heavy Duty, Rolled Steel.....	477.15	
	31 62 16 16-0027	EA	14" H-Section Standard Point Heavy Duty, Rolled Steel.....	619.82	
31 62 16 19 Unfilled Tubular Steel Piles ^(31 62 16)					
31 62 16 19-0001 Pipe Piles, Non-Filled ^(31 62 16 19)					
	31 62 16 19-0002	VLF	8" Diameter Non-Filled Steel Pipe Piles..... <i>For Piles Driven In Water, Add</i>	27.15 14.97	
	31 62 16 19-0003	VLF	10" Diameter Non-Filled Steel Pipe Piles..... <i>For Piles Driven In Water, Add</i>	30.54 15.31	
	31 62 16 19-0004	VLF	12" Diameter Non-Filled Steel Pipe Piles..... <i>For Piles Driven In Water, Add</i>	35.24 16.43	
	31 62 16 19-0005	VLF	14" Diameter Non-Filled Steel Pipe Piles..... <i>For Piles Driven In Water, Add</i>	38.24 18.07	
	31 62 16 19-0006	VLF	16" Diameter Non-Filled Steel Pipe Piles..... <i>For Piles Driven In Water, Add</i>	42.57 20.17	
	31 62 16 19-0007	VLF	18" Diameter Non-Filled Steel Pipe Piles..... <i>For Piles Driven In Water, Add</i>	51.51 22.41	
31 62 16 19-0008 Splices And Points For Pipe Pile ^(31 62 16 19)					
31 62 16 19-0009 Splice ^(31 62 16 19-0008)					
	31 62 16 19-0010	EA	8" Diameter Pipe Pile Splice Steel.....	198.47	
	31 62 16 19-0011	EA	10" Diameter Pipe Pile Splice Steel.....	209.43	
	31 62 16 19-0012	EA	12" Diameter Pipe Pile Splice Steel.....	276.04	
	31 62 16 19-0013	EA	14" Diameter Pipe Pile Splice Steel.....	286.85	
	31 62 16 19-0014	EA	16" Diameter Pipe Pile Splice Steel.....	341.22	
	31 62 16 19-0015	EA	18" Diameter Pipe Pile Splice Steel.....	406.52	
31 62 16 19-0016 Standard Point ^(31 62 16 19-0008)					



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
31 62 16 19-0017 EA 8" Diameter Steel Pipe Pile Standard Point	204.26	
31 62 16 19-0018 EA 10" Diameter Steel Pipe Pile Standard Point	213.04	
31 62 16 19-0019 EA 12" Diameter Steel Pipe Pile Standard Point	239.82	
31 62 16 19-0020 EA 14" Diameter Steel Pipe Pile Standard Point	263.96	
31 62 16 19-0021 EA 16" Diameter Steel Pipe Pile Standard Point	285.91	
31 62 16 19-0022 EA 18" Diameter Steel Pipe Pile Standard Point	331.16	
31 62 16 19-0023 Heavy Duty Point <small>(31 62 16 19-0008)</small>		
31 62 16 19-0024 EA 10" Diameter Steel Pipe Pile Point Heavy Duty	302.59	
31 62 16 19-0025 EA 12" Diameter Steel Pipe Pile Point Heavy Duty	313.56	
31 62 16 19-0026 EA 14" Diameter Steel Pipe Pile Point Heavy Duty	349.58	
31 62 16 19-0027 EA 16" Diameter Steel Pipe Pile Point Heavy Duty	393.48	
31 62 16 19-0028 EA 18" Diameter Steel Pipe Pile Point Heavy Duty	437.34	
31 62 19 Timber Piles <small>(31 62)</small>		
31 62 19 00-0001 Treated Wood Piles, Friction Or End Bearing 12 LB <small>(31 62 19)</small>		
<small>Note: Penta-treated/CF.</small>		
31 62 19 00-0002 LF 12" Butt x 8" Tip Treated Wood Piles Up To 30'	18.66	
<i>For Piles Driven In Water, Add</i>		10.38
<i>For Untreated Pile, Deduct</i>		-3.40
<i>For Each Pile Tip Point, Add</i>		12.50
<i>For Each Pile Butt, Driving Cap, Add</i>		20.10
<i>For Each Splice For Pile >50', Add</i>		139.40
31 62 19 00-0003 LF 12" Butt x 8" Tip Treated Wood Piles 30' To 39'	19.94	
<i>For Piles Driven In Water, Add</i>		11.57
<i>For Untreated Pile, Deduct</i>		-3.44
<i>For Each Pile Tip Point, Add</i>		12.50
<i>For Each Pile Butt, Driving Cap, Add</i>		20.10
<i>For Each Splice For Pile >50', Add</i>		139.40
31 62 19 00-0004 LF 12" Butt x 7" Tip Treated Wood Pile 40' To 49'	21.07	
<i>For Piles Driven In Water, Add</i>		12.32
<i>For Untreated Pile, Deduct</i>		-3.60
<i>For Each Pile Tip Point, Add</i>		12.50
<i>For Each Pile Butt, Driving Cap, Add</i>		20.10
<i>For Each Splice For Pile >50', Add</i>		139.40
31 62 19 00-0005 LF 13" Butt x 7" Tip Treated Wood Pile 50' To 59'	22.92	
<i>For Piles Driven In Water, Add</i>		13.78
<i>For Untreated Pile, Deduct</i>		-3.76
<i>For Each Pile Tip Point, Add</i>		12.50
<i>For Each Pile Butt, Driving Cap, Add</i>		20.10
<i>For Each Splice For Pile >50', Add</i>		139.40
31 62 19 00-0006 LF 13" Butt x 6" Tip Wood Pile 60' To 69'	27.77	
<i>For Piles Driven In Water, Add</i>		15.54
<i>For Untreated Pile, Deduct</i>		-5.03
<i>For Each Pile Tip Point, Add</i>		12.50
<i>For Each Pile Butt, Driving Cap, Add</i>		20.10
<i>For Each Splice For Pile >50', Add</i>		139.40
31 62 19 00-0007 LF 13" Butt x 6" Tip Wood Pile 70' To 79'	34.40	
<i>For Piles Driven In Water, Add</i>		18.76
<i>For Untreated Pile, Deduct</i>		-6.43
<i>For Each Pile Tip Point, Add</i>		12.50
<i>For Each Pile Butt, Driving Cap, Add</i>		20.10
<i>For Each Splice For Pile >50', Add</i>		139.40
31 62 23 Composite Piles <small>(31 62)</small>		
31 62 23 13 Concrete-Filled Steel Piles <small>(31 62 23)</small>		
31 62 23 13-0001 Concrete Filled Pipe Piles <small>(31 62 23 13)</small>		
<small>Note: All material included in cost.</small>		
31 62 23 13-0002 VLF 8" Diameter Concrete Filled Steel Pipe Piles, 29 LB/FT	29.72	
<i>For Piles Driven In Water, Add</i>		16.29
31 62 23 13-0003 VLF 10" Diameter Concrete Filled Steel Pipe Piles, 34 LB/FT	34.26	
<i>For Piles Driven In Water, Add</i>		17.04
31 62 23 13-0004 VLF 12" Diameter Concrete Filled Steel Pipe Piles, 42 LB/FT	40.47	
<i>For Piles Driven In Water, Add</i>		18.82
31 62 23 13-0005 VLF 14" Diameter Concrete Filled Steel Pipe Piles, 46 LB/FT	45.35	
<i>For Piles Driven In Water, Add</i>		21.80
31 62 23 13-0006 VLF 16" Diameter Concrete Filled Steel Pipe Piles, 52 LB/FT	50.18	
<i>For Piles Driven In Water, Add</i>		23.31
31 62 23 13-0007 VLF 18" Diameter Concrete Filled Steel Pipe Piles, 59 LB/FT	60.64	
<i>For Piles Driven In Water, Add</i>		25.83
31 64 Caissons <small>(31 60)</small>		
31 64 13 Box Caissons <small>(31 64)</small>		
31 64 13 00-0001 Caisson In Stable Ground No Casing Or Ground Water <small>(31 64 13)</small>		
<small>Note: Up to 50' deep. See CSI section 31 64 13 00-0070 for equipment set-up.</small>		

31 Earthwork**31 60 Special Foundations And Load-bearing Elements****31 64 Caissons**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
31 64 13 00-0002			Caisson In Stable Ground <small>(31 64 13 00-0001)</small>		
			Note: Includes 3000 PSI concrete and reinforcing.		
31 64 13 00-0003	VLF		18" Diameter Caisson, No Casing Stable Ground, No Ground Water	44.87	
			Note: 0.066 CY Concrete per VLF, 9 lbs rebar per VLF.		
			For >50' To 100' Deep, Add	4.50	
			For >100' To 150' Deep, Add	11.22	
			For >150' To 200' Deep, Add	15.16	
			For Right Angle Drilling, Add	11.45	
31 64 13 00-0004	VLF		24" Diameter Caisson, No Casing Stable Ground, No Ground Water	56.91	
			Note: 0.116 CY Concrete per VLF, 14 lbs rebar per VLF.		
			For >50' To 100' Deep, Add	6.22	
			For >100' To 150' Deep, Add	14.23	
			For >150' To 200' Deep, Add	19.87	
			For Right Angle Drilling, Add	12.93	
31 64 13 00-0005	VLF		30" Diameter Caisson, No Casing Stable Ground, No Ground Water	81.51	
			Note: 0.182 CY Concrete per VLF, 23 lbs rebar per VLF.		
			For >50' To 100' Deep, Add	9.30	
			For >100' To 150' Deep, Add	20.38	
			For >150' To 200' Deep, Add	28.94	
			For Right Angle Drilling, Add	17.31	
31 64 13 00-0006	VLF		36" Diameter Caisson, No Casing Stable Ground, No Ground Water	108.49	
			Note: 0.262 CY Concrete per VLF, 33 lbs rebar per VLF.		
			For >50' To 100' Deep, Add	12.75	
			For >100' To 150' Deep, Add	27.12	
			For >150' To 200' Deep, Add	39.00	
			For Right Angle Drilling, Add	21.85	
31 64 13 00-0007	VLF		42" Diameter Caisson, No Casing Stable Ground, No Ground Water	140.87	
			Note: 0.356 CY Concrete per VLF, 48 lbs rebar per VLF.		
			For >50' To 100' Deep, Add	17.15	
			For >100' To 150' Deep, Add	35.22	
			For >150' To 200' Deep, Add	51.37	
			For Right Angle Drilling, Add	26.53	
31 64 13 00-0008	VLF		48" Diameter Caisson No Casing Stable Ground, No Ground Water	168.60	
			Note: 0.465 CY Concrete per VLF, 57 lbs rebar per VLF.		
			For >50' To 100' Deep, Add	20.83	
			For >100' To 150' Deep, Add	42.15	
			For >150' To 200' Deep, Add	61.87	
			For Right Angle Drilling, Add	30.80	
31 64 13 00-0009	VLF		54" Diameter Caisson No Casing Stable Ground, No Ground Water	205.82	
			Note: 0.589 CY Concrete per VLF, 76 lbs rebar per VLF.		
			For >50' To 100' Deep, Add	26.17	
			For >100' To 150' Deep, Add	51.46	
			For >150' To 200' Deep, Add	76.45	
			For Right Angle Drilling, Add	35.29	
31 64 13 00-0010	VLF		60" Diameter Caisson No Casing Stable Ground, No Ground Water	242.67	
			Note: 0.727 CY Concrete per VLF, 93 lbs rebar per VLF.		
			For >50' To 100' Deep, Add	31.45	
			For >100' To 150' Deep, Add	60.67	
			For >150' To 200' Deep, Add	90.88	
			For Right Angle Drilling, Add	39.75	
31 64 13 00-0011	VLF		66" Diameter Caisson No Casing Stable Ground, No Ground Water	284.49	
			Note: 0.88 CY Concrete per VLF, 113 lbs rebar per VLF.		
			For >50' To 100' Deep, Add	37.41	
			For >100' To 150' Deep, Add	71.12	
			For >150' To 200' Deep, Add	107.22	
			For Right Angle Drilling, Add	44.89	
31 64 13 00-0012	VLF		72" Diameter Caisson No Casing Stable Ground, No Ground Water	333.50	
			Note: 1.047 CY Concrete per VLF, 134 lbs rebar per VLF.		
			For >50' To 100' Deep, Add	44.45	
			For >100' To 150' Deep, Add	83.38	
			For >150' To 200' Deep, Add	126.43	
			For Right Angle Drilling, Add	50.77	
31 64 13 00-0013	VLF		78" Diameter Caisson No Casing Stable Ground, No Ground Water	381.82	
			Note: 1.229 CY Concrete per VLF, 157 lbs rebar per VLF.		
			For >50' To 100' Deep, Add	51.50	
			For >100' To 150' Deep, Add	95.46	
			For >150' To 200' Deep, Add	145.51	
			For Right Angle Drilling, Add	56.22	
31 64 13 00-0014	VLF		84" Diameter Caisson No Casing Stable Ground, No Ground Water	433.44	
			Note: 1.425 CY Concrete per VLF, 183 lbs rebar per VLF.		
			For >50' To 100' Deep, Add	59.07	
			For >100' To 150' Deep, Add	108.36	
			For >150' To 200' Deep, Add	165.95	
			For Right Angle Drilling, Add	61.92	
31 64 13 00-0015			For Bell Excavation And Concrete, Add <small>(31 64 13 00-0001)</small>		
31 64 13 00-0016	EA		Bell Excavation And Concrete, 4' Bell Diameter Stable Ground, 24" Shaft, 0.44 CY	319.07	
			For >50' To 100' Deep, Add	25.57	
			For >100' To 150' Deep, Add	79.77	
			For >150' To 200' Deep, Add	99.76	
31 64 13 00-0017	EA		Bell Excavation And Concrete, 6' Bell Diameter Stable Ground, 30" Shaft, 1.57 CY	1,121.42	
			For >50' To 100' Deep, Add	89.99	
			For >100' To 150' Deep, Add	280.36	
			For >150' To 200' Deep, Add	350.80	



Earthwork	31
Special Foundations And Load-bearing Elements	31 60
Caissons	31 64

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
31 64 13 00-0018 EA Bell Excavation And Concrete, 7' Bell Diameter Stable Ground, 36" Shaft, 2.33 CY.....	1,692.71	
For >50' To 100' Deep, Add	137.83	
For >100' To 150' Deep, Add	423.18	
For >150' To 200' Deep, Add	531.99	
31 64 13 00-0019 EA Bell Excavation And Concrete, 8' Bell Diameter Stable Ground, 42" Shaft, 3.30 CY.....	2,349.05	
For >50' To 100' Deep, Add	191.61	
For >100' To 150' Deep, Add	587.26	
For >150' To 200' Deep, Add	738.69	
31 64 13 00-0020 EA Bell Excavation And Concrete, 9' Bell Diameter Stable Ground, 48" Shaft, 4.48 CY.....	3,195.14	
For >50' To 100' Deep, Add	256.35	
For >100' To 150' Deep, Add	798.79	
For >150' To 200' Deep, Add	999.40	
31 64 13 00-0021 EA Bell Excavation And Concrete, 10' Bell Diameter Stable Ground, 60" Shaft, 5.24 CY.....	3,757.23	
For >50' To 100' Deep, Add	301.32	
For >100' To 150' Deep, Add	939.31	
For >150' To 200' Deep, Add	1,175.07	
31 64 13 00-0022 EA Bell Excavation And Concrete, 12' Bell Diameter Stable Ground, 72" Shaft, 8.74 CY.....	6,373.82	
For >50' To 100' Deep, Add	510.23	
For >100' To 150' Deep, Add	1,593.46	
For >150' To 200' Deep, Add	1,992.22	
31 64 13 00-0023 EA Bell Excavation And Concrete, 14' Bell Diameter Stable Ground, 84" Shaft, 13.6 CY.....	9,203.82	
For >50' To 100' Deep, Add	743.65	
For >100' To 150' Deep, Add	2,300.96	
For >150' To 200' Deep, Add	2,885.38	
31 64 13 00-0024 Caisson In Wet Ground, Casing Pulled ^(31 64 13)		
Note: Up to 50' deep. See CSI section 31 64 13 00-0070 for equipment set-up.		
31 64 13 00-0025 Caisson In Wet Ground ^(31 64 13 00-0024)		
Note: Includes 3000 PSI concrete and reinforcing.		
31 64 13 00-0026 VLF 18" Diameter Caisson Wet Ground, Casing Pulled.....	49.04	
Note: 0.066 CY Concrete per VLF, 9 lbs rebar per VLF.		
For >50' To 100' Deep, Add	4.79	
For >100' To 150' Deep, Add	12.26	
For >150' To 200' Deep, Add	16.41	
For Right Angle Drilling, Add	12.93	
31 64 13 00-0027 VLF 24" Diameter Caisson Wet Ground, Casing Pulled.....	81.46	
Note: 0.116 CY Concrete per VLF, 14 lbs rebar per VLF.		
For >50' To 100' Deep, Add	7.94	
For >100' To 150' Deep, Add	20.37	
For >150' To 200' Deep, Add	27.23	
For Right Angle Drilling, Add	21.52	
31 64 13 00-0028 VLF 30" Diameter Caisson Wet Ground, Casing Pulled.....	109.09	
Note: 0.182 CY Concrete per VLF, 23 lbs rebar per VLF.		
For >50' To 100' Deep, Add	11.23	
For >100' To 150' Deep, Add	27.27	
For >150' To 200' Deep, Add	37.22	
For Right Angle Drilling, Add	26.96	
31 64 13 00-0029 VLF 36" Diameter Caisson Wet Ground, Casing Pulled.....	150.13	
Note: 0.262 CY Concrete per VLF, 33 lbs rebar per VLF.		
For >50' To 100' Deep, Add	15.67	
For >100' To 150' Deep, Add	37.53	
For >150' To 200' Deep, Add	51.49	
For Right Angle Drilling, Add	36.42	
31 64 13 00-0030 VLF 42" Diameter Caisson Wet Ground, Casing Pulled.....	192.30	
Note: 0.356 CY Concrete per VLF, 48 lbs rebar per VLF.		
For >50' To 100' Deep, Add	20.75	
For >100' To 150' Deep, Add	48.08	
For >150' To 200' Deep, Add	66.80	
For Right Angle Drilling, Add	44.53	
31 64 13 00-0031 VLF 48" Diameter Caisson Wet Ground, Casing Pulled.....	229.62	
Note: 0.465 CY Concrete per VLF, 57 lbs rebar per VLF.		
For >50' To 100' Deep, Add	25.10	
For >100' To 150' Deep, Add	57.41	
For >150' To 200' Deep, Add	80.17	
For Right Angle Drilling, Add	52.15	
31 64 13 00-0032 VLF 54" Diameter Caisson Wet Ground, Casing Pulled.....	297.51	
Note: 0.589 CY Concrete per VLF, 76 lbs rebar per VLF.		
For >50' To 100' Deep, Add	32.59	
For >100' To 150' Deep, Add	74.38	
For >150' To 200' Deep, Add	103.95	
For Right Angle Drilling, Add	67.38	
31 64 13 00-0033 VLF 60" Diameter Caisson Wet Ground, Casing Pulled.....	364.23	
Note: 0.727 CY Concrete per VLF, 93 lbs rebar per VLF.		
For >50' To 100' Deep, Add	39.96	
For >100' To 150' Deep, Add	91.06	
For >150' To 200' Deep, Add	127.34	
For Right Angle Drilling, Add	82.29	
31 64 13 00-0034 VLF 66" Diameter Caisson Wet Ground, Casing Pulled.....	417.48	
Note: 0.87 CY Concrete per VLF, 113 lbs rebar per VLF.		
For >50' To 100' Deep, Add	46.72	
For >100' To 150' Deep, Add	104.37	
For >150' To 200' Deep, Add	147.12	
For Right Angle Drilling, Add	91.44	

31 Earthwork**31 60 Special Foundations And Load-bearing Elements****31 64 Caissons**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
	31 64 13 00-0035	VLF	72" Diameter Caisson Wet Ground, Casing Pulled..... Note: 1.047 CY Concrete per VLF, 134 lbs rebar per VLF.	477.90	
			For >50' To 100' Deep, Add	54.56	
			For >100' To 150' Deep, Add	119.48	
			For >150' To 200' Deep, Add	169.75	
			For Right Angle Drilling, Add	101.31	
	31 64 13 00-0036	VLF	78" Diameter Caisson Wet Ground, Casing Pulled..... Note: 1.229 CY Concrete per VLF, 157 lbs rebar per VLF.	545.14	
			For >50' To 100' Deep, Add	62.93	
			For >100' To 150' Deep, Add	136.29	
			For >150' To 200' Deep, Add	194.51	
			For Right Angle Drilling, Add	113.38	
	31 64 13 00-0037	VLF	84" Diameter Caisson Wet Ground, Casing Pulled..... Note: 1.425 CY Concrete per VLF, 183 lbs rebar per VLF.	616.01	
			For >50' To 100' Deep, Add	71.85	
			For >100' To 150' Deep, Add	154.00	
			For >150' To 200' Deep, Add	220.72	
			For Right Angle Drilling, Add	125.82	
	31 64 13 00-0038		For Bell Excavation And Concrete, Add <small>(31 64 13 00-0024)</small>		
	31 64 13 00-0039	EA	Bell Excavation And Concrete, 4' Bell Diameter Wet Ground 24" Shaft, 0.44 CY..... For >50' To 100' Deep, Add	364.75 28.77	
			For >100' To 150' Deep, Add	91.19	
			For >150' To 200' Deep, Add	113.47	
	31 64 13 00-0040	EA	Bell Excavation And Concrete, 6' Bell Diameter Wet Ground, 30" Shaft, 1.57 CY..... For >50' To 100' Deep, Add	1,270.32 100.42	
			For >100' To 150' Deep, Add	317.58	
			For >150' To 200' Deep, Add	395.47	
	31 64 13 00-0041	EA	Bell Excavation And Concrete, 7' Bell Diameter Wet Ground, 36" Shaft, 2.33 CY..... For >50' To 100' Deep, Add	1,759.88 130.56	
			For >100' To 150' Deep, Add	439.97	
			For >150' To 200' Deep, Add	537.17	
	31 64 13 00-0042	EA	Bell Excavation And Concrete, 8' Bell Diameter Wet Ground, 42" Shaft, 3.3 CY..... For >50' To 100' Deep, Add	2,787.61 222.31	
			For >100' To 150' Deep, Add	696.90	
			For >150' To 200' Deep, Add	870.26	
	31 64 13 00-0043	EA	Bell Excavation And Concrete, 9' Bell Diameter Wet Ground, 48" Shaft, 4.48 CY..... For >50' To 100' Deep, Add	3,619.50 286.05	
			For >100' To 150' Deep, Add	904.88	
			For >150' To 200' Deep, Add	1,126.71	
	31 64 13 00-0044	EA	Bell Excavation And Concrete, 10' Bell Diameter Wet Ground, 60" Shaft, 5.24 CY..... For >50' To 100' Deep, Add	4,256.48 336.27	
			For >100' To 150' Deep, Add	1,064.12	
			For >150' To 200' Deep, Add	1,324.84	
	31 64 13 00-0045	EA	Bell Excavation And Concrete, 12' Bell Diameter Wet Ground, 72" Shaft, 8.74 CY..... For >50' To 100' Deep, Add	7,222.55 569.64	
			For >100' To 150' Deep, Add	1,805.64	
			For >150' To 200' Deep, Add	2,246.84	
	31 64 13 00-0046	EA	Bell Excavation And Concrete, 14' Bell Diameter Wet Ground, 84" Shaft, 13.6 CY..... For >50' To 100' Deep, Add	10,416.28 828.52	
			For >100' To 150' Deep, Add	2,604.07	
			For >150' To 200' Deep, Add	3,249.11	
	31 64 13 00-0047		Caisson In Soft Rock And Medium Hard Shale <small>(31 64 13)</small> Note: Up to 50' deep. See CSI section 31 64 13 00-0070 for equipment set-up.		
	31 64 13 00-0048		Caisson In Soft Rock <small>(31 64 13 00-0047)</small> Note: Includes 3000 PSI concrete and reinforcing.		
	31 64 13 00-0049	VLF	18" Diameter Caisson, Soft Rock Medium Shale, No Casing/Ground Water..... Note: 0.066 CY Concrete per VLF, 9 lbs rebar per VLF.	183.33	
			For >50' To 100' Deep, Add	14.19	
			For >100' To 150' Deep, Add	45.83	
			For >150' To 200' Deep, Add	56.69	
			For Right Angle Drilling, Add	59.93	
	31 64 13 00-0050	VLF	24" Diameter Caisson, Soft Rock Medium Shale, No Casing/Ground Water..... Note: 0.116 CY Concrete per VLF, 14 lbs rebar per VLF.	305.31	
			For >50' To 100' Deep, Add	23.61	
			For >100' To 150' Deep, Add	76.33	
			For >150' To 200' Deep, Add	94.39	
			For Right Angle Drilling, Add	99.87	
	31 64 13 00-0051	VLF	30" Diameter Caisson, Soft Rock Medium Shale, No Casing/Ground Water..... Note: 0.182 CY Concrete per VLF, 23 lbs rebar per VLF.	460.87	
			For >50' To 100' Deep, Add	35.85	
			For >100' To 150' Deep, Add	115.22	
			For >150' To 200' Deep, Add	142.75	
			For Right Angle Drilling, Add	150.08	
	31 64 13 00-0052	VLF	36" Diameter Caisson, Soft Rock Medium Shale, No Casing/Ground Water..... Note: 0.262 CY Concrete per VLF, 33 lbs rebar per VLF.	589.96	
			For >50' To 100' Deep, Add	46.46	
			For >100' To 150' Deep, Add	147.49	
			For >150' To 200' Deep, Add	183.44	
			For Right Angle Drilling, Add	190.36	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
31 64 13 00-0053 VLF 42" Diameter Caisson, Soft Rock Medium Shale, No Casing/Ground Water.....	753.36	
Note: 0.356 CY Concrete per VLF, 48 lbs rebar per VLF.		
For >50' To 100' Deep, Add	60.02	
For >100' To 150' Deep, Add	188.34	
For >150' To 200' Deep, Add	235.12	
For Right Angle Drilling, Add	240.90	
31 64 13 00-0054 VLF 48" Diameter Caisson, Soft Rock Medium Shale, No Casing/Ground Water.....	907.56	
Note: 0.465 CY Concrete per VLF, 57 lbs rebar per VLF.		
For >50' To 100' Deep, Add	72.56	
For >100' To 150' Deep, Add	226.89	
For >150' To 200' Deep, Add	283.55	
For Right Angle Drilling, Add	289.43	
31 64 13 00-0055 VLF 54" Diameter Caisson, Soft Rock Medium Shale, No Casing/Ground Water.....	1,112.27	
Note: 0.589 CY Concrete per VLF, 76 lbs rebar per VLF.		
For >50' To 100' Deep, Add	89.62	
For >100' To 150' Deep, Add	278.07	
For >150' To 200' Deep, Add	348.38	
For Right Angle Drilling, Add	352.54	
31 64 13 00-0056 VLF 60" Diameter Caisson, Soft Rock Medium Shale, No Casing/Ground Water.....	1,316.00	
Note: 0.727 CY Concrete per VLF, 93 lbs rebar per VLF.		
For >50' To 100' Deep, Add	106.58	
For >100' To 150' Deep, Add	329.00	
For >150' To 200' Deep, Add	412.88	
For Right Angle Drilling, Add	415.41	
31 64 13 00-0057 VLF 66" Diameter Caisson, Soft Rock Medium Shale, No Casing/Ground Water.....	1,448.89	
Note: 0.88 CY Concrete per VLF, 113 lbs rebar per VLF.		
For >50' To 100' Deep, Add	118.92	
For >100' To 150' Deep, Add	362.22	
For >150' To 200' Deep, Add	456.54	
For Right Angle Drilling, Add	452.43	
31 64 13 00-0058 VLF 72" Diameter Caisson, Soft Rock Medium Shale, No Casing/Ground Water.....	1,588.34	
Note: 1.047 CY Concrete per VLF, 134 lbs rebar per VLF.		
For >50' To 100' Deep, Add	132.29	
For >100' To 150' Deep, Add	397.09	
For >150' To 200' Deep, Add	502.89	
For Right Angle Drilling, Add	489.96	
31 64 13 00-0059 VLF 78" Diameter Caisson, Soft Rock Medium Shale, No Casing/Ground Water.....	1,634.17	
Note: 1.229 CY Concrete per VLF, 157 lbs rebar per VLF.		
For >50' To 100' Deep, Add	139.17	
For >100' To 150' Deep, Add	408.54	
For >150' To 200' Deep, Add	521.22	
For Right Angle Drilling, Add	494.54	
31 64 13 00-0060 VLF 84" Diameter Caisson, Soft Rock Medium Shale, No Casing/Ground Water.....	1,949.53	
Note: 1.425 CY Concrete per VLF, 183 lbs rebar per VLF.		
For >50' To 100' Deep, Add	165.20	
For >100' To 150' Deep, Add	487.38	
For >150' To 200' Deep, Add	620.77	
For Right Angle Drilling, Add	592.55	
31 64 13 00-0061 For Bell Excavation And Concrete, Add <small>(31 64 13 00-0047)</small>		
31 64 13 00-0062 EA Bell Excavation And Concrete, 4' Bell Diameter Soft Rock/Shale 24" Shaft 0.44 CY	629.56	
For >50' To 100' Deep, Add	47.30	
For >100' To 150' Deep, Add	157.39	
For >150' To 200' Deep, Add	192.91	
31 64 13 00-0063 EA Bell Excavation And Concrete, 6' Bell Diameter Soft Rock/Shale 30" Shaft 1.57 CY	2,215.24	
For >50' To 100' Deep, Add	166.56	
For >100' To 150' Deep, Add	553.81	
For >150' To 200' Deep, Add	678.94	
31 64 13 00-0064 EA Bell Excavation And Concrete, 7' Bell Diameter Soft Rock/Shale 36" Shaft 2.33 CY	3,316.05	
For >50' To 100' Deep, Add	251.46	
For >100' To 150' Deep, Add	829.01	
For >150' To 200' Deep, Add	1,018.99	
31 64 13 00-0065 EA Bell Excavation And Concrete, 8' Bell Diameter Soft Rock/Shale 42" Shaft 3.3 CY	4,721.87	
For >50' To 100' Deep, Add	357.71	
For >100' To 150' Deep, Add	1,180.47	
For >150' To 200' Deep, Add	1,450.54	
31 64 13 00-0066 EA Bell Excavation And Concrete, 9' Bell Diameter Soft Rock/Shale 48" Shaft 4.48 CY	6,246.60	
For >50' To 100' Deep, Add	469.95	
For >100' To 150' Deep, Add	1,561.65	
For >150' To 200' Deep, Add	1,914.84	
31 64 13 00-0067 EA Bell Excavation And Concrete, 10' Bell Diameter Soft Rock/Shale 60" Shaft 5.24 CY	7,614.28	
For >50' To 100' Deep, Add	571.32	
For >100' To 150' Deep, Add	1,903.57	
For >150' To 200' Deep, Add	2,332.18	
31 64 13 00-0068 EA Bell Excavation And Concrete, 12' Bell Diameter Soft Rock/Shale 72" Shaft 8.74 CY	11,503.74	
For >50' To 100' Deep, Add	869.32	
For >100' To 150' Deep, Add	2,875.94	
For >150' To 200' Deep, Add	3,531.20	
31 64 13 00-0069 EA Bell Excavation And Concrete, 14' Bell Diameter Soft Rock/Shale 84" Shaft 13.6 CY	17,296.77	
For >50' To 100' Deep, Add	1,310.16	
For >100' To 150' Deep, Add	4,324.19	
For >150' To 200' Deep, Add	5,313.26	

31	31 Earthwork
	31 60 Special Foundations And Load-bearing Elements
	31 64 Caissons



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
31 64 13 00-0070 Caisson Setup And Removal <small>(31 64 13)</small> Note: Includes mobilization of equipment, erection, dismantling of equipment, move off of site.		
31 64 13 00-0071 EA Erect, Set Up, Dismantle And Remove Caisson 18" To 36" Diameter, Complete.....	2,689.96	
31 64 13 00-0072 EA Erect, Set Up, Dismantle And Remove Caisson 48" To 84" Diameter, Complete.....	3,769.41	
31 64 13 00-0073 EA Dismantle, Relocate, Erect And Set Up On Site At Different Location (During Same Phase Of Work), Caisson 18" To 36" Diameter.....	1,276.44	
31 64 13 00-0074 EA Dismantle, Relocate, Erect And Set Up On Site At Different Location (During Same Phase Of Work), Caisson 48" To 84" Diameter.....	1,701.91	
31 64 13 00-0075 EA Relocate Caisson Equipment To Different Hole On-Site Without Dismantling.....	106.37	
 31 66 Special Foundation <small>(31 66)</small>		
31 66 13 Special Piles <small>(31 66)</small>		
31 66 13 00-0001 Helical Pier Restoration (Atlas) <small>(31 66 13)</small>		
31 66 13 00-0002 EA Structural Steel Piers (Atlas Pier System Or Equal)..... Note: Includes heavy duty bracket, pier platform, and 14' of 3.5" diameter pier sections, non-corrosive coating, hydraulic lifting, fasteners, and other related activities and materials. Excludes excavation and core drilling	2,441.16	
31 66 13 00-0003 EA Pressure Injecting Grout For Slab Repairs, Per Location Note: Includes preparation, installing and removing grout injection pipes, and finishing. Excludes grout and core drilling.	290.02	
31 66 13 00-0004 CY Pressure injected non-shrink grout	290.02	

END OF SECTION 31



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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32 Exterior Improvements

32 01 Operation And Maintenance Of Exterior Improvements ⁽³²⁾

32 01 11 Paving Cleaning ^(32 01)

32 01 11 53 Paint Removal From Paving ^(32 01 11)

32 01 11 53-0001 Remove Pavement Markings ^(32 01 11 53)

Note: Includes vacuuming of removed striped area and containment of debris. Excludes disposal.

32 01 11 53-0002	LF Remove 4" Wide Painted Or Epoxy Pavement Striping.....	1.57
	For Up To 250, Add	0.79
	For >250 To 1,000, Add	0.39
	For >5,000 To 10,000, Deduct	-0.24
	For >10,000 To 25,000, Deduct	-0.39
	For >25,000 To 50,000, Deduct	-0.55
	For >50,000, Deduct	-0.63
32 01 11 53-0003	LF Remove 6" Wide Painted Or Epoxy Pavement Striping.....	1.89
	For Up To 250, Add	0.95
	For >250 To 1,000, Add	0.47
	For >5,000 To 10,000, Deduct	-0.28
	For >10,000 To 25,000, Deduct	-0.47
	For >25,000 To 50,000, Deduct	-0.66
	For >50,000, Deduct	-0.76
32 01 11 53-0004	LF Remove 8" Wide Painted Or Epoxy Pavement Striping.....	2.26
	For Up To 250, Add	1.13
	For >250 To 1,000, Add	0.57
	For >5,000 To 10,000, Deduct	-0.34
	For >10,000 To 25,000, Deduct	-0.57
	For >25,000 To 50,000, Deduct	-0.79
	For >50,000, Deduct	-0.90
32 01 11 53-0005	LF Remove 12" Wide Painted Or Epoxy Pavement Striping.....	2.71
	For Up To 250, Add	1.36
	For >250 To 1,000, Add	0.68
	For >5,000 To 10,000, Deduct	-0.41
	For >10,000 To 25,000, Deduct	-0.68
	For >25,000 To 50,000, Deduct	-0.95
	For >50,000, Deduct	-1.08
32 01 11 53-0006	SF Remove Painted Or Epoxy Pavement Marking, Letters Or Symbols.....	2.71
	For Up To 250, Add	1.36
	For >250 To 1,000, Add	0.68
	For >5,000 To 10,000, Deduct	-0.41
	For >10,000 To 25,000, Deduct	-0.68
	For >25,000 To 50,000, Deduct	-0.95
	For >50,000, Deduct	-1.08
32 01 11 53-0007	LF Remove 4" Wide Thermoplastic Pavement Striping.....	2.02
	For Up To 250, Add	1.01
	For >250 To 1,000, Add	0.51
	For >5,000 To 10,000, Deduct	-0.30
	For >10,000 To 25,000, Deduct	-0.51
	For >25,000 To 50,000, Deduct	-0.71
	For >50,000, Deduct	-0.81
32 01 11 53-0008	LF Remove 6" Wide Thermoplastic Pavement Striping.....	2.39
	For Up To 250, Add	1.20
	For >250 To 1,000, Add	0.60
	For >5,000 To 10,000, Deduct	-0.36
	For >10,000 To 25,000, Deduct	-0.60
	For >25,000 To 50,000, Deduct	-0.84
	For >50,000, Deduct	-0.96
32 01 11 53-0009	LF Remove 8" Wide Thermoplastic Pavement Striping.....	2.89
	For Up To 250, Add	1.45
	For >250 To 1,000, Add	0.72
	For >5,000 To 10,000, Deduct	-0.43
	For >10,000 To 25,000, Deduct	-0.72
	For >25,000 To 50,000, Deduct	-1.01
	For >50,000, Deduct	-1.16
32 01 11 53-0010	LF Remove 12" Wide Thermoplastic Pavement Striping.....	3.45
	For Up To 250, Add	1.73
	For >250 To 1,000, Add	0.86
	For >5,000 To 10,000, Deduct	-0.52
	For >10,000 To 25,000, Deduct	-0.86
	For >25,000 To 50,000, Deduct	-1.21
	For >50,000, Deduct	-1.38
32 01 11 53-0011	SF Remove Thermoplastic Pavement Marking, Letters Or Symbols.....	3.45
	For Up To 250, Add	1.73
	For >250 To 1,000, Add	0.86
	For >5,000 To 10,000, Deduct	-0.52
	For >10,000 To 25,000, Deduct	-0.86
	For >25,000 To 50,000, Deduct	-1.21
	For >50,000, Deduct	-1.38

32 01 16 Flexible Paving Rehabilitation ^(32 01)

32 Exterior Improvements**32 01 Operation And Maintenance Of Exterior Improvements****32 01 16 Flexible Paving Rehabilitation**MINOR
CSI UOM DESCRIPTIONTOTAL DIRECT DEMOLITION
UNIT COST UNIT COST**32 01 16 71 Cold Milling Asphalt Pavement** (32 01 16)**32 01 16 71-0001 Removal Of Asphalt Surface Course** (32 01 16 71)

Note: Includes direct loading into truck.

32 01 16 71-0002 Production Cold Milling Of Roads And Parking Areas (32 01 16 71-0001)

Note: For removal of entire lanes of roads or parking areas. Includes work around man holes, scuppers, drainage structures, catch basins, etc.

32 01 16 71-0003	SY	Production Cold Milling Of Asphalt Up To 3" Depth	3.17
		For Up To 2,500, Add	1.59
		For >2,500 To 5,000, Add	0.79
		For >10,000 To 25,000, Deduct	-0.32
		For >25,000, Deduct	-0.48
32 01 16 71-0004	SY	>3" To 6" Depth, Production Cold Milling Of Asphalt	4.22
		For Up To 2,500, Add	2.11
		For >2,500 To 5,000, Add	1.06
		For >10,000 To 25,000, Deduct	-0.42
		For >25,000, Deduct	-0.63
32 01 16 71-0005	SY	>6" To 12" Depth, Production Cold Milling Of Asphalt	5.62
		For Up To 2,500, Add	2.81
		For >2,500 To 5,000, Add	1.41
		For >10,000 To 25,000, Deduct	-0.56
		For >25,000, Deduct	-0.84
32 01 16 71-0006	SY	Production Cold Milling Of Concrete Per Inch	4.79

32 01 16 71-0007 Limited Production Cold Milling (32 01 16 71-0001)

Note: For cross sections of roadways, trenching, partial shoulders, and other small or narrow areas. Includes work around man holes, scuppers, drainage structures, catch basins, etc.

32 01 16 71-0008	SY	Limited Cold Milling Of Asphalt Up To 3" Depth	20.02
		For >100 To 1,000, Deduct	-10.01
		For >1,000, Deduct	-15.02
32 01 16 71-0009	SY	>3" To 6" Depth, Limited Cold Milling Of Asphalt	26.51
		For >100 To 1,000, Deduct	-13.26
		For >1,000, Deduct	-19.88
32 01 16 71-0010	SY	>6" To 12" Depth, Limited Cold Milling Of Asphalt	35.30
		For >100 To 1,000, Deduct	-17.65
		For >1,000, Deduct	-26.48
32 01 16 71-0011	SY	Limited Cold Milling Of Concrete Per Inch	30.09

32 01 16 71-0012 Grind, Leave In-Place Asphalt Grindings (32 01 16 71)

Note: For use as subbase material, includes spreading and rolling.

32 01 16 71-0013	SY	Grind, Leave In-Place As Subbase Course, 6-9" Depth	5.59
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32 01 16 72 Asphalt Paving Reuse (32 01 16)**32 01 16 72-0001 Rejuvenate, Respread Asphalt Pavement** (32 01 16 72)

Note: Includes direct loading into truck.

32 01 16 72-0002	SY	Remove, Rejuvenate, Respread Asphalt Grindings To 1/2" Deep	8.91
32 01 16 72-0003	SY	Remove, Rejuvenate, Respread Asphalt Grindings To 1/2" Deep, Previously Sealed Cold Tar	10.66
32 01 16 72-0004	TON	Remove, Rejuvenate, Respread Asphalt Grindings	138.09

32 01 16 72-0005 Reclamation, Pulverize And Blending With Existing (32 01 16 72)

Note: Includes direct loading into truck.

32 01 16 72-0006	SY	Up To 2" Thick Pavement, Up To 1,000 SY, Reclamation, Pulverizing And Blending With Existing Base; Aggregate Base	10.78
32 01 16 72-0007	SY	Up To 2" Thick Pavement, >1,000 To 5,000 SY, Reclamation, Pulverizing And Blending With Existing Base; Aggregate Base	5.39
32 01 16 72-0008	SY	Up To 2" Thick Pavement, >5,000 To 15,000 SY, Reclamation, Pulverizing And Blending With Existing Base; Aggregate Base	2.70
32 01 16 72-0009	SY	Up To 2" Thick Pavement, >15,000 SY, Reclamation, Pulverizing And Blending With Existing Base; Aggregate Base	2.56
32 01 16 72-0010	SY	>2" To 3" Thick Pavement, >5,000 To 15,000 SY, Reclamation, Pulverizing And Blending With Existing Base; Aggregate Base	2.94
32 01 16 72-0011	SY	>2" To 3" Thick Pavement, Up To 1,000 SY, Reclamation, Pulverizing And Blending With Existing Base; Aggregate Base	11.77
32 01 16 72-0012	SY	>2" To 3" Thick Pavement, >1,000 To 5,000 SY, Reclamation, Pulverizing And Blending With Existing Base; Aggregate Base	5.88
32 01 16 72-0013	SY	>2" To 3" Thick Pavement, >15,000 SY, Reclamation, Pulverizing And Blending With Existing Base; Aggregate Base	2.77
32 01 16 72-0014	SY	>3" To 4" Thick Pavement, Up To 1,000 SY, Reclamation, Pulverizing And Blending With Existing Base; Aggregate Base	12.95
32 01 16 72-0015	SY	>3" To 4" Thick Pavement, >1,000 To 5,000 SY, Reclamation, Pulverizing And Blending With Existing Base; Aggregate Base	6.47
32 01 16 72-0016	SY	>3" To 4" Thick Pavement, >5,000 To 15,000 SY, Reclamation, Pulverizing And Blending With Existing Base; Aggregate Base	3.24
32 01 16 72-0017	SY	>3" To 4" Thick Pavement, >15,000 SY, Reclamation, Pulverizing And Blending With Existing Base; Aggregate Base	2.99
32 01 16 72-0018	SY	>4" To 8" Thick Pavement, Up To 1,000 SY, Reclamation, Pulverizing And Blending With Existing Base; Aggregate Base	14.12
32 01 16 72-0019	SY	>4" To 8" Thick Pavement, >1,000 To 5,000 SY, Reclamation, Pulverizing And Blending With Existing Base; Aggregate Base	7.06



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 01 16 72-0020 SY >4" To 8" Thick Pavement, >5,000 To 15,000 SY, Reclamation, Pulverizing And Blending With Existing Base; Aggregate Base.....	3.53	
32 01 16 72-0021 SY >4" To 8" Thick Pavement, >15,000 SY, Reclamation, Pulverizing And Blending With Existing Base; Aggregate Base	3.29	
32 01 16 72-0022 EA Mobilization And Demobilization For Reclamation, Pulverizing And Blending Crew.....	1,213.36	

32 01 17 Flexible Paving Repair (32 01)

See CSI section 32 12 16 00-0000 for large area resurfacing.

32 01 17 61 Sealing Cracks In Asphalt Paving (32 01 17)

Note: Includes removing loose materials and cleaning.

32 01 17 61-0001 Asphalt Pavement Crack And Sealing Repair (32 01 17 61)

Note: Includes sweeping and cleaning of area.

32 01 17 61-0002 LF Up To 200 LF Fill Cracks Up To 1/2" x 1/2" With Hot Asphalt Crack Filler.....	1.13	
Note: Includes air cleaning of cracks. Excludes backer rod where required and routing of crack.		
For 3/4" x 1/2" Fill, Add	0.30	
For 1" x 1/2" Fill, Add	0.56	
For Backer Rod, Add	0.68	
32 01 17 61-0003 LF >200 To 500 LF Fill Cracks Up To 1/2" x 1/2" With Hot Asphalt Crack Filler.....	0.90	
Note: Includes air cleaning of cracks. Excludes backer rod where required and routing of crack.		
For 3/4" x 1/2" Fill, Add	0.24	
For 1" x 1/2" Fill, Add	0.46	
For Backer Rod, Add	0.62	
32 01 17 61-0004 LF >500 To 2,000 LF Fill Cracks Up To 1/2" x 1/2" With Hot Asphalt Crack Filler.....	0.72	
Note: Includes air cleaning of cracks. Excludes backer rod where required and routing of crack.		
For 3/4" x 1/2" Fill, Add	0.20	
For 1" x 1/2" Fill, Add	0.38	
For Backer Rod, Add	0.57	
32 01 17 61-0005 LF >2,000 To 5,000 LF Fill Cracks Up To 1/2" x 1/2" With Hot Asphalt Crack Filler	0.63	
Note: Includes air cleaning of cracks. Excludes backer rod where required and routing of crack.		
For 3/4" x 1/2" Fill, Add	0.18	
For 1" x 1/2" Fill, Add	0.33	
For Backer Rod, Add	0.54	
32 01 17 61-0006 LF >5,000 To 10,000 LF Fill Cracks Up To 1/2" x 1/2" With Hot Asphalt Crack Filler.....	0.55	
Note: Includes air cleaning of cracks. Excludes backer rod where required and routing of crack.		
For 3/4" x 1/2" Fill, Add	0.15	
For 1" x 1/2" Fill, Add	0.29	
For Backer Rod, Add	0.51	
32 01 17 61-0007 LF >10,000 LF Fill Cracks Up To 1/2" x 1/2" With Hot Asphalt Crack Filler.....	0.51	
Note: Includes air cleaning of cracks. Excludes backer rod where required and routing of crack.		
For 3/4" x 1/2" Fill, Add	0.14	
For 1" x 1/2" Fill, Add	0.27	
For Backer Rod, Add	0.50	
32 01 17 61-0008 LF Up To 200 LF Fill Cracks Up To 1/4" x 1/4" With Cold Pour Rubberized Asphalt Crack Filler.....	2.37	
For 3/8" x 1/4" Fill, Add	0.50	
For 1/2" x 1/4" Fill, Add	0.89	
For 1/2" x 1/2" Fill, Add	1.99	
32 01 17 61-0009 LF >200 To 500 LF Fill Cracks Up To 1/4" x 1/4" With Cold Pour Rubberized Asphalt Crack Filler	1.90	
For 3/8" x 1/4" Fill, Add	0.40	
For 1/2" x 1/4" Fill, Add	0.73	
For 1/2" x 1/2" Fill, Add	1.64	
32 01 17 61-0010 LF >500 To 2,000 LF Fill Cracks Up To 1/4" x 1/4" With Cold Pour Rubberized Asphalt Crack Filler	1.46	
For 3/8" x 1/4" Fill, Add	0.32	
For 1/2" x 1/4" Fill, Add	0.58	
For 1/2" x 1/2" Fill, Add	1.31	
32 01 17 61-0011 LF >2,000 To 5,000 LF Fill Cracks Up To 1/4" x 1/4" With Cold Pour Rubberized Asphalt Crack Filler.....	1.28	
For 3/8" x 1/4" Fill, Add	0.28	
For 1/2" x 1/4" Fill, Add	0.51	
For 1/2" x 1/2" Fill, Add	1.16	
32 01 17 61-0012 LF >5,000 To 10,000 LF Fill Cracks Up To 1/4" x 1/4" With Cold Pour Rubberized Asphalt Crack Filler.....	1.16	
For 3/8" x 1/4" Fill, Add	0.25	
For 1/2" x 1/4" Fill, Add	0.46	
For 1/2" x 1/2" Fill, Add	1.04	
32 01 17 61-0013 LF >10,000 LF Fill Cracks Up To 1/4" x 1/4" With Cold Pour Rubberized Asphalt Crack Filler.....	1.08	
For 3/8" x 1/4" Fill, Add	0.23	
For 1/2" x 1/4" Fill, Add	0.42	
For 1/2" x 1/2" Fill, Add	0.95	
32 01 17 61-0014 LF For Routing And Cleaning Of Crack, Add Per 1/2" Depth.....	0.42	
32 01 17 61-0015 LF Crack Fill Backer Material, Up To 1" Diameter, As Required.....	1.30	

32 01 17 63 Pavement Repair (32 01 17)

32 01 17 63-0001 Temporary Pot Hole Repair (32 01 17 63)

Note: Includes removal of loose material and moisture, bonding agent, compaction, safety cones and hauling up to 15 miles. Excludes signage, barricades, flagmen, field survey or marking. See CSI section 01 74 19 00-0034 for hauling greater than 15 miles.

32 01 17 63-0002 EA Temporary Pot Hole Repairs With Cold Mix Modified, Up To 3 Tons	1,365.78
32 01 17 63-0003 TON Temporary Pot Hole Repairs With Cold Mix Modified.....	414.60
Note: Use for each ton over 3 tons.	
32 01 17 63-0004 EA Temporary Pot Hole Repairs With Cold Mix, Up To 3 Tons.....	1,299.54
32 01 17 63-0005 TON Temporary Pot Hole Repairs With Cold Mix	392.52
Note: Use for each ton over 3 tons.	
32 01 17 63-0006 EA Temporary Pot Hole Repairs With Hot Mix Modified, Up To 3 Tons	1,266.42

32 Exterior Improvements**32 01 Operation And Maintenance Of Exterior Improvements****32 01 17 Flexible Paving Repair**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 01 17 63-0007 TON Temporary Pot Hole Repairs With Hot Mix Modified.....	381.48	
Note: Use for each ton over 3 tons.		
32 01 17 63-0008 EA Temporary Pot Hole Repairs With Hot Mix, Up To 3 Tons.....	1,233.30	
32 01 17 63-0009 TON Temporary Pot Hole Repairs With Hot Mix.....	370.44	
Note: Use for each ton over 3 tons.		
32 01 17 63-0010 Permanent Pot Hole Repair (32 01 17 63)		
Note: Includes removal of loose material and moisture, saw cutting, chipping, squaring off, bonding agent, compaction and hauling up to 15 miles Tasks do not include signage, barricades, flagmen, field survey or marking. See CSI section 01 74 19 00-0034 for hauling greater than 15 miles.		
32 01 17 63-0011 EA Permanent Pot Hole Repairs With Cold Mix, Up To 3 Tons.....	1,396.37	
32 01 17 63-0012 TON Permanent Pot Hole Repairs With Cold Mix.....	454.36	
Note: Use for each ton over 3 tons.		
32 01 17 63-0013 EA Permanent Pot Hole Repairs With Hot Mix Modified, Up To 3 Tons.....	1,363.25	
32 01 17 63-0014 TON Permanent Pot Hole Repairs With Hot Mix Modified.....	443.32	
Note: Use for each ton over 3 tons.		
32 01 17 63-0015 EA Permanent Pot Hole Repairs With Hot Mix, Up To 3 Tons.....	1,330.13	
32 01 17 63-0016 TON Permanent Pot Hole Repairs With Hot Mix.....	432.28	
Note: Use for each ton over 3 tons.		
32 01 17 63-0017 Asphalt Placement For Small Repairs (32 01 17 63)		
Note: This section is used for placing up to 100 tons of asphalt after a small area of existing asphalt is removed to allow work such as trenching across or in a road, excavating a drainage structure, uncovering a utility line, etc. Includes mobilization of paving equipment such as a roller, placing the asphalt, and compaction. Excludes saw cutting, demolition of existing pavement, and new subbase material. Use approximately 0.055 tons per square yard per inch of depth. See CSI section 02 41 19 13-0049 for saw cutting, 32 12 16 13-0000 for areas requiring more than 100 tons.		
32 01 17 63-0018 EA Asphalt Placement For Small Repair Areas, Cold Mix Modified, Up To 3 Tons.....	1,847.06	
Note: For small areas of existing asphalt is removed to allow work such as trenching across or in a road, excavating a drainage structure, uncovering a utility line, etc.		
32 01 17 63-0019 TON Asphalt Placement For Small Repair Areas, Cold Mix Modified.....	249.75	
Note: For each ton over 3 to 100 tons. For small areas of existing asphalt is removed to allow work such as trenching across or in a road, excavating a drainage structure, uncovering a utility line, etc.		
32 01 17 63-0020 EA Asphalt Placement For Small Repair Areas, Cold Mix, Up To 3 Tons.....	1,780.82	
Note: For small areas of existing asphalt is removed to allow work such as trenching across or in a road, excavating a drainage structure, uncovering a utility line, etc.		
32 01 17 63-0021 TON Asphalt Placement For Small Repair Areas, Cold Mix.....	227.67	
Note: For each ton over 3 to 100 tons. For small areas of existing asphalt is removed to allow work such as trenching across or in a road, excavating a drainage structure, uncovering a utility line, etc.		
32 01 17 63-0022 EA Asphalt Placement For Small Repair Areas, Hot Mix Modified, Up To 3 Tons.....	1,747.70	
Note: For small areas of existing asphalt is removed to allow work such as trenching across or in a road, excavating a drainage structure, uncovering a utility line, etc.		
32 01 17 63-0023 TON Asphalt Placement For Small Repair Areas, Hot Mix Modified.....	216.63	
Note: For each ton over 3 to 100 tons. For small areas of existing asphalt is removed to allow work such as trenching across or in a road, excavating a drainage structure, uncovering a utility line, etc.		
32 01 17 63-0024 EA Asphalt Placement For Small Repair Areas, Hot Mix, Up To 3 Tons.....	1,714.58	
Note: For small areas of existing asphalt is removed to allow work such as trenching across or in a road, excavating a drainage structure, uncovering a utility line, etc.		
32 01 17 63-0025 TON Asphalt Placement For Small Repair Areas, Hot Mix.....	205.59	
Note: For each ton over 3 to 100 tons. For small areas of existing asphalt is removed to allow work such as trenching across or in a road, excavating a drainage structure, uncovering a utility line, etc.		
32 01 17 63-0026 Grind Asphalt (32 01 17 63)		
32 01 17 63-0027 SY Grinding Asphalt To Level Bump Or Raised Area.....	18.19	
32 01 26 Rigid Paving Rehabilitation (32 01)		
32 01 26 71 Grooving Of Concrete Paving (32 01 26)		
32 01 26 71-0001 Roadway Grooving (32 01 26 71)		
32 01 26 71-0002 SY Pavement Grooving, Concrete, Longitudinal.....	0.91	
32 01 26 71-0003 SY Pavement Grooving, Concrete, Transverse.....	0.68	
32 01 26 71-0004 Rumble Strips (32 01 26 71)		
32 01 26 71-0005 LF Safe-Strips Shoulder Rumble Strips, Asphalt.....	0.30	
32 01 26 71-0006 LF Safe-Strips Shoulder Rumble Strips, Concrete.....	0.71	
32 01 26 71-0007 Boat Ramps Grooving (32 01 26 71)		
32 01 26 71-0008 SY Concrete Grooving, Boat Ramps.....	1.46	
32 01 90 Operation And Maintenance Of Planting (32 01)		
Note: These tasks are to be used as requested by the owner to maintain existing conditions.		
32 01 90 13 Fertilizing (32 01 90)		
32 01 90 13-0001 MSF Fertilizer - 2 LB Of Nitrogen/MSF (Granular).....	12.50	
32 01 90 13-0002 MSF Fertilizer - 2 LB Of Nitrogen/MSF (Liquid).....	9.10	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 01 90 13-0003 MSF Fertilizer - 0.5 LB Of Nitrogen/MSF (Granular)	9.97	
32 01 90 13-0004 MSF Fertilizer - 0.5 LB Of Nitrogen/MSF (Liquid)	8.17	
32 01 90 19 Mowing <small>(32 01 90)</small>		
32 01 90 19-0001 ACR Grass Cutting By Bush Hog	140.95	
Note: Includes normal debris removal, cutting, and trimming. For <1 Acre, Add	35.24	
32 01 90 23 Pruning <small>(32 01 90)</small>		
32 01 90 23-0001 Tree Pruning <small>(32 01 90 23)</small>		
<p>Note: Types of pruning for mature trees (these standards are established by the ISA - International Society of Arboriculture) 1. CROWN CLEANING - Crown cleaning or cleaning out is the removal of dead, dying, diseased, crowded, weakly attached, and low-vigor branches and waterspouts from a tree crown. 2. CROWN THINNING - Crown thinning includes crown cleaning and the selective removal of branches to increase light penetration and air movement into the crown. Increased light and air stimulates and maintains interior foliage, which in turn improves branch taper and strength. Thinning reduces the wind-sail effect of the crown and the weight of the heavy limbs. Thinning the crown can emphasize the structural beauty of the trunk and branches as well as improve the growth of plants beneath the tree by increasing light penetration. When thinning the crown of mature trees, seldom should more than one-third of the live foliage be removed. At least one-half of the foliage should be on branches that arise in the lower two-thirds of the trees. Likewise, when thinning laterals from a limb, an effort should be made to retain inner lateral branches and leave the same distribution of foliage along the branch. Trees and branches so pruned will have stress more evenly distributed throughout the tree or along a branch. 3. CROWN RAISING - Crown raising removes the lower branches of a tree in order to provide clearance for buildings, vehicles, pedestrians, and vistas. It is important that a tree have at least one-half of its foliage on branches that originate in the lower two-thirds of its trunk to ensure a well-formed, tapered structure and to uniformly distribute stress within a tree. When pruning for view, it is preferable to develop "windows" through the foliage of the tree, rather than to severely raise or reduce the crown. 4. CROWN REDUCTION - Crown reduction is used to reduce the height and/or spread of a tree. Thinning cuts are most effective in maintaining the structural integrity and natural form of a tree and in delaying the time when it will need to be pruned again. The lateral to which a branch or trunk is cut should be at least one-half the diameter of the cut being made. 5. CROWN RESTORATION - Crown restoration can improve the structure and appearance of trees that have been topped or severely pruned using heading cuts. One to three sprouts on main branch stubs should be selected to reform a more natural appearing crown. Selected vigorous sprouts may need to be thinned to a lateral, or even headed, to control length growth in order to ensure adequate attachment for the size of the sprout. Restoration may require several pruning's over a number of years.</p>		
32 01 90 23-0002 EA Tree Pruning (Crown Cleaning), 1-1/2" Caliper	26.06	
For Crown Thinning, Tree Pruning, Add	5.86	
For Crown Raising, Pruning, Add	9.12	
For Crown Reduction, Tree Pruning, Add	11.73	
For Crown Restoration, Pruning, Add	17.37	
32 01 90 23-0003 EA Tree Pruning (Crown Cleaning), 2" Caliper	29.78	
For Crown Thinning, Tree Pruning, Add	6.70	
For Crown Raising, Pruning, Add	10.42	
For Crown Reduction, Tree Pruning, Add	13.40	
For Crown Restoration, Pruning, Add	19.85	
32 01 90 23-0004 EA Tree Pruning (Crown Cleaning), 2-1/2" Caliper	33.50	
For Crown Thinning, Tree Pruning, Add	7.54	
For Crown Raising, Pruning, Add	11.73	
For Crown Reduction, Tree Pruning, Add	15.08	
For Crown Restoration, Pruning, Add	22.33	
32 01 90 23-0005 EA Tree Pruning (Crown Cleaning), 3" Caliper	37.23	
For Crown Thinning, Tree Pruning, Add	8.38	
For Crown Raising, Pruning, Add	13.03	
For Crown Reduction, Tree Pruning, Add	16.75	
For Crown Restoration, Pruning, Add	24.82	
32 01 90 23-0006 EA Tree Pruning (Crown Cleaning), 4" Caliper, By Hand	56.58	
For Crown Thinning, Tree Pruning, Add	12.73	
For Crown Raising, Pruning, Add	19.80	
For Crown Reduction, Tree Pruning, Add	25.46	
For Crown Restoration, Pruning, Add	37.72	
32 01 90 23-0007 EA Tree Pruning (Crown Cleaning), 4" Caliper, Aerial Lift Equipment	90.49	
For Crown Thinning, Tree Pruning, Add	20.36	
For Crown Raising, Pruning, Add	31.67	
For Crown Reduction, Tree Pruning, Add	40.72	
For Crown Restoration, Pruning, Add	60.33	
32 01 90 23-0008 EA Tree Pruning (Crown Cleaning), 6" Caliper, By Hand	99.02	
For Crown Thinning, Tree Pruning, Add	22.28	
For Crown Raising, Pruning, Add	34.66	
For Crown Reduction, Tree Pruning, Add	44.56	
For Crown Restoration, Pruning, Add	66.02	
32 01 90 23-0009 EA Tree Pruning (Crown Cleaning), 6" Caliper, Aerial Lift Equipment	172.36	
For Crown Thinning, Tree Pruning, Add	38.78	
For Crown Raising, Pruning, Add	60.33	
For Crown Reduction, Tree Pruning, Add	77.56	
For Crown Restoration, Pruning, Add	114.91	
32 01 90 23-0010 EA Tree Pruning (Crown Cleaning), 9" Caliper, By Hand	158.55	
For Crown Thinning, Tree Pruning, Add	35.67	
For Crown Raising, Pruning, Add	55.49	
For Crown Reduction, Tree Pruning, Add	71.35	
For Crown Restoration, Pruning, Add	105.71	

32 Exterior Improvements**32 01 Operation And Maintenance Of Exterior Improvements****32 01 90 Operation And Maintenance Of Planting**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 01 90 23-0011 EA Tree Pruning (Crown Cleaning), 9" Caliper, Aerial Lift Equipment.....	275.71	
For Crown Thinning, Tree Pruning, Add	62.03	
For Crown Raising, Pruning, Add	96.50	
For Crown Reduction, Tree Pruning, Add	124.07	
For Crown Restoration, Pruning, Add	183.82	
32 01 90 23-0012 EA Tree Pruning (Crown Cleaning), 12" Caliper, By Hand.....	183.21	
For Crown Thinning, Tree Pruning, Add	41.22	
For Crown Raising, Pruning, Add	64.12	
For Crown Reduction, Tree Pruning, Add	82.44	
For Crown Restoration, Pruning, Add	122.15	
32 01 90 23-0013 EA Tree Pruning (Crown Cleaning), 12" Caliper, Aerial Lift Equipment.....	318.84	
For Crown Thinning, Tree Pruning, Add	71.74	
For Crown Raising, Pruning, Add	111.59	
For Crown Reduction, Tree Pruning, Add	143.48	
For Crown Restoration, Pruning, Add	212.57	
32 01 90 23-0014 EA Tree Pruning (Crown Cleaning), 18" Caliper By Hand.....	212.98	
For Crown Thinning, Tree Pruning, Add	47.92	
For Crown Raising, Pruning, Add	74.54	
For Crown Reduction, Tree Pruning, Add	95.84	
For Crown Restoration, Pruning, Add	141.99	
32 01 90 23-0015 EA Tree Pruning (Crown Cleaning), 18" Caliper By Hand, Aerial Lift Equipment.....	370.54	
For Crown Thinning, Tree Pruning, Add	83.37	
For Crown Raising, Pruning, Add	129.69	
For Crown Reduction, Tree Pruning, Add	166.74	
For Crown Restoration, Pruning, Add	247.04	
32 01 90 23-0016 EA Tree Pruning (Crown Cleaning), 24" Caliper, By Hand.....	259.25	
For Crown Thinning, Tree Pruning, Add	58.33	
For Crown Raising, Pruning, Add	90.74	
For Crown Reduction, Tree Pruning, Add	116.66	
For Crown Restoration, Pruning, Add	172.84	
32 01 90 23-0017 EA Tree Pruning (Crown Cleaning), 24" Caliper, Aerial Lift Equipment.....	448.17	
For Crown Thinning, Tree Pruning, Add	100.84	
For Crown Raising, Pruning, Add	156.86	
For Crown Reduction, Tree Pruning, Add	201.68	
For Crown Restoration, Pruning, Add	298.79	
32 01 90 23-0018 EA Tree Pruning (Crown Cleaning), 30" Caliper, By Hand.....	322.05	
For Crown Thinning, Tree Pruning, Add	72.46	
For Crown Raising, Pruning, Add	112.72	
For Crown Reduction, Tree Pruning, Add	144.92	
For Crown Restoration, Pruning, Add	214.71	
32 01 90 23-0019 EA Tree Pruning (Crown Cleaning), 30" Caliper, Aerial Lift Equipment.....	564.83	
For Crown Thinning, Tree Pruning, Add	127.09	
For Crown Raising, Pruning, Add	197.69	
For Crown Reduction, Tree Pruning, Add	254.17	
For Crown Restoration, Pruning, Add	376.57	
32 01 90 23-0020 EA Tree Pruning (Crown Cleaning), 36" Caliper, By Hand.....	441.10	
For Crown Thinning, Tree Pruning, Add	99.25	
For Crown Raising, Pruning, Add	154.39	
For Crown Reduction, Tree Pruning, Add	198.50	
For Crown Restoration, Pruning, Add	294.08	
32 01 90 23-0021 EA Tree Pruning (Crown Cleaning), 36" Caliper, Aerial Lift Equipment.....	765.54	
For Crown Thinning, Tree Pruning, Add	172.25	
For Crown Raising, Pruning, Add	267.94	
For Crown Reduction, Tree Pruning, Add	344.49	
For Crown Restoration, Pruning, Add	510.39	
32 01 90 23-0022 EA Tree Pruning (Crown Cleaning), 48" Caliper, By Hand.....	699.79	
For Crown Thinning, Tree Pruning, Add	157.45	
For Crown Raising, Pruning, Add	244.93	
For Crown Reduction, Tree Pruning, Add	314.91	
For Crown Restoration, Pruning, Add	466.55	
32 01 90 23-0023 EA Tree Pruning (Crown Cleaning), 48" Caliper, Aerial Lift Equipment.....	1,231.11	
For Crown Thinning, Tree Pruning, Add	277.00	
For Crown Raising, Pruning, Add	430.89	
For Crown Reduction, Tree Pruning, Add	554.00	
For Crown Restoration, Pruning, Add	820.78	
32 01 90 23-0024 EA Trim Mexican Palm Tree.....	78.94	
32 01 90 23-0025 EA Trim Date Palm Tree.....	178.13	
32 01 90 23-0026 LF Skin Palm Tree.....	20.25	
32 01 90 23-0027 Shrub Pruning <small>(32 01 90 23)</small>		
32 01 90 23-0028 MSF Shrub Pruning, Prune, Shrub Bed.....	84.84	
32 01 90 23-0029 EA Shrub Pruning, Prune, Shrub Under 3' Height.....	2.97	
32 01 90 23-0030 EA Shrub Pruning, Prune, Shrub 4' Height.....	6.70	
32 01 90 23-0031 EA Shrub Pruning, Prune, Shrub Over 6'.....	11.92	
32 01 90 23-0032 EA Shrub Pruning, Prune Trees From Ground.....	29.78	
32 01 90 23-0033 EA Shrub Pruning, Prune Trees From Ground, High Work.....	74.46	
32 01 90 23-0034 Root Pruning <small>(32 01 90 23)</small>		
Note: Cut roots cleanly after excavation with clean, sharp tools, to promote callus formation and wound closure. Wounds to be dressed with a tree rooting hormone compound. Mix soil improvements (e.g., peat moss) with fill soil to promote new root growth. Backfill the excavation and water the soil around the roots to avoid leaving air pockets.		
32 01 90 23-0035 EA Root Pruning, One Side Of Up To 1-1/2" Caliper Tree.....	14.89	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 01 90 23-0036 EA Root Pruning, One Side Of 2" Caliper Tree	18.61	
32 01 90 23-0037 EA Root Pruning, One Side Of 2-1/2" Caliper Tree	22.34	
32 01 90 23-0038 EA Root Pruning, One Side Of 3" Caliper Tree	29.78	
32 01 90 23-0039 EA Root Pruning, One Side Of 4" Caliper Tree	44.67	
32 01 90 23-0040 EA Root Pruning, One Side Of 6" Caliper Tree	55.85	
32 01 90 23-0041 EA Root Pruning, One Side Of 9" Caliper Tree	78.18	
32 01 90 23-0042 EA Root Pruning, One Side Of 12" Caliper Tree	89.35	
32 01 90 23-0043 EA Root Pruning, One Side Of 18" Caliper Tree	104.24	
32 01 90 23-0044 EA Root Pruning, One Side Of 24" Caliper Tree	130.30	
32 01 90 23-0045 EA Root Pruning, One Side Of 30" Caliper Tree	160.08	
32 01 90 23-0046 EA Root Pruning, One Side Of 36" Caliper Tree	186.15	
32 01 90 23-0047 EA Root Pruning, One Side Of 48" Caliper Tree	223.37	
32 01 90 26 Watering <small>(32 01 90)</small>		
Note: Includes delivered water. Not to be used as basis if watering with irrigation system or on-site owner provided water from hose or hydrant.		
32 01 90 26-0001 Watering Lawns, Plants And Trees <small>(32 01 90 26)</small>		
Note: Includes delivered water and watering truck. Not to be used as basis if watering with irrigation system or on-site owner provided water from hose or hydrant. These tasks are to be used as requested by the owner for extended watering period for lawns, plants and trees.		
32 01 90 26-0002 MSF Watering Sod/Grass, Per Inch Of Water	28.01	
32 01 90 26-0003 CSF Watering Groundcover.....	4.54	
32 01 90 26-0004 CSF Watering Annuals And Perennials	8.35	
32 01 90 26-0005 EA Watering Trees, 1" To 5" Diameter By Hand	8.43	
32 01 90 26-0006 EA Watering Trees, 6" To 12" Diameter By Hand	11.25	
32 01 90 26-0007 EA Watering Trees, 13" To 18" Diameter By Hand	14.23	
32 01 90 26-0008 EA Watering Trees, >18" Diameter By Hand.....	16.87	
32 01 90 26-0009 EA Watering Shrub Or Bush By Hand.....	7.37	
32 01 90 36 Weed And Brush Control <small>(32 01 90)</small>		
32 01 90 36-0001 Herbicide, Push Or Hand Spreader Applied <small>(32 01 90 36)</small>		
32 01 90 36-0002 MSF Non-Selective Post Emergent Weed Herbicide (70.4 oz/acre or 1.62 oz/MSF).....	6.63	
<i>For >45 To 90, Deduct</i>	-0.35	
<i>For >90 To 225, Deduct</i>	-1.01	
<i>For >225 To 870, Deduct</i>	-1.68	
<i>For >870, Deduct</i>	-2.03	
32 01 90 36-0003 MSF Non-Selective Post Emergent Woody Brush And Tree Herbicide (128 oz/acre or 2.94 oz/MSF)	6.96	
<i>For >45 To 90, Deduct</i>	-0.38	
<i>For >90 To 225, Deduct</i>	-1.08	
<i>For >225 To 870, Deduct</i>	-1.78	
<i>For >870, Deduct</i>	-2.16	
32 01 90 36-0004 MSF Selective Weed Herbicide (56 oz/Acre or 1.28 oz/MSF).....	6.94	
Note: Includes pre and post emergent.		
<i>For >45 To 90, Deduct</i>	-0.38	
<i>For >90 To 225, Deduct</i>	-1.08	
<i>For >225 To 870, Deduct</i>	-1.77	
<i>For >870, Deduct</i>	-2.15	
32 01 90 36-0005 MSF Selective Woody Brush And Tree Herbicide (72 oz/acre or 1.65 oz/MSF)	7.15	
Note: Includes pre and post emergents.		
<i>For >45 To 90, Deduct</i>	-0.40	
<i>For >90 To 225, Deduct</i>	-1.12	
<i>For >225 To 870, Deduct</i>	-1.83	
<i>For >870, Deduct</i>	-2.24	
32 01 90 39 Pesticides <small>(32 01 90)</small>		
32 01 90 39-0001 MSF Pesticide - Surface Eating.....	9.48	
32 01 90 39-0002 MSF Pesticide - Subsurface Eating.....	9.52	
32 01 90 39-0003 MSF Pesticide - Fungicide Application.....	10.29	
32 01 90 43 Weed And Cultivate Beds <small>(32 01 90)</small>		
32 01 90 43-0001 MSF Weed Mulched Bed	36.53	
32 01 90 43-0002 MSF Weed Unmulched Bed.....	104.37	
32 01 90 43-0003 MSF Cultivate Bed	56.20	
32 01 90 46 Hedge Trimming <small>(32 01 90)</small>		
32 01 90 46-0001 LF Trim 0-5' High Hedge, 0-3' Wide.....	4.81	
32 01 90 46-0002 LF Trim 0-5' High Hedge, 4-6' Wide.....	7.22	
32 01 90 46-0003 LF Trim 5-10' High Hedge, 0-3' Wide.....	10.93	
32 01 90 46-0004 LF Trim 5-10' High Hedge, 4-6' Wide.....	11.14	
32 01 90 53 Plant Growth Regulator Application <small>(32 01 90)</small>		
32 01 90 53-0001 EA Plant Growth Regulator Application	5.36	

32 Exterior Improvements**32 10 Bases, Ballasts, And Paving****32 01 90 Operation And Maintenance Of Planting**MINOR
CSI UOM DESCRIPTIONTOTAL DIRECT DEMOLITION
UNIT COST UNIT COST**32 10 Bases, Ballasts, And Paving** ⁽³²⁾**32 11 Base Courses** ^(32 10)**32 11 16 Subbase Courses** ^(32 11)**32 11 16 16 Aggregate Subbase Courses** ^(32 11 16)**32 11 16 16-0001 Base And Subbase Courses For Roadways And Parking Areas** ^(32 11 16 16)

Note: Includes 3/4" To 1-1/2" aggregate material, hauling up to 15 miles, dumping, spreading, grading, compacting and watering. See CSI section 01 74 19 00-0034 for hauling greater than 15 miles.

32 11 16 16-0002 Base And Subbase Courses By The CY ^(32 11 16 16-0001)

32 11 16 16-0003	CY	Graded Crushed Aggregate Roadway Base Course	75.92
		<i>For Limestone, Deduct</i>	-6.70
32 11 16 16-0004	CY	Class II Base Course	60.76
32 11 16 16-0005	CY	Class III Base Course	61.67

32 11 23 Aggregate Base Courses ^(32 11)**32 11 23 16 Aggregate Base Courses** ^(32 11 23)**32 11 23 16-0001 Base Courses For Sidewalk (Asphalt Or Concrete)** ^(32 11 23 16)

Note: Includes material, hauling up to 15 miles, placement, spreading, grading, and compaction. See CSI section 01 74 19 00-0034 for hauling greater than 15 miles.

32 11 23 16-0002	SF	2" Crushed Aggregate Base Course	0.62
		<i>For Up To 1,000, Add</i>	0.17
		<i>For >1,000 To 2,500, Add</i>	0.06
32 11 23 16-0003	SF	3" Crushed Aggregate Base Course	0.86
		<i>For Up To 1,000, Add</i>	0.23
		<i>For >1,000 To 2,500, Add</i>	0.09
32 11 23 16-0004	SF	4" Crushed Aggregate Base Course	1.09
		<i>For Up To 1,000, Add</i>	0.30
		<i>For >1,000 To 2,500, Add</i>	0.11
32 11 23 16-0005	SF	5" Crushed Aggregate Base Course	1.44
		<i>For Up To 1,000, Add</i>	0.39
		<i>For >1,000 To 2,500, Add</i>	0.14
32 11 23 16-0006	SF	6" Crushed Aggregate Base Course	1.77
		<i>For Up To 1,000, Add</i>	0.48
		<i>For >1,000 To 2,500, Add</i>	0.18
32 11 23 16-0007	SF	7" Crushed Aggregate Base Course	2.04
		<i>For Up To 1,000, Add</i>	0.55
		<i>For >1,000 To 2,500, Add</i>	0.20
32 11 23 16-0008	SF	8" Crushed Aggregate Base Course	2.31
		<i>For Up To 1,000, Add</i>	0.63
		<i>For >1,000 To 2,500, Add</i>	0.23

32 11 26 Asphaltic Base Courses ^(32 11)**32 11 26 19 Bituminous-Stabilized Base Courses** ^(32 11 26)**32 11 26 19-0001 Bituminous-Stabilized Base Courses** ^(32 11 26 19)

32 11 26 19-0002	CY	Bituminous Stabilized Base Course	129.01
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Note: 3/4" ASTM C33.

32 12 Flexible Paving ^(32 10)**32 12 13 Preparatory Coats** ^(32 12)**32 12 13 13 Tack Coats** ^(32 12 13)

32 12 13 13-0001	SY	Tack Coat, 0.04 Gallon/SY	0.40
		<i>For Up To 150, Add</i>	0.07
		<i>For >150 To 300, Add</i>	0.04
		<i>For >300 To 500, Add</i>	0.02
		<i>For >3,500 To 5,000, Deduct</i>	-0.01
		<i>For >5,000, Deduct</i>	-0.02
32 12 13 13-0002	SY	Tack Coat, 0.05 Gallon/SY	0.44
		<i>For Up To 150, Add</i>	0.08
		<i>For >150 To 300, Add</i>	0.04
		<i>For >300 To 500, Add</i>	0.02
		<i>For >3,500 To 5,000, Deduct</i>	-0.01
		<i>For >5,000, Deduct</i>	-0.03
32 12 13 13-0003	SY	Tack Coat, 0.07 Gallon/SY	0.50
		<i>For Up To 150, Add</i>	0.10
		<i>For >150 To 300, Add</i>	0.05
		<i>For >300 To 500, Add</i>	0.03
		<i>For >3,500 To 5,000, Deduct</i>	-0.01
		<i>For >5,000, Deduct</i>	-0.03



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 12 13 13-0004 SY Tack Coat, 0.08 Gallon/SY	0.54	
<i>For Up To 150, Add</i>	0.11	
<i>For >150 To 300, Add</i>	0.05	
<i>For >300 To 500, Add</i>	0.03	
<i>For >3,500 To 5,000, Deduct</i>	-0.01	
<i>For >5,000, Deduct</i>	-0.03	
32 12 13 13-0005 SY Tack Coat, 0.10 Gallon/SY	0.60	
<i>For Up To 150, Add</i>	0.12	
<i>For >150 To 300, Add</i>	0.06	
<i>For >300 To 500, Add</i>	0.03	
<i>For >3,500 To 5,000, Deduct</i>	-0.02	
<i>For >5,000, Deduct</i>	-0.04	
32 12 13 13-0006 SY Tack Coat, 0.11 Gallon/SY	0.64	
<i>For Up To 150, Add</i>	0.13	
<i>For >150 To 300, Add</i>	0.06	
<i>For >300 To 500, Add</i>	0.03	
<i>For >3,500 To 5,000, Deduct</i>	-0.02	
<i>For >5,000, Deduct</i>	-0.04	
32 12 13 19 Prime Coats <small>(32 12 13)</small>		
32 12 13 19-0001 SY Surface Prime Coat, 0.26 Gallon/SY	1.01	
<i>For Up To 150, Add</i>	0.22	
<i>For >150 To 300, Add</i>	0.10	
<i>For >300 To 500, Add</i>	0.05	
<i>For >3,500 To 5,000, Deduct</i>	-0.03	
<i>For >5,000, Deduct</i>	-0.07	
32 12 13 19-0002 SY Surface Prime Coat, 0.28 Gallon/SY	1.07	
<i>For Up To 150, Add</i>	0.24	
<i>For >150 To 300, Add</i>	0.11	
<i>For >300 To 500, Add</i>	0.05	
<i>For >3,500 To 5,000, Deduct</i>	-0.03	
<i>For >5,000, Deduct</i>	-0.07	
32 12 13 19-0003 SY Surface Prime Coat, 0.30 Gallon/SY	1.12	
<i>For Up To 150, Add</i>	0.25	
<i>For >150 To 300, Add</i>	0.11	
<i>For >300 To 500, Add</i>	0.06	
<i>For >3,500 To 5,000, Deduct</i>	-0.03	
<i>For >5,000, Deduct</i>	-0.08	
32 12 16 Asphalt Paving <small>(32 12)</small>		
32 12 16 13 Plant-Mix Asphalt Paving <small>(32 12 16)</small>		
Note: Includes delivery up to 15 miles, placement, rolling, finishing and sweeping. See CSI section 01 74 19 00-0034 for hauling greater than 15 miles.		
32 12 16 13-0001 Intermediate Binder Courses, Hot Mix Asphalt (HMA) <small>(32 12 16 13)</small>		
Note: Meets Caltran requirements.		
32 12 16 13-0002 TON Bituminous Hot Mix Intermediate Course 3,954 LB/CY	118.42	
Note: Includes Type A and Type B with 1/2" to 3/4" course or medium aggregate, placement, rolling, finishing and sweeping. Used for applications not described elsewhere in this section.		
<i>For PG64-10 Asphalt, Add</i>	14.52	
<i>For Warm Mix Additive, Add</i>	6.29	
<i>For >500 To 1,000, Deduct</i>	-5.20	
<i>For >1,000 To 2,500, Deduct</i>	-9.43	
<i>For >2,500 To 5,000, Deduct</i>	-14.63	
<i>For >5,000, Deduct</i>	-20.97	
32 12 16 13-0003 SY 1" Thick Binder Course	6.88	
Note: Includes placement, rolling, finishing and sweeping.		
<i>For PG64-10 Asphalt, Add</i>	0.80	
<i>For >10,000 To 20,000, Deduct</i>	-0.30	
<i>For >20,000 To 50,000, Deduct</i>	-0.54	
<i>For >50,000 To 100,000, Deduct</i>	-0.84	
<i>For >100,000, Deduct</i>	-1.20	
32 12 16 13-0004 SY 1-1/2" Thick Binder Course	10.15	
Note: Includes placement, rolling, finishing and sweeping.		
<i>For PG64-10 Asphalt, Add</i>	1.20	
<i>For >7,000 To 14,000, Deduct</i>	-0.44	
<i>For >14,000 To 32,000, Deduct</i>	-0.80	
<i>For >32,000 To 64,000, Deduct</i>	-1.25	
<i>For >64,000, Deduct</i>	-1.79	
32 12 16 13-0005 SY 2" Thick Binder Course	13.41	
Note: Includes placement, rolling, finishing and sweeping.		
<i>For PG64-10 Asphalt, Add</i>	1.59	
<i>For >5,000 To 10,000, Deduct</i>	-0.59	
<i>For >10,000 To 24,000, Deduct</i>	-1.07	
<i>For >24,000 To 48,000, Deduct</i>	-1.66	
<i>For >48,000, Deduct</i>	-2.38	
32 12 16 13-0006 SY 2-1/2" Thick Binder Course	16.29	
Note: Includes placement, rolling, finishing and sweeping.		
<i>For PG64-10 Asphalt, Add</i>	1.99	
<i>For >4,000 To 8,000, Deduct</i>	-0.72	
<i>For >8,000 To 20,000, Deduct</i>	-1.32	
<i>For >20,000 To 40,000, Deduct</i>	-2.04	
<i>For >40,000, Deduct</i>	-2.93	

32 Exterior Improvements
32 10 Bases, Ballasts, And Paving
32 12 Flexible Paving



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 12 16 13-0007	SY		3" Thick Binder Course Note: Includes placement, rolling, finishing and sweeping.	19.19	
			For PG64-10 Asphalt, Add	2.39	
			For >3,000 To 6,000, Deduct	-0.86	
			For >6,000 To 16,000, Deduct	-1.57	
			For >16,000 To 32,000, Deduct	-2.43	
			For >32,000, Deduct	-3.48	
32 12 16 13-0008	SY		3-1/2" Thick Binder Course Note: Includes placement, rolling, finishing and sweeping.	22.35	
			For PG64-10 Asphalt, Add	2.79	
			For >2,800 To 5,600, Deduct	-1.01	
			For >5,600 To 14,000, Deduct	-1.82	
			For >14,000 To 28,000, Deduct	-2.83	
			For >28,000, Deduct	-4.06	
32 12 16 13-0009	SY		4" Thick Binder Course Note: Includes placement, rolling, finishing and sweeping.	25.59	
			For PG64-10 Asphalt, Add	3.19	
			For >2,500 To 5,000, Deduct	-1.15	
			For >5,000 To 12,000, Deduct	-2.09	
			For >12,000 To 24,000, Deduct	-3.24	
			For >24,000, Deduct	-4.64	
32 12 16 13-0010	SY		5" Thick Binder Course Note: Includes placement, rolling, finishing and sweeping.	31.94	
			For PG64-10 Asphalt, Add	3.99	
			For >2,000 To 3,900, Deduct	-1.44	
			For >3,900 To 10,000, Deduct	-2.61	
			For >10,000 To 20,000, Deduct	-4.04	
			For >20,000, Deduct	-5.80	
32 12 16 13-0011	SY		6" Thick Binder Course Note: Includes placement, rolling, finishing and sweeping.	38.38	
			For PG64-10 Asphalt, Add	4.78	
			For >1,600 To 3,200, Deduct	-1.72	
			For >3,200 To 8,000, Deduct	-3.13	
			For >8,000 To 16,000, Deduct	-4.85	
			For >16,000, Deduct	-6.96	
32 12 16 13-0012			Surface Courses, Hot Mix Asphalt (HMA) <small>(32 12 16 13)</small>		
			Note: Meets Caltran requirements.		
32 12 16 13-0013	TON		Bituminous Hot Mix Surface Course 3954 LB/CY Note: Includes Type A and Type B with 1/2" to 3/4" course or medium aggregate, placement, rolling, finishing and sweeping. Used for applications not described elsewhere in this section.	123.83	
			For PG64-10 Asphalt, Add	7.26	
			For Warm Mix Additive, Add	6.29	
			For >500 To 1,000, Deduct	-5.29	
			For >1,000 To 2,500, Deduct	-9.61	
			For >2,500 To 5,000, Deduct	-14.89	
			For >5,000, Deduct	-21.37	
32 12 16 13-0014	TON		Tire Rubber Modified Paving Asphalt (TRMAC) Surface Course (MAC-15TR) Note: Includes 1/2" to 3/4" course or medium aggregate, placement, rolling, finishing and sweeping.	137.04	
			For Warm Mix Additive, Add	6.86	
32 12 16 13-0015	TON		Asphalt Rubberized Hot Mix (ARHM) Surface Course Note: Includes 1/2" to 3/4" course or medium aggregate, placement, rolling, finishing and sweeping.	146.72	
			For Warm Mix Additive, Add	7.49	
			For >500 To 1,000, Deduct	-6.28	
			For >1,000 To 2,500, Deduct	-11.41	
			For >2,500 To 5,000, Deduct	-17.69	
			For >5,000, Deduct	-25.39	
32 12 16 13-0016	SY		1" Thick Surface Course Note: Includes placement, rolling, finishing and sweeping.	7.03	
			For PG64-10 Asphalt, Add	0.38	
			For >10,000 To 20,000, Deduct	-0.29	
			For >20,000 To 50,000, Deduct	-0.53	
			For >50,000 To 100,000, Deduct	-0.83	
			For >100,000, Deduct	-1.19	
32 12 16 13-0017	SY		1-1/2" Thick Surface Course Note: Includes placement, rolling, finishing and sweeping.	10.34	
			For PG64-10 Asphalt, Add	0.57	
			For >7,000 To 14,000, Deduct	-0.44	
			For >14,000 To 32,000, Deduct	-0.79	
			For >32,000 To 64,000, Deduct	-1.23	
			For >64,000, Deduct	-1.77	
32 12 16 13-0018	SY		2" Thick Surface Course Note: Includes placement, rolling, finishing and sweeping.	13.62	
			For PG64-10 Asphalt, Add	0.76	
			For >5,000 To 10,000, Deduct	-0.58	
			For >10,000 To 24,000, Deduct	-1.05	
			For >24,000 To 48,000, Deduct	-1.63	
			For >48,000, Deduct	-2.34	
32 12 16 13-0019	SY		2-1/2" Thick Surface Course Note: Includes placement, rolling, finishing and sweeping.	16.43	
			For PG64-10 Asphalt, Add	0.95	
			For >4,000 To 8,000, Deduct	-0.71	
			For >8,000 To 20,000, Deduct	-1.29	
			For >20,000 To 40,000, Deduct	-2.00	
			For >40,000, Deduct	-2.87	



Exterior Improvements 32

Bases, Ballasts, And Paving 32 10

Flexible Paving 32 12

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 12 16 13-0020	SY		3" Thick Surface Course Note: Includes placement, rolling, finishing and sweeping. For PG64-10 Asphalt, Add For >3,000 To 6,000, Deduct For >6,000 To 16,000, Deduct For >16,000 To 32,000, Deduct For >32,000, Deduct	19.28 1.14 -0.84 -1.53 -2.37 -3.41	
32 12 16 13-0021	CSF		Type F Asphalt Surface Cap 1/8" To 1/4" Thick For Use Only On Top Concrete Filled Trench.....	51.27	
32 12 16 13-0022			Hand Placed, Hot Mix Asphalt (HMA) <small>(32 12 16 13)</small>		
32 12 16 13-0023	TON		Hand Placed Hot Mixed Asphalt 3,954 LB/CY Note: For small areas not reachable by machine. Includes placement, rolling, finishing and sweeping.	278.07	
32 12 16 19			Cold-Mix Asphalt Paving <small>(32 12 16)</small> Note: 0.5 Gal asphalt/SY per inch depth; well graded granular aggregate.		
32 12 16 19-0001			Cold Mix Asphalt (CMA) Pavement <small>(32 12 16 19)</small> Note: 0.5 Gal asphalt/SY per inch depth; well graded granular aggregate.		
32 12 16 19-0002	SY		Cold Laid Asphalt Pavement, Traveling Plant Mixed In Windrows, Compacted 4" Course.....	10.87	
32 12 16 19-0003	SY		Cold Laid Asphalt Pavement, Rotary Plant Mixed In Place, Compacted 4" Course	10.61	
32 12 16 19-0004	SY		Cold Laid Asphalt Pavement, Central Stationary Plant, Mixed, Compacted 4" Course	17.71	
32 12 16 39			Fabrics <small>(32 12 16)</small> See CSI section 31 32 19 16-0000 for geotextile fabric.		
32 12 16 39-0001	SY		3.6 Oz/SY, 90 LB Grab Tensile Nonwoven Polypropylene Geotextile Paving Fabric (Carthage Mills FX-38A/O) For Up To 50, Add For >50 To 150, Add For >150 To 250, Add For >250 To 500, Add	0.82 0.20 0.15 0.09 0.05	
32 12 16 39-0002	SY		4.1 Oz/SY, 101 LB Grab Tensile Nonwoven Polypropylene Geotextile Paving Fabric (Carthage Mills FX-42 A/O) For Up To 50, Add For >50 To 150, Add For >150 To 250, Add For >250 To 500, Add	0.87 0.21 0.15 0.10 0.05	
32 12 16 43			Waterproofing Membranes <small>(32 12 16)</small>		
32 12 16 43-0001			Waterproofing Membranes <small>(32 12 16 43)</small>		
32 12 16 43-0002	SY		Up To 500 SY, Preformed Rubberized Asphalt Membrane	28.63	
32 12 16 43-0003	SY		>500 To 1,000 SY, Preformed Rubberized Asphalt Membrane.....	21.58	
32 12 16 43-0004	SY		>1,000 SY, Preformed Rubberized Asphalt Membrane.....	13.59	
32 12 33			Flexible Paving Surface Treatments <small>(32 12)</small>		
32 12 33 00-0001			Bituminous Surface Treatment For Roadways <small>(32 12 33)</small> Note: 0.25 Gal bitumen per SY and 30 lb of gravel/SY.		
32 12 33 00-0002	SY		Single Course Bituminous Treatment, Prepare And Clean Surface Roadway.....	2.51	
32 12 33 00-0003	SY		Double Course Bituminous Treatment, Prepare And Clean Surface Roadway	4.49	
32 12 33 00-0004			Bituminous Surface Treatment For Trails <small>(32 12 33)</small> Note: 0.25 Gal bitumen per SY and 20 lb of gravel/SY.		
32 12 33 00-0005	SY		Bituminous Surface Treatment, For Trails	1.78	
32 12 36			Seal Coats <small>(32 12)</small>		
32 12 36 00-0001			Asphalt Seal Coating, For Roads And Parking Lot <small>(32 12 36)</small> Note: Includes sweeping and cleaning of area.		
32 12 36 00-0002	SY		Asphalt Seal Coating Minimum..... Note: For projects where the total charges are less than the minimum set-up charge, use this task exclusively. This task should not be used in conjunction with any other tasks in this section.	365.34	
32 12 36 00-0003	SY		>1,000 SY, Asphalt Seal Coating, 2 Coats Slurry Seal, Roadways Or Large Areas.....	1.73	
32 12 36 00-0004	SY		Type O Asphalt Seal Coating, No Aggregate.....	1.04	
32 12 36 00-0005	SY		Up To 500 SY, Type I Slurry Seal Asphalt Coating..... Note: 1/8" thick.	4.18	
32 12 36 00-0006	SY		>500 To 1,000 SY, Type I Slurry Seal Asphalt Coating Note: 1/8" thick. For Tire Rubber Modified Slurry Seal (TRMSS), Add For Rubberized Emulsion Aggregate Slurry (REAS), Add For Rubberized Polymer Modified Emulsion (RPME), Add	3.18 0.44 0.51 0.65	
32 12 36 00-0007	SY		>1,000 To 5,000 SY, Type I Slurry Seal Asphalt Coating Note: 1/8" thick. For Tire Rubber Modified Slurry Seal (TRMSS), Add For Rubberized Emulsion Aggregate Slurry (REAS), Add For Rubberized Polymer Modified Emulsion (RPME), Add	2.45 0.44 0.51 0.65	

32 Exterior Improvements**32 10 Bases, Ballasts, And Paving****32 12 Flexible Paving**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 12 36 00-0008	SY		>5,000 To 20,000 SY, Type I Slurry Seal Asphalt Coating Note: 1/8" thick. <i>For Tire Rubber Modified Slurry Seal (TRMSS), Add</i> <i>For Rubberized Emulsion Aggregate Slurry (REAS), Add</i> <i>For Rubberized Polymer Modified Emulsion (RPME), Add</i>	1.96 0.44 0.51 0.65	
32 12 36 00-0009	SY		>20,000 SY, Type I Slurry Seal Asphalt Coating Note: 1/8" thick. <i>For Tire Rubber Modified Slurry Seal (TRMSS), Add</i> <i>For Rubberized Emulsion Aggregate Slurry (REAS), Add</i> <i>For Rubberized Polymer Modified Emulsion (RPME), Add</i>	1.55 0.44 0.51 0.65	
32 12 36 00-0010	SY		Up To 500 SY, Type II Slurry Seal Asphalt Coating Note: 1/4" thick, 14 to 18 Lbs/SY. <i>For Rubberized Emulsion Aggregate Slurry (REAS), Add</i> <i>For Rubberized Polymer Modified Emulsion (RPME), Add</i> <i>For Latex Modified Asphalt Emulsion, Add</i> <i>For Tire Rubber Modified Slurry Seal (TRMSS), Add</i>	6.01 0.46 0.58 0.46 0.44	
32 12 36 00-0011	SY		>500 To 1,000 SY, Type II Slurry Seal Asphalt Coating Note: 1/4" thick, 14 to 18 Lbs/SY. <i>For Rubberized Emulsion Aggregate Slurry (REAS), Add</i> <i>For Rubberized Polymer Modified Emulsion (RPME), Add</i> <i>For Latex Modified Asphalt Emulsion, Add</i> <i>For Tire Rubber Modified Slurry Seal (TRMSS), Add</i>	4.91 0.40 0.52 0.40 0.44	
32 12 36 00-0012	SY		>1,000 To 5,000 SY, Type II Slurry Seal Asphalt Coating Note: 1/4" thick, 14 to 18 Lbs/SY. <i>For Rubberized Emulsion Aggregate Slurry (REAS), Add</i> <i>For Rubberized Polymer Modified Emulsion (RPME), Add</i> <i>For Latex Modified Asphalt Emulsion, Add</i> <i>For Tire Rubber Modified Slurry Seal (TRMSS), Add</i>	3.97 0.34 0.45 0.34 0.44	
32 12 36 00-0013	SY		>5,000 To 20,000 SY, Type II Slurry Seal Asphalt Coating Note: 1/4" thick, 14 to 18 Lbs/SY. <i>For Rubberized Emulsion Aggregate Slurry (REAS), Add</i> <i>For Rubberized Polymer Modified Emulsion (RPME), Add</i> <i>For Latex Modified Asphalt Emulsion, Add</i> <i>For Tire Rubber Modified Slurry Seal (TRMSS), Add</i>	3.23 0.29 0.39 0.29 0.44	
32 12 36 00-0014	SY		>20,000 SY, Type II Slurry Seal Asphalt Coating Note: 1/4" thick, 14 to 18 Lbs/SY. <i>For Rubberized Emulsion Aggregate Slurry (REAS), Add</i> <i>For Rubberized Polymer Modified Emulsion (RPME), Add</i> <i>For Latex Modified Asphalt Emulsion, Add</i> <i>For Tire Rubber Modified Slurry Seal (TRMSS), Add</i>	2.74 0.25 0.34 0.25 0.44	
32 12 36 00-0015	SY		Up To 500 SY, Type III Slurry Seal Asphalt Coating Note: 3/8" thick, 25 to 30 Lbs/SY. <i>For Rubberized Emulsion Aggregate Slurry (REAS), Add</i> <i>For Rubberized Polymer Modified Emulsion (RPME), Add</i> <i>For Latex Modified Asphalt Emulsion, Add</i> <i>For Tire Rubber Modified Slurry Seal (TRMSS), Add</i>	6.93 0.53 0.67 0.53 0.44	
32 12 36 00-0016	SY		>500 To 1,000 SY, Type III Slurry Seal Asphalt Coating Note: 3/8" thick, 25 to 30 Lbs/SY. <i>For Rubberized Emulsion Aggregate Slurry (REAS), Add</i> <i>For Rubberized Polymer Modified Emulsion (RPME), Add</i> <i>For Latex Modified Asphalt Emulsion, Add</i> <i>For Tire Rubber Modified Slurry Seal (TRMSS), Add</i>	5.78 0.47 0.62 0.47 0.44	
32 12 36 00-0017	SY		>1,000 To 5,000 SY, Type III Slurry Seal Asphalt Coating Note: 3/8" thick, 25 to 30 Lbs/SY. <i>For Rubberized Emulsion Aggregate Slurry (REAS), Add</i> <i>For Rubberized Polymer Modified Emulsion (RPME), Add</i> <i>For Latex Modified Asphalt Emulsion, Add</i> <i>For Tire Rubber Modified Slurry Seal (TRMSS), Add</i>	4.62 0.40 0.53 0.40 0.44	
32 12 36 00-0018	SY		>5,000 To 20,000 SY, Type III Slurry Seal Asphalt Coating Note: 3/8" thick, 25 to 30 Lbs/SY. <i>For Rubberized Emulsion Aggregate Slurry (REAS), Add</i> <i>For Rubberized Polymer Modified Emulsion (RPME), Add</i> <i>For Latex Modified Asphalt Emulsion, Add</i> <i>For Tire Rubber Modified Slurry Seal (TRMSS), Add</i>	3.77 0.34 0.45 0.34 0.44	
32 12 36 00-0019	SY		>20,000 SY, Type III Slurry Seal Asphalt Coating Note: 3/8" thick, 25 to 30 Lbs/SY. <i>For Rubberized Emulsion Aggregate Slurry (REAS), Add</i> <i>For Rubberized Polymer Modified Emulsion (RPME), Add</i> <i>For Latex Modified Asphalt Emulsion, Add</i> <i>For Tire Rubber Modified Slurry Seal (TRMSS), Add</i>	3.18 0.29 0.39 0.29 0.44	
32 12 36 00-0020	SY		Up To 500 SY, Type I Thermoplastic Coal-Tar Asphalt Seal	5.69	
32 12 36 00-0021	SY		>500 To 1,000 SY, Type I Thermoplastic Coal-Tar Asphalt Seal	4.79	
32 12 36 00-0022	SY		>1,000 To 5,000 SY, Type I Thermoplastic Coal-Tar Asphalt Seal	3.88	
32 12 36 00-0023	SY		>5,000 To 20,000 SY, Type I Thermoplastic Coal-Tar Asphalt Seal	3.21	
32 12 36 00-0024	SY		>20,000 SY, Type I Thermoplastic Coal-Tar Asphalt Seal	2.74	
32 12 36 00-0025	SY		Up To 500 SY, Type II Thermoplastic Coal-Tar Asphalt Seal	6.57	
32 12 36 00-0026	SY		>500 To 1,000 SY, Type II Thermoplastic Coal-Tar Asphalt Seal	5.67	
32 12 36 00-0027	SY		>1,000 To 5,000 SY, Type II Thermoplastic Coal-Tar Asphalt Seal	4.68	
32 12 36 00-0028	SY		>5,000 To 20,000 SY, Type II Thermoplastic Coal-Tar Asphalt Seal	3.93	
32 12 36 00-0029	SY		>20,000 SY, Type II Thermoplastic Coal-Tar Asphalt Seal	3.37	
32 12 36 00-0030			Water Based Emulsion Sealer Note: Includes sweeping and cleaning of area.		
32 12 36 00-0031	SY		Up To 500 SY Water Based Emulsion Sealer, For Asphalt, First Coat <i>For Additional Coats, Add</i>	3.45 1.90	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 12 36 00-0032 SY >500 To 1,000 SY Water Based Emulsion Sealer, For Asphalt, First Coat	2.78	
<i>For Additional Coats, Add</i>	1.53	
32 12 36 00-0033 SY >1,000 SY Water Based Emulsion Sealer, For Asphalt, First Coat	2.10	
<i>For Additional Coats, Add</i>	1.15	
32 12 36 00-0034 Sand Sealer <small>(32 12 36)</small>		
Note: To be added to Slurry Seal.		
32 12 36 00-0035 SY Up To 200 SY Sand Seal Spray Applied Asphalt Emulsion	2.33	
32 12 36 00-0036 SY >200 To 500 SY Sand Seal Spray Applied Asphalt Emulsion	1.76	
32 12 36 00-0037 SY >500 To 1,100 SY Sand Seal Spray Applied Asphalt Emulsion	1.58	
32 12 36 00-0038 SY >1,100 To 4,400 SY Sand Seal Spray Applied Asphalt Emulsion	1.21	
32 12 36 00-0039 SY >4,400 To 7,800 SY Sand Seal Spray Applied Asphalt Emulsion	1.10	
32 12 36 00-0040 SY >7,800 To 16,700 SY Sand Seal Spray Applied Asphalt Emulsion	1.01	
32 12 36 00-0041 SY >16,700 SY Sand Seal Spray Applied Asphalt Emulsion	0.95	
32 12 36 00-0042 Fog Sealer <small>(32 12 36)</small>		
32 12 36 00-0043 SY Up To 200 SY Fog Seal, SS-1H	2.03	
32 12 36 00-0044 SY >200 To 500 SY Fog Seal, SS-1H	1.46	
32 12 36 00-0045 SY >500 To 1,100 SY Fog Seal, SS-1	1.27	
32 12 36 00-0046 SY >1,100 To 4,400 SY Fog Seal, SS-1H	0.91	
32 12 36 00-0047 SY >4,400 To 7,800 SY Fog Seal, SS-1H	0.80	
32 12 36 00-0048 SY >7,800 To 16,700 SY Fog Seal, SS-1H	0.72	
32 12 36 00-0049 SY >16,700 SY Fog Seal, SS-1H	0.63	
32 12 36 00-0050 Asphalt Emulsion Sealers (Chip Seal) <small>(32 12 36)</small>		
32 12 36 00-0051 Fine Screenings Seal Coat <small>(32 12 36 00-0050)</small>		
Note: 12 to 20 # Per SY of 1/4" No. 10 with 0.15 to 0.30 gallons asphalt emulsion per SY.		
32 12 36 00-0052 SY Up To 200 SY Fine Screenings Asphalt Emulsion Seal Coat Spray Applied	2.95	
32 12 36 00-0053 SY >200 To 500 SY Fine Screenings Asphalt Emulsion Seal Coat Spray Applied	2.32	
32 12 36 00-0054 SY >500 To 1,100 SY Fine Screenings Asphalt Emulsion Seal Coat Spray Applied	2.11	
32 12 36 00-0055 SY >1,100 To 4,400 SY Fine Screenings Asphalt Emulsion Seal Coat Spray Applied	1.73	
32 12 36 00-0056 SY >4,400 To 7,800 SY Fine Screenings Asphalt Emulsion Seal Coat Spray Applied	1.60	
32 12 36 00-0057 SY >7,800 To 16,700 SY Fine Screenings Asphalt Emulsion Seal Coat Spray Applied	1.50	
32 12 36 00-0058 SY >16,700 SY Fine Screenings Asphalt Emulsion Seal Coat Spray Applied	1.43	
32 12 36 00-0059 Medium Fine Screenings Seal Coat <small>(32 12 36 00-0050)</small>		
Note: 16 to 25 # Per SY of 5/16" No. 8 with 0.25 to 0.35 gallons asphalt emulsion per SY.		
32 12 36 00-0060 SY Up To 200 SY Medium Fine Screenings Asphalt Emulsion Seal Coat Spray Applied	3.31	
32 12 36 00-0061 SY >200 To 500 SY Medium Fine Screenings Asphalt Emulsion Seal Coat Spray Applied	2.64	
32 12 36 00-0062 SY >500 To 1,100 SY Medium Fine Screenings Asphalt Emulsion Seal Coat Spray Applied	2.42	
32 12 36 00-0063 SY >1,100 To 4,400 SY Medium Fine Screenings Asphalt Emulsion Seal Coat Spray Applied	2.03	
32 12 36 00-0064 SY >4,400 To 7,800 SY Medium Fine Screenings Asphalt Emulsion Seal Coat Spray Applied	1.89	
32 12 36 00-0065 SY >7,800 To 16,700 SY Medium Fine Screenings Asphalt Emulsion Seal Coat Spray Applied	1.78	
32 12 36 00-0066 SY >16,700 SY Medium Fine Screenings Asphalt Emulsion Seal Coat Spray Applied	1.70	
32 12 36 00-0067 Medium Screenings Seal Coat <small>(32 12 36 00-0050)</small>		
Note: 20 to 30 # Per SY of 3/8" No. 6 with 0.25 to 0.40 gallons asphalt emulsion per SY.		
32 12 36 00-0068 SY Up To 200 SY Medium Screenings Asphalt Emulsion Seal Coat Spray Applied	3.43	
32 12 36 00-0069 SY >200 To 500 SY Medium Screenings Asphalt Emulsion Seal Coat Spray Applied	2.75	
32 12 36 00-0070 SY >500 To 1,100 SY Medium Screenings Asphalt Emulsion Seal Coat Spray Applied	2.52	
32 12 36 00-0071 SY >1,100 To 4,400 SY Medium Screenings Asphalt Emulsion Seal Coat Spray Applied	2.13	
32 12 36 00-0072 SY >4,400 To 7,800 SY Medium Screenings Asphalt Emulsion Seal Coat Spray Applied	1.99	
32 12 36 00-0073 SY >7,800 To 16,700 SY Medium Screenings Asphalt Emulsion Seal Coat Spray Applied	1.87	
32 12 36 00-0074 SY >16,700 SY Medium Screenings Asphalt Emulsion Seal Coat Spray Applied	1.79	
32 12 36 00-0075 Course Screenings Seal Coat <small>(32 12 36 00-0050)</small>		
Note: 23 to 30 # Per SY of 1/2" No. 4 with 0.30 to 0.40 gallons asphalt emulsion per SY.		
32 12 36 00-0076 SY Up To 200 SY Coarse Screenings Asphalt Emulsion Seal Coat Spray Applied	3.50	
32 12 36 00-0077 SY >200 To 500 SY Coarse Screenings Asphalt Emulsion Seal Coat Spray Applied	2.80	
32 12 36 00-0078 SY >500 To 1,100 SY Coarse Screenings Asphalt Emulsion Seal Coat Spray Applied	2.57	
32 12 36 00-0079 SY >1,100 To 4,400 SY Coarse Screenings Asphalt Emulsion Seal Coat Spray Applied	2.18	
32 12 36 00-0080 SY >4,400 To 7,800 SY Coarse Screenings Asphalt Emulsion Seal Coat Spray Applied	2.03	
32 12 36 00-0081 SY >7,800 To 16,700 SY Coarse Screenings Asphalt Emulsion Seal Coat Spray Applied	1.92	
32 12 36 00-0082 SY >16,700 SY Coarse Screenings Asphalt Emulsion Seal Coat Spray Applied	1.83	
32 12 36 00-0083 Double Screenings Seal Coat <small>(32 12 36 00-0050)</small>		
Note: First coat 23 to 30 # Per SY of 1/2" No. 4 with 0.20 to 0.35 gallons asphalt emulsion per SY, Second coat 12 to 20 # Per SY of 1/4" No. 10 with 0.20 to 0.30 gallons asphalt emulsion per SY.		
32 12 36 00-0084 SY Up To 200 SY Double Screenings Asphalt Emulsion Seal Coat Spray Applied	5.44	
32 12 36 00-0085 SY >200 To 500 SY Double Screenings Asphalt Emulsion Seal Coat Spray Applied	4.40	
32 12 36 00-0086 SY >500 To 1,100 SY Double Screenings Asphalt Emulsion Seal Coat Spray Applied	4.04	
32 12 36 00-0087 SY >1,100 To 4,400 SY Double Screenings Asphalt Emulsion Seal Coat Spray Applied	3.44	
32 12 36 00-0088 SY >4,400 To 7,800 SY Double Screenings Asphalt Emulsion Seal Coat Spray Applied	3.23	
32 12 36 00-0089 SY >7,800 To 16,700 SY Double Screenings Asphalt Emulsion Seal Coat Spray Applied	3.08	

32	Exterior Improvements
32 10	Bases, Ballasts, And Paving
32 12	Flexible Paving



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 12 36 00-0090 SY >16,700 SY Double Screenings Asphalt Emulsion Seal Coat Spray Applied	2.92	
32 12 36 00-0091 Seal Coat With Sand And Latex <small>(32 12 36)</small>		
32 12 36 00-0092 SY Up To 250 SY Seal Coat With Sand And Latex Added (One Coat)	4.36	
32 12 36 00-0093 SY >250 To 500 SY Seal Coat With Sand And Latex Added (One Coat)	3.61	
32 12 36 00-0094 SY >500 To 1,000 SY Seal Coat With Sand And Latex Added (One Coat)	2.86	
32 12 36 00-0095 SY >1,000 To 2,500 SF Seal Coat With Sand And Latex Added (One Coat)	2.10	
32 12 36 00-0096 SY >2,500 To 5,000 SY Seal Coat With Sand And Latex Added (One Coat)	1.66	
32 12 36 00-0097 SY >5,000 To 10,000 SY Seal Coat With Sand And Latex Added (One Coat)	1.51	
32 12 36 00-0098 SY >10,000 To 20,000 SY Seal Coat With Sand And Latex Added (One Coat)	1.35	
32 12 36 00-0099 SY >20,000 To 40,000 SY Seal Coat With Sand And Latex Added (One Coat)	1.20	
32 12 36 00-0100 SY >40,000 SY Seal Coat With Sand And Latex Added (One Coat)	1.05	
32 12 36 00-0101 Asphalt Rubber Aggregate Membrane <small>(32 12 36)</small>		
Note: Includes cleaning and preparing existing surface, spreading asphalt rubber and cover aggregate, rolling and sweeping.		
32 12 36 00-0102 SY Up To 200 SY 3/8" Asphalt Rubber Aggregate Membrane	5.94	
32 12 36 00-0103 SY >200 To 500 SY 3/8" Asphalt Rubber Aggregate Membrane	4.84	
32 12 36 00-0104 SY >500 To 1,100 SY 3/8" Asphalt Rubber Aggregate Membrane	4.45	
32 12 36 00-0105 SY >1,100 To 4,400 SY 3/8" Asphalt Rubber Aggregate Membrane	3.84	
32 12 36 00-0106 SY >4,400 To 7,800 SY 3/8" Asphalt Rubber Aggregate Membrane	3.61	
32 12 36 00-0107 SY >7,800 To 16,700 SY 3/8" Asphalt Rubber Aggregate Membrane	3.45	
32 12 36 00-0108 SY >16,700 SY 3/8" Asphalt Rubber Aggregate Membrane	3.28	
32 12 36 00-0109 Guardtop Seal Coat <small>(32 12 36)</small>		
Note: Includes sweeping and cleaning of area.		
32 12 36 00-0110 SY Guardtop Seal Coat	2.73	
For 3% Polyglass Additive, Add	0.04	
For 6% Polyglass Additive, Add	0.09	
For Guardtop Black Sand 60 Mesh Additive (@ 3lbs per gallon), Add	0.03	
32 12 36 00-0111 LF Guardtop Cold Crack Filler	0.93	
32 12 36 00-0112 LF Guardtop Hot Crack Filler	1.07	
32 12 36 00-0113 SY Guardtop Oil Sealer For Asphalt	3.38	
32 12 36 00-0114 EA Delivery Charge For Each Container	415.33	
Note: Includes delivery and removal.		
32 12 43 Porous Flexible Paving <small>(32 12)</small>		
32 12 43 00-0001 Flexible Recycled Plastic Porous Grid <small>(32 12 43)</small>		
Note: Includes sand fill in rings. Excludes base, earth work and grass or sod.		
32 12 43 00-0002 SY 1" Thick, Recycled Plastic Flexible Pavement With Sand Fill	21.65	
Note: Includes sand fill in rings. Excludes base, earth work and grass or sod. Invisible Structures, Inc.; Grasspave2.		
For Up To 100, Add	7.62	
For >100 To 500, Add	1.96	
For >1,000 To 5,000, Deduct	-0.88	
For >5,000, Deduct	-1.71	
32 12 73 Asphalt Paving Joint Sealants <small>(32 12)</small>		
32 12 73 00-0001 Expansion Joint In Sidewalk <small>(32 12 73)</small>		
32 12 73 00-0002 LF For Hot Asphalt Poured Over Expansion Joint In Sidewalk	3.04	
32 13 Rigid Paving <small>(32 10)</small>		
32 13 13 Concrete Paving <small>(32 13)</small>		
Note: The following section includes spreading and placing delivered Portland cement concrete mix.		
32 13 13 33 Plain Concrete Paving <small>(32 13 13)</small>		
32 13 13 33-0001 Concrete Paving Assemblies <small>(32 13 13 33)</small>		
Note: Includes forms, wire mesh (where necessary), #3-#6 reinforcing rods at 12" on center with chairs (where necessary), vapor barrier, concrete, curing, latex or hot asphalt expansion joints, control joints, screed, float and finish. Excludes excavation, base and earthwork. Includes concrete paving machine. To be used for roadways, driveways, parking areas, or other areas of vehicular traffic. See CSI section 03 05 00 00-0001 for color additive.		
32 13 13 33-0002 4,500 PSI Concrete Paving Assembly <small>(32 13 13 33-0001)</small>		



		Exterior Improvements	32
		Bases, Ballasts, And Paving	32 10
		Rigid Paving	32 13

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 13 13 33-0003 SY 4" 4,500 PSI Concrete Paving Assembly.....	39.61	
For 2,500 PSI Concrete, Deduct	-1.95	
For 3,000 PSI Concrete, Deduct	-1.27	
For 3,500 PSI Concrete, Deduct	-1.02	
For 4,000 PSI Concrete, Deduct	-0.44	
For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	2.20	
For <10' Wide Pass, Add	7.36	
For >24' Wide Pass, Deduct	-7.92	
For Air Entrainment, Add	0.85	
For Accelerator Admixtures, Add	1.02	
For Slipforming, Deduct	-3.96	
For Up To 100, Add	17.00	
For >100 To 250, Add	9.35	
For >250 To 500, Add	4.67	
For >1,000 To 2,000, Deduct	-0.85	
For >2,000 To 5,000, Deduct	-1.84	
For >5,000 To 10,000, Deduct	-2.83	
For >10,000 To 20,000, Deduct	-3.82	
For >20,000, Deduct	-4.81	
32 13 13 33-0004 SY 5" 4,500 PSI Concrete Paving Assembly.....	46.45	
For 2,500 PSI Concrete, Deduct	-2.44	
For 3,000 PSI Concrete, Deduct	-1.59	
For 3,500 PSI Concrete, Deduct	-1.27	
For 4,000 PSI Concrete, Deduct	-0.55	
For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	2.76	
For <10' Wide Pass, Add	8.43	
For >24' Wide Pass, Deduct	-9.29	
For Air Entrainment, Add	1.06	
For Accelerator Admixtures, Add	1.27	
For Slipforming, Deduct	-4.65	
For Up To 100, Add	19.37	
For >100 To 250, Add	10.75	
For >250 To 500, Add	5.37	
For >1,000 To 2,000, Deduct	-1.06	
For >2,000 To 5,000, Deduct	-2.22	
For >5,000 To 10,000, Deduct	-3.38	
For >10,000 To 20,000, Deduct	-4.55	
For >20,000, Deduct	-5.71	
32 13 13 33-0005 SY 6" 4,500 PSI Concrete Paving Assembly.....	49.71	
For 2,500 PSI Concrete, Deduct	-2.58	
For 3,000 PSI Concrete, Deduct	-1.68	
For 3,500 PSI Concrete, Deduct	-1.34	
For 4,000 PSI Concrete, Deduct	-0.58	
For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	2.91	
For <10' Wide Pass, Add	9.07	
For >24' Wide Pass, Deduct	-9.94	
For Air Entrainment, Add	1.12	
For Accelerator Admixtures, Add	1.34	
For Slipforming, Deduct	-4.97	
For Up To 100, Add	20.87	
For >100 To 250, Add	11.55	
For >250 To 500, Add	5.78	
For >1,000 To 2,000, Deduct	-1.12	
For >2,000 To 5,000, Deduct	-2.36	
For >5,000 To 10,000, Deduct	-3.61	
For >10,000 To 20,000, Deduct	-4.85	
For >20,000, Deduct	-6.09	
32 13 13 33-0006 SY 7" 4,500 PSI Concrete Paving Assembly.....	58.50	
For 2,500 PSI Concrete, Deduct	-3.25	
For 3,000 PSI Concrete, Deduct	-2.12	
For 3,500 PSI Concrete, Deduct	-1.70	
For 4,000 PSI Concrete, Deduct	-0.73	
For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	3.67	
For <10' Wide Pass, Add	10.39	
For >24' Wide Pass, Deduct	-11.70	
For Air Entrainment, Add	1.41	
For Accelerator Admixtures, Add	1.70	
For Slipforming, Deduct	-5.85	
For Up To 100, Add	23.80	
For >100 To 250, Add	13.31	
For >250 To 500, Add	6.66	
For >1,000 To 2,000, Deduct	-1.41	
For >2,000 To 5,000, Deduct	-2.88	
For >5,000 To 10,000, Deduct	-4.34	
For >10,000 To 20,000, Deduct	-5.80	
For >20,000, Deduct	-7.26	

32	Exterior Improvements
32 10	Bases, Ballasts, And Paving
32 13	Rigid Paving



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 13 13 33-0007	SY	8"	4,500 PSI Concrete Paving Assembly	67.31	
			<i>For 2,500 PSI Concrete, Deduct</i>	-3.57	
			<i>For 3,000 PSI Concrete, Deduct</i>	-2.33	
			<i>For 3,500 PSI Concrete, Deduct</i>	-1.86	
			<i>For 4,000 PSI Concrete, Deduct</i>	-0.81	
			<i>For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add</i>	4.03	
			<i>For <10' Wide Pass, Add</i>	12.18	
			<i>For >24' Wide Pass, Deduct</i>	-13.46	
			<i>For Air Entrainment, Add</i>	1.55	
			<i>For Accelerator Admixtures, Add</i>	1.86	
			<i>For Slipforming, Deduct</i>	-6.73	
			<i>For Up To 100, Add</i>	27.98	
			<i>For >100 To 250, Add</i>	15.54	
			<i>For >250 To 500, Add</i>	7.77	
			<i>For >1,000 To 2,000, Deduct</i>	-1.55	
			<i>For >2,000 To 5,000, Deduct</i>	-3.23	
			<i>For >5,000 To 10,000, Deduct</i>	-4.92	
			<i>For >10,000 To 20,000, Deduct</i>	-6.60	
			<i>For >20,000, Deduct</i>	-8.28	
32 13 13 33-0008	SY	9"	4,500 PSI Concrete Paving Assembly	75.91	
			<i>For 2,500 PSI Concrete, Deduct</i>	-4.12	
			<i>For 3,000 PSI Concrete, Deduct</i>	-2.69	
			<i>For 3,500 PSI Concrete, Deduct</i>	-2.15	
			<i>For 4,000 PSI Concrete, Deduct</i>	-0.93	
			<i>For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add</i>	4.66	
			<i>For <10' Wide Pass, Add</i>	13.60	
			<i>For >24' Wide Pass, Deduct</i>	-15.18	
			<i>For Air Entrainment, Add</i>	1.79	
			<i>For Accelerator Admixtures, Add</i>	2.15	
			<i>For Slipforming, Deduct</i>	-7.59	
			<i>For Up To 100, Add</i>	31.21	
			<i>For >100 To 250, Add</i>	17.40	
			<i>For >250 To 500, Add</i>	8.70	
			<i>For >1,000 To 2,000, Deduct</i>	-1.79	
			<i>For >2,000 To 5,000, Deduct</i>	-3.69	
			<i>For >5,000 To 10,000, Deduct</i>	-5.59	
			<i>For >10,000 To 20,000, Deduct</i>	-7.48	
			<i>For >20,000, Deduct</i>	-9.38	
32 13 13 33-0009	SY	10"	4,500 PSI Concrete Paving Assembly	84.78	
			<i>For 2,500 PSI Concrete, Deduct</i>	-4.53	
			<i>For 3,000 PSI Concrete, Deduct</i>	-2.96	
			<i>For 3,500 PSI Concrete, Deduct</i>	-2.36	
			<i>For 4,000 PSI Concrete, Deduct</i>	-1.02	
			<i>For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add</i>	5.12	
			<i>For <10' Wide Pass, Add</i>	15.28	
			<i>For >24' Wide Pass, Deduct</i>	-16.96	
			<i>For Air Entrainment, Add</i>	1.97	
			<i>For Accelerator Admixtures, Add</i>	2.36	
			<i>For Slipforming, Deduct</i>	-8.48	
			<i>For Up To 100, Add</i>	35.10	
			<i>For >100 To 250, Add</i>	19.52	
			<i>For >250 To 500, Add</i>	9.76	
			<i>For >1,000 To 2,000, Deduct</i>	-1.97	
			<i>For >2,000 To 5,000, Deduct</i>	-4.09	
			<i>For >5,000 To 10,000, Deduct</i>	-6.21	
			<i>For >10,000 To 20,000, Deduct</i>	-8.33	
			<i>For >20,000, Deduct</i>	-10.45	
32 13 13 33-0010	SY	12"	4,500 PSI Concrete Paving Assembly	101.12	
			<i>For 2,500 PSI Concrete, Deduct</i>	-5.37	
			<i>For 3,000 PSI Concrete, Deduct</i>	-3.50	
			<i>For 3,500 PSI Concrete, Deduct</i>	-2.80	
			<i>For 4,000 PSI Concrete, Deduct</i>	-1.21	
			<i>For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add</i>	6.07	
			<i>For <10' Wide Pass, Add</i>	18.28	
			<i>For >24' Wide Pass, Deduct</i>	-20.22	
			<i>For Air Entrainment, Add</i>	2.33	
			<i>For Accelerator Admixtures, Add</i>	2.80	
			<i>For Slipforming, Deduct</i>	-10.11	
			<i>For Up To 100, Add</i>	42.00	
			<i>For >100 To 250, Add</i>	23.34	
			<i>For >250 To 500, Add</i>	11.67	
			<i>For >1,000 To 2,000, Deduct</i>	-2.33	
			<i>For >2,000 To 5,000, Deduct</i>	-4.86	
			<i>For >5,000 To 10,000, Deduct</i>	-7.39	
			<i>For >10,000 To 20,000, Deduct</i>	-9.92	
			<i>For >20,000, Deduct</i>	-12.45	



		Exterior Improvements	32
		Bases, Ballasts, And Paving	32 10
		Rigid Paving	32 13

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 13 13 33-0011 SY 15" 4,500 PSI Concrete Paving Assembly.....	129.57	
For 2,500 PSI Concrete, Deduct	-6.59	
For 3,000 PSI Concrete, Deduct	-4.30	
For 3,500 PSI Concrete, Deduct	-3.44	
For 4,000 PSI Concrete, Deduct	-1.49	
For High Sulfate Resistance, Type 5 Cement Concrete ASTM C150, Add	7.45	
For <10' Wide Pass, Add	23.80	
For >24' Wide Pass, Deduct	-25.91	
For Air Entrainment, Add	2.87	
For Accelerator Admixtures, Add	3.44	
For Slipforming, Deduct	-12.96	
For Up To 100, Add	54.82	
For >100 To 250, Add	30.27	
For >250 To 500, Add	15.14	
For >1,000 To 2,000, Deduct	-2.87	
For >2,000 To 5,000, Deduct	-6.10	
For >5,000 To 10,000, Deduct	-9.34	
For >10,000 To 20,000, Deduct	-12.58	
For >20,000, Deduct	-15.82	
32 13 16 Decorative Concrete Paving (32 13)		
32 13 16 13 Patterned Concrete Paving (32 13 16)		
32 13 16 13-0001 SF For Patterned (Tactile) Finish In Sidewalk.....	3.54	
32 13 43 Pervious Concrete Paving (32 13)		
32 13 43 00-0001 Pervious Concrete Assembly (32 13 43)		
Note: Pervious concrete is a special concrete mix with high porosity that allows water to pass through it. For paving and sidewalks.		
32 13 43 00-0002 SF 6" Thick Pervious Concrete Paving.....	11.18	
Note: Includes filter fabric, concrete, curing, finish, and control joints. Excludes excavation, base, forms and expansion joints along existing.		
For >5,000 To 30,000, Deduct	-1.27	
For >30,000 To 100,000, Deduct	-2.41	
For >100,000, Deduct	-2.98	
32 13 43 00-0003 SF 9" Thick Pervious Concrete Paving.....	13.72	
Note: Includes filter fabric, concrete, curing, finish, and control joints. Excludes excavation, base, forms and expansion joints along existing.		
For >5,000 To 30,000, Deduct	-1.52	
For >30,000 To 100,000, Deduct	-2.85	
For >100,000, Deduct	-3.54	
32 13 73 Concrete Paving Joint Sealants (32 13)		
32 13 73 13 Fuel-Resistant Concrete Paving Joint Sealants (32 13 73)		
32 13 73 13-0001 Concrete Pavement Joint And Crack Repair (32 13 73 13)		
Note: Includes cutting joint, removal of existing material, sweeping and cleaning area.		
32 13 73 13-0002 LF Pavement Sealing, Roads Resealing Joints In Concrete Pavements For Roads.....	7.23	
32 13 73 16 Field-Molded Concrete Paving Joint Sealants (32 13 73)		
32 13 73 16-0001 Preformed Elastomeric Concrete Pavement Joint And Crack Repair (32 13 73 16)		
Note: Includes cutting joint, removal of existing material, sweeping and cleaning area.		
32 13 73 16-0002 LF Joint Sealing, Concrete Pavement Preformed Elastomeric.....	10.83	
32 13 73 19 Compression Concrete Paving Joint Sealants (32 13 73)		
32 13 73 19-0001 Silicone Joint Sealant For Concrete Pavement (32 13 73 19)		
Note: Installation includes high pressure water wash, sand blast, sweeping, cleaning area, backer rod and Dow Corning 888 silicone sealant. Demolition includes removal of existing material where sawcutting is not required. Excludes saw cutting.		
32 13 73 19-0002 LF 1/4" x 1/4" Expansion And Contraction Silicone Joint Sealant For Concrete Pavement.....	8.29	2.00
32 13 73 19-0003 LF 3/8" x 1/4" Expansion And Contraction Silicone Joint Sealant For Concrete Pavement.....	8.60	2.04
32 13 73 19-0004 LF 1/2" x 1/4" Expansion And Contraction Silicone Joint Sealant For Concrete Pavement.....	8.94	2.08
32 13 73 19-0005 LF 3/4" x 3/8" Expansion And Contraction Silicone Joint Sealant For Concrete Pavement.....	9.90	2.11
32 13 73 19-0006 LF 1" x 1/2" Expansion And Contraction Silicone Joint Sealant For Concrete Pavement.....	11.09	2.17
32 13 73 19-0007 LF 1-1/2" x 1/2" Expansion And Contraction Silicone Joint Sealant For Concrete Pavement.....	12.65	2.20
32 13 73 19-0008 LF 2" x 1/2" Expansion And Contraction Silicone Joint Sealant For Concrete Pavement.....	14.94	2.25
32 14 Unit Paving (32 10)		
32 14 09 Paver Restraints (32 14)		
32 14 09 00-0001 Paver Restraints (32 14 09)		
Note: Paver restraints are used along the edge of a group of pavers as a locking border. Flexible or rigid sections. Includes stakes and connecting devices. Excludes pavers, bedding, excavation, base course and compaction.		

32 Exterior Improvements
32 10 Bases, Ballasts, And Paving
32 14 Unit Paving



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 14 09 00-0002	LF		Up To 2" Height, Vinyl Paver Restraint	3.12	0.92
			<i>For >1,000 To 2,000, Deduct</i>	-0.36	
			<i>For >2,000 To 4,000, Deduct</i>	-0.52	
			<i>For >4,000, Deduct</i>	-0.67	
32 14 09 00-0003	LF		Up To 2" Height, Galvanized Steel Paver Restraint	3.34	0.92
			<i>For >500 To 1,000, Deduct</i>	-0.09	
			<i>For >1,000 To 2,000, Deduct</i>	-0.19	
			<i>For >2,000, Deduct</i>	-0.28	
32 14 09 00-0004	LF		Up To 1" Height, Aluminum Paver Restraint	3.23	0.92
			<i>For >250 To 500, Deduct</i>	-0.18	
			<i>For >500 To 1,000, Deduct</i>	-0.26	
			<i>For >1,000 To 1,500, Deduct</i>	-0.44	
32 14 09 00-0005	LF		>1" To 2" Height, Aluminum Paver Restraint	3.72	0.92
			<i>For >250 To 500, Deduct</i>	-0.22	
			<i>For >500 To 1,000, Deduct</i>	-0.34	
			<i>For >1,000 To 1,500, Deduct</i>	-0.56	
32 14 09 00-0006	LF		>2" To 3" Height, Aluminum Paver Restraint	4.67	0.92
			<i>For >250 To 500, Deduct</i>	-0.32	
			<i>For >500 To 1,000, Deduct</i>	-0.48	
			<i>For >1,000 To 1,500, Deduct</i>	-0.80	
32 14 09 00-0007	LF		>3" To 4" Height, Aluminum Paver Restraint	5.39	0.92
			<i>For >250 To 500, Deduct</i>	-0.39	
			<i>For >500 To 1,000, Deduct</i>	-0.59	
			<i>For >1,000 To 1,500, Deduct</i>	-0.98	

32 14 11 Bedding For Unit Paving (32 14)

32 14 11 00-0001 Bedding For Brick, Precast Concrete Paver And Stone Sidewalk (32 14 11)

Note: Includes delivery up to 15 miles from the closest approved source, the cost for loading, and dumping. See CSI section 01 74 19 00-0034 for hauling greater than 15 miles.

32 14 11 00-0002	SF		1" To 2" Sand Bedding, Screeded	1.01	
			<i>For Up To 100, Add</i>	0.39	
			<i>For >100 To 500, Add</i>	0.11	
			<i>For >1,000 To 5,000, Deduct</i>	-0.06	
			<i>For >5,000, Deduct</i>	-0.10	
32 14 11 00-0003	SF		1" To 2" Stone Dust Bedding, Screeded	1.38	
			<i>For Up To 100, Add</i>	0.49	
			<i>For >100 To 500, Add</i>	0.13	
			<i>For >1,000 To 5,000, Deduct</i>	-0.06	
			<i>For >5,000, Deduct</i>	-0.11	
32 14 11 00-0004	SF		3" Stone Dust Bedding, Screeded	1.89	
			<i>For Up To 100, Add</i>	0.64	
			<i>For >100 To 500, Add</i>	0.16	
			<i>For >1,000 To 5,000, Deduct</i>	-0.07	
			<i>For >5,000, Deduct</i>	-0.14	
32 14 11 00-0005	SF		4" Stone Dust Bedding, Screeded	2.44	
			<i>For Up To 100, Add</i>	0.81	
			<i>For >100 To 500, Add</i>	0.20	
			<i>For >1,000 To 5,000, Deduct</i>	-0.08	
			<i>For >5,000, Deduct</i>	-0.17	
32 14 11 00-0006	SF		1" Mortar Bedding	2.27	
			<i>For Up To 100, Add</i>	1.03	
			<i>For >100 To 500, Add</i>	0.30	
			<i>For >1,000 To 5,000, Deduct</i>	-0.18	
			<i>For >5,000, Deduct</i>	-0.29	
32 14 11 00-0007	SF		2" Mortar Bedding	3.30	
			<i>For Up To 100, Add</i>	1.44	
			<i>For >100 To 500, Add</i>	0.41	
			<i>For >1,000 To 5,000, Deduct</i>	-0.25	
			<i>For >5,000, Deduct</i>	-0.39	
32 14 11 00-0008	SF		Thin-Set Latex Portland Cement Mortar	1.15	
			<i>For Up To 100, Add</i>	0.53	
			<i>For >100 To 500, Add</i>	0.15	
			<i>For >1,000 To 5,000, Deduct</i>	-0.10	
			<i>For >5,000, Deduct</i>	-0.15	

32 14 13 Precast Concrete Unit Paving (32 14)

32 14 13 16 Pressed Precast Concrete Unit Paving (32 14 13)

32 14 13 16-0001 Precast Concrete Paver Sidewalk (32 14 13 16)

Note: Square, rectangular, or interlocking pavers. Includes sand joints and all finishes. Excludes bedding, excavation, base course and compaction. See CSI section 32 11 23 16-0001 for base course, 32 14 11 00-0001 for bedding.

32 14 13 16-0002	SF		2-3/8" Thick, Up To 32 Sl Precast Concrete Paver	8.04	2.28
			Note: Includes 2-1/2" x 5", 4" x 4", 4" x 6", 5" x 5", 4" x 8" and other similar size pavers.		
			<i>For 2-3/4" Concrete Paver, Add</i>	0.75	
			<i>For 3-1/8" Concrete Paver, Add</i>	1.21	
			<i>For Cement/Sand Mix Or Polymeric Sand Joints, Add</i>	0.63	
			<i>For Up To 100, Add</i>	3.16	
			<i>For >100 To 500, Add</i>	0.86	
			<i>For >1,000 To 5,000, Deduct</i>	-0.46	
			<i>For >5,000, Deduct</i>	-0.79	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 14 13 16-0003 SF 2-3/8" Thick, >32 to 64 SI Precast Concrete Paver Note: Includes 5" x 7", 6" x 6", 8" x 8" and other similar size pavers. <i>For 2-3/4" Concrete Paver, Add</i> <i>For 3-1/8" Concrete Paver, Add</i> <i>For Cement/Sand Mix Or Polymeric Sand Joints, Add</i> <i>For Up To 100, Add</i> <i>For >100 To 500, Add</i> <i>For >1,000 To 5,000, Deduct</i> <i>For >5,000, Deduct</i>	7.62 0.73 1.18 0.59 2.95 0.80 -0.42 -0.73	2.09
32 14 13 16-0004 SF 2-3/8" Thick, >64 to 144 SI Precast Concrete Paver Note: Includes 6" x 12", 12" x 12" and other similar size pavers. <i>For 2-3/4" Concrete Paver, Add</i> <i>For 3-1/8" Concrete Paver, Add</i> <i>For Cement/Sand Mix Or Polymeric Sand Joints, Add</i> <i>For Up To 100, Add</i> <i>For >100 To 500, Add</i> <i>For >1,000 To 5,000, Deduct</i> <i>For >5,000, Deduct</i>	7.24 0.71 1.15 0.55 2.76 0.74 -0.38 -0.67	1.66
32 14 13 16-0005 SF 2-3/8" Thick, >144 SI Precast Concrete Paver Note: Includes 16" x 16", 12" x 24", 18" x 18", 24" x 24", 24" x 36", 36" x 36" and other similar size pavers. <i>For 2-3/4" Concrete Paver, Add</i> <i>For 3-1/8" Concrete Paver, Add</i> <i>For Cement/Sand Mix Or Polymeric Sand Joints, Add</i> <i>For Up To 100, Add</i> <i>For >100 To 500, Add</i> <i>For >1,000 To 5,000, Deduct</i> <i>For >5,000, Deduct</i>	6.90 0.69 1.12 0.52 2.59 0.69 -0.35 -0.62	1.72
32 14 13 16-0006 SF 2-3/8" Thick, Precast Concrete Paver, Combinations And Patterns Note: Patterns made by combining pavers from two or more size groups. <i>For 2-3/4" Concrete Paver, Add</i> <i>For 3-1/8" Concrete Paver, Add</i> <i>For Cement/Sand Mix Or Polymeric Sand Joints, Add</i> <i>For Up To 100, Add</i> <i>For >100 To 500, Add</i> <i>For >1,000 To 5,000, Deduct</i> <i>For >5,000, Deduct</i>	7.42 0.72 1.16 0.57 2.85 0.77 -0.40 -0.70	1.98

32 14 16 Brick Unit Paving (32 14)

32 14 16 00-0001 Brick Paver Sidewalk <small>(32 14 16)</small> Note: Includes sand joints. Excludes bedding, excavation, base course and compaction. See CSI section 32 11 23 16-0001 for base course, 32 14 11 00-0001 for bedding.		
32 14 16 00-0002 SF 4" x 8" x 2-1/4" Brick Paver, Laid Flat <i>For 1-3/8" Thick Paver, Deduct</i> <i>For 2-3/4" Thick Paver (Vehicular), Add</i> <i>For Cement/Sand Mix Or Polymeric Sand Joints, Add</i> <i>For Up To 100, Add</i> <i>For >100 To 500, Add</i> <i>For >1,000 To 5,000, Deduct</i> <i>For >5,000, Deduct</i>	8.96 -1.76 3.96 0.68 3.39 0.91 -0.46 -0.82	2.28
32 14 16 00-0003 SF 4" x 8" x 2-1/4" Brick, Laid On Edge <i>For 1-3/8" Thick Paver, Deduct</i> <i>For 2-3/4" Thick Paver (Vehicular), Add</i> <i>For Cement/Sand Mix Or Polymeric Sand Joints, Add</i> <i>For Up To 100, Add</i> <i>For >100 To 500, Add</i> <i>For >1,000 To 5,000, Deduct</i> <i>For >5,000, Deduct</i>	12.98 -2.98 6.88 0.91 4.55 1.17 -0.52 -1.02	2.61

32 14 40 Stone Paving (32 14)

32 14 40 00-0001 Slate Paver Sidewalk <small>(32 14 40)</small> Note: Includes sand joints and all finishes. Excludes bedding, excavation, base course and compaction. See CSI section 32 11 23 16-0001 for base course, 32 14 11 00-0001 for bedding.		
32 14 40 00-0002 SF 1" Thick, Up to 54 SI Slate Paver Note: Includes 3" x 9", 6" x 6", 6" x 9" and other similar size pavers. <i>For Cement/Sand Mix Or Polymeric Sand Joints, Add</i> <i>For 1/4" Thick Paver, Deduct</i> <i>For 1/2" Thick Paver, Deduct</i> <i>For Up To 100, Add</i> <i>For >100 To 500, Add</i> <i>For >1,000 To 5,000, Deduct</i> <i>For >5,000, Deduct</i>	14.77 0.93 -7.97 -5.62 4.64 1.12 -0.38 -0.90	1.90
32 14 40 00-0003 SF 1" Thick, >54 to 108 SI Slate Paver Note: Includes 6" x 12", 9" x 9", 6" x 18", 9" x 12" and other similar size pavers. <i>For Cement/Sand Mix Or Polymeric Sand Joints, Add</i> <i>For 1/4" Thick Paver, Deduct</i> <i>For 1/2" Thick Paver, Deduct</i> <i>For Up To 100, Add</i> <i>For >100 To 500, Add</i> <i>For >1,000 To 5,000, Deduct</i> <i>For >5,000, Deduct</i>	14.43 0.89 -7.89 -5.57 4.47 1.07 -0.35 -0.85	1.72

32 Exterior Improvements**32 10 Bases, Ballasts, And Paving****32 14 Unit Paving**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 14 40 00-0004	SF		1" Thick, >108 to 216 SI Slate Paver Note: Includes 12" x 12", 6" x 24", 9" x 18", 9" x 24", 12" x 18" and other similar size pavers. <i>For Cement/Sand Mix Or Polymeric Sand Joints, Add</i> <i>For 1/4" Thick Paver, Deduct</i> <i>For 1/2" Thick Paver, Deduct</i> <i>For Up To 100, Add</i> <i>For >100 To 500, Add</i> <i>For >1,000 To 5,000, Deduct</i> <i>For >5,000, Deduct</i>	13.83	1.43
				0.83	
				-7.74	
				-5.48	
				4.17	
				0.98	
				-0.29	
				-0.76	
32 14 40 00-0005	SF		1" Thick, >216 SI Slate Paver Note: Includes 16" x 16", 12" x 24", 18" x 18", 24" x 24", 24" x 36", 36" x 36" and other similar size pavers. <i>For Cement/Sand Mix Or Polymeric Sand Joints, Add</i> <i>For 1/4" Thick Paver, Deduct</i> <i>For 1/2" Thick Paver, Deduct</i> <i>For Up To 100, Add</i> <i>For >100 To 500, Add</i> <i>For >1,000 To 5,000, Deduct</i> <i>For >5,000, Deduct</i>	13.57	1.30
				0.81	
				-7.67	
				-5.44	
				4.04	
				0.94	
				-0.26	
				-0.72	
32 14 40 00-0006	SF		1" Thick, Slate Paver, Combinations And Patterns Note: Patterns made by combining pavers from two or more size groups. <i>For Cement/Sand Mix Or Polymeric Sand Joints, Add</i> <i>For 1/4" Thick Paver, Deduct</i> <i>For 1/2" Thick Paver, Deduct</i> <i>For Up To 100, Add</i> <i>For >100 To 500, Add</i> <i>For >1,000 To 5,000, Deduct</i> <i>For >5,000, Deduct</i>	14.09	1.56
				0.86	
				-7.80	
				-5.52	
				4.30	
				1.02	
				-0.31	
				-0.80	
32 14 40 00-0007			Granite Paver Sidewalk <small>(32 14 40)</small> Note: Includes sand joints and all finishes. Excludes bedding, excavation, base course and compaction. See CSI section 32 11 23 16-0001 for base course, 32 14 11 00-0001 for bedding.		
32 14 40 00-0008	SF		1" Thick, Up to 54 SI Granite Paver Note: Includes 3" x 9", 6" x 6", 6" x 9" and other similar size pavers. <i>For Cement/Sand Mix Or Polymeric Sand Joints, Add</i> <i>For 2" Granite Paver, Add</i> <i>For 3" Granite Paver, Add</i> <i>For 4" Granite Paver, Add</i> <i>For Up To 100, Add</i> <i>For >100 To 500, Add</i> <i>For >1,000 To 5,000, Deduct</i> <i>For >5,000, Deduct</i>	17.10	1.90
				1.04	
				0.86	
				1.71	
				1.90	
				5.22	
				1.23	
				-0.38	
				-0.97	
32 14 40 00-0009	SF		1" Thick, >54 to 108 SI Granite Paver Note: Includes 6" x 12", 9" x 9", 6" x 18", 9" x 12" and other similar size pavers. <i>For Cement/Sand Mix Or Polymeric Sand Joints, Add</i> <i>For 2" Granite Paver, Add</i> <i>For 3" Granite Paver, Add</i> <i>For 4" Granite Paver, Add</i> <i>For Up To 100, Add</i> <i>For >100 To 500, Add</i> <i>For >1,000 To 5,000, Deduct</i> <i>For >5,000, Deduct</i>	16.76	1.72
				1.01	
				0.84	
				1.68	
				1.85	
				5.05	
				1.18	
				-0.35	
				-0.92	
32 14 40 00-0010	SF		1" Thick, >108 to 216 SI Granite Paver Note: Includes 12" x 12", 6" x 24", 9" x 18", 9" x 24", 12" x 18" and other similar size pavers. <i>For Cement/Sand Mix Or Polymeric Sand Joints, Add</i> <i>For 2" Granite Paver, Add</i> <i>For 3" Granite Paver, Add</i> <i>For 4" Granite Paver, Add</i> <i>For Up To 100, Add</i> <i>For >100 To 500, Add</i> <i>For >1,000 To 5,000, Deduct</i> <i>For >5,000, Deduct</i>	16.16	1.43
				0.95	
				0.81	
				1.62	
				1.76	
				4.75	
				1.09	
				-0.29	
				-0.83	
32 14 40 00-0011	SF		1" Thick, >216 SI Granite Paver Note: Includes 16" x 16", 12" x 24", 18" x 18", 24" x 24" and other similar size pavers. <i>For Cement/Sand Mix Or Polymeric Sand Joints, Add</i> <i>For 2" Granite Paver, Add</i> <i>For 3" Granite Paver, Add</i> <i>For 4" Granite Paver, Add</i> <i>For Up To 100, Add</i> <i>For >100 To 500, Add</i> <i>For >1,000 To 5,000, Deduct</i> <i>For >5,000, Deduct</i>	15.90	1.30
				0.92	
				0.80	
				1.59	
				1.72	
				4.62	
				1.05	
				-0.26	
				-0.79	
32 14 40 00-0012	SF		1" Thick, Granite Paver, Combinations And Patterns Note: Patterns made by combining pavers from two or more size groups. <i>For Cement/Sand Mix Or Polymeric Sand Joints, Add</i> <i>For 2" Granite Paver, Add</i> <i>For 3" Granite Paver, Add</i> <i>For 4" Granite Paver, Add</i> <i>For Up To 100, Add</i> <i>For >100 To 500, Add</i> <i>For >1,000 To 5,000, Deduct</i> <i>For >5,000, Deduct</i>	16.42	1.56
				0.98	
				0.82	
				1.64	
				1.80	
				4.88	
				1.13	
				-0.31	
				-0.87	

32 14 43 Porous Unit Paving (32 14)



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 14 43 00-0001 Turf Block <small>(32 14 43)</small> Note: Grass grid, open-cell unit paver, geoblock.		
32 14 43 00-0002 SF 3-1/8" Thick, Precast Concrete Turf Block	7.29	1.98
For Up To 100, Add	2.82	
For >100 To 500, Add	0.76	
For >1,000 To 5,000, Deduct	-0.40	
For >5,000, Deduct	-0.70	
32 14 43 00-0003 SF 4" Thick Recycled Polyvinyl Chloride (PVC) Plastic Turf Block	10.56	1.98
For Up To 100, Add	3.63	
For >100 To 500, Add	0.93	
For >1,000 To 5,000, Deduct	-0.40	
For >5,000, Deduct	-0.79	
32 15 Aggregate Surfacing <small>(32 15)</small>		
32 15 40 Crushed Stone Surfacing <small>(32 15)</small> Note: Includes delivery up to 15 miles from supplier, placement, rolling and compaction water. See CSI section 01 74 19 00-0034 for hauling greater than 15 miles.		
32 15 40 00-0001 Gravel Surfacing And Spreading <small>(32 15 40)</small> Note: Includes delivered material, placement, rolling and compaction water.		
32 15 40 00-0002 CY Gravel Surfacing And Spreading	81.64	
32 15 40 00-0003 Limestone Screenings <small>(32 15 40)</small> Note: Includes delivered material, placement, rolling and compaction water. For trail maintenance.		
32 15 40 00-0004 CY Limestone Screenings For Trail	52.30	
32 16 Curbs, Gutters, Sidewalks, And Driveways <small>(32 16)</small>		
32 16 13 Curbs And Gutters <small>(32 16)</small> Note: Includes transitions. Demolition Includes two saw cuts (each end) of curbs and gutters for lengths up to 100'. See CSI section 02 41 19 13-0049 for additional saw cuts within the 100'.		
32 16 13 13 Cast-In-Place Concrete Curbs And Gutters <small>(32 16 13)</small> Note: Includes concrete, forms, rebar, chairs (where necessary), expansion joints, finish and curing.		
32 16 13 13-0001 Concrete Curb, Cast In Place <small>(32 16 13 13)</small> Note: Includes delivered concrete, forms, rebar, chairs (where necessary), expansion joints, finish and curing.		
32 16 13 13-0002 LF 6" x 12" Cast In Place Concrete Curb (Type A1-6)	13.79	7.23
For Up To 20, Add	8.55	
For >20 To 50, Add	4.85	
For >50 To 100, Add	1.85	
For >500 To 1,000, Deduct	-1.85	
For >1,000, Deduct	-3.12	
32 16 13 13-0003 LF 6" x 12" Cast In Place Concrete Curb - Radius (Type A1-6)	15.82	8.32
For Up To 20, Add	9.85	
For >20 To 50, Add	5.60	
For >50 To 100, Add	2.13	
For >500 To 1,000, Deduct	-2.13	
For >1,000, Deduct	-3.59	
32 16 13 13-0004 LF 6" x 14" Cast In Place Concrete Curb (Type A1-8)	15.16	7.23
For Up To 20, Add	9.36	
For >20 To 50, Add	5.31	
For >50 To 100, Add	2.02	
For >500 To 1,000, Deduct	-2.02	
For >1,000, Deduct	-3.41	
32 16 13 13-0005 LF 6" x 14" Cast In Place Concrete Curb - Radius (Type A1-8)	17.40	8.32
For Up To 20, Add	10.80	
For >20 To 50, Add	6.13	
For >50 To 100, Add	2.33	
For >500 To 1,000, Deduct	-2.33	
For >1,000, Deduct	-3.94	
32 16 13 13-0006 LF 6" x 16" Cast In Place Concrete Curb	16.67	7.23
For Up To 20, Add	10.20	
For >20 To 50, Add	5.79	
For >50 To 100, Add	2.21	
For >500 To 1,000, Deduct	-2.21	
For >1,000, Deduct	-3.73	
32 16 13 13-0007 LF 6" x 16" Cast In Place Concrete Curb - Radius	19.09	10.85
For Up To 20, Add	11.77	
For >20 To 50, Add	6.68	
For >50 To 100, Add	2.55	
For >500 To 1,000, Deduct	-2.55	
For >1,000, Deduct	-4.30	
32 16 13 13-0008 LF 6" x 18" Cast In Place Concrete Curb	17.88	7.23
For Up To 20, Add	10.88	
For >20 To 50, Add	6.17	
For >50 To 100, Add	2.36	
For >500 To 1,000, Deduct	-2.36	
For >1,000, Deduct	-3.98	

32 Exterior Improvements**32 10 Bases, Ballasts, And Paving****32 16 Curbs, Gutters, Sidewalks, And Driveways**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 16 13 13-0009	LF		6" x 18" Cast In Place Concrete Curb - Radius.....	20.23	8.32
			<i>For Up To 20, Add</i>	12.36	
			<i>For >20 To 50, Add</i>	7.01	
			<i>For >50 To 100, Add</i>	2.67	
			<i>For >500 To 1,000, Deduct</i>	-2.67	
			<i>For >1,000, Deduct</i>	-4.52	
32 16 13 13-0010	LF		6" x 24" Cast In Place Concrete Curb	20.47	7.96
			<i>For Up To 20, Add</i>	12.13	
			<i>For >20 To 50, Add</i>	6.87	
			<i>For >50 To 100, Add</i>	2.63	
			<i>For >500 To 1,000, Deduct</i>	-2.63	
			<i>For >1,000, Deduct</i>	-4.46	
32 16 13 13-0011	LF		6" x 24" Cast In Place Concrete Curb - Radius.....	22.91	9.04
			<i>For Up To 20, Add</i>	13.62	
			<i>For >20 To 50, Add</i>	7.72	
			<i>For >50 To 100, Add</i>	2.95	
			<i>For >500 To 1,000, Deduct</i>	-2.95	
			<i>For >1,000, Deduct</i>	-5.00	
32 16 13 13-0012	LF		12" x 24" Cast In Place Concrete Curb	26.56	9.04
			<i>For Up To 20, Add</i>	14.35	
			<i>For >20 To 50, Add</i>	8.08	
			<i>For >50 To 100, Add</i>	3.14	
			<i>For >500 To 1,000, Deduct</i>	-3.14	
			<i>For >1,000, Deduct</i>	-5.37	
32 16 13 13-0013	LF		12" x 24" Cast In Place Concrete Curb - Radius.....	29.56	10.13
			<i>For Up To 20, Add</i>	16.03	
			<i>For >20 To 50, Add</i>	9.03	
			<i>For >50 To 100, Add</i>	3.50	
			<i>For >500 To 1,000, Deduct</i>	-3.50	
			<i>For >1,000, Deduct</i>	-5.99	
32 16 13 13-0014	EA		Additional Finish For Handicap Drop Section In Curb.....	54.24	
32 16 13 13-0015			Curb And Gutter Combined, Cast In Place <small>(32 16 13 13)</small>		
			Note: Includes concrete, forms, rebar, chairs (where necessary), transitions, expansion joints, finish and curing.		
32 16 13 13-0016	LF		6" x 12" Concrete Gutter With 6" Curb And Face - Straight	19.05	8.84
			<i>For Up To 20, Add</i>	12.98	
			<i>For >20 To 50, Add</i>	7.26	
			<i>For >50 To 100, Add</i>	2.86	
			<i>For >500 To 1,000, Deduct</i>	-2.50	
			<i>For >1,000, Deduct</i>	-4.23	
			<i>For Rolled Curb And Gutter</i>	1.35	
			<i>For Integral Colors, Add</i>	0.09	
			Note: Modifier quantity = task quantity x LB/CY color added.		
32 16 13 13-0017	LF		6" x 12" Concrete Gutter With 6" Curb And Face - Radius	20.79	11.78
			<i>For Up To 20, Add</i>	14.17	
			<i>For >20 To 50, Add</i>	7.93	
			<i>For >50 To 100, Add</i>	3.12	
			<i>For >500 To 1,000, Deduct</i>	-2.73	
			<i>For >1,000, Deduct</i>	-4.62	
			<i>For Rolled Curb And Gutter</i>	1.48	
			<i>For Integral Colors, Add</i>	0.09	
			Note: Modifier quantity = task quantity x LB/CY color added.		
32 16 13 13-0018	LF		6" x 18" Concrete Gutter With 6" Curb And Face - Straight	24.21	9.80
			<i>For Up To 20, Add</i>	16.48	
			<i>For >20 To 50, Add</i>	9.22	
			<i>For >50 To 100, Add</i>	3.63	
			<i>For >500 To 1,000, Deduct</i>	-3.16	
			<i>For >1,000, Deduct</i>	-5.35	
			<i>For Rolled Curb And Gutter</i>	1.69	
			<i>For Integral Colors, Add</i>	0.11	
			Note: Modifier quantity = task quantity x LB/CY color added.		
32 16 13 13-0019	LF		6" x 18" Concrete Gutter With 6" Curb And Face - Radius	26.78	10.91
			<i>For Up To 20, Add</i>	18.24	
			<i>For >20 To 50, Add</i>	10.21	
			<i>For >50 To 100, Add</i>	4.02	
			<i>For >500 To 1,000, Deduct</i>	-3.51	
			<i>For >1,000, Deduct</i>	-5.94	
			<i>For Rolled Curb And Gutter</i>	1.90	
			<i>For Integral Colors, Add</i>	0.12	
			Note: Modifier quantity = task quantity x LB/CY color added.		
32 16 13 13-0020	LF		6" x 24" Concrete Gutter With 6" Curb And Face - Straight (Type A3-6)	29.38	11.78
			<i>For Up To 20, Add</i>	19.99	
			<i>For >20 To 50, Add</i>	11.17	
			<i>For >50 To 100, Add</i>	4.41	
			<i>For >500 To 1,000, Deduct</i>	-3.83	
			<i>For >1,000, Deduct</i>	-6.47	
			<i>For Rolled Curb And Gutter</i>	2.04	
			<i>For Integral Colors, Add</i>	0.14	
			Note: Modifier quantity = task quantity x LB/CY color added.		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 16 13 13-0021 LF 6" x 24" Concrete Gutter With 6" Curb And Face - Radius (Type A3-6)	32.78	13.26
For Up To 20, Add	22.32	
For >20 To 50, Add	12.49	
For >50 To 100, Add	4.92	
For >500 To 1,000, Deduct	-4.29	
For >1,000, Deduct	-7.26	
For Rolled Curb And Gutter	2.31	
For Integral Colors, Add	0.15	
Note: Modifier quantity = task quantity x LB/CY color added.		
32 16 13 13-0022 LF 6" x 30" Concrete Gutter With 6" Curb And Face - Straight	34.94	13.99
For Up To 20, Add	23.76	
For >20 To 50, Add	13.28	
For >50 To 100, Add	5.24	
For >500 To 1,000, Deduct	-4.55	
For >1,000, Deduct	-7.69	
For Rolled Curb And Gutter	2.42	
For Integral Colors, Add	0.17	
Note: Modifier quantity = task quantity x LB/CY color added.		
32 16 13 13-0023 LF 6" x 30" Concrete Gutter With 6" Curb And Face - Radius	38.42	15.48
For Up To 20, Add	26.15	
For >20 To 50, Add	14.62	
For >50 To 100, Add	5.76	
For >500 To 1,000, Deduct	-5.02	
For >1,000, Deduct	-8.48	
For Rolled Curb And Gutter	2.68	
For Integral Colors, Add	0.18	
Note: Modifier quantity = task quantity x LB/CY color added.		
32 16 13 13-0024 LF 6" x 36" Concrete Gutter With 6" Curb And Face - Straight	40.47	16.21
For Up To 20, Add	27.52	
For >20 To 50, Add	15.38	
For >50 To 100, Add	6.07	
For >500 To 1,000, Deduct	-5.26	
For >1,000, Deduct	-8.91	
For Rolled Curb And Gutter	2.80	
For Integral Colors, Add	0.19	
Note: Modifier quantity = task quantity x LB/CY color added.		
32 16 13 13-0025 LF 6" x 36" Concrete Gutter With 6" Curb And Face - Radius	44.05	17.68
For Up To 20, Add	29.97	
For >20 To 50, Add	16.75	
For >50 To 100, Add	6.61	
For >500 To 1,000, Deduct	-5.74	
For >1,000, Deduct	-9.71	
For Rolled Curb And Gutter	3.06	
For Integral Colors, Add	0.21	
Note: Modifier quantity = task quantity x LB/CY color added.		
32 16 13 13-0026 LF 6" x 42" Concrete Gutter With 6" Curb And Face - Straight	46.01	18.42
For Up To 20, Add	31.29	
For >20 To 50, Add	17.49	
For >50 To 100, Add	6.90	
For >500 To 1,000, Deduct	-5.98	
For >1,000, Deduct	-10.13	
For Rolled Curb And Gutter	3.18	
For Integral Colors, Add	0.22	
Note: Modifier quantity = task quantity x LB/CY color added.		
32 16 13 13-0027 LF 6" x 42" Concrete Gutter With 6" Curb And Face - Radius	51.15	20.63
For Up To 20, Add	34.82	
For >20 To 50, Add	19.47	
For >50 To 100, Add	7.67	
For >500 To 1,000, Deduct	-6.68	
For >1,000, Deduct	-11.30	
For Rolled Curb And Gutter	3.58	
For Integral Colors, Add	0.24	
Note: Modifier quantity = task quantity x LB/CY color added.		

32 16 13 14 Machine Formed, Slip Form Curbs (32 16 13)

Note: Includes delivered concrete, steel, expansion joints and finish.

32 16 13 14-0001 Curbs, Machine Formed, Slip Form (32 16 13 14)

Note: Includes delivered concrete, steel, expansion joints and finish.

32 16 13 14-0002 JOB Machine Formed Curb Minimum Set-Up Charge.....	1,106.42
Note: For projects where the total curbing charge is less than the minimum set-up charge, use this task exclusively. This task shall not be used in conjunction with any other tasks in this section.	
32 16 13 14-0003 LF 6" x 12" Straight Curb, Machine Formed.....	8.67
32 16 13 14-0004 LF 6" x 12" Curved Curb, Machine Formed	11.97
32 16 13 14-0005 LF 6" x 18" Straight Curb, Machine Formed.....	11.42
32 16 13 14-0006 LF 6" x 18" Curved Curb, Machine Formed	15.36

32 16 13 16 Steel Faced Curbs (32 16 13)

Note: Fabrication includes handicap and other curb access cuts.

32 16 13 16-0001 Sidewalk/Curb Facing (32 16 13 16)

Note: Fabrication includes handicap and other curb access cuts.

32 16 13 16-0002 LF 3" Steel Sidewalk/Curb Facing, With Steel Anchor, 12" On Center	14.00	4.23
For Curved Section, Add	2.98	

32	Exterior Improvements
32 10	Bases, Ballasts, And Paving
32 16	Curbs, Gutters, Sidewalks, And Driveways



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 16 13 16-0003 LF 4" Steel Sidewalk/Curb Facing, With Steel Anchor, 12" On Center	15.37	4.79
For Curved Section, Add	3.34	
32 16 13 16-0004 LF 6" Steel Sidewalk/Curb Facing, With Steel Anchor, 12" On Center	20.88	5.37
For Curved Section, Add	4.11	
32 16 13 16-0005 LF 8" Steel Sidewalk/Curb Facing, With Steel Anchor, 12" On Center	25.73	6.04
For Curved Section, Add	4.83	
32 16 13 16-0006 LF 10" Steel Sidewalk/Curb Facing, With Steel Anchor, 12" On Center	31.58	6.62
For Curved Section, Add	5.63	
32 16 13 16-0007 LF 12" Steel Sidewalk/Curb Facing, With Steel Anchor, 12" On Center	41.34	8.44
For Curved Section, Add	7.28	
32 16 13 16-0008 LF 13" Steel Sidewalk/Curb Facing, With Steel Anchor, 12" On Center	47.48	10.94
For Curved Section, Add	8.83	
32 16 13 16-0009 EA Sidewalk/Curb Steel Facing, Pedestrian Ramps, Two Drops Per Section.....	150.26	

32 16 13 19 Cast-In-Place Concrete Drainage Ditches (32 16 13 19)

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 16 13 19-0001 Valley Gutter, Cast In Place (32 16 13 19) Note: Includes concrete, forms, rebar, expansion joints, finish and curing.		
32 16 13 19-0002 LF 2' Wide Valley Gutter, 6" Thick.....	20.40	
For Up To 20, Add	10.73	
For >20 To 50, Add	6.03	
For >50 To 100, Add	2.35	
For >500 To 1,000, Deduct	-2.35	
For >1,000, Deduct	-4.03	
32 16 13 19-0003 LF 2-1/2' Wide Valley Gutter, 6" Thick	24.89	
For Up To 20, Add	12.98	
For >20 To 50, Add	7.29	
For >50 To 100, Add	2.85	
For >500 To 1,000, Deduct	-2.85	
For >1,000, Deduct	-4.89	
32 16 13 19-0004 LF 3' Wide Valley Gutter, 6" Thick.....	29.32	
For Up To 20, Add	15.19	
For >20 To 50, Add	8.53	
For >50 To 100, Add	3.33	
For >500 To 1,000, Deduct	-3.33	
For >1,000, Deduct	-5.73	
32 16 13 19-0005 LF 3-1/2' Wide Valley Gutter, 6" Thick	33.73	
For Up To 20, Add	17.39	
For >20 To 50, Add	9.76	
For >50 To 100, Add	3.82	
For >500 To 1,000, Deduct	-3.82	
For >1,000, Deduct	-6.57	
32 16 13 19-0006 LF 4' Wide Valley Gutter, 6" Thick.....	38.15	
For Up To 20, Add	19.60	
For >20 To 50, Add	11.00	
For >50 To 100, Add	4.30	
For >500 To 1,000, Deduct	-4.30	
For >1,000, Deduct	-7.41	
32 16 13 19-0007 LF 5' Wide Valley Gutter, 6" Thick.....	44.69	
For Up To 20, Add	22.40	
For >20 To 50, Add	12.55	
For >50 To 100, Add	4.93	
For >500 To 1,000, Deduct	-4.93	
For >1,000, Deduct	-8.51	
32 16 13 19-0008 LF 6' Wide Valley Gutter, 6" Thick.....	50.88	
For Up To 20, Add	24.96	
For >20 To 50, Add	13.96	
For >50 To 100, Add	5.50	
For >500 To 1,000, Deduct	-5.50	
For >1,000, Deduct	-9.52	
32 16 13 19-0009 SF >6' Wide Valley Gutter, 6" Thick	8.47	
For Up To 100, Add	4.15	
For >100 To 250, Add	2.32	
For >250 To 500, Add	0.92	
For >2,500 To 5,000, Deduct	-0.92	
For >5,000, Deduct	-1.59	
32 16 13 19-0010 LF 2' Wide Valley Gutter, 7" Thick.....	22.19	
For Up To 20, Add	11.44	
For >20 To 50, Add	6.42	
For >50 To 100, Add	2.51	
For >500 To 1,000, Deduct	-2.51	
For >1,000, Deduct	-4.32	
32 16 13 19-0011 LF 2-1/2' Wide Valley Gutter, 7" Thick	27.32	
For Up To 20, Add	14.01	
For >20 To 50, Add	7.86	
For >50 To 100, Add	3.08	
For >500 To 1,000, Deduct	-3.08	
For >1,000, Deduct	-5.30	
32 16 13 19-0012 LF 3' Wide Valley Gutter, 7" Thick.....	31.95	
For Up To 20, Add	16.24	
For >20 To 50, Add	9.10	
For >50 To 100, Add	3.57	
For >500 To 1,000, Deduct	-3.57	
For >1,000, Deduct	-6.15	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 16 13 19-0013 LF 3-1/2' Wide Valley Gutter, 7" Thick	36.79	
<i>For Up To 20, Add</i>	18.60	
<i>For >20 To 50, Add</i>	10.42	
<i>For >50 To 100, Add</i>	4.09	
<i>For >500 To 1,000, Deduct</i>	-4.09	
<i>For >1,000, Deduct</i>	-7.05	
32 16 13 19-0014 LF 4' Wide Valley Gutter, 7" Thick	41.61	
<i>For Up To 20, Add</i>	20.95	
<i>For >20 To 50, Add</i>	11.74	
<i>For >50 To 100, Add</i>	4.61	
<i>For >500 To 1,000, Deduct</i>	-4.61	
<i>For >1,000, Deduct</i>	-7.95	
32 16 13 19-0015 LF 5' Wide Valley Gutter, 7" Thick	48.86	
<i>For Up To 20, Add</i>	23.98	
<i>For >20 To 50, Add</i>	13.41	
<i>For >50 To 100, Add</i>	5.29	
<i>For >500 To 1,000, Deduct</i>	-5.29	
<i>For >1,000, Deduct</i>	-9.15	
32 16 13 19-0016 LF 6' Wide Valley Gutter, 7" Thick	55.74	
<i>For Up To 20, Add</i>	26.75	
<i>For >20 To 50, Add</i>	14.94	
<i>For >50 To 100, Add</i>	5.91	
<i>For >500 To 1,000, Deduct</i>	-5.91	
<i>For >1,000, Deduct</i>	-10.26	
32 16 13 19-0017 SF >6' Wide Valley Gutter, 7" Thick	9.29	
<i>For Up To 100, Add</i>	4.46	
<i>For >100 To 250, Add</i>	2.49	
<i>For >250 To 500, Add</i>	0.98	
<i>For >2,500 To 5,000, Deduct</i>	-0.98	
<i>For >5,000, Deduct</i>	-1.71	
32 16 13 19-0018 LF 2' Wide Valley Gutter, 8" Thick	22.60	
<i>For Up To 20, Add</i>	11.90	
<i>For >20 To 50, Add</i>	6.69	
<i>For >50 To 100, Add</i>	2.61	
<i>For >500 To 1,000, Deduct</i>	-2.61	
<i>For >1,000, Deduct</i>	-4.47	
32 16 13 19-0019 LF 2-1/2' Wide Valley Gutter, 8" Thick	27.60	
<i>For Up To 20, Add</i>	14.42	
<i>For >20 To 50, Add</i>	8.10	
<i>For >50 To 100, Add</i>	3.16	
<i>For >500 To 1,000, Deduct</i>	-3.16	
<i>For >1,000, Deduct</i>	-5.43	
32 16 13 19-0020 LF 3' Wide Valley Gutter, 8" Thick	32.50	
<i>For Up To 20, Add</i>	16.86	
<i>For >20 To 50, Add</i>	9.47	
<i>For >50 To 100, Add</i>	3.70	
<i>For >500 To 1,000, Deduct</i>	-3.70	
<i>For >1,000, Deduct</i>	-6.36	
32 16 13 19-0021 LF 3-1/2' Wide Valley Gutter, 8" Thick	37.39	
<i>For Up To 20, Add</i>	19.30	
<i>For >20 To 50, Add</i>	10.83	
<i>For >50 To 100, Add</i>	4.23	
<i>For >500 To 1,000, Deduct</i>	-4.23	
<i>For >1,000, Deduct</i>	-7.29	
32 16 13 19-0022 LF 4' Wide Valley Gutter, 8" Thick	42.29	
<i>For Up To 20, Add</i>	21.75	
<i>For >20 To 50, Add</i>	12.21	
<i>For >50 To 100, Add</i>	4.77	
<i>For >500 To 1,000, Deduct</i>	-4.77	
<i>For >1,000, Deduct</i>	-8.22	
32 16 13 19-0023 LF 5' Wide Valley Gutter, 8" Thick	49.54	
32 16 13 19-0024 LF 6' Wide Valley Gutter, 8" Thick	56.41	
32 16 13 19-0025 SF >6' Wide Valley Gutter, 8" Thick	9.40	
<i>For Up To 100, Add</i>	4.62	
<i>For >100 To 250, Add</i>	2.58	
<i>For >250 To 500, Add</i>	1.02	
<i>For >2,500 To 5,000, Deduct</i>	-1.02	
<i>For >5,000, Deduct</i>	-1.76	

32 16 13 23 Precast Concrete Curbs And Gutters (32 16 13)

32 16 13 23-0001 Precast Concrete Curb (32 16 13 23)		
32 16 13 23-0002 LF 6" X 18" Precast Concrete Curb	31.26	8.07
32 16 13 23-0003 LF 6" X 18" Precast Concrete Curb, Radius	37.08	9.28

32 16 13 33 Asphalt Curbs (32 16 13)

32 16 13 33-0001 Asphalt Curbs (32 16 13 33)		
32 16 13 33-0002 LF 6" Wide x 6" High Asphalt Curb 64 LF/TON, Bituminous, Plain	10.67	4.32
32 16 13 33-0003 LF 8" Wide x 6" High Asphalt Curb 50 LF/TON, Bituminous, Plain	12.02	4.79
32 16 13 33-0004 LF 8" Wide x 8" High Asphalt Curb 44 LF/TON, Bituminous, Plain	13.26	5.28

32 Exterior Improvements**32 10 Bases, Ballasts, And Paving****32 16 Curbs, Gutters, Sidewalks, And Driveways**MINOR
CSI UOM DESCRIPTIONTOTAL DIRECT DEMOLITION
UNIT COST UNIT COST**32 16 13 43 Stone Curbs** (32 16 13)**32 16 13 43-0001 Remove And Reset Stone And Precast Curbing** (32 16 13 43)

Note: Includes storage and cleaning.

32 16 13 43-0002	LF	Remove And Reset Stone Or Precast Curbing	25.00
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Note: Includes storage and cleaning.

32 16 23 Sidewalks (32 16)**32 16 23 00-0001 Cast In Place Concrete Sidewalk** (32 16 23)

Note: Includes finish grading, delivered concrete (up to 3500 PSI) by chute, formwork, 1/4" radius joints and edges, polyethylene sheeting, control joints, expansion joints, screed, broom finish, and curing. Excludes excavation, base, base compaction and welded wire reinforcement. For bar or fiber reinforcing, add bar or fiber reinforcing tasks. See CSI section 03 31 13 00-0088 for pumping with boom truck, 03 31 13 00-0098 for buggies, 03 31 13 00-0105 for short loads, 32 11 23 16-0001 for base course.

32 16 23 00-0002	SF	4" Cast In Place Concrete Sidewalk	6.68
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		For Up To 100, Add	2.91
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		For >100 To 500, Add	0.83
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		For >1,000 To 5,000, Deduct	-0.50
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		For >5,000, Deduct	-1.08
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		For Welded Wire Reinforcement, Add	0.53
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32 16 23 00-0003	SF	5" Cast In Place Concrete Sidewalk	7.24
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		For Up To 100, Add	3.10
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		For >100 To 500, Add	0.88
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		For >1,000 To 5,000, Deduct	-0.51
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		For >5,000, Deduct	-1.13
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		For Welded Wire Reinforcement, Add	0.55
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32 16 23 00-0004	SF	6" Cast In Place Concrete Sidewalk	7.80
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		For Up To 100, Add	3.28
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		For >100 To 500, Add	0.92
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		For >1,000 To 5,000, Deduct	-0.53
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		For >5,000, Deduct	-1.19
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		For Welded Wire Reinforcement, Add	0.56
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32 16 23 00-0005	SF	7" Cast In Place Concrete Sidewalk	9.07
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		For Up To 100, Add	3.78
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		For >100 To 500, Add	1.06
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		For >1,000 To 5,000, Deduct	-0.60
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		For >5,000, Deduct	-1.36
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		For Welded Wire Reinforcement, Add	0.61
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32 16 23 00-0006	SF	8" Cast In Place Concrete Sidewalk	9.55
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		For Up To 100, Add	3.92
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		For >100 To 500, Add	1.09
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		For >1,000 To 5,000, Deduct	-0.61
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		For >5,000, Deduct	-1.40
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		For Welded Wire Reinforcement, Add	0.62
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32 16 23 00-0007	SF	For Exposed Aggregate Finish In Sidewalk	1.77
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32 16 23 00-0008	EA	Finish Concrete Handicap Drop Section In Sidewalk	105.98
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Note: Excludes patterned (tactile) finish.

32 16 23 00-0009 Bituminous Sidewalk (32 16 23)

Note: Includes finish grading, delivered asphalt, formwork, control joints, expansion joints, and compaction. Excludes excavation, base, and base compaction. See CSI section 32 11 23 16-0001 for base course.

32 16 23 00-0010	SY	1" Bituminous Sidewalk	7.95
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		For Up To 100, Add	2.94
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		For >100 To 500, Add	0.78
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		For >1,000 To 5,000, Deduct	-0.38
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		For >5,000, Deduct	-0.78
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32 16 23 00-0011	SY	1-1/2" Bituminous Sidewalk	10.00
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		For Up To 100, Add	3.65
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		For >100 To 500, Add	0.96
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		For >1,000 To 5,000, Deduct	-0.46
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		For >5,000, Deduct	-0.96
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32 16 23 00-0012	SY	2" Bituminous Sidewalk	13.93
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		For Up To 100, Add	4.91
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		For >100 To 500, Add	1.27
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		For >1,000 To 5,000, Deduct	-0.57
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		For >5,000, Deduct	-1.27
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32 16 23 00-0013	SY	2-1/2" Bituminous Sidewalk	17.42
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		For Up To 100, Add	6.12
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		For >100 To 500, Add	1.58
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		For >1,000 To 5,000, Deduct	-0.71
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		For >5,000, Deduct	-1.58
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32 16 23 00-0014	SY	3" Bituminous Sidewalk	20.08
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		For Up To 100, Add	6.93
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		For >100 To 500, Add	1.77
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		For >1,000 To 5,000, Deduct	-0.77
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		For >5,000, Deduct	-1.77
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32 16 23 00-0015	SY	3-1/2" Bituminous Sidewalk	23.23
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		For Up To 100, Add	7.91
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		For >100 To 500, Add	2.00
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		For >1,000 To 5,000, Deduct	-0.84
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		For >5,000, Deduct	-2.00
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MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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32 16 43 Asphalt Dike (32 16)**32 16 43 00-0001 Asphalt Dike** (32 16 43)

32 16 43 00-0002	LF	Type A, Asphalt Dike, 11" Base, 5" Top, 6" Height.....	9.14
32 16 43 00-0003	LF	Type B, Asphalt Dike, 13" Base, 5" Top, 8" Height.....	12.27
32 16 43 00-0004	LF	Type C-6, Asphalt Dike, 18" Base, 6" Top, 6" Height.....	12.27
32 16 43 00-0005	LF	Type C-8, Asphalt Dike, 22" Base, 6" Top, 8" Height.....	17.16
32 16 43 00-0006	LF	Type C-9, Asphalt Dike, 24" Base, 6" Top, 9" Height.....	20.23
32 16 43 00-0007	LF	Type D, Asphalt Dike, 8" Base, 4" Top, 2" Height.....	5.39
32 16 43 00-0008	LF	Type E, Mountable Asphalt Dike, 16" Base, 12" Top, 2" Height Front, 6" Height Back.....	12.58
32 16 43 00-0009	LF	Type F, Mountable Asphalt Dike, 26" Base, 20" Top, 2" Height Front, 8" Height Back.....	19.46
32 16 43 00-0010	LF	CALTRAN Type A, Asphalt Dike, 11" Base, 5" Top, 6" Height.....	9.14
32 16 43 00-0011	LF	CALTRAN Type C, Asphalt Dike, 8" Base, 4" Top, 2" Height.....	5.39
32 16 43 00-0012	LF	CALTRAN Type D, Mountable Asphalt Dike, 26" Base, 20" Top, 2" Height Front, 8" Height Back.....	19.46
32 16 43 00-0013	LF	CALTRAN Type E, Mountable Asphalt Dike, 16" Base, 12" Top, 2" Height Front, 6" Height Back.....	12.58
32 16 43 00-0014	LF	CALTRAN Type F, Asphalt Dike, 8" Base, 4" Top, 4" Height.....	7.77

32 17 Paving Specialties (32 10)**32 17 13 Parking Bumpers** (32 17)

Note: Includes dowels set.

32 17 13 16 Plastic Parking Bumpers (32 17 13)

32 17 13 16-0001	EA	4" x 6" x 4' Wheel Stop, Recycled Plastic.....	57.71	6.08
32 17 13 16-0002	EA	4" x 6" x 6' Wheel Stop, Recycled Plastic.....	64.27	6.08

32 17 13 19 Precast Concrete Parking Bumpers (32 17 13)

32 17 13 19-0001	LF	12" x 6" Precast Concrete Barrier With Dowels.....	38.60	1.47
32 17 13 19-0002	EA	6" x 8" x 4' Precast Concrete Wheel Stop.....	36.98	18.29
32 17 13 19-0003	EA	6" x 6" x 6' Precast Concrete Wheel Stop.....	42.47	18.29
32 17 13 19-0004	EA	6" x 8" x 6' Precast Concrete Wheel Stop.....	43.16	18.29
32 17 13 19-0005	EA	6" x 10" x 6' Precast Concrete Wheel Stop.....	44.60	18.29
32 17 13 19-0006	EA	8" x 4-1/2" x 6' Precast Concrete Wheel Stop.....	42.47	18.29
32 17 13 19-0007	EA	8" x 13" x 6' Precast Concrete Wheel Stop.....	50.38	18.29

32 17 13 23 Rubber Parking Bumpers (32 17 13)

32 17 13 23-0001	EA	3' Rubber Bumper Wheel Stop.....	27.26	6.08
32 17 13 23-0002	EA	4' Rubber Bumper Wheel Stop.....	31.94	6.08
32 17 13 23-0003	EA	5' Rubber Bumper Wheel Stop.....	33.81	6.08
32 17 13 23-0004	EA	6' Rubber Bumper Wheel Stop.....	36.62	6.08

32 17 13 26 Wood Parking Bumpers (32 17 13)

32 17 13 26-0001	LF	4" x 4" Timber Barrier With Saddles For Cars, Pressure Treated.....	8.18	1.47
32 17 13 26-0002	LF	6" x 6" Timber Barriers With Saddle For Trucks, Pressure Treated.....	10.51	1.47

32 17 13 33 Remove And Relocate Stops (32 17 13)

32 17 13 33-0001	EA	Remove And Relocate Precast Concrete Wheel Stop.....	29.26	
32 17 13 33-0002	EA	Remove And Relocate Plastic Or Wood Wheel Stop.....	19.02	

32 17 16 Speed Bumps (32 17)**32 17 16 00-0001 Modular Rubber Speed Tables** (32 17 16)

Note: 3" high flat topped speed humps, 18" x 42" modular rubber construction. Trafficlogix.

32 17 16 00-0002	SF	Up To 24' Road Width x 7' Run Modular Rubber Speed Table.....	36.60	
		Note: Includes drilling in pavement, lag bolts and 3" x 18" x 42" compression molded recycled synthetic and natural rubber composite modular panels.		
32 17 16 00-0003	SF	Up To 24' Road Width x 14' Run Modular Rubber Speed Table.....	31.97	
		Note: Includes drilling in pavement, lag bolts and 3" x 18" x 42" compression molded recycled synthetic and natural rubber composite modular panels.		
32 17 16 00-0004	SF	Up To 24' Road Width x 21' Run Modular Rubber Speed Table.....	29.95	
		Note: Includes drilling in pavement, lag bolts and 3" x 18" x 42" compression molded recycled synthetic and natural rubber composite modular panels.		
32 17 16 00-0005	SF	>24' To 30' Road Width x 7' Run Modular Rubber Speed Table.....	35.00	
		Note: Includes drilling in pavement, lag bolts and 3" x 18" x 42" compression molded recycled synthetic and natural rubber composite modular panels.		
32 17 16 00-0006	SF	>24' To 30' Road Width x 14' Run Modular Rubber Speed Table.....	30.74	
		Note: Includes drilling in pavement, lag bolts and 3" x 18" x 42" compression molded recycled synthetic and natural rubber composite modular panels.		
32 17 16 00-0007	SF	>24' To 30' Road Width x 21' Run Modular Rubber Speed Table.....	28.96	
		Note: Includes drilling in pavement, lag bolts and 3" x 18" x 42" compression molded recycled synthetic and natural rubber composite modular panels.		
32 17 16 00-0008	SF	>30' To 40' Road Width x 7' Run Modular Rubber Speed Table.....	33.41	
		Note: Includes drilling in pavement, lag bolts and 3" x 18" x 42" compression molded recycled synthetic and natural rubber composite modular panels.		

32 Exterior Improvements
32 10 Bases, Ballasts, And Paving
32 17 Paving Specialties



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 17 16 00-0009	SF		>30' To 40' Road Width x 14' Run Modular Rubber Speed Table..... Note: Includes drilling in pavement, lag bolts and 3" x 18" x 42" compression molded recycled synthetic and natural rubber composite modular panels.	29.79	
32 17 16 00-0010	SF		>30' To 40' Road Width x 21' Run Modular Rubber Speed Table..... Note: Includes drilling in pavement, lag bolts and 3" x 18" x 42" compression molded recycled synthetic and natural rubber composite modular panels.	28.12	
32 17 16 00-0011			Asphalt Speed Table <small>(32 17 16)</small> Note: Excludes pavement markings or reflectors.		
32 17 16 00-0012	LF		Up to 36" Wide Asphalt Speed Table With 3" Center Crown Note: Tapered on edges to roadway.	30.08	
32 17 16 00-0013	LF		>36" To 48" Wide Asphalt Speed Table With 3" Center Crown Note: Tapered on edges to roadway.	35.51	
32 17 16 00-0014	LF		Up to 36" Wide Asphalt Speed Table With 4" Center Crown Note: Tapered on edges to roadway.	37.80	
32 17 16 00-0015	LF		>36" To 48" Wide Asphalt Speed Table With 4" Center Crown Note: Tapered on edges to roadway.	44.67	
32 17 16 00-0016	LF		Up to 36" Wide Asphalt Speed Table With 6" Center Crown Note: Tapered on edges to roadway.	46.14	
32 17 16 00-0017	LF		>36" To 48" Wide Asphalt Speed Table With 6" Center Crown Note: Tapered on edges to roadway.	51.57	
32 17 16 00-0018			Speed Bumps <small>(32 17 16)</small> Note: Excludes pavement markings or reflectors.		
32 17 16 00-0019	LF		2-1/4" High x 10-1/2" Wide, Asphalt Speed Bump	30.35	1.36
32 17 16 00-0020	LF		12" x 2-1/4" Recycled Rubber Speed Bump	26.08	0.91
32 17 16 00-0021	LF		12" x 2-5/8" Recycled Plastic Speed Bump	35.91	0.91
32 17 23			Pavement Markings <small>(32 17)</small>		
32 17 23 13			Painted Pavement Markings <small>(32 17 23)</small>		
32 17 23 13-0001			Pavement Striping, Letters, Symbols And Markers For Roads <small>(32 17 23 13)</small> Note: Includes primers, adhesive and glass beads where required. For broken line modifier quantity use total lane length.		
32 17 23 13-0002			Epoxy Reflective Pavement Marking <small>(32 17 23 13-0001)</small> Note: 15 mil thickness.		
32 17 23 13-0003	LF		Single 4" Wide Solid Line, Epoxy Reflective Pavement Striping..... <i>For 20 Mil Thickness, Add</i> <i>For Up To 1 Mile, Add</i> <i>For >5 Miles, Deduct</i> <i>For Broken Line, Deduct</i>	0.38 0.11 0.08 -0.06 -0.17	
32 17 23 13-0004	LF		Single 6" Wide Solid Line, Epoxy Reflective Pavement Striping..... <i>For 20 Mil Thickness, Add</i> <i>For Up To 1 Mile, Add</i> <i>For >5 Miles, Deduct</i> <i>For Broken Line, Deduct</i>	0.52 0.15 0.10 -0.08 -0.26	
32 17 23 13-0005	LF		Single 8" Wide Solid Line, Epoxy Reflective Pavement Striping..... <i>For 20 Mil Thickness, Add</i> <i>For Up To 1 Mile, Add</i> <i>For >5 Miles, Deduct</i> <i>For Broken Line, Deduct</i>	0.64 0.19 0.13 -0.10 -0.31	
32 17 23 13-0006	LF		Single 12" Wide Solid Line, Epoxy Reflective Pavement Striping..... <i>For 20 Mil Thickness, Add</i> <i>For Up To 1 Mile, Add</i> <i>For >5 Miles, Deduct</i> <i>For Broken Line, Deduct</i>	0.97 0.29 0.19 -0.15 -0.50	
32 17 23 13-0007	LF		Double 4" Wide Solid Lines, Epoxy Reflective Pavement Striping..... <i>For 20 Mil Thickness, Add</i> <i>For Up To 1 Mile, Add</i> <i>For >5 Miles, Deduct</i> <i>For Broken Line On One Side, Deduct</i> <i>For Double Broken Line, Deduct</i>	0.60 0.18 0.12 -0.09 -0.17 -0.34	
32 17 23 13-0008	LF		Double 6" Wide Solid Lines, Epoxy Reflective Pavement Striping..... <i>For 20 Mil Thickness, Add</i> <i>For Up To 1 Mile, Add</i> <i>For >5 Miles, Deduct</i> <i>For Broken Line On One Side, Deduct</i> <i>For Double Broken Line, Deduct</i>	0.85 0.26 0.17 -0.13 -0.25 -0.50	
32 17 23 13-0009	EA		6" High, Letter/Number, Epoxy Reflective Pavement Marking..... <i>For 20 Mil Thickness, Add</i> <i>For <10, Add</i> <i>For >50 To 100, Deduct</i> <i>For >100 To 200, Deduct</i> <i>For >200, Deduct</i>	2.77 0.29 0.34 -0.17 -0.23 -0.46	
32 17 23 13-0010	EA		12" High, Letter/Number, Epoxy Reflective Pavement Marking..... <i>For 20 Mil Thickness, Add</i> <i>For <10, Add</i> <i>For >50 To 100, Deduct</i> <i>For >100 To 200, Deduct</i> <i>For >200, Deduct</i>	5.20 0.78 0.52 -0.26 -0.35 -0.69	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 17 23 13-0011 EA 24" High, Letter/Number, Epoxy Reflective Pavement Marking.....	8.80	
<i>For 20 Mil Thickness, Add</i>	1.35	
<i>For <10, Add</i>	0.86	
<i>For >50 To 100, Deduct</i>	-0.43	
<i>For >100 To 200, Deduct</i>	-0.57	
<i>For >200, Deduct</i>	-1.15	
32 17 23 13-0012 EA 36" High, Letter/Number, Epoxy Reflective Pavement Marking.....	16.86	
<i>For 20 Mil Thickness, Add</i>	2.45	
<i>For <10, Add</i>	1.72	
<i>For >50 To 100, Deduct</i>	-0.86	
<i>For >100 To 200, Deduct</i>	-1.15	
<i>For >200, Deduct</i>	-2.30	
32 17 23 13-0013 EA 48" High, Letter/Number, Epoxy Reflective Pavement Marking.....	19.86	
<i>For 20 Mil Thickness, Add</i>	3.06	
<i>For <10, Add</i>	1.93	
<i>For >50 To 100, Deduct</i>	-0.97	
<i>For >100 To 200, Deduct</i>	-1.29	
<i>For >200, Deduct</i>	-2.57	
32 17 23 13-0014 EA 72" High, Letter/Number, Epoxy Reflective Pavement Marking.....	35.66	
<i>For 20 Mil Thickness, Add</i>	5.56	
<i>For <10, Add</i>	3.43	
<i>For >50 To 100, Deduct</i>	-1.72	
<i>For >100 To 200, Deduct</i>	-2.29	
<i>For >200, Deduct</i>	-4.58	
32 17 23 13-0015 EA 96" High, Letter/Number, Epoxy Reflective Pavement Marking.....	47.55	
<i>For 20 Mil Thickness, Add</i>	7.35	
<i>For <10, Add</i>	4.61	
<i>For >50 To 100, Deduct</i>	-2.31	
<i>For >100 To 200, Deduct</i>	-3.07	
<i>For >200, Deduct</i>	-6.15	
32 17 23 13-0016 EA 120" High, Letter/Number, Epoxy Reflective Pavement Marking.....	75.60	
<i>For 20 Mil Thickness, Add</i>	14.67	
<i>For <10, Add</i>	5.71	
<i>For >50 To 100, Deduct</i>	-2.86	
<i>For >100 To 200, Deduct</i>	-3.81	
<i>For >200, Deduct</i>	-7.62	
32 17 23 13-0017 SF Letter/Number, Epoxy Reflective Pavement Marking.....	4.66	
<i>For 20 Mil Thickness, Add</i>	0.60	
32 17 23 13-0018 SF Symbols, Epoxy Reflective Pavement Marking.....	5.83	
<i>Note: Handicap, railroad, diamond, arrows, etc.</i>		
<i>For 20 Mil Thickness, Add</i>	0.67	
32 17 23 13-0019 Painted Reflective Pavement Marking (32 17 23 13-0001)		
<i>Note: 15 mil thickness.</i>		
32 17 23 13-0020 LF Single 4" Wide Solid Line, Painted Reflective Pavement Striping.....	0.20	
<i>For Up To 1 Mile, Add</i>	0.04	
<i>For >5 Miles, Deduct</i>	-0.03	
<i>For Broken Line, Deduct</i>	-0.04	
32 17 23 13-0021 LF Single 6" Wide Solid Line, Painted Reflective Pavement Striping.....	0.25	
<i>For Up To 1 Mile, Add</i>	0.05	
<i>For >5 Miles, Deduct</i>	-0.04	
<i>For Broken Line, Deduct</i>	-0.05	
32 17 23 13-0022 LF Single 8" Wide Solid Line, Painted Reflective Pavement Striping.....	0.32	
<i>For Up To 1 Mile, Add</i>	0.06	
<i>For >5 Miles, Deduct</i>	-0.05	
<i>For Broken Line, Deduct</i>	-0.07	
32 17 23 13-0023 LF Single 12" Wide Solid Line, Painted Reflective Pavement Striping.....	0.43	
<i>For Up To 1 Mile, Add</i>	0.09	
<i>For >5 Miles, Deduct</i>	-0.06	
<i>For Broken Line, Deduct</i>	-0.10	
32 17 23 13-0024 LF Double 4" Wide Solid Lines, Painted Reflective Pavement Striping.....	0.29	
<i>For Up To 1 Mile, Add</i>	0.06	
<i>For >5 Miles, Deduct</i>	-0.04	
<i>For Broken Line On One Side, Deduct</i>	-0.03	
<i>For Double Broken Line, Deduct</i>	-0.07	
32 17 23 13-0025 LF Double 6" Wide Solid Lines, Painted Reflective Pavement Striping.....	0.43	
<i>For Up To 1 Mile, Add</i>	0.09	
<i>For >5 Miles, Deduct</i>	-0.06	
<i>For Broken Line On One Side, Deduct</i>	-0.05	
<i>For Double Broken Line, Deduct</i>	-0.10	
32 17 23 13-0026 SF Solid Area, Painted Reflective Pavement Striping.....	3.47	
<i>Note: Use task for lines >12" wide, stop bars, transverse lines, diagonal lines, crossing lanes, etc.</i>		
32 17 23 13-0027 EA 6" High, Letter/Number, Painted Reflective Pavement Marking.....	2.56	
<i>For <10, Add</i>	0.34	
<i>For >50 To 100, Deduct</i>	-0.17	
<i>For >100 To 200, Deduct</i>	-0.23	
<i>For >200, Deduct</i>	-0.46	
32 17 23 13-0028 EA 12" High, Letter/Number, Painted Reflective Pavement Marking.....	4.42	
<i>For <10, Add</i>	0.52	
<i>For >50 To 100, Deduct</i>	-0.26	
<i>For >100 To 200, Deduct</i>	-0.35	
<i>For >200, Deduct</i>	-0.69	

32	Exterior Improvements
32 10	Bases, Ballasts, And Paving
32 17	Paving Specialties



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 17 23 13-0029	EA		24" High, Letter/Number, Painted Reflective Pavement Marking.....	7.43	
			<i>For <10, Add</i>	0.86	
			<i>For >50 To 100, Deduct</i>	-0.43	
			<i>For >100 To 200, Deduct</i>	-0.57	
			<i>For >200, Deduct</i>	-1.15	
32 17 23 13-0030	EA		36" High, Letter/Number, Painted Reflective Pavement Marking.....	14.45	
			<i>For <10, Add</i>	1.72	
			<i>For >50 To 100, Deduct</i>	-0.86	
			<i>For >100 To 200, Deduct</i>	-1.15	
			<i>For >200, Deduct</i>	-2.30	
32 17 23 13-0031	EA		48" High, Letter/Number, Painted Reflective Pavement Marking.....	16.73	
			<i>For <10, Add</i>	1.93	
			<i>For >50 To 100, Deduct</i>	-0.97	
			<i>For >100 To 200, Deduct</i>	-1.29	
			<i>For >200, Deduct</i>	-2.57	
32 17 23 13-0032	EA		72" High, Letter/Number, Painted Reflective Pavement Marking.....	29.95	
			<i>For <10, Add</i>	3.43	
			<i>For >50 To 100, Deduct</i>	-1.72	
			<i>For >100 To 200, Deduct</i>	-2.29	
			<i>For >200, Deduct</i>	-4.58	
32 17 23 13-0033	EA		96" High, Letter/Number, Painted Reflective Pavement Marking.....	40.03	
			<i>For <10, Add</i>	4.61	
			<i>For >50 To 100, Deduct</i>	-2.31	
			<i>For >100 To 200, Deduct</i>	-3.07	
			<i>For >200, Deduct</i>	-6.15	
32 17 23 13-0034	EA		120" High, Letter/Number, Painted Reflective Pavement Marking.....	58.83	
			<i>For <10, Add</i>	5.71	
			<i>For >50 To 100, Deduct</i>	-2.86	
			<i>For >100 To 200, Deduct</i>	-3.81	
			<i>For >200, Deduct</i>	-7.62	
32 17 23 13-0035	SF		Letter/Number, Painted Reflective Pavement Marking	4.12	
			Note: Includes solvent based and latex paints.		
32 17 23 13-0036	SF		Symbols, Painted Reflective Pavement Marking	4.90	
			Note: Handicap, railroad, diamond, arrows, etc. Includes solvent based and latex paints.		
32 17 23 13-0037			Pavement Marking (CALTRAN) (32 17 23 13-0001)		
			Note: Per LF of detail.		
32 17 23 13-0038	LF		CALTRAN Detail 1 Centerline, Painted Reflective Pavement Striping.....	0.17	
			<i>For Up To 1 Mile, Add</i>	0.03	
			<i>For >5 Miles, Deduct</i>	-0.03	
32 17 23 13-0039	LF		CALTRAN Detail 2 Centerline, Painted Reflective Pavement Striping.....	0.22	
			<i>For Up To 1 Mile, Add</i>	0.04	
			<i>For >5 Miles, Deduct</i>	-0.03	
32 17 23 13-0040	LF		CALTRAN Detail 4 Centerline.....	0.46	
			<i>For Up To 1 Mile, Add</i>	0.09	
			<i>For >5 Miles, Deduct</i>	-0.07	
32 17 23 13-0041	LF		CALTRAN Detail 5 Centerline, Painted Reflective Pavement Striping.....	0.16	
			<i>For Up To 1 Mile, Add</i>	0.03	
			<i>For >5 Miles, Deduct</i>	-0.02	
32 17 23 13-0042	LF		CALTRAN Detail 6 Centerline, Painted Reflective Pavement Striping.....	0.23	
			<i>For Up To 1 Mile, Add</i>	0.05	
			<i>For >5 Miles, Deduct</i>	-0.03	
32 17 23 13-0043	LF		CALTRAN Detail 7 Centerline.....	0.33	
			<i>For Up To 1 Mile, Add</i>	0.07	
			<i>For >5 Miles, Deduct</i>	-0.05	
32 17 23 13-0044	LF		CALTRAN Detail 8 Lanelines, Painted Reflective Pavement Striping.....	0.17	
			<i>For Up To 1 Mile, Add</i>	0.03	
			<i>For >5 Miles, Deduct</i>	-0.03	
32 17 23 13-0045	LF		CALTRAN Detail 9 Lanelines, Painted Reflective Pavement Striping.....	0.22	
			<i>For Up To 1 Mile, Add</i>	0.04	
			<i>For >5 Miles, Deduct</i>	-0.03	
32 17 23 13-0046	LF		CALTRAN Detail 10 Lanelines.....	0.46	
			<i>For Up To 1 Mile, Add</i>	0.09	
			<i>For >5 Miles, Deduct</i>	-0.07	
32 17 23 13-0047	LF		CALTRAN Detail 11 Lanelines, Painted Reflective Pavement Striping.....	0.16	
			<i>For Up To 1 Mile, Add</i>	0.03	
			<i>For >5 Miles, Deduct</i>	-0.02	
32 17 23 13-0048	LF		CALTRAN Detail 12 Lanelines, Painted Reflective Pavement Striping.....	0.22	
			<i>For Up To 1 Mile, Add</i>	0.04	
			<i>For >5 Miles, Deduct</i>	-0.03	
32 17 23 13-0049	LF		CALTRAN Detail 13 Lanelines.....	0.33	
			<i>For Up To 1 Mile, Add</i>	0.07	
			<i>For >5 Miles, Deduct</i>	-0.05	
32 17 23 13-0050	LF		CALTRAN Detail 14 Lanelines.....	0.33	
			<i>For Up To 1 Mile, Add</i>	0.07	
			<i>For >5 Miles, Deduct</i>	-0.05	
32 17 23 13-0051	LF		CALTRAN Detail 14A Lanelines, Painted Reflective Pavement Striping	0.22	
			<i>For Up To 1 Mile, Add</i>	0.04	
			<i>For >5 Miles, Deduct</i>	-0.03	
32 17 23 13-0052	LF		CALTRAN Detail 15 No Passing Zones-One Direction Lanelines, Painted Reflective Pavement Striping.....	0.22	
			<i>For Up To 1 Mile, Add</i>	0.04	
			<i>For >5 Miles, Deduct</i>	-0.03	
			<i>For Broken Line On One Side, Deduct</i>	-0.03	
			<i>For Double Broken Line, Deduct</i>	-0.05	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 17 23 13-0053 LF CALTRAN Detail 16 No Passing Zones-One Direction Lanelines, Painted Reflective Pavement Striping	0.45	
<i>For Up To 1 Mile, Add</i>	0.09	
<i>For >5 Miles, Deduct</i>	-0.07	
32 17 23 13-0054 LF CALTRAN Detail 17 No Passing Zones-One Direction Lanelines	1.31	
<i>For Up To 1 Mile, Add</i>	0.26	
<i>For >5 Miles, Deduct</i>	-0.20	
32 17 23 13-0055 LF CALTRAN Detail 18 No Passing Zones-One Direction Lanelines, Painted Reflective Pavement Striping	0.22	
<i>For Up To 1 Mile, Add</i>	0.04	
<i>For >5 Miles, Deduct</i>	-0.03	
<i>For Broken Line On One Side, Deduct</i>	-0.03	
<i>For Double Broken Line, Deduct</i>	-0.05	
32 17 23 13-0056 LF CALTRAN Detail 19 No Passing Zones-One Direction Lanelines, Painted Reflective Pavement Striping	0.38	
<i>For Up To 1 Mile, Add</i>	0.08	
<i>For >5 Miles, Deduct</i>	-0.06	
32 17 23 13-0057 LF CALTRAN Detail 20 No Passing Zones-One Direction Lanelines	1.12	
<i>For Up To 1 Mile, Add</i>	0.22	
<i>For >5 Miles, Deduct</i>	-0.17	
32 17 23 13-0058 LF CALTRAN Detail 21 No Passing Zones-Two Direction Lanelines, Painted Reflective Pavement Striping	0.25	
<i>For Up To 1 Mile, Add</i>	0.05	
<i>For >5 Miles, Deduct</i>	-0.04	
<i>For Broken Line On One Side, Deduct</i>	-0.04	
<i>For Double Broken Line, Deduct</i>	-0.08	
32 17 23 13-0059 LF CALTRAN Detail 22 No Passing Zones-Two Direction Lanelines, Painted Reflective Pavement Striping	0.49	
<i>For Up To 1 Mile, Add</i>	0.10	
<i>For >5 Miles, Deduct</i>	-0.07	
32 17 23 13-0060 LF CALTRAN Detail 23 No Passing Zones-Two Direction Lanelines	1.57	
<i>For Up To 1 Mile, Add</i>	0.31	
<i>For >5 Miles, Deduct</i>	-0.24	
32 17 23 13-0061 LF CALTRAN Detail 24 Left Edgelines, Painted Reflective Pavement Striping	0.20	
<i>For Up To 1 Mile, Add</i>	0.04	
<i>For >5 Miles, Deduct</i>	-0.03	
32 17 23 13-0062 LF CALTRAN Detail 25 Left Edgelines, Painted Reflective Pavement Striping	0.26	
<i>For Up To 1 Mile, Add</i>	0.05	
<i>For >5 Miles, Deduct</i>	-0.04	
32 17 23 13-0063 LF CALTRAN Detail 25A Left Edgelines, Painted Reflective Pavement Striping.....	0.31	
<i>For Up To 1 Mile, Add</i>	0.06	
<i>For >5 Miles, Deduct</i>	-0.05	
32 17 23 13-0064 LF CALTRAN Detail 26 Left Edgelines	0.06	
<i>For Up To 1 Mile, Add</i>	0.01	
<i>For >5 Miles, Deduct</i>	-0.01	
32 17 23 13-0065 LF CALTRAN Detail 27 Left Edgelines, Painted Reflective Pavement Striping	0.31	
<i>For Up To 1 Mile, Add</i>	0.06	
<i>For >5 Miles, Deduct</i>	-0.05	
32 17 23 13-0066 LF CALTRAN Detail 27B Right Edgelines, Painted Reflective Pavement Striping	0.20	
<i>For Up To 1 Mile, Add</i>	0.04	
<i>For >5 Miles, Deduct</i>	-0.03	
32 17 23 13-0067 LF CALTRAN Detail 27C Right Edgeline Extension Through Intersections, Painted Reflective Pavement Striping.....	0.16	
<i>For Up To 1 Mile, Add</i>	0.03	
<i>For >5 Miles, Deduct</i>	-0.02	
32 17 23 13-0068 LF CALTRAN Detail 28 Median Islands, Painted Reflective Pavement Striping.....	0.51	
<i>For Up To 1 Mile, Add</i>	0.10	
<i>For >5 Miles, Deduct</i>	-0.08	
<i>For Broken Line On One Side, Deduct</i>	-0.08	
<i>For Double Broken Line, Deduct</i>	-0.16	
32 17 23 13-0069 LF CALTRAN Detail 29 Median Islands, Painted Reflective Pavement Striping.....	0.73	
<i>For Up To 1 Mile, Add</i>	0.15	
<i>For >5 Miles, Deduct</i>	-0.11	
32 17 23 13-0070 LF CALTRAN Detail 30 Median Islands.....	3.16	
<i>For Up To 1 Mile, Add</i>	0.63	
<i>For >5 Miles, Deduct</i>	-0.47	
32 17 23 13-0071 LF CALTRAN Detail 31 Two-Way Left Turn Lanes, Painted Reflective Pavement Striping.....	0.43	
<i>For Up To 1 Mile, Add</i>	0.09	
<i>For >5 Miles, Deduct</i>	-0.06	
<i>For Broken Line On One Side, Deduct</i>	-0.05	
<i>For Double Broken Line, Deduct</i>	-0.10	
32 17 23 13-0072 LF CALTRAN Detail 32 Two-Way Left Turn Lanes, Painted Reflective Pavement Striping.....	0.72	
<i>For Up To 1 Mile, Add</i>	0.14	
<i>For >5 Miles, Deduct</i>	-0.11	
32 17 23 13-0073 LF CALTRAN Detail 33 Two-Way Left Turn Lanes.....	2.17	
<i>For Up To 1 Mile, Add</i>	0.43	
<i>For >5 Miles, Deduct</i>	-0.33	
32 17 23 13-0074 LF CALTRAN Detail 34 Intersection Treatments, Painted Reflective Pavement Striping	0.38	
<i>For Up To 1 Mile, Add</i>	0.08	
<i>For >5 Miles, Deduct</i>	-0.06	
32 17 23 13-0075 LF CALTRAN Detail 34A Intersection Treatments, Painted Reflective Pavement Striping.....	0.22	
<i>For Up To 1 Mile, Add</i>	0.04	
<i>For >5 Miles, Deduct</i>	-0.03	
32 17 23 13-0076 LF CALTRAN Detail 35 Intersection Treatments, Painted Reflective Pavement Striping	0.45	
<i>For Up To 1 Mile, Add</i>	0.09	
<i>For >5 Miles, Deduct</i>	-0.07	
32 17 23 13-0077 LF CALTRAN Detail 35A Intersection Treatments, Painted Reflective Pavement Striping.....	0.22	
<i>For Up To 1 Mile, Add</i>	0.04	
<i>For >5 Miles, Deduct</i>	-0.03	
32 17 23 13-0078 LF CALTRAN Detail 36 Exit Ramp Neutral Area (Gore) Treatment, Painted Reflective Pavement Striping.....	0.86	
<i>For Up To 1 Mile, Add</i>	0.17	
<i>For >5 Miles, Deduct</i>	-0.13	

32 Exterior Improvements**32 10 Bases, Ballasts, And Paving****32 17 Paving Specialties**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 17 23 13-0079	LF		CALTRAN Detail 36A Entrance Ramp Neutral Area (Merge) Treatment, Painted Reflective Pavement Striping.....	0.58	
			<i>For Up To 1 Mile, Add</i>	0.12	
			<i>For >5 Miles, Deduct</i>	-0.09	
32 17 23 13-0080	LF		CALTRAN Detail 36B Entrance Ramp Neutral Area (Acceleration Lane) Treatment, Painted Reflective Pavement Striping.....	0.62	
			<i>For Up To 1 Mile, Add</i>	0.12	
			<i>For >5 Miles, Deduct</i>	-0.09	
32 17 23 13-0081	LF		CALTRAN Detail 37 Lane Drop At Exit Ramps, Painted Reflective Pavement Striping.....	0.52	
			<i>For Up To 1 Mile, Add</i>	0.10	
			<i>For >5 Miles, Deduct</i>	-0.08	
32 17 23 13-0082	LF		CALTRAN Detail 37A Lane Drop At Exit Ramps.....	1.05	
			<i>For Up To 1 Mile, Add</i>	0.21	
			<i>For >5 Miles, Deduct</i>	-0.16	
32 17 23 13-0083	LF		CALTRAN Detail 37B Lane Drop At Intersections, Painted Reflective Pavement Striping.....	0.52	
			<i>For Up To 1 Mile, Add</i>	0.10	
			<i>For >5 Miles, Deduct</i>	-0.08	
32 17 23 13-0084	LF		CALTRAN Detail 37C Lane Drop At Intersections.....	1.05	
			<i>For Up To 1 Mile, Add</i>	0.21	
			<i>For >5 Miles, Deduct</i>	-0.16	
32 17 23 13-0085	LF		CALTRAN Detail 38 Channelizing Line, Painted Reflective Pavement Striping.....	0.53	
			<i>For Up To 1 Mile, Add</i>	0.11	
			<i>For >5 Miles, Deduct</i>	-0.08	
32 17 23 13-0086	LF		CALTRAN Detail 38A Channelizing Line, Painted Reflective Pavement Striping.....	0.41	
			<i>For Up To 1 Mile, Add</i>	0.08	
			<i>For >5 Miles, Deduct</i>	-0.06	
32 17 23 13-0087	LF		CALTRAN Detail 38B Channelizing Line, Painted Reflective Pavement Striping.....	0.64	
			<i>For Up To 1 Mile, Add</i>	0.13	
			<i>For >5 Miles, Deduct</i>	-0.10	
32 17 23 13-0088	LF		CALTRAN Detail 38C Channelizing Line.....	1.57	
			<i>For Up To 1 Mile, Add</i>	0.31	
			<i>For >5 Miles, Deduct</i>	-0.24	
32 17 23 13-0089	LF		CALTRAN Detail 39 Bike Lane Line, Painted Reflective Pavement Striping.....	0.25	
			<i>For Up To 1 Mile, Add</i>	0.05	
			<i>For >5 Miles, Deduct</i>	-0.04	
32 17 23 13-0090	LF		CALTRAN Detail 39A Intersection Line Bike Lane, Painted Reflective Pavement Striping.....	0.20	
			<i>For Up To 1 Mile, Add</i>	0.04	
			<i>For >5 Miles, Deduct</i>	-0.03	
32 17 23 13-0091	LF		CALTRAN Detail 40 Lane Line Extensions Through Intersections, Painted Reflective Pavement Striping.....	0.16	
			<i>For Up To 1 Mile, Add</i>	0.03	
			<i>For >5 Miles, Deduct</i>	-0.02	
32 17 23 13-0092	LF		CALTRAN Detail 40A Lane Line Extensions Through Intersections.....	0.80	
			<i>For Up To 1 Mile, Add</i>	0.16	
			<i>For >5 Miles, Deduct</i>	-0.12	
32 17 23 13-0093	LF		CALTRAN Detail 41 Center Line Extensions Through Intersections, Painted Reflective Pavement Striping.....	0.16	
			<i>For Up To 1 Mile, Add</i>	0.03	
			<i>For >5 Miles, Deduct</i>	-0.02	
32 17 23 13-0094	LF		CALTRAN Detail 41A Center Line Extensions Through Intersections.....	0.80	
			<i>For Up To 1 Mile, Add</i>	0.16	
			<i>For >5 Miles, Deduct</i>	-0.12	
32 17 23 13-0095	EA		CALTRAN 10' Arrow, Type I, Painted Reflective Pavement Marking.....	65.38	
			<i>For <10, Add</i>	8.35	
			<i>For >50 To 100, Deduct</i>	-4.18	
			<i>For >100 To 200, Deduct</i>	-5.57	
			<i>For >200, Deduct</i>	-11.14	
32 17 23 13-0096	EA		CALTRAN 18' Arrow, Type I, Painted Reflective Pavement Marking.....	114.77	
			<i>For <10, Add</i>	14.62	
			<i>For >50 To 100, Deduct</i>	-7.31	
			<i>For >100 To 200, Deduct</i>	-9.75	
			<i>For >200, Deduct</i>	-19.49	
32 17 23 13-0097	EA		CALTRAN 24' Arrow, Type I, Painted Reflective Pavement Marking.....	143.99	
			<i>For <10, Add</i>	18.38	
			<i>For >50 To 100, Deduct</i>	-9.19	
			<i>For >100 To 200, Deduct</i>	-12.25	
			<i>For >200, Deduct</i>	-24.50	
32 17 23 13-0098	EA		CALTRAN 24' Arrow With Single (L or R) Turn Arrow, Type II, Painted Reflective Pavement Marking.....	209.37	
			<i>For <10, Add</i>	26.73	
			<i>For >50 To 100, Deduct</i>	-13.37	
			<i>For >100 To 200, Deduct</i>	-17.82	
			<i>For >200, Deduct</i>	-35.64	
32 17 23 13-0099	EA		CALTRAN 24' Arrow With Both (L and R) Turn Arrows, Type II, Painted Reflective Pavement Marking.....	274.76	
			<i>For <10, Add</i>	35.09	
			<i>For >50 To 100, Deduct</i>	-17.54	
			<i>For >100 To 200, Deduct</i>	-23.39	
			<i>For >200, Deduct</i>	-46.78	
32 17 23 13-0100	EA		CALTRAN 24' Arrow Single (L or R) Turn Arrow, Type III, Painted Reflective Pavement Marking.....	193.37	
			<i>For <10, Add</i>	24.64	
			<i>For >50 To 100, Deduct</i>	-12.32	
			<i>For >100 To 200, Deduct</i>	-16.43	
			<i>For >200, Deduct</i>	-32.86	
32 17 23 13-0101	EA		CALTRAN 24' Arrow Both (L and R) Turn Arrows, Type III, Painted Reflective Pavement Marking.....	337.36	
			<i>For <10, Add</i>	43.02	
			<i>For >50 To 100, Deduct</i>	-21.51	
			<i>For >100 To 200, Deduct</i>	-28.68	
			<i>For >200, Deduct</i>	-57.36	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 17 23 13-0102 EA CALTRAN 8' Turn Arrow (L or R), Type IV, Painted Reflective Pavement Marking.....	68.87	
<i>For <10, Add</i>	8.77	
<i>For >50 To 100, Deduct</i>	-4.39	
<i>For >100 To 200, Deduct</i>	-5.85	
<i>For >200, Deduct</i>	-11.70	
32 17 23 13-0103 EA CALTRAN 24' Arrow, Type V, Painted Reflective Pavement Marking	150.94	
<i>For <10, Add</i>	19.21	
<i>For >50 To 100, Deduct</i>	-9.61	
<i>For >100 To 200, Deduct</i>	-12.81	
<i>For >200, Deduct</i>	-25.62	
32 17 23 13-0104 EA CALTRAN 18' Arrow, Type VI, Painted Reflective Pavement Marking	193.37	
<i>For <10, Add</i>	24.64	
<i>For >50 To 100, Deduct</i>	-12.32	
<i>For >100 To 200, Deduct</i>	-16.43	
<i>For >200, Deduct</i>	-32.86	
32 17 23 13-0105 EA CALTRAN 13' Arrow With Single (L or R) Turn Arrow, Type VII, Painted Reflective Pavement Marking	124.62	
<i>For <10, Add</i>	15.87	
<i>For >50 To 100, Deduct</i>	-7.94	
<i>For >100 To 200, Deduct</i>	-10.58	
<i>For >200, Deduct</i>	-21.16	
32 17 23 13-0106 EA CALTRAN 15' Arrow With Both (L and R) Turn Arrows, Type VIII, Painted Reflective Pavement Marking	164.16	
<i>For <10, Add</i>	20.88	
<i>For >50 To 100, Deduct</i>	-10.44	
<i>For >100 To 200, Deduct</i>	-13.92	
<i>For >200, Deduct</i>	-27.85	
32 17 23 13-0107 EA CALTRAN 5' Arrow, Bike Lane, Painted Reflective Pavement Marking.....	32.70	
<i>For <10, Add</i>	4.18	
<i>For >50 To 100, Deduct</i>	-2.09	
<i>For >100 To 200, Deduct</i>	-2.79	
<i>For >200, Deduct</i>	-5.57	
32 17 23 13-0108 EA CALTRAN Railroad Crossing Symbol, Painted Reflective Pavement Marking	313.01	
Note: Excludes variable width transverse lines.		
<i>For <10, Add</i>	39.68	
<i>For >50 To 100, Deduct</i>	-19.84	
<i>For >100 To 200, Deduct</i>	-26.45	
<i>For >200, Deduct</i>	-52.91	
32 17 23 13-0109 SF CALTRAN Solid Area, Painted Reflective Pavement Marking.....	4.08	
32 17 23 13-0110 EA CALTRAN Bike Lane Symbol Without Person, Painted Reflective Pavement Marking	31.86	
Note: Approximate overall dimensions: 4' width x 8' height.		
<i>For <10, Add</i>	3.01	
<i>For >50 To 100, Deduct</i>	-1.50	
<i>For >100 To 200, Deduct</i>	-2.01	
<i>For >200, Deduct</i>	-4.01	
32 17 23 13-0111 EA CALTRAN Bike Lane Symbol With Person, Painted Reflective Pavement Marking	33.78	
Note: Approximate overall dimensions: 4' width x 8' height.		
<i>For <10, Add</i>	3.17	
<i>For >50 To 100, Deduct</i>	-1.59	
<i>For >100 To 200, Deduct</i>	-2.12	
<i>For >200, Deduct</i>	-4.23	
32 17 23 13-0112 EA CALTRAN Diamond Symbol, Painted Reflective Pavement Marking	52.17	
<i>For <10, Add</i>	6.68	
<i>For >50 To 100, Deduct</i>	-3.34	
<i>For >100 To 200, Deduct</i>	-4.46	
<i>For >200, Deduct</i>	-8.91	
32 17 23 13-0113 EA CALTRAN International Symbol Of Accessibility (ISA) Marking, Painted Reflective Pavement Marking.....	106.14	
<i>For <10, Add</i>	13.53	
<i>For >50 To 100, Deduct</i>	-6.77	
<i>For >100 To 200, Deduct</i>	-9.02	
<i>For >200, Deduct</i>	-18.04	
32 17 23 13-0114 EA CALTRAN Bike Loop Detector Symbol, Painted Reflective Pavement Marking	22.50	
Note: Approximate overall dimensions: 4' width x 8' height.		
<i>For <10, Add</i>	3.17	
<i>For >50 To 100, Deduct</i>	-1.59	
<i>For >100 To 200, Deduct</i>	-2.12	
<i>For >200, Deduct</i>	-4.23	
32 17 23 13-0115 SF CALTRAN Letter/Number, Painted Reflective Pavement Marking.....	4.14	
32 17 23 13-0116 SF CALTRAN Symbols, Painted Reflective Pavement Marking.....	4.59	
Note: Handicap, railroad, diamond, arrows, etc.		
32 17 23 13-0117 Pavement Striping, Letters And Symbols For Parking Areas (32 17 23 13)		
32 17 23 13-0118 Painted Pavement Marking For Parking Areas (32 17 23 13-0117)		
32 17 23 13-0119 LF Single 4" Wide Solid Line, Painted Pavement Striping for Parking Areas.....	0.75	
32 17 23 13-0120 LF Single 6" Wide Solid Line, Painted Pavement Striping for Parking Areas.....	0.82	
32 17 23 13-0121 LF Single 8" Wide Solid Line, Painted Pavement Striping For Parking Areas.....	0.85	
32 17 23 13-0122 LF Single 12" Wide Solid Line, Painted Pavement Striping For Parking Areas.....	0.96	
32 17 23 13-0123 EA 6" High, Letter/Number, Painted Pavement Marking For Parking Areas.....	2.48	
<i>For Up To 10, Add</i>	0.33	
<i>For >50 To 100, Deduct</i>	-0.17	
<i>For >100 To 200, Deduct</i>	-0.22	
<i>For >200, Deduct</i>	-0.44	

32 Exterior Improvements**32 10 Bases, Ballasts, And Paving****32 17 Paving Specialties**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 17 23 13-0124 EA 12" High, Letter/Number, Painted Pavement Marking For Parking Areas.....	4.28	
For Up To 10, Add	0.50	
For >50 To 100, Deduct	-0.25	
For >100 To 200, Deduct	-0.33	
For >200, Deduct	-0.67	
32 17 23 13-0125 EA 24" High, Letter/Number, Painted Pavement Marking For Parking Areas.....	7.21	
For Up To 10, Add	0.84	
For >50 To 100, Deduct	-0.42	
For >100 To 200, Deduct	-0.56	
For >200, Deduct	-1.11	
32 17 23 13-0126 EA 36" High, Letter/Number, Painted Pavement Marking For Parking Areas.....	13.46	
For Up To 10, Add	1.59	
For >50 To 100, Deduct	-0.79	
For >100 To 200, Deduct	-1.06	
For >200, Deduct	-2.12	
32 17 23 13-0127 EA 42" High, Letter/Number, Painted Pavement Marking For Parking Areas.....	17.79	
For Up To 10, Add	2.17	
For >50 To 100, Deduct	-1.09	
For >100 To 200, Deduct	-1.45	
For >200, Deduct	-2.90	
32 17 23 13-0128 EA 48" High, Letter/Number/Arrow, Painted Pavement Marking For Parking Areas	21.56	
For Up To 10, Add	2.67	
For >50 To 100, Deduct	-1.34	
For >100 To 200, Deduct	-1.78	
For >200, Deduct	-3.56	
32 17 23 13-0129 EA 72" High, Letter/Number/Arrow, Painted Pavement Marking For Parking Areas	29.11	
For Up To 10, Add	3.34	
For >50 To 100, Deduct	-1.67	
For >100 To 200, Deduct	-2.23	
For >200, Deduct	-4.45	
32 17 23 13-0130 EA Through Lane Arrow, Painted Pavement Marking For Parking Areas.....	53.41	
Note: Approximate overall dimensions: 3-1/2' width x 10' height.		
32 17 23 13-0131 EA Turn Lane Arrow, Painted Pavement Marking For Parking Areas.....	61.83	
Note: Approximate overall dimensions: 6' width x 8' height.		
32 17 23 13-0132 EA Dual Turn Lane Arrow, Painted Pavement Marking For Parking Areas	89.86	
Note: Approximate overall dimensions: 11' width x 8' height.		
32 17 23 13-0133 EA Turn And Through Lane Arrow, Painted Pavement Marking For Parking Areas.....	91.80	
Note: Approximate overall dimensions: 7' width x 13' height.		
32 17 23 13-0134 EA Dual Turn And Through Lane Arrow, Painted Pavement Marking For Parking Areas.....	121.42	
Note: Approximate overall dimensions: 9' width x 15' height.		
32 17 23 13-0135 EA Handicap Symbol For Standard Parking Stalls, Painted Pavement Marking For Parking Areas	21.22	
Note: Approximate overall dimensions: 2-2/3' width x 3' height. White or blue symbol. Excludes striping.		
For Blue Background With White Symbol, Add	16.68	
For Blue Background With White Symbol And Border, Add	20.85	
32 17 23 13-0136 EA Handicap Symbol For Van Parking Stalls, Painted Pavement Marking For Parking Areas.....	32.02	
Note: Approximate overall dimensions: 4-1/3' width x 5' height. White or blue symbol. Excludes striping.		
For Blue Background With White Symbol, Add	35.14	
For Blue Background With White Symbol And Border, Add	43.93	
32 17 23 13-0137 Painted Curbs <small>(32 17 23 13)</small>		
32 17 23 13-0138 LF Reflective Painted Curb	1.52	
32 17 23 13-0139 LF Reflective Painted Curb And Gutter.....	2.78	
32 17 23 13-0140 LF Painted Curb, Any Color	1.23	
32 17 23 13-0141 LF Painted Curb And Gutter, Any Color.....	2.44	
32 17 23 13-0142 Markings For Outdoor Play Areas, Courts <small>(32 17 23 13)</small>		
32 17 23 13-0143 LF 2" Wide Marking For Outdoor Play Areas	0.75	
32 17 23 13-0144 LF 3" Wide Marking For Outdoor Play Areas	0.85	
32 17 23 13-0145 LF 4" Wide Marking For Outdoor Play Areas	0.96	
32 17 23 13-0146 LF 6" Wide Marking For Outdoor Play Areas	1.12	
32 17 23 13-0147 EA Paint Playground Game Lines On Asphalt Or Concrete (Hop Scotch, 4 Square, Numbers Games, Etcetera).....	190.52	
32 17 23 23 Raised Pavement Markings <small>(32 17 23)</small>		
32 17 23 23-0001 Raised Pavement Markers (RPMs) <small>(32 17 23 23)</small>		
32 17 23 23-0002 EA One-Way Reflective, Raised Pavement Marker (RPM)	2.77	2.21
For >100, Deduct	-0.28	
32 17 23 23-0003 EA Two-Way Reflective, Raised Pavement Marker (RPM)	2.77	2.21
For >100, Deduct	-0.28	
32 17 23 23-0004 EA Round Reflective, Raised Pavement Marker	3.24	2.21
For >100, Deduct	-0.32	
32 17 23 23-0005 EA Non-Reflective, Raised Pavement Marker (RPM).....	3.48	2.21
For >100, Deduct	-0.35	
32 17 23 26 Recessed Pavement Markings <small>(32 17 23)</small>		
32 17 23 26-0001 Recessed (Plowable) Pavement Markers <small>(32 17 23 26)</small>		
32 17 23 26-0002 EA One-Way Reflective, Recessed (Plowable) Pavement Marker With Center Rail	69.22	
32 17 23 26-0003 EA Two-Way Reflective, Recessed (Plowable) Pavement Marker With Center Rail	70.17	
32 17 23 26-0004 EA Remove And Replace Reflector For One-Way Reflective, Recessed (Plowable) Pavement Marker.....	17.75	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 17 23 26-0005 EA Remove And Replace Reflectors For Two-Way Reflective, Recessed (Plowable) Pavement Marker	22.31	
32 17 23 26-0006 EA Recessed Retroreflective Pavement Marker, Type G or H	69.22	
32 17 23 26-0007 EA Recessed Retroreflective Pavement Marker, Type C or D	70.17	
32 17 23 26-0008 EA Remove Recessed (Plowable) Pavement Marker	2.45	
32 17 23 33 Plastic Pavement Markings (32 17 23)		
32 17 23 33-0001 Thermoplastic Pavement Striping, Letters, Symbols And Markers For Roads (32 17 23 33)		
Note: Includes primers, adhesive and glass beads where required. For broken line modifier quantity use total lane length.		
32 17 23 33-0002 Thermoplastic Reflective Pavement Marking (32 17 23 33-0001)		
Note: 90 mil thickness.		
32 17 23 33-0003 LF Single 4" Wide Solid Line, Thermoplastic Reflective Pavement Striping	0.83	
For Up To 1 Mile, Add	0.17	
For >5 Miles, Deduct	-0.12	
For 60 mils Thick, Deduct	-0.11	
For 125 mils Thick, Add	0.14	
For Broken Line, Deduct	-0.47	
32 17 23 33-0004 LF Single 6" Wide Solid Line, Thermoplastic Reflective Pavement Striping	1.19	
For Up To 1 Mile, Add	0.24	
For >5 Miles, Deduct	-0.18	
For 60 mils Thick, Deduct	-0.17	
For 125 mils Thick, Add	0.21	
For Broken Line, Deduct	-0.71	
32 17 23 33-0005 LF Single 8" Wide Solid Line, Thermoplastic Reflective Pavement Striping	1.56	
For Up To 1 Mile, Add	0.31	
For >5 Miles, Deduct	-0.23	
For 60 mils Thick, Deduct	-0.22	
For 125 mils Thick, Add	0.28	
For Broken Line, Deduct	-0.95	
32 17 23 33-0006 LF Single 12" Wide Solid Line, Thermoplastic Reflective Pavement Striping	2.30	
For Up To 1 Mile, Add	0.46	
For >5 Miles, Deduct	-0.35	
For 60 mils Thick, Deduct	-0.33	
For 125 mils Thick, Add	0.43	
For Broken Line, Deduct	-1.43	
32 17 23 33-0007 LF Double 4" Wide Solid Lines, Thermoplastic Reflective Pavement Striping	1.56	
For Up To 1 Mile, Add	0.31	
For >5 Miles, Deduct	-0.23	
For 60 mils Thick, Deduct	-0.22	
For 125 mils Thick, Add	0.28	
For Broken Line On One Side, Deduct	-0.47	
For Double Broken Line, Deduct	-0.95	
32 17 23 33-0008 LF Double 6" Wide Solid Lines, Thermoplastic Reflective Pavement Striping	2.30	
For Up To 1 Mile, Add	0.46	
For >5 Miles, Deduct	-0.35	
For 60 mils Thick, Deduct	-0.33	
For 125 mils Thick, Add	0.43	
For Broken Line On One Side, Deduct	-0.71	
For Double Broken Line, Deduct	-1.43	
32 17 23 33-0009 SF Solid Area, Thermoplastic Reflective Pavement Marking	5.23	
Note: Use task for lines >12" wide, stop bars, transverse lines, diagonal lines, crossing lanes, etc.		
For 60 mils Thick, Deduct	-0.33	
For 125 mils Thick, Add	0.43	
32 17 23 33-0010 EA 6" High, Letter/Number, Thermoplastic Reflective Pavement Marking	3.48	
For Up To 10, Add	0.38	
For >50 To 100, Deduct	-0.19	
For >100 To 200, Deduct	-0.25	
For >200, Deduct	-0.50	
For 60 mils Thick, Deduct	-0.17	
For 125 mils Thick, Add	0.22	
32 17 23 33-0011 EA 12" High, Letter/Number, Thermoplastic Reflective Pavement Marking	7.29	
For Up To 10, Add	0.57	
For >50 To 100, Deduct	-0.28	
For >100 To 200, Deduct	-0.38	
For >200, Deduct	-0.76	
For 60 mils Thick, Deduct	-0.61	
For 125 mils Thick, Add	0.79	
32 17 23 33-0012 EA 24" High, Letter/Number, Thermoplastic Reflective Pavement Marking	12.42	
For Up To 10, Add	0.95	
For >50 To 100, Deduct	-0.47	
For >100 To 200, Deduct	-0.63	
For >200, Deduct	-1.26	
For 60 mils Thick, Deduct	-1.07	
For 125 mils Thick, Add	1.38	
32 17 23 33-0013 EA 36" High, Letter/Number, Thermoplastic Reflective Pavement Marking	23.41	
For Up To 10, Add	1.90	
For >50 To 100, Deduct	-0.95	
For >100 To 200, Deduct	-1.26	
For >200, Deduct	-2.53	
For 60 mils Thick, Deduct	-1.88	
For 125 mils Thick, Add	2.42	

32 Exterior Improvements
32 10 Bases, Ballasts, And Paving
32 17 Paving Specialties



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 17 23 33-0014 EA 48" High, Letter/Number, Thermoplastic Reflective Pavement Marking	28.15	
For Up To 10, Add	2.12	
For >50 To 100, Deduct	-1.06	
For >100 To 200, Deduct	-1.42	
For >200, Deduct	-2.83	
For 60 mils Thick, Deduct	-2.45	
For 125 mils Thick, Add	3.15	
32 17 23 33-0015 EA 72" High, Letter/Number, Thermoplastic Reflective Pavement Marking	50.75	
For Up To 10, Add	3.78	
For >50 To 100, Deduct	-1.89	
For >100 To 200, Deduct	-2.52	
For >200, Deduct	-5.04	
For 60 mils Thick, Deduct	-4.47	
For 125 mils Thick, Add	5.75	
32 17 23 33-0016 EA 96" High, Letter/Number, Thermoplastic Reflective Pavement Marking	67.44	
For Up To 10, Add	5.07	
For >50 To 100, Deduct	-2.54	
For >100 To 200, Deduct	-3.38	
For >200, Deduct	-6.76	
For 60 mils Thick, Deduct	-5.89	
For 125 mils Thick, Add	7.57	
32 17 23 33-0017 EA 120" High, Letter/Number, Thermoplastic Reflective Pavement Marking.....	116.97	
For Up To 10, Add	6.28	
For >50 To 100, Deduct	-3.14	
For >100 To 200, Deduct	-4.19	
For >200, Deduct	-8.38	
For 60 mils Thick, Deduct	-13.14	
For 125 mils Thick, Add	16.90	
32 17 23 33-0018 SF Letter/Number, Thermoplastic Reflective Pavement Marking	6.21	
For 60 mils Thick, Deduct	-0.42	
For 125 mils Thick, Add	0.54	
32 17 23 33-0019 SY Cross Hatch, Thermoplastic Reflective Pavement Marking	42.04	
For 60 mils Thick, Deduct	-2.97	
For 125 mils Thick, Add	3.82	
32 17 23 33-0020 EA Handicap Symbol, Thermoplastic Reflective Pavement Marking	162.03	
For 60 mils Thick, Deduct	-9.75	
For 125 mils Thick, Add	12.54	
32 17 23 33-0021 SY Solid Area, Thermoplastic Reflective Pavement Marking	50.84	
For 60 mils Thick, Deduct	-2.97	
For 125 mils Thick, Add	3.82	
32 17 23 33-0022 EA Railroad Symbol, Thermoplastic Reflective Pavement Marking.....	481.44	
For 60 mils Thick, Deduct	-29.67	
For 125 mils Thick, Add	38.15	
32 17 23 33-0023 EA Bike Lane Symbol, Thermoplastic Reflective Pavement Marking	99.03	
Note: Approximate overall dimensions: 4' width x 8' height.		
For 60 mils Thick, Deduct	-13.43	
For 125 mils Thick, Add	17.27	
32 17 23 33-0024 EA Diamond Symbol, Thermoplastic Reflective Pavement Marking.....	77.49	
For 60 mils Thick, Deduct	-4.66	
For 125 mils Thick, Add	6.00	
32 17 23 33-0025 SF Symbols, Thermoplastic Reflective Pavement Marking	7.04	
Note: Handicap, railroad, diamond, arrows, etc.		
For 60 mils Thick, Deduct	-0.42	
For 125 mils Thick, Add	0.54	
32 17 23 33-0026 EA 10' Arrow, Type I, Thermoplastic Reflective Pavement Marking.....	98.62	
For 60 mils Thick, Deduct	-5.93	
For 125 mils Thick, Add	7.63	
32 17 23 33-0027 EA 18' Arrow, Type I, Thermoplastic Reflective Pavement Marking.....	176.11	
For 60 mils Thick, Deduct	-10.60	
For 125 mils Thick, Add	13.63	
32 17 23 33-0028 EA 24' Arrow, Type I, Thermoplastic Reflective Pavement Marking.....	218.38	
For 60 mils Thick, Deduct	-13.14	
For 125 mils Thick, Add	16.90	
32 17 23 33-0029 EA 24' Arrow With Single (L or R) Turn Arrow, Type II, Thermoplastic Reflective Pavement Marking	317.01	
For 60 mils Thick, Deduct	-19.08	
For 125 mils Thick, Add	24.53	
32 17 23 33-0030 EA 24' Arrow With Both (L and R) Turn Arrows, Type II, Thermoplastic Reflective Pavement Marking	415.64	
For 60 mils Thick, Deduct	-25.01	
For 125 mils Thick, Add	32.16	
32 17 23 33-0031 EA 24' Arrow Single (L or R) Turn Arrow, Type III, Thermoplastic Reflective Pavement Marking	295.87	
For 60 mils Thick, Deduct	-17.80	
For 125 mils Thick, Add	22.89	
32 17 23 33-0032 EA 24' Arrow Both (L and R) Turn Arrows, Type III, Thermoplastic Reflective Pavement Marking	514.26	
For 60 mils Thick, Deduct	-30.95	
For 125 mils Thick, Add	39.79	
32 17 23 33-0033 EA 8' Turn Arrow (L or R), Type IV, Thermoplastic Reflective Pavement Marking	105.67	
For 60 mils Thick, Deduct	-6.36	
For 125 mils Thick, Add	8.18	
32 17 23 33-0034 EA 24' Arrow, Type V, Thermoplastic Reflective Pavement Marking.....	232.47	
For 60 mils Thick, Deduct	-13.99	
For 125 mils Thick, Add	17.99	
32 17 23 33-0035 EA 18' Arrow, Type VI, Thermoplastic Reflective Pavement Marking.....	295.87	
For 60 mils Thick, Deduct	-17.80	
For 125 mils Thick, Add	22.89	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 17 23 33-0036 EA 13' Arrow With Single (L or R) Turn Arrow, Type VII, Thermoplastic Reflective Pavement Marking.....	190.21	
<i>For 60 mils Thick, Deduct</i>	-11.45	
<i>For 125 mils Thick, Add</i>	14.72	
32 17 23 33-0037 EA 15' Arrow With Both (L and R) Turn Arrows, Type VIII, Thermoplastic Reflective Pavement Marking.....	253.61	
<i>For 60 mils Thick, Deduct</i>	-15.26	
<i>For 125 mils Thick, Add</i>	19.62	
32 17 23 33-0038 EA 5' Arrow, Bike Lane, Thermoplastic Reflective Pavement Marking.....	49.32	
<i>For 60 mils Thick, Deduct</i>	-2.97	
<i>For 125 mils Thick, Add</i>	3.82	
32 17 23 33-0039 Thermoplastic Reflective Pavement Striping By Hand For Repairs (32 17 23 33-0001)		
32 17 23 33-0040 LF Single 4" Wide Solid Line, Thermoplastic Reflective Pavement Striping By Hand For Repairs	1.81	
<i>For 60 mils Thick, Deduct</i>	-0.11	
<i>For 125 mils Thick, Add</i>	0.14	
32 17 23 33-0041 LF Single 6" Wide Solid Line, Thermoplastic Reflective Pavement Striping By Hand For Repairs	2.29	
<i>For 60 mils Thick, Deduct</i>	-0.17	
<i>For 125 mils Thick, Add</i>	0.21	
32 17 23 33-0042 LF Single 8" Wide Solid Line, Thermoplastic Reflective Pavement Striping By Hand For Repairs	2.82	
<i>For 60 mils Thick, Deduct</i>	-0.22	
<i>For 125 mils Thick, Add</i>	0.28	
32 17 23 33-0043 LF Single 12" Wide Solid Line, Thermoplastic Reflective Pavement Striping By Hand For Repairs	4.06	
<i>For 60 mils Thick, Deduct</i>	-0.33	
<i>For 125 mils Thick, Add</i>	0.43	
32 17 23 33-0044 LF Single 24" Wide Solid Line, Thermoplastic Reflective Pavement Striping By Hand For Repairs	7.31	
<i>For 60 mils Thick, Deduct</i>	-0.66	
<i>For 125 mils Thick, Add</i>	0.85	
32 17 23 33-0045 Preformed, Patterned Reflective Pavement Marking Tape (32 17 23 33-0001)		
Note: Applied with pressure sensitive adhesive. Includes adhesive. 60 mil thickness. (3M Stamark 380 Series).		
32 17 23 33-0046 LF Single 4" Wide Solid Line, Preformed Tape, Patterned Thermoplastic Reflective Pavement Striping	1.76	
<i>For Up To 1 Mile, Add</i>	0.35	
<i>For >5 Miles, Deduct</i>	-0.26	
32 17 23 33-0047 LF Single 6" Wide Solid Line, Preformed Tape, Patterned Thermoplastic Reflective Pavement Striping	2.59	
<i>For Up To 1 Mile, Add</i>	0.52	
<i>For >5 Miles, Deduct</i>	-0.39	
32 17 23 33-0048 LF Single 8" Wide Solid Line, Preformed Tape, Patterned Thermoplastic Reflective Pavement Striping	3.44	
<i>For Up To 1 Mile, Add</i>	0.69	
<i>For >5 Miles, Deduct</i>	-0.52	
32 17 23 33-0049 LF Single 12" Wide Solid Line, Preformed Tape, Patterned Thermoplastic Reflective Pavement Striping	5.10	
<i>For Up To 1 Mile, Add</i>	1.02	
<i>For >5 Miles, Deduct</i>	-0.77	
32 17 23 33-0050 SF Preformed Solid Area, Patterned Thermoplastic Reflective Pavement Marking Tape	14.14	
Note: Use task for lines >12" wide, stop bars, transverse lines, diagonal lines, crossing lanes, etc.		
32 17 23 33-0051 EA 6" High, Preformed Letter/Number, Patterned Thermoplastic Reflective Pavement Marking Tape	20.99	
<i>For <10, Add</i>	0.69	
<i>For >50 To 100, Deduct</i>	-0.34	
<i>For >100 To 200, Deduct</i>	-0.46	
<i>For >200, Deduct</i>	-0.91	
32 17 23 33-0052 EA 12" High, Preformed Letter/Number, Patterned Thermoplastic Reflective Pavement Marking Tape	37.04	
<i>For <10, Add</i>	0.87	
<i>For >50 To 100, Deduct</i>	-0.43	
<i>For >100 To 200, Deduct</i>	-0.58	
<i>For >200, Deduct</i>	-1.16	
32 17 23 33-0053 EA 24" High, Preformed Letter/Number, Patterned Thermoplastic Reflective Pavement Marking Tape	63.66	
<i>For <10, Add</i>	1.72	
<i>For >50 To 100, Deduct</i>	-0.86	
<i>For >100 To 200, Deduct</i>	-1.15	
<i>For >200, Deduct</i>	-2.30	
32 17 23 33-0054 EA 36" High, Preformed Letter/Number, Patterned Thermoplastic Reflective Pavement Marking Tape	91.91	
<i>For <10, Add</i>	3.44	
<i>For >50 To 100, Deduct</i>	-1.72	
<i>For >100 To 200, Deduct</i>	-2.29	
<i>For >200, Deduct</i>	-4.59	
32 17 23 33-0055 EA 48" High, Preformed Letter/Number, Patterned Thermoplastic Reflective Pavement Marking Tape	107.73	
<i>For <10, Add</i>	3.86	
<i>For >50 To 100, Deduct</i>	-1.93	
<i>For >100 To 200, Deduct</i>	-2.57	
<i>For >200, Deduct</i>	-5.15	
32 17 23 33-0056 EA 72" High, Preformed Letter/Number, Patterned Thermoplastic Reflective Pavement Marking Tape	137.94	
<i>For <10, Add</i>	6.87	
<i>For >50 To 100, Deduct</i>	-3.43	
<i>For >100 To 200, Deduct</i>	-4.58	
<i>For >200, Deduct</i>	-9.15	
32 17 23 33-0057 EA 96" High, Preformed Letter/Number, Patterned Thermoplastic Reflective Pavement Marking Tape	175.90	
<i>For <10, Add</i>	9.22	
<i>For >50 To 100, Deduct</i>	-4.61	
<i>For >100 To 200, Deduct</i>	-6.15	
<i>For >200, Deduct</i>	-12.30	
32 17 23 33-0058 EA 120" High, Preformed Letter/Number, Patterned Thermoplastic Reflective Pavement Marking Tape	220.47	
<i>For <10, Add</i>	11.43	
<i>For >50 To 100, Deduct</i>	-5.71	
<i>For >100 To 200, Deduct</i>	-7.62	
<i>For >200, Deduct</i>	-15.24	

32 Exterior Improvements**32 10 Bases, Ballasts, And Paving****32 17 Paving Specialties**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 17 23 33-0059 SF Prefomed Arrow, Patterned Thermoplastic Reflective Pavement Marking Tape	14.59	
32 17 23 33-0060 SF Prefomed Symbol, Patterned Thermoplastic Reflective Pavement Marking Tape..... Note: Handicap, railroad, diamond symbol, etc.	15.42	
32 17 23 33-0061 Prefomed, Thermoplastic Reflective Pavement Marking (32 17 23 33-0001) Note: Heat applied. (Flint PreMark or HotTape Series).		
32 17 23 33-0062 EA Prefomed Bike Lane Symbol, 90 Mil Thick, Thermoplastic Reflective Pavement Marking Tape	103.49	
Note: Approximate overall dimensions: 4' width x 8' height.		
32 17 23 33-0063 EA Prefomed Railroad Crossing Symbol, 125 Mil Thick, Thermoplastic Reflective Pavement Marking Tape.....	272.54	
Note: Approximate overall dimensions: 8' width x 20' height. Excludes transverse lines.		
32 17 23 33-0064 EA Prefomed Preferential Lane Symbol (Diamond), 125 Mil Thick, Thermoplastic Reflective Pavement Marking Tape	63.25	
Note: Approximate overall dimensions: 3-1/4' width x 13' height.		
32 17 23 33-0065 EA 6' Height, Prefomed Through Lane Arrow, 90 Mil Thick, Thermoplastic Reflective Pavement Marking Tape.....	57.24	
Note: Approximate overall dimensions: 2' width x 6' height.		
32 17 23 33-0066 EA 9-1/2' Height, Prefomed Through Lane Arrow, 90 Mil Thick, Thermoplastic Reflective Pavement Marking Tape	96.51	
Note: Approximate overall dimensions: 3-1/4' width x 9-1/2' height.		
32 17 23 33-0067 EA 4' Height, Prefomed Turn Lane Arrow, 90 Mil Thick, Thermoplastic Reflective Pavement Marking Tape.....	63.44	
Note: Approximate overall dimensions: 3' width x 4' height.		
32 17 23 33-0068 EA 8' Height, Prefomed Turn Lane Arrow, 90 Mil Thick, Thermoplastic Reflective Pavement Marking Tape.....	105.44	
Note: Approximate overall dimensions: 6' width x 8' height.		
32 17 23 33-0069 EA Prefomed Turn And Through Lane Arrow, 90 Mil Thick, Thermoplastic Reflective Pavement Marking Tape.....	168.89	
Note: Approximate overall dimensions: 7-1/4' width x 12-3/4' height.		
32 17 23 33-0070 EA Prefomed Dual Turn And Through Lane Arrow, 90 Mil Thick, Thermoplastic Reflective Pavement Marking Tape	245.38	
Note: Approximate overall dimensions: 11-1/4' width x 13-1/4' height.		
32 17 23 33-0071 EA Prefomed Elongated Through Lane Arrow, 90 Mil Thick, Thermoplastic Reflective Pavement Marking Tape	101.97	
Note: Approximate overall dimensions: 1-2/3' width x 12' height.		
32 17 23 33-0072 EA Prefomed Elongated Turn Lane Arrow, 90 Mil Thick, Thermoplastic Reflective Pavement Marking Tape	110.90	
Note: Approximate overall dimensions: 3' width x 12' height.		
32 17 23 33-0073 EA Prefomed Elongated Dual Turn Lane Arrow, 90 Mil Thick, Thermoplastic Reflective Pavement Marking Tape.....	188.38	
Note: Approximate overall dimensions: 5-1/2' width x 12' height.		
32 17 23 33-0074 EA Prefomed Elongated Turn And Through Lane Arrow, 90 Mil Thick, Thermoplastic Reflective Pavement Marking Tape	175.02	
Note: Approximate overall dimensions: 3-1/2' width x 20' height.		
32 17 23 33-0075 EA Prefomed Elongated Dual Turn And Through Lane Arrow, 90 Mil Thick, Thermoplastic Reflective Pavement Marking Tape.....	176.69	
Note: Approximate overall dimensions: 5-1/2' width x 20' height.		
32 17 23 33-0076 EA Prefomed Lane-Reduction Arrow, 90 Mil Thick, Thermoplastic Reflective Pavement Marking Tape.....	231.59	
Note: Approximate overall dimensions: 5-1/2' width x 18' height.		
32 17 23 33-0077 Thermoplastic Pavement Striping, Letters And Symbols For Parking Areas (32 17 23 33)		
32 17 23 33-0078 Thermoplastic Pavement Marking Tape For Parking Areas (32 17 23 33-0077) Note: Heat applied. (Flint PreMark Series).		
32 17 23 33-0079 EA 28" Handicap Symbol For Standard Parking Stalls, 90 Mil Thick, Thermoplastic Pavement Marking Tape For Parking Areas.....	39.15	
Note: White or blue symbol. Excludes striping.		
32 17 23 33-0080 EA 39" Handicap Symbol For Standard Parking Stalls, 90 Mil Thick, Thermoplastic Pavement Marking Tape For Parking Areas.....	125.16	
32 17 23 33-0081 EA 40" x 40" Handicap Symbol For Van Parking Stalls, 90 Mil Thick, Thermoplastic Pavement Marking Tape For Parking Areas.....	75.27	
Note: White symbol on blue background. Excludes striping.		
32 17 23 33-0082 EA 45" x 45" Handicap Symbol For Van Parking Stalls, 90 Mil Thick, Thermoplastic Pavement Marking Tape For Parking Areas.....	89.02	
Note: White symbol on blue background. Excludes striping.		
32 17 23 33-0083 EA 48" x 48" Handicap Symbol For Van Parking Stalls, 90 Mil Thick, Thermoplastic Pavement Marking Tape For Parking Areas.....	93.07	
32 18 Athletic And Recreational Surfacing (32 10)		
32 18 23 Athletic Surfacing (32 18)		
32 18 23 29 Synthetic Field Sport Surfacing (32 18 23)		
32 18 23 29-0001 Synthetic Turf (32 18 23 29)		
32 18 23 29-0002 Synthetic Turf (AstroTurf) (32 18 23 29-0001) Note: Includes labor, equipment and material required to install the task.		
32 18 23 29-0003 Tufted Monofilament Polyethylene Synthetic Turf (AstroTurf® GameDay Grass™ MT) (32 18 23 29-0002)		
32 18 23 29-0004 38 Oz/SY Face Weight, Tufted Monofilament Polyethylene Synthetic Turf (AstroTurf® GameDay Grass™ MT 38) (32 18 23 29-0003)		
32 18 23 29-0005 SF 38 Oz/SY Face Weight, Tufted Monofilament Polyethylene Synthetic Turf With Ambient Rubber Infill (AstroTurf® GameDay Grass™ MT 38)	3.87	
For Ambient Rubber And Sand Infill, Add	0.10	
For Cryo Rubber Infill, Add	0.26	
For Ethylene Propylene Diene Monomer (EPDM) Rubber Infill, Add	0.31	
For Cryo Rubber And Sand Infill, Add	0.36	
32 18 23 29-0006 EA Football Markings For AstroTurf® GameDay Grass™ MT 38 Fields	13,675.96	
32 18 23 29-0007 EA Baseball Markings For AstroTurf® GameDay Grass™ MT 38 Fields	11,147.20	



Exterior Improvements	32
Bases, Ballasts, And Paving	32 10
Athletic And Recreational Surfacing	32 18

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 18 23 29-0008	EA		Soccer, Lacrosse, Softball Or Field Hockey Markings For AstroTurf® GameDay Grass™ MT 38 Fields.....	3,354.48	
			Note: Per sport.		
32 18 23 29-0009	EA		Endzone Lettering For AstroTurf® GameDay Grass™ MT 38 Fields	1,238.58	
			Note: Per letter. Excludes outline.		
32 18 23 29-0010	EA		Colored Endzone For AstroTurf® GameDay Grass™ MT 38 Fields.....	1,186.97	
			Note: Per endzone.		
32 18 23 29-0011	EA		Simple Logo For AstroTurf® GameDay Grass™ MT 38 Fields	10,321.48	
			Note: Block letter.		
32 18 23 29-0012	EA		Deluxe Logo For AstroTurf® GameDay Grass™ MT 38 Fields	14,966.15	
			Note: Graphic.		
32 18 23 29-0013			41 Oz/SY Face Weight, Tufted Monofilament Polyethylene Synthetic Turf (AstroTurf® GameDay Grass™ MT 41) <small>(32 18 23 29-0003)</small>		
32 18 23 29-0014	SF		41 Oz/SY Face Weight, Tufted Monofilament Polyethylene Synthetic Turf With Ambient Rubber Infill (AstroTurf® GameDay Grass™ MT 41)	4.41	
			<i>For Ambient Rubber And Sand Infill, Add</i>	0.10	
			<i>For Cryo Rubber Infill, Add</i>	0.26	
			<i>For Ethylene Propylene Diene Monomer (EPDM) Rubber Infill, Add</i>	0.31	
			<i>For Cryo Rubber And Sand Infill, Add</i>	0.36	
32 18 23 29-0015	EA		Football Markings For AstroTurf® GameDay Grass™ MT 41 Fields.....	13,934.08	
32 18 23 29-0016	EA		Baseball Markings For AstroTurf® GameDay Grass™ MT 41 Fields.....	11,560.13	
32 18 23 29-0017	EA		Soccer, Lacrosse, Softball Or Field Hockey Markings For AstroTurf® GameDay Grass™ MT 41 Fields.....	3,612.54	
			Note: Per sport.		
32 18 23 29-0018	EA		Endzone Lettering For AstroTurf® GameDay Grass™ MT 41 Fields	1,341.80	
			Note: Per letter. Excludes outline.		
32 18 23 29-0019	EA		Colored Endzone For AstroTurf® GameDay Grass™ MT 41 Fields.....	1,238.58	
			Note: Per endzone.		
32 18 23 29-0020	EA		Simple Logo For AstroTurf® GameDay Grass™ MT 41 Fields	10,837.62	
			Note: Block letter.		
32 18 23 29-0021	EA		Deluxe Logo For AstroTurf® GameDay Grass™ MT 41 Fields	15,714.55	
			Note: Graphic.		
32 18 23 29-0022			45 Oz/SY Face Weight, Tufted Monofilament Polyethylene Synthetic Turf (AstroTurf® GameDay Grass™ MT 45) <small>(32 18 23 29-0003)</small>		
32 18 23 29-0023	SF		45 Oz/SY Face Weight, Tufted Monofilament Polyethylene Synthetic Turf With Ambient Rubber Infill (AstroTurf® GameDay Grass™ MT 45)	4.52	
			<i>For Ambient Rubber And Sand Infill, Add</i>	0.10	
			<i>For Cryo Rubber Infill, Add</i>	0.26	
			<i>For Ethylene Propylene Diene Monomer (EPDM) Rubber Infill, Add</i>	0.31	
			<i>For Cryo Rubber And Sand Infill, Add</i>	0.36	
32 18 23 29-0024	EA		Football Markings For AstroTurf® GameDay Grass™ MT 45 Fields.....	14,192.12	
32 18 23 29-0025	EA		Baseball Markings For AstroTurf® GameDay Grass™ MT 45 Fields.....	12,489.07	
32 18 23 29-0026	EA		Soccer, Lacrosse, Softball Or Field Hockey Markings For AstroTurf® GameDay Grass™ MT 45 Fields.....	3,870.58	
			Note: Per sport.		
32 18 23 29-0027	EA		Endzone Lettering For AstroTurf® GameDay Grass™ MT 45 Fields	1,445.02	
			Note: Per letter. Excludes outline.		
32 18 23 29-0028	EA		Colored Endzone For AstroTurf® GameDay Grass™ MT 45 Fields.....	1,290.19	
			Note: Per endzone.		
32 18 23 29-0029	EA		Simple Logo For AstroTurf® GameDay Grass™ MT 45 Fields	11,353.70	
			Note: Block letter.		
32 18 23 29-0030	EA		Deluxe Logo For AstroTurf® GameDay Grass™ MT 45 Fields	16,462.86	
			Note: Graphic.		
32 18 23 29-0031			Tufted Monofilament Polyethylene Synthetic Turf With Nylon Root Zone (AstroTurf® GameDay Grass™ 3D) <small>(32 18 23 29-0002)</small>		
32 18 23 29-0032			52 Oz/SY Face Weight, Tufted Slit-Film Polyethylene Synthetic Turf With Nylon Root Zone (AstroTurf® GameDay Grass™ 3DX 52) <small>(32 18 23 29-0031)</small>		
32 18 23 29-0033	SF		52 Oz/SY Face Weight, Tufted Slit-Film Polyethylene Synthetic Turf With Nylon Root Zone And Ambient Rubber Infill (AstroTurf® GameDay Grass™ 3DX 52)	5.25	
			<i>For Ambient Rubber And Sand Infill, Add</i>	0.10	
			<i>For Cryo Rubber Infill, Add</i>	0.20	
			<i>For Ethylene Propylene Diene Monomer (EPDM) Rubber Infill, Add</i>	0.25	
			<i>For Cryo Rubber And Sand Infill, Add</i>	0.30	
32 18 23 29-0034	EA		Football Markings For AstroTurf® GameDay Grass™ 3DX 52 Fields	14,708.11	
32 18 23 29-0035	EA		Baseball Markings For AstroTurf® GameDay Grass™ 3DX 52 Fields	15,688.65	
32 18 23 29-0036	EA		Soccer, Lacrosse, Softball Or Field Hockey Markings For AstroTurf® GameDay Grass™ 3DX 52 Fields.....	4,386.63	
			Note: Per sport.		
32 18 23 29-0037	EA		Endzone Lettering For AstroTurf® GameDay Grass™ 3DX 52 Fields	1,651.44	
			Note: Per letter. Excludes outline.		
32 18 23 29-0038	EA		Colored Endzone For AstroTurf® GameDay Grass™ 3DX 52 Fields.....	1,393.40	
			Note: Per endzone.		
32 18 23 29-0039	EA		Simple Logo For AstroTurf® GameDay Grass™ 3DX 52 Fields	12,385.78	
			Note: Block letter.		
32 18 23 29-0040	EA		Deluxe Logo For AstroTurf® GameDay Grass™ 3DX 52 Fields	17,959.38	
			Note: Graphic.		

32 Exterior Improvements**32 10 Bases, Ballasts, And Paving****32 18 Athletic And Recreational Surfacing**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 18 23 29-0041			60 Oz/SY Face Weight, Tufted Slit-Film Polyethylene Synthetic Turf With Nylon Root Zone (AstroTurf® GameDay Grass™ 3DX 60) <small>(32 18 23 29-0031)</small>		
32 18 23 29-0042	SF		60 Oz/SY Face Weight, Tufted Slit-Film Polyethylene Synthetic Turf With Nylon Root Zone And Ambient Rubber Infill (AstroTurf® GameDay Grass™ 3DX 60)	5.49	
			<i>For Ambient Rubber And Sand Infill, Add</i>	0.10	
			<i>For Cryo Rubber Infill, Add</i>	0.20	
			<i>For Ethylene Propylene Diene Monomer (EPDM) Rubber Infill, Add</i>	0.25	
			<i>For Cryo Rubber And Sand Infill, Add</i>	0.30	
32 18 23 29-0043	EA		Football Markings For AstroTurf® GameDay Grass™ 3DX 60 Fields	14,966.15	
32 18 23 29-0044	EA		Baseball Markings For AstroTurf® GameDay Grass™ 3DX 60 Fields	17,443.30	
32 18 23 29-0045	EA		Soccer, Lacrosse, Softball Or Field Hockey Markings For AstroTurf® GameDay Grass™ 3DX 60 Fields	4,644.67	
			Note: Per sport.		
32 18 23 29-0046	EA		Endzone Lettering For AstroTurf® GameDay Grass™ 3DX 60 Fields	1,754.65	
			Note: Per letter. Excludes outline.		
32 18 23 29-0047	EA		Colored Endzone For AstroTurf® GameDay Grass™ 3DX 60 Fields	1,445.01	
			Note: Per endzone.		
32 18 23 29-0048	EA		Simple Logo For AstroTurf® GameDay Grass™ 3DX 60 Fields	12,901.85	
			Note: Block letter.		
32 18 23 29-0049	EA		Deluxe Logo For AstroTurf® GameDay Grass™ 3DX 60 Fields	18,707.68	
			Note: Graphic.		
32 18 23 29-0050			52 Oz/SY Face Weight, Tufted Monofilament Polyethylene Synthetic Turf With Nylon Root Zone (AstroTurf® GameDay Grass™ 3D 52) <small>(32 18 23 29-0031)</small>		
32 18 23 29-0051	SF		52 Oz/SY Face Weight, Tufted Monofilament Polyethylene Synthetic Turf With Nylon Root Zone And Ambient Rubber Infill (AstroTurf® GameDay Grass™ 3D 52)	5.50	
			<i>For Ambient Rubber And Sand Infill, Add</i>	0.10	
			<i>For Cryo Rubber Infill, Add</i>	0.20	
			<i>For Ethylene Propylene Diene Monomer (EPDM) Rubber Infill, Add</i>	0.25	
			<i>For Cryo Rubber And Sand Infill, Add</i>	0.30	
32 18 23 29-0052	EA		Football Markings For AstroTurf® GameDay Grass™ 3D 52 Fields	15,224.18	
32 18 23 29-0053	EA		Baseball Markings For AstroTurf® GameDay Grass™ 3D 52 Fields	17,546.52	
32 18 23 29-0054	EA		Soccer, Lacrosse, Softball Or Field Hockey Markings For AstroTurf® GameDay Grass™ 3D 52 Fields	4,902.70	
			Note: Per sport.		
32 18 23 29-0055	EA		Endzone Lettering For AstroTurf® GameDay Grass™ 3D 52 Fields	1,857.87	
			Note: Per letter. Excludes outline.		
32 18 23 29-0056	EA		Colored Endzone For AstroTurf® GameDay Grass™ 3D 52 Fields	1,496.61	
			Note: Per endzone.		
32 18 23 29-0057	EA		Simple Logo For AstroTurf® GameDay Grass™ 3D 52 Fields	13,417.92	
			Note: Block letter.		
32 18 23 29-0058	EA		Deluxe Logo For AstroTurf® GameDay Grass™ 3D 52 Fields	19,455.99	
			Note: Graphic.		
32 18 23 29-0059			60 Oz/SY Face Weight, Tufted Monofilament Polyethylene Synthetic Turf With Nylon Root Zone (AstroTurf® GameDay Grass™ 3D 60) <small>(32 18 23 29-0031)</small>		
32 18 23 29-0060	SF		60 Oz/SY Face Weight, Tufted Monofilament Polyethylene Synthetic Turf With Nylon Root Zone And Ambient Rubber Infill (AstroTurf® GameDay Grass™ 3D 60)	5.63	
			<i>For Ambient Rubber And Sand Infill, Add</i>	0.10	
			<i>For Cryo Rubber Infill, Add</i>	0.20	
			<i>For Ethylene Propylene Diene Monomer (EPDM) Rubber Infill, Add</i>	0.25	
			<i>For Cryo Rubber And Sand Infill, Add</i>	0.30	
32 18 23 29-0061	EA		Football Markings For AstroTurf® GameDay Grass™ 3D 60 Fields	15,482.22	
32 18 23 29-0062	EA		Baseball Markings For AstroTurf® GameDay Grass™ 3D 60 Fields	18,681.88	
32 18 23 29-0063	EA		Soccer, Lacrosse, Softball Or Field Hockey Markings For AstroTurf® GameDay Grass™ 3D 60 Fields	5,160.74	
			Note: Per sport.		
32 18 23 29-0064	EA		Endzone Lettering For AstroTurf® GameDay Grass™ 3D 60 Fields	2,064.30	
			Note: Per letter. Excludes outline.		
32 18 23 29-0065	EA		Colored Endzone For AstroTurf® GameDay Grass™ 3D 60 Fields	1,548.22	
			Note: Per endzone.		
32 18 23 29-0066	EA		Simple Logo For AstroTurf® GameDay Grass™ 3D 60 Fields	13,934.00	
			Note: Block letter.		
32 18 23 29-0067	EA		Deluxe Logo For AstroTurf® GameDay Grass™ 3D 60 Fields	20,204.30	
			Note: Graphic.		
32 18 23 29-0068			Tufted Monofilament Polyethylene Synthetic Turf (AstroTurf® GameDay Grass™ XPe) <small>(32 18 23 29-0002)</small>		
32 18 23 29-0069			38 Oz/SY Face Weight, Tufted Slit-Film Polyethylene Synthetic Turf With Nylon Root Zone (AstroTurf® GameDay Grass™ XPe 38) <small>(32 18 23 29-0068)</small>		
32 18 23 29-0070	SF		38 Oz/SY Face Weight, Tufted Slit-Film Polyethylene Synthetic Turf With Nylon Root Zone And Ambient Rubber Infill (AstroTurf® GameDay Grass™ XPe 38)	4.17	
			<i>For Ambient Rubber And Sand Infill, Add</i>	0.10	
			<i>For Cryo Rubber Infill, Add</i>	0.26	
			<i>For Ethylene Propylene Diene Monomer (EPDM) Rubber Infill, Add</i>	0.31	
			<i>For Cryo Rubber And Sand Infill, Add</i>	0.36	
32 18 23 29-0071	EA		Football Markings For AstroTurf® GameDay Grass™ XPe 38 Fields	13,159.97	
32 18 23 29-0072	EA		Baseball Markings For AstroTurf® GameDay Grass™ XPe 38 Fields	9,702.25	
32 18 23 29-0073	EA		Soccer, Lacrosse, Softball Or Field Hockey Markings For AstroTurf® GameDay Grass™ XPe 38 Fields	2,838.42	
			Note: Per sport.		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 18 23 29-0074 EA Endzone Lettering For AstroTurf® GameDay Grass™ XPe 38 Fields..... Note: Per letter. Excludes outline.	1,032.15	
32 18 23 29-0075 EA Colored Endzone For AstroTurf® GameDay Grass™ XPe 38 Fields..... Note: Per endzone.	1,083.76	
32 18 23 29-0076 EA Simple Logo For AstroTurf® GameDay Grass™ XPe 38 Fields..... Note: Block letter.	9,289.39	
32 18 23 29-0077 EA Deluxe Logo For AstroTurf® GameDay Grass™ XPe 38 Fields..... Note: Graphic.	13,469.61	
32 18 23 29-0078 42 Oz/SY Face Weight, Tufted Slit-Film Polyethylene Synthetic Turf With Nylon Root Zone (AstroTurf® GameDay Grass™ XPe 42) (32 18 23 29-0068)		
32 18 23 29-0079 SF 42 Oz/SY Face Weight, Tufted Slit-Film Polyethylene Synthetic Turf With Nylon Root Zone And Ambient Rubber Infill (AstroTurf® GameDay Grass™ XPe 42)	3.70	
<i>For Ambient Rubber And Sand Infill, Add</i>	0.10	
<i>For Cryo Rubber Infill, Add</i>	0.26	
<i>For Ethylene Propylene Diene Monomer (EPDM) Rubber Infill, Add</i>	0.31	
<i>For Cryo Rubber And Sand Infill, Add</i>	0.36	
32 18 23 29-0080 EA Football Markings For AstroTurf® GameDay Grass™ XPe 42 Fields	13,417.92	
32 18 23 29-0081 EA Baseball Markings For AstroTurf® GameDay Grass™ XPe 42 Fields	10,321.48	
32 18 23 29-0082 EA Soccer, Lacrosse, Softball Or Field Hockey Markings For AstroTurf® GameDay Grass™ XPe 42 Fields..... Note: Per sport.	3,096.44	
32 18 23 29-0083 EA Endzone Lettering For AstroTurf® GameDay Grass™ XPe 42 Fields..... Note: Per letter. Excludes outline.	1,135.36	
32 18 23 29-0084 EA Colored Endzone For AstroTurf® GameDay Grass™ XPe 42 Fields..... Note: Per endzone.	1,135.36	
32 18 23 29-0085 EA Simple Logo For AstroTurf® GameDay Grass™ XPe 42 Fields..... Note: Block letter.	9,805.41	
32 18 23 29-0086 EA Deluxe Logo For AstroTurf® GameDay Grass™ XPe 42 Fields..... Note: Graphic.	14,217.84	
32 18 23 29-0087 Tufted Monofilament Nylon Synthetic Turf With Nylon Root Zone And Attached Pad (AstroTurf® PureGrass®) (32 18 23 29-0002)		
32 18 23 29-0088 SF Tufted Monofilament Nylon Synthetic Turf With Nylon Root Zone And Attached Pad (AstroTurf® PureGrass®).....	8.68	
32 18 23 29-0089 SF Tufted Monofilament Nylon Synthetic Turf With Nylon Root Zone And Ambient Rubber Infill (AstroTurf® PureGrass®)	7.63	
32 18 23 29-0090 EA Football Markings For AstroTurf® PureGrass® Fields	25,464.89	
32 18 23 29-0091 EA Baseball Markings For AstroTurf® PureGrass® Fields	30,253.16	
32 18 23 29-0092 EA Soccer, Lacrosse, Softball Or Field Hockey Markings For AstroTurf® PureGrass® Fields..... Note: Per sport.	7,400.05	
32 18 23 29-0093 EA Endzone Lettering For AstroTurf® PureGrass® Fields..... Note: Per letter. Excludes outline.	2,829.43	
32 18 23 29-0094 EA Colored Endzone For AstroTurf® PureGrass® Fields..... Note: Per endzone.	2,100.20	
32 18 23 29-0095 EA Simple Logo For AstroTurf® PureGrass® Fields..... Note: Block letter.	18,901.77	
32 18 23 29-0096 EA Deluxe Logo For AstroTurf® PureGrass® Fields	27,750.20	
Note: Graphic.		
32 18 23 29-0097 Synthetic Turf (G9 Turf) (32 18 23 29-0001)		
Note: Includes labor, equipment and material required to install the task.		
32 18 23 29-0098 SF 2-1/2" Height, 53 Ounce, Tufted 3/8" Gauge Monofilament Synthetic Turf With Thatch Layer And Ethylene Propylene Diene Monomer (EPDM) Infill (G9 Turf Playmaker Turf)	5.71	
Note: For football and multi-sport fields. Excludes preparation of sub-base, grooming, sports lines and logos.		
<i>For >35,000, Deduct</i>	-0.54	
32 18 23 29-0099 SF 2" Height, 48 Ounce, Tufted 3/8" Gauge Monofilament Synthetic Turf With Thatch Layer And Ethylene Propylene Diene Monomer (EPDM) Infill (G9 Turf Striker Turf).....	5.67	
Note: For all sports other than football. Excludes preparation of sub-base, grooming, sports lines and logos.		
<i>For >35,000, Deduct</i>	-0.53	
32 18 23 29-0100 SF 1-3/4" Height, 72 Ounce, Tufted 3/8" Gauge, Two-Color Monofilament Synthetic Turf With Thatch Layer And Acrylic Coated Sand Infill (G9 Turf Perennial Turf).....	5.89	
Note: For landscaped areas or playgrounds. Excludes preparation of sub-base, grooming, sports lines and logos.		
32 18 23 29-0101 EA Football Inlays For G9 Synthetic Turf	35,203.53	
Note: Includes field grid, numbers, arrows, coach's box and kick off lines.		
32 18 23 29-0102 EA Soccer Inlays For G9 Synthetic Turf.....	15,254.86	
32 18 23 29-0103 EA Boys Lacrosse Inlays For G9 Synthetic Turf.....	15,254.86	
32 18 23 29-0104 EA Girls Lacrosse Inlays For G9 Synthetic Turf	15,254.86	
32 18 23 29-0105 EA Field Hockey Inlays For G9 Synthetic Turf.....	15,254.86	
32 18 23 29-0106 EA Endzone Lettering For G9 Synthetic Turf	1,760.18	
Note: Priced per letter. Includes single color outlining.		
32 18 23 29-0107 SF Ethylene Propylene Diene Monomer (EPDM) Black Infill For G9 Synthetic Turf	1.65	
32 18 23 29-0108 SF Ethylene Propylene Diene Monomer (EPDM) Color Infill For G9 Synthetic Turf.....	4.30	
32 18 23 29-0109 SF Styrene-Butadiene Rubber (SBR) Infill For G9 Synthetic Turf	1.23	
32 18 23 29-0110 SF Sand Infill For G9 Synthetic Turf.....	0.62	
32 18 23 29-0111 SF Acrylic Coated Sand Infill For G9 Synthetic Turf.....	1.02	
32 18 23 29-0112 EA Gmax Compaction And Hardness Test For G9 Synthetic Turf	1,173.45	
Note: Includes a comprehensive report.		
32 18 23 29-0113 EA Safety Bridge Over Track For G9 Synthetic Turf	11,734.51	

32 Exterior Improvements**32 10 Bases, Ballasts, And Paving****32 18 Athletic And Recreational Surfacing**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 18 23 29-0114	SF		Clean And Groom Synthetic Turf.....0.39 Note: Includes using equipment to pick up metal particles in the field, air vacuum the top 2-5 mm of infill, clean and screen to remove broken strands, dirt, bandage, etc. <i>For >10,000 To 30,000, Deduct</i> -0.16 <i>For >30,000 To 60,000, Deduct</i> -0.27 <i>For >60,000, Deduct</i> -0.30		
32 18 23 29-0115	SF		Rejuvenate Synthetic Turf And Reinstall Existing Infill.....2.63 Note: Includes using equipment to extract 10 to 20 mm of infill by delivering high pressure air into the carpet, decompacting the surface and driving out the infill leaving the fiber standing straight up. Includes reinstalling the old infill that was removed.		
32 18 23 29-0116	SF		Rejuvenate Synthetic Turf For Installation Of New Infill .....2.92 Note: Includes using equipment to extract 10 to 20 mm of infill by delivering high pressure air into the carpet, decompacting the surface and driving out the infill leaving the fiber standing straight up. Includes disposing of the old infill. Excludes new infill.		
32 18 23 29-0117	SF		Drainage Layer For G9 Synthetic Turf .....2.40 Note: Used for drainage over asphalt or on roof tops.		
32 18 23 29-0118	SF		15 mm, Shock Pad For G9 Synthetic Turf .....1.47 Note: Used for additional Gmax for a stone base field.		
32 18 23 29-0119	EA		Single Visit Repair Call To Repair Up To 300 LF Of Inlay Lines Or Seams On G9 Synthetic Turf .....2,338.60 Note: Includes field inspection and report.		
32 18 23 29-0120	LF		Repair Inlay Lines Or Seams On G9 Synthetic Turf.....6.43 Note: Linear foot price for repairs over the initial repair call maximum of 300 LF.		
32 18 23 29-0121	LF		Nailer Used To Attach G9 Synthetic Turf.....2.57		
32 18 23 29-0122	SF		Remove And Recycle Existing Field .....1.81 Note: Includes removal, shipping and recycling of infill, fibers and backing.		
32 18 23 33 Running Track Surfacing (32 18 23)					
32 18 23 33-0001			Running Track Surfacing (32 18 23 33)		
32 18 23 33-0002	SY		2-1/2" Asphaltic Concrete Running Track Surfacing .....26.99		
32 18 23 33-0003			Running Track Seal And Colored Surfaces (32 18 23 33)		
32 18 23 33-0004	SY		1 Seal Coat, Striping Of Track .....11.84 Note: Includes certification.		
32 18 23 39 Synthetic Running Track Surfacing (32 18 23)					
32 18 23 39-0001			Synthetic Running Track Surfacing (XPLODE™) (32 18 23 39) Note: Excludes asphalt base. Includes striping.		
32 18 23 39-0002	SY		Paved-In-Place Styrene-Butadiene Rubber (SBR) Or Ethylene Propylene Diene Monomer (EPDM) Rubber Granule Base Mat With Polyurethane Binder, Synthetic Running Track Surfacing (XPLODE™ M100) .....36.80 <i>For >5,500, Deduct</i> -4.05 <i>For Up To 4,000, Add</i> 12.88		
32 18 23 39-0003	SY		Paved-In-Place Styrene-Butadiene Rubber (SBR) Granule Base Mat With Polyurethane Binder Finished With A Textured And Pigmented Polyurethane And Ethylene Propylene Diene Monomer (EPDM) Rubber Structural Spray Coat, Synthetic Running Track Surfacing (XPLODE™ MS200) .....49.39 <i>For >5,500, Deduct</i> -5.43 <i>For Up To 4,000, Add</i> 17.29 <i>For Custom Color Upgrade, Add</i> 4.69 <i>For Aliphatic Top Coating, Add</i> 8.89		
32 18 23 39-0004	SY		Paved-In-Place Ethylene Propylene Diene Monomer (EPDM) Rubber Granule Base Mat With Polyurethane Binder, Two-Component Polyurethane Sealer Layer And Two-Component Polyurethane Wearing Layer With Embedded Ethylene Propylene Diene Monomer (EPDM) Rubber, Synthetic Running Track Surfacing (XPLODE™ MSX500) .....83.00 <i>For >5,500, Deduct</i> -4.98 <i>For Up To 4,000, Add</i> 29.05 <i>For Custom Color Upgrade, Add</i> 6.39 <i>For Aliphatic Top Coating, Add</i> 11.87		
32 18 23 39-0005	SY		Full Pour Two-Component Polyurethane Track System With Embedded Ethylene Propylene Diene Monomer (EPDM) Rubber Surface, Synthetic Running Track Surfacing (XPLODE™ MSX500) .....107.21 <i>For >5,500, Deduct</i> -6.43 <i>For Up To 4,000, Add</i> 37.52 <i>For Custom Color Upgrade, Add</i> 8.36 <i>For Aliphatic Top Coating, Add</i> 12.22		
32 18 23 39-0006	SY		Latex Binder, Synthetic Running Track Surfacing (XPLODE™ Plexitrac® Lightning) .....33.52 <i>For >5,500, Deduct</i> -3.69 <i>For Up To 4,000, Add</i> 11.73		
32 18 23 39-0007	SY		Latex Binder, Synthetic Running Track Surfacing (XPLODE™ Plexitrac® Accelerator) .....37.73 <i>For >5,500, Deduct</i> -5.47 <i>For Up To 4,000, Add</i> 13.21		
32 18 23 39-0008	SY		Spray Retop XPLODE™ M100/MS200 Running Tracks .....33.14 <i>For Up To 4,000, Add</i> 11.60 <i>For >5,500, Deduct</i> -3.24		
32 18 23 39-0009	SY		Sandwich Retop XPLODE™ MSX500 Running Tracks .....64.15 <i>For Up To 4,000, Add</i> 22.45 <i>For >5,500, Deduct</i> -6.76		
32 18 23 39-0010	SY		Retop XPLODE™ Plexitrac® Lightning Running Tracks18.66 Note: Two layers. <i>For Up To 4,000, Add</i> 6.53 <i>For >5,500, Deduct</i> -3.09		



Exterior Improvements		32
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MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 18 23 39-0011	SY		Retop XPLODE™ Plexitrac® Accelerator Running Tracks..... Note: Two layers. <i>For Up To 4,000, Add</i> <i>For >5,500, Deduct</i>	22.72 7.95 -3.09	
32 18 23 39-0012	EA		Restripe XPLODE™ Running Track..... Note: Includes two coats of acrylic resurfacer and two coats of color. <i>For College Track Restriping, Add</i>	7,713.06 1,402.38	
32 18 23 53 Tennis Court Surfacing (32 18 23)					
32 18 23 53-0001			Tennis Court Surfacing (32 18 23 53) See CSI section 32 18 23 61-0000 for 100% acrylic tennis court surfacing.		
32 18 23 53-0002	SY		Tennis Court Bituminous Pavement, 2-1/2" Thick.....	28.44	
32 18 23 53-0003			Tennis Court Markings (32 18 23 53)		
32 18 23 53-0004	EA		Paint Markings On Asphalt Tennis Court 2 Coats.....	310.47	
32 18 23 56 Natural Tennis Court Surfacing (32 18 23)					
32 18 23 56-0001	SY		Clay Tennis Court.....	40.59	
32 18 23 56-0002	SY		Tennis Court, Pulverized Natural Greenstone, Fast Dry..... Note: Includes 4" base.	45.14	
32 18 23 56-0003	SY		Tennis Court, Rubber-Cork Base Resilient Pavement.....	17.50	
32 18 23 56-0004	SY		Resurface Clay Tennis Court.....	11.85	
32 18 23 56-0005	SY		Resurface Tennis Court, Pulverized Natural Greenstone.....	10.06	
32 18 23 56-0006	SY		Resurface Tennis Court, Resilient Pavement.....	6.61	
32 18 23 61 Multi-Use, Tennis Court, Basketball Court Athletic Surfacing (32 18 23)					
32 18 23 61-0001			100% Acrylic Athletic Surfacing System (California Products Plexipave®) (32 18 23 61) Note: Excludes asphalt or concrete sub base and repairs of sub base.		
32 18 23 61-0002			Surface Preparation For Athletic Surfacing System (California Products Plexipave®) (32 18 23 61-0001)		
32 18 23 61-0003	SY		100% Acrylic Resurfacer, Athletic Surfacing System (California Products Plexipave® Acrylic Resurfacer), Per Coat..... Note: Includes ultra fine silica sand. Applied with rubber squeegee.	1.89	
32 18 23 61-0004	SY		Acid Etching Concrete Pre-Treatment For Plexipave® Athletic Surfacing System (California Products Plexipave® Concrete Preparer®), Per Coat..... Note: For previously uncoated portland cement concrete. Applied with broom.	0.65	
32 18 23 61-0005	SY		Two-Part, Water Based Epoxy Primer For Plexipave® Athletic Surfacing System (California Products Plexipave® Ti-Coat®), Per Coat..... Note: For new or uncoated portland cement concrete. Applied with a short nap phenolic roller.	2.33	
32 18 23 61-0006	SY		Up To 1/2" Thick, Acrylic Latex Patching Compound, Athletic Surfacing System (California Products Plexipave® Court Patch Binder), Per Coat..... Note: For patching depressions and uneven texture in new or existing asphalt or concrete surfaces. Includes ultra fine silica sand and portland cement. Applied with trowel or metal screed.	94.66	
32 18 23 61-0007			Surface Coatings For Athletic Surfacing System (California Products Plexipave®) (32 18 23 61-0001) Note: Standard colors include dark green, Florida green, light green, maroon, Sahara sand, brown, California red, and cape gray.		
32 18 23 61-0008	SY		100% Acrylic Emulsion Color Coating, Athletic Surfacing System (California Products Fortified Plexipave®), First Coat..... Note: Includes ultra fine silica sand. Applied with rubber squeegee.	2.41	
			<i>For Pacific Blue, Add</i>	0.13	
			<i>For US Open Blue, Add</i>	0.44	
32 18 23 61-0009	SY		100% Acrylic Emulsion Color Coating, Athletic Surfacing System (California Products Fortified Plexipave®), Second Coat..... Note: Includes ultra fine silica sand. Applied with rubber squeegee.	1.98	
			<i>For Pacific Blue, Add</i>	0.09	
			<i>For US Open Blue, Add</i>	0.32	
32 18 23 61-0010	SY		100% Acrylic Emulsion Color Coating, Athletic Surfacing System (California Products Fortified Plexipave®), Third Coat..... Note: Price per coat for third or additional coats. Includes ultra fine silica sand. Applied with rubber squeegee.	1.75	
			<i>For Pacific Blue, Add</i>	0.07	
			<i>For US Open Blue, Add</i>	0.25	
32 18 23 61-0011	SY		Non-Textured, 100% Acrylic Emulsion Color Coating Finish, Athletic Surfacing System (California Products Plexipave® Plexichrome®), Per Coat..... Note: Non-textured finish coat over Plexipave® for faster playing surfaces. Applied with rubber squeegee followed by wide hair-type push broom.	1.75	
			<i>For Pacific Blue, Add</i>	0.04	
			<i>For US Open Or Australian Open Blue, Add</i>	0.30	
			<i>For Pro Purple, Add</i>	0.65	
32 18 23 61-0012			Specialty Coatings For Athletic Surfacing System (California Products Plexipave®) (32 18 23 61-0001)		

32 Exterior Improvements**32 10 Bases, Ballasts, And Paving****32 18 Athletic And Recreational Surfacing**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 18 23 61-0013	SY		Hard Acrylic Surface Coat, Clear Coating Finish, Athletic Surfacing System (California Products Plexipave® Clear-Glo #3®), Per Coat 1.12 Note: Final finish coat over Plexipave® for increased wear resistance for basketball and volleyball courts. Applied with wide hair-type push broom.	1.12	
32 18 23 61-0014			Line Striping For Athletic Surfacing System (California Products Plexipave®) (32 18 23 61-0001)		
32 18 23 61-0015	SY		Tennis Or Basketball Court Line Striping For Athletic Surfacing System (California Products Plexipave® Hi-Hide Plexicolor®) 5.22 Note: Textured or non-textured highly reflective line marking paint.	5.22	
32 18 23 61-0016			Cushion Coatings For Athletic Surfacing System (California Products Plexipave® Plexicushion®) (32 18 23 61-0001)		
32 18 23 61-0017	SY		Resilient Latex Undercoating Base Coat, Athletic Surfacing System (California Products Plexipave® Plexicushion® Base Coat), First Coat 3.52 Note: Applied with rubber squeegee.	3.52	
32 18 23 61-0018	SY		Resilient Latex Undercoating Base Coat, Athletic Surfacing System (California Products Plexipave® Plexicushion® Base Coat), Second Coat 4.73 Note: Applied with rubber squeegee.	4.73	
32 18 23 61-0019	SY		Resilient Latex Undercoating Base Coat, Athletic Surfacing System (California Products Plexipave® Plexicushion® Base Coat), Third Coat 4.10 Note: Price per coat for third or additional coats. Applied with rubber squeegee.	4.10	
32 18 23 61-0020	SY		Resilient Latex Undercoating, Athletic Surfacing System (California Products Plexipave® Plexicushion®), First Coat 3.12 Note: Applied with rubber squeegee.	3.12	
32 18 23 61-0021	SY		Resilient Latex Undercoating, Athletic Surfacing System (California Products Plexipave® Plexicushion®), Second Coat 2.42 Note: Price per coat for second or additional coats. Applied with rubber squeegee.	2.42	

32 30 Site Improvements (32)**32 31 Fences And Gates (32 30)****32 31 11 Gate Operators (32 31)**

32 31 11 00-0001			Gate Operators (32 31 11) Note: Excludes gates, electrical connections, access controls and concrete foundation.		
32 31 11 00-0002			Swing Gate Actuator (32 31 11 00-0001)		
32 31 11 00-0003			Single Gate, Swing Gate Actuator (32 31 11 00-0002)		
32 31 11 00-0004	EA		Up To 10' Wide Gate, 1/2 HP Motor, 115 Volt AC, Single Gate, Swing Gate Actuator (DKS™ DoorKing® 6003) 1,040.35 Note: Includes one primary operator with a 10' wide gate capacity.	1,040.35	182.67
32 31 11 00-0005	EA		Up To 14' Wide Gate, 1/2 HP Motor, 115 Volt AC, Single Gate, Swing Gate Actuator (DKS™ DoorKing® 6002) 1,332.85 Note: Includes one primary operator with a 14' wide gate capacity.	1,332.85	182.67
32 31 11 00-0006			Dual Gate, Swing Gate Actuator (32 31 11 00-0002)		
32 31 11 00-0007	EA		Up To 10' Wide Gates, 1/2 HP Motor, 115 Volt AC, Dual Gate, Swing Gate Actuator (DKS™ DoorKing® 6003) 2,080.69 Note: Includes one primary and one secondary operator each with a 10' wide gate capacity.	2,080.69	365.35
32 31 11 00-0008	EA		Up To 14' Wide Gates, 1/2 HP Motor, 115 Volt AC, Dual Gate, Swing Gate Actuator (DKS™ DoorKing® 6002) 2,665.69 Note: Includes one primary and one secondary operator each with a 14' wide gate capacity.	2,665.69	365.35
32 31 11 00-0009			Swing Gate Operators (32 31 11 00-0001)		
32 31 11 00-0010			Single Gate, Swing Gate Operators (32 31 11 00-0009)		
32 31 11 00-0011	EA		400 LB Capacity, Up To 10' Wide Gate, 1/2 HP Motor, 115 Volt AC, Single Gate, Swing Gate Operator (DKS™ DoorKing® 6050) 1,955.35 Note: Includes one primary operator with a 10' wide and 400# gate capacity.	1,955.35	182.67
32 31 11 00-0012	EA		500 LB Capacity, Up To 14' Wide Gate, 1/2 HP Motor, 115 Volt AC, Single Gate, Swing Gate Operator (DKS™ DoorKing® 6100) 2,112.85 Note: Includes one primary operator with a 14' wide and 500# gate capacity.	2,112.85	182.67
32 31 11 00-0013	EA		700 LB Capacity, Up To 18' Wide Gate, 1/2 HP Motor, 115 Volt AC, Single Gate, Swing Gate Operator (DKS™ DoorKing® 6500) 2,810.35 Note: Includes one primary operator with an 18' wide and 700# gate capacity.	2,810.35	182.67
32 31 11 00-0014	EA		For 208/230/460 Volt AC, Add 322.50 800 LB Capacity, Up To 22' Wide Gate, 1 HP Motor, 115 Volt AC, Single Gate, Swing Gate Operator (DKS™ DoorKing® 6500) 3,162.85 Note: Includes one primary operator with a 22' wide and 800# gate capacity. For 208/230/460 Volt AC, Add 322.50	3,162.85	182.67
32 31 11 00-0015			Dual Gate, Swing Gate Operators (32 31 11 00-0009)		
32 31 11 00-0016	EA		400 LB Capacity, Up To 10' Wide Gates, 1/2 HP Motor, 115 Volt AC, Dual Gate, Swing Gate Operator (DKS™ DoorKing® 6050) 3,498.19 Note: Includes one primary and one secondary operator each with a 10' wide and 400# gate capacity.	3,498.19	365.35
32 31 11 00-0017	EA		500 LB Capacity, Up To 14' Wide Gates, 1/2 HP Motor, 115 Volt AC, Dual Gate, Swing Gate Operator (DKS™ DoorKing® 6100) 3,813.19 Note: Includes one primary and one secondary operator each with a 14' wide and 500# gate capacity.	3,813.19	365.35



		Exterior Improvements	32
		Site Improvements	32 30
		Fences And Gates	32 31

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 31 11 00-0018	EA		700 LB Capacity, Up To 14' Wide Gates, 1/2 HP Motor, 115 Volt AC, Dual Gate, Swing Gate Operator (DKS™ DoorKing® 6500)..... Note: Includes one primary and one secondary operator each with an 18' wide and 700# gate capacity. For 208/230/460 Volt AC, Add	5,200.69 322.50	365.35
32 31 11 00-0019	EA		800 LB Capacity, Up To 22' Wide Gates, 1 HP Motor, 115 Volt AC, Dual Gate, Swing Gate Operator (DKS™ DoorKing® 6500)..... Note: Includes one primary and one secondary operator each with a 22' wide and 800# gate capacity. For 208/230/460 Volt AC, Add	5,973.19 322.50	365.35
32 31 11 00-0020			Sliding Gate Operators (32 31 11 00-0001) Note: Includes 20' of chain. See CSI section 32 31 11 00-0029 for additional chain over 20'.		
32 31 11 00-0021	EA		300 LB Capacity, Up To 16' Wide Gate, 1/2 HP Motor, 115 Volt AC, Sliding Gate Operator (DKS™ DoorKing® 9050)..... Note: Includes operator, chain brackets, hardware and 20' of #41 chain.	1,602.85	182.67
32 31 11 00-0022	EA		1,000 LB Capacity, Up To 30' Wide Gate, 1/2 HP Motor, 115 Volt AC, Sliding Gate Operator (DKS™ DoorKing® 9100)..... Note: Includes operator, chain brackets, hardware and 20' of #41 chain.	2,238.42	219.20
32 31 11 00-0023	EA		1,500 LB Capacity, Up To 45' Wide Gate, 1 HP Motor, 115 Volt AC, Sliding Gate Operator (DKS™ DoorKing® 9150)..... Note: Includes operator, chain brackets, hardware and 20' of #40 chain.	2,763.42	219.20
32 31 11 00-0024	EA		3,000 LB Capacity, Up To 100' Wide Gate, 1 HP Motor, 115 Volt AC, Sliding Gate Operator (DKS™ DoorKing® 9210)..... Note: Includes operator, chain brackets, hardware and 20' of #50 chain.	3,605.23	255.74
32 31 11 00-0025	EA		2,000 LB Capacity, Up To 100' Wide Gate, 1 HP Motor, 208/230 Volt AC, Variable Speed, Sliding Gate Operator (DKS™ DoorKing® 9220)..... Note: Includes operator, chain brackets, hardware and 20' of #50 chain.	4,415.23	255.74
32 31 11 00-0026	EA		5,000 LB Capacity, Up To 100' Wide Gate, 3 HP Motor, 208/230 Volt AC, Variable Speed, Sliding Gate Operator (DKS™ DoorKing® 9230)..... Note: Includes operator, chain brackets, hardware and 20' of #60 chain.	6,018.30	292.27
32 31 11 00-0027	EA		5,000 LB Capacity, Up To 100' Wide Gate, 3 HP Motor, 208/230 Volt AC, High Speed, Sliding Gate Operator (DKS™ DoorKing® 9530)..... Note: Includes operator, chain brackets, hardware and 20' of #60 chain.	10,034.55	292.27
32 31 11 00-0028	EA		10,000 LB Capacity, Up To 160' Wide Gate, 5 HP Motor, 208/230 Volt AC, High Speed, Sliding Gate Operator (DKS™ DoorKing® 9550)..... Note: Includes operator, chain brackets, hardware and 20' of #60 chain.	16,992.62	328.81
32 31 11 00-0029			Accessories For Gate Actuators And Operators (32 31 11 00-0001)		
32 31 11 00-0030	EA		Single Channel Detector Loop For Gate Actuators And Operators (DKS™ DoorKing® 9410).....	405.36	
32 31 11 00-0031	EA		Two Channel Detector Loop For Gate Actuators And Operators (DKS™ DoorKing® 9409).....	794.98	
32 31 11 00-0032	EA		Heater Kit For Gate Actuators And Operators (DKS™ DoorKing® 1601).....	446.14	
32 31 11 00-0033	EA		Photoelectric Eye For Gate Actuators And Operators (DKS™ DoorKing® 8080-031).....	511.70	
32 31 11 00-0034	EA		Reversing Edge Sensor For Gate Actuators And Operators (DKS™ DoorKing® 8080-020).....	466.70	
32 31 11 00-0035	EA		Post Mount Base Plate For Gate Actuators And Operators (DKS™ DoorKing® 9310).....	357.95	
32 31 11 00-0036	LF		#40 Chain For Sliding Gate Operators.....	5.61	
32 31 11 00-0037	LF		#41 Chain For Sliding Gate Operators.....	4.48	
32 31 11 00-0038	LF		#50 Chain For Sliding Gate Operators.....	6.23	
32 31 11 00-0039	LF		#60 Chain For Sliding Gate Operators.....	5.92	
32 31 13			Chain Link Fences And Gates (32 31)		
32 31 13 00-0001			Post Holes (32 31 13) Note: Excludes spreading of excess material on site or loading and removal of excavated material from site. See CSI section 02 41 19 13-0072 for core drilling in concrete, 02 41 19 13-0210 for core drilling in asphalt.		
32 31 13 00-0002			Drilling Post Hole In Soil (32 31 13 00-0001) Note: Auger by machine unless otherwise notified by owner.		
32 31 13 00-0003	VLF		Up To 2-1/2" Diameter Hole, Auger By Machine Fence Post Hole In Soil.....	7.67	
32 31 13 00-0004	VLF		2-1/2" Diameter Hole, Auger By Machine Fence Post Hole In Soil.....	8.63	
32 31 13 00-0005	VLF		3" Diameter Hole, Auger By Machine Fence Post Hole In Soil.....	10.22	
32 31 13 00-0006	VLF		4" Diameter Hole, Auger By Machine Fence Post Hole In Soil.....	11.50	
32 31 13 00-0007	VLF		6" Diameter Hole, Auger By Machine Fence Post Hole In Soil.....	12.54	
32 31 13 00-0008	VLF		8" Diameter Hole, Auger By Machine Fence Post Hole In Soil.....	13.80	
32 31 13 00-0009	VLF		10" Diameter Hole, Auger By Machine Fence Post Hole In Soil.....	15.33	
32 31 13 00-0010	VLF		12" Diameter Hole, Auger By Machine Fence Post Hole In Soil.....	17.25	
32 31 13 00-0011	VLF		18" Diameter Hole, Auger By Machine Fence Post Hole In Soil.....	19.72	
32 31 13 00-0012	VLF		24" Diameter Hole, Auger By Machine Fence Post Hole In Soil.....	23.01	
32 31 13 00-0013	VLF		30" Diameter Hole, Auger By Machine Fence Post Hole In Soil.....	27.61	
32 31 13 00-0014	VLF		36" Diameter Hole, Auger By Machine Fence Post Hole In Soil.....	34.50	
32 31 13 00-0015			Drilling Post Hole In Rock (32 31 13 00-0001)		
32 31 13 00-0016	CF		Jackhammer Post Hole, Rock.....	58.35	
32 31 13 00-0017	CF		Rock Drill Post Hole, Rock.....	16.56	
32 31 13 00-0018			Post Hole Fill (32 31 13 00-0001)		
32 31 13 00-0019			Concrete Fill (32 31 13 00-0018)		
32 31 13 00-0020	VLF		Concrete Fill, Up To 2-1/2" Diameter Hole.....	4.52	
32 31 13 00-0021	VLF		Concrete Fill, 2-1/2" Diameter Hole.....	5.81	

32 Exterior Improvements**32 30 Site Improvements****32 31 Fences And Gates**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
	32 31 13 00-0022	VLF	Concrete Fill, 3" Diameter Hole.....	6.35	
	32 31 13 00-0023	VLF	Concrete Fill, 4" Diameter Hole.....	7.21	
	32 31 13 00-0024	VLF	Concrete Fill, 6" Diameter Hole.....	10.12	
	32 31 13 00-0025	VLF	Concrete Fill, 8" Diameter Hole.....	13.51	
	32 31 13 00-0026	VLF	Concrete Fill, 10" Diameter Hole.....	16.49	
	32 31 13 00-0027	VLF	Concrete Fill, 12" Diameter Hole.....	19.17	
	32 31 13 00-0028	VLF	Concrete Fill, 18" Diameter Hole.....	25.85	
	32 31 13 00-0029	VLF	Concrete Fill, 24" Diameter Hole.....	31.80	
	32 31 13 00-0030	VLF	Concrete Fill, 30" Diameter Hole.....	37.57	
	32 31 13 00-0031	VLF	Concrete Fill, 36" Diameter Hole.....	43.54	
32 31 13 00-0032			Grout Fill <small>(32 31 13 00-0018)</small>		
	32 31 13 00-0033	VLF	Grout Fill, Up To 2-1/2" Diameter Hole.....	5.43	
	32 31 13 00-0034	VLF	Grout Fill, 2-1/2" Diameter Hole.....	7.01	
	32 31 13 00-0035	VLF	Grout Fill, 3" Diameter Hole.....	7.60	
	32 31 13 00-0036	VLF	Grout Fill, 4" Diameter Hole.....	8.44	
	32 31 13 00-0037	VLF	Grout Fill, 6" Diameter Hole.....	11.72	
	32 31 13 00-0038	VLF	Grout Fill, 8" Diameter Hole.....	15.64	
	32 31 13 00-0039	VLF	Grout Fill, 10" Diameter Hole.....	19.02	
	32 31 13 00-0040	VLF	Grout Fill, 12" Diameter Hole.....	22.02	
	32 31 13 00-0041	VLF	Grout Fill, 18" Diameter Hole.....	29.16	
	32 31 13 00-0042	VLF	Grout Fill, 24" Diameter Hole.....	35.31	
	32 31 13 00-0043	VLF	Grout Fill, 30" Diameter Hole.....	41.25	
	32 31 13 00-0044	VLF	Grout Fill, 36" Diameter Hole.....	47.29	
32 31 13 00-0045			Earth Fill, Compacted <small>(32 31 13 00-0018)</small>		
	32 31 13 00-0046	VLF	Earth Fill, Up To 2-1/2" Diameter Hole.....	4.06	
	32 31 13 00-0047	VLF	Earth Fill, 2-1/2" Diameter Hole.....	5.30	
	32 31 13 00-0048	VLF	Earth Fill, 3" Diameter Hole.....	5.54	
	32 31 13 00-0049	VLF	Earth Fill, 4" Diameter Hole.....	5.70	
	32 31 13 00-0050	VLF	Earth Fill, 6" Diameter Hole.....	7.61	
	32 31 13 00-0051	VLF	Earth Fill, 8" Diameter Hole.....	10.15	
	32 31 13 00-0052	VLF	Earth Fill, 10" Diameter Hole.....	12.17	
	32 31 13 00-0053	VLF	Earth Fill, 12" Diameter Hole.....	13.80	
	32 31 13 00-0054	VLF	Earth Fill, 18" Diameter Hole.....	16.82	
	32 31 13 00-0055	VLF	Earth Fill, 24" Diameter Hole.....	18.87	
	32 31 13 00-0056	VLF	Earth Fill, 30" Diameter Hole.....	20.70	
	32 31 13 00-0057	VLF	Earth Fill, 36" Diameter Hole.....	22.32	
32 31 13 00-0058			Fence Posts <small>(32 31 13)</small>		
			Note: Demolition excludes concrete footing removal on posts and excavation. See CSI section 31 23 16 36-0009 for hand excavation for footing removal (where required), 32 31 13 00-0001 for drilling for augering holes.		
32 31 13 00-0059			Fence Posts <small>(32 31 13 00-0058)</small>		
32 31 13 00-0060			1-7/8" H-Beam Post Without Top Rail Fitting, Galvanized Steel <small>(32 31 13 00-0059)</small>		
			Note: Includes cap and accessories.		
	32 31 13 00-0061	LF	1-7/8" Galvanized H-beam Post, Up To 6' In Length.....	9.03	2.15
			For Each Top Rail Fitting, Add	0.85	
	32 31 13 00-0062	LF	1-7/8" Galvanized H-beam Post, 7' To 10' In Length.....	8.42	1.83
			For Each Top Rail Fitting, Add	0.85	
	32 31 13 00-0063	LF	1-7/8" Galvanized H-beam Post, 11' To 15' In Length.....	7.67	1.51
			For Each Top Rail Fitting, Add	0.85	
	32 31 13 00-0064	LF	1-7/8" Galvanized H-beam Post, 16' To 20' In Length.....	7.08	1.19
			For Each Top Rail Fitting, Add	0.85	
	32 31 13 00-0065	LF	1-7/8" Galvanized H-beam Post, 21' To 24' In Length.....	6.68	1.04
			For Each Top Rail Fitting, Add	0.85	
	32 31 13 00-0066	LF	1-7/8" Galvanized H-beam Post, >24' In Length.....	6.06	0.72
			For Each Top Rail Fitting, Add	0.85	
32 31 13 00-0067			Post Without Top Rail Fitting, Galvanized Steel, (1.66" Nominal) <small>(32 31 13 00-0059)</small>		
			Note: 1-5/8" outside diameter, Schedule 40. Includes cap and accessories.		
	32 31 13 00-0068	LF	1-5/8" Outside Diameter Galvanized Steel Post, Up To 6' In Length.....	6.60	1.99
			For Each Top Rail Fitting, Add	0.85	
			For Each Single Barbed Wire Arm, Add	1.90	
			For Each Double Barbed Wire Arm, Add	3.40	
			For SS40 (Hot-Dip Galvanized And Chromated), Add	0.66	
			For Vinyl Coated, Add	1.57	
			For Powder Coated, Add	2.10	
			For Aluminum Coated, Add	3.28	
			For Schedule 20, Deduct	-0.52	
			For Schedule 80, Add	1.66	



Exterior Improvements	32	32
Site Improvements	32 30	
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MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 31 13 00-0069 LF 1-5/8" Outside Diameter Galvanized Steel Post, 7' To 10' In Length.....	5.99	1.67
For Each Top Rail Fitting, Add	0.85	
For Each Single Barbed Wire Arm, Add	1.90	
For Each Double Barbed Wire Arm, Add	3.40	
For SS40 (Hot-Dip Galvanized And Chromated), Add	0.66	
For Vinyl Coated, Add	1.57	
For Powder Coated, Add	2.10	
For Aluminum Coated, Add	3.28	
For Schedule 20, Deduct	-0.52	
For Schedule 80, Add	1.59	
32 31 13 00-0070 LF 1-5/8" Outside Diameter Galvanized Steel Post, 11' To 15' In Length.....	5.30	1.36
For Each Top Rail Fitting, Add	0.85	
For Each Single Barbed Wire Arm, Add	1.90	
For Each Double Barbed Wire Arm, Add	3.40	
For SS40 (Hot-Dip Galvanized And Chromated), Add	0.66	
For Vinyl Coated, Add	1.57	
For Powder Coated, Add	2.10	
For Aluminum Coated, Add	3.28	
For Schedule 20, Deduct	-0.52	
For Schedule 80, Add	1.53	
32 31 13 00-0071 LF 1-5/8" Outside Diameter Galvanized Steel Post, 16' To 20' In Length.....	4.77	1.04
For Each Top Rail Fitting, Add	0.85	
For Each Single Barbed Wire Arm, Add	1.90	
For Each Double Barbed Wire Arm, Add	3.40	
For SS40 (Hot-Dip Galvanized And Chromated), Add	0.66	
For Vinyl Coated, Add	1.57	
For Powder Coated, Add	2.10	
For Aluminum Coated, Add	3.28	
For Schedule 20, Deduct	-0.52	
For Schedule 80, Add	1.47	
32 31 13 00-0072 LF 1-5/8" Outside Diameter Galvanized Steel Post, 21' To 24' In Length.....	4.42	0.87
For Each Top Rail Fitting, Add	0.85	
For Each Single Barbed Wire Arm, Add	1.90	
For Each Double Barbed Wire Arm, Add	3.40	
For SS40 (Hot-Dip Galvanized And Chromated), Add	0.66	
For Vinyl Coated, Add	1.57	
For Powder Coated, Add	2.10	
For Aluminum Coated, Add	3.28	
For Schedule 20, Deduct	-0.52	
For Schedule 80, Add	1.44	
32 31 13 00-0073 LF 1-5/8" Outside Diameter Galvanized Steel Post, >24' In Length.....	4.02	0.72
For Each Top Rail Fitting, Add	0.85	
For Each Single Barbed Wire Arm, Add	1.90	
For Each Double Barbed Wire Arm, Add	3.40	
For SS40 (Hot-Dip Galvanized And Chromated), Add	0.66	
For Vinyl Coated, Add	1.57	
For Powder Coated, Add	2.10	
For Aluminum Coated, Add	3.28	
For Schedule 20, Deduct	-0.52	
For Schedule 80, Add	1.40	
32 31 13 00-0074 Post Without Top Rail Fitting, Galvanized Steel, (1.90" Nominal) (32 31 13 00-0059)		
Note: 2" outside diameter, Schedule 40. Includes cap and accessories.		
32 31 13 00-0075 LF 2" Outside Diameter Galvanized Steel Post, Up To 6' In Length.....	7.32	2.07
For Each Top Rail Fitting, Add	1.35	
For Each Single Barbed Wire Arm, Add	2.65	
For Each Double Barbed Wire Arm, Add	4.88	
For SS40 (Hot-Dip Galvanized And Chromated), Add	0.80	
For Vinyl Coated, Add	1.92	
For Powder Coated, Add	2.56	
For Aluminum Coated, Add	4.00	
For Schedule 20, Deduct	-0.64	
For Schedule 80, Add	1.95	
32 31 13 00-0076 LF 2" Outside Diameter Galvanized Steel Post, 7' To 10' In Length.....	6.77	1.76
For Each Top Rail Fitting, Add	1.35	
For Each Single Barbed Wire Arm, Add	2.65	
For Each Double Barbed Wire Arm, Add	4.88	
For SS40 (Hot-Dip Galvanized And Chromated), Add	0.80	
For Vinyl Coated, Add	1.92	
For Powder Coated, Add	2.56	
For Aluminum Coated, Add	4.00	
For Schedule 20, Deduct	-0.64	
For Schedule 80, Add	1.89	
32 31 13 00-0077 LF 2" Outside Diameter Galvanized Steel Post, 11' To 15' In Length.....	6.04	1.44
For Each Top Rail Fitting, Add	1.35	
For Each Single Barbed Wire Arm, Add	2.65	
For Each Double Barbed Wire Arm, Add	4.88	
For SS40 (Hot-Dip Galvanized And Chromated), Add	0.80	
For Vinyl Coated, Add	1.92	
For Powder Coated, Add	2.56	
For Aluminum Coated, Add	4.00	
For Schedule 20, Deduct	-0.64	
For Schedule 80, Add	1.82	

32 Exterior Improvements**32 30 Site Improvements****32 31 Fences And Gates**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
	32 31 13 00-0078	LF	2" Outside Diameter Galvanized Steel Post, 16' To 20' In Length	5.48	1.12
			<i>For Each Top Rail Fitting, Add</i>	1.35	
			<i>For Each Single Barbed Wire Arm, Add</i>	2.65	
			<i>For Each Double Barbed Wire Arm, Add</i>	4.88	
			<i>For SS40 (Hot-Dip Galvanized And Chromated), Add</i>	0.80	
			<i>For Vinyl Coated, Add</i>	1.92	
			<i>For Powder Coated, Add</i>	2.56	
			<i>For Aluminum Coated, Add</i>	4.00	
			<i>For Schedule 20, Deduct</i>	-0.64	
			<i>For Schedule 80, Add</i>	1.76	
	32 31 13 00-0079	LF	2" Outside Diameter Galvanized Steel Post, 21' To 24' In Length	5.10	0.96
			<i>For Each Top Rail Fitting, Add</i>	1.35	
			<i>For Each Single Barbed Wire Arm, Add</i>	2.65	
			<i>For Each Double Barbed Wire Arm, Add</i>	4.88	
			<i>For SS40 (Hot-Dip Galvanized And Chromated), Add</i>	0.80	
			<i>For Vinyl Coated, Add</i>	1.92	
			<i>For Powder Coated, Add</i>	2.56	
			<i>For Aluminum Coated, Add</i>	4.00	
			<i>For Schedule 20, Deduct</i>	-0.64	
			<i>For Schedule 80, Add</i>	1.73	
	32 31 13 00-0080	LF	2" Outside Diameter Galvanized Steel Post, >24' In Length	4.75	0.80
			<i>For Each Top Rail Fitting, Add</i>	1.35	
			<i>For Each Single Barbed Wire Arm, Add</i>	2.65	
			<i>For Each Double Barbed Wire Arm, Add</i>	4.88	
			<i>For SS40 (Hot-Dip Galvanized And Chromated), Add</i>	0.80	
			<i>For Vinyl Coated, Add</i>	1.92	
			<i>For Powder Coated, Add</i>	2.56	
			<i>For Aluminum Coated, Add</i>	4.00	
			<i>For Schedule 20, Deduct</i>	-0.64	
			<i>For Schedule 80, Add</i>	1.69	
	32 31 13 00-0081		Post Without Top Rail Fitting, Galvanized Steel, (2.375" Nominal) <small>(32 31 13 00-0059)</small>		
			Note: 2-1/2" outside diameter, Schedule 40. Includes cap and accessories.		
	32 31 13 00-0082	LF	2-1/2" Outside Diameter Galvanized Steel Post, Up To 6' In Length	8.60	2.23
			<i>For Each Top Rail Fitting, Add</i>	1.35	
			<i>For Each Single Barbed Wire Arm, Add</i>	2.65	
			<i>For Each Double Barbed Wire Arm, Add</i>	4.88	
			<i>For SS40 (Hot-Dip Galvanized And Chromated), Add</i>	1.07	
			<i>For Vinyl Coated, Add</i>	2.56	
			<i>For Powder Coated, Add</i>	3.41	
			<i>For Aluminum Coated, Add</i>	5.33	
			<i>For Schedule 20, Deduct</i>	-0.85	
			<i>For Schedule 80, Add</i>	2.48	
	32 31 13 00-0083	LF	2-1/2" Outside Diameter Galvanized Steel Post, 7' To 10' In Length	7.99	1.91
			<i>For Each Top Rail Fitting, Add</i>	1.35	
			<i>For Each Single Barbed Wire Arm, Add</i>	2.65	
			<i>For Each Double Barbed Wire Arm, Add</i>	4.88	
			<i>For SS40 (Hot-Dip Galvanized And Chromated), Add</i>	1.07	
			<i>For Vinyl Coated, Add</i>	2.56	
			<i>For Powder Coated, Add</i>	3.41	
			<i>For Aluminum Coated, Add</i>	5.33	
			<i>For Schedule 20, Deduct</i>	-0.85	
			<i>For Schedule 80, Add</i>	2.42	
	32 31 13 00-0084	LF	2-1/2" Outside Diameter Galvanized Steel Post, 11' To 15' In Length	7.24	1.51
			<i>For Each Top Rail Fitting, Add</i>	1.35	
			<i>For Each Single Barbed Wire Arm, Add</i>	2.65	
			<i>For Each Double Barbed Wire Arm, Add</i>	4.88	
			<i>For SS40 (Hot-Dip Galvanized And Chromated), Add</i>	1.07	
			<i>For Vinyl Coated, Add</i>	2.56	
			<i>For Powder Coated, Add</i>	3.41	
			<i>For Aluminum Coated, Add</i>	5.33	
			<i>For Schedule 20, Deduct</i>	-0.85	
			<i>For Schedule 80, Add</i>	2.34	
	32 31 13 00-0085	LF	2-1/2" Outside Diameter Galvanized Steel Post, 16' To 20' In Length	6.65	1.19
			<i>For Each Top Rail Fitting, Add</i>	1.35	
			<i>For Each Single Barbed Wire Arm, Add</i>	2.65	
			<i>For Each Double Barbed Wire Arm, Add</i>	4.88	
			<i>For SS40 (Hot-Dip Galvanized And Chromated), Add</i>	1.07	
			<i>For Vinyl Coated, Add</i>	2.56	
			<i>For Powder Coated, Add</i>	3.41	
			<i>For Aluminum Coated, Add</i>	5.33	
			<i>For Schedule 20, Deduct</i>	-0.85	
			<i>For Schedule 80, Add</i>	2.28	
	32 31 13 00-0086	LF	2-1/2" Outside Diameter Galvanized Steel Post, 21 To 24' In Length	6.25	1.04
			<i>For Each Top Rail Fitting, Add</i>	1.35	
			<i>For Each Single Barbed Wire Arm, Add</i>	2.65	
			<i>For Each Double Barbed Wire Arm, Add</i>	4.88	
			<i>For SS40 (Hot-Dip Galvanized And Chromated), Add</i>	1.07	
			<i>For Vinyl Coated, Add</i>	2.56	
			<i>For Powder Coated, Add</i>	3.41	
			<i>For Aluminum Coated, Add</i>	5.33	
			<i>For Schedule 20, Deduct</i>	-0.85	
			<i>For Schedule 80, Add</i>	2.24	



Exterior Improvements	32	32
Site Improvements	32 30	
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MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 31 13 00-0087 LF 2-1/2" Outside Diameter Galvanized Steel Post, >24' In Length.....	5.87	0.80
For Each Top Rail Fitting, Add	1.35	
For Each Single Barbed Wire Arm, Add	2.65	
For Each Double Barbed Wire Arm, Add	4.88	
For SS40 (Hot-Dip Galvanized And Chromated), Add	1.07	
For Vinyl Coated, Add	2.56	
For Powder Coated, Add	3.41	
For Aluminum Coated, Add	5.33	
For Schedule 20, Deduct	-0.85	
For Schedule 80, Add	2.21	
32 31 13 00-0088 Post Without Top Rail Fitting, Galvanized Steel, (2.875" Nominal) <small>(32 31 13 00-0059)</small>		
Note: 3" outside diameter, Schedule 40. Includes cap and accessories.		
32 31 13 00-0089 LF 3" Outside Diameter Galvanized Steel Post, Up To 6' In Length	11.14	2.39
For Each Top Rail Fitting, Add	1.85	
For Each Single Barbed Wire Arm, Add	3.85	
For Each Double Barbed Wire Arm, Add	7.05	
For SS40 (Hot-Dip Galvanized And Chromated), Add	1.59	
For Vinyl Coated, Add	3.82	
For Powder Coated, Add	5.09	
For Aluminum Coated, Add	7.95	
For Schedule 20, Deduct	-1.27	
For Schedule 80, Add	3.53	
32 31 13 00-0090 LF 3" Outside Diameter Galvanized Steel Post, 7' To 10' In Length	10.48	2.07
For Each Top Rail Fitting, Add	1.85	
For Each Single Barbed Wire Arm, Add	3.85	
For Each Double Barbed Wire Arm, Add	7.05	
For SS40 (Hot-Dip Galvanized And Chromated), Add	1.59	
For Vinyl Coated, Add	3.82	
For Powder Coated, Add	5.09	
For Aluminum Coated, Add	7.95	
For Schedule 20, Deduct	-1.27	
For Schedule 80, Add	3.46	
32 31 13 00-0091 LF 3" Outside Diameter Galvanized Steel Post, 11' To 15' In Length	9.67	1.67
For Each Top Rail Fitting, Add	1.85	
For Each Single Barbed Wire Arm, Add	3.85	
For Each Double Barbed Wire Arm, Add	7.05	
For SS40 (Hot-Dip Galvanized And Chromated), Add	1.59	
For Vinyl Coated, Add	3.82	
For Powder Coated, Add	5.09	
For Aluminum Coated, Add	7.95	
For Schedule 20, Deduct	-1.27	
For Schedule 80, Add	3.38	
32 31 13 00-0092 LF 3" Outside Diameter Galvanized Steel Post, 16' To 20' In Length	9.01	1.36
For Each Top Rail Fitting, Add	1.85	
For Each Single Barbed Wire Arm, Add	3.85	
For Each Double Barbed Wire Arm, Add	7.05	
For SS40 (Hot-Dip Galvanized And Chromated), Add	1.59	
For Vinyl Coated, Add	3.82	
For Powder Coated, Add	5.09	
For Aluminum Coated, Add	7.95	
For Schedule 20, Deduct	-1.27	
For Schedule 80, Add	3.32	
32 31 13 00-0093 LF 3" Outside Diameter Galvanized Steel Post, 21' To 24' In Length	8.57	1.12
For Each Top Rail Fitting, Add	1.85	
For Each Single Barbed Wire Arm, Add	3.85	
For Each Double Barbed Wire Arm, Add	7.05	
For SS40 (Hot-Dip Galvanized And Chromated), Add	1.59	
For Vinyl Coated, Add	3.82	
For Powder Coated, Add	5.09	
For Aluminum Coated, Add	7.95	
For Schedule 20, Deduct	-1.27	
For Schedule 80, Add	3.27	
32 31 13 00-0094 LF 3" Outside Diameter Galvanized Steel Post, >24' In Length.....	8.16	0.87
For Each Top Rail Fitting, Add	1.85	
For Each Single Barbed Wire Arm, Add	3.85	
For Each Double Barbed Wire Arm, Add	7.05	
For SS40 (Hot-Dip Galvanized And Chromated), Add	1.59	
For Vinyl Coated, Add	3.82	
For Powder Coated, Add	5.09	
For Aluminum Coated, Add	7.95	
For Schedule 20, Deduct	-1.27	
For Schedule 80, Add	3.23	
32 31 13 00-0095 Post Without Top Rail Fitting, Galvanized Steel, (4" Nominal) <small>(32 31 13 00-0059)</small>		
Note: 4" outside diameter, Schedule 40. Includes cap and accessories.		

32 Exterior Improvements**32 30 Site Improvements****32 31 Fences And Gates**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 31 13 00-0096 LF 4" Outside Diameter Galvanized Steel Post, Up To 6' In Length	15.37	2.55
For Each Top Rail Fitting, Add	2.60	
For Each Single Barbed Wire Arm, Add	5.10	
For Each Double Barbed Wire Arm, Add	11.25	
For SS40 (Hot-Dip Galvanized And Chromated), Add	2.59	
For Vinyl Coated, Add	6.20	
For Powder Coated, Add	8.27	
For Aluminum Coated, Add	12.93	
For Schedule 20, Deduct	-2.07	
For Schedule 80, Add	5.47	
32 31 13 00-0097 LF 4" Outside Diameter Galvanized Steel Post, 7' To 10' In Length	14.53	2.07
For Each Top Rail Fitting, Add	2.60	
For Each Single Barbed Wire Arm, Add	5.10	
For Each Double Barbed Wire Arm, Add	11.25	
For SS40 (Hot-Dip Galvanized And Chromated), Add	2.59	
For Vinyl Coated, Add	6.20	
For Powder Coated, Add	8.27	
For Aluminum Coated, Add	12.93	
For Schedule 20, Deduct	-2.07	
For Schedule 80, Add	5.38	
32 31 13 00-0098 LF 4" Outside Diameter Galvanized Steel Post, 11' To 15' In Length	13.83	1.76
For Each Top Rail Fitting, Add	2.60	
For Each Single Barbed Wire Arm, Add	5.10	
For Each Double Barbed Wire Arm, Add	11.25	
For SS40 (Hot-Dip Galvanized And Chromated), Add	2.59	
For Vinyl Coated, Add	6.20	
For Powder Coated, Add	8.27	
For Aluminum Coated, Add	12.93	
For Schedule 20, Deduct	-2.07	
For Schedule 80, Add	5.31	
32 31 13 00-0099 LF 4" Outside Diameter Galvanized Steel Post, 16' To 20' In Length	13.13	1.44
For Each Top Rail Fitting, Add	2.60	
For Each Single Barbed Wire Arm, Add	5.10	
For Each Double Barbed Wire Arm, Add	11.25	
For SS40 (Hot-Dip Galvanized And Chromated), Add	2.59	
For Vinyl Coated, Add	6.20	
For Powder Coated, Add	8.27	
For Aluminum Coated, Add	12.93	
For Schedule 20, Deduct	-2.07	
For Schedule 80, Add	5.24	
32 31 13 00-0100 LF 4" Outside Diameter Galvanized Steel Post, 21' To 24' In Length	13.13	1.44
For Each Top Rail Fitting, Add	2.60	
For Each Single Barbed Wire Arm, Add	5.10	
For Each Double Barbed Wire Arm, Add	11.25	
For SS40 (Hot-Dip Galvanized And Chromated), Add	2.59	
For Vinyl Coated, Add	6.20	
For Powder Coated, Add	8.27	
For Aluminum Coated, Add	12.93	
For Schedule 20, Deduct	-2.07	
For Schedule 80, Add	5.24	
32 31 13 00-0101 LF 4" Outside Diameter Galvanized Steel Post, >24' In Length.....	12.33	1.04
For Each Top Rail Fitting, Add	2.60	
For Each Single Barbed Wire Arm, Add	5.10	
For Each Double Barbed Wire Arm, Add	11.25	
For SS40 (Hot-Dip Galvanized And Chromated), Add	2.59	
For Vinyl Coated, Add	6.20	
For Powder Coated, Add	8.27	
For Aluminum Coated, Add	12.93	
For Schedule 20, Deduct	-2.07	
For Schedule 80, Add	5.16	
32 31 13 00-0102 Post Without Top Rail Fitting, Galvanized Steel, (6.625" Nominal) (32 31 13 00-0099)		
Note: 6-5/8" outside diameter, Schedule 40. Includes cap and accessories.		
32 31 13 00-0103 LF 6-5/8" Outside Diameter Galvanized Steel Post, Up To 6' In Length	27.51	2.78
For Each Top Rail Fitting, Add	4.55	
For Each Single Barbed Wire Arm, Add	7.15	
For Each Double Barbed Wire Arm, Add	14.95	
For SS40 (Hot-Dip Galvanized And Chromated), Add	5.48	
For Vinyl Coated, Add	13.15	
For Powder Coated, Add	17.54	
For Aluminum Coated, Add	27.40	
For Schedule 20, Deduct	-4.38	
For Schedule 80, Add	11.08	
32 31 13 00-0104 LF 6-5/8" Outside Diameter Galvanized Steel Post, 7' To 10' In Length	26.60	2.31
For Each Top Rail Fitting, Add	4.55	
For Each Single Barbed Wire Arm, Add	7.15	
For Each Double Barbed Wire Arm, Add	14.95	
For SS40 (Hot-Dip Galvanized And Chromated), Add	5.48	
For Vinyl Coated, Add	13.15	
For Powder Coated, Add	17.54	
For Aluminum Coated, Add	27.40	
For Schedule 20, Deduct	-4.38	
For Schedule 80, Add	10.99	



Exterior Improvements	32	32
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MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 31 13 00-0105 LF 6-5/8" Outside Diameter Galvanized Steel Post, 11' To 15' In Length.....	25.81	1.91
For Each Top Rail Fitting, Add	4.55	
For Each Single Barbed Wire Arm, Add	7.15	
For Each Double Barbed Wire Arm, Add	14.95	
For SS40 (Hot-Dip Galvanized And Chromated), Add	5.48	
For Vinyl Coated, Add	13.15	
For Powder Coated, Add	17.54	
For Aluminum Coated, Add	27.40	
For Schedule 20, Deduct	-4.38	
For Schedule 80, Add	10.91	
32 31 13 00-0106 LF 6-5/8" Outside Diameter Galvanized Steel Post, 16' To 20' In Length.....	25.02	1.51
For Each Top Rail Fitting, Add	4.55	
For Each Single Barbed Wire Arm, Add	7.15	
For Each Double Barbed Wire Arm, Add	14.95	
For SS40 (Hot-Dip Galvanized And Chromated), Add	5.48	
For Vinyl Coated, Add	13.15	
For Powder Coated, Add	17.54	
For Aluminum Coated, Add	27.40	
For Schedule 20, Deduct	-4.38	
For Schedule 80, Add	10.83	
32 31 13 00-0107 LF 6-5/8" Outside Diameter Galvanized Steel Post, 21' To 24' In Length.....	24.57	1.36
For Each Top Rail Fitting, Add	4.55	
For Each Single Barbed Wire Arm, Add	7.15	
For Each Double Barbed Wire Arm, Add	14.95	
For SS40 (Hot-Dip Galvanized And Chromated), Add	5.48	
For Vinyl Coated, Add	13.15	
For Powder Coated, Add	17.54	
For Aluminum Coated, Add	27.40	
For Schedule 20, Deduct	-4.38	
For Schedule 80, Add	10.79	
32 31 13 00-0108 LF 6-5/8" Outside Diameter Galvanized Steel Post, >24' In Length.....	24.13	1.12
For Each Top Rail Fitting, Add	4.55	
For Each Single Barbed Wire Arm, Add	7.15	
For Each Double Barbed Wire Arm, Add	14.95	
For SS40 (Hot-Dip Galvanized And Chromated), Add	5.48	
For Vinyl Coated, Add	13.15	
For Powder Coated, Add	17.54	
For Aluminum Coated, Add	27.40	
For Schedule 20, Deduct	-4.38	
For Schedule 80, Add	10.74	
32 31 13 00-0109 Post Without Top Rail Fitting, Galvanized Steel, (8.625" Nominal) <small>(32 31 13 00-0059)</small>		
Note: 8-5/8" outside diameter, Schedule 40. Includes cap and accessories.		
32 31 13 00-0110 LF 8-5/8" Outside Diameter Galvanized Steel Post, Up To 6' In Length.....	51.13	3.10
For Each Top Rail Fitting, Add	7.50	
For Each Single Barbed Wire Arm, Add	9.15	
For Each Double Barbed Wire Arm, Add	18.95	
For SS40 (Hot-Dip Galvanized And Chromated), Add	11.23	
For Vinyl Coated, Add	26.95	
For Powder Coated, Add	35.94	
For Aluminum Coated, Add	56.15	
For Schedule 20, Deduct	-8.98	
For Schedule 80, Add	22.18	
32 31 13 00-0111 LF 8-5/8" Outside Diameter Galvanized Steel Post, 7' To 10' In Length.....	50.11	2.63
For Each Top Rail Fitting, Add	7.50	
For Each Single Barbed Wire Arm, Add	9.15	
For Each Double Barbed Wire Arm, Add	18.95	
For SS40 (Hot-Dip Galvanized And Chromated), Add	11.23	
For Vinyl Coated, Add	26.95	
For Powder Coated, Add	35.94	
For Aluminum Coated, Add	56.15	
For Schedule 20, Deduct	-8.98	
For Schedule 80, Add	22.08	
32 31 13 00-0112 LF 8-5/8" Outside Diameter Galvanized Steel Post, 11' To 15' In Length.....	49.23	2.15
For Each Top Rail Fitting, Add	7.50	
For Each Single Barbed Wire Arm, Add	9.15	
For Each Double Barbed Wire Arm, Add	18.95	
For SS40 (Hot-Dip Galvanized And Chromated), Add	11.23	
For Vinyl Coated, Add	26.95	
For Powder Coated, Add	35.94	
For Aluminum Coated, Add	56.15	
For Schedule 20, Deduct	-8.98	
For Schedule 80, Add	21.99	
32 31 13 00-0113 LF 8-5/8" Outside Diameter Galvanized Steel Post, 16' To 20' In Length.....	48.33	1.67
For Each Top Rail Fitting, Add	7.50	
For Each Single Barbed Wire Arm, Add	9.15	
For Each Double Barbed Wire Arm, Add	18.95	
For SS40 (Hot-Dip Galvanized And Chromated), Add	11.23	
For Vinyl Coated, Add	26.95	
For Powder Coated, Add	35.94	
For Aluminum Coated, Add	56.15	
For Schedule 20, Deduct	-8.98	
For Schedule 80, Add	21.90	

32 Exterior Improvements**32 30 Site Improvements****32 31 Fences And Gates**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
	32 31 13 00-0114	LF	8-5/8" Outside Diameter Galvanized Steel Post, 21' To 24' In Length.....	47.87	1.44
			<i>For Each Top Rail Fitting, Add</i>	7.50	
			<i>For Each Single Barbed Wire Arm, Add</i>	9.15	
			<i>For Each Double Barbed Wire Arm, Add</i>	18.95	
			<i>For SS40 (Hot-Dip Galvanized And Chromated), Add</i>	11.23	
			<i>For Vinyl Coated, Add</i>	26.95	
			<i>For Powder Coated, Add</i>	35.94	
			<i>For Aluminum Coated, Add</i>	56.15	
			<i>For Schedule 20, Deduct</i>	-8.98	
			<i>For Schedule 80, Add</i>	21.86	
	32 31 13 00-0115	LF	8-5/8" Outside Diameter Galvanized Steel Post, >24' In Length.....	47.38	1.19
			<i>For Each Top Rail Fitting, Add</i>	7.50	
			<i>For Each Single Barbed Wire Arm, Add</i>	9.15	
			<i>For Each Double Barbed Wire Arm, Add</i>	18.95	
			<i>For SS40 (Hot-Dip Galvanized And Chromated), Add</i>	11.23	
			<i>For Vinyl Coated, Add</i>	26.95	
			<i>For Powder Coated, Add</i>	35.94	
			<i>For Aluminum Coated, Add</i>	56.15	
			<i>For Schedule 20, Deduct</i>	-8.98	
			<i>For Schedule 80, Add</i>	21.81	
	32 31 13 00-0116		Driven Post Supports (32 31 13) Note: OZ-Post.		
	32 31 13 00-0117		Driven Post Support For Round Chain Link Fence Posts (32 31 13 00-0116)		
	32 31 13 00-0118	EA	26" Driven Post Support For 1-5/8" Round Chain Link Fence Post.....	42.30	
			Note: OZ-Post GB-700.		
	32 31 13 00-0119	EA	26" Driven Post Support For 1-7/8" Round Chain Link Fence Post.....	42.30	
			Note: OZ-Post HB-700.		
	32 31 13 00-0120	EA	26" Driven Post Support For 2-3/8" Round Chain Link Fence Post.....	43.12	
			Note: OZ-Post IS-600.		
	32 31 13 00-0121	EA	32" Driven Post Support For 2-3/8" Round Chain Link Fence Post.....	52.26	
			Note: OZ-Post ISW-850.		
	32 31 13 00-0122		Driven Post Support For Square Ornamental Fence Posts (32 31 13 00-0116)		
	32 31 13 00-0123	EA	34" Driven Post Support For 1-3/4" Square Ornamental Fence Post.....	49.79	
			Note: OZ-Post C175-850.		
	32 31 13 00-0124	EA	24" Driven Post Support For 2" Square Ornamental Fence Post.....	48.56	
			Note: OZ-Post I2-600.		
	32 31 13 00-0125	EA	34" Driven Post Support For 2" Square Ornamental Fence Post.....	50.04	
			Note: OZ-Post I2-850.		
	32 31 13 00-0126	EA	34" Driven Post Support For 2-1/2" Square Ornamental Fence Post.....	52.26	
			Note: OZ-Post I25-850.		
	32 31 13 00-0127	EA	34" Driven Post Support For 3" Square Ornamental Fence Post.....	52.26	
			Note: OZ-Post I3-850.		
	32 31 13 00-0128		Driven Post Support For Wooden Fence Posts (32 31 13 00-0116)		
	32 31 13 00-0129	EA	24" Driven Post Support For 3-1/2" Square Wooden Fence Post.....	46.69	
			Note: OZ-Post T4-600.		
	32 31 13 00-0130	EA	34" Driven Post Support For 3-1/2" Square Wooden Fence Post.....	51.02	
			Note: OZ-Post T4-850.		
	32 31 13 00-0131	EA	34" Driven Post Support For 3-3/4" Square Wooden Fence Post.....	53.90	
			Note: OZ-Post C4-850.		
	32 31 13 00-0132	EA	34" Driven Post Support For 4" Square Wooden Fence Post.....	53.91	
			Note: OZ-Post P4-850.		
	32 31 13 00-0133	EA	36" Driven Post Support For 4" x 6" Wooden Fence Post.....	59.25	
			Note: OZ-Post T46-850.		
	32 31 13 00-0134	EA	36" Driven Post Support For 6" Square Wooden Fence Post.....	63.03	
			Note: OZ-Post T6-850.		
	32 31 13 00-0135		Driven Post Support For Vinyl Fence Posts (32 31 13 00-0116)		
	32 31 13 00-0136	EA	24" Driven Post Support For 3-1/2" Square Vinyl Fence Post.....	46.69	
			Note: OZ-Post T4-600.		
	32 31 13 00-0137	EA	34" Driven Post Support For 3-1/2" Square Vinyl Fence Post.....	51.02	
			Note: OZ-Post T4-850.		
	32 31 13 00-0138	EA	34" Driven Post Support For 4" Square Vinyl Fence Post.....	53.91	
			Note: OZ-Post P4-850.		
	32 31 13 00-0139	EA	34" Driven Post Support For 5" Square Vinyl Fence Post.....	54.56	
			Note: OZ-Post P4-850.		
	32 31 13 00-0140		Chain Link Fence Assemblies (32 31 13)		
	32 31 13 00-0141		Chain Link Fence Assembly With 2-1/2" Line Post And 3" Corner Posts (32 31 13 00-0140) Note: Includes 2" 9 gauge coiled spring mesh (knuckled selvage), tension bars, post tension bands, wire ties, truss rod (at corners or posts), 1-5/8" top rail, 1-5/8" bottom rail, 2-1/2" line post and 3" corner posts. Posts exclude drilling or augering in soil or rock, concrete or soil fill. Heights indicated are from ground to top of installed pole. Minimum 2' bury with up to one third of exposed post height to be buried in ground. Demolition excludes concrete footing removal on posts and excavation. See CSI section 31 23 16 36-0009 for hand excavation for footing removal (where required), 32 31 13 00-0640 for barb wire attachments.		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 31 13 00-0142 Galvanized <small>(32 31 13 00-0141)</small>		
32 31 13 00-0143 LF 3' Galvanized Chain Link Fence, 9 Gauge Coiled Spring Mesh, Top And Bottom Rails, 2-1/2" Line Post At 10' On Center, 3" Corner Post	19.38	2.71
For Surface Mount On Concrete (Excludes Drilling And Anchors), Add	1.50	
For 13 Gauge Fabric, Deduct	-3.05	
For 11 Gauge Fabric, Deduct	-1.78	
For 6 Gauge Fabric, Add	2.80	
For 1" Mesh Fabric, Add	3.82	
For 1-3/4" Mesh Fabric, Add	1.53	
For 2-1/8" Mesh Fabric, Deduct	-0.76	
For 2-3/8" Mesh Fabric, Deduct	-1.02	
For Posts 8' On Centers, Add	1.10	
For Posts 5' On Centers, Add	4.18	
For Up To 100, Add	3.97	
For >100 To 250, Add	1.50	
For >2,500 To 5,000, Deduct	-0.75	
For >5,000, Deduct	-1.50	
32 31 13 00-0144 LF 3'-6" Galvanized Chain Link Fence, 9 Gauge Coiled Spring Mesh, Top And Bottom Rails, 2-1/2" Line Post At 10' On Center, 3" Corner Post	20.15	2.71
For Surface Mount On Concrete (Excludes Drilling And Anchors), Add	1.55	
For 13 Gauge Fabric, Deduct	-3.26	
For 11 Gauge Fabric, Deduct	-1.90	
For 6 Gauge Fabric, Add	2.99	
For 1" Mesh Fabric, Add	4.08	
For 1-3/4" Mesh Fabric, Add	1.63	
For 2-1/8" Mesh Fabric, Deduct	-0.82	
For 2-3/8" Mesh Fabric, Deduct	-1.09	
For Posts 8' On Centers, Add	1.14	
For Posts 5' On Centers, Add	4.33	
For Up To 100, Add	4.10	
For >100 To 250, Add	1.55	
For >2,500 To 5,000, Deduct	-0.77	
For >5,000, Deduct	-1.55	
32 31 13 00-0145 LF 4' Galvanized Chain Link Fence, 9 Gauge Coiled Spring Mesh, Top And Bottom Rails, 2-1/2" Line Post At 10' On Center, 3" Corner Post	20.81	2.71
For Surface Mount On Concrete (Excludes Drilling And Anchors), Add	1.59	
For 13 Gauge Fabric, Deduct	-3.43	
For 11 Gauge Fabric, Deduct	-2.00	
For 6 Gauge Fabric, Add	3.15	
For 1" Mesh Fabric, Add	4.29	
For 1-3/4" Mesh Fabric, Add	1.72	
For 2-1/8" Mesh Fabric, Deduct	-0.86	
For 2-3/8" Mesh Fabric, Deduct	-1.14	
For Posts 8' On Centers, Add	1.17	
For Posts 5' On Centers, Add	4.46	
For Up To 100, Add	4.22	
For >100 To 250, Add	1.59	
For >2,500 To 5,000, Deduct	-0.79	
For >5,000, Deduct	-1.59	
32 31 13 00-0146 LF 5' Galvanized Chain Link Fence, 9 Gauge Coiled Spring Mesh, Top And Bottom Rails, 2-1/2" Line Post At 10' On Center, 3" Corner Post	22.35	2.71
For Surface Mount On Concrete (Excludes Drilling And Anchors), Add	1.68	
For 13 Gauge Fabric, Deduct	-3.84	
For 11 Gauge Fabric, Deduct	-2.25	
For 6 Gauge Fabric, Add	3.53	
For 1" Mesh Fabric, Add	4.81	
For 1-3/4" Mesh Fabric, Add	1.92	
For 2-1/8" Mesh Fabric, Deduct	-0.96	
For 2-3/8" Mesh Fabric, Deduct	-1.28	
For Posts 8' On Centers, Add	1.25	
For Posts 5' On Centers, Add	4.76	
For Up To 100, Add	4.48	
For >100 To 250, Add	1.68	
For >2,500 To 5,000, Deduct	-0.84	
For >5,000, Deduct	-1.68	
32 31 13 00-0147 LF 6' Galvanized Chain Link Fence, 9 Gauge Coiled Spring Mesh, Top And Bottom Rails, 2-1/2" Line Post At 10' On Center, 3" Corner Post	24.29	2.71
For Surface Mount On Concrete (Excludes Drilling And Anchors), Add	1.82	
For 13 Gauge Fabric, Deduct	-4.26	
For 11 Gauge Fabric, Deduct	-2.49	
For 6 Gauge Fabric, Add	3.91	
For 1" Mesh Fabric, Add	5.33	
For 1-3/4" Mesh Fabric, Add	2.13	
For 2-1/8" Mesh Fabric, Deduct	-1.07	
For 2-3/8" Mesh Fabric, Deduct	-1.42	
For Posts 8' On Centers, Add	1.36	
For Posts 5' On Centers, Add	5.15	
For Up To 100, Add	4.85	
For >100 To 250, Add	1.82	
For >2,500 To 5,000, Deduct	-0.91	
For >5,000, Deduct	-1.82	

32 Exterior Improvements**32 30 Site Improvements****32 31 Fences And Gates**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 31	13 00-0148	LF	7' Galvanized Chain Link Fence, 9 Gauge Coiled Spring Mesh, Top And Bottom Rails, 2-1/2" Line Post At 10' On Center, 3" Corner Post.....	25.43	4.06
			<i>For Surface Mount On Concrete (Excludes Drilling And Anchors), Add</i>	1.90	
			<i>For 13 Gauge Fabric, Deduct</i>	-4.50	
			<i>For 11 Gauge Fabric, Deduct</i>	-2.63	
			<i>For 6 Gauge Fabric, Add</i>	4.13	
			<i>For 1" Mesh Fabric, Add</i>	5.63	
			<i>For 1-3/4" Mesh Fabric, Add</i>	2.25	
			<i>For 2-1/8" Mesh Fabric, Deduct</i>	-1.13	
			<i>For 2-3/8" Mesh Fabric, Deduct</i>	-1.50	
			<i>For Posts 8' On Centers, Add</i>	1.42	
			<i>For Posts 5' On Centers, Add</i>	5.39	
			<i>For Up To 100, Add</i>	5.06	
			<i>For >100 To 250, Add</i>	1.90	
			<i>For >2,500 To 5,000, Deduct</i>	-0.95	
			<i>For >5,000, Deduct</i>	-1.90	
32 31	13 00-0149	LF	8' Galvanized Chain Link Fence, 9 Gauge Coiled Spring Mesh, Top And Bottom Rails, 2-1/2" Line Post At 10' On Center, 3" Corner Post.....	28.47	4.74
			<i>For Surface Mount On Concrete (Excludes Drilling And Anchors), Add</i>	2.09	
			<i>For 13 Gauge Fabric, Deduct</i>	-5.28	
			<i>For 11 Gauge Fabric, Deduct</i>	-3.08	
			<i>For 6 Gauge Fabric, Add</i>	4.84	
			<i>For 1" Mesh Fabric, Add</i>	6.60	
			<i>For 1-3/4" Mesh Fabric, Add</i>	2.64	
			<i>For 2-1/8" Mesh Fabric, Deduct</i>	-1.32	
			<i>For 2-3/8" Mesh Fabric, Deduct</i>	-1.76	
			<i>For Posts 8' On Centers, Add</i>	1.58	
			<i>For Posts 5' On Centers, Add</i>	5.99	
			<i>For Up To 100, Add</i>	5.60	
			<i>For >100 To 250, Add</i>	2.09	
			<i>For >2,500 To 5,000, Deduct</i>	-1.04	
			<i>For >5,000, Deduct</i>	-2.09	
32 31	13 00-0150	LF	9' Galvanized Chain Link Fence, 9 Gauge Coiled Spring Mesh, Top And Bottom Rails, 2-1/2" Line Post At 10' On Center, 3" Corner Post.....	30.44	6.10
			<i>For Surface Mount On Concrete (Excludes Drilling And Anchors), Add</i>	2.22	
			<i>For 13 Gauge Fabric, Deduct</i>	-5.74	
			<i>For 11 Gauge Fabric, Deduct</i>	-3.35	
			<i>For 6 Gauge Fabric, Add</i>	5.27	
			<i>For 1" Mesh Fabric, Add</i>	7.19	
			<i>For 1-3/4" Mesh Fabric, Add</i>	2.87	
			<i>For 2-1/8" Mesh Fabric, Deduct</i>	-1.44	
			<i>For 2-3/8" Mesh Fabric, Deduct</i>	-1.92	
			<i>For Posts 8' On Centers, Add</i>	1.69	
			<i>For Posts 5' On Centers, Add</i>	6.38	
			<i>For Up To 100, Add</i>	5.96	
			<i>For >100 To 250, Add</i>	2.22	
			<i>For >2,500 To 5,000, Deduct</i>	-1.11	
			<i>For >5,000, Deduct</i>	-2.22	
32 31	13 00-0151	LF	10' Galvanized Chain Link Fence, 9 Gauge Coiled Spring Mesh, Top And Bottom Rails, 2-1/2" Line Post At 10' On Center, 3" Corner Post.....	32.42	6.77
			<i>For Surface Mount On Concrete (Excludes Drilling And Anchors), Add</i>	2.35	
			<i>For 13 Gauge Fabric, Deduct</i>	-6.21	
			<i>For 11 Gauge Fabric, Deduct</i>	-3.63	
			<i>For 6 Gauge Fabric, Add</i>	5.70	
			<i>For 1" Mesh Fabric, Add</i>	7.77	
			<i>For 1-3/4" Mesh Fabric, Add</i>	3.11	
			<i>For 2-1/8" Mesh Fabric, Deduct</i>	-1.55	
			<i>For 2-3/8" Mesh Fabric, Deduct</i>	-2.07	
			<i>For Posts 8' On Centers, Add</i>	1.80	
			<i>For Posts 5' On Centers, Add</i>	6.78	
			<i>For Up To 100, Add</i>	6.32	
			<i>For >100 To 250, Add</i>	2.35	
			<i>For >2,500 To 5,000, Deduct</i>	-1.17	
			<i>For >5,000, Deduct</i>	-2.35	
32 31	13 00-0152	LF	12' Galvanized Chain Link Fence, 9 Gauge Coiled Spring Mesh, Top And Bottom Rails, 2-1/2" Line Post At 10' On Center, 3" Corner Post.....	36.07	8.12
			<i>For Each Additional Foot >12, Add</i>	3.33	
			<i>For Surface Mount On Concrete (Excludes Drilling And Anchors), Add</i>	2.59	
			<i>For 13 Gauge Fabric, Deduct</i>	-7.05	
			<i>For 11 Gauge Fabric, Deduct</i>	-4.12	
			<i>For 6 Gauge Fabric, Add</i>	6.48	
			<i>For 1" Mesh Fabric, Add</i>	8.83	
			<i>For 1-3/4" Mesh Fabric, Add</i>	3.53	
			<i>For 2-1/8" Mesh Fabric, Deduct</i>	-1.77	
			<i>For 2-3/8" Mesh Fabric, Deduct</i>	-2.35	
			<i>For Posts 8' On Centers, Add</i>	1.99	
			<i>For Posts 5' On Centers, Add</i>	7.52	
			<i>For Up To 100, Add</i>	6.99	
			<i>For >100 To 250, Add</i>	2.59	
			<i>For >2,500 To 5,000, Deduct</i>	-1.30	
			<i>For >5,000, Deduct</i>	-2.59	
32 31	13 00-0153		Vinyl Coated <small>(32 31 13 00-0141)</small>		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 31 13 00-0154 LF 4' Vinyl Cover Chain Link Fence, 9 Gauge Coiled Spring Mesh, Top And Bottom Rails, 2-1/2" Line Post At 10' On Center, 3" Corner Post	21.69	2.71
<i>For Powder Coated Framework (Posts, Rails, Hardware), Add</i>	1.61	
<i>For Surface Mount On Concrete (Excludes Drilling And Anchors), Add</i>	1.63	
<i>For 13 Gauge Fabric, Deduct</i>	-3.73	
<i>For 11 Gauge Fabric, Deduct</i>	-2.18	
<i>For 6 Gauge Fabric, Add</i>	3.43	
<i>For 1" Mesh Fabric, Add</i>	4.67	
<i>For 1-3/4" Mesh Fabric, Add</i>	1.87	
<i>For 2-1/8" Mesh Fabric, Deduct</i>	-0.93	
<i>For 2-3/8" Mesh Fabric, Deduct</i>	-1.25	
<i>For Posts 8' On Centers, Add</i>	1.22	
<i>For Posts 5' On Centers, Add</i>	4.62	
<i>For Up To 100, Add</i>	4.35	
<i>For >100 To 250, Add</i>	1.63	
<i>For >2,500 To 5,000, Deduct</i>	-0.82	
<i>For >5,000, Deduct</i>	-1.63	
32 31 13 00-0155 LF 5' Vinyl Cover Chain Link Fence, 9 Gauge Coiled Spring Mesh, Top And Bottom Rails, 2-1/2" Line Post At 10' On Center, 3" Corner Post	23.45	2.71
<i>For Powder Coated Framework (Posts, Rails, Hardware), Add</i>	1.82	
<i>For Surface Mount On Concrete (Excludes Drilling And Anchors), Add</i>	1.74	
<i>For 13 Gauge Fabric, Deduct</i>	-4.23	
<i>For 11 Gauge Fabric, Deduct</i>	-2.47	
<i>For 6 Gauge Fabric, Add</i>	3.88	
<i>For 1" Mesh Fabric, Add</i>	5.29	
<i>For 1-3/4" Mesh Fabric, Add</i>	2.12	
<i>For 2-1/8" Mesh Fabric, Deduct</i>	-1.06	
<i>For 2-3/8" Mesh Fabric, Deduct</i>	-1.41	
<i>For Posts 8' On Centers, Add</i>	1.31	
<i>For Posts 5' On Centers, Add</i>	4.95	
<i>For Up To 100, Add</i>	4.65	
<i>For >100 To 250, Add</i>	1.74	
<i>For >2,500 To 5,000, Deduct</i>	-0.87	
<i>For >5,000, Deduct</i>	-1.74	
32 31 13 00-0156 LF 6' Vinyl Cover Chain Link Fence, 9 Gauge Coiled Spring Mesh, Top And Bottom Rails, 2-1/2" Line Post At 10' On Center, 3" Corner Post	26.55	2.71
<i>For Powder Coated Framework (Posts, Rails, Hardware), Add</i>	2.18	
<i>For Surface Mount On Concrete (Excludes Drilling And Anchors), Add</i>	1.93	
<i>For 13 Gauge Fabric, Deduct</i>	-5.05	
<i>For 11 Gauge Fabric, Deduct</i>	-2.95	
<i>For 6 Gauge Fabric, Add</i>	4.63	
<i>For 1" Mesh Fabric, Add</i>	6.32	
<i>For 1-3/4" Mesh Fabric, Add</i>	2.53	
<i>For 2-1/8" Mesh Fabric, Deduct</i>	-1.26	
<i>For 2-3/8" Mesh Fabric, Deduct</i>	-1.68	
<i>For Posts 8' On Centers, Add</i>	1.47	
<i>For Posts 5' On Centers, Add</i>	5.56	
<i>For Up To 100, Add</i>	5.19	
<i>For >100 To 250, Add</i>	1.93	
<i>For >2,500 To 5,000, Deduct</i>	-0.96	
<i>For >5,000, Deduct</i>	-1.93	
32 31 13 00-0157 LF 7' Vinyl Cover Chain Link Fence, 9 Gauge Coiled Spring Mesh, Top And Bottom Rails, 2-1/2" Line Post At 10' On Center, 3" Corner Post	28.05	4.06
<i>For Powder Coated Framework (Posts, Rails, Hardware), Add</i>	2.34	
<i>For Surface Mount On Concrete (Excludes Drilling And Anchors), Add</i>	2.03	
<i>For 13 Gauge Fabric, Deduct</i>	-5.41	
<i>For 11 Gauge Fabric, Deduct</i>	-3.16	
<i>For 6 Gauge Fabric, Add</i>	4.97	
<i>For 1" Mesh Fabric, Add</i>	6.77	
<i>For 1-3/4" Mesh Fabric, Add</i>	2.71	
<i>For 2-1/8" Mesh Fabric, Deduct</i>	-1.35	
<i>For 2-3/8" Mesh Fabric, Deduct</i>	-1.81	
<i>For Posts 8' On Centers, Add</i>	1.55	
<i>For Posts 5' On Centers, Add</i>	5.86	
<i>For Up To 100, Add</i>	5.46	
<i>For >100 To 250, Add</i>	2.03	
<i>For >2,500 To 5,000, Deduct</i>	-1.01	
<i>For >5,000, Deduct</i>	-2.03	
32 31 13 00-0158 LF 8' Vinyl Cover Chain Link Fence, 9 Gauge Coiled Spring Mesh, Top And Bottom Rails, 2-1/2" Line Post At 10' On Center, 3" Corner Post	31.52	4.74
<i>For Powder Coated Framework (Posts, Rails, Hardware), Add</i>	2.73	
<i>For Surface Mount On Concrete (Excludes Drilling And Anchors), Add</i>	2.24	
<i>For 13 Gauge Fabric, Deduct</i>	-6.33	
<i>For 11 Gauge Fabric, Deduct</i>	-3.70	
<i>For 6 Gauge Fabric, Add</i>	5.82	
<i>For 1" Mesh Fabric, Add</i>	7.93	
<i>For 1-3/4" Mesh Fabric, Add</i>	3.17	
<i>For 2-1/8" Mesh Fabric, Deduct</i>	-1.59	
<i>For 2-3/8" Mesh Fabric, Deduct</i>	-2.11	
<i>For Posts 8' On Centers, Add</i>	1.74	
<i>For Posts 5' On Centers, Add</i>	6.54	
<i>For Up To 100, Add</i>	6.06	
<i>For >100 To 250, Add</i>	2.24	
<i>For >2,500 To 5,000, Deduct</i>	-1.12	
<i>For >5,000, Deduct</i>	-2.24	

32 Exterior Improvements**32 30 Site Improvements****32 31 Fences And Gates**

MINOR		TOTAL DIRECT	DEMOLITION
CSI	UOM DESCRIPTION	UNIT COST	UNIT COST
32 31 13 00-0159	LF 9' Vinyl Cover Chain Link Fence, 9 Gauge Coiled Spring Mesh, Top And Bottom Rails, 2-1/2" Line Post At 10' On Center, 3" Corner Post.....	33.71	6.10
	<i>For Powder Coated Framework (Posts, Rails, Hardware), Add</i>	2.97	
	<i>For Surface Mount On Concrete (Excludes Drilling And Anchors), Add</i>	2.38	
	<i>For 13 Gauge Fabric, Deduct</i>	-6.88	
	<i>For 11 Gauge Fabric, Deduct</i>	-4.02	
	<i>For 6 Gauge Fabric, Add</i>	6.31	
	<i>For 1" Mesh Fabric, Add</i>	8.61	
	<i>For 1-3/4" Mesh Fabric, Add</i>	3.44	
	<i>For 2-1/8" Mesh Fabric, Deduct</i>	-1.72	
	<i>For 2-3/8" Mesh Fabric, Deduct</i>	-2.30	
	<i>For Posts 8' On Centers, Add</i>	1.85	
	<i>For Posts 5' On Centers, Add</i>	6.97	
	<i>For Up To 100, Add</i>	6.45	
	<i>For >100 To 250, Add</i>	2.38	
	<i>For >2,500 To 5,000, Deduct</i>	-1.19	
	<i>For >5,000, Deduct</i>	-2.38	
32 31 13 00-0160	LF 10' Vinyl Cover Chain Link Fence, 9 Gauge Coiled Spring Mesh, Top And Bottom Rails, 2-1/2" Line Post At 10' On Center, 3" Corner Post.....	35.91	6.77
	<i>For Powder Coated Framework (Posts, Rails, Hardware), Add</i>	3.20	
	<i>For Surface Mount On Concrete (Excludes Drilling And Anchors), Add</i>	2.52	
	<i>For 13 Gauge Fabric, Deduct</i>	-7.42	
	<i>For 11 Gauge Fabric, Deduct</i>	-4.33	
	<i>For 6 Gauge Fabric, Add</i>	6.81	
	<i>For 1" Mesh Fabric, Add</i>	9.29	
	<i>For 1-3/4" Mesh Fabric, Add</i>	3.71	
	<i>For 2-1/8" Mesh Fabric, Deduct</i>	-1.86	
	<i>For 2-3/8" Mesh Fabric, Deduct</i>	-2.48	
	<i>For Posts 8' On Centers, Add</i>	1.97	
	<i>For Posts 5' On Centers, Add</i>	7.41	
	<i>For Up To 100, Add</i>	6.84	
	<i>For >100 To 250, Add</i>	2.52	
	<i>For >2,500 To 5,000, Deduct</i>	-1.26	
	<i>For >5,000, Deduct</i>	-2.52	
32 31 13 00-0161	LF 12' Vinyl Cover Chain Link Fence, 9 Gauge Coiled Spring Mesh, Top And Bottom Rails, 2-1/2" Line Post At 10' On Center, 3" Corner Post.....	39.15	8.12
	<i>For Each Additional Foot >12, Add</i>	3.58	
	<i>For Powder Coated Framework (Posts, Rails, Hardware), Add</i>	3.51	
	<i>For Surface Mount On Concrete (Excludes Drilling And Anchors), Add</i>	2.75	
	<i>For 13 Gauge Fabric, Deduct</i>	-8.12	
	<i>For 11 Gauge Fabric, Deduct</i>	-4.75	
	<i>For 6 Gauge Fabric, Add</i>	7.46	
	<i>For 1" Mesh Fabric, Add</i>	10.17	
	<i>For 1-3/4" Mesh Fabric, Add</i>	4.07	
	<i>For 2-1/8" Mesh Fabric, Deduct</i>	-2.03	
	<i>For 2-3/8" Mesh Fabric, Deduct</i>	-2.71	
	<i>For Posts 8' On Centers, Add</i>	2.15	
	<i>For Posts 5' On Centers, Add</i>	8.07	
	<i>For Up To 100, Add</i>	7.45	
	<i>For >100 To 250, Add</i>	2.75	
	<i>For >2,500 To 5,000, Deduct</i>	-1.37	
	<i>For >5,000, Deduct</i>	-2.75	
32 31 13 00-0162	Rails <small>(32 31 13)</small>		
	Note: Includes rail end fittings.		
32 31 13 00-0163	SS-20 Chain Link Fence Rails <small>(32 31 13 00-0162)</small>		
	Note: Includes tie wires.		
32 31 13 00-0164	LF 1-3/8" Galvanized Steel Rail, 0.08" Wall Thickness, Tie Wires And Fittings.....	3.28	0.87
	<i>For SS15, Deduct</i>	-0.15	
	<i>For SS40, Add</i>	0.36	
32 31 13 00-0165	LF 1-3/8" Vinyl Coated Rail, 0.08" Wall Thickness, Tie Wires And Fittings.....	3.77	0.87
	<i>For SS40, Add</i>	0.19	
	<i>For Powder Coated, Add</i>	0.39	
	<i>For Aluminum Coated, Add</i>	0.78	
32 31 13 00-0166	LF 1-5/8" Galvanized Steel Rail, 0.085" Wall Thickness, Tie Wires And Fittings.....	3.92	0.99
	<i>For SS15, Deduct</i>	-0.19	
	<i>For SS40, Add</i>	0.48	
32 31 13 00-0167	LF 1-5/8" Vinyl Coated Rail, 0.085" Wall Thickness, Tie Wires And Fittings.....	4.57	0.99
	<i>For SS40, Add</i>	0.26	
	<i>For Powder Coated, Add</i>	0.52	
	<i>For Aluminum Coated, Add</i>	1.03	
32 31 13 00-0168	LF 2" Galvanized Steel Rail, 0.09" Wall Thickness, Tie Wires And Fittings.....	4.55	1.12
	<i>For SS40, Add</i>	0.58	
32 31 13 00-0169	LF 2" Vinyl Coated Rail, 0.09" Wall Thickness, Tie Wires And Fittings.....	5.33	1.12
	<i>For SS40, Add</i>	0.31	
	<i>For Powder Coated, Add</i>	0.62	
	<i>For Aluminum Coated, Add</i>	1.24	
32 31 13 00-0170	Fabric <small>(32 31 13)</small>		
32 31 13 00-0171	Fabric, Galvanized Chain Link <small>(32 31 13 00-0170)</small>		



Exterior Improvements	32
Site Improvements	32 30
Fences And Gates	32 31

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 31 13 00-0172 LF 3' Full Height Fabric Chain Link #9 Gauge, 1.2 Oz Coating, 2" Mesh.....	7.35	1.59
For 2 Oz Galvanized Coating, Add	0.54	
For 13 Gauge Fabric, Deduct	-0.98	
For 11 Gauge Fabric, Deduct	-0.54	
For 6 Gauge Fabric, Add	1.74	
For 1" Mesh Fabric, Add	1.63	
For 1-3/4" Mesh Fabric, Add	0.65	
For 2-1/8" Mesh Fabric, Deduct	-0.33	
For 2-3/8" Mesh Fabric, Deduct	-0.43	
32 31 13 00-0173 LF 3'-6" Full Height Fabric Chain Link #9 Gauge, 1.2 Oz Coating, 2" Mesh.....	8.11	1.79
For 2 Oz Galvanized Coating, Add	0.63	
For 13 Gauge Fabric, Deduct	-1.14	
For 11 Gauge Fabric, Deduct	-0.63	
For 6 Gauge Fabric, Add	2.02	
For 1" Mesh Fabric, Add	1.90	
For 1-3/4" Mesh Fabric, Add	0.76	
For 2-1/8" Mesh Fabric, Deduct	-0.38	
For 2-3/8" Mesh Fabric, Deduct	-0.51	
32 31 13 00-0174 LF 4' Full Height Fabric Chain Link #9 Gauge, 1.2 Oz Coating, 2" Mesh.....	8.76	1.99
For 2 Oz Galvanized Coating, Add	0.70	
For 13 Gauge Fabric, Deduct	-1.25	
For 11 Gauge Fabric, Deduct	-0.70	
For 6 Gauge Fabric, Add	2.22	
For 1" Mesh Fabric, Add	2.09	
For 1-3/4" Mesh Fabric, Add	0.83	
For 2-1/8" Mesh Fabric, Deduct	-0.42	
For 2-3/8" Mesh Fabric, Deduct	-0.56	
32 31 13 00-0175 LF 5' Full Height Fabric Chain Link #9 Gauge, 1.2 Oz Coating, 2" Mesh.....	9.83	2.39
For 2 Oz Galvanized Coating, Add	0.87	
For 13 Gauge Fabric, Deduct	-1.56	
For 11 Gauge Fabric, Deduct	-0.87	
For 6 Gauge Fabric, Add	2.77	
For 1" Mesh Fabric, Add	2.60	
For 1-3/4" Mesh Fabric, Add	1.04	
For 2-1/8" Mesh Fabric, Deduct	-0.52	
For 2-3/8" Mesh Fabric, Deduct	-0.69	
32 31 13 00-0176 LF 6' Full Height Fabric Chain Link #9 Gauge, 1.2 Oz Coating, 2" Mesh.....	10.99	2.78
For 2 Oz Galvanized Coating, Add	1.04	
For 13 Gauge Fabric, Deduct	-1.87	
For 11 Gauge Fabric, Deduct	-1.04	
For 6 Gauge Fabric, Add	3.33	
For 1" Mesh Fabric, Add	3.12	
For 1-3/4" Mesh Fabric, Add	1.25	
For 2-1/8" Mesh Fabric, Deduct	-0.62	
For 2-3/8" Mesh Fabric, Deduct	-0.83	
32 31 13 00-0177 LF 7' Full Height Fabric Chain Link #9 Gauge, 1.2 Oz Coating, 2" Mesh.....	12.21	3.18
For 2 Oz Galvanized Coating, Add	1.21	
For 13 Gauge Fabric, Deduct	-2.18	
For 11 Gauge Fabric, Deduct	-1.21	
For 6 Gauge Fabric, Add	3.88	
For 1" Mesh Fabric, Add	3.64	
For 1-3/4" Mesh Fabric, Add	1.46	
For 2-1/8" Mesh Fabric, Deduct	-0.73	
For 2-3/8" Mesh Fabric, Deduct	-0.97	
32 31 13 00-0178 LF 8' Full Height Fabric Chain Link #9 Gauge, 1.2 Oz Coating, 2" Mesh.....	13.50	3.98
For 2 Oz Galvanized Coating, Add	1.39	
For 13 Gauge Fabric, Deduct	-2.49	
For 11 Gauge Fabric, Deduct	-1.39	
For 6 Gauge Fabric, Add	4.43	
For 1" Mesh Fabric, Add	4.16	
For 1-3/4" Mesh Fabric, Add	1.66	
For 2-1/8" Mesh Fabric, Deduct	-0.83	
For 2-3/8" Mesh Fabric, Deduct	-1.11	
32 31 13 00-0179 LF 10' Full Height Fabric Chain Link #9 Gauge, 1.2 Oz Coating, 2" Mesh.....	15.99	4.39
For 2 Oz Galvanized Coating, Add	1.80	
For 13 Gauge Fabric, Deduct	-3.24	
For 11 Gauge Fabric, Deduct	-1.80	
For 6 Gauge Fabric, Add	5.76	
For 1" Mesh Fabric, Add	5.40	
For 1-3/4" Mesh Fabric, Add	2.16	
For 2-1/8" Mesh Fabric, Deduct	-1.08	
For 2-3/8" Mesh Fabric, Deduct	-1.44	
32 31 13 00-0180 LF 12' Full Height Fabric Chain Link #9 Gauge, 1.2 Oz Coating, 2" Mesh.....	18.19	4.78
For 2 Oz Galvanized Coating, Add	2.16	
For 13 Gauge Fabric, Deduct	-3.88	
For 11 Gauge Fabric, Deduct	-2.16	
For 6 Gauge Fabric, Add	6.90	
For 1" Mesh Fabric, Add	6.47	
For 1-3/4" Mesh Fabric, Add	2.59	
For 2-1/8" Mesh Fabric, Deduct	-1.29	
For 2-3/8" Mesh Fabric, Deduct	-1.73	

32 Exterior Improvements**32 30 Site Improvements****32 31 Fences And Gates**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 31	13 00-0181	LF	14' Full Height Fabric Chain Link #9 Gauge, 1.2 Oz Coating, 2" Mesh.....	20.42	5.58
			<i>For 2 Oz Galvanized Coating, Add</i>	2.32	
			<i>For 13 Gauge Fabric, Deduct</i>	-4.17	
			<i>For 11 Gauge Fabric, Deduct</i>	-2.32	
			<i>For 6 Gauge Fabric, Add</i>	7.42	
			<i>For 1" Mesh Fabric, Add</i>	6.95	
			<i>For 1-3/4" Mesh Fabric, Add</i>	2.78	
			<i>For 2-1/8" Mesh Fabric, Deduct</i>	-1.39	
			<i>For 2-3/8" Mesh Fabric, Deduct</i>	-1.85	
32 31	13 00-0182	LF	16' Full Height Fabric Chain Link #9 Gauge, 1.2 Oz Coating, 2" Mesh.....	22.66	6.37
			<i>For 2 Oz Galvanized Coating, Add</i>	2.48	
			<i>For 13 Gauge Fabric, Deduct</i>	-4.46	
			<i>For 11 Gauge Fabric, Deduct</i>	-2.48	
			<i>For 6 Gauge Fabric, Add</i>	7.93	
			<i>For 1" Mesh Fabric, Add</i>	7.43	
			<i>For 1-3/4" Mesh Fabric, Add</i>	2.97	
			<i>For 2-1/8" Mesh Fabric, Deduct</i>	-1.49	
			<i>For 2-3/8" Mesh Fabric, Deduct</i>	-1.98	
32 31	13 00-0183		Fabric, Vinyl Coated Chain Link <small>(32 31 13 00-0170)</small>		
32 31	13 00-0184	LF	4' Full Height Vinyl Coated Fabric Chain Link #9 Gauge Fused, 2" Mesh	9.64	1.59
			<i>For 13 Gauge Fabric, Deduct</i>	-1.65	
			<i>For 11 Gauge Fabric, Deduct</i>	-0.92	
			<i>For 6 Gauge Fabric, Add</i>	2.93	
			<i>For 1" Mesh Fabric, Add</i>	2.75	
			<i>For 1-3/4" Mesh Fabric, Add</i>	1.10	
			<i>For 2-1/8" Mesh Fabric, Deduct</i>	-0.55	
			<i>For 2-3/8" Mesh Fabric, Deduct</i>	-0.73	
			<i>For Aluminum Coated, Add</i>	1.46	
32 31	13 00-0185	LF	5' Full Height Vinyl Coated Fabric Chain Link #9 Gauge Fused, 2" Mesh	10.94	2.39
			<i>For 13 Gauge Fabric, Deduct</i>	-2.06	
			<i>For 11 Gauge Fabric, Deduct</i>	-1.14	
			<i>For 6 Gauge Fabric, Add</i>	3.66	
			<i>For 1" Mesh Fabric, Add</i>	3.43	
			<i>For 1-3/4" Mesh Fabric, Add</i>	1.37	
			<i>For 2-1/8" Mesh Fabric, Deduct</i>	-0.69	
			<i>For 2-3/8" Mesh Fabric, Deduct</i>	-0.91	
			<i>For Aluminum Coated, Add</i>	1.83	
32 31	13 00-0186	LF	6' Full Height Vinyl Coated Fabric Chain Link #9 Gauge Fused, 2" Mesh	13.24	2.78
			<i>For 13 Gauge Fabric, Deduct</i>	-2.88	
			<i>For 11 Gauge Fabric, Deduct</i>	-1.60	
			<i>For 6 Gauge Fabric, Add</i>	5.13	
			<i>For 1" Mesh Fabric, Add</i>	4.81	
			<i>For 1-3/4" Mesh Fabric, Add</i>	1.92	
			<i>For 2-1/8" Mesh Fabric, Deduct</i>	-0.96	
			<i>For 2-3/8" Mesh Fabric, Deduct</i>	-1.28	
			<i>For Aluminum Coated, Add</i>	2.56	
32 31	13 00-0187	LF	7' Full Height Vinyl Coated Fabric Chain Link #9 Gauge Fused, 2" Mesh	14.82	3.18
			<i>For 13 Gauge Fabric, Deduct</i>	-3.36	
			<i>For 11 Gauge Fabric, Deduct</i>	-1.87	
			<i>For 6 Gauge Fabric, Add</i>	5.97	
			<i>For 1" Mesh Fabric, Add</i>	5.60	
			<i>For 1-3/4" Mesh Fabric, Add</i>	2.24	
			<i>For 2-1/8" Mesh Fabric, Deduct</i>	-1.12	
			<i>For 2-3/8" Mesh Fabric, Deduct</i>	-1.49	
			<i>For Aluminum Coated, Add</i>	2.98	
32 31	13 00-0188	LF	8' Full Height Vinyl Coated Fabric Chain Link #9 Gauge Fused, 2" Mesh	16.55	3.98
			<i>For 13 Gauge Fabric, Deduct</i>	-3.87	
			<i>For 11 Gauge Fabric, Deduct</i>	-2.15	
			<i>For 6 Gauge Fabric, Add</i>	6.87	
			<i>For 1" Mesh Fabric, Add</i>	6.44	
			<i>For 1-3/4" Mesh Fabric, Add</i>	2.58	
			<i>For 2-1/8" Mesh Fabric, Deduct</i>	-1.29	
			<i>For 2-3/8" Mesh Fabric, Deduct</i>	-1.72	
			<i>For Aluminum Coated, Add</i>	3.44	
32 31	13 00-0189	LF	10' Full Height Vinyl Coated Fabric Chain Link #9 Gauge Fused, 2" Mesh	19.49	4.39
			<i>For 13 Gauge Fabric, Deduct</i>	-4.82	
			<i>For 11 Gauge Fabric, Deduct</i>	-2.68	
			<i>For 6 Gauge Fabric, Add</i>	8.56	
			<i>For 1" Mesh Fabric, Add</i>	8.03	
			<i>For 1-3/4" Mesh Fabric, Add</i>	3.21	
			<i>For 2-1/8" Mesh Fabric, Deduct</i>	-1.61	
			<i>For 2-3/8" Mesh Fabric, Deduct</i>	-2.14	
			<i>For Aluminum Coated, Add</i>	4.28	
32 31	13 00-0190	LF	12' Full Height Vinyl Coated Fabric Chain Link #9 Gauge Fused, 2" Mesh	21.26	4.78
			<i>For 13 Gauge Fabric, Deduct</i>	-5.27	
			<i>For 11 Gauge Fabric, Deduct</i>	-2.93	
			<i>For 6 Gauge Fabric, Add</i>	9.36	
			<i>For 1" Mesh Fabric, Add</i>	8.78	
			<i>For 1-3/4" Mesh Fabric, Add</i>	3.51	
			<i>For 2-1/8" Mesh Fabric, Deduct</i>	-1.76	
			<i>For 2-3/8" Mesh Fabric, Deduct</i>	-2.34	
			<i>For Aluminum Coated, Add</i>	4.68	



		Exterior Improvements	32
		Site Improvements	32 30
		Fences And Gates	32 31

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 31 13 00-0191 LF 14' Full Height Vinyl Coated Fabric Chain Link #9 Gauge Fused, 2" Mesh	24.03	5.58
For 13 Gauge Fabric, Deduct	-5.80	
For 11 Gauge Fabric, Deduct	-3.22	
For 6 Gauge Fabric, Add	10.30	
For 1" Mesh Fabric, Add	9.66	
For 1-3/4" Mesh Fabric, Add	3.86	
For 2-1/8" Mesh Fabric, Deduct	-1.93	
For 2-3/8" Mesh Fabric, Deduct	-2.58	
For Aluminum Coated, Add	5.15	
32 31 13 00-0192 LF 16' Full Height Vinyl Coated Fabric Chain Link #9 Gauge Fused, 2" Mesh	26.86	6.37
For 13 Gauge Fabric, Deduct	-6.35	
For 11 Gauge Fabric, Deduct	-3.53	
For 6 Gauge Fabric, Add	11.29	
For 1" Mesh Fabric, Add	10.58	
For 1-3/4" Mesh Fabric, Add	4.23	
For 2-1/8" Mesh Fabric, Deduct	-2.12	
For 2-3/8" Mesh Fabric, Deduct	-2.82	
For Aluminum Coated, Add	5.64	
32 31 13 00-0193 Fabric, Aluminized Steel Chain Link <small>(32 31 13 00-0170)</small>		
32 31 13 00-0194 LF 3' Full Height Fabric Chain Link #9 Gauge, Aluminized Steel, 2" Mesh	7.26	1.59
For 6 Gauge Fabric, Add	1.66	
For 1" Mesh Fabric, Add	2.18	
32 31 13 00-0195 LF 3'-6" Full Height Fabric Chain Link #9 Gauge, Aluminized Steel, 2" Mesh	8.00	1.79
For 6 Gauge Fabric, Add	1.94	
For 1" Mesh Fabric, Add	2.54	
32 31 13 00-0196 LF 4' Full Height Fabric Chain Link #9 Gauge, Aluminized Steel, 2" Mesh	8.75	1.99
For 6 Gauge Fabric, Add	2.22	
For 1" Mesh Fabric, Add	2.91	
32 31 13 00-0197 LF 5' Full Height Fabric Chain Link #9 Gauge, Aluminized Steel, 2" Mesh	9.83	2.39
For 6 Gauge Fabric, Add	2.77	
For 1" Mesh Fabric, Add	3.63	
32 31 13 00-0198 LF 6' Full Height Fabric Chain Link #9 Gauge, Aluminized Steel, 2" Mesh	10.96	2.78
For 6 Gauge Fabric, Add	3.30	
For 1" Mesh Fabric, Add	4.34	
32 31 13 00-0199 LF 7' Full Height Fabric Chain Link #9 Gauge, Aluminized Steel, 2" Mesh	12.19	3.18
For 6 Gauge Fabric, Add	3.86	
For 1" Mesh Fabric, Add	5.07	
32 31 13 00-0200 LF 8' Full Height Fabric Chain Link #9 Gauge, Aluminized Steel, 2" Mesh	13.48	3.98
For 6 Gauge Fabric, Add	4.42	
For 1" Mesh Fabric, Add	5.80	
32 31 13 00-0201 LF 10' Full Height Fabric Chain Link #9 Gauge, Aluminized Steel, 2" Mesh	15.69	4.39
For 6 Gauge Fabric, Add	5.52	
For 1" Mesh Fabric, Add	7.25	
32 31 13 00-0202 LF 12' Full Height Fabric Chain Link #9 Gauge, Aluminized Steel, 2" Mesh	17.84	4.78
For 6 Gauge Fabric, Add	6.62	
For 1" Mesh Fabric, Add	8.69	
32 31 13 00-0203 Fabric, All Aluminum Chain Link <small>(32 31 13 00-0170)</small>		
32 31 13 00-0204 LF 3' Full Height Fabric Chain Link #9 Gauge, All Aluminum, 2" Mesh	10.62	1.59
For 6 Gauge Fabric, Add	4.35	
For 1" Mesh Fabric, Add	5.71	
32 31 13 00-0205 LF 3'-6" Full Height Fabric Chain Link #9 Gauge, All Aluminum, 2" Mesh	11.92	1.79
For 6 Gauge Fabric, Add	5.07	
For 1" Mesh Fabric, Add	6.66	
32 31 13 00-0206 LF 4' Full Height Fabric Chain Link #9 Gauge, All Aluminum, 2" Mesh	13.23	1.99
For 6 Gauge Fabric, Add	5.80	
For 1" Mesh Fabric, Add	7.61	
32 31 13 00-0207 LF 5' Full Height Fabric Chain Link #9 Gauge, All Aluminum, 2" Mesh	15.43	2.39
For 6 Gauge Fabric, Add	7.25	
For 1" Mesh Fabric, Add	9.51	
32 31 13 00-0208 LF 6' Full Height Fabric Chain Link #9 Gauge, All Aluminum, 2" Mesh	17.71	2.78
For 6 Gauge Fabric, Add	8.70	
For 1" Mesh Fabric, Add	11.42	
32 31 13 00-0209 LF 7' Full Height Fabric Chain Link #9 Gauge, All Aluminum, 2" Mesh	20.05	3.18
For 6 Gauge Fabric, Add	10.15	
For 1" Mesh Fabric, Add	13.32	
32 31 13 00-0210 LF 8' Full Height Fabric Chain Link #9 Gauge, All Aluminum, 2" Mesh	22.46	3.98
For 6 Gauge Fabric, Add	11.60	
For 1" Mesh Fabric, Add	15.23	
32 31 13 00-0211 LF 10' Full Height Fabric Chain Link #9 Gauge, All Aluminum, 2" Mesh	26.91	4.39
For 6 Gauge Fabric, Add	14.50	
For 1" Mesh Fabric, Add	19.03	
32 31 13 00-0212 LF 12' Full Height Fabric Chain Link #9 Gauge, All Aluminum, 2" Mesh	31.31	4.78
For 6 Gauge Fabric, Add	17.40	
For 1" Mesh Fabric, Add	22.84	
32 31 13 00-0213 Fence Inserts <small>(32 31 13 00-0170)</small>		
Note: For use with new or existing chain link fence, per lf of fence.		
32 31 13 00-0214 Vinyl Plastic Fence Inserts <small>(32 31 13 00-0213)</small>		
Note: Assorted colors.		

32 Exterior Improvements**32 30 Site Improvements****32 31 Fences And Gates**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
	32 31 13 00-0215	LF	3' High Fence, Vinyl Plastic Fence Insert.....	5.78	
	32 31 13 00-0216	LF	3-1/2' High Fence, Vinyl Plastic Fence Insert.....	6.65	
	32 31 13 00-0217	LF	4' High Fence, Vinyl Plastic Fence Insert.....	7.34	
	32 31 13 00-0218	LF	5' High Fence, Vinyl Plastic Fence Insert.....	9.20	
	32 31 13 00-0219	LF	6' High Fence, Vinyl Plastic Fence Insert.....	11.02	
	32 31 13 00-0220	LF	7' High Fence, Vinyl Plastic Fence Insert.....	12.88	
	32 31 13 00-0221	LF	8' High Fence, Vinyl Plastic Fence Insert.....	14.68	
	32 31 13 00-0222	LF	10' High Fence, Vinyl Plastic Fence Insert.....	17.16	
	32 31 13 00-0223		Aluminum Fence Inserts (32 31 13 00-0213)		
			Note: Assorted colors.		
	32 31 13 00-0224	LF	3' High Fence, Aluminum Fence Insert.....	12.25	
	32 31 13 00-0225	LF	3-1/2' High Fence, Aluminum Fence Insert.....	13.58	
	32 31 13 00-0226	LF	4' High Fence, Aluminum Fence Insert.....	15.98	
	32 31 13 00-0227	LF	5' High Fence, Aluminum Fence Insert.....	20.02	
	32 31 13 00-0228	LF	6' High Fence, Aluminum Fence Insert.....	24.02	
	32 31 13 00-0229	LF	7' High Fence, Aluminum Fence Insert.....	26.74	
	32 31 13 00-0230	LF	8' High Fence, Aluminum Fence Insert.....	32.01	
	32 31 13 00-0231	LF	10' High Fence, Aluminum Fence Insert.....	38.91	
	32 31 13 00-0232		Redwood Fence Inserts (32 31 13 00-0213)		
	32 31 13 00-0233	LF	4' High Fence, Redwood Fence Insert.....	10.89	
	32 31 13 00-0234	LF	5' High Fence, Redwood Fence Insert.....	13.79	
	32 31 13 00-0235	LF	6' High Fence, Redwood Fence Insert.....	16.56	
	32 31 13 00-0236	LF	7' High Fence, Redwood Fence Insert.....	19.28	
	32 31 13 00-0237	LF	8' High Fence, Redwood Fence Insert.....	22.06	
	32 31 13 00-0238		Diagonal Flexible Polyethylene Inserts (32 31 13 00-0213)		
	32 31 13 00-0239	SF	Diagonal Polyethylene Fence Weave	2.47	
	32 31 13 00-0240		Hedge Link Fence Inserts (32 31 13 00-0213)		
	32 31 13 00-0241	LF	3' High Fence, Hedge Link Fence Insert.....	12.37	
	32 31 13 00-0242	LF	3-1/2' High Fence, Hedge Link Fence Insert.....	14.08	
	32 31 13 00-0243	LF	4' High Fence, Hedge Link Fence Insert.....	16.72	
	32 31 13 00-0244	LF	5' High Fence, Hedge Link Fence Insert.....	20.68	
	32 31 13 00-0245	LF	6' High Fence, Hedge Link Fence Insert.....	23.86	
	32 31 13 00-0246	LF	7' High Fence, Hedge Link Fence Insert.....	29.72	
	32 31 13 00-0247	LF	8' High Fence, Hedge Link Fence Insert.....	33.78	
	32 31 13 00-0248	LF	10' High Fence, Hedge Link Fence Insert.....	40.16	
	32 31 13 00-0249	LF	12' High Fence, Hedge Link Fence Insert.....	46.00	
	32 31 13 00-0250		Fence Windscreen Fabric (32 31 13 00-0170)		
			Note: Includes plastic wire clips.		
	32 31 13 00-0251	SF	Vinyl Coated Polyester Windscreen For Fence, 7 Oz Per SY.....	1.86	
			For Sewn Boxed Vent (Each), Add	14.03	
			For Welded Boxed Vent (Each), Add	7.02	
			For 4' x 4' One Color Logo (Each), Add	292.32	
	32 31 13 00-0252		Non-Climbable Fabric, Galvanized Chain Link (32 31 13 00-0170)		
	32 31 13 00-0253	LF	3' Non-Climbable Fabric Chain Link #9 Gauge, 3/8" Mesh	17.59	1.59
			For 11 Gauge, Deduct	-2.48	
			For 10 Gauge, Deduct	-0.99	
			For 7 Gauge, Add	1.49	
			For 6 Gauge, Add	3.47	
			For 1/2" Mesh Fabric, Deduct	-0.62	
			For 5/8" Mesh Fabric, Deduct	-1.37	
			For 3/4" Mesh Fabric, Deduct	-1.99	
	32 31 13 00-0254	LF	3'-6" Non-Climbable Fabric Chain Link #9 Gauge, 3/8" Mesh.....	20.06	1.79
			For 11 Gauge, Deduct	-2.90	
			For 10 Gauge, Deduct	-1.16	
			For 7 Gauge, Add	1.74	
			For 6 Gauge, Add	4.05	
			For 1/2" Mesh Fabric, Deduct	-0.72	
			For 5/8" Mesh Fabric, Deduct	-1.59	
			For 3/4" Mesh Fabric, Deduct	-2.32	
	32 31 13 00-0255	LF	4' Non-Climbable Fabric Chain Link #9 Gauge, 3/8" Mesh	22.54	1.99
			For 11 Gauge, Deduct	-3.31	
			For 10 Gauge, Deduct	-1.32	
			For 7 Gauge, Add	1.99	
			For 6 Gauge, Add	4.64	
			For 1/2" Mesh Fabric, Deduct	-0.83	
			For 5/8" Mesh Fabric, Deduct	-1.82	
			For 3/4" Mesh Fabric, Deduct	-2.65	



Exterior Improvements	32
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MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 31 13 00-0256 LF 5' Non-Climbable Fabric Chain Link #9 Gauge, 3/8" Mesh.....	27.06	2.39
For 11 Gauge, Deduct	-4.14	
For 10 Gauge, Deduct	-1.66	
For 7 Gauge, Add	2.48	
For 6 Gauge, Add	5.79	
For 1/2" Mesh Fabric, Deduct	-1.03	
For 5/8" Mesh Fabric, Deduct	-2.28	
For 3/4" Mesh Fabric, Deduct	-3.31	
32 31 13 00-0257 LF 6' Non-Climbable Fabric Chain Link #9 Gauge, 3/8" Mesh.....	31.65	2.78
For 11 Gauge, Deduct	-4.96	
For 10 Gauge, Deduct	-1.99	
For 7 Gauge, Add	2.98	
For 6 Gauge, Add	6.95	
For 1/2" Mesh Fabric, Deduct	-1.24	
For 5/8" Mesh Fabric, Deduct	-2.73	
For 3/4" Mesh Fabric, Deduct	-3.97	
32 31 13 00-0258 LF 7' Non-Climbable Fabric Chain Link #9 Gauge, 3/8" Mesh.....	36.32	3.18
For 11 Gauge, Deduct	-5.79	
For 10 Gauge, Deduct	-2.32	
For 7 Gauge, Add	3.48	
For 6 Gauge, Add	8.11	
For 1/2" Mesh Fabric, Deduct	-1.45	
For 5/8" Mesh Fabric, Deduct	-3.19	
For 3/4" Mesh Fabric, Deduct	-4.63	
32 31 13 00-0259 LF 8' Non-Climbable Fabric Chain Link #9 Gauge, 3/8" Mesh.....	41.06	3.98
For 11 Gauge, Deduct	-6.62	
For 10 Gauge, Deduct	-2.65	
For 7 Gauge, Add	3.97	
For 6 Gauge, Add	9.27	
For 1/2" Mesh Fabric, Deduct	-1.66	
For 5/8" Mesh Fabric, Deduct	-3.64	
For 3/4" Mesh Fabric, Deduct	-5.30	
32 31 13 00-0260 LF 9' Non-Climbable Fabric Chain Link #9 Gauge, 3/8" Mesh.....	45.21	4.18
For 11 Gauge, Deduct	-7.37	
For 10 Gauge, Deduct	-2.95	
For 7 Gauge, Add	4.42	
For 6 Gauge, Add	10.32	
For 1/2" Mesh Fabric, Deduct	-1.84	
For 5/8" Mesh Fabric, Deduct	-4.05	
For 3/4" Mesh Fabric, Deduct	-5.90	
32 31 13 00-0261 LF 10' Non-Climbable Fabric Chain Link #9 Gauge, 3/8" Mesh.....	49.38	4.39
For 11 Gauge, Deduct	-8.12	
For 10 Gauge, Deduct	-3.25	
For 7 Gauge, Add	4.87	
For 6 Gauge, Add	11.37	
For 1/2" Mesh Fabric, Deduct	-2.03	
For 5/8" Mesh Fabric, Deduct	-4.46	
For 3/4" Mesh Fabric, Deduct	-6.49	
32 31 13 00-0262 LF 12' Non-Climbable Fabric Chain Link #9 Gauge, 3/8" Mesh.....	53.56	4.78
For 11 Gauge, Deduct	-8.80	
For 10 Gauge, Deduct	-3.52	
For 7 Gauge, Add	5.28	
For 6 Gauge, Add	12.32	
For 1/2" Mesh Fabric, Deduct	-2.20	
For 5/8" Mesh Fabric, Deduct	-4.84	
For 3/4" Mesh Fabric, Deduct	-7.04	
32 31 13 00-0263 Gates <small>(32 31 13)</small>		
Note: Posts exclude drilling or augering in soil or rock. For barbed wire attached directly to posts and gates, select gates and posts sizes for full finished height of gate above grade (top rail to be at lower height, includes barb wire at top area where mesh would be).		
32 31 13 00-0264 Galvanized Steel Without Barbed Wire <small>(32 31 13 00-0263)</small>		
Note: Industrial swing gate. Includes posts (3" diameter posts for up to 6' wide gate, 4" diameter to 13' wide, 6-5/8" diameter for 18' wide, 8-5/8" diameter for over 18' wide), 2" diameter schedule pipe frame, offset hinges, cap and hardware (drop rod, center locking device, gate keeper, catch bolt and tension bands). Fabric: galvanized chain link 2" mesh # 9 gauge, galvanized 1.2 ounce coating.		
32 31 13 00-0265 4' Fence Height <small>(32 31 13 00-0264)</small>		
32 31 13 00-0266 EA 3' Wide x 4' High Single Gate Galvanized Steel Without Barbed Wire	166.63	19.31
For Gate With Single Barb Wire Arm, Add	11.69	
For Gate With Double Barb Wire Arm, Add	17.00	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-19.93	
For Aluminized Steel Gate And Post, Add	51.01	
For Powder Coated Gate And Post, Add	27.63	
32 31 13 00-0267 EA 4' Wide x 4' High Single Gate Galvanized Steel Without Barbed Wire	202.06	20.12
For Gate With Single Barb Wire Arm, Add	15.59	
For Gate With Double Barb Wire Arm, Add	22.67	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-26.57	
For Aluminized Steel Gate And Post, Add	68.02	
For Powder Coated Gate And Post, Add	36.84	

32 Exterior Improvements**32 30 Site Improvements****32 31 Fences And Gates**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 31	13 00-0268	EA	5' Wide x 4' High Single Gate Galvanized Steel Without Barbed Wire.....	235.46	21.41
			<i>For Gate With Single Barb Wire Arm, Add</i>	18.82	
			<i>For Gate With Double Barb Wire Arm, Add</i>	27.37	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-32.08	
			<i>For Aluminized Steel Gate And Post, Add</i>	82.12	
			<i>For Powder Coated Gate And Post, Add</i>	44.48	
32 31	13 00-0269	EA	6' Wide x 4' High Single Gate Galvanized Steel Without Barbed Wire.....	277.72	25.74
			<i>For Gate With Single Barb Wire Arm, Add</i>	22.05	
			<i>For Gate With Double Barb Wire Arm, Add</i>	32.08	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-37.59	
			<i>For Aluminized Steel Gate And Post, Add</i>	96.23	
			<i>For Powder Coated Gate And Post, Add</i>	52.12	
32 31	13 00-0270	EA	7' Wide x 4' High Single Gate Galvanized Steel Without Barbed Wire.....	319.98	30.01
			<i>For Gate With Single Barb Wire Arm, Add</i>	25.28	
			<i>For Gate With Double Barb Wire Arm, Add</i>	36.78	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-43.10	
			<i>For Aluminized Steel Gate And Post, Add</i>	110.33	
			<i>For Powder Coated Gate And Post, Add</i>	59.76	
32 31	13 00-0271	EA	8' Wide x 4' High Single Gate Galvanized Steel Without Barbed Wire.....	363.44	34.27
			<i>For Gate With Single Barb Wire Arm, Add</i>	28.65	
			<i>For Gate With Double Barb Wire Arm, Add</i>	41.67	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-48.83	
			<i>For Aluminized Steel Gate And Post, Add</i>	125.01	
			<i>For Powder Coated Gate And Post, Add</i>	67.71	
32 31	13 00-0272	EA	9' Wide x 4' High Single Gate Galvanized Steel Without Barbed Wire.....	405.68	38.62
			<i>For Gate With Single Barb Wire Arm, Add</i>	31.88	
			<i>For Gate With Double Barb Wire Arm, Add</i>	46.37	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-54.34	
			<i>For Aluminized Steel Gate And Post, Add</i>	139.11	
			<i>For Powder Coated Gate And Post, Add</i>	75.35	
32 31	13 00-0273	EA	10' Wide x 4' High Single Gate Galvanized Steel Without Barbed Wire.....	448.45	42.89
			<i>For Gate With Single Barb Wire Arm, Add</i>	35.17	
			<i>For Gate With Double Barb Wire Arm, Add</i>	51.16	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-59.95	
			<i>For Aluminized Steel Gate And Post, Add</i>	153.47	
			<i>For Powder Coated Gate And Post, Add</i>	83.13	
32 31	13 00-0274	EA	10' Wide x 4' High Double Gate Galvanized Steel Without Barbed Wire.....	553.88	42.89
			<i>For Gate With Single Barb Wire Arm, Add</i>	46.77	
			<i>For Gate With Double Barb Wire Arm, Add</i>	68.02	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-79.71	
			<i>For Aluminized Steel Gate And Post, Add</i>	204.07	
			<i>For Powder Coated Gate And Post, Add</i>	110.54	
32 31	13 00-0275	EA	12' Wide x 4' High Double Gate Galvanized Steel Without Barbed Wire.....	648.09	45.95
			<i>For Gate With Single Barb Wire Arm, Add</i>	56.12	
			<i>For Gate With Double Barb Wire Arm, Add</i>	81.63	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-95.66	
			<i>For Aluminized Steel Gate And Post, Add</i>	244.88	
			<i>For Powder Coated Gate And Post, Add</i>	132.64	
32 31	13 00-0276	EA	14' Wide x 4' High Double Gate Galvanized Steel Without Barbed Wire.....	743.74	49.48
			<i>For Gate With Single Barb Wire Arm, Add</i>	65.47	
			<i>For Gate With Double Barb Wire Arm, Add</i>	95.23	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-111.60	
			<i>For Aluminized Steel Gate And Post, Add</i>	285.69	
			<i>For Powder Coated Gate And Post, Add</i>	154.75	
32 31	13 00-0277	EA	16' Wide x 4' High Double Gate Galvanized Steel Without Barbed Wire.....	841.15	53.58
			<i>For Gate With Single Barb Wire Arm, Add</i>	74.82	
			<i>For Gate With Double Barb Wire Arm, Add</i>	108.84	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-127.54	
			<i>For Aluminized Steel Gate And Post, Add</i>	326.51	
			<i>For Powder Coated Gate And Post, Add</i>	176.86	
32 31	13 00-0278	EA	18' Wide x 4' High Double Gate Galvanized Steel Without Barbed Wire.....	957.72	64.05
			<i>For Gate With Single Barb Wire Arm, Add</i>	84.18	
			<i>For Gate With Double Barb Wire Arm, Add</i>	122.44	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-143.48	
			<i>For Aluminized Steel Gate And Post, Add</i>	367.32	
			<i>For Powder Coated Gate And Post, Add</i>	198.97	
32 31	13 00-0279	EA	20' Wide x 4' High Double Gate Galvanized Steel Without Barbed Wire.....	1,056.49	68.65
			<i>For Gate With Single Barb Wire Arm, Add</i>	93.53	
			<i>For Gate With Double Barb Wire Arm, Add</i>	136.04	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-159.43	
			<i>For Aluminized Steel Gate And Post, Add</i>	408.13	
			<i>For Powder Coated Gate And Post, Add</i>	221.07	
32 31	13 00-0280	EA	22' Wide x 4' High Double Gate Galvanized Steel Without Barbed Wire.....	1,155.30	73.98
			<i>For Gate With Single Barb Wire Arm, Add</i>	102.66	
			<i>For Gate With Double Barb Wire Arm, Add</i>	149.32	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-174.98	
			<i>For Aluminized Steel Gate And Post, Add</i>	447.95	
			<i>For Powder Coated Gate And Post, Add</i>	242.64	
32 31	13 00-0281	EA	24' Wide x 4' High Double Gate Galvanized Steel Without Barbed Wire.....	1,256.76	80.11
			<i>For Gate With Single Barb Wire Arm, Add</i>	111.78	
			<i>For Gate With Double Barb Wire Arm, Add</i>	162.59	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-190.53	
			<i>For Aluminized Steel Gate And Post, Add</i>	487.77	
			<i>For Powder Coated Gate And Post, Add</i>	264.21	



		Exterior Improvements	32
		Site Improvements	32 30
		Fences And Gates	32 31

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 31 13 00-0282 EA 26' Wide x 4' High Double Gate Galvanized Steel Without Barbed Wire	1,361.59	87.42
For Gate With Single Barb Wire Arm, Add	120.91	
For Gate With Double Barb Wire Arm, Add	175.86	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-206.09	
For Aluminized Steel Gate And Post, Add	527.59	
For Powder Coated Gate And Post, Add	285.78	
32 31 13 00-0283 EA 28' Wide x 4' High Double Gate Galvanized Steel Without Barbed Wire	1,439.68	96.17
For Gate With Single Barb Wire Arm, Add	126.61	
For Gate With Double Barb Wire Arm, Add	184.16	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-215.81	
For Aluminized Steel Gate And Post, Add	552.47	
For Powder Coated Gate And Post, Add	299.25	
32 31 13 00-0284 EA 30' Wide x 4' High Double Gate Galvanized Steel Without Barbed Wire	1,596.18	106.82
For Gate With Single Barb Wire Arm, Add	140.30	
For Gate With Double Barb Wire Arm, Add	204.07	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-239.14	
For Aluminized Steel Gate And Post, Add	612.20	
For Powder Coated Gate And Post, Add	331.61	
32 31 13 00-0285 5' Fence Height <small>(32 31 13 00-0264)</small>		
32 31 13 00-0286 EA 3' Wide x 5' High Single Gate Galvanized Steel Without Barbed Wire	195.71	21.41
For Gate With Single Barb Wire Arm, Add	14.45	
For Gate With Double Barb Wire Arm, Add	21.01	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-24.63	
For Aluminized Steel Gate And Post, Add	63.04	
For Powder Coated Gate And Post, Add	34.15	
32 31 13 00-0287 EA 4' Wide x 5' High Single Gate Galvanized Steel Without Barbed Wire	238.92	21.41
For Gate With Single Barb Wire Arm, Add	19.20	
For Gate With Double Barb Wire Arm, Add	27.93	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-32.73	
For Aluminized Steel Gate And Post, Add	83.78	
For Powder Coated Gate And Post, Add	45.38	
32 31 13 00-0288 EA 5' Wide x 5' High Single Gate Galvanized Steel Without Barbed Wire	275.78	22.78
For Gate With Single Barb Wire Arm, Add	22.81	
For Gate With Double Barb Wire Arm, Add	33.18	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-38.88	
For Aluminized Steel Gate And Post, Add	99.54	
For Powder Coated Gate And Post, Add	53.92	
32 31 13 00-0289 EA 6' Wide x 5' High Single Gate Galvanized Steel Without Barbed Wire	324.03	27.36
For Gate With Single Barb Wire Arm, Add	26.61	
For Gate With Double Barb Wire Arm, Add	38.71	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-45.37	
For Aluminized Steel Gate And Post, Add	116.14	
For Powder Coated Gate And Post, Add	62.91	
32 31 13 00-0290 EA 7' Wide x 5' High Single Gate Galvanized Steel Without Barbed Wire	368.81	31.87
For Gate With Single Barb Wire Arm, Add	30.04	
For Gate With Double Barb Wire Arm, Add	43.69	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-51.20	
For Aluminized Steel Gate And Post, Add	131.07	
For Powder Coated Gate And Post, Add	71.00	
32 31 13 00-0291 EA 8' Wide x 5' High Single Gate Galvanized Steel Without Barbed Wire	417.86	36.69
For Gate With Single Barb Wire Arm, Add	33.84	
For Gate With Double Barb Wire Arm, Add	49.22	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-57.68	
For Aluminized Steel Gate And Post, Add	147.66	
For Powder Coated Gate And Post, Add	79.98	
32 31 13 00-0292 EA 9' Wide x 5' High Single Gate Galvanized Steel Without Barbed Wire	464.37	41.28
For Gate With Single Barb Wire Arm, Add	37.45	
For Gate With Double Barb Wire Arm, Add	54.47	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-63.84	
For Aluminized Steel Gate And Post, Add	163.42	
For Powder Coated Gate And Post, Add	88.52	
32 31 13 00-0293 EA 10' Wide x 5' High Single Gate Galvanized Steel Without Barbed Wire	510.88	45.78
For Gate With Single Barb Wire Arm, Add	41.06	
For Gate With Double Barb Wire Arm, Add	59.73	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-69.99	
For Aluminized Steel Gate And Post, Add	179.18	
For Powder Coated Gate And Post, Add	97.06	
32 31 13 00-0294 EA 10' Wide x 5' High Double Gate Galvanized Steel Without Barbed Wire	664.69	45.95
For Gate With Single Barb Wire Arm, Add	57.94	
For Gate With Double Barb Wire Arm, Add	84.28	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-98.77	
For Aluminized Steel Gate And Post, Add	252.84	
For Powder Coated Gate And Post, Add	136.96	
32 31 13 00-0295 EA 12' Wide x 5' High Double Gate Galvanized Steel Without Barbed Wire	781.07	49.48
For Gate With Single Barb Wire Arm, Add	69.58	
For Gate With Double Barb Wire Arm, Add	101.20	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-118.60	
For Aluminized Steel Gate And Post, Add	303.61	
For Powder Coated Gate And Post, Add	164.46	

32 Exterior Improvements**32 30 Site Improvements****32 31 Fences And Gates**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 31 13 00-0296 EA 14' Wide x 5' High Double Gate Galvanized Steel Without Barbed Wire	899.22	53.58
For Gate With Single Barb Wire Arm, Add	81.21	
For Gate With Double Barb Wire Arm, Add	118.13	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-138.43	
For Aluminized Steel Gate And Post, Add	354.38	
For Powder Coated Gate And Post, Add	191.96	
32 31 13 00-0297 EA 16' Wide x 5' High Double Gate Galvanized Steel Without Barbed Wire	1,036.52	64.05
For Gate With Single Barb Wire Arm, Add	92.85	
For Gate With Double Barb Wire Arm, Add	135.05	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-158.26	
For Aluminized Steel Gate And Post, Add	405.14	
For Powder Coated Gate And Post, Add	219.45	
32 31 13 00-0298 EA 18' Wide x 5' High Double Gate Galvanized Steel Without Barbed Wire	1,153.96	68.65
For Gate With Single Barb Wire Arm, Add	104.25	
For Gate With Double Barb Wire Arm, Add	151.64	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-177.70	
For Aluminized Steel Gate And Post, Add	454.92	
For Powder Coated Gate And Post, Add	246.41	
32 31 13 00-0299 EA 20' Wide x 5' High Double Gate Galvanized Steel Without Barbed Wire	1,277.65	73.98
For Gate With Single Barb Wire Arm, Add	116.11	
For Gate With Double Barb Wire Arm, Add	168.89	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-197.92	
For Aluminized Steel Gate And Post, Add	506.68	
For Powder Coated Gate And Post, Add	274.45	
32 31 13 00-0300 EA 22' Wide x 5' High Double Gate Galvanized Steel Without Barbed Wire	1,401.93	80.11
For Gate With Single Barb Wire Arm, Add	127.75	
For Gate With Double Barb Wire Arm, Add	185.82	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-217.75	
For Aluminized Steel Gate And Post, Add	557.45	
For Powder Coated Gate And Post, Add	301.95	
32 31 13 00-0301 EA 24' Wide x 5' High Double Gate Galvanized Steel Without Barbed Wire	1,527.49	87.42
For Gate With Single Barb Wire Arm, Add	139.15	
For Gate With Double Barb Wire Arm, Add	202.41	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-237.20	
For Aluminized Steel Gate And Post, Add	607.22	
For Powder Coated Gate And Post, Add	328.91	
32 31 13 00-0302 EA 26' Wide x 5' High Double Gate Galvanized Steel Without Barbed Wire	1,661.58	96.17
For Gate With Single Barb Wire Arm, Add	151.02	
For Gate With Double Barb Wire Arm, Add	219.66	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-257.42	
For Aluminized Steel Gate And Post, Add	658.98	
For Powder Coated Gate And Post, Add	356.95	
32 31 13 00-0303 EA 28' Wide x 5' High Double Gate Galvanized Steel Without Barbed Wire	1,798.11	106.82
For Gate With Single Barb Wire Arm, Add	162.51	
For Gate With Double Barb Wire Arm, Add	236.37	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-277.00	
For Aluminized Steel Gate And Post, Add	709.12	
For Powder Coated Gate And Post, Add	384.11	
32 31 13 00-0304 EA 30' Wide x 5' High Double Gate Galvanized Steel Without Barbed Wire	1,941.14	120.17
For Gate With Single Barb Wire Arm, Add	173.83	
For Gate With Double Barb Wire Arm, Add	252.84	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-296.30	
For Aluminized Steel Gate And Post, Add	758.53	
For Powder Coated Gate And Post, Add	410.87	
32 31 13 00-0305 6' Fence Height <small>(32 31 13 00-0264)</small>		
32 31 13 00-0306 EA 3' Wide x 6' High Single Gate Galvanized Steel Without Barbed Wire	209.82	22.93
For Gate With Single Barb Wire Arm, Add	15.49	
For Gate With Double Barb Wire Arm, Add	22.54	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-26.41	
For Aluminized Steel Gate And Post, Add	67.61	
For Powder Coated Gate And Post, Add	36.62	
32 31 13 00-0307 EA 4' Wide x 6' High Single Gate Galvanized Steel Without Barbed Wire	256.48	22.93
For Gate With Single Barb Wire Arm, Add	20.63	
For Gate With Double Barb Wire Arm, Add	30.00	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-35.16	
For Aluminized Steel Gate And Post, Add	90.00	
For Powder Coated Gate And Post, Add	48.75	
32 31 13 00-0308 EA 5' Wide x 6' High Single Gate Galvanized Steel Without Barbed Wire	296.43	24.38
For Gate With Single Barb Wire Arm, Add	24.55	
For Gate With Double Barb Wire Arm, Add	35.71	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-41.85	
For Aluminized Steel Gate And Post, Add	107.14	
For Powder Coated Gate And Post, Add	58.03	
32 31 13 00-0309 EA 6' Wide x 6' High Single Gate Galvanized Steel Without Barbed Wire	346.01	29.45
For Gate With Single Barb Wire Arm, Add	28.33	
For Gate With Double Barb Wire Arm, Add	41.20	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-48.28	
For Aluminized Steel Gate And Post, Add	123.60	
For Powder Coated Gate And Post, Add	66.95	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 31 13 00-0310 EA 7' Wide x 6' High Single Gate Galvanized Steel Without Barbed Wire	397.58	34.59
For Gate With Single Barb Wire Arm, Add	32.32	
For Gate With Double Barb Wire Arm, Add	47.01	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-55.09	
For Aluminized Steel Gate And Post, Add	141.02	
For Powder Coated Gate And Post, Add	76.39	
32 31 13 00-0311 EA 8' Wide x 6' High Single Gate Galvanized Steel Without Barbed Wire	446.63	39.43
For Gate With Single Barb Wire Arm, Add	36.12	
For Gate With Double Barb Wire Arm, Add	52.54	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-61.57	
For Aluminized Steel Gate And Post, Add	157.61	
For Powder Coated Gate And Post, Add	85.37	
32 31 13 00-0312 EA 9' Wide x 6' High Single Gate Galvanized Steel Without Barbed Wire	496.49	44.49
For Gate With Single Barb Wire Arm, Add	39.92	
For Gate With Double Barb Wire Arm, Add	58.07	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-68.05	
For Aluminized Steel Gate And Post, Add	174.20	
For Powder Coated Gate And Post, Add	94.36	
32 31 13 00-0313 EA 10' Wide x 6' High Single Gate Galvanized Steel Without Barbed Wire	530.78	49.57
For Gate With Single Barb Wire Arm, Add	42.01	
For Gate With Double Barb Wire Arm, Add	61.11	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-71.61	
For Aluminized Steel Gate And Post, Add	183.33	
For Powder Coated Gate And Post, Add	99.30	
32 31 13 00-0314 EA 10' Wide x 6' High Double Gate Galvanized Steel Without Barbed Wire	710.56	49.48
For Gate With Single Barb Wire Arm, Add	61.82	
For Gate With Double Barb Wire Arm, Add	89.92	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-105.38	
For Aluminized Steel Gate And Post, Add	269.76	
For Powder Coated Gate And Post, Add	146.12	
32 31 13 00-0315 EA 12' Wide x 6' High Double Gate Galvanized Steel Without Barbed Wire	834.93	53.58
For Gate With Single Barb Wire Arm, Add	74.14	
For Gate With Double Barb Wire Arm, Add	107.84	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-126.38	
For Aluminized Steel Gate And Post, Add	323.52	
For Powder Coated Gate And Post, Add	175.24	
32 31 13 00-0316 EA 14' Wide x 6' High Double Gate Galvanized Steel Without Barbed Wire	994.28	68.65
For Gate With Single Barb Wire Arm, Add	86.69	
For Gate With Double Barb Wire Arm, Add	126.09	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-147.76	
For Aluminized Steel Gate And Post, Add	378.27	
For Powder Coated Gate And Post, Add	204.90	
32 31 13 00-0317 EA 16' Wide x 6' High Double Gate Galvanized Steel Without Barbed Wire	1,122.12	73.98
For Gate With Single Barb Wire Arm, Add	99.01	
For Gate With Double Barb Wire Arm, Add	144.01	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-168.76	
For Aluminized Steel Gate And Post, Add	432.02	
For Powder Coated Gate And Post, Add	234.01	
32 31 13 00-0318 EA 18' Wide x 6' High Double Gate Galvanized Steel Without Barbed Wire	1,254.69	80.11
For Gate With Single Barb Wire Arm, Add	111.55	
For Gate With Double Barb Wire Arm, Add	162.26	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-190.15	
For Aluminized Steel Gate And Post, Add	486.77	
For Powder Coated Gate And Post, Add	263.67	
32 31 13 00-0319 EA 20' Wide x 6' High Double Gate Galvanized Steel Without Barbed Wire	1,390.62	87.42
For Gate With Single Barb Wire Arm, Add	124.10	
For Gate With Double Barb Wire Arm, Add	180.51	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-211.53	
For Aluminized Steel Gate And Post, Add	541.52	
For Powder Coated Gate And Post, Add	293.32	
32 31 13 00-0320 EA 22' Wide x 6' High Double Gate Galvanized Steel Without Barbed Wire	1,528.86	96.17
For Gate With Single Barb Wire Arm, Add	136.42	
For Gate With Double Barb Wire Arm, Add	198.43	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-232.53	
For Aluminized Steel Gate And Post, Add	595.28	
For Powder Coated Gate And Post, Add	322.44	
32 31 13 00-0321 EA 24' Wide x 6' High Double Gate Galvanized Steel Without Barbed Wire	1,673.95	106.82
For Gate With Single Barb Wire Arm, Add	148.85	
For Gate With Double Barb Wire Arm, Add	216.51	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-253.72	
For Aluminized Steel Gate And Post, Add	649.53	
For Powder Coated Gate And Post, Add	351.83	
32 31 13 00-0322 EA 26' Wide x 6' High Double Gate Galvanized Steel Without Barbed Wire	1,825.83	120.17
For Gate With Single Barb Wire Arm, Add	161.15	
For Gate With Double Barb Wire Arm, Add	234.39	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-274.68	
For Aluminized Steel Gate And Post, Add	703.18	
For Powder Coated Gate And Post, Add	380.89	
32 31 13 00-0323 EA 28' Wide x 6' High Double Gate Galvanized Steel Without Barbed Wire	1,990.61	137.31
For Gate With Single Barb Wire Arm, Add	173.60	
For Gate With Double Barb Wire Arm, Add	252.51	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-295.91	
For Aluminized Steel Gate And Post, Add	757.53	
For Powder Coated Gate And Post, Add	410.33	

32 Exterior Improvements**32 30 Site Improvements****32 31 Fences And Gates**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 31 13 00-0324	EA		30' Wide x 6' High Double Gate Galvanized Steel Without Barbed Wire	2,172.79	160.22
			<i>For Gate With Single Barb Wire Arm, Add</i>	186.08	
			<i>For Gate With Double Barb Wire Arm, Add</i>	270.66	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-317.18	
			<i>For Aluminized Steel Gate And Post, Add</i>	811.98	
			<i>For Powder Coated Gate And Post, Add</i>	439.82	
32 31 13 00-0325			7' Fence Height <small>(32 31 13 00-0264)</small>		
32 31 13 00-0326	EA		3' Wide x 7' High Single Gate Galvanized Steel Without Barbed Wire.....	221.17	24.71
			<i>For Gate With Single Barb Wire Arm, Add</i>	16.16	
			<i>For Gate With Double Barb Wire Arm, Add</i>	23.50	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-27.54	
			<i>For Aluminized Steel Gate And Post, Add</i>	70.51	
			<i>For Powder Coated Gate And Post, Add</i>	38.19	
32 31 13 00-0327	EA		4' Wide x 7' High Single Gate Galvanized Steel Without Barbed Wire.....	269.56	24.71
			<i>For Gate With Single Barb Wire Arm, Add</i>	21.48	
			<i>For Gate With Double Barb Wire Arm, Add</i>	31.25	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-36.62	
			<i>For Aluminized Steel Gate And Post, Add</i>	93.74	
			<i>For Powder Coated Gate And Post, Add</i>	50.78	
32 31 13 00-0328	EA		5' Wide x 7' High Single Gate Galvanized Steel Without Barbed Wire.....	312.53	25.99
			<i>For Gate With Single Barb Wire Arm, Add</i>	25.79	
			<i>For Gate With Double Barb Wire Arm, Add</i>	37.52	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-43.97	
			<i>For Aluminized Steel Gate And Post, Add</i>	112.55	
			<i>For Powder Coated Gate And Post, Add</i>	60.96	
32 31 13 00-0329	EA		6' Wide x 7' High Single Gate Galvanized Steel Without Barbed Wire.....	382.65	31.63
			<i>For Gate With Single Barb Wire Arm, Add</i>	31.65	
			<i>For Gate With Double Barb Wire Arm, Add</i>	46.03	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-53.95	
			<i>For Aluminized Steel Gate And Post, Add</i>	138.10	
			<i>For Powder Coated Gate And Post, Add</i>	74.80	
32 31 13 00-0330	EA		7' Wide x 7' High Single Gate Galvanized Steel Without Barbed Wire.....	451.99	37.01
			<i>For Gate With Single Barb Wire Arm, Add</i>	37.51	
			<i>For Gate With Double Barb Wire Arm, Add</i>	54.55	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-63.93	
			<i>For Aluminized Steel Gate And Post, Add</i>	163.66	
			<i>For Powder Coated Gate And Post, Add</i>	88.65	
32 31 13 00-0331	EA		8' Wide x 7' High Single Gate Galvanized Steel Without Barbed Wire.....	522.13	42.56
			<i>For Gate With Single Barb Wire Arm, Add</i>	43.36	
			<i>For Gate With Double Barb Wire Arm, Add</i>	63.07	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-73.91	
			<i>For Aluminized Steel Gate And Post, Add</i>	189.21	
			<i>For Powder Coated Gate And Post, Add</i>	102.49	
32 31 13 00-0332	EA		9' Wide x 7' High Single Gate Galvanized Steel Without Barbed Wire.....	591.46	47.96
			<i>For Gate With Single Barb Wire Arm, Add</i>	49.22	
			<i>For Gate With Double Barb Wire Arm, Add</i>	71.59	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-83.89	
			<i>For Aluminized Steel Gate And Post, Add</i>	214.77	
			<i>For Powder Coated Gate And Post, Add</i>	116.33	
32 31 13 00-0333	EA		10' Wide x 7' High Single Gate Galvanized Steel Without Barbed Wire.....	652.00	53.58
			<i>For Gate With Single Barb Wire Arm, Add</i>	54.02	
			<i>For Gate With Double Barb Wire Arm, Add</i>	78.57	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-92.08	
			<i>For Aluminized Steel Gate And Post, Add</i>	235.71	
			<i>For Powder Coated Gate And Post, Add</i>	127.68	
32 31 13 00-0334	EA		10' Wide x 7' High Double Gate Galvanized Steel Without Barbed Wire	805.52	53.58
			<i>For Gate With Single Barb Wire Arm, Add</i>	70.90	
			<i>For Gate With Double Barb Wire Arm, Add</i>	103.13	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-120.86	
			<i>For Aluminized Steel Gate And Post, Add</i>	309.40	
			<i>For Powder Coated Gate And Post, Add</i>	167.59	
32 31 13 00-0335	EA		12' Wide x 7' High Double Gate Galvanized Steel Without Barbed Wire	922.95	68.65
			<i>For Gate With Single Barb Wire Arm, Add</i>	78.84	
			<i>For Gate With Double Barb Wire Arm, Add</i>	114.68	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-134.39	
			<i>For Aluminized Steel Gate And Post, Add</i>	344.03	
			<i>For Powder Coated Gate And Post, Add</i>	186.35	
32 31 13 00-0336	EA		14' Wide x 7' High Double Gate Galvanized Steel Without Barbed Wire	1,058.26	73.98
			<i>For Gate With Single Barb Wire Arm, Add</i>	91.98	
			<i>For Gate With Double Barb Wire Arm, Add</i>	133.79	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-156.79	
			<i>For Aluminized Steel Gate And Post, Add</i>	401.37	
			<i>For Powder Coated Gate And Post, Add</i>	217.41	
32 31 13 00-0337	EA		16' Wide x 7' High Double Gate Galvanized Steel Without Barbed Wire	1,186.25	80.11
			<i>For Gate With Single Barb Wire Arm, Add</i>	104.02	
			<i>For Gate With Double Barb Wire Arm, Add</i>	151.31	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-177.31	
			<i>For Aluminized Steel Gate And Post, Add</i>	453.92	
			<i>For Powder Coated Gate And Post, Add</i>	245.87	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 31 13 00-0338 EA 18' Wide x 7' High Double Gate Galvanized Steel Without Barbed Wire	1,328.40	87.42
For Gate With Single Barb Wire Arm, Add	117.25	
For Gate With Double Barb Wire Arm, Add	170.55	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-199.87	
For Aluminized Steel Gate And Post, Add	511.66	
For Powder Coated Gate And Post, Add	277.15	
32 31 13 00-0339 EA 20' Wide x 7' High Double Gate Galvanized Steel Without Barbed Wire	1,472.86	96.17
For Gate With Single Barb Wire Arm, Add	130.26	
For Gate With Double Barb Wire Arm, Add	189.47	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-222.03	
For Aluminized Steel Gate And Post, Add	568.40	
For Powder Coated Gate And Post, Add	307.88	
32 31 13 00-0340 EA 22' Wide x 7' High Double Gate Galvanized Steel Without Barbed Wire	1,623.14	106.82
For Gate With Single Barb Wire Arm, Add	143.26	
For Gate With Double Barb Wire Arm, Add	208.38	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-244.19	
For Aluminized Steel Gate And Post, Add	625.14	
For Powder Coated Gate And Post, Add	338.62	
32 31 13 00-0341 EA 24' Wide x 7' High Double Gate Galvanized Steel Without Barbed Wire	1,781.45	120.17
For Gate With Single Barb Wire Arm, Add	156.26	
For Gate With Double Barb Wire Arm, Add	227.29	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-266.36	
For Aluminized Steel Gate And Post, Add	681.88	
For Powder Coated Gate And Post, Add	369.35	
32 31 13 00-0342 EA 26' Wide x 7' High Double Gate Galvanized Steel Without Barbed Wire	1,951.21	137.31
For Gate With Single Barb Wire Arm, Add	169.27	
For Gate With Double Barb Wire Arm, Add	246.21	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-288.52	
For Aluminized Steel Gate And Post, Add	738.62	
For Powder Coated Gate And Post, Add	400.09	
32 31 13 00-0343 EA 28' Wide x 7' High Double Gate Galvanized Steel Without Barbed Wire	2,138.16	160.22
For Gate With Single Barb Wire Arm, Add	182.27	
For Gate With Double Barb Wire Arm, Add	265.12	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-310.69	
For Aluminized Steel Gate And Post, Add	795.36	
For Powder Coated Gate And Post, Add	430.82	
32 31 13 00-0344 EA 30' Wide x 7' High Double Gate Galvanized Steel Without Barbed Wire	2,352.61	192.26
For Gate With Single Barb Wire Arm, Add	195.27	
For Gate With Double Barb Wire Arm, Add	284.03	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-332.85	
For Aluminized Steel Gate And Post, Add	852.10	
For Powder Coated Gate And Post, Add	461.55	
32 31 13 00-0345 8' Fence Height <small>(32 31 13 00-0264)</small>		
32 31 13 00-0346 EA 3' Wide x 8' High Single Gate Galvanized Steel Without Barbed Wire	255.91	26.79
For Gate With Single Barb Wire Arm, Add	19.30	
For Gate With Double Barb Wire Arm, Add	28.07	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-32.90	
For Aluminized Steel Gate And Post, Add	84.21	
For Powder Coated Gate And Post, Add	45.61	
32 31 13 00-0347 EA 4' Wide x 8' High Single Gate Galvanized Steel Without Barbed Wire	314.39	26.79
For Gate With Single Barb Wire Arm, Add	25.73	
For Gate With Double Barb Wire Arm, Add	37.43	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-43.86	
For Aluminized Steel Gate And Post, Add	112.28	
For Powder Coated Gate And Post, Add	60.82	
32 31 13 00-0348 EA 5' Wide x 8' High Single Gate Galvanized Steel Without Barbed Wire	364.83	29.85
For Gate With Single Barb Wire Arm, Add	30.26	
For Gate With Double Barb Wire Arm, Add	44.02	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-51.58	
For Aluminized Steel Gate And Post, Add	132.05	
For Powder Coated Gate And Post, Add	71.53	
32 31 13 00-0349 EA 6' Wide x 8' High Single Gate Galvanized Steel Without Barbed Wire	417.69	33.80
For Gate With Single Barb Wire Arm, Add	34.79	
For Gate With Double Barb Wire Arm, Add	50.61	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-59.31	
For Aluminized Steel Gate And Post, Add	151.83	
For Powder Coated Gate And Post, Add	82.24	
32 31 13 00-0350 EA 7' Wide x 8' High Single Gate Galvanized Steel Without Barbed Wire	479.81	40.72
For Gate With Single Barb Wire Arm, Add	39.33	
For Gate With Double Barb Wire Arm, Add	57.20	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-67.03	
For Aluminized Steel Gate And Post, Add	171.60	
For Powder Coated Gate And Post, Add	92.95	
32 31 13 00-0351 EA 8' Wide x 8' High Single Gate Galvanized Steel Without Barbed Wire	541.13	47.39
For Gate With Single Barb Wire Arm, Add	43.86	
For Gate With Double Barb Wire Arm, Add	63.79	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-74.76	
For Aluminized Steel Gate And Post, Add	191.38	
For Powder Coated Gate And Post, Add	103.66	

32 Exterior Improvements**32 30 Site Improvements****32 31 Fences And Gates**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 31 13 00-0352	EA		9' Wide x 8' High Single Gate Galvanized Steel Without Barbed Wire.....	603.26	54.39
			<i>For Gate With Single Barb Wire Arm, Add</i>	48.39	
			<i>For Gate With Double Barb Wire Arm, Add</i>	70.39	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-82.48	
			<i>For Aluminized Steel Gate And Post, Add</i>	211.16	
			<i>For Powder Coated Gate And Post, Add</i>	114.38	
32 31 13 00-0353	EA		10' Wide x 8' High Single Gate Galvanized Steel Without Barbed Wire.....	665.36	61.40
			<i>For Gate With Single Barb Wire Arm, Add</i>	52.92	
			<i>For Gate With Double Barb Wire Arm, Add</i>	76.98	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-90.21	
			<i>For Aluminized Steel Gate And Post, Add</i>	230.93	
			<i>For Powder Coated Gate And Post, Add</i>	125.09	
32 31 13 00-0354	EA		10' Wide x 8' High Double Gate Galvanized Steel Without Barbed Wire	927.90	68.65
			<i>For Gate With Single Barb Wire Arm, Add</i>	79.38	
			<i>For Gate With Double Barb Wire Arm, Add</i>	115.47	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-135.32	
			<i>For Aluminized Steel Gate And Post, Add</i>	346.41	
			<i>For Powder Coated Gate And Post, Add</i>	187.64	
32 31 13 00-0355	EA		12' Wide x 8' High Double Gate Galvanized Steel Without Barbed Wire	1,082.71	73.98
			<i>For Gate With Single Barb Wire Arm, Add</i>	94.67	
			<i>For Gate With Double Barb Wire Arm, Add</i>	137.70	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-161.37	
			<i>For Aluminized Steel Gate And Post, Add</i>	413.11	
			<i>For Powder Coated Gate And Post, Add</i>	223.77	
32 31 13 00-0356	EA		14' Wide x 8' High Double Gate Galvanized Steel Without Barbed Wire	1,242.24	80.11
			<i>For Gate With Single Barb Wire Arm, Add</i>	110.18	
			<i>For Gate With Double Barb Wire Arm, Add</i>	160.27	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-187.81	
			<i>For Aluminized Steel Gate And Post, Add</i>	480.80	
			<i>For Powder Coated Gate And Post, Add</i>	260.43	
32 31 13 00-0357	EA		16' Wide x 8' High Double Gate Galvanized Steel Without Barbed Wire	1,409.28	87.42
			<i>For Gate With Single Barb Wire Arm, Add</i>	126.15	
			<i>For Gate With Double Barb Wire Arm, Add</i>	183.49	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-215.03	
			<i>For Aluminized Steel Gate And Post, Add</i>	550.48	
			<i>For Powder Coated Gate And Post, Add</i>	298.18	
32 31 13 00-0358	EA		18' Wide x 8' High Double Gate Galvanized Steel Without Barbed Wire.....	1,580.70	96.17
			<i>For Gate With Single Barb Wire Arm, Add</i>	142.12	
			<i>For Gate With Double Barb Wire Arm, Add</i>	206.72	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-242.25	
			<i>For Aluminized Steel Gate And Post, Add</i>	620.16	
			<i>For Powder Coated Gate And Post, Add</i>	335.92	
32 31 13 00-0359	EA		20' Wide x 8' High Double Gate Galvanized Steel Without Barbed Wire	1,755.87	106.82
			<i>For Gate With Single Barb Wire Arm, Add</i>	157.86	
			<i>For Gate With Double Barb Wire Arm, Add</i>	229.62	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-269.08	
			<i>For Aluminized Steel Gate And Post, Add</i>	688.85	
			<i>For Powder Coated Gate And Post, Add</i>	373.13	
32 31 13 00-0360	EA		22' Wide x 8' High Double Gate Galvanized Steel Without Barbed Wire	1,936.99	120.17
			<i>For Gate With Single Barb Wire Arm, Add</i>	173.37	
			<i>For Gate With Double Barb Wire Arm, Add</i>	252.18	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-295.52	
			<i>For Aluminized Steel Gate And Post, Add</i>	756.54	
			<i>For Powder Coated Gate And Post, Add</i>	409.79	
32 31 13 00-0361	EA		24' Wide x 8' High Double Gate Galvanized Steel Without Barbed Wire	2,133.71	137.31
			<i>For Gate With Single Barb Wire Arm, Add</i>	189.34	
			<i>For Gate With Double Barb Wire Arm, Add</i>	275.41	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-322.74	
			<i>For Aluminized Steel Gate And Post, Add</i>	826.22	
			<i>For Powder Coated Gate And Post, Add</i>	447.54	
32 31 13 00-0362	EA		26' Wide x 8' High Double Gate Galvanized Steel Without Barbed Wire	2,347.62	160.22
			<i>For Gate With Single Barb Wire Arm, Add</i>	205.31	
			<i>For Gate With Double Barb Wire Arm, Add</i>	298.63	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-349.96	
			<i>For Aluminized Steel Gate And Post, Add</i>	895.90	
			<i>For Powder Coated Gate And Post, Add</i>	485.28	
32 31 13 00-0363	EA		28' Wide x 8' High Double Gate Galvanized Steel Without Barbed Wire	2,586.95	192.26
			<i>For Gate With Single Barb Wire Arm, Add</i>	221.05	
			<i>For Gate With Double Barb Wire Arm, Add</i>	321.53	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-376.79	
			<i>For Aluminized Steel Gate And Post, Add</i>	964.58	
			<i>For Powder Coated Gate And Post, Add</i>	522.48	
32 31 13 00-0364	EA		30' Wide x 8' High Double Gate Galvanized Steel Without Barbed Wire	2,874.39	240.34
			<i>For Gate With Single Barb Wire Arm, Add</i>	236.79	
			<i>For Gate With Double Barb Wire Arm, Add</i>	344.42	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-403.62	
			<i>For Aluminized Steel Gate And Post, Add</i>	1,033.27	
			<i>For Powder Coated Gate And Post, Add</i>	559.69	

32 31 13 00-0365 10' Fence Height (32 31 13 00-0264)



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 31 13 00-0366 EA 3' Wide x 10' High Single Gate Galvanized Steel Without Barbed Wire	316.26	29.77
For Gate With Single Barb Wire Arm, Add	24.95	
For Gate With Double Barb Wire Arm, Add	36.30	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-42.54	
For Aluminized Steel Gate And Post, Add	108.89	
For Powder Coated Gate And Post, Add	58.98	
32 31 13 00-0367 EA 4' Wide x 10' High Single Gate Galvanized Steel Without Barbed Wire	391.89	29.77
For Gate With Single Barb Wire Arm, Add	33.27	
For Gate With Double Barb Wire Arm, Add	48.40	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-56.72	
For Aluminized Steel Gate And Post, Add	145.20	
For Powder Coated Gate And Post, Add	78.65	
32 31 13 00-0368 EA 5' Wide x 10' High Single Gate Galvanized Steel Without Barbed Wire	449.10	31.06
For Gate With Single Barb Wire Arm, Add	39.13	
For Gate With Double Barb Wire Arm, Add	56.92	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-66.71	
For Aluminized Steel Gate And Post, Add	170.77	
For Powder Coated Gate And Post, Add	92.50	
32 31 13 00-0369 EA 6' Wide x 10' High Single Gate Galvanized Steel Without Barbed Wire	524.91	38.62
For Gate With Single Barb Wire Arm, Add	45.00	
For Gate With Double Barb Wire Arm, Add	65.45	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-76.70	
For Aluminized Steel Gate And Post, Add	196.34	
For Powder Coated Gate And Post, Add	106.35	
32 31 13 00-0370 EA 7' Wide x 10' High Single Gate Galvanized Steel Without Barbed Wire	600.24	45.78
For Gate With Single Barb Wire Arm, Add	50.85	
For Gate With Double Barb Wire Arm, Add	73.97	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-86.68	
For Aluminized Steel Gate And Post, Add	221.91	
For Powder Coated Gate And Post, Add	120.20	
32 31 13 00-0371 EA 8' Wide x 10' High Single Gate Galvanized Steel Without Barbed Wire	675.70	53.34
For Gate With Single Barb Wire Arm, Add	56.71	
For Gate With Double Barb Wire Arm, Add	82.49	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-96.67	
For Aluminized Steel Gate And Post, Add	247.48	
For Powder Coated Gate And Post, Add	134.05	
32 31 13 00-0372 EA 9' Wide x 10' High Single Gate Galvanized Steel Without Barbed Wire	750.71	60.59
For Gate With Single Barb Wire Arm, Add	62.58	
For Gate With Double Barb Wire Arm, Add	91.02	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-106.66	
For Aluminized Steel Gate And Post, Add	273.06	
For Powder Coated Gate And Post, Add	147.91	
32 31 13 00-0373 EA 10' Wide x 10' High Single Gate Galvanized Steel Without Barbed Wire	826.52	68.07
For Gate With Single Barb Wire Arm, Add	68.44	
For Gate With Double Barb Wire Arm, Add	99.54	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-116.65	
For Aluminized Steel Gate And Post, Add	298.63	
For Powder Coated Gate And Post, Add	161.76	
32 31 13 00-0374 EA 10' Wide x 10' High Double Gate Galvanized Steel Without Barbed Wire	1,162.35	76.33
For Gate With Single Barb Wire Arm, Add	102.65	
For Gate With Double Barb Wire Arm, Add	149.32	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-174.98	
For Aluminized Steel Gate And Post, Add	447.95	
For Powder Coated Gate And Post, Add	242.64	
32 31 13 00-0375 EA 12' Wide x 10' High Double Gate Galvanized Steel Without Barbed Wire	1,262.87	82.09
For Gate With Single Barb Wire Arm, Add	111.78	
For Gate With Double Barb Wire Arm, Add	162.59	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-190.54	
For Aluminized Steel Gate And Post, Add	487.78	
For Powder Coated Gate And Post, Add	264.21	
32 31 13 00-0376 EA 14' Wide x 10' High Double Gate Galvanized Steel Without Barbed Wire	1,432.81	89.04
For Gate With Single Barb Wire Arm, Add	128.21	
For Gate With Double Barb Wire Arm, Add	186.48	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-218.53	
For Aluminized Steel Gate And Post, Add	559.44	
For Powder Coated Gate And Post, Add	303.03	
32 31 13 00-0377 EA 16' Wide x 10' High Double Gate Galvanized Steel Without Barbed Wire	1,622.91	97.08
For Gate With Single Barb Wire Arm, Add	146.46	
For Gate With Double Barb Wire Arm, Add	213.03	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-249.64	
For Aluminized Steel Gate And Post, Add	639.08	
For Powder Coated Gate And Post, Add	346.17	
32 31 13 00-0378 EA 18' Wide x 10' High Double Gate Galvanized Steel Without Barbed Wire	1,818.08	106.82
For Gate With Single Barb Wire Arm, Add	164.70	
For Gate With Double Barb Wire Arm, Add	239.57	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-280.75	
For Aluminized Steel Gate And Post, Add	718.71	
For Powder Coated Gate And Post, Add	389.30	
32 31 13 00-0379 EA 20' Wide x 10' High Double Gate Galvanized Steel Without Barbed Wire	2,020.50	118.64
For Gate With Single Barb Wire Arm, Add	183.07	
For Gate With Double Barb Wire Arm, Add	266.28	
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-312.05	
For Aluminized Steel Gate And Post, Add	798.84	
For Powder Coated Gate And Post, Add	432.71	

32 Exterior Improvements**32 30 Site Improvements****32 31 Fences And Gates**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 31 13 00-0380	EA		22' Wide x 10' High Double Gate Galvanized Steel Without Barbed Wire	2,232.17	133.53
			<i>For Gate With Single Barb Wire Arm, Add</i>	201.43	
			<i>For Gate With Double Barb Wire Arm, Add</i>	292.99	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-343.35	
			<i>For Aluminized Steel Gate And Post, Add</i>	878.98	
			<i>For Powder Coated Gate And Post, Add</i>	476.11	
32 31 13 00-0381	EA		24' Wide x 10' High Double Gate Galvanized Steel Without Barbed Wire	2,455.07	152.46
			<i>For Gate With Single Barb Wire Arm, Add</i>	219.68	
			<i>For Gate With Double Barb Wire Arm, Add</i>	319.54	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-374.46	
			<i>For Aluminized Steel Gate And Post, Add</i>	958.61	
			<i>For Powder Coated Gate And Post, Add</i>	519.25	
32 31 13 00-0382	EA		26' Wide x 10' High Double Gate Galvanized Steel Without Barbed Wire	2,697.65	178.00
			<i>For Gate With Single Barb Wire Arm, Add</i>	237.93	
			<i>For Gate With Double Barb Wire Arm, Add</i>	346.08	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-405.57	
			<i>For Aluminized Steel Gate And Post, Add</i>	1,038.25	
			<i>For Powder Coated Gate And Post, Add</i>	562.39	
32 31 13 00-0383	EA		28' Wide x 10' High Double Gate Galvanized Steel Without Barbed Wire	2,969.90	213.46
			<i>For Gate With Single Barb Wire Arm, Add</i>	256.18	
			<i>For Gate With Double Barb Wire Arm, Add</i>	372.63	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-436.67	
			<i>For Aluminized Steel Gate And Post, Add</i>	1,117.88	
			<i>For Powder Coated Gate And Post, Add</i>	605.52	
32 31 13 00-0384	EA		30' Wide x 10' High Double Gate Galvanized Steel Without Barbed Wire	3,298.83	267.04
			<i>For Gate With Single Barb Wire Arm, Add</i>	274.66	
			<i>For Gate With Double Barb Wire Arm, Add</i>	399.50	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-468.17	
			<i>For Aluminized Steel Gate And Post, Add</i>	1,198.51	
			<i>For Powder Coated Gate And Post, Add</i>	649.19	
32 31 13 00-0385			12' Fence Height <small>(32 31 13 00-0264)</small>		
32 31 13 00-0386	EA		3' Wide x 12' High Single Gate Galvanized Steel Without Barbed Wire.....	389.72	33.07
			<i>For Gate With Single Barb Wire Arm, Add</i>	31.94	
			<i>For Gate With Double Barb Wire Arm, Add</i>	46.46	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-54.45	
			<i>For Aluminized Steel Gate And Post, Add</i>	139.39	
			<i>For Powder Coated Gate And Post, Add</i>	75.50	
32 31 13 00-0387	EA		4' Wide x 12' High Single Gate Galvanized Steel Without Barbed Wire.....	486.51	33.07
			<i>For Gate With Single Barb Wire Arm, Add</i>	42.59	
			<i>For Gate With Double Barb Wire Arm, Add</i>	61.95	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-72.60	
			<i>For Aluminized Steel Gate And Post, Add</i>	185.85	
			<i>For Powder Coated Gate And Post, Add</i>	100.67	
32 31 13 00-0388	EA		5' Wide x 12' High Single Gate Galvanized Steel Without Barbed Wire.....	558.37	34.27
			<i>For Gate With Single Barb Wire Arm, Add</i>	50.09	
			<i>For Gate With Double Barb Wire Arm, Add</i>	72.86	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-85.38	
			<i>For Aluminized Steel Gate And Post, Add</i>	218.58	
			<i>For Powder Coated Gate And Post, Add</i>	118.40	
32 31 13 00-0389	EA		6' Wide x 12' High Single Gate Galvanized Steel Without Barbed Wire.....	651.52	42.56
			<i>For Gate With Single Barb Wire Arm, Add</i>	57.59	
			<i>For Gate With Double Barb Wire Arm, Add</i>	83.77	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-98.17	
			<i>For Aluminized Steel Gate And Post, Add</i>	251.32	
			<i>For Powder Coated Gate And Post, Add</i>	136.13	
32 31 13 00-0390	EA		7' Wide x 12' High Single Gate Galvanized Steel Without Barbed Wire.....	744.64	50.94
			<i>For Gate With Single Barb Wire Arm, Add</i>	65.09	
			<i>For Gate With Double Barb Wire Arm, Add</i>	94.68	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-110.95	
			<i>For Aluminized Steel Gate And Post, Add</i>	284.04	
			<i>For Powder Coated Gate And Post, Add</i>	153.86	
32 31 13 00-0391	EA		8' Wide x 12' High Single Gate Galvanized Steel Without Barbed Wire.....	836.97	58.98
			<i>For Gate With Single Barb Wire Arm, Add</i>	72.59	
			<i>For Gate With Double Barb Wire Arm, Add</i>	105.59	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-123.74	
			<i>For Aluminized Steel Gate And Post, Add</i>	316.78	
			<i>For Powder Coated Gate And Post, Add</i>	171.59	
32 31 13 00-0392	EA		9' Wide x 12' High Single Gate Galvanized Steel Without Barbed Wire.....	930.11	67.27
			<i>For Gate With Single Barb Wire Arm, Add</i>	80.10	
			<i>For Gate With Double Barb Wire Arm, Add</i>	116.50	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-136.53	
			<i>For Aluminized Steel Gate And Post, Add</i>	349.51	
			<i>For Powder Coated Gate And Post, Add</i>	189.32	
32 31 13 00-0393	EA		10' Wide x 12' High Single Gate Galvanized Steel Without Barbed Wire.....	1,023.25	75.55
			<i>For Gate With Single Barb Wire Arm, Add</i>	87.60	
			<i>For Gate With Double Barb Wire Arm, Add</i>	127.41	
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-149.31	
			<i>For Aluminized Steel Gate And Post, Add</i>	382.24	
			<i>For Powder Coated Gate And Post, Add</i>	207.05	



Exterior Improvements	32	32
Site Improvements	32 30	
Fences And Gates	32 31	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 31	13 00-0394	EA	10' Wide x 12' High Double Gate Galvanized Steel Without Barbed Wire <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i> <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Aluminized Steel Gate And Post, Add</i> <i>For Powder Coated Gate And Post, Add</i>	1,364.08 122.05 177.52 -208.03 532.56 288.47	84.80
32 31	13 00-0395	EA	12' Wide x 12' High Double Gate Galvanized Steel Without Barbed Wire <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i> <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Aluminized Steel Gate And Post, Add</i> <i>For Powder Coated Gate And Post, Add</i>	1,493.43 134.14 195.11 -228.64 585.32 317.05	91.30
32 31	13 00-0396	EA	14' Wide x 12' High Double Gate Galvanized Steel Without Barbed Wire <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i> <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Aluminized Steel Gate And Post, Add</i> <i>For Powder Coated Gate And Post, Add</i>	1,694.78 153.75 223.64 -262.08 670.93 363.42	98.88
32 31	13 00-0397	EA	16' Wide x 12' High Double Gate Galvanized Steel Without Barbed Wire <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i> <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Aluminized Steel Gate And Post, Add</i> <i>For Powder Coated Gate And Post, Add</i>	1,920.80 175.65 255.50 -299.41 766.49 415.18	107.81
32 31	13 00-0398	EA	18 Wide x 12' High Double Gate Galvanized Steel Without Barbed Wire <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i> <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Aluminized Steel Gate And Post, Add</i> <i>For Powder Coated Gate And Post, Add</i>	2,152.19 197.55 287.35 -336.74 862.06 466.95	118.72
32 31	13 00-0399	EA	20' Wide x 12' High Double Gate Galvanized Steel Without Barbed Wire <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i> <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Aluminized Steel Gate And Post, Add</i> <i>For Powder Coated Gate And Post, Add</i>	2,392.81 219.68 319.54 -374.46 958.61 519.25	131.81
32 31	13 00-0400	EA	22' Wide x 12' High Double Gate Galvanized Steel Without Barbed Wire <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i> <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Aluminized Steel Gate And Post, Add</i> <i>For Powder Coated Gate And Post, Add</i>	2,641.72 241.58 351.39 -411.79 1,054.18 571.01	148.32
32 31	13 00-0401	EA	24' Wide x 12' High Double Gate Galvanized Steel Without Barbed Wire <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i> <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Aluminized Steel Gate And Post, Add</i> <i>For Powder Coated Gate And Post, Add</i>	2,906.21 263.71 383.58 -449.51 1,150.73 623.31	169.43
32 31	13 00-0402	EA	26' Wide x 12' High Double Gate Galvanized Steel Without Barbed Wire <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i> <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Aluminized Steel Gate And Post, Add</i> <i>For Powder Coated Gate And Post, Add</i>	3,188.39 285.38 415.10 -486.44 1,245.30 674.54	197.84
32 31	13 00-0403	EA	28' Wide x 12' High Double Gate Galvanized Steel Without Barbed Wire <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i> <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Aluminized Steel Gate And Post, Add</i> <i>For Powder Coated Gate And Post, Add</i>	3,505.66 307.28 446.95 -523.77 1,340.86 726.30	237.18
32 31	13 00-0404	EA	30' Wide x 12' High Double Gate Galvanized Steel Without Barbed Wire <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i> <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Aluminized Steel Gate And Post, Add</i> <i>For Powder Coated Gate And Post, Add</i>	3,885.66 329.41 479.14 -561.49 1,437.42 778.60	296.72
32 31	13 00-0405		Vinyl Coated Without Barb Wire Arm <small>(32 31 13 00-0263)</small> Note: Industrial swing gate. Includes posts (3" diameter posts for up to 6' wide gate, 4" diameter to 13' wide, 6-5/8" diameter for 18' wide, 8-5/8" diameter for over 18' wide), 2" diameter schedule pipe frame, offset hinges, cap and hardware (drop rod, center locking device, gate keeper, catch bolt and tension bands). Fabric: galvanized chain link 2" mesh # 9 gauge, galvanized 1.2 ounce coating.		
32 31	13 00-0406		4' Fence Height <small>(32 31 13 00-0405)</small>		
32 31	13 00-0407	EA	3' Wide x 4' High Single Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	198.73 -25.95 15.22 22.14	20.12
32 31	13 00-0408	EA	4' Wide x 4' High Single Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	244.86 -34.60 20.30 29.52	20.12
32 31	13 00-0409	EA	5' Wide x 4' High Single Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	287.33 -41.81 24.53 35.67	21.41

32 Exterior Improvements**32 30 Site Improvements****32 31 Fences And Gates**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 31	13 00-0410	EA	6' Wide x 4' High Single Gate Vinyl Coated Without Barbed Wire Arm.....	338.63	25.74
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-49.01	
			<i>For Gate With Single Barb Wire Arm, Add</i>	28.75	
			<i>For Gate With Double Barb Wire Arm, Add</i>	41.82	
32 31	13 00-0411	EA	7' Wide x 4' High Single Gate Vinyl Coated Without Barbed Wire Arm.....	389.95	30.01
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-56.22	
			<i>For Gate With Single Barb Wire Arm, Add</i>	32.98	
			<i>For Gate With Double Barb Wire Arm, Add</i>	47.97	
32 31	13 00-0412	EA	8' Wide x 4' High Single Gate Vinyl Coated Without Barbed Wire Arm.....	441.27	34.27
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-63.43	
			<i>For Gate With Single Barb Wire Arm, Add</i>	37.21	
			<i>For Gate With Double Barb Wire Arm, Add</i>	54.12	
32 31	13 00-0413	EA	9' Wide x 4' High Single Gate Vinyl Coated Without Barbed Wire Arm.....	492.58	38.62
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-70.63	
			<i>For Gate With Single Barb Wire Arm, Add</i>	41.44	
			<i>For Gate With Double Barb Wire Arm, Add</i>	60.27	
32 31	13 00-0414	EA	10' Wide x 4' High Single Gate Vinyl Coated Without Barbed Wire Arm.....	543.89	42.89
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-77.84	
			<i>For Gate With Single Barb Wire Arm, Add</i>	45.67	
			<i>For Gate With Double Barb Wire Arm, Add</i>	66.42	
32 31	13 00-0415	EA	10' Wide x 4' High Double Gate Vinyl Coated Without Barbed Wire Arm	682.27	42.89
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-103.79	
			<i>For Gate With Single Barb Wire Arm, Add</i>	60.89	
			<i>For Gate With Double Barb Wire Arm, Add</i>	88.56	
32 31	13 00-0416	EA	12' Wide x 4' High Double Gate Vinyl Coated Without Barbed Wire Arm	802.17	45.95
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-124.55	
			<i>For Gate With Single Barb Wire Arm, Add</i>	73.07	
			<i>For Gate With Double Barb Wire Arm, Add</i>	106.28	
32 31	13 00-0417	EA	14' Wide x 4' High Double Gate Vinyl Coated Without Barbed Wire Arm	923.50	49.48
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-145.30	
			<i>For Gate With Single Barb Wire Arm, Add</i>	85.24	
			<i>For Gate With Double Barb Wire Arm, Add</i>	123.99	
32 31	13 00-0418	EA	16' Wide x 4' High Double Gate Vinyl Coated Without Barbed Wire Arm	1,046.59	53.58
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-166.06	
			<i>For Gate With Single Barb Wire Arm, Add</i>	97.42	
			<i>For Gate With Double Barb Wire Arm, Add</i>	141.71	
32 31	13 00-0419	EA	18' Wide x 4' High Double Gate Vinyl Coated Without Barbed Wire Arm	1,188.83	64.05
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-186.82	
			<i>For Gate With Single Barb Wire Arm, Add</i>	109.60	
			<i>For Gate With Double Barb Wire Arm, Add</i>	159.42	
32 31	13 00-0420	EA	20' Wide x 4' High Double Gate Vinyl Coated Without Barbed Wire Arm	1,313.29	68.65
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-207.58	
			<i>For Gate With Single Barb Wire Arm, Add</i>	121.78	
			<i>For Gate With Double Barb Wire Arm, Add</i>	177.13	
32 31	13 00-0421	EA	22' Wide x 4' High Double Gate Vinyl Coated Without Barbed Wire Arm	1,439.85	73.98
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-228.33	
			<i>For Gate With Single Barb Wire Arm, Add</i>	133.96	
			<i>For Gate With Double Barb Wire Arm, Add</i>	194.84	
32 31	13 00-0422	EA	24' Wide x 4' High Double Gate Vinyl Coated Without Barbed Wire Arm	1,569.06	80.11
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-249.09	
			<i>For Gate With Single Barb Wire Arm, Add</i>	146.13	
			<i>For Gate With Double Barb Wire Arm, Add</i>	212.56	
32 31	13 00-0423	EA	26' Wide x 4' High Double Gate Vinyl Coated Without Barbed Wire Arm	1,701.64	87.42
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-269.85	
			<i>For Gate With Single Barb Wire Arm, Add</i>	158.31	
			<i>For Gate With Double Barb Wire Arm, Add</i>	230.27	
32 31	13 00-0424	EA	28' Wide x 4' High Double Gate Vinyl Coated Without Barbed Wire Arm	1,838.60	96.17
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-290.61	
			<i>For Gate With Single Barb Wire Arm, Add</i>	170.49	
			<i>For Gate With Double Barb Wire Arm, Add</i>	247.98	
32 31	13 00-0425	EA	30' Wide x 4' High Double Gate Vinyl Coated Without Barbed Wire Arm	1,981.37	106.82
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-311.36	
			<i>For Gate With Single Barb Wire Arm, Add</i>	182.67	
			<i>For Gate With Double Barb Wire Arm, Add</i>	265.70	
32 31	13 00-0426	EA	5' Fence Height <small>(32 31 13 00-0405)</small>		
			3' Wide x 5' High Single Gate Vinyl Coated Without Barbed Wire Arm.....	235.85	21.41
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-32.15	
			<i>For Gate With Single Barb Wire Arm, Add</i>	18.86	
			<i>For Gate With Double Barb Wire Arm, Add</i>	27.44	
			4' Wide x 5' High Single Gate Vinyl Coated Without Barbed Wire Arm.....	293.01	21.41
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-42.87	
			<i>For Gate With Single Barb Wire Arm, Add</i>	25.15	
			<i>For Gate With Double Barb Wire Arm, Add</i>	36.58	
			5' Wide x 5' High Single Gate Vinyl Coated Without Barbed Wire Arm.....	339.91	22.78
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-50.91	
			<i>For Gate With Single Barb Wire Arm, Add</i>	29.87	
			<i>For Gate With Double Barb Wire Arm, Add</i>	43.44	
			6' Wide x 5' High Single Gate Vinyl Coated Without Barbed Wire Arm.....	396.45	27.36
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-58.95	
			<i>For Gate With Single Barb Wire Arm, Add</i>	34.58	
			<i>For Gate With Double Barb Wire Arm, Add</i>	50.30	



Exterior Improvements	32	32
Site Improvements	32 30	
Fences And Gates	32 31	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 31	13 00-0431	EA	7' Wide x 5' High Single Gate Vinyl Coated Without Barbed Wire Arm..... <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	453.00 -66.98 39.30 57.16	31.87
32 31	13 00-0432	EA	8' Wide x 5' High Single Gate Vinyl Coated Without Barbed Wire Arm..... <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	510.35 -75.02 44.01 64.02	36.69
32 31	13 00-0433	EA	9' Wide x 5' High Single Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	566.90 -83.06 48.73 70.88	41.28
32 31	13 00-0434	EA	10' Wide x 5' High Single Gate Vinyl Coated Without Barbed Wire Arm..... <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	623.44 -91.10 53.44 77.74	45.78
32 31	13 00-0435	EA	10' Wide x 5' High Double Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	823.83 -128.61 75.45 109.74	45.95
32 31	13 00-0436	EA	12' Wide x 5' High Double Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	971.63 -154.33 90.54 131.69	49.48
32 31	13 00-0437	EA	14' Wide x 5' High Double Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	1,121.19 -180.05 105.63 153.64	53.58
32 31	13 00-0438	EA	16' Wide x 5' High Double Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	1,289.92 -205.77 120.72 175.59	64.05
32 31	13 00-0439	EA	18' Wide x 5' High Double Gate Vinyl Coated Without Barbed Wire Arm..... <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	1,440.85 -231.49 135.81 197.54	68.65
32 31	13 00-0440	EA	20' Wide x 5' High Double Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	1,593.88 -257.21 150.90 219.49	73.98
32 31	13 00-0441	EA	22' Wide x 5' High Double Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	1,749.57 -282.94 165.99 241.44	80.11
32 31	13 00-0442	EA	24' Wide x 5' High Double Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	1,908.62 -308.66 181.08 263.39	87.42
32 31	13 00-0443	EA	26' Wide x 5' High Double Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	2,072.05 -334.38 196.17 285.34	96.17
32 31	13 00-0444	EA	28' Wide x 5' High Double Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	2,241.30 -360.10 211.26 307.28	106.82
32 31	13 00-0445	EA	30' Wide x 5' High Double Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	2,418.58 -385.82 226.35 329.23	120.17
32 31	13 00-0446		6' Fence Height <small>(32 31 13 00-0405)</small>		
32 31	13 00-0447	EA	3' Wide x 6' High Single Gate Vinyl Coated Without Barbed Wire Arm..... <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	252.23 -34.36 20.16 29.32	22.93
32 31	13 00-0448	EA	4' Wide x 6' High Single Gate Vinyl Coated Without Barbed Wire Arm..... <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	313.31 -45.81 26.88 39.09	22.93
32 31	13 00-0449	EA	5' Wide x 6' High Single Gate Vinyl Coated Without Barbed Wire Arm..... <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	363.38 -54.41 31.92 46.43	24.38
32 31	13 00-0450	EA	6' Wide x 6' High Single Gate Vinyl Coated Without Barbed Wire Arm..... <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	424.49 -63.00 36.96 53.76	29.45
32 31	13 00-0451	EA	7' Wide x 6' High Single Gate Vinyl Coated Without Barbed Wire Arm..... <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	485.58 -71.59 42.00 61.09	34.59

32 Exterior Improvements**32 30 Site Improvements****32 31 Fences And Gates**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 31	13 00-0452	EA	8' Wide x 6' High Single Gate Vinyl Coated Without Barbed Wire Arm.....	545.88	39.43
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-80.18	
			<i>For Gate With Single Barb Wire Arm, Add</i>	47.04	
			<i>For Gate With Double Barb Wire Arm, Add</i>	68.42	
32 31	13 00-0453	EA	9' Wide x 6' High Single Gate Vinyl Coated Without Barbed Wire Arm.....	606.99	44.49
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-88.77	
			<i>For Gate With Single Barb Wire Arm, Add</i>	52.08	
			<i>For Gate With Double Barb Wire Arm, Add</i>	75.75	
32 31	13 00-0454	EA	10' Wide x 6' High Single Gate Vinyl Coated Without Barbed Wire Arm.....	668.10	49.57
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-97.36	
			<i>For Gate With Single Barb Wire Arm, Add</i>	57.12	
			<i>For Gate With Double Barb Wire Arm, Add</i>	83.08	
32 31	13 00-0455	EA	10' Wide x 6' High Double Gate Vinyl Coated Without Barbed Wire Arm.....	881.59	49.48
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-137.45	
			<i>For Gate With Single Barb Wire Arm, Add</i>	80.63	
			<i>For Gate With Double Barb Wire Arm, Add</i>	117.29	
32 31	13 00-0456	EA	12' Wide x 6' High Double Gate Vinyl Coated Without Barbed Wire Arm.....	1,040.57	53.58
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-164.93	
			<i>For Gate With Single Barb Wire Arm, Add</i>	96.76	
			<i>For Gate With Double Barb Wire Arm, Add</i>	140.74	
32 31	13 00-0457	EA	14' Wide x 6' High Double Gate Vinyl Coated Without Barbed Wire Arm.....	1,232.47	68.65
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-192.42	
			<i>For Gate With Single Barb Wire Arm, Add</i>	112.89	
			<i>For Gate With Double Barb Wire Arm, Add</i>	164.20	
32 31	13 00-0458	EA	16' Wide x 6' High Double Gate Vinyl Coated Without Barbed Wire Arm.....	1,394.93	73.98
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-219.91	
			<i>For Gate With Single Barb Wire Arm, Add</i>	129.01	
			<i>For Gate With Double Barb Wire Arm, Add</i>	187.66	
32 31	13 00-0459	EA	18' Wide x 6' High Double Gate Vinyl Coated Without Barbed Wire Arm.....	1,560.04	80.11
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-247.40	
			<i>For Gate With Single Barb Wire Arm, Add</i>	145.14	
			<i>For Gate With Double Barb Wire Arm, Add</i>	211.11	
32 31	13 00-0460	EA	20' Wide x 6' High Double Gate Vinyl Coated Without Barbed Wire Arm.....	1,755.61	87.42
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-279.97	
			<i>For Gate With Single Barb Wire Arm, Add</i>	164.25	
			<i>For Gate With Double Barb Wire Arm, Add</i>	238.91	
32 31	13 00-0461	EA	22' Wide x 6' High Double Gate Vinyl Coated Without Barbed Wire Arm.....	1,906.30	96.17
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-303.30	
			<i>For Gate With Single Barb Wire Arm, Add</i>	177.94	
			<i>For Gate With Double Barb Wire Arm, Add</i>	258.82	
32 31	13 00-0462	EA	24' Wide x 6' High Double Gate Vinyl Coated Without Barbed Wire Arm.....	2,080.06	106.82
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-329.87	
			<i>For Gate With Single Barb Wire Arm, Add</i>	193.52	
			<i>For Gate With Double Barb Wire Arm, Add</i>	281.49	
32 31	13 00-0463	EA	26' Wide x 6' High Double Gate Vinyl Coated Without Barbed Wire Arm.....	2,266.76	120.17
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-357.35	
			<i>For Gate With Single Barb Wire Arm, Add</i>	209.65	
			<i>For Gate With Double Barb Wire Arm, Add</i>	304.94	
32 31	13 00-0464	EA	28' Wide x 6' High Double Gate Vinyl Coated Without Barbed Wire Arm.....	2,464.92	137.31
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-384.84	
			<i>For Gate With Single Barb Wire Arm, Add</i>	225.78	
			<i>For Gate With Double Barb Wire Arm, Add</i>	328.40	
32 31	13 00-0465	EA	30' Wide x 6' High Double Gate Vinyl Coated Without Barbed Wire Arm.....	2,680.27	160.22
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-412.33	
			<i>For Gate With Single Barb Wire Arm, Add</i>	241.90	
			<i>For Gate With Double Barb Wire Arm, Add</i>	351.86	
32 31	13 00-0466		7' Fence Height (32 31 13 00-0405)		
32 31	13 00-0467	EA	3' Wide x 7' High Single Gate Vinyl Coated Without Barbed Wire Arm.....	266.75	24.71
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-36.09	
			<i>For Gate With Single Barb Wire Arm, Add</i>	21.17	
			<i>For Gate With Double Barb Wire Arm, Add</i>	30.80	
32 31	13 00-0468	EA	4' Wide x 7' High Single Gate Vinyl Coated Without Barbed Wire Arm.....	330.92	24.71
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-48.12	
			<i>For Gate With Single Barb Wire Arm, Add</i>	28.23	
			<i>For Gate With Double Barb Wire Arm, Add</i>	41.06	
32 31	13 00-0469	EA	5' Wide x 7' High Single Gate Vinyl Coated Without Barbed Wire Arm.....	382.84	25.99
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-57.15	
			<i>For Gate With Single Barb Wire Arm, Add</i>	33.53	
			<i>For Gate With Double Barb Wire Arm, Add</i>	48.77	
32 31	13 00-0470	EA	6' Wide x 7' High Single Gate Vinyl Coated Without Barbed Wire Arm.....	447.84	31.63
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-66.17	
			<i>For Gate With Single Barb Wire Arm, Add</i>	38.82	
			<i>For Gate With Double Barb Wire Arm, Add</i>	56.46	
32 31	13 00-0471	EA	7' Wide x 7' High Single Gate Vinyl Coated Without Barbed Wire Arm.....	512.06	37.01
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-75.19	
			<i>For Gate With Single Barb Wire Arm, Add</i>	44.11	
			<i>For Gate With Double Barb Wire Arm, Add</i>	64.16	
32 31	13 00-0472	EA	8' Wide x 7' High Single Gate Vinyl Coated Without Barbed Wire Arm.....	577.10	42.56
			<i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i>	-84.22	
			<i>For Gate With Single Barb Wire Arm, Add</i>	49.41	
			<i>For Gate With Double Barb Wire Arm, Add</i>	71.87	



	Exterior Improvements	32
	Site Improvements	32 30
	Fences And Gates	32 31

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 31	13 00-0473	EA	9' Wide x 7' High Single Gate Vinyl Coated Without Barbed Wire Arm..... <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	641.30 -93.24 54.70 79.56	47.96
32 31	13 00-0474	EA	10' Wide x 7' High Single Gate Vinyl Coated Without Barbed Wire Arm..... <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	706.33 -102.26 59.99 87.26	53.58
32 31	13 00-0475	EA	10' Wide x 7' High Double Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	930.89 -144.37 84.70 123.19	53.58
32 31	13 00-0476	EA	12' Wide x 7' High Double Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	1,130.16 -173.24 101.63 147.83	68.65
32 31	13 00-0477	EA	14' Wide x 7' High Double Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	1,300.01 -202.11 118.57 172.47	73.98
32 31	13 00-0478	EA	16' Wide x 7' High Double Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	1,472.49 -230.98 135.51 197.11	80.11
32 31	13 00-0479	EA	18' Wide x 7' High Double Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	1,648.37 -259.86 152.45 221.75	87.42
32 31	13 00-0480	EA	20' Wide x 7' High Double Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	1,828.59 -288.73 169.39 246.38	96.17
32 31	13 00-0481	EA	22' Wide x 7' High Double Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	2,014.63 -317.60 186.32 271.02	106.82
32 31	13 00-0482	EA	24' Wide x 7' High Double Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	2,208.74 -346.48 203.27 295.66	120.17
32 31	13 00-0483	EA	26' Wide x 7' High Double Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	2,414.30 -375.35 220.21 320.30	137.31
32 31	13 00-0484	EA	28' Wide x 7' High Double Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	2,637.01 -404.22 237.14 344.94	160.22
32 31	13 00-0485	EA	30' Wide x 7' High Double Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	2,887.26 -433.10 254.08 369.58	192.26
32 31	13 00-0486		8' Fence Height <small>(32 31 13 00-0405)</small>		
32 31	13 00-0487	EA	3' Wide x 8' High Single Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	313.77 -43.74 25.66 37.33	26.79
32 31	13 00-0488	EA	4' Wide x 8' High Single Gate Vinyl Coated Without Barbed Wire Arm..... <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	391.54 -58.33 34.22 49.77	26.79
32 31	13 00-0489	EA	5' Wide x 8' High Single Gate Vinyl Coated Without Barbed Wire Arm..... <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	443.39 -68.05 39.92 58.07	26.79
32 31	13 00-0490	EA	6' Wide x 8' High Single Gate Vinyl Coated Without Barbed Wire Arm..... <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	516.15 -77.77 45.62 66.36	33.80
32 31	13 00-0491	EA	7' Wide x 8' High Single Gate Vinyl Coated Without Barbed Wire Arm..... <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	588.91 -87.49 51.33 74.66	40.72
32 31	13 00-0492	EA	8' Wide x 8' High Single Gate Vinyl Coated Without Barbed Wire Arm..... <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	660.88 -97.21 57.03 82.95	47.39
32 31	13 00-0493	EA	9' Wide x 8' High Single Gate Vinyl Coated Without Barbed Wire Arm..... <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	733.66 -106.93 62.73 91.25	54.39

32 Exterior Improvements**32 30 Site Improvements****32 31 Fences And Gates**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 31 13 00-0494 EA 10' Wide x 8' High Single Gate Vinyl Coated Without Barbed Wire Arm.....	806.40	61.40
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-116.65	
For Gate With Single Barb Wire Arm, Add	68.44	
For Gate With Double Barb Wire Arm, Add	99.54	
32 31 13 00-0495 EA 10' Wide x 8' High Double Gate Vinyl Coated Without Barbed Wire Arm	1,139.44	68.65
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-174.98	
For Gate With Single Barb Wire Arm, Add	102.65	
For Gate With Double Barb Wire Arm, Add	149.32	
32 31 13 00-0496 EA 12' Wide x 8' High Double Gate Vinyl Coated Without Barbed Wire Arm	1,341.93	73.98
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-209.97	
For Gate With Single Barb Wire Arm, Add	123.18	
For Gate With Double Barb Wire Arm, Add	179.18	
32 31 13 00-0497 EA 14' Wide x 8' High Double Gate Vinyl Coated Without Barbed Wire Arm	1,547.08	80.11
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-244.97	
For Gate With Single Barb Wire Arm, Add	143.72	
For Gate With Double Barb Wire Arm, Add	209.04	
32 31 13 00-0498 EA 16' Wide x 8' High Double Gate Vinyl Coated Without Barbed Wire Arm	1,755.60	87.42
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-279.97	
For Gate With Single Barb Wire Arm, Add	164.25	
For Gate With Double Barb Wire Arm, Add	238.90	
32 31 13 00-0499 EA 18' Wide x 8' High Double Gate Vinyl Coated Without Barbed Wire Arm	1,968.49	96.17
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-314.96	
For Gate With Single Barb Wire Arm, Add	184.78	
For Gate With Double Barb Wire Arm, Add	268.77	
32 31 13 00-0500 EA 20' Wide x 8' High Double Gate Vinyl Coated Without Barbed Wire Arm	2,187.20	106.82
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-349.96	
For Gate With Single Barb Wire Arm, Add	205.31	
For Gate With Double Barb Wire Arm, Add	298.63	
32 31 13 00-0501 EA 22' Wide x 8' High Double Gate Vinyl Coated Without Barbed Wire Arm	2,413.95	120.17
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-384.95	
For Gate With Single Barb Wire Arm, Add	225.84	
For Gate With Double Barb Wire Arm, Add	328.49	
32 31 13 00-0502 EA 24' Wide x 8' High Double Gate Vinyl Coated Without Barbed Wire Arm	2,652.14	137.31
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-419.95	
For Gate With Single Barb Wire Arm, Add	246.37	
For Gate With Double Barb Wire Arm, Add	358.36	
32 31 13 00-0503 EA 26' Wide x 8' High Double Gate Vinyl Coated Without Barbed Wire Arm	2,907.52	160.22
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-454.94	
For Gate With Single Barb Wire Arm, Add	266.90	
For Gate With Double Barb Wire Arm, Add	388.22	
32 31 13 00-0504 EA 28' Wide x 8' High Double Gate Vinyl Coated Without Barbed Wire Arm	3,190.41	192.26
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-489.94	
For Gate With Single Barb Wire Arm, Add	287.43	
For Gate With Double Barb Wire Arm, Add	418.08	
32 31 13 00-0505 EA 30' Wide x 8' High Double Gate Vinyl Coated Without Barbed Wire Arm	3,521.39	240.34
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-524.93	
For Gate With Single Barb Wire Arm, Add	307.96	
For Gate With Double Barb Wire Arm, Add	447.94	
32 31 13 00-0506 10' Fence Height (32 31 13 00-0405)		
32 31 13 00-0507 EA 3' Wide x 10' High Single Gate Vinyl Coated Without Barbed Wire Arm.....	360.04	29.77
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-50.75	
For Gate With Single Barb Wire Arm, Add	29.77	
For Gate With Double Barb Wire Arm, Add	43.30	
32 31 13 00-0508 EA 4' Wide x 10' High Single Gate Vinyl Coated Without Barbed Wire Arm.....	450.26	29.77
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-67.66	
For Gate With Single Barb Wire Arm, Add	39.69	
For Gate With Double Barb Wire Arm, Add	57.74	
32 31 13 00-0509 EA 5' Wide x 10' High Gate Single Vinyl Coated Without Barbed Wire Arm.....	514.34	31.06
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-78.94	
For Gate With Single Barb Wire Arm, Add	46.31	
For Gate With Double Barb Wire Arm, Add	67.36	
32 31 13 00-0510 EA 6' Wide x 10' High Single Gate Vinyl Coated Without Barbed Wire Arm.....	597.01	38.62
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-90.22	
For Gate With Single Barb Wire Arm, Add	52.93	
For Gate With Double Barb Wire Arm, Add	76.98	
32 31 13 00-0511 EA 7' Wide x 10' High Single Gate Vinyl Coated Without Barbed Wire Arm.....	678.88	45.78
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-101.49	
For Gate With Single Barb Wire Arm, Add	59.54	
For Gate With Double Barb Wire Arm, Add	86.61	
32 31 13 00-0512 EA 8' Wide x 10' High Single Gate Vinyl Coated Without Barbed Wire Arm.....	761.56	53.34
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-112.77	
For Gate With Single Barb Wire Arm, Add	66.16	
For Gate With Double Barb Wire Arm, Add	96.23	
32 31 13 00-0513 EA 9' Wide x 10' High Single Gate Vinyl Coated Without Barbed Wire Arm.....	843.43	60.59
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-124.05	
For Gate With Single Barb Wire Arm, Add	72.77	
For Gate With Double Barb Wire Arm, Add	105.85	
32 31 13 00-0514 EA 10' Wide x 10' High Single Gate Vinyl Coated Without Barbed Wire Arm.....	926.10	68.07
For 1-5/8" Schedule 40 Pipe Frame, Deduct	-135.32	
For Gate With Single Barb Wire Arm, Add	79.39	
For Gate With Double Barb Wire Arm, Add	115.48	



Exterior Improvements	32
Site Improvements	32 30
Fences And Gates	32 31

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MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 31	13 00-0515	EA	10' Wide x 10' High Double Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	1,311.71 -202.98 119.08 173.21	76.33
32 31	13 00-0516	EA	12' Wide x 10' High Double Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	1,545.76 -243.58 142.90 207.85	82.09
32 31	13 00-0517	EA	14' Wide x 10' High Double Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	1,782.92 -284.18 166.72 242.50	89.04
32 31	13 00-0518	EA	16' Wide x 10' High Double Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	2,023.62 -324.77 190.53 277.14	97.08
32 31	13 00-0519	EA	18' Wide x 10' High Double Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	2,269.41 -365.37 214.35 311.78	106.82
32 31	13 00-0520	EA	20' Wide x 10' High Double Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	2,521.39 -405.97 238.17 346.42	118.64
32 31	13 00-0521	EA	22' Wide x 10' High Double Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	2,782.64 -446.56 261.98 381.07	133.53
32 31	13 00-0522	EA	24' Wide x 10' High Double Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	3,056.14 -487.16 285.80 415.71	152.46
32 31	13 00-0523	EA	26' Wide x 10' High Double Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	3,349.33 -527.76 309.62 450.35	178.00
32 31	13 00-0524	EA	28' Wide x 10' High Double Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	3,672.19 -568.35 333.43 484.99	213.46
32 31	13 00-0525	EA	30' Wide x 10' High Double Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	4,049.66 -608.95 357.25 519.64	267.04
32 31	13 00-0526		12' Fence Height (32 31 13 00-0405)		
32 31	13 00-0527	EA	3' Wide x 12' High Single Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	476.77 -70.77 41.52 60.39	33.07
32 31	13 00-0528	EA	4' Wide x 12' High Single Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	602.24 -94.30 55.32 80.47	33.07
32 31	13 00-0529	EA	5' Wide x 12' High Single Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	699.22 -111.79 65.59 95.40	34.27
32 31	13 00-0530	EA	6' Wide x 12' High Single Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	801.94 -126.38 74.14 107.84	42.56
32 31	13 00-0531	EA	7' Wide x 12' High Single Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	913.30 -142.58 83.65 121.67	50.94
32 31	13 00-0532	EA	8' Wide x 12' High Single Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	1,023.84 -158.78 93.15 135.49	58.98
32 31	13 00-0533	EA	9' Wide x 12' High Single Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	1,135.20 -174.98 102.66 149.32	67.27
32 31	13 00-0534	EA	10' Wide x 12' High Single Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	1,237.91 -189.56 111.21 161.76	75.55
32 31	13 00-0535	EA	10' Wide x 12' High Double Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	1,770.48 -284.25 166.76 242.56	84.80

32 Exterior Improvements**32 30 Site Improvements****32 31 Fences And Gates**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 31	13 00-0536	EA	12' Wide x 12' High Double Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	2,142.54 -350.35 205.54 298.96	91.30
32 31	13 00-0537	EA	14' Wide x 12' High Double Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	2,478.69 -409.07 239.98 349.07	98.88
32 31	13 00-0538	EA	16' Wide x 12' High Double Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	2,816.70 -467.39 274.20 398.84	107.81
32 31	13 00-0539	EA	18' Wide x 12' High Double Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	3,156.10 -524.94 307.96 447.95	118.72
32 31	13 00-0540	EA	20' Wide x 12' High Double Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	3,506.46 -583.27 342.18 497.72	131.81
32 31	13 00-0541	EA	22' Wide x 12' High Double Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	3,867.36 -641.60 376.40 547.49	148.32
32 31	13 00-0542	EA	24' Wide x 12' High Double Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	4,241.76 -699.92 410.62 597.27	169.43
32 31	13 00-0543	EA	26' Wide x 12' High Double Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	4,648.38 -760.19 445.98 648.70	197.84
32 31	13 00-0544	EA	28' Wide x 12' High Double Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	5,077.63 -818.52 480.20 698.47	237.18
32 31	13 00-0545	EA	30' Wide x 12' High Double Gate Vinyl Coated Without Barbed Wire Arm <i>For 1-5/8" Schedule 40 Pipe Frame, Deduct</i> <i>For Gate With Single Barb Wire Arm, Add</i> <i>For Gate With Double Barb Wire Arm, Add</i>	5,567.55 -876.85 514.42 748.24	296.72
32 31	13 00-0546		Sliding Gate <small>(32 31 13 00-0263)</small> Note: Includes posts (3" diameter posts for up to 15' wide gate and 4" diameter over 15' wide), caps, rails, wheel rollers, 2" diameter Schedule 40 pipe frame top and bottom bar, and 1-1/2" bracing. Includes truss rod, latches, track rollers with brackets, pipe track clamps and two wheel carriers. Fabric: galvanized chain link 2" mesh # 9 gauge, galvanized 1.2 ounce coating.		
32 31	13 00-0547		4' High Sliding Gate <small>(32 31 13 00-0546)</small>		
32 31	13 00-0548	EA	10' Long x 4' High Sliding Gate <i>For Gate With Barb Wire Arm, Add</i> <i>For Vinyl Coated, Add</i>	1,590.47 110.52 301.42	292.84
32 31	13 00-0549	EA	12' Long x 4' High Sliding Gate <i>For Gate With Barb Wire Arm, Add</i> <i>For Vinyl Coated, Add</i>	1,912.73 132.63 361.71	353.57
32 31	13 00-0550	EA	14' Long x 4' High Sliding Gate <i>For Gate With Barb Wire Arm, Add</i> <i>For Vinyl Coated, Add</i>	2,231.68 154.73 421.99	412.47
32 31	13 00-0551	EA	16' Long x 4' High Sliding Gate <i>For Gate With Barb Wire Arm, Add</i> <i>For Vinyl Coated, Add</i>	2,555.76 176.84 482.28	474.09
32 31	13 00-0552	EA	18' Long x 4' High Sliding Gate <i>For Gate With Barb Wire Arm, Add</i> <i>For Vinyl Coated, Add</i>	2,875.27 198.94 542.57	533.37
32 31	13 00-0553	EA	20' Long x 4' High Sliding Gate <i>For Gate With Barb Wire Arm, Add</i> <i>For Vinyl Coated, Add</i>	3,183.83 221.05 602.85	587.14
32 31	13 00-0554	EA	24' Long x 4' High Sliding Gate <i>For Gate With Barb Wire Arm, Add</i> <i>For Vinyl Coated, Add</i>	3,807.77 263.31 718.11	707.04
32 31	13 00-0555	EA	30' Long x 4' High Sliding Gate <i>For Gate With Barb Wire Arm, Add</i> <i>For Vinyl Coated, Add</i>	5,683.41 331.57 904.27	1,334.59
32 31	13 00-0556	EA	40' Long x 4' High Sliding Gate <i>For Gate With Barb Wire Arm, Add</i> <i>For Vinyl Coated, Add</i>	7,577.87 442.09 1,205.69	1,779.46
32 31	13 00-0557		5' High Sliding Gate <small>(32 31 13 00-0546)</small>		
32 31	13 00-0558	EA	10' Long x 5' High Sliding Gate <i>For Gate With Barb Wire Arm, Add</i> <i>For Vinyl Coated, Add</i>	1,671.74 113.77 310.28	318.74
32 31	13 00-0559	EA	12' Long x 5' High Sliding Gate <i>For Gate With Barb Wire Arm, Add</i> <i>For Vinyl Coated, Add</i>	2,005.20 136.52 372.34	382.08



		Exterior Improvements	32
		Site Improvements	32 30
		Fences And Gates	32 31

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 31	13 00-0560	EA	14' Long x 5' High Sliding Gate For Gate With Barb Wire Arm, Add For Vinyl Coated, Add	2,339.26 159.28 434.40	445.68
32 31	13 00-0561	EA	16' Long x 5' High Sliding Gate For Gate With Barb Wire Arm, Add For Vinyl Coated, Add	2,673.68 182.03 496.45	509.46
32 31	13 00-0562	EA	18' Long x 5' High Sliding Gate For Gate With Barb Wire Arm, Add For Vinyl Coated, Add	3,007.68 204.79 558.51	572.97
32 31	13 00-0563	EA	20' Long x 5' High Sliding Gate For Gate With Barb Wire Arm, Add For Vinyl Coated, Add	3,341.92 227.54 620.57	636.67
32 31	13 00-0564	EA	24' Long x 5' High Sliding Gate For Gate With Barb Wire Arm, Add For Vinyl Coated, Add	3,993.81 271.05 739.22	764.87
32 31	13 00-0565	EA	30' Long x 5' High Sliding Gate For Gate With Barb Wire Arm, Add For Vinyl Coated, Add	5,013.21 341.31 930.85	955.23
32 31	13 00-0566	EA	40' Long x 5' High Sliding Gate For Gate With Barb Wire Arm, Add For Vinyl Coated, Add	6,683.84 455.08 1,241.13	1,273.33
32 31 13 00-0567 6' High Sliding Gate (32 31 13 00-0546)					
32 31	13 00-0568	EA	10' Long x 6' High Sliding Gate For Gate With Barb Wire Arm, Add For Vinyl Coated, Add	1,802.25 116.04 316.49	373.68
32 31	13 00-0569	EA	12' Long x 6' High Sliding Gate For Gate With Barb Wire Arm, Add For Vinyl Coated, Add	2,160.07 139.25 379.78	447.03
32 31	13 00-0570	EA	14' Long x 6' High Sliding Gate For Gate With Barb Wire Arm, Add For Vinyl Coated, Add	2,519.90 162.46 443.08	521.45
32 31	13 00-0571	EA	16' Long x 6' High Sliding Gate For Gate With Barb Wire Arm, Add For Vinyl Coated, Add	2,880.09 185.67 506.37	596.07
32 31	13 00-0572	EA	18' Long x 6' High Sliding Gate For Gate With Barb Wire Arm, Add For Vinyl Coated, Add	3,239.93 208.88 569.67	670.50
32 31	13 00-0573	EA	20' Long x 6' High Sliding Gate For Gate With Barb Wire Arm, Add For Vinyl Coated, Add	3,604.80 232.09 632.97	747.46
32 31	13 00-0574	EA	24' Long x 6' High Sliding Gate For Gate With Barb Wire Arm, Add For Vinyl Coated, Add	4,301.56 276.46 753.99	894.15
32 31	13 00-0575	EA	30' Long x 6' High Sliding Gate For Gate With Barb Wire Arm, Add For Vinyl Coated, Add	5,400.73 348.13 949.45	1,117.98
32 31	13 00-0576	EA	40' Long x 6' High Sliding Gate For Gate With Barb Wire Arm, Add For Vinyl Coated, Add	7,199.74 464.18 1,265.94	1,489.95
32 31 13 00-0577 7' High Sliding Gate (32 31 13 00-0546)					
32 31	13 00-0578	EA	10' Long x 7' High Sliding Gate For Gate With Barb Wire Arm, Add For Vinyl Coated, Add	1,929.91 120.59 328.89	416.81
32 31	13 00-0579	EA	12' Long x 7' High Sliding Gate For Gate With Barb Wire Arm, Add For Vinyl Coated, Add	2,315.22 144.71 394.67	499.81
32 31	13 00-0580	EA	14' Long x 7' High Sliding Gate For Gate With Barb Wire Arm, Add For Vinyl Coated, Add	2,701.92 168.83 460.44	583.53
32 31	13 00-0581	EA	16' Long x 7' High Sliding Gate For Gate With Barb Wire Arm, Add For Vinyl Coated, Add	3,087.16 192.95 526.22	666.53
32 31	13 00-0582	EA	18' Long x 7' High Sliding Gate For Gate With Barb Wire Arm, Add For Vinyl Coated, Add	3,473.21 217.07 592.00	749.98
32 31	13 00-0583	EA	20' Long x 7' High Sliding Gate For Gate With Barb Wire Arm, Add For Vinyl Coated, Add	3,858.65 241.18 657.77	833.08
32 31	13 00-0584	EA	24' Long x 7' High Sliding Gate For Gate With Barb Wire Arm, Add For Vinyl Coated, Add	4,611.08 287.30 783.54	999.62
32 31	13 00-0585	EA	30' Long x 7' High Sliding Gate For Gate With Barb Wire Arm, Add For Vinyl Coated, Add	5,787.97 361.77 986.66	1,249.52
32 31	13 00-0586	EA	40' Long x 7' High Sliding Gate For Gate With Barb Wire Arm, Add For Vinyl Coated, Add	7,717.30 482.37 1,315.55	1,666.06
32 31 13 00-0587 8' High Sliding Gate (32 31 13 00-0546)					

32 Exterior Improvements**32 30 Site Improvements****32 31 Fences And Gates**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 31 13 00-0588 EA 10' Long x 8' High Sliding Gate..... <i>For Gate With Barb Wire Arm, Add</i> <i>For Vinyl Coated, Add</i>	2,031.85 124.16 338.63	451.54
32 31 13 00-0589 EA 12' Long x 8' High Sliding Gate..... <i>For Gate With Barb Wire Arm, Add</i> <i>For Vinyl Coated, Add</i>	2,435.63 149.00 406.36	540.58
32 31 13 00-0590 EA 14' Long x 8' High Sliding Gate..... <i>For Gate With Barb Wire Arm, Add</i> <i>For Vinyl Coated, Add</i>	2,841.61 173.83 474.08	630.71
32 31 13 00-0591 EA 16' Long x 8' High Sliding Gate..... <i>For Gate With Barb Wire Arm, Add</i> <i>For Vinyl Coated, Add</i>	3,247.79 198.66 541.81	720.84
32 31 13 00-0592 EA 18' Long x 8' High Sliding Gate..... <i>For Gate With Barb Wire Arm, Add</i> <i>For Vinyl Coated, Add</i>	3,652.94 223.50 609.53	810.61
32 31 13 00-0593 EA 20' Long x 8' High Sliding Gate..... <i>For Gate With Barb Wire Arm, Add</i> <i>For Vinyl Coated, Add</i>	4,059.20 248.33 677.26	900.83
32 31 13 00-0594 EA 24' Long x 8' High Sliding Gate..... <i>For Gate With Barb Wire Arm, Add</i> <i>For Vinyl Coated, Add</i>	4,851.38 295.81 806.75	1,081.08
32 31 13 00-0595 EA 30' Long x 8' High Sliding Gate..... <i>For Gate With Barb Wire Arm, Add</i> <i>For Vinyl Coated, Add</i>	6,089.47 372.49 1,015.89	1,351.56
32 31 13 00-0596 EA 40' Long x 8' High Sliding Gate..... <i>For Gate With Barb Wire Arm, Add</i> <i>For Vinyl Coated, Add</i>	8,116.59 496.66 1,354.52	1,800.75
32 31 13 00-0597 9' High Sliding Gate <small>(32 31 13 00-0546)</small>		
32 31 13 00-0598 EA 10' Long x 9' High Sliding Gate..... <i>For Gate With Barb Wire Arm, Add</i> <i>For Vinyl Coated, Add</i>	2,152.34 128.39 350.15	492.59
32 31 13 00-0599 EA 12' Long x 9' High Sliding Gate..... <i>For Gate With Barb Wire Arm, Add</i> <i>For Vinyl Coated, Add</i>	2,579.14 154.06 420.18	589.30
32 31 13 00-0600 EA 14' Long x 9' High Sliding Gate..... <i>For Gate With Barb Wire Arm, Add</i> <i>For Vinyl Coated, Add</i>	3,008.77 179.74 490.21	687.37
32 31 13 00-0601 EA 16' Long x 9' High Sliding Gate..... <i>For Gate With Barb Wire Arm, Add</i> <i>For Vinyl Coated, Add</i>	3,439.20 205.42 560.24	785.89
32 31 13 00-0602 EA 18' Long x 9' High Sliding Gate..... <i>For Gate With Barb Wire Arm, Add</i> <i>For Vinyl Coated, Add</i>	3,868.99 231.10 630.26	884.05
32 31 13 00-0603 EA 20' Long x 9' High Sliding Gate..... <i>For Gate With Barb Wire Arm, Add</i> <i>For Vinyl Coated, Add</i>	4,298.78 256.78 700.30	982.20
32 31 13 00-0604 EA 24' Long x 9' High Sliding Gate..... <i>For Gate With Barb Wire Arm, Add</i> <i>For Vinyl Coated, Add</i>	5,137.73 305.87 834.19	1,178.51
32 31 13 00-0605 EA 30' Long x 9' High Sliding Gate..... <i>For Gate With Barb Wire Arm, Add</i> <i>For Vinyl Coated, Add</i>	6,447.36 385.16 1,050.44	1,472.99
32 31 13 00-0606 EA 40' Long x 9' High Sliding Gate..... <i>For Gate With Barb Wire Arm, Add</i> <i>For Vinyl Coated, Add</i>	8,599.71 513.55 1,400.59	1,965.58
32 31 13 00-0607 10' High Sliding Gate <small>(32 31 13 00-0546)</small>		
32 31 13 00-0608 EA 10' Long x 10' High Sliding Gate..... <i>For Gate With Barb Wire Arm, Add</i> <i>For Vinyl Coated, Add</i>	2,301.06 133.91 365.21	541.85
32 31 13 00-0609 EA 12' Long x 10' High Sliding Gate..... <i>For Gate With Barb Wire Arm, Add</i> <i>For Vinyl Coated, Add</i>	2,761.27 160.69 438.25	650.20
32 31 13 00-0610 EA 14' Long x 10' High Sliding Gate..... <i>For Gate With Barb Wire Arm, Add</i> <i>For Vinyl Coated, Add</i>	3,221.84 187.47 511.29	758.73
32 31 13 00-0611 EA 16' Long x 10' High Sliding Gate..... <i>For Gate With Barb Wire Arm, Add</i> <i>For Vinyl Coated, Add</i>	3,681.91 214.26 584.33	867.08
32 31 13 00-0612 EA 18' Long x 10' High Sliding Gate..... <i>For Gate With Barb Wire Arm, Add</i> <i>For Vinyl Coated, Add</i>	4,141.90 241.04 657.37	975.34
32 31 13 00-0613 EA 20' Long x 10' High Sliding Gate..... <i>For Gate With Barb Wire Arm, Add</i> <i>For Vinyl Coated, Add</i>	4,602.12 267.82 730.42	1,083.70
32 31 13 00-0614 EA 24' Long x 10' High Sliding Gate..... <i>For Gate With Barb Wire Arm, Add</i> <i>For Vinyl Coated, Add</i>	5,502.05 319.03 870.07	1,300.95
32 31 13 00-0615 EA 30' Long x 10' High Sliding Gate..... <i>For Gate With Barb Wire Arm, Add</i> <i>For Vinyl Coated, Add</i>	6,903.17 401.73 1,095.62	1,625.55



Exterior Improvements	32	32
Site Improvements	32 30	
Fences And Gates	32 31	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 31 13 00-0616 EA 40' Long x 10' High Sliding Gate..... For Gate With Barb Wire Arm, Add For Vinyl Coated, Add	9,201.63 535.64 1,460.83	2,166.13
32 31 13 00-0617 Sliding Cantilever Gate, Single Track, Manually Operated Exposed Roller ⁽³²⁾ <small>31 13 00-0263</small> Note: Includes posts (3" diameter posts for up to 15' wide gate and 4" diameter over 15' wide), caps, rails, wheel, rollers, 2" diameter Schedule 40 pipe frame top and bottom bar, and 1-1/2" bracing. Includes truss rod, latches, single track, track rollers with brackets, pipe track clamps and two wheel carriers. Fabric: galvanized chain link 2" mesh # 9 gauge, galvanized 1.2 ounce coating. Width listed on tasks is opening width of gate. See CSI section 32 31 11 00-0020 for gate operators.		
32 31 13 00-0618 EA 5' High x 10' Wide Galvanized Cantilever Sliding Gate..... For Gate With Single Barb Wire Arm, Add For Gate With Double Barb Wire Arm, Add For Aluminized Steel Gate And Post, Add For Powder Coated Gate And Post, Add For Vinyl Coated, Add	2,874.97 236.86 344.52 1,033.55 452.18 645.97	360.87
32 31 13 00-0619 EA 5' High x 12' Wide Galvanized Cantilever Sliding Gate..... For Gate With Single Barb Wire Arm, Add For Gate With Double Barb Wire Arm, Add For Aluminized Steel Gate And Post, Add For Powder Coated Gate And Post, Add For Vinyl Coated, Add	3,201.99 252.98 367.97 1,103.91 482.96 689.94	451.09
32 31 13 00-0620 EA 5' High x 15' Wide Galvanized Cantilever Sliding Gate..... For Gate With Single Barb Wire Arm, Add For Gate With Double Barb Wire Arm, Add For Aluminized Steel Gate And Post, Add For Powder Coated Gate And Post, Add For Vinyl Coated, Add	3,531.02 269.32 391.74 1,175.23 514.16 734.52	541.31
32 31 13 00-0621 EA 5' High x 20' Wide Galvanized Cantilever Sliding Gate..... For Gate With Single Barb Wire Arm, Add For Gate With Double Barb Wire Arm, Add For Aluminized Steel Gate And Post, Add For Powder Coated Gate And Post, Add For Vinyl Coated, Add	4,218.34 305.23 443.98 1,331.93 582.72 832.46	721.74
32 31 13 00-0622 EA 6' High x 15' Wide Galvanized Cantilever Sliding Gate..... For Gate With Single Barb Wire Arm, Add For Gate With Double Barb Wire Arm, Add For Aluminized Steel Gate And Post, Add For Powder Coated Gate And Post, Add For Vinyl Coated, Add	3,965.06 277.37 403.45 1,210.35 529.53 756.47	721.74
32 31 13 00-0623 EA 6' High x 20' Wide Galvanized Cantilever Sliding Gate..... For Gate With Single Barb Wire Arm, Add For Gate With Double Barb Wire Arm, Add For Aluminized Steel Gate And Post, Add For Powder Coated Gate And Post, Add For Vinyl Coated, Add	4,734.37 312.38 454.37 1,363.10 596.36 851.94	947.29
32 31 13 00-0624 EA 6' High x 25' Wide Galvanized Cantilever Sliding Gate..... For Gate With Single Barb Wire Arm, Add For Gate With Double Barb Wire Arm, Add For Aluminized Steel Gate And Post, Add For Powder Coated Gate And Post, Add For Vinyl Coated, Add	6,205.34 424.56 617.55 1,652.64 810.53 1,157.90	1,172.83
32 31 13 00-0625 EA 6' High x 30' Wide Galvanized Cantilever Sliding Gate..... For Gate With Single Barb Wire Arm, Add For Gate With Double Barb Wire Arm, Add For Aluminized Steel Gate And Post, Add For Powder Coated Gate And Post, Add For Vinyl Coated, Add	7,056.39 468.56 681.54 2,044.62 894.52 1,277.89	1,398.38
32 31 13 00-0626 EA 8' High x 15' Wide Galvanized Cantilever Sliding Gate..... For Gate With Single Barb Wire Arm, Add For Gate With Double Barb Wire Arm, Add For Aluminized Steel Gate And Post, Add For Powder Coated Gate And Post, Add For Vinyl Coated, Add	4,689.30 317.34 461.59 1,384.77 605.84 865.48	902.18
32 31 13 00-0627 EA 8' High x 20' Wide Galvanized Cantilever Sliding Gate..... For Gate With Single Barb Wire Arm, Add For Gate With Double Barb Wire Arm, Add For Aluminized Steel Gate And Post, Add For Powder Coated Gate And Post, Add For Vinyl Coated, Add	5,684.37 357.33 519.76 1,559.27 682.18 974.54	1,217.95
32 31 13 00-0628 EA 8' High x 25' Wide Galvanized Cantilever Sliding Gate..... For Gate With Single Barb Wire Arm, Add For Gate With Double Barb Wire Arm, Add For Aluminized Steel Gate And Post, Add For Powder Coated Gate And Post, Add For Vinyl Coated, Add	7,482.54 485.66 706.42 2,119.26 927.18 1,324.54	1,533.70
32 31 13 00-0629 EA 8' High x 30' Wide Galvanized Cantilever Sliding Gate..... For Gate With Single Barb Wire Arm, Add For Gate With Double Barb Wire Arm, Add For Aluminized Steel Gate And Post, Add For Powder Coated Gate And Post, Add For Vinyl Coated, Add	8,480.80 535.93 779.53 2,338.60 1,023.14 1,461.62	1,804.36

32 31 13 00-0630 Gate Accessories (32 31 13 00-0263)

32 Exterior Improvements**32 30 Site Improvements****32 31 Fences And Gates**

MINOR		TOTAL DIRECT		DEMOLITION
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST
32 31 13 00-0631	EA	Gate Center Stop, Cast Steel, Ground.....	19.05	
32 31 13 00-0632	EA	Gate Latch, Malleable Galvanized Steel.....	31.52	
32 31 13 00-0633	EA	Gate Keeper, Full Length, Galvanized Steel.....	136.21	
32 31 13 00-0634	EA	Gate Keeper Hold-Open For Cantilever Gate.....	69.34	15.28
32 31 13 00-0635	EA	Heavy Duty Gate Latch, Malleable Galvanized Steel.....	39.75	
32 31 13 00-0636	EA	Gate Keeper, Full Length, Stainless Steel, Internal Locking Device With 3/4" Stainless Steel Rod For 3' To 5' High Gate.....	768.08	
32 31 13 00-0637	EA	Gate Keeper, Full Length, Stainless Steel, Internal Locking Device With 3/4" Stainless Steel Rod For >5' To 8' High Gate.....	823.76	
32 31 13 00-0638	EA	Gate Keeper, Full Length, Stainless Steel, Internal Locking Device With 3/4" Stainless Steel Rod For >8' To 12' High Gate.....	879.44	
32 31 13 00-0639		Accessories (32 31 13)		
32 31 13 00-0640		Barbed And Concertina Wire (32 31 13 00-0639)		
32 31 13 00-0641		Single Strand Barbed Wire (32 31 13 00-0640)		
32 31 13 00-0642	LF	Galvanized Barbed Wire, Per Strand..... Note: Includes clips. 4 points 12-1/2 Gauge, Class I. For >500 To 2,000, Deduct For >2,000, Deduct	0.86 -0.08 -0.13	0.40
32 31 13 00-0643	LF	Vinyl Coated Barbed Wire (Fused), Per Strand..... Note: Includes clips. For >500 To 2,000, Deduct For >2,000, Deduct	0.94 -0.09 -0.13	0.40
32 31 13 00-0644	EA	Barbed Wire Extension Arms 3 Strands (Single Arm).....	8.65	6.43
32 31 13 00-0645	EA	Barbed Wire Extension Arms 6 Strands (Double Arm).....	13.16	7.72
32 31 13 00-0646	EA	Barbed Wire Eye Tops (For Single Strand).....	9.32	6.43
32 31 13 00-0647		Galvanized Steel Concertina (Razor) Wire, Single Coil (32 31 13 00-0640)		
32 31 13 00-0648	LF	18" Diameter, 18" On Center Galvanized Concertina (Razor) Wire, Attach To Every 6th Barb On Top Of Chain Link Fence, Per LF Of Fence..... For >500 To 1,500, Deduct For >1,500 To 5,000, Deduct For >5,000, Deduct For Ground Installation, Deduct For Double Coil (Helix), Add	2.61 -0.24 -0.47 -0.68 -0.40 1.81	0.56
32 31 13 00-0649	LF	18" Diameter, 12" On Center Galvanized Concertina (Razor) Wire, Attach To Every 4th Barb On Top Of Chain Link Fence, Per LF Of Fence..... For >500 To 1,500, Deduct For >1,500 To 5,000, Deduct For >5,000, Deduct For Ground Installation, Deduct For Double Coil (Helix), Add	3.93 -0.36 -0.71 -1.03 -0.61 2.72	0.56
32 31 13 00-0650	LF	18" Diameter, 9" On Center Galvanized Concertina (Razor) Wire, Attach To Every 3rd Barb On Top Of Chain Link Fence, Per LF Of Fence..... For >500 To 1,500, Deduct For >1,500 To 5,000, Deduct For >5,000, Deduct For Ground Installation, Deduct For Double Coil (Helix), Add	5.22 -0.47 -0.94 -1.37 -0.81 3.61	0.56
32 31 13 00-0651	LF	24" Diameter, 18" On Center Galvanized Concertina (Razor) Wire, Attach To Every 6th Barb On Top Of Chain Link Fence, Per LF Of Fence..... For >500 To 1,500, Deduct For >1,500 To 5,000, Deduct For >5,000, Deduct For Ground Installation, Deduct For Double Coil (Helix), Add	3.19 -0.28 -0.57 -0.82 -0.45 2.30	0.56
32 31 13 00-0652	LF	24" Diameter, 12" On Center Galvanized Concertina (Razor) Wire, Attach To Every 4th Barb On Top Of Chain Link Fence, Per LF Of Fence..... For >500 To 1,500, Deduct For >1,500 To 5,000, Deduct For >5,000, Deduct For Ground Installation, Deduct For Double Coil (Helix), Add	4.80 -0.43 -0.85 -1.23 -0.67 3.46	0.56
32 31 13 00-0653	LF	24" Diameter, 9" On Center Galvanized Concertina (Razor) Wire, Attach To Every 3rd Barb On Top Of Chain Link Fence, Per LF Of Fence..... For >500 To 1,500, Deduct For >1,500 To 5,000, Deduct For >5,000, Deduct For Ground Installation, Deduct For Double Coil (Helix), Add	6.35 -0.57 -1.13 -1.63 -0.89 4.58	0.56
32 31 13 00-0654	LF	30" Diameter, 18" On Center Galvanized Concertina (Razor) Wire, Attach To Every 6th Barb On Top Of Chain Link Fence, Per LF Of Fence..... For >500 To 1,500, Deduct For >1,500 To 5,000, Deduct For >5,000, Deduct For Ground Installation, Deduct For Double Coil (Helix), Add	7.50 -0.61 -1.23 -1.70 -0.50 6.50	0.56



Exterior Improvements	32
Site Improvements	32 30
Fences And Gates	32 31

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 31 13 00-0655 LF 30" Diameter, 12" On Center Galvanized Concertina (Razor) Wire, Attach To Every 4th Barb On Top Of Chain Link Fence, Per LF Of Fence.....	11.33	0.56
<i>For >500 To 1,500, Deduct</i>	-0.93	
<i>For >1,500 To 5,000, Deduct</i>	-1.85	
<i>For >5,000, Deduct</i>	-2.57	
<i>For Ground Installation, Deduct</i>	-0.75	
<i>For Double Coil (Helix), Add</i>	9.83	
32 31 13 00-0656 LF 30" Diameter, 9" On Center Galvanized Concertina (Razor) Wire, Attach To Every 3rd Barb On Top Of Chain Link Fence, Per LF Of Fence.....	15.01	0.56
<i>For >500 To 1,500, Deduct</i>	-1.23	
<i>For >1,500 To 5,000, Deduct</i>	-2.45	
<i>For >5,000, Deduct</i>	-3.41	
<i>For Ground Installation, Deduct</i>	-1.01	
<i>For Double Coil (Helix), Add</i>	13.00	
32 31 13 00-0657 Stainless Steel Concertina (Razor) Wire, Single Coil <small>(32 31 13 00-0640)</small>		
32 31 13 00-0658 LF 18" Diameter, 18" On Center, Stainless Steel Concertina (Razor) Wire, Attach To Every 6th Barb On Top Of Chain Link Fence, Per LF Of Fence.....	3.21	0.56
<i>For >500 To 1,500, Deduct</i>	-0.28	
<i>For >1,500 To 5,000, Deduct</i>	-0.56	
<i>For >5,000, Deduct</i>	-0.80	
<i>For Ground Installation, Deduct</i>	-0.40	
<i>For Double Coil (Helix), Add</i>	2.41	
32 31 13 00-0659 LF 18" Diameter, 12" On Center, Stainless Steel Concertina (Razor) Wire, Attach To Every 4th Barb On Top Of Chain Link Fence, Per LF Of Fence.....	4.84	0.56
<i>For >500 To 1,500, Deduct</i>	-0.42	
<i>For >1,500 To 5,000, Deduct</i>	-0.85	
<i>For >5,000, Deduct</i>	-1.21	
<i>For Ground Installation, Deduct</i>	-0.61	
<i>For Double Coil (Helix), Add</i>	3.63	
32 31 13 00-0660 LF 18" Diameter, 9" On Center, Stainless Steel Concertina (Razor) Wire, Attach To Every 3rd Barb On Top Of Chain Link Fence, Per LF Of Fence.....	6.42	0.56
<i>For >500 To 1,500, Deduct</i>	-0.56	
<i>For >1,500 To 5,000, Deduct</i>	-1.12	
<i>For >5,000, Deduct</i>	-1.61	
<i>For Ground Installation, Deduct</i>	-0.81	
<i>For Double Coil (Helix), Add</i>	4.81	
32 31 13 00-0661 LF 24" Diameter, 18" On Center, Stainless Steel Concertina (Razor) Wire, Attach To Every 6th Barb On Top Of Chain Link Fence, Per LF Of Fence.....	3.99	0.56
<i>For >500 To 1,500, Deduct</i>	-0.34	
<i>For >1,500 To 5,000, Deduct</i>	-0.69	
<i>For >5,000, Deduct</i>	-0.98	
<i>For Ground Installation, Deduct</i>	-0.45	
<i>For Double Coil (Helix), Add</i>	3.10	
32 31 13 00-0662 LF 24" Diameter, 12" On Center, Stainless Steel Concertina (Razor) Wire, Attach To Every 4th Barb On Top Of Chain Link Fence, Per LF Of Fence.....	6.01	0.56
<i>For >500 To 1,500, Deduct</i>	-0.52	
<i>For >1,500 To 5,000, Deduct</i>	-1.04	
<i>For >5,000, Deduct</i>	-1.47	
<i>For Ground Installation, Deduct</i>	-0.67	
<i>For Double Coil (Helix), Add</i>	4.67	
32 31 13 00-0663 LF 24" Diameter, 9" On Center, Stainless Steel Concertina (Razor) Wire, Attach To Every 3rd Barb On Top Of Chain Link Fence, Per LF Of Fence.....	7.95	0.56
<i>For >500 To 1,500, Deduct</i>	-0.69	
<i>For >1,500 To 5,000, Deduct</i>	-1.37	
<i>For >5,000, Deduct</i>	-1.95	
<i>For Ground Installation, Deduct</i>	-0.89	
<i>For Double Coil (Helix), Add</i>	6.18	
32 31 13 00-0664 LF 30" Diameter, 18" On Center, Stainless Steel Concertina (Razor) Wire, Attach To Every 6th Barb On Top Of Chain Link Fence, Per LF Of Fence.....	10.53	0.56
<i>For >500 To 1,500, Deduct</i>	-0.84	
<i>For >1,500 To 5,000, Deduct</i>	-1.68	
<i>For >5,000, Deduct</i>	-2.31	
<i>For Ground Installation, Deduct</i>	-0.50	
<i>For Double Coil (Helix), Add</i>	9.53	
32 31 13 00-0665 LF 30" Diameter, 12" On Center, Stainless Steel Concertina (Razor) Wire, Attach To Every 4th Barb On Top Of Chain Link Fence, Per LF Of Fence.....	15.92	0.56
<i>For >500 To 1,500, Deduct</i>	-1.27	
<i>For >1,500 To 5,000, Deduct</i>	-2.54	
<i>For >5,000, Deduct</i>	-3.49	
<i>For Ground Installation, Deduct</i>	-0.75	
<i>For Double Coil (Helix), Add</i>	14.42	
32 31 13 00-0666 LF 30" Diameter, 9" On Center, Stainless Steel Concertina (Razor) Wire, Attach To Every 3rd Barb On Top Of Chain Link Fence, Per LF Of Fence.....	21.07	0.56
<i>For >500 To 1,500, Deduct</i>	-1.68	
<i>For >1,500 To 5,000, Deduct</i>	-3.36	
<i>For >5,000, Deduct</i>	-4.62	
<i>For Ground Installation, Deduct</i>	-1.01	
<i>For Double Coil (Helix), Add</i>	19.06	
32 31 13 00-0667 Grounding For Gates <small>(32 31 13 00-0639)</small>		
Note: Includes two of each of the following per opening: 5/8 ground rods, clamps, braided straps and #6 bare copper wire.		
32 31 13 00-0668 OPN Grounding For Gates (Per Opening).....	387.67	

32 Exterior Improvements**32 30 Site Improvements****32 31 Fences And Gates**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 31 13 00-0669			Coiled Spring Reinforcing Wire (32 31 13 00-0639)		
32 31 13 00-0670			Galvanized Steel (32 31 13 00-0669)		
32 31 13 00-0671	LF		7 Gauge, Galvanized Steel, Reinforcing Wire Coiled Spring	0.92	0.40
32 31 13 00-0672			Vinyl Coated Steel (32 31 13 00-0669)		
32 31 13 00-0673	LF		9 Gauge, Vinyl Coated Steel, Reinforcing Wire Coiled Spring.....	0.92	0.40
32 31 13 00-0674			Bending Of Fabric Around Pipe Railings (32 31 13 00-0639)		
			Note: Only where specified.		
32 31 13 00-0675	LF		Bend Chain Link Fence Fabric Around Pipe Railing, Top.....	1.30	
32 31 13 00-0676	LF		Bend Chain Link Fence Fabric Around Pipe Railing, Bottom.....	1.14	
32 31 13 00-0677			Mounting Plate With Anchors Or Bolts (32 31 13 00-0639)		
			Note: For drilling for anchor or bolts, installing post on or against flat surface.		
32 31 13 00-0678	EA		Mounting Plate For 1-5/8" Diameter Post.....	28.85	
32 31 13 00-0679	EA		Mounting Plate For 2" Diameter Post.....	29.24	
32 31 13 00-0680	EA		Mounting Plate For 2-1/2" Diameter Post.....	30.18	
32 31 13 00-0681	EA		Mounting Plate For 3" Diameter Post.....	35.77	
32 31 13 00-0682	EA		Mounting Plate For 4" Diameter Post.....	40.75	
32 31 13 00-0683	EA		Mounting Plate For 6-5/8" Diameter Post.....	46.72	
32 31 13 00-0684	EA		Mounting Plate For 8-5/8" Diameter Post.....	54.60	
32 31 13 00-0685			Tension Bar (32 31 13 00-0639)		
32 31 13 00-0686	EA		3' Long x 5/8" Wide x 3/16" Thick Galvanized Steel Tension Bar	9.76	
32 31 13 00-0687	EA		3-1/2' Long x 5/8" Wide x 3/16" Thick Galvanized Steel Tension Bar	10.32	
32 31 13 00-0688	EA		4' Long x 3/4" Wide x 3/16" Thick Galvanized Steel Tension Bar	11.84	
32 31 13 00-0689	EA		5' Long x 3/4" Wide x 3/16" Thick Galvanized Steel Tension Bar	13.38	
32 31 13 00-0690	EA		6' Long x 3/4" Wide x 3/16" Thick Galvanized Steel Tension Bar	15.29	
32 31 13 00-0691	EA		7' Long x 3/4" Wide x 3/16" Thick Galvanized Steel Tension Bar	17.24	
32 31 13 00-0692	EA		8' Long x 3/4" Wide x 3/16" Thick Galvanized Steel Tension Bar	19.35	
32 31 13 00-0693	EA		9' Long x 3/4" Wide x 3/16" Thick Galvanized Steel Tension Bar	22.50	
32 31 13 00-0694	EA		10' Long x 3/4" Wide x 3/16" Thick Galvanized Steel Tension Bar	26.78	
32 31 13 00-0695			Fence And Gate Repair And Replacement (32 31 13)		
32 31 13 00-0696			Fence And Gate Parts Replacement (32 31 13 00-0695)		
32 31 13 00-0697	EA		Cantilever Roller Assembly, Ball Bearing With Fittings, Replacement	85.55	
32 31 13 00-0698	EA		Sliding Gate Roller Assembly Replacement	86.67	
32 31 13 00-0699	EA		Rod And Lock Gate Keeper Replacement	83.48	
32 31 13 00-0700	EA		Galvanized Gate Holdback Replacement	20.74	
32 31 13 00-0701	LF		3/8" Cross Bracing Rod Replacement.....	1.11	
32 31 13 00-0702	LF		1-5/8" Diagonal Pipe Bracing Replacement	1.70	
32 31 13 00-0703	EA		2-3/8" Diameter Cast Steel Gate Hinge With Bolts, Replacement	11.71	
32 31 13 00-0704	EA		3" Diameter Cast Steel Gate Hinge With Bolts, Replacement	13.65	
32 31 13 00-0705	EA		4" Diameter Cast Steel Gate Hinge With Bolts, Replacement	15.51	
32 31 13 00-0706	EA		6-5/8" Diameter Cast Steel Gate Hinge With Bolts, Replacement	27.11	
32 31 13 00-0707	EA		8-5/8" Diameter Cast Steel Gate Hinge With Bolts, Replacement	32.32	
32 31 13 00-0708	EA		2-1/2" x 2" Off Set Gate Hinge Replacement	18.40	
32 31 13 00-0709	EA		3" x 2" Off Set Gate Hinge Replacement	19.25	
32 31 13 00-0710	EA		4" x 2" Off Set Gate Hinge Replacement	20.58	
32 31 13 00-0711	EA		6-5/8" x 2" Off Set Gate Hinge Replacement	31.55	
32 31 13 00-0712	EA		8-5/8" x 2" Off Set Gate Hinge Replacement	47.64	
32 31 13 00-0713	EA		1-5/8" Aluminum Die-Cast Post Cap Replacement.....	4.16	
32 31 13 00-0714	EA		2" Aluminum Die-Cast Post Cap Replacement	4.56	
32 31 13 00-0715	EA		2-1/2" Aluminum Die-Cast Post Cap Replacement.....	5.14	
32 31 13 00-0716	EA		3" Aluminum Die-Cast Post Cap Replacement	5.82	
32 31 13 00-0717	EA		2" Galvanized Post Cap Replacement.....	5.00	
32 31 13 00-0718	EA		2-1/2" Galvanized Post Cap Replacement.....	5.43	
32 31 13 00-0719	EA		3" Galvanized Post Cap Replacement.....	6.18	
32 31 13 00-0720	EA		4" Galvanized Post Cap Replacement.....	8.64	
32 31 13 00-0721	EA		6-5/8" Galvanized Post Cap Replacement.....	14.79	
32 31 13 00-0722	EA		8-5/8" Galvanized Post Cap Replacement.....	23.58	
32 31 13 00-0723	EA		1-5/8" Boulevard Clamp Replacement.....	8.54	
32 31 13 00-0724	EA		2" Boulevard Clamp Replacement	10.36	
32 31 13 00-0725	EA		2-1/2" Boulevard Clamp Replacement.....	12.16	
32 31 13 00-0726	EA		3" Boulevard Clamp Replacement	14.76	
32 31 13 00-0727	EA		1-5/8" Gate Brace Or End Rail Clamp Replacement	8.41	
32 31 13 00-0728	EA		2" Gate Brace Or End Rail Clamp Replacement.....	10.19	
32 31 13 00-0729	EA		2-1/2" Gate Brace Or End Rail Clamp Replacement	11.99	
32 31 13 00-0730	EA		3" Gate Brace Or End Rail Clamp Replacement.....	14.58	
32 31 13 00-0731	EA		1-3/8" Heavy Duty Galvanized Tension Band With Bolt, Replacement.....	8.58	
32 31 13 00-0732	EA		1-5/8" Heavy Duty Galvanized Tension Band With Bolt, Replacement.....	8.63	
32 31 13 00-0733	EA		2" Heavy Duty Galvanized Tension Band With Bolt, Replacement.....	8.78	



Exterior Improvements	32	32
Site Improvements	32 30	
Fences And Gates	32 31	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 31 13 00-0734 EA 2-1/2" Heavy Duty Galvanized Tension Band With Bolt, Replacement.....	8.72	
32 31 13 00-0735 EA 3" Heavy Duty Galvanized Tension Band With Bolt, Replacement.....	8.83	
32 31 13 00-0736 EA 3-1/2" Heavy Duty Galvanized Tension Band With Bolt, Replacement.....	8.92	
32 31 13 00-0737 EA 4" Heavy Duty Galvanized Tension Band With Bolt, Replacement.....	9.18	
32 31 13 00-0738 EA 6-5/8" Heavy Duty Galvanized Tension Band With Bolt, Replacement.....	11.11	
32 31 13 00-0739 Remove And Reinstall Chain Link Fences (32 31 13) Note: Includes removal, storage, cleaning and reinstallation of fence fabric, rails and other components. Excludes post work.		
32 31 13 00-0740 LF Removal And Reinstallation Of Chain Link Fence Up To 5' Height.....	16.09	
32 31 13 00-0741 LF Removal And Reinstallation Of Chain Link Fence 6' To 12' Height	24.14	
32 31 13 00-0742 Regulation Baseball Backstop And Fencing (32 31 13) See CSI section 32 31 13 00-0001 for auguring holes and concrete.		
32 31 13 00-0743 EA 20'-6" Wide x 13' High Baseball Backstop Prefabricated With Hood, Galvanized	8,353.61	1,651.63
32 31 13 00-0744 EA 34' Wide x 17'-6" High Baseball Backstop Prefabricated With Hood, Galvanized	11,957.95	2,202.17
32 31 13 00-0745 EA 48'-3-1/2" Wide x 24' High Baseball Backstop Prefabricated With Hood, Galvanized	15,118.53	2,569.20
32 31 13 00-0746 EA 20'-6" Wide x 13' High Baseball Backstop Prefabricated With Hood, Vinyl Coated	11,385.01	1,651.63
32 31 13 00-0747 EA 34' Wide x 17'-6" High Baseball Backstop Prefabricated With Hood, Vinyl Coated	16,493.88	2,202.17
32 31 13 00-0748 EA 48'-3-1/2" Wide x 24' High Baseball Backstop Prefabricated With Hood, Vinyl Coated	21,104.39	2,569.20
32 31 13 00-0749 Regulation Softball Backstop (32 31 13) See CSI section 32 31 13 00-0001 for auguring holes and concrete.		
32 31 13 00-0750 14' High Softball Backstop (32 31 13 00-0749) Note: Includes 3" outside diameter posts every 8', top, middle, and bottom brace rails, overhang panel with 9 gauge mesh and 1-1/8" outside diameter frame, 16' of 6 gauge mesh and 32' of 9 gauge mesh.		
32 31 13 00-0751 EA 14' Softball Backstop, Galvanized Regulation	7,110.29	1,568.98
32 31 13 00-0752 EA 14' Softball Backstop, Vinyl Coated Regulation	9,284.46	1,568.98
32 31 13 00-0753 18' High Softball Backstop (32 31 13 00-0749) Note: Includes 3" outside diameter posts every 8', top, middle, and bottom brace rails, overhang panel with 9 gauge mesh and 1-1/8" outside diameter frame, 16' of 6 gauge mesh and 32' of 9 gauge mesh.		
32 31 13 00-0754 EA 18' Softball Backstop, Galvanized Regulation	8,259.58	1,744.27
32 31 13 00-0755 EA 18' Softball Backstop Vinyl Coated Regulation	10,889.62	1,744.27
32 31 13 00-0756 20' High Softball Backstop (32 31 13 00-0749) Note: Includes 3" outside diameter posts every 8', top, middle, and bottom brace rails, overhang panel with 9 gauge mesh and 1-1/8" outside diameter frame, 16' of 6 gauge mesh and 32' of 9 gauge mesh.		
32 31 13 00-0757 EA 20' Softball Backstop, Galvanized Regulation	9,288.51	1,839.09
32 31 13 00-0758 EA 20' Softball Backstop, Vinyl Coated Regulation	12,409.53	1,839.09
32 31 13 00-0759 22' High Softball Backstop (32 31 13 00-0749) Note: Includes 3" outside diameter posts every 8', top, middle, and bottom brace rails, overhang panel with 9 gauge mesh and 1-1/8" outside diameter frame, 16' of 6 gauge mesh and 32' of 9 gauge mesh.		
32 31 13 00-0760 EA 22' Softball Backstop, Galvanized Regulation	10,627.85	1,894.57
32 31 13 00-0761 EA 22' Softball Backstop, Vinyl Coated Regulation	14,380.04	1,894.57
32 31 13 00-0762 24' High Softball Backstop (32 31 13 00-0749) Note: Includes 3" outside diameter posts every 8', top, middle, and bottom brace rails, overhang panel with 9 gauge mesh and 1-1/8" outside diameter frame, 16' of 6 gauge mesh and 32' of 9 gauge mesh.		
32 31 13 00-0763 EA 24' Softball Backstop, Galvanized Regulation	12,559.33	2,165.23
32 31 13 00-0764 EA 24' Softball Backstop, Vinyl Coated Regulation	17,223.26	2,165.23
32 31 19 Decorative Metal Fences And Gates (32 31) See CSI section 32 31 13 00-0001 for drilling and grouting.		
32 31 19 00-0001 Wrought Iron Fence (32 31 19) Note: Factory primed.		
32 31 19 00-0002 Wrought Iron Fence, Verticals At >2-1/2" To 3" On Center (32 31 19 00-0001) Note: Factory primed.		
32 31 19 00-0003 LF 3' Wrought Iron Fence, Verticals At >2-1/2" To 3" On Center	58.81	8.85
For Verticals Up To 2" On Center, Add	8.22	
For Verticals >2" To 2-1/2" On Center, Add	4.11	
For Verticals >3" To 4" On Center, Deduct	-4.11	
For Verticals >4" To 6" On Center, Deduct	-8.22	
32 31 19 00-0004 LF 4' Wrought Iron Fence, Verticals At >2-1/2" To 3" On Center	76.24	11.27
For Verticals Up To 2" On Center, Add	10.90	
For Verticals >2" To 2-1/2" On Center, Add	5.45	
For Verticals >3" To 4" On Center, Deduct	-5.45	
For Verticals >4" To 6" On Center, Deduct	-10.90	

32 Exterior Improvements**32 30 Site Improvements****32 31 Fences And Gates**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 31 19 00-0005 LF 5' Wrought Iron Fence, Verticals At >2-1/2" To 3" On Center <i>For Verticals Up To 2" On Center, Add</i> <i>For Verticals >2" To 2-1/2" On Center, Add</i> <i>For Verticals >3" To 4" On Center, Deduct</i> <i>For Verticals >4" To 6" On Center, Deduct</i>	92.38 13.74 6.87 -6.87 -13.74	11.75
32 31 19 00-0006 LF 6' Wrought Iron Fence, Verticals At >2-1/2" To 3" On Center <i>For Verticals Up To 2" On Center, Add</i> <i>For Verticals >2" To 2-1/2" On Center, Add</i> <i>For Verticals >3" To 4" On Center, Deduct</i> <i>For Verticals >4" To 6" On Center, Deduct</i>	112.05 16.73 8.37 -8.37 -16.73	14.16
32 31 19 00-0007 LF 7' Wrought Iron Fence, Verticals At >2-1/2" To 3" On Center <i>For Verticals Up To 2" On Center, Add</i> <i>For Verticals >2" To 2-1/2" On Center, Add</i> <i>For Verticals >3" To 4" On Center, Deduct</i> <i>For Verticals >4" To 6" On Center, Deduct</i>	133.95 20.80 10.40 -10.40 -20.80	14.99
32 31 19 00-0008 LF 8' Wrought Iron Fence, Verticals At >2-1/2" To 3" On Center <i>For Verticals Up To 2" On Center, Add</i> <i>For Verticals >2" To 2-1/2" On Center, Add</i> <i>For Verticals >3" To 4" On Center, Deduct</i> <i>For Verticals >4" To 6" On Center, Deduct</i>	155.84 24.86 12.43 -12.43 -24.86	15.77
32 31 19 00-0009 LF 10' Wrought Iron Fence, Verticals At >2-1/2" To 3" On Center <i>For Verticals Up To 2" On Center, Add</i> <i>For Verticals >2" To 2-1/2" On Center, Add</i> <i>For Verticals >3" To 4" On Center, Deduct</i> <i>For Verticals >4" To 6" On Center, Deduct</i>	191.96 31.31 15.66 -15.66 -31.31	17.70
32 31 19 00-0010 LF 12' Wrought Iron Fence, Verticals At >2-1/2" To 3" On Center <i>For Verticals Up To 2" On Center, Add</i> <i>For Verticals >2" To 2-1/2" On Center, Add</i> <i>For Verticals >3" To 4" On Center, Deduct</i> <i>For Verticals >4" To 6" On Center, Deduct</i>	228.23 37.60 18.80 -18.80 -37.60	20.12
32 31 19 00-0011 Wrought Iron Gates (32 31 19 00-0001) Note: Factory primed.		
32 31 19 00-0012 Single Wrought Iron Gates (32 31 19 00-0011) Note: Factory primed.		
32 31 19 00-0013 LF 3' Single Wrought Iron Gate, Hardware And Associated Trim	73.15	10.78
32 31 19 00-0014 LF 4' Single Wrought Iron Gate, Hardware And Associated Trim	96.08	13.35
32 31 19 00-0015 LF 5' Single Wrought Iron Gate, Hardware And Associated Trim	118.38	16.09
32 31 19 00-0016 LF 6' Single Wrought Iron Gate, Hardware And Associated Trim	144.27	19.31
32 31 19 00-0017 LF 8' Single Wrought Iron Gate, Hardware And Associated Trim	200.21	21.41
32 31 19 00-0018 LF 10' Single Wrought Iron Gate, Hardware And Associated Trim	245.81	23.66
32 31 19 00-0019 LF 12' Single Wrought Iron Gate, Hardware And Associated Trim	290.49	26.87
32 31 19 00-0020 Double Wrought Iron Gates (32 31 19 00-0011) Note: Factory primed.		
32 31 19 00-0021 LF 3' Double Wrought Iron Gate, Hardware And Associated Trim	90.06	9.66
32 31 19 00-0022 LF 4' Double Wrought Iron Gate, Hardware And Associated Trim	118.78	12.07
32 31 19 00-0023 LF 5' Double Wrought Iron Gate, Hardware And Associated Trim	145.83	14.49
32 31 19 00-0024 LF 6' Double Wrought Iron Gate, Hardware And Associated Trim	177.37	17.38
32 31 19 00-0025 LF 8' Double Wrought Iron Gate, Hardware And Associated Trim	247.09	19.31
32 31 19 00-0026 LF 10' Double Wrought Iron Gate, Hardware And Associated Trim	303.80	21.24
32 31 19 00-0027 LF 12' Double Wrought Iron Gate, Hardware And Associated Trim	359.46	24.14
32 31 19 00-0028 Repair Or Replace Wrought Iron Fence (32 31 19 00-0001)		
32 31 19 00-0029 LF Replace Wrought Iron Picket	18.26	
32 31 19 00-0030 LF Replace Wrought Iron Post	28.46	
32 31 19 00-0031 EA Straighten Wrought Iron Post	64.37	
32 31 19 00-0032 Steel Tube Fence, Galvanized (32 31 19) Note: Pickets are 3/4" square x 16 gauge.		
32 31 19 00-0033 Steel Tube Fence, 2 Rail (32 31 19 00-0032)		
32 31 19 00-0034 LF 3' Steel Tube Fence, Verticals At >2-1/2" To 3" On Center With 2-1/2" Square Posts..... <i>For Verticals Up To 2" On Center, Add</i> <i>For Verticals >2" To 2-1/2" On Center, Add</i> <i>For Verticals >3" To 4" On Center, Deduct</i> <i>For Verticals >4" To 6" On Center, Deduct</i> <i>For Powder Coated Finish, Add</i> <i>For Solid Pickets, Add</i> <i>For Aluminum With Satin Finish, Add</i> <i>For Third Rail, Add</i> <i>For 1" Square x 14 Gauge Pickets, Add</i> <i>For Color, Add</i> <i>For 3" Square Posts, Add</i>	42.72 5.07 2.54 -2.54 -5.07 3.81 8.31 5.01 1.90 6.34 1.27 2.54	8.85



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 31 19 00-0035 LF 4' Steel Tube Fence, Verticals At >2-1/2" To 3" On Center With 2-1/2" Square Posts	48.68	10.46
For Verticals Up To 2" On Center, Add	5.64	
For Verticals >2" To 2-1/2" On Center, Add	2.82	
For Verticals >3" To 4" On Center, Deduct	-2.82	
For Verticals >4" To 6" On Center, Deduct	-5.64	
For Powder Coated Finish, Add	4.23	
For Solid Pickets, Add	9.42	
For Aluminum With Satin Finish, Add	5.38	
For Third Rail, Add	2.11	
For 1" Square x 14 Gauge Pickets, Add	7.05	
For Color, Add	1.41	
For 3" Square Posts, Add	2.82	
32 31 19 00-0036 LF 5' Steel Tube Fence, Verticals At >2-1/2" To 3" On Center With 2-1/2" Square Posts	52.55	11.75
For Verticals Up To 2" On Center, Add	5.78	
For Verticals >2" To 2-1/2" On Center, Add	2.89	
For Verticals >3" To 4" On Center, Deduct	-2.89	
For Verticals >4" To 6" On Center, Deduct	-5.78	
For Powder Coated Finish, Add	4.33	
For Solid Pickets, Add	10.05	
For Aluminum With Satin Finish, Add	5.12	
For Third Rail, Add	2.17	
For 1" Square x 14 Gauge Pickets, Add	7.22	
For Color, Add	1.44	
For 3" Square Posts, Add	2.89	
32 31 19 00-0037 LF 6' Steel Tube Fence, Verticals At >2-1/2" To 3" On Center With 2-1/2" Square Posts	60.60	13.27
For Verticals Up To 2" On Center, Add	6.81	
For Verticals >2" To 2-1/2" On Center, Add	3.41	
For Verticals >3" To 4" On Center, Deduct	-3.41	
For Verticals >4" To 6" On Center, Deduct	-6.81	
For Powder Coated Finish, Add	5.11	
For Solid Pickets, Add	11.64	
For Aluminum With Satin Finish, Add	6.23	
For Third Rail, Add	2.55	
For 1" Square x 14 Gauge Pickets, Add	8.51	
For Color, Add	1.70	
For 3" Square Posts, Add	3.41	
32 31 19 00-0038 LF 7' Steel Tube Fence, Verticals At >2-1/2" To 3" On Center With 3" Square Posts.....	68.86	14.49
For Verticals Up To 2" On Center, Add	7.98	
For Verticals >2" To 2-1/2" On Center, Add	3.99	
For Verticals >3" To 4" On Center, Deduct	-3.99	
For Verticals >4" To 6" On Center, Deduct	-7.98	
For Powder Coated Finish, Add	5.98	
For Solid Pickets, Add	13.32	
For Aluminum With Satin Finish, Add	7.62	
For Third Rail, Add	2.99	
For 1" Square x 14 Gauge Pickets, Add	9.97	
For Color, Add	1.99	
For 4" Square Posts, Add	13.96	
32 31 19 00-0039 LF 8' Steel Tube Fence, Verticals At >2-1/2" To 3" On Center With 3" Square Posts.....	77.27	15.77
For Verticals Up To 2" On Center, Add	9.15	
For Verticals >2" To 2-1/2" On Center, Add	4.57	
For Verticals >3" To 4" On Center, Deduct	-4.57	
For Verticals >4" To 6" On Center, Deduct	-9.15	
For Powder Coated Finish, Add	6.86	
For Solid Pickets, Add	15.02	
For Aluminum With Satin Finish, Add	8.99	
For Third Rail, Add	3.43	
For 1" Square x 14 Gauge Pickets, Add	11.43	
For Color, Add	2.29	
For 4" Square Posts, Add	16.01	
32 31 19 00-0040 LF 9' Steel Tube Fence, Verticals At >2-1/2" To 3" On Center With 3" Square Posts.....	88.79	16.89
For Verticals Up To 2" On Center, Add	11.00	
For Verticals >2" To 2-1/2" On Center, Add	5.50	
For Verticals >3" To 4" On Center, Deduct	-5.50	
For Verticals >4" To 6" On Center, Deduct	-11.00	
For Powder Coated Finish, Add	8.25	
For Solid Pickets, Add	17.44	
For Aluminum With Satin Finish, Add	11.43	
For Third Rail, Add	4.12	
For 1" Square x 14 Gauge Pickets, Add	13.75	
For Color, Add	2.75	
For 4" Square Posts, Add	19.25	
32 31 19 00-0041 LF 10' Steel Tube Fence, Verticals At >2-1/2" To 3" On Center With 4" Square Posts.....	100.46	18.11
For Verticals Up To 2" On Center, Add	12.85	
For Verticals >2" To 2-1/2" On Center, Add	6.43	
For Verticals >3" To 4" On Center, Deduct	-6.43	
For Verticals >4" To 6" On Center, Deduct	-12.85	
For Powder Coated Finish, Add	9.64	
For Solid Pickets, Add	19.89	
For Aluminum With Satin Finish, Add	13.84	
For Third Rail, Add	4.82	
For 1" Square x 14 Gauge Pickets, Add	16.06	
For Color, Add	3.21	
For 6" Square Posts, Add	22.49	

32 Exterior Improvements**32 30 Site Improvements****32 31 Fences And Gates**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 31 19 00-0042	LF	12'	Steel Tube Fence, Verticals At >2-1/2" To 3" On Center With 4" Square Posts.....	117.44	20.12
			<i>For Verticals Up To 2" On Center, Add</i>	15.44	
			<i>For Verticals >2" To 2-1/2" On Center, Add</i>	7.72	
			<i>For Verticals >3" To 4" On Center, Deduct</i>	-7.72	
			<i>For Verticals >4" To 6" On Center, Deduct</i>	-15.44	
			<i>For Powder Coated Finish, Add</i>	11.58	
			<i>For Solid Pickets, Add</i>	23.41	
			<i>For Aluminum With Satin Finish, Add</i>	17.13	
			<i>For Third Rail, Add</i>	5.79	
			<i>For 1" Square x 14 Gauge Pickets, Add</i>	19.30	
			<i>For Color, Add</i>	3.86	
			<i>For 6" Square Posts, Add</i>	27.02	
32 31 19 00-0043	LF	14'	Steel Tube Fence, Verticals At >2-1/2" To 3" On Center With 4" Square Posts.....	125.93	21.73
			<i>For Verticals Up To 2" On Center, Add</i>	16.50	
			<i>For Verticals >2" To 2-1/2" On Center, Add</i>	8.25	
			<i>For Verticals >3" To 4" On Center, Deduct</i>	-8.25	
			<i>For Verticals >4" To 6" On Center, Deduct</i>	-16.50	
			<i>For Powder Coated Finish, Add</i>	12.37	
			<i>For Solid Pickets, Add</i>	25.08	
			<i>For Aluminum With Satin Finish, Add</i>	18.23	
			<i>For Third Rail, Add</i>	6.19	
			<i>For 1" Square x 14 Gauge Pickets, Add</i>	20.62	
			<i>For Color, Add</i>	4.12	
			<i>For 6" Square Posts, Add</i>	28.87	
32 31 19 00-0044			Steel Tube Swing Gates <small>(32 31 19 00-0032)</small>		
32 31 19 00-0045			4' Fence Height Steel Tube Swing Gates, 2 Rail <small>(32 31 19 00-0044)</small>		
32 31 19 00-0046	EA	4'	Wide x 4' High Steel Tube Swing Gate, Hardware And Associated Trim.....	640.52	20.12
			<i>For Solid Pickets, Add</i>	139.59	
			<i>For Aluminum With Satin Finish, Add</i>	165.00	
			<i>For Third Rail, Add</i>	43.51	
			<i>For 1" Square x 14 Gauge Pickets, Add</i>	58.02	
			<i>For Color, Add</i>	29.01	
32 31 19 00-0047	EA	5'	Wide x 4' High Steel Tube Swing Gate, Hardware And Associated Trim.....	714.16	21.41
			<i>For Solid Pickets, Add</i>	155.86	
			<i>For Aluminum With Satin Finish, Add</i>	185.28	
			<i>For Third Rail, Add</i>	48.73	
			<i>For 1" Square x 14 Gauge Pickets, Add</i>	64.98	
			<i>For Color, Add</i>	32.49	
32 31 19 00-0048	EA	6'	Wide x 4' High Steel Tube Swing Gate, Hardware And Associated Trim.....	773.46	25.74
			<i>For Solid Pickets, Add</i>	168.23	
			<i>For Aluminum With Satin Finish, Add</i>	197.28	
			<i>For Third Rail, Add</i>	52.22	
			<i>For 1" Square x 14 Gauge Pickets, Add</i>	69.62	
			<i>For Color, Add</i>	34.81	
32 31 19 00-0049	EA	7'	Wide x 4' High Steel Tube Swing Gate, Hardware And Associated Trim.....	948.78	30.01
			<i>For Solid Pickets, Add</i>	206.72	
			<i>For Aluminum With Satin Finish, Add</i>	244.08	
			<i>For Third Rail, Add</i>	64.40	
			<i>For 1" Square x 14 Gauge Pickets, Add</i>	85.87	
			<i>For Color, Add</i>	42.93	
32 31 19 00-0050	EA	8'	Wide x 4' High Steel Tube Swing Gate, Hardware And Associated Trim.....	1,064.82	30.01
			<i>For Solid Pickets, Add</i>	232.82	
			<i>For Aluminum With Satin Finish, Add</i>	278.89	
			<i>For Third Rail, Add</i>	73.10	
			<i>For 1" Square x 14 Gauge Pickets, Add</i>	97.47	
			<i>For Color, Add</i>	48.73	
32 31 19 00-0051	EA	9'	Wide x 4' High Steel Tube Swing Gate, Hardware And Associated Trim.....	1,183.38	38.62
			<i>For Solid Pickets, Add</i>	257.57	
			<i>For Aluminum With Satin Finish, Add</i>	302.88	
			<i>For Third Rail, Add</i>	80.06	
			<i>For 1" Square x 14 Gauge Pickets, Add</i>	106.75	
			<i>For Color, Add</i>	53.38	
32 31 19 00-0052	EA	10'	Wide x 4' High Steel Tube Swing Gate, Hardware And Associated Trim.....	1,289.07	42.89
			<i>For Solid Pickets, Add</i>	280.39	
			<i>For Aluminum With Satin Finish, Add</i>	328.79	
			<i>For Third Rail, Add</i>	87.03	
			<i>For 1" Square x 14 Gauge Pickets, Add</i>	116.03	
			<i>For Color, Add</i>	58.02	
32 31 19 00-0053			5' Fence Height Steel Tube Swing Gates, 2 Rail <small>(32 31 19 00-0044)</small>		
32 31 19 00-0054	EA	4'	Wide x 5' High Steel Tube Swing Gate, Hardware And Associated Trim.....	690.96	21.41
			<i>For Solid Pickets, Add</i>	150.64	
			<i>For Aluminum With Satin Finish, Add</i>	178.32	
			<i>For Third Rail, Add</i>	46.99	
			<i>For 1" Square x 14 Gauge Pickets, Add</i>	62.66	
			<i>For Color, Add</i>	31.33	
32 31 19 00-0055	EA	5'	Wide x 5' High Steel Tube Swing Gate, Hardware And Associated Trim.....	764.61	22.78
			<i>For Solid Pickets, Add</i>	166.91	
			<i>For Aluminum With Satin Finish, Add</i>	198.60	
			<i>For Third Rail, Add</i>	52.22	
			<i>For 1" Square x 14 Gauge Pickets, Add</i>	69.62	
			<i>For Color, Add</i>	34.81	



Exterior Improvements	32	32
Site Improvements	32 30	
Fences And Gates	32 31	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 31 19 00-0056 EA 6' Wide x 5' High Steel Tube Swing Gate, Hardware And Associated Trim.....	824.70	27.36
For Solid Pickets, Add	179.40	
For Aluminum With Satin Finish, Add	210.47	
For Third Rail, Add	55.70	
For 1" Square x 14 Gauge Pickets, Add	74.26	
For Color, Add	37.13	
32 31 19 00-0057 EA 7' Wide x 5' High Steel Tube Swing Gate, Hardware And Associated Trim.....	1,000.82	31.87
For Solid Pickets, Add	218.00	
For Aluminum With Satin Finish, Add	257.16	
For Third Rail, Add	67.88	
For 1" Square x 14 Gauge Pickets, Add	90.51	
For Color, Add	45.25	
32 31 19 00-0058 EA 8' Wide x 5' High Steel Tube Swing Gate, Hardware And Associated Trim.....	1,154.55	36.69
For Solid Pickets, Add	251.51	
For Aluminum With Satin Finish, Add	296.76	
For Third Rail, Add	78.32	
For 1" Square x 14 Gauge Pickets, Add	104.43	
For Color, Add	52.22	
32 31 19 00-0059 EA 9' Wide x 5' High Steel Tube Swing Gate, Hardware And Associated Trim.....	1,261.05	41.28
For Solid Pickets, Add	274.44	
For Aluminum With Satin Finish, Add	322.56	
For Third Rail, Add	85.29	
For 1" Square x 14 Gauge Pickets, Add	113.71	
For Color, Add	56.86	
32 31 19 00-0060 EA 10' Wide x 5' High Steel Tube Swing Gate, Hardware And Associated Trim.....	1,390.76	45.78
For Solid Pickets, Add	302.60	
For Aluminum With Satin Finish, Add	355.31	
For Third Rail, Add	93.99	
For 1" Square x 14 Gauge Pickets, Add	125.32	
For Color, Add	62.66	
32 31 19 00-0061 6' Fence Height Steel Tube Swing Gates, 2 Rail (32 31 19 00-0044)		
32 31 19 00-0062 EA 4' Wide x 6' High Steel Tube Swing Gate, Hardware And Associated Trim.....	765.18	22.93
For Solid Pickets, Add	166.99	
For Aluminum With Satin Finish, Add	198.52	
For Third Rail, Add	52.22	
For 1" Square x 14 Gauge Pickets, Add	69.62	
For Color, Add	34.81	
32 31 19 00-0063 EA 5' Wide x 6' High Steel Tube Swing Gate, Hardware And Associated Trim.....	839.06	24.38
For Solid Pickets, Add	183.30	
For Aluminum With Satin Finish, Add	218.76	
For Third Rail, Add	57.44	
For 1" Square x 14 Gauge Pickets, Add	76.58	
For Color, Add	38.29	
32 31 19 00-0064 EA 6' Wide x 6' High Steel Tube Swing Gate, Hardware And Associated Trim.....	900.75	29.45
For Solid Pickets, Add	196.03	
For Aluminum With Satin Finish, Add	230.40	
For Third Rail, Add	60.92	
For 1" Square x 14 Gauge Pickets, Add	81.22	
For Color, Add	40.61	
32 31 19 00-0065 EA 7' Wide x 6' High Steel Tube Swing Gate, Hardware And Associated Trim.....	1,078.48	34.59
For Solid Pickets, Add	234.87	
For Aluminum With Satin Finish, Add	276.84	
For Third Rail, Add	73.10	
For 1" Square x 14 Gauge Pickets, Add	97.47	
For Color, Add	48.73	
32 31 19 00-0066 EA 8' Wide x 6' High Steel Tube Swing Gate, Hardware And Associated Trim.....	1,218.28	39.43
For Solid Pickets, Add	265.24	
For Aluminum With Satin Finish, Add	312.26	
For Third Rail, Add	82.50	
For 1" Square x 14 Gauge Pickets, Add	110.00	
For Color, Add	55.00	
32 31 19 00-0067 EA 9' Wide x 6' High Steel Tube Swing Gate, Hardware And Associated Trim.....	1,340.33	44.49
For Solid Pickets, Add	291.56	
For Aluminum With Satin Finish, Add	341.99	
For Third Rail, Add	90.51	
For 1" Square x 14 Gauge Pickets, Add	120.68	
For Color, Add	60.34	
32 31 19 00-0068 EA 10' Wide x 6' High Steel Tube Swing Gate, Hardware And Associated Trim.....	1,471.64	49.57
For Solid Pickets, Add	319.96	
For Aluminum With Satin Finish, Add	374.51	
For Third Rail, Add	99.21	
For 1" Square x 14 Gauge Pickets, Add	132.28	
For Color, Add	66.14	
32 31 19 00-0069 7' Fence Height Steel Tube Swing Gates, 2 Rail (32 31 19 00-0044)		
32 31 19 00-0070 EA 4' Wide x 7' High Steel Tube Swing Gate, Hardware And Associated Trim.....	779.14	24.71
For Solid Pickets, Add	169.74	
For Aluminum With Satin Finish, Add	200.32	
For Third Rail, Add	52.87	
For 1" Square x 14 Gauge Pickets, Add	70.49	
For Color, Add	35.24	

32 Exterior Improvements**32 30 Site Improvements****32 31 Fences And Gates**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 31 19 00-0071	EA		5' Wide x 7' High Steel Tube Swing Gate, Hardware And Associated Trim.....	865.85	25.99
			<i>For Solid Pickets, Add</i>	188.96	
			<i>For Aluminum With Satin Finish, Add</i>	224.63	
			<i>For Third Rail, Add</i>	59.09	
			<i>For 1" Square x 14 Gauge Pickets, Add</i>	78.78	
			<i>For Color, Add</i>	39.39	
32 31 19 00-0072	EA		6' Wide x 7' High Steel Tube Swing Gate, Hardware And Associated Trim.....	949.08	31.63
			<i>For Solid Pickets, Add</i>	206.42	
			<i>For Aluminum With Satin Finish, Add</i>	242.00	
			<i>For Third Rail, Add</i>	64.06	
			<i>For 1" Square x 14 Gauge Pickets, Add</i>	85.41	
			<i>For Color, Add</i>	42.71	
32 31 19 00-0073	EA		7' Wide x 7' High Steel Tube Swing Gate, Hardware And Associated Trim.....	1,168.34	37.01
			<i>For Solid Pickets, Add</i>	254.55	
			<i>For Aluminum With Satin Finish, Add</i>	300.54	
			<i>For Third Rail, Add</i>	79.30	
			<i>For 1" Square x 14 Gauge Pickets, Add</i>	105.73	
			<i>For Color, Add</i>	52.87	
32 31 19 00-0074	EA		8' Wide x 7' High Steel Tube Swing Gate, Hardware And Associated Trim.....	1,392.56	42.56
			<i>For Solid Pickets, Add</i>	303.73	
			<i>For Aluminum With Satin Finish, Add</i>	360.20	
			<i>For Third Rail, Add</i>	94.85	
			<i>For 1" Square x 14 Gauge Pickets, Add</i>	126.46	
			<i>For Color, Add</i>	63.23	
32 31 19 00-0075	EA		9' Wide x 7' High Steel Tube Swing Gate, Hardware And Associated Trim.....	1,429.38	47.96
			<i>For Solid Pickets, Add</i>	310.81	
			<i>For Aluminum With Satin Finish, Add</i>	364.00	
			<i>For Third Rail, Add</i>	96.40	
			<i>For 1" Square x 14 Gauge Pickets, Add</i>	128.54	
			<i>For Color, Add</i>	64.27	
32 31 19 00-0076	EA		10' Wide x 7' High Steel Tube Swing Gate, Hardware And Associated Trim.....	1,570.67	53.58
			<i>For Solid Pickets, Add</i>	341.33	
			<i>For Aluminum With Satin Finish, Add</i>	398.78	
			<i>For Third Rail, Add</i>	105.73	
			<i>For 1" Square x 14 Gauge Pickets, Add</i>	140.97	
			<i>For Color, Add</i>	70.49	
32 31 19 00-0077			8' Fence Height Steel Tube Swing Gates, 2 Rail <small>(32 31 19 00-0044)</small>		
32 31 19 00-0078	EA		4' Wide x 8' High Steel Tube Swing Gate, Hardware And Associated Trim.....	868.27	26.79
			<i>For Solid Pickets, Add</i>	189.33	
			<i>For Aluminum With Satin Finish, Add</i>	224.27	
			<i>For Third Rail, Add</i>	59.09	
			<i>For 1" Square x 14 Gauge Pickets, Add</i>	78.78	
			<i>For Color, Add</i>	39.39	
32 31 19 00-0079	EA		5' Wide x 8' High Steel Tube Swing Gate, Hardware And Associated Trim.....	981.17	29.85
			<i>For Solid Pickets, Add</i>	214.03	
			<i>For Aluminum With Satin Finish, Add</i>	253.98	
			<i>For Third Rail, Add</i>	66.86	
			<i>For 1" Square x 14 Gauge Pickets, Add</i>	89.15	
			<i>For Color, Add</i>	44.57	
32 31 19 00-0080	EA		6' Wide x 8' High Steel Tube Swing Gate, Hardware And Associated Trim.....	1,013.56	33.80
			<i>For Solid Pickets, Add</i>	220.45	
			<i>For Aluminum With Satin Finish, Add</i>	258.45	
			<i>For Third Rail, Add</i>	68.41	
			<i>For 1" Square x 14 Gauge Pickets, Add</i>	91.22	
			<i>For Color, Add</i>	45.61	
32 31 19 00-0081	EA		7' Wide x 8' High Steel Tube Swing Gate, Hardware And Associated Trim.....	1,262.53	40.72
			<i>For Solid Pickets, Add</i>	274.90	
			<i>For Aluminum With Satin Finish, Add</i>	323.72	
			<i>For Third Rail, Add</i>	85.52	
			<i>For 1" Square x 14 Gauge Pickets, Add</i>	114.02	
			<i>For Color, Add</i>	57.01	
32 31 19 00-0082	EA		8' Wide x 8' High Steel Tube Swing Gate, Hardware And Associated Trim.....	1,489.97	47.39
			<i>For Solid Pickets, Add</i>	324.56	
			<i>For Aluminum With Satin Finish, Add</i>	382.90	
			<i>For Third Rail, Add</i>	101.07	
			<i>For 1" Square x 14 Gauge Pickets, Add</i>	134.76	
			<i>For Color, Add</i>	67.38	
32 31 19 00-0083	EA		9' Wide x 8' High Steel Tube Swing Gate, Hardware And Associated Trim.....	1,552.36	54.39
			<i>For Solid Pickets, Add</i>	337.03	
			<i>For Aluminum With Satin Finish, Add</i>	392.20	
			<i>For Third Rail, Add</i>	104.18	
			<i>For 1" Square x 14 Gauge Pickets, Add</i>	138.90	
			<i>For Color, Add</i>	69.45	
32 31 19 00-0084	EA		10' Wide x 8' High Steel Tube Swing Gate, Hardware And Associated Trim.....	1,656.18	61.40
			<i>For Solid Pickets, Add</i>	358.82	
			<i>For Aluminum With Satin Finish, Add</i>	413.94	
			<i>For Third Rail, Add</i>	110.39	
			<i>For 1" Square x 14 Gauge Pickets, Add</i>	147.19	
			<i>For Color, Add</i>	73.60	
32 31 19 00-0085			Replace Steel Tube Fence Pickets <small>(32 31 19 00-0032)</small>		
32 31 19 00-0086	LF		Replace 3/4" Square x 16 Gauge Steel Tube Fence Picket.....	20.42	
			<i>For 1" Square x 14 Gauge Pickets, Add</i>	0.43	



Exterior Improvements	32	32
Site Improvements	32 30	
Fences And Gates	32 31	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 31 19 00-0087 Remove And Reinstall Ornamental Fences <small>(32 31 19)</small>		
<i>Note: Removal and reinstallation of fences including storage and cleaning. Excludes augering and concrete.</i>		
32 31 19 00-0088 LF Removal And Reinstallation Of Ornamental Fence Up To 5' Height.....	36.21	
32 31 19 00-0089 LF Removal And Reinstallation Of Ornamental Fence, 6' Height	39.82	
32 31 19 00-0090 LF Removal And Reinstallation Of Ornamental Fence, 7' Height	43.45	
32 31 19 00-0091 LF Removal And Reinstallation Of Ornamental Fence, 8' Height	47.07	
32 31 19 00-0092 LF Removal And Reinstallation Of Ornamental Fence, 9' Height	50.69	
32 31 19 00-0093 LF Removal And Reinstallation Of Ornamental Fence, 10' Height	54.31	
32 31 19 00-0094 LF Removal And Reinstallation Of Ornamental Fence 12' Height	60.35	
 32 31 26 Wire Fences And Gates <small>(32 31)</small>		
32 31 26 00-0001 Chicken Wire <small>(32 31 26)</small>		
<i>Note: Posts at 4'.</i>		
32 31 26 00-0002 LF 1" Mesh, 4' High Chicken Wire Posts At 4'	6.39	1.47
32 31 26 00-0003 LF 2" Mesh, 6' High Chicken Wire Posts At 4'	7.09	1.47
 32 31 26 00-0004 Galvanized Steel <small>(32 31 26)</small>		
32 31 26 00-0005 12 Gauge, 2" x 4" Welded Mesh <small>(32 31 26 00-0004)</small>		
<i>Note: Posts 5' on center.</i>		
32 31 26 00-0006 LF 3' High 12 Gauge Galvanized Steel Fence 2" x 4" Mesh, Posts At 5'	7.75	1.47
32 31 26 00-0007 LF 5' High 12 Gauge Galvanized Steel Fence 2" x 4" Mesh, Posts At 5'	8.20	1.47
 32 31 26 00-0008 14 Gauge, 1" x 2" Welded Mesh <small>(32 31 26 00-0004)</small>		
<i>Note: Posts 5' on center.</i>		
32 31 26 00-0009 LF 3' High 14 Gauge Galvanized Steel Fence 1" x 2" Mesh, Posts At 5'	7.66	1.47
32 31 26 00-0010 LF 5' High 14 Gauge Galvanized Steel Fence 1" x 2" Mesh, Posts At 5'	8.06	1.47
 32 31 26 00-0011 Wire And Screen <small>(32 31 26)</small>		
32 31 26 00-0012 Wire And Screen For Partitions And Fences <small>(32 31 26 00-0011)</small>		
<i>Note: Excludes framing and post.</i>		
32 31 26 00-0013 Screen Wire <small>(32 31 26 00-0012)</small>		
32 31 26 00-0014 SF Screen Wire, 48" Wide Rolls.....	2.02	0.72
 32 31 26 00-0015 Hog Wire <small>(32 31 26 00-0012)</small>		
32 31 26 00-0016 SF 4" x 4" Hog Wire For Fencing	1.45	0.58
32 31 26 00-0017 SF 6" x 6" Hog Wire For Fencing	1.52	0.65
 32 31 26 00-0018 Screen For Partitions And Ceilings <small>(32 31 26 00-0011)</small>		
<i>Note: Can be used to support insulation on walls and ceilings.</i>		
32 31 26 00-0019 SF 1" Mesh Chicken Wire	1.30	
 32 31 26 00-0020 Wicket Fence <small>(32 31 26)</small>		
32 31 26 00-0021 LF Steel Wicket Fence, Painted.....	42.97	4.07
 32 31 29 Wood Fences And Gates <small>(32 31)</small>		
32 31 29 00-0001 Basket Weave <small>(32 31 29)</small>		
<i>Note: 3/8" x 4" boards, 4" x 4" post</i>		
32 31 29 00-0002 LF 6' High #1 Cedar Basket Weave Fence 3/8" x 4" Boards, 4" x 4" Post.....	25.27	2.93
<i>For Screwing Of Boards Instead Of Nails, Add</i>		
	1.57	
32 31 29 00-0003 LF 6' High, Pressure Treated Pine Basket Weave 3/8" x 4" Boards, 4" x 4" Post.....	18.88	2.93
<i>For Screwing Of Boards Instead Of Nails, Add</i>		
	1.27	
 32 31 29 00-0004 Board Fence <small>(32 31 29)</small>		
<i>Note: 1x4" board, 2x4" rail, 4x4" post.</i>		
32 31 29 00-0005 LF Board Fence, 2 - 2" x 4" Rails, 3' High 1" x 4" Boards, Preservative Treated.....	16.99	2.93
<i>For 1" x 6" Boards, Deduct</i>		
	-2.17	
<i>For 1" x 3" Boards (Stockade Top), Add</i>		
	2.81	
<i>For Screwing Of Boards Instead Of Nails, Add</i>		
	1.19	
32 31 29 00-0006 LF Board Fence, 2 - 2" x 4" Rails, 4' High 1" x 4" Boards, Preservative Treated.....	18.57	2.93
<i>For 1" x 6" Boards, Deduct</i>		
	-2.34	
<i>For 1" x 3" Boards (Stockade Top), Add</i>		
	3.03	
<i>For Screwing Of Boards Instead Of Nails, Add</i>		
	1.29	
32 31 29 00-0007 LF Board Fence, 3 - 2" x 4" Rails, 5' High 1" x 4" Boards, Preservative Treated.....	20.01	2.93
<i>For 1" x 6" Boards, Deduct</i>		
	-2.46	
<i>For 1" x 3" Boards (Stockade Top), Add</i>		
	3.16	
<i>For Screwing Of Boards Instead Of Nails, Add</i>		
	1.38	

32 Exterior Improvements**32 30 Site Improvements****32 31 Fences And Gates**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 31 29 00-0008	LF		Board Fence, 3 - 2" x 4" Rails, 6' High 1" x 4" Boards, Preservative Treated	21.11	2.93
			<i>For 1" x 6" Boards, Deduct</i>	-2.57	
			<i>For 1" x 3" Boards (Stockade Top), Add</i>	3.30	
			<i>For Screwing Of Boards Instead Of Nails, Add</i>	1.45	
32 31 29 00-0009	LF		Board Fence, 3 - 2" x 4" Rails, 8' High 1" x 4" Boards, Preservative Treated	22.26	2.93
			<i>For 1" x 6" Boards, Deduct</i>	-2.68	
			<i>For 1" x 3" Boards (Stockade Top), Add</i>	3.44	
			<i>For Screwing Of Boards Instead Of Nails, Add</i>	1.52	
32 31 29 00-0010	LF		Board Fence, 2 - 2" x 4" Rails, 3' High 1" x 4" #2 Grade Western Cedar	17.57	2.93
			<i>For 1" x 6" Boards, Deduct</i>	-2.19	
			<i>For 1" x 3" Boards (Stockade Top), Add</i>	2.83	
			<i>For Screwing Of Boards Instead Of Nails, Add</i>	1.22	
32 31 29 00-0011	LF		Board Fence, 2 - 2" x 4" Rails, 4' High 1" x 4" #2 Grade Western Cedar	19.02	2.93
			<i>For 1" x 6" Boards, Deduct</i>	-2.36	
			<i>For 1" x 3" Boards (Stockade Top), Add</i>	3.04	
			<i>For Screwing Of Boards Instead Of Nails, Add</i>	1.31	
32 31 29 00-0012	LF		Board Fence, 3 - 2" x 4" Rails, 5' High 1" x 4" #2 Grade Western Cedar	20.01	2.93
			<i>For 1" x 6" Boards, Deduct</i>	-2.46	
			<i>For 1" x 3" Boards (Stockade Top), Add</i>	3.16	
			<i>For Screwing Of Boards Instead Of Nails, Add</i>	1.38	
32 31 29 00-0013	LF		Board Fence, 3 - 2" x 4" Rails, 6' High 1" x 4" #2 Grade Western Cedar	21.11	2.93
			<i>For 1" x 6" Boards, Deduct</i>	-2.57	
			<i>For 1" x 3" Boards (Stockade Top), Add</i>	3.30	
			<i>For Screwing Of Boards Instead Of Nails, Add</i>	1.45	
32 31 29 00-0014	LF		Board Fence, 3 - 2" x 4" Rails, 8' High 1" x 4" #2 Grade Western Cedar	22.26	2.93
			<i>For 1" x 6" Boards, Deduct</i>	-2.68	
			<i>For 1" x 3" Boards (Stockade Top), Add</i>	3.44	
			<i>For Screwing Of Boards Instead Of Nails, Add</i>	1.52	
32 31 29 00-0015	LF		Board Fence, 2 - 2" x 4" Rails, 3' High 1" x 4" #1 Grade Cedar	17.57	2.93
			<i>For 1" x 6" Boards, Deduct</i>	-2.19	
			<i>For 1" x 3" Boards (Stockade Top), Add</i>	2.83	
			<i>For Screwing Of Boards Instead Of Nails, Add</i>	1.22	
32 31 29 00-0016	LF		Board Fence, 2 - 2" x 4" Rails, 4' High 1" x 4" #1 Grade Cedar	21.01	2.93
			<i>For 1" x 6" Boards, Deduct</i>	-2.44	
			<i>For 1" x 3" Boards (Stockade Top), Add</i>	3.10	
			<i>For Screwing Of Boards Instead Of Nails, Add</i>	1.41	
32 31 29 00-0017	LF		Board Fence, 3 - 2" x 4" Rails, 5' High 1" x 4" #1 Grade Cedar	21.92	2.93
			<i>For 1" x 6" Boards, Deduct</i>	-2.54	
			<i>For 1" x 3" Boards (Stockade Top), Add</i>	3.22	
			<i>For Screwing Of Boards Instead Of Nails, Add</i>	1.47	
32 31 29 00-0018	LF		Board Fence, 3 - 2" x 4" Rails, 6' High 1" x 4" #1 Grade Cedar	23.25	2.93
			<i>For 1" x 6" Boards, Deduct</i>	-2.66	
			<i>For 1" x 3" Boards (Stockade Top), Add</i>	3.36	
			<i>For Screwing Of Boards Instead Of Nails, Add</i>	1.55	
32 31 29 00-0019	LF		Board Fence, 3 - 2" x 4" Rails, 8' High 1" x 4" #1 Grade Cedar	24.64	2.93
			<i>For 1" x 6" Boards, Deduct</i>	-2.78	
			<i>For 1" x 3" Boards (Stockade Top), Add</i>	3.51	
			<i>For Screwing Of Boards Instead Of Nails, Add</i>	1.64	
32 31 29 00-0020			Shadow Box <small>(32 31 29)</small> Note: 1x6" board, 2x4" Rail, 4x4" post.		
32 31 29 00-0021	LF		Shadow Box, 3 - 2" x 4" Rails, 6' High 1" x 6" Pressure Treated Pine	17.60	2.93
			<i>For Screwing Of Boards Instead Of Nails, Add</i>	1.19	
32 31 29 00-0022	LF		Shadow Box, 3 - 2" x 4" Rails, 4' High 1" x 4" #1 Cedar	21.37	2.93
			<i>For Screwing Of Boards Instead Of Nails, Add</i>	1.43	
32 31 29 00-0023	LF		Shadow Box, 3 - 2" x 4" Rails, 6' High 1" x 4" #1 Cedar	22.64	2.93
			<i>For Screwing Of Boards Instead Of Nails, Add</i>	1.51	
32 31 29 00-0024	LF		Shadow Box, 3 - 2" x 4" Rails, 8' High 1" x 4" #1 Cedar	24.29	2.93
			<i>For Screwing Of Boards Instead Of Nails, Add</i>	1.62	
32 31 29 00-0025			Open Rail Fence <small>(32 31 29)</small>		
32 31 29 00-0026			Post And Rail Fence, Ranch Style <small>(32 31 29 00-0025)</small>		
32 31 29 00-0027	LF		Post And Rail Fence, 2 Rails, 3' High #1 Cedar	15.00	2.93
32 31 29 00-0028	LF		Post And Rail Fence, 2 Rails, 3' High #2 Cedar	13.71	2.93
32 31 29 00-0029	LF		Post And Rail Fence, 3 Rails, 4' High #1 Cedar	16.70	2.93
32 31 29 00-0030	LF		Post And Rail Fence, 3 Rails, 4' High #2 Cedar	14.69	2.93
32 31 29 00-0031			Split Rail Fence <small>(32 31 29 00-0025)</small>		
32 31 29 00-0032	LF		Split Rail Fence, 2 Rails, 3' High #1 Cedar	14.67	2.93
32 31 29 00-0033	LF		Split Rail Fence, 2 Rails, 3' High #2 Cedar	13.69	2.93
32 31 29 00-0034	LF		Split Rail Fence, 3 Rail, 4' High #1 Cedar	16.06	2.93
32 31 29 00-0035	LF		Split Rail Fence, 3 Rail, 4' High #2 Cedar	14.87	2.93
32 31 29 00-0036			Picket Fence <small>(32 31 29)</small>		
32 31 29 00-0037	LF		Picket Fence, 2 Rail, 3' High, Pressure Treated	16.09	2.93
			<i>For Screwing Of Boards Instead Of Nails, Add</i>	1.15	
32 31 29 00-0038	LF		Picket Fence, 2 Rail, 3' High #1 Cedar	15.80	2.93
			<i>For Screwing Of Boards Instead Of Nails, Add</i>	1.14	



		Exterior Improvements	32
		Site Improvements	32 30
		Fences And Gates	32 31

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 31 29 00-0039			Wood Gate (32 31 29)		
32 31 29 00-0040			Board Fence Gates, Pressure Treated Wood (32 31 29 00-0039)		
			Note: Includes galvanized extra duty hinges (1-1/2 butts per leaf), a galvanized latch and extra heavy-duty wheels per leaf, based on 2x4 frame, 1x4 cover, galvanized nails and hinges (treated lumber).		
32 31 29 00-0041	EA		3' To 5' High x 3' Wide, Pressure Treated Board Gate, 2 - 2" x 4" Rails With 1" x 4" Board, Post And Hardware	242.55	96.01
32 31 29 00-0042	EA		3' To 5' High x 3'-6" Wide, Pressure Treated Board Gate, 2 - 2" x 4" Rails With 1" x 4" Board, Post And Hardware	263.17	101.77
32 31 29 00-0043	EA		3' To 5' High x 4' Wide, Pressure Treated Board Gate, 2 - 2" x 4" Rails With 1" x 4" Board, Post And Hardware	291.46	111.37
32 31 29 00-0044	EA		3' To 5' High x 5' Wide, Pressure Treated Board Gate, 2 - 2" x 4" Rails With 1" x 4" Board, Post And Hardware	320.17	117.13
32 31 29 00-0045	EA		3' To 5' High x 6' Wide, Pressure Treated Board Gate, 2 - 2" x 4" Rails With 1" x 4" Board, Post And Hardware	348.86	122.89
32 31 29 00-0046	EA		>5' To 8' High x 3' Wide, Pressure Treated Board Gate, 3 - 2" x 4" Rails With 1" x 4" Board, Post And Hardware	314.11	126.73
32 31 29 00-0047	EA		>5' To 8' High x 3'-6" Wide, Pressure Treated Board Gate, 3 - 2" x 4" Rails With 1" x 4" Board, Post And Hardware	335.73	132.49
32 31 29 00-0048	EA		>5' To 8' High x 4' Wide, Pressure Treated Board Gate, 3 - 2" x 4" Rails With 1" x 4" Board, Post And Hardware	357.35	138.25
32 31 29 00-0049	EA		>5' To 8' High x 5' Wide, Pressure Treated Board Gate, 3 - 2" x 4" Rails With 1" x 4" Board, Post And Hardware	389.09	144.02
32 31 29 00-0050	EA		>5' To 8' High x 6' Wide, Pressure Treated Board Gate, 3 - 2" x 4" Rails With 1" x 4" Board, Post And Hardware	415.77	149.77
32 31 29 00-0051			Board Fence Gates, Grade 2 Cedar (32 31 29 00-0039)		
			Note: Includes galvanized extra duty hinges (1-1/2 butts per leaf), a galvanized latch and extra heavy-duty wheels per leaf, based on 2x4 frame, 1x4 cover, galvanized nails and hinges (cedar lumber)		
32 31 29 00-0052	EA		3' To 5' High x 3' Wide, #2 Cedar Board Gate, 3 - 2" x 4" Rails With 1" x 4" Board, Post And Hardware	319.95	91.75
32 31 29 00-0053	EA		3' To 5' High x 3'-6" Wide, #2 Cedar Board Gate, 3 - 2" x 4" Rails With 1" x 4" Board, Post And Hardware	333.99	97.26
32 31 29 00-0054	EA		3' To 5' High x 4' Wide, #2 Cedar Board Gate, 3 - 2" x 4" Rails With 1" x 4" Board, Post And Hardware	356.39	106.44
32 31 29 00-0055	EA		3' To 5' High x 5' Wide, #2 Cedar Board Gate, 3 - 2" x 4" Rails With 1" x 4" Board, Post And Hardware	375.48	111.94
32 31 29 00-0056	EA		3' To 5' High x 6' Wide, #2 Cedar Board Gate, 3 - 2" x 4" Rails With 1" x 4" Board, Post And Hardware	397.61	117.45
32 31 29 00-0057	EA		>5' To 8' High x 3' Wide, #2 Cedar Board Gate, 3 - 2" x 4" Rails With 1" x 4" Board, Post And Hardware	393.83	121.12
32 31 29 00-0058	EA		>5' To 8' High x 3'-6" Wide, #2 Cedar Board Gate, 3 - 2" x 4" Rails With 1" x 4" Board, Post And Hardware	409.89	126.62
32 31 29 00-0059	EA		>5' To 8' High x 4' Wide, #2 Cedar Board Gate, 3 - 2" x 4" Rails With 1" x 4" Board, Post And Hardware	431.01	132.13
32 31 29 00-0060	EA		>5' To 8' High x 5' Wide, #2 Cedar Board Gate, 3 - 2" x 4" Rails With 1" x 4" Board, Post And Hardware	452.13	137.63
32 31 29 00-0061	EA		>5' To 8' High x 6' Wide, #2 Cedar Board Gate, 3 - 2" x 4" Rails With 1" x 4" Board, Post And Hardware	473.24	143.14
32 31 29 00-0062			Board Fence Gates, Grade 1 Cedar (32 31 29 00-0039)		
			Note: Includes galvanized extra duty hinges (1-1/2 butts per leaf), a galvanized latch and extra heavy-duty wheels per leaf, based on 2x4 frame, 1x4 cover, galvanized nails and hinges (cedar lumber)		
32 31 29 00-0063	EA		3' To 5' High x 3' Wide, #1 Cedar Board Gate, 2 - 2" x 4" Rails With 1" x 4" Board, Post And Hardware	335.11	91.75
32 31 29 00-0064	EA		3' To 5' High x 3'-6" Wide, #1 Cedar Board Gate, 2 - 2" x 4" Rails With 1" x 4" Board, Post And Hardware	351.17	97.26
32 31 29 00-0065	EA		3' To 5' High x 4' Wide, #1 Cedar Board Gate, 2 - 2" x 4" Rails With 1" x 4" Board, Post And Hardware	374.58	106.44
32 31 29 00-0066	EA		3' To 5' High x 5' Wide, #1 Cedar Board Gate, 2 - 2" x 4" Rails With 1" x 4" Board, Post And Hardware	395.69	111.94
32 31 29 00-0067	EA		3' To 5' High x 6' Wide, #1 Cedar Board Gate, 2 - 2" x 4" Rails With 1" x 4" Board, Post And Hardware	416.81	117.45
32 31 29 00-0068	EA		>5' To 8' High x 3' Wide, #1 Cedar Board Gate, 3 - 2" x 4" Rails With 1" x 4" Board, Post And Hardware	414.04	121.12
32 31 29 00-0069	EA		>5' To 8' High x 3'-6" Wide, #1 Cedar Board Gate, 3 - 2" x 4" Rails With 1" x 4" Board, Post And Hardware	430.11	126.62
32 31 29 00-0070	EA		>5' To 8' High x 4' Wide, #1 Cedar Board Gate, 3 - 2" x 4" Rails With 1" x 4" Board, Post And Hardware	451.22	132.13
32 31 29 00-0071	EA		>5' To 8' High x 5' Wide, #1 Cedar Board Gate, 3 - 2" x 4" Rails With 1" x 4" Board, Post And Hardware	472.34	137.63
32 31 29 00-0072	EA		>5' To 8' High x 6' Wide, #1 Cedar Board Gate, 3 - 2" x 4" Rails With 1" x 4" Board, Post And Hardware	498.51	143.14
32 31 29 00-0073			Pressure Treated Wood Fence Posts (32 31 29)		
			See CSI section 32 31 13 00-0001 for drilling augering, 32 31 56 00-0014 for barbed wire.		
32 31 29 00-0074	EA		4' High, Pressure Treated Wood Fence Posts, Set In Soil, Earth Fill	23.62	9.60
32 31 29 00-0075	EA		6' High, Pressure Treated Wood Fence Posts, Set In Soil, Earth Fill	25.21	9.60
32 31 29 00-0076	EA		4' High, Pressure Treated Wood Fence Posts, Set In Concrete	43.33	18.43
32 31 29 00-0077	EA		6' High, Pressure Treated Wood Fence Posts, Set In Concrete	45.15	18.43
32 31 56			Wild Life Deterrent Fence (32 31)		
32 31 56 00-0001			Barbed Wire Fences (32 31 56)		
			See CSI section 32 31 13 00-0001 for drilling augering.		
32 31 56 00-0002			Fence Posts (32 31 56 00-0001)		
32 31 56 00-0003			Fence Post Soil, Set In Concrete (32 31 56 00-0002)		
32 31 56 00-0004	EA		Barbed Wire Fence Post, Galvanized Set In Concrete In Soil	65.90	6.43
			<i>For Bracing On Corner Post, End Post And Pull Post, Add</i>	105.49	
32 31 56 00-0005	EA		Barbed Wire Fence Post, Vinyl Coated Set In Concrete In Soil	86.23	6.43
			<i>For Bracing On Corner Post, End Post And Pull Post, Add</i>	139.44	
32 31 56 00-0006			Post In Rock (32 31 56 00-0002)		
32 31 56 00-0007	EA		Barbed Wire Fence Post, Galvanized Grouted In Rock	64.48	6.43
			<i>For Bracing On Corner Post, End Post And Pull Post, Add</i>	103.36	
32 31 56 00-0008	EA		Barbed Wire Fence Post, Vinyl Coated Grouted In Rock	84.81	6.43
			<i>For Bracing On Corner Post, End Post And Pull Post, Add</i>	137.31	
32 31 56 00-0009			Post Driven Into Dirt (32 31 56 00-0002)		
			Note: Posts for barb wire, chain link or welded wire mesh.		
32 31 56 00-0010	EA		3' Metal Posts, Driven Into Earth	20.26	
32 31 56 00-0011	EA		4' Metal Posts, Driven Into Earth	22.12	
32 31 56 00-0012	EA		5' Metal Posts, Driven Into Earth	24.53	

32 Exterior Improvements**32 30 Site Improvements****32 31 Fences And Gates**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 31 56 00-0013	EA		6' Metal Posts, Driven Into Earth.....	26.39	
32 31 56 00-0014			Barbed Wire <small>(32 31 56 00-0001)</small>		
			Note: Per strand.		
32 31 56 00-0015	LF		Barbed Wire, Galvanized Per Strand.....	0.69	0.32
32 31 56 00-0016	LF		Barbed Wire, Vinyl Coated Per Strand.....	0.73	0.32
32 31 56 00-0017			Barbed Wire Fence, Farm Style, With Wood Posts <small>(32 31 56 00-0001)</small>		
			Note: Based on post at 10' centers, two corner post and two pull post per 300 lf.		
32 31 56 00-0018	LF		Barbed Wire, Standard 3 Strand Fence With Posts.....	8.37	1.61
32 32 Retaining Walls <small>(32 30)</small>					
32 32 13 Cast-In-Place Concrete Retaining Wall <small>(32 32)</small>					
			Note: System elements include all necessary forms (4 uses), 3000 PSI concrete with an 8" chute, all necessary reinforcing steel, and underdrain. Exposed concrete is patched and rubbed. Excludes initial site grading, subbase preparation or finish grading.		
32 32 13 00-0001	LF		4' High With Base, 10" Thick Reinforced.....	273.55	103.96
			<i>For >3:1 Sloped Soil At Top, Add</i>	5.58	
32 32 13 00-0002	LF		6' High With Base, 10" Thick Reinforced.....	340.76	127.93
			<i>For >3:1 Sloped Soil At Top, Add</i>	7.21	
32 32 13 00-0003	LF		8' High With Base, 10" Thick Reinforced.....	370.78	137.99
			<i>For >3:1 Sloped Soil At Top, Add</i>	8.06	
32 32 13 00-0004	LF		10' High With Base, 13" Thick Reinforced.....	470.82	170.62
			<i>For >3:1 Sloped Soil At Top, Add</i>	11.02	
32 32 13 00-0005	LF		12' High With Base, 14" Thick Reinforced.....	542.46	195.98
			<i>For >3:1 Sloped Soil At Top, Add</i>	12.79	
32 32 13 00-0006	LF		16' High With Base, 16" Thick Reinforced.....	785.87	287.51
			<i>For >3:1 Sloped Soil At Top, Add</i>	17.93	
32 32 13 00-0007	LF		20' High With Base, 18" Thick Reinforced.....	1,079.50	396.93
			<i>For >3:1 Sloped Soil At Top, Add</i>	24.27	
32 32 13 00-0008	LF		4' High With Base, 12" Thick Reinforced.....	300.42	113.54
			<i>For >3:1 Sloped Soil At Top, Add</i>	6.23	
32 32 13 00-0009	LF		6' High With Base, 12" Thick Reinforced.....	367.10	136.80
			<i>For >3:1 Sloped Soil At Top, Add</i>	7.95	
32 32 13 00-0010	LF		8' High With Base, 12" Thick Reinforced.....	388.10	142.75
			<i>For >3:1 Sloped Soil At Top, Add</i>	8.72	
32 32 13 00-0011	LF		10' High With Base, 16" Thick Reinforced.....	532.47	191.30
			<i>For >3:1 Sloped Soil At Top, Add</i>	12.73	
32 32 13 00-0012	LF		12' High With Base, 18" Thick Reinforced.....	676.05	245.73
			<i>For >3:1 Sloped Soil At Top, Add</i>	15.69	
32 32 13 00-0013	LF		16' High With Base, 21" Thick Reinforced.....	1,014.85	372.47
			<i>For >3:1 Sloped Soil At Top, Add</i>	22.95	
32 32 13 00-0014	LF		20' High With Base, 24" Thick Reinforced.....	1,432.31	525.76
			<i>For >3:1 Sloped Soil At Top, Add</i>	32.37	
32 32 16 Precast Concrete Retaining Walls <small>(32 32)</small>					
32 32 16 00-0001			Precast Retaining Walls <small>(32 32 16)</small>		
			Note: Tied-back earth walls. Includes precast filter fabric, soil reinforcing mesh and cast-in-place coping. Excludes concrete leveling pad, or select earth excavation and backfill.		
32 32 16 00-0002	SF		Precast Concrete Retaining Walls, 10-15' high Tied-back Earth Walls.....	35.29	9.67
32 32 16 00-0003	SF		Precast Concrete Retaining Walls, 16-20' High Tied-back Earth Walls.....	34.67	7.77
32 32 16 00-0004	SF		Precast Concrete Retaining Walls, 21-25' High Tied-back Earth Walls.....	34.83	6.47
32 32 16 00-0005	SF		Precast Concrete Retaining Walls, 26-30' High Tied-back Earth Walls.....	37.29	6.47
32 32 16 00-0006	SF		Precast Concrete Retaining Walls, >30' High Tied-back Earth Walls.....	38.52	5.53
32 32 23 Segmental Retaining Walls <small>(32 32)</small>					
32 32 23 13 Segmental Concrete Unit Masonry Retaining Walls <small>(32 32 23)</small>					
32 32 23 13-0001			Modular Retaining Wall Systems <small>(32 32 23 13)</small>		
			Note: Includes installation, material and manufacture's wall design. Includes stone wall, cap stones, #57 stone backing, Geo-Grid (2/3 height of wall), miradrain and fill with earth, and compaction. Includes cap at top, pins, and installation. Excludes initial site grading, subbase preparation or finish grading.		
32 32 23 13-0002			"Amastone" Type Modular Retaining Wall Systems <small>(32 32 23 13-0001)</small>		
32 32 23 13-0003	SF		Up To 4' Height "Amastone" Type Modular Retaining Wall System.....	52.71	6.19
			<i>For >3:1 Sloped Soil At Top, Add</i>	3.43	
32 32 23 13-0004	SF		4 To 8' Height "Amastone" Type Modular Retaining Wall System.....	55.62	6.51
			<i>For >3:1 Sloped Soil At Top, Add</i>	3.62	
32 32 23 13-0005	SF		8 To 12' Height "Amastone" Type Modular Retaining Wall System.....	57.89	7.17
			<i>For >3:1 Sloped Soil At Top, Add</i>	3.70	
32 32 23 13-0006	SF		12 To 16' Height "Amastone" Type Modular Retaining Wall System.....	60.29	7.83
			<i>For >3:1 Sloped Soil At Top, Add</i>	3.80	
32 32 23 13-0007			"Diamond" Type Modular Retaining Wall Systems <small>(32 32 23 13-0001)</small>		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 32 23 13-0008 SF Up To 4' Height "Diamond" Type Modular Retaining Wall System <i>For >3:1 Sloped Soil At Top, Add</i>	54.82 3.61	6.19
32 32 23 13-0009 SF 4 To 8' Height "Diamond" Type Modular Retaining Wall System <i>For >3:1 Sloped Soil At Top, Add</i>	57.73 3.80	6.51
32 32 23 13-0010 SF 8 To 12' Height "Diamond" Type Modular Retaining Wall System <i>For >3:1 Sloped Soil At Top, Add</i>	59.99 3.88	7.17
32 32 23 13-0011 SF 12 To 16' Height "Diamond" Type Modular Retaining Wall System <i>For >3:1 Sloped Soil At Top, Add</i>	62.40 3.97	7.83
32 32 23 13-0012 "Keystone" Type Modular Retaining Wall Systems (32 32 23 13-0001)		
32 32 23 13-0013 SF Up To 4' Height "Keystone" Type Modular Retaining Wall System <i>For >3:1 Sloped Soil At Top, Add</i>	59.86 4.04	6.19
32 32 23 13-0014 SF 4 To 8' Height "Keystone" Type Modular Retaining Wall System <i>For >3:1 Sloped Soil At Top, Add</i>	62.77 4.23	6.51
32 32 23 13-0015 SF 8 To 12' Height "Keystone" Type Modular Retaining Wall System <i>For >3:1 Sloped Soil At Top, Add</i>	65.03 4.31	7.17
32 32 23 13-0016 SF 12 To 16' Height "Keystone" Type Modular Retaining Wall System <i>For >3:1 Sloped Soil At Top, Add</i>	67.44 4.40	7.83
32 32 23 13-0017 "Criblock" Type Modular Retaining Wall Systems (32 32 23 13-0001)		
32 32 23 13-0018 SF Up To 4' Height "Criblock" Type Modular Retaining Wall System <i>For >3:1 Sloped Soil At Top, Add</i> <i>For Gravel Backfill Instead Of Earth, Add</i>	52.71 3.43 0.25	6.19
32 32 23 13-0019 SF 4 To 8' Height "Criblock" Type Modular Retaining Wall System <i>For >3:1 Sloped Soil At Top, Add</i> <i>For Gravel Backfill Instead Of Earth, Add</i>	55.62 3.62 0.25	6.51
32 32 23 13-0020 SF 8 To 12' Height "Criblock" Type Modular Retaining Wall System <i>For >3:1 Sloped Soil At Top, Add</i> <i>For Gravel Backfill Instead Of Earth, Add</i>	57.89 3.70 0.25	7.17
32 32 23 13-0021 SF 12 To 16' Height "Criblock" Type Modular Retaining Wall System <i>For >3:1 Sloped Soil At Top, Add</i> <i>For Gravel Backfill Instead Of Earth, Add</i>	60.29 3.80 0.25	7.83
32 32 23 13-0022 "Versa-Lok" Type Modular Retaining Wall Systems (32 32 23 13-0001)		
32 32 23 13-0023 SF Up To 4' Height "Versa-Lok" Type Modular Retaining Wall System <i>For >3:1 Sloped Soil At Top, Add</i>	46.32 2.88	6.19
32 32 23 13-0024 SF 4 To 8' Height "Versa-Lok" Type Modular Retaining Wall System <i>For >3:1 Sloped Soil At Top, Add</i>	51.33 3.25	6.51
32 32 23 13-0025 SF 8 To 12' Height "Versa-Lok" Type Modular Retaining Wall System <i>For >3:1 Sloped Soil At Top, Add</i>	53.64 3.34	7.17
32 32 23 13-0026 SF 12 To 16' Height "Versa-Lok" Type Modular Retaining Wall System <i>For >3:1 Sloped Soil At Top, Add</i>	55.65 3.40	7.83
32 32 23 13-0027 Retaining Wall Cap Block Restoration (32 32 23 13-0001)		
32 32 23 13-0028 LF Removal And Reinstall Retaining Wall Cap Block And Pins <i>For >3:1 Sloped Soil At Top, Add</i>	20.86 1.01	
32 32 26 Metal Crib Retaining Walls (32 32)		
32 32 26 00-0001 Bin Type Retaining Wall (32 32 26)		
32 32 26 00-0002 Vertical Bin Walls (32 32 26 00-0001)		
<i>Note: Excludes excavation and backfill.</i>		
32 32 26 00-0003 SF 5.5' Vertical Bin Retaining Wall, Wall Heights To 11'	43.29	
32 32 26 00-0004 SF 7.7' Vertical Bin Retaining Wall, Wall Heights 8.33' To 16.33'	50.26	
32 32 26 00-0005 SF 9.9' Vertical Bin Retaining Wall, Wall Heights 13.67' To 21.67'	58.43	
32 32 26 00-0006 SF 12.1' Vertical Bin Retain Wall, Wall Heights 17.67' To 25.67'	62.61	
32 32 26 00-0007 SF 14.3' Vertical Bin Retain Wall, Wall Heights 20.33' To 28.33'	70.26	
32 32 26 00-0008 SF 16.5' Vertical Bin Retain Wall, Wall Heights 20.33' To 28.33'	74.44	
32 32 26 00-0009 Battered Bin Walls (32 32 26 00-0001)		
<i>Note: Excludes excavation and backfill.</i>		
32 32 26 00-0010 SF 5.5' Battered Bin Retain Wall, Wall Heights To 11'	39.74	
32 32 26 00-0011 SF 7.7' Battered Bin Retain Wall, Wall Heights 8.33' To 16.33'	42.53	
32 32 26 00-0012 SF 9.9' Battered Bin Retain Wall, Wall Heights 13.67' To 21.67'	47.85	
32 32 26 00-0013 SF 12.1' Battered Bin Retain Wall, Wall Heights 17.67' To 25.67'	52.72	
32 32 26 00-0014 SF 14.3' Battered Bin Retain Wall, Wall Heights 20.33' To 28.33'	61.81	
32 32 26 00-0015 SF 16.5' Battered Bin Retain Wall, Wall Heights 20.33' To 28.33'	63.21	
32 32 26 00-0016 Aluminized Steel Bin (32 32 26)		
<i>Note: Excludes excavation and backfill.</i>		
32 32 26 00-0017 SF 4' High, 5.5' Deep Aluminized Steel Bin	32.56	3.75
<i>For >3:1 Sloped Soil At Top, Add</i>	2.13	
<i>For Galvanized Type, Deduct</i>	-2.51	

32 Exterior Improvements**32 30 Site Improvements****32 32 Retaining Walls**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 32 26 00-0018	SF		8' High, 5.5' Deep Aluminized Steel Bin.....	36.43	3.75
			<i>For >3:1 Sloped Soil At Top, Add</i>	2.45	
			<i>For Galvanized Type, Deduct</i>	-2.89	
32 32 26 00-0019	SF		10' High, 7.7' Deep Aluminized Steel Bin.....	38.92	4.11
			<i>For >3:1 Sloped Soil At Top, Add</i>	2.61	
			<i>For Galvanized Type, Deduct</i>	-3.08	
32 32 26 00-0020	SF		12' High, 7.7' Deep Aluminized Steel Bin.....	44.32	4.63
			<i>For >3:1 Sloped Soil At Top, Add</i>	2.98	
			<i>For Galvanized Type, Deduct</i>	-3.51	
32 32 26 00-0021	SF		16' High, 7.7' Deep Aluminized Steel Bin.....	42.71	4.80
			<i>For >3:1 Sloped Soil At Top, Add</i>	2.82	
			<i>For Galvanized Type, Deduct</i>	-3.32	
32 32 26 00-0022	SF		16' High, 9.9' Deep Aluminized Steel Bin.....	47.58	4.89
			<i>For >3:1 Sloped Soil At Top, Add</i>	3.22	
			<i>For Galvanized Type, Deduct</i>	-3.79	
32 32 26 00-0023	SF		20' High, 9.9' Deep Aluminized Steel Bin.....	52.76	5.16
			<i>For >3:1 Sloped Soil At Top, Add</i>	3.60	
			<i>For Galvanized Type, Deduct</i>	-4.24	
32 32 26 00-0024	SF		20' High, 12.1' Deep Aluminized Steel Bin.....	54.03	5.41
			<i>For >3:1 Sloped Soil At Top, Add</i>	3.68	
			<i>For Galvanized Type, Deduct</i>	-4.33	
32 32 26 00-0025	SF		24' High, 12.1' Deep Aluminized Steel Bin.....	56.82	5.41
			<i>For >3:1 Sloped Soil At Top, Add</i>	3.91	
			<i>For Galvanized Type, Deduct</i>	-4.60	
32 32 26 00-0026	SF		24' High, 14.3' Deep Aluminized Steel Bin.....	59.61	5.50
			<i>For >3:1 Sloped Soil At Top, Add</i>	4.14	
			<i>For Galvanized Type, Deduct</i>	-4.87	
32 32 26 00-0027	SF		28' High, 14.3' Deep Aluminized Steel Bin.....	61.60	5.59
			<i>For >3:1 Sloped Soil At Top, Add</i>	4.29	
			<i>For Galvanized Type, Deduct</i>	-5.05	

32 32 29 Timber Retaining Walls (32 32)**32 32 29 00-0001 Wood Post Retaining Walls (32 32 29)**

Note: System elements include wood posts installed side-by-side to various heights, and underdrain. Excludes initial site grading, subbase preparation or finish grading.

32 32 29 00-0002	LF		4" x 4", 1' High, Redwood.....	54.96	20.12
			<i>For >3:1 Sloped Soil At Top, Add</i>	1.26	
32 32 29 00-0003	LF		4" x 4", 2' High, Redwood.....	107.58	39.39
			<i>For >3:1 Sloped Soil At Top, Add</i>	2.45	
32 32 29 00-0004	LF		4" x 4", 1' High, Cedar.....	53.07	20.12
			<i>For >3:1 Sloped Soil At Top, Add</i>	1.10	
32 32 29 00-0005	LF		4" x 4", 2' High, Cedar.....	103.91	39.39
			<i>For >3:1 Sloped Soil At Top, Add</i>	2.14	
32 32 29 00-0006	LF		4" x 4", 1' High, Pressure Treated Lumber.....	49.36	17.58
			<i>For >3:1 Sloped Soil At Top, Add</i>	1.20	
32 32 29 00-0007	LF		4" x 4", 2' High, Pressure Treated Lumber.....	96.60	34.38
			<i>For >3:1 Sloped Soil At Top, Add</i>	2.36	
32 32 29 00-0008	LF		4" x 4", 1' High, Creosoted Lumber.....	43.70	15.60
			<i>For >3:1 Sloped Soil At Top, Add</i>	1.06	
32 32 29 00-0009	LF		4" x 4", 2' High, Creosoted Lumber.....	79.01	28.23
			<i>For >3:1 Sloped Soil At Top, Add</i>	1.92	
32 32 29 00-0010	LF		6 x 6, 2' High, Redwood.....	143.68	47.72
			<i>For >3:1 Sloped Soil At Top, Add</i>	4.10	
32 32 29 00-0011	LF		6 x 6, 4' High, Redwood.....	283.50	93.53
			<i>For >3:1 Sloped Soil At Top, Add</i>	8.20	
32 32 29 00-0012	LF		6 x 6, 2' High, Cedar.....	141.59	47.72
			<i>For >3:1 Sloped Soil At Top, Add</i>	3.92	
32 32 29 00-0013	LF		6 x 6, 4' High, Cedar.....	278.25	93.53
			<i>For >3:1 Sloped Soil At Top, Add</i>	7.76	
32 32 29 00-0014	LF		6 x 6, 2' High, Pressure Treated Lumber.....	122.66	38.76
			<i>For >3:1 Sloped Soil At Top, Add</i>	3.83	
32 32 29 00-0015	LF		6 x 6, 4' High, Pressure Treated Lumber.....	243.30	76.52
			<i>For >3:1 Sloped Soil At Top, Add</i>	7.67	
32 32 29 00-0016	LF		6 x 6, 2' High, Creosoted Lumber.....	98.23	30.99
			<i>For >3:1 Sloped Soil At Top, Add</i>	3.08	
32 32 29 00-0017	LF		6 x 6, 4' High, Creosoted Lumber.....	193.13	60.64
			<i>For >3:1 Sloped Soil At Top, Add</i>	6.11	
32 32 29 00-0018	LF		8 x 8, 4' High, Redwood.....	350.58	103.42
			<i>For >3:1 Sloped Soil At Top, Add</i>	12.22	
32 32 29 00-0019	LF		8 x 8, 6' High, Redwood.....	655.68	193.06
			<i>For >3:1 Sloped Soil At Top, Add</i>	22.92	
32 32 29 00-0020	LF		8 x 8, 4' High, Cedar.....	340.09	103.42
			<i>For >3:1 Sloped Soil At Top, Add</i>	11.32	
32 32 29 00-0021	LF		8 x 8, 6' High, Cedar.....	635.75	193.06
			<i>For >3:1 Sloped Soil At Top, Add</i>	21.22	
32 32 29 00-0022	LF		8 x 8, 4' High, Pressure Treated Lumber.....	345.62	119.30
			<i>For >3:1 Sloped Soil At Top, Add</i>	9.10	
32 32 29 00-0023	LF		8 x 8, 6' High, Pressure Treated Lumber.....	644.90	222.79
			<i>For >3:1 Sloped Soil At Top, Add</i>	16.94	
32 32 29 00-0024	LF		8 x 8, 4' High, Creosoted Lumber.....	279.38	96.43
			<i>For >3:1 Sloped Soil At Top, Add</i>	7.36	
32 32 29 00-0025	LF		8 x 8, 6' High, Creosoted Lumber.....	518.20	178.88
			<i>For >3:1 Sloped Soil At Top, Add</i>	13.64	



Exterior Improvements	32
Site Improvements	32 30
Retaining Walls	32 32

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 32 29 00-0026 LF Random Diameter Poles, Cedar 4' High.....	105.77	39.74
For >3:1 Sloped Soil At Top, Add	2.23	
32 32 29 00-0027 LF Random Diameter Poles, Cedar 6' High.....	158.12	59.65
For >3:1 Sloped Soil At Top, Add	3.30	
32 32 29 00-0028 LF Random Diameter Poles, Cedar 8' High.....	210.42	79.49
For >3:1 Sloped Soil At Top, Add	4.37	
32 32 29 00-0029 LF Random Diameter Poles, 4' High Creosoted Lumber.....	70.64	22.45
For >3:1 Sloped Soil At Top, Add	2.18	
32 32 29 00-0030 LF Random Diameter Poles, 6' High Creosoted Lumber.....	102.58	32.40
For >3:1 Sloped Soil At Top, Add	3.21	
32 32 29 00-0031 LF Random Diameter Poles, 8' High.....	138.88	43.77
For >3:1 Sloped Soil At Top, Add	4.37	
32 32 29 00-0032 Post And Board Retaining Walls (32 32 29)		
Note: System includes all the elements that must go into a wall that resists lateral pressure. System elements include posts and boards, cap, underdrain, and deadman where required. Excludes initial site grading, subbase preparation or finish grading.		
32 32 29 00-0033 LF 4 x 4 Post, 4' Spacing, 3' High Redwood, 2' Planking.....	42.90	11.93
For >3:1 Sloped Soil At Top, Add	1.62	
32 32 29 00-0034 LF 4 x 4 Post, 2' Spacing, 4' High 2" Planking, Redwood.....	66.46	20.40
For >3:1 Sloped Soil At Top, Add	2.18	
32 32 29 00-0035 LF 6 x 6 Post, 4' Spacing, 5' High 2" Planking, Redwood.....	86.90	25.34
For >3:1 Sloped Soil At Top, Add	3.08	
32 32 29 00-0036 LF 6 x 6 Post, 3' Spacing, 6' High 2" Planking, Redwood.....	121.62	35.93
For >3:1 Sloped Soil At Top, Add	4.24	
32 32 29 00-0037 LF 6 x 6 With Deadman, 3' Spacing, 8' High 2" Planking, Redwood.....	159.01	46.74
For >3:1 Sloped Soil At Top, Add	5.57	
32 32 29 00-0038 LF 8 x 8 Post, 2' Spacing, 8' High 2" Planking, Redwood.....	325.51	92.47
For >3:1 Sloped Soil At Top, Add	11.95	
32 32 29 00-0039 LF 8 x 8 With Deadman, 2' Spacing, 9' High, 2" Planking, Redwood.....	367.42	102.42
For >3:1 Sloped Soil At Top, Add	13.82	
32 32 29 00-0040 LF 4 x 4 Post, 4' Spacing, 3' High, 2" Planking, Cedar.....	43.64	12.42
For >3:1 Sloped Soil At Top, Add	1.60	
32 32 29 00-0041 LF 4 x 4 With Deadman, 2' Spacing, 4' High 2" Planking, Cedar.....	76.67	22.10
For >3:1 Sloped Soil At Top, Add	2.76	
32 32 29 00-0042 LF 6 x 6 Post, 4' Spacing, 4' High 2" Planking, Cedar.....	75.34	21.67
For >3:1 Sloped Soil At Top, Add	2.72	
32 32 29 00-0043 LF 6 x 6 Post, 3' Spacing, 5' High 2" Planking, Cedar.....	105.78	31.14
For >3:1 Sloped Soil At Top, Add	3.70	
32 32 29 00-0044 LF 6 x 6 Post, 2' Spacing, 6' High 2" Planking, Cedar.....	164.99	49.69
For >3:1 Sloped Soil At Top, Add	5.57	
32 32 29 00-0045 LF 6 x 6 Post With Deadman, 3' Spacing, 6' High, 2" Planking, Cedar.....	130.38	38.19
For >3:1 Sloped Soil At Top, Add	4.59	
32 32 29 00-0046 LF 8 x 8 Post With Deadman, 2' Spacing, 8' High, 2" Planking, Cedar.....	336.66	95.44
For >3:1 Sloped Soil At Top, Add	12.39	
32 32 29 00-0047 LF 4 x 4 Post, 4' Spacing, 3' High 2" Planking, Pressure Treated.....	56.69	22.94
For >3:1 Sloped Soil At Top, Add	0.91	
32 32 29 00-0048 LF 4 x 4 Post, 3' Spacing, 4' High 2" Planking, Pressure Treated.....	81.86	32.61
For >3:1 Sloped Soil At Top, Add	1.41	
32 32 29 00-0049 LF 4 x 4 Post With Deadman, 2' Space, 5' High, 2" Planking, Pressure Treat.....	118.32	44.75
For >3:1 Sloped Soil At Top, Add	2.45	
32 32 29 00-0050 LF 6 x 6 Post, 3' Spacing, 6' High, 2" Planking, Pressure Treated.....	207.22	75.53
For >3:1 Sloped Soil At Top, Add	4.77	
32 32 29 00-0051 LF 6 x 6 Post, 2' Spacing, 7' High, 2" Planking, Pressure Treated.....	209.84	75.53
For >3:1 Sloped Soil At Top, Add	4.99	
32 32 29 00-0052 LF 6 x 6 Post With Deadman, 3' Spacing 8' High, 2" Planking, Pressure Treat.....	197.62	72.57
For >3:1 Sloped Soil At Top, Add	4.46	
32 32 29 00-0053 LF 8 x 8 Post With Deadman, 2' Spacing 10' High, 2" Planking, Pressure Treated.....	463.93	166.95
For >3:1 Sloped Soil At Top, Add	11.06	
32 32 29 00-0054 LF 4 x 4 Post, 4' Spacing, 3' High Creosoted 2" Planking.....	56.69	22.94
For >3:1 Sloped Soil At Top, Add	0.91	
32 32 29 00-0055 LF 4 x 4 Post, 3' Spacing, 4' High Creosoted, 2" Planking.....	81.86	32.61
For >3:1 Sloped Soil At Top, Add	1.41	
32 32 29 00-0056 LF 4 x 4 Post With Deadman, 2' Spacing, 5' High, Creosoted, 2" Planking.....	118.32	44.75
For >3:1 Sloped Soil At Top, Add	2.45	
32 32 29 00-0057 LF 6 x 6 Post, 3' Spacing, 6' High Creosoted, 2" Planking.....	148.59	55.70
For >3:1 Sloped Soil At Top, Add	3.17	
32 32 29 00-0058 LF 6 x 6 Post, 2' Spacing, 7' High Creosoted, 2" Planking.....	207.22	75.53
For >3:1 Sloped Soil At Top, Add	4.77	
32 32 29 00-0059 LF 6 x 6 Post With Deadman, 3' Spacing, 8' High, Creosoted, 2" Planking.....	197.62	72.57
For >3:1 Sloped Soil At Top, Add	4.46	
32 32 29 00-0060 LF 8 x 8 Post With Deadman, 2' Spacing, 10' High, Creosoted, 2" Planking.....	463.93	166.95
For >3:1 Sloped Soil At Top, Add	11.06	
32 32 29 00-0061 Wood Tie Retaining Walls, Rod Connector At 4' (32 32 29)		
Note: The system includes all the elements that must go into a wall that resists lateral pressure. System elements include: wood ties, threaded rod (1/2" diameter), underdrain, and deadman where required. Excludes initial site grading, subbase preparation or finish grading.		
32 32 29 00-0062 Redwood (32 32 29 00-0061)		
32 32 29 00-0063 LF 2' High, 6" x 6" Wood Tie Wall.....	74.10	24.43
For >3:1 Sloped Soil At Top, Add	2.14	

32 Exterior Improvements**32 30 Site Improvements****32 32 Retaining Walls**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 32 29 00-0064	LF		4' High, 6" x 6" Wood Tie Wall Deadman At 6'	169.05	55.70
			<i>For >3:1 Sloped Soil At Top, Add</i>	4.90	
32 32 29 00-0065	LF		6' High, 6" x 6" Wood Tie Wall Deadman At 6'	253.08	83.51
			<i>For >3:1 Sloped Soil At Top, Add</i>	7.31	
32 32 29 00-0066	LF		4' High, 8" x 8" Wood Tie Wall Deadman At 6'	242.80	71.58
			<i>For >3:1 Sloped Soil At Top, Add</i>	8.47	
32 32 29 00-0067	LF		6' High, 8" x 8" Wood Tie Wall Deadman At 6'	364.81	107.37
			<i>For >3:1 Sloped Soil At Top, Add</i>	12.75	
32 32 29 00-0068	LF		8' High, 8" x 8" Wood Tie Wall Deadman At 6'	481.64	141.18
			<i>For >3:1 Sloped Soil At Top, Add</i>	16.94	
32 32 29 00-0069			Cedar <small>(32 32 29 00-0061)</small>		
32 32 29 00-0070	LF		2' High, 6" x 6" Wood Tie Wall	73.05	24.43
			<i>For >3:1 Sloped Soil At Top, Add</i>	2.05	
32 32 29 00-0071	LF		4' High, 6" x 6" Wood Tie Wall Deadman At 6'	165.90	55.70
			<i>For >3:1 Sloped Soil At Top, Add</i>	4.64	
32 32 29 00-0072	LF		6' High, 6" x 6" Wood Tie Wall Deadman At 6'	248.88	83.51
			<i>For >3:1 Sloped Soil At Top, Add</i>	6.95	
32 32 29 00-0073	LF		4' High, 8" x 8" Wood Tie Wall Deadman At 6'	235.45	71.58
			<i>For >3:1 Sloped Soil At Top, Add</i>	7.85	
32 32 29 00-0074	LF		6' High, 8" x 8" Wood Tie Wall Deadman At 6'	354.32	107.37
			<i>For >3:1 Sloped Soil At Top, Add</i>	11.86	
32 32 29 00-0075	LF		8' High, 8" x 8" Wood Tie Wall Deadman At 6'	466.95	141.18
			<i>For >3:1 Sloped Soil At Top, Add</i>	15.69	
32 32 29 00-0076			Creosoted Wood <small>(32 32 29 00-0061)</small>		
32 32 29 00-0077	LF		2' High, 6" x 8" Wood Tie Wall	82.71	32.40
			<i>For >3:1 Sloped Soil At Top, Add</i>	1.52	
32 32 29 00-0078	LF		4' High, 6" x 8" Wood Tie Wall Deadman At 6'	189.54	74.55
			<i>For >3:1 Sloped Soil At Top, Add</i>	3.43	
32 32 29 00-0079	LF		6' High, 6" x 8" Wood Tie Wall Deadman At 6'	281.01	110.34
			<i>For >3:1 Sloped Soil At Top, Add</i>	5.13	
32 32 29 00-0080	LF		4' High, 7" x 9" Wood Tie Wall Deadman At 6'	380.98	150.08
			<i>For >3:1 Sloped Soil At Top, Add</i>	6.87	
32 32 29 00-0081	LF		6' High, 7" x 9" Wood Tie Wall Deadman At 6'	554.73	218.62
			<i>For >3:1 Sloped Soil At Top, Add</i>	9.99	
32 32 29 00-0082	LF		8' High, 7" x 9" Wood Tie Wall Deadman At 6'	736.03	289.85
			<i>For >3:1 Sloped Soil At Top, Add</i>	13.29	
32 32 29 00-0083			Pressure Treated Wood <small>(32 32 29 00-0061)</small>		
32 32 29 00-0084	LF		2' High, 6" x 6" Wood Tie Wall	64.03	20.19
			<i>For >3:1 Sloped Soil At Top, Add</i>	2.01	
32 32 29 00-0085	LF		4' High, 6" x 6" Wood Tie Wall Deadman At 6'	145.49	45.74
			<i>For >3:1 Sloped Soil At Top, Add</i>	4.59	
32 32 29 00-0086	LF		6' High, 6" x 6" Wood Tie Wall Deadman At 6'	217.97	68.61
			<i>For >3:1 Sloped Soil At Top, Add</i>	6.87	
32 32 29 00-0087	LF		4' High, 8" x 8" Wood Tie Wall Deadman At 6'	238.93	82.53
			<i>For >3:1 Sloped Soil At Top, Add</i>	6.29	
32 32 29 00-0088	LF		6' High, 8" x 8" Wood Tie Wall Deadman At 6'	358.82	123.33
			<i>For >3:1 Sloped Soil At Top, Add</i>	9.54	
32 32 29 00-0089	LF		8' High, 8" x 8" Wood Tie Wall Deadman At 6'	475.83	163.98
			<i>For >3:1 Sloped Soil At Top, Add</i>	12.57	
32 32 53			Stone Retaining Walls <small>(32 32)</small>		
32 32 53 00-0001			Stone Retaining Walls <small>(32 32 53)</small>		
			Note: Construction is either dry set or mortar set. System elements include concrete base, crushed stone, underdrain, and backfill. Standard design to have 12" thick top with vertical backside and sloped face at 2" per foot of height. Excludes initial site grading, subbase preparation or finish grading.		
32 32 53 00-0002			Stone Retaining Walls <small>(32 32 53 00-0001)</small>		
			Note: Stone at \$16.00/ton.		
32 32 53 00-0003	LF		\$16.00/ton 3' High Stone Retaining Wall, Dry Set	318.83	146.72
			<i>For >3:1 Sloped Soil At Top, Add</i>	2.15	
32 32 53 00-0004	LF		\$16.00/ton 4' High Stone Retaining Wall, Dry Set	376.84	174.55
			<i>For >3:1 Sloped Soil At Top, Add</i>	2.35	
32 32 53 00-0005	LF		\$16.00/ton 6' High Stone Retaining Wall, Dry Set	496.21	231.91
			<i>For >3:1 Sloped Soil At Top, Add</i>	2.75	
32 32 53 00-0006	LF		\$16.00/ton 8' High Stone Retaining Wall, Dry Set	767.08	362.60
			<i>For >3:1 Sloped Soil At Top, Add</i>	3.56	
32 32 53 00-0007	LF		\$16.00/ton 10' High Stone Retaining Wall, Dry Set	998.17	474.32
			<i>For >3:1 Sloped Soil At Top, Add</i>	4.21	
32 32 53 00-0008	LF		\$16.00/ton 12' High Stone Retaining Wall, Dry Set	1,239.70	590.66
			<i>For >3:1 Sloped Soil At Top, Add</i>	4.96	
32 32 53 00-0009	LF		\$16.00/ton 3' High Stone Retaining Wall, Mortar Set	285.15	129.91
			<i>For >3:1 Sloped Soil At Top, Add</i>	2.15	
32 32 53 00-0010	LF		\$16.00/ton 4' High Stone Retaining Wall, Mortar Set	335.12	153.69
			<i>For >3:1 Sloped Soil At Top, Add</i>	2.35	
32 32 53 00-0011	LF		\$16.00/ton 6' High Stone Retaining Wall, Mortar Set	434.63	201.08
			<i>For >3:1 Sloped Soil At Top, Add</i>	2.75	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 32 53 00-0012 LF \$16.00/ton 8' High Stone Retaining Wall, Mortar Set.....	667.96	313.06
<i>For >3:1 Sloped Soil At Top, Add</i>	3.56	
32 32 53 00-0013 LF \$16.00/ton 10' High Stone Retaining Wall, Mortar Set.....	859.14	404.83
<i>For >3:1 Sloped Soil At Top, Add</i>	4.21	
32 32 53 00-0014 LF \$16.00/ton 12' High Stone Retaining Wall, Mortar Set.....	1,068.21	504.95
<i>For >3:1 Sloped Soil At Top, Add</i>	4.96	
32 32 53 00-0015 Stone Retaining Walls <small>(32 32 53 00-0001)</small>		
Note: Stone at \$32.00/ton.		
32 32 53 00-0016 LF \$32.00/ton 3' High Stone Retaining Wall, Dry Set	326.49	146.72
<i>For >3:1 Sloped Soil At Top, Add</i>	2.81	
32 32 53 00-0017 LF \$32.00/ton 4' High Stone Retaining Wall, Dry Set	387.45	174.55
<i>For >3:1 Sloped Soil At Top, Add</i>	3.26	
32 32 53 00-0018 LF \$32.00/ton 6' High Stone Retaining Wall, Dry Set	511.54	231.91
<i>For >3:1 Sloped Soil At Top, Add</i>	4.06	
32 32 53 00-0019 LF \$32.00/ton 8' High Stone Retaining Wall, Dry Set	789.48	362.60
<i>For >3:1 Sloped Soil At Top, Add</i>	5.46	
32 32 53 00-0020 LF \$32.00/ton 10' High Stone Retaining Wall, Dry Set	1,028.82	474.32
<i>For >3:1 Sloped Soil At Top, Add</i>	6.81	
32 32 53 00-0021 LF \$32.00/ton 12' High Stone Retaining Wall, Dry Set	1,278.60	590.66
<i>For >3:1 Sloped Soil At Top, Add</i>	8.27	
32 32 53 00-0022 LF \$32.00/ton 3' High Stone Retaining Wall, Mortar Set.....	292.81	129.91
<i>For >3:1 Sloped Soil At Top, Add</i>	2.81	
32 32 53 00-0023 LF \$32.00/ton 4' High Stone Retaining Wall, Mortar Set.....	345.73	153.69
<i>For >3:1 Sloped Soil At Top, Add</i>	3.26	
32 32 53 00-0024 LF \$32.00/ton 6' High Stone Retaining Wall, Mortar Set.....	449.96	201.08
<i>For >3:1 Sloped Soil At Top, Add</i>	4.06	
32 32 53 00-0025 LF \$32.00/ton 8' High Stone Retaining Wall, Mortar Set.....	690.36	313.06
<i>For >3:1 Sloped Soil At Top, Add</i>	5.46	
32 32 53 00-0026 LF \$32.00/ton 10' High Stone Retaining Wall, Mortar Set.....	889.79	404.83
<i>For >3:1 Sloped Soil At Top, Add</i>	6.81	
32 32 53 00-0027 LF \$32.00/ton 12' High Stone Retaining Wall, Mortar Set.....	1,107.11	504.95
<i>For >3:1 Sloped Soil At Top, Add</i>	8.27	
32 32 53 00-0028 Stone Retaining Walls <small>(32 32 53 00-0001)</small>		
Note: Stone at \$48.00/ton.		
32 32 53 00-0029 LF \$48.00/ton 3' High Stone Retaining Wall, Dry Set	334.74	146.72
<i>For >3:1 Sloped Soil At Top, Add</i>	3.51	
32 32 53 00-0030 LF \$48.00/ton 4' High Stone Retaining Wall, Dry Set	397.94	174.55
<i>For >3:1 Sloped Soil At Top, Add</i>	4.15	
32 32 53 00-0031 LF \$48.00/ton 6' High Stone Retaining Wall, Dry Set	526.27	231.91
<i>For >3:1 Sloped Soil At Top, Add</i>	5.31	
32 32 53 00-0032 LF \$48.00/ton 8' High Stone Retaining Wall, Dry Set	811.87	362.60
<i>For >3:1 Sloped Soil At Top, Add</i>	7.36	
32 32 53 00-0033 LF \$48.00/ton 10' High Stone Retaining Wall, Dry Set	1,059.46	474.32
<i>For >3:1 Sloped Soil At Top, Add</i>	9.42	
32 32 53 00-0034 LF \$48.00/ton 12' High Stone Retaining Wall, Dry Set	1,318.08	590.66
<i>For >3:1 Sloped Soil At Top, Add</i>	11.62	
32 32 53 00-0035 LF \$48.00/ton 3' High Stone Retaining Wall, Mortar Set.....	301.06	129.91
<i>For >3:1 Sloped Soil At Top, Add</i>	3.51	
32 32 53 00-0036 LF \$48.00/ton 4' High Stone Retaining Wall, Mortar Set.....	356.33	153.69
<i>For >3:1 Sloped Soil At Top, Add</i>	4.16	
32 32 53 00-0037 LF \$48.00/ton 6' High Stone Retaining Wall, Mortar Set.....	464.69	201.08
<i>For >3:1 Sloped Soil At Top, Add</i>	5.31	
32 32 53 00-0038 LF \$48.00/ton 8' High Stone Retaining Wall, Mortar Set.....	712.75	313.06
<i>For >3:1 Sloped Soil At Top, Add</i>	7.36	
32 32 53 00-0039 LF \$48.00/ton 10' High Stone Retaining Wall, Mortar Set.....	920.43	404.83
<i>For >3:1 Sloped Soil At Top, Add</i>	9.42	
32 32 53 00-0040 LF \$48.00/ton 12' High Stone Retaining Wall, Mortar Set.....	1,146.59	504.95
<i>For >3:1 Sloped Soil At Top, Add</i>	11.62	
32 32 53 00-0041 Stone Retaining Walls <small>(32 32 53 00-0001)</small>		
Note: Stone at \$64.00/ton.		
32 32 53 00-0042 LF \$64.00/ton 3' High Stone Retaining Wall, Dry Set	342.99	146.72
<i>For >3:1 Sloped Soil At Top, Add</i>	4.21	
32 32 53 00-0043 LF \$64.00/ton 4' High Stone Retaining Wall, Dry Set	396.88	174.55
<i>For >3:1 Sloped Soil At Top, Add</i>	4.06	
32 32 53 00-0044 LF \$64.00/ton 6' High Stone Retaining Wall, Dry Set	542.18	231.91
<i>For >3:1 Sloped Soil At Top, Add</i>	6.66	
32 32 53 00-0045 LF \$64.00/ton 8' High Stone Retaining Wall, Dry Set	835.44	362.60
<i>For >3:1 Sloped Soil At Top, Add</i>	9.37	
32 32 53 00-0046 LF \$64.00/ton 10' High Stone Retaining Wall, Dry Set	1,091.29	474.32
<i>For >3:1 Sloped Soil At Top, Add</i>	12.12	
32 32 53 00-0047 LF \$64.00/ton 12' High Stone Retaining Wall, Dry Set	1,358.16	590.66
<i>For >3:1 Sloped Soil At Top, Add</i>	15.03	
32 32 53 00-0048 LF \$64.00/ton 3' High Stone Retaining Wall, Mortar Set.....	309.31	129.91
<i>For >3:1 Sloped Soil At Top, Add</i>	4.21	
32 32 53 00-0049 LF \$64.00/ton 4' High Stone Retaining Wall, Mortar Set.....	366.94	153.69
<i>For >3:1 Sloped Soil At Top, Add</i>	5.06	
32 32 53 00-0050 LF \$64.00/ton 6' High Stone Retaining Wall, Mortar Set.....	480.60	201.08
<i>For >3:1 Sloped Soil At Top, Add</i>	6.66	

32 Exterior Improvements**32 30 Site Improvements****32 32 Retaining Walls**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 32 53 00-0051 LF \$64.00/ton 8' High Stone Retaining Wall, Mortar Set.....	736.32	313.06
For >3:1 Sloped Soil At Top, Add	9.37	
32 32 53 00-0052 LF \$64.00/ton 10' High Stone Retaining Wall, Mortar Set.....	952.26	404.83
For >3:1 Sloped Soil At Top, Add	12.12	
32 32 53 00-0053 LF \$64.00/ton 12' High Stone Retaining Wall, Mortar Set.....	1,186.67	504.95
For >3:1 Sloped Soil At Top, Add	15.03	
32 33 Site Furnishings (32 30)		
32 33 23 Site Trash and Litter Receptacles (32 33)		
32 33 23 00-0001 Steel Trash Containment (32 33 23)		
32 33 23 00-0002 Steel Frame Surrounded With Kiln-Dried Wood (32 33 23 00-0001)		
32 33 23 00-0003 EA 13" x 13" x 30" Ash Receptacle Steel Frame, Kiln Dried Wood	384.60	43.84
32 33 23 00-0004 EA 24" x 24" x 30" High Open Top Trash Container Steel Frame, Kiln Dried Wood	367.70	43.84
32 33 23 00-0005 EA 21" x 21" x 31" High Flat Top Trash Container Steel Frame, Kiln Dried Wood	367.70	43.84
32 33 23 00-0006 EA 24" x 24" x 31" High, Flat Top Trash Container Steel Frame, Kiln Dried Wood	348.70	43.84
32 33 23 00-0007 EA 18" x 18" x 37" High Dome Top Trash Container Steel Frame, Kiln Dried Wood.....	384.60	43.84
32 33 23 00-0008 EA 23" x 23" x 37" High Dome Top Trash Container Steel Frame, Kiln Dried Wood.....	348.70	43.84
32 33 23 00-0009 EA 24" x 24" x 37" High Dome Top Trash Container Steel Frame, Kiln Dried Wood.....	473.28	43.84
32 33 23 00-0010 Square Steel Frames Surrounded With Flat Steel (32 33 23 00-0001)		
32 33 23 00-0011 EA 26" Diameter x 34" High Open Top Trash Square Container Steel Frame, Flat Steel Surround	685.78	43.84
32 33 23 00-0012 EA 26" Diameter x 34" High Dome Top Trash Square Container Steel Frame, Flat Steel Surround.....	739.44	43.84
32 33 23 00-0013 EA 26" Diameter x 39" High Dome Top Trash Square Container Steel Frame, Flat Steel Surround.....	739.44	43.84
32 33 23 00-0014 Round Steel Pipe And Flat Steel Frames (32 33 23 00-0001)		
Note: Surrounded with kiln-dried wood.		
32 33 23 00-0015 EA 21" Diameter x 32" High Open Top Trash Container Steel Pipe, Flat Steel Frame, Kiln Dried Wood.....	1,007.75	43.84
32 33 23 00-0016 EA 21" Diameter x 32" High Flat Top Trash Steel Container Pipe, Flat Steel Frame, Kiln Dried Wood	1,084.41	43.84
32 33 23 00-0017 EA 21" Diameter x 39" High Dome Top Trash Steel Container Pipe, Flat Steel Frame, Kiln Dried Wood.....	1,247.31	43.84
32 33 23 00-0018 EA 21" Diameter x 40" High HPR Top Trash Container Steel Pipe, Flat Steel Frame, Kiln Dried Wood.....	1,132.33	43.84
32 33 23 00-0019 Round Steel Pipe Surrounded With Perforated (32 33 23 00-0001)		
32 33 23 00-0020 EA 21" Diameter x 32" High Open Top Trash Container Perforated Round Steel Pipe.....	902.35	43.84
32 33 23 00-0021 EA 21" Diameter x 32" High Flat Top Trash Container Perforated Round Steel Pipe.....	979.01	43.84
32 33 23 00-0022 EA 21" Diameter x 39" High Dome Top Trash Container Perforated Round Steel Pipe.....	1,141.91	43.84
32 33 23 00-0023 EA 21" Diameter x 40" High HPR Top Trash Container Perforated Round Steel Pipe.....	1,036.50	43.84
32 33 23 00-0024 Round Steel Pipe Frames Surrounded With Welded Wire (32 33 23 00-0001)		
32 33 23 00-0025 EA 21" Diameter x 32" High Flat Top Trash Container Steel Pipe Frame, Welded Wire Surround	720.28	43.84
32 33 23 00-0026 EA 21" Diameter x 32" High Open Top Trash Steel Container Pipe Frame, Welded Wire Surround	796.94	43.84
32 33 23 00-0027 EA 21" Diameter x 39" High Dome Top Trash Steel Container Pipe Frame, Welded Wire Surround.....	959.84	43.84
32 33 23 00-0028 EA 21" Diameter x 40" High HPR Top Trash Container Steel Pipe Frame, Welded Wire Surround.....	854.43	43.84
32 33 23 00-0029 Litter Baskets (32 33 23)		
32 33 23 00-0030 Round Wire Litter Baskets (32 33 23 00-0029)		
32 33 23 00-0031 EA 1.33' Diameter x 1.83' High Round Wire Litter Basket	125.73	4.45
32 33 23 00-0032 EA 1.5' Diameter x 1.83' High Round Wire Litter Basket	158.52	4.45
32 33 23 00-0033 EA 1.75' Diameter x 2.33' High Round Wire Litter Basket	214.16	4.45
32 33 23 00-0034 EA 1.83' Diameter x 2.83' High Round Wire Litter Basket	245.56	4.45
32 33 23 00-0035 Trash Can/Wire Basket Holder (32 33 23 00-0029)		
32 33 23 00-0036 EA Steel Post, Single Holder	185.42	35.81
32 33 23 00-0037 EA Steel Post, Double Holder.....	248.18	35.81
32 33 23 00-0038 EA Redwood Post, Single Holder.....	112.31	35.81
32 33 23 00-0039 EA Redwood Post, Double Holder.....	130.02	35.81
32 33 23 00-0040 Litter Receptacles, Freestanding (32 33 23 00-0029)		
Note: Includes 1-1/2" outside diameter steel leg supports. Wall mounted, includes 3/8" x 3" steel wall plates. Surface mounted, includes 2-1/2" outside diameter steel tube with floor flange, embedded to include 2-1/2" outside diameter steel tube.		
32 33 23 00-0041 EA 16" Diameter x 28" High Litter Receptacle, Freestanding Or Embedded.....	1,007.87	18.26
For Powder Coated Sand Pan, Add	50.00	
For Orange Peel Lid, Add	25.00	
For Polished Granite Lid, Add	50.00	
32 33 23 00-0042 EA 16" Diameter x 32" High Litter Receptacle, Freestanding Or Embedded.....	1,060.66	18.26
For Powder Coated Sand Pan, Add	50.00	
For Orange Peel Lid, Add	25.00	
For Polished Granite Lid, Add	50.00	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 33 23 00-0043 EA 20" Diameter x 36" High Litter Receptacle, Freestanding Or Embedded..... <i>For Powder Coated Sand Pan, Add</i> <i>For Orange Peel Lid, Add</i> <i>For Polished Granite Lid, Add</i>	1,237.30 50.00 25.00 50.00	27.40
32 33 23 00-0044 EA 20" Diameter x 40" High Litter Receptacle, Freestanding Embedded..... <i>For Powder Coated Sand Pan, Add</i> <i>For Orange Peel Lid, Add</i> <i>For Polished Granite Lid, Add</i>	1,290.09 50.00 25.00 50.00	27.40
32 33 23 00-0045 EA 16" Diameter x 28" High Litter Receptacle, Pole Mount With Pole <i>For Powder Coated Sand Pan, Add</i> <i>For 1-1/2" x 8-1/2" Diameter Metal Cover Plate, Add</i> <i>For Orange Peel Lid, Add</i> <i>For Polished Granite Lid, Add</i>	1,342.88 50.00 22.50 25.00 50.00	27.40
32 33 23 00-0046 EA 16" Diameter x 32" High Litter Receptacle, Pole Mount With Pole <i>For Powder Coated Sand Pan, Add</i> <i>For 1-1/2" x 8-1/2" Diameter Metal Cover Plate, Add</i> <i>For Orange Peel Lid, Add</i> <i>For Polished Granite Lid, Add</i>	1,395.67 50.00 22.50 25.00 50.00	27.40
32 33 23 00-0047 EA 16" Diameter x 28" High Litter Receptacle, Wall Mount..... <i>For Powder Coated Sand Pan, Add</i> <i>For Orange Peel Lid, Add</i> <i>For Polished Granite Lid, Add</i> <i>For 1-1/2" x 6" Diameter Metal Cover Plate, Add</i>	1,113.85 50.00 25.00 50.00 20.00	23.75
32 33 23 00-0048 EA 16" Diameter x 32" High Litter Receptacle, Wall Mount..... <i>For Powder Coated Sand Pan, Add</i> <i>For Orange Peel Lid, Add</i> <i>For Polished Granite Lid, Add</i> <i>For 1-1/2" x 6" Diameter Metal Cover Plate, Add</i>	1,166.64 50.00 25.00 50.00 20.00	23.75
32 33 23 00-0049 Ash Receptacles <small>(32 33 23)</small>		
32 33 23 00-0050 EA 12" Diameter x 21" High Ash Receptacle, Freestanding Or Embedded <i>For 1-1/2" x 8-1/2" Diameter Metal Cover Plate, Add</i> <i>For Sand Pan, Add</i> <i>For Bowl And Funnel, Add</i>	410.04 22.50 110.00 120.00	18.26
32 33 23 00-0051 EA 18" Square Concrete Exposed Aggregate x 36" High Ash Receptacles With 3-1/2" ID iron Pipe With Cap Square Concrete With Steel Liner.....	178.49	18.26
32 33 23 00-0052 Trash Receptacles <small>(32 33 23)</small>		
32 33 23 00-0053 EA Outdoor Covered Steel Receptacle With Liner	828.38	18.26
32 33 23 00-0054 EA Driftwood And Sable Receptacle, 35 Gallon With Liner And Frame	351.23	18.26
32 33 23 00-0055 EA 24" x 24" Square Trash Containment With Exposed Aggregate Finish	441.82	18.26
32 33 23 00-0056 EA 30" x 30" Square Trash Containment With Exposed Aggregate Finish	461.38	20.09
32 33 23 00-0057 EA 36" x 36" Square Trash Containment With Exposed Aggregate Finish	496.81	21.92
32 33 23 00-0058 EA 32 Gallon, Open Round Trash Receptacle, Recycled Plastic Lumber	156.17	14.61
32 33 23 00-0059 EA 32 Gallon, Round Trash Receptacle With Liner And Lid, Recycled Plastic Lumber	182.62	14.61
32 33 23 00-0060 EA 24" x 24" Square 18" High Trash Receptacle, Fiberglass.....	241.53	18.26
32 33 23 00-0061 Trash Containers (Dumpsters) <small>(32 33 23)</small>		
32 33 23 00-0062 EA 1 CY Straight Side Trash Dumpster.....	150.52	
32 33 23 00-0063 EA 1.5 CY Straight Side Trash Dumpster.....	225.78	
32 33 23 00-0064 EA 2 CY Straight Side Trash Dumpster.....	301.04	
32 33 23 00-0065 EA 2 CY Sloped Side Trash Dumpster.....	301.04	
32 33 23 00-0066 EA 3 CY Sloped Side Trash Dumpster.....	451.56	
32 33 23 00-0067 EA 4 CY Sloped Side Trash Dumpster.....	602.08	
32 33 23 00-0068 EA 6 CY Sloped Side Trash Dumpster.....	903.12	
32 33 23 00-0069 EA 8 CY Sloped Side Trash Dumpster.....	1,204.16	
32 33 33 Site Manufactured Planters <small>(32 33)</small>		
32 33 33 00-0001 Precast Concrete Planters <small>(32 33 33)</small>		
32 33 33 00-0002 Circular Precast Concrete Planters <small>(32 33 33 00-0001)</small>		
32 33 33 00-0003 EA 24" Diameter, 17" Height, Circular Precast Concrete Planter	420.82	20.56
32 33 33 00-0004 EA 24" Diameter, 24" Height, Circular Precast Concrete Planter	472.23	24.67
32 33 33 00-0005 EA 24" Diameter, 33" Height, Circular Precast Concrete Planter	515.40	24.67
32 33 33 00-0006 EA 30" Diameter, 17" Height, Circular Precast Concrete Planter	560.45	28.78
32 33 33 00-0007 EA 30" Diameter, 30" Height, Circular Precast Concrete Planter	679.77	37.00
32 33 33 00-0008 EA 36" Diameter, 24" Height, Circular Precast Concrete Planter	738.18	37.00
32 33 33 00-0009 EA 36" Diameter, 30" Height, Circular Precast Concrete Planter	831.49	41.11
32 33 33 00-0010 EA 48" Diameter, 17" Height, Circular Precast Concrete Planter	877.20	41.11
32 33 33 00-0011 EA 48" Diameter, 24" Height, Circular Precast Concrete Planter	980.31	51.39
32 33 33 00-0012 EA 48" Diameter, 30" Height, Circular Precast Concrete Planter	1,042.77	54.68
32 33 33 00-0013 EA 48" Diameter, 36" Height, Circular Precast Concrete Planter	1,086.61	57.56
32 33 33 00-0014 EA 60" Diameter, 17" Height, Circular Precast Concrete Planter	986.22	51.39
32 33 33 00-0015 EA 60" Diameter, 24" Height, Circular Precast Concrete Planter	1,085.34	57.56
32 33 33 00-0016 EA 60" Diameter, 36" Height, Circular Precast Concrete Planter	1,384.38	61.67
32 33 33 00-0017 EA 72" Diameter, 36" Height, Circular Precast Concrete Planter	1,795.72	78.11
32 33 33 00-0018 EA 84" Diameter, 36" Height, Circular Precast Concrete Planter	2,082.05	82.23

32 Exterior Improvements**32 30 Site Improvements****32 33 Site Furnishings**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 33 33 00-0019 Square Precast Concrete Planters <small>(32 33 33 00-0001)</small>		
32 33 33 00-0020 EA 36" Square, 30" Height, Square Precast Concrete Planter	854.50	53.45
32 33 33 00-0021 EA 42" Square, 30" Height, Square Precast Concrete Planter	976.46	57.56
32 33 33 00-0022 EA 60" Square, 36" Height, Square Precast Concrete Planter	1,529.75	65.79
32 33 33 00-0023 EA 72" Square, 36" Height, Square Precast Concrete Planter	1,631.96	69.89
32 33 33 00-0024 Rectangular Precast Concrete Planters <small>(32 33 33 00-0001)</small>		
32 33 33 00-0025 EA 33" x 18", 20" Height, Rectangular Precast Concrete Planter	491.27	24.67
32 33 33 00-0026 EA 48" x 18", 20" Height, Rectangular Precast Concrete Planter	580.71	37.00
32 33 33 00-0027 EA 60" x 18", 20" Height, Rectangular Precast Concrete Planter	672.75	41.11
32 33 33 00-0028 EA 72" x 18", 20" Height, Rectangular Precast Concrete Planter	768.23	51.39
32 33 33 00-0029 Fiberglass Planters <small>(32 33 33)</small>		
32 33 33 00-0030 Circular Fiberglass Planters <small>(32 33 33 00-0029)</small>		
32 33 33 00-0031 EA 36" Diameter, 27" High, Circular Fiberglass Planter	1,020.71	20.56
32 33 33 00-0032 EA 60" Diameter, 39" High, Circular Fiberglass Planter	1,695.83	20.56
32 33 33 00-0033 EA 36" Diameter, 24" High, Circular Fiberglass Planter	681.94	20.56
32 33 33 00-0034 EA 60" Diameter, 24" High, Circular Fiberglass Planter	1,339.93	20.56
32 33 33 00-0035 Tapered Circular Fiberglass Planters <small>(32 33 33 00-0029)</small>		
32 33 33 00-0036 EA 24" Diameter, 20" High, Tapered Circular Fiberglass Planter	399.76	20.56
32 33 33 00-0037 EA 30" Diameter, 25" High, Tapered Circular Fiberglass Planter	584.09	20.56
32 33 33 00-0038 EA 36" Diameter, 30" High, Tapered Circular Fiberglass Planter	1,037.84	20.56
32 33 33 00-0039 EA 40" Diameter, 36" High, Tapered Circular Fiberglass Planter	1,447.56	20.56
32 33 33 00-0040 Square Fiberglass Planters <small>(32 33 33 00-0029)</small>		
32 33 33 00-0041 EA 24" Square, 21" High, Square Fiberglass Planter	523.62	20.56
32 33 33 00-0042 EA 24" Square, 24" High, Square Fiberglass Planter	535.17	20.56
32 33 33 00-0043 EA 30" Square, 12" High, Square Fiberglass Planter	541.28	20.56
32 33 33 00-0044 EA 30" Square, 21" High, Square Fiberglass Planter	613.45	20.56
32 33 33 00-0045 EA 30" Square, 24" High, Square Fiberglass Planter	666.03	20.56
32 33 33 00-0046 Rectangular Fiberglass Planters <small>(32 33 33 00-0029)</small>		
32 33 33 00-0047 EA 48" x 12", 12" High, Rectangular Fiberglass Planter	602.02	20.56
32 33 33 00-0048 EA 48" x 12", 21" High, Rectangular Fiberglass Planter	645.14	20.56
32 33 33 00-0049 EA 48" x 24", 12" High, Rectangular Fiberglass Planter	839.32	20.56
32 33 33 00-0050 EA 48" x 24", 21" High, Rectangular Fiberglass Planter	925.56	20.56
32 33 33 00-0051 Timber Planters <small>(32 33 33)</small>		
32 33 33 00-0052 Square Timber Planters <small>(32 33 33 00-0051)</small>		
32 33 33 00-0053 EA 14" Square, 30" High, Square Timber Planter	422.61	43.84
32 33 33 00-0054 EA 21" Square, 30" High, Square Timber Planter	422.61	43.84
32 33 33 00-0055 EA 27" Square, 30" High, Square Timber Planter	795.00	43.84
32 33 33 00-0056 EA 34" Square, 30" High, Square Timber Planter	690.10	43.84
32 33 33 00-0057 EA 41" Square, 36" High, Square Timber Planter	821.22	43.84
32 33 33 00-0058 EA 54" Square, 36" High, Square Timber Planter	2,100.99	43.84
32 33 33 00-0059 EA 81" Square, 36" High, Square Timber Planter	3,155.22	43.84
32 33 33 00-0060 Rectangular Timber Planters <small>(32 33 33 00-0051)</small>		
32 33 33 00-0061 EA 21" x 14", 30" High, Rectangular Timber Planter	417.36	43.84
32 33 33 00-0062 EA 27" x 14", 30" High, Rectangular Timber Planter	464.57	43.84
32 33 33 00-0063 EA 27" x 21", 30" High, Rectangular Timber Planter	606.18	43.84
32 33 33 00-0064 EA 34" x 21", 30" High, Rectangular Timber Planter	669.12	43.84
32 33 33 00-0065 EA 41" x 21", 30" High, Rectangular Timber Planter	857.94	43.84
32 33 33 00-0066 EA 34" x 27", 30" High, Rectangular Timber Planter	994.31	43.84
32 33 33 00-0067 EA 41" x 27", 30" High, Rectangular Timber Planter	1,109.69	43.84
32 33 33 00-0068 EA 54" x 27", 30" High, Rectangular Timber Planter	1,440.13	43.84
32 33 33 00-0069 EA 54" x 34", 30" High, Rectangular Timber Planter	1,623.70	43.84
32 33 33 00-0070 EA 68" x 34", 36" High, Rectangular Timber Planter	1,849.23	43.84
32 33 33 00-0071 EA 54" x 41", 36" High, Rectangular Timber Planter	1,760.07	43.84
32 33 33 00-0072 EA 68" x 41", 36" High, Rectangular Timber Planter	1,990.85	43.84
32 33 33 00-0073 EA 81" x 41", 36" High, Rectangular Timber Planter	2,226.87	43.84
32 33 43 Site Seating And Tables <small>(32 33)</small>		
32 33 43 13 Site Seating <small>(32 33 43)</small>		
32 33 43 13-0001 Benches (Landscapeforms) <small>(32 33 43 13)</small>		
Note: Excludes embedding in concrete See CSI section 32 31 13 00-0001 for drilling and concrete.		



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 33 43 13-0002	EA		72" Backless Wood Or PolySite Bench (Landscapeforms Balustrade).....	1,346.13	73.07
32 33 43 13-0003	EA		72" Backed Wood Or PolySite Bench (Landscapeforms Balustrade).....	1,682.13	73.07
32 33 43 13-0004	EA		96" Backed Wood Bench (Landscapeforms Balustrade).....	1,898.13	73.07
32 33 43 13-0005	EA		End Loop Arms For Backed Bench (Landscapeforms Balustrade).....	156.54	18.26
32 33 43 13-0006	EA		72" Backless Wood Or PolySite Bench (Landscapeforms Gretchen's).....	1,346.13	73.07
32 33 43 13-0007	EA		96" Backless Wood Bench (Landscapeforms Gretchen's).....	1,538.13	73.07
32 33 43 13-0008	EA		72" Backed Wood Or PolySite Bench (Landscapeforms Gretchen's).....	1,682.13	73.07
32 33 43 13-0009	EA		96" Backed Wood Bench (Landscapeforms Gretchen's).....	1,898.13	73.07
32 33 43 13-0010	EA		72" Backed Wood Or PolySite Bench With Armrest (Landscapeforms Gretchen's).....	1,922.13	73.07
32 33 43 13-0011	EA		96" Backed Wood Bench With Armrest (Landscapeforms Gretchen's).....	2,138.12	73.07
32 33 43 13-0012	EA		59" Backed Wood Or Metal Rod Bench (Landscapeforms Hyde Park).....	2,630.12	73.07
32 33 43 13-0013	EA		75" Backed Wood Or Metal Rod Bench (Landscapeforms Hyde Park).....	2,858.12	73.07
32 33 43 13-0014	EA		42" Backless Metal Grid Bench (Landscapeforms Manistee).....	745.60	54.80
32 33 43 13-0015	EA		62" Backless Metal Grid Bench (Landscapeforms Manistee).....	805.60	54.80
32 33 43 13-0016	EA		72" Backless Metal Grid Bench (Landscapeforms Manistee).....	871.86	63.93
32 33 43 13-0017	EA		82" Backless Metal Grid Bench (Landscapeforms Manistee).....	1,015.86	63.93
32 33 43 13-0018	EA		42" Backed Metal Grid Bench (Landscapeforms Manistee).....	931.86	63.93
32 33 43 13-0019	EA		62" Backed Metal Grid Bench (Landscapeforms Manistee).....	991.86	63.93
32 33 43 13-0020	EA		72" Backed Metal Grid Bench (Landscapeforms Manistee).....	1,070.13	73.07
32 33 43 13-0021	EA		82" Backed Metal Grid Bench (Landscapeforms Manistee).....	1,226.13	73.07
32 33 43 13-0022	EA		42" Backed Metal Grid Bench With Armrest Each End (Landscapeforms Manistee).....	1,039.86	63.93
32 33 43 13-0023	EA		62" Backed Metal Grid Bench With Armrest Each End (Landscapeforms Manistee).....	1,118.13	73.07
32 33 43 13-0024	EA		72" Backed Metal Grid Bench With Armrest Each End (Landscapeforms Manistee).....	1,178.13	73.07
32 33 43 13-0025	EA		82" Backed Metal Grid Bench With Armrest Each End (Landscapeforms Manistee).....	1,334.13	73.07
32 33 43 13-0026	EA		72" Backless Solid Wood Bench (Landscapeforms Palisade).....	1,874.13	73.07
32 33 43 13-0027	EA		96" Backless Solid Wood Bench (Landscapeforms Palisade).....	2,150.12	73.07
32 33 43 13-0028	EA		70" Backless Perforated Metal Bench (Landscapeforms Petoskey).....	1,394.13	73.07
32 33 43 13-0029	EA		70" Dual Support Backed Perforated Metal Bench (Landscapeforms Petoskey).....	1,682.13	73.07
32 33 43 13-0030	EA		70" Quad Support Backed Perforated Metal Bench (Landscapeforms Petoskey).....	1,826.13	73.07
32 33 43 13-0031	EA		72" Backed Wood Bench (Landscapeforms Plainwell).....	1,826.13	73.07
32 33 43 13-0032	EA		72" Backed Wood Bench With Center Arm (Landscapeforms Plainwell).....	2,042.12	73.07
32 33 43 13-0033	EA		96" Backed Wood Bench (Landscapeforms Plainwell).....	2,246.12	73.07
32 33 43 13-0034	EA		96" Backed Wood Bench With Center Arm (Landscapeforms Plainwell).....	2,462.12	73.07
32 33 43 13-0035	EA		96" Backed Wood Bench With Two Center Arms (Landscapeforms Plainwell).....	2,678.12	73.07
32 33 43 13-0036	EA		72" Backed Aluminum Bench (Landscapeforms Plainwell).....	2,342.12	73.07
32 33 43 13-0037	EA		72" Backed Aluminum Bench With Center Arm (Landscapeforms Plainwell).....	2,558.12	73.07
32 33 43 13-0038	EA		96" Backed Aluminum Bench (Landscapeforms Plainwell).....	2,870.12	73.07
32 33 43 13-0039	EA		96" Backed Aluminum Bench With Center Arm (Landscapeforms Plainwell).....	3,086.12	73.07
32 33 43 13-0040	EA		96" Backed Aluminum Bench With Two Center Arms (Landscapeforms Plainwell).....	3,302.11	73.07
32 33 43 13-0041	EA		Backless Metal Grid Seats For Straight Runs (Landscapeforms Plexus).....	504.54	18.26
32 33 43 13-0042	EA		Backless Metal Grid Seats For 60 Degree Radius (Landscapeforms Plexus).....	660.53	18.26
32 33 43 13-0043	EA		Backless Metal Grid Seats For 120 Degree Radius (Landscapeforms Plexus).....	660.53	18.26
32 33 43 13-0044	EA		Backed Metal Grid Seats For Straight Runs (Landscapeforms Plexus).....	612.54	18.26
32 33 43 13-0045	EA		Narrow-Backed Metal Grid Seats For 60 Degree Radius (Landscapeforms Plexus).....	756.53	18.26
32 33 43 13-0046	EA		Narrow-Backed Metal Grid Seats For 120 Degree Radius (Landscapeforms Plexus).....	756.53	18.26
32 33 43 13-0047	EA		Wide-Backed Metal Grid Seats For 120 Degree Radius (Landscapeforms Plexus).....	756.53	18.26
32 33 43 13-0048	EA		Armrest For Metal Grid Seats (Landscapeforms Plexus).....	120.00	18.26
32 33 43 13-0049	EA		Backless Straight Metal Grid Seats (Landscapeforms Presidio).....	684.53	18.26
32 33 43 13-0050	EA		Backless Straight Metal Grid Seats With One Arm (Landscapeforms Presidio).....	768.53	18.26
32 33 43 13-0051	EA		Backless Straight Metal Grid Seats With Two Arms (Landscapeforms Presidio).....	852.53	18.26
32 33 43 13-0052	EA		Backless Angled Metal Grid Seats (Landscapeforms Presidio).....	840.53	18.26
32 33 43 13-0053	EA		Backless Angled Metal Grid Seats With One Arm (Landscapeforms Presidio).....	924.53	18.26
32 33 43 13-0054	EA		Backless Angled Metal Grid Seats With Two Arms (Landscapeforms Presidio).....	1,008.53	18.26
32 33 43 13-0055	EA		Backed Straight Metal Grid Seats (Landscapeforms Presidio).....	828.53	18.26
32 33 43 13-0056	EA		Backed Straight Metal Grid Seats With One Arm (Landscapeforms Presidio).....	912.53	18.26
32 33 43 13-0057	EA		Backed Straight Metal Grid Seats With Two Arms (Landscapeforms Presidio).....	996.53	18.26
32 33 43 13-0058	EA		Narrow-Backed Angled Metal Grid Seats (Landscapeforms Presidio).....	1,008.53	18.26
32 33 43 13-0059	EA		Narrow-Backed Angled Metal Grid Seats With One Arm (Landscapeforms Presidio).....	1,092.53	18.26
32 33 43 13-0060	EA		Narrow-Backed Angled Metal Grid Seats With Two Arms (Landscapeforms Presidio).....	1,176.53	18.26
32 33 43 13-0061	EA		Wide-Backed Angled Metal Grid Seats (Landscapeforms Presidio).....	1,008.53	18.26
32 33 43 13-0062	EA		Wide-Backed Angled Metal Grid Seats With One Arm (Landscapeforms Presidio).....	1,092.53	18.26
32 33 43 13-0063	EA		Wide-Backed Angled Metal Grid Seats With Two Arms (Landscapeforms Presidio).....	1,176.53	18.26
32 33 43 13-0064	EA		48" Backless Horizontal Strap Bench (Landscapeforms Scarborough).....	1,406.13	73.07
32 33 43 13-0065	EA		72" Backless Horizontal Strap Bench (Landscapeforms Scarborough).....	1,430.13	73.07
32 33 43 13-0066	EA		96" Backless Horizontal Strap Bench (Landscapeforms Scarborough).....	1,742.13	73.07
32 33 43 13-0067	EA		48" Backless Woven Bench (Landscapeforms Scarborough).....	2,114.12	73.07
32 33 43 13-0068	EA		72" Backless Woven Bench (Landscapeforms Scarborough).....	2,486.12	73.07
32 33 43 13-0069	EA		96" Backless Woven Bench (Landscapeforms Scarborough).....	2,858.12	73.07
32 33 43 13-0070	EA		24" Backed Horizontal Strap Bench (Landscapeforms Scarborough).....	1,322.13	73.07
32 33 43 13-0071	EA		48" Backed Horizontal Strap Bench (Landscapeforms Scarborough).....	1,526.13	73.07
32 33 43 13-0072	EA		72" Backed Horizontal Strap Bench (Landscapeforms Scarborough).....	1,550.13	73.07
32 33 43 13-0073	EA		72" Backed Horizontal Strap Bench With Center Arm (Landscapeforms Scarborough).....	1,790.13	73.07
32 33 43 13-0074	EA		96" Backed Horizontal Strap Bench (Landscapeforms Scarborough).....	2,018.12	73.07
32 33 43 13-0075	EA		96" Backed Horizontal Strap Bench With Center Arm (Landscapeforms Scarborough).....	2,258.12	73.07
32 33 43 13-0076	EA		96" Backed Horizontal Strap Bench With Two Intermediate Arms (Landscapeforms Scarborough).....	2,498.12	73.07
32 33 43 13-0077	EA		24" Backed Woven Bench (Landscapeforms Scarborough).....	2,018.12	73.07
32 33 43 13-0078	EA		48" Backed Woven Bench (Landscapeforms Scarborough).....	2,438.12	73.07
32 33 43 13-0079	EA		72" Backed Woven Bench (Landscapeforms Scarborough).....	2,846.12	73.07
32 33 43 13-0080	EA		72" Backed Woven Bench With Center Arm (Landscapeforms Scarborough).....	3,086.12	73.07
32 33 43 13-0081	EA		96" Backed Woven Bench (Landscapeforms Scarborough).....	3,590.11	73.07
32 33 43 13-0082	EA		96" Backed Woven Bench With Center Arm (Landscapeforms Scarborough).....	3,830.11	73.07

32 Exterior Improvements**32 30 Site Improvements****32 33 Site Furnishings**

MINOR			TOTAL DIRECT	DEMOLITION
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST
32 33 43 13-0083	EA	96" Backed Woven Bench With Two Intermediate Arms (Landscapeforms Scarborough)	4,070.11	73.07
32 33 43 13-0084	EA	32" Backed Strap Or Perforated Bench (Landscapeforms Town Square)	943.86	63.93
32 33 43 13-0085	EA	49" Backed Strap Or Perforated Bench (Landscapeforms Town Square)	1,135.86	63.93
32 33 43 13-0086	EA	49" Backed Bench Or Perforated Bench With Divider (Landscapeforms Town Square)	1,231.86	63.93
32 33 43 13-0087	EA	70" Backed Strap Or Perforated Bench (Landscapeforms Town Square)	1,454.13	73.07
32 33 43 13-0088	EA	70" Backed Strap Or Perforated Bench With Two Dividers (Landscapeforms Town Square)	1,646.13	73.07
32 33 43 13-0089 Benches (Columbia Cascade, TimberForm) (32 33 43 13)				
32 33 43 13-0090 Wood Benches (Columbia Cascade, TimberForm) (32 33 43 13-0089)				
Note: Includes powder coated steel frames.				
32 33 43 13-0091	EA	70" Length, Embedment Mount, 3 x 4 And 3 x 8 Wood Slats Bench (TimberForm 2006-6-E)	461.40	36.54
32 33 43 13-0092	EA	94" Length, Embedment Mount, 3 x 4 And 3 x 8 Wood Slats Bench (TimberForm 2006-8-E)	525.29	36.54
32 33 43 13-0093	EA	118" Length, Embedment Mount, 3 x 4 And 3 x 8 Wood Slats Bench (TimberForm 2006-10-E)	665.81	36.54
32 33 43 13-0094	EA	70" Length, Pedestal Mount, 3 x 4 And 3 x 8 Wood Slats Bench (TimberForm 2006-6-P)	480.58	36.54
32 33 43 13-0095	EA	94" Length, Pedestal Mount, 3 x 4 And 3 x 8 Wood Slats Bench (TimberForm 2006-8-P)	544.45	36.54
32 33 43 13-0096	EA	118" Length, Pedestal Mount, 3 x 4 And 3 x 8 Wood Slats Bench (TimberForm 2006-10-P)	691.36	36.54
32 33 43 13-0097	EA	70" Length, Embedment Mount, 3 x 4 And 3 x 8 Wood Slats Bench With Straight Back (TimberForm 2016-6-E)	691.36	36.54
32 33 43 13-0098	EA	94" Length, Embedment Mount, 3 x 4 And 3 x 8 Wood Slats Bench With Straight Back (TimberForm 2016-8-E)	799.94	36.54
32 33 43 13-0099	EA	118" Length, Embedment Mount, 3 x 4 And 3 x 8 Wood Slats Bench With Straight Back (TimberForm 2016-10-E)	1,023.50	36.54
32 33 43 13-0100	EA	70" Length, Pedestal Mount, 3 x 4 And 3 x 8 Wood Slats Bench With Straight Back (TimberForm 2016-6-P)	723.30	36.54
32 33 43 13-0101	EA	94" Length, Pedestal Mount, 3 x 4 And 3 x 8 Wood Slats Bench With Straight Back (TimberForm 2016-8-P)	831.88	36.54
32 33 43 13-0102	EA	118" Length, Pedestal Mount, 3 x 4 And 3 x 8 Wood Slats Bench With Straight Back (TimberForm 2016-10-P)	1,068.21	36.54
32 33 43 13-0103	EA	70" Length, Embedment Mount, Back-To-Back Double Bench, 3 x 4 And 3 x 8 Wood Slats Benches With Straight Backs (TimberForm 2026-6-E)	1,310.93	36.54
32 33 43 13-0104	EA	94" Length, Embedment Mount, Back-To-Back Double Bench, 3 x 4 And 3 x 8 Wood Slats Benches With Straight Backs (TimberForm 2026-8-E)	1,534.48	36.54
32 33 43 13-0105	EA	118" Length, Embedment Mount, Back-To-Back Double Bench, 3 x 4 And 3 x 8 Wood Slats Benches With Straight Backs (TimberForm 2026-10-E)	2,000.76	36.54
32 33 43 13-0106	EA	70" Length, Pedestal Mount, Back-To-Back Double Bench, 3 x 4 And 3 x 8 Wood Slats Benches With Straight Backs (TimberForm 2026-6-P)	1,342.87	36.54
32 33 43 13-0107	EA	94" Length, Pedestal Mount, Back-To-Back Double Bench, 3 x 4 And 3 x 8 Wood Slats Benches With Straight Backs (TimberForm 2026-8-P)	1,566.42	36.54
32 33 43 13-0108	EA	118" Length, Pedestal Mount, Back-To-Back Double Bench, 3 x 4 And 3 x 8 Wood Slats Benches With Straight Backs (TimberForm 2026-10-P)	2,045.47	36.54
32 33 43 13-0109	EA	70" Length, Embedment Mount, 3 x 4 Wood Slats Concave Bench (TimberForm 2028-6-E)	531.68	36.54
32 33 43 13-0110	EA	94" Length, Embedment Mount, 3 x 4 Wood Slats Concave Bench (TimberForm 2028-8-E)	595.55	36.54
32 33 43 13-0111	EA	70" Length, Pedestal Mount, 3 x 4 Wood Slats Concave Bench (TimberForm 2028-6-P)	550.84	36.54
32 33 43 13-0112	EA	94" Length, Pedestal Mount, 3 x 4 Wood Slats Concave Bench (TimberForm 2028-8-P)	614.71	36.54
32 33 43 13-0113	EA	46" Length, Embedment Mount, 3 x 4 And 3 x 8 Wood Slats Platform Seat (TimberForm 2044-4-E)	870.21	36.54
32 33 43 13-0114	EA	70" Length, Embedment Mount, 3 x 4 And 3 x 8 Wood Slats Platform Seat (TimberForm 2044-6-E)	1,023.50	36.54
32 33 43 13-0115	EA	46" Length, Pedestal Mount, 3 x 4 And 3 x 8 Wood Slats Platform Seat (TimberForm 2044-4-P)	921.30	36.54
32 33 43 13-0116	EA	70" Length, Pedestal Mount, 3 x 4 And 3 x 8 Wood Slats Platform Seat (TimberForm 2044-6-P)	1,074.60	36.54
32 33 43 13-0117	EA	70" Length, Wall Mount, 3 x 4 And 3 x 8 Wood Slats Bench (TimberForm 2045-6)	570.78	54.80
32 33 43 13-0118	EA	94" Length, Wall Mount, 3 x 4 And 3 x 8 Wood Slats Bench (TimberForm 2045-8)	596.33	54.80
32 33 43 13-0119	EA	118" Length, Wall Mount, 3 x 4 And 3 x 8 Wood Slats Bench (TimberForm 2045-10)	794.33	54.80
32 33 43 13-0120	EA	46" Length, Embedment Mount, 3 x 4 Patterned Wood Slats Bench (TimberForm 2139-4-E)	435.87	36.54
32 33 43 13-0121	EA	70" Length, Embedment Mount, 3 x 4 Patterned Wood Slats Bench (TimberForm 2139-6-E)	499.74	36.54
32 33 43 13-0122	EA	94" Length, Embedment Mount, 3 x 4 Patterned Wood Slats Bench (TimberForm 2139-8-E)	563.61	36.54
32 33 43 13-0123	EA	118" Length, Embedment Mount, 3 x 4 Patterned Wood Slats Bench (TimberForm 2139-10-E)	716.91	36.54
32 33 43 13-0124	EA	142" Length, Embedment Mount, 3 x 4 Patterned Wood Slats Bench (TimberForm 2139-12-E)	780.78	36.54
32 33 43 13-0125	EA	46" Length, Pedestal Mount, 3 x 4 Patterned Wood Slats Bench (TimberForm 2139-4-P)	442.26	36.54
32 33 43 13-0126	EA	70" Length, Pedestal Mount, 3 x 4 Patterned Wood Slats Bench (TimberForm 2139-6-P)	506.13	36.54
32 33 43 13-0127	EA	94" Length, Pedestal Mount, 3 x 4 Patterned Wood Slats Bench (TimberForm 2139-8-P)	570.00	36.54
32 33 43 13-0128	EA	118" Length, Pedestal Mount, 3 x 4 Patterned Wood Slats Bench (TimberForm 2139-10-P)	736.07	36.54
32 33 43 13-0129	EA	142" Length, Pedestal Mount, 3 x 4 Patterned Wood Slats Bench (TimberForm 2139-12-P)	799.94	36.54
32 33 43 13-0130	EA	70" Length, Embedment Mount, 3 x 4 Patterned Wood Slats Bench With Contoured Back (TimberForm 2140-6-E)	729.68	36.54
32 33 43 13-0131	EA	94" Length, Embedment Mount, 3 x 4 Patterned Wood Slats Bench With Contoured Back (TimberForm 2140-8-E)	838.27	36.54
32 33 43 13-0132	EA	118" Length, Embedment Mount, 3 x 4 Patterned Wood Slats Bench With Contoured Back (TimberForm 2140-10-E)	1,074.60	36.54
32 33 43 13-0133	EA	142" Length, Embedment Mount, 3 x 4 Patterned Wood Slats Bench With Contoured Back (TimberForm 2140-12-E)	1,183.18	36.54
32 33 43 13-0134	EA	70" Length, Pedestal Mount, 3 x 4 Patterned Wood Slats Bench With Contoured Back (TimberForm 2140-6-P)	742.46	36.54
32 33 43 13-0135	EA	94" Length, Pedestal Mount, 3 x 4 Patterned Wood Slats Bench With Contoured Back (TimberForm 2140-8-P)	851.04	36.54
32 33 43 13-0136	EA	118" Length, Pedestal Mount, 3 x 4 Patterned Wood Slats Bench With Contoured Back (TimberForm 2140-10-P)	1,093.76	36.54
32 33 43 13-0137	EA	142" Length, Pedestal Mount, 3 x 4 Patterned Wood Slats Bench With Contoured Back (TimberForm 2140-12-P)	1,202.34	36.54
32 33 43 13-0138	EA	70" Length, Embedment Mount, 3 x 4 Patterned Wood Slats Bench With Contoured Back And Armrests (TimberForm 2141-6-E)	729.68	36.54
32 33 43 13-0139	EA	82" Length, Embedment Mount, 3 x 4 Patterned Wood Slats Bench With Contoured Back And Armrests (TimberForm 2141-7-E)	1,017.11	36.54
32 33 43 13-0140	EA	94" Length, Embedment Mount, 3 x 4 Patterned Wood Slats Bench With Contoured Back And Armrests (TimberForm 2141-8-E)	908.53	36.54
32 33 43 13-0141	EA	118" Length, Embedment Mount, 3 x 4 Patterned Wood Slats Bench With Contoured Back And Armrests (TimberForm 2141-10-E)	1,189.57	36.54
32 33 43 13-0142	EA	142" Length, Embedment Mount, 3 x 4 Patterned Wood Slats Bench With Contoured Back And Armrests (TimberForm 2141-12-E)	1,298.15	36.54
32 33 43 13-0143	EA	70" Length, Pedestal Mount, 3 x 4 Patterned Wood Slats Bench With Contoured Back And Armrests (TimberForm 2141-6-P)	831.88	36.54
32 33 43 13-0144	EA	82" Length, Pedestal Mount, 3 x 4 Patterned Wood Slats Bench With Contoured Back And Armrests (TimberForm 2141-7-P)	1,036.28	36.54
32 33 43 13-0145	EA	94" Length, Pedestal Mount, 3 x 4 Patterned Wood Slats Bench With Contoured Back And Armrests (TimberForm 2141-8-P)	921.30	36.54



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 33 43 13-0146 EA 118" Length, Pedestal Mount, 3 x 4 Patterned Wood Slats Bench With Contoured Back And Armrests (TimberForm 2141-10-P).....	1,208.73	36.54
32 33 43 13-0147 EA 142" Length, Pedestal Mount, 3 x 4 Patterned Wood Slats Bench With Contoured Back And Armrests (TimberForm 2141-12-P).....	1,317.32	36.54
32 33 43 13-0148 EA 70" Length, Wall Mount, 3 x 4 Patterned Wood Slats Bench With Contoured Back (TimberForm 2142-6)	781.56	54.80
32 33 43 13-0149 EA 94" Length, Wall Mount, 3 x 4 Patterned Wood Slats Bench With Contoured Back (TimberForm 2142-8)	896.53	54.80
32 33 43 13-0150 EA 118" Length, Wall Mount, 3 x 4 Patterned Wood Slats Bench With Contoured Back (TimberForm 2142-10)	1,139.25	54.80
32 33 43 13-0151 EA 70" Length, Wall Mount, 3 x 4 Patterned Wood Slats Bench With Contoured Back And Armrests (TimberForm 2143-6)	851.82	54.80
32 33 43 13-0152 EA 94" Length, Wall Mount, 3 x 4 Patterned Wood Slats Bench With Contoured Back And Armrests (TimberForm 2143-8)	966.79	54.80
32 33 43 13-0153 EA 118" Length, Wall Mount, 3 x 4 Patterned Wood Slats Bench With Contoured Back And Armrests (TimberForm 2143-10)	1,247.83	54.80
32 33 43 13-0154 Recycled Plastic Benches (Columbia Cascade, TimberForm) <small>(32 33 43 13-0089)</small>		
Note: Includes powder coated steel frames.		
32 33 43 13-0155 EA 70" Length, Embedment Mount, 3 x 4 Recycled Plastic Slats Concave Bench (TimberForm 2029-6-E).....	621.10	36.54
32 33 43 13-0156 EA 94" Length, Embedment Mount, 3 x 4 Recycled Plastic Slats Concave Bench (TimberForm 2029-8-E).....	838.27	36.54
32 33 43 13-0157 EA 70" Length, Pedestal Mount, 3 x 4 Recycled Plastic Slats Concave Bench (TimberForm 2029-6-P)	640.26	36.54
32 33 43 13-0158 EA 94" Length, Pedestal Mount, 3 x 4 Recycled Plastic Slats Concave Bench (TimberForm 2029-8-P)	857.43	36.54
32 33 43 13-0159 EA 46" Length, Embedment Mount, 3 x 4 Recycled Plastic Slats Platform Seat (TimberForm 2041-4-E)	959.63	36.54
32 33 43 13-0160 EA 70" Length, Embedment Mount, 3 x 4 Recycled Plastic Slats Platform Seat (TimberForm 2041-6-E)	1,119.31	36.54
32 33 43 13-0161 EA 46" Length, Pedestal Mount, 3 x 4 Recycled Plastic Slats Platform Seat (TimberForm 2041-4-P).....	1,010.73	36.54
32 33 43 13-0162 EA 70" Length, Pedestal Mount, 3 x 4 Recycled Plastic Slats Platform Seat (TimberForm 2041-6-P).....	1,170.41	36.54
32 33 43 13-0163 EA 70" Length, Wall Mount, 3 x 4 Recycled Plastic Slats Bench (TimberForm 2042-6).....	634.65	54.80
32 33 43 13-0164 EA 94" Length, Wall Mount, 3 x 4 Recycled Plastic Slats Bench (TimberForm 2042-8).....	756.01	54.80
32 33 43 13-0165 EA 118" Length, Wall Mount, 3 x 4 Recycled Plastic Slats Bench (TimberForm 2042-10).....	883.76	54.80
32 33 43 13-0166 EA 70" Length, Embedment Mount, 3 x 4 Recycled Plastic Slats Bench (TimberForm 2007-6-E).....	512.50	36.54
32 33 43 13-0167 EA 94" Length, Embedment Mount, 3 x 4 Recycled Plastic Slats Bench (TimberForm 2007-8-E).....	678.59	36.54
32 33 43 13-0168 EA 118" Length, Embedment Mount, 3 x 4 Recycled Plastic Slats Bench (TimberForm 2007-10-E).....	806.33	36.54
32 33 43 13-0169 EA 70" Length, Pedestal Mount, 3 x 4 Recycled Plastic Slats Bench (TimberForm 2007-6-P).....	531.68	36.54
32 33 43 13-0170 EA 94" Length, Pedestal Mount, 3 x 4 Recycled Plastic Slats Bench (TimberForm 2007-8-P).....	697.75	36.54
32 33 43 13-0171 EA 118" Length, Pedestal Mount, 3 x 4 Recycled Plastic Slats Bench (TimberForm 2007-10-P).....	831.88	36.54
32 33 43 13-0172 EA 70" Length, Embedment Mount, 3 x 4 Recycled Plastic Slats Bench With Straight Back (TimberForm 2017-6-E)	799.94	36.54
32 33 43 13-0173 EA 94" Length, Embedment Mount, 3 x 4 Recycled Plastic Slats Bench With Straight Back (TimberForm 2017-8-E)	1,068.21	36.54
32 33 43 13-0174 EA 118" Length, Embedment Mount, 3 x 4 Recycled Plastic Slats Bench With Straight Back (TimberForm 2017-10-E)	1,291.77	36.54
32 33 43 13-0175 EA 70" Length, Pedestal Mount, 3 x 4 Recycled Plastic Slats Bench With Straight Back (TimberForm 2017-6-P).....	831.88	36.54
32 33 43 13-0176 EA 94" Length, Pedestal Mount, 3 x 4 Recycled Plastic Slats Bench With Straight Back (TimberForm 2017-8-P).....	1,112.92	36.54
32 33 43 13-0177 EA 118" Length, Pedestal Mount, 3 x 4 Recycled Plastic Slats Bench With Straight Back (TimberForm 2017-10-P).....	1,336.48	36.54
32 33 43 13-0178 EA 70" Length, Embedment Mount, Back-To-Back Double Bench, 3 x 4 Recycled Plastic Slats Benches With Straight Backs (TimberForm 2027-6-E)	1,534.48	36.54
32 33 43 13-0179 EA 94" Length, Embedment Mount, Back-To-Back Double Bench, 3 x 4 Recycled Plastic Slats Benches With Straight Backs (TimberForm 2027-8-E)	2,102.95	36.54
32 33 43 13-0180 EA 118" Length, Embedment Mount, Back-To-Back Double Bench, 3 x 4 Recycled Plastic Slats Benches With Straight Backs (TimberForm 2027-10-E).....	2,326.51	36.54
32 33 43 13-0181 EA 70" Length, Pedestal Mount, Back-To-Back Double Bench, 3 x 4 Recycled Plastic Slats Benches With Straight Backs (TimberForm 2027-6-P)	1,566.42	36.54
32 33 43 13-0182 EA 94" Length, Pedestal Mount, Back-To-Back Double Bench, 3 x 4 Recycled Plastic Slats Benches With Straight Backs (TimberForm 2027-8-P)	2,147.67	36.54
32 33 43 13-0183 EA 118" Length, Pedestal Mount, Back-To-Back Double Bench, 3 x 4 Recycled Plastic Slats Benches With Straight Backs (TimberForm 2027-10-P)	2,371.22	36.54
32 33 43 13-0184 EA 70" Length, Embedment Mount, 3 x 4 Patterned Recycled Plastic Slats Bench With Contoured Back And Armrests (TimberForm 2155-6-E).....	972.40	36.54
32 33 43 13-0185 EA 82" Length, Embedment Mount, 3 x 4 Patterned Recycled Plastic Slats Bench With Contoured Back And Armrests (TimberForm 2155-7-E).....	1,342.87	36.54
32 33 43 13-0186 EA 94" Length, Embedment Mount, 3 x 4 Patterned Recycled Plastic Slats Bench With Contoured Back And Armrests (TimberForm 2155-8-E).....	1,285.38	36.54
32 33 43 13-0187 EA 118" Length, Embedment Mount, 3 x 4 Patterned Recycled Plastic Slats Bench With Contoured Back And Armrests (TimberForm 2155-10-E).....	1,470.61	36.54
32 33 43 13-0188 EA 142" Length, Embedment Mount, 3 x 4 Patterned Recycled Plastic Slats Bench With Contoured Back And Armrests (TimberForm 2155-12-E).....	1,968.82	36.54
32 33 43 13-0189 EA 70" Length, Pedestal Mount, 3 x 4 Patterned Recycled Plastic Slats Bench With Contoured Back And Armrests (TimberForm 2155-6-P).....	985.18	36.54
32 33 43 13-0190 EA 82" Length, Pedestal Mount, 3 x 4 Patterned Recycled Plastic Slats Bench With Contoured Back And Armrests (TimberForm 2155-7-P).....	1,362.03	36.54
32 33 43 13-0191 EA 94" Length, Pedestal Mount, 3 x 4 Patterned Recycled Plastic Slats Bench With Contoured Back And Armrests (TimberForm 2155-8-P).....	1,304.54	36.54
32 33 43 13-0192 EA 118" Length, Pedestal Mount, 3 x 4 Patterned Recycled Plastic Slats Bench With Contoured Back And Armrests (TimberForm 2155-10-P).....	1,489.77	36.54
32 33 43 13-0193 EA 142" Length, Pedestal Mount, 3 x 4 Patterned Recycled Plastic Slats Bench With Contoured Back And Armrests (TimberForm 2155-12-P).....	2,000.76	36.54
32 33 43 13-0194 EA 70" Length, Wall Mount, 3 x 4 Patterned Recycled Plastic Slats Bench With Contoured Back (TimberForm 2154-6)	941.24	54.80
32 33 43 13-0195 EA 94" Length, Wall Mount, 3 x 4 Patterned Recycled Plastic Slats Bench With Contoured Back (TimberForm 2154-8)	1,254.22	54.80
32 33 43 13-0196 EA 118" Length, Wall Mount, 3 x 4 Patterned Recycled Plastic Slats Bench With Contoured Back (TimberForm 2154-10)	1,541.65	54.80
32 33 43 13-0197 EA 70" Length, Wall Mount, 3 x 4 Patterned Recycled Plastic Slats Bench With Contoured Back And Armrests (TimberForm 2156-6)	1,049.83	54.80
32 33 43 13-0198 EA 94" Length, Wall Mount, 3 x 4 Patterned Recycled Plastic Slats Bench With Contoured Back And Armrests (TimberForm 2156-8)	1,388.35	54.80

32 Exterior Improvements**32 30 Site Improvements****32 33 Site Furnishings**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 33 43 13-0199	EA		118" Length, Wall Mount, 3 x 4 Patterned Recycled Plastic Slats Bench With Contoured Back And Armrests (TimberForm 2156-10).....	1,522.49	54.80
32 33 43 13-0200	EA		46" Length, Embedment Mount, 3 x 4 Patterned Recycled Plastic Slats Bench (TimberForm 2151-4-E)	461.42	36.54
32 33 43 13-0201	EA		70" Length, Embedment Mount, 3 x 4 Patterned Recycled Plastic Slats Bench (TimberForm 2151-6-E)	595.55	36.54
32 33 43 13-0202	EA		94" Length, Embedment Mount, 3 x 4 Patterned Recycled Plastic Slats Bench (TimberForm 2151-8-E)	793.56	36.54
32 33 43 13-0203	EA		118" Length, Embedment Mount, 3 x 4 Patterned Recycled Plastic Slats Bench (TimberForm 2151-10-E)	927.69	36.54
32 33 43 13-0204	EA		142" Length, Embedment Mount, 3 x 4 Patterned Recycled Plastic Slats Bench (TimberForm 2151-12-E)	1,074.60	36.54
32 33 43 13-0205	EA		46" Length, Pedestal Mount, 3 x 4 Patterned Recycled Plastic Slats Bench (TimberForm 2151-4-P)	474.19	36.54
32 33 43 13-0206	EA		70" Length, Pedestal Mount, 3 x 4 Patterned Recycled Plastic Slats Bench (TimberForm 2151-6-P)	608.33	36.54
32 33 43 13-0207	EA		94" Length, Pedestal Mount, 3 x 4 Patterned Recycled Plastic Slats Bench (TimberForm 2151-8-P)	812.72	36.54
32 33 43 13-0208	EA		118" Length, Pedestal Mount, 3 x 4 Patterned Recycled Plastic Slats Bench (TimberForm 2151-10-P)	946.85	36.54
32 33 43 13-0209	EA		142" Length, Pedestal Mount, 3 x 4 Patterned Recycled Plastic Slats Bench (TimberForm 2151-12-P)	1,100.15	36.54
32 33 43 13-0210	EA		70" Length, Embedment Mount, 3 x 4 Patterned Recycled Plastic Slats Bench With Contoured Back (TimberForm 2153-6-E).....	870.21	36.54
32 33 43 13-0211	EA		94" Length, Embedment Mount, 3 x 4 Patterned Recycled Plastic Slats Bench With Contoured Back (TimberForm 2153-8-E).....	1,183.18	36.54
32 33 43 13-0212	EA		118" Length, Embedment Mount, 3 x 4 Patterned Recycled Plastic Slats Bench With Contoured Back (TimberForm 2153-10-E)	1,451.45	36.54
32 33 43 13-0213	EA		142" Length, Embedment Mount, 3 x 4 Patterned Recycled Plastic Slats Bench With Contoured Back (TimberForm 2153-12-E)	1,630.29	36.54
32 33 43 13-0214	EA		70" Length, Pedestal Mount, 3 x 4 Patterned Recycled Plastic Slats Bench With Contoured Back (TimberForm 2153-6-P).....	882.98	36.54
32 33 43 13-0215	EA		94" Length, Pedestal Mount, 3 x 4 Patterned Recycled Plastic Slats Bench With Contoured Back (TimberForm 2153-8-P).....	1,202.34	36.54
32 33 43 13-0216	EA		118" Length, Pedestal Mount, 3 x 4 Patterned Recycled Plastic Slats Bench With Contoured Back (TimberForm 2153-10-P).....	1,470.61	36.54
32 33 43 13-0217	EA		142" Length, Pedestal Mount, 3 x 4 Patterned Recycled Plastic Slats Bench With Contoured Back (TimberForm 2153-12-P).....	1,655.84	36.54

32 33 43 53 Site Tables (32 33 43)

32 33 43 53-0001			Picnic Tables (32 33 43 53)		
32 33 43 53-0002			Wooden Picnic Tables (32 33 43 53-0001)		
32 33 43 53-0003	EA		6' Permanent Rectangular Redwood Table	745.27	54.80
32 33 43 53-0004			Portable Picnic Tables (32 33 43 53-0001)		
32 33 43 53-0005	EA		6' Wood Table With Aluminum Frame.....	416.53	36.54
32 33 43 53-0006	EA		6' Aluminum Table And Frame.....	582.51	36.54
32 33 43 53-0007	EA		8' Aluminum Table And Frame.....	697.81	45.67
32 33 43 53-0008	EA		6' Steel Table And Frame	876.62	36.54
32 33 43 53-0009	EA		8' Steel Table And Frame	1,004.73	45.67
32 33 43 53-0010			Concrete Picnic Tables (32 33 43 53-0001)		
32 33 43 53-0011	EA		6' Concrete Picnic Table	1,662.95	165.43
32 33 43 53-0012			Plastic Picnic Tables (32 33 43 53-0001) Note: Manufactured from recycled plastic.		
32 33 43 53-0013			Pedestal Tables - 4' Square, 2 Seats (32 33 43 53-0012)		
32 33 43 53-0014	EA		3" x 4" Slats, Pedestal Table, 4' Square, 2 Seats	471.42	54.80
32 33 43 53-0015	EA		4" x 4" Slats, Pedestal Table, 4' Square, 2 Seats	509.86	54.80
32 33 43 53-0016			Pedestal Tables - 4' Square, 4 Seats (32 33 43 53-0012)		
32 33 43 53-0017	EA		3" x 4" Slats, Pedestal Table, 4' Square, 4 Seats	596.06	54.80
32 33 43 53-0018	EA		4" x 4" Slats, Pedestal Table, 4' Square, 4 Seats	647.67	54.80
32 33 43 53-0019			Recycled Plastic Tables (32 33 43 53-0012)		
32 33 43 53-0020	EA		6' Standard "Step-Over" Table, Recycled Plastic Lumber.....	758.95	54.80
32 33 43 53-0021	EA		6' " Walk-Through" Table, Recycled Plastic Lumber	643.85	54.80
32 33 43 53-0022	EA		7' Reinforced "Step-Over" Table, Recycled Plastic Lumber, ADA Ends	696.74	54.80
32 33 43 53-0023	EA		8' " Walk-Through" Table, Recycled Plastic Lumber, ADA Ends	656.12	54.80
32 33 43 53-0024	EA		8' Reinforced "Step-Over" Table, Recycled Plastic Lumber, ADA Ends	807.51	54.80
32 33 43 53-0025	EA		4' Youth Table, Recycled Plastic Lumber.....	349.51	43.84

32 33 53 Site Grills (32 33)

32 33 53 00-0001			Picnic Grills (32 33 53)		
32 33 53 00-0002	EA		20" Wide x 14" Deep x 8-1/2" High Adjustable Grill	296.88	
			Note: 11 gauge with galvanized steel post.		
32 33 53 00-0003	EA		20" Wide x 14" Deep x 8-1/2" High Adjustable Grill	317.22	
			Note: 7 gauge with galvanized steel post.		

32 33 63 Skate Board Deterrent (32 33)



Exterior Improvements	32	32
Site Improvements	32 30	
Site Furnishings	32 33	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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32 33 63 00-0001	Skate Stoppers <small>(32 33 63)</small>		
32 33 63 00-0002	EA Aluminum Architectural Series Pieces, Skate Stopper	38.61	
	Note: Various shapes. Includes drilling and anchoring into suitable surface material.		
	For >60 To 100, Deduct	-3.76	
	For >100 To 250, Deduct	-4.83	
	For >250, Deduct	-5.90	
32 33 63 00-0003	EA Aluminum Fixed Angle Series Pieces, Skate Stopper	32.47	
	Note: Various shapes. Includes drilling and anchoring into suitable surface material.		
	For >60 To 100, Deduct	-2.90	
	For >100 To 250, Deduct	-3.79	
	For >250, Deduct	-4.67	
32 33 63 00-0004	EA Aluminum Fixed Radius Series Pieces, Skate Stopper	32.47	
	Note: Various shapes. Includes drilling and anchoring into suitable surface material.		
	For >60 To 100, Deduct	-2.90	
	For >100 To 250, Deduct	-3.79	
	For >250, Deduct	-4.67	
32 33 63 00-0005	EA Aluminum Bench Clips, Skate Stopper	22.15	
	Note: Various shapes. Includes drilling and anchoring into suitable surface material.		
	For >60 To 100, Deduct	-1.79	
	For >100 To 250, Deduct	-2.38	
	For >250, Deduct	-2.97	
32 33 63 00-0006	EA Aluminum Curve Clips, Skate Stopper	25.31	
	Note: Various shapes. Includes drilling and anchoring into suitable surface material.		
	For >60 To 100, Deduct	-2.23	
	For >100 To 250, Deduct	-2.91	
	For >250, Deduct	-3.60	
32 33 63 00-0007	EA Aluminum Hand Rail, Skate Stopper	23.03	
	Note: Various shapes. Includes drilling and anchoring into suitable surface material.		
	For >60 To 100, Deduct	-1.91	
	For >100 To 250, Deduct	-2.53	
	For >250, Deduct	-3.15	
32 33 63 00-0008	EA Aluminum 2" x 3" x 0.25" Flat Cap, Skate Stopper	21.86	
	Note: Includes drilling and anchoring into suitable surface material.		
	For >60 To 100, Deduct	-1.75	
	For >100 To 250, Deduct	-2.33	
	For >250, Deduct	-2.91	
32 33 63 00-0009	EA Aluminum 6" Diameter x 0.25" Rumble Disc, Skate Stopper	32.76	
	Note: Includes drilling and anchoring into suitable surface material.		
	For >60 To 100, Deduct	-2.94	
	For >100 To 250, Deduct	-3.83	
	For >250, Deduct	-4.73	
32 33 63 00-0010	EA Aluminum 4" x 17" x 0.25" Flat Strap, Skate Stopper	54.51	
	Note: Includes drilling and anchoring into suitable surface material.		
	For >60 To 100, Deduct	-5.99	
	For >100 To 250, Deduct	-7.53	
	For >250, Deduct	-9.08	

32 39 **Manufactured Site Specialties** (32 39)

32 39 13 **Manufactured Metal Bollards** (32 39)

32 39 13 00-0001	Metal Pipe Bollards <small>(32 39 13)</small>		
	Note: For bollards by the LF, the quantity is the total length, including the buried portion, if any. See CSI section 32 31 13 00-0001 for augering and filling holes for bollards, 32 31 13 00-0018 for concrete fill for post and post holes.		
32 39 13 00-0002	Steel Pipe Bollard, Schedule 40 Pipe, Painted Or Powder Coated <small>(32 39 13 00-0001)</small>		
32 39 13 00-0003	LF 4" Steel Pipe Bollard, Schedule 40, Painted Or Powder Coated	35.08	9.44
	For Galvanized Steel, Add	2.75	
	For 304 Stainless Steel, Add	21.87	
	For Each Surface Mounted Bollard (Includes Base Plate And Anchor Bolts), Add	99.52	
	For Each Sleeve For Removable, Lockable Bollard (Includes Tamper Proof Screw), Add	75.68	
	For Schedule 80, Add	4.32	
32 39 13 00-0004	LF 6" Steel Pipe Bollard, Schedule 40, Painted Or Powder Coated	44.43	9.44
	For Galvanized Steel, Add	4.34	
	For 304 Stainless Steel, Add	34.49	
	For Each Surface Mounted Bollard (Includes Base Plate And Anchor Bolts), Add	99.52	
	For Each Sleeve For Removable, Lockable Bollard (Includes Tamper Proof Screw), Add	75.68	
	For Schedule 80, Add	5.72	
32 39 13 00-0005	LF 8" Steel Pipe Bollard, Schedule 40, Painted Or Powder Coated	61.49	11.81
	For Galvanized Steel, Add	6.44	
	For 304 Stainless Steel, Add	51.15	
	For Each Surface Mounted Bollard (Includes Base Plate And Anchor Bolts), Add	132.40	
	For Each Sleeve For Removable, Lockable Bollard, Add	115.36	
	For Schedule 80, Add	8.04	
32 39 13 00-0006	LF 10" Steel Pipe Bollard, Schedule 40, Painted Or Powder Coated	80.16	14.16
	For Galvanized Steel, Add	8.81	
	For 304 Stainless Steel, Add	69.98	
	For Each Surface Mounted Bollard (Includes Base Plate And Anchor Bolts), Add	151.28	
	For Each Sleeve For Removable, Lockable Bollard, Add	124.80	
	For Schedule 80, Add	10.61	

32 Exterior Improvements**32 30 Site Improvements****32 39 Manufactured Site Specialties**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 39 13 00-0007 LF 12" Steel Pipe Bollard, Schedule 40, Painted Or Powder Coated.....	102.11	18.88
For Galvanized Steel, Add	10.94	
For 304 Stainless Steel, Add	86.86	
For Each Surface Mounted Bollard (Includes Base Plate And Anchor Bolts), Add	210.08	
For Each Sleeve For Removable, Lockable Bollard, Add	172.41	
For Schedule 80, Add	13.43	
32 39 16 Manufactured Concrete Bollards (32 39)		
32 39 16 00-0001 Concrete Bollards (32 39 16)		
Note: For bollards by the LF, the quantity is the total length, including the buried portion, if any.		
32 39 16 00-0002 Concrete Bollard, Exposed Aggregate (32 39 16 00-0001)		
32 39 16 00-0003 EA 12" x 12" x 30" High Concrete Bollard, Light Sandblast.....	426.01	75.53
Note: Surface mounted with anchor bolts embedded into grout pockets.		
32 39 16 00-0004 EA 12" Diameter x 30" High Concrete Bollard, Light Sandblast	426.01	75.53
Note: Surface mounted with anchor bolts embedded into grout pockets.		
32 39 19 Manufactured Wood Bollards (32 39)		
32 39 19 00-0001 Wood Bollards (32 39 19)		
Note: For bollards by the LF, the quantity is the total length, including the buried portion, if any. See CSI section 32 31 13 00-0001 for augering and filling holes for bollards, 32 31 13 00-0018 for concrete fill.		
32 39 19 00-0002 Wood Bollard, Pressure Treated Timber (32 39 19 00-0001)		
32 39 19 00-0003 LF 4" x 4", Pressure Treated Wood Bollard	17.83	7.56
For Each Sleeve For Removable, Lockable Bollard, Add	77.22	
32 39 19 00-0004 LF 6" x 6", Pressure Treated Wood Bollard	20.70	7.56
For Each Sleeve For Removable, Lockable Bollard, Add	77.22	
32 39 19 00-0005 LF 8" x 8", Pressure Treated Wood Bollard	26.96	8.50
For Each Sleeve For Removable, Lockable Bollard, Add	119.18	
32 39 19 00-0006 LF 10" x 10", Pressure Treated Wood Bollard	38.20	11.33
For Each Sleeve For Removable, Lockable Bollard, Add	130.52	
32 39 19 00-0007 LF 12" x 12", Pressure Treated Wood Bollard	52.58	15.10
For Each Sleeve For Removable, Lockable Bollard, Add	181.51	
32 39 23 Manufactured Plastic Bollards (32 39)		
32 39 23 00-0001 Plastic Bollards (32 39 23)		
See CSI section 32 31 13 00-0001 for augering and filling holes for bollards.		
32 39 23 00-0002 Recycled Plastic Bollards (32 39 23 00-0001)		
32 39 23 00-0003 EA 6" x 6" x 33" Surface Mounted Recycled Plastic Bollard.....	198.46	37.77
Note: Includes anchor bolts.		
32 39 23 00-0004 EA 6" Diameter x 6" Steel Reinforced Recycled Plastic Bollard.....	307.91	37.77
32 39 23 00-0005 Plastic Bollard Covers (32 39 23 00-0001)		
32 39 23 00-0006 EA 4" x 60", 1/8" Thick LDPE Bollard Cover, Fits 4" To 4-1/2" Pipe	51.25	9.36
For Reflective Tape, Add	5.16	
32 39 23 00-0007 EA 6" x 60", 1/8" Thick LDPE Bollard Cover, Fits 6" To 6-5/8" Pipe	55.67	10.31
For Reflective Tape, Add	5.16	
32 39 23 00-0008 EA 3" x 60", 1/4" Thick LDPE Bollard Cover, Fits 3" To 3 1/2" Pipe	67.52	9.36
For Reflective Tape, Add	5.16	
32 39 23 00-0009 EA 3-1/2" x 52", 1/4" Thick LDPE Bollard Cover, Fits 3 -1/2" To 4" Pipe.....	67.52	9.36
For Reflective Tape, Add	5.16	
32 39 23 00-0010 EA 3-1/2" x 68", 1/4" Thick LDPE Bollard Cover, Fits 3-1/2" To 4" Pipe.....	75.11	9.36
For Reflective Tape, Add	5.16	
32 39 23 00-0011 EA 4" x 52", 1/4" Thick LDPE Bollard Cover, Fits 4" To 4-1/2" Pipe.....	67.52	9.36
For Reflective Tape, Add	5.16	
32 39 23 00-0012 EA 4" x 60", 1/4" Thick LDPE Bollard Cover, Fits 4" To 4-1/2" Pipe	68.60	9.36
For Reflective Tape, Add	5.16	
32 39 23 00-0013 EA 5" x 52", 1/4" Thick LDPE Bollard Cover, Fits 5" To 5-9/16" Pipe	67.52	9.36
For Reflective Tape, Add	5.16	
32 39 23 00-0014 EA 5" x 60", 1/4" Thick LDPE Bollard Cover, Fits 5" To 5-9/16" Pipe	68.60	9.36
For Reflective Tape, Add	5.16	
32 39 23 00-0015 EA 5" x 72", 1/4" Thick LDPE Bollard Cover, Fits 5" To 5-9/16" Pipe	93.55	9.36
For Reflective Tape, Add	5.16	
32 39 23 00-0016 EA 6" x 52", 1/4" Thick LDPE Bollard Cover, Fits 6" To 6-5/8" Pipe	69.39	10.31
For Reflective Tape, Add	5.16	
32 39 23 00-0017 EA 6" x 65", 1/4" Thick LDPE Bollard Cover, Fits 6" To 6-5/8" Pipe	86.74	10.31
For Reflective Tape, Add	5.16	
32 39 23 00-0018 EA 6" x 84", 1/4" Thick LDPE Bollard Cover, Fits 6" To 6-5/8" Pipe	97.96	10.31
For Reflective Tape, Add	5.16	
32 39 23 00-0019 EA 7" x 56", 1/4" Thick LDPE Bollard Cover, Fits 6" To 6-5/8" Pipe	84.28	11.24
For Reflective Tape, Add	5.16	
32 39 23 00-0020 EA 8" x 52", 1/4" Thick LDPE Bollard Cover, Fits 7" To 7-5/16" Pipe	90.79	11.24
For Reflective Tape, Add	5.16	
32 39 23 00-0021 EA 8" x 69", 1/4" Thick LDPE Bollard Cover, Fits 8" To 8-5/8" Pipe	90.79	11.24
For Reflective Tape, Add	5.16	
32 39 23 00-0022 EA 10" x 69", 1/4" Thick LDPE Bollard Cover, Fits 10" To 11" Pipe	120.08	11.24
For Reflective Tape, Add	5.16	



Exterior Improvements	32	32
Site Improvements	32 30	
Manufactured Site Specialties	32 39	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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32 39 26 Manufactured Stone Bollards (32 39)

32 39 26 00-0001	Stone Bollards (32 39 26)		
32 39 26 00-0002	Granite Bollards (32 39 26 00-0001)		
32 39 26 00-0003	EA 16" x 16" x 30" Granite Bollard, Smooth Matt Finish Note: Surface mounted with anchors embedded into grout pockets.	948.74	94.41
32 39 26 00-0004	EA 16" x 16" x 54" Granite Bollard, Smooth Matt Finish Note: Surface mounted with anchors embedded into grout pockets.	1,203.90	132.18
32 39 26 00-0005	EA 12" x 12" x 24" Granite Bollard, Rough Finish, Pyramid Top Note: Surface mounted with anchors embedded into grout pockets.	595.03	94.41
32 39 26 00-0006	EA 12" Diameter x 18" Granite Bollard, Smooth Matt Finish Note: Flat Top, surface mounted with anchors embedded into grout pockets.	869.52	75.53
32 39 26 00-0007	EA 24" x 24" x 20" Granite Bollard, Octagonal Cross Section Note: Smooth matt finish, flat top, surface mounted with anchors embedded into grout pockets.	1,290.94	75.53

32 80 Irrigation (32)

32 82 Irrigation Pumps (32 80)

32 82 00 00-0001 Variable Frequency Booster Pump Stations (32 82)

32 82 00 00-0002	EA 200 GPM, 7.5 HP, 4" Suction/Discharge Connections, Variable Frequency, Horizontal Booster Pump Station (Rainbird) Note: Includes marine grade aluminum enclosure, separate NEMA 3R electrical controls enclosure, circuit breaker motor protection, surge protection, fan and louver cooling, glycerin filled pressure gauges, pump thermal switch and auto restart capability.	17,509.49	220.50
	<i>For Pump Bypass Manifold With Isolation Valves, Add</i>	319.74	
	<i>For Externally Mounted Pump Station Fault Alarm Light, Add</i>	382.57	
	<i>For Flow Switch, Add</i>	638.36	
	<i>For Pressure Relief Valve With Relief Piping, Add</i>	867.23	
	<i>For Environmental Package With Heater And Insulation, Add</i>	1,851.14	

32 84 Planting Irrigation (32 80)

32 84 13 Drip Irrigation (32 84)

32 84 13 00-0001 Drip Emmitter Irrigation Devices (32 84 13)

32 84 13 00-0002 Drip Emmitter Irrigation Valves (32 84 13 00-0001)

32 84 13 00-0003	EA 3/4", Shut-Off Ball Valve For Drip Emmitter Irrigation Systems (Rainbird XBV-075)	33.84	7.98
32 84 13 00-0004	EA 3/4", Check Valve For Drip Emmitter Irrigation Systems (Rainbird CV075)	43.16	7.98
32 84 13 00-0005	EA 1", Check Valve For Drip Emmitter Irrigation Systems (Rainbird CV-100)	46.38	7.98
32 84 13 00-0006	EA Air/Vacuum Relief Valve For Drip Emmitter Irrigation Systems (Rainbird ARVALVEKIT)	34.86	7.98
32 84 13 00-0007	EA 3/4", Low Flow Remote Control Valve For Drip Emmitter Irrigation Systems (Rainbird ASV-LF-075)	60.95	7.98
32 84 13 00-0008	EA 1", Low Flow Remote Control Valve For Drip Emmitter Irrigation Systems (Rainbird LRV100)	60.71	7.98
32 84 13 00-0009	EA 3/4", Anti-Siphon, Low Flow Remote Control Valve For Drip Emmitter Irrigation Systems (Rainbird LRV075)	58.95	7.98
32 84 13 00-0010	EA 3/4", Latching Solenoid, Low Flow Remote Control Valve For Drip Emmitter Irrigation Systems (Rainbird LRV075TBOS)	87.82	7.98

32 84 13 00-0011 Drip Emmitter Irrigation Filters (32 84 13 00-0001)

32 84 13 00-0012	EA 3/4" Inlet/Outlet, Inline Basket Filter For Drip Emmitter Irrigation Systems (Rainbird QKCHK-075)	121.61	7.98
32 84 13 00-0013	EA 1" Inlet/Outlet, Inline Basket Filter For Drip Emmitter Irrigation Systems (Rainbird QKCHK-100)	122.77	7.98
32 84 13 00-0014	EA 3/4" Inlet/Outlet, Inline Wye Filter For Drip Emmitter Irrigation Systems (Rainbird RBY075MPTX)	44.55	7.98
32 84 13 00-0015	EA 1" Inlet/Outlet, Inline Wye Filter For Drip Emmitter Irrigation Systems (Rainbird RBY100MPTX)	45.48	7.98
32 84 13 00-0016	EA 1" Inlet/Outlet, Pressure Regulating, Inline Basket Filter For Drip Emmitter Irrigation Systems (Rainbird PRB-QCHK-100)	132.47	7.98
32 84 13 00-0017	EA 3/4" Inlet/Outlet, Pressure Regulating, Inline RBY Filter For Drip Emmitter Irrigation Systems (Rainbird PRF075RBY)	58.58	7.98
32 84 13 00-0018	EA 1" Inlet/Outlet, Pressure Regulating, Inline RBY Filter For Drip Emmitter Irrigation Systems (Rainbird PRF100RBY)	65.87	7.98
32 84 13 00-0019	EA 3/4" Inlet/Outlet, Pressure Regulating, Inline Back Flush Filter For Drip Emmitter Irrigation Systems (Rainbird PRF075BFF)	70.88	7.98
32 84 13 00-0020	EA 1" Inlet/Outlet, Pressure Regulating, Inline Back Flush Filter For Drip Emmitter Irrigation Systems (Rainbird PRF100BFF)	78.85	7.98

32 84 13 00-0021 Drip Emmitter Irrigation Pressure Regulators (32 84 13 00-0001)

32 84 13 00-0022	EA 3/4", 6 To 300 GPH, 30 PSI, Inline Pressure Regulator For Drip Emmitter Irrigation Systems (Rainbird PSI-L30X-075)	43.61	7.98
32 84 13 00-0023	EA 3/4", 120 To 600 GPH, 30 PSI, Inline Pressure Regulator For Drip Emmitter Irrigation Systems (Rainbird PSI-M30X-075)	43.61	7.98
32 84 13 00-0024	EA 3/4", 120 To 600 GPH, 40 PSI, Inline Pressure Regulator For Drip Emmitter Irrigation Systems (Rainbird PSI-M40X-075)	43.61	7.98
32 84 13 00-0025	EA 1", 120 To 900 GPH, 40 PSI, Inline Pressure Regulator For Drip Emmitter Irrigation Systems (Rainbird PSI-M40X-100)	51.28	7.98

32 84 13 00-0026 Drip Emmitter Irrigation Tubing (32 84 13 00-0001)

Note: Includes surface installation and covering of tubing with existing pine straw, pine bark etc.

32 Exterior Improvements**32 80 Irrigation****32 84 Planting Irrigation**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 84 13 00-0027	LF		1/4", Landscape Dripline With Extruded Non-Pressure Compensating Drip Emitters (Rainbird LDQ0806100).....	2.72	1.12
32 84 13 00-0028	LF		1/2", Landscape Dripline With Extruded Pressure Compensating Drip Emitters (Rainbird XFD0612100).....	2.72	1.28
32 84 13 00-0029	LF		1/4", UV-Resistant, Polyethylene, Distribution Tubing For Drip Emitter Irrigation Systems (Rainbird XQ100).....	2.36	1.12
			<i>For Shallow Trenching And Backfill By Hand, Add</i>	4.58	
32 84 13 00-0030	LF		1/2", UV-Resistant, Polyethylene, Distribution Tubing For Drip Emitter Irrigation Systems (Rainbird XT700100).....	2.72	1.28
			<i>For Shallow Trenching And Backfill By Hand, Add</i>	4.96	
32 84 13 00-0031			Drip Emitter Irrigation Fittings <small>(32 84 13 00-0001)</small>		
32 84 13 00-0032	EA		1/4", Barbed Coupling For Irrigation Tubing (Rainbird XBF1CONN).....	2.15	
32 84 13 00-0033	EA		1/4", Barbed Elbow For Irrigation Tubing (Rainbird XBF2EL).....	2.18	
32 84 13 00-0034	EA		1/4", Barbed Tee For Irrigation Tubing (Rainbird XBF3TEE).....	2.23	
32 84 13 00-0035	EA		1/4", Self Piercing Barbed Coupling For Irrigation Tubing (Rainbird SFB025).....	2.50	
32 84 13 00-0036	EA		1/4", Plug For Irrigation Tubing (Rainbird EMAGPX).....	2.12	
32 84 13 00-0037	EA		1/2", Barbed Coupling For Irrigation Tubing (Rainbird XFDCOUP).....	2.57	
			<i>For Compression Fitting, Add</i>	0.58	
32 84 13 00-0038	EA		1/2", Barbed Elbow For Irrigation Tubing (Rainbird XFD-ELBOW).....	2.60	
			<i>For Compression Fitting, Add</i>	0.61	
32 84 13 00-0039	EA		1/2", Barbed Tee For Irrigation Tubing (Rainbird XFD-TEE).....	2.62	
			<i>For Compression Fitting, Add</i>	0.63	
32 84 13 00-0040	EA		1/2", Barbed Male Adapter For Irrigation Tubing (Rainbird XFDMA050).....	2.54	
			<i>For Compression Fitting, Add</i>	0.55	
32 84 13 00-0041	EA		1/2", Barbed Cross For Irrigation Tubing (Rainbird XFDCROSS).....	2.65	
			<i>For Compression Fitting, Add</i>	0.66	
32 84 13 00-0042	EA		1/2", Plug For Irrigation Tubing (Rainbird MDCFCAP).....	2.87	
32 84 13 00-0043	EA		6" Soil Staple For Irrigation Tubing (Rainbird NFT-LS6).....	1.67	
32 84 13 00-0044			Drip Emitters <small>(32 84 13 00-0001)</small>		
32 84 13 00-0045	EA		0.5 To 2 GPH, Single Outlet, Pressure Compensating Emitter For Drip Emitter Irrigation Systems (Rainbird XB20PC).....	4.46	
32 84 13 00-0046	EA		5 To 24 GPH, Single Outlet, Pressure Compensating Emitter For Drip Emitter Irrigation Systems (Rainbird PC24).....	5.60	
32 84 13 00-0047	EA		0.5 To 2 GPH, Six Outlet, Pressure Compensating Emitter For Drip Emitter Irrigation Systems (Rainbird XB056).....	11.83	
32 84 13 00-0048			Drip Emitter Irrigation Micro-Bubblers, Sprays And Misters <small>(32 84 13 00-0001)</small>		
32 84 13 00-0049	EA		Adjustable Stream Bubbler With Spike For Drip Emitter Irrigation Systems (Rainbird SXB360SPYK).....	17.42	7.19
32 84 13 00-0050	EA		Adjustable Micro Spray With Spike For Drip Emitter Irrigation Systems (Rainbird XS360TSPYK).....	17.46	7.19
32 84 13 00-0051	EA		12" Height, Riser Assembly With Pressure Compensating Nozzle For Drip Emitter Irrigation Systems (Rainbird XPCNADP12 With XPCN-FUL).....	20.80	7.19
32 84 13 00-0052	EA		24" Height, Riser Assembly With Pressure Compensating Nozzle For Drip Emitter Irrigation Systems Rainbird XPCNADP24 With XPCN-FUL).....	21.02	7.19
32 84 13 00-0053	EA		4" Pop-Up Height, Micro Spray Pop-Ups For Drip Emitter Irrigation Systems (Rainbird XP-400X With XPCN-FUL).....	30.35	9.42
			Note: Includes nozzle.		
32 84 13 00-0054	EA		6" Pop-Up Height, Micro Spray Pop-Ups For Drip Emitter Irrigation Systems (Rainbird XP-600X With XPCN-FUL).....	33.35	9.42
			Note: Includes nozzle.		
32 84 13 00-0055	EA		12" Pop-Up Height, Micro Spray Pop-Ups For Drip Emitter Irrigation Systems (Rainbird XP1200X With XPCN-FUL).....	35.75	9.42
			Note: Includes nozzle.		
32 84 13 00-0056			Subsurface Drip Emitter Irrigation Tubing (Rainbird XFS) <small>(32 84 13 00-0001)</small>		
			Note: Brown or purple tubing. Includes layout, trenching 4" to 6", installing tubing and backfilling trench.		
32 84 13 00-0057	LF		0.536" ID, 0.634" OD, Subsurface Drip Emitter Irrigation Tubing (Rainbird XFS Copper Shield).....	3.09	1.40
32 84 23			Underground Sprinklers <small>(32 84)</small>		
32 84 23 00-0001			Sprinkler Heads <small>(32 84 23)</small>		
32 84 23 00-0002			Spray Sprinkler Heads <small>(32 84 23 00-0001)</small>		
			Note: Includes plastic riser and case. Includes spray, variable arc or bubbler nozzle with partial or full circle coverage.		
32 84 23 00-0003	EA		2" Pop-Up Height, Spray Sprinkler Head (Rainbird 1802P).....	25.44	8.82
			<i>For Rotary Nozzle, Add</i>	3.25	
32 84 23 00-0004	EA		3" Pop-Up Height, Spray Sprinkler Head (Rainbird 1803P).....	25.44	8.82
			<i>For Rotary Nozzle, Add</i>	3.25	
32 84 23 00-0005	EA		4" Pop-Up Height, Spray Sprinkler Head (Rainbird 1804P).....	25.44	8.82
			<i>For Rotary Nozzle, Add</i>	3.25	
32 84 23 00-0006	EA		6" Pop-Up Height, Spray Sprinkler Head (Rainbird 1806P).....	32.00	8.82
			<i>For Rotary Nozzle, Add</i>	3.25	
32 84 23 00-0007	EA		12" Pop-Up Height, Spray Sprinkler Head (Rainbird 1812P).....	39.15	8.82
			<i>For Rotary Nozzle, Add</i>	3.25	
32 84 23 00-0008	EA		4" Pop-Up Height, Spray Sprinkler Head With Check Valve (Rainbird 1804-SAM).....	27.74	8.82
			<i>For Rotary Nozzle, Add</i>	3.25	
32 84 23 00-0009	EA		6" Pop-Up Height, Spray Sprinkler Head With Check Valve (Rainbird 1806-SAM).....	37.63	8.82
			<i>For Rotary Nozzle, Add</i>	3.25	
32 84 23 00-0010	EA		12" Pop-Up Height, Spray Sprinkler Head With Check Valve (Rainbird 1812-SAM).....	42.87	8.82
			<i>For Rotary Nozzle, Add</i>	3.25	
32 84 23 00-0011	EA		4" Pop-Up Height, Spray Sprinkler Head With Pressure Regulator (Rainbird 1804-PRS).....	29.39	8.82
			<i>For Rotary Nozzle, Add</i>	3.25	
32 84 23 00-0012	EA		6" Pop-Up Height, Spray Sprinkler Head With Pressure Regulator (Rainbird 1806-PRS).....	40.63	8.82
			<i>For Rotary Nozzle, Add</i>	3.25	



		Exterior Improvements	32
		Irrigation	32 80
		Planting Irrigation	32 84

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 84 23 00-0013 EA 12" Pop-Up Height, Spray Sprinkler Head With Pressure Regulator (Rainbird 1812-PRS).....	45.00	8.82
<i>For Rotary Nozzle, Add</i>	3.25	
32 84 23 00-0014 EA 4" Pop-Up Height, Spray Sprinkler Head With Check Valve And Pressure Regulator (Rainbird 1804-SAM-PRS).....	31.94	8.82
<i>For Rotary Nozzle, Add</i>	3.25	
32 84 23 00-0015 EA 6" Pop-Up Height, Spray Sprinkler Head With Check Valve And Pressure Regulator (Rainbird 1806-SAM-PRS).....	43.59	8.82
<i>For Rotary Nozzle, Add</i>	3.25	
32 84 23 00-0016 EA 12" Pop-Up Height, Spray Sprinkler Head With Check Valve And Pressure Regulator (Rainbird 1812-SAM-PRS).....	47.83	8.82
<i>For Rotary Nozzle, Add</i>	3.25	
32 84 23 00-0017 EA Bubbler Head With Screen, 1/2" NPT (Rainbird 1300)	20.55	8.82
<i>For Rotary Nozzle, Add</i>	3.25	
32 84 23 00-0018 EA Pressure Compensating Bubbler With Screen, 1/2" NPT (Rainbird 1400).....	23.12	8.82
32 84 23 00-0019 Gear-Drive, Rotary Sprinkler Heads <small>(32 84 23 00-0001)</small>		
<i>Note: Maximum spacing is equivalent to maximum radius.</i>		
32 84 23 00-0020 1/2" Inlet, Up To 35' Spacing, Gear-Drive, Rotary Sprinkler Heads <small>(32 84 23 00-0019)</small>		
<i>Note: Includes plastic riser and case, standard rubber cover and nozzle with partial or full circle coverage.</i>		
32 84 23 00-0021 EA 4" Pop-Up Height, 1/2" Inlet, Up To 35' Spacing, Gear-Drive, Rotary Sprinkler Head (Rainbird 3504PC).....	36.71	8.82
<i>For Non-Potable Cover, Add</i>	2.00	
32 84 23 00-0022 EA 4" Pop-Up Height, 1/2" Inlet, Up To 35' Spacing, Gear-Drive, Rotary Sprinkler Head With Check Valve (Rainbird 3504-PC-SAM)	40.36	8.82
<i>For Non-Potable Cover, Add</i>	2.00	
32 84 23 00-0023 3/4" Inlet, Up To 50' Spacing, Gear-Drive, Rotary Sprinkler Heads <small>(32 84 23 00-0019)</small>		
<i>Note: Includes plastic riser and case, standard rubber cover and nozzle with partial or full circle coverage.</i>		
32 84 23 00-0024 EA 12" Pop-Up Height, 3/4" Inlet, Up To 50' Spacing, Gear-Drive, Rotary Sprinkler Head (Rainbird 5512).....	74.47	8.82
<i>For Non-Potable Cover, Add</i>	2.00	
<i>For Stainless Steel Riser, Add</i>	9.00	
32 84 23 00-0025 EA 5" Pop-Up Height, 3/4" Inlet, Up To 50' Spacing, Gear-Drive, Rotary Sprinkler Head With Check Valve (Rainbird 5505)	56.43	8.82
<i>For Non-Potable Cover, Add</i>	2.00	
<i>For Stainless Steel Riser, Add</i>	9.00	
32 84 23 00-0026 EA 12" Pop-Up Height, 3/4" Inlet, Up To 50' Spacing, Gear-Drive, Rotary Sprinkler Head With Check Valve (Rainbird 5512-SAM)	77.78	8.82
<i>For Non-Potable Cover, Add</i>	2.00	
<i>For Stainless Steel Riser, Add</i>	9.00	
32 84 23 00-0027 3/4" Inlet, Up To 55' Spacing, Gear-Drive, Rotary Sprinkler Heads <small>(32 84 23 00-0019)</small>		
<i>Note: Includes plastic riser and case, standard rubber cover and nozzle with partial or full circle coverage.</i>		
32 84 23 00-0028 EA 4" Pop-Up Height, 3/4" Inlet, Up To 55' Spacing, Gear-Drive, Rotary Sprinkler Head (Rainbird 5004-PLPC).....	37.27	8.82
<i>For Non-Potable Cover, Add</i>	2.00	
<i>For Stainless Steel Riser, Add</i>	9.00	
32 84 23 00-0029 EA 6" Pop-Up Height, 3/4" Inlet, Up To 55' Spacing, Gear-Drive, Rotary Sprinkler Head (Rainbird 5006-PLPC).....	51.99	8.82
<i>For Non-Potable Cover, Add</i>	2.00	
<i>For Stainless Steel Riser, Add</i>	9.00	
32 84 23 00-0030 EA 12" Pop-Up Height, 3/4" Inlet, Up To 55' Spacing, Gear-Drive, Rotary Sprinkler Head (Rainbird 5012-PLPC).....	63.23	8.82
<i>For Non-Potable Cover, Add</i>	2.00	
<i>For Stainless Steel Riser, Add</i>	9.00	
32 84 23 00-0031 EA 4" Pop-Up Height, 3/4" Inlet, Up To 55' Spacing, Gear-Drive, Rotary Sprinkler Head With Check Valve (Rainbird 5004-PLPCS)	40.81	8.82
<i>For Non-Potable Cover, Add</i>	2.00	
<i>For Stainless Steel Riser, Add</i>	9.00	
32 84 23 00-0032 EA 6" Pop-Up Height, 3/4" Inlet, Up To 55' Spacing, Gear-Drive, Rotary Sprinkler Head With Check Valve (Rainbird 5006-PLPCS)	54.30	8.82
<i>For Non-Potable Cover, Add</i>	2.00	
<i>For Stainless Steel Riser, Add</i>	9.00	
32 84 23 00-0033 EA 12" Pop-Up Height, 3/4" Inlet, Up To 55' Spacing, Gear-Drive, Rotary Sprinkler Head With Check Valve (Rainbird 5012-PLPCS)	66.04	8.82
<i>For Non-Potable Cover, Add</i>	2.00	
<i>For Stainless Steel Riser, Add</i>	9.00	
32 84 23 00-0034 EA 4" Pop-Up Height, 3/4" Inlet, Up To 55' Spacing, Gear-Drive, Rotary Sprinkler Head With Pressure Regulator (Rainbird 5004+PCR)	45.14	8.82
<i>For Non-Potable Cover, Add</i>	2.00	
<i>For Stainless Steel Riser, Add</i>	9.00	
32 84 23 00-0035 EA 6" Pop-Up Height, 3/4" Inlet, Up To 55' Spacing, Gear-Drive, Rotary Sprinkler Head With Pressure Regulator (Rainbird 5006+PCR)	59.13	8.82
<i>For Non-Potable Cover, Add</i>	2.00	
<i>For Stainless Steel Riser, Add</i>	9.00	
32 84 23 00-0036 EA 12" Pop-Up Height, 3/4" Inlet, Up To 55' Spacing, Gear-Drive, Rotary Sprinkler Head With Pressure Regulator (Rainbird 5012+PCR)	70.42	8.82
<i>For Non-Potable Cover, Add</i>	2.00	
<i>For Stainless Steel Riser, Add</i>	9.00	
32 84 23 00-0037 EA 4" Pop-Up Height, 3/4" Inlet, Up To 55' Spacing, Gear-Drive, Rotary Sprinkler Head With Check Valve And Pressure Regulator (Rainbird 5004+FCR).....	49.09	8.82
<i>For Non-Potable Cover, Add</i>	2.00	
<i>For Stainless Steel Riser, Add</i>	9.00	
32 84 23 00-0038 EA 6" Pop-Up Height, 3/4" Inlet, Up To 55' Spacing, Gear-Drive, Rotary Sprinkler Head With Check Valve And Pressure Regulator (Rainbird 5006+PCSR)	61.94	8.82
<i>For Non-Potable Cover, Add</i>	2.00	
<i>For Stainless Steel Riser, Add</i>	9.00	

32 Exterior Improvements**32 80 Irrigation****32 84 Planting Irrigation**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 84 23 00-0039	EA		12" Pop-Up Height, 3/4" Inlet, Up To 55' Spacing, Gear-Drive, Rotary Sprinkler Head With Check Valve And Pressure Regulator (Rainbird 5012+PCSR)	74.19	8.82
			<i>For Non-Potable Cover, Add</i>	2.00	
			<i>For Stainless Steel Riser, Add</i>	9.00	
32 84 23 00-0040	EA		Shrub Type, 3/4" Inlet, Up To 55' Spacing, Gear-Drive, Rotary Sprinkler Head With Check Valve (Rainbird 5000S-PLPCS).....	39.69	8.82
			<i>For Non-Potable Cover, Add</i>	2.00	
32 84 23 00-0041	EA		Shrub Type, 3/4" Inlet, Up To 55' Spacing, Gear-Drive, Rotary Sprinkler Head With Check Valve And Pressure Regulator (Rainbird 5000S+PCR)	45.14	8.82
			<i>For Non-Potable Cover, Add</i>	2.00	
32 84 23 00-0042			1" Inlet, Up To 65' Spacing, Gear-Drive, Rotary Sprinkler Heads <small>(32 84 23 00-0019)</small> Note: Includes plastic riser and case, standard rubber cover, check valve and nozzle with partial or full circle coverage.		
32 84 23 00-0043	EA		4" Pop-Up Height, 1" Inlet, Up To 65' Spacing, Gear-Drive, Rotary Sprinkler Head (Rainbird F4PC)	69.41	8.82
			<i>For Non-Potable Cover, Add</i>	2.00	
			<i>For Stainless Steel Riser, Add</i>	9.00	
			<i>For Stainless Steel Riser And High Speed Rotor, Add</i>	40.01	
32 84 23 00-0044			1" Inlet, Up To 70' Spacing, Gear-Drive, Rotary Sprinkler Heads <small>(32 84 23 00-0019)</small> Note: Includes plastic riser and case, standard rubber cover, check valve and nozzle with partial or full circle coverage.		
32 84 23 00-0045	EA		5" Pop-Up Height, 1" Inlet, Up To 70' Spacing, Gear-Drive, Rotary Sprinkler Head (Rainbird 7005).....	98.07	8.82
			<i>For Non-Potable Cover, Add</i>	2.00	
			<i>For Stainless Steel Riser, Add</i>	9.00	
32 84 23 00-0046			1" Inlet, Up To 80' Spacing, Gear-Drive, Rotary Sprinkler Heads <small>(32 84 23 00-0019)</small> Note: Includes plastic riser and case, standard rubber cover, check valve and nozzle with partial or full circle coverage.		
32 84 23 00-0047	EA		5" Pop-Up Height, 1" Inlet, Up To 80' Spacing, Gear-Drive, Rotary Sprinkler Head (Rainbird 8005).....	103.69	8.82
			<i>For Non-Potable Cover, Add</i>	2.00	
			<i>For Stainless Steel Riser, Add</i>	9.00	
32 84 23 00-0048			1-1/2" Inlet, Up To 96' Spacing, Gear-Drive, Rotary Sprinkler Heads <small>(32 84 23 00-0019)</small> Note: Includes plastic riser and case, standard rubber cover, check valve and nozzle with partial or full circle coverage.		
32 84 23 00-0049	EA		3" Pop-Up Height, 1-1/2" Inlet, Up To 96' Spacing, Gear-Drive, Rotary Sprinkler Head (Rainbird I-90)	166.57	8.82
			<i>For Non-Potable Cover, Add</i>	2.00	
			<i>For Stainless Steel Riser, Add</i>	9.00	
32 84 23 00-0050			Impact-Drive Sprinkler Heads <small>(32 84 23 00-0001)</small> Note: Includes partial or full circle coverage. Maximum spacing is equivalent to maximum radius.		
32 84 23 00-0051	EA		1/2" Inlet, Up To 45' Spacing, Pop-Up, Impact-Drive Rotary Sprinkler Head (Rainbird 2045A-08)	48.16	8.82
			<i>For Non-Potable Cover, Add</i>	2.00	
32 84 23 00-0052	EA		1/2" Inlet, Up To 45' Spacing, Pop-Up, Impact-Drive Rotary Sprinkler Head With Pressure Regulator (Rainbird 2045A-SAM08)	51.15	8.82
			<i>For Non-Potable Cover, Add</i>	2.00	
32 84 23 00-0053	EA		1/2" Inlet, Up To 45' Spacing, Riser Mounted, Plastic Body, Impact-Drive Sprinkler Head (Rainbird 2045-PJ08).....	38.09	8.82
32 84 23 00-0054	EA		1/2" Inlet, Up To 41' Spacing, Riser Mounted, Brass/Bronze Body, Impact-Drive Sprinkler Head (Rainbird 25BPJ-FP-ADJ).....	67.22	8.82
32 84 23 00-0055	EA		3/4" Inlet, Up To 51' Spacing, Riser Mounted, Brass/Bronze Body, Impact-Drive Sprinkler Head (Rainbird 35A-ADJ-TNT).....	106.80	8.82
32 84 23 00-0056	EA		1" Inlet, Up To 65' Spacing, Riser Mounted, Brass/Bronze Body, Impact-Drive Sprinkler Head (Rainbird 65PJADJ-TNT)	274.23	8.82
32 84 23 00-0057			Electric Remote Control Irrigation Valves <small>(32 84 23)</small>		
32 84 23 00-0058			0.2 To 22 GPM, Plastic, Electric Remote Control Irrigation Valves <small>(32 84 23 00-0057)</small> Note: 5 to 125 PSI.		
32 84 23 00-0059	EA		3/4", 0.2 To 22 GPM, Plastic, Electric Remote Control Irrigation Valve	106.96	36.75
32 84 23 00-0060	EA		1", 0.2 To 40 GPM, Plastic, Electric Remote Control Irrigation Valve	106.96	36.75
32 84 23 00-0061	EA		1", 0.2 To 40 GPM, Plastic, Electric Remote Control Irrigation Angle Valve	108.08	36.75
32 84 23 00-0062			0.2 To 22 GPM, Plastic, Electric Remote Control Irrigation Valves With Flow Control <small>(32 84 23 00-0057)</small> Note: 5 to 125 PSI.		
32 84 23 00-0063	EA		1", 0.2 To 40 GPM, Plastic, Electric Remote Control Irrigation Valve With Flow Control	108.64	36.75
32 84 23 00-0064	EA		1", 0.2 To 40 GPM, Plastic, Electric Remote Control Irrigation Angle Valve With Flow Control	109.77	36.75
32 84 23 00-0065			0.25 To 200 GPM, Plastic, Electric Remote Control Irrigation Valves <small>(32 84 23 00-0057)</small> Note: 20 to 200 PSI.		
32 84 23 00-0066	EA		1", 0.25 To 200 GPM, Plastic, Electric Remote Control Irrigation Valve	197.43	36.75
32 84 23 00-0067	EA		1-1/2", 0.25 To 200 GPM, Plastic, Electric Remote Control Irrigation Valve	235.64	36.75
32 84 23 00-0068	EA		2", 0.25 To 200 GPM, Plastic, Electric Remote Control Irrigation Valve	295.21	36.75



Exterior Improvements		32
Irrigation		32 80
Planting Irrigation		32 84

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 84 23 00-0069 5 To 200 GPM, Plastic, Electric Remote Control Irrigation Valves With Pressure Regulator <small>(32 84 23 00-0057)</small>		
Note: 20 to 200 PSI operating range pressure and 15 to 100 PSI pressure regulation.		
32 84 23 00-0070 EA 1", 5 To 200 GPM, Plastic, Electric Remote Control Irrigation Valve With Pressure Regulator	294.74	41.30
32 84 23 00-0071 EA 1-1/2", 5 To 200 GPM, Plastic, Electric Remote Control Irrigation Valve With Pressure Regulator	332.95	41.30
32 84 23 00-0072 EA 2", 5 To 200 GPM, Plastic, Electric Remote Control Irrigation Valve With Pressure Regulator	392.52	41.30
32 84 23 00-0073 20 To 200 GPM, Plastic, Electric Remote Control Irrigation Valves With Pressure Regulator And Scrubber Valve <small>(32 84 23 00-0057)</small>		
Note: 20 to 200 PSI operating range pressure and 15 to 100 PSI pressure regulation.		
32 84 23 00-0074 EA 1", 5 To 200 GPM, Plastic, Electric Remote Control Irrigation Valve With Pressure Regulator And Scrubber Valve.....	337.45	41.30
32 84 23 00-0075 EA 1-1/2", 5 To 200 GPM, Plastic, Electric Remote Control Irrigation Valve With Pressure Regulator And Scrubber Valve	394.76	41.30
32 84 23 00-0076 EA 2", 5 To 200 GPM, Plastic, Electric Remote Control Irrigation Valve With Pressure Regulator And Scrubber Valve.....	448.71	41.30
32 84 23 00-0077 5 To 200 GPM, Brass, Electric Remote Control Irrigation Valves <small>(32 84 23 00-0057)</small>		
Note: 15 to 200 PSI operating range pressure.		
32 84 23 00-0078 EA 3/4", 5 To 200 GPM, Brass, Electric Remote Control Irrigation Valve.....	249.52	36.75
32 84 23 00-0079 EA 1", 5 To 200 GPM, Brass, Electric Remote Control Irrigation Valve	270.48	36.75
32 84 23 00-0080 EA 1-1/4", 5 To 200 GPM, Brass, Electric Remote Control Irrigation Valve	323.30	36.75
32 84 23 00-0081 EA 1-1/2", 5 To 200 GPM, Brass, Electric Remote Control Irrigation Valve	351.40	36.75
32 84 23 00-0082 EA 2", 5 To 200 GPM, Brass, Electric Remote Control Irrigation Valve	421.08	36.75
32 84 23 00-0083 EA 2-1/2", 5 To 200 GPM, Brass, Electric Remote Control Irrigation Valve	579.97	44.69
32 84 23 00-0084 EA 3", 5 To 200 GPM, Brass, Electric Remote Control Irrigation Valve	656.18	49.61
32 84 23 00-0085 5 To 200 GPM, Brass, Contamination Proof, Electric Remote Control Irrigation Valves <small>(32 84 23 00-0057)</small>		
Note: 15 to 200 PSI operating range pressure and 15 to 100 PSI pressure regulation.		
32 84 23 00-0086 EA 1", 5 To 200 GPM, Brass, Contamination Proof, Electric Remote Control Irrigation Valve.....	384.09	41.30
32 84 23 00-0087 EA 1-1/4", 5 To 200 GPM, Brass, Contamination Proof, Electric Remote Control Irrigation Valve.....	440.28	41.30
32 84 23 00-0088 EA 1-1/2", 5 To 200 GPM, Brass, Contamination Proof, Electric Remote Control Irrigation Valve.....	465.00	41.30
32 84 23 00-0089 EA 2", 5 To 200 GPM, Brass, Contamination Proof, Electric Remote Control Irrigation Valve.....	530.19	41.30
32 84 23 00-0090 5 To 200 GPM, Brass, Electric Remote Control Irrigation Valves With Pressure Regulator <small>(32 84 23 00-0057)</small>		
Note: 15 to 200 PSI operating range pressure and 15 to 100 PSI pressure regulation.		
32 84 23 00-0091 EA 3/4", 5 To 200 GPM, Brass, Electric Remote Control Irrigation Valve With Pressure Regulator.....	336.62	36.75
32 84 23 00-0092 EA 1", 5 To 200 GPM, Brass, Electric Remote Control Irrigation Valve With Pressure Regulator.....	357.58	36.75
32 84 23 00-0093 EA 1-1/4", 5 To 200 GPM, Brass, Electric Remote Control Irrigation Valve With Pressure Regulator	410.40	36.75
32 84 23 00-0094 EA 1-1/2", 5 To 200 GPM, Brass, Electric Remote Control Irrigation Valve With Pressure Regulator	438.50	36.75
32 84 23 00-0095 EA 2", 5 To 200 GPM, Brass, Electric Remote Control Irrigation Valve With Pressure Regulator.....	508.18	36.75
32 84 23 00-0096 EA 2-1/2", 5 To 200 GPM, Brass, Electric Remote Control Irrigation Valve With Pressure Regulator	667.07	44.69
32 84 23 00-0097 EA 3", 5 To 200 GPM, Brass, Electric Remote Control Irrigation Valve With Pressure Regulator.....	743.28	49.61
32 84 23 00-0098 5 To 200 GPM, Brass, Contamination Proof, Electric Remote Control Irrigation Valves With Pressure Regulator <small>(32 84 23 00-0057)</small>		
Note: 15 to 200 PSI operating range pressure and 15 to 100 PSI pressure regulation.		
32 84 23 00-0099 EA 1", 5 To 200 GPM, Brass, Contamination Proof, Electric Remote Control Irrigation Valve With Pressure Regulator	471.19	41.30
32 84 23 00-0100 EA 1-1/4", 5 To 200 GPM, Brass, Contamination Proof, Electric Remote Control Irrigation Valve With Pressure Regulator.....	527.38	41.30
32 84 23 00-0101 EA 1-1/2", 5 To 200 GPM, Brass, Contamination Proof, Electric Remote Control Irrigation Valve With Pressure Regulator.....	552.10	41.30
32 84 23 00-0102 EA 2", 5 To 200 GPM, Brass, Contamination Proof, Electric Remote Control Irrigation Valve With Pressure Regulator	617.29	41.30
32 84 23 00-0103 Other Electric Remote Control Valves <small>(32 84 23 00-0057)</small>		
32 84 23 00-0104 EA 3/4" TxT Electric Valve, Rainbird 75DV	109.36	41.90
32 84 23 00-0105 EA 1" TxT Electric Valve, Rainbird 100DV	110.16	41.90
32 84 23 00-0106 EA 1" TxT Electric Angle Valve, Rainbird 100DVA.....	110.16	41.90
32 84 23 00-0107 EA 1" TxT With Flow Control, Rainbird 100DVF	111.76	41.90
32 84 23 00-0108 EA 1" TxT Angle With Flow Control, Rainbird 100DVFA	111.76	41.90
32 84 23 00-0109 EA 1" SxS Electric Valve, Rainbird 100DVSS	109.36	41.90
32 84 23 00-0110 EA 1" SxS With Flow Control, Rainbird 100DVFS	110.96	41.90
32 84 23 00-0111 EA 1" M Barb Electric Valve With Flow, Rainbird 100DVFB	110.16	41.90
32 84 23 00-0112 EA 1" M x M Electric Valve With Flow, Rainbird 100DVMM	110.16	41.90
32 84 23 00-0113 EA 1" Brass Remote Control Valve With Flow Control And Captured Solenoid (Rainbird EFB-CP)	254.56	
32 84 23 00-0114 EA 1-1/2" Brass Remote Control Valve With Flow Control And Captured Solenoid (Rainbird EFB-CP)	285.83	
32 84 23 00-0115 EA 2" Brass Remote Control Valve With Flow Control And Captured Solenoid (Rainbird EFB-CP)	335.90	
32 84 23 00-0116 EA 1" Glass-Filled Nylon Remote Control Valve With Flow Control And Captured Solenoid (Rainbird PEB).....	152.91	
32 84 23 00-0117 EA 1-1/2" Glass-Filled Nylon Remote Control Valve With Flow Control And Captured Solenoid (Rainbird PEB)	175.37	
32 84 23 00-0118 EA 2" Glass-Filled Nylon Remote Control Valve With Flow Control And Captured Solenoid (Rainbird PEB).....	205.20	
32 84 23 00-0119 EA 1" Glass-Filled Nylon Remote Control Scrubber Valve With Flow Control And Captured Solenoid (Rainbird PESB).....	178.99	

32 Exterior Improvements**32 80 Irrigation****32 84 Planting Irrigation**

MINOR			TOTAL DIRECT	DEMOLITION
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST
32 84 23 00-0120	EA	1-1/2" Glass-Filled Nylon Remote Control Scrubber Valve With Flow Control And Captured Solenoid (Rainbird PESB).....	205.91	
32 84 23 00-0121	EA	2" Glass-Filled Nylon Remote Control Scrubber Valve With Flow Control And Captured Solenoid (Rainbird PESB).....	233.13	
32 84 23 00-0122	EA	Pressure Regulating For Valves (Rainbird PRS-Dial).....	77.66	
32 84 23 00-0123		Irrigation Valve Boxes (32 84 23) Note: Includes lid.		
32 84 23 00-0124	EA	6" Round Irrigation Valve Box With Lid (Rainbird® VB-6RND).....	64.53	26.46
32 84 23 00-0125	EA	7" Round Irrigation Valve Box With Lid (Rainbird® VB-7RND).....	76.78	26.46
32 84 23 00-0126	EA	10" Round Irrigation Valve Box With Lid (Rainbird® VB-10RND).....	101.54	34.84
32 84 23 00-0127	EA	21.8" x 16.6" x 12" Depth, Rectangular Irrigation Valve Box With Lid (Rainbird® VB-STD).....	150.23	50.86
32 84 23 00-0128	EA	21.8" x 16.6" x 12" Depth, Rectangular Irrigation Valve Box With Lock (Rainbird® VB-STDH).....	152.80	50.86
32 84 23 00-0129	EA	26.3" x 19.8" x 12.1" Depth, Rectangular Irrigation Valve Box With Lid (Rainbird® VB-JMB).....	171.26	50.86
32 84 23 00-0130	EA	26.3" x 19.8" x 12.1" Depth, Rectangular Irrigation Valve Box With Lock (Rainbird® VB-JMBH).....	173.46	50.86
32 84 23 00-0131	EA	33.1" x 23.8" x 15" Depth, Rectangular Irrigation Valve Box With Lock (Rainbird® VB-SPRH).....	278.95	50.86
32 84 23 00-0132	EA	40.3" x 27.1" x 18" Depth, Rectangular Irrigation Valve Box With Lock (Rainbird® VB-MAXH).....	415.58	50.86
32 84 23 00-0133		Irrigation Controllers (32 84 23)		
32 84 23 00-0134		Irrigation Controllers (32 84 23 00-0133)		
32 84 23 00-0135		Two Program, Indoor Mount, Hybrid Irrigation Controllers (32 84 23 00-0134) Note: Station timing: 0 to 99 minutes. Automatic starts: 3 per day per program. Programming schedule: 2, 3 or 5-day fixed cycle or 7-day variable cycle. Includes plastic indoor cabinet.		
32 84 23 00-0136	EA	4-Station, Two Program, Indoor Mount, Hybrid Irrigation Controller.....	211.61	29.23
32 84 23 00-0137	EA	6-Station, Two Program, Indoor Mount, Hybrid Irrigation Controller.....	267.28	29.23
32 84 23 00-0138	EA	8-Station, Two Program, Indoor Mount, Hybrid Irrigation Controller.....	322.24	29.23
32 84 23 00-0139		Three Program, Indoor Mount, Modular Irrigation Controllers (32 84 23 00-0134) Note: Station timing: 0 to 6 hours. Automatic starts: 4 per day per program. Independent programming schedule options variable per program: custom day-of-the-week, odd day watering, even day watering and variable day cycle from 1 to 31 days. Includes plastic indoor cabinet.		
32 84 23 00-0140		Three Program, Indoor Mount, Modular Irrigation Controllers (32 84 23 00-0139)		
32 84 23 00-0141	EA	4-Station, Three Program, Indoor Mount, Modular Irrigation Controller.....	217.24	29.23
		<i>For Outdoor Installations, Add</i>	38.11	
32 84 23 00-0142	EA	7-Station, Three Program, Indoor Mount, Modular Irrigation Controller.....	305.81	29.23
		<i>For Outdoor Installations, Add</i>	43.58	
32 84 23 00-0143	EA	10-Station, Three Program, Indoor Mount, Modular Irrigation Controller.....	394.35	29.23
		<i>For Outdoor Installations, Add</i>	49.04	
32 84 23 00-0144	EA	13-Station, Three Program, Indoor Mount, Modular Irrigation Controller.....	482.91	29.23
		<i>For Outdoor Installations, Add</i>	54.51	
32 84 23 00-0145		Accessories For Three Program Modular Irrigation Controllers (32 84 23 00-0139)		
32 84 23 00-0146	EA	3-Station Expansion Module For Three Program Modular Irrigation Controllers..... Note: Use task for increasing capacity of existing three program modular irrigation controllers up to a maximum of 13-stations.	147.01	
32 84 23 00-0147		Four Program, Indoor/Outdoor Mount, Hybrid Irrigation Controllers (32 84 23 00-0134) Note: Station timing: 0 to 12 hours. Automatic starts: 8 per day per program. Independent programming schedule options variable per program: custom day-of-the-week, odd day watering, even day watering and variable day cycle from 1 to 99 days. Includes powder coated steel wall mount cabinet.		
32 84 23 00-0148		Four Program, Indoor/Outdoor Mount, Hybrid Irrigation Controllers (32 84 23 00-0147)		
32 84 23 00-0149	EA	8-Station, Four Program, Indoor/Outdoor Mount, Hybrid Irrigation Controller.....	686.78	29.23
32 84 23 00-0150	EA	12-Station, Four Program, Indoor/Outdoor Mount, Hybrid Irrigation Controller.....	752.54	29.23
32 84 23 00-0151	EA	16-Station, Four Program, Indoor/Outdoor Mount, Hybrid Irrigation Controller.....	1,159.86	29.23
32 84 23 00-0152	EA	24-Station, Four Program, Indoor/Outdoor Mount, Hybrid Irrigation Controller.....	1,291.38	29.23
32 84 23 00-0153	EA	28-Station, Four Program, Indoor/Outdoor Mount, Hybrid Irrigation Controller.....	1,926.84	29.23
32 84 23 00-0154	EA	32-Station, Four Program, Indoor/Outdoor Mount, Hybrid Irrigation Controller.....	1,992.60	29.23
32 84 23 00-0155	EA	36-Station, Four Program, Indoor/Outdoor Mount, Hybrid Irrigation Controller.....	2,555.17	29.23
32 84 23 00-0156	EA	40-Station, Four Program, Indoor/Outdoor Mount, Hybrid Irrigation Controller.....	2,620.92	29.23
32 84 23 00-0157		Accessories For Four Program Hybrid Irrigation Controllers (32 84 23 00-0147)		
32 84 23 00-0158	EA	Stainless Steel Pedestal For Four Program Hybrid Irrigation Controllers..... Note: Excludes concrete foundation.	688.16	
32 84 23 00-0159		Four Program, Indoor/Outdoor Mount, Modular Irrigation Controllers (32 84 23 00-0134) Note: Station timing: 0 to 12 hours. Automatic starts: 8 per day per program. Independent programming schedule options variable per program: custom day-of-the-week, odd day watering, even day watering and variable day cycle from 1 to 31 days. Includes weather-resistant plastic cabinet.		
32 84 23 00-0160		Four Program, Indoor/Outdoor Mount, Modular Irrigation Controllers (32 84 23 00-0159)		
32 84 23 00-0161	EA	8-Station, Four Program, Indoor/Outdoor Mount, Modular Irrigation Controller.....	430.28	29.23
32 84 23 00-0162	EA	12-Station, Four Program, Indoor/Outdoor Mount, Modular Irrigation Controller.....	540.59	29.23



Exterior Improvements		32
Irrigation		32 80
Planting Irrigation		32 84

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MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 84 23 00-0163 EA 16-Station, Four Program, Indoor/Outdoor Mount, Modular Irrigation Controller	648.89	29.23
32 84 23 00-0164 EA 20-Station, Four Program, Indoor/Outdoor Mount, Modular Irrigation Controller	759.18	29.23
32 84 23 00-0165 EA 24-Station, Four Program, Indoor/Outdoor Mount, Modular Irrigation Controller	867.48	29.23
32 84 23 00-0166 EA 28-Station, Four Program, Indoor/Outdoor Mount, Modular Irrigation Controller	977.79	29.23
32 84 23 00-0167 EA 32-Station, Four Program, Indoor/Outdoor Mount, Modular Irrigation Controller	1,086.07	29.23
32 84 23 00-0168 Accessories For Four Program Modular Irrigation Controllers (32 84 23 00-0159)		
32 84 23 00-0169 EA Metal Cabinet For Four Program Modular Irrigation Controllers	302.57	
32 84 23 00-0170 EA Metal Cabinet With Pedestal For Four Program Modular Irrigation Controllers	712.46	
Note: Excludes concrete foundation.		
32 84 23 00-0171 EA ET Manager, Weather-Based Irrigation Control Module For Four Program Modular Irrigation Controllers.....	511.82	
32 84 23 00-0172 EA Satellite Remote Control Module With RS232 Communication For Four Program Modular Irrigation Controllers	594.17	
32 84 23 00-0173 EA Satellite Remote Control Module With Phone And RS232 Communication For Four Program Modular Irrigation Controllers	631.29	
32 84 23 00-0174 EA 4-Station Expansion Module For Four Program Modular Irrigation Controllers.....	219.91	
Note: Use task for increasing capacity of existing four program modular irrigation controllers up to a maximum of 32-stations.		
32 84 23 00-0175 EA 8-Station Expansion Module For Four Program Modular Irrigation Controllers.....	379.35	
Note: Use task for increasing capacity of existing four program modular irrigation controllers up to a maximum of 32-stations.		
32 84 23 00-0176 Three Program, Battery-Operated, Buriable Irrigation Control Modules (32 84 23 00-0134)		
Note: Station timing: 1 minute to 12 hours. Automatic starts: 8 per day per program. Dependent programming schedule options: odd day watering, odd-31 day watering, even day watering or 1 to 6 day cycles.		
32 84 23 00-0177 Three Program, Battery-Operated, Buriable Irrigation Control Modules (32 84 23 00-0176)		
32 84 23 00-0178 EA 1-Station, Three Program, Battery-Operated, Buriable Irrigation Control Module.....	235.50	29.23
32 84 23 00-0179 EA 2-Station, Three Program, Battery-Operated, Buriable Irrigation Control Module.....	312.66	29.23
32 84 23 00-0180 EA 4-Station, Three Program, Battery-Operated, Buriable Irrigation Control Module.....	416.34	29.23
32 84 23 00-0181 Accessories For Three Program Buriable Irrigation Control Modules (32 84 23 00- 0176)		
32 84 23 00-0182 EA Field Transmitter For Three Program Buriable Irrigation Control Modules	201.82	
32 84 23 00-0183 EA Potted Latching Solenoid For Three Program Buriable Irrigation Control Modules.....	64.89	21.93
32 84 23 00-0184 Accessories For Irrigation Controllers (32 84 23 00-0134)		
32 84 23 00-0185 EA Wired Rain Sensor For Irrigation Controllers	112.69	21.93
32 84 23 00-0186 EA Automatic Rain Shutoff Sensor For Irrigation Controllers	142.01	21.93
Note: Includes adjustable sensing probes.		
32 84 23 00-0187 Weather-Based Irrigation Management Systems (32 84 23 00-0133)		
32 84 23 00-0188 ET Manager, Weather-Based Irrigation Management System (32 84 23 00-0187)		
Note: ET Managers interface with existing irrigation controllers or two-wire decoder systems. The system receives hourly weather data from local weather station broadcasts via an internal antenna.		
32 84 23 00-0189 EA ET Manager, Weather-Based Irrigation Management System.....	815.39	29.23
32 84 23 00-0190 EA 120 Volt AC Transformer For ET Manager, Weather-Based Irrigation Management System.....	49.76	14.61
Note: External antenna for areas with a weak paging signal.		
32 84 23 00-0191 EA Tipping Rain Gauge For ET Manager, Weather-Based Irrigation Management System	226.73	29.23
32 84 23 00-0192 EA Remote Antenna Kit For ET Manager, Weather-Based Irrigation Management System	253.73	32.88
Note: External antenna for areas with a weak paging signal.		
32 84 23 00-0193 EA Outdoor Enclosure For ET Manager, Weather-Based Irrigation Management System	248.09	21.93
32 84 23 00-0194 Two-Wire Decoder Systems (32 84 23 00-0133)		
32 84 23 00-0195 Controllers For Two-Wire Decoder Systems (32 84 23 00-0194)		
32 84 23 00-0196 EA 50-Station, Modular Controller For Two-Wire Decoder Systems	2,055.63	29.23
Note: Expandable up to 200-stations with expansion modules. Includes water resistant cabinet.		
32 84 23 00-0197 Field Decoders For Two-Wire Decoder Systems (32 84 23 00-0194)		
32 84 23 00-0198 EA One Individual Valve Interface, Field Decoder For Two-Wire Decoder System.....	168.16	29.23
32 84 23 00-0199 EA One Pair Of Valves Interface, Field Decoder For Two-Wire Decoder System	211.46	29.23
32 84 23 00-0200 EA Two Pair Of Valves Interface, Field Decoder For Two-Wire Decoder System	308.67	29.23
32 84 23 00-0201 EA Up To Four Individual Valves Interface, Field Decoder For Two-Wire Decoder System.....	363.79	29.23
32 84 23 00-0202 EA Up To Six Individual Valves Interface, Field Decoder For Two-Wire Decoder System	579.26	29.23
32 84 23 00-0203 Accessories For Two-Wire Decoder Systems (32 84 23 00-0194)		
32 84 23 00-0204 EA 50-Station, Expansion Module For Two-Wire Decoder Controllers.....	999.29	
Note: Use task for increasing capacity of existing two-wire decoder system controllers up to a maximum of 200- stations.		
32 84 23 00-0205 EA Line Surge Protection For Two-Wire Decoder Systems	128.65	25.58
32 84 23 00-0206 EA Sensor Decoder Interface For Two-Wire Decoder Systems	486.11	29.23

32 Exterior Improvements**32 80 Irrigation****32 84 Planting Irrigation**
 MINOR
 CSI UOM DESCRIPTION

 TOTAL DIRECT DEMOLITION
 UNIT COST UNIT COST

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 84 23 00-0207			Calsense Controllers (32 84 23 00-0133)		
32 84 23 00-0208			Irrigation Controllers (32 84 23 00-0207)		
32 84 23 00-0209	EA		6 Station ET-Driven Irrigation Controller (Calsense ET2000E-6)	1,451.86	73.07
32 84 23 00-0210	EA		8 Station ET-Driven Irrigation Controller (Calsense ET2000E-8)	1,864.88	82.20
32 84 23 00-0211	EA		12 Station ET-Driven Irrigation Controller (Calsense ET2000E-12)	2,545.11	91.33
32 84 23 00-0212	EA		16 Station ET-Driven Irrigation Controller (Calsense ET2000E-16)	2,794.10	91.33
32 84 23 00-0213	EA		24 Station ET-Driven Irrigation Controller (Calsense ET2000E-24)	3,298.22	100.47
32 84 23 00-0214	EA		32 Station ET-Driven Irrigation Controller (Calsense ET2000E-32)	3,966.26	100.47
32 84 23 00-0215	EA		40 Station ET-Driven Irrigation Controller (Calsense ET2000E-40)	4,488.59	109.61
32 84 23 00-0216	EA		48 Station ET-Driven Irrigation Controller (Calsense ET2000E-48)	5,016.95	109.61
32 84 23 00-0217	EA		Upgrade Existing Calsense Controller To ET2000E (Calsense ET2000E-UPGRADE)	1,453.32	36.54
32 84 23 00-0218	EA		Upgrade Existing Calsense Controller With 8 Additional Stations (Calsense STATION UPGRADE)	625.17	36.54
32 84 23 00-0219			Irrigation Controller Accessories (32 84 23 00-0207)		
32 84 23 00-0220	EA		Set Of 10 Keys For Calsense Controllers Or Enclosures (Calsense KEY-1)	58.30	
32 84 23 00-0221	EA		Spare Lock For Enclosures (Calsense PAD)	63.16	
32 84 23 00-0222	EA		Hardware And Software For Up To 4 Additional Light Circuits (Calsense L)	81.42	9.14
32 84 23 00-0223	EA		Transformer For Irrigation Controllers (Calsense TR-1)	133.80	36.54
32 84 23 00-0224	EA		AC Line Protection For Irrigation Controllers (Calsense TP-110)	322.07	36.54
32 84 23 00-0225	EA		Transient Protection Board For Irrigation Controller Stations (Calsense TP-1)	419.24	36.54
			<i>For Outdoor Gray Powder Coated Stainless Steel Enclosure, Add</i>	342.35	
32 84 23 00-0226			Sensors For Irrigation Controllers (32 84 23 00-0207)		
32 84 23 00-0227			Flow Sensors (32 84 23 00-0226)		
32 84 23 00-0228	EA		1-1/2" Polyvinyl Chloride (PVC) Schedule 80 Tee Mounted Flow Meter (Calsense FM 1.5)	729.07	54.80
			<i>For Flow Meter Replacement Insert Only, Deduct</i>	-360.99	
32 84 23 00-0229	EA		2" Polyvinyl Chloride (PVC) Schedule 80 Tee Mounted Flow Meter (Calsense FM 2)	753.36	54.80
			<i>For Flow Meter Replacement Insert Only, Deduct</i>	-385.28	
32 84 23 00-0230	EA		3" Polyvinyl Chloride (PVC) Schedule 80 Tee Mounted Flow Meter (Calsense FM 3)	777.65	54.80
			<i>For Flow Meter Replacement Insert Only, Deduct</i>	-409.57	
32 84 23 00-0231	EA		1" Brass Tee Mounted Flow Meter (Calsense FM 1B)	868.84	73.07
			<i>For Flow Meter Replacement Insert Only, Deduct</i>	-500.55	
32 84 23 00-0232	EA		1-1/4" Brass Tee Mounted Flow Meter (Calsense FM 1.25B)	929.57	73.07
			<i>For Flow Meter Replacement Insert Only, Deduct</i>	-561.28	
32 84 23 00-0233	EA		1-1/2" Brass Tee Mounted Flow Meter (Calsense FM 1.5B)	953.86	73.07
			<i>For Flow Meter Replacement Insert Only, Deduct</i>	-585.57	
32 84 23 00-0234	EA		2" Brass Tee Mounted Flow Meter (Calsense FM 2B)	1,111.76	73.07
			<i>For Flow Meter Replacement Insert Only, Deduct</i>	-615.19	
32 84 23 00-0235	EA		2" Pipe Saddle Mounted Insertion Flow Meter (Calsense FMBX)	850.43	36.54
			Note: For 4" and larger pipe. Excludes pipe saddle.		
			<i>For Flow Meter Replacement Insert Only, Deduct</i>	-353.86	
32 84 23 00-0236			Moisture Sensors (32 84 23 00-0226)		
32 84 23 00-0237	EA		Soil Moisture Sensor (Calsense 1000-S)	309.87	27.40
32 84 23 00-0238			Weather Sensors (32 84 23 00-0226)		
32 84 23 00-0239	EA		Wind Gage, Irrigation Weather Sensor (Calsense WG-1)	844.55	73.07
32 84 23 00-0240	EA		Tipping Rain Bucket, Irrigation Weather Sensor (Calsense RB-1)	1,014.97	146.14
32 84 23 00-0241	EA		ET Gage, Irrigation Weather Sensor (Calsense ETG)	1,889.30	109.61
32 84 23 00-0242			Weather Sensor Accessories (32 84 23 00-0226)		
32 84 23 00-0243	EA		Replacement Ceramic Cup For ET Gage Weather Sensor (Calsense ETG-C)	558.92	
32 84 23 00-0244	EA		Replacement Circuit Board For ET Gage Weather Sensor (Calsense ETG-PCB)	1,032.62	
32 84 23 00-0245	EA		Vandal Resistant Mounting Base For ET Gage Enclosure (Calsense ETGE-BASE)	558.92	36.54
32 84 23 00-0246	EA		Vandal Resistant Stainless Steel Enclosure For ET Gage (Calsense ETGE)	1,245.09	36.54
32 84 23 00-0247			Antennas For Irrigation Controllers (32 84 23 00-0207)		
			Note: Excludes antenna cable.		
32 84 23 00-0248	EA		Local Radio Dome Antenna (Calsense LR-DOME)	303.85	36.54
32 84 23 00-0249	EA		Local Radio Stick Antenna (Calsense LR-STICK)	431.38	36.54
32 84 23 00-0250	EA		Local Radio Yagi Antenna (Calsense LR-YAGI)	504.45	73.07
32 84 23 00-0251	EA		Local Radio And Calsense Radio, Remote Dome Antenna (Calsense LR-DOME-RR)	303.85	36.54
32 84 23 00-0252	EA		Local Radio And Calsense Radio, Enhanced Remote Dome Antenna (Calsense LR-DOME-RRE)	303.85	36.54
32 84 23 00-0253	EA		GPRS Stubby Antenna (Calsense GR-STUBBY)	303.85	36.54
32 84 23 00-0254	EA		GPRS Stick Antenna (Calsense GR-STICK)	431.38	36.54
32 84 23 00-0255	EA		Spread Spectrum Dome Antenna (Calsense SR-DOME)	303.85	36.54
32 84 23 00-0256	EA		Spread Spectrum Stick Antenna (Calsense SR-STICK)	431.38	36.54
32 84 23 00-0257	EA		Spread Spectrum Yagi Antenna (Calsense SR-YAGI)	504.45	73.07
32 84 23 00-0258	EA		Spread Spectrum And Calsense Radio, Remote Dome Antenna (Calsense SR-DOME-RR)	303.85	36.54
32 84 23 00-0259	EA		Spread Spectrum And Calsense Radio, Enhanced Remote Dome Antenna (Calsense SR-DOME-RRE)	303.85	36.54
32 84 23 00-0260	EA		Spread Spectrum Stubby Antenna (Calsense SR-STUBBY)	303.85	36.54
32 84 23 00-0261	EA		WiFi Stubby Antenna (Calsense WEN-STUBBY)	303.85	36.54
32 84 23 00-0262	LF		Antenna Cable With End Connectors (Calsense LMR-400-DB)	7.91	0.44



Exterior Improvements		32
Irrigation		32 80
Planting Irrigation		32 84

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MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 84 23 00-0263 EA Surge Protection Device For Antenna (Calsense ANT-PROT).....	291.61	18.26
32 84 23 00-0264 EA 5' High, Non-Penetrating, Antenna Tripod Mount (Calsense ANT-TRIP5).....	479.97	36.54
32 84 23 00-0265 EA 3' Antenna Stand Off Mount For 3' Maximum Tower Leg (Calsense ANT-SOM).....	394.75	
32 84 23 00-0266 EA Local Radio Frequency Filter (Calsense LR-FILTER).....	558.73	
32 84 23 00-0267 EA Spread Spectrum Frequency Filter (Calsense SR-FILTER).....	412.97	
32 84 23 00-0268 Pedestals And Enclosures For Irrigation Controllers (32 84 23 00-0207)		
32 84 23 00-0269 EA 15 Amp, Circuit Breaker With Enclosure For Irrigation Controllers (Calsense SSE-BREAKER).....	291.80	54.80
32 84 23 00-0270 EA Standard Gray Powder Coated Stainless Steel Controller Enclosure (Calsense C-BOX).....	679.56	91.33
32 84 23 00-0271 EA Indoor Wall Mount, Stainless Steel Back Panel (Calsense SSBP)..... Note: Includes GFI and receptacle.	710.75	36.54
32 84 23 00-0272 EA Standard Gray Powder Coated Stainless Steel Pedestal (Calsense PD-1)..... Note: Includes factory installed transient protection board and AC line protection.	838.23	27.40
32 84 23 00-0273 EA Heavy-Duty Stainless Steel Enclosure For Irrigation Controllers (Calsense SSE)..... Note: Includes factory installed transient protection board and AC line protection.	2,588.11	27.40
32 84 23 00-0274 EA Heavy-Duty Stainless Steel Enclosure For Irrigation Controllers (Calsense SSE-R)..... Note: Includes factory installed transient protection board, AC line protection and dome antenna.	2,921.30	27.40
32 84 23 00-0275 EA Double-Wide Heavy-Duty Stainless Steel Enclosure For Irrigation Controllers (Calsense SSE-D)..... Note: Includes factory installed transient protection boards and AC line protection. Pre-wired for two controllers.	4,248.70	54.80
32 84 23 00-0276 EA Double-Wide Heavy-Duty Stainless Steel Enclosure For Irrigation Controllers (Calsense SSE-D-R)..... Note: Includes factory installed transient protection boards, AC line protection and dome antenna. Pre-wired for two controllers.	4,451.60	54.80
32 84 23 00-0277 EA Bolt Mounting Template For Heavy-Duty Stainless Steel Enclosures (Calsense SSE-CAM).....	150.76	
32 84 23 00-0278 EA Stainless Steel Fully Enclosed Riser For Calsense SSE Enclosures (Calsense SSE-PED).....	485.99	
32 84 23 00-0279 Central Computer For Irrigation Control Systems (32 84 23 00-0207)		
32 84 23 00-0280 EA Central Computer For Irrigation Control Systems (Calsense COMP-2)..... Note: Includes a minimum of 133 MHz Pentium, 32 Meg Ram, 1.2 GB hard drive, 14.4 modem and a printer. Excludes Command Center Water Management software.	3,264.21	
32 84 23 00-0281 EA Command Center Water Management Software For Central Computer (Calsense COMM-1).....	5,759.70	
32 84 23 00-0282 EA Up To 5 Simultaneous Users Capacity, Calsense Advantage Client/Server Database Add-On (Calsense CS-5)..... Note: Package price for up to 5 users. Includes remote communication through internet connection.	1,113.14	
32 84 23 00-0283 EA >5 To 10 Simultaneous Users Capacity, Calsense Advantage Client/Server Database Add-On (Calsense CS-10)..... Note: Package price for 6 to 10 users. Includes remote communication through internet connection.	2,175.12	
32 84 23 00-0284 EA Data Logger With Phone Modem For Irrigation Control Systems (Calsense DL-2).....	3,496.49	
32 84 23 00-0285 EA GPRS Radio For Use At Central Computer (Calsense DTR-G).....	2,086.94	
32 84 23 00-0286 Data Access Service (32 84 23 00-0207)		
32 84 23 00-0287 EA 1 Month, Data Access Plan For Up To 2 Controllers (Calsense COMM-1MN)..... Note: For communication between GPRS unit and up to 2 controllers.	17.67	
32 84 23 00-0288 EA 1 Year, Data Access Plan For Up To 2 Controllers (Calsense COMM-1YR)..... Note: For communication between GPRS unit and up to 2 controllers.	193.24	
32 84 23 00-0289 EA 5 Year, Data Access Plan For Up To 2 Controllers (Calsense COMM-5YR)..... Note: For communication between GPRS unit and up to 2 controllers.	828.15	
32 84 23 00-0290 EA 1 Month, Data Access Plan For Up To 2 Controllers (Calsense COMM-1MN-M)..... Note: For communication between GPRS unit and multiple controllers.	71.77	
32 84 23 00-0291 EA 1 Year, Data Access Plan For Up To 2 Controllers (Calsense COMM-1YR-M)..... Note: For communication between GPRS unit and multiple controllers.	772.94	
32 84 23 00-0292 EA 5 Year, Data Access Plan For Up To 2 Controllers (Calsense COMM-5YR-M)..... Note: For communication between GPRS unit and multiple controllers.	3,312.60	
32 84 23 00-0293 Communication Options For Irrigation Controllers (32 84 23 00-0207)		
32 84 23 00-0294 EA FCC License Fee (Calsense).....	130.40	
32 84 23 00-0295 EA P.C.I.A. And/Or A.P.C.O. Fee (Calsense)..... Note: Per frequency or frequency pair.	240.82	
32 84 23 00-0296 EA Hardware Communication Option For Irrigation Controllers (Calsense M)..... Note: Allows multiple controllers to be chained together via a communications cable and share one phone line.	640.44	
32 84 23 00-0297 EA Phone Line Communication Option For Irrigation Controllers (Calsense R).....	673.56	
32 84 23 00-0298 EA Ethernet Communication Option For Irrigation Controllers (Calsense EN).....	673.56	
32 84 23 00-0299 EA WiFi Communication Option For Irrigation Controllers (Calsense WEN).....	1,380.25	
32 84 23 00-0300 EA Local Radio Communication Option For Irrigation Controllers (Calsense LR).....	1,755.68	
32 84 23 00-0301 EA Spread Spectrum Radio Communication Option For Irrigation Controllers (Calsense SR).....	1,755.68	
32 84 23 00-0302 EA GPRS Radio Modem Communication Option For Irrigation Controllers (Calsense GR).....	1,755.68	
32 84 23 00-0303 EA Fiber Optic Modem Communication Option For Irrigation Controllers (Calsense FOM).....	5,631.42	
32 84 23 00-0304 EA Communication Hub For Irrigation Controllers (Calsense HUB)..... Note: Accepts up to two communication options. Excludes communication options.	2,181.45	
32 84 23 00-0305 Retrofit Options For Irrigation Controllers (32 84 23 00-0207)		
32 84 23 00-0306 Weather Retrofits For Irrigation Controllers (32 84 23 00-0305)		
32 84 23 00-0307 EA Add One Flow Sensor Interface To An Existing Calsense Controller (Calsense F-RETRO).....	884.66	
32 84 23 00-0308 EA Add One ET Gage Interface To An Existing Calsense Controller (Calsense G-RETRO).....	884.66	
32 84 23 00-0309 EA Add One Tipping Rain Bucket Interface To An Existing Calsense Controller (Calsense RB-RETRO).....	884.66	
32 84 23 00-0310 EA Add One Wind Gage Interface To An Existing Calsense Controller (Calsense WG-RETRO).....	884.66	
32 84 23 00-0311 Phone Communication Retrofits For Irrigation Controllers (32 84 23 00-0305)		

32 Exterior Improvements**32 80 Irrigation****32 84 Planting Irrigation**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 84 23 00-0312	EA		Add The Ability To Chain To Another Calsense Controller With The Phone Line Communication Option And Share One Phone Line (Calsense M-RETRO)	928.83	
32 84 23 00-0313	EA		Add The Phone Line Communication Option To An Existing Calsense Controller (Calsense R-RETRO)	1,094.45	
32 84 23 00-0314	EA		Add The Phone Line Communication Option And The Ability To Chain To Another Calsense Controller And Share One Phone Line (Calsense MLR-RETRO)	1,740.41	
32 84 23 00-0315			Local Radio Communication Retrofits For Irrigation Controllers (32 84 23 00-0305)		
32 84 23 00-0316	EA		Add The Ability To Chain To Another Calsense Controller With The Local Radio Communication Option And Share One Local Radio (Calsense ML-RETRO)	1,039.25	
32 84 23 00-0317	EA		Add The Local Radio Communication Option To An Existing Calsense Controller (Calsense LR-RETRO)	2,165.53	
32 84 23 00-0318	EA		Add The Local Radio Communication Option And The Ability To Chain To Another Calsense Controller And Share One Local Radio (Calsense MLR-RETRO)	2,805.97	
32 84 23 00-0319			Spread Spectrum Radio Communication Retrofits For Irrigation Controllers (32 84 23 00-0305)		
32 84 23 00-0320	EA		Add The Ability To Chain To Another Calsense Controller With The Spread Spectrum Radio Communication Option And Share One Spread Spectrum Radio (Calsense MS-Retro)	1,039.25	
32 84 23 00-0321	EA		Add The Spread Spectrum Radio Communication Option To An Existing Calsense Controller (Calsense SR-RETRO)	2,165.53	
32 84 23 00-0322	EA		Add The Spread Spectrum Radio Communication Option And The Ability To Chain To Another Calsense Controller And Share One Spread Spectrum Radio (Calsense MSR-RETRO)	2,805.97	
32 84 23 00-0323			Ethernet Communication Retrofits For Irrigation Controllers (32 84 23 00-0305)		
32 84 23 00-0324	EA		Add The Ability To Chain To Another Calsense Controller With The Ethernet Communication Option And Share One Ethernet Device (Calsense ME-Retro)	1,039.25	
32 84 23 00-0325	EA		Add The Ethernet Communication Option To An Existing Calsense Controller (Calsense EN-RETRO)	1,094.45	
32 84 23 00-0326	EA		Add The Ethernet Communication Option And The Ability To Chain To Another Calsense Controller And Share One Ethernet Device (Calsense MEN-RETRO)	1,740.41	
32 84 23 00-0327			GPRS Radio Modem Communication Retrofits For Irrigation Controllers (32 84 23 00-0305)		
32 84 23 00-0328	EA		Add The Ability To Chain To Another Calsense Controller With The GPRS Communication Option And Share One GPRS Modem (Calsense MG-RETRO)	1,039.25	
32 84 23 00-0329	EA		Add The GPRS Communication Option To An Existing Calsense Controller (Calsense GR-RETRO)	2,165.53	
32 84 23 00-0330	EA		Add The GPRS Communication Option And The Ability To Chain To Another Calsense Controller And Share One GPRS Modem (Calsense MGR-RETRO)	2,805.97	
32 84 23 00-0331			Radio Remote Units For Irrigation Controllers (32 84 23 00-0207)		
32 84 23 00-0332	EA		Enhanced Radio Remote Hand-Held Transmitter With Carry Case (Calsense RRe-TRAN)	1,044.77	
32 84 23 00-0333	EA		Calsense Integrated Radio Remote Receiver Board (Calsense RR/RRe)	218.63	
			Note: Includes polyvinyl chloride (PVC) stick antenna. Excludes antenna cable.		
32 84 23 00-0334	EA		Wall Mount Charger For Hand-Held Transmitter (Calsense RRTRAN-CHG)	93.86	
32 84 23 00-0335	EA		Replacement Battery For Hand-Held Transmitter (Calsense RRTRAN-BAT)	172.85	
32 84 23 00-0336	EA		Polyvinyl Chloride (PVC) Stick Antenna For Radio Remote Receiver Board (Calsense RR-ANT)	112.12	9.14
			Note: Excludes antenna cable.		
32 84 23 00-0337	EA		Whip Antenna For Radio Remote Receiver Board (Calsense RRe-WHIP)	211.50	9.14
			Note: Excludes antenna cable.		
32 84 23 00-0338	EA		Dome Antenna For Radio Remote Receiver Board (Calsense RR-Dome/RRe-Dome)	228.06	9.14
			Note: Excludes antenna cable.		
32 84 23 00-0339			Satellite Irrigation Controllers (Rainbird ESP-SAT) (32 84 23 00-0133)		
			Note: Satellite controllers compatible with Maxi-Con Central Control. Includes link communication with SEMET at the controller and stainless steel cabinet. Excludes concrete pad.		
32 84 23 00-0340	EA		12 Station, Satellite Irrigation Controller With Stainless Steel Cabinet (Rainbird RBESP12SATLS)	2,505.31	164.41
32 84 23 00-0341	EA		24 Station, Satellite Irrigation Controller With Stainless Steel Cabinet (Rainbird RBESP24SATLS)	2,642.18	173.54
32 84 23 00-0342	EA		40 Station, Satellite Irrigation Controller With Stainless Steel Cabinet (Rainbird RBESP40SATLS)	3,630.44	182.67
32 84 23 00-0343			Irrigation Valves (32 84 23)		
32 84 23 00-0344			Reduced Pressure Zone Valves With QT Shut-Offs (32 84 23 00-0343)		
			Note: Includes ball type test cocks, two quarter-turn (QT) full port resilient seated bronze body ball valves, and captured spring assemblies (Watts 009 QT series).		
32 84 23 00-0345	EA		3/4" Threaded Reduced Pressure Zone Assembly With Quarter Turn Shut-offs (Watts 009M3 QT series)	409.38	30.34
32 84 23 00-0346	EA		1" Threaded Reduced Pressure Zone Assembly With Quarter Turn Shut-offs (Watts 009M2 QT series)	486.51	37.04
32 84 23 00-0347	EA		1-1/4" Threaded Reduced Pressure Zone Assembly With Quarter Turn Shut-offs (Watts 009M2 QT series)	725.68	43.12
32 84 23 00-0348	EA		1-1/2" Threaded Reduced Pressure Zone Assembly With Quarter Turn Shut-offs (Watts 009M2 QT series)	769.91	49.50
32 84 23 00-0349	EA		2" Threaded Reduced Pressure Zone Assembly With Quarter Turn Shut-offs (Watts 009M2 QT series)	927.40	63.88
32 84 23 00-0350			Brass Quick-Coupling Irrigation Valves (32 84 23 00-0343)		
32 84 23 00-0351	EA		3/4", 1-Piece Brass Body, Quick-Coupling Irrigation Valve (Rainbird® 3RC)	130.73	26.46
			For Valve Key, Add	39.85	
32 84 23 00-0352	EA		3/4", 2-Piece Brass Body, Quick-Coupling Irrigation Valve (Rainbird® 33DR)	140.84	26.46
			For Locking Cover, Add	25.00	
			For Valve Key, Add	39.85	



Exterior Improvements		32
Irrigation		32 80
Planting Irrigation		32 84

32

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 84 23 00-0353	EA		1", 1-Piece Brass Body, Quick-Coupling Irrigation Valve (Rainbird® 44RC)	189.17	26.46
			<i>For Valve Key, Add</i>	87.87	
32 84 23 00-0354	EA		1", 2-Piece Brass Body, Quick-Coupling Irrigation Valve (Rainbird® 44LRC)	215.02	26.46
			<i>For Locking Cover, Add</i>	25.00	
			<i>For Valve Key, Add</i>	87.87	
32 84 23 00-0355			Anti-Siphon Pressure Type Vacuum Breaker <small>(32 84 23 00-0343)</small>		
			Note: Pressure: 15 to 150 PSI, temperature: 33 to 140 degrees Fahrenheit.		
32 84 23 00-0356	EA		3/4" Anti-Siphon Pressure Type Vacuum Breaker (Watts 800M4QT).....	132.63	22.35
32 84 23 00-0357	EA		1" Anti-Siphon Pressure Type Vacuum Breaker	184.41	25.56
32 84 23 00-0358	EA		1-1/4" Anti-Siphon Pressure Type Vacuum Breaker	320.71	29.54
32 84 23 00-0359	EA		1-1/2" Anti-Siphon Pressure Type Vacuum Breaker	389.43	32.73
32 84 23 00-0360	EA		2" Anti-Siphon Pressure Type Vacuum Breaker	398.04	39.92
32 84 23 00-0361			Irrigation Piping <small>(32 84 23)</small>		
32 84 23 00-0362	LF		3/4" Class 200 Polyvinyl Chloride (PVC) Socketweld Pipe With Fittings	2.08	0.92
			<i>For >1,000, Deduct</i>	-0.10	
32 84 23 00-0363	LF		1" Class 200 Polyvinyl Chloride (PVC) Socketweld Pipe With Fittings	2.51	1.10
			<i>For >1,000, Deduct</i>	-0.13	
32 84 23 00-0364	LF		1-1/2" Class 200 Polyvinyl Chloride (PVC) Socketweld Pipe With Fittings	3.48	1.40
			<i>For >1,000, Deduct</i>	-0.17	
32 84 23 00-0365	LF		2" Class 200 Polyvinyl Chloride (PVC) Socketweld Pipe With Fittings	4.45	1.75
			<i>For >1,000, Deduct</i>	-0.22	
32 84 23 00-0366	LF		2-1/2" Class 200 Polyvinyl Chloride (PVC) Socketweld Pipe With Fittings	5.60	2.05
			<i>For >1,000, Deduct</i>	-0.28	
32 84 23 00-0367	LF		1/2" Schedule 40 Polyvinyl Chloride (PVC) Pipe With Fittings.....	1.75	0.74
			<i>For >1,000, Deduct</i>	-0.09	
32 84 23 00-0368	LF		3/4" Schedule 40 Polyvinyl Chloride (PVC) Pipe With Fittings.....	2.19	0.92
			<i>For >1,000, Deduct</i>	-0.11	
32 84 23 00-0369	LF		1" Schedule 40 Polyvinyl Chloride (PVC) Pipe With Fittings.....	2.69	1.10
			<i>For >1,000, Deduct</i>	-0.13	
32 84 23 00-0370	LF		1-1/2" Schedule 40 Polyvinyl Chloride (PVC) Pipe With Fittings	3.61	1.40
			<i>For >1,000, Deduct</i>	-0.18	
32 84 23 00-0371	LF		2" Schedule 40 Polyvinyl Chloride (PVC) Pipe With Fittings.....	4.56	1.75
			<i>For >1,000, Deduct</i>	-0.23	
32 84 23 00-0372	LF		2-1/2" Schedule 40 Polyvinyl Chloride (PVC) Pipe With Fittings	5.76	2.05
			<i>For >1,000, Deduct</i>	-0.29	
32 84 23 00-0373	LF		3" Schedule 40 Polyvinyl Chloride (PVC) Pipe With Fittings.....	8.05	2.94
			<i>For >1,000, Deduct</i>	-0.40	
32 84 23 00-0374			Irrigation Swing Joints <small>(32 84 23)</small>		
32 84 23 00-0375	EA		3/4" Male NPT, 12" Length, Polyvinyl Chloride (PVC) Irrigation Swing Joint (Rainbird TSJ12075)	49.90	16.33
32 84 23 00-0376	EA		1" Male NPT, 12" Length, Polyvinyl Chloride (PVC) Irrigation Swing Joint (Rainbird TSJ12)	61.31	20.40
32 84 23 00-0377	EA		1" Male NPT, 18" Length, Polyvinyl Chloride (PVC) Irrigation Swing Joint (Rainbird TSJ18)	76.51	20.40
32 84 23 00-0378	EA		1-1/2" Male NPT, 12" Length, Polyvinyl Chloride (PVC) Irrigation Swing Joint (Rainbird TSJ12150)	93.69	29.59
32 84 23 00-0379	EA		3/4" Male NPT, 12" Length, Polyvinyl Chloride (PVC) Irrigation Swing Joint With 45 PSI Pressure Regulator (Rainbird TSJ075PRS)	64.19	16.33
32 84 23 00-0380	EA		1" Male NPT, 12" Length, Polyvinyl Chloride (PVC) Irrigation Swing Joint With 70 PSI Pressure Regulator (Rainbird TSJ100PRS)	75.50	20.40
32 84 23 00-0381	EA		1/2" Diameter, 12" Length, Polyvinyl Chloride (PVC) Irrigation Swing Joint, CALTRAN Type I	39.75	19.36
			Note: Consists of three threaded 90 degree elbows and 12" threaded pipe.		
32 84 23 00-0382	EA		3/4" Diameter, 12" Length, Polyvinyl Chloride (PVC) Irrigation Swing Joint, CALTRAN Type I	52.79	25.69
			Note: Consists of three threaded 90 degree elbows and 12" threaded pipe.		
32 84 23 00-0383	EA		1" Diameter, 12" Length, Polyvinyl Chloride (PVC) Irrigation Swing Joint, CALTRAN Type I	65.45	31.50
			Note: Consists of three threaded 90 degree elbows and 12" threaded pipe.		
32 84 23 00-0384	EA		1/2" Diameter, 24" Length, Polyvinyl Chloride (PVC) Irrigation Swing Joint, CALTRAN Type II	42.91	19.36
			Note: Consists of one threaded 90 degree elbow, one threaded x socket 90 degree elbow, one adapter and 24" threaded pipe.		
32 84 23 00-0385	EA		3/4" Diameter, 24" Length, Polyvinyl Chloride (PVC) Irrigation Swing Joint, CALTRAN Type II	56.71	25.69
			Note: Consists of one threaded 90 degree elbow, one threaded x socket 90 degree elbow, one adapter and 24" threaded pipe.		
32 84 23 00-0386	EA		1" Diameter, 24" Length, Polyvinyl Chloride (PVC) Irrigation Swing Joint, CALTRAN Type II	69.38	31.50
			Note: Consists of one threaded 90 degree elbow, one threaded x socket 90 degree elbow, one adapter and 24" threaded pipe.		
32 84 23 00-0387	EA		1/2" Diameter, Polyvinyl Chloride (PVC) Irrigation Swing Joint, CALTRAN Type III	24.26	11.86
			Note: Consists of two street 90 degree elbows.		
32 84 23 00-0388	EA		3/4" Diameter, Polyvinyl Chloride (PVC) Irrigation Swing Joint, CALTRAN Type III	32.39	15.81
			Note: Consists of two street 90 degree elbows.		
32 84 23 00-0389	EA		1" Diameter, Polyvinyl Chloride (PVC) Irrigation Swing Joint, CALTRAN Type III	40.59	19.60
			Note: Consists of two street 90 degree elbows.		
32 84 23 00-0390			Irrigation Control Wire <small>(32 84 23)</small>		
			Note: Excludes excavation and backfill.		
32 84 23 00-0391			18 AWG, Irrigation Control Wire, Buried In Trench <small>(32 84 23 00-0390)</small>		
32 84 23 00-0392	CLF		1-Conductor, 18 AWG, Irrigation Control Wire, Buried In Trench	32.27	11.02
32 84 23 00-0393	CLF		2-Conductor, 18 AWG, Irrigation Control Wire, Buried In Trench	41.64	12.86
32 84 23 00-0394	CLF		3-Conductor, 18 AWG, Irrigation Control Wire, Buried In Trench	47.86	14.70
32 84 23 00-0395	CLF		4-Conductor, 18 AWG, Irrigation Control Wire, Buried In Trench	54.66	16.54

32 Exterior Improvements**32 80 Irrigation****32 84 Planting Irrigation**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
	32 84 23 00-0396	CLF	5-Conductor, 18 AWG, Irrigation Control Wire, Buried In Trench	62.02	18.38
	32 84 23 00-0397	CLF	6-Conductor, 18 AWG, Irrigation Control Wire, Buried In Trench	73.38	20.21
	32 84 23 00-0398	CLF	7-Conductor, 18 AWG, Irrigation Control Wire, Buried In Trench	84.28	22.05
	32 84 23 00-0399	CLF	8-Conductor, 18 AWG, Irrigation Control Wire, Buried In Trench	91.54	23.89
	32 84 23 00-0400	CLF	9-Conductor, 18 AWG, Irrigation Control Wire, Buried In Trench	100.30	25.73
	32 84 23 00-0401	CLF	10-Conductor, 18 AWG, Irrigation Control Wire, Buried In Trench.....	110.24	27.56
	32 84 23 00-0402	CLF	11-Conductor, 18 AWG, Irrigation Control Wire, Buried In Trench.....	114.47	29.40
	32 84 23 00-0403	CLF	12-Conductor, 18 AWG, Irrigation Control Wire, Buried In Trench.....	119.28	31.24
	32 84 23 00-0404	CLF	13-Conductor, 18 AWG, Irrigation Control Wire, Buried In Trench.....	125.90	33.07
	32 84 23 00-0405		16 AWG, Irrigation Control Wire, Buried In Trench (32 84 23 00-0390)		
	32 84 23 00-0406	CLF	1-Conductor, 16 AWG, Irrigation Control Wire, Buried In Trench	33.78	11.02
	32 84 23 00-0407		14 AWG, Irrigation Control Wire, Buried In Trench (32 84 23 00-0390)		
	32 84 23 00-0408	CLF	1-Conductor, 14 AWG, Irrigation Control Wire, Buried In Trench	33.79	11.02
	32 84 23 00-0409		12 AWG, Irrigation Control Wire, Buried In Trench (32 84 23 00-0390)		
	32 84 23 00-0410	CLF	1-Conductor, 12 AWG, Irrigation Control Wire, Buried In Trench	43.78	11.02
	32 84 23 00-0411		10 AWG, Irrigation Control Wire, Buried In Trench (32 84 23 00-0390)		
	32 84 23 00-0412	CLF	1-Conductor, 10 AWG, Irrigation Control Wire, Buried In Trench	56.43	11.02
	32 84 23 00-0413		Root Watering Systems (32 84 23)		
			Note: Includes swing assembly.		
	32 84 23 00-0414	EA	0.25 GPM Bubbler On Riser, 36" Tube, 4" Diameter Grate, Root Watering System (Rainbird RWS-B-1401).....	62.21	14.70
			For Root Watering Sand Sock, Add	3.82	
	32 84 23 00-0415	EA	0.25 GPM Bubbler And Check Valve On Riser, 36" Tube, 4" Diameter Grate, Root Watering System (Rainbird RWS-B-C-1401).....	66.76	14.70
			For Root Watering Sand Sock, Add	3.82	
	32 84 23 00-0416	EA	0.5 GPM Bubbler On Riser, 36" Tube, 4" Diameter Grate, Root Watering System (Rainbird RWS-B-1402).....	62.21	14.70
			For Root Watering Sand Sock, Add	3.82	
	32 84 23 00-0417	EA	0.5 GPM Bubbler And Check Valve On Riser, 36" Tube, 4" Diameter Grate, Root Watering System (Rainbird RWS-B-C-1402).....	66.76	14.70
			For Root Watering Sand Sock, Add	3.82	
	32 84 23 00-0418	EA	1 GPM Bubbler And Check Valve On Riser, 36" Tube, 4" Diameter Grate, Root Watering System (Rainbird RWS-B-C-1404).....	66.76	14.70
			For Root Watering Sand Sock, Add	3.82	
	32 84 23 00-0419	EA	2 GPM Bubbler And Check Valve On Riser, 36" Tube, 4" Diameter Grate, Root Watering System (Rainbird RWS-B-C-1408).....	66.76	14.70
			For Root Watering Sand Sock, Add	3.82	
	32 84 23 00-0420	EA	0.25 GPM Bubbler On Riser, 18" Tube, 4" Diameter Grate, Root Watering System (Rainbird RWS-M-B-1401).....	54.02	12.86
			For Root Watering Sand Sock, Add	3.45	
	32 84 23 00-0421	EA	0.25 GPM Bubbler And Check Valve On Riser, 18" Tube, 4" Diameter Grate, Root Watering System (Rainbird RWS-M-B-C-1401).....	58.40	12.86
			For Root Watering Sand Sock, Add	3.45	
	32 84 23 00-0422	EA	0.5 GPM Bubbler On Riser, 18" Tube, 4" Diameter Grate, Root Watering System (Rainbird RWS-M-B-1402).....	54.02	12.86
			For Root Watering Sand Sock, Add	3.45	
	32 84 23 00-0423	EA	0.5 GPM Bubbler And Check Valve On Riser, 18" Tube, 4" Diameter Grate, Root Watering System (Rainbird RWS-M-B-C-1402).....	58.40	12.86
			For Root Watering Sand Sock, Add	3.45	
	32 84 23 00-0424	EA	0.25 GPM Bubbler On Riser, 10" Tube, 4" Diameter Grate, Root Watering System (Rainbird RWS-S-B-1401).....	37.10	11.02
			For Root Watering Sand Sock, Add	3.09	
	32 84 23 00-0425	EA	0.25 GPM Bubbler And Check Valve On Riser, 10" Tube, 4" Diameter Grate, Root Watering System (Rainbird RWS-S-B-C-1401).....	41.27	11.02
			For Root Watering Sand Sock, Add	3.09	

32 90 Planting (32)

Note: Plant installation includes the initial watering only. The extended watering period for the establishment of lawns, plants and trees is addressed on a per plant per amount per occurrence basis as directed in the specification. cvs = cultivar. See CSI section 32 01 90 26-0000 for additional "extended watering period" tasks.

32 91 Planting Preparation (32 90)**32 91 13 Soil Preparation** (32 91)**32 91 13 16 Mulching** (32 91 13)**32 91 13 16-0001 Mulch** (32 91 13 16)

Note: Includes loading, delivery up to 15 miles and spreading. 1 CY = 108 SF of mulch spread 3" thick. See CSI section 01 74 19 00-0034 for hauling greater than 15 miles.

32 91 13 16-0002	CY	Pine Bark Nugget Mulch	90.16	
		For >5 To 20, Deduct	-7.28	
		For >20 To 50, Deduct	-10.04	
		For >50, Deduct	-15.58	
		For Work On Slopes >2.5:1, Add	11.07	



Exterior Improvements		32
Planting		32 90
Planting Preparation		32 91

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 91 13 16-0003 CY Hardwood Bark Nugget Mulch.....	88.77	
For >5 To 20, Deduct	-7.21	
For >20 To 50, Deduct	-9.97	
For >50, Deduct	-15.51	
For Work On Slopes >2.5:1, Add	11.07	
32 91 13 16-0004 CY Pine Wood Chip Mulch.....	85.98	
For >5 To 20, Deduct	-7.07	
For >20 To 50, Deduct	-9.83	
For >50, Deduct	-15.37	
For Work On Slopes >2.5:1, Add	11.07	
32 91 13 16-0005 CY Hardwood Chip Mulch.....	94.34	
For >5 To 20, Deduct	-7.48	
For >20 To 50, Deduct	-10.25	
For >50, Deduct	-15.79	
For Work On Slopes >2.5:1, Add	11.07	
32 91 13 16-0006 CY Shredded Hardwood Mulch.....	91.55	
For >5 To 20, Deduct	-7.34	
For >20 To 50, Deduct	-10.11	
For >50, Deduct	-15.65	
For Work On Slopes >2.5:1, Add	11.07	
32 91 13 16-0007 CY Shredded Pine Mulch.....	79.02	
For >5 To 20, Deduct	-6.72	
For >20 To 50, Deduct	-9.49	
For >50, Deduct	-15.02	
For Work On Slopes >2.5:1, Add	11.07	
32 91 13 16-0008 CY Shredded Cedar Mulch.....	106.18	
For >5 To 20, Deduct	-8.08	
For >20 To 50, Deduct	-10.84	
For >50, Deduct	-16.38	
For Work On Slopes >2.5:1, Add	11.07	
32 91 13 16-0009 CY Shredded Cypress Mulch.....	104.09	
For >5 To 20, Deduct	-7.97	
For >20 To 50, Deduct	-10.74	
For >50, Deduct	-16.27	
For Work On Slopes >2.5:1, Add	11.07	
32 91 13 16-0010 CY Shredded Redwood Mulch.....	109.66	
For >5 To 20, Deduct	-8.25	
For >20 To 50, Deduct	-11.02	
For >50, Deduct	-16.55	
For Work On Slopes >2.5:1, Add	11.07	
32 91 13 16-0011 CY Pea Gravel Mulch.....	107.42	
For >5 To 20, Deduct	-8.14	
For >20 To 50, Deduct	-10.91	
For >50, Deduct	-16.44	
For Work On Slopes >2.5:1, Add	11.07	
32 91 13 16-0012 CY Chunk Recycled Tire Mulch.....	168.44	
For >5 To 20, Deduct	-11.97	
For >20 To 50, Deduct	-15.52	
For >50, Deduct	-22.61	
For Work On Slopes >2.5:1, Add	14.19	
32 91 13 16-0013 CY Chunk Colored Recycled Tire Mulch.....	264.54	
For >5 To 20, Deduct	-16.77	
For >20 To 50, Deduct	-20.32	
For >50, Deduct	-27.42	
For Work On Slopes >2.5:1, Add	14.19	
32 91 13 16-0014 CY Shredded Recycled Tire Mulch.....	265.93	
For >5 To 20, Deduct	-16.84	
For >20 To 50, Deduct	-20.39	
For >50, Deduct	-27.48	
For Work On Slopes >2.5:1, Add	14.19	
32 91 13 16-0015 CY Shredded Colored Recycled Tire Mulch.....	458.14	
For >5 To 20, Deduct	-26.45	
For >20 To 50, Deduct	-30.00	
For >50, Deduct	-37.10	
For Work On Slopes >2.5:1, Add	14.19	
32 91 13 16-0016 EA Pine Straw Mulch Bale.....	8.08	
Note: Covers 50 SF at a thickness of 2" to 4" forming a uniform mat through which none of the original ground surface can be seen.		
For >100 To 250, Deduct	-0.57	
For >250 To 500, Deduct	-0.73	
For >500, Deduct	-0.97	
For Work On Slopes >2.5:1, Add	0.64	
32 91 13 16-0017 EA Wheat Straw Mulch Bale.....	8.14	
Note: Covers 350 SF forming a uniform mat through which 20 to 40% of the original ground surface can be seen.		
For >100 To 250, Deduct	-0.53	
For >250 To 500, Deduct	-0.65	
For >500, Deduct	-0.94	
For Work On Slopes >2.5:1, Add	0.48	
32 91 13 16-0018 CY Stone/Gravel Mulch, Marble Chips.....	221.08	
For >5 To 20, Deduct	-13.82	
For >20 To 50, Deduct	-16.59	
For >50, Deduct	-22.12	
For Work On Slopes >2.5:1, Add	11.07	
32 91 13 16-0019 CY Stone Mulch, Decomposed Granite Chips.....	101.35	
For Work On Slopes >2.5:1, Add	11.07	

32 Exterior Improvements**32 90 Planting****32 91 Planting Preparation**MINOR
CSI UOM DESCRIPTIONTOTAL DIRECT DEMOLITION
UNIT COST UNIT COST**32 91 13 26****Planting Beds** (32 91 13)

Note: Not for use when installing trees and shrubs.

32 91 13 26-0001**Plant Bed Preparation** (32 91 13 26)

Note: Not for use when installing trees and shrubs.

32 91 13 26-0002	SF	Prepare Plant Bed, Up To 8" Deep By Machine	0.86
		Note: Includes loosening subgrade, removing stones, sticks, roots, rubbish, and raking surface. Excludes soil amendments.	
		<i>For Work On Slopes >2.5:1, Add</i>	0.17
32 91 13 26-0003	SF	Prepare Plant Bed, 9" To 13" Deep By Machine	1.00
		Note: Includes loosening subgrade, removing stones, sticks, roots, rubbish, and raking surface. Excludes soil amendments.	
		<i>For Work On Slopes >2.5:1, Add</i>	0.20
32 91 13 26-0004	SF	Prepare Plant Bed, 14" To 18" Deep By Machine	1.17
		Note: Includes loosening subgrade, removing stones, sticks, roots, rubbish, and raking surface. Excludes soil amendments.	
		<i>For Work On Slopes >2.5:1, Add</i>	0.23
32 91 13 26-0005	SF	Prepare Plant Bed By Hand, Up To 8" Deep	4.22
		Note: Includes loosening subgrade, removing stones, sticks, roots, rubbish, and raking surface. Excludes soil amendments.	
		<i>For Work On Slopes >2.5:1, Add</i>	0.84
32 91 13 26-0006	SF	Prepare Plant Bed By Hand, 9" To 13" Deep	4.85
		Note: Includes loosening subgrade, removing stones, sticks, roots, rubbish, and raking surface. Excludes soil amendments.	
		<i>For Work On Slopes >2.5:1, Add</i>	0.97
32 91 13 26-0007	SF	Prepare Plant Bed By Hand, 14" To 18" Deep	5.71
		Note: Includes loosening subgrade, removing stones, sticks, roots, rubbish, and raking surface. Excludes soil amendments.	
		<i>For Work On Slopes >2.5:1, Add</i>	1.14

32 91 13 26-0008**Planting Pit Preparation** (32 91 13 26)

Note: Not for use when installing trees and shrubs.

32 91 13 26-0009	CY	Excavate Planting Pit By Hand, Sandy Soil	73.07
		Note: For use with existing planting pits.	
		<i>For Work On Slopes >2.5:1, Add</i>	14.61
32 91 13 26-0010	CY	Excavate Planting Pit By Hand, Heavy Soil	146.14
		Note: For use with existing planting pits.	
		<i>For Work On Slopes >2.5:1, Add</i>	29.23
32 91 13 26-0011	CY	Excavate Planting Pit By Machine, Sandy Soil	9.98
		Note: For use with existing planting pits.	
		<i>For Work On Slopes >2.5:1, Add</i>	2.00
32 91 13 26-0012	CY	Excavate Planting Pit By Machine, Heavy Soil	12.98
		Note: For use with existing planting pits.	
		<i>For Work On Slopes >2.5:1, Add</i>	2.60
32 91 13 26-0013	CY	Backfill Planting Pit By Hand With Topsoil From Stockpile	64.93
		<i>For Work On Slopes >2.5:1, Add</i>	12.99
32 91 13 26-0014	CY	Backfill Planting Pit By Hand With Contractor Furnished Planting Mix	89.85
		<i>For Work On Slopes >2.5:1, Add</i>	9.75
32 91 13 26-0015	CY	Backfill Planting Pit By Machine, With Topsoil From Stockpile	5.86
		<i>For Work On Slopes >2.5:1, Add</i>	1.17
32 91 13 26-0016	CY	Backfill Planting Pit By Machine, With Contractor Furnished Planting Mix	45.97
		<i>For Work On Slopes >2.5:1, Add</i>	0.97

32 91 13 26-0017**Weed Barrier** (32 91 13 26)

32 91 13 26-0018	SY	Up To 3 Oz/SY Non Woven, Polypropylene Weed Barrier	1.41
		<i>For Work On Slopes >2.5:1, Add</i>	0.12
32 91 13 26-0019	SY	4 Oz/SY Woven, Polypropylene Weed Barrier	1.84
		<i>For Work On Slopes >2.5:1, Add</i>	0.12
32 91 13 26-0020	SY	5 Oz/SY Woven, Needle Punched Polypropylene Weed Barrier	2.03
		<i>For Work On Slopes >2.5:1, Add</i>	0.12

32 91 13 33**Soil Conditioners** (32 91 13)**32 91 13 33-0001****Spread Soil Conditioners** (32 91 13 33)

32 91 13 33-0002	SY	Aluminum Sulfate 1 LB/SY, Push Spreader	0.49
32 91 13 33-0003	MSF	Aluminum Sulfate 1 LB/SY, Tractor Spreader	48.37
32 91 13 33-0004	SY	Fertilizer, 0.2 LB/SY, Push Spreader	0.05
32 91 13 33-0005	MSF	Fertilizer, 0.2 LB/SY, Tractor Spread	7.60
32 91 13 33-0006	MSF	Fertilizer, 18.36 LB/MSF, Truck Spread	3.78
32 91 13 33-0007	SY	Pelletized Lime, 1 LB/SY, Push Spreader	0.10
32 91 13 33-0008	MSF	Pelletized Lime, 1 LB/SY, Tractor Spreader	8.59
32 91 13 33-0009	SY	Manure, 18 LB/SY, Push Spreader	2.86
32 91 13 33-0010	MSF	Manure, 18 LB/SY, Tractor Spreader	312.90
32 91 13 33-0011	SY	Perlite, 1" Deep, Push Spreader	4.45
32 91 13 33-0012	MSF	Perlite, 1" Deep, Tractor Spreader	463.44
32 91 13 33-0013	SY	Vermiculite, Push Spreader	4.13
32 91 13 33-0014	MSF	Vermiculite, Tractor Spreader	452.69

32 91 13 36**Lawn Bed Preparation** (32 91 13)



Exterior Improvements		32
Planting		32 90
Planting Preparation		32 91

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 91	13 36-0001		Lawn Bed Preparation (32 91 13 36)		
	32 91 13 36-0002	MSF	Rake Topsoil With Machine	64.14	
	32 91 13 36-0003	MSF	Rake Topsoil By Hand	58.45	
	32 91 13 36-0004	MSF	Screen Loam With Machine.....	82.23	
	32 91 13 36-0005	MSF	Screen Loam By Hand.....	38.97	
	32 91 13 36-0006	SY	Roll Topsoil With Machine	0.80	
	32 91 13 36-0007	SY	Roll Topsoil By Hand	2.61	
	32 91 13 36-0008	MSF	Remove Rocks And Debris With Machine	7.58	
	32 91 13 36-0009	MSF	Remove Rocks And Debris By Hand.....	24.67	
	32 91 13 36-0010	MSF	Root Raking And Loading, No Boulders	39.70	
			<i>For >45 to 225, Deduct</i>	-27.79	
			<i>For >225, Deduct</i>	-35.73	
	32 91 13 36-0011	MSF	Root Raking And Loading, With Boulders.....	66.16	
			<i>For >45 to 225, Deduct</i>	-46.31	
			<i>For >225, Deduct</i>	-59.54	
	32 91 13 36-0012	MSF	Up To 6" Deep Tilling Topsoil With Tractor	3.45	
	32 91 13 36-0013	MSF	>6" To 12" Deep Tilling Topsoil With Tractor	7.00	
			<i>For Work On Slopes >2.5:1, Add</i>	1.40	
	32 91 13 36-0014	SY	Up To 2" Deep Tilling Topsoil With Rototiller	0.62	
	32 91 13 36-0015	SY	>2" To 4" Deep Tilling Topsoil With Rototiller	0.75	
	32 91 13 36-0016	SY	>4" To 6" Deep Tilling Topsoil With Rototiller	0.93	
	32 91 13 36-0017	LF	"V" Cut Soil For Edge Of Planting Beds.....	1.03	
32 91	13 36-0018		Sod Removal (32 91 13 36)		
	32 91 13 36-0019	SY	Remove Sod By Hand	4.92	
			<i>For Work On Slopes >2.5:1, Add</i>	0.98	
	32 91 13 36-0020	SY	Remove Sod With Machine	0.47	
			<i>For Work On Slopes >2.5:1, Add</i>	0.09	
	32 91 13 36-0021	SY	Pile Sod By Hand.....	2.92	
			<i>For Work On Slopes >2.5:1, Add</i>	0.58	
	32 91 13 36-0022	SY	Pile Sod With Machine.....	0.87	
			<i>For Work On Slopes >2.5:1, Add</i>	0.17	
32 91	19		Landscape Grading (32 91)		
32 91	19 13		Topsoil Placement And Grading (32 91 19)		
32 91	19 13-0001		Remove And Stockpile Topsoil On Site (32 91 19 13)		
	32 91 19 13-0002	CY	Remove Topsoil, 4" Deep Stockpile On Site.....	3.45	
	32 91 19 13-0003	CY	Remove Topsoil, 6" Deep Stockpile On Site.....	3.41	
32 91	19 13-0004		Screening Topsoil (32 91 19 13)		
	32 91 19 13-0005	CY	Screen Topsoil With Vibrating Screen, Wet Material (Organic)	7.87	
	32 91 19 13-0006	CY	Screen Topsoil With Vibrating Screen, Dry Material	5.24	
	32 91 19 13-0007	CY	Screen Topsoil With Vibrating Screen And Mix With Conditioners	2.13	
32 91	19 13-0008		Spreading Topsoil From Stockpile (32 91 19 13)		
	32 91 19 13-0009	CY	Spread Topsoil By Machine From Stockpile	5.91	
	32 91 19 13-0010	CY	Spread Topsoil By Hand From Stockpile	55.77	
32 91	19 13-0011		Furnish And Place Imported Screened Topsoil (32 91 19 13)		
			Note: Includes delivery up to 15 miles from the closest approved source and spread by machine. Excludes hand spreading. See CSI section 01 74 19 00-0034 for hauling greater than 15 miles, 31 23 16 36-0030 for hand spreading.		
	32 91 19 13-0012	SY	Furnish And Place Imported Screened Topsoil, 2" Deep.....	3.04	
			<i>For Unscreened, Deduct</i>	-0.43	
	32 91 19 13-0013	SY	Furnish And Place Imported Screened Topsoil, 4" Deep.....	5.86	
			<i>For Unscreened, Deduct</i>	-0.86	
	32 91 19 13-0014	SY	Furnish And Place Imported Screened Topsoil, 6" Deep.....	8.50	
			<i>For Unscreened, Deduct</i>	-1.29	
	32 91 19 13-0015	SY	Furnish And Place Imported Screened Topsoil, 9" Deep.....	12.33	
			<i>For Unscreened, Deduct</i>	-1.94	
	32 91 19 13-0016	SY	Furnish And Place Imported Screened Topsoil, 12" Deep.....	16.14	
			<i>For Unscreened, Deduct</i>	-2.58	
	32 91 19 13-0017	CY	Furnish And Place Imported Screened Topsoil, Over 12" Deep	44.93	
			<i>For Unscreened, Deduct</i>	-7.75	
32 91	19 16		Scarify Subsoil (32 91 19)		
32 91	19 16-0001		Scarify Subsoil For Planting Preparation (32 91 19 16)		
			Note: Ripped in multiple directions with 3" maximum clods.		
	32 91 19 16-0002	MSF	Up To 5,000 SF Scarify Up To 8" Subsoil With Machine	46.69	
	32 91 19 16-0003	MSF	>5,000 To 20,000 SF Scarify Up To 8" Subsoil With Machine.....	32.67	
	32 91 19 16-0004	MSF	>20,000 SF Scarify Up To 8" Subsoil With Machine With Scarifier.....	19.13	

32 Exterior Improvements**32 90 Planting****32 92 Turf And Grasses**

MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

32 92 Turf And Grasses (32 90)**32 92 16 Plugging** (32 92)**32 92 16 00-0001 Bermuda Or Centipede Plugging, 1" Deep** (32 92 16)

Note: Includes fine grade and soil preparation.

32 92 16 00-0002 6" On Center Plugging (32 92 16 00-0001)

32 92 16 00-0003	MSF	Plugging By Hand, 6" On Center	195.35
32 92 16 00-0004	MSF	Plugging By Walk Behind Planter, 6" On Center.....	32.66
32 92 16 00-0005	MSF	Plugging By Towed Planter, 6" On Center.....	26.04

32 92 16 00-0006 9" On Center Plugging (32 92 16 00-0001)

32 92 16 00-0007	MSF	Plugging By Hand, 9" On Center	149.67
32 92 16 00-0008	MSF	Plugging By Walk Behind Planter, 9" On Center.....	25.27
32 92 16 00-0009	MSF	Plugging By Towed Planter, 9" On Center.....	19.43

32 92 16 00-0010 12" On Center Plugging (32 92 16 00-0001)

32 92 16 00-0011	MSF	Plugging By Hand, 12" On Center	124.88
32 92 16 00-0012	MSF	Plugging By Walk Behind Planter, 12" On Center.....	16.82
32 92 16 00-0013	MSF	Plugging By Towed Planter, 12" On Center.....	12.32

32 92 19 Seeding (32 92)**32 92 19 13 Mechanical Seeding** (32 92 19)

Note: Includes fertilizing, liming, mixing, seeding and initial watering.

32 92 19 13-0001 Tractor Spreader Mechanical Seeding (32 92 19 13)

Note: Excludes straw.

32 92 19 13-0002	MSF	California Native Grass Mix, Tractor Spreader	27.82
		For > 5 To 20, Deduct	-1.80
		For >20 To 45, Deduct	-3.31
		For >45, Deduct	-5.23
32 92 19 13-0003	MSF	Common Bluegrass, Tractor Spreader	29.45
		Note: 4 LB/MSF spread rate.	
32 92 19 13-0004	MSF	Tall Fescue, Tractor Spreader	23.94
		Note: 5.5 LB/MSF spread rate.	
32 92 19 13-0005	MSF	Rye, Tractor Spreader	24.33
		Note: 10 LB/MSF spread rate.	
32 92 19 13-0006	MSF	Shade Mix, Tractor Spreader.....	26.32
		Note: 6 LB/MSF spread rate. Mixture of red fescue, creeping red fescue, perennial rye and bluegrass.	
32 92 19 13-0007	MSF	Turf Mix, Tractor Spreader.....	27.74
		Note: 4 LB/MSF spread rate. Mixture of three varieties of bluegrass and one improved perennial ryegrass.	
32 92 19 13-0008	MSF	Slope Mix, Tractor Spreader.....	25.84
		Note: 6 LB/MSF spread rate.	
32 92 19 13-0009	MSF	Utility Mix, Tractor Spreader	23.47
		Note: 7 LB/MSF spread rate. Mixture of perennial/annual rye, creeping red fescue and bluegrass.	
32 92 19 13-0010	MSF	Wild Flower Mix, Tractor Spreader.....	19.00
		Note: 0.10 LB/MSF spread rate.	
32 92 19 13-0011	MSF	Crown Vetch Mix, Tractor Spreader.....	54.34
		Note: 4 LB/MSF spread rate.	
32 92 19 13-0012	MSF	Athletic Mix, Tractor Spreader.....	33.44
		Note: 8 LB/MSF spread rate. Mixture of three varieties of drought resistant bluegrass, tall fescue and Kentucky bluegrass.	
32 92 19 13-0013	MSF	White Clover Mix, Tractor Spreader.....	18.95
		Note: 7 LB/MSF spread rate.	
32 92 19 13-0014	MSF	Ladino Clover Mix, Tractor Spreader	20.85
		Note: 7 LB/MSF spread rate.	

32 92 19 13-0015 Hydro Or Air Mechanical Seeding (32 92 19 13)

32 92 19 13-0016	MSF	California Native Grass Mix, Hydro Or Air Seeding.....	58.17
		For > 5 To 20, Deduct	-3.88
		For >20 To 45, Deduct	-7.29
		For >45, Deduct	-11.67
		For Spot Areas Up To 1 MSF, Add	66.21
		For >1 To 4 MSF, Add	42.87
		For >4 To 7.5 MSF, Add	29.24
		For >7.5 To 10 MSF, Add	14.62
		For >45, Deduct	-4.86
32 92 19 13-0017	MSF	Common Bluegrass, Hydro Or Air Seeding	60.89
		Note: 4 LB/MSF spread rate.	
		For Spot Areas Up To 1 MSF, Add	67.30
		For >1 To 4 MSF, Add	43.41
		For >4 To 7.5 MSF, Add	29.51
		For >7.5 To 10 MSF, Add	14.76
		For >45, Deduct	-5.00



		Exterior Improvements	32
		Planting	32 90
		Turf And Grasses	32 92

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 92 19 13-0018 MSF Tall Fescue, Hydro Or Air Seeding.....	64.22	
Note: 5.5 LB/MSF spread rate.		
For Spot Areas Up To 1 MSF, Add	68.63	
For >1 To 4 MSF, Add	44.08	
For >4 To 7.5 MSF, Add	29.85	
For >7.5 To 10 MSF, Add	14.92	
For >45, Deduct	-5.16	
32 92 19 13-0019 MSF Rye, Hydro Or Air Spread.....	61.03	
Note: 10 LB/MSF spread rate.		
For Spot Areas Up To 1 MSF, Add	67.36	
For >1 To 4 MSF, Add	43.44	
For >4 To 7.5 MSF, Add	29.53	
For >7.5 To 10 MSF, Add	14.76	
For >45, Deduct	-5.00	
32 92 19 13-0020 MSF Shade Mix, Hydro Or Air Seeding.....	60.89	
Note: 6 LB/MSF spread rate. Mixture of red fescue, creeping red fescue, perennial rye and bluegrass.		
For Spot Areas Up To 1 MSF, Add	67.30	
For >1 To 4 MSF, Add	43.41	
For >4 To 7.5 MSF, Add	29.51	
For >7.5 To 10 MSF, Add	14.76	
For >45, Deduct	-5.00	
32 92 19 13-0021 MSF Turf Mix, Hydro Or Air Seeding.....	64.22	
Note: 4 LB/MSF spread rate. Mixture of three varieties of bluegrass and one improved perennial ryegrass.		
For Spot Areas Up To 1 MSF, Add	68.63	
For >1 To 4 MSF, Add	44.08	
For >4 To 7.5 MSF, Add	29.85	
For >7.5 To 10 MSF, Add	14.92	
For >45, Deduct	-5.16	
32 92 19 13-0022 MSF Slope Mix, Hydro Or Air Seeding.....	62.79	
Note: 6 LB/MSF spread rate.		
For Spot Areas Up To 1 MSF, Add	68.06	
For >1 To 4 MSF, Add	43.79	
For >4 To 7.5 MSF, Add	29.70	
For >7.5 To 10 MSF, Add	14.85	
For >45, Deduct	-5.09	
32 92 19 13-0023 MSF Utility Mix, Hydro Or Air Seeding.....	61.64	
Note: 7 LB/MSF spread rate. Mixture of perennial/annual rye, creeping red fescue and bluegrass.		
For Spot Areas Up To 1 MSF, Add	67.60	
For >1 To 4 MSF, Add	43.56	
For >4 To 7.5 MSF, Add	29.59	
For >7.5 To 10 MSF, Add	14.79	
For >45, Deduct	-5.03	
32 92 19 13-0024 MSF Wild Flower Mix, Hydro Or Air Seeding.....	57.94	
Note: 0.10 LB/MSF spread rate.		
For Spot Areas Up To 1 MSF, Add	66.12	
For >1 To 4 MSF, Add	42.82	
For >4 To 7.5 MSF, Add	29.22	
For >7.5 To 10 MSF, Add	14.61	
For >45, Deduct	-4.85	
32 92 19 13-0025 MSF Crown Vetch Mix, Hydro Or Air Seeding.....	91.29	
Note: 4 LB/MSF spread rate.		
For Spot Areas Up To 1 MSF, Add	79.46	
For >1 To 4 MSF, Add	49.49	
For >4 To 7.5 MSF, Add	32.55	
For >7.5 To 10 MSF, Add	16.28	
For >45, Deduct	-6.52	
32 92 19 13-0026 MSF Athletic Mix, Hydro Or Air Seeding.....	80.85	
Note: 8 LB/MSF spread rate. Mixture of three varieties of drought resistant bluegrass, tall fescue and Kentucky bluegrass.		
For Spot Areas Up To 1 MSF, Add	75.28	
For >1 To 4 MSF, Add	47.40	
For >4 To 7.5 MSF, Add	31.51	
For >7.5 To 10 MSF, Add	15.75	
For >45, Deduct	-5.99	
32 92 19 13-0027 MSF White Clover Mix, Hydro Or Air Seeding.....	53.43	
Note: 7 LB/MSF spread rate.		
For Spot Areas Up To 1 MSF, Add	64.32	
For >1 To 4 MSF, Add	41.92	
For >4 To 7.5 MSF, Add	28.77	
For >7.5 To 10 MSF, Add	14.38	
For >45, Deduct	-4.62	
32 92 19 13-0028 MSF Ladino Clover Mix, Hydro Or Air Seeding.....	58.99	
Note: 7 LB/MSF spread rate.		
For Spot Areas Up To 1 MSF, Add	66.54	
For >1 To 4 MSF, Add	43.03	
For >4 To 7.5 MSF, Add	29.32	
For >7.5 To 10 MSF, Add	14.66	
For >45, Deduct	-4.90	
32 92 19 13-0029 MSF 60% Kentucky Bluegrass, 20% Creeping Red Fescue, 10% Red Top And 10% Domestic Rye, Hydro Or Air Spread.....	61.84	
Note: 4 LB/MSF spread rate.		
For Spot Areas Up To 1 MSF, Add	67.68	
For >1 To 4 MSF, Add	43.60	
For >4 To 7.5 MSF, Add	29.61	
For >7.5 To 10 MSF, Add	14.80	
For >45, Deduct	-5.04	

32 Exterior Improvements**32 90 Planting****32 92 Turf And Grasses**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 92 19 13-0030	MSF	2,500 LB/Acre, High Performance - Flexible Growth Medium.....	69.32		
		Note: Applied with seed.			
		For Spot Areas Up To 1 MSF, Add	49.21		
		For >1 To 4 MSF, Add	29.49		
		For >4 To 7.5 MSF, Add	18.65		
		For >7.5 To 10 MSF, Add	9.33		
		For >45, Deduct	-4.44		
32 92 19 13-0031	MSF	3,000 LB/Acre, High Performance - Flexible Growth Medium.....	80.25		
		Note: Applied with seed.			
		For Spot Areas Up To 1 MSF, Add	54.65		
		For >1 To 4 MSF, Add	32.45		
		For >4 To 7.5 MSF, Add	20.33		
		For >7.5 To 10 MSF, Add	10.16		
		For >45, Deduct	-5.04		
32 92 19 13-0032	MSF	3,500 LB/Acre, High Performance - Flexible Growth Medium.....	91.24		
		Note: Applied with seed.			
		For Spot Areas Up To 1 MSF, Add	60.18		
		For >1 To 4 MSF, Add	35.47		
		For >4 To 7.5 MSF, Add	22.04		
		For >7.5 To 10 MSF, Add	11.02		
		For >45, Deduct	-5.64		
32 92 19 13-0033	MSF	4,000 LB/Acre, High Performance - Flexible Growth Medium.....	102.26		
		Note: Applied with seed.			
		For Spot Areas Up To 1 MSF, Add	65.76		
		For >1 To 4 MSF, Add	38.53		
		For >4 To 7.5 MSF, Add	23.79		
		For >7.5 To 10 MSF, Add	11.89		
		For >45, Deduct	-6.24		
32 92 19 13-0034	MSF	4,500 LB/Acre, High Performance - Flexible Growth Medium.....	113.35		
		Note: Applied with seed.			
		For Spot Areas Up To 1 MSF, Add	71.44		
		For >1 To 4 MSF, Add	41.65		
		For >4 To 7.5 MSF, Add	25.57		
		For >7.5 To 10 MSF, Add	12.79		
		For >45, Deduct	-6.85		
32 92 19 19		Seeding By Hand <small>(32 92 19)</small>			
		Note: Includes fertilizing, liming, mixing, seeding and initial watering. Excludes straw. See CSI section 32 91 13 16-0017 for wheat straw mulch.			
32 92 19 19-0001		Push Spreader Or Hand Seeding <small>(32 92 19 19)</small>			
		Note: Excludes straw.			
32 92 19 19-0002	MSF	California Native Grass Mix, Push Spreader Or Hand	84.54		
		For > 5 To 20, Deduct	-6.05		
		For >20 To 45, Deduct	-11.82		
		For >45, Deduct	-19.41		
32 92 19 19-0003	MSF	Common Bluegrass, Push Spreader Or Hand	86.17		
		Note: 4 LB/MSF spread rate.			
		For > 5 To 20, Deduct	-6.14		
		For >20 To 45, Deduct	-11.94		
		For >45, Deduct	-19.58		
32 92 19 19-0004	MSF	Tall Fescue, Push Spreader Or Hand	80.66		
		Note: 5.5 LB/MSF spread rate.			
		For > 5 To 20, Deduct	-5.86		
		For >20 To 45, Deduct	-11.53		
		For >45, Deduct	-19.03		
32 92 19 19-0005	MSF	Rye, Push Spreader Or Hand	81.05		
		Note: 10 LB/MSF spread rate.			
		For > 5 To 20, Deduct	-5.88		
		For >20 To 45, Deduct	-11.56		
		For >45, Deduct	-19.06		
32 92 19 19-0006	MSF	Shade Mix, Push Spreader Or Hand.....	83.04		
		Note: 6 LB/MSF spread rate. Mixture of red fescue, creeping red fescue, perennial rye and bluegrass.			
		For > 5 To 20, Deduct	-5.98		
		For >20 To 45, Deduct	-11.71		
		For >45, Deduct	-19.26		
32 92 19 19-0007	MSF	Turf Mix, Push Spreader Or Hand.....	84.46		
		Note: 4 LB/MSF spread rate. Mixture of three varieties of bluegrass and one improved perennial ryegrass.			
		For > 5 To 20, Deduct	-6.05		
		For >20 To 45, Deduct	-11.81		
		For >45, Deduct	-19.41		
32 92 19 19-0008	MSF	Slope Mix, Push Spreader Or Hand.....	82.56		
		Note: 6 LB/MSF spread rate.			
		For > 5 To 20, Deduct	-5.95		
		For >20 To 45, Deduct	-11.67		
		For >45, Deduct	-19.22		
32 92 19 19-0009	MSF	Utility Mix, Push Spreader Or Hand	80.19		
		Note: 7 LB/MSF spread rate. Mixture of perennial/annual rye, creeping red fescue and bluegrass.			
		For > 5 To 20, Deduct	-5.84		
		For >20 To 45, Deduct	-11.49		
		For >45, Deduct	-18.98		
32 92 19 19-0010	MSF	Wild Flower Mix, Push Spreader Or Hand	75.72		
		Note: 0.10 LB/MSF spread rate.			
		For > 5 To 20, Deduct	-5.61		
		For >20 To 45, Deduct	-11.16		
		For >45, Deduct	-18.53		



		Exterior Improvements	32
		Planting	32 90
		Turf And Grasses	32 92

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 92 19 19-0011	MSF		Crown Vetch Mix, Push Spreader Or Hand Note: 4 LB/MSF spread rate. <i>For > 5 To 20, Deduct</i> <i>For >20 To 45, Deduct</i> <i>For >45, Deduct</i>	111.06 -7.38 -13.81 -22.07	
32 92 19 19-0012	MSF		Athletic Mix, Push Spreader Or Hand Note: 8 LB/MSF spread rate. Mixture of drought resistant bluegrass, tall fescue and Kentucky bluegrass. <i>For > 5 To 20, Deduct</i> <i>For >20 To 45, Deduct</i> <i>For >45, Deduct</i>	90.16 -6.33 -12.24 -19.98	
32 92 19 19-0013	MSF		White Clover Mix, Push Spreader Or Hand Note: 7 LB/MSF spread rate. <i>For > 5 To 20, Deduct</i> <i>For >20 To 45, Deduct</i> <i>For >45, Deduct</i>	75.67 -5.61 -11.15 -18.53	
32 92 19 19-0014	MSF		Ladino Clover Mix, Push Spreader Or Hand Note: 7 LB/MSF spread rate. <i>For > 5 To 20, Deduct</i> <i>For >20 To 45, Deduct</i> <i>For >45, Deduct</i>	77.57 -5.71 -11.30 -18.72	
32 92 19 19-0015	MSF		100% Kentucky Bluegrass, Push Spreader Or Hand Note: 3.3 LB/MSF spread rate. <i>For > 5 To 20, Deduct</i> <i>For >20 To 45, Deduct</i> <i>For >45, Deduct</i>	87.07 -6.18 -12.01 -19.67	
32 92 19 19-0016	MSF		70% Kentucky Bluegrass And 30% Fescue, Push Spreader Or Hand Note: 3.3 LB/MSF spread rate. <i>For > 5 To 20, Deduct</i> <i>For >20 To 45, Deduct</i> <i>For >45, Deduct</i>	84.46 -6.05 -11.81 -19.41	
32 92 19 19-0017	MSF		50% Kentucky Bluegrass And 50% Fescue, Push Spreader Or Hand Note: 3.3 LB/MSF spread rate. <i>For > 5 To 20, Deduct</i> <i>For >20 To 45, Deduct</i> <i>For >45, Deduct</i>	82.56 -5.95 -11.67 -19.22	
32 92 19 19-0018	MSF		50% Kentucky Bluegrass And 50% Perennial Rye, Push Spreader Or Hand Note: 4.4 LB/MSF spread rate. <i>For > 5 To 20, Deduct</i> <i>For >20 To 45, Deduct</i> <i>For >45, Deduct</i>	86.36 -6.14 -11.96 -19.60	
32 92 19 19-0019	MSF		60% Kentucky Bluegrass, 20% Creeping Red Fescue, 10% Red Top And 10% Domestic Rye, Push Spreader Or Hand Note: 3.3 LB/MSF spread rate. <i>For > 5 To 20, Deduct</i> <i>For >20 To 45, Deduct</i> <i>For >45, Deduct</i>	83.51 -6.00 -11.74 -19.31	
32 92 19 19-0020	MSF		40% Creeping Red Fescue, 30% Kentucky Bluegrass, 10% Red Top, And 20% Blue Tag Perennial Rye, Push Spreader Or Hand Note: 3.3 LB/MSF spread rate. <i>For > 5 To 20, Deduct</i> <i>For >20 To 45, Deduct</i> <i>For >45, Deduct</i>	84.46 -6.05 -11.81 -19.41	
32 92 23			Sodding <small>(32 92)</small> Note: Includes raking preparation, rolling of sod and sanding seams for (up to 16" wide by 24" long) squares or (up to 24" wide by 54" long) rolls.		
32 92 23 00-0001			Bermuda Sod <small>(32 92 23)</small>		
32 92 23 00-0002	MSF		Up To 1,000 SF, Bermuda Sod, Installed On Level Ground	1,038.93	
32 92 23 00-0003	MSF		>1,000 To 4,000 SF, Bermuda Sod, Installed On Level Ground	1,003.25	
32 92 23 00-0004	MSF		>4,000 To 8,000 SF, Bermuda Sod, Installed On Level Ground	926.79	
32 92 23 00-0005	MSF		>8,000 SF, Bermuda Sod, Installed On Level Ground	896.21	
32 92 23 00-0006	MSF		Up To 1,000 SF, Bermuda Sod, Installed On Sloped Ground	1,324.37	
32 92 23 00-0007	MSF		>1,000 To 4,000 SF, Bermuda Sod, Installed On Sloped Ground	1,246.52	
32 92 23 00-0008	MSF		>4,000 To 8,000 SF, Bermuda Sod, Installed On Sloped Ground	1,094.63	
32 92 23 00-0009	MSF		>8,000 SF, Bermuda Sod, Installed On Sloped Ground	1,038.93	
32 92 23 00-0010			Zoysia Sod <small>(32 92 23)</small>		
32 92 23 00-0011	MSF		Up To 1,000 SF, Zoysia Sod, Installed On Level Ground	1,006.22	
32 92 23 00-0012	MSF		>1,000 To 4,000 SF, Zoysia Sod, Installed On Level Ground	970.54	
32 92 23 00-0013	MSF		>4,000 To 8,000 SF, Zoysia Sod, Installed On Level Ground	894.08	
32 92 23 00-0014	MSF		>8,000 SF, Zoysia Sod, Installed On Level Ground	863.50	
32 92 23 00-0015	MSF		Up To 1,000 SF, Zoysia Sod, Installed On Sloped Ground	1,291.66	
32 92 23 00-0016	MSF		>1,000 To 4,000 SF, Zoysia Sod, Installed On Sloped Ground	1,213.81	
32 92 23 00-0017	MSF		>4,000 To 8,000 SF, Zoysia Sod, Installed On Sloped Ground	1,061.92	
32 92 23 00-0018	MSF		>8,000 SF, Zoysia Sod, Installed On Sloped Ground	1,006.22	
32 92 23 00-0019			Tall Fescue Sod <small>(32 92 23)</small>		
32 92 23 00-0020	MSF		Up To 1,000 SF, Tall Fescue Sod, Installed On Level Ground <i>For Hybrid Fescue "Marathon", Add</i>	996.95 42.61	
32 92 23 00-0021	MSF		>1,000 To 4,000 SF, Tall Fescue Sod, Installed On Level Ground <i>For Hybrid Fescue "Marathon", Add</i>	961.27 42.61	

32 Exterior Improvements**32 90 Planting****32 92 Turf And Grasses**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 92 23 00-0022 MSF >4,000 To 8,000 SF, Tall Fescue Sod, Installed On Level Ground.....	884.81	
For Hybrid Fescue "Marathon", Add	42.61	
32 92 23 00-0023 MSF >8,000 SF, Tall Fescue Sod, Installed On Level Ground.....	854.23	
For Hybrid Fescue "Marathon", Add	42.61	
32 92 23 00-0024 MSF Up To 1,000 SF, Tall Fescue Sod, Installed On Sloped Ground.....	1,282.39	
For Hybrid Fescue "Marathon", Add	42.61	
32 92 23 00-0025 MSF >1,000 To 4,000 SF, Tall Fescue Sod, Installed On Sloped Ground.....	1,204.54	
For Hybrid Fescue "Marathon", Add	42.61	
32 92 23 00-0026 MSF >4,000 To 8,000 SF, Tall Fescue Sod, Installed On Sloped Ground.....	1,052.65	
For Hybrid Fescue "Marathon", Add	42.61	
32 92 23 00-0027 MSF >8,000 SF, Tall Fescue Sod, Installed On Sloped Ground.....	996.95	
For Hybrid Fescue "Marathon", Add	42.61	
32 92 23 00-0028 Centipede Sod (32 92 23)		
32 92 23 00-0029 MSF Up To 1,000 SF, Centipede Sod, Installed On Level Ground.....	928.81	
32 92 23 00-0030 MSF >1,000 To 4,000 SF, Centipede Sod, Installed On Level Ground.....	893.13	
32 92 23 00-0031 MSF >4,000 To 8,000 SF, Centipede Sod, Installed On Level Ground.....	816.67	
32 92 23 00-0032 MSF >8,000 SF, Centipede Sod, Installed On Level Ground.....	786.09	
32 92 23 00-0033 MSF Up To 1,000 SF, Centipede Sod, Installed On Sloped Ground.....	1,214.25	
32 92 23 00-0034 MSF >1,000 To 4,000 SF, Centipede Sod, Installed On Sloped Ground.....	1,136.40	
32 92 23 00-0035 MSF >4,000 To 8,000 SF, Centipede Sod, Installed On Sloped Ground.....	984.51	
32 92 23 00-0036 MSF >8,000 SF, Centipede Sod, Installed On Sloped Ground.....	928.81	
32 92 23 00-0037 Kentucky Blue Grass Sod (32 92 23)		
32 92 23 00-0038 MSF Up To 1,000 SF, Kentucky Blue Grass Sod, Installed On Level Ground.....	901.51	
32 92 23 00-0039 MSF >1,000 To 4,000 SF, Kentucky Blue Grass Sod, Installed On Level Ground.....	865.83	
32 92 23 00-0040 MSF >4,000 To 8,000 SF, Kentucky Blue Grass Sod, Installed On Level Ground.....	789.37	
32 92 23 00-0041 MSF >8,000 SF, Kentucky Blue Grass Sod, Installed On Level Ground.....	758.79	
32 92 23 00-0042 MSF Up To 1,000 SF, Kentucky Blue Grass Sod, Installed On Sloped Ground.....	1,186.95	
32 92 23 00-0043 MSF >1,000 To 4,000 SF, Kentucky Blue Grass Sod, Installed On Sloped Ground.....	1,109.10	
32 92 23 00-0044 MSF >4,000 To 8,000 SF, Kentucky Blue Grass Sod, Installed On Sloped Ground.....	957.21	
32 92 23 00-0045 MSF >8,000 SF, Kentucky Blue Grass Sod, Installed On Sloped Ground.....	901.51	
32 93 Plants (32 90)		
32 93 13 Ground Covers (32 93)		
Note: Materials only.		
32 93 13 00-0001 Ornamental Grasses (32 93 13)		
32 93 13 00-0002 EA 1 Gallon Cortaderia selloana - Pampas Grass.....	7.04	
32 93 13 00-0003 EA 2 Gallon Cortaderia selloana - Pampas Grass.....	8.58	
32 93 13 00-0004 EA 3 Gallon Cortaderia selloana - Pampas Grass.....	10.12	
32 93 13 00-0005 EA 10 Gallon Cortaderia selloana - Pampas Grass.....	38.87	
32 93 13 00-0006 EA 1 Quart Imperata cylindrica - Japanese Blood Grass.....	4.33	
32 93 13 00-0007 EA 1 Gallon Imperata cylindrica - Japanese Blood Grass.....	6.23	
32 93 13 00-0008 EA 2 Gallon Imperata cylindrica - Japanese Blood Grass.....	8.58	
32 93 13 00-0009 EA 1 Quart Koeleria glauca - Blue Hair Grass.....	3.08	
32 93 13 00-0010 EA 1 Gallon Koeleria glauca - Blue Hair Grass.....	5.50	
32 93 13 00-0011 EA 3 Gallon Koeleria glauca - Blue Hair Grass.....	10.12	
32 93 13 00-0012 EA 1 Gallon Miscanthus sinensis 'Gracillimus' - Maiden Grass.....	8.58	
32 93 13 00-0013 EA 3 Gallon Miscanthus sinensis 'Gracillimus' - Maiden Grass.....	14.81	
32 93 13 00-0014 EA 5 Gallon Miscanthus sinensis 'Gracillimus' - Maiden Grass.....	19.51	
32 93 13 00-0015 EA 1 Gallon Miscanthus sinensis 'Zebrinus' - Zebra Grass.....	8.58	
32 93 13 00-0016 EA 3 Gallon Miscanthus sinensis 'Zebrinus' - Zebra Grass.....	14.81	
32 93 13 00-0017 EA 5 Gallon Miscanthus sinensis 'Zebrinus' - Zebra Grass.....	19.51	
32 93 13 00-0018 EA 1 Quart Pennisetum setaceum - Fountain Grass.....	3.45	
32 93 13 00-0019 EA 1 Gallon Pennisetum setaceum - Fountain Grass.....	5.50	
32 93 13 00-0020 EA 3 Gallon Pennisetum setaceum - Fountain Grass.....	10.12	
32 93 13 00-0021 EA 1 Gallon Saccharum ravennae - Ravenna Grass.....	7.04	
32 93 13 00-0022 EA 3 Gallon Saccharum ravennae - Ravenna Grass.....	10.12	
32 93 13 00-0023 EA 7 Gallon Saccharum ravennae - Ravenna Grass.....	19.51	
32 93 13 00-0024 EA 1 Gallon Spartina pectinata - Variegated Cord Grass.....	6.23	
32 93 13 00-0025 EA 2 Gallon Spartina pectinata - Variegated Cord Grass.....	10.12	
32 93 13 00-0026 EA 1 Quart Stipa gigantea - Giant Feather Grass.....	7.77	
32 93 13 00-0027 EA 1 Gallon Stipa gigantea - Giant Feather Grass.....	11.73	
32 93 13 00-0028 Ground Covers (32 93 13)		
32 93 13 00-0029 EA 1 Gallon Agave Attenuata - Century Plant.....	6.15	
32 93 13 00-0030 EA 5 Gallon Agave Attenuata - Century Plant.....	16.59	
32 93 13 00-0031 EA 15 Gallon Agave Attenuata - Century Plant.....	54.85	
32 93 13 00-0032 EA 1 Gallon Ceanothus 'Carmel Creeper' - Wild Lilac.....	5.25	
32 93 13 00-0033 EA 5 Gallon Ceanothus 'Carmel Creeper' - Wild Lilac.....	14.61	
32 93 13 00-0034 EA 1 Gallon Ceanothus 'Yankee Point' - Wild Lilac.....	5.25	
32 93 13 00-0035 EA 5 Gallon Ceanothus 'Yankee Point' - Wild Lilac.....	13.65	
32 93 13 00-0036 EA 1 Gallon Dietes Vegata - Fortnight Lily.....	4.60	
32 93 13 00-0037 EA 5 Gallon Dietes Vegata - Fortnight Lily.....	11.35	
32 93 13 00-0038 EA 1 Gallon Juncus Patens 'Elk Blue' - California Gray Rush.....	8.55	



MINOR				TOTAL DIRECT	DEMOLITION
CSI	UOM	DESCRIPTION		UNIT COST	UNIT COST
32 93 13 00-0039	EA	5 Gallon Juncus Patens 'Elk Blue' - California Gray Rush		22.47	
32 93 13 00-0040	EA	4" Pot Miscanthus 'Morning Light' - NCN		6.41	
32 93 13 00-0041	EA	20 Count Flat Miscanthus 'Morning Light' - NCN		94.57	
32 93 13 00-0042	EA	1 Gallon Nassella Tenuissima - Mexican Feather Grass		8.55	
32 93 13 00-0043	EA	1 Gallon Trachelospermum Jasminoides - Star Jasmine		4.65	
32 93 13 00-0044	EA	5 Gallon Trachelospermum Jasminoides - Star Jasmine		11.65	
32 93 13 00-0045	EA	1 Gallon Westringia Fruticosa - Coast Rosemary		4.60	
32 93 13 00-0046	EA	5 Gallon Westringia Fruticosa - Coast Rosemary		11.35	
32 93 13 00-0047	EA	15 Gallon Westringia Fruticosa - Coast Rosemary		46.56	
32 93 13 00-0048	EA	1 Quart Carex 'Bowles Golden' - Variegated Japanese Sedge		7.77	
32 93 13 00-0049	EA	1 Gallon Carex 'Bowles Golden' - Variegated Japanese Sedge		10.12	
32 93 13 00-0050	EA	2 Gallon Juniperus horizontalis 'Plumosa Compacta' - Andorra Creeping Juniper		12.81	
32 93 13 00-0051	EA	1 Quart Waldsteinia ternata - Barren Strawberry		2.20	
32 93 13 00-0052	EA	1 Gallon Waldsteinia ternata - Barren Strawberry		5.28	
32 93 13 00-0053	EA	1 Gallon Cotoneaster dammeri - Bearberry Cotoneaster		7.19	
32 93 13 00-0054	EA	2 Gallon Cotoneaster dammeri - Bearberry Cotoneaster		13.64	
32 93 13 00-0055	EA	5 Gallon Cotoneaster dammeri - Bearberry Cotoneaster		24.05	
32 93 13 00-0056	EA	1 Gallon Liriope muscari 'Big Blue' - Big Blue Liriope		2.46	
32 93 13 00-0057	EA	1 Gallon Distictis buccinatoria - Blood Red Trumpet Vine		4.55	
32 93 13 00-0058	EA	5 Gallon Distictis buccinatoria - Blood Red Trumpet Vine		15.99	
32 93 13 00-0059	EA	1 Gallon Juniperus horizontalis 'Wiltoni' - Blue Rug Juniper		5.97	
32 93 13 00-0060	EA	4" Pot Parthenocissus tricuspidata - Boston Ivy		3.67	
32 93 13 00-0061	EA	1 Gallon Parthenocissus tricuspidata - Boston Ivy		8.36	
32 93 13 00-0062	EA	5 Gallon Parthenocissus tricuspidata - Boston Ivy		22.88	
32 93 13 00-0063	EA	3 Gallon Bougainvillea spectabilis - Bougainvillea		7.69	
32 93 13 00-0064	EA	1 Quart Iberis sempervirens - Candytuft		2.20	
32 93 13 00-0065	EA	1 Gallon Iberis sempervirens - Candytuft		5.28	
32 93 13 00-0066	EA	1 Gallon Gelsemium sempervirens - Carolina Jessamine		5.28	
32 93 13 00-0067	EA	5 Gallon Gelsemium sempervirens - Carolina Jessamine		19.07	
32 93 13 00-0068	EA	3" Pot Ajuga reptans - Carpet Bugle		1.32	
32 93 13 00-0069	EA	1 Quart Ajuga reptans - Carpet Bugle		2.20	
32 93 13 00-0070	EA	1 Gallon Ajuga reptans - Carpet Bugle		5.28	
32 93 13 00-0071	EA	24 Plant Flat Ajuga reptans - Carpet Bugle		22.73	
32 93 13 00-0072	EA	1 Gallon Macfadyena unguis-cati - Cat Claw Vine		5.28	
32 93 13 00-0073	EA	5 Gallon Macfadyena unguis-cati - Cat Claw Vine		22.88	
32 93 13 00-0074	EA	1 Gallon Wisteria sinensis - Chinese Wisteria Vine		6.89	
32 93 13 00-0075	EA	3 Gallon Wisteria sinensis - Chinese Wisteria Vine		15.25	
32 93 13 00-0076	EA	5 Gallon Wisteria sinensis - Chinese Wisteria Vine		22.88	
32 93 13 00-0077	EA	1 Gallon Ranunculaceae - Clematis Varieties		7.58	
32 93 13 00-0078	EA	2 Gallon Ranunculaceae - Clematis Varieties		14.02	
32 93 13 00-0079	EA	1 Gallon Hydrangea petiolaris - Climbing Hydrangea		9.53	
32 93 13 00-0080	EA	2 Gallon Hydrangea petiolaris - Climbing Hydrangea		17.89	
32 93 13 00-0081	EA	5 Gallon Hydrangea petiolaris - Climbing Hydrangea		29.33	
32 93 13 00-0082	EA	4" Pot Lantana camera - Common Lantana		1.32	
32 93 13 00-0083	EA	1 Gallon Lantana camera - Common Lantana		3.81	
32 93 13 00-0084	EA	1 Gallon Gardenia jasminoides 'Radicans' - Creeping Gardenia		4.55	
32 93 13 00-0085	EA	5 Gallon Gardenia jasminoides 'Radicans' - Creeping Gardenia		14.96	
32 93 13 00-0086	EA	2 Quart Lysimachia nummularia - Creeping Jenny		2.20	
32 93 13 00-0087	EA	1 Gallon Lysimachia nummularia - Creeping Jenny		4.25	
32 93 13 00-0088	EA	2 Quart Liriope spicata - Creeping Lilytuft		3.81	
32 93 13 00-0089	EA	1 Gallon Liriope spicata - Creeping Lilytuft		6.89	
32 93 13 00-0090	EA	5 Gallon Liriope spicata - Creeping Lilytuft		14.52	
32 93 13 00-0091	EA	Bare Root Liriope spicata - Creeping Liriope		0.96	
32 93 13 00-0092	EA	3" Pot Rosmarinus officinalis 'Prostratus' - Creeping Rosemary		1.32	
32 93 13 00-0093	EA	1 Gallon Rosmarinus officinalis 'Prostratus' - Creeping Rosemary		5.28	
32 93 13 00-0094	EA	2-1/4" Pot Securigera varia - Crown Vetch		0.88	
32 93 13 00-0095	EA	50 Plant Flat Securigera varia - Crown Vetch		29.77	
32 93 13 00-0096	EA	1 Quart Senecio cineraria - Dusty Miller		2.20	
32 93 13 00-0097	EA	1 Gallon Senecio cineraria - Dusty Miller		5.28	
32 93 13 00-0098	EA	2 Gallon Aristolochia macrophylla - Dutchman's Pipe		18.33	
32 93 13 00-0099	EA	5 Gallon Aristolochia macrophylla - Dutchman's Pipe		33.59	
32 93 13 00-0100	EA	1 Gallon Ilex cornuta - Dwarf Holly		3.98	
32 93 13 00-0101	EA	3 Gallon Ilex cornuta - Dwarf Holly		8.54	
32 93 13 00-0102	EA	3 Gallon Rhipiolepis umbellata 'Minor' - Dwarf Indian Hawthorn		8.54	
32 93 13 00-0103	EA	1 Gallon Tradescantia spathacea - Dwarf Oyster Plant		2.85	
32 93 13 00-0104	EA	2" To 3" Pot Hedera helix - English Ivy		1.32	
32 93 13 00-0105	EA	12" To 15" Runners Hedera helix - English Ivy		2.20	
32 93 13 00-0106	EA	1 Gallon Hedera helix - English Ivy		5.28	
32 93 13 00-0107	EA	50 Plant Flat Hedera helix - English Ivy		30.51	
32 93 13 00-0108	EA	4" Pot Lavandula angustifolia - English Lavender		1.91	
32 93 13 00-0109	EA	1 Quart Lavandula angustifolia - English Lavender		3.67	
32 93 13 00-0110	EA	1 Gallon Lavandula angustifolia - English Lavender		6.01	
32 93 13 00-0111	EA	1 Gallon Euonymus fortunei 'Kewensis' - Wintercreeper		5.72	
32 93 13 00-0112	EA	2 Gallon Euonymus fortunei 'Kewensis' - Wintercreeper		11.44	
32 93 13 00-0113	EA	1 Quart Arundo donax - Giant Reed		7.04	
32 93 13 00-0114	EA	1 Gallon Arundo donax - Giant Reed		10.12	
32 93 13 00-0115	EA	1 Gallon Lonicera x heckrottii - Gold Flame Honeysuckle		6.01	
32 93 13 00-0116	EA	2 Gallon Lonicera x heckrottii - Gold Flame Honeysuckle		11.44	
32 93 13 00-0117	EA	1 Quart Hakonechloa macra 'Aureola' - Golden Variegated Hakone Grass		7.77	
32 93 13 00-0118	EA	1 Gallon Hakonechloa macra 'Aureola' - Golden Variegated Hakone Grass		11.73	
32 93 13 00-0119	EA	3" Pot Lonicera japonica 'Halliana' - Hall's Japanese Honeysuckle		1.32	

32 Exterior Improvements**32 90 Planting****32 93 Plants**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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32 93 13 00-0120	EA	1	Gallon Lonicera japonica 'Halliana' - Hall's Japanese Honeysuckle	6.01	
32 93 13 00-0121	EA	2	Gallon Lonicera japonica 'Halliana' - Hall's Japanese Honeysuckle	11.44	
32 93 13 00-0122	EA	1	Gallon Hardenbergia violacea - Happy Wanderer	5.28	
32 93 13 00-0123	EA	5	Gallon Hardenbergia violacea - Happy Wanderer	17.60	
32 93 13 00-0124	EA	3	Gallon Hibiscus, Assorted Colors	6.88	
32 93 13 00-0125	EA	1	Gallon Acorus gramineus - Japanese Sweet Flag	5.50	
32 93 13 00-0126	EA	1	Gallon Jasminum volubile - Wax Jasmine	2.77	
32 93 13 00-0127	EA	1	Gallon Jasminum volubile - Wax Jasmine	6.88	
32 93 13 00-0128	EA	1	Gallon Juniperus davurica 'Parsonii' - Parson's Juniper	3.45	
32 93 13 00-0129	EA	3	Gallon Juniperus davurica 'Parsonii' - Parson's Juniper	7.69	
32 93 13 00-0130	EA	1	Gallon Cissus antarctica - Kangaroo Vine	4.25	
32 93 13 00-0131	EA	5	Gallon Cissus antarctica - Kangaroo Vine	13.35	
32 93 13 00-0132	EA	1	Quart Stachys byzantina - Lamb's Ear	2.20	
32 93 13 00-0133	EA	1	Quart Stachys byzantina - Lamb's Ear	5.28	
32 93 13 00-0134	EA	1	Gallon Lantana spp. Various Colors	3.11	
32 93 13 00-0135	EA	1	Gallon Lantana sellowiana - Trailing Lantana	2.05	
32 93 13 00-0136	EA	1	Gallon Cocculus laurifolius - Laurel-leaf Snailseed	4.25	
32 93 13 00-0137	EA	5	Gallon Cocculus laurifolius - Laurel-leaf Snailseed	15.25	
32 93 13 00-0138	EA	1	Gallon Liriope Evergreen Giant, 6 To 8 Bibs Minimum	3.11	
32 93 13 00-0139	EA	1	Gallon Variegated Liriope Evergreen Giant, 6 To 8 Bibs Minimum	3.93	
32 93 13 00-0140	EA	3	Gallon Variegated Liriope Evergreen Giant, 6 To 8 Bibs Minimum	6.28	
32 93 13 00-0141	EA	1	Quart Moss Phlox, Creeping Phlox	2.20	
32 93 13 00-0142	EA	1	Gallon Moss Phlox, Creeping Phlox	5.28	
32 93 13 00-0143	EA	1	Gallon Nephrolepis exaltata - Common Boston Fern	2.77	
32 93 13 00-0144	EA	4	Pot Ophiopogon Japonicus - Mondo grass	1.32	
32 93 13 00-0145	EA	1	Gallon Ophiopogon Japonicus - Mondo grass	5.28	
32 93 13 00-0146	EA	5	Gallon Ophiopogon Japonicus - Mondo grass	12.17	
32 93 13 00-0147	EA	2	To 3' High Oregon Holly-Grape	6.09	
32 93 13 00-0148	EA	1	Gallon Pachysandra terminalis - Pachysandra	7.94	
32 93 13 00-0149	EA	2-1/4" Pot	Vinca minor - Periwinkle	0.73	
32 93 13 00-0150	EA	4" Pot	Vinca minor - Periwinkle	2.20	
32 93 13 00-0151	EA		Bare Root Vinca minor - Periwinkle	0.73	
32 93 13 00-0152	EA	1	Quart Nepeta mussinii - Persian Catmint	2.20	
32 93 13 00-0153	EA	1	Gallon Nepeta mussinii - Persian Catmint	4.55	
32 93 13 00-0154	EA	1	Gallon Coprosma kirkii - Prostrate Coprosma	3.67	
32 93 13 00-0155	EA	5	Gallon Coprosma kirkii - Prostrate Coprosma	13.35	
32 93 13 00-0156	EA	1	Gallon Juniperus Horizontalis - Prostrate Juniper	6.01	
32 93 13 00-0157	EA	3	Gallon Juniperus Horizontalis - Prostrate Juniper	12.91	
32 93 13 00-0158	EA	5	Gallon Juniperus Horizontalis - Prostrate Juniper	19.07	
32 93 13 00-0159	EA	1	Quart Euonymus fortunei 'Coloratus' - Purple-leaf Wintercreeper	5.24	
32 93 13 00-0160	EA	1	Gallon Euonymus fortunei 'Coloratus' - Purple-leaf Wintercreeper	13.57	
32 93 13 00-0161	EA	24	Plant Flat Euonymus fortunei 'Coloratus' - Purple-leaf Wintercreeper	22.73	
32 93 13 00-0162	EA	1	Gallon Tradescantia spathacea - Rhoeco Discolor "Dwarf"	2.77	
32 93 13 00-0163	EA	1	Quart Festuca glauca 'Sea Urchin' - Sea Urchin Blue Fescue	3.08	
32 93 13 00-0164	EA	1	Gallon Festuca glauca 'Sea Urchin' - Sea Urchin Blue Fescue	5.50	
32 93 13 00-0165	EA	2	Gallon Festuca glauca 'Sea Urchin' - Sea Urchin Blue Fescue	8.58	
32 93 13 00-0166	EA	1	Gallon Hymenocallis latifolia - Spider Lily	3.41	
32 93 13 00-0167	EA	3	Gallon Hymenocallis latifolia - Spider Lily	9.10	
32 93 13 00-0168	EA	1	Quart Hypericum perforatum - St. John's Wort	2.20	
32 93 13 00-0169	EA	1	Gallon Hypericum perforatum - St. John's Wort	5.28	
32 93 13 00-0170	EA	5	Gallon Hypericum perforatum - St. John's Wort	13.64	
32 93 13 00-0171	EA	24"	To 30" High Viburnum awabuki - Sweet Viburnum	18.56	
32 93 13 00-0172	EA	1	Gallon Campsis radicans - Trumpet Creeper	8.07	
32 93 13 00-0173	EA	2	Gallon Campsis radicans - Trumpet Creeper	12.17	
32 93 13 00-0174	EA	5	Gallon Campsis radicans - Trumpet Creeper	29.33	
32 93 13 00-0175	EA	2-1/4" Pot	Vinca major - Variegated Greater Periwinkle	0.73	
32 93 13 00-0176	EA	4" Pot	Vinca major - Variegated Greater Periwinkle	2.20	
32 93 13 00-0177	EA		Bare Root Vinca major - Variegated Greater Periwinkle	0.73	
32 93 13 00-0178	EA	1	Quart Carex hachijoensis - Variegated Japanese Sedge	3.96	
32 93 13 00-0179	EA	1	Gallon Carex hachijoensis - Variegated Japanese Sedge	5.50	
32 93 13 00-0180	EA	2	Gallon Carex hachijoensis - Variegated Japanese Sedge	8.58	
32 93 13 00-0181	EA	1	Gallon Liriope muscari 'Variegata' - Variegated Lilyturf	6.01	
32 93 13 00-0182	EA	2	Quart Verbena peruviana "St. Paul" - St. Paul Verbena	2.79	
32 93 13 00-0183	EA	1	Gallon Verbena peruviana "St. Paul" - St. Paul Verbena	4.25	
32 93 13 00-0184	EA	48	Plant Flat Vinca minor - Lesser Periwinkle	26.14	
32 93 13 00-0185	EA	3" Pot	Parthenocissus quinquefolia - Virginia Creeper	1.32	
32 93 13 00-0186	EA	1	Gallon Parthenocissus quinquefolia - Virginia Creeper	6.89	
32 93 13 00-0187	EA	1	Gallon Jasminum polyanthum - Winter Jasmine	5.28	
32 93 13 00-0188	EA	2	Gallon Jasminum polyanthum - Winter Jasmine	10.56	
32 93 13 00-0189	EA	5	Gallon Jasminum polyanthum - Winter Jasmine	18.33	
32 93 13 00-0190	EA	1	Gallon Cistaceae - Winkleleaf Rock Rose	4.25	
32 93 13 00-0191	EA	5	Gallon Cistaceae - Winkleleaf Rock Rose	14.52	
32 93 13 00-0192	EA	1	Gallon Acemison galaber - Common Deerweed	7.49	
32 93 13 00-0193	EA	1	Gallon Acacia redolens - Bank Catclaw	3.10	
32 93 13 00-0194	EA	5	Gallon Acacia redolens - Bank Catclaw	9.63	
32 93 13 00-0195	EA	15	Gallon Acacia redolens - Bank Catclaw	37.46	
32 93 13 00-0196	EA	1	Gallon Achillea filipendulina - Fernleaf Yarrow	4.60	
32 93 13 00-0197	EA	1	Gallon Achillea millefolium - Common Yarrow	4.17	
32 93 13 00-0198	EA	5	Gallon Achillea millefolium - Common Yarrow	12.84	
32 93 13 00-0199	EA	1	Gallon Achillea millefolium 'Paprika' - Red Yarrow	4.60	
32 93 13 00-0200	EA	1	Gallon Achillea 'Moonshine' - Yellow yarrow	4.60	



		Exterior Improvements	32
		Planting	32 90
		Plants	32 93

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 93 13 00-0201 EA 1 Gallon Agave americana - Century Plant.....	6.31	
32 93 13 00-0202 EA 5 Gallon Agave americana - Century Plant.....	17.12	
32 93 13 00-0203 EA 15 Gallon Agave americana - Century Plant.....	52.44	
32 93 13 00-0204 EA 24" Box Agave americana - Century Plant.....	187.30	
32 93 13 00-0205 EA 1 Gallon Agave vilmoriniana - Octopus Agave.....	6.31	
32 93 13 00-0206 EA 5 Gallon Agave vilmoriniana - Octopus Agave.....	17.12	
32 93 13 00-0207 EA 15 Gallon Agave vilmoriniana - Octopus Agave.....	52.44	
32 93 13 00-0208 EA 24" Box Agave vilmoriniana - Octopus Agave.....	187.30	
32 93 13 00-0209 EA 5 Gallon Nolina parryi - Giant Nolina.....	17.12	

32 93 23 Plants And Bulbs (32 93)

Note: Materials only.

32 93 23 00-0001 Perennials (32 93 23)

32 93 23 00-0002 EA 2 Quart Assorted Daylilies.....	4.25	
32 93 23 00-0003 EA 1 Gallon Assorted Daylilies.....	6.01	
32 93 23 00-0004 EA 2 Gallon Assorted Daylilies.....	9.97	
32 93 23 00-0005 EA 1 Quart Azure Penstemon.....	2.20	
32 93 23 00-0006 EA 1 Gallon Azure Penstemon.....	5.50	
32 93 23 00-0007 EA 1 Quart Balloon Flower.....	2.20	
32 93 23 00-0008 EA 1 Gallon Balloon Flower.....	5.50	
32 93 23 00-0009 EA 1 Quart Black-eyed Susan.....	2.20	
32 93 23 00-0010 EA 1 Gallon Black-eyed Susan.....	5.50	
32 93 23 00-0011 EA 2 Gallon Black-eyed Susan.....	7.11	
32 93 23 00-0012 EA 1 Quart Blackberry Lily.....	2.20	
32 93 23 00-0013 EA 1 Gallon Blackberry Lily.....	5.50	
32 93 23 00-0014 EA 1 Quart Blank Flower.....	2.20	
32 93 23 00-0015 EA 1 Gallon Blank Flower.....	5.06	
32 93 23 00-0016 EA 2 Gallon Blank Flower.....	7.11	
32 93 23 00-0017 EA 1 Quart Blazing Star, Gayfeather.....	2.20	
32 93 23 00-0018 EA 1 Gallon Blazing Star, Gayfeather.....	5.50	
32 93 23 00-0019 EA 1 Quart Bloodred Geranium.....	3.74	
32 93 23 00-0020 EA 1 Gallon Bloodred Geranium.....	6.31	
32 93 23 00-0021 EA 1 Quart Blue Plumbago.....	2.20	
32 93 23 00-0022 EA 1 Gallon Blue Plumbago.....	5.50	
32 93 23 00-0023 EA 1 Quart Blue Star.....	3.96	
32 93 23 00-0024 EA 1 Gallon Blue Star.....	6.31	
32 93 23 00-0025 EA 1 Quart Cardinal Flower.....	2.20	
32 93 23 00-0026 EA 1 Gallon Cardinal Flower.....	5.50	
32 93 23 00-0027 EA 4" Pot Columbine.....	1.32	
32 93 23 00-0028 EA 1 Quart Columbine.....	2.20	
32 93 23 00-0029 EA 1 Gallon Columbine.....	5.50	
32 93 23 00-0030 EA 1 Quart Common Globeflower.....	2.20	
32 93 23 00-0031 EA 1 Gallon Common Globeflower.....	5.50	
32 93 23 00-0032 EA 1 Quart Cottage Pink, Scotch Pink.....	2.20	
32 93 23 00-0033 EA 1 Quart Cottage Pink, Scotch Pink.....	5.50	
32 93 23 00-0034 EA 1 Gallon Astilbe 'Deutschland'.....	7.92	
32 93 23 00-0035 EA 1 Quart Diploid.....	2.79	
32 93 23 00-0036 EA 1 Gallon Diploid.....	6.31	
32 93 23 00-0037 EA 3 Gallon Diploid.....	10.85	
32 93 23 00-0038 EA 4" Pot Dune Sunflower.....	3.14	
32 93 23 00-0039 EA 1 Quart Evans Begonia.....	3.96	
32 93 23 00-0040 EA 1 Gallon Evans Begonia.....	7.11	
32 93 23 00-0041 EA 1 Quart False Dragonhead.....	2.20	
32 93 23 00-0042 EA 1 Gallon False Dragonhead.....	5.50	
32 93 23 00-0043 EA 1 Quart False Spirea.....	2.20	
32 93 23 00-0044 EA 1 Gallon False Spirea.....	7.11	
32 93 23 00-0045 EA 3 Gallon False Spirea.....	9.83	
32 93 23 00-0046 EA 2 Quart False Sunflower.....	3.52	
32 93 23 00-0047 EA 1 Gallon False Sunflower.....	5.50	
32 93 23 00-0048 EA 2 Gallon False Sunflower.....	7.11	
32 93 23 00-0049 EA 1 Gallon Foxglove.....	5.06	
32 93 23 00-0050 EA 2 Gallon Foxglove.....	7.11	
32 93 23 00-0051 EA 3 Gallon Foxglove.....	10.27	
32 93 23 00-0052 EA 1 Gallon Francee Hostas.....	8.91	
32 93 23 00-0053 EA 1 Quart Garden Phlox.....	2.20	
32 93 23 00-0054 EA 1 Gallon Garden Phlox.....	5.50	
32 93 23 00-0055 EA 2 Quart Golden Groundsel.....	4.69	
32 93 23 00-0056 EA 2 Gallon Golden Groundsel.....	9.46	
32 93 23 00-0057 EA 1 Quart Golden Star.....	2.20	
32 93 23 00-0058 EA 1 Gallon Golden Star.....	5.50	
32 93 23 00-0059 EA 1 Quart Goldenrod.....	2.20	
32 93 23 00-0060 EA 1 Gallon Goldenrod.....	5.50	
32 93 23 00-0061 EA 1 Gallon Happy Returns Daylilies.....	10.24	
32 93 23 00-0062 EA 4" Pot Hardy Aster, Michaelmas Daisy.....	1.32	
32 93 23 00-0063 EA 1 Quart Hardy Aster, Michaelmas Daisy.....	2.20	
32 93 23 00-0064 EA 1 Gallon Hardy Aster, Michaelmas Daisy.....	5.50	
32 93 23 00-0065 EA 1 Quart Hardy Chrysanthemum.....	1.91	
32 93 23 00-0066 EA 6" To 8" Pot Hardy Chrysanthemum.....	3.15	
32 93 23 00-0067 EA 1 Gallon Hardy Chrysanthemum.....	5.06	
32 93 23 00-0068 EA 1 Gallon Herbaceous Peony.....	7.85	

32 Exterior Improvements**32 90 Planting****32 93 Plants**

MINOR

CSI UOM DESCRIPTION

TOTAL DIRECT
UNIT COSTDEMOLITION
UNIT COST

32 93 23 00-0069	EA	2 Gallon Herbaceous Peony	12.54	
32 93 23 00-0070	EA	3 Gallon Herbaceous Peony	16.50	
32 93 23 00-0071	EA	4" Pot Japanese Anemone	1.32	
32 93 23 00-0072	EA	1 Quart Japanese Anemone	3.96	
32 93 23 00-0073	EA	2 Gallon Japanese Anemone	7.11	
32 93 23 00-0074	EA	2" Pot Japanese Spurge	0.78	
32 93 23 00-0075	EA	6" Pot Japanese Spurge	1.17	
32 93 23 00-0076	EA	1 Gallon Japanese Spurge	5.05	
32 93 23 00-0077	EA	1 Quart Oriental Poppy	3.15	
32 93 23 00-0078	EA	1 Gallon Oriental Poppy	6.31	
32 93 23 00-0079	EA	48 Plant Flat Pachysandra terminalis	26.14	
32 93 23 00-0080	EA	1 Gallon Pacific Coast Iris	4.33	
32 93 23 00-0081	EA	3 Gallon Pacific Coast Iris	8.21	
32 93 23 00-0082	EA	1 Gallon Palace Purple Coral Bells	8.33	
32 93 23 00-0083	EA	4" Pot Perennial Salvia	1.32	
32 93 23 00-0084	EA	1 Quart Perennial Salvia	2.20	
32 93 23 00-0085	EA	1 Gallon Perennial Salvia	5.50	
32 93 23 00-0086	EA	1 Quart Pincushion Flower	2.20	
32 93 23 00-0087	EA	1 Gallon Pincushion Flower	5.50	
32 93 23 00-0088	EA	2 Quart Plantain Lily	4.25	
32 93 23 00-0089	EA	1 Gallon Plantain Lily	6.01	
32 93 23 00-0090	EA	2 Gallon Plantain Lily	9.97	
32 93 23 00-0091	EA	3 Gallon Plantain Lily	18.85	
32 93 23 00-0092	EA	2 Quart Purple Coneflower	3.96	
32 93 23 00-0093	EA	1 Gallon Purple Coneflower	5.50	
32 93 23 00-0094	EA	2 Gallon Purple Coneflower	7.11	
32 93 23 00-0095	EA	1 Quart Purple Loosestrife	2.20	
32 93 23 00-0096	EA	1 Gallon Purple Loosestrife	5.50	
32 93 23 00-0097	EA	1 Quart Rose Mallow	4.33	
32 93 23 00-0098	EA	2 Gallon Rose Mallow	7.85	
32 93 23 00-0099	EA	3 Gallon Rose Mallow	13.42	
32 93 23 00-0100	EA	1 Gallon Autumn Joy Sedum	8.39	
32 93 23 00-0101	EA	1 Quart Siberian Iris	3.74	
32 93 23 00-0102	EA	2 Gallon Siberian Iris	7.11	
32 93 23 00-0103	EA	3 Gallon Siberian Iris	9.83	
32 93 23 00-0104	EA	1 Quart Speedwell	2.20	
32 93 23 00-0105	EA	1 Gallon Speedwell	5.50	
32 93 23 00-0106	EA	1 Quart Tetraploid	5.50	
32 93 23 00-0107	EA	1 Gallon Tetraploid	10.27	
32 93 23 00-0108	EA	3 Gallon Tetraploid	14.01	
32 93 23 00-0109	EA	1 Quart Threadleaf Coreopsis	2.20	
32 93 23 00-0110	EA	1 Gallon Threadleaf Coreopsis	5.50	
32 93 23 00-0111	EA	1 Quart Torch Lily	2.20	
32 93 23 00-0112	EA	1 Quart Bluebeard	3.96	
32 93 23 00-0113	EA	1 Gallon Bluebeard	5.87	
32 93 23 00-0114	EA	2 Gallon Bluebeard	8.58	

32 93 23 00-0115 Annuals (32 93 23)

32 93 23 00-0116	EA	2-1/2" Pot Annual Flowers	1.02	
32 93 23 00-0117	EA	3" Pot Annual Flowers	1.38	
32 93 23 00-0118	EA	4" Pot Annual Flowers	2.95	
32 93 23 00-0119	EA	5-1/2" Pot Annual Flowers	3.92	
32 93 23 00-0120	EA	6" Pot Annual Flowers	7.77	
32 93 23 00-0121	EA	8" Pot Annual Flowers	12.95	
32 93 23 00-0122	EA	36 Plant Flat Annual Flowers	16.96	
32 93 23 00-0123	EA	48 Plant Flat Annual Flowers	19.23	

32 93 23 00-0124 Bulbs (32 93 23)

32 93 23 00-0125	EA	Top Size Allium giganteum - Giant Ornamental Onion	3.55	
32 93 23 00-0126	EA	Top Size Allium sphaerocephalum - Drumstick Ornamental Onion	0.20	
32 93 23 00-0127	LOT	Lot Of 100 Top Size Crocus Hybrid	23.21	
32 93 23 00-0128	LOT	Lot Of 100 Top Size Eranthis hyemalis - Winter Aconite	30.03	
32 93 23 00-0129	LOT	Lot Of 100 Top Size Galanthus nivalis - Snowdrops	38.23	
32 93 23 00-0130	LOT	Lot Of 100 Top Size Iris reticulata cvs - Dutch Iris	15.02	
32 93 23 00-0131	LOT	Lot Of 100 Top Size Muscari armeniacum - Grape Hyacinth	17.75	
32 93 23 00-0132	LOT	Lot Of 100 Top Size Muscari latifolium - Grape Hyacinth	20.48	
32 93 23 00-0133	LOT	Lot Of 50 Narcissus 'Carlton' - Carlton Daffodil DNI	61.43	
32 93 23 00-0134	LOT	Lot Of 50 Narcissus 'Dutch Master' - Dutch Master Daffodil DNI	29.35	
32 93 23 00-0135	LOT	Lot Of 50 Narcissus 'February Gold' - February Gold Daffodil DNI	30.72	
32 93 23 00-0136	LOT	Lot Of 50 Narcissus 'Ice Follies' - Ice Follies Daffodil DNI	30.72	
32 93 23 00-0137	LOT	Lot Of 50 Narcissus 'Mount Hood' - Mount Hood Daffodil DNI	32.08	
32 93 23 00-0138	LOT	Lot Of 50 Narcissus 'Papillon Blanc' - Papillon Blanc Daffodil DNI	34.13	
32 93 23 00-0139	LOT	Lot Of 50 Narcissus 'Pipit' - Pipit Daffodil DNI	32.08	
32 93 23 00-0140	LOT	Lot Of 50 Narcissus 'Salome' - Salome Daffodil DNI	30.03	
32 93 23 00-0141	LOT	Lot Of 50 Narcissus 'Tete A Tete' - Tete A Tete Daffodil DNI	32.08	
32 93 23 00-0142	LOT	Lot Of 50 Narcissus 'Thalia' - Thalia Daffodil DNI	32.08	
32 93 23 00-0143	LOT	Lot Of 100 Top Size Scilla siberica - Siberian Squill	19.11	
32 93 23 00-0144	LOT	Lot Of 60 Top Size Tulip 'Angelique' - Angelique Tulip	32.77	
32 93 23 00-0145	LOT	Lot Of 60 Top Size Tulip 'Apeldoorn' - Apeldoorn Tulip	24.57	



Exterior Improvements 32

Planting 32 90

Plants 32 93

32

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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32 93 23 00-0146	LOT	Lot Of 100 Top Size Tulip 'Apricot Beauty' - Apricot Beauty Tulip	54.61	
32 93 23 00-0147	LOT	Lot Of 100 Top Size Tulip 'Big Smile' - Big Smile Tulip	47.78	
32 93 23 00-0148	LOT	Lot Of 100 Top Size Tulip 'Black Parrot' - Black Parrot Tulip	68.26	
32 93 23 00-0149	LOT	Lot Of 100 Top Size Tulip 'Blue Heron' - Blue Heron Tulip	51.88	
32 93 23 00-0150	LOT	Lot Of 100 Top Size Tulip 'Cardinal' - Cardinal Tulip	45.05	
32 93 23 00-0151	LOT	Lot Of 100 Top Size Tulip 'Christmas Marvel' - Christmas Marvel Tulip	50.51	
32 93 23 00-0152	LOT	Lot Of 100 Top Size Tulip clusiana - Species Tulip	50.51	
32 93 23 00-0153	LOT	Lot Of 60 Top Size Tulip 'Elizabeth Arden' - Elizabeth Arden Tulip	30.31	
32 93 23 00-0154	LOT	Lot Of 60 Top Size Tulip 'Golden Apledoorn' - Golden Apledoorn Tulip	24.57	
32 93 23 00-0155	LOT	Lot Of 60 Top Size Tulip 'Golden Emperor' - Golden Emperor Tulip	23.75	
32 93 23 00-0156	LOT	Lot Of 100 Top Size Tulip 'Halcro' - Halcro Tulip	40.96	
32 93 23 00-0157	LOT	Lot Of 60 Top Size Tulip 'Ivory Floridale' - Ivory Floridale Tulip	40.96	
32 93 23 00-0158	LOT	Lot Of 60 Top Size Tulip 'Orange Emperor' - Orange Emperor Tulip	24.57	
32 93 23 00-0159	LOT	Lot Of 100 Top Size Tulip 'Passionale' - Passionale Tulip	54.61	
32 93 23 00-0160	LOT	Lot Of 60 Top Size Tulip 'Peach Blossom' - Peach Blossom Tulip	35.22	
32 93 23 00-0161	LOT	Lot Of 100 Top Size Tulip 'Peer Gynt' - Peer Gynt Tulip	61.43	
32 93 23 00-0162	LOT	Lot Of 100 Top Size Tulip 'Pink Diamond' - Pink Diamond Tulip	49.15	
32 93 23 00-0163	LOT	Lot Of 60 Top Size Tulip 'Pink Emperor' - Pink Emperor Tulip	27.85	
32 93 23 00-0164	LOT	Lot Of 60 Top Size Tulip praetens 'Fusilier' - Praetens Fusilier Tulip	30.31	
32 93 23 00-0165	LOT	Lot Of 60 Top Size Tulip 'Princeps' - Princeps Tulip	30.31	
32 93 23 00-0166	LOT	Lot Of 100 Top Size Tulip 'Red Riding Hood' - Red Riding Hood Tulip	39.59	
32 93 23 00-0167	LOT	Lot Of 100 Top Size Tulip saxatilis - Species Tulip	27.30	
32 93 23 00-0168	LOT	Lot Of 100 Top Size Tulip 'Shirley' - Shirley Tulip	40.96	
32 93 23 00-0169	LOT	Lot Of 100 Top Size Tulip 'Spring Green' - Spring Green Tulip	53.24	
32 93 23 00-0170	LOT	Lot Of 60 Top Size Tulip 'White Emperor' - White Emperor Tulip	24.57	

32 93 23 00-0171 Localized Landscaping (32 93 23)

32 93 23 00-0172	EA	Tipuana Tipu - Tipu Tree, 15 Gallon	58.80	
32 93 23 00-0173	EA	Tipuana Tipu - Tipu Tree, 24" Box	174.00	
32 93 23 00-0174	EA	Euryops Pectinatus - Euryops, 1 Gallon	3.30	
32 93 23 00-0175	EA	Euryops Pectinatus - Euryops, 5 Gallon	12.00	
32 93 23 00-0176	EA	Photinia X Fraseri - Photinia, 1 Gallon	5.70	
32 93 23 00-0177	EA	Photinia X Fraseri - Photinia, 5 Gallon	15.54	
32 93 23 00-0178	EA	Photinia X Fraseri - Photinia, 15 Gallon	57.60	
32 93 23 00-0179	EA	Rhapiolepis Indica 'Enchantress' - Indian Hawthorn, 1 Gallon	11.94	
32 93 23 00-0180	EA	Rhapiolepis Indica 'Enchantress' - Indian Hawthorn, 5 Gallon	47.94	
32 93 23 00-0181	EA	Sienna Artemisiodes - Feathery Cassia, 1 Gallon	5.10	
32 93 23 00-0182	EA	Vinca Major - Periwinkle, 1 Gallon	4.50	
32 93 23 00-0183	EA	Vinca Major - Periwinkle, 3 Gallon	9.00	
32 93 23 00-0184	EA	Agave Attenuata - Foxtail Agave, 1 Gallon	7.77	
32 93 23 00-0185	EA	Agave Attenuata - Foxtail Agave, 5 Gallon	39.25	
32 93 23 00-0186	EA	Artemesia 'Powis Castle' - Artemesia, 1 Gallon	13.19	
32 93 23 00-0187	EA	Dietes Bicolor - Fortnight Lilly, 4" Pot	1.57	
32 93 23 00-0188	EA	Dietes Bicolor - Fortnight Lilly, 1 Gallon	2.75	
32 93 23 00-0189	EA	Dietes Bicolor - Fortnight Lilly, 3 Gallon	8.64	
32 93 23 00-0190	EA	Helianthemum Nummularium - Sunrose, 1 Gallon	12.54	
32 93 23 00-0191	EA	1 Gallon Hesperaloe parvifolia - Red Yucca	9.26	
32 93 23 00-0192	EA	5 Gallon Hesperaloe parvifolia - Red Yucca	25.12	
32 93 23 00-0193	EA	Hypericum Calycium - Aaron's Beard, 4" Pot	1.57	
32 93 23 00-0194	EA	Hypericum Calycium - Aaron's Beard, 1 Gallon	5.50	
32 93 23 00-0195	EA	Lantana Montevicensis - Lantana Sellowiana, 1 Gallon	4.32	
32 93 23 00-0196	EA	Leucadendron Discolor 'Flame Tips' - Leucadendron, 1 Gallon	9.42	
32 93 23 00-0197	EA	Leucadendron Discolor 'Flame Tips' - Leucadendron, 5 Gallon	39.25	
32 93 23 00-0198	EA	Myoporum Pacificum - Myoporum, 1 Gallon	4.58	
32 93 23 00-0199	EA	Rosmarinus Offinalis - Trailing Rosemary, 1 Gallon	3.92	
32 93 23 00-0200	EA	Rosmarinus Offinalis - Trailing Rosemary, 5 Gallon	11.78	
32 93 23 00-0201	EA	Salvia Greggii - Autumn Sage, 1 Gallon	3.12	
32 93 23 00-0202	EA	Salvia Greggii - Autumn Sage, 2 Gallon	11.78	
32 93 23 00-0203	EA	Salvia Greggii - Autumn Sage, 5 Gallon	21.20	
32 93 23 00-0204	EA	Senecio Mandraliscae - Senecio, 1 Gallon	6.58	
32 93 23 00-0205	EA	Senecio Mandraliscae - Senecio, 5 Gallon	25.12	
32 93 23 00-0206	EA	Trachelospermum Jasminoides - Star Jasmine, 1 Gallon	4.76	
32 93 23 00-0207	EA	Trachelospermum Jasminoides - Star Jasmine, 3 Gallon	10.14	
32 93 23 00-0208	EA	Trachelospermum Jasminoides - Star Jasmine, 5 Gallon	19.08	
32 93 23 00-0209	EA	Tradessantia Pallida 'Purpurea' - Purple Heart, 1 Gallon	5.89	
32 93 23 00-0210	EA	Verbena Tenuisecta - Moss Verbena, 1 Gallon	3.06	
32 93 23 00-0211	EA	Verbena Tenuisecta - Moss Verbena, 5 Gallon	10.99	
32 93 23 00-0212	EA	Westringia Fruticosa - Coast Rosemary, 1 Gallon	7.85	
32 93 23 00-0213	EA	Westringia Fruticosa - Coast Rosemary, 3 Gallon	14.92	
32 93 23 00-0214	EA	Westringia Fruticosa - Coast Rosemary, 5 Gallon	21.20	

32 93 33 Shrubs (32 93)

Note: (cvs = cultivar) materials only.

32 93 33 00-0001 Shrubs (32 93 33)

32 93 33 00-0002	EA	1 Gallon Abelia x grandiflora - Abelia	3.30	
32 93 33 00-0003	EA	3 Gallon Abelia x grandiflora - Abelia	6.72	
32 93 33 00-0004	EA	5 Gallon Abelia x grandiflora - Abelia	12.90	
32 93 33 00-0005	EA	3 Gallon Aesculus parviflora 'Rogers' - Rogers Bottlebrush Buckeye	85.85	

32 Exterior Improvements**32 90 Planting****32 93 Plants**MINOR
CSI UOM DESCRIPTIONTOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

32 93 33 00-0006	EA	18" B&B Aesculus parviflora 'Rogers' - Rogers Bottlebrush Buckeye	125.47	
32 93 33 00-0007	EA	24" B&B Aesculus parviflora 'Rogers' - Rogers Bottlebrush Buckeye	139.99	
32 93 33 00-0008	EA	30" B&B Aesculus parviflora 'Rogers' - Rogers Bottlebrush Buckeye	176.97	
32 93 33 00-0009	EA	36" B&B Aesculus parviflora 'Rogers' - Rogers Bottlebrush Buckeye	196.78	
32 93 33 00-0010	EA	18" B&B Aesculus parviflora - Bottlebrush Buckeye	39.62	
32 93 33 00-0011	EA	24" B&B Aesculus parviflora - Bottlebrush Buckeye	52.83	
32 93 33 00-0012	EA	30" B&B Aesculus parviflora - Bottlebrush Buckeye	66.03	
32 93 33 00-0013	EA	36" B&B Aronia arbutifolia & cvs - Red Chokeberry	22.45	
32 93 33 00-0014	EA	42" B&B Aronia arbutifolia & cvs - Red Chokeberry	26.41	
32 93 33 00-0015	EA	48" B&B Aronia arbutifolia & cvs - Red Chokeberry	31.70	
32 93 33 00-0016	EA	60" B&B Aronia arbutifolia & cvs - Red Chokeberry	36.98	
32 93 33 00-0017	EA	72" B&B Aronia arbutifolia & cvs - Red Chokeberry	44.90	
32 93 33 00-0018	EA	36" B&B Aronia melanocarpa & cvs - Black Chokeberry	21.79	
32 93 33 00-0019	EA	42" B&B Aronia melanocarpa & cvs - Black Chokeberry	23.11	
32 93 33 00-0020	EA	48" B&B Aronia melanocarpa & cvs - Black Chokeberry	24.43	
32 93 33 00-0021	EA	60" B&B Aronia melanocarpa & cvs - Black Chokeberry	27.73	
32 93 33 00-0022	EA	36" B&B Aronia prunifolia - Purple-Fruited Chokeberry	22.12	
32 93 33 00-0023	EA	42" B&B Aronia prunifolia - Purple-Fruited Chokeberry	23.44	
32 93 33 00-0024	EA	48" B&B Aronia prunifolia - Purple-Fruited Chokeberry	24.76	
32 93 33 00-0025	EA	60" B&B Aronia prunifolia - Purple-Fruited Chokeberry	26.08	
32 93 33 00-0026	EA	1 Gallon Aspidistra elatior - Cast Iron Plant	4.54	
32 93 33 00-0027	EA	2 Gallon Aspidistra elatior - Cast Iron Plant	10.50	
32 93 33 00-0028	EA	1 Gallon Aucuba japonica "Variegata" - Gold Dust Plant	5.32	
32 93 33 00-0029	EA	3 Gallon Aucuba japonica "Variegata" - Gold Dust Plant	11.71	
32 93 33 00-0030	EA	5 Gallon Aucuba japonica "Variegata" - Gold Dust Plant	15.82	
32 93 33 00-0031	EA	1 Gallon Bauhinia purpurea - Orange-eye Butterfly Bush	5.68	
32 93 33 00-0032	EA	2 Gallon Bauhinia purpurea - Orange-eye Butterfly Bush	8.30	
32 93 33 00-0033	EA	15" To 18" Berberis - Northern Bayberry	23.69	
32 93 33 00-0034	EA	2' To 2-1/2' Berberis - Northern Bayberry	30.08	
32 93 33 00-0035	EA	2-1/2' To 3' Berberis - Northern Bayberry	42.14	
32 93 33 00-0036	EA	18" To 24" Berberis julianae - Dwarf Wintergreen Barberry	25.33	
32 93 33 00-0037	EA	2' To 2-1/2' Berberis julianae - Dwarf Wintergreen Barberry	32.42	
32 93 33 00-0038	EA	2-1/2' To 3' Berberis julianae - Dwarf Wintergreen Barberry	41.43	
32 93 33 00-0039	EA	1 Gallon Berberis thunbergii - Crimson Pygmy Barberry	6.81	
32 93 33 00-0040	EA	2 Gallon Berberis thunbergii - Crimson Pygmy Barberry	13.41	
32 93 33 00-0041	EA	3 Gallon Berberis thunbergii - Crimson Pygmy Barberry	16.39	
32 93 33 00-0042	EA	1 Gallon Berberis x mentorensis - Mentor Barberry	6.46	
32 93 33 00-0043	EA	5 Gallon Berberis x mentorensis - Mentor Barberry	18.23	
32 93 33 00-0044	EA	2' To 3' Berberis x mentorensis - Mentor Barberry	25.33	
32 93 33 00-0045	EA	3' To 4' Berberis x mentorensis - Mentor Barberry	39.09	
32 93 33 00-0046	EA	1 Gallon Buxus microphylla japonica - Japanese Boxwood	7.38	
32 93 33 00-0047	EA	5 Gallon Buxus microphylla japonica - Japanese Boxwood	19.79	
32 93 33 00-0048	EA	12" To 15" Buxus microphylla japonica - Japanese Boxwood	21.07	
32 93 33 00-0049	EA	15" To 18" Buxus microphylla japonica - Japanese Boxwood	27.10	
32 93 33 00-0050	EA	18" To 24" Buxus microphylla japonica - Japanese Boxwood	36.11	
32 93 33 00-0051	EA	24" To 30" Buxus microphylla japonica - Japanese Boxwood	54.20	
32 93 33 00-0052	EA	30" To 36" Buxus microphylla japonica - Japanese Boxwood	75.27	
32 93 33 00-0053	EA	12" To 15" Buxus sempervirens - Common Boxwood	21.07	
32 93 33 00-0054	EA	15" To 18" Buxus sempervirens - Common Boxwood	27.10	
32 93 33 00-0055	EA	18" To 24" Buxus sempervirens - Common Boxwood	36.11	
32 93 33 00-0056	EA	24" To 30" Buxus sempervirens - Common Boxwood	54.20	
32 93 33 00-0057	EA	2 Gallon Buxus Hybrid - Boxwood Cultivars	13.87	
32 93 33 00-0058	EA	5 Gallon Buxus Hybrid - Boxwood Cultivars	23.11	
32 93 33 00-0059	EA	5 Gallon Buxus microphylla & cvs - Little leaf Boxwood	60.75	
32 93 33 00-0060	EA	18" B&B Buxus microphylla & cvs - Little leaf Boxwood	33.02	
32 93 33 00-0061	EA	24" B&B Buxus microphylla & cvs - Little leaf Boxwood	44.90	
32 93 33 00-0062	EA	30" B&B Buxus microphylla & cvs - Little leaf Boxwood	60.75	
32 93 33 00-0063	EA	1 Gallon Callistemon citrinus 'Little John' - Dwarf Bottle Bush	4.17	
32 93 33 00-0064	EA	5 Gallon Callistemon citrinus 'Little John' - Dwarf Bottle Bush	12.84	
32 93 33 00-0065	EA	15 Gallon Callistemon citrinus 'Little John' - Dwarf Bottle Bush	41.74	
32 93 33 00-0066	EA	5 Gallon Calycanthus floridus - Common Sweetshrub	21.79	
32 93 33 00-0067	EA	30" B&B Calycanthus floridus - Common Sweetshrub	19.81	
32 93 33 00-0068	EA	36" B&B Calycanthus floridus - Common Sweetshrub	26.41	
32 93 33 00-0069	EA	1 Gallon Camellia "Sasanqua" - Camellia	5.32	
32 93 33 00-0070	EA	3 Gallon Camellia "Sasanqua" - Camellia	11.35	
32 93 33 00-0071	EA	5 Gallon Camellia "Sasanqua" - Camellia	18.87	
32 93 33 00-0072	EA	7 Gallon Camellia "Sasanqua" - Camellia	28.10	
32 93 33 00-0073	EA	15 Gallon Camellia "Sasanqua" - Camellia	72.90	
32 93 33 00-0074	EA	1 Gallon Camellia japonica - Camellia	5.32	
32 93 33 00-0075	EA	3 Gallon Camellia japonica - Camellia	11.35	
32 93 33 00-0076	EA	5 Gallon Camellia japonica - Camellia	18.87	
32 93 33 00-0077	EA	5 Gallon Ceanothus americanus - New Jersey Tea	21.79	
32 93 33 00-0078	EA	5 Gallon Celastrus scandens - Bittersweet	21.79	
32 93 33 00-0079	EA	36" B&B Celastrus scandens - Bittersweet	18.49	
32 93 33 00-0080	EA	5 Gallon Cephalanthus occidentalis - Buttonbush	21.79	
32 93 33 00-0081	EA	24" B&B Cephalanthus occidentalis - Buttonbush	16.51	
32 93 33 00-0082	EA	30" B&B Cephalanthus occidentalis - Buttonbush	18.49	
32 93 33 00-0083	EA	36" B&B Cephalanthus occidentalis - Buttonbush	19.81	
32 93 33 00-0084	EA	18" To 24" Chaenomeles speciosa - Flowering Quince	19.01	
32 93 33 00-0085	EA	2' To 3' Chaenomeles speciosa - Flowering Quince	25.33	
32 93 33 00-0086	EA	3' To 4' Chaenomeles speciosa - Flowering Quince	39.09	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 93 33 00-0087	EA		3 Gallon Clethra alnifolia & cvs - Summersweet Clethra	21.13	
32 93 33 00-0088	EA		18" B&B Clethra alnifolia & cvs - Summersweet Clethra	22.78	
32 93 33 00-0089	EA		24" B&B Clethra alnifolia & cvs - Summersweet Clethra	25.42	
32 93 33 00-0090	EA		30" B&B Clethra alnifolia & cvs - Summersweet Clethra	26.74	
32 93 33 00-0091	EA		36" B&B Clethra alnifolia & cvs - Summersweet Clethra	31.37	
32 93 33 00-0092	EA		2' To 3' Cornus mas - Cornelian Cherry	30.08	
32 93 33 00-0093	EA		3' To 4' Cornus mas - Cornelian Cherry	37.60	
32 93 33 00-0094	EA		4' To 5' Cornus mas - Cornelian Cherry	48.17	
32 93 33 00-0095	EA		5' To 6' Cornus mas - Cornelian Cherry	66.19	
32 93 33 00-0096	EA		5 Gallon Cornus alba & cvs - Tartarian Dogwood	19.81	
32 93 33 00-0097	EA		36" B&B Cornus alba & cvs - Tartarian Dogwood	13.87	
32 93 33 00-0098	EA		48" B&B Cornus alba & cvs - Tartarian Dogwood	15.85	
32 93 33 00-0099	EA		60" B&B Cornus alba & cvs - Tartarian Dogwood	19.81	
32 93 33 00-0100	EA		72" B&B Cornus alba & cvs - Tartarian Dogwood	23.77	
32 93 33 00-0101	EA		36" B&B Cornus amomum - Silky Dogwood	19.81	
32 93 33 00-0102	EA		5 Gallon Cornus obliqua - Blue Fruited Dogwood	21.79	
32 93 33 00-0103	EA		5 Gallon Cornus racemosa - Gray Dogwood	21.79	
32 93 33 00-0104	EA		36" B&B Cornus racemosa - Gray Dogwood	19.81	
32 93 33 00-0105	EA		48" B&B Cornus racemosa - Gray Dogwood	23.11	
32 93 33 00-0106	EA		60" B&B Cornus racemosa - Gray Dogwood	25.09	
32 93 33 00-0107	EA		72" B&B Cornus racemosa - Gray Dogwood	30.38	
32 93 33 00-0108	EA		36" B&B Cornus sanguinea & cvs - Bloodtwig Dogwood	21.46	
32 93 33 00-0109	EA		48" B&B Cornus sanguinea & cvs - Bloodtwig Dogwood	24.10	
32 93 33 00-0110	EA		60" B&B Cornus sanguinea & cvs - Bloodtwig Dogwood	27.40	
32 93 33 00-0111	EA		24" B&B Cornus sericea & cvs - Redosier Dogwood	17.17	
32 93 33 00-0112	EA		30" B&B Cornus sericea & cvs - Redosier Dogwood	19.81	
32 93 33 00-0113	EA		36" B&B Cornus sericea & cvs - Redosier Dogwood	21.13	
32 93 33 00-0114	EA		48" B&B Cornus sericea & cvs - Redosier Dogwood	23.11	
32 93 33 00-0115	EA		60" B&B Cornus sericea & cvs - Redosier Dogwood	25.75	
32 93 33 00-0116	EA		5 Gallon Corylus americana - American Filbert	20.47	
32 93 33 00-0117	EA		30" B&B Corylus americana - American Filbert	23.11	
32 93 33 00-0118	EA		36" B&B Corylus americana - American Filbert	24.76	
32 93 33 00-0119	EA		48" B&B Corylus americana - American Filbert	26.74	
32 93 33 00-0120	EA		24" B&B Corylus avellana - Contorted Hazelnut	66.03	
32 93 33 00-0121	EA		30" B&B Corylus avellana - Contorted Hazelnut	85.85	
32 93 33 00-0122	EA		36" B&B Corylus avellana - Contorted Hazelnut	92.45	
32 93 33 00-0123	EA		42" B&B Corylus avellana - Contorted Hazelnut	118.86	
32 93 33 00-0124	EA		48" B&B Corylus avellana - Contorted Hazelnut	145.28	
32 93 33 00-0125	EA		60" B&B Corylus avellana - Contorted Hazelnut	165.09	
32 93 33 00-0126	EA		5' To 6' Cotinus coggygria - Smoke Tree	63.21	
32 93 33 00-0127	EA		6' To 8' Cotinus coggygria - Smoke Tree	94.78	
32 93 33 00-0128	EA		8' To 10' Cotinus coggygria - Smoke Tree	142.94	
32 93 33 00-0129	EA		5 Gallon Cotoneaster acutifolia & cvs - Peking Cotoneaster	16.51	
32 93 33 00-0130	EA		18" B&B Cotoneaster acutifolia & cvs - Peking Cotoneaster	16.51	
32 93 33 00-0131	EA		24" B&B Cotoneaster acutifolia & cvs - Peking Cotoneaster	17.17	
32 93 33 00-0132	EA		12" To 15" Spread Cotoneaster adpressus - Creeping Cotoneaster	15.82	
32 93 33 00-0133	EA		3 Gallon Cotoneaster apiculata & cvs - Cranberry Cotoneaster	17.17	
32 93 33 00-0134	EA		18" B&B Cotoneaster apiculata & cvs - Cranberry Cotoneaster	16.51	
32 93 33 00-0135	EA		24" B&B Cotoneaster apiculata & cvs - Cranberry Cotoneaster	17.17	
32 93 33 00-0136	EA		1 Gallon Cotoneaster divaricatus - Spreading Cotoneaster	6.81	
32 93 33 00-0137	EA		2' To 3' Cotoneaster divaricatus - Spreading Cotoneaster	21.07	
32 93 33 00-0138	EA		3' To 4' Cotoneaster divaricatus - Spreading Cotoneaster	28.45	
32 93 33 00-0139	EA		4' To 5' Cotoneaster divaricatus - Spreading Cotoneaster	48.17	
32 93 33 00-0140	EA		1 Gallon Cotoneaster horizontalis - Rockspray Cotoneaster	6.81	
32 93 33 00-0141	EA		2 Gallon Cotoneaster horizontalis - Rockspray Cotoneaster	13.41	
32 93 33 00-0142	EA		1 Gallon Dendromecon harfordii - Island Bush Poppy	10.70	
32 93 33 00-0143	EA		5 Gallon Dendromecon harfordii - Island Bush Poppy	26.76	
32 93 33 00-0144	EA		18" B&B Deutzia gracilis - Slender Deutzia	16.84	
32 93 33 00-0145	EA		24" B&B Deutzia gracilis - Slender Deutzia	18.49	
32 93 33 00-0146	EA		30" B&B Deutzia gracilis - Slender Deutzia	23.77	
32 93 33 00-0147	EA		36" B&B Deutzia gracilis - Slender Deutzia	27.73	
32 93 33 00-0148	EA		42" B&B Deutzia gracilis - Slender Deutzia	31.70	
32 93 33 00-0149	EA		24" B&B Diervilla sessilifolia - Southern Bush Honeysuckle	26.41	
32 93 33 00-0150	EA		30" B&B Diervilla sessilifolia - Southern Bush Honeysuckle	31.70	
32 93 33 00-0151	EA		36" B&B Diervilla sessilifolia - Southern Bush Honeysuckle	36.98	
32 93 33 00-0152	EA		2 Gallon Diervilla splendens - Splendens Bush Honeysuckle	9.91	
32 93 33 00-0153	EA		36" B&B Diervilla splendens - Splendens Bush Honeysuckle	23.77	
32 93 33 00-0154	EA		48" B&B Diervilla splendens - Splendens Bush Honeysuckle	31.70	
32 93 33 00-0155	EA		3' To 4' Elaeagnus umbellata - Autumn Olive	19.72	
32 93 33 00-0156	EA		4' To 5' Elaeagnus umbellata - Autumn Olive	27.10	
32 93 33 00-0157	EA		5' To 6' Elaeagnus umbellata - Autumn Olive	32.42	
32 93 33 00-0158	EA		3' To 4' Elaeagnus angustifolia - Russian Olive	31.57	
32 93 33 00-0159	EA		1 Gallon Euonymus - Gold Spot	5.68	
32 93 33 00-0160	EA		2 Gallon Euonymus - Gold Spot	11.92	
32 93 33 00-0161	EA		5 Gallon Euonymus - Gold Spot	16.39	
32 93 33 00-0162	EA		1 Gallon Euonymus alatus - Winged Euonymus	4.84	
32 93 33 00-0163	EA		3 Gallon Euonymus alatus - Winged Euonymus	13.97	
32 93 33 00-0164	EA		24" B&B Euonymus alatus - Winged Euonymus	18.83	
32 93 33 00-0165	EA		30" B&B Euonymus alatus - Winged Euonymus	23.54	
32 93 33 00-0166	EA		36" B&B Euonymus alatus - Winged Euonymus	32.35	
32 93 33 00-0167	EA		42" B&B Euonymus alatus - Winged Euonymus	39.94	

32 Exterior Improvements**32 90 Planting****32 93 Plants**MINOR
CSI UOM DESCRIPTIONTOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

32 93 33 00-0168	EA	48" B&B Euonymus alatus - Winged Euonymus.....	47.08
32 93 33 00-0169	EA	54" B&B Euonymus alatus - Winged Euonymus.....	60.75
32 93 33 00-0170	EA	5 Gallon Euonymus alatus - Winged Euonymus.....	17.47
32 93 33 00-0171	EA	60" B&B Euonymus alatus - Winged Euonymus.....	75.94
32 93 33 00-0172	EA	30" B&B Euonymus alatus compactus - Compact Winged Euonymus.....	29.72
32 93 33 00-0173	EA	36" B&B Euonymus alatus compactus - Compact Winged Euonymus.....	35.33
32 93 33 00-0174	EA	42" B&B Euonymus alatus compactus - Compact Winged Euonymus.....	46.22
32 93 33 00-0175	EA	48" B&B Euonymus alatus compactus - Compact Winged Euonymus.....	55.47
32 93 33 00-0176	EA	60" B&B Euonymus alatus compactus - Compact Winged Euonymus.....	68.68
32 93 33 00-0177	EA	18" To 24" Euonymus alatus - Winged Burning Bush.....	21.07
32 93 33 00-0178	EA	2' To 2-1/2' Euonymus alatus - Winged Burning Bush.....	24.83
32 93 33 00-0179	EA	2-1/2' To 3' Euonymus alatus - Winged Burning Bush.....	33.91
32 93 33 00-0180	EA	3' To 3-1/2' Euonymus alatus - Winged Burning Bush.....	40.65
32 93 33 00-0181	EA	3-1/2' To 4' Euonymus alatus - Winged Burning Bush.....	51.15
32 93 33 00-0182	EA	4' To 5' Euonymus alatus - Winged Burning Bush.....	72.22
32 93 33 00-0183	EA	5' To 6' Euonymus alatus - Winged Burning Bush.....	90.31
32 93 33 00-0184	EA	6' To 8' Euonymus alatus - Winged Burning Bush.....	105.35
32 93 33 00-0185	EA	15" To 18" Euonymus alatus - Dwarf Winged Burning Bush.....	21.07
32 93 33 00-0186	EA	18" To 24" Euonymus alatus - Dwarf Winged Burning Bush.....	24.05
32 93 33 00-0187	EA	2' To 2-1/2' Euonymus alatus - Dwarf Winged Burning Bush.....	29.37
32 93 33 00-0188	EA	2-1/2' To 3' Euonymus alatus - Dwarf Winged Burning Bush.....	41.43
32 93 33 00-0189	EA	3' To 3-1/2' Euonymus alatus - Dwarf Winged Burning Bush.....	48.95
32 93 33 00-0190	EA	3-1/2' To 4' Euonymus alatus - Dwarf Winged Burning Bush.....	58.67
32 93 33 00-0191	EA	4' To 5' Euonymus alatus - Dwarf Winged Burning Bush.....	82.79
32 93 33 00-0192	EA	5' To 6' Euonymus alatus - Dwarf Winged Burning Bush.....	97.83
32 93 33 00-0193	EA	36" B&B Euonymus atropurpurea - Eastern Wahoo.....	17.83
32 93 33 00-0194	EA	1 Gallon Euonymus fortunei - Wintercreeper.....	6.81
32 93 33 00-0195	EA	2 Gallon Euonymus fortunei - Wintercreeper.....	13.41
32 93 33 00-0196	EA	3 Gallon Euonymus fortunei - Wintercreeper.....	16.39
32 93 33 00-0197	EA	5 Gallon Euonymus fortunei - Wintercreeper.....	19.44
32 93 33 00-0198	EA	2' To 3' Forsythia - Korean Forsythia.....	15.04
32 93 33 00-0199	EA	3' To 4' Forsythia - Korean Forsythia.....	19.01
32 93 33 00-0200	EA	4' To 5' Forsythia - Korean Forsythia.....	23.69
32 93 33 00-0201	EA	30" B&B Forsythia cvs - Forsythia cultivars.....	15.19
32 93 33 00-0202	EA	36" B&B Forsythia cvs - Forsythia cultivars.....	16.84
32 93 33 00-0203	EA	48" B&B Forsythia cvs - Forsythia cultivars.....	18.16
32 93 33 00-0204	EA	18" B&B Forsythia viridissima & cvs - Green Forsythia.....	15.85
32 93 33 00-0205	EA	24" B&B Forsythia viridissima & cvs - Green Forsythia.....	21.13
32 93 33 00-0206	EA	24" B&B Forsythia x intermedia & cvs - Border Forsythia.....	15.85
32 93 33 00-0207	EA	30" B&B Forsythia x intermedia & cvs - Border Forsythia.....	18.49
32 93 33 00-0208	EA	36" B&B Forsythia x intermedia & cvs - Border Forsythia.....	21.79
32 93 33 00-0209	EA	42" B&B Forsythia x intermedia & cvs - Border Forsythia.....	25.09
32 93 33 00-0210	EA	48" B&B Forsythia x intermedia & cvs - Border Forsythia.....	29.06
32 93 33 00-0211	EA	2 Gallon Fothergilla gardenii & cvs - Dwarf Fothergilla.....	22.45
32 93 33 00-0212	EA	3 Gallon Fothergilla gardenii & cvs - Dwarf Fothergilla.....	31.37
32 93 33 00-0213	EA	5 Gallon Fothergilla gardenii & cvs - Dwarf Fothergilla.....	33.02
32 93 33 00-0214	EA	15" B&B Fothergilla gardenii & cvs - Dwarf Fothergilla.....	34.34
32 93 33 00-0215	EA	18" B&B Fothergilla gardenii & cvs - Dwarf Fothergilla.....	36.98
32 93 33 00-0216	EA	24" B&B Fothergilla gardenii & cvs - Dwarf Fothergilla.....	44.90
32 93 33 00-0217	EA	24" B&B Fothergilla major - Large Fothergilla.....	58.11
32 93 33 00-0218	EA	30" B&B Fothergilla major - Large Fothergilla.....	66.03
32 93 33 00-0219	EA	1 Gallon Gardenia jasminoides - Cape Jasmine.....	4.90
32 93 33 00-0220	EA	3 Gallon Gardenia jasminoides - Cape Jasmine.....	12.84
32 93 33 00-0221	EA	5 Gallon Gardenia jasminoides - Cape Jasmine.....	16.39
32 93 33 00-0222	EA	5 Gallon Border Forsythia - Goldenbells.....	18.23
32 93 33 00-0223	EA	2' To 3' Border Forsythia - Goldenbells.....	15.04
32 93 33 00-0224	EA	3' To 4' Border Forsythia - Goldenbells.....	19.01
32 93 33 00-0225	EA	4' To 5' Border Forsythia - Goldenbells.....	23.69
32 93 33 00-0226	EA	5' To 6' Border Forsythia - Goldenbells.....	28.45
32 93 33 00-0227	EA	6' To 8' Border Forsythia - Goldenbells.....	39.09
32 93 33 00-0228	EA	36" B&B Hamamelis vernalis & cvs - Vernal Witchhazel.....	46.22
32 93 33 00-0229	EA	48" B&B Hamamelis vernalis & cvs - Vernal Witchhazel.....	75.28
32 93 33 00-0230	EA	60" B&B Hamamelis vernalis & cvs - Vernal Witchhazel.....	95.09
32 93 33 00-0231	EA	72" B&B Hamamelis vernalis & cvs - Vernal Witchhazel.....	145.28
32 93 33 00-0232	EA	84" B&B Hamamelis vernalis & cvs - Vernal Witchhazel.....	165.09
32 93 33 00-0233	EA	1 Gallon Hedychiium gartdnerum - Variegated Ginger.....	2.81
32 93 33 00-0234	EA	3 Gallon Hedychiium gartdnerum - Variegated Ginger.....	9.87
32 93 33 00-0235	EA	5 Gallon Hedychiium gartdnerum - Variegated Ginger.....	18.98
32 93 33 00-0236	EA	1 Gallon Hibiscus rosa-sinensis - Hibiscus.....	7.20
32 93 33 00-0237	EA	3 Gallon Hibiscus rosa-sinensis - Hibiscus.....	12.15
32 93 33 00-0238	EA	5 Gallon Hibiscus rosa-sinensis - Hibiscus.....	18.38
32 93 33 00-0239	EA	5 Gallon Hibiscus syriacus - Rose Of Sharon.....	19.01
32 93 33 00-0240	EA	2' To 3' Hibiscus syriacus - Rose Of Sharon.....	16.17
32 93 33 00-0241	EA	3' To 4' Hibiscus syriacus - Rose Of Sharon.....	21.85
32 93 33 00-0242	EA	4' To 5' Hibiscus syriacus - Rose Of Sharon.....	31.57
32 93 33 00-0243	EA	5' To 6' Hibiscus syriacus - Rose Of Sharon.....	43.63
32 93 33 00-0244	EA	2 Gallon Hydrangea - Blue Hydrangea.....	13.41
32 93 33 00-0245	EA	5 Gallon Hydrangea - Blue Hydrangea.....	18.87
32 93 33 00-0246	EA	2' To 3' Hydrangea paniculata "Grandiflora" - Peegee Hydrangea.....	21.07
32 93 33 00-0247	EA	3' To 4' Hydrangea paniculata "Grandiflora" - Peegee Hydrangea.....	24.05
32 93 33 00-0248	EA	2 Gallon Hydrangea quercifolia - Oakleaf Hydrangea.....	13.41



MINOR				TOTAL DIRECT	DEMOLITION
CSI	UOM	DESCRIPTION		UNIT COST	UNIT COST
32 93 33 00-0249	EA	5 Gallon Hydrangea arborescens & cvs - Smooth Hydrangea.....		23.11	
32 93 33 00-0250	EA	30" B&B Hydrangea arborescens & cvs - Smooth Hydrangea.....		25.09	
32 93 33 00-0251	EA	36" B&B Hydrangea arborescens & cvs - Smooth Hydrangea.....		29.06	
32 93 33 00-0252	EA	4 Gallon Hydrangea macrophylla & cvs - Bigleaf Hydrangea.....		30.38	
32 93 33 00-0253	EA	18" B&B Hydrangea macrophylla & cvs - Bigleaf Hydrangea.....		23.77	
32 93 33 00-0254	EA	24" B&B Hydrangea macrophylla & cvs - Bigleaf Hydrangea.....		31.70	
32 93 33 00-0255	EA	3 Gallon Hydrangea paniculata & cvs - Panicle Hydrangea.....		13.87	
32 93 33 00-0256	EA	5 Gallon Hydrangea paniculata & cvs - Panicle Hydrangea.....		16.51	
32 93 33 00-0257	EA	18" B&B Hydrangea paniculata & cvs - Panicle Hydrangea.....		14.20	
32 93 33 00-0258	EA	24" B&B Hydrangea paniculata & cvs - Panicle Hydrangea.....		15.19	
32 93 33 00-0259	EA	30" B&B Hydrangea paniculata & cvs - Panicle Hydrangea.....		17.17	
32 93 33 00-0260	EA	36" B&B Hydrangea paniculata & cvs - Panicle Hydrangea.....		19.81	
32 93 33 00-0261	EA	48" B&B Hydrangea paniculata & cvs - Panicle Hydrangea.....		26.41	
32 93 33 00-0262	EA	18" B&B Hydrangea quercifolia & cvs - Oakleaf Hydrangea.....		19.15	
32 93 33 00-0263	EA	24" B&B Hydrangea quercifolia & cvs - Oakleaf Hydrangea.....		21.79	
32 93 33 00-0264	EA	30" B&B Hydrangea quercifolia & cvs - Oakleaf Hydrangea.....		25.75	
32 93 33 00-0265	EA	2 Gallon Hypericum kalmianum - St. John's Wort.....		13.41	
32 93 33 00-0266	EA	3 Gallon Hypericum kalmianun - Kalm St. John's Wort.....		15.85	
32 93 33 00-0267	EA	24" B&B Hypericum kalmianun - Kalm St. John's Wort.....		17.17	
32 93 33 00-0268	EA	1 Gallon Ilex "Carissa" - Holly.....		6.81	
32 93 33 00-0269	EA	2 Gallon Ilex "Carissa" - Holly.....		13.41	
32 93 33 00-0270	EA	5 Gallon Ilex "Carissa" - Holly.....		18.87	
32 93 33 00-0271	EA	18" To 24" Ilex - Gulf tide Sweet Holly.....		18.09	
32 93 33 00-0272	EA	2' To 2-1/2' Ilex - Gulf tide Sweet Holly.....		22.91	
32 93 33 00-0273	EA	2-1/2' To 3' Ilex - Gulf tide Sweet Holly.....		29.72	
32 93 33 00-0274	EA	3' To 3-1/2' Ilex - Gulf tide Sweet Holly.....		36.11	
32 93 33 00-0275	EA	3 Gallon Ilex cornuta - Dwarf Horned Holly.....		13.51	
32 93 33 00-0276	EA	1 Gallon Ilex cornuta, Osmanthus heterophyllus - Dwarf Chinese Holly.....		6.81	
32 93 33 00-0277	EA	2 Gallon Ilex cornuta, Osmanthus heterophyllus - Dwarf Chinese Holly.....		13.41	
32 93 33 00-0278	EA	5 Gallon Ilex cornuta, Osmanthus heterophyllus - Dwarf Chinese Holly.....		19.44	
32 93 33 00-0279	EA	1 Gallon Ilex crenata - Hellers Japanese Holly.....		6.81	
32 93 33 00-0280	EA	2 Gallon Ilex crenata - Hellers Japanese Holly.....		14.90	
32 93 33 00-0281	EA	3 Gallon Ilex crenata - Hellers Japanese Holly.....		19.44	
32 93 33 00-0282	EA	2 Gallon Ilex crenata - Hetzi Japanese Holly.....		14.90	
32 93 33 00-0283	EA	3 Gallon Ilex crenata - Hetzi Japanese Holly.....		17.95	
32 93 33 00-0284	EA	2' To 3' Ilex crenata - Hetzi Japanese Holly.....		36.11	
32 93 33 00-0285	EA	3' To 4' Ilex crenata - Hetzi Japanese Holly.....		48.17	
32 93 33 00-0286	EA	2' To 3' Ilex opaca - American Holly.....		48.17	
32 93 33 00-0287	EA	3' To 4' Ilex opaca - American Holly.....		79.74	
32 93 33 00-0288	EA	4' To 5' Ilex opaca - American Holly.....		102.30	
32 93 33 00-0289	EA	5' To 6' Ilex opaca - American Holly.....		123.36	
32 93 33 00-0290	EA	6' To 7' Ilex opaca - American Holly.....		173.02	
32 93 33 00-0291	EA	7' To 8' Ilex opaca - American Holly.....		240.77	
32 93 33 00-0292	EA	8' To 10' Ilex opaca - American Holly.....		346.04	
32 93 33 00-0293	EA	10' To 12' Ilex opaca - American Holly.....		526.66	
32 93 33 00-0294	EA	12' To 14' Ilex opaca - American Holly.....		639.45	
32 93 33 00-0295	EA	14' To 16' Ilex opaca - American Holly.....		789.91	
32 93 33 00-0296	EA	2' To 3' Ilex verticillata - Winterberry (Female).....		48.17	
32 93 33 00-0297	EA	3' To 4' Ilex verticillata - Winterberry (Female).....		63.21	
32 93 33 00-0298	EA	2' To 3' Ilex verticillata - Winterberry (Male).....		39.09	
32 93 33 00-0299	EA	3' To 4' Ilex verticillata - Winterberry (Male).....		54.20	
32 93 33 00-0300	EA	4' To 5' Ilex verticillata - Winterberry (Male).....		63.21	
32 93 33 00-0301	EA	1 Gallon Ilex vomitoria - Yaupon Holly.....		6.38	
32 93 33 00-0302	EA	3 Gallon Ilex vomitoria - Yaupon Holly.....		12.84	
32 93 33 00-0303	EA	10 Gallon Ilex vomitoria - Yaupon Holly.....		45.12	
32 93 33 00-0304	EA	18" B&B Ilex glabra compacta & cvs - Compact Inkberry Holly.....		20.47	
32 93 33 00-0305	EA	24" B&B Ilex glabra compacta & cvs - Compact Inkberry Holly.....		23.11	
32 93 33 00-0306	EA	3 Gallon Ilex meserveae & cvs - Blue Holly.....		26.41	
32 93 33 00-0307	EA	18" B&B Ilex meserveae & cvs - Blue Holly.....		24.43	
32 93 33 00-0308	EA	24" B&B Ilex meserveae & cvs - Blue Holly.....		29.72	
32 93 33 00-0309	EA	5 Gallon Ilex verticillata & cvs - Common Winterberry.....		21.79	
32 93 33 00-0310	EA	24" B&B Ilex verticillata & cvs - Common Winterberry.....		21.79	
32 93 33 00-0311	EA	30" B&B Ilex verticillata & cvs - Common Winterberry.....		23.11	
32 93 33 00-0312	EA	36" B&B Ilex verticillata & cvs - Common Winterberry.....		27.73	
32 93 33 00-0313	EA	42" B&B Ilex verticillata & cvs - Common Winterberry.....		31.04	
32 93 33 00-0314	EA	48" B&B Ilex verticillata & cvs - Common Winterberry.....		33.02	
32 93 33 00-0315	EA	60" B&B Ilex verticillata & cvs - Common Winterberry.....		42.26	
32 93 33 00-0316	EA	4' To 5' Ilex x attenuata "Foster" - Holly.....		78.25	
32 93 33 00-0317	EA	5' To 6' Ilex x attenuata "Foster" - Holly.....		103.78	
32 93 33 00-0318	EA	6' To 7' Ilex x attenuata "Foster" - Holly.....		92.86	
32 93 33 00-0319	EA	7' To 8' Ilex x attenuata "Foster" - Holly.....		180.54	
32 93 33 00-0320	EA	1 Gallon Jasminum - Jasmine.....		1.75	
32 93 33 00-0321	EA	3 Gallon Jasminum - Jasmine.....		6.83	
32 93 33 00-0322	EA	3 Gallon Jasminum - Orange Jasmine.....		5.32	
32 93 33 00-0323	EA	4' - 5' Jasminum - Orange Jasmine.....		60.75	
32 93 33 00-0324	EA	6' - 7' Jasminum - Orange Jasmine.....		121.50	
32 93 33 00-0325	EA	8' - 10' Jasminum - Orange Jasmine.....		164.03	
32 93 33 00-0326	EA	3 Gallon Juniperus chinensis cvs - Chinese Juniper.....		23.11	
32 93 33 00-0327	EA	5 Gallon Juniperus chinensis cvs - Chinese Juniper.....		25.75	
32 93 33 00-0328	EA	18" B&B Juniperus chinensis cvs - Chinese Juniper.....		34.34	
32 93 33 00-0329	EA	24" B&B Juniperus chinensis cvs - Chinese Juniper.....		44.90	

32 Exterior Improvements**32 90 Planting****32 93 Plants**

MINOR
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TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

32 93 33 00-0330	EA	30" B&B Juniperus chinensis cvs - Chinese Juniper	52.83
32 93 33 00-0331	EA	36" B&B Juniperus chinensis cvs - Chinese Juniper	71.32
32 93 33 00-0332	EA	48" B&B Juniperus chinensis cvs - Chinese Juniper	97.73
32 93 33 00-0333	EA	1 Gallon Juniperus horizontalis cvs - Creeping Juniper	11.01
32 93 33 00-0334	EA	3 Gallon Juniperus horizontalis cvs - Creeping Juniper	23.11
32 93 33 00-0335	EA	5 Gallon Juniperus horizontalis cvs - Creeping Juniper	25.75
32 93 33 00-0336	EA	15" B&B Juniperus horizontalis cvs - Creeping Juniper	27.73
32 93 33 00-0337	EA	18" B&B Juniperus horizontalis cvs - Creeping Juniper	30.38
32 93 33 00-0338	EA	24" B&B Juniperus horizontalis cvs - Creeping Juniper	36.98
32 93 33 00-0339	EA	30" B&B Juniperus horizontalis cvs - Creeping Juniper	44.90
32 93 33 00-0340	EA	3 Gallon Juniperus procumbens cvs - Japanese Garden Juniper	17.83
32 93 33 00-0341	EA	18" B&B Juniperus procumbens cvs - Japanese Garden Juniper	21.13
32 93 33 00-0342	EA	24" B&B Juniperus procumbens cvs - Japanese Garden Juniper	29.06
32 93 33 00-0343	EA	30" B&B Juniperus procumbens cvs - Japanese Garden Juniper	36.98
32 93 33 00-0344	EA	36" B&B Juniperus procumbens cvs - Japanese Garden Juniper	44.90
32 93 33 00-0345	EA	3 Gallon Juniperus sabina cvs - Savin Juniper	16.51
32 93 33 00-0346	EA	5 Gallon Juniperus sabina cvs - Savin Juniper	19.81
32 93 33 00-0347	EA	4 Gallon Juniperus virginiana cvs - Red Cedar Juniper	17.17
32 93 33 00-0348	EA	36" B&B Juniperus virginiana cvs - Red Cedar Juniper	33.02
32 93 33 00-0349	EA	48" B&B Juniperus virginiana cvs - Red Cedar Juniper	51.51
32 93 33 00-0350	EA	60" B&B Juniperus virginiana cvs - Red Cedar Juniper	64.71
32 93 33 00-0351	EA	15" To 18" Kalmia latifolia - Mountain Laurel	27.10
32 93 33 00-0352	EA	18" To 24" Kalmia latifolia - Mountain Laurel	36.11
32 93 33 00-0353	EA	2' To 3' Kalmia latifolia - Mountain Laurel	52.64
32 93 33 00-0354	EA	4' To 5' Kalmia latifolia - Mountain Laurel	96.26
32 93 33 00-0355	EA	5' To 6' Kalmia latifolia - Mountain Laurel	147.48
32 93 33 00-0356	EA	6' To 8' Kalmia latifolia - Mountain Laurel	225.73
32 93 33 00-0357	EA	1 Gallon Kerria japonica - Kerria	6.03
32 93 33 00-0358	EA	5 Gallon Kerria japonica - Kerria	18.87
32 93 33 00-0359	EA	24" B&B Kolkwitzia amabilis & cvs - Beautybush	19.15
32 93 33 00-0360	EA	30" B&B Kolkwitzia amabilis & cvs - Beautybush	21.79
32 93 33 00-0361	EA	36" B&B Kolkwitzia amabilis & cvs - Beautybush	23.77
32 93 33 00-0362	EA	42" B&B Kolkwitzia amabilis & cvs - Beautybush	27.73
32 93 33 00-0363	EA	48" B&B Kolkwitzia amabilis & cvs - Beautybush	31.70
32 93 33 00-0364	EA	60" B&B Kolkwitzia amabilis & cvs - Beautybush	39.62
32 93 33 00-0365	EA	1 Gallon Lagerstroemia indica - Crepe Myrtle	4.54
32 93 33 00-0366	EA	5 Gallon Lagerstroemia indica - Crepe Myrtle	16.17
32 93 33 00-0367	EA	3' To 4' Lagerstroemia indica - Crepe Myrtle	22.56
32 93 33 00-0368	EA	4' To 5' Lagerstroemia indica - Crepe Myrtle	33.13
32 93 33 00-0369	EA	5' To 6' Lagerstroemia indica - Crepe Myrtle	52.64
32 93 33 00-0370	EA	7' To 8' Lagerstroemia indica - Crepe Myrtle	68.35
32 93 33 00-0371	EA	9' To 10' Lagerstroemia indica - Crepe Myrtle	91.13
32 93 33 00-0372	EA	11' To 12' Lagerstroemia indica - Crepe Myrtle	189.85
32 93 33 00-0373	EA	1 Gallon Leucothoe axillaris - Coast Leucothoe	6.81
32 93 33 00-0374	EA	2 Gallon Leucothoe axillaris - Coast Leucothoe	14.90
32 93 33 00-0375	EA	3 Gallon Leucothoe axillaris - Coast Leucothoe	17.95
32 93 33 00-0376	EA	1 Gallon Ligustrum lucidum - Glossy Privet	4.19
32 93 33 00-0377	EA	5 Gallon Ligustrum lucidum - Glossy Privet	12.84
32 93 33 00-0378	EA	15 Gallon Ligustrum lucidum - Glossy Privet	60.16
32 93 33 00-0379	EA	1 Gallon Ligustrum sinense - Variegated Chinese Privet	4.19
32 93 33 00-0380	EA	2 Gallon Ligustrum sinense - Variegated Chinese Privet	9.01
32 93 33 00-0381	EA	3 Gallon Ligustrum sinense - Variegated Chinese Privet	11.71
32 93 33 00-0382	EA	36" B&B Ligustrum vulgare & cvs - Common Privet	19.81
32 93 33 00-0383	EA	48" B&B Ligustrum vulgare & cvs - Common Privet	29.06
32 93 33 00-0384	EA	60" B&B Ligustrum vulgare & cvs - Common Privet	36.98
32 93 33 00-0385	EA	72" B&B Ligustrum vulgare & cvs - Common Privet	42.26
32 93 33 00-0386	EA	5 Gallon Linderia benzoin - Spicebush	21.79
32 93 33 00-0387	EA	36" B&B Linderia benzoin - Spicebush	18.49
32 93 33 00-0388	EA	48" B&B Linderia benzoin - Spicebush	22.45
32 93 33 00-0389	EA	2' To 3' Lonicera fragrantissima - Winter Honeysuckle	36.11
32 93 33 00-0390	EA	3' To 4' Lonicera fragrantissima - Winter Honeysuckle	43.63
32 93 33 00-0391	EA	30" B&B Lonicera tatarica & cvs - Tatarian Honeysuckle	19.81
32 93 33 00-0392	EA	36" B&B Lonicera tatarica & cvs - Tatarian Honeysuckle	23.77
32 93 33 00-0393	EA	42" B&B Lonicera tatarica & cvs - Tatarian Honeysuckle	26.41
32 93 33 00-0394	EA	48" B&B Lonicera tatarica & cvs - Tatarian Honeysuckle	29.06
32 93 33 00-0395	EA	1 Gallon Myrica cerifera - Wax Myrtle	3.80
32 93 33 00-0396	EA	4 Gallon Myrica cerifera - Wax Myrtle	12.15
32 93 33 00-0397	EA	7 Gallon Myrica cerifera - Wax Myrtle	26.58
32 93 33 00-0398	EA	10 Gallon Myrica cerifera - Wax Myrtle	39.49
32 93 33 00-0399	EA	15 Gallon Myrica cerifera - Wax Myrtle	60.75
32 93 33 00-0400	EA	45 Gallon Myrica cerifera - Wax Myrtle	182.26
32 93 33 00-0401	EA	1' - 2' Myrica cerifera - Wax Myrtle	5.32
32 93 33 00-0402	EA	3' - 4' Myrica cerifera - Wax Myrtle	18.23
32 93 33 00-0403	EA	5' - 6' Myrica cerifera - Wax Myrtle	33.41
32 93 33 00-0404	EA	7' - 8' Myrica cerifera - Wax Myrtle	45.56
32 93 33 00-0405	EA	9' - 10' Myrica cerifera - Wax Myrtle	60.75
32 93 33 00-0406	EA	11' - 12' Myrica cerifera - Wax Myrtle	92.65
32 93 33 00-0407	EA	3 Gallon Myrica pensylvanica - Northern Bayberry	19.81
32 93 33 00-0408	EA	24" B&B Myrica pensylvanica - Northern Bayberry	32.36
32 93 33 00-0409	EA	30" B&B Myrica pensylvanica - Northern Bayberry	47.54
32 93 33 00-0410	EA	36" B&B Myrica pensylvanica - Northern Bayberry	56.79



MINOR		TOTAL DIRECT	DEMOLITION
CSI	UOM DESCRIPTION	UNIT COST	UNIT COST
32 93 33 00-0411	EA 48" B&B Myrica pensylvanica - Northern Bayberry.....	59.43	
32 93 33 00-0412	EA 1 Gallon Nandina domestica - Heavenly Bamboo.....	6.81	
32 93 33 00-0413	EA 2 Gallon Nandina domestica - Heavenly Bamboo.....	14.90	
32 93 33 00-0414	EA 5 Gallon Nandina domestica - Heavenly Bamboo.....	22.56	
32 93 33 00-0415	EA 1 Gallon Osmanthus fragrans - Fragrant Tea Olive.....	4.19	
32 93 33 00-0416	EA 3 Gallon Osmanthus fragrans - Fragrant Tea Olive.....	11.35	
32 93 33 00-0417	EA 1 Gallon Philadelphus - Evergreen Mockorange.....	5.82	
32 93 33 00-0418	EA 5 Gallon Philadelphus - Evergreen Mockorange.....	18.87	
32 93 33 00-0419	EA 36" B&B Philadelphus x virginalis & cvs - Mockorange.....	19.81	
32 93 33 00-0420	EA 42" B&B Philadelphus x virginalis & cvs - Mockorange.....	23.11	
32 93 33 00-0421	EA 48" B&B Philadelphus x virginalis & cvs - Mockorange.....	26.41	
32 93 33 00-0422	EA 24" B&B Physocarpus opulifolius 'Nana' - Dwarf Common Ninebark.....	19.81	
32 93 33 00-0423	EA 30" B&B Physocarpus opulifolius 'Nana' - Dwarf Common Ninebark.....	23.11	
32 93 33 00-0424	EA 36" B&B Physocarpus opulifolius 'Nana' - Dwarf Common Ninebark.....	26.41	
32 93 33 00-0425	EA 42" B&B Physocarpus opulifolius 'Nana' - Dwarf Common Ninebark.....	33.02	
32 93 33 00-0426	EA 48" B&B Physocarpus opulifolius 'Nana' - Dwarf Common Ninebark.....	39.62	
32 93 33 00-0427	EA 12" To 15" Spread Pieris - Mountain Andromeda.....	18.23	
32 93 33 00-0428	EA 15" To 18" Spread Pieris - Mountain Andromeda.....	39.09	
32 93 33 00-0429	EA 12" To 15" Pieris japonica - Japanese Andromeda.....	23.69	
32 93 33 00-0430	EA 15" To 18" Pieris japonica - Japanese Andromeda.....	27.10	
32 93 33 00-0431	EA 18" To 24" Pieris japonica - Japanese Andromeda.....	33.91	
32 93 33 00-0432	EA 2' To 2-1/2' Pieris japonica - Japanese Andromeda.....	48.17	
32 93 33 00-0433	EA 2-1/2' To 3' Pieris japonica - Japanese Andromeda.....	57.18	
32 93 33 00-0434	EA 24" B&B Pinus mugo & cvs - Mugo Pine.....	33.02	
32 93 33 00-0435	EA 30" B&B Pinus mugo & cvs - Mugo Pine.....	42.26	
32 93 33 00-0436	EA 36" B&B Pinus mugo & cvs - Mugo Pine.....	50.85	
32 93 33 00-0437	EA 48" B&B Pinus mugo & cvs - Mugo Pine.....	65.37	
32 93 33 00-0438	EA 60" B&B Pinus mugo & cvs - Mugo Pine.....	78.58	
32 93 33 00-0439	EA 72" B&B Pinus mugo & cvs - Mugo Pine.....	114.90	
32 93 33 00-0440	EA 30" B&B Pinus mugo compacta - Dwarf Mugo Pine.....	71.32	
32 93 33 00-0441	EA 36" B&B Pinus mugo compacta - Dwarf Mugo Pine.....	85.85	
32 93 33 00-0442	EA 48" B&B Pinus mugo compacta - Dwarf Mugo Pine.....	114.24	
32 93 33 00-0443	EA 1 Gallon Pittosporum - Pittosporum.....	2.51	
32 93 33 00-0444	EA 3 Gallon Pittosporum - Pittosporum.....	6.45	
32 93 33 00-0445	EA 1 Gallon Pittosporum - Varigated Pittosporum.....	2.51	
32 93 33 00-0446	EA 3 Gallon Pittosporum - Varigated Pittosporum.....	6.45	
32 93 33 00-0447	EA 5 Gallon Pittosporum - Varigated Pittosporum.....	11.32	
32 93 33 00-0448	EA 2 Gallon Potentilla fruticosa & cvs - Bush Cinquefoil.....	11.23	
32 93 33 00-0449	EA 5 Gallon Potentilla fruticosa & cvs - Bush Cinquefoil.....	15.85	
32 93 33 00-0450	EA 18" B&B Potentilla fruticosa & cvs - Bush Cinquefoil.....	11.89	
32 93 33 00-0451	EA 24" B&B Potentilla fruticosa & cvs - Bush Cinquefoil.....	13.21	
32 93 33 00-0452	EA 30" B&B Potentilla fruticosa & cvs - Bush Cinquefoil.....	19.15	
32 93 33 00-0453	EA 36" B&B Potentilla fruticosa & cvs - Bush Cinquefoil.....	22.12	
32 93 33 00-0454	EA 1 Gallon Prunus caroliniana - Carolina Cherry Laurel.....	4.54	
32 93 33 00-0455	EA 3 Gallon Prunus caroliniana - Carolina Cherry Laurel.....	11.35	
32 93 33 00-0456	EA 15 Gallon Prunus caroliniana - Carolina Cherry Laurel.....	67.68	
32 93 33 00-0457	EA 15" To 18" Prunus laurocerasus - Cherry Laurel.....	17.31	
32 93 33 00-0458	EA 18" To 24" Prunus laurocerasus - Cherry Laurel.....	21.42	
32 93 33 00-0459	EA 24" To 30" Prunus laurocerasus - Cherry Laurel.....	27.88	
32 93 33 00-0460	EA 15" To 18" Prunus triloba - Double White Flowering Almond.....	15.46	
32 93 33 00-0461	EA 18" To 24" Prunus triloba - Double White Flowering Almond.....	19.79	
32 93 33 00-0462	EA 3' To 4' Prunus triloba - Double White Flowering Almond.....	31.57	
32 93 33 00-0463	EA 4' To 6' Prunus triloba - Double White Flowering Almond.....	63.21	
32 93 33 00-0464	EA 5 Gallon Prunus triloba - Pink Flowering Almond.....	19.01	
32 93 33 00-0465	EA 18" To 24" Prunus triloba - Pink Flowering Almond.....	21.35	
32 93 33 00-0466	EA 2' To 3' Prunus triloba - Pink Flowering Almond.....	24.83	
32 93 33 00-0467	EA 2' To 3' Prunus virginiana - Brilliant Chokeberry.....	16.88	
32 93 33 00-0468	EA 3' To 4' Prunus virginiana - Brilliant Chokeberry.....	20.71	
32 93 33 00-0469	EA 4' To 5' Prunus virginiana - Brilliant Chokeberry.....	24.83	
32 93 33 00-0470	EA 5' To 6' Prunus virginiana - Brilliant Chokeberry.....	28.45	
32 93 33 00-0471	EA 1 Gallon Punica granatum - Dwarf Pomegranate.....	4.47	
32 93 33 00-0472	EA 3 Gallon Punica granatum - Dwarf Pomegranate.....	13.20	
32 93 33 00-0473	EA 7 Gallon Punica granatum - Dwarf Pomegranate.....	27.10	
32 93 33 00-0474	EA 1 Gallon Pyracantha koidzumi "Santa Cruz" - Pyracantha.....	5.68	
32 93 33 00-0475	EA 5 Gallon Pyracantha koidzumi "Santa Cruz" - Pyracantha.....	18.87	
32 93 33 00-0476	EA 5 Gallon Espalier Pyracantha koidzumi "Santa Cruz" - Pyracantha.....	39.09	
32 93 33 00-0477	EA 1 Gallon Ralphialepis indica - Indian Hawthorne.....	4.54	
32 93 33 00-0478	EA 2 Gallon Ralphialepis indica - Indian Hawthorne.....	8.65	
32 93 33 00-0479	EA 5 Gallon Ralphialepis indica - Indian Hawthorne.....	15.39	
32 93 33 00-0480	EA 1 Gallon Rhamnus californica - Coffeeberry.....	6.90	
32 93 33 00-0481	EA 5 Gallon Rhamnus californica - Coffeeberry.....	19.73	
32 93 33 00-0482	EA 15 Gallon Rhamnus californica - Coffeeberry.....	59.22	
32 93 33 00-0483	EA 4' To 5' Rhamnus frangula "Columnaris" - Tallhedge.....	34.62	
32 93 33 00-0484	EA 5' To 6' Rhamnus frangula "Columnaris" - Tallhedge.....	47.46	
32 93 33 00-0485	EA 6' To 8' Rhamnus frangula "Columnaris" - Tallhedge.....	61.72	
32 93 33 00-0486	EA 10' To 12' Rhamnus frangula "Columnaris" - Tallhedge.....	112.86	
32 93 33 00-0487	EA 1 Gallon Rhododendron - Azalea Evergreen Hybrids.....	7.38	
32 93 33 00-0488	EA 2 Gallon Rhododendron - Azalea Evergreen Hybrids.....	14.90	
32 93 33 00-0489	EA 3 Gallon Rhododendron - Azalea Evergreen Hybrids.....	19.44	
32 93 33 00-0490	EA 5 Gallon Rhododendron - Azalea Evergreen Hybrids.....	22.56	
32 93 33 00-0491	EA 15" To 18" Rhododendron - Azalea Evergreen Hybrids.....	26.39	

32 Exterior Improvements**32 90 Planting****32 93 Plants**

MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

32 93 33 00-0492	EA	18" To 24" Rhododendron - Azalea Evergreen Hybrids.....	33.13	
32 93 33 00-0493	EA	2' To 2-1/2' Rhododendron - Azalea Evergreen Hybrids.....	48.17	
32 93 33 00-0494	EA	2-1/2' To 3' Rhododendron - Azalea Evergreen Hybrids.....	67.68	
32 93 33 00-0495	EA	1 Gallon Rhododendron - Azalea Exbury, Knapp Hill And Llam Hybrids.....	8.30	
32 93 33 00-0496	EA	2 Gallon Rhododendron - Azalea Exbury, Knapp Hill And Llam Hybrids.....	14.90	
32 93 33 00-0497	EA	15' To 18' Rhododendron - Azalea Exbury, Knapp Hill And Llam Hybrids.....	25.61	
32 93 33 00-0498	EA	18" To 24" Rhododendron - Azalea Exbury, Knapp Hill And Llam Hybrids.....	33.13	
32 93 33 00-0499	EA	2' To 3' Rhododendron - Azalea Exbury, Knapp Hill And Llam Hybrids.....	48.17	
32 93 33 00-0500	EA	3' To 4' Rhododendron - Azalea Exbury, Knapp Hill And Llam Hybrids.....	70.73	
32 93 33 00-0501	EA	4' To 5' Rhododendron - Azalea Exbury, Knapp Hill And Llam Hybrids.....	94.78	
32 93 33 00-0502	EA	5 Gallon Rhododendron - Boxleaf Azara.....	18.87	
32 93 33 00-0503	EA	15 Gallon Rhododendron - Boxleaf Azara.....	67.68	
32 93 33 00-0504	EA	15" To 18" Rhododendron - Carolina Rhododendron.....	21.35	
32 93 33 00-0505	EA	18" To 24" Rhododendron - Carolina Rhododendron.....	37.60	
32 93 33 00-0506	EA	24" To 30" Rhododendron - Carolina Rhododendron.....	55.69	
32 93 33 00-0507	EA	2' To 3' Rhododendron - Five-leafed Azalea.....	25.33	
32 93 33 00-0508	EA	3' To 4' Rhododendron - Five-leafed Azalea.....	33.13	
32 93 33 00-0509	EA	4' To 5' Rhododendron - Five-leafed Azalea.....	43.63	
32 93 33 00-0510	EA	15" To 18" Rhododendron - Ghent Azalea.....	25.33	
32 93 33 00-0511	EA	18" To 24" Rhododendron - Ghent Azalea.....	31.57	
32 93 33 00-0512	EA	2' To 3' Rhododendron - Ghent Azalea.....	51.15	
32 93 33 00-0513	EA	3' To 4' Rhododendron - Ghent Azalea.....	70.73	
32 93 33 00-0514	EA	4' To 5' Rhododendron - Ghent Azalea.....	94.78	
32 93 33 00-0515	EA	5' To 6' Rhododendron - Ghent Azalea.....	126.41	
32 93 33 00-0516	EA	1 Gallon Rhododendron - Hybrid Rhododendron.....	8.30	
32 93 33 00-0517	EA	2 Gallon Rhododendron - Hybrid Rhododendron.....	17.95	
32 93 33 00-0518	EA	3 Gallon Rhododendron - Hybrid Rhododendron.....	25.47	
32 93 33 00-0519	EA	5 Gallon Rhododendron - Hybrid Rhododendron.....	28.45	
32 93 33 00-0520	EA	15" To 18" Rhododendron - Hybrid Rhododendron.....	24.05	
32 93 33 00-0521	EA	18" To 24" Rhododendron - Hybrid Rhododendron.....	33.13	
32 93 33 00-0522	EA	24" To 30" Rhododendron - Hybrid Rhododendron.....	45.12	
32 93 33 00-0523	EA	30" To 36" Rhododendron - Hybrid Rhododendron.....	52.64	
32 93 33 00-0524	EA	36" To 42" Rhododendron - Hybrid Rhododendron.....	75.27	
32 93 33 00-0525	EA	42" To 48" Rhododendron - Hybrid Rhododendron.....	93.29	
32 93 33 00-0526	EA	15" To 18" Rhododendron - Pjm Rhododendron.....	27.10	
32 93 33 00-0527	EA	18" To 24" Rhododendron - Pjm Rhododendron.....	33.13	
32 93 33 00-0528	EA	2' To 2-1/2' Rhododendron - Pjm Rhododendron.....	48.17	
32 93 33 00-0529	EA	2-1/2' To 3' Rhododendron - Pjm Rhododendron.....	61.72	
32 93 33 00-0530	EA	3' To 3-1/2' Rhododendron - Pjm Rhododendron.....	75.27	
32 93 33 00-0531	EA	12" To 15" Rhododendron - Torch Azalea.....	21.07	
32 93 33 00-0532	EA	15" To 18" Rhododendron - Torch Azalea.....	25.33	
32 93 33 00-0533	EA	18" To 24" Rhododendron - Torch Azalea.....	31.57	
32 93 33 00-0534	EA	2' To 3' Rhododendron - Torch Azalea.....	52.64	
32 93 33 00-0535	EA	3 Gallon Rhododendron cvs - Lepidote Rhododendron.....	23.77	
32 93 33 00-0536	EA	5 Gallon Rhododendron cvs - Lepidote Rhododendron.....	29.06	
32 93 33 00-0537	EA	18" B&B Rhododendron cvs - Lepidote Rhododendron.....	35.66	
32 93 33 00-0538	EA	24" B&B Rhododendron cvs - Lepidote Rhododendron.....	44.90	
32 93 33 00-0539	EA	30" B&B Rhododendron cvs - Lepidote Rhododendron.....	52.83	
32 93 33 00-0540	EA	36" B&B Rhododendron cvs - Lepidote Rhododendron.....	63.39	
32 93 33 00-0541	EA	1 Gallon Rhus glabra - Dwarf Smooth Sumac.....	6.81	
32 93 33 00-0542	EA	5 Gallon Rhus glabra - Dwarf Smooth Sumac.....	18.87	
32 93 33 00-0543	EA	2 Gallon Rhus aromatica & cvs - Fragrant Sumac.....	15.85	
32 93 33 00-0544	EA	5 Gallon Rhus aromatica & cvs - Fragrant Sumac.....	21.79	
32 93 33 00-0545	EA	18" B&B Rhus aromatica & cvs - Fragrant Sumac.....	25.09	
32 93 33 00-0546	EA	24" B&B Rhus aromatica & cvs - Fragrant Sumac.....	33.02	
32 93 33 00-0547	EA	36" B&B Rhus glabra - Smooth Sumac.....	19.81	
32 93 33 00-0548	EA	48" B&B Rhus typhina & cvs - Staghorn Sumac.....	33.02	
32 93 33 00-0549	EA	72" B&B Rhus typhina & cvs - Staghorn Sumac.....	52.83	
32 93 33 00-0550	EA	15" B&B Ribes alpinum & cvs - Alpine Currant.....	17.83	
32 93 33 00-0551	EA	18" B&B Ribes alpinum & cvs - Alpine Currant.....	20.47	
32 93 33 00-0552	EA	24" B&B Ribes alpinum & cvs - Alpine Currant.....	29.72	
32 93 33 00-0553	EA	30" B&B Ribes alpinum & cvs - Alpine Currant.....	39.62	
32 93 33 00-0554	EA	1 Gallon Rosa hybrids & cvs - Shrub Rose.....	10.90	
32 93 33 00-0555	EA	2 Gallon Rosa hybrids & cvs - Shrub Rose.....	13.21	
32 93 33 00-0556	EA	3 Gallon Rosa hybrids & cvs - Shrub Rose.....	16.51	
32 93 33 00-0557	EA	2 Gallon Rosa rugosa & cvs - Rugosa Rose.....	11.89	
32 93 33 00-0558	EA	3 Gallon Rosa rugosa & cvs - Rugosa Rose.....	15.19	
32 93 33 00-0559	EA	5 Gallon Sambucus canadensis - American Elder.....	21.79	
32 93 33 00-0560	EA	2 Gallon Sarcococca hookeriana humilis - Himalayan Sarcococca.....	9.79	
32 93 33 00-0561	EA	3 Gallon Sarcococca hookeriana humilis - Himalayan Sarcococca.....	14.33	
32 93 33 00-0562	EA	1 Gallon Sarcococca humilis - Fragrant Sarcococca.....	5.32	
32 93 33 00-0563	EA	5 Gallon Sarcococca humilis - Fragrant Sarcococca.....	13.90	
32 93 33 00-0564	EA	5 Gallon Senna artemisioides - Feathery Cassia.....	12.84	
32 93 33 00-0565	EA	15 Gallon Senna artemisioides - Feathery Cassia.....	51.11	
32 93 33 00-0566	EA	24" Box Senna artemisioides - Feathery Cassia.....	160.54	
32 93 33 00-0567	EA	1 Gallon Skimmia japonica - Japanese Skimmia.....	6.81	
32 93 33 00-0568	EA	2 Gallon Skimmia japonica - Japanese Skimmia.....	13.55	
32 93 33 00-0569	EA	5 Gallon Skimmia japonica - Japanese Skimmia.....	21.85	
32 93 33 00-0570	EA	3' To 4' Spiraea - Garland Spirea.....	31.57	
32 93 33 00-0571	EA	4' To 5' Spiraea - Garland Spirea.....	48.17	
32 93 33 00-0572	EA	5 Gallon Spiraea - Snowmound Spirea.....	18.87	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 93 33 00-0573	EA	18"	To 24" Spiraea - Snowmound Spirea	15.46	
32 93 33 00-0574	EA	2'	To 3' Spiraea - Snowmound Spirea	21.85	
32 93 33 00-0575	EA	3'	To 4' Spiraea - Snowmound Spirea	25.33	
32 93 33 00-0576	EA	4'	To 5' Spiraea - Snowmound Spirea	43.63	
32 93 33 00-0577	EA	1	Gallon Spiraea japonica & cvs - Japanese Spirea	6.81	
32 93 33 00-0578	EA	2	Gallon Spiraea japonica & cvs - Japanese Spirea	13.41	
32 93 33 00-0579	EA	3	Gallon Spiraea japonica & cvs - Japanese Spirea	15.52	
32 93 33 00-0580	EA	5	Gallon Spiraea japonica & cvs - Japanese Spirea	16.84	
32 93 33 00-0581	EA	18"	B&B Spiraea japonica & cvs - Japanese Spirea	17.17	
32 93 33 00-0582	EA	24"	B&B Spiraea japonica & cvs - Japanese Spirea	19.81	
32 93 33 00-0583	EA	30"	B&B Spiraea japonica & cvs - Japanese Spirea	22.45	
32 93 33 00-0584	EA	36"	B&B Spiraea japonica & cvs - Japanese Spirea	26.08	
32 93 33 00-0585	EA	2	Gallon Spiraea nipponica & cvs - Nippon Spiraea	10.57	
32 93 33 00-0586	EA	5	Gallon Spiraea nipponica & cvs - Nippon Spiraea	15.85	
32 93 33 00-0587	EA	18"	B&B Spiraea nipponica & cvs - Nippon Spiraea	14.53	
32 93 33 00-0588	EA	24"	B&B Spiraea nipponica & cvs - Nippon Spiraea	17.17	
32 93 33 00-0589	EA	30"	B&B Spiraea nipponica & cvs - Nippon Spiraea	19.81	
32 93 33 00-0590	EA	36"	B&B Spiraea nipponica & cvs - Nippon Spiraea	22.45	
32 93 33 00-0591	EA	48"	B&B Spiraea nipponica & cvs - Nippon Spiraea	29.06	
32 93 33 00-0592	EA	1	Gallon Spiraea x bumalda & cvs - Bumalda Spirea	6.81	
32 93 33 00-0593	EA	2	Gallon Spiraea x bumalda & cvs - Bumalda Spirea	12.22	
32 93 33 00-0594	EA	4	Gallon Spiraea x bumalda & cvs - Bumalda Spirea	15.85	
32 93 33 00-0595	EA	18"	B&B Spiraea x bumalda & cvs - Bumalda Spirea	13.87	
32 93 33 00-0596	EA	24"	B&B Spiraea x bumalda & cvs - Bumalda Spirea	16.84	
32 93 33 00-0597	EA	30"	B&B Spiraea x bumalda & cvs - Bumalda Spirea	19.81	
32 93 33 00-0598	EA	36"	B&B Spiraea x bumalda & cvs - Bumalda Spirea	22.45	
32 93 33 00-0599	EA	5	Gallon Spiraea x vanhouttei & cvs - Vanhoutte Spirea	15.85	
32 93 33 00-0600	EA	18"	B&B Spiraea x vanhouttei & cvs - Vanhoutte Spirea	15.85	
32 93 33 00-0601	EA	24"	B&B Spiraea x vanhouttei & cvs - Vanhoutte Spirea	18.49	
32 93 33 00-0602	EA	30"	B&B Spiraea x vanhouttei & cvs - Vanhoutte Spirea	25.09	
32 93 33 00-0603	EA	36"	B&B Spiraea x vanhouttei & cvs - Vanhoutte Spirea	29.06	
32 93 33 00-0604	EA	42"	B&B Spiraea x vanhouttei & cvs - Vanhoutte Spirea	34.34	
32 93 33 00-0605	EA	5	Gallon Staphylea trifolia - Bladdernut	22.29	
32 93 33 00-0606	EA	2	Gallon Stephanandra incisa & cvs - Cutleaf Stephanadra	15.85	
32 93 33 00-0607	EA	5	Gallon Stephanandra incisa & cvs - Cutleaf Stephanadra	17.17	
32 93 33 00-0608	EA	24"	B&B Stephanandra incisa & cvs - Cutleaf Stephanadra	19.81	
32 93 33 00-0609	EA	30"	B&B Stephanandra incisa & cvs - Cutleaf Stephanadra	23.77	
32 93 33 00-0610	EA	2	Gallon Symphoricarpos albus - Common Snowberry	16.51	
32 93 33 00-0611	EA	5	Gallon Symphoricarpos albus - Common Snowberry	17.50	
32 93 33 00-0612	EA	24"	B&B Syringa meyeri & cvs - Meyer Lilac	29.06	
32 93 33 00-0613	EA	30"	B&B Syringa meyeri & cvs - Meyer Lilac	36.32	
32 93 33 00-0614	EA	36"	B&B Syringa meyeri & cvs - Meyer Lilac	42.26	
32 93 33 00-0615	EA	42"	B&B Syringa meyeri & cvs - Meyer Lilac	48.87	
32 93 33 00-0616	EA	18"	B&B Syringa patula 'Miss Kim' - Miss Kim Lilac	29.06	
32 93 33 00-0617	EA	24"	B&B Syringa patula 'Miss Kim' - Miss Kim Lilac	31.70	
32 93 33 00-0618	EA	30"	B&B Syringa patula 'Miss Kim' - Miss Kim Lilac	36.32	
32 93 33 00-0619	EA	36"	B&B Syringa patula 'Miss Kim' - Miss Kim Lilac	42.26	
32 93 33 00-0620	EA	42"	B&B Syringa patula 'Miss Kim' - Miss Kim Lilac	48.87	
32 93 33 00-0621	EA	60"	B&B Syringa villosa & cvs - Late Lilac	23.11	
32 93 33 00-0622	EA	72"	B&B Syringa villosa & cvs - Late Lilac	25.09	
32 93 33 00-0623	EA	36"	B&B Syringa vulgaris & cvs - Common Lilac	19.81	
32 93 33 00-0624	EA	42"	B&B Syringa vulgaris & cvs - Common Lilac	22.45	
32 93 33 00-0625	EA	48"	B&B Syringa vulgaris & cvs - Common Lilac	25.09	
32 93 33 00-0626	EA	60"	B&B Syringa vulgaris & cvs - Common Lilac	29.06	
32 93 33 00-0627	EA	72"	B&B Syringa vulgaris & cvs - Common Lilac	35.66	
32 93 33 00-0628	EA	5	Gallon Syringa x chinensis & cvs - Chinese Lilac	16.51	
32 93 33 00-0629	EA	36"	B&B Syringa x hyacinthiflora & cvs - Hybrid Lilac	19.15	
32 93 33 00-0630	EA	48"	B&B Syringa x hyacinthiflora & cvs - Hybrid Lilac	25.09	
32 93 33 00-0631	EA	48"	B&B Taxus cuspidata capitata - Capitata Japanese Yew	105.00	
32 93 33 00-0632	EA	54"	B&B Taxus cuspidata capitata - Capitata Japanese Yew	117.54	
32 93 33 00-0633	EA	60"	B&B Taxus cuspidata capitata - Capitata Japanese Yew	129.43	
32 93 33 00-0634	EA	72"	B&B Taxus cuspidata capitata - Capitata Japanese Yew	155.84	
32 93 33 00-0635	EA	18"	B&B Taxus cuspidata cvs - Dwarf & Spreading Japanese Yew	27.73	
32 93 33 00-0636	EA	24"	B&B Taxus cuspidata cvs - Dwarf & Spreading Japanese Yew	36.32	
32 93 33 00-0637	EA	30"	B&B Taxus cuspidata cvs - Dwarf & Spreading Japanese Yew	42.26	
32 93 33 00-0638	EA	36"	B&B Taxus cuspidata cvs - Dwarf & Spreading Japanese Yew	46.22	
32 93 33 00-0639	EA	15"	B&B Taxus x media & cvs - Anglojap Yew	27.73	
32 93 33 00-0640	EA	18"	B&B Taxus x media & cvs - Anglojap Yew	36.32	
32 93 33 00-0641	EA	24"	B&B Taxus x media & cvs - Anglojap Yew	42.92	
32 93 33 00-0642	EA	30"	B&B Taxus x media & cvs - Anglojap Yew	50.85	
32 93 33 00-0643	EA	36"	B&B Taxus x media & cvs - Anglojap Yew	76.60	
32 93 33 00-0644	EA	36"	B&B Thuja occidentalis & cvs - Upright Arborvitae	42.26	
32 93 33 00-0645	EA	48"	B&B Thuja occidentalis & cvs - Upright Arborvitae	56.79	
32 93 33 00-0646	EA	60"	B&B Thuja occidentalis & cvs - Upright Arborvitae	85.85	
32 93 33 00-0647	EA	72"	B&B Thuja occidentalis & cvs - Upright Arborvitae	125.47	
32 93 33 00-0648	EA	84"	B&B Thuja occidentalis & cvs - Upright Arborvitae	143.96	
32 93 33 00-0649	EA	96"	B&B Thuja occidentalis & cvs - Upright Arborvitae	167.07	
32 93 33 00-0650	EA	15"	B&B Thuja occidentalis cvs - Dwarf Arborvitae	18.49	
32 93 33 00-0651	EA	18"	B&B Thuja occidentalis cvs - Dwarf Arborvitae	25.75	
32 93 33 00-0652	EA	24"	B&B Thuja occidentalis cvs - Dwarf Arborvitae	36.32	
32 93 33 00-0653	EA	3'	To 4' Viburnum dilatatum - Linden Viburnum	31.57	

32 Exterior Improvements**32 90 Planting****32 93 Plants**MINOR
CSI UOM DESCRIPTIONTOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

32 93 33 00-0654	EA	4' To 5' Viburnum dilatatum - Linden Viburnum	48.17
32 93 33 00-0655	EA	5' To 6' Viburnum dilatatum - Linden Viburnum	63.21
32 93 33 00-0656	EA	1 Gallon Viburnum japonicum - Japanese Viburnum	3.83
32 93 33 00-0657	EA	3 Gallon Viburnum japonicum - Japanese Viburnum	10.50
32 93 33 00-0658	EA	5 Gallon Viburnum plicatum - Japanese Snowball.....	18.87
32 93 33 00-0659	EA	5' To 6' Viburnum plicatum - Japanese Snowball.....	70.73
32 93 33 00-0660	EA	2' To 3' Viburnum rhytidophyllum - Leatherleaf Viburnum.....	33.13
32 93 33 00-0661	EA	3' To 4' Viburnum rhytidophyllum - Leatherleaf Viburnum.....	39.09
32 93 33 00-0662	EA	4' To 5' Viburnum rhytidophyllum - Leatherleaf Viburnum.....	54.98
32 93 33 00-0663	EA	30" B&B Viburnum burkwoodii & cvs - Burkwood Viburnum.....	36.32
32 93 33 00-0664	EA	36" B&B Viburnum burkwoodii & cvs - Burkwood Viburnum.....	43.58
32 93 33 00-0665	EA	24" B&B Viburnum carlesii & cvs - Korean Spice Viburnum.....	33.02
32 93 33 00-0666	EA	30" B&B Viburnum carlesii & cvs - Korean Spice Viburnum.....	39.62
32 93 33 00-0667	EA	36" B&B Viburnum carlesii & cvs - Korean Spice Viburnum.....	46.22
32 93 33 00-0668	EA	42" B&B Viburnum carlesii & cvs - Korean Spice Viburnum.....	52.83
32 93 33 00-0669	EA	36" B&B Viburnum dentatum & cvs - Arrowwood Viburnum.....	18.49
32 93 33 00-0670	EA	42" B&B Viburnum dentatum & cvs - Arrowwood Viburnum.....	19.81
32 93 33 00-0671	EA	48" B&B Viburnum dentatum & cvs - Arrowwood Viburnum.....	23.11
32 93 33 00-0672	EA	60" B&B Viburnum dentatum & cvs - Arrowwood Viburnum.....	26.41
32 93 33 00-0673	EA	72" B&B Viburnum dentatum & cvs - Arrowwood Viburnum.....	29.06
32 93 33 00-0674	EA	30" B&B Viburnum lantana & cvs - Wayfaringtree Viburnum.....	17.83
32 93 33 00-0675	EA	36" B&B Viburnum lantana & cvs - Wayfaringtree Viburnum.....	19.81
32 93 33 00-0676	EA	42" B&B Viburnum lantana & cvs - Wayfaringtree Viburnum.....	25.09
32 93 33 00-0677	EA	48" B&B Viburnum lantana & cvs - Wayfaringtree Viburnum.....	29.06
32 93 33 00-0678	EA	60" B&B Viburnum lantana & cvs - Wayfaringtree Viburnum.....	39.62
32 93 33 00-0679	EA	72" B&B Viburnum lantana & cvs - Wayfaringtree Viburnum.....	47.54
32 93 33 00-0680	EA	36" B&B Viburnum lentago & cvs - Nannyberry Viburnum.....	19.81
32 93 33 00-0681	EA	48" B&B Viburnum lentago & cvs - Nannyberry Viburnum.....	26.41
32 93 33 00-0682	EA	5' B&B Viburnum lentago & cvs - Nannyberry Viburnum.....	33.02
32 93 33 00-0683	EA	6' B&B Viburnum lentago & cvs - Nannyberry Viburnum.....	46.22
32 93 33 00-0684	EA	7' B&B Viburnum lentago & cvs - Nannyberry Viburnum.....	66.03
32 93 33 00-0685	EA	8' B&B Viburnum lentago & cvs - Nannyberry Viburnum.....	92.45
32 93 33 00-0686	EA	9' B&B Viburnum lentago & cvs - Nannyberry Viburnum.....	118.86
32 93 33 00-0687	EA	30" B&B Viburnum plicatum tomentosum & cvs - Doublefile Viburnum.....	23.77
32 93 33 00-0688	EA	36" B&B Viburnum plicatum tomentosum & cvs - Doublefile Viburnum.....	26.41
32 93 33 00-0689	EA	36" B&B Viburnum prunifolium & cvs - Blackhaw Viburnum.....	47.54
32 93 33 00-0690	EA	48" B&B Viburnum prunifolium & cvs - Blackhaw Viburnum.....	72.64
32 93 33 00-0691	EA	60" B&B Viburnum prunifolium & cvs - Blackhaw Viburnum.....	92.45
32 93 33 00-0692	EA	72" B&B Viburnum prunifolium & cvs - Blackhaw Viburnum.....	112.26
32 93 33 00-0693	EA	84" B&B Viburnum prunifolium & cvs - Blackhaw Viburnum.....	138.67
32 93 33 00-0694	EA	96" B&B Viburnum prunifolium & cvs - Blackhaw Viburnum.....	165.09
32 93 33 00-0695	EA	108" B&B Viburnum prunifolium & cvs - Blackhaw Viburnum.....	198.10
32 93 33 00-0696	EA	120" B&B Viburnum prunifolium & cvs - Blackhaw Viburnum.....	231.12
32 93 33 00-0697	EA	30" B&B Viburnum sargentii & cvs - Sargent Viburnum.....	20.14
32 93 33 00-0698	EA	36" B&B Viburnum sargentii & cvs - Sargent Viburnum.....	22.12
32 93 33 00-0699	EA	48" B&B Viburnum sargentii & cvs - Sargent Viburnum.....	25.09
32 93 33 00-0700	EA	60" B&B Viburnum sargentii & cvs - Sargent Viburnum.....	29.06
32 93 33 00-0701	EA	72" B&B Viburnum sargentii & cvs - Sargent Viburnum.....	33.35
32 93 33 00-0702	EA	18" B&B Viburnum trilobum & cvs - American Cranberry Viburnum.....	19.15
32 93 33 00-0703	EA	24" B&B Viburnum trilobum & cvs - American Cranberry Viburnum.....	23.11
32 93 33 00-0704	EA	30" B&B Viburnum trilobum & cvs - American Cranberry Viburnum.....	27.73
32 93 33 00-0705	EA	36" B&B Viburnum trilobum & cvs - American Cranberry Viburnum.....	31.70
32 93 33 00-0706	EA	42" B&B Viburnum trilobum & cvs - American Cranberry Viburnum.....	38.30
32 93 33 00-0707	EA	48" B&B Viburnum trilobum & cvs - American Cranberry Viburnum.....	42.26
32 93 33 00-0708	EA	30" B&B Viburnum x carlcephalum & cvs - Fragrant Viburnum.....	33.02
32 93 33 00-0709	EA	36" B&B Viburnum x carlcephalum & cvs - Fragrant Viburnum.....	39.62
32 93 33 00-0710	EA	42" B&B Viburnum x carlcephalum & cvs - Fragrant Viburnum.....	46.22
32 93 33 00-0711	EA	48" B&B Viburnum x carlcephalum & cvs - Fragrant Viburnum.....	52.83
32 93 33 00-0712	EA	60" B&B Viburnum x carlcephalum & cvs - Fragrant Viburnum.....	59.43
32 93 33 00-0713	EA	30" B&B Viburnum x juddii & cvs - Judd Viburnum.....	42.26
32 93 33 00-0714	EA	36" B&B Viburnum x juddii & cvs - Judd Viburnum.....	47.54
32 93 33 00-0715	EA	42" B&B Viburnum x juddii & cvs - Judd Viburnum.....	54.15
32 93 33 00-0716	EA	48" B&B Viburnum x juddii & cvs - Judd Viburnum.....	62.07
32 93 33 00-0717	EA	2' To 3' Viburnum opulus "Roseum" - Fragrant Snowball.....	39.09
32 93 33 00-0718	EA	3' To 4' Viburnum opulus "Roseum" - Fragrant Snowball.....	48.17
32 93 33 00-0719	EA	4' To 5' Viburnum opulus "Roseum" - Fragrant Snowball.....	70.73
32 93 33 00-0720	EA	5 Gallon Weigela florida & cvs - Old Fashioned Weigela.....	21.79
32 93 33 00-0721	EA	24" B&B Weigela florida & cvs - Old Fashioned Weigela.....	19.81
32 93 33 00-0722	EA	30" B&B Weigela florida & cvs - Old Fashioned Weigela.....	22.45
32 93 33 00-0723	EA	36" B&B Weigela florida & cvs - Old Fashioned Weigela.....	25.09
32 93 33 00-0724	EA	42" B&B Weigela florida & cvs - Old Fashioned Weigela.....	29.06
32 93 33 00-0725	EA	48" B&B Weigela florida & cvs - Old Fashioned Weigela.....	33.02
32 93 33 00-0726	EA	1 Gallon Xylosma congestum - Shiny Xylosma.....	4.54
32 93 33 00-0727	EA	5 Gallon Xylosma congestum - Shiny Xylosma.....	12.84
32 93 33 00-0728	EA	15 Gallon Xylosma congestum - Shiny Xylosma.....	56.47
32 93 33 00-0729	EA	1 Gallon Yucca aloifolia - Spanish Bayonet.....	3.83
32 93 33 00-0730	EA	3 Gallon Yucca aloifolia - Spanish Bayonet.....	10.14
32 93 33 00-0731	EA	1 Gallon Yucca filamentosa - Adams Needle.....	5.32
32 93 33 00-0732	EA	3 Gallon Yucca filamentosa - Adams Needle.....	10.36
32 93 33 00-0733	EA	5 Gallon Yucca filamentosa - Adams Needle.....	16.39
32 93 33 00-0734	EA	3' Juniperus chinensis - Columnar Chinese Juniper.....	38.73



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 93 33 00-0735	EA		4' Juniperus chinensis - Columnar Chinese Juniper	53.16	
32 93 33 00-0736	EA		5' Juniperus chinensis - Columnar Chinese Juniper	83.53	
32 93 33 00-0737	EA		6' Juniperus chinensis - Columnar Chinese Juniper	97.20	
32 93 33 00-0738	EA		7' Juniperus chinensis - Columnar Chinese Juniper	127.58	
32 93 33 00-0739	EA		2 Gallon Chrysobalanus icaco - Cocoplum Red Tip	7.59	
32 93 33 00-0740	EA		3 Gallon Chrysobalanus icaco - Cocoplum Red Tip	10.63	
32 93 33 00-0741	EA		5 Gallon Chrysobalanus icaco - Cocoplum Red Tip	25.74	
32 93 33 00-0742	EA		2 Gallon Chrysobalanus icaco - Cocoplum Green Tip	7.59	
32 93 33 00-0743	EA		3 Gallon Chrysobalanus icaco - Cocoplum Green Tip	10.63	

32 93 43 Trees (32 93)

Note: (cvs = cultivar) materials only.

32 93 43 00-0001 Ornamental Trees (32 93 43)

Note: All trees listed by caliper of trunk or height of tree if field grown, dug with spade, balled and burlapped and delivered to site.

32 93 43 00-0002	EA		6' Clump Form Acer ginnala & cvs - Amur Maple	117.80	
32 93 43 00-0003	EA		7' Clump Form Acer ginnala & cvs - Amur Maple	143.98	
32 93 43 00-0004	EA		8' Clump Form Acer ginnala & cvs - Amur Maple	163.61	
32 93 43 00-0005	EA		10' Clump Form Acer ginnala & cvs - Amur Maple	189.79	
32 93 43 00-0006	EA		12' Clump Form Acer ginnala & cvs - Amur Maple	215.96	
32 93 43 00-0007	EA		14' Clump Form Acer ginnala & cvs - Amur Maple	255.23	
32 93 43 00-0008	EA		1-1/2" To 2" Caliper Acer griseum - Paperbark Maple	341.30	
32 93 43 00-0009	EA		2" To 2-1/2" Caliper Acer griseum - Paperbark Maple	418.84	
32 93 43 00-0010	EA		2-1/2" To 3" Caliper Acer griseum - Paperbark Maple	523.55	
32 93 43 00-0011	EA		5' Clump Form Acer griseum - Paperbark Maple	104.71	
32 93 43 00-0012	EA		1-1/2" Caliber Aesculus californica - California Buckeye	261.77	
32 93 43 00-0013	EA		2" Caliber Aesculus californica - California Buckeye	340.31	
32 93 43 00-0014	EA		2-1/2" Caliber Aesculus californica - California Buckeye	392.66	
32 93 43 00-0015	EA		3" Caliber Aesculus californica - California Buckeye	445.02	
32 93 43 00-0016	EA		3-1/2" Caliber Aesculus californica - California Buckeye	523.55	
32 93 43 00-0017	EA		36" B&B Amelanchier alnifolia & cvs - Saskatoon Serviceberry	52.83	
32 93 43 00-0018	EA		48" B&B Amelanchier alnifolia & cvs - Saskatoon Serviceberry	66.03	
32 93 43 00-0019	EA		60" B&B Amelanchier alnifolia & cvs - Saskatoon Serviceberry	81.88	
32 93 43 00-0020	EA		60" B&B Amelanchier arborea & cvs - Downy Serviceberry	66.03	
32 93 43 00-0021	EA		72" B&B Amelanchier arborea & cvs - Downy Serviceberry	79.24	
32 93 43 00-0022	EA		7' B&B Amelanchier arborea & cvs - Downy Serviceberry	92.45	
32 93 43 00-0023	EA		8' B&B Amelanchier arborea & cvs - Downy Serviceberry	105.66	
32 93 43 00-0024	EA		5' B&B Amelanchier canadensis & cvs - Shadblow Serviceberry	118.86	
32 93 43 00-0025	EA		6' B&B Amelanchier canadensis & cvs - Shadblow Serviceberry	132.07	
32 93 43 00-0026	EA		7' B&B Amelanchier canadensis & cvs - Shadblow Serviceberry	151.88	
32 93 43 00-0027	EA		8' B&B Amelanchier canadensis & cvs - Shadblow Serviceberry	171.69	
32 93 43 00-0028	EA		9' B&B Amelanchier canadensis & cvs - Shadblow Serviceberry	198.10	
32 93 43 00-0029	EA		7' B&B Amelanchier laevis & cvs - Allegheny Serviceberry	151.88	
32 93 43 00-0030	EA		8' B&B Amelanchier laevis & cvs - Allegheny Serviceberry	178.29	
32 93 43 00-0031	EA		9' B&B Amelanchier laevis & cvs - Allegheny Serviceberry	204.71	
32 93 43 00-0032	EA		10' B&B Amelanchier laevis & cvs - Allegheny Serviceberry	224.52	
32 93 43 00-0033	EA		30" B&B Amelanchier stolonifera & cvs - Running Serviceberry	52.83	
32 93 43 00-0034	EA		48" B&B Amelanchier stolonifera & cvs - Running Serviceberry	112.26	
32 93 43 00-0035	EA		60" B&B Amelanchier stolonifera & cvs - Running Serviceberry	145.28	
32 93 43 00-0036	EA		2' To 4' Amelemchier - Juneberry	16.08	
32 93 43 00-0037	EA		4' To 5' Amelemchier - Juneberry	16.87	
32 93 43 00-0038	EA		5' To 6' Amelemchier - Juneberry	20.08	
32 93 43 00-0039	EA		6' To 8' Amelemchier - Juneberry	23.96	
32 93 43 00-0040	EA		6' Cercis occidentalis - Western Redbud	73.30	
32 93 43 00-0041	EA		8' Cercis occidentalis - Western Redbud	100.85	
32 93 43 00-0042	EA		2-1/2" Caliper Cercis occidentalis - Western Redbud	207.72	
32 93 43 00-0043	EA		3" Caliper Cercis occidentalis - Western Redbud	252.87	
32 93 43 00-0044	EA		2' To 3' Magnolia virginiana - Sweetbay Magnolia	24.80	
32 93 43 00-0045	EA		3' To 4' Magnolia virginiana - Sweetbay Magnolia	37.21	
32 93 43 00-0046	EA		4' To 5' Magnolia virginiana - Sweetbay Magnolia	46.51	
32 93 43 00-0047	EA		5' To 6' Magnolia virginiana - Sweetbay Magnolia	57.93	
32 93 43 00-0048	EA		4' Clump Form Magnolia soulangiana & cvs - Saucer Magnolia	98.17	
32 93 43 00-0049	EA		5' Clump Form Magnolia soulangiana & cvs - Saucer Magnolia	130.89	
32 93 43 00-0050	EA		6' Clump Form Magnolia soulangiana & cvs - Saucer Magnolia	170.15	
32 93 43 00-0051	EA		7' Clump Form Magnolia soulangiana & cvs - Saucer Magnolia	189.79	
32 93 43 00-0052	EA		8' Clump Form Magnolia soulangiana & cvs - Saucer Magnolia	229.05	
32 93 43 00-0053	EA		9' Clump Form Magnolia soulangiana & cvs - Saucer Magnolia	255.23	
32 93 43 00-0054	EA		4' Clump Form Magnolia stellata, cvs & hybrids - Star Magnolia	98.17	
32 93 43 00-0055	EA		5' Clump Form Magnolia stellata, cvs & hybrids - Star Magnolia	130.89	
32 93 43 00-0056	EA		6' Clump Form Magnolia stellata, cvs & hybrids - Star Magnolia	170.15	
32 93 43 00-0057	EA		7' Clump Form Magnolia stellata, cvs & hybrids - Star Magnolia	189.79	
32 93 43 00-0058	EA		8' Clump Form Magnolia stellata, cvs & hybrids - Star Magnolia	229.05	
32 93 43 00-0059	EA		9' Clump Form Magnolia stellata, cvs & hybrids - Star Magnolia	255.23	
32 93 43 00-0060	EA		1 Gallon Platanus racemosa, Multi Trunk - Western Sycamore	8.15	
32 93 43 00-0061	EA		5 Gallon Platanus racemosa, Multi Trunk - Western Sycamore	34.52	
32 93 43 00-0062	EA		20 Gallon Prunus subhirtella - Flowering Cherry	92.03	
32 93 43 00-0063	EA		1-1/2" To 2" Caliper Prunus subhirtella - Flowering Cherry	95.13	
32 93 43 00-0064	EA		2" To 2-1/2" Caliper Prunus subhirtella - Flowering Cherry	118.90	
32 93 43 00-0065	EA		3-1/2" To 4" Caliper Prunus subhirtella - Flowering Cherry	248.14	
32 93 43 00-0066	EA		3" To 3-1/2" Caliper Prunus subhirtella - Flowering Cherry	191.25	

32 Exterior Improvements**32 90 Planting****32 93 Plants**MINOR
CSI UOM DESCRIPTIONTOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

32 93 43 00-0067	EA	4" To 5" Caliper Prunus subhirtella - Flowering Cherry.....	372.22	
32 93 43 00-0068	EA	5 Gallon Prunus cerasifera x 'Thundercloud' - Thundercloud Purple Leaf Plum.....	23.77	
32 93 43 00-0069	EA	15 Gallon Prunus cerasifera x 'Thundercloud' - Thundercloud Purple Leaf Plum.....	65.11	
32 93 43 00-0070	EA	20 Gallon Prunus cerasifera x 'Thundercloud' - Thundercloud Purple Leaf Plum.....	84.80	
32 93 43 00-0071	EA	5' To 6' Prunus cerasifera x 'Thundercloud' - Thundercloud Purple Leaf Plum.....	26.87	
32 93 43 00-0072	EA	6' To 8' Prunus cerasifera x 'Thundercloud' - Thundercloud Purple Leaf Plum.....	51.68	
32 93 43 00-0073	EA	1-1/2" To 2" Caliper Prunus cerasifera x 'Thundercloud' - Thundercloud Purple Leaf Plum.....	95.13	
32 93 43 00-0074	EA	2" To 2-1/2" Caliper Prunus cerasifera x 'Thundercloud' - Thundercloud Purple Leaf Plum.....	113.74	
32 93 43 00-0075	EA	1-1/2" To 1-3/4" Caliper Prunus subhirtella - Weeping Cherry.....	74.46	
32 93 43 00-0076	EA	1-1/4" To 1-1/2" Caliper Prunus subhirtella - Weeping Cherry.....	62.01	
32 93 43 00-0077	EA	1-3/4" To 2" Caliper Prunus subhirtella - Weeping Cherry.....	90.95	
32 93 43 00-0078	EA	2" To 2-1/2" Caliper Prunus subhirtella - Weeping Cherry.....	108.57	
32 93 43 00-0079	EA	2-1/2" To 3" Caliper Prunus subhirtella - Weeping Cherry.....	139.58	
32 93 43 00-0080	EA	15 Gallon Pyrus Calleryana x 'Aristocrat' - Flowering Pear.....	71.85	
32 93 43 00-0081	EA	20 Gallon Pyrus Calleryana x 'Aristocrat' - Flowering Pear.....	89.82	
32 93 43 00-0082	EA	1-1/2" To 2" Caliper Pyrus Calleryana x 'Aristocrat' - Flowering Pear.....	93.41	
32 93 43 00-0083	EA	2" To 2-1/2" Caliper Pyrus Calleryana x 'Aristocrat' - Flowering Pear.....	111.37	
32 93 43 00-0084	EA	2-1/2" To 3" Caliper Pyrus Calleryana x 'Aristocrat' - Flowering Pear.....	150.89	
32 93 43 00-0085	EA	3" To 3-1/2" Caliper Pyrus Calleryana x 'Aristocrat' - Flowering Pear.....	197.60	
32 93 43 00-0086	EA	3-1/2" To 4" Caliper Pyrus Calleryana x 'Aristocrat' - Flowering Pear.....	251.49	
32 93 43 00-0087	EA	15 Gallon Pyrus Calleryana x "Bradford" - Flowering Pear.....	71.85	
32 93 43 00-0088	EA	20 Gallon Pyrus Calleryana x "Bradford" - Flowering Pear.....	89.82	
32 93 43 00-0089	EA	1-1/2" To 2" Caliper Pyrus Calleryana x "Bradford" - Flowering Pear.....	61.08	
32 93 43 00-0090	EA	2" To 2-1/2" Caliper Pyrus Calleryana x "Bradford" - Flowering Pear.....	93.41	
32 93 43 00-0091	EA	2-1/2" To 3" Caliper Pyrus Calleryana x "Bradford" - Flowering Pear.....	111.28	
32 93 43 00-0092	EA	3" To 3-1/2" Caliper Pyrus Calleryana x "Bradford" - Flowering Pear.....	150.89	
32 93 43 00-0093	EA	3-1/2" To 4" Caliper Pyrus Calleryana x "Bradford" - Flowering Pear.....	197.60	
32 93 43 00-0094	EA	1-1/2" Caliper Pyrus calleryana & cvs - Callery Pear.....	130.89	
32 93 43 00-0095	EA	2" Caliper Pyrus calleryana & cvs - Callery Pear.....	163.61	
32 93 43 00-0096	EA	2-1/2" Caliper Pyrus calleryana & cvs - Callery Pear.....	202.87	
32 93 43 00-0097	EA	3" Caliper Pyrus calleryana & cvs - Callery Pear.....	229.05	
32 93 43 00-0098	EA	3-1/2" Caliper Pyrus calleryana & cvs - Callery Pear.....	255.23	
32 93 43 00-0099	EA	4" Caliper Pyrus calleryana & cvs - Callery Pear.....	327.22	
32 93 43 00-0100	EA	1 Gallon Ribes aureum - Golden Currant.....	7.13	
32 93 43 00-0101	EA	5 Gallon Ribes aureum - Golden Currant.....	20.40	
32 93 43 00-0102	EA	1 Gallon Ribes sanguineum - Red Flowering Currant.....	7.13	
32 93 43 00-0103	EA	5 Gallon Ribes sanguineum - Red Flowering Currant.....	20.40	
32 93 43 00-0104	EA	1 Gallon Ribes viburnifolium - Evergreen Currant.....	7.13	
32 93 43 00-0105	EA	5 Gallon Ribes viburnifolium - Evergreen Currant.....	20.40	
32 93 43 00-0106	EA	8' Cassia leptophlia - Gold Medallion Tree.....	194.90	
32 93 43 00-0107	EA	10' Cassia leptophlia - Gold Medallion Tree.....	247.37	
32 93 43 00-0108	EA	12' Cassia leptophlia - Gold Medallion Tree.....	299.84	
32 93 43 00-0109	EA	6' Magnolia grandiflora 'St. Mary's'.....	224.88	
32 93 43 00-0110	EA	8' Magnolia grandiflora 'St. Mary's'.....	397.29	
32 93 43 00-0111	EA	10' Magnolia grandiflora 'St. Mary's'.....	499.23	
32 93 43 00-0112	EA	12' Magnolia grandiflora 'St. Mary's'.....	599.68	
32 93 43 00-0113	EA	14' Magnolia grandiflora 'St. Mary's'.....	697.13	
32 93 43 00-0114	EA	16' Magnolia grandiflora 'St. Mary's'.....	824.56	
32 93 43 00-0115	EA	24" Box Magnolia grandiflora 'St. Mary's'.....	247.37	
32 93 43 00-0116	EA	6' Prunus cerasifera - Purple Leaf Plum.....	116.94	
32 93 43 00-0117	EA	8' Prunus cerasifera - Purple Leaf Plum.....	134.93	
32 93 43 00-0118	EA	10' Prunus cerasifera - Purple Leaf Plum.....	173.91	
32 93 43 00-0119	EA	24" Box Prunus cerasifera - Purple Leaf Plum.....	185.15	
32 93 43 00-0120	EA	30" Box Prunus cerasifera - Purple Leaf Plum.....	374.80	
32 93 43 00-0121	EA	36" Box Prunus cerasifera - Purple Leaf Plum.....	574.94	
32 93 43 00-0122	EA	6' Pittosporum phillyraeoides - Willow Pittorporum.....	244.37	
32 93 43 00-0123	EA	8' Pittosporum phillyraeoides - Willow Pittorporum.....	349.31	
32 93 43 00-0124	EA	10' Pittosporum phillyraeoides - Willow Pittorporum.....	418.28	
32 93 43 00-0125	EA	12' Pittosporum phillyraeoides - Willow Pittorporum.....	539.71	
32 93 43 00-0126	EA	6' Stenocarpus sinuatus - Firewheel Tree.....	359.81	
32 93 43 00-0127	EA	8' Stenocarpus sinuatus - Firewheel Tree.....	479.74	
32 93 43 00-0128	EA	10' Stenocarpus sinuatus - Firewheel Tree.....	599.68	
32 93 43 00-0129	EA	12' Stenocarpus sinuatus - Firewheel Tree.....	719.62	
32 93 43 00-0130	EA	24" Box Tabebuia ipi - Pink Trumpet.....	349.31	
32 93 43 00-0131	EA	36" Box Tabebuia ipi - Pink Trumpet.....	929.50	
32 93 43 00-0132	EA	1-1/2" Caliber Arbutus menziesii - Madrona.....	260.73	
32 93 43 00-0133	EA	2" Caliber Arbutus menziesii - Madrona.....	338.95	
32 93 43 00-0134	EA	2-1/2" Caliber Arbutus menziesii - Madrona.....	391.10	
32 93 43 00-0135	EA	3" Caliber Arbutus menziesii - Madrona.....	443.24	
32 93 43 00-0136	EA	3-1/2" Caliber Arbutus menziesii - Madrona.....	521.46	
32 93 43 00-0137	EA	1-1/2" Caliber Koelreuteria bipinnata - Chinese Lantern.....	179.90	
32 93 43 00-0138	EA	2" Caliber Koelreuteria bipinnata - Chinese Lantern.....	292.34	
32 93 43 00-0139	EA	2-1/2" Caliber Koelreuteria bipinnata - Chinese Lantern.....	359.81	
32 93 43 00-0140	EA	3" Caliber Koelreuteria bipinnata - Chinese Lantern.....	397.29	
32 93 43 00-0141	EA	24" Box Koelreuteria bipinnata - Chinese Lantern.....	175.41	
32 93 43 00-0142	EA	30" Box Koelreuteria bipinnata - Chinese Lantern.....	404.78	
32 93 43 00-0143	EA	36" Box Koelreuteria bipinnata - Chinese Lantern.....	633.41	
32 93 43 00-0144	EA	1-1/2" Cliber Koelreuteria paniculata - Golden Rain Tree.....	163.41	
32 93 43 00-0145	EA	2" Cliber Koelreuteria paniculata - Golden Rain Tree.....	265.36	
32 93 43 00-0146	EA	2-1/2" Cliber Koelreuteria paniculata - Golden Rain Tree.....	325.33	
32 93 43 00-0147	EA	3" Cliber Koelreuteria paniculata - Golden Rain Tree.....	367.30	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 93 43 00-0148	EA		6' Magnolia grandiflora - Southern Magnolia	110.94	
32 93 43 00-0149	EA		7' Magnolia grandiflora - Southern Magnolia	167.91	
32 93 43 00-0150	EA		8' Magnolia grandiflora - Southern Magnolia	235.37	
32 93 43 00-0151	EA		9' Magnolia grandiflora - Southern Magnolia	313.33	
32 93 43 00-0152	EA		10' Magnolia grandiflora - Southern Magnolia	476.75	
32 93 43 00-0153	EA		24" Box Magnolia grandiflora - Southern Magnolia.....	194.90	
32 93 43 00-0154	EA		1-1/2" Caliber Tipuana tipu - Tipu Tree.....	232.38	
32 93 43 00-0155	EA		2" Caliber Tipuana tipu - Tipu Tree	302.84	
32 93 43 00-0156	EA		2-1/2" Caliber Tipuana tipu - Tipu Tree.....	383.80	
32 93 43 00-0157	EA		3" Caliber Tipuana tipu - Tipu Tree	442.26	
32 93 43 00-0158	EA		3-1/2" Caliber Tipuana tipu - Tipu Tree.....	650.65	
32 93 43 00-0159	EA		4" Caliber Tipuana tipu - Tipu Tree	869.54	
32 93 43 00-0160	EA		24" Box Tipuana tipu - Tipu Tree	175.41	
32 93 43 00-0161	EA		6' Albizia julibrissin - Silk Tree	359.81	
32 93 43 00-0162	EA		8' Albizia julibrissin - Silk Tree	479.74	
32 93 43 00-0163	EA		10' Albizia julibrissin - Silk Tree	599.68	
32 93 43 00-0164	EA		12' Albizia julibrissin - Silk Tree	719.62	
32 93 43 00-0165	EA		6' Brachychiton acerifolius - Flame Tree	359.81	
32 93 43 00-0166	EA		8' Brachychiton acerifolius - Flame Tree	479.74	
32 93 43 00-0167	EA		10' Brachychiton acerifolius - Flame Tree.....	599.68	
32 93 43 00-0168	EA		12' Brachychiton acerifolius - Flame Tree.....	719.62	
32 93 43 00-0169	EA		1-1/2" Caliber Chilopsis linearis - Desert Willow	290.84	
32 93 43 00-0170	EA		2" Caliber Chilopsis linearis - Desert Willow	349.31	
32 93 43 00-0171	EA		2-1/2" Caliber Chilopsis linearis - Desert Willow	371.80	
32 93 43 00-0172	EA		3" Caliber Chilopsis linearis - Desert Willow	412.28	
32 93 43 00-0173	EA		5 Gallon Chionanthus retusus - Chinese Fringe Tree.....	14.99	
32 93 43 00-0174	EA		15 Gallon Chionanthus retusus - Chinese Fringe Tree.....	59.97	
32 93 43 00-0175	EA		24" Box Chionanthus retusus - Chinese Fringe Tree.....	299.84	
32 93 43 00-0176	EA		5 Gallon Calodendrum capense - Cape Chestnut	22.49	
32 93 43 00-0177	EA		15 Gallon Calodendrum capense - Cape Chestnut	89.95	
32 93 43 00-0178	EA		24" Box Calodendrum capense - Cape Chestnut	337.32	
32 93 43 00-0179	EA		6' Chionanthus virginicus - White Fringe Tree	179.90	
32 93 43 00-0180	EA		8' Chionanthus virginicus - White Fringe Tree	210.73	
32 93 43 00-0181	EA		10' Chionanthus virginicus - White Fringe Tree	293.51	
32 93 43 00-0182	EA		15 Gallon Geijera parvifolia - Australian Willow	90.31	
32 93 43 00-0183	EA		24" Box Geijera parvifolia - Australian Willow	185.89	
32 93 43 00-0184	EA		30" Box Geijera parvifolia - Australian Willow	346.20	
32 93 43 00-0185	EA		36" Box Geijera parvifolia - Australian Willow	496.72	
32 93 43 00-0186	EA		1-1/2" Caliber Ginko Biloba - Maidenhair Tree	267.93	
32 93 43 00-0187	EA		2" Caliber Ginko Biloba - Maidenhair Tree	373.29	
32 93 43 00-0188	EA		2-1/2" Caliber Ginko Biloba - Maidenhair Tree	450.05	
32 93 43 00-0189	EA		3" Caliber Ginko Biloba - Maidenhair Tree.....	525.31	
32 93 43 00-0190	EA		3-1/2" Caliber Ginko Biloba - Maidenhair Tree	687.88	
32 93 43 00-0191	EA		4" Caliber Ginko Biloba - Maidenhair Tree	734.54	
32 93 43 00-0192	EA		4-1/2" Caliber Ginko Biloba - Maidenhair Tree	782.70	
32 93 43 00-0193	EA		24" Box Ginko Biloba - Maidenhair Tree.....	244.60	
32 93 43 00-0194	EA		15 Gallon Sapium sebiferum - Chinese Tallow Tree.....	90.31	
32 93 43 00-0195	EA		24" Box Sapium sebiferum - Chinese Tallow Tree.....	331.14	
32 93 43 00-0196	EA		4' To 5' Lagerstroemia indica - Crape Myrtle	96.33	
32 93 43 00-0197	EA		6' Lagerstroemia indica - Crape Myrtle	179.12	
32 93 43 00-0198	EA		8' Lagerstroemia indica - Crape Myrtle	185.14	
32 93 43 00-0199	EA		10' Lagerstroemia indica - Crape Myrtle	224.27	
32 93 43 00-0200	EA		24" Box Lagerstroemia indica - Crape Myrtle	176.11	

32 93 43 00-0201

Shade Trees ^(32 93 43)

Note: All trees listed by caliper of trunk or height of tree if field grown, dug with spade, balled and burlapped and delivered to site.

32 93 43 00-0202	EA		3-1/2" To 4" Caliper Acer palmatum - Bloodgood Japanese Maple	292.02	
32 93 43 00-0203	EA		4" To 4-1/2" Caliper Acer palmatum - Bloodgood Japanese Maple	357.96	
32 93 43 00-0204	EA		4-1/2" To 5" Caliper Acer palmatum - Bloodgood Japanese Maple	466.29	
32 93 43 00-0205	EA		5" To 6" Caliper Acer palmatum - Bloodgood Japanese Maple	604.45	
32 93 43 00-0206	EA		2' To 2-1/2' Acer palmatum - Japanese Maple.....	30.80	
32 93 43 00-0207	EA		4' To 5' Acer palmatum - Japanese Maple	64.68	
32 93 43 00-0208	EA		5' To 6' Acer palmatum - Japanese Maple	84.70	
32 93 43 00-0209	EA		6' To 7' Acer palmatum - Japanese Maple.....	154.00	
32 93 43 00-0210	EA		7' To 8' Acer palmatum - Japanese Maple	215.60	
32 93 43 00-0211	EA		8' To 10' Acer palmatum - Japanese Maple.....	277.21	
32 93 43 00-0212	EA		10' To 12' Acer palmatum - Japanese Maple	369.61	
32 93 43 00-0213	EA		2" Caliper Acer platanoides & cvs - Norway Maple.....	157.00	
32 93 43 00-0214	EA		2" Caliper Acer platanoides & cvs - Norway Maple.....	191.13	
32 93 43 00-0215	EA		3" Caliper Acer platanoides & cvs - Norway Maple	245.74	
32 93 43 00-0216	EA		3-1/2" Caliper Acer platanoides & cvs - Norway Maple.....	286.70	
32 93 43 00-0217	EA		4" Caliper Acer platanoides & cvs - Norway Maple.....	307.17	
32 93 43 00-0218	EA		4-1/2" Caliper Acer platanoides & cvs - Norway Maple.....	334.48	
32 93 43 00-0219	EA		5" Caliper Acer platanoides & cvs - Norway Maple.....	375.43	
32 93 43 00-0220	EA		2" Caliper Acer rubrum & cvs - Red Maple	150.17	
32 93 43 00-0221	EA		2-1/2" Caliper Acer rubrum & cvs - Red Maple	191.13	
32 93 43 00-0222	EA		3" Caliper Acer rubrum & cvs - Red Maple	245.74	
32 93 43 00-0223	EA		3-1/2" Caliper Acer rubrum & cvs - Red Maple	300.35	
32 93 43 00-0224	EA		4" Caliper Acer rubrum & cvs - Red Maple	341.30	

32 Exterior Improvements**32 90 Planting****32 93 Plants**

MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

32 93 43 00-0225	EA	4-1/2" Caliper Acer rubrum & cvs - Red Maple	395.91	
32 93 43 00-0226	EA	5" Caliper Acer rubrum & cvs - Red Maple	443.70	
32 93 43 00-0227	EA	8' Clump Form Acer rubrum & cvs - Red Maple.....	184.30	
32 93 43 00-0228	EA	10' Clump Form Acer rubrum & cvs - Red Maple.....	245.74	
32 93 43 00-0229	EA	12' Clump Form Acer rubrum & cvs - Red Maple.....	286.70	
32 93 43 00-0230	EA	14' Clump Form Acer rubrum & cvs - Red Maple.....	327.65	
32 93 43 00-0231	EA	16' Clump Form Acer rubrum & cvs - Red Maple.....	368.61	
32 93 43 00-0232	EA	18' Clump Form Acer rubrum & cvs - Red Maple.....	409.57	
32 93 43 00-0233	EA	2" Caliper Aesculus hippocastanum & cvs - Common Horsechestnut	238.91	
32 93 43 00-0234	EA	2-1/2" Caliper Aesculus hippocastanum & cvs - Common Horsechestnut.....	266.22	
32 93 43 00-0235	EA	3" Caliper Aesculus hippocastanum & cvs - Common Horsechestnut	300.35	
32 93 43 00-0236	EA	3-1/2" Caliper Aesculus hippocastanum & cvs - Common Horsechestnut.....	341.30	
32 93 43 00-0237	EA	4" Caliper Aesculus hippocastanum & cvs - Common Horsechestnut.....	409.57	
32 93 43 00-0238	EA	2" Caliper Betula nigra - River Birch	170.65	
32 93 43 00-0239	EA	2-1/2" Caliper Betula nigra - River Birch	193.25	
32 93 43 00-0240	EA	3" Caliper Betula nigra - River Birch	218.43	
32 93 43 00-0241	EA	3-1/2" Caliper Betula nigra - River Birch	273.04	
32 93 43 00-0242	EA	4" Caliper Betula nigra - River Birch	307.17	
32 93 43 00-0243	EA	4-1/2" Caliper Betula nigra - River Birch	341.30	
32 93 43 00-0244	EA	5" Caliper Betula nigra - River Birch	375.43	
32 93 43 00-0245	EA	8' Clump Form Betula nigra - River Birch.....	157.00	
32 93 43 00-0246	EA	10' Clump Form Betula nigra - River Birch.....	177.48	
32 93 43 00-0247	EA	12' Clump Form Betula nigra - River Birch.....	204.78	
32 93 43 00-0248	EA	14' Clump Form Betula nigra - River Birch.....	238.91	
32 93 43 00-0249	EA	16' Clump Form Betula nigra - River Birch.....	273.04	
32 93 43 00-0250	EA	12' Clump Form Betula platyphylla japonica & cvs - Asian White Birch	204.78	
32 93 43 00-0251	EA	14' Clump Form Betula platyphylla japonica & cvs - Asian White Birch	245.74	
32 93 43 00-0252	EA	16' Clump Form Betula platyphylla japonica & cvs - Asian White Birch	286.70	
32 93 43 00-0253	EA	18' Clump Form Betula platyphylla japonica & cvs - Asian White Birch	341.30	
32 93 43 00-0254	EA	20' Clump Form Betula platyphylla japonica & cvs - Asian White Birch	354.96	
32 93 43 00-0255	EA	2" Caliper Carpinus betulus & cvs - European Hornbeam	273.04	
32 93 43 00-0256	EA	2-1/2" Caliper Carpinus betulus & cvs - European Hornbeam	307.17	
32 93 43 00-0257	EA	3" Caliper Carpinus betulus & cvs - European Hornbeam	354.96	
32 93 43 00-0258	EA	3-1/2" Caliper Carpinus betulus & cvs - European Hornbeam	430.04	
32 93 43 00-0259	EA	6' Clump Form Carpinus betulus & cvs - European Hornbeam.....	122.87	
32 93 43 00-0260	EA	7' Clump Form Carpinus betulus & cvs - European Hornbeam.....	170.65	
32 93 43 00-0261	EA	8' Clump Form Carpinus betulus & cvs - European Hornbeam.....	211.61	
32 93 43 00-0262	EA	2" Caliber Catalpa speciosa - Western Catalpa	150.17	
32 93 43 00-0263	EA	2-1/2" Caliber Catalpa speciosa - Western Catalpa.....	204.78	
32 93 43 00-0264	EA	3" Caliber Catalpa speciosa - Western Catalpa	266.22	
32 93 43 00-0265	EA	3-1/2" Caliber Catalpa speciosa - Western Catalpa.....	320.83	
32 93 43 00-0266	EA	4" Caliber Catalpa speciosa - Western Catalpa	368.61	
32 93 43 00-0267	EA	8' Clump Form Corylus cornuta californica - Western Filbert.....	191.13	
32 93 43 00-0268	EA	10' Clump Form Corylus cornuta californica - Western Filbert.....	232.09	
32 93 43 00-0269	EA	12' Clump Form Corylus cornuta californica - Western Filbert.....	273.04	
32 93 43 00-0270	EA	1-1/2" Caliber Diospyros - Persimmon	122.87	
32 93 43 00-0271	EA	2" Caliber Diospyros - Persimmon	150.17	
32 93 43 00-0272	EA	2-1/2" Caliber Diospyros - Persimmon.....	191.13	
32 93 43 00-0273	EA	3" Caliber Diospyros - Persimmon	238.91	
32 93 43 00-0274	EA	3-1/2" Caliber Diospyros - Persimmon.....	286.70	
32 93 43 00-0275	EA	2" Caliper Fagus sylvatica & cvs - European Beech	307.17	
32 93 43 00-0276	EA	2-1/2" Caliper Fagus sylvatica & cvs - European Beech.....	368.61	
32 93 43 00-0277	EA	3" Caliper Fagus sylvatica & cvs - European Beech	443.70	
32 93 43 00-0278	EA	3-1/2" Caliper Fagus sylvatica & cvs - European Beech.....	491.48	
32 93 43 00-0279	EA	4" Caliper Fagus sylvatica & cvs - European Beech.....	580.22	
32 93 43 00-0280	EA	4-1/2" Caliper Fagus sylvatica & cvs - European Beech.....	750.87	
32 93 43 00-0281	EA	5" Caliper Fagus sylvatica & cvs - European Beech.....	887.39	
32 93 43 00-0282	EA	2" Caliper Fraxinus americana & cvs - White Ash.....	170.65	
32 93 43 00-0283	EA	2-1/2" Caliper Fraxinus americana & cvs - White Ash	204.78	
32 93 43 00-0284	EA	3" Caliper Fraxinus americana & cvs - White Ash.....	259.39	
32 93 43 00-0285	EA	3-1/2" Caliper Fraxinus americana & cvs - White Ash	314.00	
32 93 43 00-0286	EA	4" Caliper Fraxinus americana & cvs - White Ash.....	368.61	
32 93 43 00-0287	EA	4-1/2" Caliper Fraxinus americana & cvs - White Ash	409.57	
32 93 43 00-0288	EA	5" Caliper Fraxinus americana & cvs - White Ash.....	477.83	
32 93 43 00-0289	EA	1-1/2" Caliper Ginkgo biloba & cvs - Ginkgo (Maidenhair Tree).....	238.91	
32 93 43 00-0290	EA	2" Caliper Ginkgo biloba & cvs - Ginkgo (Maidenhair Tree).....	266.22	
32 93 43 00-0291	EA	2-1/2" Caliper Ginkgo biloba & cvs - Ginkgo (Maidenhair Tree).....	300.35	
32 93 43 00-0292	EA	3" Caliper Ginkgo biloba & cvs - Ginkgo (Maidenhair Tree).....	334.48	
32 93 43 00-0293	EA	3-1/2" Caliper Ginkgo biloba & cvs - Ginkgo (Maidenhair Tree).....	375.43	
32 93 43 00-0294	EA	4" Caliper Ginkgo biloba & cvs - Ginkgo (Maidenhair Tree).....	409.57	
32 93 43 00-0295	EA	4-1/2" Caliper Ginkgo biloba & cvs - Ginkgo (Maidenhair Tree).....	614.35	
32 93 43 00-0296	EA	5" Caliper Ginkgo biloba & cvs - Ginkgo (Maidenhair Tree).....	682.61	
32 93 43 00-0297	EA	2" Caliper Gleditsia triacanthos inermis & cvs - Thornless Common Honeylocust.....	163.83	
32 93 43 00-0298	EA	2-1/2" Caliper Gleditsia triacanthos inermis & cvs - Thornless Common Honeylocust	204.78	
32 93 43 00-0299	EA	3" Caliper Gleditsia triacanthos inermis & cvs - Thornless Common Honeylocust.....	245.74	
32 93 43 00-0300	EA	3-1/2" Caliper Gleditsia triacanthos inermis & cvs - Thornless Common Honeylocust	286.70	
32 93 43 00-0301	EA	4" Caliper Gleditsia triacanthos inermis & cvs - Thornless Common Honeylocust.....	327.65	
32 93 43 00-0302	EA	4-1/2" Caliper Gleditsia triacanthos inermis & cvs - Thornless Common Honeylocust	368.61	
32 93 43 00-0303	EA	5" Caliper Gleditsia triacanthos inermis & cvs - Thornless Common Honeylocust.....	436.87	
32 93 43 00-0304	EA	10' - 12' Bursera Simaruba - Gumbo Limbo.....	86.35	
32 93 43 00-0305	EA	12' - 14' Bursera Simaruba - Gumbo Limbo.....	102.05	



MINOR	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 93 43 00-0306	EA	14' - 16' Bursera Simaruba - Gumbo Limbo.....	141.30	
32 93 43 00-0307	EA	17' - 18' Bursera Simaruba - Gumbo Limbo.....	183.69	
32 93 43 00-0308	EA	19' - 20' Bursera Simaruba - Gumbo Limbo.....	204.10	
32 93 43 00-0309	EA	21' - 22' Bursera Simaruba - Gumbo Limbo.....	241.78	
32 93 43 00-0310	EA	1-1/2" Caliber Juglans californica - California Walnut.....	163.83	
32 93 43 00-0311	EA	2" Caliber Juglans californica - California Walnut.....	191.13	
32 93 43 00-0312	EA	2-1/2" Caliber Juglans californica - California Walnut.....	238.91	
32 93 43 00-0313	EA	3" Caliber Juglans californica - California Walnut.....	300.35	
32 93 43 00-0314	EA	3-1/2" Caliber Juglans californica - California Walnut.....	368.61	
32 93 43 00-0315	EA	4" Caliber Juglans californica - California Walnut.....	443.70	
32 93 43 00-0316	EA	4-1/2" Caliber Juglans californica - California Walnut.....	511.96	
32 93 43 00-0317	EA	5" Caliber Juglans californica - California Walnut.....	580.22	
32 93 43 00-0318	EA	5 Gallon Koelreuteria Paniculata - Goldenrain Tree.....	18.48	
32 93 43 00-0319	EA	15 Gallon Koelreuteria Paniculata - Goldenrain Tree.....	46.20	
32 93 43 00-0320	EA	20 Gallon Koelreuteria Paniculata - Goldenrain Tree.....	92.40	
32 93 43 00-0321	EA	55 Gallon Koelreuteria Paniculata - Goldenrain Tree.....	120.12	
32 93 43 00-0322	EA	1-1/2" To 2" Caliper Koelreuteria Paniculata - Goldenrain Tree.....	87.78	
32 93 43 00-0323	EA	2" To 2-1/2" Caliper Koelreuteria Paniculata - Goldenrain Tree.....	106.26	
32 93 43 00-0324	EA	2-1/2" To 3" Caliper Koelreuteria Paniculata - Goldenrain Tree.....	147.84	
32 93 43 00-0325	EA	1-1/2" Caliper Liquidambar styraciflua - American Sweetgum.....	218.43	
32 93 43 00-0326	EA	2" Caliper Liquidambar styraciflua - American Sweetgum.....	273.04	
32 93 43 00-0327	EA	2-1/2" Caliper Liquidambar styraciflua - American Sweetgum.....	341.30	
32 93 43 00-0328	EA	3" Caliper Liquidambar styraciflua - American Sweetgum.....	409.57	
32 93 43 00-0329	EA	3-1/2" Caliper Liquidambar styraciflua - American Sweetgum.....	477.83	
32 93 43 00-0330	EA	1-1/2" Caliper Liriodendron tulipifera - Tulip Tree.....	218.43	
32 93 43 00-0331	EA	2" Caliper Liriodendron tulipifera - Tulip Tree.....	300.35	
32 93 43 00-0332	EA	2-1/2" Caliper Liriodendron tulipifera - Tulip Tree.....	354.96	
32 93 43 00-0333	EA	3" Caliper Liriodendron tulipifera - Tulip Tree.....	409.57	
32 93 43 00-0334	EA	3-1/2" Caliper Liriodendron tulipifera - Tulip Tree.....	464.17	
32 93 43 00-0335	EA	8' Clump Form Liriodendron tulipifera - Tulip Tree.....	163.83	
32 93 43 00-0336	EA	10' Clump Form Liriodendron tulipifera - Tulip Tree.....	293.52	
32 93 43 00-0337	EA	12' Clump Form Liriodendron tulipifera - Tulip Tree.....	354.96	
32 93 43 00-0338	EA	1-1/2" Caliper Nyssa sylvatica - Black Tupelo Sour Gum.....	218.43	
32 93 43 00-0339	EA	2" Caliper Nyssa sylvatica - Black Tupelo Sour Gum.....	273.04	
32 93 43 00-0340	EA	2-1/2" Caliper Nyssa sylvatica - Black Tupelo Sour Gum.....	341.30	
32 93 43 00-0341	EA	3" Caliper Nyssa sylvatica - Black Tupelo Sour Gum.....	409.57	
32 93 43 00-0342	EA	3-1/2" Caliper Nyssa sylvatica - Black Tupelo Sour Gum.....	477.83	
32 93 43 00-0343	EA	4' Clump Form Nyssa sylvatica - Black Tupelo Sour Gum.....	95.57	
32 93 43 00-0344	EA	5' Clump Form Nyssa sylvatica - Black Tupelo Sour Gum.....	109.22	
32 93 43 00-0345	EA	6' Clump Form Nyssa sylvatica - Black Tupelo Sour Gum.....	129.70	
32 93 43 00-0346	EA	7' Clump Form Nyssa sylvatica - Black Tupelo Sour Gum.....	163.83	
32 93 43 00-0347	EA	8' Clump Form Nyssa sylvatica - Black Tupelo Sour Gum.....	204.78	
32 93 43 00-0348	EA	30" Box Platanus Occidentalis - Buttonwood Sycamore.....	296.56	
32 93 43 00-0349	EA	36" Box Platanus Occidentalis - Buttonwood Sycamore.....	431.36	
32 93 43 00-0350	EA	42" Box Platanus occidentalis - Buttonwood Sycamore.....	641.68	
32 93 43 00-0351	EA	1-1/2" To 2" Caliper Platanus occidentalis - Buttonwood Sycamore.....	99.23	
32 93 43 00-0352	EA	2" To 2-1/2" Caliper Platanus occidentalis - Buttonwood Sycamore.....	118.63	
32 93 43 00-0353	EA	2-1/2" To 3" Caliper Platanus occidentalis - Buttonwood Sycamore.....	161.76	
32 93 43 00-0354	EA	3" To 3-1/2" Caliper Platanus occidentalis - Buttonwood Sycamore.....	196.30	
32 93 43 00-0355	EA	8' To 10' Platanus occidentalis - Green Or Silver Buttonwood.....	81.64	
32 93 43 00-0356	EA	10' To 12' Platanus occidentalis - Green Or Silver Buttonwood.....	102.05	
32 93 43 00-0357	EA	12' To 14' Platanus occidentalis - Green Or Silver Buttonwood.....	180.55	
32 93 43 00-0358	EA	16' To 18' Platanus occidentalis - Green Or Silver Buttonwood.....	259.05	
32 93 43 00-0359	EA	2" Caliber Platanus x acerifolia & cvs - London Planetree.....	163.83	
32 93 43 00-0360	EA	2-1/2" Caliber Platanus x acerifolia & cvs - London Planetree.....	197.96	
32 93 43 00-0361	EA	3" Caliber Platanus x acerifolia & cvs - London Planetree.....	238.91	
32 93 43 00-0362	EA	3-1/2" Caliber Platanus x acerifolia & cvs - London Planetree.....	286.70	
32 93 43 00-0363	EA	4" Caliber Platanus x acerifolia & cvs - London Planetree.....	341.30	
32 93 43 00-0364	EA	2" Caliber Populus alba & cvs - White Poplar.....	163.83	
32 93 43 00-0365	EA	2-1/2" Caliber Populus alba & cvs - White Poplar.....	191.13	
32 93 43 00-0366	EA	3" Caliber Populus alba & cvs - White Poplar.....	218.43	
32 93 43 00-0367	EA	3-1/2" Caliber Populus alba & cvs - White Poplar.....	259.39	
32 93 43 00-0368	EA	4" Caliber Populus alba & cvs - White Poplar.....	286.70	
32 93 43 00-0369	EA	4-1/2" Caliber Populus alba & cvs - White Poplar.....	327.65	
32 93 43 00-0370	EA	2" Caliber Populus deltoides & cvs - Eastern Cottonwood.....	150.17	
32 93 43 00-0371	EA	2-1/2" Caliber Populus deltoides & cvs - Eastern Cottonwood.....	197.96	
32 93 43 00-0372	EA	3" Caliber Populus deltoides & cvs - Eastern Cottonwood.....	238.91	
32 93 43 00-0373	EA	3-1/2" Caliber Populus deltoides & cvs - Eastern Cottonwood.....	286.70	
32 93 43 00-0374	EA	4" Caliber Populus deltoides & cvs - Eastern Cottonwood.....	341.30	
32 93 43 00-0375	EA	2" Caliber Quercus palustris - Pin Oak.....	150.17	
32 93 43 00-0376	EA	2-1/2" Caliber Quercus palustris - Pin Oak.....	204.78	
32 93 43 00-0377	EA	3" Caliber Quercus palustris - Pin Oak.....	266.22	
32 93 43 00-0378	EA	3-1/2" Caliber Quercus palustris - Pin Oak.....	307.17	
32 93 43 00-0379	EA	4" Caliber Quercus palustris - Pin Oak.....	354.96	
32 93 43 00-0380	EA	4-1/2" Caliber Quercus palustris - Pin Oak.....	402.74	
32 93 43 00-0381	EA	5" Caliber Quercus palustris - Pin Oak.....	443.70	
32 93 43 00-0382	EA	2" Caliber Quercus shumardii - Shumard Oak.....	232.09	
32 93 43 00-0383	EA	2-1/2" Caliber Quercus shumardii - Shumard Oak.....	293.52	
32 93 43 00-0384	EA	3" Caliber Quercus shumardii - Shumard Oak.....	341.30	
32 93 43 00-0385	EA	3-1/2" Caliber Quercus shumardii - Shumard Oak.....	409.57	
32 93 43 00-0386	EA	4" Caliber Quercus shumardii - Shumard Oak.....	477.83	

32 Exterior Improvements**32 90 Planting****32 93 Plants**MINOR
CSI UOM DESCRIPTIONTOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

32 93 43 00-0387	EA	4-1/2" Caliber Quercus shumardii - Shumard Oak.....	546.09	
32 93 43 00-0388	EA	5" Caliber Quercus shumardii - Shumard Oak.....	614.35	
32 93 43 00-0389	EA	24" Box Salix babylonica - Weeping Willow.....	172.54	
32 93 43 00-0390	EA	36" Box Salix babylonica - Weeping Willow.....	431.36	
32 93 43 00-0391	EA	1-1/2" To 2" Caliper Salix babylonica - Weeping Willow.....	99.23	
32 93 43 00-0392	EA	2" To 2-1/2" Caliper Salix babylonica - Weeping Willow.....	118.63	
32 93 43 00-0393	EA	2-1/2" To 3" Caliper Salix babylonica - Weeping Willow.....	129.41	
32 93 43 00-0394	EA	2' Thuja occidentalis - American Arborvitae.....	23.39	
32 93 43 00-0395	EA	2-1/2' Thuja occidentalis - American Arborvitae.....	25.28	
32 93 43 00-0396	EA	3' Thuja occidentalis - American Arborvitae.....	36.11	
32 93 43 00-0397	EA	4' Thuja occidentalis - American Arborvitae.....	49.61	
32 93 43 00-0398	EA	5' Thuja occidentalis - American Arborvitae.....	69.08	
32 93 43 00-0399	EA	6' Thuja occidentalis - American Arborvitae.....	95.77	
32 93 43 00-0400	EA	7' Thuja occidentalis - American Arborvitae.....	116.18	
32 93 43 00-0401	EA	8' Thuja occidentalis - American Arborvitae.....	163.28	
32 93 43 00-0402	EA	2" Caliper Tilia cordata & cvs - Littleleaf Linden.....	171.68	
32 93 43 00-0403	EA	2-1/2" Caliper Tilia cordata & cvs - Littleleaf Linden.....	207.38	
32 93 43 00-0404	EA	3" Caliper Tilia cordata & cvs - Littleleaf Linden.....	238.91	
32 93 43 00-0405	EA	3-1/2" Caliper Tilia cordata & cvs - Littleleaf Linden.....	293.52	
32 93 43 00-0406	EA	4" Caliper Tilia cordata & cvs - Littleleaf Linden.....	334.48	
32 93 43 00-0407	EA	4-1/2" Caliper Tilia cordata & cvs - Littleleaf Linden.....	375.43	
32 93 43 00-0408	EA	5" Caliper Tilia cordata & cvs - Littleleaf Linden.....	416.39	
32 93 43 00-0409	EA	2" Caliper Ulmus x 'Homestead' - Homestead Hybrid Elm.....	191.13	
32 93 43 00-0410	EA	2-1/2" Caliper Ulmus x 'Homestead' - Homestead Hybrid Elm.....	218.43	
32 93 43 00-0411	EA	3" Caliper Ulmus x 'Homestead' - Homestead Hybrid Elm.....	238.91	
32 93 43 00-0412	EA	3-1/2" Caliper Ulmus x 'Homestead' - Homestead Hybrid Elm.....	259.39	
32 93 43 00-0413	EA	4" Caliper Ulmus x 'Homestead' - Homestead Hybrid Elm.....	286.70	
32 93 43 00-0414	EA	4-1/2" Caliper Ulmus x 'Homestead' - Homestead Hybrid Elm.....	341.30	
32 93 43 00-0415	EA	5" Caliper Ulmus x 'Homestead' - Homestead Hybrid Elm.....	402.74	
32 93 43 00-0416	EA	2" Caliper Ulmus x 'Pioneer' - Pioneer Hybrid Elm.....	218.43	
32 93 43 00-0417	EA	2-1/2" Caliper Ulmus x 'Pioneer' - Pioneer Hybrid Elm.....	238.91	
32 93 43 00-0418	EA	3" Caliper Ulmus x 'Pioneer' - Pioneer Hybrid Elm.....	259.39	
32 93 43 00-0419	EA	3-1/2" Caliper Ulmus x 'Pioneer' - Pioneer Hybrid Elm.....	286.70	
32 93 43 00-0420	EA	4" Caliper Ulmus x 'Pioneer' - Pioneer Hybrid Elm.....	341.30	
32 93 43 00-0421	EA	4-1/2" Caliper Ulmus x 'Pioneer' - Pioneer Hybrid Elm.....	402.74	
32 93 43 00-0422	EA	5" Caliper Ulmus x 'Pioneer' - Pioneer Hybrid Elm.....	464.17	
32 93 43 00-0423	EA	2" Caliper Ulmus x 'Regal' - Regal Hybrid Elm.....	218.43	
32 93 43 00-0424	EA	2-1/2" Mary-Louise Parker Ulmus x 'Regal' - Regal Hybrid Elm.....	238.91	
32 93 43 00-0425	EA	3" Caliber Ulmus x 'Regal' - Regal Hybrid Elm.....	259.39	
32 93 43 00-0426	EA	3-1/2" Caliber Ulmus x 'Regal' - Regal Hybrid Elm.....	286.70	
32 93 43 00-0427	EA	4" Caliber Ulmus x 'Regal' - Regal Hybrid Elm.....	341.30	
32 93 43 00-0428	EA	4-1/2" Caliber Ulmus x 'Regal' - Regal Hybrid Elm.....	402.74	
32 93 43 00-0429	EA	5" Caliber Ulmus x 'Regal' - Regal Hybrid Elm.....	464.17	
32 93 43 00-0430	EA	1-1/2" To 2" Caliber Platanus acerifolia "Bloodgold" - London Plane.....	139.98	
32 93 43 00-0431	EA	2" To 2-1/2" Caliber Platanus acerifolia "Bloodgold" - London Plane.....	249.86	
32 93 43 00-0432	EA	2-1/2" To 3" Caliber Platanus acerifolia "Bloodgold" - London Plane.....	365.76	
32 93 43 00-0433	EA	3" To 3-1/2" Caliber Platanus acerifolia "Bloodgold" - London Plane.....	454.57	
32 93 43 00-0434	EA	3-1/2" To 4" Caliber Platanus acerifolia "Bloodgold" - London Plane.....	588.53	
32 93 43 00-0435	EA	4" To 5" Caliber Platanus acerifolia "Bloodgold" - London Plane.....	669.81	
32 93 43 00-0436	EA	24" Box Platanus acerifolia "Bloodgold" - London Plane.....	176.11	
32 93 43 00-0437	EA	1-1/2" Caliber Quercus suber - Cork Oak.....	210.73	
32 93 43 00-0438	EA	2" Caliber Quercus suber - Cork Oak.....	292.01	
32 93 43 00-0439	EA	2-1/2" Caliber Quercus suber - Cork Oak.....	373.29	
32 93 43 00-0440	EA	3" Caliber Quercus suber - Cork Oak.....	466.61	
32 93 43 00-0441	EA	3-1/2" Caliber Quercus suber - Cork Oak.....	699.92	
32 93 43 00-0442	EA	4" Caliber Quercus suber - Cork Oak.....	903.12	
32 93 43 00-0443	EA	4-1/2" Caliber Quercus suber - Cork Oak.....	1,174.06	
32 93 43 00-0444	EA	1-1/2" Caliber Quercus ilex - Holly Oak.....	233.31	
32 93 43 00-0445	EA	2" Caliber Quercus ilex - Holly Oak.....	314.59	
32 93 43 00-0446	EA	2-1/2" Caliber Quercus ilex - Holly Oak.....	385.33	
32 93 43 00-0447	EA	3" Caliber Quercus ilex - Holly Oak.....	466.61	
32 93 43 00-0448	EA	3-1/2" Caliber Quercus ilex - Holly Oak.....	699.92	
32 93 43 00-0449	EA	4" Caliber Quercus ilex - Holly Oak.....	903.12	

32 93 43 00-0450**Evergreen Trees** (32 93 43)

Note: All trees listed by caliper of trunk or height of tree if field grown, dug with spade, balled and burlapped and delivered to site.

32 93 43 00-0451	EA	2' To 3' Cedrus atlantica - Blue Atlas Cedar.....	14.56	
32 93 43 00-0452	EA	3' To 4' Cedrus atlantica - Blue Atlas Cedar.....	23.40	
32 93 43 00-0453	EA	4' To 5' Cedrus atlantica - Blue Atlas Cedar.....	34.77	
32 93 43 00-0454	EA	5' To 6' Cedrus atlantica - Blue Atlas Cedar.....	46.77	
32 93 43 00-0455	EA	7' To 8' Cedrus atlantica - Blue Atlas Cedar.....	66.41	
32 93 43 00-0456	EA	6' Cedrus decurrens - Incese Cedar.....	67.85	
32 93 43 00-0457	EA	8' Cedrus decurrens - Incese Cedar.....	140.35	
32 93 43 00-0458	EA	10' Cedrus decurrens - Incese Cedar.....	185.90	
32 93 43 00-0459	EA	12' Cedrus decurrens - Incese Cedar.....	246.32	
32 93 43 00-0460	EA	5 Gallon Cedrus deodara - Indian Cedar.....	8.33	
32 93 43 00-0461	EA	6' To 8' Cedrus deodara - Indian Cedar.....	60.09	
32 93 43 00-0462	EA	8' To 10' Cedrus deodara - Indian Cedar.....	69.57	
32 93 43 00-0463	EA	10' To 12' Cedrus deodara - Indian Cedar.....	94.85	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 93 43 00-0464	EA	12'	To 14' Cedrus deodara - Indian Cedar.....	123.30	
32 93 43 00-0465	EA	14'	To 16' Cedrus deodara - Indian Cedar.....	158.10	
32 93 43 00-0466	EA	15"	To 18" Chamaecyparis obtusa - Compact Hinoki Cypress.....	18.78	
32 93 43 00-0467	EA	18"	To 24" Chamaecyparis obtusa - Compact Hinoki Cypress.....	28.17	
32 93 43 00-0468	EA	2'	To 3' Chamaecyparis obtusa - Compact Hinoki Cypress.....	43.83	
32 93 43 00-0469	EA	3'	To 4' Chamaecyparis obtusa - Compact Hinoki Cypress.....	75.13	
32 93 43 00-0470	EA	5	Gallon Cupressocyparis leylandii - Leyland Cypress.....	10.33	
32 93 43 00-0471	EA	15	Gallon Cupressocyparis leylandii - Leyland Cypress.....	41.33	
32 93 43 00-0472	EA	4'	To 5' Cupressocyparis leylandii - Leyland Cypress.....	18.08	
32 93 43 00-0473	EA	5'	To 6' Cupressocyparis leylandii - Leyland Cypress.....	23.25	
32 93 43 00-0474	EA	6'	To 7' Cupressocyparis leylandii - Leyland Cypress.....	36.17	
32 93 43 00-0475	EA	24"	Box Cupressocyparis leylandii - Leyland Cypress.....	87.83	
32 93 43 00-0476	EA	1	Gallon Cupressus macrocarpa - Monterey Cypress.....	1.88	
32 93 43 00-0477	EA	5	Gallon Cupressus macrocarpa - Monterey Cypress.....	8.48	
32 93 43 00-0478	EA	15	Gallon Cupressus macrocarpa - Monterey Cypress.....	28.26	
32 93 43 00-0479	EA	5	Gallon Cupressus sempervirens - Italian Cypress.....	9.73	
32 93 43 00-0480	EA	15	Gallon Cupressus sempervirens - Italian Cypress.....	26.74	
32 93 43 00-0481	EA	1	Gallon Juniperus horizontalis "Bar Harbor" - Bar Harbor Juniper.....	2.86	
32 93 43 00-0482	EA	2	Gallon Juniperus horizontalis "Bar Harbor" - Bar Harbor Juniper.....	5.59	
32 93 43 00-0483	EA	3	Gallon Juniperus horizontalis "Bar Harbor" - Bar Harbor Juniper.....	6.93	
32 93 43 00-0484	EA	5	Gallon Juniperus horizontalis "Bar Harbor" - Bar Harbor Juniper.....	8.14	
32 93 43 00-0485	EA	1	Gallon Juniperus - Blue Sargent Juniper.....	2.86	
32 93 43 00-0486	EA	2	Gallon Juniperus - Blue Sargent Juniper.....	5.59	
32 93 43 00-0487	EA	3	Gallon Juniperus - Blue Sargent Juniper.....	6.93	
32 93 43 00-0488	EA	5	Gallon Juniperus - Blue Sargent Juniper.....	8.14	
32 93 43 00-0489	EA	5	Gallon Juniperus - Compact Pfitzer Juniper.....	8.14	
32 93 43 00-0490	EA	15"	To 18" Juniperus - Compact Pfitzer Juniper.....	8.81	
32 93 43 00-0491	EA	18"	To 24" Juniperus - Compact Pfitzer Juniper.....	10.64	
32 93 43 00-0492	EA	2'	To 2 1/2' Juniperus - Compact Pfitzer Juniper.....	15.80	
32 93 43 00-0493	EA	2-1/2'	To 3' Juniperus - Compact Pfitzer Juniper.....	18.30	
32 93 43 00-0494	EA	5'	To 6' Juniperus - Fairview Juniper.....	27.25	
32 93 43 00-0495	EA	1	Gallon Juniperus - Hollywood Juniper.....	3.65	
32 93 43 00-0496	EA	5	Gallon Juniperus - Hollywood Juniper.....	10.15	
32 93 43 00-0497	EA	15	Gallon Juniperus - Hollywood Juniper.....	43.03	
32 93 43 00-0498	EA	4'	To 5' Juniperus - Hollywood Juniper.....	28.45	
32 93 43 00-0499	EA	5'	To 6' Juniperus - Hollywood Juniper.....	36.65	
32 93 43 00-0500	EA	1	Gallon Juniperus - Parson's Juniper.....	2.86	
32 93 43 00-0501	EA	2	Gallon Juniperus - Parson's Juniper.....	5.65	
32 93 43 00-0502	EA	3	Gallon Juniperus - Parson's Juniper.....	6.99	
32 93 43 00-0503	EA	5	Gallon Juniperus - Parson's Juniper.....	8.27	
32 93 43 00-0504	EA	5	Gallon Juniperus - Skyrocket Juniper.....	10.21	
32 93 43 00-0505	EA	15	Gallon Juniperus - Skyrocket Juniper.....	43.46	
32 93 43 00-0506	EA	2'	To 3' Juniperus - Skyrocket Juniper.....	15.32	
32 93 43 00-0507	EA	3'	To 4' Juniperus - Skyrocket Juniper.....	21.70	
32 93 43 00-0508	EA	4'	To 5' Juniperus - Skyrocket Juniper.....	28.75	
32 93 43 00-0509	EA	5'	To 6' Juniperus - Skyrocket Juniper.....	37.08	
32 93 43 00-0510	EA	6'	To 8' Juniperus - Skyrocket Juniper.....	47.90	
32 93 43 00-0511	EA	1	Gallon Juniperus horizontalis "Wiltonii" - Blue Rug Juniper.....	2.86	
32 93 43 00-0512	EA	2	Gallon Juniperus horizontalis "Wiltonii" - Blue Rug Juniper.....	5.62	
32 93 43 00-0513	EA	3	Gallon Juniperus horizontalis "Wiltonii" - Blue Rug Juniper.....	6.90	
32 93 43 00-0514	EA	5	Gallon Juniperus horizontalis "Wiltonii" - Blue Rug Juniper.....	8.18	
32 93 43 00-0515	EA	1	Gallon Juniperus horizontalis "Plumosa" - Compact Andorra Juniper.....	2.86	
32 93 43 00-0516	EA	2	Gallon Juniperus horizontalis "Plumosa" - Compact Andorra Juniper.....	5.62	
32 93 43 00-0517	EA	3	Gallon Juniperus horizontalis "Plumosa" - Compact Andorra Juniper.....	6.90	
32 93 43 00-0518	EA	5	Gallon Juniperus horizontalis "Plumosa" - Compact Andorra Juniper.....	8.18	
32 93 43 00-0519	EA	4'	Metrosideros excelsus - New Zealand Christmas Tree.....	57.63	
32 93 43 00-0520	EA	5'	Metrosideros excelsus - New Zealand Christmas Tree.....	78.08	
32 93 43 00-0521	EA	6'	Metrosideros excelsus - New Zealand Christmas Tree.....	132.92	
32 93 43 00-0522	EA	8'	Metrosideros excelsus - New Zealand Christmas Tree.....	164.52	
32 93 43 00-0523	EA	24"	Box Metrosideros excelsus - New Zealand Christmas Tree.....	145.00	
32 93 43 00-0524	EA	3'	Pinus sylvestris - Scotch Pine.....	26.55	
32 93 43 00-0525	EA	4'	Pinus sylvestris - Scotch Pine.....	36.86	
32 93 43 00-0526	EA	5'	Pinus sylvestris - Scotch Pine.....	51.73	
32 93 43 00-0527	EA	6'	Pinus sylvestris - Scotch Pine.....	71.77	
32 93 43 00-0528	EA	7'	Pinus sylvestris - Scotch Pine.....	87.94	
32 93 43 00-0529	EA	8'	Pinus sylvestris - Scotch Pine.....	124.15	
32 93 43 00-0530	EA	9'	Pinus sylvestris - Scotch Pine.....	157.61	
32 93 43 00-0531	EA	10'	Pinus sylvestris - Scotch Pine.....	181.86	
32 93 43 00-0532	EA	12'	Pinus sylvestris - Scotch Pine.....	214.19	
32 93 43 00-0533	EA	14'	Pinus sylvestris - Scotch Pine.....	242.48	
32 93 43 00-0534	EA	16'	Pinus sylvestris - Scotch Pine.....	282.89	
32 93 43 00-0535	EA	1	Gallon Pinus thunbergiana - Japanese Black Pine.....	2.86	
32 93 43 00-0536	EA	5	Gallon Pinus thunbergiana - Japanese Black Pine.....	10.15	
32 93 43 00-0537	EA	15	Gallon Pinus thunbergiana - Japanese Black Pine.....	32.88	
32 93 43 00-0538	EA	2'	To 3' Pinus thunbergiana - Japanese Black Pine.....	13.92	
32 93 43 00-0539	EA	3'	To 4' Pinus thunbergiana - Japanese Black Pine.....	17.69	
32 93 43 00-0540	EA	4'	To 5' Pinus thunbergiana - Japanese Black Pine.....	26.56	
32 93 43 00-0541	EA	5'	To 6' Pinus thunbergiana - Japanese Black Pine.....	51.85	
32 93 43 00-0542	EA	6'	To 7' Pinus Thunbergiana - Japanese Black Pine.....	58.17	
32 93 43 00-0543	EA	7'	To 8' Pinus thunbergiana - Japanese Black Pine.....	72.70	
32 93 43 00-0544	EA	6'	Pinus flexilis & cvs - Limber Pine.....	101.03	

32 Exterior Improvements**32 90 Planting****32 93 Plants**MINOR
CSI UOM DESCRIPTIONTOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

32 93 43 00-0545	EA	7' Pinus flexilis & cvs - Limber Pine	117.20	
32 93 43 00-0546	EA	8' Pinus flexilis & cvs - Limber Pine	145.49	
32 93 43 00-0547	EA	9' Pinus flexilis & cvs - Limber Pine	177.82	
32 93 43 00-0548	EA	10' Pinus flexilis & cvs - Limber Pine	202.07	
32 93 43 00-0549	EA	1 Gallon Pinus mugo - Mugho Pine	3.77	
32 93 43 00-0550	EA	2 Gallon Pinus mugo - Mugho Pine	7.96	
32 93 43 00-0551	EA	3 Gallon Pinus mugo - Mugho Pine	9.97	
32 93 43 00-0552	EA	5 Gallon Pinus mugo - Mugho Pine	12.64	
32 93 43 00-0553	EA	12" To 15" Spread Pinus mugo - Mugho Pine.....	9.79	
32 93 43 00-0554	EA	15" To 18" Spread Pinus mugo - Mugho Pine.....	11.67	
32 93 43 00-0555	EA	18" To 24" Spread Pinus mugo - Mugho Pine.....	15.80	
32 93 43 00-0556	EA	2' To 2-1/2' Spread Pinus mugo - Mugho Pine.....	22.13	
32 93 43 00-0557	EA	2-1/2' To 3' Spread Pinus mugo - Mugho Pine.....	28.45	
32 93 43 00-0558	EA	3' To 3-1/2' Spread Pinus mugo - Mugho Pine.....	35.44	
32 93 43 00-0559	EA	3-1/2' To 4' Spread Pinus mugo - Mugho Pine.....	43.03	
32 93 43 00-0560	EA	6' Pinus nigra - Austrian Pine.....	101.03	
32 93 43 00-0561	EA	7' Pinus nigra - Austrian Pine.....	121.24	
32 93 43 00-0562	EA	8' Pinus nigra - Austrian Pine.....	157.61	
32 93 43 00-0563	EA	9' Pinus nigra - Austrian Pine.....	181.86	
32 93 43 00-0564	EA	10' Pinus nigra - Austrian Pine.....	214.19	
32 93 43 00-0565	EA	12' Pinus nigra - Austrian Pine.....	242.48	
32 93 43 00-0566	EA	14' Pinus nigra - Austrian Pine.....	270.77	
32 93 43 00-0567	EA	16' Pinus nigra - Austrian Pine.....	307.14	
32 93 43 00-0568	EA	1 Gallon Podocarpus - Chinese Podocarpus.....	1.88	
32 93 43 00-0569	EA	3 Gallon Podocarpus - Chinese Podocarpus.....	4.38	
32 93 43 00-0570	EA	7 Gallon Podocarpus - Chinese Podocarpus.....	12.64	
32 93 43 00-0571	EA	15 Gallon Podocarpus - Chinese Podocarpus.....	20.54	
32 93 43 00-0572	EA	4' To 5' Podocarpus - Chinese Podocarpus.....	31.61	
32 93 43 00-0573	EA	5' To 6' Sequoia sempervirens - Dawn Redwood	39.51	
32 93 43 00-0574	EA	6' To 8' Sequoia sempervirens - Dawn Redwood	53.34	
32 93 43 00-0575	EA	8' To 10 Sequoia sempervirens - Dawn Redwood	65.19	
32 93 43 00-0576	EA	3' To 4' Thuja occidentalis 'Wareana' - Siberian Arborvitae	7.62	
32 93 43 00-0577	EA	3' To 4' Thuja occidentalis 'Woodwardii' - Woodward Arborvitae	12.45	
32 93 43 00-0578	EA	6' Pinus canariensis - Canary Island Pine.....	223.08	
32 93 43 00-0579	EA	8' Pinus canariensis - Canary Island Pine.....	297.44	
32 93 43 00-0580	EA	10' Pinus canariensis - Canary Island Pine.....	371.80	
32 93 43 00-0581	EA	12' Pinus canariensis - Canary Island Pine.....	446.16	
32 93 43 00-0582	EA	24" Box Pinus canariensis - Canary Island Pine	132.92	
32 93 43 00-0583	EA	6' Pinus pinea - Italian Stone Pine	223.08	
32 93 43 00-0584	EA	8' Pinus pinea - Italian Stone Pine	297.44	
32 93 43 00-0585	EA	10' Pinus pinea - Italian Stone Pine	371.80	
32 93 43 00-0586	EA	12' Pinus pinea - Italian Stone Pine	446.16	
32 93 43 00-0587	EA	6' Pittosporum undulatum - Victorian Box	122.69	
32 93 43 00-0588	EA	8' Pittosporum undulatum - Victorian Box	194.27	
32 93 43 00-0589	EA	10' Pittosporum undulatum - Victorian Box	255.61	
32 93 43 00-0590	EA	6' Podocarpus gracilior - African Fern Pine.....	232.38	
32 93 43 00-0591	EA	8' Podocarpus gracilior - African Fern Pine.....	306.74	
32 93 43 00-0592	EA	10' Podocarpus gracilior - African Fern Pine.....	390.39	
32 93 43 00-0593	EA	12' Podocarpus gracilior - African Fern Pine.....	464.75	
32 93 43 00-0594	EA	24" Box Podocarpus gracilior - African Fern Pine	108.75	
32 93 43 00-0595	EA	6' Melaleuca linarifolia - Flaxleaf Paperbark.....	195.20	
32 93 43 00-0596	EA	8' Melaleuca linarifolia - Flaxleaf Paperbark.....	260.26	
32 93 43 00-0597	EA	10' Melaleuca linarifolia - Flaxleaf Paperbark.....	325.32	
32 93 43 00-0598	EA	12' Melaleuca linarifolia - Flaxleaf Paperbark.....	390.39	
32 93 43 00-0599	EA	24" Box Melaleuca linarifolia - Flaxleaf Paperbark.....	114.79	
32 93 43 00-0600	EA	6' Melaleuca quinquenervia - Cajeput Tree.....	195.20	
32 93 43 00-0601	EA	8' Melaleuca quinquenervia - Cajeput Tree.....	260.26	
32 93 43 00-0602	EA	10' Melaleuca quinquenervia - Cajeput Tree.....	325.32	
32 93 43 00-0603	EA	12' Melaleuca quinquenervia - Cajeput Tree.....	390.39	
32 93 43 00-0604	EA	24" Box Melaleuca quinquenervia - Cajeput Tree.....	108.75	
32 93 43 00-0605	EA	30" Box Melaleuca quinquenervia - Cajeput Tree.....	274.20	
32 93 43 00-0606	EA	36" Box Melaleuca quinquenervia - Cajeput Tree.....	432.22	
32 93 43 00-0607	EA	1 Gallon Podocarpus macrophyllus - Yew Pine	4.32	
32 93 43 00-0608	EA	3 Gallon Podocarpus macrophyllus - Yew Pine	10.13	
32 93 43 00-0609	EA	5 Gallon Podocarpus macrophyllus - Yew Pine	13.29	
32 93 43 00-0610	EA	15 Gallon Podocarpus macrophyllus - Yew Pine	57.63	
32 93 43 00-0611	EA	24" Box Podocarpus macrophyllus - Yew Pine	111.54	
32 93 43 00-0612	EA	24" Box Rhus lancea - African Sumac	114.79	
32 93 43 00-0613	EA	30" Box Rhus lancea - African Sumac	185.90	
32 93 43 00-0614	EA	8' Rhus lancea - African Sumac.....	278.85	
32 93 43 00-0615	EA	10' Rhus lancea - African Sumac.....	311.38	
32 93 43 00-0616	EA	12' Rhus lancea - African Sumac.....	371.80	

32 93 43 00-0617**Palm And Subtropical Trees (32 93 43)**

Note: All trees listed by caliper of trunk or height of tree if field grown, dug with spade, balled and burlapped and delivered to site.

32 93 43 00-0618	EA	4' To 5' Acacia baileyana - Bailey Acacia.....	262.50	
32 93 43 00-0619	EA	6' Acacia baileyana - Bailey Acacia	315.00	
32 93 43 00-0620	EA	8' Acacia baileyana - Bailey Acacia	367.50	
32 93 43 00-0621	EA	10' Acacia baileyana - Bailey Acacia	459.38	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 93 43 00-0622	EA	6'	Agonis flexuosa - Peppermint	157.50	
32 93 43 00-0623	EA	8'	Agonis flexuosa - Peppermint	196.88	
32 93 43 00-0624	EA	10'	Agonis flexuosa - Peppermint	236.25	
32 93 43 00-0625	EA	24"	Box Agonis flexuosa - Peppermint.....	196.22	
32 93 43 00-0626	EA	4' To 5'	Bauninia blakeana - Hong Kong Orchid	282.19	
32 93 43 00-0627	EA	6'	Bauninia blakeana - Hong Kong Orchid	334.69	
32 93 43 00-0628	EA	8'	Bauninia blakeana - Hong Kong Orchid.....	446.25	
32 93 43 00-0629	EA	10'	Bauninia blakeana - Hong Kong Orchid.....	557.81	
32 93 43 00-0630	EA	6'	Bauhinia purpurea - Purple Orchid Tree	354.38	
32 93 43 00-0631	EA	8'	Bauhinia purpurea - Purple Orchid Tree	472.50	
32 93 43 00-0632	EA	10'	Bauhinia purpurea - Purple Orchid Tree	590.62	
32 93 43 00-0633	EA	24"	Box Bauhinia purpurea - Purple Orchid Tree.....	153.56	
32 93 43 00-0634	EA	6'	Bauhinia variegata candida - White Orchid Tree.....	393.75	
32 93 43 00-0635	EA	8'	Bauhinia variegata candida - White Orchid Tree.....	525.00	
32 93 43 00-0636	EA	10'	Bauhinia variegata candida - White Orchid Tree.....	656.25	
32 93 43 00-0637	EA	6'	Callistemon citrinus - Crimson or Lemon Bottle Brush	354.38	
32 93 43 00-0638	EA	8'	Callistemon citrinus - Crimson or Lemon Bottle Brush.....	472.50	
32 93 43 00-0639	EA	10'	Callistemon citrinus - Crimson or Lemon Bottle Brush.....	590.62	
32 93 43 00-0640	EA	6'	Callistemon viminalis - Weeping Bottle Brush.....	354.38	
32 93 43 00-0641	EA	8'	Callistemon viminalis - Weeping Bottle Brush.....	472.50	
32 93 43 00-0642	EA	10'	Callistemon viminalis - Weeping Bottle Brush.....	590.62	
32 93 43 00-0643	EA	12'	Callistemon viminalis - Weeping Bottle Brush.....	708.75	
32 93 43 00-0644	EA	6'	Eriobotrya deflexa - Bronze Loquat.....	354.38	
32 93 43 00-0645	EA	8'	Eriobotrya deflexa - Bronze Loquat.....	472.50	
32 93 43 00-0646	EA	10'	Eriobotrya deflexa - Bronze Loquat.....	590.62	
32 93 43 00-0647	EA	6'	Eucalyptus erythrocorys - Red Cap Gum.....	354.38	
32 93 43 00-0648	EA	8'	Eucalyptus erythrocorys - Red Cap Gum.....	472.50	
32 93 43 00-0649	EA	10'	Eucalyptus erythrocorys - Red Cap Gum.....	590.62	
32 93 43 00-0650	EA	6'	Eucalyptus gunnii - Cider Gum.....	354.38	
32 93 43 00-0651	EA	8'	Eucalyptus gunnii - Cider Gum.....	472.50	
32 93 43 00-0652	EA	10'	Eucalyptus gunnii - Cider Gum.....	590.62	
32 93 43 00-0653	EA	6'	Eucalyptus leucoxydon - White Ironbark	354.38	
32 93 43 00-0654	EA	8'	Eucalyptus leucoxydon - White Ironbark.....	472.50	
32 93 43 00-0655	EA	10'	Eucalyptus leucoxydon - White Ironbark	590.62	
32 93 43 00-0656	EA	12'	Eucalyptus leucoxydon - White Ironbark	708.75	
32 93 43 00-0657	EA	6'	Eucalyptus polyanthemos - Silver Dollar Gum	354.38	
32 93 43 00-0658	EA	8'	Eucalyptus polyanthemos - Silver Dollar Gum	472.50	
32 93 43 00-0659	EA	10'	Eucalyptus polyanthemos - Silver Dollar Gum	590.62	
32 93 43 00-0660	EA	6'	Eucalyptus torquata - Coral Gum	354.38	
32 93 43 00-0661	EA	8'	Eucalyptus torquata - Coral Gum	472.50	
32 93 43 00-0662	EA	10'	Eucalyptus torquata - Coral Gum	590.62	
32 93 43 00-0663	EA	8'	Fraxinus oxycarpa "Raywood" - Raywood Ash.....	367.50	
32 93 43 00-0664	EA	10'	Fraxinus oxycarpa "Raywood" - Raywood Ash.....	498.75	
32 93 43 00-0665	EA	12'	Fraxinus oxycarpa "Raywood" - Raywood Ash.....	616.88	
32 93 43 00-0666	EA	6'	Jacarandra acutifolia - Jacaranda.....	354.38	
32 93 43 00-0667	EA	8'	Jacarandra acutifolia - Jacaranda.....	472.50	
32 93 43 00-0668	EA	10'	Jacarandra acutifolia - Jacaranda.....	590.62	
32 93 43 00-0669	EA	24"	Box Jacarandra acutifolia - Jacaranda	153.56	
32 93 43 00-0670	EA	6'	Olea europaea - Olive "Fruitless".....	354.38	
32 93 43 00-0671	EA	8'	Olea europaea - Olive "Fruitless".....	472.50	
32 93 43 00-0672	EA	10'	Olea europaea - Olive "Fruitless".....	590.62	
32 93 43 00-0673	EA	12'	Olea europaea - Olive "Fruitless".....	708.75	
32 93 43 00-0674	EA	24"	Box Olea europaea - Olive "Fruitless".....	435.75	
32 93 43 00-0675	EA	5 Gallon	Pistacia chinensis - Chinese Pistache.....	23.62	
32 93 43 00-0676	EA	15 Gallon	Pistacia chinensis - Chinese Pistache.....	78.75	
32 93 43 00-0677	EA	24"	Box Pistacia chinensis - Chinese Pistache.....	305.81	
32 93 43 00-0678	EA	36"	Box Pistacia chinensis - Chinese Pistache.....	813.75	
32 93 43 00-0679	EA	48"	Box Pistacia chinensis - Chinese Pistache.....	1,732.50	
32 93 43 00-0680	EA	9'	Ptychosperma elegans - Alexander Palm.....	98.44	
32 93 43 00-0681	EA	11'	Ptychosperma elegans - Alexander Palm.....	164.06	
32 93 43 00-0682	EA	15'	Ptychosperma elegans - Alexander Palm.....	249.38	
32 93 43 00-0683	EA	17'	Ptychosperma elegans - Alexander Palm.....	282.19	
32 93 43 00-0684	EA	20'	Ptychosperma elegans - Alexander Palm.....	328.12	
32 93 43 00-0685	EA	5 Gallon	Pyrus kawakamii - Evergreen Pear, Single	24.41	
32 93 43 00-0686	EA	15 Gallon	Pyrus kawakamii - Evergreen Pear, Single	81.38	
32 93 43 00-0687	EA	24"	Box Pyrus kawakamii - Evergreen Pear, Single	305.81	
32 93 43 00-0688	EA	30"	Box Pyrus kawakamii - Evergreen Pear, Single	559.12	
32 93 43 00-0689	EA	36"	Box Pyrus kawakamii - Evergreen Pear, Single	813.75	
32 93 43 00-0690	EA	5 Gallon	Pyrus kawakamii - Evergreen Pear, Multi.....	24.41	
32 93 43 00-0691	EA	15 Gallon	Pyrus kawakamii - Evergreen Pear, Multi.....	86.62	
32 93 43 00-0692	EA	24"	Box Pyrus kawakamii - Evergreen Pear, Multi.....	315.00	
32 93 43 00-0693	EA	30"	Box Pyrus kawakamii - Evergreen Pear, Multi.....	559.12	
32 93 43 00-0694	EA	36"	Box Pyrus kawakamii - Evergreen Pear, Multi.....	813.75	
32 93 43 00-0695	EA	6'	Washingtonia robusta - Mexican Fan Palm.....	354.38	
32 93 43 00-0696	EA	8'	Washingtonia robusta - Mexican Fan Palm.....	472.50	
32 93 43 00-0697	EA	10'	Washingtonia robusta - Mexican Fan Palm.....	590.62	
32 93 43 00-0698	EA	12'	Washingtonia robusta - Mexican Fan Palm.....	708.75	

32 93 53 Planting Of Trees, Shrubs And Ground Cover (32 93)

Note: Includes moving plant(s) from truck or staging site to planting site, excavation of hole, placing plant in hole, backfill and

32 Exterior Improvements**32 90 Planting****32 93 Plants**

MINOR

CSI UOM DESCRIPTION

TOTAL DIRECT
UNIT COSTDEMOLITION
UNIT COST

compaction. Use appropriate gallon, height or caliper size to match with description from plant section.

32 93 53 00-0001	Planting Trees <small>(32 93 53)</small>		
32 93 53 00-0002	EA 3" To 5" Bare Root Seedlings Tree Planting	1.14	
32 93 53 00-0003	EA 6" To 10" Bare Root Seedlings Tree Planting	1.83	
32 93 53 00-0004	EA 11" To 16" Bare Root Seedlings Tree Planting	2.29	
32 93 53 00-0005	EA 17" To 24" Bare Root Seedlings Tree Planting	3.65	
32 93 53 00-0006	EA 1 Gallon Container Tree Planting.....	18.26	
	For >10 To 25, Deduct	-0.91	
	For >25 To 50, Deduct	-2.28	
	For >50 To 100, Deduct	-3.65	
	For >100, Deduct	-5.48	
32 93 53 00-0007	EA 2 Gallon Container Tree Planting.....	25.58	
	For >10 To 25, Deduct	-1.28	
	For >25 To 50, Deduct	-3.20	
	For >50 To 100, Deduct	-5.12	
	For >100, Deduct	-7.67	
32 93 53 00-0008	EA 3 Gallon Container Tree Planting.....	32.88	
	For >10 To 25, Deduct	-1.64	
	For >25 To 50, Deduct	-4.11	
	For >50 To 100, Deduct	-6.58	
	For >100, Deduct	-9.86	
32 93 53 00-0009	EA 5 Gallon Container Tree Planting.....	54.80	
	For >10 To 25, Deduct	-2.74	
	For >25 To 50, Deduct	-6.85	
	For >50 To 100, Deduct	-10.96	
	For >100, Deduct	-16.44	
32 93 53 00-0010	EA 7 Gallon Container Tree Planting.....	73.07	
	For >10 To 25, Deduct	-3.65	
	For >25 To 50, Deduct	-9.13	
	For >50 To 100, Deduct	-14.61	
	For >100, Deduct	-21.92	
32 93 53 00-0011	EA 10 Gallon Container Tree Planting.....	94.99	
	For >10 To 25, Deduct	-4.75	
	For >25 To 50, Deduct	-11.87	
	For >50 To 100, Deduct	-19.00	
	For >100, Deduct	-28.50	
32 93 53 00-0012	EA 15 Gallon Container Tree Planting.....	135.17	
	For >10 To 25, Deduct	-6.76	
	For >25 To 50, Deduct	-16.90	
	For >50 To 100, Deduct	-27.03	
	For >100, Deduct	-40.55	
32 93 53 00-0013	EA 20 Gallon Container Tree Planting.....	222.86	
	For >10 To 25, Deduct	-11.14	
	For >25 To 50, Deduct	-27.86	
	For >50 To 100, Deduct	-44.57	
	For >100, Deduct	-66.86	
32 93 53 00-0014	EA 25 Gallon Container Tree Planting.....	288.62	
	For >10 To 25, Deduct	-14.43	
	For >25 To 50, Deduct	-36.08	
	For >50 To 100, Deduct	-57.72	
	For >100, Deduct	-86.59	
32 93 53 00-0015	EA 30 Gallon Container Tree Planting.....	347.07	
	For >10 To 25, Deduct	-17.35	
	For >25 To 50, Deduct	-43.38	
	For >50 To 100, Deduct	-69.41	
	For >100, Deduct	-104.12	
32 93 53 00-0016	EA 45 Gallon Container Tree Planting.....	431.10	
	For >10 To 25, Deduct	-21.56	
	For >25 To 50, Deduct	-53.89	
	For >50 To 100, Deduct	-86.22	
	For >100, Deduct	-129.33	
32 93 53 00-0017	EA 65 Gallon Container Tree Planting.....	511.48	
	For >10 To 25, Deduct	-25.57	
	For >25 To 50, Deduct	-63.94	
	For >50 To 100, Deduct	-102.30	
	For >100, Deduct	-153.44	
32 93 53 00-0018	EA 6' Balled And Burlapped Tree Planting	182.67	
	For >10 To 25, Deduct	-9.13	
	For >25 To 50, Deduct	-22.83	
	For >50 To 100, Deduct	-36.53	
	For >100, Deduct	-54.80	
32 93 53 00-0019	EA 7' Balled And Burlapped Tree Planting	243.32	
	For >10 To 25, Deduct	-12.17	
	For >25 To 50, Deduct	-30.42	
	For >50 To 100, Deduct	-48.66	
	For >100, Deduct	-73.00	
32 93 53 00-0020	EA 8' Balled And Burlapped Tree Planting	274.01	
	For >10 To 25, Deduct	-13.70	
	For >25 To 50, Deduct	-34.25	
	For >50 To 100, Deduct	-54.80	
	For >100, Deduct	-82.20	



Exterior Improvements		32
Planting		32 90
Plants		32 93

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 93 53 00-0021 EA 10' Balled And Burlapped Tree Planting	319.67	
For >10 To 25, Deduct	-15.98	
For >25 To 50, Deduct	-39.96	
For >50 To 100, Deduct	-63.93	
For >100, Deduct	-95.90	
32 93 53 00-0022 EA 12' Balled And Burlapped Tree Planting	427.45	
For >10 To 25, Deduct	-21.37	
For >25 To 50, Deduct	-53.43	
For >50 To 100, Deduct	-85.49	
For >100, Deduct	-128.24	
32 93 53 00-0023 EA 14' Balled And Burlapped Tree Planting	489.56	
For >10 To 25, Deduct	-24.48	
For >25 To 50, Deduct	-61.20	
For >50 To 100, Deduct	-97.91	
For >100, Deduct	-146.87	
32 93 53 00-0024 EA 16' Balled And Burlapped Tree Planting	593.69	
For >10 To 25, Deduct	-29.68	
For >25 To 50, Deduct	-74.21	
For >50 To 100, Deduct	-118.74	
For >100, Deduct	-178.11	
32 93 53 00-0025 EA 18' Balled And Burlapped Tree Planting	712.42	
For >10 To 25, Deduct	-35.62	
For >25 To 50, Deduct	-89.05	
For >50 To 100, Deduct	-142.48	
For >100, Deduct	-213.73	
32 93 53 00-0026 EA 20' Balled And Burlapped Tree Planting	822.03	
For >10 To 25, Deduct	-41.10	
For >25 To 50, Deduct	-102.75	
For >50 To 100, Deduct	-164.41	
For >100, Deduct	-246.61	
32 93 53 00-0027 EA 1-1/2" Caliber Balled And Burlapped Tree Planting	274.01	
For >10 To 25, Deduct	-13.70	
For >25 To 50, Deduct	-34.25	
For >50 To 100, Deduct	-54.80	
For >100, Deduct	-82.20	
32 93 53 00-0028 EA 2" Caliber Balled And Burlapped Tree Planting	319.67	
For >10 To 25, Deduct	-15.98	
For >25 To 50, Deduct	-39.96	
For >50 To 100, Deduct	-63.93	
For >100, Deduct	-95.90	
32 93 53 00-0029 EA 2-1/2" Caliber Balled And Burlapped Tree Planting	429.28	
For >10 To 25, Deduct	-21.46	
For >25 To 50, Deduct	-53.66	
For >50 To 100, Deduct	-85.86	
For >100, Deduct	-128.78	
32 93 53 00-0030 EA 3" Caliber Balled And Burlapped Tree Planting	493.22	
For >10 To 25, Deduct	-24.66	
For >25 To 50, Deduct	-61.65	
For >50 To 100, Deduct	-98.64	
For >100, Deduct	-147.97	
32 93 53 00-0031 EA 3-1/2" Caliber Balled And Burlapped Tree Planting	548.01	
For >10 To 25, Deduct	-27.40	
For >25 To 50, Deduct	-68.50	
For >50 To 100, Deduct	-109.60	
For >100, Deduct	-164.40	
32 93 53 00-0032 EA 4" Caliber Balled And Burlapped Tree Planting	628.39	
For >10 To 25, Deduct	-31.42	
For >25 To 50, Deduct	-78.55	
For >50 To 100, Deduct	-125.68	
For >100, Deduct	-188.52	
32 93 53 00-0033 Planting Shrubs <small>(32 93 53)</small>		
32 93 53 00-0034 EA 1 Gallon Container Shrub Planting	15.54	
For >10 To 25, Deduct	-0.78	
For >25 To 50, Deduct	-1.94	
For >50 To 100, Deduct	-3.11	
For >100, Deduct	-4.66	
32 93 53 00-0035 EA 2 Gallon Container Shrub Planting	21.93	
For >10 To 25, Deduct	-1.10	
For >25 To 50, Deduct	-2.74	
For >50 To 100, Deduct	-4.39	
For >100, Deduct	-6.58	
32 93 53 00-0036 EA 3 Gallon Container Shrub Planting	27.40	
For >10 To 25, Deduct	-1.37	
For >25 To 50, Deduct	-3.43	
For >50 To 100, Deduct	-5.48	
For >100, Deduct	-8.22	
32 93 53 00-0037 EA 4 Gallon Container Shrub Planting	36.54	
For >10 To 25, Deduct	-1.83	
For >25 To 50, Deduct	-4.57	
For >50 To 100, Deduct	-7.31	
For >100, Deduct	-10.96	

32 Exterior Improvements**32 90 Planting****32 93 Plants**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 93 53 00-0038 EA 5 Gallon Container Shrub Planting.....	45.67	
For >10 To 25, Deduct	-2.28	
For >25 To 50, Deduct	-5.71	
For >50 To 100, Deduct	-9.13	
For >100, Deduct	-13.70	
32 93 53 00-0039 EA 7 Gallon Container Shrub Planting.....	62.11	
For >10 To 25, Deduct	-3.11	
For >25 To 50, Deduct	-7.76	
For >50 To 100, Deduct	-12.42	
For >100, Deduct	-18.63	
32 93 53 00-0040 EA 10 Gallon Container Shrub Planting.....	82.20	
For >10 To 25, Deduct	-4.11	
For >25 To 50, Deduct	-10.28	
For >50 To 100, Deduct	-16.44	
For >100, Deduct	-24.66	
32 93 53 00-0041 EA 15 Gallon Container Shrub Planting.....	113.26	
For >10 To 25, Deduct	-5.66	
For >25 To 50, Deduct	-14.16	
For >50 To 100, Deduct	-22.65	
For >100, Deduct	-33.98	
32 93 53 00-0042 EA 20 Gallon Container Shrub Planting.....	189.98	
For >10 To 25, Deduct	-9.50	
For >25 To 50, Deduct	-23.75	
For >50 To 100, Deduct	-38.00	
For >100, Deduct	-56.99	
32 93 53 00-0043 EA 25 Gallon Container Shrub Planting.....	243.32	
For >10 To 25, Deduct	-12.17	
For >25 To 50, Deduct	-30.42	
For >50 To 100, Deduct	-48.66	
For >100, Deduct	-73.00	
32 93 53 00-0044 EA 15" Balled And Burlapped Shrub Planting.....	51.15	
For >10 To 25, Deduct	-2.56	
For >25 To 50, Deduct	-6.39	
For >50 To 100, Deduct	-10.23	
For >100, Deduct	-15.35	
32 93 53 00-0045 EA 18" Balled And Burlapped Shrub Planting.....	52.98	
For >10 To 25, Deduct	-2.65	
For >25 To 50, Deduct	-6.62	
For >50 To 100, Deduct	-10.60	
For >100, Deduct	-15.89	
32 93 53 00-0046 EA 24" Balled And Burlapped Shrub Planting.....	58.45	
For >10 To 25, Deduct	-2.92	
For >25 To 50, Deduct	-7.31	
For >50 To 100, Deduct	-11.69	
For >100, Deduct	-17.54	
32 93 53 00-0047 EA 30" Balled And Burlapped Shrub Planting.....	58.45	
For >10 To 25, Deduct	-2.92	
For >25 To 50, Deduct	-7.31	
For >50 To 100, Deduct	-11.69	
For >100, Deduct	-17.54	
32 93 53 00-0048 EA 36" Balled And Burlapped Shrub Planting.....	63.93	
For >10 To 25, Deduct	-3.20	
For >25 To 50, Deduct	-7.99	
For >50 To 100, Deduct	-12.79	
For >100, Deduct	-19.18	
32 93 53 00-0049 EA 42" Balled And Burlapped Shrub Planting.....	67.59	
For >10 To 25, Deduct	-3.38	
For >25 To 50, Deduct	-8.45	
For >50 To 100, Deduct	-13.52	
For >100, Deduct	-20.28	
32 93 53 00-0050 EA 48" Balled And Burlapped Shrub Planting.....	73.07	
For >10 To 25, Deduct	-3.65	
For >25 To 50, Deduct	-9.13	
For >50 To 100, Deduct	-14.61	
For >100, Deduct	-21.92	
32 93 53 00-0051 EA 5' Balled And Burlapped Shrub Planting.....	109.61	
For >10 To 25, Deduct	-5.48	
For >25 To 50, Deduct	-13.70	
For >50 To 100, Deduct	-21.92	
For >100, Deduct	-32.88	
32 93 53 00-0052 EA 6' Balled And Burlapped Shrub Planting.....	155.27	
For >10 To 25, Deduct	-7.76	
For >25 To 50, Deduct	-19.41	
For >50 To 100, Deduct	-31.05	
For >100, Deduct	-46.58	
32 93 53 00-0053 EA 7' Balled And Burlapped Shrub Planting.....	206.42	
For >10 To 25, Deduct	-10.32	
For >25 To 50, Deduct	-25.80	
For >50 To 100, Deduct	-41.28	
For >100, Deduct	-61.93	
32 93 53 00-0054 EA 8' Balled And Burlapped Shrub Planting.....	233.82	
For >10 To 25, Deduct	-11.69	
For >25 To 50, Deduct	-29.23	
For >50 To 100, Deduct	-46.76	
For >100, Deduct	-70.15	



		Exterior Improvements	32
		Planting	32 90
		Plants	32 93

MINOR	CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 93 53 00-0055	EA 9' Balled And Burlapped Shrub Planting..... <i>For >10 To 25, Deduct</i> <i>For >25 To 50, Deduct</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	252.09 -12.60 -31.51 -50.42 -75.63	
32 93 53 00-0056	EA 10' Balled And Burlapped Shrub Planting..... <i>For >10 To 25, Deduct</i> <i>For >25 To 50, Deduct</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	274.01 -13.70 -34.25 -54.80 -82.20	
32 93 53 00-0057	Planting Groundcover, Vines, Perennials, Annuals And Bulbs <small>(32 93 53)</small> See CSI section 32 91 13 16-0001 for mulch.		
32 93 53 00-0058	EA 2-1/4" Diameter Potted Groundcover And Flower Planting..... <i>For >10 To 25, Deduct</i> <i>For >25 To 50, Deduct</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	1.52 -0.08 -0.19 -0.30 -0.46	
32 93 53 00-0059	EA 3" Diameter Potted Groundcover And Flower Planting..... <i>For >10 To 25, Deduct</i> <i>For >25 To 50, Deduct</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	1.73 -0.09 -0.22 -0.35 -0.52	
32 93 53 00-0060	EA 4" Diameter Potted Groundcover And Flower Planting..... <i>For >10 To 25, Deduct</i> <i>For >25 To 50, Deduct</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	2.03 -0.10 -0.25 -0.41 -0.61	
32 93 53 00-0061	EA 5-1/2" Diameter Potted Groundcover And Flower Planting..... <i>For >10 To 25, Deduct</i> <i>For >25 To 50, Deduct</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	2.44 -0.12 -0.31 -0.49 -0.73	
32 93 53 00-0062	EA 6" Diameter Potted Groundcover And Flower Planting..... <i>For >10 To 25, Deduct</i> <i>For >25 To 50, Deduct</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	3.05 -0.15 -0.38 -0.61 -0.92	
32 93 53 00-0063	EA 8" Diameter Potted Groundcover And Flower Planting..... <i>For >10 To 25, Deduct</i> <i>For >25 To 50, Deduct</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	4.56 -0.23 -0.57 -0.91 -1.37	
32 93 53 00-0064	EA 1 Gallon Container Groundcover And Flower Planting..... <i>For >10 To 25, Deduct</i> <i>For >25 To 50, Deduct</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	14.61 -0.73 -1.83 -2.92 -4.38	
32 93 53 00-0065	EA 2 Gallon Container Groundcover And Flower Planting..... <i>For >10 To 25, Deduct</i> <i>For >25 To 50, Deduct</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	20.09 -1.00 -2.51 -4.02 -6.03	
32 93 53 00-0066	EA 3 Gallon Container Groundcover And Flower Planting..... <i>For >10 To 25, Deduct</i> <i>For >25 To 50, Deduct</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	25.58 -1.28 -3.20 -5.12 -7.67	
32 93 53 00-0067	EA 4 Gallon Container Groundcover And Flower Planting..... <i>For >10 To 25, Deduct</i> <i>For >25 To 50, Deduct</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	32.88 -1.64 -4.11 -6.58 -9.86	
32 93 53 00-0068	EA 5 Gallon Container Groundcover And Flower Planting..... <i>For >10 To 25, Deduct</i> <i>For >25 To 50, Deduct</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	40.19 -2.01 -5.02 -8.04 -12.06	
32 93 53 00-0069	EA 7 Gallon Container Groundcover And Flower Planting..... <i>For >10 To 25, Deduct</i> <i>For >25 To 50, Deduct</i> <i>For >50 To 100, Deduct</i> <i>For >100, Deduct</i>	54.80 -2.74 -6.85 -10.96 -16.44	
32 93 53 00-0070	EA Up To 25 Each Bulb Planting.....	0.91	
32 93 53 00-0071	EA 26 To 50 Each Bulb Planting.....	0.81	
32 93 53 00-0072	LOT Lots Of 50 Bulb Planting.....	34.04	
32 93 53 00-0073	LOT Lots Of 60 Bulb Planting.....	40.85	
32 93 53 00-0074	LOT Lots Of 100 Bulb Planting.....	61.27	
32 93 53 00-0075	EA Flats Of 24 Groundcover And Flower Planting..... <i>For >10 To 25, Deduct</i> <i>For >25, Deduct</i>	25.57 -1.28 -3.20	
32 93 53 00-0076	EA Flats Of 36 Groundcover And Flower Planting..... <i>For >10 To 25, Deduct</i> <i>For >25, Deduct</i>	36.27 -1.81 -4.53	

32 Exterior Improvements**32 90 Planting****32 93 Plants**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 93 53 00-0077	EA		Flats Of 48 Groundcover And Flower Planting.....	48.29	
			<i>For >10 To 25, Deduct</i>	-2.41	
			<i>For >25, Deduct</i>	-6.04	
32 93 53 00-0078			Tree Pits (32 93 53)		
			Note: Costs given show the tree pit size accommodates the soil ball and the type of soil excavated includes excavation, bank run sand and gravel fill for drainage, imported mix planting soil, hand backfill, perforated drainage pipe for watering, and drainage fabric. Includes one layer of woven fabric to be applied before mulch is spread. Excludes additional soil conditioners or mulch.		
32 93 53 00-0079	EA		2' x 1-1/4' Deep Tree Pit	93.10	
32 93 53 00-0080	EA		2' x 2-1/2' Deep Tree Pit	139.61	
32 93 53 00-0081	EA		2-1/2' x 1-1/2' Deep Tree Pit	180.02	
32 93 53 00-0082	EA		2-1/2' x 3' Deep Tree Pit	269.98	
32 93 53 00-0083	EA		3' x 1-3/4' Deep Tree Pit	278.45	
32 93 53 00-0084	EA		3' x 3-1/2' Deep Tree Pit	415.58	
32 93 53 00-0085	EA		3-1/2' x 1-3/4' Deep Tree Pit	341.56	
32 93 53 00-0086	EA		3-1/2' x 3-1/2' Deep Tree Pit	511.65	
32 93 53 00-0087	EA		4' x 2' Deep Tree Pit.....	408.41	
32 93 53 00-0088	EA		4' x 4' Deep Tree Pit.....	612.29	
32 93 53 00-0089	EA		4-1/2' x 2' Deep Tree Pit	588.54	
32 93 53 00-0090	EA		4-1/2' x 4' Deep Tree Pit	884.48	
32 93 53 00-0091	EA		5' x 2-1/4' Deep Tree Pit	782.82	
32 93 53 00-0092	EA		5' x 4-1/2' Deep Tree Pit	1,166.31	
32 93 53 00-0093	EA		6' x 2-1/2' Deep Tree Pit	1,110.16	
32 93 53 00-0094	EA		6' x 5' Deep Tree Pit.....	1,662.86	
32 93 53 00-0095	EA		7' x 3' Deep Tree Pit.....	1,870.58	
32 93 53 00-0096	EA		7' x 6' Deep Tree Pit.....	2,820.27	
32 93 53 00-0097	EA		8' x 3-1/4' Deep Tree Pit	2,573.40	
32 93 53 00-0098	EA		8' x 6-1/2' Deep Tree Pit	3,858.52	
32 94			Planting Accessories (32 90)		
32 94 13			Landscape Edging (32 94)		
			Note: Including stakes.		
32 94 13 00-0001			Landscape Edging (32 94 13)		
			Note: Includes stakes.		
32 94 13 00-0002	LF		6" Poly/Vinyl Landscape Edging With Non-Round Top.....	3.66	0.93
			<i>For >2,000 To 5,000 LF, Deduct</i>	-0.18	
			<i>For >5,000 LF, Deduct</i>	-0.36	
32 94 13 00-0003	LF		5" Polyethylene Landscape Edging With Round Top.....	2.42	0.93
			<i>For >2,000 To 5,000 LF, Deduct</i>	-0.06	
			<i>For >5,000 LF, Deduct</i>	-0.11	
32 94 13 00-0004	LF		5-1/2" Polyethylene Landscape Edging With Round Top.....	2.46	0.93
			<i>For >2,000 To 5,000 LF, Deduct</i>	-0.06	
			<i>For >5,000 LF, Deduct</i>	-0.12	
32 94 13 00-0005	LF		5" Polyethylene Landscape Edging With Corrugated Sides And Round Top.....	2.47	0.93
			<i>For >2,000 To 5,000 LF, Deduct</i>	-0.06	
			<i>For >5,000 LF, Deduct</i>	-0.12	
32 94 13 00-0006	LF		1/8" x 4", Mill Finish, Aluminum Alloy Landscape Edging	6.72	2.21
			<i>For >1,000 LF, Deduct</i>	-0.58	
32 94 13 00-0007	LF		1/8" x 4", Black Paint, Aluminum Alloy Landscape Edging	7.19	2.21
			<i>For >1,000 LF, Deduct</i>	-0.69	
32 94 13 00-0008	LF		1/8" x 4", Black Anodized, Aluminum Alloy Landscape Edging.....	7.22	2.21
			<i>For >1,000 LF, Deduct</i>	-0.70	
32 94 13 00-0009	LF		3/16" x 4", Mill Finish, Aluminum Alloy Landscape Edging	8.09	2.29
			<i>For >1,000 LF, Deduct</i>	-0.89	
32 94 13 00-0010	LF		3/16" x 4", Black Paint, Aluminum Alloy Landscape Edging	8.67	2.29
			<i>For >1,000 LF, Deduct</i>	-1.04	
32 94 13 00-0011	LF		3/16" x 4", Black Anodized, Aluminum Alloy Landscape Edging.....	8.66	2.29
			<i>For >1,000 LF, Deduct</i>	-1.03	
32 94 13 00-0012	LF		1/8" x 5-1/2", Mill Finish, Aluminum Alloy Landscape Edging	7.43	2.36
			<i>For >1,000 LF, Deduct</i>	-0.69	
32 94 13 00-0013	LF		1/8" x 5-1/2", Black Paint, Aluminum Alloy Landscape Edging	8.08	2.36
			<i>For >1,000 LF, Deduct</i>	-0.86	
32 94 13 00-0014	LF		1/8" x 5-1/2", Black Anodized, Aluminum Alloy Landscape Edging.....	8.15	2.36
			<i>For >1,000 LF, Deduct</i>	-0.87	
32 94 13 00-0015	LF		3/16" x 5-1/2", Mill Finish, Aluminum Alloy Landscape Edging	9.01	2.43
			<i>For >1,000 LF, Deduct</i>	-1.06	
32 94 13 00-0016	LF		3/16" x 5-1/2", Black Paint, Aluminum Alloy Landscape Edging	9.66	2.43
			<i>For >1,000 LF, Deduct</i>	-1.22	
32 94 13 00-0017	LF		3/16" x 5-1/2", Black Anodized, Aluminum Alloy Landscape Edging.....	9.71	2.43
			<i>For >1,000 LF, Deduct</i>	-1.23	
32 94 13 00-0018	LF		1/8" x 4" Powder Coated Steel Landscape Edging	7.09	2.29
			<i>For >1,000 LF, Deduct</i>	-0.63	
32 94 13 00-0019	LF		3/16" x 4" Powder Coated Steel Landscape Edging	8.05	2.29
			<i>For >1,000 LF, Deduct</i>	-0.87	
32 94 13 00-0020	LF		1/4" x 5" Powder Coated Steel Landscape Edging	10.62	2.29
			<i>For >1,000 LF, Deduct</i>	-1.51	
32 94 13 00-0021	LF		1/2" x 4", Recycled Plastic Landscape Edging (Bend-A-Board).....	5.68	2.21
32 94 13 00-0022	LF		1" x 4", Recycled Plastic Landscape Edging (Bend-A-Board).....	6.25	2.21
32 94 13 00-0023	LF		1" x 6", Recycled Plastic Landscape Edging (Bend-A-Board).....	6.75	2.21



Exterior Improvements		32
Planting		32 90
Planting Accessories		32 94

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 94 13 00-0024	LF		2" x 4", Recycled Plastic Landscape Edging (Bend-A-Board).....	6.86	2.21
32 94 13 00-0025	LF		4-1/2" x 12" Granite Edging	20.61	9.15
32 94 13 00-0026	LF		2" x 8" x 16" Precast Scallops, Green.....	4.09	1.41
32 94 13 00-0027	LF		2" x 8" x 16" Precast Scallops, Other Than Green.....	3.84	1.41
32 94 13 00-0028	LF		Brick, Set Horizontally, 1-1/2 Per LF.....	3.88	1.55
32 94 13 00-0029	LF		Brick, Set Horizontally, 3 Per LF.....	10.05	4.24
32 94 13 00-0030	LF		"V" Trenching By Machine, 4" Deep x 4" Wide	1.86	

32 94 16 Landscape Timbers (32 94)

32 94 16 00-0001	LF		1" x 4" Redwood Edging	3.77	1.23
32 94 16 00-0002	LF		2" x 4" Redwood Edging	5.16	1.84
32 94 16 00-0003	LF		4" x 6" Pressure Treated Hardwood	6.31	2.46
32 94 16 00-0004	LF		6" x 6" Pressure Treated Hardwood	8.10	3.07
32 94 16 00-0005	LF		6" x 8" Pressure Treated Hardwood	9.49	3.61
32 94 16 00-0006	LF		1" x 4" Pressure Treated Pine.....	2.69	1.23
32 94 16 00-0007	LF		2" x 4" Pressure Treated Pine.....	4.06	1.84
32 94 16 00-0008	LF		4" x 6" Pressure Treated Pine.....	6.00	2.38
32 94 16 00-0009	LF		6" x 6" Pressure Treated Pine.....	8.06	3.07
32 94 16 00-0010	LF		6" x 8" Pressure Treated Pine.....	9.76	3.61
32 94 16 00-0011	LF		6" x 8" Railroad Ties	10.56	3.31
32 94 16 00-0012	LF		7" x 9" Railroad Ties	12.68	4.16

32 94 43 Tree Grates (32 94)

32 94 43 00-0001 Tree Grates With Frames (32 94 43)

32 94 43 00-0002 Round Cast Iron Tree Grates With Frames (32 94 43 00-0001)

32 94 43 00-0003	EA		32" Diameter, 100 To 150 LB Cast Iron Tree Gate With Frame	460.65	43.32
			For >3 To 9, Deduct	-28.05	
			For >9, Deduct	-57.97	
32 94 43 00-0004	EA		36" Diameter, 125 To 175 LB Cast Iron Tree Gate With Frame	528.64	43.32
			For >3 To 9, Deduct	-33.15	
			For >9, Deduct	-68.51	
32 94 43 00-0005	EA		42" Diameter, 150 To 200 LB Cast Iron Tree Gate With Frame	642.52	57.76
			For >3 To 9, Deduct	-39.53	
			For >9, Deduct	-81.69	
32 94 43 00-0006	EA		48" Diameter, 200 To 250 LB Cast Iron Tree Gate With Frame	790.52	57.76
			For >3 To 9, Deduct	-50.63	
			For >9, Deduct	-104.63	
32 94 43 00-0007	EA		54" Diameter, 300 To 350 LB Cast Iron Tree Gate With Frame	1,012.40	72.21
			For >3 To 9, Deduct	-65.10	
			For >9, Deduct	-134.54	
32 94 43 00-0008	EA		60" Diameter, Up To 350 LB Cast Iron Tree Gate With Frame.....	1,069.28	86.64
			For >3 To 9, Deduct	-67.20	
			For >9, Deduct	-138.88	
32 94 43 00-0009	EA		60" Diameter, >350 LB Cast Iron Tree Gate With Frame	1,172.28	86.64
			For >3 To 9, Deduct	-74.93	
			For >9, Deduct	-154.85	
32 94 43 00-0010	EA		72" Diameter, Up To 550 LB Cast Iron Tree Gate With Frame.....	1,565.49	122.74
			For >3 To 9, Deduct	-99.00	
			For >9, Deduct	-204.60	
32 94 43 00-0011	EA		72" Diameter, >500 To 550 LB Cast Iron Tree Gate With Frame	1,625.49	122.74
			For >3 To 9, Deduct	-103.50	
			For >9, Deduct	-213.90	
32 94 43 00-0012	EA		72" Diameter, >600 To 650 LB Cast Iron Tree Gate With Frame	1,675.49	122.74
			For >3 To 9, Deduct	-107.25	
			For >9, Deduct	-221.65	
32 94 43 00-0013	EA		72" Diameter, >650 To 700 LB Cast Iron Tree Gate With Frame	1,715.49	122.74
			For >3 To 9, Deduct	-110.25	
			For >9, Deduct	-227.85	
32 94 43 00-0014	EA		72" Diameter, >700 LB Cast Iron Tree Gate With Frame	1,745.49	122.74
			For >3 To 9, Deduct	-112.50	
			For >9, Deduct	-232.50	
32 94 43 00-0015	EA		93" Diameter, 950 To 1,000 LB Cast Iron Tree Gate With Frame	1,920.81	144.40
			For >3 To 9, Deduct	-122.40	
			For >9, Deduct	-252.96	

32 94 43 00-0016 Square Cast Iron Tree Grates With Frames (32 94 43 00-0001)

32 94 43 00-0017	EA		30" x 30", 75 To 125 LB Cast Iron Tree Gate With Frame.....	426.64	43.32
			For >3 To 9, Deduct	-25.50	
			For >9, Deduct	-52.70	
32 94 43 00-0018	EA		36" x 36", 100 To 150 LB Cast Iron Tree Gate With Frame.....	511.64	43.32
			For >3 To 9, Deduct	-31.88	
			For >9, Deduct	-65.88	
32 94 43 00-0019	EA		48" x 48", Up To 200 LB Cast Iron Tree Gate With Frame	764.40	72.21
			For >3 To 9, Deduct	-46.50	
			For >9, Deduct	-96.10	
32 94 43 00-0020	EA		48" x 48", >200 To 250 LB Cast Iron Tree Gate With Frame.....	894.40	72.21
			For >3 To 9, Deduct	-56.25	
			For >9, Deduct	-116.25	

32 Exterior Improvements**32 90 Planting****32 94 Planting Accessories**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 94 43 00-0021	EA		48" x 48", >250 To 300 LB Cast Iron Tree Grate With Frame	1,014.40	72.21
			<i>For >3 To 9, Deduct</i>	-65.25	
			<i>For >9, Deduct</i>	-134.85	
32 94 43 00-0022	EA		48" x 48", >300 To 350 LB Cast Iron Tree Grate With Frame	1,124.40	72.21
			<i>For >3 To 9, Deduct</i>	-73.50	
			<i>For >9, Deduct</i>	-151.90	
32 94 43 00-0023	EA		48" x 48", >350 To 400 LB Cast Iron Tree Grate With Frame	1,224.40	72.21
			<i>For >3 To 9, Deduct</i>	-81.00	
			<i>For >9, Deduct</i>	-167.40	
32 94 43 00-0024	EA		48" x 48", >400 LB Cast Iron Tree Grate With Frame	1,314.40	72.21
			<i>For >3 To 9, Deduct</i>	-87.75	
			<i>For >9, Deduct</i>	-181.35	
32 94 43 00-0025	EA		60" x 60", Up To 400 LB Cast Iron Tree Grate With Frame	1,282.17	101.08
			<i>For >3 To 9, Deduct</i>	-81.00	
			<i>For >9, Deduct</i>	-167.40	
32 94 43 00-0026	EA		60" x 60", >400 To 450 LB Cast Iron Tree Grate With Frame	1,372.17	101.08
			<i>For >3 To 9, Deduct</i>	-87.75	
			<i>For >9, Deduct</i>	-181.35	
32 94 43 00-0027	EA		60" x 60", >450 To 500 LB Cast Iron Tree Grate With Frame	1,452.17	101.08
			<i>For >3 To 9, Deduct</i>	-93.75	
			<i>For >9, Deduct</i>	-193.75	
32 94 43 00-0028	EA		60" x 60", >500 To 550 LB Cast Iron Tree Grate With Frame	1,522.17	101.08
			<i>For >3 To 9, Deduct</i>	-99.00	
			<i>For >9, Deduct</i>	-204.60	
32 94 43 00-0029	EA		60" x 60", >550 To 600 LB Cast Iron Tree Grate With Frame	1,582.17	101.08
			<i>For >3 To 9, Deduct</i>	-103.50	
			<i>For >9, Deduct</i>	-213.90	
32 94 43 00-0030	EA		60" x 60", >600 LB Cast Iron Tree Grate With Frame	1,632.17	101.08
			<i>For >3 To 9, Deduct</i>	-107.25	
			<i>For >9, Deduct</i>	-221.65	
32 94 43 00-0031	EA		72" x 72", Up To 550 LB Cast Iron Tree Grate With Frame	1,565.49	122.74
			<i>For >3 To 9, Deduct</i>	-99.00	
			<i>For >9, Deduct</i>	-204.60	
32 94 43 00-0032	EA		72" x 72", >550 To 600 LB Cast Iron Tree Grate With Frame	1,625.49	122.74
			<i>For >3 To 9, Deduct</i>	-103.50	
			<i>For >9, Deduct</i>	-213.90	
32 94 43 00-0033	EA		72" x 72", >600 To 650 LB Cast Iron Tree Grate With Frame	1,675.49	122.74
			<i>For >3 To 9, Deduct</i>	-107.25	
			<i>For >9, Deduct</i>	-221.65	
32 94 43 00-0034	EA		72" x 72", >650 To 700 LB Cast Iron Tree Grate With Frame	1,715.49	122.74
			<i>For >3 To 9, Deduct</i>	-110.25	
			<i>For >9, Deduct</i>	-227.85	
32 94 43 00-0035	EA		72" x 72", >700 To 750 LB Cast Iron Tree Grate With Frame	1,745.49	122.74
			<i>For >3 To 9, Deduct</i>	-112.50	
			<i>For >9, Deduct</i>	-232.50	
32 94 43 00-0036	EA		72" x 72", >750 To 800 LB Cast Iron Tree Grate With Frame	1,765.49	122.74
			<i>For >3 To 9, Deduct</i>	-114.00	
			<i>For >9, Deduct</i>	-235.60	
32 94 43 00-0037	EA		72" x 72", >800 To 850 LB Cast Iron Tree Grate With Frame	1,775.49	122.74
			<i>For >3 To 9, Deduct</i>	-114.75	
			<i>For >9, Deduct</i>	-237.15	
32 94 43 00-0038	EA		72" x 72", >850 LB Cast Iron Tree Grate With Frame	1,785.49	122.74
			<i>For >3 To 9, Deduct</i>	-115.50	
			<i>For >9, Deduct</i>	-238.70	
32 94 43 00-0039			Rectangular Cast Iron Tree Grates With Frames (32 94 43 00-0001)		
32 94 43 00-0040	EA		36" x 48", 200 To 250 LB Cast Iron Tree Grate With Frame	790.52	57.76
			<i>For >3 To 9, Deduct</i>	-50.63	
			<i>For >9, Deduct</i>	-104.63	
32 94 43 00-0041	EA		36" x 60", 200 To 250 LB Cast Iron Tree Grate With Frame	805.52	57.76
			<i>For >3 To 9, Deduct</i>	-51.75	
			<i>For >9, Deduct</i>	-106.95	
32 94 43 00-0042	EA		36" x 72", 275 To 325 LB Cast Iron Tree Grate With Frame	985.40	72.21
			<i>For >3 To 9, Deduct</i>	-63.08	
			<i>For >9, Deduct</i>	-130.36	
32 94 43 00-0043	EA		48" x 72", Up To 350 LB Cast Iron Tree Grate With Frame	1,152.40	72.21
			<i>For >3 To 9, Deduct</i>	-75.60	
			<i>For >9, Deduct</i>	-156.24	
32 94 43 00-0044	EA		48" x 72", >350 LB Cast Iron Tree Grate With Frame	1,224.40	72.21
			<i>For >3 To 9, Deduct</i>	-81.00	
			<i>For >9, Deduct</i>	-167.40	
32 94 43 00-0045	EA		60" x 84", 700 To 750 LB Cast Iron Tree Grate With Frame	1,655.49	122.74
			<i>For >3 To 9, Deduct</i>	-105.75	
			<i>For >9, Deduct</i>	-218.55	

32 94 49 Tree Accessories (32 94)

32 94 49 00-0001 Tree Guying (32 94 49)

32 94 49 00-0002 Tree Guying, Stakes (32 94 49 00-0001)

Note: Includes stakes, cross brace, double #12 gauge twisted wire and reinforced rubber hose tree wrap.

32 94 49 00-0003 EA Tree Guying Up To 2" Caliper, 2 Stakes 19.78

32 94 49 00-0004 EA Tree Guying 2" To 3" Caliper, 2 Stakes 35.34



Exterior Improvements		32
Planting		32 90
Planting Accessories		32 94

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
32 94 49 00-0005	EA		Tree Guying 3" To 4" Caliper, 3 Stakes	60.77	
32 94 49 00-0006			Tree Guying, Anchors <small>(32 94 49 00-0001)</small>		
			Note: Includes arrowhead anchor, cable, turnbuckles and wrap or reinforced rubber hose.		
32 94 49 00-0007	EA		Tree Guying Up To 3" Caliper, 3" Anchors	82.84	
32 94 49 00-0008	EA		Tree Guying 3" To 6" Caliper, 4" Anchors	111.72	
32 94 49 00-0009	EA		Tree Guying 6" To 8" Caliper, 6" Anchors	142.91	
32 94 49 00-0010	EA		Tree Guying 8" And Up Caliper, 8" Anchors	184.90	
32 94 49 00-0011			Tree Wrap <small>(32 94 49)</small>		
32 94 49 00-0012	EA		Tree Wrap, Up To 1" Caliper Applied Ground Level To First Branches Of Tree	5.36	
32 94 49 00-0013	EA		Tree Wrap, 1" To 2" Caliper Applied Ground Level To First Branches Of Tree	8.81	
32 94 49 00-0014	EA		Tree Wrap, >2" To 4" Caliper Applied Ground Level To First Branches Of Tree	17.22	
32 94 49 00-0015	EA		Tree Wrap, >4" To 6" Caliper Applied Ground Level To First Branches Of Tree	26.05	
32 94 49 00-0016			Tree Guards <small>(32 94 49)</small>		
32 94 49 00-0017	EA		3' Preformed Plastic Tree Guard	8.36	
32 94 49 00-0018	EA		2' Preformed Plastic Tree Guard	7.88	
32 94 49 00-0019			Stake Out Tree And Shrub Locations <small>(32 94 49)</small>		
			Note: When no design available.		
32 94 49 00-0020	EA		Stake Out Trees Or Shrubs	5.49	
32 94 49 00-0021			Root Barriers <small>(32 94 49)</small>		
32 94 49 00-0022	EA		18" High x 24" Long Root Barrier Panel, .080" Polypropylene, With Self Locking Joiner	12.37	
32 94 49 00-0023	EA		24" High x 24" Long Root Barrier Panel, .080" Polypropylene, With Self Locking Joiner	14.66	
32 94 49 00-0024	EA		36" High x 24" Long Root Barrier Panel, .080" Polypropylene, With Self Locking Joiner	19.75	
32 94 49 00-0025	EA		48" High x 24" Long Root Barrier Panel, .080" Polypropylene, With Self Locking Joiner	26.54	
32 96			Transplanting <small>(32 96)</small>		
			See CSI section 32 94 49 00-0001 for guying.		
32 96 33			Shrub Transplanting <small>(32 96)</small>		
			Note: Includes digging up, moving on site, digging new hole and replanting.		
32 96 33 00-0001			Moving Shrubs On Site, Relocate <small>(32 96 33)</small>		
			Note: Includes digging up, moving on site, digging new hole and replanting. See CSI section 32 94 49 00-0001 for guying.		
32 96 33 00-0002	EA		Up To 18" Root Ball, Move Shrubs On Site	53.52	
			For >25 To 50, Deduct	-5.35	
			For >50, Deduct	-8.03	
32 96 33 00-0003	EA		>18" To 24" Root Ball, Move Shrubs On Site	73.40	
			For >25 To 50, Deduct	-7.34	
			For >50, Deduct	-11.01	
32 96 33 00-0004	EA		>24" To 30" Root Ball, Move Shrubs On Site	91.75	
			For >25 To 50, Deduct	-9.18	
			For >50, Deduct	-13.76	
32 96 33 00-0005	EA		>30" To 36" Root Ball, Move Shrubs On Site	119.49	
			For >25 To 50, Deduct	-11.95	
			For >50, Deduct	-17.92	
32 96 43			Tree Transplanting <small>(32 96)</small>		
			Note: Includes digging up, moving on site, digging new hole and replanting.		
32 96 43 00-0001			Moving Trees On Site, Relocate <small>(32 96 43)</small>		
			Note: Includes digging up, moving on site, digging new hole and replanting. Excludes crane where necessary for trees over 20' tall. See CSI section 32 94 49 00-0001 for guying.		
32 96 43 00-0002	EA		Up To 24" Root Ball, Move Trees On Site	222.70	
			For >5 To 10, Deduct	-11.14	
			For >10 To 20, Deduct	-22.27	
			For >20, Deduct	-33.41	
32 96 43 00-0003	EA		>24" To 30" Root Ball, Move Trees On Site	305.43	
			For >5 To 10, Deduct	-15.27	
			For >10 To 20, Deduct	-30.54	
			For >20, Deduct	-45.81	
32 96 43 00-0004	EA		>30" To 36" Root Ball, Move Trees On Site	494.90	
			For >5 To 10, Deduct	-24.75	
			For >10 To 20, Deduct	-49.49	
			For >20, Deduct	-74.24	
32 96 43 00-0005	EA		>36" To 48" Root Ball, Move Trees On Site	822.29	
			For >5 To 10, Deduct	-41.11	
			For >10 To 20, Deduct	-82.23	
			For >20, Deduct	-123.34	
32 96 43 00-0006	EA		>48" To 60" Root Ball, Move Trees On Site	1,336.22	
			For >5 To 10, Deduct	-66.81	
			For >10 To 20, Deduct	-133.62	
			For >20, Deduct	-200.43	

32 Exterior Improvements**32 90 Planting****32 96 Transplanting**

MINOR				TOTAL DIRECT	DEMOLITION
CSI	UOM	DESCRIPTION		UNIT COST	UNIT COST
32 96 43 00-0007	EA	>60" To 72" Root Ball, Move Trees On Site.....		1,724.16	
		<i>For >5 To 10, Deduct</i>		-86.21	
		<i>For >10 To 20, Deduct</i>		-172.42	
		<i>For >20, Deduct</i>		-258.62	
32 96 43 00-0008	EA	>72" To 84" Root Ball, Move Trees On Site.....		2,227.04	
		<i>For >5 To 10, Deduct</i>		-111.35	
		<i>For >10 To 20, Deduct</i>		-222.70	
		<i>For >20, Deduct</i>		-334.06	
32 96 43 00-0009	EA	>84" To 96" Root Ball, Move Trees On Site.....		2,672.44	
		<i>For >5 To 10, Deduct</i>		-133.62	
		<i>For >10 To 20, Deduct</i>		-267.24	
		<i>For >20, Deduct</i>		-400.87	
32 96 43 00-0010	EA	>96" To 120" Root Ball, Move Trees On Site.....		3,036.87	
		<i>For >5 To 10, Deduct</i>		-151.84	
		<i>For >10 To 20, Deduct</i>		-303.69	
		<i>For >20, Deduct</i>		-455.53	

END OF SECTION 32



MINOR	CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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33 Utilities

33 01 Operation And Maintenance Of Utilities ⁽³³⁾

33 01 30 Operation And Maintenance Of Sewer Utilities ^(33 01)

33 01 30 16 TV Inspection Of Pipelines ^(33 01 30)

Note: Rotating head color camera. Includes all log records and color video tape, DVD or CD.

33 01 30 16-0001	Remote Visual inspection (RVI) Of Pipe Interior And Culverts ^(33 01 30 16)		
33 01 30 16-0002	Video Camera Set-up ^(33 01 30 16-0001)		
33 01 30 16-0003	EA Initial Set Up For "Push Camera" Video Camera Inspection, 1" To 12" Diameter Pipe Or Culvert.....	654.23	
	Note: A "push camera" is a straight view camera at the end of a rigid push rod for 1"-12" diameter pipes for distances up to 300 feet.		
33 01 30 16-0004	EA Initial Set Up For "Crawler" Video Camera Inspection, 4" To 30" Diameter Pipe Or Culvert.....	1,308.46	
	Note: Crawlers are generally remotely operated vehicles (ROVs) for longer distances (over 300') and for larger diameters (4" and larger).		
33 01 30 16-0005	EA Initial Set Up For "Crawler" Video Camera Inspection, >30" Diameter Pipe Or Culvert.....	1,962.71	
33 01 30 16-0006	EA Re-Set Up/Move For "Push Camera" Video Camera Inspection, 1" To 12" Diameter Pipe Or Culvert.....	327.12	
33 01 30 16-0007	EA Re-Set Up/Move For "Crawler" Video Camera Inspection, 4" And Larger Diameter Pipe Or Culvert.....	654.23	

33 01 30 16-0008 Video Camera Planning And Analysis Inspection ^(33 01 30 16-0001)

Note: For pipe interior and culverts.

33 01 30 16-0009	LF 4" To 6" Diameter Pipe Inspection, Planning/Analysis Phase.....	1.66	
	Note: CCTV inspection of pipe interior.		
	For >500 To 1,000, Deduct	-0.17	
	For >1,000 To 5,000, Deduct	-0.42	
	For >5,000, Deduct	-0.58	
33 01 30 16-0010	LF >6" To 12" Diameter Pipe Inspection, Planning/Analysis Phase.....	2.21	
	Note: CCTV inspection of pipe interior.		
	For >500 To 1,000, Deduct	-0.22	
	For >1,000 To 5,000, Deduct	-0.55	
	For >5,000, Deduct	-0.77	
33 01 30 16-0011	LF >12" To 21" Diameter Pipe Inspection, Planning/Analysis Phase.....	2.77	
	Note: CCTV inspection of pipe interior.		
	For >500 To 1,000, Deduct	-0.28	
	For >1,000 To 5,000, Deduct	-0.69	
	For >5,000, Deduct	-0.97	
33 01 30 16-0012	LF >21" To 30" Diameter Pipe Inspection, Planning/Analysis Phase.....	3.68	
	Note: CCTV inspection of pipe interior.		
	For >500 To 1,000, Deduct	-0.37	
	For >1,000 To 5,000, Deduct	-0.92	
	For >5,000, Deduct	-1.29	
33 01 30 16-0013	LF >30" To 42" Diameter Pipe Inspection, Planning/Analysis Phase.....	5.19	
	Note: CCTV inspection of pipe interior.		
	For >500 To 1,000, Deduct	-0.52	
	For >1,000 To 5,000, Deduct	-1.30	
	For >5,000, Deduct	-1.82	
33 01 30 16-0014	LF >42" To 60" Diameter Pipe Inspection, Planning/Analysis Phase.....	6.91	
	Note: CCTV inspection of pipe interior.		
	For >500 To 1,000, Deduct	-0.69	
	For >1,000 To 5,000, Deduct	-1.73	
	For >5,000, Deduct	-2.42	
33 01 30 16-0015	LF >60" To 72" Diameter Pipe Inspection, Planning/Analysis Phase.....	9.75	
	Note: CCTV inspection of pipe interior.		
	For >500 To 1,000, Deduct	-0.98	
	For >1,000 To 5,000, Deduct	-2.44	
	For >5,000, Deduct	-3.41	
33 01 30 16-0016	LF >72" To 84" Diameter Pipe Inspection, Planning/Analysis Phase.....	13.82	
	Note: CCTV inspection of pipe interior.		
	For >500 To 1,000, Deduct	-1.38	
	For >1,000 To 5,000, Deduct	-3.46	
	For >5,000, Deduct	-4.84	

33 01 30 16-0017 Video Camera Pre-Rehab For Pipe Interior And Culverts ^(33 01 30 16-0001)

33 01 30 16-0018	LF 4" To 6" Diameter Pipe Inspection, Pre-Rehabilitation Phase.....	2.45	
	Note: CCTV inspection of pipe interior.		
	For >500 To 1,000, Deduct	-0.25	
	For >1,000 To 5,000, Deduct	-0.61	
	For >5,000, Deduct	-0.86	
33 01 30 16-0019	LF >6" To 12" Diameter Pipe Inspection, Pre-Rehabilitation Phase	3.28	
	Note: CCTV inspection of pipe interior.		
	For >500 To 1,000, Deduct	-0.33	
	For >1,000 To 5,000, Deduct	-0.82	
	For >5,000, Deduct	-1.15	
33 01 30 16-0020	LF >12" To 21" Diameter Pipe Inspection, Pre-Rehabilitation Phase	4.09	
	Note: CCTV inspection of pipe interior.		
	For >500 To 1,000, Deduct	-0.41	
	For >1,000 To 5,000, Deduct	-1.02	
	For >5,000, Deduct	-1.43	

33 Utilities**33 01 Operation And Maintenance Of Utilities****33 01 30 Operation And Maintenance Of Sewer Utilities**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 01 30 16-0021	LF		>21" To 30" Diameter Pipe Inspection, Pre-Rehabilitation Phase.....	5.46	
			Note: CCTV inspection of pipe interior.		
			For >500 To 1,000, Deduct	-0.55	
			For >1,000 To 5,000, Deduct	-1.37	
			For >5,000, Deduct	-1.91	
33 01 30 16-0022	LF		>30" To 42" Diameter Pipe Inspection, Pre-Rehabilitation Phase.....	7.66	
			Note: CCTV inspection of pipe interior.		
			For >500 To 1,000, Deduct	-0.77	
			For >1,000 To 5,000, Deduct	-1.92	
			For >5,000, Deduct	-2.68	
33 01 30 16-0023	LF		>42" To 60" Diameter Pipe Inspection, Pre-Rehabilitation Phase.....	10.22	
			Note: CCTV inspection of pipe interior.		
			For >500 To 1,000, Deduct	-1.02	
			For >1,000 To 5,000, Deduct	-2.56	
			For >5,000, Deduct	-3.58	
33 01 30 16-0024	LF		>60" To 72" Diameter Pipe Inspection, Pre-Rehabilitation Phase.....	14.43	
			Note: CCTV inspection of pipe interior.		
			For >500 To 1,000, Deduct	-1.44	
			For >1,000 To 5,000, Deduct	-3.61	
			For >5,000, Deduct	-5.05	
33 01 30 16-0025	LF		>72" To 84" Diameter Pipe Inspection, Pre-Rehabilitation Phase.....	20.45	
			Note: CCTV inspection of pipe interior.		
			For >500 To 1,000, Deduct	-2.05	
			For >1,000 To 5,000, Deduct	-5.11	
			For >5,000, Deduct	-7.16	
33 01 30 16-0026			Video Camera Post-Rehab For Pipe Interior And Culverts (33 01 30 16-0001)		
33 01 30 16-0027	LF		4" To 6" Diameter Pipe Inspection, Post-Rehabilitation Phase.....	1.75	
			Note: CCTV inspection of pipe interior.		
			For >500 To 1,000, Deduct	-0.18	
			For >1,000 To 5,000, Deduct	-0.44	
			For >5,000, Deduct	-0.61	
33 01 30 16-0028	LF		>6" To 12" Diameter Pipe Inspection, Post-Rehabilitation Phase.....	2.33	
			Note: CCTV inspection of pipe interior.		
			For >500 To 1,000, Deduct	-0.23	
			For >1,000 To 5,000, Deduct	-0.58	
			For >5,000, Deduct	-0.82	
33 01 30 16-0029	LF		>12" To 21" Diameter Pipe Inspection, Post-Rehabilitation Phase.....	2.92	
			Note: CCTV inspection of pipe interior.		
			For >500 To 1,000, Deduct	-0.29	
			For >1,000 To 5,000, Deduct	-0.73	
			For >5,000, Deduct	-1.02	
33 01 30 16-0030	LF		>21" To 30" Diameter Pipe Inspection, Post-Rehabilitation Phase.....	3.89	
			Note: CCTV inspection of pipe interior.		
			For >500 To 1,000, Deduct	-0.39	
			For >1,000 To 5,000, Deduct	-0.97	
			For >5,000, Deduct	-1.36	
33 01 30 16-0031	LF		>30" To 42" Diameter Pipe Inspection, Post-Rehabilitation Phase.....	5.48	
			Note: CCTV inspection of pipe interior.		
			For >500 To 1,000, Deduct	-0.55	
			For >1,000 To 5,000, Deduct	-1.37	
			For >5,000, Deduct	-1.92	
33 01 30 16-0032	LF		>42" To 60" Diameter Pipe Inspection, Post-Rehabilitation Phase.....	7.30	
			Note: CCTV inspection of pipe interior.		
			For >500 To 1,000, Deduct	-0.73	
			For >1,000 To 5,000, Deduct	-1.83	
			For >5,000, Deduct	-2.56	
33 01 30 16-0033	LF		>60" To 72" Diameter Pipe Inspection, Post-Rehabilitation Phase.....	10.31	
			Note: CCTV inspection of pipe interior.		
			For >500 To 1,000, Deduct	-1.03	
			For >1,000 To 5,000, Deduct	-2.58	
			For >5,000, Deduct	-3.61	
33 01 30 16-0034	LF		>72" To 84" Diameter Pipe Inspection, Post-Rehabilitation Phase.....	14.61	
			Note: CCTV inspection of pipe interior.		
			For >500 To 1,000, Deduct	-1.46	
			For >1,000 To 5,000, Deduct	-3.65	
			For >5,000, Deduct	-5.11	
33 01 30 41			Cleaning of Sewers (33 01 30)		
33 01 30 41-0001			Pipe Line Cleaning And Flushing (33 01 30 41)		
			Note: Includes flushing. Owner provided water.		
33 01 30 41-0002			Pipe Line Cleaning (33 01 30 41-0001)		
			Note: Includes removal of all debris/waste. Excludes disposal.		
33 01 30 41-0003			Hydro Jet Set-up And Reinsertion (33 01 30 41-0002)		
33 01 30 41-0004	EA		Initial Set Up And Final Equipment Removal For Jet Cleaning.....	2,009.90	
33 01 30 41-0005	EA		Move And Reset Up At Different Access/Location For Jet Cleaning.....	502.48	
33 01 30 41-0006			Hydro Jet Cleaning Of Sewer And Water Pipelines (33 01 30 41-0002)		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 01 30 41-0007 LF Up To 4" Diameter Pipe Line Cleaning, Hydro Jetting Method, Light Cleaning - 3 Passes.....	2.70	
<i>For >250 To 500, Deduct</i>	-0.14	
<i>For >500 To 1,000, Deduct</i>	-0.27	
<i>For >1,000 To 2,000, Deduct</i>	-0.41	
<i>For >2,000 To 5,000, Deduct</i>	-0.54	
<i>For >5,000, Deduct</i>	-0.68	
<i>For Heavy Cleaning, >4 Passes (Includes Attached Mechanical Device), Add</i>	2.03	
33 01 30 41-0008 LF 6" Diameter Pipe Line Cleaning, Hydro Jetting Method, Light Cleaning - 3 Passes	3.10	
<i>For >250 To 500, Deduct</i>	-0.16	
<i>For >500 To 1,000, Deduct</i>	-0.31	
<i>For >1,000 To 2,000, Deduct</i>	-0.47	
<i>For >2,000 To 5,000, Deduct</i>	-0.62	
<i>For >5,000, Deduct</i>	-0.78	
<i>For Heavy Cleaning, >4 Passes (Includes Attached Mechanical Device), Add</i>	2.33	
33 01 30 41-0009 LF 8" Diameter Pipe Line Cleaning, Hydro Jetting Method, Light Cleaning - 3 Passes	3.64	
<i>For >250 To 500, Deduct</i>	-0.18	
<i>For >500 To 1,000, Deduct</i>	-0.36	
<i>For >1,000 To 2,000, Deduct</i>	-0.55	
<i>For >2,000 To 5,000, Deduct</i>	-0.73	
<i>For >5,000, Deduct</i>	-0.91	
<i>For Heavy Cleaning, >4 Passes (Includes Attached Mechanical Device), Add</i>	2.73	
33 01 30 41-0010 LF 10" Diameter Pipe Line Cleaning, Hydro Jetting Method, Light Cleaning - 3 Passes	4.50	
<i>For >250 To 500, Deduct</i>	-0.23	
<i>For >500 To 1,000, Deduct</i>	-0.45	
<i>For >1,000 To 2,000, Deduct</i>	-0.68	
<i>For >2,000 To 5,000, Deduct</i>	-0.90	
<i>For >5,000, Deduct</i>	-1.13	
<i>For Heavy Cleaning, >4 Passes (Includes Attached Mechanical Device), Add</i>	3.38	
33 01 30 41-0011 LF 12" Diameter Pipe Line Cleaning, Hydro Jetting Method, Light Cleaning - 3 Passes	5.11	
<i>For >250 To 500, Deduct</i>	-0.26	
<i>For >500 To 1,000, Deduct</i>	-0.51	
<i>For >1,000 To 2,000, Deduct</i>	-0.77	
<i>For >2,000 To 5,000, Deduct</i>	-1.02	
<i>For >5,000, Deduct</i>	-1.28	
<i>For Heavy Cleaning, >4 Passes (Includes Attached Mechanical Device), Add</i>	3.83	
33 01 30 41-0012 LF >12" To 16" Diameter Pipe Line Cleaning, Hydro Jetting Method, Light Cleaning - 3 Passes.....	5.90	
<i>For >250 To 500, Deduct</i>	-0.30	
<i>For >500 To 1,000, Deduct</i>	-0.59	
<i>For >1,000 To 2,000, Deduct</i>	-0.89	
<i>For >2,000 To 5,000, Deduct</i>	-1.18	
<i>For >5,000, Deduct</i>	-1.48	
<i>For Heavy Cleaning, >4 Passes (Includes Attached Mechanical Device), Add</i>	4.43	
33 01 30 41-0013 LF >16" To 24" Diameter Pipe Line Cleaning, Hydro Jetting Method, Light Cleaning - 3 Passes.....	7.10	
<i>For >250 To 500, Deduct</i>	-0.36	
<i>For >500 To 1,000, Deduct</i>	-0.71	
<i>For >1,000 To 2,000, Deduct</i>	-1.07	
<i>For >2,000 To 5,000, Deduct</i>	-1.42	
<i>For >5,000, Deduct</i>	-1.78	
<i>For Heavy Cleaning, >4 Passes (Includes Attached Mechanical Device), Add</i>	5.33	
33 01 30 41-0014 LF >24" To 30" Diameter Pipe Line Cleaning, Hydro Jetting Method, Light Cleaning - 3 Passes.....	8.05	
<i>For >250 To 500, Deduct</i>	-0.40	
<i>For >500 To 1,000, Deduct</i>	-0.81	
<i>For >1,000 To 2,000, Deduct</i>	-1.21	
<i>For >2,000 To 5,000, Deduct</i>	-1.61	
<i>For >5,000, Deduct</i>	-2.01	
<i>For Heavy Cleaning, >4 Passes (Includes Attached Mechanical Device), Add</i>	6.04	
33 01 30 41-0015 Flushing Of Storm Water Pipelines <small>(33 01 30 41-0002)</small>		
Note: To remove silt and small debris from storm drainage pipes. Excludes disposal.		
33 01 30 41-0016 LF 12" To 16" Diameter Pipe Line Flushing	1.18	
<i>For >250 To 500, Deduct</i>	-0.06	
<i>For >500 To 1,000, Deduct</i>	-0.12	
<i>For >1,000 To 2,000, Deduct</i>	-0.18	
<i>For >2,000 To 5,000, Deduct</i>	-0.24	
<i>For >5,000, Deduct</i>	-0.30	
33 01 30 41-0017 LF >16" To 24" Diameter Pipe Line Flushing.....	1.35	
<i>For >250 To 500, Deduct</i>	-0.07	
<i>For >500 To 1,000, Deduct</i>	-0.14	
<i>For >1,000 To 2,000, Deduct</i>	-0.20	
<i>For >2,000 To 5,000, Deduct</i>	-0.27	
<i>For >5,000, Deduct</i>	-0.34	
33 01 30 41-0018 LF >24" To 30" Diameter Pipe Line Flushing.....	1.58	
<i>For >250 To 500, Deduct</i>	-0.08	
<i>For >500 To 1,000, Deduct</i>	-0.16	
<i>For >1,000 To 2,000, Deduct</i>	-0.24	
<i>For >2,000 To 5,000, Deduct</i>	-0.32	
<i>For >5,000, Deduct</i>	-0.40	
33 01 30 41-0019 LF >30" To 42" Diameter Pipe Line Flushing.....	1.83	
<i>For >250 To 500, Deduct</i>	-0.09	
<i>For >500 To 1,000, Deduct</i>	-0.18	
<i>For >1,000 To 2,000, Deduct</i>	-0.27	
<i>For >2,000 To 5,000, Deduct</i>	-0.37	
<i>For >5,000, Deduct</i>	-0.46	

33 Utilities**33 01 Operation And Maintenance Of Utilities****33 01 30 Operation And Maintenance Of Sewer Utilities**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 01 30 41-0020 LF >42" To 60" Diameter Pipe Line Flushing	2.44	
For >250 To 500, Deduct	-0.12	
For >500 To 1,000, Deduct	-0.24	
For >1,000 To 2,000, Deduct	-0.37	
For >2,000 To 5,000, Deduct	-0.49	
For >5,000, Deduct	-0.61	
33 01 30 41-0021 Hydro Jet Cleaning Of Culverts (33 01 30 41-0002)		
33 01 30 41-0022 LF Jet Cleaning Of Culvert, 0-250 LF.....	12.50	
For >250 To 500, Deduct	-0.63	
For >500 To 1,000, Deduct	-1.25	
For >1,000 To 2,000, Deduct	-1.88	
For >2,000 To 5,000, Deduct	-2.50	
For >5,000, Deduct	-3.13	
33 01 30 41-0023 Pipe Line Cleaning, Mechanical Method (33 01 30 41-0001)		
Note: Power winching buckets, scrapers, scooters, porcupines, brushes and other debris removing equipment. Includes removal of all debris/waste. Excludes disposal.		
33 01 30 41-0024 EA Initial Set Up And Final Equipment Removal For Mechanical Cleaning.....	958.73	
33 01 30 41-0025 EA Move And Reset Up At Different Access/Location	319.57	
33 01 30 41-0026 LF Up To 4" Diameter Pipe Line Cleaning, Mechanical Method	5.48	
For >250 To 500, Deduct	-0.27	
For >500 To 1,000, Deduct	-0.53	
For >1,000 To 2,000, Deduct	-0.80	
For >2,000 To 5,000, Deduct	-1.07	
For >5,000, Deduct	-1.33	
33 01 30 41-0027 LF 6" Diameter Pipe Line Cleaning, Mechanical Method	7.15	
For >250 To 500, Deduct	-0.34	
For >500 To 1,000, Deduct	-0.69	
For >1,000 To 2,000, Deduct	-1.03	
For >2,000 To 5,000, Deduct	-1.37	
For >5,000, Deduct	-1.71	
33 01 30 41-0028 LF 8" Diameter Pipe Line Cleaning, Mechanical Method	8.36	
For >250 To 500, Deduct	-0.40	
For >500 To 1,000, Deduct	-0.80	
For >1,000 To 2,000, Deduct	-1.20	
For >2,000 To 5,000, Deduct	-1.60	
For >5,000, Deduct	-2.00	
33 01 30 41-0029 LF 10" Diameter Pipe Line Cleaning, Mechanical Method	9.67	
For >250 To 500, Deduct	-0.46	
For >500 To 1,000, Deduct	-0.92	
For >1,000 To 2,000, Deduct	-1.38	
For >2,000 To 5,000, Deduct	-1.84	
For >5,000, Deduct	-2.31	
33 01 30 41-0030 LF 12" Diameter Pipe Line Cleaning, Mechanical Method	10.51	
For >250 To 500, Deduct	-0.50	
For >500 To 1,000, Deduct	-1.00	
For >1,000 To 2,000, Deduct	-1.50	
For >2,000 To 5,000, Deduct	-2.00	
For >5,000, Deduct	-2.50	
33 01 30 41-0031 Pipe Line Auguring/Rod Out Pipe (33 01 30 41-0001)		
33 01 30 41-0032 EA Initial Set Up And Final Equipment Removal For Auguring.....	958.73	
33 01 30 41-0033 EA Move And Reset Up At Different Location	319.57	
33 01 30 41-0034 LF Up To 4" Diameter Pipe Line Auguring/Rod Out.....	3.19	
For >250 To 500, Deduct	-0.16	
For >500 To 1,000, Deduct	-0.32	
For >1,000 To 2,000, Deduct	-0.48	
For >2,000 To 5,000, Deduct	-0.64	
For >5,000, Deduct	-0.80	
33 01 30 41-0035 LF 6" Diameter Pipe Line Auguring/Rod Out.....	4.13	
For >250 To 500, Deduct	-0.21	
For >500 To 1,000, Deduct	-0.41	
For >1,000 To 2,000, Deduct	-0.62	
For >2,000 To 5,000, Deduct	-0.83	
For >5,000, Deduct	-1.03	
33 01 30 41-0036 LF 8" Diameter Pipe Line Auguring/Rod Out.....	4.80	
For >250 To 500, Deduct	-0.24	
For >500 To 1,000, Deduct	-0.48	
For >1,000 To 2,000, Deduct	-0.72	
For >2,000 To 5,000, Deduct	-0.96	
For >5,000, Deduct	-1.20	
33 01 30 41-0037 LF 10" Diameter Pipe Line Auguring/Rod Out.....	5.57	
For >250 To 500, Deduct	-0.28	
For >500 To 1,000, Deduct	-0.56	
For >1,000 To 2,000, Deduct	-0.84	
For >2,000 To 5,000, Deduct	-1.11	
For >5,000, Deduct	-1.39	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 01 30 41-0038 LF 12" Diameter Pipe Line Auguring/Rod Out	6.00	
<i>For >250 To 500, Deduct</i>	-0.30	
<i>For >500 To 1,000, Deduct</i>	-0.60	
<i>For >1,000 To 2,000, Deduct</i>	-0.90	
<i>For >2,000 To 5,000, Deduct</i>	-1.20	
<i>For >5,000, Deduct</i>	-1.50	
33 01 30 41-0039 LF >12" To 16" Diameter Pipe Line Auguring/Rod Out	6.85	
<i>For >250 To 500, Deduct</i>	-0.34	
<i>For >500 To 1,000, Deduct</i>	-0.69	
<i>For >1,000 To 2,000, Deduct</i>	-1.03	
<i>For >2,000 To 5,000, Deduct</i>	-1.37	
<i>For >5,000, Deduct</i>	-1.71	
33 01 30 41-0040 LF >16" To 24" Diameter Pipe Line Auguring/Rod Out	8.41	
<i>For >250 To 500, Deduct</i>	-0.42	
<i>For >500 To 1,000, Deduct</i>	-0.84	
<i>For >1,000 To 2,000, Deduct</i>	-1.26	
<i>For >2,000 To 5,000, Deduct</i>	-1.68	
<i>For >5,000, Deduct</i>	-2.10	
33 01 30 41-0041 LF >24" To 30" Diameter Pipe Line Auguring/Rod Out	9.40	
<i>For >250 To 500, Deduct</i>	-0.47	
<i>For >500 To 1,000, Deduct</i>	-0.94	
<i>For >1,000 To 2,000, Deduct</i>	-1.41	
<i>For >2,000 To 5,000, Deduct</i>	-1.88	
<i>For >5,000, Deduct</i>	-2.35	
33 01 30 41-0042 LF >30" To 42" Diameter Pipe Line Auguring/Rod Out	10.89	
<i>For >250 To 500, Deduct</i>	-0.54	
<i>For >500 To 1,000, Deduct</i>	-1.09	
<i>For >1,000 To 2,000, Deduct</i>	-1.63	
<i>For >2,000 To 5,000, Deduct</i>	-2.18	
<i>For >5,000, Deduct</i>	-2.72	
33 01 30 41-0043 LF >42 To 60" Diameter Pipe Line Auguring/Rod Out	14.98	
<i>For >250 To 500, Deduct</i>	-0.75	
<i>For >500 To 1,000, Deduct</i>	-1.50	
<i>For >1,000 To 2,000, Deduct</i>	-2.25	
<i>For >2,000 To 5,000, Deduct</i>	-3.00	
<i>For >5,000, Deduct</i>	-3.75	
33 01 30 41-0044 LF >60" Diameter Pipe Line Auguring/Rod Out	15.98	
<i>For >250 To 500, Deduct</i>	-0.80	
<i>For >500 To 1,000, Deduct</i>	-1.60	
<i>For >1,000 To 2,000, Deduct</i>	-2.40	
<i>For >2,000 To 5,000, Deduct</i>	-3.20	
<i>For >5,000, Deduct</i>	-4.00	

33 01 30 42 Cleaning of Manholes (33 01 30)

33 01 30 42-0001 Structure Cleaning And Flushing (33 01 30 42)
 Note: Includes flushing. Owner provided water.

33 01 30 42-0002 Rod Out Structures And Other Hand Operations (33 01 30 42-0001)

33 01 30 42-0003 EA Rod Out Sewer Catch Basin	75.45	
33 01 30 42-0004 EA Clean Out Debris From Entrance To Inlet Structure	188.62	
33 01 30 42-0005 EA 3' To 4' Diameter, Clean Out Blocked Manhole By Hand.....	730.69	
<i>For >10 To 100, Deduct</i>	-109.60	
<i>For >100 To 250, Deduct</i>	-164.41	
<i>For >250, Deduct</i>	-219.21	
33 01 30 42-0006 EA 5' To 6' Diameter, Clean Out Blocked Manhole By Hand.....	876.83	
<i>For >10 To 100, Deduct</i>	-131.52	
<i>For >100 To 250, Deduct</i>	-197.29	
<i>For >250, Deduct</i>	-263.05	
33 01 30 42-0007 EA Clean Out Blocked Catch Basin By Hand.....	438.42	
<i>For >10 To 100, Deduct</i>	-65.76	
<i>For >100 To 250, Deduct</i>	-98.64	
<i>For >250, Deduct</i>	-131.53	

33 01 30 42-0008 Cleaning Manholes And Drainage Structures (33 01 30 42-0001)

Note: Includes removal of debris. Excludes disposal.		
33 01 30 42-0009 VLF Waterblast Cleaning For 3' To 4' Diameter Manhole	83.75	
33 01 30 42-0010 VLF Waterblast Cleaning For 5' To 6' Diameter Manhole	104.68	
33 01 30 42-0011 EA Vacuum Out 1 To 2 Catch Basins Or Manholes	1,066.42	
Note: Includes vacuum pump equipment.		
33 01 30 42-0012 EA Vacuum Out 3 To 10 Catch Basins Or Manholes	799.81	
Note: Includes vacuum pump equipment.		
33 01 30 42-0013 EA Vacuum Out 11 To 25 Catch Basins Or Manholes	533.21	
Note: Includes vacuum pump equipment.		
33 01 30 42-0014 EA Vacuum Out 26 To 100 Catch Basins Or Manholes	466.56	
Note: Includes vacuum pump equipment.		
33 01 30 42-0015 EA Vacuum Out 101 To 250 Catch Basins Or Manholes	433.23	
Note: Includes vacuum pump equipment.		
33 01 30 42-0016 EA Vacuum Out >250 Catch Basins Or Manholes	399.91	
Note: Includes vacuum pump equipment.		

33 01 30 51 Maintenance Of Utilities (33 01 30)

33 Utilities**33 01 Operation And Maintenance Of Utilities****33 01 30 Operation And Maintenance Of Sewer Utilities**

MINOR		TOTAL DIRECT	DEMOLITION
CSI	UOM DESCRIPTION	UNIT COST	UNIT COST
33 01 30 51-0001	Pipe Repair <small>(33 01 30 51)</small>		
33 01 30 51-0002	Pipe Repair Clamp, Full Circle, Single Band <small>(33 01 30 51-0001)</small>		
	Note: Repair clamps for asbestos cement pipe, cast iron soil pipe, non-reinforced concrete pipe, PVC pipe, vitrified clay pipe, gray iron pipe and ductile iron pipe.		
33 01 30 51-0003	EA 2" Diameter, 7-1/2" Long, Pipe Repair Clamp, Single Band With Alloy Bolts And Nuts (Smith-Blair 226)	107.92	
	For Stainless Steel Nuts And Bolts, Add	18.76	
33 01 30 51-0004	EA 2" Diameter, 10" Long, Pipe Repair Clamp, Single Band With Alloy Bolts And Nuts (Smith-Blair 226)	154.87	
	For Stainless Steel Nuts And Bolts, Add	28.27	
33 01 30 51-0005	EA 2" Diameter, 12-1/2" Long, Pipe Repair Clamp, Single Band With Alloy Bolts And Nuts (Smith-Blair 226)	179.52	
	For Stainless Steel Nuts And Bolts, Add	33.30	
33 01 30 51-0006	EA 2" Diameter, 15" Long, Pipe Repair Clamp, Single Band With Alloy Bolts And Nuts (Smith-Blair 226)	204.87	
	For Stainless Steel Nuts And Bolts, Add	38.31	
33 01 30 51-0007	EA 2-1/2" Diameter, 7-1/2" Long, Pipe Repair Clamp, Single Band With Alloy Bolts And Nuts (Smith-Blair 226)	116.53	
	For Stainless Steel Nuts And Bolts, Add	20.38	
33 01 30 51-0008	EA 2-1/2" Diameter, 10" Long, Pipe Repair Clamp, Single Band With Alloy Bolts And Nuts (Smith-Blair 226)	164.72	
	For Stainless Steel Nuts And Bolts, Add	30.17	
33 01 30 51-0009	EA 2-1/2" Diameter, 12-1/2" Long, Pipe Repair Clamp, Single Band With Alloy Bolts And Nuts (Smith-Blair 226)	189.26	
	For Stainless Steel Nuts And Bolts, Add	35.08	
33 01 30 51-0010	EA 2-1/2" Diameter, 15" Long, Pipe Repair Clamp, Single Band With Alloy Bolts And Nuts (Smith-Blair 226)	219.18	
	For Stainless Steel Nuts And Bolts, Add	41.05	
33 01 30 51-0011	EA 3" Diameter, 7-1/2" Long, Pipe Repair Clamp, Single Band With Alloy Bolts And Nuts (Smith-Blair 226)	125.67	
	For Stainless Steel Nuts And Bolts, Add	22.29	
33 01 30 51-0012	EA 3" Diameter, 10" Long, Pipe Repair Clamp, Single Band With Alloy Bolts And Nuts (Smith-Blair 226)	171.50	
	For Stainless Steel Nuts And Bolts, Add	31.55	
33 01 30 51-0013	EA 3" Diameter, 12-1/2" Long, Pipe Repair Clamp, Single Band With Alloy Bolts And Nuts (Smith-Blair 226)	198.74	
	For Stainless Steel Nuts And Bolts, Add	36.99	
33 01 30 51-0014	EA 3" Diameter, 15" Long, Pipe Repair Clamp, Single Band With Alloy Bolts And Nuts (Smith-Blair 226)	232.44	
	For Stainless Steel Nuts And Bolts, Add	43.91	
33 01 30 51-0015	EA 4" Diameter, 7-1/2" Long, Pipe Repair Clamp, Single Band With Alloy Bolts And Nuts (Smith-Blair 226)	141.79	
	For Stainless Steel Nuts And Bolts, Add	25.34	
33 01 30 51-0016	EA 4" Diameter, 10" Long, Pipe Repair Clamp, Single Band With Alloy Bolts And Nuts (Smith-Blair 226)	187.87	
	For Stainless Steel Nuts And Bolts, Add	34.12	
33 01 30 51-0017	EA 4" Diameter, 12-1/2" Long, Pipe Repair Clamp, Single Band With Alloy Bolts And Nuts (Smith-Blair 226)	227.99	
	For Stainless Steel Nuts And Bolts, Add	41.53	
33 01 30 51-0018	EA 4" Diameter, 15" Long, Pipe Repair Clamp, Single Band With Alloy Bolts And Nuts (Smith-Blair 226)	274.72	
	For Stainless Steel Nuts And Bolts, Add	50.10	
33 01 30 51-0019	EA 4" Diameter, 20" Long, Pipe Repair Clamp, Single Band With Alloy Bolts And Nuts (Smith-Blair 226)	360.83	
	For Stainless Steel Nuts And Bolts, Add	67.29	
33 01 30 51-0020	EA 4" Diameter, 25" Long, Pipe Repair Clamp, Single Band With Alloy Bolts And Nuts (Smith-Blair 226)	449.64	
	For Stainless Steel Nuts And Bolts, Add	84.48	
33 01 30 51-0021	EA 4" Diameter, 30" Long, Pipe Repair Clamp, Single Band With Alloy Bolts And Nuts (Smith-Blair 226)	549.07	
	For Stainless Steel Nuts And Bolts, Add	103.63	
33 01 30 51-0022	EA 6" Diameter, 7-1/2" Long, Pipe Repair Clamp, Single Band With Alloy Bolts And Nuts (Smith-Blair 226)	166.79	
	For Stainless Steel Nuts And Bolts, Add	29.91	
33 01 30 51-0023	EA 6" Diameter, 10" Long, Pipe Repair Clamp, Single Band With Alloy Bolts And Nuts (Smith-Blair 226)	222.33	
	For Stainless Steel Nuts And Bolts, Add	40.57	
33 01 30 51-0024	EA 6" Diameter, 12-1/2" Long, Pipe Repair Clamp, Single Band With Alloy Bolts And Nuts (Smith-Blair 226)	263.13	
	For Stainless Steel Nuts And Bolts, Add	47.84	
33 01 30 51-0025	EA 6" Diameter, 15" Long, Pipe Repair Clamp, Single Band With Alloy Bolts And Nuts (Smith-Blair 226)	307.86	
	For Stainless Steel Nuts And Bolts, Add	55.59	
33 01 30 51-0026	EA 6" Diameter, 20" Long, Pipe Repair Clamp, Single Band With Alloy Bolts And Nuts (Smith-Blair 226)	429.62	
	For Stainless Steel Nuts And Bolts, Add	80.56	
33 01 30 51-0027	EA 6" Diameter, 25" Long, Pipe Repair Clamp, Single Band With Alloy Bolts And Nuts (Smith-Blair 226)	522.65	
	For Stainless Steel Nuts And Bolts, Add	98.23	
33 01 30 51-0028	EA 6" Diameter, 30" Long, Pipe Repair Clamp, Single Band With Alloy Bolts And Nuts (Smith-Blair 226)	624.30	
	For Stainless Steel Nuts And Bolts, Add	117.39	
33 01 30 51-0029	EA 8" Diameter, 7-1/2" Long, Pipe Repair Clamp, Single Band With Alloy Bolts And Nuts (Smith-Blair 226)	214.37	
	For Stainless Steel Nuts And Bolts, Add	35.78	
33 01 30 51-0030	EA 8" Diameter, 10" Long, Pipe Repair Clamp, Single Band With Alloy Bolts And Nuts (Smith-Blair 226)	279.35	
	For Stainless Steel Nuts And Bolts, Add	47.35	
33 01 30 51-0031	EA 8" Diameter, 12-1/2" Long, Pipe Repair Clamp, Single Band With Alloy Bolts And Nuts (Smith-Blair 226)	337.31	
	For Stainless Steel Nuts And Bolts, Add	57.30	
33 01 30 51-0032	EA 8" Diameter, 15" Long, Pipe Repair Clamp, Single Band With Alloy Bolts And Nuts (Smith-Blair 226)	402.69	
	For Stainless Steel Nuts And Bolts, Add	68.28	
33 01 30 51-0033	EA 8" Diameter, 20" Long, Pipe Repair Clamp, Single Band With Alloy Bolts And Nuts (Smith-Blair 226)	538.39	
	For Stainless Steel Nuts And Bolts, Add	94.59	
33 01 30 51-0034	EA 8" Diameter, 25" Long, Pipe Repair Clamp, Single Band With Alloy Bolts And Nuts (Smith-Blair 226)	643.91	
	For Stainless Steel Nuts And Bolts, Add	113.10	
33 01 30 51-0035	EA 8" Diameter, 30" Long, Pipe Repair Clamp, Single Band With Alloy Bolts And Nuts (Smith-Blair 226)	761.82	
	For Stainless Steel Nuts And Bolts, Add	133.12	
33 01 30 51-0036	EA 10" Diameter, 7-1/2" Long, Pipe Repair Clamp, Single Band With Alloy Bolts And Nuts (Smith-Blair 226)	252.56	
	For Stainless Steel Nuts And Bolts, Add	43.55	
33 01 30 51-0037	EA 10" Diameter, 10" Long, Pipe Repair Clamp, Single Band With Alloy Bolts And Nuts (Smith-Blair 226)	340.91	
	For Stainless Steel Nuts And Bolts, Add	60.24	
33 01 30 51-0038	EA 10" Diameter, 12-1/2" Long, Pipe Repair Clamp, Single Band With Alloy Bolts And Nuts (Smith-Blair 226)	401.04	
	For Stainless Steel Nuts And Bolts, Add	70.43	
33 01 30 51-0039	EA 10" Diameter, 15" Long, Pipe Repair Clamp, Single Band With Alloy Bolts And Nuts (Smith-Blair 226)	492.68	
	For Stainless Steel Nuts And Bolts, Add	87.11	
33 01 30 51-0040	EA 10" Diameter, 20" Long, Pipe Repair Clamp, Single Band With Alloy Bolts And Nuts (Smith-Blair 226)	650.45	
	For Stainless Steel Nuts And Bolts, Add	118.16	
33 01 30 51-0041	EA 10" Diameter, 25" Long, Pipe Repair Clamp, Single Band With Alloy Bolts And Nuts (Smith-Blair 226)	738.09	
	For Stainless Steel Nuts And Bolts, Add	132.06	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 01 30 51-0042 EA 10" Diameter, 30" Long, Pipe Repair Clamp, Single Band With Alloy Bolts And Nuts (Smith-Blair 226) <i>For Stainless Steel Nuts And Bolts, Add</i>	953.77 174.23	
33 01 30 51-0043 EA 12" Diameter, 7-1/2" Long, Pipe Repair Clamp, Single Band With Alloy Bolts And Nuts (Smith-Blair 226) <i>For Stainless Steel Nuts And Bolts, Add</i>	287.07 49.12	
33 01 30 51-0044 EA 12" Diameter, 10" Long, Pipe Repair Clamp, Single Band With Alloy Bolts And Nuts (Smith-Blair 226) <i>For Stainless Steel Nuts And Bolts, Add</i>	375.92 65.33	
33 01 30 51-0045 EA 12" Diameter, 12-1/2" Long, Pipe Repair Clamp, Single Band With Alloy Bolts And Nuts (Smith-Blair 226) <i>For Stainless Steel Nuts And Bolts, Add</i>	453.96 79.05	
33 01 30 51-0046 EA 12" Diameter, 15" Long, Pipe Repair Clamp, Single Band With Alloy Bolts And Nuts (Smith-Blair 226) <i>For Stainless Steel Nuts And Bolts, Add</i>	559.40 98.23	
33 01 30 51-0047 EA 12" Diameter, 20" Long, Pipe Repair Clamp, Single Band With Alloy Bolts And Nuts (Smith-Blair 226) <i>For Stainless Steel Nuts And Bolts, Add</i>	722.89 129.75	
33 01 30 51-0048 EA 12" Diameter, 25" Long, Pipe Repair Clamp, Single Band With Alloy Bolts And Nuts (Smith-Blair 226) <i>For Stainless Steel Nuts And Bolts, Add</i>	849.15 151.52	
33 01 30 51-0049 EA 12" Diameter, 30" Long, Pipe Repair Clamp, Single Band With Alloy Bolts And Nuts (Smith-Blair 226) <i>For Stainless Steel Nuts And Bolts, Add</i>	1,082.78 196.47	
33 01 30 51-0050 Pipe Repair Clamp, Full Circle, Double Bands <small>(33 01 30 51-0001)</small>		
<i>Note: Repair clamps for reinforced concrete pipe, gray iron pipe and ductile iron pipe.</i>		
33 01 30 51-0051 EA 14.38"-15.13" OD Diameter Pipe, 10" Long, Pipe Repair Clamp, Double Bands With Alloy Bolts And Nuts (Smith-Blair 228) <i>For Stainless Steel Nuts And Bolts, Add</i>	655.82 188.99	
33 01 30 51-0052 EA 14.38"-15.13" OD Diameter Pipe, 15" Long, Pipe Repair Clamp, Double Bands With Alloy Bolts And Nuts (Smith-Blair 228) <i>For Stainless Steel Nuts And Bolts, Add</i>	932.77 272.83	
33 01 30 51-0053 EA 14.38"-15.13" OD Diameter Pipe, 20" Long, Pipe Repair Clamp, Double Bands With Alloy Bolts And Nuts (Smith-Blair 228) <i>For Stainless Steel Nuts And Bolts, Add</i>	1,257.65 370.00	
33 01 30 51-0054 EA 14.38"-15.13" OD Diameter Pipe, 30" Long, Pipe Repair Clamp, Double Bands With Alloy Bolts And Nuts (Smith-Blair 228) <i>For Stainless Steel Nuts And Bolts, Add</i>	1,860.32 557.66	
33 01 30 51-0055 EA 15.07"-15.82" OD Diameter Pipe, 10" Long, Pipe Repair Clamp, Double Bands With Alloy Bolts And Nuts (Smith-Blair 228) <i>For Stainless Steel Nuts And Bolts, Add</i>	688.32 198.29	
33 01 30 51-0056 EA 15.07"-15.82" OD Diameter Pipe, 15" Long, Pipe Repair Clamp, Double Bands With Alloy Bolts And Nuts (Smith-Blair 228) <i>For Stainless Steel Nuts And Bolts, Add</i>	976.37 285.48	
33 01 30 51-0057 EA 15.07"-15.82" OD Diameter Pipe, 20" Long, Pipe Repair Clamp, Double Bands With Alloy Bolts And Nuts (Smith-Blair 228) <i>For Stainless Steel Nuts And Bolts, Add</i>	1,313.07 385.97	
33 01 30 51-0058 EA 15.07"-15.82" OD Diameter Pipe, 30" Long, Pipe Repair Clamp, Double Bands With Alloy Bolts And Nuts (Smith-Blair 228) <i>For Stainless Steel Nuts And Bolts, Add</i>	1,949.96 584.27	
33 01 30 51-0059 EA 15.92"-16.67" OD Diameter Pipe, 10" Long, Pipe Repair Clamp, Double Bands With Alloy Bolts And Nuts (Smith-Blair 228) <i>For Stainless Steel Nuts And Bolts, Add</i>	705.24 202.30	
33 01 30 51-0060 EA 15.92"-16.67" OD Diameter Pipe, 15" Long, Pipe Repair Clamp, Double Bands With Alloy Bolts And Nuts (Smith-Blair 228) <i>For Stainless Steel Nuts And Bolts, Add</i>	998.66 290.82	
33 01 30 51-0061 EA 15.92"-16.67" OD Diameter Pipe, 20" Long, Pipe Repair Clamp, Double Bands With Alloy Bolts And Nuts (Smith-Blair 228) <i>For Stainless Steel Nuts And Bolts, Add</i>	1,346.61 394.62	
33 01 30 51-0062 EA 15.92"-16.67" OD Diameter Pipe, 30" Long, Pipe Repair Clamp, Double Bands With Alloy Bolts And Nuts (Smith-Blair 228) <i>For Stainless Steel Nuts And Bolts, Add</i>	1,998.15 596.91	
33 01 30 51-0063 EA 16.56"-17.31" OD Diameter Pipe, 10" Long, Pipe Repair Clamp, Double Bands With Alloy Bolts And Nuts (Smith-Blair 228) <i>For Stainless Steel Nuts And Bolts, Add</i>	722.87 206.29	
33 01 30 51-0064 EA 16.56"-17.31" OD Diameter Pipe, 15" Long, Pipe Repair Clamp, Double Bands With Alloy Bolts And Nuts (Smith-Blair 228) <i>For Stainless Steel Nuts And Bolts, Add</i>	1,024.00 296.80	
33 01 30 51-0065 EA 16.56"-17.31" OD Diameter Pipe, 20" Long, Pipe Repair Clamp, Double Bands With Alloy Bolts And Nuts (Smith-Blair 228) <i>For Stainless Steel Nuts And Bolts, Add</i>	1,378.42 401.94	
33 01 30 51-0066 EA 16.56"-17.31" OD Diameter Pipe, 30" Long, Pipe Repair Clamp, Double Bands With Alloy Bolts And Nuts (Smith-Blair 228) <i>For Stainless Steel Nuts And Bolts, Add</i>	2,045.90 608.90	
33 01 30 51-0067 EA 17.15"-17.90" OD Diameter Pipe, 10" Long, Pipe Repair Clamp, Double Bands With Alloy Bolts And Nuts (Smith-Blair 228) <i>For Stainless Steel Nuts And Bolts, Add</i>	738.56 209.62	
33 01 30 51-0068 EA 17.15"-17.90" OD Diameter Pipe, 15" Long, Pipe Repair Clamp, Double Bands With Alloy Bolts And Nuts (Smith-Blair 228) <i>For Stainless Steel Nuts And Bolts, Add</i>	1,045.39 301.45	
33 01 30 51-0069 EA 17.15"-17.90" OD Diameter Pipe, 20" Long, Pipe Repair Clamp, Double Bands With Alloy Bolts And Nuts (Smith-Blair 228) <i>For Stainless Steel Nuts And Bolts, Add</i>	1,410.23 409.25	
33 01 30 51-0070 EA 17.15"-17.90" OD Diameter Pipe, 30" Long, Pipe Repair Clamp, Double Bands With Alloy Bolts And Nuts (Smith-Blair 228) <i>For Stainless Steel Nuts And Bolts, Add</i>	2,088.51 618.87	
33 01 30 51-0071 EA 17.82"-18.57" OD Diameter Pipe, 10" Long, Pipe Repair Clamp, Double Bands With Alloy Bolts And Nuts (Smith-Blair 228) <i>For Stainless Steel Nuts And Bolts, Add</i>	753.49 212.96	

33 Utilities**33 01 Operation And Maintenance Of Utilities****33 01 30 Operation And Maintenance Of Sewer Utilities**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 01	30 51-0072	EA	17.82"-18.57" OD Diameter Pipe, 15" Long, Pipe Repair Clamp, Double Bands With Alloy Bolts And Nuts (Smith-Blair 228)	1,067.66	
			<i>For Stainless Steel Nuts And Bolts, Add</i>	306.78	
33 01	30 51-0073	EA	17.82"-18.57" OD Diameter Pipe, 20" Long, Pipe Repair Clamp, Double Bands With Alloy Bolts And Nuts (Smith-Blair 228)	1,438.63	
			<i>For Stainless Steel Nuts And Bolts, Add</i>	415.91	
33 01	30 51-0074	EA	17.82"-18.57" OD Diameter Pipe, 30" Long, Pipe Repair Clamp, Double Bands With Alloy Bolts And Nuts (Smith-Blair 228)	2,114.92	
			<i>For Stainless Steel Nuts And Bolts, Add</i>	623.86	
33 01	30 51-0075	EA	18.46"-19.21" OD Diameter Pipe, 10" Long, Pipe Repair Clamp, Double Bands With Alloy Bolts And Nuts (Smith-Blair 228)	770.82	
			<i>For Stainless Steel Nuts And Bolts, Add</i>	217.10	
33 01	30 51-0076	EA	18.46"-19.21" OD Diameter Pipe, 15" Long, Pipe Repair Clamp, Double Bands With Alloy Bolts And Nuts (Smith-Blair 228)	1,094.21	
			<i>For Stainless Steel Nuts And Bolts, Add</i>	313.43	
33 01	30 51-0077	EA	18.46"-19.21" OD Diameter Pipe, 20" Long, Pipe Repair Clamp, Double Bands With Alloy Bolts And Nuts (Smith-Blair 228)	1,468.96	
			<i>For Stainless Steel Nuts And Bolts, Add</i>	423.23	
33 01	30 51-0078	EA	18.46"-19.21" OD Diameter Pipe, 30" Long, Pipe Repair Clamp, Double Bands With Alloy Bolts And Nuts (Smith-Blair 228)	2,177.84	
			<i>For Stainless Steel Nuts And Bolts, Add</i>	641.50	
33 01 30 73 Rehabilitation Of Manholes And Sewer Structures (33 01 30)					
33 01	30 73-0001		Restoration And Rehabilitation Of Manholes (33 01 30 73) Note: Work is in confined spaces.		
33 01	30 73-0002		Manhole Seals (33 01 30 73-0001)		
33 01	30 73-0003		Internal Manhole Chimney Seals (33 01 30 73-0002) Note: Cretex.		
33 01	30 73-0004	EA	20" Internal Manhole Chimney Seal	364.22	
33 01	30 73-0005	EA	22" Internal Manhole Chimney Seal	383.92	
33 01	30 73-0006	EA	24" Internal Manhole Chimney Seal	393.76	
33 01	30 73-0007	EA	26" Internal Manhole Chimney Seal	452.82	
33 01	30 73-0008	EA	28" Internal Manhole Chimney Seal	511.88	
33 01	30 73-0009	EA	30" Internal Manhole Chimney Seal	570.95	
33 01	30 73-0010	EA	36" Internal Manhole Chimney Seal	689.08	
33 01	30 73-0011		External Manhole Encapsulation (33 01 30 73-0002) Note: Wrapidseal.		
33 01	30 73-0012	EA	24" External Manhole Encapsulation	531.57	
33 01	30 73-0013	EA	30" External Manhole Encapsulation	561.10	
33 01	30 73-0014	EA	36" External Manhole Encapsulation	600.48	
33 01	30 73-0015	EA	42" External Manhole Encapsulation	649.70	
33 01	30 73-0016	EA	48" External Manhole Encapsulation	718.62	
33 01	30 73-0017	EA	54" External Manhole Encapsulation	797.36	
33 01	30 73-0018	EA	60" External Manhole Encapsulation	895.80	
33 01	30 73-0019		Manhole Restoration (33 01 30 73-0001) Note: Includes power washing and cleaning of manhole interiors.		
33 01	30 73-0020		Cementitious Manhole Restoration, Interior (33 01 30 73-0019)		
33 01	30 73-0021	VLF	1/2" Cementitious Restoration On 3' Diameter Manhole Interior	104.11	
			<i>For Each Additional 1/2" Thick Material, Add</i>	24.20	
			<i>For 2 To 5 Manholes, Deduct</i>	-7.38	
			<i>For 6 To 10 Manholes, Deduct</i>	-12.15	
			<i>For >10 Manholes, Deduct</i>	-24.30	
33 01	30 73-0022	VLF	1/2" Cementitious Restoration On 3-1/2' Diameter Manhole Interior	120.70	
			<i>For Each Additional 1/2" Thick Material, Add</i>	28.15	
			<i>For 2 To 5 Manholes, Deduct</i>	-8.55	
			<i>For 6 To 10 Manholes, Deduct</i>	-14.08	
			<i>For >10 Manholes, Deduct</i>	-28.17	
33 01	30 73-0023	VLF	1/2" Cementitious Restoration On 4' Diameter Manhole Interior	137.28	
			<i>For Each Additional 1/2" Thick Material, Add</i>	32.10	
			<i>For 2 To 5 Manholes, Deduct</i>	-9.72	
			<i>For 6 To 10 Manholes, Deduct</i>	-16.01	
			<i>For >10 Manholes, Deduct</i>	-32.02	
33 01	30 73-0024	VLF	1/2" Cementitious Restoration On 5' Diameter Manhole Interior	161.45	
			<i>For Each Additional 1/2" Thick Material, Add</i>	39.23	
			<i>For 2 To 5 Manholes, Deduct</i>	-11.39	
			<i>For 6 To 10 Manholes, Deduct</i>	-18.74	
			<i>For >10 Manholes, Deduct</i>	-37.48	
33 01	30 73-0025	VLF	1/2" Cementitious Restoration On 6' Diameter Manhole Interior	176.21	
			<i>For Each Additional 1/2" Thick Material, Add</i>	45.18	
			<i>For 2 To 5 Manholes, Deduct</i>	-12.35	
			<i>For 6 To 10 Manholes, Deduct</i>	-20.30	
			<i>For >10 Manholes, Deduct</i>	-40.61	
33 01	30 73-0026		Polyurethane Manhole Restoration, Interior (33 01 30 73-0019)		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 01 30 73-0027 VLF 60 Mil Polyurethane Restoration Of 3' Diameter Manhole Interior	260.29	
For 80 Mil Material, Add	33.61	
For 100 Mil Material, Add	67.21	
For 125 Mil Material, Add	105.36	
For 150 Mil Material, Add	143.51	
For 200 Mil Material, Add	209.52	
For 2 To 5 Manholes, Deduct	-18.16	
For 6 To 10 Manholes, Deduct	-29.81	
For >10 Manholes, Deduct	-59.62	
33 01 30 73-0028 VLF 60 Mil Polyurethane Restoration Of 3-1/2' Diameter Manhole Interior	315.17	
For 80 Mil Material, Add	40.09	
For 100 Mil Material, Add	80.17	
For 125 Mil Material, Add	125.56	
For 150 Mil Material, Add	170.96	
For 200 Mil Material, Add	249.16	
For 2 To 5 Manholes, Deduct	-22.05	
For 6 To 10 Manholes, Deduct	-36.21	
For >10 Manholes, Deduct	-72.43	
33 01 30 73-0029 VLF 60 Mil Polyurethane Restoration Of 4' Diameter Manhole Interior	347.06	
For 80 Mil Material, Add	44.81	
For 100 Mil Material, Add	89.62	
For 125 Mil Material, Add	140.49	
For 150 Mil Material, Add	191.36	
For 200 Mil Material, Add	279.38	
For 2 To 5 Manholes, Deduct	-24.21	
For 6 To 10 Manholes, Deduct	-39.75	
For >10 Manholes, Deduct	-79.50	
33 01 30 73-0030 VLF 60 Mil Polyurethane Restoration Of 5' Diameter Manhole Interior	433.87	
For 80 Mil Material, Add	56.03	
For 100 Mil Material, Add	112.06	
For 125 Mil Material, Add	175.67	
For 150 Mil Material, Add	239.28	
For 200 Mil Material, Add	349.35	
For 2 To 5 Manholes, Deduct	-30.27	
For 6 To 10 Manholes, Deduct	-49.69	
For >10 Manholes, Deduct	-99.37	
33 01 30 73-0031 VLF 60 Mil Polyurethane Restoration Of 6' Diameter Manhole Interior	520.64	
For 80 Mil Material, Add	67.23	
For 100 Mil Material, Add	134.46	
For 125 Mil Material, Add	210.79	
For 150 Mil Material, Add	287.11	
For 200 Mil Material, Add	419.18	
For 2 To 5 Manholes, Deduct	-36.32	
For 6 To 10 Manholes, Deduct	-59.63	
For >10 Manholes, Deduct	-119.25	
33 01 30 73-0032 Epoxy Manhole Restoration, Interior (33 01 30 73-0019)		
33 01 30 73-0033 VLF 60 Mil Epoxy Restoration Of 3' Diameter Manhole Interior	236.37	
For 80 Mil Material, Add	25.63	
For 100 Mil Material, Add	51.27	
For 125 Mil Material, Add	79.45	
For 150 Mil Material, Add	107.63	
For 200 Mil Material, Add	153.71	
For 2 To 5 Manholes, Deduct	-16.96	
For 6 To 10 Manholes, Deduct	-28.02	
For >10 Manholes, Deduct	-56.03	
33 01 30 73-0034 VLF 60 Mil Epoxy Restoration Of 3-1/2' Diameter Manhole Interior	287.23	
For 80 Mil Material, Add	30.77	
For 100 Mil Material, Add	61.54	
For 125 Mil Material, Add	95.29	
For 150 Mil Material, Add	129.05	
For 200 Mil Material, Add	183.97	
For 2 To 5 Manholes, Deduct	-20.65	
For 6 To 10 Manholes, Deduct	-34.12	
For >10 Manholes, Deduct	-68.23	
33 01 30 73-0035 VLF 60 Mil Epoxy Restoration Of 4' Diameter Manhole Interior	315.16	
For 80 Mil Material, Add	34.18	
For 100 Mil Material, Add	68.35	
For 125 Mil Material, Add	105.93	
For 150 Mil Material, Add	143.51	
For 200 Mil Material, Add	204.94	
For 2 To 5 Manholes, Deduct	-22.62	
For 6 To 10 Manholes, Deduct	-37.36	
For >10 Manholes, Deduct	-74.71	
33 01 30 73-0036 VLF 60 Mil Epoxy Restoration Of 5' Diameter Manhole Interior	393.97	
For 80 Mil Material, Add	42.73	
For 100 Mil Material, Add	85.46	
For 125 Mil Material, Add	132.44	
For 150 Mil Material, Add	179.43	
For 200 Mil Material, Add	256.25	
For 2 To 5 Manholes, Deduct	-28.27	
For 6 To 10 Manholes, Deduct	-46.69	
For >10 Manholes, Deduct	-93.39	

33 Utilities**33 01 Operation And Maintenance Of Utilities****33 01 30 Operation And Maintenance Of Sewer Utilities**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 01 30 73-0037 VLF 60 Mil Epoxy Restoration Of 6' Diameter Manhole Interior	472.77	
For 80 Mil Material, Add	51.28	
For 100 Mil Material, Add	102.55	
For 125 Mil Material, Add	158.93	
For 150 Mil Material, Add	215.31	
For 200 Mil Material, Add	307.49	
For 2 To 5 Manholes, Deduct	-33.93	
For 6 To 10 Manholes, Deduct	-56.03	
For >10 Manholes, Deduct	-112.07	
33 01 30 73-0038 Polyvinyl Chloride (PVC) Lining Manhole Restoration, Interior (33 01 30 73-0019)		
Note: Wound strip liners.		
33 01 30 73-0039 VLF 3' Diameter CIP Multiplex Liner For Existing Manhole	318.85	
For 2 To 5 Manholes, Deduct	-19.12	
For 6 To 10 Manholes, Deduct	-30.27	
For >10 Manholes, Deduct	-60.53	
33 01 30 73-0040 VLF 3-1/2' Diameter CIP Multiplex Liner For Existing Manhole	390.39	
For 2 To 5 Manholes, Deduct	-23.40	
For 6 To 10 Manholes, Deduct	-37.04	
For >10 Manholes, Deduct	-74.09	
33 01 30 73-0041 VLF 4' Diameter CIP Multiplex Liner For Existing Manhole	456.31	
For 2 To 5 Manholes, Deduct	-27.05	
For 6 To 10 Manholes, Deduct	-42.69	
For >10 Manholes, Deduct	-85.39	
33 01 30 73-0042 VLF 5' Diameter CIP Multiplex Liner For Existing Manhole	572.06	
For 2 To 5 Manholes, Deduct	-33.90	
For 6 To 10 Manholes, Deduct	-53.49	
For >10 Manholes, Deduct	-106.98	
33 01 30 73-0043 VLF 6' Diameter CIP Multiplex Liner For Existing Manhole	687.80	
For 2 To 5 Manholes, Deduct	-40.74	
For 6 To 10 Manholes, Deduct	-64.29	
For >10 Manholes, Deduct	-128.58	
33 01 30 73-0044 Manhole Crack Repair (33 01 30 73-0001)		
Note: Includes removing loose materials and cleaning.		
33 01 30 73-0045 LF Up To 1/4" Wide, Epoxy Grout Injection, Manhole Crack Repair	42.31	
33 01 30 73-0046 LF >1/4" To 1/2" Wide, Epoxy Grout Injection, Manhole Crack Repair	56.87	
33 01 30 73-0047 LF Up To 1/4" Wide, Urethane Grout Injection, Manhole Crack Repair	40.72	
33 01 30 73-0048 LF >1/4" To 1/2" Wide, Urethane Grout Injection, Manhole Crack Repair	54.98	
33 01 30 73-0049 Manhole Patching (33 01 30 73-0001)		
Note: Includes removing loose materials and cleaning.		
33 01 30 73-0050 SF Up To 1/4" Thick, Cementitious Grout, Manhole Patching	10.57	
33 01 30 73-0051 SF Up To 1/4" Thick, Epoxy Grout, Manhole Patching	25.30	
33 01 30 73-0052 Manhole Joint Restoration (33 01 30 73-0001)		
Note: Includes drilling holes at joints, fill joints with grout.		
33 01 30 73-0053 EA 3' Diameter Joint Restoration, Grout Fill Per Each Manhole	1,350.94	
Note: Includes two (2) joints sections to be grouted and two (2) pipe connections.		
For Grouting Each Additional Manhole Joint Section, Add	184.74	
33 01 30 73-0054 EA 3-1/2' Diameter Joint Restoration, Grout Fill Per Each Manhole	1,576.96	
Note: Includes two (2) joints sections to be grouted and two (2) pipe connections.		
For Grouting Each Additional Manhole Joint Section, Add	203.03	
33 01 30 73-0055 EA 4' Diameter Joint Restoration, Grout Fill Per Each Manhole	1,801.26	
Note: Includes two (2) joints sections to be grouted and two (2) pipe connections.		
For Grouting Each Additional Manhole Joint Section, Add	221.32	
33 01 30 73-0056 EA 5' Diameter Joint Restoration, Grout Fill Per Each Manhole	2,115.25	
Note: Includes two (2) joints sections to be grouted and two (2) pipe connections.		
For Grouting Each Additional Manhole Joint Section, Add	230.47	
33 01 30 73-0057 EA 6' Diameter Joint Restoration, Grout Fill Per Each Manhole	2,428.38	
Note: Includes two (2) joints sections to be grouted and two (2) pipe connections.		
For Grouting Each Additional Manhole Joint Section, Add	239.61	
33 01 30 73-0058 Step Installation In Existing Manholes (33 01 30 73-0001)		
Note: Including drilling in existing concrete manhole, step and grout. Demolition cost includes removal of old step and patching holes.		
33 01 30 73-0059 EA Drill And Grout 8" x 9" Cast Iron Manhole Steps	92.32	18.61
33 01 30 73-0060 EA Drill And Grout Galvanized Steel Manhole Step	79.58	18.61
33 01 30 73-0061 EA Bolt On Galvanized Steel Manhole Step	80.08	18.61
33 01 30 73-0062 EA Drill And Grout Aluminum Manhole Step	77.10	18.61
33 01 30 73-0063 EA Drill And Insert Polypropylene Manhole Step	49.80	14.89
33 01 30 73-0064 Invert Restoration (33 01 30 73-0001)		
Note: Includes removal of existing defective material and installation of new material.		
33 01 30 73-0065 Concrete Invert Restoration (33 01 30 73-0064)		
33 01 30 73-0066 EA 2' Diameter, Concrete Invert Restoration	257.21	
33 01 30 73-0067 EA 3' Diameter, Concrete Invert Restoration	290.64	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 01 30 73-0068 EA 4' Diameter, Concrete Invert Restoration.....	324.07	
33 01 30 73-0069 EA 5' Diameter, Concrete Invert Restoration.....	357.50	
33 01 30 73-0070 EA 6' Diameter, Concrete Invert Restoration.....	457.80	
33 01 30 73-0071 SF Square Or Rectangular, Concrete Invert Restoration.....	25.77	
33 01 30 73-0072 Brick Invert Restoration <small>(33 01 30 73-0064)</small>		
33 01 30 73-0073 EA 2' Diameter, Brick Invert Restoration.....	388.86	
33 01 30 73-0074 EA 3' Diameter, Brick Invert Restoration.....	422.28	
33 01 30 73-0075 EA 4' Diameter, Brick Invert Restoration.....	455.72	
33 01 30 73-0076 EA 5' Diameter, Brick Invert Restoration.....	489.15	
33 01 30 73-0077 EA 6' Diameter, Brick Invert Restoration.....	522.59	
33 01 30 73-0078 SF Square Or Rectangular, Brick Invert Restoration.....	36.42	

33 05 Common Work Results For Utilities (33)

33 05 16 Utility Structures (33 05)

33 05 16 13 Precast Concrete Directional Structures (33 05 16)

33 05 16 13-0001 Underground Utility Vaults And Structures (33 05 16 13)
 See CSI section 33 39 13 00-0001 for manholes, 33 39 13 00-0123 for frames and covers.

33 05 16 13-0002 Precast Concrete Underground Utility Vault (33 05 16 13-0001)
 Note: Sizes given are for inside dimensions.

33 05 16 13-0003 6' High Precast Concrete Underground Utility Vault (33 05 16 13-0002)

33 05 16 13-0004 EA 4' x 4' x 6' Precast Concrete Underground Utility Vault.....	2,449.67	
Note: 6" thick walls and 8" thick top.		
33 05 16 13-0005 EA 4' x 6' x 6' Precast Concrete Underground Utility Vault.....	3,193.17	
Note: 6" thick walls and 8" thick top.		
33 05 16 13-0006 EA 5' x 10' x 6' Precast Concrete Underground Utility Vault.....	5,268.03	
Note: 6" thick walls and 8" thick top.		
33 05 16 13-0007 EA 5' x 12' x 6' Precast Concrete Underground Utility Vault.....	6,082.75	
Note: 6" thick walls and 8" thick top.		
33 05 16 13-0008 EA 6' x 6' x 6' Precast Concrete Underground Utility Vault.....	4,080.74	
Note: 6" thick walls and 8" thick top.		
33 05 16 13-0009 EA 6' x 8' x 6' Precast Concrete Underground Utility Vault.....	4,967.48	
Note: 6" thick walls and 8" thick top.		
33 05 16 13-0010 EA 6' x 10' x 6' Precast Concrete Underground Utility Vault.....	5,855.04	
Note: 6" thick walls and 8" thick top.		
33 05 16 13-0011 EA 6' x 12' x 6' Precast Concrete Underground Utility Vault.....	8,459.43	
Note: 8" thick walls and top.		
33 05 16 13-0012 EA 6' x 14' x 6' Precast Concrete Underground Utility Vault.....	8,459.43	
Note: 8" thick walls and top.		
33 05 16 13-0013 EA 6' x 16' x 6' Precast Concrete Underground Utility Vault.....	10,651.75	
Note: 8" thick walls and top.		
33 05 16 13-0014 EA 8' x 8' x 6' Precast Concrete Underground Utility Vault.....	5,999.12	
Note: 6" thick walls and 8" thick top.		
33 05 16 13-0015 EA 8' x 10' x 6' Precast Concrete Underground Utility Vault.....	7,029.95	
Note: 6" thick walls and 8" thick top.		
33 05 16 13-0016 EA 8' x 12' x 6' Precast Concrete Underground Utility Vault.....	10,048.71	
Note: 8" thick walls and top.		
33 05 16 13-0017 EA 8' x 14' x 6' Precast Concrete Underground Utility Vault.....	11,309.81	
Note: 8" thick walls and top.		

33 05 16 13-0018 7' High Precast Concrete Underground Utility Vault (33 05 16 13-0002)

33 05 16 13-0019 EA 4' x 4' x 7' Precast Concrete Underground Utility Vault.....	2,696.86	
Note: 6" thick walls and 8" thick top.		
33 05 16 13-0020 EA 4' x 6' x 7' Precast Concrete Underground Utility Vault.....	3,501.76	
Note: 6" thick walls and 8" thick top.		
33 05 16 13-0021 EA 4' x 8' x 7' Precast Concrete Underground Utility Vault.....	4,306.65	
Note: 6" thick walls and 8" thick top.		
33 05 16 13-0022 EA 5' x 10' x 7' Precast Concrete Underground Utility Vault.....	5,730.51	
Note: 6" thick walls and 8" thick top.		
33 05 16 13-0023 EA 5' x 12' x 7' Precast Concrete Underground Utility Vault.....	6,607.43	
Note: 6" thick walls and 8" thick top.		
33 05 16 13-0024 EA 6' x 6' x 7' Precast Concrete Underground Utility Vault.....	4,450.71	
Note: 6" thick walls and 8" thick top.		
33 05 16 13-0025 EA 6' x 8' x 7' Precast Concrete Underground Utility Vault.....	5,399.69	
Note: 6" thick walls and 8" thick top.		
33 05 16 13-0026 EA 6' x 10' x 7' Precast Concrete Underground Utility Vault.....	6,348.62	
Note: 6" thick walls and 8" thick top.		
33 05 16 13-0027 EA 6' x 12' x 7' Precast Concrete Underground Utility Vault.....	9,199.37	
Note: 8" thick walls and top.		
33 05 16 13-0028 EA 6' x 16' x 7' Precast Concrete Underground Utility Vault.....	11,556.22	
Note: 8" thick walls and top.		
33 05 16 13-0029 EA 8' x 8' x 7' Precast Concrete Underground Utility Vault.....	6,492.69	
Note: 6" thick walls and 8" thick top.		
33 05 16 13-0030 EA 8' x 10' x 7' Precast Concrete Underground Utility Vault.....	7,584.90	
Note: 6" thick walls and 8" thick top.		

33 Utilities**33 05 Common Work Results For Utilities****33 05 16 Utility Structures**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 05 16 13-0031 EA 8' x 12' x 7' Precast Concrete Underground Utility Vault..... Note: 8" thick walls and top.	10,871.40	
33 05 16 13-0032 EA 8' x 14' x 7' Precast Concrete Underground Utility Vault..... Note: 8" thick walls and top.	12,213.45	
33 05 16 13-0033 EA 10' x 10' x 7' Precast Concrete Underground Utility Vault..... Note: 8" thick walls and top.	11,035.29	
33 05 16 13-0034 8' High Precast Concrete Underground Utility Vault <small>(33 05 16 13-0002)</small>		
33 05 16 13-0035 EA 4' x 4' x 8' Precast Concrete Underground Utility Vault..... Note: 6" thick walls and 8" thick top.	2,943.24	
33 05 16 13-0036 EA 4' x 6' x 8' Precast Concrete Underground Utility Vault..... Note: 6" thick walls and 8" thick top.	3,810.35	
33 05 16 13-0037 EA 5' x 10' x 8' Precast Concrete Underground Utility Vault..... Note: 6" thick walls and 8" thick top.	6,192.98	
33 05 16 13-0038 EA 5' x 12' x 8' Precast Concrete Underground Utility Vault..... Note: 6" thick walls and 8" thick top.	7,131.29	
33 05 16 13-0039 EA 6' x 6' x 8' Precast Concrete Underground Utility Vault..... Note: 6" thick walls and 8" thick top.	4,820.69	
33 05 16 13-0040 EA 6' x 8' x 8' Precast Concrete Underground Utility Vault..... Note: 6" thick walls and 8" thick top.	5,831.05	
33 05 16 13-0041 EA 6' x 10' x 8' Precast Concrete Underground Utility Vault..... Note: 6" thick walls and 8" thick top.	6,841.40	
33 05 16 13-0042 EA 6' x 12' x 8' Precast Concrete Underground Utility Vault..... Note: 8" thick walls and top.	9,939.31	
33 05 16 13-0043 EA 6' x 16' x 8' Precast Concrete Underground Utility Vault..... Note: 8" thick walls and top.	12,460.73	
33 05 16 13-0044 EA 8' x 8' x 8' Precast Concrete Underground Utility Vault..... Note: 6" thick walls and 8" thick top.	6,985.45	
33 05 16 13-0045 EA 8' x 10' x 8' Precast Concrete Underground Utility Vault..... Note: 6" thick walls and 8" thick top.	8,139.86	
33 05 16 13-0046 EA 8' x 12' x 8' Precast Concrete Underground Utility Vault..... Note: 8" thick walls and top.	11,693.19	
33 05 16 13-0047 EA 8' x 14' x 8' Precast Concrete Underground Utility Vault..... Note: 8" thick walls and top.	13,117.97	
33 05 16 13-0048 EA 10' x 10' x 8' Precast Concrete Underground Utility Vault..... Note: 8" thick walls and top.	11,857.71	
33 05 16 13-0049 10' High Precast Concrete Underground Utility Vault <small>(33 05 16 13-0002)</small>		
33 05 16 13-0050 EA 6' x 6' x 10' Precast Concrete Underground Utility Vault..... Note: 6" thick walls and 8" thick top.	5,190.68	
33 05 16 13-0051 EA 6' x 8' x 10' Precast Concrete Underground Utility Vault..... Note: 6" thick walls and 8" thick top.	6,262.41	
33 05 16 13-0052 EA 10' x 10' x 10' Precast Concrete Underground Utility Vault..... Note: 8" thick walls and top.	12,679.48	
33 05 16 13-0053 12' High Precast Concrete Underground Utility Vault <small>(33 05 16 13-0002)</small>		
33 05 16 13-0054 EA 6' x 6' x 12' Precast Concrete Underground Utility Vault..... Note: 6" thick walls and 8" thick top.	5,560.65	
33 05 16 13-0055 EA 6' x 8' x 12' Precast Concrete Underground Utility Vault..... Note: 6" thick walls and 8" thick top.	6,694.60	
33 05 16 13-0056 Meter Pit <small>(33 05 16 13-0001)</small>		
33 05 16 13-0057 Precast Concrete Meter Pit <small>(33 05 16 13-0056)</small>		
33 05 16 13-0058 EA 4' x 4' x 4' Deep Precast Concrete Meter Pit.....	1,767.13	
33 05 16 13-0059 EA 4' x 4' x 6' Deep Precast Concrete Meter Pit.....	2,343.37	
33 05 16 13-0060 EA 4' x 4' x 8' Deep Precast Concrete Meter Pit.....	2,865.92	
33 05 16 13-0061 EA 4' x 4' x 10' Deep Precast Concrete Meter Pit.....	3,506.77	
33 05 16 13-0062 EA 4' x 4' x 15' Deep Precast Concrete Meter Pit.....	4,695.38	
33 05 16 13-0063 EA 6' x 6' x 4' Deep Precast Concrete Meter Pit.....	2,630.42	
33 05 16 13-0064 EA 6' x 6' x 6' Deep Precast Concrete Meter Pit.....	3,506.77	
33 05 16 13-0065 EA 6' x 6' x 8' Deep Precast Concrete Meter Pit.....	4,444.83	
33 05 16 13-0066 EA 6' x 6' x 10' Deep Precast Concrete Meter Pit.....	5,548.01	
33 05 16 13-0067 EA 6' x 6' x 15' Deep Precast Concrete Meter Pit.....	7,571.63	
33 05 16 13-0068 Handhole Or Pull Box Enclosures <small>(33 05 16 13-0001)</small>		
33 05 16 13-0069 Polymer Concrete Handhole Enclosures <small>(33 05 16 13-0068)</small>		
33 05 16 13-0070 Polymer Concrete Handhole Enclosures <small>(33 05 16 13-0069)</small>		
33 05 16 13-0071 Flared Sides, Polymer Concrete Handhole Enclosures <small>(33 05 16 13-0070)</small>		
33 05 16 13-0072 Open Bottom, Flared Sides, Polymer Concrete Handhole Enclosures <small>(33 05 16 13-0071)</small>		
33 05 16 13-0073 EA 12" x 12", 24" Depth, 15,000 LB Design Load, Open Bottom, Flared Sides, Polymer Concrete Handhole Enclosure.....	194.33	19.73
33 05 16 13-0074 EA 10" x 15", 18" Depth, 15,000 LB Design Load, Open Bottom, Flared Sides, Polymer Concrete Handhole Enclosure.....	181.90	43.83



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 05 16 13-0075 EA 13" x 24", 18" Depth, 15,000 LB Design Load, Open Bottom, Flared Sides, Polymer Concrete Handhole Enclosure.....	277.10	65.75
33 05 16 13-0076 EA 17" x 30", 18" Depth, 15,000 LB Design Load, Open Bottom, Flared Sides, Polymer Concrete Handhole Enclosure.....	316.48	65.75
33 05 16 13-0077 EA 13" x 24", 18" Depth, 22,500 LB Design Load, Open Bottom, Flared Sides, Polymer Concrete Handhole Enclosure.....	303.47	65.75
33 05 16 13-0078 EA 13" x 24", 26" Depth, 22,500 LB Design Load, Open Bottom, Flared Sides, Polymer Concrete Handhole Enclosure.....	360.26	65.75
33 05 16 13-0079 EA 17" x 30", 18" Depth, 22,500 LB Design Load, Open Bottom, Flared Sides, Polymer Concrete Handhole Enclosure.....	351.69	65.75
33 05 16 13-0080 EA 17" x 30", 26" Depth, 22,500 LB Design Load, Open Bottom, Flared Sides, Polymer Concrete Handhole Enclosure.....	466.69	65.75
33 05 16 13-0081 EA 27" Round, 36" Depth, 22,500 LB Design Load, Open Bottom, Flared Sides, Polymer Concrete Handhole Enclosure.....	659.85	87.67
33 05 16 13-0082 EA 27" Round, 48" Depth, 22,500 LB Design Load, Open Bottom, Flared Sides, Polymer Concrete Handhole Enclosure.....	907.33	87.67
33 05 16 13-0083 EA 24" x 36", 18" Depth, 22,500 LB Design Load, Open Bottom, Flared Sides, Polymer Concrete Handhole Enclosure.....	620.60	120.54
33 05 16 13-0084 EA 24" x 36", 26" Depth, 22,500 LB Design Load, Open Bottom, Flared Sides, Polymer Concrete Handhole Enclosure.....	698.10	120.54
33 05 16 13-0085 EA 24" x 36", 48" Depth, 22,500 LB Design Load, Open Bottom, Flared Sides, Polymer Concrete Handhole Enclosure.....	1,101.28	120.54
33 05 16 13-0086 EA 39" Round, 18" Depth, 22,500 LB Design Load, Open Bottom, Flared Sides, Polymer Concrete Handhole Enclosure.....	664.19	131.49
33 05 16 13-0087 EA 39" Round, 24" Depth, 22,500 LB Design Load, Open Bottom, Flared Sides, Polymer Concrete Handhole Enclosure.....	918.06	131.49
33 05 16 13-0088 EA 39" Round, 36" Depth, 22,500 LB Design Load, Open Bottom, Flared Sides, Polymer Concrete Handhole Enclosure.....	1,125.66	131.49
33 05 16 13-0089 EA 39" Round, 48" Depth, 22,500 LB Design Load, Open Bottom, Flared Sides, Polymer Concrete Handhole Enclosure.....	1,616.68	131.49
33 05 16 13-0090 EA 30" x 48", 24" Depth, 22,500 LB Design Load, Open Bottom, Flared Sides, Polymer Concrete Handhole Enclosure.....	944.64	189.46
33 05 16 13-0091 EA 30" x 48", 48" Depth, 22,500 LB Design Load, Open Bottom, Flared Sides, Polymer Concrete Handhole Enclosure.....	1,326.73	189.46
33 05 16 13-0092 Gasketed, Open Bottom, Flared Sides, Polymer Concrete Handhole Enclosures <small>(33 05 16 13-0071)</small>		
33 05 16 13-0093 EA 12" x 12", 24" Depth, 15,000 LB Design Load, Gasketed, Open Bottom, Flared Sides, Polymer Concrete Handhole Enclosure.....	245.77	19.73
33 05 16 13-0094 EA 13" x 24", 18" Depth, 15,000 LB Design Load, Gasketed, Open Bottom, Flared Sides, Polymer Concrete Handhole Enclosure.....	338.37	65.75
33 05 16 13-0095 EA 17" x 30", 18" Depth, 15,000 LB Design Load, Gasketed, Open Bottom, Flared Sides, Polymer Concrete Handhole Enclosure.....	401.76	65.75
33 05 16 13-0096 EA 13" x 24", 18" Depth, 22,500 LB Design Load, Gasketed, Open Bottom, Flared Sides, Polymer Concrete Handhole Enclosure.....	373.38	65.75
33 05 16 13-0097 EA 13" x 24", 26" Depth, 22,500 LB Design Load, Gasketed, Open Bottom, Flared Sides, Polymer Concrete Handhole Enclosure.....	421.92	65.75
33 05 16 13-0098 EA 17" x 30", 18" Depth, 22,500 LB Design Load, Gasketed, Open Bottom, Flared Sides, Polymer Concrete Handhole Enclosure.....	434.65	65.75
33 05 16 13-0099 EA 17" x 30", 26" Depth, 22,500 LB Design Load, Gasketed, Open Bottom, Flared Sides, Polymer Concrete Handhole Enclosure.....	550.36	65.75
33 05 16 13-0100 EA 24" x 36", 18" Depth, 22,500 LB Design Load, Gasketed, Open Bottom, Flared Sides, Polymer Concrete Handhole Enclosure.....	750.88	120.54
33 05 16 13-0101 EA 24" x 36", 26" Depth, 22,500 LB Design Load, Gasketed, Open Bottom, Flared Sides, Polymer Concrete Handhole Enclosure.....	828.38	120.54
33 05 16 13-0102 EA 24" x 36", 48" Depth, 22,500 LB Design Load, Gasketed, Open Bottom, Flared Sides, Polymer Concrete Handhole Enclosure.....	1,231.57	120.54
33 05 16 13-0103 EA 30" x 48", 24" Depth, 22,500 LB Design Load, Gasketed, Open Bottom, Flared Sides, Polymer Concrete Handhole Enclosure.....	1,096.89	189.46
33 05 16 13-0104 EA 30" x 48", 48" Depth, 22,500 LB Design Load, Gasketed, Open Bottom, Flared Sides, Polymer Concrete Handhole Enclosure.....	1,481.88	189.46
33 05 16 13-0105 Straight Sides, Polymer Concrete Handhole Enclosures <small>(33 05 16 13-0070)</small>		
33 05 16 13-0106 Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosures <small>(33 05 16 13-0105)</small>		
33 05 16 13-0107 EA 5" x 16", 12" Depth, 5,000 LB Design Load, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	311.97	19.73
33 05 16 13-0108 EA 10" x 12", 15" Depth, 5,000 LB Design Load, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	265.41	19.73
33 05 16 13-0109 EA 13" x 24", 12" Depth, 5,000 LB Design Load, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	242.74	65.75
33 05 16 13-0110 EA 17" x 30", 12" Depth, 5,000 LB Design Load, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	270.22	65.75
33 05 16 13-0111 EA 6" x 8", 6" Depth, 15,000 LB Design Load, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	81.49	19.73
33 05 16 13-0112 EA 12" x 12", 12" Depth, 15,000 LB Design Load, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	120.43	19.73
33 05 16 13-0113 EA 8" x 18", 7" Depth, 15,000 LB Design Load, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	188.01	19.73
33 05 16 13-0114 EA 8" x 18", 8" Depth, 15,000 LB Design Load, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	196.19	19.73
33 05 16 13-0115 EA 11" x 18", 12" Depth, 15,000 LB Design Load, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	179.05	43.83
33 05 16 13-0116 EA 11" x 18", 18" Depth, 15,000 LB Design Load, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	191.59	43.83

33 Utilities**33 05 Common Work Results For Utilities****33 05 16 Utility Structures**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 05 16 13-0117	EA		8" x 8", 12" Depth, 22,500 LB Design Load, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure	118.76	19.73
33 05 16 13-0118	EA		8" x 8", 18" Depth, 22,500 LB Design Load, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure	134.08	19.73
33 05 16 13-0119	EA		11" x 18", 12" Depth, 22,500 LB Design Load, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	190.29	43.83
33 05 16 13-0120	EA		11" x 18", 18" Depth, 22,500 LB Design Load, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	211.38	43.83
33 05 16 13-0121	EA		11" x 20", 12" Depth, 22,500 LB Design Load, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	197.73	43.83
33 05 16 13-0122	EA		13" x 24", 12" Depth, 22,500 LB Design Load, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	244.02	65.75
33 05 16 13-0123	EA		13" x 24", 18" Depth, 22,500 LB Design Load, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	264.71	65.75
33 05 16 13-0124	EA		17" x 30", 12" Depth, 22,500 LB Design Load, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	280.09	65.75
33 05 16 13-0125	EA		17" x 30", 18" Depth, 22,500 LB Design Load, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	303.26	65.75
33 05 16 13-0126	EA		17" x 30", 22" Depth, 22,500 LB Design Load, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	349.46	65.75
33 05 16 13-0127	EA		17" x 30", 24" Depth, 22,500 LB Design Load, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	377.49	65.75
33 05 16 13-0128	EA		17" x 30", 28" Depth, 22,500 LB Design Load, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	408.16	65.75
33 05 16 13-0129	EA		17" x 30", 30" Depth, 22,500 LB Design Load, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	427.45	65.75
33 05 16 13-0130	EA		24" x 24", 24" Depth, 22,500 LB Design Load, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	514.47	87.67
33 05 16 13-0131	EA		24" x 36", 18" Depth, 22,500 LB Design Load, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	536.64	120.54
33 05 16 13-0132	EA		24" x 36", 24" Depth, 22,500 LB Design Load, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	670.96	120.54
33 05 16 13-0133	EA		24" x 36", 30" Depth, 22,500 LB Design Load, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	794.98	120.54
33 05 16 13-0134	EA		24" x 36", 36" Depth, 22,500 LB Design Load, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	873.31	120.54
33 05 16 13-0135	EA		24" x 36", 42" Depth, 22,500 LB Design Load, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	951.22	120.54
33 05 16 13-0136	EA		36" x 36", 36" Depth, 22,500 LB Design Load, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	1,093.70	189.46
33 05 16 13-0137	EA		30" x 48", 18" Depth, 22,500 LB Design Load, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	819.13	189.46
33 05 16 13-0138	EA		30" x 48", 24" Depth, 22,500 LB Design Load, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	918.61	189.46
33 05 16 13-0139	EA		30" x 48", 36" Depth, 22,500 LB Design Load, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	1,108.83	189.46
33 05 16 13-0140	EA		30" x 60", 21" Depth, 22,500 LB Design Load, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	1,106.88	189.46
33 05 16 13-0141	EA		30" x 60", 30" Depth, 22,500 LB Design Load, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	1,177.88	189.46
33 05 16 13-0142	EA		30" x 60", 36" Depth, 22,500 LB Design Load, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	1,314.44	189.46
33 05 16 13-0143	EA		36" x 60", 19" Depth, 22,500 LB Design Load, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	1,221.76	202.99
33 05 16 13-0144	EA		36" x 60", 24" Depth, 22,500 LB Design Load, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	1,318.18	202.99
33 05 16 13-0145	EA		36" x 60", 31" Depth, 22,500 LB Design Load, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	1,441.27	202.99
33 05 16 13-0146	EA		36" x 60", 36" Depth, 22,500 LB Design Load, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	1,490.52	202.99
33 05 16 13-0147	EA		48" x 48", 36" Depth, 22,500 LB Design Load, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	1,507.64	202.99
33 05 16 13-0148	EA		48" x 48", 48" Depth, 22,500 LB Design Load, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	1,695.20	202.99
33 05 16 13-0149	EA		36" x 72", 21" Depth, 22,500 LB Design Load, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	1,330.95	202.99
33 05 16 13-0150	EA		36" x 72", 36" Depth, 22,500 LB Design Load, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	1,726.15	202.99
33 05 16 13-0151	EA		48" x 72", 36" Depth, 22,500 LB Design Load, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	1,937.61	216.53
33 05 16 13-0152	EA		48" x 72", 48" Depth, 22,500 LB Design Load, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	2,367.60	216.53
33 05 16 13-0153	EA		48" x 96", 48" Depth, 22,500 LB Design Load, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	3,008.41	216.53
33 05 16 13-0154			Gasketed, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosures <small>(33 05 16 13-0105)</small>		
33 05 16 13-0155	EA		13" x 24", 12" Depth, 5,000 LB Design Load, Gasketed, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure	314.07	65.75
33 05 16 13-0156	EA		17" x 30", 12" Depth, 5,000 LB Design Load, Gasketed, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure	354.83	65.75
33 05 16 13-0157	EA		6" x 8", 6" Depth, 15,000 LB Design Load, Gasketed, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	130.34	19.73
33 05 16 13-0158	EA		12" x 12", 12" Depth, 15,000 LB Design Load, Gasketed, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure	183.56	19.73



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 05 16 13-0159 EA 8" x 18", 7" Depth, 15,000 LB Design Load, Gasketed, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	242.38	19.73
33 05 16 13-0160 EA 8" x 18", 8" Depth, 15,000 LB Design Load, Gasketed, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	250.57	19.73
33 05 16 13-0161 EA 10" x 15", 18" Depth, 15,000 LB Design Load, Gasketed, Open Bottom, Flared Sides, Polymer Concrete Handhole Enclosure.....	232.60	43.83
33 05 16 13-0162 EA 11" x 18", 12" Depth, 15,000 LB Design Load, Gasketed, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	241.34	43.83
33 05 16 13-0163 EA 11" x 18", 18" Depth, 15,000 LB Design Load, Gasketed, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	253.01	43.83
33 05 16 13-0164 EA 8" x 8", 12" Depth, 22,500 LB Design Load, Gasketed, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	172.02	19.73
33 05 16 13-0165 EA 8" x 8", 18" Depth, 22,500 LB Design Load, Gasketed, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	201.31	19.73
33 05 16 13-0166 EA 11" x 18", 12" Depth, 22,500 LB Design Load, Gasketed, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	252.72	43.83
33 05 16 13-0167 EA 11" x 18", 18" Depth, 22,500 LB Design Load, Gasketed, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	273.81	43.83
33 05 16 13-0168 EA 11" x 20", 12" Depth, 22,500 LB Design Load, Gasketed, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	260.83	43.83
33 05 16 13-0169 EA 13" x 24", 12" Depth, 22,500 LB Design Load, Gasketed, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	313.68	65.75
33 05 16 13-0170 EA 13" x 24", 18" Depth, 22,500 LB Design Load, Gasketed, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	334.62	65.75
33 05 16 13-0171 EA 17" x 30", 12" Depth, 22,500 LB Design Load, Gasketed, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	363.21	65.75
33 05 16 13-0172 EA 17" x 30", 18" Depth, 22,500 LB Design Load, Gasketed, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	386.24	65.75
33 05 16 13-0173 EA 17" x 30", 22" Depth, 22,500 LB Design Load, Gasketed, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	432.30	65.75
33 05 16 13-0174 EA 17" x 30", 24" Depth, 22,500 LB Design Load, Gasketed, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	460.45	65.75
33 05 16 13-0175 EA 17" x 30", 28" Depth, 22,500 LB Design Load, Gasketed, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	490.99	65.75
33 05 16 13-0176 EA 17" x 30", 30" Depth, 22,500 LB Design Load, Gasketed, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	510.41	65.75
33 05 16 13-0177 EA 24" x 24", 24" Depth, 22,500 LB Design Load, Gasketed, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	629.08	87.67
33 05 16 13-0178 EA 24" x 36", 18" Depth, 22,500 LB Design Load, Gasketed, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	666.93	120.54
33 05 16 13-0179 EA 24" x 36", 24" Depth, 22,500 LB Design Load, Gasketed, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	801.09	120.54
33 05 16 13-0180 EA 24" x 36", 30" Depth, 22,500 LB Design Load, Gasketed, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	924.98	120.54
33 05 16 13-0181 EA 24" x 36", 36" Depth, 22,500 LB Design Load, Gasketed, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	1,003.19	120.54
33 05 16 13-0182 EA 24" x 36", 42" Depth, 22,500 LB Design Load, Gasketed, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	1,081.35	120.54
33 05 16 13-0183 EA 30" x 48", 18" Depth, 22,500 LB Design Load, Gasketed, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	969.94	189.46
33 05 16 13-0184 EA 30" x 48", 24" Depth, 22,500 LB Design Load, Gasketed, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	1,069.56	189.46
33 05 16 13-0185 EA 30" x 48", 36" Depth, 22,500 LB Design Load, Gasketed, Open Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	1,259.64	189.46
33 05 16 13-0186 Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosures <small>(33 05 16 13-0185)</small>		
33 05 16 13-0187 EA 13" x 24", 12" Depth, 5,000 LB Design Load, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	291.30	65.75
33 05 16 13-0188 EA 17" x 30", 12" Depth, 5,000 LB Design Load, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	333.18	65.75
33 05 16 13-0189 EA 6" x 8", 6" Depth, 15,000 LB Design Load, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	99.20	19.73
33 05 16 13-0190 EA 12" x 12", 12" Depth, 15,000 LB Design Load, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	156.22	19.73
33 05 16 13-0191 EA 8" x 18", 7" Depth, 15,000 LB Design Load, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	219.63	19.73
33 05 16 13-0192 EA 8" x 18", 8" Depth, 15,000 LB Design Load, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	227.96	19.73
33 05 16 13-0193 EA 11" x 18", 12" Depth, 15,000 LB Design Load, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	217.63	43.83
33 05 16 13-0194 EA 11" x 18", 18" Depth, 15,000 LB Design Load, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	241.90	43.83
33 05 16 13-0195 EA 8" x 8", 18" Depth, 22,500 LB Design Load, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	138.06	19.73
33 05 16 13-0196 EA 11" x 18", 12" Depth, 22,500 LB Design Load, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	229.55	43.83
33 05 16 13-0197 EA 11" x 18", 18" Depth, 22,500 LB Design Load, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	259.80	43.83
33 05 16 13-0198 EA 11" x 20", 12" Depth, 22,500 LB Design Load, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	237.41	43.83
33 05 16 13-0199 EA 13" x 24", 12" Depth, 22,500 LB Design Load, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	310.47	65.75
33 05 16 13-0200 EA 13" x 24", 18" Depth, 22,500 LB Design Load, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	351.81	65.75
33 05 16 13-0201 EA 17" x 30", 12" Depth, 22,500 LB Design Load, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	365.56	65.75
33 05 16 13-0202 EA 17" x 30", 18" Depth, 22,500 LB Design Load, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	398.30	65.75

33 Utilities**33 05 Common Work Results For Utilities****33 05 16 Utility Structures**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 05 16 13-0203 EA 17" x 30", 22" Depth, 22,500 LB Design Load, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	428.42	65.75
33 05 16 13-0204 EA 17" x 30", 24" Depth, 22,500 LB Design Load, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	456.85	65.75
33 05 16 13-0205 EA 17" x 30", 28" Depth, 22,500 LB Design Load, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	507.76	65.75
33 05 16 13-0206 EA 17" x 30", 30" Depth, 22,500 LB Design Load, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	514.86	65.75
33 05 16 13-0207 EA 24" x 24", 24" Depth, 22,500 LB Design Load, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	637.96	87.67
33 05 16 13-0208 EA 24" x 36", 18" Depth, 22,500 LB Design Load, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	678.45	120.54
33 05 16 13-0209 EA 24" x 36", 24" Depth, 22,500 LB Design Load, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	826.61	120.54
33 05 16 13-0210 EA 24" x 36", 30" Depth, 22,500 LB Design Load, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	973.14	120.54
33 05 16 13-0211 EA 24" x 36", 36" Depth, 22,500 LB Design Load, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	1,070.47	120.54
33 05 16 13-0212 EA 24" x 36", 42" Depth, 22,500 LB Design Load, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	1,167.80	120.54
33 05 16 13-0213 EA 36" x 36", 36" Depth, 22,500 LB Design Load, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	1,275.04	189.46
33 05 16 13-0214 EA 30" x 48", 18" Depth, 22,500 LB Design Load, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	1,000.47	189.46
33 05 16 13-0215 EA 30" x 48", 24" Depth, 22,500 LB Design Load, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	1,107.71	189.46
33 05 16 13-0216 EA 30" x 48", 36" Depth, 22,500 LB Design Load, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	1,297.80	189.46
33 05 16 13-0217 EA 30" x 60", 21" Depth, 22,500 LB Design Load, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	1,381.65	189.46
33 05 16 13-0218 EA 30" x 60", 30" Depth, 22,500 LB Design Load, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	1,407.91	189.46
33 05 16 13-0219 EA 30" x 60", 36" Depth, 22,500 LB Design Load, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	1,662.62	189.46
33 05 16 13-0220 EA 36" x 60", 19" Depth, 22,500 LB Design Load, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	1,555.08	202.99
33 05 16 13-0221 EA 36" x 60", 24" Depth, 22,500 LB Design Load, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	1,604.90	202.99
33 05 16 13-0222 EA 36" x 60", 31" Depth, 22,500 LB Design Load, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	1,746.22	202.99
33 05 16 13-0223 EA 36" x 60", 36" Depth, 22,500 LB Design Load, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	1,853.18	202.99
33 05 16 13-0224 EA 36" x 72", 21" Depth, 22,500 LB Design Load, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	1,710.21	202.99
33 05 16 13-0225 EA 36" x 72", 36" Depth, 22,500 LB Design Load, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	2,092.73	202.99
33 05 16 13-0226 EA 48" x 48", 36" Depth, 22,500 LB Design Load, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	1,829.30	202.99
33 05 16 13-0227 EA 48" x 48", 48" Depth, 22,500 LB Design Load, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	2,000.94	202.99
33 05 16 13-0228 EA 48" x 72", 36" Depth, 22,500 LB Design Load, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	2,409.70	216.53
33 05 16 13-0229 EA 48" x 72", 48" Depth, 22,500 LB Design Load, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	2,839.86	216.53
33 05 16 13-0230 EA 48" x 96", 48" Depth, 22,500 LB Design Load, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	3,794.46	216.53
33 05 16 13-0231 Gasketed, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosures <small>(33 05 16 13-0105)</small>		
33 05 16 13-0232 EA 13" x 24", 12" Depth, 5,000 LB Design Load, Gasketed, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure	362.61	65.75
33 05 16 13-0233 EA 17" x 30", 12" Depth, 5,000 LB Design Load, Gasketed, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure	417.95	65.75
33 05 16 13-0234 EA 6" x 8", 6" Depth, 15,000 LB Design Load, Gasketed, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	147.66	19.73
33 05 16 13-0235 EA 12" x 12", 12" Depth, 15,000 LB Design Load, Gasketed, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure	219.22	19.73
33 05 16 13-0236 EA 8" x 18", 7" Depth, 15,000 LB Design Load, Gasketed, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	273.88	19.73
33 05 16 13-0237 EA 8" x 18", 8" Depth, 15,000 LB Design Load, Gasketed, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	282.33	19.73
33 05 16 13-0238 EA 11" x 18", 12" Depth, 15,000 LB Design Load, Gasketed, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure	280.06	43.83
33 05 16 13-0239 EA 11" x 18", 18" Depth, 15,000 LB Design Load, Gasketed, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure	304.19	43.83
33 05 16 13-0240 EA 8" x 8", 18" Depth, 22,500 LB Design Load, Gasketed, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure.....	207.30	19.73
33 05 16 13-0241 EA 11" x 18", 12" Depth, 22,500 LB Design Load, Gasketed, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure	291.71	43.83
33 05 16 13-0242 EA 11" x 18", 18" Depth, 22,500 LB Design Load, Gasketed, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure	321.95	43.83
33 05 16 13-0243 EA 11" x 20", 12" Depth, 22,500 LB Design Load, Gasketed, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure	282.69	43.83



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 05 16 13-0244 EA 13" x 24", 12" Depth, 22,500 LB Design Load, Gasketed, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure	380.41	65.75
33 05 16 13-0245 EA 13" x 24", 18" Depth, 22,500 LB Design Load, Gasketed, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure	421.75	65.75
33 05 16 13-0246 EA 17" x 30", 12" Depth, 22,500 LB Design Load, Gasketed, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure	448.53	65.75
33 05 16 13-0247 EA 17" x 30", 18" Depth, 22,500 LB Design Load, Gasketed, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure	481.27	65.75
33 05 16 13-0248 EA 17" x 30", 22" Depth, 22,500 LB Design Load, Gasketed, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure	511.38	65.75
33 05 16 13-0249 EA 17" x 30", 24" Depth, 22,500 LB Design Load, Gasketed, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure	539.83	65.75
33 05 16 13-0250 EA 17" x 30", 28" Depth, 22,500 LB Design Load, Gasketed, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure	590.75	65.75
33 05 16 13-0251 EA 17" x 30", 30" Depth, 22,500 LB Design Load, Gasketed, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure	597.82	65.75
33 05 16 13-0252 EA 24" x 24", 24" Depth, 22,500 LB Design Load, Gasketed, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure	752.41	87.67
33 05 16 13-0253 EA 24" x 36", 18" Depth, 22,500 LB Design Load, Gasketed, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure	808.73	120.54
33 05 16 13-0254 EA 24" x 36", 24" Depth, 22,500 LB Design Load, Gasketed, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure	956.76	120.54
33 05 16 13-0255 EA 24" x 36", 30" Depth, 22,500 LB Design Load, Gasketed, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure	1,103.13	120.54
33 05 16 13-0256 EA 24" x 36", 36" Depth, 22,500 LB Design Load, Gasketed, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure	1,200.53	120.54
33 05 16 13-0257 EA 24" x 36", 42" Depth, 22,500 LB Design Load, Gasketed, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure	1,297.93	120.54
33 05 16 13-0258 EA 30" x 48", 18" Depth, 22,500 LB Design Load, Gasketed, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure	1,151.42	189.46
33 05 16 13-0259 EA 30" x 48", 24" Depth, 22,500 LB Design Load, Gasketed, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure	1,258.81	189.46
33 05 16 13-0260 EA 30" x 48", 36" Depth, 22,500 LB Design Load, Gasketed, Solid Bottom, Straight Sides, Polymer Concrete Handhole Enclosure	1,448.76	189.46
33 05 16 13-0261 Footed, Straight Sides, Polymer Concrete Handhole Enclosures <small>(33 05 16 13-0105)</small>		
33 05 16 13-0262 EA 17" x 30", 12" Depth, 5,000 LB Design Load, Footed, Straight Sides, Polymer Concrete Handhole Enclosure	308.68	65.75
33 05 16 13-0263 EA 11" x 18", 12" Depth, 15,000 LB Design Load, Footed, Straight Sides, Polymer Concrete Handhole Enclosure	208.18	43.83
33 05 16 13-0264 EA 11" x 18", 18" Depth, 15,000 LB Design Load, Footed, Straight Sides, Polymer Concrete Handhole Enclosure	231.50	43.83
33 05 16 13-0265 EA 13" x 24", 12" Depth, 15,000 LB Design Load, Footed, Straight Sides, Polymer Concrete Handhole Enclosure	278.42	65.75
33 05 16 13-0266 EA 11" x 18", 12" Depth, 22,500 LB Design Load, Footed, Straight Sides, Polymer Concrete Handhole Enclosure	215.82	43.83
33 05 16 13-0267 EA 11" x 18", 18" Depth, 22,500 LB Design Load, Footed, Straight Sides, Polymer Concrete Handhole Enclosure	238.15	43.83
33 05 16 13-0268 Polymer Concrete Handhole Enclosure Extensions <small>(33 05 16 13-0069)</small>		
33 05 16 13-0269 EA 13" x 24", 8" Extension, 22,500 LB Design Load, Straight Sides, Polymer Concrete Handhole Enclosure Extension	235.01	65.75
33 05 16 13-0270 EA 17" x 30", 8" Extension, 22,500 LB Design Load, Straight Sides, Polymer Concrete Handhole Enclosure Extension	259.31	65.75
33 05 16 13-0271 EA 24" x 24", 6" Extension, 22,500 LB Design Load, Straight Sides, Polymer Concrete Handhole Enclosure Extension	304.15	87.67
33 05 16 13-0272 EA 24" x 24", 12" Extension, 22,500 LB Design Load, Straight Sides, Polymer Concrete Handhole Enclosure Extension	328.01	87.67
33 05 16 13-0273 EA 24" x 36", 8" Extension, 22,500 LB Design Load, Straight Sides, Polymer Concrete Handhole Enclosure Extension	397.51	120.54
33 05 16 13-0274 EA 36" x 36", 12" Extension, 22,500 LB Design Load, Straight Sides, Polymer Concrete Handhole Enclosure Extension	677.60	189.46
33 05 16 13-0275 EA 30" x 48", 8" Extension, 22,500 LB Design Load, Straight Sides, Polymer Concrete Handhole Enclosure Extension	651.52	189.46
33 05 16 13-0276 EA 30" x 48", 11" Extension, 22,500 LB Design Load, Straight Sides, Polymer Concrete Handhole Enclosure Extension	657.21	189.46
33 05 16 13-0277 EA 36" x 60", 12" Extension, 22,500 LB Design Load, Straight Sides, Polymer Concrete Handhole Enclosure Extension	861.38	202.99
33 05 16 13-0278 EA 48" x 72", 12" Extension, 22,500 LB Design Load, Straight Sides, Polymer Concrete Handhole Enclosure Extension	1,316.65	216.53
33 05 16 13-0279 EA 48" x 96", 12" Extension, 22,500 LB Design Load, Straight Sides, Polymer Concrete Handhole Enclosure Extension	1,695.55	216.53
33 05 16 13-0280 EA 13" x 24", 8" Extension, 22,500 LB Design Load, Straight Sides, Polymer Concrete Handhole Enclosure Solid Base Extension	362.51	65.75
33 05 16 13-0281 EA 17" x 30", 8" Extension, 22,500 LB Design Load, Straight Sides, Polymer Concrete Handhole Enclosure Solid Base Extension	377.36	65.75
33 05 16 13-0282 EA 24" x 24", 6" Extension, 22,500 LB Design Load, Straight Sides, Polymer Concrete Handhole Enclosure Solid Base Extension	412.92	87.67
33 05 16 13-0283 EA 24" x 24", 12" Extension, 22,500 LB Design Load, Straight Sides, Polymer Concrete Handhole Enclosure Solid Base Extension	437.03	87.67
33 05 16 13-0284 EA 24" x 36", 8" Extension, 22,500 LB Design Load, Straight Sides, Polymer Concrete Handhole Enclosure Solid Base Extension	516.80	120.54
33 05 16 13-0285 EA 30" x 48", 8" Extension, 22,500 LB Design Load, Straight Sides, Polymer Concrete Handhole Enclosure Solid Base Extension	820.10	189.46
33 05 16 13-0286 EA 13" x 24", 3" Extension, 22,500 LB Design Load, Straight Sides, Polymer Concrete Handhole Enclosure Grade Adjustable Extension	289.94	65.75
33 05 16 13-0287 EA 17" x 30", 3" Extension, 22,500 LB Design Load, Straight Sides, Polymer Concrete Handhole Enclosure Grade Adjustable Extension	319.22	65.75

33 Utilities**33 05 Common Work Results For Utilities****33 05 16 Utility Structures**

MINOR
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TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

33 05 16 13-0288	EA	24" x 36", 4" Extension, 22,500 LB Design Load, Straight Sides, Polymer Concrete Handhole Enclosure Grade Adjustable Extension	439.52	120.54
33 05 16 13-0289	EA	36" x 60", 3" Extension, 22,500 LB Design Load, Straight Sides, Polymer Concrete Handhole Enclosure Grade Adjustable Extension	833.45	202.99

33 05 16 13-0290 Polymer Concrete Handhole Enclosure Covers (33 05 16 13-0069)**33 05 16 13-0291 Polymer Concrete Handhole Enclosure Covers** (33 05 16 13-0290)

33 05 16 13-0292	EA	5" x 16", 5,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover	75.90	8.77
33 05 16 13-0293	EA	10" x 12", 5,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover	76.84	8.77
33 05 16 13-0294	EA	12" x 12", 5,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover	71.49	8.77
33 05 16 13-0295	EA	8" x 18", 5,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover	77.02	8.77
33 05 16 13-0296	EA	11" x 18", 5,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover	77.74	8.77
33 05 16 13-0297	EA	13" x 24", 5,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover	88.63	8.77
33 05 16 13-0298	EA	17" x 30", 5,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover	102.11	8.77
33 05 16 13-0299	EA	30" x 59", 5,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover	654.03	24.36
33 05 16 13-0300	EA	30" x 60", 5,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover	573.66	24.36
33 05 16 13-0301	EA	36" x 60", 5,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover	853.59	24.36
33 05 16 13-0302	EA	48" x 48", 5,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover	863.13	24.36
33 05 16 13-0303	EA	36" x 72", 5,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover	976.39	24.36
33 05 16 13-0304	EA	48" x 72", 5,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover	1,062.91	24.36
33 05 16 13-0305	EA	48" x 96", 5,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover	1,701.67	24.36
33 05 16 13-0306	EA	10" x 15", 8,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover	65.55	8.77
33 05 16 13-0307	EA	11" x 18", 8,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover	92.30	8.77
33 05 16 13-0308	EA	11" x 20", 8,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover	93.54	8.77
33 05 16 13-0309	EA	13" x 24", 8,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover	116.72	8.77
33 05 16 13-0310	EA	13" x 24", 8,000 LB Design Load, Standard Duty, Service Box, Polymer Concrete Handhole Enclosure Cover	88.98	8.77
33 05 16 13-0311	EA	17" x 30", 8,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover	137.39	8.77
33 05 16 13-0312	EA	17" x 30", 8,000 LB Design Load, Standard Duty, Service Box, Polymer Concrete Handhole Enclosure Cover	108.68	8.77
33 05 16 13-0313	EA	27" Round, 8,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover	219.09	8.77
33 05 16 13-0314	EA	24" x 24", 8,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover	194.31	13.15
33 05 16 13-0315	EA	24" x 36", 8,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover	242.10	13.15
33 05 16 13-0316	EA	39" Round, 8,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover	311.35	15.34
33 05 16 13-0317	EA	36" x 36", 8,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover	434.91	18.95
33 05 16 13-0318	EA	30" x 48", 8,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover	452.73	36.09
33 05 16 13-0319	EA	11" x 18", 15,000 LB Design Load, Heavy Duty, Polymer Concrete Handhole Enclosure Cover	118.11	8.77
33 05 16 13-0320	EA	13" x 24", 15,000 LB Design Load, Heavy Duty, Polymer Concrete Handhole Enclosure Cover	166.81	8.77
33 05 16 13-0321	EA	17" x 30", 15,000 LB Design Load, Heavy Duty, Polymer Concrete Handhole Enclosure Cover	189.29	8.77
33 05 16 13-0322	EA	27" Round, 15,000 LB Design Load, Heavy Duty, Polymer Concrete Handhole Enclosure Cover	312.27	8.77
33 05 16 13-0323	EA	24" x 24", 15,000 LB Design Load, Heavy Duty, Polymer Concrete Handhole Enclosure Cover	260.01	13.15
33 05 16 13-0324	EA	39" Round, 15,000 LB Design Load, Heavy Duty, Polymer Concrete Handhole Enclosure Cover	436.48	15.34
33 05 16 13-0325	EA	36" x 36", 15,000 LB Design Load, Heavy Duty, Polymer Concrete Handhole Enclosure Cover	570.45	18.95
33 05 16 13-0326	EA	30" x 59", 15,000 LB Design Load, Heavy Duty, Polymer Concrete Handhole Enclosure Cover	769.25	24.36
33 05 16 13-0327	EA	30" x 60", 15,000 LB Design Load, Heavy Duty, Polymer Concrete Handhole Enclosure Cover	685.04	24.36
33 05 16 13-0328	EA	36" x 60", 15,000 LB Design Load, Heavy Duty, Polymer Concrete Handhole Enclosure Cover	952.81	24.36
33 05 16 13-0329	EA	48" x 48", 15,000 LB Design Load, Heavy Duty, Polymer Concrete Handhole Enclosure Cover	1,237.58	24.36
33 05 16 13-0330	EA	36" x 72", 15,000 LB Design Load, Heavy Duty, Polymer Concrete Handhole Enclosure Cover	1,185.63	24.36
33 05 16 13-0331	EA	48" x 72", 15,000 LB Design Load, Heavy Duty, Polymer Concrete Handhole Enclosure Cover	1,794.41	24.36
33 05 16 13-0332	EA	48" x 96", 15,000 LB Design Load, Heavy Duty, Polymer Concrete Handhole Enclosure Cover	2,766.07	24.36
33 05 16 13-0333	EA	11" x 18", 22,500 LB Design Load, Extra Heavy Duty, Polymer Concrete Handhole Enclosure Cover	154.19	8.77
33 05 16 13-0334	EA	11" x 20", 22,500 LB Design Load, Extra Heavy Duty, Polymer Concrete Handhole Enclosure Cover	168.26	8.77
33 05 16 13-0335	EA	13" x 24", 22,500 LB Design Load, Extra Heavy Duty, Polymer Concrete Handhole Enclosure Cover	220.37	8.77
33 05 16 13-0336	EA	17" x 30", 22,500 LB Design Load, Extra Heavy Duty, Polymer Concrete Handhole Enclosure Cover	250.61	8.77
33 05 16 13-0337	EA	27" Round, 22,500 LB Design Load, Extra Heavy Duty, Polymer Concrete Handhole Enclosure Cover	430.44	8.77
33 05 16 13-0338	EA	24" x 24", 22,500 LB Design Load, Extra Heavy Duty, Polymer Concrete Handhole Enclosure Cover	315.69	13.15
33 05 16 13-0339	EA	24" x 36", 22,500 LB Design Load, Extra Heavy Duty, Polymer Concrete Handhole Enclosure Cover	429.55	13.15
33 05 16 13-0340	EA	39" Round, 22,500 LB Design Load, Extra Heavy Duty, Polymer Concrete Handhole Enclosure Cover	663.84	15.34
33 05 16 13-0341	EA	36" x 36", 22,500 LB Design Load, Extra Heavy Duty, Polymer Concrete Handhole Enclosure Cover	759.14	18.95
33 05 16 13-0342	EA	30" x 48", 22,500 LB Design Load, Extra Heavy Duty, Polymer Concrete Handhole Enclosure Cover	790.57	36.09
33 05 16 13-0343	EA	30" x 60", 22,500 LB Design Load, Extra Heavy Duty, Polymer Concrete Handhole Enclosure Cover	914.22	24.36
33 05 16 13-0344	EA	36" x 60", 22,500 LB Design Load, Extra Heavy Duty, Polymer Concrete Handhole Enclosure Cover	1,272.22	24.36
33 05 16 13-0345	EA	48" x 48", 22,500 LB Design Load, Extra Heavy Duty, Polymer Concrete Handhole Enclosure Cover	1,775.78	24.36
33 05 16 13-0346	EA	36" x 72", 22,500 LB Design Load, Extra Heavy Duty, Polymer Concrete Handhole Enclosure Cover	1,585.74	24.36
33 05 16 13-0347	EA	48" x 72", 22,500 LB Design Load, Extra Heavy Duty, Polymer Concrete Handhole Enclosure Cover	2,621.12	24.36
33 05 16 13-0348	EA	48" x 96", 22,500 LB Design Load, Extra Heavy Duty, Polymer Concrete Handhole Enclosure Cover	4,040.12	24.36

33 05 16 13-0349 Polymer Concrete Handhole Enclosure Covers With Gaskets (33 05 16 13-0290)

33 05 16 13-0350	EA	12" x 12", 5,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover With Gasket	86.61	8.77
33 05 16 13-0351	EA	8" x 18", 5,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover With Gasket	91.32	8.77
33 05 16 13-0352	EA	11" x 18", 5,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover With Gasket	92.86	8.77
33 05 16 13-0353	EA	13" x 24", 5,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover With Gasket	93.44	8.77
33 05 16 13-0354	EA	17" x 30", 5,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover With Gasket	107.25	8.77
33 05 16 13-0355	EA	10" x 15", 8,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover With Gasket	69.89	8.77
33 05 16 13-0356	EA	11" x 18", 8,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover With Gasket	96.75	8.77
33 05 16 13-0357	EA	11" x 20", 8,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover With Gasket	97.61	8.77
33 05 16 13-0358	EA	13" x 24", 8,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover With Gasket	121.31	8.77
33 05 16 13-0359	EA	13" x 24", 8,000 LB Design Load, Standard Duty, Service Box, Polymer Concrete Handhole Enclosure Cover With Gasket	93.97	8.77



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 05 16 13-0360 EA 17" x 30", 8,000 LB Design Load, Standard Duty, Service Box, Polymer Concrete Handhole Enclosure Cover With Gasket.....	113.95	8.77
33 05 16 13-0361 EA 17" x 30", 8,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover With Gasket.....	142.25	8.77
33 05 16 13-0362 EA 24" x 24", 8,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover With Gasket.....	197.57	13.15
33 05 16 13-0363 EA 24" x 36", 8,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover With Gasket.....	247.11	13.15
33 05 16 13-0364 EA 30" x 48", 8,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover With Gasket.....	457.87	36.09
33 05 16 13-0365 EA 6" x 8", 15,000 LB Design Load, Heavy Duty, Polymer Concrete Handhole Enclosure Cover With Gasket.....	58.85	8.77
33 05 16 13-0366 EA 8" x 8", 15,000 LB Design Load, Heavy Duty, Polymer Concrete Handhole Enclosure Cover With Gasket.....	89.85	8.77
33 05 16 13-0367 EA 8" x 18", 15,000 LB Design Load, Heavy Duty, Polymer Concrete Handhole Enclosure Cover With Gasket.....	99.52	8.77
33 05 16 13-0368 EA 12" x 12", 15,000 LB Design Load, Heavy Duty, Polymer Concrete Handhole Enclosure Cover With Gasket.....	95.22	8.77
33 05 16 13-0369 EA 10" x 15", 15,000 LB Design Load, Heavy Duty, Polymer Concrete Handhole Enclosure Cover With Gasket.....	79.13	8.77
33 05 16 13-0370 EA 11" x 18", 15,000 LB Design Load, Heavy Duty, Polymer Concrete Handhole Enclosure Cover With Gasket.....	122.55	8.77
33 05 16 13-0371 EA 11" x 20", 15,000 LB Design Load, Heavy Duty, Polymer Concrete Handhole Enclosure Cover With Gasket.....	132.58	8.77
33 05 16 13-0372 EA 13" x 24", 15,000 LB Design Load, Heavy Duty, Polymer Concrete Handhole Enclosure Cover With Gasket.....	171.53	8.77
33 05 16 13-0373 EA 17" x 30", 15,000 LB Design Load, Heavy Duty, Polymer Concrete Handhole Enclosure Cover With Gasket.....	194.42	8.77
33 05 16 13-0374 EA 24" x 24", 15,000 LB Design Load, Heavy Duty, Polymer Concrete Handhole Enclosure Cover With Gasket.....	264.60	13.15
33 05 16 13-0375 EA 24" x 36", 15,000 LB Design Load, Heavy Duty, Polymer Concrete Handhole Enclosure Cover With Gasket.....	328.95	13.15
33 05 16 13-0376 EA 30" x 48", 15,000 LB Design Load, Heavy Duty, Polymer Concrete Handhole Enclosure Cover With Gasket.....	600.08	36.09
33 05 16 13-0377	Polymer Concrete Handhole Enclosure Covers Without Bolts (33 05 16 13-0290)	
33 05 16 13-0378 EA 6" x 9", 5,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover Without Bolts.....	48.18	8.77
33 05 16 13-0379 EA 7" x 13", 5,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover Without Bolts.....	56.52	8.77
33 05 16 13-0380 EA 12" x 12", 5,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover Without Bolts.....	67.75	8.77
33 05 16 13-0381 EA 8" x 18", 5,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover Without Bolts.....	72.74	8.77
33 05 16 13-0382 EA 11" x 18", 5,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover Without Bolts.....	72.61	8.77
33 05 16 13-0383 EA 13" x 24", 5,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover Without Bolts.....	85.40	8.77
33 05 16 13-0384 EA 17" x 30", 5,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover Without Bolts.....	97.97	8.77
33 05 16 13-0385 EA 24" x 36", 5,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover Without Bolts.....	233.91	13.15
33 05 16 13-0386 EA 30" x 48", 5,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover Without Bolts.....	434.02	36.09
33 05 16 13-0387 EA 30" x 59", 5,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover Without Bolts.....	647.00	24.36
33 05 16 13-0388 EA 30" x 60", 5,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover Without Bolts.....	565.73	24.36
33 05 16 13-0389 EA 48" x 48", 5,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover Without Bolts.....	840.54	24.36
33 05 16 13-0390 EA 36" x 60", 5,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover Without Bolts.....	811.48	24.36
33 05 16 13-0391 EA 36" x 72", 5,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover Without Bolts.....	968.82	24.36
33 05 16 13-0392 EA 48" x 72", 5,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover Without Bolts.....	1,034.92	24.36
33 05 16 13-0393 EA 48" x 96", 5,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover Without Bolts.....	1,647.88	24.36
33 05 16 13-0394 EA 10" x 15", 8,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover Without Bolts.....	63.17	8.77
33 05 16 13-0395 EA 10" x 16", 8,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover Without Bolts.....	61.79	8.77
33 05 16 13-0396 EA 11" x 20", 8,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover Without Bolts.....	89.30	8.77
33 05 16 13-0397 EA 11" x 21", 8,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover Without Bolts.....	97.72	8.77
33 05 16 13-0398 EA 13" x 24", 8,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover Without Bolts.....	110.07	8.77
33 05 16 13-0399 EA 13" x 24", 8,000 LB Design Load, Standard Duty, Service Box, Polymer Concrete Handhole Enclosure Cover Without Bolts.....	84.67	8.77
33 05 16 13-0400 EA 18" x 19", 8,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover Without Bolts.....	93.97	8.77
33 05 16 13-0401 EA 17" x 30", 8,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover Without Bolts.....	131.56	8.77
33 05 16 13-0402 EA 24" x 24", 8,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover Without Bolts.....	190.54	13.15
33 05 16 13-0403 EA 20" x 42", 8,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover Without Bolts.....	236.51	13.15
33 05 16 13-0404 EA 24" x 36", 8,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover Without Bolts.....	233.78	13.15
33 05 16 13-0405 EA 36" x 36", 8,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover Without Bolts.....	417.84	18.95
33 05 16 13-0406 EA 30" x 48", 8,000 LB Design Load, Standard Duty, Polymer Concrete Handhole Enclosure Cover Without Bolts.....	434.02	21.66
33 05 16 13-0407	Overlapping, Polymer Concrete Handhole Enclosure Covers (33 05 16 13-0290)	
33 05 16 13-0408 EA 30" x 60", 5,000 LB Design Load, Standard Duty, Overlapping, Polymer Concrete Handhole Enclosure Cover.....	673.19	24.36
33 05 16 13-0409 EA 36" x 60", 5,000 LB Design Load, Standard Duty, Overlapping, Polymer Concrete Handhole Enclosure Cover.....	969.79	24.36
33 05 16 13-0410 EA 30" x 48", 8,000 LB Design Load, Standard Duty, Overlapping, Polymer Concrete Handhole Enclosure Cover.....	565.38	36.09
33 05 16 13-0411 EA 30" x 48", 15,000 LB Design Load, Heavy Duty, Overlapping, Polymer Concrete Handhole Enclosure Cover.....	746.45	36.09
33 05 16 13-0412 EA 30" x 60", 15,000 LB Design Load, Heavy Duty, Overlapping, Polymer Concrete Handhole Enclosure Cover.....	797.73	24.36
33 05 16 13-0413 EA 36" x 60", 15,000 LB Design Load, Heavy Duty, Overlapping, Polymer Concrete Handhole Enclosure Cover.....	1,083.19	24.36
33 05 16 13-0414	Split, Polymer Concrete Handhole Enclosure Covers (33 05 16 13-0290)	
33 05 16 13-0415 EA 24" x 36", 8,000 LB Design Load, Standard Duty, Split, Polymer Concrete Handhole Enclosure Cover.....	264.68	13.15
33 05 16 13-0416 EA 36" x 36", 8,000 LB Design Load, Standard Duty, Split, Polymer Concrete Handhole Enclosure Cover.....	488.33	18.95
33 05 16 13-0417 EA 30" x 48", 8,000 LB Design Load, Standard Duty, Split, Polymer Concrete Handhole Enclosure Cover.....	511.43	36.09
33 05 16 13-0418 EA 6" x 8", 15,000 LB Design Load, Heavy Duty, Split, Polymer Concrete Handhole Enclosure Cover.....	45.86	8.77
33 05 16 13-0419 EA 8" x 8", 15,000 LB Design Load, Heavy Duty, Split, Polymer Concrete Handhole Enclosure Cover.....	73.19	8.77
33 05 16 13-0420 EA 12" x 12", 15,000 LB Design Load, Heavy Duty, Split, Polymer Concrete Handhole Enclosure Cover.....	80.10	8.77
33 05 16 13-0421 EA 8" x 18", 15,000 LB Design Load, Heavy Duty, Split, Polymer Concrete Handhole Enclosure Cover.....	84.67	8.77
33 05 16 13-0422 EA 10" x 15", 15,000 LB Design Load, Heavy Duty, Split, Polymer Concrete Handhole Enclosure Cover.....	74.82	8.77
33 05 16 13-0423 EA 11" x 20", 15,000 LB Design Load, Heavy Duty, Split, Polymer Concrete Handhole Enclosure Cover.....	128.51	8.77
33 05 16 13-0424 EA 24" x 36", 15,000 LB Design Load, Heavy Duty, Split, Polymer Concrete Handhole Enclosure Cover.....	352.47	13.15
33 05 16 13-0425 EA 36" x 36", 15,000 LB Design Load, Heavy Duty, Split, Polymer Concrete Handhole Enclosure Cover.....	646.64	18.95
33 05 16 13-0426 EA 30" x 48", 15,000 LB Design Load, Heavy Duty, Split, Polymer Concrete Handhole Enclosure Cover.....	678.48	36.09
33 05 16 13-0427	Precast Concrete Handholes With Steel Cover (33 05 16 13-0068)	
Note: 8000 To 12000 pound traffic rated top. Includes cover stamped with utility (Electrical, Sewer, Water, Etc.).		

33 Utilities**33 05 Common Work Results For Utilities****33 05 16 Utility Structures**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 05 16 13-0428 EA 12" x 12" x 12" Precast Concrete Handholes With Steel Cover Note: 8000 To 12000 pound traffic rated top. For 15,000 to 22,500 Pound Traffic Rated Top, Add	549.77 18.00	171.53
33 05 16 13-0429 EA 12" x 24" x 21" Precast Concrete Handholes With Steel Cover Note: 8000 To 12000 pound traffic rated top. For 15,000 to 22,500 Pound Traffic Rated Top, Add	908.92 85.78	257.30
33 05 16 13-0430 EA 18" x 30" x 18" Precast Concrete Handholes With Steel Cover Note: 8000 To 12000 pound traffic rated top. For 15,000 to 22,500 Pound Traffic Rated Top, Add	1,116.99 144.97	343.06
33 05 16 13-0431 EA 24" x 24" x 24" Precast Concrete Handholes With Steel Cover Note: 8000 To 12000 pound traffic rated top. For 15,000 to 22,500 Pound Traffic Rated Top, Add	1,153.77 180.16	343.06
33 05 16 13-0432 EA 24" x 24" x 30" Precast Concrete Handholes With Steel Cover Note: 8000 To 12000 pound traffic rated top. For 15,000 to 22,500 Pound Traffic Rated Top, Add	1,368.82 214.33	428.82
33 05 16 13-0433 EA 30" x 36" x 30" Precast Concrete Handholes With Steel Cover Note: 8000 To 12000 pound traffic rated top. For 15,000 to 22,500 Pound Traffic Rated Top, Add	1,430.23 242.69	428.82
33 05 16 13-0434 EA 36" x 36" x 48" Precast Concrete Handholes With Steel Cover Note: 8000 To 12000 pound traffic rated top. For 15,000 to 22,500 Pound Traffic Rated Top, Add	1,661.93 281.21	514.59
33 05 16 13-0435 EA 48" x 48" x 48" Precast Concrete Handholes With Steel Cover Note: 8000 To 12000 pound traffic rated top. For 15,000 to 22,500 Pound Traffic Rated Top, Add	1,912.80 413.16	600.36
33 05 16 13-0436 EA 48" x 72" x 36" Precast Concrete Handholes With Steel Cover Note: 8000 To 12000 pound traffic rated top. For 15,000 to 22,500 Pound Traffic Rated Top, Add	1,843.29 470.53	514.59
33 05 16 13-0437 EA 54" x 38" x 24" Precast Concrete Handholes With Steel Cover Note: 8000 To 12000 pound traffic rated top. For 15,000 to 22,500 Pound Traffic Rated Top, Add	1,858.89 300.33	514.59
33 05 16 13-0438 EA 6" Diameter Precast Concrete Handholes With Steel Cover Note: 8000 To 12000 pound traffic rated top. For 15,000 to 22,500 Pound Traffic Rated Top, Add	449.95 15.00	171.53
33 05 16 13-0439 EA 9" Diameter Precast Concrete Handholes With Steel Cover Note: 8000 To 12000 pound traffic rated top. For 15,000 to 22,500 Pound Traffic Rated Top, Add	525.69 15.00	192.97
33 05 16 13-0440 EA 12" Diameter Precast Concrete Handholes With Steel Cover Note: 8000 To 12000 pound traffic rated top. For 15,000 to 22,500 Pound Traffic Rated Top, Add	634.27 15.00	214.41

33 05 26 Utility Identification (33 05)**33 05 26 26 Utility Identification Warning Tape** (33 05 26)

33 05 26 26-0001 Non-Detectable Utility Warning Tape <small>(33 05 26 26)</small> Note: Labor installation is included with pipe and excavation..		
33 05 26 26-0002 LF 3" Non-Detectable Utility Warning Tape.....	0.02	
33 05 26 26-0003 LF 6" Non-Detectable Utility Warning Tape.....	0.03	
33 05 26 26-0004 Detectable Utility Warning Tape <small>(33 05 26 26)</small> Note: Labor installation is included with pipe and excavation..		
33 05 26 26-0005 LF 2" Detectable Utility Warning Tape	0.02	
33 05 26 26-0006 LF 3" Detectable Utility Warning Tape	0.03	
33 05 26 26-0007 LF 6" Detectable Utility Warning Tape	0.06	

33 10 Water Utilities (33)**33 11 Water Utility Distribution Piping** (33 10)

Note: Piping includes hydrostatic testing, disinfecting and warning tape. See CSI section 31 23 16 00-0000 for excavation, 31 23 16 36-0016 for backfill.

33 11 13 Public Water Utility Distribution Piping (33 11)**33 11 13 13 Ductile Iron Public Water Utility Distribution Piping** (33 11 13)

33 11 13 13-0001 Ductile Iron Piping <small>(33 11 13 13)</small>		
33 11 13 13-0002 Mechanical Joint Ductile Iron Piping <small>(33 11 13 13-0001)</small> Note: Cement lining and bituminous coating shall conform to ANSI A21.4.		
33 11 13 13-0003 Mechanical Joint Ductile Iron Pipe <small>(33 11 13 13-0002)</small> Note: Conforming to ANSI/AWWA C151/A21.51, federal specification WW-P-421D class 50.		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 11 13 13-0004 LF 4" Mechanical Joint Ductile Iron Pipe.....	34.63	10.28
For 40 Mil Glass Fiber Epoxy Or Polyurethane Lining, Add	13.34	
For Cement Mortar Lining (CML), Add	1.91	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	1.43	
Note: ANSI/AWWA C151/A21.51		
For >1,000, Deduct	-1.73	
For Class 51, Add	1.77	
For Class 52, Add	3.81	
For Class 53, Add	5.78	
For Class 54, Add	7.77	
For Class 55, Add	9.69	
For Class 56, Add	12.11	
33 11 13 13-0005 LF 6" Mechanical Joint Ductile Iron Pipe.....	36.17	10.78
For 40 Mil Glass Fiber Epoxy Or Polyurethane Lining, Add	13.90	
For Cement Mortar Lining (CML), Add	1.99	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	1.49	
Note: ANSI/AWWA C151/A21.51		
For >1,000, Deduct	-1.81	
For Class 51, Add	1.84	
For Class 52, Add	3.98	
For Class 53, Add	6.03	
For Class 54, Add	8.10	
For Class 55, Add	10.10	
For Class 56, Add	12.62	
33 11 13 13-0006 LF 8" Mechanical Joint Ductile Iron Pipe.....	42.38	11.21
For 40 Mil Glass Fiber Epoxy Or Polyurethane Lining, Add	17.78	
For Cement Mortar Lining (CML), Add	2.54	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	1.91	
Note: ANSI/AWWA C151/A21.51		
For >1,000, Deduct	-2.12	
For Class 51, Add	2.31	
For Class 52, Add	4.99	
For Class 53, Add	7.57	
For Class 54, Add	10.16	
For Class 55, Add	12.68	
For Class 56, Add	15.85	
33 11 13 13-0007 LF 10" Mechanical Joint Ductile Iron Pipe.....	57.25	15.98
For 40 Mil Glass Fiber Epoxy Or Polyurethane Lining, Add	19.82	
For Cement Mortar Lining (CML), Add	3.30	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	2.48	
Note: ANSI/AWWA C151/A21.51		
For >1,000, Deduct	-2.86	
For Class 51, Add	3.03	
For Class 52, Add	6.54	
For Class 53, Add	9.92	
For Class 54, Add	13.33	
For Class 55, Add	16.62	
For Class 56, Add	20.78	
33 11 13 13-0008 LF 12" Mechanical Joint Ductile Iron Pipe.....	69.10	17.75
For 40 Mil Glass Fiber Epoxy Or Polyurethane Lining, Add	21.10	
For Cement Mortar Lining (CML), Add	4.22	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	3.17	
Note: ANSI/AWWA C151/A21.51		
For >1,000, Deduct	-3.46	
For Class 51, Add	3.82	
For Class 52, Add	8.25	
For Class 53, Add	12.52	
For Class 54, Add	16.82	
For Class 55, Add	20.98	
For Class 56, Add	26.24	
33 11 13 13-0009 Mechanical Joint Ductile Iron 90 Degree Elbow <small>(33 11 13 13-0002)</small>		
33 11 13 13-0010 EA 4" Mechanical Joint Ductile Iron 90 Degree Elbow	207.06	36.43
For Cement Mortar Lining (CML), Add	15.19	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	11.39	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0011 EA 6" Mechanical Joint Ductile Iron 90 Degree Elbow	329.84	53.84
For Cement Mortar Lining (CML), Add	24.83	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	18.62	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0012 EA 8" Mechanical Joint Ductile Iron 90 Degree Elbow	457.98	63.86
For Cement Mortar Lining (CML), Add	36.12	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	27.09	
Note: ANSI/AWWA C151/A21.51		

33 Utilities**33 10 Water Utilities****33 11 Water Utility Distribution Piping**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 11 13 13-0013 EA 10" Mechanical Joint Ductile Iron 90 Degree Elbow	681.94	70.84
For Cement Mortar Lining (CML), Add	57.46	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	43.10	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0014 EA 12" Mechanical Joint Ductile Iron 90 Degree Elbow	899.55	83.10
For Cement Mortar Lining (CML), Add	77.37	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	58.03	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0015 Mechanical Joint Ductile Iron 45 Degree Elbow (33 11 13 13-0002)		
33 11 13 13-0016 EA 4" Mechanical Joint Ductile Iron 45 Degree Elbow	180.38	36.43
For Cement Mortar Lining (CML), Add	12.52	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	9.39	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0017 EA 6" Mechanical Joint Ductile Iron 45 Degree Elbow	282.64	53.84
For Cement Mortar Lining (CML), Add	20.11	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	15.08	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0018 EA 8" Mechanical Joint Ductile Iron 45 Degree Elbow	390.26	63.86
For Cement Mortar Lining (CML), Add	29.35	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	22.01	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0019 EA 10" Mechanical Joint Ductile Iron 45 Degree Elbow	536.23	70.84
For Cement Mortar Lining (CML), Add	42.89	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	32.17	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0020 EA 12" Mechanical Joint Ductile Iron 45 Degree Elbow	766.16	83.10
For Cement Mortar Lining (CML), Add	64.03	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	48.02	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0021 Mechanical Joint Ductile Iron 22-1/2 Degree Elbow (33 11 13 13-0002)		
33 11 13 13-0022 EA 4" Mechanical Joint Ductile Iron 22-1/2 Degree Elbow	174.22	36.43
For Cement Mortar Lining (CML), Add	11.90	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	8.93	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0023 EA 6" Mechanical Joint Ductile Iron 22-1/2 Degree Elbow	266.22	53.84
For Cement Mortar Lining (CML), Add	18.47	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	13.85	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0024 EA 8" Mechanical Joint Ductile Iron 22-1/2 Degree Elbow	384.10	63.86
For Cement Mortar Lining (CML), Add	28.73	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	21.55	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0025 EA 10" Mechanical Joint Ductile Iron 22-1/2 Degree Elbow	534.18	70.84
For Cement Mortar Lining (CML), Add	42.69	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	32.02	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0026 EA 12" Mechanical Joint Ductile Iron 22-1/2 Degree Elbow	686.12	83.10
For Cement Mortar Lining (CML), Add	56.03	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	42.02	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0027 Mechanical Joint Ductile Iron 11-1/4 Degree Elbow (33 11 13 13-0002)		
33 11 13 13-0028 EA 4" Mechanical Joint Ductile Iron 11-1/4 Degree Elbow	168.06	36.43
For Cement Mortar Lining (CML), Add	11.29	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	8.47	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0029 EA 6" Mechanical Joint Ductile Iron 11-1/4 Degree Elbow	272.38	53.84
For Cement Mortar Lining (CML), Add	19.09	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	14.31	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0030 EA 8" Mechanical Joint Ductile Iron 11-1/4 Degree Elbow	357.42	63.86
For Cement Mortar Lining (CML), Add	26.06	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	19.55	
Note: ANSI/AWWA C151/A21.51		



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
	33 11 13 13-0031	EA		10" Mechanical Joint Ductile Iron 11-1/4 Degree Elbow <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i> <i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	530.07 42.28 31.71	70.84
	33 11 13 13-0032	EA		12" Mechanical Joint Ductile Iron 11-1/4 Degree Elbow <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i> <i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	651.23 52.54 39.40	83.10
	33 11 13 13-0033	EA		14" Mechanical Joint Ductile Iron 11-1/4 Degree Elbow <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i> <i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	1,304.81 116.36 87.27	93.19
	33 11 13 13-0034	EA		16" Mechanical Joint Ductile Iron 11-1/4 Degree Elbow <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i> <i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	1,435.81 127.44 95.58	106.50
	33 11 13 13-0035	EA		18" Mechanical Joint Ductile Iron 11-1/4 Degree Elbow <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i> <i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	2,095.47 186.96 140.22	149.11
	33 11 13 13-0036	EA		20" Mechanical Joint Ductile Iron 11-1/4 Degree Elbow <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i> <i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	2,176.59 189.42 142.07	186.38
	33 11 13 13-0037	EA		24" Mechanical Joint Ductile Iron 11-1/4 Degree Elbow <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i> <i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	2,902.40 252.63 189.47	248.19
	33 11 13 13-0038			Mechanical Joint x Plain End (MJxPE) Ductile Iron 90 Degree Elbow <small>(33 11 13 13-0002)</small>		
	33 11 13 13-0039	EA		4" Mechanical Joint x Plain End (MJxPE) Ductile Iron 90 Degree Elbow <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i> <i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	235.79 18.06 13.55	36.43
	33 11 13 13-0040	EA		6" Mechanical Joint x Plain End (MJxPE) Ductile Iron 90 Degree Elbow <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i> <i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	381.15 29.96 22.47	53.84
	33 11 13 13-0041	EA		8" Mechanical Joint x Plain End (MJxPE) Ductile Iron 90 Degree Elbow <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i> <i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	525.71 42.89 32.17	63.86
	33 11 13 13-0042	EA		10" Mechanical Joint x Plain End (MJxPE) Ductile Iron 90 Degree Elbow <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i> <i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	780.44 67.31 50.48	70.84
	33 11 13 13-0043	EA		12" Mechanical Joint x Plain End (MJxPE) Ductile Iron 90 Degree Elbow <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i> <i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	1,006.27 88.04 66.03	83.10
	33 11 13 13-0044	EA		14" Mechanical Joint x Plain End (MJxPE) Ductile Iron 90 Degree Elbow <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i> <i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	1,778.88 163.77 122.83	93.19
	33 11 13 13-0045	EA		16" Mechanical Joint x Plain End (MJxPE) Ductile Iron 90 Degree Elbow <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i> <i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	2,755.40 259.40 194.55	106.50
	33 11 13 13-0046	EA		18" Mechanical Joint x Plain End (MJxPE) Ductile Iron 90 Degree Elbow <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i> <i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	3,172.90 294.70 221.03	149.11
	33 11 13 13-0047	EA		20" Mechanical Joint x Plain End (MJxPE) Ductile Iron 90 Degree Elbow <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i> <i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	4,327.33 404.50 303.37	186.38

33 Utilities**33 10 Water Utilities****33 11 Water Utility Distribution Piping**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 11 13 13-0048	EA		24" Mechanical Joint x Plain End (MJxPE) Ductile Iron 90 Degree Elbow.....	5,235.79	248.19
			<i>For Cement Mortar Lining (CML), Add</i>	485.97	
			<i>Note: ANSI/AWWA C104/A21.4</i>		
			<i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i>	364.48	
			<i>Note: ANSI/AWWA C151/A21.51</i>		
33 11 13 13-0049			Mechanical Joint x Plain End (MJxPE) Ductile Iron 45 Degree Elbow <small>(33 11 13 13-0002)</small>		
33 11 13 13-0050	EA		4" Mechanical Joint x Plain End (MJxPE) Ductile Iron 45 Degree Elbow.....	186.53	36.43
			<i>For Cement Mortar Lining (CML), Add</i>	13.13	
			<i>Note: ANSI/AWWA C104/A21.4</i>		
			<i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i>	9.85	
			<i>Note: ANSI/AWWA C151/A21.51</i>		
33 11 13 13-0051	EA		6" Mechanical Joint x Plain End (MJxPE) Ductile Iron 45 Degree Elbow.....	305.21	53.84
			<i>For Cement Mortar Lining (CML), Add</i>	22.37	
			<i>Note: ANSI/AWWA C104/A21.4</i>		
			<i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i>	16.78	
			<i>Note: ANSI/AWWA C151/A21.51</i>		
33 11 13 13-0052	EA		8" Mechanical Joint x Plain End (MJxPE) Ductile Iron 45 Degree Elbow.....	455.93	63.86
			<i>For Cement Mortar Lining (CML), Add</i>	35.91	
			<i>Note: ANSI/AWWA C104/A21.4</i>		
			<i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i>	26.94	
			<i>Note: ANSI/AWWA C151/A21.51</i>		
33 11 13 13-0053	EA		10" Mechanical Joint x Plain End (MJxPE) Ductile Iron 45 Degree Elbow.....	640.89	70.84
			<i>For Cement Mortar Lining (CML), Add</i>	53.36	
			<i>Note: ANSI/AWWA C104/A21.4</i>		
			<i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i>	40.02	
			<i>Note: ANSI/AWWA C151/A21.51</i>		
33 11 13 13-0054	EA		12" Mechanical Joint x Plain End (MJxPE) Ductile Iron 45 Degree Elbow.....	885.19	83.10
			<i>For Cement Mortar Lining (CML), Add</i>	75.93	
			<i>Note: ANSI/AWWA C104/A21.4</i>		
			<i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i>	56.95	
			<i>Note: ANSI/AWWA C151/A21.51</i>		
33 11 13 13-0055	EA		14" Mechanical Joint x Plain End (MJxPE) Ductile Iron 45 Degree Elbow.....	1,563.39	93.19
			<i>For Cement Mortar Lining (CML), Add</i>	142.22	
			<i>Note: ANSI/AWWA C104/A21.4</i>		
			<i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i>	106.67	
			<i>Note: ANSI/AWWA C151/A21.51</i>		
33 11 13 13-0056	EA		16" Mechanical Joint x Plain End (MJxPE) Ductile Iron 45 Degree Elbow.....	2,416.78	106.50
			<i>For Cement Mortar Lining (CML), Add</i>	225.54	
			<i>Note: ANSI/AWWA C104/A21.4</i>		
			<i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i>	169.16	
			<i>Note: ANSI/AWWA C151/A21.51</i>		
33 11 13 13-0057	EA		18" Mechanical Joint x Plain End (MJxPE) Ductile Iron 45 Degree Elbow.....	2,830.17	149.11
			<i>For Cement Mortar Lining (CML), Add</i>	260.43	
			<i>Note: ANSI/AWWA C104/A21.4</i>		
			<i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i>	195.32	
			<i>Note: ANSI/AWWA C151/A21.51</i>		
33 11 13 13-0058	EA		20" Mechanical Joint x Plain End (MJxPE) Ductile Iron 45 Degree Elbow.....	3,682.93	186.38
			<i>For Cement Mortar Lining (CML), Add</i>	340.06	
			<i>Note: ANSI/AWWA C104/A21.4</i>		
			<i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i>	255.04	
			<i>Note: ANSI/AWWA C151/A21.51</i>		
33 11 13 13-0059	EA		24" Mechanical Joint x Plain End (MJxPE) Ductile Iron 45 Degree Elbow.....	4,613.97	248.19
			<i>For Cement Mortar Lining (CML), Add</i>	423.79	
			<i>Note: ANSI/AWWA C104/A21.4</i>		
			<i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i>	317.84	
			<i>Note: ANSI/AWWA C151/A21.51</i>		
33 11 13 13-0060			Mechanical Joint Ductile Iron Tee <small>(33 11 13 13-0002)</small>		
33 11 13 13-0061	EA		4" x 4" Mechanical Joint Ductile Iron Tee.....	280.59	53.84
			<i>For Cement Mortar Lining (CML), Add</i>	19.91	
			<i>Note: ANSI/AWWA C104/A21.4</i>		
			<i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i>	14.93	
			<i>Note: ANSI/AWWA C151/A21.51</i>		
33 11 13 13-0062	EA		6" x 4" Mechanical Joint Ductile Iron Tee.....	441.50	70.61
			<i>For Cement Mortar Lining (CML), Add</i>	33.45	
			<i>Note: ANSI/AWWA C104/A21.4</i>		
			<i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i>	25.09	
			<i>Note: ANSI/AWWA C151/A21.51</i>		
33 11 13 13-0063	EA		6" x 6" Mechanical Joint Ductile Iron Tee.....	478.86	79.06
			<i>For Cement Mortar Lining (CML), Add</i>	35.91	
			<i>Note: ANSI/AWWA C104/A21.4</i>		
			<i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i>	26.94	
			<i>Note: ANSI/AWWA C151/A21.51</i>		
33 11 13 13-0064	EA		8" x 4" Mechanical Joint Ductile Iron Tee.....	511.85	81.83
			<i>For Cement Mortar Lining (CML), Add</i>	38.79	
			<i>Note: ANSI/AWWA C104/A21.4</i>		
			<i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i>	29.09	
			<i>Note: ANSI/AWWA C151/A21.51</i>		



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
	33 11 13	13-0065	EA	8" x 6" Mechanical Joint Ductile Iron Tee..... <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i>	584.11 44.74	90.24
				<i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	33.55	
	33 11 13	13-0066	EA	8" x 8" Mechanical Joint Ductile Iron Tee..... <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i>	684.96 53.97	95.87
				<i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	40.48	
	33 11 13	13-0067	EA	10" x 4" Mechanical Joint Ductile Iron Tee..... <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i>	728.55 59.52	88.04
				<i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	44.64	
	33 11 13	13-0068	EA	10" x 6" Mechanical Joint Ductile Iron Tee..... <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i>	722.18 57.67	96.03
				<i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	43.25	
	33 11 13	13-0069	EA	10" x 8" Mechanical Joint Ductile Iron Tee..... <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i>	828.77 67.52	101.36
				<i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	50.64	
	33 11 13	13-0070	EA	10" x 10" Mechanical Joint Ductile Iron Tee..... <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i>	933.01 77.16	106.50
				<i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	57.87	
	33 11 13	13-0071	EA	12" x 4" Mechanical Joint Ductile Iron Tee..... <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i>	878.08 72.86	98.69
				<i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	54.64	
	33 11 13	13-0072	EA	12" x 6" Mechanical Joint Ductile Iron Tee..... <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i>	1,003.05 84.14	106.68
				<i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	63.11	
	33 11 13	13-0073	EA	12" x 8" Mechanical Joint Ductile Iron Tee..... <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i>	1,251.24 108.15	112.01
				<i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	81.11	
	33 11 13	13-0074	EA	12" x 10" Mechanical Joint Ductile Iron Tee..... <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i>	1,343.17 116.57	117.16
				<i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	87.43	
	33 11 13	13-0075	EA	12" x 12" Mechanical Joint Ductile Iron Tee..... <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i>	1,262.99 107.74	122.48
				<i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	80.81	
	33 11 13	13-0076		Mechanical Joint Ductile Iron Wye (Laterals) <small>(33 11 13 13-0002)</small>		
	33 11 13	13-0077	EA	4" x 4" Mechanical Joint Ductile Iron Wye (Lateral) <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i>	407.83 32.63	53.80
				<i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	24.47	
	33 11 13	13-0078	EA	6" x 4" Mechanical Joint Ductile Iron Wye (Lateral) <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i>	443.55 33.66	70.61
				<i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	25.24	
	33 11 13	13-0079	EA	6" x 6" Mechanical Joint Ductile Iron Wye (Lateral) <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i>	612.26 49.25	79.01
				<i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	36.94	
	33 11 13	13-0080	EA	8" x 4" Mechanical Joint Ductile Iron Wye (Lateral) <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i>	803.27 67.93	81.83
				<i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	50.95	
	33 11 13	13-0081	EA	8" x 6" Mechanical Joint Ductile Iron Wye (Lateral) <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i>	705.19 56.85	90.24
				<i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	42.64	

33 Utilities**33 10 Water Utilities****33 11 Water Utility Distribution Piping**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 11 13 13-0082 EA 8" x 8" Mechanical Joint Ductile Iron Wye (Lateral)	863.50	95.84
For Cement Mortar Lining (CML), Add	71.83	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	53.87	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0083 EA 10" x 4" Mechanical Joint Ductile Iron Wye (Lateral)	1,276.50	88.04
For Cement Mortar Lining (CML), Add	114.31	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	85.73	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0084 EA 10" x 6" Mechanical Joint Ductile Iron Wye (Lateral)	1,348.11	96.03
For Cement Mortar Lining (CML), Add	120.26	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	90.20	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0085 EA 10" x 8" Mechanical Joint Ductile Iron Wye (Lateral)	1,557.31	101.36
For Cement Mortar Lining (CML), Add	140.37	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	105.28	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0086 EA 10" x 10" Mechanical Joint Ductile Iron Wye (Lateral)	1,760.07	106.50
For Cement Mortar Lining (CML), Add	159.87	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	119.90	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0087 EA 12" x 4" Mechanical Joint Ductile Iron Wye (Lateral)	1,641.51	98.69
For Cement Mortar Lining (CML), Add	149.20	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	111.90	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0088 EA 12" x 6" Mechanical Joint Ductile Iron Wye (Lateral)	1,860.88	106.68
For Cement Mortar Lining (CML), Add	169.93	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	127.44	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0089 EA 12" x 8" Mechanical Joint Ductile Iron Wye (Lateral)	2,256.84	112.01
For Cement Mortar Lining (CML), Add	208.71	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	156.53	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0090 EA 12" x 10" Mechanical Joint Ductile Iron Wye (Lateral)	2,320.04	117.16
For Cement Mortar Lining (CML), Add	214.25	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	160.69	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0091 EA 12" x 12" Mechanical Joint Ductile Iron Wye (Lateral)	2,087.99	122.47
For Cement Mortar Lining (CML), Add	190.24	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	142.68	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0092 EA 14" x 6" Mechanical Joint Ductile Iron Wye (Lateral)	2,478.64	124.31
For Cement Mortar Lining (CML), Add	229.03	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	171.77	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0093 EA 14" x 8" Mechanical Joint Ductile Iron Wye (Lateral)	2,847.91	129.64
For Cement Mortar Lining (CML), Add	265.15	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	198.86	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0094 EA 14" x 10" Mechanical Joint Ductile Iron Wye (Lateral)	3,748.43	134.78
For Cement Mortar Lining (CML), Add	354.42	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	265.82	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0095 EA 14" x 12" Mechanical Joint Ductile Iron Wye (Lateral)	4,019.18	140.10
For Cement Mortar Lining (CML), Add	380.69	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	285.52	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0096 EA 14" x 14" Mechanical Joint Ductile Iron Wye (Lateral)	3,917.61	148.91
For Cement Mortar Lining (CML), Add	369.20	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	276.90	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0097 EA 16" x 6" Mechanical Joint Ductile Iron Wye (Lateral)	2,528.52	149.09
For Cement Mortar Lining (CML), Add	230.26	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	172.70	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0098 EA 16" x 8" Mechanical Joint Ductile Iron Wye (Lateral)	2,791.08	154.43
For Cement Mortar Lining (CML), Add	255.71	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	191.78	
Note: ANSI/AWWA C151/A21.51		



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 11 13 13-0099	EA			16" x 10" Mechanical Joint Ductile Iron Wye (Lateral) <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i> <i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	3,309.88 306.81 230.11	159.57
33 11 13 13-0100	EA			16" x 12" Mechanical Joint Ductile Iron Wye (Lateral) <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i> <i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	3,714.03 346.42 259.81	164.90
33 11 13 13-0101	EA			16" x 14" Mechanical Joint Ductile Iron Wye (Lateral) <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i> <i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	4,675.52 441.23 330.92	173.72
33 11 13 13-0102	EA			16" x 16" Mechanical Joint Ductile Iron Wye (Lateral) <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i> <i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	4,493.19 421.12 315.84	186.11
33 11 13 13-0103	EA			18" x 6" Mechanical Joint Ductile Iron Wye (Lateral) <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i> <i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	4,018.04 372.89 279.67	190.82
33 11 13 13-0104	EA			18" x 8" Mechanical Joint Ductile Iron Wye (Lateral) <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i> <i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	4,333.95 403.68 302.76	196.14
33 11 13 13-0105	EA			18" x 10" Mechanical Joint Ductile Iron Wye (Lateral) <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i> <i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	4,639.32 433.43 325.07	201.29
33 11 13 13-0106	EA			18" x 12" Mechanical Joint Ductile Iron Wye (Lateral) <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i> <i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	4,971.64 465.86 349.39	206.61
33 11 13 13-0107	EA			18" x 14" Mechanical Joint Ductile Iron Wye (Lateral) <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i> <i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	5,021.94 469.55 352.16	215.43
33 11 13 13-0108	EA			18" x 16" Mechanical Joint Ductile Iron Wye (Lateral) <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i> <i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	5,065.34 472.02 354.01	227.83
33 11 13 13-0109	EA			18" x 18" Mechanical Joint Ductile Iron Wye (Lateral) <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i> <i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	4,600.31 422.35 316.76	248.69
33 11 13 13-0110	EA			20" x 6" Mechanical Joint Ductile Iron Wye (Lateral) <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i> <i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	4,728.41 431.38 323.54	273.63
33 11 13 13-0111	EA			20" x 8" Mechanical Joint Ductile Iron Wye (Lateral) <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i> <i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	4,832.94 441.03 330.77	278.96
33 11 13 13-0112	EA			20" x 10" Mechanical Joint Ductile Iron Wye (Lateral) <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i> <i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	5,325.06 489.46 367.09	284.11
33 11 13 13-0113	EA			20" x 12" Mechanical Joint Ductile Iron Wye (Lateral) <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i> <i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	5,813.36 537.48 403.11	289.43
33 11 13 13-0114	EA			20" x 14" Mechanical Joint Ductile Iron Wye (Lateral) <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i> <i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	5,867.75 541.59 406.19	298.24
33 11 13 13-0115	EA			20" x 16" Mechanical Joint Ductile Iron Wye (Lateral) <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i> <i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	5,929.64 545.90 409.42	310.65

33 Utilities**33 10 Water Utilities****33 11 Water Utility Distribution Piping**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 11 13 13-0116 EA 20" x 18" Mechanical Joint Ductile Iron Wye (Lateral) For Cement Mortar Lining (CML), Add Note: ANSI/AWWA C104/A21.4 For Bituminous Or Coal Tar Coating, 1 Mil, Add Note: ANSI/AWWA C151/A21.51	6,892.96 639.07 479.30	331.50
33 11 13 13-0117 EA 20" x 20" Mechanical Joint Ductile Iron Wye (Lateral) For Cement Mortar Lining (CML), Add Note: ANSI/AWWA C104/A21.4 For Bituminous Or Coal Tar Coating, 1 Mil, Add Note: ANSI/AWWA C151/A21.51	6,483.68 591.87 443.90	372.91
33 11 13 13-0118 EA 24" x 6" Mechanical Joint Ductile Iron Wye (Lateral) For Cement Mortar Lining (CML), Add Note: ANSI/AWWA C104/A21.4 For Bituminous Or Coal Tar Coating, 1 Mil, Add Note: ANSI/AWWA C151/A21.51	5,729.82 519.01 389.26	356.20
33 11 13 13-0119 EA 24" x 8" Mechanical Joint Ductile Iron Wye (Lateral) For Cement Mortar Lining (CML), Add Note: ANSI/AWWA C104/A21.4 For Bituminous Or Coal Tar Coating, 1 Mil, Add Note: ANSI/AWWA C151/A21.51	5,803.56 525.58 394.18	361.52
33 11 13 13-0120 EA 24" x 10" Mechanical Joint Ductile Iron Wye (Lateral) For Cement Mortar Lining (CML), Add Note: ANSI/AWWA C104/A21.4 For Bituminous Or Coal Tar Coating, 1 Mil, Add Note: ANSI/AWWA C151/A21.51	6,490.65 593.51 445.13	366.67
33 11 13 13-0121 EA 24" x 12" Mechanical Joint Ductile Iron Wye (Lateral) For Cement Mortar Lining (CML), Add Note: ANSI/AWWA C104/A21.4 For Bituminous Or Coal Tar Coating, 1 Mil, Add Note: ANSI/AWWA C151/A21.51	6,802.43 623.88 467.91	372.00
33 11 13 13-0122 EA 24" x 14" Mechanical Joint Ductile Iron Wye (Lateral) For Cement Mortar Lining (CML), Add Note: ANSI/AWWA C104/A21.4 For Bituminous Or Coal Tar Coating, 1 Mil, Add Note: ANSI/AWWA C151/A21.51	7,891.16 731.42 548.56	380.81
33 11 13 13-0123 EA 24" x 16" Mechanical Joint Ductile Iron Wye (Lateral) For Cement Mortar Lining (CML), Add Note: ANSI/AWWA C104/A21.4 For Bituminous Or Coal Tar Coating, 1 Mil, Add Note: ANSI/AWWA C151/A21.51	8,790.36 819.46 614.59	393.21
33 11 13 13-0124 EA 24" x 18" Mechanical Joint Ductile Iron Wye (Lateral) For Cement Mortar Lining (CML), Add Note: ANSI/AWWA C104/A21.4 For Bituminous Or Coal Tar Coating, 1 Mil, Add Note: ANSI/AWWA C151/A21.51	9,856.29 922.89 692.17	414.07
33 11 13 13-0125 EA 24" x 20" Mechanical Joint Ductile Iron Wye (Lateral) For Cement Mortar Lining (CML), Add Note: ANSI/AWWA C104/A21.4 For Bituminous Or Coal Tar Coating, 1 Mil, Add Note: ANSI/AWWA C151/A21.51	10,828.18 1,013.81 760.36	455.48
33 11 13 13-0126 EA 24" x 24" Mechanical Joint Ductile Iron Wye (Lateral) For Cement Mortar Lining (CML), Add Note: ANSI/AWWA C104/A21.4 For Bituminous Or Coal Tar Coating, 1 Mil, Add Note: ANSI/AWWA C151/A21.51	9,536.25 878.36 658.77	496.76
33 11 13 13-0127 Mechanical Joint Ductile Iron Cross (33 11 13 13-0002)		
33 11 13 13-0128 EA 4" x 4" Mechanical Joint Ductile Iron Cross For Cement Mortar Lining (CML), Add Note: ANSI/AWWA C104/A21.4 For Bituminous Or Coal Tar Coating, 1 Mil, Add Note: ANSI/AWWA C151/A21.51	530.82 42.89 32.17	67.25
33 11 13 13-0129 EA 6" x 4" Mechanical Joint Ductile Iron Cross For Cement Mortar Lining (CML), Add Note: ANSI/AWWA C104/A21.4 For Bituminous Or Coal Tar Coating, 1 Mil, Add Note: ANSI/AWWA C151/A21.51	603.77 46.79 35.09	89.67
33 11 13 13-0130 EA 6" x 6" Mechanical Joint Ductile Iron Cross For Cement Mortar Lining (CML), Add Note: ANSI/AWWA C104/A21.4 For Bituminous Or Coal Tar Coating, 1 Mil, Add Note: ANSI/AWWA C151/A21.51	695.19 52.54 39.40	112.08
33 11 13 13-0131 EA 8" x 4" Mechanical Joint Ductile Iron Cross For Cement Mortar Lining (CML), Add Note: ANSI/AWWA C104/A21.4 For Bituminous Or Coal Tar Coating, 1 Mil, Add Note: ANSI/AWWA C151/A21.51	614.47 46.59 34.94	98.08
33 11 13 13-0132 EA 8" x 6" Mechanical Joint Ductile Iron Cross For Cement Mortar Lining (CML), Add Note: ANSI/AWWA C104/A21.4 For Bituminous Or Coal Tar Coating, 1 Mil, Add Note: ANSI/AWWA C151/A21.51	726.41 54.38 40.79	120.50



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 11 13 13-0133	EA			8" x 8" Mechanical Joint Ductile Iron Cross For Cement Mortar Lining (CML), Add Note: ANSI/AWWA C104/A21.4 For Bituminous Or Coal Tar Coating, 1 Mil, Add Note: ANSI/AWWA C151/A21.51	767.90 57.26 42.94	128.89
33 11 13 13-0134	EA			10" x 4" Mechanical Joint Ductile Iron Cross For Cement Mortar Lining (CML), Add Note: ANSI/AWWA C104/A21.4 For Bituminous Or Coal Tar Coating, 1 Mil, Add Note: ANSI/AWWA C151/A21.51	763.47 60.75 45.56	102.97
33 11 13 13-0135	EA			10" x 6" Mechanical Joint Ductile Iron Cross For Cement Mortar Lining (CML), Add Note: ANSI/AWWA C104/A21.4 For Bituminous Or Coal Tar Coating, 1 Mil, Add Note: ANSI/AWWA C151/A21.51	869.63 68.13 51.10	124.27
33 11 13 13-0136	EA			10" x 8" Mechanical Joint Ductile Iron Cross For Cement Mortar Lining (CML), Add Note: ANSI/AWWA C104/A21.4 For Bituminous Or Coal Tar Coating, 1 Mil, Add Note: ANSI/AWWA C151/A21.51	1,045.92 84.55 63.41	132.26
33 11 13 13-0137	EA			10" x 10" Mechanical Joint Ductile Iron Cross For Cement Mortar Lining (CML), Add Note: ANSI/AWWA C104/A21.4 For Bituminous Or Coal Tar Coating, 1 Mil, Add Note: ANSI/AWWA C151/A21.51	1,132.54 91.74 68.80	142.00
33 11 13 13-0138	EA			12 x 4" Mechanical Joint Ductile Iron Cross..... For Cement Mortar Lining (CML), Add Note: ANSI/AWWA C104/A21.4 For Bituminous Or Coal Tar Coating, 1 Mil, Add Note: ANSI/AWWA C151/A21.51	936.98 76.75 57.57	111.83
33 11 13 13-0139	EA			12" x 6" Mechanical Joint Ductile Iron Cross For Cement Mortar Lining (CML), Add Note: ANSI/AWWA C104/A21.4 For Bituminous Or Coal Tar Coating, 1 Mil, Add Note: ANSI/AWWA C151/A21.51	1,086.24 88.45 66.34	133.13
33 11 13 13-0140	EA			12" x 8" Mechanical Joint Ductile Iron Cross For Cement Mortar Lining (CML), Add Note: ANSI/AWWA C104/A21.4 For Bituminous Or Coal Tar Coating, 1 Mil, Add Note: ANSI/AWWA C151/A21.51	1,609.35 139.55 104.66	141.13
33 11 13 13-0141	EA			12" x 10" Mechanical Joint Ductile Iron Cross For Cement Mortar Lining (CML), Add Note: ANSI/AWWA C104/A21.4 For Bituminous Or Coal Tar Coating, 1 Mil, Add Note: ANSI/AWWA C151/A21.51	1,624.15 139.55 104.66	150.90
33 11 13 13-0142	EA			12" x 12" Mechanical Joint Ductile Iron Cross For Cement Mortar Lining (CML), Add Note: ANSI/AWWA C104/A21.4 For Bituminous Or Coal Tar Coating, 1 Mil, Add Note: ANSI/AWWA C151/A21.51	1,853.07 161.10 120.83	159.76
33 11 13 13-0143				Mechanical Joint x Mechanical Joint Ductile Iron Reducers (33 11 13 13-0002)		
33 11 13 13-0144	EA			6" x 4" Mechanical Joint x Mechanical Joint Ductile Iron Reducer..... For Cement Mortar Lining (CML), Add Note: ANSI/AWWA C104/A21.4 For Bituminous Or Coal Tar Coating, 1 Mil, Add Note: ANSI/AWWA C151/A21.51	210.74 14.37 10.77	44.28
33 11 13 13-0145	EA			8" x 4" Mechanical Joint x Mechanical Joint Ductile Iron Reducer..... For Cement Mortar Lining (CML), Add Note: ANSI/AWWA C104/A21.4 For Bituminous Or Coal Tar Coating, 1 Mil, Add Note: ANSI/AWWA C151/A21.51	272.68 19.70 14.78	49.89
33 11 13 13-0146	EA			8" x 6" Mechanical Joint x Mechanical Joint Ductile Iron Reducer..... For Cement Mortar Lining (CML), Add Note: ANSI/AWWA C104/A21.4 For Bituminous Or Coal Tar Coating, 1 Mil, Add Note: ANSI/AWWA C151/A21.51	297.64 20.93 15.70	58.29
33 11 13 13-0147	EA			10" x 4" Mechanical Joint x Mechanical Joint Ductile Iron Reducer..... For Cement Mortar Lining (CML), Add Note: ANSI/AWWA C104/A21.4 For Bituminous Or Coal Tar Coating, 1 Mil, Add Note: ANSI/AWWA C151/A21.51	336.14 25.65 19.24	52.55
33 11 13 13-0148	EA			10" x 6" Mechanical Joint x Mechanical Joint Ductile Iron Reducer..... For Cement Mortar Lining (CML), Add Note: ANSI/AWWA C104/A21.4 For Bituminous Or Coal Tar Coating, 1 Mil, Add Note: ANSI/AWWA C151/A21.51	362.61 27.09 20.32	60.53
33 11 13 13-0149	EA			10" x 8" Mechanical Joint x Mechanical Joint Ductile Iron Reducer..... For Cement Mortar Lining (CML), Add Note: ANSI/AWWA C104/A21.4 For Bituminous Or Coal Tar Coating, 1 Mil, Add Note: ANSI/AWWA C151/A21.51	397.35 29.76 22.32	65.86

33 Utilities**33 10 Water Utilities****33 11 Water Utility Distribution Piping**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 11 13 13-0150 EA 12" x 4" Mechanical Joint x Mechanical Joint Ductile Iron Reducer.....	411.92	57.87
For Cement Mortar Lining (CML), Add	32.43	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	24.32	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0151 EA 12" x 6" Mechanical Joint x Mechanical Joint Ductile Iron Reducer.....	456.86	65.86
For Cement Mortar Lining (CML), Add	35.71	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	26.78	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0152 EA 12" x 8" Mechanical Joint x Mechanical Joint Ductile Iron Reducer.....	475.20	71.18
For Cement Mortar Lining (CML), Add	36.74	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	27.55	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0153 EA 12" x 10" Mechanical Joint x Mechanical Joint Ductile Iron Reducer.....	521.99	76.33
For Cement Mortar Lining (CML), Add	40.63	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	30.48	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0154 Mechanical Joint Ductile Iron Caps (33 11 13 13-0002)		
33 11 13 13-0155 EA 4" Mechanical Joint Ductile Iron Caps.....	179.95	82.20
For Cement Mortar Lining (CML), Add	5.54	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	4.16	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0156 EA 6" Mechanical Joint Ductile Iron Caps.....	254.19	102.74
For Cement Mortar Lining (CML), Add	9.85	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	7.39	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0157 EA 8" Mechanical Joint Ductile Iron Caps.....	342.09	117.43
For Cement Mortar Lining (CML), Add	16.42	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	12.31	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0158 EA 10" Mechanical Joint Ductile Iron Caps.....	476.23	177.51
For Cement Mortar Lining (CML), Add	20.73	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	15.55	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0159 EA 12" Mechanical Joint Ductile Iron Caps.....	603.29	193.64
For Cement Mortar Lining (CML), Add	30.99	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	23.24	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0160 Mechanical Joint Ductile Iron Plug (33 11 13 13-0002)		
33 11 13 13-0161 EA 4" Mechanical Joint Ductile Iron Plug.....	192.26	82.20
For Cement Mortar Lining (CML), Add	6.77	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	5.08	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0162 EA 6" Mechanical Joint Ductile Iron Plug.....	287.02	102.74
For Cement Mortar Lining (CML), Add	13.13	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	9.85	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0163 EA 8" Mechanical Joint Ductile Iron Plug.....	374.93	117.43
For Cement Mortar Lining (CML), Add	19.70	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	14.78	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0164 EA 10" Mechanical Joint Ductile Iron Plug.....	609.62	177.51
For Cement Mortar Lining (CML), Add	34.07	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	25.55	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0165 EA 12" Mechanical Joint Ductile Iron Plug.....	640.23	193.64
For Cement Mortar Lining (CML), Add	34.68	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	26.01	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0166 EA 14" Mechanical Joint Ductile Iron Plug.....	1,028.71	213.01
For Cement Mortar Lining (CML), Add	70.60	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	52.95	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0167 EA 16" Mechanical Joint Ductile Iron Plug.....	448.90	236.65
For Cement Mortar Lining (CML), Add	9.03	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	6.77	
Note: ANSI/AWWA C151/A21.51		



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
	33 11 13	13-0168	EA	18" Mechanical Joint Ductile Iron Plug..... <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i>	1,523.94 112.05	266.26
				<i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	84.04	
	33 11 13	13-0169	EA	20" Mechanical Joint Ductile Iron Plug..... <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i>	1,934.56 147.35	304.26
				<i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	110.51	
	33 11 13	13-0170	EA	24" Mechanical Joint Ductile Iron Plug..... <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i>	2,581.94 204.40	355.02
				<i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	153.30	
	33 11 13	13-0171		Mechanical Joint x Flanged End (MJxFE) Ductile Iron Adapters <small>(33 11 13 13-0002)</small>		
	33 11 13	13-0172	EA	4" Mechanical Joint x Flanged End (MJxFE) Ductile Iron Adapters..... <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i>	330.47 14.37	123.29
				<i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	10.77	
	33 11 13	13-0173	EA	6" Mechanical Joint x Flanged End (MJxFE) Ductile Iron Adapters..... <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i>	432.57 19.91	154.11
				<i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	14.93	
	33 11 13	13-0174	EA	8" Mechanical Joint x Flanged End (MJxFE) Ductile Iron Adapters..... <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i>	568.54 30.17	176.11
				<i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	22.63	
	33 11 13	13-0175	EA	10" Mechanical Joint x Flanged End (MJxFE) Ductile Iron Adapters..... <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i>	928.79 52.54	266.26
				<i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	39.40	
	33 11 13	13-0176	EA	12" Mechanical Joint x Flanged End (MJxFE) Ductile Iron Adapters..... <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i>	1,113.23 67.31	290.46
				<i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	50.48	
	33 11 13	13-0177		Mechanical Joint Ductile Iron Long Sleeves <small>(33 11 13 13-0002)</small>		
	33 11 13	13-0178	EA	4" Mechanical Joint Ductile Iron Long Sleeves..... <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i>	320.21 13.34	123.29
				<i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	10.01	
	33 11 13	13-0179	EA	6" Mechanical Joint Ductile Iron Long Sleeves..... <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i>	457.19 22.37	154.11
				<i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	16.78	
	33 11 13	13-0180	EA	8" Mechanical Joint Ductile Iron Long Sleeves..... <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i>	634.21 36.74	176.11
				<i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	27.55	
	33 11 13	13-0181	EA	10" Mechanical Joint Ductile Iron Long Sleeves..... <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i>	840.55 43.71	266.26
				<i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	32.78	
	33 11 13	13-0182	EA	12" Mechanical Joint Ductile Iron Long Sleeves..... <i>For Cement Mortar Lining (CML), Add</i> <i>Note: ANSI/AWWA C104/A21.4</i>	1,031.15 59.11	290.46
				<i>For Bituminous Or Coal Tar Coating, 1 Mil, Add</i> <i>Note: ANSI/AWWA C151/A21.51</i>	44.33	
	33 11 13	13-0183		Mechanical Joint Ductile Iron Gland Packs <small>(33 11 13 13-0002)</small>		
				<i>Note: Includes ductile iron retainer gland, gasket, break off torque bolts and all nuts.</i>		
	33 11 13	13-0184		Mechanical Joint Gland, Gasket, T-Head Bolts And Nuts <small>(33 11 13 13-0183)</small>		
				<i>Note: Labor installation is included with pipe fittings or valves.</i>		
	33 11 13	13-0185	EA	4" Mechanical Joint Gland, Gasket, T-Head Bolts And Nuts..... <i>Note: Includes four (4) 3/4" diameter plain finish Boltss with nut.</i>	21.97	
	33 11 13	13-0186	EA	6" Mechanical Joint Gland, Gasket, T-Head Bolts And Nuts..... <i>Note: Includes six (6) 3/4" diameter plain finish Boltss with nut.</i>	26.55	
	33 11 13	13-0187	EA	8" Mechanical Joint Gland, Gasket, T-Head Bolts And Nuts..... <i>Note: Includes six (6) 3/4" diameter plain finish Boltss with nut.</i>	31.12	
	33 11 13	13-0188	EA	10" Mechanical Joint Gland, Gasket, T-Head Bolts And Nuts..... <i>Note: Includes eight (8) 3/4" diameter plain finish Boltss with nut.</i>	43.03	

33 Utilities**33 10 Water Utilities****33 11 Water Utility Distribution Piping**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 11 13 13-0189 EA 12" Mechanical Joint Gland, Gasket, T-Head Bolts And Nuts..... Note: Includes eight (8) 3/4" diameter plain finish Boltss with nut.	45.77	
33 11 13 13-0190 EA 14" Mechanical Joint Gland, Gasket, T-Head Bolts And Nuts..... Note: Includes ten (10) 3/4" diameter plain finish Boltss with nut.	75.07	
33 11 13 13-0191 EA 16" Mechanical Joint Gland, Gasket, T-Head Bolts And Nuts..... Note: Includes twelve (12) 3/4" diameter plain finish Boltss with nut.	79.64	
33 11 13 13-0192 EA 18" Mechanical Joint Gland, Gasket, T-Head Bolts And Nuts..... Note: Includes twelve (12) 3/4" diameter plain finish Boltss with nut.	106.19	
33 11 13 13-0193 EA 20" Mechanical Joint Gland, Gasket, T-Head Bolts And Nuts..... Note: Includes fourteen (14) 3/4" diameter plain finish Boltss with nut.	137.32	
33 11 13 13-0194 EA 24" Mechanical Joint Gland, Gasket, T-Head Bolts And Nuts..... Note: Includes sixteen (16) 3/4" diameter plain finish Boltss with nut.	191.33	
33 11 13 13-0195 Mechanical Joint Gland, Gasket, Star Blue Fluoropolymer Coated T-Head Bolts And Nuts <small>(33 11 13 13-0183)</small> Note: Labor installation is included with pipe fittings or valves.		
33 11 13 13-0196 EA 4" Mechanical Joint Gland, Gasket, Star Blue Fluoropolymer Coated T-Head Bolts And Nuts..... Note: Includes four (4) 3/4" diameter plain finish Boltss with nut.	31.12	
33 11 13 13-0197 EA 6" Mechanical Joint Gland, Gasket, Star Blue Fluoropolymer Coated T-Head Bolts And Nuts..... Note: Includes six (6) 3/4" diameter plain finish Boltss with nut.	39.36	
33 11 13 13-0198 EA 8" Mechanical Joint Gland, Gasket, Star Blue Fluoropolymer Coated T-Head Bolts And Nuts..... Note: Includes six (6) 3/4" diameter plain finish Boltss with nut.	43.03	
33 11 13 13-0199 EA 10" Mechanical Joint Gland, Gasket, Star Blue Fluoropolymer Coated T-Head Bolts And Nuts..... Note: Includes eight (8) 3/4" diameter plain finish Boltss with nut.	59.50	
33 11 13 13-0200 EA 12" Mechanical Joint Gland, Gasket, Star Blue Fluoropolymer Coated T-Head Bolts And Nuts..... Note: Includes eight (8) 3/4" diameter plain finish Boltss with nut.	62.25	
33 11 13 13-0201 EA 14" Mechanical Joint Gland, Gasket, Star Blue Fluoropolymer Coated T-Head Bolts And Nuts..... Note: Includes ten (10) 3/4" diameter plain finish Boltss with nut.	94.29	
33 11 13 13-0202 EA 16" Mechanical Joint Gland, Gasket, Star Blue Fluoropolymer Coated T-Head Bolts And Nuts..... Note: Includes twelve (12) 3/4" diameter plain finish Boltss with nut.	103.44	
33 11 13 13-0203 EA 18" Mechanical Joint Gland, Gasket, Star Blue Fluoropolymer Coated T-Head Bolts And Nuts..... Note: Includes twelve (12) 3/4" diameter plain finish Boltss with nut.	137.32	
33 11 13 13-0204 EA 20" Mechanical Joint Gland, Gasket, Star Blue Fluoropolymer Coated T-Head Bolts And Nuts..... Note: Includes fourteen (14) 3/4" diameter plain finish Boltss with nut.	177.60	
33 11 13 13-0205 EA 24" Mechanical Joint Gland, Gasket, Star Blue Fluoropolymer Coated T-Head Bolts And Nuts..... Note: Includes sixteen (16) 3/4" diameter plain finish Boltss with nut.	248.08	
33 11 13 13-0206 Epoxy Coated Mechanical Joint Gland, Gasket, T-Head Bolts And Nuts <small>(33 11 13 13-0183)</small> Note: Labor installation is included with pipe fittings or valves.		
33 11 13 13-0207 EA 4" Epoxy Coated Mechanical Joint Gland, Gasket, T-Head Bolts And Nuts Note: Includes four (4) 3/4" diameter plain finish Boltss with nut.	23.80	
33 11 13 13-0208 EA 6" Epoxy Coated Mechanical Joint Gland, Gasket, T-Head Bolts And Nuts Note: Includes six (6) 3/4" diameter plain finish Boltss with nut.	28.38	
33 11 13 13-0209 EA 8" Epoxy Coated Mechanical Joint Gland, Gasket, T-Head Bolts And Nuts Note: Includes six (6) 3/4" diameter plain finish Boltss with nut.	33.87	
33 11 13 13-0210 EA 10" Epoxy Coated Mechanical Joint Gland, Gasket, T-Head Bolts And Nuts Note: Includes eight (8) 3/4" diameter plain finish Boltss with nut.	46.69	
33 11 13 13-0211 EA 12" Epoxy Coated Mechanical Joint Gland, Gasket, T-Head Bolts And Nuts Note: Includes eight (8) 3/4" diameter plain finish Boltss with nut.	49.43	
33 11 13 13-0212 EA 14" Epoxy Coated Mechanical Joint Gland, Gasket, T-Head Bolts And Nuts Note: Includes ten (10) 3/4" diameter plain finish Boltss with nut.	81.47	
33 11 13 13-0213 EA 16" Epoxy Coated Mechanical Joint Gland, Gasket, T-Head Bolts And Nuts Note: Includes twelve (12) 3/4" diameter plain finish Boltss with nut.	86.05	
33 11 13 13-0214 EA 18" Epoxy Coated Mechanical Joint Gland, Gasket, T-Head Bolts And Nuts Note: Includes twelve (12) 3/4" diameter plain finish Boltss with nut.	116.26	
33 11 13 13-0215 EA 20" Epoxy Coated Mechanical Joint Gland, Gasket, T-Head Bolts And Nuts Note: Includes fourteen (14) 3/4" diameter plain finish Boltss with nut.	149.22	
33 11 13 13-0216 EA 24" Epoxy Coated Mechanical Joint Gland, Gasket, T-Head Bolts And Nuts Note: Includes sixteen (16) 3/4" diameter plain finish Boltss with nut.	208.72	
33 11 13 13-0217 Mechanical Joint Restraints For Ductile Iron Pipe (Megalug 1100) <small>(33 11 13 13-0002)</small> Note: Includes ductile iron retainer gland, gasket, break off torque bolts and all nuts and bolts. Excludes pipe and fitting.		
33 11 13 13-0218 EA 4" Mechanical Joint Restraints For Ductile Iron Pipe (Megalug 1100)	245.43	63.25
33 11 13 13-0219 EA 6" Mechanical Joint Restraints For Ductile Iron Pipe (Megalug 1100)	304.72	78.29
33 11 13 13-0220 EA 8" Mechanical Joint Restraints For Ductile Iron Pipe (Megalug 1100)	390.97	91.37
33 11 13 13-0221 EA 10" Mechanical Joint Restraints For Ductile Iron Pipe (Megalug 1100)	562.65	133.13
33 11 13 13-0222 EA 12" Mechanical Joint Restraints For Ductile Iron Pipe (Megalug 1100)	714.38	152.18
33 11 13 13-0223 Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Piping <small>(33 11 13 13-0001)</small> Note: .		
33 11 13 13-0224 Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron 90 Degree Elbow <small>(33 11 13 13-0223)</small>		
33 11 13 13-0225 EA 4" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron 90 Degree Elbow	578.51	36.51
33 11 13 13-0226 EA 6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron 90 Degree Elbow	900.36	53.49
33 11 13 13-0227 EA 8" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron 90 Degree Elbow	1,239.89	63.68



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 11 13 13-0228 EA 10" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron 90 Degree Elbow	1,716.27	71.01
33 11 13 13-0229 EA 12" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron 90 Degree Elbow	2,182.20	83.10
33 11 13 13-0230 EA 14" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron 90 Degree Elbow	3,125.15	93.60
33 11 13 13-0231 EA 16" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron 90 Degree Elbow	3,797.94	106.50
33 11 13 13-0232 EA 18" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron 90 Degree Elbow	4,570.47	149.27
33 11 13 13-0233 EA 20" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron 90 Degree Elbow	5,696.19	186.38
33 11 13 13-0234 EA 24" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron 90 Degree Elbow	8,067.90	248.51
33 11 13 13-0235 Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron 45 Degree Elbow <small>(33 11 13 13-0223)</small>		
33 11 13 13-0236 EA 4" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron 45 Degree Elbow	539.52	36.51
33 11 13 13-0237 EA 6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron 45 Degree Elbow	832.64	53.49
33 11 13 13-0238 EA 8" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron 45 Degree Elbow	1,135.22	63.68
33 11 13 13-0239 EA 10" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron 45 Degree Elbow	1,494.62	71.01
33 11 13 13-0240 EA 12" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron 45 Degree Elbow	1,983.14	83.10
33 11 13 13-0241 EA 14" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron 45 Degree Elbow	2,698.28	93.60
33 11 13 13-0242 EA 16" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron 45 Degree Elbow	3,235.63	106.50
33 11 13 13-0243 EA 18" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron 45 Degree Elbow	3,804.99	149.27
33 11 13 13-0244 EA 20" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron 45 Degree Elbow	4,614.66	186.38
33 11 13 13-0245 EA 24" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron 45 Degree Elbow	6,079.28	248.51
33 11 13 13-0246 Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron 22-1/2 Degree Elbow <small>(33 11 13 13-0223)</small>		
33 11 13 13-0247 EA 4" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron 22-1/2 Degree Elbow	533.36	36.51
33 11 13 13-0248 EA 6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron 22-1/2 Degree Elbow	808.01	53.49
33 11 13 13-0249 EA 8" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron 22-1/2 Degree Elbow	1,127.01	63.68
33 11 13 13-0250 EA 10" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron 22-1/2 Degree Elbow	1,492.57	71.01
33 11 13 13-0251 EA 12" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron 22-1/2 Degree Elbow	1,864.11	83.10
33 11 13 13-0252 EA 14" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron 22-1/2 Degree Elbow	2,714.70	93.60
33 11 13 13-0253 EA 16" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron 22-1/2 Degree Elbow	3,161.74	106.50
33 11 13 13-0254 EA 18" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron 22-1/2 Degree Elbow	3,786.52	149.27
33 11 13 13-0255 EA 20" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron 22-1/2 Degree Elbow	4,784.99	186.38
33 11 13 13-0256 EA 24" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron 22-1/2 Degree Elbow	5,943.83	248.51
33 11 13 13-0257 EA 30" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron 22-1/2 Degree Elbow	10,083.84	266.26
33 11 13 13-0258 EA 36" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron 22-1/2 Degree Elbow	13,846.59	276.75
33 11 13 13-0259 EA 42" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron 22-1/2 Degree Elbow	19,885.99	319.51
33 11 13 13-0260 EA 48" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron 22-1/2 Degree Elbow	25,527.71	339.69
33 11 13 13-0261 Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron 11-1/4 Degree Elbow <small>(33 11 13 13-0223)</small>		
33 11 13 13-0262 EA 4" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron 11-1/4 Degree Elbow	646.24	36.51
33 11 13 13-0263 EA 6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron 11-1/4 Degree Elbow	816.22	53.49
33 11 13 13-0264 EA 8" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron 11-1/4 Degree Elbow	1,090.07	63.68
33 11 13 13-0265 EA 10" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron 11-1/4 Degree Elbow	1,488.47	71.01
33 11 13 13-0266 EA 12" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron 11-1/4 Degree Elbow	1,808.70	83.10
33 11 13 13-0267 EA 14" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron 11-1/4 Degree Elbow	2,930.18	93.60
33 11 13 13-0268 EA 16" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron 11-1/4 Degree Elbow	3,262.30	106.50
33 11 13 13-0269 EA 18" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron 11-1/4 Degree Elbow	4,369.35	149.27
33 11 13 13-0270 EA 20" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron 11-1/4 Degree Elbow	4,608.50	186.38
33 11 13 13-0271 EA 24" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron 11-1/4 Degree Elbow	5,945.88	248.51
33 11 13 13-0272 Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Plain End (MJxPE) Ductile Iron 90 Degree Elbow <small>(33 11 13 13-0223)</small>		
33 11 13 13-0273 EA 4" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Plain End (MJxPE) Ductile Iron 90 Degree Elbow	625.71	36.51
33 11 13 13-0274 EA 6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Plain End (MJxPE) Ductile Iron 90 Degree Elbow	978.35	53.49
33 11 13 13-0275 EA 8" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Plain End (MJxPE) Ductile Iron 90 Degree Elbow	1,338.40	63.68
33 11 13 13-0276 EA 10" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Plain End (MJxPE) Ductile Iron 90 Degree Elbow	1,859.92	71.01
33 11 13 13-0277 EA 12" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Plain End (MJxPE) Ductile Iron 90 Degree Elbow	2,340.23	83.10
33 11 13 13-0278 EA 14" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Plain End (MJxPE) Ductile Iron 90 Degree Elbow	4,260.04	93.60
33 11 13 13-0279 EA 16" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Plain End (MJxPE) Ductile Iron 90 Degree Elbow	6,685.44	106.50
33 11 13 13-0280 EA 18" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Plain End (MJxPE) Ductile Iron 90 Degree Elbow	7,613.94	149.27
33 11 13 13-0281 EA 20" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Plain End (MJxPE) Ductile Iron 90 Degree Elbow	8,762.24	186.38
33 11 13 13-0282 EA 24" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Plain End (MJxPE) Ductile Iron 90 Degree Elbow	9,430.58	248.51

33 Utilities**33 10 Water Utilities****33 11 Water Utility Distribution Piping**MINOR
CSI UOM DESCRIPTIONTOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 11 13 13-0283			Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Plain End (MJxPE) Ductile Iron 45 Degree Elbow <small>(33 11 13 13-0223)</small>		
33 11 13 13-0284	EA		4" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Plain End (MJxPE) Ductile Iron 45 Degree Elbow.....	547.73	36.51
33 11 13 13-0285	EA		6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Plain End (MJxPE) Ductile Iron 45 Degree Elbow.....	865.48	53.49
33 11 13 13-0286	EA		8" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Plain End (MJxPE) Ductile Iron 45 Degree Elbow.....	1,235.78	63.68
33 11 13 13-0287	EA		10" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Plain End (MJxPE) Ductile Iron 45 Degree Elbow.....	1,652.65	71.01
33 11 13 13-0288	EA		12" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Plain End (MJxPE) Ductile Iron 45 Degree Elbow.....	2,159.63	83.10
33 11 13 13-0289	EA		14" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Plain End (MJxPE) Ductile Iron 45 Degree Elbow.....	2,895.30	93.60
33 11 13 13-0290	EA		16" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Plain End (MJxPE) Ductile Iron 45 Degree Elbow.....	3,483.95	106.50
33 11 13 13-0291	EA		18" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Plain End (MJxPE) Ductile Iron 45 Degree Elbow.....	6,567.30	149.27
33 11 13 13-0292	EA		20" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Plain End (MJxPE) Ductile Iron 45 Degree Elbow.....	6,861.85	186.38
33 11 13 13-0293	EA		24" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Plain End (MJxPE) Ductile Iron 45 Degree Elbow.....	7,095.12	248.51
33 11 13 13-0294			Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee <small>(33 11 13 13-0223)</small>		
33 11 13 13-0295	EA		4" x 4" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	676.67	53.49
33 11 13 13-0296	EA		6" x 4" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	1,057.17	70.48
33 11 13 13-0297	EA		6" x 6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	1,110.95	78.97
33 11 13 13-0298	EA		8" x 4" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	1,301.97	81.52
33 11 13 13-0299	EA		8" x 6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	1,407.06	90.01
33 11 13 13-0300	EA		8" x 8" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	1,551.00	95.95
33 11 13 13-0301	EA		10" x 4" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	1,769.04	87.95
33 11 13 13-0302	EA		10" x 6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	1,758.56	96.01
33 11 13 13-0303	EA		10" x 8" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	1,908.25	101.66
33 11 13 13-0304	EA		10" x 10" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	2,061.74	106.50
33 11 13 13-0305	EA		12" x 4" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	2,136.10	98.44
33 11 13 13-0306	EA		12" x 6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	2,148.20	106.50
33 11 13 13-0307	EA		12" x 8" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	2,326.61	112.15
33 11 13 13-0308	EA		12" x 10" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	2,693.55	117.00
33 11 13 13-0309	EA		12" x 12" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	2,695.45	122.65
33 11 13 13-0310	EA		14" x 4" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	3,067.63	124.25
33 11 13 13-0311	EA		14" x 8" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	3,324.03	129.90
33 11 13 13-0312	EA		14" x 10" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	4,056.26	134.74
33 11 13 13-0313	EA		14" x 12" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	4,283.91	140.39
33 11 13 13-0314	EA		14" x 14" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	3,950.45	149.27
33 11 13 13-0315	EA		16" x 6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	3,669.50	149.27
33 11 13 13-0316	EA		16" x 8" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	3,870.56	154.11
33 11 13 13-0317	EA		16" x 10" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	4,668.46	159.76
33 11 13 13-0318	EA		16" x 12" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	4,364.59	164.60
33 11 13 13-0319	EA		16" x 14" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	5,734.47	173.48
33 11 13 13-0320	EA		16" x 16" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	5,160.15	186.38
33 11 13 13-0321	EA		18" x 6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	4,822.52	191.23
33 11 13 13-0322	EA		18" x 8" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	5,091.22	196.07
33 11 13 13-0323	EA		18" x 10" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	5,433.54	200.91
33 11 13 13-0324	EA		18" x 12" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	5,749.44	206.56
33 11 13 13-0325	EA		18" x 14" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	5,904.40	215.43
33 11 13 13-0326	EA		18" x 16" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	6,311.05	227.53
33 11 13 13-0327	EA		18" x 18" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	7,050.68	248.51
33 11 13 13-0328	EA		20" x 6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	5,491.84	273.52
33 11 13 13-0329	EA		20" x 8" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	5,584.06	279.17
33 11 13 13-0330	EA		20" x 10" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	6,158.27	284.01
33 11 13 13-0331	EA		20" x 12" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	6,470.07	289.66
33 11 13 13-0332	EA		20" x 14" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	6,528.57	298.54
33 11 13 13-0333	EA		20" x 16" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	6,430.38	310.64
33 11 13 13-0334	EA		20" x 18" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	8,284.37	331.62
33 11 13 13-0335	EA		20" x 20" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	6,976.22	372.77
33 11 13 13-0336	EA		24" x 6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	6,643.06	355.82
33 11 13 13-0337	EA		24" x 8" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	6,704.49	362.28
33 11 13 13-0338	EA		24" x 10" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	6,827.22	366.31
33 11 13 13-0339	EA		24" x 12" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	7,011.76	371.96
33 11 13 13-0340	EA		24" x 14" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	8,016.35	380.83
33 11 13 13-0341	EA		24" x 16" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	8,365.55	392.93
33 11 13 13-0342	EA		24" x 18" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	10,363.20	413.92
33 11 13 13-0343	EA		24" x 20" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	10,672.21	455.87
33 11 13 13-0344	EA		24" x 24" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Tee.....	9,944.64	497.02
33 11 13 13-0345			Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Laterals) <small>(33 11 13 13-0223)</small>		



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
				33 11 13 13-0346 EA 4" x 4" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	865.48	53.49
				33 11 13 13-0347 EA 6" x 4" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	1,061.27	70.48
				33 11 13 13-0348 EA 6" x 6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	1,305.91	78.97
				33 11 13 13-0349 EA 8" x 4" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	1,739.09	81.52
				33 11 13 13-0350 EA 8" x 6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	1,587.65	90.01
				33 11 13 13-0351 EA 8" x 8" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	1,791.12	95.95
				33 11 13 13-0352 EA 10" x 4" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	2,587.88	87.95
				33 11 13 13-0353 EA 10" x 6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	2,690.28	96.01
				33 11 13 13-0354 EA 10" x 8" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	3,016.45	101.66
				33 11 13 13-0355 EA 10" x 10" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	3,297.19	106.50
				33 11 13 13-0356 EA 12" x 4" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	3,168.37	98.44
				33 11 13 13-0357 EA 12" x 6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	3,599.13	106.50
				33 11 13 13-0358 EA 12" x 8" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	4,276.24	112.15
				33 11 13 13-0359 EA 12" x 10" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	4,273.77	117.00
				33 11 13 13-0360 EA 12" x 12" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	3,926.79	122.65
				33 11 13 13-0361 EA 14" x 6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	4,693.01	124.25
				33 11 13 13-0362 EA 14" x 8" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	5,411.16	129.90
				33 11 13 13-0363 EA 14" x 10" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	7,173.62	134.74
				33 11 13 13-0364 EA 14" x 12" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	7,698.84	140.39
				33 11 13 13-0365 EA 14" x 14" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	7,471.82	149.27
				33 11 13 13-0366 EA 16" x 6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	4,861.92	149.27
				33 11 13 13-0367 EA 16" x 8" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	5,383.06	154.11
				33 11 13 13-0368 EA 16" x 10" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	6,419.02	159.76
				33 11 13 13-0369 EA 16" x 12" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	6,622.06	164.60
				33 11 13 13-0370 EA 16" x 14" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	8,240.26	173.48
				33 11 13 13-0371 EA 16" x 16" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	7,766.51	186.38
				33 11 13 13-0372 EA 18" x 6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	6,915.80	191.23
				33 11 13 13-0373 EA 18" x 8" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	7,471.82	196.07
				33 11 13 13-0374 EA 18" x 10" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	8,009.10	200.91
				33 11 13 13-0375 EA 18" x 12" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	8,591.80	206.56
				33 11 13 13-0376 EA 18" x 14" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	8,670.82	215.43
				33 11 13 13-0377 EA 18" x 16" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	8,757.32	227.53
				33 11 13 13-0378 EA 18" x 18" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	7,883.89	248.51
				33 11 13 13-0379 EA 20" x 6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	8,081.77	273.52
				33 11 13 13-0380 EA 20" x 8" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	8,260.18	279.17
				33 11 13 13-0381 EA 20" x 10" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	9,129.92	284.01
				33 11 13 13-0382 EA 20" x 12" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	9,991.72	289.66
				33 11 13 13-0383 EA 20" x 14" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	10,076.90	298.54
				33 11 13 13-0384 EA 20" x 16" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	10,173.67	310.64
				33 11 13 13-0385 EA 20" x 18" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	11,859.38	331.62
				33 11 13 13-0386 EA 20" x 20" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	11,084.80	372.77
				33 11 13 13-0387 EA 24" x 6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	9,764.52	355.82
				33 11 13 13-0388 EA 24" x 8" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	9,889.57	361.47
				33 11 13 13-0389 EA 24" x 10" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	11,104.08	366.31
				33 11 13 13-0390 EA 24" x 12" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	11,651.87	371.96
				33 11 13 13-0391 EA 24" x 14" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	13,575.87	380.83
				33 11 13 13-0392 EA 24" x 16" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	15,160.52	392.93
				33 11 13 13-0393 EA 24" x 18" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	17,028.87	413.92
				33 11 13 13-0394 EA 24" x 20" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	18,708.78	455.87
				33 11 13 13-0395 EA 24" x 24" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Wye (Lateral)	16,364.05	497.02
				33 11 13 13-0396 Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Flanged End (MJxFE) Ductile Iron Hydrant Tee <small>(33 11 13 13-0223)</small>		
				33 11 13 13-0397 EA 6" x 6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Flanged End (MJxFE) Ductile Iron Hydrant Tee.....	1,186.88	78.97
				33 11 13 13-0398 EA 8" x 6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Flanged End (MJxFE) Ductile Iron Hydrant Tee.....	1,485.04	90.01
				33 11 13 13-0399 EA 10" x 6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Flanged End (MJxFE) Ductile Iron Hydrant Tee.....	2,169.01	96.01
				33 11 13 13-0400 EA 12" x 6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Flanged End (MJxFE) Ductile Iron Hydrant Tee.....	2,501.18	106.50
				33 11 13 13-0401 EA 14" x 6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Flanged End (MJxFE) Ductile Iron Hydrant Tee.....	3,328.27	124.25
				33 11 13 13-0402 EA 16" x 6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Flanged End (MJxFE) Ductile Iron Hydrant Tee.....	4,057.44	149.27
				33 11 13 13-0403 EA 18" x 6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Flanged End (MJxFE) Ductile Iron Hydrant Tee.....	4,771.21	191.23
				33 11 13 13-0404 EA 20" x 6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Flanged End (MJxFE) Ductile Iron Hydrant Tee.....	6,392.78	273.52
				33 11 13 13-0405 EA 24" x 6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Flanged End (MJxFE) Ductile Iron Hydrant Tee.....	7,436.08	355.82
				33 11 13 13-0406 Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross <small>(33 11 13 13-0223)</small>		
				33 11 13 13-0407 EA 4" x 4" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross	1,039.77	67.08
				33 11 13 13-0408 EA 6" x 4" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross	1,283.06	90.01
				33 11 13 13-0409 EA 6" x 6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross	1,401.16	112.08
				33 11 13 13-0410 EA 8" x 4" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross	1,359.43	98.49
				33 11 13 13-0411 EA 8" x 6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross	1,596.56	120.57

33 Utilities**33 10 Water Utilities****33 11 Water Utility Distribution Piping**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 11 13 13-0412 EA 8" x 8" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross.....	1,568.27	129.07
33 11 13 13-0413 EA 10" x 4" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross.....	1,613.10	103.28
33 11 13 13-0414 EA 10" x 6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross.....	1,797.25	124.25
33 11 13 13-0415 EA 10" x 8" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross.....	2,154.13	132.33
33 11 13 13-0416 EA 10" x 10" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross.....	2,335.15	142.00
33 11 13 13-0417 EA 12" x 4" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross.....	2,098.55	112.15
33 11 13 13-0418 EA 12" x 6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross.....	2,424.30	133.13
33 11 13 13-0419 EA 12" x 8" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross.....	2,635.47	141.20
33 11 13 13-0420 EA 12" x 10" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross.....	3,091.50	150.89
33 11 13 13-0421 EA 12" x 12" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross.....	3,546.17	159.76
33 11 13 13-0422 EA 14" x 6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross.....	3,690.16	146.04
33 11 13 13-0423 EA 14" x 8" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross.....	4,400.04	154.11
33 11 13 13-0424 EA 14" x 10" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross.....	4,498.98	164.60
33 11 13 13-0425 EA 14" x 12" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross.....	4,748.42	172.67
33 11 13 13-0426 EA 14" x 14" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross.....	5,269.31	186.38
33 11 13 13-0427 EA 16" x 6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross.....	4,128.83	165.40
33 11 13 13-0428 EA 16" x 8" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross.....	4,744.30	172.67
33 11 13 13-0429 EA 16" x 10" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross.....	5,754.44	183.16
33 11 13 13-0430 EA 16" x 12" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross.....	6,451.26	192.03
33 11 13 13-0431 EA 16" x 14" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross.....	7,873.10	204.94
33 11 13 13-0432 EA 16" x 16" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross.....	8,205.06	223.50
33 11 13 13-0433 EA 18" x 6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross.....	7,244.61	195.26
33 11 13 13-0434 EA 18" x 8" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross.....	7,669.23	203.32
33 11 13 13-0435 EA 18" x 10" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross.....	8,028.81	213.01
33 11 13 13-0436 EA 18" x 12" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross.....	8,733.84	221.88
33 11 13 13-0437 EA 18" x 14" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross.....	10,264.44	234.79
33 11 13 13-0438 EA 18" x 16" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross.....	10,914.49	253.35
33 11 13 13-0439 EA 18" x 18" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross.....	11,372.63	284.01
33 11 13 13-0440 EA 20" x 6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross.....	9,109.50	245.28
33 11 13 13-0441 EA 20" x 8" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross.....	9,538.21	252.55
33 11 13 13-0442 EA 20" x 10" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross.....	9,825.96	263.03
33 11 13 13-0443 EA 20" x 12" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross.....	10,524.84	271.90
33 11 13 13-0444 EA 20" x 14" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross.....	10,684.55	284.82
33 11 13 13-0445 EA 20" x 16" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross.....	13,052.33	303.38
33 11 13 13-0446 EA 20" x 18" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross.....	13,510.45	333.23
33 11 13 13-0447 EA 20" x 20" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross.....	14,550.35	383.25
33 11 13 13-0448 EA 24" x 6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross.....	12,506.71	306.60
33 11 13 13-0449 EA 24" x 8" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross.....	12,796.13	314.67
33 11 13 13-0450 EA 24" x 10" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross.....	13,290.91	324.35
33 11 13 13-0451 EA 24" x 12" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross.....	13,716.84	333.23
33 11 13 13-0452 EA 24" x 14" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross.....	13,942.22	346.13
33 11 13 13-0453 EA 24" x 16" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross.....	14,454.76	364.69
33 11 13 13-0454 EA 24" x 18" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross.....	19,386.79	395.36
33 11 13 13-0455 EA 24" x 20" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross.....	20,354.83	444.57
33 11 13 13-0456 EA 24" x 24" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Cross.....	22,377.06	505.89
33 11 13 13-0457 Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Mechanical Joint Ductile Iron Reducers <small>(33 11 13 13-0223)</small>		
33 11 13 13-0458 EA 6" x 4" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Mechanical Joint Ductile Iron Reducer.....	732.01	44.15
33 11 13 13-0459 EA 8" x 4" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Mechanical Joint Ductile Iron Reducer.....	970.44	50.10
33 11 13 13-0460 EA 8" x 6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Mechanical Joint Ductile Iron Reducer.....	1,001.56	58.59
33 11 13 13-0461 EA 10" x 4" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Mechanical Joint Ductile Iron Reducer.....	1,198.08	52.45
33 11 13 13-0462 EA 10" x 6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Mechanical Joint Ductile Iron Reducer.....	1,247.12	60.51
33 11 13 13-0463 EA 10" x 8" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Mechanical Joint Ductile Iron Reducer.....	1,294.18	66.16
33 11 13 13-0464 EA 12" x 4" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Mechanical Joint Ductile Iron Reducer.....	1,388.79	58.09
33 11 13 13-0465 EA 12" x 6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Mechanical Joint Ductile Iron Reducer.....	1,534.29	66.16
33 11 13 13-0466 EA 12" x 8" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Mechanical Joint Ductile Iron Reducer.....	1,554.68	71.01
33 11 13 13-0467 EA 12" x 10" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Mechanical Joint Ductile Iron Reducer.....	1,621.99	76.65
33 11 13 13-0468 EA 14" x 6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Mechanical Joint Ductile Iron Reducer.....	2,434.21	75.04
33 11 13 13-0469 EA 14" x 8" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Mechanical Joint Ductile Iron Reducer.....	2,442.28	79.88
33 11 13 13-0470 EA 14" x 10" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Mechanical Joint Ductile Iron Reducer.....	2,107.36	85.53
33 11 13 13-0471 EA 14" x 12" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Mechanical Joint Ductile Iron Reducer.....	2,146.21	90.37
33 11 13 13-0472 EA 16" x 6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Mechanical Joint Ductile Iron Reducer.....	2,920.90	87.14
33 11 13 13-0473 EA 16" x 8" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Mechanical Joint Ductile Iron Reducer.....	2,824.32	92.79



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 11 13 13-0474 EA 16" x 10" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Mechanical Joint Ductile Iron Reducer.....	2,639.20	97.63
33 11 13 13-0475 EA 16" x 12" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Mechanical Joint Ductile Iron Reducer.....	2,600.07	102.47
33 11 13 13-0476 EA 16" x 14" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Mechanical Joint Ductile Iron Reducer.....	2,945.88	111.35
33 11 13 13-0477 EA 18" x 8" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Mechanical Joint Ductile Iron Reducer.....	3,153.50	112.96
33 11 13 13-0478 EA 18" x 10" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Mechanical Joint Ductile Iron Reducer.....	3,567.64	118.60
33 11 13 13-0479 EA 18" x 12" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Mechanical Joint Ductile Iron Reducer.....	3,395.11	123.44
33 11 13 13-0480 EA 18" x 14" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Mechanical Joint Ductile Iron Reducer.....	4,077.49	132.33
33 11 13 13-0481 EA 18" x 16" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Mechanical Joint Ductile Iron Reducer.....	3,536.02	145.24
33 11 13 13-0482 EA 20" x 8" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Mechanical Joint Ductile Iron Reducer.....	4,195.15	154.92
33 11 13 13-0483 EA 20" x 10" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Mechanical Joint Ductile Iron Reducer.....	4,223.48	159.76
33 11 13 13-0484 EA 20" x 12" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Mechanical Joint Ductile Iron Reducer.....	3,812.89	165.40
33 11 13 13-0485 EA 20" x 14" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Mechanical Joint Ductile Iron Reducer.....	3,799.56	174.28
33 11 13 13-0486 EA 20" x 16" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Mechanical Joint Ductile Iron Reducer.....	3,687.00	186.38
33 11 13 13-0487 EA 20" x 18" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Mechanical Joint Ductile Iron Reducer.....	4,377.38	207.36
33 11 13 13-0488 EA 24" x 12" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Mechanical Joint Ductile Iron Reducer.....	5,270.96	206.56
33 11 13 13-0489 EA 24" x 14" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Mechanical Joint Ductile Iron Reducer.....	5,341.77	215.43
33 11 13 13-0490 EA 24" x 16" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Mechanical Joint Ductile Iron Reducer.....	5,426.23	227.53
33 11 13 13-0491 EA 24" x 18" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Mechanical Joint Ductile Iron Reducer.....	5,314.17	248.51
33 11 13 13-0492 EA 24" x 20" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Mechanical Joint Ductile Iron Reducer.....	6,125.99	289.66
33 11 13 13-0493 Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Caps <small>(33 11 13 13-0223)</small>		
33 11 13 13-0494 EA 4" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Caps	469.32	82.37
33 11 13 13-0495 EA 6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Caps	705.68	102.74
33 11 13 13-0496 EA 8" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Caps	968.02	117.18
33 11 13 13-0497 EA 10" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Caps	1,264.29	177.51
33 11 13 13-0498 EA 12" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Caps	1,627.36	193.64
33 11 13 13-0499 EA 14" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Caps	1,857.82	213.01
33 11 13 13-0500 EA 16" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Caps	2,285.65	236.41
33 11 13 13-0501 EA 18" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Caps	2,689.62	266.26
33 11 13 13-0502 EA 20" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Caps	3,262.36	304.18
33 11 13 13-0503 EA 24" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Caps	4,221.68	355.02
33 11 13 13-0504 Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Plug <small>(33 11 13 13-0223)</small>		
33 11 13 13-0505 EA 4" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Plug.....	489.84	82.37
33 11 13 13-0506 EA 6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Plug.....	759.04	102.74
33 11 13 13-0507 EA 8" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Plug.....	1,021.38	117.18
33 11 13 13-0508 EA 10" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Plug.....	1,570.07	177.51
33 11 13 13-0509 EA 12" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Plug.....	1,697.13	193.64
33 11 13 13-0510 EA 14" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Plug.....	2,303.15	213.01
33 11 13 13-0511 EA 16" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Plug.....	2,800.77	236.41
33 11 13 13-0512 EA 18" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Plug.....	3,348.38	266.26
33 11 13 13-0513 EA 20" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Plug.....	4,153.03	304.18
33 11 13 13-0514 EA 24" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Plug.....	5,489.97	355.02
33 11 13 13-0515 Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Flanged End (MJxFE) Ductile Iron Adapters <small>(33 11 13 13-0223)</small>		
33 11 13 13-0516 EA 4" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Flanged End (MJxFE) Ductile Iron Adapters	701.92	123.12
33 11 13 13-0517 EA 6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Flanged End (MJxFE) Ductile Iron Adapters	982.57	154.54
33 11 13 13-0518 EA 8" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Flanged End (MJxFE) Ductile Iron Adapters	1,319.66	175.76
33 11 13 13-0519 EA 10" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Flanged End (MJxFE) Ductile Iron Adapters	1,938.50	266.26
33 11 13 13-0520 EA 12" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Flanged End (MJxFE) Ductile Iron Adapters	2,344.58	290.46
33 11 13 13-0521 EA 14" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Flanged End (MJxFE) Ductile Iron Adapters	3,131.50	319.51

33 Utilities**33 10 Water Utilities****33 11 Water Utility Distribution Piping**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 11 13 13-0522 EA 16" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Flanged End (MJxFE) Ductile Iron Adapters	3,562.91	355.02
33 11 13 13-0523 EA 18" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Flanged End (MJxFE) Ductile Iron Adapters	4,746.56	399.39
33 11 13 13-0524 EA 20" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Flanged End (MJxFE) Ductile Iron Adapters	5,512.30	456.68
33 11 13 13-0525 EA 24" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint x Flanged End (MJxFE) Ductile Iron Adapters	6,694.73	532.52
33 11 13 13-0526 Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Long Sleeves (33 11 13 13-0223)		
33 11 13 13-0527 EA 4" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Long Sleeves	671.14	123.12
33 11 13 13-0528 EA 6" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Long Sleeves	1,017.46	154.54
33 11 13 13-0529 EA 8" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Long Sleeves	1,414.06	175.76
33 11 13 13-0530 EA 10" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Long Sleeves	1,807.15	266.26
33 11 13 13-0531 EA 12" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Long Sleeves	2,221.44	290.46
33 11 13 13-0532 EA 14" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Long Sleeves	2,868.81	319.51
33 11 13 13-0533 EA 16" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Long Sleeves	3,423.36	355.02
33 11 13 13-0534 EA 18" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Long Sleeves	4,114.47	399.39
33 11 13 13-0535 EA 20" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Long Sleeves	4,800.17	456.68
33 11 13 13-0536 EA 24" Ceramic Epoxy Lined (P401), Bituminous Seal Coat, Mechanical Joint Ductile Iron Long Sleeves	6,042.11	532.52
33 11 13 13-0537 Push-On Joint Ductile Iron Piping (33 11 13 13-0001)		
33 11 13 13-0538 Push-On Joint Ductile Iron Pipe (33 11 13 13-0537)		
Note: Conforming to ANSI/AWWA C151/A21.51, federal specification WW-P-421D class 50.		
33 11 13 13-0539 LF 4" Push-On Joint Ductile Iron Pipe	20.32	7.00
For 40 Mil Glass Fiber Epoxy Or Polyurethane Lining, Add	6.80	
For Cement Mortar Lining (CML), Add	0.97	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	0.73	
Note: ANSI/AWWA C151/A21.51		
For >1,000, Deduct	-1.02	
For Class 51, Add	0.93	
For Class 52, Add	2.01	
For Class 53, Add	3.05	
For Class 54, Add	4.09	
For Class 55, Add	5.10	
For Class 56, Add	6.37	
33 11 13 13-0540 LF 6" Push-On Joint Ductile Iron Pipe	25.85	7.73
For 40 Mil Glass Fiber Epoxy Or Polyurethane Lining, Add	9.95	
For Cement Mortar Lining (CML), Add	1.42	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	1.07	
Note: ANSI/AWWA C151/A21.51		
For >1,000, Deduct	-1.29	
For Class 51, Add	1.32	
For Class 52, Add	2.85	
For Class 53, Add	4.32	
For Class 54, Add	5.80	
For Class 55, Add	7.23	
For Class 56, Add	9.03	
33 11 13 13-0541 LF 8" Push-On Joint Ductile Iron Pipe	32.88	8.49
For 40 Mil Glass Fiber Epoxy Or Polyurethane Lining, Add	14.10	
For Cement Mortar Lining (CML), Add	2.01	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	1.51	
Note: ANSI/AWWA C151/A21.51		
For >1,000, Deduct	-1.64	
For Class 51, Add	1.82	
For Class 52, Add	3.94	
For Class 53, Add	5.97	
For Class 54, Add	8.02	
For Class 55, Add	10.01	
For Class 56, Add	12.52	
33 11 13 13-0542 LF 10" Push-On Joint Ductile Iron Pipe	44.71	12.02
For 40 Mil Glass Fiber Epoxy Or Polyurethane Lining, Add	15.94	
For Cement Mortar Lining (CML), Add	2.66	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	1.99	
Note: ANSI/AWWA C151/A21.51		
For >1,000, Deduct	-2.24	
For Class 51, Add	2.42	
For Class 52, Add	5.23	
For Class 53, Add	7.93	
For Class 54, Add	10.65	
For Class 55, Add	13.28	
For Class 56, Add	16.61	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 11 13 13-0543 LF 12" Push-On Joint Ductile Iron Pipe.....	54.01	13.31
For 40 Mil Glass Fiber Epoxy Or Polyurethane Lining, Add	16.92	
For Cement Mortar Lining (CML), Add	3.38	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	2.54	
Note: ANSI/AWWA C151/A21.51		
For >1,000, Deduct	-2.70	
For Class 51, Add	3.04	
For Class 52, Add	6.58	
For Class 53, Add	9.99	
For Class 54, Add	13.42	
For Class 55, Add	16.74	
For Class 56, Add	20.94	
33 11 13 13-0544 Push-On Joint Ductile Iron 90 Degree Elbow <small>(33 11 13 13-0537)</small>		
33 11 13 13-0545 EA 4" 90 Degree Elbow, Push-On Joint Ductile Iron	150.62	27.34
For Cement Mortar Lining (CML), Add	10.92	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	8.19	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0546 EA 6" 90 Degree Elbow, Push-On Joint Ductile Iron	218.53	40.33
For Cement Mortar Lining (CML), Add	15.74	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	11.80	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0547 EA 8" 90 Degree Elbow, Push-On Joint Ductile Iron	290.92	47.89
For Cement Mortar Lining (CML), Add	21.83	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	16.37	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0548 EA 10" 90 Degree Elbow, Push-On Joint Ductile Iron	439.85	53.09
For Cement Mortar Lining (CML), Add	33.01	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	24.75	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0549 EA 12" 90 Degree Elbow, Push-On Joint Ductile Iron	565.39	62.29
For Cement Mortar Lining (CML), Add	43.67	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	32.75	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0550 Push-On Joint Ductile Iron Tee <small>(33 11 13 13-0537)</small>		
33 11 13 13-0551 EA 4" Tee, Push-On Joint Ductile Iron.....	229.97	40.33
For Cement Mortar Lining (CML), Add	16.88	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	12.66	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0552 EA 6" Tee, Push-On Joint Ductile Iron.....	320.85	59.27
For Cement Mortar Lining (CML), Add	23.10	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	17.33	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0553 EA 8" Tee, Push-On Joint Ductile Iron.....	436.44	71.83
For Cement Mortar Lining (CML), Add	32.75	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	24.56	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0554 EA 10" Tee, Push-On Joint Ductile Iron.....	636.38	80.69
For Cement Mortar Lining (CML), Add	51.54	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	38.65	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0555 EA 12" Tee, Push-On Joint Ductile Iron.....	791.10	93.03
For Cement Mortar Lining (CML), Add	64.99	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	48.74	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0556 Flanged End x Push-On Joint Ductile Iron Adapters <small>(33 11 13 13-0537)</small>		
33 11 13 13-0557 EA 4" Flanged End x Push-On Joint Adapter, Ductile Iron	406.48	94.85
For Cement Mortar Lining (CML), Add	26.28	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	19.71	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0558 EA 6" Flanged End x Push-On Joint Adapter, Ductile Iron	496.43	117.43
For Cement Mortar Lining (CML), Add	31.85	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	23.89	
Note: ANSI/AWWA C151/A21.51		

33 Utilities**33 10 Water Utilities****33 11 Water Utility Distribution Piping**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 11 13 13-0559 EA 8" Flanged End x Push-On Joint Adapter, Ductile Iron	665.43	136.97
For Cement Mortar Lining (CML), Add	45.79	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	34.34	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0560 EA 12" Flanged End x Push-On Joint Adapter, Ductile Iron	899.80	199.70
For Cement Mortar Lining (CML), Add	59.72	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	44.79	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0561 EA 12" Flanged End x Push-On Joint Adapter, Ductile Iron	1,102.29	228.25
For Cement Mortar Lining (CML), Add	75.65	
Note: ANSI/AWWA C104/A21.4		
For Bituminous Or Coal Tar Coating, 1 Mil, Add	56.74	
Note: ANSI/AWWA C151/A21.51		
33 11 13 13-0562 Push-On Joint Ductile Iron Pipe And Fitting Restraints (33 11 13 13-0537)		
Note: Includes ductile iron follower gland, restraint ring and all nuts and bolts. Excludes pipe and fitting.		
33 11 13 13-0563 EA 4" Pipe And Fitting Restraint, Push-On Joint Ductile Iron	32.09	10.28
33 11 13 13-0564 EA 6" Pipe And Fitting Restraint, Push-On Joint Ductile Iron	35.68	10.28
33 11 13 13-0565 EA 8" Pipe And Fitting Restraint, Push-On Joint Ductile Iron	47.67	14.52
33 11 13 13-0566 EA 10" Pipe And Fitting Restraint, Push-On Joint Ductile Iron	57.35	15.98
33 11 13 13-0567 EA 12" Pipe And Fitting Restraint, Push-On Joint Ductile Iron	68.23	17.75
33 11 13 13-0568 Push-On Joint Ductile Iron Bell Restraint Harness (Megalug 1700) (33 11 13 13-0537)		
33 11 13 13-0569 EA 4" Bell Restraint Harness, Ductile Iron (Megalug 1700)	157.78	54.46
33 11 13 13-0570 EA 6" Bell Restraint Harness, Ductile Iron (Megalug 1700)	206.27	66.48
33 11 13 13-0571 EA 8" Bell Restraint Harness, Ductile Iron (Megalug 1700)	264.11	81.09
33 11 13 13-0572 EA 10" Bell Restraint Harness, Ductile Iron (Megalug 1700)	390.51	98.92
33 11 13 13-0573 EA 12" Bell Restraint Harness, Ductile Iron (Megalug 1700)	483.73	120.62
33 11 13 13-0574 EA 14" Bell Restraint Harness, Ductile Iron (Megalug 1700)	814.19	147.17
33 11 13 13-0575 EA 16" Bell Restraint Harness, Ductile Iron (Megalug 1700)	933.30	179.61
33 11 13 13-0576 EA 18" Bell Restraint Harness, Ductile Iron (Megalug 1700)	1,064.49	219.06
33 11 13 13-0577 EA 20" Bell Restraint Harness, Ductile Iron (Megalug 1700)	1,436.99	267.31
33 11 13 13-0578 EA 24" Bell Restraint Harness, Ductile Iron (Megalug 1700)	1,828.08	326.05
33 11 13 23 Plastic Public Water Utility Distribution Piping (33 11 13)		
33 11 13 23-0001 Class 200, SDR 21 Polyvinyl Chloride (PVC) Pressure Piping (33 11 13 23)		
33 11 13 23-0002 Class 200, SDR 21 Polyvinyl Chloride (PVC) Pressure Pipe (33 11 13 23-0001)		
33 11 13 23-0003 LF 3/4" Class 200, SDR 21 Polyvinyl Chloride (PVC) Pressure Pipe	1.70	0.62
For >1,000, Deduct	-0.09	
For Coloring Of Polyvinyl Chloride (PVC) Pipe For Reclaimed Water Identification, Add	0.02	
33 11 13 23-0004 LF 1" Class 200, SDR 21 Polyvinyl Chloride (PVC) Pressure Pipe	1.86	0.67
For >1,000, Deduct	-0.09	
For Coloring Of Polyvinyl Chloride (PVC) Pipe For Reclaimed Water Identification, Add	0.03	
33 11 13 23-0005 LF 1-1/4" Class 200, SDR 21 Polyvinyl Chloride (PVC) Pressure Pipe	2.12	0.73
For >1,000, Deduct	-0.11	
For Coloring Of Polyvinyl Chloride (PVC) Pipe For Reclaimed Water Identification, Add	0.05	
33 11 13 23-0006 LF 1-1/2" Class 200, SDR 21 Polyvinyl Chloride (PVC) Pressure Pipe	2.42	0.80
For >1,000, Deduct	-0.12	
For Coloring Of Polyvinyl Chloride (PVC) Pipe For Reclaimed Water Identification, Add	0.06	
33 11 13 23-0007 LF 2" Class 200, SDR 21 Polyvinyl Chloride (PVC) Pressure Pipe	3.02	0.89
For >1,000, Deduct	-0.15	
For Coloring Of Polyvinyl Chloride (PVC) Pipe For Reclaimed Water Identification, Add	0.12	
33 11 13 23-0008 LF 2-1/2" Class 200, SDR 21 Polyvinyl Chloride (PVC) Pressure Pipe	3.79	1.02
For >1,000, Deduct	-0.19	
For Coloring Of Polyvinyl Chloride (PVC) Pipe For Reclaimed Water Identification, Add	0.19	
33 11 13 23-0009 LF 3" Class 200, SDR 21 Polyvinyl Chloride (PVC) Pressure Pipe	4.64	1.18
For >1,000, Deduct	-0.23	
For Coloring Of Polyvinyl Chloride (PVC) Pipe For Reclaimed Water Identification, Add	0.25	
33 11 13 23-0010 LF 4" Class 200, SDR 21 Polyvinyl Chloride (PVC) Pressure Pipe	6.41	1.45
For >1,000, Deduct	-0.32	
For Coloring Of Polyvinyl Chloride (PVC) Pipe For Reclaimed Water Identification, Add	0.42	
33 11 13 23-0011 LF 6" Class 200, SDR 21 Polyvinyl Chloride (PVC) Pressure Pipe	10.65	1.85
For >1,000, Deduct	-0.53	
For Coloring Of Polyvinyl Chloride (PVC) Pipe For Reclaimed Water Identification, Add	0.90	
33 11 13 23-0012 LF 8" Class 200, SDR 21 Polyvinyl Chloride (PVC) Pressure Pipe	16.26	2.41
For >1,000, Deduct	-0.81	
For Coloring Of Polyvinyl Chloride (PVC) Pipe For Reclaimed Water Identification, Add	1.53	
33 11 13 23-0013 LF 10" Class 200, SDR 21 Polyvinyl Chloride (PVC) Pressure Pipe	23.96	3.23
For >1,000, Deduct	-1.20	
For Coloring Of Polyvinyl Chloride (PVC) Pipe For Reclaimed Water Identification, Add	2.38	
33 11 13 23-0014 LF 12" Class 200, SDR 21 Polyvinyl Chloride (PVC) Pressure Pipe	33.26	4.35
For >1,000, Deduct	-1.66	
For Coloring Of Polyvinyl Chloride (PVC) Pipe For Reclaimed Water Identification, Add	3.36	
33 11 13 23-0015 90 Degree Elbows, Class 200, SDR 21 Polyvinyl Chloride (PVC) (33 11 13 23-0001)		
33 11 13 23-0016 EA 3/4" 90 Degree Elbow, Class 200, SDR 21 Polyvinyl Chloride (PVC)	18.69	7.41



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 11 13 23-0017 EA 1" 90 Degree Elbow, Class 200, SDR 21 Polyvinyl Chloride (PVC).....	23.58	9.26
33 11 13 23-0018 EA 1-1/4" 90 Degree Elbow, Class 200, SDR 21 Polyvinyl Chloride (PVC)	29.62	11.58
33 11 13 23-0019 EA 1-1/2" 90 Degree Elbow, Class 200, SDR 21 Polyvinyl Chloride (PVC)	40.86	12.81
33 11 13 23-0020 EA 2" 90 Degree Elbow, Class 200, SDR 21 Polyvinyl Chloride (PVC).....	44.56	14.36
33 11 13 23-0021 EA 2-1/2" 90 Degree Elbow, Class 200, SDR 21 Polyvinyl Chloride (PVC)	52.22	16.29
33 11 13 23-0022 EA 3" 90 Degree Elbow, Class 200, SDR 21 Polyvinyl Chloride (PVC).....	60.21	18.95
33 11 13 23-0023 EA 4" 90 Degree Elbow, Class 200, SDR 21 Polyvinyl Chloride (PVC).....	81.01	23.27
33 11 13 23-0024 EA 6" 90 Degree Elbow, Class 200, SDR 21 Polyvinyl Chloride (PVC).....	113.28	29.56
33 11 13 23-0025 EA 8" 90 Degree Elbow, Class 200, SDR 21 Polyvinyl Chloride (PVC).....	175.64	38.81
33 11 13 23-0026 EA 10" 90 Degree Elbow, Class 200, SDR 21 Polyvinyl Chloride (PVC).....	219.58	51.92
33 11 13 23-0027 EA 12" 90 Degree Elbow, Class 200, SDR 21 Polyvinyl Chloride (PVC).....	291.32	69.88
33 11 13 23-0028 45 Degree Elbows, Class 200, SDR 21 Polyvinyl Chloride (PVC) (33 11 13 23-0001)		
33 11 13 23-0029 EA 3/4" 45 Degree Elbow, Class 200, SDR 21 Polyvinyl Chloride (PVC).....	18.92	7.41
33 11 13 23-0030 EA 1" 45 Degree Elbow, Class 200, SDR 21 Polyvinyl Chloride (PVC).....	23.75	9.26
33 11 13 23-0031 EA 1-1/4" 45 Degree Elbow, Class 200, SDR 21 Polyvinyl Chloride (PVC)	29.72	11.58
33 11 13 23-0032 EA 1-1/2" 45 Degree Elbow, Class 200, SDR 21 Polyvinyl Chloride (PVC)	37.78	12.81
33 11 13 23-0033 EA 2" 45 Degree Elbow, Class 200, SDR 21 Polyvinyl Chloride (PVC).....	44.85	14.36
33 11 13 23-0034 EA 2-1/2" 45 Degree Elbow, Class 200, SDR 21 Polyvinyl Chloride (PVC)	53.39	16.29
33 11 13 23-0035 EA 3" 45 Degree Elbow, Class 200, SDR 21 Polyvinyl Chloride (PVC).....	59.72	18.95
33 11 13 23-0036 EA 4" 45 Degree Elbow, Class 200, SDR 21 Polyvinyl Chloride (PVC).....	79.95	23.27
33 11 13 23-0037 EA 6" 45 Degree Elbow, Class 200, SDR 21 Polyvinyl Chloride (PVC).....	111.14	29.56
33 11 13 23-0038 EA 8" 45 Degree Elbow, Class 200, SDR 21 Polyvinyl Chloride (PVC).....	171.55	38.81
33 11 13 23-0039 EA 10" 45 Degree Elbow, Class 200, SDR 21 Polyvinyl Chloride (PVC).....	202.65	51.92
33 11 13 23-0040 EA 12" 45 Degree Elbow, Class 200, SDR 21 Polyvinyl Chloride (PVC).....	267.89	69.88
33 11 13 23-0041 Tees Or Wyes, Class 200, SDR 21 Polyvinyl Chloride (PVC) (33 11 13 23-0001)		
33 11 13 23-0042 EA 3/4" Tees Or Wyes, Class 200 SDR 21 Polyvinyl Chloride (PVC).....	28.03	11.11
33 11 13 23-0043 EA 1" Tees Or Wyes, Class 200 SDR 21 Polyvinyl Chloride (PVC).....	35.31	13.97
33 11 13 23-0044 EA 1-1/4" Tees Or Wyes, Class 200 SDR 21 Polyvinyl Chloride (PVC).....	44.21	17.45
33 11 13 23-0045 EA 1-1/2" Tees Or Wyes, Class 200 SDR 21 Polyvinyl Chloride (PVC).....	57.49	19.30
33 11 13 23-0046 EA 2" Tees Or Wyes, Class 200 SDR 21 Polyvinyl Chloride (PVC).....	65.09	21.46
33 11 13 23-0047 EA 2-1/2" Tees Or Wyes, Class 200 SDR 21 Polyvinyl Chloride (PVC).....	75.32	24.47
33 11 13 23-0048 EA 3" Tees Or Wyes, Class 200 SDR 21 Polyvinyl Chloride (PVC).....	91.63	28.35
33 11 13 23-0049 EA 4" Tees Or Wyes, Class 200 SDR 21 Polyvinyl Chloride (PVC).....	118.37	34.94
33 11 13 23-0050 EA 6" Tees Or Wyes, Class 200 SDR 21 Polyvinyl Chloride (PVC).....	184.73	44.41
33 11 13 23-0051 EA 8" Tees Or Wyes, Class 200 SDR 21 Polyvinyl Chloride (PVC).....	269.76	58.21
33 11 13 23-0052 EA 10" Tees Or Wyes, Class 200 SDR 21 Polyvinyl Chloride (PVC).....	319.05	77.48
33 11 13 23-0053 EA 12" Tees Or Wyes, Class 200 SDR 21 Polyvinyl Chloride (PVC).....	404.59	104.27
33 11 13 23-0054 Couplings, Class 200, SDR 21 Polyvinyl Chloride (PVC) (33 11 13 23-0001)		
33 11 13 23-0055 EA 3/4" Coupling, Class 200 SDR 21 Polyvinyl Chloride (PVC).....	12.50	4.94
33 11 13 23-0056 EA 1" Coupling, Class 200 SDR 21 Polyvinyl Chloride (PVC).....	16.85	6.64
33 11 13 23-0057 EA 1-1/4" Coupling, Class 200 SDR 21 Polyvinyl Chloride (PVC).....	22.38	8.72
33 11 13 23-0058 EA 1-1/2" Coupling, Class 200 SDR 21 Polyvinyl Chloride (PVC).....	29.23	9.65
33 11 13 23-0059 EA 2" Coupling, Class 200 SDR 21 Polyvinyl Chloride (PVC).....	32.33	10.73
33 11 13 23-0060 EA 2-1/2" Coupling, Class 200 SDR 21 Polyvinyl Chloride (PVC).....	36.78	12.20
33 11 13 23-0061 EA 3" Coupling, Class 200 SDR 21 Polyvinyl Chloride (PVC).....	43.23	14.17
33 11 13 23-0062 EA 4" Coupling, Class 200 SDR 21 Polyvinyl Chloride (PVC).....	57.64	17.44
33 11 13 23-0063 EA 6" Coupling, Class 200 SDR 21 Polyvinyl Chloride (PVC).....	80.04	22.21
33 11 13 23-0064 EA 8" Coupling, Class 200 SDR 21 Polyvinyl Chloride (PVC).....	128.72	29.10
33 11 13 23-0065 EA 10" Coupling, Class 200 SDR 21 Polyvinyl Chloride (PVC).....	152.89	38.78
33 11 13 23-0066 EA 12" Coupling, Class 200 SDR 21 Polyvinyl Chloride (PVC).....	196.94	52.14
33 11 13 23-0067 Schedule 40 Polyvinyl Chloride (PVC) Pipe And Fittings (33 11 13 23)		
33 11 13 23-0068 Schedule 40 Polyvinyl Chloride (PVC) Pipe (33 11 13 23-0067)		
33 11 13 23-0069 LF 3/4" Schedule 40 Polyvinyl Chloride (PVC) Pipe	1.82	0.62
For >1,000, Deduct	-0.09	
For Coloring Of Polyvinyl Chloride (PVC) Pipe For Reclaimed Water Identification, Add	0.04	
33 11 13 23-0070 LF 1" Schedule 40 Polyvinyl Chloride (PVC) Pipe	2.08	0.67
For >1,000, Deduct	-0.10	
For Coloring Of Polyvinyl Chloride (PVC) Pipe For Reclaimed Water Identification, Add	0.06	
33 11 13 23-0071 LF 1-1/2" Schedule 40 Polyvinyl Chloride (PVC) Pipe.....	2.63	0.80
For >1,000, Deduct	-0.13	
For Coloring Of Polyvinyl Chloride (PVC) Pipe For Reclaimed Water Identification, Add	0.09	
33 11 13 23-0072 LF 2" Schedule 40 Polyvinyl Chloride (PVC) Pipe	3.10	0.89
For >1,000, Deduct	-0.16	
For Coloring Of Polyvinyl Chloride (PVC) Pipe For Reclaimed Water Identification, Add	0.13	
33 11 13 23-0073 LF 2-1/2" Schedule 40 Polyvinyl Chloride (PVC) Pipe	3.92	1.02
For >1,000, Deduct	-0.20	
For Coloring Of Polyvinyl Chloride (PVC) Pipe For Reclaimed Water Identification, Add	0.21	
33 11 13 23-0074 LF 3" Schedule 40 Polyvinyl Chloride (PVC) Pipe	4.72	1.18
For >1,000, Deduct	-0.24	
For Coloring Of Polyvinyl Chloride (PVC) Pipe For Reclaimed Water Identification, Add	0.27	
33 11 13 23-0075 LF 4" Schedule 40 Polyvinyl Chloride (PVC) Pipe	6.19	1.45
For >1,000, Deduct	-0.31	
For Coloring Of Polyvinyl Chloride (PVC) Pipe For Reclaimed Water Identification, Add	0.38	

33 Utilities**33 10 Water Utilities****33 11 Water Utility Distribution Piping**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 11 13 23-0076 LF 6" Schedule 40 Polyvinyl Chloride (PVC) Pipe	9.07	1.85
For >1,000, Deduct	-0.45	
For Coloring Of Polyvinyl Chloride (PVC) Pipe For Reclaimed Water Identification, Add	0.67	
33 11 13 23-0077 90 Degree Elbows, Schedule 40 Polyvinyl Chloride (PVC) (33 11 13 23-0067)		
33 11 13 23-0078 EA 3/4" 90 Degree Elbow, Schedule 40 Polyvinyl Chloride (PVC)	18.77	7.41
33 11 13 23-0079 EA 1" 90 Degree Elbow, Schedule 40 Polyvinyl Chloride (PVC)	23.63	9.26
33 11 13 23-0080 EA 1-1/2" 90 Degree Elbow, Schedule 40 Polyvinyl Chloride (PVC)	32.80	12.81
33 11 13 23-0081 EA 2" 90 Degree Elbow, Schedule 40 Polyvinyl Chloride (PVC)	36.90	14.36
33 11 13 23-0082 EA 2-1/2" 90 Degree Elbow, Schedule 40 Polyvinyl Chloride (PVC)	43.61	16.29
33 11 13 23-0083 EA 3" 90 Degree Elbow, Schedule 40 Polyvinyl Chloride (PVC)	50.79	18.95
33 11 13 23-0084 EA 4" 90 Degree Elbow, Schedule 40 Polyvinyl Chloride (PVC)	65.25	23.27
33 11 13 23-0085 EA 6" 90 Degree Elbow, Schedule 40 Polyvinyl Chloride (PVC)	96.40	29.56
33 11 13 23-0086 45 Degree Elbows, Schedule 40 Polyvinyl Chloride (PVC) (33 11 13 23-0067)		
33 11 13 23-0087 EA 3/4" 45 Degree Elbow, Schedule 40 Polyvinyl Chloride (PVC)	18.75	7.41
33 11 13 23-0088 EA 1" 45 Degree Elbow, Schedule 40 Polyvinyl Chloride (PVC)	23.61	9.26
33 11 13 23-0089 EA 1-1/2" 45 Degree Elbow, Schedule 40 Polyvinyl Chloride (PVC)	32.80	12.81
33 11 13 23-0090 EA 2" 45 Degree Elbow, Schedule 40 Polyvinyl Chloride (PVC)	36.82	14.36
33 11 13 23-0091 EA 2-1/2" 45 Degree Elbow, Schedule 40 Polyvinyl Chloride (PVC)	43.39	16.29
33 11 13 23-0092 EA 3" 45 Degree Elbow, Schedule 40 Polyvinyl Chloride (PVC)	50.54	18.95
33 11 13 23-0093 EA 4" 45 Degree Elbow, Schedule 40 Polyvinyl Chloride (PVC)	64.73	23.27
33 11 13 23-0094 EA 6" 45 Degree Elbow, Schedule 40 Polyvinyl Chloride (PVC)	94.74	29.56
33 11 13 23-0095 Tees Or Wyes, Schedule 40 Polyvinyl Chloride (PVC) (33 11 13 23-0067)		
33 11 13 23-0096 EA 3/4" Tees Or Wyes, Schedule 40 Polyvinyl Chloride (PVC)	28.12	11.11
33 11 13 23-0097 EA 1" Tees Or Wyes, Schedule 40 Polyvinyl Chloride (PVC)	35.38	13.97
33 11 13 23-0098 EA 1-1/2" Tees Or Wyes, Schedule 40 Polyvinyl Chloride (PVC)	49.08	19.30
33 11 13 23-0099 EA 2" Tees Or Wyes, Schedule 40 Polyvinyl Chloride (PVC)	55.06	21.46
33 11 13 23-0100 EA 2-1/2" Tees Or Wyes, Schedule 40 Polyvinyl Chloride (PVC)	65.55	24.47
33 11 13 23-0101 EA 3" Tees Or Wyes, Schedule 40 Polyvinyl Chloride (PVC)	77.25	28.35
33 11 13 23-0102 EA 4" Tees Or Wyes, Schedule 40 Polyvinyl Chloride (PVC)	95.75	34.94
33 11 13 23-0103 EA 6" Tees Or Wyes, Schedule 40 Polyvinyl Chloride (PVC)	146.20	44.41
33 11 13 23-0104 Couplings, Schedule 40 Polyvinyl Chloride (PVC) (33 11 13 23-0067)		
33 11 13 23-0105 EA 3/4" Coupling, Schedule 40 Polyvinyl Chloride (PVC)	12.54	4.94
33 11 13 23-0106 EA 1" Coupling, Schedule 40 Polyvinyl Chloride (PVC)	16.89	6.64
33 11 13 23-0107 EA 1-1/2" Coupling, Schedule 40 Polyvinyl Chloride (PVC)	24.48	9.65
33 11 13 23-0108 EA 2" Coupling, Schedule 40 Polyvinyl Chloride (PVC)	27.52	10.73
33 11 13 23-0109 EA 2-1/2" Coupling, Schedule 40 Polyvinyl Chloride (PVC)	32.00	12.20
33 11 13 23-0110 EA 3" Coupling, Schedule 40 Polyvinyl Chloride (PVC)	37.70	14.17
33 11 13 23-0111 EA 4" Coupling, Schedule 40 Polyvinyl Chloride (PVC)	46.61	17.44
33 11 13 23-0112 EA 6" Coupling, Schedule 40 Polyvinyl Chloride (PVC)	65.71	22.21
33 11 13 23-0113 Crosses, Schedule 40 Polyvinyl Chloride (PVC) (33 11 13 23-0067)		
33 11 13 23-0114 EA 3/4" Cross, Schedule 40 Polyvinyl Chloride (PVC)	37.57	14.82
33 11 13 23-0115 EA 1" Cross, Schedule 40 Polyvinyl Chloride (PVC)	47.12	18.60
33 11 13 23-0116 EA 1-1/2" Cross, Schedule 40 Polyvinyl Chloride (PVC)	65.43	25.71
33 11 13 23-0117 EA 2" Cross, Schedule 40 Polyvinyl Chloride (PVC)	73.40	28.63
33 11 13 23-0118 EA 2-1/2" Cross, Schedule 40 Polyvinyl Chloride (PVC)	87.37	32.57
33 11 13 23-0119 EA 3" Cross, Schedule 40 Polyvinyl Chloride (PVC)	102.95	37.82
33 11 13 23-0120 EA 4" Cross, Schedule 40 Polyvinyl Chloride (PVC)	127.62	46.54
33 11 13 23-0121 EA 6" Cross, Schedule 40 Polyvinyl Chloride (PVC)	194.73	59.20
33 11 13 23-0122 Schedule 80 Polyvinyl Chloride (PVC) Pipe And Fittings (33 11 13 23)		
33 11 13 23-0123 Schedule 80 Polyvinyl Chloride (PVC) Pipe (33 11 13 23-0122)		
33 11 13 23-0124 LF 1" Schedule 80 Polyvinyl Chloride (PVC) Pipe	2.21	0.67
For >1,000, Deduct	-0.11	
For Coloring Of Polyvinyl Chloride (PVC) Pipe For Reclaimed Water Identification, Add	0.08	
33 11 13 23-0125 LF 1-1/2" Schedule 80 Polyvinyl Chloride (PVC) Pipe	2.89	0.80
For >1,000, Deduct	-0.14	
For Coloring Of Polyvinyl Chloride (PVC) Pipe For Reclaimed Water Identification, Add	0.13	
33 11 13 23-0126 LF 2" Schedule 80 Polyvinyl Chloride (PVC) Pipe	3.54	0.89
For >1,000, Deduct	-0.18	
For Coloring Of Polyvinyl Chloride (PVC) Pipe For Reclaimed Water Identification, Add	0.20	
33 11 13 23-0127 LF 2-1/2" Schedule 80 Polyvinyl Chloride (PVC) Pipe	4.48	1.02
For >1,000, Deduct	-0.22	
For Coloring Of Polyvinyl Chloride (PVC) Pipe For Reclaimed Water Identification, Add	0.29	
33 11 13 23-0128 LF 3" Schedule 80 Polyvinyl Chloride (PVC) Pipe	5.52	1.18
For >1,000, Deduct	-0.28	
For Coloring Of Polyvinyl Chloride (PVC) Pipe For Reclaimed Water Identification, Add	0.39	
33 11 13 23-0129 LF 4" Schedule 80 Polyvinyl Chloride (PVC) Pipe	7.41	1.45
For >1,000, Deduct	-0.37	
For Coloring Of Polyvinyl Chloride (PVC) Pipe For Reclaimed Water Identification, Add	0.57	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 11 13 23-0130 LF 6" Schedule 80 Polyvinyl Chloride (PVC) Pipe <i>For >1,000, Deduct</i> <i>For Coloring Of Polyvinyl Chloride (PVC) Pipe For Reclaimed Water Identification, Add</i>	11.79 -0.59 1.08	1.85
33 11 13 23-0131 90 Degree Elbows, Schedule 80 Polyvinyl Chloride (PVC) <small>(33 11 13 23-0122)</small>		
33 11 13 23-0132 EA 1" 90 Degree Elbow, Schedule 80 Polyvinyl Chloride (PVC)	24.30	9.26
33 11 13 23-0133 EA 1-1/2" 90 Degree Elbow, Schedule 80 Polyvinyl Chloride (PVC)	32.80	12.81
33 11 13 23-0134 EA 2" 90 Degree Elbow, Schedule 80 Polyvinyl Chloride (PVC)	37.58	14.36
33 11 13 23-0135 EA 2-1/2" 90 Degree Elbow, Schedule 80 Polyvinyl Chloride (PVC)	45.05	16.29
33 11 13 23-0136 EA 3" Schedule 80 Polyvinyl Chloride (PVC) 90 Degree Elbow	52.13	18.95
33 11 13 23-0137 EA 4" Schedule 80 Polyvinyl Chloride (PVC) 90 Degree Elbow	65.57	23.27
33 11 13 23-0138 EA 6" Schedule 80 Polyvinyl Chloride (PVC) 90 Degree Elbow	94.88	29.56
33 11 13 23-0139 45 Degree Elbows, Schedule 80 Polyvinyl Chloride (PVC) <small>(33 11 13 23-0122)</small>		
33 11 13 23-0140 EA 1" Schedule 80 Polyvinyl Chloride (PVC) 45 Degree Elbow	27.07	9.26
33 11 13 23-0141 EA 1-1/2" Schedule 80 Polyvinyl Chloride (PVC) 45 Degree Elbow	35.46	12.81
33 11 13 23-0142 EA 2" Schedule 80 Polyvinyl Chloride (PVC) 45 Degree Elbow	40.14	14.36
33 11 13 23-0143 EA 2-1/2" Schedule 80 Polyvinyl Chloride (PVC) 45 Degree Elbow	49.86	16.29
33 11 13 23-0144 EA 3" Schedule 80 Polyvinyl Chloride (PVC) 45 Degree Elbow	58.39	18.95
33 11 13 23-0145 EA 4" Schedule 80 Polyvinyl Chloride (PVC) 45 Degree Elbow	78.16	23.27
33 11 13 23-0146 EA 6" Schedule 80 Polyvinyl Chloride (PVC) 45 Degree Elbow	94.04	29.56
33 11 13 23-0147 Tees Or Wyes, Schedule 80 Polyvinyl Chloride (PVC) <small>(33 11 13 23-0122)</small>		
33 11 13 23-0148 EA 1" Schedule 80 Polyvinyl Chloride (PVC) Tees Or Wyes	36.80	13.97
33 11 13 23-0149 EA 1-1/2" Schedule 80 Polyvinyl Chloride (PVC) Tees Or Wyes	53.39	19.30
33 11 13 23-0150 EA 2" Schedule 80 Polyvinyl Chloride (PVC) Tees Or Wyes	60.19	21.46
33 11 13 23-0151 EA 2-1/2" Schedule 80 Polyvinyl Chloride (PVC) Tees Or Wyes	68.26	24.47
33 11 13 23-0152 EA 3" Schedule 80 Polyvinyl Chloride (PVC) Tees Or Wyes	79.84	28.35
33 11 13 23-0153 EA 4" Schedule 80 Polyvinyl Chloride (PVC) Tees Or Wyes	97.62	34.94
33 11 13 23-0154 EA 6" Schedule 80 Polyvinyl Chloride (PVC) Tees Or Wyes	146.13	44.41
33 11 13 23-0155 Couplings, Schedule 80 Polyvinyl Chloride (PVC) <small>(33 11 13 23-0122)</small>		
33 11 13 23-0156 EA 1" Schedule 80 Polyvinyl Chloride (PVC) Coupling	17.90	6.64
33 11 13 23-0157 EA 1-1/2" Schedule 80 Polyvinyl Chloride (PVC) Coupling	26.22	9.65
33 11 13 23-0158 EA 2" Schedule 80 Polyvinyl Chloride (PVC) Coupling	29.16	10.73
33 11 13 23-0159 EA 2-1/2" Schedule 80 Polyvinyl Chloride (PVC) Coupling	36.21	12.20
33 11 13 23-0160 EA 3" Schedule 80 Polyvinyl Chloride (PVC) Coupling	41.93	14.17
33 11 13 23-0161 EA 4" Schedule 80 Polyvinyl Chloride (PVC) Coupling	51.76	17.44
33 11 13 23-0162 EA 6" Schedule 80 Polyvinyl Chloride (PVC) Coupling	72.90	22.21
33 11 13 23-0163 Crosses, Schedule 80 Polyvinyl Chloride (PVC) <small>(33 11 13 23-0122)</small>		
33 11 13 23-0164 EA 1" Schedule 80 Polyvinyl Chloride (PVC) Cross	49.00	18.60
33 11 13 23-0165 EA 1-1/2" Schedule 80 Polyvinyl Chloride (PVC) Cross	71.14	25.71
33 11 13 23-0166 EA 2" Schedule 80 Polyvinyl Chloride (PVC) Cross	80.21	28.63
33 11 13 23-0167 EA 2-1/2" Schedule 80 Polyvinyl Chloride (PVC) Cross	90.98	32.57
33 11 13 23-0168 EA 3" Schedule 80 Polyvinyl Chloride (PVC) Cross	106.40	37.82
33 11 13 23-0169 EA 4" Schedule 80 Polyvinyl Chloride (PVC) Cross	130.11	46.54
33 11 13 23-0170 EA 6" Schedule 80 Polyvinyl Chloride (PVC) Cross	194.64	59.20
33 11 13 23-0171 AWWA C900/C905 Polyvinyl Chloride (PVC) Pipe <small>(33 11 13 23)</small>		
Note: Includes hub on one end of pipe. C900 is available in blue, white, purple or green.		
33 11 13 23-0172 AWWA C900, DR 25, PR 100 Polyvinyl Chloride (PVC) Pipe <small>(33 11 13 23-0171)</small>		
33 11 13 23-0173 LF 4" AWWA C900, DR 25, PR 100 Polyvinyl Chloride (PVC) Pipe	13.31	6.68
33 11 13 23-0174 LF 6" AWWA C900, DR 25, PR 100 Polyvinyl Chloride (PVC) Pipe	17.02	7.73
33 11 13 23-0175 LF 8" AWWA C900, DR 25, PR 100 Polyvinyl Chloride (PVC) Pipe	21.89	8.96
33 11 13 23-0176 LF 10" AWWA C900, DR 25, PR 100 Polyvinyl Chloride (PVC) Pipe	25.96	9.41
33 11 13 23-0177 LF 12" AWWA C900, DR 25, PR 100 Polyvinyl Chloride (PVC) Pipe	30.84	9.75
33 11 13 23-0178 AWWA C900, DR 18, PR 150 Polyvinyl Chloride (PVC) Pipe <small>(33 11 13 23-0171)</small>		
33 11 13 23-0179 LF 4" AWWA C900, DR 18, PR 150 Polyvinyl Chloride (PVC) Pipe	13.99	6.68
33 11 13 23-0180 LF 6" AWWA C900, DR 18, PR 150 Polyvinyl Chloride (PVC) Pipe	18.42	7.73
33 11 13 23-0181 LF 8" AWWA C900, DR 18, PR 150 Polyvinyl Chloride (PVC) Pipe	24.25	8.96
33 11 13 23-0182 LF 10" AWWA C900, DR 18, PR 150 Polyvinyl Chloride (PVC) Pipe	29.62	9.41
33 11 13 23-0183 LF 12" AWWA C900, DR 18, PR 150 Polyvinyl Chloride (PVC) Pipe	35.95	9.75
33 11 13 23-0184 AWWA C900, DR 14, PR 200 Polyvinyl Chloride (PVC) Pipe <small>(33 11 13 23-0171)</small>		
33 11 13 23-0185 LF 4" AWWA C900, DR 14, PR 200 Polyvinyl Chloride (PVC) Pipe	14.65	6.68
33 11 13 23-0186 LF 6" AWWA C900, DR 14, PR 200 Polyvinyl Chloride (PVC) Pipe	19.80	7.73
33 11 13 23-0187 LF 8" AWWA C900, DR 14, PR 200 Polyvinyl Chloride (PVC) Pipe	26.61	8.96
33 11 13 23-0188 LF 10" AWWA C900, DR 14, PR 200 Polyvinyl Chloride (PVC) Pipe	33.21	9.41
33 11 13 23-0189 LF 12" AWWA C900, DR 14, PR 200 Polyvinyl Chloride (PVC) Pipe	41.06	9.75

33 Utilities**33 10 Water Utilities****33 11 Water Utility Distribution Piping**

MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
33 11 13 23-0190		AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC) Fittings (33 11 13 23)			
		Note: Includes rubber gaskets.			
33 11 13 23-0191		90 Degree Elbows, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC) (33 11 13 23-0190)			
33 11 13 23-0192	EA	4" 90 Degree Elbow, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC).....	103.40		9.26
		For DR 25, Deduct	-5.09		
33 11 13 23-0193	EA	6" 90 Degree Elbow, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC).....	206.10		10.43
		For DR 25, Deduct	-11.12		
33 11 13 23-0194	EA	8" 90 Degree Elbow, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC).....	306.91		11.58
		For DR 25, Deduct	-17.03		
33 11 13 23-0195	EA	10" 90 Degree Elbow, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC).....	468.58		18.11
		For DR 25, Deduct	-25.94		
33 11 13 23-0196	EA	12" 90 Degree Elbow, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC).....	532.00		30.18
		For DR 25, Deduct	-28.30		
33 11 13 23-0197		45 Degree Elbows, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC) (33 11 13 23-0190)			
33 11 13 23-0198	EA	4" 45 Degree Elbow, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC).....	92.31		9.26
		For DR 25, Deduct	-4.43		
33 11 13 23-0199	EA	6" 45 Degree Elbow, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC).....	155.84		10.43
		For DR 25, Deduct	-8.10		
33 11 13 23-0200	EA	8" 45 Degree Elbow, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC).....	196.42		11.58
		For DR 25, Deduct	-10.40		
33 11 13 23-0201	EA	10" 45 Degree Elbow, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC).....	278.56		18.11
		For DR 25, Deduct	-14.54		
33 11 13 23-0202	EA	12" 45 Degree Elbow, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC).....	376.21		30.18
		For DR 25, Deduct	-18.95		
33 11 13 23-0203		22-1/2 Degree Elbows, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC) (33 11 13 23-0190)			
33 11 13 23-0204	EA	4" 22-1/2 Degree Elbow, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC).....	90.96		9.26
		For DR 25, Deduct	-4.35		
33 11 13 23-0205	EA	6" 22-1/2 Degree Elbow, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC).....	155.84		10.43
		For DR 25, Deduct	-8.10		
33 11 13 23-0206	EA	8" 22-1/2 Degree Elbow, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC).....	196.42		11.58
		For DR 25, Deduct	-10.40		
33 11 13 23-0207	EA	10" 22-1/2 Degree Elbow, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC).....	278.57		18.11
		For DR 25, Deduct	-14.54		
33 11 13 23-0208	EA	12" 22-1/2 Degree Elbow, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC).....	376.21		30.18
		For DR 25, Deduct	-18.95		
33 11 13 23-0209		11-1/4 Degree Elbows, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC) (33 11 13 23-0190)			
33 11 13 23-0210	EA	4" 11-1/4 Degree Elbow, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC).....	81.04		9.26
		For DR 25, Deduct	-3.75		
33 11 13 23-0211	EA	6" 11-1/4 Degree Elbow, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC).....	155.84		10.43
		For DR 25, Deduct	-8.10		
33 11 13 23-0212	EA	8" 11-1/4 Degree Elbow, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC).....	196.42		11.58
		For DR 25, Deduct	-10.40		
33 11 13 23-0213	EA	10" 11-1/4 Degree Elbow, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC).....	278.57		18.11
		For DR 25, Deduct	-14.54		
33 11 13 23-0214	EA	12" 11-1/4 Degree Elbow, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC).....	376.21		30.18
		For DR 25, Deduct	-18.95		
33 11 13 23-0215		Tees Or Wyes, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC) (33 11 13 23-0190)			
33 11 13 23-0216	EA	4" Tees Or Wyes, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC).....	122.50		10.43
		For DR 25, Deduct	-6.10		
33 11 13 23-0217	EA	6" Tees Or Wyes, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC).....	230.98		11.58
		For DR 25, Deduct	-12.47		
33 11 13 23-0218	EA	8" Tees Or Wyes, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC).....	320.33		13.13
		For DR 25, Deduct	-17.64		
33 11 13 23-0219	EA	10" Tees Or Wyes, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC).....	657.08		22.64
		For DR 25, Deduct	-36.71		
33 11 13 23-0220	EA	12" Tees Or Wyes, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC).....	813.19		45.27
		For DR 25, Deduct	-43.36		
33 11 13 23-0221		Reducing Tees Or Wyes, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC) (33 11 13 23-0190)			
33 11 13 23-0222	EA	6" x 4" Reducing Tees Or Wyes, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC).....	232.30		15.05
		For DR 25, Deduct	-12.13		
33 11 13 23-0223	EA	8" x 4" Reducing Tees Or Wyes, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC).....	313.18		16.22
		For DR 25, Deduct	-16.85		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 11 13 23-0224 EA 8" x 6" Reducing Tees Or Wyes, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC)	321.14	16.79
For DR 25, Deduct	-17.25	
33 11 13 23-0225 EA 10" x 4" Reducing Tees Or Wyes, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC)	3,099.93	22.64
For DR 25, Deduct	-183.28	
33 11 13 23-0226 EA 10" x 6" Reducing Tees Or Wyes, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC)	599.76	23.20
For DR 25, Deduct	-30.80	
33 11 13 23-0227 EA 10" x 8" Reducing Tees Or Wyes, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC)	598.15	23.77
For DR 25, Deduct	-33.04	
33 11 13 23-0228 EA 12" x 4" Reducing Tees Or Wyes, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC)	640.19	34.71
For DR 25, Deduct	-34.25	
33 11 13 23-0229 EA 12" x 6" Reducing Tees Or Wyes, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC)	731.96	35.27
For DR 25, Deduct	-39.69	
33 11 13 23-0230 EA 12" x 8" Reducing Tees Or Wyes, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC)	775.52	35.84
For DR 25, Deduct	-42.23	
33 11 13 23-0231 EA 12" x 10" Reducing Tees Or Wyes, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC)	791.87	39.23
For DR 25, Deduct	-42.80	
33 11 13 23-0232 Cross, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC) <small>(33 11 13 23-0190)</small>		
33 11 13 23-0233 EA 4" Cross, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC)	172.60	18.52
For DR 25, Deduct	-8.13	
33 11 13 23-0234 EA 6" Cross, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC)	301.81	20.84
For DR 25, Deduct	-15.61	
33 11 13 23-0235 EA 8" Cross, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC)	414.10	23.16
For DR 25, Deduct	-22.07	
33 11 13 23-0236 EA 10" Cross, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC)	836.89	36.21
For DR 25, Deduct	-45.87	
33 11 13 23-0237 EA 12" Cross, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC)	994.05	45.27
For DR 25, Deduct	-54.21	
33 11 13 23-0238 Reducing Cross, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC) <small>(33 11 13 23-0190)</small>		
33 11 13 23-0239 EA 6" x 4" Reducing Cross, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC)	292.32	19.69
For DR 25, Deduct	-15.18	
33 11 13 23-0240 EA 8" x 4" Reducing Cross, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC)	393.06	20.84
For DR 25, Deduct	-21.08	
33 11 13 23-0241 EA 8" x 6" Reducing Cross, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC)	403.53	22.00
For DR 25, Deduct	-21.57	
33 11 13 23-0242 EA 10" x 4" Reducing Cross, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC)	600.76	27.16
For DR 25, Deduct	-32.79	
33 11 13 23-0243 EA 10" x 6" Reducing Cross, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC)	698.37	28.29
For DR 25, Deduct	-38.51	
33 11 13 23-0244 EA 10" x 8" Reducing Cross, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC)	766.13	29.43
For DR 25, Deduct	-42.44	
33 11 13 23-0245 EA 12" x 4" Reducing Cross, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC)	792.16	39.23
For DR 25, Deduct	-42.82	
33 11 13 23-0246 EA 12" x 6" Reducing Cross, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC)	907.47	40.36
For DR 25, Deduct	-49.60	
33 11 13 23-0247 EA 12" x 8" Reducing Cross, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC)	962.79	41.50
For DR 25, Deduct	-52.79	
33 11 13 23-0248 EA 12" x 10" Reducing Cross, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC)	988.26	48.28
For DR 25, Deduct	-53.50	
33 11 13 23-0249 Couplings, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC) <small>(33 11 13 23-0190)</small>		
33 11 13 23-0250 EA 4" Coupling, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC)	64.23	9.26
For DR 25, Deduct	-2.74	
33 11 13 23-0251 EA 6" Coupling, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC)	115.18	10.43
For DR 25, Deduct	-5.66	
33 11 13 23-0252 EA 8" Coupling, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC)	138.00	11.58
For DR 25, Deduct	-6.89	
33 11 13 23-0253 EA 10" Coupling, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC)	196.87	18.11
For DR 25, Deduct	-9.64	
33 11 13 23-0254 EA 12" Coupling, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC)	309.23	22.64
For DR 25, Deduct	-15.84	
33 11 13 23-0255 Flanged End x Gasket Joint Adapter, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC) <small>(33 11 13 23-0190)</small>		
33 11 13 23-0256 EA 4" Flanged End x Gasket Joint Adapter, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC)	78.14	9.26
For DR 25, Deduct	-3.58	
33 11 13 23-0257 EA 6" Flanged End x Gasket Joint Adapter, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC)	104.74	10.43
For DR 25, Deduct	-5.03	
33 11 13 23-0258 EA 8" Flanged End x Gasket Joint Adapter, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC)	149.90	11.58
For DR 25, Deduct	-7.60	
33 11 13 23-0259 EA 10" Flanged End x Gasket Joint Adapter, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC)	206.14	18.11
For DR 25, Deduct	-10.20	
33 11 13 23-0260 EA 12" Flanged End x Gasket Joint Adapter, AWWA C900/905, DR 18, PR 150 Polyvinyl Chloride (PVC)	331.08	30.18
For DR 25, Deduct	-16.24	

33 Utilities**33 10 Water Utilities****33 11 Water Utility Distribution Piping**MINOR
CSI UOM DESCRIPTIONTOTAL DIRECT DEMOLITION
UNIT COST UNIT COST**33 11 13 26 Galvanized Steel Public Water Utility Distribution Piping (33 11 13)**

See CSI section 22 11 16 00-0013 for galvanized steel pipe.

33 11 13 36 Steel Public Water Utility Distribution Piping (33 11 13)**33 11 13 36-0001 Steel Piping (33 11 13 36)****33 11 13 36-0002 Welded, Plain End, Uncoated Steel Piping (33 11 13 36-0001)**

Note: ASTM A252 steel pipe.

33 11 13 36-0003 Up To 1/4" Wall Thickness Welded, Plain End, Uncoated Steel Piping (33 11 13 36-0002)

33 11 13 36-0004	LF	8" Diameter, 3/16" Wall Thickness Welded, Plain End, Uncoated Steel Pipe.....	43.57	20.19
		For >1,000, Deduct	-2.18	
33 11 13 36-0005	LF	8" Diameter, 1/4" Wall Thickness Welded, Plain End, Uncoated Steel Pipe.....	47.71	20.19
		For >1,000, Deduct	-2.39	
33 11 13 36-0006	LF	10" Diameter, 3/16" Wall Thickness Welded, Plain End, Uncoated Steel Pipe.....	49.63	22.02
		For >1,000, Deduct	-2.48	
33 11 13 36-0007	LF	10" Diameter, 1/4" Wall Thickness Welded, Plain End, Uncoated Steel Pipe.....	54.86	22.02
		For >1,000, Deduct	-2.74	
33 11 13 36-0008	LF	12" Diameter, 3/16" Wall Thickness Welded, Plain End, Uncoated Steel Pipe.....	56.09	23.07
		For >1,000, Deduct	-2.80	
33 11 13 36-0009	LF	12" Diameter, 1/4" Wall Thickness Welded, Plain End, Uncoated Steel Pipe.....	60.15	23.07
		For >1,000, Deduct	-3.01	

33 11 13 36-0010 Flexible Couplings (Dresser Style 38) (33 11 13 36-0001)

33 11 13 36-0011	EA	2" Dresser Coupling For Plain End Welded Steel Pipe.....	95.13	19.11
33 11 13 36-0012	EA	3" Dresser Coupling For Plain End Welded Steel Pipe.....	134.45	36.75
33 11 13 36-0013	EA	4" Dresser Coupling For Plain End Welded Steel Pipe.....	178.87	48.51
33 11 13 36-0014	EA	6" Dresser Coupling For Plain End Welded Steel Pipe.....	287.97	73.50
33 11 13 36-0015	EA	8" Dresser Coupling For Plain End Welded Steel Pipe.....	379.49	92.61
33 11 13 36-0016	EA	10" Dresser Coupling For Plain End Welded Steel Pipe.....	547.00	121.03
33 11 13 36-0017	EA	12" Dresser Coupling For Plain End Welded Steel Pipe.....	646.83	151.68

33 11 13 39 Copper Public Water Utility Distribution Piping (33 11 13)**33 11 13 39-0001 Type K Copper Water Distribution Piping (33 11 13 39)**

33 11 13 39-0002	LF	1/2" Type K Copper Water Distribution Pipe.....	5.23	1.46
33 11 13 39-0003	LF	3/4" Type K Copper Water Distribution Pipe.....	6.93	1.64
33 11 13 39-0004	LF	1" Type K Copper Water Distribution Pipe.....	8.90	1.82
33 11 13 39-0005	LF	1-1/4" Type K Copper Water Distribution Pipe.....	10.55	2.18
33 11 13 39-0006	LF	1-1/2" Type K Copper Water Distribution Pipe.....	13.30	2.91
33 11 13 39-0007	LF	2" Type K Copper Water Distribution Pipe.....	18.48	3.63
33 11 13 39-0008	LF	2-1/2" Type K Copper Water Distribution Pipe.....	26.79	4.36
33 11 13 39-0009	LF	3" Type K Copper Water Distribution Pipe.....	34.87	4.80
33 11 13 39-0010	LF	3-1/2" Type K Copper Water Distribution Pipe.....	46.08	6.03
33 11 13 39-0011	LF	4" Type K Copper Water Distribution Pipe.....	58.83	7.63
33 11 13 39-0012	LF	5" Type K Copper Water Distribution Pipe.....	131.67	9.52
33 11 13 39-0013	LF	6" Type K Copper Water Distribution Pipe.....	184.26	11.49
33 11 13 39-0014	LF	8" Type K Copper Water Distribution Pipe.....	326.41	12.86

33 11 13 43 Public Water Utility Distribution Piping Coatings And Wraps (33 11 13)**33 11 13 43-0001 8 Mil Polyethylene Encasement Tubing (33 11 13 43)**

Note: ANSI/AWWA C105/A21.5-99 section 4.2.

33 11 13 43-0002	LF	3" To 8" Diameter, 8 Mil Polyethylene Encasement Tubing.....	0.57	
33 11 13 43-0003	LF	10" To 12" Diameter, 8 Mil Polyethylene Encasement Tubing.....	0.97	
33 11 13 43-0004	LF	14" To 16" Diameter, 8 Mil Polyethylene Encasement Tubing.....	1.23	
33 11 13 43-0005	LF	18" To 20" Diameter, 8 Mil Polyethylene Encasement Tubing.....	1.57	
33 11 13 43-0006	LF	24" Diameter, 8 Mil Polyethylene Encasement Tubing.....	2.21	

33 11 13 53 Public Water Utility Distribution Piping Saddles And Adapters (33 11 13)**33 11 13 53-0001 Double Stud Stainless Steel Service Saddles (33 11 13 53)**

Note: 1/2" listed taps are compression, 3/4" to 2" are either compression or NPT.

33 11 13 53-0002	EA	4" Diameter x 1/2", 3/4" Or 1" Tap Double Stud Stainless Steel Service Saddle (Smith-Blair 372).....	202.97	
33 11 13 53-0003	EA	4" Diameter x 1-1/4" Or 1-1/2" Tap Double Stud Stainless Steel Service Saddle (Smith-Blair 372).....	295.98	
33 11 13 53-0004	EA	4" Diameter x 2" Tap Double Stud Stainless Steel Service Saddle (Smith-Blair 372).....	304.57	
33 11 13 53-0005	EA	6" Diameter x 1/2", 3/4" Or 1" Tap Double Stud Stainless Steel Service Saddle (Smith-Blair 372).....	247.15	
33 11 13 53-0006	EA	6" Diameter x 1-1/4", 1-1/2" Or 2" Tap Double Stud Stainless Steel Service Saddle (Smith-Blair 372).....	315.01	
33 11 13 53-0007	EA	8" Diameter x 1/2", 3/4" Or 1" Tap Double Stud Stainless Steel Service Saddle (Smith-Blair 372).....	257.49	
33 11 13 53-0008	EA	8" Diameter x 1-1/4", 1-1/2" Or 2" Tap Double Stud Stainless Steel Service Saddle (Smith-Blair 372).....	329.40	
33 11 13 53-0009	EA	10" Diameter x 1/2", 3/4" Or 1" Tap Double Stud Stainless Steel Service Saddle (Smith-Blair 372).....	292.32	
33 11 13 53-0010	EA	10" Diameter x 1-1/4", 1-1/2" Or 2" Tap Double Stud Stainless Steel Service Saddle (Smith-Blair 372).....	346.94	
33 11 13 53-0011	EA	12" Diameter x 1/2", 3/4" Or 1" Tap Double Stud Stainless Steel Service Saddle (Smith-Blair 372).....	304.20	
33 11 13 53-0012	EA	12" Diameter x 1-1/4", 1-1/2" Or 2" Tap Double Stud Stainless Steel Service Saddle (Smith-Blair 372).....	357.25	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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33 11 13 53-0013

Double Bale Epoxy Coated Ductile Iron Body Service Saddles (33 11 13 53)

Note: Electro-galvanized steel bales. 5/8" listed taps are compression. 3/4" to 2" are either compression or NPT. 2-1/2", 3" or 4" are NPT.

33 11 13 53-0014	EA	1-1/4" To 1-1/2" Diameter x 5/8" To 1" Tap Double Bale Epoxy Coated Ductile Iron Body Service Saddle (Smith-Blair 313)	162.26	
33 11 13 53-0015	EA	2" Diameter x 5/8" To 1" Tap Double Bale Epoxy Coated Ductile Iron Body Service Saddle (Smith-Blair 313)	162.39	
33 11 13 53-0016	EA	2" Diameter x 1-1/4" To 1-1/2" Tap Double Bale Epoxy Coated Ductile Iron Body Service Saddle (Smith-Blair 313)	172.67	
33 11 13 53-0017	EA	2-1/2" Diameter x 5/8" To 1" Tap Double Bale Epoxy Coated Ductile Iron Body Service Saddle (Smith-Blair 313)	165.67	
33 11 13 53-0018	EA	3" Diameter x 5/8" To 1" Tap Double Bale Epoxy Coated Ductile Iron Body Service Saddle (Smith-Blair 313)	177.36	
33 11 13 53-0019	EA	3" Diameter x 1-1/4" To 1-1/2" Tap Double Bale Epoxy Coated Ductile Iron Body Service Saddle (Smith-Blair 313)	197.77	
33 11 13 53-0020	EA	3" Diameter x 2" Tap Double Bale Epoxy Coated Ductile Iron Body Service Saddle (Smith-Blair 313)	210.51	
33 11 13 53-0021	EA	4" Diameter x 5/8" To 1" Tap Double Bale Epoxy Coated Ductile Iron Body Service Saddle (Smith-Blair 313)	191.32	
33 11 13 53-0022	EA	4" Diameter x 1-1/4" To 1-1/2" Tap Double Bale Epoxy Coated Ductile Iron Body Service Saddle (Smith-Blair 313)	211.90	
33 11 13 53-0023	EA	4" Diameter x 2" To 2-1/2" Tap Double Bale Epoxy Coated Ductile Iron Body Service Saddle (Smith-Blair 313)	222.47	
33 11 13 53-0024	EA	5" Diameter x 5/8" To 1" Tap Double Bale Epoxy Coated Ductile Iron Body Service Saddle (Smith-Blair 313)	201.70	
33 11 13 53-0025	EA	5" Diameter x 1-1/4" To 1-1/2" Tap Double Bale Epoxy Coated Ductile Iron Body Service Saddle (Smith-Blair 313)	223.03	
33 11 13 53-0026	EA	5" Diameter x 2" To 2-1/2" Tap Double Bale Epoxy Coated Ductile Iron Body Service Saddle (Smith-Blair 313)	233.53	
33 11 13 53-0027	EA	6" Diameter x 5/8" To 1" Tap Double Bale Epoxy Coated Ductile Iron Body Service Saddle (Smith-Blair 313)	212.55	
33 11 13 53-0028	EA	6" Diameter x 1-1/4" To 1-1/2" Tap Double Bale Epoxy Coated Ductile Iron Body Service Saddle (Smith-Blair 313)	233.18	
33 11 13 53-0029	EA	6" Diameter x 2" To 2-1/2" Tap Double Bale Epoxy Coated Ductile Iron Body Service Saddle (Smith-Blair 313)	243.53	
33 11 13 53-0030	EA	6" Diameter x 3" Tap Double Bale Epoxy Coated Ductile Iron Body Service Saddle (Smith-Blair 313)	375.89	
33 11 13 53-0031	EA	6" Diameter x 4" Tap Double Bale Epoxy Coated Ductile Iron Body Service Saddle (Smith-Blair 313)	384.48	
33 11 13 53-0032	EA	8" Diameter x 5/8" To 1" Tap Double Bale Epoxy Coated Ductile Iron Body Service Saddle (Smith-Blair 313)	231.45	
33 11 13 53-0033	EA	8" Diameter x 1-1/4" To 1-1/2" Tap Double Bale Epoxy Coated Ductile Iron Body Service Saddle (Smith-Blair 313)	256.85	
33 11 13 53-0034	EA	8" Diameter x 2" To 2-1/2" Tap Double Bale Epoxy Coated Ductile Iron Body Service Saddle (Smith-Blair 313)	266.28	
33 11 13 53-0035	EA	8" Diameter x 3" To 4" Tap Double Bale Epoxy Coated Ductile Iron Body Service Saddle (Smith-Blair 313)	449.54	
33 11 13 53-0036	EA	10" Diameter x 5/8" To 1" Tap Double Bale Epoxy Coated Ductile Iron Body Service Saddle (Smith-Blair 313)	262.20	
33 11 13 53-0037	EA	10" Diameter x 1-1/4" To 1-1/2" Tap Double Bale Epoxy Coated Ductile Iron Body Service Saddle (Smith-Blair 313)	293.10	
33 11 13 53-0038	EA	10" Diameter x 3" To 4" Tap Double Bale Epoxy Coated Ductile Iron Body Service Saddle (Smith-Blair 313)	505.92	
33 11 13 53-0039	EA	12" Diameter x 5/8" To 1" Tap Double Bale Epoxy Coated Ductile Iron Body Service Saddle (Smith-Blair 313)	287.09	
33 11 13 53-0040	EA	12" Diameter x 1-1/4" To 1-1/2" Tap Double Bale Epoxy Coated Ductile Iron Body Service Saddle (Smith-Blair 313)	319.91	
33 11 13 53-0041	EA	12" Diameter x 2" To 2-1/2" Tap Double Bale Epoxy Coated Ductile Iron Body Service Saddle (Smith-Blair 313)	330.98	
33 11 13 53-0042	EA	12" Diameter x 3" To 4" Tap Double Bale Epoxy Coated Ductile Iron Body Service Saddle (Smith-Blair 313)	568.83	
33 11 13 53-0043	EA	14" Diameter x 5/8" To 1" Tap Double Bale Epoxy Coated Ductile Iron Body Service Saddle (Smith-Blair 313)	340.94	
33 11 13 53-0044	EA	14" Diameter x 1-1/4" To 1-1/2" Tap Double Bale Epoxy Coated Ductile Iron Body Service Saddle (Smith-Blair 313)	366.18	
33 11 13 53-0045	EA	14" Diameter x 2" To 2-1/2" Tap Double Bale Epoxy Coated Ductile Iron Body Service Saddle (Smith-Blair 313)	396.12	
33 11 13 53-0046	EA	14" Diameter x 3" To 4" Tap Double Bale Epoxy Coated Ductile Iron Body Service Saddle (Smith-Blair 313)	709.94	
33 11 13 53-0047	EA	15" Diameter x 5/8" To 1" Tap Double Bale Epoxy Coated Ductile Iron Body Service Saddle (Smith-Blair 313)	349.54	
33 11 13 53-0048	EA	15" Diameter x 1-1/4" To 1-1/2" Tap Double Bale Epoxy Coated Ductile Iron Body Service Saddle (Smith-Blair 313)	403.05	
33 11 13 53-0049	EA	15" Diameter x 2" To 2-1/2" Tap Double Bale Epoxy Coated Ductile Iron Body Service Saddle (Smith-Blair 313)	419.92	
33 11 13 53-0050	EA	15" Diameter x 3" To 4" Tap Double Bale Epoxy Coated Ductile Iron Body Service Saddle (Smith-Blair 313)	765.25	
33 11 13 53-0051	EA	16" Diameter x 5/8" To 1" Tap Double Bale Epoxy Coated Ductile Iron Body Service Saddle (Smith-Blair 313)	365.38	
33 11 13 53-0052	EA	16" Diameter x 1-1/4" To 1-1/2" Tap Double Bale Epoxy Coated Ductile Iron Body Service Saddle (Smith-Blair 313)	420.96	
33 11 13 53-0053	EA	16" Diameter x 2" To 2-1/2" Tap Double Bale Epoxy Coated Ductile Iron Body Service Saddle (Smith-Blair 313)	438.32	
33 11 13 53-0054	EA	16" Diameter x 3" To 4" Tap Double Bale Epoxy Coated Ductile Iron Body Service Saddle (Smith-Blair 313)	796.66	
33 11 13 53-0055	EA	18" Diameter x 5/8" To 1" Tap Double Bale Epoxy Coated Ductile Iron Body Service Saddle (Smith-Blair 313)	408.09	
33 11 13 53-0056	EA	18" Diameter x 1-1/4" To 1-1/2" Tap Double Bale Epoxy Coated Ductile Iron Body Service Saddle (Smith-Blair 313)	476.34	
33 11 13 53-0057	EA	20" Diameter x 5/8" To 1" Tap Double Bale Epoxy Coated Ductile Iron Body Service Saddle (Smith-Blair 313)	470.82	
33 11 13 53-0058	EA	20" Diameter x 1-1/4" To 2-1/2" Tap Double Bale Epoxy Coated Ductile Iron Body Service Saddle (Smith-Blair 313)	523.13	
33 11 13 53-0059	EA	24" Diameter x 5/8" To 1" Tap Double Bale Epoxy Coated Ductile Iron Body Service Saddle (Smith-Blair 313)	492.14	
33 11 13 53-0060	EA	24" Diameter x 1-1/4" To 2-1/2" Tap Double Bale Epoxy Coated Ductile Iron Body Service Saddle (Smith-Blair 313)	559.11	

33 11 13 53-0061

Double Bale Bronze Service Saddles (33 11 13 53)

33 11 13 53-0062	EA	4" Diameter x 3/4" To 1" Tap Double Bale Bronze Service Saddle (Mueller BR2B)	232.73	
33 11 13 53-0063	EA	4" Diameter x 1-1/4" To 2" Tap Double Bale Bronze Service Saddle (Mueller BR2B)	255.72	
33 11 13 53-0064	EA	6" Diameter x 3/4" To 1" Tap Double Bale Bronze Service Saddle (Mueller BR2B)	265.30	
33 11 13 53-0065	EA	6" Diameter x 1-1/4" To 2" Tap Double Bale Bronze Service Saddle (Mueller BR2B)	288.53	
33 11 13 53-0066	EA	8" Diameter x 3/4" To 1" Tap Double Bale Bronze Service Saddle (Mueller BR2B)	298.18	
33 11 13 53-0067	EA	8" Diameter x 1-1/4" To 2" Tap Double Bale Bronze Service Saddle (Mueller BR2B)	313.43	
33 11 13 53-0068	EA	10" Diameter x 3/4" To 1" Tap Double Bale Bronze Service Saddle (Mueller BR2B)	285.50	
33 11 13 53-0069	EA	10" Diameter x 1-1/4" To 2" Tap Double Bale Bronze Service Saddle (Mueller BR2B)	304.39	
33 11 13 53-0070	EA	12" Diameter x 3/4" To 1" Tap Double Bale Bronze Service Saddle (Mueller BR2B)	372.25	
33 11 13 53-0071	EA	12" Diameter x 1-1/4" To 2" Tap Double Bale Bronze Service Saddle (Mueller BR2B)	404.28	
33 11 13 53-0072	EA	14" Diameter x 3/4" To 1" Tap Double Bale Bronze Service Saddle (Mueller BR2B)	581.85	
33 11 13 53-0073	EA	14" Diameter x 1-1/4" To 2" Tap Double Bale Bronze Service Saddle (Mueller BR2B)	483.60	
33 11 13 53-0074	EA	16" Diameter x 3/4" To 1" Tap Double Bale Bronze Service Saddle (Mueller BR2B)	680.45	
33 11 13 53-0075	EA	16" Diameter x 1-1/4" To 2" Tap Double Bale Bronze Service Saddle (Mueller BR2B)	554.25	

33 11 13 53-0076

Stainless Steel Double Straps, Bronze Body Service Saddle (33 11 13 53)

Note: Taps are compression or NPT.

33 11 13 53-0077	EA	4" Diameter x 3/4" To 1" Tap Stainless Steel Double Straps, Bronze Body Service Saddle (Mueller BR2S)	246.42	
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33 Utilities**33 10 Water Utilities****33 11 Water Utility Distribution Piping**

MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

33 11 13 53-0078	EA	4" Diameter x 1-1/4" To 2" Tap Stainless Steel Double Straps, Bronze Body Service Saddle (Mueller BR2S)	273.00	
33 11 13 53-0079	EA	6" Diameter x 3/4" To 1" Tap Stainless Steel Double Straps, Bronze Body Service Saddle (Mueller BR2S)	281.48	
33 11 13 53-0080	EA	6" Diameter x 1-1/4" To 2" Tap Stainless Steel Double Straps, Bronze Body Service Saddle (Mueller BR2S)	307.02	
33 11 13 53-0081	EA	8" Diameter x 3/4" To 1" Tap Stainless Steel Double Straps, Bronze Body Service Saddle (Mueller BR2S)	318.18	
33 11 13 53-0082	EA	8" Diameter x 1-1/4" To 2" Tap Stainless Steel Double Straps, Bronze Body Service Saddle (Mueller BR2S)	334.51	
33 11 13 53-0083	EA	10" Diameter x 3/4" To 1" Tap Stainless Steel Double Straps, Bronze Body Service Saddle (Mueller BR2S)	361.74	
33 11 13 53-0084	EA	10" Diameter x 1-1/4" To 2" Tap Stainless Steel Double Straps, Bronze Body Service Saddle (Mueller BR2S)	388.16	
33 11 13 53-0085	EA	12" Diameter x 3/4" To 1" Tap Stainless Steel Double Straps, Bronze Body Service Saddle (Mueller BR2S)	390.59	
33 11 13 53-0086	EA	12" Diameter x 1-1/4" To 2" Tap Stainless Steel Double Straps, Bronze Body Service Saddle (Mueller BR2S)	424.97	
33 11 13 53-0087	EA	14" Diameter x 3/4" To 1" Tap Stainless Steel Double Straps, Bronze Body Service Saddle (Mueller BR2S)	627.27	
33 11 13 53-0088	EA	14" Diameter x 1-1/4" To 2" Tap Stainless Steel Double Straps, Bronze Body Service Saddle (Mueller BR2S)	516.42	
33 11 13 53-0089	EA	16" Diameter x 3/4" To 1" Tap Stainless Steel Double Straps, Bronze Body Service Saddle (Mueller BR2S)	734.34	
33 11 13 53-0090	EA	16" Diameter x 1-1/4" To 2" Tap Stainless Steel Double Straps, Bronze Body Service Saddle (Mueller BR2S)	593.37	

33 11 13 53-0091**Ductile Iron Mechanical Joint Tapping Sleeve** (33 11 13 53)

33 11 13 53-0092	EA	4" Diameter x 4" Tap Ductile Iron Mechanical Joint Tapping Sleeve (Mueller H-615)	1,152.97	
33 11 13 53-0093	EA	6" Diameter x 4" Or 6" Tap Ductile Iron Mechanical Joint Tapping Sleeve (Mueller H-615)	1,389.46	
33 11 13 53-0094	EA	8" Diameter x 4" Or 6" Tap Ductile Iron Mechanical Joint Tapping Sleeve (Mueller H-615)	1,667.00	
33 11 13 53-0095	EA	8" Diameter x 8" Tap Ductile Iron Mechanical Joint Tapping Sleeve (Mueller H-615)	1,769.23	
33 11 13 53-0096	EA	10" Diameter x 4" Or 6" Tap Ductile Iron Mechanical Joint Tapping Sleeve (Mueller H-615)	2,761.21	
33 11 13 53-0097	EA	10" Diameter x 8" Tap Ductile Iron Mechanical Joint Tapping Sleeve (Mueller H-615)	2,906.00	
33 11 13 53-0098	EA	10" Diameter x 10" Tap Ductile Iron Mechanical Joint Tapping Sleeve (Mueller H-615)	2,965.62	
33 11 13 53-0099	EA	12" Diameter x 4" Or 6" Tap Ductile Iron Mechanical Joint Tapping Sleeve (Mueller H-615)	2,890.10	
33 11 13 53-0100	EA	12" Diameter x 8" Tap Ductile Iron Mechanical Joint Tapping Sleeve (Mueller H-615)	3,034.29	
33 11 13 53-0101	EA	12" Diameter x 10" Tap Ductile Iron Mechanical Joint Tapping Sleeve (Mueller H-615)	3,391.86	
33 11 13 53-0102	EA	12" Diameter x 12" Tap Ductile Iron Mechanical Joint Tapping Sleeve (Mueller H-615)	3,479.38	
33 11 13 53-0103	EA	14" Diameter x 6" Tap Ductile Iron Mechanical Joint Tapping Sleeve (Mueller H-615)	5,962.84	
33 11 13 53-0104	EA	14" Diameter x 8" Tap Ductile Iron Mechanical Joint Tapping Sleeve (Mueller H-615)	6,126.33	
33 11 13 53-0105	EA	14" Diameter x 10" Tap Ductile Iron Mechanical Joint Tapping Sleeve (Mueller H-615)	6,197.45	
33 11 13 53-0106	EA	14" Diameter x 12" Tap Ductile Iron Mechanical Joint Tapping Sleeve (Mueller H-615)	6,225.56	
33 11 13 53-0107	EA	14" Diameter x 14" Tap Ductile Iron Mechanical Joint Tapping Sleeve (Mueller H-615)	6,454.87	
33 11 13 53-0108	EA	16" Diameter x 4" Tap Ductile Iron Mechanical Joint Tapping Sleeve (Mueller H-615)	6,437.73	
33 11 13 53-0109	EA	16" Diameter x 6" Tap Ductile Iron Mechanical Joint Tapping Sleeve (Mueller H-615)	6,454.92	
33 11 13 53-0110	EA	16" Diameter x 8" Tap Ductile Iron Mechanical Joint Tapping Sleeve (Mueller H-615)	6,638.12	
33 11 13 53-0111	EA	16" Diameter x 10" Tap Ductile Iron Mechanical Joint Tapping Sleeve (Mueller H-615)	6,678.01	
33 11 13 53-0112	EA	16" Diameter x 12" Tap Ductile Iron Mechanical Joint Tapping Sleeve (Mueller H-615)	6,722.34	
33 11 13 53-0113	EA	16" Diameter x 14" Tap Ductile Iron Mechanical Joint Tapping Sleeve (Mueller H-615)	10,464.93	
33 11 13 53-0114	EA	16" Diameter x 16" Tap Ductile Iron Mechanical Joint Tapping Sleeve (Mueller H-615)	7,047.75	
33 11 13 53-0115	EA	18" Diameter x 4" Tap Ductile Iron Mechanical Joint Tapping Sleeve (Mueller H-615)	9,027.09	
33 11 13 53-0116	EA	18" Diameter x 6" Tap Ductile Iron Mechanical Joint Tapping Sleeve (Mueller H-615)	9,446.24	
33 11 13 53-0117	EA	18" Diameter x 8", 10", 12" Or 16" Tap Ductile Iron Mechanical Joint Tapping Sleeve (Mueller H-615)	9,552.54	
33 11 13 53-0118	EA	18" Diameter x 18" Tap Ductile Iron Mechanical Joint Tapping Sleeve (Mueller H-615)	9,887.47	
33 11 13 53-0119	EA	20" Diameter x 4" Tap Ductile Iron Mechanical Joint Tapping Sleeve (Mueller H-615)	8,380.75	
33 11 13 53-0120	EA	20" Diameter x 6" Tap Ductile Iron Mechanical Joint Tapping Sleeve (Mueller H-615)	8,054.70	
33 11 13 53-0121	EA	20" Diameter x 8" Tap Ductile Iron Mechanical Joint Tapping Sleeve (Mueller H-615)	8,211.87	
33 11 13 53-0122	EA	20" Diameter x 10" Tap Ductile Iron Mechanical Joint Tapping Sleeve (Mueller H-615)	8,270.60	
33 11 13 53-0123	EA	20" Diameter x 12" Tap Ductile Iron Mechanical Joint Tapping Sleeve (Mueller H-615)	8,580.48	
33 11 13 53-0124	EA	20" Diameter x 14" Tap Ductile Iron Mechanical Joint Tapping Sleeve (Mueller H-615)	11,736.30	
33 11 13 53-0125	EA	20" Diameter x 16", 18" Or 20" Tap Ductile Iron Mechanical Joint Tapping Sleeve (Mueller H-615)	11,954.86	
33 11 13 53-0126	EA	24" Diameter x 4", 6" Or 8" Tap Ductile Iron Mechanical Joint Tapping Sleeve (Mueller H-615)	10,156.26	
33 11 13 53-0127	EA	24" Diameter x 10" Tap Ductile Iron Mechanical Joint Tapping Sleeve (Mueller H-615)	10,293.64	
33 11 13 53-0128	EA	24" Diameter x 12" Tap Ductile Iron Mechanical Joint Tapping Sleeve (Mueller H-615)	10,331.18	
33 11 13 53-0129	EA	24" Diameter x 14" Tap Ductile Iron Mechanical Joint Tapping Sleeve (Mueller H-615)	14,472.90	
33 11 13 53-0130	EA	24" Diameter x 16" Tap Ductile Iron Mechanical Joint Tapping Sleeve (Mueller H-615)	14,656.31	
33 11 13 53-0131	EA	24" Diameter x 18" Tap Ductile Iron Mechanical Joint Tapping Sleeve (Mueller H-615)	14,690.68	
33 11 13 53-0132	EA	24" Diameter x 20" Tap Ductile Iron Mechanical Joint Tapping Sleeve (Mueller H-615)	15,097.66	
33 11 13 53-0133	EA	24" Diameter x 24" Tap Ductile Iron Mechanical Joint Tapping Sleeve (Mueller H-615)	15,286.43	

33 11 13 53-0134**Carbon Steel Epoxy Coated Flange, Stainless Steel Tapping Sleeve** (33 11 13 53)

33 11 13 53-0135	EA	4" Diameter x 4" Epoxy Coated Carbon Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 662)	952.36	
33 11 13 53-0136	EA	6" Diameter x 4" Epoxy Coated Carbon Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 662)	999.86	
33 11 13 53-0137	EA	6" Diameter x 6" Epoxy Coated Carbon Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 662)	1,099.60	
33 11 13 53-0138	EA	8" Diameter x 4" Epoxy Coated Carbon Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 662)	1,121.94	
33 11 13 53-0139	EA	8" Diameter x 6" Epoxy Coated Carbon Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 662)	1,169.38	
33 11 13 53-0140	EA	8" Diameter x 8" Epoxy Coated Carbon Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 662)	1,359.61	
33 11 13 53-0141	EA	10" Diameter x 4" Epoxy Coated Carbon Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 662)	1,219.18	
33 11 13 53-0142	EA	10" Diameter x 6" Epoxy Coated Carbon Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 662)	1,265.24	
33 11 13 53-0143	EA	10" Diameter x 8" Epoxy Coated Carbon Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 662)	1,431.91	
33 11 13 53-0144	EA	10" Diameter x 10" Epoxy Coated Carbon Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 662)	2,036.11	
33 11 13 53-0145	EA	12" Diameter x 4" Epoxy Coated Carbon Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 662)	1,363.12	
33 11 13 53-0146	EA	12" Diameter x 6" Epoxy Coated Carbon Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 662)	1,432.80	
33 11 13 53-0147	EA	12" Diameter x 8" Epoxy Coated Carbon Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 662)	1,596.76	
33 11 13 53-0148	EA	12" Diameter x 10" Epoxy Coated Carbon Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 662)	2,137.54	
33 11 13 53-0149	EA	12" Diameter x 12" Epoxy Coated Carbon Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 662)	2,344.27	
33 11 13 53-0150	EA	14" Diameter x 4" Epoxy Coated Carbon Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 662)	1,822.44	
33 11 13 53-0151	EA	14" Diameter x 6" Epoxy Coated Carbon Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 662)	1,879.30	
33 11 13 53-0152	EA	14" Diameter x 8" Epoxy Coated Carbon Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 662)	2,236.36	
33 11 13 53-0153	EA	14" Diameter x 10" Epoxy Coated Carbon Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 662)	2,680.13	
33 11 13 53-0154	EA	14" Diameter x 12" Epoxy Coated Carbon Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 662)	2,967.09	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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33 11 13 53-0155	EA		16" Diameter x 4" Epoxy Coated Carbon Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 662).....	2,176.63	
33 11 13 53-0156	EA		16" Diameter x 6" Epoxy Coated Carbon Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 662).....	2,235.49	
33 11 13 53-0157	EA		16" Diameter x 8" Epoxy Coated Carbon Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 662).....	2,470.30	
33 11 13 53-0158	EA		16" Diameter x 10" Epoxy Coated Carbon Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 662).....	3,106.98	
33 11 13 53-0159	EA		16" Diameter x 12" Epoxy Coated Carbon Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 662).....	3,253.95	
33 11 13 53-0160	EA		18" Diameter x 4" Epoxy Coated Carbon Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 662).....	2,286.02	
33 11 13 53-0161	EA		18" Diameter x 6" Epoxy Coated Carbon Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 662).....	2,396.37	
33 11 13 53-0162	EA		18" Diameter x 8" Epoxy Coated Carbon Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 662).....	2,551.44	
33 11 13 53-0163	EA		18" Diameter x 10" Epoxy Coated Carbon Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 662).....	3,301.44	
33 11 13 53-0164	EA		18" Diameter x 12" Epoxy Coated Carbon Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 662).....	3,448.24	
33 11 13 53-0165	EA		20" Diameter x 4" Epoxy Coated Carbon Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 662).....	2,779.70	
33 11 13 53-0166	EA		20" Diameter x 6" Epoxy Coated Carbon Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 662).....	2,838.41	
33 11 13 53-0167	EA		20" Diameter x 8" Epoxy Coated Carbon Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 662).....	3,192.12	
33 11 13 53-0168	EA		20" Diameter x 10" Epoxy Coated Carbon Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 662).....	3,793.37	
33 11 13 53-0169	EA		20" Diameter x 12" Epoxy Coated Carbon Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 662).....	4,045.86	
33 11 13 53-0170	EA		24" Diameter x 4" Epoxy Coated Carbon Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 662).....	2,988.26	
33 11 13 53-0171	EA		24" Diameter x 6" Epoxy Coated Carbon Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 662).....	3,122.39	
33 11 13 53-0172	EA		24" Diameter x 8" Epoxy Coated Carbon Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 662).....	3,305.14	
33 11 13 53-0173	EA		24" Diameter x 10" Epoxy Coated Carbon Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 662).....	4,160.43	
33 11 13 53-0174	EA		24" Diameter x 12" Epoxy Coated Carbon Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 662).....	4,313.69	

33 11 13 53-0175 Stainless Steel Flange, Stainless Steel Tapping Sleeve (33 11 13 53)

33 11 13 53-0176	EA		4" Diameter x 4" Stainless Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 663).....	1,116.95	
33 11 13 53-0177	EA		6" Diameter x 4" Stainless Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 663).....	1,207.74	
33 11 13 53-0178	EA		6" Diameter x 6" Stainless Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 663).....	1,280.74	
33 11 13 53-0179	EA		8" Diameter x 4" Stainless Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 663).....	1,295.82	
33 11 13 53-0180	EA		8" Diameter x 6" Stainless Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 663).....	1,380.62	
33 11 13 53-0181	EA		8" Diameter x 8" Stainless Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 663).....	1,643.00	
33 11 13 53-0182	EA		10" Diameter x 4" Stainless Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 663).....	1,488.38	
33 11 13 53-0183	EA		10" Diameter x 6" Stainless Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 663).....	1,582.90	
33 11 13 53-0184	EA		10" Diameter x 8" Stainless Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 663).....	1,817.59	
33 11 13 53-0185	EA		10" Diameter x 10" Stainless Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 663).....	2,500.62	
33 11 13 53-0186	EA		12" Diameter x 4" Stainless Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 663).....	1,693.60	
33 11 13 53-0187	EA		12" Diameter x 6" Stainless Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 663).....	1,824.10	
33 11 13 53-0188	EA		12" Diameter x 8" Stainless Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 663).....	2,135.63	
33 11 13 53-0189	EA		12" Diameter x 10" Stainless Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 663).....	2,542.89	
33 11 13 53-0190	EA		12" Diameter x 12" Stainless Steel Flange, Stainless Steel Tapping Sleeve (Smith-Blair 663).....	2,853.18	

33 11 13 53-0191 Ductile Iron Body, Flanged Coupling Adapter (33 11 13 53)

33 11 13 53-0192	EA		3" Ductile Iron Body, Flanged Coupling Adapter (Smith-Blair 912).....	276.04	42.89
33 11 13 53-0193	EA		4" Ductile Iron Body, Flanged Coupling Adapter (Smith-Blair 912).....	345.65	54.08
33 11 13 53-0194	EA		6" Ductile Iron Body, Flanged Coupling Adapter (Smith-Blair 912).....	452.51	74.59
33 11 13 53-0195	EA		8" Ductile Iron Body, Flanged Coupling Adapter (Smith-Blair 912).....	591.63	87.65
33 11 13 53-0196	EA		10" Ductile Iron Body, Flanged Coupling Adapter (Smith-Blair 912).....	951.37	98.83
33 11 13 53-0197	EA		12" Ductile Iron Body, Flanged Coupling Adapter (Smith-Blair 912).....	1,061.97	111.89

33 11 13 53-0198 Steel Body, Flanged Coupling Adapter (33 11 13 53)

33 11 13 53-0199	EA		3" Steel Body, Flanged Coupling Adapter (Smith-Blair 913).....	414.10	42.89
33 11 13 53-0200	EA		4" Steel Body, Flanged Coupling Adapter (Smith-Blair 913).....	487.71	54.08
33 11 13 53-0201	EA		6" Steel Body, Flanged Coupling Adapter (Smith-Blair 913).....	649.83	74.59
33 11 13 53-0202	EA		8" Steel Body, Flanged Coupling Adapter (Smith-Blair 913).....	797.00	87.65
33 11 13 53-0203	EA		10" Steel Body, Flanged Coupling Adapter (Smith-Blair 913).....	977.72	98.83
33 11 13 53-0204	EA		12" Steel Body, Flanged Coupling Adapter (Smith-Blair 913).....	1,141.19	111.89

33 11 13 53-0205 Ductile Iron Body, Omni Coupling System (33 11 13 53)

33 11 13 53-0206	EA		2" Ductile Iron Body, Omni Coupling System (Smith-Blair 441).....	118.85	29.83
33 11 13 53-0207	EA		2-1/2" Ductile Iron Body, Omni Coupling System (Smith-Blair 441).....	147.37	35.43
33 11 13 53-0208	EA		3" Ductile Iron Body, Omni Coupling System (Smith-Blair 441).....	183.01	42.89
33 11 13 53-0209	EA		4" Ductile Iron Body, Omni Coupling System (Smith-Blair 441).....	229.69	54.08
33 11 13 53-0210	EA		6" Ductile Iron Body, Omni Coupling System (Smith-Blair 441).....	305.06	74.59
33 11 13 53-0211	EA		8" Ductile Iron Body, Omni Coupling System (Smith-Blair 441).....	372.34	87.65
33 11 13 53-0212	EA		10" Ductile Iron Body, Omni Coupling System (Smith-Blair 441).....	471.24	98.83
33 11 13 53-0213	EA		12" Ductile Iron Body, Omni Coupling System (Smith-Blair 441).....	553.19	111.89

33 12 Water Utility Distribution Equipment (33 12)

33 12 13 Water Service Connections (33 12)

33 12 13 23 Water Service Hydrants (33 12 13)

33 12 13 23-0001 Yard Hydrants (33 12 13 23)

Note: With 3/4" hose thread outlet.					
33 12 13 23-0002	EA		2' Bury Depth Yard Hydrant, 3/4" Galvanized Column And 3/4" Threaded Hose Outlet.....	170.77	23.95
33 12 13 23-0003	EA		4' Bury Depth Yard Hydrant, 3/4" Galvanized Column And 3/4" Threaded Hose Outlet.....	180.75	23.95
33 12 13 23-0004	EA		6' Bury Depth Yard Hydrant, 3/4" Galvanized Column And 3/4" Threaded Hose Outlet.....	190.74	23.95
33 12 13 23-0005	EA		2' Bury Depth Yard Hydrant, 1" Galvanized Column And 3/4" Threaded Hose Outlet.....	216.47	30.34

33 Utilities**33 10 Water Utilities****33 12 Water Utility Distribution Equipment**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 12 13 23-0006 EA 4' Bury Depth Yard Hydrant, 1" Galvanized Column And 3/4" Threaded Hose Outlet.....	226.41	30.34
33 12 13 23-0007 EA 6' Bury Depth Yard Hydrant, 1" Galvanized Column And 3/4" Threaded Hose Outlet.....	236.36	30.34
33 12 13 23-0008 Sanitary Yard Hydrants (33 12 13 23) Note: With 3/4" hose thread outlet.		
33 12 13 23-0009 EA 2' Bury Depth Sanitary Yard Hydrant, 1" Galvanized Column And 3/4" Threaded Hose Outlet.....	657.63	49.90
33 12 13 23-0010 EA 4' Bury Depth Sanitary Yard Hydrant, 1" Galvanized Column And 3/4" Threaded Hose Outlet.....	688.82	49.90
33 12 13 23-0011 EA 6' Bury Depth Sanitary Yard Hydrant, 1" Galvanized Column And 3/4" Threaded Hose Outlet.....	720.02	49.90
33 12 13 23-0012 Flushing Hydrants (33 12 13 23)		
33 12 13 23-0013 EA 2" Inlet x 2-1/2" Outlet Steel Flushing Hydrant, 3' Bury Depth.....	457.95	30.86
33 12 16 Water Utility Distribution Valves (33 12) Note: Flanged valves excludes bolt and gasket set. See CSI section 23 21 13 23-0526 for bolt and gasket sets.		
33 12 16 00-0001 Accessories For Valves (33 12 16)		
33 12 16 00-0002 EA 1' Valve Extension Stem.....	68.32	
For Each Additional LF, Add	4.76	
33 12 16 00-0003 EA Up to 80" Long Indicator Post Telescoping Barrel Assembly.....	860.68	73.50
Note: Excludes valve.		
33 12 16 00-0004 EA >80" To 114" Long Indicator Post Telescoping Barrel Assembly.....	975.04	80.85
Note: Excludes valve.		
33 12 16 00-0005 EA Adjust Water Valve Box To Grade.....	73.50	
33 12 16 00-0006 Roadway Or Curb Valve Boxes (33 12 16)		
33 12 16 00-0007 Round Head, Cast Iron Service, Roadway Or Valve Boxes (33 12 16 00-0006)		
33 12 16 00-0008 EA 36" To 48" High, Two Piece, Screw Type, 2-1/2" Shaft, Round Head, Cast Iron Service Box.....	129.65	9.70
Note: Includes cover, top section and bottom section.		
33 12 16 00-0009 EA 36" To 54" High, Two Piece, Screw Type, 2-1/2" Shaft, Round Head, Cast Iron Service Box.....	149.66	9.70
Note: Includes cover, top section and bottom section.		
33 12 16 00-0010 EA 42" To 60" High, Two Piece, Screw Type, 2-1/2" Shaft, Round Head, Cast Iron Service Box.....	150.58	9.70
Note: Includes cover, top section and bottom section.		
33 12 16 00-0011 EA 9" Extension For Screw Type, 2-1/2" Shaft, Round Head, Cast Iron Service Box.....	40.17	4.86
33 12 16 00-0012 EA 16" Extension For Screw Type, 2-1/2" Shaft, Round Head, Cast Iron Service Box.....	45.46	4.86
33 12 16 00-0013 EA 24" Extension For Screw Type, 2-1/2" Shaft, Round Head, Cast Iron Service Box.....	53.43	4.86
33 12 16 00-0014 EA 36" To 48" High, Screw Type, 4-1/4" Shaft, Round Head, Cast Iron Roadway Box.....	193.97	12.13
Note: Includes cover, top section and bottom section.		
33 12 16 00-0015 EA 45" To 54" High, Three Piece, Screw Type, 5-1/4" Shaft, Round Head, Cast Iron Valve Box.....	333.46	16.97
Note: Includes cover, top section, bottom section and #6 round base.		
33 12 16 00-0016 EA 45" To 66" High, Three Piece, Screw Type, 5-1/4" Shaft, Round Head, Cast Iron Valve Box.....	370.78	16.97
Note: Includes cover, top section, bottom section and #6 round base.		
33 12 16 00-0017 EA 24" To 36" High, Two Piece, Screw Type, 5-1/4" Shaft, Round Head, Cast Iron Valve Box.....	201.37	12.13
Note: Includes cover, top section and bottom section.		
33 12 16 00-0018 EA 36" To 48" High, Two Piece, Screw Type, 5-1/4" Shaft, Round Head, Cast Iron Valve Box.....	210.28	12.13
Note: Includes cover, top section and bottom section.		
33 12 16 00-0019 EA 24" To 36" High, Two Piece, Slip Type, 5-1/4" Shaft, Round Head, Cast Iron Valve Box.....	203.47	12.13
Note: Includes cover, top section and bottom section.		
33 12 16 00-0020 EA 12" Extension For Screw Type, 5-1/4" Shaft, Round Head, Cast Iron Valve Box.....	74.03	4.86
33 12 16 00-0021 EA 18" To 24" High Round Head Cast Iron Roadway Or Curb Valve Boxes.....	127.67	19.96
33 12 16 00-0022 EA 22" To 28" High Round Head Cast Iron Roadway Or Curb Valve Boxes.....	131.72	20.76
33 12 16 00-0023 EA 30" To 36" High Round Head Cast Iron Roadway Or Curb Valve Boxes.....	146.51	21.56
33 12 16 00-0024 EA 36" To 48" High Round Head Cast Iron Roadway Or Curb Valve Box.....	197.81	22.76
33 12 16 00-0025 EA 48" To 60" High Round Head Cast Iron Roadway Or Curb Valve Boxes.....	237.46	23.95
33 12 16 00-0026 EA 18" Cast Iron Service Box Extension Section.....	54.96	
33 12 16 00-0027 Plastic Roadway Grade Water Meter Box And Cover (33 12 16 00-0006)		
33 12 16 00-0028 EA 12" Wide x 16" Long x 16" Deep Plastic Meter Box And Cover.....	168.82	27.94
33 12 16 00-0029 EA 9-3/4" Wide x 19-1/4" Long x 16" Deep Oval Plastic Meter Box And Cover.....	126.41	19.96
33 12 16 00-0030 EA Cast Iron Lid For Plastic Meter Box.....	36.67	
33 12 16 00-0031 Roadway Utility Box (33 12 16)		
33 12 16 00-0032 Utility Box (33 12 16 00-0031) Note: Christy Concrete Products.		
33 12 16 00-0033 B3 Utility Box, 9-3/8" x 15-1/2" (33 12 16 00-0032)		
33 12 16 00-0034 EA 9-3/8" x 15-1/2" Precast Concrete Utility Box.....	59.85	36.55
33 12 16 00-0035 EA Cast Iron Lid For 9-3/8" x 15-1/2" Utility Box.....	46.74	4.06
33 12 16 00-0036 EA Reinforced Concrete Lid For 9-3/8" x 15-1/2" Utility Box.....	21.71	4.06
33 12 16 00-0037 EA Steel Checkered Plate Cover For 9-3/8" x 15-1/2" Utility Box.....	97.64	4.06
33 12 16 00-0038 EA 12-1/8" x 18-5/8" Reinforced Concrete Slab For 9-3/8" x 15-1/2" Utility Box.....	33.01	8.12
33 12 16 00-0039 EA 3" High Reinforced Concrete Base For 9-3/8" x 15-1/2" Utility Box.....	44.08	8.12
33 12 16 00-0040 B9 Utility Box, 10-1/4" x 17-1/4" (33 12 16 00-0032)		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 12 16 00-0041 EA 10-1/4" x 17-1/4" Precast Concrete Utility Box.....	74.69	48.73
33 12 16 00-0042 EA Cast Iron Lid For 10-1/4" x 17-1/4" Utility Box.....	54.86	4.87
33 12 16 00-0043 EA Reinforced Concrete Lid For 10-1/4" x 17-1/4" Utility Box.....	24.43	4.87
33 12 16 00-0044 EA Steel Checkered Plate Cover For 10-1/4" x 17-1/4" Utility Box.....	102.24	4.06
33 12 16 00-0045 EA 13" x 19-3/4" Reinforced Concrete Slab For 10-1/4" x 17-1/4" Utility Box.....	36.06	8.12
33 12 16 00-0046 EA 5-3/4" High Reinforced Concrete Base For 10-1/4" x 17-1/4" Utility Box.....	49.53	12.18
33 12 16 00-0047 EA 12" High Reinforced Concrete Extension For 10-1/4" x 17-1/4" Utility Box.....	66.20	22.33
33 12 16 00-0048 B12 Utility Box, 12" x 20" <small>(33 12 16 00-0032)</small>		
33 12 16 00-0049 EA 12" x 20" Precast Concrete Utility Box.....	81.74	52.79
33 12 16 00-0050 EA Cast Iron Lid For 12" x 20" Utility Box.....	96.24	6.09
33 12 16 00-0051 EA Reinforced Concrete Lid For 12" x 20" Utility Box.....	34.28	8.12
33 12 16 00-0052 EA Steel Checkered Plate Cover For 12" x 20" Utility Box.....	140.04	8.12
33 12 16 00-0053 EA 12" High Reinforced Concrete Extension For 12" x 20" Utility Box.....	85.65	28.43
33 12 16 00-0054 B16 Utility Box, 12" x 22-1/4" <small>(33 12 16 00-0032)</small>		
33 12 16 00-0055 EA 12" x 22-1/4" Precast Concrete Utility Box.....	94.54	61.72
33 12 16 00-0056 EA Cast Iron Lid For 12" x 22-1/4" Utility Box.....	109.92	8.12
33 12 16 00-0057 EA Reinforced Concrete Lid For 12" x 22-1/4" Utility Box.....	40.55	8.12
33 12 16 00-0058 EA Steel Checkered Plate Cover For 12" x 22-1/4" Utility Box.....	140.79	8.12
33 12 16 00-0059 EA 16" x 27" Reinforced Concrete Slab For 12" x 22-1/4" Utility Box.....	59.23	13.80
33 12 16 00-0060 EA 12" High Reinforced Concrete Extension For 12" x 22-1/4" Utility Box.....	86.69	28.43
33 12 16 00-0061 B30 Utility Box, 13-1/4" x 24" <small>(33 12 16 00-0032)</small>		
33 12 16 00-0062 EA 13-1/4" x 24" Precast Concrete Utility Box.....	113.29	73.09
33 12 16 00-0063 EA Reinforced Concrete Lid For 13-1/4" x 24" Utility Box.....	56.58	12.99
33 12 16 00-0064 EA Steel Checkered Plate Cover For 13-1/4" x 24" Utility Box.....	174.54	10.56
33 12 16 00-0065 EA 16" x 27" Reinforced Concrete Slab For 13-1/4" x 24" Utility Box.....	59.23	13.80
33 12 16 00-0066 EA 5-1/2" High Reinforced Concrete Base For 13-1/4" x 24" Utility Box.....	92.24	22.74
33 12 16 00-0067 EA 6" High Reinforced Concrete Extension For 13-1/4" x 24" Utility Box.....	69.83	15.43
33 12 16 00-0068 EA 12" High Reinforced Concrete Extension For 13-1/4" x 24" Utility Box.....	112.06	36.55
33 12 16 00-0069 B36 Utility Box, 17-1/4" x 30" <small>(33 12 16 00-0032)</small>		
33 12 16 00-0070 EA 17-1/4" x 30" Precast Concrete Utility Box.....	146.65	92.58
33 12 16 00-0071 EA Reinforced Concrete Lid For 17-1/4" x 30" Utility Box.....	93.29	22.33
33 12 16 00-0072 EA Steel Checkered Plate Cover For 17-1/4" x 30" Utility Box.....	220.88	15.43
33 12 16 00-0073 EA 20" x 34" Reinforced Concrete Slab For 17-1/4" x 30" Utility Box.....	92.69	29.24
33 12 16 00-0074 EA 6" High Reinforced Concrete Base For 17-1/4" x 30" Utility Box.....	140.76	32.49
33 12 16 00-0075 EA 12" High Reinforced Concrete Extension For 17-1/4" x 30" Utility Box.....	148.02	47.10
33 12 16 00-0076 B40 Utility Box, 24-1/2" x 36" <small>(33 12 16 00-0032)</small>		
33 12 16 00-0077 EA 24-1/2" x 36" Precast Concrete Utility Box.....	280.41	142.94
33 12 16 00-0078 EA Reinforced Concrete Lid For 24-1/2" x 36" Utility Box.....	248.15	53.60
33 12 16 00-0079 EA Steel Checkered Plate Cover For 24-1/2" x 36" Utility Box.....	315.28	23.55
33 12 16 00-0080 EA 30" x 40" Reinforced Concrete Slab For 24-1/2" x 36" Utility Box.....	209.07	50.35
33 12 16 00-0081 EA 10" High Reinforced Concrete Extension For 24-1/2" x 36" Utility Box.....	221.23	52.79
33 12 16 00-0082 B48 Utility Box, 30-1/4" x 48-1/4" <small>(33 12 16 00-0032)</small>		
33 12 16 00-0083 EA 30-1/4" x 48-1/4" Precast Concrete Utility Box.....	370.56	162.42
33 12 16 00-0084 EA 1 Piece Reinforced Concrete Lid For 30-1/4" x 48-1/4" Utility Box.....	355.93	88.52
33 12 16 00-0085 EA 2 Piece Reinforced Concrete Lid For 30-1/4" x 48-1/4" Utility Box.....	426.90	88.52
33 12 16 00-0086 EA 2 Piece Steel Checkered Plate Cover For 30-1/4" x 48-1/4" Utility Box.....	502.29	40.61
33 12 16 00-0087 EA 36" x 53" Reinforced Concrete Slab For 30-1/4" x 48-1/4" Utility Box.....	338.39	109.64
33 12 16 00-0088 EA 10" High Reinforced Concrete Extension For 30-1/4" x 48-1/4" Utility Box.....	281.63	73.90
33 12 16 00-0089 Water Utility Distribution Valves <small>(33 12 16)</small>		
33 12 16 00-0090 Angle Valves <small>(33 12 16 00-0089)</small>		
Note: For connecting meters to water service.		
33 12 16 00-0091 Threaded, Class 150, Bronze Angle Valve <small>(33 12 16 00-0090)</small>		
Note: Nibco T-335Y		
33 12 16 00-0092 EA 1/2" Threaded, Class 150, Bronze Angle Valve.....	48.86	12.78
33 12 16 00-0093 EA 3/4" Threaded, Class 150, Bronze Angle Valve.....	65.89	17.17
33 12 16 00-0094 EA 1" Threaded, Class 150, Bronze Angle Valve.....	86.41	21.16
33 12 16 00-0095 EA 1-1/4" Threaded, Class 150, Bronze Angle Valve.....	110.81	26.59
33 12 16 00-0096 EA 1-1/2" Threaded, Class 150, Bronze Angle Valve.....	135.87	30.74
33 12 16 00-0097 EA 2" Threaded, Class 150, Bronze Angle Valve.....	193.25	35.93
33 12 16 00-0098 EA 2-1/2" Threaded, Class 150, Bronze Angle Valve.....	300.44	49.02
33 12 16 00-0099 EA 3" Threaded, Class 150, Bronze Angle Valve.....	438.38	56.60
33 12 16 00-0100 Butterfly Valves <small>(33 12 16 00-0089)</small>		

33 Utilities**33 10 Water Utilities****33 12 Water Utility Distribution Equipment**MINOR
CSI UOM DESCRIPTIONTOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 12 16 00-0101			Flanged, ANSI Class 125, Cast Iron Body, Acrylonitrile-Butadiene Packing, Acrylonitrile-Butadiene Seat, Class AWWA C-504, Cast Iron Disc, 304 Stainless Steel Pin, Butterfly Valves (33 12 16 00-0100)		
33 12 16 00-0102	EA		3" Handwheel Operated, Flanged, ANSI Class 125, Cast Iron Body, Acrylonitrile-Butadiene Packing, Acrylonitrile-Butadiene Seat, Class AWWA C-504, Cast Iron Disc, 304 Stainless Steel Pin, Butterfly Valve (DeZurik BAW,3,F1,Ci,NBRN-NBR,150B,Ci-S1*MS-3-HD8).....	1,098.89	135.91
33 12 16 00-0103	EA		3" Chainwheel Operated, Flanged, ANSI Class 125, Cast Iron Body, Acrylonitrile-Butadiene Packing, Acrylonitrile-Butadiene Seat, Class AWWA C-504, Cast Iron Disc, 304 Stainless Steel Pin, Butterfly Valve (DeZurik BAW,3,F1,Ci,NBRN-NBR,150B,Ci-S1*MS-3-CW8).....	1,255.89	135.91
33 12 16 00-0104	EA		4" Handwheel Operated, Flanged, ANSI Class 125, Cast Iron Body, Acrylonitrile-Butadiene Packing, Acrylonitrile-Butadiene Seat, Class AWWA C-504, Cast Iron Disc, 304 Stainless Steel Pin, Butterfly Valve (DeZurik BAW,4,F1,Ci,NBRN-NBR,150B,Ci-S1*MS-3-HD8).....	1,207.50	210.00
33 12 16 00-0105	EA		4" Chainwheel Operated, Flanged, ANSI Class 125, Cast Iron Body, Acrylonitrile-Butadiene Packing, Acrylonitrile-Butadiene Seat, Class AWWA C-504, Cast Iron Disc, 304 Stainless Steel Pin, Butterfly Valve (DeZurik BAW,4,F1,Ci,NBRN-NBR,150B,Ci-S1*MS-3-CW8).....	1,364.50	210.00
33 12 16 00-0106	EA		6" Handwheel Operated, Flanged, ANSI Class 125, Cast Iron Body, Acrylonitrile-Butadiene Packing, Acrylonitrile-Butadiene Seat, Class AWWA C-504, Cast Iron Disc, 304 Stainless Steel Pin, Butterfly Valve (DeZurik BAW,6,F1,Ci,NBRN-NBR,150B,Ci-S1*MS-3-HD8).....	1,479.42	293.93
33 12 16 00-0107	EA		6" Chainwheel Operated, Flanged, ANSI Class 125, Cast Iron Body, Acrylonitrile-Butadiene Packing, Acrylonitrile-Butadiene Seat, Class AWWA C-504, Cast Iron Disc, 304 Stainless Steel Pin, Butterfly Valve (DeZurik BAW,6,F1,Ci,NBRN-NBR,150B,Ci-S1*MS-3-CW8).....	1,636.42	293.93
33 12 16 00-0108	EA		8" Handwheel Operated, Flanged, ANSI Class 125, Cast Iron Body, Acrylonitrile-Butadiene Packing, Acrylonitrile-Butadiene Seat, Class AWWA C-504, Cast Iron Disc, 304 Stainless Steel Pin, Butterfly Valve (DeZurik BAW,8,F1,Ci,NBRN-NBR,150B,Ci-S1*MS-3-HD8).....	1,668.88	335.91
33 12 16 00-0109	EA		8" Chainwheel Operated, Flanged, ANSI Class 125, Cast Iron Body, Acrylonitrile-Butadiene Packing, Acrylonitrile-Butadiene Seat, Class AWWA C-504, Cast Iron Disc, 304 Stainless Steel Pin, Butterfly Valve (DeZurik BAW,8,F1,Ci,NBRN-NBR,150B,Ci-S1*MS-3-CW8).....	1,826.88	335.91
33 12 16 00-0110	EA		10" Handwheel Operated, Flanged, ANSI Class 125, Cast Iron Body, Acrylonitrile-Butadiene Packing, Acrylonitrile-Butadiene Seat, Class AWWA C-504, Cast Iron Disc, 304 Stainless Steel Pin, Butterfly Valve (DeZurik BAW,10,F1,Ci,NBRN-NBR,150B,Ci-S1*MS-3-HD16).....	2,189.38	411.51
33 12 16 00-0111	EA		10" Chainwheel Operated, Flanged, ANSI Class 125, Cast Iron Body, Acrylonitrile-Butadiene Packing, Acrylonitrile-Butadiene Seat, Class AWWA C-504, Cast Iron Disc, 304 Stainless Steel Pin, Butterfly Valve (DeZurik BAW,10,F1,Ci,NBRN-NBR,150B,Ci-S1*MS-3-CW20).....	2,589.38	411.51
33 12 16 00-0112	EA		12" Handwheel Operated, Flanged, ANSI Class 125, Cast Iron Body, Acrylonitrile-Butadiene Packing, Acrylonitrile-Butadiene Seat, Class AWWA C-504, Cast Iron Disc, 304 Stainless Steel Pin, Butterfly Valve (DeZurik BAW,12,F1,Ci,NBRN-NBR,150B,Ci-S1*MS-3-HD24).....	2,577.49	498.79
33 12 16 00-0113	EA		12" Chainwheel Operated, Flanged, ANSI Class 125, Cast Iron Body, Acrylonitrile-Butadiene Packing, Acrylonitrile-Butadiene Seat, Class AWWA C-504, Cast Iron Disc, 304 Stainless Steel Pin, Butterfly Valve (DeZurik BAW,12,F1,Ci,NBRN-NBR,150B,Ci-S1*MS-3-CW20).....	2,904.49	498.79
33 12 16 00-0114	EA		14" Handwheel Operated, Flanged, ANSI Class 125, Cast Iron Body, Acrylonitrile-Butadiene Packing, Acrylonitrile-Butadiene Seat, Class AWWA C-504, Cast Iron Disc, 304 Stainless Steel Pin, Butterfly Valve (DeZurik BAW,14,F1,Ci,NBRN-NBR,150B,Ci-S1*MS-7-HD12).....	3,368.30	657.04
33 12 16 00-0115	EA		14" Chainwheel Operated, Flanged, ANSI Class 125, Cast Iron Body, Acrylonitrile-Butadiene Packing, Acrylonitrile-Butadiene Seat, Class AWWA C-504, Cast Iron Disc, 304 Stainless Steel Pin, Butterfly Valve (DeZurik BAW,14,F1,Ci,NBRN-NBR,150B,Ci-S1*MS-7-CW20).....	3,904.30	657.04
33 12 16 00-0116	EA		16" Handwheel Operated, Flanged, ANSI Class 125, Cast Iron Body, Acrylonitrile-Butadiene Packing, Acrylonitrile-Butadiene Seat, Class AWWA C-504, Cast Iron Disc, 304 Stainless Steel Pin, Butterfly Valve (DeZurik BAW,16,F1,Ci,NBRN-NBR,150B,Ci-S1*MS-7-HD16).....	4,006.43	722.75
33 12 16 00-0117	EA		16" Chainwheel Operated, Flanged, ANSI Class 125, Cast Iron Body, Acrylonitrile-Butadiene Packing, Acrylonitrile-Butadiene Seat, Class AWWA C-504, Cast Iron Disc, 304 Stainless Steel Pin, Butterfly Valve (DeZurik BAW,16,F1,Ci,NBRN-NBR,150B,Ci-S1*MS-7-CW20).....	4,348.43	722.75
33 12 16 00-0118	EA		18" Handwheel Operated, Flanged, ANSI Class 125, Cast Iron Body, Acrylonitrile-Butadiene Packing, Acrylonitrile-Butadiene Seat, Class AWWA C-504, Cast Iron Disc, 304 Stainless Steel Pin, Butterfly Valve (DeZurik BAW,18,F1,Ci,NBRN-NBR,150B,Ci-S1*MS-7-HD16).....	4,984.79	803.04
33 12 16 00-0119	EA		18" Chainwheel Operated, Flanged, ANSI Class 125, Cast Iron Body, Acrylonitrile-Butadiene Packing, Acrylonitrile-Butadiene Seat, Class AWWA C-504, Cast Iron Disc, 304 Stainless Steel Pin, Butterfly Valve (DeZurik BAW,18,F1,Ci,NBRN-NBR,150B,Ci-S1*MS-7-CW20).....	5,321.79	803.04
33 12 16 00-0120	EA		20" Handwheel Operated, Flanged, ANSI Class 125, Cast Iron Body, Acrylonitrile-Butadiene Packing, Acrylonitrile-Butadiene Seat, Class AWWA C-504, Cast Iron Disc, 304 Stainless Steel Pin, Butterfly Valve (DeZurik BAW,20,F1,Ci,NBRN-NBR,150B,Ci-S1*MS-7-HD30).....	5,879.29	903.43
33 12 16 00-0121	EA		20" Chainwheel Operated, Flanged, ANSI Class 125, Cast Iron Body, Acrylonitrile-Butadiene Packing, Acrylonitrile-Butadiene Seat, Class AWWA C-504, Cast Iron Disc, 304 Stainless Steel Pin, Butterfly Valve (DeZurik BAW,20,F1,Ci,NBRN-NBR,150B,Ci-S1*MS-7-CW20).....	6,095.29	903.43
33 12 16 00-0122	EA		24" Handwheel Operated, Flanged, ANSI Class 125, Ductile Iron Body, Acrylonitrile-Butadiene Packing, Acrylonitrile-Butadiene Seat, Class AWWA C-504, Ductile Iron Disc, 304 Stainless Steel Pin, Butterfly Valve (DeZurik BAW,24,F1,DI,NBRN-NBR,150B,DI-S1,S304G0*MS-7-HD30).....	8,657.90	1,111.92
33 12 16 00-0123	EA		24" Chainwheel Operated, Flanged, ANSI Class 125, Ductile Iron Body, Acrylonitrile-Butadiene Packing, Acrylonitrile-Butadiene Seat, Class AWWA C-504, Ductile Iron Disc, 304 Stainless Steel Pin, Butterfly Valve (DeZurik BAW,24,F1,DI,NBRN-NBR,150B,DI-S1,S304G0*MS-7-CW20).....	8,873.90	1,111.92
33 12 16 00-0124			Check Valves (33 12 16 00-0089)		
33 12 16 00-0125			Flanged, Swing Type Gravity Operated Check Valves (33 12 16 00-0124) Note: AWWA C508. Bronze disc facing. Mueller A-2600-6.		
33 12 16 00-0126	EA		2-1/2" Flanged, Swing Type Gravity Operated Check Valve.....	619.80	99.23
33 12 16 00-0127	EA		3" Flanged, Swing Type Gravity Operated Check Valve.....	660.96	117.60
33 12 16 00-0128	EA		4" Flanged, Swing Type Gravity Operated Check Valve.....	836.33	158.03
33 12 16 00-0129	EA		4" x 6" Flanged, Swing Type Gravity Operated Check Valve.....	1,158.34	180.07
33 12 16 00-0130	EA		4" x 8" Flanged, Swing Type Gravity Operated Check Valve.....	1,248.50	205.80
33 12 16 00-0131	EA		6" Flanged, Swing Type Gravity Operated Check Valve.....	1,153.32	183.75
33 12 16 00-0132	EA		6" x 8" Flanged, Swing Type Gravity Operated Check Valve.....	1,468.48	202.13
33 12 16 00-0133	EA		6" x 10" Flanged, Swing Type Gravity Operated Check Valve.....	1,533.85	220.50
33 12 16 00-0134	EA		8" Flanged, Swing Type Gravity Operated Check Valve.....	1,591.21	220.50



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 12 16 00-0135 EA 10" Flanged, Swing Type Gravity Operated Check Valve.....	2,578.30	257.25
33 12 16 00-0136 EA 12" Flanged, Swing Type Gravity Operated Check Valve.....	3,847.96	308.71
33 12 16 00-0137 EA 14" Flanged, Swing Type Gravity Operated Check Valve.....	5,374.16	402.44
33 12 16 00-0138 EA 16" Flanged, Swing Type Gravity Operated Check Valve.....	7,096.29	451.72
33 12 16 00-0139 EA 18" Flanged, Swing Type Gravity Operated Check Valve.....	10,175.94	500.99
33 12 16 00-0140 EA 20" Flanged, Swing Type Gravity Operated Check Valve.....	11,831.00	564.64
33 12 16 00-0141 Combination Air Release Valves (33 12 16 00-0089)		
33 12 16 00-0142 EA 1" Combination Air Release Valve.....	420.55	15.43
33 12 16 00-0143 EA 2" Combination Air Release Valve.....	678.68	26.46
33 12 16 00-0144 Corporation Stop And Curb Valve (33 12 16 00-0089) Note: AWWA C800		
33 12 16 00-0145 Ball Corporation Valves (33 12 16 00-0144) Note: Mueller B-25000.		
33 12 16 00-0146 EA 3/4" Ball Corporation Valve.....	65.55	15.43
33 12 16 00-0147 EA 1" Ball Corporation Valve.....	82.54	19.11
33 12 16 00-0148 EA 1-1/2" Ball Corporation Valve.....	150.90	27.94
33 12 16 00-0149 EA 2" Ball Corporation Valve.....	231.59	33.07
33 12 16 00-0150 Gate Valve, AWWA C500 And C509 (33 12 16 00-0089)		
33 12 16 00-0151 Gate Valve, Flanged (33 12 16 00-0150) Note: Mueller A-2380-6.		
33 12 16 00-0152 EA 2" Gate Valve, Flanged.....	395.52	78.28
33 12 16 00-0153 EA 2-1/2" Gate Valve, Flanged.....	481.59	98.12
33 12 16 00-0154 EA 3" Gate Valve, Flanged.....	576.03	117.60
33 12 16 00-0155 EA 4" Gate Valve, Flanged.....	691.50	156.56
33 12 16 00-0156 EA 6" Gate Valve, Flanged.....	873.34	183.75
33 12 16 00-0157 EA 8" Gate Valve, Flanged.....	1,231.47	220.50
33 12 16 00-0158 EA 10" Gate Valve, Flanged.....	1,770.63	257.25
33 12 16 00-0159 EA 12" Gate Valve, Flanged.....	2,134.00	308.71
33 12 16 00-0160 EA 14" Gate Valve, Flanged.....	4,426.87	402.44
33 12 16 00-0161 EA 16" Gate Valve, Flanged.....	5,743.50	451.72
33 12 16 00-0162 EA 18" Gate Valve, Flanged.....	8,925.98	500.99
33 12 16 00-0163 EA 20" Gate Valve, Flanged.....	10,644.19	564.64
33 12 16 00-0164 Resilient Wedge Gate Valve, Flanged (33 12 16 00-0150) Note: Mueller A-2360-6.		
33 12 16 00-0165 EA 2" Resilient Wedge Gate Valve, Flanged.....	382.01	78.28
33 12 16 00-0166 EA 2-1/2" Resilient Wedge Gate Valve, Flanged.....	465.43	98.12
33 12 16 00-0167 EA 3" Resilient Wedge Gate Valve, Flanged.....	556.86	118.70
33 12 16 00-0168 EA 4" Resilient Wedge Gate Valve, Flanged.....	670.08	156.56
33 12 16 00-0169 EA 6" Resilient Wedge Gate Valve, Flanged.....	844.70	183.75
33 12 16 00-0170 EA 8" Resilient Wedge Gate Valve, Flanged.....	1,186.73	220.50
33 12 16 00-0171 EA 10" Resilient Wedge Gate Valve, Flanged.....	1,699.54	257.25
33 12 16 00-0172 EA 12" Resilient Wedge Gate Valve, Flanged.....	2,048.16	308.71
33 12 16 00-0173 Gate Valve, Mechanical Joint (33 12 16 00-0150) Note: Mueller A-2380-20.		
33 12 16 00-0174 EA 2" Gate Valve, Mechanical Joint.....	429.19	78.28
33 12 16 00-0175 EA 2-1/2" Gate Valve, Mechanical Joint.....	476.09	98.12
33 12 16 00-0176 EA 3" Gate Valve, Mechanical Joint.....	594.37	118.70
33 12 16 00-0177 EA 4" Gate Valve, Mechanical Joint.....	721.41	156.56
33 12 16 00-0178 EA 6" Gate Valve, Mechanical Joint.....	896.03	183.75
33 12 16 00-0179 EA 8" Gate Valve, Mechanical Joint.....	1,263.26	220.50
33 12 16 00-0180 EA 10" Gate Valve, Mechanical Joint.....	1,792.33	257.25
33 12 16 00-0181 EA 12" Gate Valve, Mechanical Joint.....	2,232.52	308.71
33 12 16 00-0182 EA 14" Gate Valve, Mechanical Joint.....	4,695.57	402.44
33 12 16 00-0183 EA 16" Gate Valve, Mechanical Joint.....	6,018.76	451.72
33 12 16 00-0184 EA 18" Gate Valve, Mechanical Joint.....	9,417.57	500.99
33 12 16 00-0185 EA 20" Gate Valve, Mechanical Joint.....	11,176.18	564.64
33 12 16 00-0186 Resilient Wedge Gate Valve, Mechanical Joint (33 12 16 00-0150) Note: Mueller A-2360-20.		
33 12 16 00-0187 EA 2" Resilient Wedge Gate Valve, Mechanical Joint.....	413.76	78.28
33 12 16 00-0188 EA 3" Resilient Wedge Gate Valve, Mechanical Joint.....	574.16	118.70
33 12 16 00-0189 EA 4" Resilient Wedge Gate Valve, Mechanical Joint.....	698.30	156.56
33 12 16 00-0190 EA 6" Resilient Wedge Gate Valve, Mechanical Joint.....	866.12	183.75
33 12 16 00-0191 EA 8" Resilient Wedge Gate Valve, Mechanical Joint.....	1,216.72	220.50
33 12 16 00-0192 EA 10" Resilient Wedge Gate Valve, Mechanical Joint.....	1,720.00	257.25
33 12 16 00-0193 EA 12" Resilient Wedge Gate Valve, Mechanical Joint.....	2,141.08	308.71

33 Utilities**33 10 Water Utilities****33 12 Water Utility Distribution Equipment**

MINOR CSI UOM DESCRIPTION		TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 12 16 00-0194 Resilient Wedge Gate Valve, Mechanical Joint X Flange Joint (33 12 16 00-0150)			
Note: Mueller A-2361.			
33 12 16 00-0195	EA 14" Resilient Wedge Gate Valve, Mechanical Joint X Flanged Joint	4,277.24	402.44
33 12 16 00-0196	EA 16" Resilient Wedge Gate Valve, Mechanical Joint X Flanged Joint	4,670.72	451.72
33 12 16 00-0197	EA 18" Resilient Wedge Gate Valve, Mechanical Joint X Flanged Joint	7,169.02	500.99
33 12 16 00-0198	EA 20" Resilient Wedge Gate Valve, Mechanical Joint X Flanged Joint	8,535.77	564.64
33 12 16 00-0199	EA 24" Resilient Wedge Gate Valve, Mechanical Joint X FL.....	14,050.55	657.04
33 12 16 00-0200 Gate Valve, Threaded, WW-V-51 Class A, Type 1 (33 12 16 00-0150)			
Note: NIBCO T-113.			
33 12 16 00-0201	EA 1/4" Gate Valve, Bronze, Threaded	32.57	12.86
33 12 16 00-0202	EA 3/8" Gate Valve, Bronze, Threaded	33.79	12.86
33 12 16 00-0203	EA 1/2" Gate Valve, Bronze, Threaded	34.20	12.86
33 12 16 00-0204	EA 3/4" Gate Valve, Bronze, Threaded	44.77	17.37
33 12 16 00-0205	EA 1" Gate Valve, Bronze, Threaded	54.83	21.00
33 12 16 00-0206	EA 1-1/4" Gate Valve, Bronze, Threaded	72.67	26.59
33 12 16 00-0207	EA 1-1/2" Gate Valve, Bronze, Threaded	84.16	30.74
33 12 16 00-0208	EA 2" Gate Valve, Bronze, Threaded	101.20	35.93
33 12 16 00-0209	EA 2-1/2" Gate Valve, Bronze, Threaded	175.02	49.02
33 12 16 00-0210	EA 3" Gate Valve, Bronze, Threaded	207.70	56.23
33 12 16 00-0211 Globe Valve, AWWA (33 12 16 00-0089)			
33 12 16 00-0212 Globe Valve, Threaded, WW-V-51 Class B, Type 1 (33 12 16 00-0211)			
Note: NIBCO T-235.			
33 12 16 00-0213	EA 1/8" Globe Valve, Threaded	42.65	12.86
33 12 16 00-0214	EA 1/4" Globe Valve, Threaded	40.19	12.86
33 12 16 00-0215	EA 3/8" Globe Valve, Threaded	41.41	12.86
33 12 16 00-0216	EA 1/2" Globe Valve, Threaded	42.65	12.86
33 12 16 00-0217	EA 3/4" Globe Valve, Threaded	57.83	17.37
33 12 16 00-0218	EA 1" Globe Valve, Threaded	77.94	21.00
33 12 16 00-0219	EA 1-1/4" Globe Valve, Threaded	110.02	26.59
33 12 16 00-0220	EA 1-1/2" Globe Valve, Threaded	130.35	30.74
33 12 16 00-0221	EA 2" Globe Valve, Threaded	175.28	35.93
33 12 16 00-0222	EA 2-1/2" Globe Valve, Threaded	305.55	49.02
33 12 16 00-0223	EA 3" Globe Valve, Threaded	408.27	56.53
33 12 16 00-0224 Tapping Valve, AWWA C500 And C509 (33 12 16 00-0089)			
33 12 16 00-0225 Tapping Valve, AWWA C500 And C509 (33 12 16 00-0224)			
Note: Flanged inlet X mechanical joint, Mueller H-667.			
33 12 16 00-0226	EA 2" Resilient Wedge Tapping Gate Valve, Mechanical Joint X Flanged Joint.....	564.05	98.12
33 12 16 00-0227	EA 3" Resilient Wedge Tapping Gate Valve, Mechanical Joint X Flanged Joint.....	712.16	118.70
33 12 16 00-0228	EA 4" Resilient Wedge Tapping Gate Valve, Mechanical Joint X Flanged Joint.....	823.00	156.56
33 12 16 00-0229	EA 6" Resilient Wedge Tapping Gate Valve, Mechanical Joint X Flanged Joint.....	1,074.28	183.75
33 12 16 00-0230	EA 8" Resilient Wedge Tapping Gate Valve, Mechanical Joint X Flanged Joint.....	1,489.18	220.50
33 12 16 00-0231	EA 10" Resilient Wedge Tapping Gate Valve, Mechanical Joint X Flanged Joint.....	2,083.81	257.25
33 12 16 00-0232	EA 12" Resilient Wedge Tapping Gate Valve, Mechanical Joint X Flanged Joint.....	3,015.85	308.71
33 12 16 00-0233	EA 14" Resilient Wedge Tapping Gate Valve, Mechanical Joint X Flanged Joint.....	5,333.95	402.44
33 12 16 00-0234	EA 16" Resilient Wedge Tapping Gate Valve, Mechanical Joint X Flanged Joint.....	6,704.01	451.72
33 12 16 00-0235	EA 18" Resilient Wedge Tapping Gate Valve, Mechanical Joint X Flanged Joint.....	10,629.13	501.81
33 12 19 Water Utility Distribution Fire Hydrants (33 12)			
33 12 19 00-0001 Fire Hydrants (33 12 19)			
Note: Breakaway type.			
33 12 19 00-0002 Three Way, Standard (Traditional) Model Fire Hydrant (33 12 19 00-0001)			
Note: Mechanical joint shoe. Includes shoe, lower barrel and upper barrel (hydrant).			
33 12 19 00-0003	EA 1-1/2' Burial Section, 4-1/2" Valve, Three Way, Standard Type (Traditional) Fire Hydrant	1,739.89	205.75
33 12 19 00-0004	EA 2' Burial Section, 4-1/2" Valve, Three Way, Standard Type (Traditional) Fire Hydrant	1,770.99	205.75
33 12 19 00-0005	EA 2-1/2' Burial Section, 4-1/2" Valve, Three Way, Standard Type (Traditional) Fire Hydrant	1,802.17	205.75
33 12 19 00-0006	EA 3' Burial Section, 4-1/2" Valve, Three Way, Standard Type (Traditional) Fire Hydrant	1,847.90	220.45
33 12 19 00-0007	EA 3-1/2' Burial Section, 4-1/2" Valve, Three Way, Standard Type (Traditional) Fire Hydrant	1,879.03	220.45
33 12 19 00-0008	EA 4' Burial Section, 4-1/2" Valve, Three Way, Standard Type (Traditional) Fire Hydrant	1,928.56	238.82
33 12 19 00-0009	EA 4-1/2' Burial Section, 4-1/2" Valve, Three Way, Standard Type (Traditional) Fire Hydrant	1,959.64	238.82
33 12 19 00-0010	EA 5' Burial Section, 4-1/2" Valve, Three Way, Standard Type (Traditional) Fire Hydrant	2,009.18	257.19
33 12 19 00-0011	EA 5-1/2' Burial Section, 4-1/2" Valve, Three Way, Standard Type (Traditional) Fire Hydrant	2,040.31	257.19
33 12 19 00-0012	EA 6' Burial Section, 4-1/2" Valve, Three Way, Standard Type (Traditional) Fire Hydrant	2,089.76	275.56
33 12 19 00-0013	EA 6-1/2' Burial Section, 4-1/2" Valve, Three Way, Standard Type (Traditional) Fire Hydrant	2,139.25	293.93
33 12 19 00-0014	EA 7' Burial Section, 4-1/2" Valve, Three Way, Standard Type (Traditional) Fire Hydrant	2,207.06	330.67
33 12 19 00-0015	EA 1-1/2' Burial Section, 5-1/4" Valve, Three Way, Standard Type (Traditional) Fire Hydrant	1,768.27	205.75
33 12 19 00-0016	EA 2' Burial Section, 5-1/4" Valve, Three Way, Standard Type (Traditional) Fire Hydrant	1,808.63	205.75
33 12 19 00-0017	EA 2-1/2' Burial Section, 5-1/4" Valve, Three Way, Standard Type (Traditional) Fire Hydrant	1,848.89	205.75
33 12 19 00-0018	EA 3' Burial Section, 5-1/4" Valve, Three Way, Standard Type (Traditional) Fire Hydrant	1,903.85	220.45
33 12 19 00-0019	EA 3-1/2' Burial Section, 5-1/4" Valve, Three Way, Standard Type (Traditional) Fire Hydrant	1,944.11	220.45
33 12 19 00-0020	EA 4' Burial Section, 5-1/4" Valve, Three Way, Standard Type (Traditional) Fire Hydrant	2,002.89	238.82
33 12 19 00-0021	EA 4-1/2' Burial Section, 5-1/4" Valve, Three Way, Standard Type (Traditional) Fire Hydrant	2,043.10	238.82



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 12 19 00-0022 EA 5' Burial Section, 5-1/4" Valve, Three Way, Standard Type (Traditional) Fire Hydrant	2,101.77	257.19
33 12 19 00-0023 EA 5-1/2' Burial Section, 5-1/4" Valve, Three Way, Standard Type (Traditional) Fire Hydrant	2,142.02	257.19
33 12 19 00-0024 EA 6' Burial Section, 5-1/4" Valve, Three Way, Standard Type (Traditional) Fire Hydrant	2,200.58	275.56
33 12 19 00-0025 EA 6-1/2' Burial Section, 5-1/4" Valve, Three Way, Standard Type (Traditional) Fire Hydrant	2,259.31	293.93
33 12 19 00-0026 EA 7' Burial Section, 5-1/4" Valve, Three Way, Standard Type (Traditional) Fire Hydrant	2,336.24	330.67
33 12 19 00-0027 Two Way, Standard (Traditional) Model Fire Hydrant <small>(33 12 19 00-0001)</small>		
<small>Note: Mechanical joint shoe. Includes shoe, lower barrel and upper barrel (hydrant).</small>		
33 12 19 00-0028 EA 1-1/2' Burial Section, 4-1/2" Valve, Two Way, Standard Type (Traditional) Fire Hydrant	1,569.18	205.75
33 12 19 00-0029 EA 2' Burial Section, 4-1/2" Valve, Two Way, Standard Type (Traditional) Fire Hydrant	1,600.17	205.75
33 12 19 00-0030 EA 2-1/2' Burial Section, 4-1/2" Valve, Two Way, Standard Type (Traditional) Fire Hydrant	1,631.34	205.75
33 12 19 00-0031 EA 3' Burial Section, 4-1/2" Valve, Two Way, Standard Type (Traditional) Fire Hydrant	1,677.20	220.45
33 12 19 00-0032 EA 3-1/2' Burial Section, 4-1/2" Valve, Two Way, Standard Type (Traditional) Fire Hydrant	1,708.23	220.45
33 12 19 00-0033 EA 4' Burial Section, 4-1/2" Valve, Two Way, Standard Type (Traditional) Fire Hydrant	1,757.69	238.82
33 12 19 00-0034 EA 4-1/2' Burial Section, 4-1/2" Valve, Two Way, Standard Type (Traditional) Fire Hydrant	1,788.82	238.82
33 12 19 00-0035 EA 5' Burial Section, 4-1/2" Valve, Two Way, Standard Type (Traditional) Fire Hydrant	1,838.39	257.19
33 12 19 00-0036 EA 5-1/2' Burial Section, 4-1/2" Valve, Two Way, Standard Type (Traditional) Fire Hydrant	1,869.45	257.19
33 12 19 00-0037 EA 6' Burial Section, 4-1/2" Valve, Two Way, Standard Type (Traditional) Fire Hydrant	1,919.07	275.56
33 12 19 00-0038 EA 6-1/2' Burial Section, 4-1/2" Valve, Two Way, Standard Type (Traditional) Fire Hydrant	1,968.36	293.93
33 12 19 00-0039 EA 7' Burial Section, 4-1/2" Valve, Two Way, Standard Type (Traditional) Fire Hydrant	2,036.24	330.67
33 12 19 00-0040 EA 1-1/2' Burial Section, 5-1/4" Valve, Two Way, Standard Type (Traditional) Fire Hydrant	1,613.02	205.75
33 12 19 00-0041 EA 2' Burial Section, 5-1/4" Valve, Two Way, Standard Type (Traditional) Fire Hydrant	1,653.29	205.75
33 12 19 00-0042 EA 2-1/2' Burial Section, 5-1/4" Valve, Two Way, Standard Type (Traditional) Fire Hydrant	1,693.50	205.75
33 12 19 00-0043 EA 3' Burial Section, 5-1/4" Valve, Two Way, Standard Type (Traditional) Fire Hydrant	1,748.56	220.45
33 12 19 00-0044 EA 3-1/2' Burial Section, 5-1/4" Valve, Two Way, Standard Type (Traditional) Fire Hydrant	1,788.72	220.45
33 12 19 00-0045 EA 4' Burial Section, 5-1/4" Valve, Two Way, Standard Type (Traditional) Fire Hydrant	1,847.43	238.82
33 12 19 00-0046 EA 4-1/2' Burial Section, 5-1/4" Valve, Two Way, Standard Type (Traditional) Fire Hydrant	1,887.61	238.82
33 12 19 00-0047 EA 5' Burial Section, 5-1/4" Valve, Two Way, Standard Type (Traditional) Fire Hydrant	1,946.41	257.19
33 12 19 00-0048 EA 5-1/2' Burial Section, 5-1/4" Valve, Two Way, Standard Type (Traditional) Fire Hydrant	1,986.57	257.19
33 12 19 00-0049 EA 6' Burial Section, 5-1/4" Valve, Two Way, Standard Type (Traditional) Fire Hydrant	2,045.27	275.56
33 12 19 00-0050 EA 6-1/2' Burial Section, 5-1/4" Valve, Two Way, Standard Type (Traditional) Fire Hydrant	2,103.80	293.93
33 12 19 00-0051 EA 7' Burial Section, 5-1/4" Valve, Two Way, Standard Type (Traditional) Fire Hydrant	2,180.95	330.67
33 12 19 00-0052 Three Way, Modern Model Fire Hydrant <small>(33 12 19 00-0001)</small>		
<small>Note: Mechanical joint shoe. Includes shoe, lower barrel and upper barrel (hydrant).</small>		
33 12 19 00-0053 EA 1-1/2' Burial Section, Three Way, Modern Type Fire Hydrant	1,812.47	205.75
33 12 19 00-0054 EA 2' Burial Section, Three Way, Modern Type Fire Hydrant	1,852.68	205.75
33 12 19 00-0055 EA 2-1/2' Burial Section, Three Way, Modern Type Fire Hydrant	1,893.01	205.75
33 12 19 00-0056 EA 3' Burial Section, Three Way, Modern Type Fire Hydrant	1,947.99	220.45
33 12 19 00-0057 EA 3-1/2' Burial Section, Three Way, Modern Type Fire Hydrant	1,988.23	220.45
33 12 19 00-0058 EA 4' Burial Section, Three Way, Modern Type Fire Hydrant	2,046.86	238.82
33 12 19 00-0059 EA 4-1/2' Burial Section, Three Way, Modern Type Fire Hydrant	2,087.15	238.82
33 12 19 00-0060 EA 5' Burial Section, Three Way, Modern Type Fire Hydrant	2,145.79	257.19
33 12 19 00-0061 EA 5-1/2' Burial Section, Three Way, Modern Type Fire Hydrant	2,186.04	257.19
33 12 19 00-0062 EA 6' Burial Section, Three Way, Modern Type Fire Hydrant	2,244.67	257.19
33 12 19 00-0063 EA 6-1/2' Burial Section, Three Way, Modern Type Fire Hydrant	2,303.42	293.93
33 12 19 00-0064 EA 7' Burial Section, Three Way, Modern Type Fire Hydrant	2,379.93	293.93
33 12 19 00-0065 Two Way, Modern Model Fire Hydrant <small>(33 12 19 00-0001)</small>		
<small>Note: Mechanical joint shoe. Includes shoe, lower barrel and upper barrel (hydrant).</small>		
33 12 19 00-0066 EA 1-1/2' Burial Section, Two Way, Modern Type Fire Hydrant	1,308.28	205.75
33 12 19 00-0067 EA 2' Burial Section, Two Way, Modern Type Fire Hydrant	1,338.88	205.75
33 12 19 00-0068 EA 2-1/2' Burial Section, Two Way, Modern Type Fire Hydrant	1,369.82	205.75
33 12 19 00-0069 EA 3' Burial Section, Two Way, Modern Type Fire Hydrant	1,414.76	220.45
33 12 19 00-0070 EA 3-1/2' Burial Section, Two Way, Modern Type Fire Hydrant	1,445.35	220.45
33 12 19 00-0071 EA 4' Burial Section, Two Way, Modern Type Fire Hydrant	1,494.31	238.82
33 12 19 00-0072 EA 4-1/2' Burial Section, Two Way, Modern Type Fire Hydrant	1,524.89	238.82
33 12 19 00-0073 EA 5' Burial Section, Two Way, Modern Type Fire Hydrant	1,573.89	257.19
33 12 19 00-0074 EA 5-1/2' Burial Section, Two Way, Modern Type Fire Hydrant	1,604.39	257.19
33 12 19 00-0075 EA 6' Burial Section, Two Way, Modern Type Fire Hydrant	1,653.36	275.56
33 12 19 00-0076 EA 6-1/2' Burial Section, Two Way, Modern Type Fire Hydrant	1,702.36	293.93
33 12 19 00-0077 EA 7' Burial Section, Two Way, Modern Type Fire Hydrant	1,769.31	330.67
33 12 19 00-0078 Fire Hydrant Extension Kits <small>(33 12 19 00-0001)</small>		
33 12 19 00-0079 EA 6" Long, 4-1/2" Diameter, Fire Hydrant Extension Kit	282.59	18.38
33 12 19 00-0080 EA 12" Long, 4-1/2" Diameter, Fire Hydrant Extension Kit	337.23	22.96
33 12 19 00-0081 EA 18" Long, 4-1/2" Diameter, Fire Hydrant Extension Kit	371.03	27.56
33 12 19 00-0082 EA 24" Long, 4-1/2" Diameter, Fire Hydrant Extension Kit	425.16	33.99
33 12 19 00-0083 EA 30" Long, 4-1/2" Diameter, Fire Hydrant Extension Kit	621.54	35.37
33 12 19 00-0084 EA 36" Long, 4-1/2" Diameter, Fire Hydrant Extension Kit	662.52	36.74
33 12 19 00-0085 EA 42" Long, 4-1/2" Diameter, Fire Hydrant Extension Kit	674.24	38.58
33 12 19 00-0086 EA 48" Long, 4-1/2" Diameter, Fire Hydrant Extension Kit	712.90	41.34
33 12 19 00-0087 EA 54" Long, 4-1/2" Diameter, Fire Hydrant Extension Kit	791.11	49.60
33 12 19 00-0088 EA 60" Long, 4-1/2" Diameter, Fire Hydrant Extension Kit	844.29	59.70
33 12 19 00-0089 EA 6" Long, 5-1/4" Diameter, Fire Hydrant Extension Kit	314.07	20.57
33 12 19 00-0090 EA 12" Long, 5-1/4" Diameter, Fire Hydrant Extension Kit	373.73	24.99
33 12 19 00-0091 EA 18" Long, 5-1/4" Diameter, Fire Hydrant Extension Kit	430.43	30.13

33 Utilities**33 10 Water Utilities****33 12 Water Utility Distribution Equipment**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 12 19 00-0092 EA 24" Long, 5-1/4" Diameter, Fire Hydrant Extension Kit	485.79	37.48
33 12 19 00-0093 EA 30" Long, 5-1/4" Diameter, Fire Hydrant Extension Kit	649.30	38.95
33 12 19 00-0094 EA 36" Long, 5-1/4" Diameter, Fire Hydrant Extension Kit	690.90	40.42
33 12 19 00-0095 EA 42" Long, 5-1/4" Diameter, Fire Hydrant Extension Kit	720.83	42.62
33 12 19 00-0096 EA 48" Long, 5-1/4" Diameter, Fire Hydrant Extension Kit	837.90	45.56
33 12 19 00-0097 EA 54" Long, 5-1/4" Diameter, Fire Hydrant Extension Kit	924.24	54.38
33 12 19 00-0098 EA 60" Long, 5-1/4" Diameter, Fire Hydrant Extension Kit	981.96	65.40
33 12 19 00-0099 Remove And Reinstall Standard Fire Hydrant <small>(33 12 19 00-0001)</small>		
Note: Includes all necessary fittings for resetting, storage and cleaning. Excludes excavation, backfill and thrust blocking around fire hydrant.		
33 12 19 00-0100 EA Up To 5' Burial Section, Remove And Reinstall Fire Hydrant	587.86	
33 12 19 00-0101 EA >5' Burial Section, Remove And Reinstall Fire Hydrant	857.30	
33 12 19 00-0102 EA Reset Fire Hydrant Upper Barrel	728.28	
Note: Includes Safety Repair Kit		
33 12 33 Water Utility Metering <small>(33 12)</small>		
33 12 33 00-0001 Bronze Disk Type Water Service Meters <small>(33 12 33)</small>		
33 12 33 00-0002 EA 5/8" Diameter, 0 - 20 GPM, Screwed, Water Supply Meter, Disk Type, Bronze	134.86	41.52
33 12 33 00-0003 EA 3/4" Diameter, 0 - 30 GPM, Screwed, Water Supply Meter, Disk Type, Bronze	168.20	49.50
33 12 33 00-0004 EA 1" Diameter, 0 - 50 GPM, Screwed, Water Supply Meter, Disk Type, Bronze	221.43	56.69
33 12 33 00-0005 EA 1-1/2" Diameter, 0 - 100 GPM, Screwed, Water Supply Meter, Disk Type, Bronze	419.21	84.63
33 12 33 00-0006 EA 2" Diameter, 0 - 160 GPM, Screwed, Water Supply Meter, Disk Type, Bronze	566.13	110.19
33 12 33 00-0007 Magnetic Driven, Positive Displacement Type Water Service Meters <small>(33 12 33)</small>		
33 12 33 00-0008 EA 5/8" Diameter Transmitting Water Supply Meter, Screwed, 150 PSI Max. (Neptune T10 E-Coder/R900i)	300.43	41.52
<i>For Owner Furnished Material, Deduct</i>		
	-258.40	
33 12 33 00-0009 EA 3/4" Diameter Transmitting Water Supply Meter, Screwed, 150 PSI Max.(Neptune T10 E-Coder/R900i)	343.02	49.50
<i>For Owner Furnished Material, Deduct</i>		
	-293.12	
33 12 33 00-0010 EA 1" Diameter Transmitting Water Supply Meter, Screwed, 150 PSI Max.(Neptune T10 E-Coder/R900i)	506.79	56.69
<i>For Owner Furnished Material, Deduct</i>		
	-449.76	
33 12 33 00-0011 EA 1-1/2" Diameter Transmitting Water Supply Meter, Screwed, 150 PSI Max.(Neptune T10 E-Coder/R900i)	855.02	84.63
<i>For Owner Furnished Material, Deduct</i>		
	-770.08	
33 12 33 00-0012 EA 2" Diameter Transmitting Water Supply Meter, Screwed, 150 PSI Max.(Neptune T10 E-Coder/R900i)	1,059.85	110.19
<i>For Owner Furnished Material, Deduct</i>		
	-948.96	
33 12 33 00-0013 EA Electronic Transmitter	240.15	19.96
Note: For use with transmitting meter valve.		
<i>For Owner Furnished Material, Deduct</i>		
	-220.19	
33 12 33 00-0014 Flanged Compound Type Water Service Meter <small>(33 12 33)</small>		
33 12 33 00-0015 EA 2" Diameter, 0 - 160 GPM Water Service Meter Compound Type, Flanged And Bronze	1,646.75	128.56
33 12 33 00-0016 EA 3" Diameter, 0 - 320 GPM Water Service Meter Compound Type, Flanged And Bronze	2,008.38	170.75
33 12 33 00-0017 EA 4" Diameter, 0 - 500 GPM Water Service Meter Compound Type, Flanged And Bronze	3,243.64	236.67
33 12 33 00-0018 EA 6" Diameter, 0 - 1,000 GPM Water Service Meter Compound Type, Flanged And Bronze	4,583.17	349.86
33 12 33 00-0019 EA 8" Diameter, 0 - 1,600 GPM Water Service Meter Compound Type, Flanged And Bronze	9,163.52	459.39
33 12 33 00-0020 EA 10" Diameter, 0 - 2,500 GPM Water Service Meter Compound Type, Flanged And Bronze	15,440.51	556.77
33 12 33 00-0021 Flanged Turbine Water Service Meter <small>(33 12 33)</small>		
33 12 33 00-0022 Vertical Turbine Meters <small>(33 12 33 00-0021)</small>		
33 12 33 00-0023 EA 1-1/2" Diameter, 0-100 GPM Vertical Turbine Meter, Flanged.....	473.54	101.44
33 12 33 00-0024 EA 2" Diameter, 0-160 GPM Vertical Turbine Meter, Flanged.....	649.27	128.56
33 12 33 00-0025 EA 3" Diameter, 0-350 GPM Vertical Turbine Meter, Flanged.....	1,120.63	210.29
33 12 33 00-0026 EA 4" Diameter, 0-650 GPM Vertical Turbine Meter, Flanged.....	1,624.54	291.21
33 12 33 00-0027 EA 6" Diameter, 0-1300 GPM Vertical Turbine Meter, Flanged.....	2,997.74	428.59
33 12 33 00-0028 Horizontal Turbine Meters <small>(33 12 33 00-0021)</small>		
33 12 33 00-0029 EA 1-1/2" Diameter, 0-120 GPM Horizontal Turbine Meter, Flanged	678.99	101.44
33 12 33 00-0030 EA 2" Diameter, 0-160 GPM Horizontal Turbine Meter, Flanged.....	942.57	128.56
33 12 33 00-0031 EA 3" Diameter, 0-600 GPM Horizontal Turbine Meter, Flanged.....	1,238.22	210.29
33 12 33 00-0032 EA 4" Diameter, 0-1,000 GPM Horizontal Turbine Meter, Flanged.....	1,779.97	291.21
33 12 33 00-0033 EA 6" Diameter, 0-2,000 GPM Horizontal Turbine Meter, Flanged.....	3,564.06	428.59
33 12 33 00-0034 EA 8" Diameter, 0-3,500 GPM Horizontal Turbine Meter, Flanged.....	4,772.17	562.51
33 12 33 00-0035 EA 10" Diameter, 0-5,500 GPM Horizontal Turbine Meter, Flanged.....	6,566.01	681.80
33 12 33 00-0036 EA 12" Diameter, 0-6,600 GPM Horizontal Turbine Meter, Flanged.....	7,741.43	830.57
33 13 Disinfecting of Water Utility Distribution <small>(33 10)</small>		
33 13 00 00-0001 Water Main Disinfection/Sterilization <small>(33 13)</small>		
Note: Gas chlorination. Continuous or plug method.		
33 13 00 00-0002 EA Setting Up And Removing Equipment For Water Main Disinfection/Sterilization, Gas Chlorination Method.....	798.94	
33 13 00 00-0003 EA Re-Set Up/Move Equipment For Water Main Disinfection/Sterilization, Gas Chlorination Method	399.47	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 13 00 00-0004 LF Up To 4" Diameter Pipe Water Main Disinfection/Sterilization.....	0.30	
For >250 To 500, Deduct	-0.02	
For >500 To 1,000, Deduct	-0.03	
For >1,000 To 2,000, Deduct	-0.05	
For >2,000 To 5,000, Deduct	-0.06	
For >5,000, Deduct	-0.08	
33 13 00 00-0005 LF 6" Diameter Pipe Water Main Disinfection/Sterilization.....	0.46	
For >250 To 500, Deduct	-0.02	
For >500 To 1,000, Deduct	-0.05	
For >1,000 To 2,000, Deduct	-0.07	
For >2,000 To 5,000, Deduct	-0.09	
For >5,000, Deduct	-0.12	
33 13 00 00-0006 LF 8" Diameter Pipe Water Main Disinfection/Sterilization.....	0.60	
For >250 To 500, Deduct	-0.03	
For >500 To 1,000, Deduct	-0.06	
For >1,000 To 2,000, Deduct	-0.09	
For >2,000 To 5,000, Deduct	-0.12	
For >5,000, Deduct	-0.15	
33 13 00 00-0007 LF 10" Diameter Pipe Water Main Disinfection/Sterilization.....	0.70	
For >250 To 500, Deduct	-0.04	
For >500 To 1,000, Deduct	-0.07	
For >1,000 To 2,000, Deduct	-0.11	
For >2,000 To 5,000, Deduct	-0.14	
For >5,000, Deduct	-0.18	
33 13 00 00-0008 LF 12" Diameter Pipe Water Main Disinfection/Sterilization.....	0.92	
For >250 To 500, Deduct	-0.05	
For >500 To 1,000, Deduct	-0.09	
For >1,000 To 2,000, Deduct	-0.14	
For >2,000 To 5,000, Deduct	-0.18	
For >5,000, Deduct	-0.23	

33 16 Water Utility Storage Tanks (33 10)

33 16 13 Aboveground Water Utility Storage Tanks (33 16)

33 16 13 13 Steel Aboveground Water Utility Storage Tanks (33 16 13)

See CSI section 23 13 23 16-0000 for aboveground steel storage tanks.

33 16 16 Underground Water Utility Storage Tanks (33 16)

See CSI section 23 13 13 00-0000 for underground storage tanks.

33 20 Wells (33)

33 21 Water Supply Wells (33 20)

33 21 13 Public Water Supply Wells (33 21)

33 21 13 00-0001 Submersible Well Pumps (33 21 13)

Note: Includes pump end, motor and control box.

33 21 13 00-0002 4" Submersible Well Pumps (33 21 13 00-0001)

33 21 13 00-0003 Powder Coated Case And Cast Iron Ends (33 21 13 00-0002)

33 21 13 00-0004	EA	1/2 HP Submersible Well Pump, 4" Diameter Powder Coated Case And Cast Iron Ends.....	1,100.72	344.09
33 21 13 00-0005	EA	3/4 HP Submersible Well Pump, 4" Diameter Powder Coated Case And Cast Iron Ends.....	1,257.80	381.37
33 21 13 00-0006	EA	1 HP Submersible Well Pump, 4" Diameter Powder Coated Case And Cast Iron Ends.....	1,395.69	423.75

33 21 13 00-0007 Stainless Steel Case And Ends (33 21 13 00-0002)

33 21 13 00-0008	EA	1/2 HP Submersible Well Pump, 4" Diameter Stainless Steel	1,265.75	339.00
33 21 13 00-0009	EA	3/4 HP Submersible Well Pump, 4" Diameter Stainless Steel	1,446.58	381.37
33 21 13 00-0010	EA	1 HP Submersible Well Pump, 4" Diameter Stainless Steel	1,624.01	423.75
33 21 13 00-0011	EA	1-1/2 HP Submersible Well Pump, 4" Diameter Stainless Steel	1,871.52	466.12
33 21 13 00-0012	EA	2 HP Submersible Well Pump, 4" Diameter Stainless Steel	2,129.21	508.49
33 21 13 00-0013	EA	3 HP Submersible Well Pump, 4" Diameter Stainless Steel	2,637.80	593.25
33 21 13 00-0014	EA	5 HP Submersible Well Pump, 4" Diameter Stainless Steel	3,357.75	677.99

33 21 13 00-0015 6" Submersible Well Pumps (33 21 13 00-0001)

33 21 13 00-0016	EA	5 HP Submersible Well Pump, 6" Diameter Stainless Steel	3,155.34	847.49
33 21 13 00-0017	EA	7.5 HP Submersible Well Pump, 6" Diameter Stainless Steel	3,664.95	932.24
33 21 13 00-0018	EA	10 HP Submersible Well Pump, 6" Diameter Stainless Steel	4,196.25	1,016.99
33 21 13 00-0019	EA	15 HP Submersible Well Pump, 6" Diameter Stainless Steel	5,345.67	1,186.49

33 26 Relief Wells (33 20)

33 26 00 00-0001 Drainage Wells (33 26)

33 26 00 00-0002	LF	12" Diameter Drainage Well With Corrugated Metal Liner.....	22.35	
33 26 00 00-0003	LF	18" Diameter Drainage Well With Corrugated Metal Liner.....	26.94	
33 26 00 00-0004	LF	24" Diameter Drainage Well With Corrugated Metal Liner.....	35.41	

33 Utilities**33 30 Sanitary Sewerage Utilities****33 26 Relief Wells**

MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

33 30 Sanitary Sewerage Utilities ⁽³³⁾**33 31 Sanitary Utility Sewerage Piping** ^(33 30)

Note: Piping includes hydrostatic testing, disinfecting and warning tape. Excludes excavation and backfill. See CSI section 31 23 16 00-0000 for excavation, 31 23 16 36-0016 for backfill.

33 31 00 00-0001 Cast Iron Service Saddles With U Bolt ^(33 31)

33 31 00 00-0002	EA	2" Diameter x 2" Tapped Tee Cast Iron Service Saddles With U Bolt.....	84.64	
33 31 00 00-0003	EA	3" Diameter x 1-1/2" Tapped Tee Cast Iron Service Saddles With U Bolt	85.07	
33 31 00 00-0004	EA	3" Diameter x 2" Tapped Tee Cast Iron Service Saddles With U Bolt.....	93.66	
33 31 00 00-0005	EA	4" Diameter x 1-1/2" Tapped Tee Cast Iron Service Saddles With U Bolt	90.57	
33 31 00 00-0006	EA	4" Diameter x 2" Hub Tee Cast Iron Service Saddles With U Bolt	102.13	
33 31 00 00-0007	EA	4" Diameter x 3" Hub Tee Cast Iron Service Saddles With U Bolt	114.77	
33 31 00 00-0008	EA	4" Diameter x 4" Hub Tee Cast Iron Service Saddles With U Bolt	135.92	
33 31 00 00-0009	EA	6" Diameter x 2" Hub Tee Cast Iron Service Saddles With U Bolt	114.89	
33 31 00 00-0010	EA	6" Diameter x 3" Hub Tee Cast Iron Service Saddles With U Bolt	123.03	
33 31 00 00-0011	EA	6" Diameter x 4" Hub Tee Cast Iron Service Saddles With U Bolt	144.92	
33 31 00 00-0012	EA	4" Diameter x 1-1/2" Tapped Wye Cast Iron Service Saddle With U Bolt	93.02	
33 31 00 00-0013	EA	4" Diameter x 2" Tapped Wye Cast Iron Service Saddle With U Bolt	101.61	
33 31 00 00-0014	EA	4" Diameter x 3" Hub Wye Cast Iron Service Saddle With U Bolt	120.49	
33 31 00 00-0015	EA	4" Diameter x 4" Hub Wye Cast Iron Service Saddle With U Bolt	142.95	
33 31 00 00-0016	EA	6" Diameter x 4" Hub Wye Cast Iron Service Saddle With U Bolt	153.67	

33 31 00 00-0017 Plastic Sewer And Drain Piping ^(33 31)**33 31 00 00-0018 Schedule 40 Polyvinyl Chloride (PVC) Sewer And Drain Pipe** ^(33 31 00 00-0017)

33 31 00 00-0019	LF	1-1/2" Schedule 40 Polyvinyl Chloride (PVC) Sewer And Drain Pipe	4.26	2.55
33 31 00 00-0020	LF	2" Schedule 40 Polyvinyl Chloride (PVC) Sewer And Drain Pipe	5.18	3.09
33 31 00 00-0021	LF	3" Schedule 40 Polyvinyl Chloride (PVC) Sewer And Drain Pipe	7.78	4.40
33 31 00 00-0022	LF	4" Schedule 40 Polyvinyl Chloride (PVC) Sewer And Drain Pipe	8.87	4.79
33 31 00 00-0023	LF	6" Schedule 40 Polyvinyl Chloride (PVC) Sewer And Drain Pipe	12.15	6.17
33 31 00 00-0024	LF	8" Schedule 40 Polyvinyl Chloride (PVC) Sewer And Drain Pipe	16.87	8.26
33 31 00 00-0025	LF	10" Schedule 40 Polyvinyl Chloride (PVC) Sewer And Drain Pipe	24.01	10.96

33 31 00 00-0026 Belled End Polyvinyl Chloride (PVC) Sewer And Drain Pipe ^(33 31 00 00-0017)

Note: D-2729 PVC pipe.

33 31 00 00-0027	LF	3" Belled End Polyvinyl Chloride (PVC) Sewer And Drain Pipe	6.94	4.19
33 31 00 00-0028	LF	4" Belled End Polyvinyl Chloride (PVC) Sewer And Drain Pipe	8.69	5.29
33 31 00 00-0029	LF	6" Belled End Polyvinyl Chloride (PVC) Sewer And Drain Pipe	13.40	7.94

33 31 00 00-0030 Polyvinyl Chloride (PVC) Sewer And Drain Fittings ^(33 31 00 00-0017)**33 31 00 00-0031 1/4 Bends, Polyvinyl Chloride (PVC) Sewer And Drain** ^(33 31 00 00-0030)

33 31 00 00-0032	EA	1-1/2" 1/4 Bend, Polyvinyl Chloride (PVC) Sewer And Drain	15.90	10.26
33 31 00 00-0033	EA	2" 1/4 Bend, Polyvinyl Chloride (PVC) Sewer And Drain	20.50	13.28
33 31 00 00-0034	EA	3" 1/4 Bend, Polyvinyl Chloride (PVC) Sewer And Drain	28.72	17.83
33 31 00 00-0035	EA	4" 1/4 Bend, Polyvinyl Chloride (PVC) Sewer And Drain	34.98	20.61
33 31 00 00-0036	EA	6" 1/4 Bend, Polyvinyl Chloride (PVC) Sewer And Drain	65.19	26.78
33 31 00 00-0037	EA	8" 1/4 Bend, Polyvinyl Chloride (PVC) Sewer And Drain	96.82	36.05
33 31 00 00-0038	EA	10" 1/4 Bend, Polyvinyl Chloride (PVC) Sewer And Drain	128.46	48.02

33 31 00 00-0039 1/8 Bends, Polyvinyl Chloride (PVC) Sewer And Drain ^(33 31 00 00-0030)

33 31 00 00-0040	EA	1-1/2" 1/8 Bend, Polyvinyl Chloride (PVC) Sewer And Drain	16.01	10.26
33 31 00 00-0041	EA	2" 1/8 Bend, Polyvinyl Chloride (PVC) Sewer And Drain	20.49	13.28
33 31 00 00-0042	EA	3" 1/8 Bend, Polyvinyl Chloride (PVC) Sewer And Drain	28.55	17.83
33 31 00 00-0043	EA	4" 1/8 Bend, Polyvinyl Chloride (PVC) Sewer And Drain	34.15	20.61
33 31 00 00-0044	EA	6" 1/8 Bend, Polyvinyl Chloride (PVC) Sewer And Drain	63.07	26.78
33 31 00 00-0045	EA	8" 1/8 Bend, Polyvinyl Chloride (PVC) Sewer And Drain	91.91	36.05
33 31 00 00-0046	EA	10" 1/8 Bend, Polyvinyl Chloride (PVC) Sewer And Drain	114.01	48.02

33 31 00 00-0047 Long Sweep 1/4 Bends, Polyvinyl Chloride (PVC) Sewer And Drain ^(33 31 00 00-0030)

33 31 00 00-0048	EA	1-1/2" Long Sweep 1/4 Bend, Polyvinyl Chloride (PVC) Sewer And Drain	17.08	10.11
33 31 00 00-0049	EA	2" Long Sweep 1/4 Bend, Polyvinyl Chloride (PVC) Sewer And Drain	21.30	13.28
33 31 00 00-0050	EA	3" Long Sweep 1/4 Bend, Polyvinyl Chloride (PVC) Sewer And Drain	31.35	18.22
33 31 00 00-0051	EA	4" Long Sweep 1/4 Bend, Polyvinyl Chloride (PVC) Sewer And Drain	41.14	22.23
33 31 00 00-0052	EA	6" Long Sweep 1/4 Bend, Polyvinyl Chloride (PVC) Sewer And Drain	56.27	25.71
33 31 00 00-0053	EA	8" Long Sweep 1/4 Bend, Polyvinyl Chloride (PVC) Sewer And Drain	77.31	29.33
33 31 00 00-0054	EA	10" Long Sweep 1/4 Bend, Polyvinyl Chloride (PVC) Sewer And Drain	107.59	34.20

33 31 00 00-0055 1/16 Bends, Polyvinyl Chloride (PVC) Sewer And Drain ^(33 31 00 00-0030)

33 31 00 00-0056	EA	1-1/2" 1/16 Bend, Polyvinyl Chloride (PVC) Sewer And Drain	16.26	10.26
33 31 00 00-0057	EA	2" 1/16 Bend, Polyvinyl Chloride (PVC) Sewer And Drain	20.74	13.28
33 31 00 00-0058	EA	3" 1/16 Bend, Polyvinyl Chloride (PVC) Sewer And Drain	29.25	17.83



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 31 00 00-0059 EA 4" 1/16 Bend, Polyvinyl Chloride (PVC) Sewer And Drain.....	35.46	20.61
33 31 00 00-0060 EA 6" 1/16 Bend, Polyvinyl Chloride (PVC) Sewer And Drain.....	72.22	26.78
33 31 00 00-0061 EA 8" 1/16 Bend, Polyvinyl Chloride (PVC) Sewer And Drain.....	107.06	36.05
33 31 00 00-0062 EA 10" 1/16 Bend, Polyvinyl Chloride (PVC) Sewer And Drain.....	130.79	48.02
33 31 00 00-0063 Reducers, Polyvinyl Chloride (PVC) Sewer And Drain (33 31 00 00-0030)		
33 31 00 00-0064 EA 2" x 1-1/2" Reducer, Polyvinyl Chloride (PVC) Sewer And Drain.....	20.86	13.28
33 31 00 00-0065 EA 3" x 1-1/2" Reducer, Polyvinyl Chloride (PVC) Sewer And Drain.....	30.51	18.22
33 31 00 00-0066 EA 3" x 2" Reducer, Polyvinyl Chloride (PVC) Sewer And Drain.....	30.00	18.22
33 31 00 00-0067 EA 4" x 2" Reducer, Polyvinyl Chloride (PVC) Sewer And Drain.....	36.07	20.61
33 31 00 00-0068 EA 4" x 3" Reducer, Polyvinyl Chloride (PVC) Sewer And Drain.....	36.31	20.61
33 31 00 00-0069 EA 6" x 4" Reducer, Polyvinyl Chloride (PVC) Sewer And Drain.....	62.22	26.78
33 31 00 00-0070 EA 8" x 6" Reducer, Polyvinyl Chloride (PVC) Sewer And Drain.....	97.56	31.65
33 31 00 00-0071 EA 10" x 4" Reducer, Polyvinyl Chloride (PVC) Sewer And Drain.....	110.74	57.20
33 31 00 00-0072 EA 10" x 6" Reducer, Polyvinyl Chloride (PVC) Sewer And Drain.....	124.72	57.20
33 31 00 00-0073 EA 10" x 8" Reducer, Polyvinyl Chloride (PVC) Sewer And Drain.....	119.19	57.20
33 31 00 00-0074 Sanitary Tees, Polyvinyl Chloride (PVC) Sewer And Drain (33 31 00 00-0030)		
33 31 00 00-0075 EA 1-1/2" Sanitary Tee, Polyvinyl Chloride (PVC) Sewer And Drain.....	24.13	15.52
33 31 00 00-0076 EA 2" Sanitary Tee, Polyvinyl Chloride (PVC) Sewer And Drain.....	31.31	20.07
33 31 00 00-0077 EA 3" Sanitary Tee, Polyvinyl Chloride (PVC) Sewer And Drain.....	43.09	26.48
33 31 00 00-0078 EA 4" Sanitary Tee, Polyvinyl Chloride (PVC) Sewer And Drain.....	55.66	32.89
33 31 00 00-0079 EA 6" Sanitary Tee, Polyvinyl Chloride (PVC) Sewer And Drain.....	91.09	36.05
33 31 00 00-0080 EA 8" Sanitary Tee, Polyvinyl Chloride (PVC) Sewer And Drain.....	119.94	48.02
33 31 00 00-0081 Wyes, Polyvinyl Chloride (PVC) Sewer And Drain (33 31 00 00-0030)		
33 31 00 00-0082 EA 1-1/2" Wye, Polyvinyl Chloride (PVC) Sewer And Drain.....	25.01	15.52
33 31 00 00-0083 EA 2" Wye, Polyvinyl Chloride (PVC) Sewer And Drain.....	31.81	20.07
33 31 00 00-0084 EA 3" Wye, Polyvinyl Chloride (PVC) Sewer And Drain.....	43.74	26.48
33 31 00 00-0085 EA 4" Wye, Polyvinyl Chloride (PVC) Sewer And Drain.....	56.73	32.89
33 31 00 00-0086 EA 6" Wye, Polyvinyl Chloride (PVC) Sewer And Drain.....	87.09	36.05
33 31 00 00-0087 EA 8" Wye, Polyvinyl Chloride (PVC) Sewer And Drain.....	112.34	48.02
33 31 00 00-0088 EA 10" Wye, Polyvinyl Chloride (PVC) Sewer And Drain.....	148.94	64.07
33 31 00 00-0089 Reducing Wyes, Polyvinyl Chloride (PVC) Sewer And Drain (33 31 00 00-0030)		
33 31 00 00-0090 EA 2" x 1-1/2" x 1-1/2" Reducing Wye, Polyvinyl Chloride (PVC) Sewer And Drain.....	26.38	15.52
33 31 00 00-0091 EA 2" x 2" x 1" Reducing Wye, Polyvinyl Chloride (PVC) Sewer And Drain.....	33.15	20.07
33 31 00 00-0092 EA 3" x 3" x 2" Reducing Wye, Polyvinyl Chloride (PVC) Sewer And Drain.....	42.84	26.48
33 31 00 00-0093 EA 4" x 4" x 2" Reducing Wye, Polyvinyl Chloride (PVC) Sewer And Drain.....	55.26	32.89
33 31 00 00-0094 EA 4" x 4" x 3" Reducing Wye, Polyvinyl Chloride (PVC) Sewer And Drain.....	56.26	32.89
33 31 00 00-0095 Double Wyes, Polyvinyl Chloride (PVC) Sewer And Drain (33 31 00 00-0030)		
33 31 00 00-0096 EA 1-1/2" Double Wye, Polyvinyl Chloride (PVC) Sewer And Drain.....	33.79	20.07
33 31 00 00-0097 EA 2" Double Wye, Polyvinyl Chloride (PVC) Sewer And Drain.....	44.55	26.48
33 31 00 00-0098 EA 3" Double Wye, Polyvinyl Chloride (PVC) Sewer And Drain.....	65.98	35.74
33 31 00 00-0099 EA 4" Double Wye, Polyvinyl Chloride (PVC) Sewer And Drain.....	90.01	43.23
33 31 00 00-0100 EA 2" x 2" x 1-1/2" x 1-1/2" Double Wye, Polyvinyl Chloride (PVC) Sewer And Drain.....	44.14	26.48
33 31 00 00-0101 EA 3" x 3" x 2" x 2" Double Wye, Polyvinyl Chloride (PVC) Sewer And Drain.....	62.81	35.74
33 31 00 00-0102 EA 4" x 4" x 3" x 3" Double Wye, Polyvinyl Chloride (PVC) Sewer And Drain.....	84.77	43.23
33 31 00 00-0103 Combination Wye And 1/8 Bends, Polyvinyl Chloride (PVC) Sewer And Drain (33 31 00 00-0030)		
33 31 00 00-0104 EA 1-1/2" Combination Wye And 1/8 Bend, Polyvinyl Chloride (PVC) Sewer And Drain.....	26.10	15.52
33 31 00 00-0105 EA 2" Combination Wye And 1/8 Bend, Polyvinyl Chloride (PVC) Sewer And Drain.....	33.52	20.07
33 31 00 00-0106 EA 3" Combination Wye And 1/8 Bend, Polyvinyl Chloride (PVC) Sewer And Drain.....	48.87	26.48
33 31 00 00-0107 EA 4" Combination Wye And 1/8 Bend, Polyvinyl Chloride (PVC) Sewer And Drain.....	68.24	32.89
33 31 00 00-0108 EA 2" x 2" x 1-1/2" Combination Wye And 1/8 Bend, Polyvinyl Chloride (PVC) Sewer And Drain.....	37.24	20.07
33 31 00 00-0109 EA 3" x 3" x 1-1/2" Combination Wye And 1/8 Bend, Polyvinyl Chloride (PVC) Sewer And Drain.....	52.24	26.48
33 31 00 00-0110 EA 3" x 3" x 2" Combination Wye And 1/8 Bend, Polyvinyl Chloride (PVC) Sewer And Drain.....	47.56	26.48
33 31 00 00-0111 EA 4" x 4" x 2" Combination Wye And 1/8 Bend, Polyvinyl Chloride (PVC) Sewer And Drain.....	66.66	32.89
33 31 00 00-0112 EA 4" x 4" x 3" Combination Wye And 1/8 Bend, Polyvinyl Chloride (PVC) Sewer And Drain.....	68.10	32.89
33 31 00 00-0113 Double Combination Wye And 1/8 Bends, Polyvinyl Chloride (PVC) Sewer And Drain (33 31 00 00-0030)		
33 31 00 00-0114 EA 1-1/2" Double Combination Wye And 1/8 Bend, Polyvinyl Chloride (PVC) Sewer And Drain.....	34.64	20.07
33 31 00 00-0115 EA 2" Double Combination Wye And 1/8 Bend, Polyvinyl Chloride (PVC) Sewer And Drain.....	44.65	26.48
33 31 00 00-0116 EA 3" Double Combination Wye And 1/8 Bend, Polyvinyl Chloride (PVC) Sewer And Drain.....	62.08	35.74
33 31 00 00-0117 EA 4" Double Combination Wye And 1/8 Bend, Polyvinyl Chloride (PVC) Sewer And Drain.....	109.69	43.23
33 31 00 00-0118 EA 6" Double Combination Wye And 1/8 Bend, Polyvinyl Chloride (PVC) Sewer And Drain.....	234.58	47.86
33 31 00 00-0119 Clean Out Tees With Plug, Polyvinyl Chloride (PVC) Sewer And Drain (33 31 00 00-0030)		

33	Utilities
33 30	Sanitary Sewerage Utilities
33 31	Sanitary Utility Sewerage Piping



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 31 00 00-0120 EA 4" Clean Out Tees With Plug, Polyvinyl Chloride (PVC) Sewer And Drain	155.91	85.42
33 31 00 00-0121 EA 6" Clean Out Tees With Plug, Polyvinyl Chloride (PVC) Sewer And Drain	245.92	110.20
33 31 00 00-0122 EA 8" Clean Out Tees With Plug, Polyvinyl Chloride (PVC) Sewer And Drain	333.40	155.30
33 31 00 00-0123 EA 10" Clean Out Tees With Plug, Polyvinyl Chloride (PVC) Sewer And Drain	507.84	249.82
33 31 00 00-0124 Couplings, Polyvinyl Chloride (PVC) Sewer And Drain (33 31 00 00-0030)		
33 31 00 00-0125 EA 1-1/2" Coupling, Polyvinyl Chloride (PVC) Sewer And Drain	15.87	10.26
33 31 00 00-0126 EA 2" Coupling, Polyvinyl Chloride (PVC) Sewer And Drain	20.24	13.20
33 31 00 00-0127 EA 3" Coupling, Polyvinyl Chloride (PVC) Sewer And Drain	27.79	17.67
33 31 00 00-0128 EA 4" Coupling, Polyvinyl Chloride (PVC) Sewer And Drain	32.90	20.61
33 31 00 00-0129 EA 6" Coupling, Polyvinyl Chloride (PVC) Sewer And Drain	51.36	26.78
33 31 00 00-0130 EA 8" Coupling, Polyvinyl Chloride (PVC) Sewer And Drain	86.26	36.05
33 31 00 00-0131 EA 10" Coupling, Polyvinyl Chloride (PVC) Sewer And Drain	121.99	48.02
33 31 00 00-0132 Adapters, Polyvinyl Chloride (PVC) Sewer And Drain (33 31 00 00-0030)		
33 31 00 00-0133 EA 4" Male, Plastic Pipe x Malleable Iron Pipe Adapter, Drain And Sewer Fitting.....	81.59	51.60
33 31 00 00-0134 EA 2" x 3" x 3" Downspout Adapter, Drain And Sewer Fitting	60.24	39.25
33 31 00 00-0135 EA 2" x 3" x 4" Downspout Adapter, Drain And Sewer Fitting	60.85	39.25
33 31 00 00-0136 EA 3" x 4" x 4" Downspout Adapter, Drain And Sewer Fitting	62.49	39.25
33 31 00 00-0137 EA 4" Hub, Cast Iron Pipe x Plastic Pipe Adapter, Drain And Sewer Fitting.....	82.04	51.60
33 31 00 00-0138 EA 4" Spigot, Clay Pipe x Plastic Pipe Adapter, Drain And Sewer Fitting.....	80.73	51.60
33 31 00 00-0139 EA 4" Spigot, Fiberglass Pipe x Plastic Pipe Adapter, Drain And Sewer Fitting.....	78.58	51.60
33 31 00 00-0140 EA 4" Drain Grate, Drain And Sewer Fitting	41.34	26.54
33 31 00 00-0141 Caps, Polyvinyl Chloride (PVC) Sewer And Drain (33 31 00 00-0030)		
33 31 00 00-0142 EA 3" Cap, Polyvinyl Chloride (PVC) Drain And Sewer Fitting	20.33	11.04
33 31 00 00-0143 EA 4" Cap, Polyvinyl Chloride (PVC) Drain And Sewer Fitting	29.08	13.75
33 31 00 00-0144 EA 6" Cap, Polyvinyl Chloride (PVC) Drain And Sewer Fitting	46.93	17.75
33 31 00 00-0145 Plug Cleanout, Polyvinyl Chloride (PVC) Sewer And Drain (33 31 00 00-0030)		
33 31 00 00-0146 EA 1-1/2" Plug Cleanout, Polyvinyl Chloride (PVC) Sewer And Drain.....	16.16	10.26
33 31 00 00-0147 EA 2" Plug Cleanout, Polyvinyl Chloride (PVC) Sewer And Drain	20.91	13.28
33 31 00 00-0148 EA 3" Plug Cleanout, Polyvinyl Chloride (PVC) Sewer And Drain.....	29.21	17.83
33 31 00 00-0149 EA 4" Plug Cleanout, Polyvinyl Chloride (PVC) Sewer And Drain.....	35.55	20.61
33 31 00 00-0150 EA 6" Plug Cleanout, Polyvinyl Chloride (PVC) Sewer And Drain.....	52.53	26.78
33 31 00 00-0151 EA 8" Plug Cleanout, Polyvinyl Chloride (PVC) Sewer And Drain.....	133.38	36.05
33 31 00 00-0152 Gasketed SDR 35 Polyvinyl Chloride (PVC) Pipe (33 31 00 00-0017)		
Note: ASTM 3034.		
33 31 00 00-0153 LF 4" Gasketed SDR 35 Polyvinyl Chloride (PVC) Pipe	8.64	3.79
33 31 00 00-0154 LF 6" Gasketed SDR 35 Polyvinyl Chloride (PVC) Pipe	11.30	4.09
33 31 00 00-0155 LF 8" Gasketed SDR 35 Polyvinyl Chloride (PVC) Pipe	14.56	4.22
33 31 00 00-0156 LF 10" Gasketed SDR 35 Polyvinyl Chloride (PVC) Pipe	19.54	4.97
33 31 00 00-0157 LF 12" Gasketed SDR 35 Polyvinyl Chloride (PVC) Pipe	24.44	5.13
33 31 00 00-0158 LF 15" Gasketed SDR 35 Polyvinyl Chloride (PVC) Pipe	37.92	8.45
33 31 00 00-0159 LF 18" Gasketed SDR 35 Polyvinyl Chloride (PVC) Pipe	51.08	10.87
33 31 00 00-0160 LF 21" Gasketed SDR 35 Polyvinyl Chloride (PVC) Pipe	66.58	12.68
33 31 00 00-0161 LF 24" Gasketed SDR 35 Polyvinyl Chloride (PVC) Pipe	81.08	14.49
33 31 00 00-0162 LF 27" Gasketed SDR 35 Polyvinyl Chloride (PVC) Pipe	98.99	16.29
33 31 00 00-0163 Solvent Weld SDR 35 Polyvinyl Chloride (PVC) Pipe (33 31 00 00-0017)		
Note: ASTM 3034.		
33 31 00 00-0164 LF 4" Solvent Weld SDR 35 Polyvinyl Chloride (PVC) Pipe.....	7.66	3.79
33 31 00 00-0165 LF 6" Solvent Weld SDR 35 Polyvinyl Chloride (PVC) Pipe.....	9.55	4.09
33 31 00 00-0166 LF 8" Solvent Weld SDR 35 Polyvinyl Chloride (PVC) Pipe.....	11.72	4.22
33 31 00 00-0167 Gasketed SDR 35 Polyvinyl Chloride (PVC) Fittings (33 31 00 00-0017)		
Note: ASTM 3034.		
33 31 00 00-0168 1/4 Bends, Gasketed SDR 35 Polyvinyl Chloride (PVC) (33 31 00 00-0167)		
33 31 00 00-0169 EA 4" 1/4 Bend, Gasketed SDR 35 Polyvinyl Chloride (PVC)	49.70	19.55
33 31 00 00-0170 EA 6" 1/4 Bend, Gasketed SDR 35 Polyvinyl Chloride (PVC)	69.37	22.74
33 31 00 00-0171 EA 8" 1/4 Bend, Gasketed SDR 35 Polyvinyl Chloride (PVC)	130.23	25.77
33 31 00 00-0172 EA 10" 1/4 Bend, Gasketed SDR 35 Polyvinyl Chloride (PVC)	343.26	30.31
33 31 00 00-0173 EA 12" 1/4 Bend, Gasketed SDR 35 Polyvinyl Chloride (PVC)	443.19	38.65
33 31 00 00-0174 1/8 Bends, Gasketed SDR 35 Polyvinyl Chloride (PVC) (33 31 00 00-0167)		
33 31 00 00-0175 EA 4" 1/8 Bend, Gasketed SDR 35 Polyvinyl Chloride (PVC)	46.18	19.55
33 31 00 00-0176 EA 6" 1/8 Bend, Gasketed SDR 35 Polyvinyl Chloride (PVC)	65.49	22.74
33 31 00 00-0177 EA 8" 1/8 Bend, Gasketed SDR 35 Polyvinyl Chloride (PVC)	120.43	25.77
33 31 00 00-0178 EA 10" 1/8 Bend, Gasketed SDR 35 Polyvinyl Chloride (PVC)	250.96	30.31
33 31 00 00-0179 EA 12" 1/8 Bend, Gasketed SDR 35 Polyvinyl Chloride (PVC)	355.43	38.65



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 31 00 00-0180 EA 15" 1/8 Bend, Gasketed SDR 35 Polyvinyl Chloride (PVC)	742.59	54.57
33 31 00 00-0181 EA 18" 1/8 Bend, Gasketed SDR 35 Polyvinyl Chloride (PVC)	1,171.84	77.31
33 31 00 00-0182 EA 21" 1/8 Bend, Gasketed SDR 35 Polyvinyl Chloride (PVC)	1,936.92	102.32
33 31 00 00-0183 EA 24" 1/8 Bend, Gasketed SDR 35 Polyvinyl Chloride (PVC)	2,638.91	136.42
33 31 00 00-0184 Sanitary Tees, Gasketed SDR 35 Polyvinyl Chloride (PVC) <small>(33 31 00 00-0167)</small>		
33 31 00 00-0185 EA 4" Sanitary Tees, Gasketed SDR 35 Polyvinyl Chloride (PVC)	75.05	29.34
33 31 00 00-0186 EA 6" x 4" Sanitary Tees, Gasketed SDR 35 Polyvinyl Chloride (PVC)	110.81	32.51
33 31 00 00-0187 EA 6" Sanitary Tees, Gasketed SDR 35 Polyvinyl Chloride (PVC)	122.88	34.11
33 31 00 00-0188 EA 8" x 4" Sanitary Tees, Gasketed SDR 35 Polyvinyl Chloride (PVC)	134.32	35.70
33 31 00 00-0189 EA 8" x 6" Sanitary Tees, Gasketed SDR 35 Polyvinyl Chloride (PVC)	151.37	37.29
33 31 00 00-0190 EA 8" Sanitary Tees, Gasketed SDR 35 Polyvinyl Chloride (PVC)	267.81	38.89
33 31 00 00-0191 EA 10" x 4" Sanitary Tees, Gasketed SDR 35 Polyvinyl Chloride (PVC)	336.22	39.79
33 31 00 00-0192 EA 10" x 6" Sanitary Tees, Gasketed SDR 35 Polyvinyl Chloride (PVC)	378.72	41.69
33 31 00 00-0193 EA 10" x 8" Sanitary Tees, Gasketed SDR 35 Polyvinyl Chloride (PVC)	546.82	43.27
33 31 00 00-0194 EA 10" Sanitary Tees, Gasketed SDR 35 Polyvinyl Chloride (PVC)	705.34	45.47
33 31 00 00-0195 EA 12" x 4" Sanitary Tees, Gasketed SDR 35 Polyvinyl Chloride (PVC)	413.34	48.44
33 31 00 00-0196 EA 12" x 6" Sanitary Tees, Gasketed SDR 35 Polyvinyl Chloride (PVC)	437.85	50.02
33 31 00 00-0197 EA 12" x 8" Sanitary Tees, Gasketed SDR 35 Polyvinyl Chloride (PVC)	611.35	51.61
33 31 00 00-0198 EA 12" x 10" Sanitary Tees, Gasketed SDR 35 Polyvinyl Chloride (PVC)	867.80	53.81
33 31 00 00-0199 EA 12" Sanitary Tees, Gasketed SDR 35 Polyvinyl Chloride (PVC)	976.16	57.99
33 31 00 00-0200 Wyes, Gasketed SDR 35 Polyvinyl Chloride (PVC) <small>(33 31 00 00-0167)</small>		
33 31 00 00-0201 EA 4" Wye, Gasketed SDR 35 Polyvinyl Chloride (PVC)	72.32	29.34
33 31 00 00-0202 EA 6" x 4" Wye, Gasketed SDR 35 Polyvinyl Chloride (PVC)	101.72	32.51
33 31 00 00-0203 EA 6" Wye, Gasketed SDR 35 Polyvinyl Chloride (PVC)	110.67	34.11
33 31 00 00-0204 EA 8" x 4" Wye, Gasketed SDR 35 Polyvinyl Chloride (PVC)	130.42	35.70
33 31 00 00-0205 EA 8" x 6" Wye, Gasketed SDR 35 Polyvinyl Chloride (PVC)	146.72	37.29
33 31 00 00-0206 EA 8" Wye, Gasketed SDR 35 Polyvinyl Chloride (PVC)	212.25	38.89
33 31 00 00-0207 EA 10" x 4" Wye, Gasketed SDR 35 Polyvinyl Chloride (PVC)	310.02	40.10
33 31 00 00-0208 EA 10" x 6" Wye, Gasketed SDR 35 Polyvinyl Chloride (PVC)	316.78	41.69
33 31 00 00-0209 EA 10" x 8" Wye, Gasketed SDR 35 Polyvinyl Chloride (PVC)	463.42	43.27
33 31 00 00-0210 EA 10" Wye, Gasketed SDR 35 Polyvinyl Chloride (PVC)	511.20	45.47
33 31 00 00-0211 EA 12" x 4" Wye, Gasketed SDR 35 Polyvinyl Chloride (PVC)	391.32	48.44
33 31 00 00-0212 EA 12" x 6" Wye, Gasketed SDR 35 Polyvinyl Chloride (PVC)	403.65	50.02
33 31 00 00-0213 EA 12" x 8" Wye, Gasketed SDR 35 Polyvinyl Chloride (PVC)	564.48	51.61
33 31 00 00-0214 EA 12" x 10" Wye, Gasketed SDR 35 Polyvinyl Chloride (PVC)	674.48	53.81
33 31 00 00-0215 EA 12" Wye, Gasketed SDR 35 Polyvinyl Chloride (PVC)	705.48	57.99
33 31 00 00-0216 EA 15" x 10" Wye, Gasketed SDR 35 Polyvinyl Chloride (PVC)	868.25	69.73
33 31 00 00-0217 EA 15" x 12" Wye, Gasketed SDR 35 Polyvinyl Chloride (PVC)	960.93	73.90
33 31 00 00-0218 EA 15" Wye, Gasketed SDR 35 Polyvinyl Chloride (PVC)	1,194.26	81.86
33 31 00 00-0219 Couplings, Gasketed SDR 35 Polyvinyl Chloride (PVC) <small>(33 31 00 00-0167)</small>		
33 31 00 00-0220 EA 4" Coupling, Gasketed SDR 35 Polyvinyl Chloride (PVC)	49.39	19.55
33 31 00 00-0221 EA 6" Coupling, Gasketed SDR 35 Polyvinyl Chloride (PVC)	71.44	22.74
33 31 00 00-0222 EA 8" Coupling, Gasketed SDR 35 Polyvinyl Chloride (PVC)	100.17	25.92
33 31 00 00-0223 EA 10" Coupling, Gasketed SDR 35 Polyvinyl Chloride (PVC)	176.97	30.31
33 31 00 00-0224 EA 12" Coupling, Gasketed SDR 35 Polyvinyl Chloride (PVC)	248.12	38.65
33 31 00 00-0225 EA 15" Coupling, Gasketed SDR 35 Polyvinyl Chloride (PVC)	471.02	54.57
33 31 00 00-0226 EA 18" Coupling, Gasketed SDR 35 Polyvinyl Chloride (PVC)	868.70	77.31
33 31 00 00-0227 EA 21" Coupling, Gasketed SDR 35 Polyvinyl Chloride (PVC)	1,431.41	102.32
33 31 00 00-0228 EA 24" Coupling, Gasketed SDR 35 Polyvinyl Chloride (PVC)	2,064.21	136.42
33 31 00 00-0229 Increaser, Gasketed SDR 35 Polyvinyl Chloride (PVC) <small>(33 31 00 00-0167)</small>		
33 31 00 00-0230 EA 6" x 4" Increaser, Gasketed SDR 35 Polyvinyl Chloride (PVC)	83.46	21.15
33 31 00 00-0231 EA 8" x 4" Increaser, Gasketed SDR 35 Polyvinyl Chloride (PVC)	114.44	22.74
33 31 00 00-0232 EA 8" x 6" Increaser, Gasketed SDR 35 Polyvinyl Chloride (PVC)	120.92	24.33
33 31 00 00-0233 EA 10" x 6" Increaser, Gasketed SDR 35 Polyvinyl Chloride (PVC)	253.14	26.52
33 31 00 00-0234 EA 10" x 8" Increaser, Gasketed SDR 35 Polyvinyl Chloride (PVC)	289.32	28.12
33 31 00 00-0235 EA 12" x 6" Increaser, Gasketed SDR 35 Polyvinyl Chloride (PVC)	322.80	30.70
33 31 00 00-0236 EA 12" x 8" Increaser, Gasketed SDR 35 Polyvinyl Chloride (PVC)	368.48	32.29
33 31 00 00-0237 EA 12" x 10" Increaser, Gasketed SDR 35 Polyvinyl Chloride (PVC)	420.77	34.49
33 31 00 00-0238 EA 15" x 12" Increaser, Gasketed SDR 35 Polyvinyl Chloride (PVC)	629.91	46.61
33 31 00 00-0239 Saddle Wye With Stainless Steel Clamps, SDR 35 Polyvinyl Chloride (PVC) <small>(33 31 00 00-0167)</small>		
33 31 00 00-0240 EA 6" x 4" Saddle Wye With Stainless Steel Clamps, SDR 35 Polyvinyl Chloride (PVC)	72.62	
33 31 00 00-0241 EA 8" x 4" Saddle Wye With Stainless Steel Clamps, SDR 35 Polyvinyl Chloride (PVC)	94.05	
33 31 00 00-0242 EA 8" x 6" Saddle Wye With Stainless Steel Clamps, SDR 35 Polyvinyl Chloride (PVC)	95.73	
33 31 00 00-0243 EA 10" x 4" Saddle Wye With Stainless Steel Clamps, SDR 35 Polyvinyl Chloride (PVC)	149.39	
33 31 00 00-0244 EA 10" x 6" Saddle Wye With Stainless Steel Clamps, SDR 35 Polyvinyl Chloride (PVC)	156.44	
33 31 00 00-0245 EA 10" x 8" Saddle Wye With Stainless Steel Clamps, SDR 35 Polyvinyl Chloride (PVC)	277.73	
33 31 00 00-0246 EA 12" x 4" Saddle Wye With Stainless Steel Clamps, SDR 35 Polyvinyl Chloride (PVC)	171.78	
33 31 00 00-0247 EA 12" x 6" Saddle Wye With Stainless Steel Clamps, SDR 35 Polyvinyl Chloride (PVC)	185.00	
33 31 00 00-0248 EA 12" x 8" Saddle Wye With Stainless Steel Clamps, SDR 35 Polyvinyl Chloride (PVC)	380.81	

33 Utilities**33 30 Sanitary Sewerage Utilities****33 31 Sanitary Utility Sewerage Piping**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 31 00 00-0249 EA 12" x 10" Saddle Wye With Stainless Steel Clamps, SDR 35 Polyvinyl Chloride (PVC).....	444.45	
33 31 00 00-0250 EA 15" x 4" Saddle Wye With Stainless Steel Clamps, SDR 35 Polyvinyl Chloride (PVC).....	204.08	
33 31 00 00-0251 EA 15" x 6" Saddle Wye With Stainless Steel Clamps, SDR 35 Polyvinyl Chloride (PVC).....	215.62	
33 31 00 00-0252 Saddle Tee With Stainless Steel Clamps, SDR 35 Polyvinyl Chloride (PVC) <small>(33 31 00 00-0167)</small>		
33 31 00 00-0253 EA 6" x 4" Saddle Tee With Stainless Steel Clamps, SDR 35 Polyvinyl Chloride (PVC).....	76.57	
33 31 00 00-0254 EA 8" x 4" Saddle Tee With Stainless Steel Clamps, SDR 35 Polyvinyl Chloride (PVC).....	94.05	
33 31 00 00-0255 EA 8" x 6" Saddle Tee With Stainless Steel Clamps, SDR 35 Polyvinyl Chloride (PVC).....	101.10	
33 31 00 00-0256 EA 10" x 4" Saddle Tee With Stainless Steel Clamps, SDR 35 Polyvinyl Chloride (PVC).....	138.93	
33 31 00 00-0257 EA 10" x 6" Saddle Tee With Stainless Steel Clamps, SDR 35 Polyvinyl Chloride (PVC).....	155.59	
33 31 00 00-0258 EA 10" x 8" Saddle Tee With Stainless Steel Clamps, SDR 35 Polyvinyl Chloride (PVC).....	225.08	
33 31 00 00-0259 EA 12" x 4" Saddle Tee With Stainless Steel Clamps, SDR 35 Polyvinyl Chloride (PVC).....	170.94	
33 31 00 00-0260 EA 12" x 6" Saddle Tee With Stainless Steel Clamps, SDR 35 Polyvinyl Chloride (PVC).....	184.20	
33 31 00 00-0261 EA 12" x 8" Saddle Tee With Stainless Steel Clamps, SDR 35 Polyvinyl Chloride (PVC).....	262.94	
33 31 00 00-0262 EA 12" x 10" Saddle Tee With Stainless Steel Clamps, SDR 35 Polyvinyl Chloride (PVC).....	314.33	
33 31 00 00-0263 EA 15" x 4" Saddle Tee With Stainless Steel Clamps, SDR 35 Polyvinyl Chloride (PVC).....	203.57	
33 31 00 00-0264 EA 15" x 6" Saddle Tee With Stainless Steel Clamps, SDR 35 Polyvinyl Chloride (PVC).....	211.71	
33 31 00 00-0265 EA 15" x 8" Saddle Tee With Stainless Steel Clamps, SDR 35 Polyvinyl Chloride (PVC).....	328.14	
33 31 00 00-0266 EA 15" x 10" Saddle Tee With Stainless Steel Clamps, SDR 35 Polyvinyl Chloride (PVC).....	359.15	
33 31 00 00-0267 EA 15" x 12" Saddle Tee With Stainless Steel Clamps, SDR 35 Polyvinyl Chloride (PVC).....	492.44	
33 31 00 00-0268 Couplings And Plug Fittings <small>(33 31)</small>		
33 31 00 00-0269 Cast Iron/Plastic To Cast Iron/Plastic, Elastomeric Polyvinyl Chloride (PVC) Flexible Pipe Couplings <small>(33 31 00 00-0268)</small>		
Note: For cast iron or plastic to cast iron to plastic pipe. Includes stainless steel clamps. Fernco 1056.		
33 31 00 00-0270 EA 1-1/2" Cast Iron/Plastic To Cast Iron/Plastic, Elastomeric Polyvinyl Chloride (PVC) Flexible Pipe Coupling.....	13.48	4.87
33 31 00 00-0271 EA 2" Cast Iron/Plastic To Cast Iron/Plastic, Elastomeric Polyvinyl Chloride (PVC) Flexible Pipe Coupling.....	14.76	5.68
33 31 00 00-0272 EA 3" Cast Iron/Plastic To Cast Iron/Plastic, Elastomeric Polyvinyl Chloride (PVC) Flexible Pipe Coupling.....	17.04	6.50
33 31 00 00-0273 EA 4" Cast Iron/Plastic To Cast Iron/Plastic, Elastomeric Polyvinyl Chloride (PVC) Flexible Pipe Coupling.....	19.27	6.90
33 31 00 00-0274 EA 5" Cast Iron/Plastic To Cast Iron/Plastic, Elastomeric Polyvinyl Chloride (PVC) Flexible Pipe Coupling.....	23.45	7.31
33 31 00 00-0275 EA 6" Cast Iron/Plastic To Cast Iron/Plastic, Elastomeric Polyvinyl Chloride (PVC) Flexible Pipe Coupling.....	27.66	8.12
33 31 00 00-0276 EA 8" Cast Iron/Plastic To Cast Iron/Plastic, Elastomeric Polyvinyl Chloride (PVC) Flexible Pipe Coupling.....	34.97	8.93
33 31 00 00-0277 EA 10" Cast Iron/Plastic To Cast Iron/Plastic, Elastomeric Polyvinyl Chloride (PVC) Flexible Pipe Coupling.....	42.99	9.34
33 31 00 00-0278 EA 12" Cast Iron/Plastic To Cast Iron/Plastic, Elastomeric Polyvinyl Chloride (PVC) Flexible Pipe Coupling.....	82.94	9.74
33 32 Wastewater Utility Pumping Stations <small>(33 30)</small>		
33 32 16 Packaged Utility Wastewater Pumping Stations <small>(33 32)</small>		
33 32 16 13 Packaged Sewage Grinder Pumping Units <small>(33 32 16)</small>		
33 32 16 13-0001 Submersible Grinder Pumps, Cast Iron With Bronze Impeller <small>(33 32 16 13)</small>		
33 32 16 13-0002 EA 2 HP Submersible Grinder Pump, 200/208, 230 Volt, 1 Phase, 3450 RPM, 1-1/2" Threaded Discharge.....	1,897.01	239.71
Note: Zoeller 840 series.		
33 32 16 13-0003 EA 2 HP Submersible Grinder Pump, 200/208, 230, 460 Volt, 3 Phase, 3450 RPM, 1-1/2" Threaded Discharge.....	1,867.71	239.71
Note: Zoeller 840 series.		
33 32 16 13-0004 EA Simplex Control Panel With Auto Reversing Switch.....	920.66	79.88
Note: For Zoeller 840 series grinder pump.		
33 32 16 13-0005 EA Duplex Control Panel With Auto Reversing Switch.....	1,465.22	79.88
Note: For Zoeller 840 series grinder pump.		
33 32 16 13-0006 EA Grinder Pump, 120 Gallon Sewage Basin, 1 HP, 120 V (Environment One 2012-74).....	7,305.25	
33 32 16 13-0007 Submersible Grinder Pumps <small>(33 32 16 13)</small>		
Note: Includes 50' of cord with pumps unless otherwise noted.		
33 32 16 13-0008 EA 2 HP Submersible Grinder Pump @ 3450RPM, Explosion Proof.....	3,317.81	508.49
33 32 16 13-0009 EA 3 HP Submersible Grinder Pump @ 3450RPM, Explosion Proof.....	5,064.07	593.25
33 32 16 13-0010 EA 5 HP Submersible Grinder Pump @ 3450RPM, Explosion Proof.....	6,178.50	762.75
33 39 Sanitary Utility Sewerage Structures <small>(33 30)</small>		
33 39 13 Sanitary Utility Sewerage Manholes, Frames, And Covers <small>(33 39)</small>		
See CSI section 22 13 19 26-0043 for oil interceptors, 22 13 23 00-0000 for sediment interceptors, 31 23 16 00-0000 for excavation, 31 23 16 36-0016 for backfill, 33 44 19 00-0000 for oil separators.		
33 39 13 00-0001 Manholes <small>(33 39 13)</small>		
33 39 13 00-0002 Cast In Place Concrete, 8" Thick <small>(33 39 13 00-0001)</small>		
Note: Includes base, wall, top and block-out for openings.		
33 39 13 00-0003 48" Diameter <small>(33 39 13 00-0002)</small>		
33 39 13 00-0004 EA 4' Diameter x 4' Deep Cast In Place Manhole 8" Thick.....	1,473.42	508.17
33 39 13 00-0005 EA 4' Diameter x 6' Deep Cast In Place Manhole 8" Thick.....	2,030.15	695.25
33 39 13 00-0006 EA 4' Diameter x 8' Deep Cast In Place Manhole 8" Thick.....	2,906.77	1,042.26
33 39 13 00-0007 VLF 4' Diameter x Vertical Linear Foot Depth Cast In Place Manhole 8" Thick, Over 8'.....	359.71	130.34



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 39 13 00-0008 Precast Concrete Manholes <small>(33 39 13 00-0001)</small> Note: Includes base, riser(s), reducer and openings. See CSI section 33 39 13 00-0038 for top slabs.		
33 39 13 00-0009 3' Diameter, 8" Thick Walls, Precast Concrete Manholes <small>(33 39 13 00-0008)</small>		
33 39 13 00-0010 EA 4' Deep x 3' Diameter, 8" Thick Walls, Precast Concrete Manhole.....	915.30	240.52
For 6" Thick Wall, Deduct	-67.48	
33 39 13 00-0011 EA 6' Deep x 3' Diameter, 8" Thick Walls, Precast Concrete Manhole.....	1,274.93	328.92
For 6" Thick Wall, Deduct	-94.60	
33 39 13 00-0012 EA 8' Deep x 3' Diameter, 8" Thick Walls, Precast Concrete Manhole.....	1,786.69	493.37
For 6" Thick Wall, Deduct	-129.33	
33 39 13 00-0013 VLF Vertical Linear Foot Depth Over 8', x 3' Diameter, 8" Thick Walls, Precast Concrete Manhole.....	220.49	65.79
For 6" Thick Wall, Deduct	-15.88	
33 39 13 00-0014 3'-6" Diameter, 8" Thick Walls, Precast Concrete Manholes <small>(33 39 13 00-0008)</small>		
33 39 13 00-0015 EA 4' Deep x 3'-6" Diameter, 8" Thick Walls, Precast Concrete Manhole	1,021.60	250.80
For 6" Thick Wall, Deduct	-77.08	
33 39 13 00-0016 EA 6' Deep x 3'-6" Diameter, 8" Thick Walls, Precast Concrete Manhole	1,419.07	342.89
For 6" Thick Wall, Deduct	-107.62	
33 39 13 00-0017 EA 8' Deep x 3'-6" Diameter, 8" Thick Walls, Precast Concrete Manhole	1,974.40	513.93
For 6" Thick Wall, Deduct	-146.05	
33 39 13 00-0018 VLF Vertical Linear Foot Depth Over 8', x 3'-6" Diameter, 8" Thick Walls, Precast Concrete Manhole.....	242.72	65.79
For 6" Thick Wall, Deduct	-17.86	
33 39 13 00-0019 4' Diameter, 8" Thick Walls, Precast Concrete Manholes <small>(33 39 13 00-0008)</small>		
33 39 13 00-0020 EA 4' Deep x 4' Diameter, 8" Thick Walls, Precast Concrete Manhole.....	1,130.84	259.02
For 6" Thick Wall, Deduct	-87.01	
33 39 13 00-0021 EA 6' Deep x 4' Diameter, 8" Thick Walls, Precast Concrete Manhole.....	1,565.89	353.59
For 6" Thick Wall, Deduct	-120.96	
33 39 13 00-0022 EA 8' Deep x 4' Diameter, 8" Thick Walls, Precast Concrete Manhole.....	2,166.05	534.49
For 6" Thick Wall, Deduct	-163.16	
33 39 13 00-0023 VLF Vertical Linear Foot Depth Over 8', x 4' Diameter, 8" Thick Walls, Precast Concrete Manhole.....	265.67	67.83
For 6" Thick Wall, Deduct	-19.89	
33 39 13 00-0024 VLF Vertical Linear Foot Depth x 4' Diameter, 8" Thick Walls, Precast Manhole Polyvinyl Chloride (PVC) Lined Riser / Cone.....	316.17	67.83
For 6" Thick Wall, Deduct	-24.94	
33 39 13 00-0025 5' Diameter, 8" Thick Walls, Precast Concrete Manholes <small>(33 39 13 00-0008)</small>		
33 39 13 00-0026 EA 4' Deep x 5' Diameter, 8" Thick Walls, Precast Concrete Manhole.....	1,377.14	287.80
For 6" Thick Wall, Deduct	-108.85	
33 39 13 00-0027 EA 6' Deep x 5' Diameter, 8" Thick Walls, Precast Concrete Manhole.....	1,892.97	394.70
For 6" Thick Wall, Deduct	-149.88	
33 39 13 00-0028 EA 8' Deep x 5' Diameter, 8" Thick Walls, Precast Concrete Manhole.....	2,591.83	592.06
For 6" Thick Wall, Deduct	-200.06	
33 39 13 00-0029 VLF Vertical Linear Foot Depth Over 8', x 5' Diameter, 8" Thick Walls, Precast Concrete Manhole.....	316.20	74.01
For 6" Thick Wall, Deduct	-24.22	
33 39 13 00-0030 VLF Vertical Linear Foot Depth x 5' Diameter, 8" Thick Walls, Precast Manhole Polyvinyl Chloride (PVC) Lined Riser / Cone.....	370.77	74.01
For 6" Thick Wall, Deduct	-29.68	
33 39 13 00-0031 6' Diameter, 8" Thick Walls, Precast Concrete Manholes <small>(33 39 13 00-0008)</small>		
33 39 13 00-0032 EA 4' Deep x 6' Diameter, 8" Thick Walls, Precast Concrete Manhole.....	1,646.52	320.70
33 39 13 00-0033 EA 6' Deep x 6' Diameter, 8" Thick Walls, Precast Concrete Manhole.....	2,247.55	435.82
33 39 13 00-0034 EA 8' Deep x 6' Diameter, 8" Thick Walls, Precast Concrete Manhole.....	3,053.50	657.83
33 39 13 00-0035 VLF Vertical Linear Foot Depth Over 8', x 6' Diameter, 8" Thick Walls, Precast Concrete Manhole.....	370.16	82.23
33 39 13 00-0036 VLF Vertical Linear Foot Depth x 6' Diameter, 8" Thick Walls, Precast Manhole Polyvinyl Chloride (PVC) Lined Riser / Cone.....	420.66	82.23
33 39 13 00-0037 Manhole Accessories <small>(33 39 13)</small>		
33 39 13 00-0038 Precast Concrete Manhole Tops <small>(33 39 13 00-0037)</small>		
33 39 13 00-0039 Precast Concrete Manhole Slab Tops <small>(33 39 13 00-0038)</small>		
33 39 13 00-0040 EA 3' Diameter x 8" Thick Precast Manhole Top Slab.....	383.82	61.67
33 39 13 00-0041 EA 3'-6" Diameter x 8" Thick Precast Manhole Top Slab	444.00	64.14
33 39 13 00-0042 EA 4' Diameter x 8" Thick Precast Manhole Top Slab.....	510.93	66.61
33 39 13 00-0043 EA 5' Diameter x 8" Thick Precast Manhole Top Slab.....	665.88	71.53
33 39 13 00-0044 EA 6' Diameter x 8" Thick Precast Manhole Top Slab.....	785.40	76.47
33 39 13 00-0045 Precast Concrete Manhole Cone Tops <small>(33 39 13 00-0038)</small>		
33 39 13 00-0046 EA 3' Diameter x 8" Thick Precast Manhole Top Cone	582.63	77.09
33 39 13 00-0047 EA 3'-6" Diameter x 8" Thick Precast Manhole Top Cone	640.67	80.17
33 39 13 00-0048 EA 4' Diameter x 8" Thick Precast Manhole Top Cone	698.73	83.26
33 39 13 00-0049 EA 5' Diameter x 8" Thick Precast Manhole Top Cone	810.70	88.39
33 39 13 00-0050 EA 6' Diameter x 8" Thick Precast Manhole Top Cone	926.79	94.57

33 Utilities**33 30 Sanitary Sewerage Utilities****33 39 Sanitary Utility Sewerage Structures**
 MINOR
 CSI UOM DESCRIPTION

 TOTAL DIRECT DEMOLITION
 UNIT COST UNIT COST

33 39 13 00-0051	Pipe To Manhole Connector <small>(33 39 13 00-0037)</small>		
33 39 13 00-0052	Ethylene Propylene Diene Monomer (EPDM) Pipe To Manhole Boot Connectors <small>(33 39 13 00-0051)</small>		
33 39 13 00-0053	EA 4" Ethylene Propylene Diene Monomer (EPDM) Pipe To Manhole Boot Connector.....	53.27	
33 39 13 00-0054	EA 6" Ethylene Propylene Diene Monomer (EPDM) Pipe To Manhole Boot Connector.....	75.94	
33 39 13 00-0055	EA 8" Ethylene Propylene Diene Monomer (EPDM) Pipe To Manhole Boot Connector.....	85.73	
33 39 13 00-0056	EA 10" Ethylene Propylene Diene Monomer (EPDM) Pipe To Manhole Boot Connector.....	125.78	
33 39 13 00-0057	EA 12" Ethylene Propylene Diene Monomer (EPDM) Pipe To Manhole Boot Connector.....	174.18	
33 39 13 00-0058	EA 15" Ethylene Propylene Diene Monomer (EPDM) Pipe To Manhole Boot Connector.....	232.04	
33 39 13 00-0059	EA 18" Ethylene Propylene Diene Monomer (EPDM) Pipe To Manhole Boot Connector.....	408.75	
33 39 13 00-0060	EA 21" Ethylene Propylene Diene Monomer (EPDM) Pipe To Manhole Boot Connector.....	565.45	
33 39 13 00-0061	EA 24" Ethylene Propylene Diene Monomer (EPDM) Pipe To Manhole Boot Connector.....	880.97	
33 39 13 00-0062	EA 27" Ethylene Propylene Diene Monomer (EPDM) Pipe To Manhole Boot Connector.....	1,040.66	
33 39 13 00-0063	Elastomeric Polyvinyl Chloride (PVC) Flexible Manhole Adapter And Grout <small>(33 39 13 00-0051)</small> Note: Fernco CMA.		
33 39 13 00-0064	EA 4" Elastomeric Polyvinyl Chloride (PVC) Flexible Manhole Adapter And Grout.....	74.98	
33 39 13 00-0065	EA 6" Elastomeric Polyvinyl Chloride (PVC) Flexible Manhole Adapter And Grout.....	103.20	
33 39 13 00-0066	EA 8" Elastomeric Polyvinyl Chloride (PVC) Flexible Manhole Adapter And Grout.....	130.11	
33 39 13 00-0067	EA 10" Elastomeric Polyvinyl Chloride (PVC) Flexible Manhole Adapter And Grout.....	156.93	
33 39 13 00-0068	EA 12" Elastomeric Polyvinyl Chloride (PVC) Flexible Manhole Adapter And Grout.....	182.26	
33 39 13 00-0069	Brick And Grout Pipe To Manhole Connector <small>(33 39 13 00-0051)</small>		
33 39 13 00-0070	EA Seal Gap Between Pipe And Structure With Brick And Grout.....	160.13	
33 39 13 00-0071	Inverts For Manholes <small>(33 39 13 00-0037)</small>		
33 39 13 00-0072	EA Single Channel Concrete Invert For Manholes.....	291.51	
33 39 13 00-0073	EA Double Channel Concrete Invert For Manholes.....	421.99	
33 39 13 00-0074	EA Triple Channel Concrete Invert For Manholes.....	567.79	
33 39 13 00-0075	EA Quad Channel Concrete Invert For Manholes.....	713.56	
33 39 13 00-0076	EA Single Channel Brick Invert For Manholes.....	400.36	
33 39 13 00-0077	EA Double Channel Brick Invert For Manholes.....	599.77	
33 39 13 00-0078	EA Triple Channel Brick Invert For Manholes.....	802.72	
33 39 13 00-0079	EA Quad Channel Brick Invert For Manholes.....	1,002.86	
33 39 13 00-0080	Steps For Cast-In-Place Manholes <small>(33 39 13 00-0037)</small> See CSI section 33 01 30 73-0058 for installation of steps in existing manholes.		
33 39 13 00-0081	EA Cast Iron Manhole Step For New Manholes.....	51.41	
33 39 13 00-0082	EA Galvanized Steel Manhole Step For New Manholes.....	38.67	
33 39 13 00-0083	EA Aluminum Manhole Step For New Manholes.....	36.19	
33 39 13 00-0084	EA Polypropylene Manhole Step For New Manholes.....	30.63	
33 39 13 00-0085	Protective Coating For New Manholes <small>(33 39 13 00-0037)</small>		
33 39 13 00-0086	Polyurethane Protective Coating For New Manholes <small>(33 39 13 00-0085)</small>		
33 39 13 00-0087	VLF 60 Mil Polyurethane Coating Of 3' Diameter Manhole Interior.....	133.49	
	For 80 Mil Material, Add	17.92	
	For 100 Mil Material, Add	35.83	
	For 125 Mil Material, Add	56.30	
	For 150 Mil Material, Add	76.77	
	For 200 Mil Material, Add	112.56	
	For 2 To 5 Manholes, Deduct	-9.25	
	For 6 To 10 Manholes, Deduct	-15.16	
	For >10 Manholes, Deduct	-30.31	
33 39 13 00-0088	VLF 60 Mil Polyurethane Coating Of 3-1/2' Diameter Manhole Interior.....	161.47	
	For 80 Mil Material, Add	21.34	
	For 100 Mil Material, Add	42.68	
	For 125 Mil Material, Add	67.00	
	For 150 Mil Material, Add	91.32	
	For 200 Mil Material, Add	133.67	
	For 2 To 5 Manholes, Deduct	-11.22	
	For 6 To 10 Manholes, Deduct	-18.40	
	For >10 Manholes, Deduct	-36.79	
33 39 13 00-0089	VLF 60 Mil Polyurethane Coating Of 4' Diameter Manhole Interior.....	177.98	
	For 80 Mil Material, Add	23.89	
	For 100 Mil Material, Add	47.78	
	For 125 Mil Material, Add	75.07	
	For 150 Mil Material, Add	102.35	
	For 200 Mil Material, Add	150.07	
	For 2 To 5 Manholes, Deduct	-12.33	
	For 6 To 10 Manholes, Deduct	-20.21	
	For >10 Manholes, Deduct	-40.42	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 39 13 00-0090 VLF 60 Mil Polyurethane Coating Of 5' Diameter Manhole Interior	222.50	
<i>For 80 Mil Material, Add</i>	29.87	
<i>For 100 Mil Material, Add</i>	59.74	
<i>For 125 Mil Material, Add</i>	93.86	
<i>For 150 Mil Material, Add</i>	127.99	
<i>For 200 Mil Material, Add</i>	187.66	
<i>For 2 To 5 Manholes, Deduct</i>	-15.41	
<i>For 6 To 10 Manholes, Deduct</i>	-25.26	
<i>For >10 Manholes, Deduct</i>	-50.52	
33 39 13 00-0091 VLF 60 Mil Polyurethane Coating Of 6' Diameter Manhole Interior	257.86	
<i>For 80 Mil Material, Add</i>	35.16	
<i>For 100 Mil Material, Add</i>	70.31	
<i>For 125 Mil Material, Add</i>	110.57	
<i>For 150 Mil Material, Add</i>	150.83	
<i>For 200 Mil Material, Add</i>	221.52	
<i>For 2 To 5 Manholes, Deduct</i>	-17.81	
<i>For 6 To 10 Manholes, Deduct</i>	-29.17	
<i>For >10 Manholes, Deduct</i>	-58.34	
33 39 13 00-0092 Polyvinyl Chloride (PVC) Liner <small>(33 39 13 00-0085)</small>		
Note: For new manholes and shop applied.		
33 39 13 00-0093 VLF 3' Diameter Polyvinyl Chloride (PVC) Liner For New Manhole	143.86	
33 39 13 00-0094 VLF 3-1/2' Diameter Polyvinyl Chloride (PVC) Liner For New Manhole	176.34	
33 39 13 00-0095 VLF 4' Diameter Polyvinyl Chloride (PVC) Liner For New Manhole	215.19	
33 39 13 00-0096 VLF 5' Diameter Polyvinyl Chloride (PVC) Liner For New Manhole	270.24	
33 39 13 00-0097 VLF 6' Diameter Polyvinyl Chloride (PVC) Liner For New Manhole	325.28	
33 39 13 00-0098 SF Polyvinyl Chloride (PVC) Liner At Structures	22.58	
33 39 13 00-0099 Concrete Grade Extensions/Grade Rings <small>(33 39 13 00-0037)</small>		
33 39 13 00-0100 18" Diameter <small>(33 39 13 00-0099)</small>		
33 39 13 00-0101 EA 4" High, 8" Wall, 18" Diameter Concrete Grade Extension	70.68	
33 39 13 00-0102 EA 6" High, 8" Wall, 18" Diameter Concrete Grade Extension	77.42	
33 39 13 00-0103 EA 8" High, 8" Wall, 18" Diameter Concrete Grade Extension	84.16	
33 39 13 00-0104 EA 10" High, 8" Wall, 18" Diameter Concrete Grade Extension	89.77	
33 39 13 00-0105 24" Diameter <small>(33 39 13 00-0099)</small>		
33 39 13 00-0106 EA 4" High, 8" Wall, 24" Diameter Concrete Grade Extension	79.39	
33 39 13 00-0107 EA 6" High, 8" Wall, 24" Diameter Concrete Grade Extension	87.05	
33 39 13 00-0108 EA 8" High, 8" Wall, 24" Diameter Concrete Grade Extension	94.70	
33 39 13 00-0109 EA 10" High, 8" Wall, 24" Diameter Concrete Grade Extension	102.36	
33 39 13 00-0110 30" Diameter <small>(33 39 13 00-0099)</small>		
33 39 13 00-0111 EA 4" High, 8" Wall, 30" Diameter Concrete Grade Extension	87.91	
33 39 13 00-0112 EA 6" High, 8" Wall, 30" Diameter Concrete Grade Extension	96.45	
33 39 13 00-0113 EA 8" High, 8" Wall, 30" Diameter Concrete Grade Extension	104.99	
33 39 13 00-0114 EA 10" High, 8" Wall, 30" Diameter Concrete Grade Extension	113.52	
33 39 13 00-0115 Bentonite Collar <small>(33 39 13 00-0037)</small>		
33 39 13 00-0116 Bentonite Collar At Manhole Connections <small>(33 39 13 00-0115)</small>		
33 39 13 00-0117 EA Up To 12" Pipe, Bentonite Collar At Manhole Connection	93.66	
33 39 13 00-0118 EA >12" To 21", Bentonite Collar At Manhole Connection	148.52	
33 39 13 00-0119 EA >21" To 30" Pipe, Bentonite Collar At Manhole Connection	236.86	
33 39 13 00-0120 EA >30" To 36" Pipe, Bentonite Collar At Manhole Connection	555.39	
33 39 13 00-0121 EA >36" To 48" Pipe, Bentonite Collar At Manhole Connection	856.28	
33 39 13 00-0122 EA >48" To 60" Pipe, Bentonite Collar At Manhole Connection	1,551.94	
33 39 13 00-0123 Manhole Covers And Frames <small>(33 39 13)</small>		
Note: Includes moisture-tight masonry joints and waterproof grouting.		
33 39 13 00-0124 Regular Manhole Covers And Frames, City Type <small>(33 39 13 00-0123)</small>		
33 39 13 00-0125 EA 18" Square x 75 LB Regular Cast Iron Manhole Cover With Frame, City Type	445.03	70.71
<i>For Malleable Iron Castings, Add</i>	69.37	
<i>For Ductile Iron Castings, Add</i>	161.87	
<i>For Heavy Duty, Add</i>	166.45	
33 39 13 00-0126 EA 18" Diameter x 100 LB Regular Cast Iron Manhole Cover With Frame, City Type	659.14	70.71
<i>For Malleable Iron Castings, Add</i>	133.61	
<i>For Ductile Iron Castings, Add</i>	311.75	
<i>For Heavy Duty, Add</i>	241.39	
33 39 13 00-0127 EA 24" Square x 126 LB Regular Cast Iron Manhole Cover With Frame, City Type	673.45	77.29
<i>For Malleable Iron Castings, Add</i>	132.32	
<i>For Ductile Iron Castings, Add</i>	308.75	
<i>For Heavy Duty, Add</i>	247.33	

33 Utilities**33 30 Sanitary Sewerage Utilities****33 39 Sanitary Utility Sewerage Structures**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 39 13 00-0128 EA 24" Diameter x 200 LB Regular Cast Iron Manhole Cover With Frame, City Type	694.86	77.29
For Malleable Iron Castings, Add	138.74	
For Ductile Iron Castings, Add	323.74	
For Heavy Duty, Add	254.82	
33 39 13 00-0129 EA 24" Diameter x 300 LB Regular Cast Iron Manhole Cover With Frame, City Type	756.27	82.23
For Malleable Iron Castings, Add	152.87	
For Ductile Iron Castings, Add	356.71	
For Heavy Duty, Add	277.03	
33 39 13 00-0130 EA 24" Diameter x 400 LB Regular Cast Iron Manhole Cover With Frame, City Type	832.92	91.27
For Malleable Iron Castings, Add	167.65	
For Ductile Iron Castings, Add	391.18	
For Heavy Duty, Add	305.23	
33 39 13 00-0131 EA 24" Square x 500 LB Regular Cast Iron Manhole Cover With Frame, City Type	976.37	91.27
For Malleable Iron Castings, Add	210.68	
For Ductile Iron Castings, Add	491.60	
For Heavy Duty, Add	355.43	
33 39 13 00-0132 EA 26" Diameter x 475 LB Regular Cast Iron Manhole Cover With Frame, City Type	971.65	98.67
For Malleable Iron Castings, Add	202.34	
For Ductile Iron Castings, Add	472.12	
For Heavy Duty, Add	354.94	
33 39 13 00-0133 EA 30" Diameter x 620 LB Regular Cast Iron Manhole Cover With Frame, City Type	1,098.42	102.79
For Malleable Iron Castings, Add	237.02	
For Ductile Iron Castings, Add	553.05	
For Heavy Duty, Add	399.86	
33 39 13 00-0134 Watertight Type Manhole Covers And Frames (33 39 13 00-0123)		
33 39 13 00-0135 EA 20" Diameter x 200 LB Watertight Manhole Cover With Frame	675.59	58.39
For Malleable Iron Castings, Add	132.96	
For Ductile Iron Castings, Add	310.25	
33 39 13 00-0136 EA 22" Diameter x 300 LB Watertight Manhole Cover With Frame	861.82	58.39
For Malleable Iron Castings, Add	183.09	
For Ductile Iron Castings, Add	427.20	
33 39 13 00-0137 EA 24" Diameter x 350 LB Watertight Manhole Cover With Frame	967.79	68.25
For Malleable Iron Castings, Add	208.11	
For Ductile Iron Castings, Add	485.59	
33 39 13 00-0138 EA 26" Diameter x 500 LB Watertight Manhole Cover With Frame	1,188.22	76.47
For Malleable Iron Castings, Add	267.31	
For Ductile Iron Castings, Add	623.71	
33 39 13 00-0139 EA 30" Diameter x 550 LB Watertight Manhole Cover With Frame	1,152.58	78.11
For Malleable Iron Castings, Add	253.27	
For Ductile Iron Castings, Add	590.96	
33 39 13 00-0140 EA 32" Diameter x 575 LB Watertight Manhole Cover With Frame	1,238.00	79.77
For Malleable Iron Castings, Add	277.68	
For Ductile Iron Castings, Add	647.93	
33 39 13 00-0141 EA 36" Diameter x 600 LB Watertight Manhole Cover With Frame	1,404.93	82.23
For Malleable Iron Castings, Add	326.51	
For Ductile Iron Castings, Add	761.85	
33 39 13 00-0142 Aluminum Manhole Covers And Frames (33 39 13 00-0123)		
33 39 13 00-0143 EA 12" Square Aluminum Manhole Cover With Frame	375.07	24.10
33 39 13 00-0144 EA 18" Square Aluminum Manhole Cover With Frame	644.37	26.69
33 39 13 00-0145 EA 24" Square Aluminum Manhole Cover With Frame	904.86	30.99
33 39 13 00-0146 Remove And Reinstall Manhole Cover And Frame (33 39 13 00-0123)		
Note: Includes surrounding asphalt removal and repair. Excludes saw cutting.		
33 39 13 00-0147 EA Remove And Reinstall Manhole Cover And Frame.....	329.69	
33 39 13 00-0148 Rainguard Inflow Protectors (33 39 13 00-0123)		
33 39 13 00-0149 EA 18" Diameter Acrylonitrile Butadiene Styrene (ABS) Rainguard Inflow Protectors.....	98.35	18.61
33 39 13 00-0150 EA 22" Diameter Acrylonitrile Butadiene Styrene (ABS) Rainguard Inflow Protectors.....	110.06	18.61
33 39 13 00-0151 EA 24" Diameter Acrylonitrile Butadiene Styrene (ABS) Rainguard Inflow Protectors.....	131.69	22.34
33 39 13 00-0152 EA 26" Diameter Acrylonitrile Butadiene Styrene (ABS) Rainguard Inflow Protectors.....	139.09	22.34
33 39 13 00-0153 EA 30" Diameter Acrylonitrile Butadiene Styrene (ABS) Rainguard Inflow Protectors.....	170.47	26.06
33 39 13 00-0154 EA 32" Diameter Acrylonitrile Butadiene Styrene (ABS) Rainguard Inflow Protectors.....	179.56	26.06
33 39 13 00-0155 Waste Water Collection System Taps (33 39 13)		
Note: For tapping existing structures only. Includes grout.		
33 39 13 00-0156 Brick Manhole Taps (33 39 13 00-0155)		
33 39 13 00-0157 EA 4" Tap In 6" Brick Manhole.....	384.97	
33 39 13 00-0158 EA 6" Tap In 6" Brick Manhole.....	431.60	
33 39 13 00-0159 EA 8" Tap In 6" Brick Manhole.....	477.39	
33 39 13 00-0160 EA 10" Tap In 6" Brick Manhole.....	523.09	
33 39 13 00-0161 EA 12" Tap In 6" Brick Manhole.....	574.52	
33 39 13 00-0162 EA 15" Tap In 6" Brick Manhole.....	620.12	
33 39 13 00-0163 Precast Concrete Manhole Tap (33 39 13 00-0155)		



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 39 13 00-0164 EA 4" Tap In 8" Thick Precast Concrete Manhole	574.72	
33 39 13 00-0165 EA 6" Tap In 8" Thick Precast Concrete Manhole	644.65	
33 39 13 00-0166 EA 8" Tap In 8" Thick Precast Concrete Manhole	719.56	
33 39 13 00-0167 EA 10" Tap In 8" Thick Precast Concrete Manhole	788.10	
33 39 13 00-0168 EA 12" Tap In 8" Thick Precast Concrete Manhole	856.52	
33 39 13 00-0169 EA 15" Tap In 8" Thick Precast Concrete Manhole	926.59	

33 40 Storm Drainage Utilities ⁽³³⁾

33 41 Storm Utility Drainage Piping ^(33 40)

Note: Piping includes hydrostatic testing, disinfecting and warning tape. See CSI section 31 23 16 00-0000 for excavation, 31 23 16 36-0016 for backfill.

33 41 13 Public Storm Utility Drainage Piping ^(33 41)

33 41 13 00-0001 Reinforced Concrete Piping ^(33 41 13)

33 41 13 00-0002 Class 3 Reinforced Concrete Pipe Without Gaskets ^(33 41 13 00-0001)

33 41 13 00-0003	LF	12" Diameter Class 3 Reinforced Concrete Pipe Without Gaskets	34.65	
		<i>For >1,000, Deduct</i>	-1.73	
		<i>For Class 4, Add</i>	1.51	
		<i>For Class 5, Add</i>	4.78	
33 41 13 00-0004	LF	15" Diameter Class 3 Reinforced Concrete Pipe Without Gaskets	41.22	14.59
		<i>For >1,000, Deduct</i>	-2.06	
		<i>For Class 4, Add</i>	1.94	
		<i>For Class 5, Add</i>	6.11	
33 41 13 00-0005	LF	18" Diameter Class 3 Reinforced Concrete Pipe Without Gaskets	47.43	18.20
		<i>For >1,000, Deduct</i>	-2.37	
		<i>For Class 4, Add</i>	2.04	
		<i>For Class 5, Add</i>	6.43	
33 41 13 00-0006	LF	21" Diameter Class 3 Reinforced Concrete Pipe Without Gaskets	60.65	22.95
		<i>For >1,000, Deduct</i>	-3.03	
		<i>For Class 4, Add</i>	2.65	
		<i>For Class 5, Add</i>	8.36	
33 41 13 00-0007	LF	24" Diameter Class 3 Reinforced Concrete Pipe Without Gaskets	71.35	27.87
		<i>For >1,000, Deduct</i>	-3.57	
		<i>For Class 4, Add</i>	3.00	
		<i>For Class 5, Add</i>	9.46	

33 41 13 00-0008 Concrete Reducing Wye Without Gaskets ^(33 41 13 00-0001)

33 41 13 00-0009	EA	12" Concrete Reducing Wye Without Gaskets	386.83	49.96
33 41 13 00-0010	EA	15" Concrete Reducing Wye Without Gaskets	464.23	60.89
33 41 13 00-0011	EA	18" Concrete Reducing Wye Without Gaskets	570.99	67.14
33 41 13 00-0012	EA	21" Concrete Reducing Wye Without Gaskets	657.30	82.75
33 41 13 00-0013	EA	24" Concrete Reducing Wye Without Gaskets	744.84	99.93

33 41 13 00-0014 Concrete Pipe Joint Gaskets ^(33 41 13 00-0001)

33 41 13 00-0015	EA	12" Diameter Concrete Pipe Joint Gasket	3.53	
33 41 13 00-0016	EA	15" Diameter Concrete Pipe Joint Gasket	4.18	
33 41 13 00-0017	EA	18" Diameter Concrete Pipe Joint Gasket	4.84	
33 41 13 00-0018	EA	21" Diameter Concrete Pipe Joint Gasket	5.85	
33 41 13 00-0019	EA	24" Diameter Concrete Pipe Joint Gasket	6.85	

33 41 13 00-0020 Precast Concrete End Sections ^(33 41 13 00-0001)

33 41 13 00-0021 Precast Concrete End Sections ^(33 41 13 00-0020)

33 41 13 00-0022	EA	12" Diameter Pipe, Precast Concrete End Section	592.58	91.57
33 41 13 00-0023	EA	15" Diameter Pipe, Precast Concrete End Section	797.11	113.35
33 41 13 00-0024	EA	18" Diameter Pipe, Precast Concrete End Section	986.41	143.48
33 41 13 00-0025	EA	21" Diameter Pipe, Precast Concrete End Section	1,130.82	171.59
33 41 13 00-0026	EA	24" Diameter Pipe, Precast Concrete End Section	1,199.06	198.60

33 41 13 00-0027 Flared Precast Concrete End Sections ^(33 41 13 00-0020)

33 41 13 00-0028	EA	12" Diameter Pipe, Flared Precast Concrete End Section	745.24	95.11
33 41 13 00-0029	EA	15" Diameter Pipe, Flared Precast Concrete End Section	896.79	118.53
33 41 13 00-0030	EA	18" Diameter Pipe, Flared Precast Concrete End Section	1,087.49	150.05
33 41 13 00-0031	EA	21" Diameter Pipe, Flared Precast Concrete End Section	1,241.05	179.44
33 41 13 00-0032	EA	24" Diameter Pipe, Flared Precast Concrete End Section	1,516.62	207.69

33 41 13 00-0033 Prestressed Concrete Cylinder Piping ^(33 41 13)

33 41 13 00-0034 150 PSI Prestressed Concrete Cylinder Pipe And Fittings ^(33 41 13 00-0033)

33 41 13 00-0035 150 PSI Prestressed Concrete Cylinder Pipe With Gaskets ^(33 41 13 00-0034)

Note: Lined-cylinder pipe (AWWA C301) up to 48". Embedded-cylinder pipe (AWWA C301) >48".

33	Utilities
33 40	Storm Drainage Utilities
33 41	Storm Utility Drainage Piping



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
	33 41 13 00-0036	LF	12" 150 PSI Prestressed Concrete Cylinder Pipe With Gaskets..... <i>For >1,000, Deduct</i> <i>For 100 PSI, Deduct</i>	87.31 -4.37 -17.15	13.12
	33 41 13 00-0037	LF	15" 150 PSI Prestressed Concrete Cylinder Pipe With Gaskets..... <i>For >1,000, Deduct</i> <i>For 100 PSI, Deduct</i>	93.39 -4.67 -18.14	14.59
	33 41 13 00-0038	LF	18" 150 PSI Prestressed Concrete Cylinder Pipe With Gaskets..... <i>For >1,000, Deduct</i> <i>For 100 PSI, Deduct</i>	102.51 -5.13 -19.13	18.20
	33 41 13 00-0039	LF	21" 150 PSI Prestressed Concrete Cylinder Pipe With Gaskets..... <i>For >1,000, Deduct</i> <i>For 100 PSI, Deduct</i>	113.28 -5.66 -20.12	22.95
	33 41 13 00-0040	LF	24" 150 PSI Prestressed Concrete Cylinder Pipe With Gaskets..... <i>For >1,000, Deduct</i> <i>For 100 PSI, Deduct</i>	124.28 -6.21 -21.12	27.87
33 41 13 00-0041			150 PSI Prestressed Concrete Cylinder 90 Degree Elbows With Gaskets ⁽³³⁾ <small>^{41 13 00-0034}</small>		
	33 41 13 00-0042	EA	12" 90 Degree Elbows With Gaskets, 150 PSI Prestressed Concrete Cylinder Piping.....	337.95	122.95
	33 41 13 00-0043	EA	15" 90 Degree Elbows With Gaskets, 150 PSI Prestressed Concrete Cylinder Piping.....	470.40	175.64
	33 41 13 00-0044	EA	18" 90 Degree Elbows With Gaskets, 150 PSI Prestressed Concrete Cylinder Piping.....	609.17	234.19
	33 41 13 00-0045	EA	21" 90 Degree Elbows With Gaskets, 150 PSI Prestressed Concrete Cylinder Piping.....	747.91	292.74
	33 41 13 00-0046	EA	24" 90 Degree Elbows With Gaskets, 150 PSI Prestressed Concrete Cylinder Piping.....	912.41	363.78
	33 41 13 00-0047	EA	30" 90 Degree Elbows With Gaskets, 150 PSI Prestressed Concrete Cylinder Piping.....	1,162.90	487.91
	33 41 13 00-0048	EA	42" 90 Degree Elbows With Gaskets, 150 PSI Prestressed Concrete Cylinder Piping.....	1,667.83	666.97
	33 41 13 00-0049	EA	54" 90 Degree Elbows With Gaskets, 150 PSI Prestressed Concrete Cylinder Piping.....	2,323.11	951.08
33 41 13 00-0050			150 PSI Prestressed Concrete Cylinder 45 Degree Elbows With Gaskets ⁽³³⁾ <small>^{41 13 00-0034}</small>		
	33 41 13 00-0051	EA	12" 45 Degree Elbows With Gaskets, 150 PSI Prestressed Concrete Cylinder Piping.....	319.54	122.95
	33 41 13 00-0052	EA	15" 45 Degree Elbows With Gaskets, 150 PSI Prestressed Concrete Cylinder Piping.....	446.58	175.64
	33 41 13 00-0053	EA	18" 45 Degree Elbows With Gaskets, 150 PSI Prestressed Concrete Cylinder Piping.....	581.01	234.19
	33 41 13 00-0054	EA	21" 45 Degree Elbows With Gaskets, 150 PSI Prestressed Concrete Cylinder Piping.....	715.43	292.74
	33 41 13 00-0055	EA	24" 45 Degree Elbows With Gaskets, 150 PSI Prestressed Concrete Cylinder Piping.....	875.59	363.78
	33 41 13 00-0056	EA	30" 45 Degree Elbows With Gaskets, 150 PSI Prestressed Concrete Cylinder Piping.....	1,112.37	455.12
	33 41 13 00-0057	EA	42" 45 Degree Elbows With Gaskets, 150 PSI Prestressed Concrete Cylinder Piping.....	1,601.06	666.97
	33 41 13 00-0058	EA	54" 45 Degree Elbows With Gaskets, 150 PSI Prestressed Concrete Cylinder Piping.....	2,214.43	951.08
33 41 13 00-0059			Vitrified Clay Piping ^(33 41 13)		
33 41 13 00-0060			Extra Strength Vitrified Clay Piping ^(33 41 13 00-0059)		
33 41 13 00-0061			Plain Joint, Extra Strength, Vitrified Clay Piping ^(33 41 13 00-0060) Note: ASTM C700.		
	33 41 13 00-0062	LF	4" Plain Joint, Extra Strength, Vitrified Clay Pipe..... <i>For 3' Lengths, Add</i> <i>For 2' Lengths, Add</i> <i>For Standard Strength, Deduct</i> <i>For >1,000, Deduct</i>	14.81 1.08 1.44 -0.36 -0.74	
	33 41 13 00-0063	LF	6" Plain Joint, Extra Strength, Vitrified Clay Pipe..... <i>For 3' Lengths, Add</i> <i>For 2' Lengths, Add</i> <i>For Standard Strength, Deduct</i> <i>For >1,000, Deduct</i>	19.10 1.68 2.24 -0.56 -0.96	
	33 41 13 00-0064	LF	8" Plain Joint, Extra Strength, Vitrified Clay Pipe..... <i>For 3' Lengths, Add</i> <i>For 2' Lengths, Add</i> <i>For Standard Strength, Deduct</i> <i>For >1,000, Deduct</i>	23.79 2.40 3.20 -0.80 -1.19	
	33 41 13 00-0065	LF	10" Plain Joint, Extra Strength, Vitrified Clay Pipe..... <i>For 3' Lengths, Add</i> <i>For 2' Lengths, Add</i> <i>For Standard Strength, Deduct</i> <i>For >1,000, Deduct</i>	29.44 3.68 4.90 -1.23 -1.47	
	33 41 13 00-0066	LF	12" Plain Joint, Extra Strength, Vitrified Clay Pipe..... <i>For 3' Lengths, Add</i> <i>For 2' Lengths, Add</i> <i>For Standard Strength, Deduct</i> <i>For >1,000, Deduct</i>	36.67 5.19 6.92 -1.73 -1.83	
33 41 13 00-0067			Compression Joint, Extra Strength, Vitrified Clay Piping ^(33 41 13 00-0060) Note: ASTM C425.		
	33 41 13 00-0068	LF	4" Compression Joint, Extra Strength, Vitrified Clay Pipe..... <i>For 3' Lengths, Add</i> <i>For 2' Lengths, Add</i> <i>For Standard Strength, Deduct</i> <i>For >1,000, Deduct</i>	17.70 1.28 1.70 -0.43 -0.89	



Utilities	33	CS
Storm Drainage Utilities	33 40	
Storm Utility Drainage Piping	33 41	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 41 13 00-0069 LF 6" Compression Joint, Extra Strength, Vitrified Clay Pipe.....	23.14	
For 3' Lengths, Add	2.08	
For 2' Lengths, Add	2.78	
For Standard Strength, Deduct	-0.69	
For >1,000, Deduct	-1.16	
33 41 13 00-0070 LF 8" Compression Joint, Extra Strength, Vitrified Clay Pipe.....	28.76	
For 3' Lengths, Add	2.94	
For 2' Lengths, Add	3.92	
For Standard Strength, Deduct	-0.98	
For >1,000, Deduct	-1.44	
33 41 13 00-0071 LF 10" Compression Joint, Extra Strength, Vitrified Clay Pipe.....	36.72	
For 3' Lengths, Add	4.83	
For 2' Lengths, Add	6.44	
For Standard Strength, Deduct	-1.61	
For >1,000, Deduct	-1.84	
33 41 13 00-0072 LF 12" Compression Joint, Extra Strength, Vitrified Clay Pipe.....	44.39	
For 3' Lengths, Add	6.35	
For 2' Lengths, Add	8.46	
For Standard Strength, Deduct	-2.12	
For >1,000, Deduct	-2.22	
33 41 13 00-0073 Extra Strength, Vitrified Clay Pipe Fittings (33 41 13 00-0059)		
33 41 13 00-0074 1/8 Bends, Extra Strength, Vitrified Clay (33 41 13 00-0073)		
33 41 13 00-0075 Plain End 1/8 Bend, Extra Strength, Vitrified Clay (33 41 13 00-0074)		
33 41 13 00-0076 EA 4" Plain End 1/8 Bend, Extra Strength, Vitrified Clay.....	59.36	
33 41 13 00-0077 EA 6" Plain End 1/8 Bend, Extra Strength, Vitrified Clay.....	79.19	
33 41 13 00-0078 EA 8" Plain End 1/8 Bend, Extra Strength, Vitrified Clay.....	111.07	
33 41 13 00-0079 EA 10" Plain End 1/8 Bend, Extra Strength, Vitrified Clay.....	150.08	
33 41 13 00-0080 EA 12" Plain End 1/8 Bend, Extra Strength, Vitrified Clay.....	196.28	
33 41 13 00-0081 Compression Joint 1/8 Bends, Extra Strength, Vitrified Clay (33 41 13 00-0074)		
33 41 13 00-0082 EA 4" Compression Joint 1/8 Bend, Extra Strength, Vitrified Clay.....	67.56	
33 41 13 00-0083 EA 6" Compression Joint 1/8 Bend, Extra Strength, Vitrified Clay.....	94.32	
33 41 13 00-0084 EA 8" Compression Joint 1/8 Bend, Extra Strength, Vitrified Clay.....	126.00	
33 41 13 00-0085 EA 10" Compression Joint 1/8 Bend, Extra Strength, Vitrified Clay.....	166.13	
33 41 13 00-0086 EA 12" Compression Joint 1/8 Bend, Extra Strength, Vitrified Clay.....	209.11	
33 41 13 00-0087 1/4 Bends, Extra Strength, Vitrified Clay (33 41 13 00-0073)		
33 41 13 00-0088 Plain End 1/4 Bends, Extra Strength, Vitrified Clay (33 41 13 00-0087)		
33 41 13 00-0089 EA 4" Plain End 1/4 Bend, Extra Strength, Vitrified Clay.....	70.56	
33 41 13 00-0090 EA 6" Plain End 1/4 Bend, Extra Strength, Vitrified Clay.....	92.69	
33 41 13 00-0091 EA 8" Plain End 1/4 Bend, Extra Strength, Vitrified Clay.....	126.87	
33 41 13 00-0092 EA 10" Plain End 1/4 Bend, Extra Strength, Vitrified Clay.....	166.26	
33 41 13 00-0093 EA 12" Plain End 1/4 Bend, Extra Strength, Vitrified Clay.....	215.64	
33 41 13 00-0094 Compression Joint 1/4 Bends, Extra Strength, Vitrified Clay (33 41 13 00-0087)		
33 41 13 00-0095 EA 4" Compression Joint 1/4 Bend, Extra Strength, Vitrified Clay.....	81.01	
33 41 13 00-0096 EA 6" Compression Joint 1/4 Bend, Extra Strength, Vitrified Clay.....	110.53	
33 41 13 00-0097 EA 8" Compression Joint 1/4 Bend, Extra Strength, Vitrified Clay.....	144.95	
33 41 13 00-0098 EA 10" Compression Joint 1/4 Bend, Extra Strength, Vitrified Clay.....	186.75	
33 41 13 00-0099 EA 12" Compression Joint 1/4 Bend, Extra Strength, Vitrified Clay.....	232.34	
33 41 13 00-0100 Wyes Or Tees, Extra Strength, Vitrified Clay (33 41 13 00-0073)		
33 41 13 00-0101 Plain End Wyes Or Tees, Extra Strength, Vitrified Clay (33 41 13 00-0100)		
33 41 13 00-0102 EA 4" Plain End Wyes Or Tees, Extra Strength, Vitrified Clay.....	78.91	
33 41 13 00-0103 EA 6" Plain End Wyes Or Tees, Extra Strength, Vitrified Clay.....	101.86	
33 41 13 00-0104 EA 8" Plain End Wyes Or Tees, Extra Strength, Vitrified Clay.....	135.84	
33 41 13 00-0105 EA 10" Plain End Wyes Or Tees, Extra Strength, Vitrified Clay.....	175.97	
33 41 13 00-0106 EA 12" Plain End Wyes Or Tees, Extra Strength, Vitrified Clay.....	220.04	
33 41 13 00-0107 Compression Joint Wyes Or Tees, Extra Strength, Vitrified Clay (33 41 13 00-0100)		
33 41 13 00-0108 EA 4" Compression Joint Wyes Or Tees, Extra Strength, Vitrified Clay.....	96.16	
33 41 13 00-0109 EA 6" Compression Joint Wyes Or Tees, Extra Strength, Vitrified Clay.....	129.58	
33 41 13 00-0110 EA 8" Compression Joint Wyes Or Tees, Extra Strength, Vitrified Clay.....	168.22	
33 41 13 00-0111 EA 10" Compression Joint Wyes Or Tees, Extra Strength, Vitrified Clay.....	213.90	
33 41 13 00-0112 EA 12" Compression Joint Wyes Or Tees, Extra Strength, Vitrified Clay.....	264.29	

33 42 Culverts (33 40)

33 42 16 Concrete Culverts (33 42)



MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

33 42 16 13 Precast Concrete Culverts ^(33 42 16 13)

33 42 16 13-0001

Precast Reinforced Concrete Box Culvert ^(33 42 16 13)

Note: The quantity required shall be the entire length of the culvert including the length of the cut-off sections. Includes delivery, handling, hoisting into place, alignment, bracing, permanent connections, grouting of joints and caulking of joints. Excludes excavation and backfill. Minimum length 6'-0".

33 42 16 13-0002	LF 4' x 2' Precast Reinforced Concrete Box Culvert	206.97	40.82
	<i>For Each LF Of Cut-Off Section, Add</i>	8.28	
33 42 16 13-0003	LF 4' x 3' Precast Reinforced Concrete Box Culvert	224.11	40.82
	<i>For Each LF Of Cut-Off Section, Add</i>	8.96	
33 42 16 13-0004	LF 5' x 3' Precast Reinforced Concrete Box Culvert	293.69	51.02
	<i>For Each LF Of Cut-Off Section, Add</i>	11.75	
33 42 16 13-0005	LF 5' x 4' Precast Reinforced Concrete Box Culvert	314.36	51.02
	<i>For Each LF Of Cut-Off Section, Add</i>	12.57	
33 42 16 13-0006	LF 5' x 5' Precast Reinforced Concrete Box Culvert	335.02	51.02
	<i>For Each LF Of Cut-Off Section, Add</i>	13.40	
33 42 16 13-0007	LF 6' x 3' Precast Reinforced Concrete Box Culvert	354.11	53.06
	<i>For Each LF Of Cut-Off Section, Add</i>	14.16	
33 42 16 13-0008	LF 6' x 4' Precast Reinforced Concrete Box Culvert	378.27	53.06
	<i>For Each LF Of Cut-Off Section, Add</i>	15.13	
33 42 16 13-0009	LF 6' x 6' Precast Reinforced Concrete Box Culvert	426.41	53.06
	<i>For Each LF Of Cut-Off Section, Add</i>	17.06	
33 42 16 13-0010	LF 7' x 4' Precast Reinforced Concrete Box Culvert	460.73	61.23
	<i>For Each LF Of Cut-Off Section, Add</i>	18.43	
33 42 16 13-0011	LF 7' x 6' Precast Reinforced Concrete Box Culvert	559.50	83.27
	<i>For Each LF Of Cut-Off Section, Add</i>	22.38	
33 42 16 13-0012	LF 8' x 2' Precast Reinforced Concrete Box Culvert	417.12	53.06
	<i>For Each LF Of Cut-Off Section, Add</i>	16.68	
33 42 16 13-0013	LF 8' x 3' Precast Reinforced Concrete Box Culvert	456.35	61.23
	<i>For Each LF Of Cut-Off Section, Add</i>	18.25	
33 42 16 13-0014	LF 8' x 4' Precast Reinforced Concrete Box Culvert	488.22	61.23
	<i>For Each LF Of Cut-Off Section, Add</i>	19.53	
33 42 16 13-0015	LF 8' x 5' Precast Reinforced Concrete Box Culvert	556.28	81.64
	<i>For Each LF Of Cut-Off Section, Add</i>	22.25	
33 42 16 13-0016	LF 8' x 6' Precast Reinforced Concrete Box Culvert	583.75	81.64
	<i>For Each LF Of Cut-Off Section, Add</i>	23.35	
33 42 16 13-0017	LF 8' x 8' Precast Reinforced Concrete Box Culvert	679.29	102.05
	<i>For Each LF Of Cut-Off Section, Add</i>	27.17	
33 42 16 13-0018	LF 9' x 4' Precast Reinforced Concrete Box Culvert	605.65	81.64
	<i>For Each LF Of Cut-Off Section, Add</i>	24.23	
33 42 16 13-0019	LF 9' x 6' Precast Reinforced Concrete Box Culvert	708.00	102.05
	<i>For Each LF Of Cut-Off Section, Add</i>	28.32	
33 42 16 13-0020	LF 10' x 3' Precast Reinforced Concrete Box Culvert	695.40	102.05
	<i>For Each LF Of Cut-Off Section, Add</i>	27.82	
33 42 16 13-0021	LF 10' x 4' Precast Reinforced Concrete Box Culvert	728.53	102.05
	<i>For Each LF Of Cut-Off Section, Add</i>	29.14	
33 42 16 13-0022	LF 10' x 5' Precast Reinforced Concrete Box Culvert	804.57	122.46
	<i>For Each LF Of Cut-Off Section, Add</i>	32.18	
33 42 16 13-0023	LF 10' x 6' Precast Reinforced Concrete Box Culvert	839.07	122.46
	<i>For Each LF Of Cut-Off Section, Add</i>	33.56	
33 42 16 13-0024	LF 10' x 7' Precast Reinforced Concrete Box Culvert	873.57	122.46
	<i>For Each LF Of Cut-Off Section, Add</i>	34.94	
33 42 16 13-0025	LF 10' x 8' Precast Reinforced Concrete Box Culvert	907.85	122.46
	<i>For Each LF Of Cut-Off Section, Add</i>	36.31	
33 42 16 13-0026	LF 12' x 3' Precast Reinforced Concrete Box Culvert	789.77	142.86
	<i>For Each LF Of Cut-Off Section, Add</i>	31.59	
33 42 16 13-0027	LF 12' x 4' Precast Reinforced Concrete Box Culvert	998.83	142.86
	<i>For Each LF Of Cut-Off Section, Add</i>	39.95	
33 42 16 13-0028	LF 12' x 6' Precast Reinforced Concrete Box Culvert	1,081.47	142.86
	<i>For Each LF Of Cut-Off Section, Add</i>	43.26	
33 42 16 13-0029	LF 12' x 8' Precast Reinforced Concrete Box Culvert	1,164.09	142.86
	<i>For Each LF Of Cut-Off Section, Add</i>	46.56	
33 42 16 13-0030	LF 16' x 10' Precast Reinforced Concrete Box Culvert	1,452.37	163.27
	<i>For Each LF Of Cut-Off Section, Add</i>	58.09	
33 42 16 13-0031	LF 24' x 10' Precast Reinforced Concrete Box Culvert	1,782.89	163.27
	<i>For Each LF Of Cut-Off Section, Add</i>	71.32	

33 42 16 13-0032

Precast Reinforced Concrete Box Culvert For Roadways ^(33 42 16 13)

Note: AASHTO H/20, H/25 Rated. The quantity required shall be the entire length of the culvert including the length of the cut-off sections. Includes delivery, handling, hoisting into place, alignment, bracing, permanent connections, grouting of joints and caulking of joints. Excludes excavation and backfill. Minimum length 6'-0".

33 42 16 13-0033	LF 4' x 2' Precast Reinforced Concrete Box Culvert For Roadways	587.93	40.82
	<i>For Each LF Of Cut-Off Section, Add</i>	23.52	
33 42 16 13-0034	LF 4' x 3' Precast Reinforced Concrete Box Culvert For Roadways	656.97	40.82
	<i>For Each LF Of Cut-Off Section, Add</i>	26.28	
33 42 16 13-0035	LF 5' x 3' Precast Reinforced Concrete Box Culvert For Roadways	746.41	51.02
	<i>For Each LF Of Cut-Off Section, Add</i>	29.86	
33 42 16 13-0036	LF 5' x 4' Precast Reinforced Concrete Box Culvert For Roadways	815.45	51.02
	<i>For Each LF Of Cut-Off Section, Add</i>	32.62	
33 42 16 13-0037	LF 5' x 5' Precast Reinforced Concrete Box Culvert For Roadways	884.49	51.02
	<i>For Each LF Of Cut-Off Section, Add</i>	35.38	
33 42 16 13-0038	LF 6' x 3' Precast Reinforced Concrete Box Culvert For Roadways	819.53	53.06
	<i>For Each LF Of Cut-Off Section, Add</i>	32.78	



Utilities	33	CS
Storm Drainage Utilities	33 40	
Culverts	33 42	

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 42 16 13-0039	LF		6' x 4' Precast Reinforced Concrete Box Culvert For Roadways <i>For Each LF Of Cut-Off Section, Add</i>	888.57 35.54	53.06
33 42 16 13-0040	LF		6' x 6' Precast Reinforced Concrete Box Culvert For Roadways <i>For Each LF Of Cut-Off Section, Add</i>	1,026.66 41.07	53.06
33 42 16 13-0041	LF		7' x 4' Precast Reinforced Concrete Box Culvert For Roadways <i>For Each LF Of Cut-Off Section, Add</i>	973.94 38.96	61.23
33 42 16 13-0042	LF		7' x 6' Precast Reinforced Concrete Box Culvert For Roadways <i>For Each LF Of Cut-Off Section, Add</i>	1,156.09 46.24	83.27
33 42 16 13-0043	LF		8' x 2' Precast Reinforced Concrete Box Culvert For Roadways <i>For Each LF Of Cut-Off Section, Add</i>	888.57 35.54	53.06
33 42 16 13-0044	LF		8' x 3' Precast Reinforced Concrete Box Culvert For Roadways <i>For Each LF Of Cut-Off Section, Add</i>	973.94 38.96	61.23
33 42 16 13-0045	LF		8' x 4' Precast Reinforced Concrete Box Culvert For Roadways <i>For Each LF Of Cut-Off Section, Add</i>	1,042.99 41.72	61.23
33 42 16 13-0046	LF		8' x 4' Precast Reinforced Concrete Box Culvert For Roadways <i>For Each LF Of Cut-Off Section, Add</i>	1,152.82 46.11	81.64
33 42 16 13-0047	LF		8' x 6' Precast Reinforced Concrete Box Culvert For Roadways <i>For Each LF Of Cut-Off Section, Add</i>	1,221.87 48.87	81.64
33 42 16 13-0048	LF		8' x 8' Precast Reinforced Concrete Box Culvert For Roadways <i>For Each LF Of Cut-Off Section, Add</i>	1,400.77 56.03	102.05
33 42 16 13-0049	LF		9' x 4' Precast Reinforced Concrete Box Culvert For Roadways <i>For Each LF Of Cut-Off Section, Add</i>	1,233.17 49.33	81.64
33 42 16 13-0050	LF		9' x 6' Precast Reinforced Concrete Box Culvert For Roadways <i>For Each LF Of Cut-Off Section, Add</i>	1,421.55 56.86	102.05
33 42 16 13-0051	LF		10' x 3' Precast Reinforced Concrete Box Culvert For Roadways <i>For Each LF Of Cut-Off Section, Add</i>	1,406.53 56.26	102.05
33 42 16 13-0052	LF		10' x 4' Precast Reinforced Concrete Box Culvert For Roadways <i>For Each LF Of Cut-Off Section, Add</i>	1,488.51 59.54	102.05
33 42 16 13-0053	LF		10' x 5' Precast Reinforced Concrete Box Culvert For Roadways <i>For Each LF Of Cut-Off Section, Add</i>	1,611.32 64.45	122.46
33 42 16 13-0054	LF		10' x 6' Precast Reinforced Concrete Box Culvert For Roadways <i>For Each LF Of Cut-Off Section, Add</i>	1,693.30 67.73	122.46
33 42 16 13-0055	LF		10' x 7' Precast Reinforced Concrete Box Culvert For Roadways <i>For Each LF Of Cut-Off Section, Add</i>	1,775.29 71.01	122.46
33 42 16 13-0056	LF		10' x 8' Precast Reinforced Concrete Box Culvert For Roadways <i>For Each LF Of Cut-Off Section, Add</i>	1,857.27 74.29	122.46
33 42 16 13-0057	LF		12' x 3' Precast Reinforced Concrete Box Culvert For Roadways <i>For Each LF Of Cut-Off Section, Add</i>	1,870.19 74.81	142.86
33 42 16 13-0058	LF		12' x 4' Precast Reinforced Concrete Box Culvert For Roadways <i>For Each LF Of Cut-Off Section, Add</i>	1,963.37 78.53	142.86
33 42 16 13-0059	LF		12' x 6' Precast Reinforced Concrete Box Culvert For Roadways <i>For Each LF Of Cut-Off Section, Add</i>	2,149.78 85.99	142.86
33 42 16 13-0060	LF		12' x 8' Precast Reinforced Concrete Box Culvert For Roadways <i>For Each LF Of Cut-Off Section, Add</i>	2,336.19 93.45	142.86
33 42 16 13-0061	LF		16' x 10' Precast Reinforced Concrete Box Culvert For Roadways <i>For Each LF Of Cut-Off Section, Add</i>	2,791.25 111.65	163.27
33 42 16 13-0062	LF		24' x 10' Precast Reinforced Concrete Box Culvert For Roadways <i>For Each LF Of Cut-Off Section, Add</i>	3,495.45 139.82	163.27
33 44 Storm Utility Water Drains (33 40)					
33 44 13 Utility Area Drains (33 44)					
33 44 13 13 Catchbasins (33 44 13)					
33 44 13 13-0001 Storm Drains (33 44 13 13)					
33 44 13 13-0002 Catch Basins And Inlet Basins (33 44 13 13-0001) Note: Includes base slab, opening and grout. Excludes frame, grate, excavation and backfill.					
33 44 13 13-0003 Cast In Place, Grate Drop Inlet Basins (33 44 13 13-0002) Note: Inside dimensions.					
33 44 13 13-0004 3' x 3' x 4" Thick Wall, Cast In Place, Grate Drop Inlet Basins (33 44 13 13-0003)					
33 44 13 13-0005	EA		2' Deep, 3' x 3' x 4" Thick Wall, Cast In Place, Grate Drop Inlet Basin	1,261.63	243.34
33 44 13 13-0006	EA		3' Deep, 3' x 3' x 4" Thick Wall, Cast In Place, Grate Drop Inlet Basin	1,503.50	285.12
33 44 13 13-0007	EA		4' Deep, 3' x 3' x 4" Thick Wall, Cast In Place, Grate Drop Inlet Basin	1,745.38	326.83
33 44 13 13-0008	EA		5' Deep, 3' x 3' x 4" Thick Wall, Cast In Place, Grate Drop Inlet Basin	1,987.25	368.61
33 44 13 13-0009	EA		6' Deep, 3' x 3' x 4" Thick Wall, Cast In Place, Grate Drop Inlet Basin	2,229.13	410.31
33 44 13 13-0010 3'-8" x 3'-8" x 6" Thick Wall, Cast In Place, Grate Drop Inlet Basins (33 44 13 13-0003)					
33 44 13 13-0011	EA		2' Deep, 3'-8" x 3'-8" x 6" Thick Wall, Cast In Place, Grate Drop Inlet Basin	1,585.36	241.88
33 44 13 13-0012	EA		3' Deep, 3'-8" x 3'-8" x 6" Thick Wall, Cast In Place, Grate Drop Inlet Basin	1,970.62	322.50
33 44 13 13-0013	EA		4' Deep, 3'-8" x 3'-8" x 6" Thick Wall, Cast In Place, Grate Drop Inlet Basin	2,529.99	439.77
33 44 13 13-0014	EA		5' Deep, 3'-8" x 3'-8" x 6" Thick Wall, Cast In Place, Grate Drop Inlet Basin	3,070.90	513.08
33 44 13 13-0015	EA		6' Deep, 3'-8" x 3'-8" x 6" Thick Wall, Cast In Place, Grate Drop Inlet Basin	3,514.46	586.37
33 44 13 13-0016 4' x 4' x 8" Thick Wall, Cast In Place, Grate Drop Inlet Basins (33 44 13 13-0003)					
33 44 13 13-0017	EA		2' Deep, 4' x 4' x 8" Thick Wall, Cast In Place, Grate Drop Inlet Basin	1,701.91	263.87
33 44 13 13-0018	EA		3' Deep, 4' x 4' x 8" Thick Wall, Cast In Place, Grate Drop Inlet Basin	2,356.02	366.48
33 44 13 13-0019	EA		4' Deep, 4' x 4' x 8" Thick Wall, Cast In Place, Grate Drop Inlet Basin	2,894.74	476.42

33	Utilities
33 40	Storm Drainage Utilities
33 44	Storm Utility Water Drains



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 44 13 13-0020 EA 5' Deep, 4' x 4' x 8" Thick Wall, Cast In Place, Grate Drop Inlet Basin	3,343.29	549.72
33 44 13 13-0021 EA 6' Deep, 4' x 4' x 8" Thick Wall, Cast In Place, Grate Drop Inlet Basin	4,244.18	703.64
33 44 13 13-0022 Cast In Place, Catch Basin (33 44 13 13-0002) Note: Inside span, overall depth.		
33 44 13 13-0023 3' x 3', Cast In Place, Catch Basins (33 44 13 13-0022)		
33 44 13 13-0024 EA 3' Deep, 3' x 3' x 6" Thick Wall, Cast In Place, Catch Basin	1,564.05	294.21
33 44 13 13-0025 EA 3'-6" Deep, 3' x 3' x 6" Thick Wall, Cast In Place, Catch Basin	1,659.77	312.83
33 44 13 13-0026 EA 4' Deep, 3' x 3' x 6" Thick Wall, Cast In Place, Catch Basin	1,808.17	335.99
33 44 13 13-0027 EA 4'-6" Deep, 3' x 3' x 8" Thick Wall, Cast In Place, Catch Basin	2,031.42	371.90
33 44 13 13-0028 EA 5' Deep, 3' x 3' x 8" Thick Wall, Cast In Place, Catch Basin	2,186.17	395.87
33 44 13 13-0029 EA 5'-6" Deep, 3' x 3' x 8" Thick Wall, Cast In Place, Catch Basin	2,290.38	415.15
33 44 13 13-0030 EA 6' Deep, 3' x 3' x 8" Thick Wall, Cast In Place, Catch Basin	2,445.26	439.11
33 44 13 13-0031 EA 6'-6" Deep, 3' x 3' x 8" Thick Wall, Cast In Place, Catch Basin	2,547.31	458.47
33 44 13 13-0032 EA 7' Deep, 3' x 3' x 8" Thick Wall, Cast In Place, Catch Basin	2,703.19	482.36
33 44 13 13-0033 EA 7'-6" Deep, 3' x 3' x 8" Thick Wall, Cast In Place, Catch Basin	2,806.40	501.71
33 44 13 13-0034 EA 8' Deep, 3' x 3' x 8" Thick Wall, Cast In Place, Catch Basin	2,961.22	525.67
33 44 13 13-0035 VLF >8' Deep, 3' x 3' x 8" Thick Wall, Cast In Place, Catch Basin	370.17	65.67
33 44 13 13-0036 3'-6" x 3'-6", Cast In Place, Catch Basins (33 44 13 13-0022)		
33 44 13 13-0037 EA 3' Deep, 3'-6" x 3'-6" x 6" Thick Wall, Cast In Place, Catch Basin	1,802.04	340.10
33 44 13 13-0038 EA 3'-6" Deep, 3'-6" x 3'-6" x 6" Thick Wall, Cast In Place, Catch Basin	1,923.41	363.99
33 44 13 13-0039 EA 4' Deep, 3'-6" x 3'-6" x 6" Thick Wall, Cast In Place, Catch Basin	2,078.14	387.95
33 44 13 13-0040 EA 4'-6" Deep, 3'-6" x 3'-6" x 8" Thick Wall, Cast In Place, Catch Basin	2,338.78	429.66
33 44 13 13-0041 EA 5' Deep, 3'-6" x 3'-6" x 8" Thick Wall, Cast In Place, Catch Basin	2,509.69	456.78
33 44 13 13-0042 EA 5'-6" Deep, 3'-6" x 3'-6" x 8" Thick Wall, Cast In Place, Catch Basin	2,629.90	479.28
33 44 13 13-0043 EA 6' Deep, 3'-6" x 3'-6" x 8" Thick Wall, Cast In Place, Catch Basin	2,802.82	506.40
33 44 13 13-0044 EA 6'-6" Deep, 3'-6" x 3'-6" x 8" Thick Wall, Cast In Place, Catch Basin	2,923.04	528.90
33 44 13 13-0045 EA 7' Deep, 3'-6" x 3'-6" x 8" Thick Wall, Cast In Place, Catch Basin	3,094.85	556.03
33 44 13 13-0046 EA 7'-6" Deep, 3'-6" x 3'-6" x 8" Thick Wall, Cast In Place, Catch Basin	3,215.19	578.52
33 44 13 13-0047 EA 8' Deep, 3'-6" x 3'-6" x 8" Thick Wall, Cast In Place, Catch Basin	3,387.07	605.64
33 44 13 13-0048 VLF >8' Deep, 3'-6" x 3'-6" x 8" Thick Wall, Cast In Place, Catch Basin	423.40	75.71
33 44 13 13-0049 4' x 4', Cast In Place, Catch Basins (33 44 13 13-0022)		
33 44 13 13-0050 EA 3' Deep, 4' x 4' x 6" Thick Wall, Cast In Place, Catch Basin	2,056.74	389.05
33 44 13 13-0051 EA 3'-6" Deep, 4' x 4' x 6" Thick Wall, Cast In Place, Catch Basin	2,184.45	413.75
33 44 13 13-0052 EA 4' Deep, 4' x 4' x 6" Thick Wall, Cast In Place, Catch Basin	2,363.82	443.00
33 44 13 13-0053 EA 4'-6" Deep, 4' x 4' x 8" Thick Wall, Cast In Place, Catch Basin	2,662.31	490.57
33 44 13 13-0054 EA 5' Deep, 4' x 4' x 8" Thick Wall, Cast In Place, Catch Basin	2,851.30	520.84
33 44 13 13-0055 EA 5'-6" Deep, 4' x 4' x 8" Thick Wall, Cast In Place, Catch Basin	2,988.56	546.56
33 44 13 13-0056 EA 6' Deep, 4' x 4' x 8" Thick Wall, Cast In Place, Catch Basin	3,177.56	576.84
33 44 13 13-0057 EA 6'-6" Deep, 4' x 4' x 8" Thick Wall, Cast In Place, Catch Basin	3,314.71	602.57
33 44 13 13-0058 EA 7' Deep, 4' x 4' x 8" Thick Wall, Cast In Place, Catch Basin	3,503.71	632.84
33 44 13 13-0059 EA 7'-6" Deep, 4' x 4' x 8" Thick Wall, Cast In Place, Catch Basin	3,640.96	658.56
33 44 13 13-0060 EA 8' Deep, 4' x 4' x 8" Thick Wall, Cast In Place, Catch Basin	3,829.97	688.91
33 44 13 13-0061 VLF >8' Deep, 4' x 4' x 8" Thick Wall, Cast In Place, Catch Basin	478.71	86.13
33 44 13 13-0062 4'-6" x 4'-6", Cast In Place, Catch Basins (33 44 13 13-0022)		
33 44 13 13-0063 EA 3' Deep, 4'-6" x 4'-6" x 6" Thick Wall, Cast In Place, Catch Basin	2,377.36	451.14
33 44 13 13-0064 EA 3'-6" Deep, 4'-6" x 4'-6" x 6" Thick Wall, Cast In Place, Catch Basin	2,526.20	476.65
33 44 13 13-0065 EA 4' Deep, 4'-6" x 4'-6" x 6" Thick Wall, Cast In Place, Catch Basin	2,725.67	509.63
33 44 13 13-0066 EA 4'-6" Deep, 4'-6" x 4'-6" x 8" Thick Wall, Cast In Place, Catch Basin	3,065.99	563.72
33 44 13 13-0067 EA 5' Deep, 4'-6" x 4'-6" x 8" Thick Wall, Cast In Place, Catch Basin	3,276.63	597.88
33 44 13 13-0068 EA 5'-6" Deep, 4'-6" x 4'-6" x 8" Thick Wall, Cast In Place, Catch Basin	3,435.59	627.41
33 44 13 13-0069 EA 6' Deep, 4'-6" x 4'-6" x 8" Thick Wall, Cast In Place, Catch Basin	3,646.32	661.57
33 44 13 13-0070 EA 6'-6" Deep, 4'-6" x 4'-6" x 8" Thick Wall, Cast In Place, Catch Basin	3,805.28	691.18
33 44 13 13-0071 EA 7' Deep, 4'-6" x 4'-6" x 8" Thick Wall, Cast In Place, Catch Basin	4,015.91	725.34
33 44 13 13-0072 EA 7'-6" Deep, 4'-6" x 4'-6" x 8" Thick Wall, Cast In Place, Catch Basin	4,173.87	754.87
33 44 13 13-0073 EA 8' Deep, 4'-6" x 4'-6" x 8" Thick Wall, Cast In Place, Catch Basin	4,385.61	789.03
33 44 13 13-0074 VLF >8' Deep, 4'-6" x 4'-6" x 8" Thick Wall, Cast In Place, Catch Basin	548.24	98.65
33 44 13 13-0075 5' x 5', Cast In Place, Catch Basins (33 44 13 13-0022)		
33 44 13 13-0076 EA 4' Deep, 5' x 5' x 6" Thick Wall, Cast In Place, Catch Basin	3,054.13	572.22
33 44 13 13-0077 EA 4'-6" Deep, 5' x 5' x 8" Thick Wall, Cast In Place, Catch Basin	3,433.10	632.32
33 44 13 13-0078 EA 5' Deep, 5' x 5' x 8" Thick Wall, Cast In Place, Catch Basin	3,662.12	669.78
33 44 13 13-0079 EA 5'-6" Deep, 5' x 5' x 8" Thick Wall, Cast In Place, Catch Basin	3,838.49	702.62
33 44 13 13-0080 EA 6' Deep, 5' x 5' x 8" Thick Wall, Cast In Place, Catch Basin	4,065.41	740.00
33 44 13 13-0081 EA 6'-6" Deep, 5' x 5' x 8" Thick Wall, Cast In Place, Catch Basin	4,242.77	772.83
33 44 13 13-0082 EA 7' Deep, 5' x 5' x 8" Thick Wall, Cast In Place, Catch Basin	4,470.81	810.29
33 44 13 13-0083 EA 7'-6" Deep, 5' x 5' x 8" Thick Wall, Cast In Place, Catch Basin	4,646.07	843.12
33 44 13 13-0084 EA 8' Deep, 5' x 5' x 8" Thick Wall, Cast In Place, Catch Basin	4,875.09	880.50
33 44 13 13-0085 VLF >8' Deep, 5' x 5' x 8" Thick Wall, Cast In Place, Catch Basin	813.67	110.09



Utilities	33	CS
Storm Drainage Utilities	33 40	
Storm Utility Water Drains	33 44	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 44 13 13-0086 5'-6" x 5'-6", Cast In Place, Catch Basins <small>(33 44 13 13-0022)</small>		
33 44 13 13-0087 EA 4' Deep, 5'-6" x 5'-6" x 6" Thick Wall, Cast In Place, Catch Basin.....	3,398.57	638.12
33 44 13 13-0088 EA 4'-6" Deep, 5'-6" x 5'-6" x 8" Thick Wall, Cast In Place, Catch Basin.....	3,942.48	722.33
33 44 13 13-0089 EA 5' Deep, 5'-6" x 5'-6" x 8" Thick Wall, Cast In Place, Catch Basin.....	4,196.70	763.96
33 44 13 13-0090 EA 5'-6" Deep, 5'-6" x 5' x 8" Thick Wall, Cast In Place, Catch Basin.....	4,398.24	801.27
33 44 13 13-0091 EA 6' Deep, 5'-6" x 5'-6" x 8" Thick Wall, Cast In Place, Catch Basin.....	4,653.57	843.19
33 44 13 13-0092 EA 6'-6" Deep, 5'-6" x 5'-6" x 8" Thick Wall, Cast In Place, Catch Basin.....	4,856.11	880.50
33 44 13 13-0093 EA 7' Deep, 5'-6" x 5'-6" x 8" Thick Wall, Cast In Place, Catch Basin.....	5,110.34	922.43
33 44 13 13-0094 EA 7'-6" Deep, 5'-6" x 5'-6" x 8" Thick Wall, Cast In Place, Catch Basin.....	5,311.89	959.74
33 44 13 13-0095 EA 8' Deep, 5'-6" x 5'-6" x 8" Thick Wall, Cast In Place, Catch Basin.....	5,566.11	1,001.66
33 44 13 13-0096 VLF >8' Deep, 5'-6" x 5'-6" x 8" Thick Wall, Cast In Place, Catch Basin.....	695.76	125.19
33 44 13 13-0097 6' x 6', Cast In Place, Catch Basins <small>(33 44 13 13-0022)</small>		
33 44 13 13-0098 EA 4' Deep, 6' x 6' x 6" Thick Wall, Cast In Place, Catch Basin.....	3,761.13	707.09
33 44 13 13-0099 EA 4'-6" Deep, 6' x 6' x 8" Thick Wall, Cast In Place, Catch Basin.....	4,360.41	799.51
33 44 13 13-0100 EA 5' Deep, 6' x 6' x 8" Thick Wall, Cast In Place, Catch Basin.....	4,633.47	844.81
33 44 13 13-0101 EA 5'-6" Deep, 6' x 6' x 8" Thick Wall, Cast In Place, Catch Basin.....	4,853.74	885.49
33 44 13 13-0102 EA 6' Deep, 6' x 6' x 8" Thick Wall, Cast In Place, Catch Basin.....	5,125.80	930.78
33 44 13 13-0103 EA 6'-6" Deep, 6' x 6' x 8" Thick Wall, Cast In Place, Catch Basin.....	5,347.19	971.46
33 44 13 13-0104 EA 7' Deep, 6' x 6' x 8" Thick Wall, Cast In Place, Catch Basin.....	5,619.14	1,016.76
33 44 13 13-0105 EA 7'-6" Deep, 6' x 6' x 8" Thick Wall, Cast In Place, Catch Basin.....	5,839.53	1,057.44
33 44 13 13-0106 EA 8' Deep, 6' x 6' x 8" Thick Wall, Cast In Place, Catch Basin.....	6,112.59	1,102.73
33 44 13 13-0107 VLF >8' Deep, 6' x 6' x 8" Thick Wall, Cast In Place, Catch Basin.....	764.12	137.87
33 44 13 13-0108 6'-6" x 6'-6", Cast In Place, Catch Basins <small>(33 44 13 13-0022)</small>		
33 44 13 13-0109 EA 4' Deep, 6'-6" x 6'-6" x 6" Thick Wall, Cast In Place, Catch Basin.....	4,139.68	779.36
33 44 13 13-0110 EA 4'-6" Deep, 6'-6" x 6'-6" x 8" Thick Wall, Cast In Place, Catch Basin.....	4,955.02	902.93
33 44 13 13-0111 EA 5' Deep, 6'-6" x 6'-6" x 8" Thick Wall, Cast In Place, Catch Basin.....	5,255.65	953.07
33 44 13 13-0112 EA 5'-6" Deep, 6'-6" x 6'-6" x 8" Thick Wall, Cast In Place, Catch Basin.....	5,504.54	998.59
33 44 13 13-0113 EA 6' Deep, 6'-6" x 6'-6" x 8" Thick Wall, Cast In Place, Catch Basin.....	5,805.17	1,048.65
33 44 13 13-0114 EA 6'-6" Deep, 6'-6" x 6'-6" x 8" Thick Wall, Cast In Place, Catch Basin.....	6,054.06	1,094.24
33 44 13 13-0115 EA 7' Deep, 6'-6" x 6'-6" x 8" Thick Wall, Cast In Place, Catch Basin.....	6,354.69	1,144.30
33 44 13 13-0116 EA 7'-6" Deep, 6'-6" x 6'-6" x 8" Thick Wall, Cast In Place, Catch Basin.....	6,603.58	1,189.81
33 44 13 13-0117 EA 8' Deep, 6'-6" x 6'-6" x 8" Thick Wall, Cast In Place, Catch Basin.....	6,905.32	1,239.95
33 44 13 13-0118 VLF >8' Deep, 6'-6" x 6'-6" x 8" Thick Wall, Cast In Place, Catch Basin.....	863.13	155.02
33 44 13 13-0119 7' x 7', Cast In Place, Catch Basins <small>(33 44 13 13-0022)</small>		
33 44 13 13-0120 EA 4' Deep, 7' x 7' x 6" Thick Wall, Cast In Place, Catch Basin.....	4,535.37	854.78
33 44 13 13-0121 EA 4'-6" Deep, 7' x 7' x 8" Thick Wall, Cast In Place, Catch Basin.....	5,427.52	989.64
33 44 13 13-0122 EA 5' Deep, 7' x 7' x 8" Thick Wall, Cast In Place, Catch Basin.....	5,747.42	1,043.29
33 44 13 13-0123 EA 5'-6" Deep, 7' x 7' x 8" Thick Wall, Cast In Place, Catch Basin.....	6,014.57	1,092.26
33 44 13 13-0124 EA 6' Deep, 7' x 7' x 8" Thick Wall, Cast In Place, Catch Basin.....	6,335.40	1,145.84
33 44 13 13-0125 EA 6'-6" Deep, 7' x 7' x 8" Thick Wall, Cast In Place, Catch Basin.....	6,602.52	1,194.87
33 44 13 13-0126 EA 7' Deep, 7' x 7' x 8" Thick Wall, Cast In Place, Catch Basin.....	6,922.44	1,248.45
33 44 13 13-0127 EA 7'-6" Deep, 7' x 7' x 8" Thick Wall, Cast In Place, Catch Basin.....	7,190.57	1,297.48
33 44 13 13-0128 EA 8' Deep, 7' x 7' x 8" Thick Wall, Cast In Place, Catch Basin.....	7,510.41	1,351.06
33 44 13 13-0129 VLF >8' Deep, 7' x 7' x 8" Thick Wall, Cast In Place, Catch Basin.....	938.84	168.87
33 44 13 13-0130 7'-6" x 7'-6", Cast In Place, Catch Basins <small>(33 44 13 13-0022)</small>		
33 44 13 13-0131 EA 4' Deep, 7'-6" x 7'-6" x 6" Thick Wall, Cast In Place, Catch Basin.....	5,129.56	959.37
33 44 13 13-0132 EA 4'-6" Deep, 7'-6" x 7'-6" x 8" Thick Wall, Cast In Place, Catch Basin.....	5,919.37	1,079.87
33 44 13 13-0133 EA 5' Deep, 7'-6" x 7'-6" x 8" Thick Wall, Cast In Place, Catch Basin.....	6,257.46	1,136.97
33 44 13 13-0134 EA 5'-6" Deep, 7'-6" x 7'-6" x 8" Thick Wall, Cast In Place, Catch Basin.....	6,544.87	1,189.44
33 44 13 13-0135 EA 6' Deep, 7'-6" x 7'-6" x 8" Thick Wall, Cast In Place, Catch Basin.....	6,883.86	1,246.54
33 44 13 13-0136 EA 6'-6" Deep, 7'-6" x 7'-6" x 8" Thick Wall, Cast In Place, Catch Basin.....	7,171.28	1,299.03
33 44 13 13-0137 EA 7' Deep, 7'-6" x 7'-6" x 8" Thick Wall, Cast In Place, Catch Basin.....	7,509.36	1,356.12
33 44 13 13-0138 EA 7'-6" Deep, 7'-6" x 7'-6" x 8" Thick Wall, Cast In Place, Catch Basin.....	7,796.77	1,408.60
33 44 13 13-0139 EA 8' Deep, 7'-6" x 7'-6" x 8" Thick Wall, Cast In Place, Catch Basin.....	8,135.84	1,465.70
33 44 13 13-0140 VLF >8' Deep, 7'-6" x 7'-6" x 8" Thick Wall, Cast In Place, Catch Basin.....	1,016.95	183.24
33 44 13 13-0141 8' x 8', Cast In Place, Catch Basins <small>(33 44 13 13-0022)</small>		
33 44 13 13-0142 EA 4' Deep, 8' x 8' x 6" Thick Wall, Cast In Place, Catch Basin.....	5,576.71	1,043.80
33 44 13 13-0143 EA 4'-6" Deep, 8' x 8' x 8" Thick Wall, Cast In Place, Catch Basin.....	6,429.32	1,173.61
33 44 13 13-0144 EA 5' Deep, 8' x 8' x 8" Thick Wall, Cast In Place, Catch Basin.....	6,786.64	1,234.16
33 44 13 13-0145 EA 5'-6" Deep, 8' x 8' x 8" Thick Wall, Cast In Place, Catch Basin.....	7,093.33	1,290.15
33 44 13 13-0146 EA 6' Deep, 8' x 8' x 8" Thick Wall, Cast In Place, Catch Basin.....	7,450.58	1,350.70
33 44 13 13-0147 EA 6'-6" Deep, 8' x 8' x 8" Thick Wall, Cast In Place, Catch Basin.....	7,755.27	1,406.69
33 44 13 13-0148 EA 7' Deep, 8' x 8' x 8" Thick Wall, Cast In Place, Catch Basin.....	8,114.52	1,467.24
33 44 13 13-0149 EA 7'-6" Deep, 8' x 8' x 8" Thick Wall, Cast In Place, Catch Basin.....	8,421.21	1,523.23
33 44 13 13-0150 EA 8' Deep, 8' x 8' x 8" Thick Wall, Cast In Place, Catch Basin.....	8,771.95	1,583.78
33 44 13 13-0151 VLF >8' Deep, 8' x 8' x 8" Thick Wall, Cast In Place, Catch Basin.....	1,097.31	197.97

33	Utilities
33 40	Storm Drainage Utilities
33 44	Storm Utility Water Drains



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 44 13 13-0152 Precast Concrete Catch Basins (33 44 13 13-0002) Note: Inside dimensions.		
33 44 13 13-0153 1'-6" Diameter Precast Catch Basins (33 44 13 13-0152)		
33 44 13 13-0154 EA 4' Deep, 1'-6" Diameter Precast Catch Basins.....	497.14	164.46
33 44 13 13-0155 EA 6' Deep, 1'-6" Diameter Precast Catch Basins.....	696.80	246.69
33 44 13 13-0156 EA 8' Deep, 1'-6" Diameter Precast Catch Basins.....	887.44	320.70
33 44 13 13-0157 EA 10' Deep, 1'-6" Diameter Precast Catch Basins.....	1,060.44	379.07
33 44 13 13-0158 EA 12' Deep, 1'-6" Diameter Precast Catch Basins.....	1,310.42	481.04
33 44 13 13-0159 EA 14' Deep, 1'-6" Diameter Precast Catch Basins.....	1,500.66	555.05
33 44 13 13-0160 VLF Vertical Linear Foot Over 14' Deep, 1'-6" Diameter Precast Catch Basins.....	104.95	37.00
33 44 13 13-0161 2' Diameter Precast Catch Basins (33 44 13 13-0152)		
33 44 13 13-0162 EA 4' Deep, 2' Diameter Precast Catch Basin.....	565.15	182.96
33 44 13 13-0163 EA 6' Deep, 2' Diameter Precast Catch Basin.....	787.87	271.36
33 44 13 13-0164 EA 8' Deep, 2' Diameter Precast Catch Basin.....	999.37	357.69
33 44 13 13-0165 EA 10' Deep, 2' Diameter Precast Catch Basin.....	1,190.04	417.31
33 44 13 13-0166 EA 12' Deep, 2' Diameter Precast Catch Basin.....	1,480.14	534.49
33 44 13 13-0167 EA 14' Deep, 2' Diameter Precast Catch Basin.....	1,692.85	616.72
33 44 13 13-0168 VLF Vertical Linear Foot Over 14' Deep, 2' Diameter Precast Catch Basin.....	118.44	44.40
33 44 13 13-0169 3' Diameter Precast Catch Basins (33 44 13 13-0152)		
33 44 13 13-0170 EA 4' Deep, 3' Diameter Precast Catch Basin.....	737.21	215.85
33 44 13 13-0171 EA 6' Deep, 3' Diameter Precast Catch Basin.....	1,014.27	319.05
33 44 13 13-0172 EA 8' Deep, 3' Diameter Precast Catch Basin.....	1,281.21	421.42
33 44 13 13-0173 EA 10' Deep, 3' Diameter Precast Catch Basin.....	1,595.53	526.27
33 44 13 13-0174 EA 12' Deep, 3' Diameter Precast Catch Basin.....	1,887.22	627.41
33 44 13 13-0175 EA 14' Deep, 3' Diameter Precast Catch Basin.....	2,170.04	730.20
33 44 13 13-0176 VLF Vertical Linear Foot Over 14' Deep, 3' Diameter Precast Catch Basin.....	149.92	52.16
33 44 13 13-0177 4' Diameter Precast Catch Basins (33 44 13 13-0152)		
33 44 13 13-0178 EA 4' Deep, 4' Diameter Precast Catch Basin.....	884.89	240.11
33 44 13 13-0179 EA 6' Deep, 4' Diameter Precast Catch Basin.....	1,156.38	328.92
33 44 13 13-0180 EA 8' Deep, 4' Diameter Precast Catch Basin.....	1,565.94	493.37
33 44 13 13-0181 EA 10' Deep, 4' Diameter Precast Catch Basin.....	1,954.26	616.72
33 44 13 13-0182 EA 12' Deep, 4' Diameter Precast Catch Basin.....	2,313.53	740.06
33 44 13 13-0183 EA 14' Deep, 4' Diameter Precast Catch Basin.....	2,663.28	863.41
33 44 13 13-0184 VLF Vertical Linear Foot Over 14' Deep, 4' Diameter Precast Catch Basin.....	183.58	61.67
33 44 13 13-0185 5' Diameter Precast Catch Basins (33 44 13 13-0152)		
33 44 13 13-0186 EA 4' Deep, 5' Diameter Precast Catch Basin.....	1,193.13	328.92
33 44 13 13-0187 EA 6' Deep, 5' Diameter Precast Catch Basin.....	1,647.61	493.37
33 44 13 13-0188 EA 8' Deep, 5' Diameter Precast Catch Basin.....	2,104.52	657.83
33 44 13 13-0189 EA 10' Deep, 5' Diameter Precast Catch Basin.....	2,578.66	822.29
33 44 13 13-0190 EA 12' Deep, 5' Diameter Precast Catch Basin.....	3,047.07	986.75
33 44 13 13-0191 EA 14' Deep, 5' Diameter Precast Catch Basin.....	3,549.20	1,151.21
33 44 13 13-0192 VLF Vertical Linear Foot Over 14' Deep, 5' Diameter Precast Catch Basin.....	244.31	82.23
33 44 13 13-0193 6' Diameter Precast Catch Basins (33 44 13 13-0152)		
33 44 13 13-0194 EA 4' Deep, 6' Diameter Precast Catch Basin.....	1,749.69	493.37
33 44 13 13-0195 EA 6' Deep, 6' Diameter Precast Catch Basin.....	2,395.19	740.06
33 44 13 13-0196 EA 8' Deep, 6' Diameter Precast Catch Basin.....	3,082.04	986.75
33 44 13 13-0197 EA 10' Deep, 6' Diameter Precast Catch Basin.....	3,842.34	1,233.44
33 44 13 13-0198 EA 12' Deep, 6' Diameter Precast Catch Basin.....	4,582.23	1,480.12
33 44 13 13-0199 EA 14' Deep, 6' Diameter Precast Catch Basin.....	5,308.13	1,726.81
33 44 13 13-0200 VLF Vertical Linear Foot Over 14' Deep, 6' Diameter Precast Catch Basin.....	364.43	123.34
33 44 13 13-0201 Precast Catch Basins Accessories (33 44 13 13-0152)		
33 44 13 13-0202 EA Single Or Double Wing Slab Top With Throat.....	1,134.60	534.49
33 44 13 13-0203 EA 4' x 4' Weir Box, Precast Catch Basin.....	461.73	65.79
33 44 13 13-0204 EA 4' Diameter Inlet Round To Square Adapter, Precast Catch Basin.....	270.86	69.89
33 44 13 13-0205 EA 3' Diameter, Up To 6" High, Precast Extension Ring.....	342.45	102.79
For Each Additional Inch In Height, Add	39.93	
33 44 13 13-0206 EA 4' Diameter, Up To 6" High, Precast Extension Ring.....	404.66	123.34
For Each Additional Inch In Height, Add	46.87	
33 44 13 13-0207 EA 5' Diameter, Up To 6" High, Precast Extension Ring.....	471.91	143.90
For Each Additional Inch In Height, Add	54.69	
33 44 13 13-0208 EA 6' Diameter, Up To 6" High, Precast Extension Ring.....	599.27	205.57
For Each Additional Inch In Height, Add	65.65	
33 44 13 13-0209 EA Adjust Existing Catch Basin Inlet Grate To Match Grade.....	493.35	
33 44 13 13-0210 Catch Basin Risers (33 44 13 13-0152)		
33 44 13 13-0211 EA Up To 860 Square Inch, Up To 2" Rise, Catch Basin Riser.....	290.34	



		Utilities	33
		Storm Drainage Utilities	33 40
		Storm Utility Water Drains	33 44

MINOR		TOTAL DIRECT	DEMOLITION
CSI	UOM DESCRIPTION	UNIT COST	UNIT COST
33 44 13 13-0212	EA >860 To 1140 Square Inch, Up To 2' Rise, Catch Basin Riser.....	323.31	
33 44 13 13-0213	EA >1140 Square Inch, Up To 2' Rise, Catch Basin Riser.....	362.47	
33 44 13 13-0214	EA Up To 860 Square Inch, >2" To 3" Rise, Catch Basin Riser.....	312.45	
33 44 13 13-0215	EA >860 To 1140 Square Inch, >2" To 3" Rise, Catch Basin Riser.....	347.64	
33 44 13 13-0216	EA >1140 Square Inch, >2" To 3" Rise, Catch Basin Riser.....	391.04	
33 44 13 13-0217	EA Up To 860 Square Inch, >3" To 4" Rise, Catch Basin Riser.....	345.24	
33 44 13 13-0218	EA >860 To 1140 Square Inch, >3" To 4" Rise, Catch Basin Riser.....	376.53	
33 44 13 13-0219	EA >1140 Square Inch, >3" To 4" Rise, Catch Basin Riser.....	420.10	
33 44 13 13-0220	Concrete Drainage Inlet Structures (CALTRAN) (33 44 13 13-0001)		
33 44 13 13-0221	Type OS Concrete Drainage Inlet Structure (33 44 13 13-0220)		
33 44 13 13-0222	EA 3' Deep Type OS Concrete Drainage Inlet Structure, 6" Wall Thickness.....	1,813.43	
33 44 13 13-0223	EA 4' Deep Type OS Concrete Drainage Inlet Structure, 6" Wall Thickness.....	2,106.08	
33 44 13 13-0224	EA 5' Deep Type OS Concrete Drainage Inlet Structure, 6" Wall Thickness.....	2,377.54	
33 44 13 13-0225	EA 6' Deep Type OS Concrete Drainage Inlet Structure, 6" Wall Thickness.....	2,627.79	
33 44 13 13-0226	EA 7' Deep Type OS Concrete Drainage Inlet Structure, 6" Wall Thickness.....	2,856.82	
33 44 13 13-0227	EA 8' Deep Type OS Concrete Drainage Inlet Structure, 6" Wall Thickness.....	3,064.65	
33 44 13 13-0228	EA 8' Deep Type OS Concrete Drainage Inlet Structure, 8" Wall Thickness.....	4,170.11	
33 44 13 13-0229	EA 10' Deep Type OS Concrete Drainage Inlet Structure, 8" Wall Thickness.....	4,860.59	
33 44 13 13-0230	EA 12' Deep Type OS Concrete Drainage Inlet Structure, 8" Wall Thickness.....	5,497.46	
33 44 13 13-0231	EA 14' Deep Type OS Concrete Drainage Inlet Structure, 8" Wall Thickness.....	6,082.39	
33 44 13 13-0232	EA 16' Deep Type OS Concrete Drainage Inlet Structure, 8" Wall Thickness.....	6,643.93	
33 44 13 13-0233	EA 18' Deep Type OS Concrete Drainage Inlet Structure, 8" Wall Thickness.....	7,159.47	
33 44 13 13-0234	EA 20' Deep Type OS Concrete Drainage Inlet Structure, 8" Wall Thickness.....	7,629.02	
33 44 13 13-0235	Type OL-7 Concrete Drainage Inlet Structure (33 44 13 13-0220)		
33 44 13 13-0236	EA 3' Deep Type OL-7 Concrete Drainage Inlet Structure, 6" Wall Thickness.....	2,469.35	
33 44 13 13-0237	EA 4' Deep Type OL-7 Concrete Drainage Inlet Structure, 6" Wall Thickness.....	2,742.63	
33 44 13 13-0238	EA 5' Deep Type OL-7 Concrete Drainage Inlet Structure, 6" Wall Thickness.....	2,994.70	
33 44 13 13-0239	EA 6' Deep Type OL-7 Concrete Drainage Inlet Structure, 6" Wall Thickness.....	3,225.57	
33 44 13 13-0240	EA 7' Deep Type OL-7 Concrete Drainage Inlet Structure, 6" Wall Thickness.....	3,434.40	
33 44 13 13-0241	EA 8' Deep Type OL-7 Concrete Drainage Inlet Structure, 6" Wall Thickness.....	3,622.85	
33 44 13 13-0242	EA 8' Deep Type OL-7 Concrete Drainage Inlet Structure, 8" Wall Thickness.....	4,695.47	
33 44 13 13-0243	EA 10' Deep Type OL-7 Concrete Drainage Inlet Structure, 8" Wall Thickness.....	5,369.70	
33 44 13 13-0244	EA 12' Deep Type OL-7 Concrete Drainage Inlet Structure, 8" Wall Thickness.....	5,990.33	
33 44 13 13-0245	EA 14' Deep Type OL-7 Concrete Drainage Inlet Structure, 8" Wall Thickness.....	6,558.17	
33 44 13 13-0246	EA 16' Deep Type OL-7 Concrete Drainage Inlet Structure, 8" Wall Thickness.....	7,105.56	
33 44 13 13-0247	EA 18' Deep Type OL-7 Concrete Drainage Inlet Structure, 8" Wall Thickness.....	7,606.94	
33 44 13 13-0248	EA 20' Deep Type OL-7 Concrete Drainage Inlet Structure, 8" Wall Thickness.....	8,062.33	
33 44 13 13-0249	Type OL-10 Concrete Drainage Inlet Structure (33 44 13 13-0220)		
33 44 13 13-0250	EA 3' Deep Type OL-10 Concrete Drainage Inlet Structure, 6" Wall Thickness.....	3,073.82	
33 44 13 13-0251	EA 4' Deep Type OL-10 Concrete Drainage Inlet Structure, 6" Wall Thickness.....	3,329.42	
33 44 13 13-0252	EA 5' Deep Type OL-10 Concrete Drainage Inlet Structure, 6" Wall Thickness.....	3,562.99	
33 44 13 13-0253	EA 6' Deep Type OL-10 Concrete Drainage Inlet Structure, 6" Wall Thickness.....	3,776.18	
33 44 13 13-0254	EA 7' Deep Type OL-10 Concrete Drainage Inlet Structure, 6" Wall Thickness.....	3,967.33	
33 44 13 13-0255	EA 8' Deep Type OL-10 Concrete Drainage Inlet Structure, 6" Wall Thickness.....	4,137.28	
33 44 13 13-0256	EA 8' Deep Type OL-10 Concrete Drainage Inlet Structure, 8" Wall Thickness.....	5,220.84	
33 44 13 13-0257	EA 10' Deep Type OL-10 Concrete Drainage Inlet Structure, 8" Wall Thickness.....	5,877.99	
33 44 13 13-0258	EA 12' Deep Type OL-10 Concrete Drainage Inlet Structure, 8" Wall Thickness.....	6,483.18	
33 44 13 13-0259	EA 14' Deep Type OL-10 Concrete Drainage Inlet Structure, 8" Wall Thickness.....	7,034.78	
33 44 13 13-0260	EA 16' Deep Type OL-10 Concrete Drainage Inlet Structure, 8" Wall Thickness.....	7,567.18	
33 44 13 13-0261	EA 18' Deep Type OL-10 Concrete Drainage Inlet Structure, 8" Wall Thickness.....	8,054.40	
33 44 13 13-0262	EA 20' Deep Type OL-10 Concrete Drainage Inlet Structure, 8" Wall Thickness.....	8,494.82	
33 44 13 13-0263	Type OL-14 Concrete Drainage Inlet Structure (33 44 13 13-0220)		
33 44 13 13-0264	EA 3' Deep Type OL-14 Concrete Drainage Inlet Structure, 6" Wall Thickness.....	3,935.52	
33 44 13 13-0265	EA 4' Deep Type OL-14 Concrete Drainage Inlet Structure, 6" Wall Thickness.....	4,164.95	
33 44 13 13-0266	EA 5' Deep Type OL-14 Concrete Drainage Inlet Structure, 6" Wall Thickness.....	4,373.17	
33 44 13 13-0267	EA 6' Deep Type OL-14 Concrete Drainage Inlet Structure, 6" Wall Thickness.....	4,560.19	
33 44 13 13-0268	EA 7' Deep Type OL-14 Concrete Drainage Inlet Structure, 6" Wall Thickness.....	4,726.00	
33 44 13 13-0269	EA 8' Deep Type OL-14 Concrete Drainage Inlet Structure, 6" Wall Thickness.....	4,870.60	
33 44 13 13-0270	EA 8' Deep Type OL-14 Concrete Drainage Inlet Structure, 8" Wall Thickness.....	5,965.12	
33 44 13 13-0271	EA 10' Deep Type OL-14 Concrete Drainage Inlet Structure, 8" Wall Thickness.....	6,599.16	
33 44 13 13-0272	EA 12' Deep Type OL-14 Concrete Drainage Inlet Structure, 8" Wall Thickness.....	7,180.43	
33 44 13 13-0273	EA 14' Deep Type OL-14 Concrete Drainage Inlet Structure, 8" Wall Thickness.....	7,708.92	
33 44 13 13-0274	EA 16' Deep Type OL-14 Concrete Drainage Inlet Structure, 8" Wall Thickness.....	8,222.03	
33 44 13 13-0275	EA 18' Deep Type OL-14 Concrete Drainage Inlet Structure, 8" Wall Thickness.....	8,688.32	
33 44 13 13-0276	EA 20' Deep Type OL-14 Concrete Drainage Inlet Structure, 8" Wall Thickness.....	9,108.60	
33 44 13 13-0277	Type OL-21 Concrete Drainage Inlet Structure (33 44 13 13-0220)		
33 44 13 13-0278	EA 3' Deep Type OL-21 Concrete Drainage Inlet Structure, 6" Wall Thickness.....	5,684.64	
33 44 13 13-0279	EA 4' Deep Type OL-21 Concrete Drainage Inlet Structure, 6" Wall Thickness.....	5,862.12	
33 44 13 13-0280	EA 5' Deep Type OL-21 Concrete Drainage Inlet Structure, 6" Wall Thickness.....	6,018.40	

33	Utilities
33 40	Storm Drainage Utilities
33 44	Storm Utility Water Drains



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 44 13 13-0281 EA 6' Deep Type OL-21 Concrete Drainage Inlet Structure, 6" Wall Thickness	6,153.46	
33 44 13 13-0282 EA 7' Deep Type OL-21 Concrete Drainage Inlet Structure, 6" Wall Thickness	6,266.49	
33 44 13 13-0283 EA 8' Deep Type OL-21 Concrete Drainage Inlet Structure, 6" Wall Thickness	6,359.14	
33 44 13 13-0284 EA 8' Deep Type OL-21 Concrete Drainage Inlet Structure, 8" Wall Thickness	7,420.83	
33 44 13 13-0285 EA 10' Deep Type OL-21 Concrete Drainage Inlet Structure, 8" Wall Thickness	8,009.32	
33 44 13 13-0286 EA 12' Deep Type OL-21 Concrete Drainage Inlet Structure, 8" Wall Thickness	8,545.06	
33 44 13 13-0287 EA 14' Deep Type OL-21 Concrete Drainage Inlet Structure, 8" Wall Thickness	9,028.01	
33 44 13 13-0288 EA 16' Deep Type OL-21 Concrete Drainage Inlet Structure, 8" Wall Thickness	9,501.40	
33 44 13 13-0289 EA 18' Deep Type OL-21 Concrete Drainage Inlet Structure, 8" Wall Thickness	9,927.97	
33 44 13 13-0290 EA 20' Deep Type OL-21 Concrete Drainage Inlet Structure, 8" Wall Thickness	10,308.53	
33 44 13 13-0291 Type GOL-7 Concrete Drainage Inlet Structure (33 44 13 13-0220)		
33 44 13 13-0292 EA 3' Deep Type GOL-7 Concrete Drainage Inlet Structure, 6" Wall Thickness	2,996.65	
33 44 13 13-0293 EA 4' Deep Type GOL-7 Concrete Drainage Inlet Structure, 6" Wall Thickness	3,298.22	
33 44 13 13-0294 EA 5' Deep Type GOL-7 Concrete Drainage Inlet Structure, 6" Wall Thickness	3,575.40	
33 44 13 13-0295 EA 6' Deep Type GOL-7 Concrete Drainage Inlet Structure, 6" Wall Thickness	3,828.22	
33 44 13 13-0296 EA 7' Deep Type GOL-7 Concrete Drainage Inlet Structure, 6" Wall Thickness	4,057.46	
33 44 13 13-0297 EA 8' Deep Type GOL-7 Concrete Drainage Inlet Structure, 6" Wall Thickness	4,263.14	
33 44 13 13-0298 EA 8' Deep Type GOL-7 Concrete Drainage Inlet Structure, 8" Wall Thickness	5,428.80	
33 44 13 13-0299 EA 10' Deep Type GOL-7 Concrete Drainage Inlet Structure, 8" Wall Thickness	6,179.66	
33 44 13 13-0300 EA 12' Deep Type GOL-7 Concrete Drainage Inlet Structure, 8" Wall Thickness	6,871.16	
33 44 13 13-0301 EA 14' Deep Type GOL-7 Concrete Drainage Inlet Structure, 8" Wall Thickness	7,502.49	
33 44 13 13-0302 EA 16' Deep Type GOL-7 Concrete Drainage Inlet Structure, 8" Wall Thickness	8,112.16	
33 44 13 13-0303 EA 18' Deep Type GOL-7 Concrete Drainage Inlet Structure, 8" Wall Thickness	8,670.09	
33 44 13 13-0304 EA 20' Deep Type GOL-7 Concrete Drainage Inlet Structure, 8" Wall Thickness	9,175.44	
33 44 13 13-0305 Type GOL-10 Concrete Drainage Inlet Structure (33 44 13 13-0220)		
33 44 13 13-0306 EA 3' Deep Type GOL-10 Concrete Drainage Inlet Structure, 6" Wall Thickness	3,652.58	
33 44 13 13-0307 EA 4' Deep Type GOL-10 Concrete Drainage Inlet Structure, 6" Wall Thickness	3,933.95	
33 44 13 13-0308 EA 5' Deep Type GOL-10 Concrete Drainage Inlet Structure, 6" Wall Thickness	4,191.76	
33 44 13 13-0309 EA 6' Deep Type GOL-10 Concrete Drainage Inlet Structure, 6" Wall Thickness	4,426.00	
33 44 13 13-0310 EA 7' Deep Type GOL-10 Concrete Drainage Inlet Structure, 6" Wall Thickness	4,635.86	
33 44 13 13-0311 EA 8' Deep Type GOL-10 Concrete Drainage Inlet Structure, 6" Wall Thickness	4,821.35	
33 44 13 13-0312 EA 8' Deep Type GOL-10 Concrete Drainage Inlet Structure, 8" Wall Thickness	5,987.01	
33 44 13 13-0313 EA 10' Deep Type GOL-10 Concrete Drainage Inlet Structure, 8" Wall Thickness	6,720.12	
33 44 13 13-0314 EA 12' Deep Type GOL-10 Concrete Drainage Inlet Structure, 8" Wall Thickness	7,393.89	
33 44 13 13-0315 EA 14' Deep Type GOL-10 Concrete Drainage Inlet Structure, 8" Wall Thickness	8,008.31	
33 44 13 13-0316 EA 16' Deep Type GOL-10 Concrete Drainage Inlet Structure, 8" Wall Thickness	8,602.49	
33 44 13 13-0317 EA 18' Deep Type GOL-10 Concrete Drainage Inlet Structure, 8" Wall Thickness	9,144.91	
33 44 13 13-0318 EA 20' Deep Type GOL-10 Concrete Drainage Inlet Structure, 8" Wall Thickness	9,635.57	
33 44 13 13-0319 Type G-1 Concrete Drainage Inlet Structure (33 44 13 13-0220)		
33 44 13 13-0320 EA 3' Deep Type G-1 Concrete Drainage Inlet Structure, 6" Wall Thickness	1,221.81	
33 44 13 13-0321 EA 4' Deep Type G-1 Concrete Drainage Inlet Structure, 6" Wall Thickness	1,460.25	
33 44 13 13-0322 EA 5' Deep Type G-1 Concrete Drainage Inlet Structure, 6" Wall Thickness	1,680.85	
33 44 13 13-0323 EA 6' Deep Type G-1 Concrete Drainage Inlet Structure, 6" Wall Thickness	1,885.23	
33 44 13 13-0324 EA 7' Deep Type G-1 Concrete Drainage Inlet Structure, 6" Wall Thickness	2,073.42	
33 44 13 13-0325 EA 8' Deep Type G-1 Concrete Drainage Inlet Structure, 6" Wall Thickness	2,243.76	
33 44 13 13-0326 Type G-2 Concrete Drainage Inlet Structure (33 44 13 13-0220)		
33 44 13 13-0327 EA 3' Deep Type G-2 Concrete Drainage Inlet Structure, 6" Wall Thickness	1,684.81	
33 44 13 13-0328 EA 4' Deep Type G-2 Concrete Drainage Inlet Structure, 6" Wall Thickness	1,952.64	
33 44 13 13-0329 EA 5' Deep Type G-2 Concrete Drainage Inlet Structure, 6" Wall Thickness	2,201.09	
33 44 13 13-0330 EA 6' Deep Type G-2 Concrete Drainage Inlet Structure, 6" Wall Thickness	2,430.16	
33 44 13 13-0331 EA 7' Deep Type G-2 Concrete Drainage Inlet Structure, 6" Wall Thickness	2,639.85	
33 44 13 13-0332 EA 8' Deep Type G-2 Concrete Drainage Inlet Structure, 6" Wall Thickness	2,829.33	
33 44 13 13-0333 EA 8' Deep Type G-2 Concrete Drainage Inlet Structure, 8" Wall Thickness	3,830.81	
33 44 13 13-0334 EA 10' Deep Type G-2 Concrete Drainage Inlet Structure, 8" Wall Thickness	4,467.82	
33 44 13 13-0335 EA 12' Deep Type G-2 Concrete Drainage Inlet Structure, 8" Wall Thickness	5,056.32	
33 44 13 13-0336 EA 14' Deep Type G-2 Concrete Drainage Inlet Structure, 8" Wall Thickness	5,596.32	
33 44 13 13-0337 EA 16' Deep Type G-2 Concrete Drainage Inlet Structure, 8" Wall Thickness	6,114.81	
33 44 13 13-0338 EA 18' Deep Type G-2 Concrete Drainage Inlet Structure, 8" Wall Thickness	6,591.03	
33 44 13 13-0339 EA 20' Deep Type G-2 Concrete Drainage Inlet Structure, 8" Wall Thickness	7,024.17	
33 44 13 13-0340 Type G-3 Concrete Drainage Inlet Structure (33 44 13 13-0220)		
33 44 13 13-0341 EA 3' Deep Type G-3 Concrete Drainage Inlet Structure, 6" Wall Thickness	1,324.70	
33 44 13 13-0342 EA 4' Deep Type G-3 Concrete Drainage Inlet Structure, 6" Wall Thickness	1,559.74	
33 44 13 13-0343 EA 5' Deep Type G-3 Concrete Drainage Inlet Structure, 6" Wall Thickness	1,777.77	
33 44 13 13-0344 EA 6' Deep Type G-3 Concrete Drainage Inlet Structure, 6" Wall Thickness	1,979.58	
33 44 13 13-0345 EA 7' Deep Type G-3 Concrete Drainage Inlet Structure, 6" Wall Thickness	2,163.55	
33 44 13 13-0346 EA 8' Deep Type G-3 Concrete Drainage Inlet Structure, 6" Wall Thickness	2,331.32	
33 44 13 13-0347 Type G-4_24 Concrete Drainage Inlet Structure (33 44 13 13-0220)		
33 44 13 13-0348 EA 3' Deep Type G-4_24 Concrete Drainage Inlet Structure, 6" Wall Thickness	1,633.36	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 44 13 13-0349 EA 4' Deep Type G-4_24 Concrete Drainage Inlet Structure, 6" Wall Thickness	1,902.89	
33 44 13 13-0350 EA 5' Deep Type G-4_24 Concrete Drainage Inlet Structure, 6" Wall Thickness	2,153.03	
33 44 13 13-0351 EA 6' Deep Type G-4_24 Concrete Drainage Inlet Structure, 6" Wall Thickness	2,382.98	
33 44 13 13-0352 EA 7' Deep Type G-4_24 Concrete Drainage Inlet Structure, 6" Wall Thickness	2,594.37	
33 44 13 13-0353 EA 8' Deep Type G-4_24 Concrete Drainage Inlet Structure, 6" Wall Thickness	2,785.54	
33 44 13 13-0354 EA 8' Deep Type G-4_24 Concrete Drainage Inlet Structure, 8" Wall Thickness	3,808.92	
33 44 13 13-0355 EA 10' Deep Type G-4_24 Concrete Drainage Inlet Structure, 8" Wall Thickness	4,447.19	
33 44 13 13-0356 EA 12' Deep Type G-4_24 Concrete Drainage Inlet Structure, 8" Wall Thickness	5,036.13	
33 44 13 13-0357 EA 14' Deep Type G-4_24 Concrete Drainage Inlet Structure, 8" Wall Thickness	5,576.57	
33 44 13 13-0358 EA 16' Deep Type G-4_24 Concrete Drainage Inlet Structure, 8" Wall Thickness	6,095.40	
33 44 13 13-0359 EA 18' Deep Type G-4_24 Concrete Drainage Inlet Structure, 8" Wall Thickness	6,571.97	
33 44 13 13-0360 EA 20' Deep Type G-4_24 Concrete Drainage Inlet Structure, 8" Wall Thickness	7,006.29	
33 44 13 13-0361 Type G-4_18 Concrete Drainage Inlet Structure (33 44 13 13-0220)		
33 44 13 13-0362 EA 3' Deep Type G-4_18 Concrete Drainage Inlet Structure, 6" Wall Thickness	1,684.81	
33 44 13 13-0363 EA 4' Deep Type G-4_18 Concrete Drainage Inlet Structure, 6" Wall Thickness	1,952.64	
33 44 13 13-0364 EA 5' Deep Type G-4_18 Concrete Drainage Inlet Structure, 6" Wall Thickness	2,201.09	
33 44 13 13-0365 EA 6' Deep Type G-4_18 Concrete Drainage Inlet Structure, 6" Wall Thickness	2,430.16	
33 44 13 13-0366 EA 7' Deep Type G-4_18 Concrete Drainage Inlet Structure, 6" Wall Thickness	2,639.85	
33 44 13 13-0367 EA 8' Deep Type G-4_18 Concrete Drainage Inlet Structure, 6" Wall Thickness	2,829.33	
33 44 13 13-0368 EA 8' Deep Type G-4_18 Concrete Drainage Inlet Structure, 8" Wall Thickness	3,830.81	
33 44 13 13-0369 EA 10' Deep Type G-4_18 Concrete Drainage Inlet Structure, 8" Wall Thickness	4,467.82	
33 44 13 13-0370 EA 12' Deep Type G-4_18 Concrete Drainage Inlet Structure, 8" Wall Thickness	5,056.32	
33 44 13 13-0371 EA 14' Deep Type G-4_18 Concrete Drainage Inlet Structure, 8" Wall Thickness	5,596.32	
33 44 13 13-0372 EA 16' Deep Type G-4_18 Concrete Drainage Inlet Structure, 8" Wall Thickness	6,114.81	
33 44 13 13-0373 EA 18' Deep Type G-4_18 Concrete Drainage Inlet Structure, 8" Wall Thickness	6,591.03	
33 44 13 13-0374 EA 20' Deep Type G-4_18 Concrete Drainage Inlet Structure, 8" Wall Thickness	7,024.17	
33 44 13 13-0375 Type G-5 Concrete Drainage Inlet Structure (33 44 13 13-0220)		
33 44 13 13-0376 EA 3' Deep Type G-5 Concrete Drainage Inlet Structure, 6" Wall Thickness	1,311.84	
33 44 13 13-0377 EA 4' Deep Type G-5 Concrete Drainage Inlet Structure, 6" Wall Thickness	1,547.10	
33 44 13 13-0378 EA 5' Deep Type G-5 Concrete Drainage Inlet Structure, 6" Wall Thickness	1,766.17	
33 44 13 13-0379 EA 6' Deep Type G-5 Concrete Drainage Inlet Structure, 6" Wall Thickness	1,967.39	
33 44 13 13-0380 EA 7' Deep Type G-5 Concrete Drainage Inlet Structure, 6" Wall Thickness	2,152.39	
33 44 13 13-0381 EA 8' Deep Type G-5 Concrete Drainage Inlet Structure, 6" Wall Thickness	2,320.37	
33 44 13 13-0382 Type G-6 Concrete Drainage Inlet Structure (33 44 13 13-0220)		
33 44 13 13-0383 EA 3' Deep Type G-6 Concrete Drainage Inlet Structure, 6" Wall Thickness	1,337.56	
33 44 13 13-0384 EA 4' Deep Type G-6 Concrete Drainage Inlet Structure, 6" Wall Thickness	1,572.39	
33 44 13 13-0385 EA 5' Deep Type G-6 Concrete Drainage Inlet Structure, 6" Wall Thickness	1,790.19	
33 44 13 13-0386 EA 6' Deep Type G-6 Concrete Drainage Inlet Structure, 6" Wall Thickness	1,990.97	
33 44 13 13-0387 EA 7' Deep Type G-6 Concrete Drainage Inlet Structure, 6" Wall Thickness	2,174.72	
33 44 13 13-0388 EA 8' Deep Type G-6 Concrete Drainage Inlet Structure, 6" Wall Thickness	2,342.26	
33 44 13 13-0389 Type GT1 Concrete Drainage Inlet Structure (33 44 13 13-0220)		
33 44 13 13-0390 EA 3' Deep Type GT1 Concrete Drainage Inlet Structure, 6" Wall Thickness	2,237.85	
33 44 13 13-0391 EA 4' Deep Type GT1 Concrete Drainage Inlet Structure, 6" Wall Thickness	2,605.20	
33 44 13 13-0392 EA 5' Deep Type GT1 Concrete Drainage Inlet Structure, 6" Wall Thickness	2,970.27	
33 44 13 13-0393 EA 6' Deep Type GT1 Concrete Drainage Inlet Structure, 6" Wall Thickness	3,260.54	
33 44 13 13-0394 EA 7' Deep Type GT1 Concrete Drainage Inlet Structure, 6" Wall Thickness	3,547.68	
33 44 13 13-0395 EA 8' Deep Type GT1 Concrete Drainage Inlet Structure, 6" Wall Thickness	3,808.92	
33 44 13 13-0396 Type GT2 Concrete Drainage Inlet Structure (33 44 13 13-0220)		
33 44 13 13-0397 EA 3' Deep Type GT2 Concrete Drainage Inlet Structure, 6" Wall Thickness	2,713.71	
33 44 13 13-0398 EA 4' Deep Type GT2 Concrete Drainage Inlet Structure, 6" Wall Thickness	3,113.59	
33 44 13 13-0399 EA 5' Deep Type GT2 Concrete Drainage Inlet Structure, 6" Wall Thickness	3,483.46	
33 44 13 13-0400 EA 6' Deep Type GT2 Concrete Drainage Inlet Structure, 6" Wall Thickness	3,824.16	
33 44 13 13-0401 EA 7' Deep Type GT2 Concrete Drainage Inlet Structure, 6" Wall Thickness	4,134.85	
33 44 13 13-0402 EA 8' Deep Type GT2 Concrete Drainage Inlet Structure, 6" Wall Thickness	4,416.38	
33 44 13 13-0403 EA 8' Deep Type GT2 Concrete Drainage Inlet Structure, 8" Wall Thickness	5,910.40	
33 44 13 13-0404 EA 10' Deep Type GT2 Concrete Drainage Inlet Structure, 8" Wall Thickness	6,849.51	
33 44 13 13-0405 EA 12' Deep Type GT2 Concrete Drainage Inlet Structure, 8" Wall Thickness	7,715.93	
33 44 13 13-0406 EA 14' Deep Type GT2 Concrete Drainage Inlet Structure, 8" Wall Thickness	8,510.50	
33 44 13 13-0407 EA 16' Deep Type GT2 Concrete Drainage Inlet Structure, 8" Wall Thickness	9,274.57	
33 44 13 13-0408 EA 18' Deep Type GT2 Concrete Drainage Inlet Structure, 8" Wall Thickness	9,975.20	
33 44 13 13-0409 EA 20' Deep Type GT2 Concrete Drainage Inlet Structure, 8" Wall Thickness	10,612.43	
33 44 13 13-0410 Type GT3 Concrete Drainage Inlet Structure (33 44 13 13-0220)		
33 44 13 13-0411 EA 3' Deep Type GT3 Concrete Drainage Inlet Structure, 6" Wall Thickness	2,224.98	
33 44 13 13-0412 EA 4' Deep Type GT3 Concrete Drainage Inlet Structure, 6" Wall Thickness	2,592.57	
33 44 13 13-0413 EA 5' Deep Type GT3 Concrete Drainage Inlet Structure, 6" Wall Thickness	2,934.23	
33 44 13 13-0414 EA 6' Deep Type GT3 Concrete Drainage Inlet Structure, 6" Wall Thickness	3,249.15	
33 44 13 13-0415 EA 7' Deep Type GT3 Concrete Drainage Inlet Structure, 6" Wall Thickness	3,536.52	
33 44 13 13-0416 EA 8' Deep Type GT3 Concrete Drainage Inlet Structure, 6" Wall Thickness	3,797.97	

33 Utilities**33 40 Storm Drainage Utilities****33 44 Storm Utility Water Drains**
 MINOR
 CSI UOM DESCRIPTION

 TOTAL DIRECT DEMOLITION
 UNIT COST UNIT COST

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 44 13 13-0417			Type GT4 Concrete Drainage Inlet Structure (33 44 13 13-0220)		
33 44 13 13-0418	EA		3' Deep Type GT4 Concrete Drainage Inlet Structure, 6" Wall Thickness	2,803.74	
33 44 13 13-0419	EA		4' Deep Type GT4 Concrete Drainage Inlet Structure, 6" Wall Thickness	3,200.43	
33 44 13 13-0420	EA		5' Deep Type GT4 Concrete Drainage Inlet Structure, 6" Wall Thickness	3,567.96	
33 44 13 13-0421	EA		6' Deep Type GT4 Concrete Drainage Inlet Structure, 6" Wall Thickness	3,905.48	
33 44 13 13-0422	EA		7' Deep Type GT4 Concrete Drainage Inlet Structure, 6" Wall Thickness	4,213.82	
33 44 13 13-0423	EA		8' Deep Type GT4 Concrete Drainage Inlet Structure, 6" Wall Thickness	4,492.99	
33 44 13 13-0424	EA		8' Deep Type GT4 Concrete Drainage Inlet Structure, 8" Wall Thickness	5,921.34	
33 44 13 13-0425	EA		10' Deep Type GT4 Concrete Drainage Inlet Structure, 8" Wall Thickness	6,860.24	
33 44 13 13-0426	EA		12' Deep Type GT4 Concrete Drainage Inlet Structure, 8" Wall Thickness	7,726.45	
33 44 13 13-0427	EA		14' Deep Type GT4 Concrete Drainage Inlet Structure, 8" Wall Thickness	8,519.97	
33 44 13 13-0428	EA		16' Deep Type GT4 Concrete Drainage Inlet Structure, 8" Wall Thickness	9,283.85	
33 44 13 13-0429	EA		18' Deep Type GT4 Concrete Drainage Inlet Structure, 8" Wall Thickness	9,984.32	
33 44 13 13-0430	EA		20' Deep Type GT4 Concrete Drainage Inlet Structure, 8" Wall Thickness	10,621.37	
33 44 13 13-0431			Type GO Concrete Drainage Inlet Structure (33 44 13 13-0220)		
33 44 13 13-0432	EA		3' Deep Type GO Concrete Drainage Inlet Structure, 6" Wall Thickness	1,594.78	
33 44 13 13-0433	EA		4' Deep Type GO Concrete Drainage Inlet Structure, 6" Wall Thickness	1,853.15	
33 44 13 13-0434	EA		5' Deep Type GO Concrete Drainage Inlet Structure, 6" Wall Thickness	2,092.57	
33 44 13 13-0435	EA		6' Deep Type GO Concrete Drainage Inlet Structure, 6" Wall Thickness	2,313.03	
33 44 13 13-0436	EA		7' Deep Type GO Concrete Drainage Inlet Structure, 6" Wall Thickness	2,514.57	
33 44 13 13-0437	EA		8' Deep Type GO Concrete Drainage Inlet Structure, 6" Wall Thickness	2,697.98	
33 44 13 13-0438	EA		8' Deep Type GO Concrete Drainage Inlet Structure, 8" Wall Thickness	3,710.41	
33 44 13 13-0439	EA		10' Deep Type GO Concrete Drainage Inlet Structure, 8" Wall Thickness	4,328.53	
33 44 13 13-0440	EA		12' Deep Type GO Concrete Drainage Inlet Structure, 8" Wall Thickness	4,898.29	
33 44 13 13-0441	EA		14' Deep Type GO Concrete Drainage Inlet Structure, 8" Wall Thickness	5,421.33	
33 44 13 13-0442	EA		16' Deep Type GO Concrete Drainage Inlet Structure, 8" Wall Thickness	5,924.58	
33 44 13 13-0443	EA		18' Deep Type GO Concrete Drainage Inlet Structure, 8" Wall Thickness	6,385.52	
33 44 13 13-0444	EA		20' Deep Type GO Concrete Drainage Inlet Structure, 8" Wall Thickness	6,805.81	
33 44 13 13-0445			Type GDO Concrete Drainage Inlet Structure (33 44 13 13-0220)		
33 44 13 13-0446	EA		3' Deep Type GDO Concrete Drainage Inlet Structure, 6" Wall Thickness	2,083.50	
33 44 13 13-0447	EA		4' Deep Type GDO Concrete Drainage Inlet Structure, 6" Wall Thickness	2,423.09	
33 44 13 13-0448	EA		5' Deep Type GDO Concrete Drainage Inlet Structure, 6" Wall Thickness	2,737.90	
33 44 13 13-0449	EA		6' Deep Type GDO Concrete Drainage Inlet Structure, 6" Wall Thickness	3,028.75	
33 44 13 13-0450	EA		7' Deep Type GDO Concrete Drainage Inlet Structure, 6" Wall Thickness	3,294.00	
33 44 13 13-0451	EA		8' Deep Type GDO Concrete Drainage Inlet Structure, 6" Wall Thickness	3,535.29	
33 44 13 13-0452	EA		8' Deep Type GDO Concrete Drainage Inlet Structure, 8" Wall Thickness	4,772.10	
33 44 13 13-0453	EA		10' Deep Type GDO Concrete Drainage Inlet Structure, 8" Wall Thickness	5,568.73	
33 44 13 13-0454	EA		12' Deep Type GDO Concrete Drainage Inlet Structure, 8" Wall Thickness	6,304.13	
33 44 13 13-0455	EA		14' Deep Type GDO Concrete Drainage Inlet Structure, 8" Wall Thickness	6,979.12	
33 44 13 13-0456	EA		16' Deep Type GDO Concrete Drainage Inlet Structure, 8" Wall Thickness	7,627.58	
33 44 13 13-0457	EA		18' Deep Type GDO Concrete Drainage Inlet Structure, 8" Wall Thickness	8,222.62	
33 44 13 13-0458	EA		20' Deep Type GDO Concrete Drainage Inlet Structure, 8" Wall Thickness	8,764.24	
33 44 13 13-0459			Headwalls (33 44 13 13-0001)		
			Note: Excludes excavation and backfill. Select pipe with closest opening area for square or round culverts.		
33 44 13 13-0460			Cast In Place Concrete Headwalls (33 44 13 13-0459)		
33 44 13 13-0461			Skewed Wingwall, Cast In Place Concrete Headwall (33 44 13 13-0460)		
			Note: Sized by pipe diameter.		
33 44 13 13-0462	EA		12" Pipe, Skewed Wingwall, Cast In Place Concrete Headwall	968.55	494.74
33 44 13 13-0463			Precast Concrete Headwalls (33 44 13 13-0459)		
33 44 13 13-0464	EA		12" Pipe, Precast Concrete Headwall	489.50	140.51
33 44 13 13-0465			Precast Concrete Wingwalls (33 44 13 13-0459)		
33 44 13 13-0466	EA		18" ID Pipe (26" Hole) Precast Concrete Wingwall	3,161.22	1,454.78
			Note: 12" Thick wall and base. Wingwalls are configured at 0-30 degrees off centerline of pipe.		
33 44 13 13-0467	EA		24" ID Pipe (32" Hole) Precast Concrete Wingwall	3,406.12	1,616.42
			Note: 12" Thick wall and base. Wingwalls are configured at 0-30 degrees off centerline of pipe.		
33 44 13 13-0468			Catch Basin Frames And Covers (33 44 13 13-0001)		
33 44 13 13-0469			Cast Iron Frames And Covers (33 44 13 13-0468)		
33 44 13 13-0470	EA		18" Diameter Cast Iron Catch Basin Frame And Cover	404.37	82.23
33 44 13 13-0471	EA		22" Diameter Cast Iron Catch Basin Frame And Cover	502.24	92.92
33 44 13 13-0472	EA		24" Diameter Cast Iron Catch Basin Frame And Cover	560.64	96.21
33 44 13 13-0473	EA		26" Diameter Cast Iron Catch Basin Frame And Cover	628.68	111.83
33 44 13 13-0474	EA		28" Diameter Cast Iron Catch Basin Frame And Cover	726.76	127.46
33 44 13 13-0475	EA		32" Diameter Cast Iron Catch Basin Frame And Cover	1,121.44	133.21
33 44 13 13-0476	EA		16" x 16" Cast Iron Catch Basin Frame And Cover	622.18	101.14



Utilities	33	CS
Storm Drainage Utilities	33 40	
Storm Utility Water Drains	33 44	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 44 13 13-0477 EA 18" x 24" Cast Iron Catch Basin Frame And Cover	799.42	116.76
33 44 13 13-0478 EA 20" x 27" Cast Iron Catch Basin Frame And Cover	896.29	121.70
33 44 13 13-0479 EA 23" x 23" Cast Iron Catch Basin Frame And Cover	851.95	121.70
33 44 13 13-0480 EA 24" x 24" Cast Iron Catch Basin Frame And Cover	881.28	126.63
33 44 13 13-0481 EA 26" x 26" Cast Iron Catch Basin Frame And Cover	943.14	131.56
33 44 13 13-0482 EA 24" x 36" Cast Iron Catch Basin Frame And Cover	1,121.34	141.44
33 44 13 13-0483 Curb Inlet Frames And Covers (33 44 13 13-0001)		
33 44 13 13-0484 Cast Iron Curb Inlet Frames And Covers (33 44 13 13-0483)		
33 44 13 13-0485 EA 20" x 22" Cast Iron Curb Inlet Frame And Cover	764.06	96.21
33 44 13 13-0486 EA 22" x 24" Cast Iron Curb Inlet Frame And Cover	818.77	111.83
33 44 13 13-0487 EA 24" x 24" Cast Iron Curb Inlet Frame And Cover	847.82	111.83
33 44 13 13-0488 EA 27" x 27" Cast Iron Curb Inlet Frame And Cover	928.87	131.56
33 44 13 13-0489 EA 36" x 24" Cast Iron Curb Inlet Frame And Cover	923.78	140.62
33 44 13 13-0490 Area Yard Drain (33 44 13 13-0001)		
33 44 13 13-0491 Ductile Iron Grates (33 44 13 13-0490) Note: Not for traffic loading.		
33 44 13 13-0492 EA 8" Diameter Ductile Iron Grate Adapter Necks Down To 4" and 6" Diameter Pipe	99.33	28.42
33 44 13 13-0493 EA 10" Diameter Ductile Iron Grate Adapters To 4", 6", or 8" Diameter Pipe	118.76	30.31
33 44 13 13-0494 EA 12" Diameter Ductile Iron Grate Adapters To 4" Through 12" Diameter Pipe	254.59	37.90
33 44 13 13-0495 EA 15" Diameter Ductile Iron Grate Adapters To 4" Through 12" Diameter Pipe	304.32	45.47
33 44 16 Utility Trench Drains (33 44)		
33 44 16 00-0001 Modular Trench Drains (33 44 16) See CSI section 03 31 13 00-0011 for concrete.		
33 44 16 00-0002 Modular Trench Drains (33 44 16 00-0001) Note: Excludes grates. See CSI section 33 44 16 00-0096 for grates.		
33 44 16 00-0003 6" Wide, Modular Trench Drains (33 44 16 00-0002)		
33 44 16 00-0004 6" Wide, High Density Polyethylene, Modular Trench Drains (33 44 16 00-0003)		
33 44 16 00-0005 6" Wide, High Density Polyethylene, Modular Trench Drains (33 44 16 00-0004)		
33 44 16 00-0006 LF 6" Wide, High Density Polyethylene, Modular Trench Drain	77.53	13.16
<i>For Extra Heavy Duty Frame Assembly With Anchor Studs And Grate Lockdown, Add</i>	29.64	
<i>For Galvanized Extra Heavy Duty Frame Assembly With Anchor Studs And Grate Lockdown, Add</i>	59.29	
<i>For Stainless Steel Extra Heavy Duty Frame Assembly With Anchor Studs And Grate Lockdown, Add</i>	94.86	
<i>For Type 304 Stainless Steel Top Veneer Frame, Add</i>	23.72	
<i>For Aluminum Veneer Bronze Anodized Frame, Add</i>	11.86	
33 44 16 00-0007 Outlet Adapters For 6" Wide, High Density Polyethylene, Modular Trench Drains (33 44 16 00-0004)		
33 44 16 00-0008 EA Closed End Cap For 6" Wide, High Density Polyethylene, Modular Trench Drains	37.78	
33 44 16 00-0009 EA No-Hub End Outlet For 6" Wide, High Density Polyethylene, Modular Trench Drains	46.01	
33 44 16 00-0010 EA No-Hub Bottom Outlet For 6" Wide, High Density Polyethylene, Modular Trench Drains	46.01	
33 44 16 00-0011 Other Fittings For 6" Wide, High Density Polyethylene, Modular Trench Drains (33 44 16 00-0004)		
33 44 16 00-0012 EA Bottom Dome Strainer For 6" Wide, High Density Polyethylene, Modular Trench Drains	60.96	
33 44 16 00-0013 EA Joint Connector For 6" Wide, High Density Polyethylene, Modular Trench Drains	60.96	
33 44 16 00-0014 EA 90 Degree, 45 Degree, Tee Or Side Outlet Charge For 6" Wide, High Density Polyethylene, Modular Trench Drains	278.27	
33 44 16 00-0015 EA Cross For 6" Wide, High Density Polyethylene, Modular Trench Drains	515.43	
33 44 16 00-0016 EA Cutting Charge For 6" Wide, High Density Polyethylene, Modular Trench Drains	59.29	
33 44 16 00-0017 6" Wide, Fiber Reinforced Polyester, Modular Trench Drains (33 44 16 00-0003)		
33 44 16 00-0018 6" Wide, Fiber Reinforced Polyester, Modular Trench Drains (33 44 16 00-0017)		
33 44 16 00-0019 LF 6" Wide, Fiber Reinforced Polyester, Modular Trench Drain	105.39	13.16
<i>For Black Acid Resistant Coated Frame, Add</i>	22.53	
<i>For Galvanized Top Frame Assembly, Add</i>	22.53	
<i>For Type 304 Stainless Steel Top Frame Assembly, Add</i>	83.01	
33 44 16 00-0020 Outlet Adapters For 6" Wide, Fiber Reinforced Polyester, Modular Trench Drains (33 44 16 00-0017)		
33 44 16 00-0021 EA Closed End Cap For 6" Wide, Fiber Reinforced Polyester, Modular Trench Drains	40.16	
33 44 16 00-0022 EA No-Hub End Outlet For 6" Wide, Fiber Reinforced Polyester, Modular Trench Drains	48.39	
33 44 16 00-0023 EA No-Hub Bottom Outlet For 6" Wide, Fiber Reinforced Polyester, Modular Trench Drains	48.39	

33 Utilities**33 40 Storm Drainage Utilities****33 44 Storm Utility Water Drains**

MINOR		TOTAL DIRECT		DEMOLITION	
CSI	UOM	DESCRIPTION	UNIT COST	UNIT COST	UNIT COST
33 44 16 00-0024		Other Fittings For 6" Wide, Fiber Reinforced Polyester, Modular Trench Drains <small>(33 44 16 00-0017)</small>			
33 44 16 00-0025	EA	Bottom Dome Strainer For 6" Wide, Fiber Reinforced Polyester, Modular Trench Drains	60.96		
33 44 16 00-0026	EA	Joint Connector For 6" Wide, Fiber Reinforced Polyester, Modular Trench Drains	60.96		
33 44 16 00-0027	EA	90 Degree, 45 Degree, Tee Or Side Outlet For 6" Wide, Fiber Reinforced Polyester, Modular Trench Drains	278.27		
33 44 16 00-0028	EA	Cross For 6" Wide, Fiber Reinforced Polyester, Modular Trench Drains	515.43		
33 44 16 00-0029	EA	Cutting Charge For 6" Wide, Fiber Reinforced Polyester, Modular Trench Drains	59.29		
33 44 16 00-0030		6" Wide, Vinylester Fiberglass, Modular Trench Drains <small>(33 44 16 00-0003)</small>			
33 44 16 00-0031		6" Wide, Vinylester Fiberglass, Modular Trench Drains <small>(33 44 16 00-0030)</small>			
33 44 16 00-0032	LF	6" Wide, Vinylester Fiberglass, Modular Trench Drain.....	131.48		13.16
		<i>For Black Acid Resistant Coated Frame, Add</i>	22.53		
		<i>For Galvanized Top Frame Assembly, Add</i>	22.53		
		<i>For Type 304 Stainless Steel Top Frame Assembly, Add</i>	83.01		
33 44 16 00-0033		Outlet Adapters For 6" Wide, Vinylester Fiberglass, Modular Trench Drains <small>(33 44 16 00-0030)</small>			
33 44 16 00-0034	EA	Closed End Cap For 6" Wide, Vinylester Fiberglass, Modular Trench Drains.....	59.13		
33 44 16 00-0035	EA	No-Hub End Outlet For 6" Wide, Vinylester Fiberglass, Modular Trench Drains	67.36		
33 44 16 00-0036	EA	No-Hub Bottom Outlet For 6" Wide, Vinylester Fiberglass, Modular Trench Drains	67.36		
33 44 16 00-0037		Other Fittings For 6" Wide, Vinylester Fiberglass, Modular Trench Drains <small>(33 44 16 00-0030)</small>			
33 44 16 00-0038	EA	Bottom Dome Strainer For 6" Wide, Vinylester Fiberglass, Modular Trench Drains	60.96		
33 44 16 00-0039	EA	Joint Connector For 6" Wide, Vinylester Fiberglass, Modular Trench Drains.....	60.96		
33 44 16 00-0040	EA	90 Degree, 45 Degree, Tee Or Side Outlet For 6" Wide, Vinylester Fiberglass, Modular Trench Drains	278.27		
33 44 16 00-0041	EA	Cross For 6" Wide, Vinylester Fiberglass, Modular Trench Drains	515.43		
33 44 16 00-0042	EA	Cutting Charge For 6" Wide, Vinylester Fiberglass, Modular Trench Drains.....	59.29		
33 44 16 00-0043		12" Wide, Modular Trench Drains <small>(33 44 16 00-0002)</small>			
33 44 16 00-0044		12" Wide, High Density Polyethylene, Modular Trench Drains <small>(33 44 16 00-0043)</small>			
33 44 16 00-0045		12" Wide, High Density Polyethylene, Modular Trench Drains <small>(33 44 16 00-0044)</small>			
33 44 16 00-0046	LF	12" Wide, High Density Polyethylene, Modular Trench Drain	136.97		18.09
		<i>For Acid Resistant Coated Top Frame, Add</i>	30.83		
		<i>For Galvanized Welded Frame Assembly, Add</i>	32.31		
		<i>For Type 304 Stainless Steel Top Frame, Add</i>	184.98		
33 44 16 00-0047		Outlet Adapters For 12" Wide, High Density Polyethylene, Modular Trench Drains <small>(33 44 16 00-0044)</small>			
33 44 16 00-0048	EA	End Cap For 12" Wide, High Density Polyethylene, Modular Trench Drains.....	70.55		
33 44 16 00-0049	EA	No-Hub End Outlet For 12" Wide, High Density Polyethylene, Modular Trench Drains.....	81.51		
33 44 16 00-0050	EA	No-Hub Bottom Outlet For 12" Wide, High Density Polyethylene, Modular Trench Drains.....	81.51		
33 44 16 00-0051		Other Fittings For 12" Wide, High Density Polyethylene, Modular Trench Drains <small>(33 44 16 00-0044)</small>			
33 44 16 00-0052	EA	Bottom Dome Strainer For 12" Wide, High Density Polyethylene, Modular Trench Drains.....	105.81		
33 44 16 00-0053	EA	Joint Connector For 12" Wide, High Density Polyethylene, Modular Trench Drains.....	135.45		
33 44 16 00-0054	EA	90 Degree, 45 Degree, Tee Or Side Outlet For 12" Wide, High Density Polyethylene, Modular Trench Drains.....	537.57		
33 44 16 00-0055	EA	Cross For 12" Wide, High Density Polyethylene, Modular Trench Drains.....	1,011.89		
33 44 16 00-0056	EA	Cutting Charges For 12" Wide, High Density Polyethylene, Modular Trench Drains	118.58		
33 44 16 00-0057		12" Wide, Fiber Reinforced Polyester, Modular Trench Drains <small>(33 44 16 00-0043)</small>			
33 44 16 00-0058		12" Wide, Fiber Reinforced Polyester, Modular Trench Drains <small>(33 44 16 00-0057)</small>			
33 44 16 00-0059	LF	12" Wide, Fiber Reinforced Polyester, Modular Trench Drain.....	166.62		18.09
		<i>For Acid Resistant Coated Top Frame, Add</i>	30.83		
		<i>For Galvanized Welded Frame Assembly, Add</i>	32.31		
		<i>For Type 304 Stainless Steel Top Frame, Add</i>	184.98		
33 44 16 00-0060		Outlet Adapters For 12" Wide, Fiber Reinforced Polyester, Modular Trench Drains <small>(33 44 16 00-0057)</small>			
33 44 16 00-0061	EA	End Cap For 12" Wide, Fiber Reinforced Polyester, Modular Trench Drains.....	72.92		
33 44 16 00-0062	EA	No-Hub End Outlet For 12" Wide, Fiber Reinforced Polyester, Modular Trench Drains	83.88		
33 44 16 00-0063	EA	No-Hub Bottom Outlet For 12" Wide, Fiber Reinforced Polyester, Modular Trench Drains	83.88		
33 44 16 00-0064		Other Fittings For 12" Wide, Fiber Reinforced Polyester, Modular Trench Drains <small>(33 44 16 00-0057)</small>			
33 44 16 00-0065	EA	Bottom Dome Strainer For 12" Wide, Fiber Reinforced Polyester, Modular Trench Drains.....	105.81		



Utilities	33	CS
Storm Drainage Utilities	33 40	
Storm Utility Water Drains	33 44	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 44 16 00-0066 EA Joint Connector For 12" Wide, Fiber Reinforced Polyester, Modular Trench Drains	135.45	
33 44 16 00-0067 EA 90 Degree, 45 Degree, Tee Or Side Outlet For 12" Wide, Fiber Reinforced Polyester, Modular Trench Drains	537.57	
33 44 16 00-0068 EA Cross For 12" Wide, Fiber Reinforced Polyester, Modular Trench Drains	1,011.89	
33 44 16 00-0069 EA Cutting Charges For 12" Wide, Fiber Reinforced Polyester, Modular Trench Drains.....	118.58	
33 44 16 00-0070 12" Wide, Vinylester Fiberglass, Modular Trench Drains (33 44 16 00-0043)		
33 44 16 00-0071 12" Wide, Vinylester Fiberglass, Modular Trench Drains (33 44 16 00-0070)		
33 44 16 00-0072 LF 12" Wide, Vinylester Fiberglass, Modular Trench Drain.....	225.91	18.09
For Acid Resistant Coated Top Frame, Add	30.83	
For Galvanized Welded Frame Assembly, Add	32.31	
For Type 304 Stainless Steel Top Frame, Add	184.98	
33 44 16 00-0073 Outlet Adapters For 12" Wide, Vinylester Fiberglass, Modular Trench Drains (33 44 16 00-0070)		
33 44 16 00-0074 EA End Cap For 12" Wide, Vinylester Fiberglass, Modular Trench Drains.....	161.85	
33 44 16 00-0075 EA No-Hub End Outlet For 12" Wide, Vinylester Fiberglass, Modular Trench Drains	172.81	
33 44 16 00-0076 EA No-Hub Bottom Outlet For 12" Wide, Vinylester Fiberglass, Modular Trench Drains	172.81	
33 44 16 00-0077 Other Fittings For 12" Wide, Vinylester Fiberglass, Modular Trench Drains (33 44 16 00-0070)		
33 44 16 00-0078 EA Bottom Dome Strainer For 12" Wide, Vinylester Fiberglass, Modular Trench Drains	105.81	
33 44 16 00-0079 EA Joint Connector For 12" Wide, Vinylester Fiberglass, Modular Trench Drains	135.45	
33 44 16 00-0080 EA 90 Degree, 45 Degree, Tee Or Side Outlet For 12" Wide, Vinylester Fiberglass, Modular Trench Drains	537.57	
33 44 16 00-0081 EA Cross For 12" Wide, Vinylester Fiberglass, Modular Trench Drains	1,011.89	
33 44 16 00-0082 EA Cutting Charges For 12" Wide, Vinylester Fiberglass, Modular Trench Drains.....	118.58	
33 44 16 00-0083 23" Wide, Modular Trench Drains (33 44 16 00-0002)		
33 44 16 00-0084 23" Wide, High Density Polyethylene, Modular Trench Drains (33 44 16 00-0083)		
33 44 16 00-0085 23" Wide, High Density Polyethylene, Modular Trench Drains (33 44 16 00-0084)		
33 44 16 00-0086 LF 23" Wide, High Density Polyethylene, Modular Trench Drain.....	190.54	24.67
For Acid Resistant Coated Frame, Add	46.25	
For Galvanized Frame Assembly, Add	46.25	
For Type 304 Stainless Steel Top Frame, Add	284.59	
33 44 16 00-0087 Outlet Adapters For 23" Wide, High Density Polyethylene, Modular Trench Drains (33 44 16 00-0084)		
33 44 16 00-0088 EA End Cap For 23" Wide, High Density Polyethylene, Modular Trench Drains.....	200.00	
33 44 16 00-0089 EA No-Hub End Outlet For 23" Wide, High Density Polyethylene, Modular Trench Drains.....	310.25	
33 44 16 00-0090 EA No-Hub Bottom Outlet For 23" Wide, High Density Polyethylene, Modular Trench Drains.....	310.25	
33 44 16 00-0091 Other Fittings For 23" Wide, High Density Polyethylene, Modular Trench Drains (33 44 16 00-0084)		
33 44 16 00-0092 EA Bottom Dome Strainer For 23" Wide, High Density Polyethylene, Modular Trench Drains.....	232.19	
33 44 16 00-0093 EA 90 Degree, 45 Degree, Tee Or Side Outlet For 23" Wide, High Density Polyethylene, Modular Trench Drains.....	1,051.42	
33 44 16 00-0094 EA Cross For 23" Wide, High Density Polyethylene, Modular Trench Drains.....	2,000.06	
33 44 16 00-0095 EA Cutting Charges For 23" Wide, High Density Polyethylene, Modular Trench Drains	237.16	
33 44 16 00-0096 Modular Trench Drain Grates (33 44 16 00-0001)		
33 44 16 00-0097 6" Wide, Modular Trench Drain Grates (33 44 16 00-0096)		
33 44 16 00-0098 LF 6" Wide, Galvanized Ductile Iron Cast Bar, Modular Trench Drain Grate	61.04	2.46
33 44 16 00-0099 LF 6" Wide, Ductile Iron Cast Bar, Modular Trench Drain Grate.....	52.09	2.46
33 44 16 00-0100 LF 6" Wide, Ductile Iron Solid Cover, Modular Trench Drain Grate	54.58	2.46
33 44 16 00-0101 LF 6" Wide, Ductile Iron Slotted, Modular Trench Drain Grate.....	47.99	2.46
33 44 16 00-0102 LF 6" Wide, Galvanized Ductile Iron Slotted, Modular Trench Drain Grate.....	51.55	2.46
33 44 16 00-0103 LF 6" Wide, Heel Proof Ductile Iron, Modular Trench Drain Grate.....	52.14	2.46
33 44 16 00-0104 LF 6" Wide, Ductile Iron Longitudinal Slotted, Modular Trench Drain Grate	52.14	2.46
33 44 16 00-0105 LF 6" Wide, Galvanized Cast Iron Slotted, Modular Trench Drain Grate	51.55	2.46
33 44 16 00-0106 LF 6" Wide, Galvanized Steel Slotted, Modular Trench Drain Grate.....	45.62	2.46
33 44 16 00-0107 LF 6" Wide, Perforated Galvanized Steel, Modular Trench Drain Grate	45.62	2.46
33 44 16 00-0108 LF 6" Wide, Reinforced Galvanized Steel Slotted, Modular Trench Drain Grate	48.35	2.46
33 44 16 00-0109 LF 6" Wide, Reinforced Perforated Galvanized Steel, Modular Trench Drain Grate.....	48.35	2.46
33 44 16 00-0110 LF 6" Wide, Fabricated Stainless Steel Slotted, Modular Trench Drain Grate	62.22	2.46
33 44 16 00-0111 LF 6" Wide, Perforated Stainless Steel, Modular Trench Drain Grate	62.22	2.46
33 44 16 00-0112 LF 6" Wide, Reinforced Stainless Steel Slotted, Modular Trench Drain Grate.....	112.03	2.46
33 44 16 00-0113 LF 6" Wide, Reinforced Perforated Stainless Steel, Modular Trench Drain Grate	112.03	2.46
33 44 16 00-0114 LF 6" Wide, Stainless Steel Bar, Modular Trench Drain Grate.....	307.68	2.46
33 44 16 00-0115 LF 6" Wide, Heel Proof Polyethylene, Modular Trench Drain Grate	43.25	2.46
33 44 16 00-0116 LF 6" Wide, Fiberglass, Modular Trench Drain Grate	90.68	2.46

33 Utilities**33 40 Storm Drainage Utilities****33 44 Storm Utility Water Drains**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 44 16 00-0117 12" Wide, Modular Trench Drain Grates <small>(33 44 16 00-0096)</small>		
33 44 16 00-0118 LF 12" Wide, Black Acid Resistant Coated Ductile Iron, Modular Trench Drain Grate.....	164.60	2.67
33 44 16 00-0119 LF 12" Wide, Ductile Iron Solid Cover, Modular Trench Drain Grate.....	157.49	2.67
33 44 16 00-0120 LF 12" Wide, Galvanized Ductile Iron Slotted, Modular Trench Drain Grate.....	137.33	2.67
33 44 16 00-0121 LF 12" Wide, Heel Proof Ductile Iron, Modular Trench Drain Grate.....	144.15	2.67
33 44 16 00-0122 LF 12" Wide, Perforated Galvanized Steel, Modular Trench Drain Grate.....	124.88	2.67
33 44 16 00-0123 LF 12" Wide, Reinforced Galvanized Steel Slotted, Modular Trench Drain Grate.....	241.98	2.67
33 44 16 00-0124 LF 12" Wide, Reinforced Perforated Galvanized Steel, Modular Trench Drain Grate.....	241.98	2.67
33 44 16 00-0125 LF 12" Wide, Fabricated Stainless Steel Slotted, Modular Trench Drain Grate.....	308.08	2.67
33 44 16 00-0126 LF 12" Wide, Perforated Stainless Steel, Modular Trench Drain Grate.....	308.08	2.67
33 44 16 00-0127 LF 12" Wide, Reinforced Stainless Steel Slotted, Modular Trench Drain Grate.....	392.57	2.67
33 44 16 00-0128 LF 12" Wide, Reinforced Perforated Stainless Steel Slotted, Modular Trench Drain Grate.....	392.57	2.67
33 44 16 00-0129 LF 12" Wide, Stainless Steel Cast Bar, Modular Trench Drain Grate.....	372.71	2.67
33 44 16 00-0130 LF 12" Wide, Fiberglass, Modular Trench Drain Grate.....	177.35	2.67
33 44 16 00-0131 23" Wide, Modular Trench Drain Grates <small>(33 44 16 00-0096)</small>		
33 44 16 00-0132 LF 23" Wide, Ductile Iron Solid Cover, Modular Trench Drain Grate.....	258.70	2.88
33 44 16 00-0133 LF 23" Wide, Ductile Iron Slotted, Modular Trench Drain Grate.....	218.38	2.88
33 44 16 00-0134 LF 23" Wide, Galvanized Ductile Iron Slotted, Modular Trench Drain Grate.....	336.96	2.88
33 44 16 00-0135 LF 23" Wide, Heel Proof Longitudinal Ductile Iron, Modular Trench Drain Grate.....	250.40	2.88
33 44 19 Utility Oil and Gas Separators <small>(33 44)</small>		
33 44 19 19 Utility Oil and Gas Separators <small>(33 44 19)</small>		
33 44 19 19-0001 Oil/Water Separator <small>(33 44 19 19)</small> Note: Complete with internal sensors and detectors.		
33 44 19 19-0002 Coalescing Oil Water Separator <small>(33 44 19 19-0001)</small> Note: Underground tank with interior polyurethane coating. Includes manways, coalescer, inlet and outlet spools, pump mount, 2" level sensor pipe and 4" pump out pipe. HighGuard as manufactured by Highland Tank, Stoystown, PA.		
33 44 19 19-0003 Single Wall Steel Coalescing Oil Water Separator <small>(33 44 19 19-0002)</small>		
33 44 19 19-0004 EA 550 Gallon, 55 GPM Single Wall Steel Coalescing Oil Water Separator With Manways.....	11,274.99	
Note: HTC-G 550. 3'-6" diameter x 10'-9" long tank.		
For Interior Polyurethane Coating, Add	711.00	
33 44 19 19-0005 EA 1,000 Gallon, 100 GPM Single Wall Steel Coalescing Oil Water Separator With Manways.....	13,349.92	
Note: HTC-G 1000. 4' diameter x 14' long tank.		
For Interior Polyurethane Coating, Add	893.70	
33 44 19 19-0006 EA 2,000 Gallon, 200 GPM Single Wall Steel Coalescing Oil Water Separator With Manways.....	15,583.71	
Note: HTC-G 2000. 5'-4" diameter x 15' long tank.		
For Interior Polyurethane Coating, Add	1,340.10	
33 44 19 19-0007 Double Wall Steel Coalescing Oil Water Separator <small>(33 44 19 19-0002)</small>		
33 44 19 19-0008 EA 550 Gallon, 55 GPM Double Wall Steel Coalescing Oil Water Separator With Manways.....	16,409.46	
Note: HTC-G 550. 3'-6" diameter x 10'-9" long tank.		
For Interior Polyurethane Coating, Add	711.00	
33 44 19 19-0009 EA 1,000 Gallon, 100 GPM Double Wall Steel Coalescing Oil Water Separator With Manways.....	18,569.69	
Note: HTC-G 1000. 4' diameter x 14' long tank.		
For Interior Polyurethane Coating, Add	893.70	
33 44 19 19-0010 EA 2,000 Gallon, 200 GPM Double Wall Steel Coalescing Oil Water Separator With Manways.....	22,247.77	
Note: HTC-G 2000. 5'-4" diameter x 15' long tank.		
For Interior Polyurethane Coating, Add	1,340.10	
33 44 19 19-0011 EA 3,000 Gallon, 300 GPM Double Wall Steel Coalescing Oil Water Separator With Manways.....	25,577.73	
Note: HTC-G 3000. 5'-4" diameter x 21'-4" long tank.		
For Interior Polyurethane Coating, Add	1,550.70	
33 44 19 19-0012 EA 5,000 Gallon, 500 GPM Double Wall Steel Coalescing Oil Water Separator With Manways.....	33,151.48	
Note: HTC-G 5000. 6' diameter x 28'-8" long tank.		
For Interior Polyurethane Coating, Add	2,057.80	
33 44 19 19-0013 Accessories For Coalescing Oil Water Separators <small>(33 44 19 19-0002)</small>		
33 44 19 19-0014 EA Single Channel Alarm Panel For Coalescing Oil Water Separator.....	627.10	
Note: HTAP1.		
33 44 19 19-0015 EA Two Channel Alarm Panel For Coalescing Oil Water Separator.....	848.62	
Note: HTAP2.		
33 44 19 19-0016 EA Float Interface Sensor For Coalescing Oil Water Separator.....	494.87	
Note: Required for UL 2215 label.		
33 44 19 19-0017 EA 1-1/2" Liquid Only Sensor For Coalescing Oil Water Separator.....	370.54	
Note: Required for UL 2215 label.		
33 44 19 19-0018 EA Polyvinyl Chloride (PVC) Cap For 2" Sensor For Coalescing Oil Water Separator.....	137.42	
Note: Required for UL 2215 label.		
33 44 19 19-0019 EA 550, 1,000 Or 2,000 Gallon Tank Concrete Deadmen Set (2 Each) For Coalescing Oil Water Separator.....	2,106.56	
33 44 19 19-0020 EA 3,000 Gallon Tank Concrete Deadmen Set (4 Each) For Coalescing Oil Water Separator.....	4,213.10	
33 44 19 19-0021 EA 5,000 Gallon Tank Concrete Deadmen Set (6 Each) For Coalescing Oil Water Separator.....	6,319.72	
33 44 19 19-0022 EA 550 Or 1,000 Gallon Tank Polyester Hold Down Straps (2 Each) With Galvanized Turnbuckle And Clamps For Coalescing Oil Water Separator.....	406.11	
33 44 19 19-0023 EA 2,000 Gallon Tank Polyester Hold Down Straps (2 Each) With Galvanized Turnbuckle And Clamps For Coalescing Oil Water Separator.....	472.42	



Utilities	33	CS
Storm Drainage Utilities	33 40	
Storm Utility Water Drains	33 44	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 44 19 19-0024 EA 3,000 Gallon Tank Polyester Hold Down Straps (4 Each) With Galvanized Turnbuckle And Clamps For Coalescing Oil Water Separator	944.83	
33 44 19 19-0025 EA 5,000 Gallon Tank Polyester Hold Down Straps (6 Each) With Galvanized Turnbuckle And Clamps For Coalescing Oil Water Separator	2,038.90	
33 44 19 19-0026 EA 30" Diameter Grade Level Manway For Coalescing Oil Water Separator	561.52	
Note: Required when installed in paved areas.		
33 44 19 19-0027 EA 36" Diameter Grade Level Manway For Coalescing Oil Water Separator	724.70	
Note: Required when installed in paved areas.		
33 44 19 19-0028 EA 48" Diameter Grade Level Manway For Coalescing Oil Water Separator	991.48	
Note: Required when installed in paved areas.		
33 44 19 19-0029 EA 54" x 54" Grade Level Manway For Coalescing Oil Water Separator	1,766.47	
Note: Required when installed in paved areas.		
33 44 19 19-0030 EA 66" x 54" Grade Level Manway For Coalescing Oil Water Separator	2,257.57	
Note: Required when installed in paved areas.		
33 44 19 19-0031 EA 66" x 66" Grade Level Manway For Coalescing Oil Water Separator	2,821.20	
Note: Required when installed in paved areas.		
33 44 19 19-0032 EA 78" x 66" Grade Level Manway For Coalescing Oil Water Separator	3,544.39	
Note: Required when installed in paved areas.		
33 44 19 19-0033 EA 550 Gallon Petroscreen (Material Only) For Coalescing Oil Water Separator	691.07	
33 44 19 19-0034 EA 1,000 Gallon Petroscreen (Material Only) For Coalescing Oil Water Separator	842.33	
33 44 19 19-0035 EA 2,000 Gallon Petroscreen (Material Only) For Coalescing Oil Water Separator	1,323.07	
33 44 19 19-0036 EA 550 Gallon Corrugated Coalescer Plate (Material Only) For Coalescing Oil Water Separator	658.95	
33 44 19 19-0037 EA 1,000 Gallon Corrugated Coalescer Plate (Material Only) For Coalescing Oil Water Separator	799.85	
33 44 19 19-0038 EA 2,000 Gallon Corrugated Coalescer Plate (Material Only) For Coalescing Oil Water Separator	949.05	
33 44 19 19-0039 EA 18" Manhole Gasket (Material Only) For Coalescing Oil Water Separator	55.95	
33 44 19 19-0040 EA 24" Manhole Gasket (Material Only) For Coalescing Oil Water Separator	63.20	
33 44 19 19-0041 Oil Skimmers <small>(33 44 19 19)</small>		
33 44 19 19-0042 Oil Skimmers, 12" And 24" Models <small>(33 44 19 19-0041)</small>		
33 44 19 19-0043 EA Oil Skimmers, TENV, 12" Open, 1/2 HP, 230/460 Volt, 3 Phase	4,556.40	441.08
33 44 19 19-0044 EA Oil Skimmers, Explosion-Proof, 12" Open, 1/2 HP, 230/460 Volt, 3 Phase	4,781.48	441.08
33 44 19 19-0045 EA Oil Skimmers, TENV, 12" Open, 1/2 HP, 115/220 Volt, 1 Phase	4,577.24	441.08
33 44 19 19-0046 EA Oil Skimmers, Explosion-Proof, 12" Open, 1/2 HP, 115/220 Volt, 1 Phase	4,865.88	441.08
33 44 19 19-0047 EA Oil Skimmers, TENV, 12" Enclosed, 1/2 HP, 230/460 Volt, 3 Phase	4,813.78	441.08
33 44 19 19-0048 EA Oil Skimmers, Explosion-Proof, 12" Enclosed, 1/2 HP, 230/460 Volt, 3 Phase	5,004.47	441.08
33 44 19 19-0049 EA Oil Skimmers, TENV, 12" Enclosed, 1/2 HP, 115/220 Volt, 1 Phase	4,862.76	441.08
33 44 19 19-0050 EA Oil Skimmers, Explosion-Proof, 12" Enclosed, 1/2 HP, 115/220 Volt, 1 Phase	5,150.36	441.08
33 44 19 19-0051 EA Oil Skimmers, TENV, 24" Open, 1/2 HP, 230/460 Volt, 3 Phase	5,092.39	588.23
33 44 19 19-0052 EA Oil Skimmers, Explosion-Proof, 24" Open, 1/2 HP, 230/460 Volt, 3 Phase	5,333.10	588.23
33 44 19 19-0053 EA Oil Skimmers, TENV, 24" Open, 1/2 HP, 115/220 Volt, 1 Phase	5,155.95	588.23
33 44 19 19-0054 EA Oil Skimmers, Explosion-Proof, 24" Open, 1/2 HP, 115/220 Volt, 1 Phase	5,501.91	588.23
33 44 19 19-0055 EA Oil Skimmers, TENV, 24" Enclosed, 1/2 HP, 230/460 Volt, 3 Phase	5,700.94	588.23
33 44 19 19-0056 EA Oil Skimmers, Explosion-Proof, 24" Enclosed, 1/2 HP, 230/460 Volt, 3 Phase	5,941.65	588.23
33 44 19 19-0057 EA Oil Skimmers, TENV, 24" Enclosed, 1/2 HP, 115/220 Volt, 1 Phase	5,752.00	588.23
33 44 19 19-0058 EA Oil Skimmers, Explosion-Proof, 24" Enclosed, 1/2 HP, 115/220 Volt, 1 Phase	6,099.00	588.23
33 44 19 19-0059 Oil Skimmers, Add-Ons <small>(33 44 19 19-0041)</small>		
33 44 19 19-0060 LF Add For Belt Projection, 12" Width	15.63	
33 44 19 19-0061 LF Add For Belt Projection, 24" Width	29.18	
33 44 19 19-0062 LF Add For Spacer Stands, 12" Models	227.72	
33 44 19 19-0063 LF Add For Spacer Stands, 24" Models	273.57	
33 46 Subdrainage <small>(33 40)</small>		
33 46 16 Subdrainage Piping <small>(33 46)</small>		
33 46 16 00-0001 Perforated Polyvinyl Chloride (PVC) Drainage Piping, D2729 <small>(33 46 16)</small>		
Note: Includes fittings, couplings, elbows, etc.		
33 46 16 00-0002 LF 3" Perforated Polyvinyl Chloride (PVC) Drainage Piping	4.67	3.39
33 46 16 00-0003 LF 4" Perforated Polyvinyl Chloride (PVC) Drainage Piping	5.09	3.66
33 46 16 00-0004 LF 6" Perforated Polyvinyl Chloride (PVC) Drainage Piping	6.86	4.40
33 46 16 00-0005 LF 8" Perforated Polyvinyl Chloride (PVC) Drainage Piping	10.09	5.50
33 46 16 00-0006 LF 10" Perforated Polyvinyl Chloride (PVC) Drainage Piping	15.45	6.28
33 46 16 00-0007 LF 12" Perforated Polyvinyl Chloride (PVC) Drainage Piping	19.61	7.33
33 46 16 00-0008 LF 15" Perforated Polyvinyl Chloride (PVC) Drainage Piping	32.64	8.79
33 46 16 00-0009 Perforated Non Reinforced Concrete Drainage Piping, C444 <small>(33 46 16)</small>		
33 46 16 00-0010 LF 6" Perforated Non Reinforced Concrete Drainage Pipe	19.34	4.69
For Extra Strength, Add	1.11	
For >1,000, Deduct	-0.97	
33 46 16 00-0011 LF 8" Perforated Non Reinforced Concrete Drainage Pipe	22.46	5.47
For Extra Strength, Add	1.37	
For >1,000, Deduct	-1.12	
33 46 16 00-0012 LF 10" Perforated Non Reinforced Concrete Drainage Pipe	25.43	6.25
For Extra Strength, Add	1.60	
For >1,000, Deduct	-1.27	

33	Utilities
33 40	Storm Drainage Utilities
33 46	Subdrainage



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 46 16 00-0013	LF		12" Perforated Non Reinforced Concrete Drainage Pipe..... <i>For Extra Strength, Add</i> <i>For >1,000, Deduct</i>	30.20 2.00 -1.51	7.81
33 46 16 00-0014			Extra Strength Porous Non Reinforced Concrete Drainage Piping, C654 <small>(33 46 16)</small> <small>Note: Bell and spigot or tongue and groove. With seals and gaskets.</small>		
33 46 16 00-0015	LF		6" Extra Strength Porous Non Reinforced Concrete Drainage Pipe..... <i>For >1,000, Deduct</i>	20.09 -1.00	9.84
33 46 16 00-0016	LF		8" Extra Strength Porous Non Reinforced Concrete Drainage Pipe..... <i>For >1,000, Deduct</i>	22.23 -1.11	10.93
33 46 16 00-0017	LF		10" Extra Strength Porous Non Reinforced Concrete Drainage Pipe..... <i>For >1,000, Deduct</i>	24.52 -1.23	12.02
33 46 16 00-0018	LF		12" Extra Strength Porous Non Reinforced Concrete Drainage Pipe..... <i>For >1,000, Deduct</i>	27.77 -1.39	12.49
33 46 16 00-0019	LF		15" Extra Strength Porous Non Reinforced Concrete Drainage Pipe..... <i>For >1,000, Deduct</i>	32.05 -1.60	14.06
33 46 16 00-0020	LF		18" Extra Strength Porous Non Reinforced Concrete Drainage Pipe..... <i>For >1,000, Deduct</i>	39.71 -1.99	17.95
33 46 16 00-0021	LF		21" Extra Strength Porous Non Reinforced Concrete Drainage Pipe..... <i>For >1,000, Deduct</i>	49.68 -2.48	23.03
33 46 16 00-0022	LF		24" Extra Strength Porous Non Reinforced Concrete Drainage Pipe..... <i>For >1,000, Deduct</i>	60.54 -3.03	28.10
33 46 16 00-0023			Standard Strength Porous Non Reinforced Concrete Drainage Piping, C654 <small>(33 46 16)</small>		
33 46 16 00-0024	LF		6" Standard Strength Porous Non Reinforced Concrete Drainage Pipe..... <i>For >1,000, Deduct</i>	14.75 -0.74	4.69
33 46 16 00-0025	LF		8" Standard Strength Porous Non Reinforced Concrete Drainage Pipe..... <i>For >1,000, Deduct</i>	18.66 -0.93	5.47
33 46 16 00-0026	LF		10" Standard Strength Porous Non Reinforced Concrete Drainage Pipe..... <i>For >1,000, Deduct</i>	23.74 -1.19	6.25
33 46 16 00-0027	LF		12" Standard Strength Porous Non Reinforced Concrete Drainage Pipe..... <i>For >1,000, Deduct</i>	34.77 -1.74	12.49
33 46 16 00-0028	LF		15" Standard Strength Porous Non Reinforced Concrete Drainage Pipe..... <i>For >1,000, Deduct</i>	39.67 -1.98	14.06
33 46 16 00-0029	LF		18" Standard Strength Porous Non Reinforced Concrete Drainage Pipe..... <i>For >1,000, Deduct</i>	51.15 -2.56	17.95
33 46 16 00-0030			Perforated Vitrified Clay Drainage Piping, C700 <small>(33 46 16)</small>		
33 46 16 00-0031	LF		4" Perforated Vitrified Clay Drainage Pipe.....	12.94	6.25
33 46 16 00-0032	LF		6" Perforated Vitrified Clay Drainage Pipe.....	16.97	6.25
33 46 16 00-0033	LF		8" Perforated Vitrified Clay Drainage Pipe.....	19.69	6.25
33 46 16 00-0034	LF		10" Perforated Vitrified Clay Drainage Pipe.....	24.22	6.25
33 46 16 00-0035	LF		12" Perforated Vitrified Clay Drainage Pipe.....	29.09	6.25
33 46 16 00-0036			Geotextile Filter Fabric Sock <small>(33 46 16)</small>		
33 46 16 00-0037	LF		3" Geotextile Filter Fabric Sock.....	0.55	
33 46 16 00-0038	LF		4" Geotextile Filter Fabric Sock.....	0.73	
33 46 16 00-0039	LF		6" Geotextile Filter Fabric Sock.....	1.12	
33 46 16 00-0040	LF		8" Geotextile Filter Fabric Sock.....	1.50	
33 46 16 00-0041	LF		10" Geotextile Filter Fabric Sock.....	2.16	
33 46 16 00-0042	LF		12" Geotextile Filter Fabric Sock.....	2.89	
33 46 16 00-0043	LF		15" Geotextile Filter Fabric Sock.....	3.36	
33 46 16 00-0044			Prefabricated Composite Drains <small>(33 46 16)</small>		
33 46 16 00-0045			Panel-Shaped, Oblong Corrugated HDPE Drainage Pipe (ADS AdvanEDGE) <small>(33 46 16 00-0044)</small> <small>Note: Excludes excavation and backfill. See CSI section 31 23 16 13-0000 for excavation and backfill.</small>		
33 46 16 00-0046	LF		12" Height, Panel-Shaped, Oblong Corrugated HDPE Drainage Pipe (ADS AdvanEDGE)..... <i>For External Typar Geotextile Wrap, Add</i>	6.86 1.05	1.76
33 46 16 00-0047	EA		Coupler For 12" Height, Panel-Shaped, Oblong Corrugated HDPE Drainage Pipe (ADS AdvanEDGE).....	30.04	
33 46 16 00-0048	EA		End Cap For 12" Height, Panel-Shaped, Oblong Corrugated HDPE Drainage Pipe (ADS AdvanEDGE).....	30.04	
33 46 16 00-0049	EA		Side Outlet For 12" Height, Panel-Shaped, Oblong Corrugated HDPE Drainage Pipe (ADS AdvanEDGE).....	54.38	
33 46 16 00-0050	EA		End Outlet For 12" Height, Panel-Shaped, Oblong Corrugated HDPE Drainage Pipe (ADS AdvanEDGE).....	54.38	
33 46 16 00-0051	LF		18" Height, Panel-Shaped, Oblong Corrugated HDPE Drainage Pipe (ADS AdvanEDGE)..... <i>For External Typar Geotextile Wrap, Add</i>	10.58 1.58	2.20
33 46 16 00-0052	EA		Coupler For 18" Height, Panel-Shaped, Oblong Corrugated HDPE Drainage Pipe (ADS AdvanEDGE).....	42.53	
33 46 16 00-0053	EA		End Cap For 18" Height, Panel-Shaped, Oblong Corrugated HDPE Drainage Pipe (ADS AdvanEDGE).....	42.53	
33 46 16 00-0054	EA		Side Outlet For 18" Height, Panel-Shaped, Oblong Corrugated HDPE Drainage Pipe (ADS AdvanEDGE).....	59.22	
33 46 16 00-0055	EA		End Outlet For 18" Height, Panel-Shaped, Oblong Corrugated HDPE Drainage Pipe (ADS AdvanEDGE).....	59.22	

33 46 23 Underslab Drainage (33 46)



	Utilities	33	CS
	Storm Drainage Utilities	33 40	
	Subdrainage	33 46	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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33 46 23 00-0001	Capillary Water Barrier Underslab Drainage <small>(33 46 23)</small>		
	Note: Consists of a layer of fine granular material overlying a coarse layer.		
33 46 23 00-0002	CY 2" Stone Capillary Water Barrier (Compacted Thickness) Underslab Drainage	46.19	
33 46 23 00-0003	CY 4" Stone Capillary Water Barrier (Compacted Thickness) Underslab Drainage	44.10	
33 46 23 00-0004	CY 6" Stone Capillary Water Barrier (Compacted Thickness) Underslab Drainage	43.27	
33 46 23 00-0005	CY 8" Stone Capillary Water Barrier (Compacted Thickness) Underslab Drainage	42.03	

33 50 Fuel Distribution Utilities (33)

33 51 Natural-Gas Distribution (33 50)

33 51 13 Natural-Gas Piping (33 51)

See CSI section 23 05 23 00-0000 for gas valves.

33 51 13 00-0001 Gas Distribution Lines (33 51 13)

Note: Excludes excavation and backfill.

33 51 13 00-0002 Medium Density Polyethylene (MDPE) Gas Distribution Piping (33 51 13 00-0001)

Note: 60 PSI, PE2406/PE2708. Includes couplings, #12 tracer wire, helically wrapped around piping.

33 51 13 00-0003	LF 1/2" DR 9 (200 PSI) Medium Density Polyethylene (MDPE) Gas Distribution Pipe	4.24	1.31
33 51 13 00-0004	LF 3/4" DR 11 (160 PSI) Medium Density Polyethylene (MDPE) Gas Distribution Pipe	4.56	1.40
33 51 13 00-0005	LF 1" DR 11 (160 PSI) Medium Density Polyethylene (MDPE) Gas Distribution Pipe	4.88	1.49
33 51 13 00-0006	LF 1-1/4" DR 11 (160 PSI) Medium Density Polyethylene (MDPE) Gas Distribution Pipe	5.36	1.59
33 51 13 00-0007	LF 1-1/2" DR 11 (160 PSI) Medium Density Polyethylene (MDPE) Gas Distribution Pipe	6.60	1.91
33 51 13 00-0008	LF 2" DR 11 (160 PSI) Medium Density Polyethylene (MDPE) Gas Distribution Pipe	7.35	2.08
33 51 13 00-0009	LF 2-1/2" DR 11 (160 PSI) Medium Density Polyethylene (MDPE) Gas Distribution Pipe	9.14	2.42
33 51 13 00-0010	LF 3" DR 11 (160 PSI) Medium Density Polyethylene (MDPE) Gas Distribution Pipe	11.21	2.88
33 51 13 00-0011	LF 4" DR 11 (160 PSI) Medium Density Polyethylene (MDPE) Gas Distribution Pipe	15.06	3.40
33 51 13 00-0012	LF 6" DR 11 (160 PSI) Medium Density Polyethylene (MDPE) Gas Distribution Pipe	20.83	3.40
33 51 13 00-0013	LF 8" DR 11 (160 PSI) Medium Density Polyethylene (MDPE) Gas Distribution Pipe	28.27	4.25

33 51 13 00-0014 Gas Line Taps (33 51 13 00-0001)

Note: Includes material to tap into main and gas valve.

33 51 13 00-0015 Polyethylene, 60 PSI (33 51 13 00-0014)

33 51 13 00-0016	EA 2" Polyethylene Hot Tap, With Valve	985.72	
33 51 13 00-0017	EA 2-1/2" Polyethylene Hot Tap, With Valve	1,137.56	
33 51 13 00-0018	EA 3" Polyethylene Hot Tap, With Valve	1,206.14	
33 51 13 00-0019	EA 4" Polyethylene Hot Tap, With Valve	1,753.39	
33 51 13 00-0020	EA 6" Polyethylene Hot Tap, With Valve	2,671.19	

33 51 13 00-0021 Steel, Schedule 40 (33 51 13 00-0014)

Note: For punch steel service tee.

33 51 13 00-0022	EA 1/2" Iron Pipe Size Weld Base, 1/2" Iron Pipe Size Compression/Plain End Pipe Outlet Punch Valve Steel Service Tee	1,508.81	
33 51 13 00-0023	EA 3/4" Iron Pipe Size Weld Base, 1/2" Iron Pipe Size Compression/Plain End Pipe Outlet Punch Valve Steel Service Tee	1,534.32	
33 51 13 00-0024	EA 3/4" Iron Pipe Size Weld Base, 3/4" Iron Pipe Size Compression/Plain End Pipe Outlet Punch Valve Steel Service Tee	1,571.93	
33 51 13 00-0025	EA 3/4" Iron Pipe Size Weld Base, 1" Iron Pipe Size Compression/Plain End Pipe Outlet Punch Valve Steel Service Tee	1,608.13	
33 51 13 00-0026	EA 1" Iron Pipe Size Weld Base, 1" Iron Pipe Size Compression/Plain End Pipe Outlet Punch Valve Steel Service Tee	1,633.54	
33 51 13 00-0027	EA 1-1/4" Iron Pipe Size Weld Base, 1" Iron Pipe Size Compression/Plain End Pipe Outlet Punch Valve Steel Service Tee	1,775.13	
33 51 13 00-0028	EA 1-1/4" Iron Pipe Size Weld Base, 1-1/4" Iron Pipe Size Compression/Plain End Pipe Outlet Punch Valve Steel Service Tee	1,822.34	

33 51 13 00-0029 Protective Pipe And Fitting Wrap (33 51 13 00-0001)

Note: Pipe is cleaned and primed.

33 51 13 00-0030 Corrosion Resistance Wrap And Coat - Pipe (33 51 13 00-0029)

Note: Field applied.

33 51 13 00-0031	LF 1/2" Pipe Wrap	2.54	
33 51 13 00-0032	LF 3/4" Pipe Wrap	2.67	
33 51 13 00-0033	LF 1" Pipe Wrap	2.82	
33 51 13 00-0034	LF 1-1/4" Pipe Wrap	3.17	
33 51 13 00-0035	LF 1-1/2" Pipe Wrap	3.40	
33 51 13 00-0036	LF 2" Pipe Wrap	3.92	
33 51 13 00-0037	LF 2-1/2" Pipe Wrap	4.77	
33 51 13 00-0038	LF 3" Pipe Wrap	5.94	
33 51 13 00-0039	LF 4" Pipe Wrap	7.50	
33 51 13 00-0040	LF 6" Pipe Wrap	9.99	

33 51 13 00-0041 Corrosion Resistance Wrap And Coat - Fittings (33 51 13 00-0029)

Note: Field applied.

33 51 13 00-0042	EA 1/2" Fitting Wrap	13.74	
33 51 13 00-0043	EA 3/4" Fitting Wrap	13.74	

33 Utilities**33 50 Fuel Distribution Utilities****33 51 Natural-Gas Distribution**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
	33 51	13 00-0044	EA 1" Fitting Wrap	16.93	
	33 51	13 00-0045	EA 1-1/4" Fitting Wrap	19.13	
	33 51	13 00-0046	EA 1-1/2" Fitting Wrap	19.13	
	33 51	13 00-0047	EA 2" Fitting Wrap	22.65	
	33 51	13 00-0048	EA 2-1/2" Fitting Wrap	30.21	
	33 51	13 00-0049	EA 3" Fitting Wrap	41.73	
	33 51	13 00-0050	EA 4" Fitting Wrap	42.27	
	33 51	13 00-0051	EA 6" Fitting Wrap	48.71	
33 51	13 00-0052		Service Fittings <small>(33 51 13 00-0001)</small>		
33 51	13 00-0053		Brass Fittings <small>(33 51 13 00-0052)</small>		
	33 51	13 00-0054	EA 1/2" X 2" Long Nipples, Threaded Both Ends, Brass	24.73	
	33 51	13 00-0055	EA 3/4" X 2" Long Nipples, Threaded Both Ends, Brass	28.45	
	33 51	13 00-0056	EA 1" X 2" Long Nipples, Threaded Both Ends, Brass	35.63	
	33 51	13 00-0057	EA 1-1/4" X 2" Long Nipples, Threaded Both Ends, Brass	43.55	
	33 51	13 00-0058	EA 1-1/2" X 2" Long Nipples, Threaded Both Ends, Brass	48.56	
	33 51	13 00-0059	EA 2" X 2" Long Nipples, Threaded Both Ends, Brass	61.80	
	33 51	13 00-0060	EA 1/2" 90 Degree Elbow, Brass	21.66	
	33 51	13 00-0061	EA 3/4" 90 Degree Elbow, Brass	24.61	
	33 51	13 00-0062	EA 1" 90 Degree Elbow, Brass	31.23	
	33 51	13 00-0063	EA 1-1/4" 90 Degree Elbow, Brass	39.25	
	33 51	13 00-0064	EA 1-1/2" 90 Degree Elbow, Brass	44.36	
	33 51	13 00-0065	EA 2" 90 Degree Elbow, Brass	57.34	
	33 51	13 00-0066	EA 1/2" Diameter Chrome Plated Nipple	16.97	
	33 51	13 00-0067	EA 3/4" Diameter Chrome Plated Nipple	21.74	
	33 51	13 00-0068	EA 1" Diameter Chrome Plated Nipple	28.30	
	33 51	13 00-0069	EA 1-1/4" Diameter Chrome Plated Nipple	40.10	
	33 51	13 00-0070	EA 1-1/2" Diameter Chrome Plated Nipple	48.25	
	33 51	13 00-0071	EA 2" Diameter Chrome Plated Nipple	64.15	
33 51	13 00-0072		Anodless Gas Riser <small>(33 51 13 00-0052)</small>		
	33 51	13 00-0073	EA 3/4" Anodless Gas Riser	62.11	
	33 51	13 00-0074	EA 1" Anodless Gas Riser	76.29	
	33 51	13 00-0075	EA 1-1/4" Anodless Gas Riser	88.36	
	33 51	13 00-0076	EA 1-1/2" Anodless Gas Riser	108.25	
	33 51	13 00-0077	EA 2" Anodless Gas Riser	123.19	
33 51	13 00-0078		Brass Service Adapter <small>(33 51 13 00-0052)</small>		
	33 51	13 00-0079	EA 1/2" Brass Service Adapter	41.89	
	33 51	13 00-0080	EA 3/4" Brass Service Adapter	46.09	
	33 51	13 00-0081	EA 1" Brass Service Adapter	54.92	
	33 51	13 00-0082	EA 1-1/4" Brass Service Adapter	63.17	
	33 51	13 00-0083	EA 1-1/2" Brass Service Adapter	72.31	
	33 51	13 00-0084	EA 2" Brass Service Adapter	82.95	
	33 51	13 00-0085	EA 2-1/2" Brass Service Adapter	127.05	
	33 51	13 00-0086	EA 3" Brass Service Adapter	154.37	
	33 51	13 00-0087	EA 4" Brass Service Adapter	217.31	
33 56			Fuel-Storage Tanks <small>(33 50)</small>		
33 56 13			Aboveground Fuel-Storage Tanks <small>(33 56)</small>		
			See CSI section 23 13 23 00-0000 for aboveground storage tanks.		
33 56 16			Underground Fuel-Storage Tanks <small>(33 56)</small>		
			See CSI section 23 13 13 00-0000 for underground storage tanks.		
33 60			Hydronic And Steam Energy Utilities <small>(33)</small>		
33 61			Hydronic Energy Distribution <small>(33 60)</small>		
33 61 13			Underground Hydronic Energy Distribution <small>(33 61)</small>		
33 61 13 00-0001			Preinsulated Pipe <small>(33 61 13)</small>		
			Note: Includes coupling per full length of pipe. Excludes excavation and backfill. See CSI section 23 01 20 00-0025 for purging of existing system.		
33 61 13 00-0002			Preinsulated Schedule 40 Black Steel Pipe <small>(33 61 13 00-0001)</small>		
			Note: With polyurethane insulation and non-metallic casing. Excludes excavation or backfill.		
33 61 13 00-0003			Standard Black Steel Carrier Pipe <small>(33 61 13 00-0002)</small>		
			Note: With 1/2" polyurethane insulation and non-metallic fiberglass reinforced polyester (FRP) casing.		
	33 61	13 00-0004	LF 3/4" Diameter Preinsulated Schedule 40 Black Steel Pipe With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	39.87	
			For High Density Polyethylene (HDPE) Jacket, Add	0.42	
			For Schedule 80 Pipe, Add	4.24	
	33 61	13 00-0005	LF 1" Diameter Preinsulated Schedule 40 Black Steel Pipe With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	43.47	
			For High Density Polyethylene (HDPE) Jacket, Add	0.47	
			For Schedule 80 Pipe, Add	4.66	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 61 13 00-0006 LF 1-1/4" Diameter Preinsulated Schedule 40 Black Steel Pipe With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i> <i>For Schedule 80 Pipe, Add</i>	47.66 0.53 5.25	
33 61 13 00-0007 LF 1-1/2" Diameter Preinsulated Schedule 40 Black Steel Pipe With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i> <i>For Schedule 80 Pipe, Add</i>	50.78 0.56 5.64	
33 61 13 00-0008 LF 2" Diameter Preinsulated Schedule 40 Black Steel Pipe With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i> <i>For Schedule 80 Pipe, Add</i>	53.45 0.59 5.89	
33 61 13 00-0009 LF 2-1/2" Diameter Preinsulated Schedule 40 Black Steel Pipe With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i> <i>For Schedule 80 Pipe, Add</i>	61.69 0.64 6.40	
33 61 13 00-0010 LF 3" Diameter Preinsulated Schedule 40 Black Steel Pipe With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i> <i>For Schedule 80 Pipe, Add</i>	70.79 0.69 6.92	
33 61 13 00-0011 LF 4" Diameter Preinsulated Schedule 40 Black Steel Pipe With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i> <i>For Schedule 80 Pipe, Add</i>	89.66 0.87 8.71	
33 61 13 00-0012 LF 5" Diameter Preinsulated Schedule 40 Black Steel Pipe With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i> <i>For Schedule 80 Pipe, Add</i>	112.18 1.11 11.14	
33 61 13 00-0013 LF 6" Diameter Preinsulated Schedule 40 Black Steel Pipe With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i> <i>For Schedule 80 Pipe, Add</i>	130.84 1.29 12.94	
33 61 13 00-0014 LF 8" Diameter Preinsulated Schedule 40 Black Steel Pipe With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i> <i>For Schedule 80 Pipe, Add</i>	174.07 1.88 18.83	
33 61 13 00-0015 LF 10" Diameter Preinsulated Schedule 40 Black Steel Pipe With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i> <i>For Schedule 80 Pipe, Add</i>	219.35 2.48 24.85	
33 61 13 00-0016 LF 12" Diameter Preinsulated Schedule 40 Black Steel Pipe With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i> <i>For Schedule 80 Pipe, Add</i>	272.05 3.10 30.99	
33 61 13 00-0017 Standard Black Steel Carrier Pipe <small>(33 61 13 00-0002)</small> Note: With 1" polyurethane insulation and non-metallic fiberglass reinforced polyester (FRP) casing.		
33 61 13 00-0018 LF 3/4" Diameter Preinsulated Schedule 40 Black Steel Pipe With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i> <i>For Schedule 80 Pipe, Add</i>	41.99 0.47 4.66	
33 61 13 00-0019 LF 1" Diameter Preinsulated Schedule 40 Black Steel Pipe With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i> <i>For Schedule 80 Pipe, Add</i>	45.80 0.51 5.13	
33 61 13 00-0020 LF 1-1/4" Diameter Preinsulated Schedule 40 Black Steel Pipe With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i> <i>For Schedule 80 Pipe, Add</i>	50.28 0.58 5.78	
33 61 13 00-0021 LF 1-1/2" Diameter Preinsulated Schedule 40 Black Steel Pipe With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i> <i>For Schedule 80 Pipe, Add</i>	53.59 0.62 6.20	
33 61 13 00-0022 LF 2" Diameter Preinsulated Schedule 40 Black Steel Pipe With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i> <i>For Schedule 80 Pipe, Add</i>	56.39 0.65 6.48	
33 61 13 00-0023 LF 2-1/2" Diameter Preinsulated Schedule 40 Black Steel Pip With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i> <i>For Schedule 80 Pipe, Add</i>	64.89 0.70 7.04	
33 61 13 00-0024 LF 3" Diameter Preinsulated Schedule 40 Black Steel Pipe With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i> <i>For Schedule 80 Pipe, Add</i>	74.25 0.76 7.61	
33 61 13 00-0025 LF 4" Diameter Preinsulated Schedule 40 Black Steel Pipe With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i> <i>For Schedule 80 Pipe, Add</i>	94.01 0.96 9.58	
33 61 13 00-0026 LF 5" Diameter Preinsulated Schedule 40 Black Steel Pipe With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i> <i>For Schedule 80 Pipe, Add</i>	117.75 1.23 12.26	

33 Utilities**33 60 Hydronic And Steam Energy Utilities****33 61 Hydronic Energy Distribution**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 61 13 00-0027	LF		6" Diameter Preinsulated Schedule 40 Black Steel Pipe With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	137.31	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	1.42	
			<i>For Schedule 80 Pipe, Add</i>	14.23	
33 61 13 00-0028	LF		8" Diameter Preinsulated Schedule 40 Black Steel Pipe With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	183.48	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	2.07	
			<i>For Schedule 80 Pipe, Add</i>	20.71	
33 61 13 00-0029	LF		10" Diameter Preinsulated Schedule 40 Black Steel Pipe With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	231.78	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	2.73	
			<i>For Schedule 80 Pipe, Add</i>	27.33	
33 61 13 00-0030	LF		12" Diameter Preinsulated Schedule 40 Black Steel Pipe With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	287.55	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	3.41	
			<i>For Schedule 80 Pipe, Add</i>	34.09	
33 61 13 00-0031			Standard Black Steel Carrier Pipe <small>(33 61 13 00-0002)</small>		
			Note: With 1-1/2" polyurethane insulation and non-metallic fiberglass reinforced polyester (FRP) casing.		
33 61 13 00-0032	LF		3/4" Diameter Preinsulated Schedule 40 Black Steel Pipe With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	43.05	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	0.49	
			<i>For Schedule 80 Pipe, Add</i>	4.88	
33 61 13 00-0033	LF		1" Diameter Preinsulated Schedule 40 Black Steel Pipe With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	46.97	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	0.54	
			<i>For Schedule 80 Pipe, Add</i>	5.36	
33 61 13 00-0034	LF		1-1/4" Diameter Preinsulated Schedule 40 Black Steel Pipe With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	51.59	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	0.60	
			<i>For Schedule 80 Pipe, Add</i>	6.04	
33 61 13 00-0035	LF		1-1/2" Diameter Preinsulated Schedule 40 Black Steel Pipe With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	55.00	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	0.65	
			<i>For Schedule 80 Pipe, Add</i>	6.48	
33 61 13 00-0036	LF		2" Diameter Preinsulated Schedule 40 Black Steel Pipe With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	57.87	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	0.68	
			<i>For Schedule 80 Pipe, Add</i>	6.78	
33 61 13 00-0037	LF		2-1/2" Diameter Preinsulated Schedule 40 Black Steel Pipe With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	66.49	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	0.74	
			<i>For Schedule 80 Pipe, Add</i>	7.36	
33 61 13 00-0038	LF		3" Diameter Preinsulated Schedule 40 Black Steel Pipe With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	75.98	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	0.80	
			<i>For Schedule 80 Pipe, Add</i>	7.95	
33 61 13 00-0039	LF		4" Diameter Preinsulated Schedule 40 Black Steel Pipe With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	96.19	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	1.00	
			<i>For Schedule 80 Pipe, Add</i>	10.02	
33 61 13 00-0040	LF		5" Diameter Preinsulated Schedule 40 Black Steel Pipe With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	120.54	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	1.28	
			<i>For Schedule 80 Pipe, Add</i>	12.81	
33 61 13 00-0041	LF		6" Diameter Preinsulated Schedule 40 Black Steel Pipe With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	140.54	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	1.49	
			<i>For Schedule 80 Pipe, Add</i>	14.88	
33 61 13 00-0042	LF		8" Diameter Preinsulated Schedule 40 Black Steel Pipe With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	188.19	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	2.17	
			<i>For Schedule 80 Pipe, Add</i>	21.65	
33 61 13 00-0043	LF		10" Diameter Preinsulated Schedule 40 Black Steel Pipe With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	237.99	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	2.86	
			<i>For Schedule 80 Pipe, Add</i>	28.57	
33 61 13 00-0044	LF		12" Diameter Preinsulated Schedule 40 Black Steel Pipe With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	295.30	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	3.56	
			<i>For Schedule 80 Pipe, Add</i>	35.64	
33 61 13 00-0045			Standard Black Steel Carrier Pipe <small>(33 61 13 00-0002)</small>		
			Note: With 2" polyurethane insulation and non-metallic fiberglass reinforced polyester (FRP) casing.		
33 61 13 00-0046	LF		3/4" Diameter Preinsulated Schedule 40 Black Steel Pipe With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	44.64	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	0.52	
			<i>For Schedule 80 Pipe, Add</i>	5.19	
33 61 13 00-0047	LF		1" Diameter Preinsulated Schedule 40 Black Steel Pipe With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	48.71	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	0.57	
			<i>For Schedule 80 Pipe, Add</i>	5.71	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 61 13 00-0048 LF 1-1/4" Diameter Preinsulated Schedule 40 Black Steel Pipe With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i> <i>For Schedule 80 Pipe, Add</i>	53.56 0.64 6.43	
33 61 13 00-0049 LF 1-1/2" Diameter Preinsulated Schedule 40 Black Steel Pipe With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i> <i>For Schedule 80 Pipe, Add</i>	57.12 0.69 6.90	
33 61 13 00-0050 LF 2" Diameter Preinsulated Schedule 40 Black Steel Pipe With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i> <i>For Schedule 80 Pipe, Add</i>	60.08 0.72 7.22	
33 61 13 00-0051 LF 2-1/2" Diameter Preinsulated Schedule 40 Black Steel Pipe With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i> <i>For Schedule 80 Pipe, Add</i>	68.89 0.78 7.84	
33 61 13 00-0052 LF 3" Diameter Preinsulated Schedule 40 Black Steel Pipe With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i> <i>For Schedule 80 Pipe, Add</i>	78.57 0.85 8.47	
33 61 13 00-0053 LF 4" Diameter Preinsulated Schedule 40 Black Steel Pipe With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i> <i>For Schedule 80 Pipe, Add</i>	99.45 1.07 10.67	
33 61 13 00-0054 LF 5" Diameter Preinsulated Schedule 40 Black Steel Pipe With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i> <i>For Schedule 80 Pipe, Add</i>	124.72 1.37 13.65	
33 61 13 00-0055 LF 6" Diameter Preinsulated Schedule 40 Black Steel Pipe With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i> <i>For Schedule 80 Pipe, Add</i>	145.39 1.58 15.85	
33 61 13 00-0056 LF 8" Diameter Preinsulated Schedule 40 Black Steel Pipe With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i> <i>For Schedule 80 Pipe, Add</i>	195.25 2.31 23.06	
33 61 13 00-0057 LF 10" Diameter Preinsulated Schedule 40 Black Steel Pipe With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i> <i>For Schedule 80 Pipe, Add</i>	247.31 3.04 30.44	
33 61 13 00-0058 LF 12" Diameter Preinsulated Schedule 40 Black Steel Pipe With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i> <i>For Schedule 80 Pipe, Add</i>	306.92 3.80 37.97	
33 61 13 00-0059 Preinsulated Black Steel Fittings (33 61 13 00-0001) Note: No excavation or backfill.		
33 61 13 00-0060 Elbows (33 61 13 00-0059)		
33 61 13 00-0061 Elbows (33 61 13 00-0060) Note: With 1/2" polyurethane insulation and non-metallic fiberglass reinforced polyester (FRP) casing.		
33 61 13 00-0062 EA 3/4" Diameter Preinsulated Black Steel Elbow With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	303.10 4.35	
33 61 13 00-0063 EA 1" Diameter Preinsulated Black Steel Elbow With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	314.82 4.46	
33 61 13 00-0064 EA 1-1/4" Diameter Preinsulated Black Steel Elbow With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	362.28 5.07	
33 61 13 00-0065 EA 1-1/2" Diameter Preinsulated Black Steel Elbow With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	409.49 5.53	
33 61 13 00-0066 EA 2" Diameter Preinsulated Black Steel Elbow With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	487.44 5.76	
33 61 13 00-0067 EA 2-1/2" Diameter Preinsulated Black Steel Elbow With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	591.07 5.99	
33 61 13 00-0068 EA 3" Diameter Preinsulated Black Steel Elbow With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	687.17 6.92	
33 61 13 00-0069 EA 4" Diameter Preinsulated Black Steel Elbow With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	801.98 8.07	
33 61 13 00-0070 EA 5" Diameter Preinsulated Black Steel Elbow With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	945.26 10.37	
33 61 13 00-0071 EA 6" Diameter Preinsulated Black Steel Elbow With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	1,036.95 11.78	
33 61 13 00-0072 EA 8" Diameter Preinsulated Black Steel Elbow With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	1,449.51 17.03	

33 Utilities**33 60 Hydronic And Steam Energy Utilities****33 61 Hydronic Energy Distribution**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 61	13 00-0073	EA	10" Diameter Preinsulated Black Steel Elbow With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	1,961.19	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	21.77	
33 61	13 00-0074	EA	12" Diameter Preinsulated Black Steel Elbow With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	2,488.40	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	28.82	
33 61 13 00-0075 Elbows <small>(33 61 13 00-0060)</small>					
Note: With 1" polyurethane insulation and non-metallic fiberglass reinforced polyester (FRP) casing.					
33 61	13 00-0076	EA	3/4" Diameter Preinsulated Black Steel Elbow With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	319.43	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	4.68	
33 61	13 00-0077	EA	1" Diameter Preinsulated Black Steel Elbow With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	331.54	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	4.79	
33 61	13 00-0078	EA	1-1/4" Diameter Preinsulated Black Steel Elbow With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	381.30	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	5.45	
33 61	13 00-0079	EA	1-1/2" Diameter Preinsulated Black Steel Elbow With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	430.23	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	5.95	
33 61	13 00-0080	EA	2" Diameter Preinsulated Black Steel Elbow With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	509.05	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	6.20	
33 61	13 00-0081	EA	2-1/2" Diameter Preinsulated Black Steel Elbow With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	613.55	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	6.44	
33 61	13 00-0082	EA	3" Diameter Preinsulated Black Steel Elbow With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	713.10	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	7.43	
33 61	13 00-0083	EA	4" Diameter Preinsulated Black Steel Elbow With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	832.24	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	8.67	
33 61	13 00-0084	EA	5" Diameter Preinsulated Black Steel Elbow With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	984.16	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	11.15	
33 61	13 00-0085	EA	6" Diameter Preinsulated Black Steel Elbow With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	1,081.14	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	12.67	
33 61	13 00-0086	EA	8" Diameter Preinsulated Black Steel Elbow With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	1,513.39	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	18.31	
33 61	13 00-0087	EA	10" Diameter Preinsulated Black Steel Elbow With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	2,042.84	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	23.41	
33 61	13 00-0088	EA	12" Diameter Preinsulated Black Steel Elbow With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	2,596.47	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	30.98	
33 61 13 00-0089 Elbows <small>(33 61 13 00-0060)</small>					
Note: With 1-1/2" polyurethane insulation and non-metallic fiberglass reinforced polyester (FRP) casing.					
33 61	13 00-0090	EA	3/4" Diameter Preinsulated Black Steel Elbow With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	335.76	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	5.01	
33 61	13 00-0091	EA	1" Diameter Preinsulated Black Steel Elbow With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	348.25	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	5.13	
33 61	13 00-0092	EA	1-1/4" Diameter Preinsulated Black Steel Elbow With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	400.32	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	5.83	
33 61	13 00-0093	EA	1-1/2" Diameter Preinsulated Black Steel Elbow With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	450.98	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	6.36	
33 61	13 00-0094	EA	2" Diameter Preinsulated Black Steel Elbow With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	530.67	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	6.63	
33 61	13 00-0095	EA	2-1/2" Diameter Preinsulated Black Steel Elbow With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	636.02	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	6.89	
33 61	13 00-0096	EA	3" Diameter Preinsulated Black Steel Elbow With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	739.04	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	7.95	
33 61	13 00-0097	EA	4" Diameter Preinsulated Black Steel Elbow With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	862.50	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	9.28	
33 61	13 00-0098	EA	5" Diameter Preinsulated Black Steel Elbow With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	1,023.07	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	11.93	
33 61	13 00-0099	EA	6" Diameter Preinsulated Black Steel Elbow With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	1,125.33	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	13.55	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 61 13 00-0100 EA 8" Diameter Preinsulated Black Steel Elbow With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	1,577.27	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	19.59	
33 61 13 00-0101 EA 10" Diameter Preinsulated Black Steel Elbow With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	2,124.49	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	25.04	
33 61 13 00-0102 EA 12" Diameter Preinsulated Black Steel Elbow With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	2,704.53	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	33.14	
33 61 13 00-0103 Elbows <small>(33 61 13 00-0060)</small>		
<i>Note: With 2" polyurethane insulation and non-metallic fiberglass reinforced polyester (FRP) casing.</i>		
33 61 13 00-0104 EA 3/4" Diameter Preinsulated Black Steel Elbow With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	352.09	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	5.33	
33 61 13 00-0105 EA 1" Diameter Preinsulated Black Steel Elbow With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	364.96	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	5.46	
33 61 13 00-0106 EA 1-1/4" Diameter Preinsulated Black Steel Elbow With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	419.34	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	6.21	
33 61 13 00-0107 EA 1-1/2" Diameter Preinsulated Black Steel Elbow With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	471.73	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	6.78	
33 61 13 00-0108 EA 2" Diameter Preinsulated Black Steel Elbow With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	552.28	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	7.06	
33 61 13 00-0109 EA 2-1/2" Diameter Preinsulated Black Steel Elbow With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	658.50	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	7.34	
33 61 13 00-0110 EA 3" Diameter Preinsulated Black Steel Elbow With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	764.97	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	8.47	
33 61 13 00-0111 EA 4" Diameter Preinsulated Black Steel Elbow With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	892.75	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	9.88	
33 61 13 00-0112 EA 5" Diameter Preinsulated Black Steel Elbow With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	1,061.97	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	12.71	
33 61 13 00-0113 EA 6" Diameter Preinsulated Black Steel Elbow With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	1,169.51	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	14.43	
33 61 13 00-0114 EA 8" Diameter Preinsulated Black Steel Elbow With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	1,641.14	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	20.87	
33 61 13 00-0115 EA 10" Diameter Preinsulated Black Steel Elbow With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	2,206.14	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	26.67	
33 61 13 00-0116 EA 12" Diameter Preinsulated Black Steel Elbow With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	2,812.59	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	35.30	
33 61 13 00-0117 Tees <small>(33 61 13 00-0059)</small>		
33 61 13 00-0118 Tees <small>(33 61 13 00-0117)</small>		
<i>Note: With 1/2" polyurethane insulation and non-metallic fiberglass reinforced polyester (FRP) casing.</i>		
33 61 13 00-0119 EA 3/4" Diameter Preinsulated Black Steel Tee With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	451.34	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	6.47	
33 61 13 00-0120 EA 1" Diameter Preinsulated Black Steel Tee With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	468.77	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	6.62	
33 61 13 00-0121 EA 1-1/4" Diameter Preinsulated Black Steel Tee With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	539.47	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	7.53	
33 61 13 00-0122 EA 1-1/2" Diameter Preinsulated Black Steel Tee With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	609.92	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	8.22	
33 61 13 00-0123 EA 2" Diameter Preinsulated Black Steel Tee With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	726.48	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	8.56	
33 61 13 00-0124 EA 2-1/2" Diameter Preinsulated Black Steel Tee With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	881.57	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	8.90	
33 61 13 00-0125 EA 3" Diameter Preinsulated Black Steel Tee With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	1,025.56	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	10.27	
33 61 13 00-0126 EA 4" Diameter Preinsulated Black Steel Tee With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	1,196.91	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	11.98	
33 61 13 00-0127 EA 5" Diameter Preinsulated Black Steel Tee With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	1,412.36	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	15.41	

33 Utilities**33 60 Hydronic And Steam Energy Utilities****33 61 Hydronic Energy Distribution**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 61	13 00-0128	EA	6" Diameter Preinsulated Black Steel Tee With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	1,547.22	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	17.50	
33 61	13 00-0129	EA	8" Diameter Preinsulated Black Steel Tee With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	2,160.40	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	25.30	
33 61	13 00-0130	EA	10" Diameter Preinsulated Black Steel Tee With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	2,926.99	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	32.33	
33 61	13 00-0131	EA	12" Diameter Preinsulated Black Steel Tee With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	3,710.99	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	42.79	
33 61	13 00-0132		Tees <small>(33 61 13 00-0117)</small>		
			Note: With 1" polyurethane insulation and non-metallic fiberglass reinforced polyester (FRP) casing.		
33 61	13 00-0133	EA	3/4" Diameter Preinsulated Black Steel Tee With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	475.59	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	6.95	
33 61	13 00-0134	EA	1" Diameter Preinsulated Black Steel Tee With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	493.59	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	7.12	
33 61	13 00-0135	EA	1-1/4" Diameter Preinsulated Black Steel Tee With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	567.72	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	8.10	
33 61	13 00-0136	EA	1-1/2" Diameter Preinsulated Black Steel Tee With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	640.73	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	8.83	
33 61	13 00-0137	EA	2" Diameter Preinsulated Black Steel Tee With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	758.57	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	9.20	
33 61	13 00-0138	EA	2-1/2" Diameter Preinsulated Black Steel Tee With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	914.95	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	9.57	
33 61	13 00-0139	EA	3" Diameter Preinsulated Black Steel Tee With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	1,064.08	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	11.04	
33 61	13 00-0140	EA	4" Diameter Preinsulated Black Steel Tee With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	1,241.84	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	12.88	
33 61	13 00-0141	EA	5" Diameter Preinsulated Black Steel Tee With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	1,470.14	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	16.56	
33 61	13 00-0142	EA	6" Diameter Preinsulated Black Steel Tee With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	1,612.84	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	18.81	
33 61	13 00-0143	EA	8" Diameter Preinsulated Black Steel Tee With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	2,255.26	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	27.19	
33 61	13 00-0144	EA	10" Diameter Preinsulated Black Steel Tee With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	3,048.24	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	34.76	
33 61	13 00-0145	EA	12" Diameter Preinsulated Black Steel Tee With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	3,871.46	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	46.00	
33 61	13 00-0146		Tees <small>(33 61 13 00-0117)</small>		
			Note: With 1-1/2" polyurethane insulation and non-metallic fiberglass reinforced polyester (FRP) casing.		
33 61	13 00-0147	EA	3/4" Diameter Preinsulated Black Steel Tee With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	499.84	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	7.44	
33 61	13 00-0148	EA	1" Diameter Preinsulated Black Steel Tee With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	518.41	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	7.61	
33 61	13 00-0149	EA	1-1/4" Diameter Preinsulated Black Steel Tee With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	595.96	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	8.66	
33 61	13 00-0150	EA	1-1/2" Diameter Preinsulated Black Steel Tee With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	671.54	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	9.45	
33 61	13 00-0151	EA	2" Diameter Preinsulated Black Steel Tee With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	790.67	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	9.84	
33 61	13 00-0152	EA	2-1/2" Diameter Preinsulated Black Steel Tee With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	948.33	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	10.24	
33 61	13 00-0153	EA	3" Diameter Preinsulated Black Steel Tee With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	1,102.59	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	11.81	
33 61	13 00-0154	EA	4" Diameter Preinsulated Black Steel Tee With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	1,286.78	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	13.78	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 61 13 00-0155 EA 5" Diameter Preinsulated Black Steel Tee With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	1,527.91	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	17.72	
33 61 13 00-0156 EA 6" Diameter Preinsulated Black Steel Tee With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	1,678.45	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	20.12	
33 61 13 00-0157 EA 8" Diameter Preinsulated Black Steel Tee With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	2,350.12	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	29.09	
33 61 13 00-0158 EA 10" Diameter Preinsulated Black Steel Tee With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	3,169.49	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	37.18	
33 61 13 00-0159 EA 12" Diameter Preinsulated Black Steel Tee With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	4,031.94	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	49.21	
33 61 13 00-0160 Tees <small>(33 61 13 00-0117)</small>		
Note: With 2" polyurethane insulation and non-metallic fiberglass reinforced polyester (FRP) casing.		
33 61 13 00-0161 EA 3/4" Diameter Preinsulated Black Steel Tee With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	524.09	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	7.92	
33 61 13 00-0162 EA 1" Diameter Preinsulated Black Steel Tee With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	543.23	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	8.11	
33 61 13 00-0163 EA 1-1/4" Diameter Preinsulated Black Steel Tee With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	624.20	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	9.23	
33 61 13 00-0164 EA 1-1/2" Diameter Preinsulated Black Steel Tee With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	702.35	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	10.07	
33 61 13 00-0165 EA 2" Diameter Preinsulated Black Steel Tee With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	822.76	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	10.48	
33 61 13 00-0166 EA 2-1/2" Diameter Preinsulated Black Steel Tee With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	981.71	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	10.90	
33 61 13 00-0167 EA 3" Diameter Preinsulated Black Steel Tee With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	1,141.11	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	12.58	
33 61 13 00-0168 EA 4" Diameter Preinsulated Black Steel Tee With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	1,331.71	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	14.68	
33 61 13 00-0169 EA 5" Diameter Preinsulated Black Steel Tee With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	1,585.68	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	18.87	
33 61 13 00-0170 EA 6" Diameter Preinsulated Black Steel Tee With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	1,744.07	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	21.43	
33 61 13 00-0171 EA 8" Diameter Preinsulated Black Steel Tee With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	2,444.98	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	30.99	
33 61 13 00-0172 EA 10" Diameter Preinsulated Black Steel Tee With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	3,290.74	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	39.61	
33 61 13 00-0173 EA 12" Diameter Preinsulated Black Steel Tee With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	4,192.42	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	52.42	
33 61 13 00-0174 Reducers <small>(33 61 13 00-0059)</small>		
33 61 13 00-0175 Reducers <small>(33 61 13 00-0174)</small>		
Note: With 1/2" polyurethane insulation and non-metallic fiberglass reinforced polyester (FRP) casing.		
33 61 13 00-0176 EA 3/4" Diameter Preinsulated Black Steel Reducer With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	257.58	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	3.61	
33 61 13 00-0177 EA 1" Diameter Preinsulated Black Steel Reducer With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	267.72	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	3.70	
33 61 13 00-0178 EA 1-1/4" Diameter Preinsulated Black Steel Reducer With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	308.30	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	4.21	
33 61 13 00-0179 EA 1-1/2" Diameter Preinsulated Black Steel Reducer With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	349.12	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	4.59	
33 61 13 00-0180 EA 2" Diameter Preinsulated Black Steel Reducer With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	418.43	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	4.78	
33 61 13 00-0181 EA 2-1/2" Diameter Preinsulated Black Steel Reducer With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	517.53	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	4.98	
33 61 13 00-0182 EA 3" Diameter Preinsulated Black Steel Reducer With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	596.99	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	5.74	

33 Utilities**33 60 Hydronic And Steam Energy Utilities****33 61 Hydronic Energy Distribution**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 61	13 00-0183	EA	4" Diameter Preinsulated Black Steel Reducer With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	693.37	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	6.70	
33 61	13 00-0184	EA	5" Diameter Preinsulated Black Steel Reducer With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	814.56	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	8.61	
33 61	13 00-0185	EA	6" Diameter Preinsulated Black Steel Reducer With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	892.17	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	9.78	
33 61	13 00-0186	EA	8" Diameter Preinsulated Black Steel Reducer With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	1,245.07	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	14.14	
33 61	13 00-0187	EA	10" Diameter Preinsulated Black Steel Reducer With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	1,689.23	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	18.07	
33 61	13 00-0188	EA	12" Diameter Preinsulated Black Steel Reducer With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	2,137.10	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	23.92	
33 61	13 00-0189		Reducers <small>(33 61 13 00-0174)</small>		
			Note: With 1" polyurethane insulation and non-metallic fiberglass reinforced polyester (FRP) casing.		
33 61	13 00-0190	EA	3/4" Diameter Preinsulated Black Steel Reducer With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	271.13	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	3.89	
33 61	13 00-0191	EA	1" Diameter Preinsulated Black Steel Reducer With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	281.59	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	3.98	
33 61	13 00-0192	EA	1-1/4" Diameter Preinsulated Black Steel Reducer With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	324.09	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	4.53	
33 61	13 00-0193	EA	1-1/2" Diameter Preinsulated Black Steel Reducer With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	366.34	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	4.94	
33 61	13 00-0194	EA	2" Diameter Preinsulated Black Steel Reducer With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	436.37	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	5.14	
33 61	13 00-0195	EA	2-1/2" Diameter Preinsulated Black Steel Reducer With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	536.19	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	5.35	
33 61	13 00-0196	EA	3" Diameter Preinsulated Black Steel Reducer With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	618.52	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	6.17	
33 61	13 00-0197	EA	4" Diameter Preinsulated Black Steel Reducer With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	718.48	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	7.20	
33 61	13 00-0198	EA	5" Diameter Preinsulated Black Steel Reducer With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	846.85	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	9.26	
33 61	13 00-0199	EA	6" Diameter Preinsulated Black Steel Reducer With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	928.84	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	10.51	
33 61	13 00-0200	EA	8" Diameter Preinsulated Black Steel Reducer With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	1,298.09	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	15.20	
33 61	13 00-0201	EA	10" Diameter Preinsulated Black Steel Reducer With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	1,757.00	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	19.43	
33 61	13 00-0202	EA	12" Diameter Preinsulated Black Steel Reducer With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	2,226.80	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	25.71	
33 61	13 00-0203		Reducers <small>(33 61 13 00-0174)</small>		
			Note: With 1-1/2" polyurethane insulation and non-metallic fiberglass reinforced polyester (FRP) casing.		
33 61	13 00-0204	EA	3/4" Diameter Preinsulated Black Steel Reducer With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	284.68	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	4.16	
33 61	13 00-0205	EA	1" Diameter Preinsulated Black Steel Reducer With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	295.46	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	4.25	
33 61	13 00-0206	EA	1-1/4" Diameter Preinsulated Black Steel Reducer With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	339.87	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	4.84	
33 61	13 00-0207	EA	1-1/2" Diameter Preinsulated Black Steel Reducer With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	383.56	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	5.28	
33 61	13 00-0208	EA	2" Diameter Preinsulated Black Steel Reducer With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	454.31	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	5.50	
33 61	13 00-0209	EA	2-1/2" Diameter Preinsulated Black Steel Reducer With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	554.84	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	5.72	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 61 13 00-0210 EA 3" Diameter Preinsulated Black Steel Reducer With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	640.04	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	6.60	
33 61 13 00-0211 EA 4" Diameter Preinsulated Black Steel Reducer With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	743.59	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	7.70	
33 61 13 00-0212 EA 5" Diameter Preinsulated Black Steel Reducer With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	879.14	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	9.90	
33 61 13 00-0213 EA 6" Diameter Preinsulated Black Steel Reducer With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	965.52	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	11.25	
33 61 13 00-0214 EA 8" Diameter Preinsulated Black Steel Reducer With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	1,351.10	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	16.26	
33 61 13 00-0215 EA 10" Diameter Preinsulated Black Steel Reducer With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	1,824.77	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	20.78	
33 61 13 00-0216 EA 12" Diameter Preinsulated Black Steel Reducer With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	2,316.49	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	27.51	
33 61 13 00-0217 Reducers <small>(33 61 13 00-0174)</small>		
<i>Note: With 2" polyurethane insulation and non-metallic fiberglass reinforced polyester (FRP) casing.</i>		
33 61 13 00-0218 EA 3/4" Diameter Preinsulated Black Steel Reducer With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	298.24	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	4.43	
33 61 13 00-0219 EA 1" Diameter Preinsulated Black Steel Reducer With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	309.34	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	4.53	
33 61 13 00-0220 EA 1-1/4" Diameter Preinsulated Black Steel Reducer With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	355.66	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	5.16	
33 61 13 00-0221 EA 1-1/2" Diameter Preinsulated Black Steel Reducer With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	400.78	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	5.63	
33 61 13 00-0222 EA 2" Diameter Preinsulated Black Steel Reducer With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	472.25	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	5.86	
33 61 13 00-0223 EA 2-1/2" Diameter Preinsulated Black Steel Reducer With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	573.50	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	6.09	
33 61 13 00-0224 EA 3" Diameter Preinsulated Black Steel Reducer With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	661.57	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	7.03	
33 61 13 00-0225 EA 4" Diameter Preinsulated Black Steel Reducer With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	768.71	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	8.20	
33 61 13 00-0226 EA 5" Diameter Preinsulated Black Steel Reducer With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	911.43	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	10.55	
33 61 13 00-0227 EA 6" Diameter Preinsulated Black Steel Reducer With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	1,002.19	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	11.98	
33 61 13 00-0228 EA 8" Diameter Preinsulated Black Steel Reducer With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	1,404.12	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	17.32	
33 61 13 00-0229 EA 10" Diameter Preinsulated Black Steel Reducer With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	1,892.53	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	22.14	
33 61 13 00-0230 EA 12" Diameter Preinsulated Black Steel Reducer With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	2,406.19	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	29.30	
33 61 13 00-0231 Preinsulated Type K Copper Pipe <small>(33 61 13 00-0001)</small>		
<i>Note: With polyurethane insulation and non-metallic casing. Excludes excavation or backfill.</i>		
33 61 13 00-0232 Type K Copper Carrier Pipe <small>(33 61 13 00-0231)</small>		
<i>Note: With 1/2" polyurethane insulation and non-metallic fiberglass reinforced polyester (FRP) casing.</i>		
33 61 13 00-0233 LF 3/4" Diameter Preinsulated Type K Copper Pipe With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	44.55	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	0.53	
33 61 13 00-0234 LF 1" Diameter Preinsulated Type K Copper Pipe With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	48.63	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	0.58	
33 61 13 00-0235 LF 1-1/4" Diameter Preinsulated Type K Copper Pipe With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	53.50	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	0.65	
33 61 13 00-0236 LF 1-1/2" Diameter Preinsulated Type K Copper Pipe With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	57.07	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	0.70	
33 61 13 00-0237 LF 2" Diameter Preinsulated Type K Copper Pipe With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	60.01	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	0.73	

33 Utilities**33 60 Hydronic And Steam Energy Utilities****33 61 Hydronic Energy Distribution**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 61	13 00-0238	LF	2-1/2" Diameter Preinsulated Type K Copper Pipe With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	68.74	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	0.79	
33 61	13 00-0239	LF	3" Diameter Preinsulated Type K Copper Pipe With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	78.33	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	0.86	
33 61	13 00-0240	LF	4" Diameter Preinsulated Type K Copper Pipe With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	99.13	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	1.08	
33 61	13 00-0241	LF	5" Diameter Preinsulated Type K Copper Pipe With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	124.36	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	1.38	
33 61	13 00-0242	LF	6" Diameter Preinsulated Type K Copper Pipe With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	144.97	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	1.60	
33 61	13 00-0243	LF	8" Diameter Preinsulated Type K Copper Pipe With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	194.96	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	2.33	
33 61	13 00-0244	LF	10" Diameter Preinsulated Type K Copper Pipe With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	247.15	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	3.08	
33 61	13 00-0245	LF	12" Diameter Preinsulated Type K Copper Pipe With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	306.72	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	3.84	
33 61	13 00-0246		Type K Copper Carrier Pipe <small>(33 61 13 00-0231)</small>		
			Note: With 1" polyurethane insulation and non-metallic fiberglass reinforced polyester (FRP) casing.		
33 61	13 00-0247	LF	3/4" Diameter Preinsulated Type K Copper Pipe With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	47.18	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	0.58	
33 61	13 00-0248	LF	1" Diameter Preinsulated Type K Copper Pipe With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	51.52	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	0.64	
33 61	13 00-0249	LF	1-1/4" Diameter Preinsulated Type K Copper Pipe With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	56.75	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	0.72	
33 61	13 00-0250	LF	1-1/2" Diameter Preinsulated Type K Copper Pipe With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	60.56	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	0.77	
33 61	13 00-0251	LF	2" Diameter Preinsulated Type K Copper Pipe With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	63.66	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	0.80	
33 61	13 00-0252	LF	2-1/2" Diameter Preinsulated Type K Copper Pipe With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	72.71	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	0.87	
33 61	13 00-0253	LF	3" Diameter Preinsulated Type K Copper Pipe With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	82.61	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	0.94	
33 61	13 00-0254	LF	4" Diameter Preinsulated Type K Copper Pipe With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	104.53	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	1.19	
33 61	13 00-0255	LF	5" Diameter Preinsulated Type K Copper Pipe With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	131.26	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	1.52	
33 61	13 00-0256	LF	6" Diameter Preinsulated Type K Copper Pipe With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	152.98	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	1.76	
33 61	13 00-0257	LF	8" Diameter Preinsulated Type K Copper Pipe With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	206.62	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	2.57	
33 61	13 00-0258	LF	10" Diameter Preinsulated Type K Copper Pipe With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	262.54	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	3.39	
33 61	13 00-0259	LF	12" Diameter Preinsulated Type K Copper Pipe With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	325.92	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	4.22	
33 61	13 00-0260		Type K Copper Carrier Pipe <small>(33 61 13 00-0231)</small>		
			Note: With 1-1/2" polyurethane insulation and non-metallic fiberglass reinforced polyester (FRP) casing.		
33 61	13 00-0261	LF	3/4" Diameter Preinsulated Type K Copper Pipe With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	48.49	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	0.60	
33 61	13 00-0262	LF	1" Diameter Preinsulated Type K Copper Pipe With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	52.96	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	0.66	
33 61	13 00-0263	LF	1-1/4" Diameter Preinsulated Type K Copper Pipe With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	58.38	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	0.75	
33 61	13 00-0264	LF	1-1/2" Diameter Preinsulated Type K Copper Pipe With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	62.31	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	0.80	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 61 13 00-0265 LF 2" Diameter Preinsulated Type K Copper Pipe With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	65.48 0.84	
33 61 13 00-0266 LF 2-1/2" Diameter Preinsulated Type K Copper Pipe With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	74.69 0.91	
33 61 13 00-0267 LF 3" Diameter Preinsulated Type K Copper Pipe With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	84.75 0.99	
33 61 13 00-0268 LF 4" Diameter Preinsulated Type K Copper Pipe With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	107.23 1.24	
33 61 13 00-0269 LF 5" Diameter Preinsulated Type K Copper Pipe With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	134.71 1.59	
33 61 13 00-0270 LF 6" Diameter Preinsulated Type K Copper Pipe With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	156.99 1.84	
33 61 13 00-0271 LF 8" Diameter Preinsulated Type K Copper Pipe With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	212.45 2.68	
33 61 13 00-0272 LF 10" Diameter Preinsulated Type K Copper Pipe With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	270.24 3.54	
33 61 13 00-0273 LF 12" Diameter Preinsulated Type K Copper Pipe With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	335.52 4.42	
33 61 13 00-0274 Type K Copper Carrier Pipe <small>(33 61 13 00-0231)</small> Note: With 2" polyurethane insulation and non-metallic fiberglass reinforced polyester (FRP) casing.		
33 61 13 00-0275 LF 3/4" Diameter Preinsulated Type K Copper Pipe With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket..... <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	50.46 0.84	
33 61 13 00-0276 LF 1" Diameter Preinsulated Type K Copper Pipe With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket..... <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	55.13 0.71	
33 61 13 00-0277 LF 1-1/4" Diameter Preinsulated Type K Copper Pipe With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	60.82 0.80	
33 61 13 00-0278 LF 1-1/2" Diameter Preinsulated Type K Copper Pipe With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	64.93 0.86	
33 61 13 00-0279 LF 2" Diameter Preinsulated Type K Copper Pipe With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket..... <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	68.22 0.89	
33 61 13 00-0280 LF 2-1/2" Diameter Preinsulated Type K Copper Pipe With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	77.67 0.97	
33 61 13 00-0281 LF 3" Diameter Preinsulated Type K Copper Pipe With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket..... <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	87.97 1.05	
33 61 13 00-0282 LF 4" Diameter Preinsulated Type K Copper Pipe With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket..... <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	111.27 1.32	
33 61 13 00-0283 LF 5" Diameter Preinsulated Type K Copper Pipe With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket..... <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	139.89 1.69	
33 61 13 00-0284 LF 6" Diameter Preinsulated Type K Copper Pipe With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket..... <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	163.00 1.96	
33 61 13 00-0285 LF 8" Diameter Preinsulated Type K Copper Pipe With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket..... <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	221.20 2.86	
33 61 13 00-0286 LF 10" Diameter Preinsulated Type K Copper Pipe With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket..... <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	281.78 3.77	
33 61 13 00-0287 LF 12" Diameter Preinsulated Type K Copper Pipe With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket..... <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	349.92 4.70	
33 61 13 00-0288 Preinsulated Copper Fittings <small>(33 61 13 00-0001)</small>		
33 61 13 00-0289 Elbows <small>(33 61 13 00-0288)</small>		
33 61 13 00-0290 Elbows <small>(33 61 13 00-0289)</small> Note: With 1/2" polyurethane insulation and non-metallic fiberglass reinforced polyester (FRP) casing.		
33 61 13 00-0291 EA 3/4" Diameter Preinsulated Type K Copper Elbow With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	373.58 5.99	
33 61 13 00-0292 EA 1" Diameter Preinsulated Type K Copper Elbow With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	386.36 6.13	

33 Utilities**33 60 Hydronic And Steam Energy Utilities****33 61 Hydronic Energy Distribution**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 61 13 00-0293 EA 1-1/4" Diameter Preinsulated Type K Copper Elbow With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	443.16	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	6.97	
33 61 13 00-0294 EA 1-1/2" Diameter Preinsulated Type K Copper Elbow With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	495.86	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	7.61	
33 61 13 00-0295 EA 2" Diameter Preinsulated Type K Copper Elbow With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	569.47	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	7.92	
33 61 13 00-0296 EA 2-1/2" Diameter Preinsulated Type K Copper Elbow With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	665.39	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	8.24	
33 61 13 00-0297 EA 3" Diameter Preinsulated Type K Copper Elbow With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	772.25	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	9.51	
33 61 13 00-0298 EA 4" Diameter Preinsulated Type K Copper Elbow With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	901.19	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	11.09	
33 61 13 00-0299 EA 5" Diameter Preinsulated Type K Copper Elbow With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	1,084.03	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	14.26	
33 61 13 00-0300 EA 6" Diameter Preinsulated Type K Copper Elbow With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	1,199.38	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	16.20	
33 61 13 00-0301 EA 8" Diameter Preinsulated Type K Copper Elbow With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	1,690.79	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	23.42	
33 61 13 00-0302 EA 10" Diameter Preinsulated Type K Copper Elbow With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	2,255.37	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	29.93	
33 61 13 00-0303 EA 12" Diameter Preinsulated Type K Copper Elbow With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	2,891.85	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	39.62	
33 61 13 00-0304 Elbows <small>(33 61 13 00-0289)</small>		
Note: With 1" polyurethane insulation and non-metallic fiberglass reinforced polyester (FRP) casing.		
33 61 13 00-0305 EA 3/4" Diameter Preinsulated Type K Copper Elbow With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	396.03	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	6.44	
33 61 13 00-0306 EA 1" Diameter Preinsulated Type K Copper Elbow With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	409.34	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	6.59	
33 61 13 00-0307 EA 1-1/4" Diameter Preinsulated Type K Copper Elbow With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	469.30	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	7.50	
33 61 13 00-0308 EA 1-1/2" Diameter Preinsulated Type K Copper Elbow With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	524.39	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	8.18	
33 61 13 00-0309 EA 2" Diameter Preinsulated Type K Copper Elbow With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	599.18	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	8.52	
33 61 13 00-0310 EA 2-1/2" Diameter Preinsulated Type K Copper Elbow With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	696.29	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	8.86	
33 61 13 00-0311 EA 3" Diameter Preinsulated Type K Copper Elbow With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	807.90	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	10.22	
33 61 13 00-0312 EA 4" Diameter Preinsulated Type K Copper Elbow With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	942.79	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	11.93	
33 61 13 00-0313 EA 5" Diameter Preinsulated Type K Copper Elbow With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	1,137.52	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	15.33	
33 61 13 00-0314 EA 6" Diameter Preinsulated Type K Copper Elbow With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	1,260.13	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	17.41	
33 61 13 00-0315 EA 8" Diameter Preinsulated Type K Copper Elbow With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	1,778.61	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	25.18	
33 61 13 00-0316 EA 10" Diameter Preinsulated Type K Copper Elbow With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	2,367.63	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	32.18	
33 61 13 00-0317 EA 12" Diameter Preinsulated Type K Copper Elbow With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	3,040.42	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	42.59	
33 61 13 00-0318 Elbows <small>(33 61 13 00-0289)</small>		
Note: With 1-1/2" polyurethane insulation and non-metallic fiberglass reinforced polyester (FRP) casing.		
33 61 13 00-0319 EA 3/4" Diameter Preinsulated Type K Copper Elbow With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	418.48	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	6.88	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 61 13 00-0320 EA 1" Diameter Preinsulated Type K Copper Elbow With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	432.31	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	7.05	
33 61 13 00-0321 EA 1-1/4" Diameter Preinsulated Type K Copper Elbow With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	495.45	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	8.02	
33 61 13 00-0322 EA 1-1/2" Diameter Preinsulated Type K Copper Elbow With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	552.91	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	8.75	
33 61 13 00-0323 EA 2" Diameter Preinsulated Type K Copper Elbow With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	628.90	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	9.11	
33 61 13 00-0324 EA 2-1/2" Diameter Preinsulated Type K Copper Elbow With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	727.19	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	9.48	
33 61 13 00-0325 EA 3" Diameter Preinsulated Type K Copper Elbow With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	843.56	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	10.93	
33 61 13 00-0326 EA 4" Diameter Preinsulated Type K Copper Elbow With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	984.39	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	12.76	
33 61 13 00-0327 EA 5" Diameter Preinsulated Type K Copper Elbow With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	1,191.00	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	16.40	
33 61 13 00-0328 EA 6" Diameter Preinsulated Type K Copper Elbow With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	1,321.07	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	18.63	
33 61 13 00-0329 EA 8" Diameter Preinsulated Type K Copper Elbow With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	1,866.31	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	26.93	
33 61 13 00-0330 EA 10" Diameter Preinsulated Type K Copper Elbow With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	2,479.56	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	34.42	
33 61 13 00-0331 EA 12" Diameter Preinsulated Type K Copper Elbow With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	3,189.22	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	45.56	
33 61 13 00-0332 Elbows <small>(33 61 13 00-0289)</small>		
Note: With 2" polyurethane insulation and non-metallic fiberglass reinforced polyester (FRP) casing.		
33 61 13 00-0333 EA 3/4" Diameter Preinsulated Type K Copper Elbow With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	440.94	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	7.33	
33 61 13 00-0334 EA 1" Diameter Preinsulated Type K Copper Elbow With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	455.29	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	7.51	
33 61 13 00-0335 EA 1-1/4" Diameter Preinsulated Type K Copper Elbow With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	521.60	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	8.54	
33 61 13 00-0336 EA 1-1/2" Diameter Preinsulated Type K Copper Elbow With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	581.44	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	9.32	
33 61 13 00-0337 EA 2" Diameter Preinsulated Type K Copper Elbow With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	658.61	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	9.71	
33 61 13 00-0338 EA 2-1/2" Diameter Preinsulated Type K Copper Elbow With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	758.09	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	10.09	
33 61 13 00-0339 EA 3" Diameter Preinsulated Type K Copper Elbow With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	879.22	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	11.65	
33 61 13 00-0340 EA 4" Diameter Preinsulated Type K Copper Elbow With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	1,025.99	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	13.59	
33 61 13 00-0341 EA 5" Diameter Preinsulated Type K Copper Elbow With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	1,244.49	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	17.47	
33 61 13 00-0342 EA 6" Diameter Preinsulated Type K Copper Elbow With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	1,381.81	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	19.84	
33 61 13 00-0343 EA 8" Diameter Preinsulated Type K Copper Elbow With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	1,954.14	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	28.69	
33 61 13 00-0344 EA 10" Diameter Preinsulated Type K Copper Elbow With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	2,591.82	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	36.67	
33 61 13 00-0345 EA 12" Diameter Preinsulated Type K Copper Elbow With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	3,337.79	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	48.53	
33 61 13 00-0346 Tees <small>(33 61 13 00-0288)</small>		
33 61 13 00-0347 Tees <small>(33 61 13 00-0346)</small>		
Note: With 1/2" polyurethane insulation and non-metallic fiberglass reinforced polyester (FRP) casing.		

33 Utilities**33 60 Hydronic And Steam Energy Utilities****33 61 Hydronic Energy Distribution**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 61	13 00-0348	EA	3/4" Diameter Preinsulated Type K Copper Tee With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	555.83	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	8.89	
33 61	13 00-0349	EA	1" Diameter Preinsulated Type K Copper Tee With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	574.82	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	9.10	
33 61	13 00-0350	EA	1-1/4" Diameter Preinsulated Type K Copper Tee With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	659.38	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	10.35	
33 61	13 00-0351	EA	1-1/2" Diameter Preinsulated Type K Copper Tee With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	737.93	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	11.30	
33 61	13 00-0352	EA	2" Diameter Preinsulated Type K Copper Tee With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	847.92	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	11.77	
33 61	13 00-0353	EA	2-1/2" Diameter Preinsulated Type K Copper Tee With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	991.46	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	12.24	
33 61	13 00-0354	EA	3" Diameter Preinsulated Type K Copper Tee With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	1,151.26	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	14.12	
33 61	13 00-0355	EA	4" Diameter Preinsulated Type K Copper Tee With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	1,343.51	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	16.47	
33 61	13 00-0356	EA	5" Diameter Preinsulated Type K Copper Tee With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	1,617.34	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	21.18	
33 61	13 00-0357	EA	6" Diameter Preinsulated Type K Copper Tee With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	1,787.38	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	24.06	
33 61	13 00-0358	EA	8" Diameter Preinsulated Type K Copper Tee With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	2,517.53	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	34.78	
33 61	13 00-0359	EA	10" Diameter Preinsulated Type K Copper Tee With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	3,361.88	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	44.45	
33 61	13 00-0360	EA	12" Diameter Preinsulated Type K Copper Tee With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	4,308.06	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	58.83	
33 61	13 00-0361		Tees <small>(33 61 13 00-0346)</small>		
			Note: With 1" polyurethane insulation and non-metallic fiberglass reinforced polyester (FRP) casing.		
33 61	13 00-0362	EA	3/4" Diameter Preinsulated Type K Copper Tee With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	589.17	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	9.56	
33 61	13 00-0363	EA	1" Diameter Preinsulated Type K Copper Tee With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	608.95	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	9.78	
33 61	13 00-0364	EA	1-1/4" Diameter Preinsulated Type K Copper Tee With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	698.21	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	11.13	
33 61	13 00-0365	EA	1-1/2" Diameter Preinsulated Type K Copper Tee With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	780.29	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	12.14	
33 61	13 00-0366	EA	2" Diameter Preinsulated Type K Copper Tee With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	892.05	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	12.65	
33 61	13 00-0367	EA	2-1/2" Diameter Preinsulated Type K Copper Tee With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	1,037.36	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	13.16	
33 61	13 00-0368	EA	3" Diameter Preinsulated Type K Copper Tee With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	1,204.21	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	15.18	
33 61	13 00-0369	EA	4" Diameter Preinsulated Type K Copper Tee With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	1,405.28	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	17.71	
33 61	13 00-0370	EA	5" Diameter Preinsulated Type K Copper Tee With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	1,696.77	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	22.77	
33 61	13 00-0371	EA	6" Diameter Preinsulated Type K Copper Tee With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	1,877.59	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	25.86	
33 61	13 00-0372	EA	8" Diameter Preinsulated Type K Copper Tee With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	2,647.95	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	37.39	
33 61	13 00-0373	EA	10" Diameter Preinsulated Type K Copper Tee With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	3,528.58	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	47.79	
33 61	13 00-0374	EA	12" Diameter Preinsulated Type K Copper Tee With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	4,528.69	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	63.25	



MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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33 61 13 00-0375

Tees

(33 61 13 00-0346)

Note: With 1-1/2" polyurethane insulation and non-metallic fiberglass reinforced polyester (FRP) casing.

33 61 13 00-0376	EA	3/4"	Diameter Preinsulated Type K Copper Tee With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	622.51	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	10.22	
33 61 13 00-0377	EA	1"	Diameter Preinsulated Type K Copper Tee With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	643.07	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	10.46	
33 61 13 00-0378	EA	1-1/4"	Diameter Preinsulated Type K Copper Tee With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	737.04	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	11.91	
33 61 13 00-0379	EA	1-1/2"	Diameter Preinsulated Type K Copper Tee With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	822.65	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	12.99	
33 61 13 00-0380	EA	2"	Diameter Preinsulated Type K Copper Tee With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	936.17	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	13.53	
33 61 13 00-0381	EA	2-1/2"	Diameter Preinsulated Type K Copper Tee With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	1,083.25	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	14.07	
33 61 13 00-0382	EA	3"	Diameter Preinsulated Type K Copper Tee With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	1,257.16	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	16.24	
33 61 13 00-0383	EA	4"	Diameter Preinsulated Type K Copper Tee With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	1,467.06	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	18.94	
33 61 13 00-0384	EA	5"	Diameter Preinsulated Type K Copper Tee With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	1,776.20	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	24.36	
33 61 13 00-0385	EA	6"	Diameter Preinsulated Type K Copper Tee With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	1,968.09	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	27.67	
33 61 13 00-0386	EA	8"	Diameter Preinsulated Type K Copper Tee With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	2,777.62	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	39.99	
33 61 13 00-0387	EA	10"	Diameter Preinsulated Type K Copper Tee With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	3,693.52	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	51.12	
33 61 13 00-0388	EA	12"	Diameter Preinsulated Type K Copper Tee With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	4,751.34	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	67.66	

33 61 13 00-0389

Tees

(33 61 13 00-0346)

Note: With 2" polyurethane insulation and non-metallic fiberglass reinforced polyester (FRP) casing.

33 61 13 00-0390	EA	3/4"	Diameter Preinsulated Type K Copper Tee With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	655.85	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	10.89	
33 61 13 00-0391	EA	1"	Diameter Preinsulated Type K Copper Tee With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	677.19	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	11.15	
33 61 13 00-0392	EA	1-1/4"	Diameter Preinsulated Type K Copper Tee With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	775.87	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	12.68	
33 61 13 00-0393	EA	1-1/2"	Diameter Preinsulated Type K Copper Tee With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	865.01	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	13.84	
33 61 13 00-0394	EA	2"	Diameter Preinsulated Type K Copper Tee With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	980.30	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	14.41	
33 61 13 00-0395	EA	2-1/2"	Diameter Preinsulated Type K Copper Tee With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	1,129.14	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	14.99	
33 61 13 00-0396	EA	3"	Diameter Preinsulated Type K Copper Tee With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	1,310.11	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	17.30	
33 61 13 00-0397	EA	4"	Diameter Preinsulated Type K Copper Tee With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	1,528.83	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	20.18	
33 61 13 00-0398	EA	5"	Diameter Preinsulated Type K Copper Tee With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	1,855.62	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	25.95	
33 61 13 00-0399	EA	6"	Diameter Preinsulated Type K Copper Tee With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	2,058.31	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	29.47	
33 61 13 00-0400	EA	8"	Diameter Preinsulated Type K Copper Tee With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	2,908.03	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	42.60	
33 61 13 00-0401	EA	10"	Diameter Preinsulated Type K Copper Tee With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	3,860.22	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	54.45	
33 61 13 00-0402	EA	12"	Diameter Preinsulated Type K Copper Tee With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket	4,971.97	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	72.07	

33 Utilities**33 60 Hydronic And Steam Energy Utilities****33 61 Hydronic Energy Distribution**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 61 13 00-0403			Reducers <small>(33 61 13 00-0288)</small>		
33 61 13 00-0404			Reducers <small>(33 61 13 00-0403)</small>		
			Note: With 1/2" polyurethane insulation and non-metallic fiberglass reinforced polyester (FRP) casing.		
33 61 13 00-0405	EA		3/4" Diameter Preinsulated Type K Copper Reducer With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	315.28	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	4.97	
33 61 13 00-0406	EA		1" Diameter Preinsulated Type K Copper Reducer With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	326.26	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	5.09	
33 61 13 00-0407	EA		1-1/4" Diameter Preinsulated Type K Copper Reducer With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	374.44	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	5.79	
33 61 13 00-0408	EA		1-1/2" Diameter Preinsulated Type K Copper Reducer With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	419.59	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	6.31	
33 61 13 00-0409	EA		2" Diameter Preinsulated Type K Copper Reducer With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	484.71	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	6.58	
33 61 13 00-0410	EA		2-1/2" Diameter Preinsulated Type K Copper Reducer With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	575.70	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	6.84	
33 61 13 00-0411	EA		3" Diameter Preinsulated Type K Copper Reducer With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	664.12	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	7.89	
33 61 13 00-0412	EA		4" Diameter Preinsulated Type K Copper Reducer With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	772.10	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	9.21	
33 61 13 00-0413	EA		5" Diameter Preinsulated Type K Copper Reducer With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	925.85	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	11.84	
33 61 13 00-0414	EA		6" Diameter Preinsulated Type K Copper Reducer With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	1,022.87	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	13.45	
33 61 13 00-0415	EA		8" Diameter Preinsulated Type K Copper Reducer With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	1,439.82	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	19.44	
33 61 13 00-0416	EA		10" Diameter Preinsulated Type K Copper Reducer With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	1,925.45	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	24.85	
33 61 13 00-0417	EA		12" Diameter Preinsulated Type K Copper Reducer With 1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	2,462.61	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	32.88	
33 61 13 00-0418			Reducers <small>(33 61 13 00-0403)</small>		
			Note: With 1" polyurethane insulation and non-metallic fiberglass reinforced polyester (FRP) casing.		
33 61 13 00-0419	EA		3/4" Diameter Preinsulated Type K Copper Reducer With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	333.92	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	5.34	
33 61 13 00-0420	EA		1" Diameter Preinsulated Type K Copper Reducer With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	345.33	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	5.47	
33 61 13 00-0421	EA		1-1/4" Diameter Preinsulated Type K Copper Reducer With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	396.14	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	6.22	
33 61 13 00-0422	EA		1-1/2" Diameter Preinsulated Type K Copper Reducer With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	443.27	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	6.79	
33 61 13 00-0423	EA		2" Diameter Preinsulated Type K Copper Reducer With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	509.37	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	7.07	
33 61 13 00-0424	EA		2-1/2" Diameter Preinsulated Type K Copper Reducer With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	601.35	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	7.35	
33 61 13 00-0425	EA		3" Diameter Preinsulated Type K Copper Reducer With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	693.72	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	8.48	
33 61 13 00-0426	EA		4" Diameter Preinsulated Type K Copper Reducer With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	806.63	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	9.90	
33 61 13 00-0427	EA		5" Diameter Preinsulated Type K Copper Reducer With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	970.24	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	12.73	
33 61 13 00-0428	EA		6" Diameter Preinsulated Type K Copper Reducer With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	1,073.29	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	14.45	
33 61 13 00-0429	EA		8" Diameter Preinsulated Type K Copper Reducer With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	1,512.71	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	20.90	
33 61 13 00-0430	EA		10" Diameter Preinsulated Type K Copper Reducer With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	2,018.62	
			<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	26.71	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 61 13 00-0431 EA 12" Diameter Preinsulated Type K Copper Reducer With 1" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	2,585.93 35.35	
33 61 13 00-0432 Reducers <small>(33 61 13 00-0403)</small> Note: With 1-1/2" polyurethane insulation and non-metallic fiberglass reinforced polyester (FRP) casing.		
33 61 13 00-0433 EA 3/4" Diameter Preinsulated Type K Copper Reducer With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	352.55 5.71	
33 61 13 00-0434 EA 1" Diameter Preinsulated Type K Copper Reducer With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	364.41 5.85	
33 61 13 00-0435 EA 1-1/4" Diameter Preinsulated Type K Copper Reducer With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	417.84 6.66	
33 61 13 00-0436 EA 1-1/2" Diameter Preinsulated Type K Copper Reducer With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	466.95 7.26	
33 61 13 00-0437 EA 2" Diameter Preinsulated Type K Copper Reducer With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	534.03 7.56	
33 61 13 00-0438 EA 2-1/2" Diameter Preinsulated Type K Copper Reducer With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	627.00 7.87	
33 61 13 00-0439 EA 3" Diameter Preinsulated Type K Copper Reducer With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	723.32 9.08	
33 61 13 00-0440 EA 4" Diameter Preinsulated Type K Copper Reducer With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	841.16 10.59	
33 61 13 00-0441 EA 5" Diameter Preinsulated Type K Copper Reducer With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	1,014.63 13.61	
33 61 13 00-0442 EA 6" Diameter Preinsulated Type K Copper Reducer With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	1,123.87 15.46	
33 61 13 00-0443 EA 8" Diameter Preinsulated Type K Copper Reducer With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	1,585.33 22.35	
33 61 13 00-0444 EA 10" Diameter Preinsulated Type K Copper Reducer With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	2,111.54 28.57	
33 61 13 00-0445 EA 12" Diameter Preinsulated Type K Copper Reducer With 1-1/2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	2,709.42 37.82	
33 61 13 00-0446 Reducers <small>(33 61 13 00-0403)</small> Note: With 2" polyurethane insulation and non-metallic fiberglass reinforced polyester (FRP) casing.		
33 61 13 00-0447 EA 3/4" Diameter Preinsulated Type K Copper Reducer With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	371.19 6.09	
33 61 13 00-0448 EA 1" Diameter Preinsulated Type K Copper Reducer With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	383.48 6.23	
33 61 13 00-0449 EA 1-1/4" Diameter Preinsulated Type K Copper Reducer With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	439.55 7.09	
33 61 13 00-0450 EA 1-1/2" Diameter Preinsulated Type K Copper Reducer With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	490.62 7.73	
33 61 13 00-0451 EA 2" Diameter Preinsulated Type K Copper Reducer With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	558.70 8.06	
33 61 13 00-0452 EA 2-1/2" Diameter Preinsulated Type K Copper Reducer With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	652.65 8.38	
33 61 13 00-0453 EA 3" Diameter Preinsulated Type K Copper Reducer With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	752.91 9.67	
33 61 13 00-0454 EA 4" Diameter Preinsulated Type K Copper Reducer With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	875.69 11.28	
33 61 13 00-0455 EA 5" Diameter Preinsulated Type K Copper Reducer With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	1,059.03 14.50	
33 61 13 00-0456 EA 6" Diameter Preinsulated Type K Copper Reducer With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	1,174.29 16.47	
33 61 13 00-0457 EA 8" Diameter Preinsulated Type K Copper Reducer With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket <i>For High Density Polyethylene (HDPE) Jacket, Add</i>	1,658.22 23.81	

33 Utilities**33 60 Hydronic And Steam Energy Utilities****33 61 Hydronic Energy Distribution**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 61 13 00-0458 EA 10" Diameter Preinsulated Type K Copper Reducer With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	2,204.71	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	30.44	
33 61 13 00-0459 EA 12" Diameter Preinsulated Type K Copper Reducer With 2" Polyurethane Foam Insulation And Fiberglass Reinforced Polyester (FRP) Jacket.....	2,832.74	
<i>For High Density Polyethylene (HDPE) Jacket, Add</i>	40.28	
33 61 13 00-0460 Preinsulated Ductile Iron Carrier Pipe <small>(33 61 13 00-0001)</small> Note: With polyurethane insulation and non-metallic casing. Excludes excavation or backfill.		
33 61 13 00-0461 Ductile Iron Carrier Pipe <small>(33 61 13 00-0460)</small> Note: With 1" polyurethane insulation and non-metallic fiberglass reinforced polyester (FRP) casing.		
33 61 13 00-0462 LF 4" Diameter Preinsulated Ductile Iron Pipe With 1" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket.....	97.18	
33 61 13 00-0463 LF 6" Diameter Preinsulated Ductile Iron Pipe With 1" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket.....	141.71	
33 61 13 00-0464 LF 8" Diameter Preinsulated Ductile Iron Pipe With 1" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket.....	187.83	
33 61 13 00-0465 LF 10" Diameter Preinsulated Ductile Iron Pipe With 1" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket.....	236.20	
33 61 13 00-0466 LF 12" Diameter Preinsulated Ductile Iron Pipe With 1" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket.....	292.85	
33 61 13 00-0467 Ductile Iron Carrier Pipe <small>(33 61 13 00-0460)</small> Note: With 2" polyurethane insulation and non-metallic fiberglass reinforced polyester (FRP) casing.		
33 61 13 00-0468 LF 4" Diameter Preinsulated Ductile Iron Pipe With 2" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket.....	102.32	
33 61 13 00-0469 LF 6" Diameter Preinsulated Ductile Iron Pipe With 2" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket.....	149.35	
33 61 13 00-0470 LF 8" Diameter Preinsulated Ductile Iron Pipe With 2" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket.....	198.94	
33 61 13 00-0471 LF 10" Diameter Preinsulated Ductile Iron Pipe With 2" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket.....	250.86	
33 61 13 00-0472 LF 12" Diameter Preinsulated Ductile Iron Pipe With 2" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket.....	311.13	
33 61 13 00-0473 LF 14" Diameter Preinsulated Ductile Iron Pipe With 2" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket.....	339.26	
33 61 13 00-0474 LF 16" Diameter Preinsulated Ductile Iron Pipe With 2" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket.....	379.69	
33 61 13 00-0475 LF 18" Diameter Preinsulated Ductile Iron Pipe With 2" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket.....	424.40	
33 61 13 00-0476 LF 20" Diameter Preinsulated Ductile Iron Pipe With 2" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket.....	465.06	
33 61 13 00-0477 LF 24" Diameter Preinsulated Ductile Iron Pipe With 2" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket.....	545.25	
33 61 13 00-0478 Preinsulated Ductile Iron Fittings <small>(33 61 13 00-0001)</small>		
33 61 13 00-0479 Elbows <small>(33 61 13 00-0478)</small>		
33 61 13 00-0480 Elbows <small>(33 61 13 00-0479)</small> Note: With 1" polyurethane insulation and non-metallic fiberglass reinforced polyester (FRP) casing.		
33 61 13 00-0481 EA 4" Diameter Preinsulated Ductile Iron Elbow With 1" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket.....	853.45	
33 61 13 00-0482 EA 6" Diameter Preinsulated Ductile Iron Elbow With 1" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket.....	1,112.12	
33 61 13 00-0483 EA 8" Diameter Preinsulated Ductile Iron Elbow With 1" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket.....	1,558.17	
33 61 13 00-0484 EA 10" Diameter Preinsulated Ductile Iron Elbow With 1" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket.....	2,100.08	
33 61 13 00-0485 EA 12" Diameter Preinsulated Ductile Iron Elbow With 1" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket.....	2,672.23	
33 61 13 00-0486 Elbows <small>(33 61 13 00-0479)</small> Note: With 2" polyurethane insulation and non-metallic fiberglass reinforced polyester (FRP) casing.		
33 61 13 00-0487 EA 4" Diameter Preinsulated Ductile Iron Elbow With 2" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket.....	916.93	
33 61 13 00-0488 EA 6" Diameter Preinsulated Ductile Iron Elbow With 2" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket.....	1,204.81	
33 61 13 00-0489 EA 8" Diameter Preinsulated Ductile Iron Elbow With 2" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket.....	1,692.18	
33 61 13 00-0490 EA 10" Diameter Preinsulated Ductile Iron Elbow With 2" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket.....	2,271.37	
33 61 13 00-0491 EA 12" Diameter Preinsulated Ductile Iron Elbow With 2" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket.....	2,898.93	
33 61 13 00-0492 EA 14" Diameter Preinsulated Ductile Iron Elbow With 2" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket.....	3,516.99	
33 61 13 00-0493 EA 16" Diameter Preinsulated Ductile Iron Elbow With 2" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket.....	4,138.36	
33 61 13 00-0494 EA 18" Diameter Preinsulated Ductile Iron Elbow With 2" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket.....	5,159.40	



	MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
	33 61	13 00-0495	EA	20" Diameter Preinsulated Ductile Iron Elbow With 2" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket	6,559.29	
	33 61	13 00-0496	EA	24" Diameter Preinsulated Ductile Iron Elbow With 2" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket	8,573.19	
	33 61	13 00-0497		Tees <small>(33 61 13 00-0478)</small>		
	33 61	13 00-0498		Tees <small>(33 61 13 00-0497)</small> Note: With 1" polyurethane insulation and non-metallic fiberglass reinforced polyester (FRP) casing.		
	33 61	13 00-0499	EA	4" Diameter Preinsulated Ductile Iron Tee With 1" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket.....	1,273.34	
	33 61	13 00-0500	EA	6" Diameter Preinsulated Ductile Iron Tee With 1" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket.....	1,658.84	
	33 61	13 00-0501	EA	8" Diameter Preinsulated Ductile Iron Tee With 1" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket.....	2,321.76	
	33 61	13 00-0502	EA	10" Diameter Preinsulated Ductile Iron Tee With 1" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket.....	3,133.25	
	33 61	13 00-0503	EA	12" Diameter Preinsulated Ductile Iron Tee With 1" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket.....	3,983.97	
	33 61	13 00-0504		Tees <small>(33 61 13 00-0497)</small> Note: With 2" polyurethane insulation and non-metallic fiberglass reinforced polyester (FRP) casing.		
	33 61	13 00-0505	EA	4" Diameter Preinsulated Ductile Iron Tee With 2" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket.....	1,367.61	
	33 61	13 00-0506	EA	6" Diameter Preinsulated Ductile Iron Tee With 2" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket.....	1,796.49	
	33 61	13 00-0507	EA	8" Diameter Preinsulated Ductile Iron Tee With 2" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket.....	2,520.76	
	33 61	13 00-0508	EA	10" Diameter Preinsulated Ductile Iron Tee With 2" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket.....	3,387.61	
	33 61	13 00-0509	EA	12" Diameter Preinsulated Ductile Iron Tee With 2" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket.....	4,320.62	
	33 61	13 00-0510	EA	14" Diameter Preinsulated Ductile Iron Tee With 2" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket.....	5,119.64	
	33 61	13 00-0511	EA	16" Diameter Preinsulated Ductile Iron Tee With 2" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket.....	6,025.99	
	33 61	13 00-0512	EA	18" Diameter Preinsulated Ductile Iron Tee With 2" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket.....	7,514.04	
	33 61	13 00-0513	EA	20" Diameter Preinsulated Ductile Iron Tee With 2" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket.....	9,559.02	
	33 61	13 00-0514	EA	24" Diameter Preinsulated Ductile Iron Tee With 2" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket.....	12,493.33	
	33 61	13 00-0515		Reducers <small>(33 61 13 00-0478)</small>		
	33 61	13 00-0516		Reducers <small>(33 61 13 00-0515)</small> Note: With 1" polyurethane insulation and non-metallic fiberglass reinforced polyester (FRP) casing.		
	33 61	13 00-0517	EA	4" Diameter Preinsulated Ductile Iron Reducer With 1" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket	736.09	
	33 61	13 00-0518	EA	6" Diameter Preinsulated Ductile Iron Reducer With 1" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket	954.55	
	33 61	13 00-0519	EA	8" Diameter Preinsulated Ductile Iron Reducer With 1" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket	1,335.26	
	33 61	13 00-0520	EA	10" Diameter Preinsulated Ductile Iron Reducer With 1" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket	1,804.51	
	33 61	13 00-0521	EA	12" Diameter Preinsulated Ductile Iron Reducer With 1" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket	2,289.68	
	33 61	13 00-0522		Reducers <small>(33 61 13 00-0515)</small> Note: With 2" polyurethane insulation and non-metallic fiberglass reinforced polyester (FRP) casing.		
	33 61	13 00-0523	EA	4" Diameter Preinsulated Ductile Iron Reducer With 2" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket	788.77	
	33 61	13 00-0524	EA	6" Diameter Preinsulated Ductile Iron Reducer With 2" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket	1,031.49	
	33 61	13 00-0525	EA	8" Diameter Preinsulated Ductile Iron Reducer With 2" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket	1,446.48	
	33 61	13 00-0526	EA	10" Diameter Preinsulated Ductile Iron Reducer With 2" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket	1,946.67	
	33 61	13 00-0527	EA	12" Diameter Preinsulated Ductile Iron Reducer With 2" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket	2,477.84	
	33 61	13 00-0528	EA	14" Diameter Preinsulated Ductile Iron Reducer With 2" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket	2,932.91	
	33 61	13 00-0529	EA	16" Diameter Preinsulated Ductile Iron Reducer With 2" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket	3,447.08	
	33 61	13 00-0530	EA	18" Diameter Preinsulated Ductile Iron Reducer With 2" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket	4,266.07	
	33 61	13 00-0531	EA	20" Diameter Preinsulated Ductile Iron Reducer With 2" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket	5,468.03	
	33 61	13 00-0532	EA	24" Diameter Preinsulated Ductile Iron Reducer With 2" Polyurethane Foam Insulation And High Density Polyethylene (HDPE) Jacket	7,167.14	

33 Utilities**33 60 Hydronic And Steam Energy Utilities****33 61 Hydronic Energy Distribution**MINOR
CSI UOM DESCRIPTIONTOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

33 61 13 00-0533	Tempered Water Piping Pre-Insulated <small>(33 61 13 00-0001)</small>		
33 61 13 00-0534	Fiberglass Reinforced Polyester (FRP) Carrier And Casing, 1" Polyurethane Insulation <small>(33 61 13 00-0533)</small>		
33 61 13 00-0535	LF 4" Fiberglass Reinforced Polyester (FRP) Carrier And Casing With 1" Polyurethane Insulation	47.60	16.60
33 61 13 00-0536	LF 6" Fiberglass Reinforced Polyester (FRP) Carrier And Casing With 1" Polyurethane Insulation	56.31	17.58
33 61 13 00-0537	LF 8" Fiberglass Reinforced Polyester (FRP) Carrier And Casing With 1" Polyurethane Insulation	74.62	19.26
33 61 13 00-0538	LF 10" Fiberglass Reinforced Polyester (FRP) Carrier And Casing With 1" Polyurethane Insulation	99.27	24.07
33 61 13 00-0539	LF 12" Fiberglass Reinforced Polyester (FRP) Carrier And Casing With 1" Polyurethane Insulation	126.34	29.69
33 61 13 00-0540	Fiberglass Reinforced Polyester (FRP) Carrier And Polyvinyl Chloride (PVC) Casing, 1" Polyurethane Insulation <small>(33 61 13 00-0533)</small>		
33 61 13 00-0541	LF 4" Fiberglass Reinforced Polyester (FRP) Carrier And Polyvinyl Chloride (PVC) Casing With 1" Polyurethane Insulation	32.96	17.58
33 61 13 00-0542	LF 6" Fiberglass Reinforced Polyester (FRP) Carrier And Polyvinyl Chloride (PVC) Casing With 1" Polyurethane Insulation	35.10	17.58
33 61 13 00-0543	LF 8" Fiberglass Reinforced Polyester (FRP) Carrier And Polyvinyl Chloride (PVC) Casing With 1" Polyurethane Insulation	37.10	17.58
33 61 13 00-0544	LF 10" Fiberglass Reinforced Polyester (FRP) Carrier And Polyvinyl Chloride (PVC) Casing With 1" Polyurethane Insulation	44.59	20.77
33 61 13 00-0545	LF 12" Fiberglass Reinforced Polyester (FRP) Carrier And Polyvinyl Chloride (PVC) Casing With 1" Polyurethane Insulation	54.59	26.36
33 61 13 00-0546	Polyvinyl Chloride (PVC) Carrier And Casing, 1" Polyurethane Insulation <small>(33 61 13 00-0533)</small>		
33 61 13 00-0547	LF 4" Polyvinyl Chloride (PVC) Carrier And Casing With 1" Polyurethane Insulation	32.96	17.58
33 61 13 00-0548	LF 6" Polyvinyl Chloride (PVC) Carrier And Casing With 1" Polyurethane Insulation	35.10	17.58
33 61 13 00-0549	LF 8" Polyvinyl Chloride (PVC) Carrier And Casing With 1" Polyurethane Insulation	37.10	17.58
33 61 13 00-0550	LF 10" Polyvinyl Chloride (PVC) Carrier And Casing With 1" Polyurethane Insulation	44.59	20.77
33 61 13 00-0551	LF 12" Polyvinyl Chloride (PVC) Carrier And Casing With 1" Polyurethane Insulation	54.59	26.36

33 70 Electrical Utilities (33)**33 71 Electrical Utility Transmission And Distribution** (33 70)**33 71 19 Electrical Underground Ducts And Manholes** (33 71)

Note: Excludes excavation and backfill. See CSI section 31 23 16 00-0000 for excavation, 31 23 16 36-0016 for backfill.

33 71 19 00-0001	Electrical Handholes And Pull Boxes <small>(33 71 19)</small>		
33 71 19 00-0002	Electrical Pull Boxes <small>(33 71 19 00-0001)</small>		
	See CSI section 33 05 16 13-0427 for handholes.		
33 71 19 00-0003	EA 24" x 36" x 24", Electric Pull Boxes, Precast Concrete	1,269.14	
33 71 19 00-0004	EA 24" x 36" x 36", Electric Pull Boxes, Precast Concrete	1,505.65	
33 71 19 00-0005	EA 30" x 48" x 36", Electric Pull Boxes, Precast Concrete	1,730.43	
33 71 19 00-0006	EA 36" x 72" x 24", Electric Pull Boxes, Precast Concrete	2,621.68	
33 71 19 00-0007	EA 36" x 60" x 36", Electric Pull Boxes, Precast Concrete	2,780.92	
33 71 19 00-0008	EA 48" x 48" x 36", Electric Pull Boxes, Precast Concrete	2,983.00	
33 71 19 00-0009	EA 48" x 60" x 48", Electric Pull Boxes, Precast Concrete	3,426.53	
33 71 19 00-0010	Electrical Pull Boxes (CALTRAN) <small>(33 71 19 00-0001)</small>		
33 71 19 00-0011	EA Body, CALTRANS 3-1/2 Precast Concrete Pull Box	95.87	
33 71 19 00-0012	EA Concrete Cover, CALTRANS 3-1/2 Precast Concrete Pull Box	32.21	
33 71 19 00-0013	EA Bolt Down Concrete Cover, CALTRANS 3-1/2 Precast Concrete Pull Box	52.32	
33 71 19 00-0014	EA Bolt Down Cast Iron Cover, CALTRANS 3-1/2 Precast Concrete Pull Box	97.14	
33 71 19 00-0015	EA Bolt Down Steel Cover, CALTRANS 3-1/2 Precast Concrete Pull Box	143.62	
	<i>For Galvanized Steel Cover, Add</i>	22.50	
33 71 19 00-0016	EA 12" Extension, CALTRANS 3-1/2 Precast Concrete Pull Box	45.17	
33 71 19 00-0017	EA Flat Plate Base, CALTRANS 3-1/2 Precast Concrete Pull Box	45.17	
33 71 19 00-0018	EA Body, CALTRANS 5 Precast Concrete Pull Box	139.28	
33 71 19 00-0019	EA Concrete Cover, CALTRANS 5 Precast Concrete Pull Box	41.01	
33 71 19 00-0020	EA Bolt Down Concrete Cover, CALTRANS 5 Precast Concrete Pull Box	61.12	
33 71 19 00-0021	EA Bolt Down Steel Cover, CALTRANS 5 Precast Concrete Pull Box	186.52	
	<i>For Galvanized Steel Cover, Add</i>	41.25	
33 71 19 00-0022	EA 12" Extension, CALTRANS 5 Precast Concrete Pull Box	58.92	
33 71 19 00-0023	EA Flat Plate Base, CALTRANS 5 Precast Concrete Pull Box	55.90	
33 71 19 00-0024	EA Body, CALTRANS 6 Precast Concrete Pull Box	148.08	
33 71 19 00-0025	EA Concrete Cover, CALTRANS 6 Precast Concrete Pull Box	52.83	
33 71 19 00-0026	EA Bolt Down Concrete Cover, CALTRANS 6 Precast Concrete Pull Box	72.94	
33 71 19 00-0027	EA Bolt Down Steel Cover, CALTRANS 6 Precast Concrete Pull Box	251.42	
	<i>For Galvanized Steel Cover, Add</i>	57.75	
33 71 19 00-0028	EA 12" Extension, CALTRANS 6 Precast Concrete Pull Box	67.72	
33 71 19 00-0029	EA Flat Plate Base, CALTRANS 6 Precast Concrete Pull Box	64.42	
33 71 19 00-0030	EA 6" Return Flat Plate Base, CALTRANS 6 Precast Concrete Pull Box	84.22	
33 71 19 00-0031	EA Body, CALTRANS 3-1/2-T Precast Concrete Pull Box	176.45	
33 71 19 00-0032	EA Bolt Down Concrete Cover, CALTRANS 3-1/2-T Precast Concrete Pull Box	221.72	



Utilities	33	33
Electrical Utilities	33 70	
Electrical Utility Transmission And Distribution	33 71	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
33 71 19 00-0033 EA 12" Extension, CALTRANS 3-1/2-T Precast Concrete Pull Box	78.72	
33 71 19 00-0034 EA Flat Plate Base, CALTRANS 3-1/2-T Precast Concrete Pull Box	73.22	
33 71 19 00-0035 EA Body, CALTRANS 5-T Precast Concrete Pull Box	236.08	
33 71 19 00-0036 EA Bolt Down Concrete Cover, CALTRANS 5-T Precast Concrete Pull Box	315.22	
33 71 19 00-0037 EA 12" Extension, CALTRANS 5-T Precast Concrete Pull Box.....	91.92	
33 71 19 00-0038 EA Flat Plate Base, CALTRANS 5-T Precast Concrete Pull Box	89.72	
33 71 19 00-0039 EA Body, CALTRANS 6-T Precast Concrete Pull Box	316.38	
33 71 19 00-0040 EA Bolt Down Concrete Cover, CALTRANS 6-T Precast Concrete Pull Box	436.22	
33 71 19 00-0041 EA 12" Extension, CALTRANS 6-T Precast Concrete Pull Box.....	146.92	
33 71 19 00-0042 EA Flat Plate Base, CALTRANS 6-T Precast Concrete Pull Box	117.22	
33 71 19 00-0043 Electrical Property Line Boxes <small>(33 71 19)</small>		
33 71 19 00-0044 EA 3'-6" x 2'-9" x 2' Deep Property Line Box	2,328.01	289.45
33 71 19 00-0045 EA 4'-6" x 3'-6" x 4' Deep Property Line Box	2,706.68	300.17
33 71 19 00-0046 EA 6' x 4' x 5' Deep Property Line Box	2,995.46	364.50
33 71 19 00-0047 EA 11'-6" x 4'-6" x 6' Deep Property Line Box	4,570.30	536.03
33 71 19 00-0048 Underground Electrical Concrete Markers <small>(33 71 19)</small>		
33 71 19 00-0049 EA 36" x 6" x 6", Underground Electric Concrete Marker	240.31	
33 71 19 00-0050 Manhole Accessories <small>(33 71 19)</small>		
33 71 19 00-0051 EA 6" Precast Grade Ring Riser Casting.....	328.13	
33 71 19 00-0052 EA 12" Precast Grade Ring Riser Casting.....	355.35	
33 71 19 00-0053 EA 36" Opening Cast Iron Frame And Cover NEENAH #R-1640-D	1,195.47	
33 71 19 00-0054 EA 42" Opening Cast Iron Frame And Cover NEENAH #R-1740-E1	1,555.70	
33 71 19 00-0055 EA Cast Iron Adjusting Ring NEENAH #R-1979.....	524.01	
33 71 19 00-0056 EA Cast Iron Frame And Cover NEENAH #R-1640-B.....	658.55	

END OF SECTION 33

33 Utilities

33 70 Electrical Utilities

33 71 Electrical Utility Transmission And Distribution



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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34 Transportation

34 70 Transportation Construction And Equipment ⁽³⁴⁾

34 71 Roadway Construction ^(34 70)

34 71 13 Vehicle Barriers ^(34 71)

34 71 13 13 Vehicle Median Barriers ^(34 71 13)

34 71 13 13-0001 Concrete Median Barrier ^(34 71 13 13)

34 71 13 13-0002	LF	Median Barrier, Precast, 42" High Single Face.....	46.77	3.27
34 71 13 13-0003	LF	Median Barrier, Precast, 32" High, 2' Wide Base, Double Face	49.57	3.27
34 71 13 13-0004	LF	Median Barrier, Precast, 42" High, 2' Wide Base, Double Face	53.79	3.27
34 71 13 13-0005	LF	Median Barrier, Cast In Place With Steel Forms.....	31.64	4.18
34 71 13 13-0006	LF	Median Barrier, Slipformed Concrete.....	27.69	2.59

34 71 13 16 Vehicle Crash Barriers ^(34 71 13)

34 71 13 16-0001 Impact Barrier, Non-Redirective ^(34 71 13 16)

34 71 13 16-0002 Sand Barrel Impact Attenuator ^(34 71 13 16-0001)

Note: Includes containers, inserts, and lid. Excludes sand.

34 71 13 16-0003	EA	200, 400 Or 700 LB Sand Barrel.....	975.09	42.07
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Note: Includes containers, inserts, and lid.

34 71 13 26 Vehicle Guide Rails ^(34 71 13)

34 71 13 26-0001 Corrugated Beam Guide Rail ^(34 71 13 26)

34 71 13 26-0002 Corrugated Beam Guide Railing ^(34 71 13 26-0001)

34 71 13 26-0003 Corrugated Beam Guide Railing, Straight Sections ^(34 71 13 26-0002)

Note: Add additional length for back-up sections.

34 71 13 26-0004	LF	Corrugated Beam Guide Railing.....	6.92	1.90
34 71 13 26-0005	LF	Corrugated Beam Guide Railing (Rustic).....	6.57	1.90

34 71 13 26-0006 Corrugated Beam Guide Railing, Shop Curved ^(34 71 13 26-0002)

Note: Add additional length for back-up sections.

34 71 13 26-0007	LF	Shop Curved Corrugated Beam Guide Railing	8.45	1.90
34 71 13 26-0008	LF	Shop Curved Corrugated Beam Guide Railing (Rustic).....	8.14	1.90
34 71 13 26-0009	LF	Shop Curved Corrugated Beam Guide Railing End.....	18.73	1.90

Note: Treatment for mall barriers driveways, walkways, special end, etc.

34 71 13 26-0010	LF	Shop Curved Corrugated Beam Guide Railing (Rustic) End	17.69	1.90
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Note: Treatment for mall barriers shop curved corrugated beam guide railing end etc.

34 71 13 26-0011 Corrugated Beam Guide Railing, Manufactured End Sections ^(34 71 13 26-0001)

34 71 13 26-0012	EA	Corrugated Beam Guide Railing End Section At Anchor Unit.....	62.98	25.04
34 71 13 26-0013	EA	Corrugated Beam Guide Railing End Section (Rustic) At Anchor Unit	65.06	25.04
34 71 13 26-0014	EA	Corrugated Beam Guide Railing Flared Or 180 Degree End Section	75.50	25.04
34 71 13 26-0015	EA	Corrugated Beam Guide Railing Flared Or 180 Degree End Section (Rustic).....	77.58	25.04
34 71 13 26-0016	EA	Corrugated Beam Guide Railing 225 Degree End Section	75.50	25.04
34 71 13 26-0017	EA	Corrugated Beam Guide Railing 225 Degree End Section (Rustic).....	77.58	25.04

34 71 13 26-0018 Corrugated Beam Guide Rail Posts ^(34 71 13 26-0001)

Note: Includes mounting hardware.

34 71 13 26-0019	EA	Standard Post For Corrugated Beam Guide Rail.....	48.62	11.44
		<i>For Installation Without Soil Plate, Deduct</i>	-5.00	
		<i>For Installation In Rock, Add</i>	3.05	
34 71 13 26-0020	EA	Standard Post For (Rustic) Corrugated Beam Guide Rail.....	50.71	11.44
		<i>For Installation Without Soil Plate, Deduct</i>	-5.00	
		<i>For Installation In Rock, Add</i>	3.05	
34 71 13 26-0021	EA	Extra Long Post for Corrugated Beam Guide Rail	52.80	11.44
		<i>For Installation Without Soil Plate, Deduct</i>	-5.00	
		<i>For Installation In Rock, Add</i>	3.05	
34 71 13 26-0022	EA	Extra Long Post (Rustic) for Corrugated Beam Guide Rail.....	54.88	11.44
		<i>For Installation Without Soil Plate, Deduct</i>	-5.00	
		<i>For Installation In Rock, Add</i>	3.05	
34 71 13 26-0023	EA	6B8-1/2" or Mall Barrier Post for Corrugated Beam Guide Rail	48.62	11.44
		<i>For Installation Without Soil Plate, Deduct</i>	-5.00	
		<i>For Installation In Rock, Add</i>	3.05	
34 71 13 26-0024	EA	Post Struts for Corrugated Beam Guide Rail Mall Barrier Post.....	65.32	11.44
		<i>For Installation In Rock, Add</i>	3.05	

34 Transportation**34 70 Transportation Construction And Equipment****34 71 Roadway Construction**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
34 71 13 26-0025 Heavy Post Blocked Out Corrugated Beam Guide Rail Posts (34 71 13 26-0001) Note: Includes mounting hardware. Excludes triangular mounting brackets.		
34 71 13 26-0026 EA Standard Post For Heavy Post Blocked Out Corrugated Beam Guide	48.62	11.44
34 71 13 26-0027 EA Standard Rustic Post For Heavy Post Blocked Out Corrugated Beam Guide	50.71	11.44
34 71 13 26-0028 EA Extra Long Post for Heavy Post Blocked Out Corrugated Beam Guide.....	52.80	11.44
34 71 13 26-0029 EA Extra Long Post (Rustic) For heavy post blocked out corrugated beam guide rail.....	54.88	11.44
Note: For heavy post blocked out corrugated beam guide (rustic)		
34 71 13 26-0030 EA Type A Post 1630mm Post	47.58	11.44
Note: For heavy post blocked out corrugated beam guide rail		
34 71 13 26-0031 EA Type A Post 1630mm Post (Rustic).....	49.67	11.44
Note: For heavy post blocked out corrugated beam guide rail		
34 71 13 26-0032 EA Type B Post 1460mm	45.49	11.44
Note: For heavy post blocked out corrugated beam guide rail		
34 71 13 26-0033 EA Type B Post 1460mm (Rustic)	47.58	11.44
Note: For heavy post blocked out corrugated beam guide rail		
34 71 13 26-0034 EA Type C Post 1290mm	43.41	11.44
Note: For heavy post blocked out corrugated beam guide rail		
34 71 13 26-0035 EA Type C Post 1290mm (Rustic).....	45.49	11.44
Note: For heavy post blocked out corrugated beam guide rail		
34 71 13 26-0036 EA Breakaway Wood Or Steel Post In Steel Foundation Tube	153.28	11.44
34 71 13 26-0037 EA Wood, Metal, Plastic Or Composite Offset Block Or Beam.....	25.67	11.44
Note: For heavy post blocked out corrugated beam guide rail.		
34 71 13 26-0038 Corrugated Beam Guide Rail Accessories (34 71 13 26-0001)		
34 71 13 26-0039 EA Triangular Mounting Brackets (Galvanized Or Rustic) For All Post Types A, B And C	58.80	28.46
34 71 13 26-0040 Corrugated Beam Guide Rail Repair for Existing Guide Rail (34 71 13 26-0001) Note: Includes associated hardware.		
34 71 13 26-0041 LF Remove And Store Corrugated Beam Guide Railing And Post	11.12	
34 71 13 26-0042 EA Install Stored Post For Corrugated Beam Guide Rail.....	37.94	
34 71 13 26-0043 LF Install Stored Corrugated Beam Guide Railing And Post.....	6.45	
34 71 13 26-0044 Corrugated Thrie Beam Guide Railing (34 71 13 26-0001)		
34 71 13 26-0045 Corrugated Thrie Beam Guide Railing. Straight Sections (34 71 13 26-0044) Note: Add additional length for back-up sections.		
34 71 13 26-0046 LF Corrugated Thrie Beam Guide Railing.....	13.84	2.39
34 71 13 26-0047 LF Corrugated Thrie Beam Guide Railing (Rustic).....	14.48	2.39
34 71 13 26-0048 Corrugated Thrie Beam Guide Railing. Shop Curved (34 71 13 26-0044) Note: Add additional length for back-up sections.		
34 71 13 26-0049 LF Shop Curved Corrugated Thrie Beam Guide Railing	16.39	2.39
34 71 13 26-0050 LF Shop Curved Corrugated Thrie Beam Guide Railing (Rustic).....	17.02	2.39
34 71 13 26-0051 Corrugated Thrie Beam Guide Rail Posts (34 71 13 26-0044) Note: Includes hardware for mounting.		
34 71 13 26-0052 EA Standard Post For Corrugated Thrie Beam Guide Rail.....	49.09	2.39
For Installation Without Soil Plate, Deduct	-5.00	
For 32" Soil Plate, Add	7.00	
34 71 13 26-0053 EA Standard Post (Rustic) For Corrugated Thrie Beam Guide Rail	51.18	2.39
For Installation Without Soil Plate, Deduct	-5.00	
For 32" Soil Plate, Add	7.00	
34 71 13 26-0055 Timber Guide Rails (34 71 13 26) Note: Includes drilling and fasteners. Excludes excavation, auguring and concrete.		
34 71 13 26-0056 Timber Guide Rail Posts (34 71 13 26-0055)		
34 71 13 26-0057 EA 6" x 8" Timber Guide Rail Post.....	64.35	9.49
34 71 13 26-0058 EA 6" x 9" Timber Guide Rail Post.....	72.56	9.49
34 71 13 26-0059 EA 10" x 10" Timber Guide Rail Post.....	136.92	9.49
34 71 13 26-0060 EA 10" x 12" Timber Guide Rail Post.....	144.59	9.49
34 71 13 26-0061 EA 12" x 12" Timber Guide Rail Post.....	166.47	9.49
34 71 13 26-0062 Timber Guide Rails (34 71 13 26-0055) Note: Excludes posts, spacer blocks and steel backup plates.		
34 71 13 26-0063 LF 4" x 9" Timber Guide Rail.....	7.96	1.14
34 71 13 26-0064 LF 6" x 10" Timber Guide Rail.....	10.91	1.14
34 71 13 26-0065 LF 6" x 12" Timber Guide Rail.....	12.65	1.14
34 71 13 26-0066 Spacer Blocks For Timber Guide Rails (34 71 13 26-0055)		
34 71 13 26-0067 EA 4" x 9" Spacer Block For Timber Guide Rails.....	10.38	1.52
34 71 13 26-0068 EA 6" x 8" Spacer Block For Timber Guide Rails.....	11.80	1.52
34 71 13 26-0069 EA 8" x 8" Spacer Block For Timber Guide Rails.....	13.61	1.52



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
34 71 13 26-0070 Weathering Steel Backup Plates For Timber Guide Rails <small>(34 71 13 26-0055)</small>		
34 71 13 26-0071 LF 6" High, Weathering Steel Backup Plate For Timber Guide Rails.....	13.74	0.95
34 71 13 26-0072 Weathering Steel Splice And Bearing Plates For Timber Guide Rails <small>(34 71 13 26-0055)</small>		
34 71 13 26-0073 EA Weathering Steel Splice Plate For Timber Guide Rails	99.71	13.28
34 71 13 26-0074 EA Weathering Steel Bearing Termination Plate For Timber Guide Rails	63.26	9.49
34 71 13 26-0075 Cable Guide Rail <small>(34 71 13 26)</small>		
34 71 13 26-0076 Cable Guide Rail <small>(34 71 13 26-0075)</small>		
34 71 13 26-0077 LF Cable (Each Cable)	4.51	2.05
34 71 13 26-0078 EA Cable Splice With Wedges	81.57	14.23
34 71 13 26-0079 Cable Guide Rail Posts <small>(34 71 13 26-0075)</small>		
34 71 13 26-0080 EA Standard Post for Cable Guide Rail	82.11	38.10
<i>For Installation Without Soil Plate, Deduct</i>	-5.00	
<i>For Installation In Rock, Add</i>	10.16	
34 71 13 26-0081 EA Standard Post (Rustic) for Cable Guide Rail	84.19	38.10
<i>For Installation Without Soil Plate, Deduct</i>	-5.00	
<i>For Installation In Rock, Add</i>	10.16	
34 71 13 26-0082 EA Extra Long Post for Cable Guide Rail	84.19	38.10
<i>For Installation Without Soil Plate, Deduct</i>	-5.00	
<i>For Installation In Rock, Add</i>	10.16	
34 71 13 26-0083 EA Extra Long Post (Rustic) for Cable Guide Rail	86.28	38.10
<i>For Installation Without Soil Plate, Deduct</i>	-5.00	
<i>For Installation In Rock, Add</i>	10.16	
34 71 13 26-0084 EA Slip Impact Post Top for Anchor Unit.....	45.36	15.24
34 71 13 26-0085 EA Slip Impact Post Base and Keeper Plate	97.52	15.24
Note: For anchor unit.		
34 71 13 26-0086 Cable Guide Rail Accessories For Breakaway Anchor Angle Systems <small>(34 71 13 26-0075)</small>		
34 71 13 26-0087 EA Turnbuckle Cable End Assembly For Use With Breakaway Anchors	324.42	190.11
34 71 13 26-0088 EA Turnbuckle Cable End Assembly	54.41	9.51
34 71 13 26-0089 EA Spring Cable End Assembly (Compensating Device) For Use With Breakaway Anchors	152.36	4.72
34 71 13 26-0090 EA Spring Cable End Assembly (Compensating Device) Without Turnbuckle	156.53	4.72
34 71 13 26-0091 EA Breakaway Anchor Angle.....	66.93	9.51
34 71 13 26-0092 EA Standard End Post Cap Assembly.....	31.34	4.72
34 71 13 26-0093 EA Driveway End Post Cap Assembly	27.16	4.72
34 71 13 26-0094 EA End Post Ground Support Plates	16.73	4.72
34 71 13 26-0095 EA 11" Stud Bolt, Cable Guide Rail	15.17	4.72
34 71 13 26-0096 EA 18" Stud Bolt, Cable Guide Rail	17.25	4.72
34 71 13 26-0097 EA 25" Stud Bolt, Cable Guide Rail	19.34	4.72
34 71 13 26-0098 EA 1-1/4" Diameter Turnbuckle, Cable Guide Rail	137.87	9.51
34 71 13 26-0099 EA 1-1/2" Diameter Turnbuckle, Cable Guide Rail	146.22	9.51
34 71 13 26-0100 EA 5/8" Diameter Turnbuckle With 12" Take-up And Shackle Ends, Cable Guide Rail.....	100.31	9.51
34 71 13 26-0101 EA 5/8" Eye Bolt 18" Long, Cable Guide Rail.....	60.55	4.72
34 71 13 26-0102 EA 3/4" Eye Bolt 8'-6" Long, Cable Guide Rail	66.93	9.51
34 71 13 26-0103 EA 1-5/8" Anchor Rod 10' Long With Plate, Cable Guide Rail.....	75.31	14.23
34 71 13 26-0104 Cable Guide Rail Accessories For Slip Impact Post Systems <small>(34 71 13 26-0075)</small>		
34 71 13 26-0105 EA Turnbuckle Cable End Assembly	115.04	12.72
Note: For use with slip impact post.		
34 71 13 26-0106 EA Spring Cable End Assembly (Compensating Device).....	215.19	12.72
Note: For use with slip impact post.		
34 71 13 26-0107 EA Anchor Angle For Slip Impact Post System	71.22	12.72
34 71 13 26-0108 EA Cable End Assembly Rod	60.79	12.72
Note: Includes cable end, threaded rod and keeper to anchor angle.		
34 71 13 26-0109 Cable Guide Rail Repair For Existing Guide Rail <small>(34 71 13 26-0075)</small>		
Note: All tasks include associated hardware.		
34 71 13 26-0110 LF Retention Existing Cable (Each Cable).....	1.27	
34 71 13 26-0111 LF Remove and Store Cable Guide Railing	7.64	
34 71 13 26-0112 EA Install Stored Post For Cable Guide Railing.....	50.81	
34 71 13 26-0113 LF Install Stored Cable, (Each Cable).....	3.38	
Note: Includes retensioning. Excludes splices.		
34 71 13 26-0114 6" x 6" Box Beam Guide Rail <small>(34 71 13 26)</small>		
34 71 13 26-0115 Box Beam Guide Rail, 6" x 6" <small>(34 71 13 26-0114)</small>		

34 Transportation**34 70 Transportation Construction And Equipment****34 71 Roadway Construction**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
34 71 13 26-0116			Straight Sections, Box Beam Guide Rail (34 71 13 26-0115)		
34 71 13 26-0117	LF		Box Beam Guide Railing 6" x 6" x 3/16" Galvanized.....	16.23	2.39
			Note: Excludes splices.		
			<i>For Flush Mounting Directly To Structure, Add</i>	1.83	
34 71 13 26-0118	LF		Box Beam Guide Railing 6" x 6" x 3/16" (Rustic)	18.14	2.39
			Note: Excludes splices.		
			<i>For Flush Mounting Directly To Structure, Add</i>	1.83	
34 71 13 26-0119			Shop Curved, Box Beam Guide Rail (34 71 13 26-0115)		
34 71 13 26-0120	LF		Shop Curved Box Beam Guide Railing 6" x 6" x 3/16" Galvanized.....	23.54	2.39
			Note: Excludes splices.		
			<i>For Shop Curved At <20' Radius, Add</i>	2.44	
			<i>For Flush Mounting Directly To Structure, Add</i>	1.83	
34 71 13 26-0121	LF		Shop Curved Box Beam Guide Railing 6" x 6" x 3/16" (Rustic)	25.45	2.39
			Note: Excludes splices.		
			<i>For Shop Curved At <20' Radius, Add</i>	2.44	
			<i>For Flush Mounting Directly To Structure, Add</i>	1.83	
34 71 13 26-0122			Box Beam Guide Rail End Treatment Sections (34 71 13 26-0114)		
			Note: Includes rail, end cover plate and hardware only. Excludes posts and splice.		
34 71 13 26-0123	EA		Box Beam End Piece Guide Railing Section.....	246.59	28.46
			Note: Galvanized excludes splices.		
34 71 13 26-0124	EA		Box Beam End Piece Guide Railing Section (Rustic)	269.54	28.46
			Note: Excludes splices.		
34 71 13 26-0125	EA		Box Beam Guide Railing End Treatment Section At Driveway, Galvanized	234.07	28.46
			Note: Excludes splices.		
34 71 13 26-0126	EA		Box Beam Guide Railing End Treatment Section At Driveway, (Rustic)	242.42	28.46
			Note: Excludes splices.		
34 71 13 26-0127			Splices For Box Beam Guide Rail (34 71 13 26-0114)		
34 71 13 26-0128	EA		Splice For Box Beam Guide Rail.....	115.79	42.25
34 71 13 26-0129	EA		Splice For Box Beam Guide Rail (Rustic)	130.39	42.25
34 71 13 26-0130			Box Beam Guide Rail Posts (34 71 13 26-0114)		
			Note: Includes hardware for box beam mounting.		
34 71 13 26-0131	EA		Standard Post For Box Beam Guide Rail.....	84.19	38.10
			<i>For Installation Without Soil Plate, Deduct</i>	-5.00	
			<i>For Installation In Rock, Add</i>	10.16	
34 71 13 26-0132	EA		Standard Post (Rustic) for Box Beam Guide Railing.....	86.28	38.10
			<i>For Installation Without Soil Plate, Deduct</i>	-5.00	
			<i>For Installation In Rock, Add</i>	10.16	
34 71 13 26-0133	EA		Extra Long Post For Box Beam Guide Rail.....	88.37	38.10
			<i>For Installation Without Soil Plate, Deduct</i>	-5.00	
			<i>For Installation In Rock, Add</i>	10.16	
34 71 13 26-0134	EA		Extra Long Post (Rustic) For Box Beam Guide Rail.....	90.45	38.10
			<i>For Installation Without Soil Plate, Deduct</i>	-5.00	
			<i>For Installation In Rock, Add</i>	10.16	
34 71 13 26-0135	EA		Type I End Assembly Post.....	82.11	38.10
			<i>For Installation Without Soil Plate, Deduct</i>	-5.00	
			<i>For Installation In Rock, Add</i>	10.16	
34 71 13 26-0136	EA		Type I End Assembly Post (Rustic).....	84.19	38.10
			<i>For Installation Without Soil Plate, Deduct</i>	-5.00	
			<i>For Installation In Rock, Add</i>	10.16	
34 71 13 26-0137	EA		Type II End Assembly Post.....	80.02	38.10
			<i>For Installation Without Soil Plate, Deduct</i>	-5.00	
			<i>For Installation In Rock, Add</i>	10.16	
34 71 13 26-0138	EA		Type II End Assembly Post (Rustic).....	82.11	38.10
			<i>For Installation Without Soil Plate, Deduct</i>	-5.00	
			<i>For Installation In Rock, Add</i>	10.16	
34 71 13 26-0139			Box Beam Guide Rail Accessories (34 71 13 26-0114)		
34 71 13 26-0140	EA		Box Beam Guide Rail End Cover Plate.....	36.42	8.54
34 71 13 26-0141	EA		Box Beam Guide Rail End Cover Plate (Rustic)	38.50	8.54
34 71 13 26-0142			Box Beam Guide Railing Repair, And Resetting (34 71 13 26-0114)		
			Note: For existing guide rail.		
34 71 13 26-0143	LF		Remove And Store Box Beam Guide Rail And Post.....	3.74	
34 71 13 26-0144	LF		Reset Box Beam Guide Rail	10.95	
34 71 13 26-0145			6" x 8" Box Beam Median Barrier (34 71 13 26)		
34 71 13 26-0146			Box Beam Median Barrier, 6" x 8" (34 71 13 26-0145)		
34 71 13 26-0147			Straight Sections, Box Beam Median Barrier (34 71 13 26-0146)		
34 71 13 26-0148	LF		Box Beam Median Barrier Galvanized Excludes Splices.....	31.41	8.54
			<i>For Flush Mounting Directly To Structure, Add</i>	1.83	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
34 71 13 26-0149 LF Box Beam Median Barrier (Rustic) Excludes Splices <i>For Flush Mounting Directly To Structure, Add</i>	33.32 1.83	8.54
34 71 13 26-0150 Shop Curved, Box Beam Median Barrier (34 71 13 26-0146)		
34 71 13 26-0151 LF Shop Curved Box Beam Median Barrier Galvanized..... Note: Excludes splices. <i>For Shop Curved At <20' Radius, Add</i> <i>For Flush Mounting Directly To Structure, Add</i>	36.43 2.44 1.83	8.54
34 71 13 26-0152 LF Shop Curved Box Beam Median Barrier Rustic..... Note: Excludes splices. <i>For Shop Curved At <20' Radius, Add</i> <i>For Flush Mounting Directly To Structure, Add</i>	42.69 2.44 1.83	8.54
34 71 13 26-0153 Box Beam Median Barrier End Treatment Sections (34 71 13 26-0145)		
Note: Includes rail, end cover plate and hardware. Excludes posts.		
34 71 13 26-0154 EA Box Beam Median Barrier Type A End Treatment Section, Galvanized..... Note: Excludes splices and post.	745.26	28.46
34 71 13 26-0155 EA Box Beam Median Barrier Type A End Treatment Section (Rustic)..... Note: Excludes splices and post.	761.96	28.46
34 71 13 26-0156 EA Box Beam Median Barrier Type B End Treatment Section, Galvanized..... Note: Excludes splices and post.	745.26	28.46
34 71 13 26-0157 EA Box Beam Median Barrier Type B End Treatment Section (Rustic)..... Note: Excludes splices and post.	761.96	28.46
34 71 13 26-0158 Splices For Box Beam Median Barrier (34 71 13 26-0145)		
34 71 13 26-0159 EA Splice for Box Beam Median Barrier.....	76.26	22.77
34 71 13 26-0160 EA Splice for Box Beam Median Barrier (Rustic).....	107.56	22.77
34 71 13 26-0161 Box Beam Median Barrier Posts Driven With Soil Plate (34 71 13 26-0145)		
Note: Includes all associated hardware.		
34 71 13 26-0162 EA Standard Post for Box Beam Median Barrier..... <i>For Installation Without Soil Plate, Deduct</i> <i>For Installation In Rock, Add</i>	84.19 -5.00 10.16	38.10
34 71 13 26-0163 EA Standard Post (Rustic) for Box Beam Median Barrier..... <i>For Installation Without Soil Plate, Deduct</i> <i>For Installation In Rock, Add</i>	86.28 -5.00 10.16	38.10
34 71 13 26-0164 EA Extra Long Post for Box Beam Median Barrier..... <i>For Installation Without Soil Plate, Deduct</i> <i>For Installation In Rock, Add</i>	88.37 -5.00 10.16	38.10
34 71 13 26-0165 EA Extra Long Post (Rustic) for Box Beam Median Barrier..... <i>For Installation Without Soil Plate, Deduct</i> <i>For Installation In Rock, Add</i>	90.45 -5.00 10.16	38.10
34 71 13 26-0166 EA Type B End Treatment or Rub Back Anchor Post for Box Beam..... Note: For median barrier. <i>For Installation Without Soil Plate, Deduct</i> <i>For Installation In Rock, Add</i>	80.02 -5.00 10.16	38.10
34 71 13 26-0167 EA Type B End Treatment or Rub Back Anchor Post (Rustic)..... Note: For box beam median barrier. <i>For Installation Without Soil Plate, Deduct</i> <i>For Installation In Rock, Add</i>	80.02 -5.00 10.16	38.10
34 71 13 26-0168 EA Type I End Assembly Post for Box Beam Median Barrier to Concrete..... Note: For median barrier transition. <i>For Installation Without Soil Plate, Deduct</i> <i>For Installation In Rock, Add</i>	88.37 -5.00 10.16	38.10
34 71 13 26-0169 EA Type I End Assembly Post (Rustic) for Box Beam Median Barrier..... Note: For Concrete median barrier transition. <i>For Installation Without Soil Plate, Deduct</i> <i>For Installation In Rock, Add</i>	90.45 -5.00 10.16	38.10
34 71 13 26-0170 Box Beam Median Barrier Accessories (34 71 13 26-0145)		
34 71 13 26-0171 EA Box Beam Median Barrier End Cover Plate.....	56.44	20.04
34 71 13 26-0172 EA Box Beam Median Barrier End Cover Plate (Rustic).....	58.53	20.04
34 71 13 26-0173 Box Beam Median Barrier Repair, And Resetting (34 71 13 26-0145)		
Note: For existing guide rail.		
34 71 13 26-0174 LF Remove and Store Box Beam Median Barrier and Posts.....	3.88	
34 71 13 26-0175 LF Reset Box Beam Median Barrier.....	11.46	
34 71 13 26-0176 Universal Guide Rail Items (34 71 13 26)		
34 71 13 26-0177 Guide Rail Concrete Anchor Units For All Types Of Guide Rail (34 71 13 26-0176)		
Note: For cast in place or precast. Includes excavation, formwork, concrete, reinforcement, anchor rods and/or imbedded plate. Excludes anchor angle. For anchor angles and other terminal connections, use accessories section for respective guide rail type.		
34 71 13 26-0178 CY Guide Rail Concrete Anchor Unit..... <i>For Each Additional Set Of Anchor Rods, Add</i>	593.28 38.00	

34 Transportation**34 70 Transportation Construction And Equipment****34 71 Roadway Construction**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
34 71 13 26-0179 EA Reset Existing Anchorage Unit for All Types of Guide Rail..... Note: Includes excavation and backfill.	435.20	
34 71 13 26-0180 Guide Rail Repair For All Types Of Existing Guide Rail (34 71 13 26-0176) Note: All tasks include associated hardware.		
34 71 13 26-0181 EA Straighten And Reset Post Mounted On Concrete For Guide Rail..... Note: With base plate for guide rail. Includes new anchor bolts.	53.81	
34 71 13 26-0182 Additional Wood and Steel Posts (34 71 13 26-0176)		
34 71 13 26-0183 LF 4" x 6" Wood Post..... For Installation In Rock, Add	26.88 3.39	12.74
34 71 13 26-0184 LF 6" x 8" Wood Post..... For Installation In Rock, Add	30.01 3.39	12.74
34 71 13 26-0185 LF 6" x 7/8" Steel Post Galvanized..... For Installation In Rock, Add	22.88 3.39	12.74
34 71 13 26-0186 EA Base Plate With Anchor Bolts For Mounting Post On Concrete.....	161.19	12.72
34 71 13 26-0187 Accessories For All Types of Guide Rail (34 71 13 26-0176)		
34 71 13 26-0188 EA Reflector, Guard Rail	15.71	
34 71 13 26-0189 Guide Rail Transitions (34 71 13 26)		
34 71 13 26-0190 Transition Box Beam Guide Rail To Corrugated Beam (34 71 13 26-0189)		
34 71 13 26-0191 EA Box Beam To Corrugated Beam Rail Bolted Section.....	378.67	
34 71 13 26-0192 EA Box Beam To Corrugated Beam Rail Bolted Plate..... Note: For making cable connections.	295.21	
34 71 13 26-0193 Transition Box Beam Median Barrier To Corrugated Beam Median (34 71 13 26-0189)		
34 71 13 26-0194 EA Box Beam Median Barrier To Corrugated Beam Bolted Section	382.84	
34 71 13 26-0195 EA Box Beam Median Barrier To Corrugated Beam Harness Plate..... Note: For making cable connections.	295.21	
34 71 13 26-0196 Transition Box Beam Guide Rail To Cable Guide Rail (34 71 13 26-0189)		
34 71 13 26-0197 EA Box Beam to Cable Guide Rail U-bolt And Plate	46.21	15.18
34 71 13 26-0198 Transition Box Beam Median Barrier To Concrete Median Barrier (34 71 13 26-0189)		
34 71 13 26-0199 EA Box Beam Median Barrier To Concrete Barrier End Connection	462.13	
34 71 13 26-0200 Transition Thrie Beam To Concrete Median Barrier (34 71 13 26-0189)		
34 71 13 26-0201 EA Thrie Beam Terminal Connector At Concrete Median Barrier.....	357.80	
34 71 13 26-0202 EA Thrie Beam Transition Section To Corrugated Beam Guide Rail.....	409.97	
34 71 13 26-0203 Resilient Guard Fence And Light Shield (34 71 13 26)		
34 71 13 26-0204 LF Resilient Guard Fence And Light Shield, Up To 6' High	53.23	5.85
34 71 13 26-0205 Individual Concrete Posts (34 71 13 26)		
34 71 13 26-0206 EA 6'-5" Concrete Posts, Round.....	63.86	5.85
34 71 13 26-0207 EA 6'-5" Concrete Posts, Square.....	71.51	6.59
34 71 13 26-0208 EA 6'-5" Concrete Posts, Triangular	69.76	6.59
34 71 16 Impact Attenuating Devices (34 71)		
34 71 16 00-0001 Guard Rail Energy Absorbing Terminals (34 71 16) Note: Crushable foam cartridges surrounded by steel guardrail for narrow hazards. QuadGuard System as manufactured by Energy Absorption Systems, Inc.		
34 71 16 00-0002 24" Wide Guard Rail Energy Absorbing Terminals (34 71 16 00-0001)		
34 71 16 00-0003 EA 24" Wide, 3 Cartridge Bays, Energy Absorbing Crash Attenuator	17,626.26	2,706.54
34 71 16 00-0004 EA 24" Wide, 5 Cartridge, Bays Energy Absorbing Crash Attenuator	24,134.87	3,608.72
34 71 16 00-0005 EA 24" Wide, 7 Cartridge, Bays Energy Absorbing Crash Attenuator	32,505.39	4,736.45
34 71 16 00-0006 EA 24" Wide, 9 Cartridge, Bays Energy Absorbing Crash Attenuator	37,506.08	5,864.17
34 71 16 00-0007 30" Wide Guard Rail Energy Absorbing Terminals (34 71 16 00-0001)		
34 71 16 00-0008 EA 30" Wide, 3 Cartridge Bays, Energy Absorbing Crash Attenuator	19,279.27	3,044.85
34 71 16 00-0009 EA 30" Wide, 5 Cartridge Bays, Energy Absorbing Crash Attenuator	26,439.40	4,059.81
34 71 16 00-0010 EA 30" Wide, 7 Cartridge Bays, Energy Absorbing Crash Attenuator	35,921.88	5,413.07
34 71 16 00-0011 EA 30" Wide, 9 Cartridge Bays, Energy Absorbing Crash Attenuator	41,923.40	6,540.80



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Transportation Construction And Equipment	34 70	
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MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
34 71 16 00-0012 36" Wide Guard Rail Energy Absorbing Terminals <small>(34 71 16 00-0001)</small>		
34 71 16 00-0013 EA 36" Wide, 3 Cartridge Bays, Energy Absorbing Crash Attenuator	20,942.52	3,383.17
34 71 16 00-0014 EA 36" Wide, 5 Cartridge Bays, Energy Absorbing Crash Attenuator	28,753.60	4,510.89
34 71 16 00-0015 EA 36" Wide, 7 Cartridge Bays, Energy Absorbing Crash Attenuator	38,878.29	5,976.94
34 71 16 00-0016 EA 36" Wide, 9 Cartridge Bays, Energy Absorbing Crash Attenuator	46,329.74	7,217.44
34 71 16 00-0017 69" Wide Guard Rail Energy Absorbing Terminals <small>(34 71 16 00-0001)</small>		
34 71 16 00-0018 EA 69" Wide, 3 Cartridge Bays, Energy Absorbing Crash Attenuator	22,811.22	3,721.49
34 71 16 00-0019 EA 69" Wide, 5 Cartridge Bays, Energy Absorbing Crash Attenuator	31,147.75	4,961.99
34 71 16 00-0020 EA 69" Wide, 7 Cartridge Bays, Energy Absorbing Crash Attenuator	42,153.40	6,540.80
34 71 16 00-0021 EA 69" Wide, 9 Cartridge Bays, Energy Absorbing Crash Attenuator	50,075.10	7,894.07
34 71 16 00-0022 90" Wide Guard Rail Energy Absorbing Terminals <small>(34 71 16 00-0001)</small>		
34 71 16 00-0023 EA 90" Wide, 3 Cartridge Bays, Energy Absorbing Crash Attenuator	24,709.40	4,059.81
34 71 16 00-0024 EA 90" Wide, 5 Cartridge Bays, Energy Absorbing Crash Attenuator	33,576.88	5,413.07
34 71 16 00-0025 EA 90" Wide, 7 Cartridge Bays, Energy Absorbing Crash Attenuator	45,949.74	7,217.44
34 71 16 00-0026 EA 90" Wide, 9 Cartridge Bays, Energy Absorbing Crash Attenuator	53,883.85	8,570.70
34 71 19 Vehicle Delineators <small>(34 71)</small>		
34 71 19 16 Flexible Vehicle Delineators <small>(34 71 19)</small>		
34 71 19 16-0001 EA 2' High, 3" Diameter Flexible Fixed Stanchion Delineator	58.45	7.32

END OF SECTION 34

34 Transportation

34 70 Transportation Construction And Equipment

34 71 Roadway Construction



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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35 Waterway and Marine Construction

35 05 Common Work Results for Waterway and Marine Construction⁽³⁵⁾

35 05 70 Common Work Results for Dams^(35 05)

35 05 70 00-0001 Rubber Dam Repair^(35 05 70)

35 05 70 00-0002	EA	Class A Rubber Dam Repair (Bullet And Similar Holes).....	26.51
35 05 70 00-0003	SF	Class B Rubber Dam Repair (Minor Surface Rubber Damage).....	51.62
35 05 70 00-0004	SF	Class C Rubber Dam Repair (Major Surface Rubber Damage).....	76.63
35 05 70 00-0005	SF	Class D Rubber Dam Repair (Serious Surface Rubber Damage), Per Layer Of Material	84.78

35 20 Waterway and Marine Construction and Equipment⁽³⁵⁾

35 20 16 Hydraulic Gates^(35 20)

35 20 16 26 Hydraulic Sluice Gates^(35 20 16)

35 20 16 26-0001 Heavy Duty Cast Iron Sluice Gates Self Contained^(35 20 16 26)

Note: Includes crank operated geared gate lift, anchor bolts, and grouting.

35 20 16 26-0002	EA	18" x 18" Heavy Duty Sluice Gates Self Contained With Crank Operated Gate.....	8,157.42	915.98
		<i>For Electric Motor Operated Valve, Add</i>	1,033.20	
35 20 16 26-0003	EA	24" x 24" Heavy Duty Sluice Gates Self Contained With Crank Operated Gate.....	11,676.93	1,374.01
		<i>For Electric Motor Operated Valve, Add</i>	1,124.80	
35 20 16 26-0004	EA	30" x 30" Heavy Duty Sluice Gates Self Contained With Crank Operated Gate.....	14,065.57	1,526.72
		<i>For Electric Motor Operated Valve, Add</i>	1,155.34	
35 20 16 26-0005	EA	36" x 36" Heavy Duty Sluice Gates Self Contained With Crank Operated Gate.....	16,148.25	1,717.51
		<i>For Electric Motor Operated Valve, Add</i>	1,193.50	
35 20 16 26-0006	EA	42" x 42" Heavy Duty Sluice Gates Self Contained With Crank Operated Gate.....	18,118.88	1,962.88
		<i>For Electric Motor Operated Valve, Add</i>	1,242.58	
35 20 16 26-0007	EA	48" x 48" Heavy Duty Sluice Gates Self Contained With Crank Operated Gate.....	21,374.57	2,748.03
		<i>For Electric Motor Operated Valve, Add</i>	1,399.61	
35 20 16 26-0008	EA	54" x 54" Heavy Duty Sluice Gates Self Contained With Crank Operated Gate.....	34,253.47	4,158.65
		<i>For Electric Motor Operated Valve, Add</i>	1,681.73	
35 20 16 26-0009	EA	60" x 60" Heavy Duty Sluice Gates Self Contained With Crank Operated Gate.....	42,677.77	6,870.07
		<i>For Electric Motor Operated Valve, Add</i>	2,224.01	
35 20 16 26-0010	EA	66" x 66" Heavy Duty Sluice Gates Self Contained With Crank Operated Gate.....	48,930.33	6,870.07
		<i>For Electric Motor Operated Valve, Add</i>	2,224.01	
35 20 16 26-0011	EA	72" x 72" Heavy Duty Sluice Gates Self Contained With Crank Operated Gate.....	53,870.00	9,135.72
		<i>For Electric Motor Operated Valve, Add</i>	2,677.15	
35 20 16 26-0012	EA	78" x 78" Heavy Duty Sluice Gates Self Contained With Crank Operated Gate.....	60,224.01	9,135.72
		<i>For Electric Motor Operated Valve, Add</i>	3,077.15	
35 20 16 26-0013	EA	84" x 84" Heavy Duty Sluice Gates Self Contained With Crank Operated Gate.....	76,717.95	13,740.14
		<i>For Electric Motor Operated Valve, Add</i>	3,998.03	
35 20 16 26-0014	EA	90" x 90" Heavy Duty Sluice Gates Self Contained With Crank Operated Gate.....	75,491.94	7,645.74
		<i>For Electric Motor Operated Valve, Add</i>	2,779.15	
35 20 16 26-0015	EA	96" x 96" Heavy Duty Sluice Gates Self Contained With Crank Operated Gate.....	84,835.99	7,645.74
		<i>For Electric Motor Operated Valve, Add</i>	2,779.15	
35 20 16 26-0016	EA	108" x 108" Heavy Duty Sluice Gates Self Contained With Crank Operated Gate.....	107,870.34	10,167.21
		<i>For Electric Motor Operated Valve, Add</i>	3,283.44	
35 20 16 26-0017	EA	120" x 120" Heavy Duty Sluice Gates Self Contained With Crank Operated Gate.....	138,853.27	15,291.48
		<i>For Electric Motor Operated Valve, Add</i>	4,308.30	
35 20 16 26-0018	EA	132" x 132" Heavy Duty Sluice Gates Self Contained With Crank Operated Gate.....	165,829.81	15,291.48
		<i>For Electric Motor Operated Valve, Add</i>	4,308.30	

35 20 16 61 Other Hydraulic Gates^(35 20 16)

35 20 16 61-0001 Steel Slide Gates Self Contained^(35 20 16 61)

Note: Includes anchors and bolts.

35 20 16 61-0002	EA	12" x 12" Steel Slide Gates Self Contained Including Anchor Bolts And Grouting.....	2,801.29	343.50
		<i>For Electric Motor Operated Valve, Add</i>	918.70	
35 20 16 61-0003	EA	18" x 18" Steel Slide Gates Self Contained Including Anchor Bolts And Grouting.....	3,743.62	392.58
		<i>For Electric Motor Operated Valve, Add</i>	928.52	
35 20 16 61-0004	EA	24" x 24" Steel Slide Gates Self Contained Including Anchor Bolts And Grouting.....	4,269.96	458.03
		<i>For Electric Motor Operated Valve, Add</i>	941.60	
35 20 16 61-0005	EA	30" x 30" Steel Slide Gates Self Contained Including Anchor Bolts And Grouting.....	5,160.45	549.61
		<i>For Electric Motor Operated Valve, Add</i>	959.92	
35 20 16 61-0006	EA	36" x 36" Steel Slide Gates Self Contained Including Anchor Bolts And Grouting.....	6,606.48	687.01
		<i>For Electric Motor Operated Valve, Add</i>	987.40	
35 20 16 61-0007	EA	42" x 42" Steel Slide Gates Self Contained Including Anchor Bolts And Grouting.....	7,726.15	915.98
		<i>For Electric Motor Operated Valve, Add</i>	1,033.20	
35 20 16 61-0008	EA	48" x 48" Steel Slide Gates Self Contained Including Anchor Bolts And Grouting.....	10,573.91	1,374.01
		<i>For Electric Motor Operated Valve, Add</i>	1,124.80	
35 20 16 61-0009	EA	54" x 54" Steel Slide Gates Self Contained Including Anchor Bolts And Grouting.....	16,109.32	1,717.51
		<i>For Electric Motor Operated Valve, Add</i>	1,193.50	
35 20 16 61-0010	EA	60" x 60" Steel Slide Gates Self Contained Including Anchor Bolts And Grouting.....	20,934.88	2,748.03
		<i>For Electric Motor Operated Valve, Add</i>	1,399.61	

35 Waterway and Marine Construction
35 20 Waterway and Marine Construction and Equipment
35 20 16 Hydraulic Gates



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
35 20 16 61-0011 EA 72" x 72" Steel Slide Gates Self Contained Including Anchor Bolts And Grouting..... <i>For Electric Motor Operated Valve, Add</i>	26,511.66 1,766.01	4,580.08
35 20 16 61-0012 SF Over 36 SF Steel Slide Gates Self Contained Including Anchor..... <i>For Electric Motor Operated Valve, Add</i>	735.36 1,575.32	126.61
35 20 16 61-0013 Cast Iron Canal Gates (35 20 16 61)		
35 20 16 61-0014 EA 12" Diameter Canal Gates..... <i>For Electric Motor Operated Valve, Add</i>	1,169.65 918.70	343.50
35 20 16 61-0015 EA 18" Diameter Canal Gates..... <i>For Electric Motor Operated Valve, Add</i>	1,579.45 928.52	392.58
35 20 16 61-0016 EA 20" Diameter Canal Gates..... <i>For Electric Motor Operated Valve, Add</i>	1,783.42 935.88	429.38
35 20 16 61-0017 EA 24" Diameter Canal Gates..... <i>For Electric Motor Operated Valve, Add</i>	2,064.72 941.60	458.03
35 20 16 61-0018 EA 30" Diameter Canal Gates..... <i>For Electric Motor Operated Valve, Add</i>	2,953.17 959.92	549.61
35 20 16 61-0019 EA 36" Diameter Canal Gates..... <i>For Electric Motor Operated Valve, Add</i>	3,650.06 987.40	687.01
35 20 16 61-0020 EA 42" Diameter Canal Gates..... <i>For Electric Motor Operated Valve, Add</i>	5,871.21 1,033.20	915.98
35 20 16 61-0021 EA 48" Diameter Canal Gates..... <i>For Electric Motor Operated Valve, Add</i>	7,870.03 1,124.80	1,374.01
35 20 16 61-0022 EA 54" Diameter Canal Gates..... <i>For Electric Motor Operated Valve, Add</i>	10,934.60 1,193.50	1,717.51
35 20 16 61-0023 EA 60" Diameter Canal Gates..... <i>For Electric Motor Operated Valve, Add</i>	14,635.88 1,399.61	2,748.03
35 20 16 61-0024 EA 66" Diameter Canal Gates..... <i>For Electric Motor Operated Valve, Add</i>	19,870.98 1,537.01	3,435.04
35 20 16 61-0025 EA 72" Diameter Canal Gates..... <i>For Electric Motor Operated Valve, Add</i>	24,625.84 1,766.01	4,580.08
35 20 16 61-0026 Aluminum Flap Gates (35 20 16 61)		
35 20 16 61-0027 EA 18" Diameter Aluminum Flap Gates..... <i>For Electric Motor Operated Valve, Add</i>	2,599.28 918.70	343.50
35 20 16 61-0028 EA 20" Diameter Aluminum Flap Gates..... <i>For Electric Motor Operated Valve, Add</i>	2,892.87 923.60	368.04
35 20 16 61-0029 EA 24" Diameter Aluminum Flap Gates..... <i>For Electric Motor Operated Valve, Add</i>	3,183.89 928.52	392.58
35 20 16 61-0030 EA 30" Diameter Aluminum Flap Gates..... <i>For Electric Motor Operated Valve, Add</i>	4,316.01 941.60	458.03
35 20 16 61-0031 EA 36" Diameter Aluminum Flap Gates..... <i>For Electric Motor Operated Valve, Add</i>	5,350.46 959.92	549.61
35 20 16 61-0032 EA 42" Diameter Aluminum Flap Gates..... <i>For Electric Motor Operated Valve, Add</i>	7,572.76 987.40	687.01
35 20 16 61-0033 EA 48" Diameter Aluminum Flap Gates..... <i>For Electric Motor Operated Valve, Add</i>	9,582.02 1,033.20	915.98
35 20 16 61-0034 EA 54" Diameter Aluminum Flap Gates..... <i>For Electric Motor Operated Valve, Add</i>	12,398.03 1,124.80	1,374.01
35 20 16 61-0035 EA 60" Diameter Aluminum Flap Gates..... <i>For Electric Motor Operated Valve, Add</i>	16,390.09 1,242.58	1,962.88
35 20 16 61-0036 EA 66" Diameter Aluminum Flap Gates..... <i>For Electric Motor Operated Valve, Add</i>	21,196.61 1,399.61	2,748.03
35 20 16 61-0037 EA 72" Diameter Aluminum Flap Gates..... <i>For Electric Motor Operated Valve, Add</i>	26,437.35 1,635.15	3,925.76
35 20 16 61-0038 Steel Knife Gates Including Handwheel Operator (35 20 16 61) Note: ANSI 150 PSI. for hub, flange, or spigot ends.		
35 20 16 61-0039 EA 6" Diameter Knife Gates Including Handwheel Operator For Hub..... <i>For Electric Motor Operated Valve, Add</i>	1,402.69 871.63	108.15
35 20 16 61-0040 EA 8" Diameter Knife Gates Including Handwheel Operator For Hub..... <i>For Electric Motor Operated Valve, Add</i>	1,891.45 875.24	126.15
35 20 16 61-0041 EA 10" Diameter Knife Gates Including Handwheel Operator For Hub..... <i>For Electric Motor Operated Valve, Add</i>	2,654.52 887.85	189.27
35 20 16 61-0042 EA 12" Diameter Knife Gates Including Handwheel Operator For Hub..... <i>For Electric Motor Operated Valve, Add</i>	3,311.47 900.47	252.38
35 20 16 61-0043 EA 14" Diameter Knife Gates Including Handwheel Operator For Hub..... <i>For Electric Motor Operated Valve, Add</i>	4,068.71 904.08	270.38
35 20 16 61-0044 EA 16" Diameter Knife Gates Including Handwheel Operator For Hub..... <i>For Electric Motor Operated Valve, Add</i>	5,284.21 908.24	291.16
35 20 16 61-0045 EA 18" Diameter Knife Gates Including Handwheel Operator For Hub..... <i>For Electric Motor Operated Valve, Add</i>	7,049.63 910.57	302.83
35 20 16 61-0046 EA 20" Diameter Knife Gates Including Handwheel Operator For Hub..... <i>For Electric Motor Operated Valve, Add</i>	8,824.37 918.82	344.15
35 20 16 61-0047 EA 24" Diameter Knife Gates Including Handwheel Operator For Hub..... <i>For Electric Motor Operated Valve, Add</i>	11,331.55 925.71	378.53
35 20 16 61-0048 EA 30" Diameter Knife Gates Including Handwheel Operator For Hub..... <i>For Electric Motor Operated Valve, Add</i>	20,678.52 950.94	504.69
35 20 16 61-0049 EA 36" Diameter Knife Gates Including Handwheel Operator For Hub..... <i>For Electric Motor Operated Valve, Add</i>	27,486.70 1,001.41	757.07



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
35 20 16 61-0050 Steel Hollow Jet Flow Gate Valve <small>(35 20 16 61)</small>		
35 20 16 61-0051 EA 6" Diameter Jet Flow Gate Valve Including Handwheel Operator For Hub..... <i>For Electric Motor Operated Valve, Add</i>	1,338.69 <i>877.48</i>	137.40
35 20 16 61-0052 EA 8" Diameter Jet Flow Gate Valve Including Handwheel Operator For Hub..... <i>For Electric Motor Operated Valve, Add</i>	2,071.82 <i>882.09</i>	160.47
35 20 16 61-0053 EA 10" Diameter Jet Flow Gate Valve Including Handwheel Operator For Hub..... <i>For Electric Motor Operated Valve, Add</i>	2,488.71 <i>898.09</i>	240.46
35 20 16 61-0054 EA 12" Diameter Jet Flow Gate Valve Including Handwheel Operator For Hub..... <i>For Electric Motor Operated Valve, Add</i>	3,173.09 <i>914.10</i>	320.44
35 20 16 61-0055 EA 14" Diameter Jet Flow Gate Valve Including Handwheel Operator For Hub..... <i>For Electric Motor Operated Valve, Add</i>	4,773.71 <i>918.70</i>	343.50
35 20 16 61-0056 EA 16" Diameter Jet Flow Gate Valve Including Handwheel Operator For Hub..... <i>For Electric Motor Operated Valve, Add</i>	5,757.09 <i>924.00</i>	370.00
35 20 16 61-0057 EA 18" Diameter Jet Flow Gate Valve Including Handwheel Operator For Hub..... <i>For Electric Motor Operated Valve, Add</i>	9,673.08 <i>926.95</i>	384.73
35 20 16 61-0058 EA 20" Diameter Jet Flow Gate Valve Including Handwheel Operator For Hub..... <i>For Electric Motor Operated Valve, Add</i>	12,164.93 <i>937.45</i>	437.23
35 20 16 61-0059 EA 24" Diameter Jet Flow Gate Valve Including Handwheel Operator For Hub..... <i>For Electric Motor Operated Valve, Add</i>	17,493.23 <i>946.19</i>	480.91
35 20 16 61-0060 EA 30" Diameter Jet Flow Gate Valve Including Handwheel Operator For Hub..... <i>For Electric Motor Operated Valve, Add</i>	21,429.60 <i>978.27</i>	641.37
35 20 16 61-0061 EA 36" Diameter Jet Flow Gate Valve Including Handwheel Operator For Hub..... <i>For Electric Motor Operated Valve, Add</i>	30,581.23 <i>1,042.33</i>	961.81
35 20 16 61-0062 EA 42" Diameter Jet Flow Gate Valve Including Handwheel Operator For Hub..... <i>For Electric Motor Operated Valve, Add</i>	36,447.13 <i>1,485.60</i>	1,177.73
35 20 16 61-0063 EA 48" Diameter Jet Flow Gate Valve Including Handwheel Operator For Hub..... <i>For Electric Motor Operated Valve, Add</i>	43,219.07 <i>1,524.80</i>	1,374.01
35 20 16 61-0064 EA 54" Diameter Jet Flow Gate Valve Including Handwheel Operator For Hub..... <i>For Electric Motor Operated Valve, Add</i>	56,915.99 <i>1,593.50</i>	1,717.51
35 20 16 61-0065 EA 60" Diameter Jet Flow Gate Valve Including Handwheel Operator For Hub..... <i>For Electric Motor Operated Valve, Add</i>	63,390.81 <i>1,662.37</i>	2,061.02
35 20 16 61-0066 EA 66" Diameter Jet Flow Gate Valve Including Handwheel Operator For Hub..... <i>For Electric Motor Operated Valve, Add</i>	80,898.46 <i>1,819.66</i>	2,846.17
35 20 16 61-0067 Steel Dish Head Valve <small>(35 20 16 61)</small>		
35 20 16 61-0068 EA 12" Diameter Dish Head Valve	1,700.97	343.50
35 20 16 61-0069 EA 18" Diameter Dish Head Valve	2,453.88	392.58
35 20 16 61-0070 EA 20" Diameter Dish Head Valve	2,825.90	429.38
35 20 16 61-0071 EA 24" Diameter Dish Head Valve	3,329.31	458.03
35 20 16 61-0072 EA 30" Diameter Dish Head Valve	4,994.16	549.61
35 20 16 61-0073 EA 36" Diameter Dish Head Valve	6,155.70	687.01
35 20 16 61-0074 EA 42" Diameter Dish Head Valve	10,317.84	915.98
35 20 16 61-0075 EA 48" Diameter Dish Head Valve	13,508.71	1,374.01
35 20 16 61-0076 EA 54" Diameter Dish Head Valve	19,190.68	1,717.51
35 20 16 61-0077 EA 60" Diameter Dish Head Valve	24,697.66	2,748.03
35 20 16 61-0078 EA 66" Diameter Dish Head Valve	34,183.33	3,435.04
35 20 16 61-0079 EA 72" Diameter Dish Head Valve	41,651.66	4,580.08
35 20 19 Hydraulic Valves <small>(35 20)</small>		
35 20 19 13 Hydraulic Butterfly Valves <small>(35 20 19)</small>		
35 20 19 13-0001 IN Butterfly Valve, Cast Iron, Custom Made, >54" Diameter, Per Inch Of Diameter Of Valve.....	719.80	73.61

END OF SECTION 35

35 Waterway and Marine Construction

35 20 Waterway and Marine Construction and Equipment

35 20 19 Hydraulic Valves



MINOR
CSI UOM DESCRIPTION

TOTAL DIRECT DEMOLITION
UNIT COST UNIT COST

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MINOR	CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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40 Process Interconnections

40 05 Common Work Results For Process Interconnections ⁽⁴⁰⁾

40 05 23 Stainless Steel Process Pipe and Tubing ^(40 05)

40 05 23 43 Stainless Steel Process Pipe ^(40 05 23)

40 05 23 43-0001	Schedule 40 Pipe, Type 304, With 150 LB Screwed Fittings Assembly ^(40 05 23)		
	⁴³ Note: Includes hangers and fittings. Fittings are assumed every 10'. Not for use where detail is available.		
40 05 23 43-0002	LF 1/2" Stainless Steel Pipe, Schedule 40 Type 304 With 150 LB Screwed Fitting Assembly 22.73		6.54
	Note: Includes all fittings and hangers. Fittings are assumed every 10'. Not for use where detail is available.		
	<i>For Type 316, Add</i>	2.49	
	<i>For Work In Restricted Working Space, Add</i>	3.95	
40 05 23 43-0003	LF 3/4" Stainless Steel Pipe, Schedule 40 Type 304 With 150 LB Screwed Fitting Assembly 25.67		7.50
	Note: Includes all fittings and hangers. Fittings are assumed every 10'. Not for use where detail is available.		
	<i>For Type 316, Add</i>	2.61	
	<i>For Work In Restricted Working Space, Add</i>	4.69	
40 05 23 43-0004	LF 1" Stainless Steel Pipe, Schedule 40 Type 304 With 150 LB Screwed Fitting Assembly 29.89		8.47
	Note: Includes all fittings and hangers. Fittings are assumed every 10'. Not for use where detail is available.		
	<i>For Type 316, Add</i>	3.06	
	<i>For Work In Restricted Working Space, Add</i>	5.44	
40 05 23 43-0005	LF 1-1/4" Stainless Steel Pipe, Schedule 40 Type 304 With 150 LB Screwed Fitting Assembly 34.36		10.22
	Note: Includes all fittings and hangers. Fittings are assumed every 10'. Not for use where detail is available.		
	<i>For Type 316, Add</i>	3.86	
	<i>For Work In Restricted Working Space, Add</i>	5.86	
40 05 23 43-0006	LF 1-1/2" Stainless Steel Pipe, Schedule 40 Type 304 With 150 LB Screwed Fitting Assembly 37.93		10.51
	Note: Includes all fittings and hangers. Fittings are assumed every 10'. Not for use where detail is available.		
	<i>For Type 316, Add</i>	4.42	
	<i>For Work In Restricted Working Space, Add</i>	6.28	
40 05 23 43-0007	LF 2" Stainless Steel Pipe, Schedule 40 Type 304 With 150 LB Screwed Fitting Assembly 45.95		13.89
	Note: Includes all fittings and hangers. Fittings are assumed every 10'. Not for use where detail is available.		
	<i>For Type 316, Add</i>	5.39	
	<i>For Work In Restricted Working Space, Add</i>	7.56	
40 05 23 43-0008	LF 2-1/2" Stainless Steel Pipe, Schedule 40 Type 304 With 150 LB Screwed Fitting Assembly 66.89		17.13
	Note: Includes all fittings and hangers. Fittings are assumed every 10'. Not for use where detail is available.		
	<i>For Type 316, Add</i>	9.27	
	<i>For Work In Restricted Working Space, Add</i>	9.37	
40 05 23 43-0009	LF 3" Stainless Steel Pipe, Schedule 40 Type 304 With 150 LB Screwed Fitting Assembly 84.64		19.85
	Note: Includes all fittings and hangers. Fittings are assumed every 10'. Not for use where detail is available.		
	<i>For Type 316, Add</i>	12.07	
	<i>For Work In Restricted Working Space, Add</i>	11.46	
40 05 23 43-0010	LF 4" Stainless Steel Pipe, Schedule 40 Type 304 With 150 LB Screwed Fitting Assembly 115.36		19.85
	Note: Includes all fittings and hangers. Fittings are assumed every 10'. Not for use where detail is available.		
	<i>For Work In Restricted Working Space, Add</i>	14.54	

40 05 23 43-0011 Stainless Steel Tubing And Fittings ^(40 05 23 43)

40 05 23 43-0012 Type 304 Tubing ^(40 05 23 43-0011)

40 05 23 43-0013 0.035" Wall ^(40 05 23 43-0012)

40 05 23 43-0014	LF 1/4" Stainless Steel Tubing, Type 304, 0.035" Wall 5.25		2.16
	<i>For Work In Restricted Working Space, Add</i>	1.28	
40 05 23 43-0015	LF 3/8" Stainless Steel Tubing, Type 304, 0.035" Wall 6.16		2.56
	<i>For Work In Restricted Working Space, Add</i>	1.54	
40 05 23 43-0016	LF 1/2" Stainless Steel Tubing, Type 304, 0.035" Wall 7.30		3.03
	<i>For Work In Restricted Working Space, Add</i>	1.80	
40 05 23 43-0017	LF 5/8" Stainless Steel Tubing, Type 304, 0.035" Wall 10.82		3.43
	<i>For Work In Restricted Working Space, Add</i>	2.06	
40 05 23 43-0018	LF 3/4" Stainless Steel Tubing, Type 304, 0.035" Wall 12.67		3.84
	<i>For Work In Restricted Working Space, Add</i>	2.32	
40 05 23 43-0019	LF 7/8" Stainless Steel Tubing, Type 304, 0.035" Wall 14.04		4.31
	<i>For Work In Restricted Working Space, Add</i>	2.58	
40 05 23 43-0020	LF 1" Stainless Steel Tubing, Type 304, 0.035" Wall 15.94		5.19
	<i>For Work In Restricted Working Space, Add</i>	3.09	

40 05 23 43-0021 0.049" Wall ^(40 05 23 43-0012)

40 05 23 43-0022	LF 1/4" Stainless Steel Tubing, Type 304, 0.049" Wall 8.02		2.56
	<i>For Work In Restricted Working Space, Add</i>	1.54	
40 05 23 43-0023	LF 3/8" Stainless Steel Tubing, Type 304, 0.049" Wall 9.03		3.03
	<i>For Work In Restricted Working Space, Add</i>	1.80	
40 05 23 43-0024	LF 1/2" Stainless Steel Tubing, Type 304, 0.049" Wall 10.73		3.43
	<i>For Work In Restricted Working Space, Add</i>	2.06	
40 05 23 43-0025	LF 5/8" Stainless Steel Tubing, Type 304, 0.049" Wall 13.54		4.31
	<i>For Work In Restricted Working Space, Add</i>	2.58	
40 05 23 43-0026	LF 3/4" Stainless Steel Tubing, Type 304, 0.049" Wall 15.66		5.19
	<i>For Work In Restricted Working Space, Add</i>	3.09	
40 05 23 43-0027	LF 7/8" Stainless Steel Tubing, Type 304, 0.049" Wall 17.76		5.99
	<i>For Work In Restricted Working Space, Add</i>	3.60	

40 Process Interconnections**40 05 Common Work Results For Process Interconnections****40 05 23 Stainless Steel Process Pipe and Tubing**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
40 05 23 43-0028	LF		1" Stainless Steel Tubing, Type 304, 0.049" Wall <i>For Work In Restricted Working Space, Add</i>	20.43 4.10	6.79
40 05 23 43-0029			0.065" Wall <small>(40 05 23 43-0012)</small>		
40 05 23 43-0030	LF		1/4" Stainless Steel Tubing, Type 304, 0.065" Wall <i>For Work In Restricted Working Space, Add</i>	9.35 1.80	3.03
40 05 23 43-0031	LF		3/8" Stainless Steel Tubing, Type 304, 0.065" Wall <i>For Work In Restricted Working Space, Add</i>	10.75 2.06	3.43
40 05 23 43-0032	LF		1/2" Stainless Steel Tubing, Type 304, 0.065" Wall <i>For Work In Restricted Working Space, Add</i>	13.30 2.58	4.31
40 05 23 43-0033	LF		5/8" Stainless Steel Tubing, Type 304, 0.065" Wall <i>For Work In Restricted Working Space, Add</i>	15.70 3.09	5.19
40 05 23 43-0034	LF		3/4" Stainless Steel Tubing, Type 304, 0.065" Wall <i>For Work In Restricted Working Space, Add</i>	18.47 3.60	5.99
40 05 23 43-0035	LF		7/8" Stainless Steel Tubing, Type 304, 0.065" Wall <i>For Work In Restricted Working Space, Add</i>	21.18 4.10	6.79
40 05 23 43-0036	LF		1" Stainless Steel Tubing, Type 304, 0.065" Wall <i>For Work In Restricted Working Space, Add</i>	23.86 4.61	7.67
40 05 23 43-0037			Type 304 Tube Fittings <small>(40 05 23 43-0011)</small>		
40 05 23 43-0038			90 Degree Elbows <small>(40 05 23 43-0037)</small>		
40 05 23 43-0039	EA		1/4" 90 Degree Elbow, Stainless Steel Type 304 <i>For Work In Restricted Working Space, Add</i>	29.40 5.15	8.62
40 05 23 43-0040	EA		3/8" 90 Degree Elbow, Stainless Steel Type 304 <i>For Work In Restricted Working Space, Add</i>	34.21 5.64	9.43
40 05 23 43-0041	EA		1/2" 90 Degree Elbow, Stainless Steel Type 304 <i>For Work In Restricted Working Space, Add</i>	48.94 6.39	10.63
40 05 23 43-0042	EA		5/8" 90 Degree Elbow, Stainless Steel Type 304 <i>For Work In Restricted Working Space, Add</i>	52.68 7.15	11.91
40 05 23 43-0043	EA		3/4" 90 Degree Elbow, Stainless Steel Type 304 <i>For Work In Restricted Working Space, Add</i>	58.59 7.73	12.86
40 05 23 43-0044	EA		7/8" 90 Degree Elbow, Stainless Steel Type 304 <i>For Work In Restricted Working Space, Add</i>	77.56 8.56	14.29
40 05 23 43-0045	EA		1" 90 Degree Elbow, Stainless Steel Type 304 <i>For Work In Restricted Working Space, Add</i>	97.91 10.20	17.01
40 05 23 43-0046			Union Tees <small>(40 05 23 43-0037)</small>		
40 05 23 43-0047	EA		1/4" Union Tee, Stainless Steel Type 304 <i>For Work In Restricted Working Space, Add</i>	46.10 7.73	12.86
40 05 23 43-0048	EA		3/8" Union Tee, Stainless Steel Type 304 <i>For Work In Restricted Working Space, Add</i>	54.91 8.56	14.29
40 05 23 43-0049	EA		1/2" Union Tee, Stainless Steel Type 304 <i>For Work In Restricted Working Space, Add</i>	72.41 9.59	15.98
40 05 23 43-0050	EA		5/8" Union Tee, Stainless Steel Type 304 <i>For Work In Restricted Working Space, Add</i>	78.62 10.89	18.13
40 05 23 43-0051	EA		3/4" Union Tee, Stainless Steel Type 304 <i>For Work In Restricted Working Space, Add</i>	97.69 11.69	19.49
40 05 23 43-0052	EA		7/8" Union Tee, Stainless Steel Type 304 <i>For Work In Restricted Working Space, Add</i>	148.28 12.95	21.57
40 05 23 43-0053	EA		1" Union Tee, Stainless Steel Type 304 <i>For Work In Restricted Working Space, Add</i>	177.63 15.46	25.80
40 05 23 43-0054			Unions <small>(40 05 23 43-0037)</small>		
40 05 23 43-0055	EA		1/4" Union, Stainless Steel Type 304 <i>For Work In Restricted Working Space, Add</i>	44.48 7.73	12.86
40 05 23 43-0056	EA		3/8" Union, Stainless Steel Type 304 <i>For Work In Restricted Working Space, Add</i>	55.82 8.56	14.29
40 05 23 43-0057	EA		1/2" Union, Stainless Steel Type 304 <i>For Work In Restricted Working Space, Add</i>	73.01 9.59	15.98
40 05 23 43-0058	EA		5/8" Union, Stainless Steel Type 304 <i>For Work In Restricted Working Space, Add</i>	88.02 10.89	18.13
40 05 23 43-0059	EA		3/4" Union, Stainless Steel Type 304 <i>For Work In Restricted Working Space, Add</i>	103.41 11.69	19.49
40 05 23 43-0060	EA		7/8" Union, Stainless Steel Type 304 <i>For Work In Restricted Working Space, Add</i>	152.84 12.95	21.57
40 05 23 43-0061	EA		1" Union, Stainless Steel Type 304 <i>For Work In Restricted Working Space, Add</i>	164.71 15.46	25.80
40 05 23 43-0062			Male Connectors <small>(40 05 23 43-0037)</small>		
40 05 23 43-0063	EA		1/4" x 1/4" Male Connection, Stainless Steel Type 304 <i>For Work In Restricted Working Space, Add</i>	23.60 5.15	8.62
40 05 23 43-0064	EA		3/8" x 3/8" Male Connection, Stainless Steel Type 304 <i>For Work In Restricted Working Space, Add</i>	28.52 5.64	9.43
40 05 23 43-0065	EA		1/2" x 1/2" Male Connection, Stainless Steel Type 304 <i>For Work In Restricted Working Space, Add</i>	35.84 6.39	10.63
40 05 23 43-0066	EA		5/8" x 5/8" Male Connection, Stainless Steel Type 304 <i>For Work In Restricted Working Space, Add</i>	40.33 7.15	11.91



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
40 05 23 43-0067 EA 3/4" x 3/4" Male Connection, Stainless Steel Type 304 <i>For Work In Restricted Working Space, Add</i>	47.62 7.73	12.86
40 05 23 43-0068 EA 7/8" x 7/8" Male Connection, Stainless Steel Type 304 <i>For Work In Restricted Working Space, Add</i>	67.94 8.56	14.29
40 05 23 43-0069 EA 1" x 1" Male Connection, Stainless Steel Type 304 <i>For Work In Restricted Working Space, Add</i>	72.66 10.20	17.01
40 05 23 43-0070 Type 304 Valves (40 05 23 43-0011)		
40 05 23 43-0071 Gate Valves (40 05 23 43-0070)		
40 05 23 43-0072 EA 1/4" Gate Valve, Stainless Steel Type 304 <i>For Work In Restricted Working Space, Add</i>	155.28 6.98	12.86
40 05 23 43-0073 EA 3/8" Gate Valve, Stainless Steel Type 304 <i>For Work In Restricted Working Space, Add</i>	262.53 7.34	15.10
40 05 23 43-0074 EA 1/2" Gate Valve, Stainless Steel Type 304 <i>For Work In Restricted Working Space, Add</i>	272.04 10.20	17.01
40 05 23 43-0075 EA 3/4" Gate Valve, Stainless Steel Type 304 <i>For Work In Restricted Working Space, Add</i>	301.49 11.69	19.49
40 05 23 43-0076 EA 1" Gate Valve, Stainless Steel Type 304 <i>For Work In Restricted Working Space, Add</i>	275.80 15.46	25.80
40 05 23 43-0077 Globe Valves (40 05 23 43-0070)		
40 05 23 43-0078 EA 1/4" Globe Valve, Stainless Steel Type 304 <i>For Work In Restricted Working Space, Add</i>	157.44 6.98	12.86
40 05 23 43-0079 EA 3/8" Globe Valve, Stainless Steel Type 304 <i>For Work In Restricted Working Space, Add</i>	103.46 7.34	15.10
40 05 23 43-0080 EA 1/2" Globe Valve, Stainless Steel Type 304 <i>For Work In Restricted Working Space, Add</i>	186.48 10.20	17.01
40 05 23 43-0081 EA 3/4" Globe Valve, Stainless Steel Type 304 <i>For Work In Restricted Working Space, Add</i>	207.52 11.69	19.49
40 05 23 43-0082 EA 1" Globe Valve, Stainless Steel Type 304 <i>For Work In Restricted Working Space, Add</i>	303.04 15.46	25.80
40 05 23 43-0083 Check Valves (40 05 23 43-0070)		
40 05 23 43-0084 EA 1/4" Check Valve, Stainless Steel Type 304 <i>For Work In Restricted Working Space, Add</i>	221.00 6.98	12.86
40 05 23 43-0085 EA 3/8" Check Valve, Stainless Steel Type 304 <i>For Work In Restricted Working Space, Add</i>	222.22 7.34	15.10
40 05 23 43-0086 EA 1/2" Check Valve, Stainless Steel Type 304 <i>For Work In Restricted Working Space, Add</i>	144.52 10.20	17.01
40 05 23 43-0087 EA 3/4" Check Valve, Stainless Steel Type 304 <i>For Work In Restricted Working Space, Add</i>	151.10 11.69	19.49
40 05 23 43-0088 EA 1" Check Valve, Stainless Steel Type 304 <i>For Work In Restricted Working Space, Add</i>	166.87 15.46	25.80
40 05 23 43-0089 Plug Valves (40 05 23 43-0070)		
40 05 23 43-0090 EA 1/2" Plug Valve, Stainless Steel Type 304 <i>For Work In Restricted Working Space, Add</i>	341.95 10.20	17.01
40 05 23 43-0091 EA 3/4" Plug Valve, Stainless Steel Type 304 <i>For Work In Restricted Working Space, Add</i>	374.30 11.69	19.49
40 05 23 43-0092 EA 1" Plug Valve, Stainless Steel Type 304 <i>For Work In Restricted Working Space, Add</i>	423.36 15.46	25.80
40 05 23 43-0093 EA 1-1/2" Plug Valve, Stainless Steel Type 304 <i>For Work In Restricted Working Space, Add</i>	588.80 17.49	29.15
40 05 23 43-0094 EA 2" Plug Valve, Stainless Steel Type 304 <i>For Work In Restricted Working Space, Add</i>	766.50 23.96	39.94
40 05 23 43-0095 Type 316 Tubing (40 05 23 43-0011)		
40 05 23 43-0096 0.035" Wall (40 05 23 43-0095)		
40 05 23 43-0097 LF 1/4" Stainless Steel Tubing, Type 316, 0.035" Wall <i>For Work In Restricted Working Space, Add</i>	5.40 1.28	2.16
40 05 23 43-0098 LF 3/8" Stainless Steel Tubing, Type 316, 0.035" Wall <i>For Work In Restricted Working Space, Add</i>	6.88 1.54	2.56
40 05 23 43-0099 LF 1/2" Stainless Steel Tubing, Type 316, 0.035" Wall <i>For Work In Restricted Working Space, Add</i>	7.74 1.80	3.03
40 05 23 43-0100 LF 5/8" Stainless Steel Tubing, Type 316, 0.035" Wall <i>For Work In Restricted Working Space, Add</i>	11.98 2.06	3.43
40 05 23 43-0101 LF 3/4" Stainless Steel Tubing, Type 316, 0.035" Wall <i>For Work In Restricted Working Space, Add</i>	13.58 2.32	3.84
40 05 23 43-0102 LF 7/8" Stainless Steel Tubing, Type 316, 0.035" Wall <i>For Work In Restricted Working Space, Add</i>	16.83 2.58	4.31
40 05 23 43-0103 LF 1" Stainless Steel Tubing, Type 316, 0.035" Wall <i>For Work In Restricted Working Space, Add</i>	18.10 3.09	5.19
40 05 23 43-0104 0.049" Wall (40 05 23 43-0095)		

40 Process Interconnections**40 05 Common Work Results For Process Interconnections****40 05 23 Stainless Steel Process Pipe and Tubing**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
40 05 23 43-0105	LF		1/4" Stainless Steel Tubing, Type 316, 0.049" Wall <i>For Work In Restricted Working Space, Add</i>	8.64 1.54	2.56
40 05 23 43-0106	LF		3/8" Stainless Steel Tubing, Type 316, 0.049" Wall <i>For Work In Restricted Working Space, Add</i>	9.68 1.80	3.03
40 05 23 43-0107	LF		1/2" Stainless Steel Tubing, Type 316, 0.049" Wall <i>For Work In Restricted Working Space, Add</i>	11.34 2.06	3.43
40 05 23 43-0108	LF		5/8" Stainless Steel Tubing, Type 316, 0.049" Wall <i>For Work In Restricted Working Space, Add</i>	14.68 2.58	4.31
40 05 23 43-0109	LF		3/4" Stainless Steel Tubing, Type 316, 0.049" Wall <i>For Work In Restricted Working Space, Add</i>	17.07 3.09	5.19
40 05 23 43-0110	LF		7/8" Stainless Steel Tubing, Type 316, 0.049" Wall <i>For Work In Restricted Working Space, Add</i>	21.39 3.60	5.99
40 05 23 43-0111	LF		1" Stainless Steel Tubing, Type 316, 0.049" Wall <i>For Work In Restricted Working Space, Add</i>	22.33 4.10	6.79
40 05 23 43-0112			0.065" Wall <small>(40 05 23 43-0095)</small>		
40 05 23 43-0113	LF		1/4" Stainless Steel Tubing, Type 316, 0.065" Wall <i>For Work In Restricted Working Space, Add</i>	10.10 1.80	3.03
40 05 23 43-0114	LF		3/8" Stainless Steel Tubing, Type 316, 0.065" Wall <i>For Work In Restricted Working Space, Add</i>	11.32 2.06	3.43
40 05 23 43-0115	LF		1/2" Stainless Steel Tubing, Type 316, 0.065" Wall <i>For Work In Restricted Working Space, Add</i>	14.20 2.58	4.31
40 05 23 43-0116	LF		5/8" Stainless Steel Tubing, Type 316, 0.065" Wall <i>For Work In Restricted Working Space, Add</i>	16.94 3.09	5.19
40 05 23 43-0117	LF		3/4" Stainless Steel Tubing, Type 316, 0.065" Wall <i>For Work In Restricted Working Space, Add</i>	20.36 3.60	5.99
40 05 23 43-0118	LF		7/8" Stainless Steel Tubing, Type 316, 0.065" Wall <i>For Work In Restricted Working Space, Add</i>	22.58 4.10	6.79
40 05 23 43-0119	LF		1" Stainless Steel Tubing, Type 316, 0.065" Wall <i>For Work In Restricted Working Space, Add</i>	26.11 4.61	7.67
40 05 23 43-0120			Type 316 Tube Fittings <small>(40 05 23 43-0011)</small>		
40 05 23 43-0121			90 Degree Elbows <small>(40 05 23 43-0120)</small>		
40 05 23 43-0122	EA		1/4" 90 Degree Elbow, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	38.22 5.15	8.62
40 05 23 43-0123	EA		3/8" 90 Degree Elbow, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	45.34 5.64	9.43
40 05 23 43-0124	EA		1/2" 90 Degree Elbow, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	68.89 6.39	10.63
40 05 23 43-0125	EA		5/8" 90 Degree Elbow, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	73.49 7.15	11.91
40 05 23 43-0126	EA		3/4" 90 Degree Elbow, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	82.29 7.73	12.86
40 05 23 43-0127	EA		7/8" 90 Degree Elbow, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	112.96 8.56	14.29
40 05 23 43-0128	EA		1" 90 Degree Elbow, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	144.05 10.20	17.01
40 05 23 43-0129			Union Tees <small>(40 05 23 43-0120)</small>		
40 05 23 43-0130	EA		1/4" Union Tee, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	60.78 7.73	12.86
40 05 23 43-0131	EA		3/8" Union Tee, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	73.95 8.56	14.29
40 05 23 43-0132	EA		1/2" Union Tee, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	101.63 9.59	15.98
40 05 23 43-0133	EA		5/8" Union Tee, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	109.18 10.89	18.13
40 05 23 43-0134	EA		3/4" Union Tee, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	140.10 11.69	19.49
40 05 23 43-0135	EA		7/8" Union Tee, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	224.16 12.95	21.57
40 05 23 43-0136	EA		1" Union Tee, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	268.68 15.46	25.80
40 05 23 43-0137			Unions <small>(40 05 23 43-0120)</small>		
40 05 23 43-0138	EA		1/4" Union, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	42.24 7.73	12.86
40 05 23 43-0139	EA		3/8" Union, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	52.56 8.56	14.29
40 05 23 43-0140	EA		1/2" Union, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	68.10 9.59	15.98
40 05 23 43-0141	EA		5/8" Union, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	81.83 10.89	18.13
40 05 23 43-0142	EA		3/4" Union, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	95.71 11.69	19.49
40 05 23 43-0143	EA		7/8" Union, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	139.73 12.95	21.57



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
40 05 23 43-0144 EA 1" Union, Stainless Steel Type 316..... <i>For Work In Restricted Working Space, Add</i>	151.18 15.46	25.80
40 05 23 43-0145 Male Connectors (40 05 23 43-0120)		
40 05 23 43-0146 EA 1/4" x 1/4" Male Connector, Stainless Steel Type 316..... <i>For Work In Restricted Working Space, Add</i>	28.15 5.15	8.62
40 05 23 43-0147 EA 3/8" x 3/8" Male Connector, Stainless Steel Type 316..... <i>For Work In Restricted Working Space, Add</i>	35.39 5.64	9.43
40 05 23 43-0148 EA 1/2" x 1/2" Male Connector, Stainless Steel Type 316..... <i>For Work In Restricted Working Space, Add</i>	46.13 6.39	10.63
40 05 23 43-0149 EA 5/8" x 5/8" Male Connector, Stainless Steel Type 316..... <i>For Work In Restricted Working Space, Add</i>	51.98 7.15	11.91
40 05 23 43-0150 EA 3/4" x 3/4" Male Connector, Stainless Steel Type 316..... <i>For Work In Restricted Working Space, Add</i>	63.07 7.73	12.86
40 05 23 43-0151 EA 7/8" x 7/8" Male Connector, Stainless Steel Type 316..... <i>For Work In Restricted Working Space, Add</i>	95.80 8.56	14.29
40 05 23 43-0152 EA 1" x 1" Male Connector, Stainless Steel Type 316..... <i>For Work In Restricted Working Space, Add</i>	100.00 10.20	17.01
40 05 23 43-0153 Type 316 Valves (40 05 23 43-0011)		
40 05 23 43-0154 Gate Valves (40 05 23 43-0153)		
40 05 23 43-0155 EA 1/4" Gate Valve, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	197.90 6.98	12.86
40 05 23 43-0156 EA 3/8" Gate Valve, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	339.39 7.34	15.10
40 05 23 43-0157 EA 1/2" Gate Valve, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	348.90 10.20	17.01
40 05 23 43-0158 EA 3/4" Gate Valve, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	386.25 11.69	19.49
40 05 23 43-0159 EA 1" Gate Valve, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	348.21 15.46	25.80
40 05 23 43-0160 EA 1-1/4" Gate Valve, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	479.92 16.06	26.75
40 05 23 43-0161 EA 1-1/2" Gate Valve, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	773.52 17.49	29.15
40 05 23 43-0162 EA 2" Gate Valve, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	919.07 23.96	39.94
40 05 23 43-0163 EA 2-1/2" Gate Valve, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	1,352.36 76.71	127.88
40 05 23 43-0164 Globe Valves (40 05 23 43-0153)		
40 05 23 43-0165 EA 1/4" Globe Valve, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	200.76 6.98	12.86
40 05 23 43-0166 EA 3/8" Globe Valve, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	128.96 7.34	15.10
40 05 23 43-0167 EA 1/2" Globe Valve, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	235.71 10.20	17.01
40 05 23 43-0168 EA 3/4" Globe Valve, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	261.94 11.69	19.49
40 05 23 43-0169 EA 1" Globe Valve, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	384.24 15.46	25.80
40 05 23 43-0170 EA 1-1/4" Globe Valve, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	480.90 15.94	26.60
40 05 23 43-0171 EA 1-1/2" Globe Valve, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	802.13 17.49	29.15
40 05 23 43-0172 EA 2" Globe Valve, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	947.68 23.96	39.94
40 05 23 43-0173 EA 2-1/2" Globe Valve, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	1,171.17 76.71	127.88
40 05 23 43-0174 Check Valves (40 05 23 43-0153)		
40 05 23 43-0175 EA 1/4" Check Valve, Stainless Steel Type 316..... <i>For Work In Restricted Working Space, Add</i>	284.85 6.98	12.86
40 05 23 43-0176 EA 3/8" Check Valve, Stainless Steel Type 316..... <i>For Work In Restricted Working Space, Add</i>	286.07 7.34	15.10
40 05 23 43-0177 EA 1/2" Check Valve, Stainless Steel Type 316..... <i>For Work In Restricted Working Space, Add</i>	180.21 10.20	17.01
40 05 23 43-0178 EA 3/4" Check Valve, Stainless Steel Type 316..... <i>For Work In Restricted Working Space, Add</i>	187.30 11.69	19.49
40 05 23 43-0179 EA 1" Check Valve, Stainless Steel Type 316..... <i>For Work In Restricted Working Space, Add</i>	204.11 15.46	25.80
40 05 23 43-0180 EA 1-1/4" Check Valve, Stainless Steel Type 316..... <i>For Work In Restricted Working Space, Add</i>	284.11 16.06	26.75
40 05 23 43-0181 EA 1-1/2" Check Valve, Stainless Steel Type 316..... <i>For Work In Restricted Working Space, Add</i>	640.01 17.49	29.15
40 05 23 43-0182 EA 2" Check Valve, Stainless Steel Type 316..... <i>For Work In Restricted Working Space, Add</i>	776.03 23.96	39.94

40 Process Interconnections**40 05 Common Work Results For Process Interconnections****40 05 23 Stainless Steel Process Pipe and Tubing**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
40 05 23 43-0183 EA 2-1/2" Check Valve, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	1,527.20 76.71	127.88
40 05 23 43-0184 Diaphragm Valves, Ethylene Propylene Diene Monomer (EPDM) Lined (40 05 23 43-0153)		
40 05 23 43-0185 EA 1/2" Diaphragm Valve, Stainless Steel Type 316, Ethylene Propylene Diene Monomer (EPDM) Lined <i>For Work In Restricted Working Space, Add</i>	305.09 10.20	17.01
40 05 23 43-0186 EA 3/4" Diaphragm Valve, Stainless Steel Type 316, Ethylene Propylene Diene Monomer (EPDM) Lined <i>For Work In Restricted Working Space, Add</i>	356.48 11.69	19.49
40 05 23 43-0187 EA 1" Diaphragm Valve, Stainless Steel Type 316, Ethylene Propylene Diene Monomer (EPDM) Lined <i>For Work In Restricted Working Space, Add</i>	454.46 15.46	25.80
40 05 23 43-0188 EA 1-1/2" Diaphragm Valve, Stainless Steel Type 316, Ethylene Propylene Diene Monomer (EPDM) Lined <i>For Work In Restricted Working Space, Add</i>	726.76 17.49	29.15
40 05 23 43-0189 EA 2" Diaphragm Valve, Stainless Steel Type 316, Ethylene Propylene Diene Monomer (EPDM) Lined <i>For Work In Restricted Working Space, Add</i>	1,015.72 23.96	39.94
40 05 23 43-0190 Diaphragm Valves, Teflon Lined (40 05 23 43-0153)		
40 05 23 43-0191 EA 1/2" Diaphragm Valve, Stainless Steel Type 316, Teflon Lined <i>For Work In Restricted Working Space, Add</i>	405.36 10.20	17.01
40 05 23 43-0192 EA 3/4" Diaphragm Valve, Stainless Steel Type 316, Teflon Lined <i>For Work In Restricted Working Space, Add</i>	466.03 11.69	19.49
40 05 23 43-0193 EA 1" Diaphragm Valve, Stainless Steel Type 316, Teflon Lined <i>For Work In Restricted Working Space, Add</i>	564.02 15.46	25.80
40 05 23 43-0194 EA 1-1/2" Diaphragm Valve, Stainless Steel Type 316, Teflon Lined <i>For Work In Restricted Working Space, Add</i>	880.87 17.49	29.15
40 05 23 43-0195 EA 2" Diaphragm Valve, Stainless Steel Type 316, Teflon Lined <i>For Work In Restricted Working Space, Add</i>	1,199.55 23.96	39.94
40 05 23 43-0196 Strainers (40 05 23 43-0153)		
40 05 23 43-0197 EA 1/2" Strainer, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	406.32 10.20	17.01
40 05 23 43-0198 EA 3/4" Strainer, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	486.44 11.74	19.57
40 05 23 43-0199 EA 1" Strainer, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	636.39 15.58	25.96
40 05 23 43-0200 EA 1-1/4" Strainer, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	791.44 16.06	26.75
40 05 23 43-0201 EA 1-1/2" Strainer, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	994.39 17.49	29.15
40 05 23 43-0202 EA 2" Strainer, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	1,434.52 23.96	39.94
40 05 23 43-0203 EA 2-1/2" Strainer, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	1,971.82 31.87	53.12
40 05 23 43-0204 EA 3" Strainer, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	2,870.95 47.93	79.88
40 05 23 43-0205 EA 4" Strainer, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	3,669.09 76.68	127.80
40 05 23 43-0206 Plug Valves (40 05 23 43-0153)		
40 05 23 43-0207 EA 1/2" Plug Valve, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	433.24 10.20	17.01
40 05 23 43-0208 EA 3/4" Plug Valve, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	473.69 11.69	19.49
40 05 23 43-0209 EA 1" Plug Valve, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	533.58 15.46	25.80
40 05 23 43-0210 EA 1-1/2" Plug Valve, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	746.05 17.49	29.15
40 05 23 43-0211 EA 2" Plug Valve, Stainless Steel Type 316 <i>For Work In Restricted Working Space, Add</i>	970.03 23.96	39.94
40 05 23 43-0212 Stainless Steel Pipe And Fittings (40 05 23 43)		
40 05 23 43-0213 Type 304, Schedule 40 Pipe And 150 LB Threaded Fittings (40 05 23 43-0212)		
40 05 23 43-0214 Pipe (40 05 23 43-0213)		
40 05 23 43-0215 LF 1/2" Pipe, Stainless Steel, Schedule 40 Type 304 For 150 LB Threaded Fitting <i>For Work In Restricted Working Space, Add</i>	11.57 2.06	3.43
40 05 23 43-0216 LF 3/4" Pipe, Stainless Steel, Schedule 40 Type 304 For 150 LB Threaded Fitting <i>For Work In Restricted Working Space, Add</i>	14.25 2.58	4.31
40 05 23 43-0217 LF 1" Pipe, Stainless Steel, Schedule 40 Type 304 For 150 LB Threaded Fitting <i>For Work In Restricted Working Space, Add</i>	17.50 3.09	5.19
40 05 23 43-0218 LF 1-1/4" Pipe, Stainless Steel, Schedule 40 Type 304 For 150 LB Threaded Fitting <i>For Work In Restricted Working Space, Add</i>	21.00 3.60	5.99
40 05 23 43-0219 LF 1-1/2" Pipe, Stainless Steel, Schedule 40 Type 304 For 150 LB Threaded Fitting <i>For Work In Restricted Working Space, Add</i>	24.30 4.10	6.79
40 05 23 43-0220 LF 2" Pipe, Stainless Steel, Schedule 40 Type 304 For 150 LB Threaded Fitting <i>For Work In Restricted Working Space, Add</i>	31.01 5.15	8.62
40 05 23 43-0221 LF 2-1/2" Pipe, Stainless Steel, Schedule 40 Type 304 For 150 LB Threaded Fitting <i>For Work In Restricted Working Space, Add</i>	41.84 6.14	10.22



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
40 05 23 43-0222 LF 3" Pipe, Stainless Steel, Schedule 40 Type 304 For 150 LB Threaded Fitting <i>For Work In Restricted Working Space, Add</i>	52.60 7.73	12.86
40 05 23 43-0223 LF 4" Pipe, Stainless Steel, Schedule 40 Type 304 For 150 LB Threaded Fitting <i>For Work In Restricted Working Space, Add</i>	71.14 10.20	17.01
40 05 23 43-0224 90 Degree Elbows <small>(40 05 23 43-0213)</small>		
40 05 23 43-0225 EA 1/2" 90 Degree Elbow, Stainless Steel, Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	32.32 7.73	12.86
40 05 23 43-0226 EA 3/4" 90 Degree Elbow, Stainless Steel, Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	41.43 10.20	17.01
40 05 23 43-0227 EA 1" 90 Degree Elbow, Stainless Steel, Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	53.06 12.95	21.57
40 05 23 43-0228 EA 1-1/4" 90 Degree Elbow, Stainless Steel, Schedule 40 Type 304 <i>For Work In Restricted Working Space, Add</i>	74.01 17.75	29.55
40 05 23 43-0229 EA 1-1/2" 90 Degree Elbow, Stainless Steel, Schedule 40 Type 304 <i>For Work In Restricted Working Space, Add</i>	86.32 20.84	34.74
40 05 23 43-0230 EA 2" 90 Degree Elbow, Stainless Steel, Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	108.44 25.22	42.02
40 05 23 43-0231 EA 2-1/2" 90 Degree Elbow, Stainless Steel, Schedule 40 Type 304 <i>For Work In Restricted Working Space, Add</i>	200.39 39.94	66.53
40 05 23 43-0232 EA 3" 90 Degree Elbow, Stainless Steel, Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	256.72 51.53	85.86
40 05 23 43-0233 EA 4" 90 Degree Elbow, Stainless Steel, Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	379.52 63.90	106.47
40 05 23 43-0234 45 Degree Elbows <small>(40 05 23 43-0213)</small>		
40 05 23 43-0235 EA 1/2" 45 Degree Elbow, Stainless Steel, Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	34.74 7.73	12.86
40 05 23 43-0236 EA 3/4" 45 Degree Elbow, Stainless Steel, Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	43.71 10.20	17.01
40 05 23 43-0237 EA 1" 45 Degree Elbow, Stainless Steel, Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	53.88 12.95	21.57
40 05 23 43-0238 EA 1-1/4" 45 Degree Elbow, Stainless Steel, Schedule 40 Type 304 <i>For Work In Restricted Working Space, Add</i>	73.03 17.75	29.55
40 05 23 43-0239 EA 1-1/2" 45 Degree Elbow, Stainless Steel, Schedule 40 Type 304 <i>For Work In Restricted Working Space, Add</i>	87.37 20.84	34.74
40 05 23 43-0240 EA 2" 45 Degree Elbow, Stainless Steel, Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	109.41 25.22	42.02
40 05 23 43-0241 EA 2-1/2" 45 Degree Elbow, Stainless Steel, Schedule 40 Type 304 <i>For Work In Restricted Working Space, Add</i>	220.76 39.94	66.53
40 05 23 43-0242 EA 3" 45 Degree Elbow, Stainless Steel, Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	295.63 51.53	85.86
40 05 23 43-0243 EA 4" 45 Degree Elbow, Stainless Steel, Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	436.97 63.90	106.47
40 05 23 43-0244 Tees <small>(40 05 23 43-0213)</small>		
40 05 23 43-0245 EA 1/2" Tee, Stainless Steel, Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	48.79 11.69	19.49
40 05 23 43-0246 EA 3/4" Tee, Stainless Steel, Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	62.02 15.46	25.80
40 05 23 43-0247 EA 1" Tee, Stainless Steel, Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	76.30 19.17	31.95
40 05 23 43-0248 EA 1-1/4" Tee, Stainless Steel, Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	109.02 26.63	44.41
40 05 23 43-0249 EA 1-1/2" Tee, Stainless Steel, Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	125.32 29.96	49.92
40 05 23 43-0250 EA 2" Tee, Stainless Steel, Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	163.89 39.94	66.53
40 05 23 43-0251 EA 2-1/2" Tee, Stainless Steel, Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	294.28 57.74	96.25
40 05 23 43-0252 EA 3" Tee, Stainless Steel, Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	412.58 77.30	128.85
40 05 23 43-0253 EA 4" Tee, Stainless Steel, Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	569.15 95.85	159.75
40 05 23 43-0254 Reducers <small>(40 05 23 43-0213)</small>		
40 05 23 43-0255 EA 3/4" x 1/2" Reducer, Stainless Steel, Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	40.16 10.20	17.01
40 05 23 43-0256 EA 1" x 3/4" Reducer, Stainless Steel, Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	52.29 12.95	21.57
40 05 23 43-0257 EA 1-1/4" x 1" Reducer, Stainless Steel, Schedule 40 Type 304 <i>For Work In Restricted Working Space, Add</i>	77.84 17.75	29.55
40 05 23 43-0258 EA 1-1/2" x 1-1/4" Reducer, Stainless Steel, Schedule 40 Type 304 <i>For Work In Restricted Working Space, Add</i>	90.05 20.84	34.74
40 05 23 43-0259 EA 2" x 1-1/2" Reducer, Stainless Steel, Schedule 40 Type 304 <i>For Work In Restricted Working Space, Add</i>	116.19 25.22	42.02
40 05 23 43-0260 EA 2-1/2" x 2" Reducer, Stainless Steel, Schedule 40 Type 304 <i>For Work In Restricted Working Space, Add</i>	200.59 39.94	66.53

40 Process Interconnections**40 05 Common Work Results For Process Interconnections****40 05 23 Stainless Steel Process Pipe and Tubing**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
40 05 23 43-0261	EA		3" x 2-1/2" Reducer, Stainless Steel, Schedule 40 Type 304	243.95	85.86
			<i>For Work In Restricted Working Space, Add</i>	51.53	
40 05 23 43-0262	EA		4" x 3" Reducer, Stainless Steel, Schedule 40 Type 304.....	353.87	106.47
			<i>For Work In Restricted Working Space, Add</i>	63.90	
40 05 23 43-0263	EA		4" x 2" Reducer, Stainless Steel, Schedule 40 Type 304.....	298.79	97.85
			<i>For Work In Restricted Working Space, Add</i>	58.71	
40 05 23 43-0264			Unions <small>(40 05 23 43-0213)</small>		
40 05 23 43-0265	EA		1/2" Union, Stainless Steel, Schedule 40 Type 304	52.62	19.49
			<i>For Work In Restricted Working Space, Add</i>	11.69	
40 05 23 43-0266	EA		3/4" Union, Stainless Steel, Schedule 40 Type 304.....	70.25	25.80
			<i>For Work In Restricted Working Space, Add</i>	15.46	
40 05 23 43-0267	EA		1" Union, Stainless Steel, Schedule 40 Type 304.....	91.08	31.95
			<i>For Work In Restricted Working Space, Add</i>	19.17	
40 05 23 43-0268	EA		1-1/4" Union, Stainless Steel, Schedule 40 Type 304.....	138.70	44.41
			<i>For Work In Restricted Working Space, Add</i>	26.63	
40 05 23 43-0269	EA		1-1/2" Union, Stainless Steel, Schedule 40 Type 304.....	158.56	49.92
			<i>For Work In Restricted Working Space, Add</i>	29.96	
40 05 23 43-0270	EA		2" Union, Stainless Steel, Schedule 40 Type 304.....	207.25	66.53
			<i>For Work In Restricted Working Space, Add</i>	39.94	
40 05 23 43-0271			Flanges <small>(40 05 23 43-0213)</small>		
40 05 23 43-0272	EA		2-1/2" Flange, Stainless Steel, Schedule 40 Type 304.....	192.92	66.53
			<i>For Work In Restricted Working Space, Add</i>	39.94	
40 05 23 43-0273	EA		3" Flange, Stainless Steel, Schedule 40 Type 304.....	236.97	85.86
			<i>For Work In Restricted Working Space, Add</i>	51.53	
40 05 23 43-0274	EA		4" Flange, Stainless Steel, Schedule 40 Type 304.....	306.68	106.47
			<i>For Work In Restricted Working Space, Add</i>	63.90	
40 05 23 43-0275			Caps <small>(40 05 23 43-0213)</small>		
40 05 23 43-0276	EA		1/2" Caps, Stainless Steel, Schedule 40 Type 304.....	15.39	6.47
			<i>For Work In Restricted Working Space, Add</i>	3.86	
40 05 23 43-0277	EA		3/4" Caps, Stainless Steel, Schedule 40 Type 304.....	20.83	8.62
			<i>For Work In Restricted Working Space, Add</i>	5.15	
40 05 23 43-0278	EA		1" Caps, Stainless Steel, Schedule 40 Type 304.....	26.68	10.63
			<i>For Work In Restricted Working Space, Add</i>	6.39	
40 05 23 43-0279	EA		1-1/4" Caps, Stainless Steel, Schedule 40 Type 304.....	44.23	15.10
			<i>For Work In Restricted Working Space, Add</i>	9.04	
40 05 23 43-0280	EA		1-1/2" Caps, Stainless Steel, Schedule 40 Type 304.....	50.25	17.01
			<i>For Work In Restricted Working Space, Add</i>	10.20	
40 05 23 43-0281	EA		2" Caps, Stainless Steel, Schedule 40 Type 304.....	63.80	21.57
			<i>For Work In Restricted Working Space, Add</i>	12.95	
40 05 23 43-0282	EA		2-1/2" Caps, Stainless Steel, Schedule 40 Type 304.....	98.86	31.95
			<i>For Work In Restricted Working Space, Add</i>	19.17	
40 05 23 43-0283	EA		3" Caps, Stainless Steel, Schedule 40 Type 304.....	132.41	42.02
			<i>For Work In Restricted Working Space, Add</i>	25.22	
40 05 23 43-0284	EA		4" Caps, Stainless Steel, Schedule 40 Type 304.....	195.84	53.28
			<i>For Work In Restricted Working Space, Add</i>	31.95	
40 05 23 43-0285			Additional Fittings <small>(40 05 23 43-0213)</small>		
40 05 23 43-0286	EA		1/2" Thread-O-Let, Stainless Steel, Schedule 40 Type 304.....	63.50	26.75
			<i>For Work In Restricted Working Space, Add</i>	16.06	
40 05 23 43-0287	EA		3/4" Thread-O-Let, Stainless Steel, Schedule 40 Type 304.....	74.44	31.95
			<i>For Work In Restricted Working Space, Add</i>	19.17	
40 05 23 43-0288	EA		1" Thread-O-Let, Stainless Steel, Schedule 40 Type 304.....	109.35	36.34
			<i>For Work In Restricted Working Space, Add</i>	21.81	
40 05 23 43-0289	EA		1-1/4" Thread-O-Let, Stainless Steel, Schedule 40 Type 304.....	130.49	39.94
			<i>For Work In Restricted Working Space, Add</i>	23.96	
40 05 23 43-0290	EA		1-1/2" Thread-O-Let, Stainless Steel, Schedule 40 Type 304.....	130.49	39.94
			<i>For Work In Restricted Working Space, Add</i>	23.96	
40 05 23 43-0291	EA		2" Thread-O-Let, Stainless Steel, Schedule 40 Type 304.....	165.29	43.93
			<i>For Work In Restricted Working Space, Add</i>	26.36	
40 05 23 43-0292			Type 304 Schedule 5 Pipe And Welded Butt Fittings <small>(40 05 23 43-0212)</small>		
40 05 23 43-0293			Pipe <small>(40 05 23 43-0292)</small>		
40 05 23 43-0294	LF		1/2" Pipe, Stainless Steel Schedule 5 Type 304 For Butt Weld Fitting.....	12.68	3.35
			<i>For Work In Restricted Working Space, Add</i>	2.02	
40 05 23 43-0295	LF		3/4" Pipe, Stainless Steel Schedule 5 Type 304 For Butt Weld Fitting.....	15.06	4.10
			<i>For Work In Restricted Working Space, Add</i>	2.46	
40 05 23 43-0296	LF		1" Pipe, Stainless Steel Schedule 5 Type 304 For Butt Weld Fitting	17.91	4.85
			<i>For Work In Restricted Working Space, Add</i>	2.89	
40 05 23 43-0297	LF		1-1/4" Pipe, Stainless Steel Schedule 5 Type 304 For Butt Weld Fitting	21.49	6.04
			<i>For Work In Restricted Working Space, Add</i>	3.61	
40 05 23 43-0298	LF		1-1/2" Pipe, Stainless Steel Schedule 5 Type 304 For Butt Weld Fitting	24.48	6.79
			<i>For Work In Restricted Working Space, Add</i>	4.07	
40 05 23 43-0299	LF		2" Pipe, Stainless Steel Schedule 5 Type 304 For Butt Weld Fitting	30.48	8.42
			<i>For Work In Restricted Working Space, Add</i>	5.04	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
40 05 23 43-0300 LF 2-1/2" Pipe, Stainless Steel Schedule 5 Type 304 For Butt Weld Fitting <i>For Work In Restricted Working Space, Add</i>	38.24 5.76	9.62
40 05 23 43-0301 LF 3" Pipe, Stainless Steel Schedule 5 Type 304 For Butt Weld Fitting <i>For Work In Restricted Working Space, Add</i>	44.57 6.49	10.82
40 05 23 43-0302 LF 4" Pipe, Stainless Steel Schedule 5 Type 304 For Butt Weld Fitting <i>For Work In Restricted Working Space, Add</i>	54.92 7.68	12.83
40 05 23 43-0303 LF 6" Pipe, Stainless Steel Schedule 5 Type 304 For Butt Weld Fitting <i>For Work In Restricted Working Space, Add</i>	87.98 10.08	16.86
40 05 23 43-0304 LF 8" Pipe, Stainless Steel Schedule 5 Type 304 For Welded Butt Fitting <i>For Work In Restricted Working Space, Add</i>	148.99 19.72	30.68
40 05 23 43-0305 LF 10" Pipe, Stainless Steel Schedule 5 Type 304 For Welded Butt Fitting <i>For Work In Restricted Working Space, Add</i>	189.56 21.69	33.74
40 05 23 43-0306 LF 12" Pipe, Stainless Steel Schedule 5 Type 304 For Welded Butt Fitting <i>For Work In Restricted Working Space, Add</i>	216.47 24.10	37.51
40 05 23 43-0307 90 Degree Elbows <small>(40 05 23 43-0292)</small>		
40 05 23 43-0308 EA 1/2" 90 Degree Elbow, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	98.57 25.51	42.52
40 05 23 43-0309 EA 3/4" 90 Degree Elbow, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	104.50 27.08	45.13
40 05 23 43-0310 EA 1" 90 Degree Elbow, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	114.68 29.76	49.60
40 05 23 43-0311 EA 1-1/4" 90 Degree Elbow, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	132.95 32.45	54.08
40 05 23 43-0312 EA 1-1/2" 90 Degree Elbow, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	138.72 35.77	59.67
40 05 23 43-0313 EA 2" 90 Degree Elbow, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	158.94 39.85	66.39
40 05 23 43-0314 EA 2-1/2" 90 Degree Elbow, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	207.01 50.95	85.04
40 05 23 43-0315 EA 3" 90 Degree Elbow, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	245.73 59.64	99.58
40 05 23 43-0316 EA 4" 90 Degree Elbow, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	324.91 71.45	119.35
40 05 23 43-0317 EA 6" 90 Degree Elbow, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	545.76 89.37	149.18
40 05 23 43-0318 EA 8" 90 Degree Elbow, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	937.73 154.91	240.97
40 05 23 43-0319 EA 10" 90 Degree Elbow, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	1,556.01 206.54	321.29
40 05 23 43-0320 EA 12" 90 Degree Elbow, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	2,404.83 309.82	481.93
40 05 23 43-0321 45 Degree Elbows <small>(40 05 23 43-0292)</small>		
40 05 23 43-0322 EA 1/2" 45 Degree Elbow, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	104.51 25.51	42.52
40 05 23 43-0323 EA 3/4" 45 Degree Elbow, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	109.73 27.08	45.13
40 05 23 43-0324 EA 1" 45 Degree Elbow, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	121.14 29.76	49.60
40 05 23 43-0325 EA 1-1/4" 45 Degree Elbow, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	145.28 32.43	54.08
40 05 23 43-0326 EA 1-1/2" 45 Degree Elbow, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	139.31 35.82	59.67
40 05 23 43-0327 EA 2" 45 Degree Elbow, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	155.75 39.85	66.39
40 05 23 43-0328 EA 2-1/2" 45 Degree Elbow, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	208.05 51.00	85.04
40 05 23 43-0329 EA 3" 45 Degree Elbow, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	238.18 59.77	99.58
40 05 23 43-0330 EA 4" 45 Degree Elbow, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	307.51 71.54	119.35
40 05 23 43-0331 EA 6" 45 Degree Elbow, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	447.08 89.51	149.18
40 05 23 43-0332 EA 8" 45 Degree Elbow, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	776.62 154.91	240.97
40 05 23 43-0333 EA 10" 45 Degree Elbow, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	1,272.73 206.54	321.29
40 05 23 43-0334 EA 12" 45 Degree Elbow, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	1,962.21 309.82	481.93
40 05 23 43-0335 Tees <small>(40 05 23 43-0292)</small>		
40 05 23 43-0336 EA 1/2" Tees, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	162.95 32.42	54.08
40 05 23 43-0337 EA 3/4" Tees, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	187.55 39.80	66.39
40 05 23 43-0338 EA 1" Tees, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	201.30 44.72	74.59
40 05 23 43-0339 EA 1-1/4" Tees, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	259.40 51.00	85.04

40 Process Interconnections**40 05 Common Work Results For Process Interconnections****40 05 23 Stainless Steel Process Pipe and Tubing**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
40 05 23 43-0340 EA 1-1/2" Tees, Stainless Steel Schedule 5 Type 304.....	234.70	91.38
<i>For Work In Restricted Working Space, Add</i>	54.74	
40 05 23 43-0341 EA 2" Tees, Stainless Steel Schedule 5 Type 304.....	253.90	99.58
<i>For Work In Restricted Working Space, Add</i>	59.71	
40 05 23 43-0342 EA 2-1/2" Tees, Stainless Steel Schedule 5 Type 304.....	394.26	119.35
<i>For Work In Restricted Working Space, Add</i>	71.54	
40 05 23 43-0343 EA 3" Tees, Stainless Steel Schedule 5 Type 304.....	400.64	149.18
<i>For Work In Restricted Working Space, Add</i>	89.65	
40 05 23 43-0344 EA 4" Tees, Stainless Steel Schedule 5 Type 304.....	478.80	167.83
<i>For Work In Restricted Working Space, Add</i>	100.62	
40 05 23 43-0345 EA 6" Tees, Stainless Steel Schedule 5 Type 304.....	880.96	223.77
<i>For Work In Restricted Working Space, Add</i>	134.16	
40 05 23 43-0346 EA 8" Tee, Stainless Steel Schedule 5 Type 304.....	1,679.94	321.29
<i>For Work In Restricted Working Space, Add</i>	206.54	
40 05 23 43-0347 EA 10" Tee, Stainless Steel Schedule 5 Type 304.....	2,590.73	481.93
<i>For Work In Restricted Working Space, Add</i>	309.82	
40 05 23 43-0348 EA 12" Tee, Stainless Steel Schedule 5 Type 304.....	3,282.67	602.42
<i>For Work In Restricted Working Space, Add</i>	387.27	
40 05 23 43-0349 Reducers (40 05 23 43-0292)		
40 05 23 43-0350 EA 3/4" Reducer, Stainless Steel Schedule 5 Type 304.....	108.46	41.03
<i>For Work In Restricted Working Space, Add</i>	24.64	
40 05 23 43-0351 EA 1" Reducer, Stainless Steel Schedule 5 Type 304.....	119.91	44.76
<i>For Work In Restricted Working Space, Add</i>	26.85	
40 05 23 43-0352 EA 1-1/4" Reducer, Stainless Steel Schedule 5 Type 304.....	146.68	49.60
<i>For Work In Restricted Working Space, Add</i>	29.76	
40 05 23 43-0353 EA 1-1/2" Reducer, Stainless Steel Schedule 5 Type 304.....	128.44	54.08
<i>For Work In Restricted Working Space, Add</i>	32.43	
40 05 23 43-0354 EA 2" Reducer, Stainless Steel Schedule 5 Type 304.....	141.42	59.67
<i>For Work In Restricted Working Space, Add</i>	35.82	
40 05 23 43-0355 EA 2-1/2" Reducer, Stainless Steel Schedule 5 Type 304.....	182.57	74.59
<i>For Work In Restricted Working Space, Add</i>	44.75	
40 05 23 43-0356 EA 3" Reducer, Stainless Steel Schedule 5 Type 304.....	202.88	85.04
<i>For Work In Restricted Working Space, Add</i>	50.95	
40 05 23 43-0357 EA 4" Reducer, Stainless Steel Schedule 5 Type 304.....	236.30	99.58
<i>For Work In Restricted Working Space, Add</i>	59.71	
40 05 23 43-0358 EA 6" Reducer, Stainless Steel Schedule 5 Type 304.....	304.21	126.80
<i>For Work In Restricted Working Space, Add</i>	76.01	
40 05 23 43-0359 EA 8" Reducer, Stainless Steel Schedule 5 Type 304.....	646.11	192.77
<i>For Work In Restricted Working Space, Add</i>	123.92	
40 05 23 43-0360 EA 10" Reducer, Stainless Steel Schedule 5 Type 304.....	840.47	240.97
<i>For Work In Restricted Working Space, Add</i>	154.91	
40 05 23 43-0361 EA 12" Reducer, Stainless Steel Schedule 5 Type 304.....	1,117.59	321.29
<i>For Work In Restricted Working Space, Add</i>	206.54	
40 05 23 43-0362 Weld Neck Flanges (40 05 23 43-0292)		
40 05 23 43-0363 EA 1/2" Flanges, Stainless Steel Schedule 5 Type 304.....	61.13	17.16
<i>For Work In Restricted Working Space, Add</i>	10.30	
40 05 23 43-0364 EA 3/4" Flanges, Stainless Steel Schedule 5 Type 304.....	64.12	18.65
<i>For Work In Restricted Working Space, Add</i>	11.19	
40 05 23 43-0365 EA 1" Flanges, Stainless Steel Schedule 5 Type 304.....	76.80	24.99
<i>For Work In Restricted Working Space, Add</i>	15.00	
40 05 23 43-0366 EA 1-1/4" Flanges, Stainless Steel Schedule 5 Type 304.....	85.27	26.11
<i>For Work In Restricted Working Space, Add</i>	15.66	
40 05 23 43-0367 EA 1-1/2" Flanges, Stainless Steel Schedule 5 Type 304.....	98.99	29.83
<i>For Work In Restricted Working Space, Add</i>	17.90	
40 05 23 43-0368 EA 2" Flanges, Stainless Steel Schedule 5 Type 304.....	118.02	33.56
<i>For Work In Restricted Working Space, Add</i>	20.12	
40 05 23 43-0369 EA 2-1/2" Flanges, Stainless Steel Schedule 5 Type 304.....	159.93	42.89
<i>For Work In Restricted Working Space, Add</i>	25.73	
40 05 23 43-0370 EA 3" Flanges, Stainless Steel Schedule 5 Type 304.....	176.89	49.60
<i>For Work In Restricted Working Space, Add</i>	29.74	
40 05 23 43-0371 EA 4" Flanges, Stainless Steel Schedule 5 Type 304.....	242.39	67.13
<i>For Work In Restricted Working Space, Add</i>	40.28	
40 05 23 43-0372 EA 6" Flanges, Stainless Steel Schedule 5 Type 304.....	367.00	99.58
<i>For Work In Restricted Working Space, Add</i>	59.71	
40 05 23 43-0373 EA 8" Flange, Stainless Steel Schedule 5 Type 304.....	679.39	120.49
<i>For Work In Restricted Working Space, Add</i>	77.45	
40 05 23 43-0374 EA 10" Flange, Stainless Steel Schedule 5 Type 304.....	1,030.70	140.56
<i>For Work In Restricted Working Space, Add</i>	90.36	
40 05 23 43-0375 EA 12" Flange, Stainless Steel Schedule 5 Type 304.....	1,421.41	160.64
<i>For Work In Restricted Working Space, Add</i>	103.27	
40 05 23 43-0376 Slip-On Flanges (40 05 23 43-0292)		
40 05 23 43-0377 EA 1/2" Flange, Stainless Steel Schedule 5 Type 304.....	102.51	37.30
<i>For Work In Restricted Working Space, Add</i>	22.38	
40 05 23 43-0378 EA 3/4" Flange, Stainless Steel Schedule 5 Type 304.....	106.27	37.30
<i>For Work In Restricted Working Space, Add</i>	22.38	
40 05 23 43-0379 EA 1" Flange, Stainless Steel Schedule 5 Type 304.....	125.73	45.87
<i>For Work In Restricted Working Space, Add</i>	27.53	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
40 05 23 43-0380 EA 1-1/4" Flange, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	138.51 29.76	49.60
40 05 23 43-0381 EA 1-1/2" Flange, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	154.50 32.68	54.45
40 05 23 43-0382 EA 2" Flange, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	180.00 35.77	59.67
40 05 23 43-0383 EA 2-1/2" Flange, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	221.83 40.28	67.13
40 05 23 43-0384 EA 3" Flange, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	242.90 44.72	74.59
40 05 23 43-0385 EA 4" Flange, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	331.23 59.96	99.96
40 05 23 43-0386 EA 6" Flange, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	501.62 89.37	149.18
40 05 23 43-0387 EA 8" Flange, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	1,466.16 154.91	240.97
40 05 23 43-0388 Caps <small>(40 05 23 43-0292)</small>		
40 05 23 43-0389 EA 1/2" Cap, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	52.13 10.30	17.16
40 05 23 43-0390 EA 3/4" Cap, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	57.59 11.19	18.65
40 05 23 43-0391 EA 1" Cap, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	72.36 14.78	24.62
40 05 23 43-0392 EA 1-1/4" Cap, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	78.08 15.66	26.11
40 05 23 43-0393 EA 1-1/2" Cap, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	87.40 17.90	29.83
40 05 23 43-0394 EA 2" Cap, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	95.73 20.12	33.56
40 05 23 43-0395 EA 2-1/2" Cap, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	119.06 25.73	42.89
40 05 23 43-0396 EA 3" Cap, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	136.12 29.74	49.60
40 05 23 43-0397 EA 4" Cap, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	197.43 39.82	66.39
40 05 23 43-0398 EA 6" Cap, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	265.57 59.71	99.58
40 05 23 43-0399 Reducing Tees <small>(40 05 23 43-0292)</small>		
40 05 23 43-0400 EA 3/4" Reducing Tees, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	139.69 27.09	54.08
40 05 23 43-0401 EA 1" Reducing Tees, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	160.06 33.20	66.39
40 05 23 43-0402 EA 1-1/4" Reducing Tees, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	190.45 37.30	74.59
40 05 23 43-0403 EA 1-1/2" Reducing Tees, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	189.63 42.52	85.04
40 05 23 43-0404 EA 2" Reducing Tees, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	206.45 45.69	91.38
40 05 23 43-0405 EA 2-1/2" Reducing Tees, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	301.36 49.79	99.58
40 05 23 43-0406 EA 3" Reducing Tees, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	292.66 59.68	119.35
40 05 23 43-0407 EA 4" Reducing Tees, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	384.03 74.59	149.18
40 05 23 43-0408 EA 6" Reducing Tees, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	690.26 85.23	170.45
40 05 23 43-0409 EA 8" Reducing Tee, Stainless Steel Schedule 5 Type 304L <i>For Work In Restricted Working Space, Add</i>	1,280.64 129.09	240.97
40 05 23 43-0410 EA 10" Reducing Tee, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	2,052.59 172.12	321.29
40 05 23 43-0411 EA 12" Reducing Tee, Stainless Steel Schedule 5 Type 304 <i>For Work In Restricted Working Space, Add</i>	2,751.87 258.18	481.93
40 05 23 43-0412 Type 304 Schedule 10 Pipe And Welded Butt Fittings <small>(40 05 23 43-0212)</small>		
40 05 23 43-0413 Pipe <small>(40 05 23 43-0412)</small>		
40 05 23 43-0414 LF 1/2" Pipe, Stainless Steel Schedule 10 Type 304 For Butt Weld Fitting <i>For Work In Restricted Working Space, Add</i>	12.82 2.02	3.35
40 05 23 43-0415 LF 3/4" Pipe, Stainless Steel Schedule 10 Type 304 For Butt Weld Fitting <i>For Work In Restricted Working Space, Add</i>	15.27 2.46	4.10
40 05 23 43-0416 LF 1" Pipe, Stainless Steel Schedule 10 Type 304 For Butt Weld Fitting <i>For Work In Restricted Working Space, Add</i>	20.14 2.89	4.85
40 05 23 43-0417 LF 1-1/4" Pipe, Stainless Steel Schedule 10 Type 304 For Butt Weld Fitting <i>For Work In Restricted Working Space, Add</i>	24.61 3.61	6.04
40 05 23 43-0418 LF 1-1/2" Pipe, Stainless Steel Schedule 10 Type 304 For Butt Weld Fitting <i>For Work In Restricted Working Space, Add</i>	27.40 4.07	6.79
40 05 23 43-0419 LF 2" Pipe, Stainless Steel Schedule 10 Type 304 For Butt Weld Fitting <i>For Work In Restricted Working Space, Add</i>	33.88 5.04	8.42

40 Process Interconnections**40 05 Common Work Results For Process Interconnections****40 05 23 Stainless Steel Process Pipe and Tubing**

MINOR	CSI	UOM	DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
40 05 23 43-0420	LF		2-1/2" Pipe, Stainless Steel Schedule 10 Type 304 For Butt Weld Fitting <i>For Work In Restricted Working Space, Add</i>	40.45 5.76	9.62
40 05 23 43-0421	LF		3" Pipe, Stainless Steel Schedule 10 Type 304 For Butt Weld Fitting <i>For Work In Restricted Working Space, Add</i>	47.66 6.49	10.82
40 05 23 43-0422	LF		4" Pipe, Stainless Steel Schedule 10 Type 304 For Butt Weld Fitting <i>For Work In Restricted Working Space, Add</i>	59.75 7.68	12.83
40 05 23 43-0423	LF		6" Pipe, Stainless Steel Schedule 10 Type 304 For Butt Weld Fitting <i>For Work In Restricted Working Space, Add</i>	86.92 10.08	16.86
40 05 23 43-0424	LF		8" Pipe, Stainless Steel Schedule 10 Type 304 For Welded Butt Fitting <i>For Work In Restricted Working Space, Add</i>	147.37 19.72	30.68
40 05 23 43-0425	LF		10" Pipe, Stainless Steel Schedule 10 Type 304 For Welded Butt Fitting <i>For Work In Restricted Working Space, Add</i>	187.27 21.69	33.74
40 05 23 43-0426	LF		12" Pipe, Stainless Steel Schedule 10 Type 304 For Welded Butt Fitting <i>For Work In Restricted Working Space, Add</i>	223.63 24.10	37.51
40 05 23 43-0427			90 Degree Elbows <small>(40 05 23 43-0412)</small>		
40 05 23 43-0428	EA		1/2" 90 Degree Elbow, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	95.91 25.51	42.52
40 05 23 43-0429	EA		3/4" 90 Degree Elbow, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	101.13 27.08	45.13
40 05 23 43-0430	EA		1" 90 Degree Elbow, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	110.08 29.76	49.60
40 05 23 43-0431	EA		1-1/4" 90 Degree Elbow, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	124.03 32.46	54.08
40 05 23 43-0432	EA		1-1/2" 90 Degree Elbow, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	139.50 35.78	59.67
40 05 23 43-0433	EA		2" 90 Degree Elbow, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	154.09 39.85	66.39
40 05 23 43-0434	EA		2-1/2" 90 Degree Elbow, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	199.98 50.96	85.04
40 05 23 43-0435	EA		3" 90 Degree Elbow, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	236.84 59.67	99.58
40 05 23 43-0436	EA		4" 90 Degree Elbow, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	309.15 71.49	119.35
40 05 23 43-0437	EA		6" 90 Degree Elbow, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	500.13 89.33	149.18
40 05 23 43-0438	EA		8" 90 Degree Elbow, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	978.12 154.91	240.97
40 05 23 43-0439	EA		10" 90 Degree Elbow, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	1,545.11 206.54	321.29
40 05 23 43-0440	EA		12" 90 Degree Elbow, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	2,376.58 309.82	481.93
40 05 23 43-0441			45 Degree Elbows <small>(40 05 23 43-0412)</small>		
40 05 23 43-0442	EA		1/2" 45 Degree Elbow, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	100.37 25.51	42.52
40 05 23 43-0443	EA		3/4" 45 Degree Elbow, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	105.59 27.08	45.13
40 05 23 43-0444	EA		1" 45 Degree Elbow, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	114.54 29.76	49.60
40 05 23 43-0445	EA		1-1/4" 45 Degree Elbow, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	125.27 32.43	54.08
40 05 23 43-0446	EA		1-1/2" 45 Degree Elbow, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	136.93 35.82	59.67
40 05 23 43-0447	EA		2" 45 Degree Elbow, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	162.02 39.85	66.39
40 05 23 43-0448	EA		2-1/2" 45 Degree Elbow, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	199.43 51.00	85.04
40 05 23 43-0449	EA		3" 45 Degree Elbow, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	229.79 59.74	99.58
40 05 23 43-0450	EA		4" 45 Degree Elbow, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	292.47 71.56	119.35
40 05 23 43-0451	EA		6" 45 Degree Elbow, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	413.60 89.51	149.18
40 05 23 43-0452	EA		8" 45 Degree Elbow, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	869.04 154.91	240.97
40 05 23 43-0453	EA		10" 45 Degree Elbow, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	1,269.46 206.54	321.29
40 05 23 43-0454	EA		12" 45 Degree Elbow, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	1,959.43 309.82	481.93
40 05 23 43-0455			Tees <small>(40 05 23 43-0412)</small>		
40 05 23 43-0456	EA		1/2" Tees, Stainless Steel Schedule 10 Type 304 <i>For Work In Restricted Working Space, Add</i>	144.56 32.42	54.08
40 05 23 43-0457	EA		3/4" Tees, Stainless Steel Schedule 10 Type 304 <i>For Work In Restricted Working Space, Add</i>	169.16 39.80	66.39
40 05 23 43-0458	EA		1" Tees, Stainless Steel Schedule 10 Type 304 <i>For Work In Restricted Working Space, Add</i>	185.56 44.72	74.59
40 05 23 43-0459	EA		1-1/4" Tees, Stainless Steel Schedule 10 Type 304 <i>For Work In Restricted Working Space, Add</i>	210.21 51.02	85.04



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
40 05 23 43-0460 EA 1-1/2" Tees, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	223.89 54.76	91.38
40 05 23 43-0461 EA 2" Tees, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	263.50 59.71	99.58
40 05 23 43-0462 EA 2-1/2" Tees, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	317.59 71.56	119.35
40 05 23 43-0463 EA 3" Tees, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	410.65 89.63	149.18
40 05 23 43-0464 EA 4" Tees, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	456.96 100.60	167.83
40 05 23 43-0465 EA 6" Tees, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	785.63 134.25	223.77
40 05 23 43-0466 EA 8" Tee, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	1,335.10 206.54	321.29
40 05 23 43-0467 EA 10" Tee, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	1,961.49 309.82	481.93
40 05 23 43-0468 EA 12" Tee, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	3,303.22 387.27	602.42
40 05 23 43-0469 Reducers <small>(40 05 23 43-0412)</small>		
40 05 23 43-0470 EA 3/4" Reducer, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	109.85 24.64	41.03
40 05 23 43-0471 EA 1" Reducer, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	121.52 26.85	44.76
40 05 23 43-0472 EA 1-1/4" Reducer, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	149.19 29.76	49.60
40 05 23 43-0473 EA 1-1/2" Reducer, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	129.49 32.42	54.08
40 05 23 43-0474 EA 2" Reducer, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	142.55 35.81	59.67
40 05 23 43-0475 EA 2-1/2" Reducer, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	184.31 44.75	74.59
40 05 23 43-0476 EA 3" Reducer, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	204.64 50.96	85.04
40 05 23 43-0477 EA 4" Reducer, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	238.26 59.71	99.58
40 05 23 43-0478 EA 6" Reducer, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	306.91 76.02	126.80
40 05 23 43-0479 EA 8" Reducer, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	658.38 123.92	192.77
40 05 23 43-0480 EA 10" Reducer, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	857.52 154.91	240.97
40 05 23 43-0481 EA 12" Reducer, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	1,140.17 206.54	321.29
40 05 23 43-0482 Flanges <small>(40 05 23 43-0412)</small>		
40 05 23 43-0483 EA 1/2" Flanges, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	62.54 10.30	17.16
40 05 23 43-0484 EA 3/4" Flanges, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	65.53 11.19	18.65
40 05 23 43-0485 EA 1" Flanges, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	78.21 15.00	24.99
40 05 23 43-0486 EA 1-1/4" Flanges, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	87.01 15.66	26.11
40 05 23 43-0487 EA 1-1/2" Flanges, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	101.06 17.90	29.83
40 05 23 43-0488 EA 2" Flanges, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	120.71 20.13	33.56
40 05 23 43-0489 EA 2-1/2" Flanges, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	163.85 25.74	42.89
40 05 23 43-0490 EA 3" Flanges, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	180.98 29.74	49.60
40 05 23 43-0491 EA 4" Flanges, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	248.10 40.28	67.13
40 05 23 43-0492 EA 6" Flanges, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	375.80 59.69	99.58
40 05 23 43-0493 EA 8" Flange, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	701.55 77.45	120.49
40 05 23 43-0494 EA 10" Flange, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	1,069.09 90.36	140.56
40 05 23 43-0495 EA 12" Flange, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	1,478.11 103.27	160.64
40 05 23 43-0496 Slip-On Flanges <small>(40 05 23 43-0412)</small>		
40 05 23 43-0497 EA 1/2" Flange, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	103.98 22.38	37.30
40 05 23 43-0498 EA 3/4" Flange, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	107.94 22.38	37.30
40 05 23 43-0499 EA 1" Flange, Stainless Steel Schedule 10 Type 304..... <i>For Work In Restricted Working Space, Add</i>	127.51 27.53	45.87

40 Process Interconnections**40 05 Common Work Results For Process Interconnections****40 05 23 Stainless Steel Process Pipe and Tubing**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
40 05 23 43-0500 EA 1-1/4" Flange, Stainless Steel Schedule 10 Type 304	140.58	49.60
<i>For Work In Restricted Working Space, Add</i>	29.76	
40 05 23 43-0501 EA 1-1/2" Flange, Stainless Steel Schedule 10 Type 304	156.89	54.45
<i>For Work In Restricted Working Space, Add</i>	32.67	
40 05 23 43-0502 EA 2" Flange, Stainless Steel Schedule 10 Type 304	183.23	59.67
<i>For Work In Restricted Working Space, Add</i>	35.78	
40 05 23 43-0503 EA 2-1/2" Flange, Stainless Steel Schedule 10 Type 304	226.46	67.13
<i>For Work In Restricted Working Space, Add</i>	40.28	
40 05 23 43-0504 EA 3" Flange, Stainless Steel Schedule 10 Type 304	247.85	74.59
<i>For Work In Restricted Working Space, Add</i>	44.72	
40 05 23 43-0505 EA 4" Flange, Stainless Steel Schedule 10 Type 304	338.18	99.96
<i>For Work In Restricted Working Space, Add</i>	59.97	
40 05 23 43-0506 EA 6" Flange, Stainless Steel Schedule 10 Type 304	512.53	149.18
<i>For Work In Restricted Working Space, Add</i>	89.42	
40 05 23 43-0507 EA 8" Flange, Stainless Steel Schedule 10 Type 304	1,516.15	240.97
<i>For Work In Restricted Working Space, Add</i>	154.91	
40 05 23 43-0508 Caps <small>(40 05 23 43-0412)</small>		
40 05 23 43-0509 EA 1/2" Cap, Stainless Steel Schedule 10 Type 304	53.07	17.16
<i>For Work In Restricted Working Space, Add</i>	10.30	
40 05 23 43-0510 EA 3/4" Cap, Stainless Steel Schedule 10 Type 304	58.66	18.65
<i>For Work In Restricted Working Space, Add</i>	11.19	
40 05 23 43-0511 EA 1" Cap, Stainless Steel Schedule 10 Type 304	73.57	24.62
<i>For Work In Restricted Working Space, Add</i>	14.78	
40 05 23 43-0512 EA 1-1/4" Cap, Stainless Steel Schedule 10 Type 304	79.44	26.11
<i>For Work In Restricted Working Space, Add</i>	15.66	
40 05 23 43-0513 EA 1-1/2" Cap, Stainless Steel Schedule 10 Type 304	88.86	29.83
<i>For Work In Restricted Working Space, Add</i>	17.90	
40 05 23 43-0514 EA 2" Cap, Stainless Steel Schedule 10 Type 304	97.25	33.56
<i>For Work In Restricted Working Space, Add</i>	20.13	
40 05 23 43-0515 EA 2-1/2" Cap, Stainless Steel Schedule 10 Type 304	120.82	42.89
<i>For Work In Restricted Working Space, Add</i>	25.74	
40 05 23 43-0516 EA 3" Cap, Stainless Steel Schedule 10 Type 304	138.06	49.60
<i>For Work In Restricted Working Space, Add</i>	29.74	
40 05 23 43-0517 EA 4" Cap, Stainless Steel Schedule 10 Type 304	200.88	66.39
<i>For Work In Restricted Working Space, Add</i>	39.83	
40 05 23 43-0518 EA 6" Cap, Stainless Steel Schedule 10 Type 304	269.03	99.58
<i>For Work In Restricted Working Space, Add</i>	59.69	
40 05 23 43-0519 Reducing Tees <small>(40 05 23 43-0412)</small>		
40 05 23 43-0520 EA 3/4" Reducing Tees, Stainless Steel Schedule 10 Type 304	143.60	54.08
<i>For Work In Restricted Working Space, Add</i>	27.09	
40 05 23 43-0521 EA 1" Reducing Tees, Stainless Steel Schedule 10 Type 304	177.39	66.39
<i>For Work In Restricted Working Space, Add</i>	33.20	
40 05 23 43-0522 EA 1-1/4" Reducing Tees, Stainless Steel Schedule 10 Type 304	197.80	74.59
<i>For Work In Restricted Working Space, Add</i>	37.30	
40 05 23 43-0523 EA 1-1/2" Reducing Tees, Stainless Steel Schedule 10 Type 304	221.95	85.04
<i>For Work In Restricted Working Space, Add</i>	42.52	
40 05 23 43-0524 EA 2" Reducing Tees, Stainless Steel Schedule 10 Type 304	246.47	91.38
<i>For Work In Restricted Working Space, Add</i>	45.69	
40 05 23 43-0525 EA 2-1/2" Reducing Tees, Stainless Steel Schedule 10 Type 304	354.93	99.58
<i>For Work In Restricted Working Space, Add</i>	49.79	
40 05 23 43-0526 EA 3" Reducing Tees, Stainless Steel Schedule 10 Type 304	362.43	119.35
<i>For Work In Restricted Working Space, Add</i>	59.68	
40 05 23 43-0527 EA 4" Reducing Tees, Stainless Steel Schedule 10 Type 304	448.85	149.18
<i>For Work In Restricted Working Space, Add</i>	74.59	
40 05 23 43-0528 EA 6" Reducing Tees, Stainless Steel Schedule 10 Type 304	778.14	170.45
<i>For Work In Restricted Working Space, Add</i>	85.23	
40 05 23 43-0529 EA 8" Reducing Tee, Stainless Steel Schedule 10 Type 304	1,375.12	240.97
<i>For Work In Restricted Working Space, Add</i>	129.09	
40 05 23 43-0530 EA 10" Reducing Tee, Stainless Steel Schedule 10 Type 304	2,898.25	321.29
<i>For Work In Restricted Working Space, Add</i>	172.12	
40 05 23 43-0531 EA 12" Reducing Tee, Stainless Steel Schedule 10 Type 304	3,800.94	481.93
<i>For Work In Restricted Working Space, Add</i>	258.18	
40 05 23 43-0532 Type 304 Schedule 40 Pipe And Welded Butt Fittings <small>(40 05 23 43-0212)</small>		
40 05 23 43-0533 Pipe <small>(40 05 23 43-0532)</small>		
40 05 23 43-0534 LF 1/2" Pipe, Stainless Steel Schedule 40 Type 304 For Butt Weld Fitting	14.32	3.35
<i>For Work In Restricted Working Space, Add</i>	2.02	
40 05 23 43-0535 LF 3/4" Pipe, Stainless Steel Schedule 40 Type 304 For Butt Weld Fitting	17.40	4.10
<i>For Work In Restricted Working Space, Add</i>	2.46	
40 05 23 43-0536 LF 1" Pipe, Stainless Steel Schedule 40 Type 304 For Butt Weld Fitting	21.28	4.85
<i>For Work In Restricted Working Space, Add</i>	2.89	
40 05 23 43-0537 LF 1-1/4" Pipe, Stainless Steel Schedule 40 Type 304 For Butt Weld Fitting	26.61	5.97
<i>For Work In Restricted Working Space, Add</i>	3.61	
40 05 23 43-0538 LF 1-1/2" Pipe, Stainless Steel Schedule 40 Type 304 For Butt Weld Fitting	30.65	6.72
<i>For Work In Restricted Working Space, Add</i>	4.07	
40 05 23 43-0539 LF 2" Pipe, Stainless Steel Schedule 40 Type 304 For Butt Weld Fitting	39.23	8.58
<i>For Work In Restricted Working Space, Add</i>	5.04	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
40 05 23 43-0540 LF 2-1/2" Pipe, Stainless Steel Schedule 40 Type 304 For Butt Weld Fitting <i>For Work In Restricted Working Space, Add</i>	48.61 5.76	9.69
40 05 23 43-0541 LF 3" Pipe, Stainless Steel Schedule 40 Type 304 For Butt Weld Fitting <i>For Work In Restricted Working Space, Add</i>	47.51 6.49	10.82
40 05 23 43-0542 LF 4" Pipe, Stainless Steel Schedule 40 Type 304 For Butt Weld Fitting <i>For Work In Restricted Working Space, Add</i>	77.95 7.68	12.68
40 05 23 43-0543 LF 6" Pipe, Stainless Steel Schedule 40 Type 304 For Butt Weld Fitting <i>For Work In Restricted Working Space, Add</i>	121.08 10.08	16.79
40 05 23 43-0544 LF 8" Pipe, Stainless Steel Schedule 40 Type 304 For Welded Butt Fitting <i>For Work In Restricted Working Space, Add</i>	215.69 19.72	30.52
40 05 23 43-0545 LF 10" Pipe, Stainless Steel Schedule 40 Type 304 For Welded Butt Fitting <i>For Work In Restricted Working Space, Add</i>	272.25 21.69	33.74
40 05 23 43-0546 LF 12" Pipe, Stainless Steel Schedule 40 Type 304 For Welded Butt Fitting <i>For Work In Restricted Working Space, Add</i>	338.61 24.10	37.35
40 05 23 43-0547 90 Degree Elbows <small>(40 05 23 43-0532)</small>		
40 05 23 43-0548 EA 1/2" 90 Degree Elbow, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	100.79 25.51	42.52
40 05 23 43-0549 EA 3/4" 90 Degree Elbow, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	106.01 27.08	45.13
40 05 23 43-0550 EA 1" 90 Degree Elbow, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	117.08 29.76	49.60
40 05 23 43-0551 EA 1-1/4" 90 Degree Elbow, Stainless Steel Schedule 40 Type 304 <i>For Work In Restricted Working Space, Add</i>	134.93 32.46	54.08
40 05 23 43-0552 EA 1-1/2" 90 Degree Elbow, Stainless Steel Schedule 40 Type 304 <i>For Work In Restricted Working Space, Add</i>	141.57 35.78	59.67
40 05 23 43-0553 EA 2" 90 Degree Elbow, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	162.58 39.85	66.39
40 05 23 43-0554 EA 2-1/2" 90 Degree Elbow, Stainless Steel Schedule 40 Type 304 <i>For Work In Restricted Working Space, Add</i>	231.85 50.96	85.04
40 05 23 43-0555 EA 3" 90 Degree Elbow, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	282.99 59.67	99.58
40 05 23 43-0556 EA 4" 90 Degree Elbow, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	387.03 71.49	119.35
40 05 23 43-0557 EA 6" 90 Degree Elbow, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	793.48 89.33	149.18
40 05 23 43-0558 EA 8" 90 Degree Elbow, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	1,348.48 154.91	240.97
40 05 23 43-0559 EA 10" 90 Degree Elbow, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	2,450.09 206.54	321.29
40 05 23 43-0560 EA 12" 90 Degree Elbow, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	3,467.11 309.82	481.93
40 05 23 43-0561 45 Degree <small>(40 05 23 43-0532)</small>		
40 05 23 43-0562 EA 1/2" 45 Degree Elbow, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	107.34 25.51	42.52
40 05 23 43-0563 EA 3/4" 45 Degree Elbow, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	112.56 27.08	45.13
40 05 23 43-0564 EA 1" 45 Degree Elbow, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	121.51 29.76	49.60
40 05 23 43-0565 EA 1-1/4" 45 Degree Elbow, Stainless Steel Schedule 40 Type 304 <i>For Work In Restricted Working Space, Add</i>	130.42 32.43	54.08
40 05 23 43-0566 EA 1-1/2" 45 Degree Elbow, Stainless Steel Schedule 40 Type 304 <i>For Work In Restricted Working Space, Add</i>	149.13 35.82	59.67
40 05 23 43-0567 EA 2" 45 Degree Elbow, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	164.09 39.85	66.39
40 05 23 43-0568 EA 2-1/2" 45 Degree Elbow, Stainless Steel Schedule 40 Type 304 <i>For Work In Restricted Working Space, Add</i>	229.32 51.00	85.04
40 05 23 43-0569 EA 3" 45 Degree Elbow, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	258.45 59.74	99.58
40 05 23 43-0570 EA 4" 45 Degree Elbow, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	342.99 71.56	119.35
40 05 23 43-0571 EA 6" 45 Degree Elbow, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	595.80 89.51	149.18
40 05 23 43-0572 EA 8" 45 Degree Elbow, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	1,065.20 154.91	240.97
40 05 23 43-0573 EA 10" 45 Degree Elbow, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	1,741.91 206.54	321.29
40 05 23 43-0574 EA 12" 45 Degree Elbow, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	2,395.98 309.82	481.93
40 05 23 43-0575 Tees <small>(40 05 23 43-0532)</small>		
40 05 23 43-0576 EA 1/2" Tees, Stainless Steel Schedule 40 Type 304 <i>For Work In Restricted Working Space, Add</i>	160.30 32.42	54.08
40 05 23 43-0577 EA 3/4" Tees, Stainless Steel Schedule 40 Type 304 <i>For Work In Restricted Working Space, Add</i>	184.90 39.80	66.39
40 05 23 43-0578 EA 1" Tees, Stainless Steel Schedule 40 Type 304 <i>For Work In Restricted Working Space, Add</i>	201.30 44.72	74.59
40 05 23 43-0579 EA 1-1/4" Tees, Stainless Steel Schedule 40 Type 304 <i>For Work In Restricted Working Space, Add</i>	254.17 51.02	85.04

40 Process Interconnections**40 05 Common Work Results For Process Interconnections****40 05 23 Stainless Steel Process Pipe and Tubing**

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
40 05 23 43-0580 EA 1-1/2" Tees, Stainless Steel Schedule 40 Type 304	234.77	91.38
<i>For Work In Restricted Working Space, Add</i>	54.76	
40 05 23 43-0581 EA 2" Tees, Stainless Steel Schedule 40 Type 304	253.92	99.58
<i>For Work In Restricted Working Space, Add</i>	59.71	
40 05 23 43-0582 EA 2-1/2" Tees, Stainless Steel Schedule 40 Type 304	387.25	119.35
<i>For Work In Restricted Working Space, Add</i>	71.56	
40 05 23 43-0583 EA 3" Tees, Stainless Steel Schedule 40 Type 304	417.37	149.18
<i>For Work In Restricted Working Space, Add</i>	89.63	
40 05 23 43-0584 EA 4" Tees, Stainless Steel Schedule 40 Type 304	496.44	167.83
<i>For Work In Restricted Working Space, Add</i>	100.60	
40 05 23 43-0585 EA 6" Tees, Stainless Steel Schedule 40 Type 304	930.85	223.77
<i>For Work In Restricted Working Space, Add</i>	134.25	
40 05 23 43-0586 EA 8" Tee, Stainless Steel Schedule 40 Type 304	1,989.77	321.29
<i>For Work In Restricted Working Space, Add</i>	206.54	
40 05 23 43-0587 EA 10" Tee, Stainless Steel Schedule 40 Type 304	3,511.37	481.93
<i>For Work In Restricted Working Space, Add</i>	309.82	
40 05 23 43-0588 EA 12" Tee, Stainless Steel Schedule 40 Type 304	4,389.21	602.42
<i>For Work In Restricted Working Space, Add</i>	387.27	
40 05 23 43-0589 Reducers (40 05 23 43-0532)		
40 05 23 43-0590 EA 3/4" Reducer, Stainless Steel Schedule 40 Type 304	113.18	41.03
<i>For Work In Restricted Working Space, Add</i>	24.64	
40 05 23 43-0591 EA 1" Reducer, Stainless Steel Schedule 40 Type 304	125.36	44.76
<i>For Work In Restricted Working Space, Add</i>	26.85	
40 05 23 43-0592 EA 1-1/4" Reducer, Stainless Steel Schedule 40 Type 304	155.18	49.60
<i>For Work In Restricted Working Space, Add</i>	29.76	
40 05 23 43-0593 EA 1-1/2" Reducer, Stainless Steel Schedule 40 Type 304	132.08	54.08
<i>For Work In Restricted Working Space, Add</i>	32.43	
40 05 23 43-0594 EA 2" Reducer, Stainless Steel Schedule 40 Type 304	145.36	59.67
<i>For Work In Restricted Working Space, Add</i>	35.82	
40 05 23 43-0595 EA 2-1/2" Reducer, Stainless Steel Schedule 40 Type 304	188.55	74.59
<i>For Work In Restricted Working Space, Add</i>	44.75	
40 05 23 43-0596 EA 3" Reducer, Stainless Steel Schedule 40 Type 304	208.79	85.04
<i>For Work In Restricted Working Space, Add</i>	50.95	
40 05 23 43-0597 EA 4" Reducer, Stainless Steel Schedule 40 Type 304	242.97	99.58
<i>For Work In Restricted Working Space, Add</i>	59.71	
40 05 23 43-0598 EA 6" Reducer, Stainless Steel Schedule 40 Type 304	313.31	126.80
<i>For Work In Restricted Working Space, Add</i>	76.01	
40 05 23 43-0599 EA 8" Reducer, Stainless Steel Schedule 40 Type 304	687.81	192.77
<i>For Work In Restricted Working Space, Add</i>	123.92	
40 05 23 43-0600 EA 10" Reducer, Stainless Steel Schedule 40 Type 304	898.46	240.97
<i>For Work In Restricted Working Space, Add</i>	154.91	
40 05 23 43-0601 EA 12" Reducer, Stainless Steel Schedule 40 Type 304	1,194.38	321.29
<i>For Work In Restricted Working Space, Add</i>	206.54	
40 05 23 43-0602 Flanges (40 05 23 43-0532)		
40 05 23 43-0603 EA 1/2" Flanges, Stainless Steel Schedule 40 Type 304	65.92	17.16
<i>For Work In Restricted Working Space, Add</i>	10.30	
40 05 23 43-0604 EA 3/4" Flanges, Stainless Steel Schedule 40 Type 304	68.91	18.65
<i>For Work In Restricted Working Space, Add</i>	11.19	
40 05 23 43-0605 EA 1" Flanges, Stainless Steel Schedule 40 Type 304	81.59	24.99
<i>For Work In Restricted Working Space, Add</i>	15.00	
40 05 23 43-0606 EA 1-1/4" Flanges, Stainless Steel Schedule 40 Type 304	91.19	26.11
<i>For Work In Restricted Working Space, Add</i>	15.66	
40 05 23 43-0607 EA 1-1/2" Flanges, Stainless Steel Schedule 40 Type 304	106.02	29.83
<i>For Work In Restricted Working Space, Add</i>	17.90	
40 05 23 43-0608 EA 2" Flanges, Stainless Steel Schedule 40 Type 304	127.15	33.56
<i>For Work In Restricted Working Space, Add</i>	20.13	
40 05 23 43-0609 EA 2-1/2" Flanges, Stainless Steel Schedule 40 Type 304	173.21	42.89
<i>For Work In Restricted Working Space, Add</i>	25.74	
40 05 23 43-0610 EA 3" Flanges, Stainless Steel Schedule 40 Type 304	190.80	49.60
<i>For Work In Restricted Working Space, Add</i>	29.74	
40 05 23 43-0611 EA 4" Flanges, Stainless Steel Schedule 40 Type 304	261.76	67.13
<i>For Work In Restricted Working Space, Add</i>	40.28	
40 05 23 43-0612 EA 6" Flanges, Stainless Steel Schedule 40 Type 304	397.01	99.58
<i>For Work In Restricted Working Space, Add</i>	59.69	
40 05 23 43-0613 EA 8" Flange, Stainless Steel Schedule 40 Type 304	754.76	120.49
<i>For Work In Restricted Working Space, Add</i>	77.45	
40 05 23 43-0614 EA 10" Flange, Stainless Steel Schedule 40 Type 304	1,161.24	140.56
<i>For Work In Restricted Working Space, Add</i>	90.36	
40 05 23 43-0615 EA 12" Flange, Stainless Steel Schedule 40 Type 304	1,614.17	160.64
<i>For Work In Restricted Working Space, Add</i>	103.27	
40 05 23 43-0616 Slip-On Flanges (40 05 23 43-0532)		
40 05 23 43-0617 EA 1/2" Flange, Stainless Steel Schedule 40 Type 304	107.50	37.30
<i>For Work In Restricted Working Space, Add</i>	22.38	
40 05 23 43-0618 EA 3/4" Flange, Stainless Steel Schedule 40 Type 304	111.94	37.30
<i>For Work In Restricted Working Space, Add</i>	22.38	
40 05 23 43-0619 EA 1" Flange, Stainless Steel Schedule 40 Type 304	131.80	45.87
<i>For Work In Restricted Working Space, Add</i>	27.53	



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
40 05 23 43-0620 EA 1-1/4" Flange, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	145.54 29.76	49.60
40 05 23 43-0621 EA 1-1/2" Flange, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	162.65 32.67	54.45
40 05 23 43-0622 EA 2" Flange, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	190.90 35.78	59.67
40 05 23 43-0623 EA 2-1/2" Flange, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	237.52 40.28	67.13
40 05 23 43-0624 EA 3" Flange, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	259.70 44.72	74.59
40 05 23 43-0625 EA 4" Flange, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	354.78 59.97	99.96
40 05 23 43-0626 EA 6" Flange, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	538.26 89.42	149.18
40 05 23 43-0627 EA 8" Flange, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	1,636.13 154.91	240.97
40 05 23 43-0628 Caps <small>(40 05 23 43-0532)</small>		
40 05 23 43-0629 EA 1/2" Cap, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	55.32 10.30	17.16
40 05 23 43-0630 EA 3/4" Cap, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	61.22 11.19	18.65
40 05 23 43-0631 EA 1" Cap, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	76.49 14.78	24.62
40 05 23 43-0632 EA 1-1/4" Cap, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	82.71 15.66	26.11
40 05 23 43-0633 EA 1-1/2" Cap, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	92.36 17.90	29.83
40 05 23 43-0634 EA 2" Cap, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	100.87 20.13	33.56
40 05 23 43-0635 EA 2-1/2" Cap, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	125.02 25.74	42.89
40 05 23 43-0636 EA 3" Cap, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	142.73 29.74	49.60
40 05 23 43-0637 EA 4" Cap, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	209.05 39.83	66.39
40 05 23 43-0638 EA 6" Cap, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	277.43 59.69	99.58
40 05 23 43-0639 Reducing Tees <small>(40 05 23 43-0532)</small>		
40 05 23 43-0640 EA 1/2" Reducing Tees, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	147.49 27.01	54.08
40 05 23 43-0641 EA 3/4" Reducing Tees, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	167.98 33.16	66.39
40 05 23 43-0642 EA 1" Reducing Tees, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	181.67 37.27	74.59
40 05 23 43-0643 EA 1-1/4" Reducing Tees, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	234.17 42.50	85.04
40 05 23 43-0644 EA 1-1/2" Reducing Tees, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	209.50 45.62	91.38
40 05 23 43-0645 EA 2" Reducing Tees, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	226.22 49.76	99.58
40 05 23 43-0646 EA 2-1/2" Reducing Tees, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	362.31 59.62	119.35
40 05 23 43-0647 EA 3" Reducing Tees, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	379.51 74.71	149.18
40 05 23 43-0648 EA 4" Reducing Tees, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	456.71 83.85	167.83
40 05 23 43-0649 EA 6" Reducing Tees, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	904.33 111.80	223.77
40 05 23 43-0650 EA 8" Reducing Tee, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	2,005.15 172.12	321.29
40 05 23 43-0651 EA 10" Reducing Tee, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	3,587.12 258.18	481.93
40 05 23 43-0652 EA 12" Reducing Tee, Stainless Steel Schedule 40 Type 304..... <i>For Work In Restricted Working Space, Add</i>	4,483.90 322.73	602.42

END OF SECTION 40

40 Process Interconnections**40 05 Common Work Results For Process Interconnections**

40 05 23 Stainless Steel Process Pipe and Tubing



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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MINOR	CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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41 Material Processing And Handling Equipment

41 01 Operation And Maintenance Of Material Processing And Handling Equipment ⁽⁴¹⁾

41 01 20 Operation And Maintenance Of Piece Material Handling Equipment ^(41 01)

41 01 20 00-0001 Maintenance ^(41 01 20)

41 01 20 00-0002	EA	Regular Inspection.....	304.87
41 01 20 00-0003	HR	Hoist Or Crane Servicing, Labor Only.....	86.31
41 01 20 00-0004	MO	Hoist Or Crane Maintenance Contract.....	581.75

41 20 Piece Material Handling Equipment ⁽⁴¹⁾

41 22 Cranes And Hoists ^(41 20)

41 22 23 Hoists ^(41 22)

41 22 23 13 Fixed Hoists ^(41 22 23)

41 22 23 13-0001 Electric Hoists ^(41 22 23 13)

41 22 23 13-0002 Electric Industrial Chain Hoists ^(41 22 23 13-0001)

Note: Includes 20' of chain. Excludes beams.

41 22 23 13-0003	EA	500 LB Capacity, Electric Industrial Chain Hoist.....	2,604.57	262.37
		<i>For DC Electrical Operated, Add</i>	519.55	
		<i>For Each LF Copper Conductor Bar, Add</i>	10.50	
41 22 23 13-0004	EA	1,000 LB Capacity, Electric Industrial Chain Hoist.....	2,718.28	262.37
		<i>For DC Electrical Operated, Add</i>	547.63	
		<i>For Each LF Copper Conductor Bar, Add</i>	10.50	
41 22 23 13-0005	EA	2,000 LB Capacity, Electric Industrial Chain Hoist.....	3,004.61	262.37
		<i>For DC Electrical Operated, Add</i>	617.05	
		<i>For Each LF Copper Conductor Bar, Add</i>	10.50	
41 22 23 13-0006	EA	3,000 LB Capacity, Electric Industrial Chain Hoist.....	4,528.18	271.43
		<i>For DC Electrical Operated, Add</i>	992.21	
		<i>For Each LF Copper Conductor Bar, Add</i>	10.50	
41 22 23 13-0007	EA	4,000 LB Capacity, Electric Industrial Chain Hoist.....	3,902.78	271.43
		<i>For DC Electrical Operated, Add</i>	834.25	
		<i>For Each LF Copper Conductor Bar, Add</i>	10.50	
41 22 23 13-0008	EA	5,000 LB Capacity, Electric Industrial Chain Hoist.....	5,579.44	280.47
		<i>For DC Electrical Operated, Add</i>	1,246.12	
		<i>For Each LF Copper Conductor Bar, Add</i>	10.50	
41 22 23 13-0009	EA	6,000 LB Capacity, Electric Industrial Chain Hoist.....	5,046.38	307.62
		<i>For DC Electrical Operated, Add</i>	1,087.54	
		<i>For Each LF Copper Conductor Bar, Add</i>	10.50	
41 22 23 13-0010	EA	7,500 LB Capacity, Electric Industrial Chain Hoist.....	6,240.19	380.00
		<i>For DC Electrical Operated, Add</i>	1,381.57	
		<i>For Each LF Copper Conductor Bar, Add</i>	10.50	
41 22 23 13-0011	EA	10,000 LB Capacity, Electric Industrial Chain Hoist.....	7,405.26	405.59
		<i>For DC Electrical Operated, Add</i>	1,675.90	
		<i>For Each LF Copper Conductor Bar, Add</i>	10.50	
41 22 23 13-0012	EA	15,000 LB Capacity, Electric Industrial Chain Hoist.....	11,913.27	423.23
		<i>For DC Electrical Operated, Add</i>	2,766.52	
		<i>For Each LF Copper Conductor Bar, Add</i>	10.50	
41 22 23 13-0013	EA	20,000 LB Capacity, Electric Industrial Chain Hoist.....	14,272.48	440.86
		<i>For DC Electrical Operated, Add</i>	3,347.16	
		<i>For Each LF Copper Conductor Bar, Add</i>	10.50	
41 22 23 13-0014	EA	25,000 LB Capacity, Electric Industrial Chain Hoist.....	19,746.30	458.49
		<i>For DC Electrical Operated, Add</i>	4,706.20	
		<i>For Each LF Copper Conductor Bar, Add</i>	10.50	
41 22 23 13-0015	EA	30,000 LB Capacity, Electric Industrial Chain Hoist.....	25,272.31	502.59
		<i>For DC Electrical Operated, Add</i>	6,065.55	
		<i>For Each LF Copper Conductor Bar, Add</i>	10.50	

41 22 23 13-0016 Hand Chain Hoists ^(41 22 23 13)

41 22 23 13-0017	EA	1,000 LB Capacity, Hand Chain Hoist.....	955.26	105.42
41 22 23 13-0018	EA	2,000 LB Capacity, Hand Chain Hoist.....	1,117.56	106.86
41 22 23 13-0019	EA	3,000 LB Capacity, Hand Chain Hoist.....	1,485.73	111.91
41 22 23 13-0020	EA	4,000 LB Capacity, Hand Chain Hoist.....	1,666.53	113.36
41 22 23 13-0021	EA	5,000 LB Capacity, Hand Chain Hoist.....	2,003.14	119.13
41 22 23 13-0022	EA	6,000 LB Capacity, Hand Chain Hoist.....	2,246.06	139.35
41 22 23 13-0023	EA	10,000 LB Capacity, Hand Chain Hoist.....	3,091.84	143.68
41 22 23 13-0024	EA	16,000 LB Capacity, Hand Chain Hoist.....	4,031.00	173.29
41 22 23 13-0025	EA	20,000 LB Capacity, Hand Chain Hoist.....	4,909.64	181.23
41 22 23 13-0026	EA	30,000 LB Capacity, Hand Chain Hoist.....	8,601.71	207.23

41	41	Material Processing And Handling Equipment
	41 20	Piece Material Handling Equipment
	41 22	Cranes And Hoists



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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END OF SECTION 41



Process Gas and Liquid Handling, Purification, and Storage Equipment	43	43
Liquid Handling Equipment	43 20	
Dry Location Liquid Pumps	43 23	

MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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43 Process Gas and Liquid Handling, Purification, and Storage Equipment

43 20 Liquid Handling Equipment ⁽⁴³⁾

43 23 Dry Location Liquid Pumps ^(43 20)

43 23 78 Controlled Volume Horizontal Reciprocating Pumps ^(43 23)

43 23 78 31 Controlled Volume Horizontal Mechanically-Coupled Diaphragm Simplex Reciprocating Pumps ^(43 23 78)

43 23 78 31-0001 Diaphragm Pump ^(43 23 78 31)

43 23 78 31-0002 EA 28 GPH Diaphragm Pump, Adjustable Flow 0-100% 250 PSI 2,454.17

43 24 Suspended Liquid Pumps ^(43 20)

43 24 41 Archimedes Screw Pumps ^(43 24)

43 24 41 23 Positive-Displacement Inclined Closed-casing Archimedes Screw-type Pumps ^(43 24 41)

43 24 41 23-0001 Positive Displacement Pump ^(43 24 41 23)

43 24 41 23-0002 EA 25 GPH Positive Displacement Pump, Adjustable Flow 0-100% 200 PSI Neoprene Packing..... 2,026.69

43 40 Gas and Liquid Storage ⁽⁴³⁾

43 41 Non-pressurized Tanks And Vessels ^(43 40)

43 41 31 Metallic Specialty Tanks ^(43 41)

43 41 31 00-0001 L.P.G. Tanks With Regulator And Safety Controls ^(43 41 31)

43 41 31 00-0002	EA	250 Gallon LP Gas Storage Tank	1,865.93	45.94
43 41 31 00-0003	EA	500 Gallon LP Gas Storage Tank	2,541.39	55.13
43 41 31 00-0004	EA	1,000 Gallon LP Gas Storage Tank	4,425.82	64.31

END OF SECTION 43

43 Process Gas and Liquid Handling, Purification, and Storage Equipment

43 40 Gas and Liquid Storage

43 41 Non-pressurized Tanks And Vessels



MINOR CSI UOM DESCRIPTION	TOTAL DIRECT UNIT COST	DEMOLITION UNIT COST
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